DL151/D
Rev. 3, Nov-2000

# Rectifier Device Data

ON Semiconductor™

Datasheet.Directory

# Rectifier Device Data

DL151/D
Rev. 3, Oct–2000

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ON Semiconductor™

This book presents technical data for ON Semiconductor's broad line of rectifiers. Complete specifications are provided in the form of data sheets and accompanying selection guides provide a quick comparison of characteristics to simplify the task of choosing the best device for a circuit.

The information in this book has been carefully checked and is believed to be accurate; however, no responsibility is assumed for inaccuracies.

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# ON SEMICONDUCTOR DEVICE CLASSIFICATIONS

In an effort to provide up–to–date information to the customer regarding the status of any given device, ON Semiconductor has classified all devices into three categories: Preferred devices, Current products and Not Recommended for New Design products.

A Preferred type is a device which is recommended as a first choice for future use. These devices are "preferred" by virtue of their performance, price, functionality, or combination of attributes which offer the overall "best" value to the customer. This category contains both advanced and mature devices which will remain available for the foreseeable future.

| "Preferred devices" are denoted below the device part numbers on the individual data sheets. |
|---|

Device types identified as "current" may not be a first choice for **new** designs, but will continue to be available because of the popularity and/or standardization or volume usage in current production designs. These products can be acceptable for new designs but the preferred types are considered better alternatives for long term usage.

| Any device that has not been identified as a "preferred device" is a "current" device. |
|---|

This data book does not contain any "Not Recommended for New Design" devices.

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# CHAPTER 1
# Master Index

# ALPHANUMERIC MASTER INDEX

# CHAPTER 2
# Selector Guide

Continuing investment in research and development for discrete products has created a rectifier manufacturing facility that matches the precision and versatility of the most advanced integrated circuits. As a result, ON Semiconductor's silicon rectifiers span all high tech applications with quality levels capable of passing the most stringent environmental tests . . . including those for automotive under–hood applications.

**Product Highlights:**

- Surface Mount Devices – A major thrust has been the development and introduction of a broad range of power rectifiers, Schottky and Ultrafast, 1/2 amp to 25 amp, 15 to 600 volts.
- Application Specific Rectifiers –
  - – Schottky rectifiers having lower forward voltage drop (0.3 to 0.6 volts) for use in low voltage SMPS outputs and as "OR"ing diodes.
  - – MEGAHERTZ™ series for high frequency power supplies and power factor correction.
  - – Ultrasoft rectifiers for high speed rectification.
  - – Energy rated rectifiers with guaranteed energy handling capability.
  - – Automotive transient suppressors.
- Ultrafast rectifiers having reverse recovery times as low as 25 ns to complement the Schottky devices for higher voltage requirements in high frequency applications.
- A wide variety of package options to match virtually any potential requirement.

The rectifier selector section that follows has generally been arranged by package and technology. The individual tables have been sorted by voltage and current with the package types for the devices listed shown above each table. The Application Specific Rectifiers are also included in their respective tables.

**Page**

# RECTIFIER NUMBERING SYSTEM

**PART NUMBER KEY** XXX X  XX  XX  XX X  XX

PREFIX (TYPE DESIGNATOR)

F = FULLY ISOLATED
A = SURFACE MT (SMA)
S = SURFACE MT (SMB/SMC)
D = DPAK
B = $D^2$PAK
H = MEGAHERTZ
M = POWERMITE
P = POWERTAP

$I_O$

$V_R$ (X10 EXCEPT SCHOTTKY)

SUFFIX (DUAL DESIGNATOR)

R = REVERSE
L = LOW $V_F$
E = ENERGY

PACKAGING DESIGNATOR*

**PREFIX KEY**

MUR = ULTRA FAST RECTIFIER
MBR = (SCHOTTKY) BARRIER RECTIFIER
MR = STANDARD & FAST RECOVERY
MSR = ULTRASOFT

**SUFFIX KEY**

CT = CENTER TAP (DUAL) TO–220, POWERTAP, DPAK, $D^2$PAK
PT = CENTER TAP (DUAL) TO–218 PACKAGE
WT = CENTER TAP (DUAL) TO–247

**EXAMPLE:**

| MUR | 30 | 20 | WT |
|---|---|---|---|
| ULTRAFAST | 30 AMP | 200 V | CENTER TAP (DUAL) TO–247 |

**EXAMPLE:**

| MBR | 30 | 45 | WT |
|---|---|---|---|
| SCHOTTKY | 30 AMP | 45 V | CENTER TAP (DUAL) TO–247 |

*For available packaging options consult Sales Office or see Data Sheet.

## Application Specific Rectifiers

### Table 1. Low $V_F$ Schottky Rectifiers

| Device | $I_O$ (Amps) | $V_{RRM}$ (Volts) | $V_F$ @ Rated $I_O$ and $T_C$ = 25°C Volts (Max) | $I_R$ @ Rated $V_{RRM}$ mAmps (Max) | Package |
|---|---|---|---|---|---|
| ***MBR0520LT1, T3*** | 0.5 | 20 | 0.33 | 0.25 | SOD-123 |
| ***MBRS130LT3*** | 1 | 30 | 0.395 | 1 | SMB |
| ***MBRD835L*** | 8 | 35 | 0.41 | 1.4 | DPAK |
| ***MBRD1035CTL*** | 10 | 35 | 0.41 | 6 | DPAK |
| ***MBR2030CTL*** | 20 | 30 | 0.48 | 5 | TO-220 |
| ***MBRB2535CTL*** | 25 | 35 | 0.41 | 10 | $D^2$PAK |
| ***MBR2535CTL*** | 25 | 35 | 0.41 | 5 | TO-220 |
| ***MBRB2515L*** | 25 | 15 | 0.42 | 15 | $D^2$PAK |
| ***MBR2515L*** | 25 | 15 | 0.42 | 15 | TO-220 |
| ***MBRB3030CTL*** | 30 | 30 | 0.51 | 5 | $D^2$PAK |
| ***MBR4015LWT*** | 40 | 15 | 0.42 | 5 | TO-247 |
| ***MBRP20030CTL*** | 200 | 30 | 0.52 | 5 | POWERTAP II |
| ***MBRP20035L*** | 200 | 35 | 0.57 | 10 | POWERTAP III |
| ***MBRP30035L*** | 300 | 35 | 0.57 | 10 | POWERTAP III |
| ***MBRP40045CTL*** | 400 | 45 | 0.57 | 10 | POWERTAP II |
| ***MBRP400100CTL*** | 400 | 100 | 0.83 | 6 | POWERTAP II |
| ***MBRP60035CTL*** | 600 | 35 | 0.57 | 10 | POWERTAP II |

### Table 2. MEGAHERTZ™ Rectifiers

| Device | $I_O$ (Amps) | $V_{RRM}$ (Volts) | Maximum | | $t_{rr}$ (Nanosecond) |
|---|---|---|---|---|---|
| | | | $V_F$ @ Rated $I_O$ and Temp. (Volts) | $I_R$ @ Rated $V_{RRM}$ (mAmps) | |
| ***MURH840CT/MURHB840CT*** | 8 | 400 | 1.7 | 0.01 | 28 |
| ***MURH860CT*** | 8 | 600 | 2.0 | 0.01 | 35 |
| ***MURHB860CT*** | 8 | 600 | 2.0 | 0.01 | 35 |
| ***MURHF860CT*** | 8 | 600 | 2.0 | 0.01 | 35 |

### Table 3. UltraSoft Rectifiers (For High Speed Rectification)

| Device | $I_O$ (Amps) | $V_{RRM}$ (Volts) | Max $V_F$ @ $I_F$ (Volts) | Max $t_{rr}$ (ηSec) | $T_J$Max (°C) |
|---|---|---|---|---|---|
| ***MSRP10040*** | 100 | 400 | 1.75 @ 100 A | 75 | 150 |
| ***MSRD620CT*** | 6 | 200 | 1.2 @ 6.0 A | 55 | 150 |
| ***MSR860*** | 8 | 600 | 1.7 @ 8.0 A | 120 | 150 |
| ***MSR1560*** | 15 | 600 | 1.8 @ 15 A | 45 | 150 |

### Table 4. Energy Rated Rectifiers

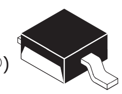
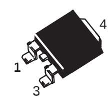
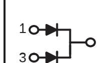
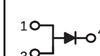
| Device | $I_O$ (Amps) | $V_{RRM}$ (Volts) | Max $V_F$ @ Rated unless Noted (Volts) | $I_R$ @ $V_{RRM}$ (mAmps) | Waval ($M_J$) |
|---|---|---|---|---|---|
| ***MUR180E*** | 1.0 | 800 | 1.75 | 10 | 10 |
| ***MUR1100E*** | 1.0 | 1000 | 1.75 | 10 | 10 |
| ***MUR480E*** | 4.0 | 800 | 1.75 | 25 | 20 |
| ***MUR4100E*** | 4.0 | 1000 | 1.75 | 25 | 20 |
| ***MUR880E*** | 8.0 | 800 | 1.8 | 25 | 20 |
| ***MUR8100E*** | 8.0 | 1000 | 1.8 | 25 | 20 |
| ***MUR10120E*** | 10 | 1200 | 2.2 @ 6.5 A | 100 | 20 |
| ***MUR10150E*** | 10 | 1500 | 2.5 @ 6.5 A | 100 | 20 |
| ***MUR5150E*** | 5.0 | 1500 | 2.4 | 50 | 20 |

### Table 5. Automotive Transient Suppressors

| Device | $I_O$ (Amps) | $V_{RRM}$ (Volts) | Max $V_F$ @ $I_F$ (Volts) | $I_{RSM}$ (Amps) | $T_J$Max (°C) |
|---|---|---|---|---|---|
| ***MR2535L*** | 6.0 | 20 | 1.1 @ 100 A | 62 @ 10 mS | 175 |
| ***MR2835S*** | 32 | 23 | 1.1 @ 100 A | 62 @ 10 mS | 175 |
| ***MR3227N, P*** | 32 | 18 | 1.18 @ 100 A | 90 @ 10 mS | 200 |
| ***MR4027N, P*** | 40 | 18 | 1.1 @ 100 A | 110 @ 10 mS | 200 |
| ***MR4045N, P*** | 40 | 30 | 1.1 @ 100 A | 55 @ 10 mS | 200 |

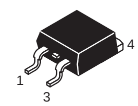
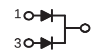
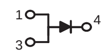
## SCHOTTKY Rectifiers

**Table 6. Surface Mount Schottky Rectifiers**

| $V_{RRM}$ (Volts) | $I_O$(1) (Amperes) | $I_O$ Rating Condition | Device | Max $V_F$ @ $i_F$ $T_C = 25°C$ (Volts) | $I_{FSM}$ (Amperes) | $T_J$ Max (°C) | Max $I_R$(2) $T_J = 25°C$ (mA) | Max $I_R$(3) (mA) | Package |
|---|---|---|---|---|---|---|---|---|---|
| 20 | 0.5 | $T_L = 90°C$ | ***MBR0520LT1*** ***MBR0520LT3*** | 0.310 @ 0.1 A 0.385 @ 0.5 A | 5 | 125 | .075 @ 10 V .250 @ 20 V | 5 @ 10 V 8 @ 20 V | **CASE 425-04** (SOD-123) Cathode = Band  |
| 30 | 0.5 | $T_L = 100°C$ | ***MBR0530T1*** ***MBR0530T3*** | 0.375 @ 0.1 A 0.430 @ 0.5 A | 5 | 125 | .020 @ 15 V .130 @ 30 V | – | |
| 40 | 0.5 | $T_L = 110°C$ | ***MBR0540T1*** ***MBR0540T3*** | 0.53 @ 0.5 A | 5 | 150 | .010 @ 20 V .020 @ 40 V | – | |
| 20 | 1 | $T_C = 130°C$ | ***MBRM120ET3*** | 0.455 @ 0.1 A 0.530 @ 1.0 A | 50 | 150 | 0.010 @ 20 V | 1.6 @ 20 V | **CASE 457–04** (POWERMITE®)  |
| 20 | 1 | $T_{tab} \leq 100°C$ | ***MBRM120LT3*** | 0.36 @ 0.1 A 0.45 @ 1 A | 50 | 125 | 0.4 @ 20 V | N/A | |
| 30 | 1 | $T_C = 135°C$ | ***MBRM130LT3★*** | 0.45 @ 1.0 A | 50 | 125 | 1 | N/A | |
| 40 | 1 | $T_{tab} \leq 100°C$ | ***MBRM140T3*** | 0.39 @ 0.1 A 0.55 @ 1 A | 50 | 125 | 0.5 @ 40 V | N/A | |
| 30 | 1 | $T_C \leq 105°C$ | ***MBRA130LT3*** | 0.41 @ 1 A 0.47 @ 2 A | 25 | 125 | 1.0 @ 30 V 0.4 @ 15 V | 25 @ 30 V | **CASE 403B-01** (SMA) Cathode = Notch or Polarity Band  |
| 40 | 1 | $T_C \leq 100°C$ | ***MBRA140T3*** | 0.60 @ 1 A 0.73 @ 2 A | 25 | 125 | 0.5 @ 40 V 0.1 @ 20 V | 10 @ 40 V | |
| 20 | 1 | $T_L = 115°C$ | ***MBRS120T3*** | 0.55 @ 1.0 A | 40 | 125 | 1 | 10 | **CASE 403-03** (SMB) Cathode = Notch or Polarity Band  |
| 30 | 1 | $T_L = 120°C$ | ***MBRS130LT3*** | 0.395 @ 1.0 A | 40 | 125 | 1 | 10 | |
| 30 | 1 | $T_L = 115°C$ | ***MBRS130T3*** | 0.55 @ 1.0 A | 40 | 125 | 1 | 10 | |
| 40 | 1 | $T_L = 115°C$ | ***MBRS140T3*** | 0.6 @ 1.0 A | 40 | 125 | 1 | 10 | |
| 40 | 1 | $T_C = 110°C$ | ***MBRS140LT3*** | 0.5 @ 1.0 A | 40 | 125 | 0.4 | 10 | |
| 90 | 1 | $T_L = 120°C$ | ***MBRS190T3*** | 0.75 @ 1.0 A | 50 | 125 | 0.5 | 5 | |
| 100 | 1 | $T_L = 120°C$ | ***MBRS1100T3*** | 0.75 @ 1.0 A | 40 | 150 | 0.5 | 5 | |
| 40 | 1.5 | $T_C = 100°C$ | ***MBRS1540T3*** | 0.46 @ 1.5 A | 40 | 125 | 0.8 | 5.7 | |
| 40 | 2 | $T_C \leq 95°C$ | ***MBRS240LT3*** | 0.43 @ 2 A 0.53 @ 4 A | 25 | 125 | 2.0 @ 40 V 0.5 @ 20 V | 60 @ 40 V 40 @ 20 V | |
| 40 | 2 | $T_C = 103°C$ | ***MBRS2040LT3*** | 0.43 @ 2 A 0.50 @ 4 A | 70 | 125 | 0.80 @ 40 V 0.10 @ 20 V | 20 @ 40 V 6.0 @ 20 V | |
| 20 | 3 | $T_L = 100°C$ | ***MBRS320T3*** | 0.50 @ 3.0 A | 80 | 125 | 2 | 20 | **CASE 403A-03** (SMC) Cathode = Notch  |
| 30 | 3 | $T_L = 100°C$ | ***MBRS330T3*** | 0.50 @ 3.0 A | 80 | 125 | 2 | 20 | |
| 40 | 3 | $T_L = 100°C$ | ***MBRS340T3*** | 0.525 @ 3.0 A | 80 | 125 | 2 | 20 | |
| 60 | 3 | $T_L = 100°C$ | ***MBRS360T3*** | 0.74 @ 3.0 A | 80 | 125 | 0.5 | 20 | |
| 20 | 3 | $T_C = 125°C$ | ***MBRD320T4*** | 0.60 @ 3.0 A | 75 | 150 | 0.2 | 20 @ 125°C | **CASE 369A-13** (DPAK)   "CT" Suffix  Non-"CT" Suffix |
| 30 | 3 | $T_C = 125°C$ | ***MBRD330T4*** | 0.60 @ 3.0 A | 75 | 150 | 0.2 | 20 @ 125°C | |
| 40 | 3 | $T_C = 125°C$ | ***MBRD340T4*** | 0.60 @ 3.0 A | 75 | 150 | 0.2 | 20 @ 125°C | |
| 50 | 3 | $T_C = 125°C$ | ***MBRD350T4*** | 0.60 @ 3.0 A | 75 | 150 | 0.2 | 20 @ 125°C | |
| 60 | 3 | $T_C = 125°C$ | ***MBRD360T4*** | 0.60 @ 3.0 A | 75 | 150 | 0.2 | 20 @ 125°C | |
| 20 | 6 | $T_C = 130°C$ | ***MBRD620CTT4*** | 0.70 @ 3.0 A | 75 | 150 | 0.1 | 15 @ 125°C | |
| 30 | 6 | $T_C = 130°C$ | ***MBRD630CTT4*** | 0.70 @ 3.0 A | 75 | 150 | 0.1 | 15 @ 125°C | |
| 40 | 6 | $T_C = 130°C$ | ***MBRD640CTT4*** | 0.70 @ 3.0 A | 75 | 150 | 0.1 | 15 @ 125°C | |
| 50 | 6 | $T_C = 130°C$ | ***MBRD650CTT4*** | 0.70 @ 3.0 A | 75 | 150 | 0.1 | 15 @ 125°C | |
| 60 | 6 | $T_C = 130°C$ | ***MBRD660CTT4*** | 0.70 @ 3.0 A | 75 | 150 | 0.1 | 15 @ 125°C | |
| 35 | 8 | $T_C = 100°C$ | ***MBRD835L*** | 0.40 @ 3.0 A 0.51 @ 8.0 A | 100 | 125 | 1.4 | 35 | |
| 35 | 10 | $T_C = 90°C$ | ***MBRD1035CTL*** | 0.49 @ 10 A | 100 | 125 | 2 | 130 @ 125°C | |

## SCHOTTKY Rectifiers

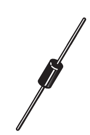
### Table 6.  Surface Mount Schottky Rectifiers (continued)

| $V_{RRM}$ (Volts) | $I_O$[1] (Amperes) | $I_O$ Rating Condition | Device | Max $V_F$ @ $i_F$ $T_C = 25°C$ (Volts) | $I_{FSM}$ (Amperes) | $T_J$ Max (°C) | Max $I_R$[2] $T_J = 25°C$ (mA) | Max $I_R$[3] (mA) | Package |
|---|---|---|---|---|---|---|---|---|---|
| 10 | 45 | $T_C = 135°C$ | ***MBRB1045★*** | 0.84 @ 20 A | 150 | 150 | 0.1 | 15 @ 125°C | CASE 418B-03 (D²PAK)   “CT” Suffix  Non-“CT” Suffix |
| 45 | 15 | $T_C = 105°C$ | ***MBRB1545CT*** | 0.84 @ 15 A | 150 | 150 | 0.1 | 15 @ 125°C | |
| 60 | 20 | $T_C = 110°C$ | ***MBRB2060CT*** | 0.95 @ 20 A | 150 | 150 | 0.15 | 150 @ 125°C | |
| 100 | 20 | $T_C = 110°C$ | ***MBRB20100CT*** | 0.85 @ 10 A<br>0.95 @ 20 A | 150 | 150 | 0.1 | 6 @ 125°C | |
| 200 | 20 | $T_C = 125°C$ | ***MBRB20200CT*** | 1.0 @ 20 A | 150 | 150 | 1 | 50 @ 125°C | |
| 15 | 25 | $T_C = 90°C$ | ***MBRB2515L*** | 0.45 @ 25 A | 150 | 100 | 15 | 200 @ 70°C | |
| 35 | 25 | $T_C = 110°C$ | ***MBRB2535CTL*** | 0.47 @ 12.5 A<br>0.55 @ 25 A | 150 | 125 | 10 | 500 @ 125°C | |
| 45 | 25 | $T_C = 130°C$ | ***MBRB2545CT*** | 0.82 @ 30 A | 150 | 150 | 0.2 | 40 @ 125°C | |
| 30 | 30 | $T_C = 115°C$ | ***MBRB3030CT*** | 0.54 @ 15 A<br>0.67 @ 30 A | 300 | 150 | 1.2 | 145 @ 150°C<br>46 @ 10 V, 150°C | |
| 30 | 30 | $T_C = 95°C$ | ***MBRB3030CTL*** | 0.45 @ 15 A<br>0.51 @ 30 A | 150 | 125 | 2 | 195 @ 125°C<br>75 @ 10 V, 125°C | |
| 30 | 40 | $T_C = 110°C$ | ***MBRB4030*** | 0.46 @ 20 A<br>0.55 @ 40 A | 300 | 150 | 1 | 150 @ 125°C | |

(1) $I_O$ is total device current capability.
(2) $V_{RRM}$ unless noted
(3) $V_{RRM}$, $T_J = 100°C$ unless noted
★New Product

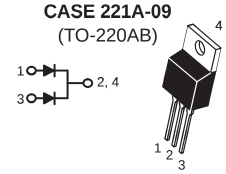
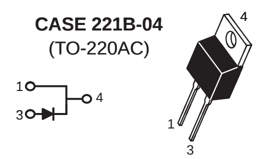
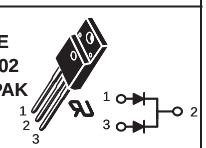
All devices listed are ON Semiconductor preferred devices

### Table 7.  Axial Lead Schottky Rectifiers

| $V_{RRM}$ (Volts) | $I_O$ (Amperes) | $I_O$ Rating Condition | Device | Max $V_F$ @ $i_F$ $T_C = 25°C$ (Volts) | $I_{FSM}$ (Amperes) | $T_J$ Max (°C) | Max $I_R$[2] $T_L = 25°C$ (mA) | Max $I_R$[3] $T_L$ (mA) | Package |
|---|---|---|---|---|---|---|---|---|---|
| 20 | 1 | $T_A = 55°C$<br>$R_{\theta JA} = 80°C/W$ | ***1N5817*** | 0.45 @ 1.0 A | 25 | 125 | 1 | 10 | **CASE 59–04 Plastic**  Cathode = Polarity Band |
| 30 | 1 | $T_A = 55°C$<br>$R_{\theta JA} = 80°C/W$ | ***1N5818*** | 0.55 @ 1.0 A | 25 | 125 | 1 | 10 | |
| 40 | 1 | $T_A = 55°C$<br>$R_{\theta JA} = 80°C/W$ | ***1N5819*** | 0.60 @ 1.0 A | 25 | 125 | 1 | 10 | |
| 50 | 1 | $T_A = 55°C$ | ***MBR150*** | 0.75 @ 1.0 A | 25 | 150 | 0.5 | 5 | |
| 60 | 1 | $T_A = 55°C$<br>$R_{\theta JA} = 80°C/W$ | ***MBR160*** | 0.75 @ 1.0 A | 25 | 150 | 0.5 | 5 | |
| 100 | 1 | $T_A = 120°C$<br>$R_{\theta JA} = 50°C/W$ | ***MBR1100*** | 0.79 @ 1.0 A | 50 | 150 | 0.5 | 5 | |
| 20 | 3 | $T_A = 76°C$<br>$R_{\theta JA} = 28°C/W$ | ***1N5820*** | 0.457 @ 3.0 A | 80 | 125 | 2 | 20 | **CASE 267-03 Plastic**  Cathode = Polarity Band |
| 30 | 3 | $T_A = 71°C$<br>$R_{\theta JA} = 28°C/W$ | ***1N5821*** | 0.500 @ 3.0 A | 80 | 125 | 2 | 20 | |
| 40 | 3 | $T_A = 61°C$<br>$R_{\theta JA} = 28°C/W$ | ***1N5822*** | 0.525 @ 3.0 A | 80 | 125 | 2 | 20 | |
| 40 | 3 | $T_A = 65°C$<br>$R_{\theta JA} = 28°C/W$ | ***MBR340*** | 0.600 @ 3.0 A | 80 | 150 | 0.6 | 20 | |
| 50 | 3 | $T_A = 65°C$ | ***MBR350RL*** | 0.600 @ 3.0 A | 80 | 150 | 0.6 | 20 | |
| 60 | 3 | $T_A = 65°C$<br>$R_{\theta JA} = 28°C/W$ | ***MBR360RL*** | 0.740 @ 3.0 A | 80 | 150 | 0.6 | 20 | |
| 100 | 3 | $T_A = 100°C$<br>$R_{\theta JA} = 28°C/W$ | ***MBR3100*** | 0.79 @ 3.0 A | 150 | 150 | 0.6 | 20 | |

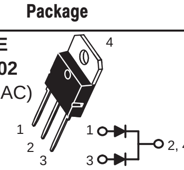
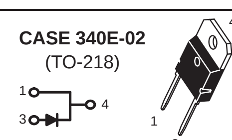
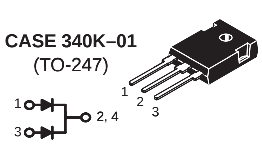
(2) $V_{RRM}$ unless noted
(3) $V_{RRM}$, $T_J = 100°C$ unless noted

**Table 8. TO-220 Thru–Hole Schottky Rectifiers**

| $V_{RRM}$ (Volts) | $I_O$ (Amperes) | $I_O$ Rating Condition | Device | Max $V_F$ @ $i_F$ $T_C$ = 25°C (Volts) | $I_{FSM}$ (Amperes) | $T_J$ Max (°C) | Max $I_R^{(2)}$ $T_C$ = 25°C (mA) | Max $I_R^{(3)}$ (mA) | Package |
|---|---|---|---|---|---|---|---|---|---|
| 35 | 15 | $T_C$ = 105°C | ***MBR1535CT*** | 0.84 @ 15 A | 150 | 150 | 0.1 | 15 @ 125°C | **CASE 221A-09** (TO-220AB)  |
| 45 | 15 | $T_C$ = 105°C | ***MBR1545CT*** | 0.84 @ 15 A | 150 | 150 | 0.1 | 15 @ 125°C | |
| 100 | 16 | $T_C$ = 133°C | ***MBR16100CT*** | 0.84 @ 16 A | 150 | 175 | 0.1 | 5 @ 125°C | |
| 30 | 20 | $T_C$ = 137°C | ***MBR2030CTL*** | 0.52 @ 10 A<br>0.58 @ 20 A | 150 | 150 | 5 | 40 | |
| 45 | 20 | $T_C$ = 135°C | ***MBR2045CT*** | 0.84 @ 20 A | 150 | 150 | 0.1 | 15 @ 125°C | |
| 60 | 20 | $T_C$ = 133°C | ***MBR2060CT*** | 0.85 @ 10 A<br>0.95 @ 20 A | 150 | 150 | 0.1 | 6 @ 125°C | |
| 80 | 20 | $T_C$ = 133°C | ***MBR2080CT*** | 0.95 @ 20 A | 150 | 150 | 0.1 | 6 @ 125°C | |
| 90 | 20 | $T_C$ = 133°C | ***MBR2090CT*** | 0.95 @ 20 A | 150 | 150 | 0.1 | 6 @ 125°C | |
| 100 | 20 | $T_C$ = 133°C | ***MBR20100CT*** | 0.85 @ 10 A<br>0.95 @ 20 A | 150 | 150 | 0.1 | 6 @ 125°C | |
| 200 | 20 | $T_C$ = 125°C | ***MBR20200CT*** | 1.0 @ 20 A | 150 | 150 | 1 | 50 @ 125°C | |
| 35 | 25 | $T_C$ = 95°C | ***MBR2535CTL*** | 0.55 @ 25 A | 150 | 125 | 5 | 500 @ 125°C | |
| 45 | 25 | $T_C$ = 130°C | ***MBR2545CT*** | 0.82 @ 30 A | 150 | 150 | 0.2 | 40 @ 125°C | |
| 45 | 30 | $T_C$ = 130°C | ***MBR3045ST*** | 0.76 @ 30 A | 150 | 150 | 0.2 | 40 @ 125°C | |
| 35 | 7.5 | $T_C$ = 105°C | ***MBR735*** | 0.84 @ 15 A | 150 | 150 | 0.1 | 15 @ 125°C | **CASE 221B-04** (TO-220AC)  |
| 45 | 7.5 | $T_C$ = 105°C | ***MBR745*** | 0.84 @ 15 A | 150 | 150 | 0.1 | 15 @ 125°C | |
| 35 | 10 | $T_C$ = 135°C | ***MBR1035*** | 0.84 @ 20 A | 150 | 150 | 0.1 | 15 @ 125°C | |
| 45 | 10 | $T_C$ = 135°C | ***MBR1045*** | 0.84 @ 20 A | 150 | 150 | 0.1 | 15 @ 125°C | |
| 60 | 10 | $T_C$ = 133°C | ***MBR1060*** | 0.80 @ 10 A | 150 | 150 | 0.1 | 6 @ 125°C | |
| 90 | 10 | $T_C$ = 133°C | ***MBR1090*** | 0.70 @ 10 A | 150 | 150 | 0.1 | 6 @ 125°C | |
| 100 | 10 | $T_C$ = 133°C | ***MBR10100*** | 0.80 @ 10 A | 150 | 150 | 0.1 | 6 @ 125°C | |
| 35 | 16 | $T_C$ = 125°C | ***MBR1635*** | 0.63 @ 16 A | 150 | 150 | 0.2 | 40 @ 125°C | |
| 45 | 16 | $T_C$ = 125°C | ***MBR1645*** | 0.63 @ 16 A | 150 | 150 | 0.2 | 40 @ 125°C | |
| 15 | 25 | $T_C$ = 90°C | ***MBR2515L*** | 0.45 @ 25 A | 150 | 100 | 15 | 200 @ 70°C | |
| 60 | 20 | $T_C$ = 133°C | ***MBRF2060CT*** | 0.95 @ 20 A | 150 | 150 | 0.15 | 15 @ 125°C | **CASE 221D-02 FULL PAK**  |
| 100 | 20 | $T_C$ = 133°C | ***MBRF20100CT*** | 0.95 @ 20 A | 150 | 150 | 0.15 | 15 @ 125°C | |
| 200 | 20 | $T_C$ = 125°C | ***MBRF20200CT*** | 1.0 @ 20 A | 150 | 150 | 1 | 50 @ 125°C | |
| 45 | 25 | $T_C$ = 125°C | ***MBRF2545CT*** | 0.82 @ 25 A | 150 | 150 | 0.2 | 40 @ 125°C | |

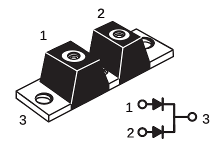
(2)$V_{RRM}$ unless noted
(3)$V_{RRM}$, $T_J$ = 100°C unless noted
Indicates UL Recognized – File #E69369

**Table 9. TO-218 and TO-247 Schottky Rectifiers**

| $V_{RRM}$ (Volts) | $I_O$ (Amperes) | $I_O$ Rating Condition | Device | Max $V_F$ @ $i_F$ $T_C$ = 25°C (Volts) | $I_{FSM}$ (Amperes) | $T_J$ Max (°C) | Max $I_R^{(2)}$ $T_C$ = 25°C (mA) | Max $I_R^{(3)}$ (mA) | Package |
|---|---|---|---|---|---|---|---|---|---|
| 45 | 30 | $T_C$ = 105°C | ***MBR3045PT*** | 0.76 @ 30 A | 200 | 150 | 1 | 100 @ 125°C | **CASE 340D-02** (TO-218AC)  |
| 45 | 40 | $T_C$ = 125°C | ***MBR4045PT*** | 0.70 @ 20 A<br>0.80 @ 40 A | 400 | 150 | 1 | 50 | |
| 45 | 60 | $T_C$ = 125°C | ***MBR6045PT*** | 0.62 @ 30 A<br>0.75 @ 60 A | 500 | 150 | 1 | 50 | |
| 25 | 50 | $T_C$ = 125°C | ***MBR5025L*** | 0.54 @ 30 A<br>0.62 @ 50 A | 300 | 150 | 0.5 | 60 | **CASE 340E-02** (TO-218)  |
| 45 | 30 | $T_C$ = 105°C | ***MBR3045WT*** | 0.76 @ 30 A | 200 | 150 | 1 | 100 @ 125°C | **CASE 340K–01** (TO-247)  |
| 15 | 40 | $T_C$ = 125°C | ***MBR4015LWT*** | 0.42 @ 20 A<br>0.50 @ 40 A | 400 | 100 | 5 | 150 @ 75°C | |
| 45 | 40 | $T_C$ = 125°C | ***MBR4045WT*** | 0.70 @ 20 A<br>0.80 @ 40 A | 400 | 150 | 1 | 50 | |
| 45 | 60 | $T_C$ = 125°C | ***MBR6045WT*** | 0.62 @ 30 A<br>0.75 @ 60 A | 500 | 150 | 1 | 50 | |

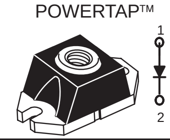
(2)$V_{RRM}$ unless noted
(3)$V_{RRM}$, $T_J$ = 100°C unless noted

**Table 10. POWERTAP II Schottky Rectifiers**

| $V_{RRM}$ (Volts) | $I_O^{(1)}$ (Amperes) | $I_O$ Rating Condition | Device | Max $V_F$ @ $i_F$ $T_C$ = 25°C (Volts) | $I_{FSM}$ (Amperes) | $T_J$ Max (°C) | Max $I_R$(2) $T_C$ = 25°C (mA) | Max $I_R^{(3)}$ (mA) | Package |
|---|---|---|---|---|---|---|---|---|---|
| 30 | 200 | $T_C$ = 125°C | ***MBRP20030CTL*** | 0.52 @ 100 A<br>0.60 @ 200 A | 1500 | 150 | 5 | – | **CASE 357C-03**<br>POWERTAP™<br><br>Cathode = Mounting Plate<br>Anode = Terminal |
| 30 | 400 | $T_C$ = 100°C | ***MBRP40030CTL***★ | 0.50 @ 200 A | 1500 | 150 | 20 | 1000 @ 100°C | |
| 35 | 600 | $T_C$ = 100°C | ***MBRP60035CTL*** | 0.57 @ 300 A | 4000 | 150 | 10 | 250 | |
| 45 | 200 | $T_C$ = 125°C | ***MBRP20045CT*** | 0.78 @ 100 A | 1500 | 150 | 0.5 | 50 @ 125°C | |
| 45 | 300 | $T_C$ = 120°C | ***MBRP30045CT*** | 0.70 @ 150 A<br>0.82 @ 300 A | 2500 | 150 | 0.8 | 75 @ 125°C | |
| 45 | 400 | $T_C$ = 100°C | ***MBRP40045CTL*** | 0.57 @ 200 A | 2500 | 150 | 10 | – | |
| 60 | 200 | $T_C$ = 125°C | ***MBRP20060CT*** | 0.800 @ 100 A | 1500 | 150 | 0.5 | 50 @ 125°C | |
| 60 | 300 | $T_C$ = 120°C | ***MBRP30060CT*** | 0.79 @ 150 A<br>0.89 @ 300 A | 2500 | 150 | 0.8 | 75 @ 125°C | |
| 100 | 400 | $T_C$ = 100°C | ***MBRP400100CTL*** | 0.83 @ 200 A | 2500 | 150 | 6 | – | |

(1)$I_O$ is total device current capability.
(2)$V_{RRM}$ unless noted
(3)$V_{RRM}$, $T_J$ = 100°C unless noted

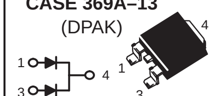
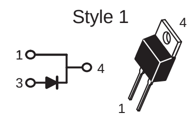
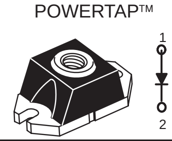
**Table 11. POWERTAP III Schottky Rectifiers**

| $V_{RRM}$ (Volts) | $I_O^{(1)}$ (Amperes) | $I_O$ Rating Condition | Device | Max $V_F$ @ $i_F$ $T_C$ = 25°C (Volts) | $I_{FSM}$ (Amperes) | $T_J$ Max (°C) | Max $I_R$(2) $T_C$ = 25°C (μA) | Max $I_R^{(3)}$ (μA) $T_J$ = 100°C | Package |
|---|---|---|---|---|---|---|---|---|---|
| 35 | 200 | $T_C$ = 100°C | ***MBRP20035L*** | 0.57 @ 200 A | 2000 | 150 | 10 | 250 | **CASE 357D-01**<br>POWERTAP™<br> |
| | 300 | $T_C$ = 100°C | ***MBRP30035L*** | 0.57 @ 300 A | 3000 | 150 | 10 | 250 | |

(1)$I_O$ is total device current capability. ★New Product
(2)$V_{RRM}$ unless noted
(3)$V_{RRM}$, $T_J$ = 100°C unless noted

## NEW UltraSoft Rectifiers

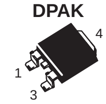
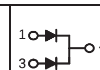
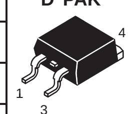
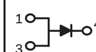
**Table 12. UltraSoft Rectifiers (For High Speed Rectification)**

| $V_{RRM}$ (Volts) | $I_O^{(1)}$ (Amperes) | $I_O$ Rating Condition | Device | Max $V_F$ @ $i_F$ $T_C$ = 29°C (Volts) | $t_{rr}$ (ηSec) | $T_J$ Max (°C) | Max $I_R$(2) $T_C$ = 25°C (μA) | Max $I_R^{(3)}$ (μA) $T_J$ = 150°C | Package |
|---|---|---|---|---|---|---|---|---|---|
| 200 | 6 | $T_C$ = 145°C | ***MSRD620CT***★ | 1.2 @ 6.0 A | 55 | 150 | 5 | 200 | **CASE 369A–13**<br>(DPAK)<br> |
| 600 | 8 | $T_C$ = 125°C | ***MSR860*** | 1.7 @ 8.0 A | 120 | 150 | 10 μA | 1000 | **CASE 221B–04**<br>Style 1<br> |
| 600 | 15 | $T_C$ = 125°C | ***MSR1560*** | 1.8 @ 15 A | 45 | 150 | 15 | 5000 | |
| 400 | 100 | $T_C$ = 100°C | ***MSRP10040***★ | 1.75 @ 100 A | 75 | 150 | 100 | 500 | **CASE 357D-01**<br>POWERTAP™<br> |

(1)$I_O$ is total device current capability. ★New Product
(2)$V_{RRM}$ unless noted
(3)$V_{RRM}$, $T_J$ = 150°C unless noted

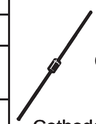
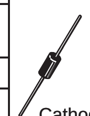
## Ultrafast Rectifiers

### Table 13. Surface Mount Ultrafast Rectifiers

| $V_{RRM}$ (Volts) | $I_O$[1] (Amperes) | $I_O$ Rating Condition | Device | Max $t_{rr}$ (ns) | Max $V_F$ @ $i_F$ $T_C$ = 25°C (Volts) | $I_{FSM}$ (Amperes) | $T_J$ Max (°C) | Max $I_R$[2] $T_J$ = 25°C (μA) | Max $I_R$[4] (μA) Package | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| 50 | 1 | $T_L$ = 155°C | ***MURS105T3*** | 35 | 0.875 @ 1.0 A | 40 | 175 | 2 | 50 | **SMB** Cathode = Polarity Band  |
| 100 | 1 | $T_L$ = 155°C | ***MURS110T3*** | 35 | 0.875 @ 1.0 A | 40 | 175 | 2 | 50 | |
| 150 | 1 | $T_L$ = 155°C | ***MURS115T3*** | 35 | 0.875 @ 1.0 A | 40 | 175 | 2 | 50 | |
| 200 | 1 | $T_L$ = 155°C | ***MURS120T3*** | 35 | 0.875 @ 1.0 A | 40 | 175 | 2 | 50 | |
| 400 | 1 | $T_L$ = 150°C | ***MURS140T3*** | 75 | 1.25 @ 1.0 A | 35 | 175 | 5 | 150 | |
| 600 | 1 | $T_L$ = 150°C | ***MURS160T3*** | 75 | 1.25 @ 1.0 A | 35 | 175 | 5 | 150 | |
| 200 | 2 | $T_C$ = 145°C | ***MURS220T3*** | 35 | 0.95 @ 2.0 A | 40 | 175 | 2 | 50 | |
| 300 | 2 | $T_C$ = 125°C | ***MURS230T3*** | 65 | 1.15 @ 2.0 A | 35 | 175 | 5 | 150 | |
| 400 | 2 | $T_C$ = 125°C | ***MURS240T3*** | 65 | 1.15 @ 2.0 A | 35 | 175 | 5 | 150 | |
| 600 | 2 | $T_C$ = 125°C | ***MURS260T3*** | 75 | 1.15 @ 2.0 A | 35 | 175 | 5 | 150 | |
| 400 | 3 | $T_L$ = 130°C | ***MURS320T3*** | 35 | 0.875 @ 3.0 A | 75 | 175 | 5 | 15 | **SMC** Cathode = Notch  |
| 400 | 3 | $T_L$ = 130°C | ***MURS340T3*** | 75 | 1.25 @ 3.0 A | 75 | 175 | 10 | 250 | |
| 600 | 3 | $T_L$ = 130°C | ***MURS360T3*** | 75 | 1.25 @ 3.0 A | 75 | 175 | 10 | 250 | |
| 200 | 6 | $T_L$ = 145°C | ***MURD620CT*** | 35 | 1.0 @ 3.0 A | 63 | 175 | 5 | 250 @ 125°C | **DPAK**   "CT" Suffix |
| 200 | 3 | $T_C$ = 158°C | ***MURD320*** | 35 | .95 @ 3.0 A | 75 | 175 | 5 | 500 @ 125°C | |
| 400 | 8 | $T_L$ = 120°C | ***MURHB840CT*** | 28 | 2.2 @ 4.0 A | 100 | 175 | 10 | 500 | **D²PAK**   Non-"CT" Suffix |
| 600 | 8 | $T_L$ = 120°C | ***MURHB860CT*** | 35 | 2.8 @ 4.0 A | 100 | 175 | 10 | 500 | |
| 200 | 16 | $T_L$ = 150°C | ***MURB1620CT*** | 35 | 0.975 @ 8.0 A | 100 | 175 | 5 | 250 | |
| 600 | 16 | $T_C$ = 150°C | ***MURB1660CT*** | 60 | 1.5 @ 8.0 A | 100 | 175 | 10 | 500 | |

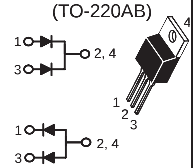
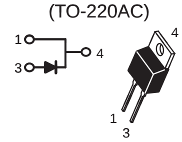
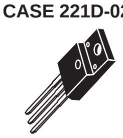
(1) $I_O$ is total device current capability.
(2) $V_{RRM}$ unless noted
(4) $V_{RRM}$, $T_J$ = 150°C unless noted
★New Product

**Table 14. Axial Lead Ultrafast Rectifiers**

| $V_{RRM}$ (Volts) | $I_O$ (Amperes) | $I_O$ Rating Condition | Device | Max $t_{rr}$ (ns) | Max $V_F$ @ $i_F$ $T_C$ = 25°C (Volts) | $I_{FSM}$ (Amperes) | $T_J$ Max (°C) | Max $I_R$(2) $T_J$ = 25°C (μA) | Max $I_R$(4) (μA) | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| 50 | 1 | $T_A$ = 130°C | ***MUR105*** | 35 | 0.875 @ 1.0 A | 35 | 175 | 2 | 50 |  **CASE 59-04**<br>Plastic<br>Cathode = Polarity Band |
| 100 | 1 | $T_A$ = 130°C | ***MUR110*** | 35 | 0.875 @ 1.0 A | 35 | 175 | 2 | 50 | |
| 150 | 1 | $T_A$ = 130°C | ***MUR115*** | 35 | 0.875 @ 1.0 A | 35 | 175 | 2 | 50 | |
| 200 | 1 | $T_A$ = 130°C<br>$R_{θJA}$ = 50°C/W | ***MUR120*** | 25 | 0.875 @ 1.0 A | 35 | 175 | 2 | 50 | |
| 300 | 1 | $T_A$ = 120°C | ***MUR130*** | 75 | 1.25 @ 1.0 A | 35 | 175 | 5 | 150 | |
| 400 | 1 | $T_A$ = 120°C | ***MUR140*** | 75 | 1.25 @ 1.0 A | 35 | 175 | 5 | 150 | |
| 600 | 1 | $T_A$ = 120°C<br>$R_{θJA}$ = 50°C/W | ***MUR160*** | 50 | 1.25 @ 1.0 A | 35 | 175 | 5 | 150 | |
| 800 | 1 | $T_A$ = 95°C | ***MUR180E*** | 100 | 1.75 @ 1.0 A | 35 | 175 | 10 | 600 | |
| 1000 | 1 | $T_A$ = 95°C<br>$R_{θJA}$ = 50°C/W | ***MUR1100E*** | 75 | 1.75 @ 1.0 A | 35 | 175 | 10 | 600 @ 100°C | |
| 200 | 2 | $T_A$ = 90°C | ***MUR220*** | 35 | 0.95 @ 2.0 A | 35 | 175 | 2 | 50 | |
| 400 | 2 | $T_A$ = 85°C | ***MUR240*** | 65 | 1.15 @ 2.0 A | 35 | 175 | 5 | 150 | |
| 600 | 2 | $T_A$ = 60°C | ***MUR260*** | 75 | 1.35 @ 2.0 A | 35 | 175 | 5 | 150 | |
| 1000 | 2 | $T_A$ = 35°C | ***MUR2100E*** | 100 | 2.2 @ 2.0 A | 35 | 175 | 10 | 600 | |
| 50 | 4 | $T_A$ = 80°C | ***MUR405*** | 35 | 0.89 @ 2.0 A | 125 | 175 | 5 | 150 |  **CASE 267-03**<br>Plastic<br>Cathode = Polarity Band |
| 100 | 4 | $T_A$ = 80°C | ***MUR410*** | 35 | 0.89 @ 2.0 A | 125 | 175 | 5 | 150 | |
| 150 | 4 | $T_A$ = 80°C | ***MUR415*** | 35 | 0.89 @ 2.0 A | 125 | 175 | 5 | 150 | |
| 200 | 4 | $T_A$ = 80°C<br>$R_{θJA}$ = 28°C/W | ***MUR420*** | 25 | 0.875 @ 3.0 A | 125 | 175 | 5 | 150 | |
| 400 | 4 | $T_A$ = 40°C | ***MUR440*** | 75 | | 75 | 175 | 10 | 250 | |
| 600 | 4 | $T_A$ = 40°C<br>$R_{θJA}$ = 28°C/W | ***MUR460*** | 50 | 1.25 @ 3.0 A | 70 | 175 | 10 | 250 | |
| 800 | 4 | $T_A$ = 35°C | ***MUR480E*** | 100 | 1.75 @ 3.0 A | 70 | 175 | 25 | 900 @ 100°C | |
| 1000 | 4 | $T_A$ = 35°C<br>$R_{θJA}$ = 28°C/W | ***MUR4100E*** | 75 | 1.75 @ 3.0 A | 70 | 175 | 25 | 900 @ 100°C | |

(2)$V_{RRM}$ unless noted
(4)$V_{RRM}$, $T_J$ = 150°C unless noted

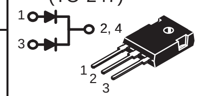
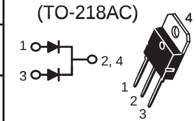
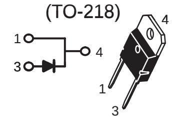
**Table 15. TO-220 Ultrafast and MEGAHERTZ™ Rectifiers**

| $V_{RRM}$ (Volts) | $I_O^{(1)}$ (Amperes) | $I_O$ Rating Condition | Device | Max $t_{rr}$ (ns) | Max $V_F$ @ $i_F$ $T_C$ = 25°C (Volts) | $I_{FSM}$ (Amperes) | $T_J$ Max (°C) | Max $I_R^{(2)}$ $T_C$ = 25°C (μA) | Max $I_R^{(4)}$ (μA) | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 6 | $T_C$ = 130°C | ***MUR620CT*** | 35 | 0.975 @ 3.0 A | 75 | 175 | 5 | 250 | **CASE 221A-09** (TO-220AB)  **MUR1620CTR Only** |
| 400 | 8 | $T_C$ = 120°C | ***MURH840CT*** | 28 | 2.0 @ 4.0 A | 100 | 175 | 10 | 500 | |
| 600 | 8 | $T_C$ = 120°C | ***MURH860CT*** | 35 | 2.8 @ 4.0 A | 100 | 175 | 10 | 500 | |
| 100 | 16 | $T_C$ = 150°C | ***MUR1610CT*** | 35 | 0.975 @ 8.0 A | 100 | 175 | 5 | 250 | |
| 150 | 16 | $T_C$ = 150°C | ***MUR1615CT*** | 35 | 0.975 @ 8.0 A | 100 | 175 | 5 | 250 | |
| 200 | 16 | $T_C$ = 150°C | ***MUR1620CT*** | 35 | 0.975 @ 8.0 A | 100 | 175 | 5 | 250 | |
| 200 | 16 | $T_C$ = 160°C | ***MUR1620CTR*** | 85 | 1.2 @ 8.0 A | 100 | 175 | 5 | 500 | |
| 400 | 16 | $T_C$ = 150°C | ***MUR1640CT*** | 60 | 1.30 @ 8.0 A | 100 | 175 | 10 | 250 | |
| 600 | 16 | $T_C$ = 150°C | ***MUR1660CT*** | 60 | 1.5 @ 8.0 A | 100 | 175 | 10 | 500 | |
| 50 | 8 | $T_C$ = 150°C | ***MUR805*** | 35 | 0.975 @ 8.0 A | 100 | 175 | 5 | 250 | **CASE 221B-04** (TO-220AC)  |
| 100 | 8 | $T_C$ = 150°C | ***MUR810*** | 35 | 0.975 @ 8.0 A | 100 | 175 | 5 | 250 | |
| 150 | 8 | $T_C$ = 150°C | ***MUR815*** | 35 | 0.975 @ 8.0 A | 100 | 175 | 5 | 250 | |
| 200 | 8 | $T_C$ = 150°C | ***MUR820*** | 35 | 0.975 @ 8.0 A | 100 | 175 | 5 | 250 | |
| 400 | 8 | $T_C$ = 150°C | ***MUR840*** | 50 | 1.30 @ 8.0 A | 100 | 175 | 10 | 500 | |
| 600 | 8 | $T_C$ = 150°C | ***MUR860*** | 50 | 1.50 @ 8.0 A | 100 | 175 | 10 | 500 | |
| 800 | 8 | $T_C$ = 175°C | ***MUR880E*** | 75 | 1.80 @ 8.0 A | 100 | 175 | 25 | 500 @ 100°C | |
| 100 | 15 | $T_C$ = 150°C | ***MUR1510*** | 35 | 1.05 @ 15 A | 200 | 175 | 10 | 500 | |
| 150 | 15 | $T_C$ = 150°C | ***MUR1515*** | 35 | 1.05 @ 15 A | 200 | 175 | 10 | 500 | |
| 200 | 15 | $T_C$ = 150°C | ***MUR1520*** | 35 | 1.05 @ 15 A | 200 | 175 | 10 | 500 | |
| 400 | 15 | $T_C$ = 150°C | ***MUR1540*** | 60 | 1.25 @ 15 A | 150 | 175 | 10 | 500 | |
| 600 | 15 | $T_C$ = 145°C | ***MUR1560*** | 60 | 1.50 @ 15 A | 150 | 175 | 10 | 1000 | |
| 200 | 20 | $T_C$ = 125°C | ***MUR2020R*** | 95 | 1.10 @ 20 A | 250 | 175 | 50 | 1000 | |
| 1000 | 8 | $T_C$ = 150°C | ***MUR8100E*** | 75 | 1.80 @ 8.0 A | 100 | 175 | 25 | 500 @ 100°C | |
| 1200 | 10 | $T_C$ = 125°C | ***MUR10120E*** | 175 | 2.2 @ 6.5 A | 100 | 125 | 100 | 1000 @ 125°C | |
| 1500 | 10 | $T_C$ = 125°C | ***MUR10150E*** | 175 | 2.4 @ 6.5 A | 100 | 125 | 100 | 1000 @ 125°C | |
| 1500 | 5 | $T_C$ = 100°C | ***MUR5150E*** | 175 | 2.4 @ 5 A | 100 | 125 | 50 | 500 @ 125°C | |
| 200 | 16 | $T_C$ = 150°C | ᴿᵁ ***MURF1620CT*** | 25 | 0.975 @ 8.0 A | 100 | 150 | 5 | 250 | **CASE 221D-02**  |
| 600 | 16 | $T_C$ = 150°C | ***MURF1660CT*** | 60 | 1.5 @ 8.0 A | 100 | 175 | 10 | 500 | |
| 600 | 8 | $T_C \leq$ 120°C | ***MURHF860CT*** ★ | 35 | 2.8 @ 4.0 A | 100 | 175 | 10 | 500 | |

[1] $I_O$ is total device capability
[2] $V_{RRM}$ unless noted
(4) $V_{RRM}$, $T_J$ = 150°C unless noted

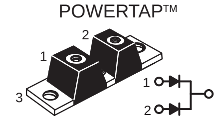
ᴿᵁ Indicates UL Recognized – File #E69369
★ New Product

**Table 16. TO-218 and TO-247 Ultrafast Rectifiers**

| $V_{RRM}$ (Volts) | $I_O$ (Amperes) | $I_O$ Rating Condition | Device | Max $t_{rr}$ (ns) | Max $V_F$ @ $i_F$ $T_C$ = 25°C (Volts) | $I_{FSM}$ (Amperes) | $T_J$ Max (°C) | Max $I_R$(2) $T_J$ = 25°C (μA) | Max $I_R$(4) (mA) | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 30 | $T_C$ = 145°C | ***MUR3020WT*** | 35 | 1.05 @ 15 A | 150 | 175 | 10 | 0.5 | **CASE 340K–01** (TO-247)  |
| 600 | 30 | $T_C$ = 145°C | ***MUR3060WT*** | 60 | 1.70 @ 15 A | 150 | 175 | 10 | 1 | |
| 200 | 30 | $T_C$ = 150°C | ***MUR3020PT*** | 35 | 1.12 @ 15 A | 200 | 175 | 10 | 0.5 | **CASE 340D-02** (TO-218AC)  |
| 400 | 30 | $T_C$ = 150°C | ***MUR3040PT*** | 60 | 1.12 @ 15 A | 150 | 175 | 10 | 0.5 | |
| 600 | 30 | $T_C$ = 145°C | ***MUR3060PT*** | 60 | 1.20 @ 15 A | 150 | 175 | 10 | 1 | |
| 400 | 30 | $T_C$ = 70°C | ***MUR3040*** | 100 | 1.5 @ 30 A | 300 | 175 | 35 | 6 @ 100°C | **CASE 340E-02** (TO-218)  |
| 800 | 30 | $T_C$ = 70°C | ***MUR3080*** | 110 | 1.90 @ 30 A | 300 | 175 | 100 | 5 @ 100°C | |
| 400 | 60 | $T_C$ = 70°C | ***MUR6040*** | 100 | 1.50 @ 60 A | 600 | 175 | 60 | 10 @ 100°C | |

(1)$I_O$ is total device capability
(2)$V_{RRM}$ unless noted
(4)$V_{RRM}$, $T_J$ = 150°C unless noted

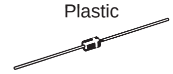
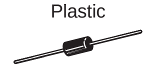
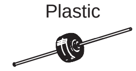
**Table 17. POWERTAP II Ultrafast Rectifiers**

| $V_{RRM}$ (Volts) | $I_O$(1) (Amperes) | $I_O$ Rating Condition | Device | Max $t_{rr}$ (ns) | Max $V_F$ @ $i_F$ $T_C$ = 25°C (Volts) | $I_{FSM}$ (Amperes) | $T_J$ Max (°C) | Max $I_R$(2) $T_J$ = 25°C (μA) | Max $I_R$(4) (mA) | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| 200 | 200 | $T_C$ = 130°C | ***MURP20020CT*** | 50 | 1.00 @ 100 A | 800 | 175 | 150 | 1 @ 125°C | **CASE 357C-03** POWERTAP™  Cathode = Mounting Plate Anode = Terminal |
| 400 | 200 | $T_C$ = 100°C | ***MURP20040CT*** | 50 | 1.30 @ 100 A | 800 | 175 | 50 | 0.5 @ 125°C | |

(1)$I_O$ is total device current capability.
(2)$V_{RRM}$ unless noted
(4)$V_{RRM}$, $T_J$ = 150°C unless noted
⋆ New Product

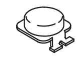
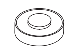
## Fast Recovery Rectifiers/General-Purpose Rectifiers

**Table 18. Fast Recovery Rectifiers/General Purpose Rectifiers**

| $V_{RRM}$ (Volts) | $I_O$ (Amperes) | $I_O$ Rating Condition | Device | Max $V_F$ @ $i_F$ $T_J$ = 25°C (Volts) | Max $t_{rr}$ (ns) | $I_{FSM}$ (Amperes) | $T_J$ Max (°C) | Max $I_R$[2] $T_J$ = 25°C (μA) | Max $I_R$[3] (μA) | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| 400 | 1.5 | $T_L$ = 118°C | *MRS1504T3* | 1.04 @ 1.5 A | – | 50 | 150 | 1 | 340 | **CASE 403A-03 SMB**  |
| 300 | 1 | $T_L$ = 150°C | *MRA4003T3* ⋆ | 1.1 @ 1.0 A | – | 30 | 175 | 10 | 50 | **CASE 403B-01 SMA**  Cathode = Notch |
| 400 | 1 | $T_L$ = 150°C | *MRA4004T3* ⋆ | 1.1 @ 1.0 A | – | 30 | 175 | 10 | 50 | |
| 600 | 1 | $T_L$ = 150°C | *MRA4005T3* ⋆ | 1.1 @ 1.0 A | – | 30 | 175 | 10 | 50 | |
| 800 | 1 | $T_L$ = 150°C | *MRA4006T3* ⋆ | 1.1 @ 1.0 A | – | 30 | 175 | 10 | 50 | |
| 1000 | 1 | $T_L$ = 150°C | *MRA4007T3* ⋆ | 1.1 @ 1.0 A | – | 30 | 175 | 10 | 50 | |
| 50 | 1 | $T_A$ = 75°C | *1N4001RL* | 1.1 @ 1.0 A | – | 30 | 150 | 10 | 50 | **CASE 59-03**[7] Plastic  Cathode = Polarity Band |
| 100 | 1 | $T_A$ = 75°C | *1N4002RL* | 1.1 @ 1.0 A | – | 30 | 150 | 10 | 50 | |
| 200 | 1 | $T_A$ = 75°C | *1N4003RL* | 1.1 @ 1.0 A | – | 30 | 150 | 10 | 50 | |
| 400 | 1 | $T_A$ = 75°C | *1N4004RL* | 1.1 @ 1.0 A | – | 30 | 150 | 10 | 50 | |
| 600 | 1 | $T_A$ = 75°C | *1N4005RL* | 1.1 @ 1.0 A | – | 30 | 150 | 10 | 50 | |
| 800 | 1 | $T_A$ = 75°C | *1N4006RL* | 1.1 @ 1.0 A | – | 30 | 150 | 10 | 50 | |
| 1000 | 1 | $T_A$ = 75°C | *1N4007RL* | 1.1 @ 1.0 A | – | 30 | 150 | 10 | 50 | |
| 50 | 1 | $T_A$ = 75°C | *1N4933RL* | 1.2 @ 1.0 A | 200 | 30 | 150 | 5 | 100 | |
| 100 | 1 | $T_A$ = 75°C | *1N4934RL* | 1.2 @ 1.0 A | 200 | 30 | 150 | 5 | 100 | |
| 200 | 1 | $T_A$ = 75°C | *1N4935RL* | 1.2 @ 1.0 A | 200 | 30 | 150 | 5 | 100 | |
| 400 | 1 | $T_A$ = 75°C | *1N4936RL* | 1.2 @ 1.0 A | 200 | 30 | 150 | 5 | 100 | |
| 600 | 1 | $T_A$ = 75°C | *1N4937RL* | 1.2 @ 1.0 A | 200 | 30 | 150 | 5 | 100 | |
| 50 | 3 | $T_L$ = 105°C | *1N5400RL* | 1.2 @ 9.4 A | – | 200 | 150 | 10 | 500 @ 150°C | **CASE 267-03** Plastic  Cathode = Polarity Band |
| 100 | 3 | $T_L$ = 105°C | *1N5401RL* | 1.2 @ 9.4 A | – | 200 | 150 | 10 | 500 @ 150°C | |
| 200 | 3 | $T_L$ = 105°C | *1N5402RL* | 1.2 @ 9.4 A | – | 200 | 150 | 10 | 500 @ 150°C | |
| 400 | 3 | $T_L$ = 105°C | *1N5404RL* | 1.2 @ 9.4 A | – | 200 | 150 | 10 | 500 @ 150°C | |
| 600 | 3 | $T_L$ = 105°C | *1N5406RL* | 1.2 @ 9.4 A | – | 200 | 150 | 10 | 500 @ 150°C | |
| 800 | 3 | $T_L$ = 105°C | *1N5407RL* | 1.2 @ 9.4 A | – | 200 | 150 | 10 | 500 @ 150°C | |
| 1000 | 3 | $T_L$ = 105°C | *1N5408RL* | 1.2 @ 9.4 A | – | 200 | 150 | 10 | 500 @ 150°C | |
| 200 | 3 | $T_A$ = 80°C[8] | *MR852RL* | 1.25 @ 3.0 A | 200 | 100 | 150 | 10 | 150 | |
| 400 | 3 | $T_A$ = 80°C[8] | *MR854RL* | 1.25 @ 3.0 A | 200 | 100 | 150 | 10 | 150 | |
| 600 | 3 | $T_A$ = 80°C[8] | *MR856RL* | 1.25 @ 3.0 A | 200 | 100 | 150 | 10 | 150 | |
| 50 | 6 | $T_A$ = 60°C $R_{\theta JA}$ = 25°C/W | *MR750RL* | 1.25 @ 100 A | – | 400 | 175 | 25 | 1000 | **CASE 194-04** Plastic  Cathode indicated by diode symbol |
| 100 | 6 | $T_A$ = 60°C $R_{\theta JA}$ = 25°C/W | *MR751RL* | 1.25 @ 100 A | – | 400 | 175 | 25 | 1000 | |
| 200 | 6 | $T_A$ = 60°C $R_{\theta JA}$ = 25°C/W | *MR752RL* | 1.25 @ 100 A | – | 400 | 175 | 25 | 1000 | |
| 400 | 6 | $T_A$ = 60°C $R_{\theta JA}$ = 25°C/W | *MR754RL* | 1.25 @ 100 A | – | 400 | 175 | 25 | 1000 | |
| 600 | 6 | $T_A$ = 60°C $R_{\theta JA}$ = 25°C/W | *MR756RL* | 1.25 @ 100 A | – | 400 | 175 | 25 | 1000 | |
| 1000 | 6 | $T_A$ = 60°C $R_{\theta JA}$ = 25°C/W | *MR760RL* | 1.25 @ 100 A | – | 400 | 175 | 25 | 1000 | |
| 200 | 25 | $T_C$ = 150°C | *MR2502* | 1.18 @ 78.5 A | – | 400 | 175 | 100 | 500 | **CASE 193-04** Plastic  Cathode = Polarity Band |
| 400 | 25 | $T_C$ = 150°C | *MR2504* | 1.18 @ 78.5 A | – | 400 | 175 | 100 | 500 | |
| 1000 | 25 | $T_C$ = 150°C | *MR2510* | 1.18 @ 78.5 A | – | 400 | 175 | 100 | 500 | |
| 250 | 32 | $T_C$ = 150°C | *TRA3225* | 1.15 @ 100 A | – | 500 | 175 | 10 | 250 | |
| 250 | 25 | $T_C$ = 150°C | *TRA2525* | 1.18 @ 100 A | – | 400 | 175 | 10 | 250 | |

(2) $V_{RRM}$ unless noted
(3) $V_{RRM}$, $T_J$ = 100°C unless noted
(7) Package Size: 0.120” max diameter by 0.260” length.
(8) Must be derated for reverse power dissipation. See data sheet.
(9) Overvoltage Transient Suppressor: 24–32 volts avalanche voltage.
⋆ New Product

### Table 19. Overvoltage Transient Suppressors

| $V_{RRM}$ (Volts) | $V_{BR}$[1] (Volts) | $V_{BR}$ (Volts) | $I_O$ (Amperes) | Device | Max $V_F$ $T_J = 25°C$ (Volts) | $I_{FSM}$ (Amperes) | $T_J$ Max (°C) | $I_{RSM}$ (Amperes) | Max $I_R$[7] (µA) | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| 23 | 24–32 | 40[4] | 6<br>$T_L = 125°C$ | ***MR2520L*** | 1.25<br>$I_F = 100A$ | 400 | 175 | 58[5] | 10 | **CASE 194–04**<br>Plastic<br><br>Cathode = Diode Symbol |
| 20 | 24–32 | 40[2] | 6<br>$T_C = 125°C$ | ***MR2535L*** | 1.1<br>$I_F = 100A$ | 400 | 175 | 62[5] | 0.2 | |
| 20 | 24–32 | 40[3] | 32<br>$T_C = 150°C$ | ***TRA2532*** | 1.18<br>$I_F = 100A$ | 500 | 175 | 80[5] | 10 | **CASE 193-04**<br>Plastic<br><br>Cathode = Polarity Band |
| 23 | 24–32 | 40[3] | 32<br>$T_C = 150°C$ | ***MR2835S*** | 1.1<br>$I_F = 100A$ | 400 | 175 | 62[5] | 5 @ 20 V | **CASE 460–02**<br>Top Can<br><br>Cathode = Terminal |
| 18 | 20–27 | 37[3]<br>35[4] | 32<br>$T_C = 185°C$ | ***MR3227N***<br>and<br>***MR3227P*** | 1.18<br>$I_F = 100A$ | 400 | 200 | 90[5]<br>40[6] | 1 @ 16 V | **CASE 193A–02**<br>Button Can<br><br>N = Anode to Case<br>P = Cathode to Case |
| 18 | 20–27 | 37[3]<br>35[4] | 40<br>$T_C = 185°C$ | ***MR4027N***<br>and<br>***MR4027P*** | 1.1<br>$I_F = 100A$ | 500 | 200 | 110[5]<br>50[6] | 1 @ 16 V | |
| 30 | 34–45 | 55[3]<br>53[4] | 40<br>$T_C = 185°C$ | ***MR4045N***<br>and<br>***MR4045P*** | 1.1<br>$I_F = 100A$ | 500 | 200 | 55[5]<br>25[6] | 1 @ 28 V | |

[1] At Ir = 100 mA, 25°C
[2] At Ir = 90 A, Tc = 150°C, PW = 80 µS
[3] At Ir = 80 A, Tc = 85°C, PW = 80 µS
[4] At Ir = 80 A, Tc = 25°C, PW = 80 µS
[5] Time Constant = 10 mS, 25°C
[6] Time Constant = 80 mS, 25°C
[7] At $V_{RRM}$, $T_j = 25°C$ unless noted

# CHAPTER 3
# Schottky Data Sheets

# MBR0520LT1, MBR0520LT3

**Preferred Devices**

# Surface Mount Schottky Power Rectifier

## Plastic SOD–123 Package

The Schottky Power Rectifier employs the Schottky Barrier principle with a barrier metal that produces optimal forward voltage drop–reverse current tradeoff. Ideally suited for low voltage, high frequency rectification, or as free wheeling and polarity protection diodes in surface mount applications where compact size and weight are critical to the system. This package provides an alternative to the leadless 34 MELF style package. These state–of–the–art devices have the following features:

- Guardring for Stress Protection
- Very Low Forward Voltage (0.38 V Max @ 0.5 A, 25°C)
- 125°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″
- Package Designed for Optimal Automated Board Assembly

**Mechanical Characteristics**

- Reel Options: MBR0520LT1 = 3,000 per 7″ reel/8 mm tape.
  MBR0520LT3 = 10,000 per 13″ reel/8 mm tape.
- Device Marking: B2
- Polarity Designator: Cathode Band
- Weight: 11.7 mg (approximately)
- Case: Epoxy, Molded
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 20 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_L$ = 90°C) | $I_{F(AV)}$ | 0.5 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 5.5 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +125 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +125 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 1000 | V/μs |

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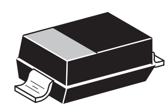
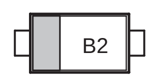
**SCHOTTKY BARRIER RECTIFIER 0.5 AMPERES 20 VOLTS**



**SOD–123**
**CASE 425**
**STYLE 1**

**MARKING DIAGRAM**




B2 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR0520LT1 | SOD–123 | 3000/Tape & Reel |
| MBR0520LT3 | SOD–123 | 10,000/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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## THERMAL CHARACTERISTICS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Ambient (Note 1.) | $R_{\theta JA}$ | 206 | °C/W |
| Thermal Resistance — Junction to Lead | $R_{\theta JL}$ | 150 | °C/W |

## ELECTRICAL CHARACTERISTICS

| | | | | |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.) | $v_F$ | $T_J$ = 25°C | $T_J$ = 100°C | Volts |
| ($i_F$ = 0.1 Amps)<br>($i_F$ = 0.5 Amps) | | 0.300<br>0.385 | 0.220<br>0.330 | |
| Maximum Instantaneous Reverse Current (Note 2.) | $I_R$ | $T_J$ = 25°C | $T_J$ = 100°C | mA |
| ($V_R$ = 10 V)<br>(Rated dc Voltage = 20 V) | | 75 µA<br>250 µA | 5 mA<br>8 mA | |

1. 1 inch square pad size (1 x 0.5 inch for each lead) on FR4 board.
2. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2%.

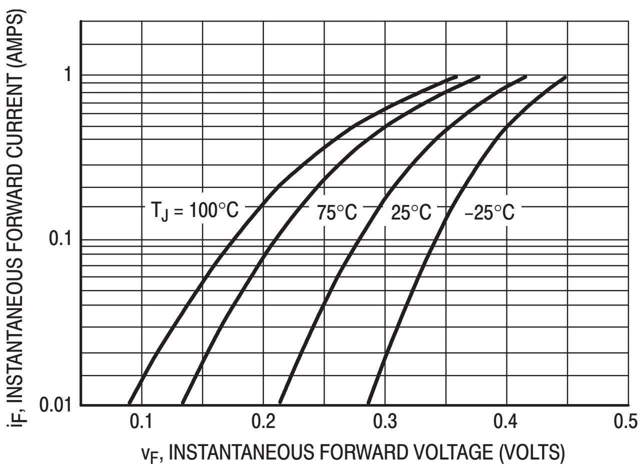


**Figure 1. Typical Forward Voltage**

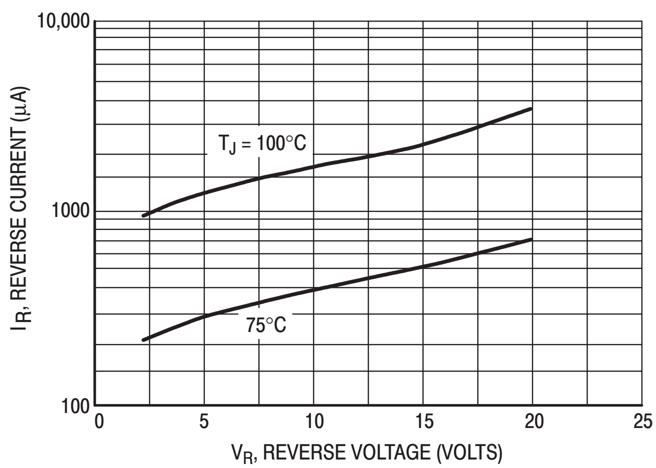


**Figure 2. Typical Reverse Current**

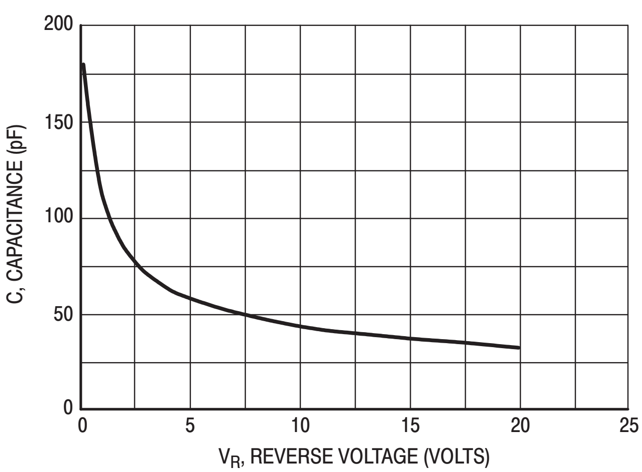


**Figure 3. Typical Capacitance**

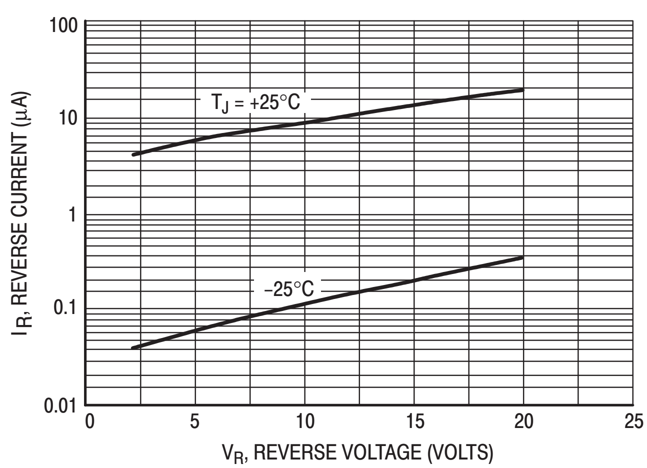


**Figure 4. Typical Reverse Current**

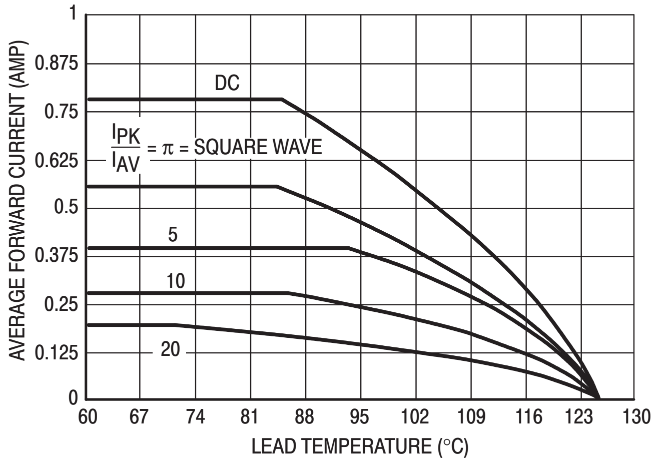


**Figure 5. Current Derating (Lead)**

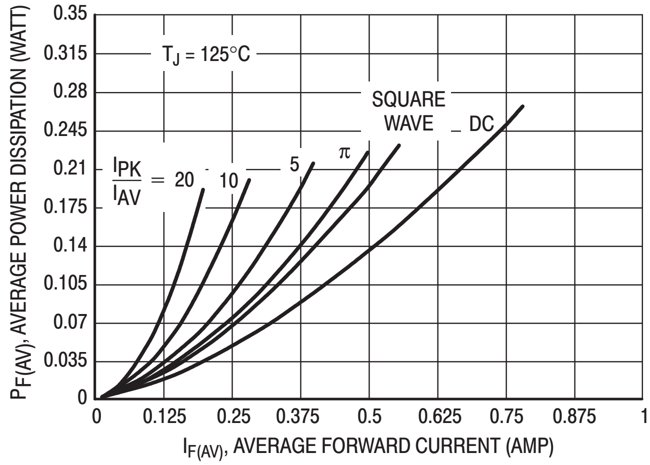


**Figure 6. Power Dissipation**

# MBR0530T1, MBR0530T3

**Preferred Devices**

# Surface Mount Schottky Power Rectifier

## Plastic SOD–123 Package

. . . using the Schottky Barrier principle with a large area metal–to–silicon power diode. Ideally suited for low voltage, high frequency rectification or as free wheeling and polarity protection diodes in surface mount applications where compact size and weight are critical to the system. This package also provides an easy to work with alternative to leadless 34 package style. These state–of–the–art devices have the following features:

- Guardring for Stress Protection
- Low Forward Voltage
- 125°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″
- Package Designed for Optimal Automated Board Assembly

**Mechanical Characteristics**

- Reel Options: MBR0530T1 = 3,000 per 7″ reel/8 mm tape
  MBR0530T3 = 10,000 per 13″ reel/8 mm tape
- Device Marking: B3
- Polarity Designator: Cathode Band
- Weight: 11.7 mg (approximately)
- Case: Epoxy, Molded
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 30 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_L$ = 100°C) | $I_{F(AV)}$ | 0.5 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 5.5 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +125 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +125 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 1000 | V/µs |

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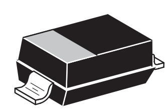
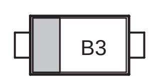
**SCHOTTKY BARRIER RECTIFIER 0.5 AMPERES 30 VOLTS**



**SOD–123**
**CASE 425**
**STYLE 1**

**MARKING DIAGRAM**




B3 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR0530T1 | SOD–123 | 3000/Tape & Reel |
| MBR0530T3 | SOD–123 | 10,000/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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### THERMAL CHARACTERISTICS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Ambient (Note 1.) | $R_{\theta JA}$ | 206 | °C/W |
| Thermal Resistance — Junction to Lead | $R_{\theta JL}$ | 150 | °C/W |

### ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.)<br>($i_F$ = 0.1 Amps, $T_J$ = 25°C)<br>($i_F$ = 0.5 Amps, $T_J$ = 25°C) | $v_F$ | <br>0.375<br>0.43 | Volts |
| Maximum Instantaneous Reverse Current (Note 2.)<br>(Rated dc Voltage, $T_C$ = 25°C)<br>($V_R$ = 15 V, $T_C$ = 25°C) | $I_R$ | <br>130<br>20 | μA |

1. 1 inch square pad size (1 x 0.5 inch for each lead) on FR4 board.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2%.

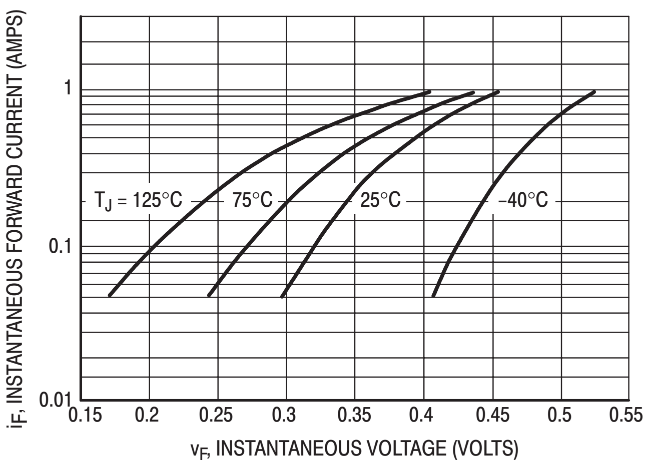


**Figure 1. Typical Forward Voltage**

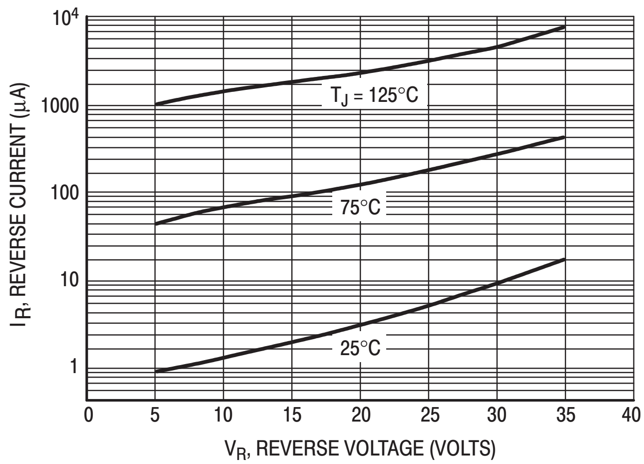


**Figure 2. Typical Reverse Current**

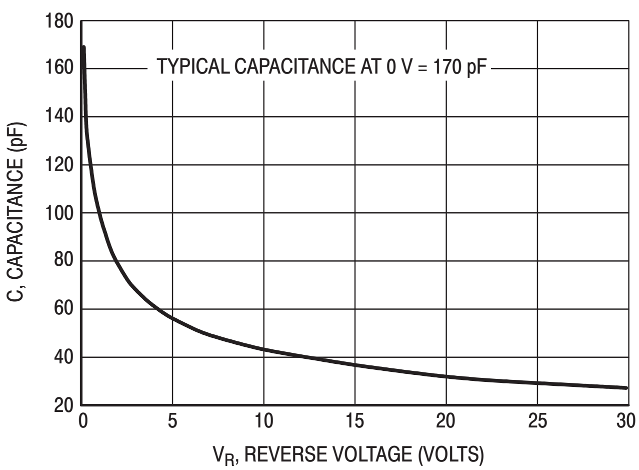


**Figure 3. Typical Capacitance**

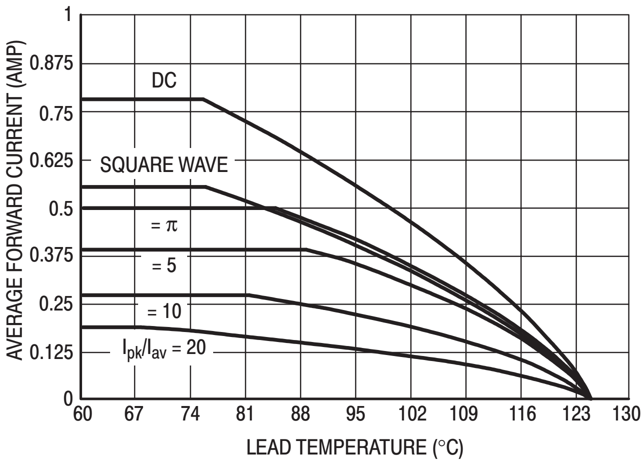


**Figure 4. Current Derating (Lead)**

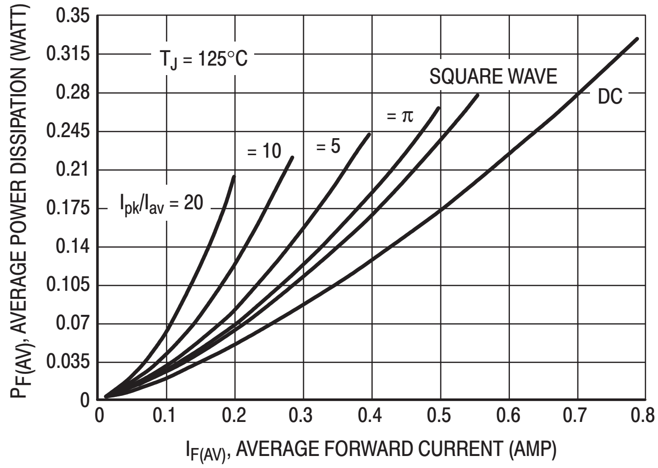


**Figure 5. Power Dissipation**

# MBR0540T1, MBR0540T3

## Surface Mount Schottky Power Rectifier

### SOD–123 Power Surface Mount Package

The Schottky Power Rectifier employs the Schottky Barrier principle with a barrier metal that produces optimal forward voltage drop–reverse current tradeoff. Ideally suited for low voltage, high frequency rectification, or as a free wheeling and polarity protection diodes in surface mount applications where compact size and weight are critical to the system. This package provides an alternative to the leadless 34 MELF style package. These state–of–the–art devices have the following features:

- Guardring for Stress Protection
- Very Low Forward Voltage
- Epoxy Meets UL94, VO at 1/8″
- Package Designed for Optimal Automated Board Assembly

**Mechanical Characteristics:**

- Reel Options: 3,000 per 7 inch reel/8 mm tape
- Reel Options: 10,000 per 13 inch reel/8 mm tape
- Device Marking: B4
- Polarity Designator: Cathode Band
- Weight: 11.7 mg (approximately)
- Case: Epoxy Molded
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C max. for 10 Seconds

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 40 | V |
| Average Rectified Forward Current (At Rated $V_R$, $T_C$ = 115°C) | $I_O$ | 0.5 | A |
| Peak Repetitive Forward Current (At Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 115°C) | $I_{FRM}$ | 1.0 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 5.5 | A |
| Storage/Operating Case Temperature Range | $T_{stg}$, $T_C$ | –55 to +150 | °C |
| Operating Junction Temperature | $T_J$ | –55 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$, $T_J$ = 25°C) | dv/dt | 1000 | V/μs |

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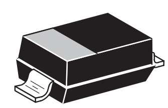
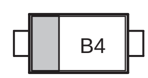
**SCHOTTKY BARRIER RECTIFIER**
**0.5 AMPERES**
**40 VOLTS**



**SOD–123**
**CASE 425**
**STYLE 1**

**MARKING DIAGRAM**




B4 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR0540T1 | SOD–123 | 3000/Tape & Reel |
| MBR0540T3 | SOD–123 | 10,000/Tape & Reel |

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### THERMAL CHARACTERISTICS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance – Junction–to–Lead (Note 1.)<br>Thermal Resistance – Junction–to–Ambient (Note 2.) | $R_{tjl}$<br>$R_{tja}$ | 118<br>206 | °C/W |

### ELECTRICAL CHARACTERISTICS

| | | | | |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 3.) | $v_F$ | $T_J$ = 25°C | $T_J$ = 100°C | V |
| ($i_F$ = 0.5 A)<br>($i_F$ = 1 A) | | 0.51<br>0.62 | 0.46<br>0.61 | |
| Maximum Instantaneous Reverse Current (Note 3.) | $I_R$ | $T_J$ = 25°C | $T_J$ = 100°C | μA |
| ($V_R$ = 40 V)<br>($V_R$ = 20 V) | | 20<br>10 | 13,000<br>5,000 | |

1. Mounted with minimum recommended pad size, PC Board FR4.
2. 1 inch square pad size (1 X 0.5 inch for each lead) on FR4 board.
3. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2.0%.

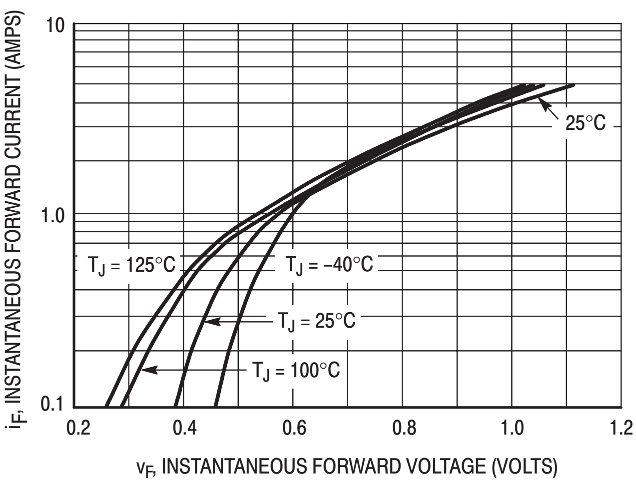


Figure 1. Typical Forward Voltage

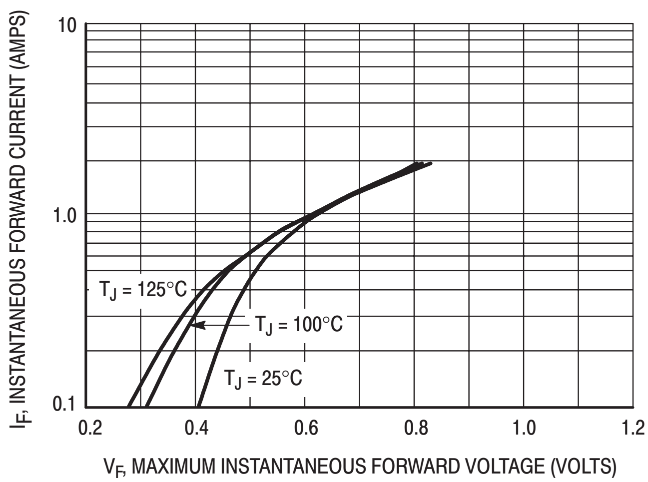


Figure 2. Maximum Forward Voltage

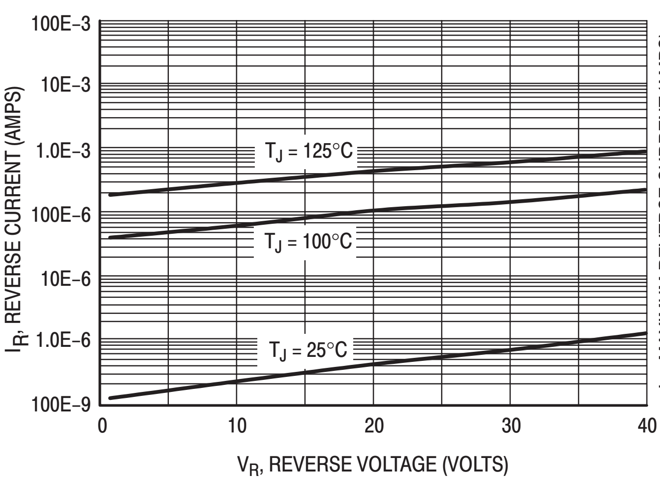


Figure 3. Typical Reverse Current

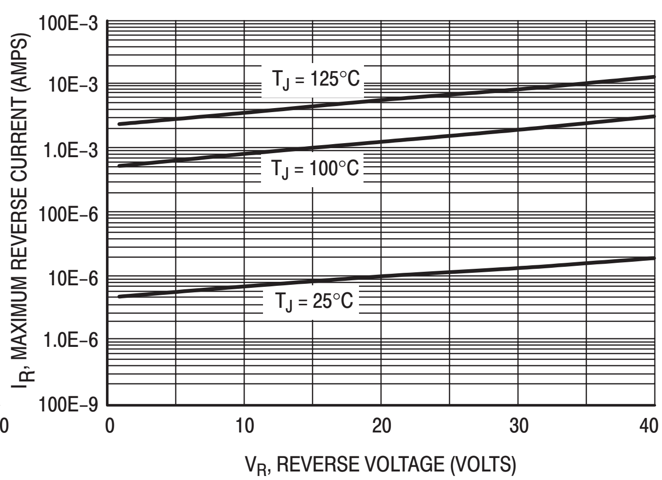


Figure 4. Maximum Reverse Current

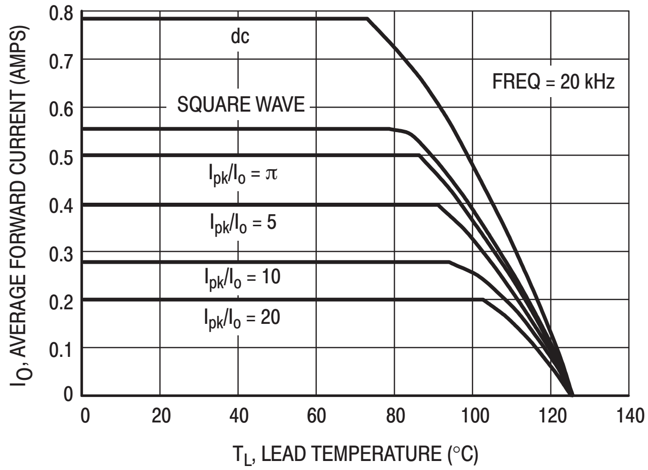


**Figure 5. Current Derating**

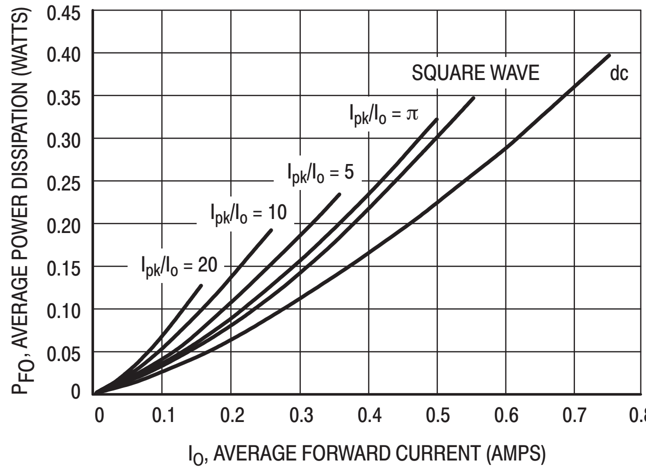


**Figure 6. Forward Power Dissipation**

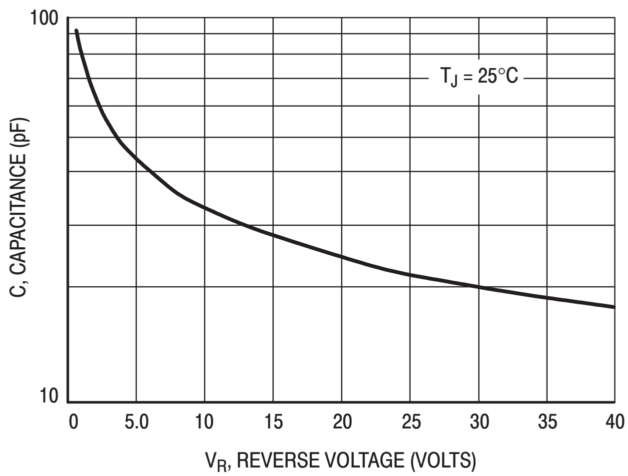


**Figure 7. Capacitance**

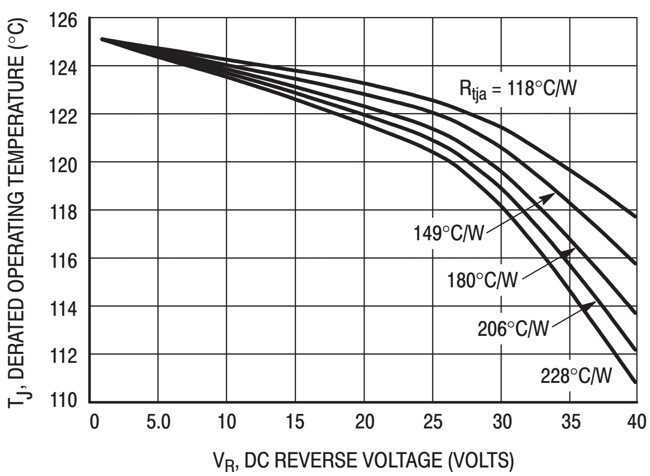


**Figure 8. Typical Operating Temperature Derating***

* Reverse power dissipation and the possibility of thermal runaway must be considered when operating this device under any reverse voltage conditions. Calculations of $T_J$ therefore must include forward and reverse power effects. The allowable operating $T_J$ may be calculated from the equation: $T_J = T_{Jmax} - r(t)(Pf + Pr)$ where

r(t) = thermal impedance under given conditions,
Pf = forward power dissipation, and
Pr = reverse power dissipation

This graph displays the derated allowable $T_J$ due to reverse bias under DC conditions only and is calculated as $T_J = T_{Jmax} - r(t)Pr$, where r(t) = Rthja. For other power applications further calculations must be performed.

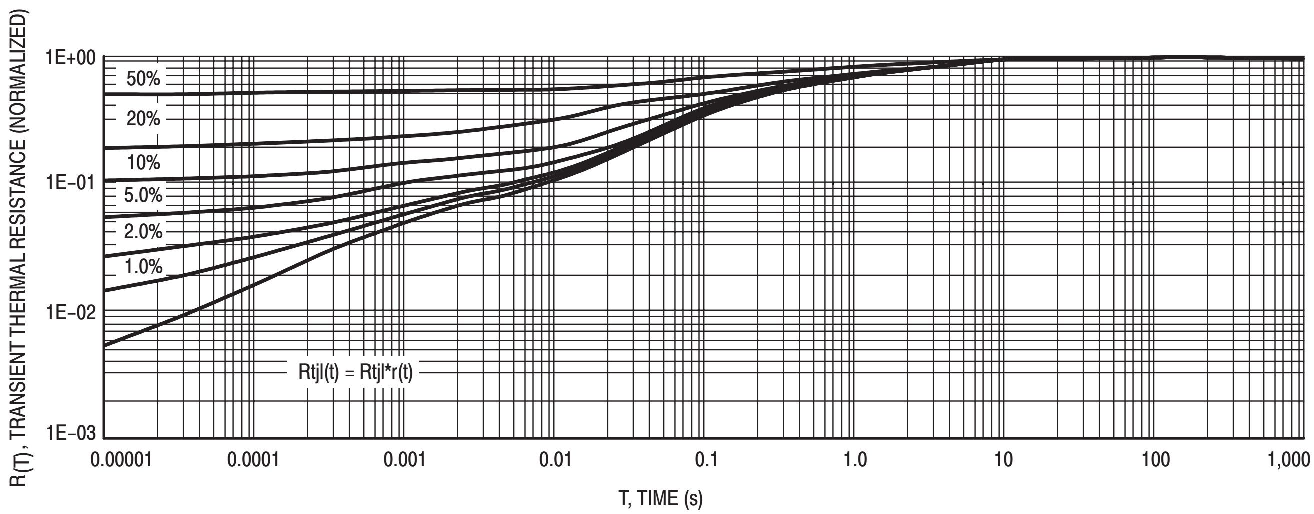


**Figure 9. Thermal Response Junction to Lead**

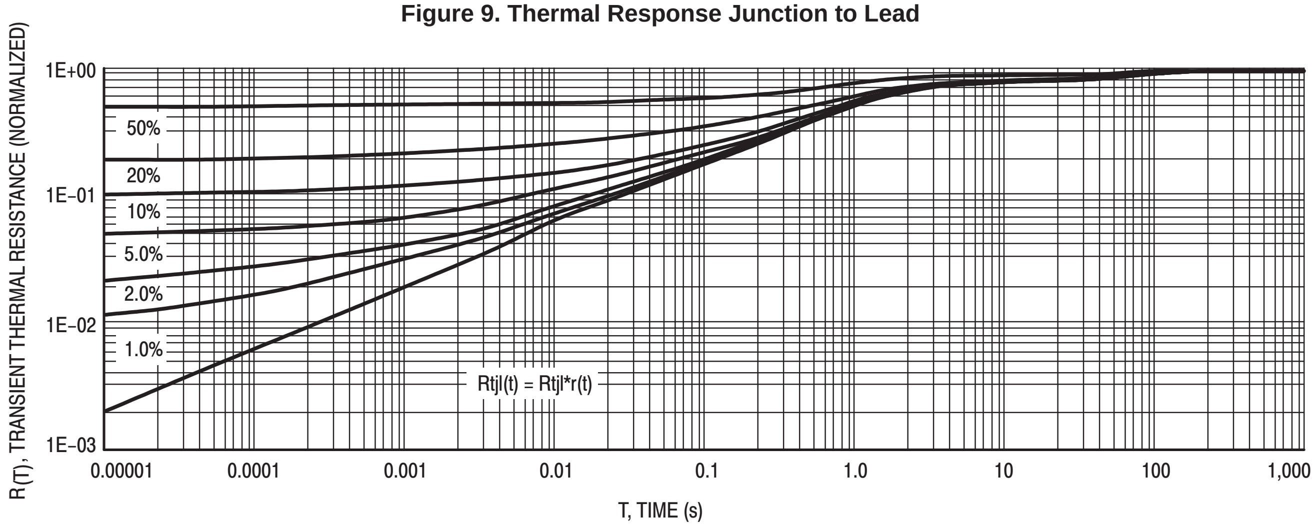


**Figure 10. Thermal Response Junction to Ambient**

# MBRM120ET3

# Surface Mount Schottky Power Rectifier

## POWERMITE®
## Power Surface Mount Package

The Schottky Powermite employs the Schottky Barrier principle with a barrier metal and epitaxial construction that produces optimal forward voltage drop–reverse current tradeoff. The advanced packaging techniques provide for a highly efficient micro miniature, space saving surface mount Rectifier. With its unique heatsink design, the Powermite has the same thermal performance as the SMA while being 50% smaller in footprint area, and delivering one of the lowest height profiles, < 1.1 mm in the industry. Because of its small size, it is ideal for use in portable and battery powered products such as cellular and cordless phones, chargers, notebook computers, printers, PDAs and PCMCIA cards. Typical applications are ac/dc and dc–dc converters, reverse battery protection, and “Oring” of multiple supply voltages and any other application where performance and size are critical.

**Features:**

- Low Profile — Maximum Height of 1.1 mm
- Small Footprint — Footprint Area of 8.45 mm2
- Low $V_F$ Provides Higher Efficiency and Extends Battery Life
- Supplied in 12 mm Tape and Reel — 12,000 Units per Reel
- Low Thermal Resistance with Direct Thermal Path of Die on Exposed Cathode Heat Sink

**Mechanical Characteristics:**

- Powermite is JEDEC Registered as D0–216AA
- Case: Molded Epoxy
- Epoxy Meets UL94, VO at 1/8″
- Weight: 62 mg (approximately)
- Device Marking: BCV
- Lead and Mounting Surface Temperature for Soldering Purposes. 260°C Maximum for 10 Seconds

**MAXIMUM RATINGS**

| Please See the Table on the Following Page |
|---|

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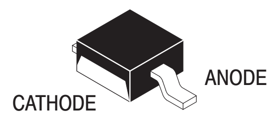
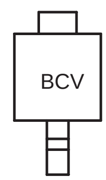
**SCHOTTKY BARRIER RECTIFIER**
**1.0 AMPERES**
**20 VOLTS**




**POWERMITE**
**CASE 457**
**PLASTIC**

**MARKING DIAGRAM**




BCV = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRM120ET3 | POWERMITE | 12,000/Tape & Reel |

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## MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 20 | V |
| Average Rectified Forward Current (At Rated $V_R$, $T_C$ = 130°C) | $I_O$ | 1.0 | A |
| Peak Repetitive Forward Current<br>(At Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 135°C) | $I_{FRM}$ | 2.0 | A |
| Non–Repetitive Peak Surge Current<br>(Non–Repetitive peak surge current, halfwave, single phase, 60 Hz) | $I_{FSM}$ | 50 | A |
| Storage Temperature | $T_{stg}$ | –65 to 150 | °C |
| Operating Junction Temperature | $T_J$ | –65 to 150 | °C |
| Voltage Rate of Change (Rated $V_R$, $T_J$ = 25°C) | dv/dt | 10,000 | V/μs |

## THERMAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Thermal Resistance – Junction–to–Lead (Anode) (Note 1.)<br>Thermal Resistance – Junction–to–Tab (Cathode) (Note 1.)<br>Thermal Resistance – Junction–to–Ambient (Note 1.) | $R_{tjl}$<br>$R_{tjtab}$<br>$R_{tja}$ | 35<br>23<br>277 | °C/W |

1. Mounted with minimum recommended pad size, PC Board FR4, See Figures 9 and 10.

## ELECTRICAL CHARACTERISTICS

| | | | | |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.), See Figure 2 | $V_F$ | **$T_J$ = 25°C** | **$T_J$ = 100°C** | V |
| ($I_F$ = 0.1 A)<br>($I_F$ = 1.0 A)<br>($I_F$ = 2.0 A) | | 0.455<br>0.530<br>0.595 | 0.360<br>0.455<br>0.540 | |
| Maximum Instantaneous Reverse Current (Note 2.), See Figure 4 | $I_R$ | **$T_J$ = 25°C** | **$T_J$ = 100°C** | μA |
| ($V_R$ = 20 V)<br>($V_R$ = 10 V)<br>($V_R$ = 5.0 V) | | 10<br>1.0<br>0.5 | 1600<br>500<br>300 | |

2. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2%.

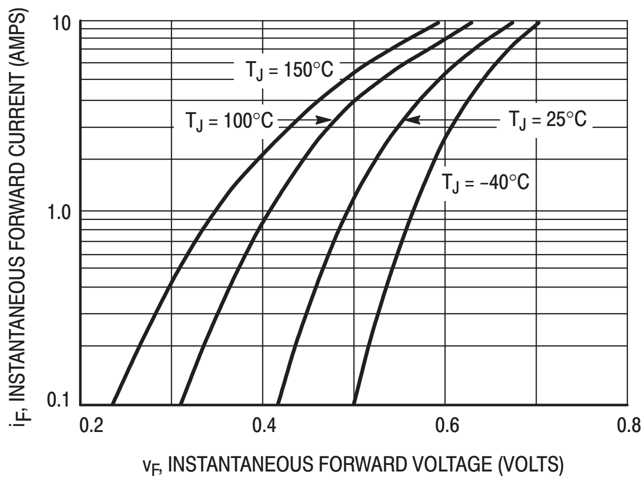



Figure 1. Typical Forward Voltage

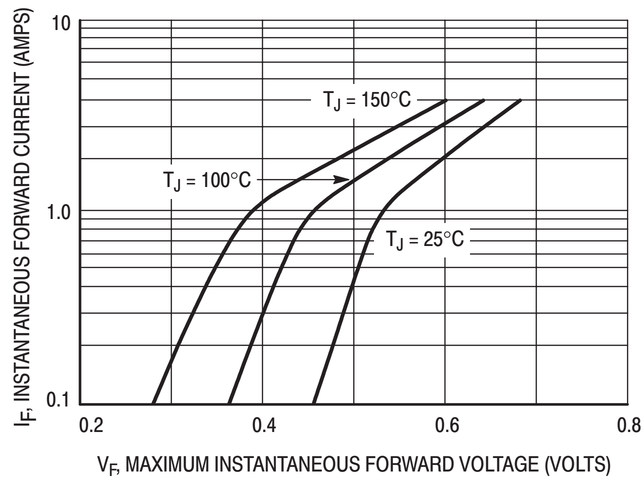



Figure 2. Maximum Forward Voltage

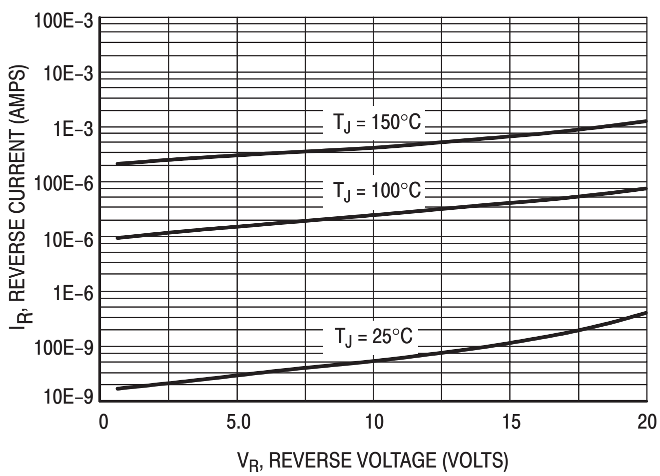



Figure 3. Typical Reverse Current

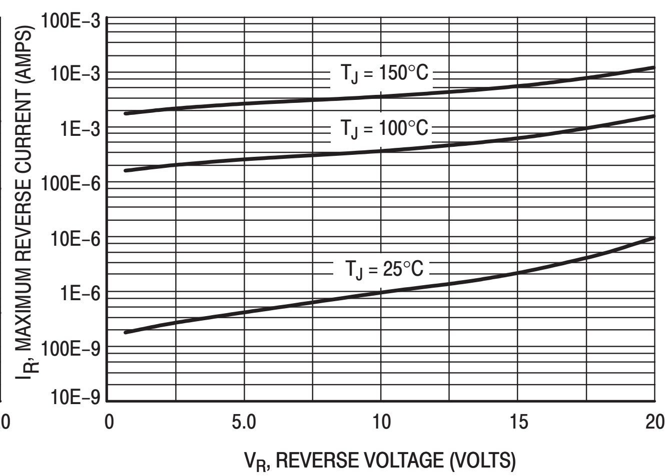



Figure 4. Maximum Reverse Current

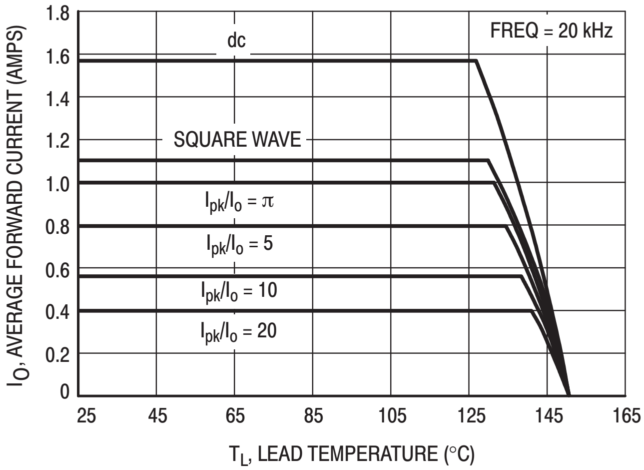



**Figure 5. Current Derating**

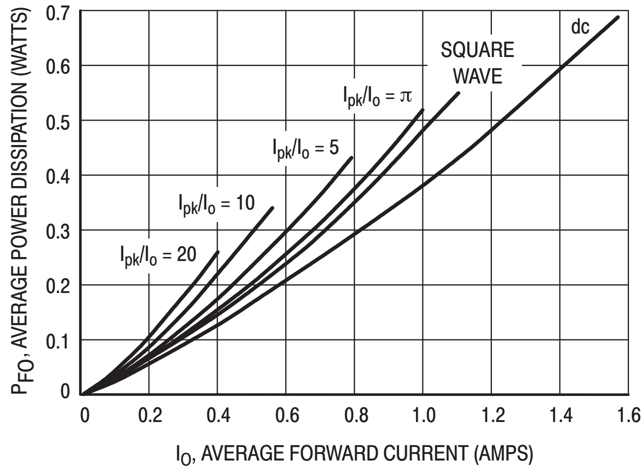



**Figure 6. Forward Power Dissipation**

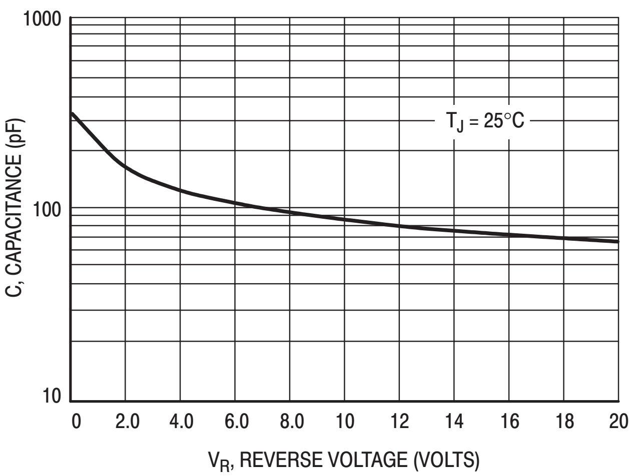



**Figure 7. Capacitance**

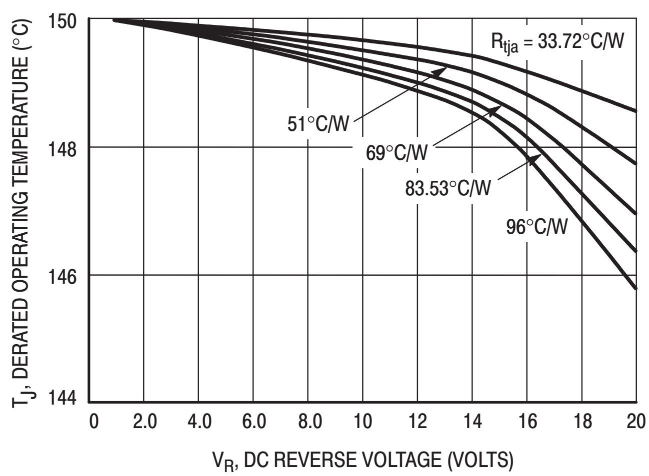



**Figure 8. Typical Operating Temperature Derating***

* Reverse power dissipation and the possibility of thermal runaway must be considered when operating this device under any reverse voltage conditions. Calculations of $T_J$ therefore must include forward and reverse power effects. The allowable operating $T_J$ may be calculated from the equation: $T_J = T_{Jmax} - r(t)(Pf + Pr)$ where
r(t) = thermal impedance under given conditions,
Pf = forward power dissipation, and
Pr = reverse power dissipation

This graph displays the derated allowable $T_J$ due to reverse bias under DC conditions only and is calculated as $T_J = T_{Jmax} - r(t)Pr$, where r(t) = Rthja. For other power applications further calculations must be performed.

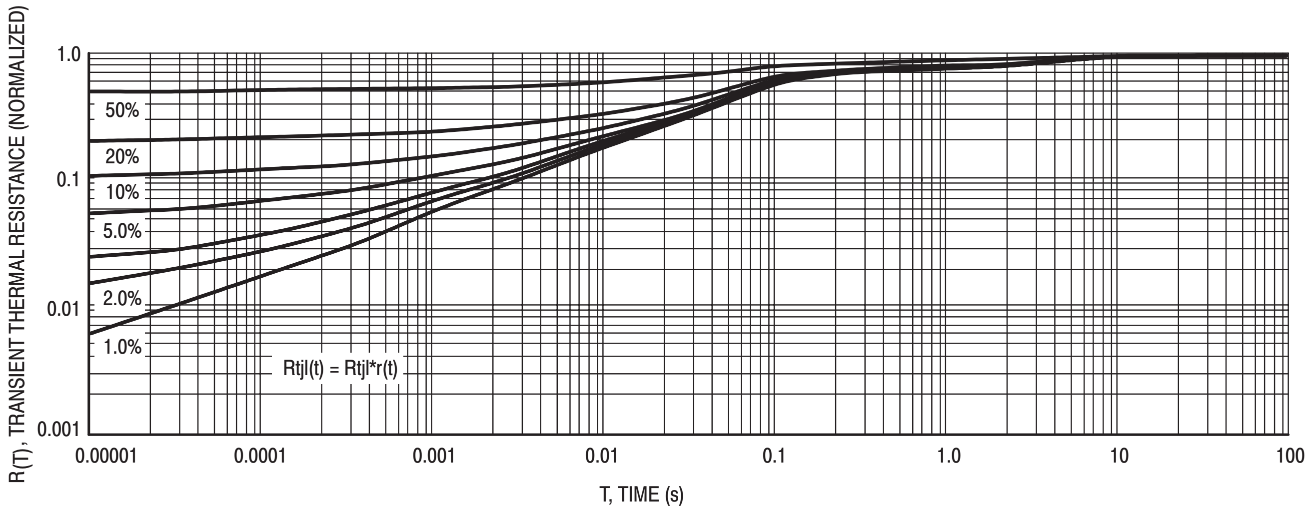



**Figure 9. Thermal Response Junction to Lead**

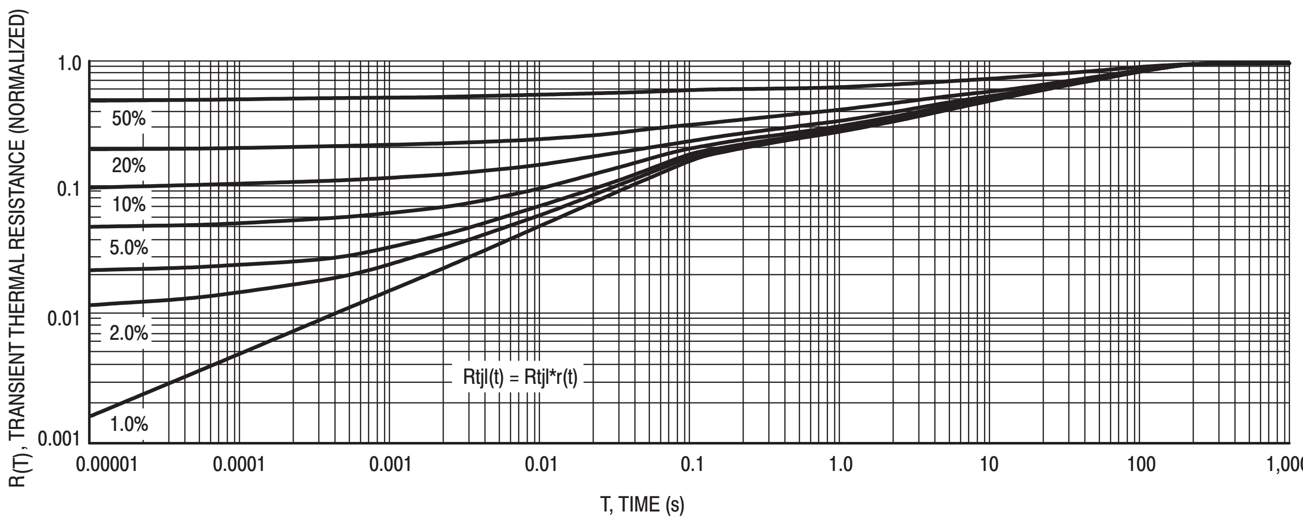



**Figure 10. Thermal Response Junction to Ambient**

# MBRM120LT3

# Surface Mount Schottky Power Rectifier

## POWERMITE®
## Power Surface Mount Package

The Schottky Powermite employs the Schottky Barrier principle with a barrier metal and epitaxial construction that produces optimal forward voltage drop–reverse current tradeoff. The advanced packaging techniques provide for a highly efficient micro miniature, space saving surface mount Rectifier. With its unique heatsink design, the Powermite has the same thermal performance as the SMA while being 50% smaller in footprint area, and delivering one of the lowest height profiles, < 1.1 mm in the industry. Because of its small size, it is ideal for use in portable and battery powered products such as cellular and cordless phones, chargers, notebook computers, printers, PDAs and PCMCIA cards. Typical applications are ac/dc and dc–dc converters, reverse battery protection, and “Oring” of multiple supply voltages and any other application where performance and size are critical.

**Features:**
- Low Profile — Maximum Height of 1.1 mm
- Small Footprint — Footprint Area of 8.45 mm2
- Low $V_F$ Provides Higher Efficiency and Extends Battery Life
- Supplied in 12 mm Tape and Reel — 12,000 Units per Reel
- Low Thermal Resistance with Direct Thermal Path of Die on Exposed Cathode Heat Sink

**Mechanical Characteristics:**
- Powermite is JEDEC Registered as D0–216AA
- Case: Molded Epoxy
- Epoxy Meets UL94, VO at 1/8″
- Weight: 62 mg (approximately)
- Device Marking: BCF
- Lead and Mounting Surface Temperature for Soldering Purposes. 260°C Maximum for 10 Seconds

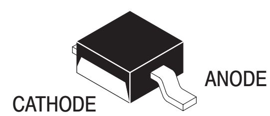
**MAXIMUM RATINGS**

| |
|---|
| Please See the Table on the Following Page |

**ON Semiconductor™**

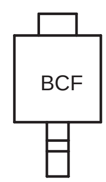
**http://onsemi.com**

**SCHOTTKY BARRIER RECTIFIER**
**1.0 AMPERES**
**20 VOLTS**




**POWERMITE**
**CASE 457**
**PLASTIC**

**MARKING DIAGRAM**




BCF = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRM120LT3 | POWERMITE | 12,000/Tape & Reel |

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## MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 20 | V |
| Average Rectified Forward Current (At Rated $V_R$, $T_C$ = 135°C) | $I_O$ | 1.0 | A |
| Peak Repetitive Forward Current (At Rated $V_R$, Square Wave, 100 kHz, $T_C$ = 135°C) | $I_{FRM}$ | 2.0 | A |
| Non–Repetitive Peak Surge Current (Non–Repetitive peak surge current, halfwave, single phase, 60 Hz) | $I_{FSM}$ | 50 | A |
| Storage Temperature | $T_{stg}$ | –55 to 150 | °C |
| Operating Junction Temperature | $T_J$ | –55 to 125 | °C |
| Voltage Rate of Change (Rated $V_R$, $T_J$ = 25°C) | dv/dt | 10,000 | V/µs |

## THERMAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Thermal Resistance – Junction–to–Lead (Anode) (Note 1.)<br>Thermal Resistance – Junction–to–Tab (Cathode) (Note 1.)<br>Thermal Resistance – Junction–to–Ambient (Note 1.) | $R_{tjl}$<br>$R_{tjtab}$<br>$R_{tja}$ | 35<br>23<br>277 | °C/W |

1. Mounted with minimum recommended pad size, PC Board FR4, See Figures 9 & 10.

## ELECTRICAL CHARACTERISTICS

| | | | | |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.), See Figure 2 | $V_F$ | **$T_J$ = 25°C** | **$T_J$ = 85°C** | V |
| ($I_F$ = 0.1 A)<br>($I_F$ = 1.0 A)<br>($I_F$ = 3.0 A) | | 0.34<br>0.45<br>0.65 | 0.26<br>0.415<br>0.67 | |
| Maximum Instantaneous Reverse Current (Note 2.), See Figure 4 | $I_R$ | **$T_J$ = 25°C** | **$T_J$ = 85°C** | mA |
| ($V_R$ = 20 V)<br>($V_R$ = 10 V) | | 0.40<br>0.10 | 25<br>18 | |

2. Pulse Test: Pulse Width ≤ 250 µs, Duty Cycle ≤ 2%.

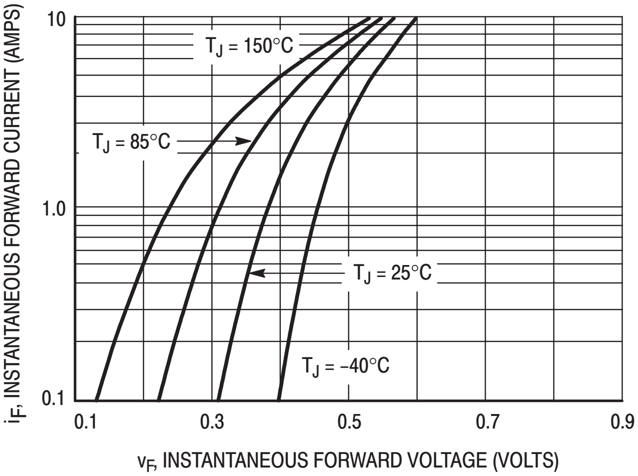



**Figure 1. Typical Forward Voltage**

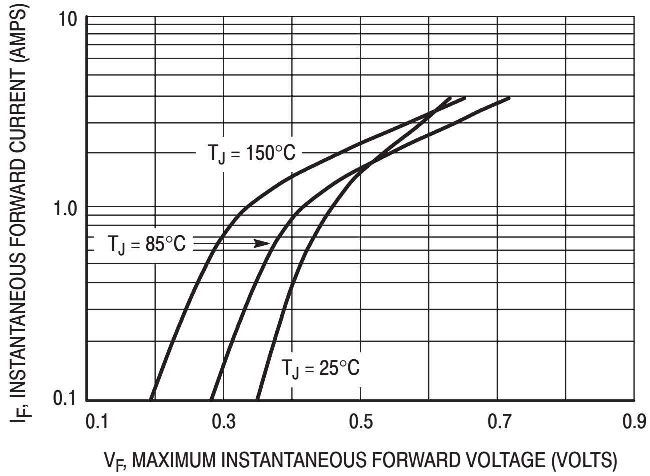



**Figure 2. Maximum Forward Voltage**

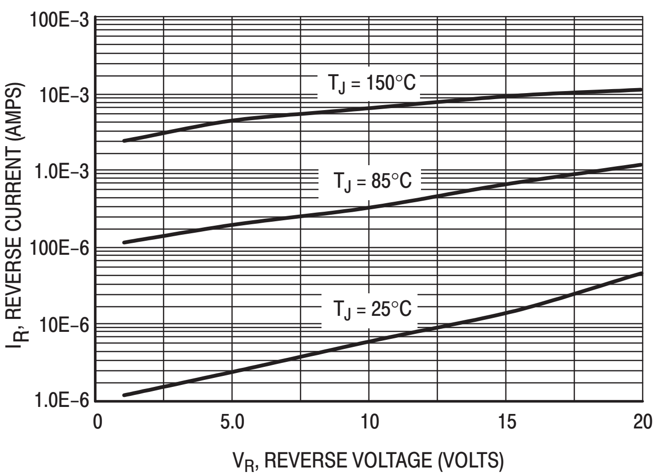



**Figure 3. Typical Reverse Current**

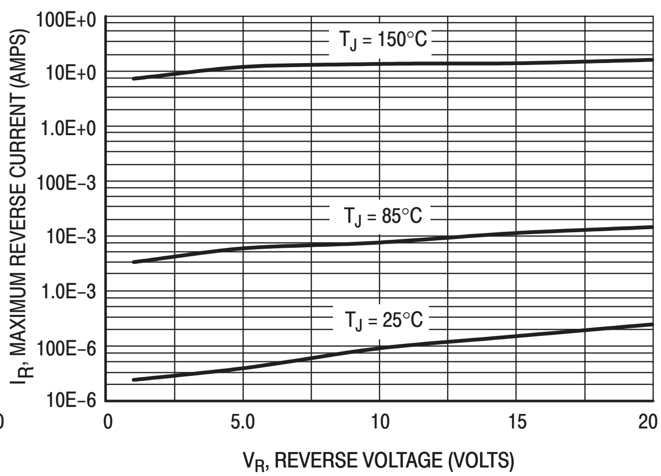



**Figure 4. Maximum Reverse Current**

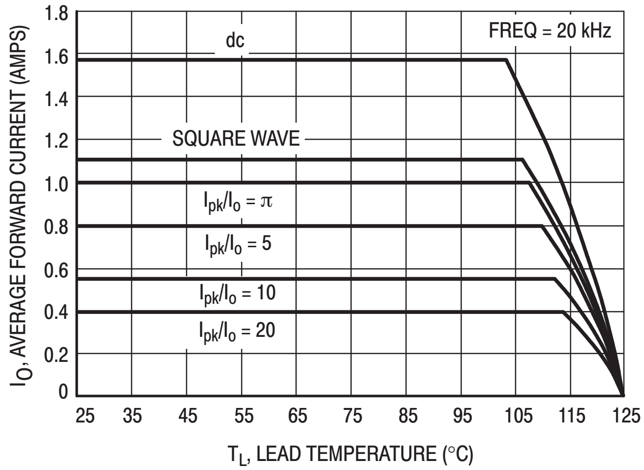



**Figure 5. Current Derating**

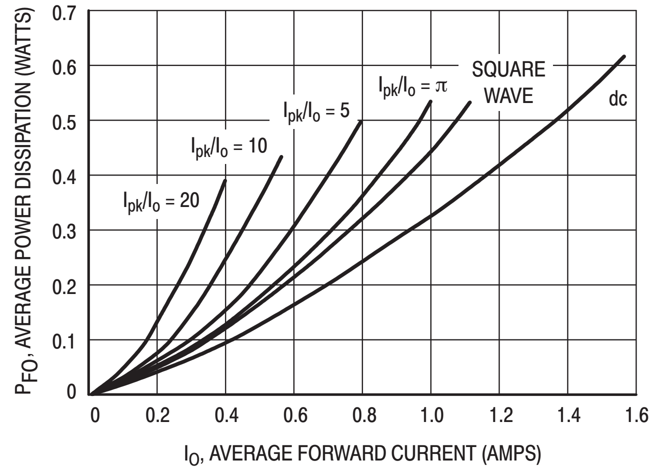



**Figure 6. Forward Power Dissipation**

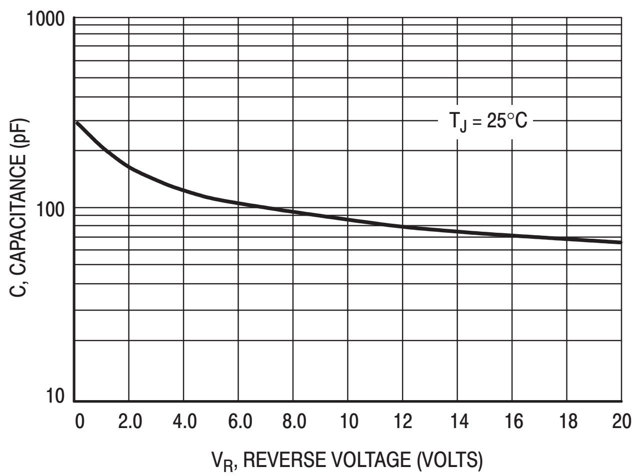



**Figure 7. Capacitance**

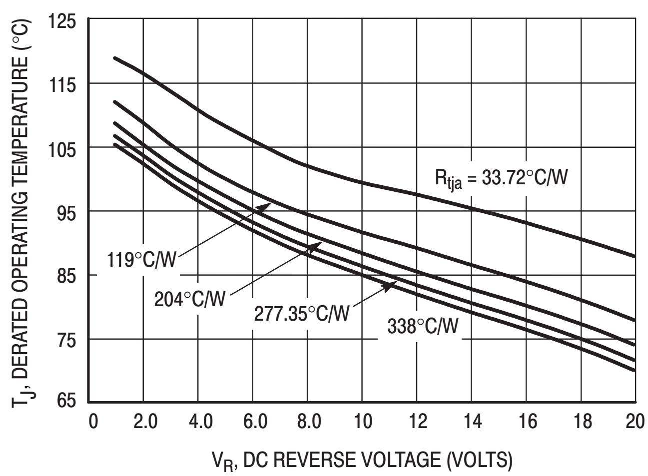



**Figure 8. Typical Operating Temperature Derating***

* Reverse power dissipation and the possibility of thermal runaway must be considered when operating this device under any reverse voltage conditions. Calculations of $T_J$ therefore must include forward and reverse power effects. The allowable operating $T_J$ may be calculated from the equation: $T_J = T_{Jmax} - r(t)(Pf + Pr)$ where
r(t) = thermal impedance under given conditions,
Pf = forward power dissipation, and
Pr = reverse power dissipation

This graph displays the derated allowable $T_J$ due to reverse bias under DC conditions only and is calculated as $T_J = T_{Jmax} - r(t)Pr$, where r(t) = Rthja. For other power applications further calculations must be performed.

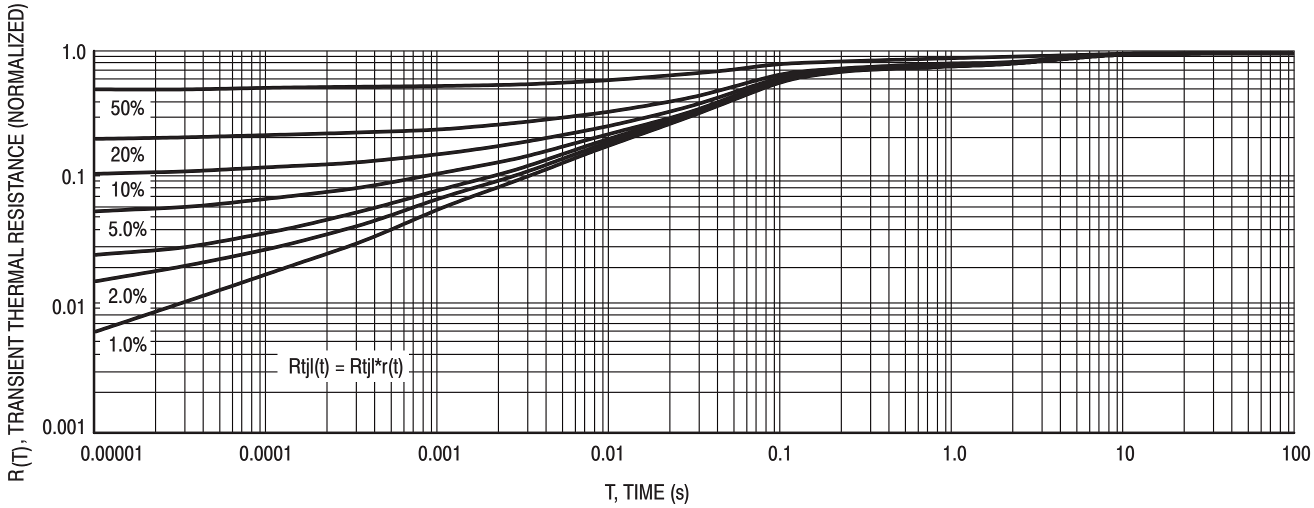



**Figure 9. Thermal Response Junction to Lead**

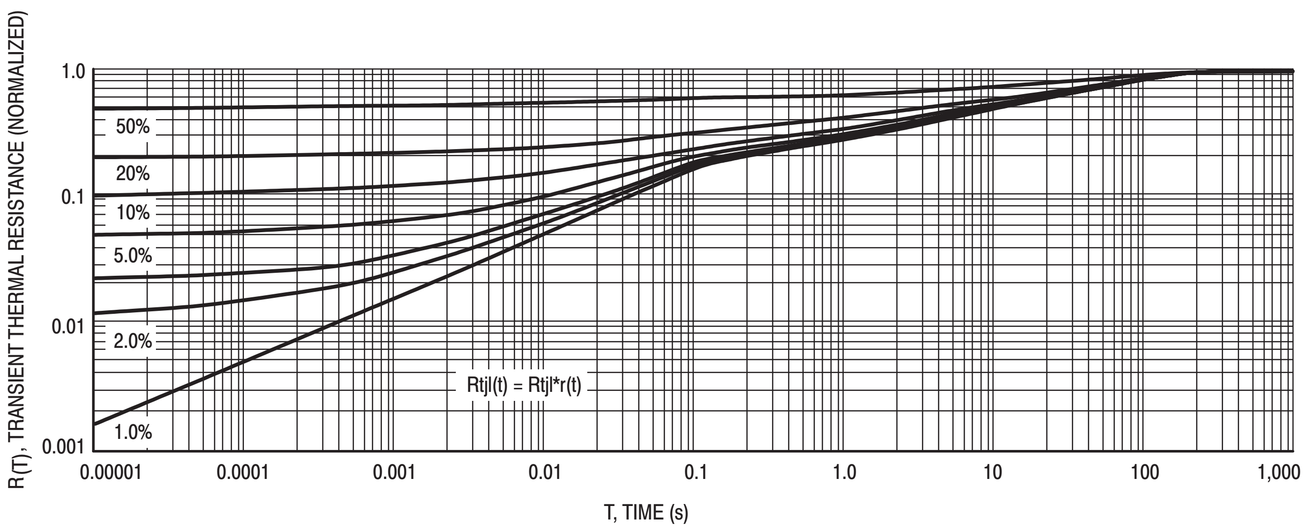



**Figure 10. Thermal Response Junction to Ambient**

# MBRM130LT3

# Surface Mount Schottky Power Rectifier

## POWERMITE®
## Power Surface Mount Package

The Schottky Powermite employs the Schottky Barrier principle with a barrier metal and epitaxial construction that produces optimal forward voltage drop–reverse current tradeoff. The advanced packaging techniques provide for a highly efficient micro miniature, space saving surface mount Rectifier. With its unique heatsink design, the Powermite has the same thermal performance as the SMA while being 50% smaller in footprint area, and delivering one of the lowest height profiles, < 1.1 mm in the industry. Because of its small size, it is ideal for use in portable and battery powered products such as cellular and cordless phones, chargers, notebook computers, printers, PDAs and PCMCIA cards. Typical applications are ac/dc and dc–dc converters, reverse battery protection, and "Oring" of multiple supply voltages and any other application where performance and size are critical.

**Features:**

- Low Profile — Maximum Height of 1.1 mm
- Small Footprint — Footprint Area of 8.45 mm2
- Low $V_F$ Provides Higher Efficiency and Extends Battery Life
- Supplied in 12 mm Tape and Reel — 12,000 Units per Reel
- Low Thermal Resistance with Direct Thermal Path of Die on Exposed Cathode Heat Sink

**Mechanical Characteristics:**

- Powermite is JEDEC Registered as D0–216AA
- Case: Molded Epoxy
- Epoxy Meets UL94, VO at 1/8″
- Weight: 62 mg (approximately)
- Device Marking: BCG
- Lead and Mounting Surface Temperature for Soldering Purposes. 260°C Maximum for 10 Seconds

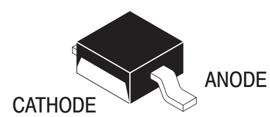
**MAXIMUM RATINGS**

| |
|---|
| Please See the Table on the Following Page |

ON Semiconductor™

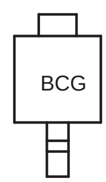
http://onsemi.com

**SCHOTTKY BARRIER RECTIFIER**
**1.0 AMPERES**
**30 VOLTS**




**POWERMITE**
**CASE 457**
**PLASTIC**

**MARKING DIAGRAM**




BCG = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRM130LT3 | POWERMITE | 12,000/Tape & Reel |

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## MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 30 | V |
| Average Rectified Forward Current (At Rated $V_R$, $T_C$ = 135°C) | $I_O$ | 1.0 | A |
| Peak Repetitive Forward Current<br>(At Rated $V_R$, Square Wave, 100 kHz, $T_C$ = 135°C) | $I_{FRM}$ | 2.0 | A |
| Non–Repetitive Peak Surge Current<br>(Non–Repetitive peak surge current, halfwave, single phase, 60 Hz) | $I_{FSM}$ | 50 | A |
| Storage Temperature | $T_{stg}$ | –55 to 150 | °C |
| Operating Junction Temperature | $T_J$ | –55 to 125 | °C |
| Voltage Rate of Change (Rated $V_R$, $T_J$ = 25°C) | dv/dt | 10,000 | V/μs |

## THERMAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Thermal Resistance – Junction–to–Lead (Anode) (Note 1.)<br>Thermal Resistance – Junction–to–Tab (Cathode) (Note 1.)<br>Thermal Resistance – Junction–to–Ambient (Note 1.) | $R_{tjl}$<br>$R_{tjtab}$<br>$R_{tja}$ | 35<br>23<br>277 | °C/W |

1. Mounted with minimum recommended pad size, PC Board FR4, See Figures 9 & 10.

## ELECTRICAL CHARACTERISTICS

| | | | | |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.), See Figure 2 | $V_F$ | **$T_J$ = 25°C** | **$T_J$ = 85°C** | V |
| ($I_F$ = 0.1 A)<br>($I_F$ = 1.0 A)<br>($I_F$ = 3.0 A) | | 0.30<br>0.38<br>0.52 | 0.20<br>0.33<br>0.50 | |
| Maximum Instantaneous Reverse Current (Note 2.), See Figure 4 | $I_R$ | **$T_J$ = 25°C** | **$T_J$ = 85°C** | mA |
| ($V_R$ = 30 V)<br>($V_R$ = 20 V)<br>($V_R$ = 10 V) | | 0.41<br>0.13<br>0.05 | 11<br>5.3<br>3.2 | |

2. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2%.

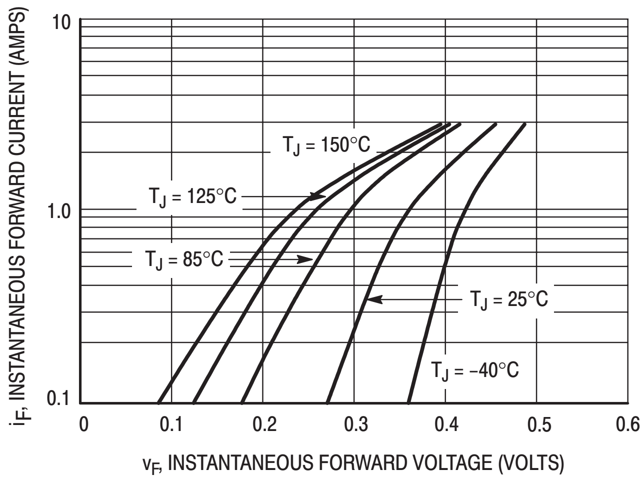



**Figure 1. Typical Forward Voltage**

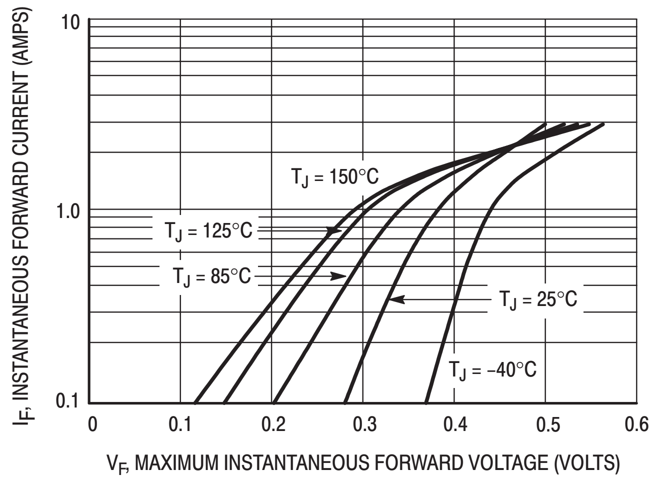



**Figure 2. Maximum Forward Voltage**

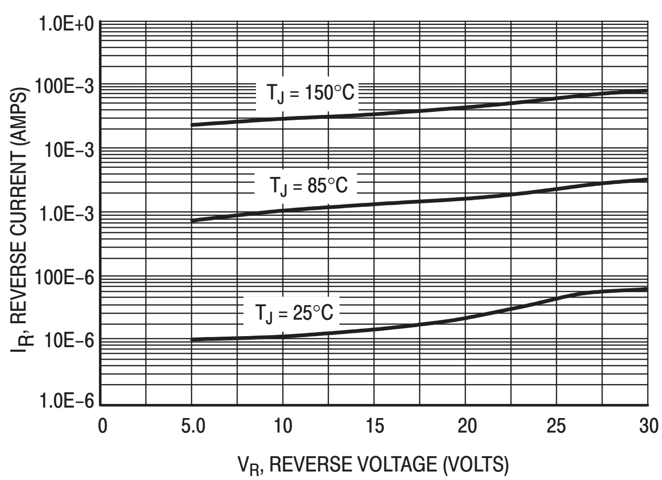



**Figure 3. Typical Reverse Current**

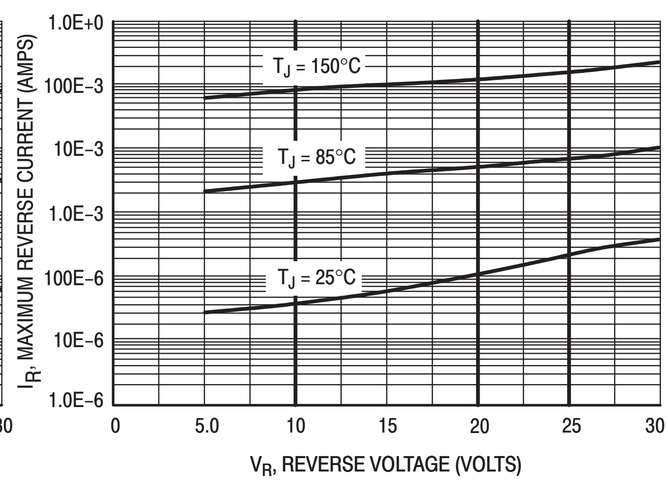



**Figure 4. Maximum Reverse Current**

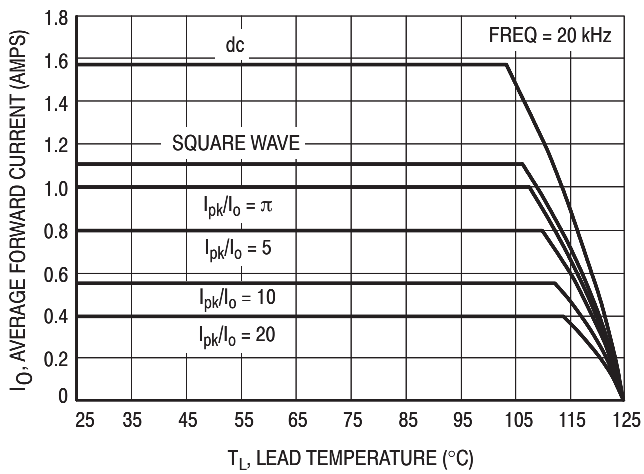



**Figure 5. Current Derating**

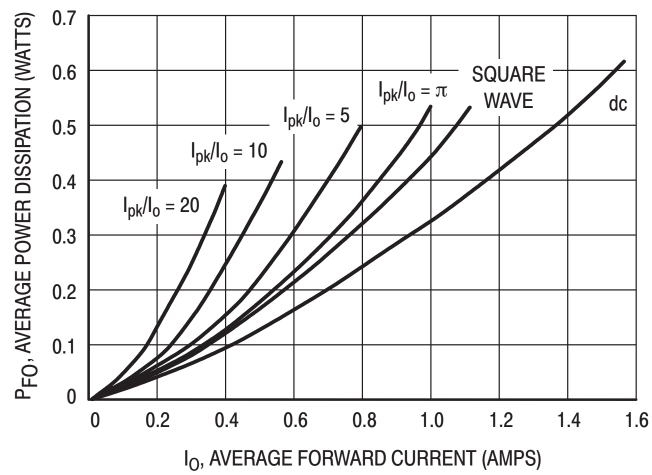



**Figure 6. Forward Power Dissipation**

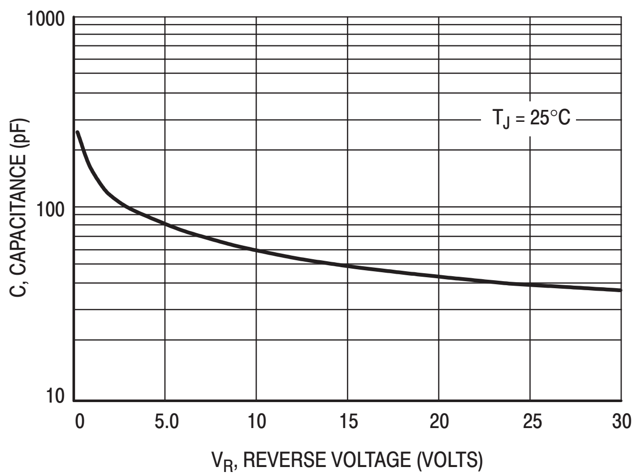



**Figure 7. Capacitance**

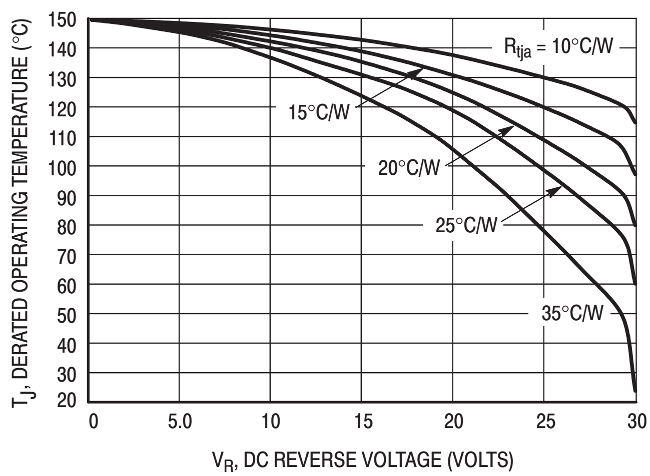



**Figure 8. Typical Operating Temperature Derating***

* Reverse power dissipation and the possibility of thermal runaway must be considered when operating this device under any reverse voltage conditions. Calculations of $T_J$ therefore must include forward and reverse power effects. The allowable operating $T_J$ may be calculated from the equation: $T_J = T_{Jmax} – r(t)(Pf + Pr)$ where

r(t) = thermal impedance under given conditions,
Pf = forward power dissipation, and
Pr = reverse power dissipation

This graph displays the derated allowable $T_J$ due to reverse bias under DC conditions only and is calculated as $T_J = T_{Jmax} – r(t)Pr$, where r(t) = Rthja. For other power applications further calculations must be performed.

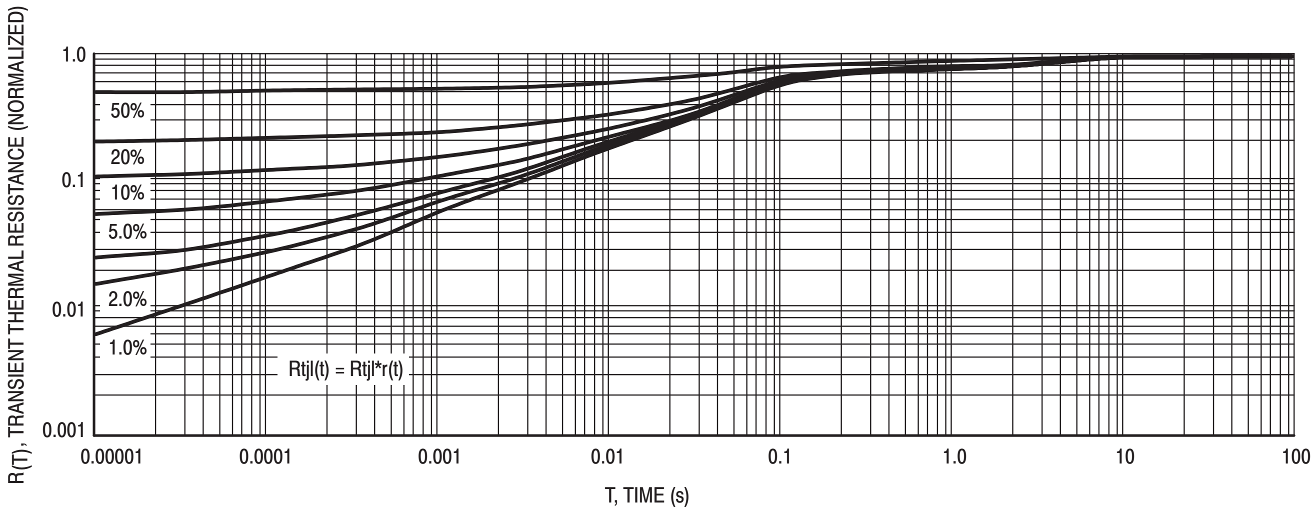



**Figure 9. Thermal Response Junction to Lead**

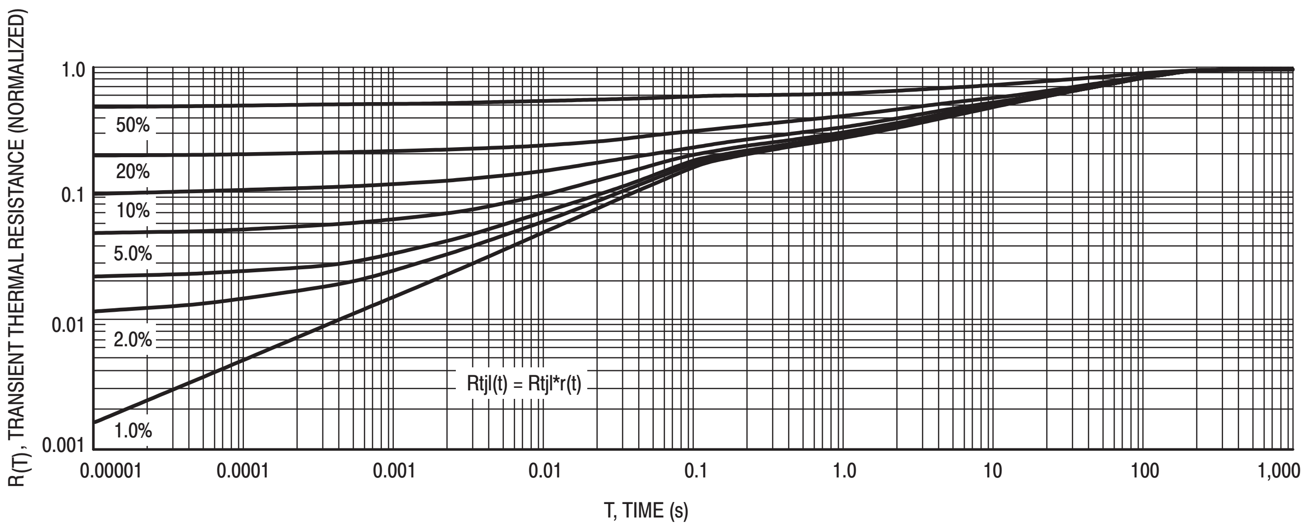



**Figure 10. Thermal Response Junction to Ambient**

# MBRM140T3

*Advance Information*

## Surface Mount Schottky Power Rectifier

### POWERMITE®
### Power Surface Mount Package

The Schottky Powermite employs the Schottky Barrier principle with a barrier metal and epitaxial construction that produces optimal forward voltage drop–reverse current tradeoff. The advanced packaging techniques provide for a highly efficient micro miniature, space saving surface mount Rectifier. With its unique heatsink design, the Powermite has the same thermal performance as the SMA while being 50% smaller in footprint area, and delivering one of the lowest height profiles, < 1.1 mm in the industry. Because of its small size, it is ideal for use in portable and battery powered products such as cellular and cordless phones, chargers, notebook computers, printers, PDAs and PCMCIA cards. Typical applications are ac/dc and dc–dc converters, reverse battery protection, and “Oring” of multiple supply voltages and any other application where performance and size are critical.

**Features:**
- Low Profile — Maximum Height of 1.1 mm
- Small Footprint — Footprint Area of 8.45 mm2
- Low $V_F$ Provides Higher Efficiency and Extends Battery Life
- Supplied in 12 mm Tape and Reel — 12,000 Units per Reel
- Low Thermal Resistance with Direct Thermal Path of Die on Exposed Cathode Heat Sink

**Mechanical Characteristics:**
- Powermite is JEDEC Registered as D0–216AA
- Case: Molded Epoxy
- Epoxy Meets UL94, VO at 1/8″
- Weight: 62 mg (approximately)
- Device Marking: BCJ
- Lead and Mounting Surface Temperature for Soldering Purposes. 260°C Maximum for 10 Seconds

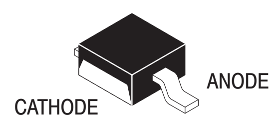
**MAXIMUM RATINGS**

| |
|---|
| Please See the Table on the Following Page |

ON Semiconductor™

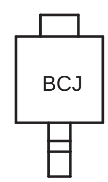
http://onsemi.com

**SCHOTTKY BARRIER RECTIFIER**
**1.0 AMPERES**
**40 VOLTS**




**POWERMITE**
**CASE 457**
**PLASTIC**

**MARKING DIAGRAM**




BCJ = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRM140T3 | POWERMITE | 12,000/Tape & Reel |

This document contains information on a new product. Specifications and information herein are subject to change without notice.

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## MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 40 | V |
| Average Rectified Forward Current (At Rated $V_R$, $T_C$ = 110°C) | $I_O$ | 1.0 | A |
| Peak Repetitive Forward Current<br>(At Rated $V_R$, Square Wave, 100 kHz, $T_C$ = 110°C) | $I_{FRM}$ | 2.0 | A |
| Non–Repetitive Peak Surge Current<br>(Non–Repetitive peak surge current, halfwave, single phase, 60 Hz) | $I_{FSM}$ | 50 | A |
| Storage Temperature | $T_{stg}$ | –55 to 150 | °C |
| Operating Junction Temperature | $T_J$ | –55 to 125 | °C |
| Voltage Rate of Change (Rated $V_R$, $T_J$ = 25°C) | dv/dt | 10,000 | V/µs |

## THERMAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Thermal Resistance – Junction–to–Lead (Anode) (Note 1.)<br>Thermal Resistance – Junction–to–Tab (Cathode) (Note 1.)<br>Thermal Resistance – Junction–to–Ambient (Note 1.) | $R_{tjl}$<br>$R_{tjtab}$<br>$R_{tja}$ | 35<br>23<br>277 | °C/W |

1. Mounted with minimum recommended pad size, PC Board FR4, See Figures 9 & 10.

## ELECTRICAL CHARACTERISTICS

| | | | | |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.), See Figure 2 | $V_F$ | **$T_J$ = 25°C** | **$T_J$ = 85°C** | V |
| ($I_F$ = 0.1 A)<br>($I_F$ = 1.0 A)<br>($I_F$ = 3.0 A) | | 0.36<br>0.55<br>0.85 | 0.30<br>0.515<br>0.88 | |
| Maximum Instantaneous Reverse Current (Note 2.), See Figure 4 | $I_R$ | **$T_J$ = 25°C** | **$T_J$ = 85°C** | mA |
| ($V_R$ = 40 V)<br>($V_R$ = 20 V) | | 0.5<br>0.15 | 25<br>18 | |

2. Pulse Test: Pulse Width ≤ 250 µs, Duty Cycle ≤ 2%.

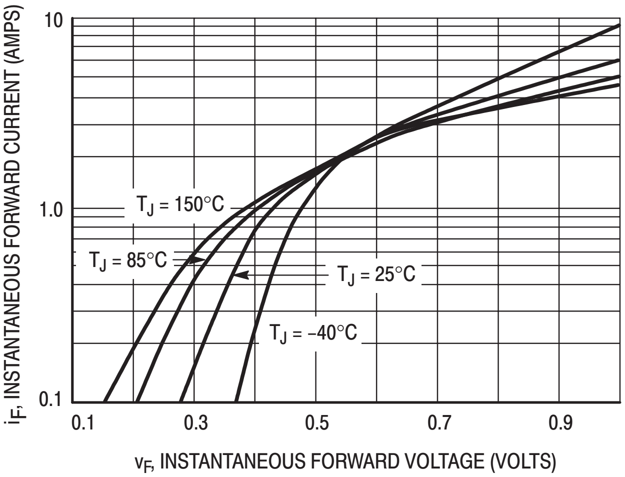


**Figure 1. Typical Forward Voltage**

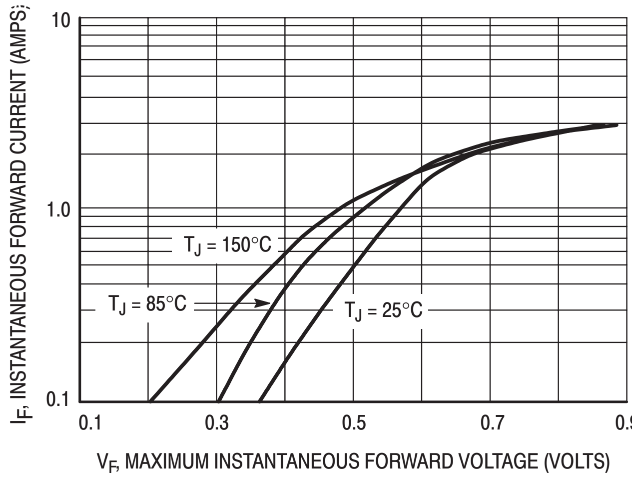


**Figure 2. Maximum Forward Voltage**

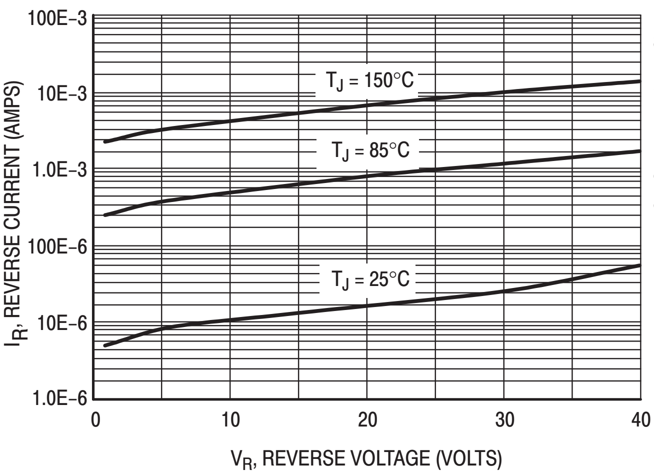


**Figure 3. Typical Reverse Current**

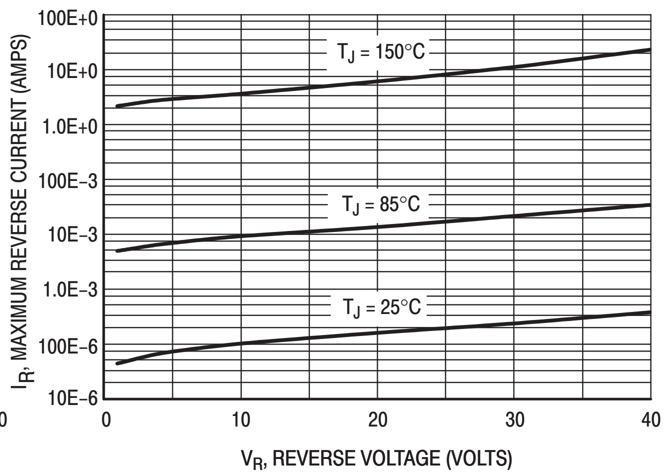


**Figure 4. Maximum Reverse Current**

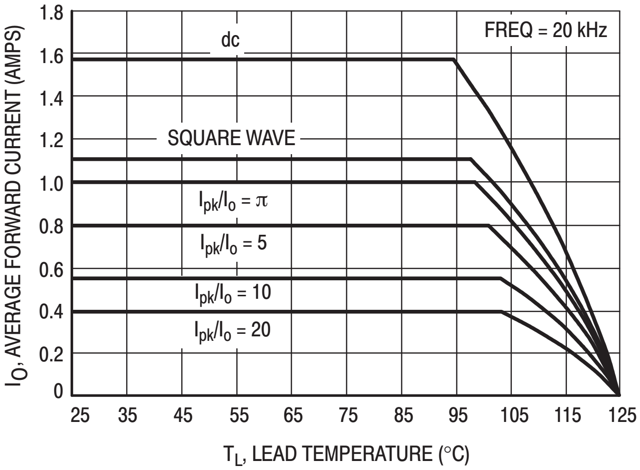


**Figure 5. Current Derating**

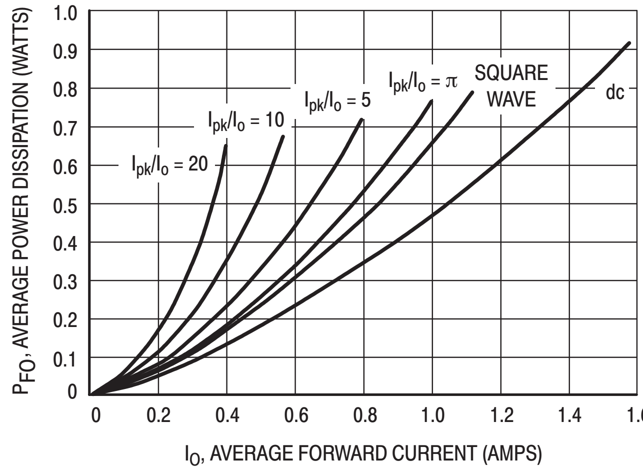


**Figure 6. Forward Power Dissipation**

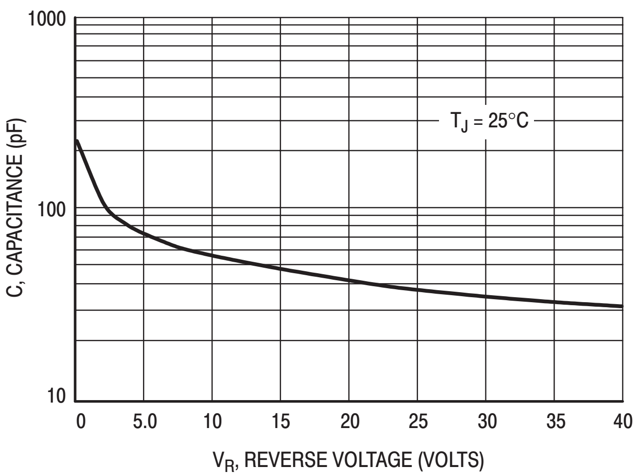


**Figure 7. Capacitance**

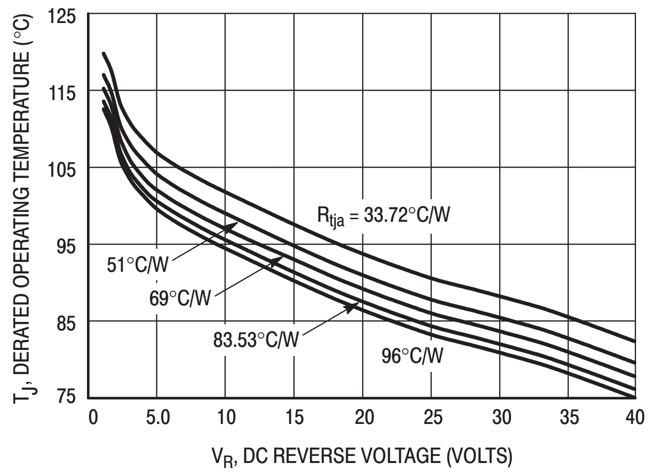


**Figure 8. Typical Operating Temperature Derating***

* Reverse power dissipation and the possibility of thermal runaway must be considered when operating this device under any reverse voltage conditions. Calculations of $T_J$ therefore must include forward and reverse power effects. The allowable operating $T_J$ may be calculated from the equation: $T_J = T_{Jmax} - r(t)(Pf + Pr)$ where
r(t) = thermal impedance under given conditions,
Pf = forward power dissipation, and
Pr = reverse power dissipation

This graph displays the derated allowable $T_J$ due to reverse bias under DC conditions only and is calculated as $T_J = T_{Jmax} - r(t)Pr$, where r(t) = Rthja. For other power applications further calculations must be performed.

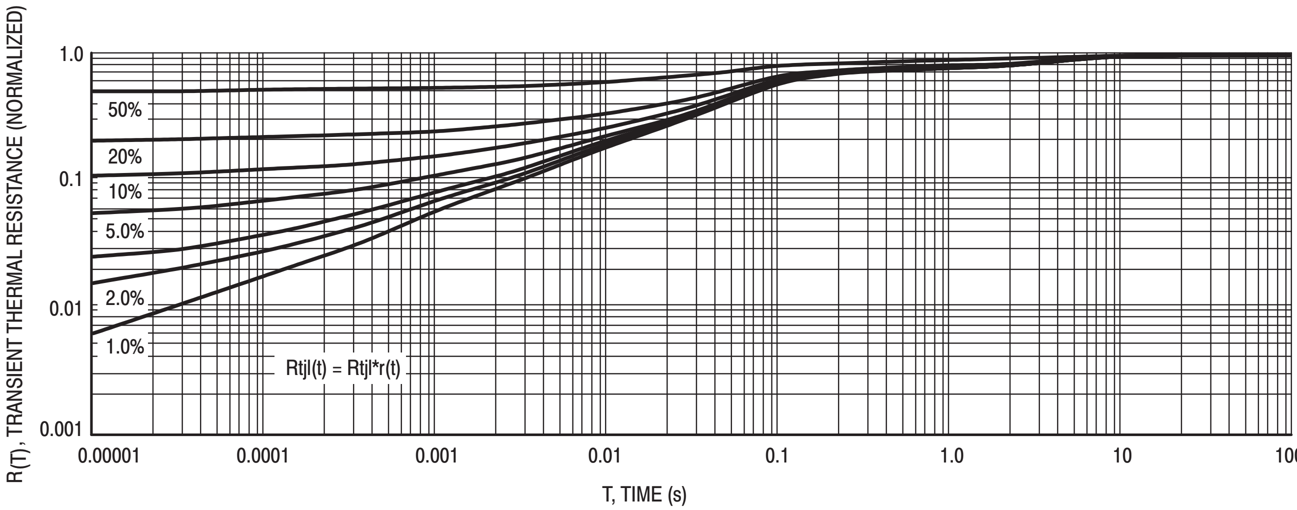


**Figure 9. Thermal Response Junction to Lead**

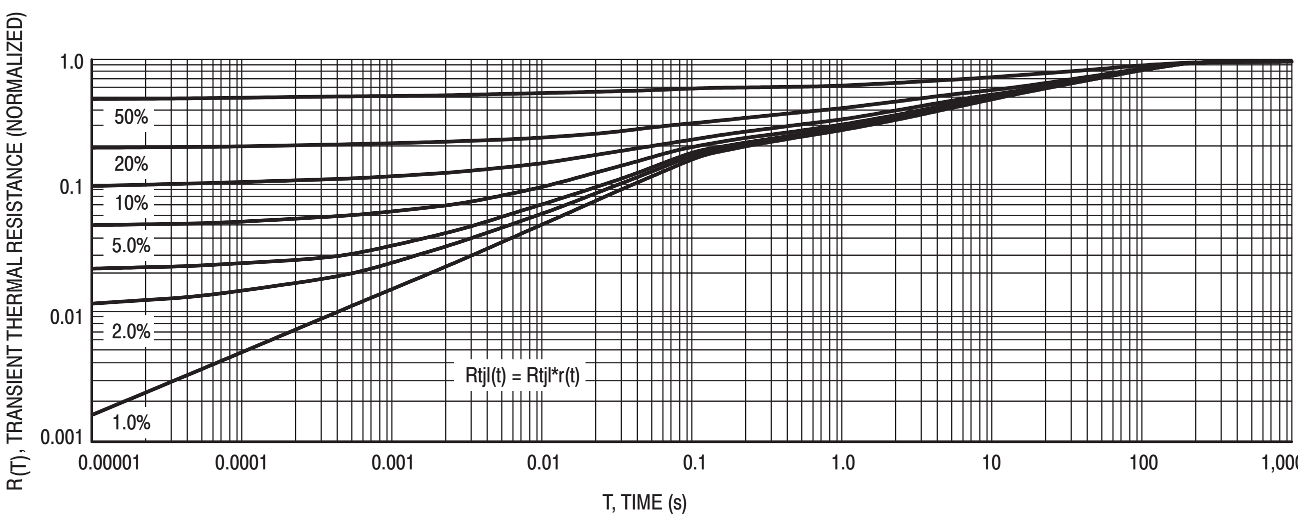


**Figure 10. Thermal Response Junction to Ambient**

# MBRA130LT3

# Surface Mount Schottky Power Rectifier

## SMA Power Surface Mount Package

. . . employing the Schottky Barrier principle in a metal–to–silicon power rectifier. Features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency switching power supplies; free wheeling diodes and polarity protection diodes.

- Compact Package with J–Bend Leads Ideal for Automated Handling
- Highly Stable Oxide Passivated Junction
- Guardring for Over–Voltage Protection
- Low Forward Voltage Drop

**Mechanical Characteristics:**

- Case: Molded Epoxy
- Epoxy Meets UL94, $V_O$ at 1/8″
- Weight: 70 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Polarity: Cathode Lead Indicated by Either Notch in Plastic Body or Polarity Band
- Available in 12 mm Tape, 5000 Units per 13 inch Reel, Add “T3” Suffix to Part Number
- Marking: B1L3

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 30 | V |
| Average Rectified Forward Current (At Rated $V_R$, $T_C$ = 105°C) | $I_O$ | 1.0 | A |
| Peak Repetitive Forward Current (At Rated $V_R$, Square Wave, 100 kHz, $T_C$ = 105°C) | $I_{FRM}$ | 2.0 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 25 | A |
| Storage/Operating Case Temperature | $T_{stg}$, $T_C$ | –55 to +150 | °C |
| Operating Junction Temperature | $T_J$ | –55 to +125 | °C |
| Voltage Rate of Change (Rated $V_R$, $T_J$ = 25°C) | dv/dt | 10,000 | V/μs |

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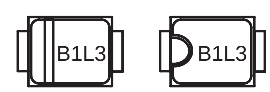
http://onsemi.com

**SCHOTTKY BARRIER RECTIFIER**
**1.0 AMPERES**
**30 VOLTS**

**SMA**
**CASE 403A**
**PLASTIC**

**SMA**
**CASE 403B**
**PLASTIC**

**MARKING DIAGRAM**




B1L3 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRA130LT3 | SMA | 5000/Tape & Reel |

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### THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction–to–Lead (Note 1.)<br>Thermal Resistance — Junction–to–Ambient (Note 1.) | $R_{\theta JL}$<br>$R_{\theta JA}$ | 35<br>86 | °C/W |

### ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | $T_J$ = 25°C | $T_J$ = 100°C | Unit |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.) see Figure 2 ($I_F$ = 1.0 A)<br>($I_F$ = 2.0 A) | $V_F$ | 0.41<br>0.47 | 0.35<br>0.43 | Volts |
| Maximum Instantaneous Reverse Current see Figure 4 ($V_R$ = 30 V)<br>($V_R$ = 15 V) | $I_R$ | 1.0<br>0.4 | 25<br>12 | mA |

1. Mounted on 2″ Square PC Board with 1″ Square Total Pad Size, PC Board FR4.
2. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2.0%.

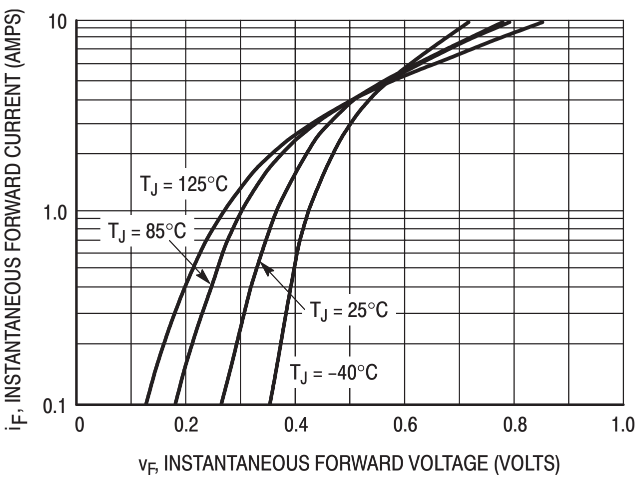



**Figure 1. Typical Forward Voltage**

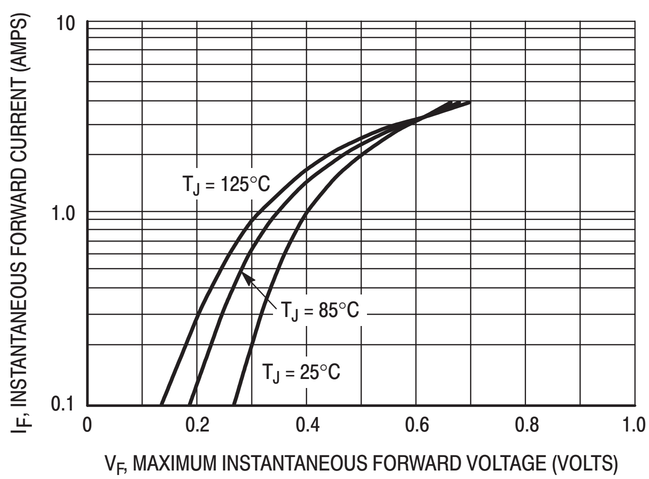



**Figure 2. Maximum Forward Voltage**

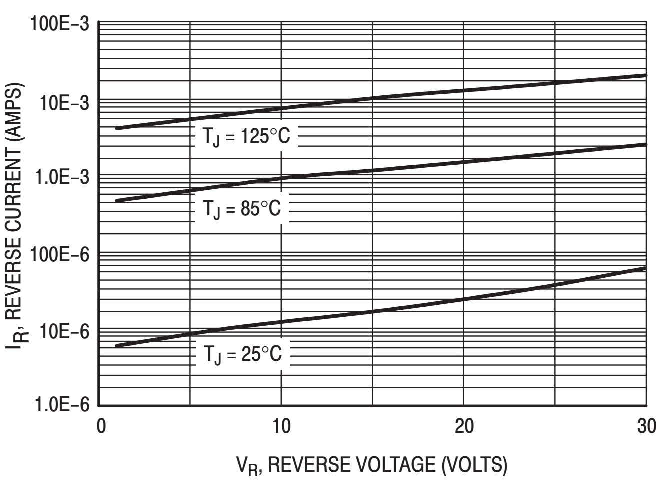



**Figure 3. Typical Reverse Current**

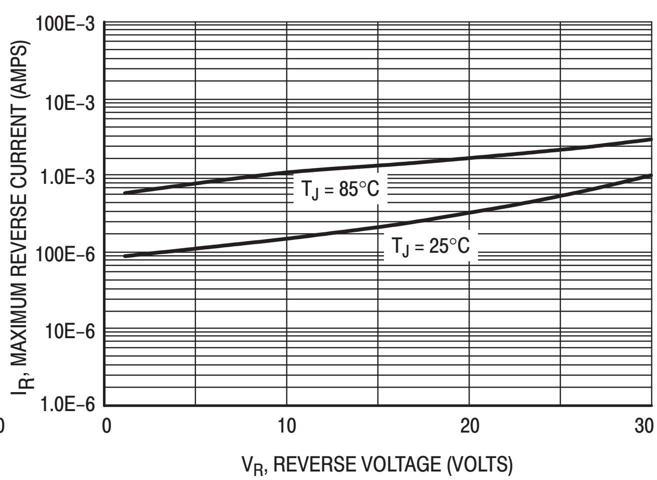



**Figure 4. Maximum Reverse Current**

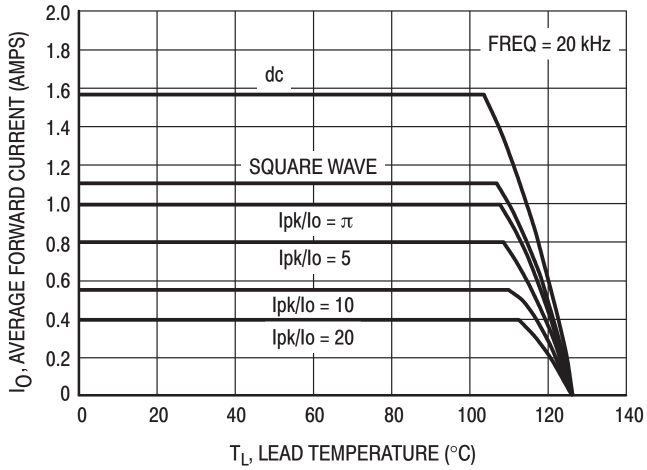



**Figure 5. Current Derating**

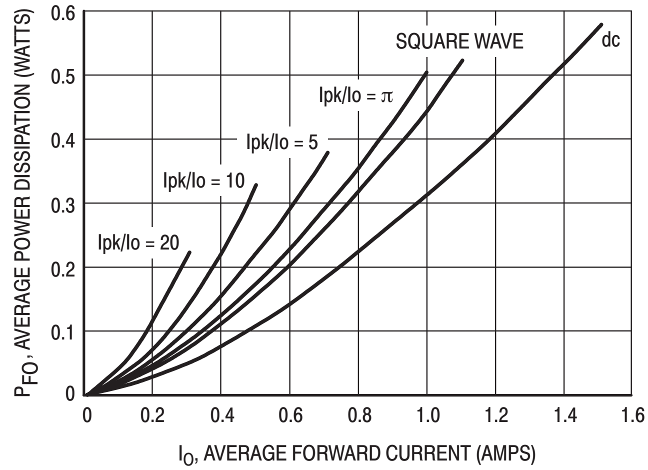



**Figure 6. Forward Power Dissipation**

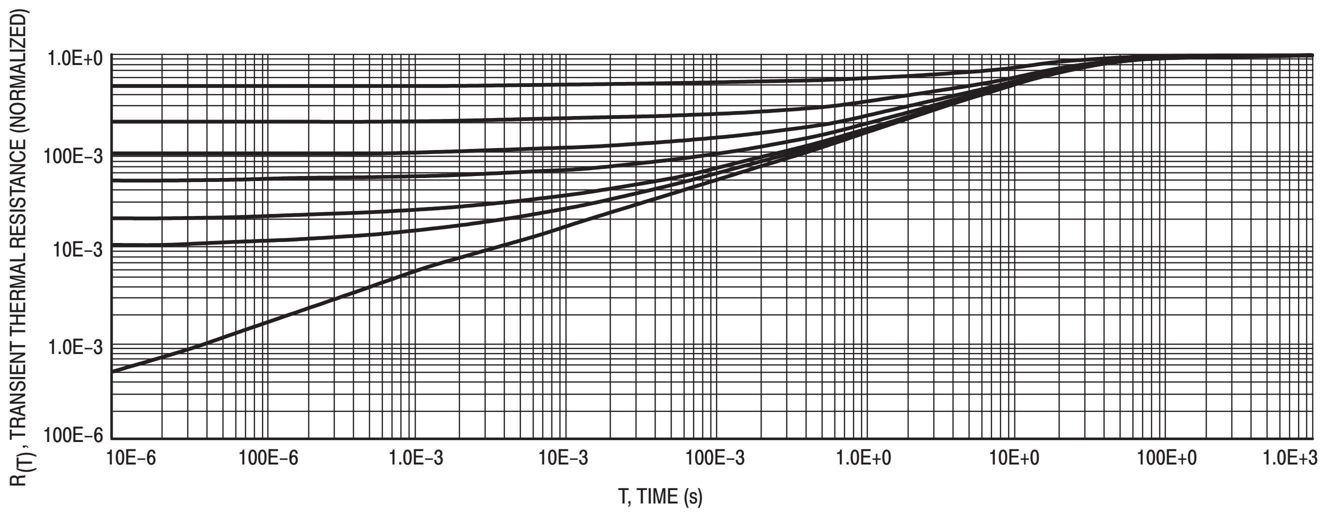



**Figure 7. Thermal Response**

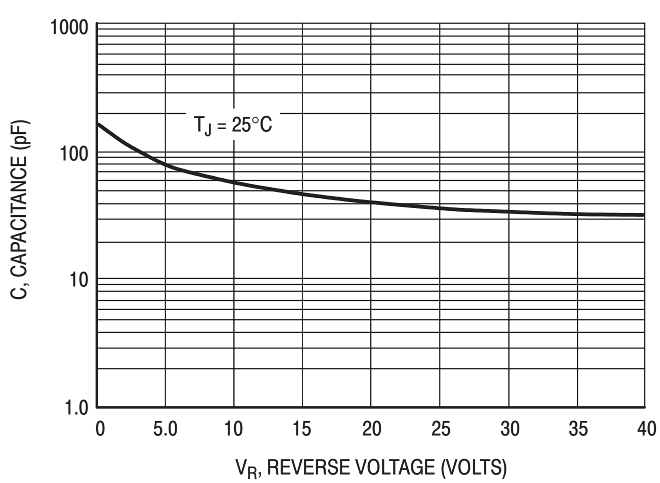



**Figure 8. Capacitance**

# MBRA140T3

# Surface Mount Schottky Power Rectifier

## SMA Power Surface Mount Package

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State of the art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency rectification, or as free wheeling and polarity diodes in surface mount applications where compact size and weight are critical to the system.

- Small Compact Surface Mountable Package with J–Bent Leads
- Rectangular Package for Automated Handling
- Highly Stable Oxide Passivated Junction
- Very Low Forward Voltage Drop
- Guardring for Stress Protection

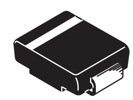
**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 70 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 12 mm tape, 5000 units per 13 inch reel
- Polarity: Cathode Lead Indicated by Either Notch in Plastic Body or Polarity Band
- Marking: B14

**ON Semiconductor™**

**http://onsemi.com**

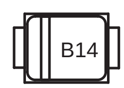
**SCHOTTKY BARRIER RECTIFIER 1.0 AMPERES 40 VOLTS**

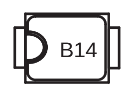


**SMA CASE 403A PLASTIC**

**SMA CASE 403B PLASTIC**

**MARKING DIAGRAM**




B14 = Device Code

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 40 | V |
| Average Rectified Forward Current (At Rated $V_R$, $T_C$ = 95°C) | $I_O$ | 1.0 | A |
| Peak Repetitive Forward Current (At Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 100°C) | $I_{FRM}$ | 2.0 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 30 | A |
| Storage/Operating Case Temperature | $T_{stg}$, $T_C$ | –55 to +150 | °C |
| Operating Junction Temperature | $T_J$ | –55 to +125 | °C |
| Voltage Rate of Change (Rated $V_R$, $T_J$ = 25°C) | dv/dt | 10,000 | V/μs |

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRA140T3 | SMA | 5000/Tape & Reel |

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## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction–to–Lead (Note 1.)<br>Thermal Resistance — Junction–to–Ambient (Note 1.) | $R_{\theta JL}$<br>$R_{\theta JA}$ | 35<br>86 | °C/W |

## ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | $T_J$ = 25°C | $T_J$ = 100°C | Unit |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.)<br>($I_F$ = 1.0 A)<br>see Figure 2 for other Values ($I_F$ = 2.0 A) | $V_F$ | 0.55<br>0.71 | 0.505<br>0.74 | Volts |
| Maximum Instantaneous Reverse Current<br>($V_R$ = 40 V)<br>see Figure 4 for other Values ($V_R$ = 20 V) | $I_R$ | 0.5<br>0.1 | 10<br>4.0 | mA |

1. Mounted on 2″ Square PC Board with 1″ Square Total Pad Size, PC Board FR4.
2. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2.0%.

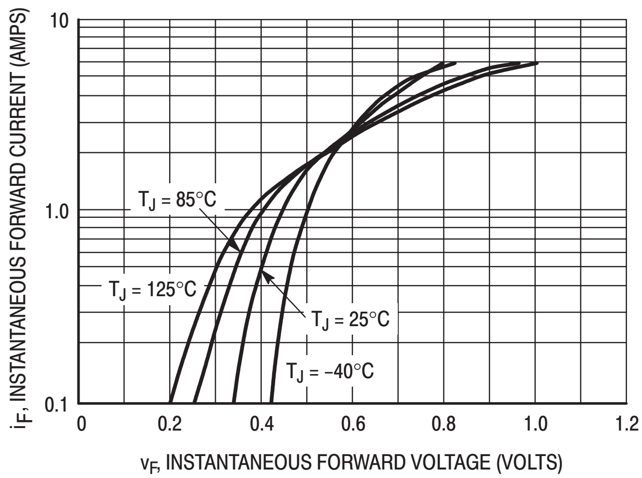


**Figure 1. Typical Forward Voltage**

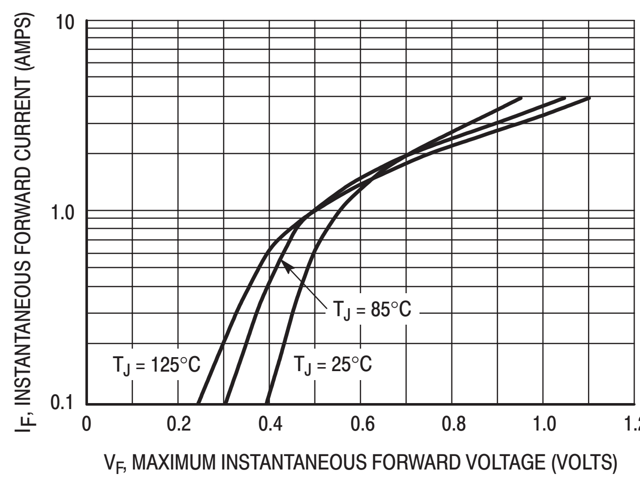


**Figure 2. Maximum Forward Voltage**

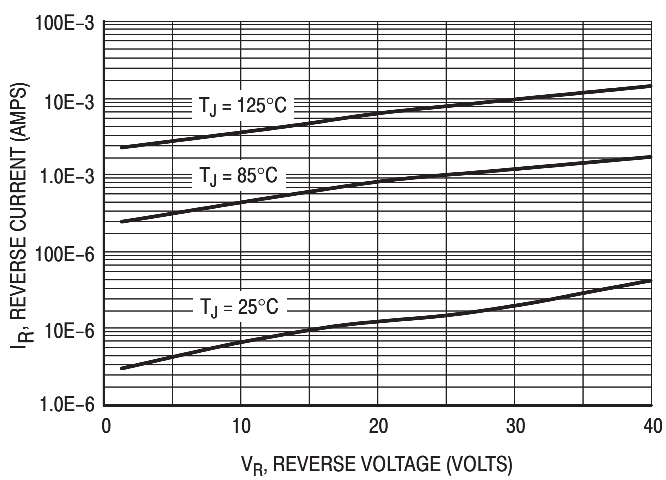


**Figure 3. Typical Reverse Current**

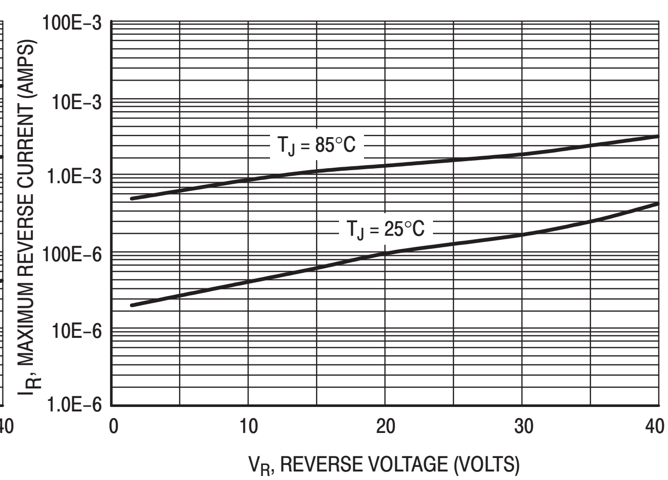


**Figure 4. Maximum Reverse Current**

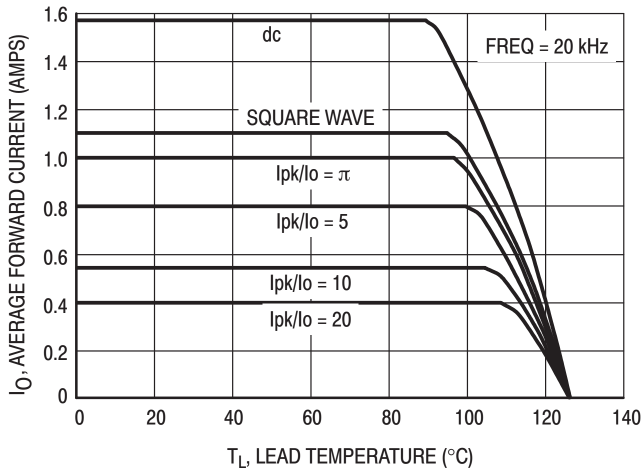


**Figure 5. Current Derating**

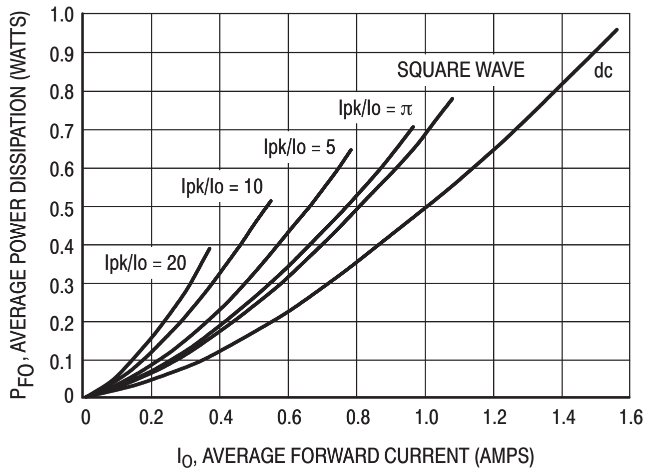


**Figure 6. Forward Power Dissipation**

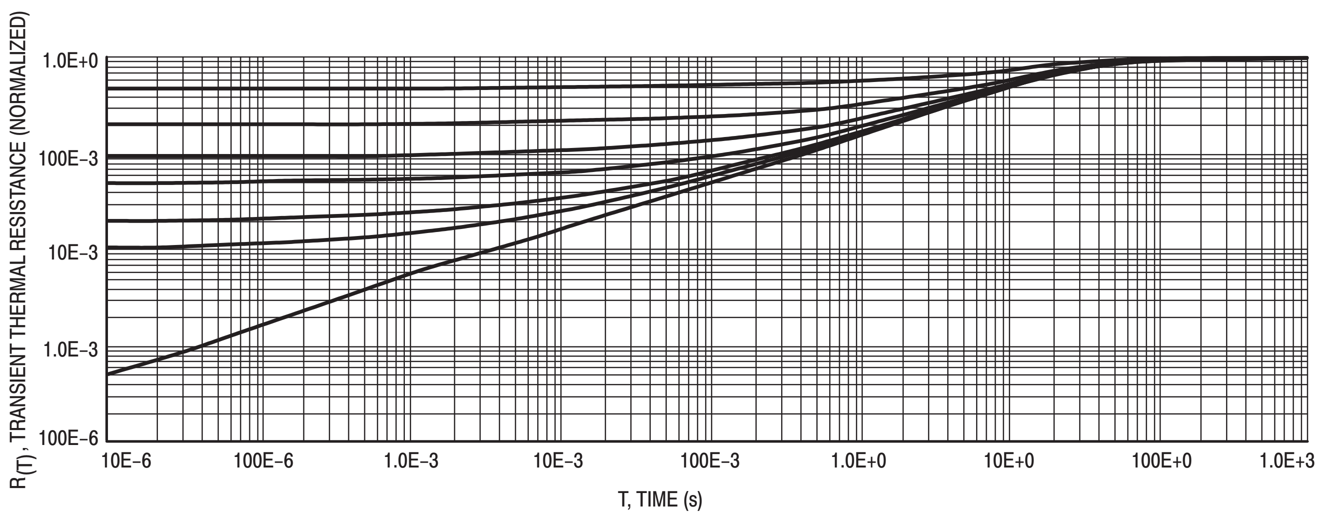


**Figure 7. Thermal Response**

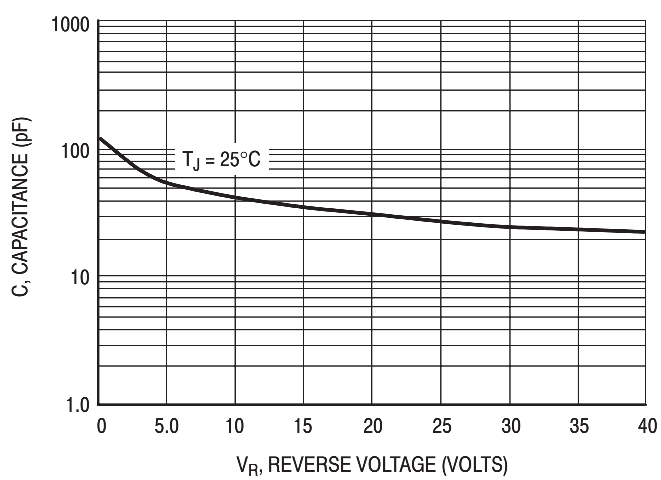


**Figure 8. Capacitance**

# MBRS120T3

**Preferred Device**

# Surface Mount Schottky Power Rectifier

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency rectification, or as free wheeling and polarity protection diodes in surface mount applications where compact size and weight are critical to the system.

- Small Compact Surface Mountable Package with J–Bend Leads
- Rectangular Package for Automated Handling
- Highly Stable Oxide Passivated Junction
- Very Low Forward Voltage Drop (0.55 Volts Max @ 1.0 A, $T_J$ = 25°C)
- Excellent Ability to Withstand Reverse Avalanche Energy Transients
- Guardring for Stress Protection

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 95 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 12 mm Tape and Reel, 2500 units per reel
- Cathode Polarity Band
- Marking: B12

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 20 | V |
| Average Rectified Forward Current ($T_L$ = 115°C) | $I_{F(AV)}$ | 1.0 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 40 | A |
| Operating Junction Temperature | $T_J$ | –65 to +125 | °C |

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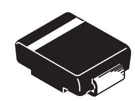
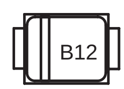
**SCHOTTKY BARRIER RECTIFIER**
**1.0 AMPERE**
**20 VOLTS**



**SMB**
**CASE 403A**
**PLASTIC**

**MARKING DIAGRAM**




B12 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRS120T3 | SMB | 2500/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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### THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Lead ($T_L$ = 25°C) | $R_{\theta JL}$ | 12 | °C/W |

### ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.) ($i_F$ = 1.0 A, $T_J$ = 25°C) | $V_F$ | 0.6 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, $T_J$ = 25°C) (Rated dc Voltage, $T_J$ = 100°C) | $i_R$ | 1.0<br>10 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

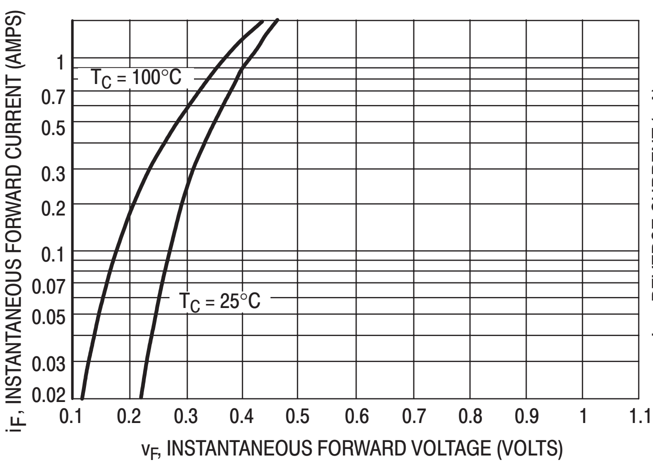


**Figure 1. Typical Forward Voltage**

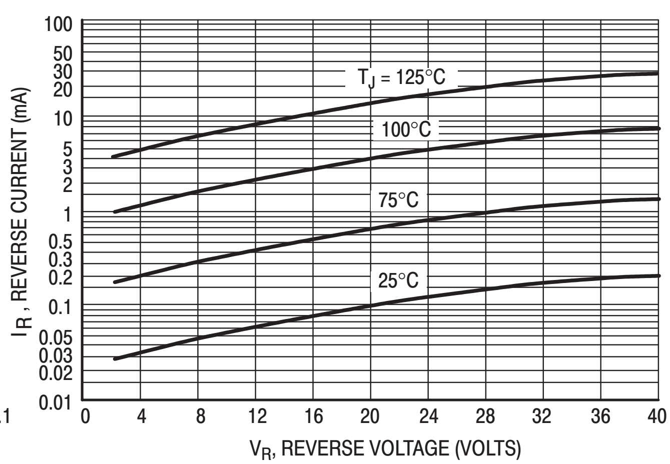


**Figure 2. Typical Reverse Current**

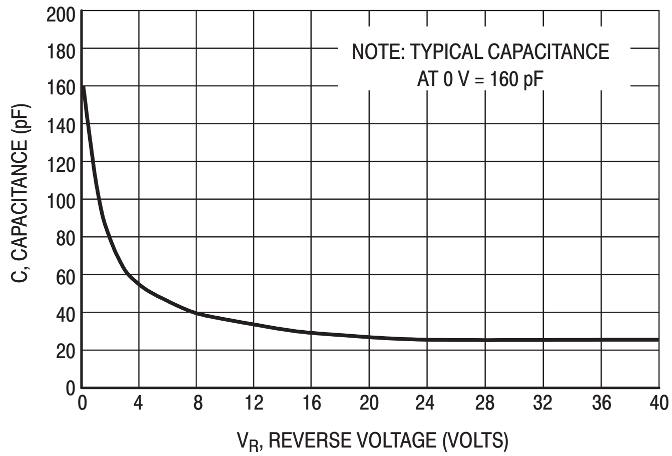


**Figure 3. Typical Capacitance**

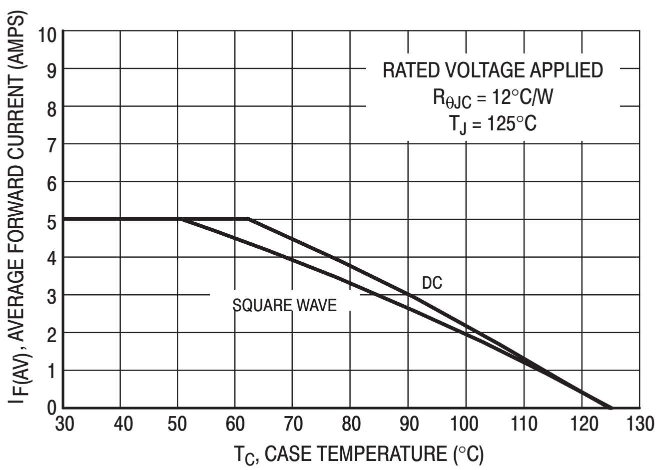


**Figure 4. Current Derating (Case)**

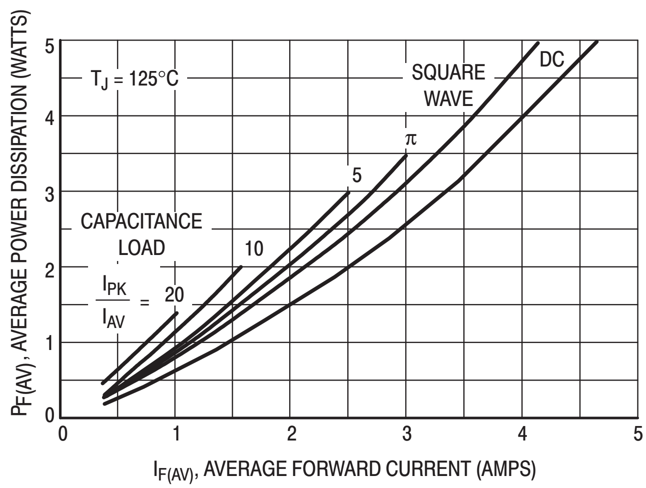


**Figure 5. Power Dissipation**

# MBRS130LT3

**Preferred Device**

# Schottky Power Rectifier

## Surface Mount Power Package

. . . Employs the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency rectification, or as free wheeling and polarity protection diodes, in surface mount applications where compact size and weight are critical to the system.

- Very Low Forward Voltage Drop (0.395 Volts Max @ 1.0 A, $T_J$ = 25°C)
- Small Compact Surface Mountable Package with J–Bend Leads
- Highly Stable Oxide Passivated Junction
- Guardring for Stress Protection

### Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 95 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 12 mm Tape and Reel, 2500 units per reel
- Cathode Polarity Band
- Marking: 1BL3

### MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 30 | V |
| Average Rectified Forward Current<br>$T_L$ = 120°C<br>$T_L$ = 110°C | $I_{F(AV)}$ | <br>1.0<br>2.0 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 40 | A |
| Operating Junction Temperature | $T_J$ | –65 to +125 | °C |

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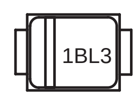
**SCHOTTKY BARRIER RECTIFIER 1.0 AMPERE 30 VOLTS**

**SMB**
**CASE 403A**
**PLASTIC**

**MARKING DIAGRAM**




1BL3 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRS130LT3 | SMB | 2500/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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## THERMAL CHARACTERISTICS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Lead ($T_L$ = 25°C) | $R_{\theta JL}$ | 12 | °C/W |

## ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 1.0 A, $T_J$ = 25°C)<br>($i_F$ = 2.0 A, $T_J$ = 25°C) | $V_F$ | <br>0.395<br>0.445 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_J$ = 25°C)<br>(Rated dc Voltage, $T_J$ = 100°C) | $I_R$ | <br>1.0<br>10 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2%.

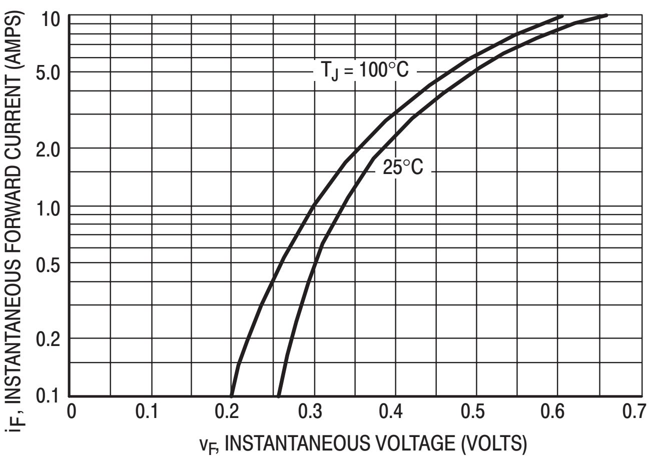


**Figure 1. Typical Forward Voltage**

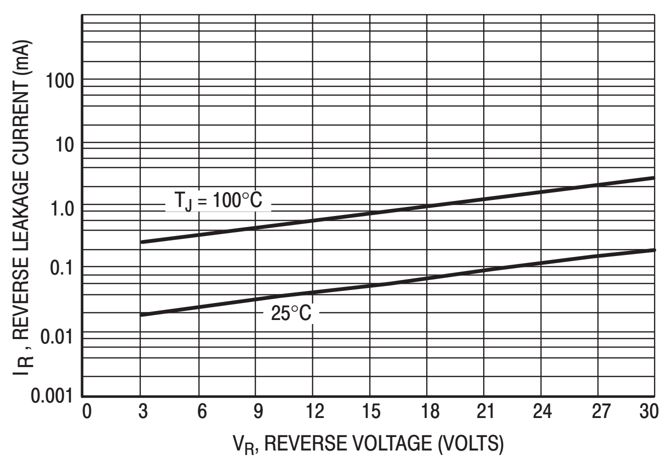


**Figure 2. Typical Reverse Leakage Current**

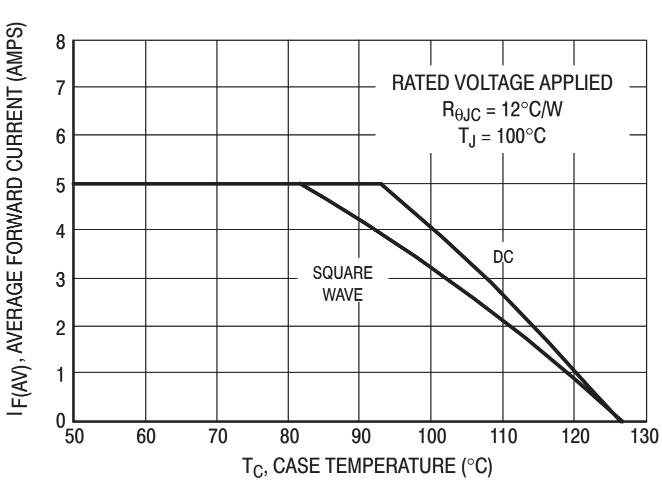


**Figure 3. Current Derating (Case)**

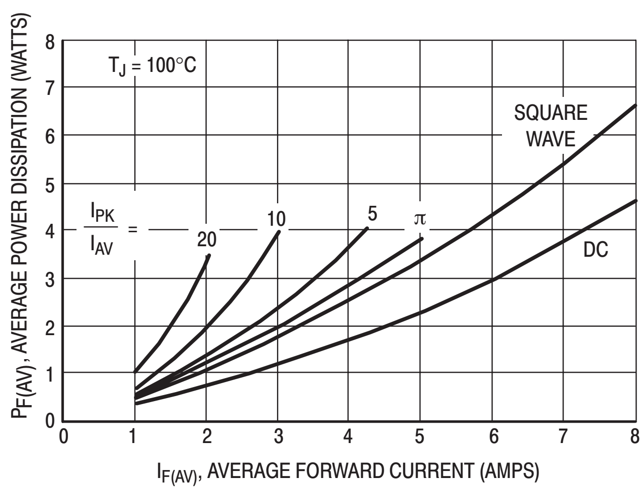


**Figure 4. Typical Power Dissipation**

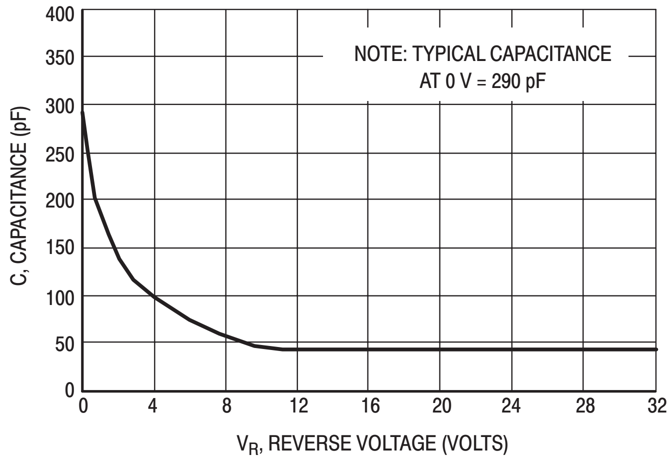


**Figure 5. Typical Capacitance**

# MBRS130T3

Preferred Device

# Surface Mount Schottky Power Rectifier

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency rectification, or as free wheeling and polarity protection diodes in surface mount applications where compact size and weight are critical to the system.

- Small Compact Surface Mountable Package with J–Bend Leads
- Rectangular Package for Automated Handling
- Highly Stable Oxide Passivated Junction
- Very Low Forward Voltage Drop (0.55 Volts Max @ 1.0 A, $T_J$ = 25°C)
- Excellent Ability to Withstand Reverse Avalanche Energy Transients
- Guardring for Stress Protection

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 95 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 12 mm Tape and Reel, 2500 units per reel
- Cathode Polarity Band
- Marking: B13

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 30 | V |
| Average Rectified Forward Current ($T_L$ = 115°C) | $I_{F(AV)}$ | 1.0 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 40 | A |
| Operating Junction Temperature | $T_J$ | –65 to +125 | °C |

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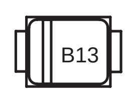
**SCHOTTKY BARRIER RECTIFIER**
**1.0 AMPERE**
**30 VOLTS**

**SMB**
**CASE 403A**
**PLASTIC**

**MARKING DIAGRAM**




B13 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRS130T3 | SMB | 2500/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS**

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Lead<br>($T_L$ = 25°C) | $R_{\theta JL}$ | 12 | °C/W |

**ELECTRICAL CHARACTERISTICS**

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 1.0 A, $T_J$ = 25°C) | $V_F$ | 0.6 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_J$ = 25°C)<br>(Rated dc Voltage, $T_J$ = 100°C) | $i_R$ | <br>1.0<br>10 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

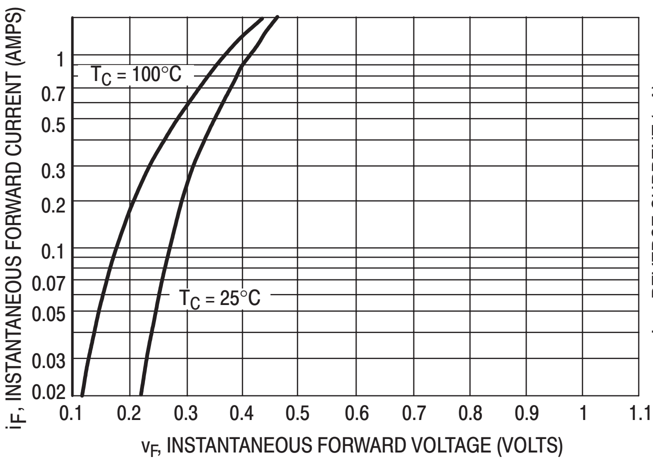


**Figure 1. Typical Forward Voltage**

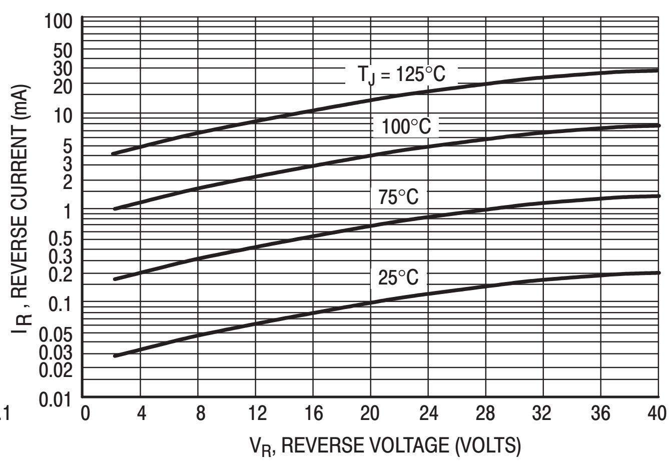


**Figure 2. Typical Reverse Current**

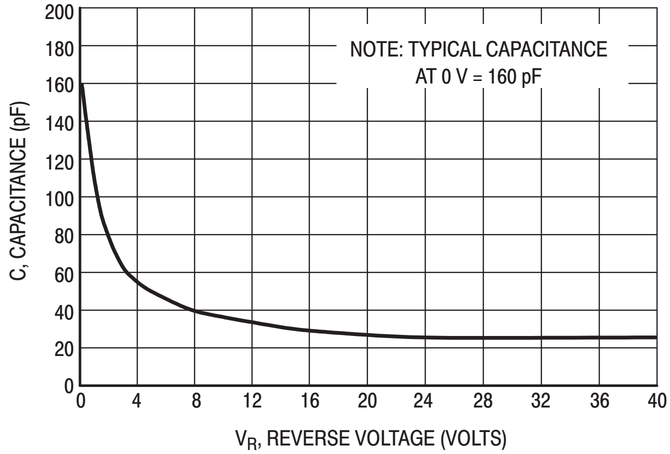


**Figure 3. Typical Capacitance**

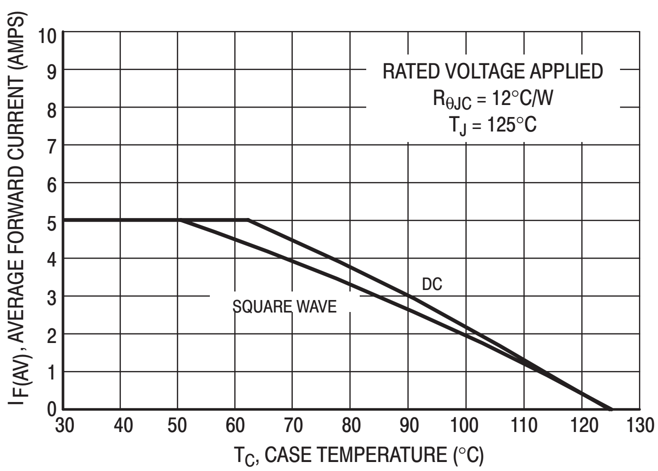


**Figure 4. Current Derating (Case)**

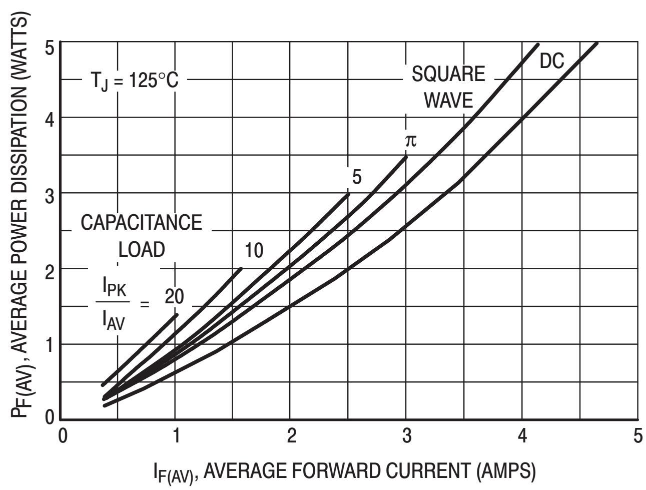


**Figure 5. Power Dissipation**

# MBRS140T3

**Preferred Device**

# Surface Mount Schottky Power Rectifier

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency rectification, or as free wheeling and polarity protection diodes in surface mount applications where compact size and weight are critical to the system.

- Small Compact Surface Mountable Package with J–Bend Leads
- Rectangular Package for Automated Handling
- Highly Stable Oxide Passivated Junction
- Very Low Forward Voltage Drop (0.55 Volts Max @ 1.0 A, $T_J$ = 25°C)
- Excellent Ability to Withstand Reverse Avalanche Energy Transients
- Guardring for Stress Protection

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 95 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 12 mm Tape and Reel, 2500 units per reel
- Cathode Polarity Band
- Marking: B14

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 40 | V |
| Average Rectified Forward Current ($T_L$ = 115°C) | $I_{F(AV)}$ | 1.0 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 40 | A |
| Operating Junction Temperature | $T_J$ | –65 to +125 | °C |

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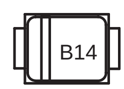
**SCHOTTKY BARRIER RECTIFIER**
**1.0 AMPERE**
**40 VOLTS**

**SMB**
**CASE 403A**
**PLASTIC**

**MARKING DIAGRAM**




B14 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRS140T3 | SMB | 2500/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS**

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Lead<br>($T_L$ = 25°C) | $R_{\theta JL}$ | 12 | °C/W |

**ELECTRICAL CHARACTERISTICS**

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 1.0 A, $T_J$ = 25°C) | $V_F$ | 0.6 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_J$ = 25°C)<br>(Rated dc Voltage, $T_J$ = 100°C) | $i_R$ | <br>1.0<br>10 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

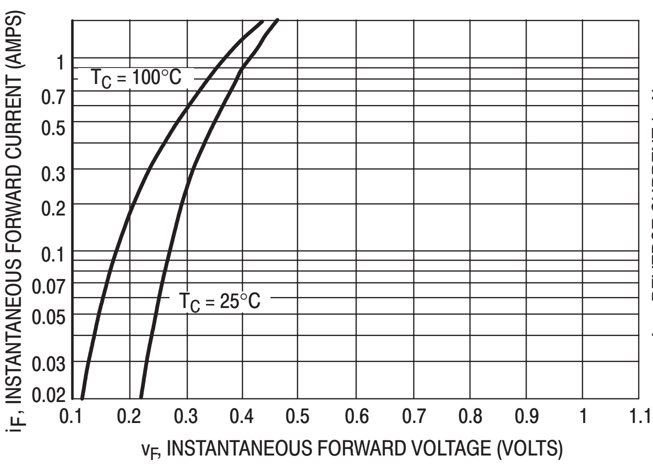


**Figure 1. Typical Forward Voltage**

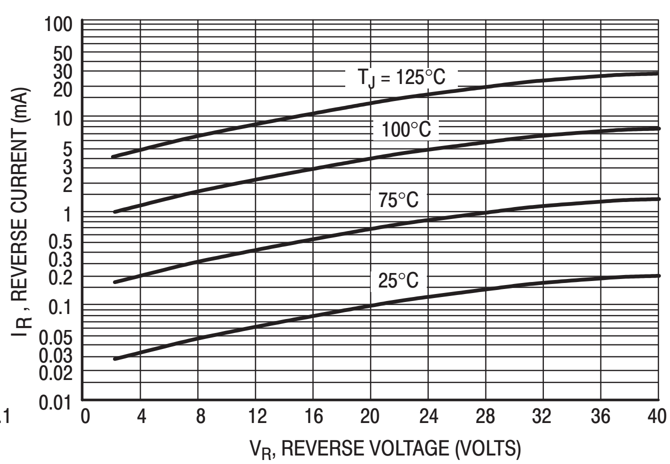


**Figure 2. Typical Reverse Current**

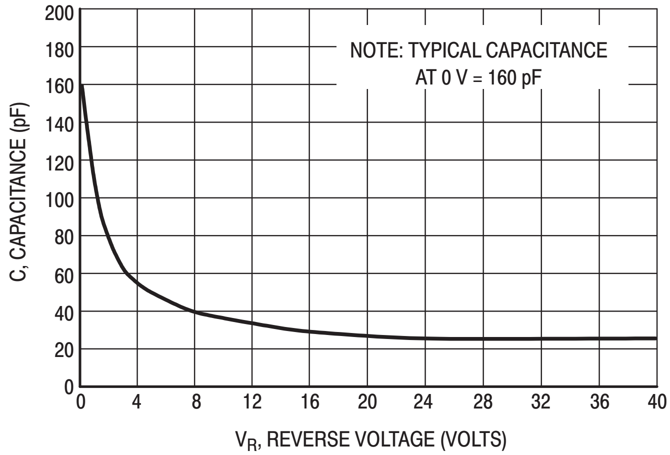


**Figure 3. Typical Capacitance**

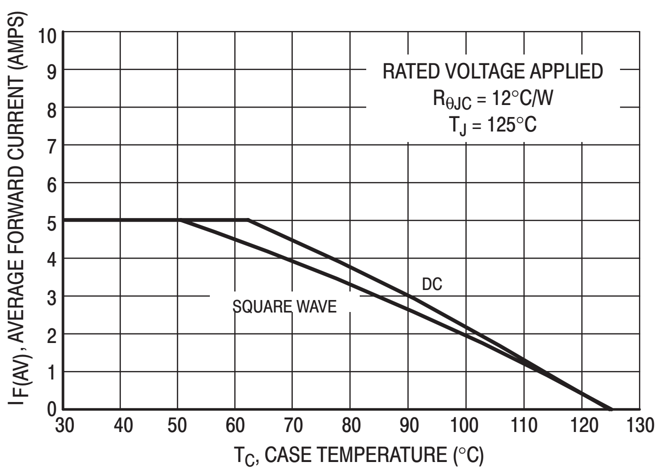


**Figure 4. Current Derating (Case)**

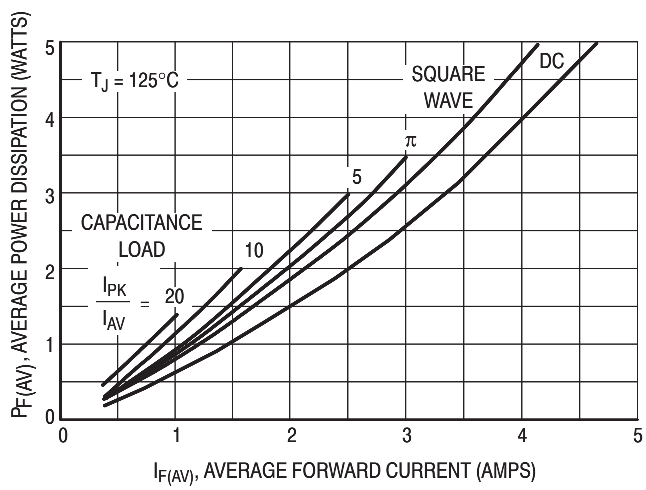


**Figure 5. Power Dissipation**

# MBRS140LT3

# Surface Mount Schottky Power Rectifier

## SMB Power Surface Mount Package

. . . employing the Schottky Barrier principle in a metal–to–silicon power rectifier. Features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency switching power supplies; free wheeling diodes and polarity protection diodes.

- Compact Package with J–Bend Leads Ideal for Automated Handling
- Highly Stable Oxide Passivated Junction
- Guardring for Over–Voltage Protection
- Low Forward Voltage Drop

**Mechanical Characteristics:**

- Case: Molded Epoxy
- Epoxy Meets UL94, VO at 1/8″
- Weight: 95 mg (approximately)
- Cathode Polarity Band
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Available in 12 mm Tape, 2500 Units per 13″ Reel, Add “T3” Suffix to Part Number
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Marking: B14L

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 40 | V |
| Average Rectified Forward Current (At Rated $V_R$, $T_C$ = 110°C) | $I_O$ | 1.0 | A |
| Peak Repetitive Forward Current (At Rated $V_R$, Square Wave, 100 kHz, $T_C$ = 110°C) | $I_{FRM}$ | 2.0 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 40 | A |
| Storage/Operating Case Temperature | $T_{stg}$, $T_C$ | –55 to +150 | °C |
| Operating Junction Temperature | $T_J$ | –55 to +125 | °C |
| Voltage Rate of Change (Rated $V_R$, $T_J$ = 25°C) | dv/dt | 10,000 | V/μs |

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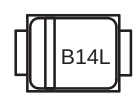
**SCHOTTKY BARRIER RECTIFIER 1.0 AMPERE 40 VOLTS**

**SMB CASE 403A PLASTIC**

**MARKING DIAGRAM**




B14L = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRS140LT3 | SMB | 2500/Tape & Reel |

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### THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance — Junction–to–Lead (Note 1.) | $R_{\theta JL}$ | 24 | °C/W |
| Thermal Resistance — Junction–to–Ambient (Note 2.) | $R_{\theta JA}$ | 80 | |

### ELECTRICAL CHARACTERISTICS

| Characteristic | | Symbol | $T_J$ = 25°C | $T_J$ = 125°C | Unit |
|---|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 3.) see Figure 2 | ($i_F$ = 1.0 A) | $v_F$ | 0.5 | 0.425 | Volts |
| | ($i_F$ = 2.0 A) | | 0.6 | 0.58 | |
| | | | **$T_J$ = 25°C** | **$T_J$ = 100°C** | |
| Maximum Instantaneous Reverse Current (Note 3.) see Figure 4 | ($V_R$ = 40 V) | $I_R$ | 0.4 | 10 | mA |
| | ($V_R$ = 20 V) | | 0.02 | 5.0 | |

1. Mounted with minimum recommended pad size, PC Board FR4.
2. 1 inch square pad size (1 x 0.5 inch for each lead) on FR4 board.
3. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2.0%.

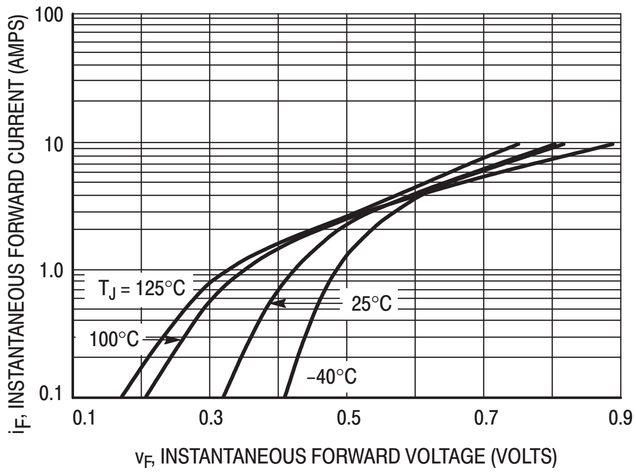


Figure 1. Typical Forward Voltage

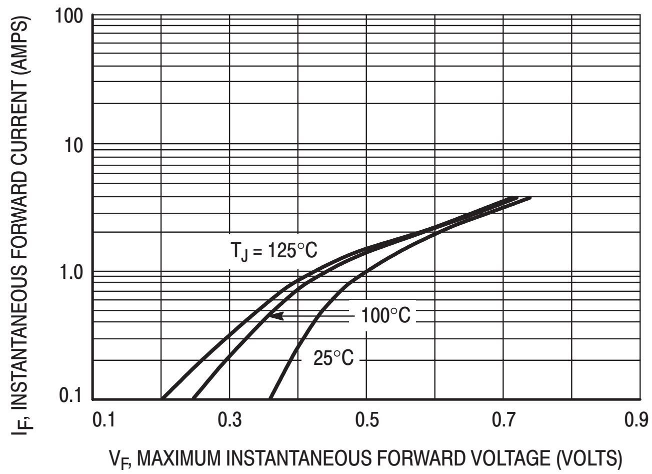


Figure 2. Maximum Forward Voltage

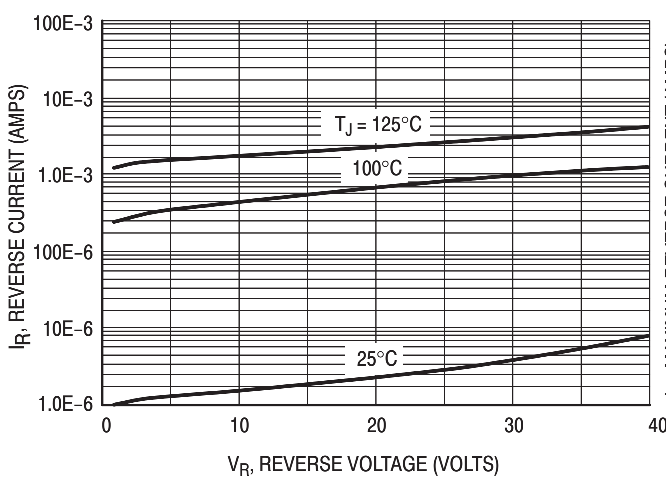


Figure 3. Typical Reverse Current

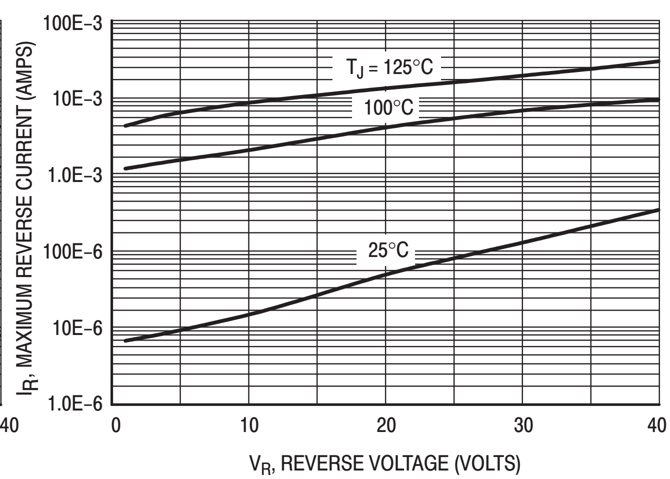


Figure 4. Maximum Reverse Current

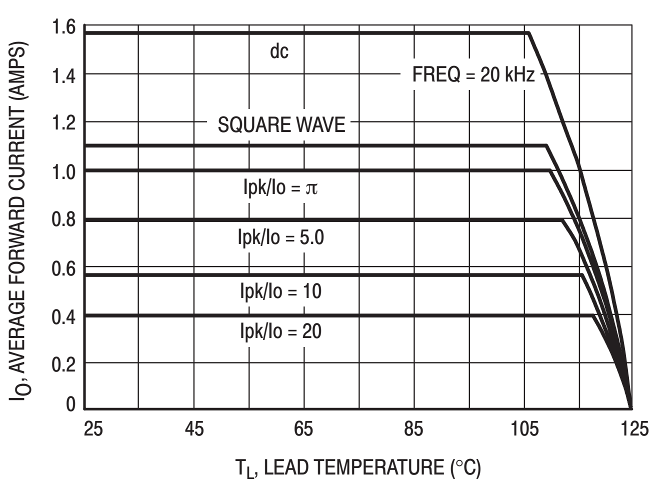


Figure 5. Current Derating

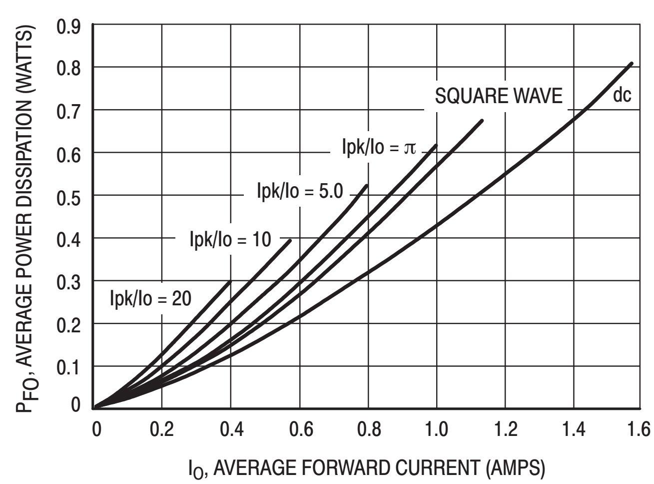


Figure 6. Forward Power Dissipation

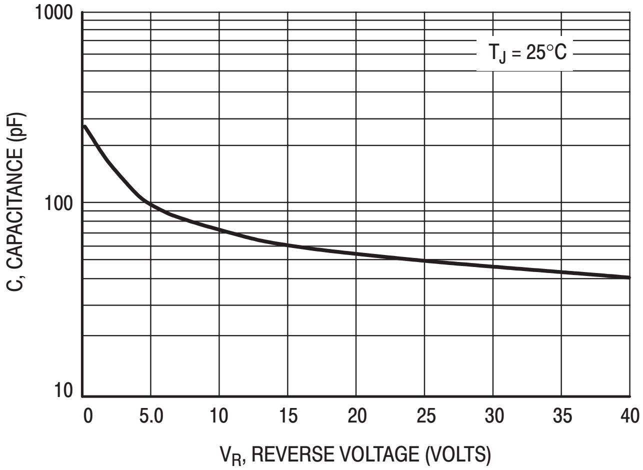


**Figure 7. Capacitance**

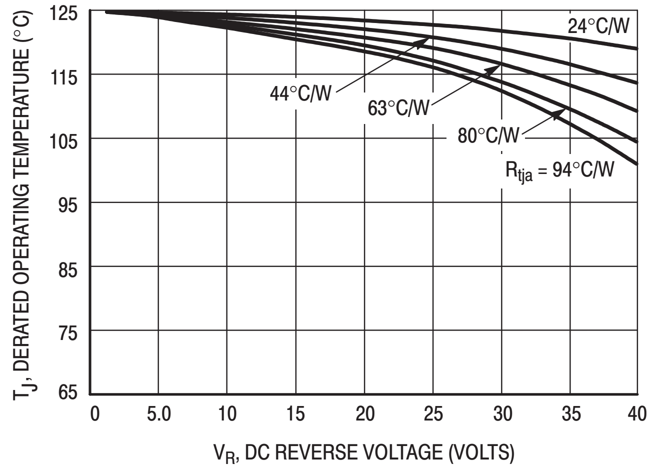


**Figure 8. Typical Operating Temperature Derating***

* Reverse power dissipation and the possibility of thermal runaway must be considered when operating this device under any reverse voltage conditions. Calculations of $T_J$ therefore must include forward and reverse power effects. The allowable operating $T_J$ may be calculated from the equation: $T_J = T_{Jmax} - r(t)(Pf + Pr)$ where

r(t) = thermal impedance under given conditions,

Pf = forward power dissipation, and

Pr = reverse power dissipation

This graph displays the derated allowable $T_J$ due to reverse bias under DC conditions only and is calculated as $T_J = T_{Jmax} - r(t)Pr$, where r(t) = Rthja. For other power applications further calculations must be performed.

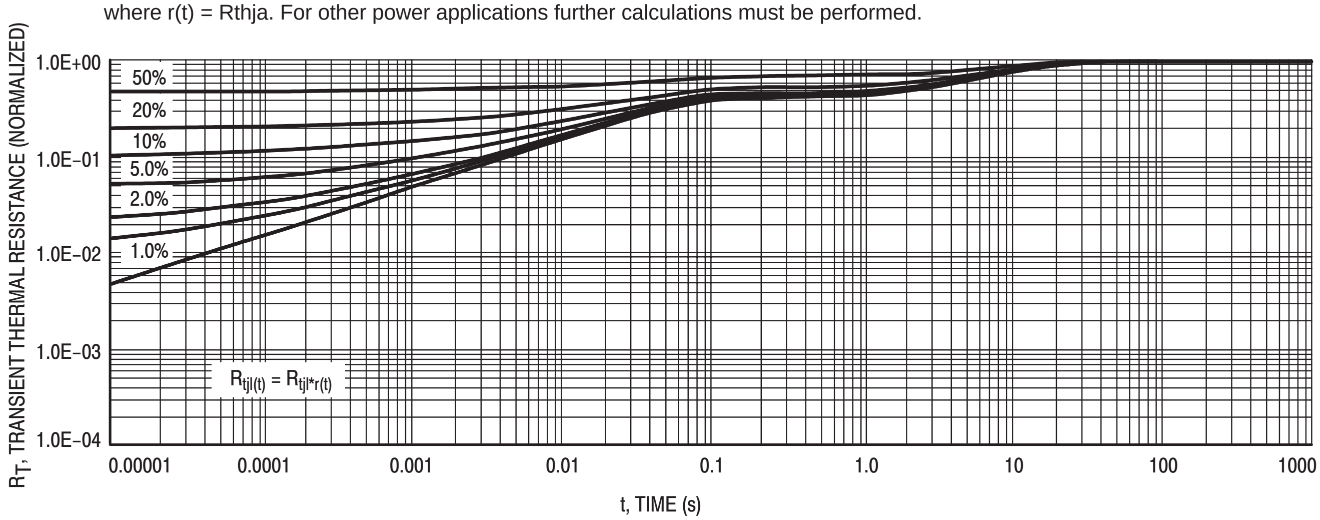


**Figure 9. Thermal Response — Junction to Lead**

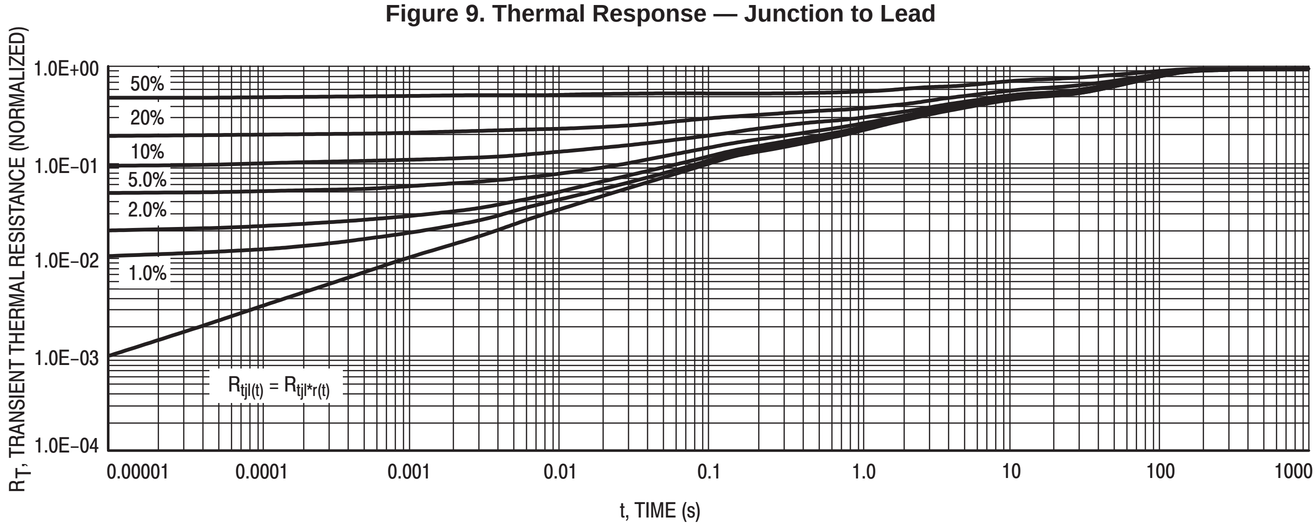


**Figure 10. Thermal Response — Junction to Ambient**

# MBRS1100T3, MBRS190T3

**Preferred Devices**

# Schottky Power Rectifier

## Surface Mount Power Package

Schottky Power Rectifiers employ the use of the Schottky Barrier principle in a large area metal-to-silicon power diode. State-of-the-art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency rectification, or as free wheeling and polarity protection diodes, in surface mount applications where compact size and weight are critical to the system. These state-of-the-art devices have the following features:

- Small Compact Surface Mountable Package with J-Bend Leads
- Rectangular Package for Automated Handling
- Highly Stable Oxide Passivated Junction
- High Blocking Voltage — 100 Volts
- 150°C Operating Junction Temperature
- Guardring for Stress Protection

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 95 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 12 mm Tape and Reel, 2500 units per reel
- Cathode Polarity Band
- Markings; MBRS190T3: B19
  MBRS1100T3: B1C

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage MBRS190T3<br>MBRS1100T3 | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | <br><br>90<br>100 | V |
| Average Rectified Forward Current<br>$T_L$ = 120°C<br>$T_L$ = 100°C | $I_{F(AV)}$ | <br>1.0<br>2.0 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 50 | A |
| Operating Junction Temperature | $T_J$ | –65 to +150 | °C |
| Voltage Rate of Change | dv/dt | 10 | V/ns |

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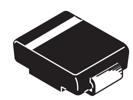
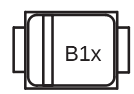
**SCHOTTKY BARRIER RECTIFIER 1.0 AMPERE 90, 100 VOLTS**



**SMB**
**CASE 403A**
**PLASTIC**

**MARKING DIAGRAM**




B1x = Device Code
x = 9 or C

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRS1100T3 | SMB | 2500/Tape & Reel |
| MBRS190T3 | SMB | 2500/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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### THERMAL CHARACTERISTICS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Lead ($T_L$ = 25°C) | $R_{\theta JL}$ | 22 | °C/W |

### ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 1.0 A, $T_J$ = 25°C) | $V_F$ | 0.75 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, TJ = 25°C)<br>(Rated dc Voltage, $T_J$ = 100°C) | $I_R$ | <br>0.5<br>5.0 | mA |

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

## TYPICAL ELECTRICAL CHARACTERISTICS

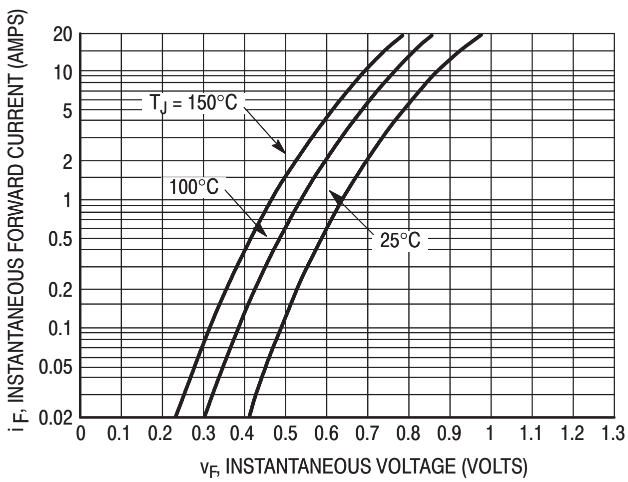


**Figure 1. Typical Forward Voltage**

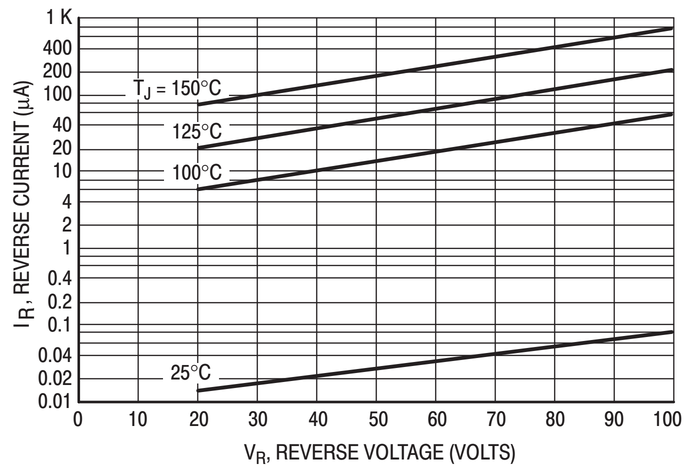


**Figure 2. Typical Reverse Current***

*The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these curves if $V_R$ is sufficient below rated $V_R$.

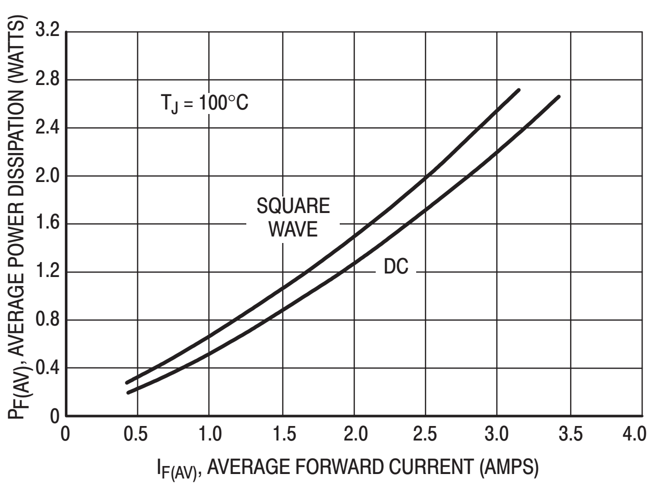


**Figure 3. Power Dissipation**

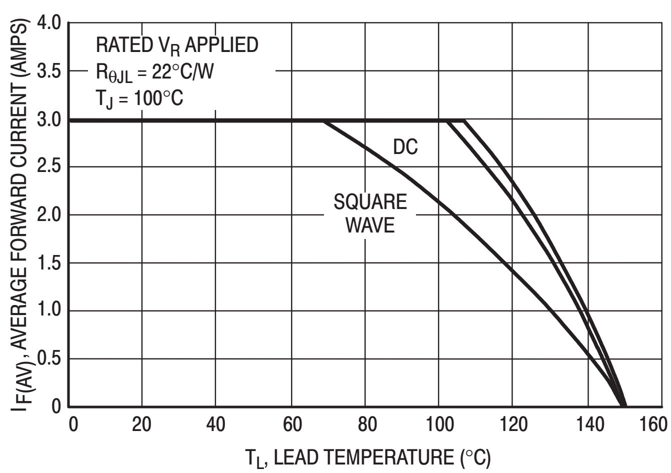


**Figure 4. Current Derating, Lead**

## TYPICAL ELECTRICAL CHARACTERISTICS

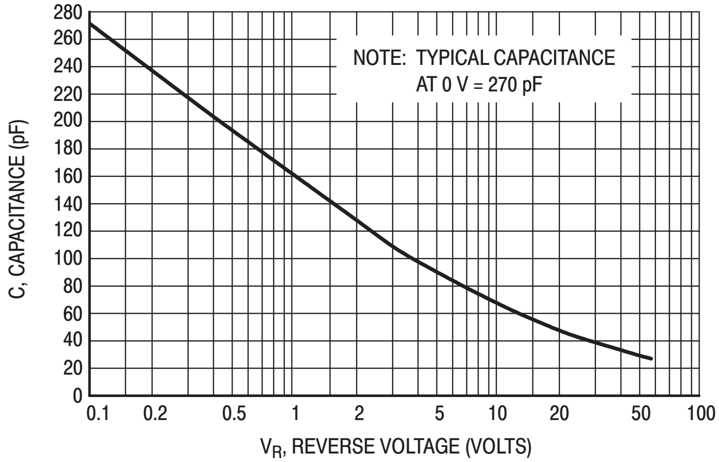


**Figure 5. Typical Capacitance**

# MBRS1540T3

# Surface Mount Schottky Power Rectifier

## SMB Power Surface Mount Package

. . . employing the Schottky Barrier principle in a metal–to–silicon power rectifier. Features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency switching power supplies; free wheeling diodes and polarity protection diodes.

- Compact Package with J–Bend Leads Ideal for Automated Handling
- Highly Stable Oxide Passivated Junction
- Guardring for Over–Voltage Protection
- Low Forward Voltage Drop

**Mechanical Characteristics:**

- Case: Molded Epoxy
- Epoxy Meets UL94, VO at 1/8″
- Weight: 95 mg (approximately)
- Cathode Polarity Band
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Available in 12 mm Tape, 2500 Units per 13″ Reel, Add “T3” Suffix to Part Number
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Marking: BGJ

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 40 | V |
| Average Rectified Forward Current (At Rated $V_R$, $T_C$ = 100°C) | $I_O$ | 1.5 | A |
| Peak Repetitive Forward Current (At Rated $V_R$, Square Wave, 100 kHz, $T_C$ = 105°C) | $I_{FRM}$ | 3.0 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 40 | A |
| Storage/Operating Case Temperature | $T_{stg}$, $T_C$ | –55 to +150 | °C |
| Operating Junction Temperature | $T_J$ | –55 to +125 | °C |
| Voltage Rate of Change (Rated $V_R$, $T_J$ = 25°C) | dv/dt | 10,000 | V/μs |

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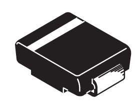
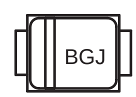
**SCHOTTKY BARRIER RECTIFIER 1.5 AMPERES 40 VOLTS**



**SMB**
**CASE 403A**
**PLASTIC**

**MARKING DIAGRAM**




BGJ = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRS1540T3 | SMB | 2500/Tape & Reel |

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### THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction–to–Lead (Note 1.)<br>Thermal Resistance — Junction–to–Ambient (Note 2.) | $R_{\theta JL}$<br>$R_{\theta JA}$ | 24<br>80 | °C/W |

### ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | | | Unit |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 3.) | $v_F$ | **$T_J$ = 25°C** | **$T_J$ = 125°C** | Volts |
| ($i_F$ = 1.5 A) | | 0.46 | 0.39 | |
| see Figure 2 ($i_F$ = 3.0 A) | | 0.54 | 0.54 | |
| Maximum Instantaneous Reverse Current (Note 3.) | $I_R$ | **$T_J$ = 25°C** | **$T_J$ = 100°C** | mA |
| ($V_R$ = 40 V) | | 0.8 | 5.7 | |
| see Figure 4 ($V_R$ = 20 V) | | 0.1 | 1.6 | |

1. Mounted with minimum recommended pad size, PC Board FR4.
2. 1 inch square pad size (1 x 0.5 inch for each lead) on FR4 board.
3. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2.0%.

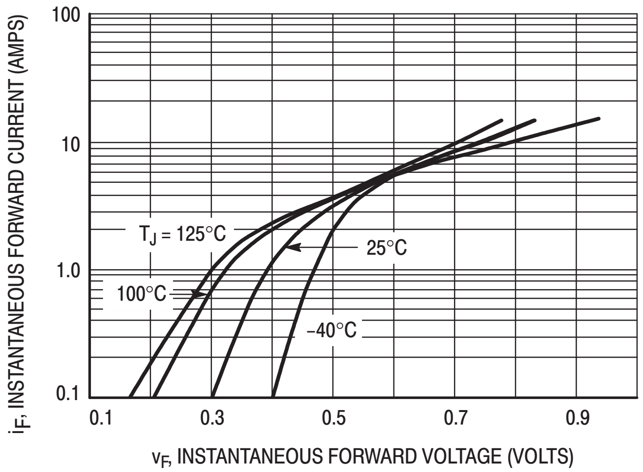


**Figure 1. Typical Forward Voltage**

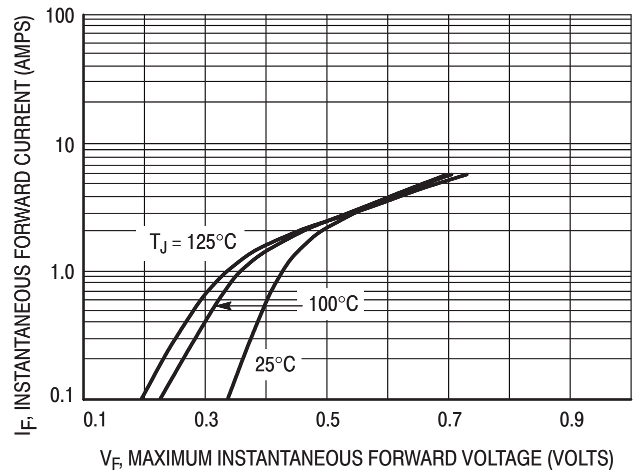


**Figure 2. Maximum Forward Voltage**

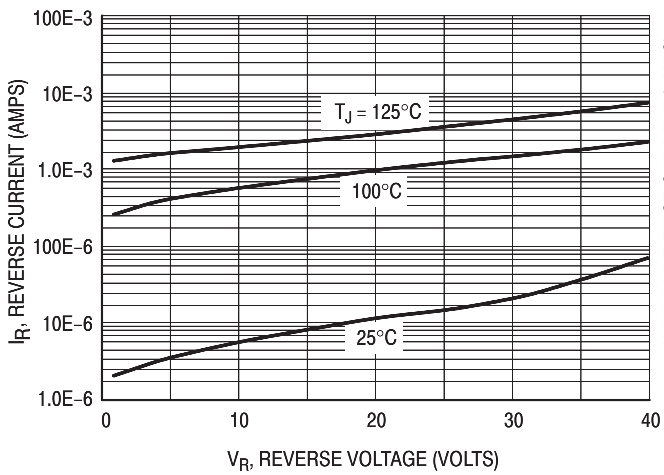


**Figure 3. Typical Reverse Current**

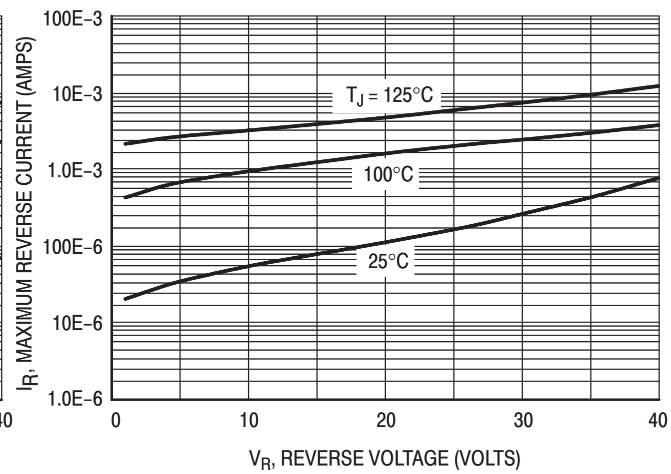


**Figure 4. Maximum Reverse Current**

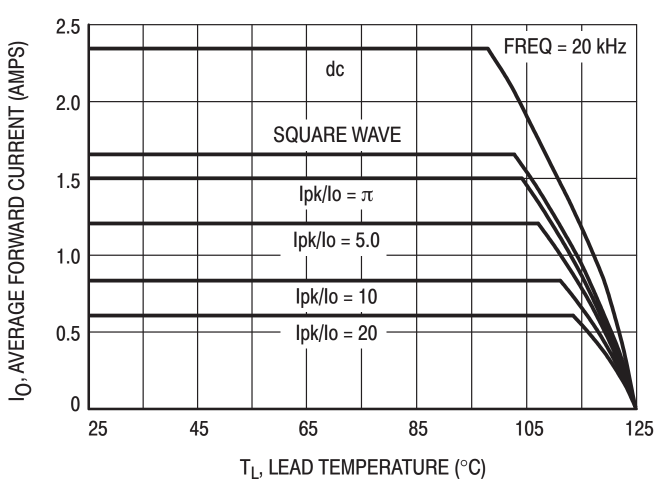


**Figure 5. Current Derating**

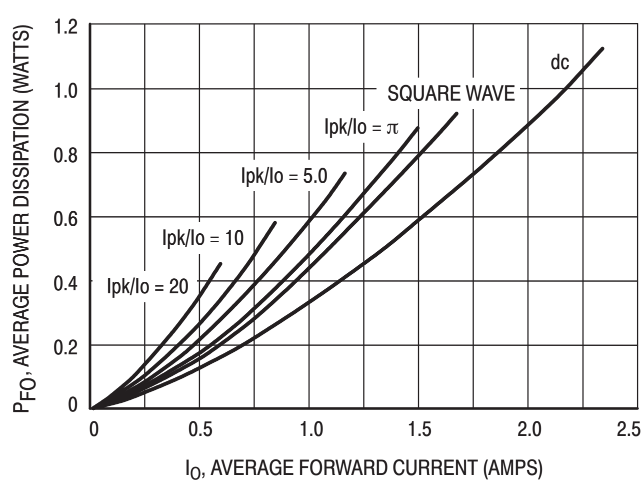


**Figure 6. Forward Power Dissipation**

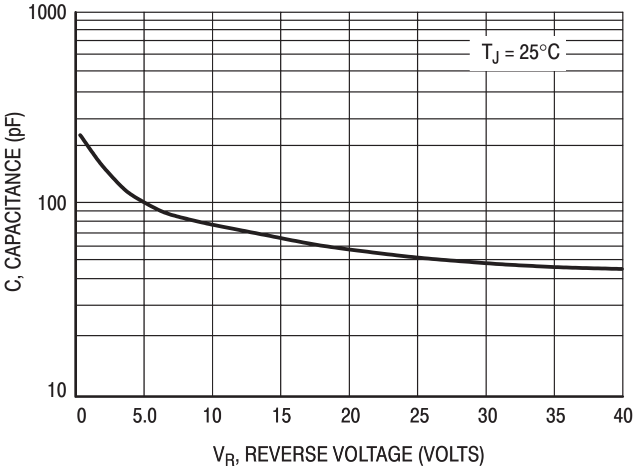


**Figure 7. Capacitance**

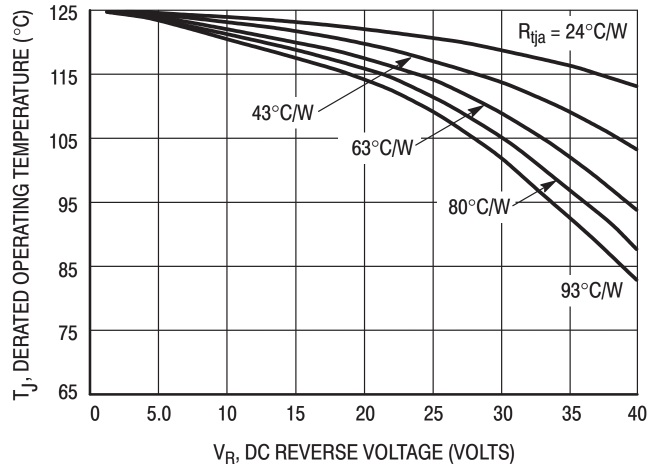


**Figure 8. Typical Operating Temperature Derating***

* Reverse power dissipation and the possibility of thermal runaway must be considered when operating this device under any reverse voltage conditions. Calculations of $T_J$ therefore must include forward and reverse power effects. The allowable operating $T_J$ may be calculated from the equation: $T_J = T_{Jmax} - r(t)(Pf + Pr)$ where

r(t) = thermal impedance under given conditions,

Pf = forward power dissipation, and

Pr = reverse power dissipation

This graph displays the derated allowable $T_J$ due to reverse bias under DC conditions only and is calculated as $T_J = T_{Jmax} - r(t)Pr$, where r(t) = Rthja. For other power applications further calculations must be performed.

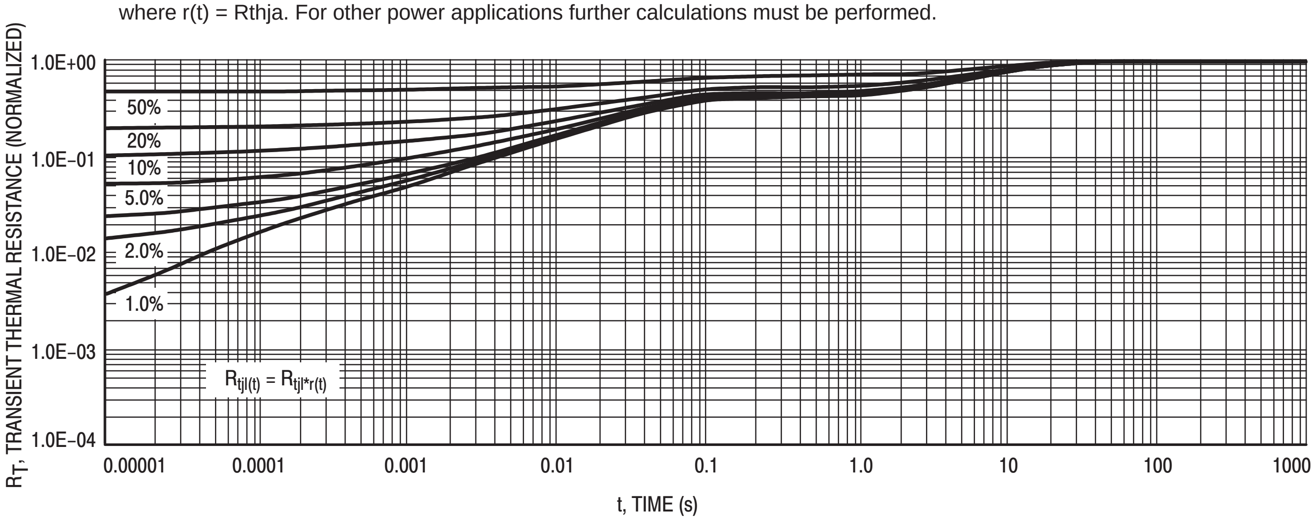


**Figure 9. Thermal Response — Junction to Case**

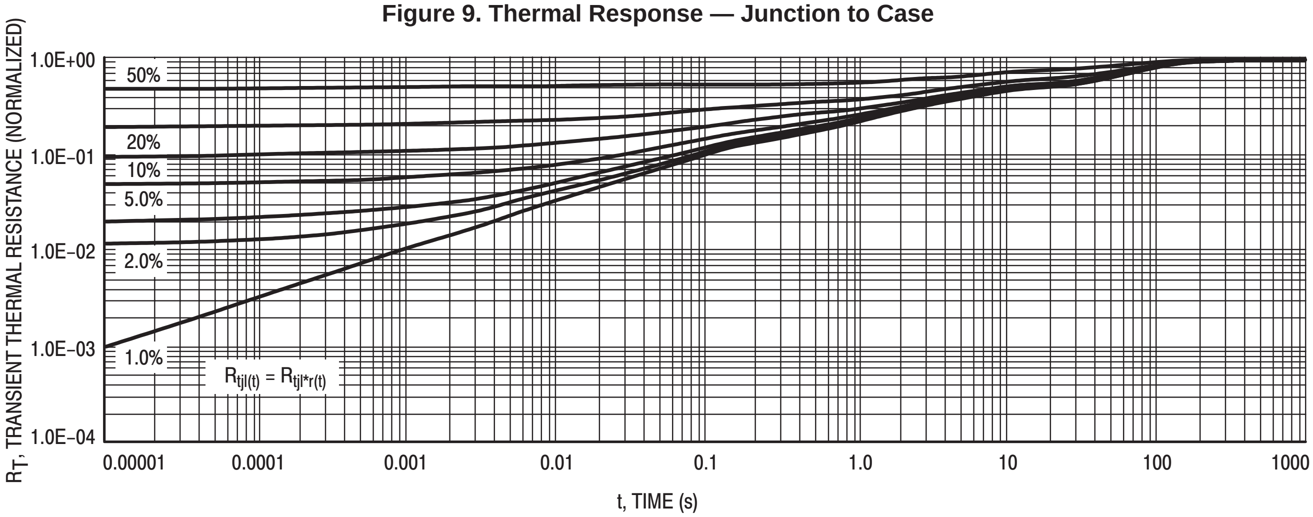


**Figure 10. Thermal Response — Junction to Ambient**

# MBRS240LT3

# Surface Mount Schottky Power Rectifier

## SMB Power Surface Mount Package

. . . employing the Schottky Barrier principle in a metal–to–silicon power rectifier. Features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency switching power supplies; free wheeling diodes and polarity protection diodes.

- Compact Package with J–Bend Leads Ideal for Automated Handling
- Highly Stable Oxide Passivated Junction
- Guardring for Over–Voltage Protection
- Low Forward Voltage Drop

**Mechanical Characteristics:**

- Case: Molded Epoxy
- Epoxy Meets UL94, VO at 1/8″
- Weight: 95 mg (approximately)
- Cathode Polarity Band
- Maximum Temperature of 260°C/10 Seconds for Soldering
- Available in 12 mm Tape, 2500 Units per 13″ Reel, Add “T3” Suffix to Part Number
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Marking: 2BL4

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 40 | V |
| Average Rectified Forward Current (At Rated $V_R$, $T_C$ = 100°C) | $I_O$ | 2.0 | A |
| Peak Repetitive Forward Current (At Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 105°C) | $I_{FRM}$ | 4.0 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 25 | A |
| Storage/Operating Case Temperature | $T_{stg}$, $T_C$ | –55 to +150 | °C |
| Operating Junction Temperature | $T_J$ | –55 to +125 | °C |
| Voltage Rate of Change (Rated $V_R$, $T_J$ = 25°C) | dv/dt | 10,000 | V/μs |

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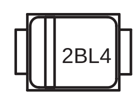
**SCHOTTKY BARRIER RECTIFIER**
**2.0 AMPERES**
**40 VOLTS**

**SMB**
**CASE 403A**
**PLASTIC**

**MARKING DIAGRAM**




2BL4 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRS240LT3 | SMB | 2500/Tape & Reel |

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### THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction–to–Lead (Note 1.)<br>Thermal Resistance — Junction–to–Ambient (Note 3.) | $R_{\theta JL}$<br>$R_{\theta JA}$ | 18<br>78 | °C/W |

### ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | | | Unit |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.) | $V_F$ | **$T_J$ = 25°C** | **$T_J$ = 125°C** | Volts |
| ($I_F$ = 2.0 A) | | 0.43 | 0.375 | |
| see Figure 2 ($I_F$ = 4.0 A) | | 0.54 | 0.55 | |
| Maximum Instantaneous Reverse Current (Note 2.) | $I_R$ | **$T_J$ = 25°C** | **$T_J$ = 100°C** | mA |
| ($V_R$ = 40 V) | | 2.0 | 60 | |
| see Figure 4 ($V_R$ = 20 V) | | 0.5 | 40 | |

1. Mounted with minimum recommended pad size, PC Board FR4.
2. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2.0%.
3. 1 inch square pad size (1 x 0.5 inch for each lead) on FR4 board.

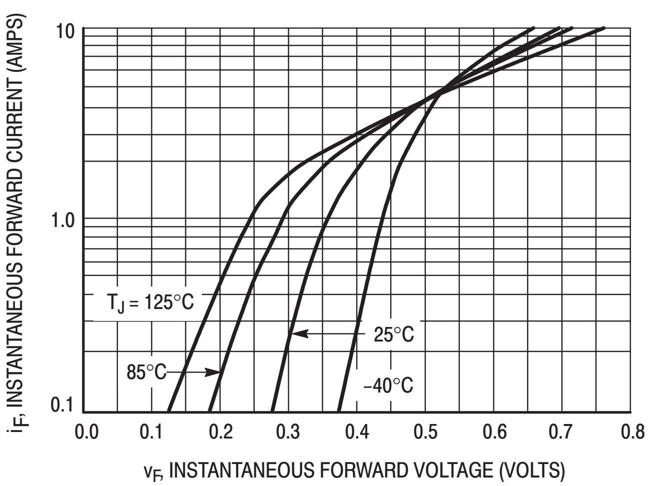


**Figure 1. Typical Forward Voltage**

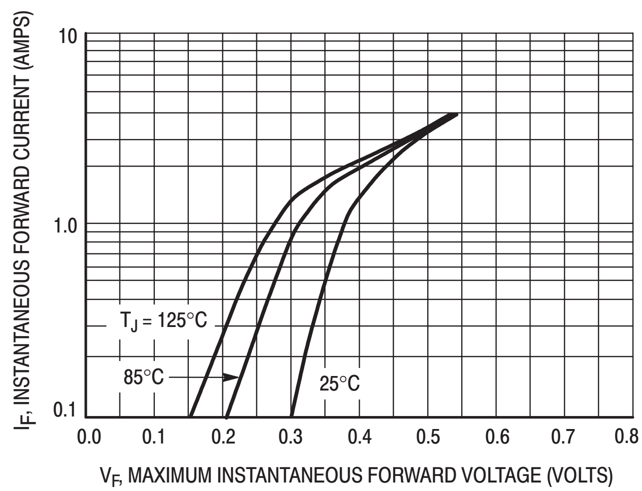


**Figure 2. Maximum Forward Voltage**

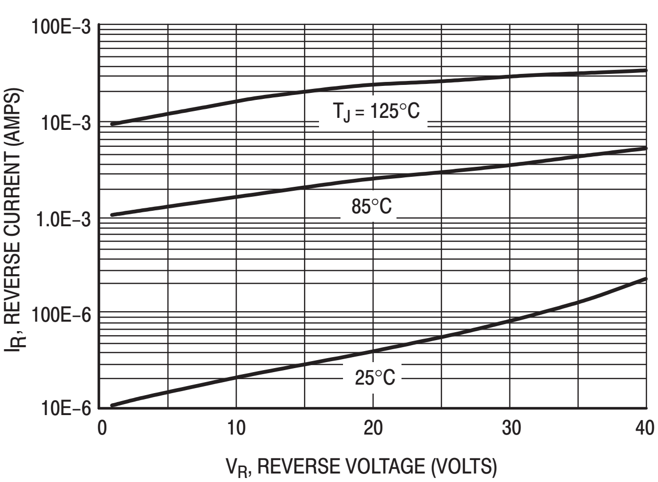


**Figure 3. Typical Reverse Current**

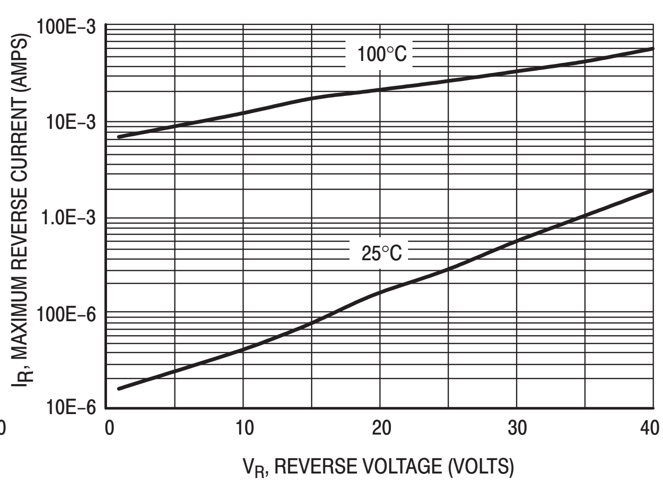


**Figure 4. Maximum Reverse Current**

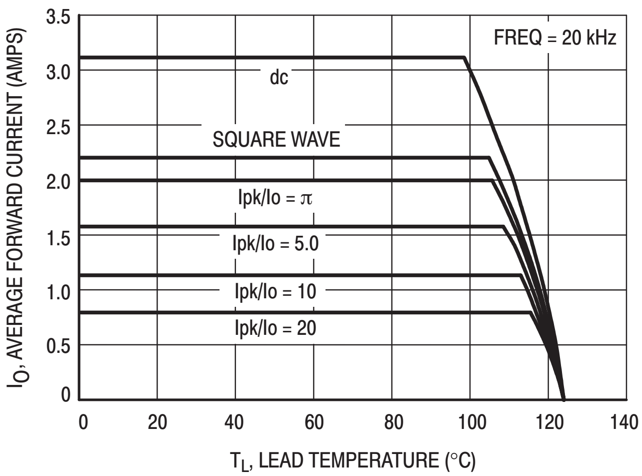


**Figure 5. Current Derating**

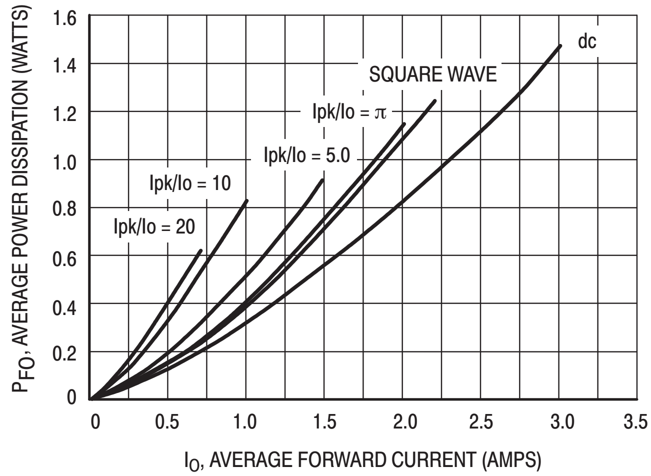


**Figure 6. Forward Power Dissipation**

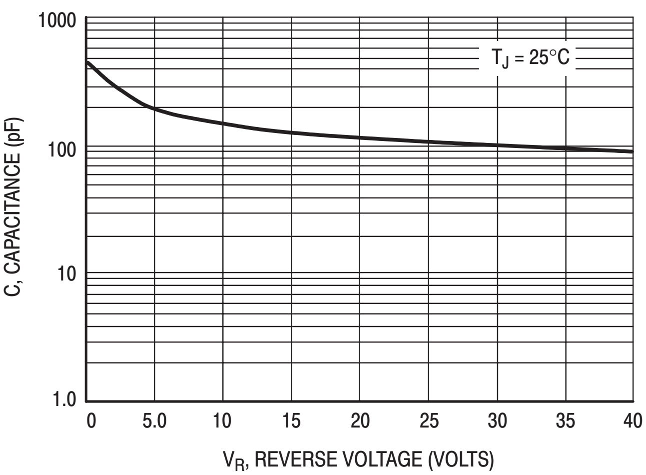


**Figure 7. Capacitance**

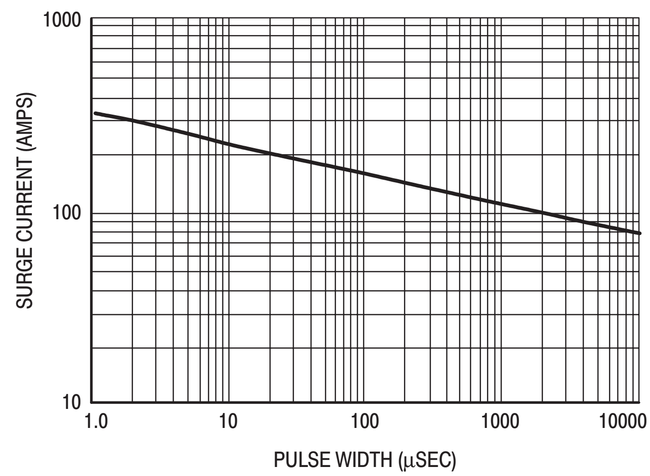


**Figure 8. Maximum Non–Repetitive Forward Surge Current**

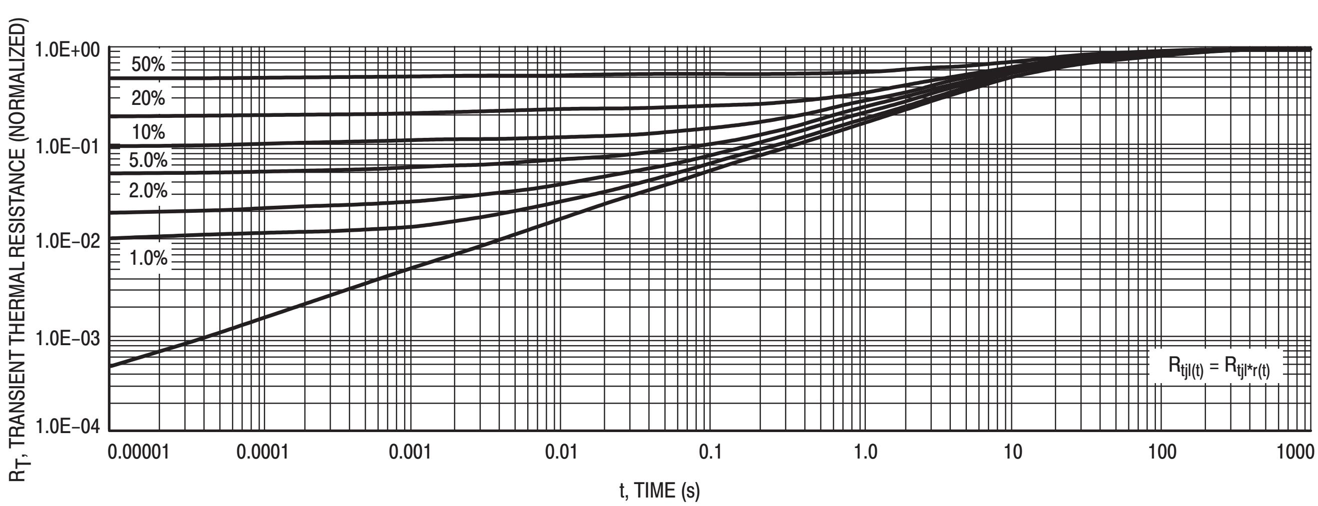


**Figure 9. Thermal Response**

# MBRS2040LT3

# Surface Mount Schottky Power Rectifier

## SMB Power Surface Mount Package

. . . employing the Schottky Barrier principle in a metal–to–silicon power rectifier. Features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency switching power supplies; free wheeling diodes and polarity protection diodes.

- Compact Package with J–Bend Leads Ideal for Automated Handling
- Highly Stable Oxide Passivated Junction
- Guardring for Over–Voltage Protection
- Low Forward Voltage Drop

**Mechanical Characteristics:**

- Case: Molded Epoxy
- Epoxy Meets UL94, VO at 1/8″
- Weight: 95 mg (approximately)
- Maximum Temperature of 260°C / 10 Seconds for Soldering
- Cathode Polarity Band
- Available in 12 mm Tape, 2500 Units per 13 inch Reel, Add “T3” Suffix to Part Number
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Marking: BKJL

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 40 | V |
| Average Rectified Forward Current (At Rated $V_R$, $T_C$ = 103°C) | $I_O$ | 2.0 | A |
| Peak Repetitive Forward Current (At Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 104°C) | $I_{FRM}$ | 4.0 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 70 | A |
| Storage/Operating Case Temperature | $T_{stg}$, $T_C$ | –55 to +150 | °C |
| Operating Junction Temperature | $T_J$ | –55 to +125 | °C |
| Voltage Rate of Change (Rated $V_R$, $T_J$ = 25°C) | dv/dt | 10,000 | V/μs |

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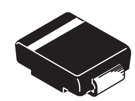
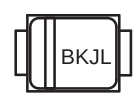
**SCHOTTKY BARRIER RECTIFIER**
**2.0 AMPERES**
**40 VOLTS**



**SMB**
**CASE 403A**
**PLASTIC**

**MARKING DIAGRAM**




BKJL = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRS2040LT3 | SMB | 2500/Tape & Reel |

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## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction–to–Lead (Note 1.)<br>Thermal Resistance — Junction–to–Ambient (Note 2.) | $R_{\theta JL}$<br>$R_{\theta JA}$ | 22.5<br>78 | °C/W |

## ELECTRICAL CHARACTERISTICS

| | | | | |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 3.) | $V_F$ | **$T_J$ = 25°C** | **$T_J$ = 125°C** | Volts |
| ($I_F$ = 2.0 A)<br>see Figure 2 ($I_F$ = 4.0 A) | | 0.43<br>0.50 | 0.34<br>0.45 | |
| Maximum Instantaneous Reverse Current (Note 3.) | $I_R$ | **$T_J$ = 25°C** | **$T_J$ = 100°C** | mA |
| ($V_R$ = 40 V)<br>see Figure 4 ($V_R$ = 20 V) | | 0.8<br>0.1 | 20<br>6.0 | |

1. Minimum pad size (0.108 X 0.085 inch) for each lead on FR4 board.
2. 1 inch square pad size (1 x 0.5 inch for each lead) on FR4 board.
3. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2.0%.

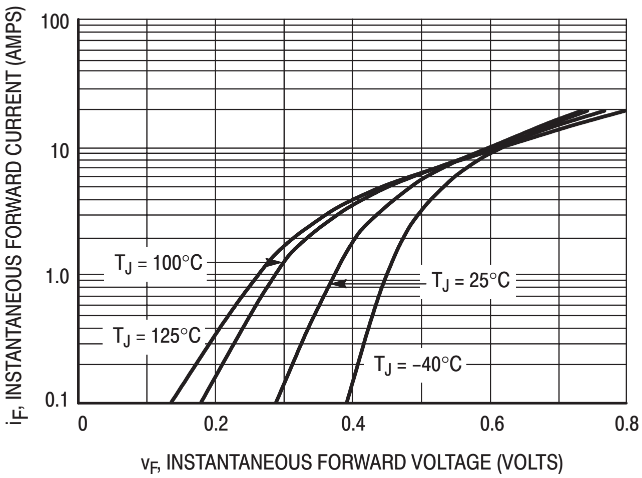



Figure 1. Typical Forward Voltage

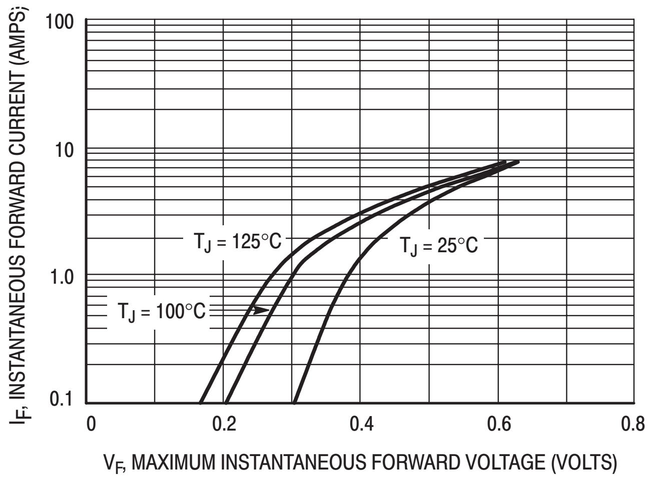



Figure 2. Maximum Forward Voltage

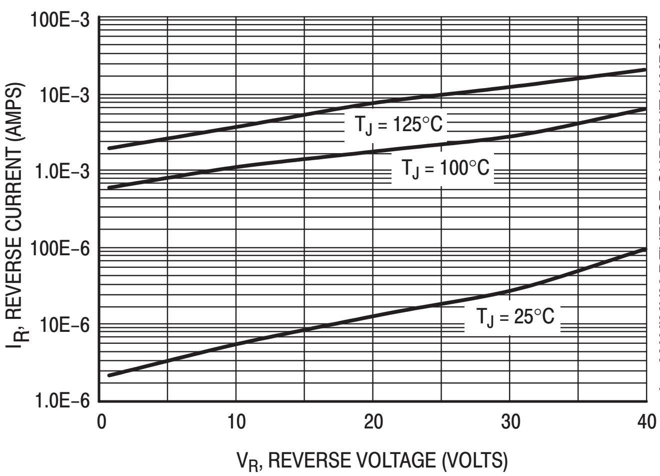



Figure 3. Typical Reverse Current

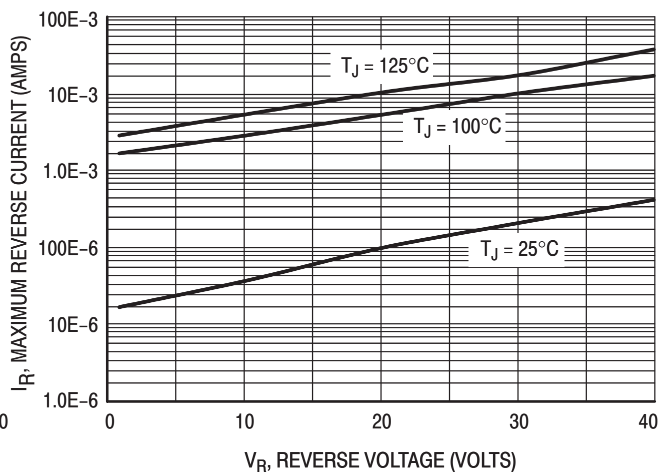



Figure 4. Maximum Reverse Current

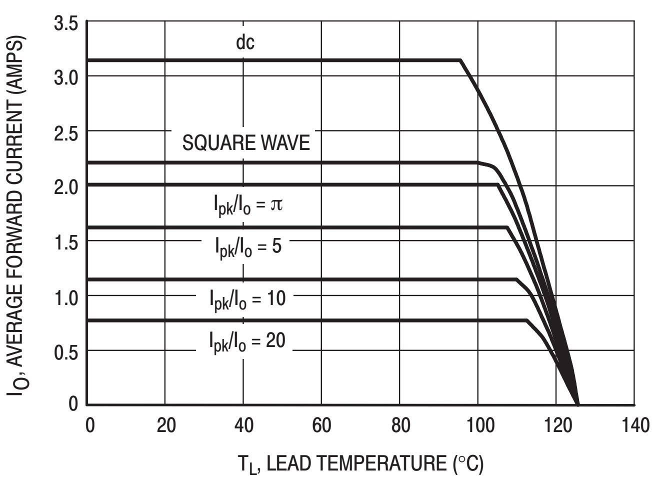



Figure 5. Current Derating

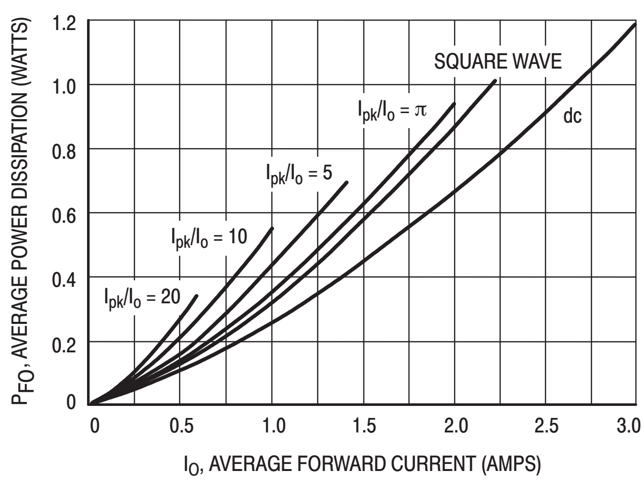



Figure 6. Forward Power Dissipation

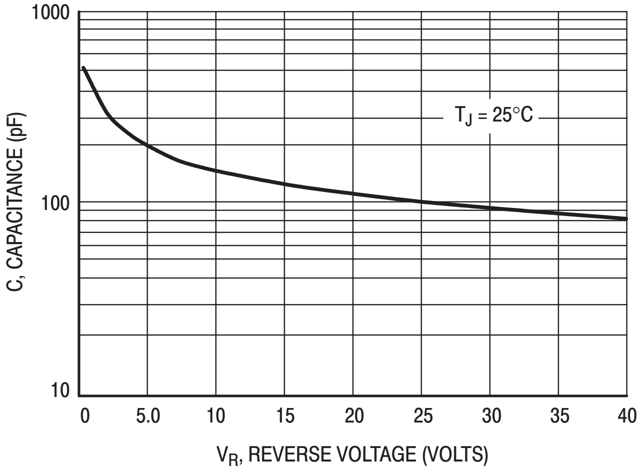



**Figure 7. Capacitance**

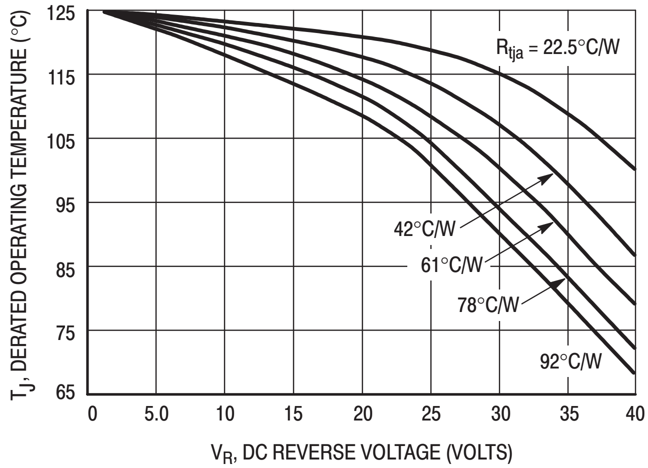



**Figure 8. Typical Operating Temperature Derating***

* Reverse power dissipation and the possibility of thermal runaway must be considered when operating this device under any reverse voltage conditions. Calculations of $T_J$ therefore must include forward and reverse power effects. The allowable operating $T_J$ may be calculated from the equation: $T_J = T_{Jmax} - r(t)(Pf + Pr)$ where

r(t) = thermal impedance under given conditions,
Pf = forward power dissipation, and
Pr = reverse power dissipation

This graph displays the derated allowable $T_J$ due to reverse bias under DC conditions only and is calculated as $T_J = T_{Jmax} - r(t)Pr$, where r(t) = Rthja. For other power applications further calculations must be performed.

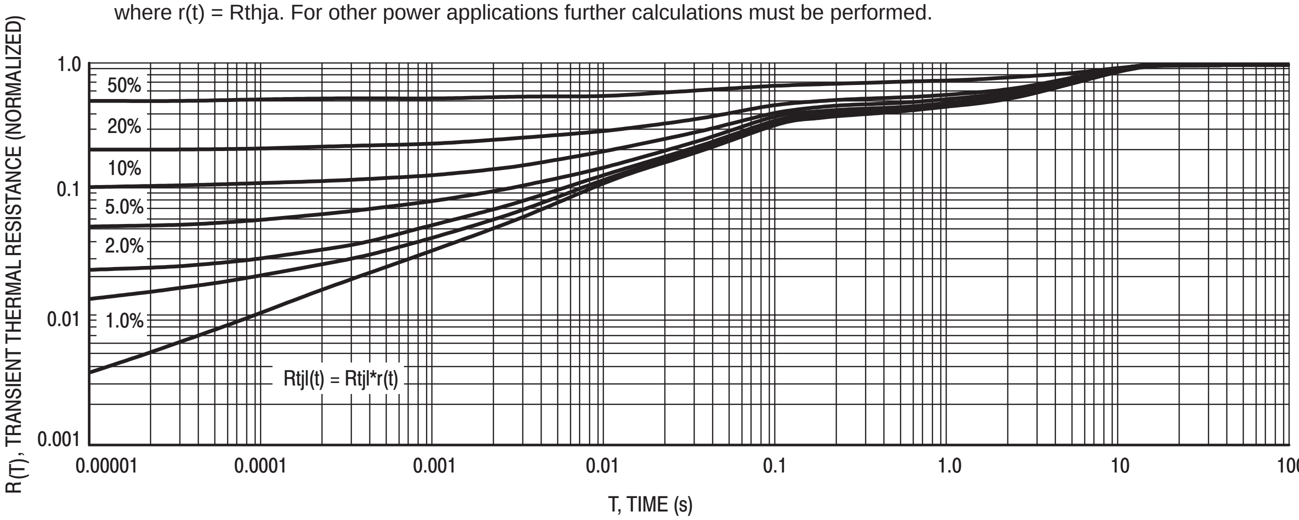



**Figure 9. Thermal Response Junction to Lead**

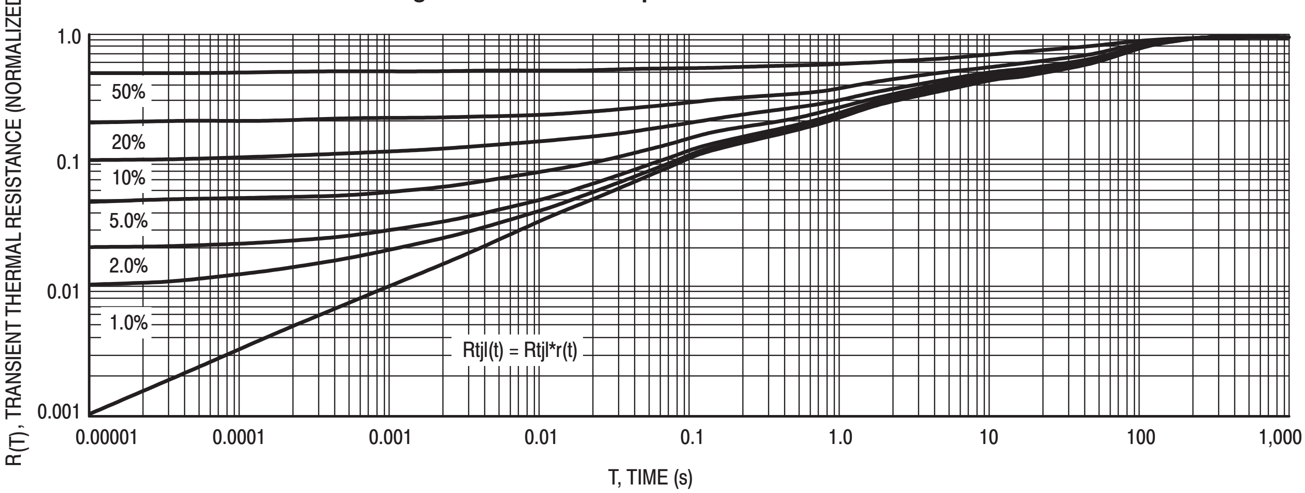



**Figure 10. Thermal Response Junction to Ambient**

# MBRS320T3, MBRS330T3, MBRS340T3, MBRS360T3

**Preferred Devices**

# Surface Mount Schottky Power Rectifier

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency rectification, or as free wheeling and polarity protection diodes, in surface mount applications where compact size and weight are critical to the system.

- Small Compact Surface Mountable Package with J–Bend Leads
- Rectangular Package for Automated Handling
- Highly Stable Oxide Passivated Junction
- Very Low Forward Voltage Drop (0.5 Volts Max @ 3.0 A, $T_J$ = 25°C)
- Excellent Ability to Withstand Reverse Avalanche Energy Transients
- Guardring for Stress Protection

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 217 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 16 mm Tape and Reel, 2500 units per reel
- Polarity: Notch in Plastic Body Indicates Cathode Lead
- Marking: B32, B33, B34, B36

**MAXIMUM RATINGS**

| |
|---|
| Please See the Table on the Following Page |

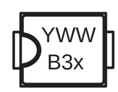
**ON Semiconductor™**

**http://onsemi.com**

**SCHOTTKY BARRIER RECTIFIERS 3.0 AMPERES 20, 30, 40, 60 VOLTS**

**SMC CASE 403 PLASTIC**

**MARKING DIAGRAM**




B3x = Device Code
x = 2, 3, 4 or 6
Y = Year
W = Work Week

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRS320T3 | SMC | 2500/Tape & Reel |
| MBRS330T3 | SMC | 2500/Tape & Reel |
| MBRS340T3 | SMC | 2500/Tape & Reel |
| MBRS360T3 | SMC | 2500/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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### MAXIMUM RATINGS

| Rating | Symbol | MBRS320T3 | MBRS330T3 | MBRS340T3 | MBRS360T3 | Unit |
|---|---|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 20 | 30 | 40 | 60 | Volts |
| Average Rectified Forward Current | $I_{F(AV)}$ | 3.0 @ $T_L$ = 100°C<br>4.0 @ $T_L$ = 90°C | | | | Amps |
| Nonrepetitive Peak Surge Current<br>(Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 80 | 80 | 80 | 80 | Amps |
| Operating Junction Temperature | $T_J$ | – 65 to +125 | – 65 to +125 | – 65 to +125 | | °C |

### THERMAL CHARACTERISTICS

| | | | | | | |
|---|---|---|---|---|---|---|
| Thermal Resistance — Junction to Lead | $R_{\theta JL}$ | 11 | 11 | 11 | 11 | °C/W |

### ELECTRICAL CHARACTERISTICS

| | | | | | | |
|---|---|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 3.0 A, $T_J$ = 25°C) | $V_F$ | 0.50 | 0.50 | 0.525 | 0.740 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_J$ = 25°C)<br>(Rated dc Voltage, $T_J$ = 100°C) | $i_R$ | <br>2.0<br>20 | <br>2.0<br>20 | <br>2.0<br>20 | <br>0.5<br>20 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

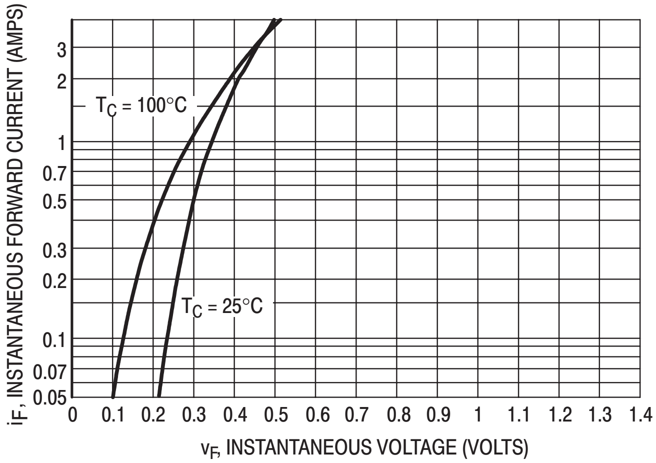



**Figure 1. Typical Forward Voltage**

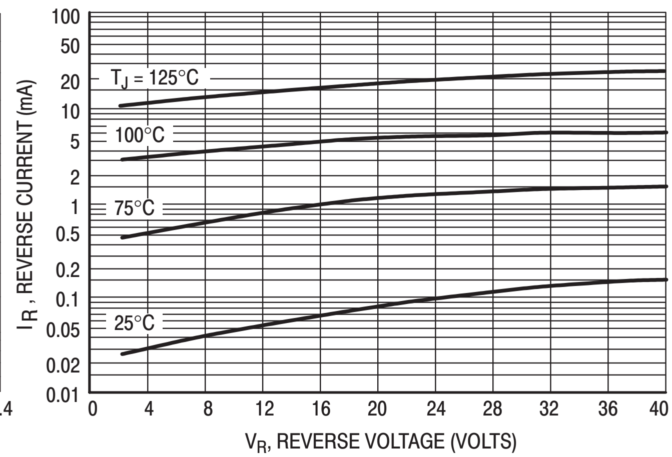



**Figure 2. Typical Reverse Current**

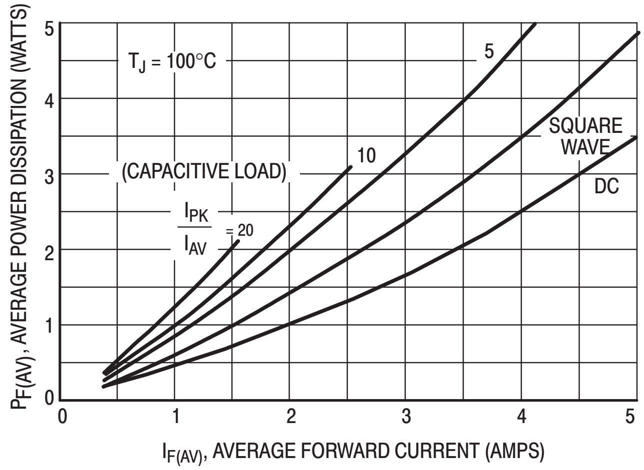



**Figure 3. Power Dissipation**

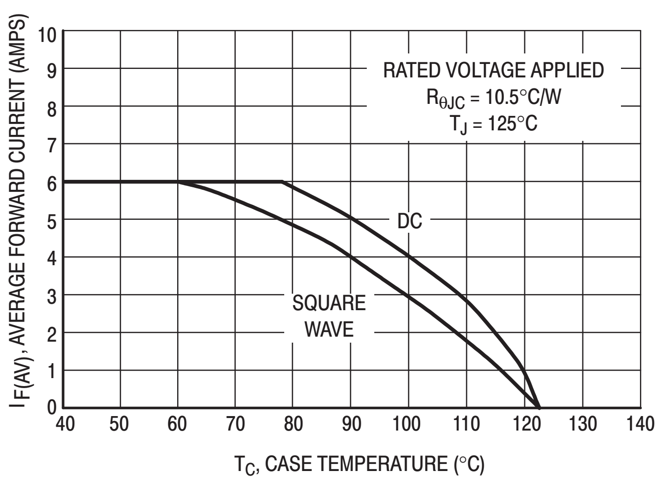



**Figure 4. Current Derating (Case)**

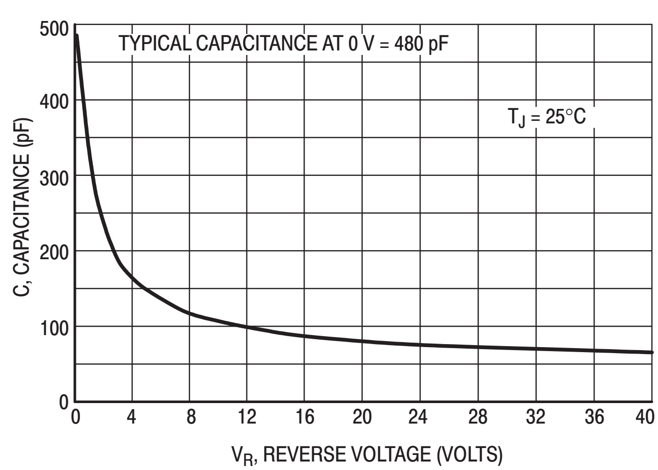



**Figure 5. Typical Capacitance**

# MBRD320, MBRD330, MBRD340, MBRD350, MBRD360

**MBRD320, MBRD340 and MBRD360 are Preferred Devices**

# SWITCHMODE™ Power Rectifiers

## DPAK Surface Mount Package

. . . designed for use as output rectifiers, free wheeling, protection and steering diodes in switching power supplies, inverters and other inductive switching circuits. These state–of–the–art devices have the following features:

- Extremely Fast Switching
- Extremely Low Forward Drop
- Platinum Barrier with Avalanche Guardrings

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 75 units per plastic tube
- Available in 16 mm Tape and Reel, 2500 units per reel, by adding a "T4'' suffix to the part number
- Marking: B320, B330, B340, B350, B360

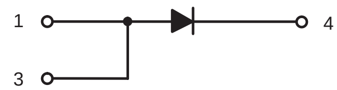
**MAXIMUM RATINGS**

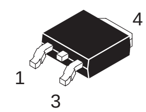
Please See the Table on the Following Page

ON Semiconductor™

http://onsemi.com

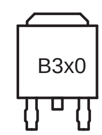
**SCHOTTKY BARRIER RECTIFIERS**
**3.0 AMPERES**
**20 TO 60 VOLTS**




**DPAK**
**CASE 369A**
**PLASTIC**

**MARKING DIAGRAM**




B3x0 = Device Code
x = 2, 3, 4, 5 or 6

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRD320 | DPAK | 75 Units/Rail |
| MBRD320RL | DPAK | 1800/Tape & Reel |
| MBRD320T4 | DPAK | 2500/Tape & Reel |
| MBRD330 | DPAK | 75 Units/Rail |
| MBRD330RL | DPAK | 1800/Tape & Reel |
| MBRD330T4 | DPAK | 2500/Tape & Reel |
| MBRD340 | DPAK | 75 Units/Rail |
| MBRD340RL | DPAK | 1800/Tape & Reel |
| MBRD340T4 | DPAK | 2500/Tape & Reel |
| MBRD350 | DPAK | 75 Units/Rail |
| MBRD350RL | DPAK | 1800/Tape & Reel |
| MBRD350T4 | DPAK | 2500/Tape & Reel |
| MBRD360 | DPAK | 75 Units/Rail |
| MBRD360RL | DPAK | 1800/Tape & Reel |
| MBRD360T4 | DPAK | 2500/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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October, 2000 – Rev. 2

Publication Order Number:
MBRD320/D

## MAXIMUM RATINGS

| Rating | Symbol | MBRD | | | | | Unit |
|---|---|---|---|---|---|---|---|
| | | 320 | 330 | 340 | 350 | 360 | |
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 20 | 30 | 40 | 50 | 60 | Volts |
| Average Rectified Forward Current ($T_C$ = +125°C, Rated $V_R$) | $I_{F(AV)}$ | 3 | | | | | Amps |
| Peak Repetitive Forward Current, $T_C$ = +125°C<br>(Rated $V_R$, Square Wave, 20 kHz) | $I_{FRM}$ | 6 | | | | | Amps |
| Nonrepetitive Peak Surge Current<br>(Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 75 | | | | | Amps |
| Peak Repetitive Reverse Surge Current (2 µs, 1 kHz) | $I_{RRM}$ | 1 | | | | | Amp |
| Operating Junction Temperature Range | $T_J$ | –65 to +150 | | | | | °C |
| Storage Temperature Range | $T_{stg}$ | –65 to +175 | | | | | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | | | | | V/µs |

## THERMAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 6 | °C/W |
| Maximum Thermal Resistance, Junction to Ambient (Note 1.) | $R_{\theta JA}$ | 80 | °C/W |

## ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.)<br>$i_F$ = 3 Amps, $T_C$ = +25°C<br>$i_F$ = 3 Amps, $T_C$ = +125°C<br>$i_F$ = 6 Amps, $T_C$ = +25°C<br>$i_F$ = 6 Amps, $T_C$ = +125°C | $V_F$ | <br>0.6<br>0.45<br>0.7<br>0.625 | Volts |
| Maximum Instantaneous Reverse Current (Note 2.)<br>(Rated dc Voltage, $T_C$ = +25°C)<br>(Rated dc Voltage, $T_C$ = +125°C) | $i_R$ | <br>0.2<br>20 | mA |

1. Rating applies when surface mounted on the minimum pad size recommended.
2. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

## TYPICAL CHARACTERISTICS

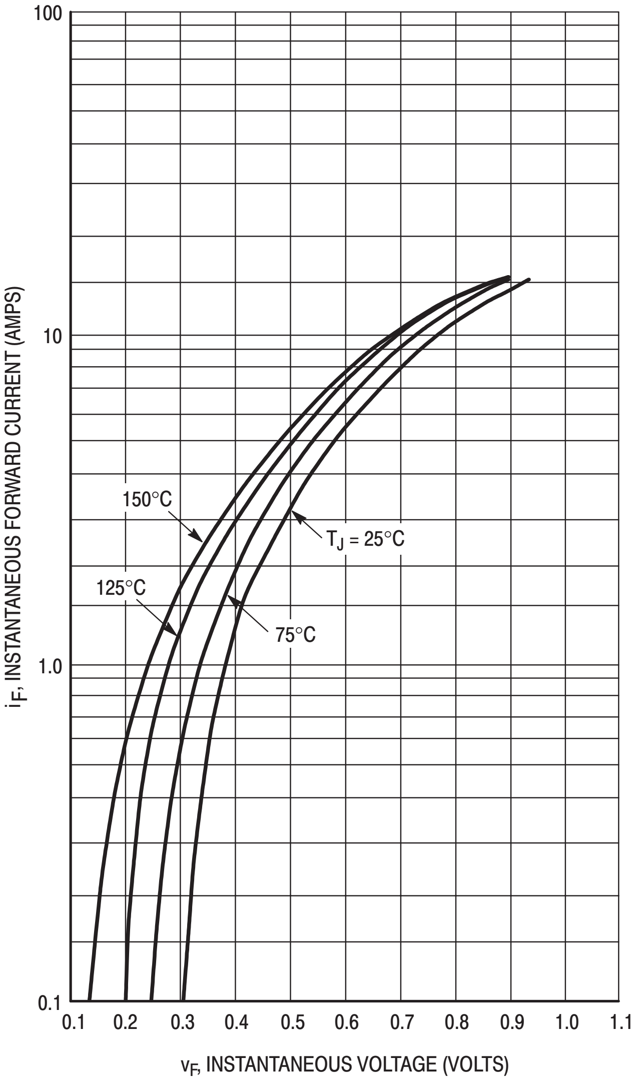
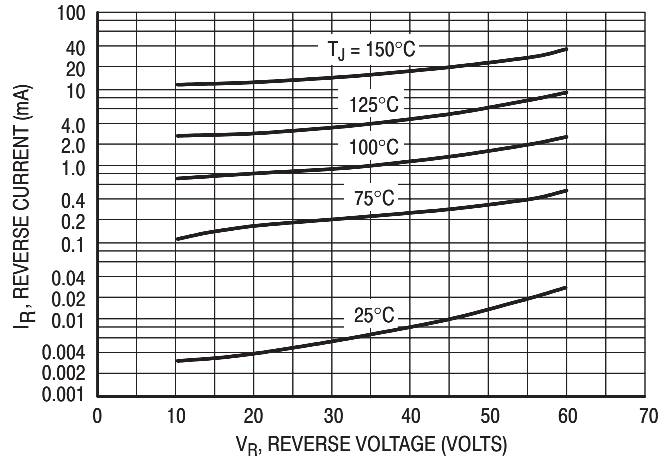



**Figure 1. Typical Forward Voltage**




*The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these curves if $V_R$ is sufficient below rated $V_R$.

**Figure 2. Typical Reverse Current**

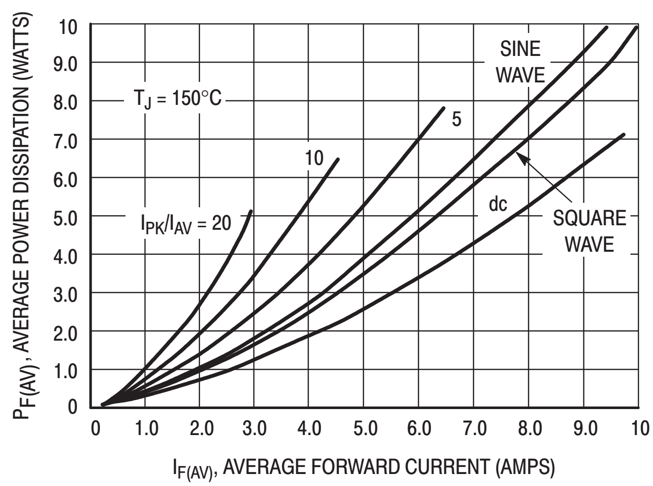



**Figure 3. Average Power Dissipation**

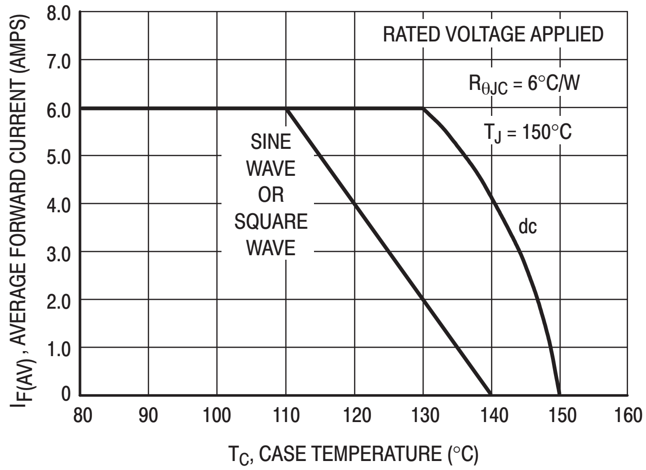



**Figure 4. Current Derating, Case**

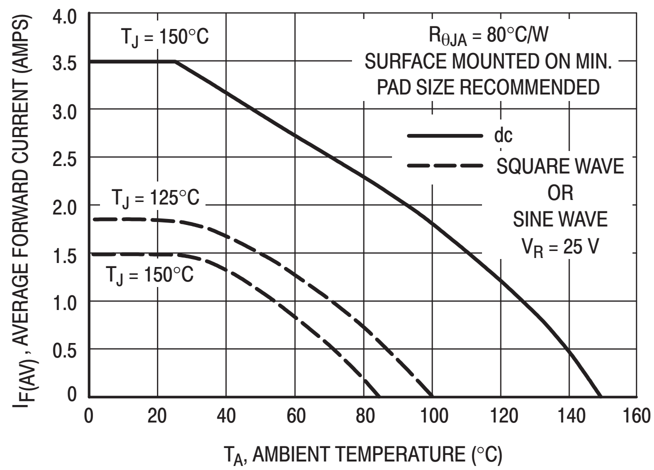



**Figure 5. Current Derating, Ambient**

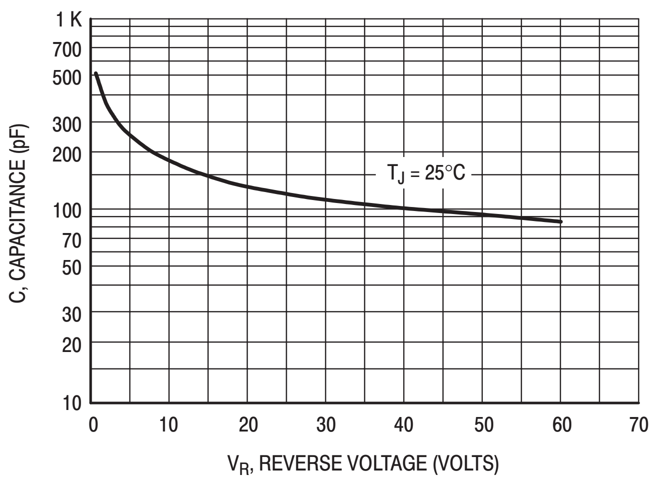



**Figure 6. Typical Capacitance**

# MBRD620CT, MBRD630CT, MBRD640CT, MBRD650CT, MBRD660CT

**MBRD620CT, MBRD640CT and MBRD660CT are Preferred Devices**

# SWITCHMODE™ Power Rectifiers

## DPAK Surface Mount Package

. . . in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Extremely Fast Switching
- Extremely Low Forward Drop
- Platinum Barrier with Avalanche Guardrings

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 75 units per plastic tube
- Available in 16 mm Tape and Reel, 2500 units per reel, by adding a “T4’’ suffix to the part number
- Marking: B620T, B630T, B640T, B650T, B660T

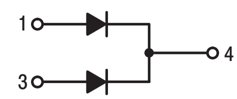
**MAXIMUM RATINGS**

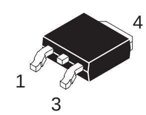
Please See the Table on the Following Page

ON Semiconductor™

http://onsemi.com

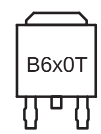
**SCHOTTKY BARRIER RECTIFIERS 6.0 AMPERES 20 TO 60 VOLTS**




**DPAK CASE 369A PLASTIC**

**MARKING DIAGRAM**




B6x0T = Device Code
x = 2, 3, 4, 5 or 6

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRD620CTT4 | DPAK | 2500/Tape & Reel |
| MBRD630CTT4 | DPAK | 2500/Tape & Reel |
| MBRD640CTT4 | DPAK | 2500/Tape & Reel |
| MBRD650CT | DPAK | 75 Units/Rail |
| MBRD650CTT4 | DPAK | 2500/Tape & Reel |
| MBRD660CT | DPAK | 75 Units/Rail |
| MBRD660CTRL | DPAK | 1800/Tape & Reel |
| MBRD660CTT4 | DPAK | 2500/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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## MAXIMUM RATINGS

| Rating | Symbol | MBRD | | | | | Unit |
|---|---|---|---|---|---|---|---|
| | | 620CT | 630CT | 640CT | 650CT | 660CT | |
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 20 | 30 | 40 | 50 | 60 | Volts |
| Average Rectified Forward Current Per Diode<br>$T_C$ = 130°C (Rated $V_R$) Per Device | $I_{F(AV)}$ | 3<br>6 | | | | | Amps |
| Peak Repetitive Forward Current, $T_C$ = 130°C<br>(Rated $V_R$, Square Wave, 20 kHz) Per Diode | $I_{FRM}$ | 6 | | | | | Amps |
| Nonrepetitive Peak Surge Current<br>(Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 75 | | | | | Amps |
| Peak Repetitive Reverse Surge Current (2 μs, 1 kHz) | $I_{RRM}$ | 1 | | | | | Amp |
| Operating Junction Temperature | $T_J$ | –65 to +150 | | | | | °C |
| Storage Temperature | $T_{stg}$ | –65 to +175 | | | | | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | | | | | V/μs |

## THERMAL CHARACTERISTICS PER DIODE

| | | | |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 6 | °C/W |
| Maximum Thermal Resistance, Junction to Ambient (Note 1.) | $R_{\theta JA}$ | 80 | °C/W |

## ELECTRICAL CHARACTERISTICS PER DIODE

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.)<br>$i_F$ = 3 Amps, $T_C$ = 25°C<br>$i_F$ = 3 Amps, $T_C$ = 125°C<br>$i_F$ = 6 Amps, $T_C$ = 25°C<br>$i_F$ = 6 Amps, $T_C$ = 125°C | $V_F$ | <br>0.7<br>0.65<br>0.9<br>0.85 | Volts |
| Maximum Instantaneous Reverse Current (Note 2.)<br>(Rated dc Voltage, $T_C$ = 25°C)<br>(Rated dc Voltage, $T_C$ = 125°C) | $i_R$ | <br>0.1<br>15 | mA |

1. Rating applies when surface mounted on the minimum pad size recommended.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

## TYPICAL CHARACTERISTICS

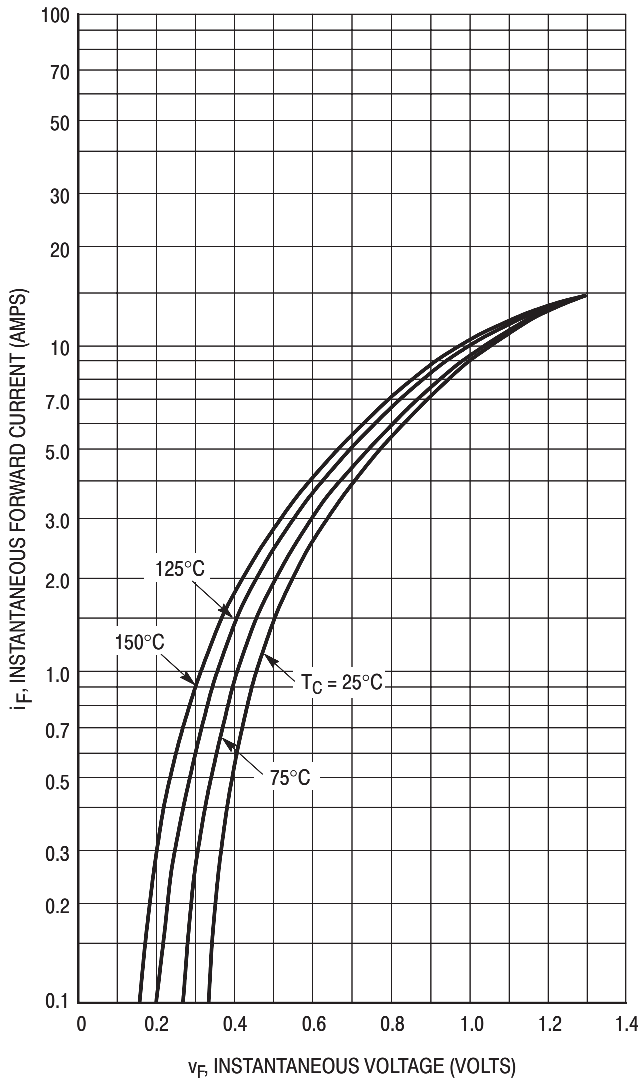
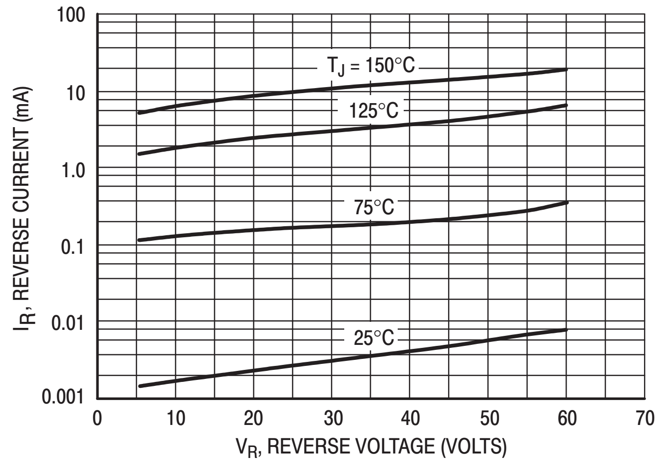



Figure 1. Typical Forward Voltage, Per Leg




*The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these curves if $V_R$ is sufficient below rated $V_R$.

Figure 2. Typical Reverse Current,* Per Leg

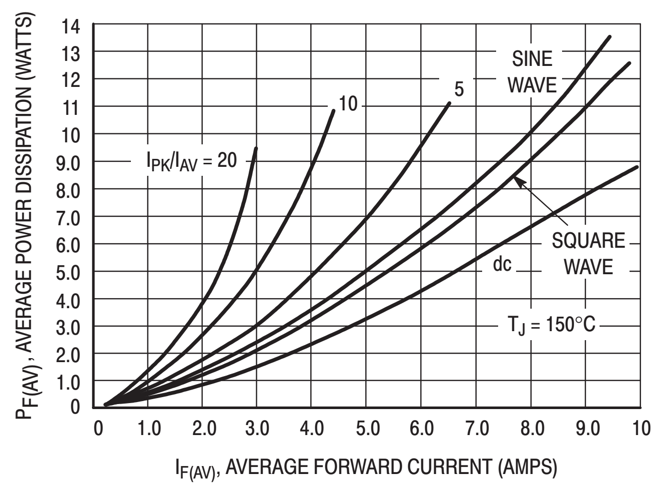



Figure 3. Average Power Dissipation, Per Leg

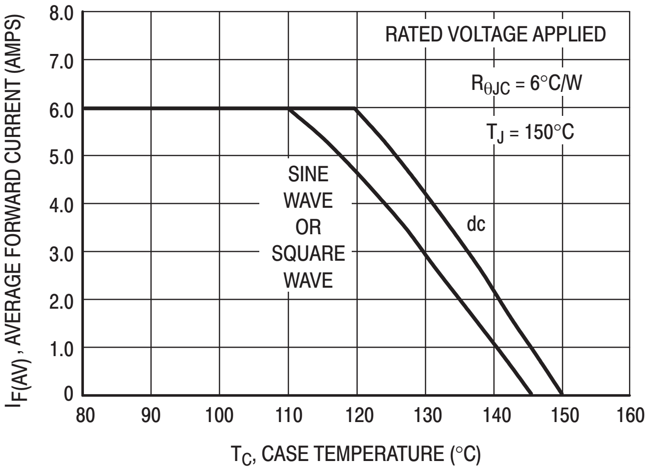



**Figure 4. Current Derating, Case, Per Leg**

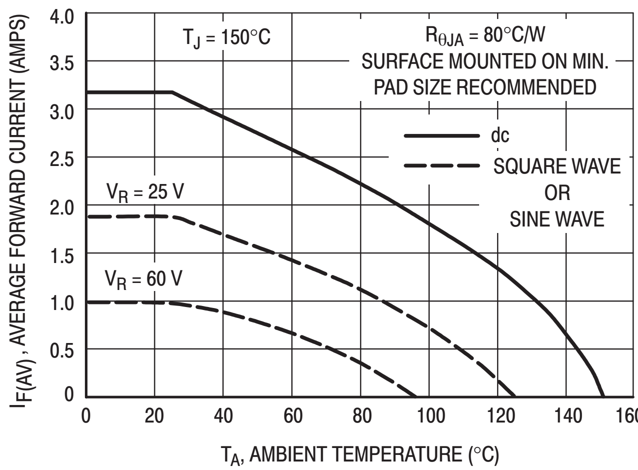



**Figure 5. Current Derating, Ambient, Per Leg**

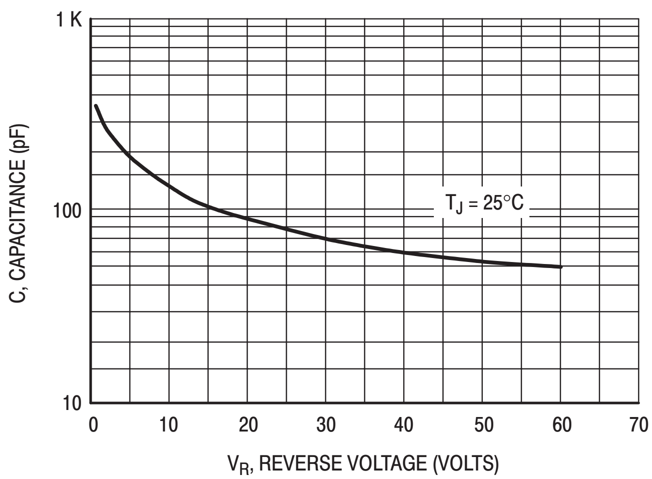



**Figure 6. Typical Capacitance, Per Leg**

# MBRD835L

**Preferred Device**

# SWITCHMODE™ Power Rectifier

## DPAK Surface Mount Package

This SWITCHMODE power rectifier which uses the Schottky Barrier principle with a proprietary barrier metal, is designed for use as output rectifiers, free wheeling, protection and steering diodes in switching power supplies, inverters and other inductive switching circuits. This state of the art device has the following features:

- Low Forward Voltage
- 125°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″
- Compact Size
- Lead Formed for Surface Mount

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 75 units per plastic tube
- Available in 16 mm Tape and Reel, 2500 units per 13″ reel, by adding a "T4" suffix to the part number
- Marking: B835L

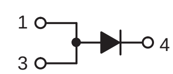
**MAXIMUM RATINGS**

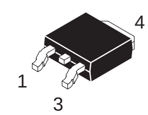
| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 35 | V |
| Average Rectified Forward Current (At Rated $V_R$, $T_C$ = 88°C) | $I_{F(AV)}$ | 8.0 | A |
| Peak Repetitive Forward Current (At Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 80°C) | $I_{FRM}$ | 16 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 75 | A |
| Repetitive Avalanche Current (Current Decaying Linearly to Zero in 1 μs, Frequency Limited by $T_{Jmax}$) | $I_{AR}$ | 2.0 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +150 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +125 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/μs |

**ON Semiconductor™**

**http://onsemi.com**

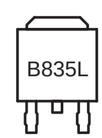
**SCHOTTKY BARRIER RECTIFIER**
**8.0 AMPERES**
**35 VOLTS**




**DPAK**
**CASE 369A**
**STYLE 3**

**MARKING DIAGRAM**




B835L = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRD835L | DPAK | 75 Units/Rail |
| MBRD835LT4 | DPAK | 2500/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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### THERMAL CHARACTERISTICS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case | $R_{\theta JC}$ | 6 | °C/W |
| Thermal Resistance — Junction to Ambient (Note 1.) | $R_{\theta JA}$ | 80 | °C/W |

### ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.) ($i_F$ = 8 Amps, $T_C$ = +25°C)<br>($i_F$ = 8 Amps, $T_C$ = +125°C) | $V_F$ | 0.51<br>0.41 | Volts |
| Maximum Instantaneous Reverse Current (Note 2.) (Rated dc Voltage, $T_C$ = +25°C)<br>(Rated dc Voltage, $T_C$ = +100°C) | $I_R$ | 1.4<br>35 | mA |

1. Rating applies when surface mounted on the minimum pad size recommended.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2%.

## TYPICAL CHARACTERISTICS

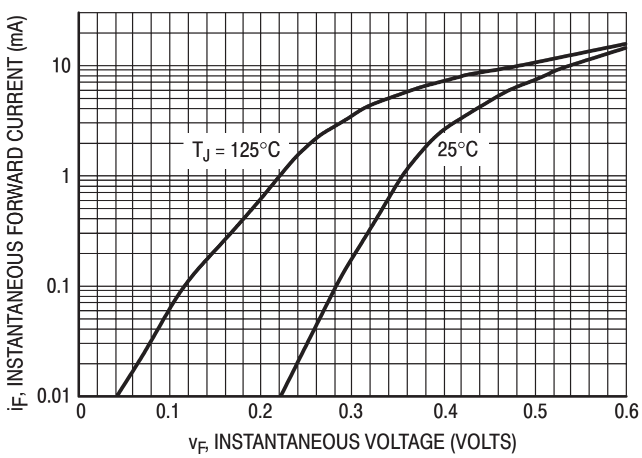



**Figure 1. Maximum Forward Voltage**

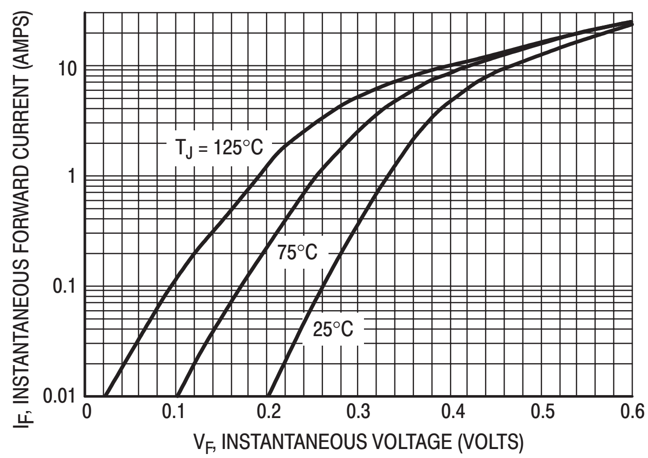



**Figure 2. Typical Forward Voltage**

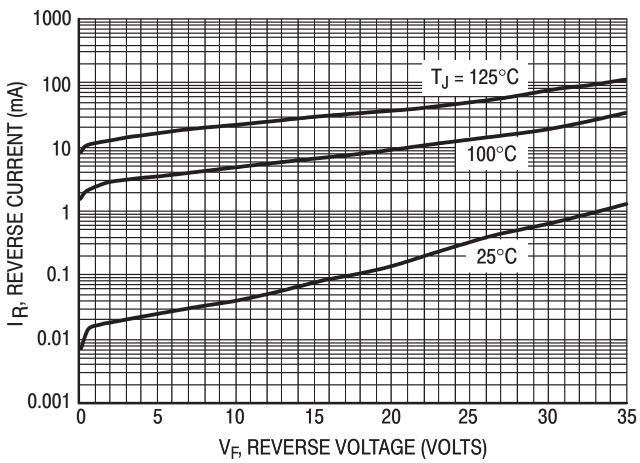



**Figure 3. Maximum Reverse Current**

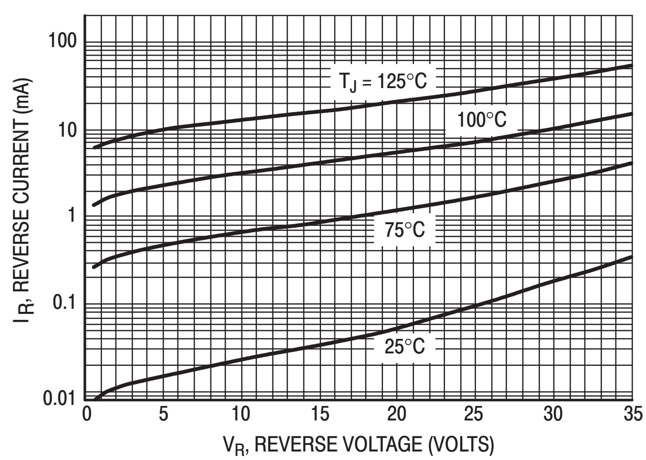



**Figure 4. Typical Reverse Current**

## TYPICAL CHARACTERISTICS

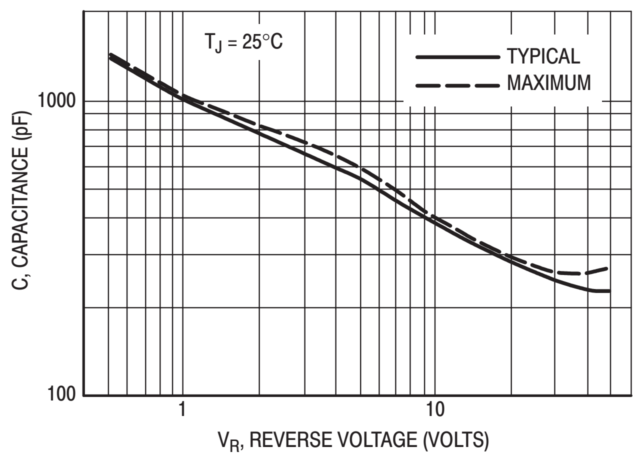



**Figure 5. Maximum and Typical Capacitance**

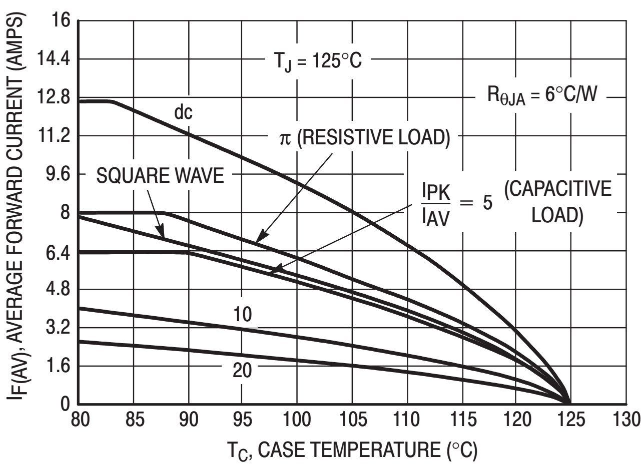



**Figure 6. Current Derating, Infinite Heatsink**

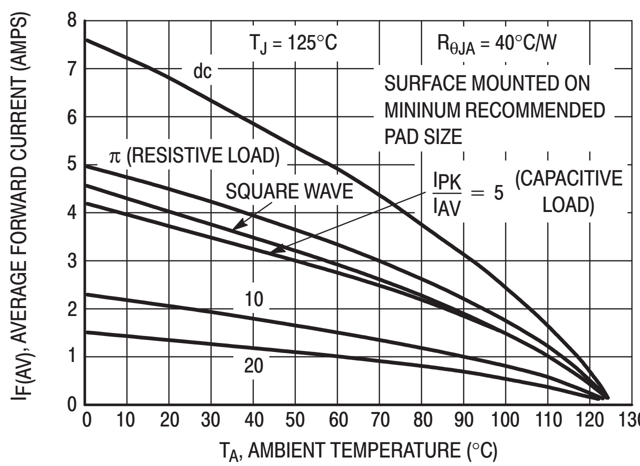



**Figure 7. Current Derating**

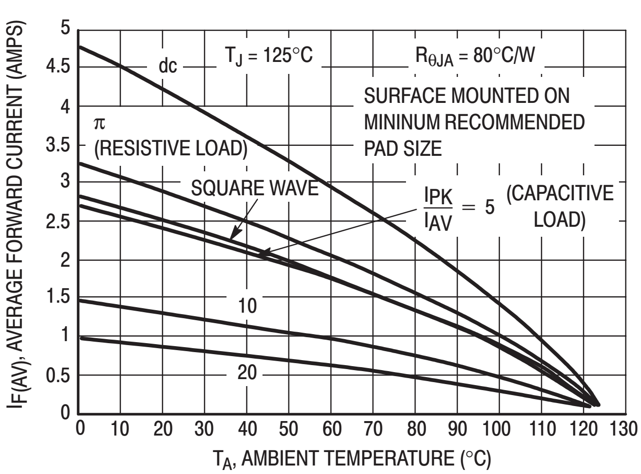



**Figure 8. Current Derating, Free Air**

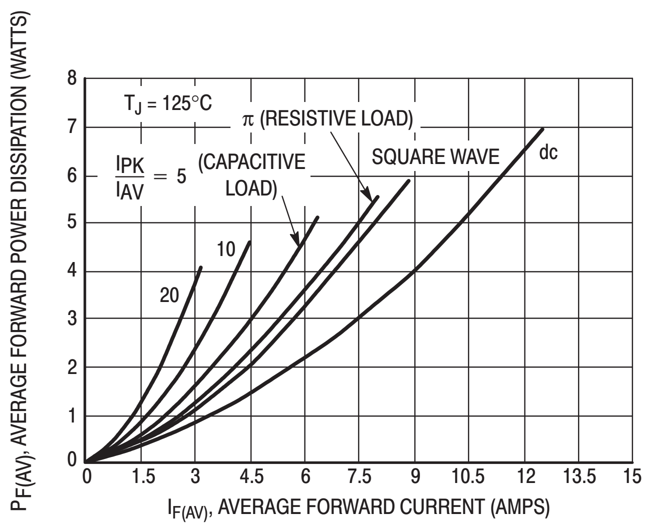



**Figure 9. Forward Power Dissipation**

# MBRD1035CTL

# SWITCHMODE™ Schottky Power Rectifier

## DPAK Power Surface Mount Package

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State of the art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency switching power supplies, free wheeling diode and polarity protection diodes.

- Highly Stable Oxide Passivated Junction
- Guardring for Stress Protection
- Matched Dual Die Construction – May be Paralleled for High Current Output
- High dv/dt Capability
- Short Heat Sink Tap Manufactured – Not Sheared
- Very Low Forward Voltage Drop
- Epoxy Meets UL94, VO at 1/8”

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 75 units per plastic tube
- Available in 16 mm Tape and Reel, 2500 units per Reel, Add “T4’’ to Suffix part #
- Marking: B1035CL

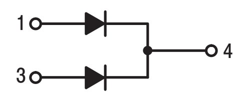
**MAXIMUM RATINGS**

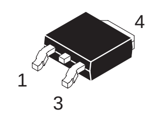
| |
|---|
| Please See the Table on the Following Page |

**ON Semiconductor**™

**http://onsemi.com**

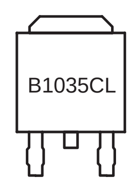
**SCHOTTKY BARRIER RECTIFIER**
**10 AMPERES**
**35 VOLTS**




**DPAK**
**CASE 369A**
**PLASTIC**

**MARKING DIAGRAM**




B1035CL = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRD1035CTL | DPAK | 75 Units/Rail |
| MBRD1035CTLT4 | DPAK | 2500/Tape & Reel |

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## MAXIMUM RATINGS

| Rating | | Symbol | Value | Unit |
|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 35 | Volts |
| Average Rectified Forward Current<br>(At Rated $V_R$, $T_C$ = 115°C) | Per Leg<br>Per Package | $I_O$ | 5.0<br>10 | Amps |
| Peak Repetitive Forward Current<br>(At Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 115°C) | Per Leg | $I_{FRM}$ | 10 | Amps |
| Non–Repetitive Peak Surge Current<br>(Surge applied at rated load conditions, halfwave, single phase, 60 Hz) | Per Package | $I_{FSM}$ | 50 | Amps |
| Storage / Operating Case Temperature | | $T_{stg}$, $T_c$ | –55 to +125 | °C |
| Operating Junction Temperature | | $T_J$ | –55 to +125 | °C |
| Voltage Rate of Change (Rated $V_R$, $T_J$ = 25°C) | | dv/dt | 10,000 | V/µs |

## THERMAL CHARACTERISTICS

| | | | | |
|---|---|---|---|---|
| Thermal Resistance – Junction to Case | Per Leg | $R_{\theta JC}$ | 2.43 | °C/W |
| Thermal Resistance – Junction to Ambient (Note 1.) | Per Leg | $R_{\theta JA}$ | 68 | °C/W |

## ELECTRICAL CHARACTERISTICS

| | | | | |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.)<br>see Figure 2<br>$I_F$ = 5 Amps, $T_J$ = 25°C<br>$I_F$ = 5 Amps, $T_J$ = 100°C<br>$I_F$ = 10 Amps, $T_J$ = 25°C<br>$I_F$ = 10 Amps, $T_J$ = 100°C | Per Leg | $V_F$ | 0.47<br>0.41<br>0.56<br>0.55 | Volts |
| Maximum Instantaneous Reverse Current (Note 2.)<br>see Figure 4<br>($V_R$ = 35 V, $T_J$ = 25°C)<br>($V_R$ = 35 V, $T_J$ = 100°C)<br>($V_R$ = 17.5 V, $T_J$ = 25°C)<br>($V_R$ = 17.5 V, $T_J$ = 100°C) | Per Leg | $I_R$ | 2.0<br>30<br>0.20<br>5.0 | mA |

1. Rating applies when using minimum pad size, FR4 PC Board
2. Pulse Test: Pulse Width ≤ 250 µs, Duty Cycle ≤ 2.0%.

## TYPICAL CHARACTERISTICS

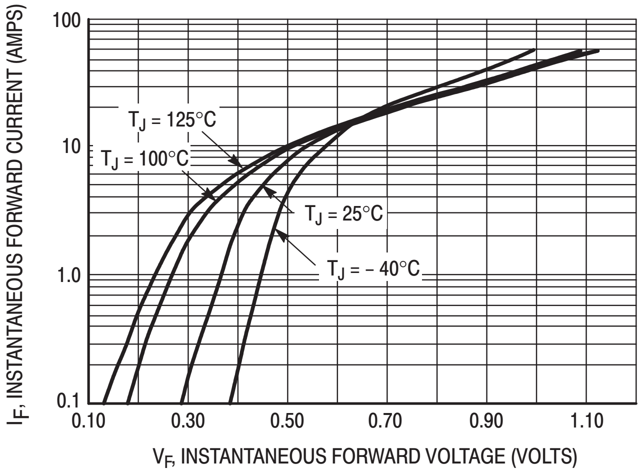


**Figure 1. Typical Forward Voltage Per Leg**

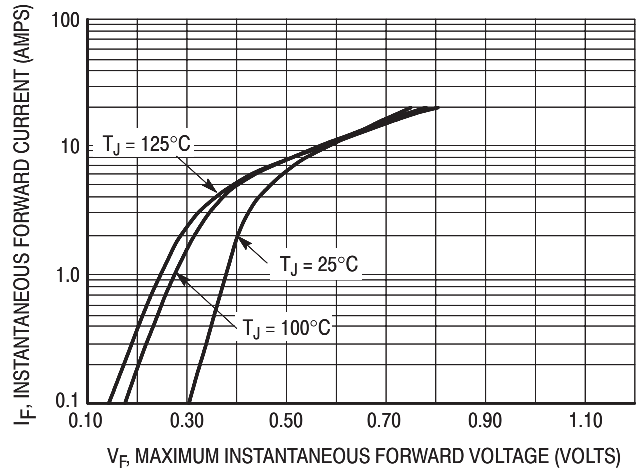


**Figure 2. Maximum Forward Voltage Per Leg**

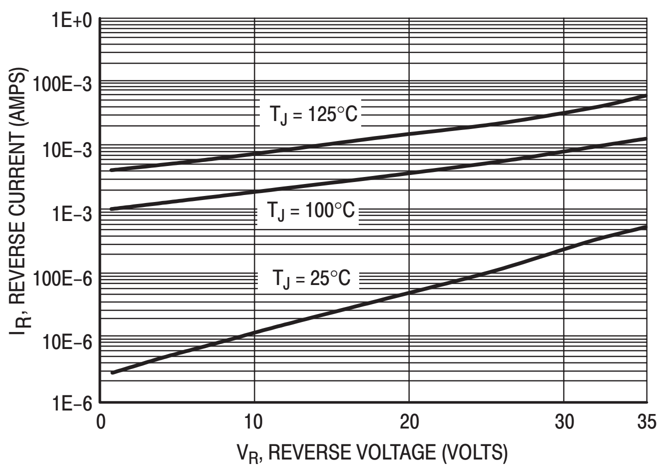


**Figure 3. Typical Reverse Current Per Leg**

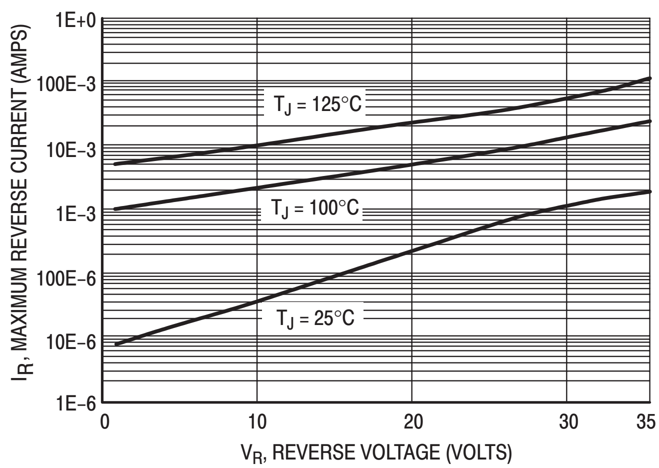


**Figure 4. Maximum Reverse Current Per Leg**

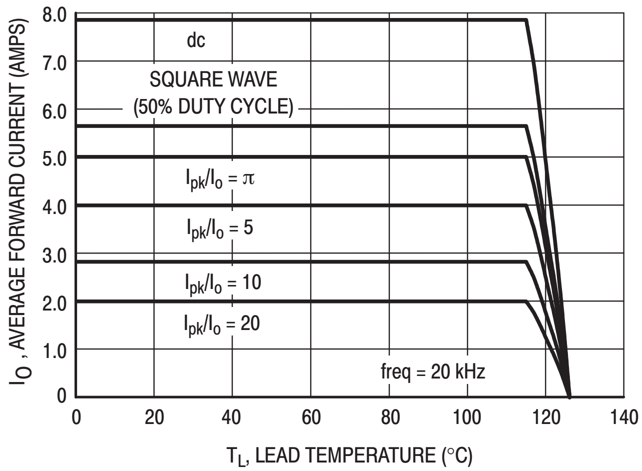


**Figure 5. Current Derating Per Leg**

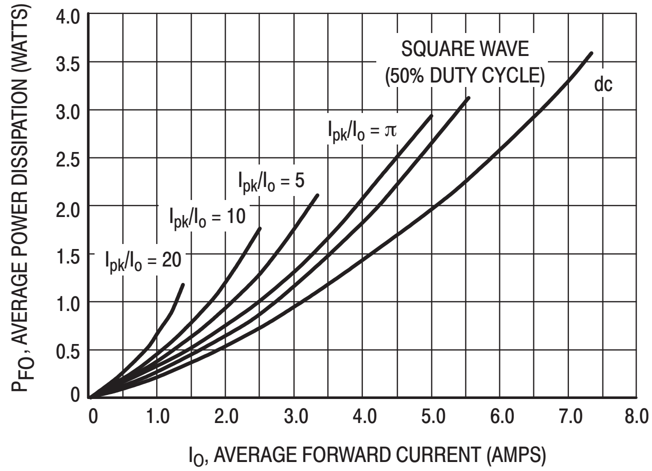


**Figure 6. Forward Power Dissipation Per Leg**

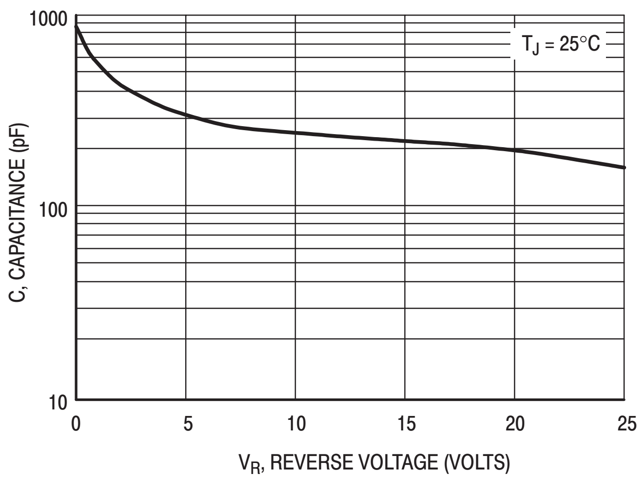


**Figure 7. Capacitance Per Leg**

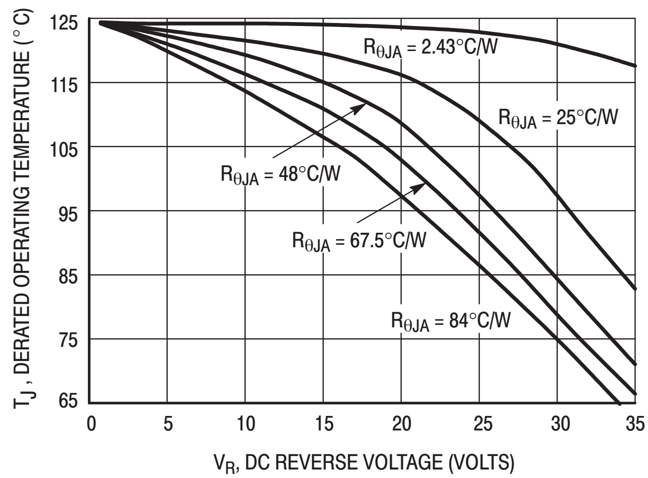


**Figure 8. Typical Operating Temperature Derating Per Leg ***

* Reverse power dissipation and the possibility of thermal runaway must be considered when operating this device under any reverse voltage conditions. Calculations of $T_J$ therefore must include forward and reverse power effects. The allowable operating $T_J$ may be calculated from the equation: $T_J = T_{Jmax} – r(t)(Pf + Pr)$ where

r(t) = thermal impedance under given conditions,
Pf = forward power dissipation, and
Pr = reverse power dissipation

This graph displays the derated allowable $T_J$ due to reverse bias under DC conditions only and is calculated as $T_J = T_{Jmax} – r(t)Pr$, where r(t) = Rthja. For other power applications further calculations must be performed.

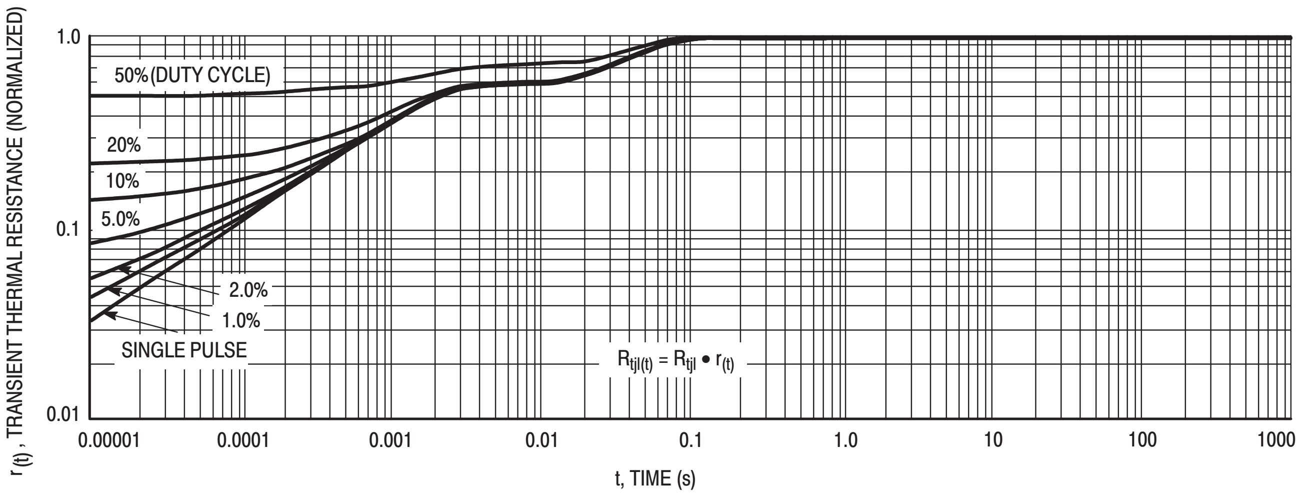


**Figure 9. Thermal Response Junction to Case (Per Leg)**

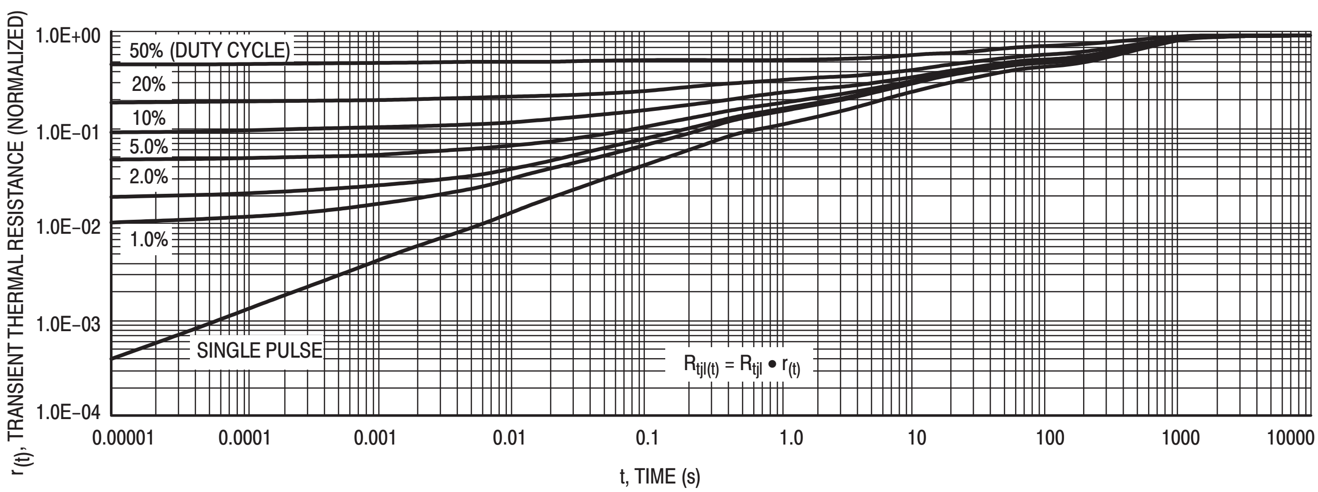


**Figure 10. Thermal Response Junction to Ambient (Per Leg)**

# MBRB1045

Preferred Device

# SWITCHMODE™ Power Rectifier

## $D^2$PAK Surface Mount Power Package

The $D^2$PAK Power Rectifier employs the Schottky Barrier principle in a large metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for use in low voltage, high frequency switching power supplies, free wheeling diodes, and polarity protection diodes. These state–of–the–art devices have the following features:

- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″
- Short Heat Sink Tab Manufactured — Not Sheared!
- Similar in Size to the Industry Standard TO–220 Package

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per 13″ reel by adding a "T4" suffix to the part number
- Marking: MBRB1045

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 45 | Volts |
| Average Rectified Forward Current (Rated $V_R$) $T_C$ = 135°C | $I_{F(AV)}$ | 10 | Amps |
| Peak Repetitive Forward Current (Rated $V_R$, Square Wave, 20 kHz) $T_C$ = 135°C | $I_{FRM}$ | 20 | Amps |
| Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 150 | Amps |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10000 | V/µs |

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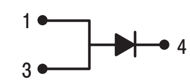
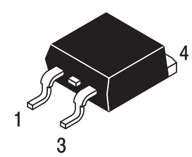
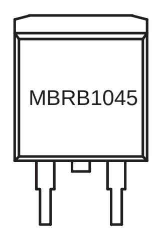
**SCHOTTKY BARRIER RECTIFIER 10 AMPERES 45 VOLTS**




**$D^2$PAK CASE 418B PLASTIC**

**MARKING DIAGRAM**




MBRB1045 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRB1045 | $D^2$PAK | 50 Units/Tube |
| MBRB1045T4 | $D^2$PAK | 800/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case (Note 1.)<br>— Junction to Ambient (Note 1.) | $R_{\theta JC}$<br>$R_{\theta JA}$ | 1.0<br>34 | °C/W |

## ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.)<br>($I_F$ = 10 Amps, $T_J$ = 125°C)<br>($I_F$ = 20 Amps, $T_J$ = 125°C)<br>($I_F$ = 20 Amps, $T_J$ = 25°C) | $V_F$ | <br>0.57<br>0.72<br>0.84 | Volts |
| Maximum Instantaneous Reverse Current (Note 2.)<br>(Rated dc Voltage, TJ = 125°C)<br>(Rated dc Voltage, $T_J$ = 25°C) | $I_R$ | <br>15<br>0.1 | mA |

1. When mounted using minimum recommended pad size on FR–4 board.
2. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%

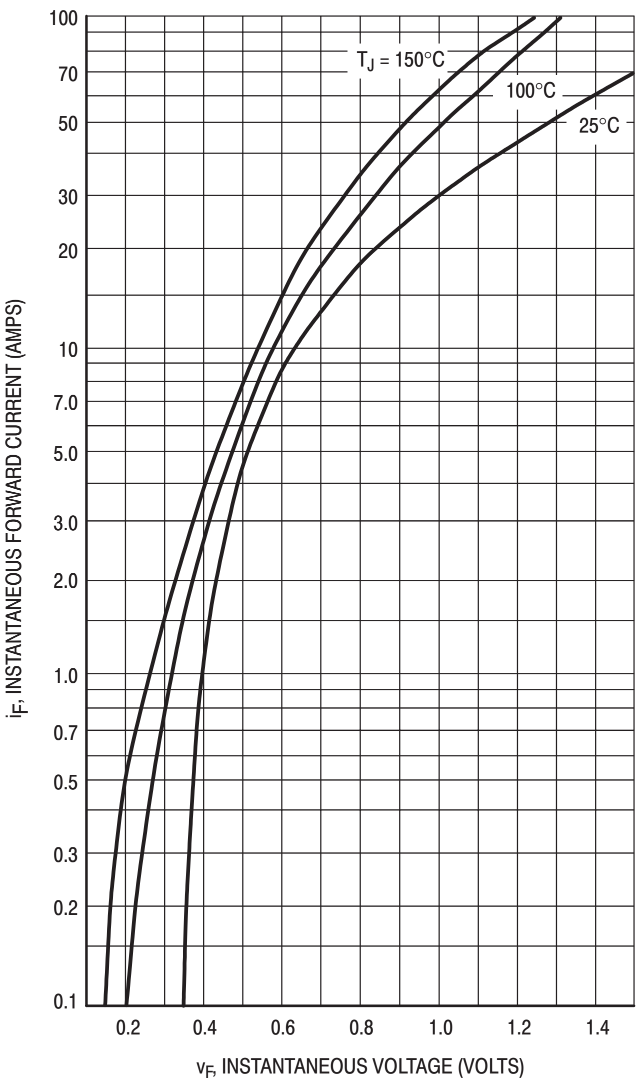



**Figure 1. Maximum Forward Voltage**

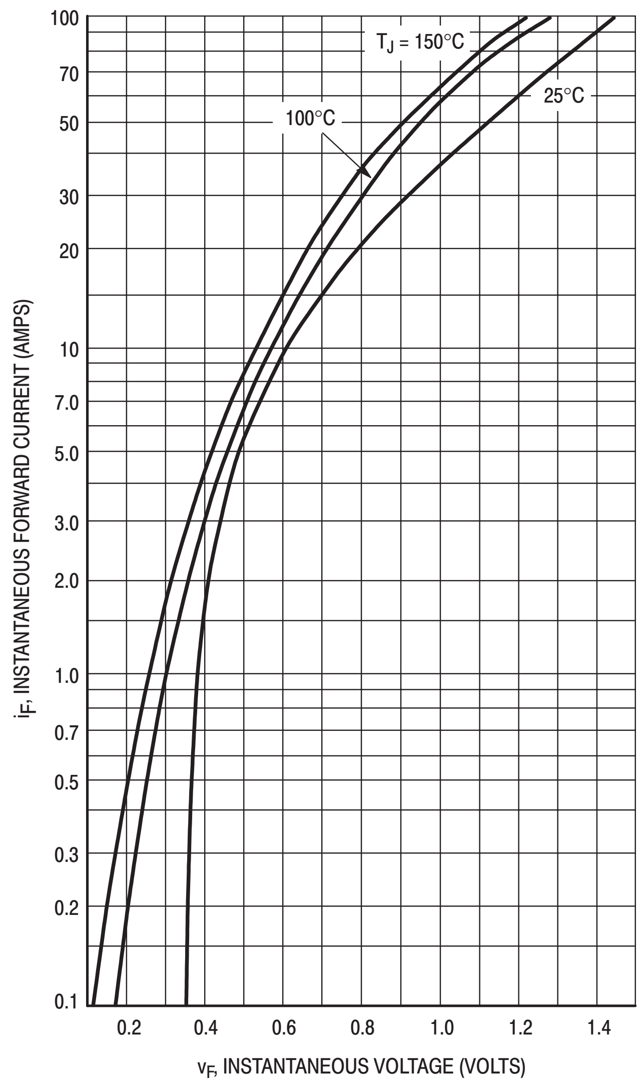



**Figure 2. Typical Forward Voltage**

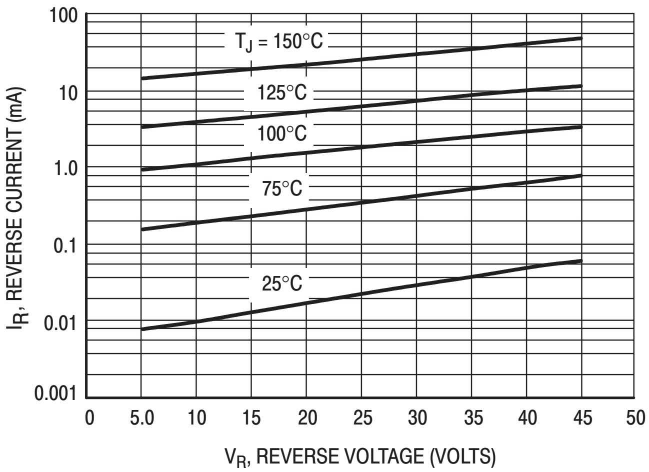



**Figure 3. Maximum Reverse Current**

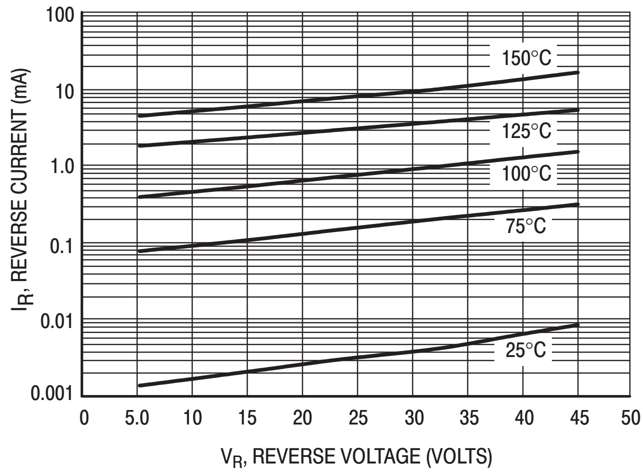



**Figure 4. Typical Reverse Current**

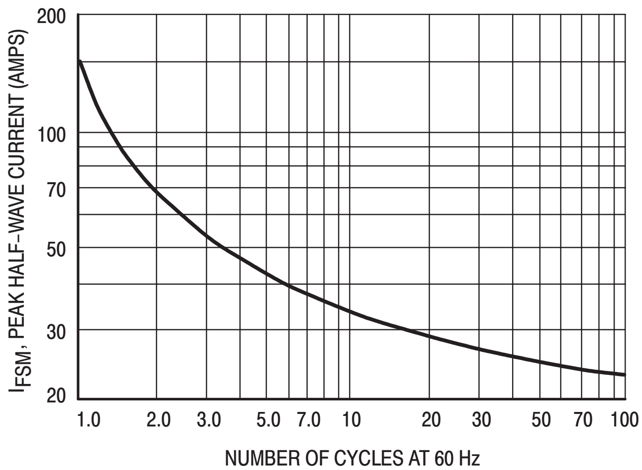



**Figure 8. Maximum Surge Capability**

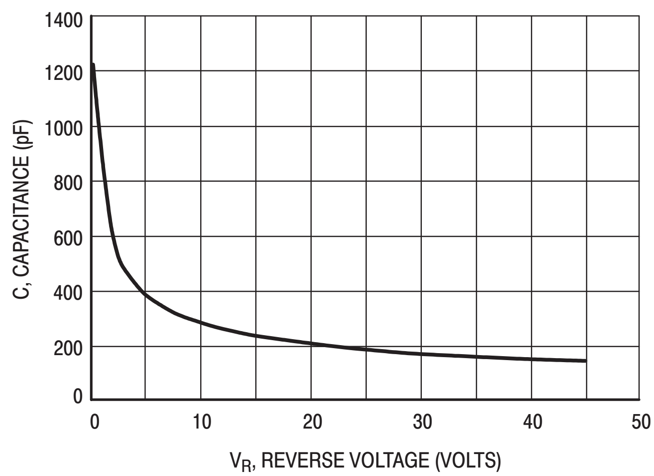



**Figure 5. Typical Capacitance**

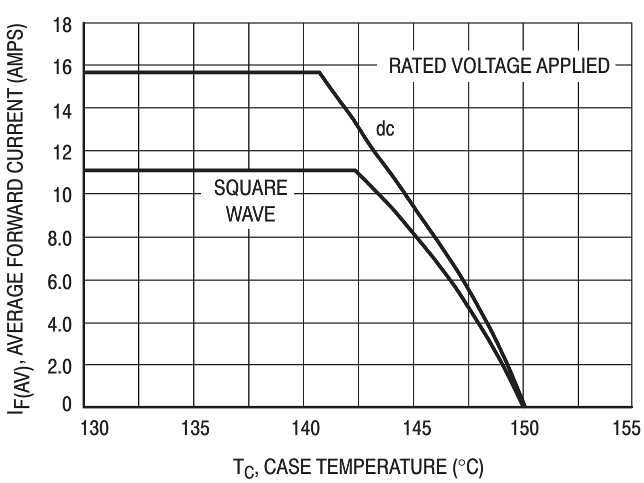



**Figure 6. Current Derating, Case, $R_{\theta JC}$ = 1.0 °C/W**

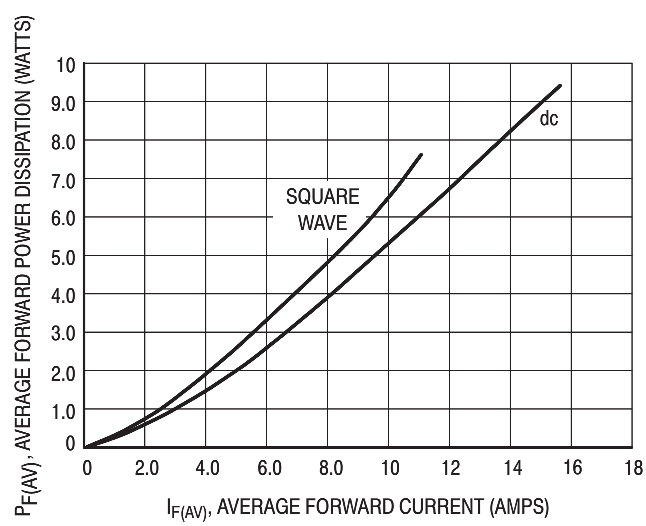



**Figure 7. Forward Power Dissipation**

# MBRB1545CT

**Preferred Device**

# SWITCHMODE™ Power Rectifier

## $D^2$PAK Surface Mount Power Package

The $D^2$PAK Power Rectifier employs the Schottky Barrier principle with a platinum barrier metal. These state-of-the-art devices have the following features:

- Center-Tap Configuration
- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″
- Short Heat Sink Tab Manufactured — Not Sheared!
- Similar in Size to the Industry Standard TO-220 Package

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per 13″ reel by adding a “T4” suffix to the part number
- Marking: B1545T

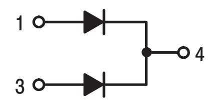
**MAXIMUM RATINGS** (Per Leg)

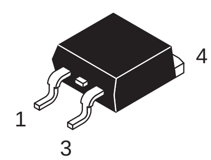
| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 45 | V |
| Average Rectified Forward Current<br>(Rated $V_R$, $T_C$ = 105°C) Total Device | $I_{F(AV)}$ | 7.5<br>15 | A |
| Peak Repetitive Forward Current<br>(Rated $V_R$, Square Wave,<br>20 kHz, $T_C$ = 105°C) | $I_{FRM}$ | 15 | A |
| Non–Repetitive Peak Surge Current<br>(Surge Applied at Rated Load<br>Conditions Halfwave, Single<br>Phase, 60 Hz) | $I_{FSM}$ | 150 | A |
| Peak Repetitive Reverse Surge<br>Current (2.0 μs, 1.0 kHz) | $I_{RRM}$ | 1.0 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +175 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/μs |

**ON Semiconductor™**

http://onsemi.com

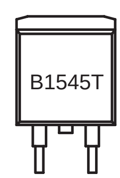
**SCHOTTKY BARRIER RECTIFIER 15 AMPERES 45 VOLTS**




**$D^2$PAK CASE 418B STYLE 3**

**MARKING DIAGRAM**




B1545T = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRB1545CT | $D^2$PAK | 50/Rail |
| MBRB1545CTT4 | $D^2$PAK | 800/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS** (Per Leg)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case | $R_{\theta JC}$ | 2.0 | °C/W |
| — Junction to Ambient (Note 1.) | $R_{\theta JA}$ | 50 | |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.) | $V_F$ | | Volts |
| ($i_F$ = 7.5 Amps, $T_J$ = 125°C) | | 0.57 | |
| ($i_F$ = 15 Amps, $T_J$ = 125°C) | | 0.72 | |
| ($i_F$ = 15 Amps, $T_J$ = 25°C) | | 0.84 | |
| Maximum Instantaneous Reverse Current (Note 2.) | $i_R$ | | mA |
| (Rated dc Voltage, $T_J$ = 125°C) | | 15 | |
| (Rated dc Voltage, $T_J$ = 25°C) | | 0.1 | |

1. When mounted using minimum recommended pad size on FR–4 board.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

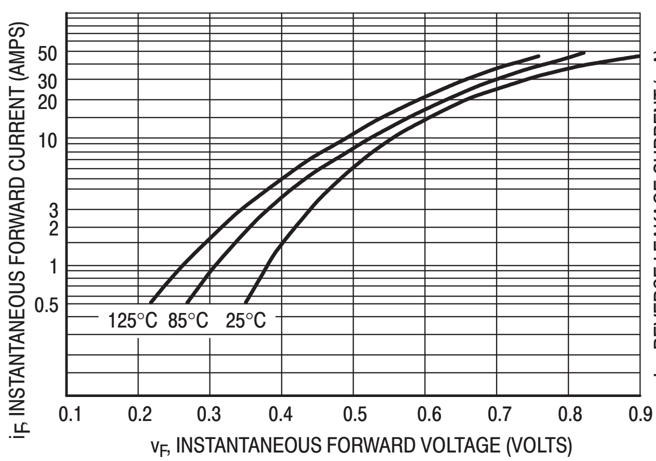


**Figure 1. Typical Forward Voltage, Per Leg**

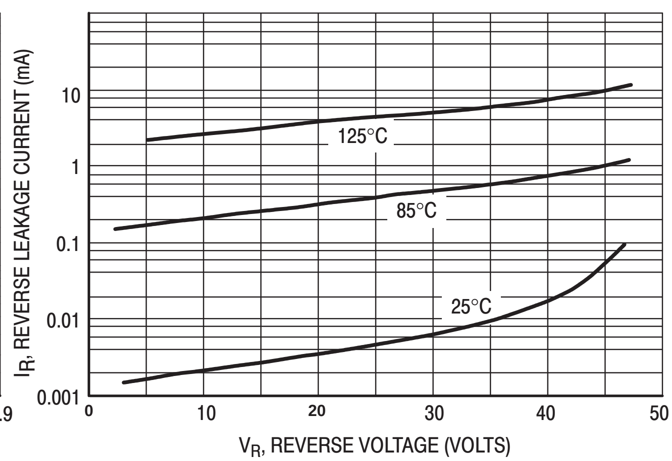


**Figure 2. Typical Reverse Current, Per Leg**

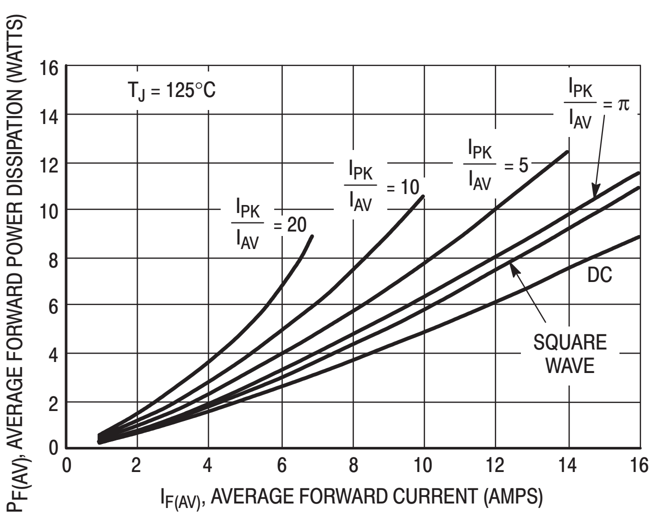


**Figure 3. Typical Forward Power Dissipation**

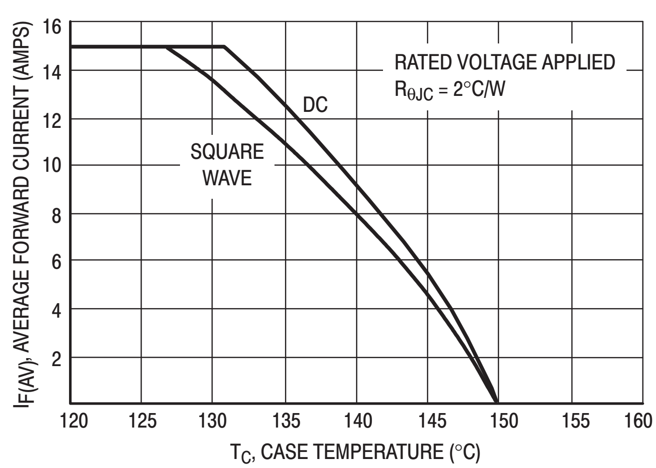


**Figure 4. Current Derating, Case**

# MBRB2060CT

**Preferred Device**

# SWITCHMODE™ Power Rectifier

## D$^2$PAK Surface Mount Power Package

Employs the use of the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Package Designed for Power Surface Mount Applications
- Center–Tap Configuration
- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, $V_O$ at 1/8″
- Short Heat Sink Tab Manufactured — Not Sheared!
- Similar in Size to Industry Standard TO–220 Package

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per 13″ reel by adding a “T4” suffix to the part number
- Marking: B2060T

**MAXIMUM RATINGS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 60 | V |
| Average Rectified Forward Current<br>(Rated $V_R$, $T_C$ = 110°C) Total Device | $I_{F(AV)}$ | 10<br>20 | A |
| Peak Repetitive Forward Current<br>(Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 100°C) | $I_{FRM}$ | 20 | A |
| Non–Repetitive Peak Surge Current<br>(Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 150 | A |
| Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) | $I_{RRM}$ | 0.5 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +175 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/μs |

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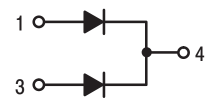
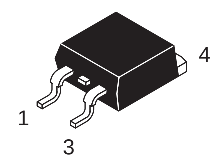
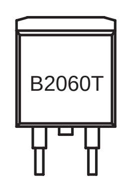
**SCHOTTKY BARRIER RECTIFIER**
**20 AMPERES**
**60 VOLTS**




**D$^2$PAK**
**CASE 418B**
**STYLE 3**

**MARKING DIAGRAM**




B2060T = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRB2060CT | D$^2$PAK | 50/Rail |
| MBRB2060CTT4 | D$^2$PAK | 800/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS** (Per Leg)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case<br>— Junction to Ambient (Note 1.) | $R_{\theta JC}$<br>$R_{\theta JA}$ | 2.0<br>50 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.)<br>($i_F$ = 20 Amps, $T_J$ = 125°C)<br>($i_F$ = 20 Amps, $T_J$ = 25°C) | $v_F$ | <br>0.85<br>0.95 | Volts |
| Maximum Instantaneous Reverse Current (Note 2.)<br>(Rated dc Voltage, $T_J$ = 125°C)<br>(Rated dc Voltage, $T_J$ = 25°C) | $i_R$ | <br>150<br>0.15 | mA |

1. When mounted using minimum recommended pad size on FR–4 board.
2. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

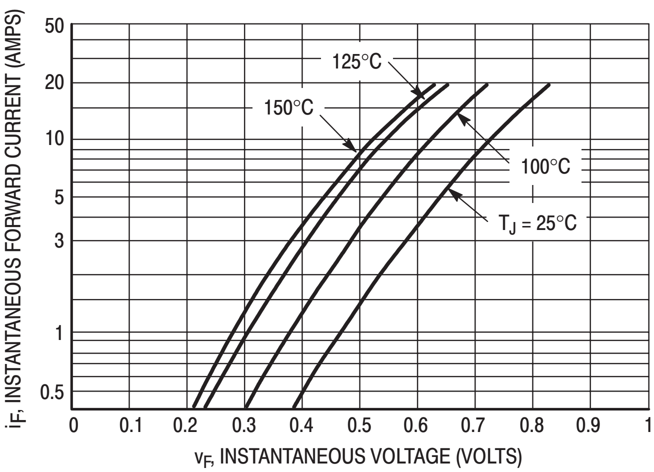


**Figure 1. Typical Forward Voltage Per Diode**

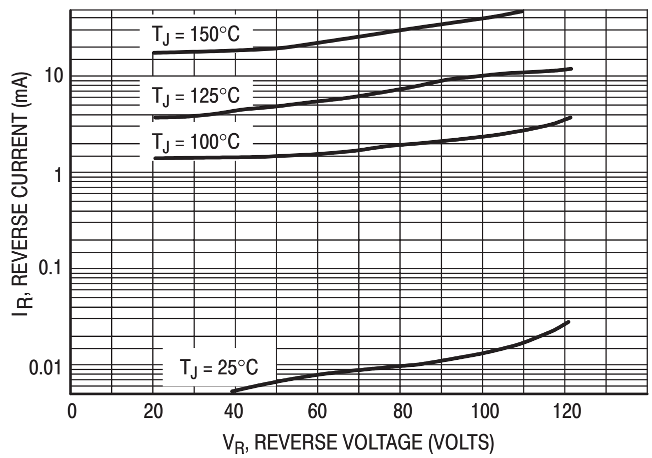


**Figure 2. Typical Reverse Current Per Diode**

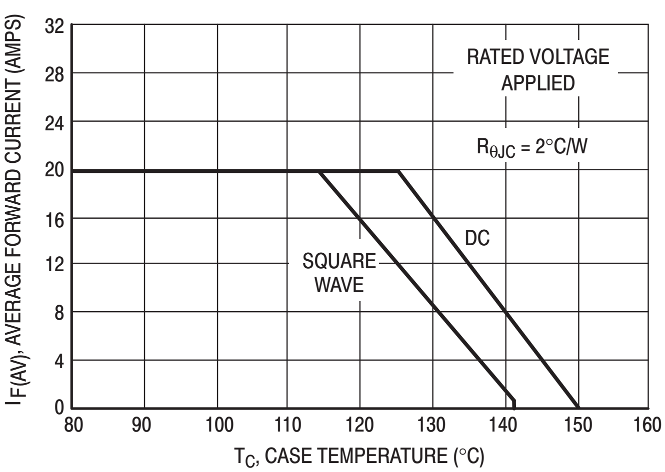


**Figure 3. Typical Current Derating, Case, Per Leg**

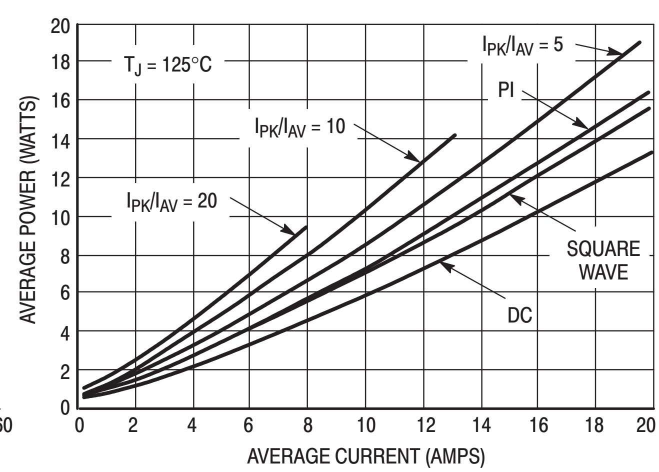


**Figure 4. Average Power Dissipation and Average Current**

# MBRB20100CT

Preferred Device

# SWITCHMODE™ Power Rectifier

## $D^2PAK$ Surface Mount Power Package

The $D^2PAK$ Power Rectifier employs the use of the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Package Designed for Power Surface Mount Applications
- Center–Tap Configuration
- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, $V_O$ at 1/8″
- Short Heat Sink Tab Manufactured — Not Sheared!
- Similar in Size to Industry Standard TO–220 Package

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per 13″ reel by adding a “T4” suffix to the part number
- Marking: B20100

**MAXIMUM RATINGS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 100 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_C$ = 110°C) Total Device | $I_{F(AV)}$ | 10<br>20 | A |
| Peak Repetitive Forward Current (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 100°C) | $I_{FRM}$ | 20 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 150 | A |
| Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) | $I_{RRM}$ | 0.5 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +175 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/μs |

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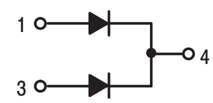
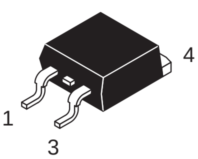
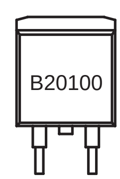
**SCHOTTKY BARRIER RECTIFIER**
**20 AMPERES**
**100 VOLTS**




**$D^2PAK$**
**CASE 418B**
**STYLE 3**

**MARKING DIAGRAM**




B20100 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRB20100CT | $D^2PAK$ | 50/Rail |
| MBRB20100CTT4 | $D^2PAK$ | 800/Tape & Reel |

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**THERMAL CHARACTERISTICS** (Per Leg)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case<br>— Junction to Ambient (Note 1.) | $R_{\theta JC}$<br>$R_{\theta JA}$ | 2.0<br>50 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.)<br>($i_F$ = 10 Amp, $T_C$ = 125°C)<br>($i_F$ = 10 Amp, $T_C$ = 25°C)<br>($i_F$ = 20 Amp, $T_C$ = 125°C)<br>($i_F$ = 20 Amp, $T_C$ = 25°C) | $v_F$ | <br>0.75<br>0.85<br>0.85<br>0.95 | Volts |
| Maximum Instantaneous Reverse Current (Note 2.)<br>(Rated dc Voltage, $T_J$ = 125°C)<br>(Rated dc Voltage, $T_J$ = 25°C) | $i_R$ | <br>6.0<br>0.1 | mA |

1. When mounted using minimum recommended pad size on FR–4 board.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

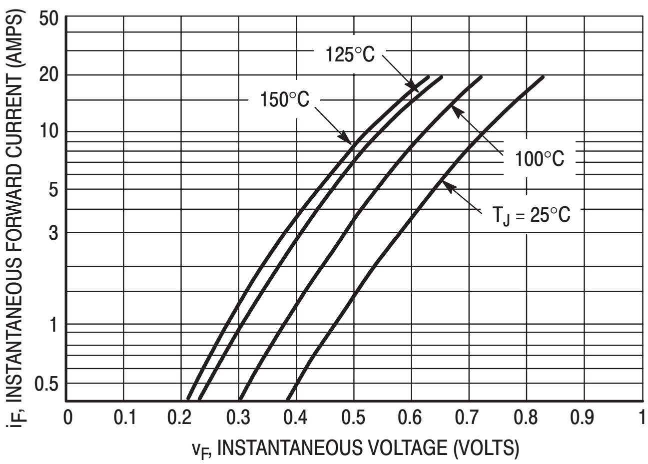


**Figure 1. Typical Forward Voltage Per Diode**

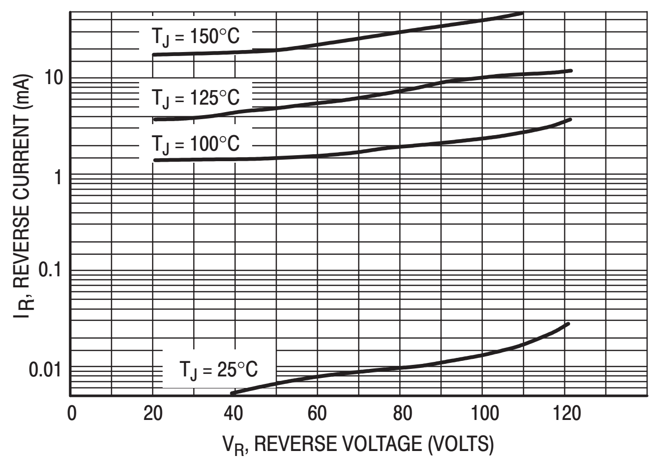


**Figure 2. Typical Reverse Current Per Diode**

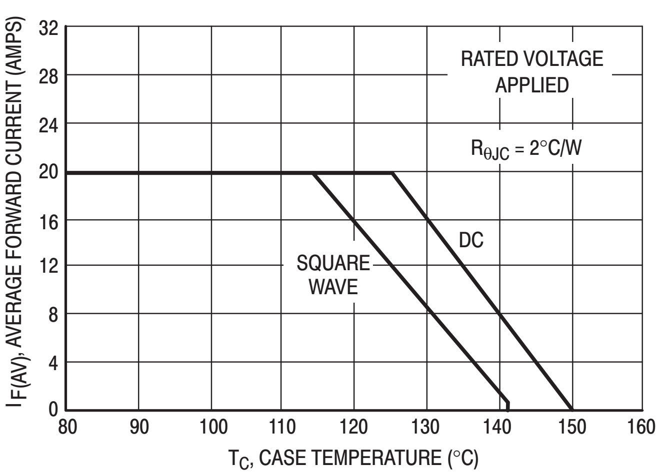


**Figure 3. Typical Current Derating, Case, Per Leg**

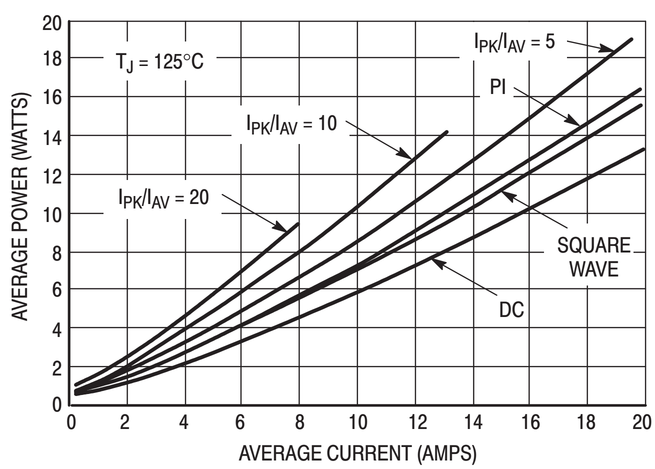


**Figure 4. Average Power Dissipation and Average Current**

# MBRB20200CT

**Preferred Device**

# SWITCHMODE™ Power Rectifier

## Dual Schottky Rectifier

. . . using Schottky Barrier technology with a platinum barrier metal. This state–of–the–art device is designed for use in high frequency switching power supplies and converters with up to 48 volt outputs. They block up to 200 volts and offer improved Schottky performance at frequencies from 250 kHz to 5.0 MHz.

- **200 Volt Blocking Voltage**
- Low Forward Voltage Drop
- Guardring for Stress Protection and High dv/dt Capability (10,000 V/μs)
- Dual Diode Construction — Terminals 1 and 3 Must be Connected for Parallel Operation at Full Rating

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per 13″ reel by adding a “T4” suffix to the part number
- Marking: B20200

**MAXIMUM RATINGS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 200 | V |
| Average Rectified Forward Current (At Rated $V_R$, $T_C$ = 134°C)<br>Per Device<br>Per Leg | $I_{F(AV)}$ | <br><br>10<br>20 | A |
| Peak Repetitive Forward Current (At Rated $V_R$, Square Wave, 20 kHz, $T_C$ = +137°C) Per Leg | $I_{FRM}$ | 20 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 150 | A |
| Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) | $I_{RRM}$ | 1.0 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +175 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/μs |

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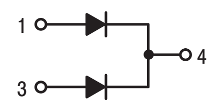
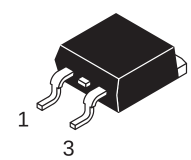
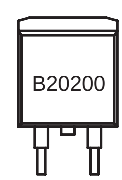
**SCHOTTKY BARRIER RECTIFIER**
**20 AMPERES**
**200 VOLTS**




**D²PAK**
**CASE 418B**
**STYLE 3**

**MARKING DIAGRAM**




B20200 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRB20200CT | D²PAK | 50/Rail |
| MBRB20200CTT4 | D²PAK | 800/Tape & Reel |

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**THERMAL CHARACTERISTICS** (Per Leg)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case | $R_{\theta JC}$ | 2.0 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($I_F$ = 10 Amps, $T_C$ = 25°C)<br>($I_F$ = 10 Amps, $T_C$ = 125°C)<br>($I_F$ = 20 Amps, $T_C$ = 25°C)<br>($I_F$ = 20 Amps, $T_C$ = 125°C) | $V_F$ | <br>0.9<br>0.8<br>1.0<br>0.9 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_C$ = 25°C)<br>(Rated dc Voltage, $T_C$ = 125°C) | $I_R$ | <br>1.0<br>50 | mA |

**DYNAMIC CHARACTERISTICS** (Per Leg)

| | | | |
|---|---|---|---|
| Capacitance ($V_R$ = –5.0 V, $T_C$ = 25°C, Frequency = 1.0 MHz) | $C_T$ | 500 | pF |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

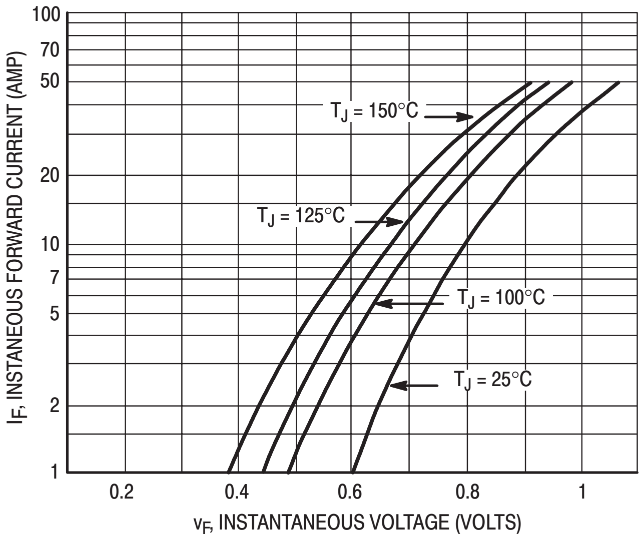


**Figure 1. Typical Forward Voltage (Per Leg)**

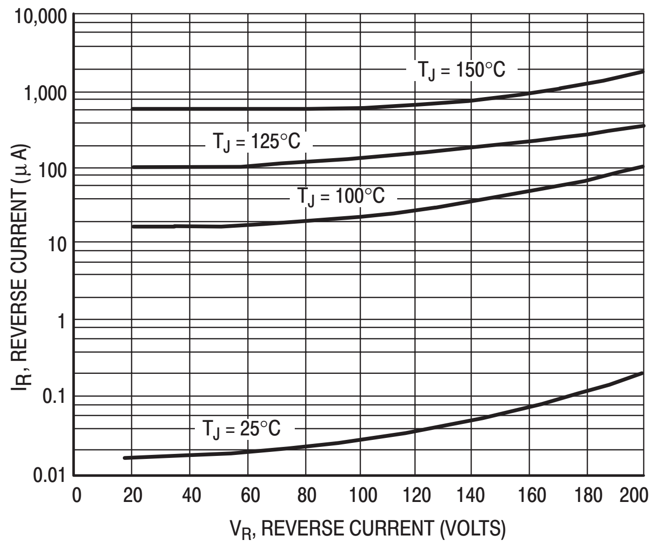


**Figure 2. Typical Reverse Current (Per Leg)**

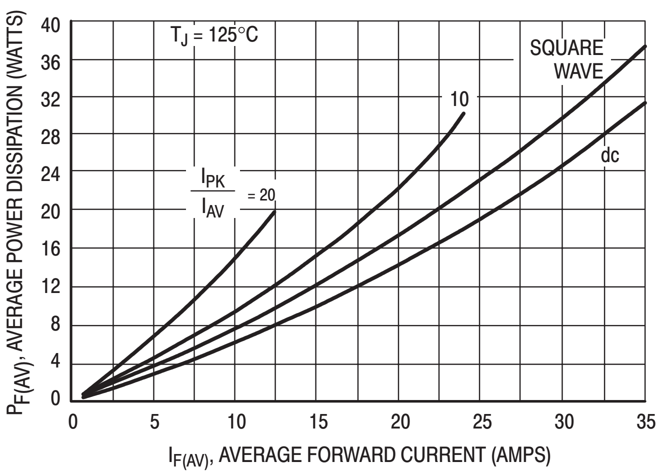


**Figure 3. Forward Power Dissipation**

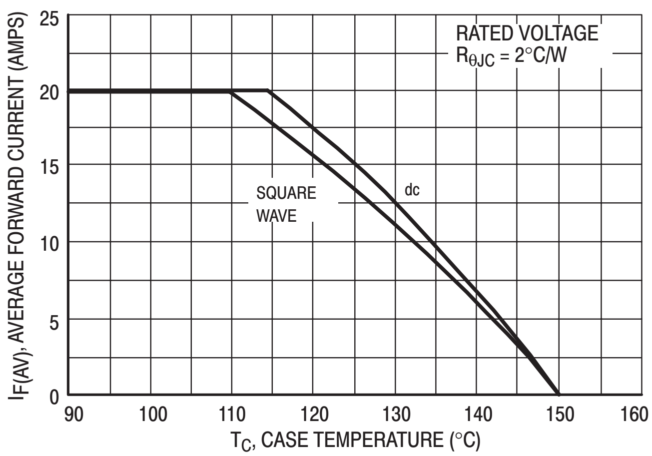


**Figure 4. Current Derating, Case**

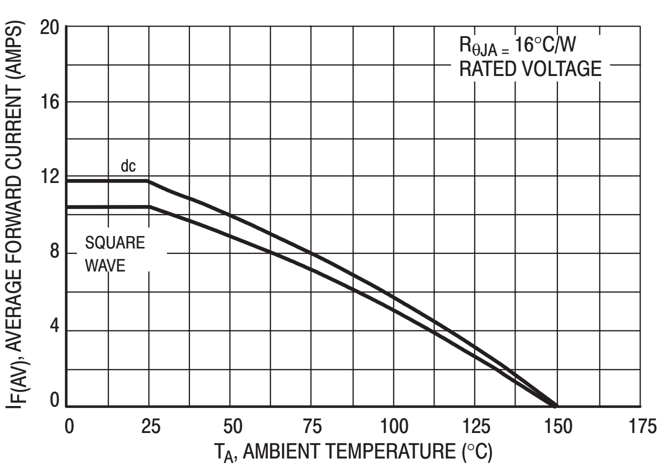


**Figure 5. Current Derating, Ambient**

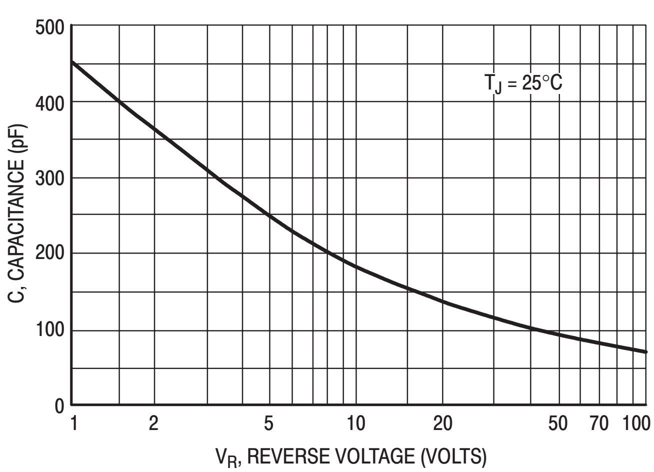


**Figure 6. Typical Capacitance (Per Leg)**

# MBRB2515L

**Preferred Device**

# SWITCHMODE™ Power Rectifier OR’ing Function Diode

## $D^2PAK$ Surface Mount Power Package

The $D^2PAK$ Power Rectifier employs the Schottky Barrier principle in a large metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for use in low voltage, high frequency switching power supplies, free wheeling diodes, and polarity protection diodes. These state–of–the–art devices have the following features:

- Guardring for Stress Protection
- Low Forward Voltage
- 100°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″
- Short Heat Sink Tab Manufactured — Not Sheared!
- Similar in Size to the Industry Standard TO–220 Package

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per 13″ reel by adding a “T4” suffix to the part number
- Marking: B2515L

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 15 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_C$ = 90°C) | $I_{F(AV)}$ | 25 | A |
| Peak Repetitive Forward Current (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 100°C) | $I_{FRM}$ | 30 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 150 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +150 | °C |
| Operating Junction Temperature | $T_J$ | 100 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/μs |

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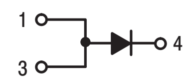
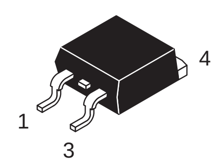
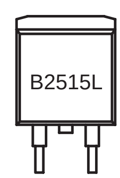
**SCHOTTKY BARRIER RECTIFIER 25 AMPERES 15 VOLTS**




**$D^2PAK$**
**CASE 418B**
**STYLE 3**

**MARKING DIAGRAM**




B2515L = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRB2515L | $D^2PAK$ | 50/Rail |
| MBRB2515LT4 | $D^2PAK$ | 800/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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### THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case<br>— Junction to Ambient (Note 1.) | $R_{\theta JC}$<br>$R_{\theta JA}$ | 1.0<br>50 | °C/W |

### ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.)<br>($i_F$ = 19 Amps, $T_J$ = 70°C)<br>($i_F$ = 25 Amps, $T_J$ = 70°C)<br>($i_F$ = 25 Amps, $T_J$ = 25°C) | $v_F$ | <br>0.28<br>0.42<br>0.45 | Volts |
| Maximum Instantaneous Reverse Current (Note 2.)<br>(Rated dc Voltage, $T_J$ = 70°C)<br>(Rated dc Voltage, $T_J$ = 25°C) | $I_R$ | <br>200<br>15 | mA |

1. When mounted using minimum recommended pad size on FR–4 board.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

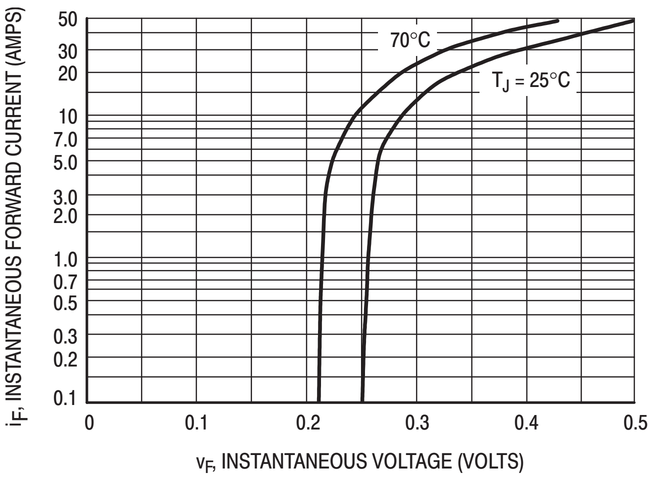


Figure 1. Typical Forward Voltage

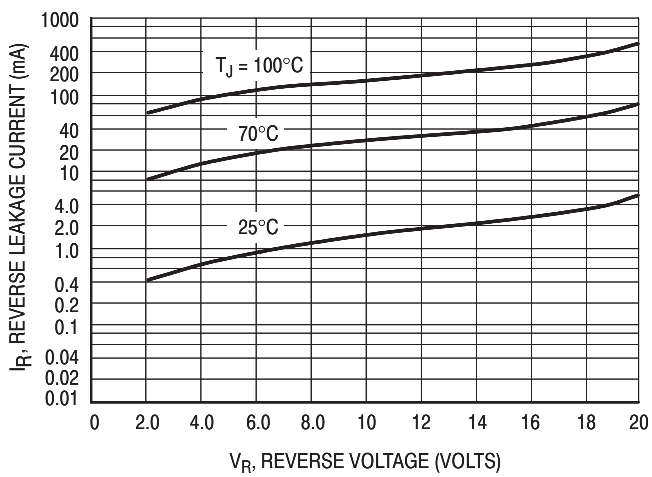


Figure 2. Typical Reverse Leakage Current

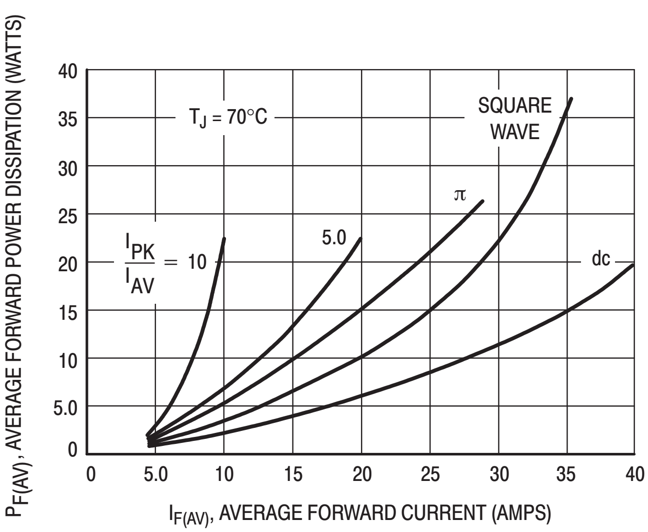


Figure 3. Typical Forward Power Dissipation

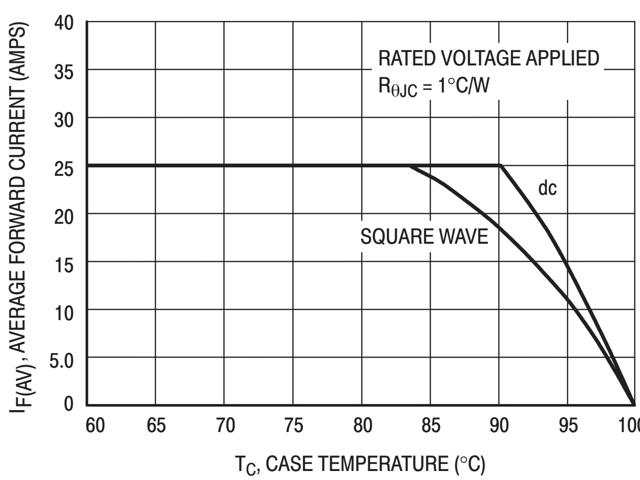


Figure 4. Current Derating, Case

# MBRB2535CTL

**Preferred Device**

# SWITCHMODE™ Power Rectifier

## D²PAK Surface Mount Power Package

The D²PAK Power Rectifier employs the Schottky Barrier principle in a large metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for use in low voltage, high frequency switching power supplies, free wheeling diodes, and polarity protection diodes. These state–of–the–art devices have the following features:

- Center–Tap Configuration
- Guardring for Stress Protection
- Low Forward Voltage
- 125°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″
- Short Heat Sink Tab Manufactured — Not Sheared!
- Similar in Size to the Industry Standard TO–220 Package

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per 13″ reel by adding a “T4” suffix to the part number
- Marking: B2535L

**MAXIMUM RATINGS**

| Please See the Table on the Following Page |
|---|

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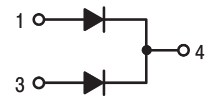
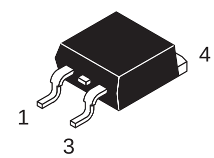
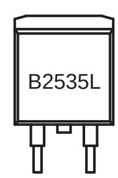
**SCHOTTKY BARRIER RECTIFIER**
**25 AMPERES**
**35 VOLTS**




**D²PAK**
**CASE 418B**
**STYLE 3**

**MARKING DIAGRAM**




B2535L = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRB2535CTL | D²PAK | 50/Rail |
| MBRB2535CTLT4 | D²PAK | 800/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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**MAXIMUM RATINGS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 35 | V |
| Average Rectified Forward Current<br>(Rated $V_R$, $T_C$ = 110°C) | $I_{F(AV)}$ | 12.5 | A |
| Peak Repetitive Forward Current<br>(Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 90°C) | $I_{FRM}$ | 25 | A |
| Non–Repetitive Peak Surge Current<br>(Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 150 | A |
| Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) | $I_{RRM}$ | 1.0 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +150 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +125 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/μs |

**THERMAL CHARACTERISTICS** (Per Leg)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case<br>— Junction to Ambient (Note 1.) | $R_{\theta JC}$<br>$R_{\theta JA}$ | 2.0<br>50 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.)<br>($i_F$ = 25 Amps, $T_J$ = 25°C)<br>($i_F$ = 12.5 Amps, $T_J$ = 125°C)<br>($i_F$ = 12.5 Amps, $T_J$ = 25°C) | $v_F$ | <br>0.55<br>0.41<br>0.47 | Volts |
| Maximum Instantaneous Reverse Current (Note 2.)<br>(Rated dc Voltage, $T_J$ = 125°C)<br>(Rated dc Voltage, $T_J$ = 25°C) | $I_R$ | <br>500<br>10 | mA |

1. When mounted using minimum recommended pad size on FR–4 board.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

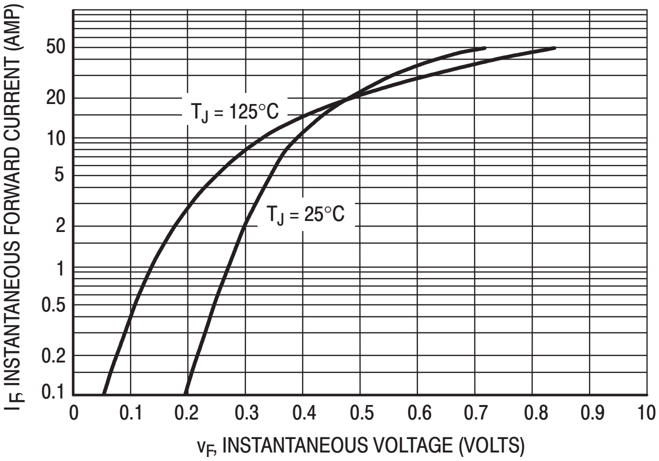


**Figure 1. Typical Forward Voltage, Per Leg**

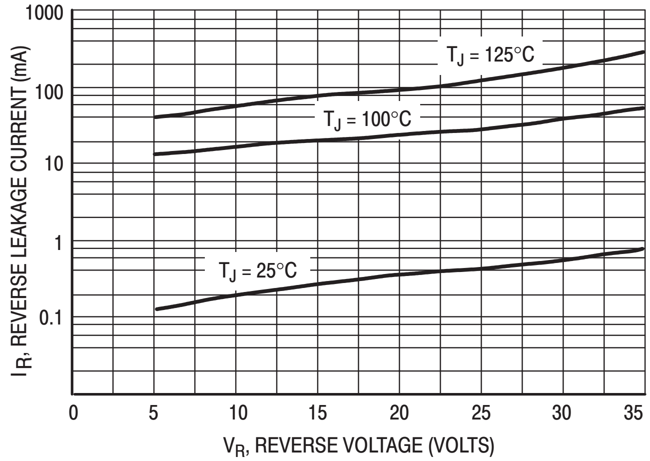


**Figure 2. Typical Reverse Current, Per Leg**

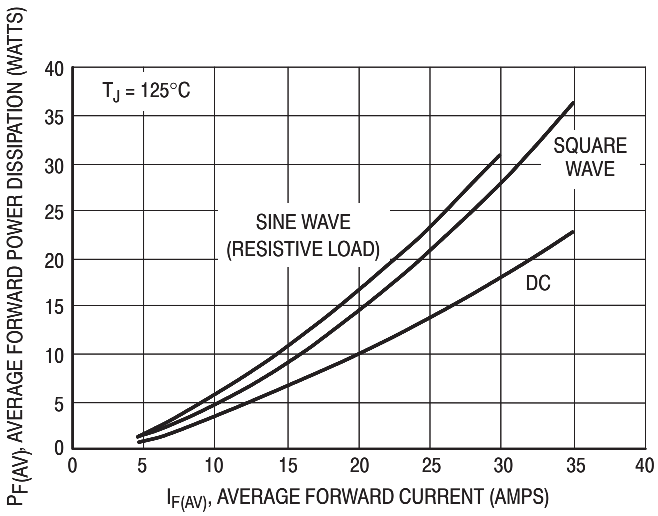


**Figure 3. Typical Forward Power Dissipation**

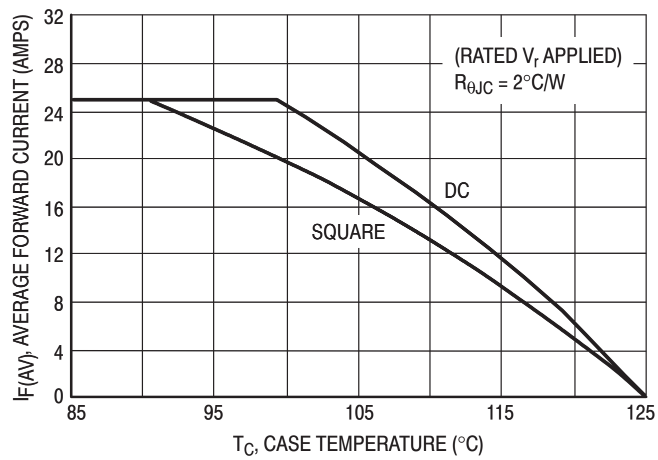


**Figure 4. Current Derating, Case**

# MBRB2545CT

**Preferred Device**

# SWITCHMODE™ Power Rectifier

## D$^2$PAK Surface Mount Power Package

The D$^2$PAK Power Rectifier employs the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Center–Tap Configuration
- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″
- Short Heat Sink Tab Manufactured — Not Sheared!
- Similar in Size to the Industry Standard TO–220 Package

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per 13″ reel by adding a “T4” suffix to the part number
- Marking: B2545T

**MAXIMUM RATINGS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 45 | V |
| Average Rectified Forward Current<br>(Rated $V_R$, $T_C$ = 130°C) Total Device | $I_{F(AV)}$ | 15<br>30 | A |
| Peak Repetitive Forward Current<br>(Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 130°C) | $I_{FRM}$ | 30 | A |
| Non–Repetitive Peak Surge Current<br>(Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 150 | A |
| Peak Repetitive Reverse Surge Current (2.0 µs, 1.0 kHz) | $I_{RRM}$ | 1.0 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +175 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +150 | °C |
| Voltage Rate of Change<br>(Rated $V_R$) | dv/dt | 10,000 | V/µs |

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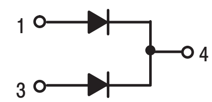
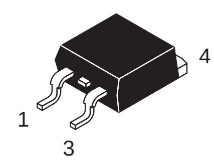
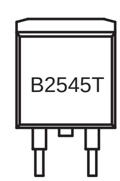
**SCHOTTKY BARRIER RECTIFIER**
**30 AMPERES**
**45 VOLTS**




**D$^2$PAK**
**CASE 418B**
**STYLE 3**

**MARKING DIAGRAM**




B2545T = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRB2545CT | D$^2$PAK | 50/Rail |
| MBRB2545CTT4 | D$^2$PAK | 800/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS** (Per Leg)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case<br>— Junction to Ambient (Note 1.) | $R_{\theta JC}$<br>$R_{\theta JA}$ | 1.5<br>50 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.)<br>($i_F$ = 30 Amps, $T_J$ = 125°C)<br>($i_F$ = 30 Amps, $T_J$ = 25°C) | $v_F$ | 0.73<br>0.82 | Volts |
| Maximum Instantaneous Reverse Current (Note 2.)<br>(Rated dc Voltage, $T_J$ = 125°C)<br>(Rated dc Voltage, $T_J$ = 25°C) | $i_R$ | 40<br>0.2 | mA |

1. When mounted using minimum recommended pad size on FR–4 board.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

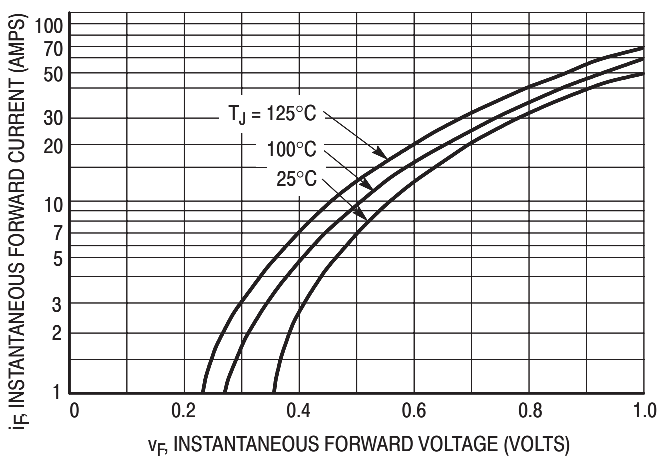


**Figure 1. Typical Forward Voltage, Per Leg**

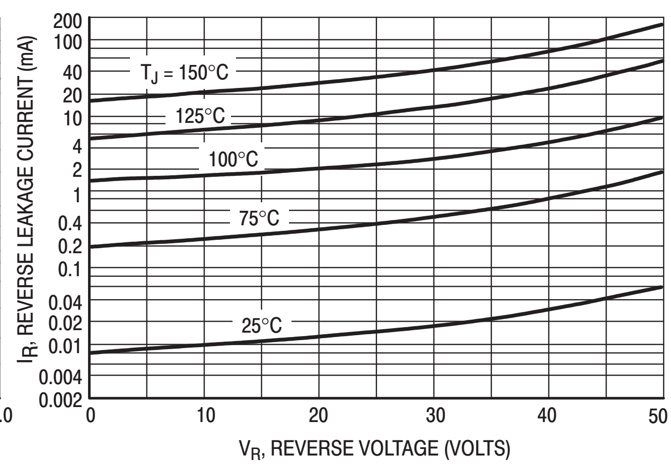


**Figure 2. Typical Reverse Current, Per Leg**

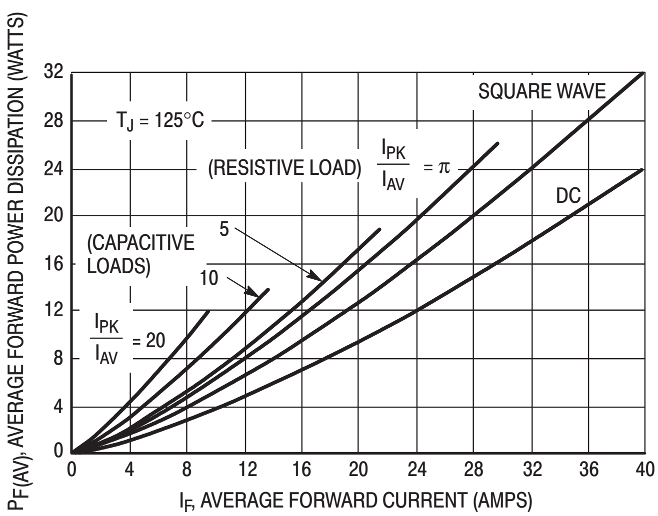


**Figure 3. Typical Forward Power Dissipation**

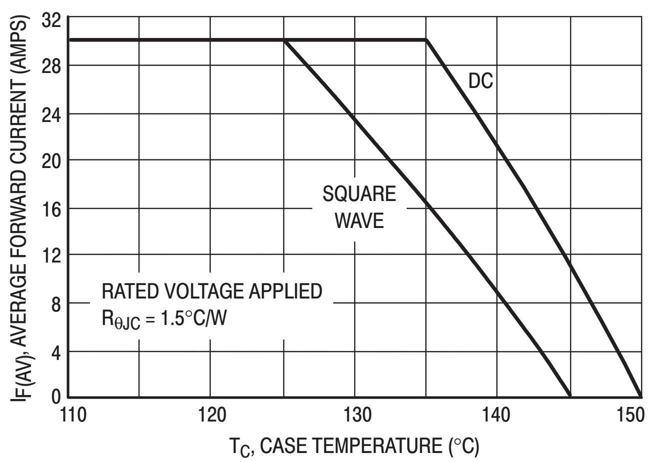


**Figure 4. Current Derating, Case**

# MBRB3030CT

**Preferred Device**

# SWITCHMODE™ Power Rectifier

Using the Schottky Barrier principle with a proprietary barrier metal. These state–of–the–art devices have the following features:

- Guardring for Stress Protection
- Maximum Die Size
- 150°C Operating Junction Temperature
- Short Heat Sink Tab Manufactured – Not Sheared

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 Units per Plastic Tube
- Available in 24 mm Tape and Reel, 800 Units per 13” Reel by Adding a “T4” Suffix to the Part Number
- Marking: B3030

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 30 | V |
| Average Rectified Forward Current<br>(At Rated $V_R$, $T_C$ = 134°C)<br>Per Device<br>Per Leg | $I_{F(AV)}$ | <br><br>30<br>15 | A |
| Peak Repetitive Forward Current<br>(At Rated $V_R$, Square Wave,<br>20 kHz, $T_C$ = +137°C) Per Leg | $I_{FRM}$ | 30 | A |
| Non–Repetitive Peak Surge Current<br>(Surge Applied at Rated Load Conditions, Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 200 | A |
| Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) | $I_{RRM}$ | 2.0 | A |
| Storage Temperature Range | $T_{stg}$ | –55 to +150 | °C |
| Operating Junction Temperature | $T_J$ | –55 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/μs |
| Reverse Energy<br>(Unclamped Inductive Surge)<br>(Inductance = 3 mH, $T_C$ = 25°C) | W | 100 | mJ |

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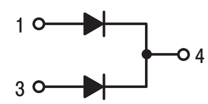
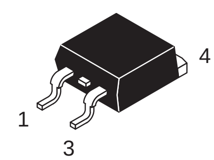
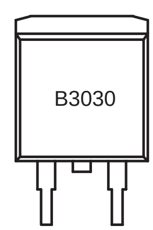
**SCHOTTKY BARRIER RECTIFIER**
**30 AMPERES**
**30 VOLTS**




**D2PAK**
**CASE 418B**
**STYLE 3**

**MARKING DIAGRAM**




B3030 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRB3030CT | D2PAK | 50/Rail |
| MBRB3030CTT4 | D2PAK | 800/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS** (Per Leg)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case<br>— Junction to Ambient (Note 1.) | $R_{\theta JC}$<br>$R_{\theta JA}$ | 1.0<br>50 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.), Per Leg<br>($I_F$ = 15 Amps, $T_C$ = +25°C)<br>($I_F$ = 15 Amps, $T_C$ = +150°C)<br>($I_F$ = 30 Amps, $T_C$ = +25°C)<br>($I_F$ = 30 Amps, $T_C$ = +150°C) | $V_F$ | <br>0.54<br>0.47<br>0.67<br>0.66 | Volts |
| Maximum Instantaneous Reverse Current (Note 2.), Per Leg<br>(Rated dc Voltage, $T_C$ = +25°C)<br>(Reverse Voltage = 10 V, $T_C$ = +150°C)<br>(Rated dc Voltage, $T_C$ = +150°C) | $I_R$ | <br>0.6<br>46<br>145 | mA |

1. When mounted using minimum recommended pad size on FR–4 board.
2. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

## ELECTRICAL CHARACTERISTICS

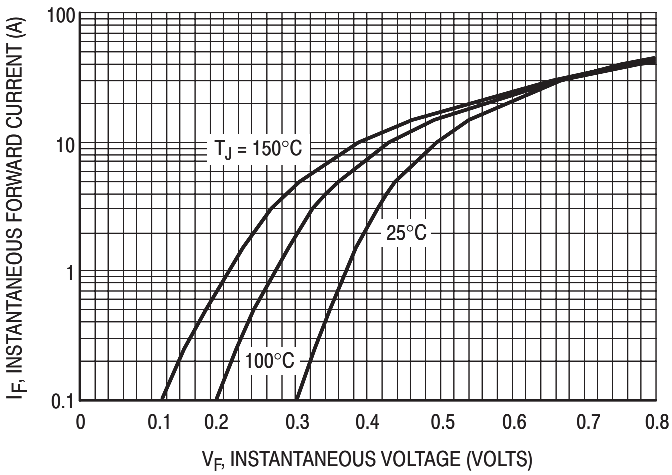


**Figure 1. Maximum Forward Voltage, Per Leg**

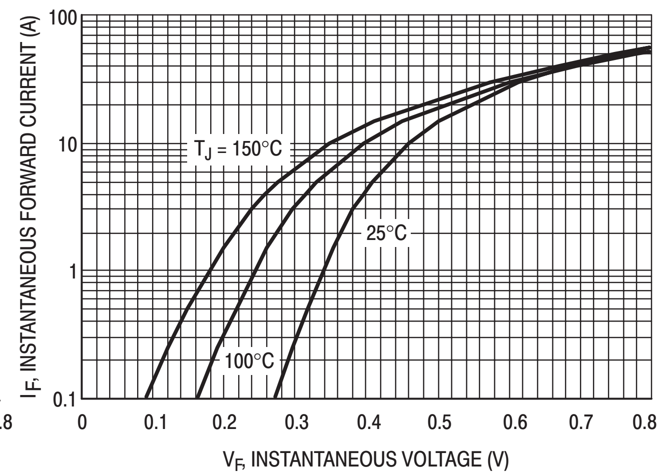


**Figure 2. Typical Forward Voltage, Per Leg**

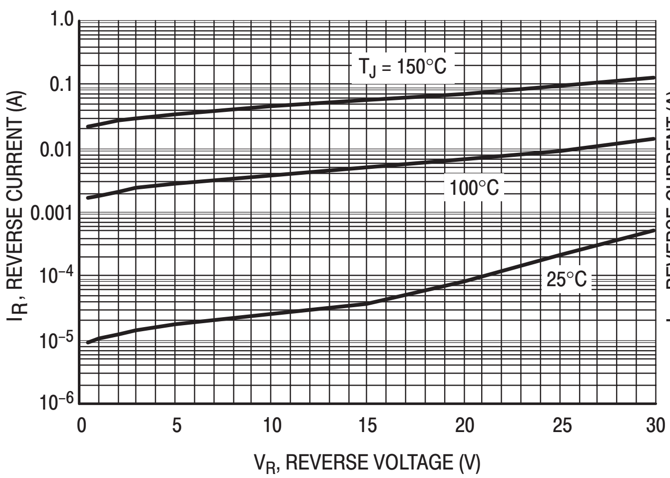


**Figure 3. Maximum Reverse Current, Per Leg**

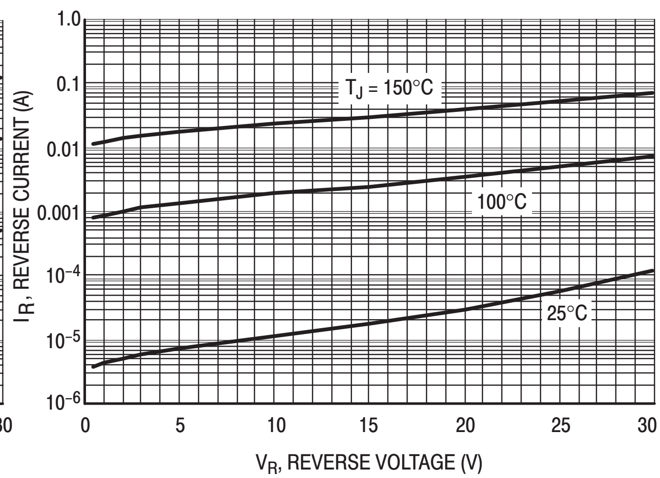


**Figure 4. Typical Reverse Current, Per Leg**

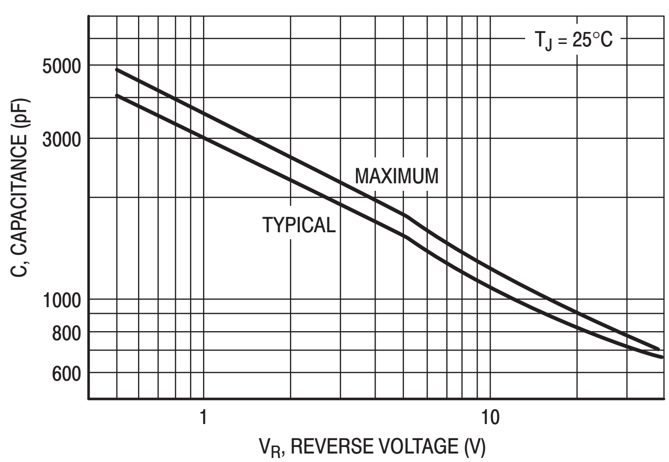


**Figure 5. Capacitance**

## TYPICAL CHARACTERISTICS

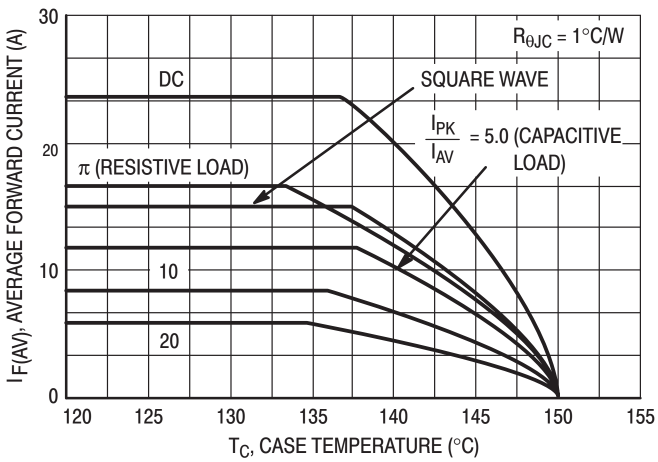


**Figure 6. Current Derating, Infinite Heatsink**

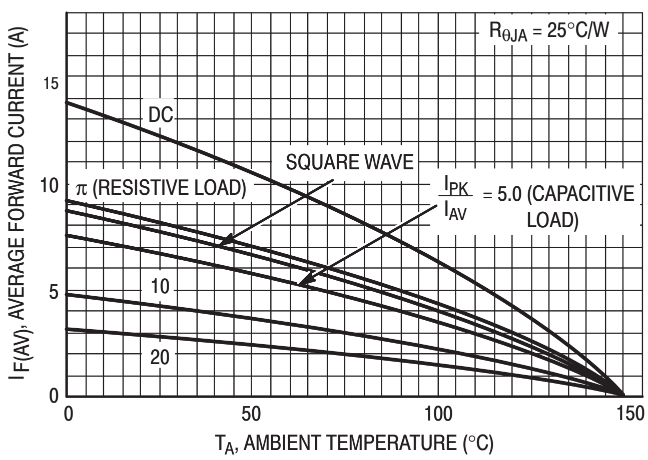


**Figure 7. Current Derating**

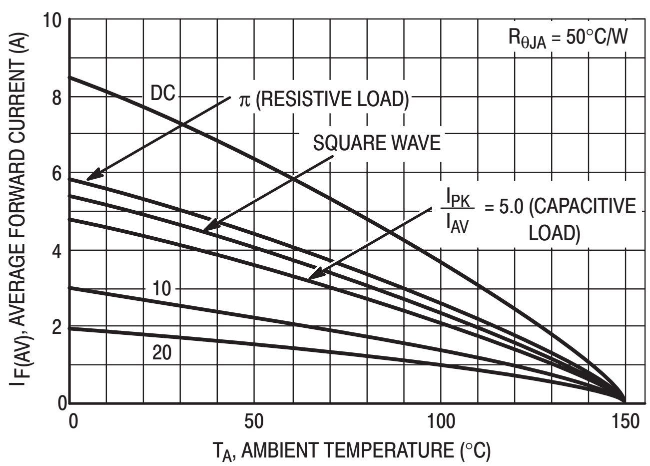


**Figure 8. Current Derating, Free Air**

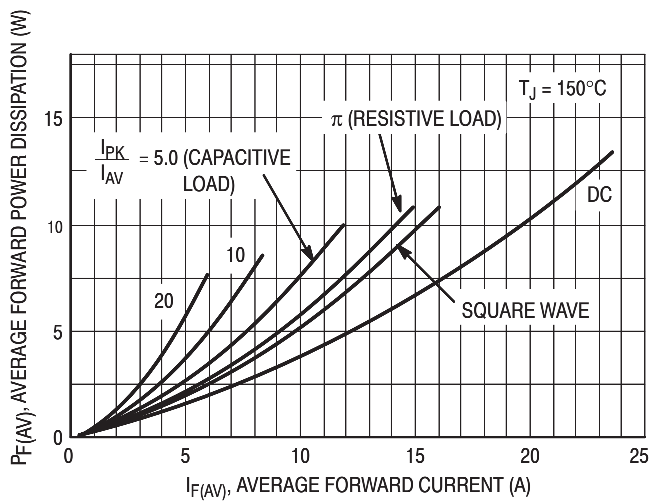


**Figure 9. Forward Power Dissipation**

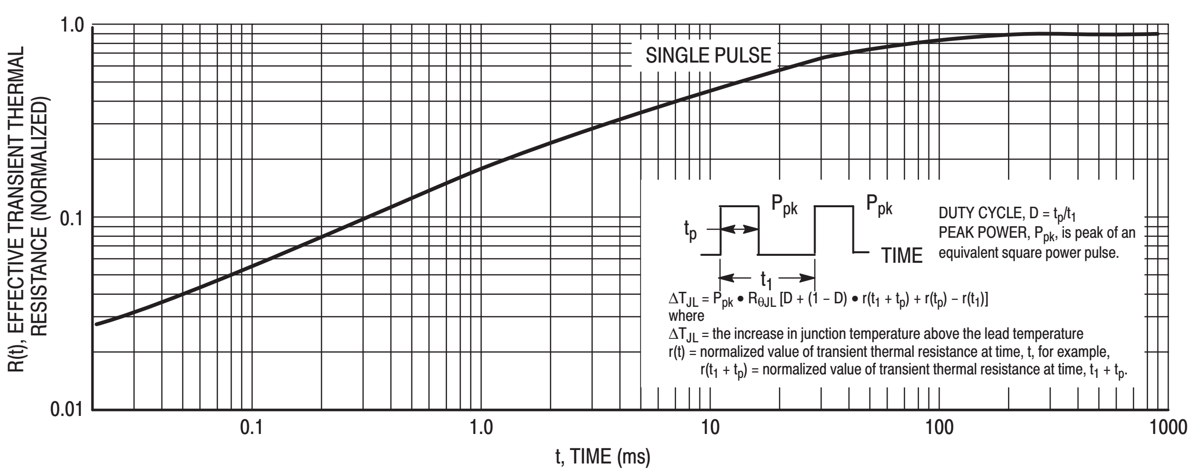


**Figure 10. Thermal Response**

# MBRB3030CTL

*Advance Information*

## SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a proprietary barrier metal. These state–of–the–art devices have the following features:

**Features:**

- Dual Diode Construction — May be Paralleled for Higher Current Output
- Guardring for Stress Protection
- Low Forward Voltage Drop
- 125°C Operating Junction Temperature
- Maximum Die Size
- Short Heat Sink Tab Manufactured — Not Sheared!

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 30 | V |
| Average Rectified Forward Current (At Rated $V_R$, $T_C$ = 115°C) Per Device | $I_O$ | 15<br>30 | A |
| Peak Repetitive Forward Current (At Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 115°C) | $I_{FRM}$ | 30 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 300 | A |
| Peak Repetitive Reverse Surge Current (1.0 μs, 1.0 kHz) | $I_{RRM}$ | 2.0 | A |
| Storage Temperature Range | $T_{stg}$ | –55 to +150 | °C |
| Operating Junction Temperature Range | $T_J$ | –55 to +125 | °C |
| Voltage Rate of Change (Rated $V_R$, $T_J$ = 25°C) | dv/dt | 10,000 | V/μs |
| Reverse Energy, Unclamped Inductive Surge ($T_J$ = 25°C, L = 3.0 mH) | $E_{AS}$ | 224.5 | mJ |

This document contains information on a new product. Specifications and information herein are subject to change without notice.

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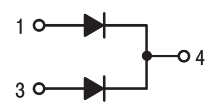
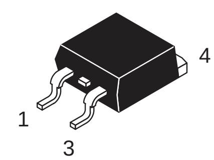
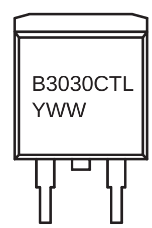
**SCHOTTKY BARRIER RECTIFIER**
**30 AMPERES**
**30 VOLTS**




**D²PAK**
**CASE 418B**
**PLASTIC**

**MARKING DIAGRAM**




B3030CTL = Device Code
Y = Year
WW = Work Week

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRB3030CTL | $D^2$PAK | 50/Rail |
| MBRB3030CTLT4 | $D^2$PAK | 800/Tape & Reel |

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### THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Ambient (Note 1.) | $R_{\theta JA}$ | 50 | °C/W |
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.0 | °C/W |

### ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.)<br>($I_F$ = 15 A, $T_J$ = 25°C)<br>($I_F$ = 30 A, $T_J$ = 25°C) | $V_F$ | <br>0.44<br>0.51 | V |
| Maximum Instantaneous Reverse Current (Note 2.)<br>(Rated $V_R$, $T_J$ = 25°C)<br>(Rated $V_R$, $T_J$ = 125°C) | $I_R$ | <br>2.0<br>195 | mA |

1. Mounted using minimum recommended pad size on FR–4 board.
2. Pulse Test: Pulse Width = 250 μs, Duty Cycle ≤ 2.0%.

All device data is “Per Leg” except where noted.

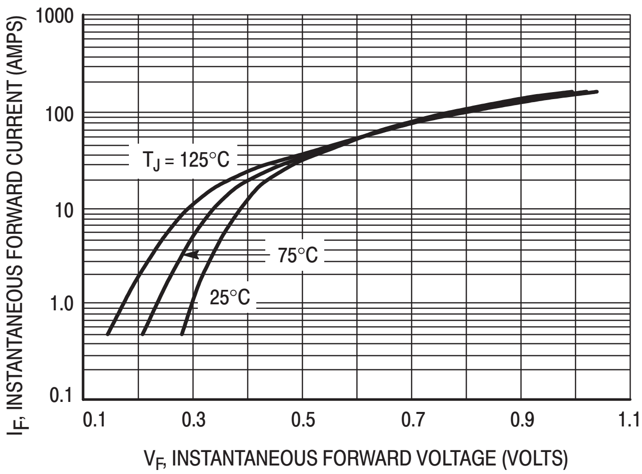



**Figure 1. Typical Forward Voltage**

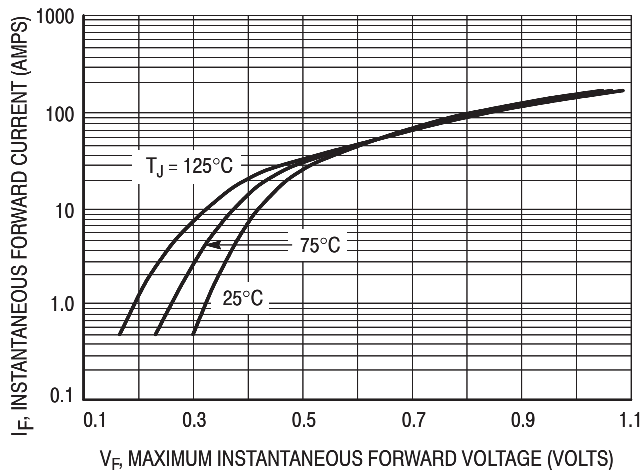



**Figure 2. Maximum Forward Voltage**

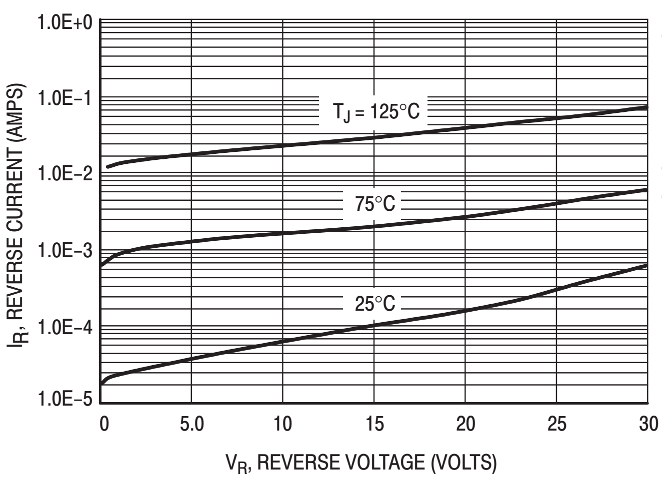



**Figure 3. Typical Reverse Current**

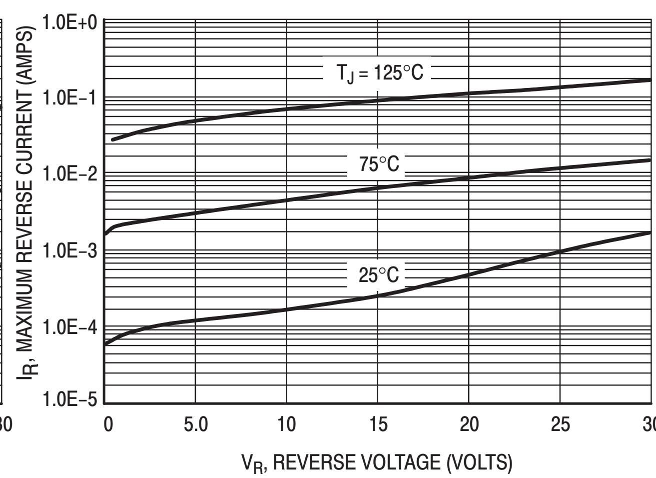



**Figure 4. Maximum Reverse Current**

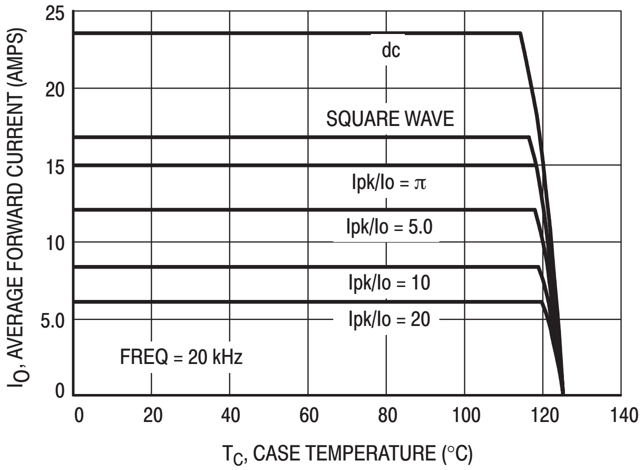



**Figure 5. Current Derating**

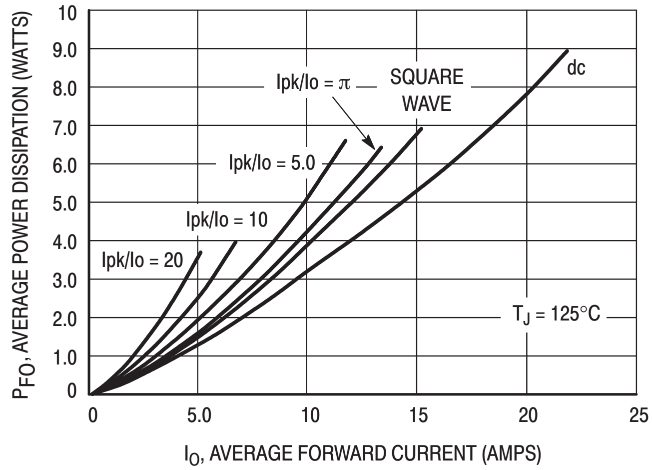



**Figure 6. Forward Power Dissipation**

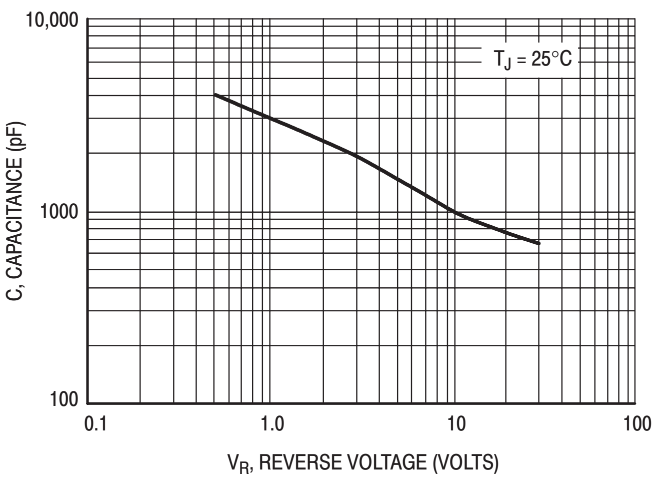



**Figure 7. Typical Capacitance**

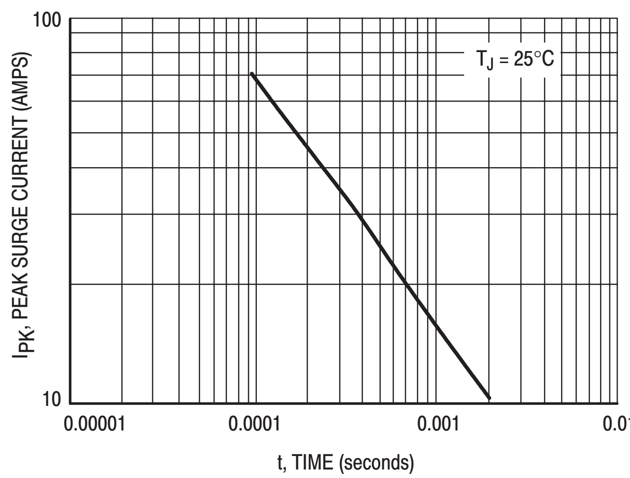



**Figure 8. Typical Unclamped Inductive Surge**

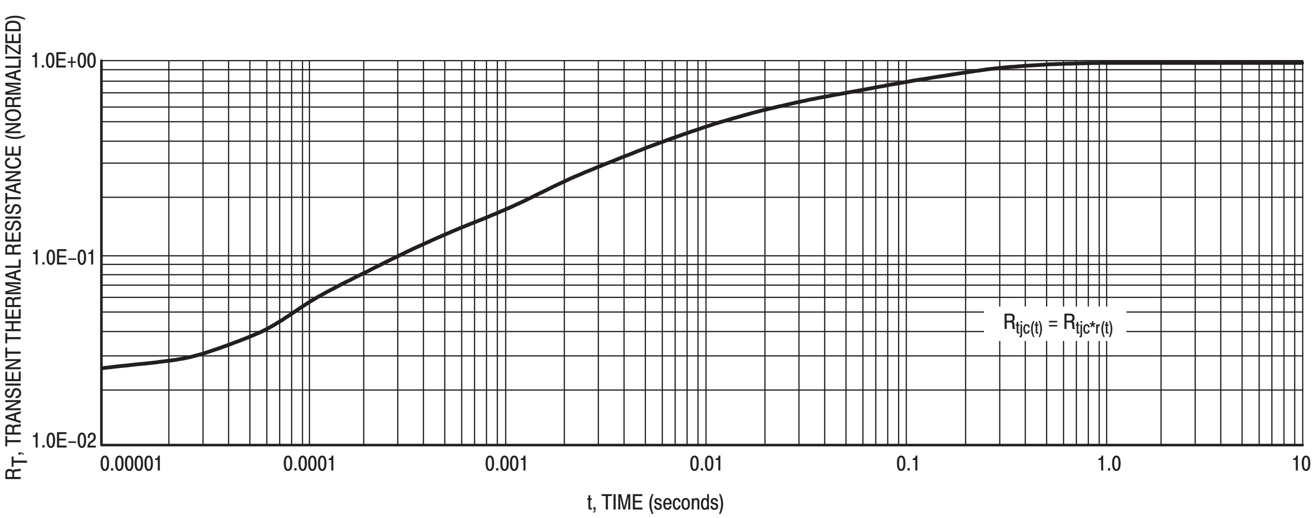



**Figure 9. Typical Thermal Response**

# Modeling Reverse Energy Characteristics of Power Rectifiers

**Prepared by: David Shumate & Larry Walker**
**Motorola Semiconductor Products Sector**

## ABSTRACT

Power semiconductor rectifiers are used in a variety of applications where the reverse energy requirements often vary dramatically based on the operating conditions of the application circuit. A characterization method was devised using the Unclamped Inductive Surge (UIS) test technique. By testing at only a few different operating conditions (i.e. different inductor sizes) a safe operating range can be established for a device. A relationship between peak avalanche current and inductor discharge time was established. Using this relationship and circuit parameters, the part applicability can be determined. This technique offers a power supply designer the total operating conditions for a device as opposed to the present single–data–point approach.

## INTRODUCTION

In today's modern power supplies, converters and other switching circuitry, large voltage spikes due to parasitic inductance can propagate throughout the circuit, resulting in catastrophic device failures. Concurrent with this, in an effort to provide low–loss power rectifiers, i.e. devices with lower forward voltage drops, schottky technology is being applied to devices used in this switching power circuitry. This technology lends itself to lower reverse breakdown voltages. This combination of high voltage spikes and low reverse breakdown voltage devices can lead to reverse energy destruction of power rectifiers in their applications. This phenomena, however, is not limited to just schottky technology.

In order to meet the challenges of these situations, power semiconductor manufacturers attempt to characterize their devices with respect to reverse energy robustness. The typical reverse energy specification, if provided at all, is usually given as energy–to–failure (mJ) with a particular inductor specified for the UIS test circuit. Sometimes, the peak reverse test current is also specified. Practically all reverse energy characterizations are performed using the UIS test circuit shown in Figure 10. Typical UIS voltage and current waveforms are shown in Figure 11.

In order to provide the designer with a more extensive characterization than the above mentioned one–point approach, a more comprehensive method for characterizing these devices was developed. A designer can use the given information to determine the appropriateness and safe operating area (SOA) of the selected device.

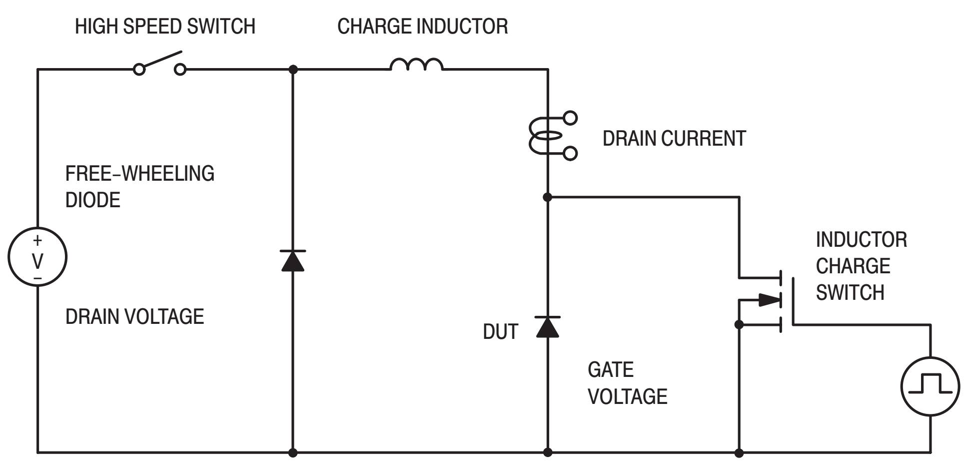



**Figure 10. Simplified UIS Test Circuit**

### Suggested Method of Characterization

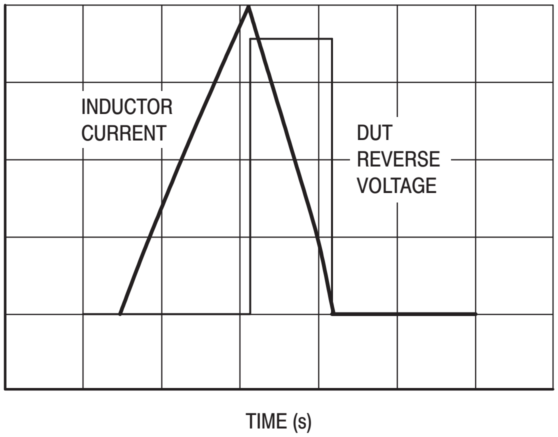



**Figure 11. Typical Voltage and Current UIS Waveforms**

Utilizing the UIS test circuit in Figure 10, devices are tested to failure using inductors ranging in value from 0.01 to 159 mH. The reverse voltage and current waveforms are acquired to determine the exact energy seen by the device and the inductive current decay time. At least 4 distinct inductors and 5 to 10 devices per inductor are used to generate the characteristic current versus time relationship. This relationship when coupled with the application circuit conditions, defines the SOA of the device uniquely for this application.

### Example Application

The device used for this example was an MBR3035CT, which is a 30 A (15 A per side) forward current, 35 V reverse breakdown voltage rectifier. All parts were tested to destruction at 25°C. The inductors used for the characterization were 10, 3.0, 1.0 and 0.3 mH. The data recorded from the testing were peak reverse current (Ip), peak reverse breakdown voltage (BVR), maximum withstand energy, inductance and inductor discharge time (see Table 1). A plot of the Peak Reverse Current versus Time at device destruction, as shown in Figure 12, was generated. The area under the curve is the region of lower reverse energy or lower stress on the device. This area is known as the safe operating area or SOA.

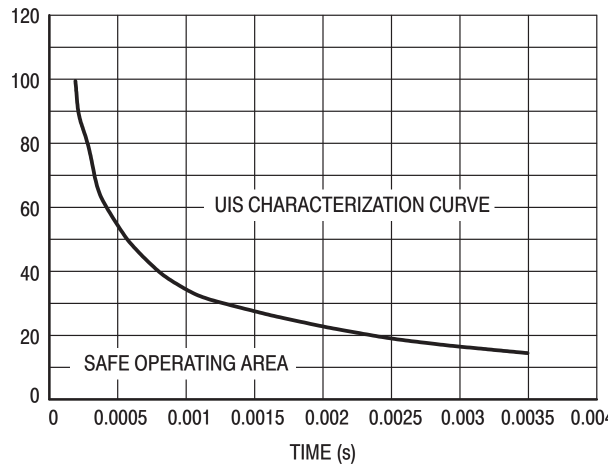



**Figure 12. Peak Reverse Current versus Time for DUT**

**Table 1. UIS Test Data**

| PART NO. | $I_P$ (A) | $B_{VR}$ (V) | ENERGY (mJ) | L (mH) | TIME (μs) |
|---|---|---|---|---|---|
| 1 | 46.6 | 65.2 | 998.3 | 1 | 715 |
| 2 | 41.7 | 63.4 | 870.2 | 1 | 657 |
| 3 | 46.0 | 66.0 | 1038.9 | 1 | 697 |
| 4 | 42.7 | 64.8 | 904.2 | 1 | 659 |
| 5 | 44.9 | 64.8 | 997.3 | 1 | 693 |
| 6 | 44.1 | 64.1 | 865.0 | 1 | 687 |
| 7 | 26.5 | 63.1 | 1022.6 | 3 | 1261 |
| 8 | 26.4 | 62.8 | 1024.9 | 3 | 1262 |
| 9 | 24.4 | 62.2 | 872.0 | 3 | 1178 |
| 10 | 27.6 | 62.9 | 1091.0 | 3 | 1316 |
| 11 | 27.7 | 63.2 | 1102.4 | 3 | 1314 |
| 12 | 17.9 | 62.6 | 1428.6 | 10 | 2851 |
| 13 | 18.9 | 62.1 | 1547.4 | 10 | 3038 |
| 14 | 18.8 | 60.7 | 1521.1 | 10 | 3092 |
| 15 | 19.0 | 62.6 | 1566.2 | 10 | 3037 |
| 16 | 74.2 | 69.1 | 768.4 | 0.3 | 322 |
| 17 | 77.3 | 69.6 | 815.4 | 0.3 | 333 |
| 18 | 75.2 | 68.9 | 791.7 | 0.3 | 328 |
| 19 | 77.3 | 69.6 | 842.6 | 0.3 | 333 |
| 20 | 73.8 | 69.1 | 752.4 | 0.3 | 321 |
| 21 | 75.6 | 69.2 | 823.2 | 0.3 | 328 |
| 22 | 74.7 | 68.6 | 747.5 | 0.3 | 327 |
| 23 | 78.4 | 70.3 | 834.0 | 0.3 | 335 |
| 24 | 70.5 | 66.6 | 678.4 | 0.3 | 317 |
| 25 | 78.3 | 69.4 | 817.3 | 0.3 | 339 |

The procedure to determine if a rectifier is appropriate, from a reverse energy standpoint, to be used in the application circuit is as follows:

a. Obtain "Peak Reverse Current versus Time" curve from data book.
b. Determine steady state operating voltage (OV) of circuit.
c. Determine parasitic inductance (L) of circuit section of interest.
d. Obtain rated breakdown voltage (BVR) of rectifier from data book.
e. From the following relationships,

$$V = L \cdot \frac{d}{dt} i(t) \qquad I = \frac{(BVR - OV) \cdot t}{L}$$

a "designer" l versus t curve is plotted alongside the device characteristic plot.
f. The point where the two curves intersect is the current level where the devices will start to fail. A peak inductor current below this intersection should be chosen for safe operating.

As an example, the values were chosen as L = 200 μH, OV = 12 V and BVR = 35 V.

Figure 13 illustrates the example. Note the UIS characterization curve, the parasitic inductor current curve and the safe operating region as indicated.

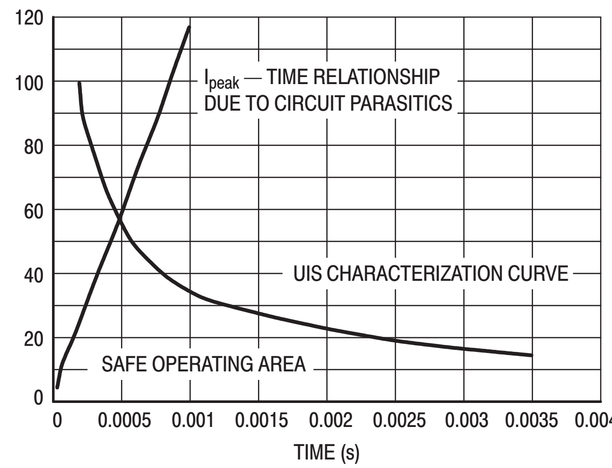



**Figure 13. DUT Peak Reverse and Circuit Parasitic Inductance Current versus Time**

## SUMMARY

Traditionally, power rectifier users have been supplied with single–data–point reverse–energy characteristics by the supplier's device data sheet; however, as has been shown here and in previous work, the reverse withstand energy can vary significantly depending on the application. What was done in this work was to create a characterization scheme by which the designer can overlay or map their particular requirements onto the part capability and determine quite accurately if the chosen device is applicable. This characterization technique is very robust due to its statistical approach, and with proper guardbanding (6σ) can be used to give worst–case device performance for the entire product line. A "typical" characteristic curve is probably the most applicable for designers allowing them to design in their own margins.

## References

1. Borras, R., Aliosi, P., Shumate, D., 1993, "Avalanche Capability of Today's Power Semiconductors, "Proceedings, European Power Electronic Conference," 1993, Brighton, England

2. Pshaenich, A., 1985, "Characterizing Overvoltage Transient Suppressors," Powerconversion International, June/July

# MBRB4030

**Preferred Device**

# SWITCHMODE™ Power Rectifier

Using the Schottky Barrier principle with a proprietary barrier metal. These state–of–the–art devices have the following features:

- Guardring for Stress Protection
- Maximum Die Size
- 150°C Operating Junction Temperature
- Short Heat Sink Tab Manufactured – Not Sheared

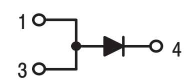
**Mechanical Characteristics**

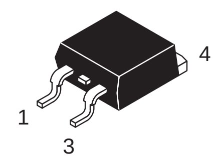
- Case: Epoxy, Molded
- Weight: 1.7 Grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads Readily Solderable
- Shipped 50 Units per Plastic Tube
- Available in 24 mm Tape and Reel, 800 Units per 13″ Reel by Adding a “T4” Suffix to the Part Number
- Marking: B4030

ON Semiconductor™

http://onsemi.com

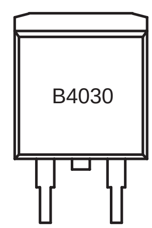
**SCHOTTKY BARRIER RECTIFIER 40 AMPERES 30 VOLTS**




**D²PAK**
**CASE 418B**
**STYLE 3**

**MARKING DIAGRAM**




B4030 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRB4030 | $D^2$PAK | 50/Rail |
| MBRB4030T4 | $D^2$PAK | 800/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 30 | V |
| Average Rectified Forward Current (At Rated $V_R$) $T_C$ = +115°C (Note 1.) | $I_{F(AV)}$ | 40 | A |
| Peak Repetitive Forward Current (At Rated $V_R$, Square Wave, 20 kHz) $T_C$ = +112°C | $I_{FRM}$ | 80 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 300 | A |
| Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) | $I_{RRM}$ | 2.0 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +150 | °C |
| Operating Junction Temperature Range | $T_J$ | –65 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/μs |
| Reverse Energy (Unclamped Inductive Surge) ($T_C$ = 25°C, L = 3.0 mH) | W | 600 | mJ |

1. Rating applies when pins 1 and 3 are connected.

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**THERMAL CHARACTERISTICS**

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance – Junction to Case | $R_{\theta JC}$ | 1.0 | °C/W |
| Thermal Resistance – Junction to Ambient (Note 3.) | $R_{\theta JA}$ | 50 | °C/W |

**ELECTRICAL CHARACTERISTICS**

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Notes 2. and 4.), per Device<br>($I_F$ = 20 A, $T_C$ = + 25°C)<br>($I_F$ = 20 A, $T_C$ = +150°C)<br>($I_F$ = 40 A, $T_C$ = + 25°C)<br>($I_F$ = 40 A, $T_C$ = +150°C) | $V_F$ | <br>0.46<br>0.34<br>0.55<br>0.45 | V |
| Maximum Instantaneous Reverse Current (Note 4.), per Device<br>(Rated DC Voltage, $T_C$ = + 25°C)<br>(Rated DC Voltage, $T_C$ = +125°C) | $I_R$ | <br>0.35<br>150 | mA |

2. Rating applies when pins 1 and 3 are connected.
3. Rating applies when surface mounted on the miniumum pad size recommended.
4. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

## ELECTRICAL CHARACTERISTICS

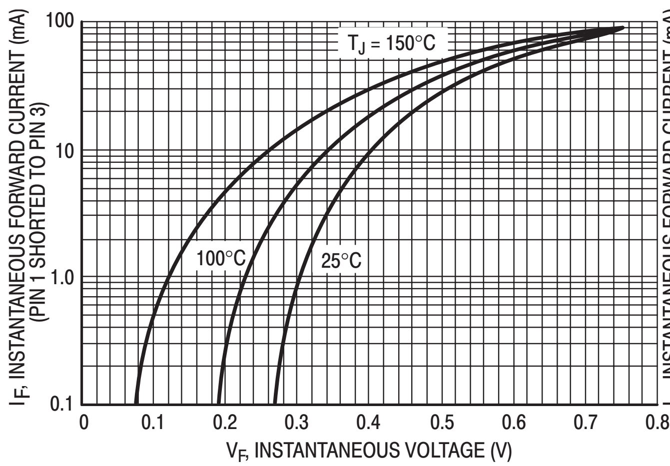


**Figure 1. Maximum Forward Voltage**

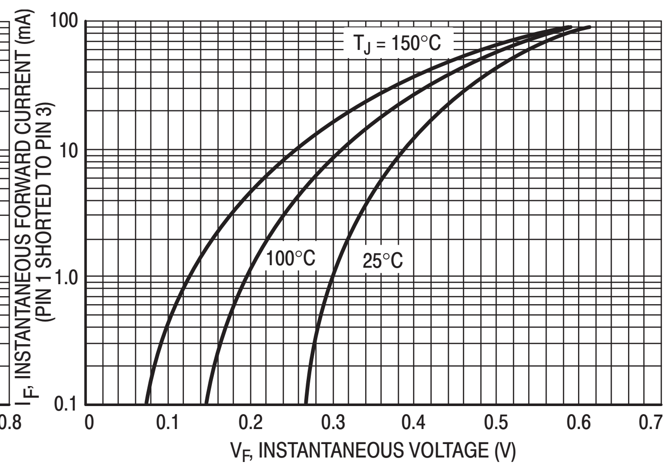


**Figure 2. Typical Forward Voltage**

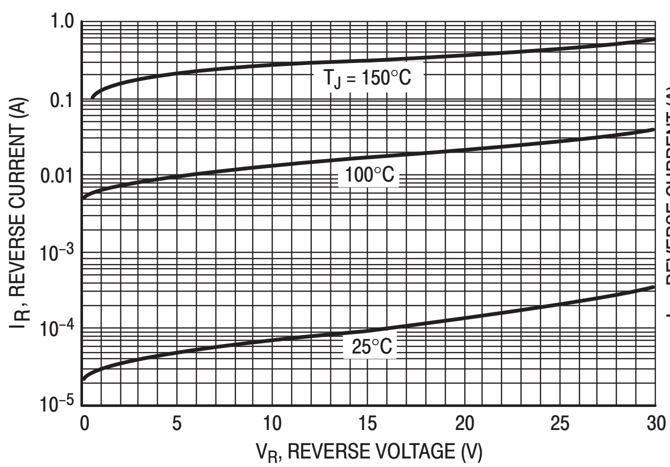


**Figure 3. Maximum Reverse Current**

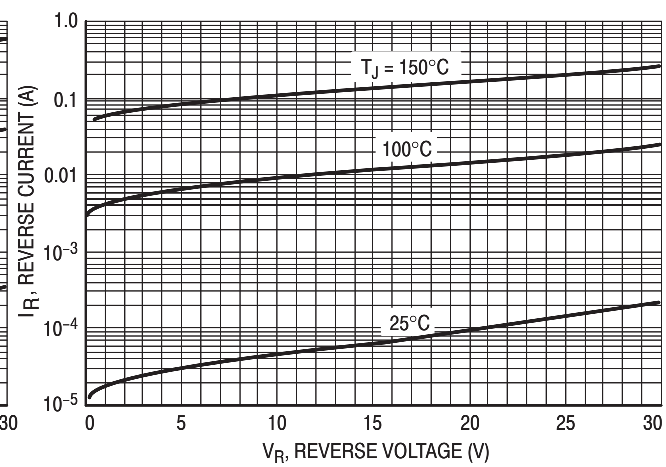


**Figure 4. Typical Reverse Current**

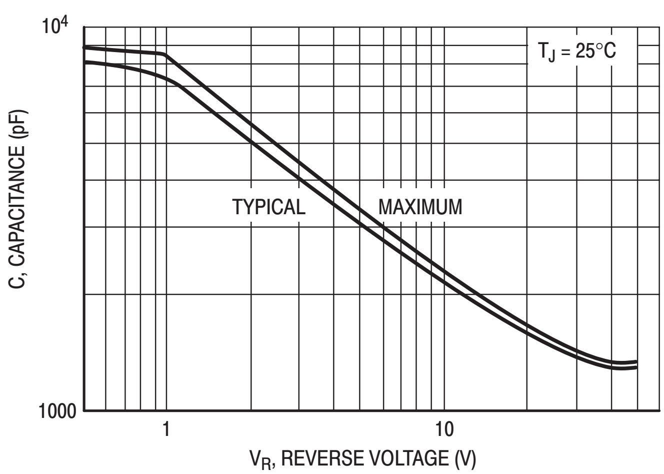


**Figure 5. Maximum and Typical Capacitance**

## ELECTRICAL CHARACTERISTICS

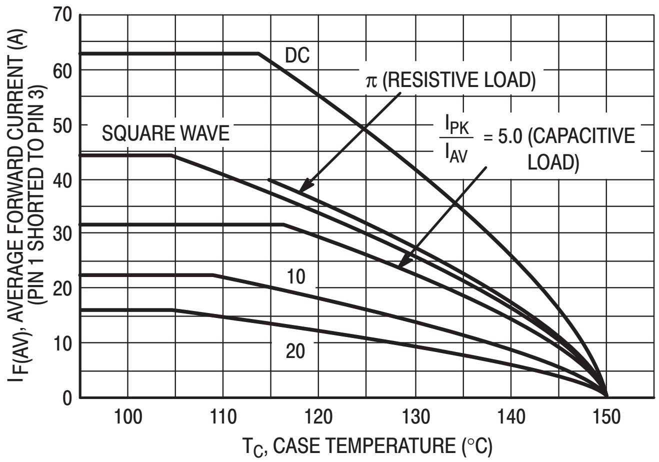


**Figure 6. Current Derating, Infinite Heatsink**

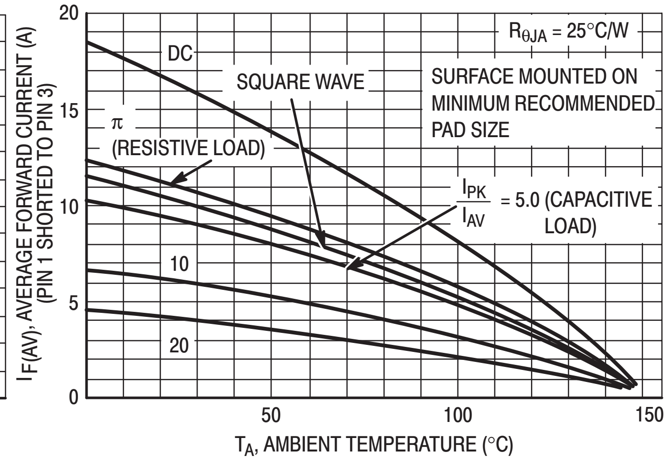


**Figure 7. Current Derating**

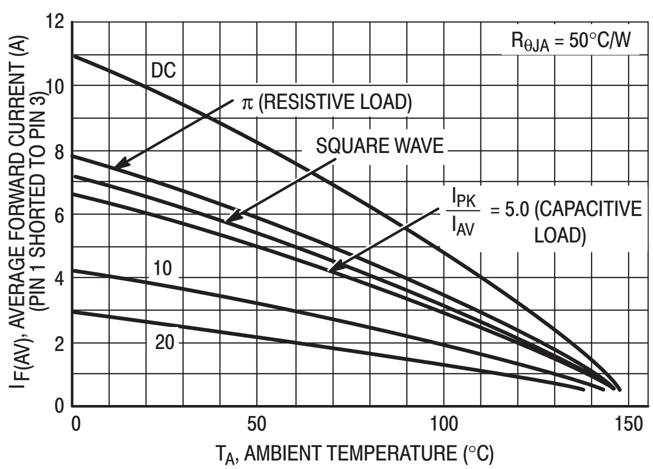


**Figure 8. Current Derating, Free Air**

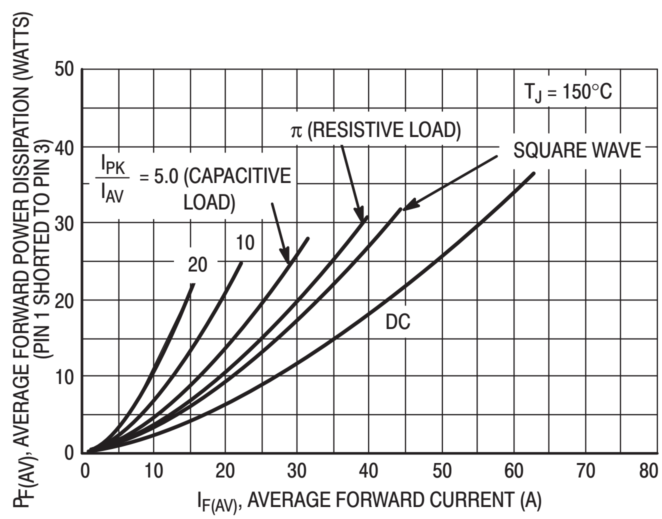


**Figure 9. Forward Power Dissipation**

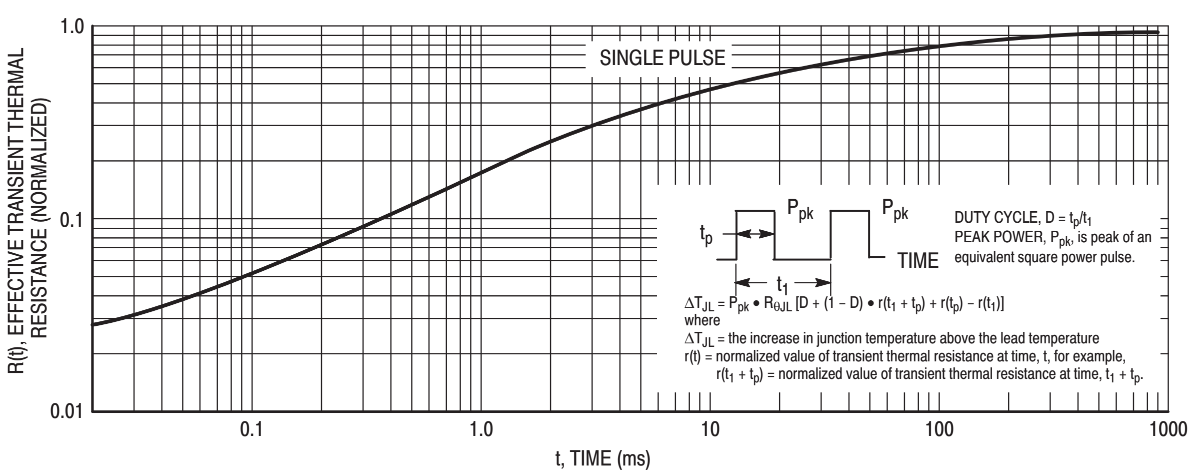


**Figure 10. Thermal Response**

# 1N5817, 1N5818, 1N5819

**1N5817 and 1N5819 are Preferred Devices**

# Axial Lead Rectifiers

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features chrome barrier metal, epitaxial construction with oxide passivation and metal overlap contact. Ideally suited for use as rectifiers in low–voltage, high–frequency inverters, free wheeling diodes, and polarity protection diodes.

- Extremely Low $V_F$
- Low Stored Charge, Majority Carrier Conduction
- Low Power Loss/High Efficiency

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 1000 per bag.
- Available Tape and Reeled, 5000 per reel, by adding a “RL” suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: 1N5817, 1N5818, 1N5819

**MAXIMUM RATINGS**

| |
|---|
| Please See the Table on the Following Page |

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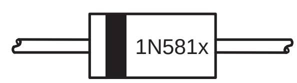
**http://onsemi.com**

**SCHOTTKY BARRIER RECTIFIERS 1.0 AMPERE 20, 30 and 40 VOLTS**

**AXIAL LEAD CASE 59–04 PLASTIC**

**MARKING DIAGRAM**




1N581x = Device Code
x = 7, 8 or 9

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| 1N5817 | Axial Lead | 1000 Units/Bag |
| 1N5817RL | Axial Lead | 5000/Tape & Reel |
| 1N5818 | Axial Lead | 1000 Units/Bag |
| 1N5818RL | Axial Lead | 5000/Tape & Reel |
| 1N5819 | Axial Lead | 1000 Units/Bag |
| 1N5819RL | Axial Lead | 5000/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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**MAXIMUM RATINGS**

| Rating | Symbol | 1N5817 | 1N5818 | 1N5819 | Unit |
|---|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 20 | 30 | 40 | V |
| Non–Repetitive Peak Reverse Voltage | $V_{RSM}$ | 24 | 36 | 48 | V |
| RMS Reverse Voltage | $V_{R(RMS)}$ | 14 | 21 | 28 | V |
| Average Rectified Forward Current (Note 5.)<br>($V_{R(equiv)} \leq 0.2\ V_R$(dc), $T_L$ = 90°C,<br>$R_{\theta JA}$ = 80°C/W, P.C. Board Mounting, see Note 8., $T_A$ = 55°C) | $I_O$ | 1.0 | | | A |
| Ambient Temperature (Rated $V_R$(dc), $P_{F(AV)}$ = 0, $R_{\theta JA}$ = 80°C/W) | $T_A$ | 85 | 80 | 75 | °C |
| Non–Repetitive Peak Surge Current<br>(Surge applied at rated load conditions, half–wave, single phase 60 Hz,<br>$T_L$ = 70°C) | $I_{FSM}$ | 25 (for one cycle) | | | A |
| Operating and Storage Junction Temperature Range<br>(Reverse Voltage applied) | $T_J$, $T_{stg}$ | –65 to +125 | | | °C |
| Peak Operating Junction Temperature (Forward Current applied) | $T_{J(pk)}$ | 150 | | | °C |

**THERMAL CHARACTERISTICS** (Note 5.)

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 80 | °C/W |

**ELECTRICAL CHARACTERISTICS** ($T_L$ = 25°C unless otherwise noted) (Note 5.)

| Characteristic | Symbol | 1N5817 | 1N5818 | 1N5819 | Unit |
|---|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 6.) ($i_F$ = 0.1 A)<br>($i_F$ = 1.0 A)<br>($i_F$ = 3.0 A) | $v_F$ | 0.32<br>0.45<br>0.75 | 0.33<br>0.55<br>0.875 | 0.34<br>0.6<br>0.9 | V |
| Maximum Instantaneous Reverse Current @ Rated dc Voltage (Note 6.)<br>($T_L$ = 25°C)<br>($T_L$ = 100°C) | $I_R$ | <br>1.0<br>10 | <br>1.0<br>10 | <br>1.0<br>10 | mA |

5. Lead Temperature reference is cathode lead 1/32″ from case.
6. Pulse Test: Pulse Width = 300 μs, Duty Cycle = 2.0%.

**NOTE 7. — DETERMINING MAXIMUM RATINGS**

Reverse power dissipation and the possibility of thermal runaway must be considered when operating this rectifier at reverse voltages above 0.1 $V_{RWM}$. Proper derating may be accomplished by use of equation (1).

$$T_{A(max)} = T_{J(max)} - R_{\theta JA}P_{F(AV)} - R_{\theta JA}P_{R(AV)} \quad (1)$$

where $T_{A(max)}$ = Maximum allowable ambient temperature
$T_{J(max)}$ = Maximum allowable junction temperature (125°C or the temperature at which thermal runaway occurs, whichever is lowest)
$P_{F(AV)}$ = Average forward power dissipation
$P_{R(AV)}$ = Average reverse power dissipation
$R_{\theta JA}$ = Junction–to–ambient thermal resistance

Figures 1, 2, and 3 permit easier use of equation (1) by taking reverse power dissipation and thermal runaway into consideration. The figures solve for a reference temperature as determined by equation (2).

$$T_R = T_{J(max)} - R_{\theta JA}P_{R(AV)} \quad (2)$$

Substituting equation (2) into equation (1) yields:

$$T_{A(max)} = T_R - R_{\theta JA}P_{F(AV)} \quad (3)$$

Inspection of equations (2) and (3) reveals that $T_R$ is the ambient temperature at which thermal runaway occurs or where $T_J$ = 125°C, when forward power is zero. The transition from one boundary condition to the other is evident on the curves of Figures 1, 2, and 3 as a difference in the rate of change of the slope in the vicinity of 115°C. The data of Figures 1, 2, and 3 is based upon dc conditions. For use in common rectifier circuits, Table 1 indicates suggested factors for an equivalent dc voltage to use for conservative design, that is:

$$V_{R(equiv)} = V_{in(PK)} \times F \quad (4)$$

The factor F is derived by considering the properties of the various rectifier circuits and the reverse characteristics of Schottky diodes.

EXAMPLE: Find $T_{A(max)}$ for 1N5818 operated in a 12–volt dc supply using a bridge circuit with capacitive filter such that $I_{DC}$ = 0.4 A ($I_{F(AV)}$ = 0.5 A), $I_{(FM)}/I_{(AV)}$ = 10, Input Voltage = 10 $V_{(rms)}$, $R_{\theta JA}$ = 80°C/W.

Step 1. Find $V_{R(equiv)}$. Read F = 0.65 from Table 1,
$\therefore V_{R(equiv)} = (1.41)(10)(0.65) = 9.2$ V.
Step 2. Find $T_R$ from Figure 2. Read $T_R$ = 109°C
@ $V_R$ = 9.2 V and $R_{\theta JA}$ = 80°C/W.
Step 3. Find $P_{F(AV)}$ from Figure 4. **Read $P_{F(AV)}$ = 0.5 W
@ $\frac{I_{(FM)}}{I_{(AV)}}$ = 10 and IF(AV) = 0.5 A.
Step 4. Find $T_{A(max)}$ from equation (3).
$T_{A(max)}$ = 109 – (80) (0.5) = 69°C.

**Values given are for the 1N5818. Power is slightly lower for the 1N5817 because of its lower forward voltage, and higher for the 1N5819.

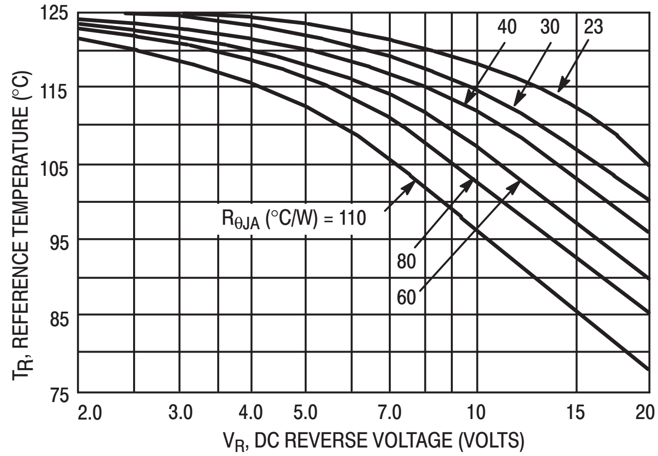



**Figure 1. Maximum Reference Temperature 1N5817**

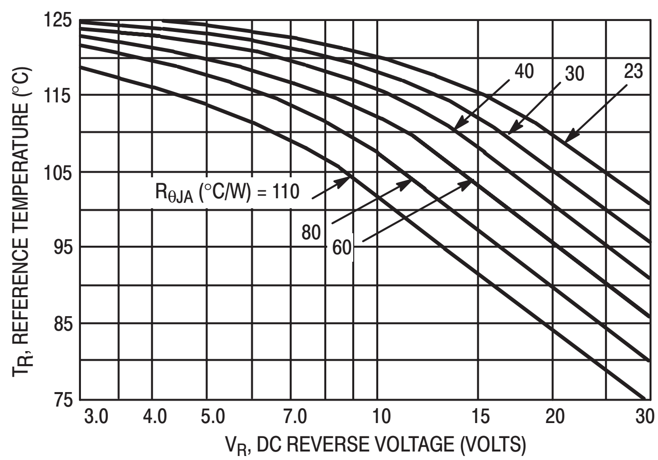



**Figure 2. Maximum Reference Temperature 1N5818**

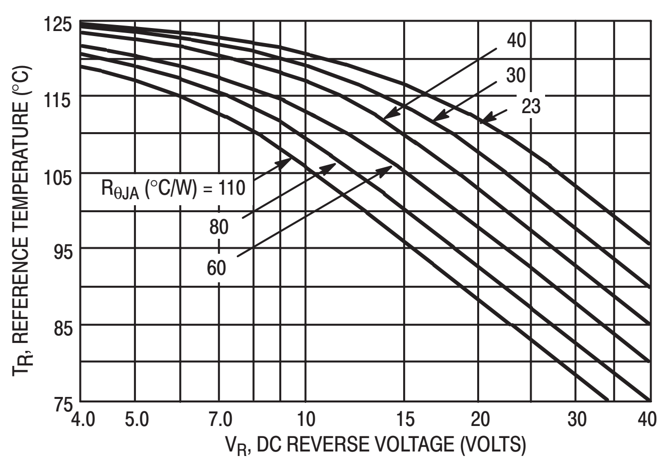



**Figure 3. Maximum Reference Temperature 1N5819**

**Table 1. Values for Factor F**

| Circuit | Half Wave | | Full Wave, Bridge | | Full Wave, Center Tapped*† | |
|---|---|---|---|---|---|---|
| **Load** | **Resistive** | **Capacitive*** | **Resistive** | **Capacitive** | **Resistive** | **Capacitive** |
| Sine Wave | 0.5 | 1.3 | 0.5 | 0.65 | 1.0 | 1.3 |
| Square Wave | 0.75 | 1.5 | 0.75 | 0.75 | 1.5 | 1.5 |

*Note that $V_{R(PK)} \approx 2.0\ V_{in(PK)}$. †Use line to center tap voltage for $V_{in}$.

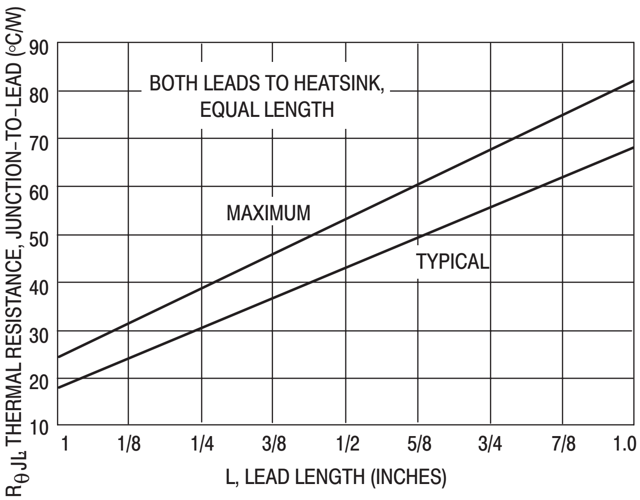



**Figure 4. Steady−State Thermal Resistance**

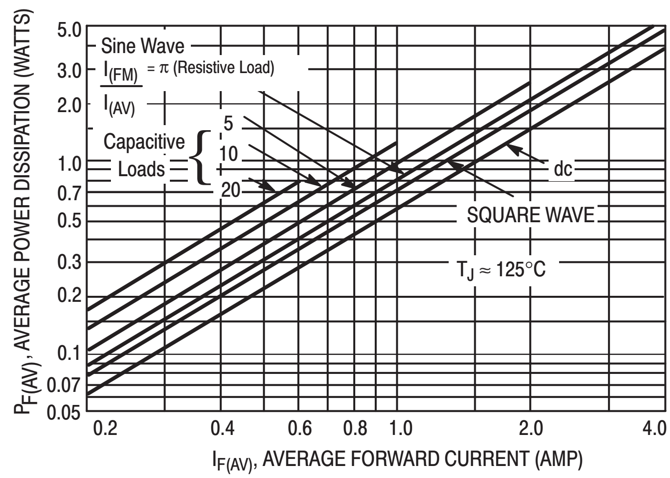



**Figure 5. Forward Power Dissipation 1N5817−19**

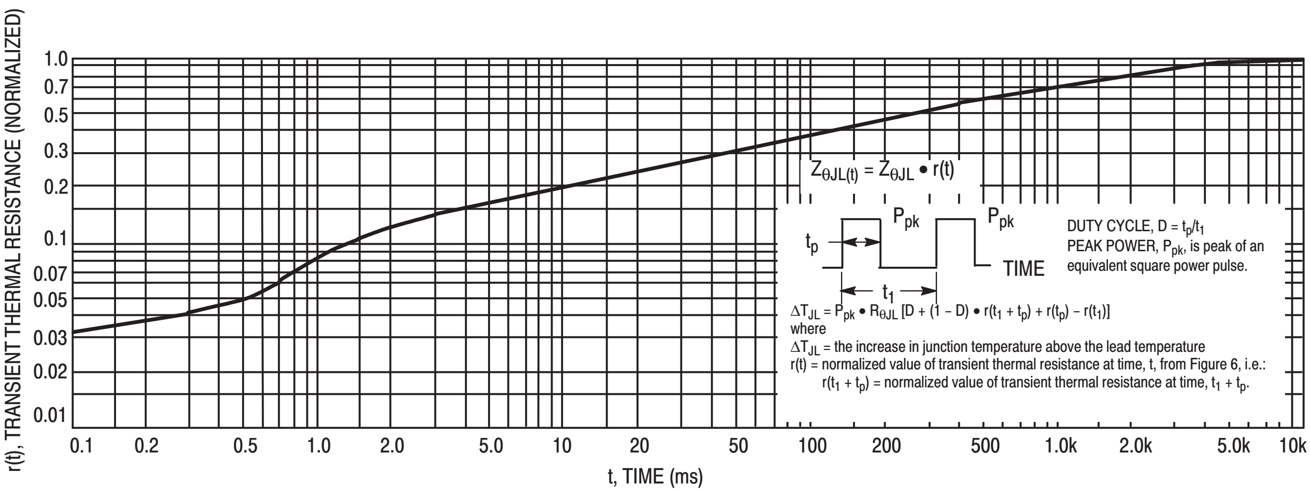



**Figure 6. Thermal Response**

### NOTE 8. — MOUNTING DATA

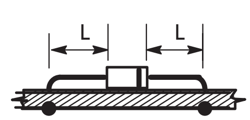
Data shown for thermal resistance junction–to–ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering, or in case the tie point temperature cannot be measured.

### TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR

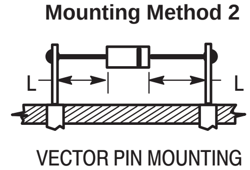
| Mounting Method | Lead Length, L (in) | | | | $R_{\theta JA}$ |
|---|---|---|---|---|---|
| | 1/8 | 1/4 | 1/2 | 3/4 | |
| 1 | 52 | 65 | 72 | 85 | °C/W |
| 2 | 67 | 80 | 87 | 100 | °C/W |
| 3 | 50 | | | | °C/W |

**Mounting Method 1**

P.C. Board with 1–1/2″ x 1–1/2″ copper surface.

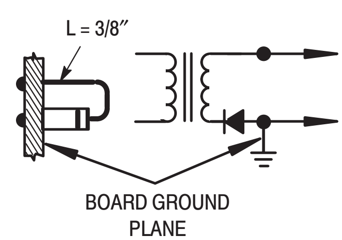



**Mounting Method 2**

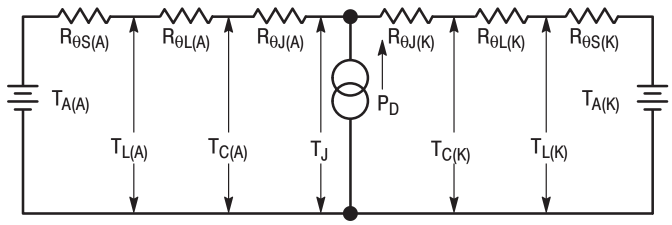



**Mounting Method 3**

P.C. Board with 1–1/2″ x 1–1/2″ copper surface.



**NOTE 9. — THERMAL CIRCUIT MODEL**
(For heat conduction through the leads)




Use of the above model permits junction to lead thermal resistance for any mounting configuration to be found. For a given total lead length, lowest values occur when one side of the rectifier is brought as close as possible to the heatsink. Terms in the model signify:

$T_A$ = Ambient Temperature    $T_C$ = Case Temperature
$T_L$ = Lead Temperature    $T_J$ = Junction Temperature
$R_{\theta S}$ = Thermal Resistance, Heatsink to Ambient
$R_{\theta L}$ = Thermal Resistance, Lead to Heatsink
$R_{\theta J}$ = Thermal Resistance, Junction to Case
$P_D$ = Power Dissipation

(Subscripts A and K refer to anode and cathode sides, respectively.) Values for thermal resistance components are:

$R_{\theta L}$ = 100°C/W/in typically and 120°C/W/in maximum
$R_{\theta J}$ = 36°C/W typically and 46°C/W maximum.

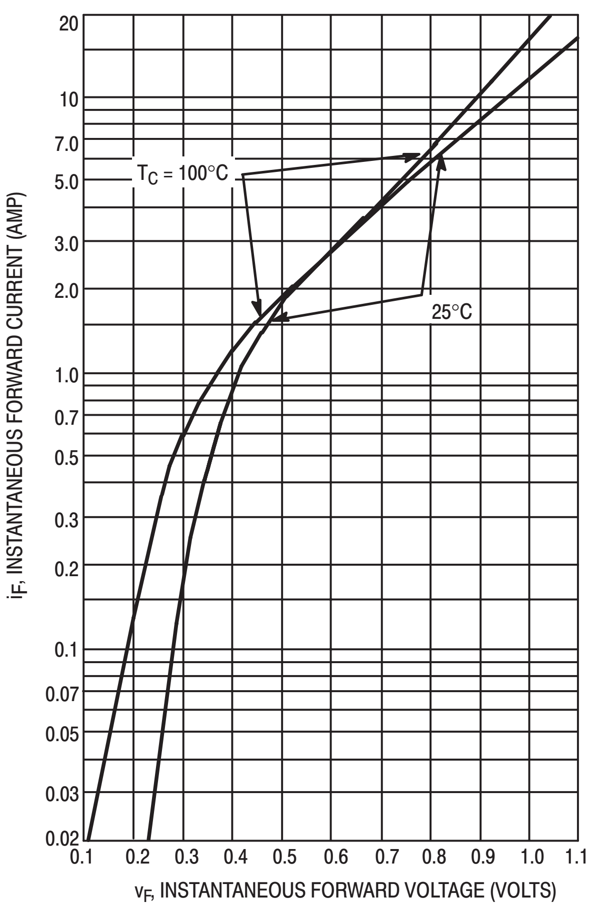



**Figure 7. Typical Forward Voltage**

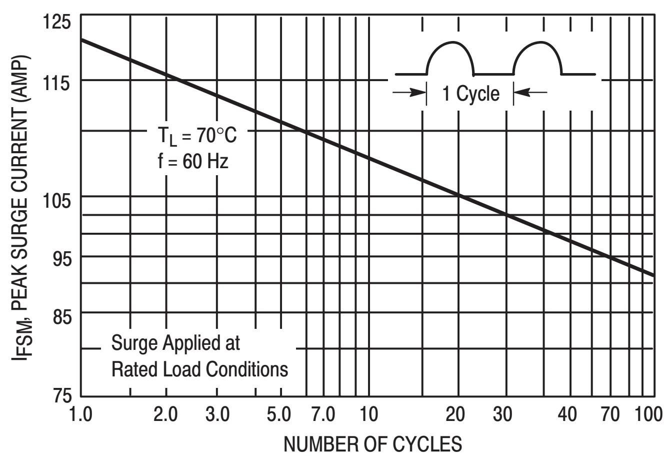



**Figure 8. Maximum Non–Repetitive Surge Current**

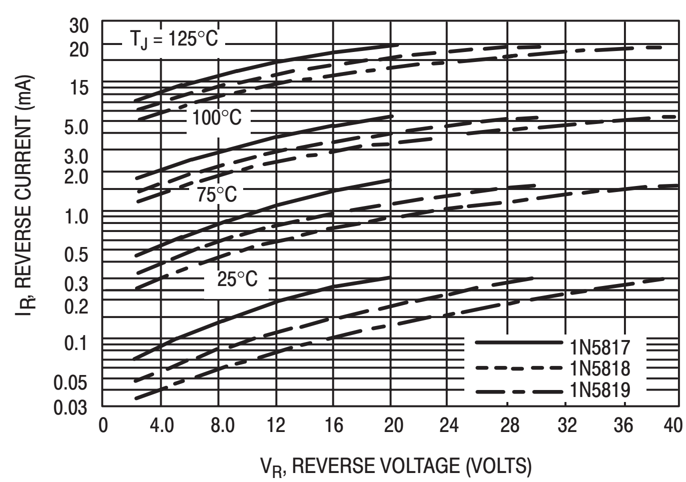



**Figure 9. Typical Reverse Current**

### NOTE 10. — HIGH FREQUENCY OPERATION

Since current flow in a Schottky rectifier is the result of majority carrier conduction, it is not subject to junction diode forward and reverse recovery transients due to minority carrier injection and stored charge. Satisfactory circuit analysis work may be performed by using a model consisting of an ideal diode in parallel with a variable capacitance. (See Figure 10.)

Rectification efficiency measurements show that operation will be satisfactory up to several megahertz. For example, relative waveform rectification efficiency is approximately 70 percent at 2.0 MHz, e.g., the ratio of dc power to RMS power in the load is 0.28 at this frequency, whereas perfect rectification would yield 0.406 for sine wave inputs. However, in contrast to ordinary junction diodes, the loss in waveform efficiency is not indicative of power loss: it is simply a result of reverse current flow through the diode capacitance, which lowers the dc output voltage.

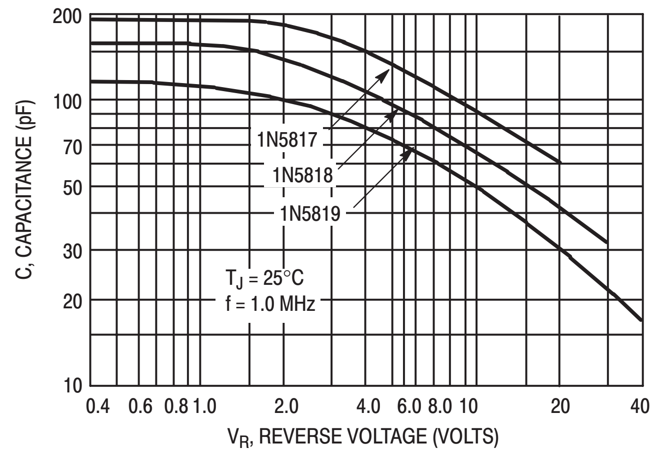



**Figure 10. Typical Capacitance**

# MBR150, MBR160

**MBR160 is a Preferred Device**

# Axial Lead Rectifiers

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlap contact. Ideally suited for use as rectifiers in low–voltage, high–frequency inverters, free wheeling diodes, and polarity protection diodes.

- Low Reverse Current
- Low Stored Charge, Majority Carrier Conduction
- Low Power Loss/High Efficiency
- Highly Stable Oxide Passivated Junction

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 1000 per bag
- Available Tape and Reeled, 5000 per reel, by adding a "RL'' suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: B150, B160

**MAXIMUM RATINGS**

Please See the Table on the Following Page

ON Semiconductor™

http://onsemi.com

**SCHOTTKY BARRIER RECTIFIERS 1.0 AMPERE 50, 60 VOLTS**

**AXIAL LEAD CASE 59–04 PLASTIC**

**MARKING DIAGRAM**


B1x0 = Device Code
x = 5 or 6

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR150 | Axial Lead | 1000 Units/Bag |
| MBR150RL | Axial Lead | 5000/Tape & Reel |
| MBR160 | Axial Lead | 1000 Units/Bag |
| MBR160RL | Axial Lead | 5000/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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## MAXIMUM RATINGS

| Rating | Symbol | MBR150 | MBR160 | Unit |
|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 50 | 60 | Volts |
| RMS Reverse Voltage | $V_{R(RMS)}$ | 35 | 42 | Volts |
| Average Rectified Forward Current (Note 1.)<br>($V_{R(equiv)} \leq 0.2\ V_R$(dc), $T_L$ = 90°C, $R_{\theta JA}$ = 80°C/W, P.C. Board Mounting, see Note 3., $T_A$ = 55°C) | $I_O$ | 1.0 | | Amp |
| Nonrepetitive Peak Surge Current<br>(Surge applied at rated load conditions, halfwave, single phase, 60 Hz, $T_L$ = 70°C) | $I_{FSM}$ | 25 (for one cycle) | | Amps |
| Operating and Storage Junction Temperature Range (Reverse Voltage Applied) | $T_J$, $T_{stg}$ | – 65 to +150 | | °C |
| Peak Operating Junction Temperature (Forward Current Applied) | $T_{J(pk)}$ | 150 | | °C |

## THERMAL CHARACTERISTICS (Notes 3. and 4.)

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 80 | °C/W |

## ELECTRICAL CHARACTERISTICS ($T_L$ = 25°C unless otherwise noted) (Note 1.)

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.)<br>($i_F$ = 0.1 A)<br>($i_F$ = 1.0 A)<br>($i_F$ = 3.0 A) | $v_F$ | <br>0.550<br>0.750<br>1.000 | Volt |
| Maximum Instantaneous Reverse Current @ Rated dc Voltage (Note 2.)<br>($T_L$ = 25°C)<br>($T_L$ = 100°C) | $i_R$ | <br>0.5<br>5.0 | mA |

1. Lead Temperature reference is cathode lead 1/32″ from case.
2. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

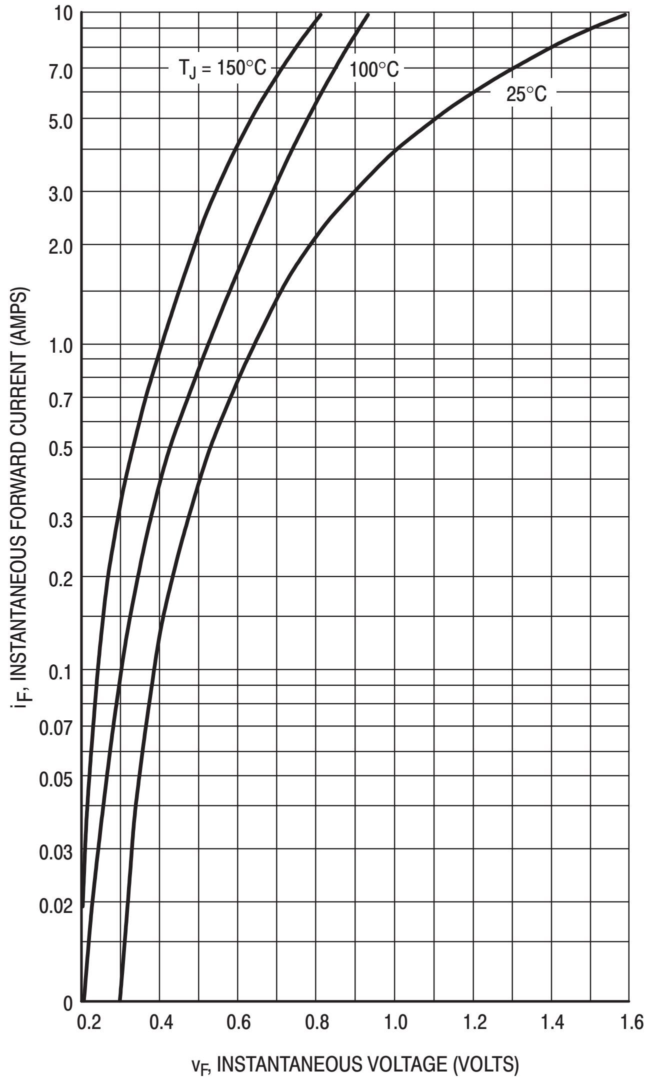



**Figure 1. Typical Forward Voltage**

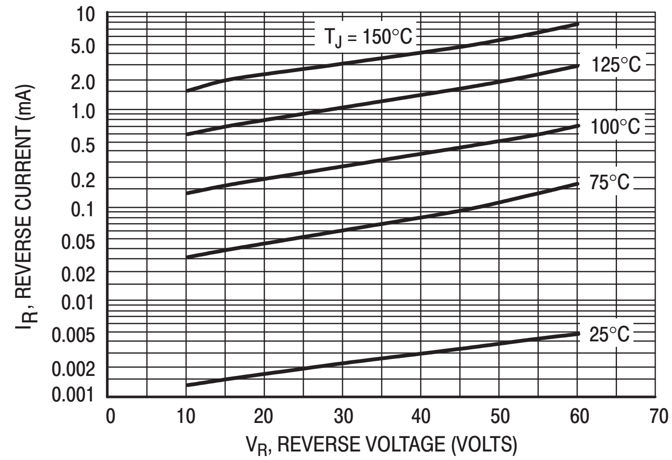



**Figure 2. Typical Reverse Current***

*The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if $V_R$ is sufficiently below rated $V_R$.

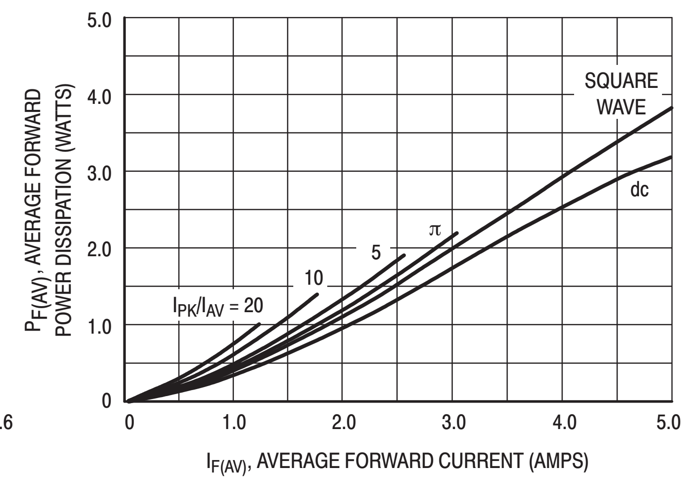



**Figure 3. Forward Power Dissipation**

## THERMAL CHARACTERISTICS

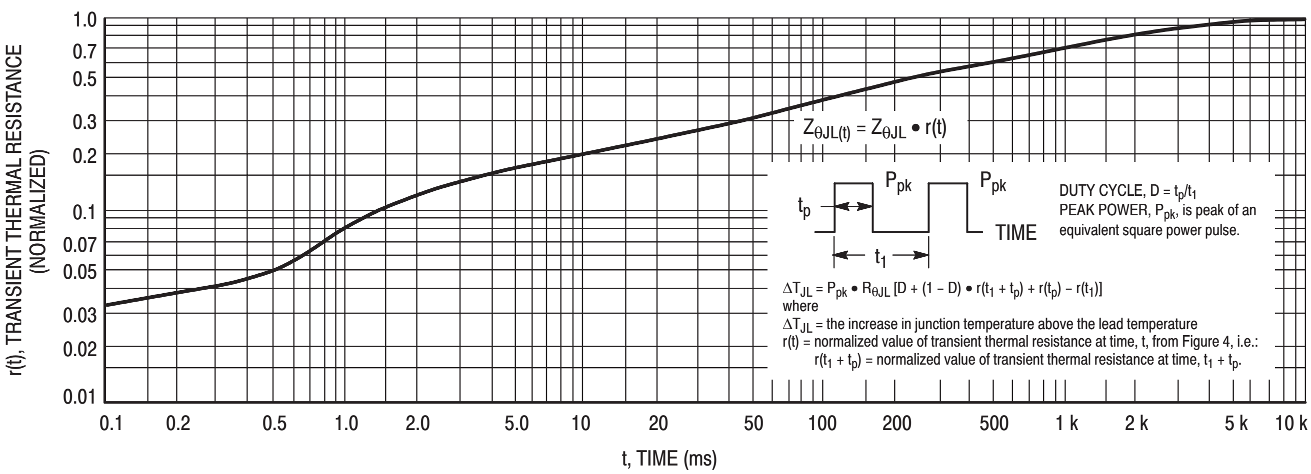



**Figure 4. Thermal Response**

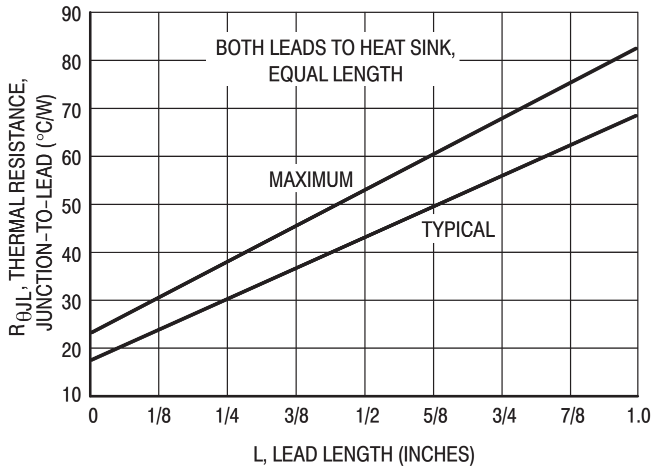



**Figure 5. Steady–State Thermal Resistance**

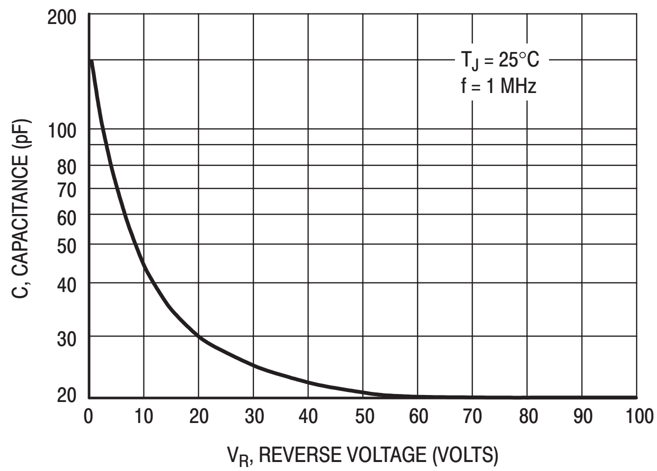


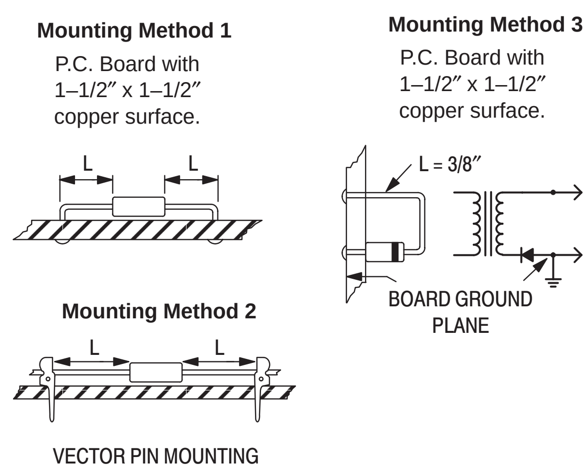

**Figure 6. Typical Capacitance**

**NOTE 3. — MOUNTING DATA:**

Data shown for thermal resistance junction–to–ambient ($R_{\theta JA}$) for the mounting shown is to be used as a typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

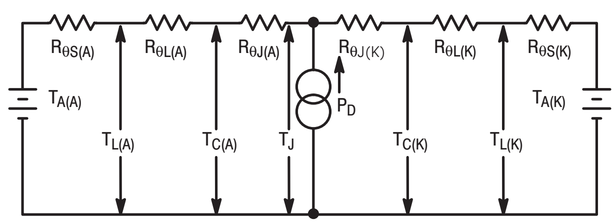
**Typical Values for $R_{\theta JA}$ in Still Air**

| Mounting Method | Lead Length, L (in) | | | | $R_{\theta JA}$ |
|---|---|---|---|---|---|
| | 1/8 | 1/4 | 1/2 | 3/4 | |
| 1 | 52 | 65 | 72 | 85 | °C/W |
| 2 | 67 | 80 | 87 | 100 | °C/W |
| 3 | — | 50 | | | °C/W |




**NOTE 4. — THERMAL CIRCUIT MODEL:**

(For heat conduction through the leads)




Use of the above model permits junction to lead thermal resistance for any mounting configuration to be found. For a given total lead length, lowest values occur when one side of the rectifier is brought as close as possible to the heat sink. Terms in the model signify:

$T_A$ = Ambient Temperature  $T_C$ = Case Temperature
$T_L$ = Lead Temperature  $T_J$ = Junction Temperature
$R_{\theta S}$ = Thermal Resistance, Heat Sink to Ambient
$R_{\theta L}$ = Thermal Resistance, Lead to Heat Sink
$R_{\theta J}$ = Thermal Resistance, Junction to Case
$P_D$ = Power Dissipation

(Subscripts A and K refer to anode and cathode sides, respectively.) Values for thermal resistance components are:
$R_{\theta L}$ = 100°C/W/in typically and 120°C/W/in maximum.
$R_{\theta J}$ = 36°C/W typically and 46°C/W maximum.

**NOTE 5. — HIGH FREQUENCY OPERATION:**

Since current flow in a Schottky rectifier is the result of majority carrier conduction, it is not subject to junction diode forward and reverse recovery transients due to minority carrier injection and stored charge. Satisfactory circuit analysis work may be performed by using a model consisting of an ideal diode in parallel with a variable capacitance. (See Figure 6.)

Rectification efficiency measurements show that operation will be satisfactory up to several megahertz. For example, relative waveform rectification efficiency is approximately 70 percent at 2 MHz, e.g., the ratio of dc power to RMS power in the load is 0.28 at this frequency, whereas perfect rectification would yield 0.406 for sine wave inputs. However, in contrast to ordinary junction diodes, the loss in waveform efficiency is not indicative of power loss: it is simply a result of reverse current flow through the diode capacitance, which lowers the dc output voltage.

# MBR1100

**Preferred Device**

# Axial Lead Rectifier

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlap contact. Ideally suited for use as rectifiers in low–voltage, high–frequency inverters, free wheeling diodes, and polarity protection diodes.

- Low Reverse Current
- Low Stored Charge, Majority Carrier Conduction
- Low Power Loss/High Efficiency
- Highly Stable Oxide Passivated Junction
- Guard–Ring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- High Surge Capacity

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 1000 per bag
- Available Tape and Reeled, 5000 per reel, by adding a “RL’’ suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: B1100

**MAXIMUM RATINGS**

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 100 | V |
| Average Rectified Forward Current<br>($V_{R(equiv)} \le 0.2\ V_R$(dc), $R_{\theta JA}$ = 50°C/W, P.C. Board Mounting, see Note 1., $T_A$ = 120°C) | $I_O$ | 1.0 | A |
| Non–Repetitive Peak<br>Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 50 | A |
| Operating and Storage Junction<br>Temperature Range | $T_J$, $T_{stg}$ | –65 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10 | V/ns |

**ON Semiconductor™**

**http://onsemi.com**

**SCHOTTKY BARRIER RECTIFIER**
**1.0 AMPERE**
**100 VOLTS**

**AXIAL LEAD**
**CASE 59–04**
**PLASTIC**

**MARKING DIAGRAM**


B1100 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR1100 | Axial Lead | 1000 Units/Bag |
| MBR1100RL | Axial Lead | 5000/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS** (See Note 2.)

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | See Note 1. | °C/W |

**ELECTRICAL CHARACTERISTICS** ($T_L$ = 25°C unless otherwise noted)

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage *<br>($i_F$ = 1 A, $T_L$ = 25°C)<br>($i_F$ = 1 A, $T_L$ = 100°C) | $V_F$ | <br>0.79<br>0.69 | Volt |
| Maximum Instantaneous Reverse Current @ Rated dc Voltage *<br>($T_L$ = 25°C)<br>($T_L$ = 100°C) | $i_R$ | <br>0.5<br>5.0 | mA |

* Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

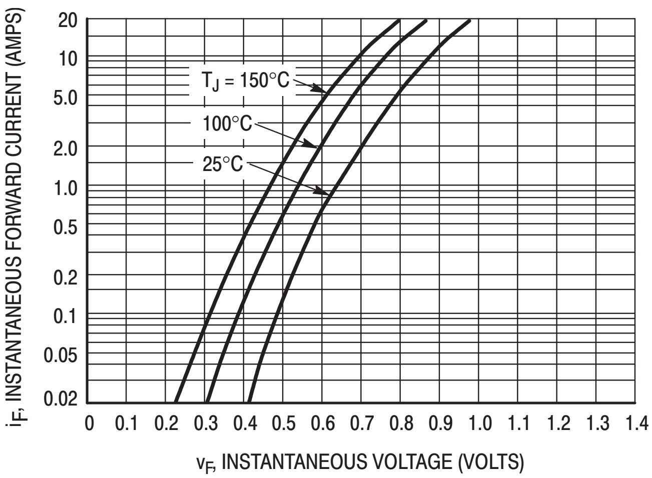



**Figure 1. Typical Forward Voltage**

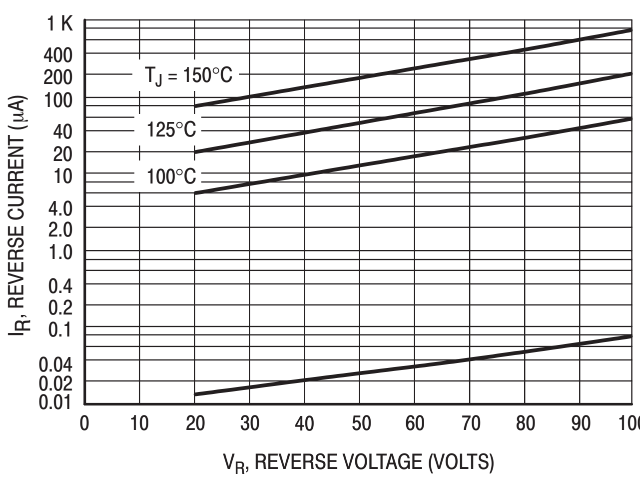



**Figure 2. Typical Reverse Current †**

† The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if $V_R$ is sufficiently below rated $V_R$.

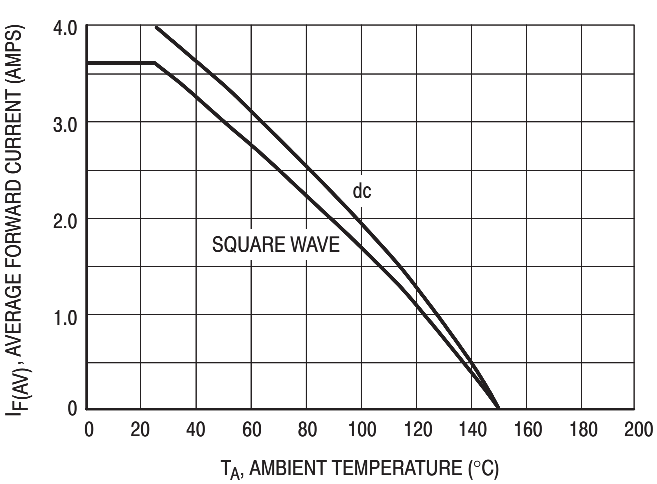



**Figure 3. Current Derating (Mounting Method 3 per Note 1.)**

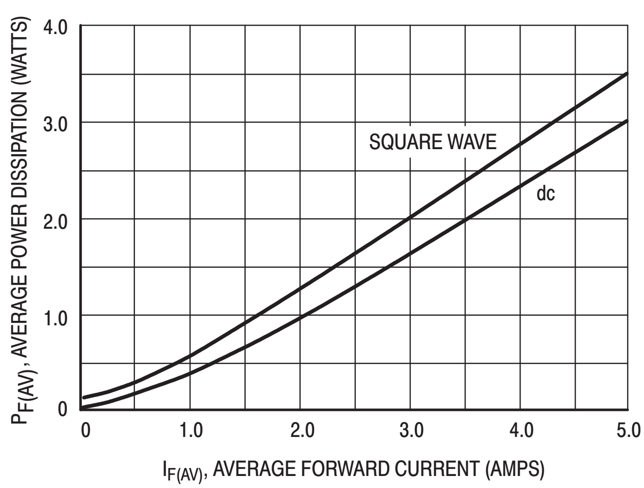



**Figure 4. Power Dissipation**

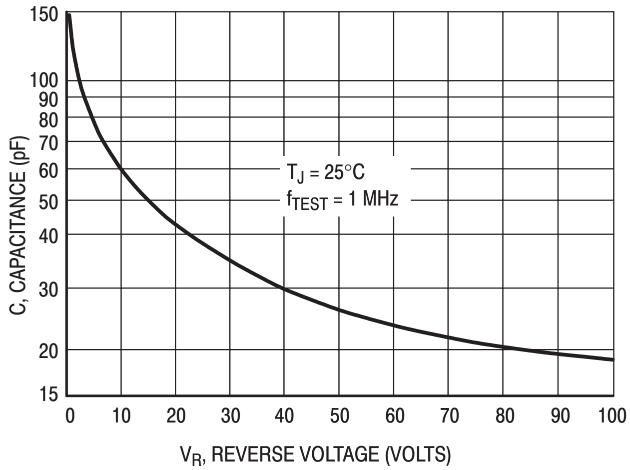



**Figure 5. Typical Capacitance**

**NOTE 1. — MOUNTING DATA:**

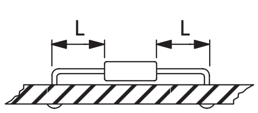
Data shown for thermal resistance junction–to–ambient ($R_{\theta JA}$) for the mounting shown is to be used as a typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

**Typical Values for $R_{\theta JA}$ in Still Air**

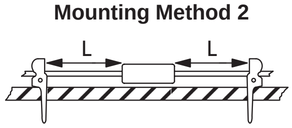
| Mounting Method | Lead Length, L (in) | | | | $R_{\theta JA}$ |
|---|---|---|---|---|---|
| | 1/8 | 1/4 | 1/2 | 3/4 | |
| 1 | 52 | 65 | 72 | 85 | °C/W |
| 2 | 67 | 80 | 87 | 100 | °C/W |
| 3 | — | 50 | | | °C/W |

**Mounting Method 1**

P.C. Board with 1–1/2″ x 1–1/2″ copper surface.



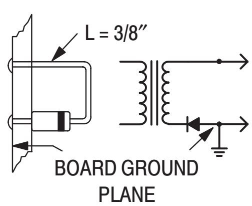

**Mounting Method 2**




VECTOR PIN MOUNTING

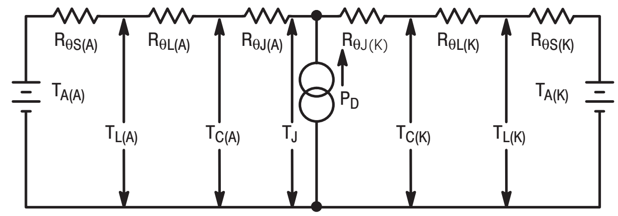
**Mounting Method 3**

P.C. Board with 1–1/2″ x 1–1/2″ copper surface.




**NOTE 2. — THERMAL CIRCUIT MODEL:**

(For heat conduction through the leads)




Use of the above model permits junction to lead thermal resistance for any mounting configuration to be found. For a given total lead length, lowest values occur when one side of the rectifier is brought as close as possible to the heat sink. Terms in the model signify:

$T_A$ = Ambient Temperature  $T_C$ = Case Temperature
$T_L$ = Lead Temperature  $T_J$ = Junction Temperature
$R_{\theta S}$ = Thermal Resistance, Heat Sink to Ambient
$R_{\theta L}$ = Thermal Resistance, Lead to Heat Sink
$R_{\theta J}$ = Thermal Resistance, Junction to Case
$P_D$ = Power Dissipation

(Subscripts A and K refer to anode and cathode sides, respectively.) Values for thermal resistance components are:
$R_{\theta L}$ = 100°C/W/in typically and 120°C/W/in maximum.
$R_{\theta J}$ = 36°C/W typically and 46°C/W maximum.

**NOTE 3. — HIGH FREQUENCY OPERATION:**

Since current flow in a Schottky rectifier is the result of majority carrier conduction, it is not subject to junction diode forward and reverse recovery transients due to minority carrier injection and stored charge. Satisfactory circuit analysis work may be performed by using a model consisting of an ideal diode in parallel with a variable capacitance. (See Figure 5)

Rectification efficiency measurements show that operation will be satisfactory up to several megahertz. For example, relative waveform rectification efficiency is approximately 70 percent at 2 MHz, e.g., the ratio of dc power to RMS power in the load is 0.28 at this frequency, whereas perfect rectification would yield 0.406 for sine wave inputs. However, in contrast to ordinary junction diodes, the loss in waveform efficiency is not indicative of power loss: it is simply a result of reverse current flow through the diode capacitance, which lowers the dc output voltage.

# 1N5820, 1N5821, 1N5822

**1N5820 and 1N5822 are Preferred Devices**

# Axial Lead Rectifiers

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features chrome barrier metal, epitaxial construction with oxide passivation and metal overlap contact. Ideally suited for use as rectifiers in low–voltage, high–frequency inverters, free wheeling diodes, and polarity protection diodes.

- Extremely Low $V_F$
- Low Power Loss/High Efficiency
- Low Stored Charge, Majority Carrier Conduction

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 1.1 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 500 per bag
- Available Tape and Reeled, 1500 per reel, by adding a "RL" suffix to the part number
- Polarity: Cathode indicated by Polarity Band
- Marking: 1N5820, 1N5821, 1N5822

**MAXIMUM RATINGS**

| Please See the Table on the Following Page |
|---|

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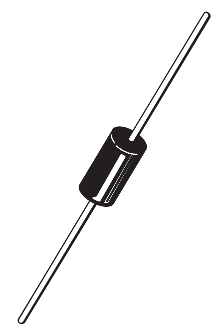
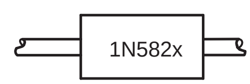
**SCHOTTKY BARRIER RECTIFIERS**
**3.0 AMPERES**
**20, 30, 40 VOLTS**



**AXIAL LEAD**
**CASE 267–03**
**STYLE 1**

**MARKING DIAGRAM**




1N582x = Device Code
x = 0, 1 or 2

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| 1N5820 | Axial Lead | 500 Units/Bag |
| 1N5820RL | Axial Lead | 1500/Tape & Reel |
| 1N5821 | Axial Lead | 500 Units/Bag |
| 1N5821RL | Axial Lead | 1500/Tape & Reel |
| 1N5822 | Axial Lead | 500 Units/Bag |
| 1N5822RL | Axial Lead | 1500/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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**MAXIMUM RATINGS**

| Rating | Symbol | 1N5820 | 1N5821 | 1N5822 | Unit |
|---|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 20 | 30 | 40 | V |
| Non–Repetitive Peak Reverse Voltage | $V_{RSM}$ | 24 | 36 | 48 | V |
| RMS Reverse Voltage | $V_{R(RMS)}$ | 14 | 21 | 28 | V |
| Average Rectified Forward Current (Note 1.)<br>$V_{R(equiv)} \leq 0.2\ V_{R(dc)}$, $T_L = 95°C$<br>($R_{\theta JA}$ = 28°C/W, P.C. Board Mounting, see Note 5.) | $I_O$ | ← 3.0 → | | | A |
| Ambient Temperature<br>Rated $V_{R(dc)}$, $P_{F(AV)} = 0$<br>$R_{\theta JA}$ = 28°C/W | $T_A$ | 90 | 85 | 80 | °C |
| Non–Repetitive Peak Surge Current<br>(Surge applied at rated load conditions, half wave, single phase<br>60 Hz, $T_L$ = 75°C) | $I_{FSM}$ | ← 80 (for one cycle) → | | | A |
| Operating and Storage Junction Temperature Range<br>(Reverse Voltage applied) | $T_J$, $T_{stg}$ | ← –65 to +125 → | | | °C |
| Peak Operating Junction Temperature (Forward Current applied) | $T_{J(pk)}$ | ← 150 → | | | °C |

***THERMAL CHARACTERISTICS** (Note 5.)

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 28 | °C/W |

***ELECTRICAL CHARACTERISTICS** ($T_L$ = 25°C unless otherwise noted) (Note 1.)

| Characteristic | Symbol | 1N5820 | 1N5821 | 1N5822 | Unit |
|---|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.)<br>($i_F$ = 1.0 Amp)<br>($i_F$ = 3.0 Amp)<br>($i_F$ = 9.4 Amp) | $V_F$ | <br>0.370<br>0.475<br>0.850 | <br>0.380<br>0.500<br>0.900 | <br>0.390<br>0.525<br>0.950 | V |
| Maximum Instantaneous Reverse Current<br>@ Rated dc Voltage (Note 2.)<br>$T_L$ = 25°C<br>$T_L$ = 100°C | $i_R$ | <br><br>2.0<br>20 | <br><br>2.0<br>20 | <br><br>2.0<br>20 | mA |

1. Lead Temperature reference is cathode lead 1/32″ from case.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle = 2.0%.

*Indicates JEDEC Registered Data for 1N5820–22.

## NOTE 3. — DETERMINING MAXIMUM RATINGS

Reverse power dissipation and the possibility of thermal runaway must be considered when operating this rectifier at reverse voltages above 0.1 $V_{RWM}$. Proper derating may be accomplished by use of equation (1).

$$T_{A(max)} = T_{J(max)} - R_{\theta JA}P_{F(AV)} - R_{\theta JA}P_{R(AV)} \quad (1)$$

where $T_{A(max)}$ = Maximum allowable ambient temperature
$T_{J(max)}$ = Maximum allowable junction temperature (125°C or the temperature at which thermal runaway occurs, whichever is lowest)
$P_{F(AV)}$ = Average forward power dissipation
$P_{R(AV)}$ = Average reverse power dissipation
$R_{\theta JA}$ = Junction–to–ambient thermal resistance

Figures 1, 2, and 3 permit easier use of equation (1) by taking reverse power dissipation and thermal runaway into consideration. The figures solve for a reference temperature as determined by equation (2).

$$T_R = T_{J(max)} - R_{\theta JA}P_{R(AV)} \quad (2)$$

Substituting equation (2) into equation (1) yields:

$$T_{A(max)} = T_R - R_{\theta JA}P_{F(AV)} \quad (3)$$

Inspection of equations (2) and (3) reveals that $T_R$ is the ambient temperature at which thermal runaway occurs or where $T_J$ = 125°C, when forward power is zero. The transition from one boundary condition to the other is evident on the curves of Figures 1, 2, and 3 as a difference in the rate of change of the slope in the vicinity of 115°C. The data of Figures 1, 2, and 3 is based upon dc conditions. For use in common rectifier circuits, Table 1. indicates suggested factors for an equivalent dc voltage to use for conservative design, that is:

$$V_{R(equiv)} = V_{(FM)} \times F \quad (4)$$

The factor F is derived by considering the properties of the various rectifier circuits and the reverse characteristics of Schottky diodes.

EXAMPLE: Find $T_{A(max)}$ for 1N5821 operated in a 12–volt dc supply using a bridge circuit with capacitive filter such that $I_{DC}$ = 2.0 A ($I_{F(AV)}$ = 1.0 A), $I_{(FM)}/I_{(AV)}$ = 10, Input Voltage = 10 $V_{(rms)}$, $R_{\theta JA}$ = 40°C/W.

Step 1. Find $V_{R(equiv)}$. Read F = 0.65 from Table 1. ,

$\therefore V_{R(equiv)}$ = (1.41) (10) (0.65) = 9.2 V.

Step 2. Find $T_R$ from Figure 2. Read $T_R$ = 108°C

@ $V_R$ = 9.2 V and $R_{\theta JA}$ = 40°C/W.

Step 3. Find $P_{F(AV)}$ from Figure 6. **Read $P_{F(AV)}$ = 0.85 W

$$@\frac{I_{(FM)}}{I_{(AV)}} = 10 \text{ and } I_{F(AV)} = 1.0 \text{ A.}$$

Step 4. Find $T_{A(max)}$ from equation (3).

$T_{A(max)}$ = 108 − (0.85) (40) = 74°C.

**Values given are for the 1N5821. Power is slightly lower for the 1N5820 because of its lower forward voltage, and higher for the 1N5822. Variations will be similar for the MBR–prefix devices, using $P_{F(AV)}$ from Figure 6.

**Table 1. Values for Factor F**

| Circuit | Half Wave | | Full Wave, Bridge | | Full Wave, Center Tapped*† | |
|---|---|---|---|---|---|---|
| **Load** | **Resistive** | **Capacitive*** | **Resistive** | **Capacitive** | **Resistive** | **Capacitive** |
| Sine Wave | 0.5 | 1.3 | 0.5 | 0.65 | 1.0 | 1.3 |
| Square Wave | 0.75 | 1.5 | 0.75 | 0.75 | 1.5 | 1.5 |

*Note that $V_{R(PK)} \approx 2.0\ V_{in(PK)}$. †Use line to center tap voltage for $V_{in}$.

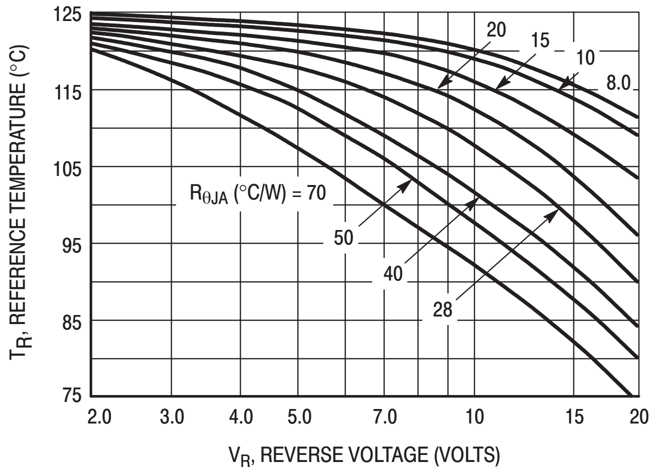



**Figure 1. Maximum Reference Temperature 1N5820**

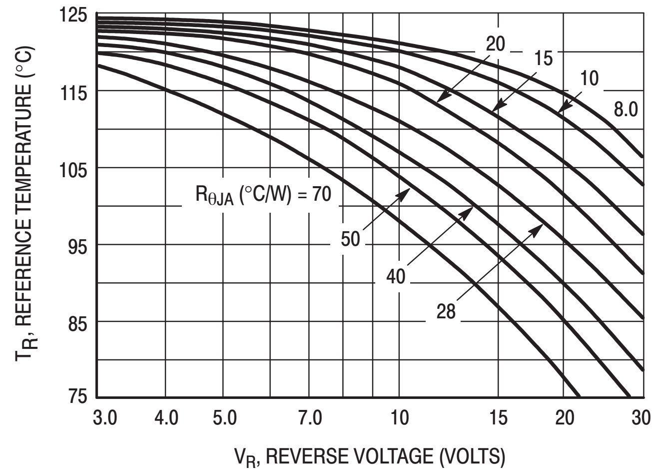



**Figure 2. Maximum Reference Temperature 1N5821**

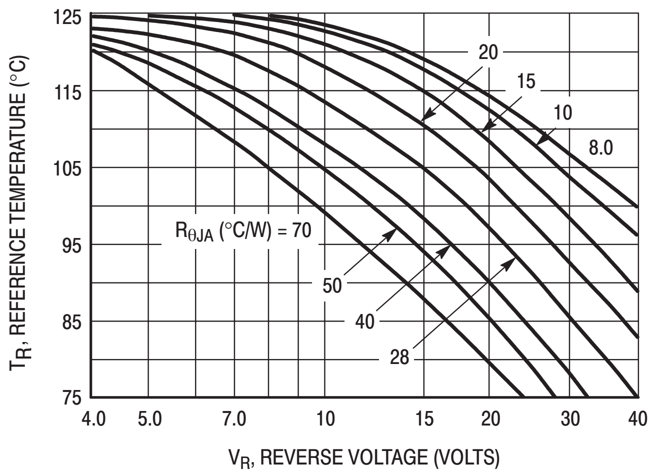



**Figure 3. Maximum Reference Temperature 1N5822**

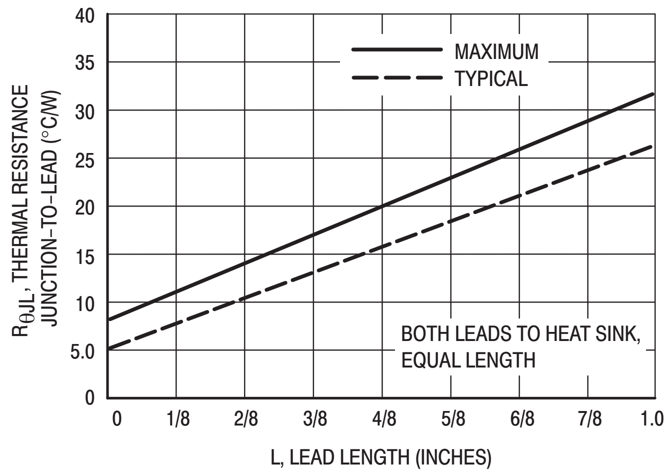



**Figure 4. Steady−State Thermal Resistance**

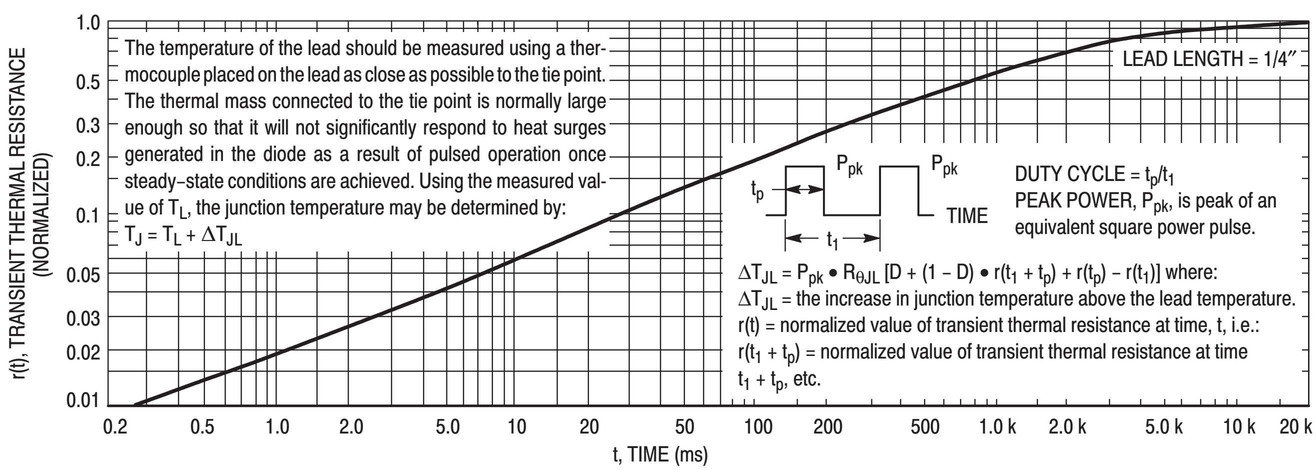



**Figure 5. Thermal Response**

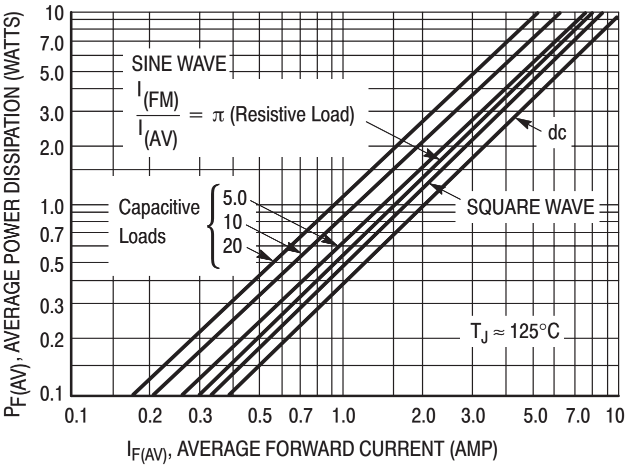
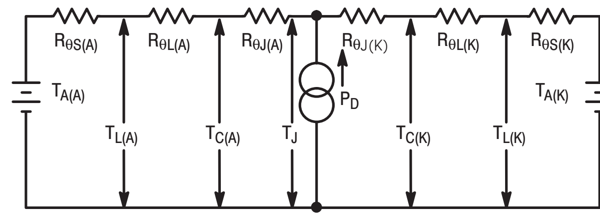



**Figure 6. Forward Power Dissipation 1N5820–22**

### NOTE 4. – APPROXIMATE THERMAL CIRCUIT MODEL




Use of the above model permits junction to lead thermal resistance for any mounting configuration to be found. For a given total lead length, lowest values occur when one side of the rectifier is brought as close as possible to the heat sink. Terms in the model signify:

$T_A$ = Ambient Temperature $T_C$ = Case Temperature
$T_L$ = Lead Temperature $T_J$ = Junction Temperature
$R_{\theta S}$ = Thermal Resistance, Heat Sink to Ambient
$R_{\theta L}$ = Thermal Resistance, Lead to Heat Sink
$R_{\theta J}$ = Thermal Resistance, Junction to Case
$P_D$ = Total Power Dissipation = $P_F + P_R$
$P_F$ = Forward Power Dissipation
$P_R$ = Reverse Power Dissipation

(Subscripts (A) and (K) refer to anode and cathode sides, respectively.) Values for thermal resistance components are:

$R_{\theta L}$ = 42°C/W/in typically and 48°C/W/in maximum
$R_{\theta J}$ = 10°C/W typically and 16°C/W maximum

The maximum lead temperature may be found as follows:

$T_L = T_{J(max)} - \Delta T_{JL}$
where $\Delta T_{JL} \approx R_{\theta JL} \cdot P_D$

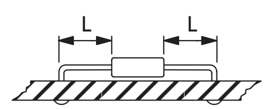
### NOTE 5. — MOUNTING DATA

Data shown for thermal resistance junction–to–ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering, or in case the tie point temperature cannot be measured.

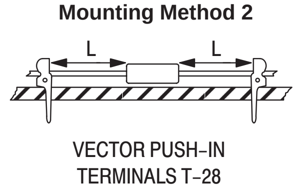
**TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR**

| Mounting Method | Lead Length, L (in) | | | | $R_{\theta JA}$ |
|---|---|---|---|---|---|
| | 1/8 | 1/4 | 1/2 | 3/4 | |
| 1 | 50 | 51 | 53 | 55 | °C/W |
| 2 | 58 | 59 | 61 | 63 | °C/W |
| 3 | 28 | | | | °C/W |

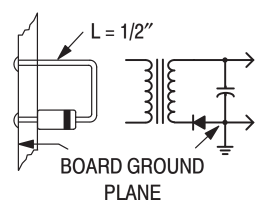
**Mounting Method 1**
P.C. Board where available copper surface is small.




**Mounting Method 2**




**Mounting Method 3**
P.C. Board with 2–1/2″ x 2–1/2″ copper surface.



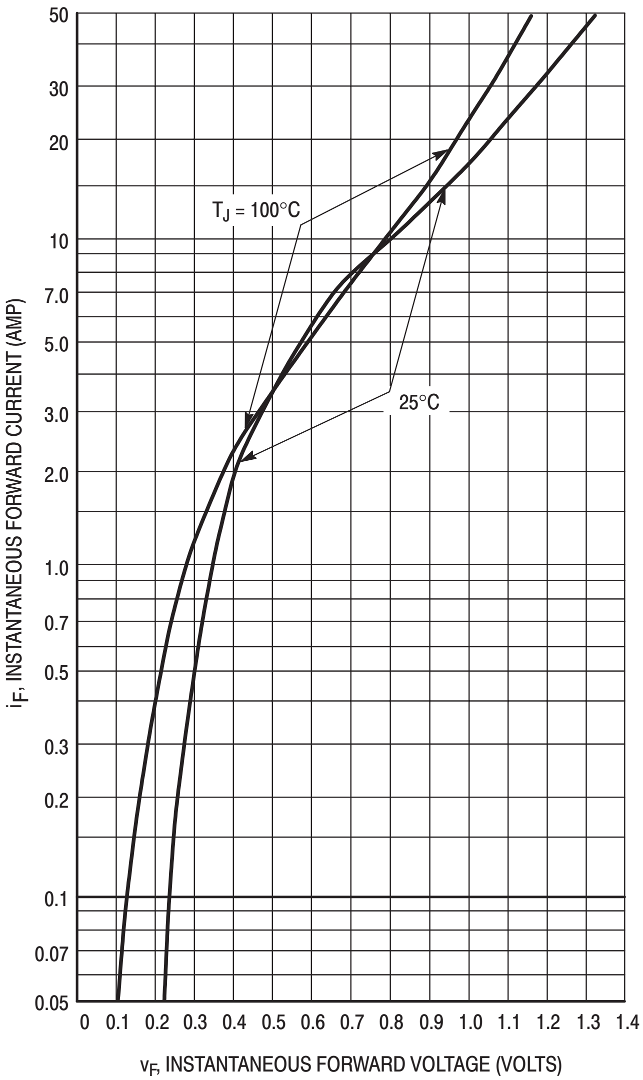



**Figure 7. Typical Forward Voltage**

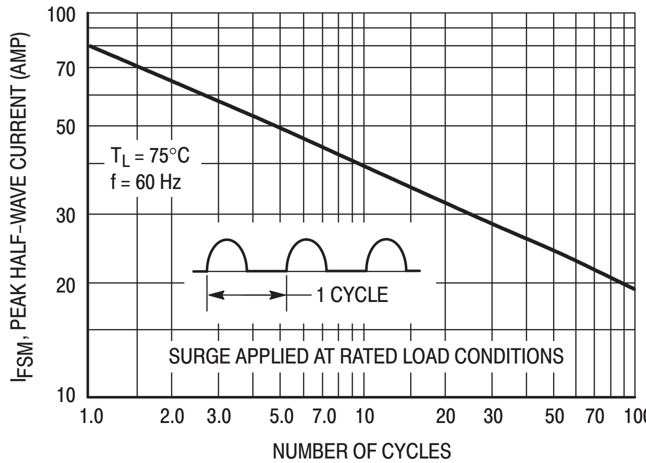



**Figure 8. Maximum Non–Repetitive Surge Current**

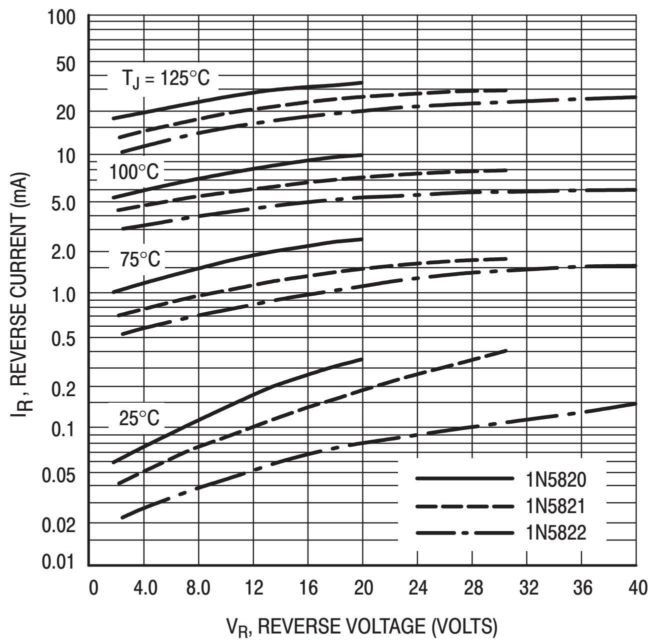



**Figure 9. Typical Reverse Current**

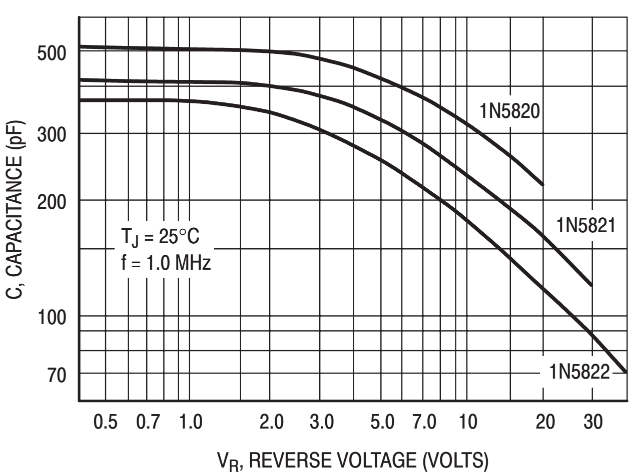



**Figure 10. Typical Capacitance**

### NOTE 6. — HIGH FREQUENCY OPERATION

Since current flow in a Schottky rectifier is the result of majority carrier conduction, it is not subject to junction diode forward and reverse recovery transients due to minority carrier injection and stored charge. Satisfactory circuit analysis work may be performed by using a model consisting of an ideal diode in parallel with a variable capacitance. (See Figure 10.)

# MBR340

**Preferred Device**

# Axial Lead Rectifier

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlap contact. Ideally suited for use as rectifiers in low–voltage, high–frequency inverters, free wheeling diodes, and polarity protection diodes.

- Extremely Low $V_F$
- Low Power Loss/High Efficiency
- Highly Stable Oxide Passivated Junction
- Low Stored Charge, Majority Carrier Conduction

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 1.1 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 500 per bag
- Available Tape and Reeled, 1500 per reel, by adding a “RL’’ suffix to the part number
- Polarity: Cathode indicated by Polarity Band
- Marking: B340

**MAXIMUM RATINGS**

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 40 | V |
| Average Rectified Forward Current<br>$T_A$ = 65°C ($R_{\theta JA}$ = 28°C/W, P.C. Board Mounting) | $I_O$ | 3.0 | A |
| Non–Repetitive Peak Surge Current (Note 1.) (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz, $T_L$ = 75°C) | $I_{FSM}$ | 80 | A |
| Operating and Storage Junction Temperature Range (Reverse Voltage Applied) | $T_J$, $T_{stg}$ | –65 to +150 | °C |
| Peak Operating Junction Temperature (Forward Current Applied) | $T_{J(pk)}$ | 150 | °C |

1. Lead Temperature reference is cathode lead 1/32″ from case.

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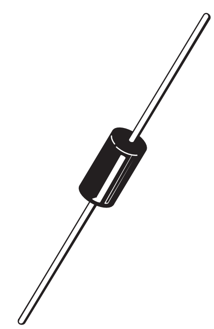
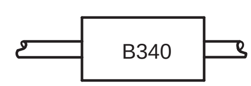
**SCHOTTKY BARRIER RECTIFIER 3.0 AMPERES 40 VOLTS**



**AXIAL LEAD CASE 267–03 STYLE 1**

**MARKING DIAGRAM**




B340 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR340 | Axial Lead | 500 Units/Bag |
| MBR340P | Axial Lead | 500 Units/Bag |
| MBR340PRL | Axial Lead | 1500/Tape & Reel |
| MBR340RL | Axial Lead | 1500/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS**

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Ambient (see Note 3., Mounting Method 3) | $R_{\theta JA}$ | 28 | °C/W |

**ELECTRICAL CHARACTERISTICS** ($T_L$ = 25°C unless otherwise noted) (Note 1.)

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.)<br>($i_F$ = 1.0 Amp)<br>($i_F$ = 3.0 Amp)<br>($i_F$ = 9.4 Amp) | $v_F$ | <br>0.500<br>0.600<br>0.850 | V |
| Maximum Instantaneous Reverse Current @ Rated dc Voltage (Note 2.)<br>$T_L$ = 25°C<br>$T_L$ = 100°C | $i_R$ | <br>0.60<br>20 | mA |

1. Lead Temperature reference is cathode lead 1/32″ from case.
2. Pulse Test: Pulse Width = 300 µs, Duty Cycle = 2.0%.

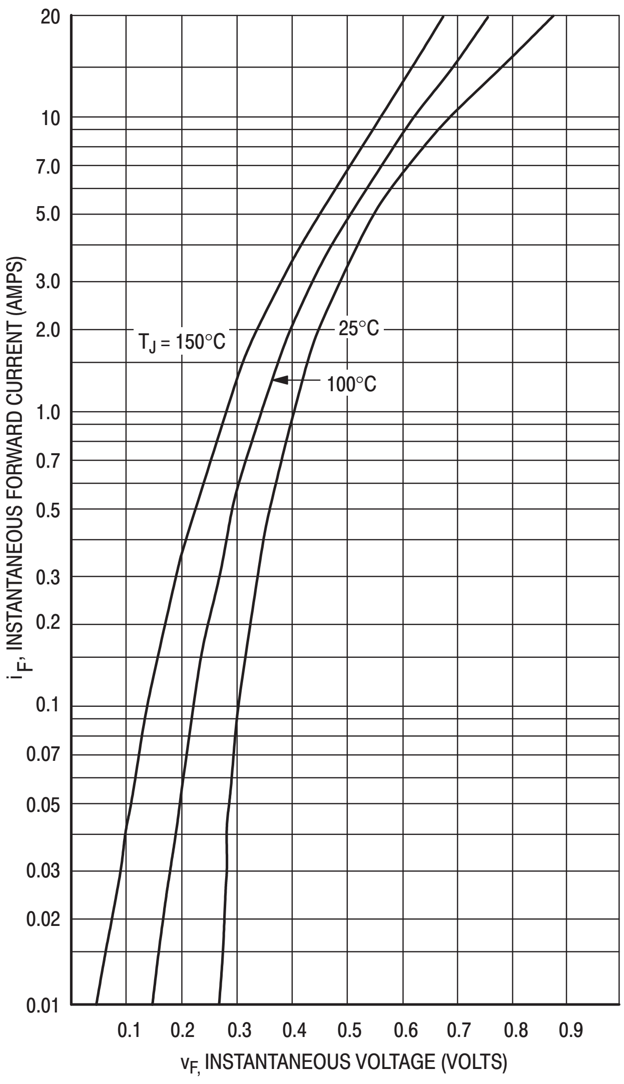



**Figure 1. Typical Forward Voltage**

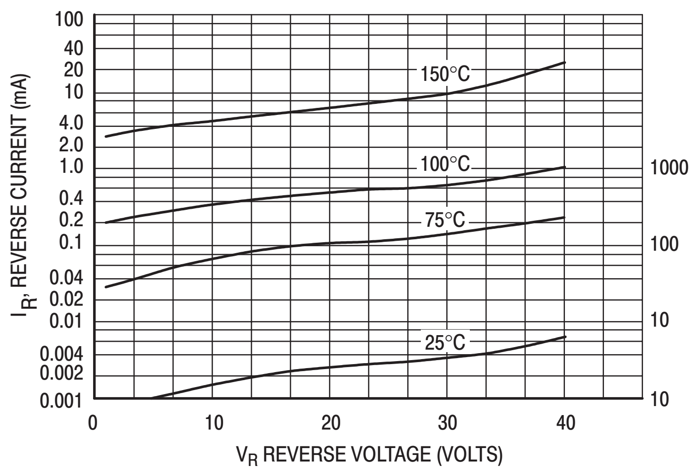



**Figure 2. Typical Reverse Current***

*The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if $V_R$ is sufficiently below rated $V_R$.

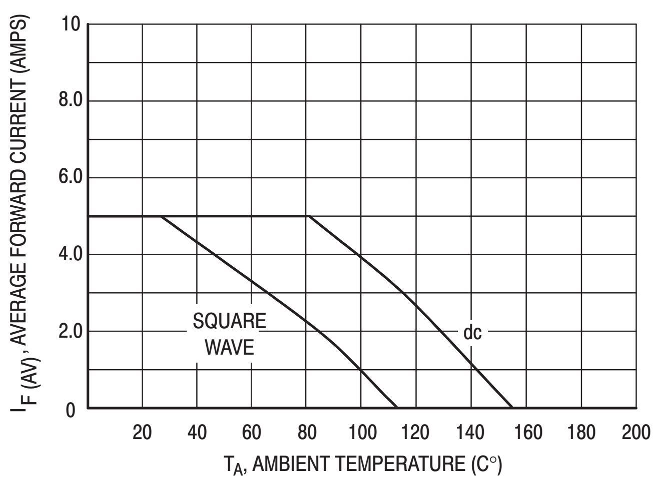



**Figure 3. Current Derating (Mounting Method #3 per Note 3.)**

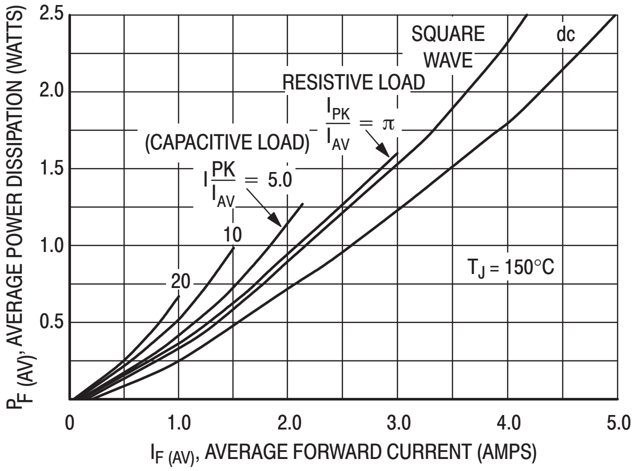



**Figure 4. Power Dissipation**

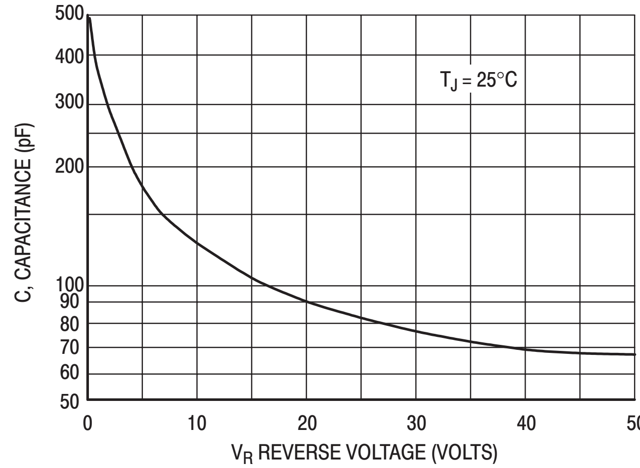



**Figure 5. Typical Capacitance**

## NOTE 3. — MOUNTING DATA

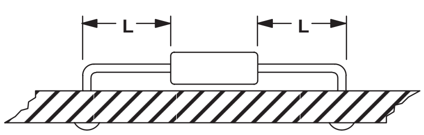
Data shown for thermal resistance junction–to–ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering, or in case the tie point temperature cannot be measured.

**TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR**

| Mounting Method | Lead Length, L (in) | | | | $R_{\theta JA}$ |
|---|---|---|---|---|---|
| | 1/8 | 1/4 | 1/2 | 3/4 | |
| 1 | 50 | 51 | 53 | 55 | °C/W |
| 2 | 58 | 59 | 61 | 63 | °C/W |
| 3 | 28 | | | | °C/W |

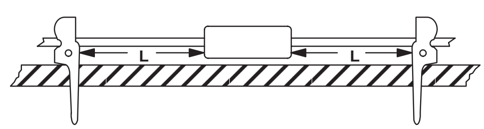
### Mounting Method 1

P.C. Board where available copper surface is small.



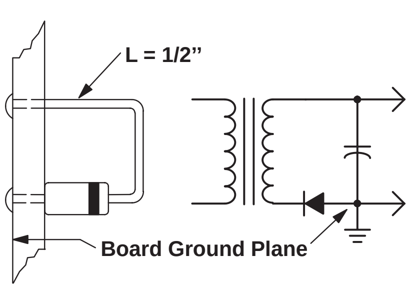

### Mounting Method 2

Vector Push–In Terminals T–28




### Mounting Method 3

P.C. Board with 2–1/2″ X 2–1/2″ copper surface.



# MBR350, MBR360

**MBR360 is a Preferred Device**

# Axial Lead Rectifiers

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlap contact. Ideally suited for use as rectifiers in low–voltage, high–frequency inverters, free wheeling diodes, and polarity protection diodes.

- Extremely Low $v_F$
- Low Power Loss/High Efficiency
- Highly Stable Oxide Passivated Junction
- Low Stored Charge, Majority Carrier Conduction

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 1.1 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 500 per bag
- Available Tape and Reeled, 1500 per reel, by adding a “RL’’ suffix to the part number
- Polarity: Cathode indicated by Polarity Band
- Marking: B350, B360

**MAXIMUM RATINGS**

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage MBR350<br>MBR360 | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | <br><br>50<br>60 | V |
| Average Rectified Forward Current<br>$T_A$ = 65°C ($R_{\theta JA}$ = 28°C/W,<br>P.C. Board Mounting) | $I_O$ | 3.0 | A |
| Non–Repetitive Peak<br>Surge Current (Note 1.)<br>(Surge Applied at Rated Load<br>Conditions Halfwave, Single<br>Phase, 60 Hz, $T_L$ = 75°C) | $I_{FSM}$ | 80 | A |
| Operating and Storage Junction<br>Temperature Range<br>(Reverse Voltage Applied) | $T_J$, $T_{stg}$ | –65 to +150 | °C |
| Peak Operating Junction<br>Temperature<br>(Forward Current Applied) | $T_{J(pk)}$ | 150 | °C |

1. Lead Temperature reference is cathode lead 1/32″ from case.

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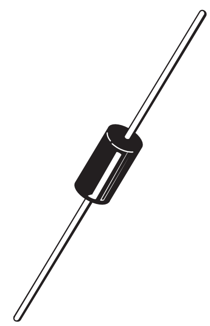
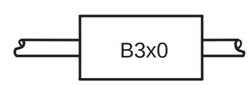
**SCHOTTKY BARRIER RECTIFIERS**
**3.0 AMPERES**
**50, 60 VOLTS**



**AXIAL LEAD**
**CASE 267–03**
**STYLE 1**

**MARKING DIAGRAM**




B3x0 = Device Code
x = 5 or 6

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR350 | Axial Lead | 500 Units/Bag |
| MBR350RL | Axial Lead | 1500/Tape & Reel |
| MBR360 | Axial Lead | 500 Units/Bag |
| MBR360RL | Axial Lead | 1500/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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### THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Ambient (see Note 3., Mounting Method 3) | $R_{\theta JA}$ | 28 | °C/W |

### ELECTRICAL CHARACTERISTICS ($T_L$ = 25°C unless otherwise noted) (Note 1.)

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.)<br>($i_F$ = 1.0 Amp)<br>($i_F$ = 3.0 Amp)<br>($i_F$ = 9.4 Amp) | $v_F$ | <br>0.600<br>0.740<br>1.080 | V |
| Maximum Instantaneous Reverse Current @ Rated dc Voltage (Note 2.)<br>$T_L$ = 25°C<br>$T_L$ = 100°C | $i_R$ | <br>0.60<br>20 | mA |

1. Lead Temperature reference is cathode lead 1/32″ from case.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle = 2.0%.

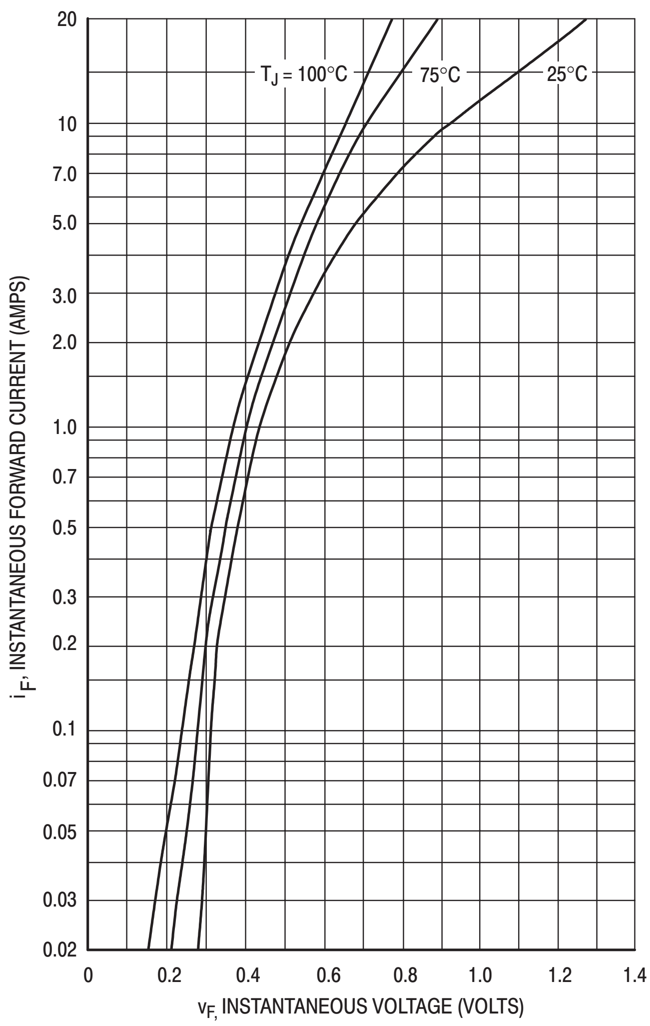



**Figure 1. Typical Forward Voltage**

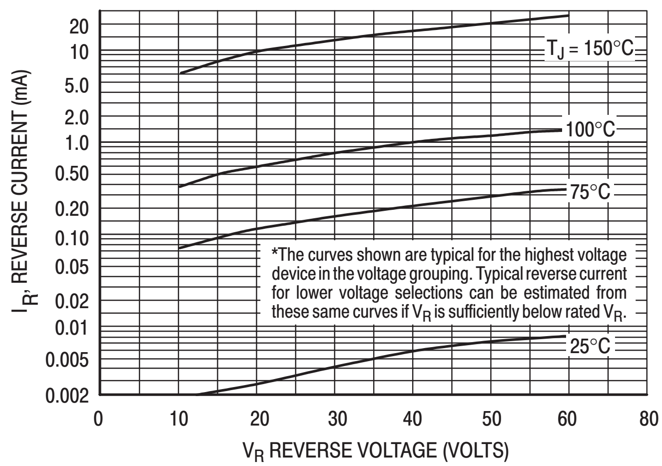



**Figure 2. Typical Reverse Current***

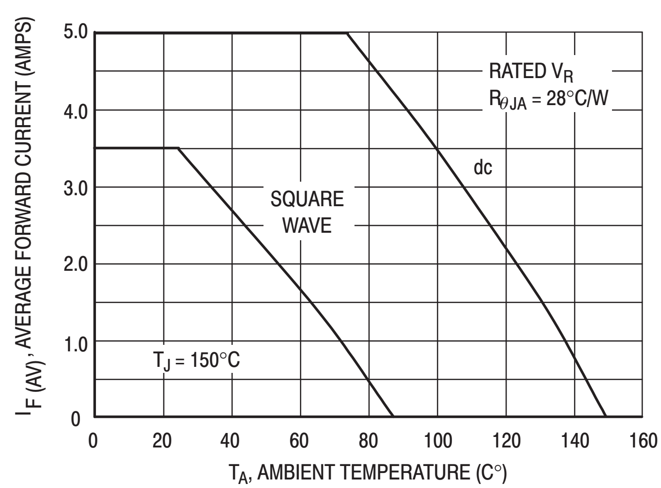



**Figure 3. Current Derating Ambient (Mounting Method #3 per Note 3.)**

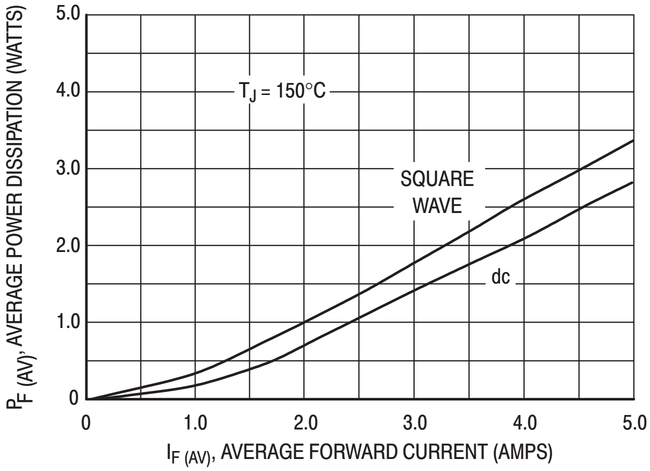



**Figure 4. Power Dissipation**

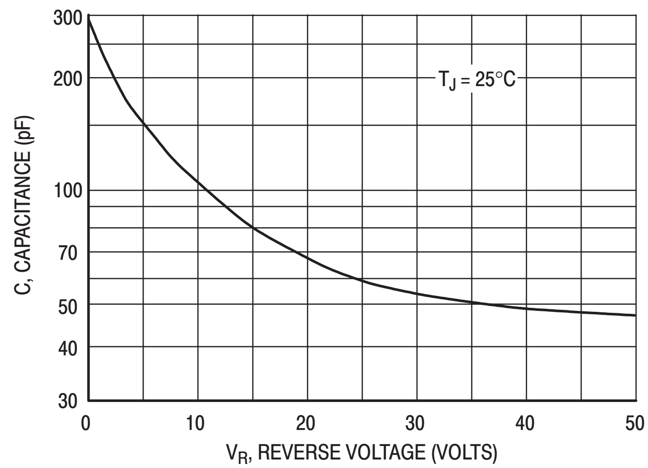



**Figure 5. Typical Capacitance**

### NOTE 3. — MOUNTING DATA

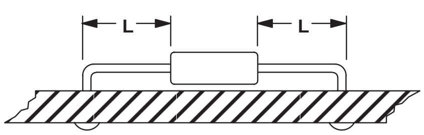
Data shown for thermal resistance junction–to–ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering, or in case the tie point temperature cannot be measured.

**TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR**

| Mounting Method | Lead Length, L (in) | | | | $R_{\theta JA}$ |
|---|---|---|---|---|---|
| | 1/8 | 1/4 | 1/2 | 3/4 | |
| 1 | 50 | 51 | 53 | 55 | °C/W |
| 2 | 58 | 59 | 61 | 63 | °C/W |
| 3 | 28 | | | | °C/W |

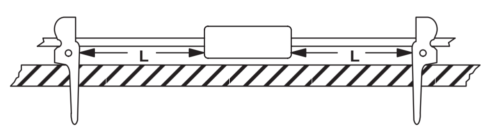
**Mounting Method 1**

P.C. Board where available copper surface is small.



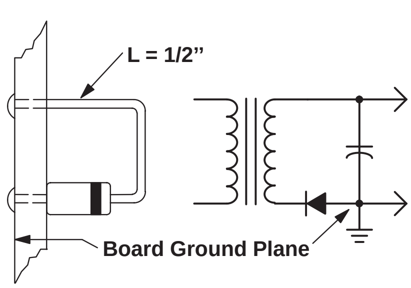

**Mounting Method 2**

Vector Push–In Terminals T–28




**Mounting Method 3**

P.C. Board with 2–1/2″ X 2–1/2″ copper surface.



# MBR3100

**Preferred Device**

# Axial Lead Rectifier

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlap contact. Ideally suited for use as rectifiers in low–voltage, high–frequency inverters, free wheeling diodes, and polarity protection diodes.

- Low Reverse Current
- Low Stored Charge, Majority Carrier Conduction
- Low Power Loss/High Efficiency
- Highly Stable Oxide Passivated Junction
- Guard–Ring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- High Surge Capacity

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 1.1 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 500 per bag
- Available Tape and Reeled, 1500 per reel, by adding a “RL’’ suffix to the part number
- Polarity: Cathode indicated by Polarity Band
- Marking: B3100

**MAXIMUM RATINGS**

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 100 | V |
| Average Rectified Forward Current<br>$T_A$ = 100°C ($R_{\theta JA}$ = 28°C/W,<br>P.C. Board Mounting, see Note 2.) | $I_O$ | 3.0 | A |
| Non–Repetitive Peak Surge Current<br>(Surge Applied at Rated Load<br>Conditions Halfwave, Single<br>Phase, 60 Hz) | $I_{FSM}$ | 150 | A |
| Operating and Storage Junction<br>Temperature Range<br>(Reverse Voltage Applied) | $T_J$, $T_{stg}$ | –65 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10 | V/ns |

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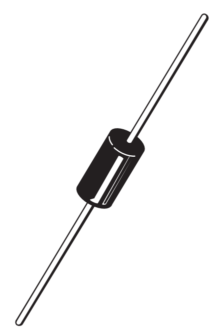
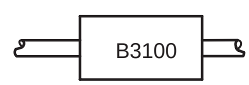
**SCHOTTKY BARRIER RECTIFIER 3.0 AMPERES 100 VOLTS**



**AXIAL LEAD**
**CASE 267–03**
**STYLE 1**

**MARKING DIAGRAM**




B3100 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR3100 | Axial Lead | 500 Units/Bag |
| MBR3100RL | Axial Lead | 1500/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Ambient (see Note 2., Mounting Method 3) | $R_{\theta JA}$ | 28 | °C/W |

## ELECTRICAL CHARACTERISTICS ($T_L$ = 25°C unless otherwise noted)

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 3.0 Amps, $T_L$ = 25°C)<br>($i_F$ = 3.0 Amps, $T_L$ = 100°C) | $v_F$ | <br>0.79<br>0.69 | V |
| Maximum Instantaneous Reverse Current @ Rated dc Voltage (Note 1.)<br>$T_L$ = 25°C<br>$T_L$ = 100°C | $i_R$ | <br>0.6<br>20 | mA |

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle = 2.0%.

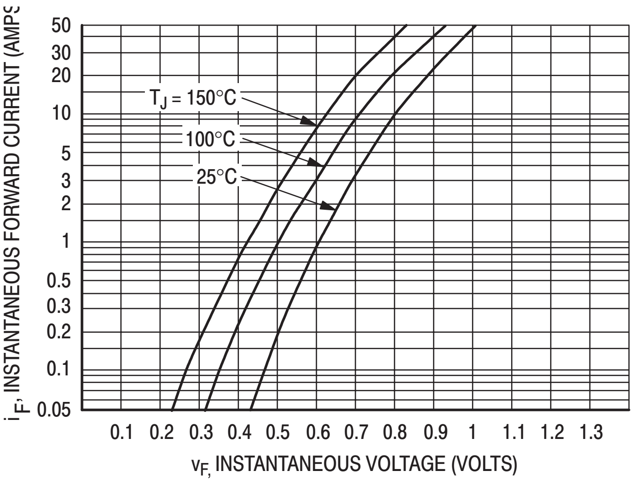



**Figure 1. Typical Forward Voltage**

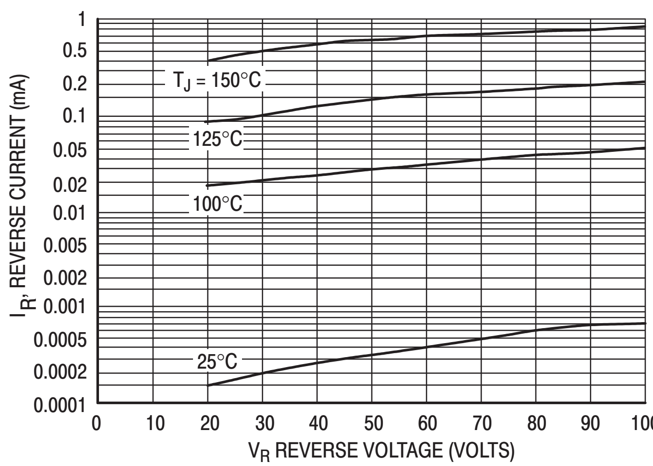



**Figure 2. Typical Reverse Current***

*The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these curves if $V_R$ is sufficient below rated $V_R$.

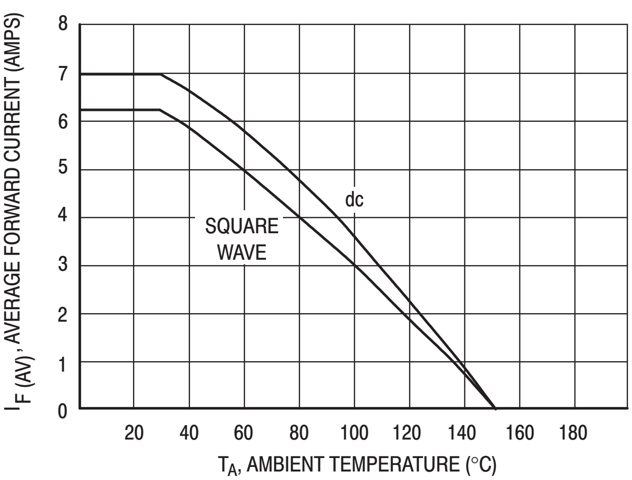



**Figure 3. Current Derating (Mounting Method #3 per Note 2.)**

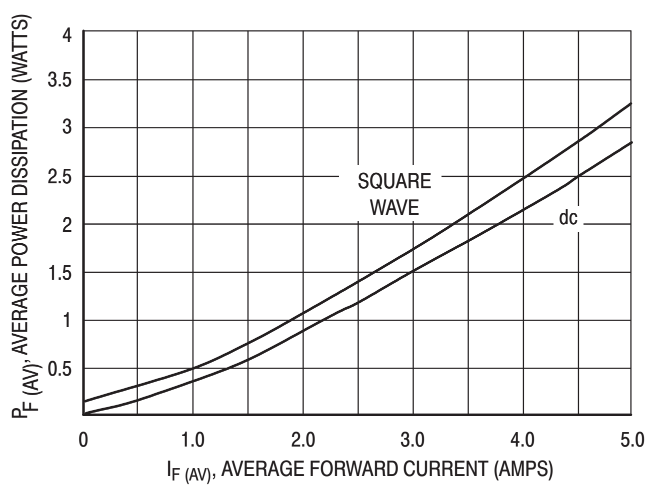



**Figure 4. Power Dissipation**

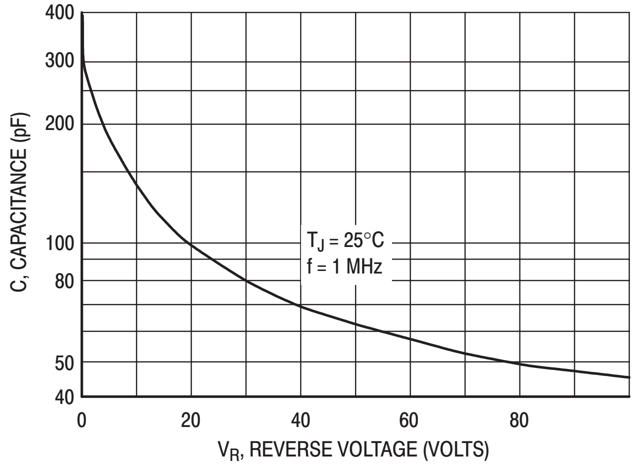



**Figure 5. Typical Capacitance**

## NOTE 2. — MOUNTING DATA

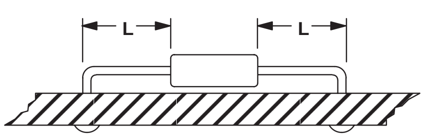
Data shown for thermal resistance junction–to–ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering, or in case the tie point temperature cannot be measured.

**TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR**

| Mounting Method | Lead Length, L (in) | | | | $R_{\theta JA}$ |
|---|---|---|---|---|---|
| | 1/8 | 1/4 | 1/2 | 3/4 | |
| 1 | 50 | 51 | 53 | 55 | °C/W |
| 2 | 58 | 59 | 61 | 63 | °C/W |
| 3 | 28 | | | | °C/W |

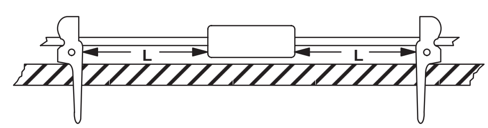
**Mounting Method 1**

P.C. Board where available copper surface is small.



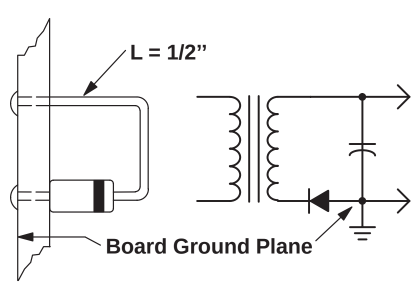

**Mounting Method 2**

Vector Push–In Terminals T–28




**Mounting Method 3**

P.C. Board with 2–1/2″ X 2–1/2″ copper surface.



# MBR1535CT, MBR1545CT

**MBR1545CT is a Preferred Device**

# SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Center–Tap Configuration
- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B1535, B1545

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Volta MBR1535CT<br>MBR1545CT | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | <br><br>35<br>45 | V |
| Average Rectified Forward Current<br>(Rated $V_R$, $T_C$ = 105°C) Per Diode<br>Per Device | $I_{F(AV)}$ | <br>7.5<br>15 | A |
| Peak Repetitive Forward Current<br>(Rated $V_R$, Square Wave,<br>20 kHz, $T_C$ = 105°C) Per Diode | $I_{FRM}$ | 15 | A |
| Non–Repetitive Peak Surge Current<br>(Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 150 | A |
| Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) | $I_{RRM}$ | 1.0 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +175 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 1000 | V/μs |

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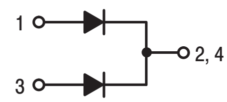
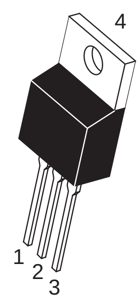
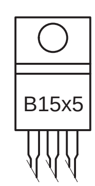
**SCHOTTKY BARRIER RECTIFIERS**
**15 AMPERES**
**35 and 45 VOLTS**




**TO–220AB**
**CASE 221A**
**PLASTIC**

**MARKING DIAGRAM**




B15x5 = Device Code
x = 3 or 4

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR1535CT | TO–220 | 50 Units/Rail |
| MBR1545CT | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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### THERMAL CHARACTERISTICS PER DIODE

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 3.0 | °C/W |
| Maximum Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 60 | °C/W |

### ELECTRICAL CHARACTERISTICS PER DIODE

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.) | $V_F$ | | Volts |
| ($i_F$ = 7.5 Amps, $T_C$ = 125°C) | | 0.57 | |
| ($i_F$ = 15 Amps, $T_C$ = 125°C) | | 0.72 | |
| ($i_F$ = 15 Amps, $T_C$ = 25°C) | | 0.84 | |
| Maximum Instantaneous Reverse Current (Note 1.) | $i_R$ | | mA |
| (Rated dc Voltage, $T_C$ = 125°C) | | 15 | |
| (Rated dc Voltage, $T_C$ = 25°C) | | 0.1 | |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

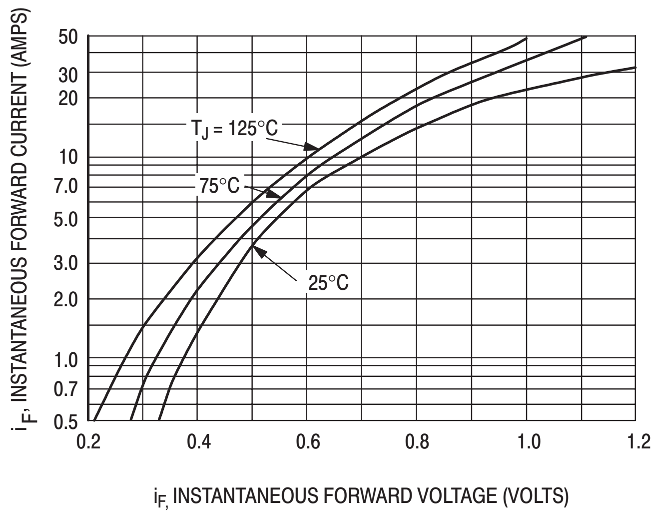


**Figure 6. Typical Forward Voltage**

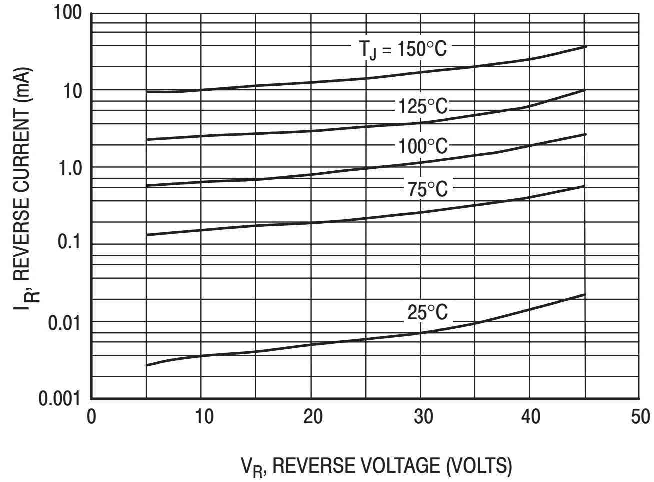


**Figure 7. Typical Reverse Current**

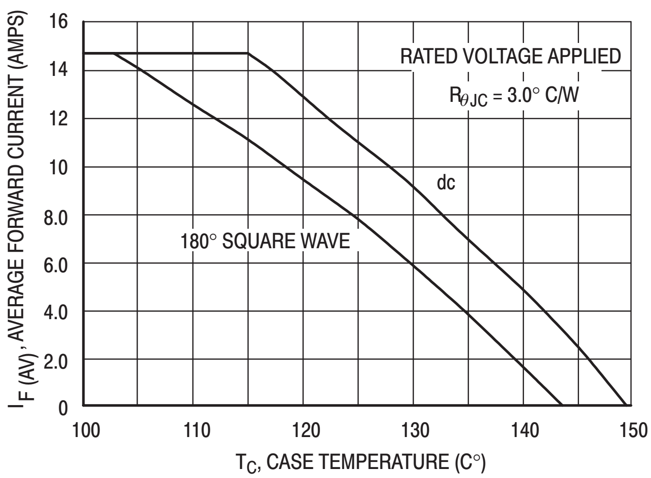


**Figure 8. Current Derating, Case**

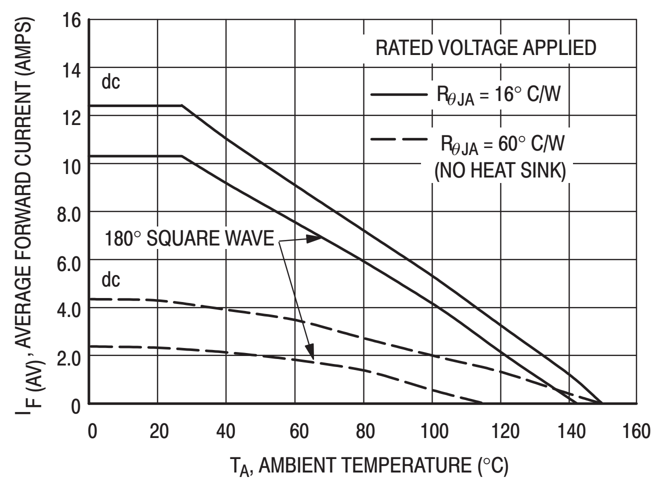


**Figure 9. Current Derating, Ambient**

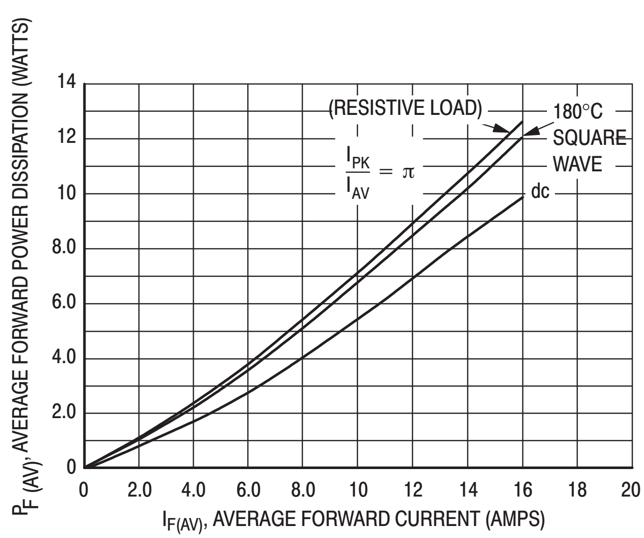


**Figure 10. Power Dissipation**

# MBR16100CT

# SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- 16 Amps Total (8.0 Amps Per Diode Leg)
- Guard–Ring for Stress Protection
- Low Forward Voltage
- 175°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″
- Low Power Loss/High Efficiency
- High Surge Capacity
- Low Stored Charge Majority Carrier Conduction

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B16100

**MAXIMUM RATINGS** (Per Diode Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 100 | V |
| Average Rectified Forward Current (Rated $V_R$) $T_C$ = 133°C | $I_{F(AV)}$ | 8.0 | A |
| Peak Repetitive Forward Current (Rated $V_R$, Square Wave, 20 kHz) $T_C$ = 133°C | $I_{FRM}$ | 16 | A |
| Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 150 | A |
| Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) | $I_{RRM}$ | 0.5 | A |
| Operating Junction Temperature | $T_J$ | – 65 to +175 | °C |
| Storage Temperature | $T_{stg}$ | – 65 to +175 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/μs |

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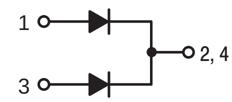
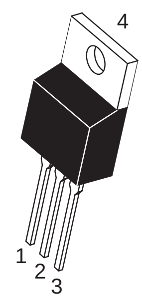
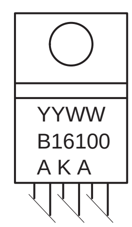
**SCHOTTKY BARRIER RECTIFIER 16 AMPERES 100 VOLTS**




**TO–220AB CASE 221A PLASTIC**

**MARKING DIAGRAM**




YY = Year
WW = Work Week
B16100 = Device Code
AKA = Polarity Designator

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR16100CT | TO–220 | 50 Units/Rail |

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## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Thermal Resistance – Junction to Case<br>– Junction to Ambient | $R_{\theta JC}$<br>$R_{\theta JA}$ | 2.0<br>60 | °C/W |

## ELECTRICAL CHARACTERISTICS (Per Diode Leg)

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 8.0 Amps, $T_C$ = 125°C)<br>($i_F$ = 8.0 Amps, $T_C$ = 25°C)<br>($i_F$ = 16 Amps, $T_C$ = 125°C)<br>($i_F$ = 16 Amps, $T_C$ = 25°C) | $v_F$ | <br>0.6<br>0.74<br>0.69<br>0.84 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_C$ = 125°C)<br>(Rated dc Voltage, $T_C$ = 25°C) | $i_R$ | <br>5.0<br>0.1 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2%.

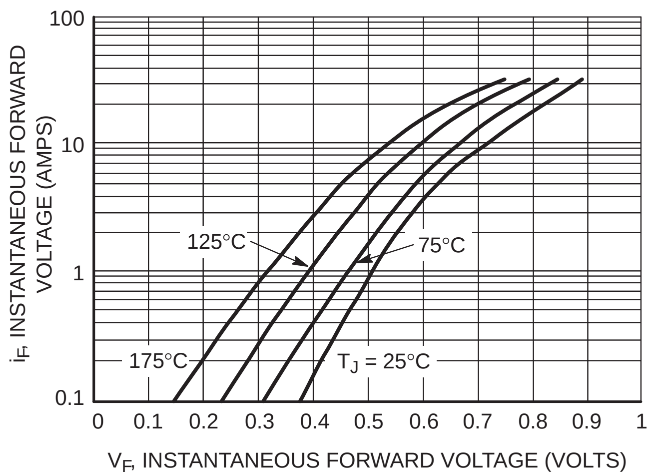



**Figure 1. Typical Forward Voltage Per Diode**

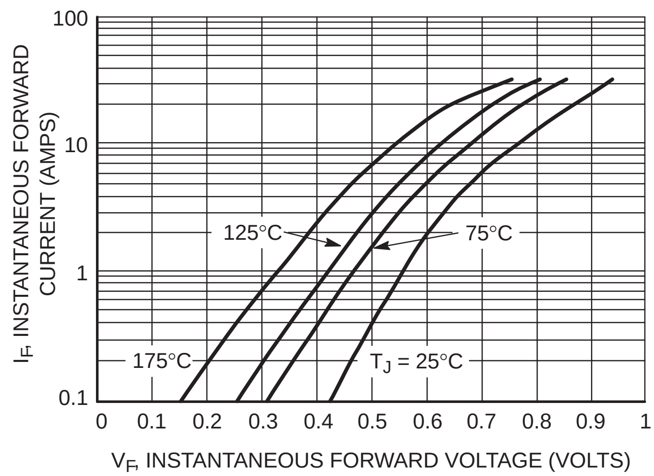



**Figure 2. Maximum Forward Voltage Per Diode**

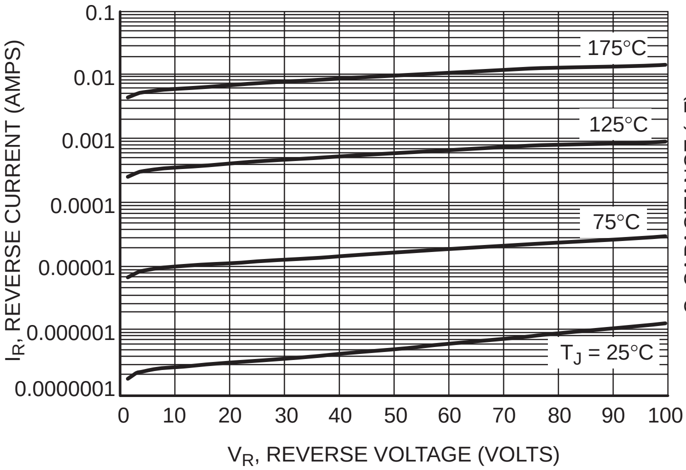



**Figure 3. Typical Reverse Current Per Diode**

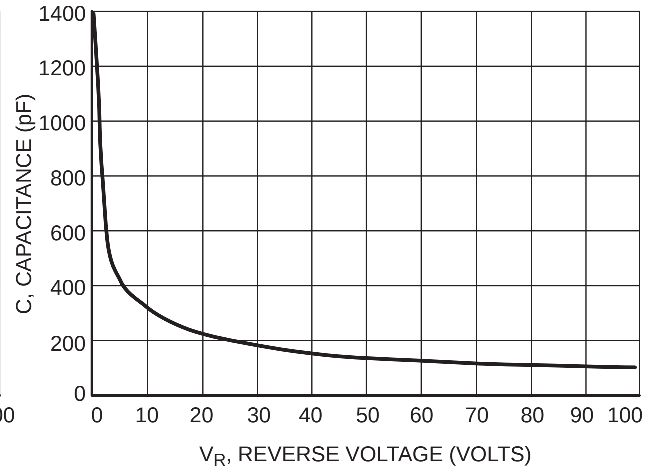



**Figure 4. Typical Capacitance Per Diode**

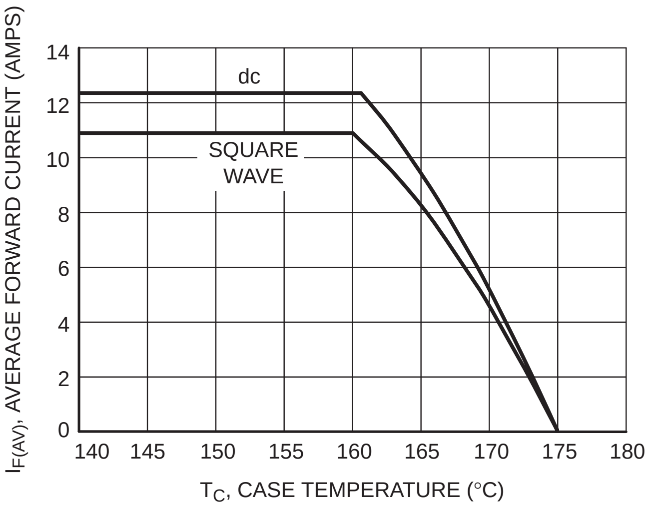



**Figure 5. Current Derating (Per Diode), Case**

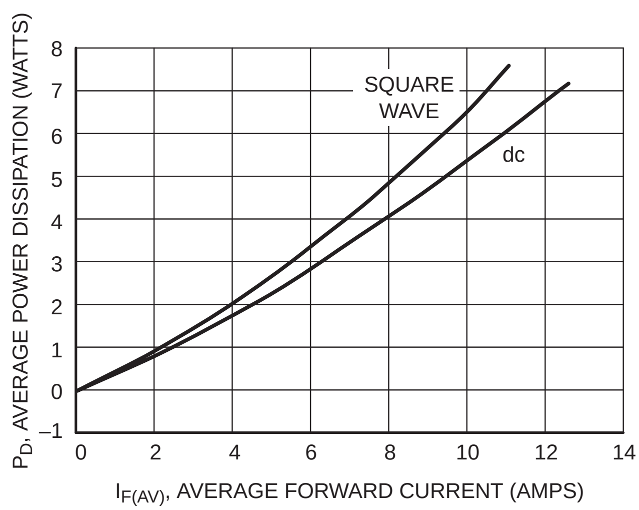



**Figure 6. Average Power Dissipation**

# MBR2030CTL

**Preferred Device**

# SWITCHMODE™ Dual Schottky Power Rectifier

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for use as rectifiers in very low–voltage, high–frequency switching power supplies, free wheeling diodes and polarity protection diodes.

- Highly Stable Oxide Passivated Junction
- Very Low Forward Voltage Drop (0.4 Max @ 10 A, $T_C$ = 150°C)
- 150°C Operating Junction Temperature
- Matched Dual Die Construction (10 A per Leg or 20 A per Package)
- High Junction Temperature Capability
- High dv/dt Capability
- Excellent Ability to Withstand Reverse Avalanche Energy Transients
- Guardring for Stress Protection
- Epoxy Meets UL94, VO at 1/8″

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B2030

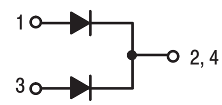
**MAXIMUM RATINGS**

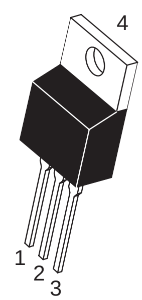
| Please See the Table on the Following Page |
|---|

ON Semiconductor™

http://onsemi.com

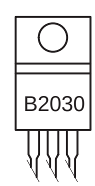
**SCHOTTKY BARRIER RECTIFIER**
**20 AMPERES**
**30 VOLTS**




**TO–220AB**
**CASE 221A**
**PLASTIC**

**MARKING DIAGRAM**




B2030 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR2030CTL | TO–220 | 50 Units/Tube |

**Preferred** devices are recommended choices for future use and best overall value.

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**MAXIMUM RATINGS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 30 | Volts |
| Average Rectified Forward Current | $I_{F(AV)}$ | 10 | Amps |
| Nonrepetitive Peak Surge Current<br>(Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 150 | Amps |
| Peak Repetitive Reverse Surge Current (2.0 µs, 1.0 kHz) | $I_{RRM}$ | 1.0 | Amp |
| Operating Junction Temperature | $T_J$ | – 65 to +150 | °C |
| Storage Temperature | $T_{stg}$ | – 65 to +175 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 1000 | V/µs |

**THERMAL CHARACTERISTICS** (Per Leg)

| | | | |
|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 2.0 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 10 Amps, $T_C$ = 25°C)<br>($i_F$ = 10 Amps, $T_C$ = 150°C)<br>($i_F$ = 20 Amps, $T_C$ = 25°C)<br>($i_F$ = 20 Amps, $T_C$ = 150°C) | $v_F$ | <br>0.52<br>0.40<br>0.58<br>0.48 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated DC Voltage, $T_C$ = 25°C)<br>(Rated DC Voltage, $T_C$ = 100°C)<br>(Rated DC Voltage, $T_C$ = 125°C) | $i_R$ | <br>5.0<br>40<br>75 | mA |

1. Pulse Test: Pulse Width = 5.0 ms, Duty Cycle ≤ 10%.

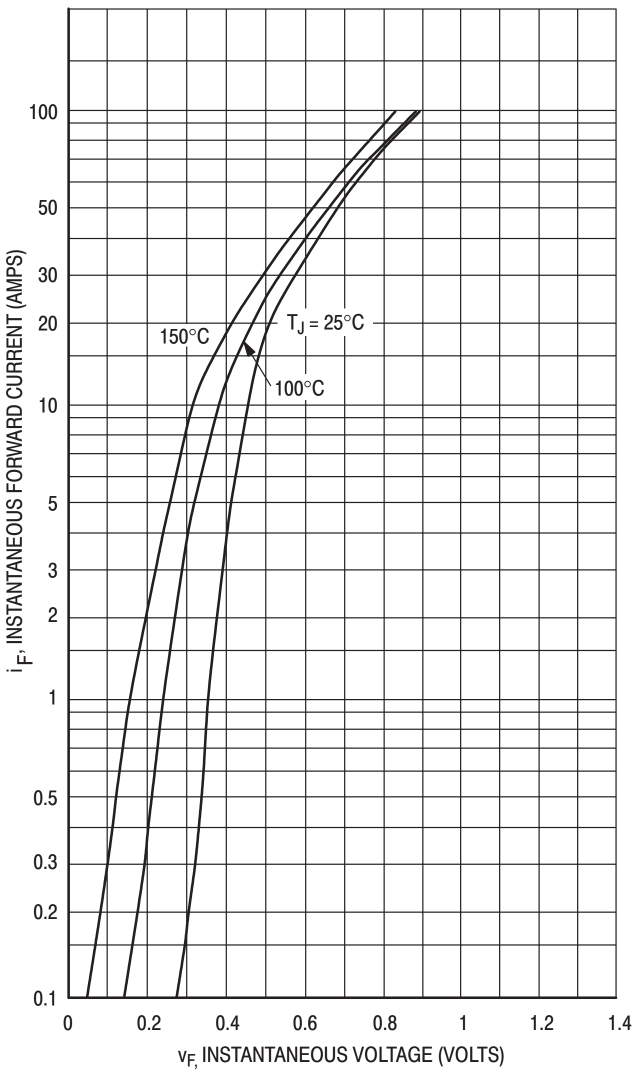



**Figure 1. Typical Forward Voltage (Per Leg)**

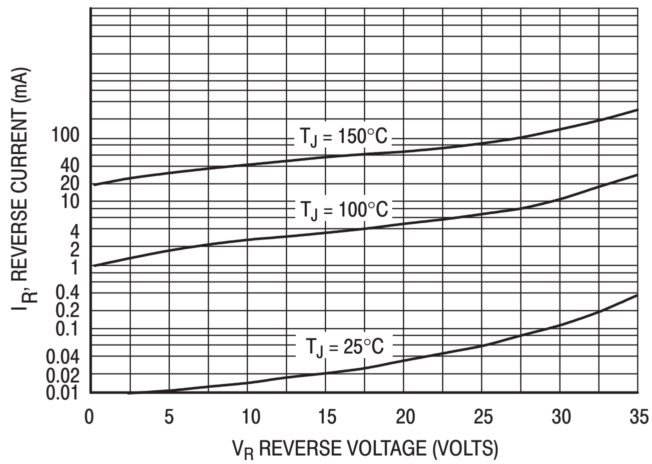



**Figure 2. Typical Reverse Current (Per Leg)**

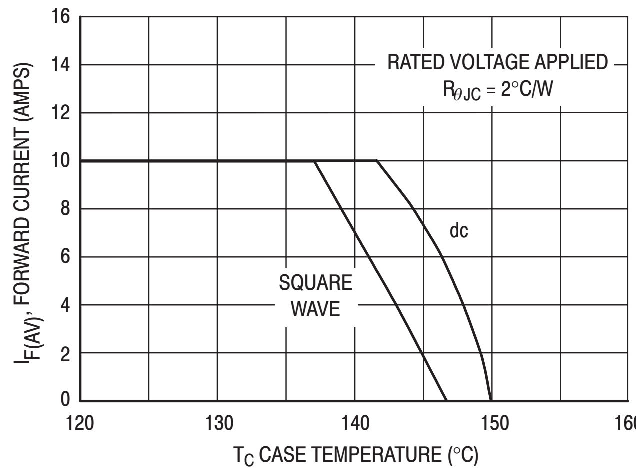



**Figure 3. Current Derating, Case**

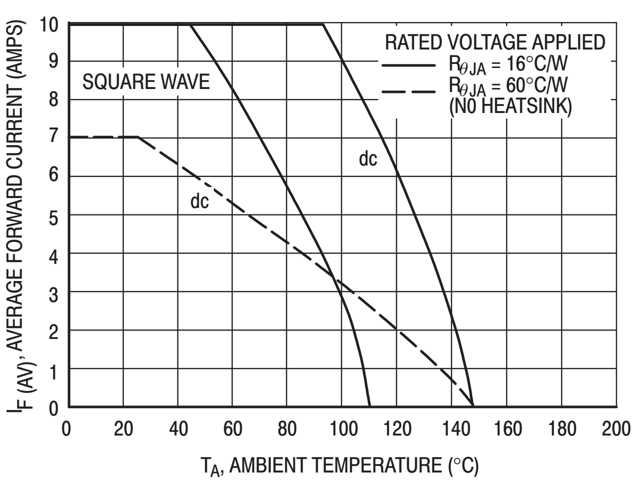



**Figure 4. Current Derating, Ambient**

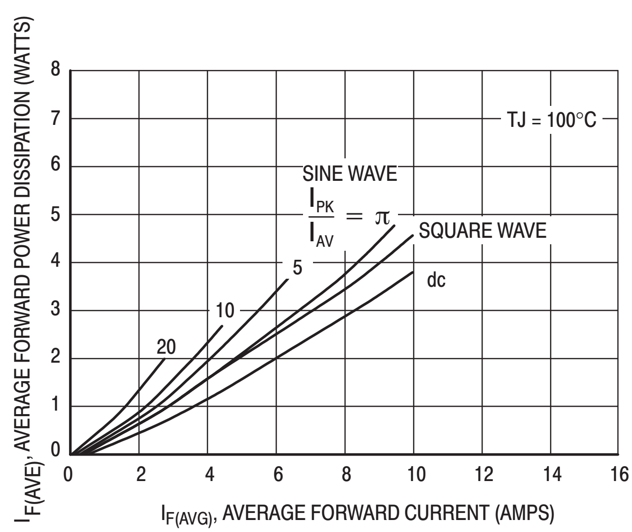



**Figure 5. Forward Power Dissipation**

### HIGH FREQUENCY OPERATION

Since current flow in a Schottky rectifier is the result of majority carrier conduction, it is not subject to junction diode forward and reverse recovery transients due to minority carrier injection and stored charge. Satisfactory circuit analysis work may be performed by using a model consisting of an ideal diode in parallel with a variable capacitance. (See Figure 6.)

Rectification efficiency measurements show that operation will be satisfactory up to several megahertz. For example, relative waveform rectification efficiency is approximately 70 percent at 2.0 MHz, e.g., the ratio of dc power to RMS power in the load is 0.28 at this frequency, whereas perfect rectification would yield 0.406 for sine wave inputs. However, in contrast to ordinary junction diodes, the loss in waveform efficiency is not indicative of power loss; it is simply a result of reverse current flow through the diode capacitance, which lowers the dc output voltage.

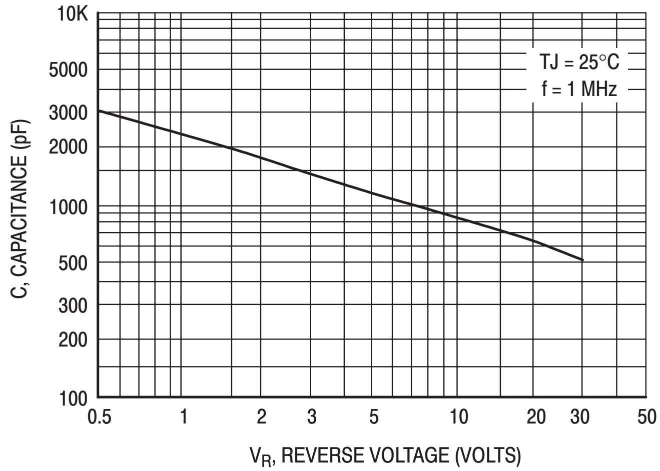



**Figure 6. Typical Capacitance**

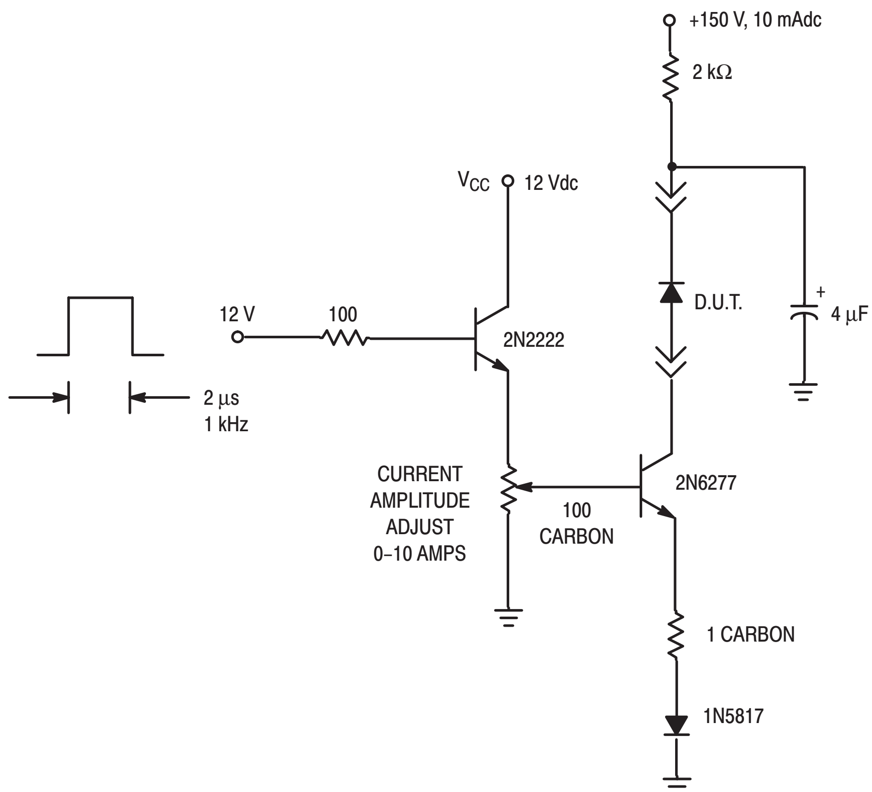



**Figure 7. Test Circuit for dv/dt and Reverse Surge Current**

# MBR2045CT

**Preferred Device**

# SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B2045

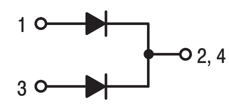
**MAXIMUM RATINGS**

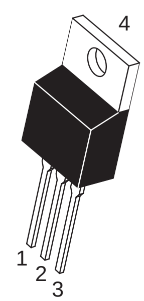
| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 45 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_C$ = 135°C) | $I_{F(AV)}$ | 20 | A |
| Peak Repetitive Forward Current per Diode Leg (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 135°C) | $I_{FRM}$ | 20 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 150 | A |
| Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) See Figure 11 | $I_{RRM}$ | 1.0 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +175 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 1000 | V/μs |

**ON Semiconductor™**

**http://onsemi.com**

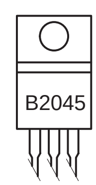
**SCHOTTKY BARRIER RECTIFIER**
**20 AMPERES**
**45 VOLTS**




**TO–220AB**
**CASE 221A**
**PLASTIC**

**MARKING DIAGRAM**




B2045 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR2045CT | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 2.0 | °C/W |

## ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 10 Amps, $T_C$ = 125°C)<br>($i_F$ = 20 Amps, $T_C$ = 125°C)<br>($i_F$ = 20 Amps, $T_C$ = 25°C) | $v_F$ | <br>0.57<br>0.72<br>0.84 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_C$ = 125°C)<br>(Rated dc Voltage, $T_C$ = 25°C) | $i_R$ | <br>15<br>0.1 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

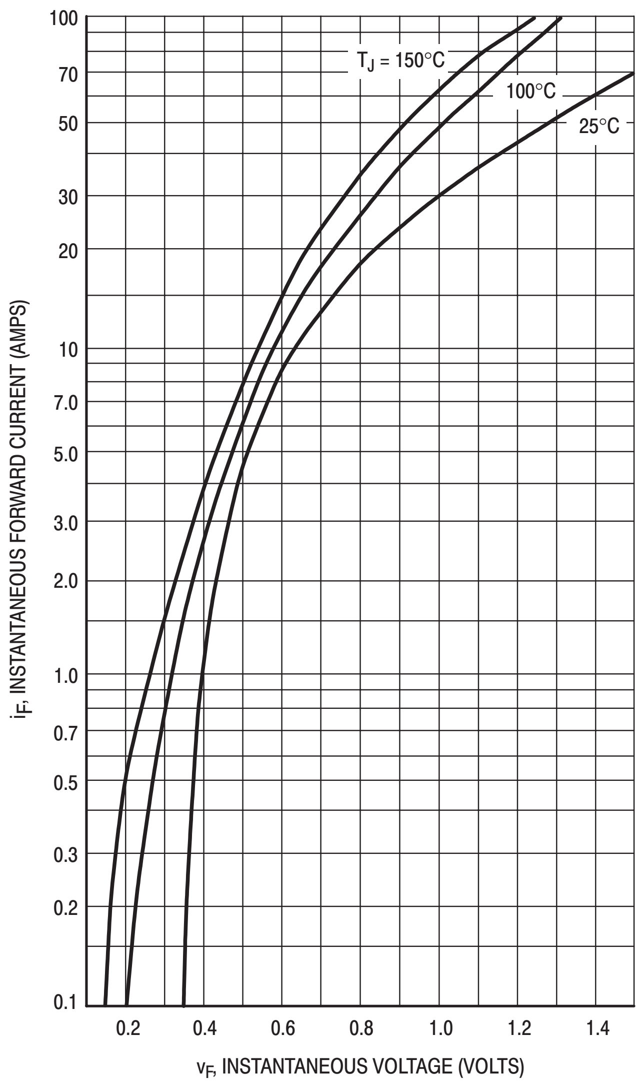



**Figure 1. Maximum Forward Voltage**

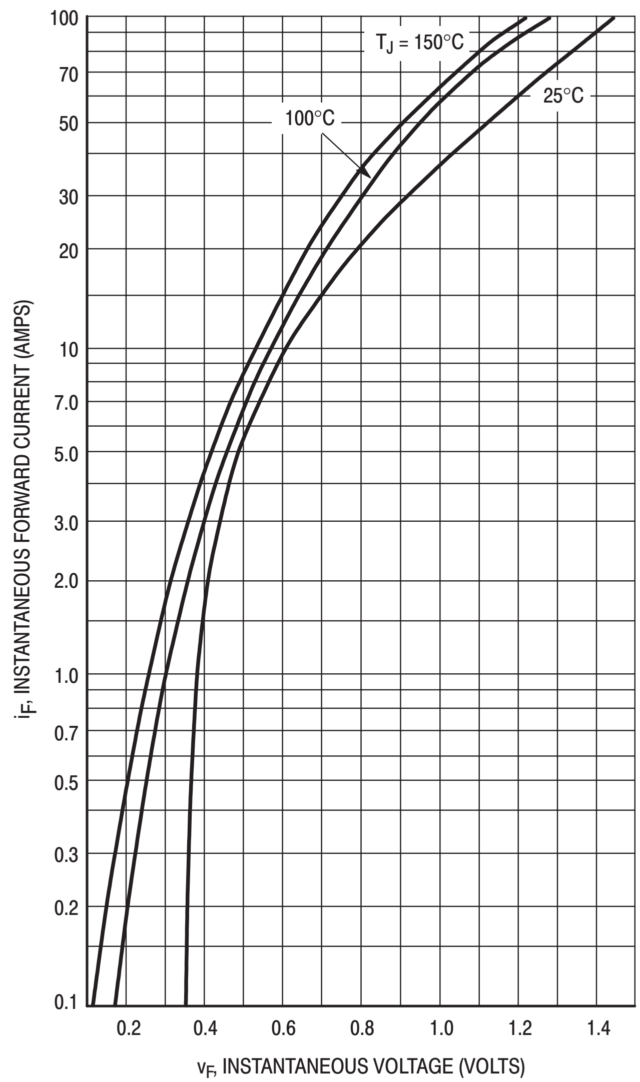



**Figure 2. Typical Forward Voltage**

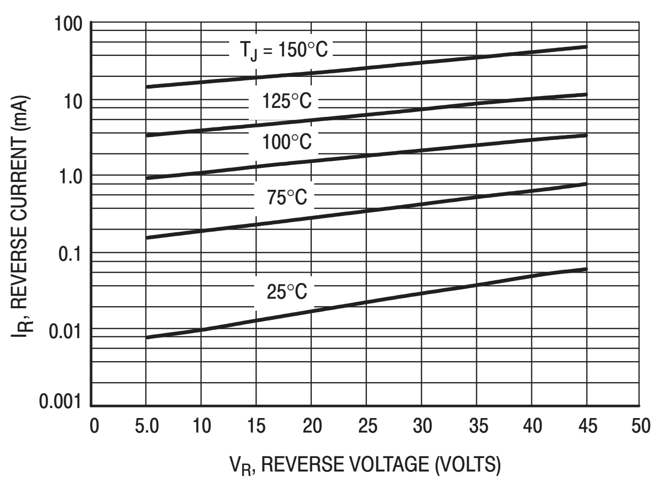



**Figure 3. Maximum Reverse Current**

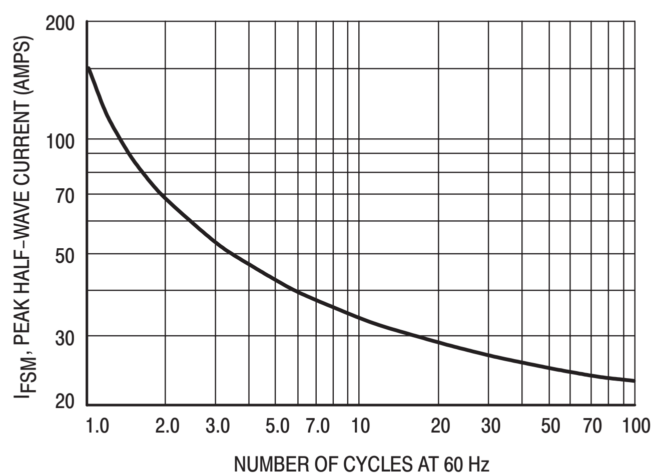



**Figure 4. Maximum Surge Capability**

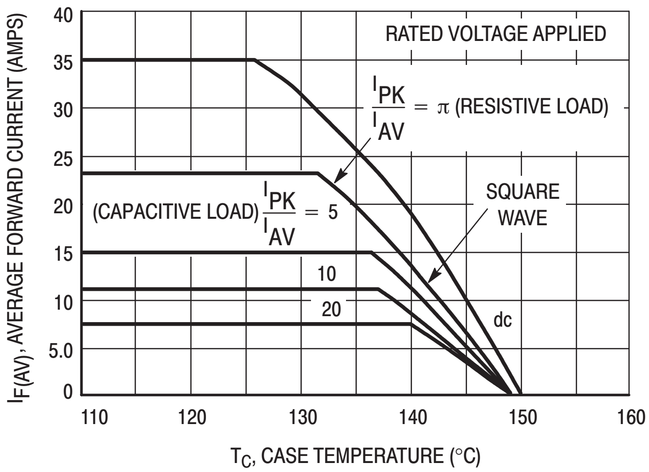



**Figure 5. Current Derating, Infinite Heatsink**

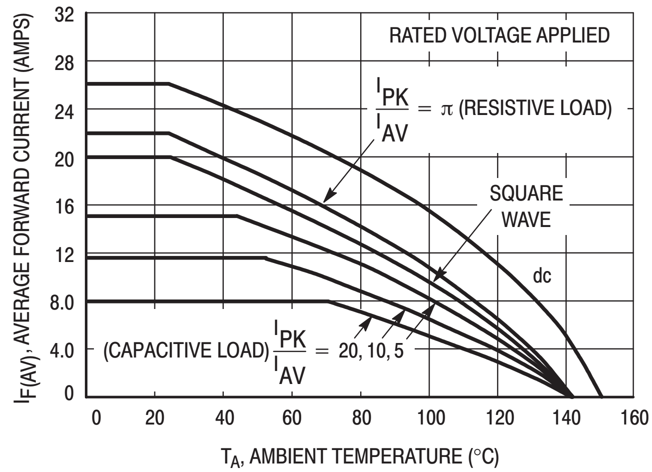



**Figure 6. Current Derating, $R_{\theta JA}$ = 16°C/W**

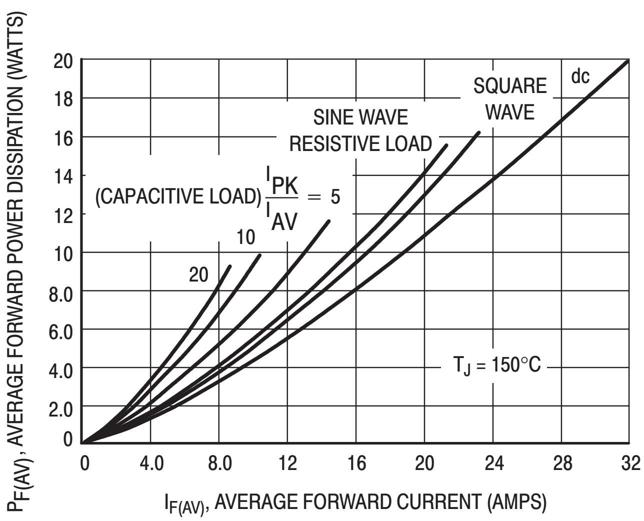



**Figure 7. Forward Power Dissipation**

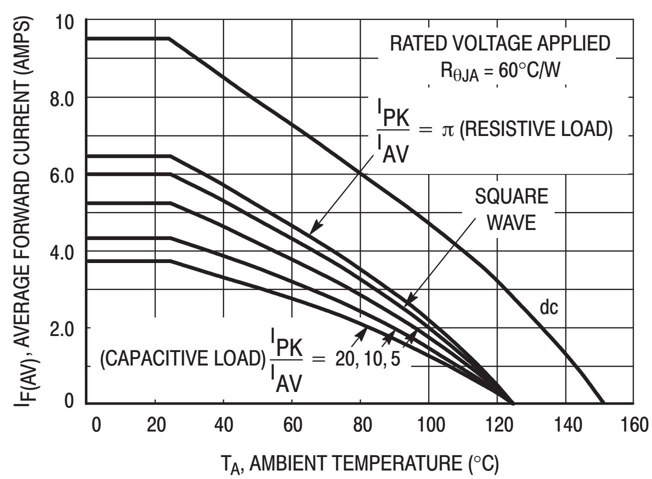



**Figure 8. Current Derating, Free Air**

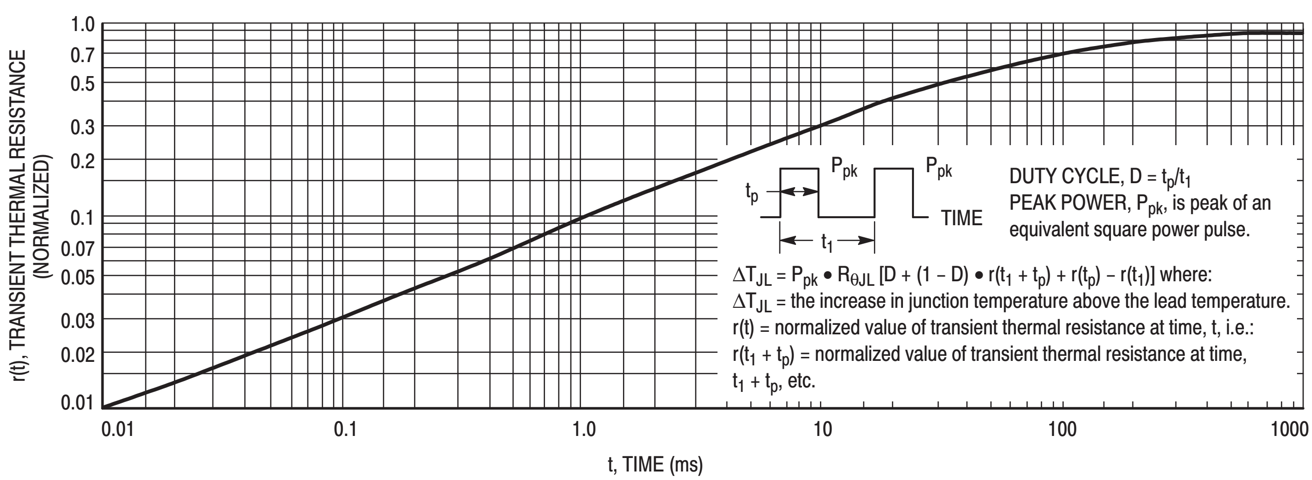



**Figure 9. Thermal Response**

### HIGH FREQUENCY OPERATION

Since current flow in a Schottky rectifier is the result of majority carrier conduction, it is not subject to junction diode forward and reverse recovery transients due to minority carrier injection and stored charge. Satisfactory circuit analysis work may be performed by using a model consisting of an ideal diode in parallel with a variable capacitance. (See Figure 10.)

Rectification efficiency measurements show that operation will be satisfactory up to several megahertz. For example, relative waveform rectification efficiency is approximately 70 percent at 2.0 MHz, e.g., the ratio of dc power to RMS power in the load is 0.28 at this frequency, whereas perfect rectification would yield 0.406 for sine wave inputs. However, in contrast to ordinary junction diodes, the loss in waveform efficiency is not indicative of power loss; it is simply a result of reverse current flow through the diode capacitance, which lowers the dc output voltage.

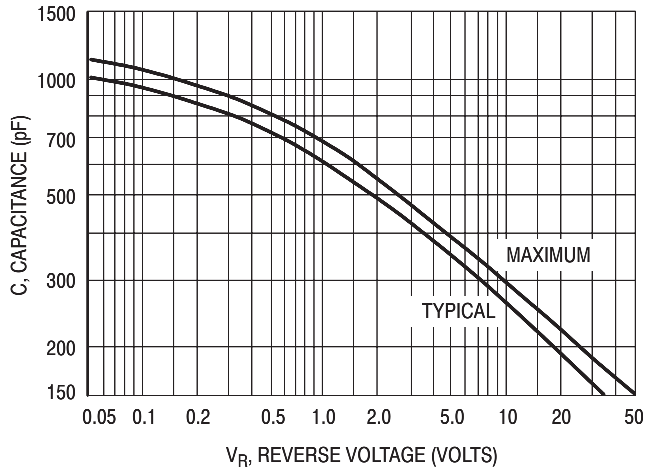



**Figure 10. Capacitance**

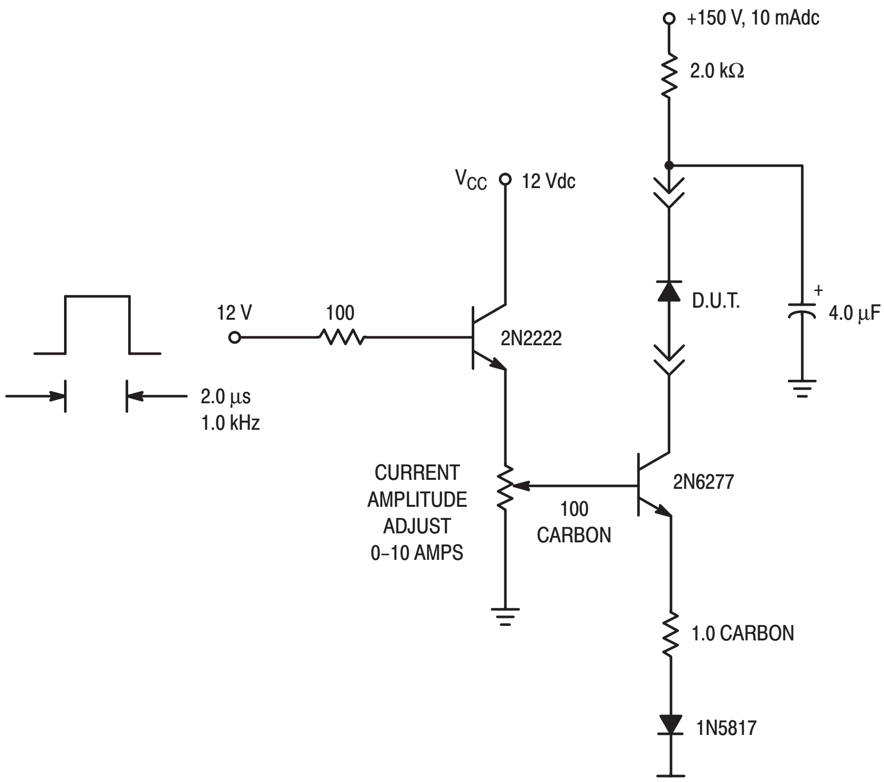



**Figure 11. Test Circuit for dv/dt and Reverse Surge Current**

# MBR2060CT, MBR2080CT, MBR2090CT, MBR20100CT

**MBR2060CT and MBR20100CT are Preferred Devices**

# SWITCHMODE™ Power Rectifiers

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- 20 Amps Total (10 Amps Per Diode Leg)
- Guard–Ring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″
- Low Power Loss/High Efficiency
- High Surge Capacity
- Low Stored Charge Majority Carrier Conduction

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B2060, B2080, B2090, B20100

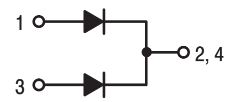
**MAXIMUM RATINGS**

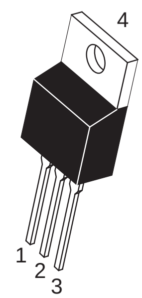
| |
|---|
| Please See the Table on the Following Page |

**ON Semiconductor™**

**http://onsemi.com**

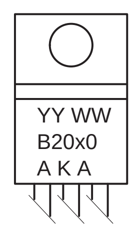
**SCHOTTKY BARRIER RECTIFIERS 20 AMPERES 60–100 VOLTS**




**TO–220AB CASE 221A PLASTIC**

**MARKING DIAGRAM**




| | |
|---|---|
| YY | = Year |
| WW | = Work Week |
| B20x0 | = Device Code |
| x | = 6, 8, 9 or 10 |
| AKA | = Polarity Designator |

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR2060CT | TO–220 | 50 Units/Rail |
| MBR2080CT | TO–220 | 50 Units/Rail |
| MBR2090CT | TO–220 | 50 Units/Rail |
| MBR20100CT | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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**MAXIMUM RATINGS** (Per Diode Leg)

| Rating | Symbol | MBR 2060CT | MBR 2080CT | MBR 2090CT | MBR 20100CT | Unit |
|---|---|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 60 | 80 | 90 | 100 | Volts |
| Average Rectified Forward Current<br>(Rated $V_R$) $T_C$ = 133°C | $I_{F(AV)}$ | 10 | | | | Amps |
| Peak Repetitive Forward Current<br>(Rated $V_R$, Square Wave, 20 kHz) $T_C$ = 133°C | $I_{FRM}$ | 20 | | | | Amps |
| Nonrepetitive Peak Surge Current<br>(Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 150 | | | | Amps |
| Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) | $I_{RRM}$ | 0.5 | | | | Amp |
| Operating Junction Temperature | $T_J$ | – 65 to +150 | | | | °C |
| Storage Temperature | $T_{stg}$ | – 65 to +175 | | | | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | | | | V/μs |

**THERMAL CHARACTERISTICS**

| | | | |
|---|---|---|---|
| Maximum Thermal Resistance — Junction to Case<br>— Junction to Ambient | $R_{\theta JC}$<br>$R_{\theta JA}$ | 2.0<br>60 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Diode Leg)

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 10 Amps, $T_C$ = 125°C)<br>($i_F$ = 10 Amps, $T_C$ = 25°C)<br>($i_F$ = 20 Amps, $T_C$ = 125°C)<br>($i_F$ = 20 Amps, $T_C$ = 25°C) | $v_F$ | <br>0.75<br>0.85<br>0.85<br>0.95 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_C$ = 125°C)<br>(Rated dc Voltage, $T_C$ = 25°C) | $i_R$ | <br>6.0<br>0.1 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

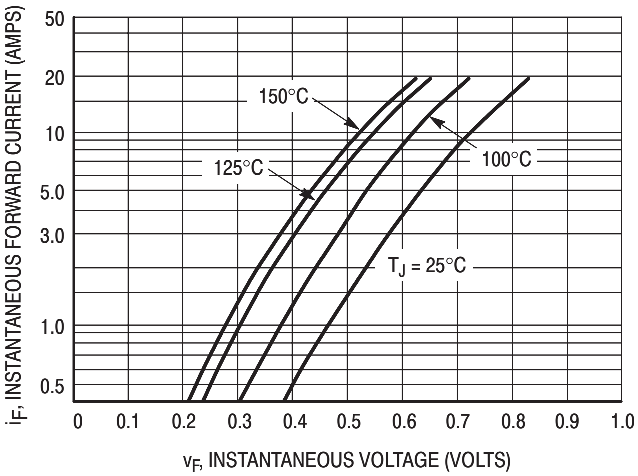


**Figure 1. Typical Forward Voltage Per Diode**

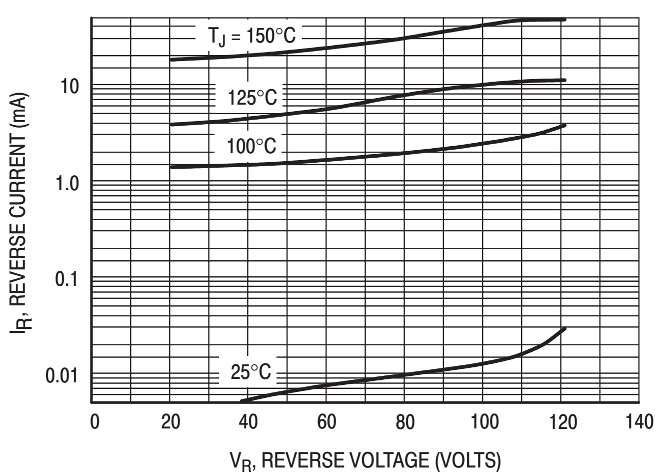


**Figure 2. Typical Reverse Current Per Diode**

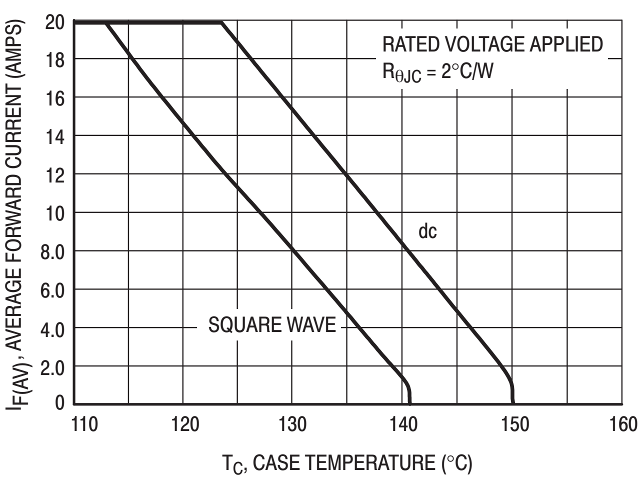


**Figure 3. Current Derating, Case**

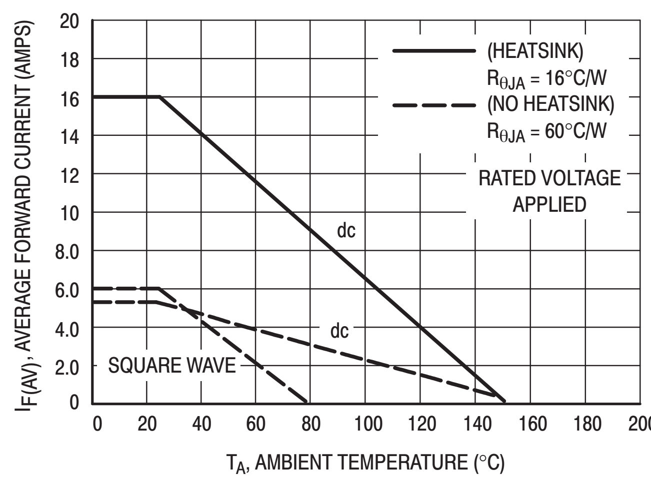


**Figure 4. Current Derating, Ambient**

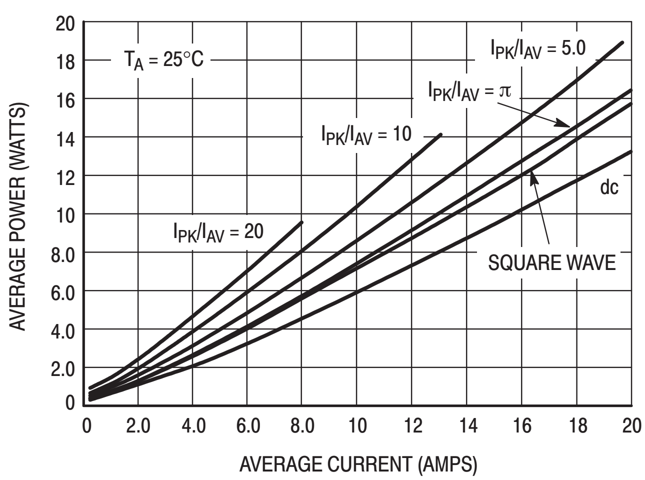


**Figure 5. Average Power Dissipation and Average Current**

# MBR20200CT

# SWITCHMODE™ Power

## Dual Schottky Rectifier

. . . using Schottky Barrier technology with a platinum barrier metal. This state–of–the–art device is designed for use in high frequency switching power supplies and converters with up to 48 volt outputs. They block up to 200 volts and offer improved Schottky performance at frequencies from 250 kHz to 5.0 MHz.

- **200 Volt Blocking Voltage**
- Low Forward Voltage Drop
- Guardring for Stress Protection and High dv/dt Capability (10,000 V/µs)
- Dual Diode Construction — Terminals 1 and 3 Must be Connected for Parallel Operation at Full Rating

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B20200

**MAXIMUM RATINGS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 200 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_C$ = 125°C) Per Leg<br>Per Package | $I_{F(AV)}$ | 10<br>20 | A |
| Peak Repetitive Forward Current per Leg (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 90°C) | $I_{FRM}$ | 20 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 150 | A |
| Peak Repetitive Reverse Surge Current (2.0 µs, 1.0 kHz) | $I_{RRM}$ | 1.0 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +175 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/µs |

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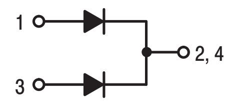
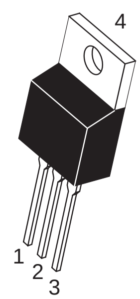
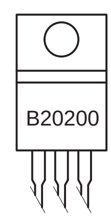
**SCHOTTKY BARRIER RECTIFIER**
**20 AMPERES**
**200 VOLTS**




**TO–220AB**
**CASE 221A**
**PLASTIC**

**MARKING DIAGRAM**




B20200 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR20200CT | TO–220 | 50 Units/Rail |

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**THERMAL CHARACTERISTICS** (Per Leg)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case | $R_{\theta JC}$ | 2.0 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.) ($I_F$ = 10 Amps, $T_C$ = 25°C)<br>($I_F$ = 10 Amps, $T_C$ = 125°C)<br>($I_F$ = 20 Amps, $T_C$ = 25°C)<br>($I_F$ = 20 Amps, $T_C$ = 125°C) | $V_F$ | 0.9<br>0.8<br>1.0<br>0.9 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, $T_C$ = 25°C)<br>(Rated dc Voltage, $T_C$ = 125°C) | $I_R$ | 1.0<br>50 | mA |

**DYNAMIC CHARACTERISTICS** (Per Leg)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Capacitance ($V_R$ = –5.0 V, $T_C$ = 25°C, Frequency = 1.0 MHz) | $C_T$ | 500 | pF |

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

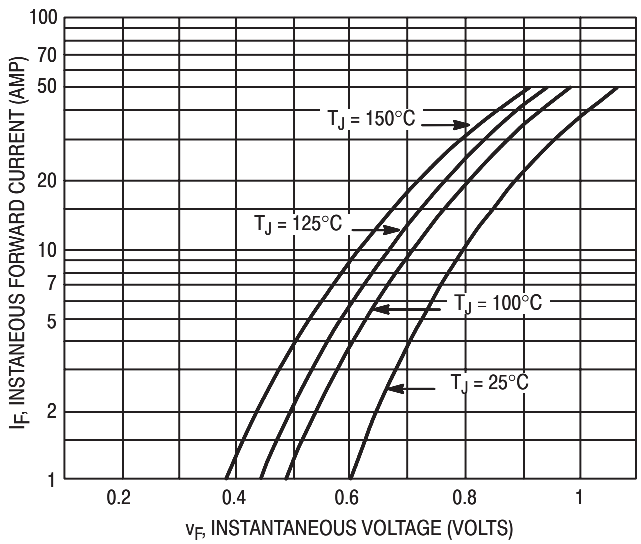


**Figure 1. Typical Forward Voltage (Per Leg)**

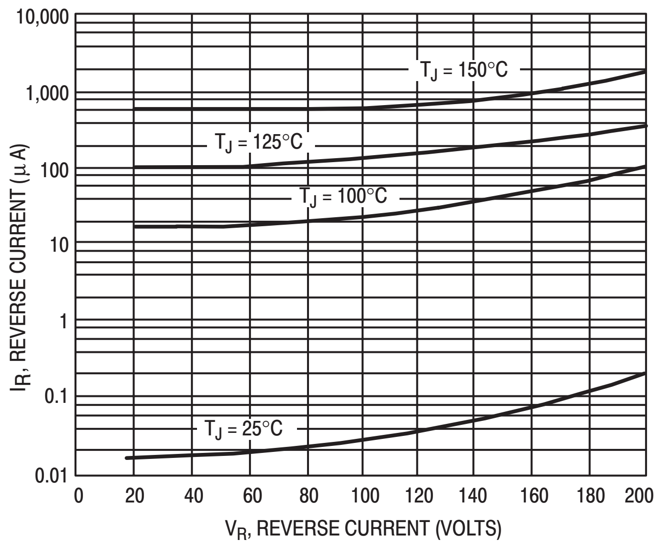


**Figure 2. Typical Reverse Current (Per Leg)**

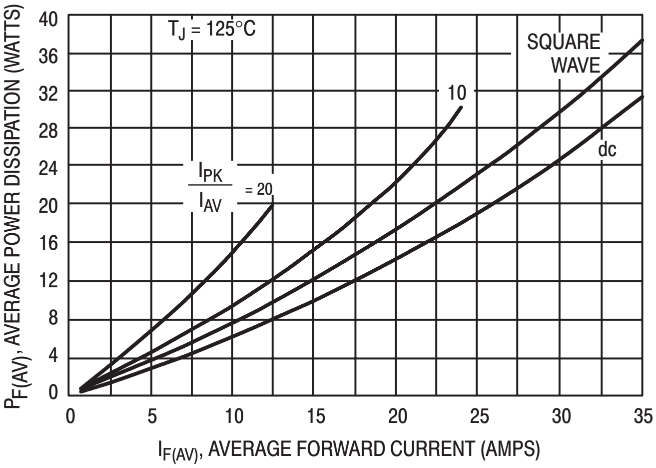


**Figure 3. Forward Power Dissipation**

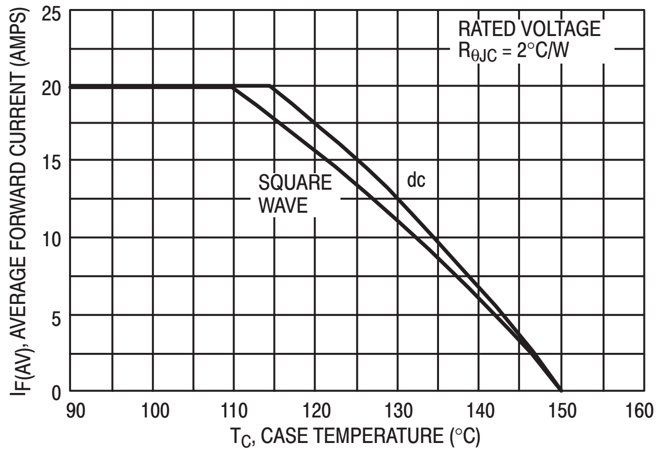


**Figure 4. Current Derating, Case**

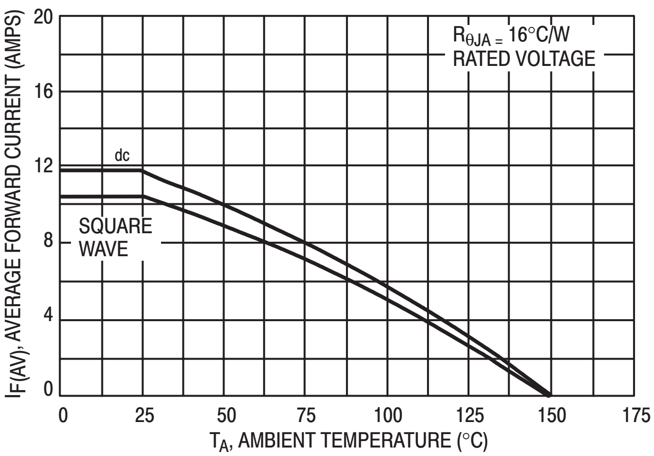


**Figure 5. Current Derating, Ambient**

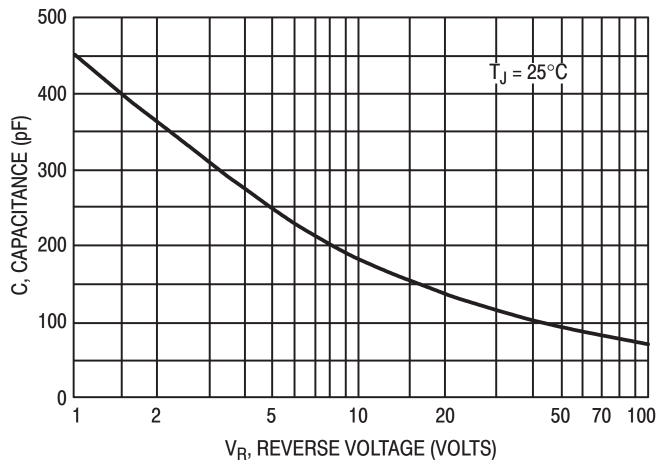


**Figure 6. Typical Capacitance (Per Leg)**

# MBR2535CTL

# SWITCHMODE™ Power Rectifier

. . . employing the Schottky Barrier principle in a large metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for use in low voltage, high frequency switching power supplies, free wheeling diodes, and polarity protection diodes.

- Very Low Forward Voltage (0.55 V Maximum @ 25 Amps)
- Matched Dual Die Construction (12.5 A per Leg or 25 A per Package)
- Guardring for Stress Protection
- Highly Stable Oxide Passivated Junction (125°C Operating Junction Temperature)
- Epoxy Meets UL94, VO at 1/8″

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B2535L

**MAXIMUM RATINGS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 35 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_C$ = 110°C) | $I_{F(AV)}$ | 12.5 | A |
| Peak Repetitive Forward Current, per Leg (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 95°C) | $I_{FRM}$ | 25 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions, Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 150 | A |
| Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) | $I_{RRM}$ | 1.0 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +150 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +125 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/μs |
| Controlled Avalanche Energy | $W_{aval}$ | 20 | mJ |

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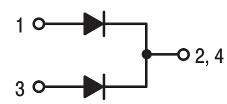
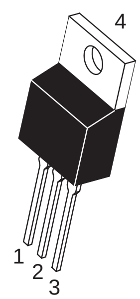
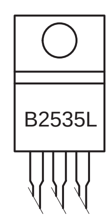
**SCHOTTKY BARRIER RECTIFIER**
**25 AMPERES**
**35 VOLTS**




**TO–220AB**
**CASE 221A**
**PLASTIC**

**MARKING DIAGRAM**




B2535L = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR2535CTL | TO–220 | 50 Units/Rail |

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**THERMAL CHARACTERISTICS**

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case | $R_{\theta JC}$ | 2.0 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($I_F$ = 25 Amps, $T_J$ = 25°C)<br>($I_F$ = 12.5 Amps, $T_J$ = 25°C)<br>($I_F$ = 12.5 Amps, $T_J$ = 125°C) | $V_F$ | <br>0.55<br>0.47<br>0.41 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_J$ = 25°C)<br>(Rated dc Voltage, $T_J$ = 125°C) | $I_R$ | <br>5.0<br>500 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

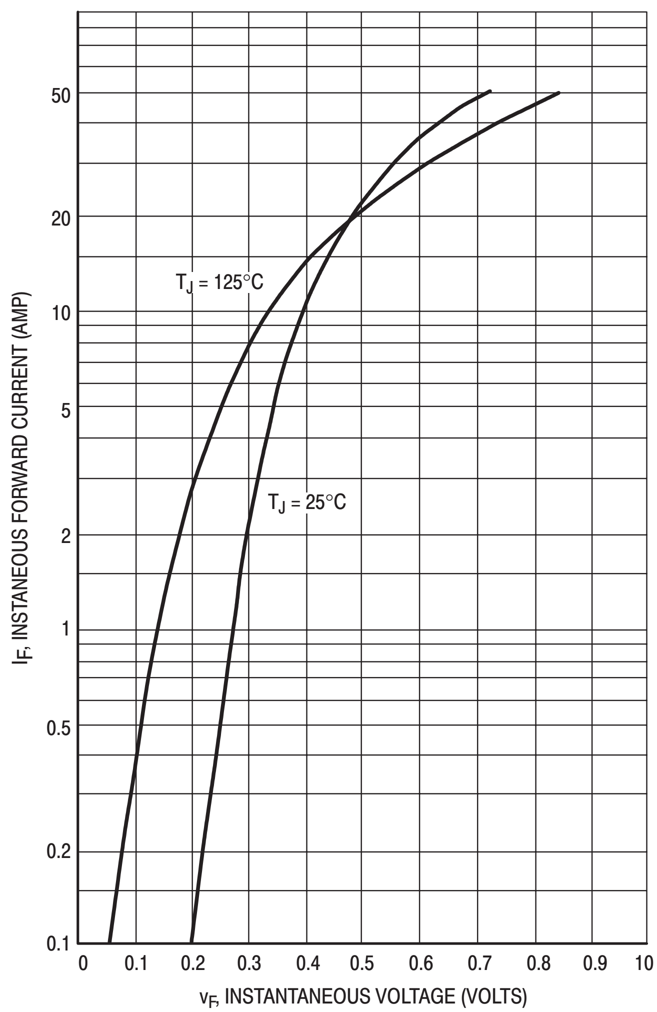


**Figure 1. Typical Forward Voltage, Per Leg**

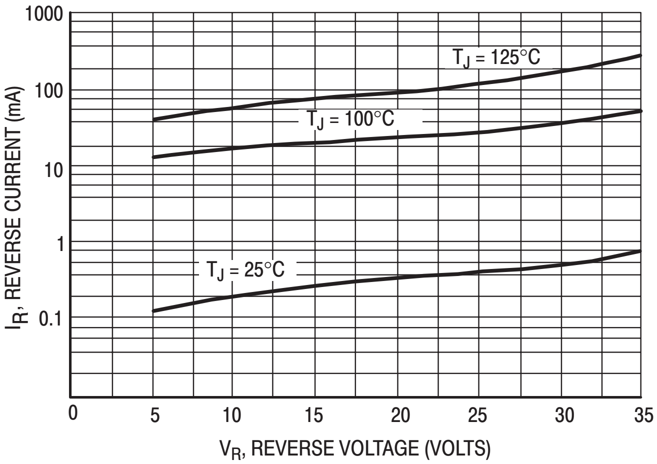


**Figure 2. Typical Reverse Current, Per Leg**

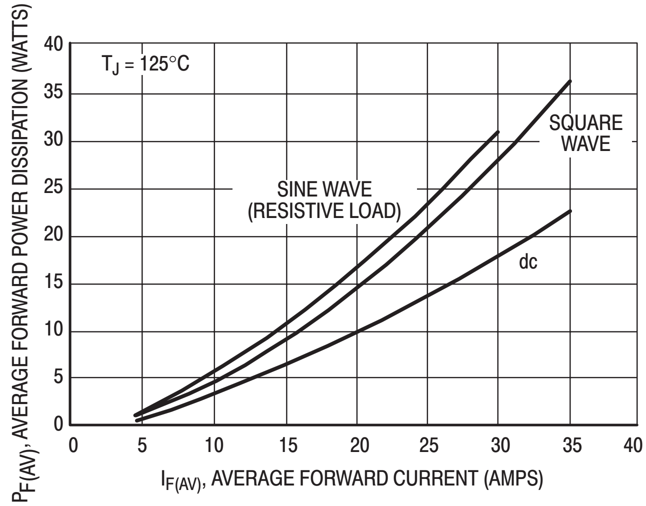


**Figure 3. Forward Power Dissipation, Per Leg**

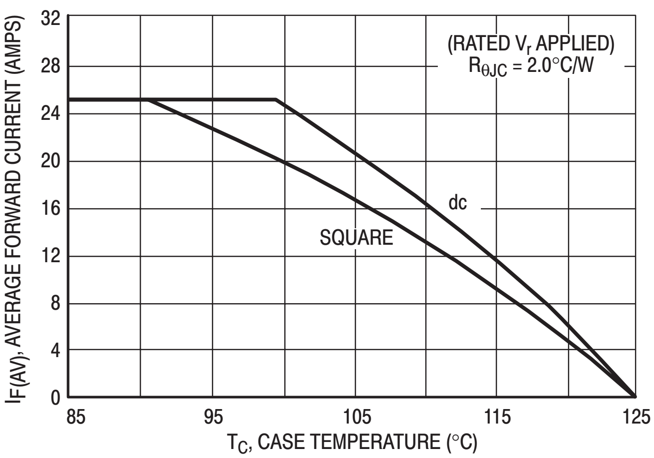


**Figure 4. Current Derating**

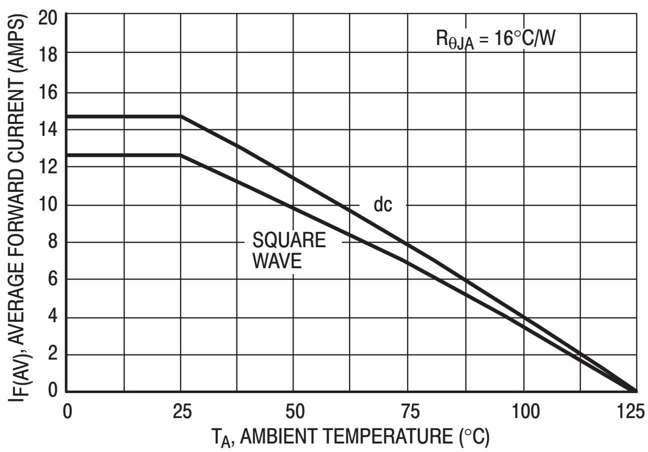


**Figure 5. Current Derating Ambient, Per Leg**

# MBR2535CT, MBR2545CT

**MBR2545CT is a Preferred Device**

# SWITCHMODE™ Power Rectifiers

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B2535, B2545

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage MBR2535CT<br>MBR2545CT | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | <br><br>35<br>45 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_C$ = 130°C) | $I_{F(AV)}$ | 30 | A |
| Peak Repetitive Forward Current, per Diode Leg (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 130°C) | $I_{FRM}$ | 30 | A |
| Non–Repetitive Peak Surge Current per Diode Leg (Surge Applied at Rated Load Conditions, Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 150 | A |
| Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) | $I_{RRM}$ | 1.0 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +175 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 1000 | V/μs |

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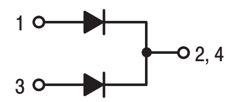
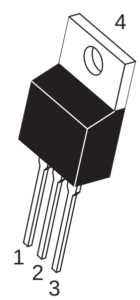
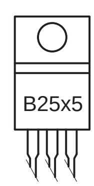
**SCHOTTKY BARRIER RECTIFIERS 25 AMPERES 35 and 45 VOLTS**




**TO–220AB CASE 221A PLASTIC**

**MARKING DIAGRAM**




B25x5 = Device Code
x = 3 or 4

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR2535CT | TO–220 | 50 Units/Rail |
| MBR2545CT | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS** (Per Diode Leg)

| Characteristic | Symbol | MBR2535CT | MBR2545CT | Unit |
|---|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.5 | 1.5 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Diode Leg)

| Characteristic | Symbol | MBR2535CT | MBR2545CT | Unit |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 30 Amps, $T_C$ = 125°C)<br>($i_F$ = 30 Amps, $T_C$ = 25°C) | $v_F$ | <br>0.73<br>0.82 | <br>0.73<br>0.82 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_C$ = 125°C)<br>(Rated dc Voltage, $T_C$ = 25°C) | $i_R$ | <br>40<br>0.2 | <br>40<br>0.2 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

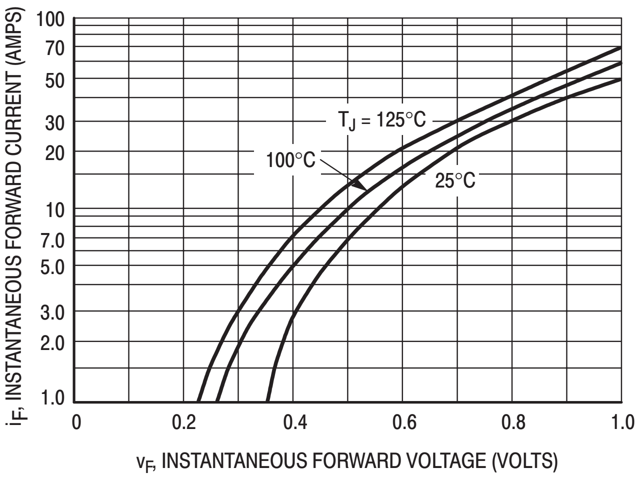


**Figure 1. Typical Forward Voltage**

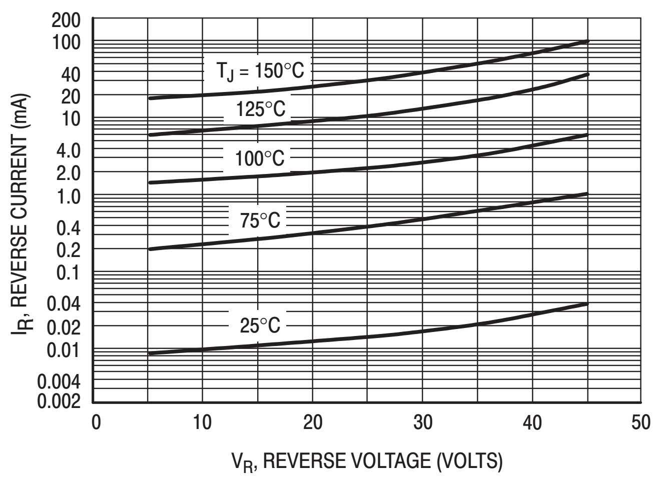


**Figure 2. Typical Reverse Current**

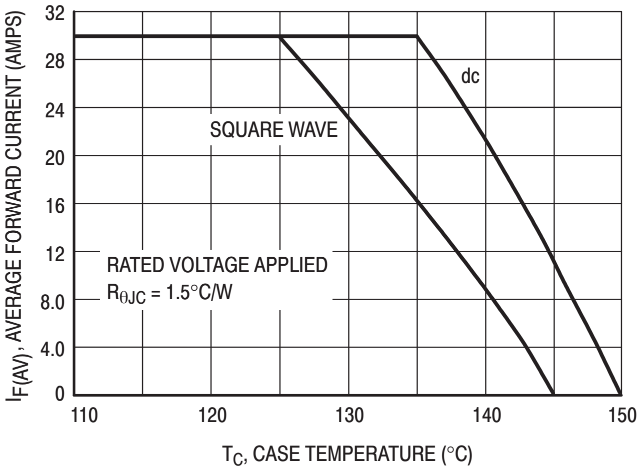


**Figure 3. Current Derating, Case**

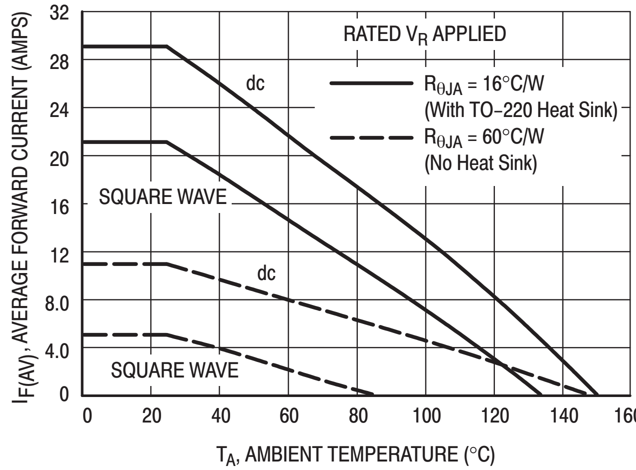


**Figure 4. Current Derating, Ambient**

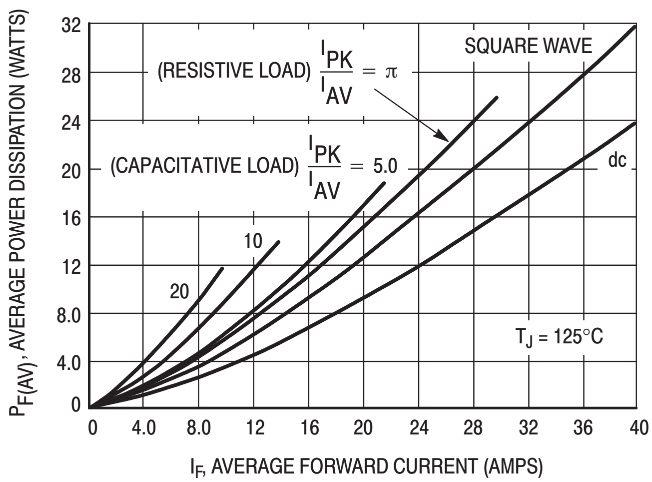


**Figure 5. Forward Power Dissipation**

# MBR3045ST

**Preferred Device**

# SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a platinum barrier metal. This state–of–the–art device has the following features:

- Dual Diode Construction — Terminals 1 and 3 May Be Connected for Parallel Operation at Full Rating
- 45 V Blocking Voltage
- Low Forward Voltage Drop
- Guardring for Stress Protection
- 150°C Operating Junction Temperature

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 Units Per Plastic Tube
- Marking: B3045

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 45 | V |
| Average Rectified Current<br>Per Device<br>($T_C$ = 130°C) Per Diode | $I_{F(AV)}$ | <br>30<br>15 | A |
| Peak Repetitive Forward Current, per Diode (Square Wave, $V_R$ = 45 V, 20 kHz) | $I_{FRM}$ | 30 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions, Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 150 | A |
| Peak Repetitive Reverse Current, per Diode (2.0 μs, 1.0 kHz) | $I_{RRM}$ | 2.0 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +175 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +150 | °C |
| Peak Surge Junction Temperature (Forward Current Applied) | $T_{J(pk)}$ | 175 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/μs |

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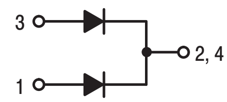
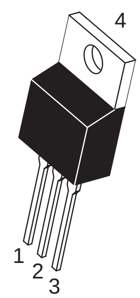
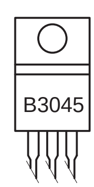
**SCHOTTKY BARRIER RECTIFIER**
**30 AMPERES**
**45 VOLTS**




**TO–220AB**
**CASE 221A**
**STYLE 6**

**MARKING DIAGRAM**




B3045 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR3045ST | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS** (Per Diode)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.5 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Diode)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.) ($i_F$ = 30 Amp, $T_C$ = 25°C)<br>($i_F$ = 30 Amp, $T_C$ = 125°C)<br>($i_F$ = 20 Amp, $T_C$ = 125°C) | $v_F$ | 0.76<br>0.72<br>0.60 | Volts |
| Instantaneous Reverse Current (Note 1.) ($V_R$ = 45 Volts, $T_C$ = 25°C)<br>($V_R$ = 45 Volts, $T_C$ = 125°C) | $I_R$ | 0.2<br>40 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

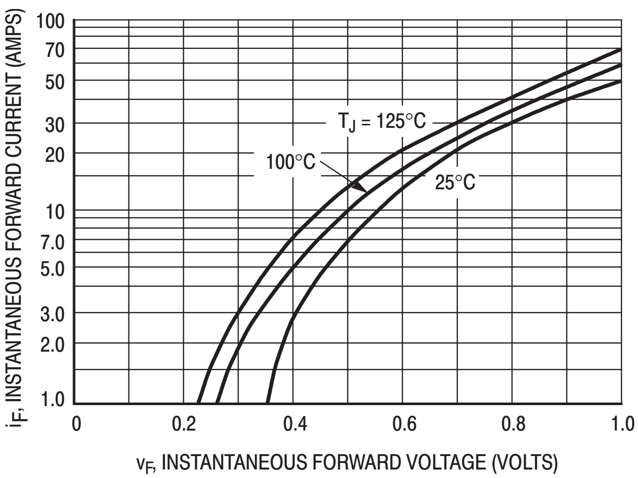


**Figure 1. Typical Forward Voltage**

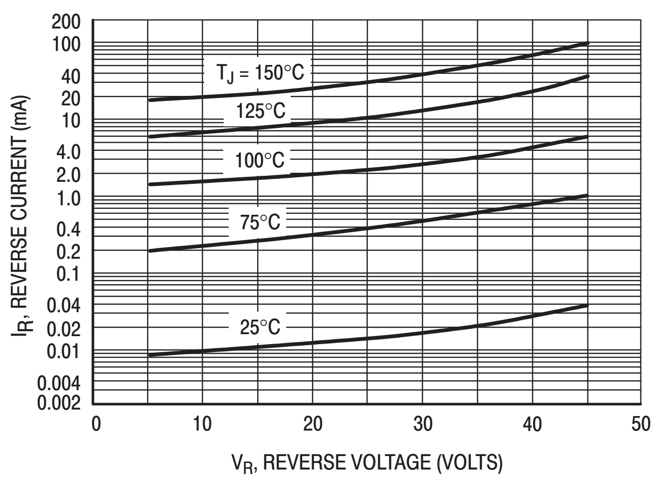


**Figure 2. Typical Reverse Current**

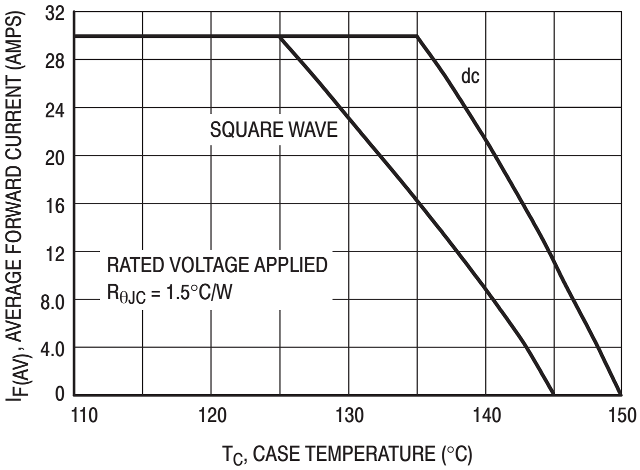


Figure 3. Current Derating, Case

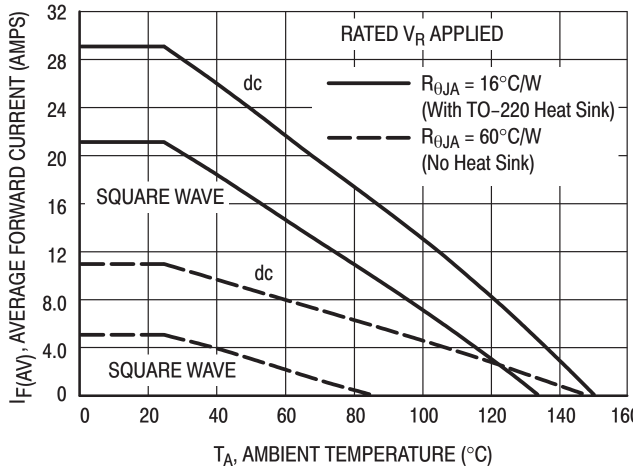


Figure 4. Current Derating, Ambient

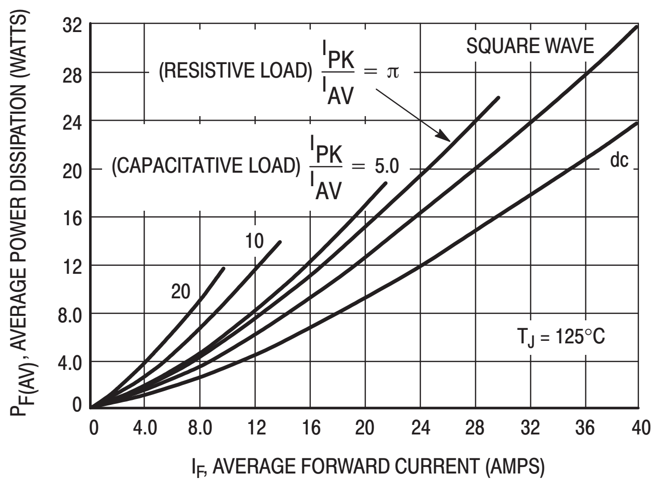


Figure 5. Forward Power Dissipation

# MBR735, MBR745

MBR745 is a Preferred Device

# SWITCHMODE™ Power Rectifiers

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B735, B745

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage MBR735<br>MBR745 | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | <br><br>35<br>45 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_C$ = 105°C) | $I_{F(AV)}$ | 7.5 | A |
| Peak Repetitive Forward Current, (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 105°C) | $I_{FRM}$ | 15 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 150 | A |
| Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) | $I_{RRM}$ | 1.0 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +175 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/μs |

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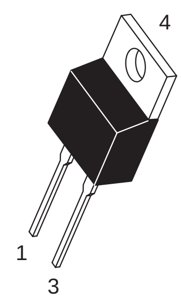
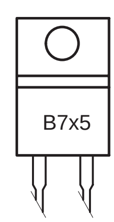
**SCHOTTKY BARRIER RECTIFIERS**
**7.5 AMPERES**
**35 and 45 VOLTS**


**TO–220AC**
**CASE 221B**
**PLASTIC**

**MARKING DIAGRAM**




B7x5 = Device Code
x = 3 or 4

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR735 | TO–220 | 50 Units/Rail |
| MBR745 | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 3.0 | °C/W |
| Maximum Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 60 | °C/W |

## ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 7.5 Amps, $T_C$ = 125°C)<br>($i_F$ = 15 Amps, $T_C$ = 125°C)<br>($i_F$ = 15 Amps, $T_C$ = 25°C) | $v_F$ | <br>0.57<br>0.72<br>0.84 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_C$ = 125°C)<br>(Rated dc Voltage, $T_C$ = 25°C) | $i_R$ | <br>15<br>0.1 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

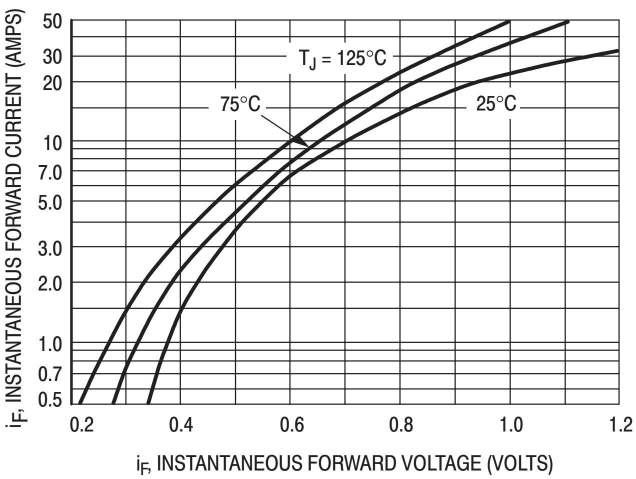


**Figure 1. Typical Forward Voltage**

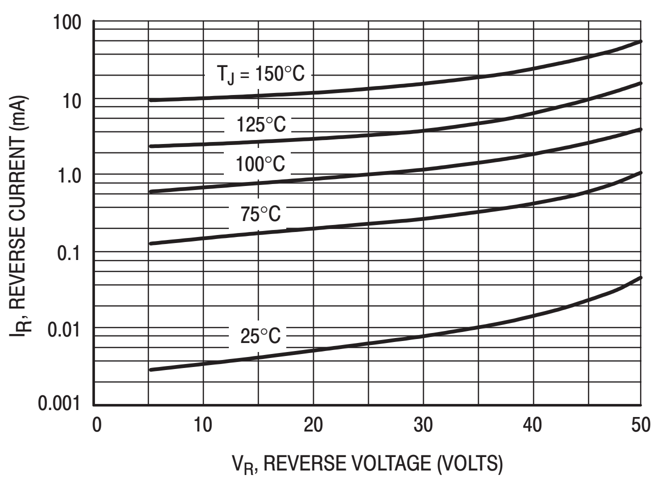


**Figure 2. Typical Reverse Current**

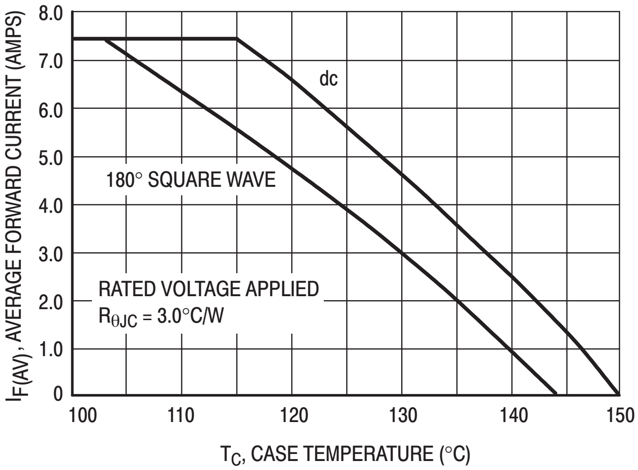


**Figure 3. Current Derating, Case**

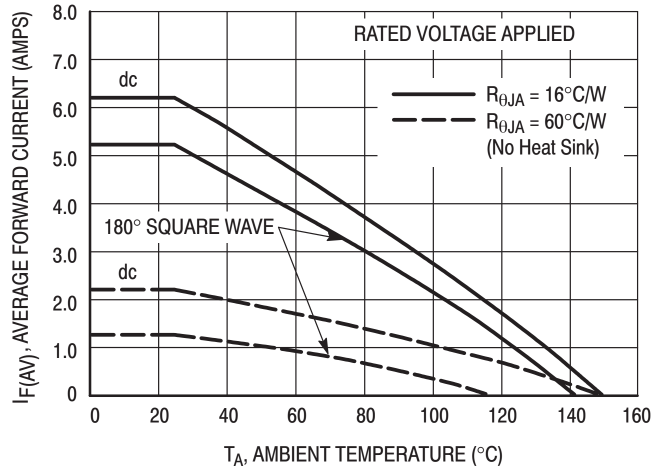


**Figure 4. Current Derating, Ambient**

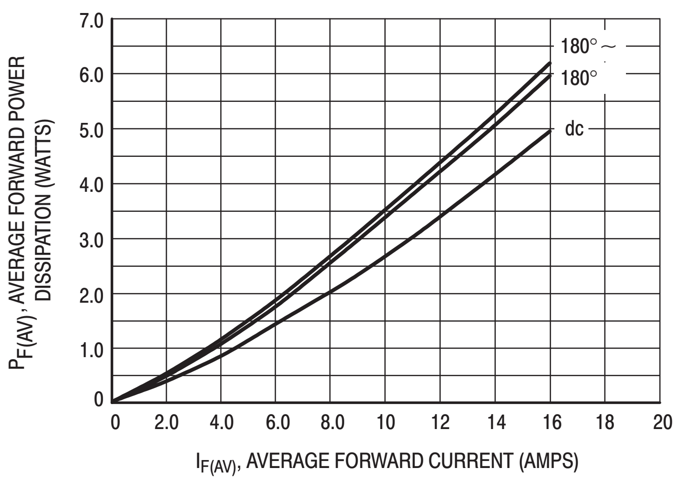


**Figure 5. Power Dissipation**

# MBR1035, MBR1045

**MBR1045 is a Preferred Device**

# SWITCHMODE™ Power Rectifiers

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B1035, B1045

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage MBR1035<br>MBR1045 | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | <br><br>35<br>45 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_C$ = 135°C) | $I_{F(AV)}$ | 10 | A |
| Peak Repetitive Forward Current, (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 135°C) | $I_{FRM}$ | 20 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 150 | A |
| Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) See Figure 12. | $I_{RRM}$ | 1.0 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +175 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/μs |

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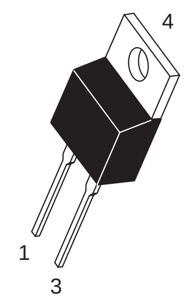
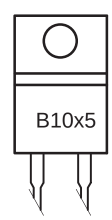
**SCHOTTKY BARRIER RECTIFIERS**
**10 AMPERES**
**35 to 45 VOLTS**


**TO–220AC**
**CASE 221B**
**PLASTIC**

**MARKING DIAGRAM**




B10x5 = Device Code
x = 3 or 4

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR1035 | TO–220 | 50 Units/Rail |
| MBR1045 | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 2.0 | °C/W |

## ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 10 Amps, TC = 125°C)<br>($i_F$ = 20 Amps, $T_C$ = 125°C)<br>($i_F$ = 20 Amps, $T_C$ = 25°C) | $v_F$ | <br>0.57<br>0.72<br>0.84 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_C$ = 125°C)<br>(Rated dc Voltage, $T_C$ = 25°C) | $i_R$ | <br>15<br>0.1 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

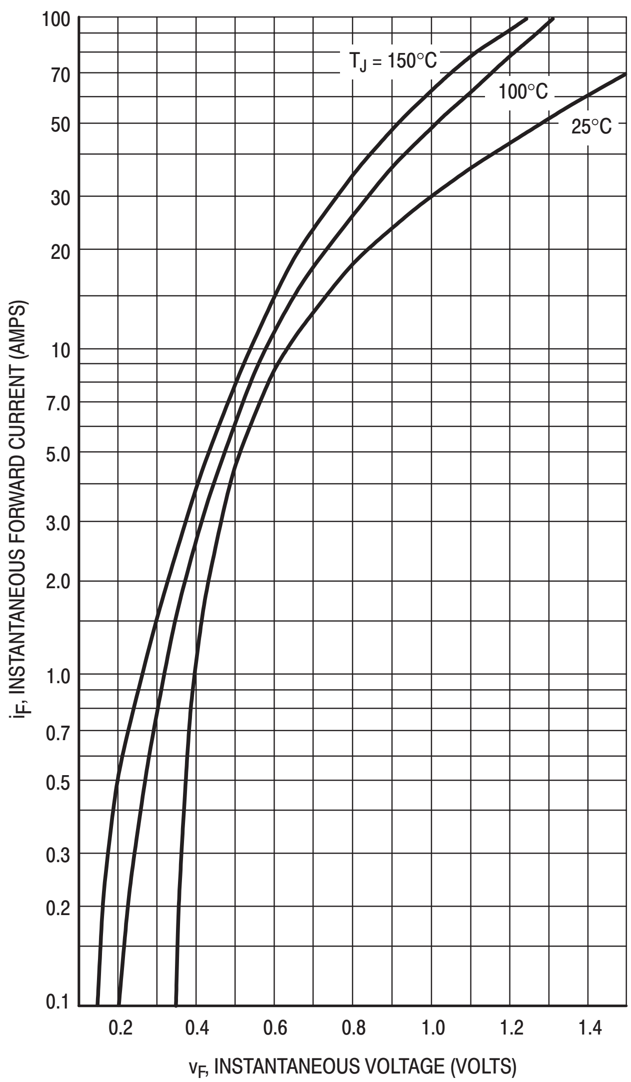



**Figure 1. Maximum Forward Voltage**

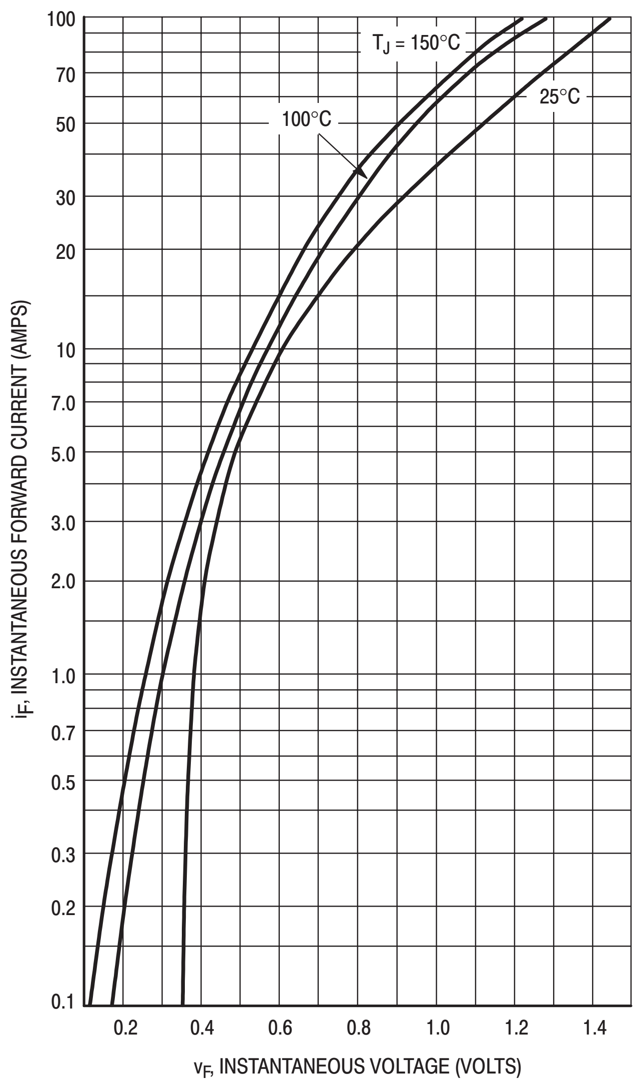



**Figure 2. Typical Forward Voltage**

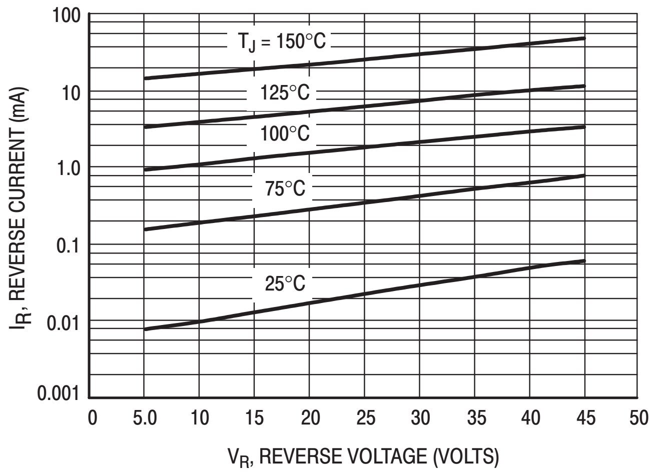



**Figure 3. Maximum Reverse Current**

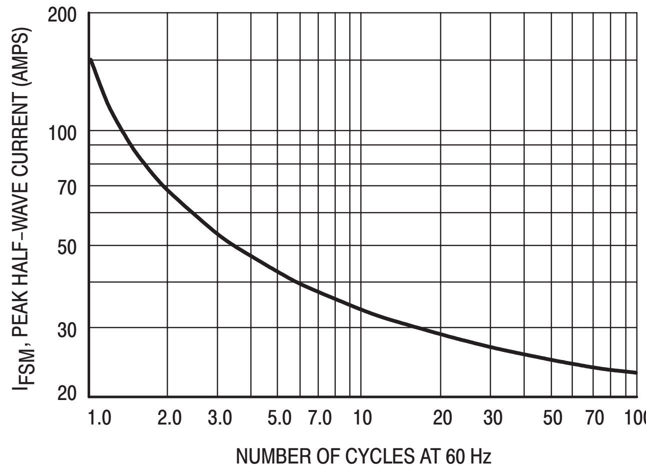



**Figure 4. Maximum Surge Capability**

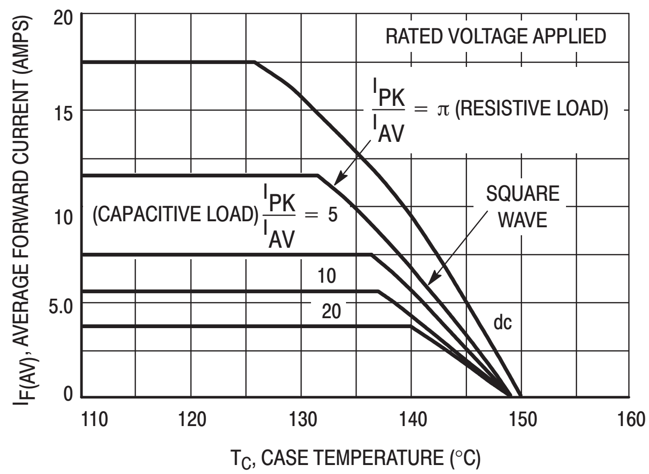



**Figure 5. Current Derating, Infinite Heatsink**

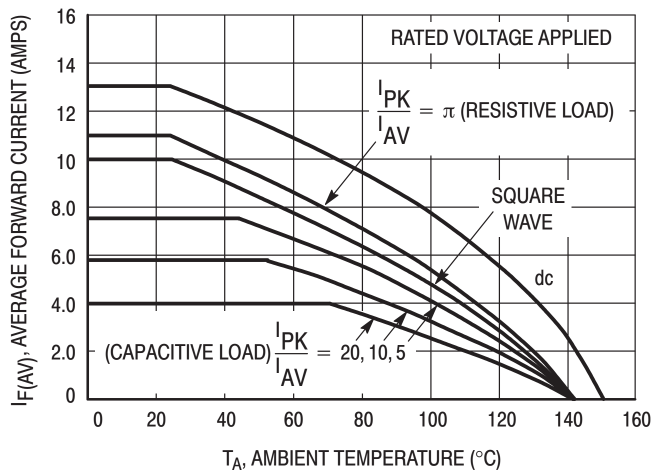



**Figure 6. Current Derating, $R_{\theta JA}$ = 16°C/W**

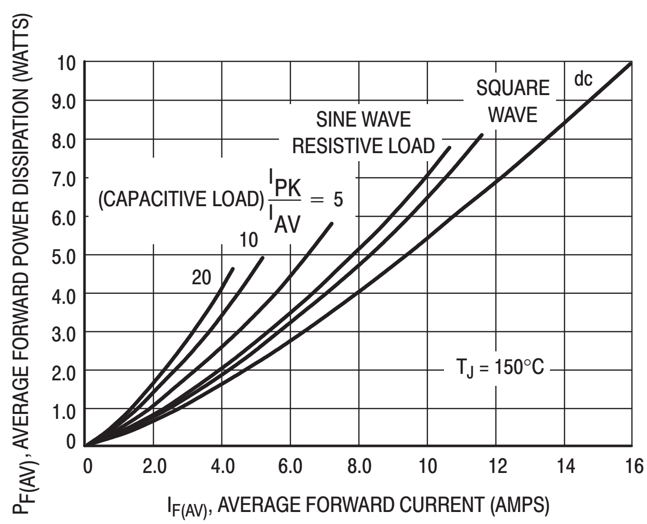



**Figure 7. Forward Power Dissipation**

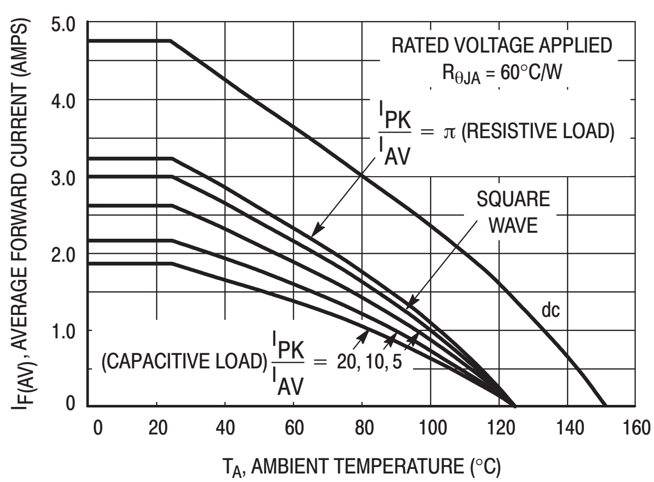



**Figure 8. Current Derating, Free Air**

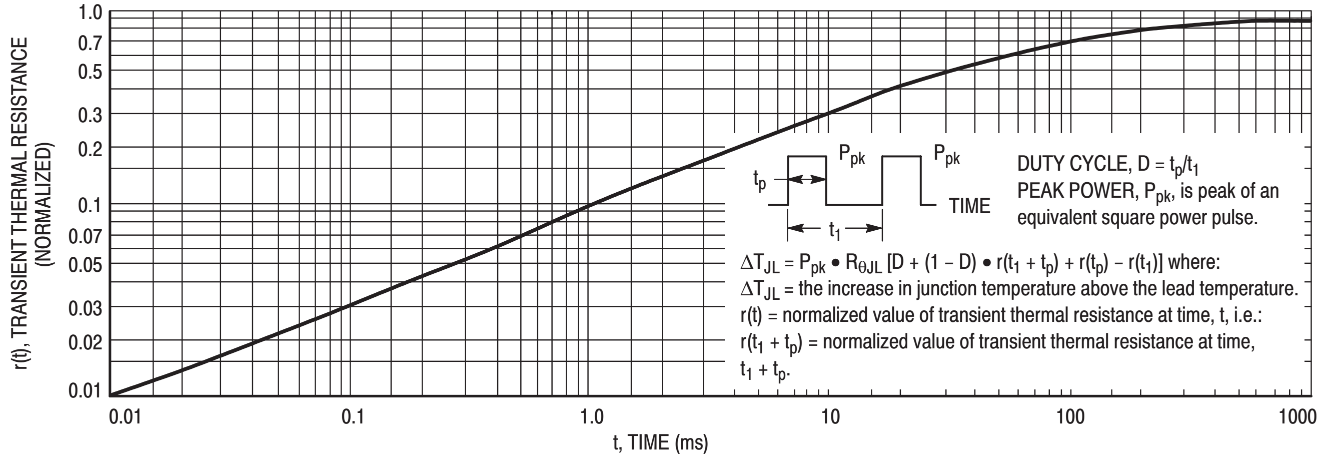



**Figure 9. Thermal Response**

### HIGH FREQUENCY OPERATION

Since current flow in a Schottky rectifier is the result of majority carrier conduction, it is not subject to junction diode forward and reverse recovery transients due to minority carrier injection and stored charge. Satisfactory circuit analysis work may be performed by using a model consisting of an ideal diode in parallel with a variable capacitance. (See Figure 10. )

Rectification efficiency measurements show that operation will be satisfactory up to several megahertz. For example, relative waveform rectification efficiency is approximately 70 percent at 2.0 MHz, e.g., the ratio of dc power to RMS power in the load is 0.28 at this frequency, whereas perfect rectification would yield 0.406 for sine wave inputs. However, in contrast to ordinary junction diodes, the loss in waveform efficiency is not indicative of power loss; it is simply a result of reverse current flow through the diode capacitance, which lowers the dc output voltage.

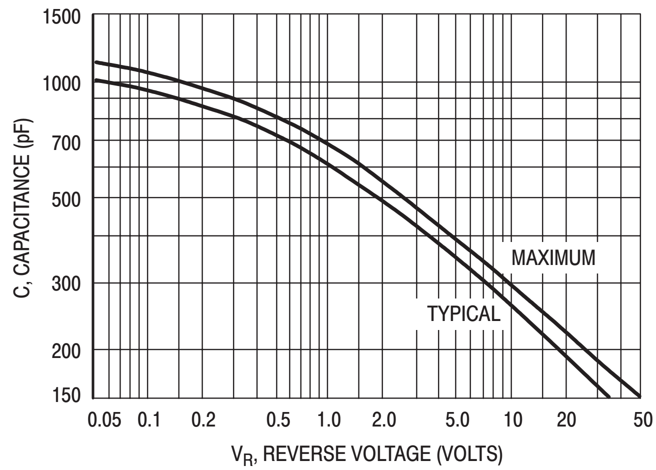



**Figure 10. Capacitance**

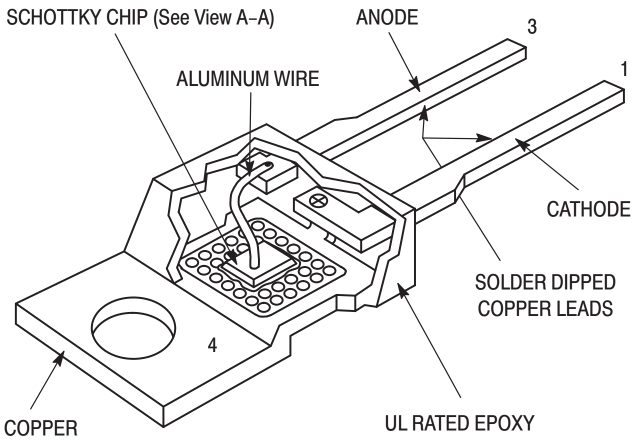
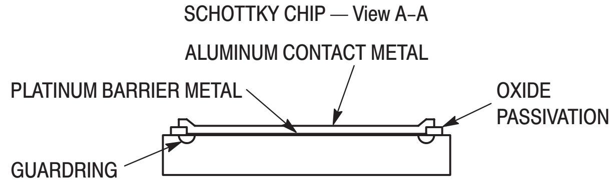



**Figure 11. Schottky Rectifier**




Motorola builds quality and reliability into its Schottky Rectifiers.

First is the chip, which has an interface metal between the barrier metal and aluminum–contact metal to eliminate any possible interaction between the two. The indicated guardring prevents dv/dt problems, so snubbers are not mandatory. The guardring also operates like a zener to absorb over–voltage transients.

Second is the package. The Schottky chip is bonded to the copper heat sink using a specially formulated solder. This gives the unit the capability of passing 10,000 operating thermal–fatigue cycles having a $\Delta T_J$ of 100°C. The epoxy molding compound is rated per UL 94, V0 @ 1/8″. Wire bonds are 100% tested in assembly as they are made.

Third is the electrical testing, which includes 100% dv/dt at 1600 V/μs and reverse avalanche as part of device characterization.

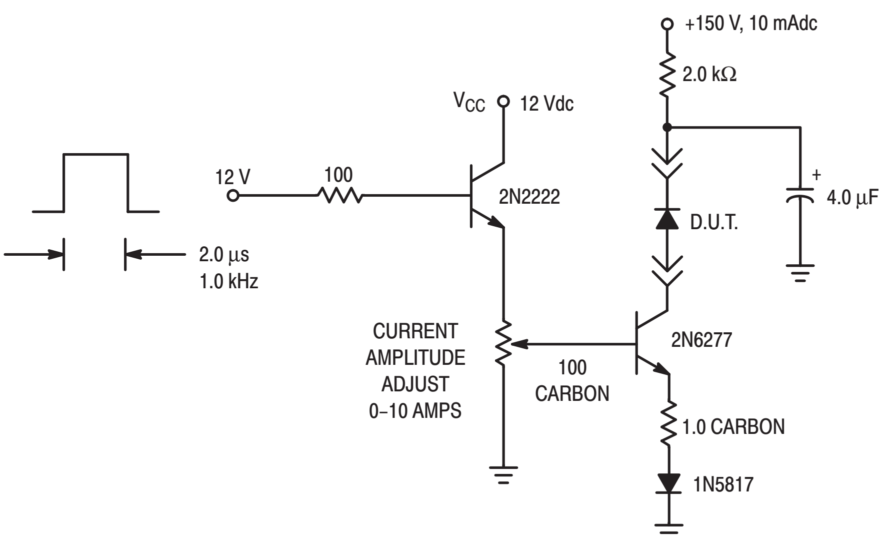



**Figure 12. Test Circuit for dv/dt and Reverse Surge Current**

# MBR1060, MBR1080, MBR1090, MBR10100

**MBR1060 and MBR10100 are Preferred Devices**

# SWITCHMODE™ Power Rectifiers

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Guard–Ring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, VO at 1/8″
- Low Power Loss/High Efficiency
- High Surge Capacity
- Low Stored Charge Majority Carrier Conduction

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B1060, B1080, B1090, B10100

**MAXIMUM RATINGS**

Please See the Table on the Following Page

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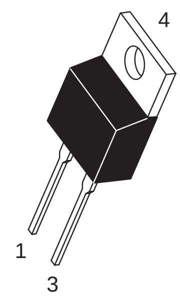
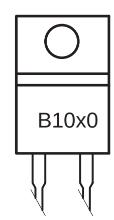
**SCHOTTKY BARRIER RECTIFIERS 10 AMPERES 60 to 100 VOLTS**


**TO–220AC CASE 221B PLASTIC**

**MARKING DIAGRAM**




B10x0 = Device Code
x = 6, 8, 9 or 10

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR1060 | TO–220 | 50 Units/Rail |
| MBR1080 | TO–220 | 50 Units/Rail |
| MBR1090 | TO–220 | 50 Units/Rail |
| MBR10100 | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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## MAXIMUM RATINGS

| Rating | Symbol | MBR | | | | Unit |
|---|---|---|---|---|---|---|
| | | 1060 | 1080 | 1090 | 10100 | |
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 60 | 80 | 90 | 100 | Volts |
| Average Rectified Forward Current (Rated $V_R$) $T_C$ = 133°C | $I_{F(AV)}$ | 10 | | | | Amps |
| Peak Repetitive Forward Current<br>(Rated $V_R$, Square Wave, 20 kHz) $T_C$ = 133°C | $I_{FRM}$ | 20 | | | | Amps |
| Nonrepetitive Peak Surge Current<br>(Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 150 | | | | Amps |
| Peak Repetitive Reverse Surge Current (2.0 µs, 1.0 kHz) | $I_{RRM}$ | 0.5 | | | | Amp |
| Operating Junction Temperature | $T_J$ | – 65 to +150 | | | | °C |
| Storage Temperature | $T_{stg}$ | – 65 to +175 | | | | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | | | | V/µs |

## THERMAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Thermal Resistance — Junction to Case<br>— Junction to Ambient | $R_{\theta JC}$<br>$R_{\theta JA}$ | 2.0<br>60 | °C/W |

## ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 10 Amps, $T_C$ = 125°C)<br>($i_F$ = 10 Amps, $T_C$ = 25°C)<br>($i_F$ = 20 Amps, $T_C$ = 125°C)<br>($i_F$ = 20 Amps, $T_C$ = 25°C) | $v_F$ | <br>0.7<br>0.8<br>0.85<br>0.95 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_C$ = 125°C)<br>(Rated dc Voltage, $T_C$ = 25°C) | $i_R$ | <br>6.0<br>0.10 | mA |

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

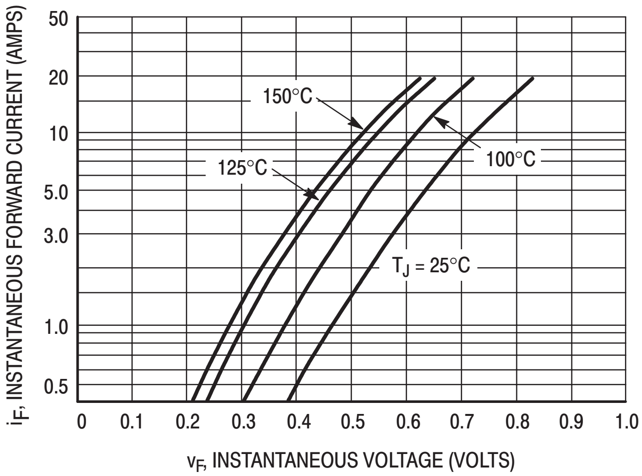


**Figure 1. Typical Forward Voltage**

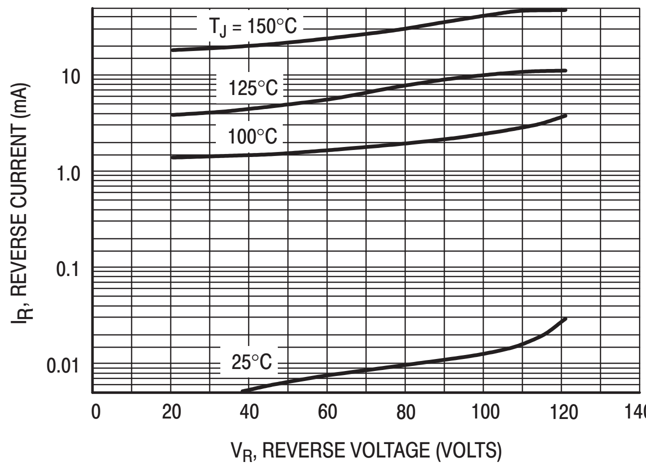


**Figure 2. Typical Reverse Current**

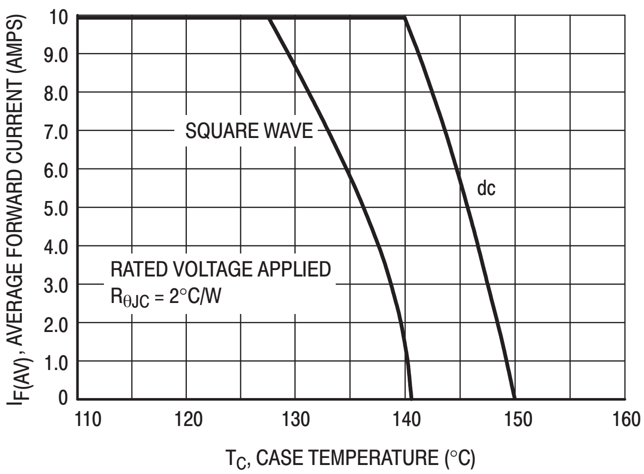


**Figure 3. Current Derating, Case**

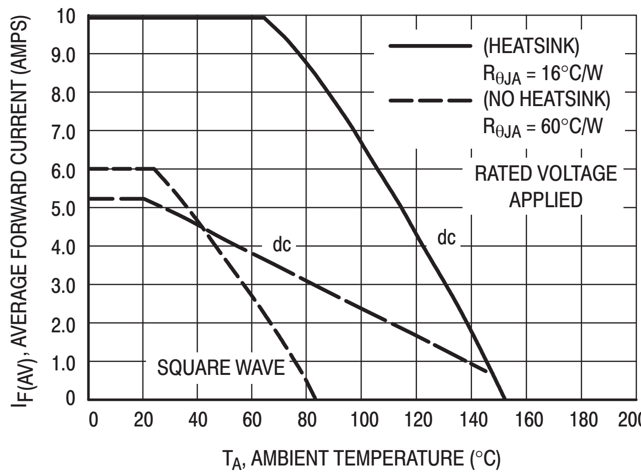


**Figure 4. Current Derating, Ambient**

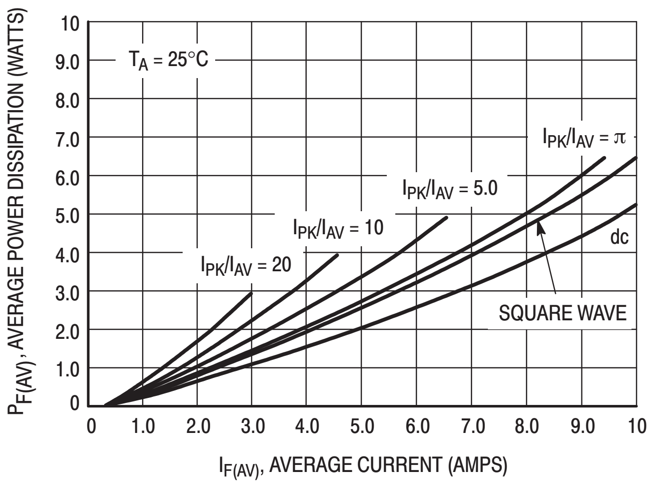


**Figure 5. Forward Power Dissipation**

# MBR1635, MBR1645

**MBR1645 is a Preferred Device**

# SWITCHMODE™ Power Rectifiers

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B1635, B1645

### MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage MBR1635<br>MBR1645 | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | <br><br>35<br>45 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_C$ = 125°C) | $I_{F(AV)}$ | 16 | A |
| Peak Repetitive Forward Current, (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 125°C) | $I_{FRM}$ | 32 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 150 | A |
| Peak Repetitive Reverse Surge Current (2.0 µs, 1.0 kHz) | $I_{RRM}$ | 1.0 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +175 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/µs |

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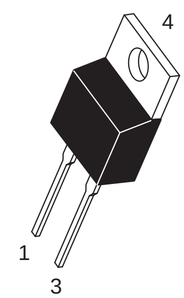
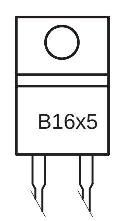
**SCHOTTKY BARRIER RECTIFIERS**
**16 AMPERES**
**35 and 45 VOLTS**


**TO–220AC**
**CASE 221B**
**PLASTIC**

**MARKING DIAGRAM**




B16x5 = Device Code
x = 3 or 4

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR1635 | TO–220 | 50 Units/Rail |
| MBR1645 | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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### THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.5 | °C/W |

### ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 16 Amps, $T_C$ = 125°C)<br>($i_F$ = 16 Amps, $T_C$ = 25°C) | $v_F$ | <br>0.57<br>0.63 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_C$ = 125°C)<br>(Rated dc Voltage, $T_C$ = 25°C) | $i_R$ | <br>40<br>0.2 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

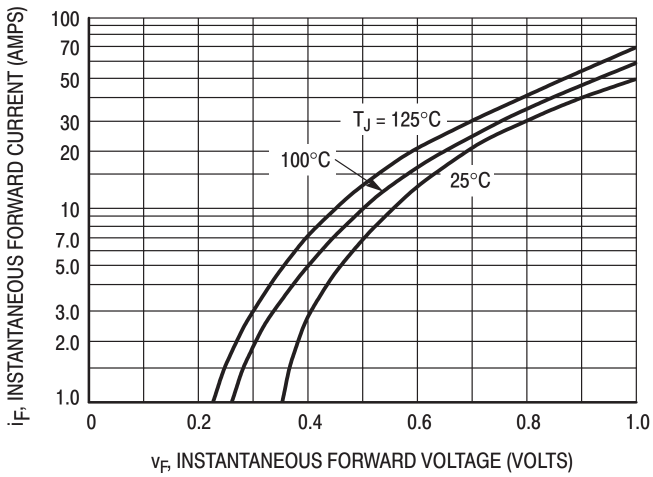


**Figure 1. Typical Forward Voltage**

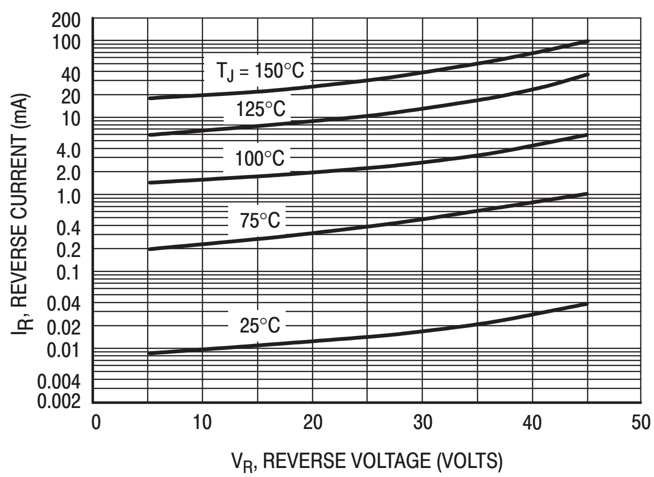


**Figure 2. Typical Reverse Current**

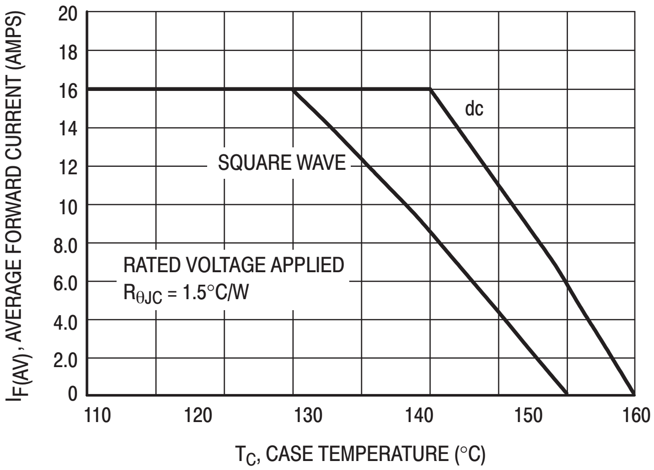


**Figure 3. Current Derating, Case**

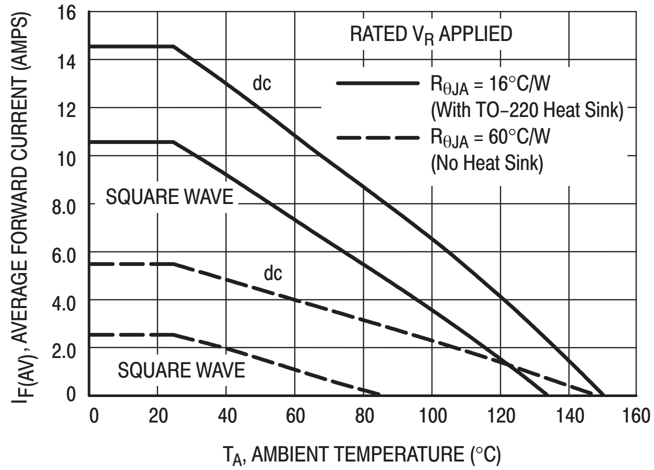


**Figure 4. Current Derating, Ambient**

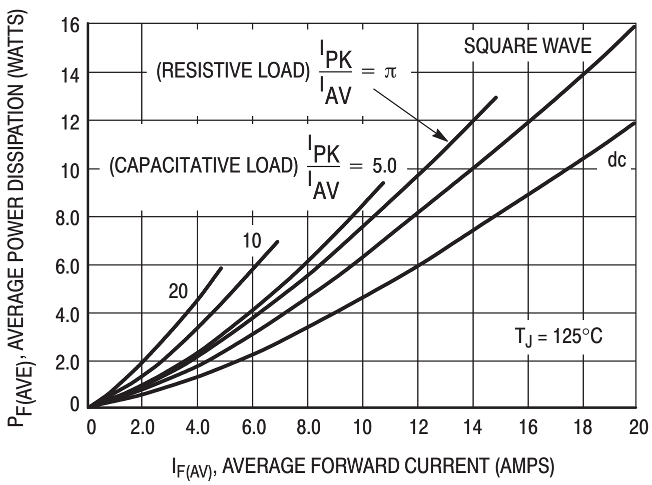


**Figure 5. Forward Power Dissipation**

# MBR2515L

# SWITCHMODE™ Power Rectifier

. . . employing the Schottky Barrier principle in a large metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for use in low voltage, high frequency switching power supplies, low voltage converters, OR'ing diodes, and polarity protection devices.

- Very Low Forward Voltage (0.28 V Maximum @ 19 Amps, 70°C)
- Guardring for Stress Protection
- Highly Stable Oxide Passivated Junction (100°C Operating Junction Temperature)
- Epoxy Meets UL94, VO at 1/8″

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 Units Per Plastic Tube
- Marking: B2515L

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 15 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_C$ = 90°C) | $I_{F(AV)}$ | 25 | A |
| Peak Repetitive Forward Current, per Leg (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 90°C) | $I_{FRM}$ | 30 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 150 | A |
| Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) | $I_{RRM}$ | 1.0 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +125 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +100 | °C |

**THERMAL CHARACTERISTICS**

| | | | |
|---|---|---|---|
| Thermal Resistance — Junction to Case | $R_{\theta JC}$ | 2.0 | °C/W |

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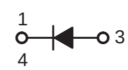
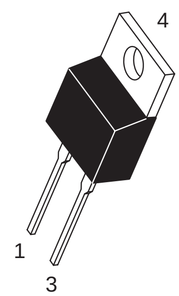
http://onsemi.com

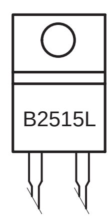
**SCHOTTKY BARRIER RECTIFIER 25 AMPERES 15 VOLTS**




**TO–220AC CASE 221B STYLE 1**

**MARKING DIAGRAM**




B2515L = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR2515L | TO–220 | 50 Units/Rail |

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## ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 25 Amps, $T_J$ = 25°C)<br>($i_F$ = 25 Amps, $T_J$ = 70°C)<br>($i_F$ = 19 Amps, $T_J$ = 70°C) | $v_F$ | <br>0.45<br>0.42<br>0.28 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated DC Voltage, $T_J$ = 25°C)<br>(Rated DC Voltage, $T_J$ = 70°C) | $I_R$ | <br>15<br>200 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

# MBRF2060CT

**Preferred Device**

# SWITCHMODE™ Schottky Power Rectifier

The SWITCHMODE Power Rectifier employs the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for use as rectifiers in very low–voltage, high–frequency switching power supplies, free wheeling diodes and polarity protection diodes.

- Highly Stable Oxide Passivated Junction
- Very Low Forward Voltage Drop
- Matched Dual Die Construction
- High Junction Temperature Capability
- High dv/dt Capability
- Excellent Ability to Withstand Reverse Avalanche Energy Transients
- Guardring for Stress Protection
- Epoxy Meets UL94, $V_O$ at 1/8″
- Electrically Isolated. No Isolation Hardware Required.
- UL Recognized File #E69369 (Note 1.)

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B2060

**MAXIMUM RATINGS**

| |
|---|
| Please See the Table on the Following Page |

1. UL Recognized mounting method is per Figure 4.

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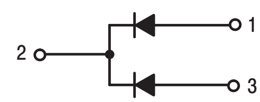
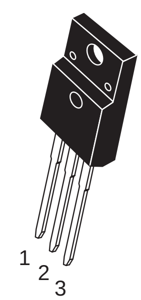
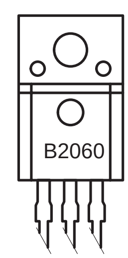
**SCHOTTKY BARRIER RECTIFIER 20 AMPERES 60 VOLTS**




**ISOLATED TO–220**
**CASE 221D**
**STYLE 3**

**MARKING DIAGRAM**




B2060 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRF2060CT | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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**MAXIMUM RATINGS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 60 | Volts |
| Average Rectified Forward Current<br>(Rated $V_R$), $T_C$ = 133°C Total Device | $I_{F(AV)}$ | 10<br>20 | Amps |
| Peak Repetitive Forward Current<br>(Rated $V_R$, Square Wave, 20 kHz), $T_C$ = 133°C | $I_{FRM}$ | 20 | Amps |
| Nonrepetitive Peak Surge Current<br>(Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 150 | Amps |
| Peak Repetitive Reverse Surge Current (2.0 µs, 1.0 kHz) | $I_{RRM}$ | 0.5 | Amp |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | – 65 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10000 | V/µs |
| RMS Isolation Voltage (t = 1.0 second, R.H. ≤ 30%, $T_A$ = 25°C) (Note 2.) Per Figure 3.<br>Per Figure 4. (Note 1.)<br>Per Figure 5. | $V_{iso1}$<br>$V_{iso2}$<br>$V_{iso3}$ | 4500<br>3500<br>1500 | Volts |

**THERMAL CHARACTERISTICS** (Per Leg)

| | | | |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 4.0 | °C/W |
| Lead Temperature for Soldering Purposes: 1/8″ from Case for 5 Seconds | $T_L$ | 260 | °C |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 3.)<br>($i_F$ = 10 Amp, $T_C$ = 25°C)<br>($i_F$ = 10 Amp, $T_C$ = 125°C)<br>($i_F$ = 20 Amp, $T_C$ = 25°C)<br>($i_F$ = 20 Amp, $T_C$ = 125°C) | $v_F$ | <br>0.85<br>0.75<br>0.95<br>0.85 | Volts |
| Maximum Instantaneous Reverse Current (Note 3.)<br>(Rated DC Voltage, $T_C$ = 25°C)<br>(Rated DC Voltage, $T_C$ = 125°C) | $i_R$ | <br>0.15<br>150 | mA |

1. UL Recognized mounting method is per Figure 4.
2. Proper strike and creepage distance must be provided.
3. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%

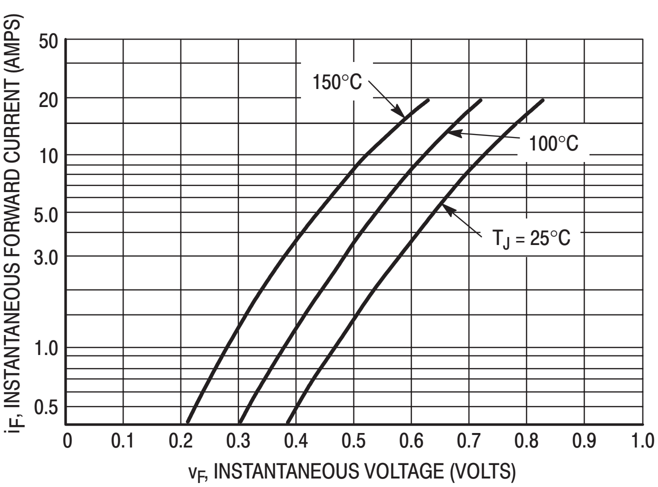



**Figure 1. Typical Forward Voltage Per Diode**

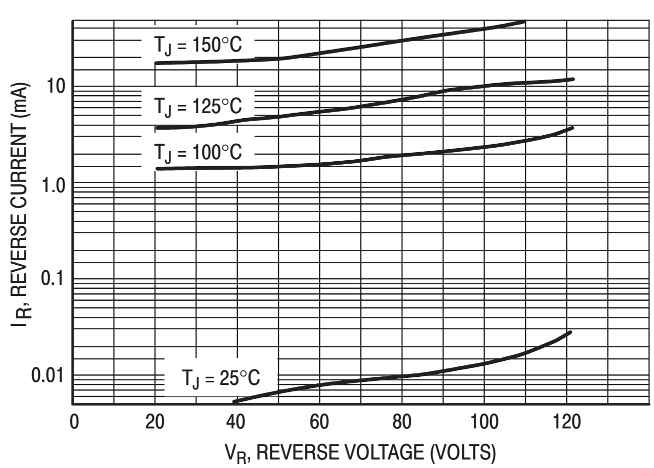



**Figure 2. Typical Reverse Current Per Diode**

## TEST CONDITIONS FOR ISOLATION TESTS*

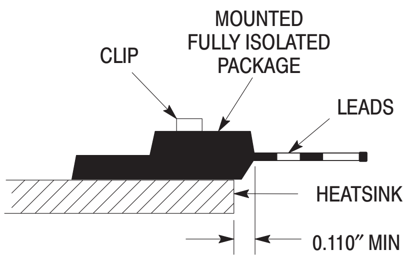



**Figure 3. Clip Mounting Position for Isolation Test Number 1**

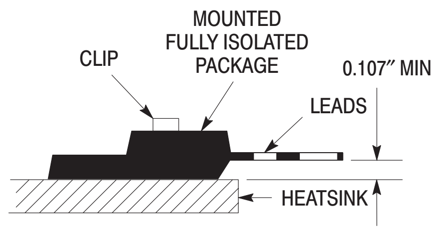



**Figure 4. Clip Mounting Position for Isolation Test Number 2**

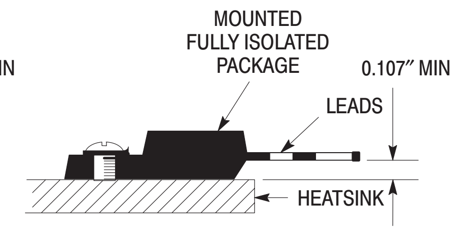
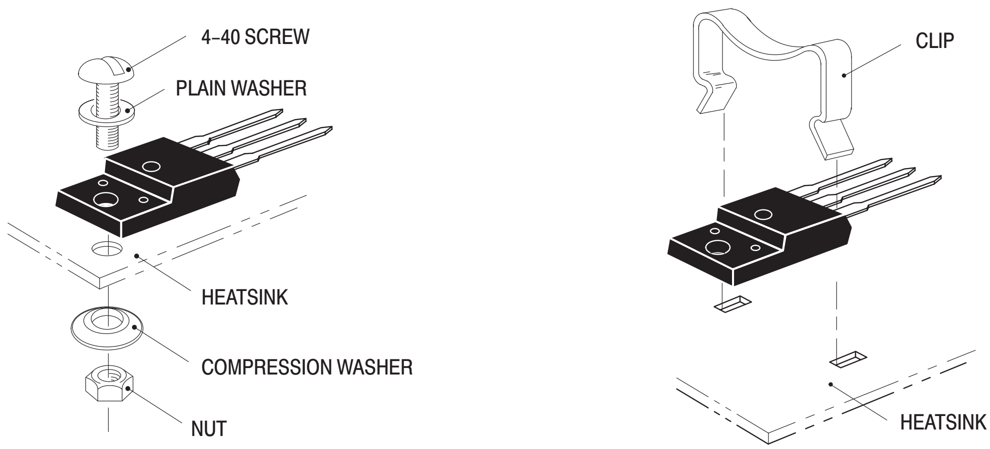



**Figure 5. Screw Mounting Position for Isolation Test Number 3**

* Measurement made between leads and heatsink with all leads shorted together.

## MOUNTING INFORMATION**




**6a. Screw–Mounted** **6b. Clip–Mounted**

**Figure 6. Typical Mounting Techniques**

Laboratory tests on a limited number of samples indicate, when using the screw and compression washer mounting technique, a screw torque of 6 to 8 in · lbs is sufficient to provide maximum power dissipation capability. The compression washer helps to maintain a constant pressure on the package over time and during large temperature excursions.

Destructive laboratory tests show that using a hex head 4–40 screw, without washers, and applying a torque in excess of 20 in · lbs will cause the plastic to crack around the mounting hole, resulting in a loss of isolation capability.

Additional tests on slotted 4–40 screws indicate that the screw slot fails between 15 to 20 in · lbs without adversely affecting the package. However, in order to positively ensure the package integrity of the fully isolated device, ON Semiconductor does not recommend exceeding 10 in · lbs of mounting torque under any mounting conditions.

**For more information about mounting power semiconductors see Application Note AN1040.

# MBRF20100CT

Preferred Device

# SWITCHMODE™ Schottky Power Rectifier

The SWITCHMODE Power Rectifier employs the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for use as rectifiers in very low–voltage, high–frequency switching power supplies, free wheeling diodes and polarity protection diodes.

- Highly Stable Oxide Passivated Junction
- Very Low Forward Voltage Drop
- Matched Dual Die Construction
- High Junction Temperature Capability
- High dv/dt Capability
- Excellent Ability to Withstand Reverse Avalanche Energy Transients
- Guardring for Stress Protection
- Epoxy Meets UL94, $V_O$ at 1/8″
- Electrically Isolated. No Isolation Hardware Required.
- UL Recognized File #E69369 (Note 1.)

### Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B20100

### MAXIMUM RATINGS

| |
|---|
| Please See the Table on the Following Page |

1. UL Recognized mounting method is per Figure 4.

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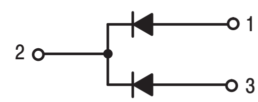
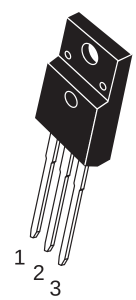
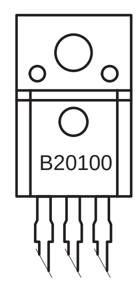
**SCHOTTKY BARRIER RECTIFIER**
**20 AMPERES**
**100 VOLTS**




**ISOLATED TO–220**
**CASE 221D**
**STYLE 3**

### MARKING DIAGRAM




B20100 = Device Code

### ORDERING INFORMATION

| Device | Package | Shipping |
|---|---|---|
| MBRF20100CT | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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**MAXIMUM RATINGS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 100 | Volts |
| Average Rectified Forward Current<br>(Rated $V_R$), $T_C$ = 133°C Total Device | $I_{F(AV)}$ | 10<br>20 | Amps |
| Peak Repetitive Forward Current<br>(Rated $V_R$, Square Wave, 20 kHz), $T_C$ = 133°C | $I_{FRM}$ | 20 | Amps |
| Non–repetitive Peak Surge Current<br>(Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 150 | Amps |
| Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) | $I_{RRM}$ | 0.5 | Amp |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | – 65 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10000 | V/μs |
| RMS Isolation Voltage (t = 1.0 second, R.H. ≤ 30%, $T_A$ = 25°C) (Note 2.) Per Figure 3.<br>Per Figure 4. (Note 1.)<br>Per Figure 5. | $V_{iso1}$<br>$V_{iso2}$<br>$V_{iso3}$ | 4500<br>3500<br>1500 | Volts |

**THERMAL CHARACTERISTICS** (Per Leg)

| | | | |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 3.5 | °C/W |
| Lead Temperature for Soldering Purposes: 1/8″ from Case for 5 Seconds | $T_L$ | 260 | °C |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 3.)<br>($i_F$ = 10 Amp, $T_C$ = 25°C)<br>($i_F$ = 10 Amp, $T_C$ = 125°C)<br>($i_F$ = 20 Amp, $T_C$ = 25°C)<br>($i_F$ = 20 Amp, $T_C$ = 125°C) | $v_F$ | <br>0.85<br>0.75<br>0.95<br>0.85 | Volts |
| Maximum Instantaneous Reverse Current (Note 3.)<br>(Rated DC Voltage, $T_C$ = 25°C)<br>(Rated DC Voltage, $T_C$ = 125°C) | $i_R$ | <br>0.15<br>150 | mA |

1. UL Recognized mounting method is per Figure 4.
2. Proper strike and creepage distance must be provided.
3. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

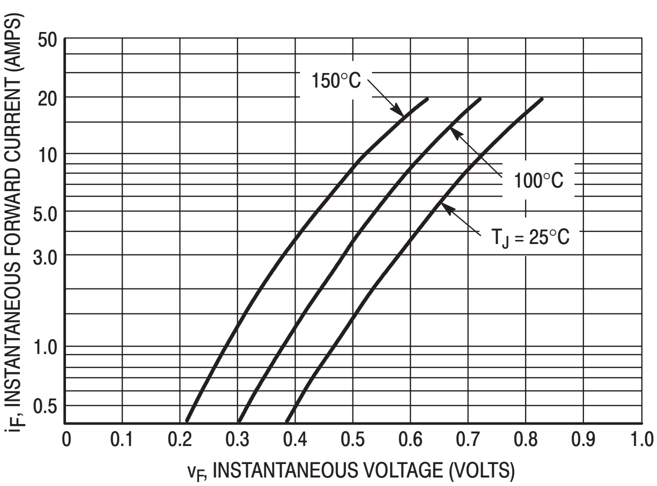



**Figure 1. Typical Forward Voltage Per Diode**

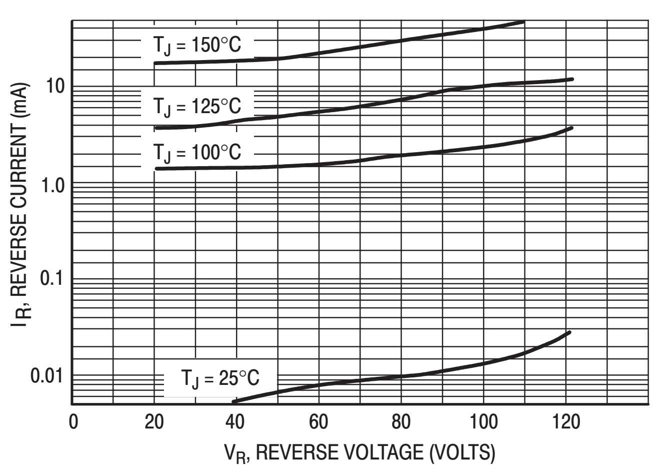



**Figure 2. Typical Reverse Current Per Diode**

## TEST CONDITIONS FOR ISOLATION TESTS*

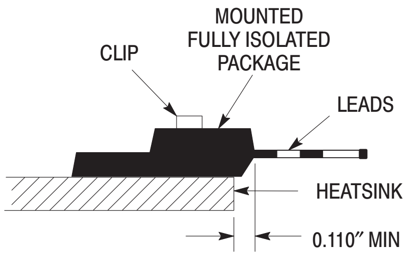



**Figure 3. Clip Mounting Position for Isolation Test Number 1**

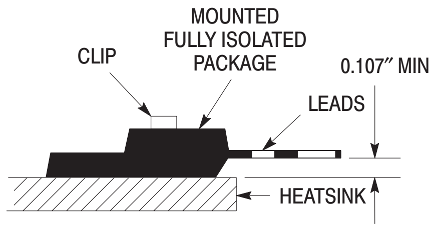



**Figure 4. Clip Mounting Position for Isolation Test Number 2**

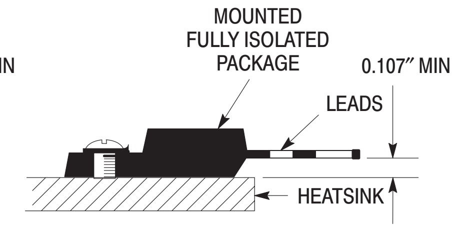
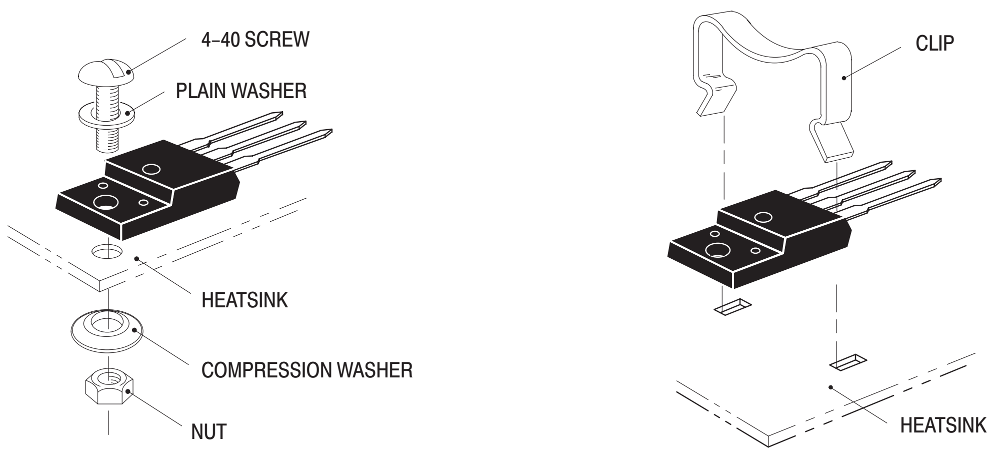



**Figure 5. Screw Mounting Position for Isolation Test Number 3**

* Measurement made between leads and heatsink with all leads shorted together.

## MOUNTING INFORMATION**




**6a. Screw–Mounted** **6b. Clip–Mounted**

**Figure 6. Typical Mounting Techniques**

Laboratory tests on a limited number of samples indicate, when using the screw and compression washer mounting technique, a screw torque of 6 to 8 in · lbs is sufficient to provide maximum power dissipation capability. The compression washer helps to maintain a constant pressure on the package over time and during large temperature excursions.

Destructive laboratory tests show that using a hex head 4–40 screw, without washers, and applying a torque in excess of 20 in · lbs will cause the plastic to crack around the mounting hole, resulting in a loss of isolation capability.

Additional tests on slotted 4–40 screws indicate that the screw slot fails between 15 to 20 in · lbs without adversely affecting the package. However, in order to positively ensure the package integrity of the fully isolated device, ON Semiconductor does not recommend exceeding 10 in · lbs of mounting torque under any mounting conditions.

**For more information about mounting power semiconductors see Application Note AN1040.

# MBRF20200CT

**Preferred Device**

# SWITCHMODE™ Schottky Power Rectifier

The SWITCHMODE Power Rectifier employs the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for use as rectifiers in very low–voltage, high–frequency switching power supplies, free wheeling diodes and polarity protection diodes.

- Highly Stable Oxide Passivated Junction
- Very Low Forward Voltage Drop
- Matched Dual Die Construction
- High Junction Temperature Capability
- High dv/dt Capability
- Excellent Ability to Withstand Reverse Avalanche Energy Transients
- Guardring for Stress Protection
- Epoxy Meets UL94, $V_O$ at 1/8″
- Electrically Isolated. No Isolation Hardware Required.
- UL Recognized File #E69369

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B20200

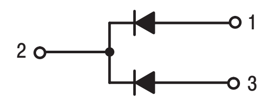
**MAXIMUM RATINGS**

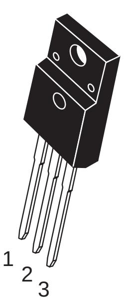
| |
|---|
| Please See the Table on the Following Page |

ON Semiconductor™

http://onsemi.com

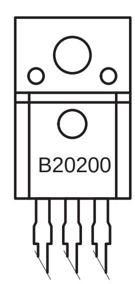
**SCHOTTKY BARRIER RECTIFIER 20 AMPERES 200 VOLTS**




**ISOLATED TO–220 CASE 221D STYLE 3**

**MARKING DIAGRAM**




B20200 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRF20200CT | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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**MAXIMUM RATINGS** (Per Leg)

| Rating | | Symbol | Value | Unit |
|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 200 | Volts |
| Average Rectified Forward Current<br>(Rated $V_R$) $T_C$ = 125°C | Per Leg<br>Per Package | $I_{F(AV)}$ | 10<br>20 | Amps |
| Peak Repetitive Forward Current, Per Leg<br>(Rated $V_R$, Square Wave, 20 kHz) $T_C$ = 90°C | | $I_{FRM}$ | 20 | Amps |
| Nonrepetitive Peak Surge Current<br>(Surge applied at rated load conditions halfwave, single phase, 60 Hz) | | $I_{FSM}$ | 150 | Amps |
| Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) | | $I_{RRM}$ | 1.0 | Amp |
| Operating Junction Temperature and Storage Temperature | | $T_J$, $T_{stg}$ | –65 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | | dv/dt | 10,000 | V/μs |

**THERMAL CHARACTERISTICS** (Per Leg)

| | | | |
|---|---|---|---|
| Thermal Resistance — Junction to Case | $R_{\theta JC}$ | 3.5 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 10 Amp, $T_C$ = 25°C)<br>($i_F$ = 10 Amp, $T_C$ = 125°C)<br>($i_F$ = 20 Amp, $T_C$ = 25°C)<br>($i_F$ = 20 Amp, $T_C$ = 125°C) | $v_F$ | <br>0.9<br>0.8<br>1.0<br>0.9 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_C$ = 25°C)<br>(Rated dc Voltage, $T_C$ = 125°C) | $i_R$ | <br>1.0<br>50 | mA |

**DYNAMIC CHARACTERISTICS** (Per Leg)

| | | | |
|---|---|---|---|
| Capacitance ($V_R$ = –5.0 V, $T_C$ = 25°C, Freq. = 1.0 MHz) | $C_T$ | 500 | pF |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

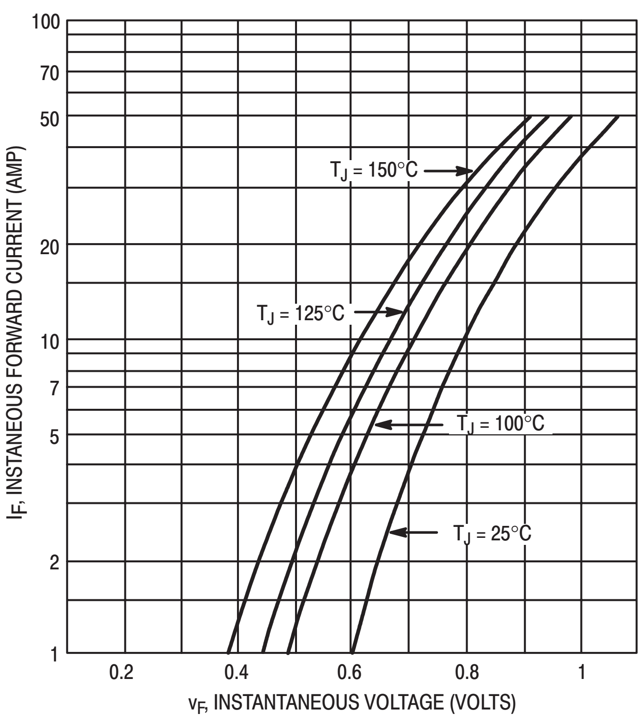



**Figure 1. Typical Forward Voltage (Per Leg)**

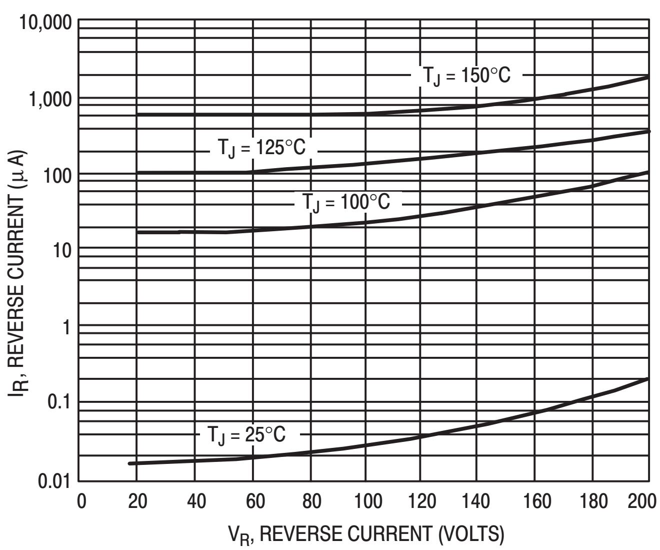



**Figure 2. Typical Reverse Current (Per Leg)**

## TEST CONDITIONS FOR ISOLATION TESTS*

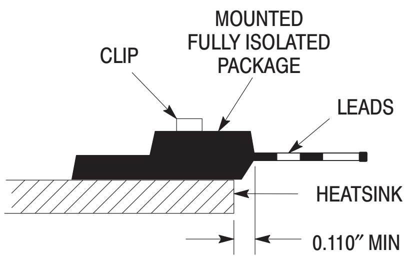



**Figure 3. Clip Mounting Position for Isolation Test Number 1**

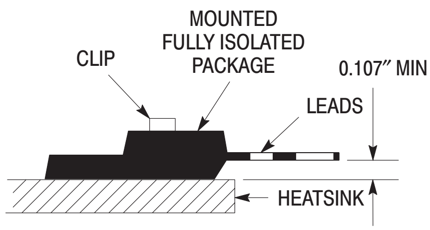



**Figure 4. Clip Mounting Position for Isolation Test Number 2**

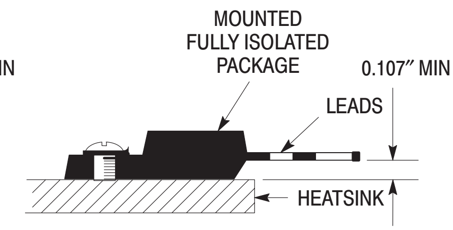
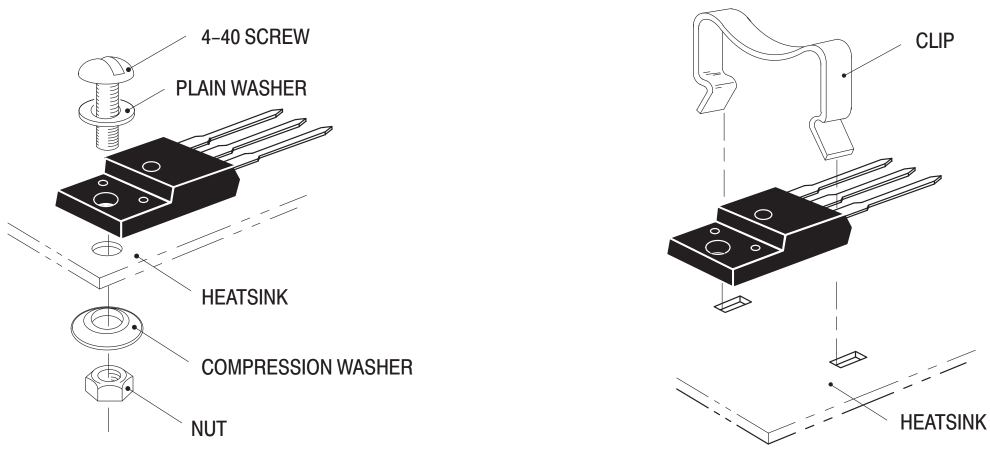



**Figure 5. Screw Mounting Position for Isolation Test Number 3**

* Measurement made between leads and heatsink with all leads shorted together.

## MOUNTING INFORMATION**




**6a. Screw–Mounted** **6b. Clip–Mounted**

**Figure 6. Typical Mounting Techniques**

Laboratory tests on a limited number of samples indicate, when using the screw and compression washer mounting technique, a screw torque of 6 to 8 in · lbs is sufficient to provide maximum power dissipation capability. The compression washer helps to maintain a constant pressure on the package over time and during large temperature excursions.

Destructive laboratory tests show that using a hex head 4–40 screw, without washers, and applying a torque in excess of 20 in · lbs will cause the plastic to crack around the mounting hole, resulting in a loss of isolation capability.

Additional tests on slotted 4–40 screws indicate that the screw slot fails between 15 to 20 in · lbs without adversely affecting the package. However, in order to positively ensure the package integrity of the fully isolated device, ON Semiconductor does not recommend exceeding 10 in · lbs of mounting torque under any mounting conditions.

**For more information about mounting power semiconductors see Application Note AN1040.

# MBRF2545CT

**Preferred Device**

# SWITCHMODE™ Schottky Power Rectifier

The SWITCHMODE Power Rectifier employs the Schottky Barrier principle in a large area metal–to–silicon power diode. State–of–the–art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for use as rectifiers in very low–voltage, high–frequency switching power supplies, free wheeling diodes and polarity protection diodes.

- Highly Stable Oxide Passivated Junction
- Very Low Forward Voltage Drop
- Matched Dual Die Construction
- High Junction Temperature Capability
- High dv/dt Capability
- Excellent Ability to Withstand Reverse Avalanche Energy Transients
- Guardring for Stress Protection
- Epoxy Meets UL94, $V_O$ at 1/8″
- Electrically Isolated. No Isolation Hardware Required.
- UL Recognized File #E69369 (Note 1.)

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: B2545

**MAXIMUM RATINGS**

| Please See the Table on the Following Page |
|---|

1. UL Recognized mounting method is per Figure 4.

ON Semiconductor™

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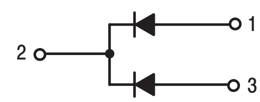
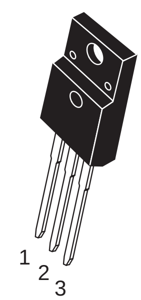
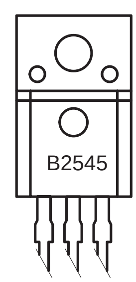
**SCHOTTKY BARRIER RECTIFIER 25 AMPERES 45 VOLTS**




**ISOLATED TO–220 CASE 221D STYLE 3**

**MARKING DIAGRAM**




B2545 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRF2545CT | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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**MAXIMUM RATINGS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 45 | Volts |
| Average Rectified Forward Current<br>(Rated $V_R$), $T_C$ = 125°C Total Device | $I_{F(AV)}$ | 12.5<br>25 | Amps |
| Peak Repetitive Forward Current<br>(Rated $V_R$, Square Wave, 20 kHz), $T_C$ = 125°C | $I_{FRM}$ | 25 | Amps |
| Non–repetitive Peak Surge Current<br>(Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 150 | Amps |
| Peak Repetitive Reverse Surge Current (2.0 µs, 1.0 kHz) | $I_{RRM}$ | 1.0 | Amp |
| Operating Junction and Storage Temperature | $T_J$, $T_{stg}$ | – 65 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10000 | V/µs |
| RMS Isolation Voltage (t = 1.0 second, R.H. ≤ 30%, $T_A$ = 25°C) (Note 2.) Per Figure 3.<br>Per Figure 4. (Note 1.)<br>Per Figure 5. | $V_{iso1}$<br>$V_{iso2}$<br>$V_{iso3}$ | 4500<br>3500<br>1500 | Volts |

**THERMAL CHARACTERISTICS** (Per Leg)

| | | | |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 3.5 | °C/W |
| Maximum Lead Temperature for Soldering Purposes: 1/8″ from Case for 5 Seconds | $T_L$ | 260 | °C |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 3.)<br>($i_F$ = 12.5 Amps, $T_C$ = 25°C)<br>($i_F$ = 12.5 Amps, $T_C$ = 125°C) | $v_F$ | 0.7<br>0.62 | Volts |
| Maximum Instantaneous Reverse Current (Note 3.)<br>(Rated DC Voltage, $T_C$ = 25°C)<br>(Rated DC Voltage, $T_C$ = 125°C) | $i_R$ | 0.2<br>40 | mA |

1. UL Recognized mounting method is per Figure 4.
2. Proper strike and creepage distance must be provided.
3. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%

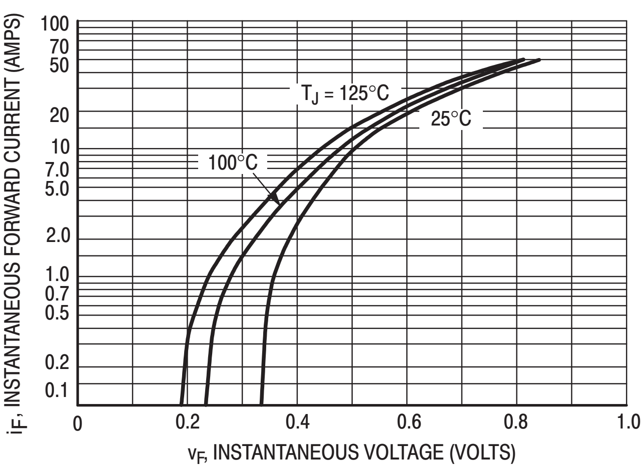



**Figure 1. Typical Forward Voltage, Per Leg**

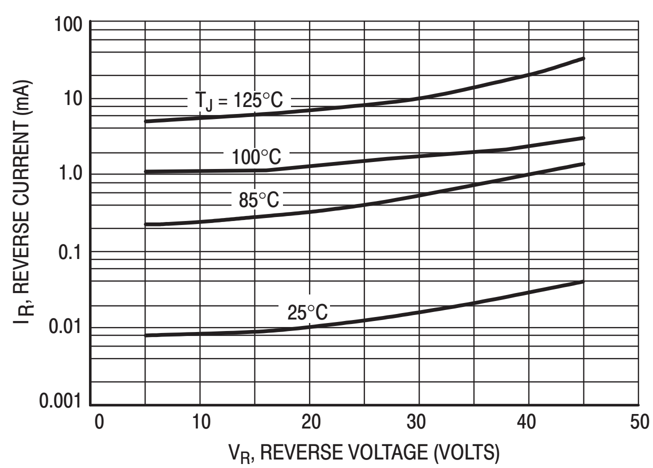



**Figure 2. Typical Reverse Current, Per Leg**

## TEST CONDITIONS FOR ISOLATION TESTS*

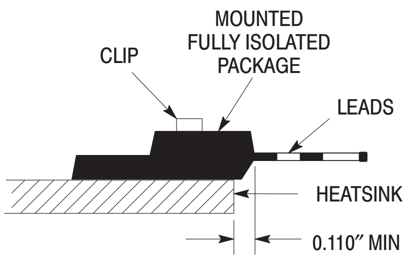



**Figure 3. Clip Mounting Position for Isolation Test Number 1**

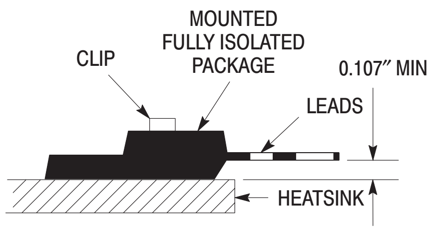



**Figure 4. Clip Mounting Position for Isolation Test Number 2**

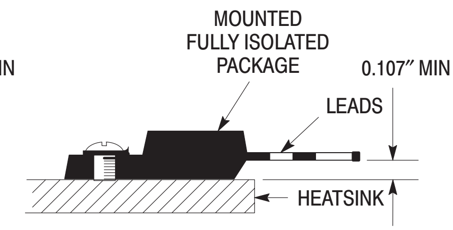
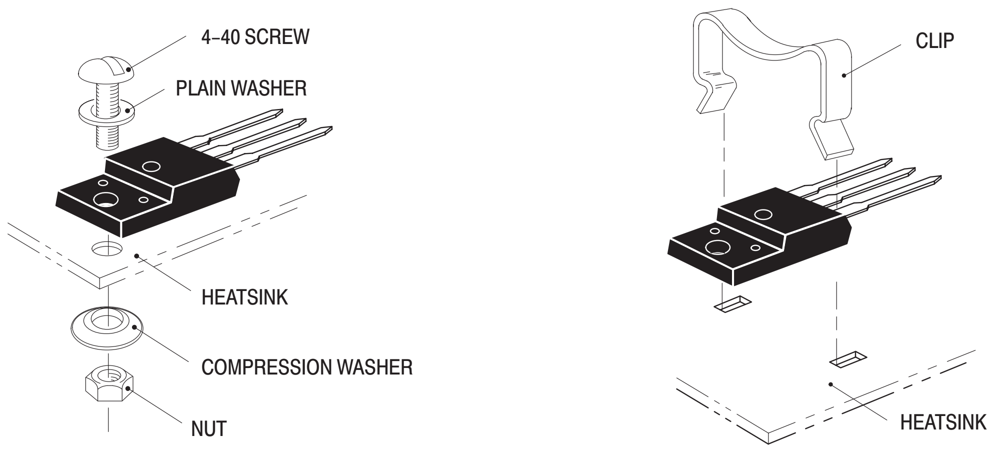



**Figure 5. Screw Mounting Position for Isolation Test Number 3**

* Measurement made between leads and heatsink with all leads shorted together.

## MOUNTING INFORMATION**




**6a. Screw–Mounted** **6b. Clip–Mounted**

**Figure 6. Typical Mounting Techniques**

Laboratory tests on a limited number of samples indicate, when using the screw and compression washer mounting technique, a screw torque of 6 to 8 in · lbs is sufficient to provide maximum power dissipation capability. The compression washer helps to maintain a constant pressure on the package over time and during large temperature excursions.

Destructive laboratory tests show that using a hex head 4–40 screw, without washers, and applying a torque in excess of 20 in · lbs will cause the plastic to crack around the mounting hole, resulting in a loss of isolation capability.

Additional tests on slotted 4–40 screws indicate that the screw slot fails between 15 to 20 in · lbs without adversely affecting the package. However, in order to positively ensure the package integrity of the fully isolated device, ON Semiconductor does not recommend exceeding 10 in · lbs of mounting torque under any mounting conditions.

**For more information about mounting power semiconductors see Application Note AN1040.

# MBR3045PT

**Preferred Device**

# SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Dual Diode Construction — Terminals 1 and 3 may be Connected for Parallel Operation at Full Rating
- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature

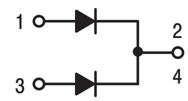
**Mechanical Characteristics:**

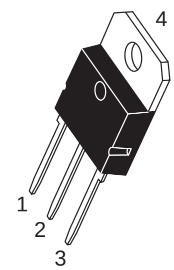
- Case: Epoxy, Molded
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 30 units per plastic tube
- Marking: B3045

**ON Semiconductor™**

**http://onsemi.com**

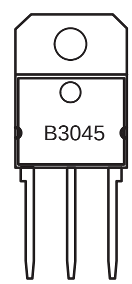
**SCHOTTKY BARRIER RECTIFIER**
**30 AMPERES**
**45 VOLTS**




**SOT–93**
**CASE 340D**
**PLASTIC**

**MARKING DIAGRAM**




B3045 = Device Code

**MAXIMUM RATINGS**

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 45 | V |
| Average Rectified Forward Current<br>(Rated $V_R$, $T_C$ = 105°C) Per Device<br>Per Diode | $I_{F(AV)}$ | <br>30<br>15 | A |
| Peak Repetitive Forward Current,<br>(Rated $V_R$, Square Wave,<br>20 kHz) Per Diode | $I_{FRM}$ | 30 | A |
| Non–Repetitive Peak Surge Current<br>(Surge Applied at Rated Load<br>Conditions Halfwave, Single<br>Phase, 60 Hz) | $I_{FSM}$ | 200 | A |
| Peak Repetitive Reverse Current<br>(2.0 μs, 1.0 kHz) Per Diode<br>See Figure 6. | $I_{RRM}$ | 2.0 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +175 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +150 | °C |
| Peak Surge Junction Temperature<br>(Forward Current Applied) | $T_{J(pk)}$ | 175 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/μs |

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR3045PT | SOT–93 | 30 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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## THERMAL CHARACTERISTICS PER DIODE

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.4 | °C/W |
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 40 | °C/W |

## ELECTRICAL CHARACTERISTICS PER DIODE

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 20 Amps, $T_C$ = 125°C)<br>($i_F$ = 30 Amps, $T_C$ = 125°C)<br>($i_F$ = 30 Amps, $T_C$ = 25°C) | $v_F$ | <br>0.60<br>0.72<br>0.76 | Volts |
| Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_C$ = 125°C)<br>(Rated dc Voltage, $T_C$ = 25°C) | $i_R$ | <br>100<br>1.0 | mA |

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

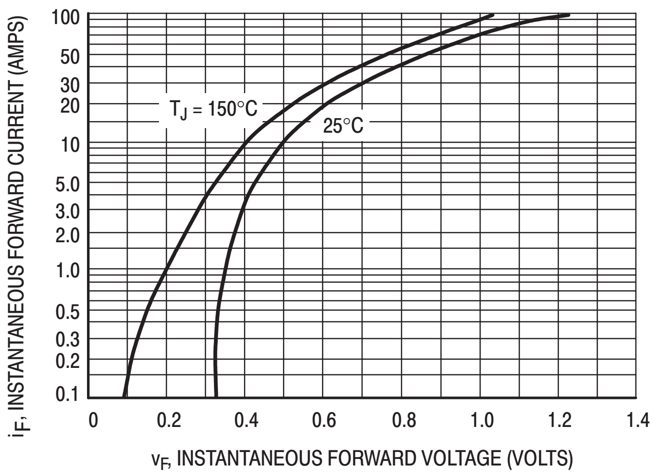



**Figure 1. Typical Forward Voltage**

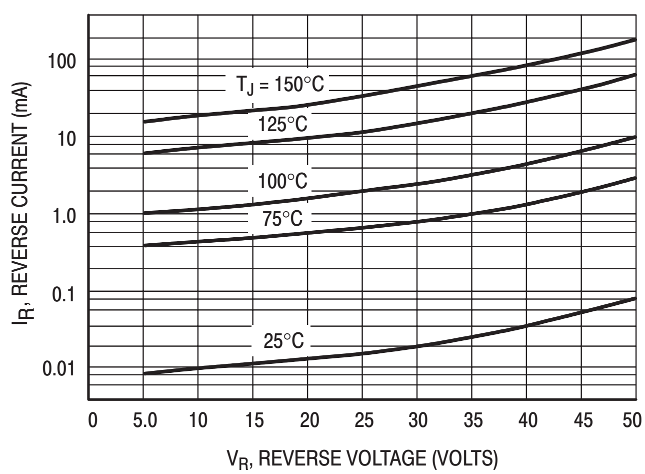



**Figure 2. Typical Reverse Current**

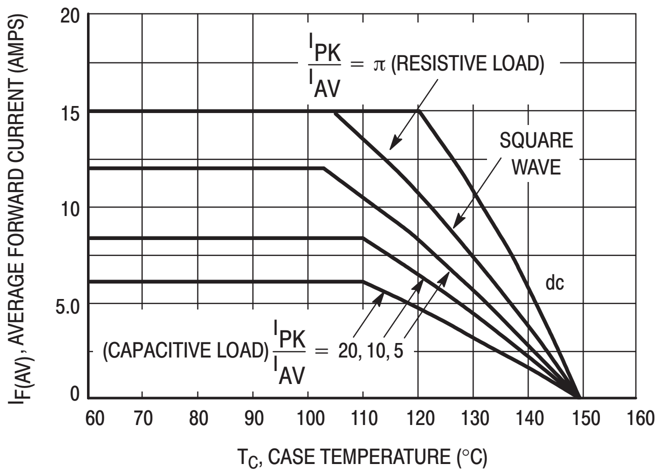



Figure 3. Current Derating (Per Leg)

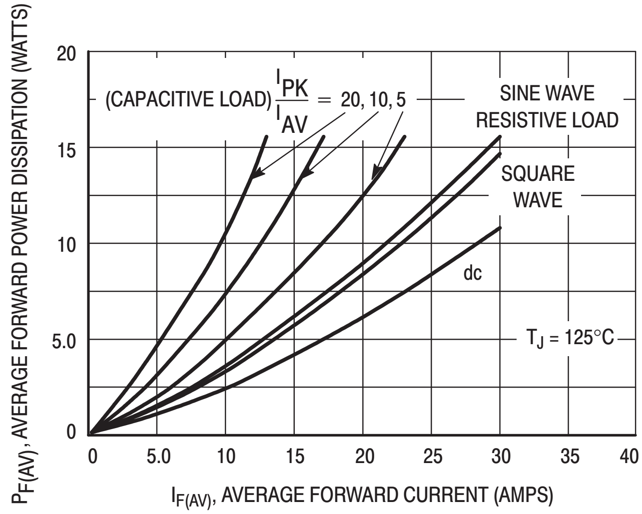



Figure 4. Forward Power Dissipation (Per Leg)

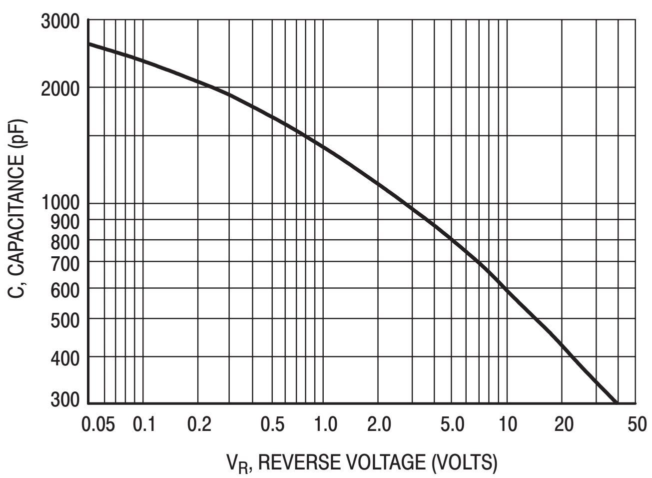



Figure 5. Capacitance

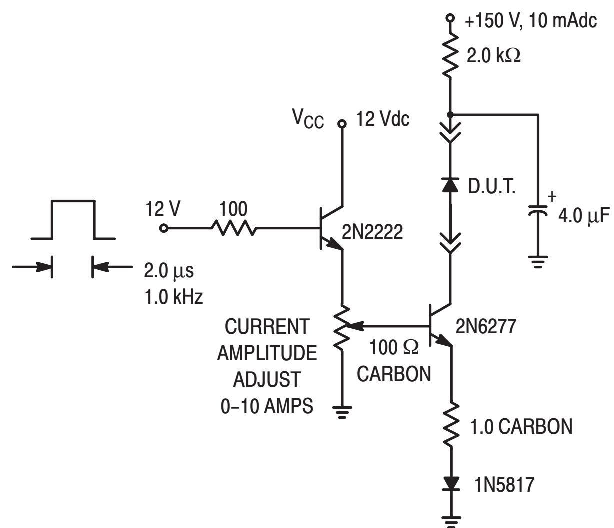



Figure 6. Test Circuit for Repetitive Reverse Current

# MBR4045PT

# SWITCHMODE™ Power Rectifier

The SWITCHMODE power rectifier employs the use of the Schottky Barrier principle with a Platinum barrier metal. This state-of-the-art device has the following features:

- Dual Diode Construction — Terminals 1 and 3 May Be Connected for Parallel Operation at Full Rating
- 45 Volt Blocking Voltage
- Low Forward Voltage Drop
- Guardring for Stress Protection and High dv/dt Capability (> 10 V/ns)
- 150°C Operating Junction Temperature

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 30 Units Per Plastic Tube
- Marking: B4045

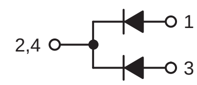
**MAXIMUM RATINGS**

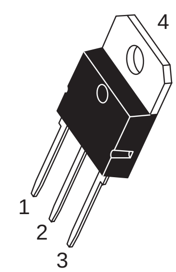
| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 45 | V |
| Average Rectified Forward Current<br>(Rated $V_R$, $T_C$ = 125°C) Per Diode<br>Per Device | $I_{F(AV)}$ | <br>20<br>40 | A |
| Peak Repetitive Forward Current,<br>(Rated $V_R$, Square Wave, 20 kHz<br>@ $T_C$ = 90°C) Per Diode | $I_{FRM}$ | 40 | A |
| Non–Repetitive Peak Surge Current<br>(Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 400 | A |
| Peak Repetitive Reverse Current<br>(2.0 μs, 1.0 kHz) | $I_{RRM}$ | 2.0 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +175 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +150 | °C |
| Peak Surge Junction Temperature<br>(Forward Current Applied) | $T_{J(pk)}$ | 175 | °C |
| Voltage Rate of Change | dv/dt | 10,000 | V/μs |

ON Semiconductor™

http://onsemi.com

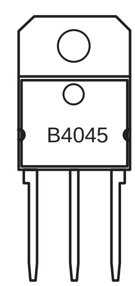
**SCHOTTKY BARRIER RECTIFIER**
**40 AMPERES**
**45 VOLTS**




**SOT–93**
**CASE 340D**
**STYLE 2**

**MARKING DIAGRAM**




B4045 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR4045PT | SOT–93 | 30 Units/Rail |

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### THERMAL CHARACTERISTICS

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case | $R_{\theta JC}$ | 1.4 | °C/W |

### ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.)<br>@ $I_F$ = 20 Amps, $T_C$ = 25°C<br>@ $I_F$ = 20 Amps, $T_C$ = 125°C<br>@ $I_F$ = 40 Amps, $T_C$ = 25°C<br>@ $I_F$ = 40 Amps, $T_C$ = 125°C | $V_F$ | <br>0.70<br>0.60<br>0.80<br>0.75 | Volts |
| Instantaneous Reverse Current (Note 1.)<br>@ Rated DC Voltage, $T_C$ = 25°C<br>@ Rated DC Voltage, $T_C$ = 100°C | $I_R$ | <br>1.0<br>50 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

### TYPICAL ELECTRICAL CHARACTERISTICS

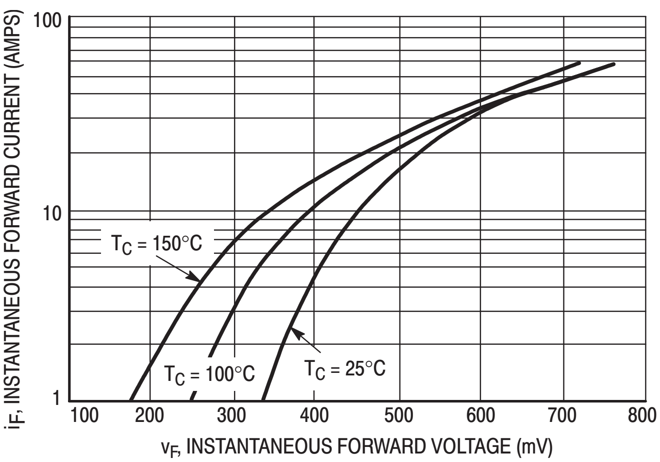


**Figure 1. Typical Forward Voltage**

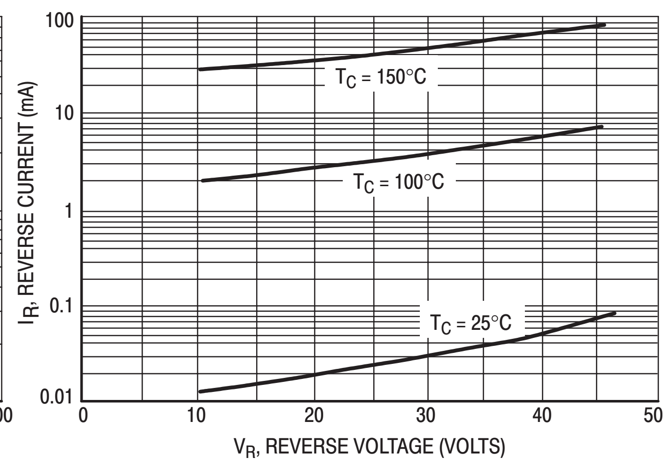


**Figure 2. Typical Reverse Current**

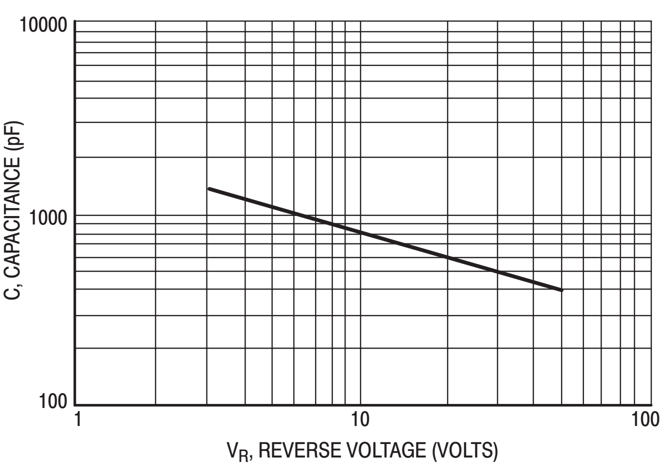


**Figure 3. Typical Capacitance Per Leg**

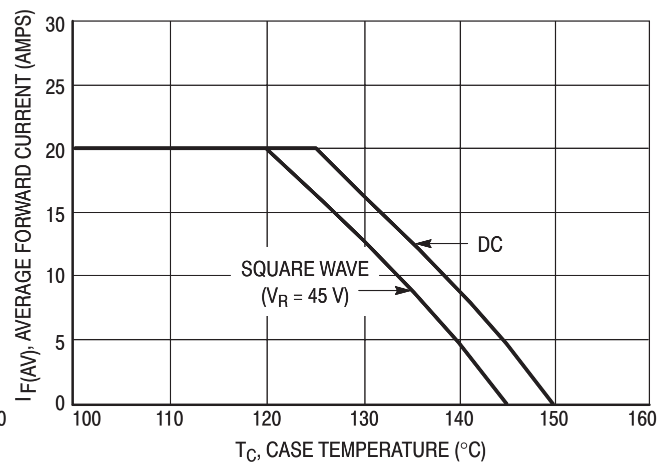


**Figure 4. Current Derating Per Leg**

# MBR6045PT

# SWITCHMODE™ Power Rectifier

The SWITCHMODE power rectifier employs the use of the Schottky Barrier principle with a Platinum barrier metal. This state-of-the-art device has the following features:

- Dual Diode Construction — Terminals 1 and 3 May Be Connected for Parallel Operation at Full Rating
- 45 Volt Blocking Voltage
- Low Forward Voltage Drop
- Guardring for Stress Protection and High dv/dt Capability (> 10 V/ns)
- 150°C Operating Junction Temperature

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 30 Units Per Plastic Tube
- Marking: B6045

**MAXIMUM RATINGS**

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 45 | V |
| Average Rectified Forward Current<br>(Rated $V_R$, $T_C$ = 125°C) Per Diode<br>Per Device | $I_{F(AV)}$ | <br>30<br>60 | A |
| Peak Repetitive Forward Current,<br>(Rated $V_R$, Square Wave, 20 kHz<br>@ $T_C$ = 90°C) Per Diode | $I_{FRM}$ | 60 | A |
| Non–Repetitive Peak Surge Current<br>(Surge Applied at Rated Load<br>Conditions Halfwave, Single<br>Phase, 60 Hz) | $I_{FSM}$ | 500 | A |
| Peak Repetitive Reverse Current<br>(2.0 μs, 1.0 kHz) | $I_{RRM}$ | 2.0 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +175 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +150 | °C |
| Peak Surge Junction Temperature<br>(Forward Current Applied) | $T_{J(pk)}$ | 175 | °C |
| Voltage Rate of Change | dv/dt | 10,000 | V/μs |

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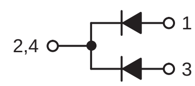
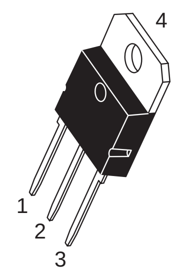
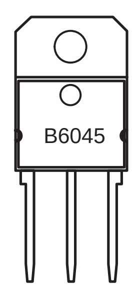
**SCHOTTKY BARRIER RECTIFIER 60 AMPERES 45 VOLTS**




**SOT–93**
**CASE 340D**
**STYLE 2**

**MARKING DIAGRAM**




B6045 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR6045PT | SOT–93 | 30 Units/Rail |

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### THERMAL CHARACTERISTICS

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case | $R_{\theta JC}$ | 1.0 | °C/W |

### ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.)<br>@ $I_F$ = 30 Amps, $T_C$ = 25°C<br>@ $I_F$ = 30 Amps, $T_C$ = 125°C<br>@ $I_F$ = 60 Amps, $T_C$ = 25°C | $V_F$ | <br>0.62<br>0.55<br>0.75 | Volts |
| Instantaneous Reverse Current (Note 1.)<br>@ Rated DC Voltage, $T_C$ = 25°C<br>@ Rated DC Voltage, $T_C$ = 100°C | $I_R$ | <br>1.0<br>50 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

## TYPICAL ELECTRICAL CHARACTERISTICS

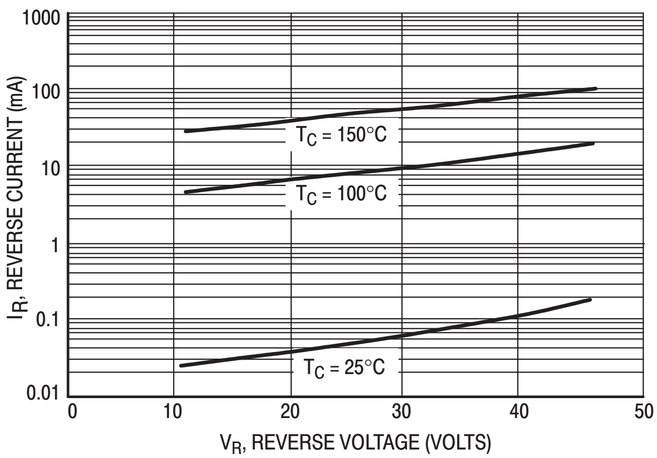


Figure 1. Typical Reverse Current

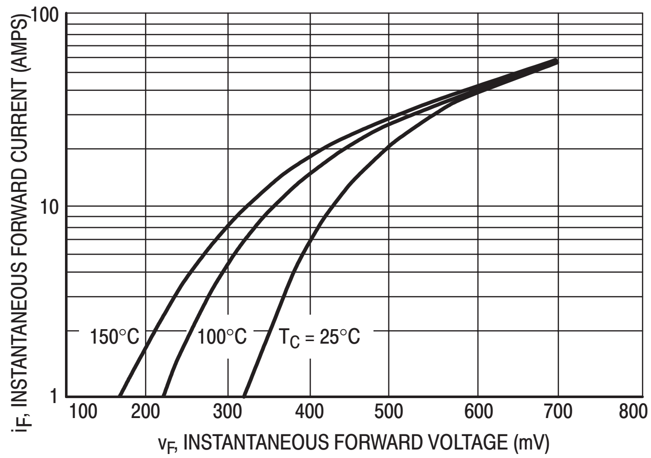


Figure 2. Typical Forward Voltage

# MBR5025L

**Preferred Device**

# SWITCHMODE™ Power Rectifier

The SWITCHMODE power rectifier employs the use of the Schottky Barrier principle with a Platinum barrier metal. This state-of-the-art device has the following features:

- Very Low Forward Voltage Drop (Max 0.58 V @ 100°C)
- Guardring for Stress Protection and High dv/dt Capability (> 10 V/ns)
- 150°C Operating Junction Temperature
- Specially Designed for SWITCHMODE Power Supplies with Operating Frequency up to 300 kHz

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 30 Units Per Plastic Tube
- Marking: B5025L

**MAXIMUM RATINGS**

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 25 | V |
| Average Rectified Forward Current<br>$T_C$ = 125°C | $I_{F(AV)}$ | 50 | A |
| Peak Repetitive Forward Current,<br>(Rated $V_R$, Square Wave, 20 kHz<br>@ $T_C$ = 90°C) Per Diode | $I_{FRM}$ | 150 | A |
| Non–Repetitive Peak Surge Current<br>(Surge Applied at Rated Load<br>Conditions Halfwave, Single<br>Phase, 60 Hz) | $I_{FSM}$ | 300 | A |
| Peak Repetitive Reverse Current<br>(2.0 µs, 1.0 kHz) | $I_{RRM}$ | 2.0 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +175 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +150 | °C |
| Peak Surge Junction Temperature<br>(Forward Current Applied) | $T_{J(pk)}$ | 175 | °C |
| Voltage Rate of Change | dv/dt | 10,000 | V/µs |

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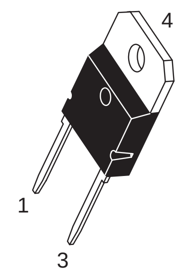
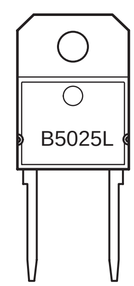
**SCHOTTKY BARRIER RECTIFIER LOW $V_F$ 50 AMPERES 25 VOLTS**


**TO–218 CASE 340E STYLE 1**

**MARKING DIAGRAM**




B5025L = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR5025L | TO–218 | 30 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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### THERMAL CHARACTERISTICS

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case | $R_{\theta JC}$ | 0.75 | °C/W |

### ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.)<br>@ $I_F$ = 50 Amps, $T_C$ = 25°C<br>@ $I_F$ = 50 Amps, $T_C$ = 125°C<br>@ $I_F$ = 30 Amps, $T_C$ = 25°C | $V_F$ | <br>0.62<br>0.58<br>0.54 | Volts |
| Instantaneous Reverse Current (Note 1.)<br>@ Rated DC Voltage, $T_C$ = 25°C<br>@ Rated DC Voltage, $T_C$ = 100°C | $I_R$ | <br>0.5<br>60 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

## TYPICAL ELECTRICAL CHARACTERISTICS

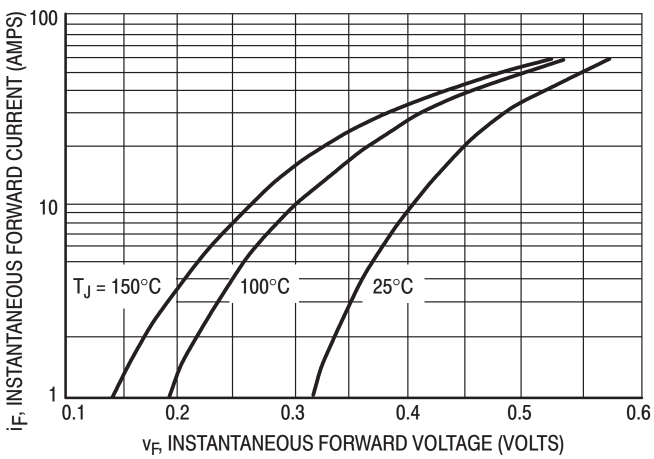


**Figure 1. Typical Forward Voltage**

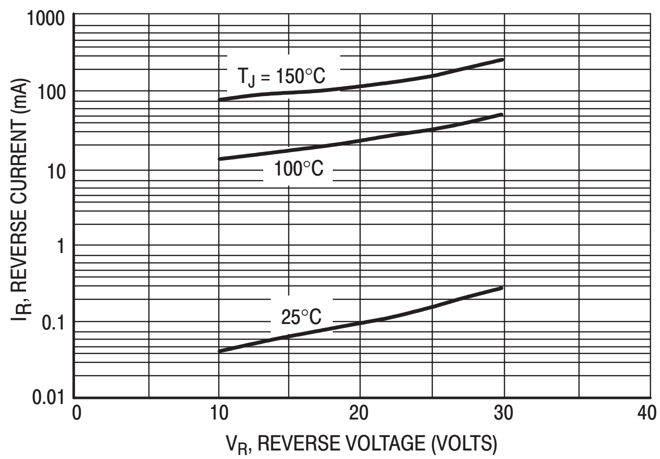


**Figure 2. Typical Reverse Current**

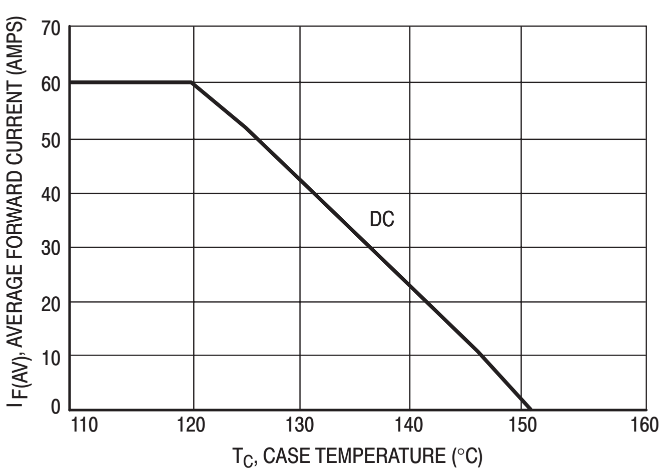


**Figure 3. Current Derating, Case**

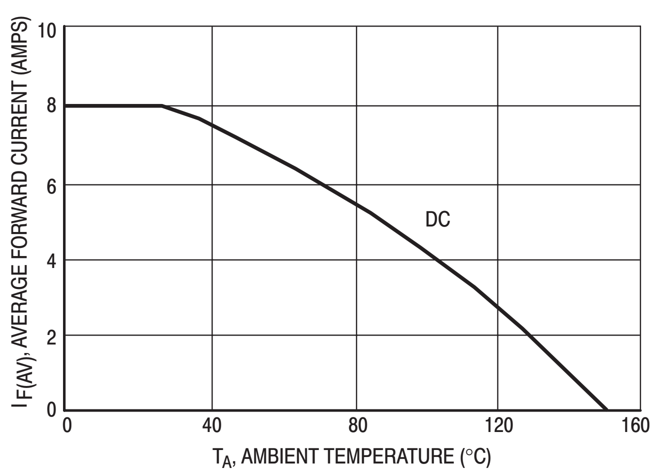


**Figure 4. Current Derating, Ambient**

# MBR3045WT

**Preferred Device**

# SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Dual Diode Construction — Terminals 1 and 3 may be Connected for Parallel Operation at Full Rating
- Guardring for Stress Protection
- Low Forward Voltage
- 150°C Operating Junction Temperature
- Popular TO–247 Package

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 30 units per plastic tube
- Marking: B3045

**MAXIMUM RATINGS**

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 45 | V |
| Average Rectified Forward Current<br>(Rated $V_R$, $T_C$ = 105°C) Per Device<br>Per Diode | $I_{F(AV)}$ | <br>30<br>15 | A |
| Peak Repetitive Forward Current,<br>(Rated $V_R$, Square Wave,<br>20 kHz) Per Diode | $I_{FRM}$ | 30 | A |
| Non–Repetitive Peak Surge Current<br>(Surge Applied at Rated Load<br>Conditions Halfwave, Single<br>Phase, 60 Hz) | $I_{FSM}$ | 200 | A |
| Peak Repetitive Reverse Current<br>(2.0 μs, 1.0 kHz) Per Diode<br>See Figure 6. | $I_{RRM}$ | 2.0 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +175 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +150 | °C |
| Peak Surge Junction Temperature<br>(Forward Current Applied) | $T_{J(pk)}$ | 175 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/μs |

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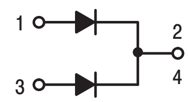
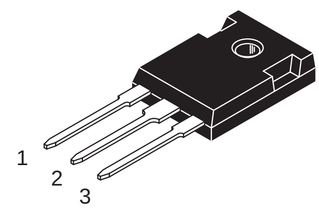
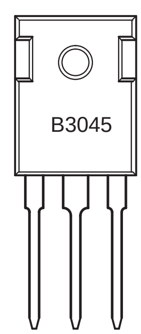
**SCHOTTKY BARRIER RECTIFIER 30 AMPERES 45 VOLTS**




**TO–247 CASE 340L PLASTIC**

**MARKING DIAGRAM**




B3045 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR3045WT | TO–247 | 30 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS** (Per Diode)

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case<br>— Junction to Ambient | $R_{\theta JC}$<br>$R_{\theta JA}$ | 1.4<br>40 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Diode)

| | | | |
|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 20 Amps, $T_C$ = 125°C)<br>($i_F$ = 30 Amps, $T_C$ = 125°C)<br>($i_F$ = 30 Amps, $T_C$ = 25°C) | $v_F$ | <br>0.6<br>0.72<br>0.76 | Volts |
| Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_C$ = 125°C)<br>(Rated dc Voltage, $T_C$ = 25°C) | $i_R$ | <br>100<br>1.0 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

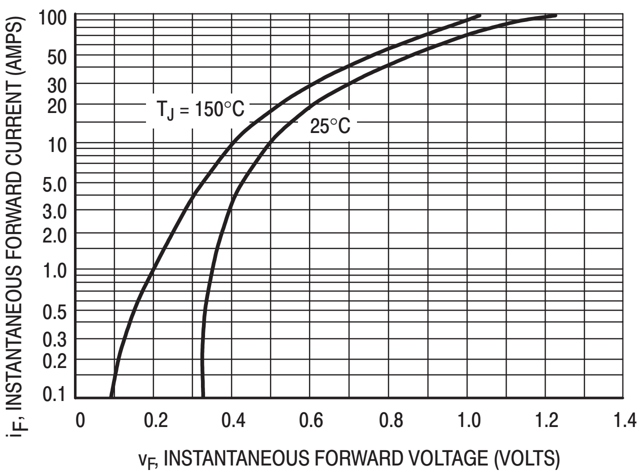


**Figure 1. Typical Forward Voltage**

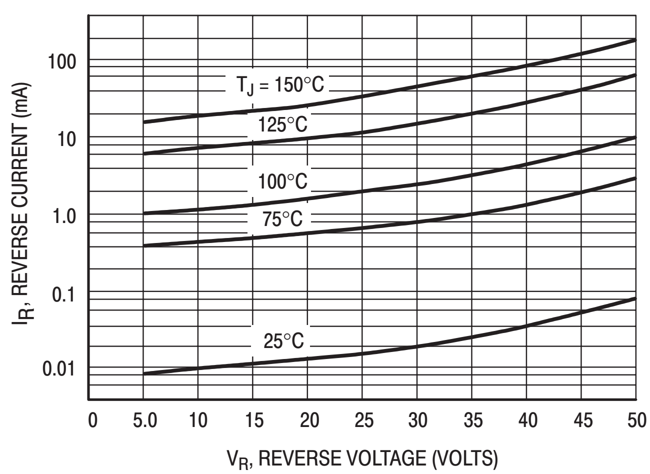


**Figure 2. Typical Reverse Current**

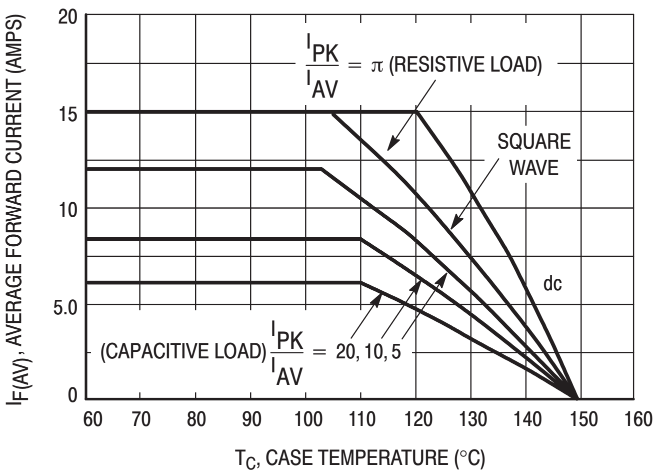


**Figure 3. Current Derating (Per Leg)**

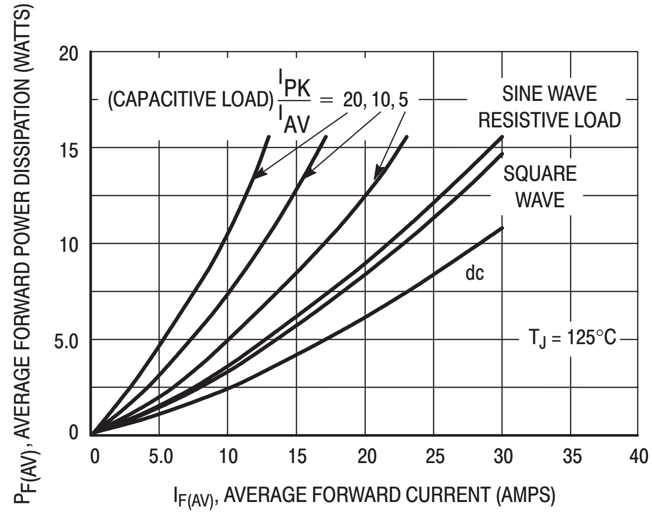


**Figure 4. Forward Power Dissipation (Per Leg)**

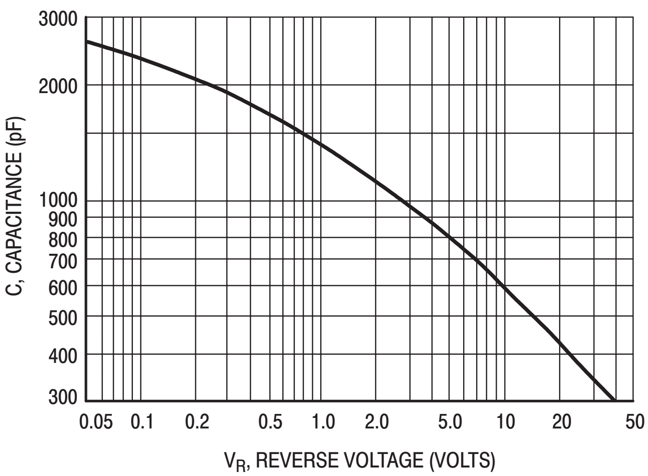


**Figure 5. Capacitance**

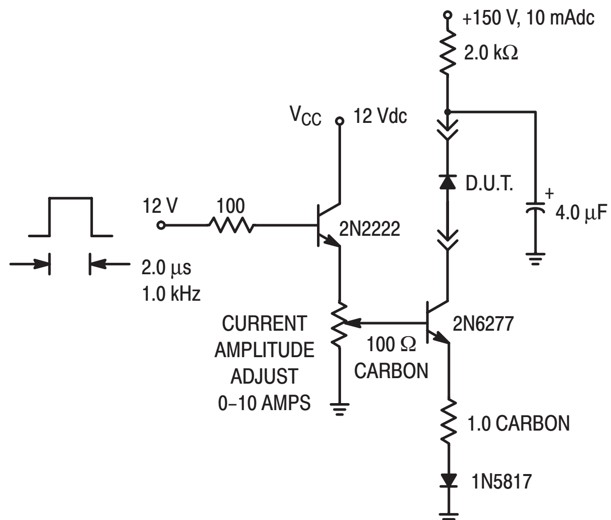


**Figure 6. Test Circuit for Repetitive Reverse Current**

# MBR4015LWT

# SWITCHMODE™ Schottky Power Rectifier

## TO247 Power Package

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power rectifier. Features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency switching power supplies; free wheeling diodes and polarity protection diodes.

- Highly Stable Oxide Passivated Junction
- Guardring for Over–Voltage Protection
- Low Forward Voltage Drop
- Monolithic Dual Die Construction. May Be Paralleled for High Current Output.
- Full Electrical Isolation without Additional Hardware

**Mechanical Characteristics:**

- Case: Molded Epoxy
- Epoxy Meets UL94, $V_O$ at 1/8″
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 30 Units Per Plastic Tube
- Marking: B4015L

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 15 | V |
| Average Rectified Forward Current (At Rated $V_R$, $T_C$ = 95°C) Per Leg<br>Per Package | $I_O$ | 20<br>40 | A |
| Peak Repetitive Forward Current, (At Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 95°C) Per Leg | $I_{FRM}$ | 40 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) Per Package | $I_{FSM}$ | 120 | A |
| Storage/Operating Case Temperature | $T_{stg}$, $T_C$ | –55 to +100 | °C |
| Operating Junction Temperature | $T_J$ | –55 to +100 | °C |
| Voltage Rate of Change (Rated $V_R$, $T_J$ = 25°C) | dv/dt | 10,000 | V/µs |

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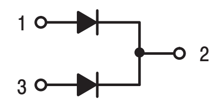
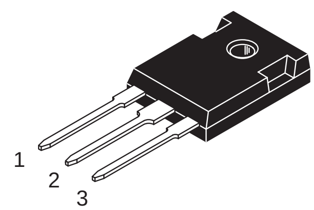
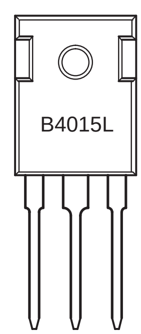
**SCHOTTKY BARRIER RECTIFIER**
**40 AMPERES**
**15 VOLTS**




**TO–247**
**CASE 340L**
**STYLE 2**

**MARKING DIAGRAM**




B4015L = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR4015LWT | TO–247 | 30 Units/Rail |

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### THERMAL CHARACTERISTICS

| Rating | | Symbol | Value | Unit |
|---|---|---|---|---|
| Thermal Resistance — Junction–to–Case<br>— Junction–to–Ambient | Per Leg<br>Per Leg | $R_{\theta JC}$<br>$R_{\theta JA}$ | 0.57<br>55 | °C/W |

### ELECTRICAL CHARACTERISTICS

| | | | | | |
|---|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.), See Figure 2. | Per Leg | $V_F$ | **$T_J$ = 25°C** | **$T_J$ = 100°C** | V |
| ($I_F$ = 20 A)<br>($I_F$ = 40 A) | | | 0.42<br>0.50 | 0.36<br>0.48 | |
| Maximum Instantaneous Reverse Current (Note 1.), See Figure 4. | Per Leg | $I_R$ | **$T_J$ = 25°C** | **$T_J$ = 100°C** | mA |
| ($V_R$ = 15 V)<br>($V_R$ = 7.5 V) | | | 5.0<br>2.7 | 530<br>370 | |

1. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2%.

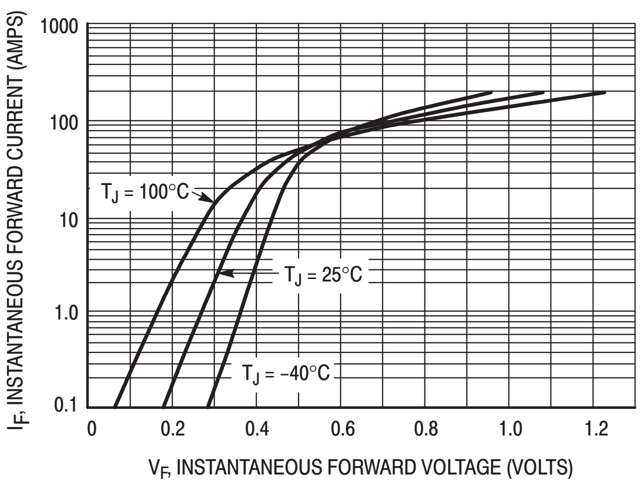


**Figure 1. Typical Forward Voltage Per Leg**

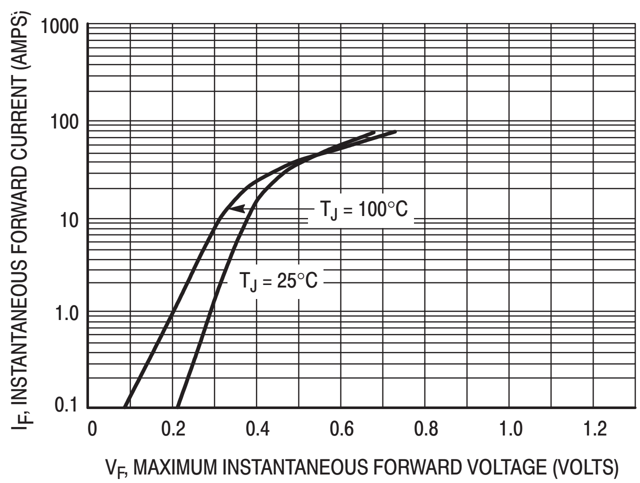


**Figure 2. Maximum Forward Voltage Per Leg**

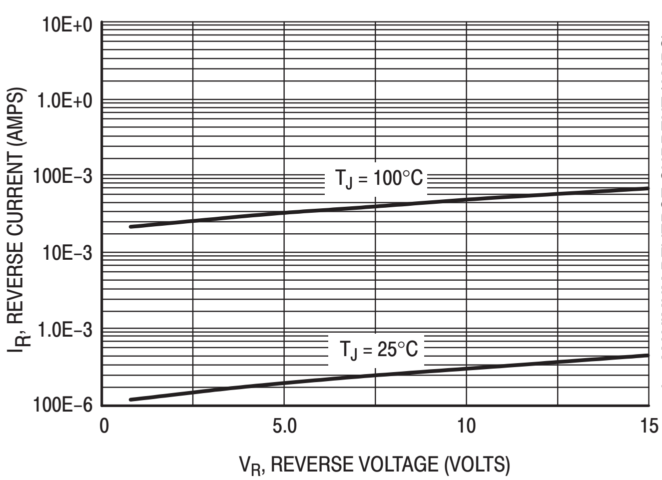


**Figure 3. Typical Reverse Current Per Leg**

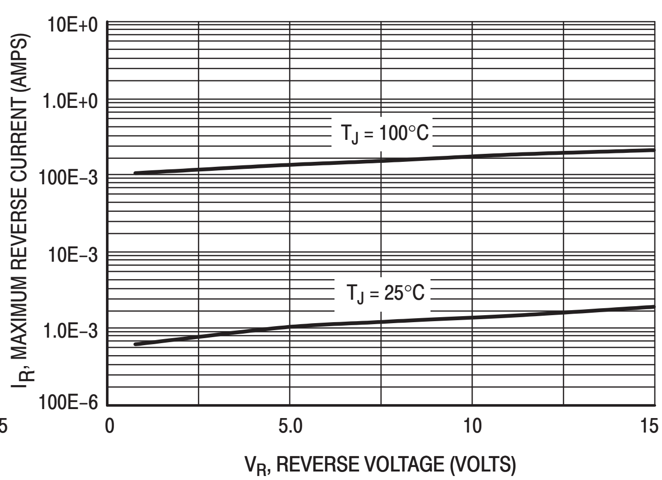


**Figure 4. Maximum Reverse Current Per Leg**

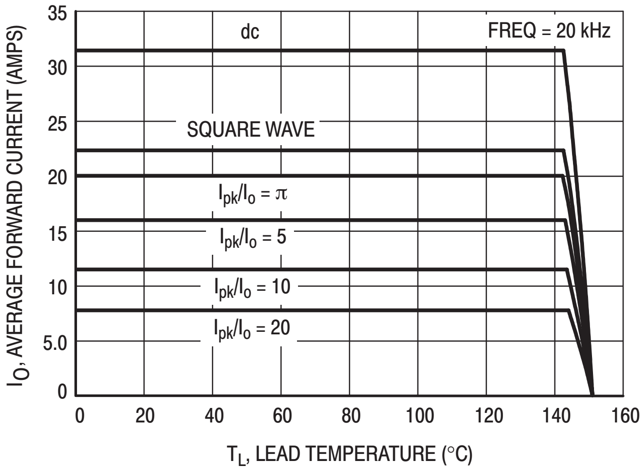


**Figure 5. Current Derating Per Leg**

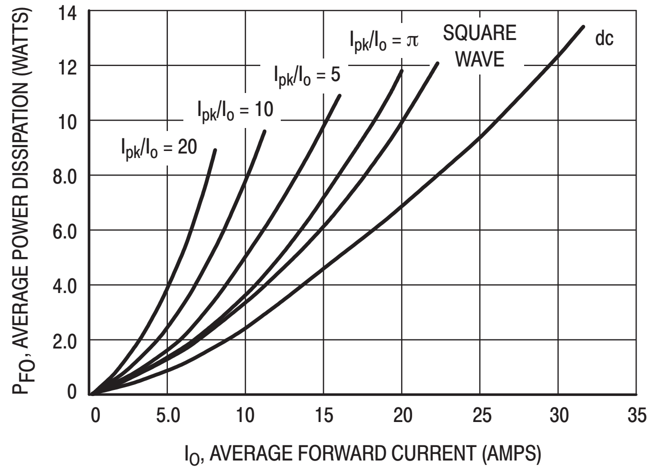


**Figure 6. Forward Power Dissipation Per Leg**

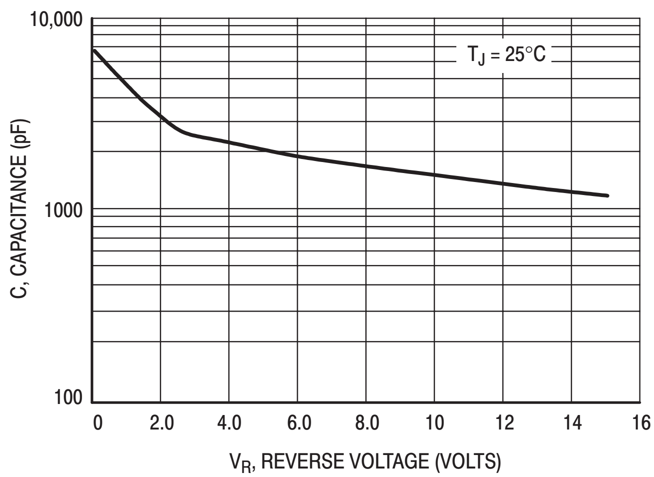


**Figure 7. Capacitance Per Leg**

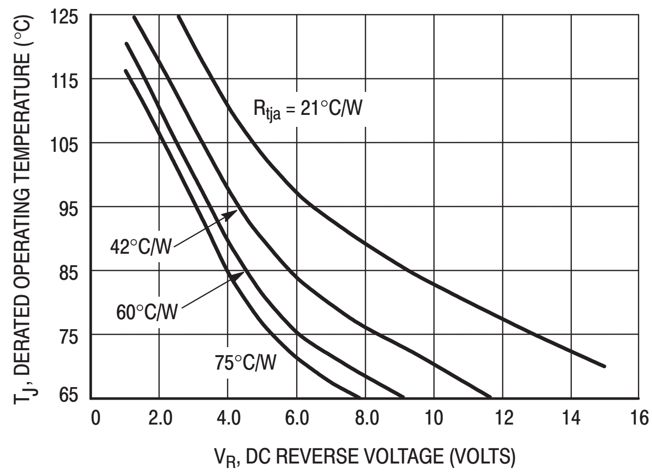


**Figure 8. Typical Operating Temperature Derating Per Leg***

* Reverse power dissipation and the possibility of thermal runaway must be considered when operating this device under any reverse voltage conditions. Calculations of $T_J$ therefore must include forward and reverse power effects. The allowable operating $T_J$ may be calculated from the equation: $T_J = T_{Jmax} – r(t)(Pf + Pr)$ where
r(t) = thermal impedance under given conditions,
Pf = forward power dissipation, and
Pr = reverse power dissipation

This graph displays the derated allowable $T_J$ due to reverse bias under DC conditions only and is calculated as $T_J = T_{Jmax} – r(t)Pr$, where r(t) = Rthja. For other power applications further calculations must be performed.

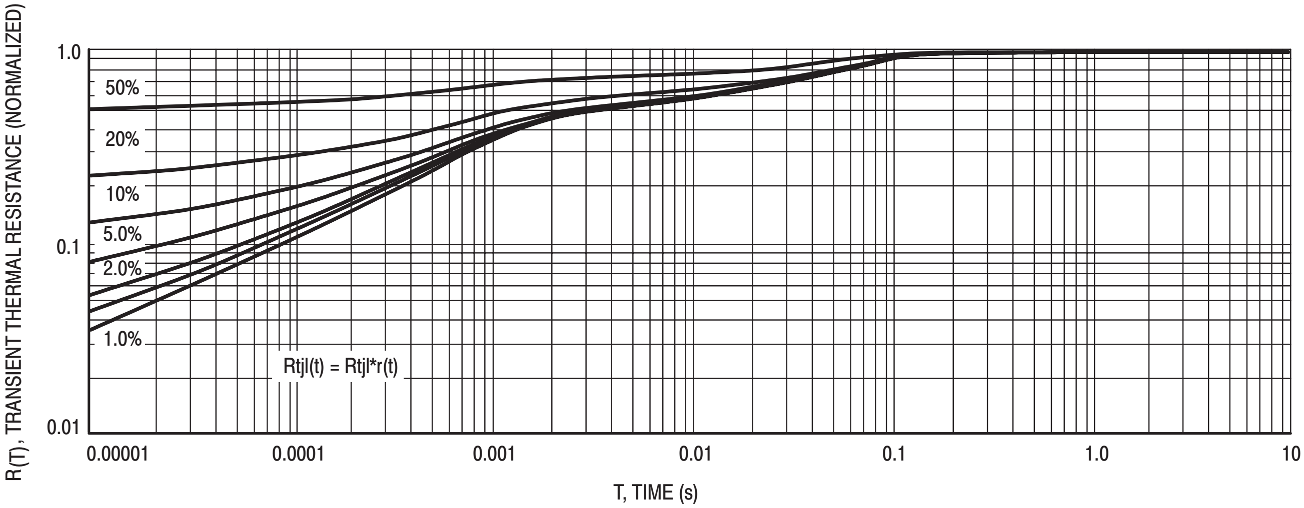


**Figure 9. Thermal Response Junction to Lead (Per Leg)**

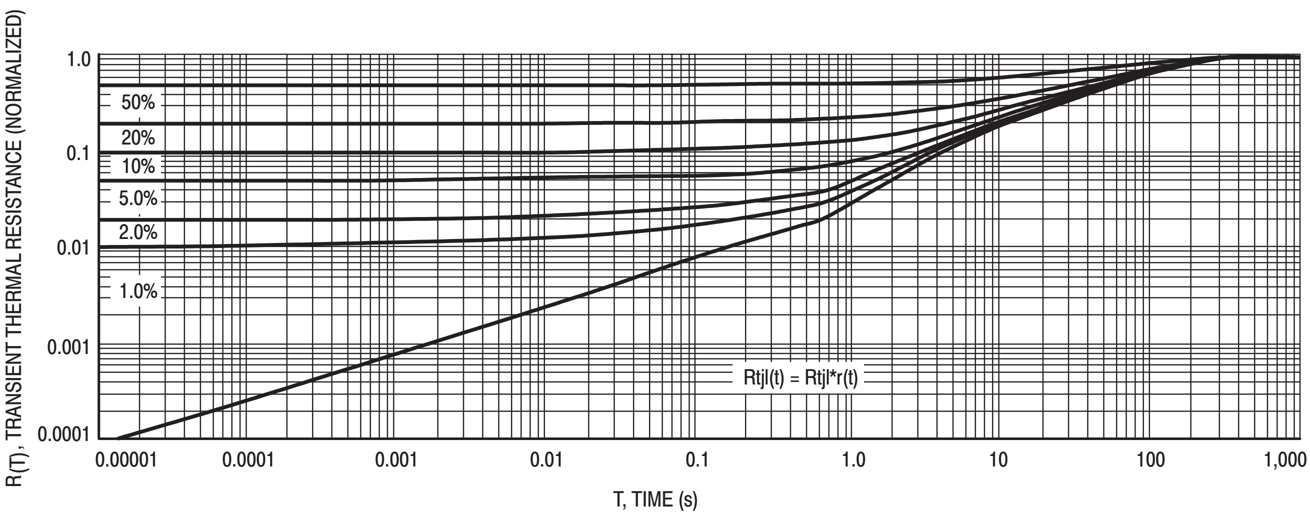


**Figure 10. Thermal Response Junction to Ambient (Per Leg)**

# MBR4045WT

# SWITCHMODE™ Power Rectifier

The SWITCHMODE power rectifier employs the use of the Schottky Barrier principle with a Platinum barrier metal. This state-of-the-art device has the following features:

- Dual Diode Construction — Terminals 1 and 3 May Be Connected for Parallel Operation at Full Rating
- 45 Volt Blocking Voltage
- Low Forward Voltage Drop
- Guardring for Stress Protection and High dv/dt Capability (> 10 V/ns)
- 150°C Operating Junction Temperature

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 30 Units Per Plastic Tube
- Marking: B4045

**MAXIMUM RATINGS**

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 45 | V |
| Average Rectified Forward Current<br>(Rated $V_R$, $T_C$ = 125°C) Per Diode<br>Per Device | $I_{F(AV)}$ | <br>20<br>40 | A |
| Peak Repetitive Forward Current,<br>(Rated $V_R$, Square Wave,<br>20 kHz, $T_C$ = 90°C) Per Diode | $I_{FRM}$ | 40 | A |
| Non–Repetitive Peak Surge Current<br>(Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 400 | A |
| Peak Repetitive Reverse Current<br>(2.0 μs, 1.0 kHz) | $I_{RRM}$ | 2.0 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +175 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +150 | °C |
| Peak Surge Junction Temperature<br>(Forward Current Applied) | $T_{J(pk)}$ | 175 | °C |
| Voltage Rate of Change | dv/dt | 10,000 | V/μs |

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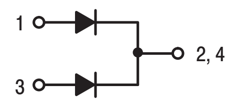
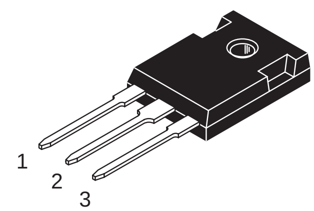
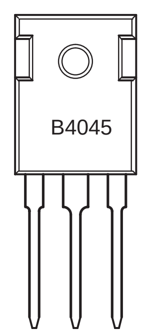
**SCHOTTKY BARRIER RECTIFIER**
**40 AMPERES**
**45 VOLTS**




**TO–247AC**
**CASE 340L**
**STYLE 2**

**MARKING DIAGRAM**




B4045 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR4045WT | TO–247 | 30 Units/Rail |

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**THERMAL CHARACTERISTICS** (Per Diode)

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case | $R_{\theta JC}$ | 1.4 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Diode)

| | | | |
|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.)<br>@ $I_F$ = 20 Amps, $T_C$ = 25°C<br>@ $I_F$ = 20 Amps, $T_C$ = 125°C<br>@ $I_F$ = 40 Amps, $T_C$ = 25°C<br>@ $I_F$ = 40 Amps, $T_C$ = 125°C | $V_F$ | <br>0.70<br>0.60<br>0.80<br>0.75 | Volts |
| Instantaneous Reverse Current (Note 1.)<br>@ Rated DC Voltage, $T_C$ = 25°C<br>@ Rated DC Voltage, $T_C$ = 100°C | $I_R$ | <br>1.0<br>50 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle < 2.0%

## TYPICAL ELECTRICAL CHARACTERISTICS

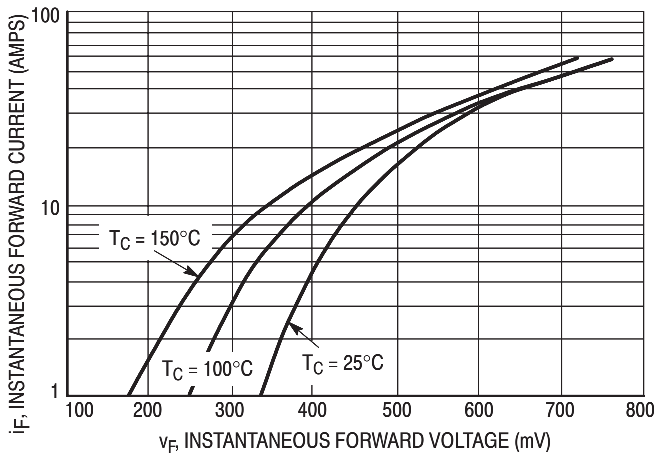


**Figure 1. Typical Forward Voltage**

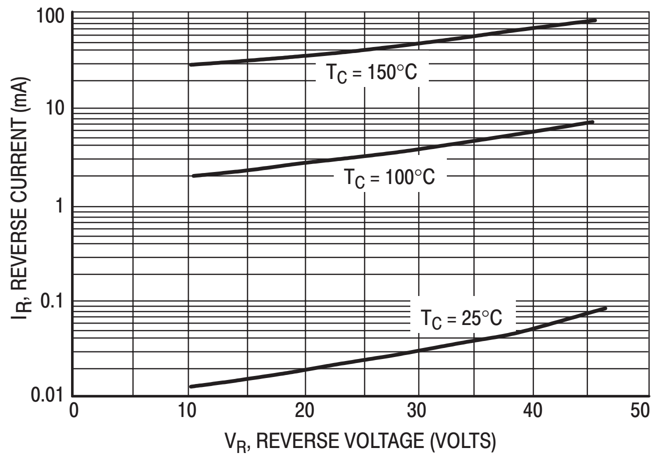


**Figure 2. Typical Reverse Current**

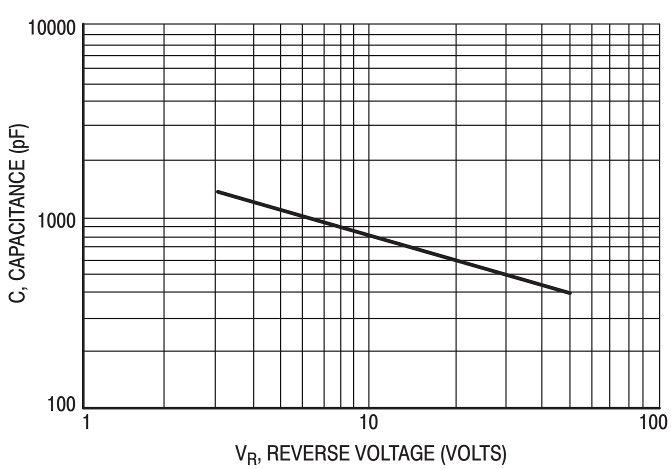


**Figure 3. Typical Capacitance Per Leg**

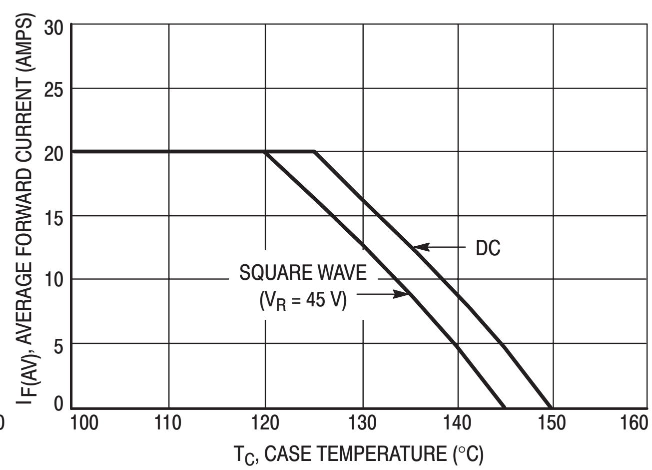


**Figure 4. Current Derating Per Leg**

# MBR6045WT

# SWITCHMODE™ Power Rectifier

The SWITCHMODE power rectifier employs the use of the Schottky Barrier principle with a Platinum barrier metal. This state-of-the-art device has the following features:

- Dual Diode Construction — Terminals 1 and 3 May Be Connected for Parallel Operation at Full Rating
- 45 Volt Blocking Voltage
- Low Forward Voltage Drop
- Guardring for Stress Protection and High dv/dt Capability (> 10 V/ns)
- 150°C Operating Junction Temperature

### Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 30 Units Per Plastic Tube
- Marking: B6045

### MAXIMUM RATINGS

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 45 | V |
| Average Rectified Forward Current<br>(Rated $V_R$, $T_C$ = 125°C) Per Diode<br>Per Device | $I_{F(AV)}$ | <br>30<br>60 | A |
| Peak Repetitive Forward Current,<br>(Rated $V_R$, Square Wave,<br>20 kHz, $T_C$ = 90°C) Per Diode | $I_{FRM}$ | 60 | A |
| Non–Repetitive Peak Surge Current<br>(Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 500 | A |
| Peak Repetitive Reverse Current<br>(2.0 μs, 1.0 kHz) | $I_{RRM}$ | 2.0 | A |
| Storage Temperature Range | $T_{stg}$ | –65 to +175 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +150 | °C |
| Peak Surge Junction Temperature<br>(Forward Current Applied) | $T_{J(pk)}$ | 175 | °C |
| Voltage Rate of Change | dv/dt | 10,000 | V/μs |

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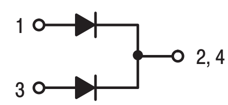
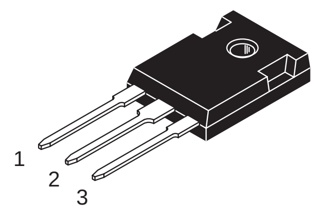
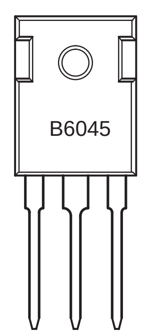
**SCHOTTKY BARRIER RECTIFIER**
**60 AMPERES**
**45 VOLTS**




**TO–247AC**
**CASE 340L**
**STYLE 2**

**MARKING DIAGRAM**




B6045 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBR6045WT | TO–247 | 30 Units/Rail |

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**THERMAL CHARACTERISTICS** (Per Diode)

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case | $R_{\theta JC}$ | 1.0 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Diode)

| | | | |
|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.)<br>@ $I_F$ = 30 Amps, $T_C$ = 25°C<br>@ $I_F$ = 30 Amps, $T_C$ = 125°C<br>@ $I_F$ = 60 Amps, $T_C$ = 25°C | $V_F$ | <br>0.62<br>0.55<br>0.75 | Volts |
| Instantaneous Reverse Current (Note 1.)<br>@ Rated DC Voltage, $T_C$ = 25°C<br>@ Rated DC Voltage, $T_C$ = 100°C | $I_R$ | <br>1.0<br>50 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle < 2.0%

## TYPICAL ELECTRICAL CHARACTERISTICS

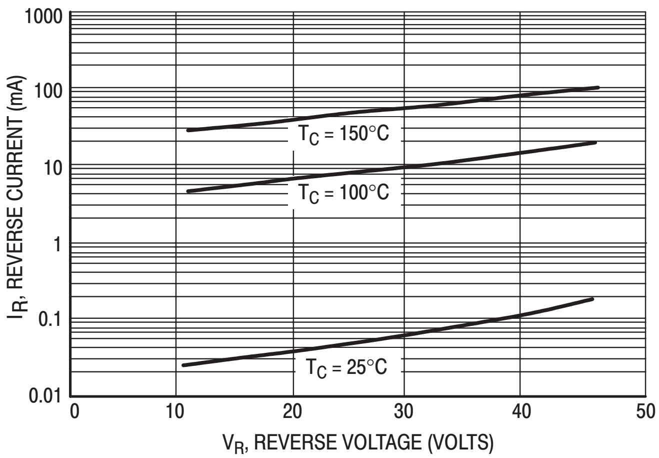


**Figure 1. Typical Reverse Current**

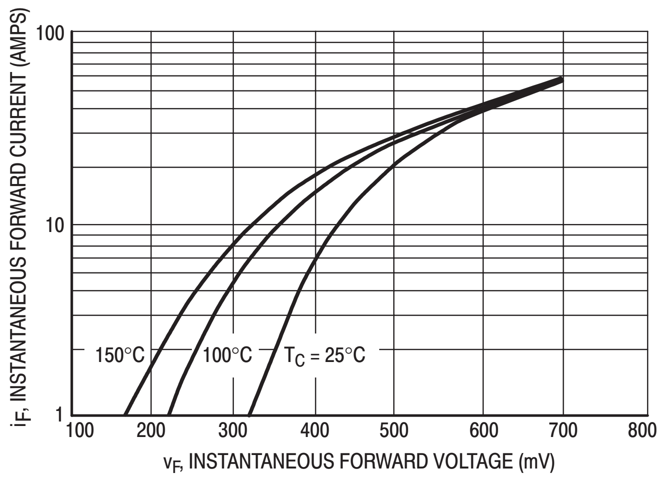


**Figure 2. Typical Forward Voltage**

# MBRP20030CTL

**Preferred Device**

# POWERTAP™ II SWITCHMODE™ Power Rectifier

The SWITCHMODE Power Rectifier uses the Schottky Barrier principle with a platinum barrier metal. This state–of–the–art device has the following features:

- Dual Diode Construction — May Be Paralleled for Higher Current Output
- Guardring for Stress Protection
- Low Forward Voltage Drop
- 150°C Operating Junction Temperature
- Recyclable Epoxy
- Guaranteed Reverse Avalanche Energy Capability
- Improved Mechanical Ratings

**Mechanical Characteristics**

- Case: Epoxy, Molded with metal heatsink base
- Weight: 80 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant
- Top Terminal Torque: 25–40 lb–in max
- Base Plate Torques: See procedure given in the Package Outline Section
- Shipped 25 units per foam
- Marking: B20030L

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 30 | V |
| Average Rectified Forward Current (At Rated $V_R$, $T_C$ = 125°C) Per Leg<br>Per Device | $I_{F(AV)}$ | 100<br>200 | A |
| Peak Repetitive Forward Current, (At Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 100°C) | $I_{FRM}$ | 200 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 1500 | A |
| Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) | $I_{RRM}$ | 2.0 | A |
| Storage Temperature Range | $T_{stg}$ | –55 to +150 | °C |
| Operating Junction Temperature | $T_J$ | –55 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/μs |

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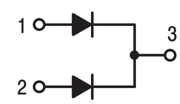
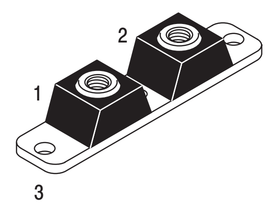
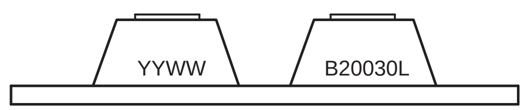
**LOW $V_F$ SCHOTTKY BARRIER RECTIFIER 200 AMPERES 30 VOLTS**




**POWERTAP II CASE 357C PLASTIC**

**MARKING DIAGRAM**




B20030L = Device Code
YY = Year
WW = Work Week

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRP20030CTL | POWERTAP II | 25 Units/Tray |

**Preferred** devices are recommended choices for future use and best overall value.

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### THERMAL CHARACTERISTICS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case | $R_{\theta JC}$ | 0.45 | °C/W |

### ELECTRICAL CHARACTERISTICS

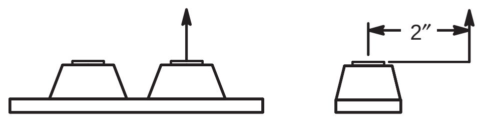
| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($I_F$ = 200 Amps, $T_C$ = +125°C)<br>($I_F$ = 200 Amps, $T_C$ = +25°C) | $V_F$ | <br>0.52<br>0.60 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_C$ = +25°C) | $I_R$ | 5.0 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2%.

### MAXIMUM MECHANICAL RATINGS

| | |
|---|---|
| Terminal Penetration: | 0.235 max |
| Terminal Torque: | 25–40 in-lb max |
| Mounting Torque — Outside Holes: | 30–40 in-lb max |
| Mounting Torque — Center Hole: | 8–10 in-lb max |
| Seating Plane Flatness | 1 mil per in. (between mounting holes) |

### POWERTAP MECHANICAL DATA APPLIES OVER OPERATING TEMPERATURE



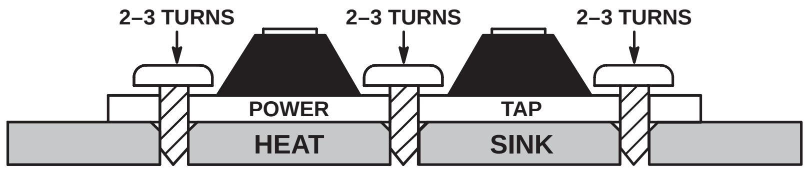

**Vertical Pull 250 lbs. max** **2 in. Lever Pull 50 lbs. max**

Note: While the POWERTAP is capable of sustaining these vertical and levered tensions, the intimate contact between POWERTAP and heat sink may be lost. This could lead to thermal runaway. The use of very flexible leads is recommended for the anode connections. Use of thermal grease is highly recommended.

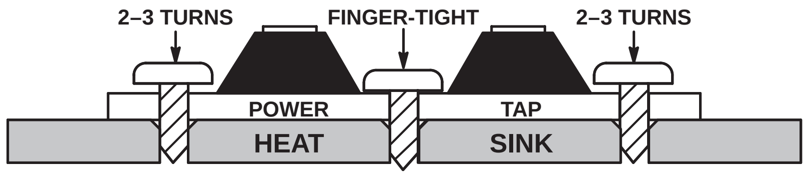
## MOUNTING PROCEDURE

The POWERTAP package requires special mounting considerations because of the long longitudinal axis of the copper heat sink. It is important to follow the proper tightening sequence to avoid warping the heat sink, which can reduce thermal contact between the POWERTAP and heat sink.

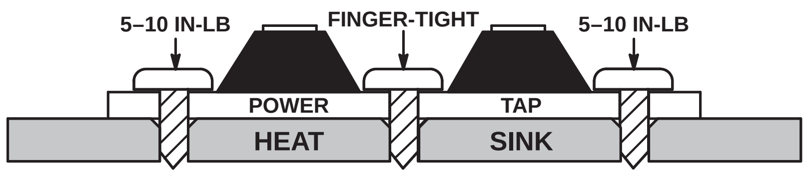
**STEP 1:**
Locate the POWERTAP on the heat sink and start mounting bolts into the threads by hand (2 or 3 turns).



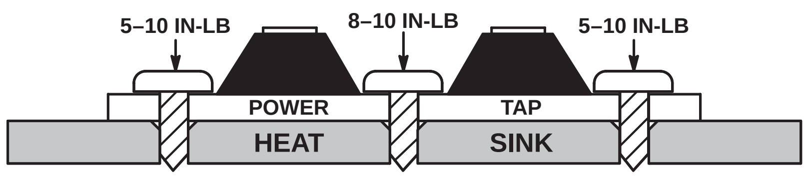

**STEP 2:**
Finger tighten the center bolt. The bolt may catch on the threads of the heat sink so it is important to make sure the face of the bolt or washer is in contact with the surface of the POWERTAP.



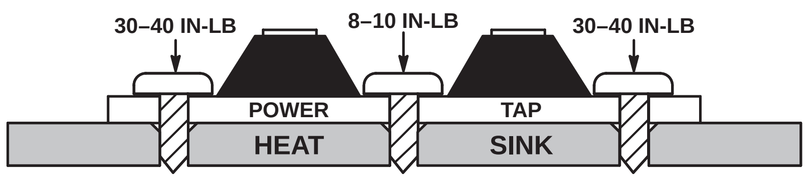

**STEP 3:**
Tighten each of the end bolts between 5 to 10 in-lb.




**STEP 4:**
Tighten the center bolt between 8 to 10 in-lb.




**STEP 5:**
Finally, tighten the end bolts between 30 to 40 in-lb.



# MBRP40030CTL

**Preferred Device**

# POWERTAP™ II SWITCHMODE™ Power Rectifier

The SWITCHMODE Power Rectifier uses the Schottky Barrier principle with a platinum barrier metal. This state-of-the-art device has the following features:

- Dual Diode Construction – May Be Paralleled for Higher Current Output
- Guardring for Stress Protection
- Low Forward Voltage Drop
- 150°C Operating Junction Temperature
- Recyclable Epoxy
- Improved Mechanical Ratings

**Mechanical Characteristics**

- Case: Epoxy, Molded with metal heatsink base
- Weight: 80 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant
- Top Terminal Torque: 25–40 lb–in max
- Base Plate Torques: See procedure given in the Package Outline Section
- Shipped 25 units per foam
- Marking: B40030L

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 30 | V |
| Average Rectified Forward Current (At Rated $V_R$, $T_C$ = 100°C) Per Leg<br>Per Device | $I_{F(AV)}$ | 200<br>400 | A |
| Peak Repetitive Forward Current, (At Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 100°C) | $I_{FRM}$ | 200 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 1500 | A |
| Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) | $I_{RRM}$ | 2.0 | A |
| Storage Temperature Range | $T_{stg}$ | –55 to +150 | °C |
| Operating Junction Temperature | $T_J$ | –55 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/μs |

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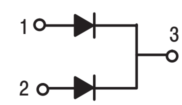
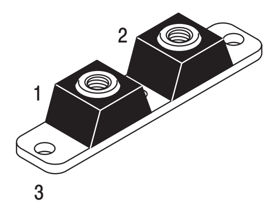
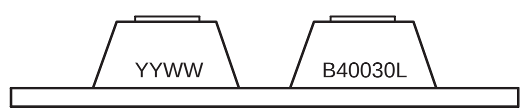
**LOW $V_F$ SCHOTTKY BARRIER RECTIFIER 400 AMPERES 30 VOLTS**




**POWERTAP II CASE 357C PLASTIC**

**MARKING DIAGRAM**




B40030L = Device Code
YY = Year
WW = Work Week

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRP40030CTL | POWERTAP II | 25 Units/Tray |

**Preferred** devices are recommended choices for future use and best overall value.

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### THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance – Junction to Case (Note 1.) | $R_{\theta JC}$ | 0.4 | °C/W |

### ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.)<br>($i_F$ = 200 Amps, $T_C$ = +25°C)<br>($i_F$ = 200 Amps, $T_C$ = +100°C) | $V_F$ | <br>0.5<br>0.41 | Volts |
| Maximum Instantaneous Reverse Current (Note 2.)<br>(Rated dc Voltage, $T_C$ = +25°C)<br>(Rated dc Voltage, $T_C$ = +100°C) | $I_R$ | <br>20<br>1000 | mA |

1. Rating applies when surface mounted on the minimum pad size recommended.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2%.

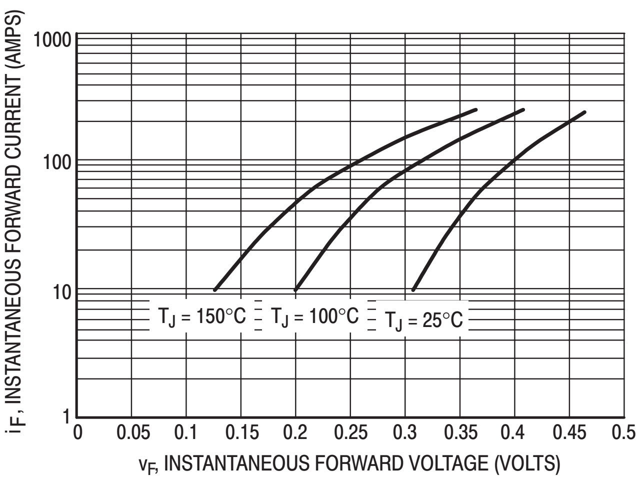



**Figure 1. Typical Instantaneous Forward Voltage**

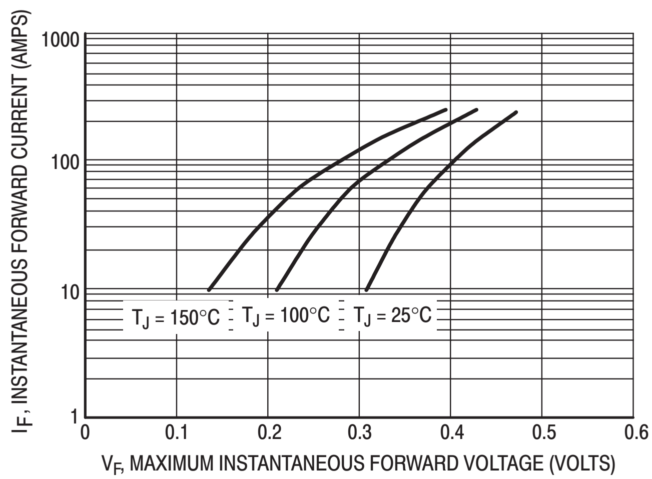



**Figure 2. Maximum Instantaneous Forward Voltage**

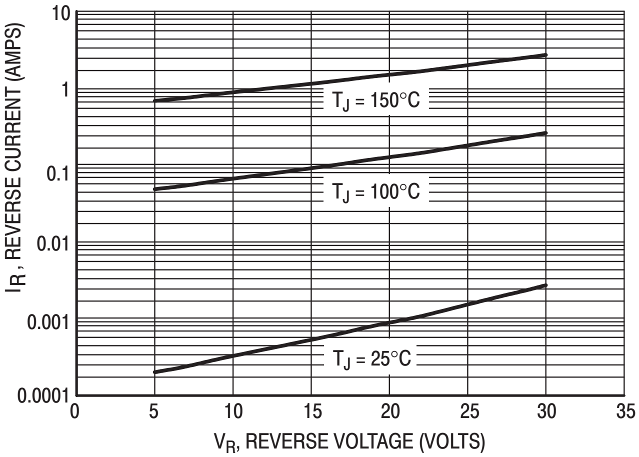



**Figure 3. Typical Reverse Current**

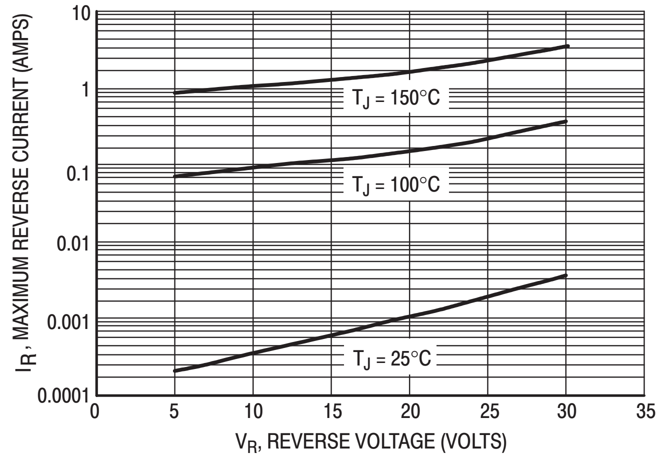



**Figure 4. Maximum Reverse Current**

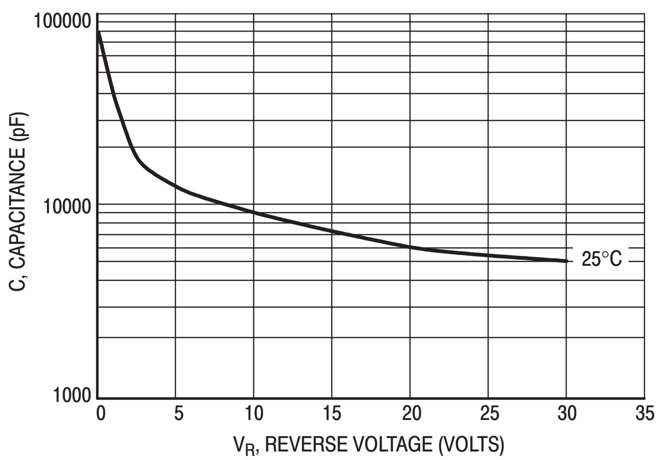
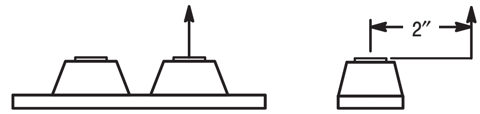



**Figure 5. Typical Capacitance**

### MAXIMUM MECHANICAL RATINGS

| | |
|---|---|
| Terminal Penetration: | 0.235 max |
| Terminal Torque: | 25–40 in-lb max |
| Mounting Torque – Outside Holes: | 30–40 in-lb max |
| Mounting Torque – Center Hole: | 8–10 in-lb max |
| Seating Plane Flatness | 1 mil per in. (between mounting holes) |

### POWERTAP MECHANICAL DATA APPLIES OVER OPERATING TEMPERATURE



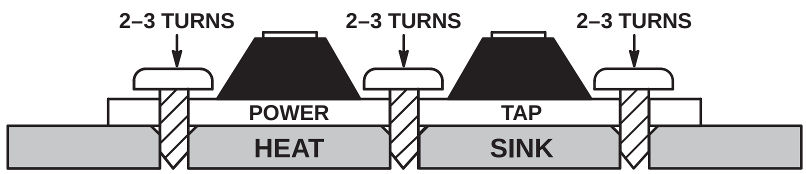

**Vertical Pull 250 lbs. max** **2 in. Lever Pull 50 lbs. max**

Note: While the POWERTAP is capable of sustaining these vertical and levered tensions, the intimate contact between POWERTAP and heat sink may be lost. This could lead to thermal runaway. The use of very flexible leads is recommended for the anode connections. Use of thermal grease is highly recommended.

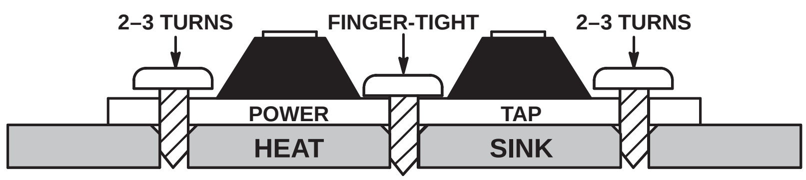
### MOUNTING PROCEDURE

The POWERTAP package requires special mounting considerations because of the long longitudinal axis of the copper heat sink. It is important to follow the proper tightening sequence to avoid warping the heat sink, which can reduce thermal contact between the POWERTAP and heat sink.

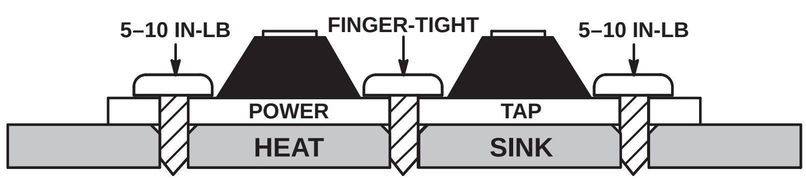
**STEP 1:**
Locate the POWERTAP on the heat sink and start mounting bolts into the threads by hand (2 or 3 turns).



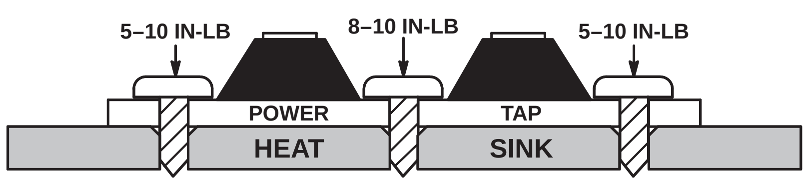

**STEP 2:**
Finger tighten the center bolt. The bolt may catch on the threads of the heat sink so it is important to make sure the face of the bolt or washer is in contact with the surface of the POWERTAP.



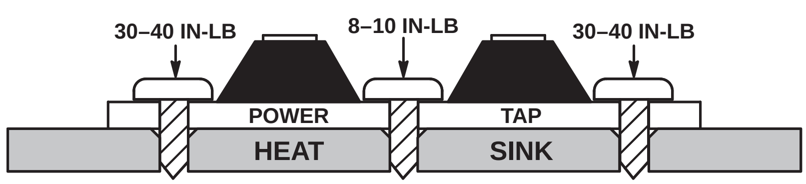

**STEP 3:**
Tighten each of the end bolts between 5 to 10 in-lb.




**STEP 4:**
Tighten the center bolt between 8 to 10 in-lb.




**STEP 5:**
Finally, tighten the end bolts between 30 to 40 in-lb.



# MBRP60035CTL

Preferred Device

# POWERTAP™ II SWITCHMODE™ Power Rectifier

The SWITCHMODE Power Rectifier uses the Schottky Barrier principle with a platinum barrier metal. This state-of-the-art device has the following features:

- Dual Diode Construction — May Be Paralleled for Higher Current Output
- Guardring for Stress Protection
- Low Forward Voltage Drop
- 150°C Operating Junction Temperature
- Recyclable Epoxy
- Guaranteed Reverse Avalanche Energy Capability
- Improved Mechanical Ratings

**Mechanical Characteristics**

- Case: Epoxy, Molded with metal heatsink base
- Weight: 80 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant
- Top Terminal Torque: 25–40 lb–in max
- Base Plate Torques: See procedure given in the Package Outline Section
- Shipped 25 units per foam
- Marking: B60035L

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 35 | V |
| Average Rectified Forward Current (At Rated $V_R$, $T_C$ = 100°C) Per Leg<br>Per Device | $I_{F(AV)}$ | 300<br>600 | A |
| Peak Repetitive Forward Current, (At Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 100°C) | $I_{FRM}$ | 300 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 4000 | A |
| Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) | $I_{RRM}$ | 2.0 | A |
| Storage Temperature Range | $T_{stg}$ | –55 to +150 | °C |
| Operating Junction Temperature | $T_J$ | –55 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/μs |

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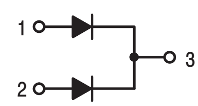
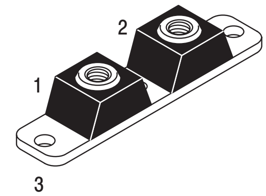
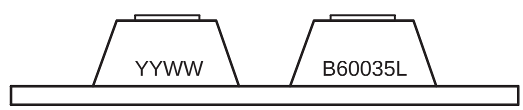
**LOW $V_F$ SCHOTTKY BARRIER RECTIFIER 600 AMPERES 35 VOLTS**




**POWERTAP II CASE 357C PLASTIC**

**MARKING DIAGRAM**




B60035L = Device Code
YY = Year
WW = Work Week

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRP60035CTL | POWERTAP II | 25 Units/Tray |

**Preferred** devices are recommended choices for future use and best overall value.

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## THERMAL CHARACTERISTICS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case | $R_{\theta JC}$ | 0.4 | °C/W |

## ELECTRICAL CHARACTERISTICS

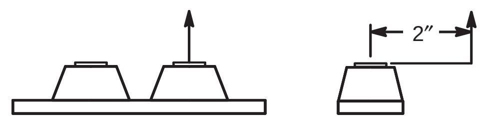
| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 300 Amps, $T_C$ = +25°C)<br>($i_F$ = 300 Amps, $T_C$ = +100°C) | $V_F$ | <br>0.57<br>0.50 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_C$ = +25°C)<br>(Rated dc Voltage, $T_C$ = +100°C) | $I_R$ | <br>10<br>250 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2%.

### MAXIMUM MECHANICAL RATINGS

| | |
|---|---|
| Terminal Penetration: | 0.235 max |
| Terminal Torque: | 25–40 in-lb max |
| Mounting Torque — Outside Holes: | 30–40 in-lb max |
| Mounting Torque — Center Hole: | 8–10 in-lb max |
| Seating Plane Flatness | 1 mil per in. (between mounting holes) |

### POWERTAP MECHANICAL DATA APPLIES OVER OPERATING TEMPERATURE




**Vertical Pull 250 lbs. max**

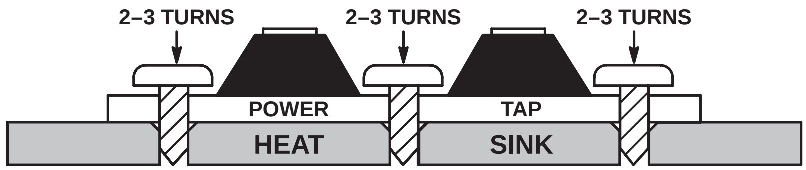
**2 in. Lever Pull 50 lbs. max**

Note: While the POWERTAP is capable of sustaining these vertical and levered tensions, the intimate contact between POWERTAP and heat sink may be lost. This could lead to thermal runaway. The use of very flexible leads is recommended for the anode connections. Use of thermal grease is highly recommended.

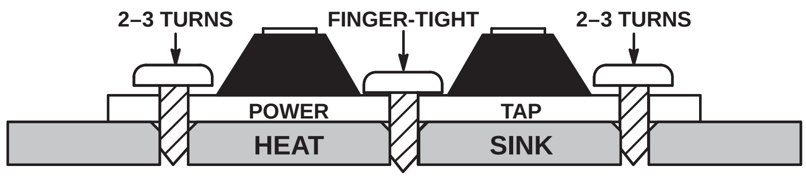
## MOUNTING PROCEDURE

The POWERTAP package requires special mounting considerations because of the long longitudinal axis of the copper heat sink. It is important to follow the proper tightening sequence to avoid warping the heat sink, which can reduce thermal contact between the POWERTAP and heat sink.

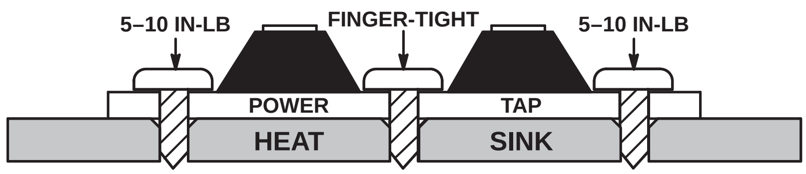
**STEP 1:**
Locate the POWERTAP on the heat sink and start mounting bolts into the threads by hand (2 or 3 turns).



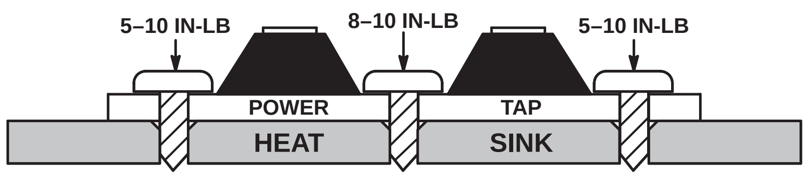

**STEP 2:**
Finger tighten the center bolt. The bolt may catch on the threads of the heat sink so it is important to make sure the face of the bolt or washer is in contact with the surface of the POWERTAP.



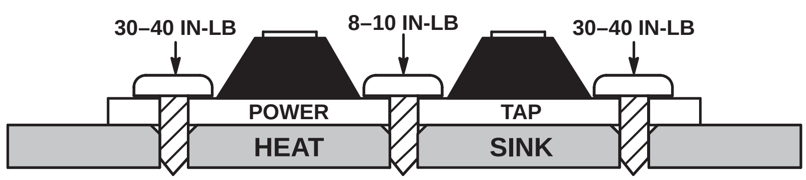

**STEP 3:**
Tighten each of the end bolts between 5 to 10 in-lb.




**STEP 4:**
Tighten the center bolt between 8 to 10 in-lb.




**STEP 5:**
Finally, tighten the end bolts between 30 to 40 in-lb.



# MBRP20045CT

**Preferred Device**

# POWERTAP™ II SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Dual Diode Construction — May Be Paralleled for Higher Current Output
- Guardring for Stress Protection
- Low Forward Voltage
- 175°C Operating Junction Temperature
- Guaranteed Reverse Avalanche

**Mechanical Characteristics:**

- Case: Epoxy, Molded with metal heatsink base
- Weight: 80 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant
- Top Terminal Torque: 25–40 lb–in max
- Base Plate Torques: See procedure given in the Package Outline Section
- Shipped 25 units per foam
- Marking: B20045T

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 45 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_C$ = 140°C) Per Leg<br>Per Device | $I_{F(AV)}$ | 100<br>200 | A |
| Peak Repetitive Forward Current, (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 140°C) Per Leg | $I_{FRM}$ | 200 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 1500 | A |
| Peak Repetitive Reverse Current (2.0 μs, 1.0 kHz) Per Leg | $I_{RRM}$ | 2.0 | A |
| Storage Temperature Range | $T_{stg}$ | –55 to +150 | °C |
| Operating Junction Temperature | $T_J$ | –55 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/μs |

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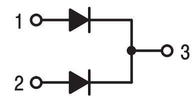
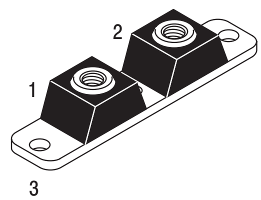
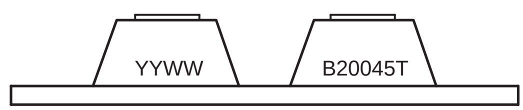
**SCHOTTKY BARRIER RECTIFIER 200 AMPERES 45 VOLTS**




**POWERTAP II CASE 357C PLASTIC**

**MARKING DIAGRAM**




B20045T = Device Code
YY = Year
WW = Work Week

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRP20045CT | POWERTAP II | 25 Units/Tray |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 0.6 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

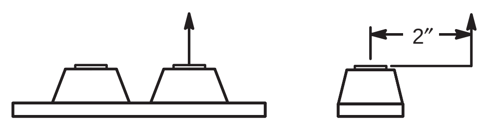
| | | | |
|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 200 Amps, $T_J$ = 25°C)<br>($i_F$ = 200 Amps, $T_J$ = 125°C) | $v_F$ | <br>0.89<br>0.78 | Volts |
| Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_J$ = 125°C)<br>(Rated dc Voltage, $T_J$ = 25°C) | $i_R$ | <br>50<br>0.5 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

**MAXIMUM MECHANICAL RATINGS**

| | |
|---|---|
| Terminal Penetration: | 0.235 max |
| Terminal Torque: | 25–40 in-lb max |
| Mounting Torque —<br>Outside Holes: | 30–40 in-lb max |
| Mounting Torque —<br>Center Hole: | 8–10 in-lb max |
| Seating Plane<br>Flatness | 1 mil per in.<br>(between mounting holes) |

**POWERTAP MECHANICAL DATA**
**APPLIES OVER OPERATING TEMPERATURE**




**Vertical Pull 250 lbs. max**

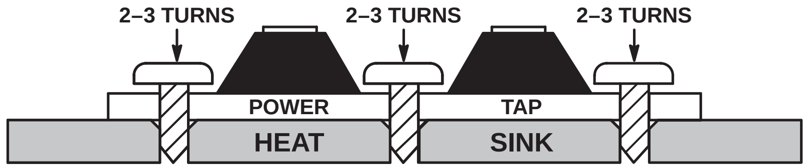
**2 in. Lever Pull 50 lbs. max**

Note: While the POWERTAP is capable of sustaining these vertical and levered tensions, the intimate contact between POWERTAP and heat sink may be lost. This could lead to thermal runaway. The use of very flexible leads is recommended for the anode connections. Use of thermal grease is highly recommended.

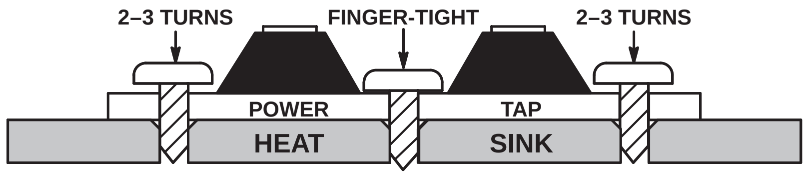
## MOUNTING PROCEDURE

The POWERTAP package requires special mounting considerations because of the long longitudinal axis of the copper heat sink. It is important to follow the proper tightening sequence to avoid warping the heat sink, which can reduce thermal contact between the POWERTAP and heat sink.

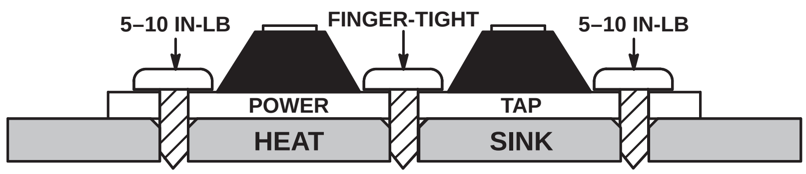
**STEP 1:**
Locate the POWERTAP on the heat sink and start mounting bolts into the threads by hand (2 or 3 turns).



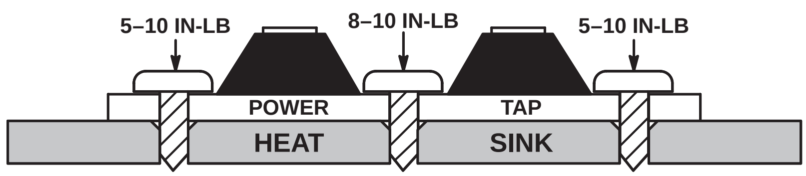

**STEP 2:**
Finger tighten the center bolt. The bolt may catch on the threads of the heat sink so it is important to make sure the face of the bolt or washer is in contact with the surface of the POWERTAP.



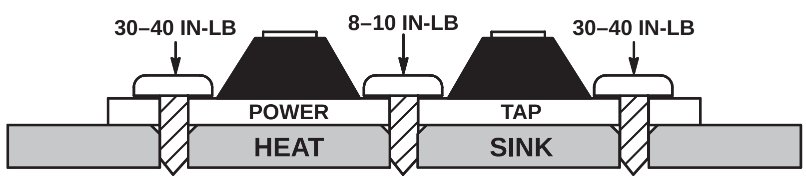

**STEP 3:**
Tighten each of the end bolts between 5 to 10 in-lb.




**STEP 4:**
Tighten the center bolt between 8 to 10 in-lb.




**STEP 5:**
Finally, tighten the end bolts between 30 to 40 in-lb.



# MBRP30045CT

**Preferred Device**

# POWERTAP™ II SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Dual Diode Construction — May Be Paralleled for Higher Current Output
- Guardring for Stress Protection
- Low Forward Voltage
- 175°C Operating Junction Temperature
- Guaranteed Reverse Avalanche

**Mechanical Characteristics:**

- Case: Epoxy, Molded with metal heatsink base
- Weight: 80 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant
- Top Terminal Torque: 25–40 lb–in max
- Base Plate Torques: See procedure given in the Package Outline Section
- Shipped 25 units per foam
- Marking: B30045T

**MAXIMUM RATINGS**

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 45 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_C$ = 140°C) Per Leg<br>Per Device | $I_{F(AV)}$ | 150<br>300 | A |
| Peak Repetitive Forward Current, (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 140°C) Per Leg | $I_{FRM}$ | 300 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) Per Leg | $I_{FSM}$ | 2500 | A |
| Peak Repetitive Reverse Current (2.0 μs, 1.0 kHz) Per Leg | $I_{RRM}$ | 2.0 | A |
| Storage Temperature Range | $T_{stg}$ | –55 to +150 | °C |
| Operating Junction Temperature | $T_J$ | –55 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/μs |

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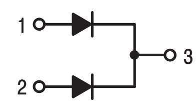
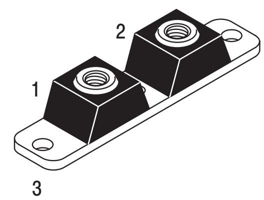
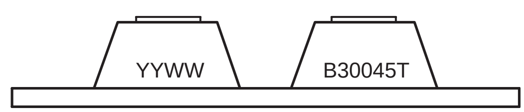
**SCHOTTKY BARRIER RECTIFIER 300 AMPERES 45 VOLTS**




**POWERTAP II CASE 357C PLASTIC**

**MARKING DIAGRAM**




B30045T = Device Code
YY = Year
WW = Work Week

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRP30045CT | POWERTAP II | 25 Units/Tray |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 0.45 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

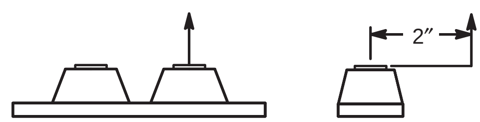
| | | | |
|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 150 Amps, $T_J$ = 25°C)<br>($i_F$ = 300 Amps, $T_J$ = 25°C) | $v_F$ | <br>0.70<br>0.82 | Volts |
| Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_J$ = 125°C)<br>(Rated dc Voltage, $T_J$ = 25°C) | $i_R$ | <br>75<br>0.8 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

**MAXIMUM MECHANICAL RATINGS**

| | |
|---|---|
| Terminal Penetration: | 0.235 max |
| Terminal Torque: | 25–40 in-lb max |
| Mounting Torque — Outside Holes: | 30–40 in-lb max |
| Mounting Torque — Center Hole: | 8–10 in-lb max |
| Seating Plane Flatness | 1 mil per in. (between mounting holes) |

**POWERTAP MECHANICAL DATA APPLIES OVER OPERATING TEMPERATURE**



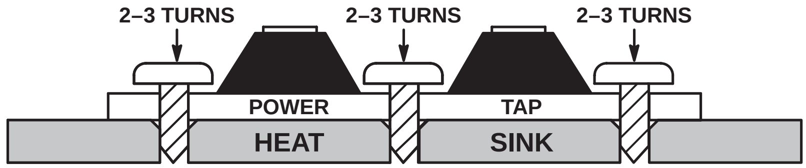

**Vertical Pull 250 lbs. max** **2 in. Lever Pull 50 lbs. max**

Note: While the POWERTAP is capable of sustaining these vertical and levered tensions, the intimate contact between POWERTAP and heat sink may be lost. This could lead to thermal runaway. The use of very flexible leads is recommended for the anode connections. Use of thermal grease is highly recommended.

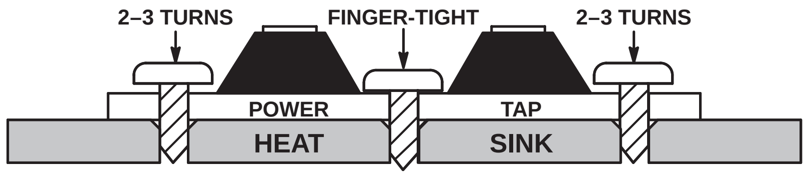
## MOUNTING PROCEDURE

The POWERTAP package requires special mounting considerations because of the long longitudinal axis of the copper heat sink. It is important to follow the proper tightening sequence to avoid warping the heat sink, which can reduce thermal contact between the POWERTAP and heat sink.

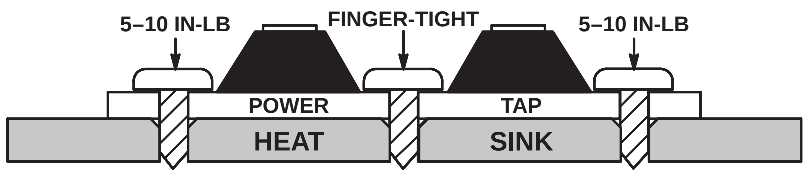
**STEP 1:**
Locate the POWERTAP on the heat sink and start mounting bolts into the threads by hand (2 or 3 turns).



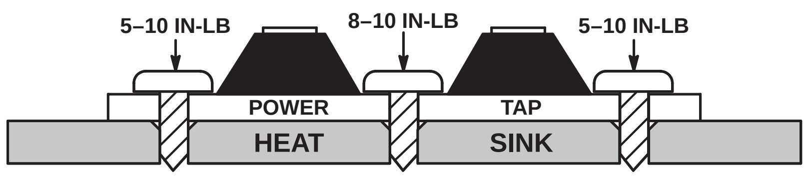

**STEP 2:**
Finger tighten the center bolt. The bolt may catch on the threads of the heat sink so it is important to make sure the face of the bolt or washer is in contact with the surface of the POWERTAP.



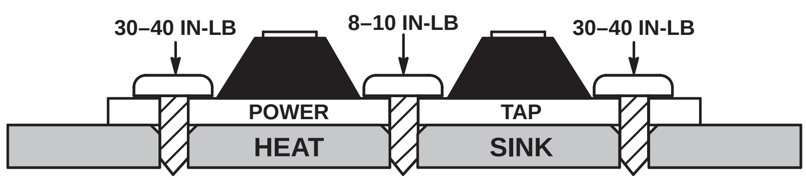

**STEP 3:**
Tighten each of the end bolts between 5 to 10 in-lb.




**STEP 4:**
Tighten the center bolt between 8 to 10 in-lb.




**STEP 5:**
Finally, tighten the end bolts between 30 to 40 in-lb.



# MBRP40045CTL

# POWERTAP™ II SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

**Features:**

- Dual Diode Construction — May be Paralleled for Higher Current Output
- Guardring for Stress Protection
- Low Forward Voltage Drop
- 150°C Operating Junction Temperature
- Recyclable Epoxy
- Guaranteed Reverse Avalanche Energy Capability
- Improved Mechanical Ratings

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 45 | V |
| Average Rectified Forward Current (At Rated $V_R$, $T_C$ = 100°C) Per Leg<br>Per Device | $I_{F(AV)}$ | 200<br>400 | A |
| Peak Repetitive Forward Current (At Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 100°C) | $I_{FRM}$ | 400 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 2500 | A |
| Peak Repetitive Reverse Current (2.0 μs, 1.0 kHz) | $I_{RRM}$ | 2.0 | A |
| Storage and Operating Case Temperature Range | $T_{stg}$, $T_C$ | –55 to +150 | °C |
| Operating Junction Temperature | $T_J$ | –55 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 1000 | V/μs |

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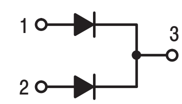
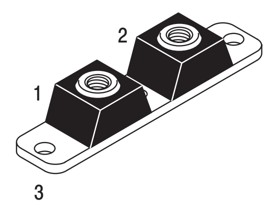
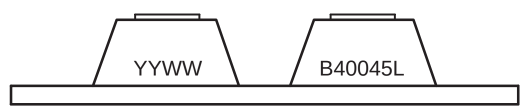
**SCHOTTKY BARRIER RECTIFIER 400 AMPERES 45 VOLTS**




**POWERTAP II CASE 357C PLASTIC**

**MARKING DIAGRAM**




B40045L = Device Code
YY = Year
WW = Work Week

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRP40045CTL | POWERTAP II | 25 Units/Tray |

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### THERMAL CHARACTERISTICS

| Rating | | Symbol | Value | Unit |
|---|---|---|---|---|
| Thermal Resistance — Junction–to–Case | Per Leg | $R_{\theta JC}$ | 0.45 | °C/W |

### ELECTRICAL CHARACTERISTICS

| Rating | | Symbol | Value | | Unit |
|---|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.) | Per Leg | $V_F$ | $T_C$ = 25°C | $T_C$ = 125°C | V |
| ($I_F$ = 200 A)<br>($I_F$ = 400 A) | | | 0.57<br>0.73 | 0.52<br>0.68 | |
| Maximum Instantaneous Reverse Current (Note 1.) | Per Leg | $I_R$ | $T_C$ = 25°C | $T_C$ = 125°C | mA |
| (Rated DC Voltage) | | | 10 | 400 | |

1. Pulse Test: Pulse Width = 380 μs, Duty Cycle ≤ 2%.

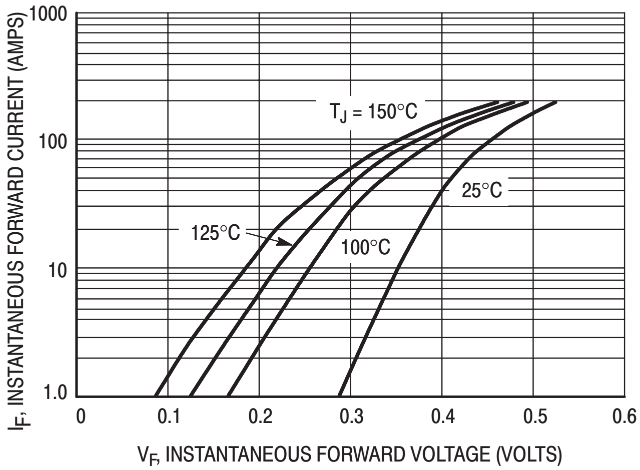


**Figure 1. Typical Forward Voltage**

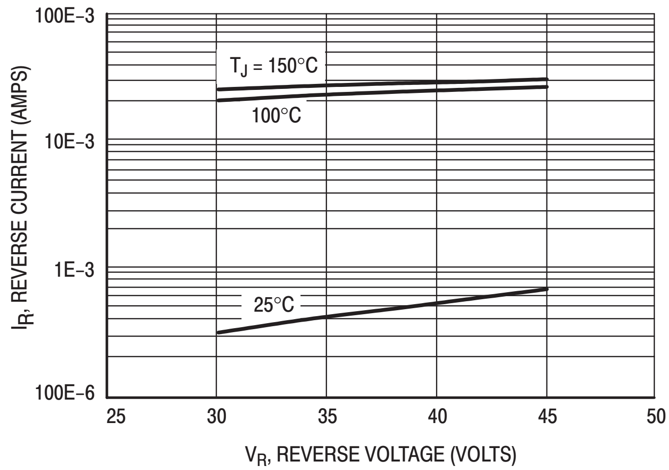


**Figure 2. Typical Reverse Current**

# MBRP20060CT

**Preferred Device**

# POWERTAP™ II SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Dual Diode Construction — May Be Paralleled for Higher Current Output
- Guardring for Stress Protection
- Low Forward Voltage
- 175°C Operating Junction Temperature

**Mechanical Characteristics:**

- Case: Epoxy, Molded with metal heatsink base
- Weight: 80 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant
- Top Terminal Torque: 25–40 lb–in max
- Base Plate Torques: See procedure given in the Package Outline Section
- Shipped 25 units per foam
- Marking: B20060T

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 60 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_C$ = 140°C) Per Leg<br>Per Device | $I_{F(AV)}$ | 100<br>200 | A |
| Peak Repetitive Forward Current, (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 140°C) Per Leg | $I_{FRM}$ | 200 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 1500 | A |
| Peak Repetitive Reverse Current (2.0 μs, 1.0 kHz) Per Leg | $I_{RRM}$ | 2.0 | A |
| Storage Temperature Range | $T_{stg}$ | –55 to +150 | °C |
| Operating Junction Temperature | $T_J$ | –55 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/μs |

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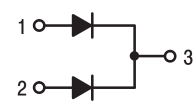
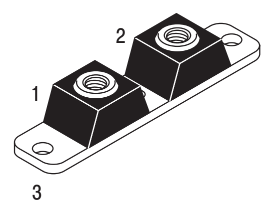
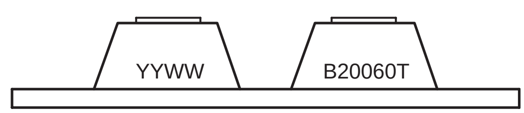
**SCHOTTKY BARRIER RECTIFIER 200 AMPERES 60 VOLTS**




**POWERTAP II CASE 357C PLASTIC**

**MARKING DIAGRAM**




B20060T = Device Code
YY = Year
WW = Work Week

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRP20060CT | POWERTAP II | 25 Units/Tray |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 0.6 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| | | | |
|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 200 Amps, $T_J$ = 25°C)<br>($i_F$ = 200 Amps, $T_J$ = 100°C) | $v_F$ | <br>0.91<br>0.80 | Volts |
| Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_J$ = 125°C)<br>(Rated dc Voltage, $T_J$ = 25°C) | $i_R$ | <br>50<br>0.5 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

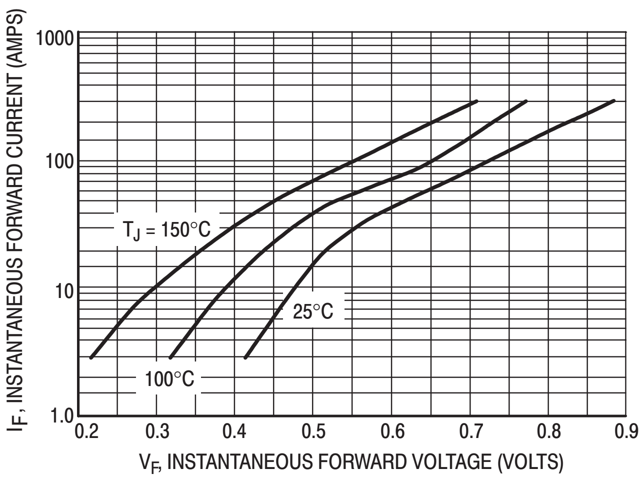



**Figure 1. Typical Forward Voltage**

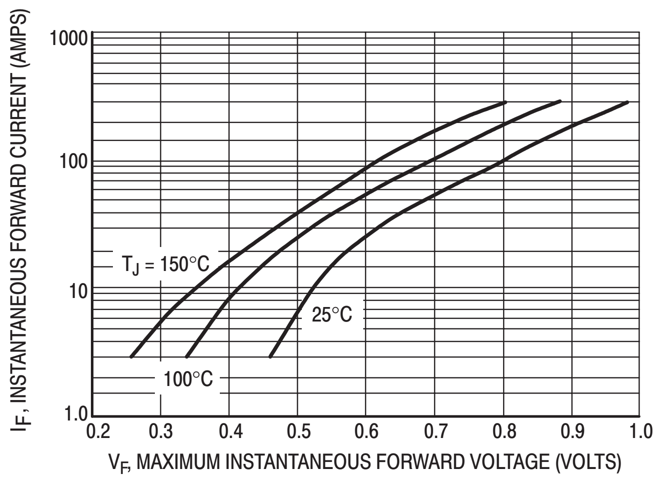



**Figure 2. Maximum Forward Voltage**

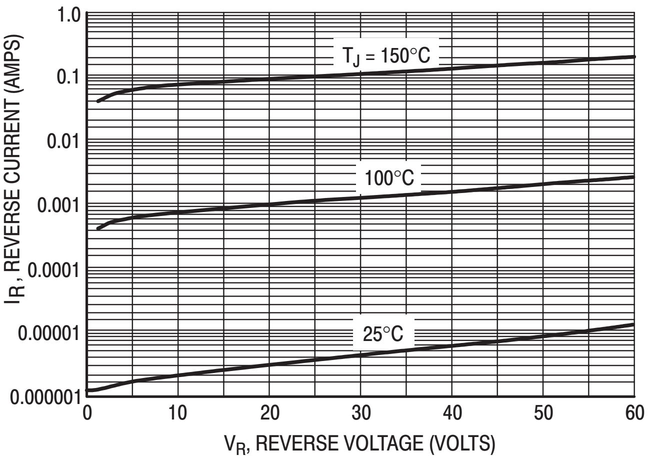



**Figure 3. Typical Reverse Current**

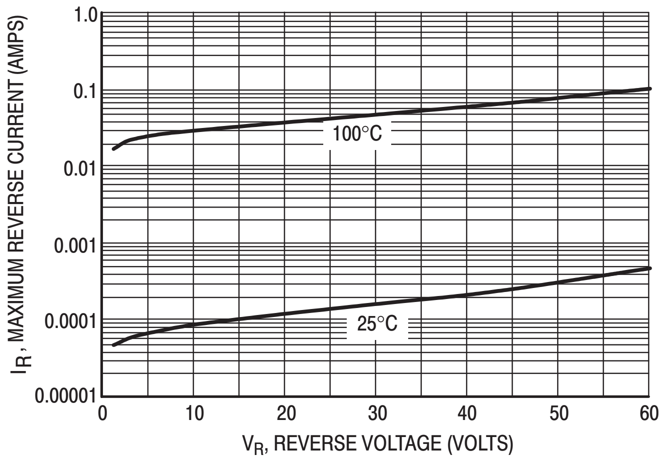



**Figure 4. Maximum Reverse Current**

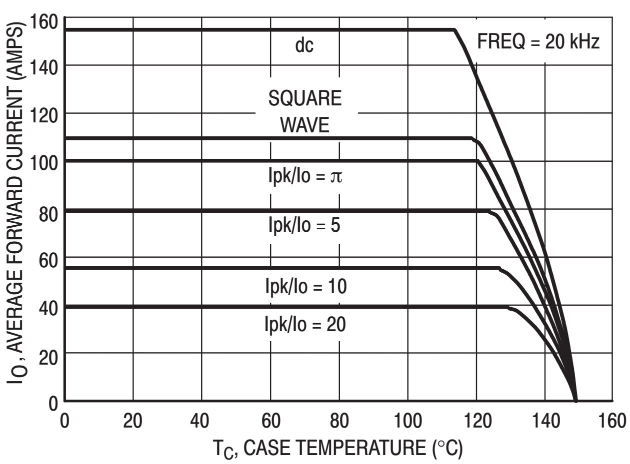



**Figure 5. Current Derating**
**(PER LEG)**

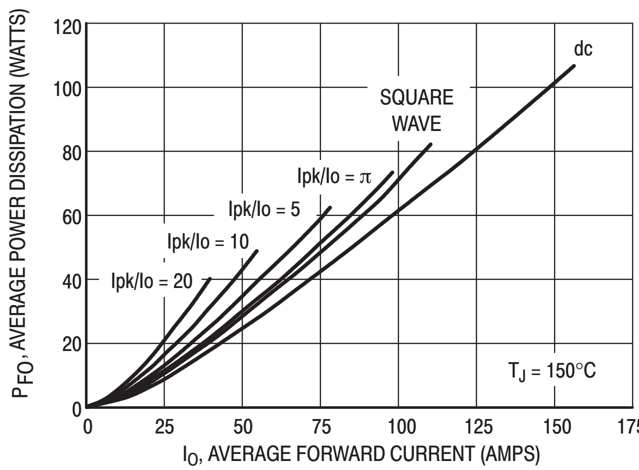



**Figure 6. Forward Power Dissipation**
**(PER LEG)**

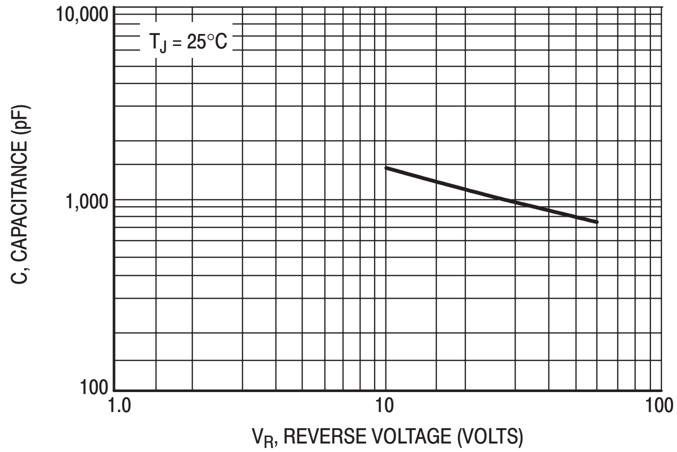



**Figure 7. Capacitance**

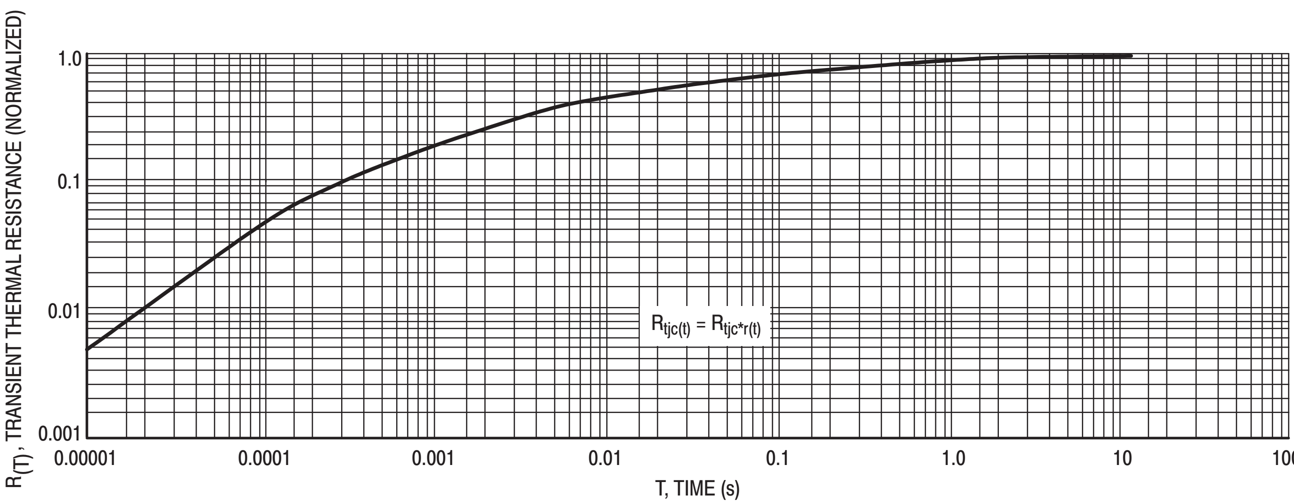



**Figure 8. Thermal Response**

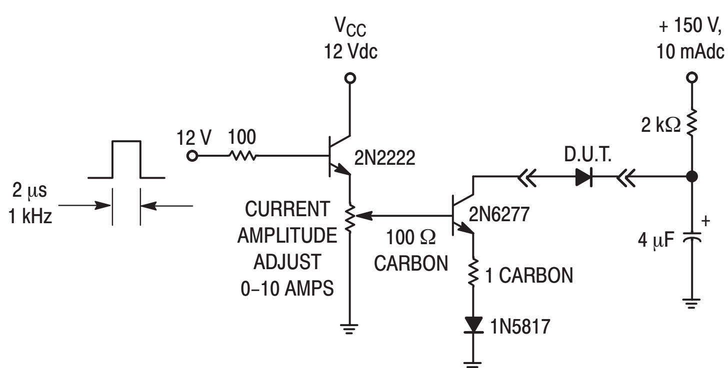
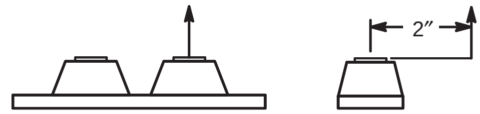



**Figure 9. Test Circuit for Repetitive Reverse Current**

## MAXIMUM MECHANICAL RATINGS

| | |
|---|---|
| Terminal Penetration: | 0.235 max |
| Terminal Torque: | 25–40 in-lb max |
| Mounting Torque — Outside Holes: | 30–40 in-lb max |
| Mounting Torque — Center Hole: | 8–10 in-lb max |
| Seating Plane Flatness | 1 mil per in. (between mounting holes) |

## POWERTAP MECHANICAL DATA APPLIES OVER OPERATING TEMPERATURE




**Vertical Pull**
**250 lbs. max**

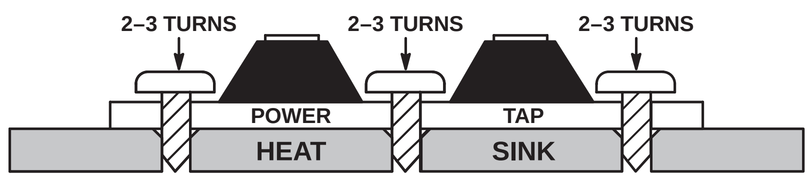
**2 in. Lever Pull**
**50 lbs. max**

Note: While the POWERTAP is capable of sustaining these vertical and levered tensions, the intimate contact between POWERTAP and heat sink may be lost. This could lead to thermal runaway. The use of very flexible leads is recommended for the anode connections. Use of thermal grease is highly recommended.

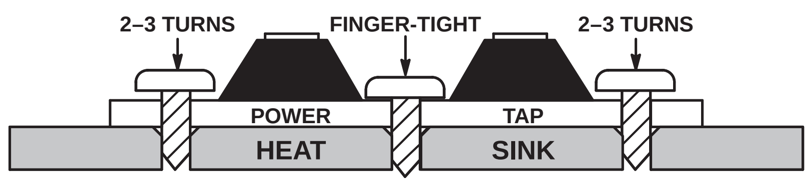
## MOUNTING PROCEDURE

The POWERTAP package requires special mounting considerations because of the long longitudinal axis of the copper heat sink. It is important to follow the proper tightening sequence to avoid warping the heat sink, which can reduce thermal contact between the POWERTAP and heat sink.

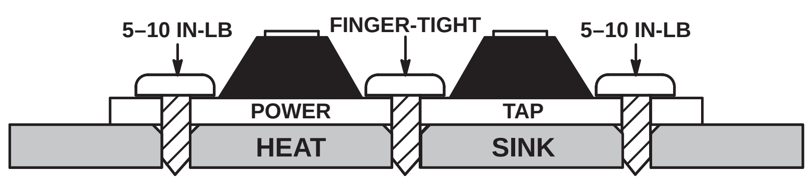
**STEP 1:**
Locate the POWERTAP on the heat sink and start mounting bolts into the threads by hand (2 or 3 turns).



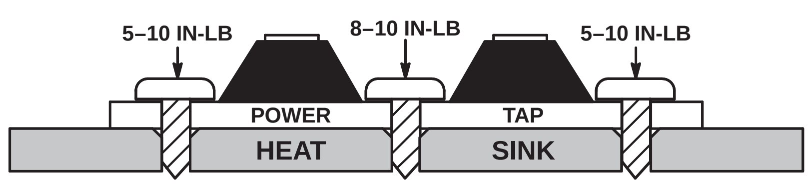

**STEP 2:**
Finger tighten the center bolt. The bolt may catch on the threads of the heat sink so it is important to make sure the face of the bolt or washer is in contact with the surface of the POWERTAP.



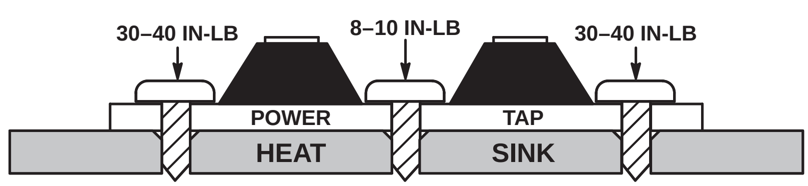

**STEP 3:**
Tighten each of the end bolts between 5 to 10 in-lb.




**STEP 4:**
Tighten the center bolt between 8 to 10 in-lb.




**STEP 5:**
Finally, tighten the end bolts between 30 to 40 in-lb.



# MBRP30060CT

**Preferred Device**

# POWERTAP™ II SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

- Dual Diode Construction — May Be Paralleled for Higher Current Output
- Guardring for Stress Protection
- Low Forward Voltage
- 175°C Operating Junction Temperature

**Mechanical Characteristics:**

- Case: Epoxy, Molded with metal heatsink base
- Weight: 80 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant
- Top Terminal Torque: 25–40 lb–in max
- Base Plate Torques: See procedure given in the Package Outline Section
- Shipped 25 units per foam
- Marking: B30060T

**MAXIMUM RATINGS**

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 60 | V |
| Average Rectified Forward Current<br>(Rated $V_R$, $T_C$ = 140°C) Per Leg<br>Per Device | $I_{F(AV)}$ | <br>150<br>300 | A |
| Peak Repetitive Forward Current,<br>(Rated $V_R$, Square Wave,<br>20 kHz, $T_C$ = 140°C) Per Leg | $I_{FRM}$ | <br><br>300 | A |
| Non–Repetitive Peak Surge Current<br>(Surge Applied at Rated Load<br>Conditions Halfwave, Single<br>Phase, 60 Hz) Per Leg | $I_{FSM}$ | 2500 | A |
| Peak Repetitive Reverse Current<br>(2.0 µs, 1.0 kHz) Per Leg | $I_{RRM}$ | <br>2.0 | A |
| Storage Temperature Range | $T_{stg}$ | –55 to +150 | °C |
| Operating Junction Temperature | $T_J$ | –55 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 10,000 | V/µs |

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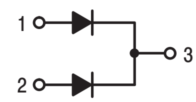
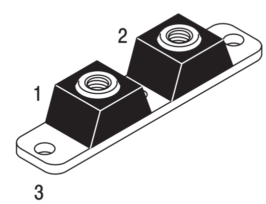
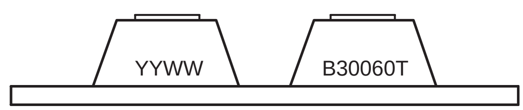
**SCHOTTKY BARRIER RECTIFIER 300 AMPERES 60 VOLTS**




**POWERTAP II CASE 357C PLASTIC**

**MARKING DIAGRAM**




B30060T = Device Code
YY = Year
WW = Work Week

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRP30060CT | POWERTAP II | 25 Units/Tray |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 0.45 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

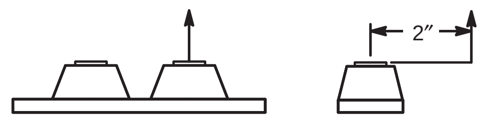
| | | | |
|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 150 Amps, $T_J$ = 25°C)<br>($i_F$ = 300 Amps, $T_J$ = 25°C) | $v_F$ | <br>0.79<br>0.89 | Volts |
| Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_J$ = 125°C)<br>(Rated dc Voltage, $T_J$ = 25°C) | $i_R$ | <br>75<br>0.8 | mA |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

**MAXIMUM MECHANICAL RATINGS**

| | |
|---|---|
| Terminal Penetration: | 0.235 max |
| Terminal Torque: | 25–40 in-lb max |
| Mounting Torque — Outside Holes: | 30–40 in-lb max |
| Mounting Torque — Center Hole: | 8–10 in-lb max |
| Seating Plane Flatness | 1 mil per in. (between mounting holes) |

**POWERTAP MECHANICAL DATA APPLIES OVER OPERATING TEMPERATURE**




**Vertical Pull 250 lbs. max**

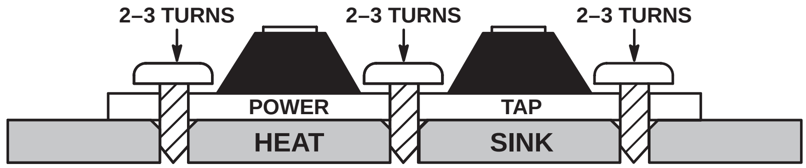
**2 in. Lever Pull 50 lbs. max**

Note: While the POWERTAP is capable of sustaining these vertical and levered tensions, the intimate contact between POWERTAP and heat sink may be lost. This could lead to thermal runaway. The use of very flexible leads is recommended for the anode connections. Use of thermal grease is highly recommended.

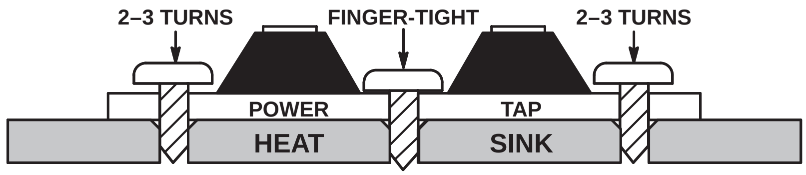
## MOUNTING PROCEDURE

The POWERTAP package requires special mounting considerations because of the long longitudinal axis of the copper heat sink. It is important to follow the proper tightening sequence to avoid warping the heat sink, which can reduce thermal contact between the POWERTAP and heat sink.

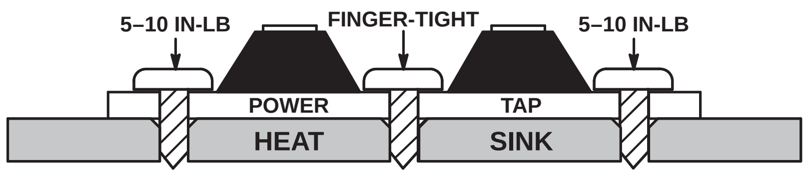
**STEP 1:**
Locate the POWERTAP on the heat sink and start mounting bolts into the threads by hand (2 or 3 turns).



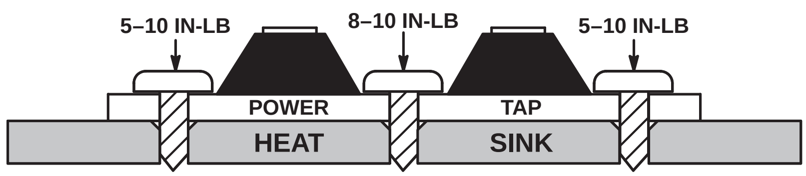

**STEP 2:**
Finger tighten the center bolt. The bolt may catch on the threads of the heat sink so it is important to make sure the face of the bolt or washer is in contact with the surface of the POWERTAP.



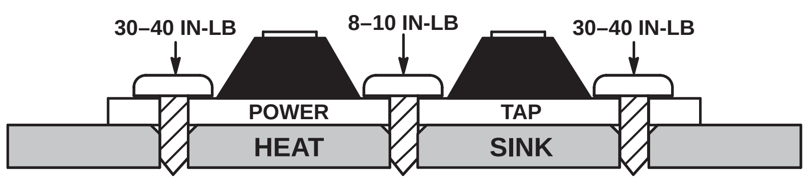

**STEP 3:**
Tighten each of the end bolts between 5 to 10 in-lb.




**STEP 4:**
Tighten the center bolt between 8 to 10 in-lb.




**STEP 5:**
Finally, tighten the end bolts between 30 to 40 in-lb.



# MBRP400100CTL

# POWERTAP™ II SWITCHMODE™ Power Rectifier

. . . using the Schottky Barrier principle with a platinum barrier metal. These state–of–the–art devices have the following features:

**Features:**

- Dual Diode Construction — May be Paralleled for Higher Current Output
- Guardring for Stress Protection
- Low Forward Voltage Drop
- 150°C Operating Junction Temperature
- Recyclable Epoxy
- Guaranteed Reverse Avalanche Energy Capability
- Improved Mechanical Ratings

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 100 | V |
| Average Rectified Forward Current<br>(At Rated $V_R$, $T_C$ = 100°C) Per Leg<br>Per Device | $I_{F(AV)}$ | <br>200<br>400 | A |
| Peak Repetitive Forward Current<br>(At Rated $V_R$, Square Wave,<br>20 kHz, $T_C$ = 100°C) | $I_{FRM}$ | 400 | A |
| Non–Repetitive Peak Surge Current<br>(Surge Applied at Rated Load<br>Conditions Halfwave, Single<br>Phase, 60 Hz) | $I_{FSM}$ | 2500 | A |
| Peak Repetitive Reverse Current<br>(2.0 μs, 1.0 kHz) | $I_{RRM}$ | 2.0 | A |
| Storage and Operating Case<br>Temperature Range | $T_{stg}$, $T_C$ | –55 to +150 | °C |
| Operating Junction Temperature | $T_J$ | –55 to +150 | °C |
| Voltage Rate of Change (Rated $V_R$) | dv/dt | 1000 | V/μs |

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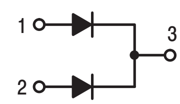
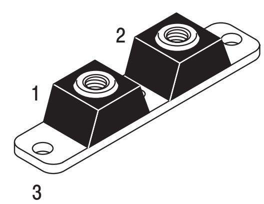
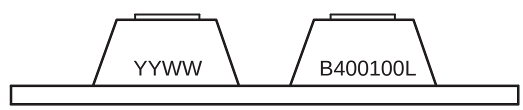
**SCHOTTKY BARRIER RECTIFIER 400 AMPERES 100 VOLTS**




**POWERTAP II**
**CASE 357C**
**PLASTIC**

**MARKING DIAGRAM**




B400100L = Device Code
YY = Year
WW = Work Week

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRP400100CTL | POWERTAP II | 25 Units/Tray |

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### THERMAL CHARACTERISTICS

| Rating | | Symbol | Value | Unit |
|---|---|---|---|---|
| Thermal Resistance — Junction–to–Case | Per Leg | $R_{\theta JC}$ | 0.45 | °C/W |

### ELECTRICAL CHARACTERISTICS

| Rating | | Symbol | Value | | Unit |
|---|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.) | Per Leg | $V_F$ | **$T_C$ = 25°C** | **$T_C$ = 125°C** | V |
| ($I_F$ = 200 A)<br>($I_F$ = 400 A) | | | 0.83<br>0.97 | 0.69<br>0.82 | |
| Maximum Instantaneous Reverse Current (Note 1.) | Per Leg | $I_R$ | **$T_C$ = 25°C** | **$T_C$ = 125°C** | mA |
| (Rated DC Voltage) | | | 6.0 | 80 | |

1. Pulse Test: Pulse Width = 380 μs, Duty Cycle ≤ 2%.

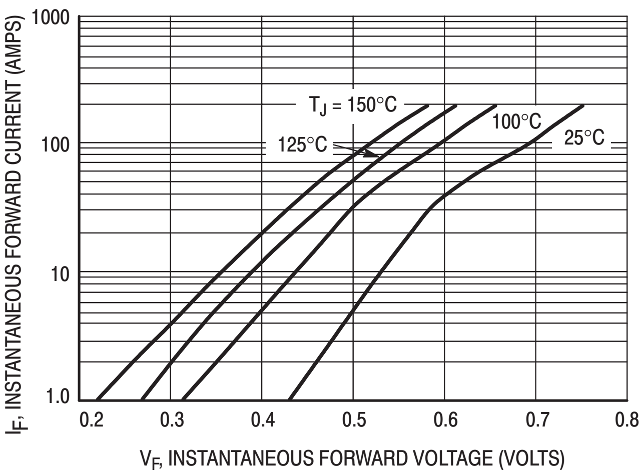


**Figure 1. Typical Forward Voltage**

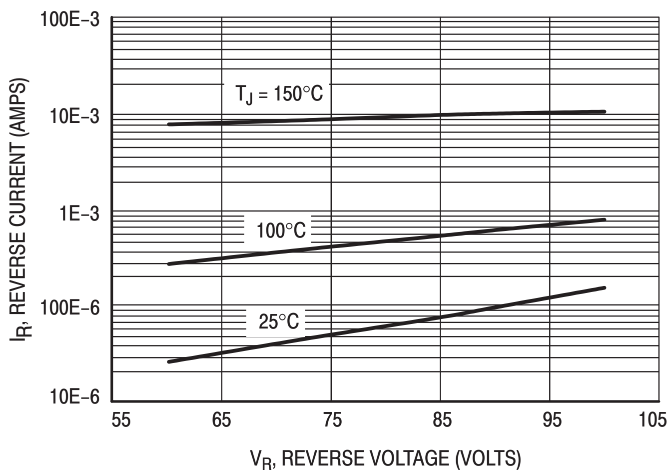


**Figure 2. Typical Reverse Current**

# MBRP20035L

# SWITCHMODE™ Schottky Power Rectifier

## POWERTAP™ III Package

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State of the art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency switching power supplies, free wheeling diode and polarity protection diodes.

- Very Low Forward Voltage Drop
- Highly Stable Oxide Passivated Junction
- Guardring for Stress Protection
- High dv/dt Capability

**Mechanical Characteristics:**

- Dual Die Construction
- Case: Epoxy, Molded with Plated Copper Heatsink Base
- Weight: 40 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant
- Base Plate Torques: See procedure given in the Package Outline Section
- Top Terminal Torque: 25–40 lb–in max.
- Shipped 50 units per foam
- Marking: MBRP20035L

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 35 | V |
| Average Rectified Forward Current<br>(At Rated $V_R$, $T_C$ = 100°C) | $I_O$ | 200 | A |
| Peak Repetitive Forward Current<br>(At Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 100°C) | $I_{FRM}$ | 400 | A |
| Non–Repetitive Peak Surge Current<br>(Surge applied at rated load conditions, halfwave, single phase, 60 Hz) | $I_{FSM}$ | 2000 | A |
| Peak Repetitive Reverse Surge Current (2.0 µs, 1.0 kHz) | $I_{RRM}$ | 2.0 | A |
| Storage/Operating Case Temperature Range | $T_{stg}$, $T_C$ | – 55 to +150 | °C |
| Operating Junction Temperature | $T_J$ | – 55 to +150 | °C |
| Voltage Rate of Change<br>(Rated $V_R$, $T_J$ = 25°C) | dv/dt | 10,000 | V/µs |

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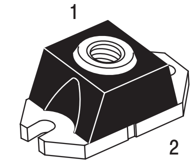
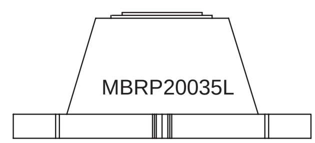
**SCHOTTKY BARRIER RECTIFIER 200 AMPERES 35 VOLTS**


**POWERTAP III CASE 357D PLASTIC**

**MARKING DIAGRAM**




MBRP20035L = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRP20035L | POWERTAP III | 50 Units/Foam |

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## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction–to–Case | $R_{\theta JC}$ | 0.45 | °C/W |

## ELECTRICAL CHARACTERISTICS

| | | | | |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.) ($I_F$ = 200 A) | $V_F$ | **$T_J$ = 25°C** | **$T_J$ = 100°C** | Volts |
| | | 0.57 | 0.5 | |
| Maximum Instantaneous Reverse Current ($V_R$ = 35 V) | $I_R$ | **$T_J$ = 25°C** | **$T_J$ = 100°C** | mA |
| | | 10 | 250 | |

1. Pulse Test: Pulse Width ≤ 380 µs, Duty Cycle ≤ 2%.

# MBRP30035L

# SWITCHMODE™ Schottky Power Rectifier

## POWERTAP™ III Package

. . . employing the Schottky Barrier principle in a large area metal–to–silicon power diode. State of the art geometry features epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for low voltage, high frequency switching power supplies, free wheeling diode and polarity protection diodes.

- Very Low Forward Voltage Drop
- Highly Stable Oxide Passivated Junction
- Guardring for Stress Protection
- High dv/dt Capability

**Mechanical Characteristics:**

- Dual Die Construction
- Case: Epoxy, Molded with Plated Copper Heatsink Base
- Weight: 40 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant
- Base Plate Torques: See procedure given in the Package Outline Section
- Top Terminal Torque: 25–40 lb–in max.
- Shipped 50 units per foam
- Marking: MBRP30035L

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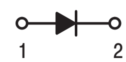
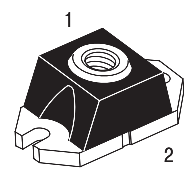
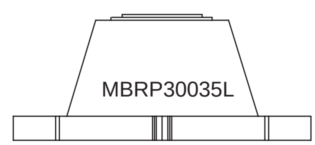
**SCHOTTKY BARRIER RECTIFIER 300 AMPERES 35 VOLTS**




**POWERTAP III CASE 357D PLASTIC**

**MARKING DIAGRAM**




MBRP30035L = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MBRP30035L | POWERTAP III | 50 Units/Foam |

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 35 | V |
| Average Rectified Forward Current<br>(At Rated $V_R$, $T_C$ = 100°C) | $I_O$ | 300 | A |
| Peak Repetitive Forward Current<br>(At Rated $V_R$, Square Wave,<br>20 kHz, $T_C$ = 100°C) | $I_{FRM}$ | 600 | A |
| Non–Repetitive Peak Surge Current<br>(Surge applied at rated load conditions, halfwave, single phase, 60 Hz) | $I_{FSM}$ | 3000 | A |
| Peak Repetitive Reverse Surge Current (2.0 μs, 1.0 kHz) | $I_{RRM}$ | 2.0 | A |
| Storage/Operating Case Temperature Range | $T_{stg}$, $T_C$ | – 55 to +150 | °C |
| Operating Junction Temperature | $T_J$ | – 55 to +150 | °C |
| Voltage Rate of Change<br>(Rated $V_R$, $T_J$ = 25°C) | dv/dt | 10,000 | V/μs |

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## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction–to–Case | $R_{\theta JC}$ | 0.4 | °C/W |

## ELECTRICAL CHARACTERISTICS

| | | | | |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.) ($I_F$ = 300 A) | $V_F$ | **$T_J$ = 25°C** | **$T_J$ = 100°C** | Volts |
| | | 0.57 | 0.5 | |
| Maximum Instantaneous Reverse Current ($V_R$ = 35 V) | $I_R$ | **$T_J$ = 25°C** | **$T_J$ = 100°C** | mA |
| | | 10 | 250 | |

1. Pulse Test: Pulse Width ≤ 380 μs, Duty Cycle ≤ 2%.

# CHAPTER 4
# Ultrafast Data Sheets

# MURS120T3 Series

**Preferred Devices**

# Surface Mount Ultrafast Power Rectifiers

## MURS105T3, MURS110T3, MURS115T3, MURS120T3, MURS140T3, MURS160T3

Ideally suited for high voltage, high frequency rectification, or as free wheeling and protection diodes in surface mount applications where compact size and weight are critical to the system.

- Small Compact Surface Mountable Package with J–Bend Leads
- Rectangular Package for Automated Handling
- High Temperature Glass Passivated Junction
- Low Forward Voltage Drop (0.71 to 1.05 Volts Max @ 1.0 A, $T_J$ = 150°C)

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 95 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 12 mm Tape and Reel, 2500 units per reel
- Polarity: Polarity Band Indicates Cathode Lead
- Marking: U1A, U1B, U1C, U1D, U1G, U1J

**MAXIMUM RATINGS**

| Please See the Table on the Following Page |
| --- |

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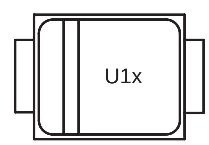
**ULTRAFAST RECTIFIERS**
**1.0 AMPERE**
**50–600 VOLTS**

**SMB**
**CASE 403A**

**MARKING DIAGRAM**




U1x= Device Code
x = Specific Device Code
A, B, C, D, G or J

**ORDERING INFORMATION**

See detailed ordering and shipping information in the table on page 287 of this data sheet.

**DEVICE MARKING INFORMATION**

See general marking information in the device marking table on page 287 of this data sheet.

**Preferred** devices are recommended choices for future use and best overall value.

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## MAXIMUM RATINGS

| Rating | Symbol | MURS | | | | | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | 105T3 | 110T3 | 115T3 | 120T3 | 140T3 | 160T3 | |
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 50 | 100 | 150 | 200 | 400 | 600 | Volts |
| Average Rectified Forward Current | $I_{F(AV)}$ | 1.0 @ $T_L$ = 155°C<br>2.0 @ $T_L$ = 145°C | | | | 1.0 @ $T_L$ = 150°C<br>2.0 @ $T_L$ = 125°C | | Amps |
| Non–Repetitive Peak Surge Current<br>(Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 40 | | | | 35 | | Amps |
| Operating Junction Temperature | $T_J$ | – 65 to +175 | | | | | | °C |

## THERMAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Thermal Resistance, Junction to Lead<br>($T_L$ = 25°C) | $R_{\theta JL}$ | 13 | °C/W |

## ELECTRICAL CHARACTERISTICS

| | | | | |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 1.0 A, $T_J$ = 25°C)<br>($i_F$ = 1.0 A, $T_J$ = 150°C) | $v_F$ | <br>0.875<br>0.71 | <br>1.25<br>1.05 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_J$ = 25°C)<br>(Rated dc Voltage, $T_J$ = 150°C) | $i_R$ | <br>2.0<br>50 | <br>5.0<br>150 | µA |
| Maximum Reverse Recovery Time<br>($i_F$ = 1.0 A, di/dt = 50 A/µs)<br>($i_F$ = 0.5 A, $i_R$ = 1.0 A, $I_R$ to 0.25 A) | $t_{rr}$ | <br>35<br>25 | <br>75<br>50 | ns |
| Maximum Forward Recovery Time<br>($i_F$ = 1.0 A, di/dt = 100 A/µs, Rec. to 1.0 V) | $t_{fr}$ | 25 | 50 | ns |

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

## DEVICE MARKING AND ORDERING INFORMATION

| Device | Marking | Package | Shipping |
|---|---|---|---|
| MURS105T3 | U1A | SMB | 2500 Units/Tape & Reel |
| MURS110T3 | U1B | SMB | 2500 Units/Tape & Reel |
| MURS115T3 | U1C | SMB | 2500 Units/Tape & Reel |
| MURS120T3 | U1D | SMB | 2500 Units/Tape & Reel |
| MURS140T3 | U1G | SMB | 2500 Units/Tape & Reel |
| MURS160T3 | U1J | SMB | 2500 Units/Tape & Reel |

## MURS105T3, MURS110T3, MURS115T3, MURS120T3

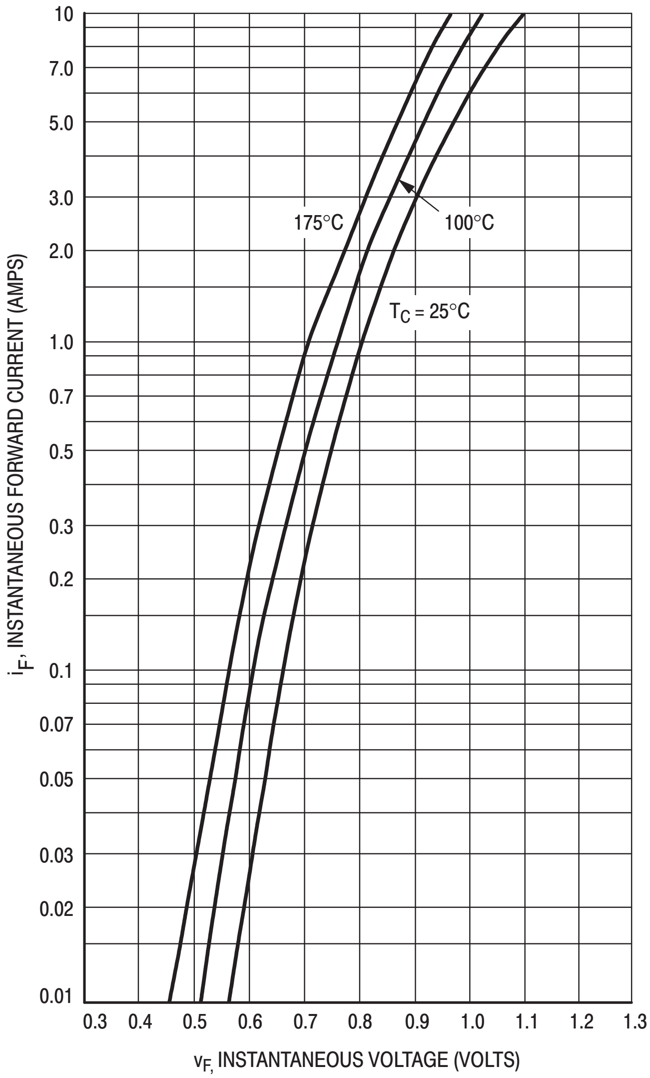


**Figure 1. Typical Forward Voltage**

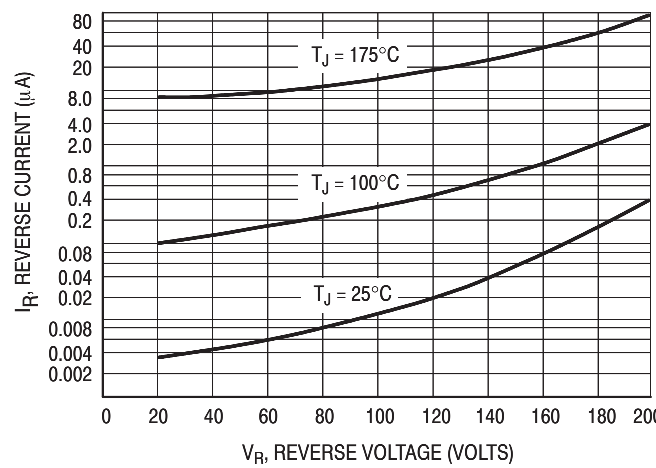


**Figure 2. Typical Reverse Current***

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if applied $V_R$ is sufficiently below rated $V_R$.

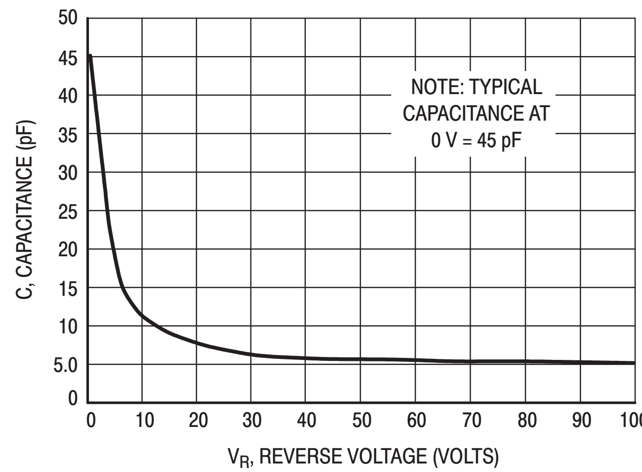


**Figure 3. Typical Capacitance**

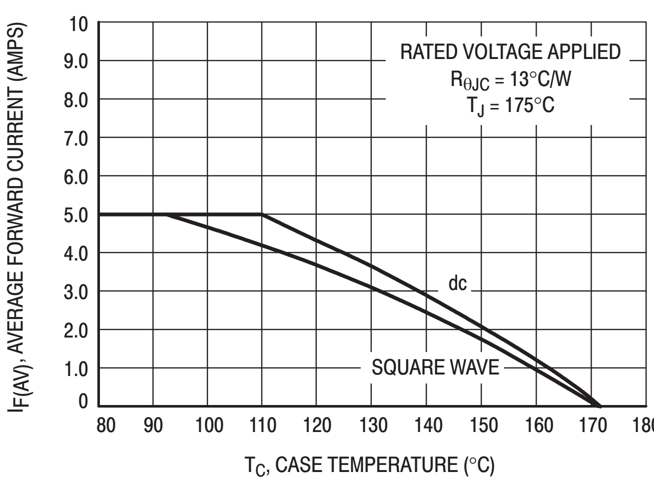


**Figure 4. Current Derating, Case**

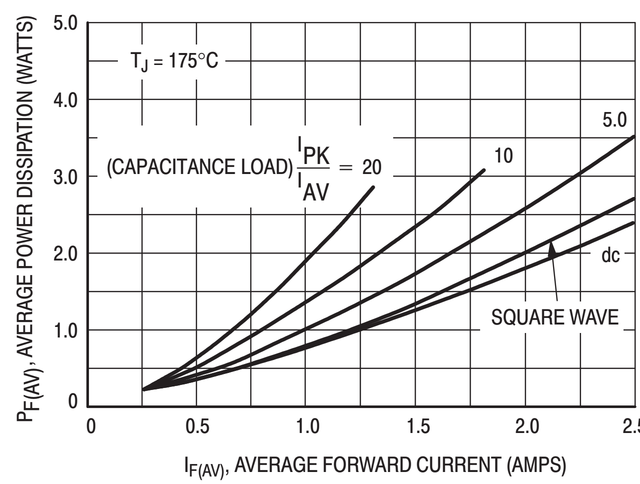


**Figure 5. Power Dissipation**

## MURS140T3, MURS160T3

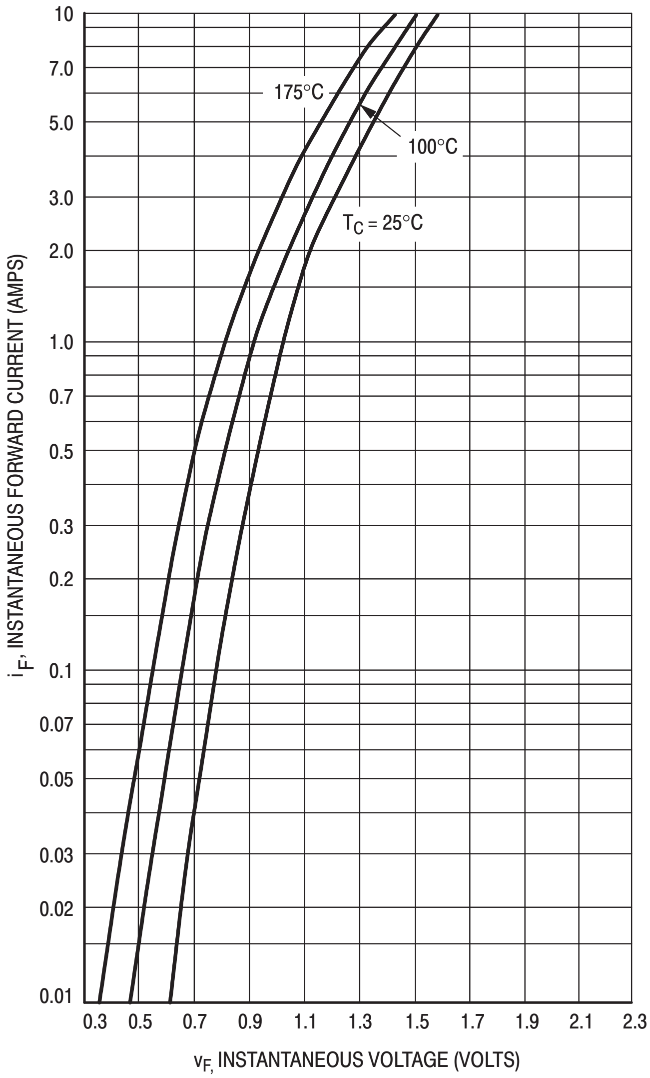


**Figure 6. Typical Forward Voltage**

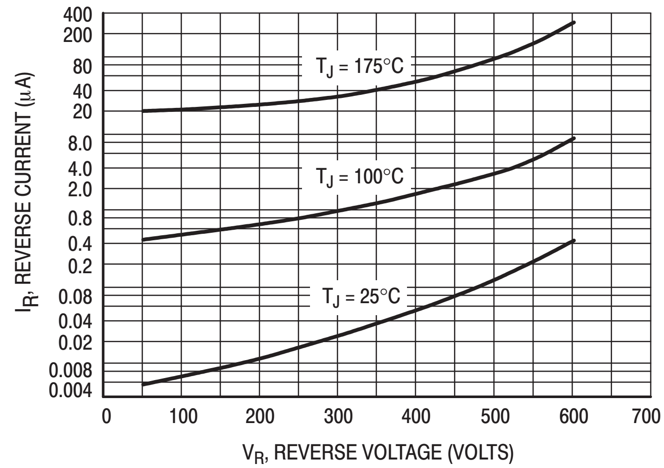


**Figure 7. Typical Reverse Current***

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if applied $V_R$ is sufficiently below rated $V_R$.

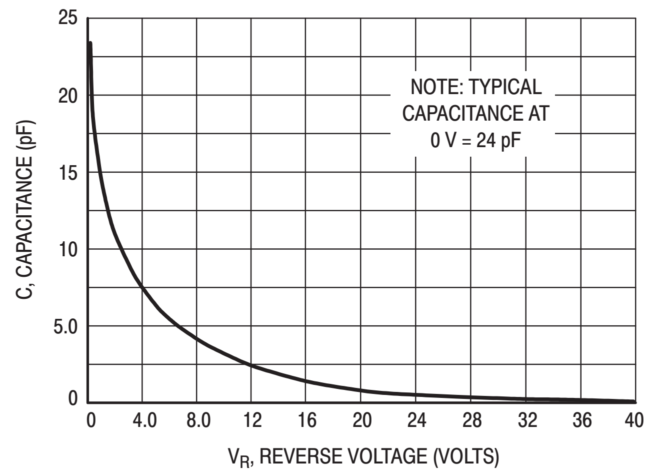


**Figure 8. Typical Capacitance**

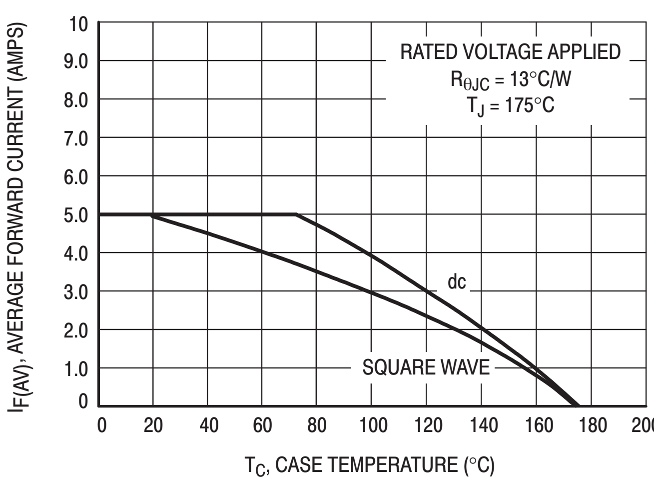


**Figure 9. Current Derating, Case**

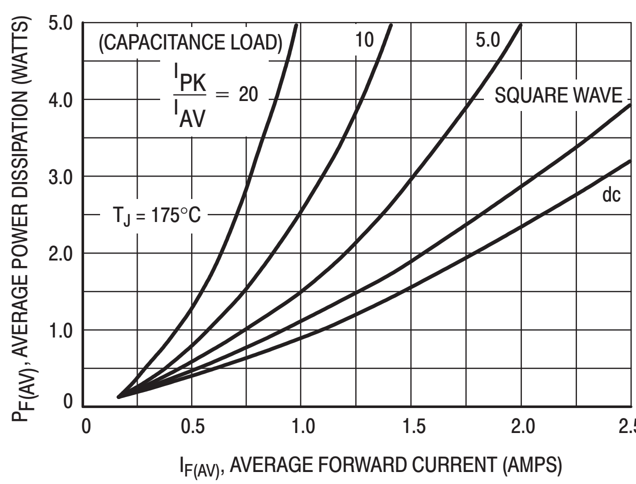


**Figure 10. Power Dissipation**

# MURS220T3

**Preferred Device**

# Surface Mount Ultrafast Power Rectifiers

Ideally suited for high voltage, high frequency rectification, or as free wheeling and protection diodes in surface mount applications where compact size and weight are critical to the system.

- Small Compact Surface Mountable Package with J–Bend Leads
- Rectangular Package for Automated Handling
- High Temperature Glass Passivated Junction
- Low Forward Voltage Drop (0.77 Volts Max @ 2.0 A, $T_J$ = 150°C)

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 95 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 12 mm Tape and Reel, 2500 units per reel
- Polarity: Polarity Band Indicates Cathode Lead
- Marking: U2D

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 200 | V |
| Average Rectified Forward Current | $I_{F(AV)}$ | 2.0 @ $T_L$ = 145°C | A |
| Non–Repetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 40 | A |
| Operating Junction Temperature Range | $T_J$ | –65 to +175 | °C |

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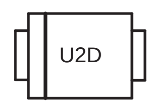
**ULTRAFAST RECTIFIERS**
**2 AMPERES**
**200 VOLTS**

**SMB**
**CASE 403A**

**MARKING DIAGRAM**




U2D = Specific Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MURS220T3 | SMB | 2500/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Lead ($T_L$ = 25°C) | $R_{\theta JL}$ | 13 | °C/W |

## ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.) | $v_F$ | | Volts |
| ($i_F$ = 2.0 A, $T_J$ = 25°C) | | 0.95 | |
| ($i_F$ = 2.0 A, $T_J$ = 150°C) | | 0.77 | |
| Maximum Instantaneous Reverse Current (Note 1.) | $i_R$ | | μA |
| (Rated dc Voltage, $T_J$ = 25°C) | | 2.0 | |
| (Rated dc Voltage, $T_J$ = 150°C) | | 50 | |
| Maximum Reverse Recovery Time | $t_{rr}$ | | ns |
| ($i_F$ = 1.0 A, di/dt = 50 A/μs) | | 35 | |
| ($i_F$ = 0.5 A, $i_R$ = 1.0 A, $I_R$ to 0.25 A) | | 25 | |
| Maximum Forward Recovery Time ($i_F$ = 1.0 A, di/dt = 100 A/μs, Rec. to 1.0 V) | $t_{fr}$ | 25 | ns |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

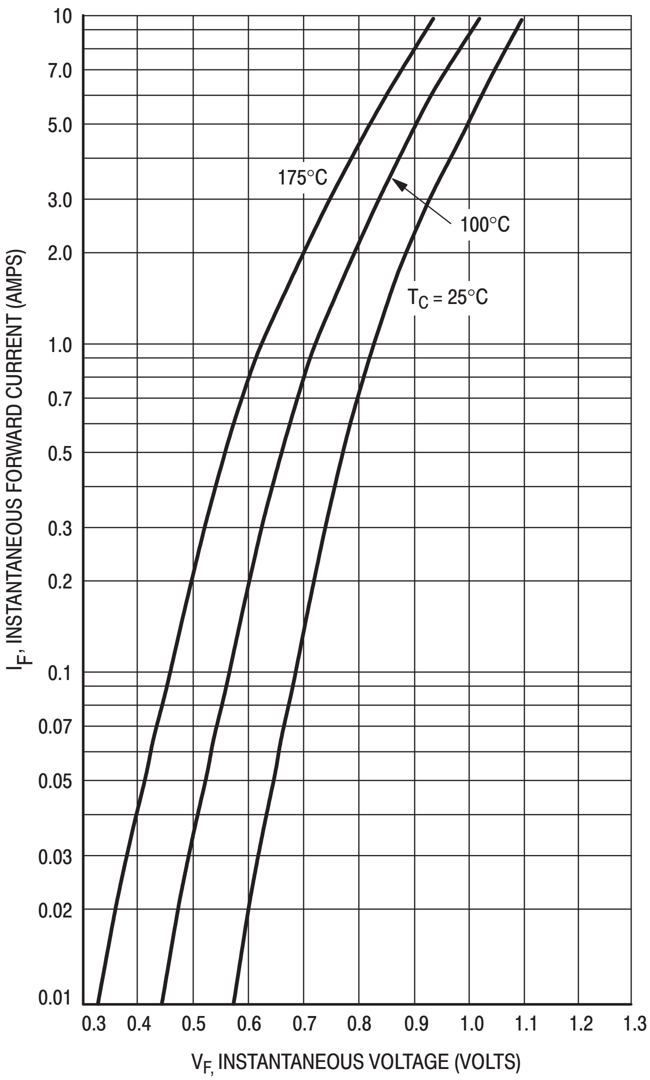


**Figure 1. Typical Forward Voltage**

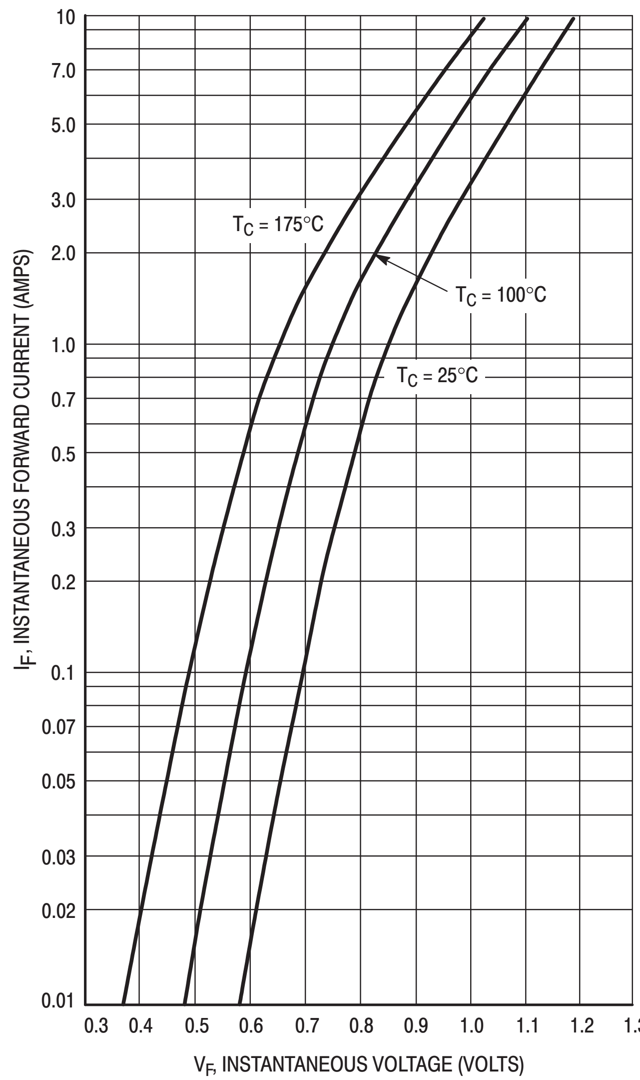


**Figure 2. Maximum Forward Voltage**

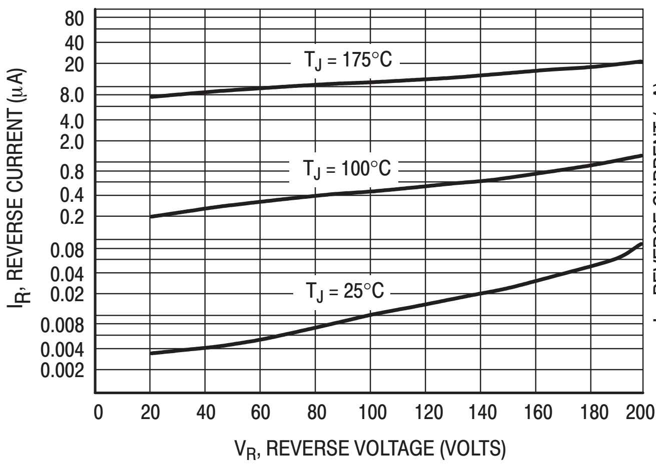


**Figure 3. Typical Reverse Current***

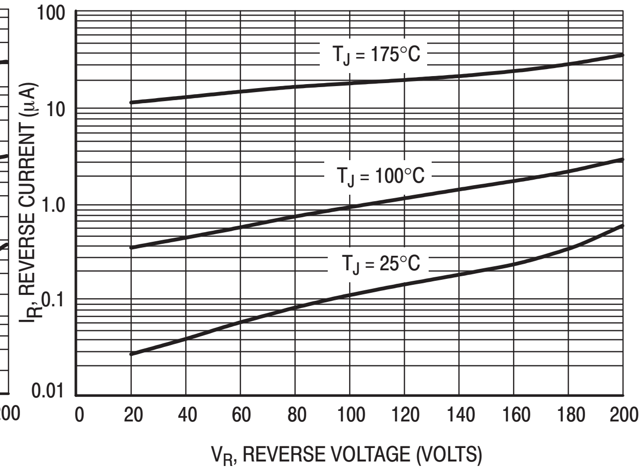


**Figure 4. Maximum Reverse Current**

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if applied $V_R$ is sufficiently below rated $V_R$.

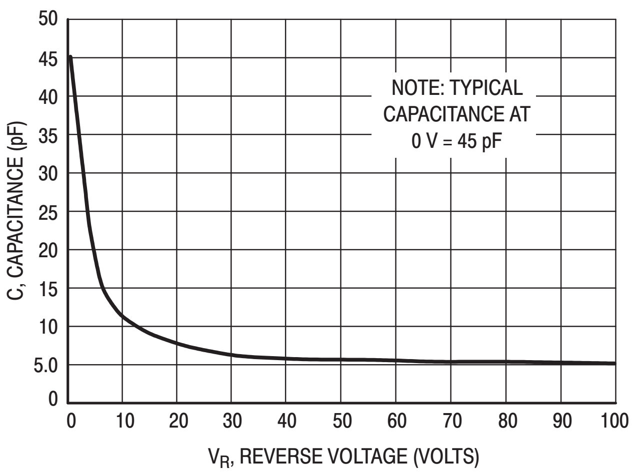


**Figure 5. Typical Capacitance**

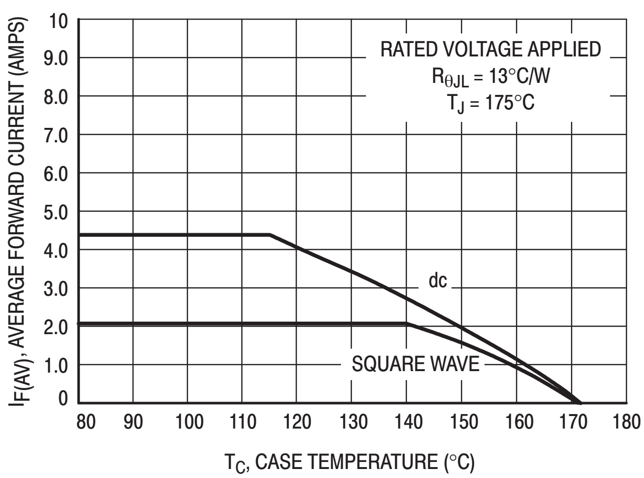


**Figure 6. Current Derating, Case**

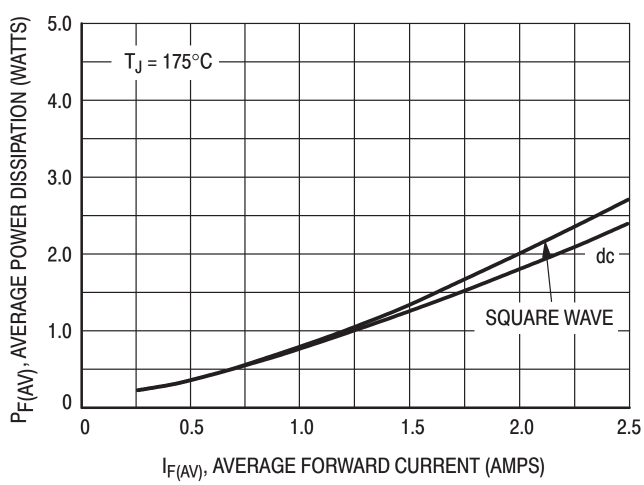


**Figure 7. Power Dissipation**

# MURS230T3, MURS240T3

**Preferred Device**

# Surface Mount Ultrafast Power Rectifiers

Ideally suited for high voltage, high frequency rectification, or as free wheeling and protection diodes in surface mount applications where compact size and weight are critical to the system.

- Small Compact Surface Mountable Package with J–Bend Leads
- Rectangular Package for Automated Handling
- High Temperature Glass Passivated Junction
- Low Forward Voltage Drop (0.95 Volts Max @ 2.0 A, $T_J$ = 150°C)

**Mechanical Characteristics:**
- Case: Epoxy, Molded
- Weight: 95 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 12 mm Tape and Reel, 2500 units per reel
- Polarity: Polarity Band Indicates Cathode Lead
- Marking: U2F, U2G

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage MURS230T3<br>MURS240T3 | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | <br><br>300<br>400 | V |
| Average Rectified Forward Current | $I_{F(AV)}$ | 1.0 @ $T_L$ = 150°C<br>2.0 @ $T_L$ = 125°C | A |
| Non–Repetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 35 | A |
| Operating Junction Temperature Range | $T_J$ | –65 to +175 | °C |

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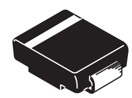
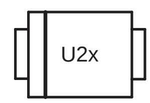
**ULTRAFAST RECTIFIERS**
**2 AMPERES**
**300–400 VOLTS**



**SMB**
**CASE 403A**

**MARKING DIAGRAM**




x = F (230T3)
G (240T3)

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MURS230T3 | SMB | 2500/Tape & Reel |
| MURS240T3 | SMB | 2500/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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## THERMAL CHARACTERISTICS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Lead ($T_L$ = 25°C) | $R_{\theta JL}$ | 13 | °C/W |

## ELECTRICAL CHARACTERISTICS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 2.0 A, $T_J$ = 25°C)<br>($i_F$ = 2.0 A, $T_J$ = 150°C) | $v_F$ | <br>1.15<br>0.95 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_J$ = 25°C)<br>(Rated dc Voltage, $T_J$ = 150°C) | $i_R$ | <br>5.0<br>150 | μA |
| Maximum Reverse Recovery Time<br>($i_F$ = 1.0 A, di/dt = 50 A/μs)<br>($i_F$ = 0.5 A, $i_R$ = 1.0 A, $I_R$ to 0.25 A) | $t_{rr}$ | <br>65<br>50 | ns |
| Maximum Forward Recovery Time<br>($i_F$ = 1.0 A, di/dt = 100 A/μs, Rec. to 1.0 V) | $t_{fr}$ | 50 | ns |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

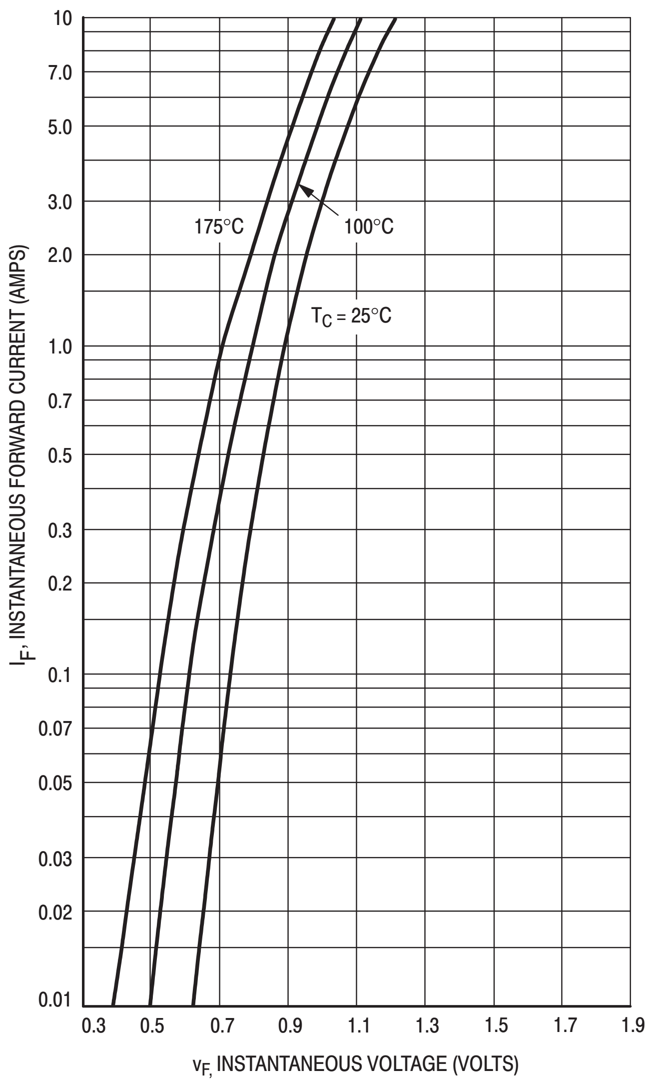


**Figure 1. Typical Forward Voltage**

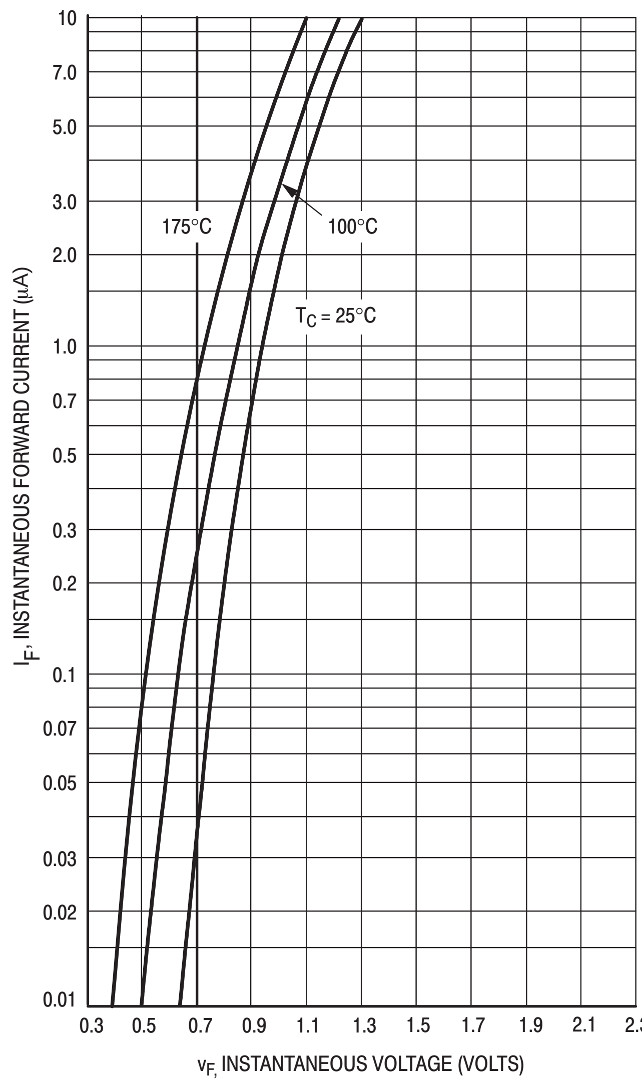


**Figure 2. Maximum Forward Voltage**

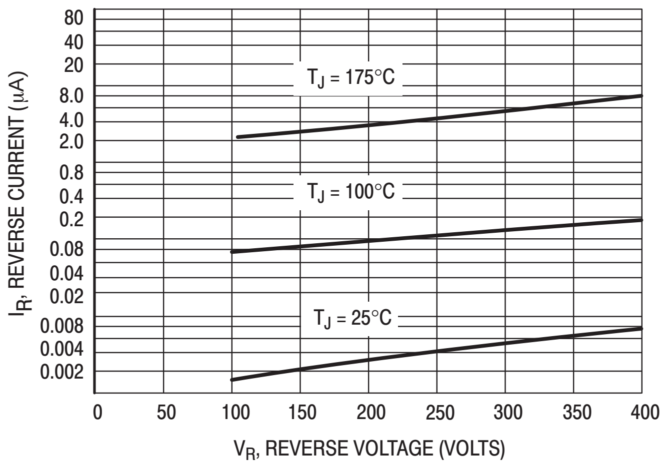


**Figure 3. Typical Reverse Current***

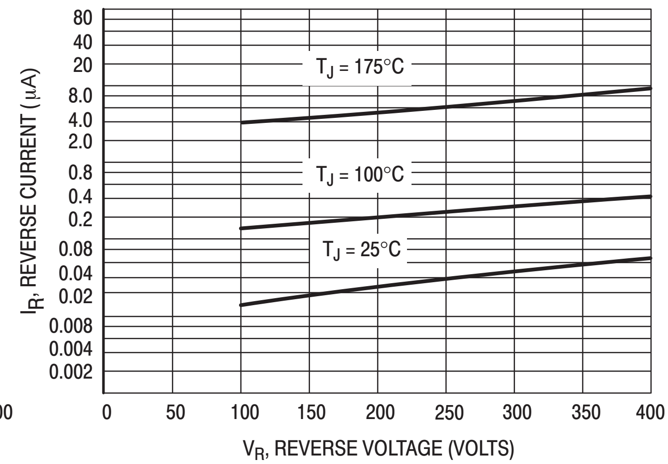


**Figure 4. Maximum Reverse Current***

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if applied $V_R$ is sufficiently below rated $V_R$.

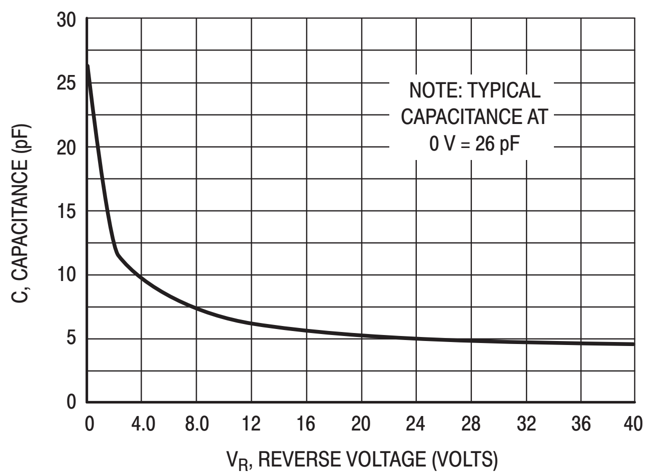


**Figure 5. Typical Capacitance**

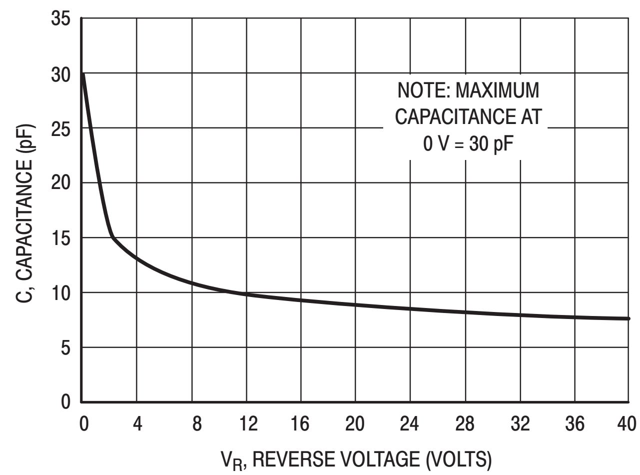


**Figure 6. Maximum Capacitance**

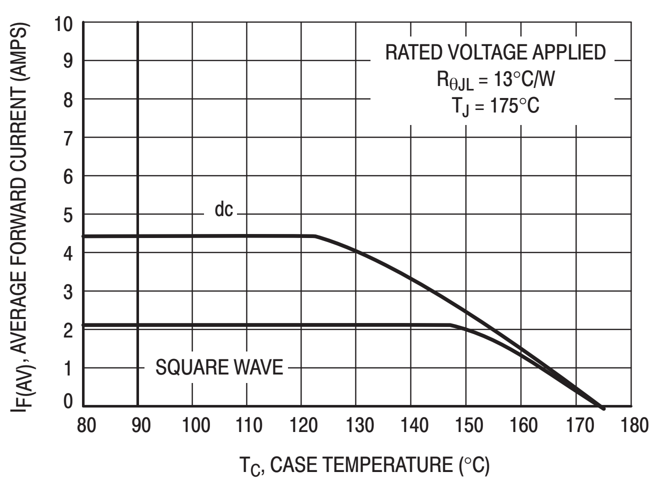


**Figure 7. Current Derating, Case**

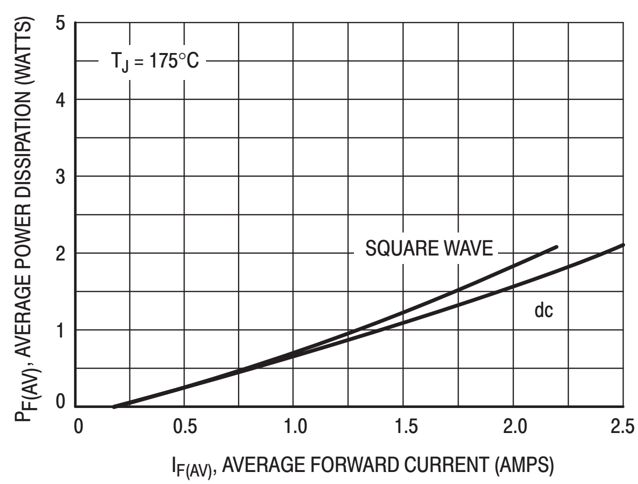


**Figure 8. Power Dissipation**

# MURS260T3

Preferred Device

# Surface Mount Ultrafast Power Rectifiers

Ideally suited for high voltage, high frequency rectification, or as free wheeling and protection diodes in surface mount applications where compact size and weight are critical to the system.

- Small Compact Surface Mountable Package with J–Bend Leads
- Rectangular Package for Automated Handling
- High Temperature Glass Passivated Junction
- Low Forward Voltage Drop (1.20 Volts Max @ 2.0 A, $T_J$ = 150°C)

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 95 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 12 mm Tape and Reel, 2500 units per reel
- Polarity: Polarity Band Indicates Cathode Lead
- Marking: U2J

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 600 | Volts |
| Average Rectified Forward Current | $I_{F(AV)}$ | 2.0 @ $T_L$ = 125°C | Amps |
| Non–Repetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 35 | Amps |
| Operating Junction Temperature | $T_J$ | – 65 to +175 | °C |

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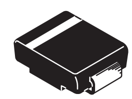
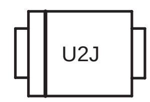
**ULTRAFAST RECTIFIERS**
**2 AMPERES**
**600 VOLTS**



**SMB**
**CASE 403A**

**MARKING DIAGRAM**




U2J = Specific Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MURS260T3 | SMB | 2500/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Lead ($T_L$ = 25°C) | $R_{\theta JL}$ | 13 | °C/W |

## ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 2.0 A, $T_J$ = 25°C)<br>($i_F$ = 2.0 A, $T_J$ = 150°C) | $v_F$ | <br>1.45<br>1.20 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_J$ = 25°C)<br>(Rated dc Voltage, $T_J$ = 150°C) | $i_R$ | <br>5.0<br>150 | μA |
| Maximum Reverse Recovery Time<br>($i_F$ = 1.0 A, di/dt = 50 A/μs)<br>($i_F$ = 0.5 A, $i_R$ = 1.0 A, $I_R$ to 0.25 A) | $t_{rr}$ | <br>75<br>50 | ns |
| Maximum Forward Recovery Time<br>($i_F$ = 1.0 A, di/dt = 100 A/μs, Rec. to 1.0 V) | $t_{fr}$ | 50 | ns |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

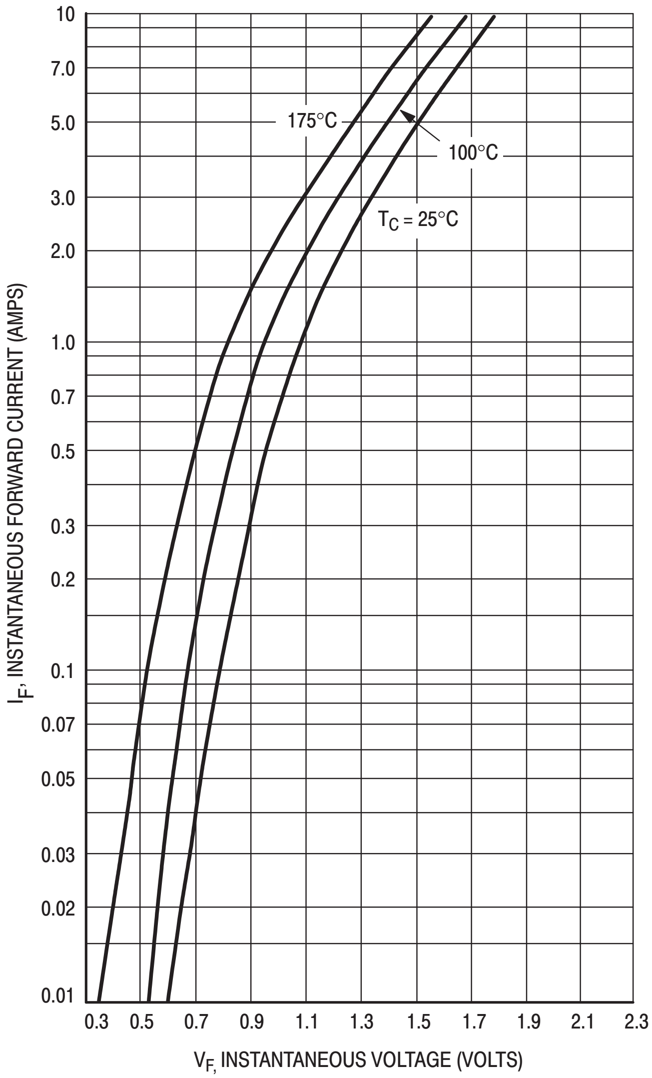


**Figure 1. Typical Forward Voltage**

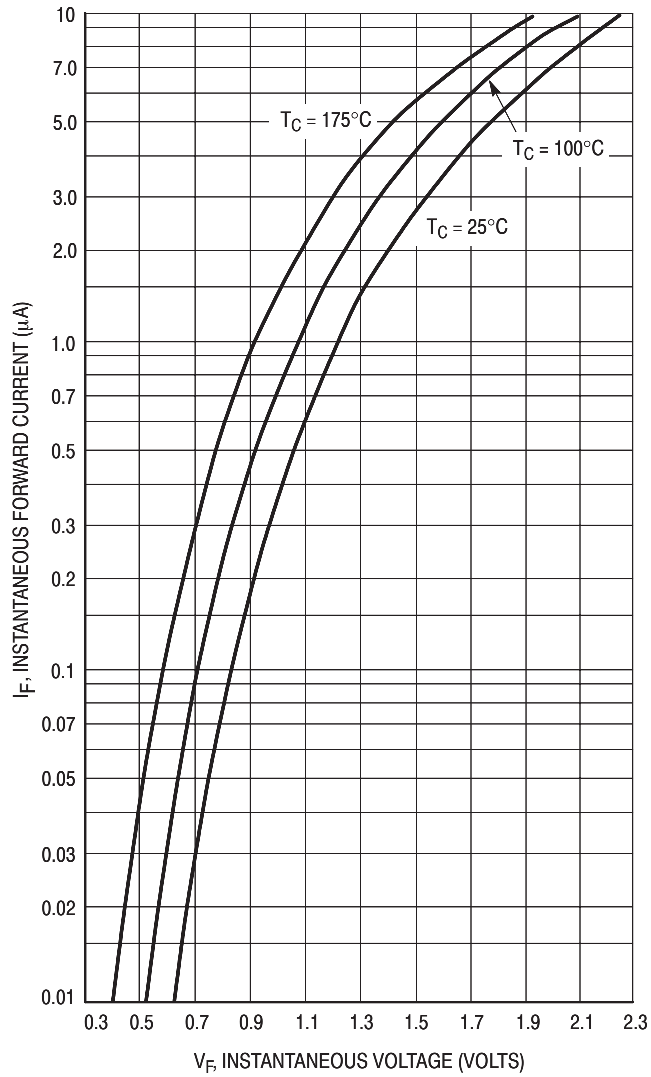


**Figure 2. Maximum Forward Voltage**

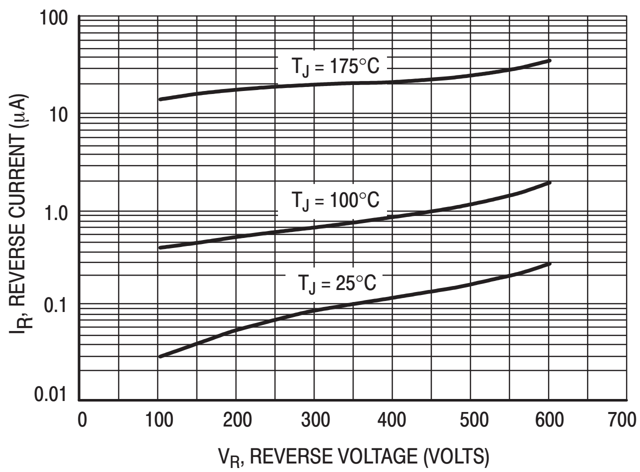


**Figure 3. Typical Reverse Current***

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if applied $V_R$ is sufficiently below rated $V_R$.

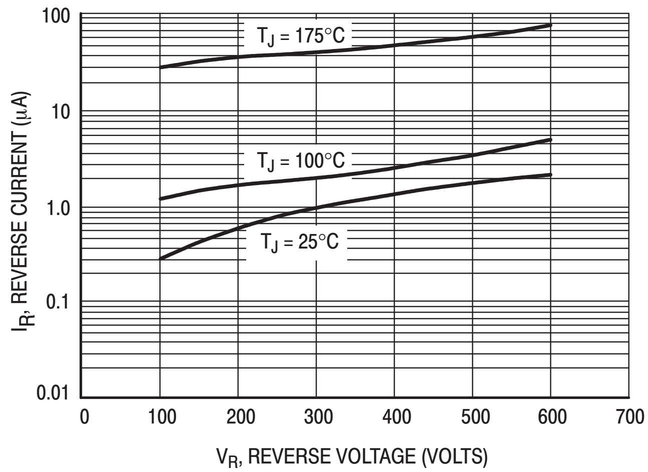


**Figure 4. Maximum Reverse Current**

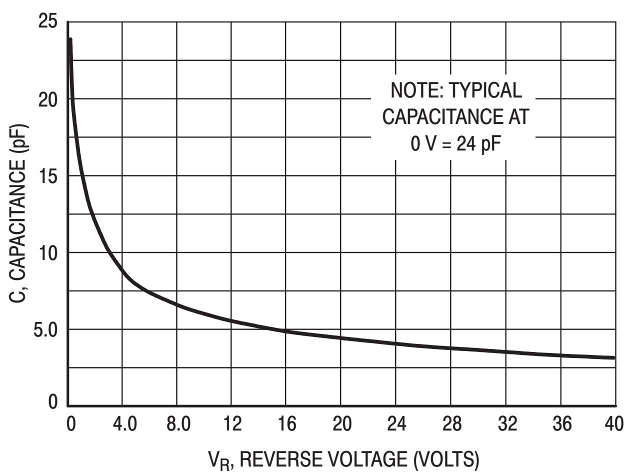


**Figure 5. Typical Capacitance**

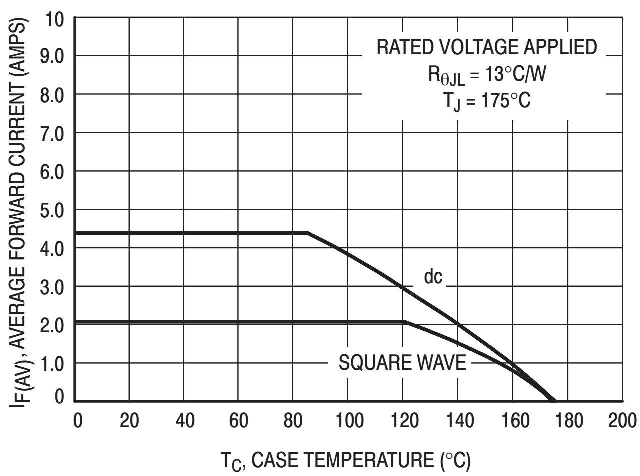


**Figure 6. Current Derating, Case**

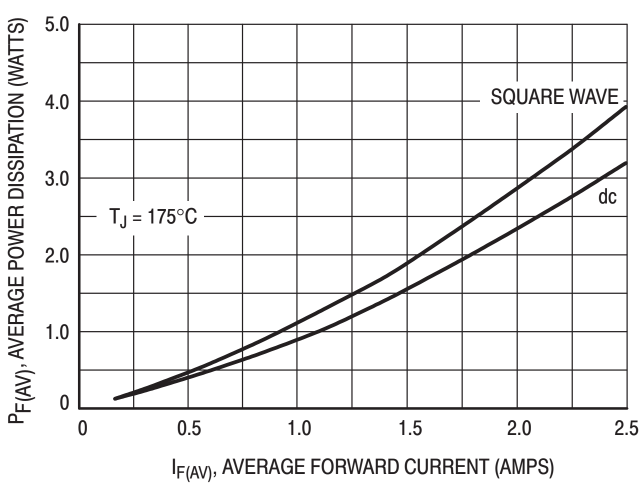


**Figure 7. Power Dissipation**

# MURS320T3, MURS340T3, MURS360T3

**Preferred Devices**

# Surface Mount Ultrafast Power Rectifiers

. . . employing state–of–the–art epitaxial construction with oxide passivation and metal overlay contact. Ideally suited for high voltage, high frequency rectification, or as free wheeling and protection diodes, in surface mount applications where compact size and weight are critical to the system.

- Small Compact Surface Mountable Package with J–Bend Leads
- Rectangular Package for Automated Handling
- Highly Stable Oxide Passivated Junction
- Low Forward Voltage Drop (0.71 to 1.05 Volts Max @ 3.0 A, $T_J$ = 150°C)

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 217 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 16 mm Tape and Reel, 2500 units per reel
- Polarity: Notch in Plastic Body Indicates Cathode Lead
- Marking: U3D, U3G, U3J

**MAXIMUM RATINGS**

| Please See the Table on the Following Page |
|---|

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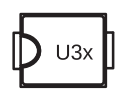
**ULTRAFAST RECTIFIERS**
**3.0 AMPERES**
**200–600 VOLTS**

**SMC**
**CASE 403**
**PLASTIC**

**MARKING DIAGRAM**




U3x = Device Code
x = D, G , or J

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MURS320T3 | SMC | 2500/Tape & Reel |
| MURS340T3 | SMC | 2500/Tape & Reel |
| MURS360T3 | SMC | 2500/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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## MAXIMUM RATINGS

| Rating | Symbol | MURS320T3 | MURS340T3 | MURS360T3 | Unit |
|---|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 200 | 400 | 600 | Volts |
| Average Rectified Forward Current | $I_{F(AV)}$ | 3.0 @ $T_L$ = 140°C<br>4.0 @ $T_L$ = 130°C | 3.0 @ $T_L$ = 130°C<br>4.0 @ $T_L$ = 115°C | 3.0 @ $T_L$ = 130°C<br>4.0 @ $T_L$ = 115°C | Amps |
| Non–Repetitive Peak Surge Current<br>(Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 75 | | | Amps |
| Operating Junction Temperature | $T_J$ | – 65 to +175 | | | °C |

## THERMAL CHARACTERISTICS

| | | | | | |
|---|---|---|---|---|---|
| Thermal Resistance, Junction to Lead | $R_{\theta JL}$ | 11 | | | °C/W |

## ELECTRICAL CHARACTERISTICS

| | | | | | |
|---|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 3.0 A, $T_J$ = 25°C)<br>($i_F$ = 4.0 A, $T_J$ = 25°C)<br>($i_F$ = 3.0 A, $T_J$ = 150°C) | $v_F$ | <br>0.875<br>0.89<br>0.71 | <br>1.25<br>1.28<br>1.05 | <br>1.25<br>1.28<br>1.05 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_J$ = 25°C)<br>(Rated dc Voltage, $T_J$ = 150°C) | $i_R$ | <br>5.0<br>15 | <br>10<br>250 | <br>10<br>250 | µA |
| Maximum Reverse Recovery Time<br>($i_F$ = 1.0 A, di/dt = 50 A/µs)<br>($i_F$ = 0.5 A, $i_R$ = 1.0 A, $I_{REC}$ to 0.25 A) | $t_{rr}$ | <br>35<br>25 | <br>75<br>50 | <br>75<br>50 | ns |
| Maximum Forward Recovery Time<br>($i_F$ = 1.0 A, di/dt = 100 A/µs, Recovery to 1.0 V) | $t_{fr}$ | 25 | 50 | 50 | ns |

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

## MURS320T3

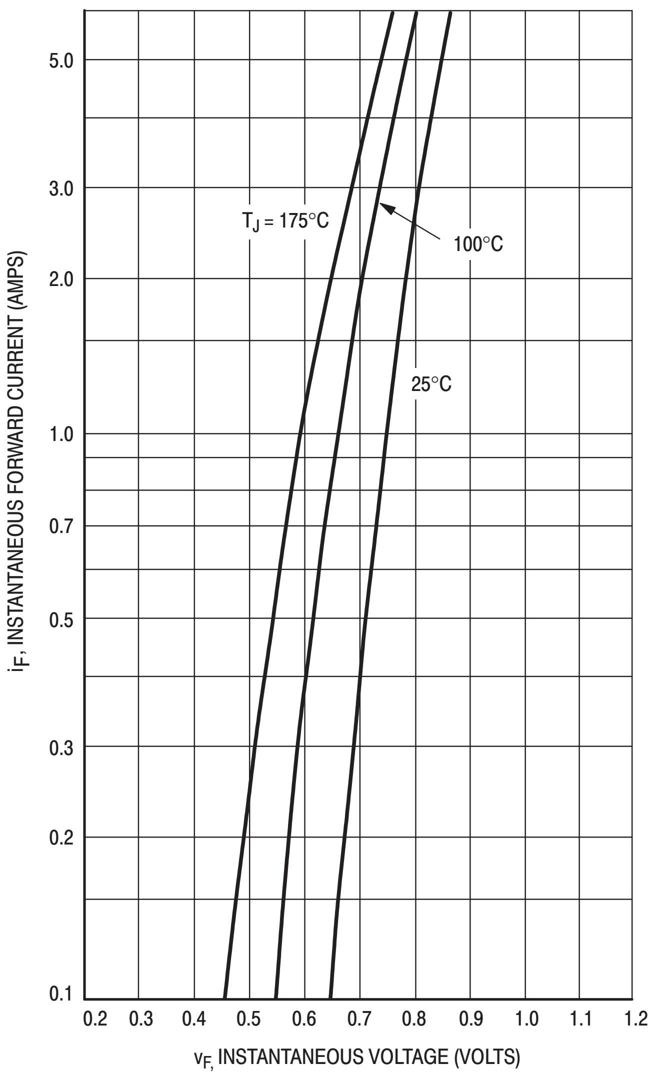


**Figure 1. Typical Forward Voltage**

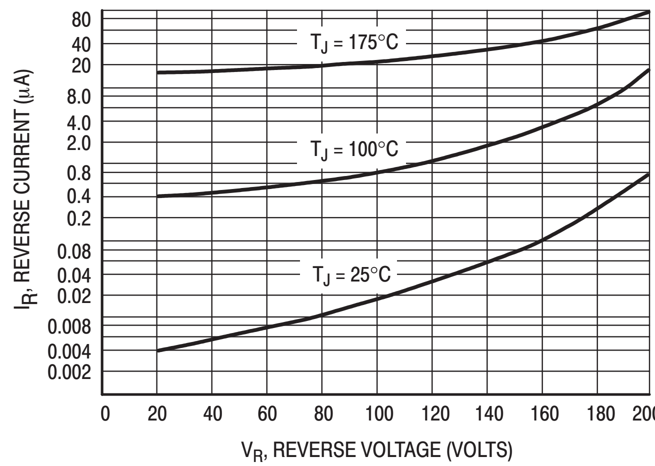


**Figure 2. Typical Reverse Current***

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if $V_R$ is sufficiently below rated $V_R$.

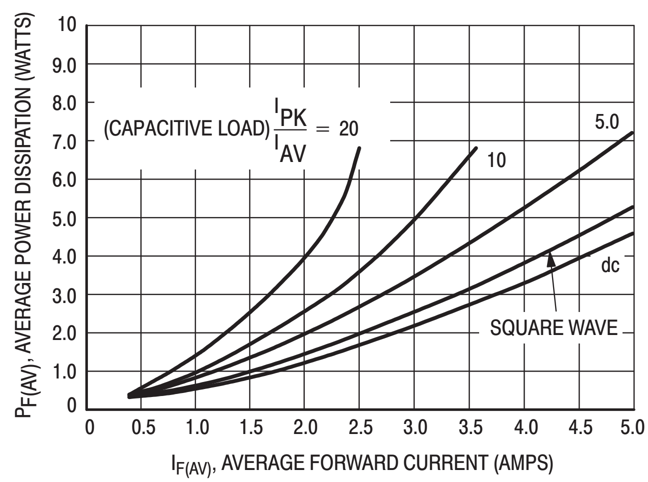


**Figure 3. Power Dissipation**

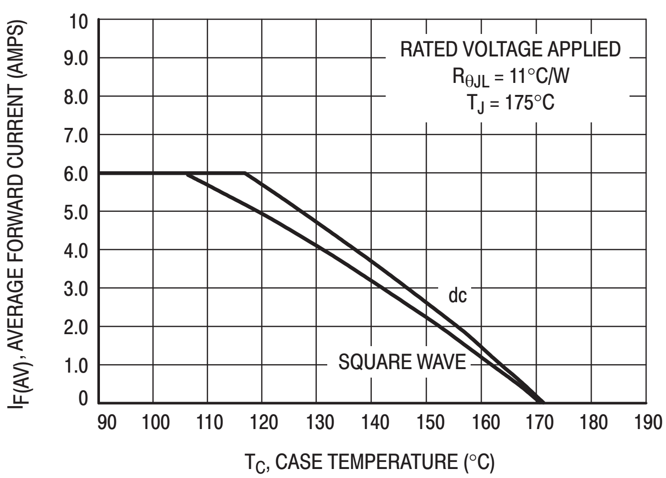


**Figure 4. Current Derating, Case**

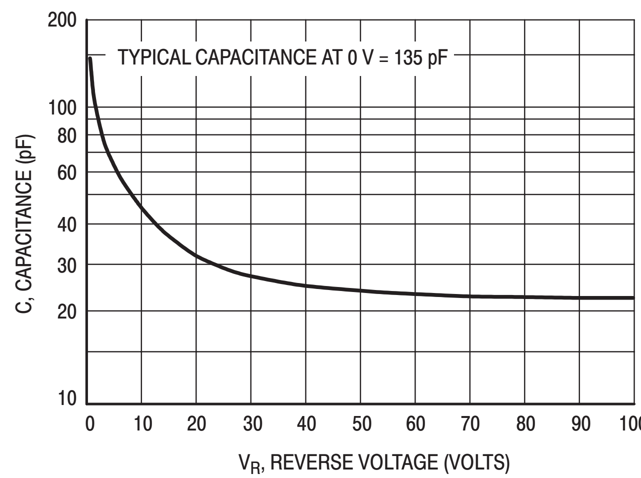


**Figure 5. Typical Capacitance**

## MURS340T3, MURS360T3

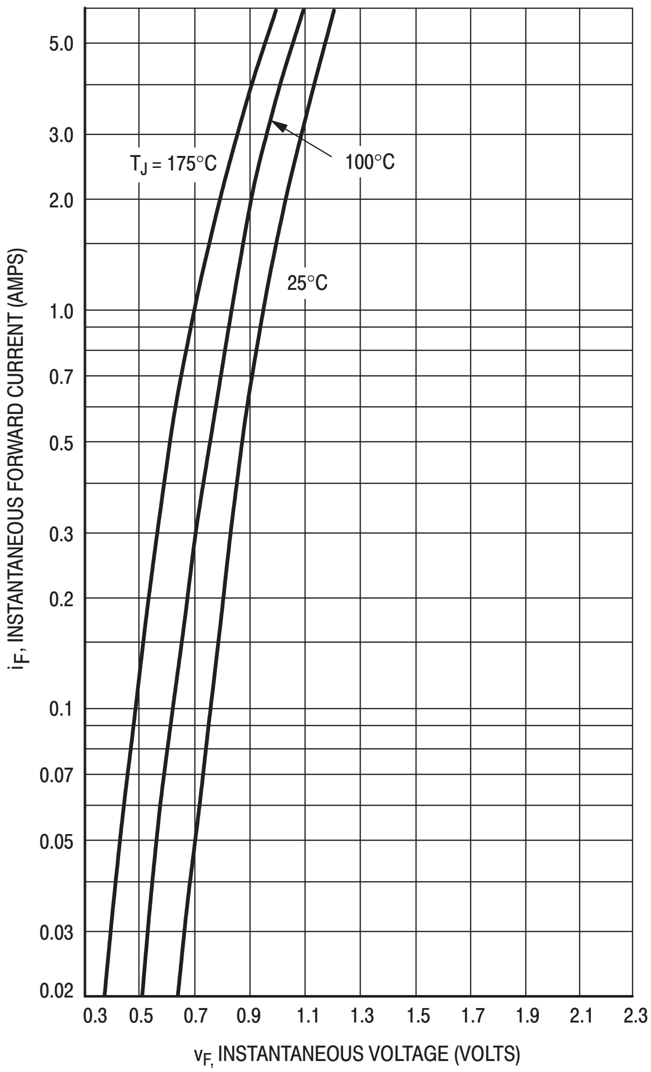


**Figure 6. Typical Forward Voltage**

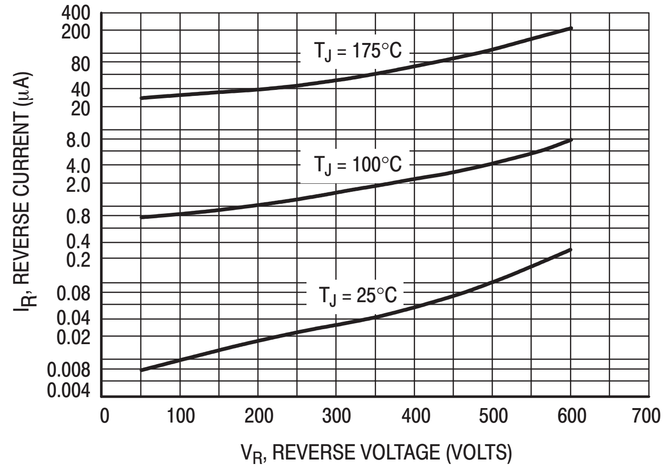


**Figure 7. Typical Reverse Current***

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if $V_R$ is sufficiently below rated $V_R$.

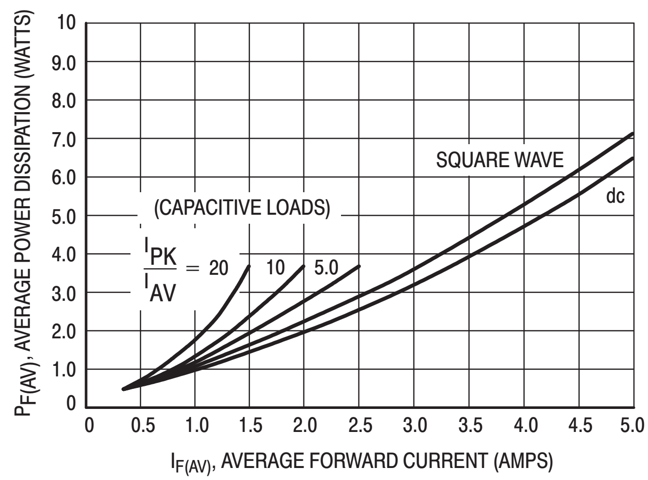


**Figure 8. Power Dissipation**

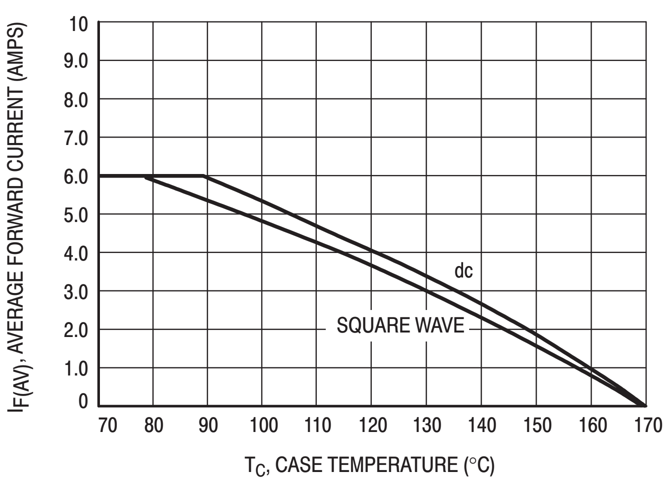


**Figure 9. Current Derating, Case**

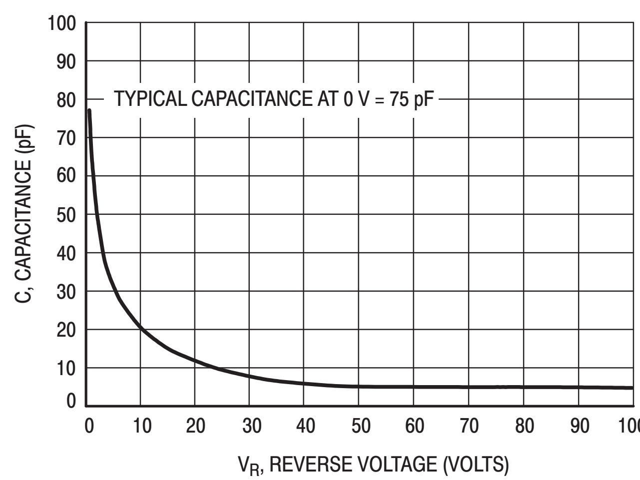


**Figure 10. Typical Capacitance**

# MURD320

Preferred Device

# SWITCHMODE™ Power Rectifier

## DPAK Surface Mount Package

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 35 Nanosecond Recovery Time
- Low Forward Voltage Drop
- Low Leakage

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 75 units per plastic tube
- Available in 16 mm Tape and Reel, 2500 units per reel, by adding a “T4’’ suffix to the part number
- Marking: U320

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 200 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_C$ = 158°C) | $I_{F(AV)}$ | 3.0 | A |
| Peak Repetitive Forward Current (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 158°C) | $I_{FRM}$ | 6.0 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, 60 Hz) | $I_{FSM}$ | 75 | A |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | °C |

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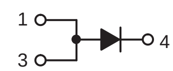
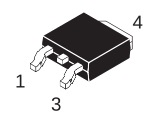
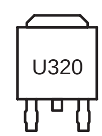
**ULTRAFAST RECTIFIER 3.0 AMPERES 200 VOLTS**




**DPAK CASE 369A PLASTIC**

**MARKING DIAGRAM**




U320 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MURD320 | DPAK | 75 Units/Rail |
| MURD320T4 | DPAK | 2500/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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## THERMAL CHARACTERISTICS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case<br>Junction to Ambient (Note 1.) | $R_{\theta JC}$<br>$R_{\theta JA}$ | 6<br>80 | °C/W |

## ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage Drop (Note 2.)<br>($i_F$ = 3 Amps, $T_J$ = 25°C)<br>($i_F$ = 3 Amps, $T_J$ = 125°C) | $v_F$ | <br>0.95<br>0.75 | Volts |
| Maximum Instantaneous Reverse Current (Note 2.)<br>($T_J$ = 25°C, Rated dc Voltage)<br>($T_J$ = 125°C, Rated dc Voltage) | $i_R$ | <br>5<br>500 | μA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1 Amp, di/dt = 50 Amps/μs, $V_R$ = 30 V, $T_J$ = 25°C)<br>($I_F$ = 0.5 Amp, $i_R$ = 1 Amp, $I_{REC}$ = 0.25 A, $V_R$ = 30 V, $T_J$ = 25°C) | $t_{rr}$ | <br>35<br>25 | ns |

1. Rating applies when surface mounted on the minimum pad sizes recommended.
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

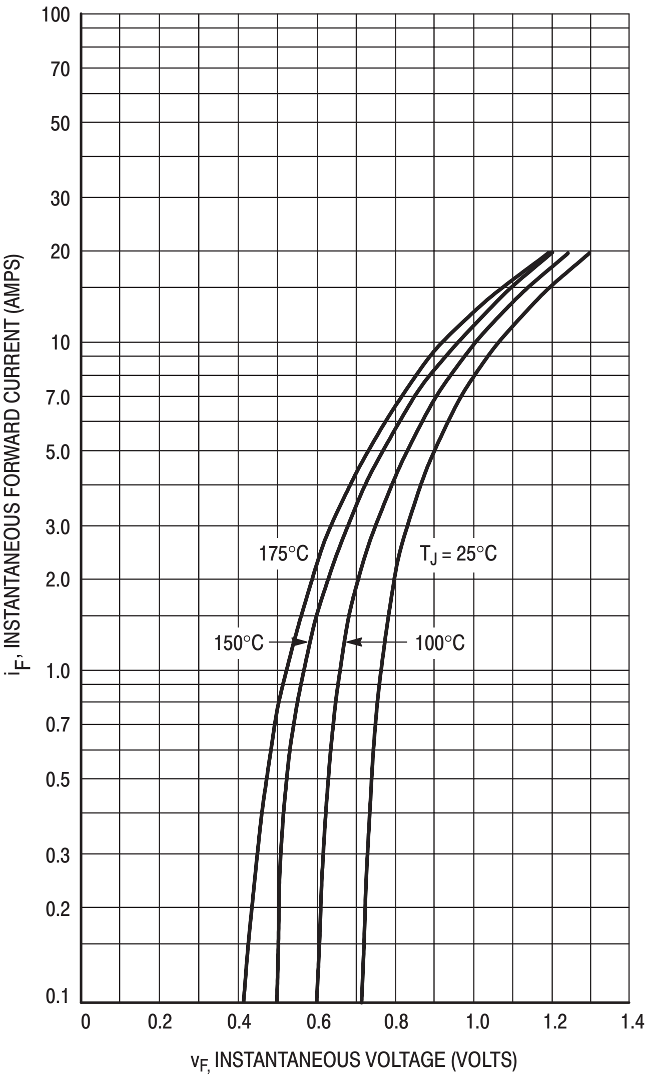



**Figure 1. Typical Forward Voltage**

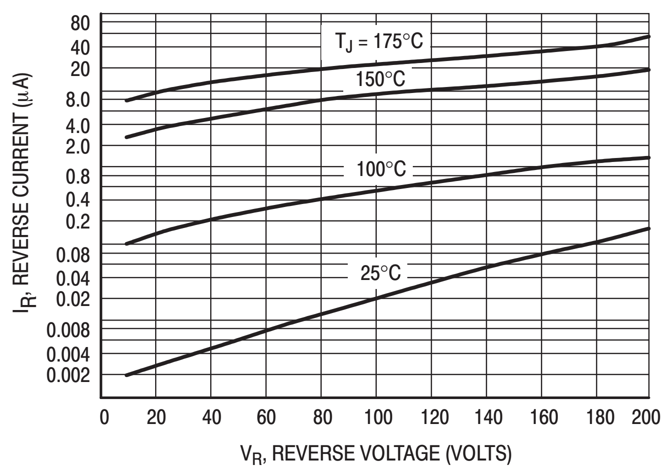



**Figure 2. Typical Reverse Current***

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these curves if $V_R$ is sufficiently below rated $V_R$.

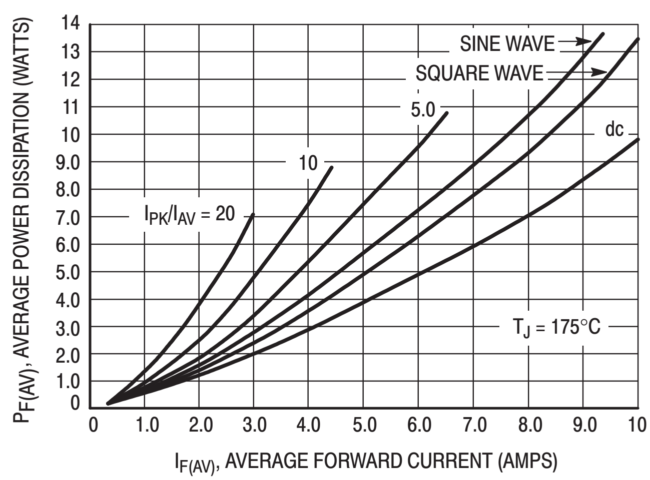



**Figure 3. Average Power Dissipation**

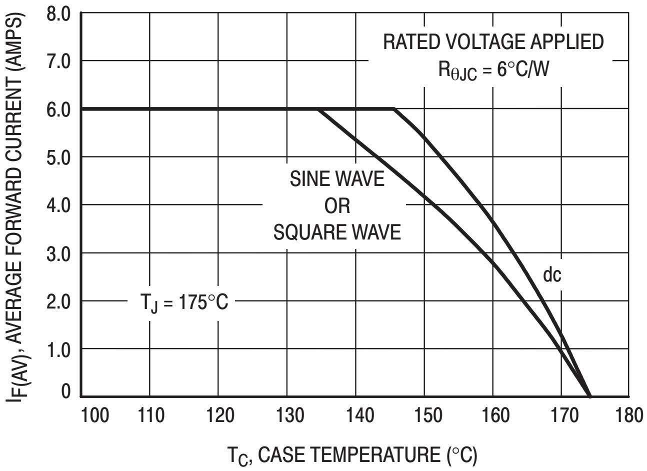



**Figure 4. Current Derating, Case**

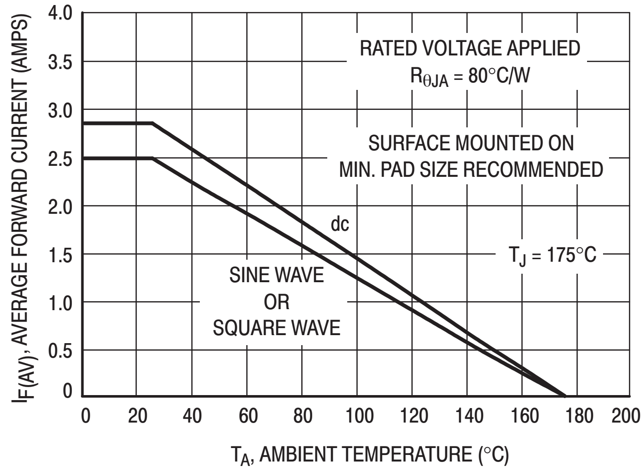



**Figure 5. Current Derating, Ambient**

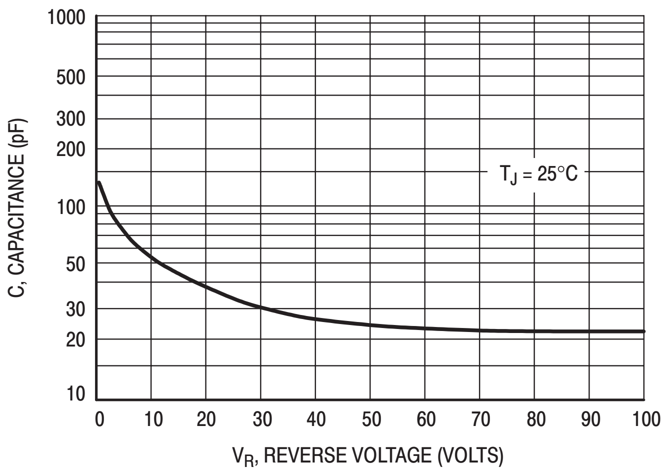



**Figure 6. Typical Capacitance**

# MURD620CT

**Preferred Device**

# SWITCHMODE™ Power Rectifier

## DPAK Surface Mount Package

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 35 Nanosecond Recovery Time
- Low Forward Voltage Drop
- Low Leakage

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 75 units per plastic tube
- Available in 16 mm Tape and Reel, 2500 units per reel, by adding a “T4’’ suffix to the part number
- Marking: U620T

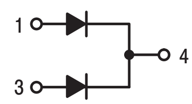
**MAXIMUM RATINGS**

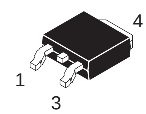
| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 200 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_C$ = 140°C) Per Diode<br>Per Device | $I_{F(AV)}$ | <br>3.0<br>6.0 | A |
| Peak Repetitive Forward Current (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 145°C) Per Diode | $I_F$ | 6.0 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, 60 Hz) | $I_{FSM}$ | 50 | A |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | °C |

**ON Semiconductor™**

**http://onsemi.com**

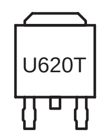
**ULTRAFAST RECTIFIER**
**6.0 AMPERES**
**200 VOLTS**




**DPAK**
**CASE 369A**
**PLASTIC**

**MARKING DIAGRAM**




U620T = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MURD620CT | DPAK | 75 Units/Rail |
| MURD620CTT4 | DPAK | 2500/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS** (Per Diode)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case<br>Junction to Ambient (Note 1.) | $R_{\theta JC}$<br>$R_{\theta JA}$ | 9<br>80 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Diode)

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage Drop (Note 2.)<br>($i_F$ = 3 Amps, $T_C$ = 25°C)<br>($i_F$ = 3 Amps, $T_C$ = 125°C)<br>($i_F$ = 6 Amps, $T_C$ = 25°C)<br>($i_F$ = 6 Amps, $T_C$ = 125°C) | $v_F$ | <br>1<br>0.96<br>1.2<br>1.13 | Volts |
| Maximum Instantaneous Reverse Current (Note 2.)<br>($T_J$ = 25°C, Rated dc Voltage)<br>($T_J$ = 125°C, Rated dc Voltage) | $i_R$ | <br>5<br>250 | µA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1 Amp, di/dt = 50 Amps/µs, $V_R$ = 30 V, $T_J$ = 25°C)<br>($I_F$ = 0.5 Amp, $i_R$ = 1 Amp, $I_{REC}$ = 0.25 A, $V_R$ = 30 V, $T_J$ = 25°C) | $t_{rr}$ | <br>35<br>25 | ns |

1. Rating applies when surface mounted on the minimum pad sizes recommended.
2. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

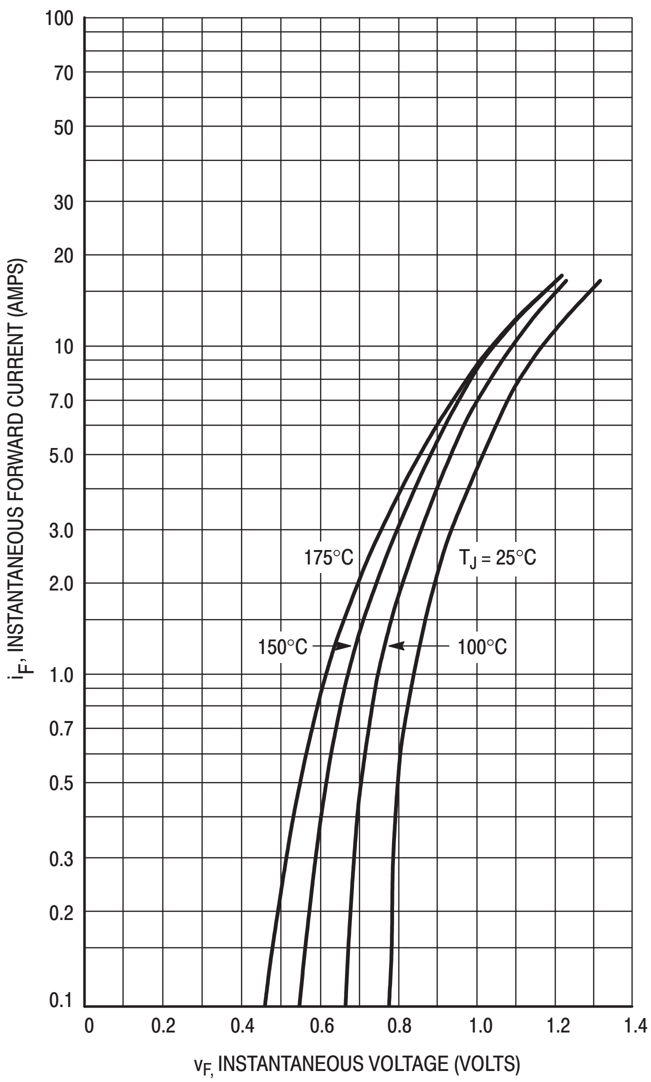



**Figure 1. Typical Forward Voltage (Per Leg)**

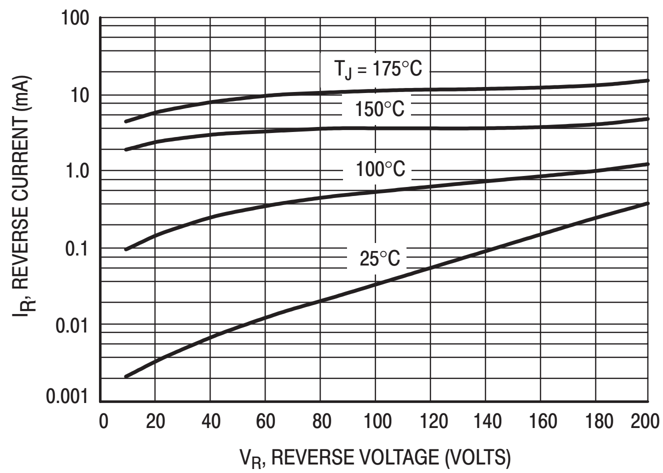



**Figure 2. Typical Leakage Current* (Per Leg)**

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these curves if $V_R$ is sufficiently below rated $V_R$.

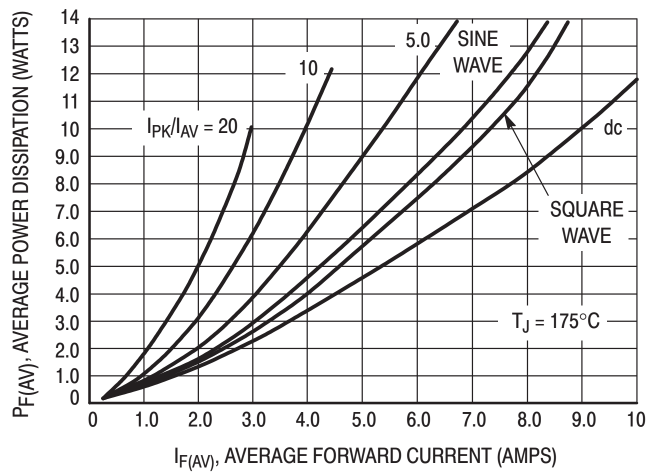



**Figure 3. Average Power Dissipation (Per Leg)**

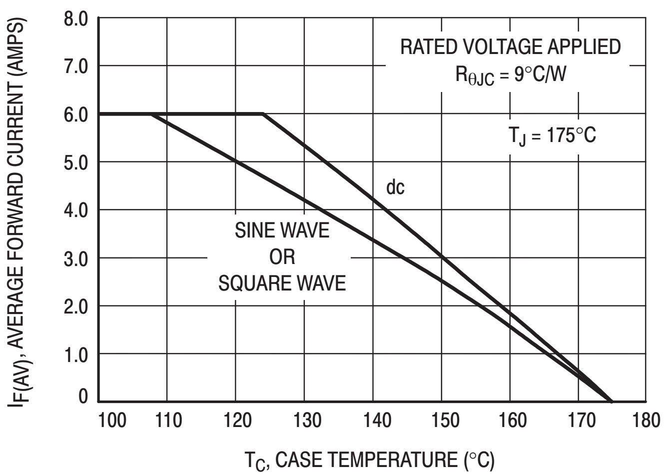



**Figure 4. Current Derating, Case (Per Leg)**

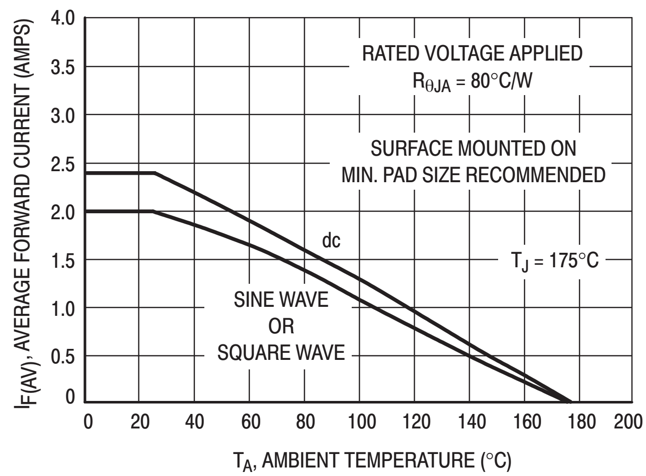



**Figure 5. Current Derating, Ambient (Per Leg)**

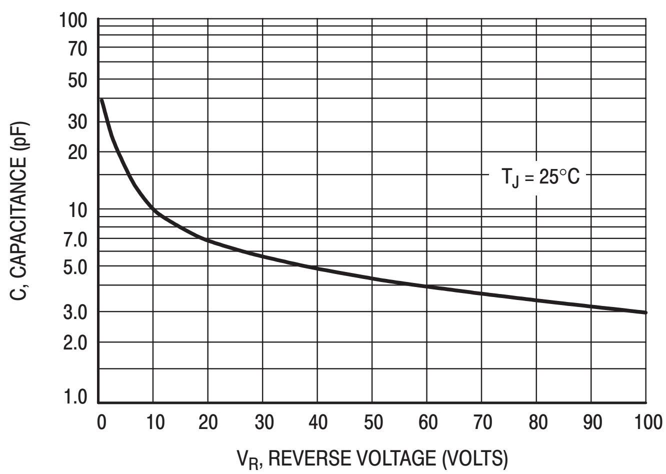



**Figure 6. Typical Capacitance (Per Leg)**

# MSRD620CT

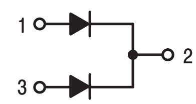
# SWITCHMODE™
# Soft Ultrafast Recovery Power Rectifier

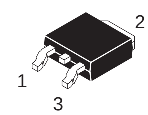
## Plastic DPAK Package

ON Semiconductor™

http://onsemi.com

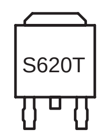
**SOFT ULTRAFAST RECTIFIER**
**6.0 AMPERES**
**200 VOLTS**




**DPAK**
**CASE 369A**
**PLASTIC**

**MARKING DIAGRAM**




S620T = Device Code

State of the art geometry features epitaxial construction with glass passivation and metal overlay contact. Ideally suited for low voltage, high frequency switching power supplies, free wheeling diode and polarity protection diodes.

- Soft Ultrafast Recovery (35 ns typ.)
- Highly Stable Oxide Passivated Junction
- Matched Dual Die Construction — May Be Paralleled for High Current Output
- Short Heat Sink Tab Manufactured — Not Sheared
- Epoxy Meets UL94, $V_O$ at 1/8″

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 0.4 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 75 units per plastic tube
- Available in 16 mm Tape and Reel, 2500 units per Reel, Add “T4’’ to Suffix part number
- Marking: S620T

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 200 | V |
| Average Rectified Forward Current (At Rated $V_R$, $T_C$ = 137°C) Per Leg<br>Per Package | $I_O$ | 3.0<br>6.0 | A |
| Peak Repetitive Forward Current (At Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 138°C) Per Leg | $I_{FRM}$ | 6.0 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) Per Package | $I_{FSM}$ | 50 | A |
| Storage/Operating Case Temperature Range | $T_{stg}$, $T_C$ | –55 to +175 | °C |
| Operating Junction Temperature Range | $T_J$ | –55 to +175 | °C |

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MSRD620CT | DPAK | 75 Units/Rail |
| MSRD620CTT4 | DPAK | 2500/Tape & Reel |

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## THERMAL CHARACTERISTICS

| Rating | | Symbol | Value | Unit |
|---|---|---|---|---|
| Thermal Resistance – Junction to Case<br>– Junction to Ambient | Per Leg<br>Per Leg | $R_{\theta JC}$<br>$R_{\theta JA}$ | 9.0<br>80 | °C/W |

## ELECTRICAL CHARACTERISTICS

| Rating | | Symbol | Value | | Unit |
|---|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.), see Figure 2. | Per Leg | $V_F$ | **$T_J$ = 25°C** | **$T_J$ = 150°C** | V |
| ($I_F$ = 3.0 A)<br>($I_F$ = 6.0 A) | | | 1.15<br>1.35 | 1.05<br>1.30 | |
| Maximum Instantaneous Reverse Current, see Figure 4. | Per Leg | $I_R$ | **$T_J$ = 25°C** | **$T_J$ = 150°C** | μA |
| ($V_R$ = 200 V)<br>($V_R$ = 100 V) | | | 5.0<br>2.0 | 200<br>100 | |
| Maximum Reverse Recovery Time (Note 2.)<br>($V_R$ = 30 V, $I_F$ = 1.0 A, di/dt = 50 A/μs)<br>($V_R$ = 30 V, $I_F$ = 3.0 A, di/dt = 50 A/μs) | Per Leg | $t_{rr}$ | 45<br>55 | | ns |
| Maximum Peak Reverse Recovery Current<br>($V_R$ = 30 V, $I_F$ = 1.0 A, di/dt = 50 A/μs)<br>($V_R$ = 30 V, $I_F$ = 3.0 A, di/dt = 50 A/μs) | Per Leg | $I_{RM}$ | 2.0<br>3.0 | | A |

1. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2%.
2. $t_{rr}$ measured projecting from 25% of $I_{RM}$ to ground.

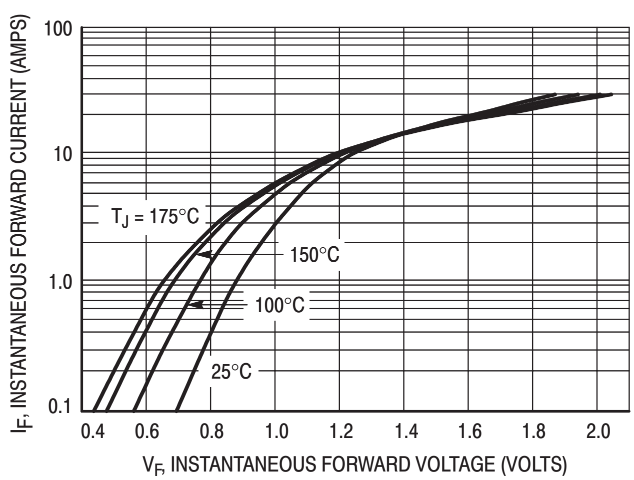


**Figure 1. Typical Forward Voltage, Per Leg**

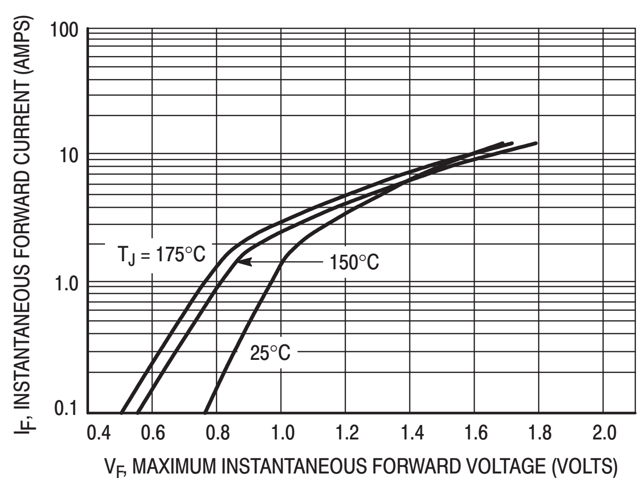


**Figure 2. Maximum Forward Voltage, Per Leg**

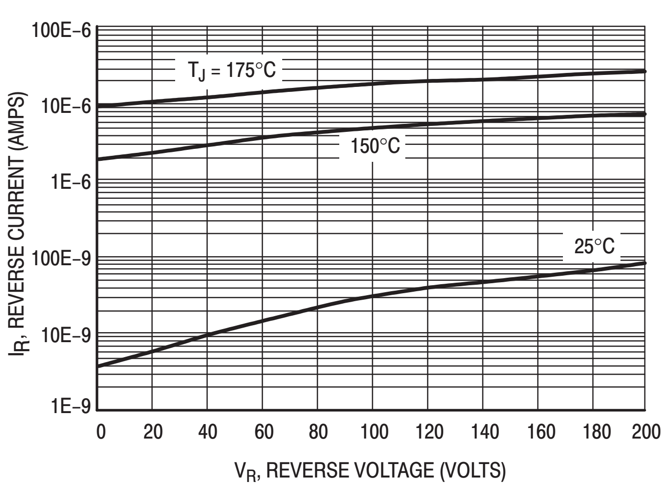


**Figure 3. Typical Reverse Current, Per Leg**

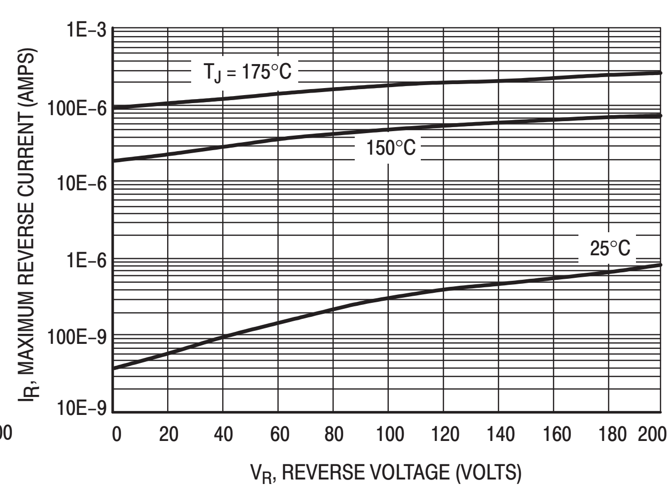


**Figure 4. Maximum Reverse Current, Per Leg**

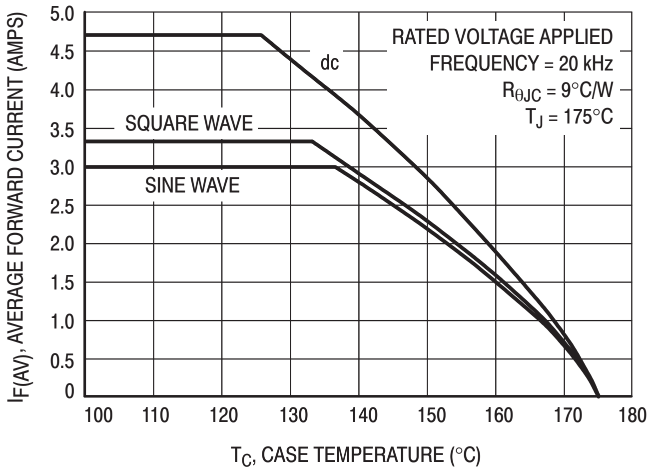


**Figure 5. Current Derating, Case (Per Leg)**

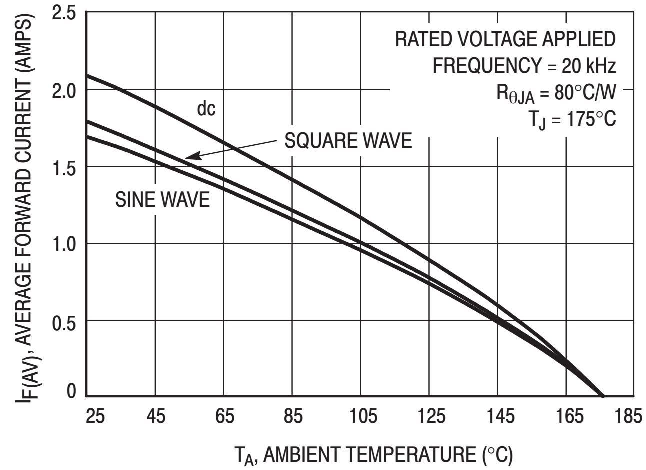


**Figure 6. Current Derating, Ambient (Per Leg)**

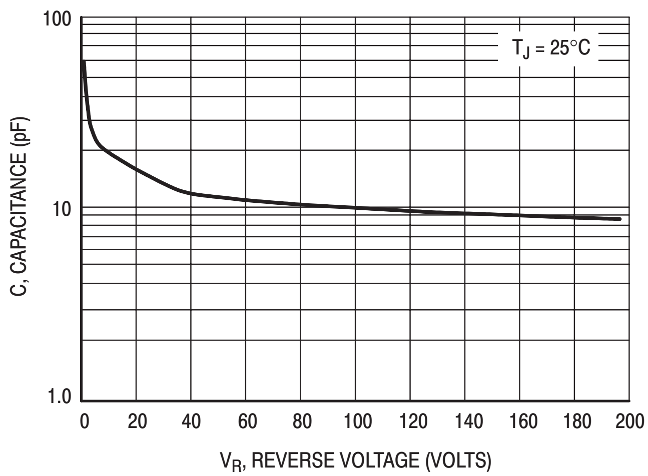


**Figure 7. Typical Capacitance (Per Leg)**

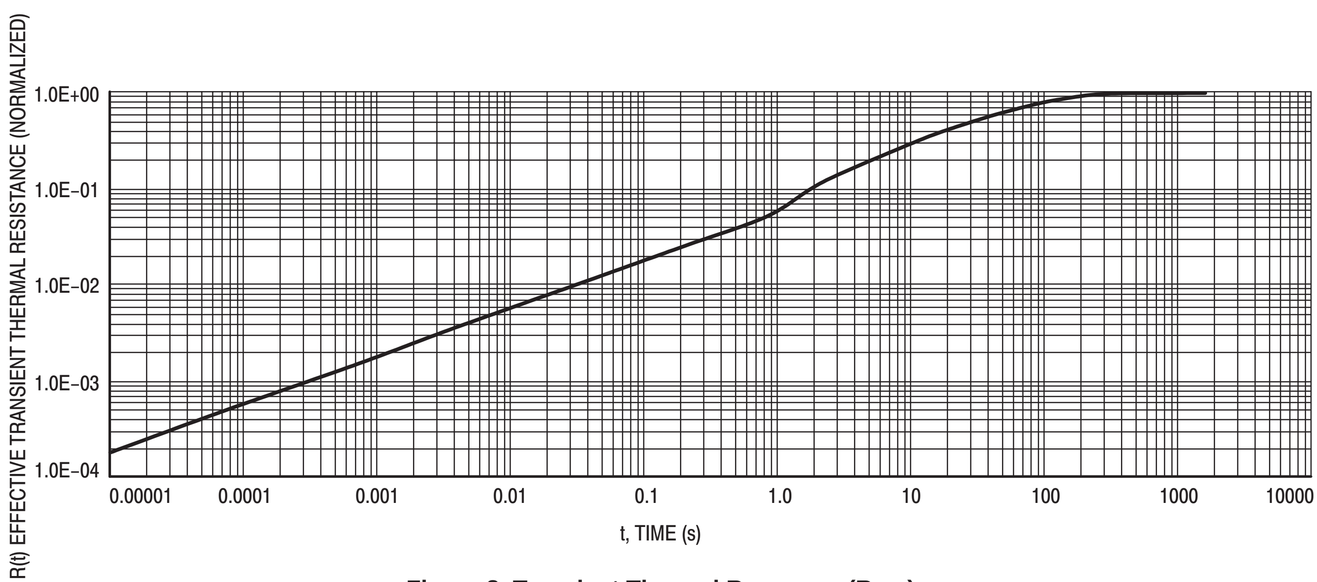


**Figure 8. Transient Thermal Response ($R_{\theta JA}$)**

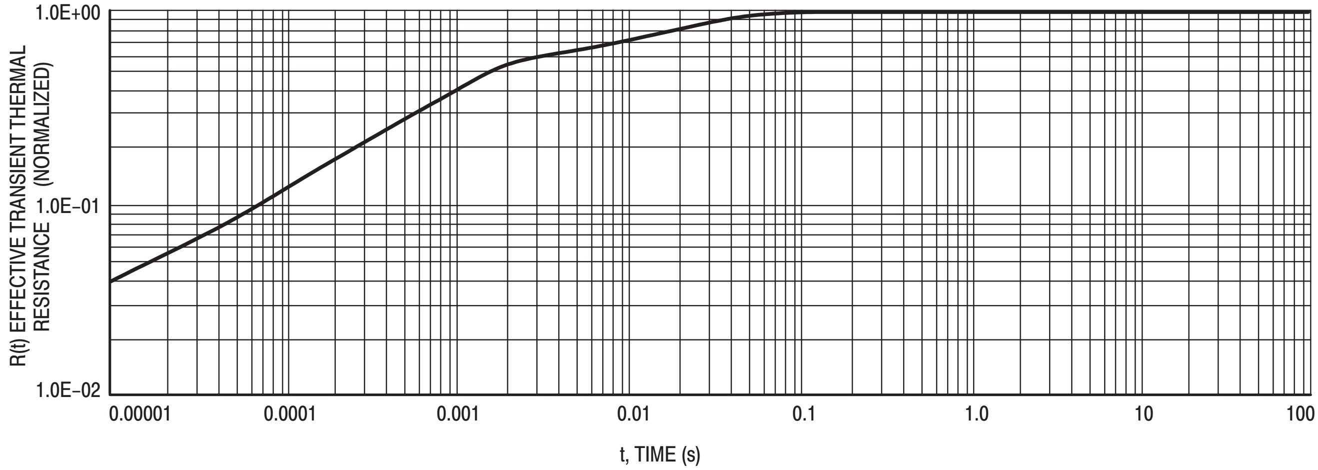


**Figure 9. Transient Thermal Response ($R_{\theta JC}$)**

# MURB1620CT

**Preferred Device**

# SWITCHMODE™ Power Rectifier

## D²PAK Power Surface Mount Package

Designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Package Designed for Power Surface Mount Applications
- Ultrafast 35 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Epoxy Meets UL94, $V_O$ @ 1/8″
- High Temperature Glass Passivated Junction
- Low Leakage Specified @ 150°C Case Temperature
- Short Heat Sink Tab Manufactured — Not Sheared!
- Similar in Size to Industrial Standard TO–220 Package

### Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per reel by adding a “T4” suffix to the part number
- Marking: U1620T

**MAXIMUM RATINGS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 200 | V |
| Average Rectified Forward Current<br>(Rated $V_R$, $T_C$ = 150°C) Total Device | $I_{F(AV)}$ | 8.0<br>16 | A |
| Peak Repetitive Forward Current<br>(Rated $V_R$, Square Wave,<br>20 kHz, $T_C$ = 150°C) | $I_{FM}$ | 16 | A |
| Non–Repetitive Peak Surge Current<br>(Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 100 | A |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | °C |

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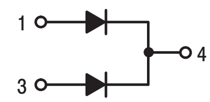
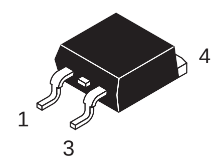
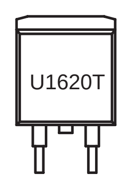
**ULTRAFAST RECTIFIER**
**16 AMPERES**
**200 VOLTS**




**D²PAK**
**CASE 418B**
**STYLE 3**

**MARKING DIAGRAM**




U1620T = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MURB1620CT | D²PAK | 50 Units/Rail |
| MURB1620CTT4 | D²PAK | 800/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.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**THERMAL CHARACTERISTICS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 3 | °C/W |
| Maximum Thermal Resistance, Junction to Ambient (Note 1.) | $R_{\theta JA}$ | 50 | °C/W |
| Temperature for Soldering Purposes: 1/8″ from Case for 5 Seconds | $T_L$ | 260 | °C |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.)<br>($i_F$ = 8 Amp, $T_C$ = 150°C)<br>($i_F$ = 8 Amp, $T_C$ = 25°C) | $v_F$ | <br>0.895<br>0.975 | Volts |
| Maximum Instantaneous Reverse Current (Note 2.)<br>(Rated dc Voltage, $T_C$ = 150°C)<br>(Rated dc Voltage, $T_C$ = 25°C) | $i_R$ | <br>250<br>5 | µA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1 Amp, di/dt = 50 Amp/µs)<br>($I_F$ = 0.5 Amp, $i_R$ = 1 Amp, $I_{REC}$ = 0.25 Amp) | $t_{rr}$ | <br>35<br>25 | ns |

1. See Chapter 7 for mounting conditions
2. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤2.0%

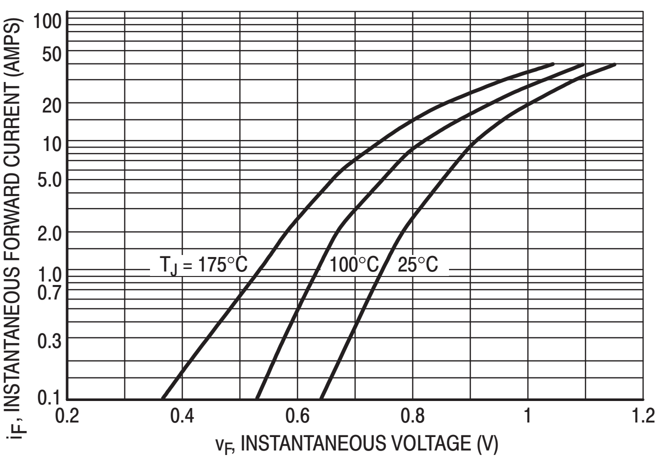


**Figure 1. Typical Forward Voltage, Per Leg**

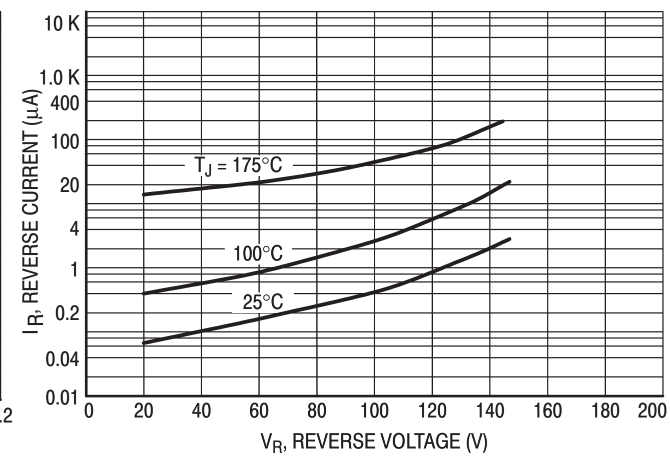


**Figure 2. Typical Reverse Current, Per Leg***

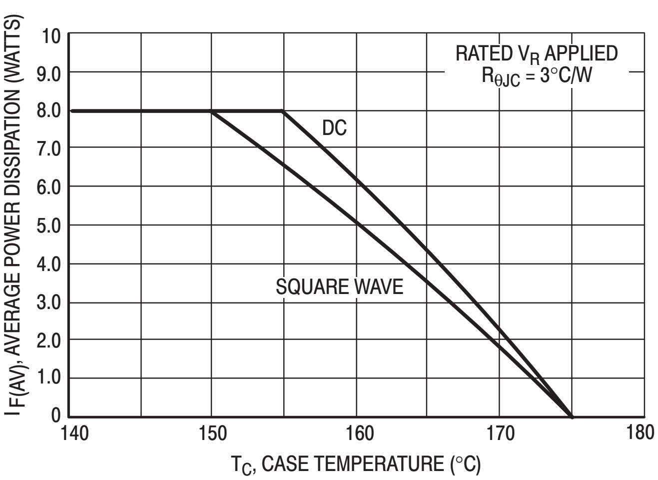


**Figure 3. Current Derating Case, Per Leg**

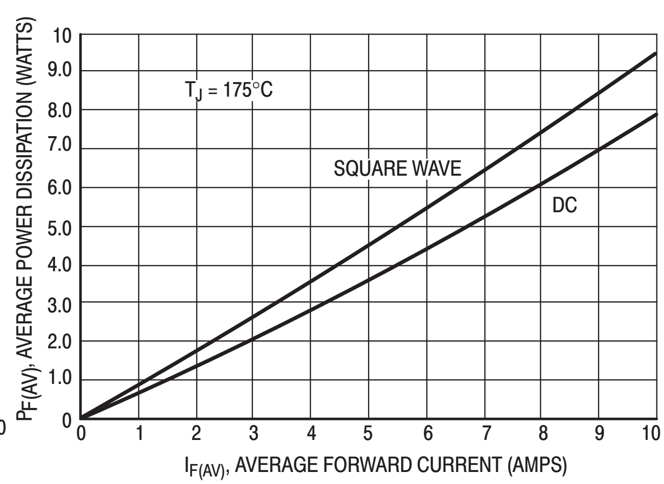


**Figure 4. Power Dissipation, Per Leg**

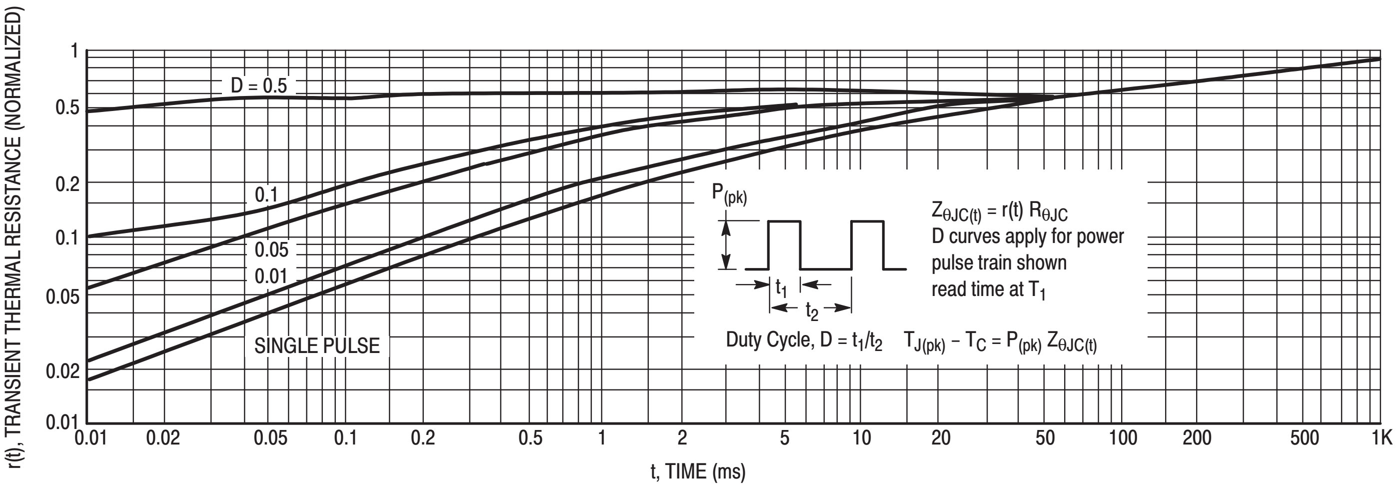


**Figure 5. Thermal Response**

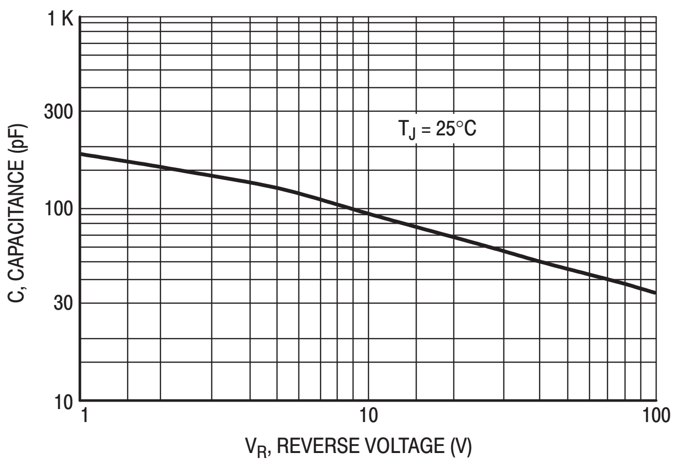


**Figure 6. Typical Capacitance, Per Leg**

# MURB1660CT

Preferred Device

## SWITCHMODE™ Power Rectifier

### $D^2$PAK Power Surface Mount Package

Designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Package Designed for Power Surface Mount Applications
- Ultrafast 60 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Epoxy Meets UL94, $V_O$ @ 1/8″
- High Temperature Glass Passivated Junction
- High Voltage Capability to 600 V
- Low Leakage Specified @ 150°C Case Temperature
- Short Heat Sink Tab Manufactured – Not Sheared!
- Similar in Size to Industrial Standard TO–220 Package

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per reel by adding a “T4” suffix to the part number
- Marking: U1660T

**MAXIMUM RATINGS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 600 | V |
| Average Rectified Forward Current<br>(Rated $V_R$, $T_C$ = 150°C) Total Device | $I_{F(AV)}$ | 8.0<br>16 | A |
| Peak Repetitive Forward Current<br>(Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 150°C) | $I_{FM}$ | 16 | A |
| Non–Repetitive Peak Surge Current<br>(Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 100 | A |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | °C |

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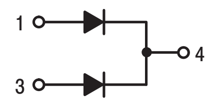
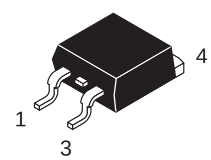
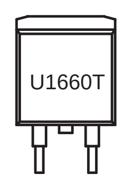
**ULTRAFAST RECTIFIER 16 AMPERES 600 VOLTS**




**$D^2$PAK**
**CASE 418B**
**STYLE 3**

**MARKING DIAGRAM**




U1660T = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MURB1660CT | $D^2$PAK | 50 Units/Rail |
| MURB1660CTT4 | $D^2$PAK | 800/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 2 | °C/W |
| Maximum Thermal Resistance, Junction to Ambient (Note 1.) | $R_{\theta JA}$ | 50 | °C/W |
| Temperature for Soldering Purposes: 1/8″ from Case for 5 Seconds | $T_L$ | 260 | °C |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.)<br>($i_F$ = 8 Amp, $T_C$ = 150°C)<br>($i_F$ = 8 Amp, $T_C$ = 25°C) | $v_F$ | <br>1.20<br>1.50 | Volts |
| Maximum Instantaneous Reverse Current (Note 2.)<br>(Rated dc Voltage, $T_C$ = 150°C)<br>(Rated dc Voltage, $T_C$ = 25°C) | $i_R$ | <br>500<br>10 | µA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1 Amp, di/dt = 50 Amp/µs)<br>($I_F$ = 0.5 Amp, $i_R$ = 1 Amp, $I_{REC}$ = 0.25 Amp) | $t_{rr}$ | <br>60<br>50 | ns |

1. See Chapter 7 for mounting conditions
2. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤2.0%

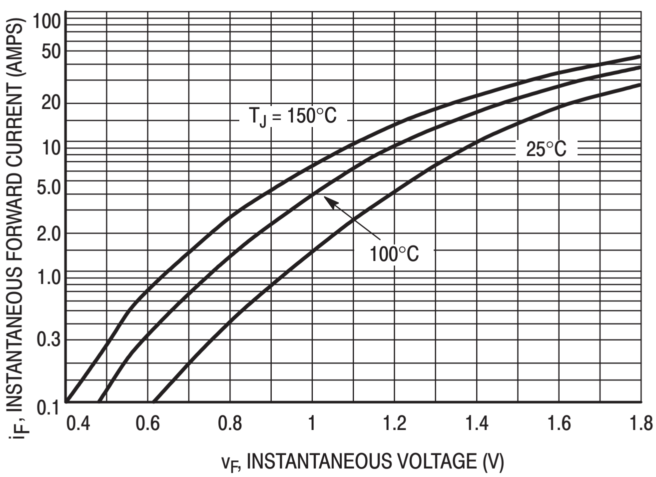


**Figure 1. Typical Forward Voltage, Per Leg**

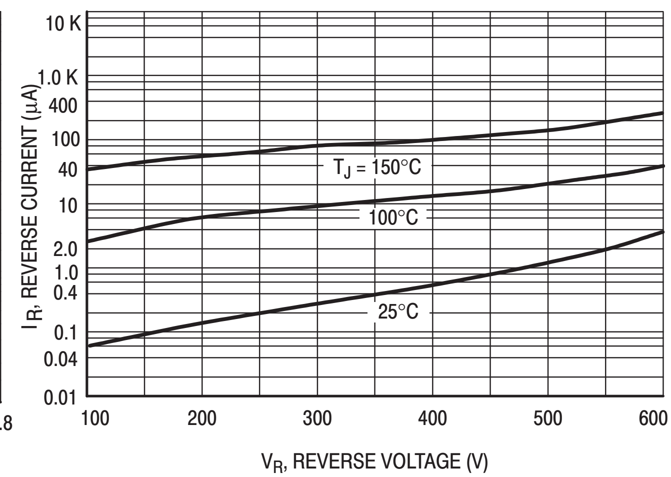


**Figure 2. Typical Reverse Current, Per Leg**

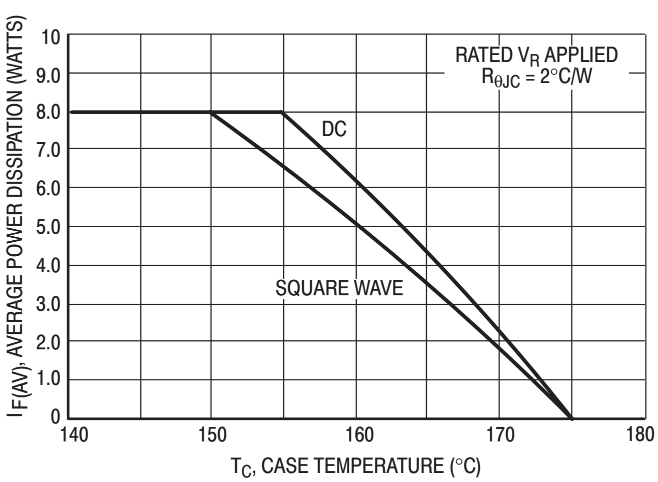


**Figure 3. Current Derating, Case, Per Leg**

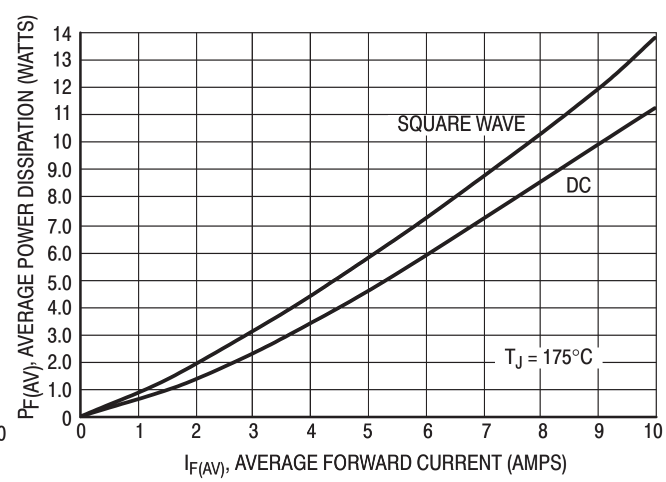


**Figure 4. Power Dissipation, Per Leg**

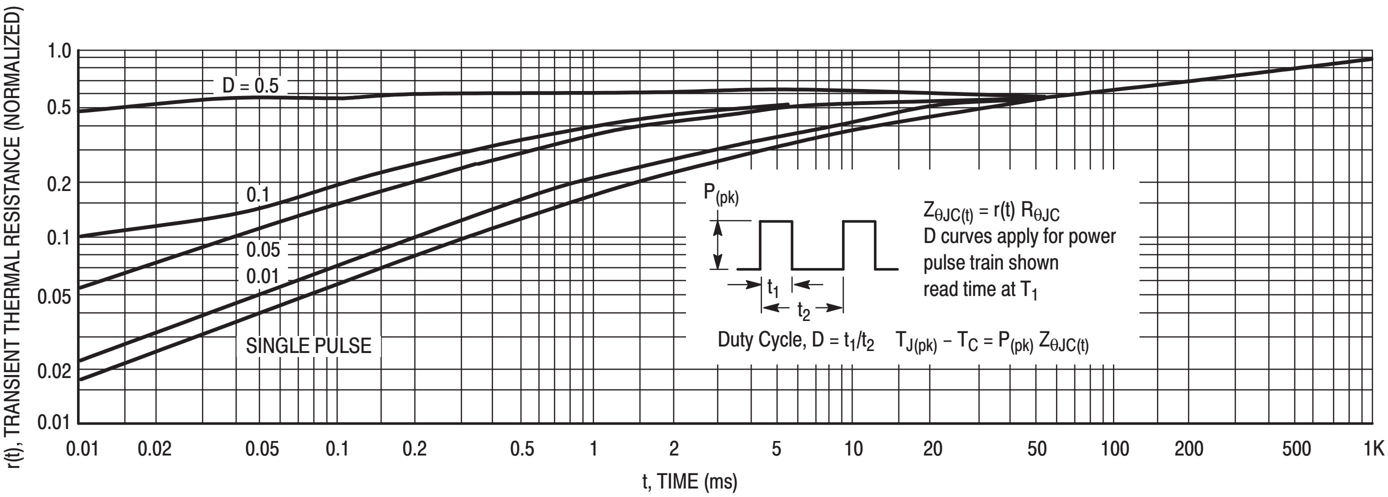


**Figure 5. Thermal Response**

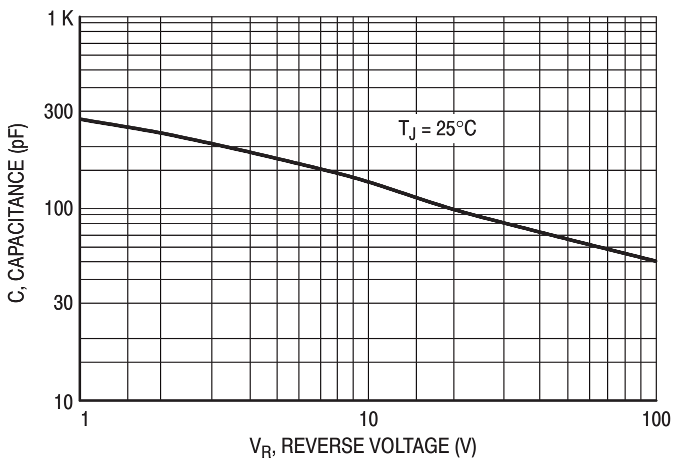


**Figure 6. Typical Capacitance, Per Leg**

# MURHB840CT

**Preferred Device**

# MEGAHERTZ™ Power Rectifier

## D²PAK Power Surface Mount Package

Designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Package Designed for Power Surface Mount Applications
- Ultrafast 28 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Epoxy Meets UL94, $V_O$ @ 1/8″
- High Temperature Glass Passivated Junction
- High Voltage Capability
- Low Leakage Specified @ 150°C Case Temperature
- Short Heat Sink Tab Manufactured – Not Sheared!
- Similar in Size to Industrial Standard TO–220 Package

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per reel by adding a “T4” suffix to the part number
- Marking: UH840

**MAXIMUM RATINGS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 400 | V |
| Average Rectified Forward Current<br>(Rated $V_R$, $T_C$ = 120°C) Total Device | $I_{F(AV)}$ | 4.0<br>8.0 | A |
| Peak Repetitive Forward Current<br>(Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 120°C) | $I_{FM}$ | 8.0 | A |
| Non–Repetitive Peak Surge Current<br>(Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 100 | A |
| Controlled Avalanche Energy | $W_{AVAL}$ | 20 | mJ |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | °C |

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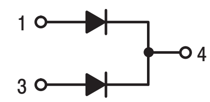
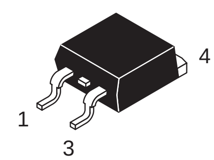
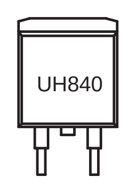
**ULTRAFAST RECTIFIER**
**8.0 AMPERES**
**400 VOLTS**




**D²PAK**
**CASE 418B**
**STYLE 3**

**MARKING DIAGRAM**




UH840 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MURHB840CT | D²PAK | 50 Units/Rail |
| MURHB840CTT4 | D²PAK | 800/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 3.0 | °C/W |
| Maximum Thermal Resistance, Junction to Ambient (Note 1.) | $R_{\theta JA}$ | 50 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.) ($i_F$ = 4.0 Amps, $T_C$ = 150°C)<br>($i_F$ = 4.0 Amps, $T_C$ = 25°C) | $v_F$ | 1.9<br>2.2 | Volts |
| Maximum Instantaneous Reverse Current (Note 2.) (Rated dc Voltage, $T_C$ = 150°C)<br>(Rated dc Voltage, $T_C$ = 25°C) | $i_R$ | 500<br>10 | μA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1.0 Amp, di/dt = 50 Amps/μs) | $t_{rr}$ | 28 | ns |

1. See Chapter 7 for mounting conditions
2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤2.0%

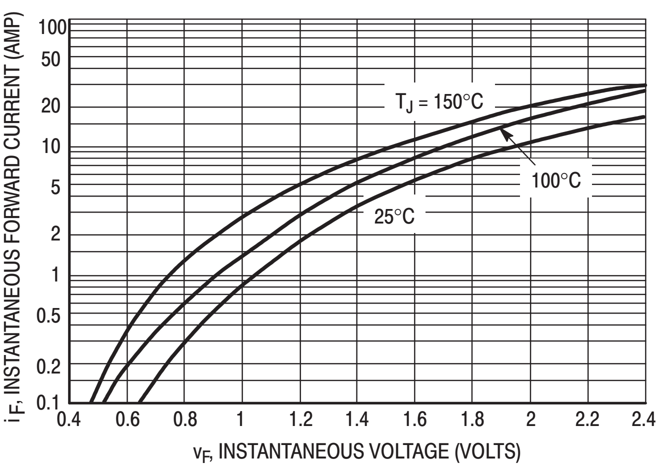


**Figure 1. Typical Forward Voltage**

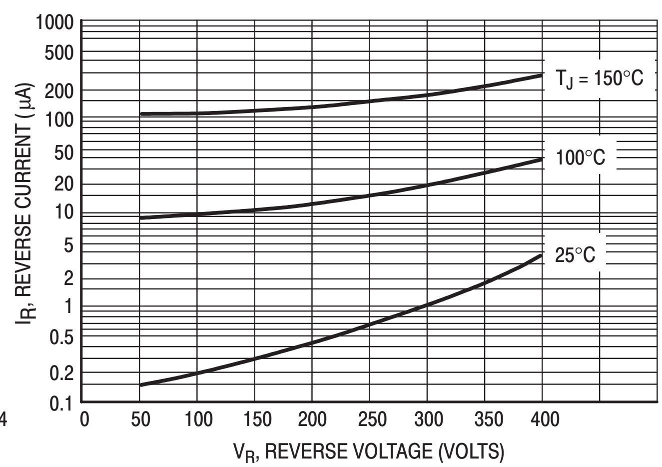


**Figure 2. Typical Reverse Current, Per Leg**

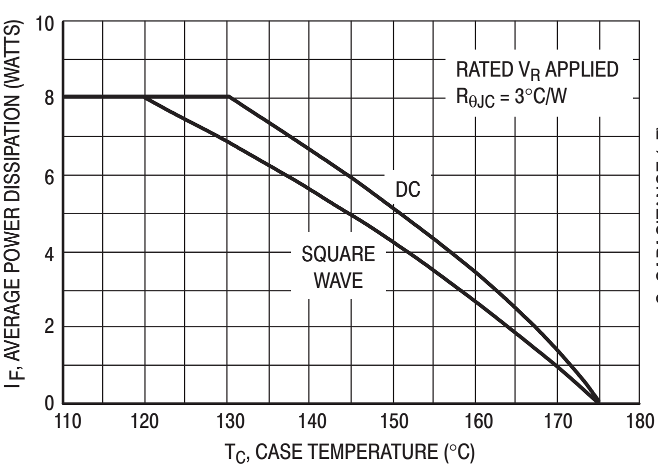


**Figure 3. Current Derating, Case**

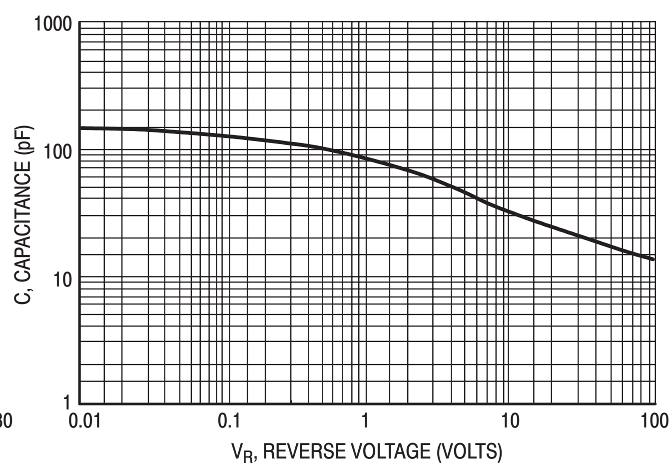


**Figure 4. Typical Capacitance, Per Leg**

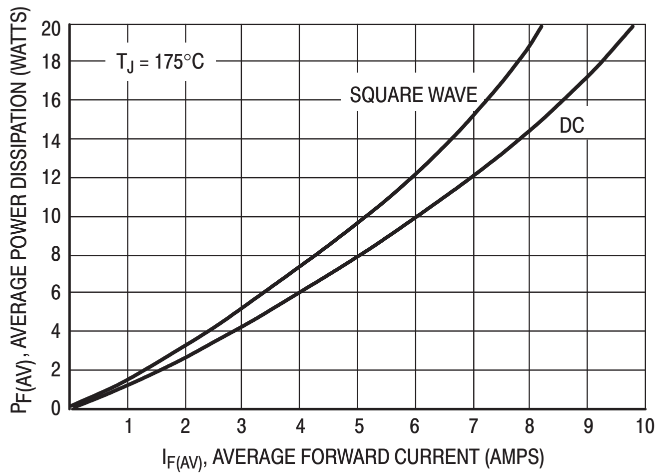


**Figure 5. Forward Power Dissipation, Per Leg**

# MURHB860CT

**Preferred Device**

# MEGAHERTZ™ Power Rectifier

## $D^2PAK$ Power Surface Mount Package

Designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Package Designed for Power Surface Mount Applications
- Ultrafast 35 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Epoxy Meets UL94, $V_O$ @ 1/8″
- High Temperature Glass Passivated Junction
- High Voltage Capability to 600 Volts
- Low Leakage Specified @ 150°C Case Temperature
- Short Heat Sink Tab Manufactured — Not Sheared!
- Similar in Size to Industry Standard TO–220 Package

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 1.7 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Available in 24 mm Tape and Reel, 800 units per reel by adding a “T4” suffix to the part number
- Marking: UH860

**MAXIMUM RATINGS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 600 | V |
| Average Rectified Forward Current<br>(Rated $V_R$, $T_C$ = 120°C) Total Device | $I_{F(AV)}$ | 4.0<br>8.0 | A |
| Peak Repetitive Forward Current<br>(Rated $V_R$, Square Wave,<br>20 kHz, $T_C$ = 120°C) | $I_{FM}$ | 8.0 | A |
| Non–Repetitive Peak Surge Current<br>(Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 100 | A |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | °C |

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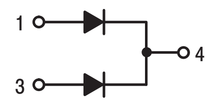
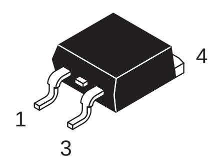
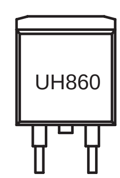
**ULTRAFAST RECTIFIER 8.0 AMPERES 600 VOLTS**




**$D^2PAK$**
**CASE 418B**
**STYLE 3**

**MARKING DIAGRAM**




UH860 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MURHB860CT | $D^2PAK$ | 50 Units/Rail |
| MURHB860CTT4 | $D^2PAK$ | 800/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 3.0 | °C/W |
| Maximum Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 50 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.) ($i_F$ = 4.0 Amps, $T_C$ = 150°C)<br>($i_F$ = 4.0 Amps, $T_C$ = 25°C) | $v_F$ | 2.5<br>2.8 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.) (Rated dc Voltage, $T_C$ = 150°C)<br>(Rated dc Voltage, $T_C$ = 25°C) | $i_R$ | 500<br>10 | μA |
| Maximum Reverse Recovery Time ($I_F$ = 1.0 Amp, di/dt = 50 Amps/μs) | $t_{rr}$ | 35 | ns |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤2.0%

# MUR120 Series

**Preferred Devices**

# SWITCHMODE ™ Power Rectifiers

## MUR105, MUR110, MUR115, MUR120, MUR130, MUR140, MUR160

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 25, 50 and 75 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction
- Reverse Voltage to 600 Volts

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 1000 per bag
- Available Tape and Reeled, 5000 per reel, by adding a “RL’’ suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: MUR105, MUR110, MUR115, MUR120, MUR130, MUR140, MUR160

**MAXIMUM RATINGS**

| |
|---|
| Please See the Table on the Following Page |

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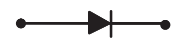
**ULTRAFAST RECTIFIERS**
**1.0 AMPERE**
**50–600 VOLTS**



**AXIAL LEAD**
**CASE 59–04**
**PLASTIC**

**MARKING DIAGRAM**


MUR1 = Device Code
xx = Specific Device Code

**ORDERING INFORMATION**

See detailed ordering and shipping information in the package dimensions section on page 325 of this data sheet.

**Preferred** devices are recommended choices for future use and best overall value.

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## MAXIMUM RATINGS

| Rating | Symbol | MUR 105 | 110 | 115 | 120 | 130 | 140 | 160 | Unit |
|---|---|---|---|---|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 50 | 100 | 150 | 200 | 300 | 400 | 600 | Volts |
| Average Rectified Forward Current<br>(Square Wave Mounting Method #3 Per Note 2.) | $I_{F(AV)}$ | 1.0 @ $T_A$ = 130°C | | | | 1.0 @ $T_A$ = 120°C | | | Amps |
| Nonrepetitive Peak Surge Current<br>(Surge applied at rated load conditions, halfwave, single phase, 60 Hz) | $I_{FSM}$ | 35 | | | | | | | Amps |
| Operating Junction Temperature and<br>Storage Temperature | $T_J$, $T_{stg}$ | – 65 to +175 | | | | | | | °C |

## THERMAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | See Note 2. | °C/W |

## ELECTRICAL CHARACTERISTICS

| | | | | |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 1.0 Amp, $T_J$ = 150°C)<br>($i_F$ = 1.0 Amp, $T_J$ = 25°C) | $v_F$ | <br>0.710<br>0.875 | <br>1.05<br>1.25 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_J$ = 150°C)<br>(Rated dc Voltage, $T_J$ = 25°C) | $i_R$ | <br>50<br>2.0 | <br>150<br>5.0 | μA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1.0 Amp, di/dt = 50 Amp/μs)<br>($I_F$ = 0.5 Amp, $i_R$ = 1.0 Amp, $I_{REC}$ = 0.25 A) | $t_{rr}$ | <br>35<br>25 | <br>75<br>50 | ns |
| Maximum Forward Recovery Time<br>($I_F$ = 1.0 A, di/dt = 100 A/μs, $I_{REC}$ to 1.0 V) | $t_{fr}$ | 25 | 50 | ns |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

## ORDERING INFORMATION

| Device | Marking | Package | Shipping |
|---|---|---|---|
| MUR105 | MUR105 | Axial Lead | 1000 Units/Bag |
| MUR105RL | MUR105 | Axial Lead | 5000 Units/Tape & Reel |
| MUR110 | MUR110 | Axial Lead | 1000 Units/Bag |
| MUR110RL | MUR110 | Axial Lead | 5000 Units/Tape & Reel |
| MUR115 | MUR115 | Axial Lead | 1000 Units/Bag |
| MUR115RL | MUR115 | Axial Lead | 5000 Units/Tape & Reel |
| MUR120 | MUR120 | Axial Lead | 1000 Units/Bag |
| MUR120RL | MUR120 | Axial Lead | 5000 Units/Tape & Reel |
| MUR130 | MUR130 | Axial Lead | 1000 Units/Bag |
| MUR130RL | MUR130 | Axial Lead | 5000 Units/Tape & Reel |
| MUR140 | MUR140 | Axial Lead | 1000 Units/Bag |
| MUR140RL | MUR140 | Axial Lead | 5000 Units/Tape & Reel |
| MUR160 | MUR160 | Axial Lead | 1000 Units/Bag |
| MUR160RL | MUR160 | Axial Lead | 5000 Units/Tape & Reel |

## MUR105, MUR110, MUR115, MUR120

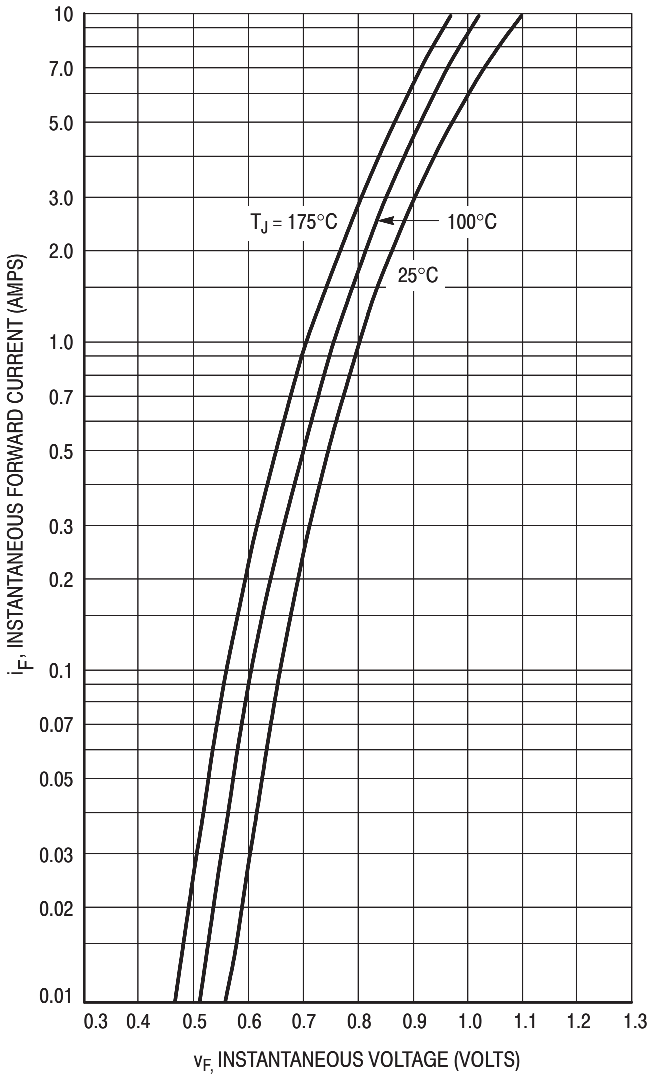



**Figure 1. Typical Forward Voltage**

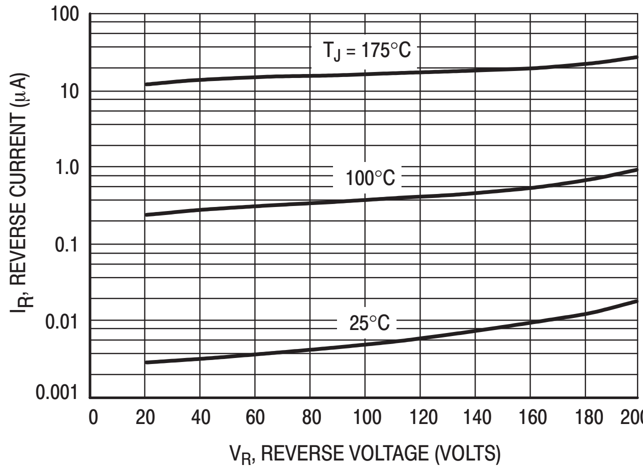



**Figure 2. Typical Reverse Current***

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if $V_R$ is sufficiently below rated $V_R$.

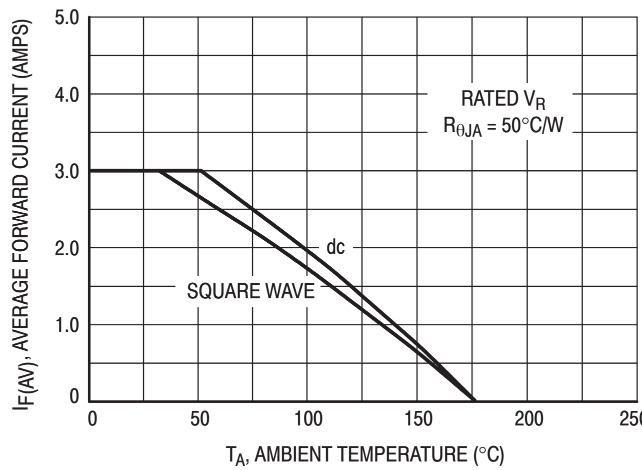



**Figure 3. Current Derating (Mounting Method #3 Per Note 1)**

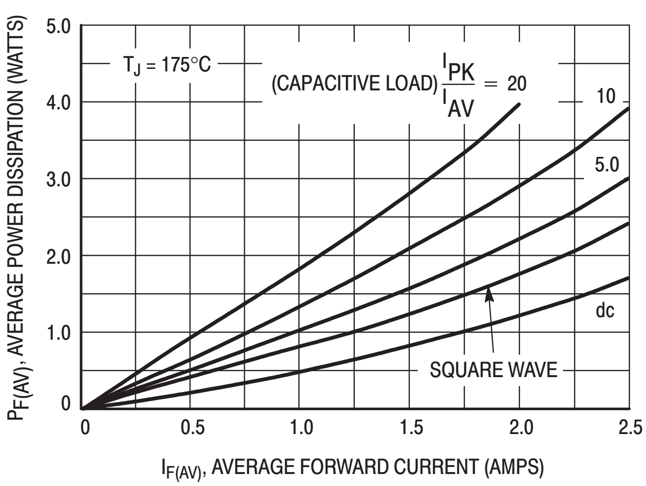



**Figure 4. Power Dissipation**

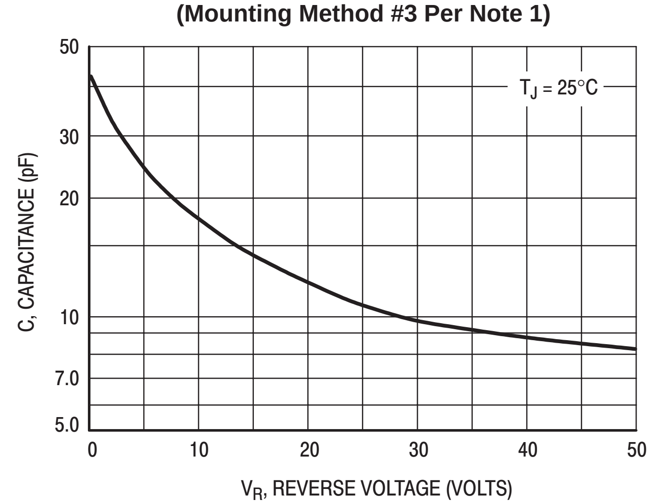



**Figure 5. Typical Capacitance**

## MUR130, MUR140, MUR160

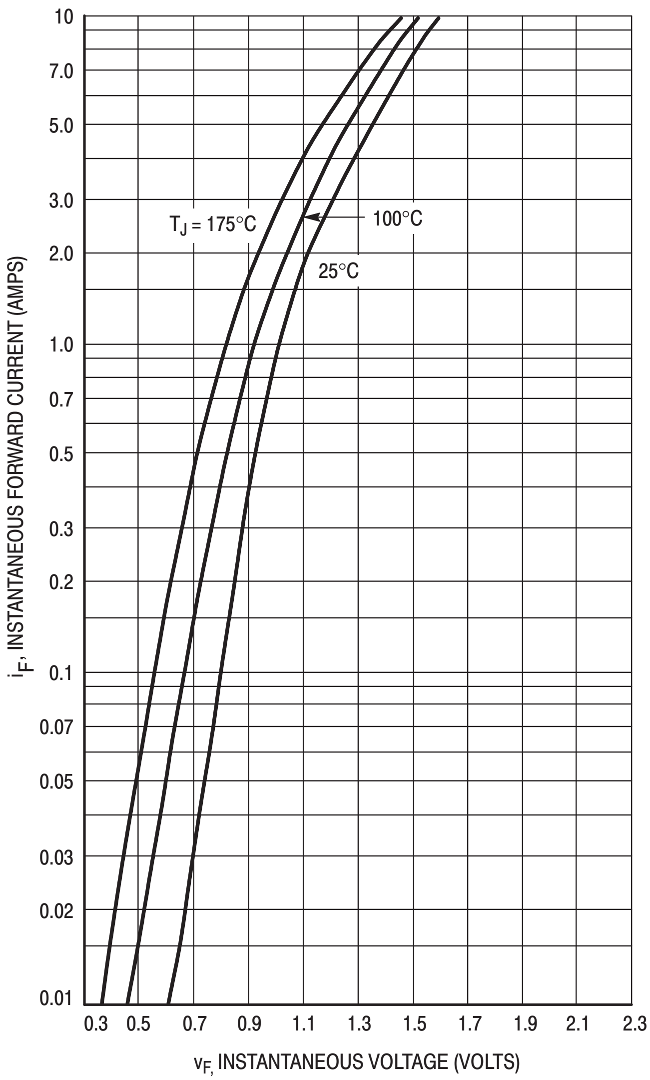



**Figure 6. Typical Forward Voltage**

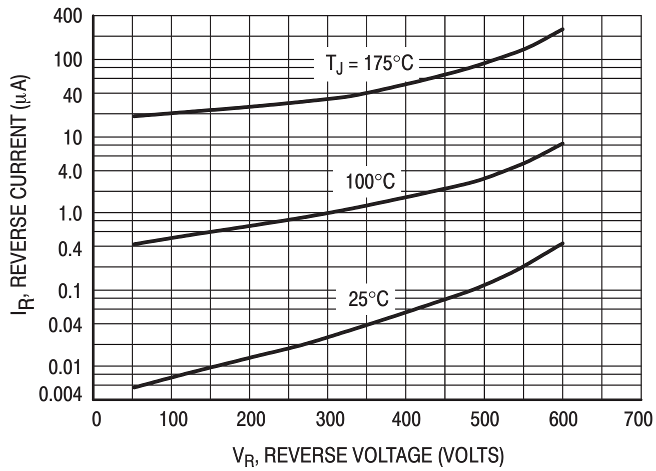



**Figure 7. Typical Reverse Current***

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if $V_R$ is sufficiently below rated $V_R$.

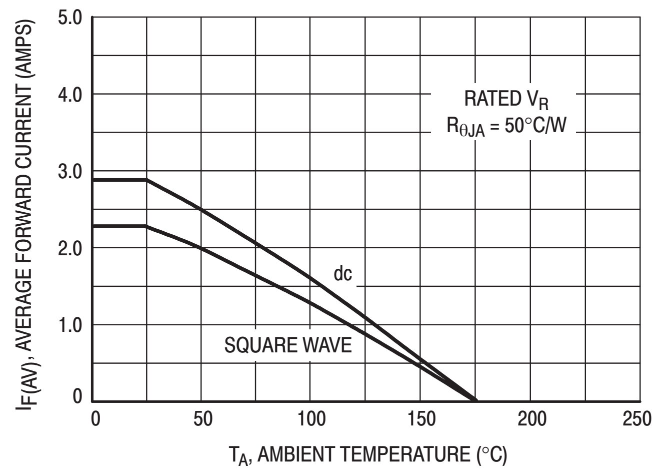



**Figure 8. Current Derating**
**(Mounting Method #3 Per Note 1)**

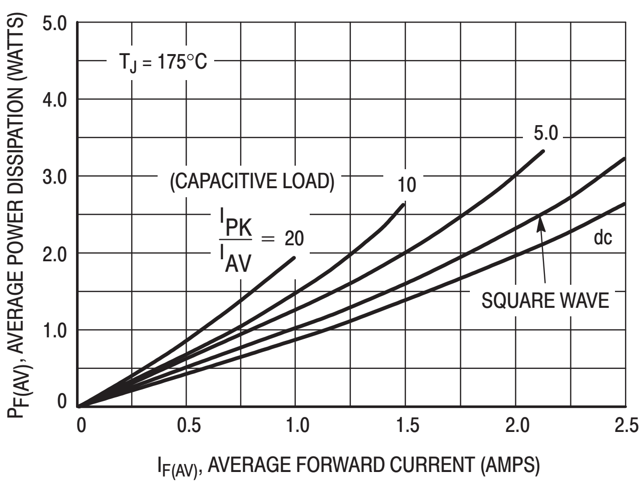



**Figure 9. Power Dissipation**

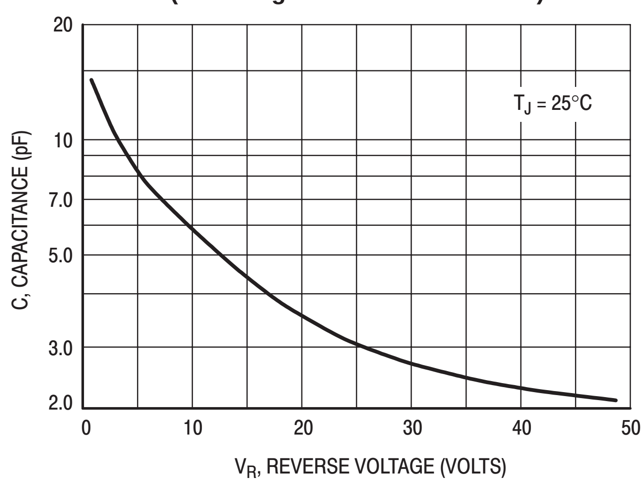



**Figure 10. Typical Capacitance**

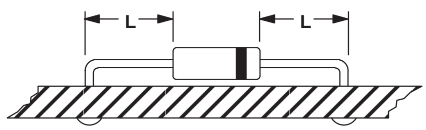
### NOTE 2. — AMBIENT MOUNTING DATA

Data shown for thermal resistance junction to ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

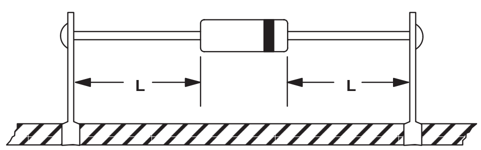
**TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR**

| Mounting Method | | Lead Length, L | | | Units |
|---|---|---|---|---|---|
| | | 1/8 | 1/4 | 1/2 | |
| 1 | $R_{\theta JA}$ | 52 | 65 | 72 | °C/W |
| 2 | $R_{\theta JA}$ | 67 | 80 | 87 | °C/W |
| 3 | $R_{\theta JA}$ | 50 | | | °C/W |

**MOUNTING METHOD 1**

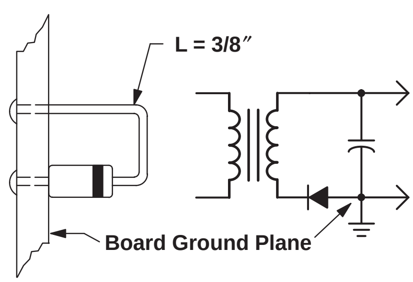



**MOUNTING METHOD 2**




**Vector Pin Mounting**

**MOUNTING METHOD 3**




**P.C. Board with**
**1–1/2″ X 1–1/2″ Copper Surface**

# MUR180E, MUR1100E

MUR1100E is a Preferred Device

# SWITCHMODE™ Power Rectifiers

## Ultrafast "E" Series with High Reverse Energy Capability

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- 10 mjoules Avalanche Energy Guaranteed
- Excellent Protection Against Voltage Transients in Switching Inductive Load Circuits
- Ultrafast 75 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction
- Reverse Voltage to 1000 Volts

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 1000 per bag
- Available Tape and Reeled, 5000 per reel, by adding a "RL" suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: MUR180E, MUR1100E

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage MUR180E<br>MUR1100E | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | <br><br>800<br>1000 | V |
| Average Rectified Forward Current (Note 1.) (Square Wave Mounting Method #3 Per Note 3.) | $I_{F(AV)}$ | 1.0 @ $T_A$ = 95°C | A |
| Non-Repetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz) | $I_{FSM}$ | 35 | A |
| Operating Junction Temperature and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | °C |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

ON Semiconductor™

http://onsemi.com

**ULTRAFAST RECTIFIERS 1.0 AMPERES 800–1000 VOLTS**

AXIAL LEAD
CASE 059–04
PLASTIC

**MARKING DIAGRAM**


MUR1x0E = Device Code
x = 8 or 10

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MUR180E | Axial Lead | 1000 Units/Bag |
| MUR180ERL | Axial Lead | 5000/Tape & Reel |
| MUR1100E | Axial Lead | 1000 Units/Bag |
| MUR1100ERL | Axial Lead | 5000/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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## THERMAL CHARACTERISTICS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | See Note 3. | °C/W |

## ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.)<br>($i_F$ = 1.0 Amp, $T_J$ = 150°C)<br>($i_F$ = 1.0 Amp, $T_J$ = 25°C) | $v_F$ | <br>1.50<br>1.75 | Volts |
| Maximum Instantaneous Reverse Current (Note 2.)<br>(Rated dc Voltage, $T_J$ = 100°C)<br>(Rated dc Voltage, $T_J$ = 25°C) | $i_R$ | <br>600<br>10 | μA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1.0 Amp, di/dt = 50 Amp/μs)<br>($I_F$ = 0.5 Amp, $i_R$ = 1.0 Amp, $I_{REC}$ = 0.25 Amp) | $t_{rr}$ | <br>100<br>75 | ns |
| Maximum Forward Recovery Time<br>($I_F$ = 1.0 Amp, di/dt = 100 Amp/μs, Recovery to 1.0 V) | $t_{fr}$ | 75 | ns |
| Controlled Avalanche Energy (See Test Circuit in Figure 6) | $W_{AVAL}$ | 10 | mJ |

2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

## ELECTRICAL CHARACTERISTICS

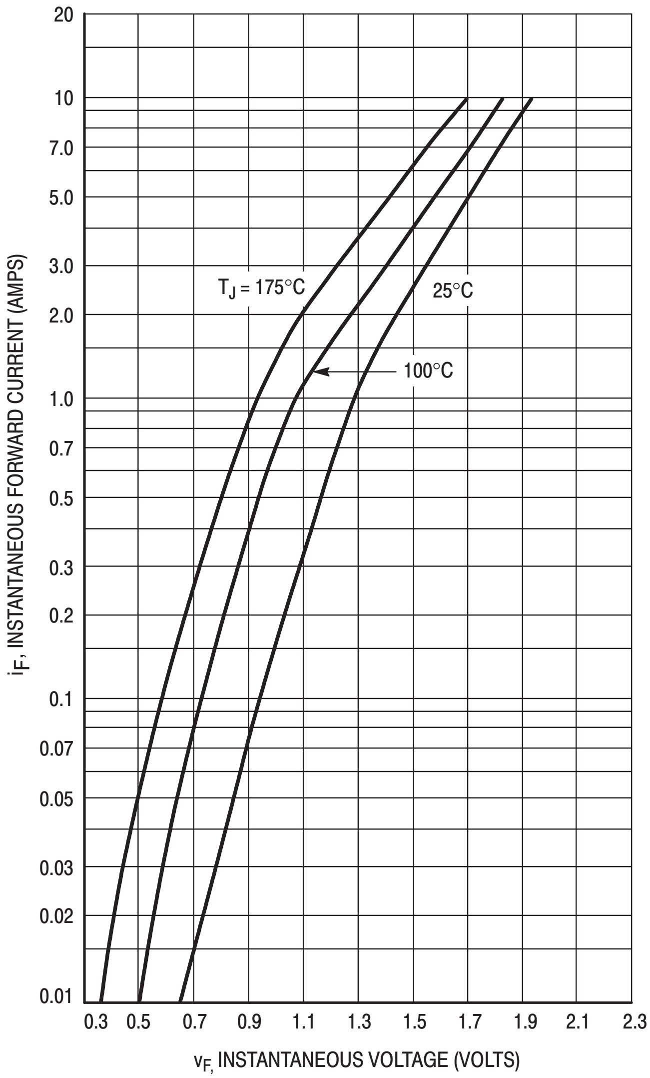



**Figure 1. Typical Forward Voltage**

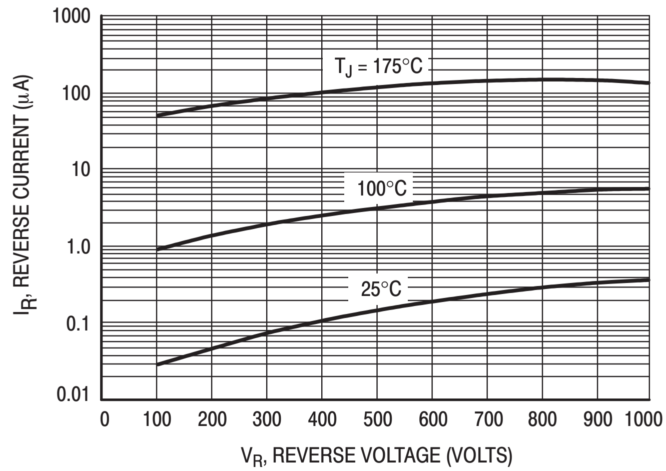



**Figure 2. Typical Reverse Current***

* The curves shown are typical for the highest voltage device in the grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if $V_R$ is sufficiently below rated $V_R$.

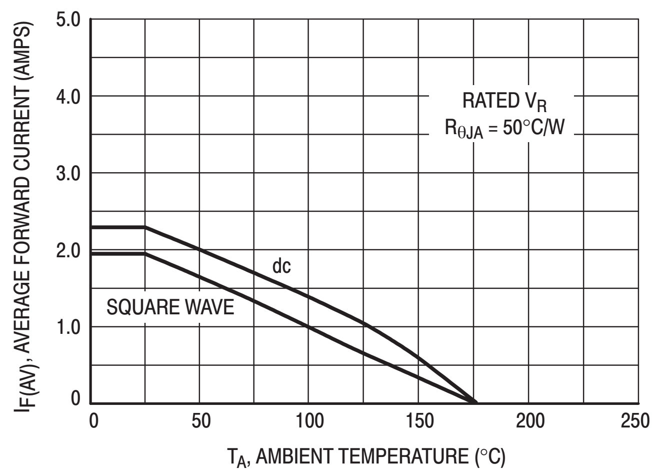



**Figure 3. Current Derating (Mounting Method #3 Per Note 1)**

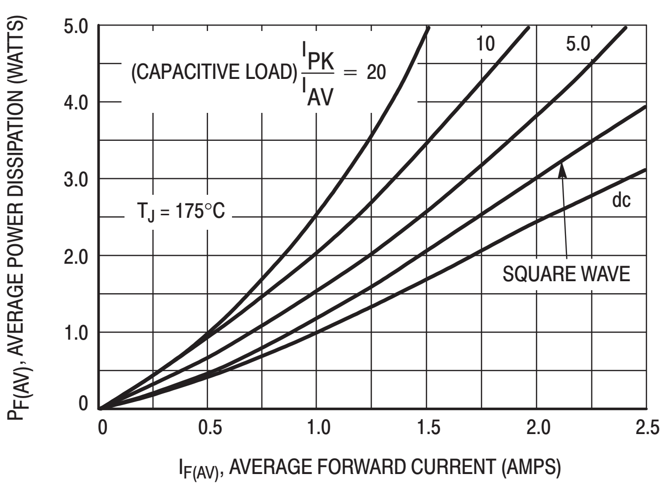



**Figure 4. Power Dissipation**

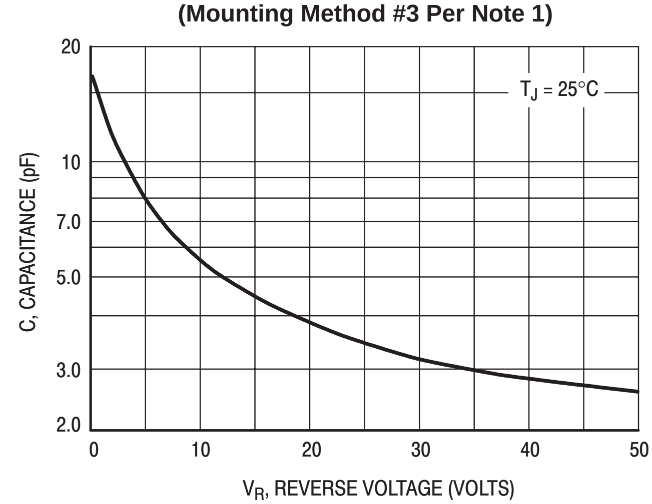



**Figure 5. Typical Capacitance**

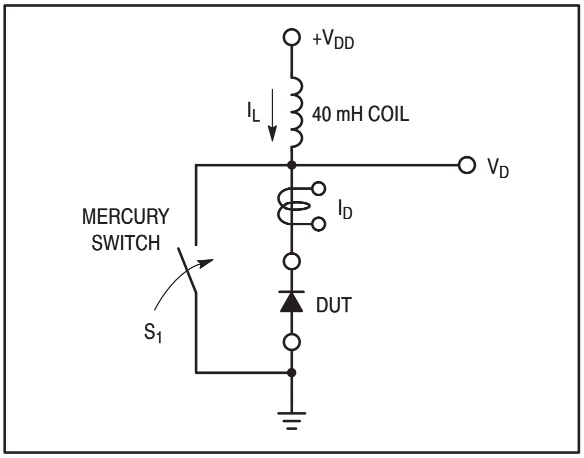



**Figure 6. Test Circuit**

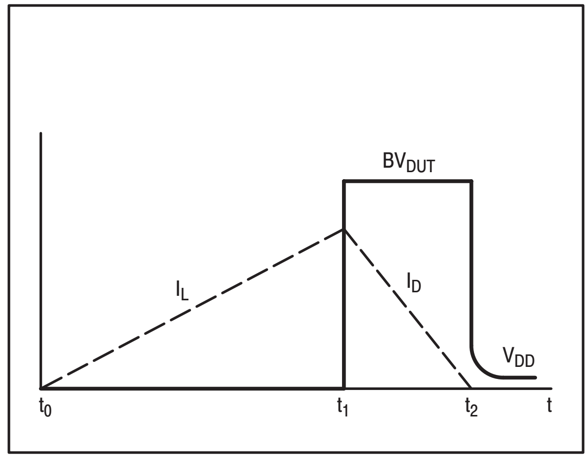



**Figure 7. Current–Voltage Waveforms**

The unclamped inductive switching circuit shown in Figure 6 was used to demonstrate the controlled avalanche capability of the new "E'' series Ultrafast rectifiers. A mercury switch was used instead of an electronic switch to simulate a noisy environment when the switch was being opened.

When $S_1$ is closed at $t_0$ the current in the inductor $I_L$ ramps up linearly; and energy is stored in the coil. At $t_1$ the switch is opened and the voltage across the diode under test begins to rise rapidly, due to di/dt effects, when this induced voltage reaches the breakdown voltage of the diode, it is clamped at $BV_{DUT}$ and the diode begins to conduct the full load current which now starts to decay linearly through the diode, and goes to zero at $t_2$.

By solving the loop equation at the point in time when $S_1$ is opened; and calculating the energy that is transferred to the diode it can be shown that the total energy transferred is equal to the energy stored in the inductor plus a finite amount of energy from the $V_{DD}$ power supply while the diode is in breakdown (from $t_1$ to $t_2$) minus any losses due to finite component resistances. Assuming the component resistive elements are small Equation (1) approximates the total energy transferred to the diode. It can be seen from this equation that if the $V_{DD}$ voltage is low compared to the breakdown voltage of the device, the amount of energy contributed by the supply during breakdown is small and the total energy can be assumed to be nearly equal to the energy stored in the coil during the time when $S_1$ was closed, Equation (2).

The oscilloscope picture in Figure 8, shows the information obtained for the MUR8100E (similar die construction as the MUR1100E Series) in this test circuit conducting a peak current of one ampere at a breakdown voltage of 1300 volts, and using Equation (2) the energy absorbed by the MUR8100E is approximately 20 mjoules.

Although it is not recommended to design for this condition, the new "E'' series provides added protection against those unforeseen transient viruses that can produce unexplained random failures in unfriendly environments.

**EQUATION (1):**

$$W_{AVAL} \approx \frac{1}{2} L I_{LPK}^{2} \left( \frac{BV_{DUT}}{BV_{DUT} - V_{DD}} \right)$$

**EQUATION (2):**

$$W_{AVAL} \approx \frac{1}{2} L I_{LPK}^{2}$$

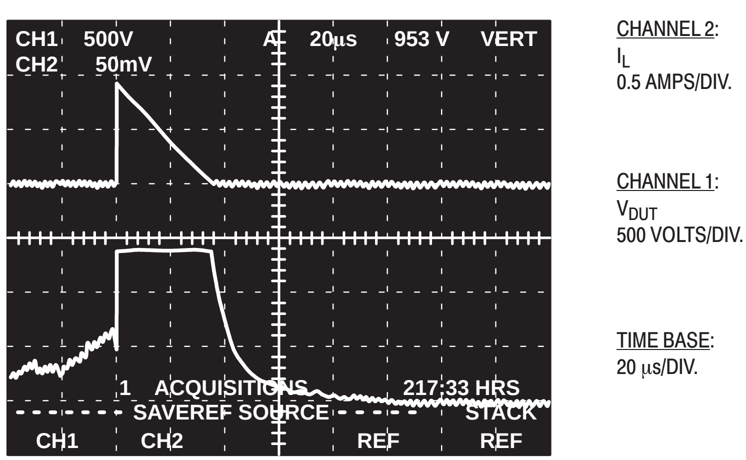



**Figure 8. Current–Voltage Waveforms**

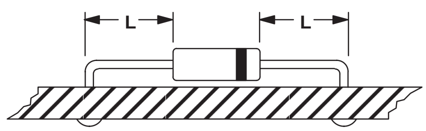
### NOTE 3. — AMBIENT MOUNTING DATA

Data shown for thermal resistance junction to ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

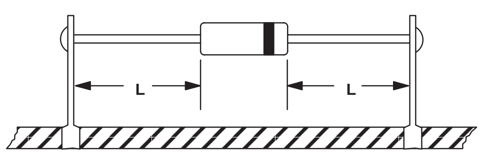
**TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR**

| Mounting Method | | Lead Length, L | | | Units |
|---|---|---|---|---|---|
| | | 1/8 | 1/4 | 1/2 | |
| 1 | $R_{\theta JA}$ | 52 | 65 | 72 | °C/W |
| 2 | | 67 | 80 | 87 | °C/W |
| 3 | | 50 | | | °C/W |

**MOUNTING METHOD 1**

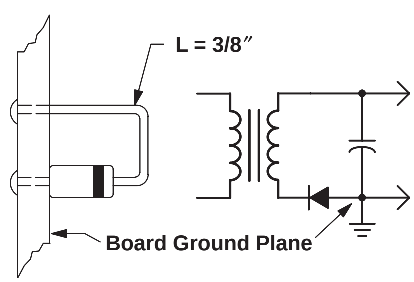



**MOUNTING METHOD 2**




**Vector Pin Mounting**

**MOUNTING METHOD 3**




**P.C. Board with 1–1/2″ X 1–1/2″ Copper Surface**

# MUR220

**Preferred Device**

# SWITCHMODE™ Power Rectifier

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 25 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 1000 per bag
- Available Tape and Reeled, 5000 per reel, by adding a “RL’’ suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: MUR220

ON Semiconductor™

http://onsemi.com

**ULTRAFAST RECTIFIER**
**2 AMPERES**
**200 VOLTS**

**AXIAL LEAD**
**CASE 059–04**
**PLASTIC**

**MARKING DIAGRAM**


MUR220 = Device Code

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 200<br>— | Volts |
| Average Rectified Forward Current (Note 1.) (Square Wave Mounting Method #3 Per Note 3.) | $I_{F(AV)}$ | 2.0 @ $T_A = 90°C$ | Amps |
| Non-Repetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz) | $I_{FSM}$ | 35 | Amps |
| Operating Junction Temperature and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | °C |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MUR220 | Axial Lead | 1000 Units/Bag |
| MUR220RL | Axial Lead | 5000/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | See Note 3. | °C/W |

## ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.)<br>($I_F$ = 2.0 Amp, $T_J$ = 150°C)<br>($I_F$ = 2.0 Amp, $T_J$ = 25°C) | $v_F$ | <br>0.75<br>0.95 | Volts |
| Maximum Instantaneous Reverse Current (Note 2.)<br>(Rated dc Voltage, $T_J$ = 150°C)<br>(Rated dc Voltage, $T_J$ = 25°C) | $i_R$ | <br>50<br>2.0 | μA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1.0 Amp, di/dt = 50 Amp/μs)<br>($I_F$ = 0.5 Amp, $I_R$ = 1.0 Amp, $I_{REC}$ = 0.25 A) | $t_{rr}$ | <br>35<br>25 | ns |
| Maximum Forward Recovery Time<br>($I_F$ = 1.0 A, di/dt = 100 A/μs, $I_{REC}$ to 1.0 V) | $t_{fr}$ | 25 | ns |

2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

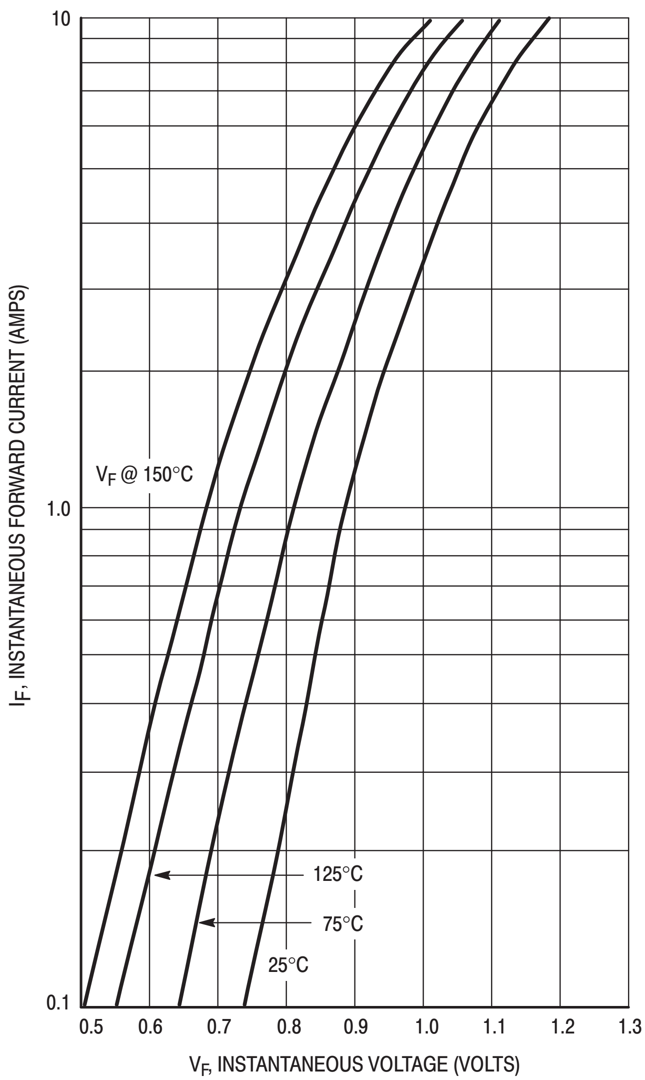



**Figure 1. Maximum Forward Voltage**

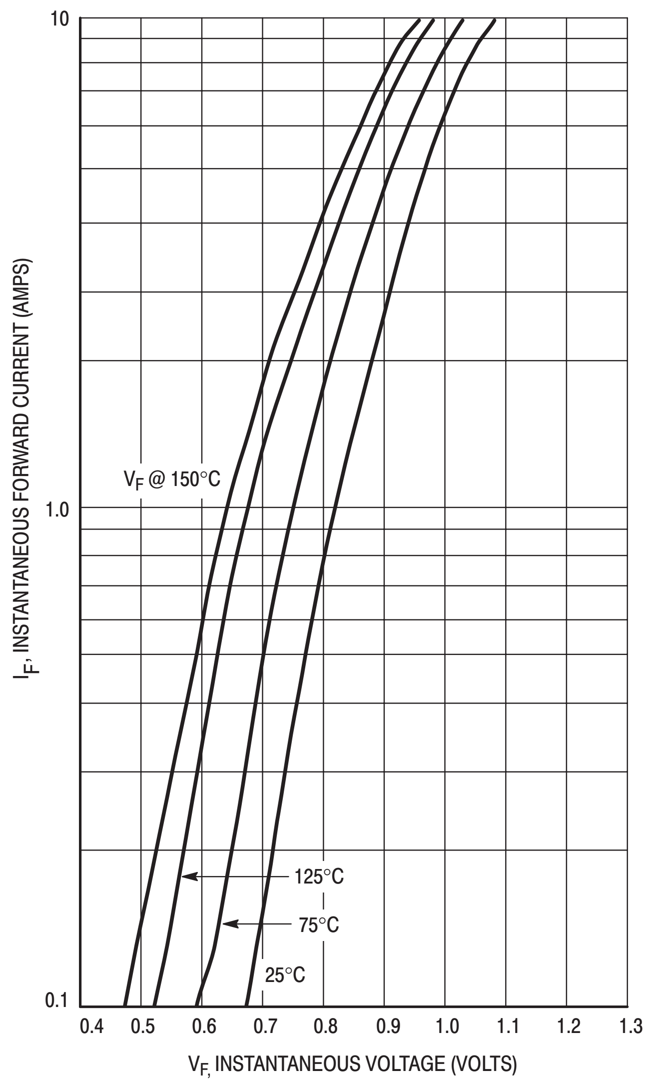



**Figure 2. Typical Forward Voltage**

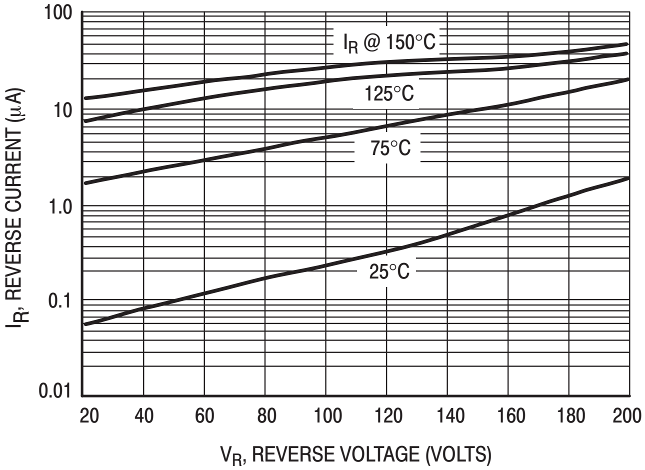



**Figure 3. Maximum Reverse Current**

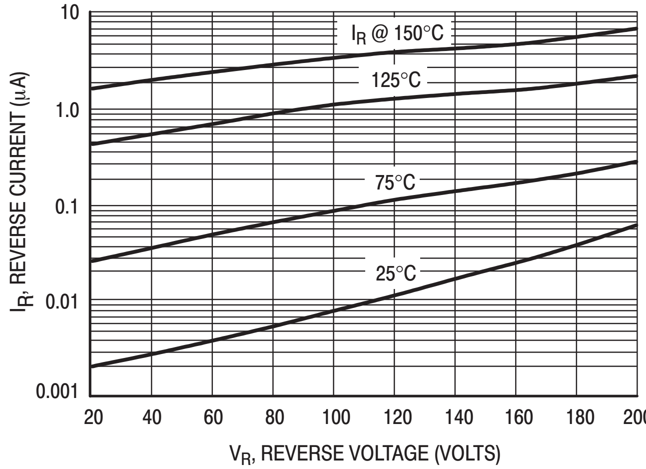



**Figure 4. Typical Reverse Current**

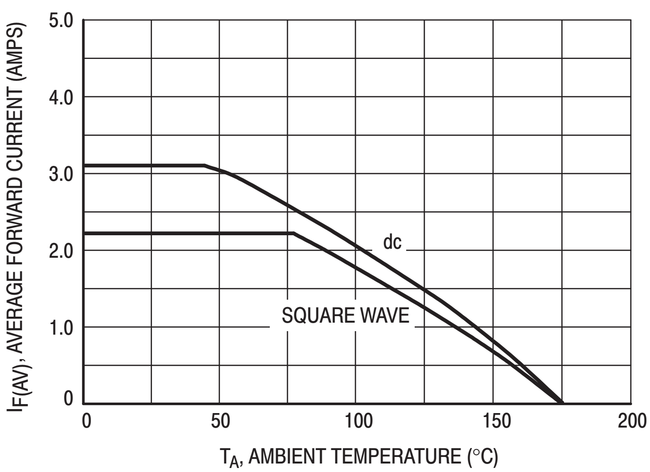



**Figure 5. Current Derating**

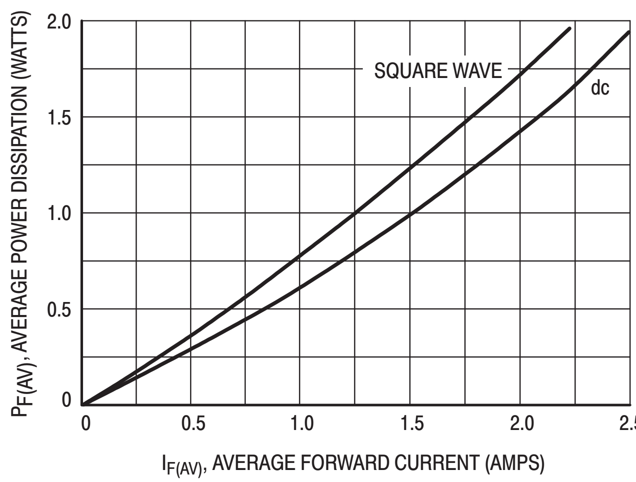



**Figure 6. Power Dissipation**

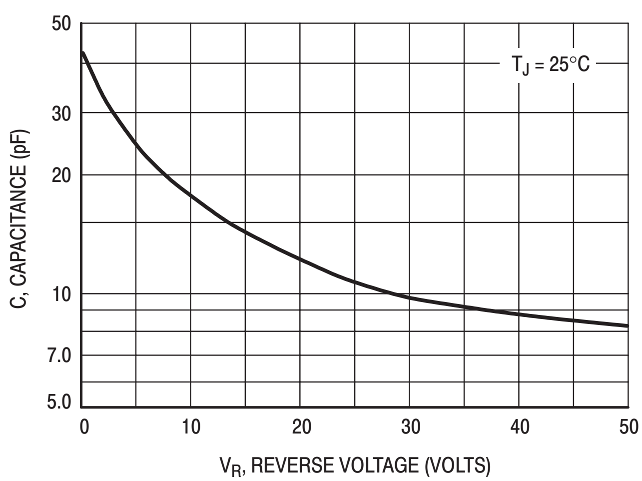



**Figure 7. Typical Capacitance**

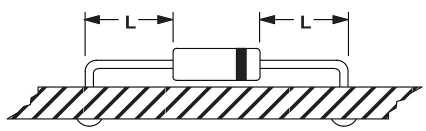
## NOTE 3. – AMBIENT MOUNTING DATA

Data shown for thermal resistance junction to ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

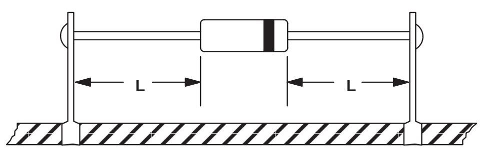
**TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR**

| Mounting Method | | Lead Length, L | | | Units |
|---|---|---|---|---|---|
| | | 1/8 | 1/4 | 1/2 | |
| 1 | $R_{\theta JA}$ | 52 | 65 | 72 | °C/W |
| 2 | | 67 | 80 | 87 | °C/W |
| 3 | | 50 | | | °C/W |

**MOUNTING METHOD 1**

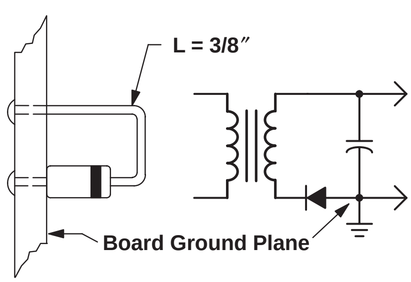



**MOUNTING METHOD 2**




**Vector Pin Mounting**

**MOUNTING METHOD 3**




**P.C. Board with**
**1–1/2″ X 1–1/2″ Copper Surface**

# MUR240

Preferred Device

# SWITCHMODE™ Power Rectifier

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast Recovery Times
- 175°C Operating Junction Temperature
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction

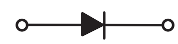
**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 1000 per bag
- Available Tape and Reeled, 5000 per reel, by adding a "RL" suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: MUR240

ON Semiconductor™

http://onsemi.com

**ULTRAFAST RECTIFIER 2 AMPERES 400 VOLTS**



AXIAL LEAD
CASE 059–04
PLASTIC

**MARKING DIAGRAM**


MUR240 = Device Code

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 400<br>– | V |
| Average Rectified Forward Current (Note 1.) (Square Wave Mounting Method #3 Per Note 3.) | $I_{F(AV)}$ | 2.0 @ $T_A$ = 85°C | A |
| Non-Repetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz) | $I_{FSM}$ | 35 | A |
| Operating Junction Temperature and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | °C |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MUR240 | Axial Lead | 1000 Units/Bag |
| MUR240RL | Axial Lead | 5000/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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### THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | See Note 3. | °C/W |

### ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.)<br>($I_F$ = 2.0 Amp, $T_J$ = 150°C)<br>($I_F$ = 2.0 Amp, $T_J$ = 25°C) | $V_F$ | <br>0.95<br>1.15 | Volts |
| Maximum Instantaneous Reverse Current (Note 2.)<br>(Rated dc Voltage, $T_J$ = 150°C)<br>(Rated dc Voltage, $T_J$ = 25°C) | $I_R$ | <br>150<br>5.0 | μA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1.0 Amp, di/dt = 50 Amp/μs) | $t_{rr}$ | <br>65 | ns |
| Maximum Forward Recovery Time<br>($I_F$ = 1.0 A, di/dt = 100 A/μs) | $t_{rr}$ | 50 | ns |

2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

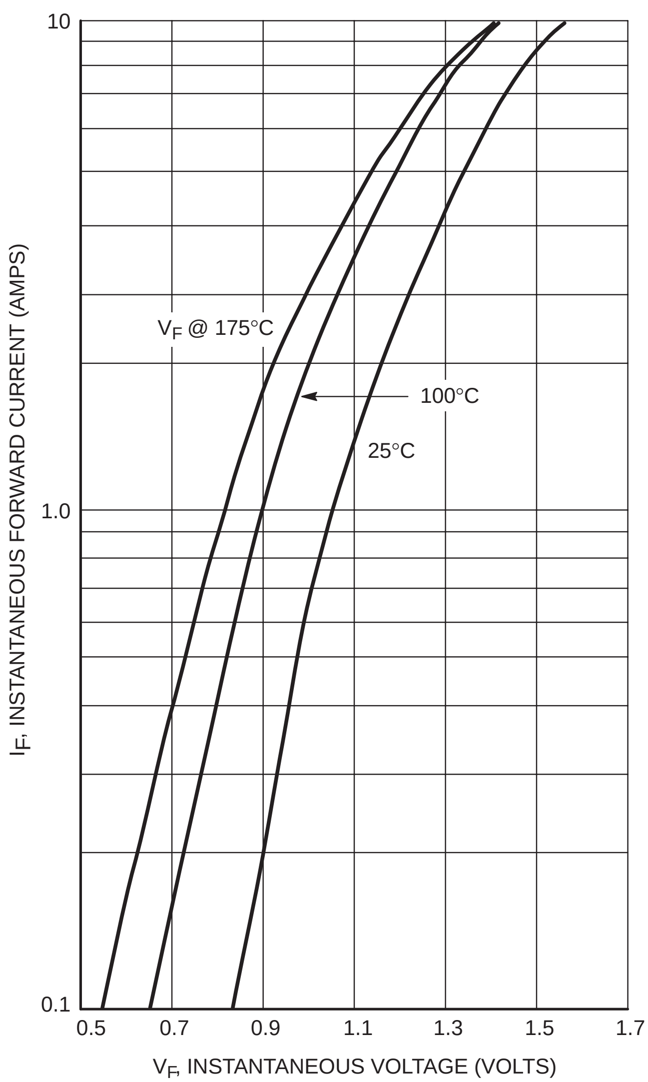



**Figure 1. Maximum Forward Current**

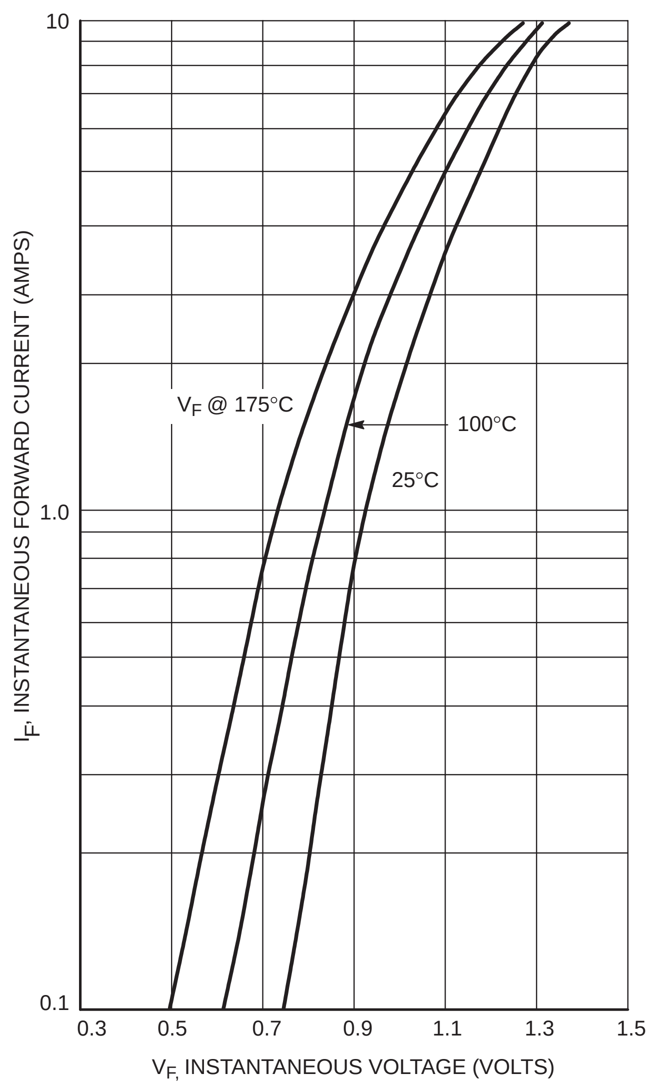



**Figure 2. Typical Forward Current**

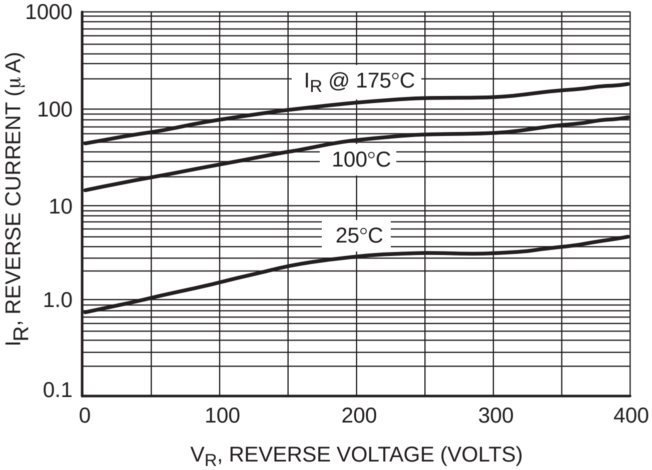



**Figure 3. Maximum Reverse Current**

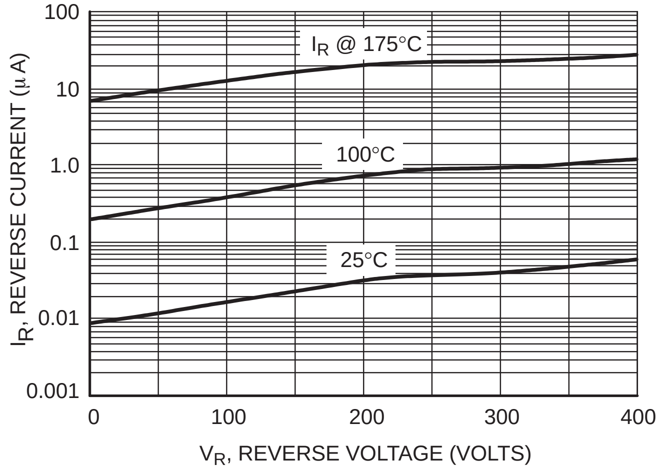



**Figure 4. Typical Reverse Current**

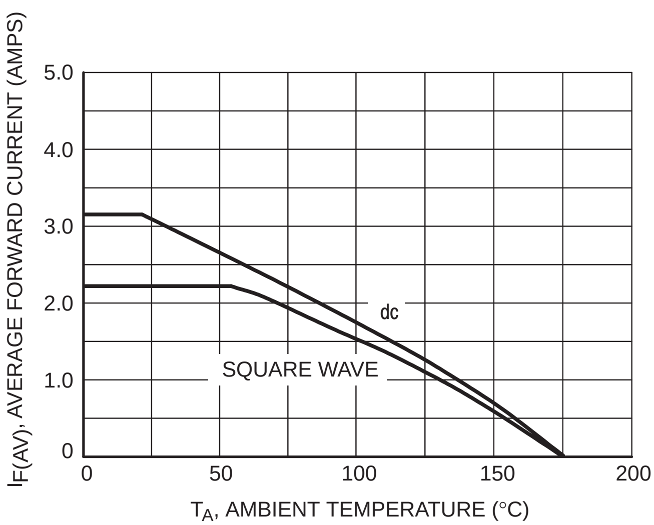



**Figure 5. Current Derating**

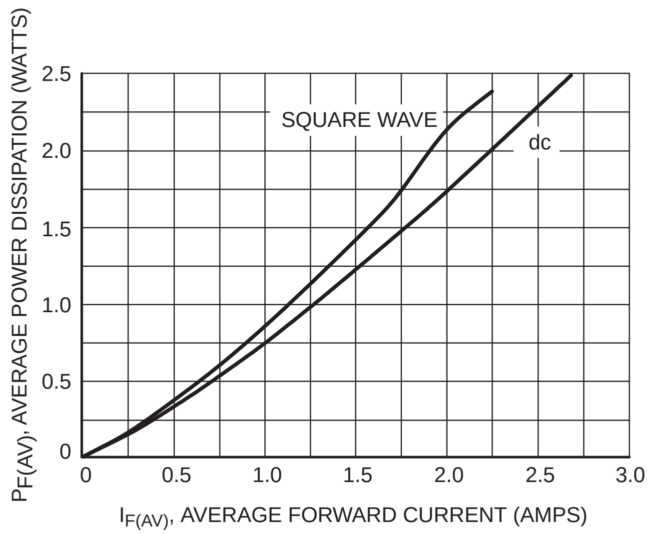



**Figure 6. Power Dissipation**

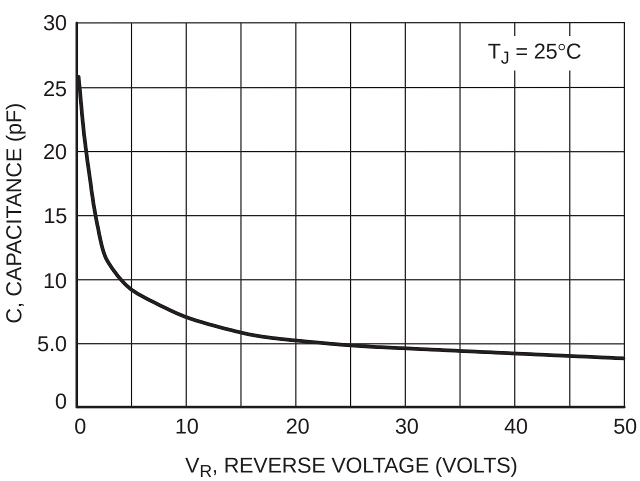



**Figure 7. Typical Capacitance**

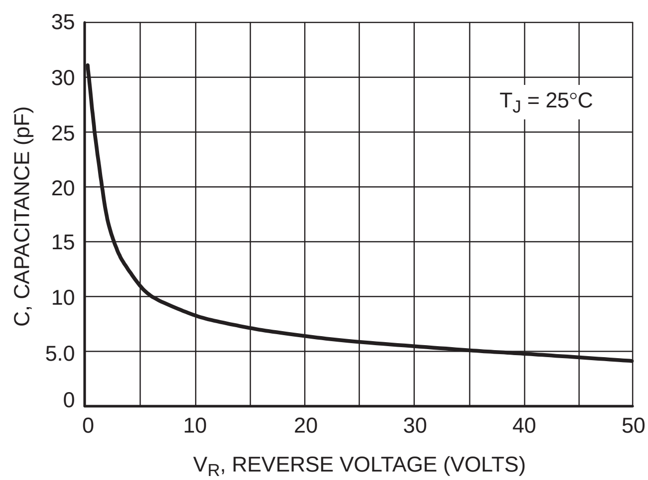



**Figure 8. Maximum Capacitance**

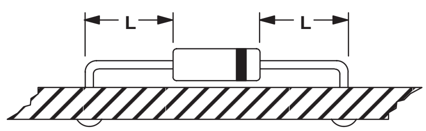
## NOTE 3. – AMBIENT MOUNTING DATA

Data shown for thermal resistance junction to ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

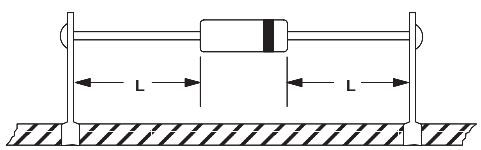
**TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR**

| Mounting Method | | Lead Length, L | | | Units |
|---|---|---|---|---|---|
| | | 1/8 | 1/4 | 1/2 | |
| 1 | $R_{\theta JA}$ | 52 | 65 | 72 | °C/W |
| 2 | | 67 | 80 | 87 | °C/W |
| 3 | | 50 | | | °C/W |

**MOUNTING METHOD 1**

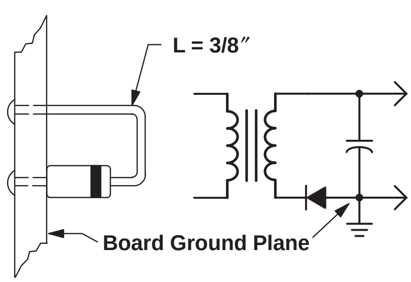



**MOUNTING METHOD 2**




**Vector Pin Mounting**

**MOUNTING METHOD 3**




**P.C. Board with**
**1–1/2″ X 1–1/2″ Copper Surface**

# MUR260

**Preferred Device**

# SWITCHMODE™ Power Rectifier

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 50 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 1000 per bag
- Available Tape and Reeled, 5000 per reel, by adding a “RL’’ suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: MUR260

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 600<br>– | Volts |
| Average Rectified Forward Current (Note 1.) (Square Wave Mounting Method #3 Per Note 3.) | $I_{F(AV)}$ | 2.0 @<br>$T_A$ = 60°C | Amps |
| Non-Repetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz) | $I_{FSM}$ | 35 | Amps |
| Operating Junction Temperature and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | °C |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

**ON Semiconductor™**

**http://onsemi.com**

**ULTRAFAST RECTIFIER 2 AMPERES 600 VOLTS**

**AXIAL LEAD CASE 059–04 PLASTIC**

**MARKING DIAGRAM**


MUR260 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MUR260 | Axial Lead | 1000 Units/Bag |
| MUR260RL | Axial Lead | 5000/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | See Note 3. | °C/W |

## ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.)<br>($I_F$ = 2.0 Amp, $T_J$ = 150°C)<br>($I_F$ = 2.0 Amp, $T_J$ = 25°C) | $v_F$ | <br>1.15<br>1.35 | Volts |
| Maximum Instantaneous Reverse Current (Note 2.)<br>(Rated dc Voltage, $T_J$ = 150°C)<br>(Rated dc Voltage, $T_J$ = 25°C) | $i_R$ | <br>150<br>5.0 | μA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1.0 Amp, di/dt = 50 Amp/μs)<br>($I_F$ = 0.5 Amp, $I_R$ = 1.0 Amp, $I_{REC}$ = 0.25 A) | $t_{rr}$ | <br>75<br>50 | ns |
| Maximum Forward Recovery Time<br>($I_F$ = 1.0 A, di/dt = 100 A/μs, $I_{REC}$ to 1.0 V) | $t_{fr}$ | 50 | ns |

2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

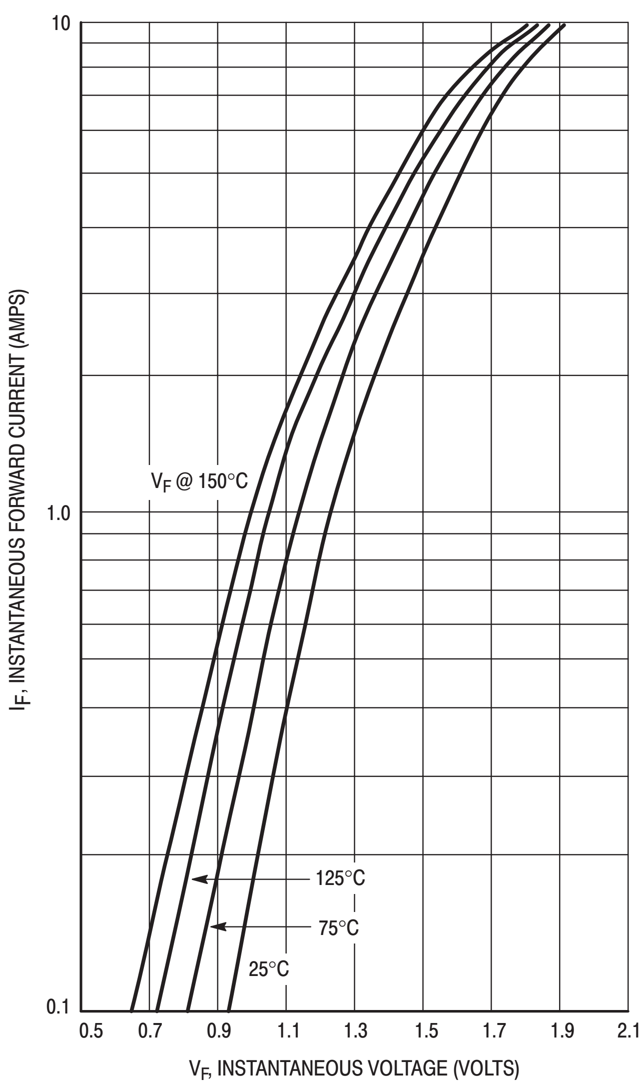



**Figure 1. Maximum Forward Voltage**

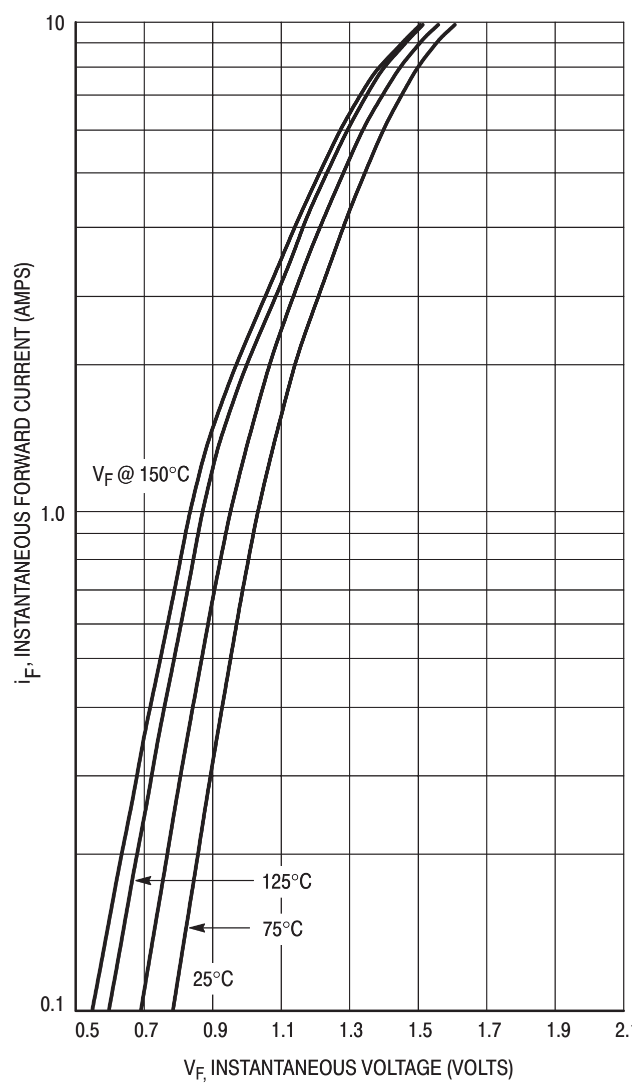



**Figure 2. Typical Forward Voltage**

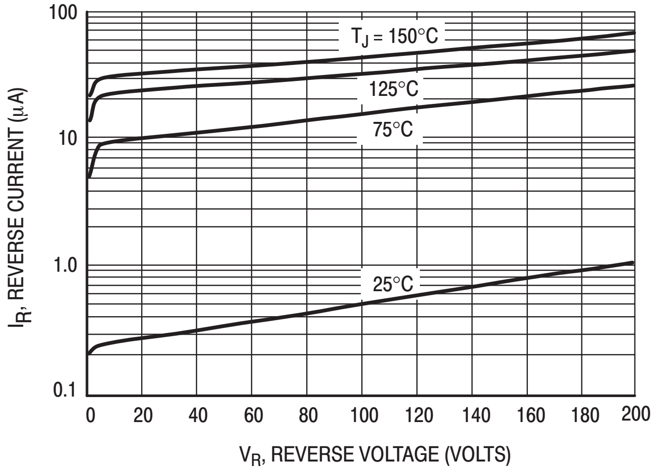



**Figure 3. Maximum Reverse Current**

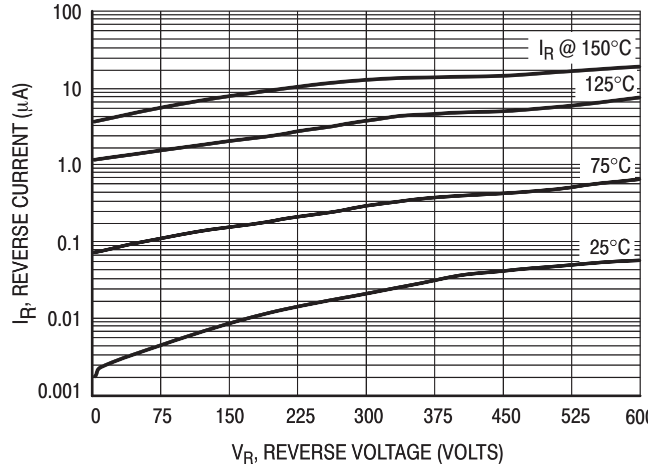



**Figure 4. Typical Reverse Current**

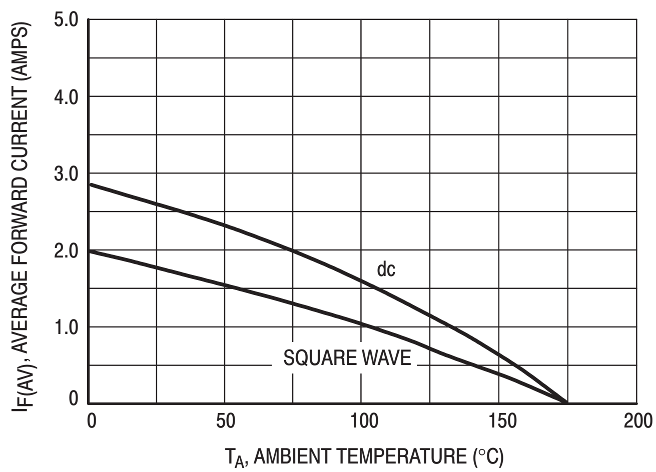



**Figure 5. Current Derating**

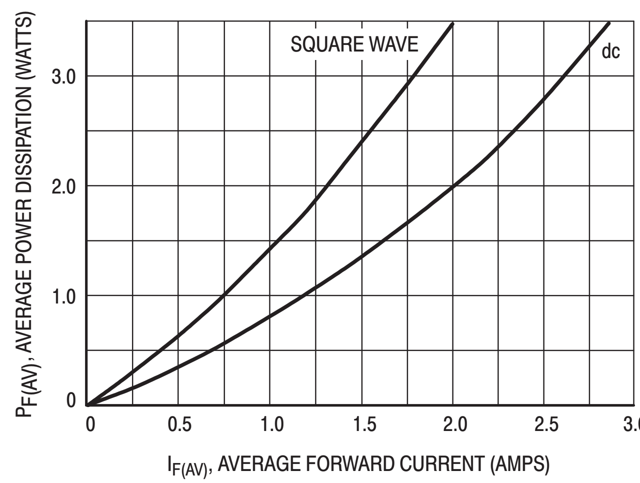



**Figure 6. Power Dissipation**

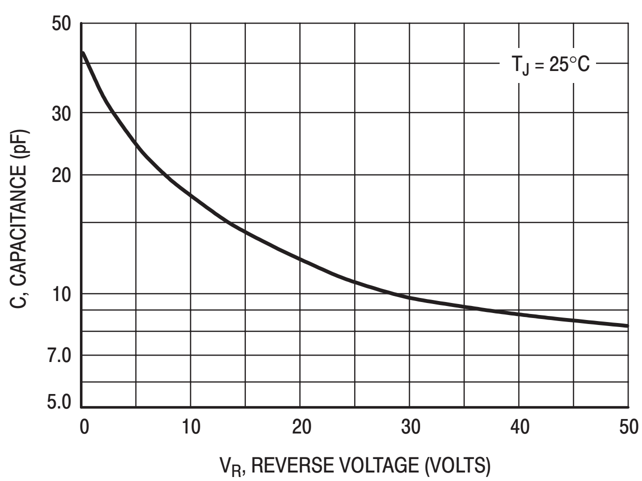



**Figure 7. Typical Capacitance**

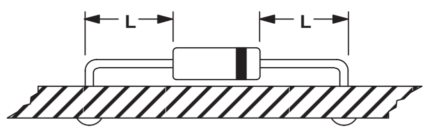
## NOTE 3. — AMBIENT MOUNTING DATA

Data shown for thermal resistance junction to ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

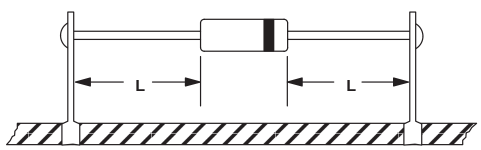
**TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR**

| Mounting Method | | Lead Length, L | | | Units |
|---|---|---|---|---|---|
| | | 1/8 | 1/4 | 1/2 | |
| 1 | $R_{\theta JA}$ | 52 | 65 | 72 | °C/W |
| 2 | $R_{\theta JA}$ | 67 | 80 | 87 | °C/W |
| 3 | $R_{\theta JA}$ | 50 | | | °C/W |

**MOUNTING METHOD 1**

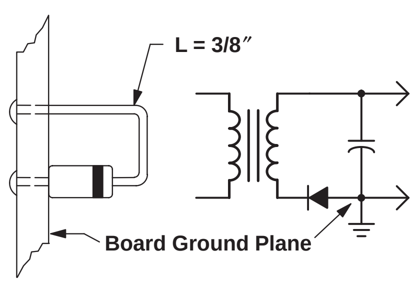



**MOUNTING METHOD 2**




**Vector Pin Mounting**

**MOUNTING METHOD 3**




**P.C. Board with**
**1–1/2″ X 1–1/2″ Copper Surface**

# MUR2100E

**Preferred Device**

# SWITCHMODE™ Power Rectifier

## Ultrafast “E” Series with High Reverse Energy Capability

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- 20 mjoules Avalanche Energy Guaranteed
- Excellent Protection Against Voltage Transients in Switching Inductive Load Circuits
- Ultrafast 75 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 1000 per bag
- Available Tape and Reeled, 5000 per reel, by adding a “RL’’ suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: MUR2100E

**MAXIMUM RATINGS**

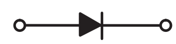
| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 1000 | Volts |
| Average Rectified Forward Current (Note 1.) (Square Wave Mounting Method #3 Per Note 3.) | $I_{F(AV)}$ | 2.0 @ $T_A$ = 35°C | Amps |
| Non-Repetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz) | $I_{FSM}$ | 35 | Amps |
| Operating Junction Temperature and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | °C |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

**ON Semiconductor**™

**http://onsemi.com**

**ULTRAFAST RECTIFIER 2 AMPERES 1000 VOLTS**



**AXIAL LEAD CASE 059–04 PLASTIC**

**MARKING DIAGRAM**


MUR2100E = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MUR2100E | Axial Lead | 1000 Units/Bag |
| MUR2100ERL | Axial Lead | 5000/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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### THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | See Note 3. | °C/W |

### ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 2.)<br>($I_F$ = 2.0 Amp, $T_J$ = 150°C)<br>($I_F$ = 2.0 Amp, $T_J$ = 25°C) | $v_F$ | <br>1.75<br>2.20 | Volts |
| Maximum Instantaneous Reverse Current (Note 2.)<br>(Rated dc Voltage, $T_J$ = 100°C)<br>(Rated dc Voltage, $T_J$ = 25°C) | $i_R$ | <br>600<br>10 | μA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1.0 Amp, di/dt = 50 Amp/μs)<br>($I_F$ = 0.5 Amp, $I_R$ = 1.0 Amp, $I_{REC}$ = 0.25 A) | $t_{rr}$ | <br>100<br>75 | ns |
| Maximum Forward Recovery Time<br>($I_F$ = 1.0 A, di/dt = 100 A/μs, $I_{REC}$ to 1.0 V) | $t_{fr}$ | 75 | ns |
| Controlled Avalanche Energy (See Test Circuit in Figure 6) | $W_{AVAL}$ | 10 | mJ |

2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

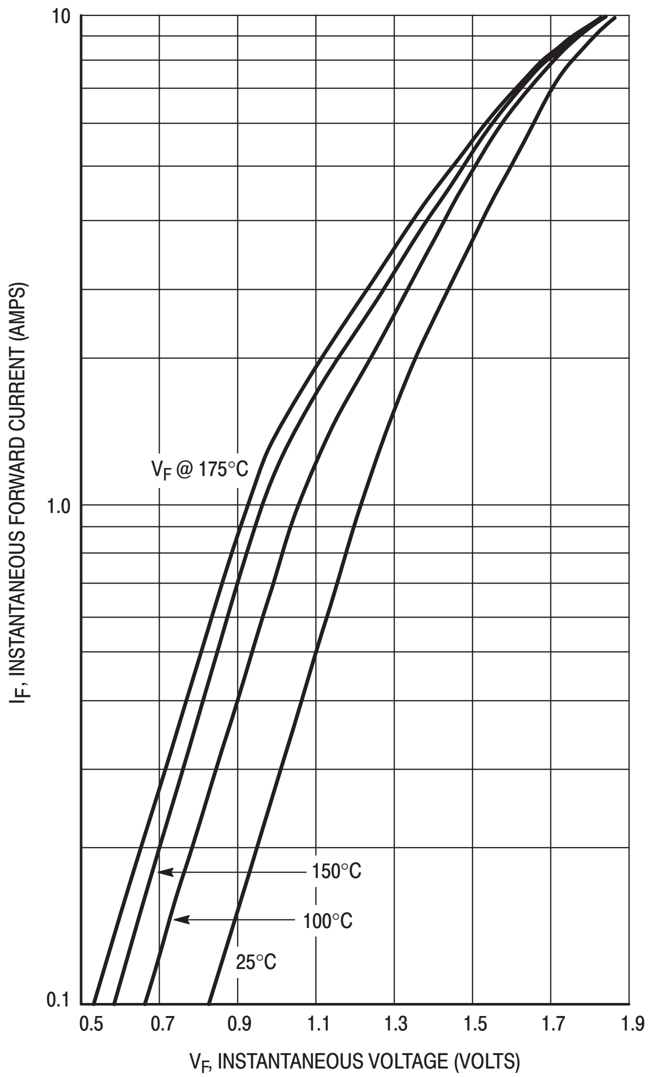



Figure 1. Maximum Forward Voltage

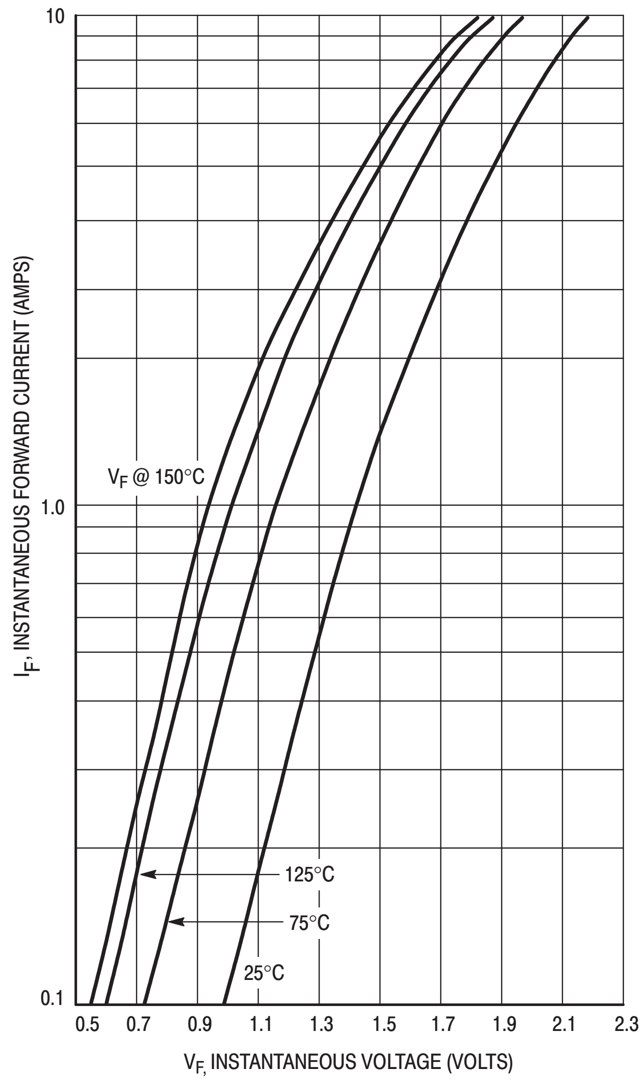



Figure 2. Typical Forward Voltage

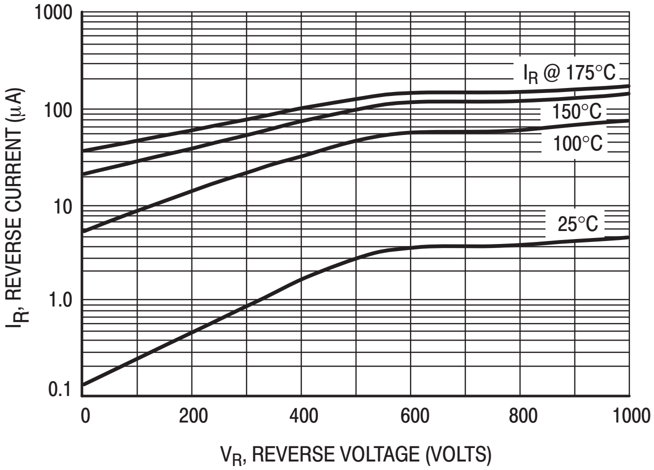



**Figure 3. Maximum Reverse Current**

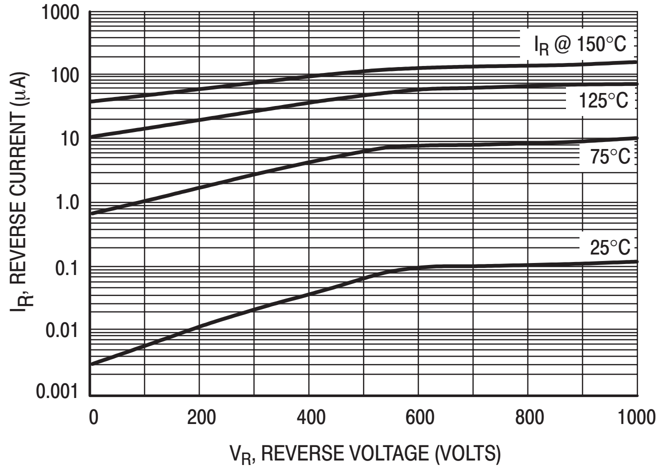



**Figure 4. Typical Reverse Current**

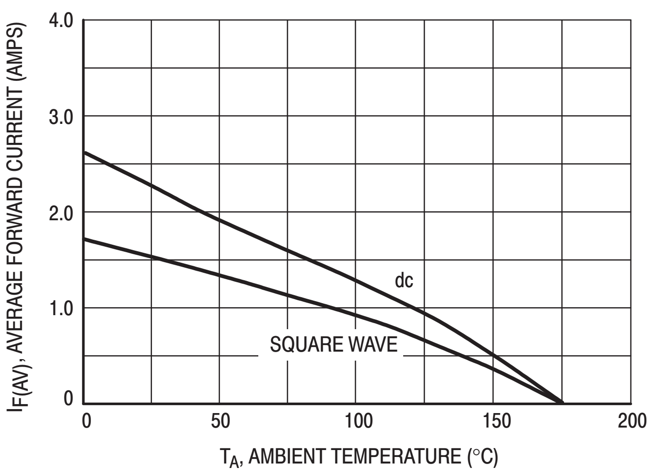



**Figure 5. Current Derating**

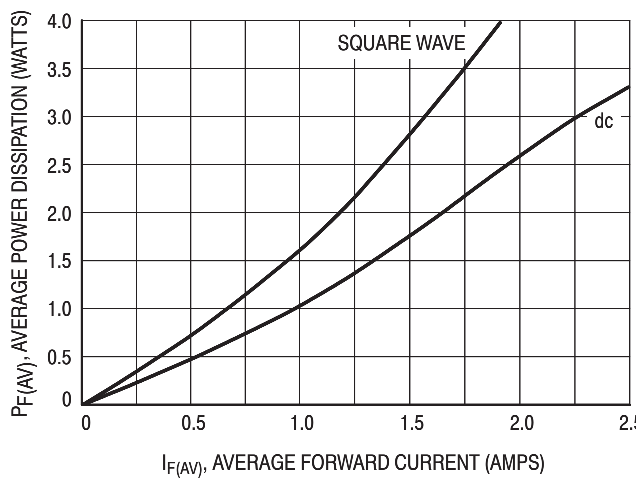



**Figure 6. Power Dissipation**

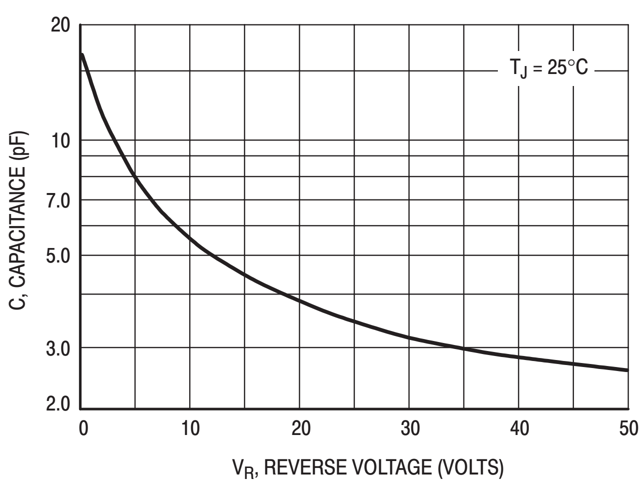



**Figure 7. Typical Capacitance**

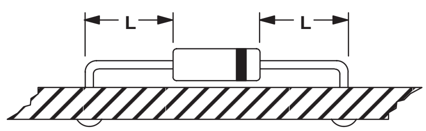
## NOTE 3. — AMBIENT MOUNTING DATA

Data shown for thermal resistance junction to ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

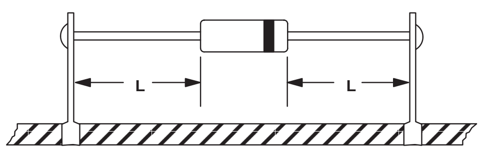
**TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR**

| Mounting Method | | Lead Length, L | | | Units |
|---|---|---|---|---|---|
| | | 1/8 | 1/4 | 1/2 | |
| 1 | $R_{\theta JA}$ | 52 | 65 | 72 | °C/W |
| 2 | $R_{\theta JA}$ | 67 | 80 | 87 | °C/W |
| 3 | $R_{\theta JA}$ | 50 | | | °C/W |

**MOUNTING METHOD 1**

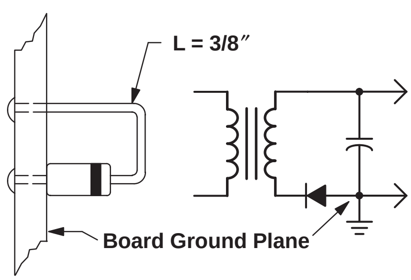



**MOUNTING METHOD 2**




**Vector Pin Mounting**

**MOUNTING METHOD 3**




**P.C. Board with**
**1–1/2″ X 1–1/2″ Copper Surface**

# MUR405, MUR410, MUR415, MUR420, MUR440, MUR460

**MUR420 and MUR460 are Preferred Devices**

# Switchmode™ Power Rectifiers

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 25, 50 and 75 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction
- Reverse Voltage to 600 Volts

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 1.1 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 5,000 per bag
- Available Tape and Reeled, 1500 per reel, by adding a “RL” suffix to the part number
- Polarity: Cathode indicated by Polarity Band
- Marking: MUR405, MUR410, MUR415, MUR420, MUR440, MUR460

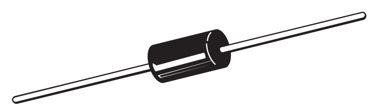
**MAXIMUM RATINGS**

Please See the Table on the Following Page

**ON Semiconductor™**

**http://onsemi.com**

**ULTRAFAST RECTIFIERS**
**4.0 AMPERES**
**50–600 VOLTS**



**AXIAL LEAD**
**CASE 267–03**
**STYLE 1**

**MARKING DIAGRAM**


MUR4xx = Device Code
xx = 05, 10, 15, 20, 40, 60

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MUR405 | Axial Lead | 5000 Units/Bag |
| MUR405RL | Axial Lead | 1500/Tape & Reel |
| MUR410 | Axial Lead | 5000 Units/Bag |
| MUR410RL | Axial Lead | 1500/Tape & Reel |
| MUR415 | Axial Lead | 5000 Units/Bag |
| MUR415RL | Axial Lead | 1500/Tape & Reel |
| MUR420 | Axial Lead | 5000 Units/Bag |
| MUR420RL | Axial Lead | 1500/Tape & Reel |
| MUR440 | Axial Lead | 5000 Units/Bag |
| MUR440RL | Axial Lead | 1500/Tape & Reel |
| MUR460 | Axial Lead | 5000 Units/Bag |
| MUR460RL | Axial Lead | 1500/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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## MAXIMUM RATINGS

| Rating | Symbol | MUR 405 | MUR 410 | MUR 415 | MUR 420 | MUR 440 | MUR 460 | Unit |
|---|---|---|---|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 50 | 100 | 150 | 200 | 400 | 600 | Volts |
| Average Rectified Forward Current (Square Wave)<br>(Mounting Method #3 Per Note 2.) | $I_{F(AV)}$ | 4.0 @ $T_A$ = 80°C | | | | 4.0 @ $T_A$ = 40°C | | Amps |
| Nonrepetitive Peak Surge Current<br>(Surge applied at rated load conditions, half wave, single phase, 60 Hz) | $I_{FSM}$ | 125 | | | | 70 | | Amps |
| Operating Junction Temperature & Storage Temperature | $T_J$, $T_{stg}$ | – 65 to +175 | | | | | | °C |

## THERMAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | See Note 2. | °C/W |

## ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | MUR405–MUR420 | MUR440–MUR460 | Unit |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 3.0 Amps, $T_J$ = 150°C)<br>($i_F$ = 3.0 Amps, $T_J$ = 25°C)<br>($i_F$ = 4.0 Amps, $T_J$ = 25°C) | $v_F$ | <br>0.710<br>0.875<br>0.890 | <br>1.05<br>1.25<br>1.28 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_J$ = 150°C)<br>(Rated dc Voltage, $T_J$ = 25°C) | $i_R$ | <br>150<br>5.0 | <br>250<br>10 | μA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1.0 Amp, di/dt = 50 Amp/μs)<br>($I_F$ = 0.5 Amp, $i_R$ = 1.0 Amp, $I_{REC}$ = 0.25 Amp) | $t_{rr}$ | <br>35<br>25 | <br>75<br>50 | ns |
| Maximum Forward Recovery Time<br>($I_F$ = 1.0 A, di/dt = 100 A/μs, Recovery to 1.0 V) | $t_{fr}$ | 25 | 50 | ns |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

## MUR405, MUR410, MUR415, MUR420

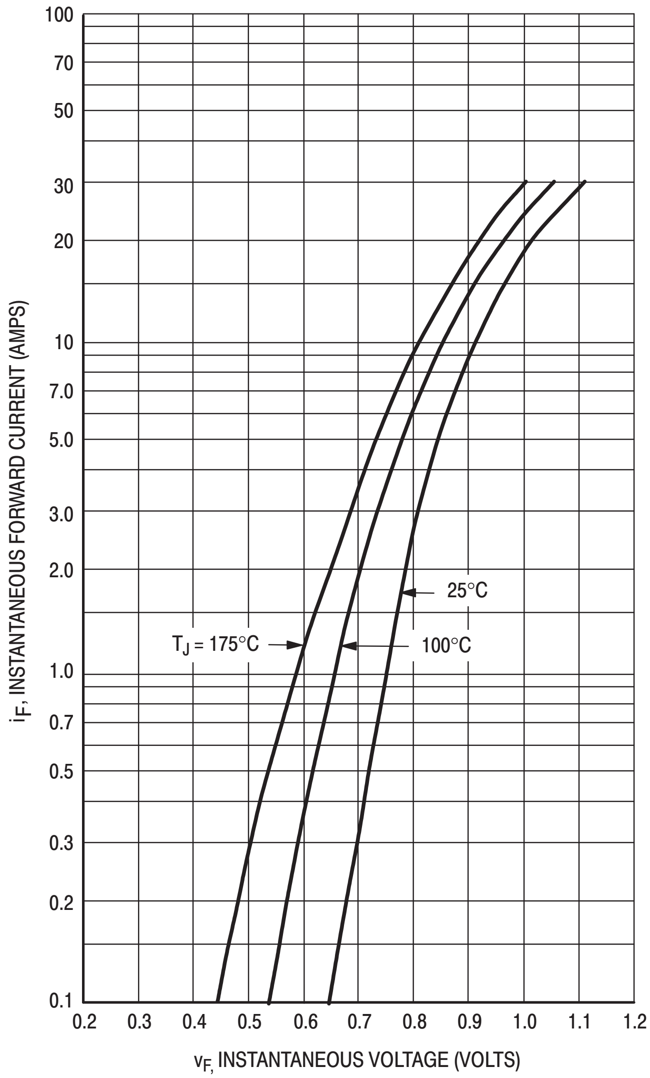



**Figure 1. Typical Forward Voltage**

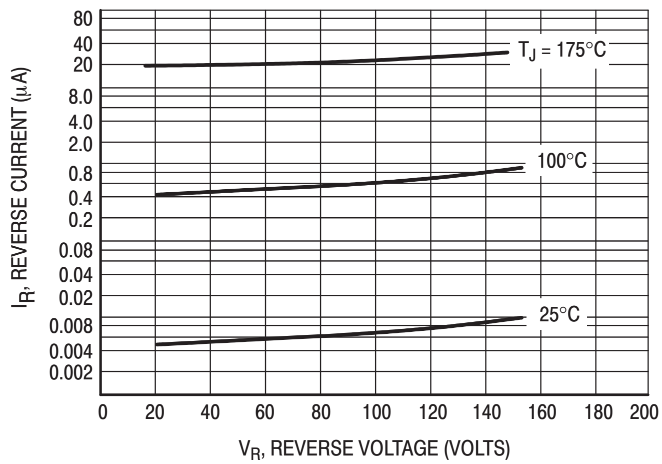



**Figure 2. Typical Reverse Current**

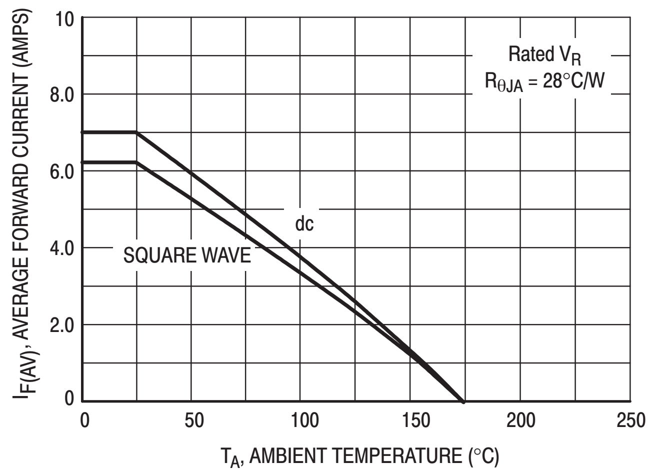



**Figure 3. Current Derating (Mounting Method #3 Per Note 1)**

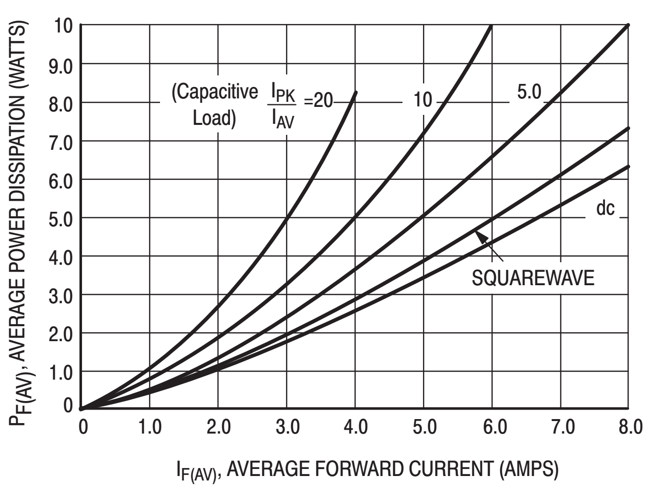



**Figure 4. Power Dissipation**

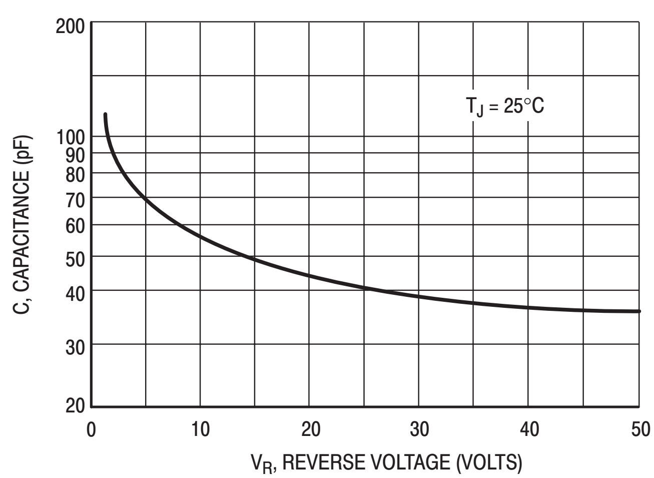



**Figure 5. Typical Capacitance**

**MUR440, MUR460**

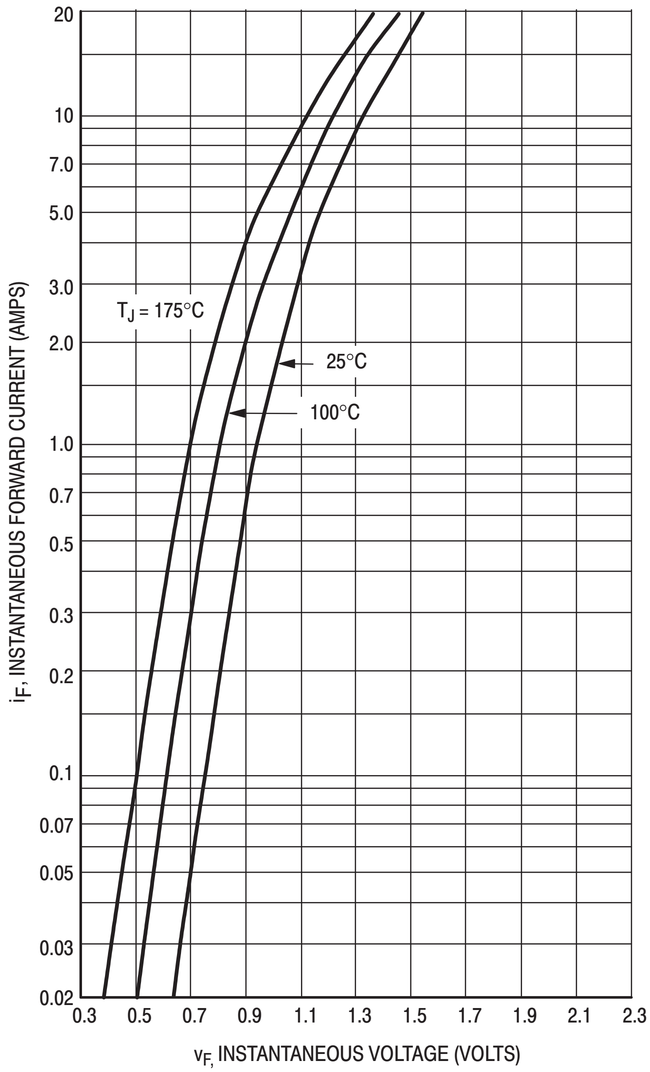



**Figure 6. Typical Forward Voltage**

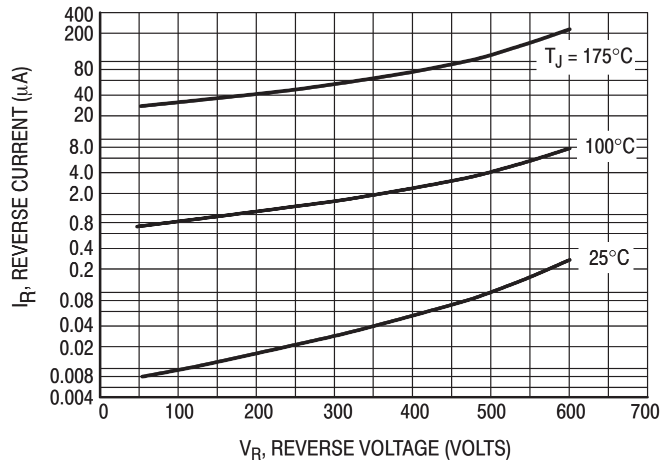



**Figure 7. Typical Reverse Current**

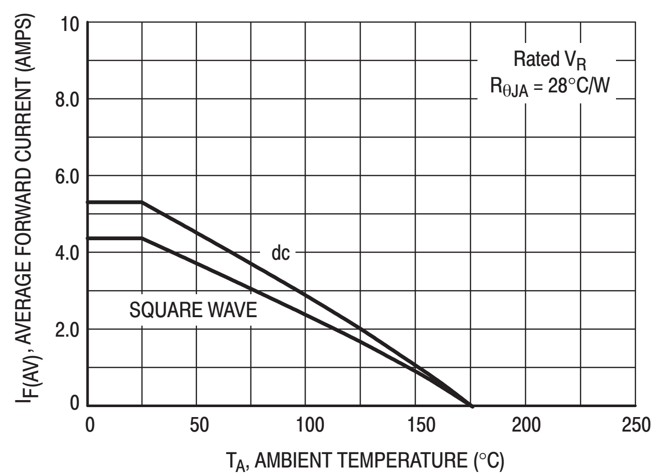



**Figure 8. Current Derating (Mounting Method #3 Per Note 1)**

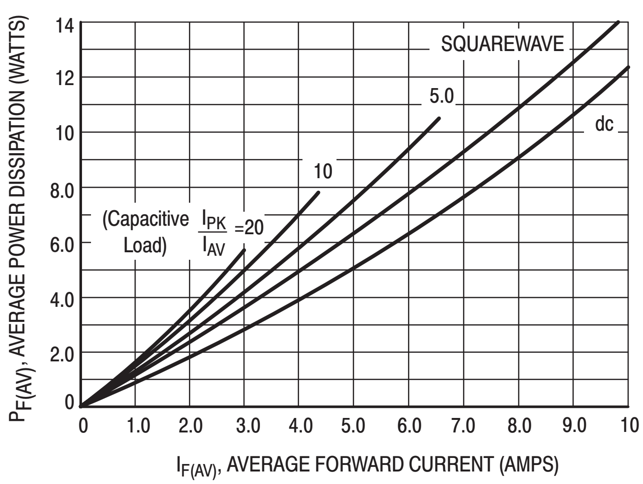



**Figure 9. Power Dissipation**

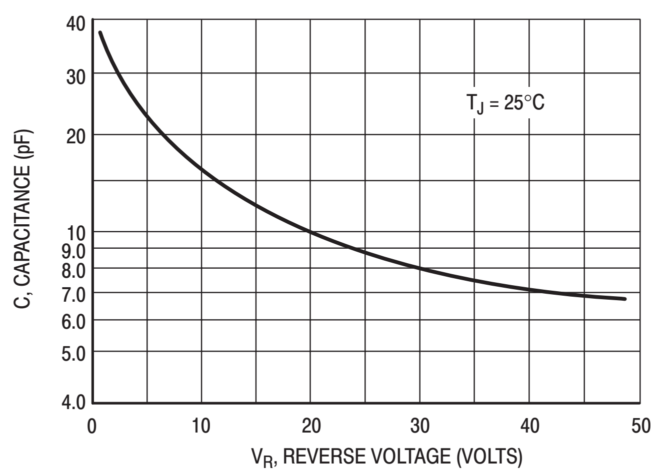



**Figure 10. Typical Capacitance**

## NOTE 2. — AMBIENT MOUNTING DATA

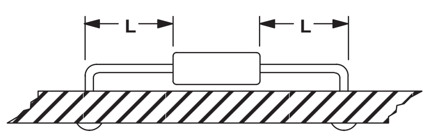
Data shown for thermal resistance junction–to–ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

**TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR**

| Mounting Method | | Lead Length, L (IN) | | | | Units |
|---|---|---|---|---|---|---|
| | | 1/8 | 1/4 | 1/2 | 3/4 | |
| 1 | $R_{\theta JA}$ | 50 | 51 | 53 | 55 | °C/W |
| 2 | $R_{\theta JA}$ | 58 | 59 | 61 | 63 | °C/W |
| 3 | $R_{\theta JA}$ | 28 | | | | °C/W |

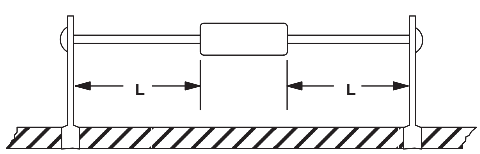
**MOUNTING METHOD 1**

**P.C. Board Where Available Copper Surface area is small.**



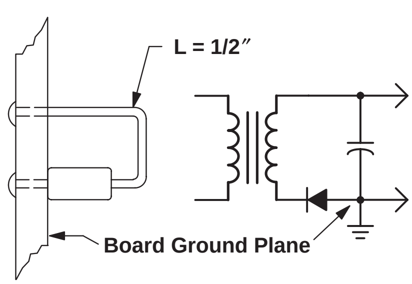

**MOUNTING METHOD 2**

**Vector Push–In Terminals T–28**




**MOUNTING METHOD 3**

**P.C. Board with 1–1/2″ x 1–1/2″ Copper Surface**



# MUR480E, MUR4100E

# SWITCHMODE™ Power Rectifiers

## Ultrafast "E" Series with High Reverse Energy Capability

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- 20 mJ Avalanche Energy Guaranteed
- Excellent Protection Against Voltage Transients in Switching Inductive Load Circuits
- Ultrafast 75 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction
- Reverse Voltage to 1000 Volts

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 1.1 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 5,000 per bag
- Available Tape and Reeled, 1500 per reel, by adding a "RL'' suffix to the part number
- Polarity: Cathode indicated by Polarity Band
- Marking: MUR480E, MUR4100E

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage MUR480E<br>MUR4100E | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | <br><br>800<br>1000 | V |
| Average Rectified Forward Current (Square Wave) (Mounting Method #3 Per Note 2.) | $I_{F(AV)}$ | 4.0 @ $T_A$ = 35°C | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 70 | A |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | °C |

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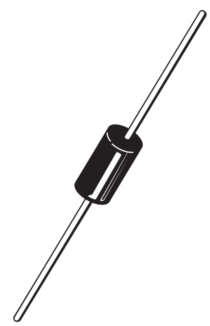
**ULTRAFAST RECTIFIER**
**4.0 AMPERES**
**800–1000 VOLTS**



**AXIAL LEAD**
**CASE 267–03**
**STYLE 1**

**MARKING DIAGRAM**


MUR4x0E = Device Code
x = 8 or 10

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MUR480E | Axial Lead | 5000 Units/Bag |
| MUR480ERL | Axial Lead | 1500/Tape & Reel |
| MUR4100E | Axial Lead | 5000 Units/Bag |
| MUR4100ERL | Axial Lead | 1500/Tape & Reel |

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## THERMAL CHARACTERISTICS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | See Note 2. | °C/W |

## ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 3.0 Amps, $T_J$ = 150°C)<br>($i_F$ = 3.0 Amps, $T_J$ = 25°C)<br>($i_F$ = 4.0 Amps, $T_J$ = 25°C) | $v_F$ | <br>1.53<br>1.75<br>1.85 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_J$ = 100°C)<br>(Rated dc Voltage, $T_J$ = 25°C) | $i_R$ | <br>900<br>25 | μA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1.0 Amp, di/dt = 50 Amp/μs)<br>($I_F$ = 0.5 Amp, $i_R$ = 1.0 Amp, $I_{REC}$ = 0.25 Amp) | $t_{rr}$ | <br>100<br>75 | ns |
| Maximum Forward Recovery Time<br>($I_F$ = 1.0 Amp, di/dt = 100 Amp/μs, Recovery to 1.0 V) | $t_{fr}$ | 75 | ns |
| Controlled Avalanche Energy (See Test Circuit in Figure 6. ) | $W_{AVAL}$ | 20 | mJ |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

## MUR480E, MUR4100E

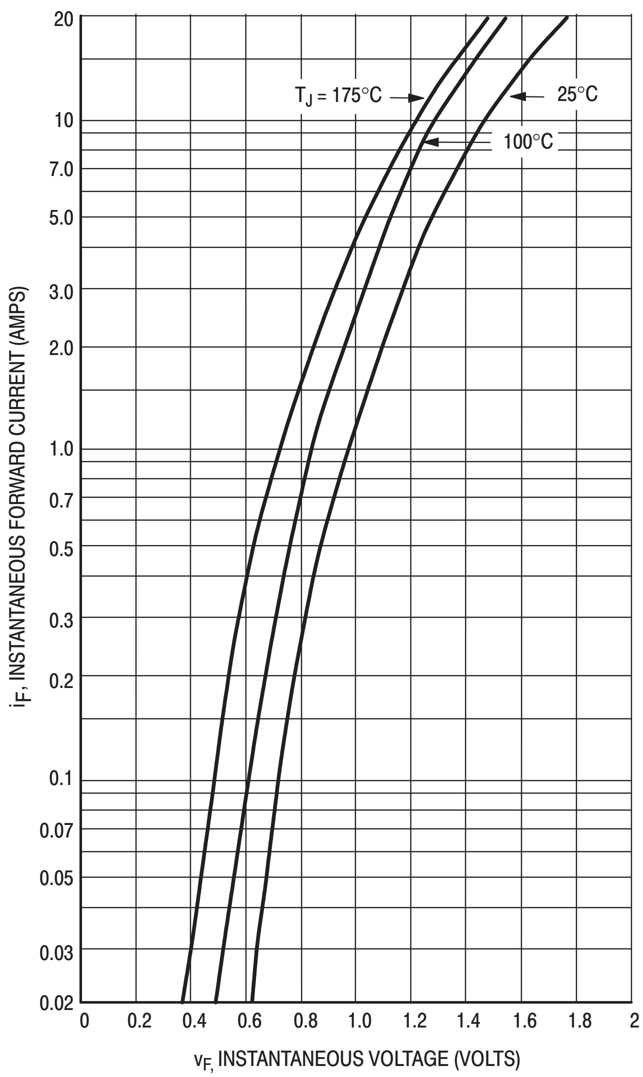



**Figure 1. Typical Forward Voltage**

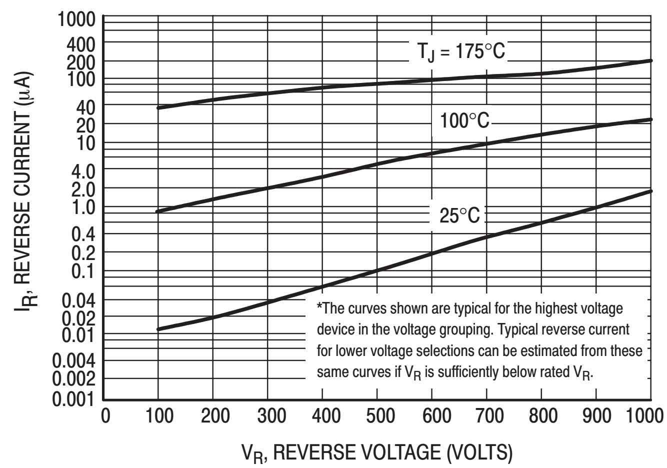



**Figure 2. Typical Reverse Current***

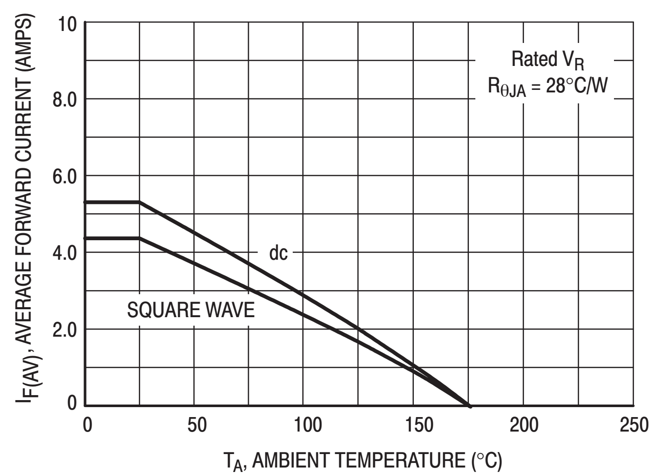



**Figure 3. Current Derating (Mounting Method #3 Per Note 1)**

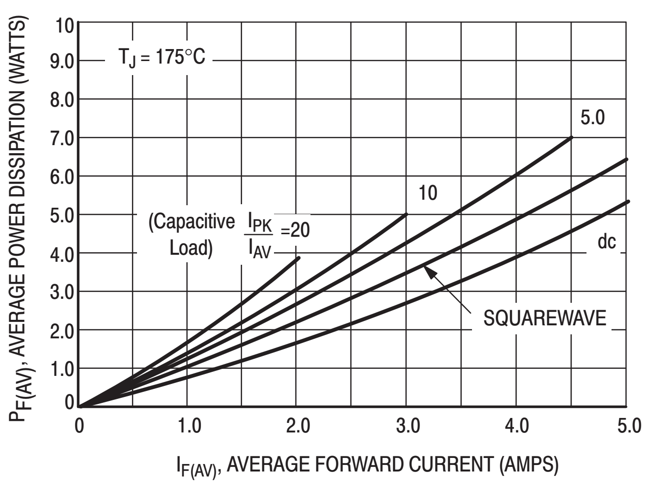



**Figure 4. Power Dissipation**

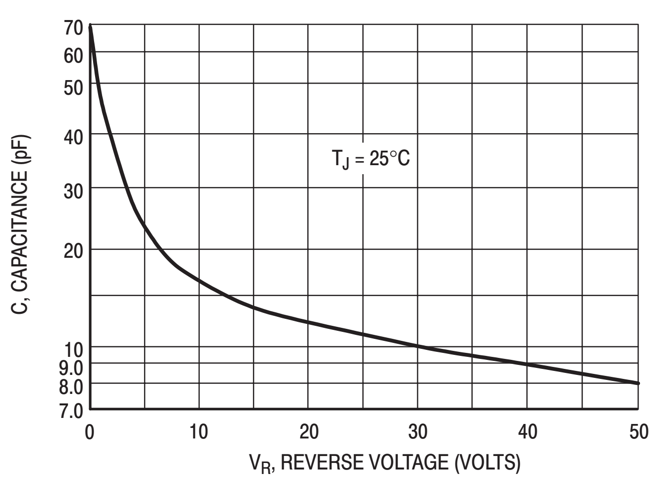



**Figure 5. Typical Capacitance**

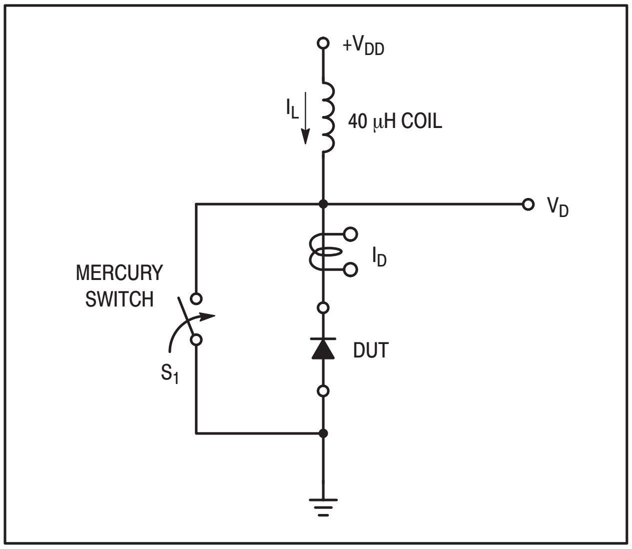



**Figure 6. Test Circuit**

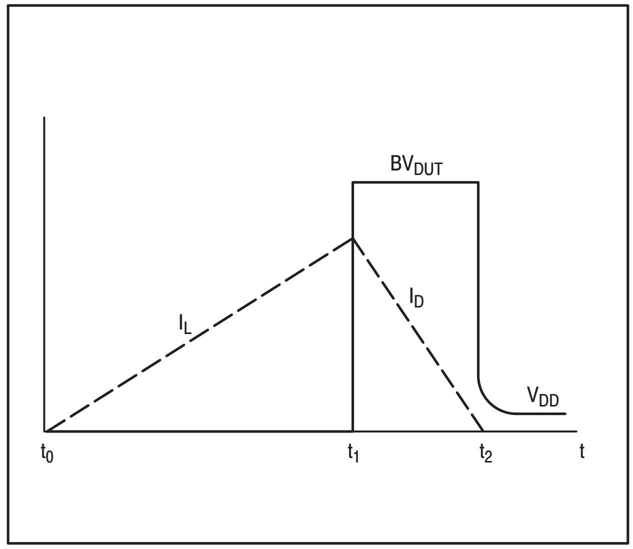



**Figure 7. Current–Voltage Waveforms**

The unclamped inductive switching circuit shown in Figure 6. was used to demonstrate the controlled avalanche capability of the new “E’’ series Ultrafast rectifiers. A mercury switch was used instead of an electronic switch to simulate a noisy environment when the switch was being opened.

When $S_1$ is closed at $t_0$ the current in the inductor $I_L$ ramps up linearly; and energy is stored in the coil. At $t_1$ the switch is opened and the voltage across the diode under test begins to rise rapidly, due to di/dt effects, when this induced voltage reaches the breakdown voltage of the diode, it is clamped at $BV_{DUT}$ and the diode begins to conduct the full load current which now starts to decay linearly through the diode, and goes to zero at $t_2$.

By solving the loop equation at the point in time when $S_1$ is opened; and calculating the energy that is transferred to the diode it can be shown that the total energy transferred is equal to the energy stored in the inductor plus a finite amount of energy from the $V_{DD}$ power supply while the diode is in breakdown (from $t_1$ to $t_2$) minus any losses due to finite component resistances. Assuming the component resistive elements are small Equation (1) approximates the total energy transferred to the diode. It can be seen from this equation that if the $V_{DD}$ voltage is low compared to the breakdown voltage of the device, the amount of energy contributed by the supply during breakdown is small and the total energy can be assumed to be nearly equal to the energy stored in the coil during the time when $S_1$ was closed, Equation (2).

The oscilloscope picture in Figure 8. , shows the information obtained for the MUR8100E (similar die construction as the MUR4100E Series) in this test circuit conducting a peak current of one ampere at a breakdown voltage of 1300 volts, and using Equation (2) the energy absorbed by the MUR8100E is approximately 20 mjoules.

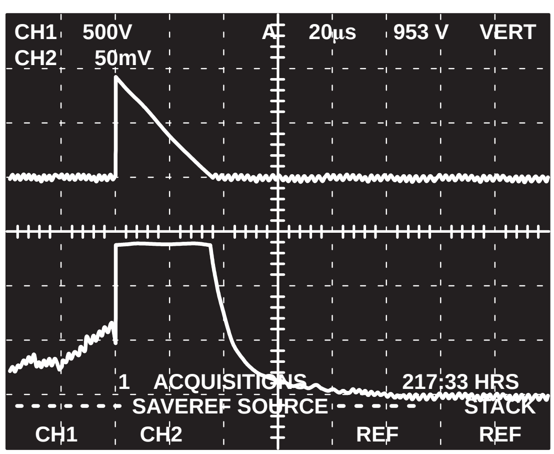
Although it is not recommended to design for this condition, the new “E’’ series provides added protection against those unforeseen transient viruses that can produce unexplained random failures in unfriendly environments.

**EQUATION (1):**

$$W_{AVAL} \approx \frac{1}{2} LI_{LPK}^{2} \left( \frac{BV_{DUT}}{BV_{DUT} - V_{DD}} \right)$$

**EQUATION (2):**

$$W_{AVAL} \approx \frac{1}{2} LI_{LPK}^{2}$$




CHANNEL 2:
$I_L$
0.5 AMPS/DIV.

CHANNEL 1:
$V_{DUT}$
500 VOLTS/DIV.

TIME BASE:
20 μs/DIV.

**Figure 8. Current–Voltage Waveforms**

## NOTE 2. – AMBIENT MOUNTING DATA

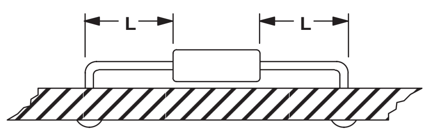
Data shown for thermal resistance junction–to–ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

**TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR**

| Mounting Method | | Lead Length, L (IN) 1/8 | 1/4 | 1/2 | 3/4 | Units |
|---|---|---|---|---|---|---|
| 1 | $R_{\theta JA}$ | 50 | 51 | 53 | 55 | °C/W |
| 2 | $R_{\theta JA}$ | 58 | 59 | 61 | 63 | °C/W |
| 3 | $R_{\theta JA}$ | 28 | | | | °C/W |

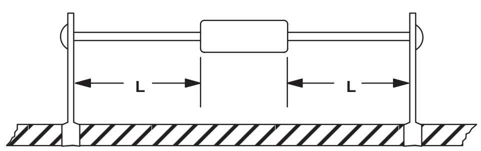
**MOUNTING METHOD 1**

**P.C. Board Where Available Copper Surface area is small.**



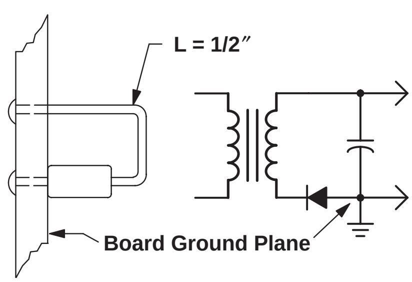

**MOUNTING METHOD 2**

**Vector Push–In Terminals T–28**




**MOUNTING METHOD 3**

**P.C. Board with 1–1/2″ x 1–1/2″ Copper Surface**



# MUR5150E

**Preferred Device**

# SCANSWITCH™ Power Rectifier

## For Use As A Damper Diode In High and Very High Resolution Monitors

The MUR5150E is a state-of-the-art Ultrafast Power Rectifier specifically designed for use as a damper diode in horizontal deflection circuits for high and very high resolution monitors. In these applications, the outstanding performance of the MUR5150E is fully realized when paired with the appropriate 1500 V SCANSWITCH Bipolar Power Transistor.

- 1500 V Blocking Voltage
- 20 mjoules Avalanche Energy Guaranteed
- Peak Transient Overshoot Voltage Specified, 17 Volts (typical)
- Forward Recovery Time Specified, 175 ns (typical)
- Epoxy Meets UL94, $V_O$ at 1/8″

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U5150E

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 1500 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_C$ = 100°C) | $I_{F(AV)}$ | 5.0 | A |
| Peak Repetitive Forward Current (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 100°C) Per Leg | $I_{FRM}$ | 10 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 100 | A |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +125 | °C |
| Controlled Avalanche Energy | $W_{AVAL}$ | 20 | mJ |

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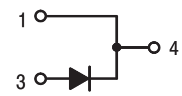
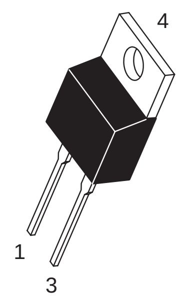
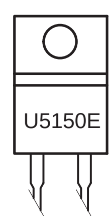
**SCANSWITCH RECTIFIER 5.0 AMPERES 1500 VOLTS**




**TO–220AC CASE 221B STYLE 1**

**MARKING DIAGRAM**




U5150E = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MUR5150E | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case | $R_{\theta JC}$ | 2.0 | °C/W |

## ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | Typ | Max | Unit |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 2.0 Amps, $T_J$ = 25°C)<br>($i_F$ = 5.0 Amps, $T_J$ = 25°C) | $v_F$ | <br>1.7<br>2.0 | <br>2.0<br>2.4 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_J$ = 125°C)<br>(Rated dc Voltage, $T_J$ = 25°C) | $i_R$ | <br>100<br>10 | <br>500<br>50 | μA |
| Maximum Reverse Recovery Time ($I_F$ = 1.0 Amps, di/dt = 50 Amps/μs) | $t_{rr}$ | 130 | 175 | ns |
| Maximum Forward Recovery Time ($I_F$ = 6.5 Amps, di/dt = 12 Amps/μs) | $t_{fr}$ | 175 | 225 | ns |
| Peak Transient Overshoot Voltage | $V_{RFM}$ | 17 | 20 | Volts |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

## TYPICAL ELECTRICAL CHARACTERISTICS

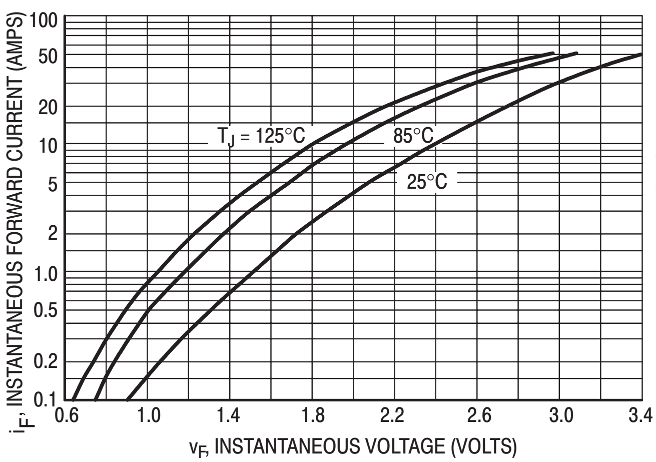


**Figure 1. Typical Forward Voltage**

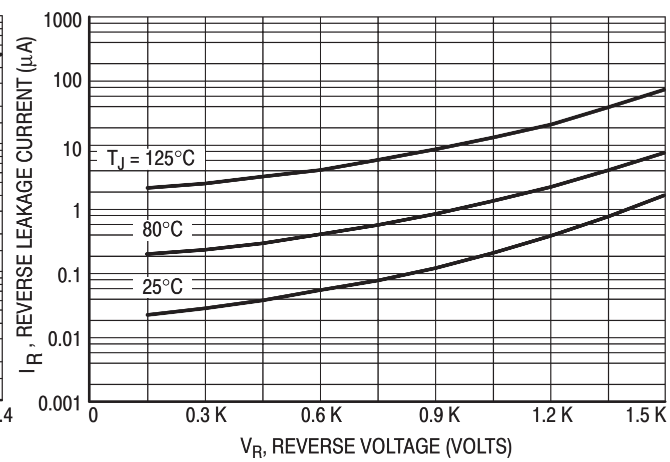


**Figure 2. Typical Reverse Leakage Current**

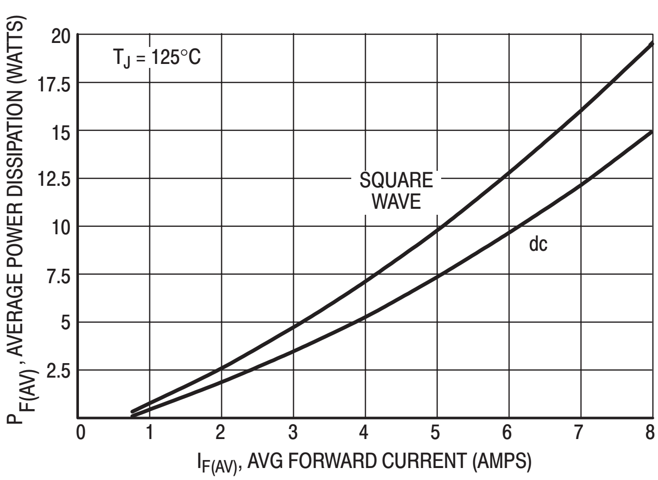


**Figure 3. Forward Power Dissipation**

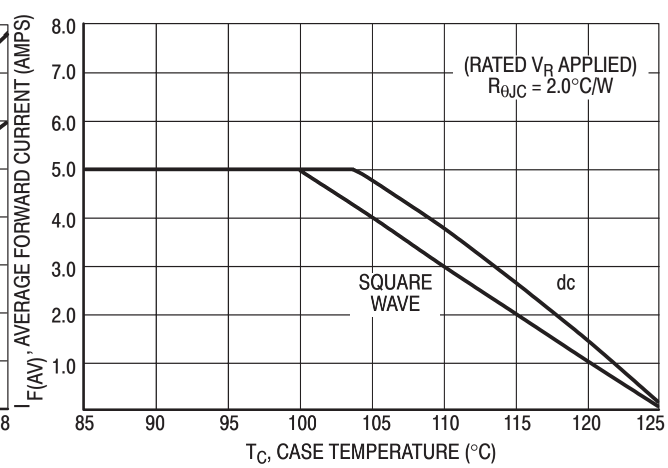


**Figure 4. Current Derating Case**

## TYPICAL ELECTRICAL CHARACTERISTICS

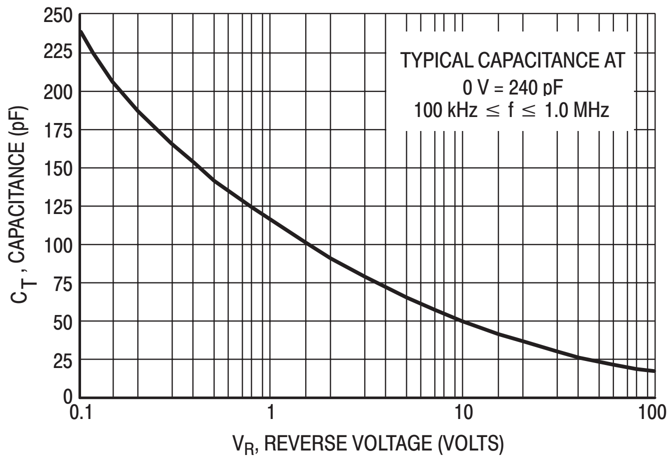


**Figure 5. Typical Capacitance**

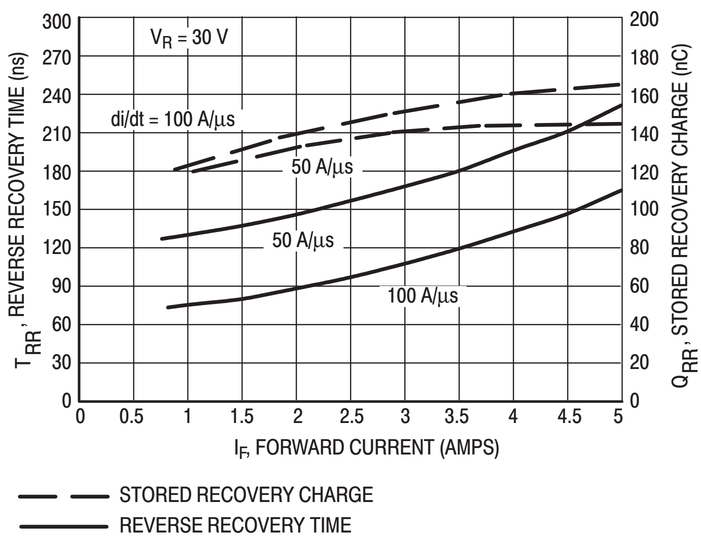


**Figure 6. Typical Reverse Switching Characteristics**

# MUR620CT

**Preferred Device**

# SWITCHMODE™ Power Rectifier

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 35 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- Popular TO–220 Package

**Mechanical Characteristics:**
- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U620

### MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 200 | V |
| Average Rectified Forward Voltage (Rated $V_R$, $T_C$ = 130°C) Per Diode<br>Total Device | $I_{F(AV)}$ | <br>3.0<br>6.0 | A |
| Peak Repetitive Forward Current per Diode Leg (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 130°C) | $I_{FRM}$ | 6.0 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 75 | A |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | °C |

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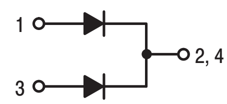
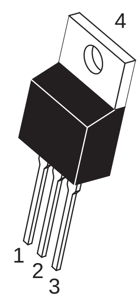
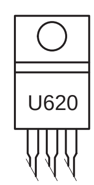
**ULTRAFAST RECTIFIER 6.0 AMPERES 200 VOLTS**




**TO–220AB**
**CASE 221A**
**PLASTIC**

**MARKING DIAGRAM**




U620 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MUR620CT | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS** (Per Diode Leg)

| Rating | Symbol | Typical | Maximum | Unit |
|---|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 5.0–6.0 | 7.0 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Diode Leg)

| | | | | |
|---|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 3.0 Amps, $T_C$ = 150°C)<br>($i_F$ = 3.0 Amps, $T_C$ = 25°C) | $v_F$ | <br>0.80<br>0.94 | <br>0.895<br>0.975 | Volts |
| Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_C$ = 150°C)<br>(Rated dc Voltage, $T_C$ = 25°C) | $i_R$ | <br>2.0–10<br>0.01–3.0 | <br>250<br>5.0 | μA |
| Reverse Recovery Time<br>($I_F$ = 1.0 Amp, di/dt = 50 Amps/μs) | $t_{rr}$ | 20–30 | 35 | ns |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

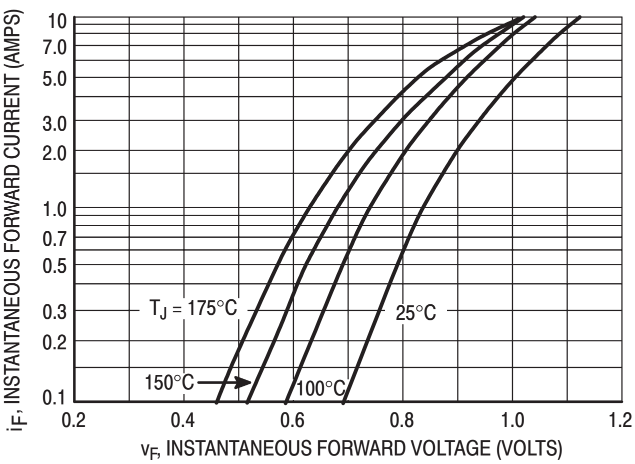



**Figure 1. Typical Forward Voltage**

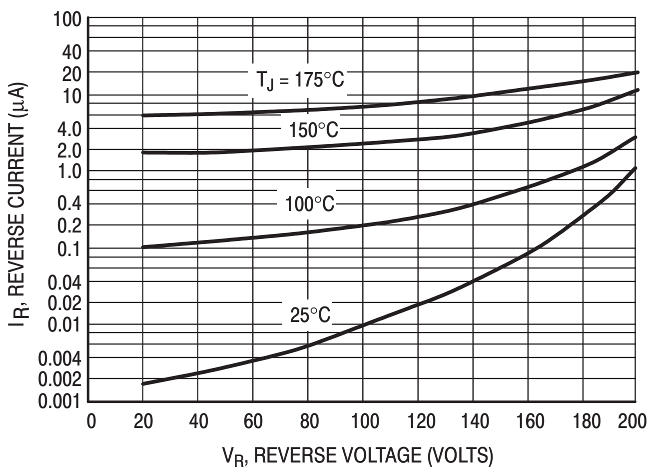



**Figure 2. Typical Reverse Current**

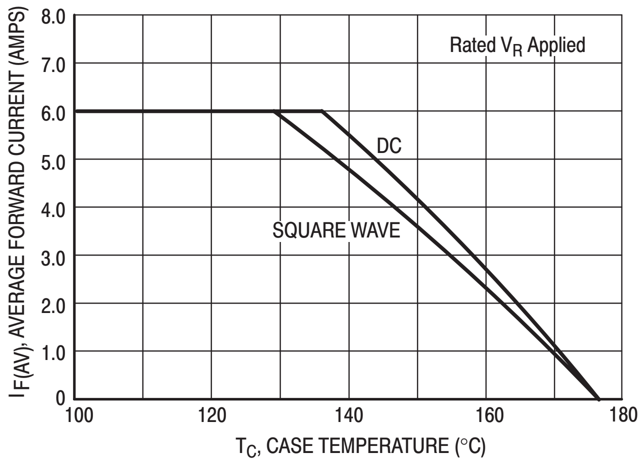



**Figure 3. Total Device Current Derating, Case**

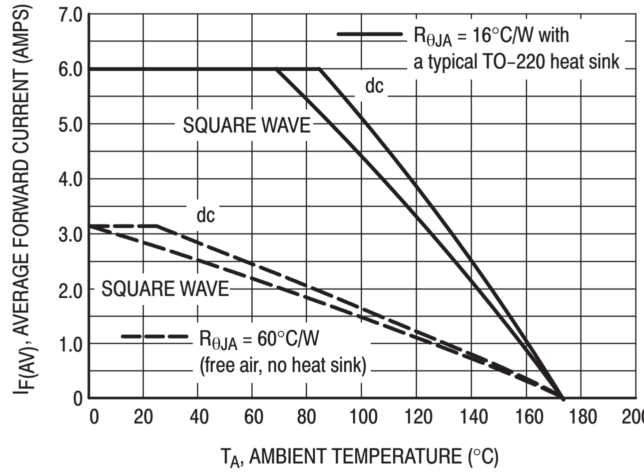



**Figure 4. Total Device Current Derating, Ambient**

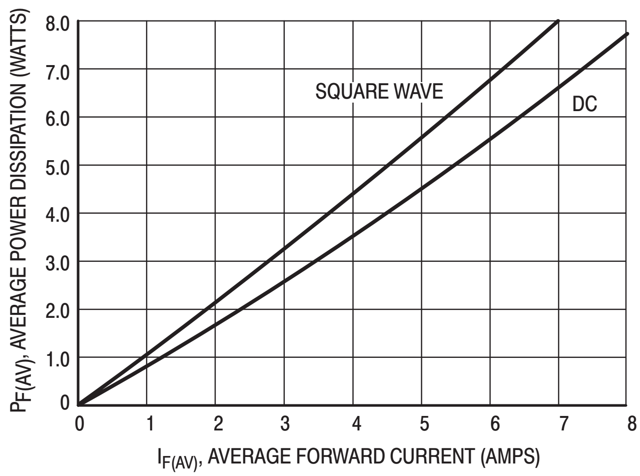



**Figure 5. Power Dissipation**

# MSR860

# SWITCHMODE™ Soft Recovery Power Rectifier

## Plastic TO–220 Package

Designed for use as free wheeling diodes in variable speed motor control applications and switching power supplies. These state–of–the–art devices have the following features:

- Soft Recovery with Guaranteed Low Reverse Recovery Charge ($Q_{RR}$) and Peak Reverse Recovery Current ($I_{RRM}$)
- 150°C Operating Junction Temperature
- Popular TO–220 Package
- Epoxy meets UL94, $V_O$ @ 1/8″
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction

**Mechanical Characteristics:**

- Case: Molded Epoxy
- Weight: 1.9 Grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 50 Units per Plastic Tube
- Marking: MSR860

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 600 | V |
| Average Rectified Forward Current (At Rated $V_R$, $T_C$ = 125°C) | $I_O$ | 8.0 | A |
| Peak Repetitive Forward Current (At Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 125°C) | $I_{FRM}$ | 16 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 100 | A |
| Storage/Operating Case Temperature Range | $T_{stg}$, $T_C$ | –65 to +150 | °C |
| Operating Junction Temperature Range | $T_J$ | –65 to +150 | °C |

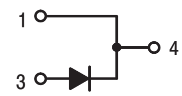
**THERMAL CHARACTERISTICS**

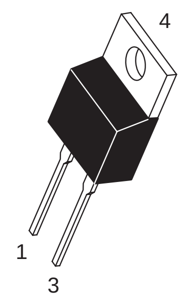
| | | | |
|---|---|---|---|
| Thermal Resistance – Junction–to–Case<br>Thermal Resistance – Junction–to–Ambient | $R_{\theta JC}$<br>$R_{\theta JA}$ | 1.6<br>72.8 | °C/W |

**ON Semiconductor™**

http://onsemi.com

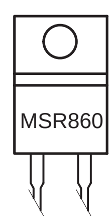
**SOFT RECOVERY POWER RECTIFIER 8.0 AMPERES 600 VOLTS**




**TO–220AC**
**CASE 221B**
**STYLE 1**

**MARKING DIAGRAM**




MSR860 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MSR860 | TO–220 | 50 Units/Rail |

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## ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | Value | | Unit |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.) ($I_F$ = 8.0 A) *Typical* | $V_F$ | **$T_J$ = 25°C** 1.7 *1.4* | **$T_J$ = 150°C** 1.3 *1.1* | V |
| Maximum Instantaneous Reverse Current ($V_R$ = 600 V) *Typical* | $I_R$ | **$T_J$ = 25°C** 10 *2.0* | **$T_J$ = 150°C** 1000 *80* | μA |
| Maximum Reverse Recovery Time (Note 2.) ($V_R$ = 400 V, $I_F$ = 8.0 A, di/dt = 200 A/μs) *Typical* | $t_{rr}$ | **$T_J$ = 25°C** 120 *95* | **$T_J$ = 125°C** 190 *125* | ns |
| Typical Recovery Softness Factor ($V_R$ = 400 V, $I_F$ = 8.0 A, di/dt = 200 A/μs) | $s = t_b/t_a$ | *2.5* | *3.0* | |
| Maximum Peak Reverse Recovery Current ($V_R$ = 400 V, $I_F$ = 8.0 A, di/dt = 200 A/μs) | $I_{RRM}$ | 5.8 | 8.3 | A |
| Maximum Reverse Recovery Charge ($V_R$ = 400 V, $I_F$ = 8.0 A, di/dt = 200 A/μs) | $Q_{RR}$ | 350 | 700 | nC |

1. Pulse Test: Pulse Width ≤ 380 μs, Duty Cycle ≤ 2%
2. $T_{RR}$ measured projecting from 25% of $I_{RRM}$ to zero current

## TYPICAL ELECTRICAL CHARACTERISTICS

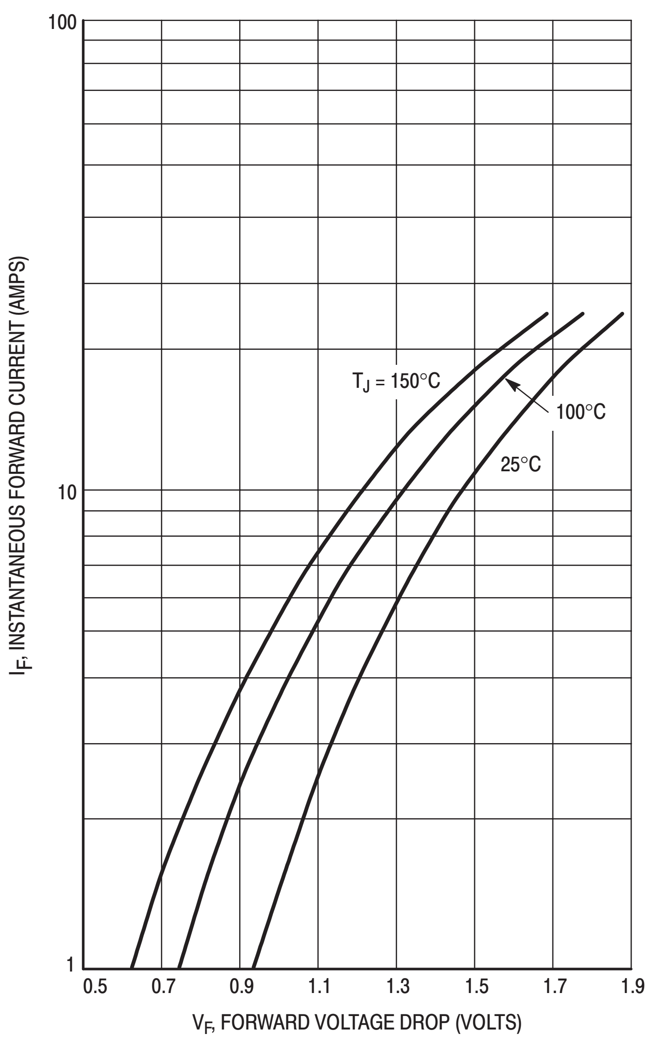


**Figure 1. Typical Forward Voltage**

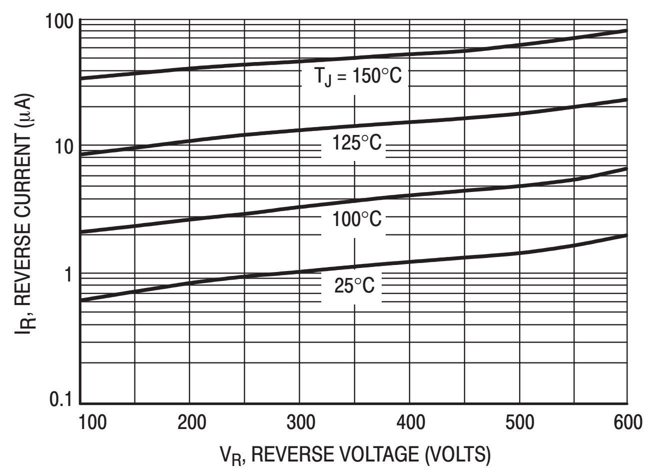


**Figure 2. Typical Reverse Current**

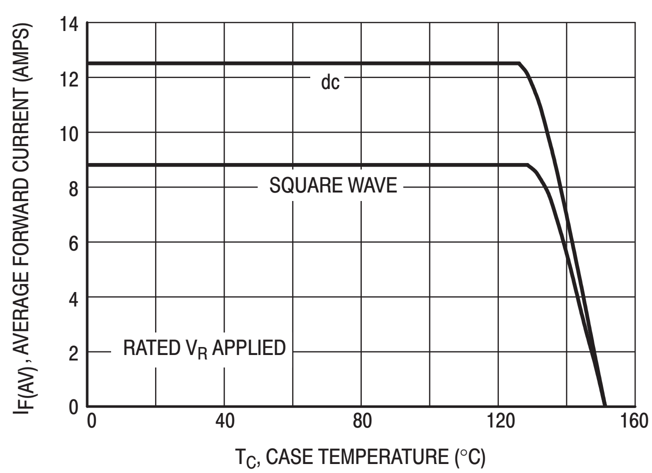


**Figure 3. Current Derating, Case**

## TYPICAL ELECTRICAL CHARACTERISTICS

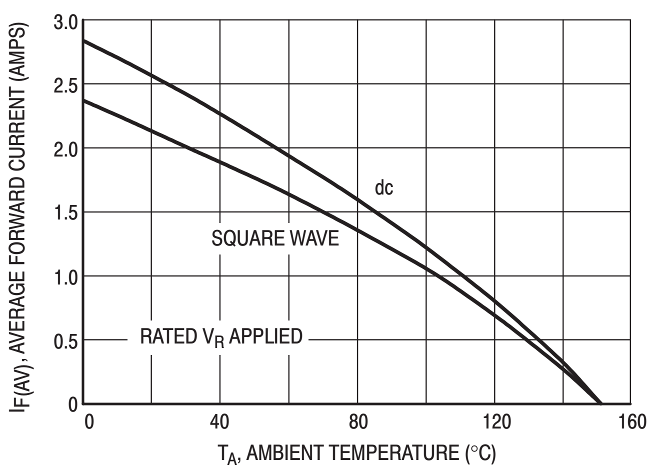


**Figure 4. Current Derating, Ambient**

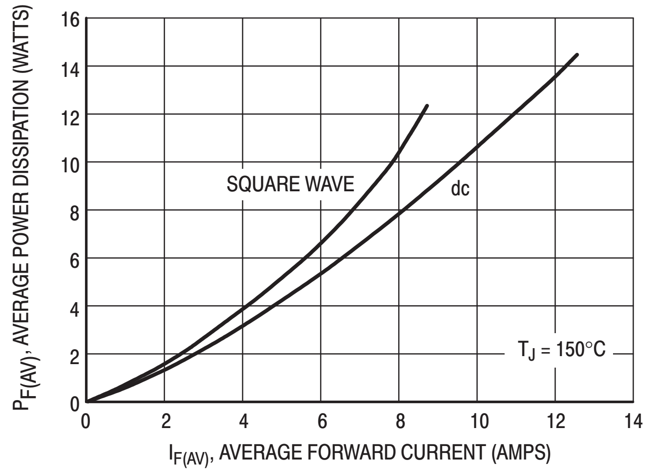


**Figure 5. Power Dissipation**

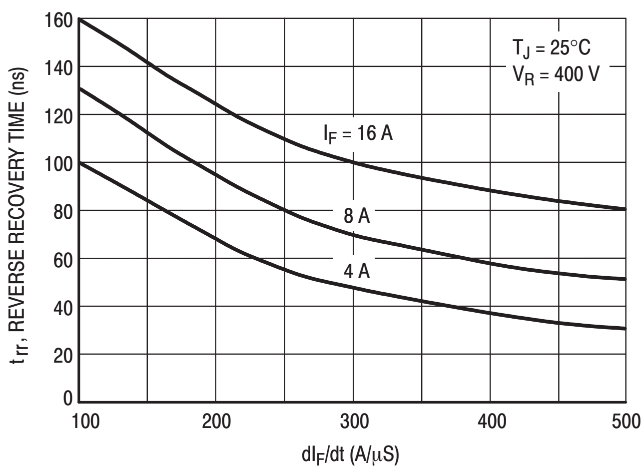


**Figure 6. Typical Reverse Recovery Time**

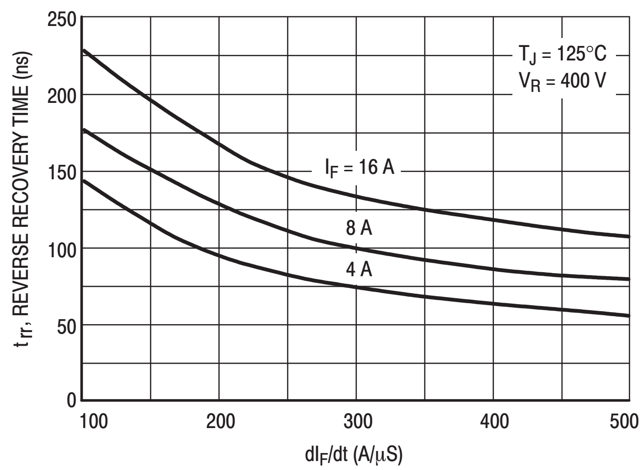


**Figure 7. Typical Reverse Recovery Time**

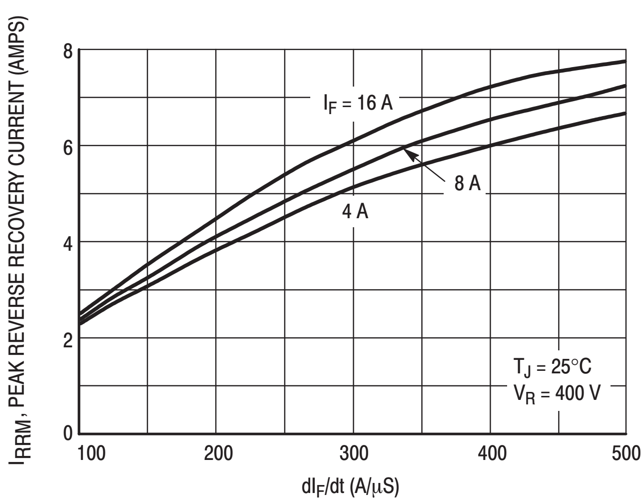


**Figure 8. Typical Peak Reverse Recovery Current**

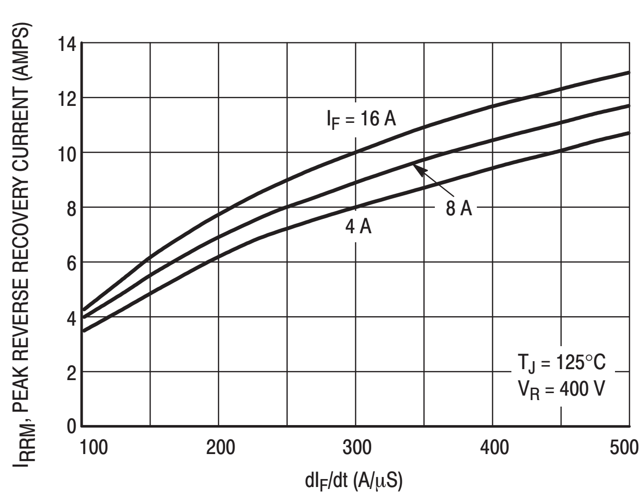


**Figure 9. Typical Peak Reverse Recovery Current**

## TYPICAL ELECTRICAL CHARACTERISTICS

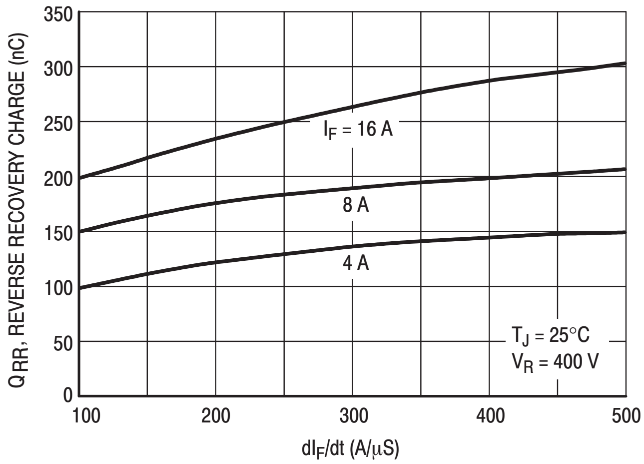


**Figure 10. Typical Reverse Recovery Charge**

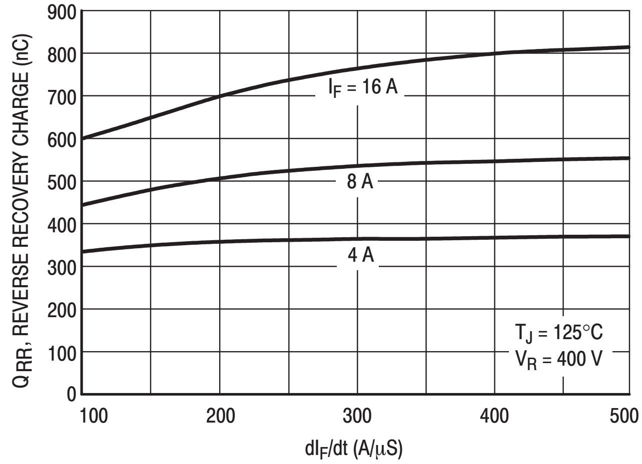


**Figure 11. Typical Reverse Recovery Charge**

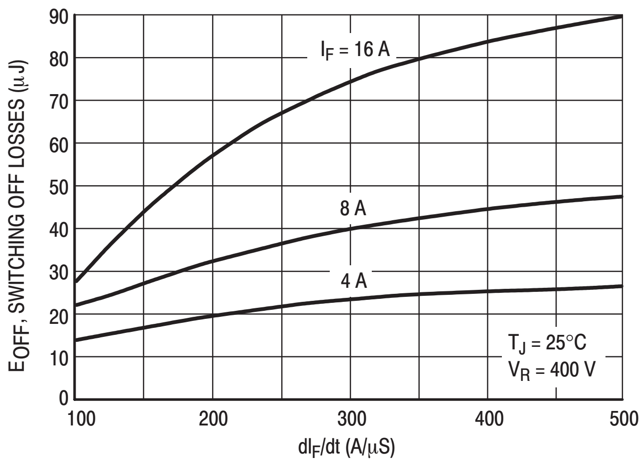


**Figure 12. Typical Switching Off Losses**

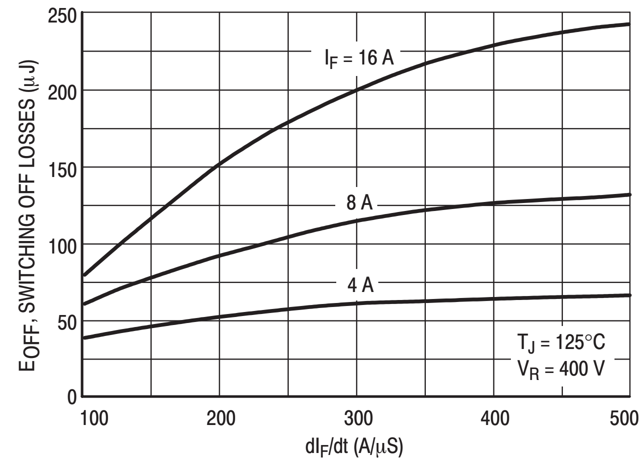


**Figure 13. Typical Switching Off Losses**

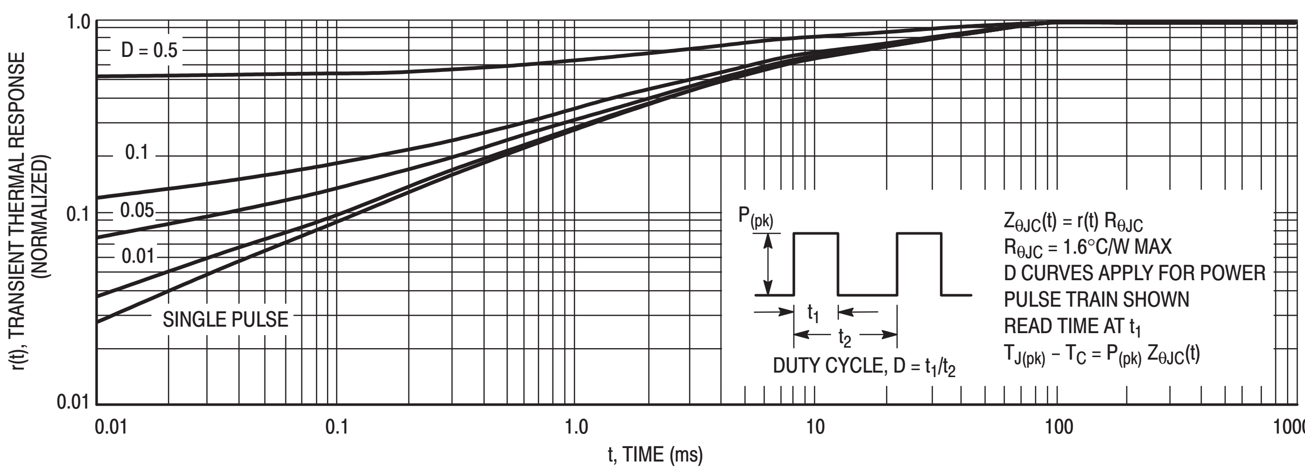


**Figure 14. Thermal Response**

# MUR805, MUR810, MUR815, MUR820, MUR840, MUR860

**Preferred Devices**

# SWITCHMODE™ Power Rectifiers

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 25, 50 and 75 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- Popular TO–220 Package
- Epoxy Meets UL94, $V_O$ @ 1/8″
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction
- Reverse Voltage to 600 Volts

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U805, U810, U815, U820, U840, U860

**MAXIMUM RATINGS**

| |
|---|
| Please See the Table on the Following Page |

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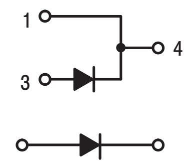
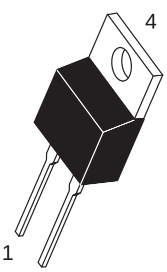
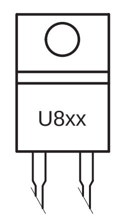
**ULTRAFAST RECTIFIERS**
**8.0 AMPERES**
**50–600 VOLTS**




**CASE 221B**
**TO–220AC**
**PLASTIC**

**MARKING DIAGRAM**




U8xx = Device Code
xx = 05, 10, 15, 20, 40 or 60

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MUR805 | TO–220 | 50 Units/Rail |
| MUR810 | TO–220 | 50 Units/Rail |
| MUR815 | TO–220 | 50 Units/Rail |
| MUR820 | TO–220 | 50 Units/Rail |
| MUR840 | TO–220 | 50 Units/Rail |
| MUR860 | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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## MAXIMUM RATINGS

| Rating | Symbol | MUR 805 | MUR 810 | MUR 815 | MUR 820 | MUR 840 | MUR 860 | Unit |
|---|---|---|---|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 50 | 100 | 150 | 200 | 400 | 600 | Volts |
| Average Rectified Forward Current<br>Total Device, (Rated $V_R$), $T_C$ = 150°C | $I_{F(AV)}$ | 8.0 | | | | | | Amps |
| Peak Repetitive Forward Current<br>(Rated $V_R$, Square Wave, 20 kHz), $T_C$ = 150°C | $I_{FM}$ | 16 | | | | | | Amps |
| Nonrepetitive Peak Surge Current<br>(Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 100 | | | | | | Amps |
| Operating Junction Temperature and<br>Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | | | | | | °C |

## THERMAL CHARACTERISTICS

| Rating | Symbol | MUR 805 | MUR 810 | MUR 815 | MUR 820 | MUR 840 | MUR 860 | Unit |
|---|---|---|---|---|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 3.0 | | | | 2.0 | | °C/W |

## ELECTRICAL CHARACTERISTICS

| Rating | Symbol | MUR 805 | MUR 810 | MUR 815 | MUR 820 | MUR 840 | MUR 860 | Unit |
|---|---|---|---|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 8.0 Amps, $T_C$ = 150°C)<br>($i_F$ = 8.0 Amps, $T_C$ = 25°C) | $v_F$ | <br>0.895<br>0.975 | | | | <br>1.00<br>1.30 | <br>1.20<br>1.50 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_J$ = 150°C)<br>(Rated dc Voltage, $T_J$ = 25°C) | $i_R$ | <br>250<br>5.0 | | | | <br>500<br>10 | | µA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1.0 Amp, di/dt = 50 Amps/µs)<br>($I_F$ = 0.5 Amp, $i_R$ = 1.0 Amp, $I_{REC}$ = 0.25 Amp) | $t_{rr}$ | <br>35<br>25 | | | | <br>60<br>50 | | ns |

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

## MUR805, MUR810, MUR815, MUR820

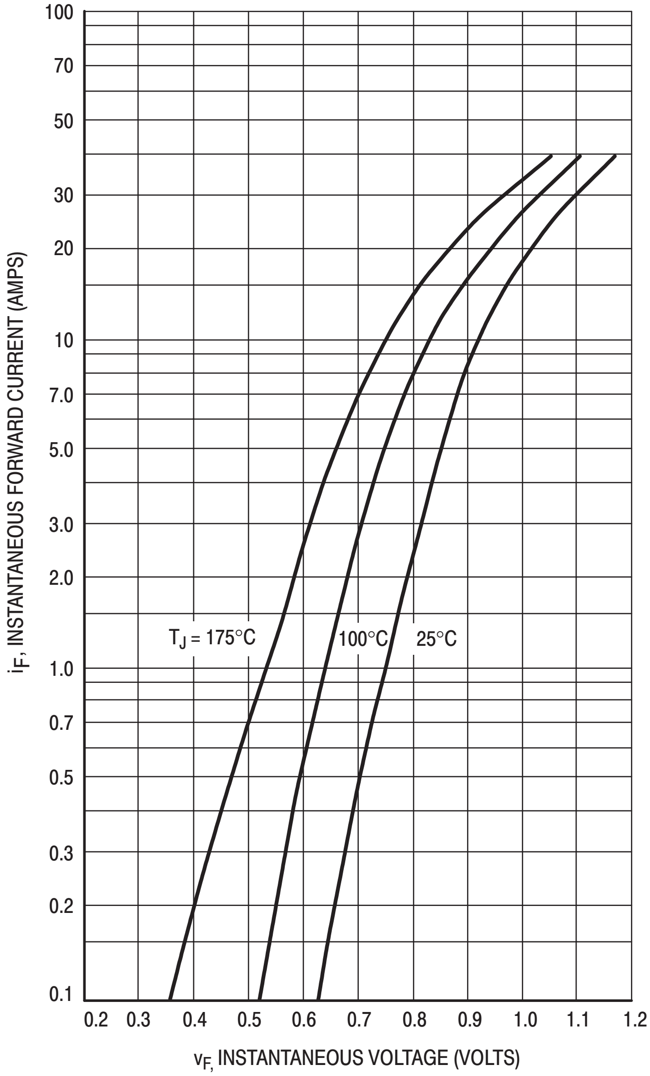


**Figure 1. Typical Forward Voltage**

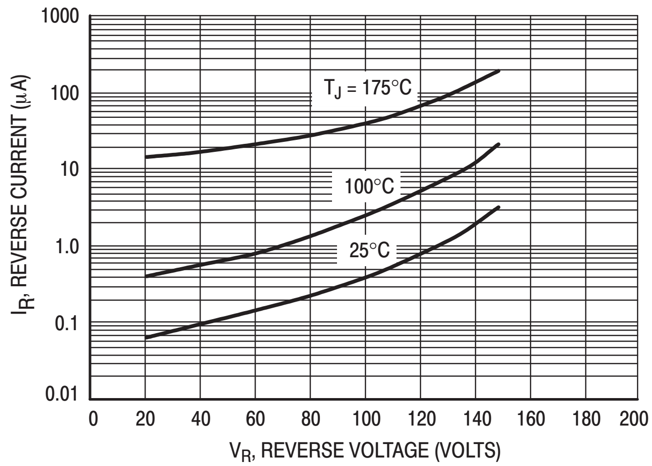


**Figure 2. Typical Reverse Current***

* The curves shown are typical for the highest voltage device in the grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if $V_R$ is sufficiently below rated $V_R$.

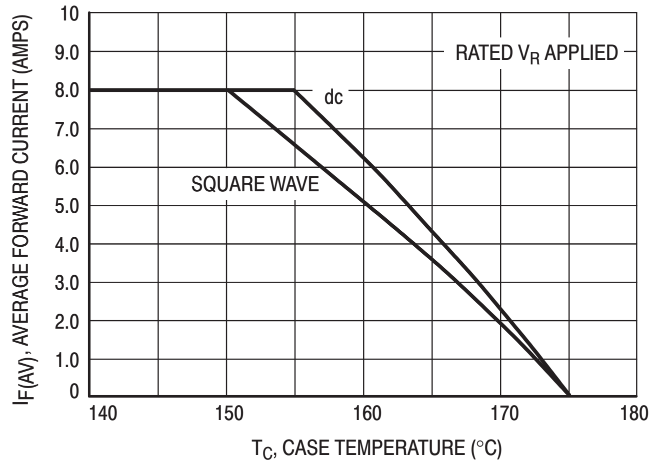


**Figure 3. Current Derating, Case**

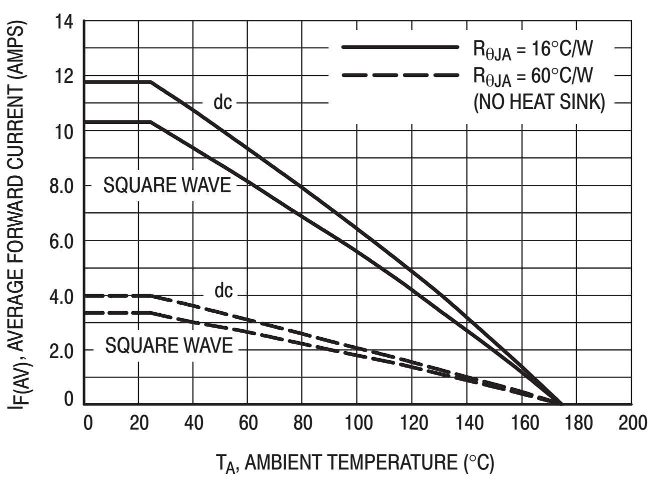


**Figure 4. Current Derating, Ambient**

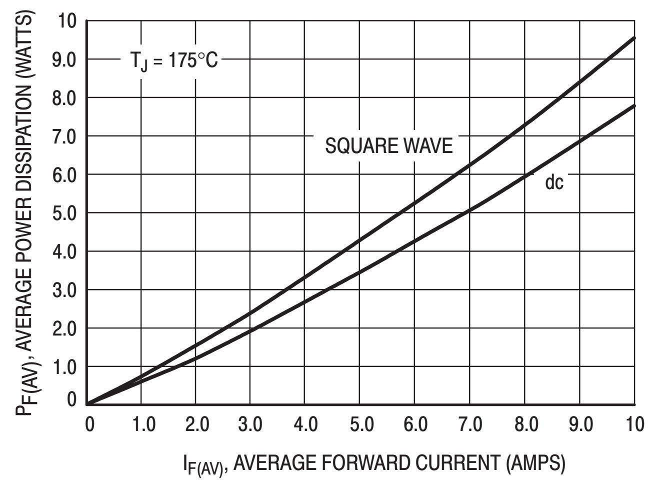


**Figure 5. Power Dissipation**

**MUR840**

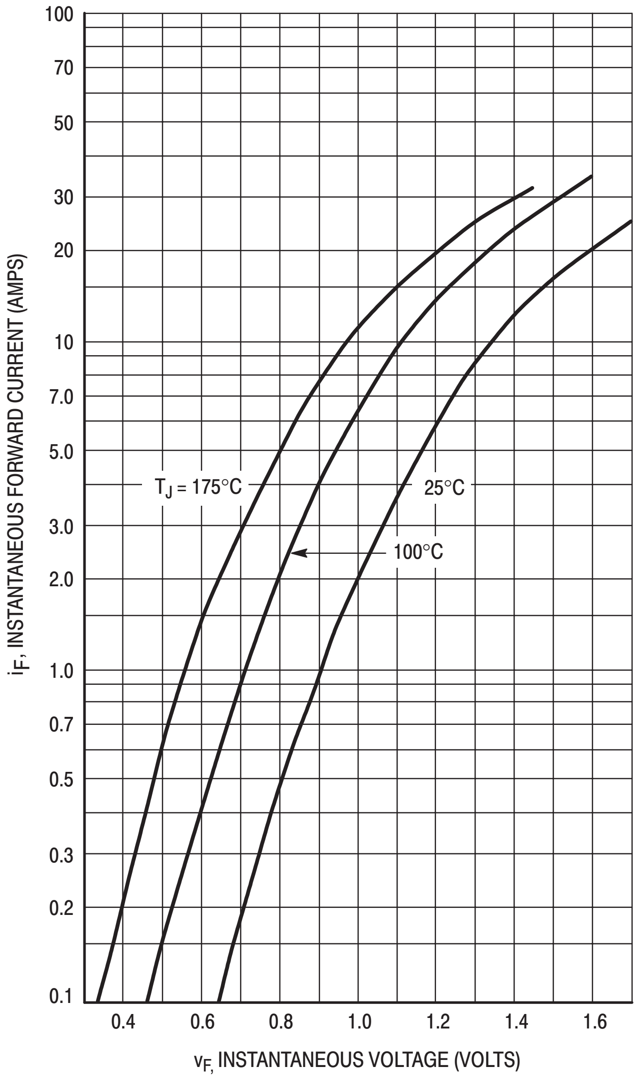


**Figure 6. Typical Forward Voltage**

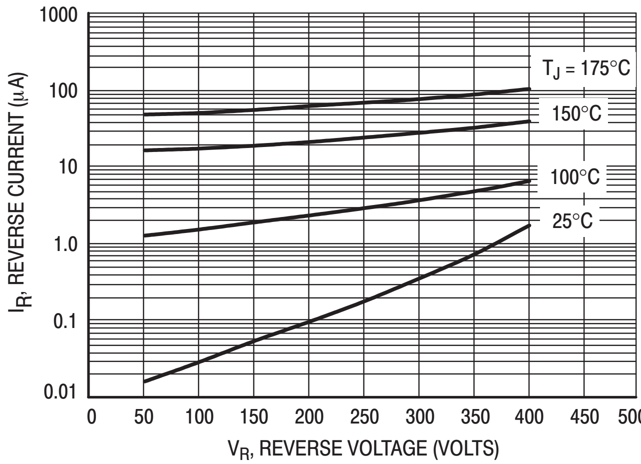


**Figure 7. Typical Reverse Current***

* The curves shown are typical for the highest voltage device in the grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if $V_R$ is sufficiently below rated $V_R$.

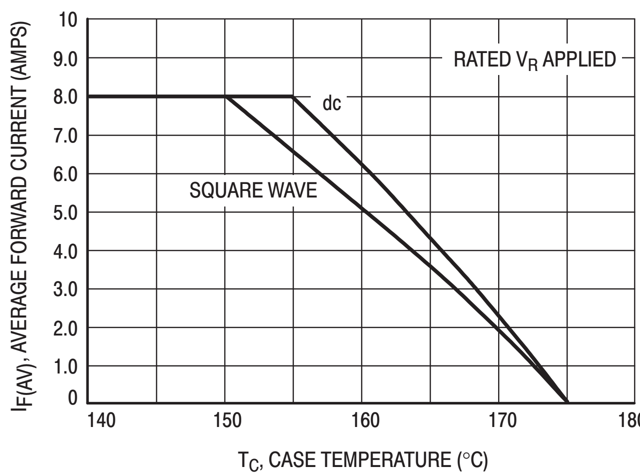


**Figure 8. Current Derating, Case**

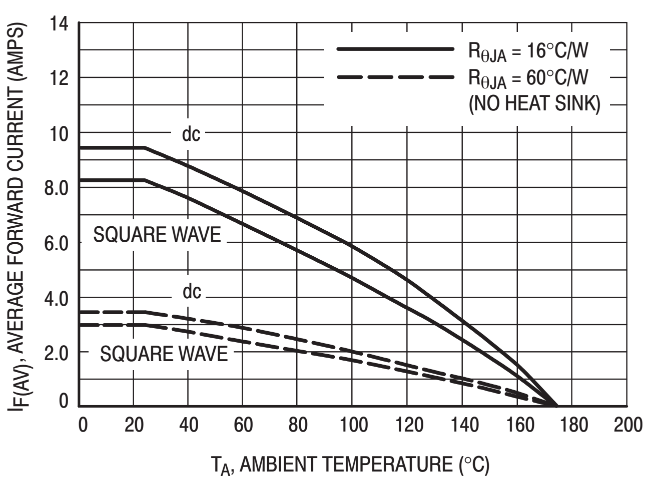


**Figure 9. Current Derating, Ambient**

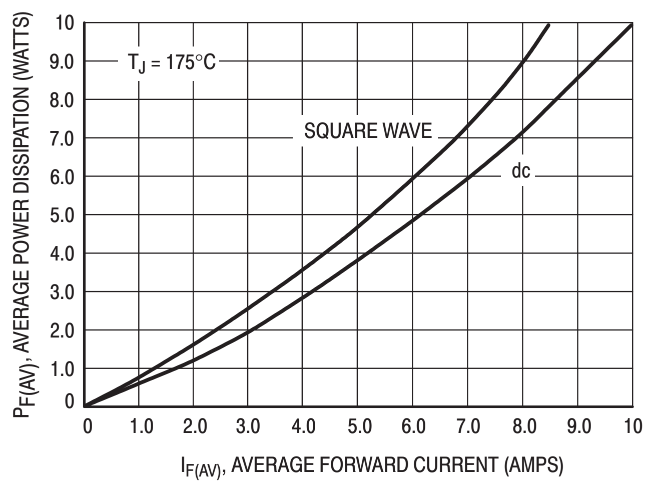


**Figure 10. Power Dissipation**

**MUR860**

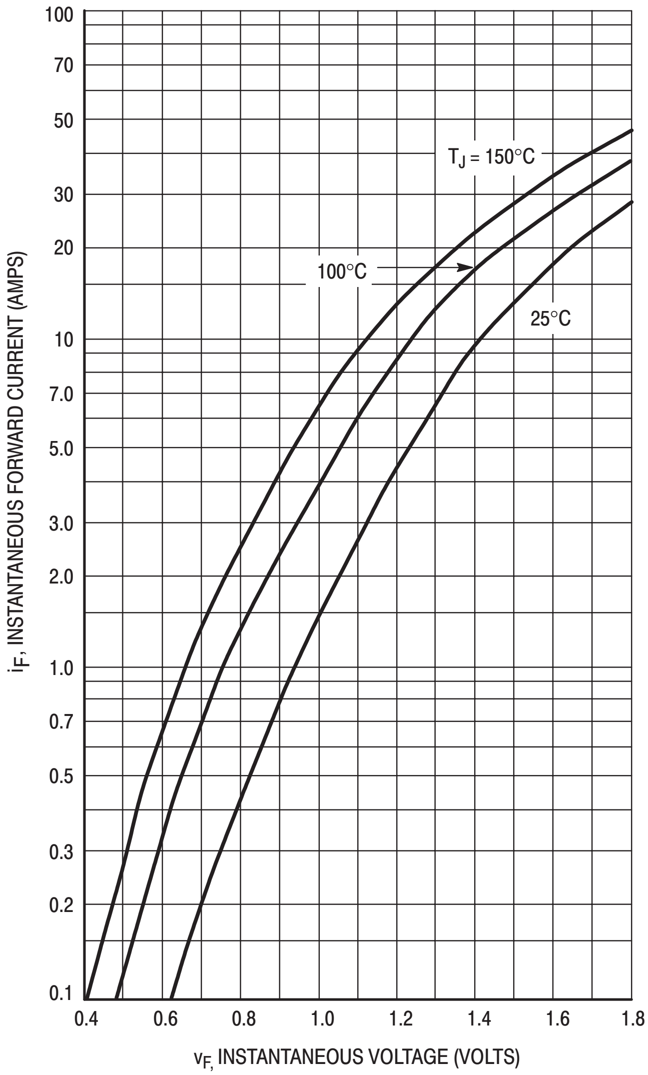


**Figure 11. Typical Forward Voltage**

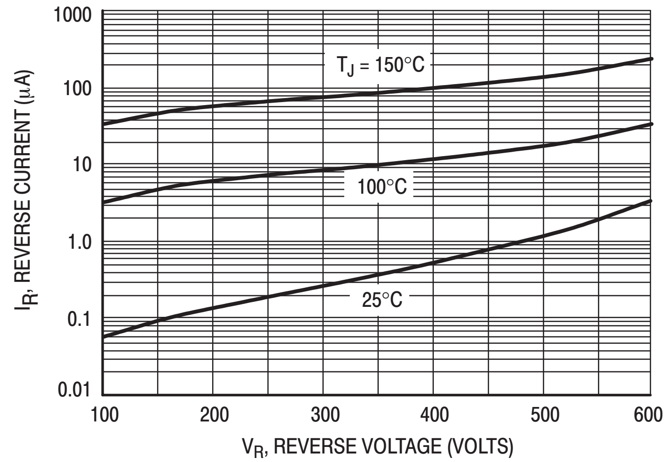


**Figure 12. Typical Reverse Current***

* The curves shown are typical for the highest voltage device in the grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if $V_R$ is sufficiently below rated $V_R$.

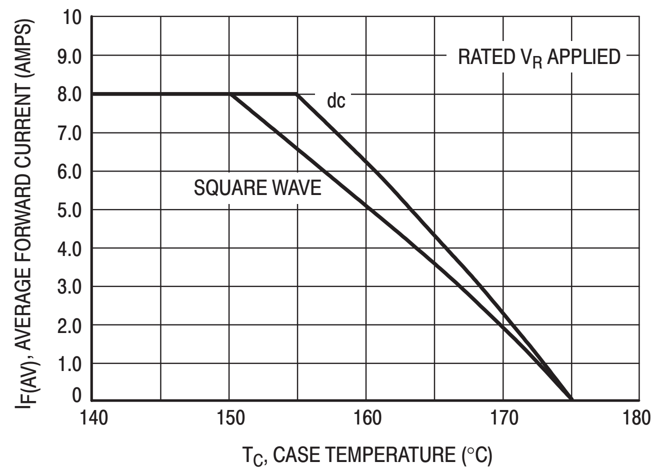


**Figure 13. Current Derating, Case**

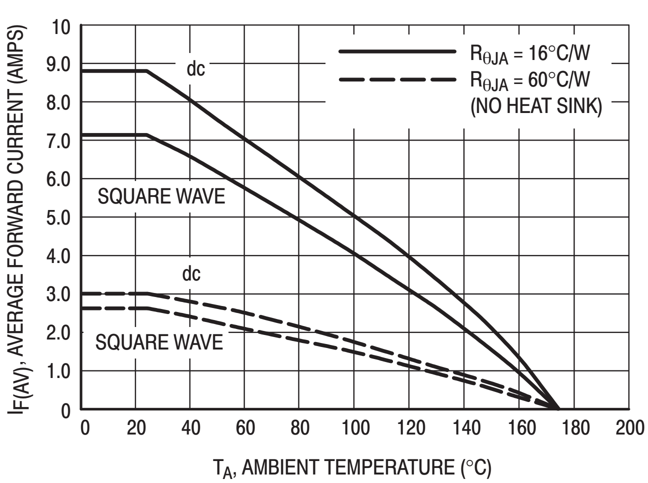


**Figure 14. Current Derating, Ambient**

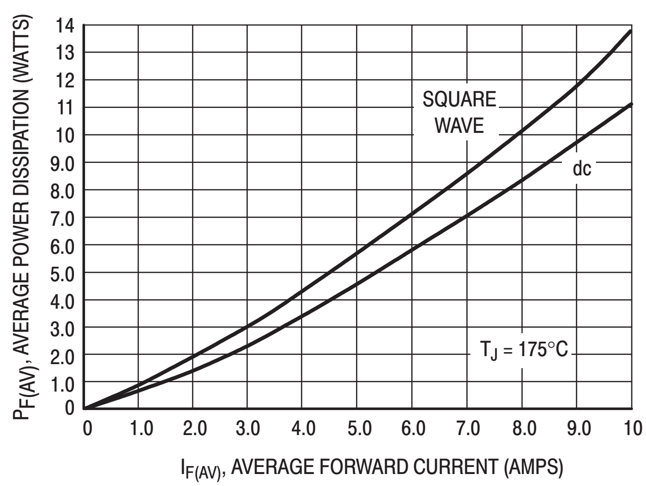


**Figure 15. Power Dissipation**

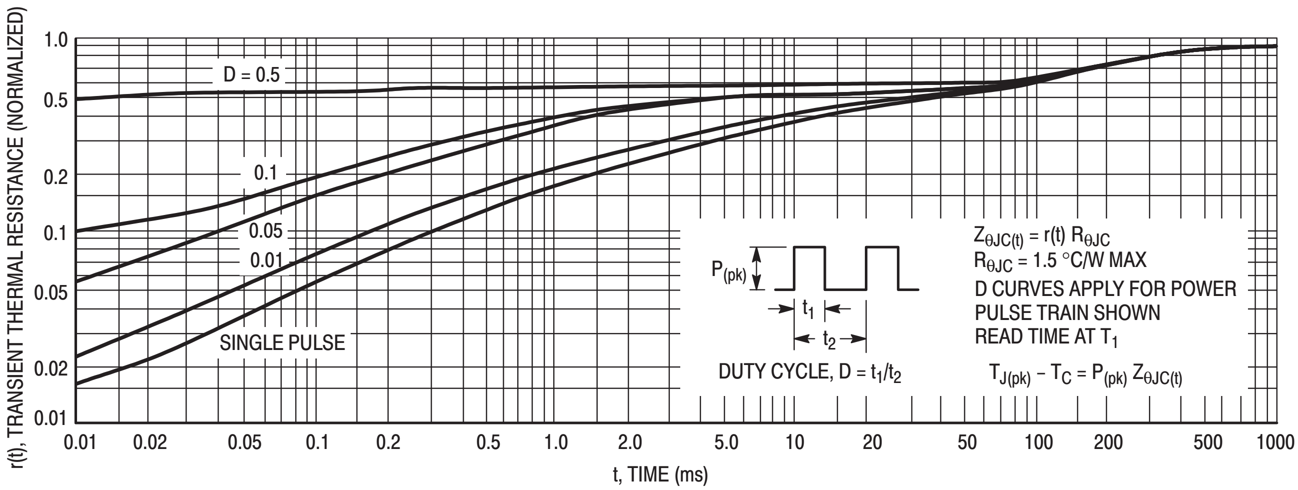


**Figure 16. Thermal Response**

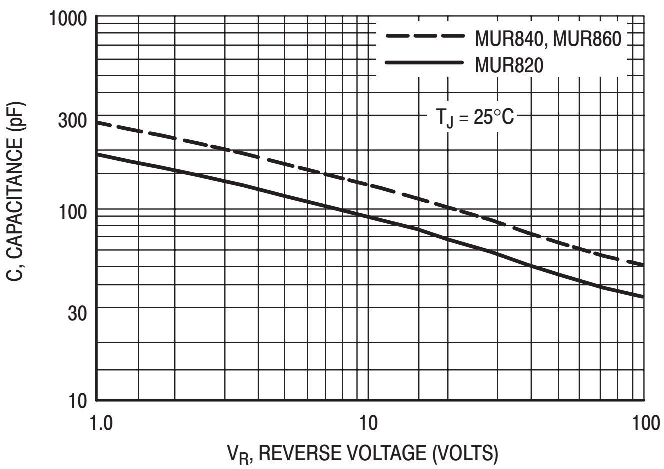


**Figure 17. Typical Capacitance**

# MUR8100E, MUR880E

MUR8100E is a Preferred Device

# SWITCHMODE™ Power Rectifiers

## Ultrafast "E" Series with High Reverse Energy Capability

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- 20 mjoules Avalanche Energy Guaranteed
- Excellent Protection Against Voltage Transients in Switching Inductive Load Circuits
- Ultrafast 75 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- Popular TO–220 Package
- Epoxy Meets UL94, $V_O$ @ 1/8″
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction
- Reverse Voltage to 1000 Volts

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U880E, U8100E

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage MUR880E<br>MUR8100E | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | <br><br>800<br>1000 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_C$ = 150°C) Total Device | $I_{F(AV)}$ | 8.0 | A |
| Peak Repetitive Forward Current (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 150°C) | $I_{FM}$ | 16 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 100 | A |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | °C |

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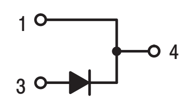
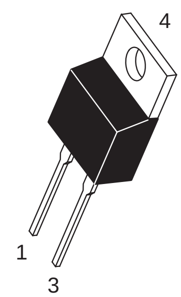
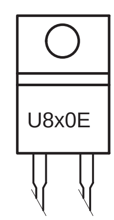
**ULTRAFAST RECTIFIERS**
**8.0 AMPERES**
**800–1000 VOLTS**




**TO–220AC**
**CASE 221B**
**PLASTIC**

**MARKING DIAGRAM**




U8x0E = Device Code
x = 8 or 10

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MUR8100E | TO–220 | 50 Units/Rail |
| MUR880E | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 2.0 | °C/W |

## ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | MUR880E | MUR8100E | Unit |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 8.0 Amps, $T_C$ = 150°C)<br>($i_F$ = 8.0 Amps, $T_C$ = 25°C) | $v_F$ | <br>1.5<br>1.8 | | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_C$ = 100°C)<br>(Rated dc Voltage, $T_C$ = 25°C) | $i_R$ | <br>500<br>25 | | μA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1.0 Amp, di/dt = 50 Amps/μs)<br>($I_F$ = 0.5 Amp, $i_R$ = 1.0 Amp, $I_{REC}$ = 0.25 Amp) | $t_{rr}$ | <br>100<br>75 | | ns |
| Controlled Avalanche Energy<br>(See Test Circuit in Figure 6. ) | $W_{AVAL}$ | 20 | | mJ |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

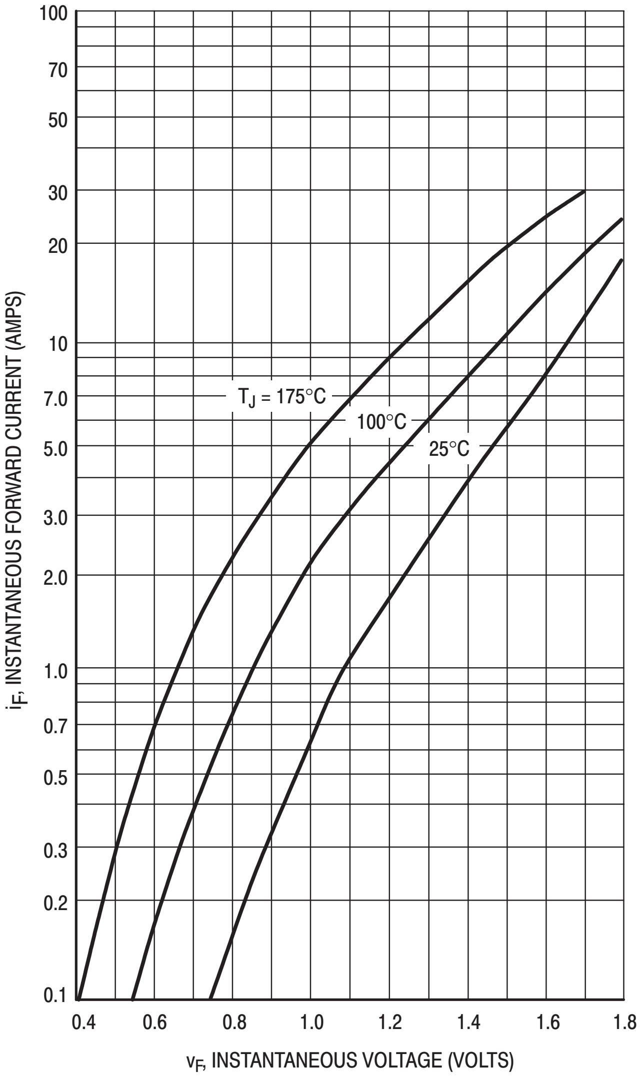


Figure 1. Typical Forward Voltage

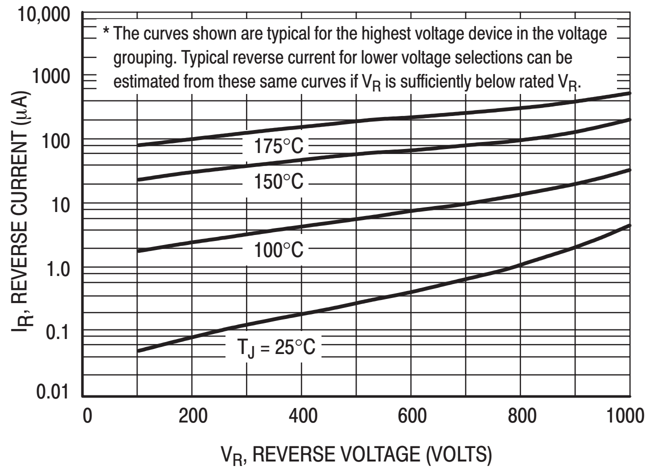


Figure 2. Typical Reverse Current*

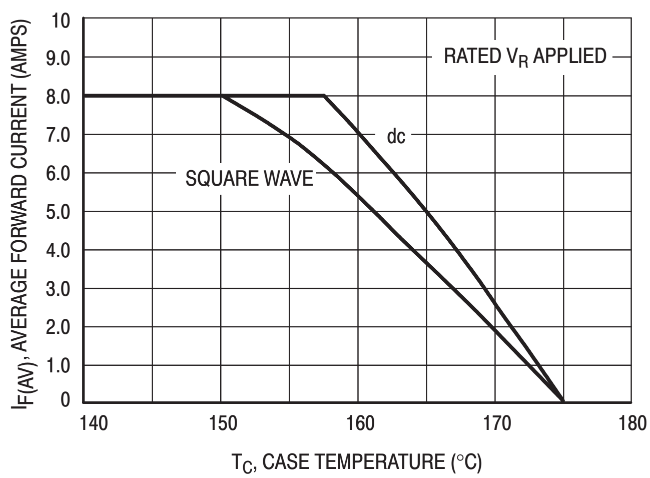


Figure 3. Current Derating, Case

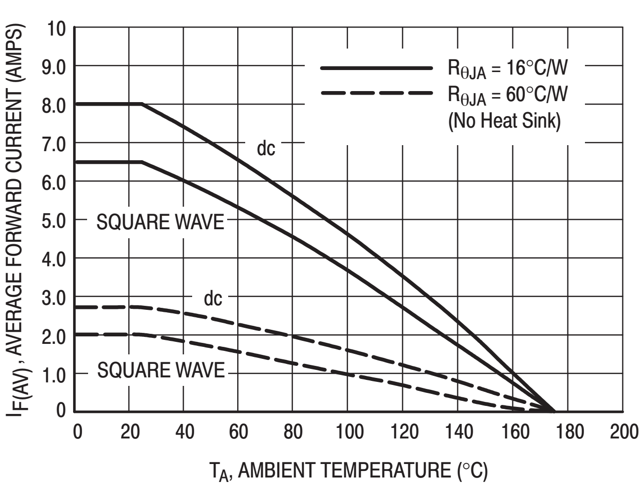


Figure 4. Current Derating, Ambient

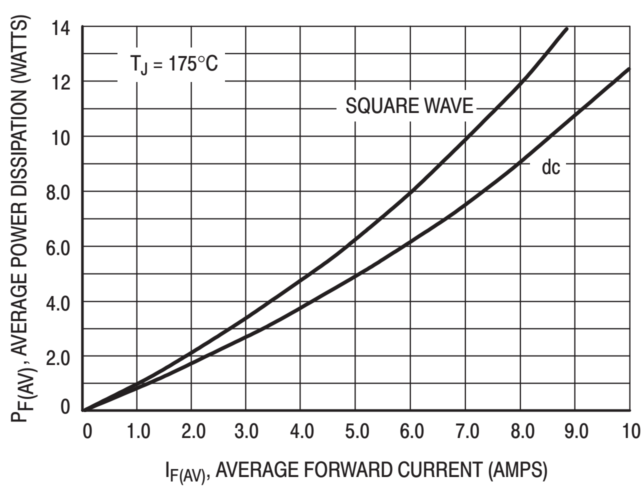


Figure 5. Power Dissipation

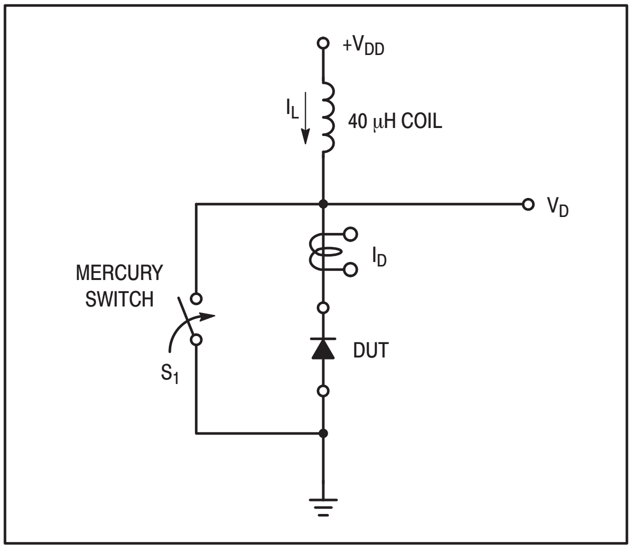


**Figure 6. Test Circuit**

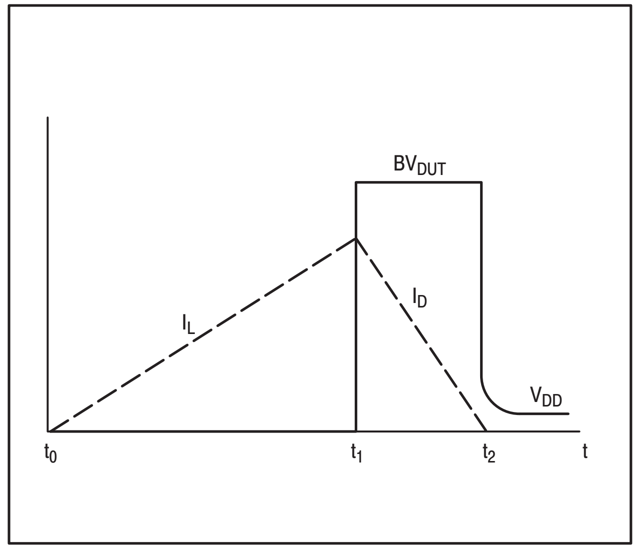


**Figure 7. Current–Voltage Waveforms**

The unclamped inductive switching circuit shown in Figure 6. was used to demonstrate the controlled avalanche capability of the new “E’’ series Ultrafast rectifiers. A mercury switch was used instead of an electronic switch to simulate a noisy environment when the switch was being opened.

When $S_1$ is closed at $t_0$ the current in the inductor $I_L$ ramps up linearly; and energy is stored in the coil. At $t_1$ the switch is opened and the voltage across the diode under test begins to rise rapidly, due to di/dt effects, when this induced voltage reaches the breakdown voltage of the diode, it is clamped at $BV_{DUT}$ and the diode begins to conduct the full load current which now starts to decay linearly through the diode, and goes to zero at $t_2$.

By solving the loop equation at the point in time when $S_1$ is opened; and calculating the energy that is transferred to the diode it can be shown that the total energy transferred is equal to the energy stored in the inductor plus a finite amount of energy from the $V_{DD}$ power supply while the diode is in breakdown (from $t_1$ to $t_2$) minus any losses due to finite component resistances. Assuming the component resistive elements are small Equation (1) approximates the total energy transferred to the diode. It can be seen from this equation that if the $V_{DD}$ voltage is low compared to the breakdown voltage of the device, the amount of energy contributed by the supply during breakdown is small and the total energy can be assumed to be nearly equal to the energy stored in the coil during the time when $S_1$ was closed, Equation (2).

The oscilloscope picture in Figure 8. , shows the MUR8100E in this test circuit conducting a peak current of one ampere at a breakdown voltage of 1300 volts, and using Equation (2) the energy absorbed by the MUR8100E is approximately 20 mjoules.

Although it is not recommended to design for this condition, the new “E’’ series provides added protection against those unforeseen transient viruses that can produce unexplained random failures in unfriendly environments.

**EQUATION (1):**

$$W_{AVAL} \approx \frac{1}{2} L I_{LPK}^{2} \left( \frac{BV_{DUT}}{BV_{DUT} - V_{DD}} \right)$$

**EQUATION (2):**

$$W_{AVAL} \approx \frac{1}{2} L I_{LPK}^{2}$$

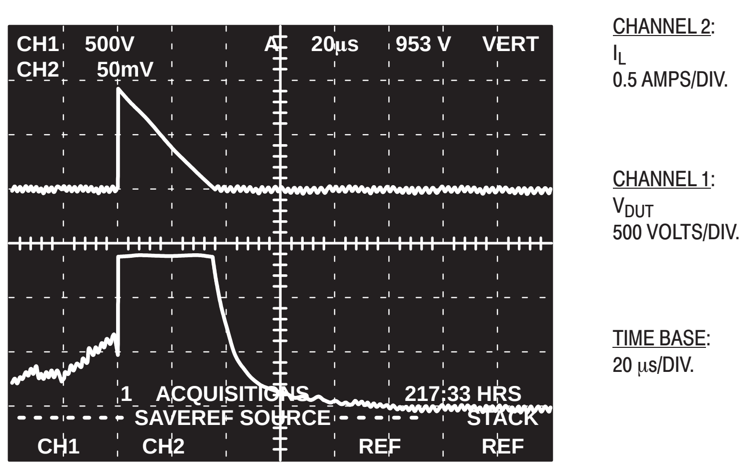


**Figure 8. Current–Voltage Waveforms**

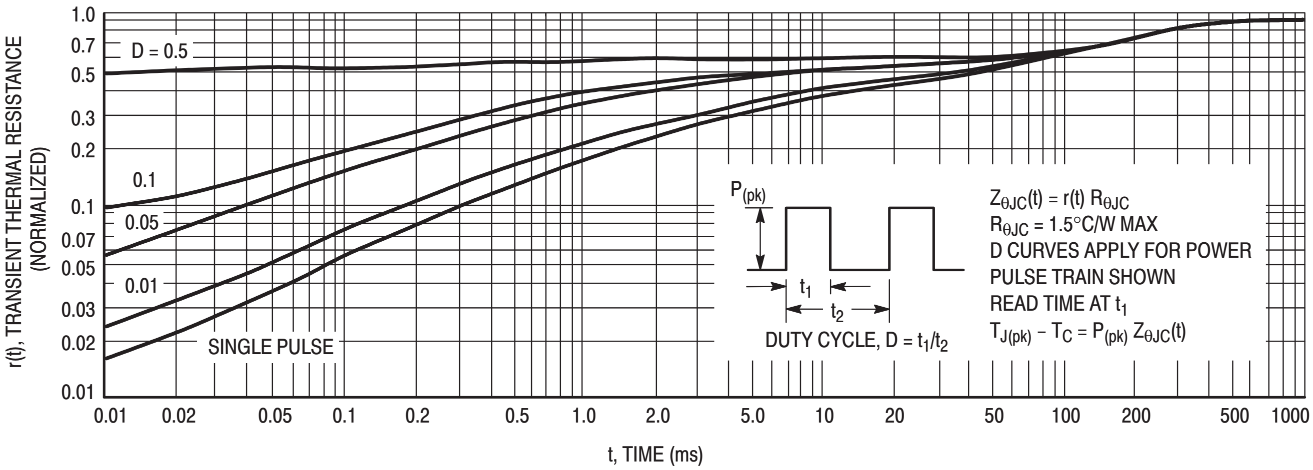


**Figure 9. Thermal Response**

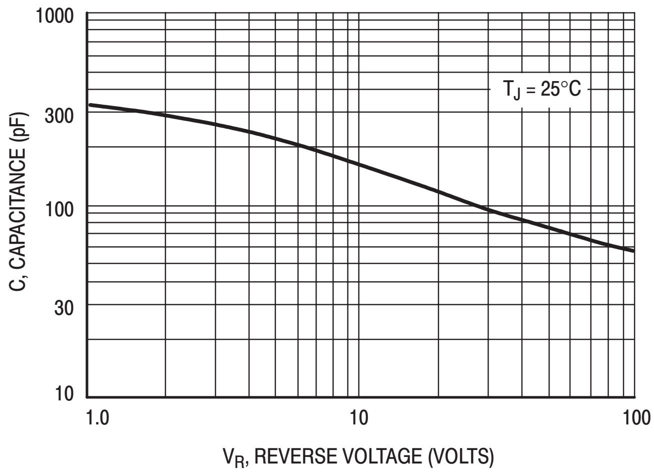


**Figure 10. Typical Capacitance**

# MURH840CT

**Preferred Device**

# MEGAHERTZ™ Power Rectifier

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 28 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- Popular TO–220 Package
- Epoxy Meets UL94, $V_O$ @ 1/8″
- High Temperature Glass Passivated Junction
- High Voltage Capability to 400 Volts
- Low Leakage Specified @ 150°C Case Temperature
- Current Derating @ Both Case and Ambient Temperatures

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: UH840

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 400 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_C$ = 120°C) Per Leg<br>Total Device | $I_{F(AV)}$ | 4.0<br>8.0 | A |
| Peak Repetitive Forward Current per Diode Leg (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 120°C) | $I_{FM}$ | 16 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 100 | A |
| Controlled Avalanche Energy | $W_{AVAL}$ | 20 | mJ |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | °C |

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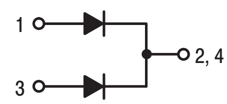
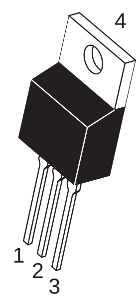
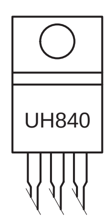
**ULTRAFAST RECTIFIER 8.0 AMPERES 400 VOLTS**




**TO–220AB CASE 221A PLASTIC**

**MARKING DIAGRAM**




UH840 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MURH840CT | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS** (Per Diode Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 3.0 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Diode Leg)

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 4.0 Amps, $T_C$ = 150°C)<br>($i_F$ = 4.0 Amps, $T_C$ = 25°C) | $v_F$ | <br>1.9<br>2.2 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_C$ = 150°C)<br>(Rated dc Voltage, $T_C$ = 25°C) | $i_R$ | <br>500<br>10 | µA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1.0 Amp, di/dt = 50 Amps/µs) | $t_{rr}$ | 28 | ns |

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

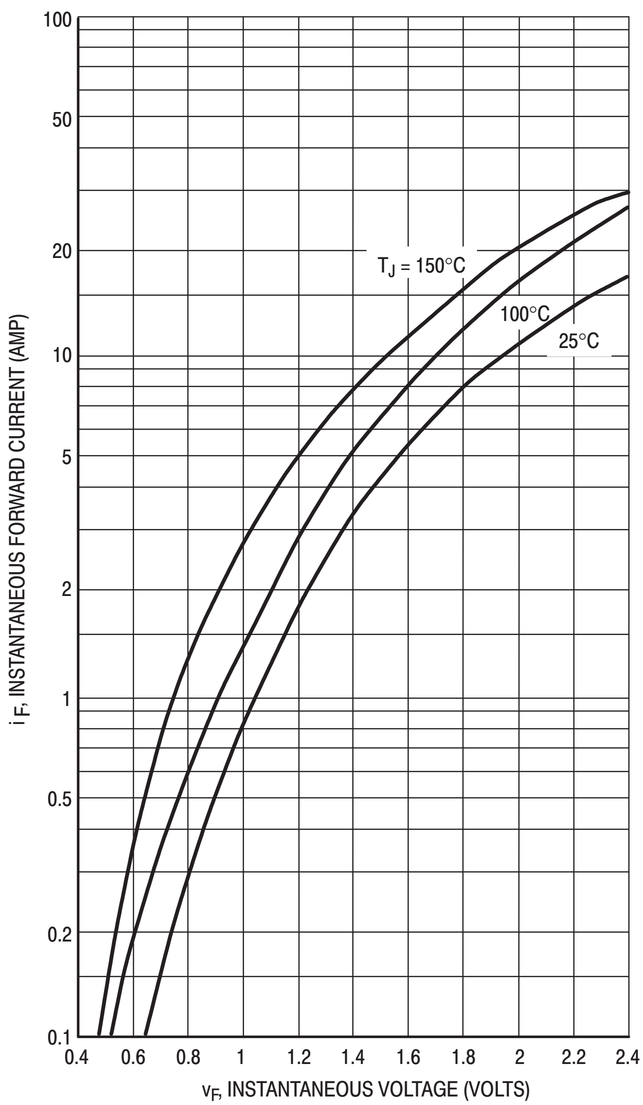


**Figure 1. Typical Forward Voltage**

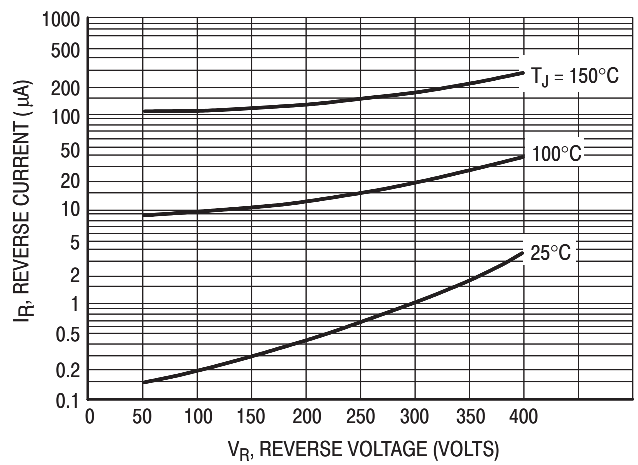


**Figure 2. Typical Reverse Current, Per Leg**

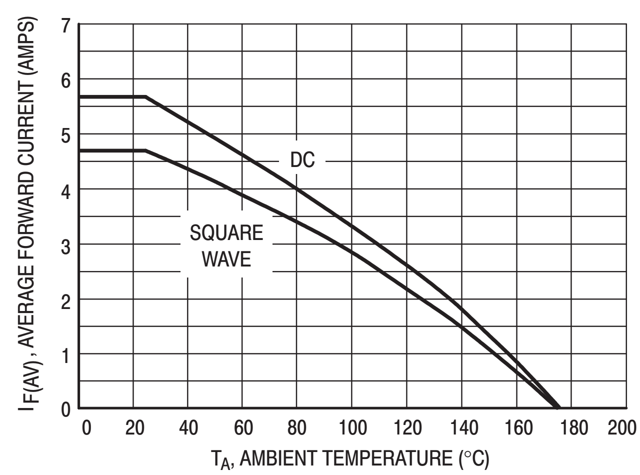


**Figure 3. Forward Current Derating, Ambient, Per Leg**

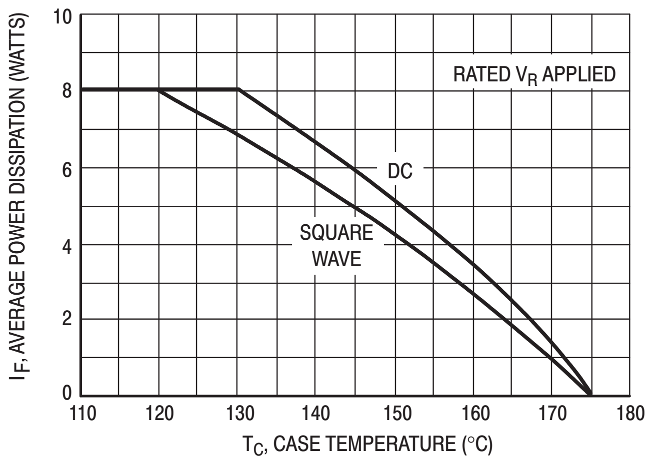


**Figure 4. Current Derating, Case, Per Leg**

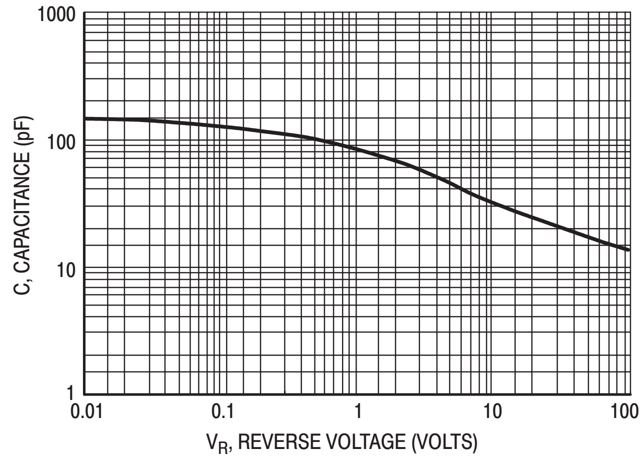


**Figure 5. Typical Capacitance, Per Leg**

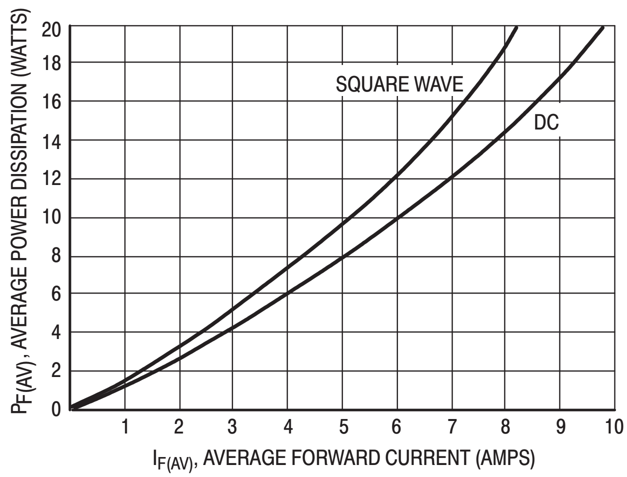


**Figure 6. Forward Power Dissipation, Per Leg**

# MURH860CT

**Preferred Device**

# MEGAHERTZ™ Power Rectifier

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state-of-the-art devices have the following features:

- Ultrafast 35 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Popular TO-220 Package
- Epoxy Meets UL94, $V_O$ @ 1/8″
- High Temperature Glass Passivated Junction
- High Voltage Capability to 600 Volts
- Low Leakage Specified @ 150°C Case Temperature
- Current Derating @ Both Case and Ambient Temperatures

### Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: UH860

**MAXIMUM RATINGS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 600 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_C$ = 120°C)<br>Total Device | $I_{F(AV)}$ | 4.0<br>8.0 | A |
| Peak Repetitive Forward Current (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 120°C) | $I_{FM}$ | 16 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 100 | A |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | °C |

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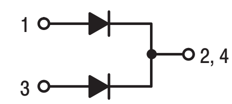
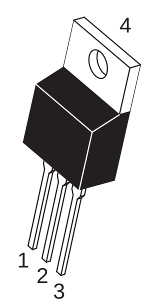
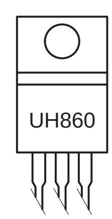
**ULTRAFAST RECTIFIER 8.0 AMPERES 600 VOLTS**




**TO–220AB CASE 221A PLASTIC**

**MARKING DIAGRAM**




UH860 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MURH860CT | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

**THERMAL CHARACTERISTICS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 3.0 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 4.0 Amps, $T_C$ = 150°C)<br>($i_F$ = 4.0 Amps, $T_C$ = 25°C) | $v_F$ | <br>2.5<br>2.8 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_C$ = 150°C)<br>(Rated dc Voltage, $T_C$ = 25°C) | $i_R$ | <br>500<br>10 | µA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1.0 Amp, di/dt = 50 Amps/µs) | $t_{rr}$ | 35 | ns |

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%

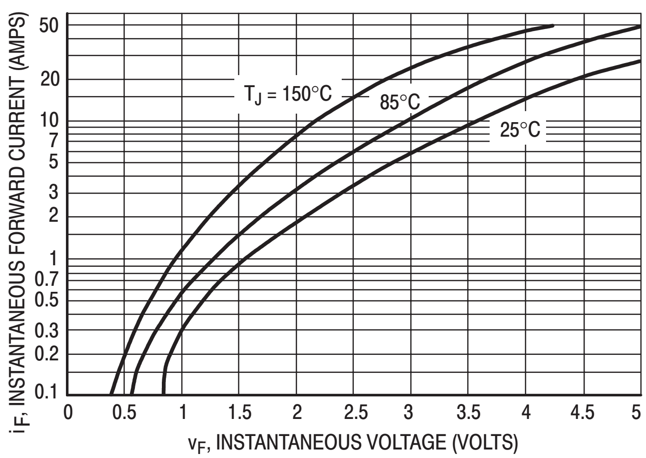



**Figure 1. Typical Forward Voltage, Per Leg**

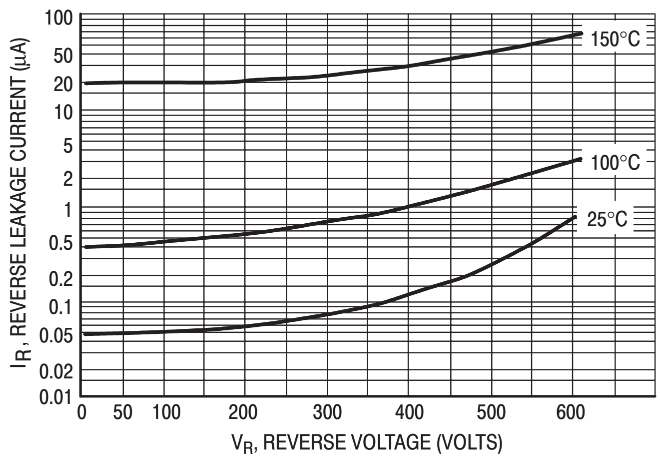



**Figure 2. Typical Reverse Leakage Current, Per Leg**

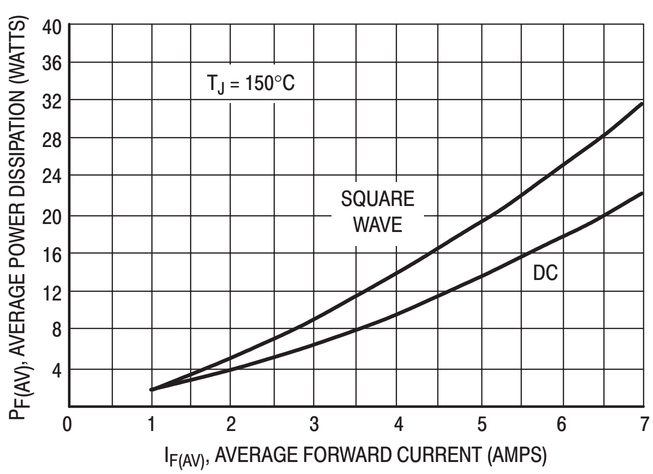



**Figure 3. Typical Forward Dissipation, Per Leg**

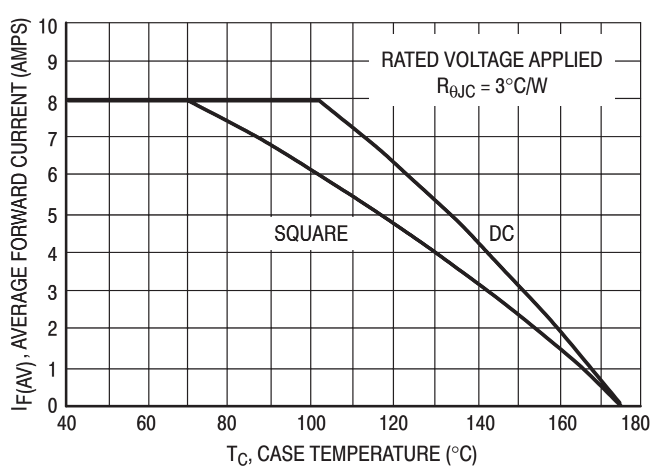



**Figure 4. Typical Current Derating, Case, Per Leg**

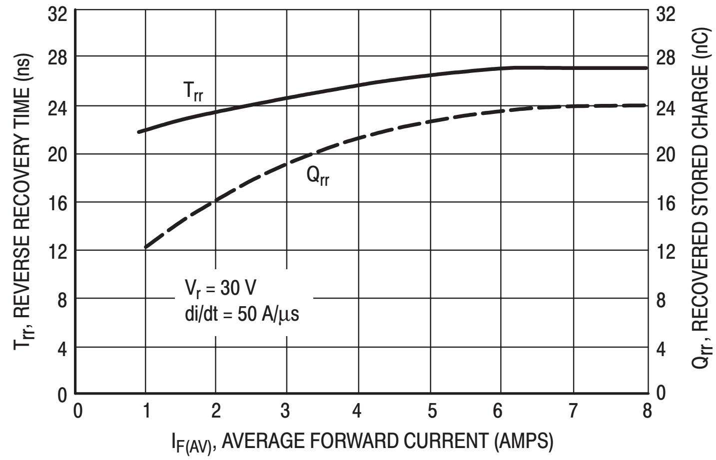



**Figure 5. Typical Recovery Characteristics**

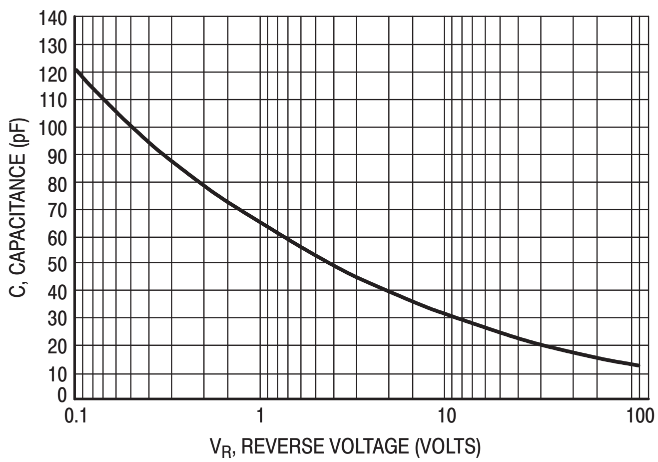



**Figure 6. Typical Capacitance, Per Leg**

# MUR10120E

**Preferred Device**

# SCANSWITCH™ Power Rectifier

## For High and Very High Resolution Monitors

This state–of–the–art power rectifier is specifically designed for use as a damper diode in horizontal deflection circuits for high and very high resolution monitors.

- 1200 Volt Blocking Voltage
- 20 mJ Avalanche Energy (Guaranteed)
- 12 Volt (Typical) Peak Transient Overshoot Voltage
- 135 ns (Typical) Forward Recovery Time

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U10120E

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 1200 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_C$ = 125°C) | $I_{F(AV)}$ | 10 | A |
| Peak Repetitive Forward Current (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 125°C) Per Leg | $I_{FRM}$ | 20 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 100 | A |
| Operating Junction Temperature Range | $T_J$ | –65 to +125 | °C |
| Controlled Avalanche Energy | $W_{AVAL}$ | 20 | mJ |

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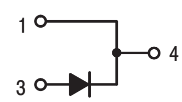
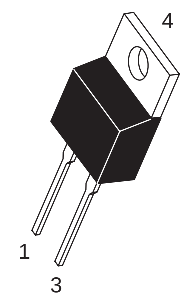
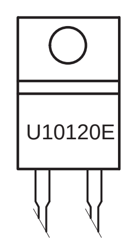
**SCANSWITCH RECTIFIER 10 AMPERES 1200 VOLTS**




**TO–220AC CASE 221B STYLE 1**

**MARKING DIAGRAM**




U10120E = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MUR10120E | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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## THERMAL CHARACTERISTICS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case | $R_{\theta JC}$ | 2.0 | °C/W |

## ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | Typ | Max | Unit |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 6.5 Amps, $T_J$ = 125°C)<br>($i_F$ = 6.5 Amps, $T_J$ = 25°C) | $v_F$ | <br>1.7<br>1.9 | <br>2.0<br>2.2 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_J$ = 25°C)<br>(Rated dc Voltage, $T_J$ = 125°C) | $i_R$ | <br>25<br>750 | <br>100<br>1000 | μA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1.0 A, di/dt = 50 Amps/μs) | $t_{rr}$ | 150 | 175 | ns |
| Maximum Forward Recovery Time<br>$I_F$ = 6.5 Amps, di/dt = 12 Amps/μs (As Measured on a Deflection Circuit) | $t_{fr}$ | 135 | 175 | ns |
| Peak Transient Overshoot Voltage | $V_{RFM}$ | 12 | 14 | Volts |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

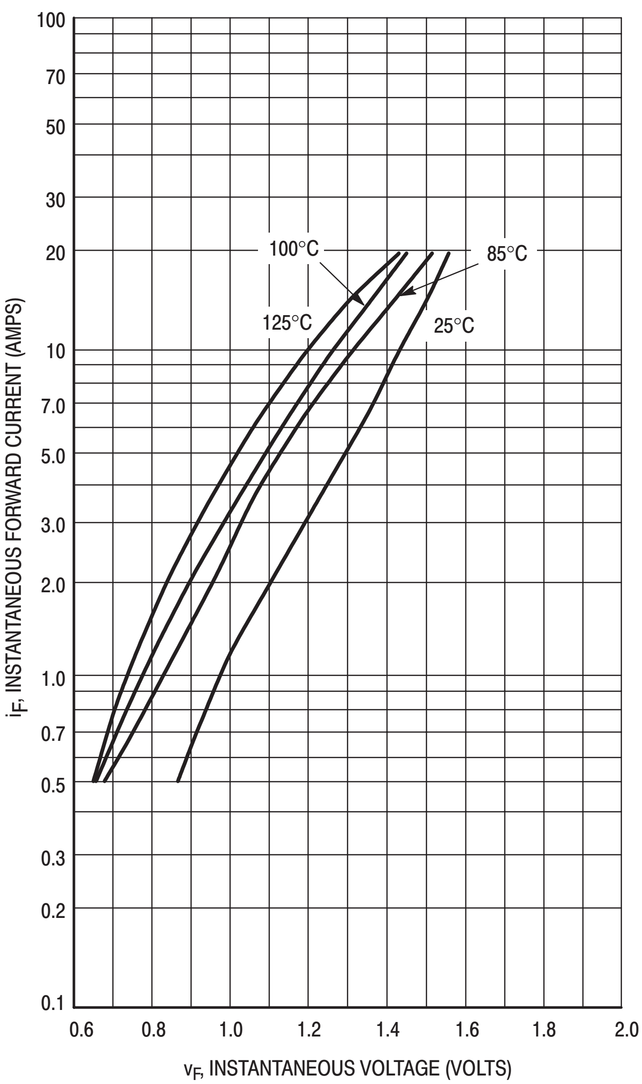



Figure 1. Typical Forward Voltage

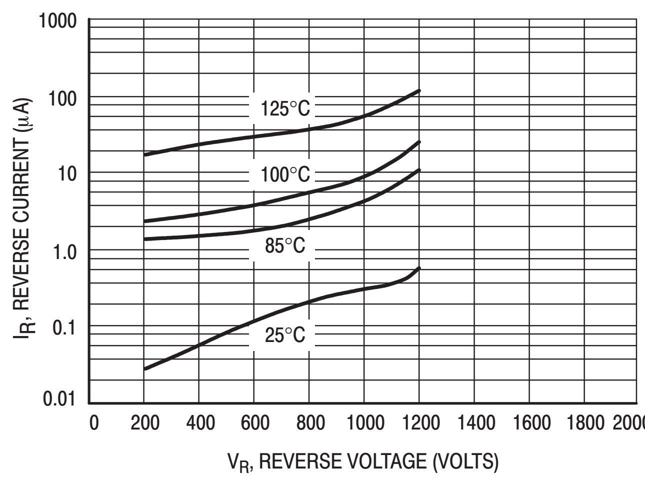



Figure 2. Typical Reverse Current

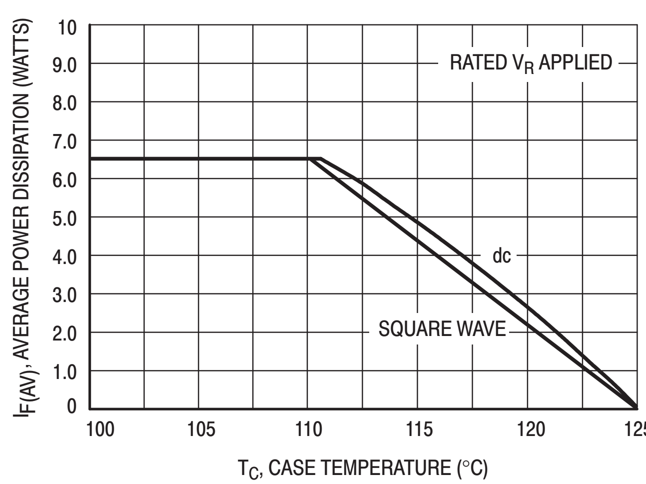



Figure 3. Current Derating, Case

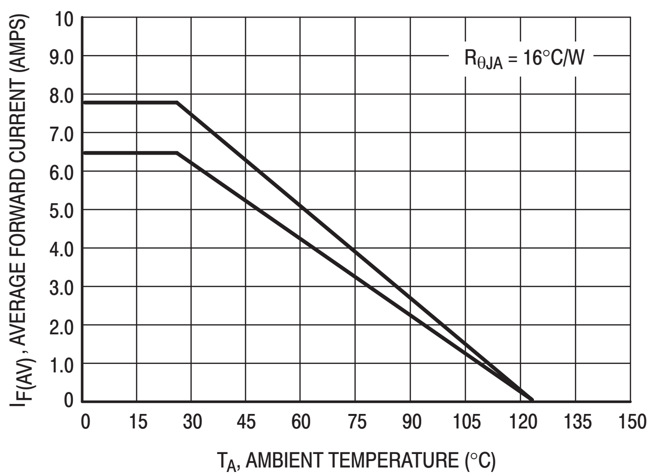



Figure 4. Current Derating, Ambient

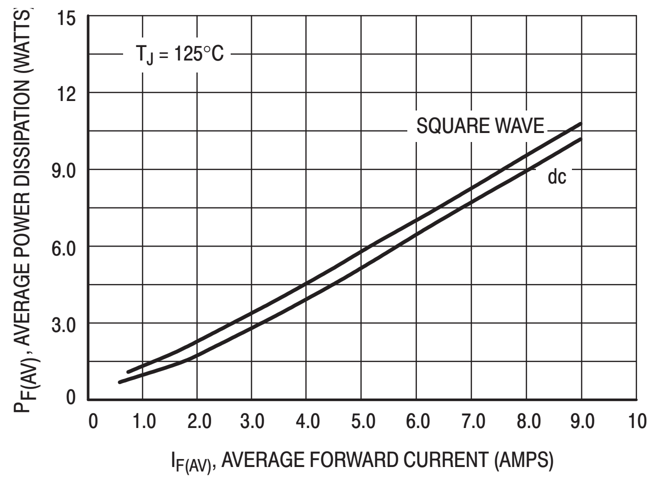



Figure 5. Power Dissipation

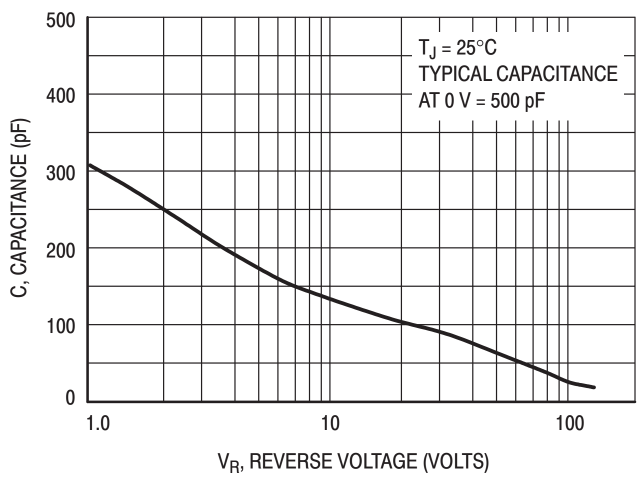



Figure 6. Typical Capacitance

# MUR10150E

**Preferred Device**

# SCANSWITCH™ Power Rectifier

## For Use As A Damper Diode In High and Very High Resolution Monitors

The MUR10150E is a state-of-the-art Power Rectifier specifically designed for use as a damper diode in horizontal deflection circuits for high and very high resolution monitors.

- 1500 V Blocking Voltage
- 20 mJ Avalanche Energy Guaranteed
- Peak Transient Overshoot Voltage Specified, 14 Volts (typical)
- Forward Recovery Time Specified, 135 ns (typical)
- Epoxy Meets UL94, $V_O$ at 1/8″

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U10150E

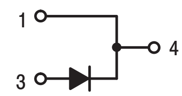
**MAXIMUM RATINGS**

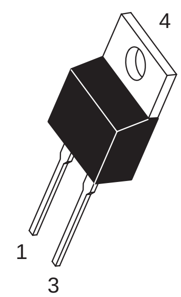
| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 1500 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_C$ = 125°C) | $I_{F(AV)}$ | 10 | A |
| Peak Repetitive Forward Current (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 125°C) Per Leg | $I_{FRM}$ | 20 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 100 | A |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +125 | °C |
| Controlled Avalanche Energy | $W_{AVAL}$ | 20 | mJ |

**ON Semiconductor™**

http://onsemi.com

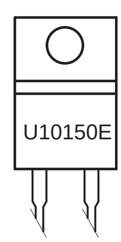
**SCANSWITCH RECTIFIER 10 AMPERES 1500 VOLTS**




**TO–220AC**
**CASE 221B**
**STYLE 1**

**MARKING DIAGRAM**




U10150E = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MUR10150E | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case | $R_{\theta JC}$ | 2.0 | °C/W |

**ELECTRICAL CHARACTERISTICS**

| Characteristic | Symbol | Typ | Max | Unit |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 6.5 Amps, $T_J$ = 125°C)<br>($i_F$ = 6.5 Amps, $T_J$ = 25°C) | $v_F$ | <br>1.7<br>1.9 | <br>2.2<br>2.4 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_J$ = 125°C)<br>(Rated dc Voltage, $T_J$ = 25°C) | $i_R$ | <br>750<br>25 | <br>1000<br>100 | μA |
| Maximum Reverse Recovery Time ($I_F$ = 1.0 Amp, di/dt = 50 Amps/μs) | $t_{rr}$ | 150 | 175 | ns |
| Maximum Forward Recovery Time ($I_F$ = 6.5 Amps, di/dt = 12 Amps/μs) | $t_{fr}$ | 135 | 175 | ns |
| Peak Transient Overshoot Voltage | $V_{RFM}$ | 14 | 16 | Volts |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

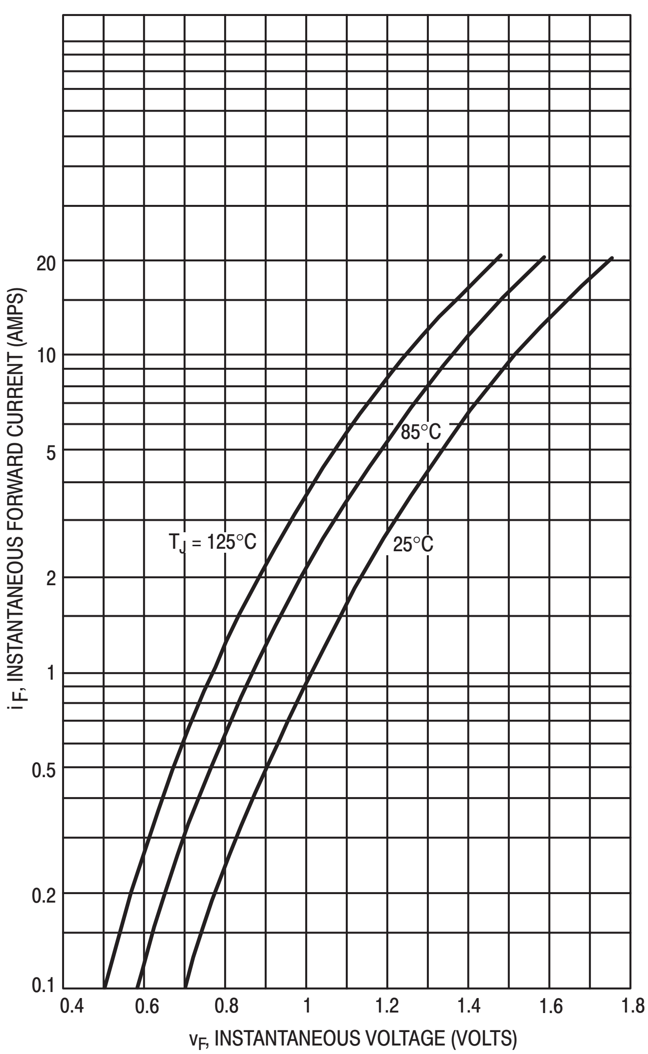


**Figure 1. Typical Forward Voltage**

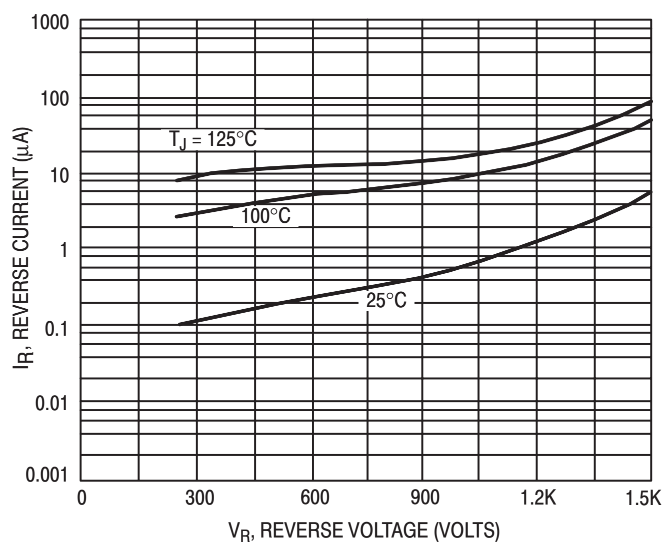


**Figure 2. Typical Reverse Current**

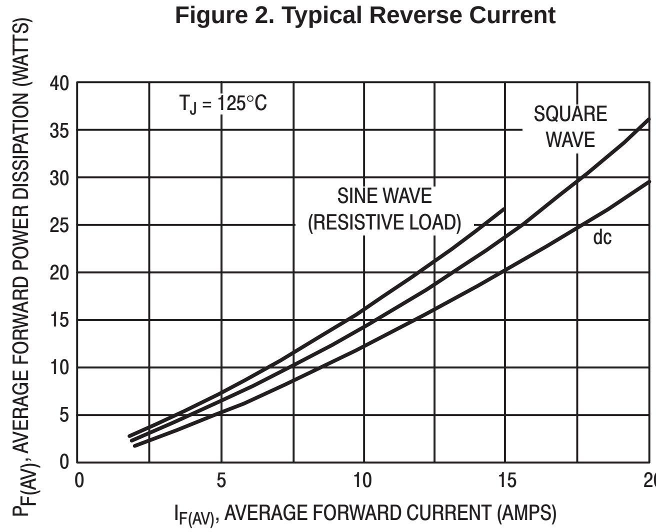


**Figure 3. Forward Power Dissipation**

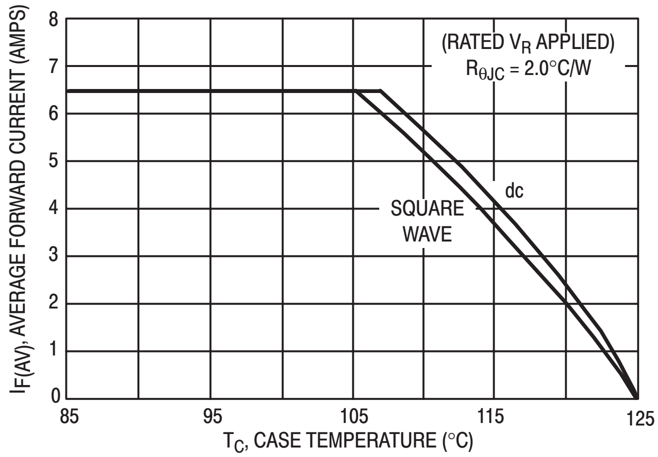


**Figure 4. Current Derating Case**

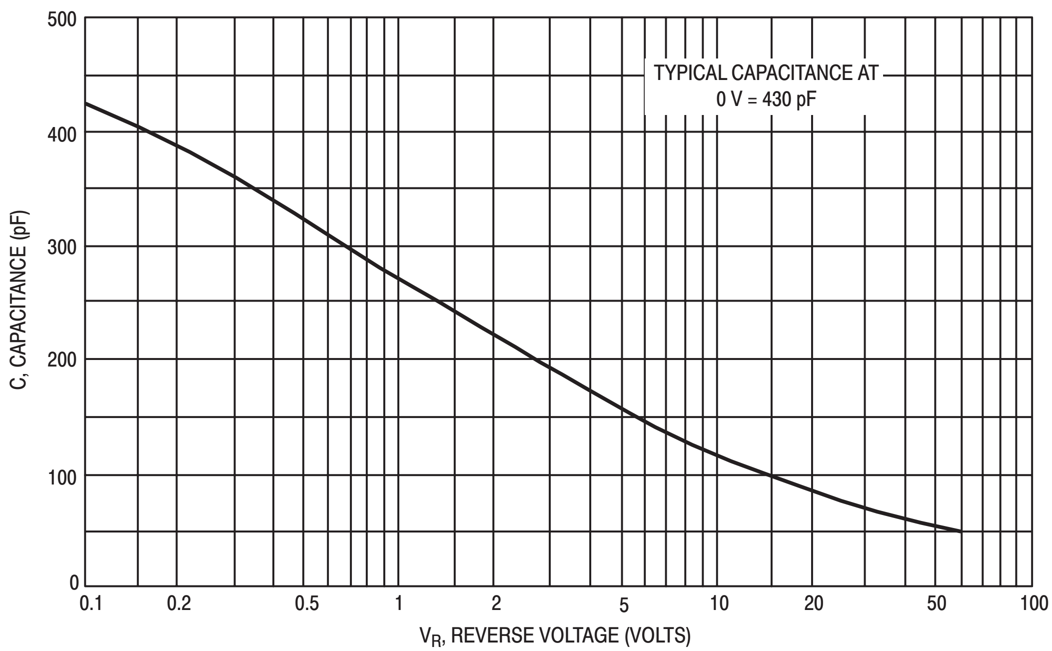


**Figure 5. Typical Capacitance**

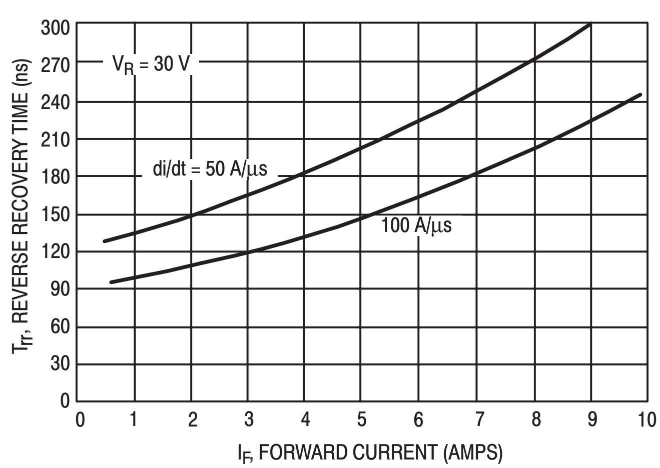


**Figure 6. Typical Reverse Recovery Time**

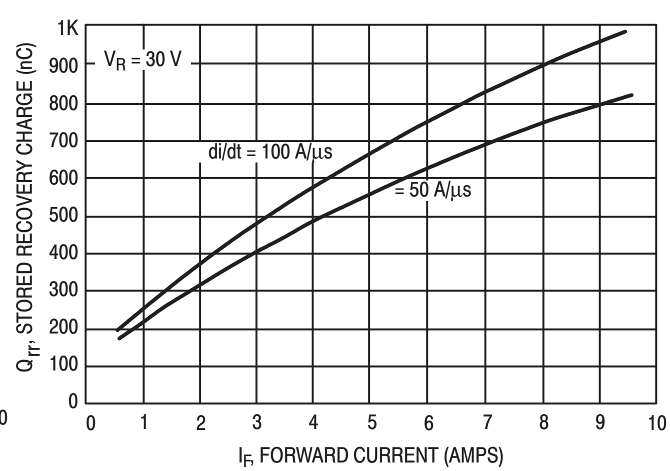


**Figure 7. Typical Stored Recovery Charge**

# MUR1510, MUR1515, MUR1520, MUR1540, MUR1560

**Preferred Devices**

# SWITCHMODE™ Power Rectifiers

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 35 and 60 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- Popular TO–220 Package
- High Voltage Capability to 600 Volts
- Low Forward Drop
- Low Leakage Specified @ 150°C Case Temperature
- Current Derating Specified @ Both Case and Ambient Temperatures

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U1510, U1515, U1520, U1540, U1560

**MAXIMUM RATINGS**

| |
|---|
| Please See the Table on the Following Page |

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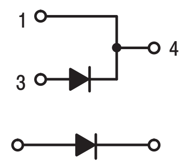
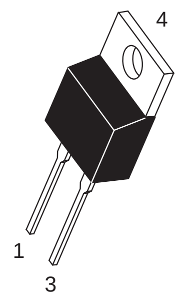
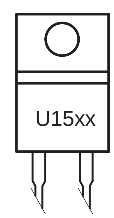
**ULTRAFAST RECTIFIERS**
**15 AMPERES**
**100–600 VOLTS**




**TO–220AC**
**CASE 221B**
**PLASTIC**

**MARKING DIAGRAM**




U15xx = Device Code
xx = 10, 15, 20, 40 or 60

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MUR1510 | TO–220 | 50 Units/Rail |
| MUR1515 | TO–220 | 50 Units/Rail |
| MUR1520 | TO–220 | 50 Units/Rail |
| MUR1540 | TO–220 | 50 Units/Rail |
| MUR1560 | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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## MAXIMUM RATINGS

| Rating | Symbol | MUR 1510 | MUR 1515 | MUR 1520 | MUR 1540 | MUR 1560 | Unit |
|---|---|---|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 100 | 150 | 200 | 400 | 600 | Volts |
| Average Rectified Forward Current<br>(Rated $V_R$) | $I_{F(AV)}$ | 15<br>@ $T_C$ = 150°C | | | | 15<br>@ $T_C$ = 145°C | Amps |
| Peak Rectified Forward Current<br>(Rated $V_R$, Square Wave, 20 kHz) | $I_{FRM}$ | 30<br>@ $T_C$ = 150°C | | | | 30<br>@ $T_C$ = 145°C | Amps |
| Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 200 | | | 150 | | Amps |
| Operating Junction Temperature and<br>Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | | | | | °C |

## THERMAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.5 | °C/W |

## ELECTRICAL CHARACTERISTICS

| | | 1510–1520 | 1540 | 1560 | |
|---|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 15 Amps, $T_C$ = 150°C)<br>($i_F$ = 15 Amps, $T_C$ = 25°C) | $v_F$ | <br>0.85<br>1.05 | <br>1.12<br>1.25 | <br>1.20<br>1.50 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_C$ = 150°C)<br>(Rated dc Voltage, $T_C$ = 25°C) | $i_R$ | <br>500<br>10 | <br>500<br>10 | <br>1000<br>10 | μA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1.0 Amp, di/dt = 50 Amps/μs) | $t_{rr}$ | 35 | 60 | | ns |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

## MUR1510, MUR1515, MUR1520

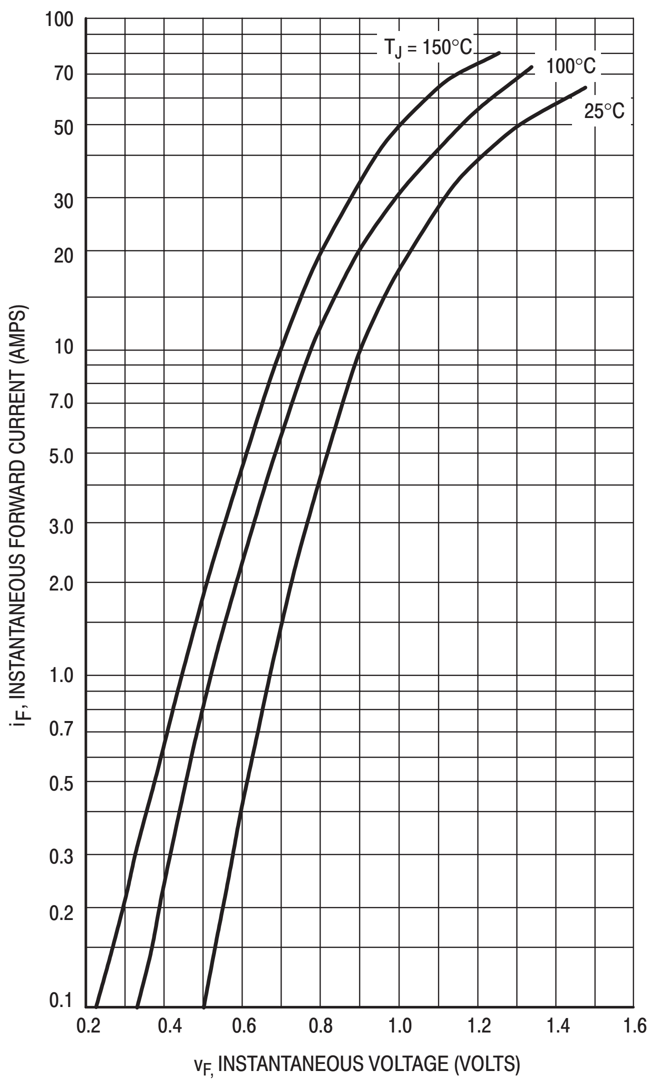



Figure 1. Typical Forward Voltage

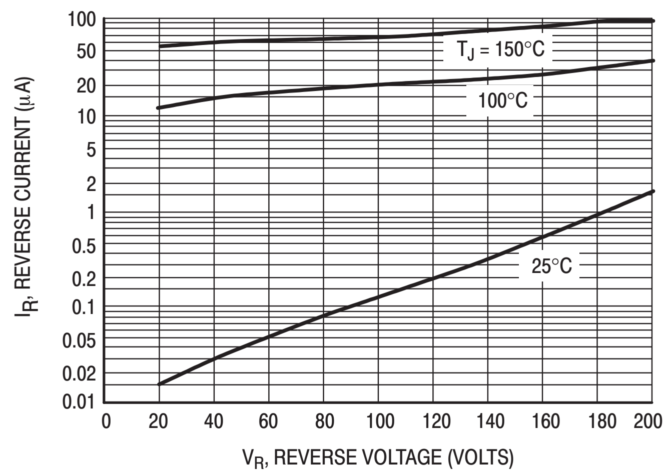



Figure 2. Typical Reverse Current

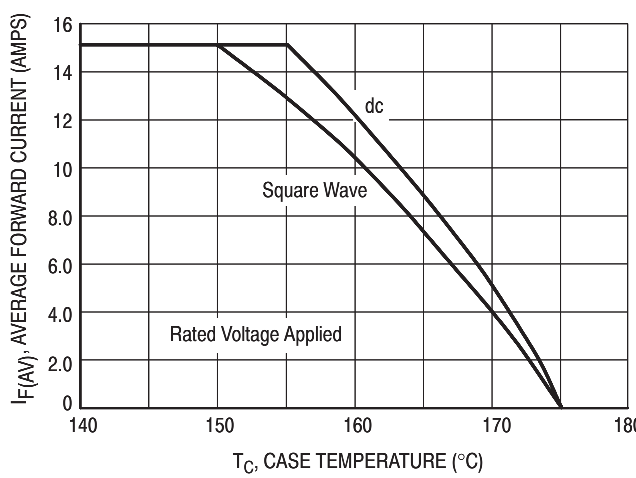



Figure 3. Current Derating, Case

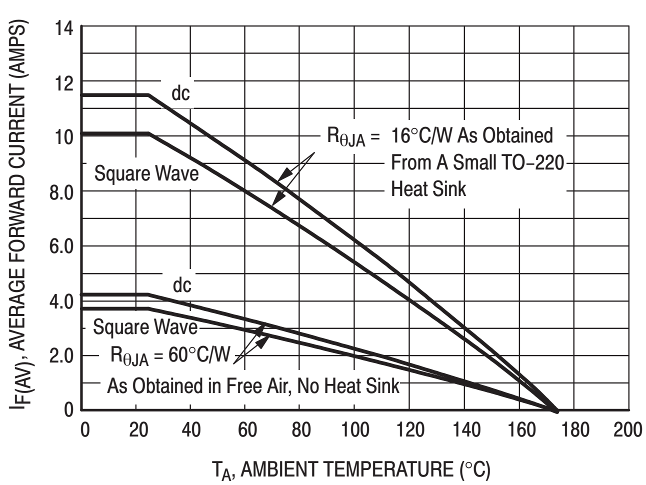



Figure 4. Current Derating, Ambient

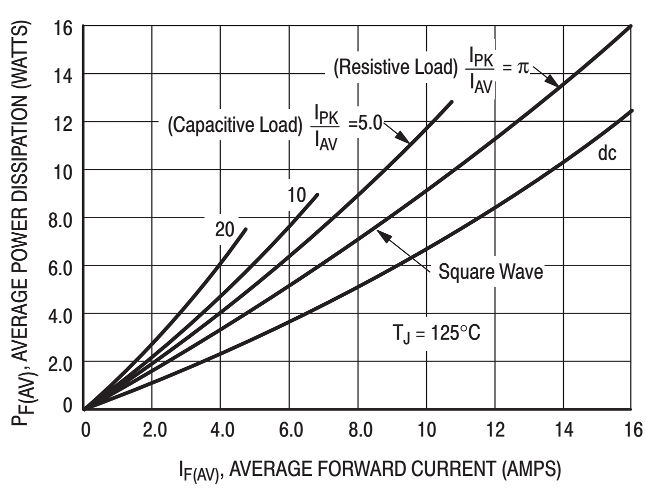



Figure 5. Power Dissipation

**MUR1540**

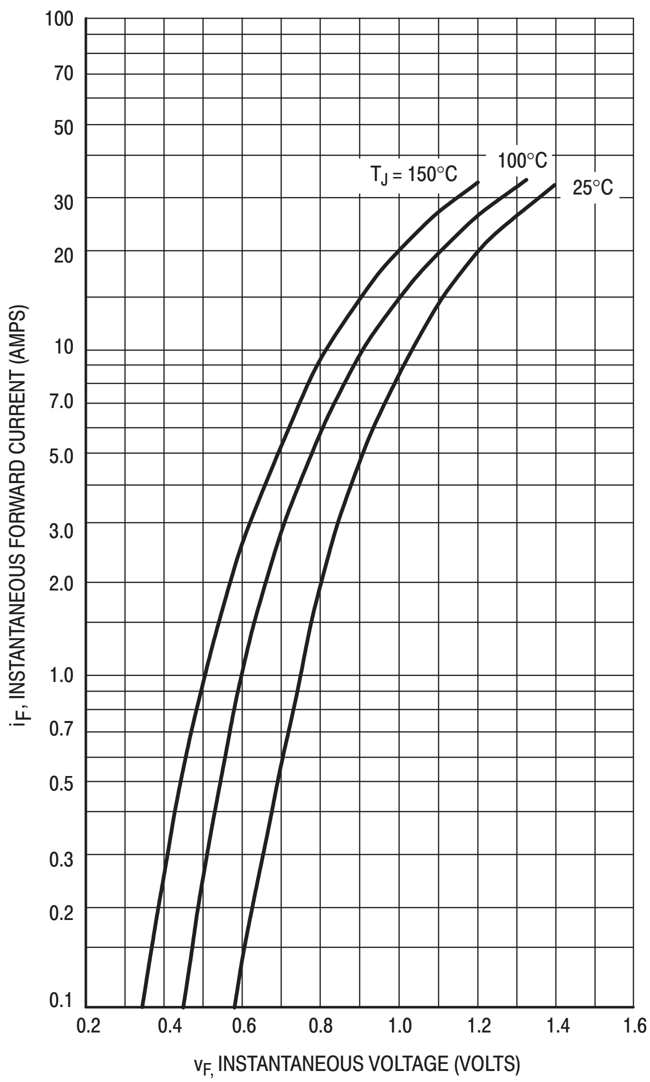



Figure 6. Typical Forward Voltage

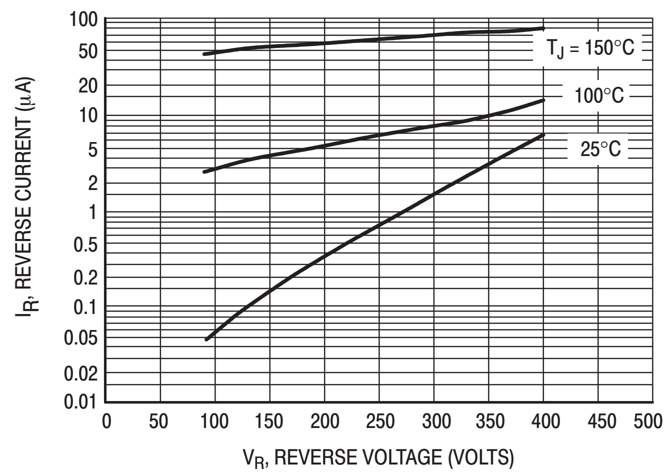



Figure 7. Typical Reverse Current

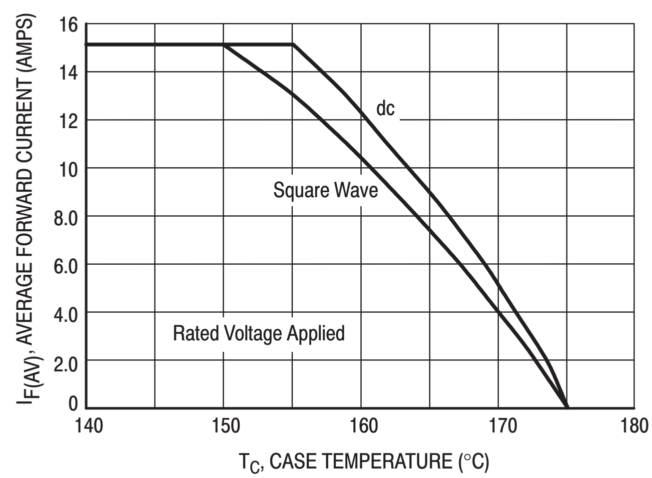



Figure 8. Current Derating, Case

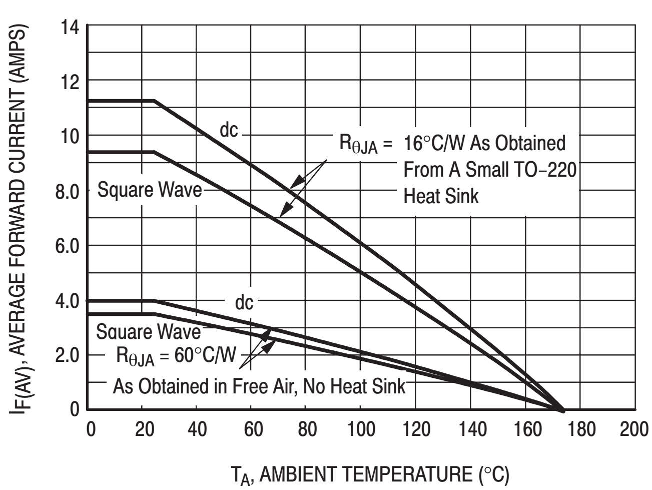



Figure 9. Current Derating, Ambient

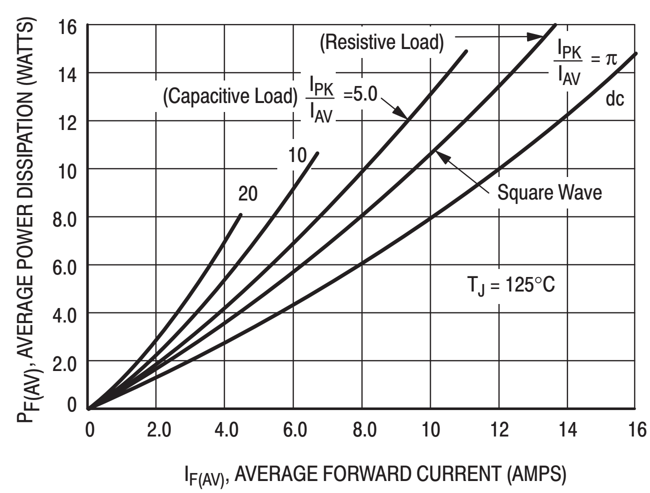



Figure 10. Power Dissipation

## MUR1560

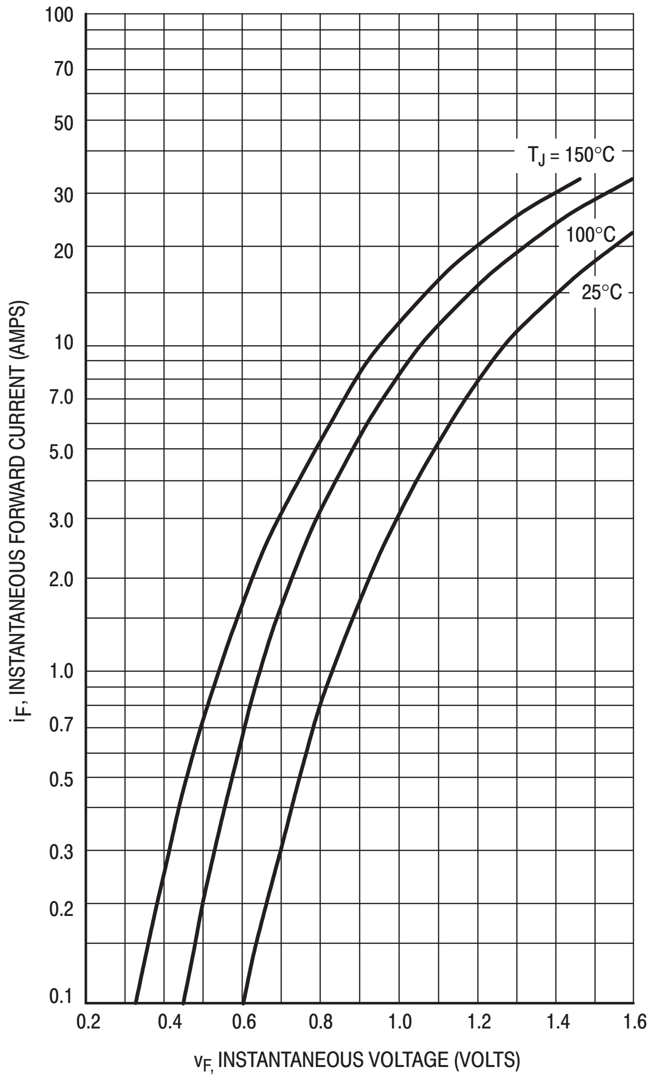



**Figure 11. Typical Forward Voltage**

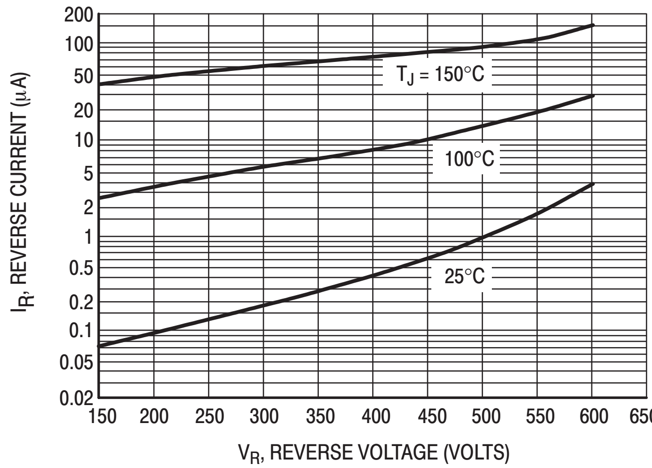



**Figure 12. Typical Reverse Current**

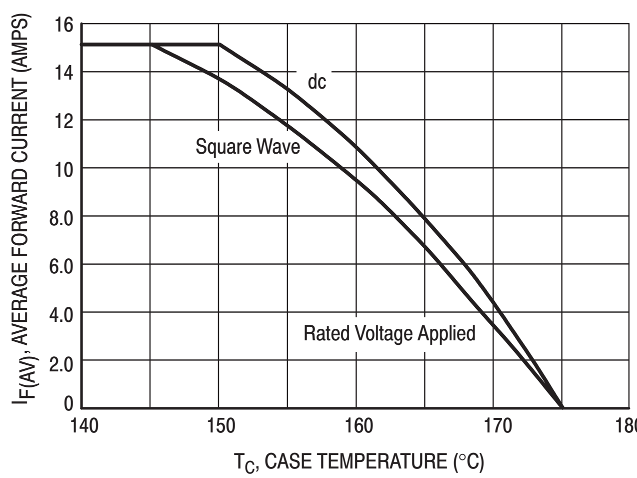



**Figure 13. Current Derating, Case**

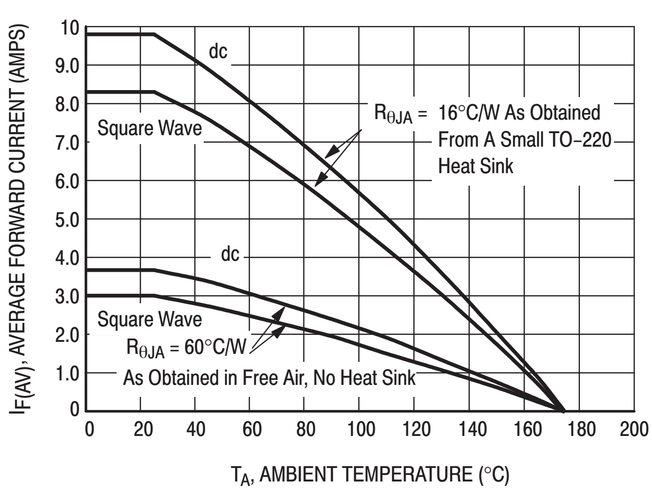



**Figure 14. Current Derating, Ambient**

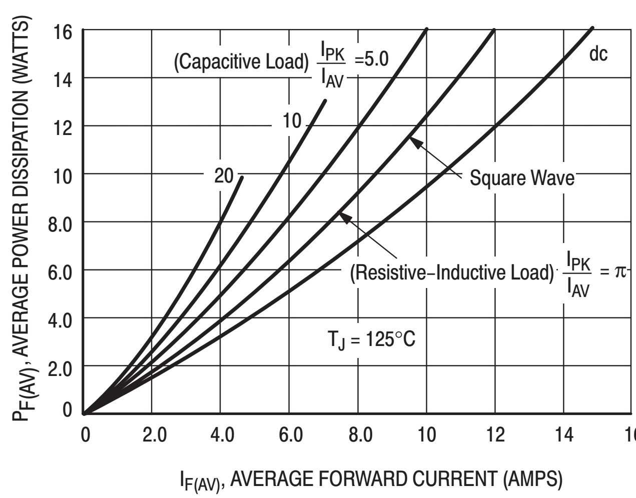



**Figure 15. Power Dissipation**

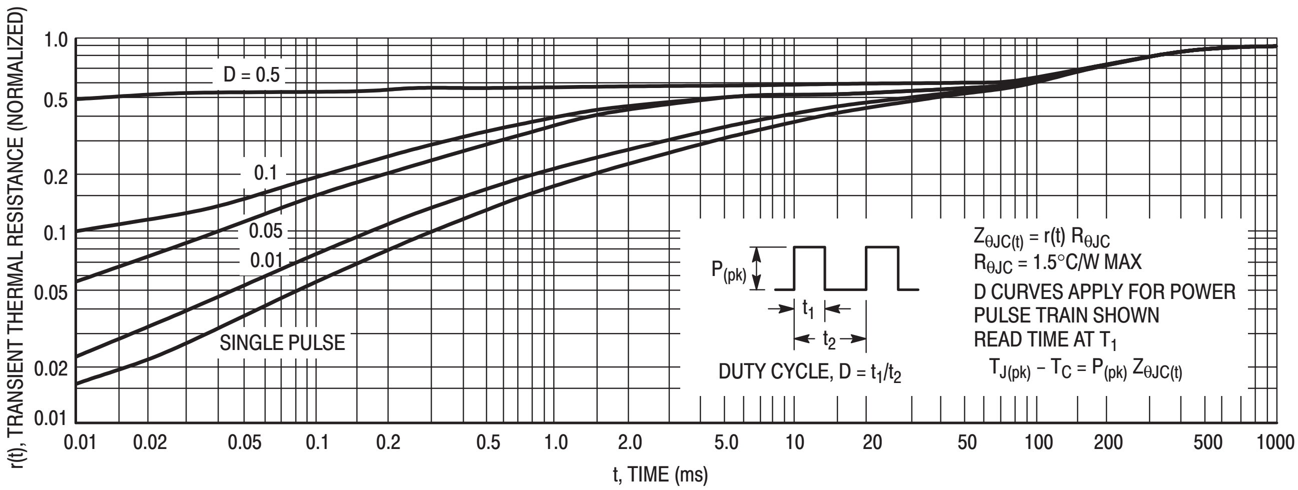



**Figure 16. Thermal Response**

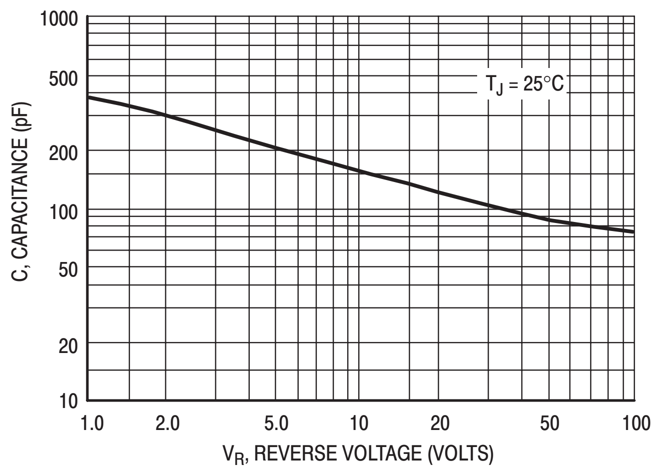



**Figure 17. Typical Capacitance**

# MUR2020R

**Preferred Device**

# SWITCHMODE™ Ultrafast Power Rectifier

. . . designed for use in negative switching power supplies, inverters and as free wheeling diode. Also, used in conjunction with a standard cathode dual Ultrafast Rectifier, makes a single phase full–wave bridge. These state–of–the–art devices have the following features:

- Reverse Polarity Rectifier
- Ultrafast 95 Nanosecond Reverse Recovery Times
- Exhibits Soft Recovery Characteristics
- High Temperature Glass Passivated Junction
- Low Leakage Specified @ 150°C Case Temperature
- Current Derating @ Case Temperature
- Epoxy Meets UL94, $V_O$ @ 1/8″

**Mechanical Characteristics:**
- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U2020R

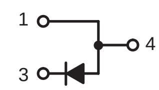
**MAXIMUM RATINGS** (Per Leg)

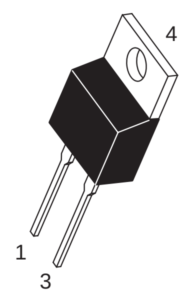
| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 200 | Volts |
| Average Rectified Forward Voltage, (Rated $V_R$), $T_C$ = 125°C | $I_{F(AV)}$ | 20 | Amps |
| Peak Repetitive Forward Current (Rated $V_R$), $T_C$ = 125°C | $I_{FRM}$ | 40 | Amps |
| Nonrepetitive Peak Surge Current (Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 250 | Amps |
| Operating Junction Temperature and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | °C |

**ON Semiconductor™**

**http://onsemi.com**

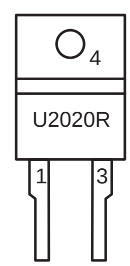
**ULTRAFAST RECTIFIER**
**20 AMPERES**
**200 VOLTS**




**TO–220AC**
**CASE 221B**
**PLASTIC**

**MARKING DIAGRAM**




**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MUR2020R | TO–220AC | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS** (Per Leg)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance – Junction to Case | $R_{\theta JC}$ | 2.0 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($I_F$ = 20 Amps, $T_C$ = 25°C)<br>($I_F$ = 20 Amps, $T_C$ = 150°C) | $V_F$ | <br>1.1<br>1.0 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_C$ = 25°C)<br>(Rated dc Voltage, $T_C$ = 150°C) | $I_R$ | <br>50<br>1 | <br>μA<br>mA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1.0 Amp, di/dt = 50 Amps/μs)<br>($I_F$ = 1.0 Amp, di/dt = 100 Amps/μs) | $t_{rr}$ | <br>95<br>75 | ns |

1. Pulse Test: Pulse Width = 5.0 ms, Duty Cycle ≤ 10%.

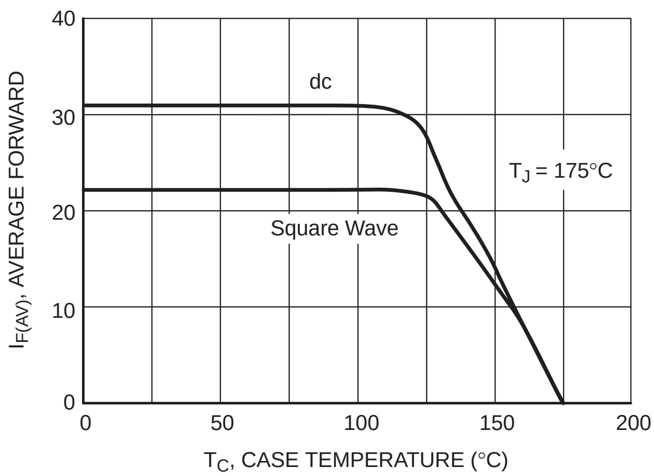



**Figure 7. Current Derating**

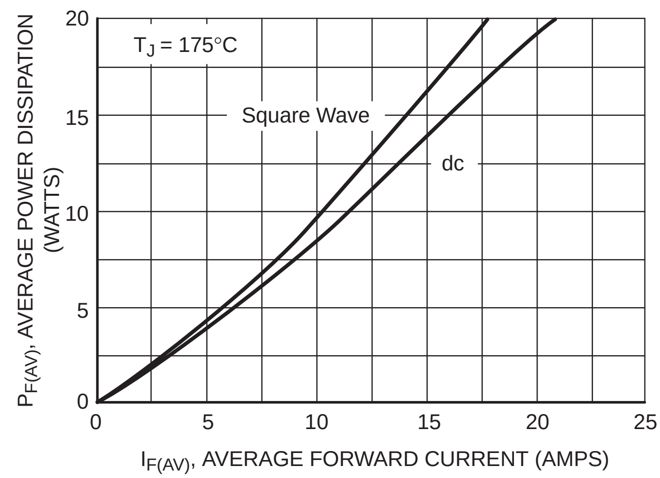



**Figure 8. Power Dissipation**

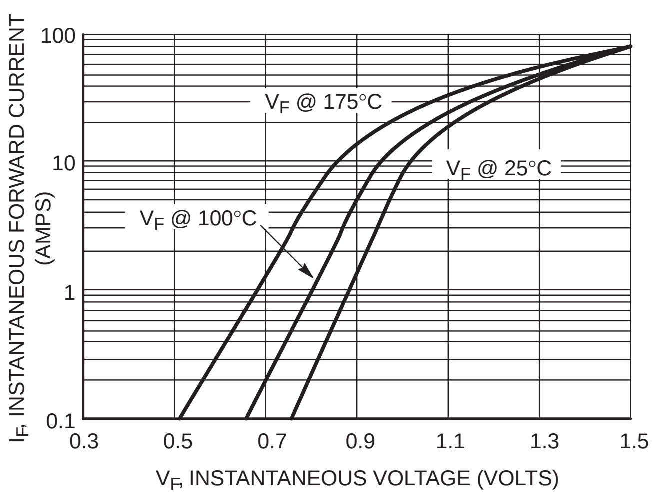



**Figure 9. Maximum Forward Voltage**

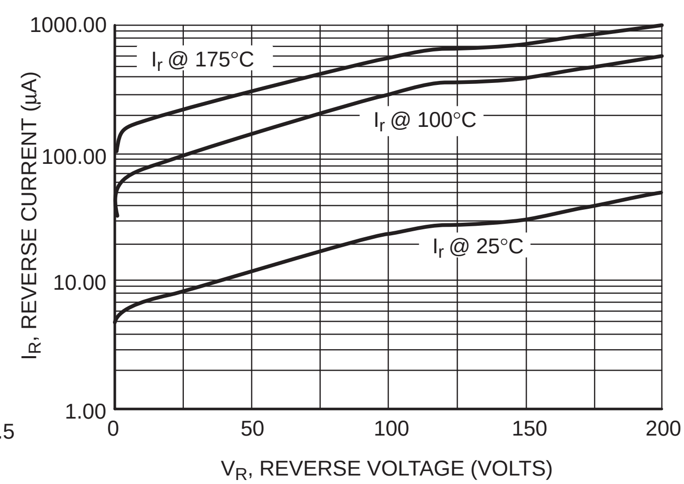



**Figure 10. Maximum Reverse Current**

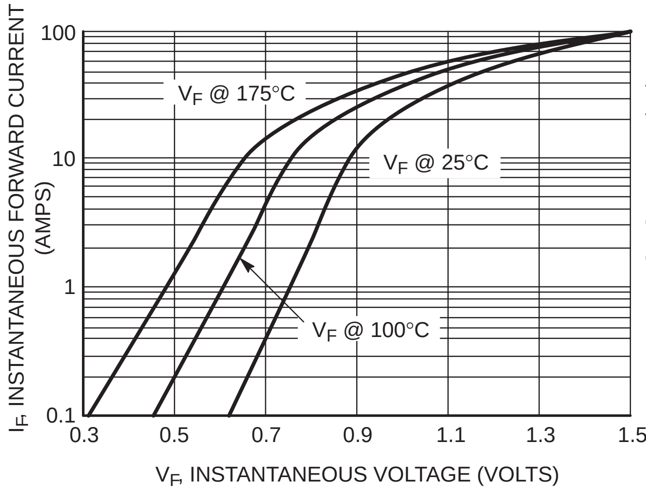



**Figure 11. Typical Forward Voltage**

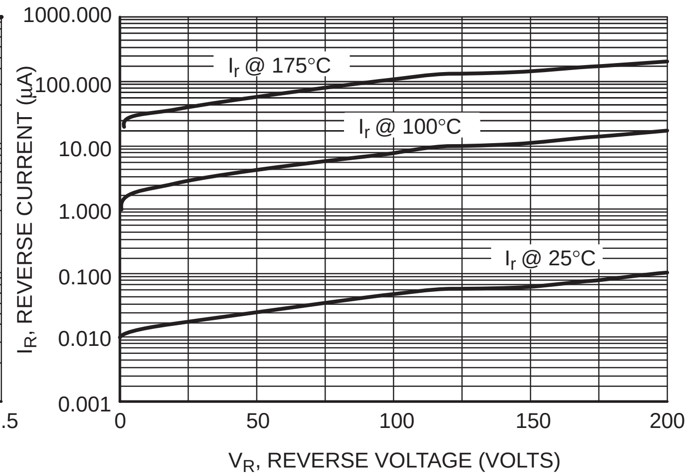



**Figure 12. Typical Reverse Current**

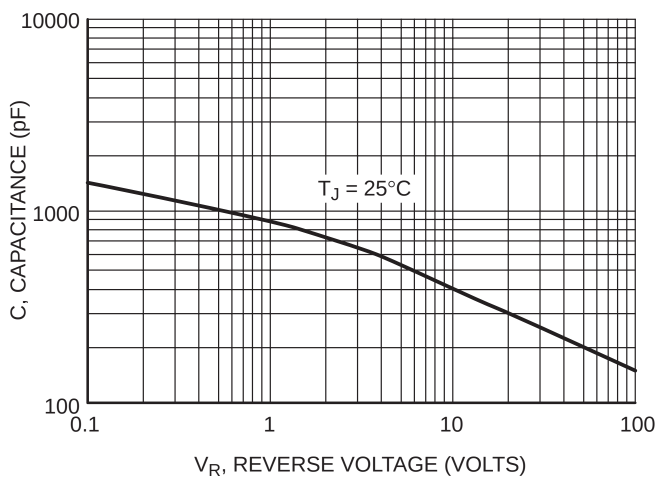



**Figure 14. Maximum Capacitance**

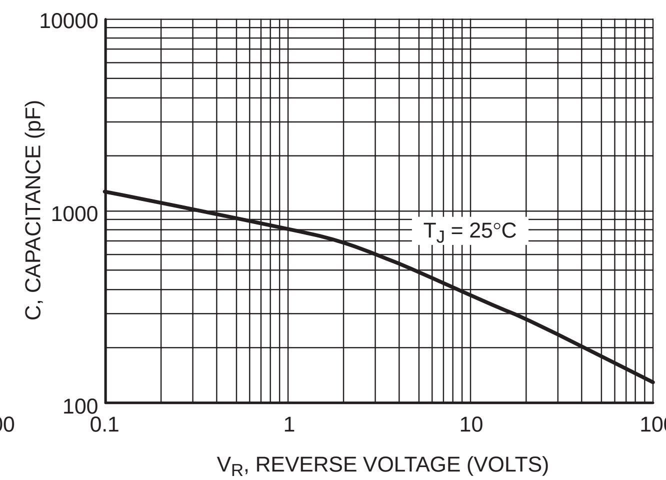



**Figure 15. Typical Capacitance**

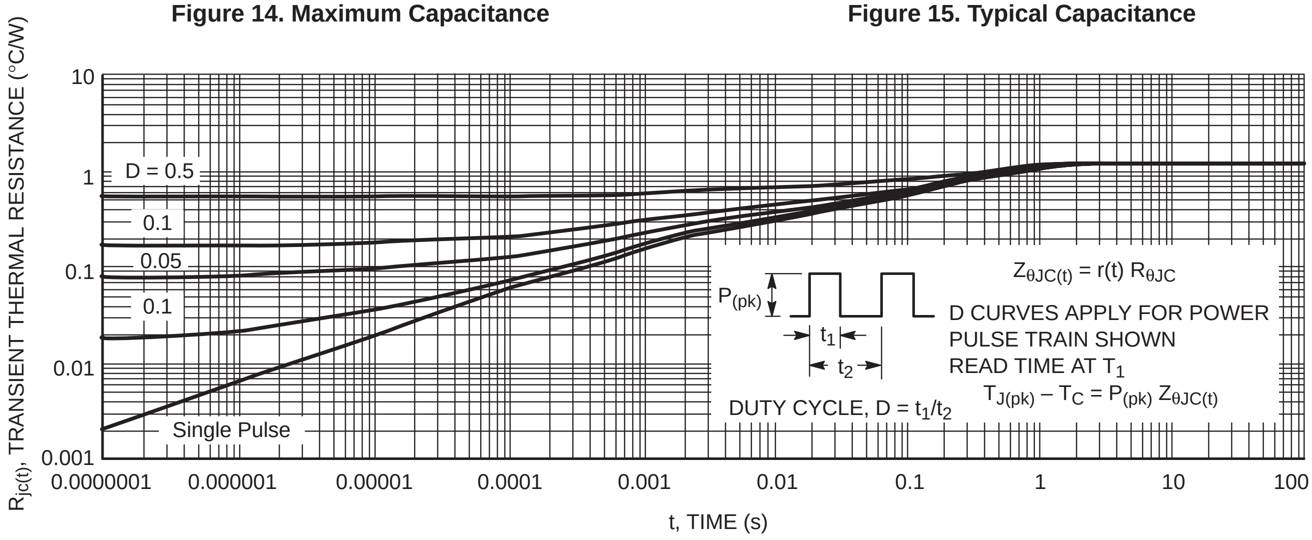



**Figure 13. Thermal Response**

# MUR1610CT, MUR1615CT, MUR1620CT, MUR1640CT, MUR1660CT

## SWITCHMODE™ Power Rectifiers

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 35 and 60 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Popular TO–220 Package
- Epoxy Meets UL94, $V_O$ @ 1/8″
- High Temperature Glass Passivated Junction
- High Voltage Capability to 600 Volts
- Low Leakage Specified @ 150°C Case Temperature
- Current Derating @ Both Case and Ambient Temperatures

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U1610, U1615, U1620, U1640, U1660

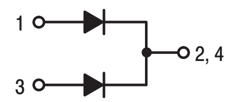
### MAXIMUM RATINGS

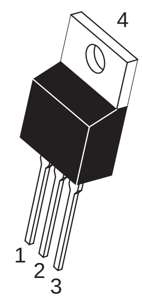
| Please See the Table on the Following Page |
|---|

**ON Semiconductor**™

http://onsemi.com

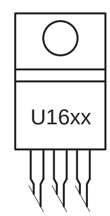
**ULTRAFAST RECTIFIERS 8.0 AMPERES 100–600 VOLTS**




TO–220AB
CASE 221A
PLASTIC

**MARKING DIAGRAM**




U16xx = Device Code
xx = 10, 15, 20, 40 or 60

### ORDERING INFORMATION

| Device | Package | Shipping |
|---|---|---|
| MUR1610CT | TO–220 | 50 Units/Rail |
| MUR1615CT | TO–220 | 50 Units/Rail |
| MUR1620CT | TO–220 | 50 Units/Rail |
| MUR1640CT | TO–220 | 50 Units/Rail |
| MUR1660CT | TO–220 | 50 Units/Rail |

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## MAXIMUM RATINGS

| Rating | Symbol | MUR16 10CT | MUR16 15CT | MUR16 20CT | MUR16 40CT | MUR16 60CT | Unit |
|---|---|---|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 100 | 150 | 200 | 400 | 600 | Volts |
| Average Rectified Forward Current — Per Leg<br>Total Device, (Rated $V_R$), $T_C$ = 150°C — Total Device | $I_{F(AV)}$ | 8.0<br>16 | | | | | Amps |
| Peak Rectified Forward Current — Per Diode Leg<br>(Rated $V_R$, Square Wave, 20 kHz), $T_C$ = 150°C | $I_{FM}$ | 16 | | | | | Amps |
| Nonrepetitive Peak Surge Current<br>(Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 100 | | | | | Amps |
| Operating Junction Temperature and Storage Temperature | $T_J$, $T_{stg}$ | – 65 to +175 | | | | | °C |

**THERMAL CHARACTERISTICS** (Per Diode Leg)

| Rating | Symbol | 10CT / 15CT / 20CT | 40CT / 60CT | Unit |
|---|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 3.0 | 2.0 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Diode Leg)

| Rating | Symbol | 10CT / 15CT / 20CT | 40CT | 60CT | Unit |
|---|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 8.0 Amps, $T_C$ = 150°C)<br>($i_F$ = 8.0 Amps, $T_C$ = 25°C) | $v_F$ | <br>0.895<br>0.975 | <br>1.00<br>1.30 | <br>1.20<br>1.50 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_C$ = 150°C)<br>(Rated dc Voltage, $T_C$ = 25°C) | $i_R$ | <br>250<br>5.0 | <br>500<br>10 | | µA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1.0 Amp, di/dt = 50 Amps/µs)<br>($I_F$ = 0.5 Amp, $I_R$ = 1.0 Amp, $I_{REC}$ = 0.25 Amp) | $t_{rr}$ | <br>35<br>25 | <br>60<br>50 | | ns |

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%

## MUR1610CT, MUR1615CT, MUR1620CT

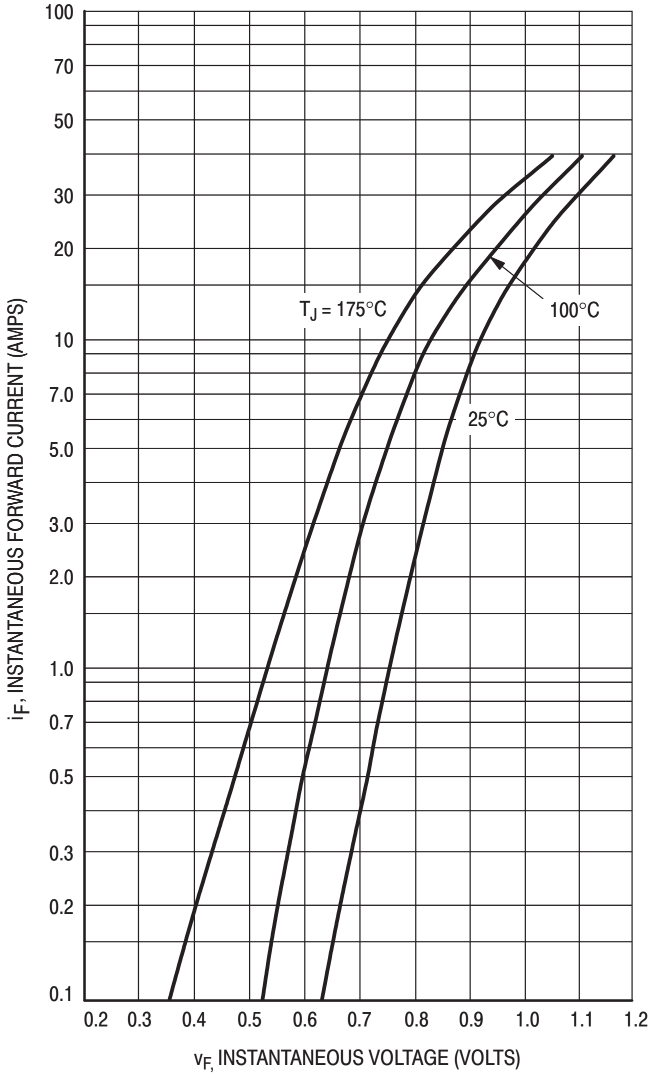


**Figure 1. Typical Forward Voltage, Per Leg**

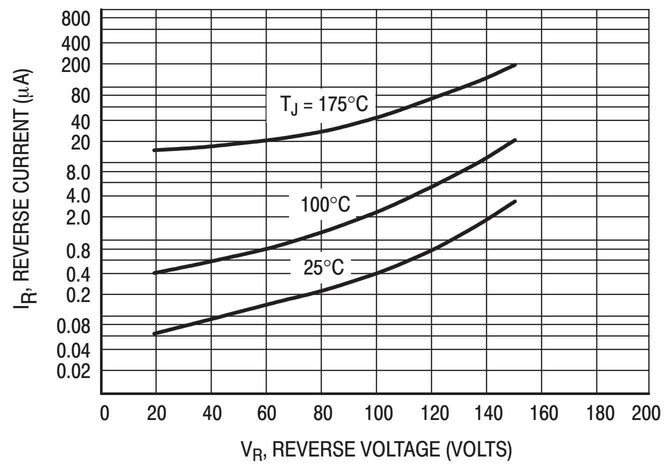


**Figure 2. Typical Reverse Current, Per Leg***

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if $V_R$ is sufficiently below rated $V_R$.

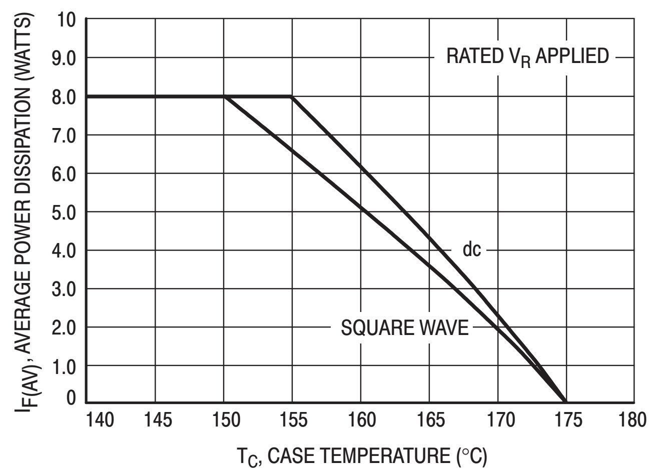


**Figure 3. Current Derating, Case, Per Leg**

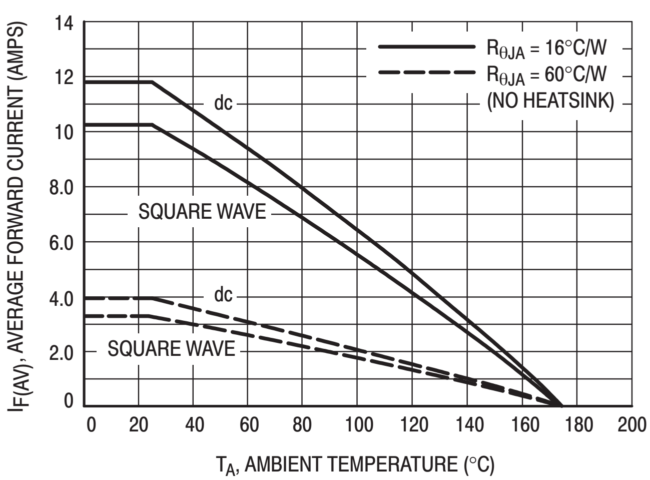


**Figure 4. Current Derating, Ambient, Per Leg**

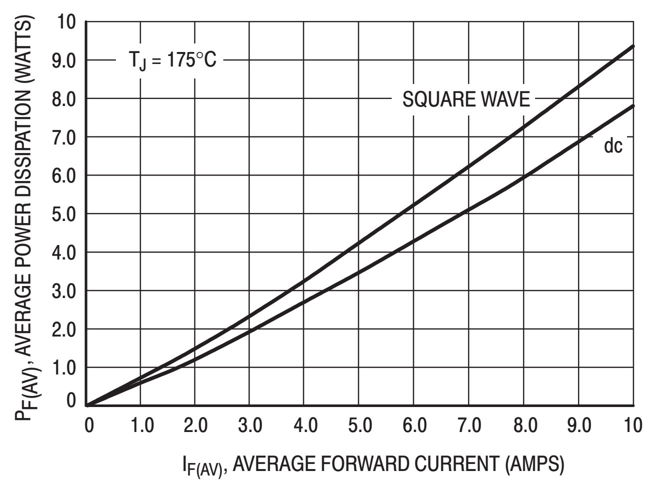


**Figure 5. Power Dissipation, Per Leg**

## MUR1640CT

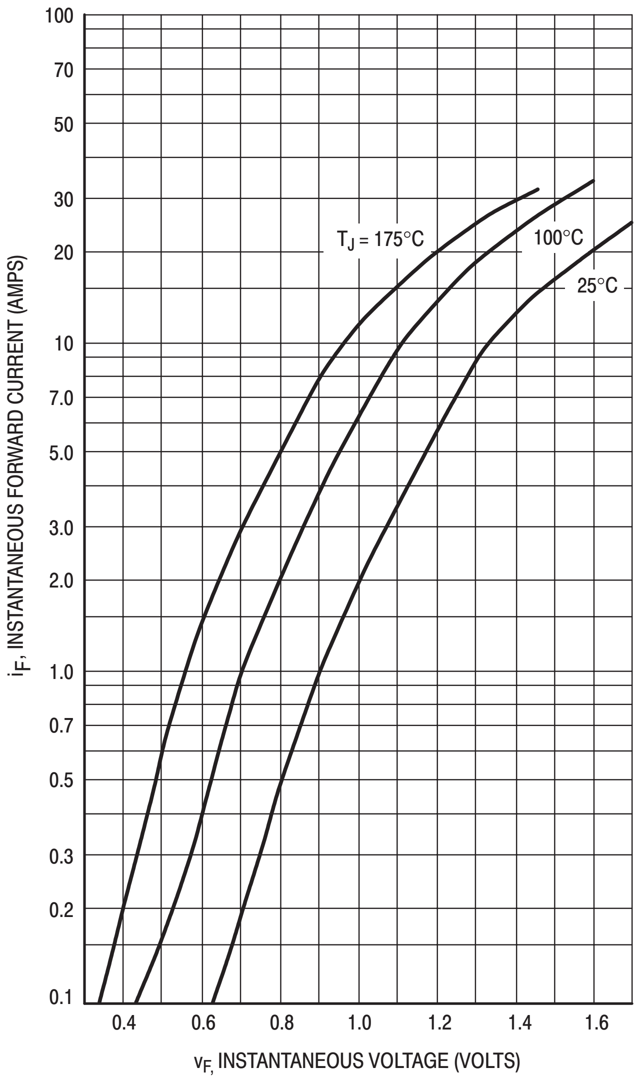


**Figure 6. Typical Forward Voltage, Per Leg**

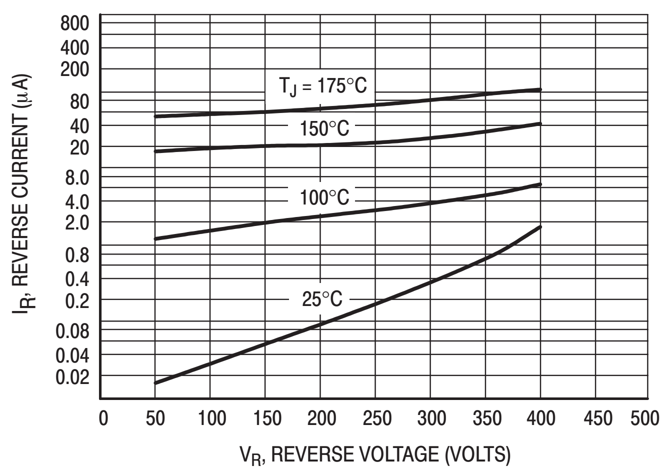


**Figure 7. Typical Reverse Current, Per Leg***

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these curves if $V_R$ is sufficiently below rated $V_R$.

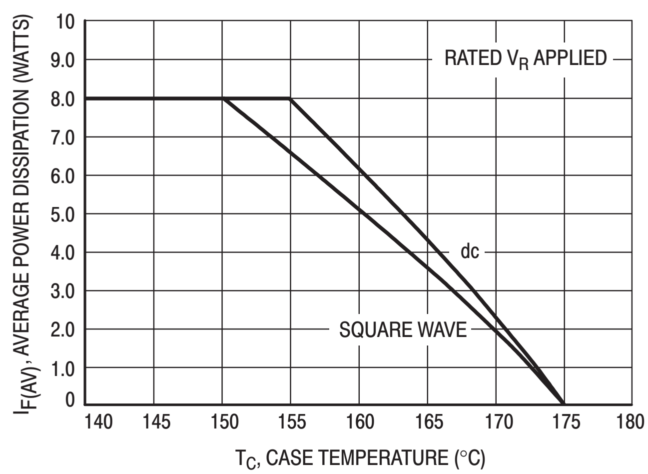


**Figure 8. Current Derating, Case, Per Leg**

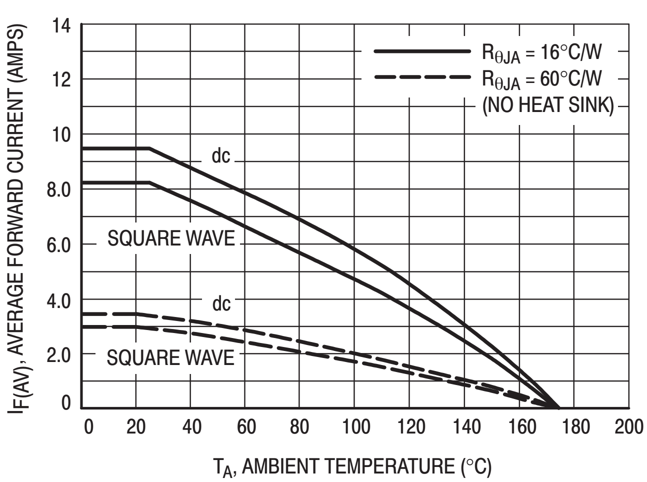


**Figure 9. Current Derating, Ambient, Per Leg**

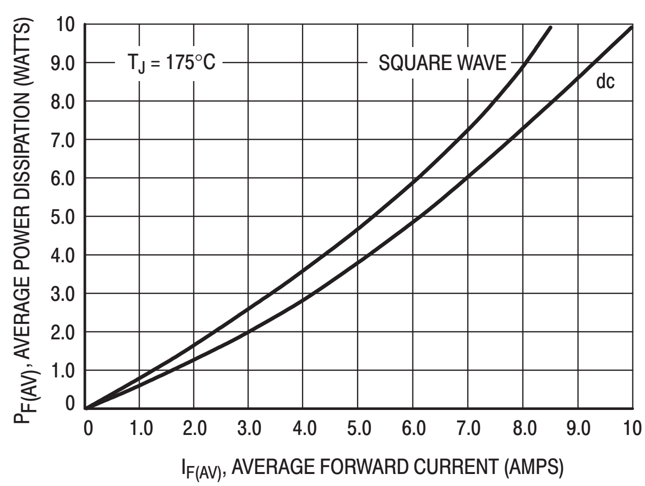


**Figure 10. Power Dissipation, Per Leg**

## MUR1660CT

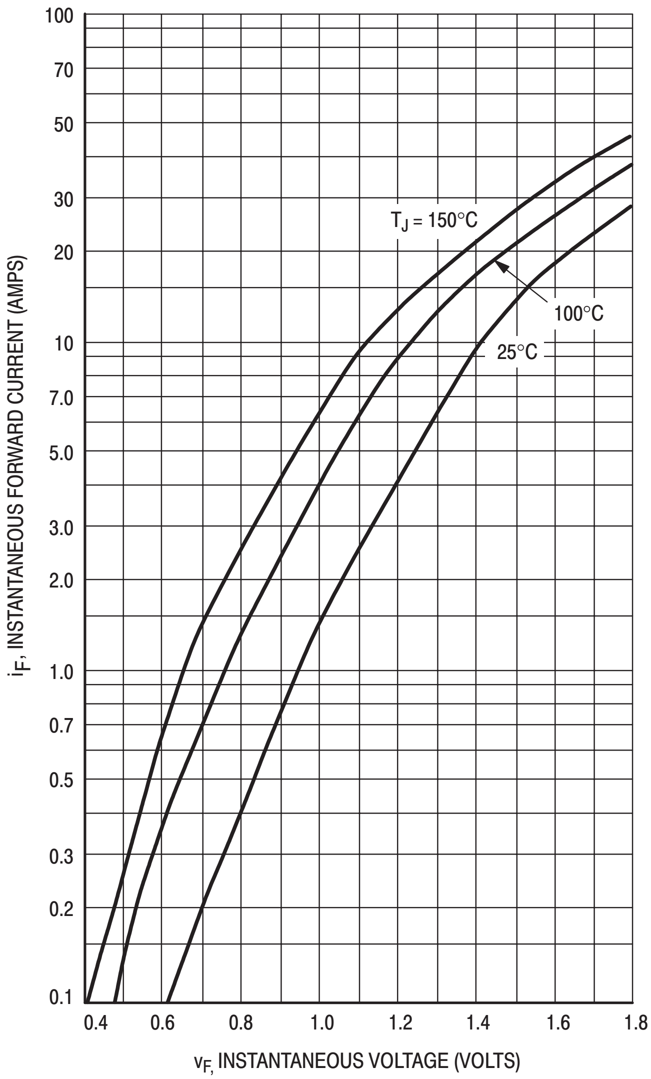


**Figure 11. Typical Forward Voltage, Per Leg**

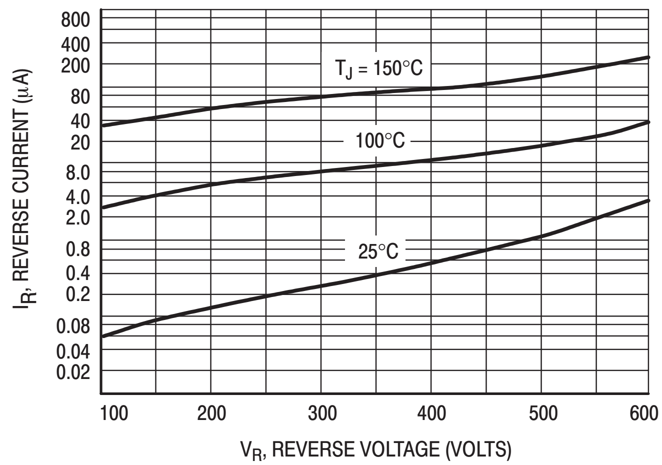


**Figure 12. Typical Reverse Current, Per Leg***

* The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if $V_R$ is sufficiently below rated $V_R$.

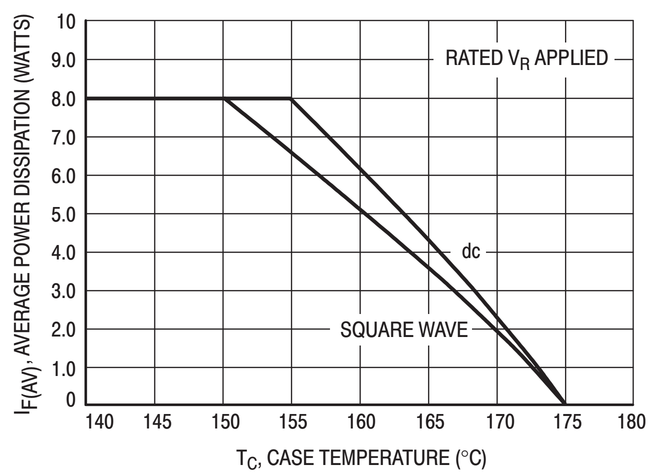


**Figure 13. Current Derating, Case, Per Leg**

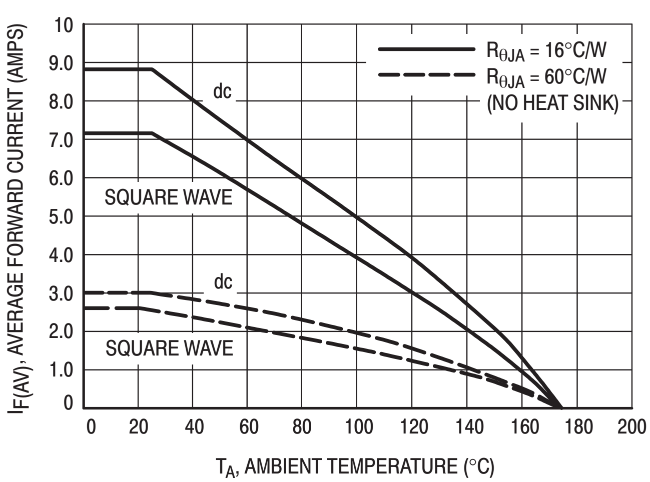


**Figure 14. Current Derating, Ambient, Per Leg**

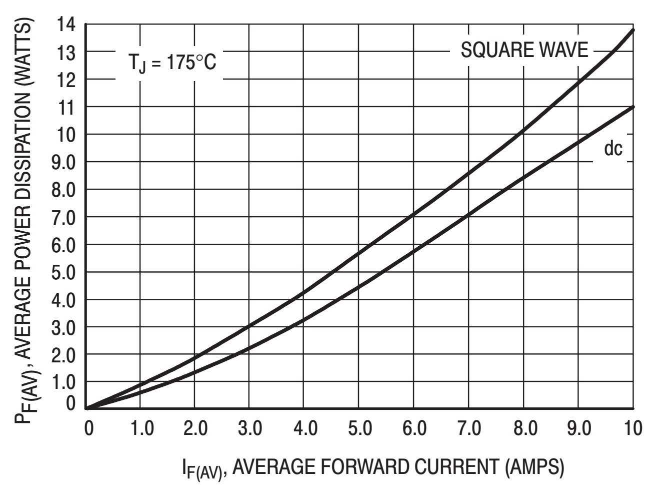


**Figure 15. Power Dissipation, Per Leg**

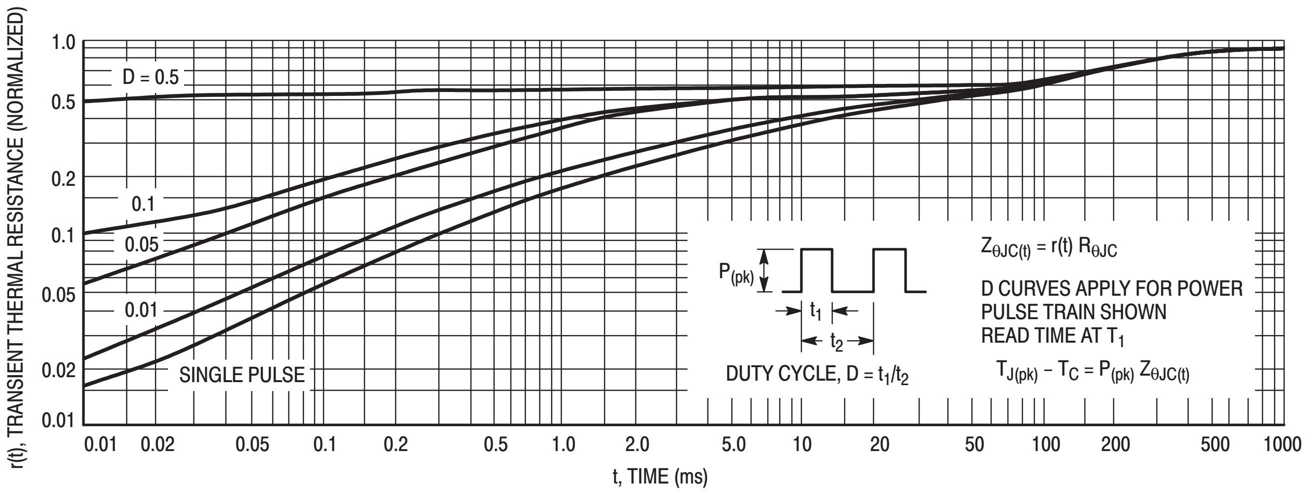


**Figure 16. Thermal Response**

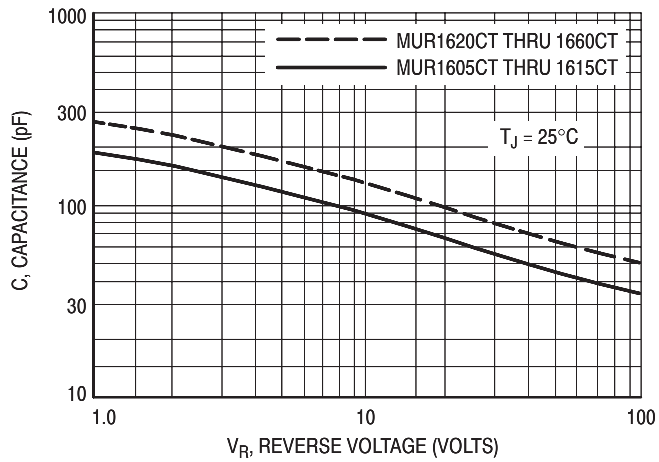


**Figure 17. Typical Capacitance, Per Leg**

# MUR1620CTR

**Preferred Device**

# SWITCHMODE™ Dual Ultrafast Power Rectifier

. . . designed for use in negative switching power supplies, inverters and as free wheeling diodes. Also, used in conjunction with common cathode dual Ultrafast Rectifiers, makes a single phase full–wave bridge. These state–of–the–art devices have the following features:

- Common Anode Dual Rectifier (8.0 A per Leg or 16 A per Package)
- Ultrafast 35 Nanosecond Reverse Recovery Times
- Exhibits Soft Recovery Characteristics
- High Temperature Glass Passivated Junction
- Low Leakage Specified @ 150°C Case Temperature
- Current Derating @ Both Case and Ambient Temperatures
- Epoxy Meets UL94, $V_O$ @ 1/8″
- Complement to MUR1620CT Common Cathode Device

**Mechanical Characteristics:**
- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U1620R

**MAXIMUM RATINGS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 200 | V |
| Average Rectified Forward Voltage (Rated $V_R$, $T_C$ = 160°C) Per Leg<br>Per Total Device | $I_{F(AV)}$ | 8.0<br>16 | A |
| Peak Repetitive Surge Current (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 140°C) Per Diode | $I_{FM}$ | 16 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 100 | A |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | °C |

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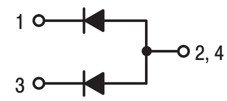
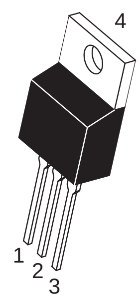
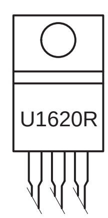
**ULTRAFAST RECTIFIER**
**16 AMPERES**
**200 VOLTS**




**TO–220AB**
**CASE 221A**
**STYLE 7**

**MARKING DIAGRAM**




U1620R = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MUR1620CTR | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction to Case | $R_{\theta JC}$ | 2.0 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| | | | |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 8.0 Amps, $T_C$ = 25°C)<br>($i_F$ = 8.0 Amps, $T_C$ = 150°C) | $v_F$ | <br>1.2<br>1.1 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_C$ = 25°C)<br>(Rated dc Voltage, $T_C$ = 150°C) | $i_R$ | <br>5.0<br>500 | μA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1.0 Amp, di/dt = 50 Amps/μs)<br>($I_F$ = 0.5 Amp, di/dt = 100 Amps/μs) | $t_{rr}$ | <br>85<br>35 | ns |

1. Pulse Test: Pulse Width = 5.0 ms, Duty Cycle ≤ 10%.

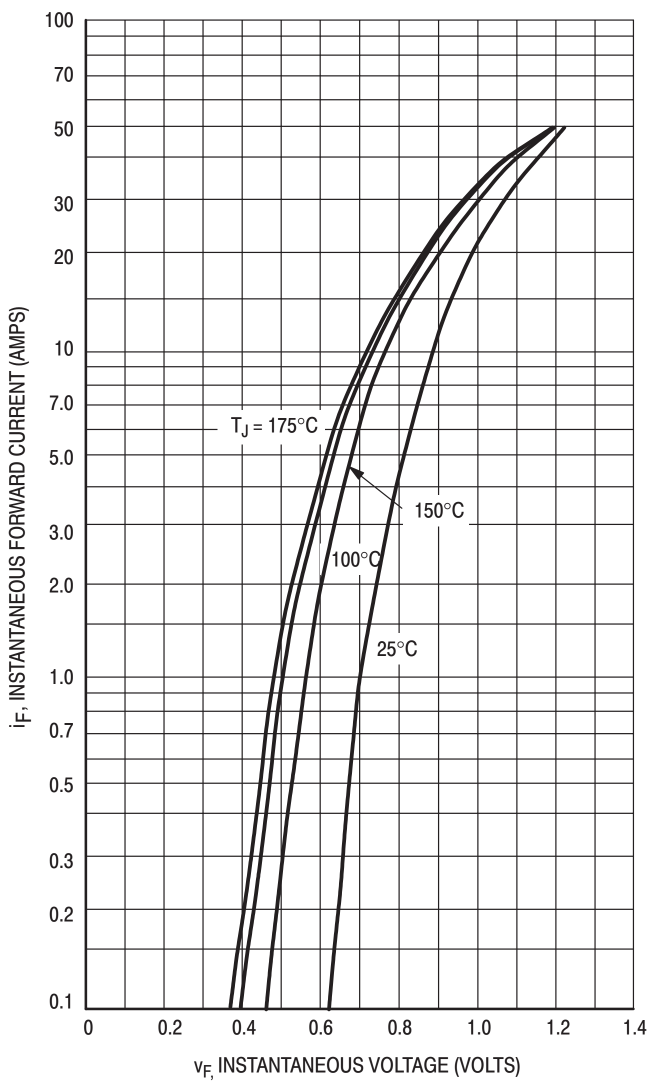



**Figure 1. Typical Forward Voltage (Per Leg)**

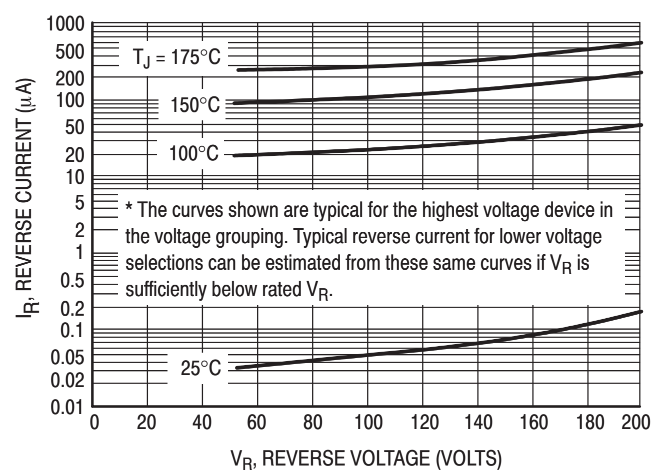



**Figure 2. Typical Reverse Current* (Per Leg)**

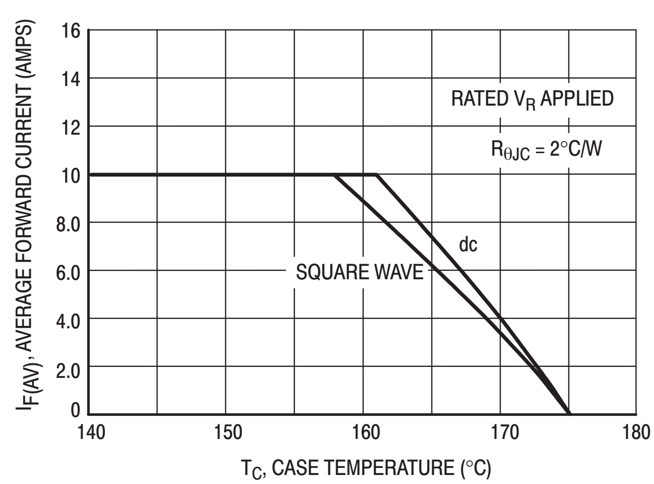



**Figure 3. Current Derating, Case (Per Leg)**

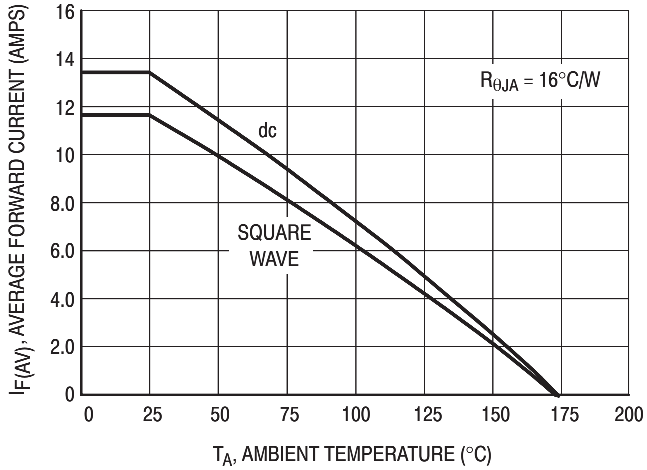



**Figure 4. Current Derating, Ambient (Per Leg)**

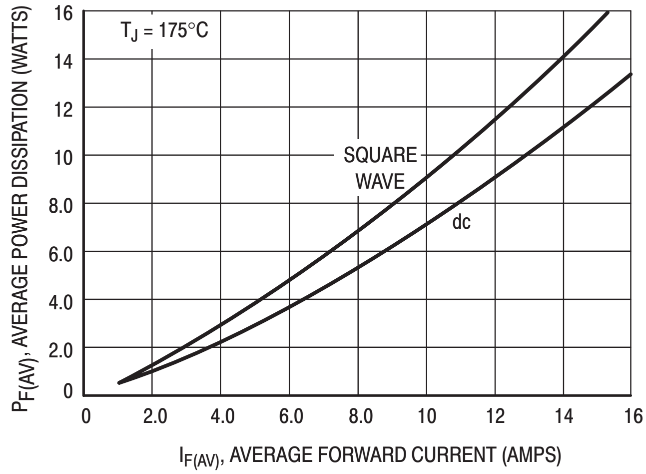



**Figure 5. Power Dissipation (Per Leg)**

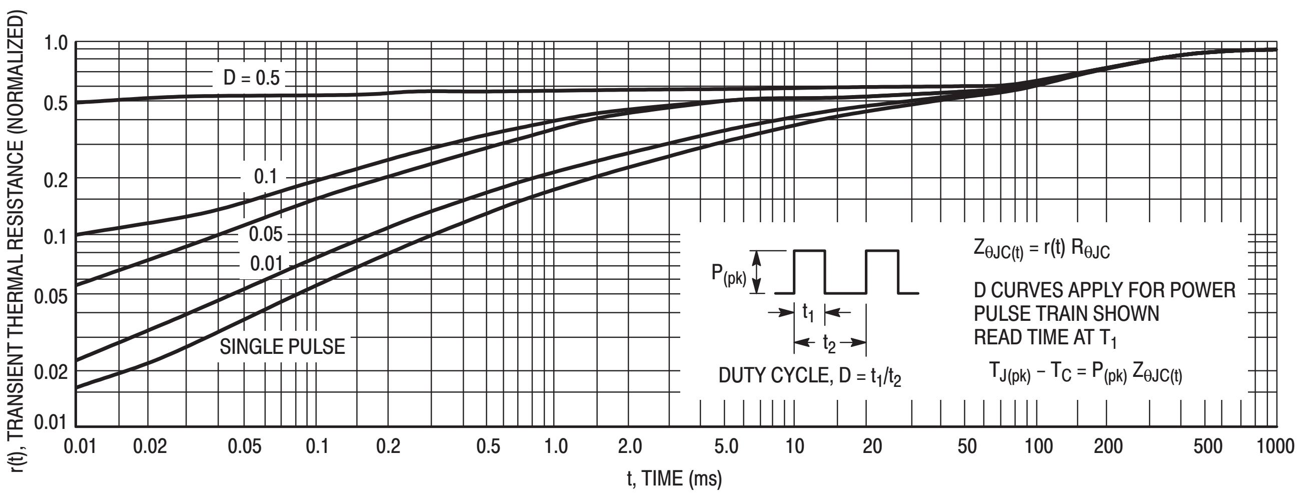



**Figure 6. Thermal Response**

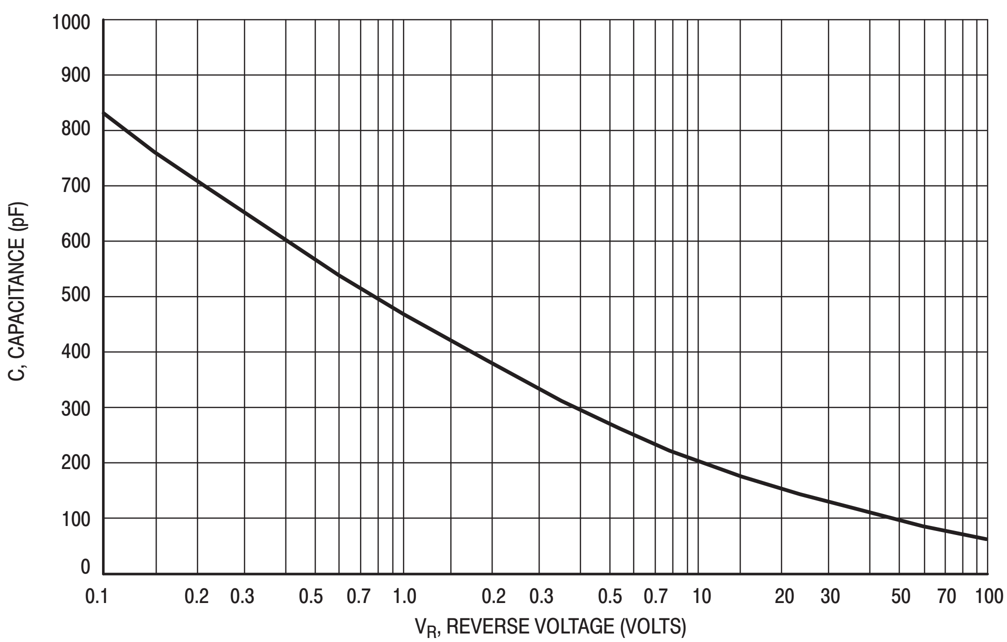



**Figure 7. Typical Capacitance (Per Leg)**

# MURF1620CT

**Preferred Device**

# SWITCHMODE™ Power Rectifier

Designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 35 Nanosecond Recovery Times
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, $V_O$ @ 1/8″
- High Temperature Glass Passivated Junction
- Low Leakage Specified @ 150°C Case Temperature
- Current Derating @ Both Case and Ambient Temperatures
- Electrically Isolated. No Isolation Hardware Required.
- UL Recognized File #E69369 (Note 1.)

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U1620

**MAXIMUM RATINGS**

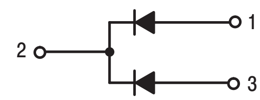
| Please See the Table on the Following Page |
|---|

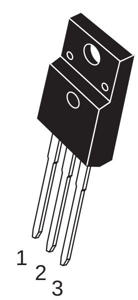
1. UL Recognized mounting method is per Figure 4.

**ON Semiconductor™**

**http://onsemi.com**

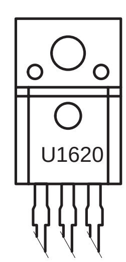
**ULTRAFAST RECTIFIER 16 AMPERES 200 VOLTS**




**ISOLATED TO–220**
**CASE 221D**
**STYLE 3**

**MARKING DIAGRAM**




U1620 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MURF1620CT | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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**MAXIMUM RATINGS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 200 | Volts |
| Average Rectified Forward Current<br>Total Device, (Rated $V_R$), $T_C$ = 150°C   Total Device | $I_{F(AV)}$ | 8<br>16 | Amps |
| Peak Repetitive Forward Current<br>(Rated $V_R$, Square Wave, 20 kHz), $T_C$ = 150°C | $I_{FM}$ | 16 | Amps |
| Non–repetitive Peak Surge Current<br>(Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 100 | Amps |
| Operating Junction and Storage Temperature | $T_J$, $T_{stg}$ | – 65 to +150 | °C |
| RMS Isolation Voltage (t = 1 second, R.H. ≤ 30%, $T_A$ = 25°C) (Note 3.)   Per Figure 3.<br>Per Figure 4. (Note 2.)<br>Per Figure 5. | $V_{iso1}$<br>$V_{iso2}$<br>$V_{iso3}$ | 4500<br>3500<br>1500 | Volts |

**THERMAL CHARACTERISTICS** (Per Leg)

| | | | |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 4.2 | °C/W |
| Lead Temperature for Soldering<br>Purposes: 1/8″ from the Case for 5 seconds | $T_L$ | 260 | °C |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 4.)<br>($i_F$ = 8.0 Amp, $T_C$ = 150°C)<br>($i_F$ = 8.0 Amp, $T_C$ = 25°C) | $v_F$ | <br>0.895<br>0.975 | Volts |
| Maximum Instantaneous Reverse Current (Note 4.)<br>(Rated dc Voltage, $T_C$ = 150°C)<br>(Rated dc Voltage, $T_C$ = 25°C) | $i_R$ | <br>250<br>5.0 | µA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1.0 Amp, di/dt = 50 Amp/µs)<br>($I_F$ = 0.5 Amp, $i_R$ = 1.0 Amp, $I_{REC}$ = 0.25 Amp) | $t_{rr}$ | <br>35<br>25 | ns |

2. UL Recognized mounting method is per Figure 4.
3. Proper strike and creepage distance must be provided.
4. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%.

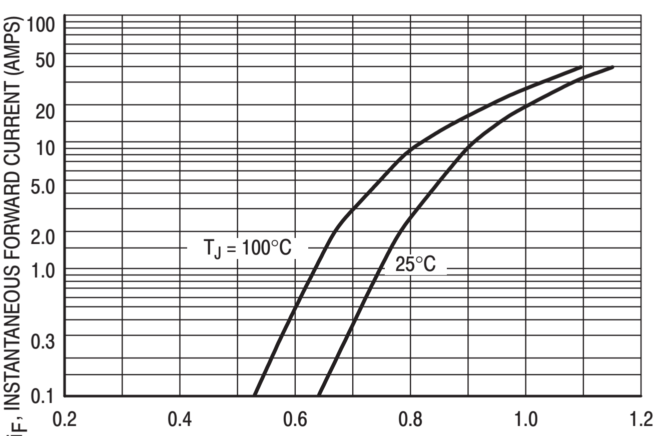



**Figure 1. Typical Forward Voltage, Per Leg**

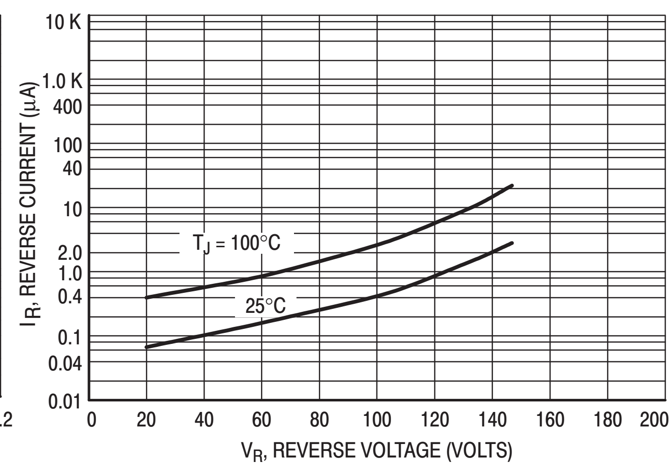



**Figure 2. Typical Reverse Current, Per Leg***

## TEST CONDITIONS FOR ISOLATION TESTS*

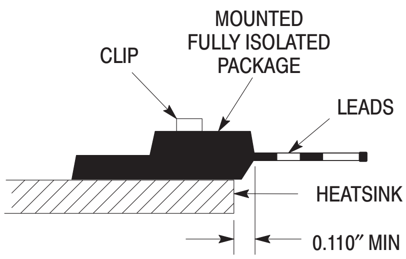



**Figure 3. Clip Mounting Position for Isolation Test Number 1**

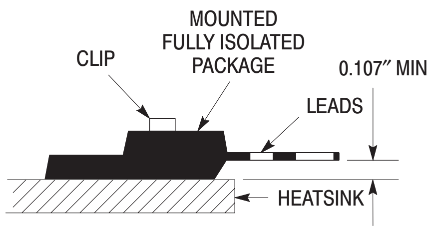



**Figure 4. Clip Mounting Position for Isolation Test Number 2**

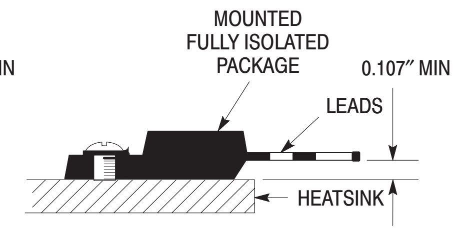
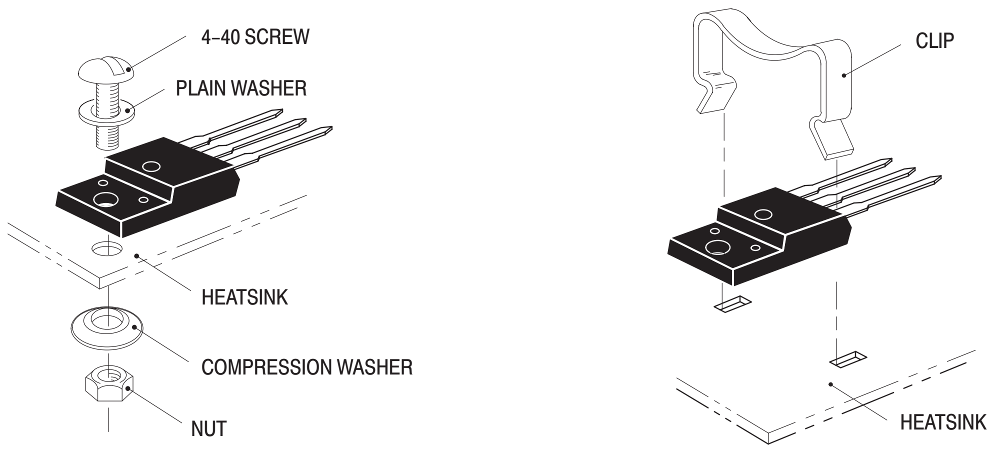



**Figure 5. Screw Mounting Position for Isolation Test Number 3**

* Measurement made between leads and heatsink with all leads shorted together.

## MOUNTING INFORMATION**




**6a. Screw–Mounted** **6b. Clip–Mounted**

**Figure 6. Typical Mounting Techniques**

Laboratory tests on a limited number of samples indicate, when using the screw and compression washer mounting technique, a screw torque of 6 to 8 in · lbs is sufficient to provide maximum power dissipation capability. The compression washer helps to maintain a constant pressure on the package over time and during large temperature excursions.

Destructive laboratory tests show that using a hex head 4–40 screw, without washers, and applying a torque in excess of 20 in · lbs will cause the plastic to crack around the mounting hole, resulting in a loss of isolation capability.

Additional tests on slotted 4–40 screws indicate that the screw slot fails between 15 to 20 in · lbs without adversely affecting the package. However, in order to positively ensure the package integrity of the fully isolated device, ON Semiconductor does not recommend exceeding 10 in · lbs of mounting torque under any mounting conditions.

**For more information about mounting power semiconductors see Application Note AN1040.

# MURHF860CT

**Preferred Device**

# SWITCHMODE™ Power Rectifier

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state-of-the-art devices have the following features:

- Ultrafast 35 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Electrically Isolated. No Isolation Hardware Required.
- Epoxy Meets UL94, $V_O$ @ 1/8″
- High Temperature Glass Passivated Junction
- High Voltage Capability to 600 Volts
- Low Leakage Specified @ 150°C Case Temperature

### Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: UH860

**MAXIMUM RATINGS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 600 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_C$ = 120°C) Total Device | $I_{F(AV)}$ | 4.0<br>8.0 | A |
| Peak Repetitive Forward Current (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 120°C) | $I_{FM}$ | 16 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 100 | A |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +150 | °C |

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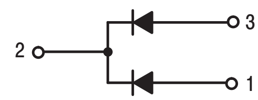
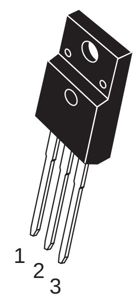
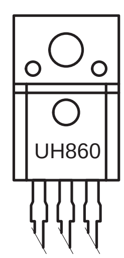
**ULTRAFAST RECTIFIER 8.0 AMPERES 600 VOLTS**




**ISOLATED TO–220**
**CASE 221D**
**STYLE 4**

**MARKING DIAGRAM**




UH860 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MURHF860CT | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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**THERMAL CHARACTERISTICS** (Per Leg)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 4.1 | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 4.0 Amps, $T_C$ = 150°C)<br>($i_F$ = 4.0 Amps, $T_C$ = 25°C) | $v_F$ | <br>2.5<br>2.8 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_C$ = 150°C)<br>(Rated dc Voltage, $T_C$ = 25°C) | $i_R$ | <br>500<br>10 | μA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1.0 Amp, di/dt = 50 Amps/μs) | $t_{rr}$ | 35 | ns |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

# MURF1660CT

**Preferred Device**

# SWITCHMODE™ Power Rectifier

Designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 60 Nanosecond Recovery Times
- 150°C Operating Junction Temperature
- Epoxy Meets UL94, $V_O$ @ 1/8″
- High Temperature Glass Passivated Junction
- Low Leakage Specified @ 150°C Case Temperature
- Current Derating @ Both Case and Ambient Temperatures
- Electrically Isolated. No Isolation Hardware Required.
- UL Recognized File #E69369 (Note 1.)

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 1.9 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 50 units per plastic tube
- Marking: U1660

**MAXIMUM RATINGS**

| |
|---|
| Please See the Table on the Following Page |

1. UL Recognized mounting method is per Figure 4.

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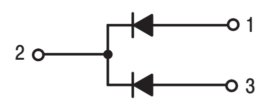
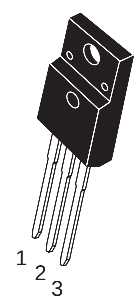
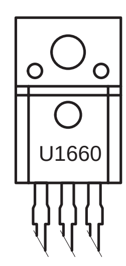
**ULTRAFAST RECTIFIER 16 AMPERES 600 VOLTS**




**ISOLATED TO–220**
**CASE 221D**
**STYLE 3**

**MARKING DIAGRAM**




U1660 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MURF1660CT | TO–220 | 50 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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**MAXIMUM RATINGS** (Per Leg)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 600 | Volts |
| Average Rectified Forward Current — Per Diode<br>Total Device, (Rated $V_R$), $T_C$ = 150°C — Per Device | $I_{F(AV)}$ | 8<br>16 | Amps |
| Peak Repetitive Forward Current<br>(Rated $V_R$, Square Wave, 20 kHz), $T_C$ = 150°C | $I_{FM}$ | 16 | Amps |
| Non–repetitive Peak Surge Current<br>(Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 100 | Amps |
| Operating Junction and Storage Temperature | $T_J$, $T_{stg}$ | – 65 to +150 | °C |
| RMS Isolation Voltage (t = 1 second, R.H. ≤ 30%, $T_A$ = 25°C) (Note 3.) Per Figure 3.<br>Per Figure 4. (Note 2.)<br>Per Figure 5. | $V_{iso1}$<br>$V_{iso2}$<br>$V_{iso3}$ | 4500<br>3500<br>1500 | Volts |

**THERMAL CHARACTERISTICS** (Per Leg)

| | | | |
|---|---|---|---|
| Maximum Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 3.0 | °C/W |
| Lead Temperature for Soldering<br>Purposes: 1/8″ from Case for 5 Seconds | $T_L$ | 260 | °C |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 4.)<br>($i_F$ = 8.0 Amp, $T_C$ = 150°C)<br>($i_F$ = 8.0 Amp, $T_C$ = 25°C) | $v_F$ | <br>1.20<br>1.50 | Volts |
| Maximum Instantaneous Reverse Current (Note 4.)<br>(Rated dc Voltage, $T_C$ = 150°C)<br>(Rated dc Voltage, $T_C$ = 25°C) | $i_R$ | <br>500<br>10 | μA |
| Maximum Reverse Recovery Time<br>($I_F$ = 1.0 Amp, di/dt = 50 Amp/μs)<br>($I_F$ = 0.5 Amp, $i_R$ = 1.0 Amp, $I_{REC}$ = 0.25 Amp) | $t_{rr}$ | <br>60<br>50 | ns |

2. UL Recognized mounting method is per Figure 4.
3. Proper strike and creepage distance must be provided.
4. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

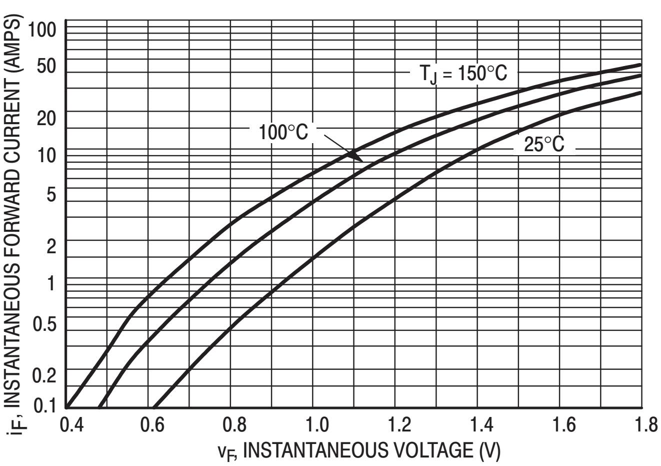



**Figure 1. Typical Forward Voltage, Per Leg**

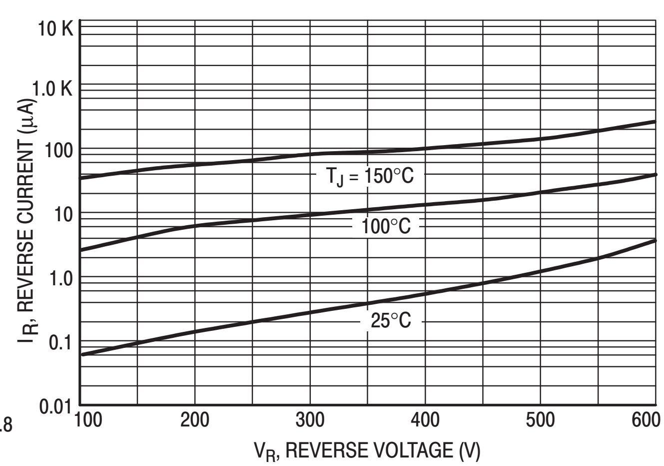



**Figure 2. Typical Reverse Current, Per Leg***

## TEST CONDITIONS FOR ISOLATION TESTS*

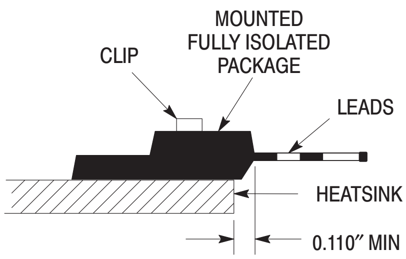



**Figure 3. Clip Mounting Position for Isolation Test Number 1**

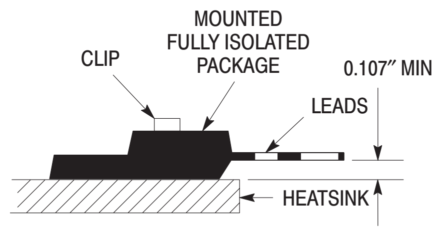



**Figure 4. Clip Mounting Position for Isolation Test Number 2**

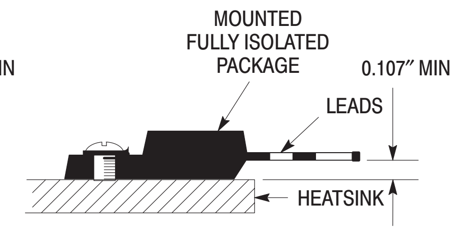
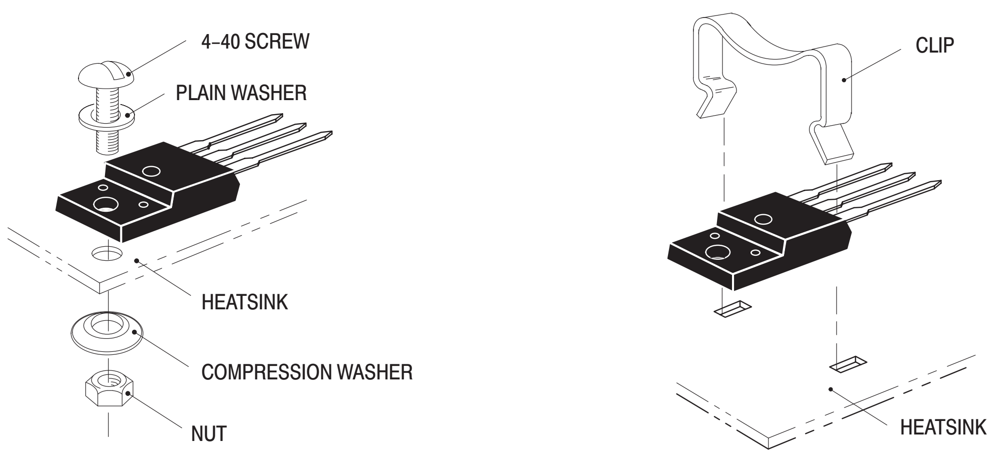



**Figure 5. Screw Mounting Position for Isolation Test Number 3**

* Measurement made between leads and heatsink with all leads shorted together.

## MOUNTING INFORMATION**




**6a. Screw–Mounted**

**6b. Clip–Mounted**

**Figure 6. Typical Mounting Techniques**

Laboratory tests on a limited number of samples indicate, when using the screw and compression washer mounting technique, a screw torque of 6 to 8 in · lbs is sufficient to provide maximum power dissipation capability. The compression washer helps to maintain a constant pressure on the package over time and during large temperature excursions.

Destructive laboratory tests show that using a hex head 4–40 screw, without washers, and applying a torque in excess of 20 in · lbs will cause the plastic to crack around the mounting hole, resulting in a loss of isolation capability.

Additional tests on slotted 4–40 screws indicate that the screw slot fails between 15 to 20 in · lbs without adversely affecting the package. However, in order to positively ensure the package integrity of the fully isolated device, ON Semiconductor does not recommend exceeding 10 in · lbs of mounting torque under any mounting conditions.

**For more information about mounting power semiconductors see Application Note AN1040.

# MUR3040

**Preferred Device**

# SWITCHMODE™ Power Rectifier

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 100 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- High Voltage Capability to 400 Volts
- Low Forward Voltage Drop
- High Temperature Glass Passivated Junction

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 30 Units Per Plastic Tube
- Marking: U3040

**MAXIMUM RATINGS**

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 400 | V |
| Average Rectified Forward Current $T_C$ = 70°C | $I_{F(AV)}$ | 30 | A |
| Peak Repetitive Forward Current (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 150°C) | $I_{FRM}$ | 30 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 300 | A |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | °C |

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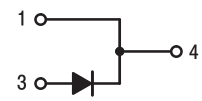
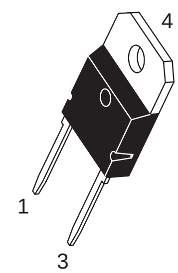
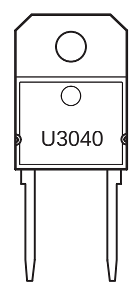
**ULTRAFAST RECTIFIER 30 AMPERES 400 VOLTS**




**TO–218**
**CASE 340E**
**STYLE 1**

**MARKING DIAGRAM**




U3040 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MUR3040 | TO–218 | 30 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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### THERMAL CHARACTERISTICS

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.0 | °C/W |

### ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.)<br>@ $I_F$ = 30 Amps, $T_C$ = 100°C<br>@ $I_F$ = 30 Amps, $T_C$ = 25°C | $V_F$ | <br>1.4<br>1.5 | Volts |
| Instantaneous Reverse Current (Note 1.)<br>@ Rated dc Voltage, $T_C$ = 100°C<br>@ Rated dc Voltage, $T_C$ = 25°C | $I_R$ | <br>6.0<br>35 | <br>mA<br>μA |
| Reverse Recovery Time<br>$I_F$ = 1.0 Amp, dI/dt = 15 Amp/μs | $t_{RR}$ | 100 | ns |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%

## TYPICAL ELECTRICAL CHARACTERISTICS

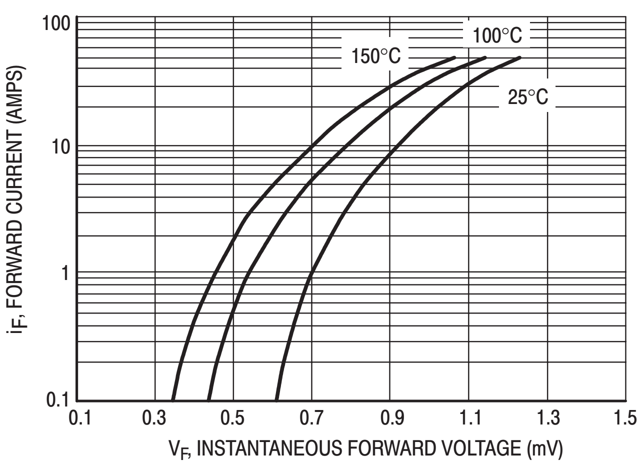


**Figure 1. Typical Forward Voltage**

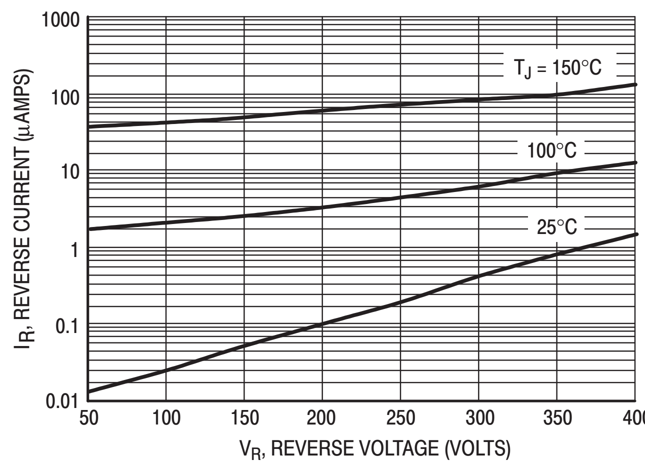


**Figure 2. Typical Reverse Current**

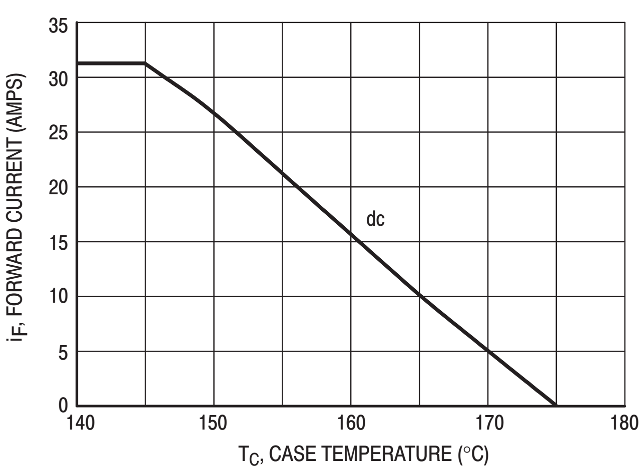


**Figure 3. Current Derating, Case**

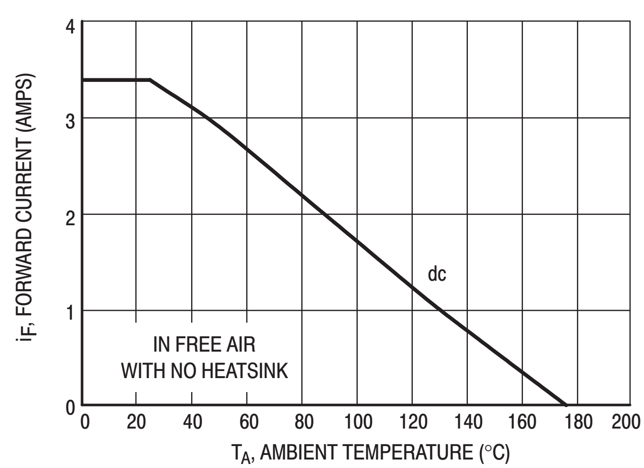


**Figure 4. Current Derating, Ambient**

# MUR3080

Preferred Device

# SWITCHMODE™ Power Rectifier

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 75 ns (Typ) Soft Recovery Time
- 175°C Operating Junction Temperature
- High Voltage Capability to 800 Volts
- Low Forward Voltage Drop
- High Temperature Glass Passivated Junction

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 30 Units Per Plastic Tube
- Marking: U3080

**MAXIMUM RATINGS**

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 800 | V |
| Average Rectified Forward Current (Rated $V_R$, $T_C$ = 70°C) | $I_{F(AV)}$ | 30 | A |
| Peak Repetitive Forward Current (Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 150°C) | $I_{FRM}$ | 30 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 300 | A |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | °C |

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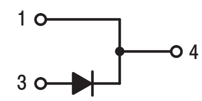
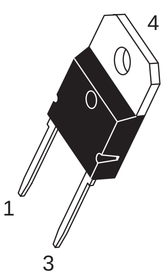
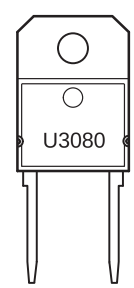
**ULTRAFAST RECTIFIER 30 AMPERES 800 VOLTS**




**TO–218**
**CASE 340E**
**STYLE 1**

**MARKING DIAGRAM**




U3080 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MUR3080 | TO–218 | 30 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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## THERMAL CHARACTERISTICS

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.0 | °C/W |

## ELECTRICAL CHARACTERISTICS (Typical Data)

| | | | |
|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.)<br>@ $I_F$ = 30 Amps, $T_C$ = 25°C<br>@ $I_F$ = 30 Amps, $T_C$ = 100°C | $V_F$ | <br>1.9<br>1.8 | Volts |
| Instantaneous Reverse Current (Note 1.)<br>@ Rated DC Voltage, $T_C$ = 25°C<br>@ Rated DC Voltage, $T_C$ = 100°C | $I_R$ | <br>100<br>5.0 | <br>μA<br>mA |
| Reverse Recovery Time<br>$I_F$ = 1.0 Amp, $V_R$ = 30 V, dI/dt = 50 A/μs | $t_{RR}$ | 110 | ns |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

# MUR6040

**Preferred Device**

# SWITCHMODE™ Power Rectifier

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 100 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- High Voltage Capability to 400 Volts
- Low Forward Voltage Drop
- High Temperature Glass Passivated Junction

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 30 Units Per Plastic Tube
- Marking: U6040

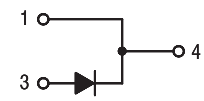
**MAXIMUM RATINGS**

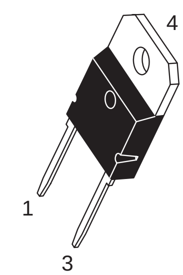
| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 400 | V |
| Average Rectified Forward Current $T_C = 70°C$ | $I_{F(AV)}$ | 60 | A |
| Peak Repetitive Forward Current (Rated $V_R$, Square Wave, 20 kHz, $T_C = 150°C$) | $I_{FRM}$ | 60 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 600 | A |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | °C |

**ON Semiconductor™**

http://onsemi.com

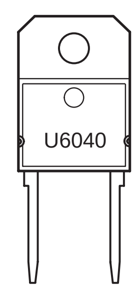
**ULTRAFAST RECTIFIER 60 AMPERES 400 VOLTS**




**TO–218 CASE 340E STYLE 1**

**MARKING DIAGRAM**




U6040 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MUR6040 | TO–218 | 30 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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### THERMAL CHARACTERISTICS

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 0.8 | °C/W |

### ELECTRICAL CHARACTERISTICS

| | | | |
|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.)<br>@ $I_F$ = 60 Amps, $T_C$ = 100°C<br>@ $I_F$ = 60 Amps, $T_C$ = 25°C | $V_F$ | <br>1.4<br>1.5 | Volts |
| Instantaneous Reverse Current (Note 1.)<br>@ Rated dc Voltage, $T_C$ = 100°C<br>@ Rated dc Voltage, $T_C$ = 25°C | $I_R$ | <br>10<br>60 | <br>mA<br>µA |
| Reverse Recovery Time<br>$I_F$ = 1.0 Amp, dI/dt = 15 Amp/µs | $t_{RR}$ | 100 | ns |

1. Pulse Test: Pulse Width = 300 µs, Duty Cycle ≤ 2.0%

## TYPICAL ELECTRICAL CHARACTERISTICS

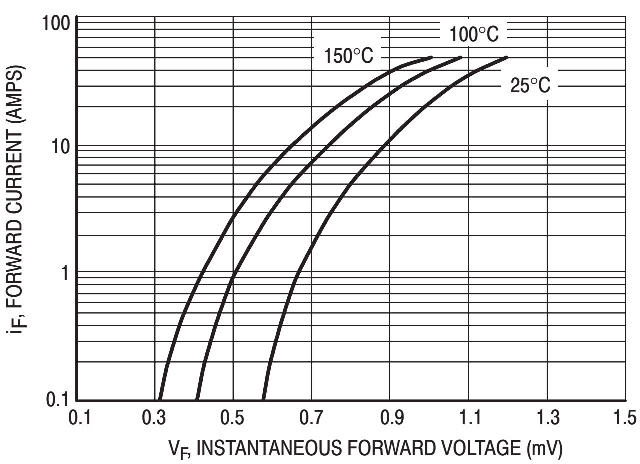


**Figure 1. Typical Forward Voltage**

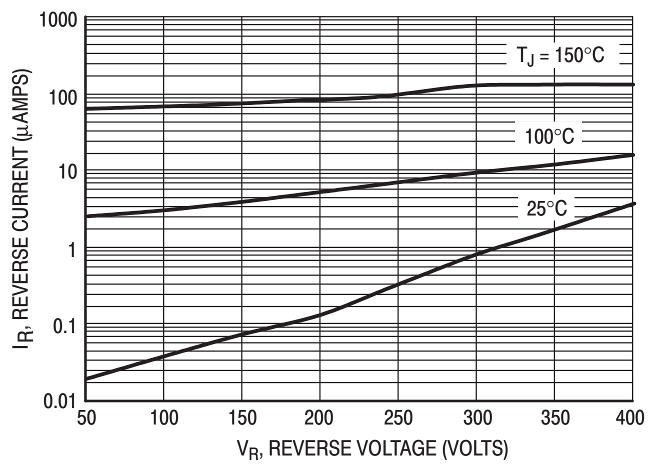


**Figure 2. Typical Reverse Current**

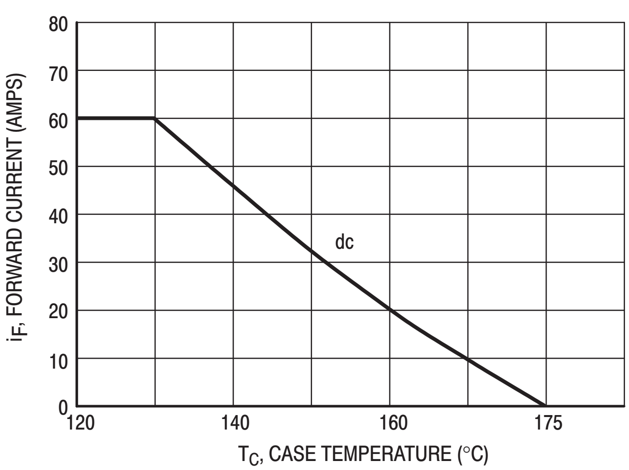


**Figure 3. Current Derating, Case**

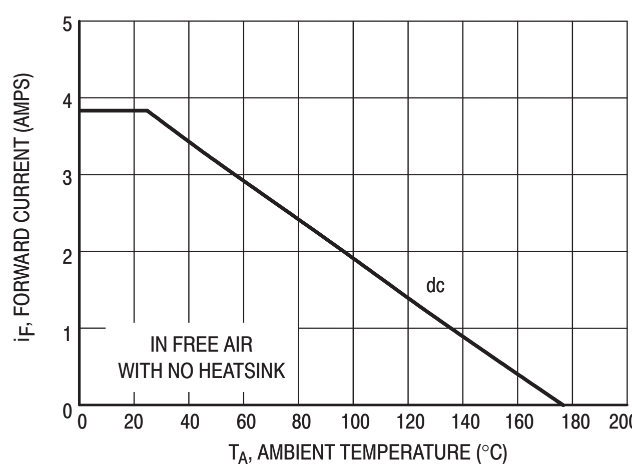


**Figure 4. Current Derating, Ambient**

# MUR3020PT, MUR3040PT, MUR3060PT

## SWITCHMODE™ Power Rectifiers

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 35 and 60 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- High Voltage Capability to 600 Volts
- Low Forward Drop
- Low Leakage Specified @ 150°C Case Temperature
- Current Derating Specified @ Both Case and Ambient Temperatures
- Epoxy Meets UL94, $V_O$ @ 1/8″
- High Temperature Glass Passivated Junction

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 30 units per plastic tube
- Marking: U3020, U3040, U3060

**MAXIMUM RATINGS**

| |
|---|
| Please See the Table on the Following Page |

**ON Semiconductor™**

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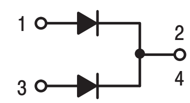
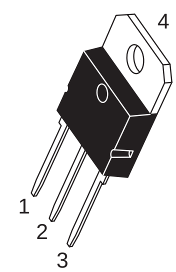
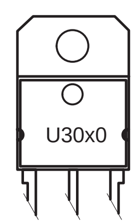
**ULTRAFAST RECTIFIERS 30 AMPERES 200–600 VOLTS**




**TO–218AC**
**CASE 340D**
**STYLE 2**

**MARKING DIAGRAM**




U30x0 = Device Code
x = 2, 4 or 6

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MUR3020PT | SOT–93 | 30 Units/Rail |
| MUR3040PT | SOT–93 | 30 Units/Rail |
| MUR3060PT | SOT–93 | 30 Units/Rail |

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October, 2000 – Rev. 5

Publication Order Number:
MUR3020PT/D

**MAXIMUM RATINGS** (Per Leg)

| Rating | Symbol | MUR3020PT | MUR3040PT | MUR3060PT | Unit |
|---|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 200 | 400 | 600 | Volts |
| Average Rectified Forward Current (Rated $V_R$)<br>Per Leg<br>Per Device | $I_{F(AV)}$ | 15 @ $T_C$ = 150°C<br>30 @ $T_C$ = 150°C | | 15 @ $T_C$ =<br>30 145°C | Amps |
| Peak Rectified Forward Current, Per Leg<br>(Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 150°C) | $I_{FRM}$ | 30<br>@ $T_C$ = 150°C | | 30<br>@ $T_C$ =145°C | Amps |
| Nonrepetitive Peak Surge Current<br>(Surge applied at rated load conditions,<br>halfwave, single phase, 60 Hz) Per Leg | $I_{FSM}$ | 200 | 150 | | Amps |
| Operating Junction and Storage Temperature | $T_J$, $T_{stg}$ | – 65 to +175 | | | °C |

**THERMAL CHARACTERISTICS** (Per Diode Leg)

| Rating | Symbol | MUR3020PT | MUR3040PT | MUR3060PT | Unit |
|---|---|---|---|---|---|
| Maximum Thermal Resistance — Junction to Case<br>— Junction to Ambient | $R_{\theta JC}$<br>$R_{\theta JA}$ | 1.5<br>40 | | | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Diode Leg)

| Rating | Symbol | MUR3020PT | MUR3040PT | MUR3060PT | Unit |
|---|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($I_F$ = 15 Amp, $T_C$ = 150°C)<br>($I_F$ = 15 Amp, $T_C$ = 25°C) | $V_F$ | 0.85<br>1.05 | 1.12<br>1.25 | 1.2<br>1.5 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated DC Voltage, $T_J$ = 150°C)<br>(Rated DC Voltage, $T_J$ = 25°C) | $i_R$ | 500<br>10 | | 1000<br>10 | μA |
| Maximum Reverse Recovery Time<br>($i_F$ = 1.0 Amp, di/dt = 50 Amps/μs) | $t_{rr}$ | 35 | 60 | | ns |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

## MUR3020PT

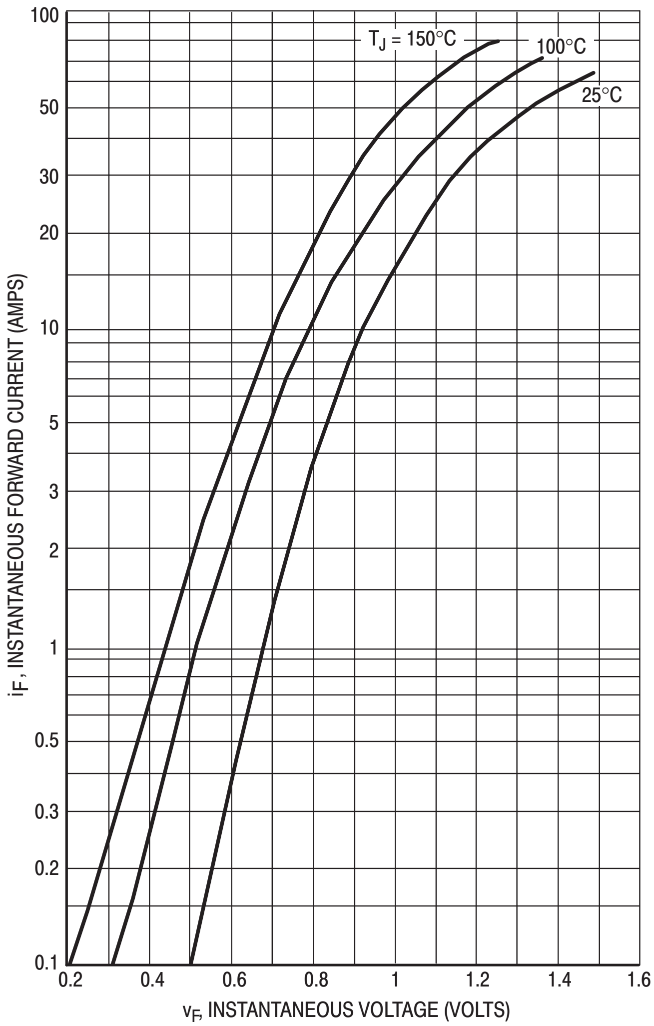



Figure 1. Typical Forward Voltage (Per Leg)

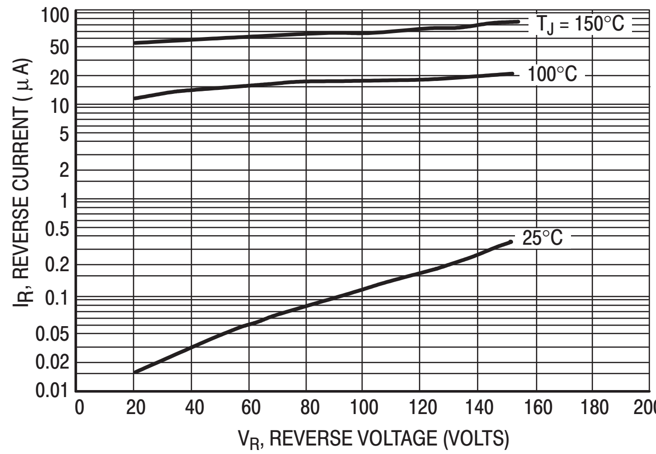



Figure 2. Typical Reverse Current (Per Leg)

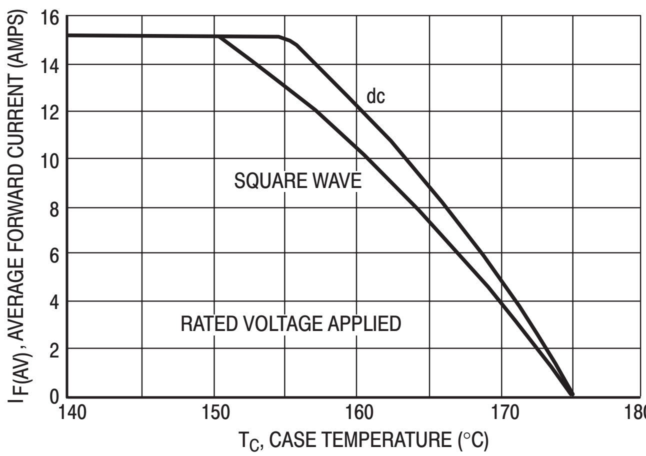



Figure 3. Current Derating, Case (Per Leg)

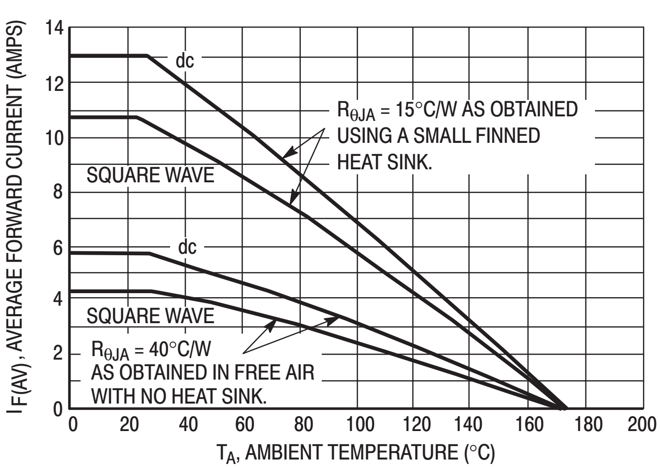



Figure 4. Current Derating, Ambient (Per Leg)

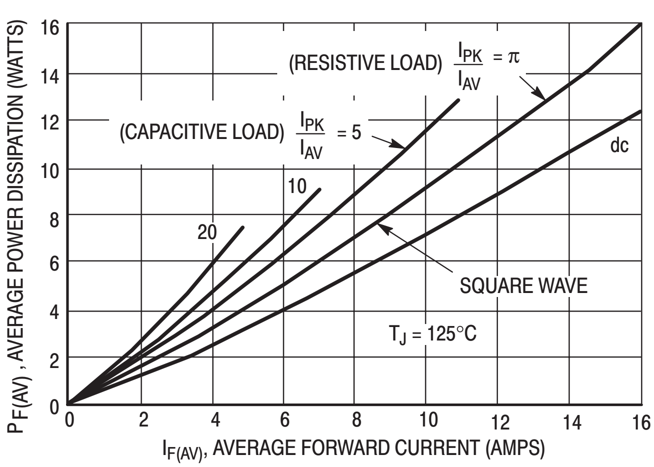



Figure 5. Power Dissipation (Per Leg)

**MUR3040PT**

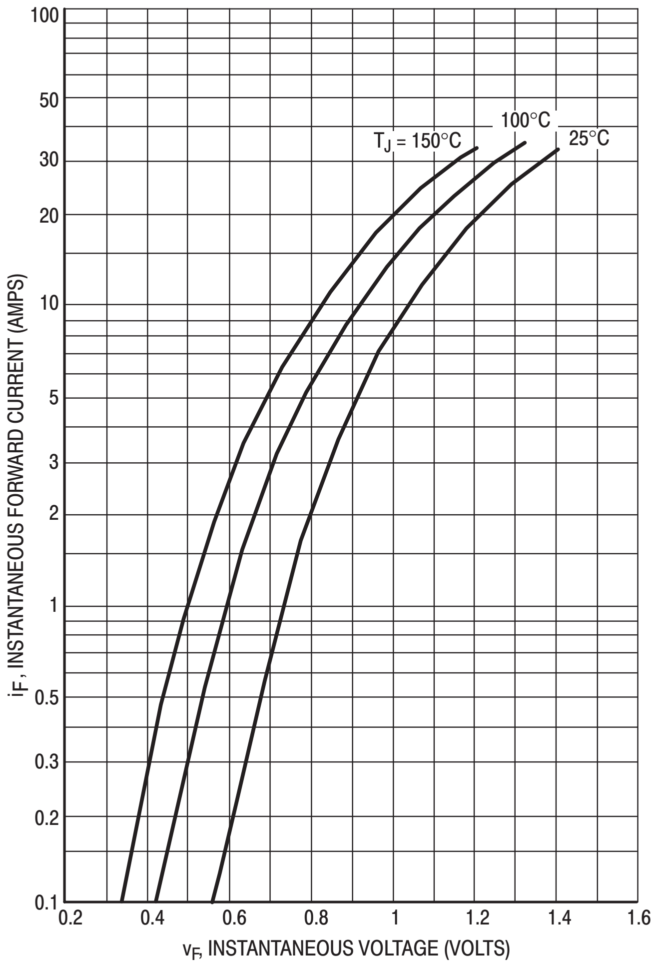



Figure 6. Typical Forward Voltage (Per Leg)

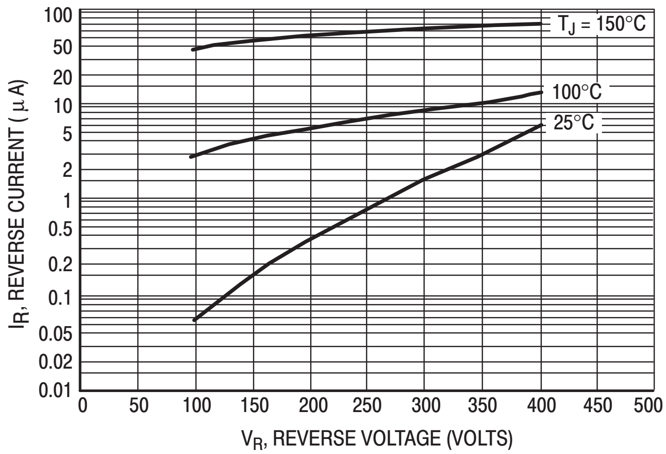



Figure 7. Typical Reverse Current (Per Leg)

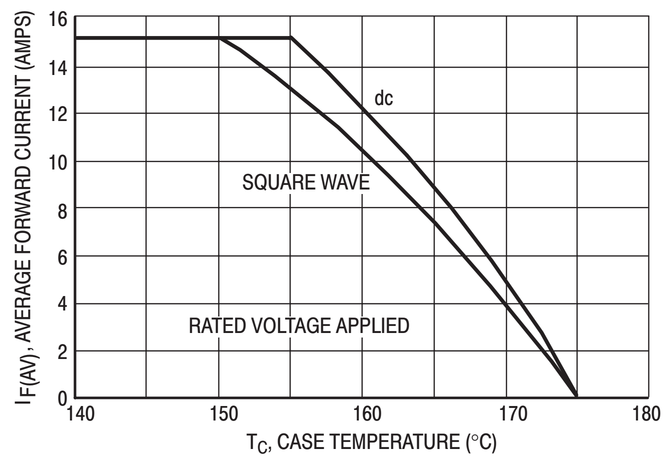



Figure 8. Current Derating, Case (Per Leg)

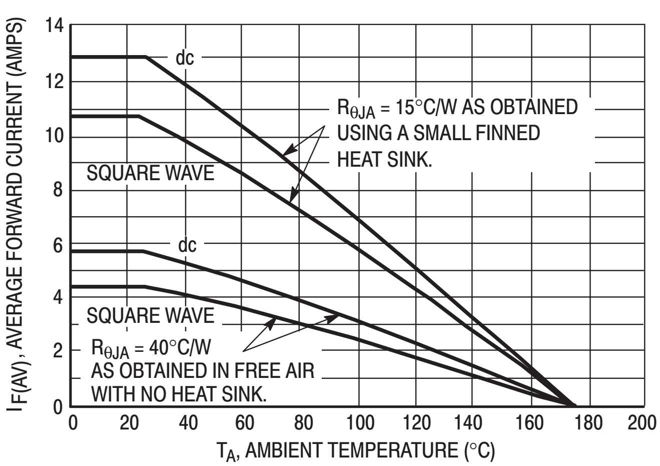



Figure 9. Current Derating, Ambient (Per Leg)

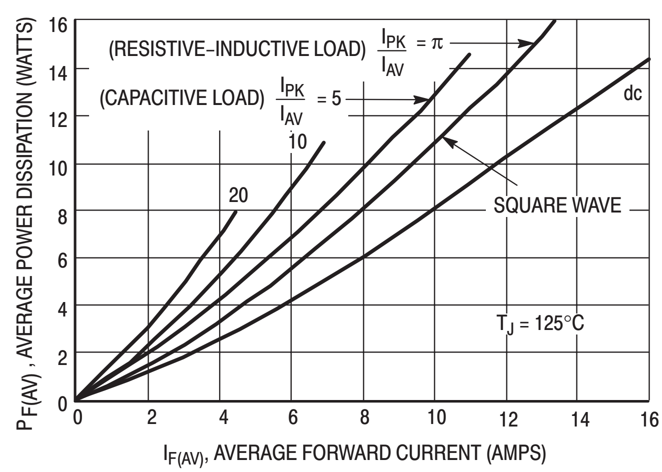



Figure 10. Power Dissipation (Per Leg)

**MUR3060PT**

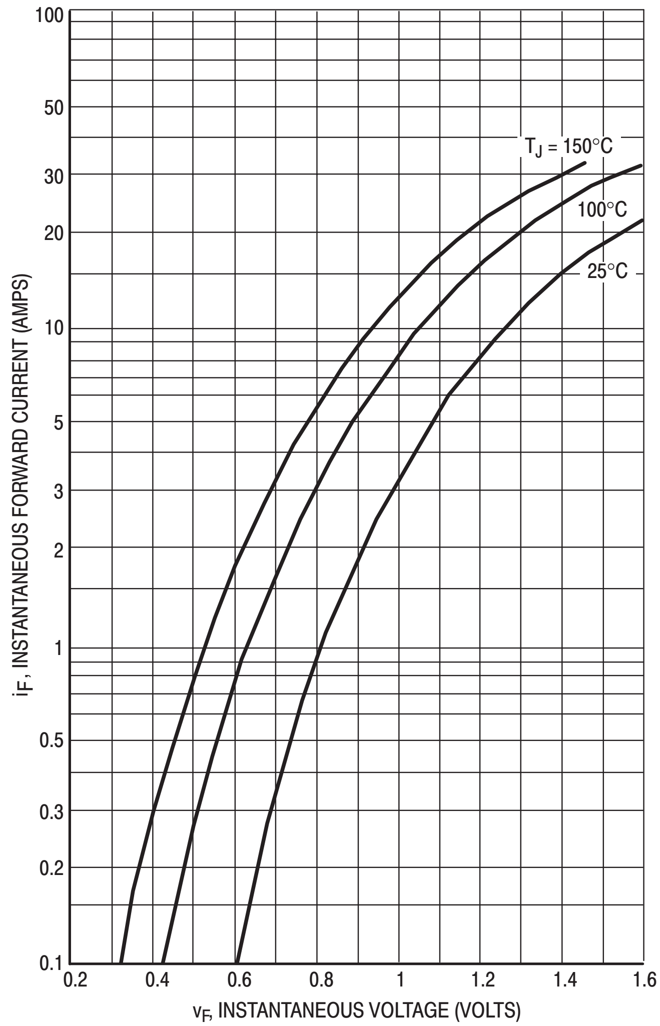



**Figure 11. Typical Forward Voltage (Per Leg)**

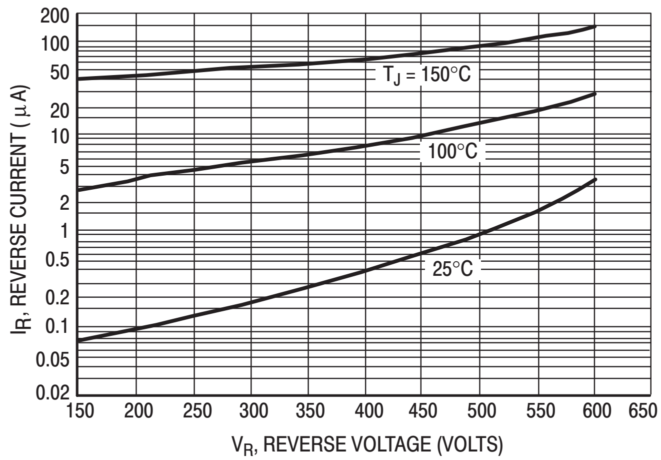



**Figure 12. Typical Reverse Current (Per Leg)**

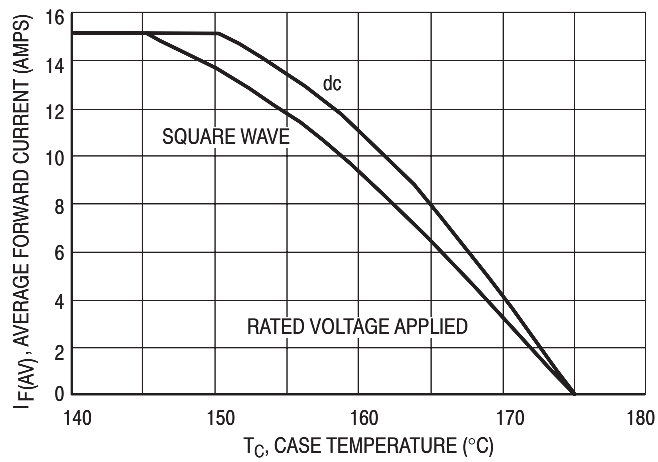



**Figure 13. Current Derating, Case (Per Leg)**

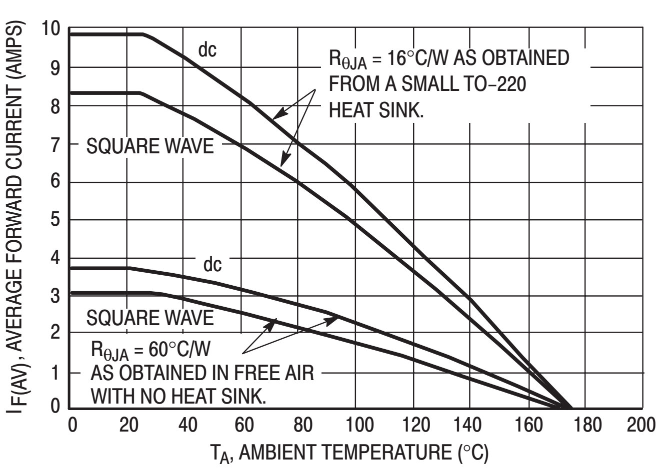



**Figure 14. Current Derating, Ambient (Per Leg)**

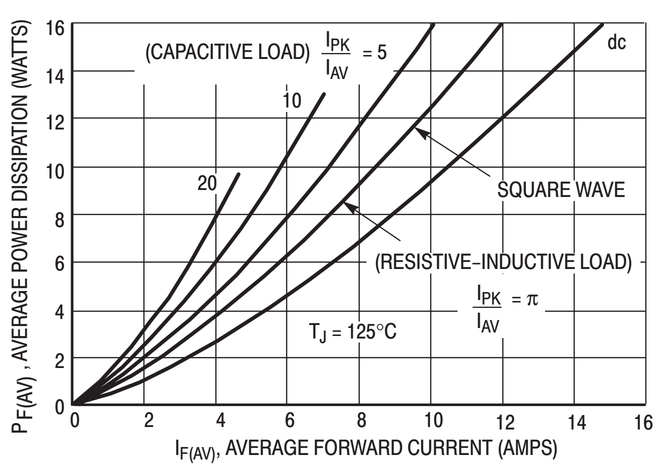



**Figure 15. Power Dissipation (Per Leg)**

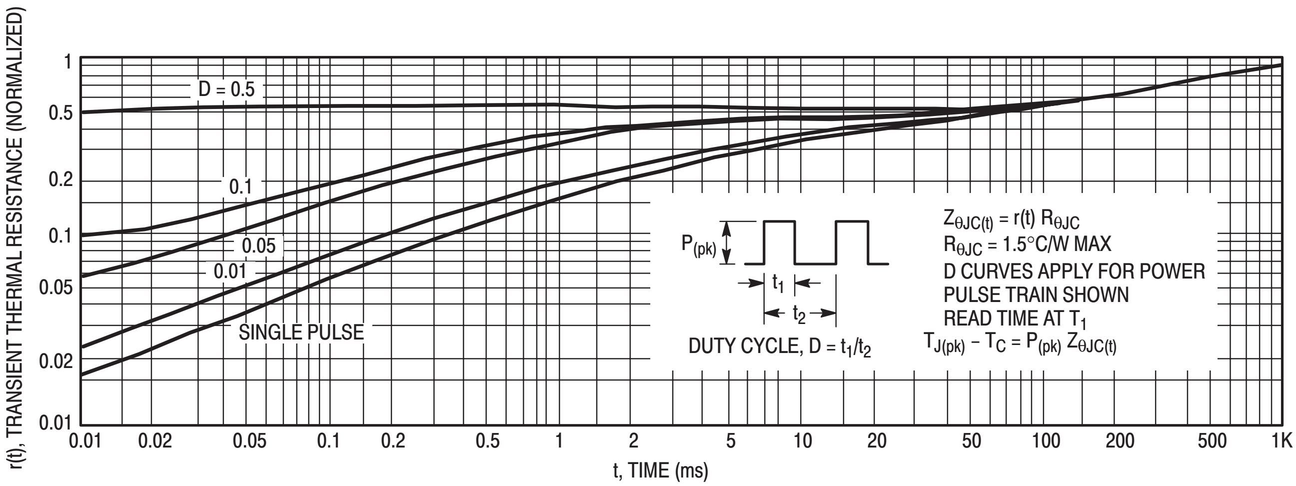



Figure 16. Thermal Response

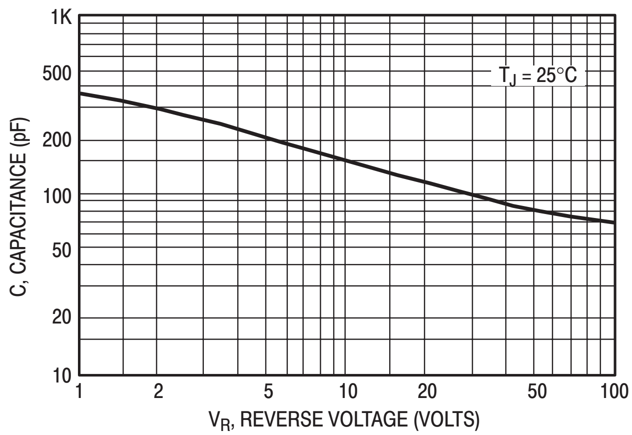



Figure 17. Typical Capacitance (Per Leg)

# MUR3020WT, MUR3060WT

**Preferred Devices**

# SWITCHMODE™ Power Rectifiers

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 35 and 60 Nanosecond Recovery Time
- 175°C Operating Junction Temperature
- Popular TO–247 Package
- High Voltage Capability to 600 Volts
- Low Forward Drop
- Low Leakage Specified @ 150°C Case Temperature
- Current Derating Specified @ Both Case and Ambient Temperatures
- Epoxy Meets UL94, $V_O$ @ 1/8″
- High Temperature Glass Passivated Junction

### Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 4.3 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped 30 units per plastic tube
- Marking: U3020, U3060

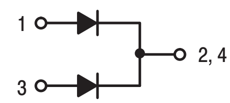
### MAXIMUM RATINGS

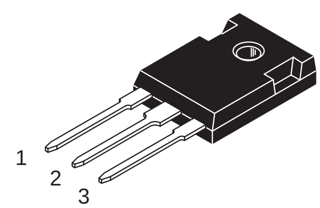
| |
|---|
| Please See the Table on the Following Page |

ON Semiconductor™

http://onsemi.com

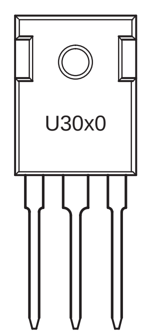
**ULTRAFAST RECTIFIERS**
**30 AMPERES**
**200–600 VOLTS**




**TO–247 PSI**
**CASE 340L**
**PLASTIC**

### MARKING DIAGRAM




U30x0 = Device Code
x = 2 or 6

### ORDERING INFORMATION

| Device | Package | Shipping |
|---|---|---|
| MUR3020WT | TO–247 | 30 Units/Rail |
| MUR3060WT | TO–247 | 30 Units/Rail |

**Preferred** devices are recommended choices for future use and best overall value.

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**MAXIMUM RATINGS** (Per Leg)

| Rating | Symbol | MUR3020WT | MUR3060WT | Unit |
|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 200 | 600 | Volts |
| Average Rectified Forward Current @ 145°C<br>Total Device | $I_{F(AV)}$ | 15<br>30 | | Amps |
| Peak Repetitive Surge Current<br>(Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 145°C) | $I_{FM}$ | 30 | | Amps |
| Nonrepetitive Peak Surge Current<br>(Surge applied at rated load conditions,<br>halfwave, single phase, 60 Hz) | $I_{FSM}$ | 200 | 150 | Amps |
| Operating Junction and Storage Temperature | $T_J$, $T_{stg}$ | – 65 to +175 | | °C |

**THERMAL CHARACTERISTICS** (Per Leg)

| | | | | |
|---|---|---|---|---|
| Maximum Thermal Resistance — Junction to Case<br>— Junction to Ambient | $R_{\theta JC}$<br>$R_{\theta JA}$ | 1.5<br>40 | | °C/W |

**ELECTRICAL CHARACTERISTICS** (Per Leg)

| | | | | |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.)<br>($I_F$ = 15 Amp, $T_C$ = 150°C)<br>($I_F$ = 15 Amp, $T_C$ = 25°C) | $V_F$ | <br>0.85<br>1.05 | <br>1.4<br>1.7 | Volts |
| Maximum Instantaneous Reverse Current (Note 1.)<br>(Rated DC Voltage, $T_J$ = 150°C)<br>(Rated DC Voltage, $T_J$ = 25°C) | $i_R$ | <br>500<br>10 | <br>1000<br>10 | μA |
| Maximum Reverse Recovery Time<br>($i_F$ = 1.0 A, di/dt = 50 Amps/μs) | $t_{rr}$ | 35 | 60 | ns |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

## MUR3020WT

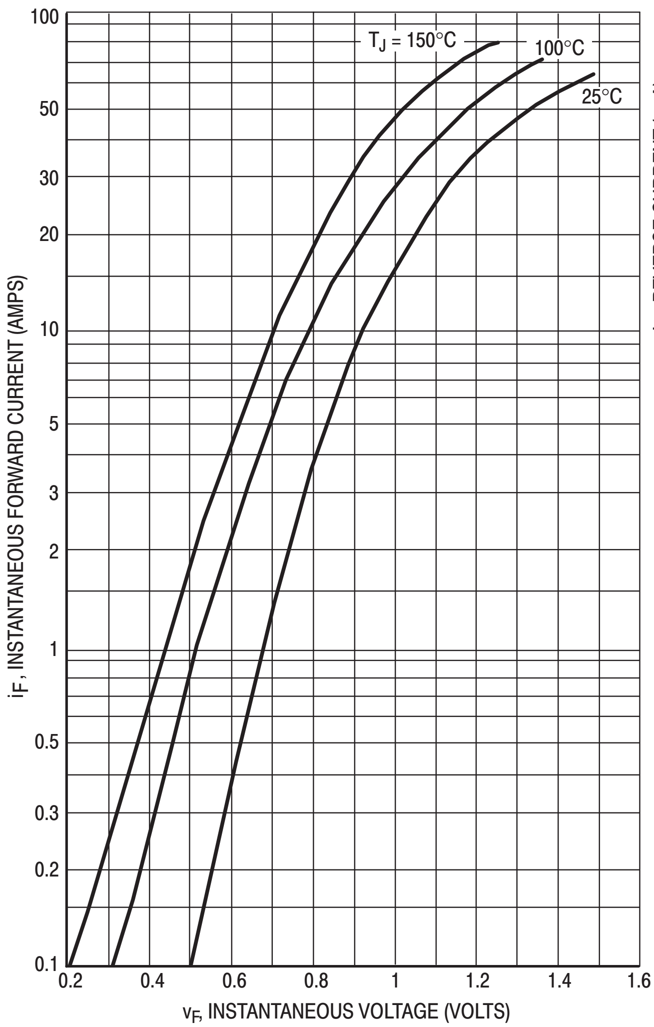
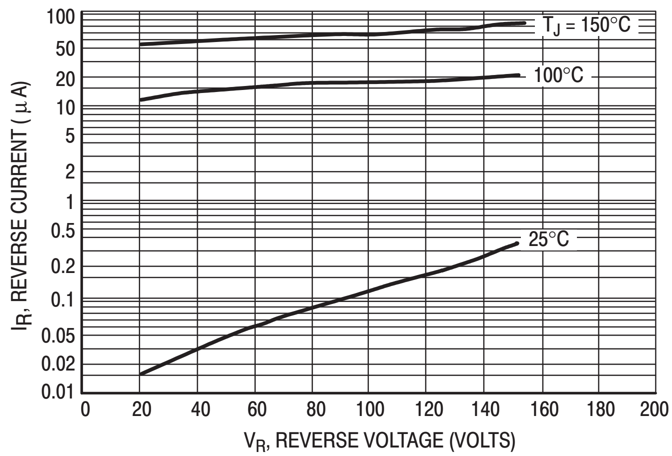



**Figure 1. Typical Forward Voltage (Per Leg)**




*The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if $V_R$ is sufficiently below rated $V_R$.

**Figure 2. Typical Reverse Current (Per Leg)***

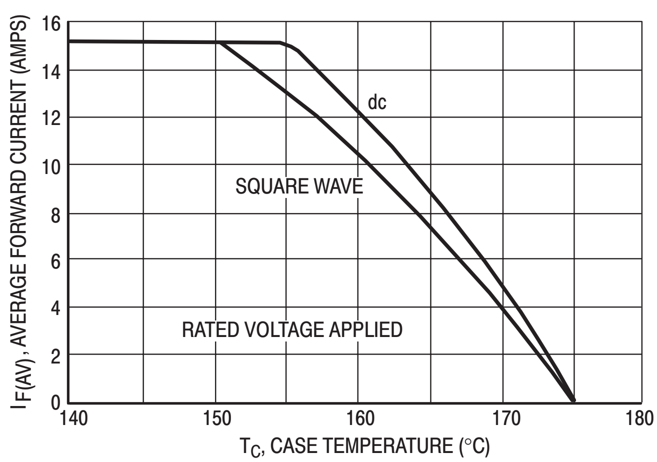



**Figure 3. Current Derating, Case (Per Leg)**

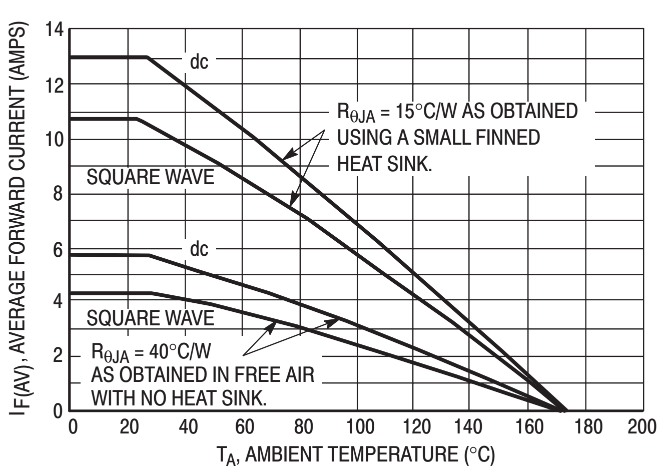



**Figure 4. Current Derating, Ambient (Per Leg)**

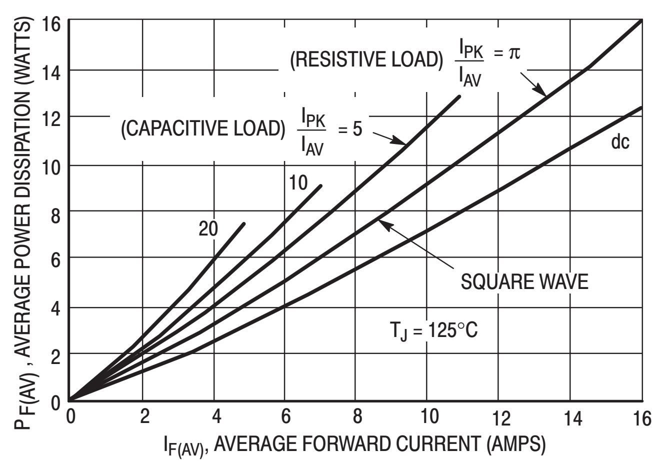



**Figure 5. Power Dissipation (Per Leg)**

## MUR3060WT

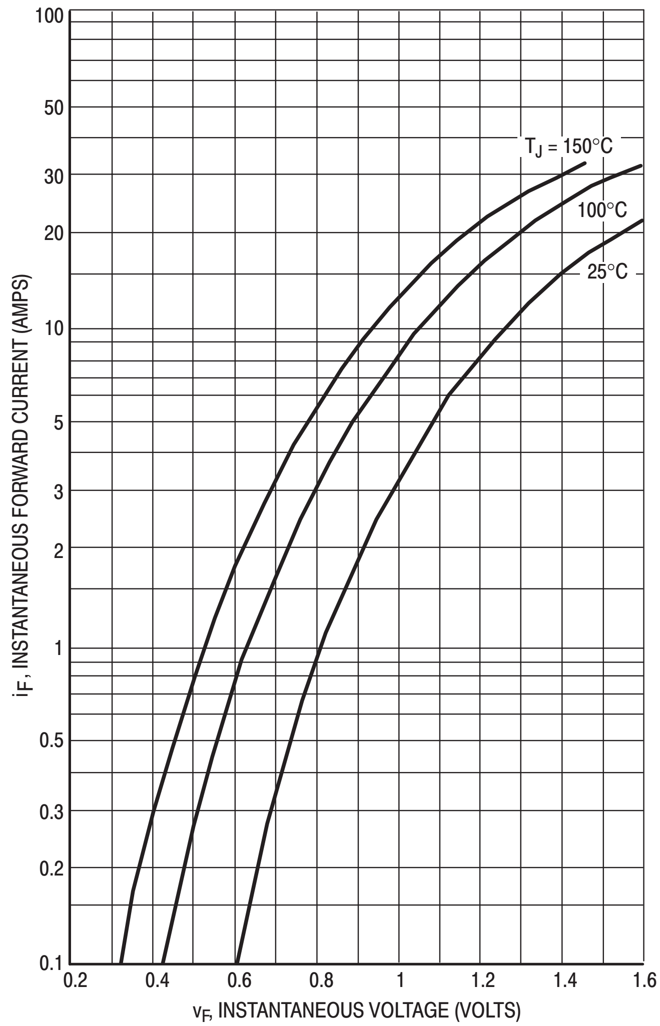
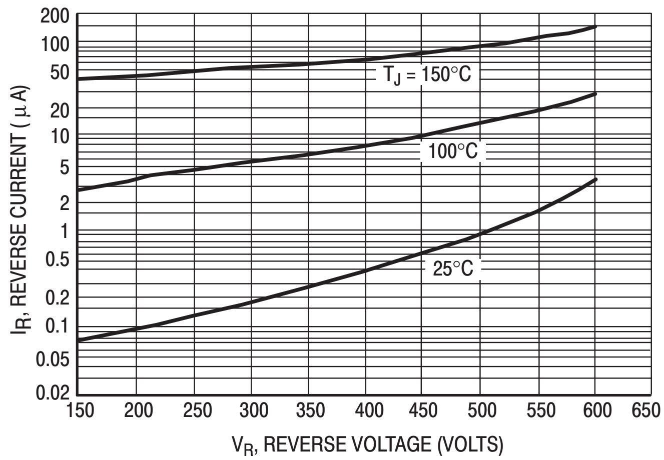



**Figure 6. Typical Forward Voltage (Per Leg)**




*The curves shown are typical for the highest voltage device in the voltage grouping. Typical reverse current for lower voltage selections can be estimated from these same curves if $V_R$ is sufficiently below rated $V_R$.

**Figure 7. Typical Reverse Current (Per Leg)***

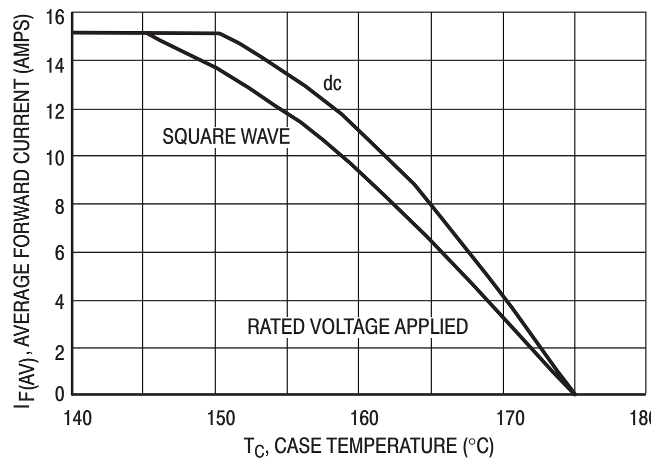



**Figure 8. Current Derating, Case (Per Leg)**

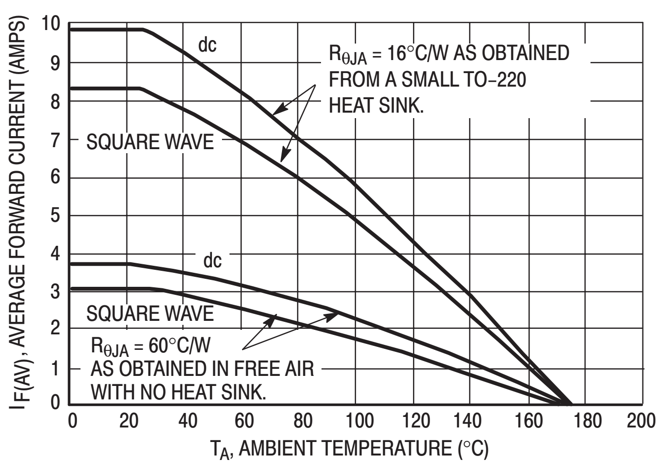



**Figure 9. Current Derating, Ambient (Per Leg)**

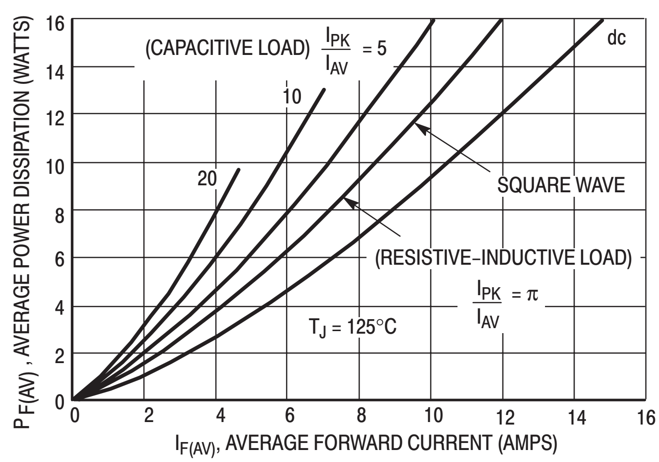



**Figure 10. Power Dissipation (Per Leg)**

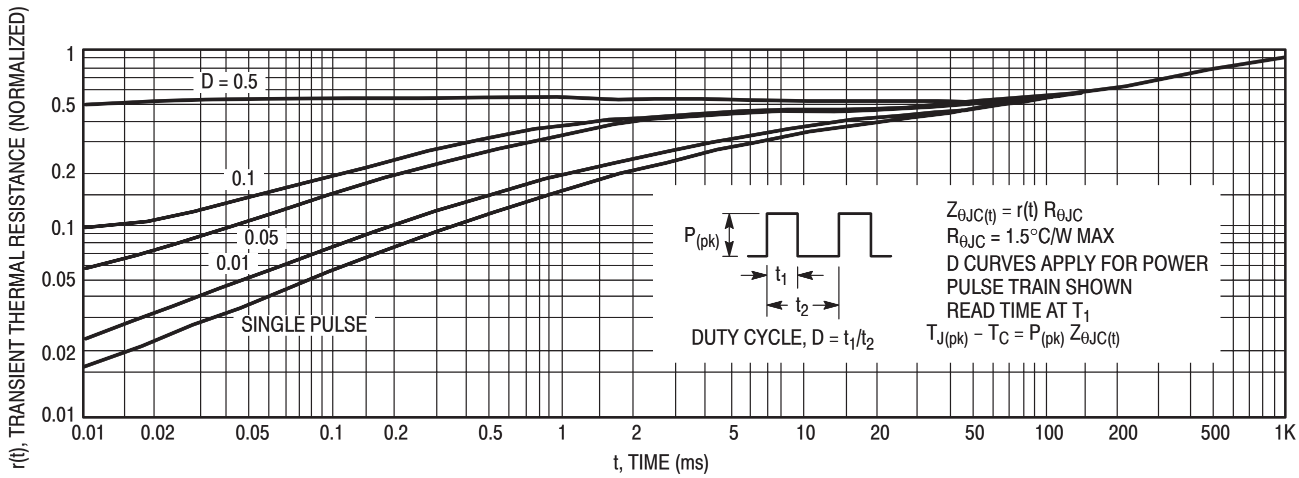



**Figure 11. Thermal Response**

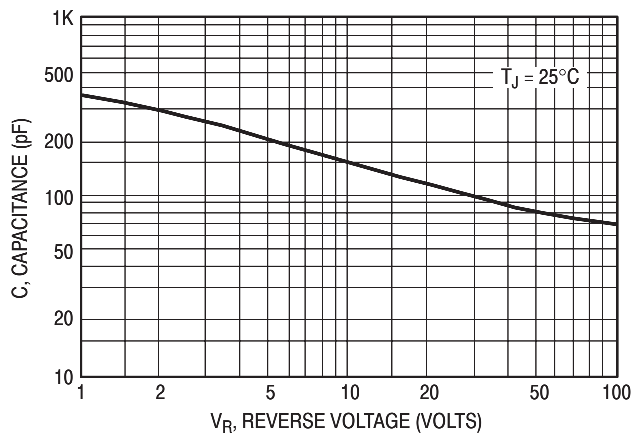



**Figure 12. Typical Capacitance (Per Leg)**

# MURP20020CT, MURP20040CT

**Preferred Devices**

# POWERTAP™ II Ultrafast SWITCHMODE™ Power Rectifiers

. . . designed for use in switching power supplies, inverters, and as free wheeling diodes. These state–of–the–art devices have the following features:

- Dual Diode Construction
- Low Leakage Current
- Low Forward Voltage
- 175°C Operating Junction Temperature
- Labor Saving POWERTAP Package

**Mechanical Characteristics:**

- Case: Epoxy, Molded with metal heatsink base
- Weight: 80 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant
- Top Terminal Torque: 25–40 lb–in max
- Base Plate Torques: See procedure given in the Package Outline Section
- Shipped 25 units per foam
- Marking: UP20020, UP20040

**MAXIMUM RATINGS**

Please See the Table on the Following Page

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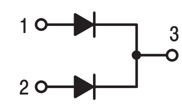
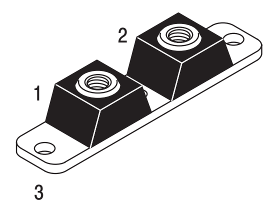
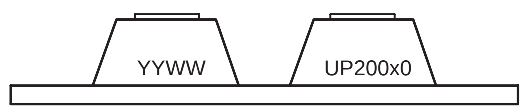
**ULTRAFAST RECTIFIERS 200 AMPERES 200–400 VOLTS**




**PLASTIC CASE 357C POWERTAP II**

**MARKING DIAGRAM**




UP200x0 = Device Code
x = 2 or 4
YY = Year
WW = Work Week

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MURP20020CT | POWERTAP II | 25 Units/Tray |
| MURP20040CT | POWERTAP II | 25 Units/Tray |

**Preferred** devices are recommended choices for future use and best overall value.

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## MAXIMUM RATINGS

| Rating | Symbol | MURP20020CT | MURP20040CT | Unit |
|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 200 | 400 | Volts |
| Average Rectified Forward Current (Rated $V_R$) Per Device<br>Per Leg | $I_{F(AV)}$ | 200 ($T_C$ = 130°C)<br>100 ($T_C$ = 130°C) | 200 ($T_C$ = 100°C)<br>100 ($T_C$ = 100°C) | Amps |
| Peak Repetitive Forward Current, Per Leg (Rated $V_R$, Square Wave, 20 kHz), $T_C$ = 95°C | $I_{FRM}$ | 200 | 200 | Amps |
| Nonrepetitive Peak Surge Current Per Leg (Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 800 | 800 | Amps |
| Operating Junction Temperature | $T_J$ | – 55 to +175 | – 55 to +175 | °C |
| Storage Temperature | $T_{stg}$ | – 55 to +150 | – 55 to +150 | °C |

## THERMAL CHARACTERISTICS (Per Leg)

| Rating | Symbol | Max | | Unit |
|---|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 0.45 | 0.45 | °C/W |

## ELECTRICAL CHARACTERISTICS (Per Leg)

| | | | | |
|---|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.)<br>($i_F$ = 100 Amps, $T_C$ = +25°C)<br>($i_F$ = 200 Amps, $T_C$ = 25°C)<br>($i_F$ = 100 Amps, $T_C$ = 125°C) | $v_F$ | <br>1.00<br>1.10<br>0.95 | <br>1.30<br>1.75<br>1.15 | Volts |
| Instantaneous Reverse Current (Note 1.)<br>(Rated dc Voltage, $T_C$ = 125°C)<br>(Rated dc Voltage, $T_C$ = 25°C) | $i_R$ | <br>1000<br>150 | <br>500<br>50 | μA |
| Maximum Reverse Recovery Time ($I_F$ = 1.0 Amp, di/dt = 50 Amps/μs) | $t_{rr}$ | 50 | 75 | ns |

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

# MSRP10040

# SWITCHMODE™ Soft Recovery Power Rectifier

## POWERTAP™ III Package

State of the art geometry features epitaxial construction with glass passivation and metal overlay contact. Ideally suited for low voltage, high frequency switching power supplies, free wheeling diode and polarity protection diodes.

- Soft Recovery Rectifier
- Low $I_{RRM}$ Losses
- Highly Stable Glass Passivated Junction

**Mechanical Characteristics:**

- Dual Die Construction
- Case: Epoxy, Molded with Plated Copper Heatsink Base
- Weight: 40 Grams (approximately)
- Finish: All External Surfaces Corrosion Resistant
- Top Terminal Torque: 25 – 40 lb–in max.
- Shipped 50 Units per Foam
- Marking: MSRP10040

**MAXIMUM RATINGS**

| Rating | Symbol | Max | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 400 | V |
| Average Rectified Forward Current (At Rated $V_R$, $T_C$ = 100°C) | $I_O$ | 100 | A |
| Peak Repetitive Forward Current (At Rated $V_R$, Square Wave, 100 kHz, $T_C$ = TBD°C) | $I_{FRM}$ | 200 | A |
| Non–Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 800 | A |
| Storage/Operating Case Temperature Range | $T_{stg}$, $T_C$ | –55 to +150 | °C |
| Operating Junction Temperature Range | $T_J$ | –55 to +150 | °C |

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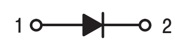
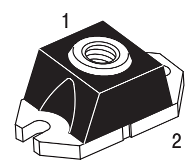
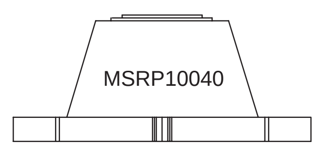
**SOFT RECOVERY RECTIFIER 100 AMPERES 400 VOLTS**




**POWERTAP III CASE 357D PLASTIC**

**MARKING DIAGRAM**




MSRP10040 = Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MSRP10040 | POWERTAP III | 50 Units/Tray |

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October, 2000 – Rev. 1



Publication Order Number:
MSRP10040/D

## THERMAL CHARACTERISTICS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance — Junction–to–Case | $R_{\theta JC}$ | 0.5 | °C/W |

## ELECTRICAL CHARACTERISTICS

| | | | | |
|---|---|---|---|---|
| Typical Instantaneous Forward Voltage (Note 1.) | $V_F$ | **$T_J$ = 25°C** | **$T_J$ = 100°C** | Volts |
| ($I_F$ = 100 A)<br>($I_F$ = 200 A) | | 1.75<br>2.00 | 1.25<br>1.50 | |
| Typical Instantaneous Reverse Current | $I_R$ | **$T_J$ = 25°C** | **$T_J$ = 100°C** | μA |
| ($V_R$ = 400 V)<br>($V_R$ = 200 V) | | 100<br>50 | 500<br>250 | |
| Typical Reverse Recovery Time (Note 2.)<br>($V_R$ = 30 V, $I_F$ = 10 A, di/dt = 200 A/μs) | $t_{rr}$ | 75 | | ns |
| Typical Peak Reverse Recovery Current<br>($V_R$ = 30 V, $I_F$ = 10 A, di/dt = 200 A/μs) | $I_{rm}$ | 7.0 | | Amps |

1. Pulse Test: Pulse Width $\leq$ 250 μs, Duty Cycle $\leq$ 2%.
2. $t_{rr}$ measured projecting from 25% of IRM to zero.

# MSR1560

## SWITCHMODE™ Soft Recovery Power Rectifier

Designed for boost converter or hard–switched converter applications, especially for Power Factor Correction application. It could also be used as a free wheeling diode in variable speed motor control applications and switching mode power supplies. These state–of–the–art devices have the following features:

- Soft Recovery with Low Reverse Recovery Charge ($Q_{RR}$) and Peak Reverse Recovery Current ($I_{RRM}$)
- 150°C Operating Junction Temperature
- Popular TO–220 Package
- Epoxy meets UL94, $V_O$ @ 1/8″
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction

**Mechanical Characteristics:**

- Case: Molded Epoxy
- Weight: 1.9 Grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Shipped in 50 Units per Plastic Tube
- Marking: MSR1560

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 600 | V |
| Average Rectified Forward Current (At Rated $V_R$, $T_C$ = 125°C) | $I_O$ | 15 | A |
| Peak Repetitive Forward Current (At Rated $V_R$, Square Wave, 20 kHz, $T_C$ = 125°C) | $I_{FRM}$ | 30 | A |
| Non–Repetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz) | $I_{FSM}$ | 100 | A |
| Storage/Operating Case Temperature | $T_{stg}$, $T_C$ | –65 to +150 | °C |
| Operating Junction Temperature | $T_J$ | –65 to +150 | °C |

**THERMAL CHARACTERISTICS**

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance – Junction–to–Case | $R_{\theta JC}$ | 1.6 | °C/W |
| Thermal Resistance – Junction–to–Ambient | $R_{\theta JA}$ | 72.8 | |

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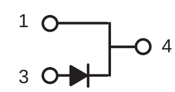
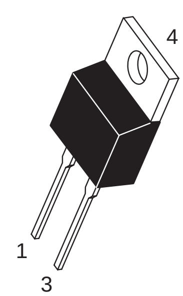
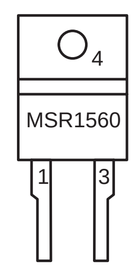
**SOFT RECOVERY POWER RECTIFIER 15 AMPERES 600 VOLTS**




**TO–220 CASE 221B PLASTIC**

**MARKING DIAGRAM**




**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MSR1560 | TO–220 | 50 Units/Rail |

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## ELECTRICAL CHARACTERISTICS

| | | | | |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.) ($I_F$ = 15 A) | $V_F$ | **$T_J$ = 25°C** | **$T_J$ = 150°C** | V |
| *Typical* | | 1.8<br>*1.5* | 1.4<br>*1.2* | |
| Maximum Instantaneous Reverse Current ($V_R$ = 600 V) | $I_R$ | **$T_J$ = 25°C** | **$T_J$ = 150°C** | μA |
| *Typical* | | 15<br>*0.4* | 5000<br>*100* | |
| Maximum Reverse Recovery Time (Note 2.) ($V_R$ = 30 V, $I_F$ = 1 A, di/dt = 100 A/μs) | $t_{rr}$ | **$T_J$ = 25°C** | **$T_J$ = 100°C** | ns |
| *Typical* | | 45<br>*35* | 65<br>*54* | |
| Typical Recovery Softness Factor ($V_R$ = 30 V, $I_F$ = 1 A, di/dt = 100 A/μs) | $s = t_b/t_a$ | *.67* | *.74* | |
| Typical Peak Reverse Recovery Current ($V_R$ = 30 V, $I_F$ = 1 A, di/dt = 100 A/μs) | $I_{RRM}$ | 2.3 | 3.2 | A |
| Typical Reverse Recovery Charge ($V_R$ = 30 V, $I_F$ = 1 A, di/dt = 100 A/μs) | $Q_{RR}$ | 31 | 78 | nC |

1. Pulse Test: Pulse Width ≤ 380 μs, Duty Cycle ≤ 2%
2. $T_{RR}$ measured projecting from 25% of $I_{RRM}$ to zero current

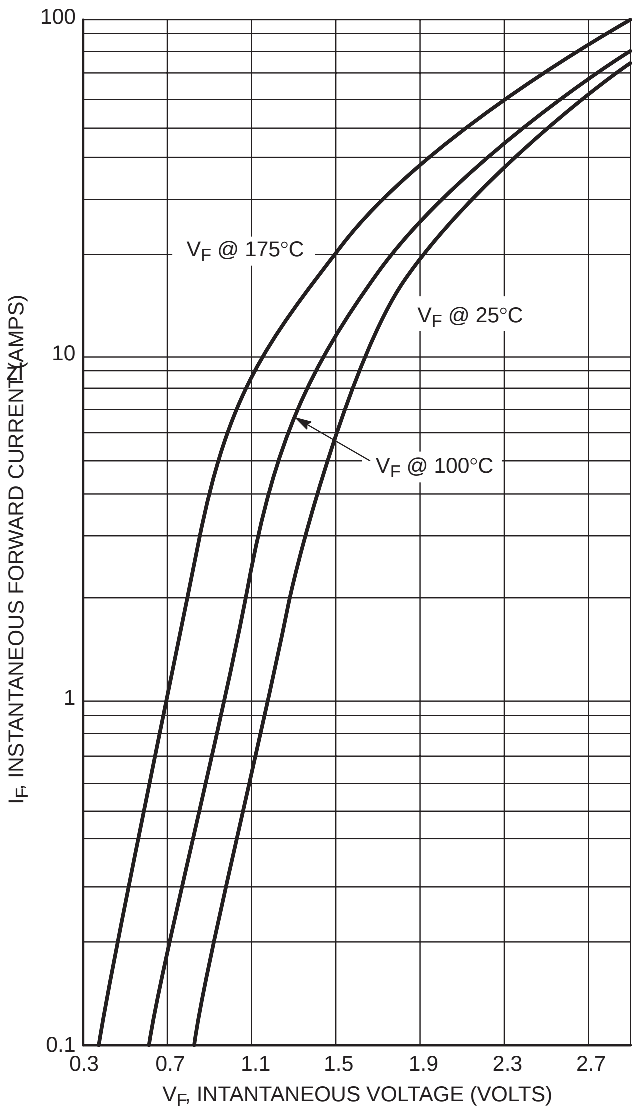


**Figure 1. Maximum Forward Voltage**

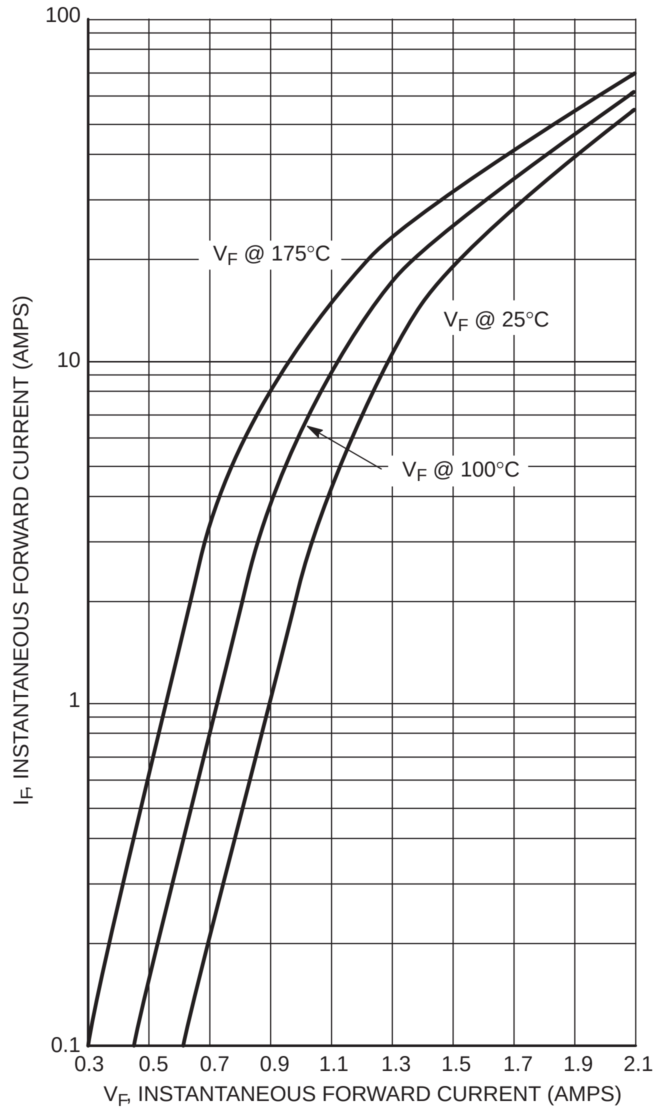


**Figure 2. Typical Forward Voltage**

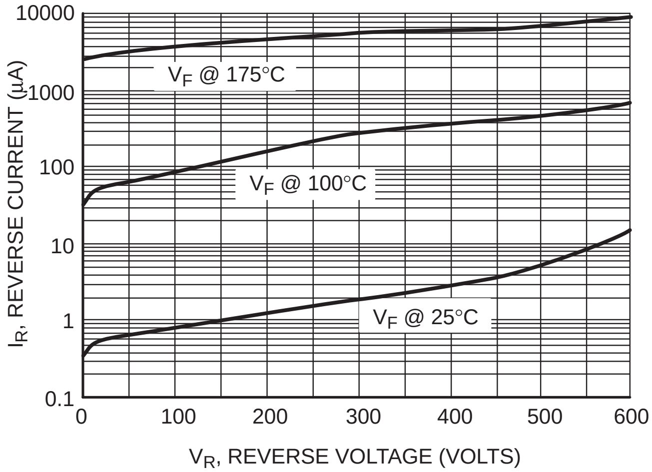


**Figure 3. Maximum Reverse Current**

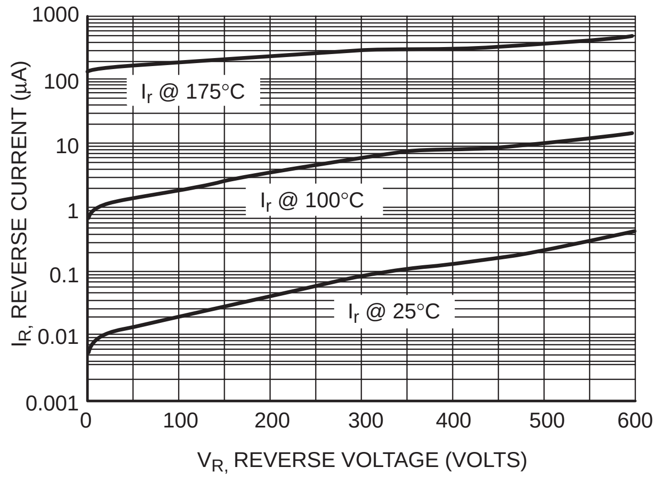


**Figure 4. Typical Reverse Current**

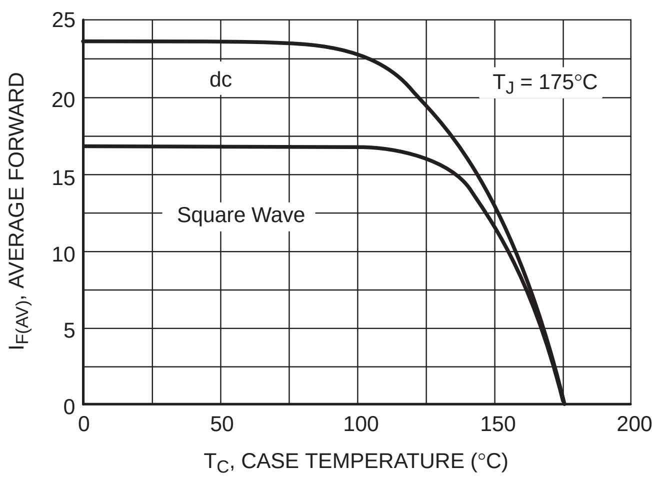


**Figure 5. Current Derating**

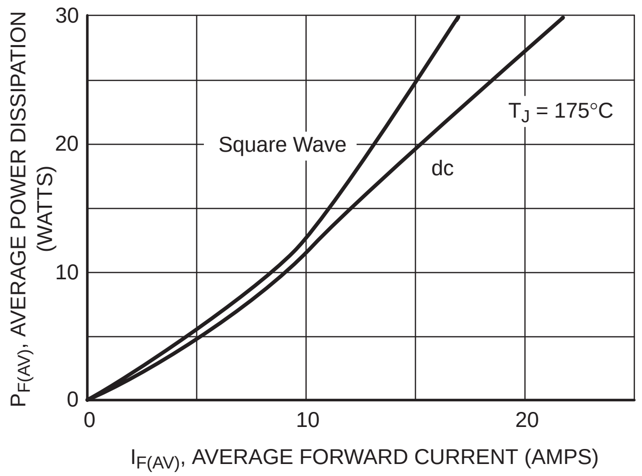


**Figure 6. Power Dissipation**

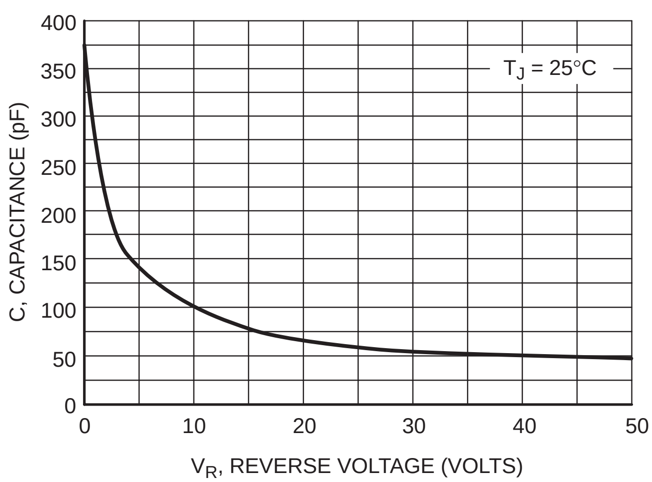


**Figure 7. Maximum Capacitance**

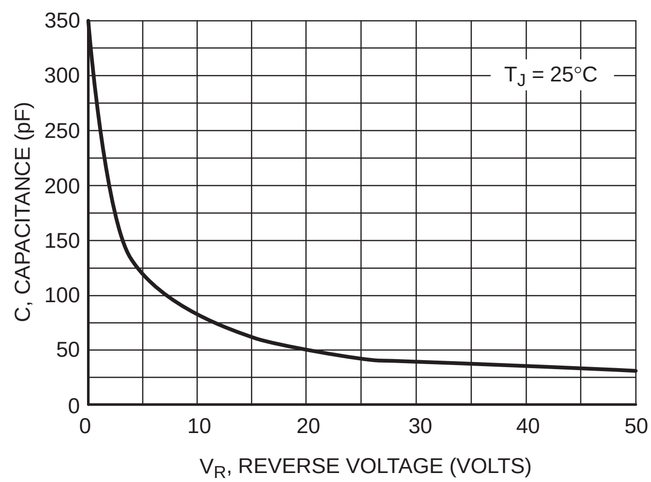


**Figure 8. Typical Capacitance**

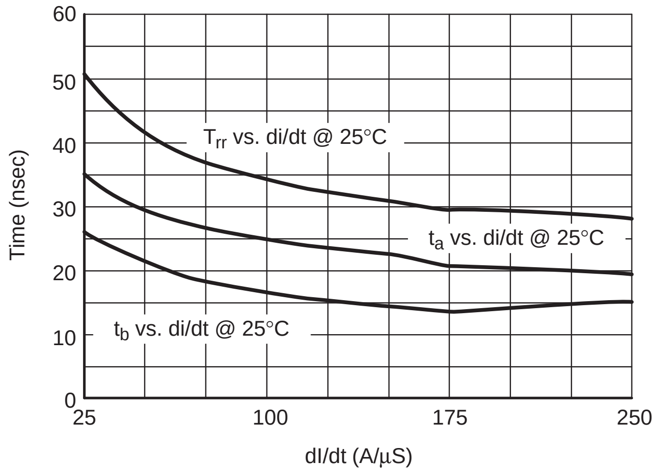


**Figure 9. Typical Trr vs. di/dt**

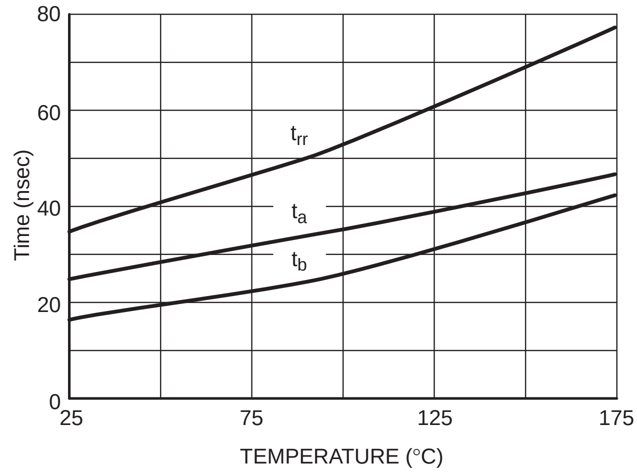


**Figure 10. Typical Trr vs. Temperature**

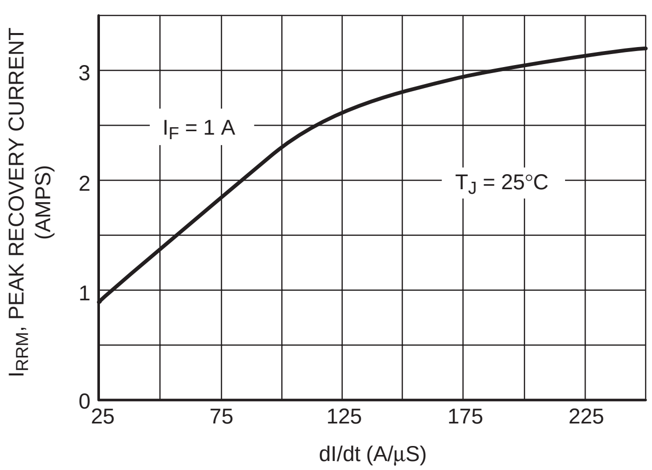


**Figure 11. Typical Peak Reverse Recovery Current**

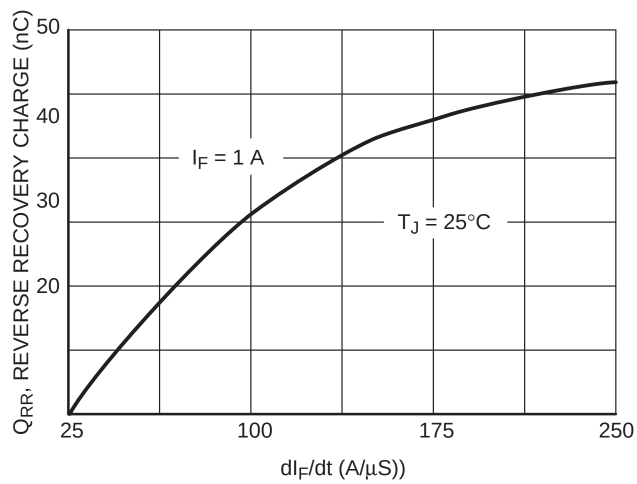


**Figure 12. Typical Reverse Recovery Charge**

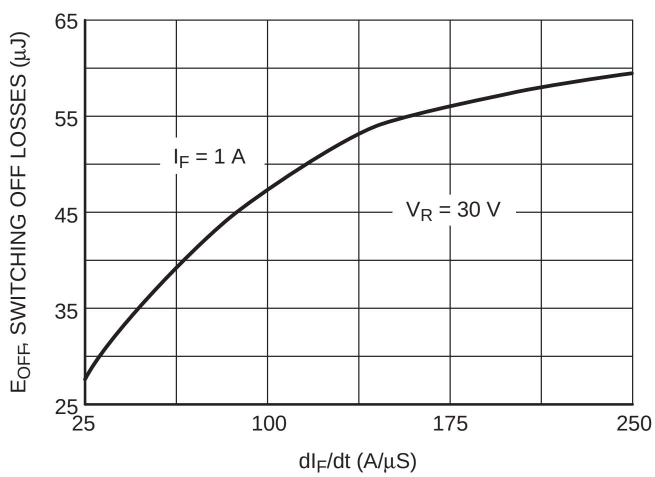


**Figure 13. Typical Switching Off Losses**

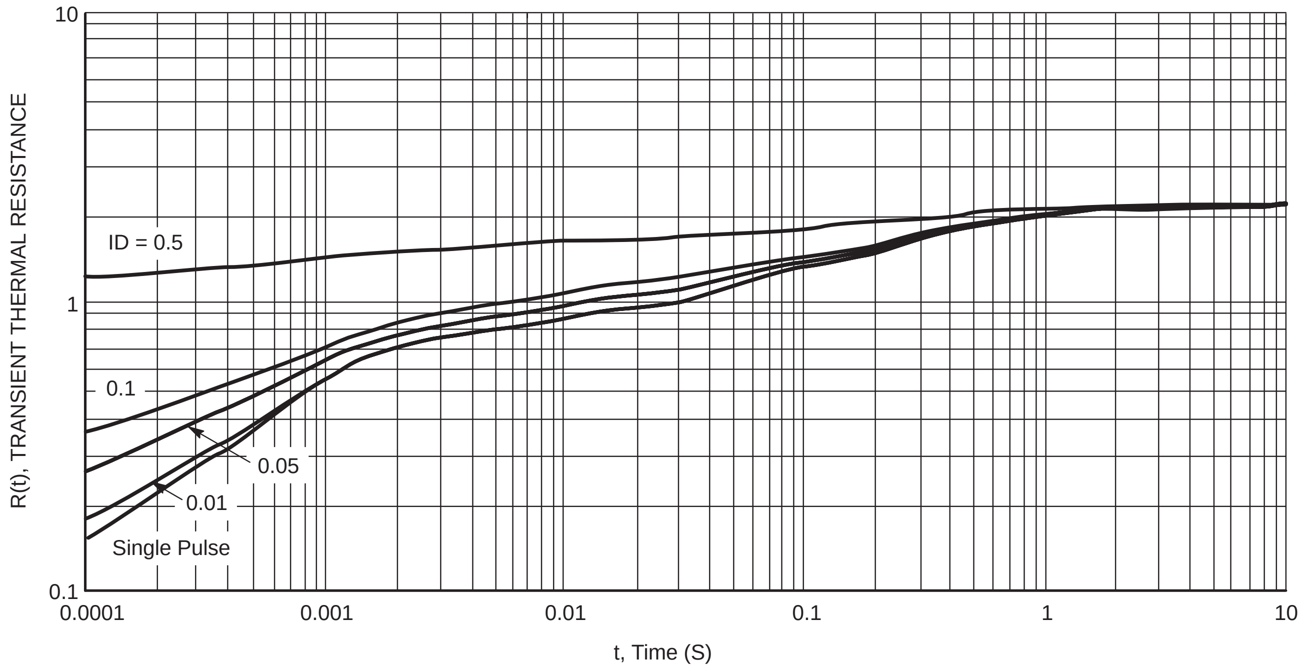


**Figure 14. Transient Thermal Response**

# CHAPTER 5
# Standard and Fast Recovery Data Sheets

# 1N4001, 1N4002, 1N4003, 1N4004, 1N4005, 1N4006, 1N4007

**1N4004 and 1N4007 are Preferred Devices**

# Axial Lead Standard Recovery Rectifiers

This data sheet provides information on subminiature size, axial lead mounted rectifiers for general–purpose low–power applications.

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 1000 per bag.
- Available Tape and Reeled, 5000 per reel, by adding a “RL” suffix to the part number
- Available in Fan–Fold Packaging, 3000 per box, by adding a “FF” suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: 1N4001, 1N4002, 1N4003, 1N4004, 1N4005, 1N4006, 1N4007

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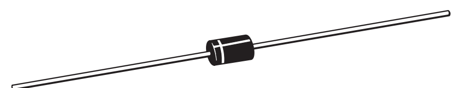
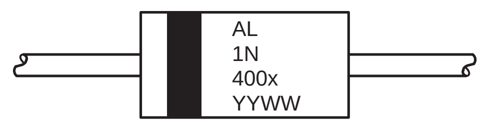
**LEAD MOUNTED RECTIFIERS**
**50–1000 VOLTS**
**DIFFUSED JUNCTION**



**CASE 59**
**AXIAL LEAD**
**PLASTIC**

**MARKING DIAGRAM**




AL = Assembly Location
1N400x = Device Number
x = 1, 2, 3, 4, 5, 6 or 7
YY = Year
WW = Work Week

**MAXIMUM RATINGS**

| Rating | Symbol | 1N4001 | 1N4002 | 1N4003 | 1N4004 | 1N4005 | 1N4006 | 1N4007 | Unit |
|---|---|---|---|---|---|---|---|---|---|
| *Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 50 | 100 | 200 | 400 | 600 | 800 | 1000 | Volts |
| *Non–Repetitive Peak Reverse Voltage (halfwave, single phase, 60 Hz) | $V_{RSM}$ | 60 | 120 | 240 | 480 | 720 | 1000 | 1200 | Volts |
| *RMS Reverse Voltage | $V_{R(RMS)}$ | 35 | 70 | 140 | 280 | 420 | 560 | 700 | Volts |
| *Average Rectified Forward Current (single phase, resistive load, 60 Hz, $T_A$ = 75°C) | $I_O$ | 1.0 | | | | | | | Amp |
| *Non–Repetitive Peak Surge Current (surge applied at rated load conditions) | $I_{FSM}$ | 30 (for 1 cycle) | | | | | | | Amp |
| Operating and Storage Junction Temperature Range | $T_J$<br>$T_{stg}$ | –65 to +175 | | | | | | | °C |

*Indicates JEDEC Registered Data

**ORDERING INFORMATION**

See detailed ordering and shipping information on page 448 of this data sheet.

**Preferred** devices are recommended choices for future use and best overall value.

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## ELECTRICAL CHARACTERISTICS*

| Rating | Symbol | Typ | Max | Unit |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage Drop ($i_F$ = 1.0 Amp, $T_J$ = 25°C) | $v_F$ | 0.93 | 1.1 | Volts |
| Maximum Full–Cycle Average Forward Voltage Drop ($I_O$ = 1.0 Amp, $T_L$ = 75°C, 1 inch leads) | $V_{F(AV)}$ | – | 0.8 | Volts |
| Maximum Reverse Current (rated dc voltage)<br>($T_J$ = 25°C)<br>($T_J$ = 100°C) | $I_R$ | <br>0.05<br>1.0 | <br>10<br>50 | μA |
| Maximum Full–Cycle Average Reverse Current ($I_O$ = 1.0 Amp, $T_L$ = 75°C, 1 inch leads) | $I_{R(AV)}$ | – | 30 | μA |

*Indicates JEDEC Registered Data

## ORDERING & SHIPPING INFORMATION

| Device | Package | Shipping |
|---|---|---|
| 1N4001 | Axial Lead | 1000 Units/Bag |
| 1N4001FF | Axial Lead | 3000 Units/Box |
| 1N4001RL | Axial Lead | 5000/Tape & Reel |
| 1N4002 | Axial Lead | 1000 Units/Bag |
| 1N4002FF | Axial Lead | 3000 Units/Box |
| 1N4002RL | Axial Lead | 5000/Tape & Reel |
| 1N4003 | Axial Lead | 1000 Units/Bag |
| 1N4003FF | Axial Lead | 3000 Units/Box |
| 1N4003RL | Axial Lead | 5000/Tape & Reel |
| 1N4004 | Axial Lead | 1000 Units/Bag |
| 1N4004FF | Axial Lead | 3000 Units/Box |
| 1N4004RL | Axial Lead | 5000/Tape & Reel |
| 1N4005 | Axial Lead | 1000 Units/Bag |
| 1N4005FF | Axial Lead | 3000 Units/Box |
| 1N4005RL | Axial Lead | 5000/Tape & Reel |
| 1N4006 | Axial Lead | 1000 Units/Bag |
| 1N4006FF | Axial Lead | 3000 Units/Box |
| 1N4006RL | Axial Lead | 5000/Tape & Reel |
| 1N4007 | Axial Lead | 1000 Units/Bag |
| 1N4007FF | Axial Lead | 3000 Units/Box |
| 1N4007RL | Axial Lead | 5000/Tape & Reel |

# 1N5400 thru 1N5408

**1N5404 and 1N5406 are Preferred Devices**

# Axial-Lead Standard Recovery Rectifiers

Lead mounted standard recovery rectifiers are designed for use in power supplies and other applications having need of a device with the following features:

- High Current to Small Size
- High Surge Current Capability
- Low Forward Voltage Drop
- Void–Free Economical Plastic Package
- Available in Volume Quantities
- Plastic Meets UL 94V–0 for Flammability

### Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 1.1 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Polarity: Cathode Indicated by Polarity Band
- Marking: 1N5400, 1N5401, 1N5402, 1N5404, 1N5406, 1N5407, 1N5408

### MAXIMUM RATINGS

Please See the Table on the Following Page

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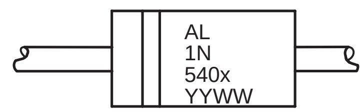
**STANDARD RECOVERY RECTIFIERS**
**50–1000 VOLTS**
**3.0 AMPERES**

**AXIAL LEAD**
**CASE 267–05**
**STYLE 1**

### MARKING DIAGRAM




AL = Assembly Location
1N540x = Device Number
x = 0, 1, 2, 4, 6, 7 or 8
YY = Year
WW = Work Week

### ORDERING INFORMATION

| Device | Package | Shipping |
|---|---|---|
| 1N5400 | Axial Lead | 500 Units/Box |
| 1N5400RL | Axial Lead | 1200/Tape & Reel |
| 1N5401 | Axial Lead | 500 Units/Box |
| 1N5401RL | Axial Lead | 1200/Tape & Reel |
| 1N5402 | Axial Lead | 500 Units/Box |
| 1N5402RL | Axial Lead | 1200/Tape & Reel |
| 1N5404 | Axial Lead | 500 Units/Box |
| 1N5404RL | Axial Lead | 1200/Tape & Reel |
| 1N5406 | Axial Lead | 500 Units/Box |
| 1N5406RL | Axial Lead | 1200/Tape & Reel |
| 1N5407 | Axial Lead | 500 Units/Box |
| 1N5407RL | Axial Lead | 1200/Tape & Reel |
| 1N5408 | Axial Lead | 500 Units/Box |
| 1N5408RL | Axial Lead | 1200/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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### MAXIMUM RATINGS

| Rating | Symbol | 1N5400 | 1N5401 | 1N5402 | 1N5404 | 1N5406 | 1N5407 | 1N5408 | Unit |
|---|---|---|---|---|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 50 | 100 | 200 | 400 | 600 | 800 | 1000 | Volts |
| Non–repetitive Peak Reverse Voltage | $V_{RSM}$ | 100 | 200 | 300 | 525 | 800 | 1000 | 1200 | Volts |
| Average Rectified Forward Current (Single Phase Resistive Load, 1/2″ Leads, $T_L$ = 105°C) | $I_O$ | 3.0 | | | | | | | Amp |
| Non–repetitive Peak Surge Current (Surge Applied at Rated Load Conditions) | $I_{FSM}$ | 200 (one cycle) | | | | | | | Amp |
| Operating and Storage Junction Temperature Range | $T_J$<br>$T_{stg}$ | – 65 to +170<br>– 65 to +175 | | | | | | | °C |

### THERMAL CHARACTERISTICS

| Characteristic | Symbol | Typ | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Ambient (PC Board Mount, 1/2″ Leads) | $R_{\theta JA}$ | 53 | °C/W |

### ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Forward Voltage ($I_F$ = 3.0 Amp, $T_A$ = 25°C) | $v_F$ | – | – | 1.0 | Volts |
| Reverse Current (Rated dc Voltage) | $I_R$ | | | | µA |
| $T_A$ = 25°C | | – | – | 10 | |
| $T_A$ = 150°C | | – | – | 100 | |

Ratings at 25°C ambient temperature unless otherwise specified.
60 Hz resistive or inductive loads.
For capacitive load, derate current by 20%.

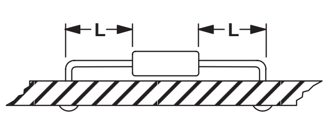
### NOTE 1 — AMBIENT MOUNTING DATA

Data shown for thermal resistance junction–to–ambient ($R_{\theta JA}$) for the mountings shown is to be used as typical guideline values for preliminary engineering or in case the tie point temperature cannot be measured.

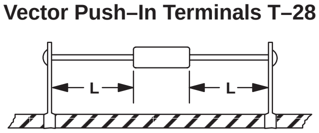
**TYPICAL VALUES FOR $R_{\theta JA}$ IN STILL AIR**

| Mounting Method | Lead Length, L (IN) | | | | $R_{\theta JA}$ |
|---|---|---|---|---|---|
| | 1/8 | 1/4 | 1/2 | 3/4 | |
| 1 | 50 | 51 | 53 | 55 | °C/W |
| 2 | 58 | 59 | 61 | 63 | °C/W |
| 3 | 28 | | | | °C/W |

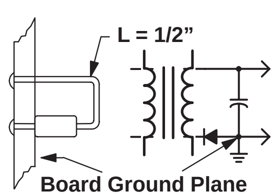
**MOUNTING METHOD 1**
**P.C. Board Where Available Copper Surface area is small**




**MOUNTING METHOD 2**
**Vector Push–In Terminals T–28**




**MOUNTING METHOD 3**
**P.C. Board with 1–1/2” x 1–1/2” Copper Surface**



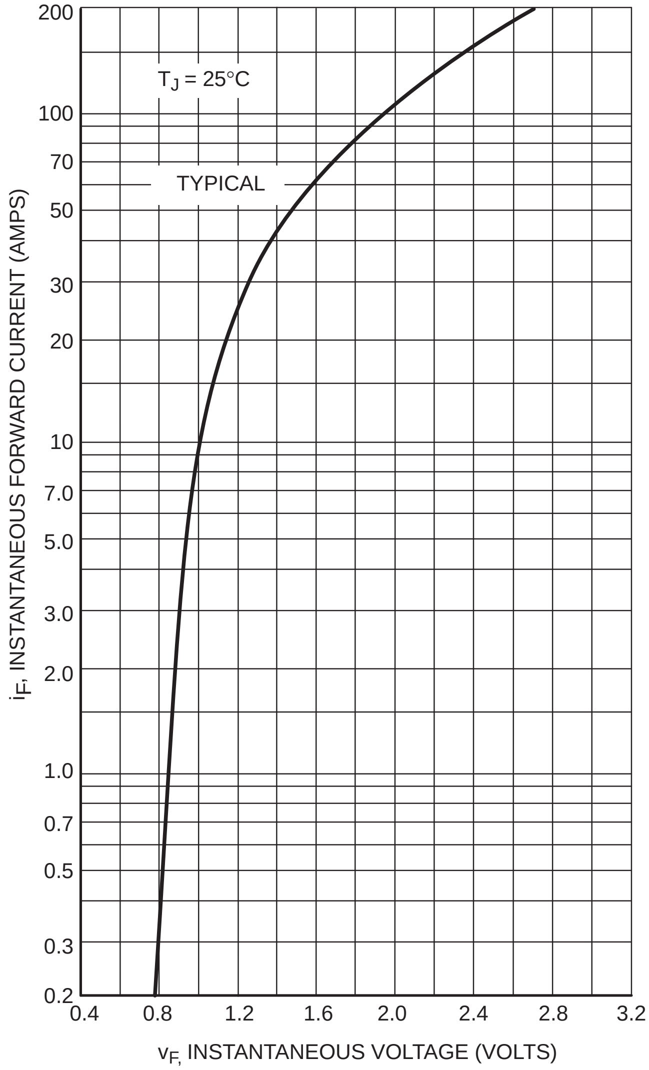



Figure 1. Forward Voltage

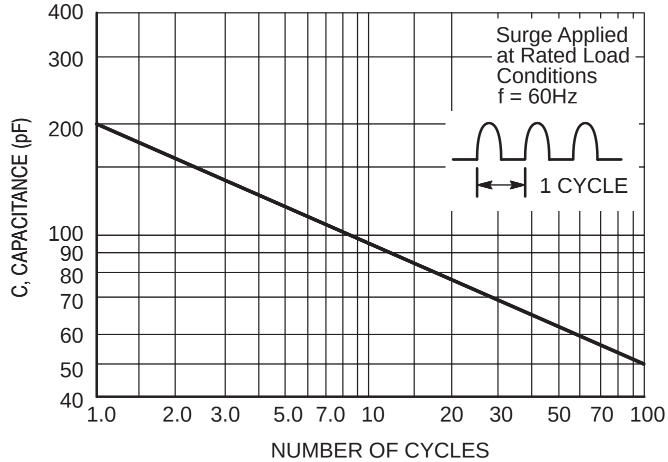



Figure 2. Maximum Nonrepetitive Surge Current

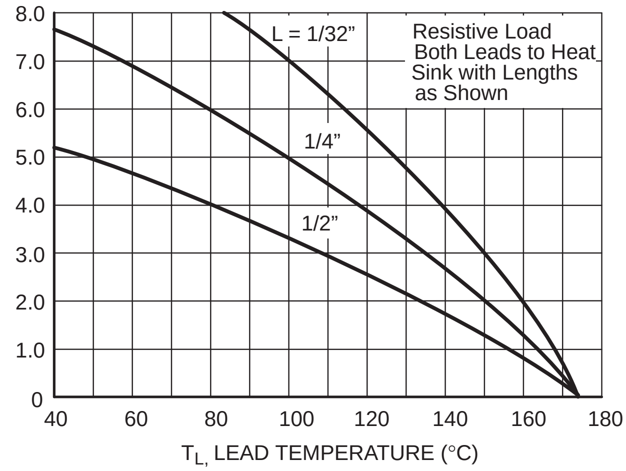



Figure 3. Current Derating Various Lead Lengths

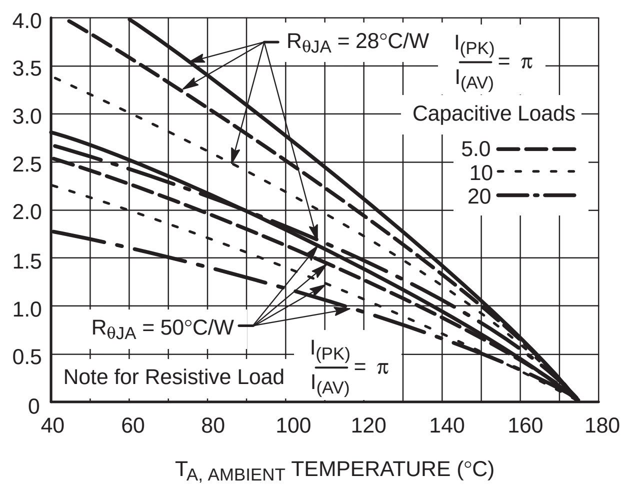



Figure 4. Current Derating PC Board Mounting

# 1N4933, 1N4934, 1N4935, 1N4936, 1N4937

**1N4935 and 1N4937 are Preferred Devices**

# Axial-Lead Fast-Recovery Rectifiers

Axial–lead, fast–recovery rectifiers are designed for special applications such as dc power supplies, inverters, converters, ultrasonic systems, choppers, low RF interference and free wheeling diodes. A complete line of fast recovery rectifiers having typical recovery time of 150 nanoseconds providing high efficiency at frequencies to 250 kHz.

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 0.4 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 1000 per bag.
- Available Tape and Reeled, 5000 per reel, by adding a “RL” suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: 1N4933, 1N4934, 1N4935, 1N4936, 1N4937

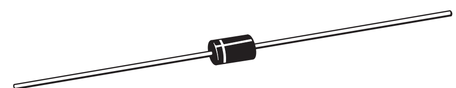
**MAXIMUM RATINGS**

| |
|---|
| Please See the Table on the Following Page |

ON Semiconductor™

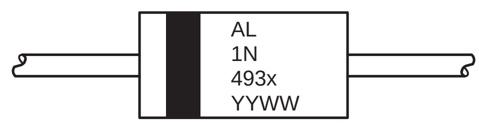
http://onsemi.com

**FAST RECOVERY RECTIFIERS 1.0 AMPERE 50–600 VOLTS**



**CASE 59**
**AXIAL LEAD**
**PLASTIC**

**MARKING DIAGRAM**




AL = Assembly Location
1N493x = Device Number
x = 3, 4, 5, 6 or 7
YY = Year
WW = Work Week

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| 1N4933 | Axial Lead | 1000 Units/Bag |
| 1N4933RL | Axial Lead | 5000/Tape & Reel |
| 1N4934 | Axial Lead | 1000 Units/Bag |
| 1N4934RL | Axial Lead | 5000/Tape & Reel |
| 1N4935 | Axial Lead | 1000 Units/Bag |
| 1N4935RL | Axial Lead | 5000/Tape & Reel |
| 1N4936 | Axial Lead | 1000 Units/Bag |
| 1N4936RL | Axial Lead | 5000/Tape & Reel |
| 1N4937 | Axial Lead | 1000 Units/Bag |
| 1N4937RL | Axial Lead | 5000/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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**MAXIMUM RATINGS** (Note 1.)

| Rating | Symbol | 1N4933 | 1N4934 | 1N4935 | 1N4936 | 1N4937 | Unit |
|---|---|---|---|---|---|---|---|
| *Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 50 | 100 | 200 | 400 | 600 | Volts |
| *Non–Repetitive Peak Reverse Voltage<br>RMS Reverse Voltage | $V_{RSM}$<br>$V_{R(RMS)}$ | 75<br>35 | 150<br>70 | 250<br>140 | 450<br>280 | 650<br>420 | Volts |
| *Average Rectified Forward Current<br>(Single phase, resistive load, $T_A$ = 75°C) (Note 2.) | $I_O$ | 1.0 | | | | | Amp |
| *Non–Repetitive Peak Surge Current<br>(Surge applied at rated load conditions) | $I_{FSM}$ | 30 | | | | | Amps |
| Operating Junction Temperature Range<br>Storage Temperature Range | $T_J$<br>$T_{stg}$ | – 65 to +150<br>– 65 to +150 | | | | | °C |

**THERMAL CHARACTERISTICS**

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Ambient<br>(Typical Printed Circuit Board Mounting) | $R_{\theta JC}$ | 65 | °C/W |

**ELECTRICAL CHARACTERISTICS**

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Instantaneous Forward Voltage<br>($I_F$ = 3.14 Amp, $T_J$ = 125°C) | $v_F$ | – | 1.0 | 1.2 | Volts |
| Forward Voltage<br>($I_F$ = 1.0 Amp, $T_A$ = 25°C) | $V_F$ | – | 1.0 | 1.1 | Volts |
| *Reverse Current (Rated dc Voltage) $T_A$ = 25°C<br>$T_A$ = 100°C | $I_R$ | –<br>– | 1.0<br>50 | 5.0<br>100 | μA |

***REVERSE RECOVERY CHARACTERISTICS**

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Reverse Recovery Time<br>($I_F$ = 1.0 Amp to $V_R$ = 30 Vdc)<br>($I_{FM}$ = 15 Amp, di/dt = 10 A/μs) | $t_{rr}$ | <br>–<br>– | <br>150<br>175 | <br>200<br>300 | ns |
| Reverse Recovery Current<br>($I_F$ = 1.0 Amp to $V_R$ = 30 Vdc) | $I_{RM(REC)}$ | – | 1.0 | 2.0 | Amp |

1. Ratings at 25°C ambient temperature unless otherwise specified.
2. Derate by 20% for capacitive loads.

*Indicates JEDEC Registered Data for 1N4933 Series.

# MR850, MR851, MR852, MR854, MR856

**MR852 and MR856 are Preferred Devices**

# Axial Lead Fast Recovery Rectifiers

Axial lead mounted fast recovery power rectifiers are designed for special applications such as dc power supplies, inverters, converters, ultrasonic systems, choppers, low RF interference and free wheeling diodes. A complete line of fast recovery rectifiers having typical recovery time of 100 nanoseconds providing high efficiency at frequencies to 250 kHz.

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 1.1 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 500 per box
- Available Tape and Reeled, 1200 per reel, by adding a "RL" suffix to the part number
- Polarity: Cathode Indicated by Polarity Band
- Marking: MR850, MR851, MR852, MR854, MR856

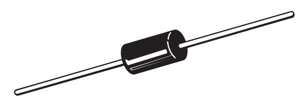
**MAXIMUM RATINGS**

Please See the Table on the Following Page

**ON Semiconductor™**

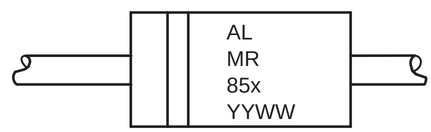
**http://onsemi.com**

**FAST RECOVERY POWER RECTIFIERS 3.0 AMPERES 50–600 VOLTS**



**AXIAL LEAD**
**CASE 267–05**
**STYLE 1**

**MARKING DIAGRAM**




AL = Assembly Location
MR85x = Device Number
x = 0, 1, 2, 4 or 6
YY = Year
WW = Work Week

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MR850 | Axial Lead | 500 Units/Box |
| MR850RL | Axial Lead | 1200/Tape & Reel |
| MR851 | Axial Lead | 500 Units/Box |
| MR851RL | Axial Lead | 1200/Tape & Reel |
| MR852 | Axial Lead | 500 Units/Box |
| MR852RL | Axial Lead | 1200/Tape & Reel |
| MR854 | Axial Lead | 500 Units/Box |
| MR854RL | Axial Lead | 1200/Tape & Reel |
| MR856 | Axial Lead | 500 Units/Box |
| MR856RL | Axial Lead | 1200/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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## MAXIMUM RATINGS

| Rating | Symbol | MR850 | MR851 | MR852 | MR854 | MR856 | Unit |
|---|---|---|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 50 | 100 | 200 | 400 | 600 | Volts |
| Non–Repetitive Peak Reverse Voltage | $V_{RSM}$ | 75 | 150 | 250 | 450 | 650 | Volts |
| RMS Reverse Voltage | $V_{R(RMS)}$ | 35 | 70 | 140 | 280 | 420 | Volts |
| Average Rectified Forward Current<br>(Single phase resistive load, $T_A$ = 80°C) | $I_O$ | 3.0 | | | | | Amp |
| Non–Repetitive Peak Surge Current<br>(surge applied at rated load conditions) | $I_{FSM}$ | 100<br>(one cycle) | | | | | Amp |
| Operating and Storage Junction<br>Temperature Range | $T_J$,<br>$T_{stg}$ | – 65 to +125<br>– 65 to +150 | | | | | °C |

## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Ambient<br>(Recommended Printed Circuit Board Mounting) | $R_{\theta JA}$ | 28 | °C/W |

## ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Forward Voltage<br>($I_F$ = 3.0 Amp, $T_J$ = 25°C) | $V_F$ | – | 1.04 | 1.25 | Volts |
| Reverse Current (rated dc voltage) $T_J$ = 25°C | $I_R$ | – | 2.0 | 10 | µA |
| $T_J$ = 80°C MR850 | | – | – | 150 | |
| MR851 | | – | 60 | 150 | |
| MR852 | | – | – | 200 | |
| MR854 | | – | – | 250 | |
| MR856 | | – | 100 | 300 | |

## REVERSE RECOVERY CHARACTERISTICS

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Reverse Recovery Time | $t_{rr}$ | | | | ns |
| ($I_F$ = 1.0 Amp to $V_R$ = 30 Vdc) | | – | 100 | 200 | |
| ($I_F$ = 15 Amp, di/dt = 10 A/µs) | | – | 150 | 300 | |
| Reverse Recovery Current<br>($I_F$ = 1.0 Amp to $V_R$ = 30 Vdc) | $I_{RM(REC)}$ | – | – | 2.0 | Amp |

# MRA4003T3 Series

# Surface Mount Standard Recovery Power Rectifier

## SMA Power Surface Mount Package

Features construction with glass passivation. Ideally suited for surface mounted Automotive application.

- Compact Package with J–Bend Leads Ideal for Automated Handling
- Stable, High Temperature, Glass Passivated Junction

### Mechanical Characteristics

- Case: Molded Epoxy
  Epoxy meets UL94, VO at 1/8″
- Weight: 70 mg (Approximately)
- Finish: All External Surfaces are Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 260°C Max. for 10 seconds in Solder Bath
- Polarity: Notch and/or Band in Plastic Body Indicates Cathode Lead
- Available in 12 mm Tape, 5000 Units per 13 inch Reel, Add “T3” Suffix to Part Number
- Marking: MRA4003T3 — R13
  MRA4004T3 — R14
  MRA4005T3 — R15
  MRA4006T3 — R16
  MRA4007T3 — R17

### MAXIMUM RATINGS

Please See the Table on the Following Page

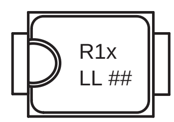
**ON Semiconductor™**

**http://onsemi.com**

**STANDARD RECOVERY RECTIFIERS
1.0 AMPERES
300–1000 VOLTS**

**CASE 403B
SMA
PLASTIC**

**MARKING DIAGRAM**




R1x = Device Code
x = 3, 4, 5, 6 or 7
LL = Location Code
## = Date Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MRA4003T3 | SMA | 5000/Tape & Reel |
| MRA4004T3 | SMA | 5000/Tape & Reel |
| MRA4005T3 | SMA | 5000/Tape & Reel |
| MRA4006T3 | SMA | 5000/Tape & Reel |
| MRA4007T3 | SMA | 5000/Tape & Reel |

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## MAXIMUM RATINGS

| Rating | Symbol | Value | | | | | Unit |
|---|---|---|---|---|---|---|---|
| | | MRA4003T3 | MRA4004T3 | MRA4005T3 | MRA4006T3 | MRA4007T3 | |
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 300 | 400 | 600 | 800 | 1000 | Volts |
| Avg. Rectified Forward Current (At Rated $V_R$, $T_L$ = 150°C) | $I_O$ | 1 | | | | | Amp |
| Peak Repetitive Forward Current (At Rated $V_R$, Square Wave, 20 kHz, $T_L$ = 150°C) | $I_{FRM}$ | 2 | | | | | Amps |
| Non–Repetitive Peak Surge Current (Surge applied at rated load conditions, halfwave, single phase, 60 Hz) | $I_{FSM}$ | 30 | | | | | Amps |
| Storage/Operating Case Temperature | $T_{stg}$, $T_C$ | –55 to 150 | | | | | °C |
| Operating Junction Temperature | $T_J$ | –55 to 175 | | | | | °C |

## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Lead (Note 1.)<br>Thermal Resistance, Junction to Ambient (Note 2.) | $R_{\theta JL}$<br>$R_{\theta JA}$ | 16.2<br>88.3 | °C/W |

## ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | Value | | Unit |
|---|---|---|---|---|
| | | $T_J$ = 25°C | $T_J$ = 100°C | |
| Maximum Instantaneous Forward Voltage (Note 3.)<br>($I_F$ = 1 A)<br>($I_F$ = 2 A) | $V_F$ | <br>1.1<br>1.18 | <br>1.04<br>1.12 | Volts |
| Maximum Instantaneous Reverse Current (at rated DC voltage) | $I_R$ | 10 | 50 | μA |

1. Minimum Pad Size
2. 1 inch Pad Size
3. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2%.

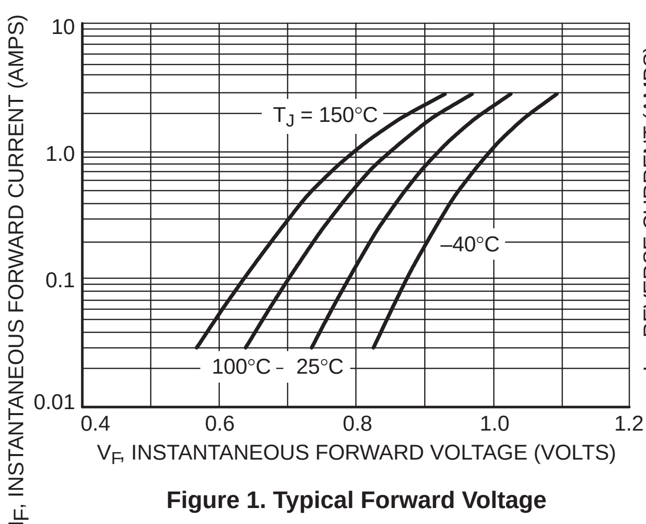


**Figure 1. Typical Forward Voltage**

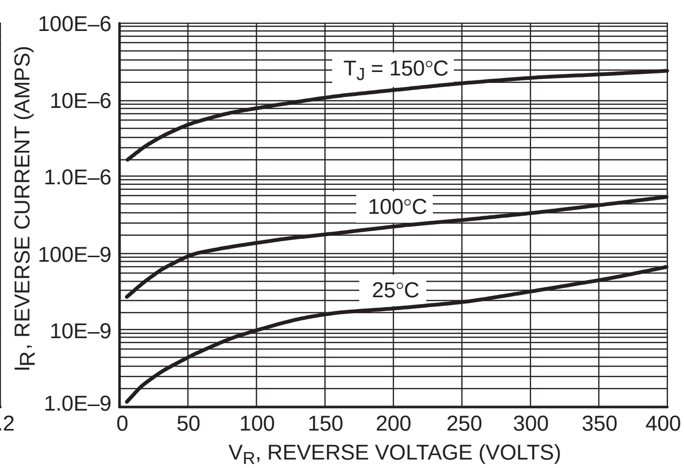


**Figure 2. Typical Reverse Current**

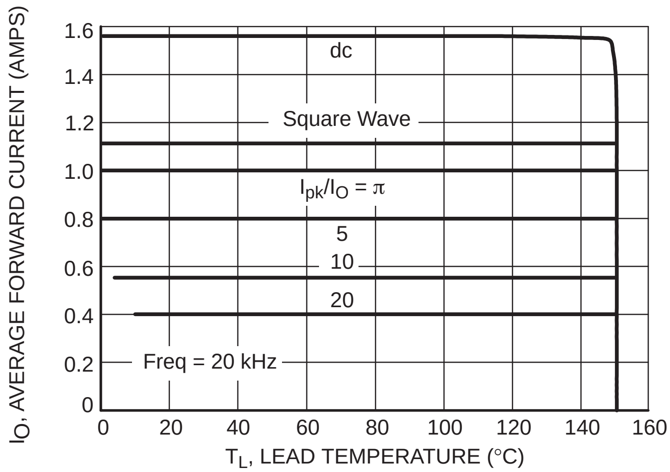


**Figure 3. Current Derating per Leg**

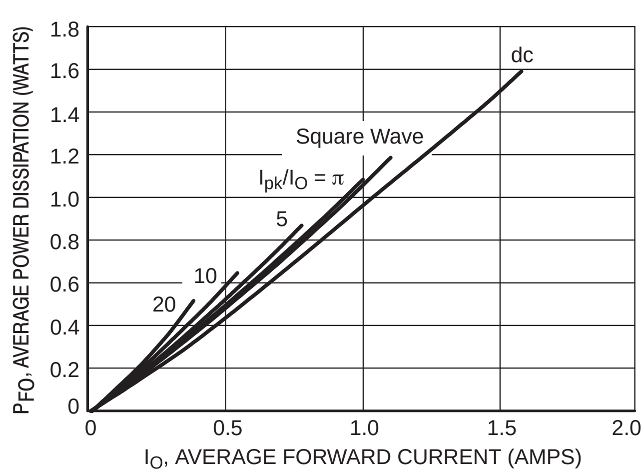


**Figure 4. Forward Power Dissipation per Leg**

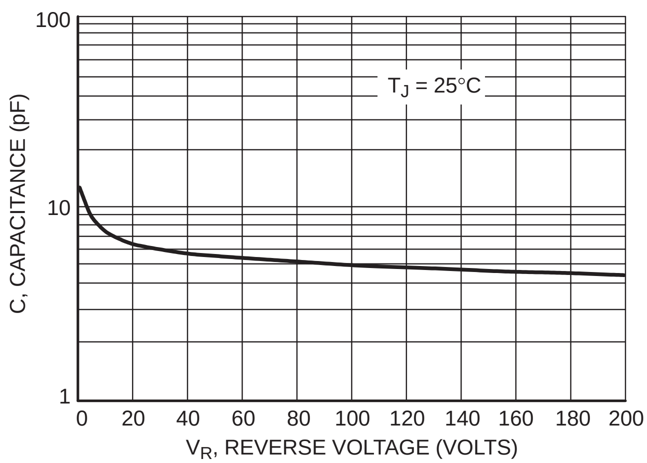


**Figure 5. Capacitance**

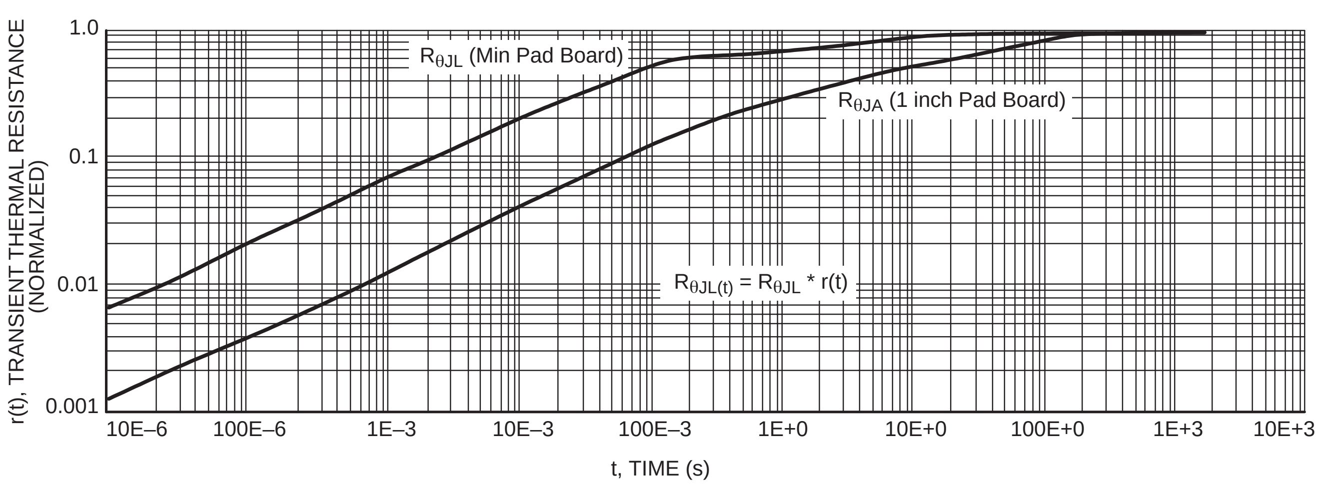


**Figure 6. Thermal Response**

# MRS1504T3

# Surface Mount Standard Recovery Power Rectifier

## SMB Power Surface Mount Package

Features mesa epitaxial construction with glass passivation. Ideally suited for high frequency switching power supplies; free wheeling diodes and polarity protection diodes.

- Compact Package with J–Bend Leads Ideal for Automated Handling
- Stable, High Temperature, Glass Passivated Junction

**Mechanical Characteristics:**
- Case: Molded Epoxy
- Epoxy Meets UL94, VO at 1/8″
- Weight: 95 mg (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Maximum Temperature of 260°C / 10 Seconds for Soldering
- Available in 12 mm Tape, 2500 Units per 13 inch Reel, Add “T3” Suffix to Part Number
- Polarity: Notch and/or band in Plastic Body Indicates Cathode Lead
- Marking: RGG

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 400 | V |
| Average Rectified Forward Current<br>(At Rated $V_R$, $T_l$ = 118°C) | $I_O$ | 1.5 | A |
| Peak Repetitive Forward Current<br>(At Rated $V_R$, Square Wave, 20 kHz, $T_l$ = 118°C) | $I_{FRM}$ | 3.0 | A |
| Non–Repetitive Peak Surge Current<br>(Surge applied at rated load conditions, halfwave, single phase, 60 Hz) | $I_{FSM}$ | 50 | A |
| Storage/Operating Case<br>Temperature Range | $T_{stg}$, $T_C$ | –55 to 150 | °C |
| Operating Junction Temperature Range | $T_J$ | –55 to 150 | °C |

**ON Semiconductor™**

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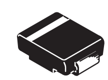
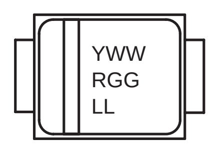
**STANDARD RECOVERY RECTIFIER**
**1.5 AMPERES**
**400 VOLTS**



**SMB**
**CASE 403A**
**PLASTIC**

**MARKING DIAGRAM**




Y = Year
WW = Work Week
RGG = Device Code
LL = Location Code

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MRS1504T3 | SMB | 2500/Tape & Reel |

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## THERMAL CHARACTERISTICS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance – Junction–to–Lead (Note 2.)<br>Thermal Resistance – Junction–to–Ambient (on 1″ sq. Cu. PCB pattern) | $R_{tjl}$<br>$R_{tja}$ | 18<br>79 | °C/W |

## ELECTRICAL CHARACTERISTICS

| | | | | |
|---|---|---|---|---|
| Maximum Instantaneous Forward Voltage (Note 1.), see Figure 2 | $V_F$ | **$T_J$ = 25°C** | **$T_J$ = 100°C** | V |
| ($I_F$ = 1.5 A)<br>($I_F$ = 2.25 A) | | 1.04<br>1.10 | 0.96<br>1.02 | |
| Maximum Instantaneous Reverse Current, see Figure 4 | $I_R$ | **$T_J$ = 25°C** | **$T_J$ = 100°C** | μA |
| ($V_R$ = 400 V)<br>($V_R$ = 200 V) | | 1.0<br>0.5 | 340<br>180 | |

1. Pulse Test: Pulse Width ≤ 250 μs, Duty Cycle ≤ 2.0%.
2. Minimum pad size

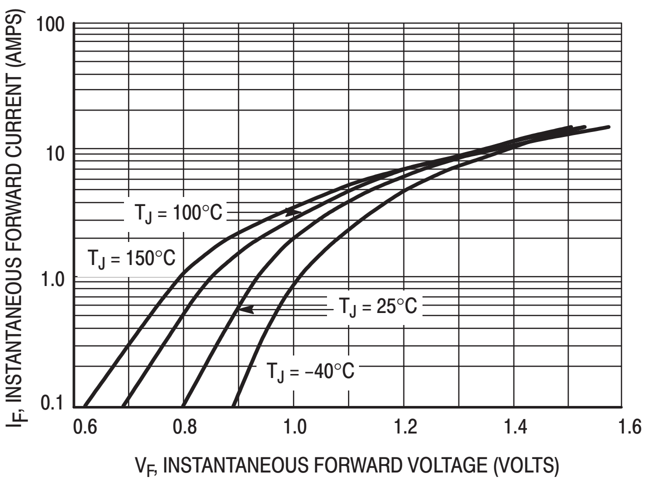



**Figure 1. Typical Forward Voltage**

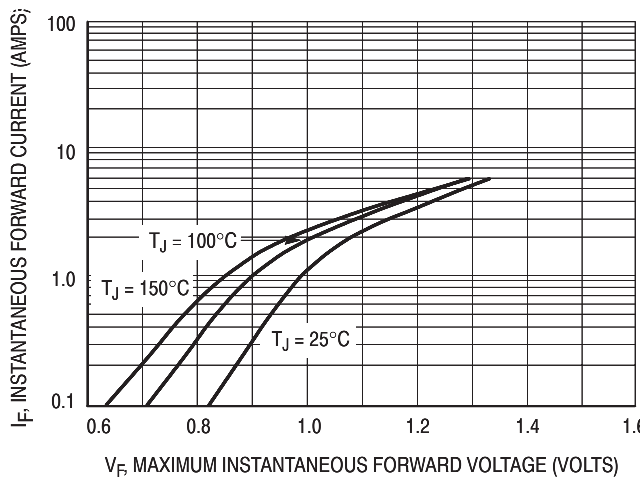



**Figure 2. Maximum Forward Voltage**

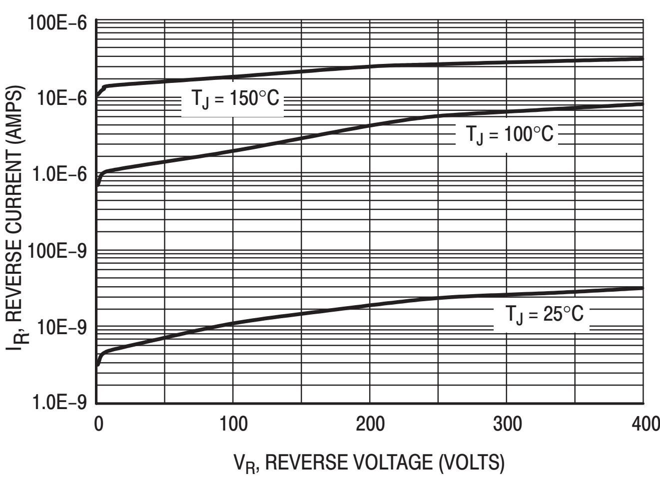



**Figure 3. Typical Reverse Current**

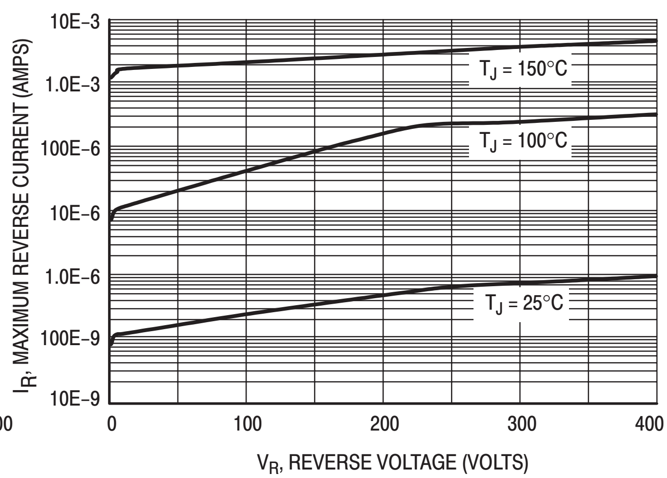



**Figure 4. Maximum Reverse Current**

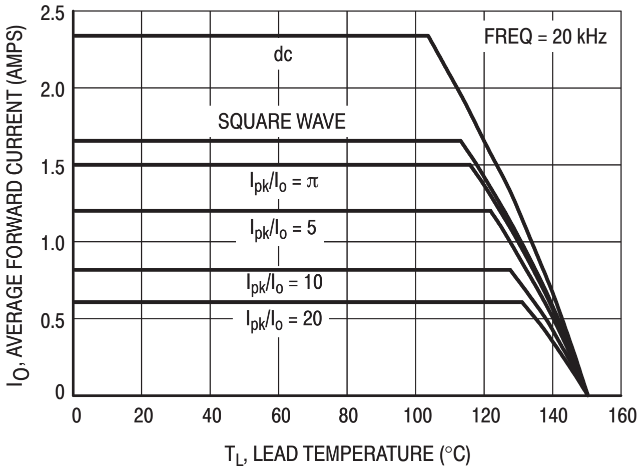



**Figure 5. Current Derating**

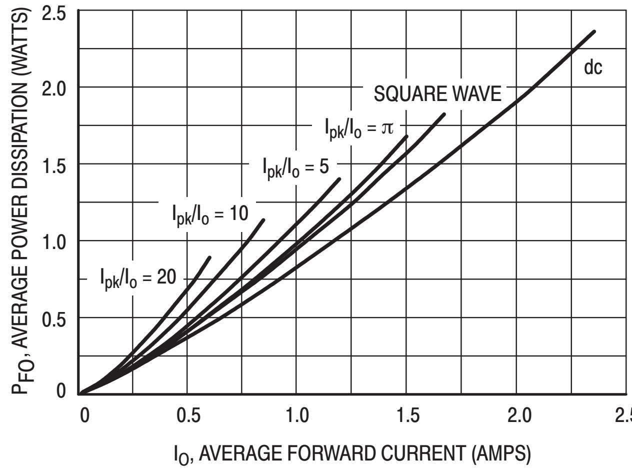



**Figure 6. Forward Power Dissipation**

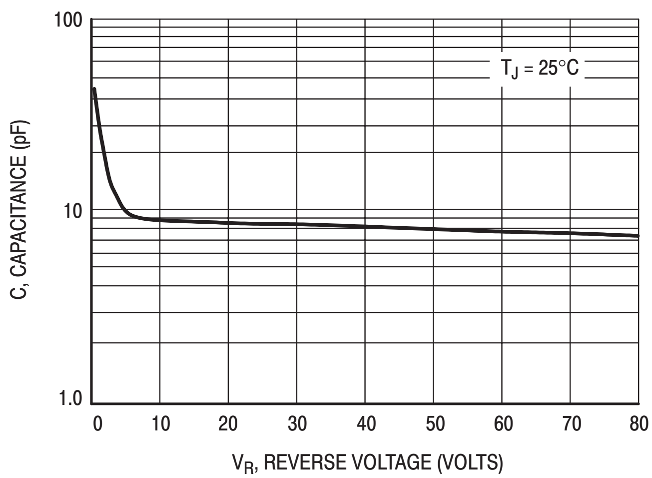



**Figure 7. Capacitance**

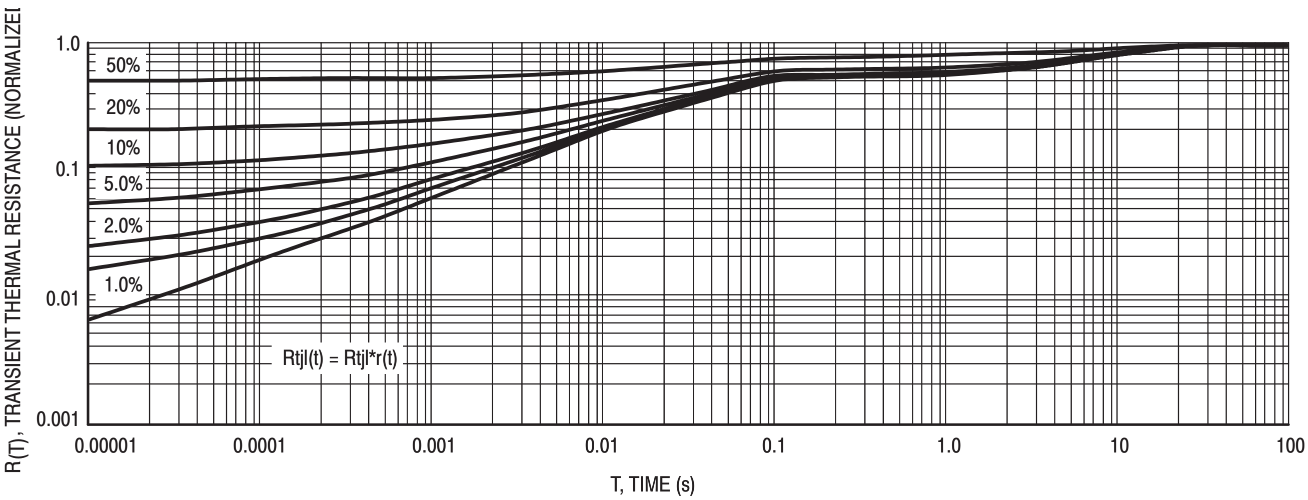



**Figure 8. Thermal Response Junction to Lead**

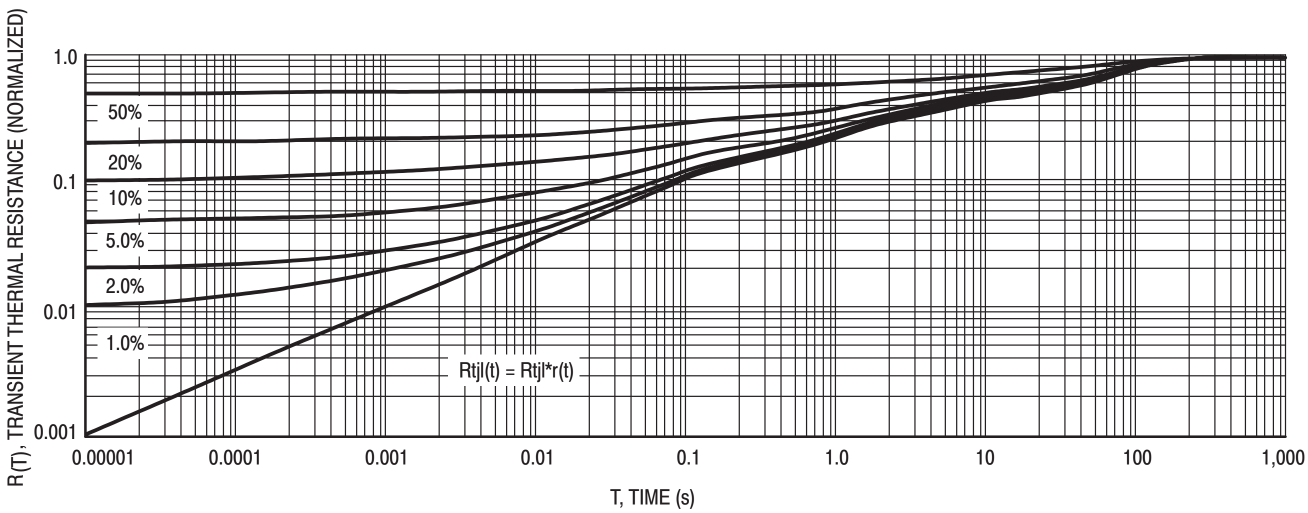



**Figure 9. Thermal Response Junction to Ambient**

# MR2502, MR2504, MR2510

**MR2504 and MR2510 are Preferred Devices**

# Medium-Current Silicon Rectifiers

. . . compact, highly efficient silicon rectifiers for medium–current applications requiring:

- High Current Surge — 400 Amperes @ $T_J = 175°C$
- Peak Performance @ Elevated Temperature — 25 Amperes @ $T_C = 150°C$
- Low Cost
- Compact, Molded Package — For Optimum Efficiency in a Small Case Configuration

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 1.8 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminals are Readily Solderable
- Lead Temperature for Soldering Purposes: requires a custom temperature soldering profile
- Polarity: Cathode Polarity Band
- Shipped 5000 units per box

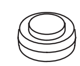
**MAXIMUM RATINGS**

Please See the Table on the Following Page

**ON Semiconductor™**

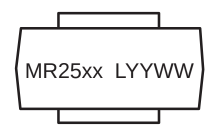
**http://onsemi.com**

**MEDIUM–CURRENT
SILICON RECTIFIERS
25 AMPERES
200–1000 VOLTS
DIFFUSED JUNCTION**



**MICRODE BUTTON
CASE 193**

**MARKING DIAGRAM**




MR25xx = Device Code
xx = 02, 04 or 10
L = Location Code
YY = Year
WW = Work Week

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MR2502 | Microde Button | 5000 Units/Box |
| MR2504 | Microde Button | 5000 Units/Box |
| MR2510 | Microde Button | 5000 Units/Box |

**Preferred** devices are recommended choices for future use and best overall value.

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## MAXIMUM RATINGS

| Characteristic | Symbol | MR2502 | MR2504 | MR2510 | Unit |
|---|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 200 | 400 | 1000 | Volts |
| Non–Repetitive Peak Reverse Voltage<br>(Halfwave, single phase, 60 Hz peak) | $V_{RSM}$ | 240 | 480 | 1200 | Volts |
| Average Rectified Forward Current<br>(Single phase, resistive load, 60 Hz, $T_C$ = 150°C) | $I_O$ | 25 | | | Amps |
| Non–Repetitive Peak Surge Current<br>(Surge applied at rated load conditions, halfwave, single phase, 60 Hz) | $I_{FSM}$ | 400 (for 1 cycle) | | | Amps |
| Operating and Storage Junction Temperature Range | $T_J$, $T_{stg}$ | – 65 to +175 | | | °C |

## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case<br>(Single Side Cooled) | $R_{\theta JC}$ | 1.0 | °C/W |

## ELECTRICAL CHARACTERISTICS

| Characteristics and Conditions | Symbol | Max | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage<br>($i_F$ = 78.5 Amps, $T_C$ = 25°C) | $v_F$ | 1.18 | Volts |
| Maximum Reverse Current (rated dc voltage)<br>$T_C$ = 25°C<br>$T_C$ = 100°C | $I_R$ | <br>100<br>500 | μA |

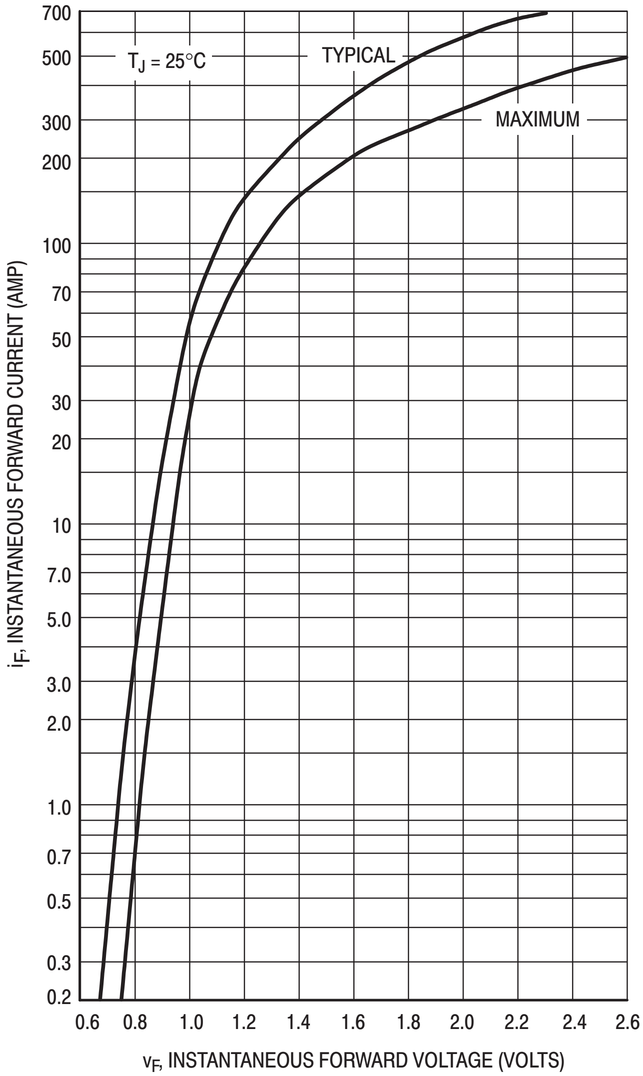



Figure 1. Forward Voltage

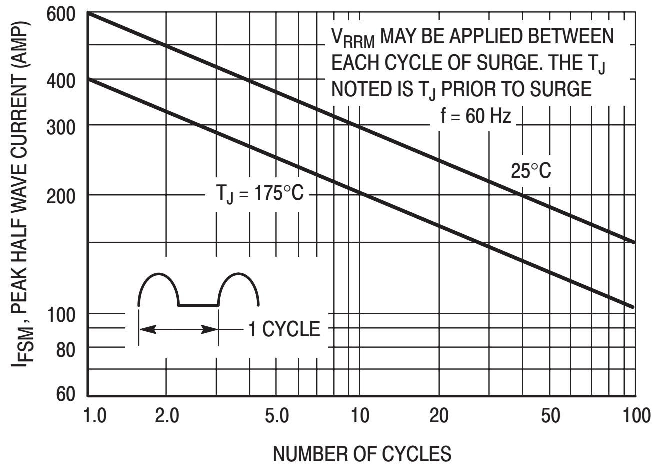



Figure 2. Non–Repetitive Surge Current

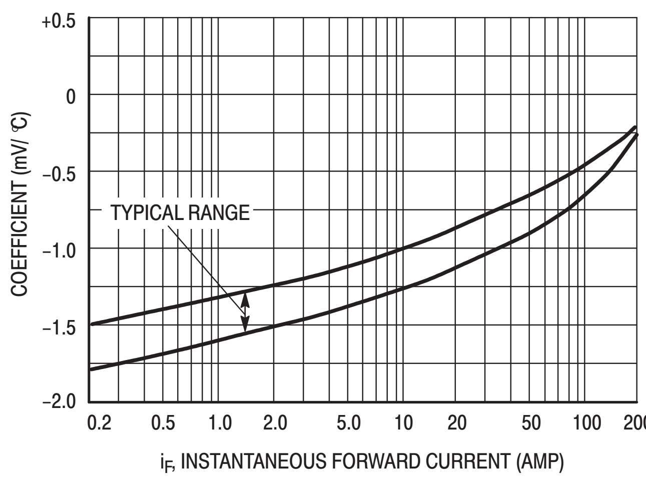



Figure 3. Forward Voltage Temperature Coefficient

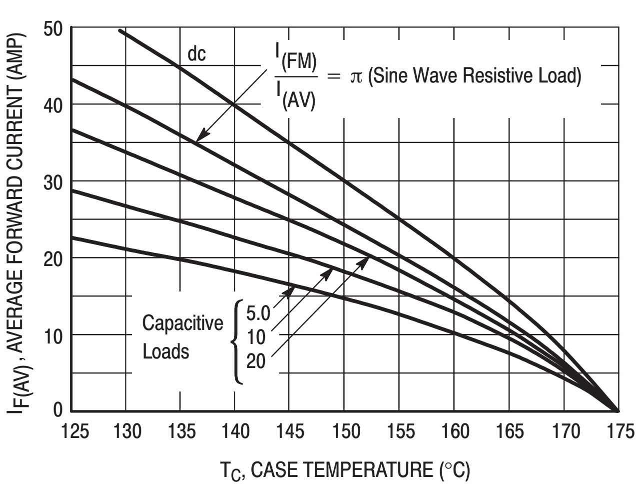



Figure 4. Current Derating

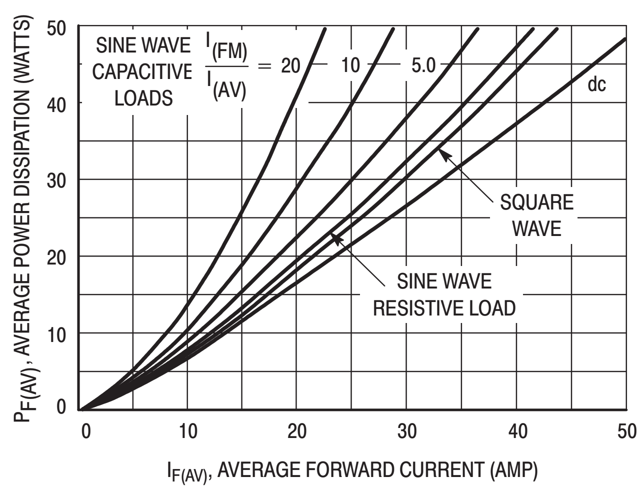



Figure 5. Forward Power Dissipation

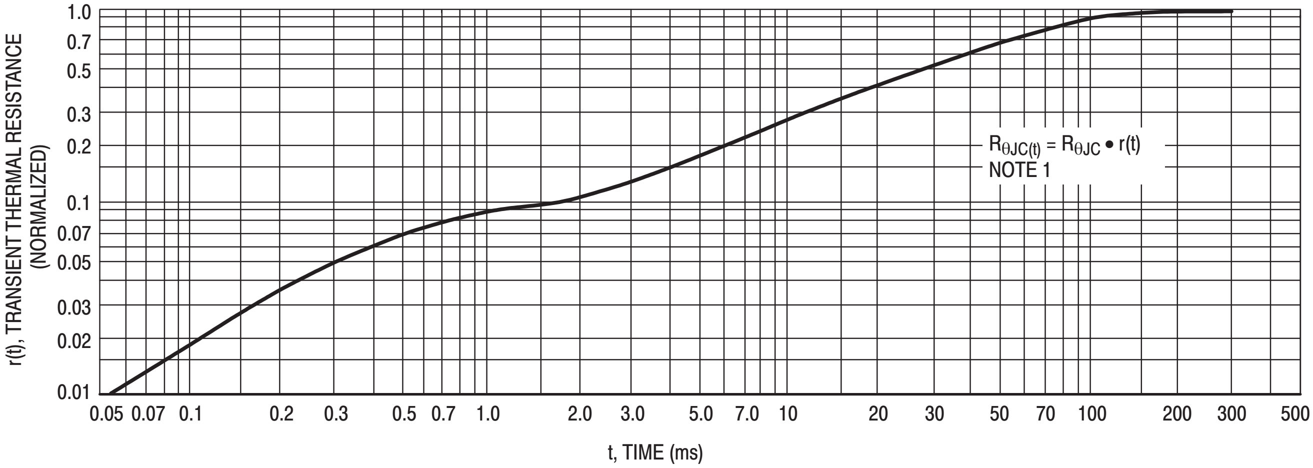
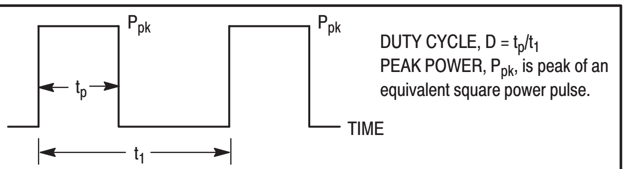



Figure 6. Thermal Response




To determine maximum junction temperature of the diode in a given situation, the following procedure is recommended:

The temperature of the case should be measured using a thermocouple placed on the case at the temperature reference point (see the outline drawing on page 1). The thermal mass connected to the case is normally large enough so that it will not significantly respond to heat surges generated in the diode as a result of pulsed operation once steady–state conditions are achieved. Using the measured value of $T_C$, the junction temperature may be determined by:

$$T_J = T_C + \Delta T_{JC}$$

where $\Delta T_{JC}$ is the increase in junction temperature above the case temperature, it may be determined by:

$\Delta T_{JC} = P_{pk} \cdot R_{\theta JC} [D + (1 - D) \cdot r(t_1 + t_p) + r(t_p) - r(t_1)]$ where

r(t) = normalized value of transient thermal resistance at time, t, from Figure 6, i.e.:

$r(t_1 + t_p)$ = normalized value of transient thermal resistance at time $t_1 + t_p$.

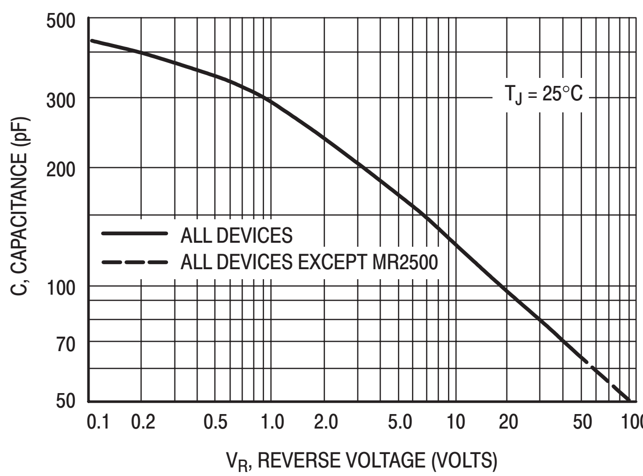



Figure 7. Capacitance

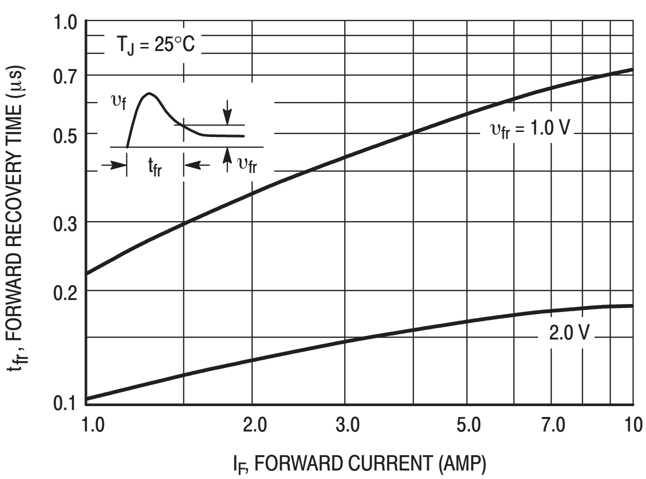



Figure 8. Forward Recovery Time

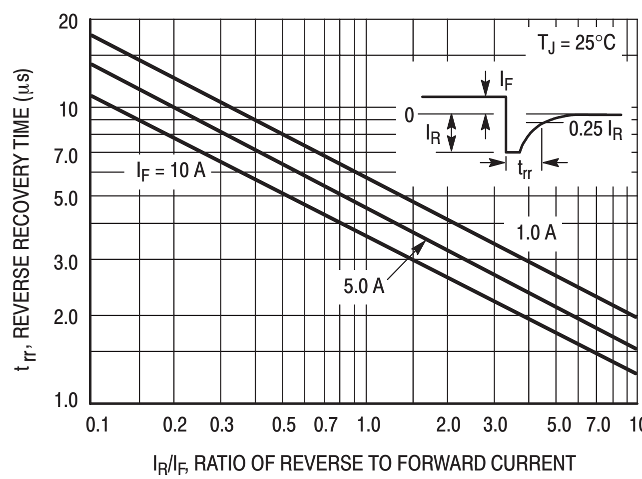



Figure 9. Reverse Recovery Time

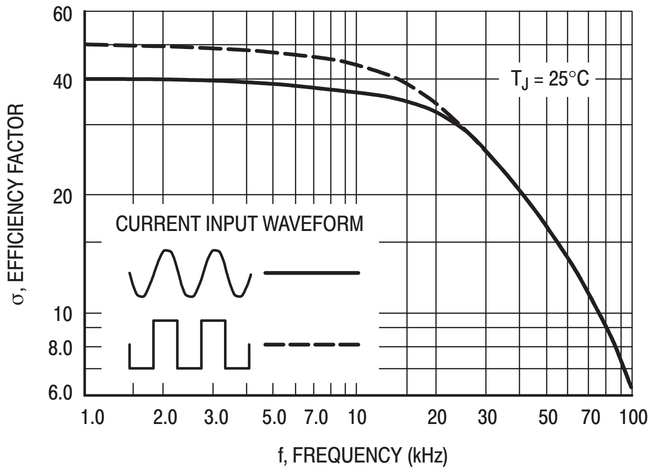



**Figure 10. Rectification Waveform Efficiency**

## RECTIFICATION EFFICIENCY NOTE

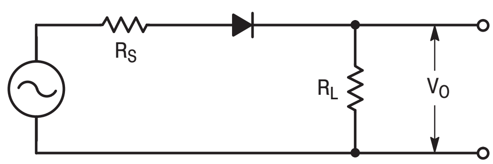



**Figure 11. Single–Phase Half–Wave Rectifier Circuit**

The rectification efficiency factor σ shown in Figure 10 was calculated using the formula:

$$\sigma = \frac{P_{(dc)}}{P_{(rms)}} = \frac{\frac{V^2{}_{o(dc)}}{R_L}}{\frac{V^2{}_{o(rms)}}{R_L}} \cdot 100\% = \frac{V^2{}_{o(dc)}}{V^2{}_{o(ac)} + V^2{}_{o(dc)}} \cdot 100\% \qquad (1)$$

For a sine wave input $V_m$ sin (ωt) to the diode, assume lossless, the maximum theoretical efficiency factor becomes:

$$\sigma_{(sine)} = \frac{\frac{V^2{}_m}{\pi^2 R_L}}{\frac{V^2{}_m}{4R_L}} \cdot 100\% = \frac{4}{\pi^2} \cdot 100\% = 40.6\% \qquad (2)$$

For a square wave input of amplitude $V_m$, the efficiency factor becomes:

$$\sigma_{(square)} = \frac{\frac{V^2{}_m}{2R_L}}{\frac{V^2{}_m}{R_L}} \cdot 100\% = 50\% \qquad (3)$$

(A full wave circuit has twice these efficiencies)

As the frequency of the input signal is increased, the reverse recovery time of the diode (Figure 9) becomes significant, resulting in an increasing ac voltage component across $R_L$ which is opposite in polarity to the forward current, thereby reducing the value of the efficiency factor σ, as shown on Figure 10.

It should be emphasized that Figure 10 shows waveform efficiency only; it does not provide a measure of diode losses. Data was obtained by measuring the ac component of $V_O$ with a true rms ac voltmeter and the dc component with a dc voltmeter. The data was used in Equation 1 to obtain points for Figure 10.

### ASSEMBLY AND SOLDERING INFORMATION

There are *two basic areas* of consideration for successful implementation of button rectifiers:

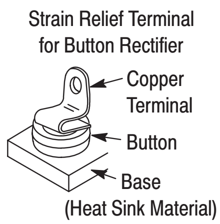
1. Mounting and Handling
2. Soldering

each should be carefully examined before attempting a finished assembly or mounting operation.

### MOUNTING AND HANDLING

The button rectifier lends itself to a multitude of assembly arrangements but one key consideration must *always* be included:

**One Side of the Connections to the Button Must Be Flexible!**




This stress relief to the button should also be chosen for maximum contact area to afford the best heat transfer — but not at the expense of flexibility. For an annealed copper terminal a thickness of 0.015″ is suggested.

The base heat sink may be of various materials whose shape and size are a function of the individual application and the heat transfer requirements.

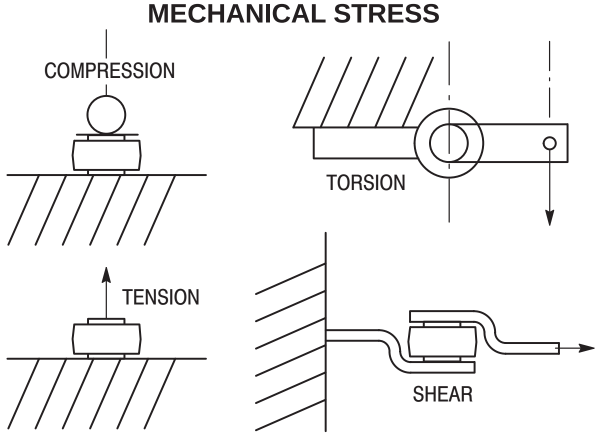
| Common Materials | Advantages and Disadvantages |
| --- | --- |
| Steel | Low Cost; relatively low heat conductivity |
| Copper | High Cost; high heat conductivity |
| Aluminum | Medium Cost; medium heat conductivity<br>Relatively expensive to plate and not all platers can process aluminum. |

Handling of the button during assembly must be relatively gentle to minimize sharp impact shocks and avoid nicking of the plastic. Improperly designed automatic handling equipment is the worst source of unnecessary shocks. Techniques for vacuum handling and spring loading should be investigated.

The mechanical stress limits for the button diode are as follows:

| | | |
| --- | --- | --- |
| Compression | 32 lbs. | 142.3 Newton |
| Tension | 32 lbs. | 142.3 Newton |
| Torsion | 6–inch lbs. | 0.68 Newton–meters |
| Shear | 55 lbs. | 244.7 Newton |

**MECHANICAL STRESS**




Exceeding these recommended maximums can result in electrical degradation of the device.

### SOLDERING

The button rectifier is basically a semiconductor chip bonded between two nickel–plated copper heat sinks with an encapsulating material of thermal–setting silicone. The exposed metal areas are also tin plated to enhance solderability.

In the soldering process it is important that the temperature not exceed 250°C if device damage is to be avoided. Various solder alloys can be used for this operation but two types are recommended for best results:

1. 95% Sn, 5% Sb; melting point 237°C
2. 96.5% tin, 3.5% silver; melting point 221°C
3. 63% tin, 37% lead; melting point 183°C

Solder is available as preforms or paste. The paste contains both the metal and flux and can be dispensed rapidly. The solder preform requires the application of a flux to assure good wetting of the solder. The type of flux used depends upon the degree of cleaning to be accomplished and is a function of the metals involved. These fluxes range from a mild rosin to a strong acid; e.g., Nickel plating oxides are best removed by an acid base flux while an activated rosin flux may be sufficient for tin plated parts.

Since the button is relatively light–weight, there is a tendency for it to float when the solder becomes liquid. To prevent bad joints and misalignment it is suggested that a weighting or spring loaded fixture be employed. It is also important that severe thermal shock (either heating or cooling) be avoided as it may lead to damage of the die or encapsulant of the part.

Button holding fixtures for use during soldering may be of various materials. Stainless steel has a longer use life while black anodized aluminum is less expensive and will limit heat reflection and enhance absorption. The assembly volume will influence the choice of materials. Fixture dimension tolerances for locating the button must allow for expansion during soldering as well as allowing for button clearance.

### HEATING TECHNIQUES

The following four heating methods have their advantages and disadvantages depending on volume of buttons to be soldered.

1. **Belt Furnaces** readily handle large or small volumes and are adaptable to establishment of “on–line’’ assembly since a variable belt speed sets the run rate. Individual furnace zone controls make excellent temperature control possible.
2. **Flame Soldering** involves the directing of natural gas flame jets at the base of a heatsink as the heatsink is indexed to various loading–heating–cooling–unloading positions. This is the most economical labor method of soldering large volumes. Flame soldering offers good temperature control but requires sophisticated temperature monitoring systems such as infrared.

**ASSEMBLY AND SOLDERING INFORMATION (continued)**

3. **Ovens** are good for batch soldering and are production limited. There are handling problems because of slow cooling. Response time is load dependent, being a function of the watt rating of the oven and the mass of parts. Large ovens may not give an acceptable temperature gradient. Capital cost is low compared to belt furnaces and flame soldering.
4. **Hot Plates** are good for soldering small quantities of prototype devices. Temperature control is fair with overshoot common because of the exposed heating surface. Solder flow and positioning can be corrected during soldering since the assembly is exposed. Investment cost is very low.

Regardless of the heating method used, a soldering profile giving the time–temperature relationship of the particular method must be determined to assure proper soldering. Profiling must be performed on a scheduled basis to minimize poor soldering. The time–temperature relationship will change depending on the heating method used.

## SOLDER PROCESS EVALUATION

Characteristics to look for when setting up the soldering process:

I **Overtemperature** is indicated by any one or all three of the following observations.

1. Remelting of the solder inside the button rectifier shows the temperature has exceeded 285°C and is noted by "islands" of shiny solder and solder dewetting when a unit is broken apart.
2. Cracked die inside the button may be observed by a moving reverse oscilloscope trace when pressure is applied to the unit.
3. Cracked plastic may be caused by thermal shock as well as overtemperature so cooling rate should also be checked.

II **Cold soldering** gives a grainy appearance and solder build–up without a smooth continuous solder fillet. The temperature must be adjusted until the proper solder fillet is obtained within the maximum temperature limits.

III **Incomplete solder fillets** result from insufficient solder or parts not making proper contact.

IV **Tilted buttons** can cause a void in the solder between the heatsink and button rectifier which will result in poor heat transfer during operation. An eight degree tilt is a suggested maximum value.

V **Plating problems** require a knowledge of plating operations for complete understanding of observed deficiencies.

1. Peeling or plating separation is generally seen when a button is broken away for solder inspection. If heatsink or terminal base metal is present the plating is poor and must be corrected.
2. Thin plating allows the solder to penetrate through to the base metal and can give a poor connection. A suggested minimum plating thickness is 300 microinches.
3. Contaminated soldering surfaces may out–gas and cause non–wetting resulting in voids in the solder connection. The exact cause is not always readily apparent and can be because of:
   (a) improper plating
   (b) mishandling of parts
   (c) improper and/or excessive storage time

## SOLDER PROCESS MONITORING

Continuous monitoring of the soldering process must be established to minimize potential problems. All parts used in the soldering operation should be sampled on a lot by lot basis by assembly of a controlled sample. Evaluate the control sample by break–apart tests to view the solder connections, by physical strength tests and by dimensional characteristics for part mating.

A shear test is a suggested way of testing the solder bond strength.

## POST SOLDERING OPERATION CONSIDERATIONS

After soldering, the completed assembly must be unloaded, washed and inspected.

**Unloading** must be done carefully to avoid unnecessary stress. Assembly fixtures should be cooled to room temperature so solder profiles are not affected.

**Washing** is mandatory if an acid flux is used because of its ionic and corrosive nature. Wash the assemblies in agitated hot water and detergent for three to five minutes. After washing; rinse, blow off excessive water and bake 30 minutes at 150°C to remove trapped moisture.

**Inspection** should be both electrical and physical. Any rejects can be reworked as required.

## SUMMARY

The Button Rectifier is an excellent building block for specialized applications. The prime example of its use is the output bridge of the automative alternator where millions are used each year. Although the material presented here is not all inclusive, primary considerations for use are presented. For further information, contact the nearest ON Semiconductor Sales Office or franchised distributor.

# TRA2525 MR3025

# Medium-Current Silicon Rectifiers

## 250 Volts, 25 Amperes

Compact, highly efficient silicon rectifiers for medium–current applications requiring:

- High Current Surge — 400 Amperes @ $T_J$ = 175°C
- Peak Performance @ Elevated Temperature — 25 Amperes
- Low Cost
- Compact, Molded Package for Optimum Efficiency in a Small Case Configuration

### Mechanical Characteristics

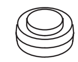
- Finish: All External Surfaces are Corrosion Resistant, and Contact Areas are Readily Solderable
- Polarity: Indicated by Cathode Band
- Weight: 1.8 Grams (Approximately)
- Maximum Temperature for Soldering Purposes: 260°C
- Marking: 2525 or MR3025

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| DC Blocking Voltage | $V_R$ | 250 | Volts |
| Non–Repetitive Peak Reverse Voltage (Halfwave, Single Phase, 60 Hz) | $V_{RSM}$ | 310 | Volts |
| Average Forward Current (Single Phase, Resistive Load, $T_C$ = 150°C) | $I_O$ | 25 | Amps |
| Non–Repetitive Peak Surge Current (Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 400 | Amps |
| Operating Junction Temperature Range | $T_J$ | –65 to +175 | °C |
| Storage Temperature Range | $T_{stg}$ | –65 to +175 | °C |

**ON Semiconductor™**

**http://onsemi.com**



**MICRODE BUTTON**
**CASE 193**

**MARKING DIAGRAM**


2525 = Device Code
L = Location Code
YY = Year
WW = Work Week

**MARKING DIAGRAM**


MR3025 = Device Code
L = Location Code
YY = Year
WW = Work Week

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| TRA2525 | Microde Button | 5000 Units/Box |
| MR3025 | Microde Button | 5000 Units/Box |

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## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.0 | °C/W |

## ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.)<br>($I_F$ = 100 Amps, $T_C$ = 25°C) | $V_F$ | — | 1.18 | Volts |
| Reverse Current(1)<br>($V_R$ = 250 V, $T_C$ = 25°C)<br>($V_R$ = 250 V, $T_C$ = 100°C) | $I_R$ | <br>—<br>— | <br>10<br>250 | μA |
| Forward Voltage Temperature Coefficient @ $I_F$ = 10 mA | $V_{FTC}$ | – 2* | – 2* | mV/°C |

1. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2%.

*Typical

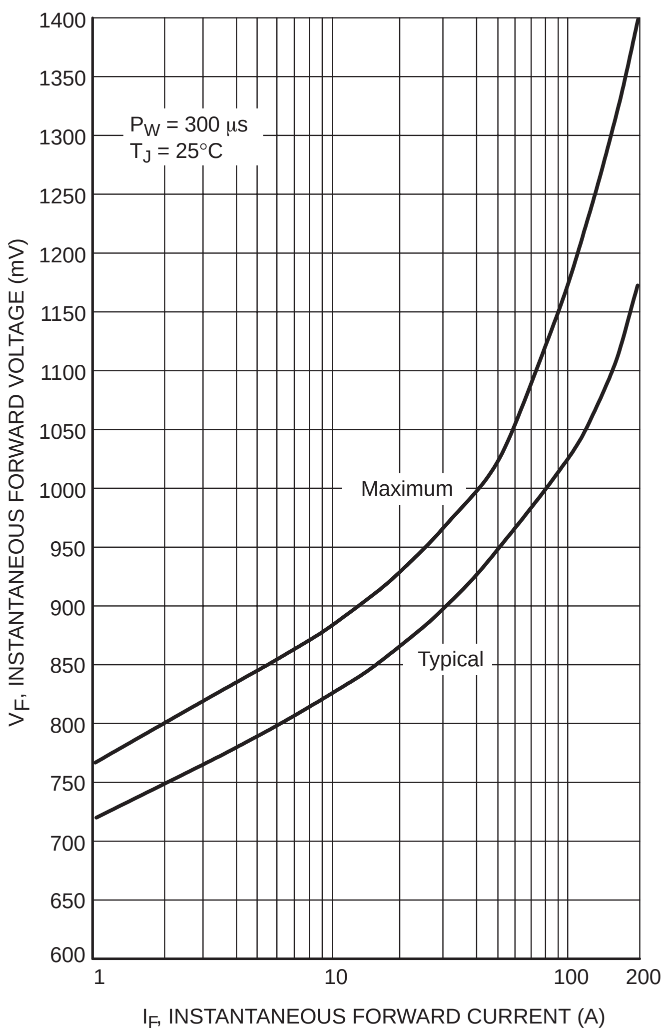



**Figure 1. Forward Voltage**

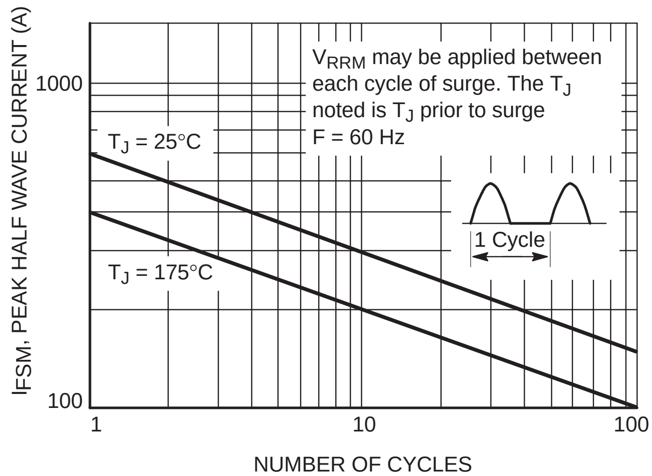



**Figure 2. Non–Repetitive Surge Current**

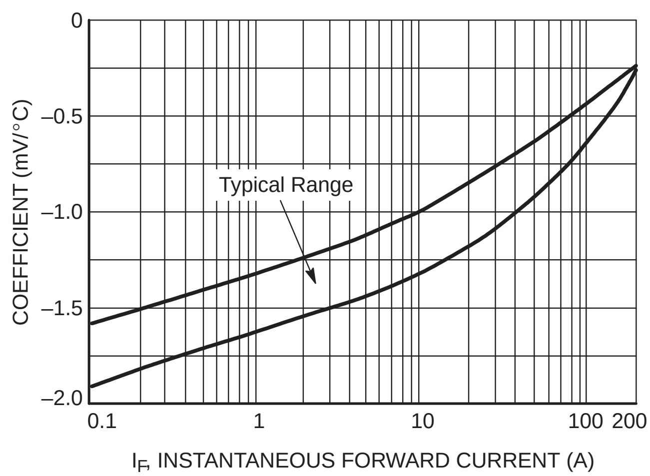



**Figure 3. $V_F$ Temperature Coefficient**

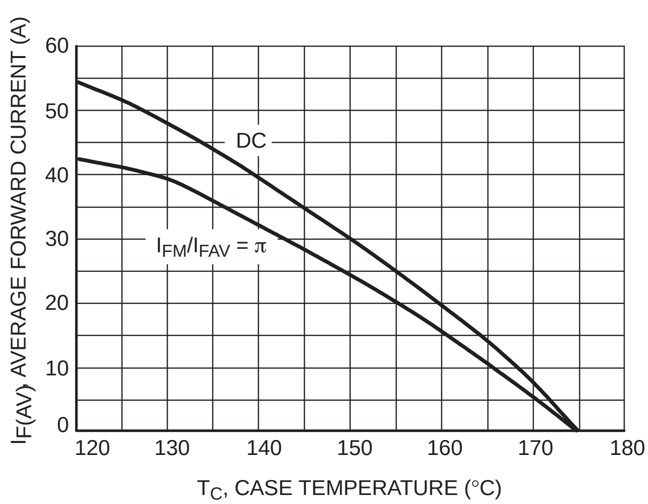



**Figure 4. Current Derating**

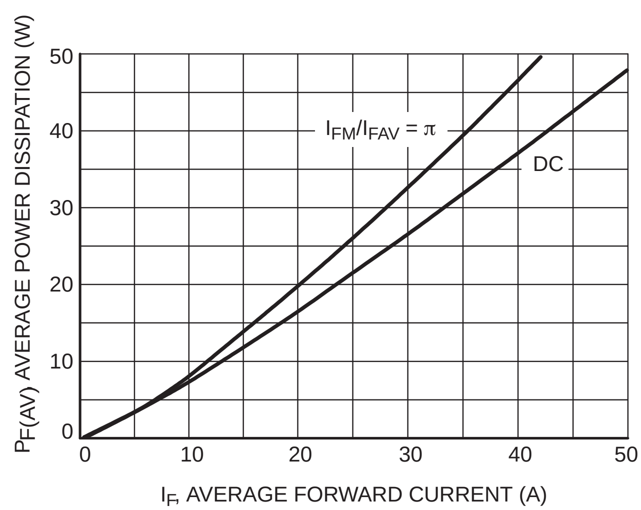



**Figure 5. Forward Power Dissipation**

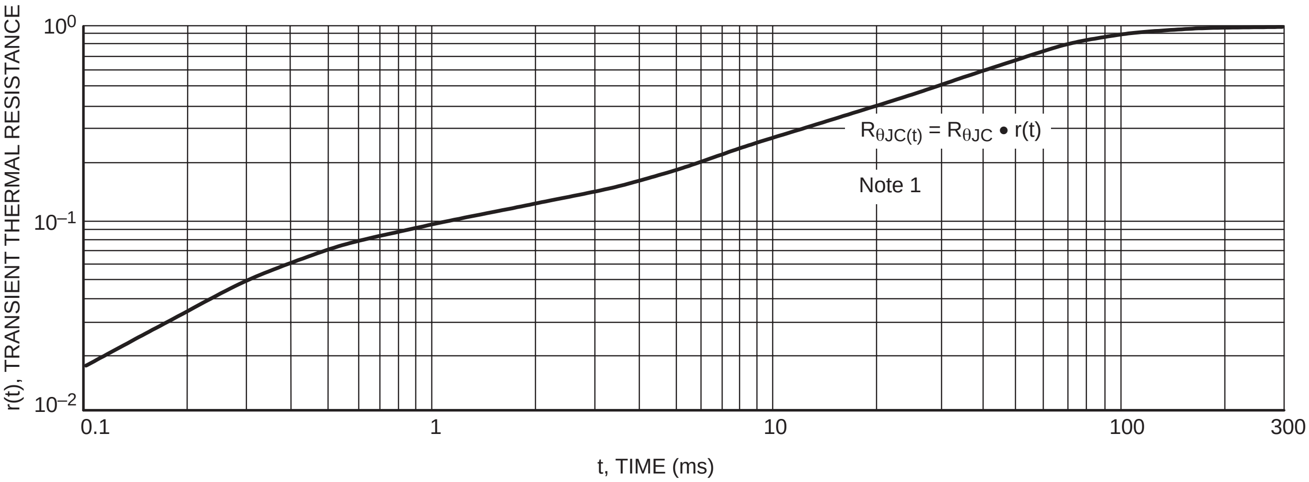
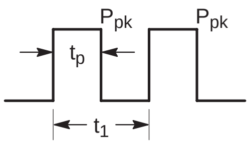



**Figure 6. Thermal Response**

NOTE 1




DUTY CYCLE, $D = t_p/t_1$
PEAK POWER, $P_{pk}$ is peak of an equivalent square power pulse

To determine maximum junction temperature of the diode in a given situation, the following procedure is recommended.

The temperature of the case should be measured using a thermocouple placed on the case at the temperature reference point (see the outline drawing on page 1). The thermal mass connected to the case is normally large enough so that it will not significantly respond to heat surges generated in the diode as a result of pulse operation once steady state conditions are achieved.

Using the measured value of $T_C$, the junction temperature may be determined by:

$$T_J = T_C + \Delta T_{JC}$$

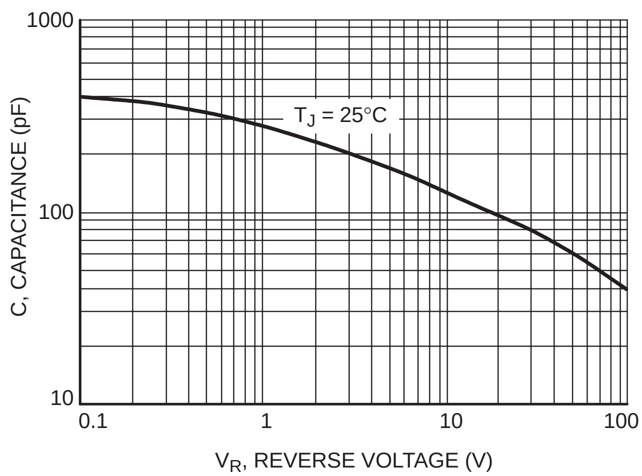
Where $\Delta T_{JC}$ is the increase in junction temperature above the case temperature, it may be determined by:

$$\Delta T_{JC} = P_{pk} \cdot R_{\theta JC} [D + (1 - D) \cdot r(t_1 + t_p) + r(t_p) - r(t_1)]$$

where:

$r(t)$ = normalized value of transient thermal resistance at time, t, from Figure 6, i.e.:

$r(t_1 + t_p)$ = normalized value of transient thermal resistance at time $t_1 + t_p$.

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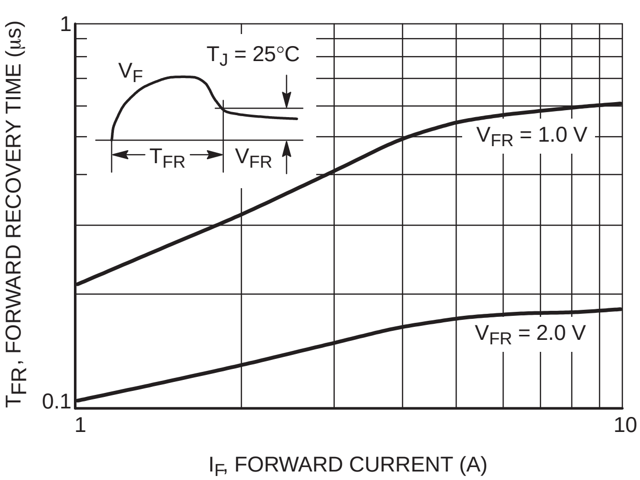


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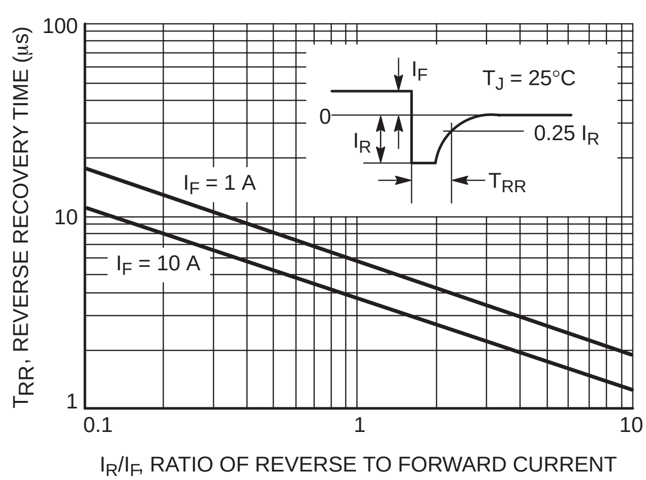



**Figure 9. Reverse Recovery Time**

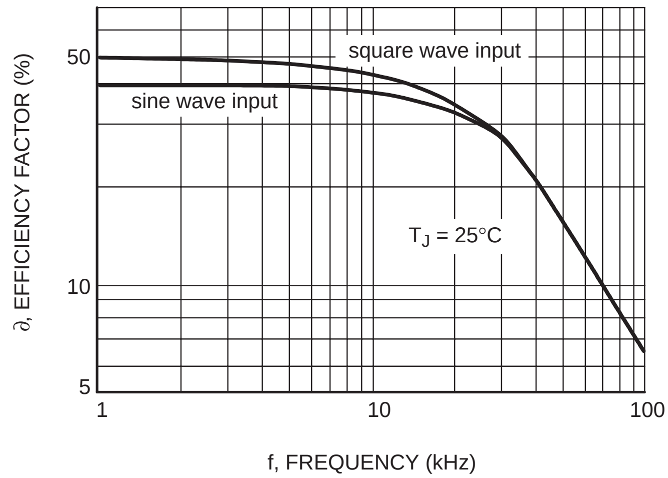



**Figure 10. Rectification Waveform Efficiency**

## RECTIFICATION EFFICIENCY NOTE

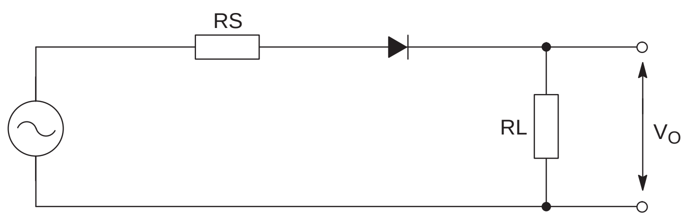



**Figure 11. Single Phase Half–Wave Rectifier Circuit**

The rectification efficiency factor ∂ shown in Figure 10 was calculated using the formula:

$$\partial = \frac{P_{(dc)}}{P_{(rms)}} = \frac{\frac{V^2{}_{o(dc)}}{R_L}}{\frac{V^2{}_{o(rms)}}{R_L}} \cdot 100\% = \frac{V^2{}_{o(dc)}}{V^2{}_{o(ac)} + V^2{}_{o(dc)}} \cdot 100\% \qquad (1)$$

For a sine wave input Vm sin(wt) to the diode, assume lossless, the maximum theoretical efficiency factor becomes:

$$\partial_{(sine)} = \frac{\frac{V^2{}_m}{\pi^2 R_L}}{\frac{V^2{}_m}{4R_L}} \cdot 100\% = \frac{4}{\pi^2} \cdot 100\% = 40.6\% \qquad (2)$$

For a square wave input of amplitude Vm, the efficiency factor becomes:

$$\partial_{(square)} = \frac{\frac{V^2{}_m}{2R_L}}{\frac{V^2{}_m}{R_L}} \cdot 100\% = 50\% \qquad (3)$$

(a full wave circuit has twice these efficiencies)

As the frequency of the input signal is increased, the reverse recovery time of the diode (Figure 9) becomes significant, resulting in an increase ac voltage component across RL which is opposite in polarity to the forward current, thereby reducing the value of the efficiency factor ∂, as shown on Figure 10.

It should be emphasized that Figure 10 shows waveform efficiency only; it does not provide a measure of diode losses. Data was obtained by measuring the ac component of $V_O$ with a true rms ac voltmeter and the dc component with a dc voltmeter. The data was used in Equation 1 to obtain points for Figure 10.

### Assembly and Soldering Information

There are t*wo basic areas* of consideration for successful implementation of button rectifiers:

1. Mounting and Handling
2. Soldering

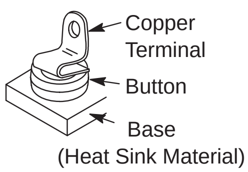
Each should be carefully examined before attempting a finished assembly or mounting operation.

### Mounting and Handling

The button rectifier lends itself to a multitude of assembly arrangements, but one key consideration must *always* be included: One Side of the Connections to the Button Must be Flexible!

This stress relief to the button should also be chosen for maximum contact area to afford the best heat transfer — but not at the expense of flexibility. For an annealed copper terminal a thickness of 0.015″ is suggested.

Strain Relief Terminal
for Button Rectifier




The base heat sink may be of various materials whose shape and size are a function of the individual application and the heat transfer requirements.

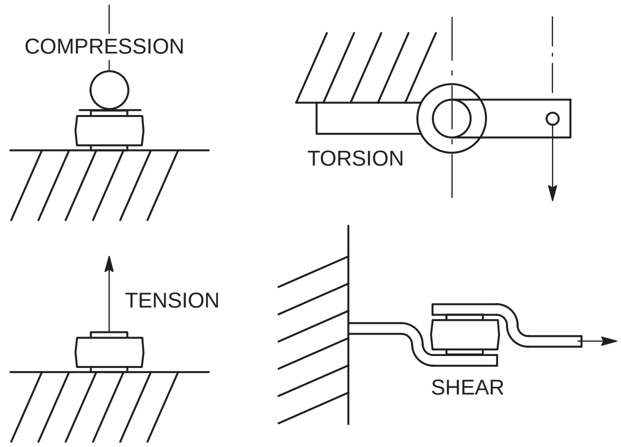
| Common Materials | Advantages and Disadvantages |
|---|---|
| Steel | Low Cost: relatively low heat conductivity |
| Copper | High Cost: high heat conductivity |
| Aluminum | Medium Cost: medium heat conductivity. Relatively expensive to plate and not all platers can process aluminum. |

Handling of the button during assembly must be relatively gentle to minimize sharp impact shocks and avoid nicking of the plastic. Improperly designed automatic handling equipment is the worst source of unnecessary shocks. Techniques for vacuum handling and spring loading should be investigated.

The mechanical stress limits for the button diode are as follows:

| | | |
|---|---|---|
| Compression | 32 lbs. | 142.3 Newton |
| Tension | 32 lbs. | 142.3 Newton |
| Torsion | 6–inch lbs. | 0.68 Newtons–meters |
| Shear | 55 lbs. | 244.7 Newton |

MECHANICAL STRESS




Exceeding these recommended maximums can result in electrical degradation of the device.

### Soldering

The button rectifier is basically a semiconductor chip bonded between two nickel–plated copper heat sinks with an encapsulating material of epoxy compound. The exposed metal areas are also tin plated to enhance solderability.

In the soldering process it is important that the temperature not exceed 260°C if device damage is to be avoided. Various solder alloys can be used for this operation but two types are recommended for best results:

1. 95% Sn, 5% Sb; melting point 237°C
2. 96.5% tin, 3.5% silver; melting point 221°C
3. 63% tin, 37% lead; melting point 183°C

Solder is available as preforms or paste. The paste contains both the metal and flux and can be dispensed rapidly. The solder preform requires the application of a flux to assure good wetting of the solder. The type of flux used depends upon the degree of cleaning to be accomplished and is a function of the metal involved. These fluxes range from a mild rosin to a strong acid; e.g., Nickel plating oxides are best removed by an acid base flux while an activated rosin flux may be sufficient for tin plated parts.

Since the button is relatively lightweight, there is a tendency for it to float when the solder becomes liquid. To prevent bad joints and misalignment, it is suggested that a weighting or spring loaded fixture be employed. It is also important that severe thermal shock (either heating or cooling) be avoided as it may lead to damage of the die or encapsulant of the part.

Button holding fixtures for use during soldering may be of various materials. Stainless steel has a longer use life while black anodized aluminum is less expensive and will limit heat reflection and enhance absorption. The assembly volume will influence the choice of materials. Fixture dimension tolerances for locating the button must allow for expansion during soldering as well as allowing for button clearance.

### Heating Techniques

The following four heating methods have their advantages and disadvantages depending on volume of buttons to be soldered.

1. **Belt furnaces** readily handle large or small volumes and are adaptable to establishment of “on–line’’ assembly since a variable belt speed sets the run rate. Individual furnace zone controls make excellent temperature control possible.
2. **Flame Soldering** involves the directing of natural gas flame jets at the base of a heatsink as the heatsink is indexed to various loading–heating–cooling–unloading positions. This is the most economical labor method of soldering large volumes. Flame soldering offers good temperature control but requires sophisticated temperature monitoring systems such as infrared.
3. **Ovens** are good for batch soldering and are production limited. There are handling problems because of slow cooling. Response time is load dependent, being a function of the watt rating of the oven and the mass of parts. Large ovens may not give an acceptable temperature gradient. Capital cost is low compared to belt furnaces and flame soldering.
4. **Hot Plates** are good for soldering small quantities of prototype devices. Temperature control is fair with overshoot common because of the exposed heating surface. Solder flow and positioning can be corrected during soldering since the assembly is exposed. Investment cost is very low.

Regardless of the heating method used, a soldering profile giving the time–temperature relationship of the particular method must be determined to assure proper soldering. Profiling must be performed on a scheduled basis to minimize poor soldering. The time–temperature relationship will change depending on the heating method used.

# TRA3225

## Medium-Current Silicon Rectifier

### 250 Volts, 32 Amperes

Compact, highly efficient silicon rectifiers for medium–current applications requiring:

- High Current Surge – 500 Amperes @ $T_J$ = 175°C
- Peak Performance @ Elevated Temperature – 32 Amperes
- Low Cost
- Compact, Molded Package for Optimum Efficiency in a Small Case Configuration

**Mechanical Characteristics**

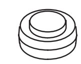
- Finish: All External Surfaces are Corrosion Resistant, and Contact Areas are Readily Solderable
- Polarity: Indicated by Cathode Band
- Weight: 1.8 Grams (Approximately)
- Maximum Temperature for Soldering Purposes: 260°C
- Marking: 3225

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| DC Blocking Voltage | $V_R$ | 250 | Volts |
| Non–Repetitive Peak Reverse Voltage (Halfwave, Single Phase, 60 Hz) | $V_{RSM}$ | 310 | Volts |
| Average Forward Current (Single Phase, Resistive Load, $T_C$ = 150°C) | $I_O$ | 32 | Amps |
| Non–Repetitive Peak Surge Current (Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 500 | Amps |
| Operating Junction Temperature Range | $T_J$ | –65 to +175 | °C |
| Storage Temperature Range | $T_{stg}$ | –65 to +175 | °C |

ON Semiconductor™

http://onsemi.com



**MICRODE BUTTON**
**CASE 193**

**MARKING DIAGRAM**


3225 = Device Code
L = Location Code
YY = Year
WW = Work Week

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| TRA3225 | Microde Button | 5000 Units/Box |

© Semiconductor Components Industries, LLC, 2000

## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 0.8 | °C/W |

## ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.)<br>($I_F$ = 100 Amps, $T_C$ = 25°C) | $V_F$ | – | 1.15 | Volts |
| Reverse Current (Note 1.)<br>($V_R$ = 250 V, $T_C$ = 25°C)<br>($V_R$ = 250 V, $T_C$ = 100°C) | $I_R$ | <br>–<br>– | <br>20<br>250 | μA |
| Forward Voltage Temperature Coefficient ($I_F$ = 10 mA) | $V_{FTC}$ | – 2* | – 2* | mV/°C |

1. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2%.

*Typical

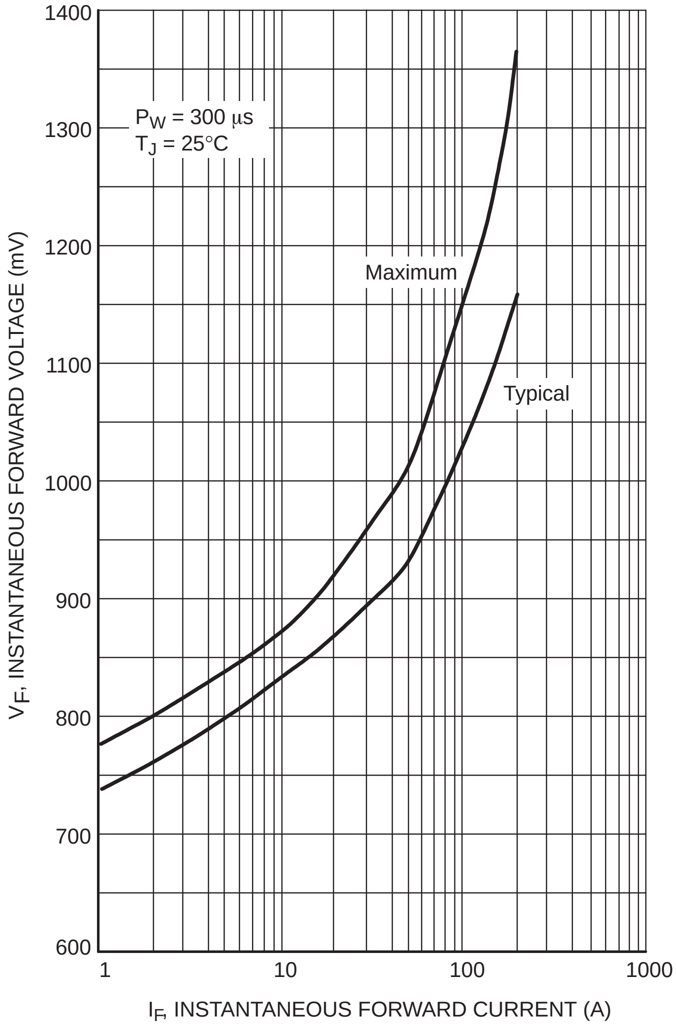



**Figure 1. Forward Voltage**

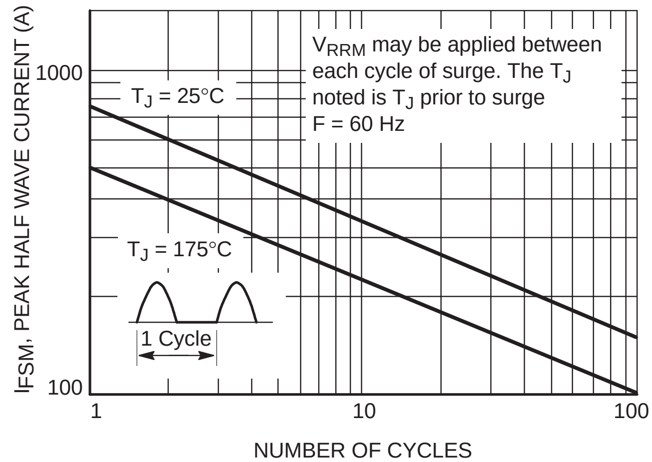



**Figure 2. Non–Repetitive Surge Current**

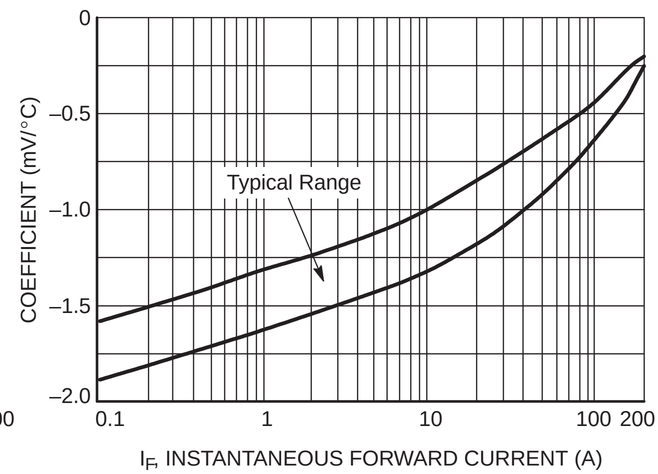



**Figure 3. $V_F$ Temperature Coefficient**

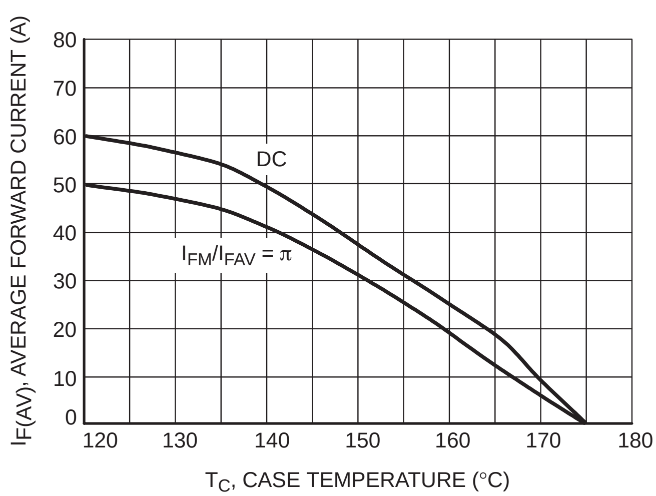



**Figure 4. Current Derating**

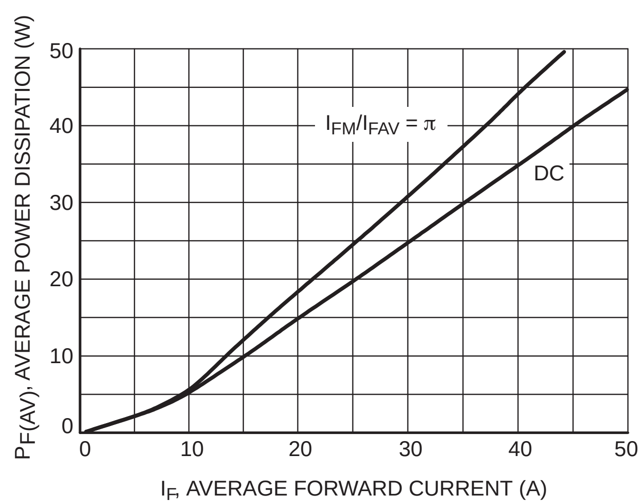



**Figure 5. Forward Power Dissipation**

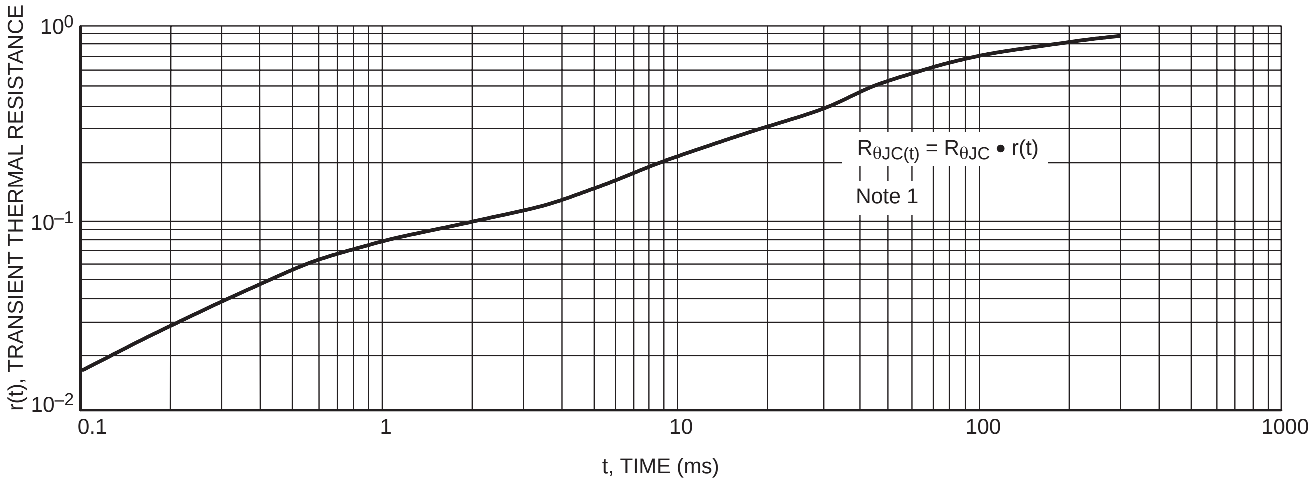
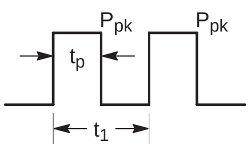



**Figure 6. Thermal Response**

NOTE 1




DUTY CYCLE, $D = t_p/t_1$
PEAK POWER, $P_{pk}$ is peak of an equivalent square power pulse

To determine maximum junction temperature of the diode in a given situation, the following procedure is recommended.

The temperature of the case should be measured using a thermocouple placed on the case at the temperature reference point (see the outline drawing on page 1). The thermal mass connected to the case is normally large enough so that it will not significantly respond to heat surges generated in the diode as a result of pulse operation once steady state conditions are achieved.

Using the measured value of $T_C$, the junction temperature may be determined by:

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Where $\Delta T_{JC}$ is the increase in junction temperature above the case temperature, it may be determined by:

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where:

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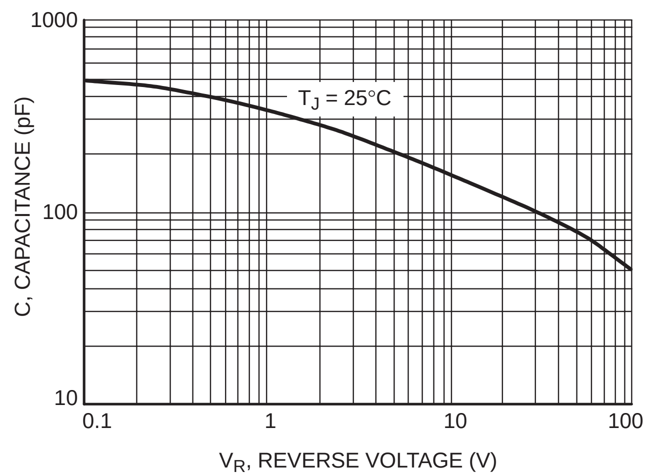


**Figure 7. Typical Capacitance**

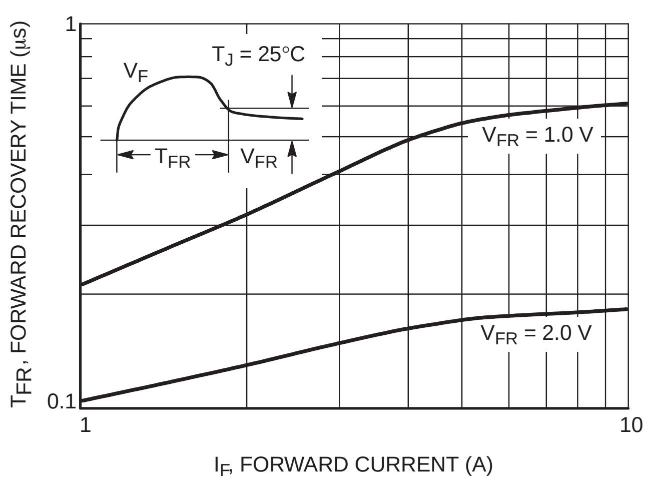


**Figure 8. Forward Recovery Time**

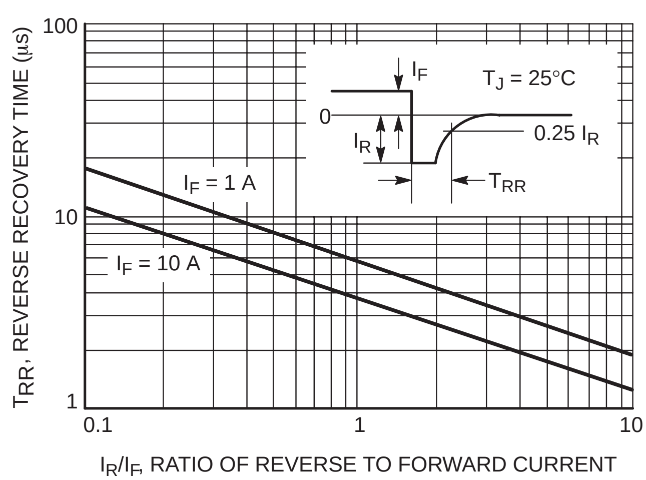


**Figure 9. Reverse Recovery Time**

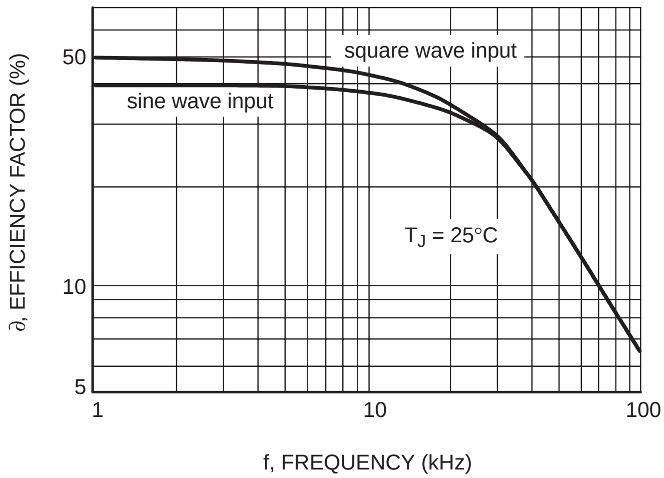


**Figure 10. Rectification Waveform Efficiency**

## RECTIFICATION EFFICIENCY NOTE

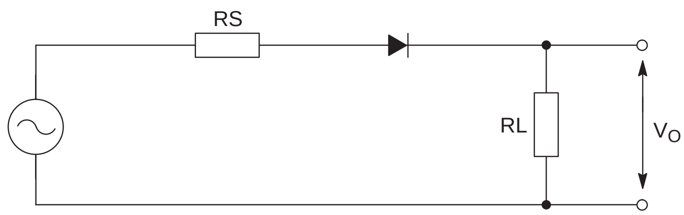


**Figure 11. Single Phase Half–Wave Rectifier Circuit**

The rectification efficiency factor ∂ shown in Figure 10 was calculated using the formula:

$$\partial = \frac{P_{(dc)}}{P_{(rms)}} = \frac{\frac{V^2{}_{o(dc)}}{R_L}}{\frac{V^2{}_{o(rms)}}{R_L}} \cdot 100\% = \frac{V^2{}_{o(dc)}}{V^2{}_{o(ac)} + V^2{}_{o(dc)}} \cdot 100\% \qquad (1)$$

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(a full wave circuit has twice these efficiencies)

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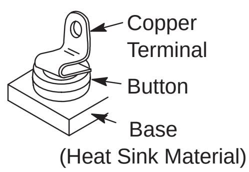


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| | | |
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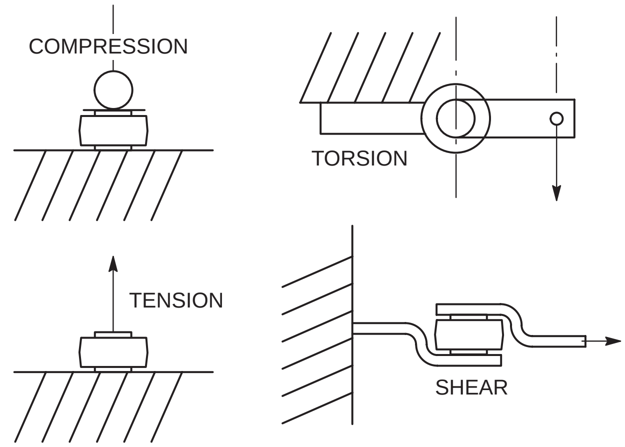
**MECHANICAL STRESS**




Exceeding these recommended maximums can result in electrical degradation of the device.

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# MR750 SERIES

**MR754 and MR760 are Preferred Devices**

# High Current Lead Mounted Rectifiers

- Current Capacity Comparable to Chassis Mounted Rectifiers
- Very High Surge Capacity
- Insulated Case

**Mechanical Characteristics:**

- Case: Epoxy, Molded
- Weight: 2.5 grams (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Lead is Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds
- Polarity: Cathode Polarity Band
- Shipped 1000 units per plastic bag. Available Tape and Reeled, 800 units per reel by adding a “RL’’ suffix to the part number

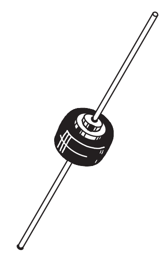
**MAXIMUM RATINGS**

| Please See the Table on the Following Page |
|---|

ON Semiconductor™

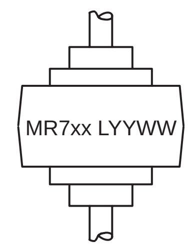
http://onsemi.com

**HIGH CURRENT LEAD MOUNTED SILICON RECTIFIERS 50 – 1000 VOLTS DIFFUSED JUNCTION**



**AXIAL LEAD BUTTON CASE 194 STYLE 1**

**MARKING DIAGRAM**




MR7xx = Device Code
xx = 50, 51, 52, 54, 56 or 60
L = Location Code
YY = Year
WW = Work Week

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MR750 | Axial Lead | 1000 Units/Bag |
| MR750RL | Axial Lead | 800/Tape & Reel |
| MR751 | Axial Lead | 1000 Units/Bag |
| MR751RL | Axial Lead | 800/Tape & Reel |
| MR752 | Axial Lead | 1000 Units/Bag |
| MR752RL | Axial Lead | 800/Tape & Reel |
| MR754 | Axial Lead | 1000 Units/Bag |
| MR754RL | Axial Lead | 800/Tape & Reel |
| MR756 | Axial Lead | 1000 Units/Bag |
| MR756RL | Axial Lead | 800/Tape & Reel |
| MR760 | Axial Lead | 1000 Units/Bag |
| MR760RL | Axial Lead | 800/Tape & Reel |

**Preferred** devices are recommended choices for future use and best overall value.

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## MAXIMUM RATINGS

| Characteristic | Symbol | MR750 | MR751 | MR752 | MR754 | MR756 | MR760 | Unit |
|---|---|---|---|---|---|---|---|---|
| Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 50 | 100 | 200 | 400 | 600 | 1000 | Volts |
| Non–Repetitive Peak Reverse Voltage<br>(Halfwave, single phase, 60 Hz peak) | $V_{RSM}$ | 60 | 120 | 240 | 480 | 720 | 1200 | Volts |
| RMS Reverse Voltage | $V_{R(RMS)}$ | 35 | 70 | 140 | 280 | 420 | 700 | Volts |
| Average Rectified Forward Current<br>(Single phase, resistive load, 60 Hz)<br>See Figures 5 and 6 | $I_O$ | 22 ($T_L$ = 60°C, 1/8″ Lead Lengths)<br>6.0 ($T_A$ = 60°C, P.C. Board mounting) | | | | | | Amps |
| Non–Repetitive Peak Surge Current<br>(Surge applied at rated load conditions) | $I_{FSM}$ | 400 (for 1 cycle) | | | | | | Amps |
| Operating and Storage Junction<br>Temperature Range | $T_J$, $T_{stg}$ | – 65 to +175 | | | | | | °C |

## ELECTRICAL CHARACTERISTICS

| Characteristic and Conditions | Symbol | Max | Unit |
|---|---|---|---|
| Maximum Instantaneous Forward Voltage Drop<br>($i_F$ = 100 Amps, $T_J$ = 25°C) | $v_F$ | 1.25 | Volts |
| Maximum Forward Voltage Drop<br>($I_F$ = 6.0 Amps, $T_A$ = 25°C, 3/8″ leads) | $V_F$ | 0.90 | Volts |
| Maximum Reverse Current $T_J$ = 25°C<br>(Rated dc Voltage) $T_J$ = 100°C | $I_R$ | 25<br>1.0 | µA<br>mA |

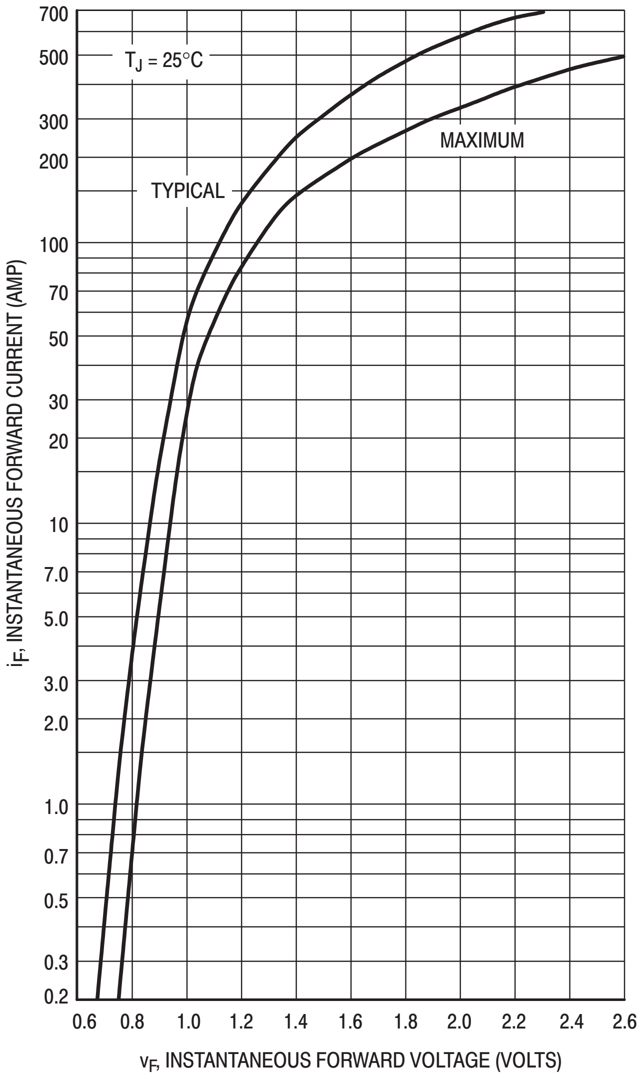



Figure 1. Forward Voltage

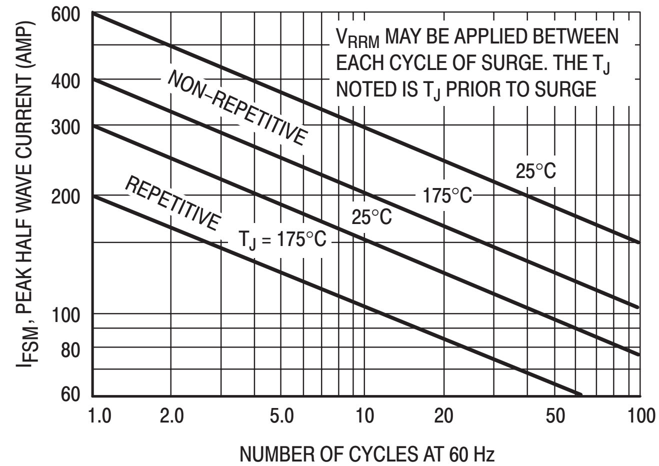



Figure 2. Maximum Surge Capability

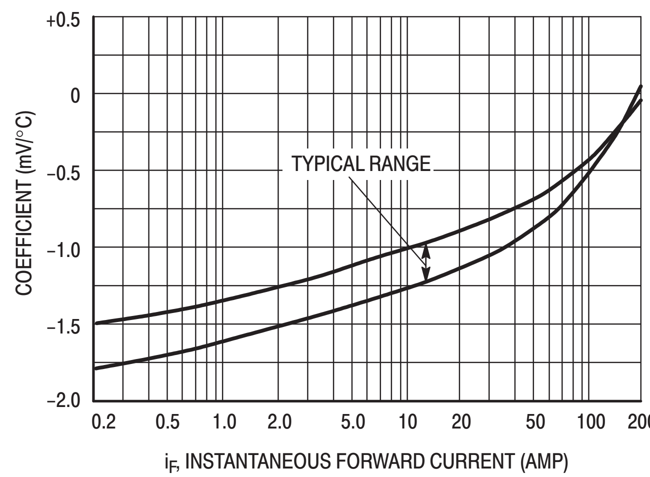



Figure 3. Forward Voltage Temperature Coefficient

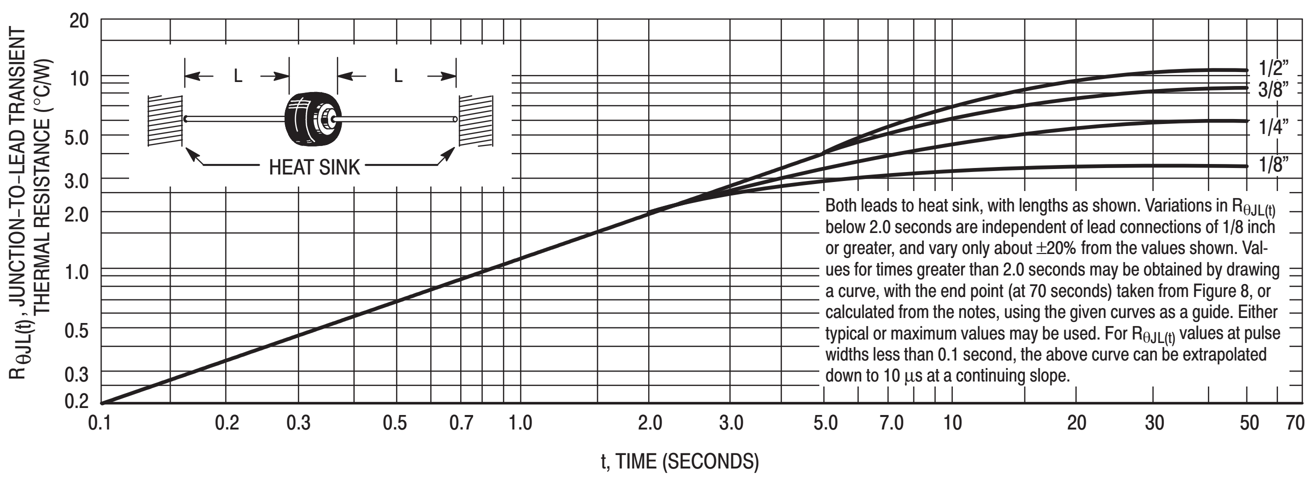



Figure 4. Typical Transient Thermal Resistance

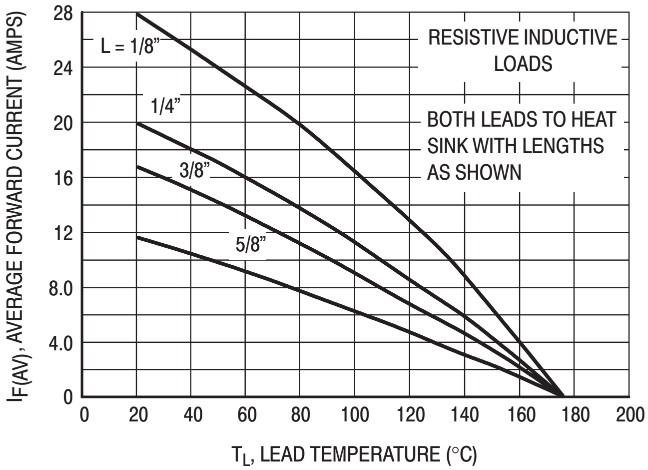



**Figure 5. Maximum Current Ratings**

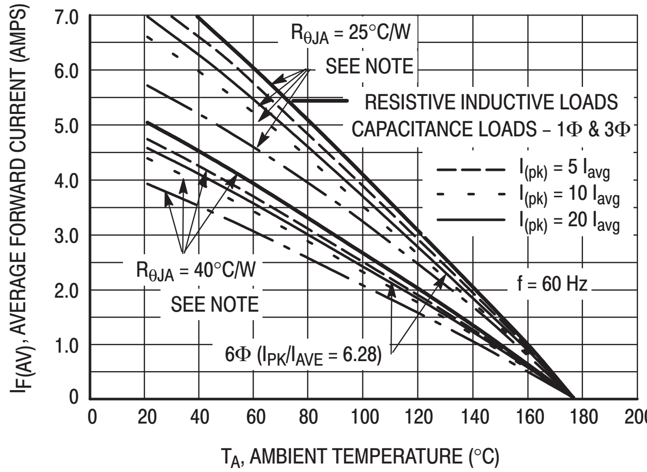



**Figure 6. Maximum Current Ratings**

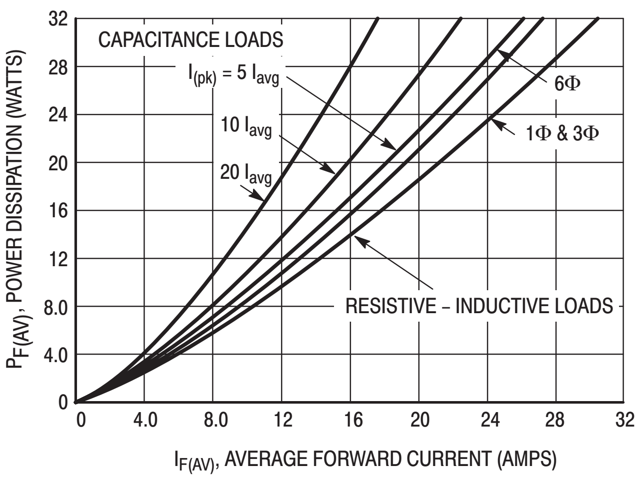



**Figure 7. Power Dissipation**

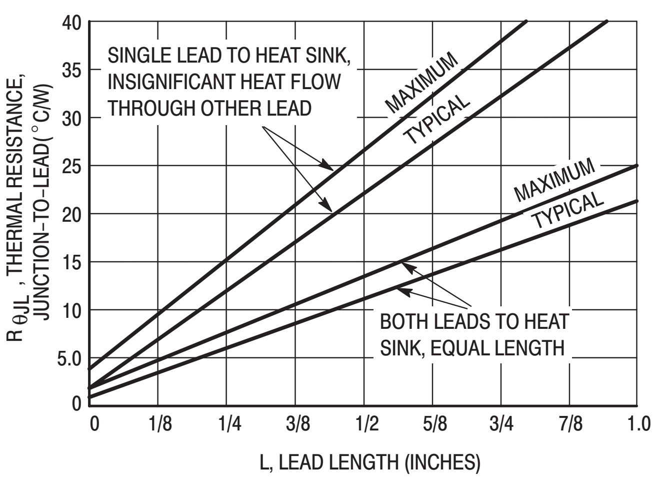
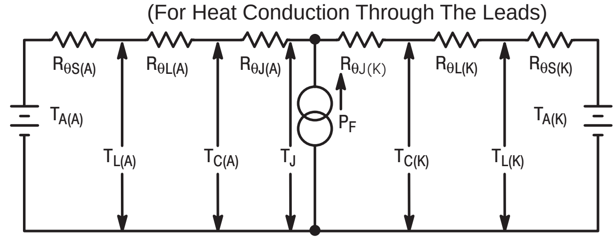



**Figure 8. Steady State Thermal Resistance**

## NOTES

### THERMAL CIRCUIT MODEL

(For Heat Conduction Through The Leads)

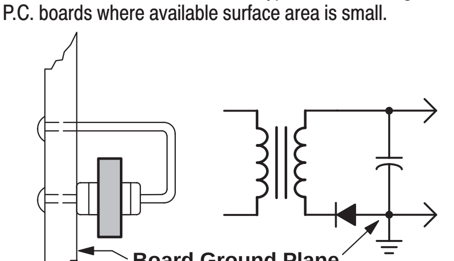



Use of the above model permits junction to lead thermal resistance for any mounting configuration to be found. Lowest values occur when one side of the rectifier is brought as close as possible to the heat sink as shown below. Terms in the model signify:

$T_A$ = Ambient Temperature $T_C$ = Case Temperature
$T_L$ = Lead Temperature $T_J$ = Junction Temperature
$R_{\theta S}$ = Thermal Resistance, Heat Sink to Ambient
$R_{\theta L}$ = Thermal Resistance, Lead to Heat Sink
$R_{\theta J}$ = Thermal Resistance, Junction to Case
$P_F$ = Power Dissipation
(Subscripts A and K refer to anode and cathode sides, respectively.)
Values for thermal resistance components are:
$R_{\theta L}$ = 40°C/W/in. Typically and 44°C/W/in Maximum.
$R_{\theta J}$ = 2°C/W typically and 4°C/W Maximum.

Since $R_{\theta J}$ is so low, measurements of the case temperature, $T_C$, will be approximately equal to junction temperature in practical lead mounted applications. When used as a 60 Hz rectifierm the slow thermal response holds $T_{J(PK)}$ close to $T_{J(AVG)}$. Therefore maximum lead temperature may be found from: $T_L = 175° – R_{\theta JL} P_F$. $P_F$ may be found from Figure 7.

The recommended method of mounting to a P.C. board is shown on the sketch, where $R_{\theta JA}$ is approximately 25°C/W for a 1–1/2” x 1–1/2” copper surface area. Values of 40°C/W are typical for mounting to terminal strips or P.C. boards where available surface area is small.




**Recommended mounting for half wave circuit**

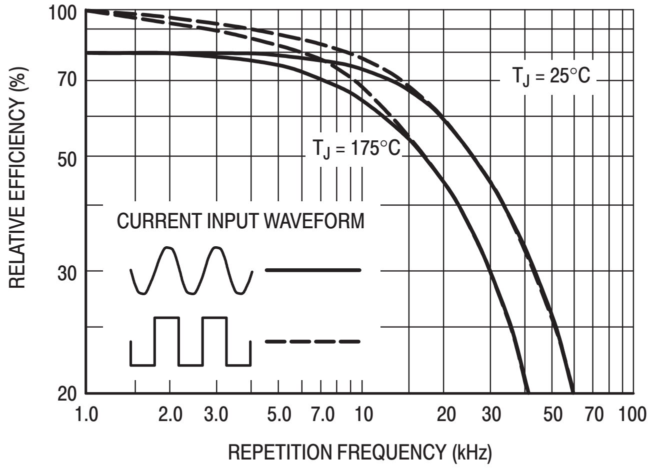



**Figure 9. Rectification Efficiency**

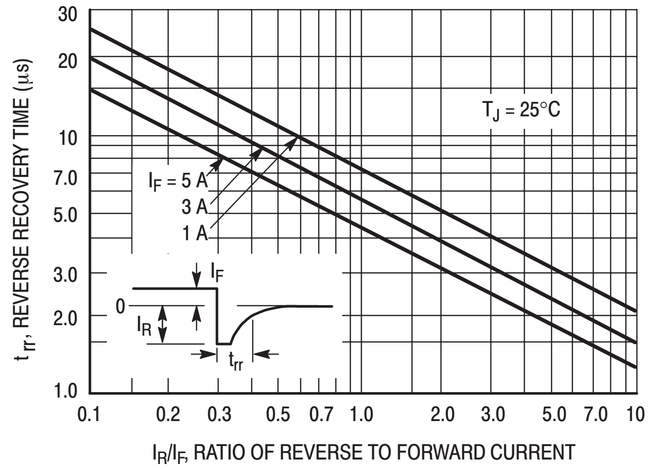



**Figure 10. Reverse Recovery Time**

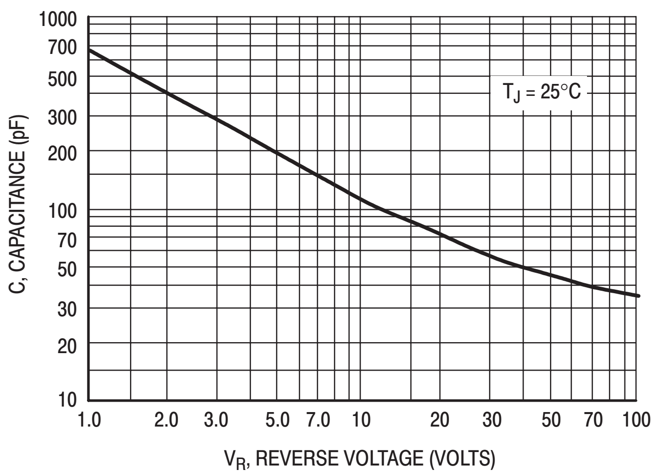



**Figure 11. Junction Capacitance**

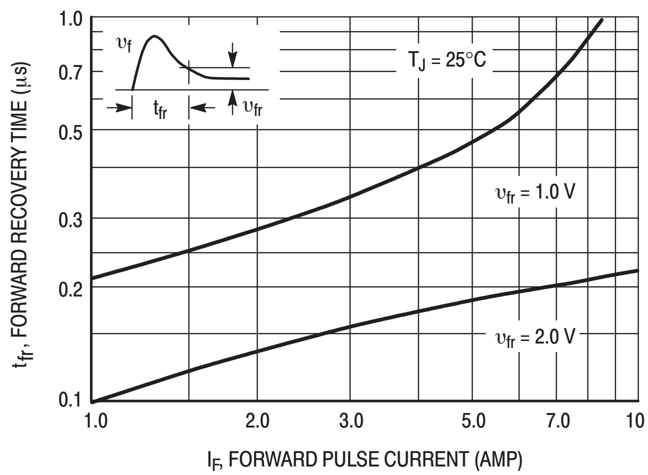



**Figure 12. Forward Recovery Time**

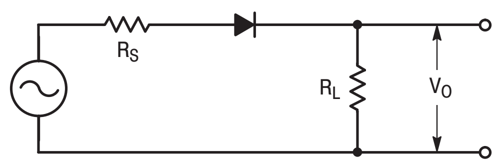



**Figure 13. Single–Phase Half–Wave Rectifier Circuit**

The rectification efficiency factor σ shown in Figure 9 was calculated using the formula:

$$\sigma = \frac{P_{(dc)}}{P_{(rms)}} = \frac{\frac{V^2{}_{o(dc)}}{R_L}}{\frac{V^2{}_{o(rms)}}{R_L}} \cdot 100\% = \frac{V^2{}_{o(dc)}}{V^2{}_{o(ac)} + V^2{}_{o(dc)}} \cdot 100\% \qquad (1)$$

For a sine wave input $V_m$ sin (wt) to the diode, assumed lossless, the maximum theoretical efficiency factor becomes:

$$\sigma_{(sine)} = \frac{\frac{V^2{}_m}{\pi^2 R_L}}{\frac{V^2{}_m}{4R_L}} \cdot 100\% = \frac{4}{\pi^2} \cdot 100\% = 40.6\% \qquad (2)$$

For a square wave input of amplitude $V_m$, the efficiency factor becomes:

$$\sigma_{(square)} = \frac{\frac{V^2{}_m}{2R_L}}{\frac{V^2{}_m}{R_L}} \cdot 100\% = 50\% \qquad (3)$$

(A full wave circuit has twice these efficiencies)

As the frequency of the input signal is increased, the reverse recovery time of the diode (Figure 10) becomes significant, resulting in an increasing ac voltage component across $R_L$ which is opposite in polarity to the forward current, thereby reducing the value of the efficiency factor σ, as shown on Figure 9.

It should be emphasized that Figure 9 shows waveform efficiency only; it does not provide a measure of diode losses. Data was obtained by measuring the ac component of $V_o$ with a true rms ac voltmeter and the dc component with a dc voltmeter. The data was used in Equation 1 to obtain points for Figure 9.

# TRA2532

# Overvoltage Transient Suppressor

## 24 V–32 V

Designed for applications requiring a diode with reverse avalanche characteristics for use as reverse power transient suppressor. Developed to suppress transients in automotive system, this device operates in the forward mode as standard rectifier or reverse mode as power zener diode and will protect expensive modules such as ignition, injection, antiblocking system . . . from overvoltage conditions.

- High Power Capability
- Economical

**Mechanical Characteristics**

- Finish: All External Surfaces are Corrosion Resistant, and Contact Areas are Readily Solderable
- Polarity: Indicated by Cathode Band
- Weight: 1.8 Grams (Approximately)
- Maximum Temperature for Soldering Purposes: 260°C
- Marking: 2532

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| DC Blocking Voltage | $V_R$ | 23 | Volts |
| Average Forward Current (Single Phase, Resistive Load, $T_C$ = 150°C) | $I_O$ | 32 | Amps |
| Peak Repetitive Reverse Surge Current (Time Constant = 10 ms, $T_C$ = 25°C) | $I_{RSM}$ | 80 | Amps |
| Non–Repetitive Peak Surge Current (Halfwave, Single Phase, 60 Hz) | $I_{FSM}$ | 500 | Amps |
| Operating Junction Temperature Range | $T_J$ | –65 to +175 | °C |
| Storage Temperature Range | $T_{stg}$ | –65 to +150 | °C |

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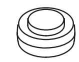

**MICRODE BUTTON**
**CASE 193**

**MARKING DIAGRAM**


2532 = Device Code
L = Location Code
YY = Year
WW = Work Week

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| TRA2532 | Microde Button | 5000 Units/Box |

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## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 0.8 | °C/W |

## ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.) ($i_F$ = 100 Amps, $T_C$ = 25°C) | $v_F$ | – | 1.18 | Volts |
| Reverse Current(1) ($V_R$ = 23 Vdc, $T_C$ = 25°C) | $I_R$ | – | 10 | µA |
| Breakdown Voltage(1) ($I_Z$ = 100 mA, $T_C$ = 25°C) | $V_{(BR)}$ | 24 | 32 | Volts |
| Breakdown Voltage ($I_Z$ = 80 Amps, $T_C$ = 25°C, $P_W$ = 80 µs) | $V_{(BR)}$ | – | 40 | Volts |
| Breakdown Voltage Temperature Coefficient | $V_{(BR)TC}$ | 0.096* | 0.096* | %/°C |
| Forward Voltage Temperature Coefficient @ $I_F$ = 10 mA | $V_{FTC}$ | – 2* | – 2* | mV/°C |

1. Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 2%.

*Typical

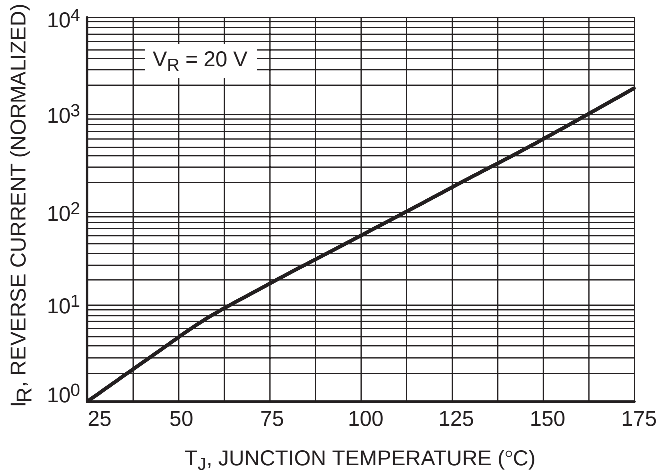



Figure 1. Normalized Reverse Current

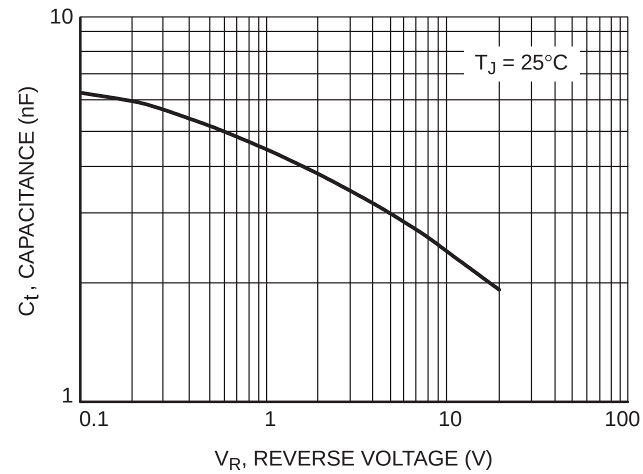



Figure 2. Typical Reverse Capacitance

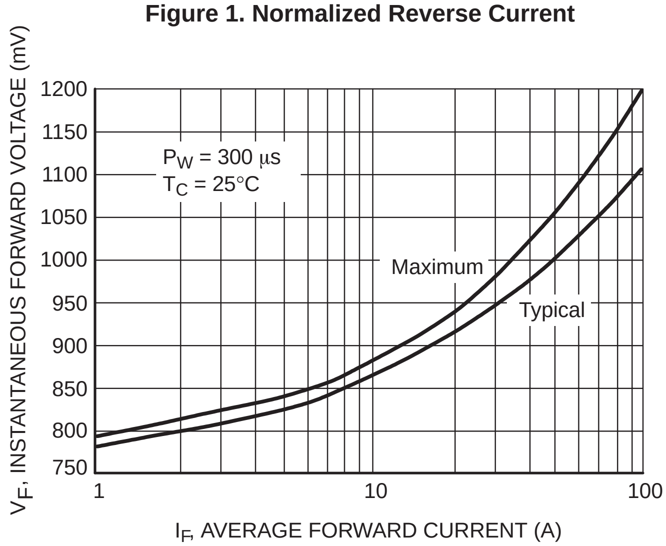



Figure 3. Forward Voltage

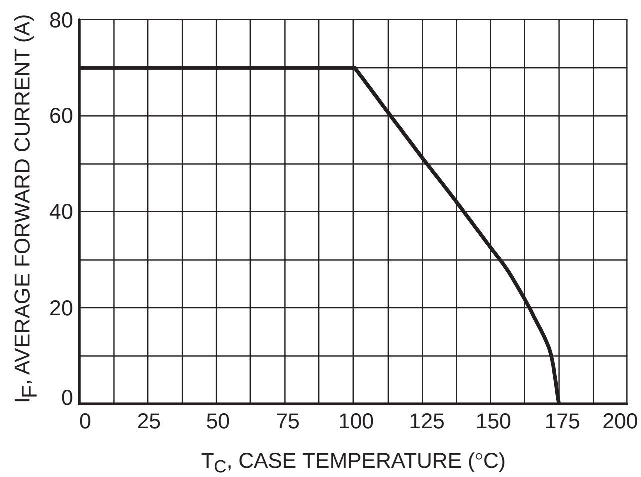



Figure 4. Maximum Current Rating

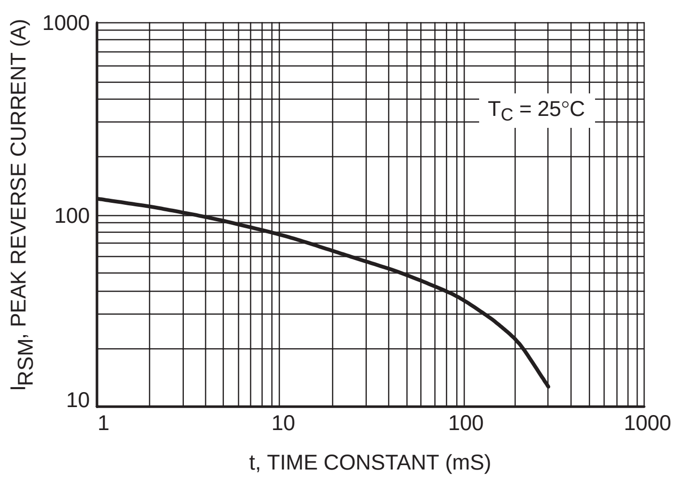



Figure 5. Maximum Peak Reverse Current

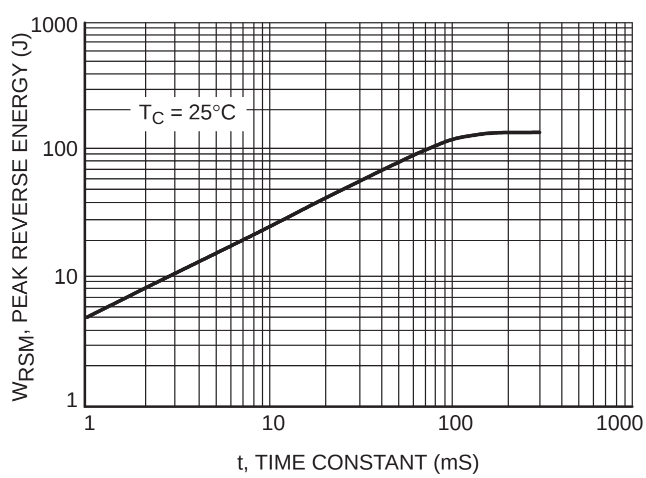



Figure 6. Maximum Reverse Energy

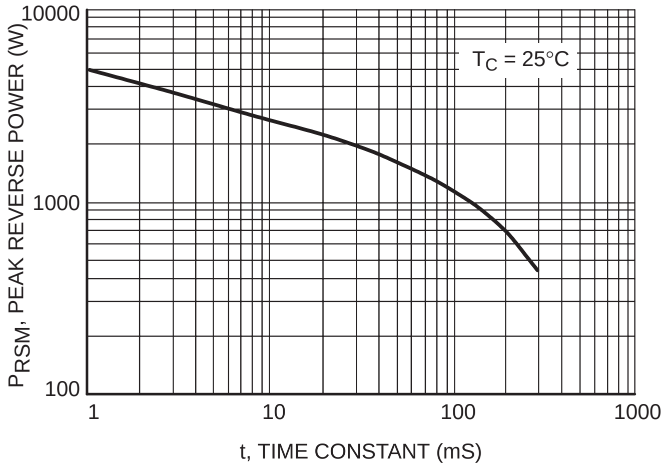



**Figure 7. Maximum Peak Reverse Power**

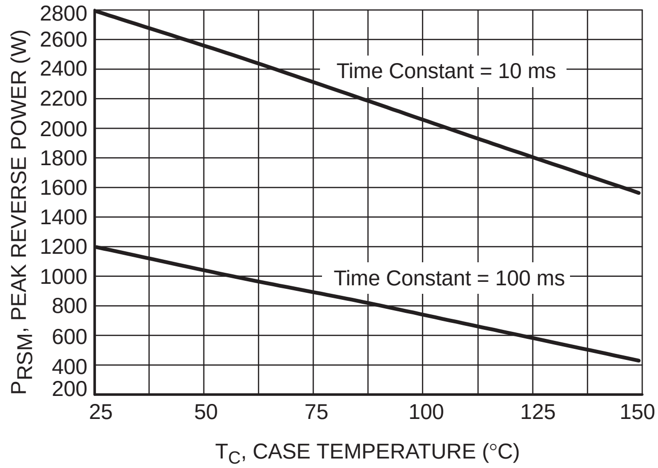



**Figure 8. Reverse Power Derating**

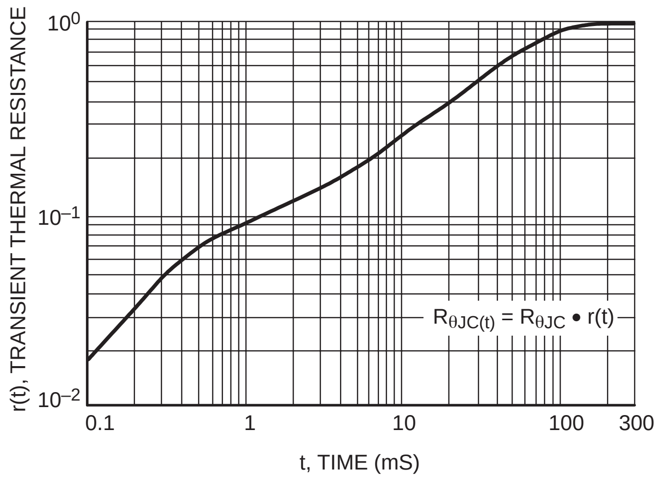



**Figure 9. Thermal Response**

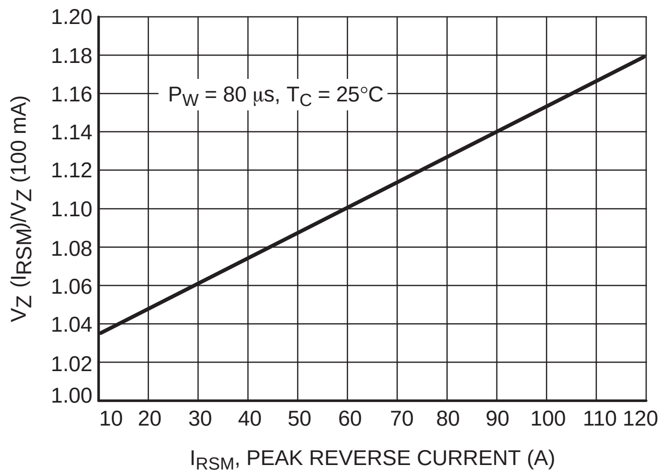



**Figure 10. Typical Clamping Factor**

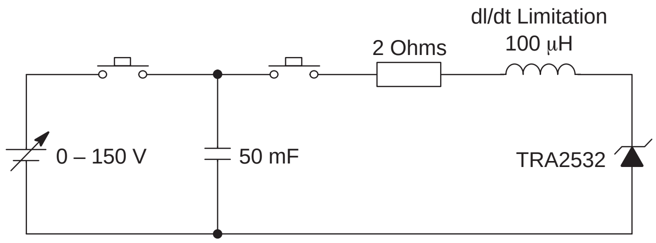



**Figure 11. Load Dump Test Circuit**

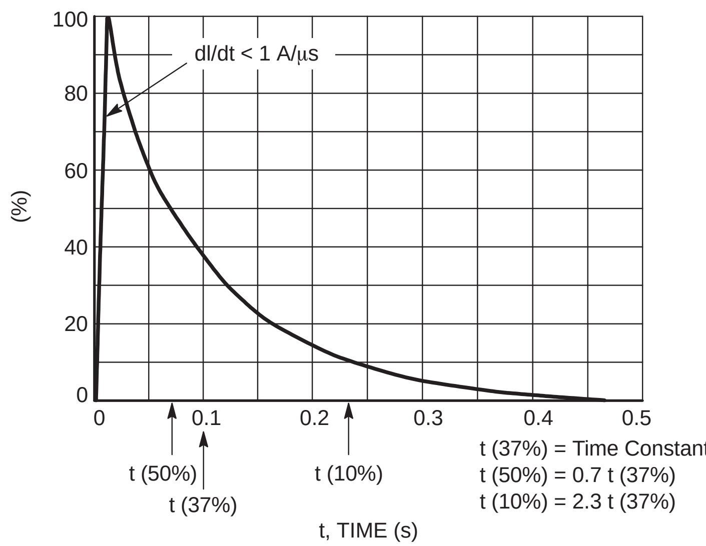



**Figure 12. Load Dump Pulse Current**

### Assembly and Soldering Information

There are t*wo basic areas* of consideration for successful implementation of button rectifiers:

1. Mounting and Handling
2. Soldering

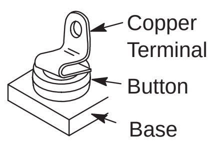
Each should be carefully examined before attempting a finished assembly or mounting operation.

### Mounting and Handling

The button rectifier lends itself to a multitude of assembly arrangements, but one key consideration must *always* be included: One Side of the Connections to the Button Must be Flexible!

This stress relief to the button should also be chosen for maximum contact area to afford the best heat transfer – but not at the expense of flexibility. For an annealed copper terminal a thickness of 0.015″ is suggested.

Strain Relief Terminal
for Button Rectifier




The base heat sink may be of various materials whose shape and size are a function of the individual application and the heat transfer requirements.

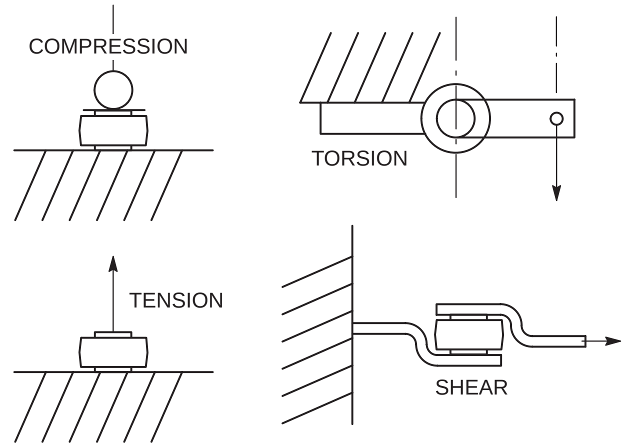
| Common Materials | Advantages and Disadvantages |
|---|---|
| Steel | Low Cost: relatively low heat conductivity |
| Copper | High Cost: high heat conductivity |
| Aluminum | Medium Cost: medium heat conductivity. Relatively expensive to plate and not all platers can process aluminum. |

Handling of the button during assembly must be relatively gentle to minimize sharp impact shocks and avoid nicking of the plastic. Improperly designed automatic handling equipment is the worst source of unnecessary shocks. Techniques for vacuum handling and spring loading should be investigated.

The mechanical stress limits for the button diode are as follows:

| | | |
|---|---|---|
| Compression | 32 lbs. | 142.3 Newton |
| Tension | 32 lbs. | 142.3 Newton |
| Torsion | 6–inch lbs. | 0.68 Newtons–meters |
| Shear | 55 lbs. | 244.7 Newton |

**MECHANICAL STRESS**




Exceeding these recommended maximums can result in electrical degradation of the device.

### Soldering

The button rectifier is basically a semiconductor chip bonded between two nickel–plated copper heat sinks with an encapsulating material of epoxy compound. The exposed metal areas are also tin plated to enhance solderability.

In the soldering process it is important that the temperature not exceed 260°C if device damage is to be avoided. Various solder alloys can be used for this operation but two types are recommended for best results:

1. 95% Sn, 5% Sb; melting point 237°C
2. 96.5% tin, 3.5% silver; melting point 221°C
3. 63% tin, 37% lead; melting point 183°C

Solder is available as preforms or paste. The paste contains both the metal and flux and can be dispensed rapidly. The solder preform requires the application of a flux to assure good wetting of the solder. The type of flux used depends upon the degree of cleaning to be accomplished and is a function of the metal involved. These fluxes range from a mild rosin to a strong acid; e.g., Nickel plating oxides are best removed by an acid base flux while an activated rosin flux may be sufficient for tin plated parts.

Since the button is relatively lightweight, there is a tendency for it to float when the solder becomes liquid. To prevent bad joints and misalignment, it is suggested that a weighting or spring loaded fixture be employed. It is also important that severe thermal shock (either heating or cooling) be avoided as it may lead to damage of the die or encapsulant of the part.

Button holding fixtures for use during soldering may be of various materials. Stainless steel has a longer use life while black anodized aluminum is less expensive and will limit heat reflection and enhance absorption. The assembly volume will influence the choice of materials. Fixture dimension tolerances for locating the button must allow for expansion during soldering as well as allowing for button clearance.

### Heating Techniques

The following four heating methods have their advantages and disadvantages depending on volume of buttons to be soldered.

1. **Belt furnaces** readily handle large or small volumes and are adaptable to establishment of “on–line’’ assembly since a variable belt speed sets the run rate. Individual furnace zone controls make excellent temperature control possible.
2. **Flame Soldering** involves the directing of natural gas flame jets at the base of a heatsink as the heatsink is indexed to various loading–heating–cooling–unloading positions. This is the most economical labor method of soldering large volumes. Flame soldering offers good temperature control but requires sophisticated temperature monitoring systems such as infrared.
3. **Ovens** are good for batch soldering and are production limited. There are handling problems because of slow cooling. Response time is load dependent, being a function of the watt rating of the oven and the mass of parts. Large ovens may not give an acceptable temperature gradient. Capital cost is low compared to belt furnaces and flame soldering.
4. **Hot Plates** are good for soldering small quantities of prototype devices. Temperature control is fair with overshoot common because of the exposed heating surface. Solder flow and positioning can be corrected during soldering since the assembly is exposed. Investment cost is very low.

Regardless of the heating method used, a soldering profile giving the time–temperature relationship of the particular method must be determined to assure proper soldering. Profiling must be performed on a scheduled basis to minimize poor soldering. The time–temperature relationship will change depending on the heating method used.

# MR2520L

# Overvoltage Transient Suppressor

Designed for applications requiring a low voltage rectifier with reverse avalanche characteristics for use as reverse power transient suppressors. Developed to suppress transients in the automotive system, these devices operate in the forward mode as standard rectifiers or reverse mode as power avalanche rectifier and will protect electronic equipment from overvoltage conditions.

- High Power Capability
- Economical
- Increased Capacity by Parallel Operation

**Mechanical Characteristics**

- Case: Epoxy, Molded
- Weight: 2.5 Grams (Approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Maximum Lead Temperature for Soldering Purposes: 350°C 3/8″ from Case for 10 Seconds at 5 lbs. Tension
- Polarity: Indicated by Diode Symbol or Cathode Band
- Marking: MR2520L

**MAXIMUM RATINGS** ($T_J$ = 25°C unless otherwise noted)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| DC Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 23 | Volts |
| Repetitive Peak Reverse Surge Current<br>(Time Constant = 10 ms,<br>Duty Cycle ≤ 1%, $T_C$ = 25°C) | $I_{RSM}$ | 58 | Amps |
| Peak Reverse Power<br>(Time Constant = 10 ms,<br>Duty Cycle ≤ 1%, $T_C$ = 25°C) | $P_{RSM}$ | 2500 | Watts |
| Average Rectified Forward Current<br>(Single Phase, Resistive Load, 60 Hz,<br>$T_C$ = 125°C) (See Figure 4) | $I_O$ | 6.0 | Amps |
| Non–Repetitive Peak Surge Current<br>Surge Supplied at Rated Load<br>Conditions Halfwave, Single Phase | $I_{FSM}$ | 400 | Amps |
| Operating and Storage Junction<br>Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | °C |

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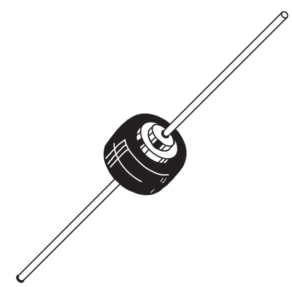
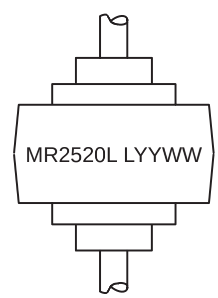
**OVERVOLTAGE**
**TRANSIENT SUPPRESSOR**
**24 – 32 VOLTS**



**AXIAL LEAD BUTTON**
**CASE 194**
**STYLE 1**




| | |
|---|---|
| MR2520L | = Device Code |
| L | = Location Code |
| YY | = Year |
| WW | = Work Week |

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MR2520L | Axial Lead Button | 1000/Box |
| MR2520LRL | Axial Lead Button | 800/Reel |

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## THERMAL CHARACTERISTICS

| Characteristic | Lead Length | Symbol | Max | Unit |
|---|---|---|---|---|
| Thermal Resistance, Junction to Lead, Both Leads to Heat Sink with Equal Length | 6.25 mm<br>10 mm<br>15 mm | $R_{\theta JL}$ | 7.5<br>10<br>15 | °C/W |
| Thermal Resistance Junction to Case | – | $R_{\theta JC}$ | 1.0 | °C/W |

*Typical

## ELECTRICAL CHARACTERISTICS ($T_J$ = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.) ($I_F$ = 100 Amps, $T_C$ = 25°C) | $V_F$ | – | 1.25 | Volts |
| Instantaneous Forward Voltage (Note 1.) ($I_F$ = 100 Amps, $T_C$ = 25°C) | $V_F$ | – | 0.90 | Volts |
| Reverse Current ($V_R$ = 20 Vdc, $T_C$ = 25°C) | $I_R$ | – | 10 | nAdc |
| Reverse Current ($V_R$ = 20 Vdc, $T_C$ = 25°C) | $I_R$ | – | 300 | nAdc |
| Breakdown Voltage (Note 1.) ($I_R$ = 100 mAdc, $T_C$ = 25°C) | $V_{(BR)}$ | 24 | 32 | Volts |
| Breakdown Voltage (Note 1.) ($I_R$ = 90 Amp, $T_C$ = 150°C, PW = 80 µs) | $V_{(BR)}$ | – | 40 | Volts |
| Dynamic Resistance ($I_R$ = 100 mA, $T_J$ = 25°C, f = 1.0 kHz) | $R_Z$ | – | 5.0 | Ω |
| Dynamic Resistance ($I_R$ = 40 mA, $T_J$ = 25°C) | $R_Z$ | – | 0.15 | Ω |
| Breakdown Voltage Temperature Coefficient | $V_{(BR)TC}$ | – | 0.09* | %/°C |
| Forward Voltage Temperature Coefficient @ $I_F$ = 10 mA | $V_{FTC}$ | – | –2* | mV/°C |

1. Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 2%.

*Typical

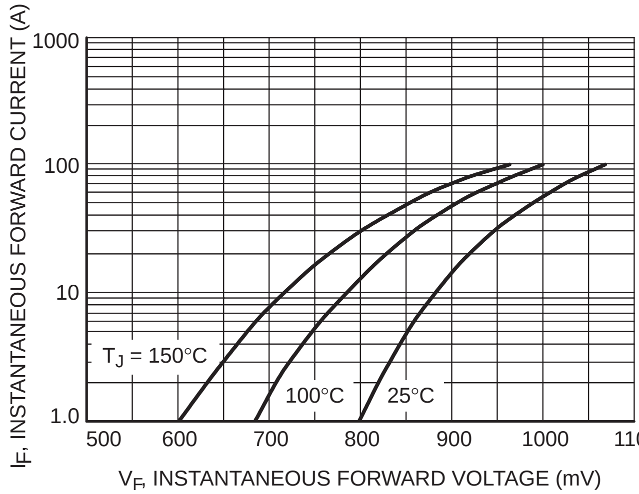



**Figure 1. Forward Voltage**

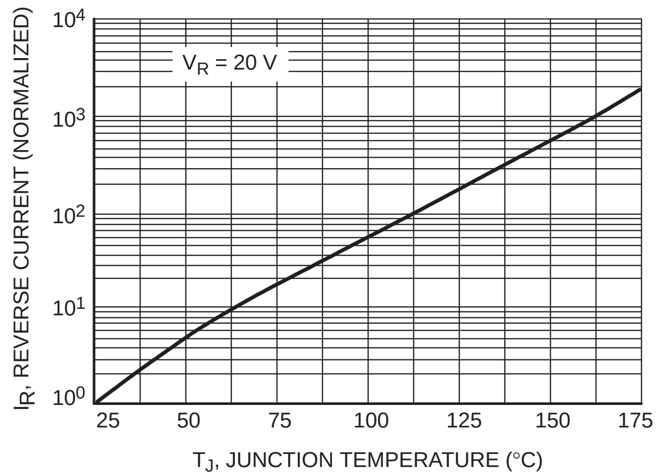



**Figure 2. Normalized Reverse Current**

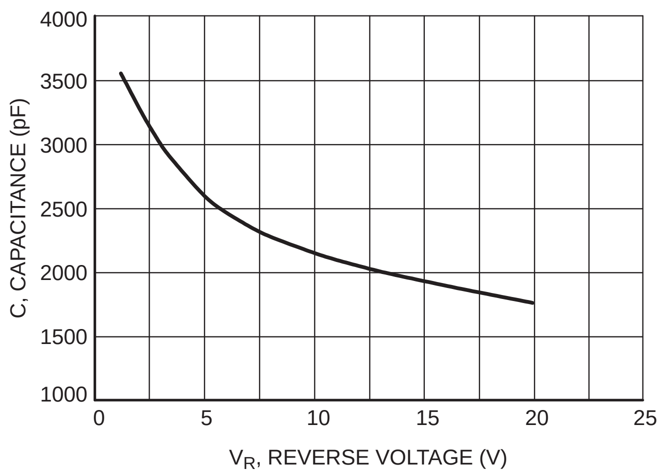



**Figure 3. Typical Capacitance**

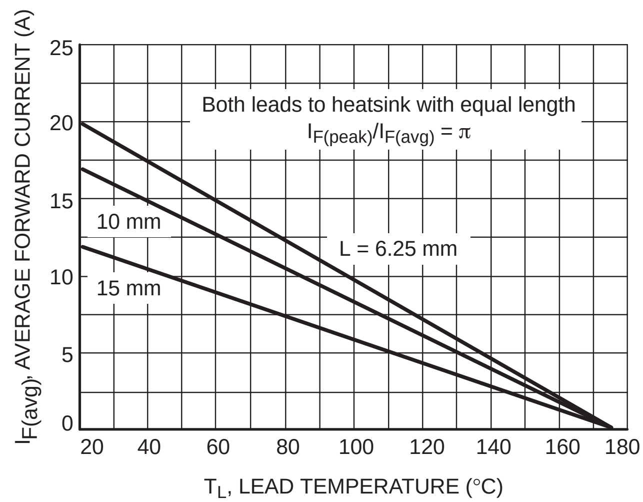



**Figure 4. Maximum Current Ratings**

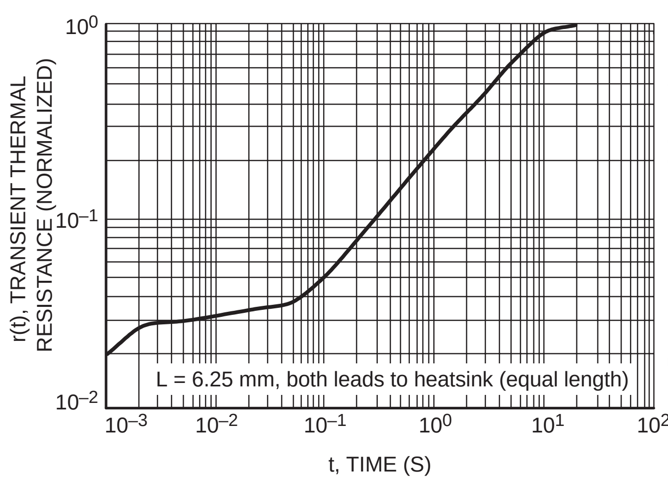



**Figure 5. Thermal Response**

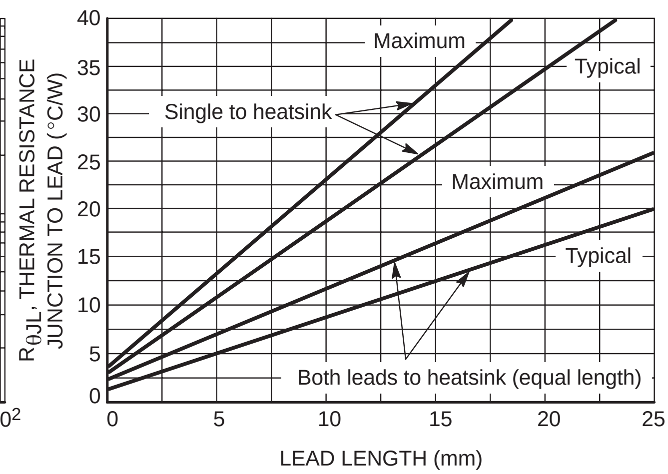



**Figure 6. Steady State Thermal Resistance**

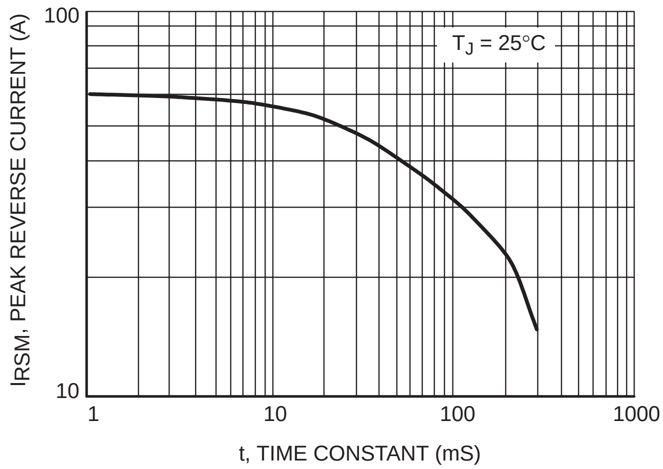



**Figure 7. Maximum Peak Reverse Current**

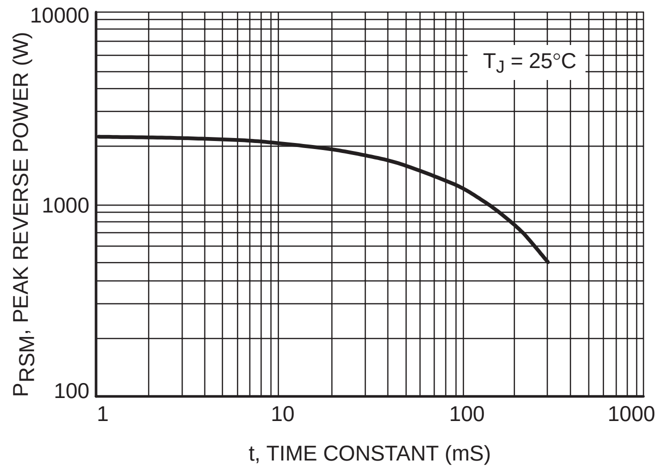



**Figure 8. Maximum Peak Reverse Power**

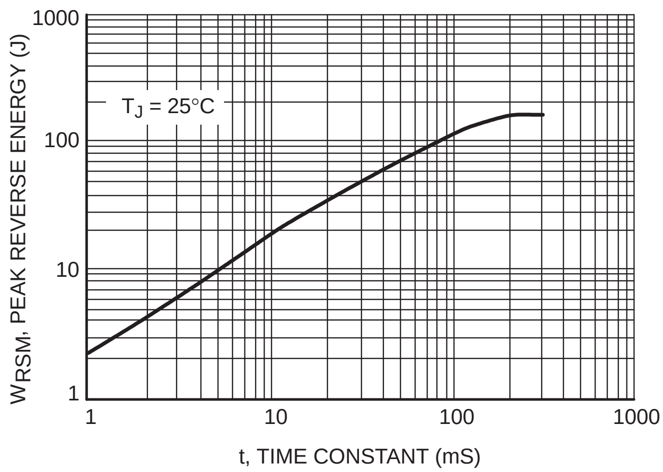



**Figure 9. Maximum Reverse Energy**

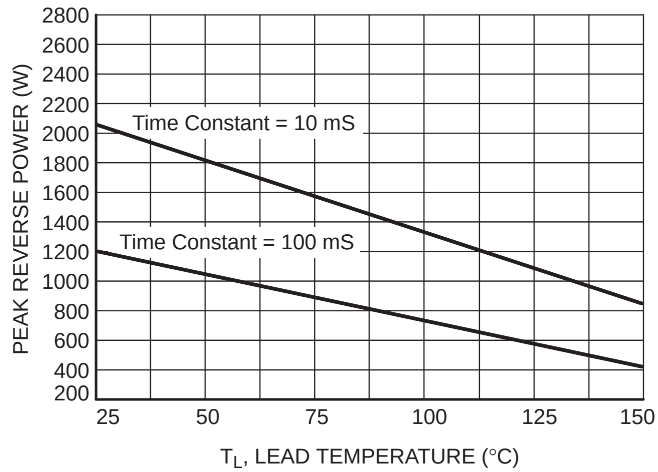



**Figure 10. Reverse Power Derating**

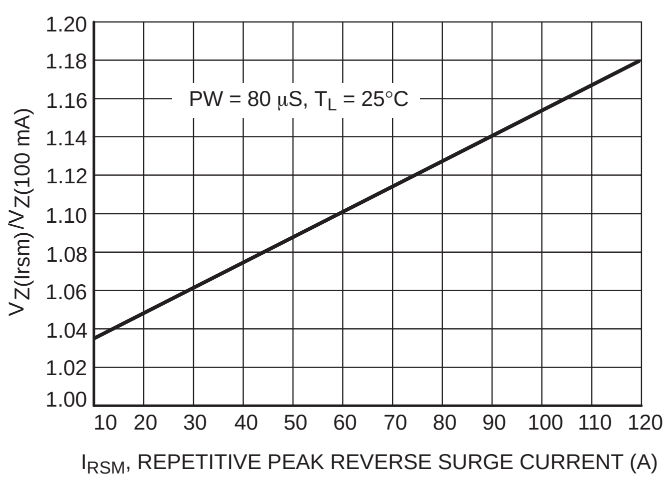



**Figure 11. Typical Clamping Factor**

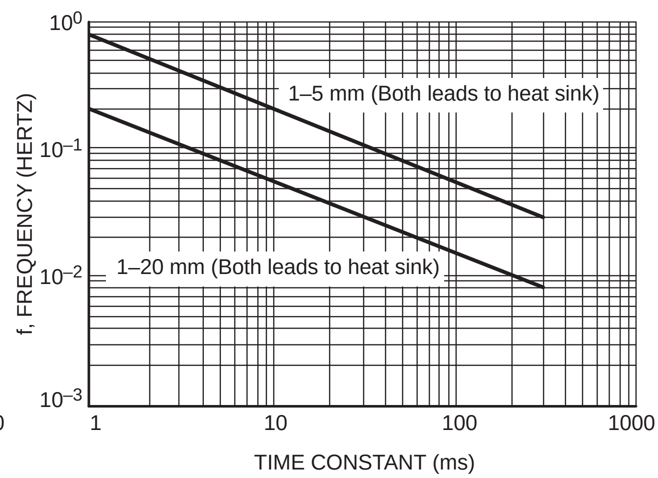



**Figure 12. Maximum Load Dump Frequency**

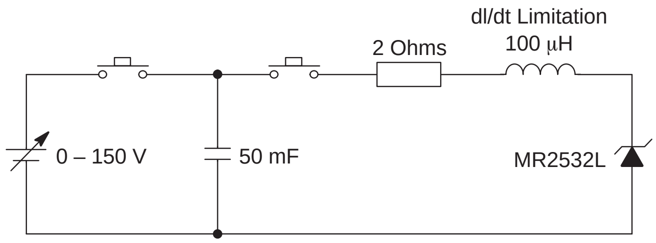



**Figure 13. Load Dump Test Circuit**

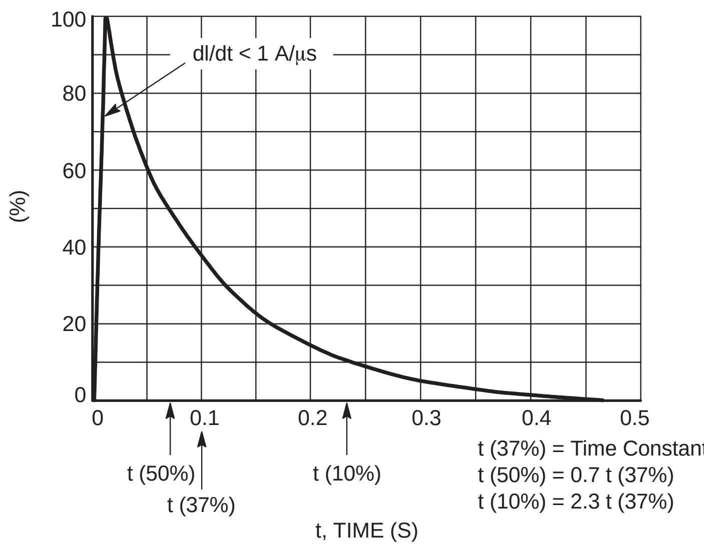



**Figure 14. Load Dump Pulse Current**

# MR2535L

# Overvoltage Transient Suppressors

## Medium Current

ON Semiconductor™

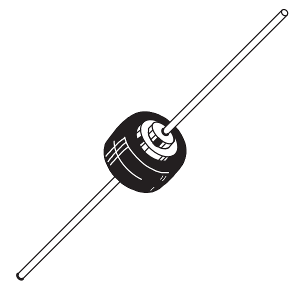
http://onsemi.com

Designed for applications requiring a low voltage rectifier with reverse avalanche characteristics for use as reverse power transient suppressors. Developed to suppress transients in the automotive system, these devices operate in the forward mode as standard rectifiers or reverse mode as power avalanche rectifier and will protect electronic equipment from overvoltage conditions.

- Avalanche Voltage 24 to 32 Volts
- High Power Capability
- Economical
- Increased Capacity by Parallel Operation

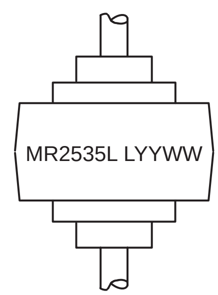
### Mechanical Characteristics

- Case: Epoxy, Molded
- Weight: 2.5 Grams (Approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Maximum Lead Temperature for Soldering Purposes: 350°C 3/8″ from Case for 10 Seconds at 5 lbs. Tension
- Polarity: Indicated by Diode Symbol or Cathode Band
- Marking: MR2535L



AXIAL LEAD BUTTON
CASE 194
STYLE 1

**MARKING DIAGRAM**




MR2535L = Device Code
L = Location Code
YY = Year
WW = Work Week

**MAXIMUM RATINGS** ($T_J$ = 25°C unless otherwise noted)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| DC Peak Repetitive Reverse Voltage<br>Working Peak Reverse Voltage<br>DC Blocking Voltage | $V_{RRM}$<br>$V_{RWM}$<br>$V_R$ | 20 | Volts |
| Repetitive Peak Reverse Surge Current (Time Constant = 10 ms, Duty Cycle ≤ 1%, $T_C$ = 25°C) (See Note 1) | $I_{RSM}$ | 62 | Amps |
| Average Rectified Forward Current (Single Phase, Resistive Load, 60 Hz, $T_C$ = 125°C) (See Figure 4) | $I_O$ | 6.0 | Amps |
| Non–Repetitive Peak Surge Current<br>Surge Supplied at Rated Load Conditions<br>Halfwave, Single Phase | $I_{FSM}$ | 600 | Amps |
| Operating and Storage Junction Temperature Range | $T_J$, $T_{stg}$ | –65 to +175 | °C |

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MR2535L | Axial Lead Button | 1000/Box |
| MR2535LRL | Axial Lead Button | 800/Reel |

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## THERMAL CHARACTERISTICS

| Characteristic | Lead Length | Symbol | Max | Unit |
|---|---|---|---|---|
| Thermal Resistance, Junction to Lead @ Both Leads to Heat Sink, Equal Length | 1/4″<br>3/8″<br>1/2″ | $R_{\theta JL}$ | 7.5<br>10<br>13 | °C/W |
| Thermal Resistance Junction to Case | | $R_{\theta JC}$ | 0.8* | °C/W |

## ELECTRICAL CHARACTERISTICS ($T_J$ = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.) ($i_F$ = 100 Amps, $T_C$ = 25°C) | $v_F$ | – | 1.1 | Volts |
| Reverse Current ($V_R$ = 20 Vdc, $T_C$ = 25°C) | $I_R$ | – | 200 | nAdc |
| Breakdown Voltage (Note 1.) ($I_R$ = 100 mAdc, $T_C$ = 25°C) | $V_{(BR)}$ | 24 | 32 | Volts |
| Breakdown Voltage (Note 1.) ($I_R$ = 90 Amp, $T_C$ = 150°C, PW = 80 µs) | $V_{(BR)}$ | – | 40 | Volts |
| Breakdown Voltage Temperature Coefficient | $V_{(BR)TC}$ | – | 0.096* | %/°C |
| Forward Voltage Temperature Coefficient @ $I_F$ = 10 mA | $V_{FTC}$ | – | 2* | mV/°C |

1. Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 2%.

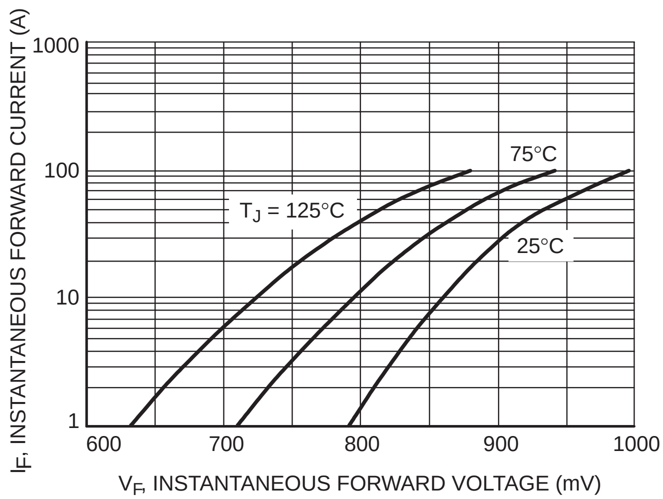


**Figure 1. Typical Forward Voltage**

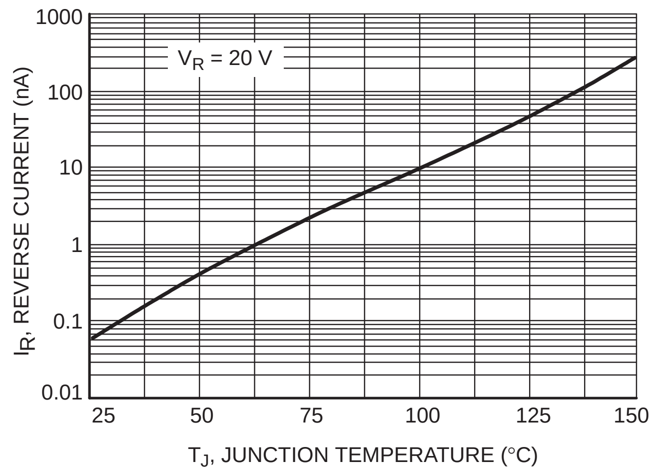


**Figure 2. Typical Reverse Current versus Junction Temperature**

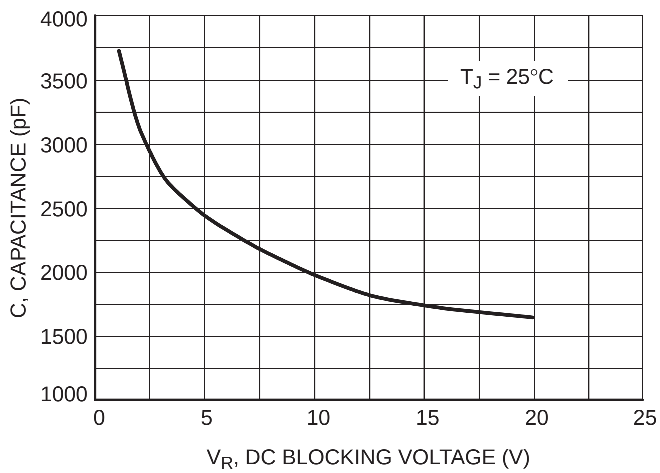


**Figure 3. Typical Capacitance**

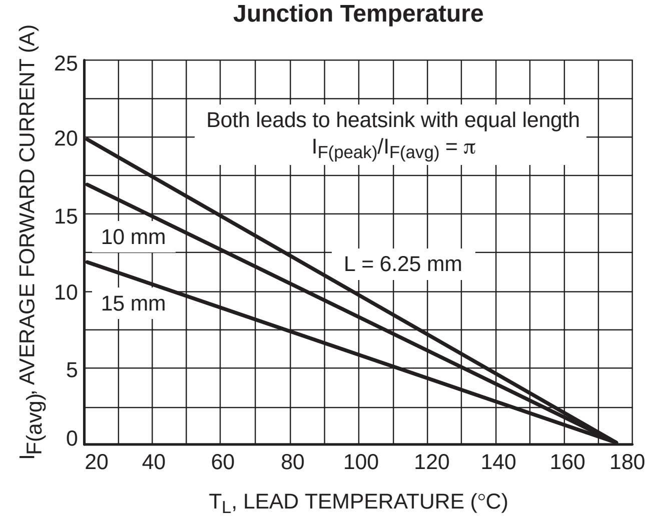


**Figure 4. Maximum Current Ratings**

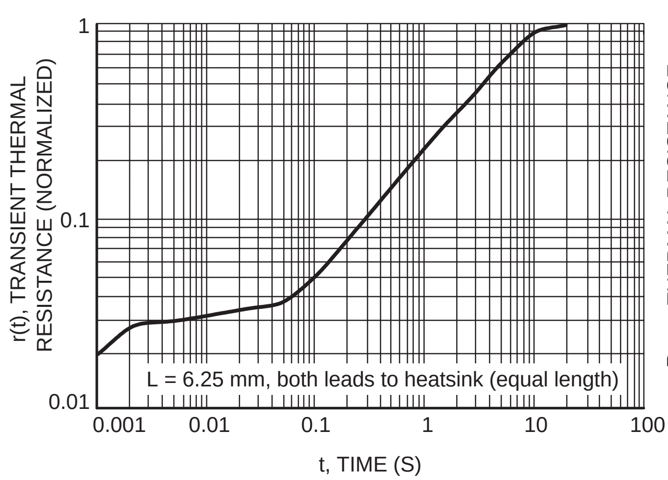


**Figure 5. Thermal Response**

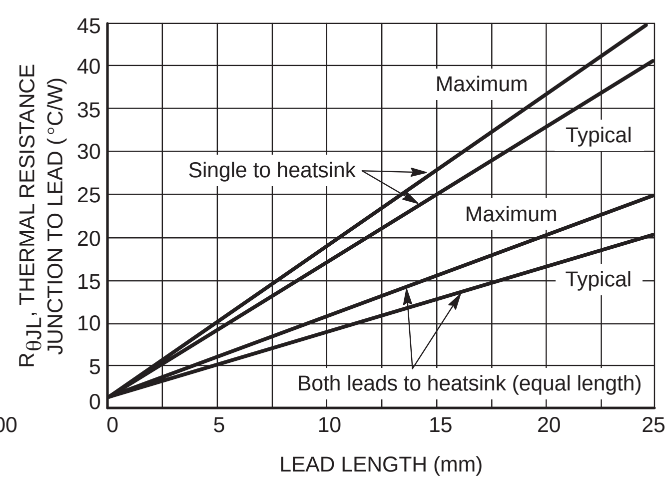


**Figure 6. Steady State Thermal Resistance**

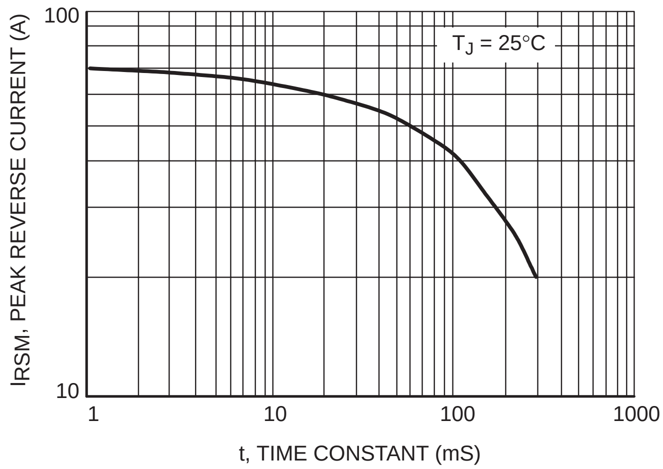


**Figure 7. Maximum Peak Reverse Current**

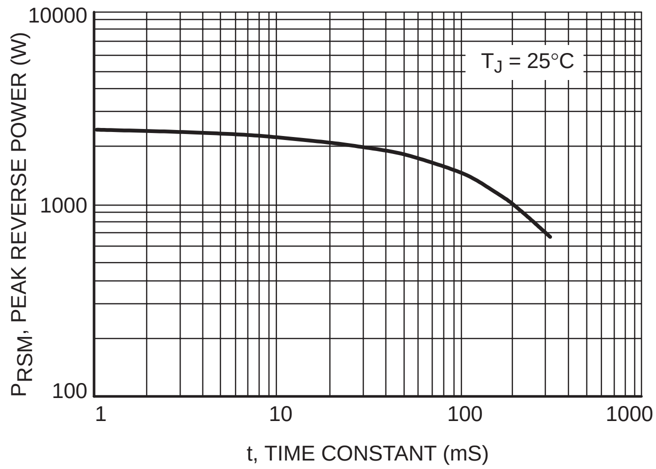


**Figure 8. Maximum Peak Reverse Power**

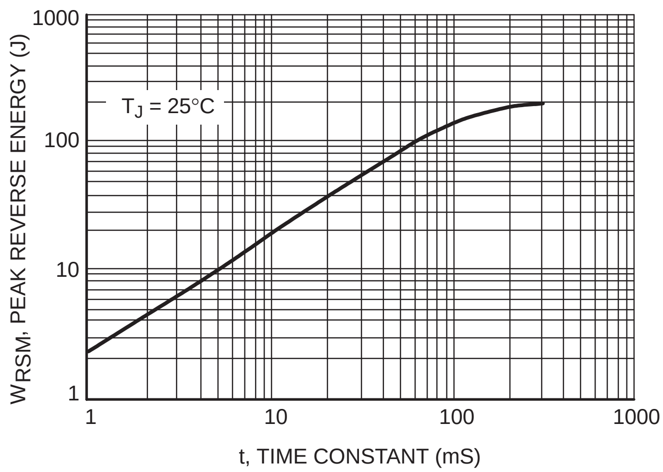


**Figure 9. Maximum Reverse Energy**

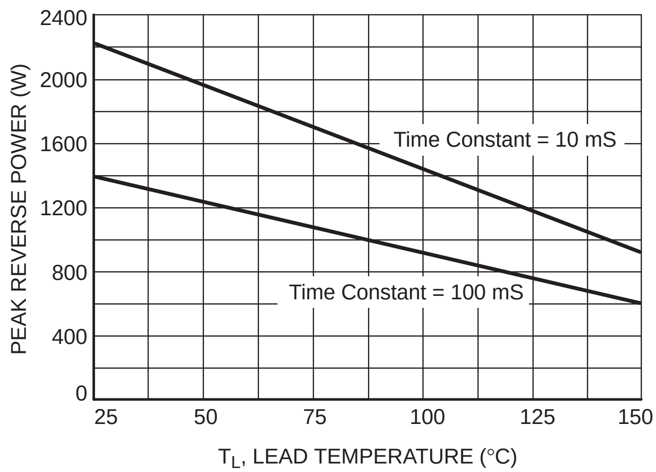


**Figure 10. Reverse Power Derating**

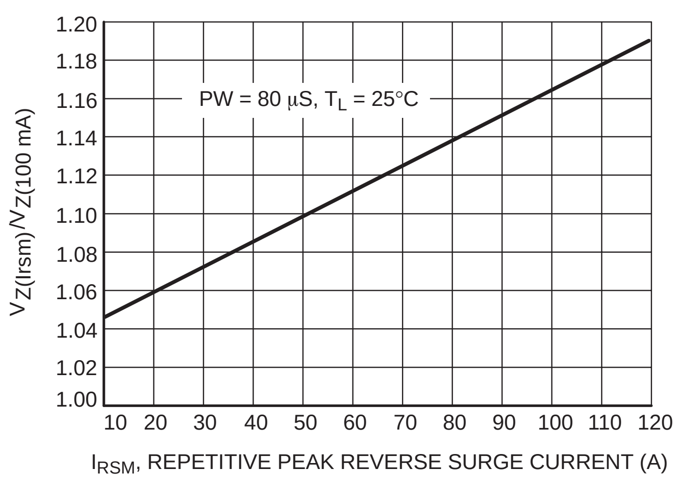


**Figure 11. Typical Clamping Factor**

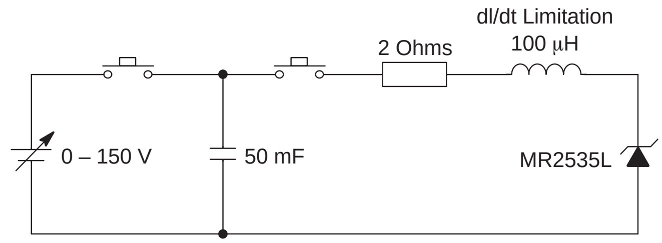


**Figure 12. Load Dump Test Circuit**

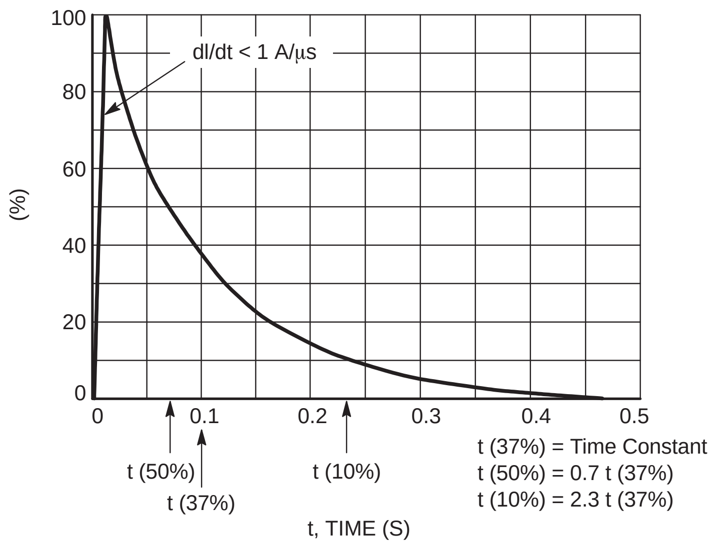


**Figure 13. Load Dump Pulse Current**

# MR2835S

# Overvoltage Transient Suppressor

...designed for applications requiring a diode with reverse avalanche characteristics for use as reverse power transient suppressor.

Developed to suppress transients in the automotive system, this device operates in reverse mode as power zener diode and will protect expensive modules such as ignition, injection and autoblocking systems from overvoltage conditions.

- High Power Capability
- Economical

**Mechanical Characteristics**

- Finish: All External Surfaces are Corrosion Resistant
- Polarity: Cathode to Terminal
- Weight: 1.78 Grams (Approximately)
- Maximum Temperature for Soldering Purposes: 260°C for 10 s using a Belt Furnace
- Marking: MR2835S

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| DC Blocking Voltage | $V_R$ | 23 | Volts |
| Peak Repetitive Reverse Surge Current (Time Constant = 10 ms, $T_C$ = 25°C) | $I_{RSM}$ | 62 | Amps |
| Non–Repetitive Peak Surge Current (Halfwave, Single Phase, 50 Hz) | $I_{FSM}$ | 400 | Amps |
| Storage Temperature Range | $T_{stg}$ | –40 to +150 | °C |
| Operating Junction Temperature Range | $T_J$ | –40 to +150 | °C |

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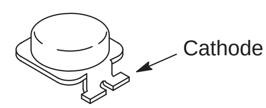
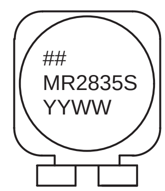



**TOP CAN**
**CASE 460**

**MARKING DIAGRAM**




| | |
|---|---|
| ## | = Lot Number |
| MR2835S | = Specific Device Code |
| YY | = Year |
| WW | = Work Week |

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MR2835S | Top Can | 500/Tape & Reel |

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## THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 1.0 | °C/W |

## ELECTRICAL CHARACTERISTICS ($T_C$ = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Instantaneous Forward Voltage ($I_F$ = 100 A) (Note 1.) | $V_F$ | – | 1.1 | Volts |
| Reverse Current ($V_R$ = 20 V) (Note 1.) | $I_R$ | – | 5.0 | μA |
| Breakdown Voltage ($I_Z$ = 100 mA) (Note 1.) | $V_{(BR)}$ | 24 | 32 | Volts |
| Breakdown Voltage ($I_Z$ = 80 A, $T_C$ = 85°C, PW = 80 μs) | $V_{(BR)}$ | – | 40 | Volts |
| Breakdown Voltage Temperature Coefficient | $V_{(BR)TC}$ | – | 0.09 | %/°C |
| Forward Voltage Temperature Coefficient ($I_F$ = 10 mA) | $V_{FTC}$ | – | –2.0* | mV/°C |

1. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2%.

*Typical

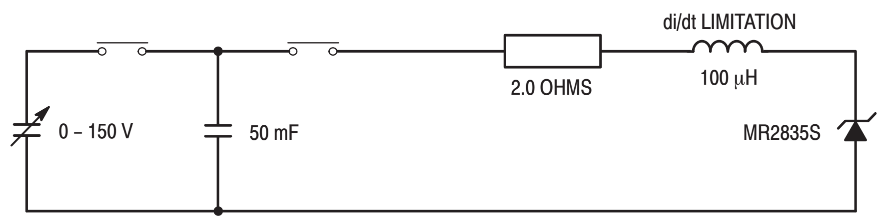


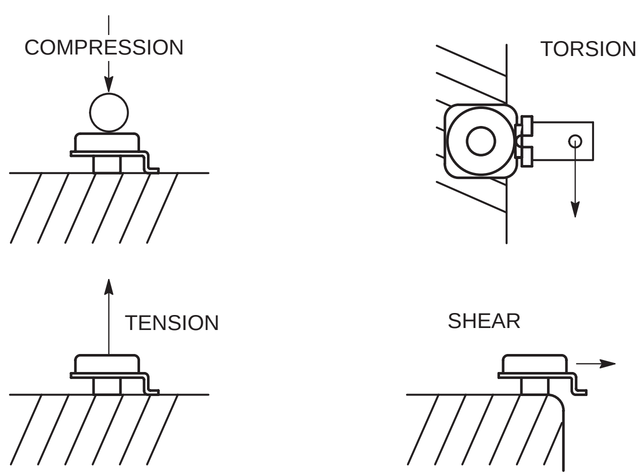

**Figure 1. Load Dump Test Circuit**

## MOUNTING AND HANDLING

The mechanical stress limits for the Top Can diode are as follows:

| | | |
|---|---|---|
| Compression: | 33.7 lbs | 150 newtons |
| Tension: | 33.7 lbs | 150 newtons |
| Torsion: | 6.3 inch lbs | 0.7 newton meters |
| Shear: | 56.2 lbs | 250 newtons |

## MECHANICAL STRESS



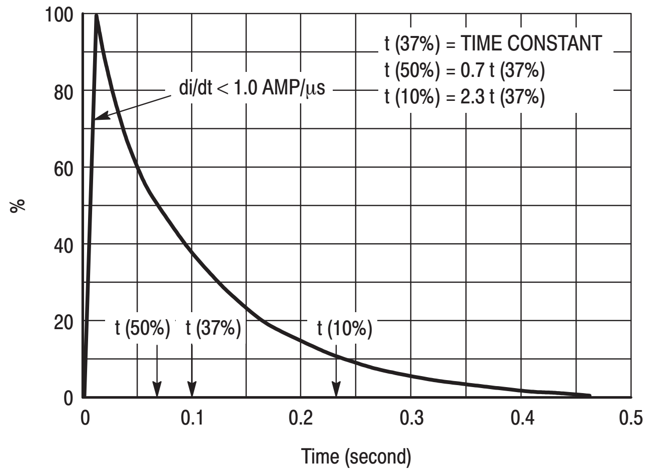



**Figure 2. Load Dump Pulse Current**

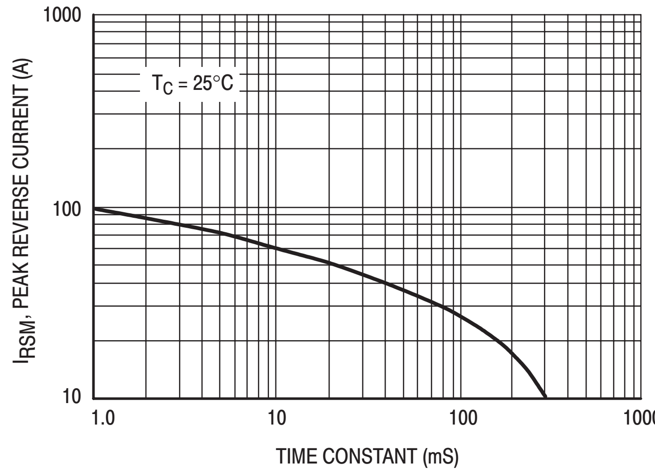



**Figure 3. Maximum Peak Reverse Current**

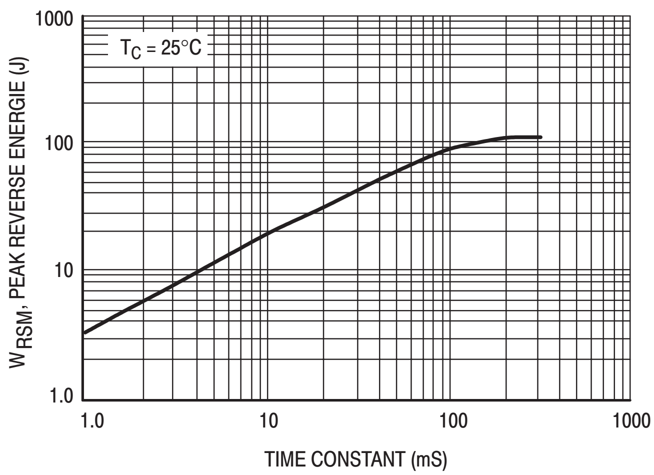



**Figure 4. Maximum Reverse Energie**

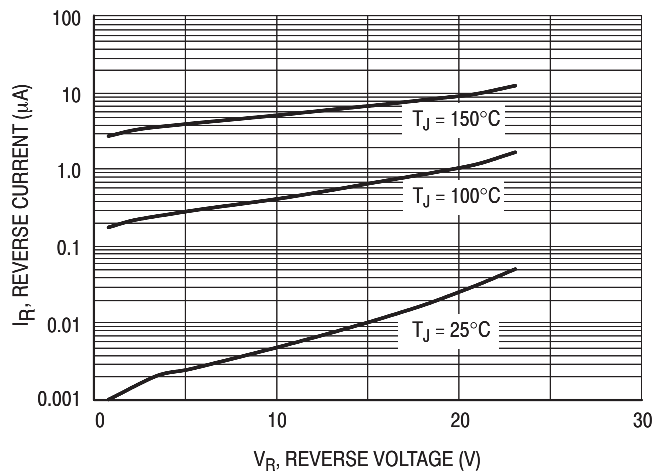



**Figure 5. Typical Reverse Current**

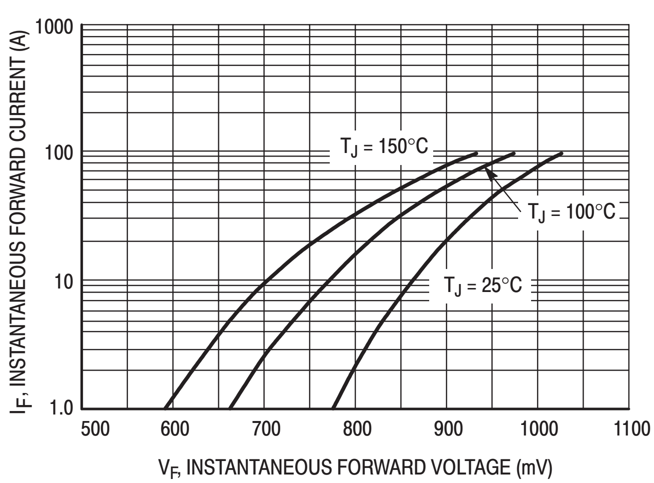



**Figure 6. Typical Forward Voltage**

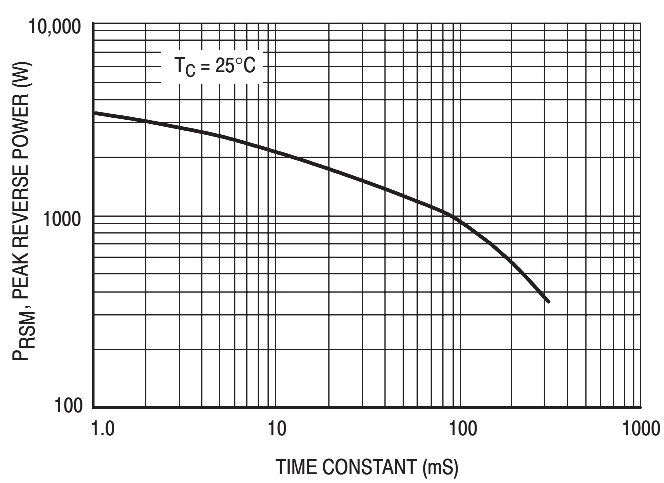



**Figure 7. Maximum Peak Reverse Power**

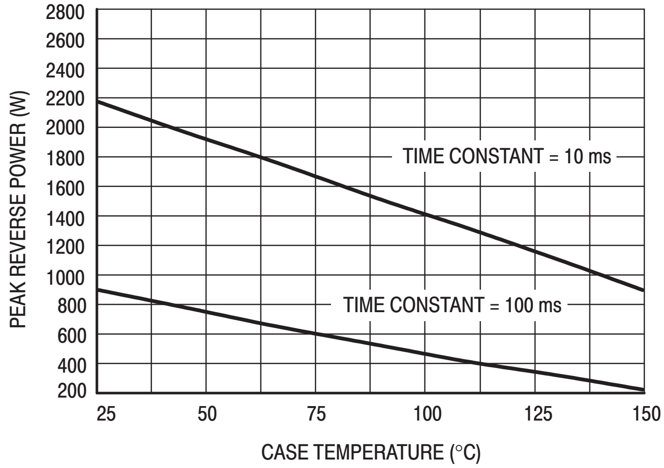



**Figure 8. Reverse Power Derating**

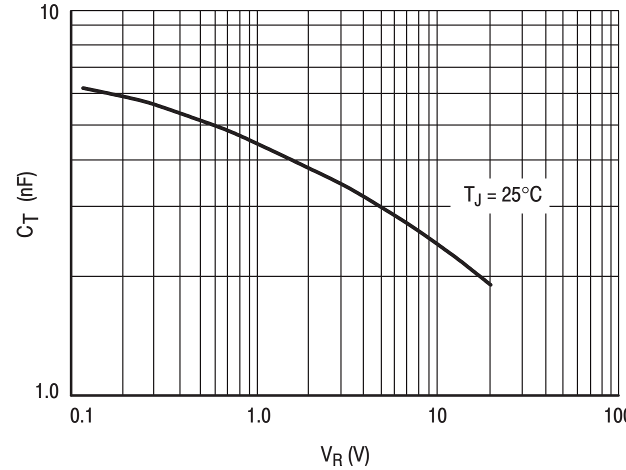
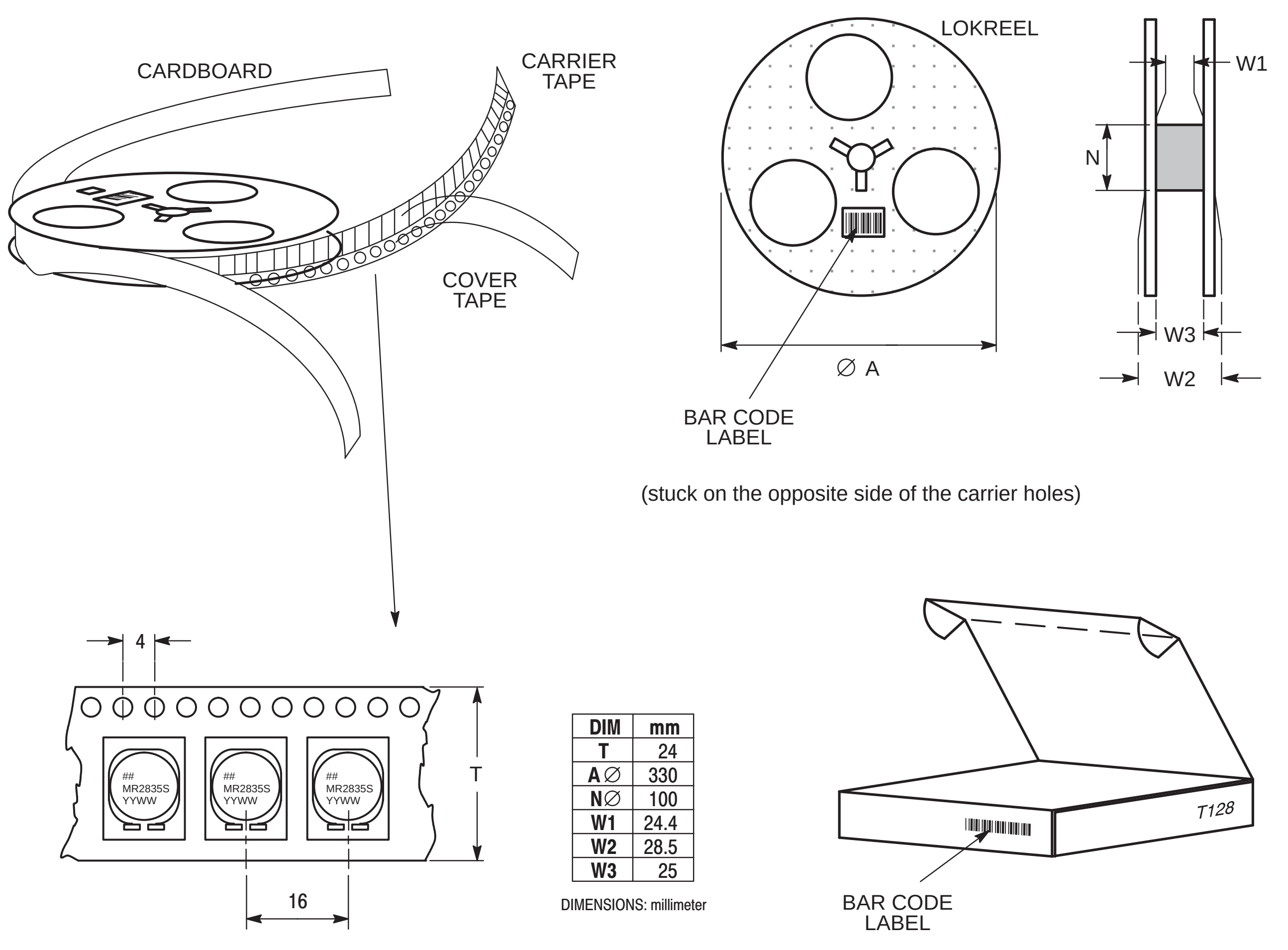



**Figure 9. Typical Reverse Capacitance**

**Reel of 500 Units**




(stuck on the opposite side of the carrier holes)

| DIM | mm |
|---|---|
| T | 24 |
| A ∅ | 330 |
| N ∅ | 100 |
| W1 | 24.4 |
| W2 | 28.5 |
| W3 | 25 |

DIMENSIONS: millimeter

**Figure 10. Reel Packing of MR2835S – Top Can**

# MR3227

## Automotive Transient Voltage Suppressor

### 20 V – 27 V

Designed for Automotive Applications (Alternator) requiring Reverse Avalanche Capability for use as Transient Voltage Suppressor. Developed to suppress transients in automotive systems, this device operates in the forward mode as Standard Rectifier or in Reverse as Transient Voltage Suppressor for Centralized Protection.

For further information referring to Mounting or Operating Conditions, contact your nearest ON Semiconductor Sales Representative.

**Mechanical Characteristics**

- Finish: 100% Tin Plated
  All External Surfaces are Corrosion Resistant
- Weight: 2.5 Grams (Approximately)

**Packaging/Labeling**

- Two Sealed Bags into a Cardboard Box
- Device Number Labeled on the Bag

**Marking**

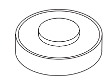
- The Devices are Laser Marked on the Epoxy Surface

**MAXIMUM RATING**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| DC Blocking Voltage | $V_R$ | 18 | Volts |
| Average Forward Current (Single Phase, Resistive Load, $T_C$ = 185°C) | $I_O$ | 32 | Amps |
| Peak Repetitive Reverse Surge Current (Time Constant = 10 ms, $T_C$ = 25°C) (Time Constant = 80 ms, $T_C$ = 25°C) | $I_{RSM}$ $I_{RSM}$ | 90 40 | Amps |
| Non–Repetitive Peak Surge Current (Halfwave, Single Phase, 50 Hz) | $I_{FSM}$ | 400 | Amps |
| Storage Temperature Range | $T_{stg}$ | –40 to +200 | °C |
| Maximum Operating Junction Temperature | $T_J$ | 200 | °C |

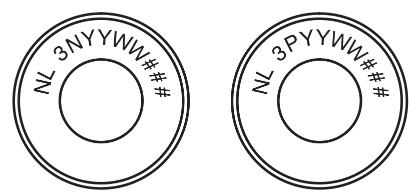
**ON Semiconductor**

**http://onsemi.com**



**N SUFFIX**
(Anode to Cup)
**P SUFFIX**
(Cathode to Cup)
**CASE 193A**

**MARKING DIAGRAM**




NL = Location Code
3N or 3P = Device Code and Polarity
YY = Year
WW = Work Week
### = Assembly Lot Number

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MR3227N | Button Can | 5000 Units/Box |
| MR3227P | Button Can | 5000 Units/Box |

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### THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance Junction to Case | $R_{\theta JC}$ | 0.5 | °C/W |

### ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.) ($I_F$ = 100 Amps, $T_C$ = 25°C) | $v_F$ | – | 1.18 | Volts |
| Reverse Current (Note 1.) ($V_R$ = 16 Vdc, $T_C$ = 25°C) | $I_R$ | – | 1.0 | μA |
| Breakdown Voltage (Note 1.) ($I_R$ = 100 mA, $T_C$ = 25°C) | $V_{(BR)}$ | 20 | 27 | Volts |
| Breakdown Voltage<br>($I_R$ = 80 Amps, $T_C$ = 25°C, PW = 80 μs)<br>($I_R$ = 80 Amps, $T_C$ = 85°C, PW = 80 μs) | $V_{(BR)}$ | <br>–<br>– | <br>35<br>37 | Volts |
| Breakdown Voltage Temperature Coefficient | $V_{(BR)TC}$ | 0.095* | | %/°C |
| Forward Voltage Temperature Coefficient ($I_F$ = 10 mA) | $V_{FTC}$ | –2* | | mV/°C |

1. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2%.

*Typical

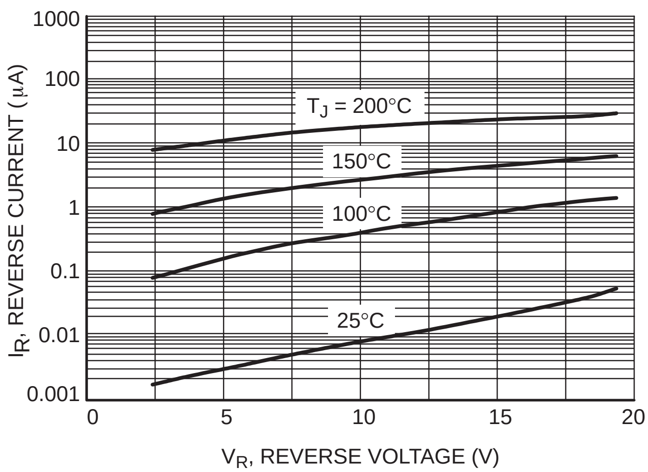


Figure 1. Typical Reverse Current

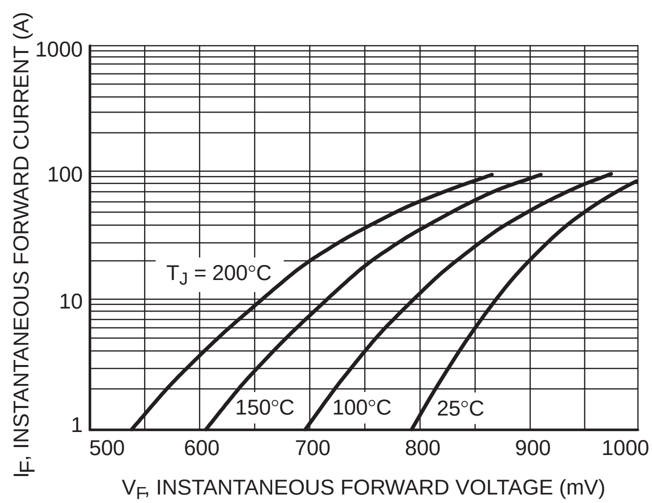


Figure 2. Typical Forward Voltage

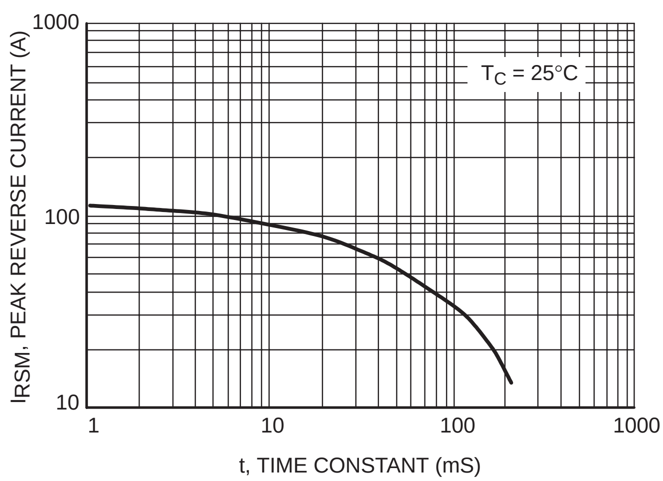


Figure 3. Maximum Peak Reverse Current

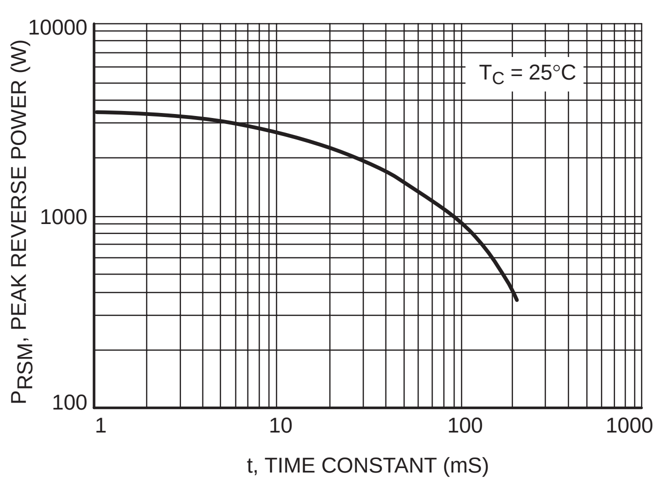


Figure 4. Maximum Peak Reverse Power

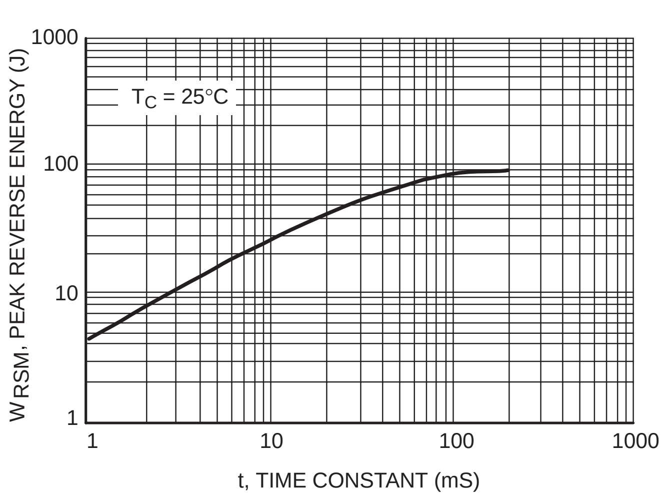


**Figure 5. Maximum Reverse Energy**

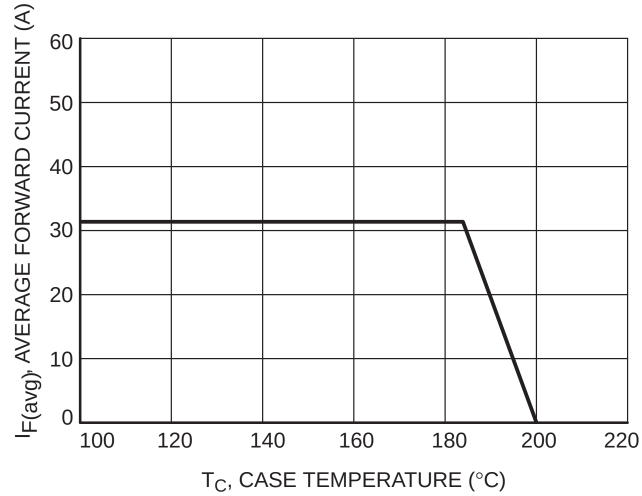


**Figure 6. Maximum Current Rating**

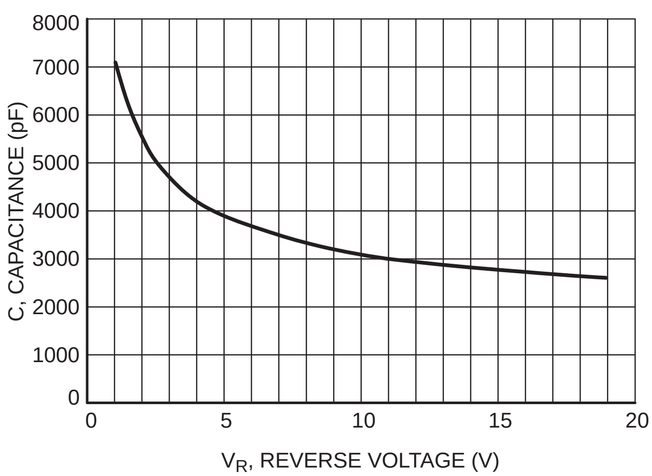


**Figure 7. Typical Capacitance**

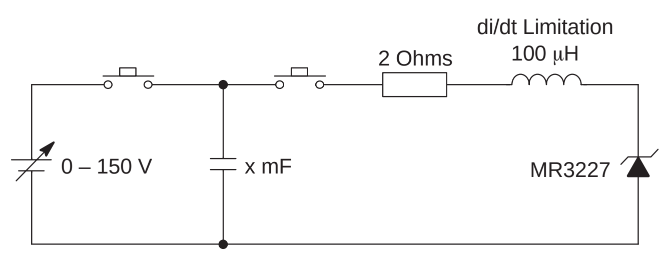


**Figure 8. Load Dump Test Circuit**

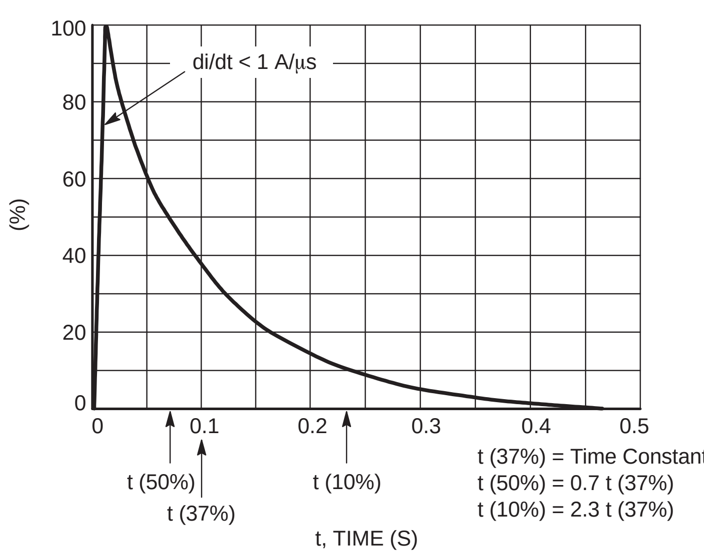


**Figure 9. Load Dump Pulse Current**

# MR4027

## Automotive Transient Voltage Suppressor

### 20 V – 27 V

Designed for Automotive Applications (Alternator) requiring Reverse Avalanche Capability for use as Transient Voltage Suppressor. Developed to suppress transients in automotive systems, this device operates in the forward mode as Standard Rectifier or in Reverse as Transient Voltage Suppressor for Centralized Protection.

For further information referring to Mounting or Operating Conditions, contact your nearest ON Semiconductor Sales Representative.

**Mechanical Characteristics**

- Finish: 100% Tin Plated
  All External Surfaces are Corrosion Resistant
- Weight: 2.6 Grams (Approximately)

**Packaging/Labeling**

- Two Sealed Bags into a Cardboard Box
- Device Number Labeled on the Bag

**Marking**

- The Devices are Laser Marked on the Epoxy Surface

**MAXIMUM RATING**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| DC Blocking Voltage | $V_R$ | 18 | Volts |
| Average Forward Current (Single Phase, Resistive Load, $T_C$ = 185°C) | $I_O$ | 40 | Amps |
| Peak Repetitive Reverse Surge Current<br>(Time Constant = 10 ms, $T_C$ = 25°C)<br>(Time Constant = 80 ms, $T_C$ = 25°C) | <br>$I_{RSM}$<br>$I_{RSM}$ | <br>110<br>50 | Amps |
| Non–Repetitive Peak Surge Current (Halfwave, Single Phase, 50 Hz) | $I_{FSM}$ | 500 | Amps |
| Storage Temperature Range | $T_{stg}$ | –40 to +200 | °C |
| Maximum Operating Junction Temperature | $T_J$ | 200 | °C |

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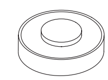
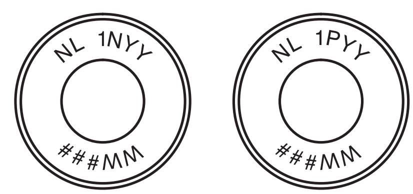


**N SUFFIX**
(Anode to Cup)
**P SUFFIX**
(Cathode to Cup)
**CASE 193A**

**MARKING DIAGRAM**




NL = Location Code
1N or 1P = Device Code and Polarity
YY = Year
WW = Work Week
### = Assembly Lot Number

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MR4027N | Button Can | 5000 Units/Box |
| MR4027P | Button Can | 5000 Units/Box |

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### THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance Junction to Case | $R_{\theta JC}$ | 0.4 | °C/W |

### ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.) ($I_F$ = 100 Amps, $T_C$ = 25°C) | $v_F$ | – | 1.1 | Volts |
| Reverse Current (Note 1.) ($V_R$ = 16 Vdc, $T_C$ = 25°C) | $I_R$ | – | 1.0 | μA |
| Breakdown Voltage (Note 1.) ($I_R$ = 100 mA, $T_C$ = 25°C) | $V_{(BR)}$ | 20 | 27 | Volts |
| Breakdown Voltage<br>($I_R$ = 80 Amps, $T_C$ = 25°C, PW = 80 μs)<br>($I_R$ = 80 Amps, $T_C$ = 85°C, PW = 80 μs) | $V_{(BR)}$ | <br>–<br>– | <br>35<br>37 | Volts |
| Breakdown Voltage Temperature Coefficient | $V_{(BR)TC}$ | 0.095* | | %/°C |
| Forward Voltage Temperature Coefficient ($I_F$ = 10 mA) | $V_{FTC}$ | –2* | | mV/°C |

1. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2%.

*Typical

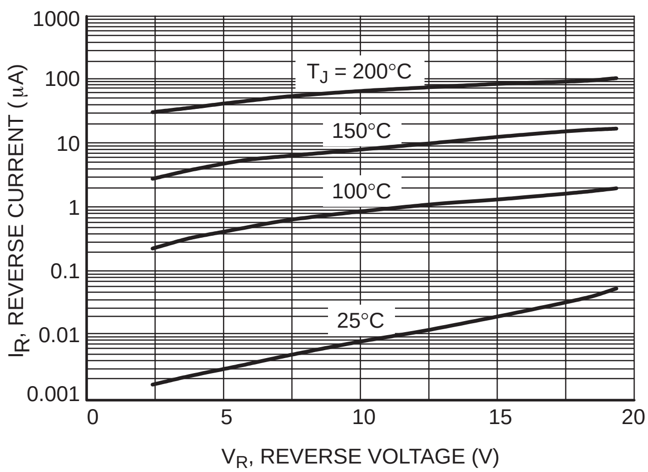


**Figure 1. Typical Reverse Current**

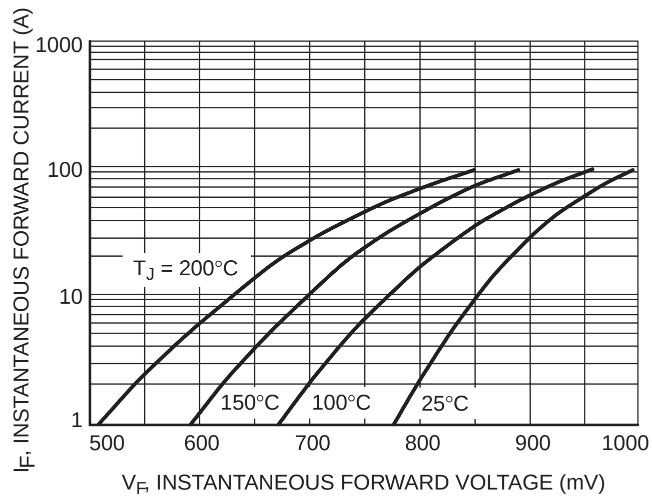


**Figure 2. Typical Forward Voltage**

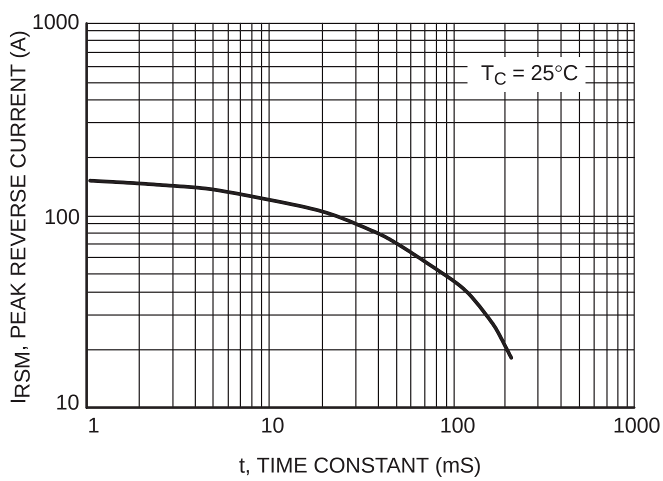


**Figure 3. Maximum Peak Reverse Current**

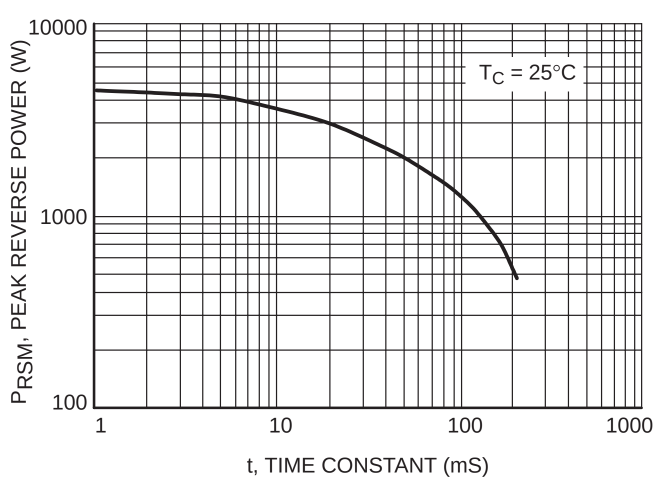


**Figure 4. Maximum Peak Reverse Power**

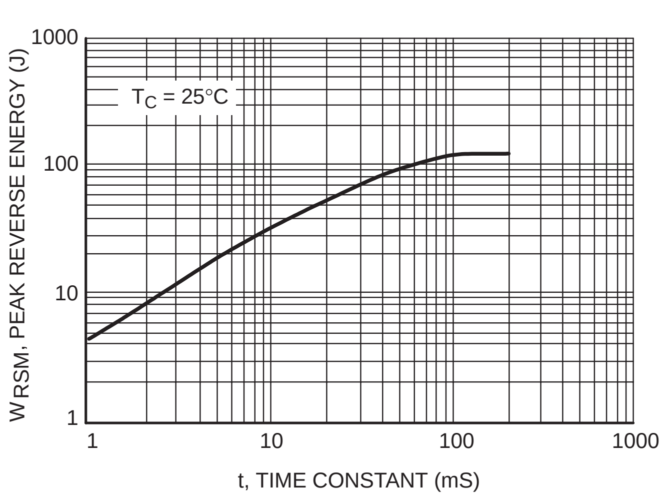


**Figure 5. Maximum Reverse Energy**

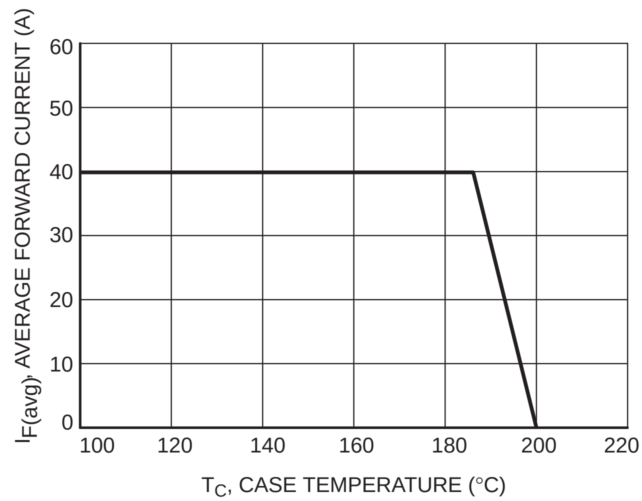


**Figure 6. Maximum Current Rating**

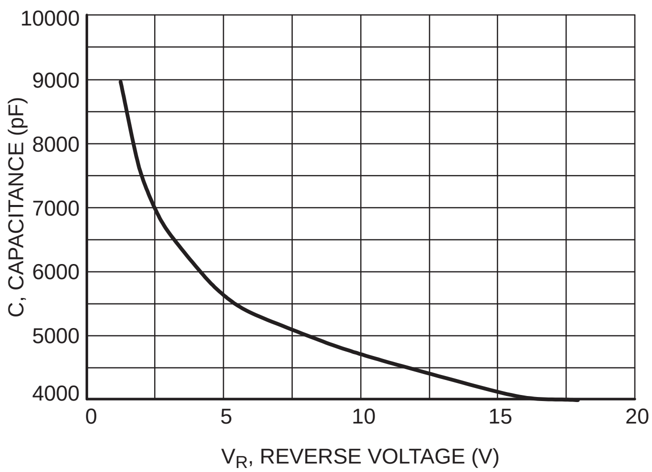


**Figure 7. Typical Capacitance**

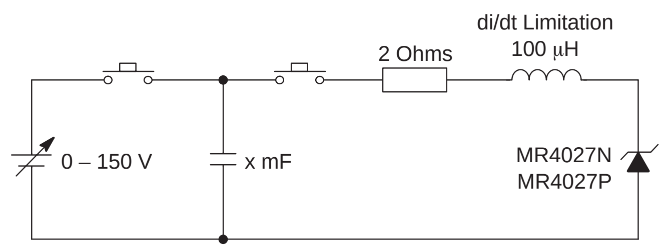


**Figure 8. Load Dump Test Circuit**

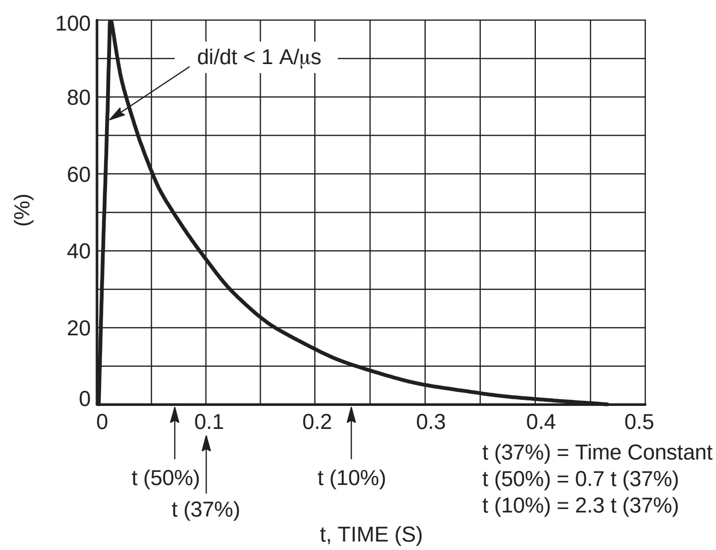


**Figure 9. Load Dump Pulse Current**

# MR4045

## Automotive Transient Voltage Suppressor

### 34 V – 45 V

Designed for Automotive Applications (Alternator) requiring Reverse Avalanche Capability for use as Transient Voltage Suppressor. Developed to suppress transients in automotive systems, this device operates in the forward mode as Standard Rectifier or in Reverse as Transient Voltage Suppressor for Centralized Protection.

For further information referring to Mounting or Operating Conditions, contact your nearest ON Semiconductor Sales Representative.

**Mechanical Characteristics**

- Finish: 100% Tin Plated
  All External Surfaces are Corrosion Resistant
- Weight: 2.6 Grams (Approximately)

**Packaging/Labeling**

- Two Sealed Bags into a Cardboard Box
- Device Number Labeled on the Bag

**Marking**

- The Devices are Laser Marked on the Epoxy Surface

**MAXIMUM RATING**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| DC Blocking Voltage | $V_R$ | 30 | Volts |
| Average Forward Current (Single Phase, Resistive Load, $T_C$ = 185°C) | $I_O$ | 40 | Amps |
| Peak Repetitive Reverse Surge Current<br>(Time Constant = 10 ms, $T_C$ = 25°C)<br>(Time Constant = 80 ms, $T_C$ = 25°C) | <br>$I_{RSM}$<br>$I_{RSM}$ | <br>55<br>25 | Amps |
| Non–Repetitive Peak Surge Current (Halfwave, Single Phase, 50 Hz) | $I_{FSM}$ | 500 | Amps |
| Storage Temperature Range | $T_{stg}$ | –40 to +200 | °C |
| Maximum Operating Junction Temperature | $T_J$ | 200 | °C |

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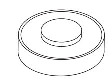
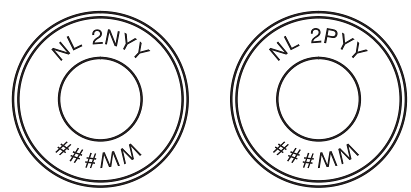


**N SUFFIX**
(Anode to Cup)
**P SUFFIX**
(Cathode to Cup)
**CASE 193A**

**MARKING DIAGRAM**




NL = Location Code
2N or 2P = Device Code and Polarity
YY = Year
WW = Work Week
### = Assembly Lot Number

**ORDERING INFORMATION**

| Device | Package | Shipping |
|---|---|---|
| MR4045N | Button Can | 5000 Units/Box |
| MR4045P | Button Can | 5000 Units/Box |

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### THERMAL CHARACTERISTICS

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance Junction to Case | $R_{\theta JC}$ | 0.4 | °C/W |

### ELECTRICAL CHARACTERISTICS

| Characteristic | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Instantaneous Forward Voltage (Note 1.) ($I_F$ = 100 Amps, $T_C$ = 25°C) | $v_F$ | – | 1.1 | Volts |
| Reverse Current (Note 1.) ($V_R$ = 28 Vdc, $T_C$ = 25°C) | $I_R$ | – | 1.0 | μA |
| Breakdown Voltage (Note 1.) ($I_R$ = 100 mA, $T_C$ = 25°C) | $V_{(BR)}$ | 34 | 45 | Volts |
| Breakdown Voltage<br>($I_R$ = 80 Amps, $T_C$ = 25°C, PW = 80 μs)<br>($I_R$ = 80 Amps, $T_C$ = 85°C, PW = 80 μs) | $V_{(BR)}$ | <br>–<br>– | <br>53<br>55 | Volts |
| Breakdown Voltage Temperature Coefficient | $V_{(BR)TC}$ | 0.095* | | %/°C |
| Forward Voltage Temperature Coefficient ($I_F$ = 10 mA) | $V_{FTC}$ | –2* | | mV/°C |

1. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2%.

*Typical

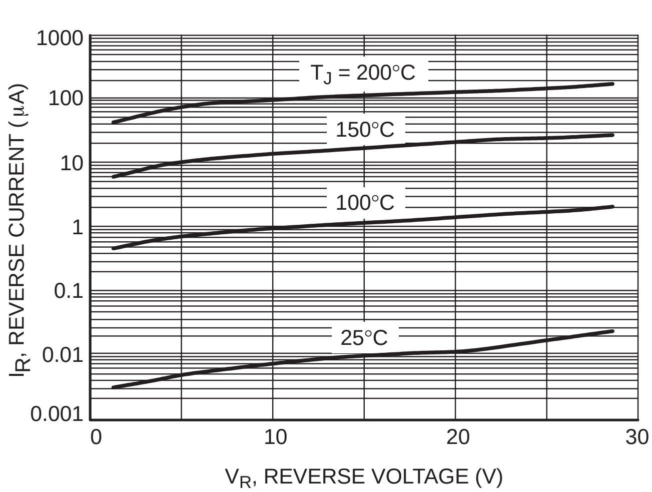



**Figure 1. Typical Reverse Current**

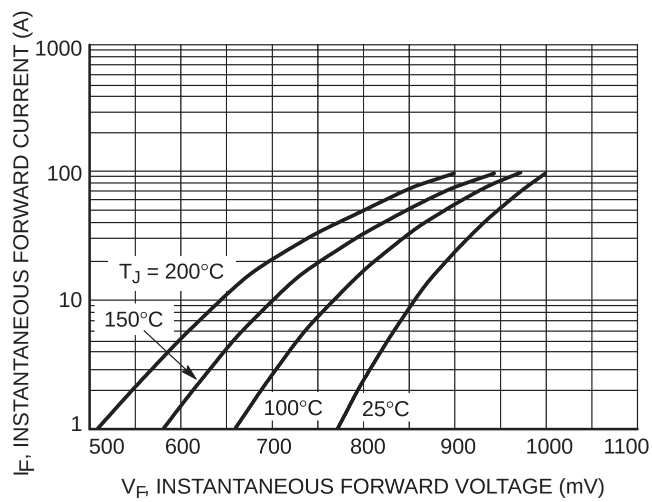



**Figure 2. Typical Forward Voltage**

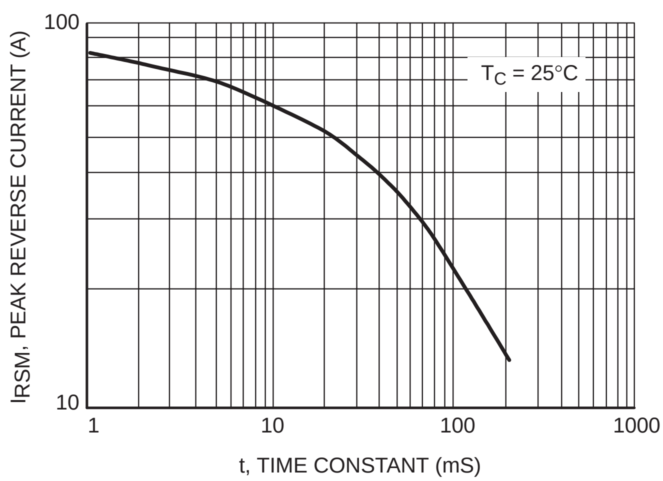



**Figure 3. Maximum Peak Reverse Current**

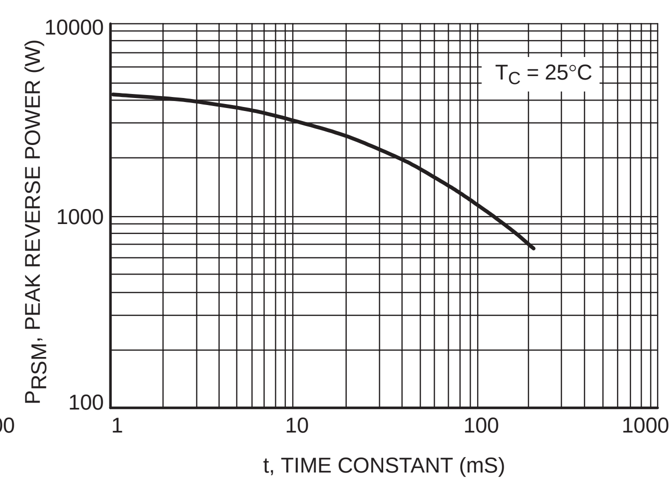



**Figure 4. Maximum Peak Reverse Power**

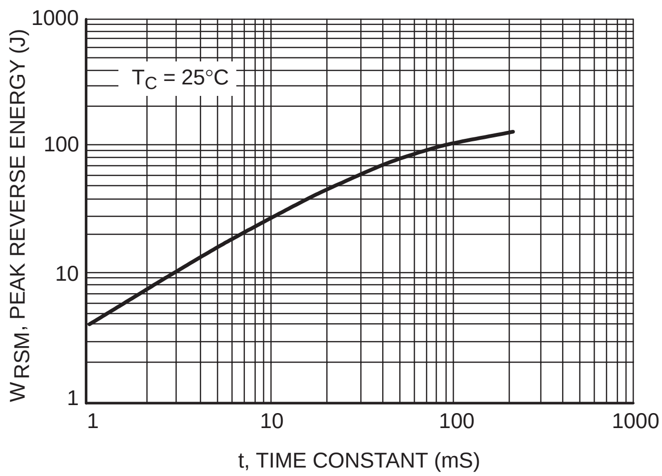



**Figure 5. Maximum Reverse Energy**

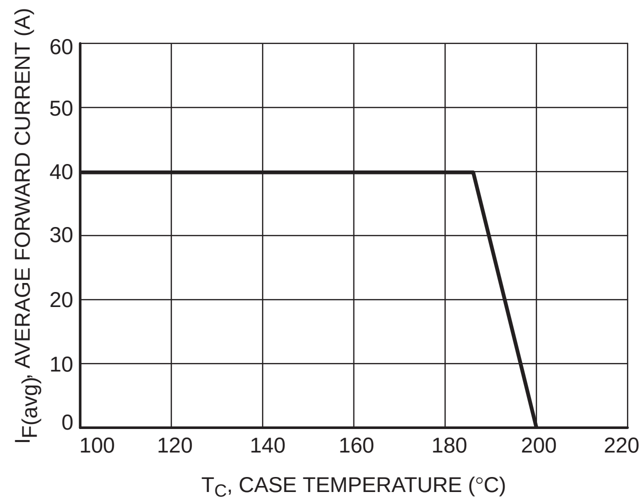



**Figure 6. Maximum Current Rating**

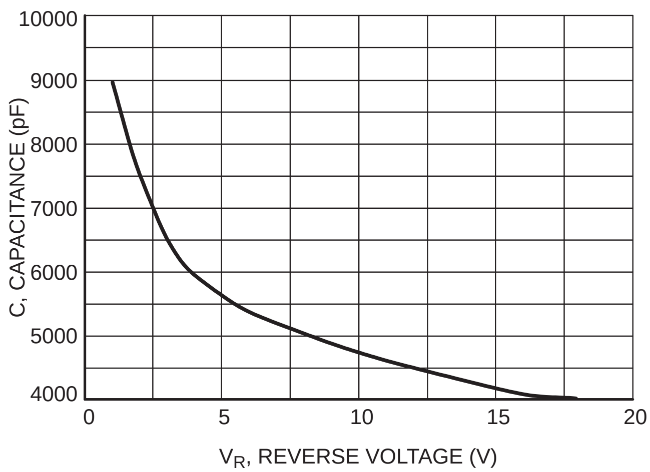



**Figure 7. Typical Capacitance**

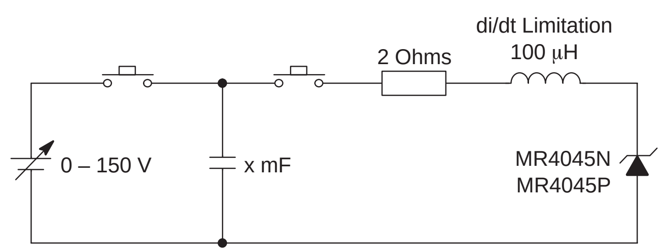



**Figure 8. Load Dump Test Circuit**

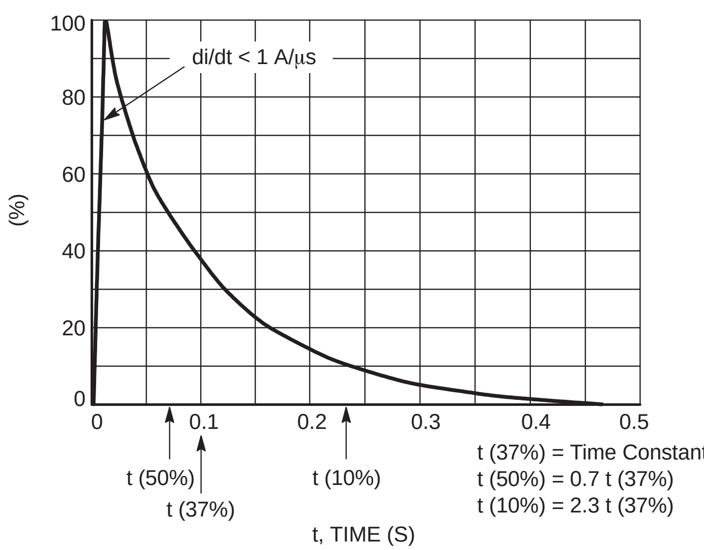



**Figure 9. Load Dump Pulse Current**

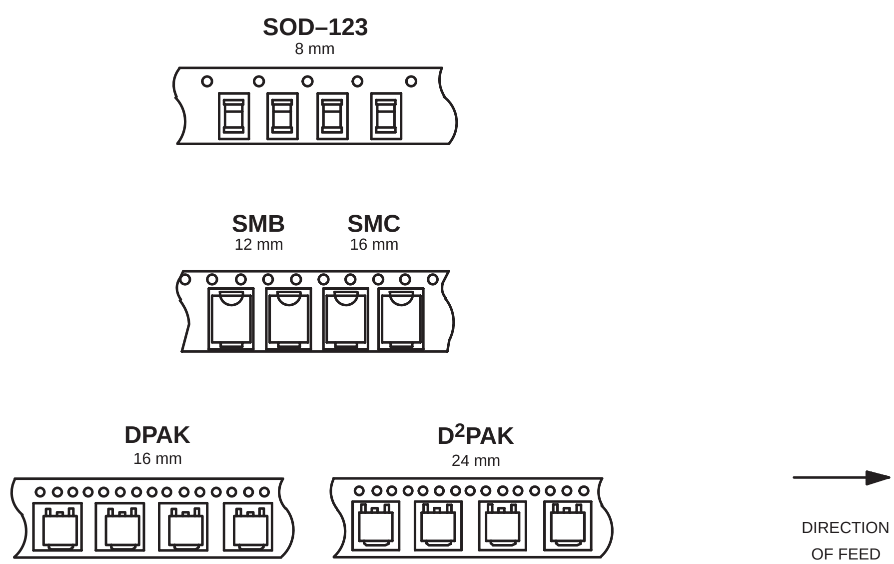
# CHAPTER 6
# Tape & Reel/Packaging Specifications

# Tape and Reel Specifications and Packaging Specifications

Embossed Tape and Reel is used to facilitate automatic pick and place equipment feed requirements. The tape is used as the shipping container for various products and requires a minimum of handling. The antistatic/conductive tape provides a secure cavity for the product when sealed with the “peel–back” cover tape.

- Two Reel Sizes Available (7″ and 13″)
- Used for Automatic Pick and Place Feed Systems
- Minimizes Product Handling
- EIA 481, –1, –2
- SOD–123 in 8 mm Tape
- SMB in 12 mm Tape
- DPAK, SMC in 16 mm Tape
- D$^2$PAK in 24 mm Tape

Use the standard device title and add the required suffix as listed in the option table on the following page. Note that the individual reels have a finite number of devices depending on the type of product contained in the tape. Also note the minimum lot size is one full reel for each line item, and orders are required to be in increments of the single reel quantity.

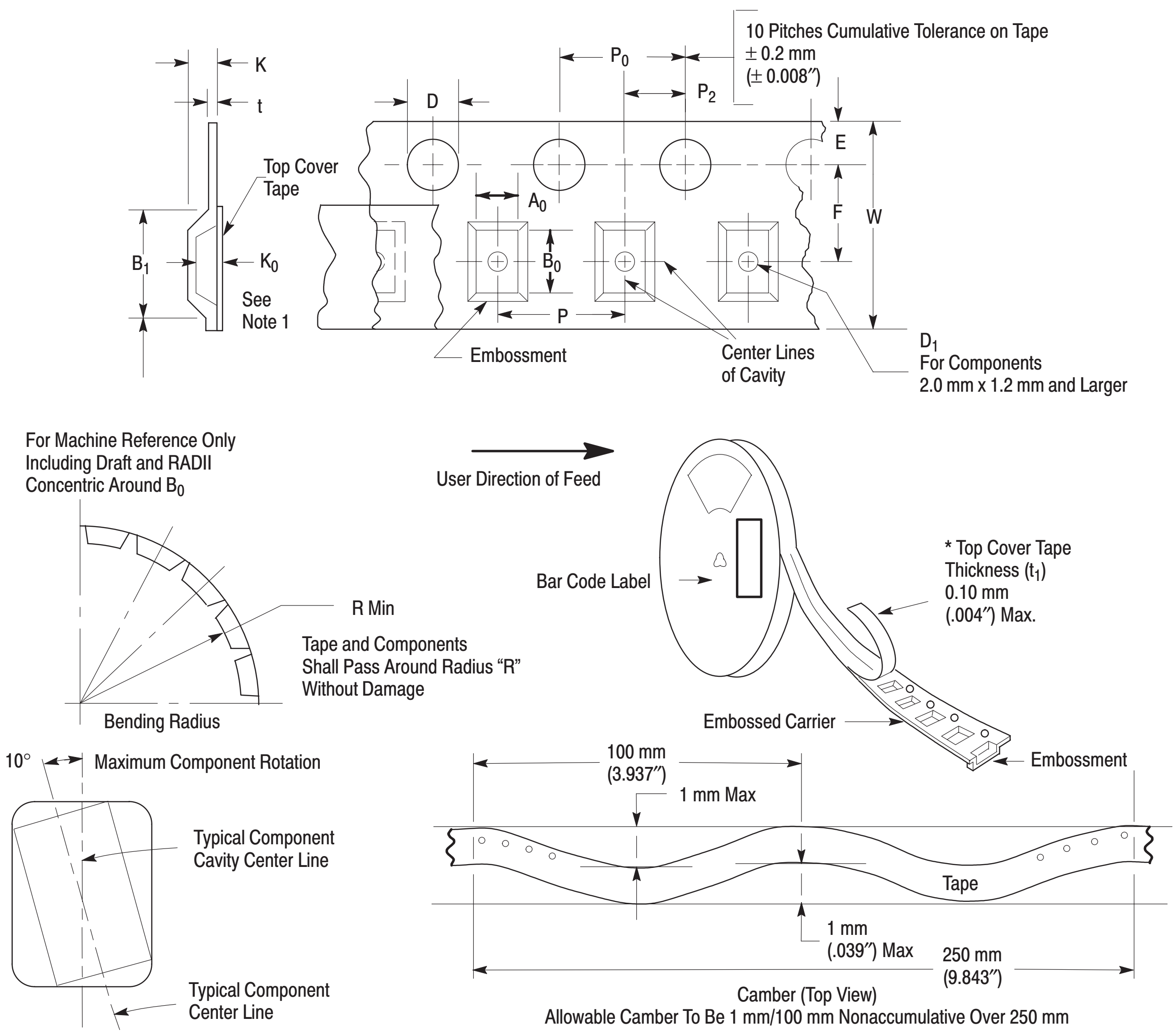



### EMBOSSED TAPE AND REEL ORDERING INFORMATION

| Package | Tape Width (mm) | Pitch mm (inch) | Reel Size mm (inch) | Devices Per Reel and Minimum Order Quantity | Device Suffix |
|---|---|---|---|---|---|
| DPAK | 16 | 8.0 ± 0.1 (.315 ± .004) | 330 (13) | 2,500 | T4 |
| D$^2$PAK | 24 | 16.0 ± 0.1 (.630 ± .004) | 330 (13) | 800 | T4 |
| SMB | 12 | 8.0 ± 0.1 (.315 ± .004) | 330 (13) | 2,500 | T3 |
| SMC | 16 | 8.0 ± 0.1 (.315 ± .004) | 330 (13) | 2,500 | T3 |
| SOD–123 | 8 | 4.0 ± 0.1 (.157 ± .004) | 178 (7) | 3,000 | T1 |
| | 8 | | 330 (13) | 10,000 | T3 |

# EMBOSSED TAPE AND REEL DATA FOR DISCRETES

## CARRIER TAPE SPECIFICATIONS




## DIMENSIONS

| Tape Size | $B_1$ Max | D | $D_1$ | E | F | K | $P_0$ | $P_2$ | R Min | T Max | W Max |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 mm | 4.55 mm (.179″) | 1.5+0.1 mm −0.0 (.059+.004″ −0.0) | 1.0 Min (.039″) | 1.75±0.1 mm (.069±.004″) | 3.5±0.05 mm (.138±.002″) | 2.4 mm Max (.094″) | 4.0±0.1 mm (.157±.004″) | 2.0±0.1 mm (.079±.002″) | 25 mm (.98″) | 0.6 mm (.024″) | 8.3 mm (.327″) |
| 12 mm | 8.2 mm (.323″) | | 1.5 mm Min (.060″) | | 5.5±0.05 mm (.217±.002″) | 6.4 mm Max (.252″) | | | 30 mm (1.18″) | | 12±.30 mm (.470±.012″) |
| 16 mm | 12.1 mm (.476″) | | | | 7.5±0.10 mm (.295±.004″) | 7.9 mm Max (.311″) | | | | | 16.3 mm (.642″) |
| 24 mm | 20.1 mm (.791″) | | | | 11.5±0.1 mm (.453±.004″) | 11.9 mm Max (.468″) | | | | | 24.3 mm (.957″) |

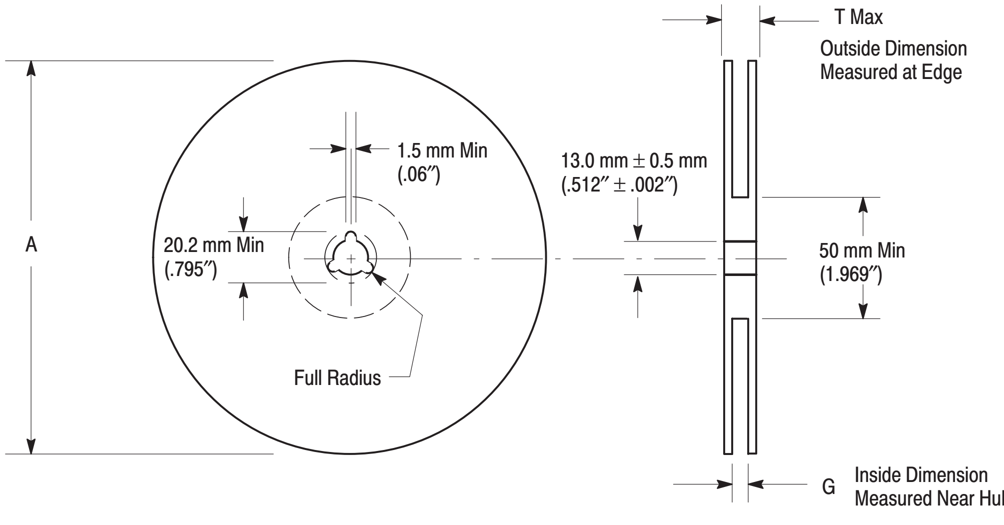
Metric dimensions govern — English are in parentheses for reference only.

NOTE 1: $A_0$, $B_0$, and $K_0$ are determined by component size. The clearance between the components and the cavity must be within .05 mm min. to .50 mm max.,

the component cannot rotate more than 10° within the determined cavity.

NOTE 2: If $B_1$ exceeds 4.2 mm (.165) for 8 mm embossed tape, the tape may not feed through all tape feeders.

NOTE 3: Pitch information is contained in the Embossed Tape and Reel Ordering Information on pg. 6–3.




| Size | A Max | G | T Max |
|---|---|---|---|
| 8 mm | 330 mm (12.992″) | 8.4 mm + 1.5 mm, –0.0 (.33″ + .059″, –0.00) | 14.4 mm (.56″) |
| 12 mm | 330 mm (12.992″) | 12.4 mm + 2.0 mm, –0.0 (.49″ + .079″, –0.00) | 18.4 mm (.72″) |
| 16 mm | 360 mm (14.173″) | 16.4 mm + 2.0 mm, –0.0 (.646″ + .078″, –0.00) | 22.4 mm (.882″) |
| 24 mm | 360 mm (14.173″) | 24.4 mm + 2.0 mm, –0.0 (.961″ + .070″, –0.00) | 30.4 mm (1.197″) |

## Reel Dimensions

**Metric Dimensions Govern — English are in parentheses for reference only**

## LEAD TAPE PACKAGING STANDARDS FOR AXIAL–LEAD COMPONENTS

| Case Type | Product Category | Device Title Suffix | MPQ Quantity Per Reel (Item 3.3.7) | Component Spacing A Dimension | Tape Spacing B Dimension | Reel Dimension C | Reel Dimension D (Max) | Max Off Alignment E |
|---|---|---|---|---|---|---|---|---|
| Case 17–02 | Surmetic 40 & 600 Watt TVS | RL | 4000 | 0.2 +/– 0.015 | 2.062 +/– 0.059 | 3 | 14 | 0.047 |
| Case 41A–02 | 1500 Watt TVS | RL4 | 1500 | 0.4 +/– 0.02 | 2.062 +/– 0.059 | 3 | 14 | 0.047 |
| Case 51–02 | DO–7 Glass (For Reference only) | RL | 3000 | 0.2 +/– 0.02 | 2.062 +/– 0.059 | 3 | 14 | 0.047 |
| Case 59–03 | DO–41 Glass & DO–41 Surmetic 30 | RL | 6000 | 0.2 +/– 0.015 | 2.062 +/– 0.059 | 3 | 14 | 0.047 |
| | Rectifier | | | | | | | |
| Case 59–04 | 500 Watt TVS | RL | 5000 | 0.2 +/– 0.02 | 2.062 +/– 0.059 | 3 | 14 | 0.047 |
| | Rectifier | | | | | | | |
| Case 194–04 | 110 Amp TVS (Automotive) | RL | 800 | 0.4 +/– 0.02 | 1.875 +/– 0.059 | 3 | 14 | 0.047 |
| | Rectifier | | | | | | | |
| Case 267–02 | Rectifier | RL | 1500 | 0.4 +/– 0.02 | 2.062 +/– 0.059 | 3 | 14 | 0.047 |
| Case 299–02 | DO–35 Glass | RL | 5000 | 0.2 +/– 0.02 | 2.062 +/– 0.059 | 3 | 14 | 0.047 |

**Table 1. Packaging Details (all dimensions in inches)**

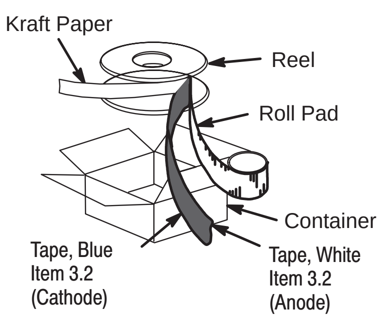



**Figure 1. Reel Packing**

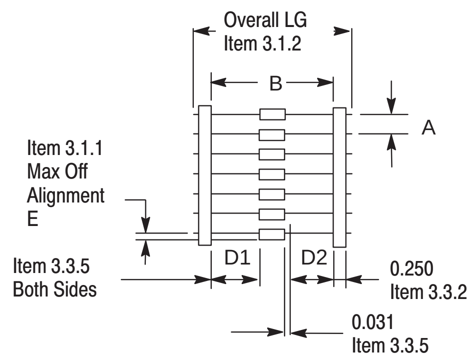



**Figure 2. Component Spacing**

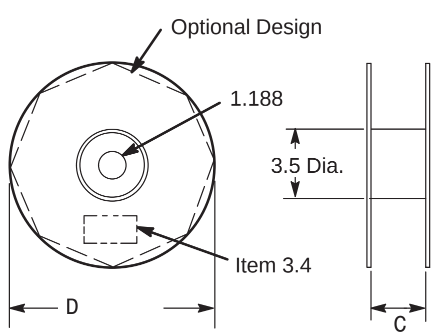



**Figure 3. Reel Dimensions**

# CHAPTER 7
# Surface Mount Information

# INFORMATION FOR USING SURFACE MOUNT PACKAGES

## RECOMMENDED FOOTPRINTS FOR SURFACE MOUNTED APPLICATIONS

Surface mount board layout is a critical portion of the total design. The footprint for the semiconductor packages must be the correct size to ensure proper solder connection interface between the board and the package. With the correct pad geometry, the packages will self align when subjected to a solder reflow process.

## POWER DISSIPATION FOR A SURFACE MOUNT DEVICE

The power dissipation for a surface mount device is a function of the drain/collector pad size. These can vary from the minimum pad size for soldering to a pad size given for maximum power dissipation. Power dissipation for a surface mount device is determined by $T_{J(max)}$, the maximum rated junction temperature of the die, $R_{\theta JA}$, the thermal resistance from the device junction to ambient, and the operating temperature, $T_A$. Using the values provided on the data sheet, $P_D$ can be calculated as follows:

$$P_D = \frac{T_{J(max)} - T_A}{R_{\theta JA}}$$

The values for the equation are found in the maximum ratings table on the data sheet. Substituting these values into the equation for an ambient temperature $T_A$ of 25°C, one can calculate the power dissipation of the device. For example, for a SOT–223 device, $P_D$ is calculated as follows.

$$P_D = \frac{150°C - 25°C}{156°C/W} = 800 \text{ milliwatts}$$

The 156°C/W for the SOT–223 package assumes the use of the recommended footprint on a glass epoxy printed circuit board to achieve a power dissipation of 800 milliwatts. There are other alternatives to achieving higher power dissipation from the surface mount packages. One is to increase the area of the drain/collector pad. By increasing the area of the drain/collector pad, the power dissipation can be increased. Although the power dissipation can almost be doubled with this method, area is taken up on the printed circuit board which can defeat the purpose of using surface mount technology. For example, a graph of $R_{\theta JA}$ versus drain pad area is shown in Figures 1, 2 and 3.

Another alternative would be to use a ceramic substrate or an aluminum core board such as Thermal Clad™. Using a board material such as Thermal Clad, an aluminum core board, the power dissipation can be doubled using the same footprint.

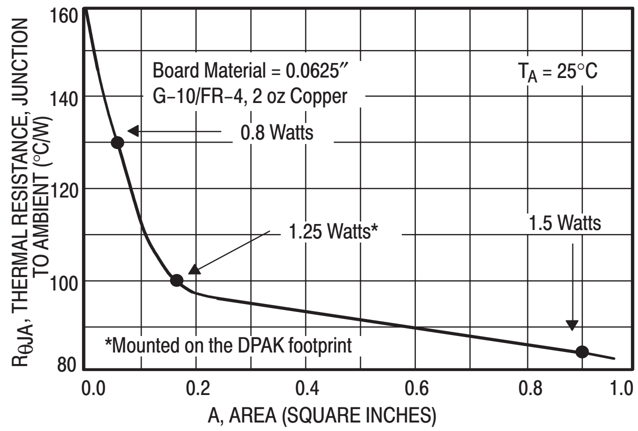



**Figure 1. Thermal Resistance versus Drain Pad Area for the SOT–223 Package (Typical)**

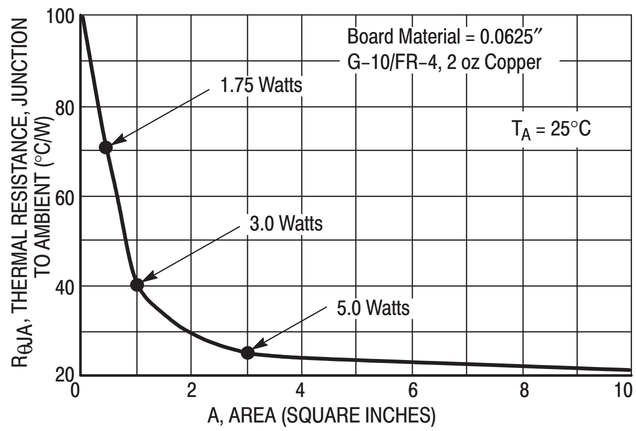



**Figure 2. Thermal Resistance versus Drain Pad Area for the DPAK Package (Typical)**

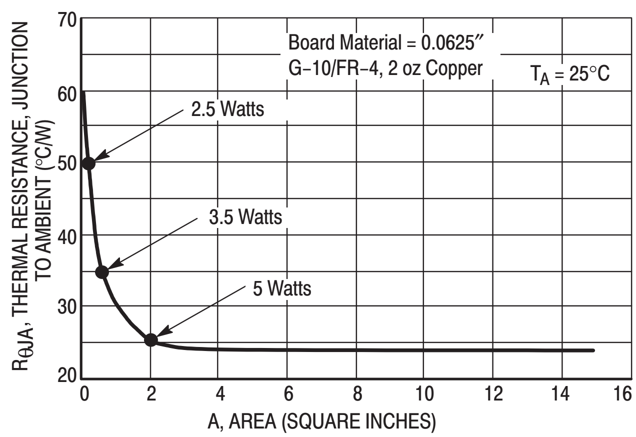



**Figure 3. Thermal Resistance versus Drain Pad Area for the $D^2$PAK Package (Typical)**

## SOLDER STENCIL GUIDELINES

Prior to placing surface mount components onto a printed circuit board, solder paste must be applied to the pads. Solder stencils are used to screen the optimum amount. These stencils are typically 0.008 inches thick and may be made of brass or stainless steel. For packages such as the SC–59, SC–70/SOT–323, SOD–123, SOT–23, SOT–143, SOT–223, SO–8, SO–14, SO–16, and SMB/SMC diode packages, the stencil opening should be the same as the pad size or a 1:1 registration. This is not the case with the DPAK and D$^2$PAK packages. If a 1:1 opening is used to screen solder onto the drain pad, misalignment and/or “tombstoning” may occur due to an excess of solder. For these two packages, the opening in the stencil for the paste should be approximately 50% of the tab area. The opening for the leads is still a 1:1 registration. Figure 4 shows a typical stencil for the DPAK and D$^2$PAK packages. The pattern of the opening in the stencil for the drain pad is not critical as long as it allows approximately 50% of the pad to be covered with paste.

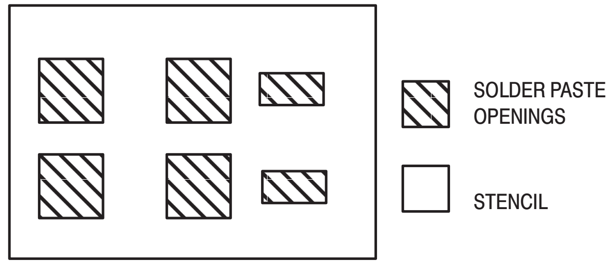



**Figure 4. Typical Stencil for DPAK and D$^2$PAK Packages**

## SOLDERING PRECAUTIONS

The melting temperature of solder is higher than the rated temperature of the device. When the entire device is heated to a high temperature, failure to complete soldering within a short time could result in device failure. Therefore, the following items should always be observed in order to minimize the thermal stress to which the devices are subjected.

- Always preheat the device.
- The delta temperature between the preheat and soldering should be 100°C or less.*
- When preheating and soldering, the temperature of the leads and the case must not exceed the maximum temperature ratings as shown on the data sheet. When using infrared heating with the reflow soldering method, the difference should be a maximum of 10°C.
- The soldering temperature and time should not exceed 260°C for more than 10 seconds.
- When shifting from preheating to soldering, the maximum temperature gradient shall be 5°C or less.
- After soldering has been completed, the device should be allowed to cool naturally for at least three minutes. Gradual cooling should be used since the use of forced cooling will increase the temperature gradient and will result in latent failure due to mechanical stress.
- Mechanical stress or shock should not be applied during cooling.

* Soldering a device without preheating can cause excessive thermal shock and stress which can result in damage to the device.

* Due to shadowing and the inability to set the wave height to incorporate other surface mount components, the D$^2$PAK is not recommended for wave soldering.

## TYPICAL SOLDER HEATING PROFILE

For any given circuit board, there will be a group of control settings that will give the desired heat pattern. The operator must set temperatures for several heating zones and a figure for belt speed. Taken together, these control settings make up a heating "profile" for that particular circuit board. On machines controlled by a computer, the computer remembers these profiles from one operating session to the next. Figure 5 shows a typical heating profile for use when soldering a surface mount device to a printed circuit board. This profile will vary among soldering systems, but it is a good starting point. Factors that can affect the profile include the type of soldering system in use, density and types of components on the board, type of solder used, and the type of board or substrate material being used. This profile shows temperature versus time. The line on the graph shows the actual temperature that might be experienced on the surface of a test board at or near a central solder joint. The two profiles are based on a high density and a low density board. The Vitronics SMD310 convection/infrared reflow soldering system was used to generate this profile. The type of solder used was 62/36/2 Tin Lead Silver with a melting point between 177–189°C. When this type of furnace is used for solder reflow work, the circuit boards and solder joints tend to heat first. The components on the board are then heated by conduction. The circuit board, because it has a large surface area, absorbs the thermal energy more efficiently, then distributes this energy to the components. Because of this effect, the main body of a component may be up to 30 degrees cooler than the adjacent solder joints.

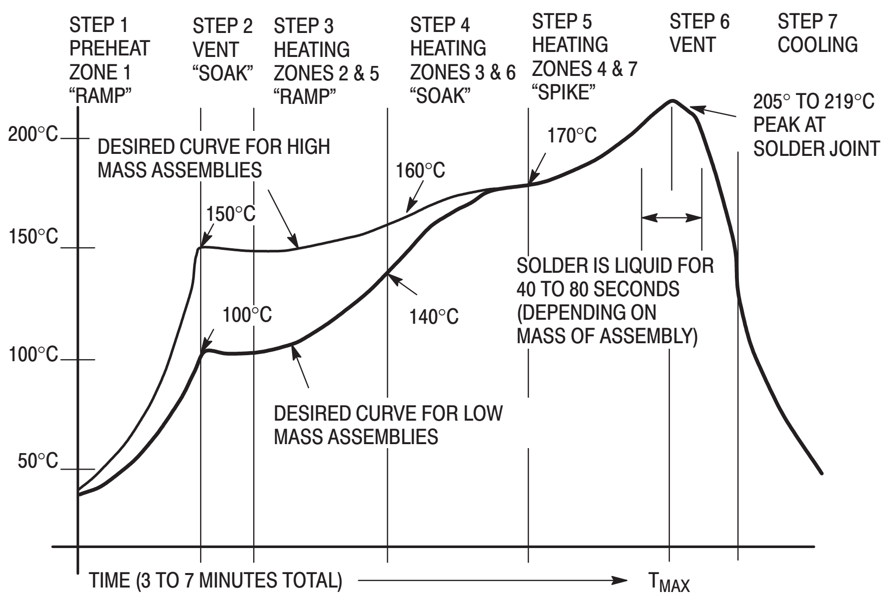
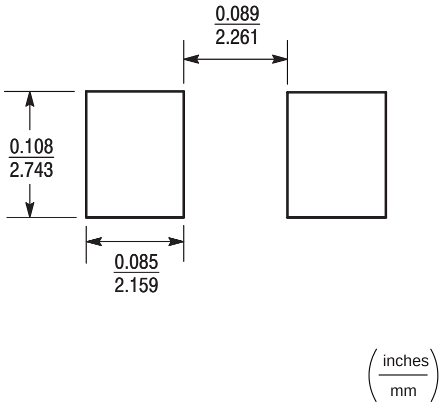
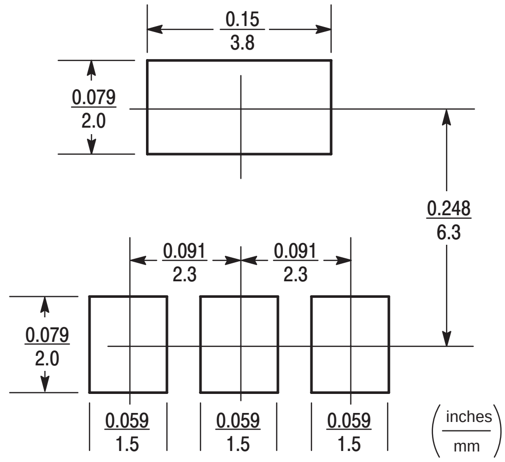



**Figure 5. Typical Solder Heating Profile**

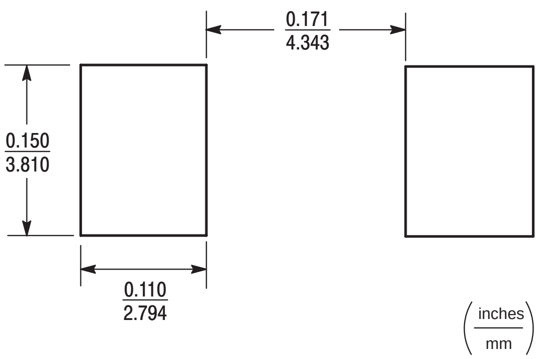
# Footprints for Soldering



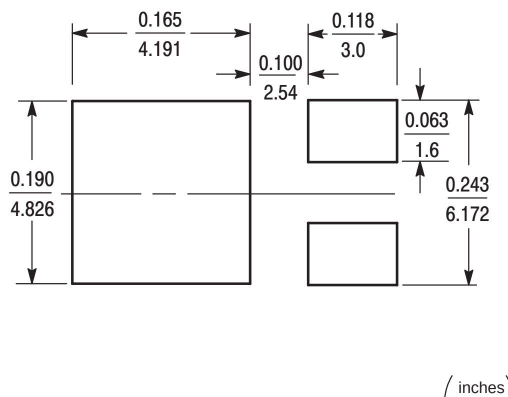

**SMB**



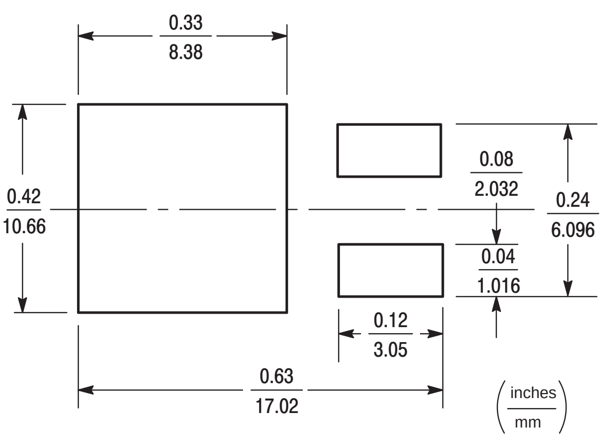

**SOT–223**



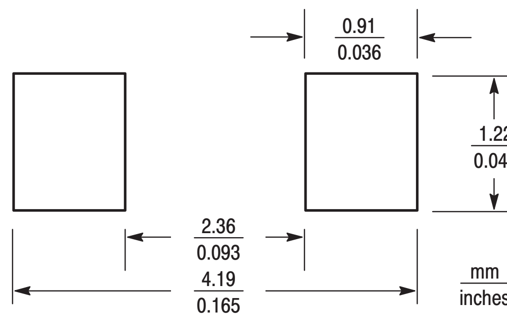

**SMC**




**DPAK**

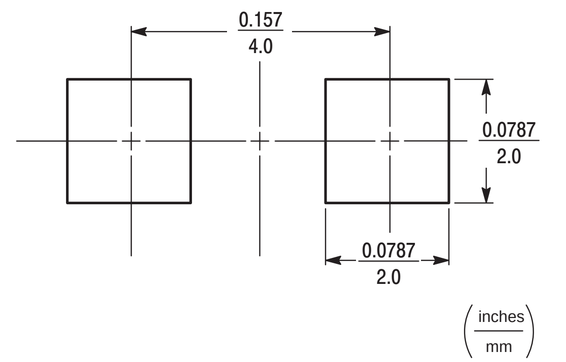



**D2PAK**

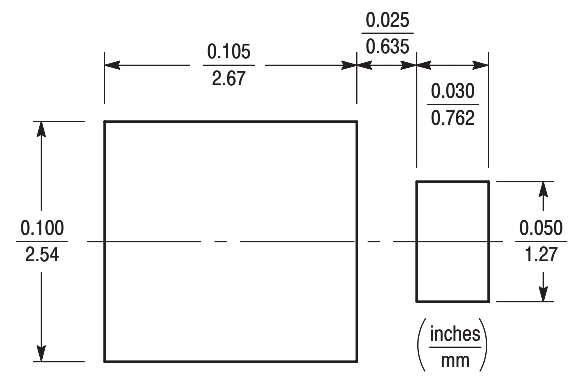



**SOD–123**

# Footprints for Soldering




SMA



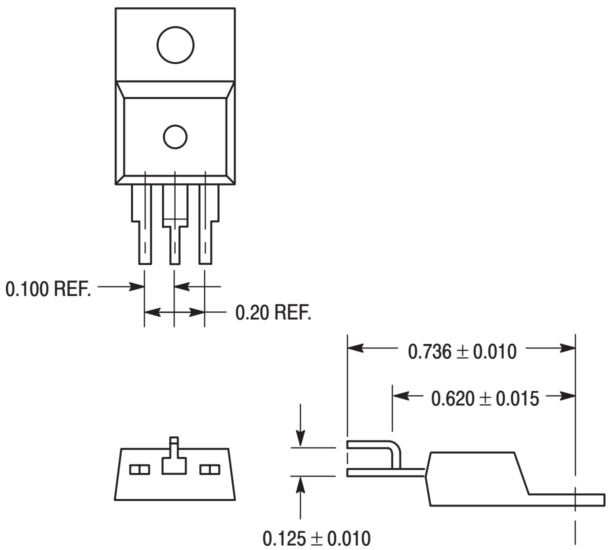

POWERMITE

# CHAPTER 8
# TO–220 Leadform Information

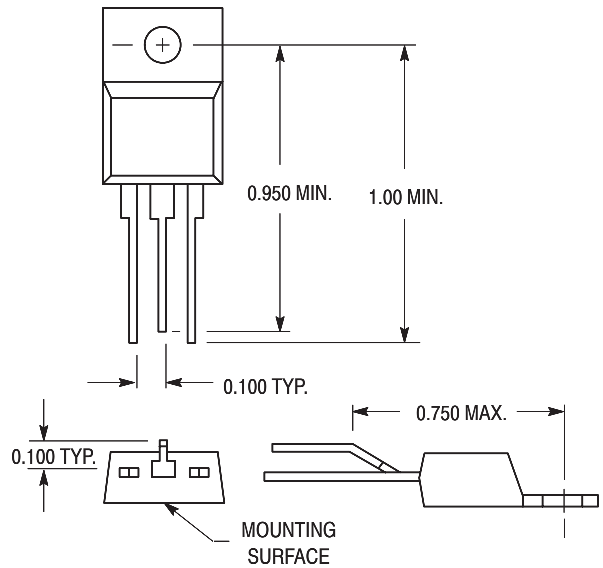
# Leadform Options — TO-220 (Case 221A)

- Leadform options require assignment of a special part number before ordering.
- Contact your local ON Semiconductor representative for special part number and pricing.
- 10,000 piece minimum quantity orders are required.
- Leadform orders are non-cancellable after processing.
- Leadforms apply to both ON Semiconductor Case 221A-04 and 221A-06 except as noted.

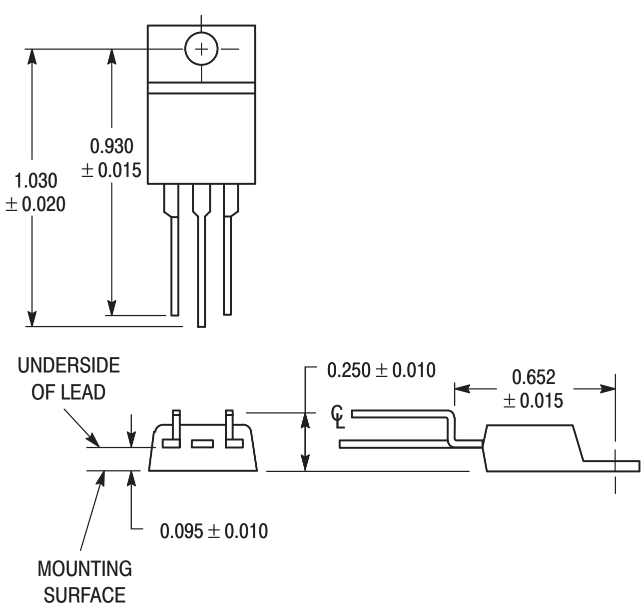
**LEADFORM AS**



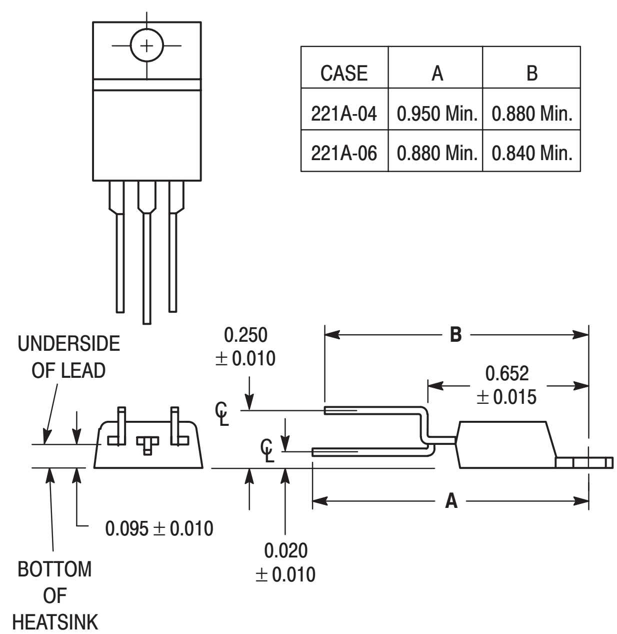

**LEADFORM BC**




**LEADFORM AC**



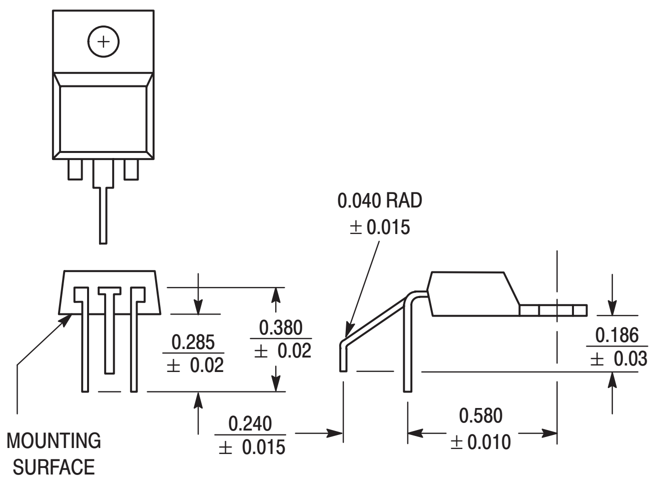

**LEADFORM AD**



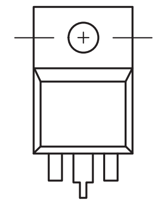

| CASE | A | B |
|---|---|---|
| 221A-04 | 0.950 Min. | 0.880 Min. |
| 221A-06 | 0.880 Min. | 0.840 Min. |

# TO-220 Leadform Options (continued)

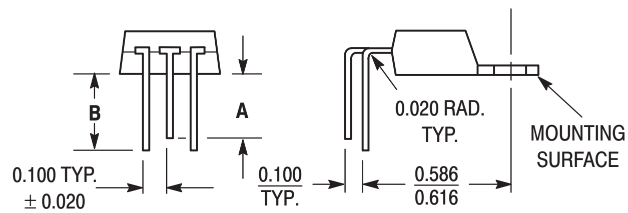
**LEADFORM AN**



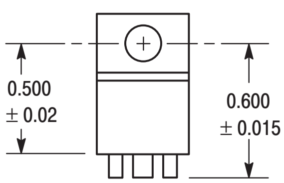

**LEADFORM BA**



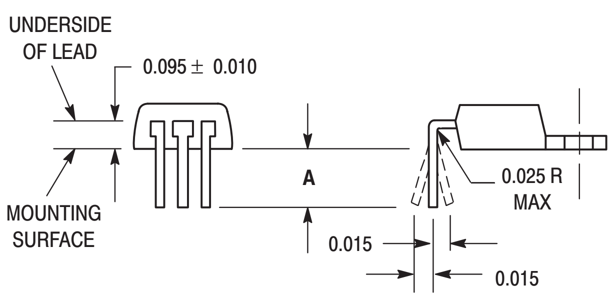
| CASE | A | B |
|---|---|---|
| 221A-04 | 0.220 Min. | 0.325 Min. |
| 221A-06 | 0.190 Min. | 0.290 Min. |



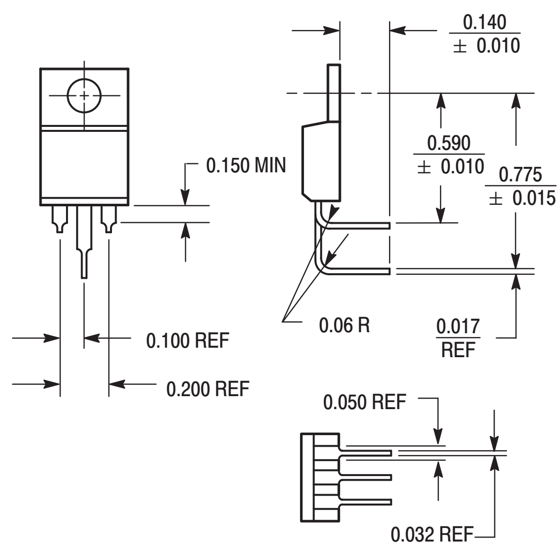

**LEADFORM BL**




| CASE | A |
|---|---|
| 221A-04 | 0.325 Min. |
| 221A-06 | 0.290 Min. |

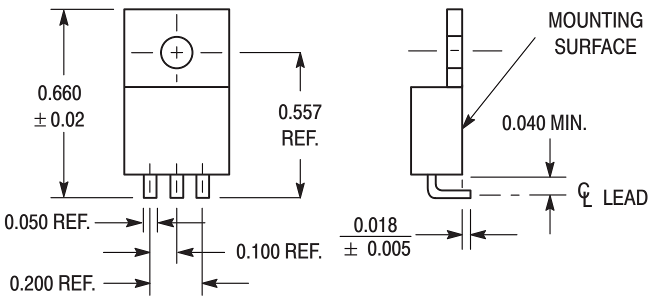



**LEADFORM AK**

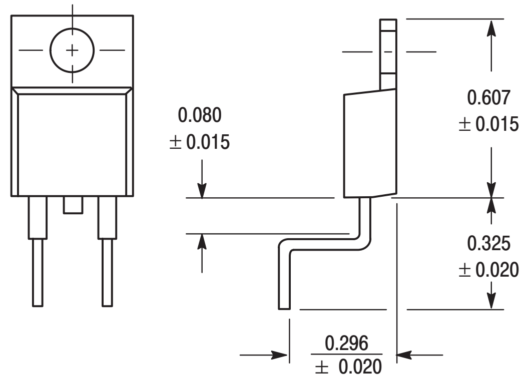


# TO-220 Leadform Options (continued)

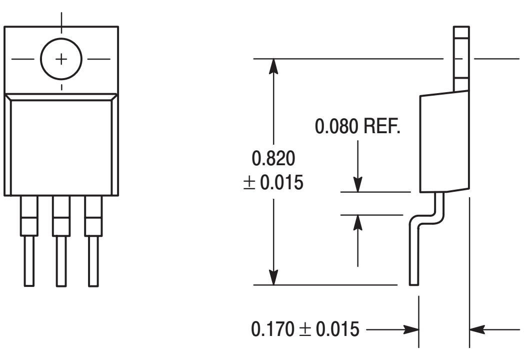
**LEADFORM AF**




**LEADFORM BS**

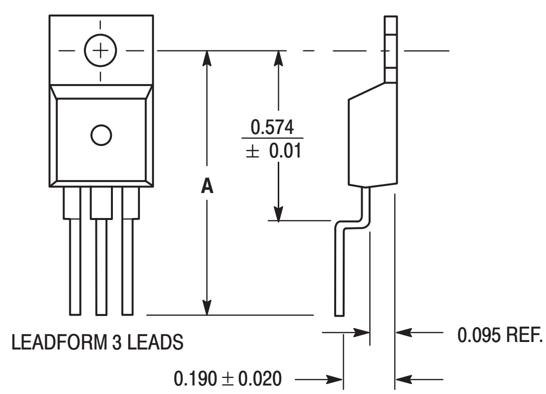



**LEADFORM BR**



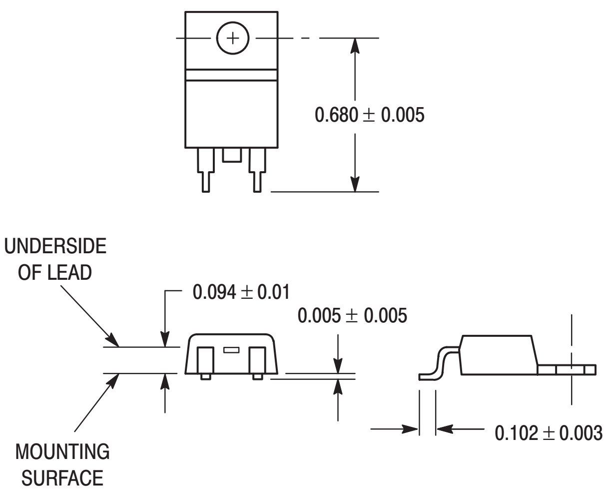

**LEADFORM AU**

| CASE | A |
|---|---|
| 221A-04 | 0.920 Min. |
| 221A-06 | 0.885 Min. |

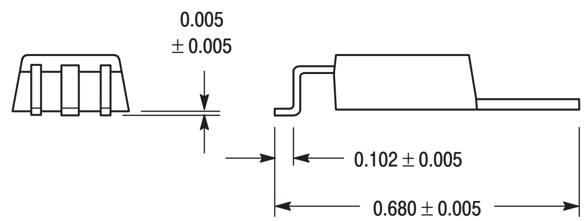


## TO-220 Leadform Options (continued)

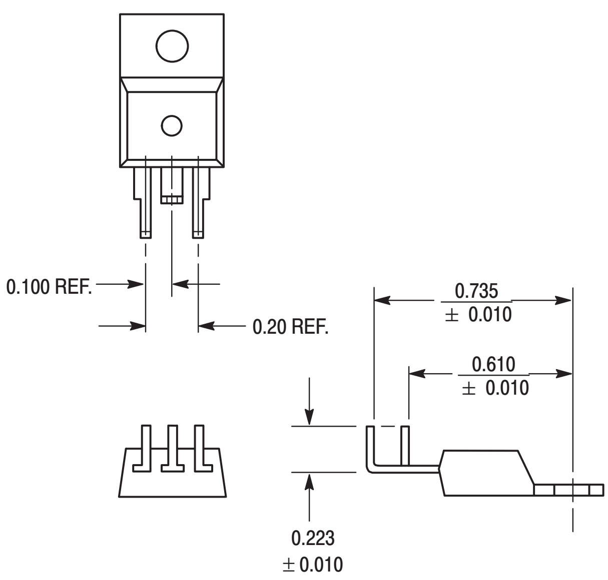
LEADFORM BU



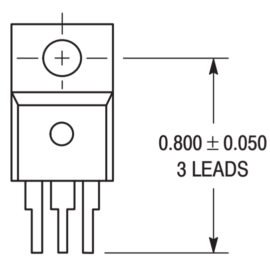

LEADFORM BV




LEADFORM BD

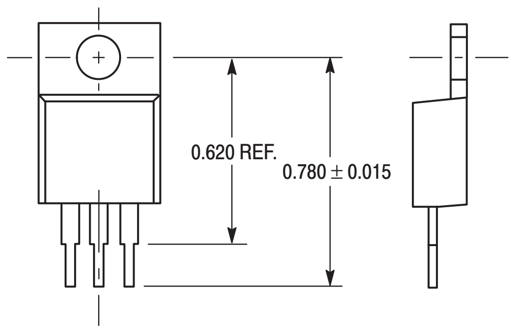



LEADFORM DW

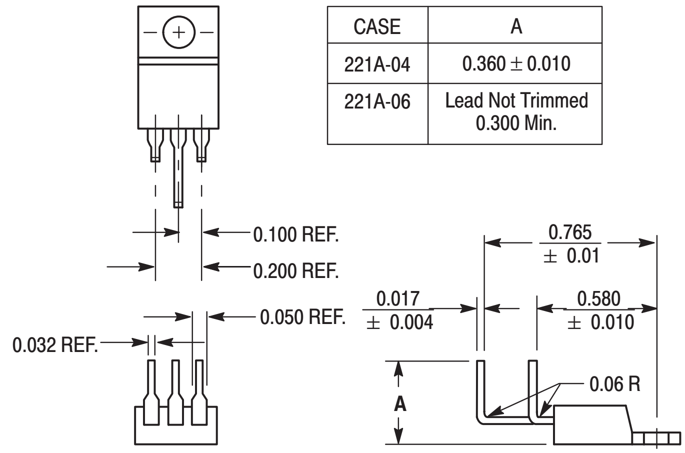


# TO-220 Leadform Options (continued)

**LEADFORM BG**




**LEADFORM AJ**

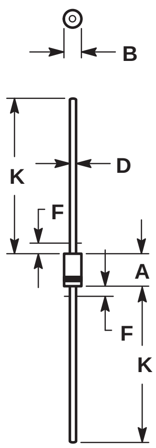



| CASE | A |
|---|---|
| 221A-04 | 0.360 ± 0.010 |
| 221A-06 | Lead Not Trimmed 0.300 Min. |

# CHAPTER 9
# Package Outline Dimensions

# Package Outline Dimensions

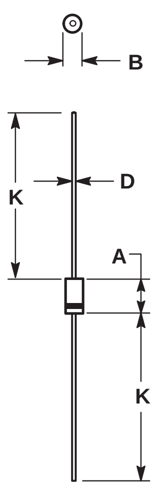
**GLASS/PLASTIC**
**DO–41**
CASE 59–03
ISSUE M




NOTES:
1. ALL RULES AND NOTES ASSOCIATED WITH JEDEC DO-41 OUTLINE SHALL APPLY.
2. POLARITY DENOTED BY CATHODE BAND.
3. LEAD DIAMETER NOT CONTROLLED WITHIN F DIMENSION.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 4.07 | 5.20 | 0.160 | 0.205 |
| B | 2.04 | 2.71 | 0.080 | 0.107 |
| D | 0.71 | 0.86 | 0.028 | 0.034 |
| F | --- | 1.27 | --- | 0.050 |
| K | 27.94 | --- | 1.100 | --- |

**MINI MOSORB**
CASE 59–04
ISSUE M

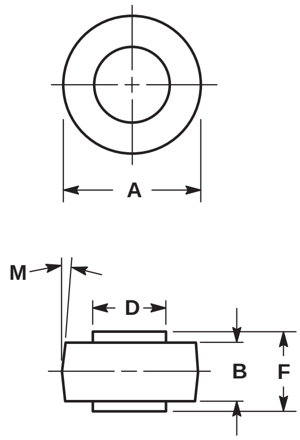



NOTES:
1. ALL RULES AND NOTES ASSOCIATED WITH JEDEC DO-41 OUTLINE SHALL APPLY.
2. POLARITY DENOTED BY CATHODE BAND.
3. LEAD DIAMETER NOT CONTROLLED WITHIN F DIMENSION.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 5.97 | 6.60 | 0.235 | 0.260 |
| B | 2.79 | 3.05 | 0.110 | 0.120 |
| D | 0.76 | 0.86 | 0.030 | 0.034 |
| K | 27.94 | --- | 1.100 | --- |

## PACKAGE OUTLINE DIMENSIONS (continued)

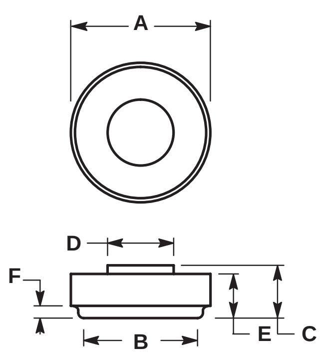
**MICRODE BUTTON**
CASE 193–04
ISSUE J




| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 8.43 | 8.69 | 0.332 | 0.342 |
| B | 4.19 | 4.45 | 0.165 | 0.175 |
| D | 5.54 | 5.64 | 0.218 | 0.222 |
| F | 5.94 | 6.25 | 0.234 | 0.246 |
| M | 5° NOM | | 5° NOM | |

---

**CAN BUTTON**
CASE 193A–02
ISSUE A




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

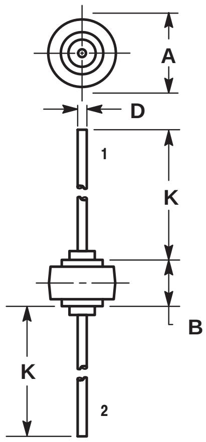
| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 11.4 | 11.6 | 0.449 | 0.457 |
| B | 9.3 | 9.7 | 0.366 | 0.382 |
| C | 4.3 | 4.9 | 0.169 | 0.193 |
| D | 5.4 | 5.6 | 0.213 | 0.220 |
| E | 3.6 | 4.2 | 0.142 | 0.165 |
| F | 1.0 | 2.0 | 0.039 | 0.079 |

## PACKAGE OUTLINE DIMENSIONS (continued)

### AXIAL LEAD BUTTON

CASE 194–04

ISSUE F




NOTES:
1. CATHODE SYMBOL ON PACKAGE.

| DIM | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 8.43 | 8.69 | 0.332 | 0.342 |
| B | 5.94 | 6.25 | 0.234 | 0.246 |
| D | 1.27 | 1.35 | 0.050 | 0.053 |
| K | 25.15 | 25.65 | 0.990 | 1.010 |

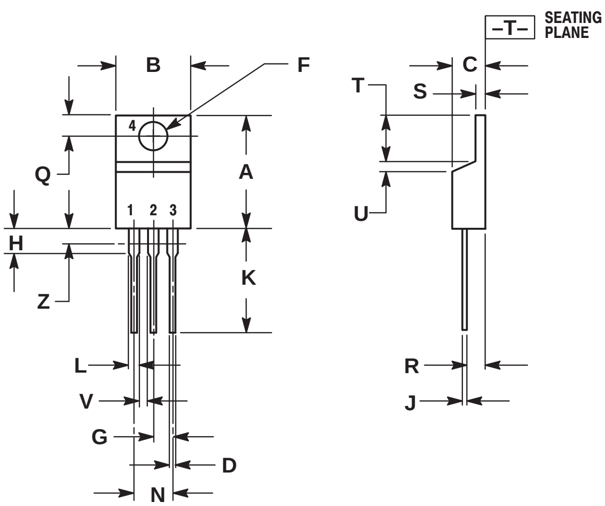
STYLE 1:
PIN 1. CATHODE
2. ANODE

---

### TO–220 THREE–LEAD
### TO–220

CASE 221A–09

ISSUE AA




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

| DIM | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 0.570 | 0.620 | 14.48 | 15.75 |
| B | 0.380 | 0.405 | 9.66 | 10.28 |
| C | 0.160 | 0.190 | 4.07 | 4.82 |
| D | 0.025 | 0.035 | 0.64 | 0.88 |
| F | 0.142 | 0.147 | 3.61 | 3.73 |
| G | 0.095 | 0.105 | 2.42 | 2.66 |
| H | 0.110 | 0.155 | 2.80 | 3.93 |
| J | 0.018 | 0.025 | 0.46 | 0.64 |
| K | 0.500 | 0.562 | 12.70 | 14.27 |
| L | 0.045 | 0.060 | 1.15 | 1.52 |
| N | 0.190 | 0.210 | 4.83 | 5.33 |
| Q | 0.100 | 0.120 | 2.54 | 3.04 |
| R | 0.080 | 0.110 | 2.04 | 2.79 |
| S | 0.045 | 0.055 | 1.15 | 1.39 |
| T | 0.235 | 0.255 | 5.97 | 6.47 |
| U | 0.000 | 0.050 | 0.00 | 1.27 |
| V | 0.045 | --- | 1.15 | --- |
| Z | --- | 0.080 | --- | 2.04 |

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 2:
PIN 1. BASE
2. EMITTER
3. COLLECTOR
4. EMITTER

STYLE 3:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

STYLE 4:
PIN 1. MAIN TERMINAL 1
2. MAIN TERMINAL 2
3. GATE
4. MAIN TERMINAL 2

STYLE 5:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

STYLE 6:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

STYLE 7:
PIN 1. CATHODE
2. ANODE
3. CATHODE
4. ANODE

STYLE 8:
PIN 1. CATHODE
2. ANODE
3. EXTERNAL TRIP/DELAY
4. ANODE

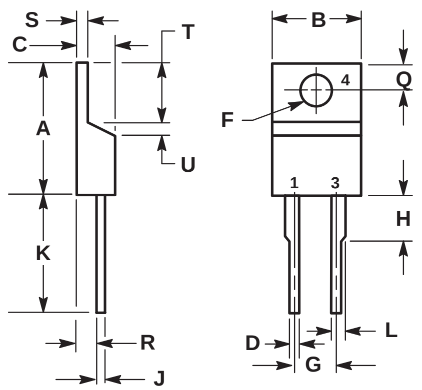
STYLE 9:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 10:
PIN 1. GATE
2. SOURCE
3. DRAIN
4. SOURCE

STYLE 11:
PIN 1. DRAIN
2. SOURCE
3. GATE
4. SOURCE

## PACKAGE OUTLINE DIMENSIONS (continued)

### TO–220 TWO–LEAD
CASE 221B–04
ISSUE D




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES MIN | INCHES MAX | MILLIMETERS MIN | MILLIMETERS MAX |
|---|---|---|---|---|
| A | 0.595 | 0.620 | 15.11 | 15.75 |
| B | 0.380 | 0.405 | 9.65 | 10.29 |
| C | 0.160 | 0.190 | 4.06 | 4.82 |
| D | 0.025 | 0.035 | 0.64 | 0.89 |
| F | 0.142 | 0.147 | 3.61 | 3.73 |
| G | 0.190 | 0.210 | 4.83 | 5.33 |
| H | 0.110 | 0.130 | 2.79 | 3.30 |
| J | 0.018 | 0.025 | 0.46 | 0.64 |
| K | 0.500 | 0.562 | 12.70 | 14.27 |
| L | 0.045 | 0.060 | 1.14 | 1.52 |
| Q | 0.100 | 0.120 | 2.54 | 3.04 |
| R | 0.080 | 0.110 | 2.04 | 2.79 |
| S | 0.045 | 0.055 | 1.14 | 1.39 |
| T | 0.235 | 0.255 | 5.97 | 6.48 |
| U | 0.000 | 0.050 | 0.00 | 1.27 |

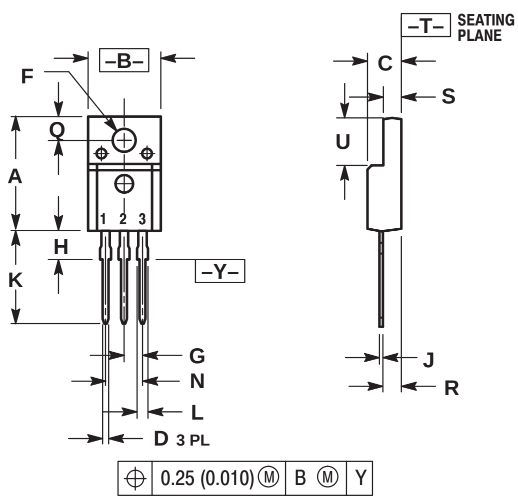
STYLE 1:
PIN 1. CATHODE
2. N/A
3. ANODE
4. CATHODE

STYLE 2:
PIN 1. ANODE
2. N/A
3. CATHODE
4. ANODE

---

### TO–220 FULLPACK TRANSISTOR
CASE 221D–02
ISSUE D

**SCALE 1:1**




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES MIN | INCHES MAX | MILLIMETERS MIN | MILLIMETERS MAX |
|---|---|---|---|---|
| A | 0.621 | 0.629 | 15.78 | 15.97 |
| B | 0.394 | 0.402 | 10.01 | 10.21 |
| C | 0.181 | 0.189 | 4.60 | 4.80 |
| D | 0.026 | 0.034 | 0.67 | 0.86 |
| F | 0.121 | 0.129 | 3.08 | 3.27 |
| G | 0.100 BSC | | 2.54 BSC | |
| H | 0.123 | 0.129 | 3.13 | 3.27 |
| J | 0.018 | 0.025 | 0.46 | 0.64 |
| K | 0.500 | 0.562 | 12.70 | 14.27 |
| L | 0.045 | 0.060 | 1.14 | 1.52 |
| N | 0.200 BSC | | 5.08 BSC | |
| Q | 0.126 | 0.134 | 3.21 | 3.40 |
| R | 0.107 | 0.111 | 2.72 | 2.81 |
| S | 0.096 | 0.104 | 2.44 | 2.64 |
| U | 0.259 | 0.267 | 6.58 | 6.78 |

STYLE 1:
PIN 1. GATE
2. DRAIN
3. SOURCE

STYLE 2:
PIN 1. BASE
2. COLLECTOR
3. EMITTER

STYLE 3:
PIN 1. ANODE
2. CATHODE
3. ANODE

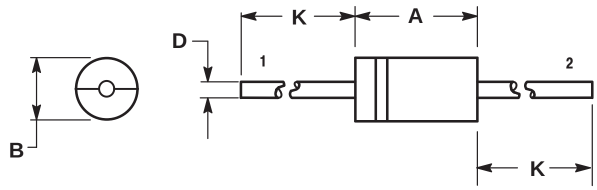
STYLE 4:
PIN 1. CATHODE
2. ANODE
3. CATHODE

STYLE 5:
PIN 1. CATHODE
2. ANODE
3. GATE

STYLE 6:
PIN 1. MT 1
2. MT 2
3. GATE

## PACKAGE OUTLINE DIMENSIONS (continued)

**AXIAL LEAD**
CASE 267–03
ISSUE G



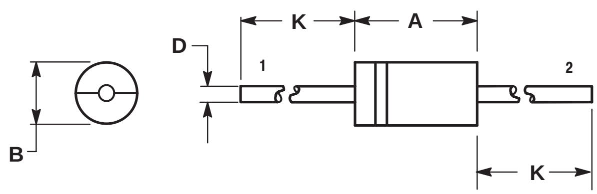

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.370 | 0.380 | 9.40 | 9.65 |
| B | 0.190 | 0.210 | 4.83 | 5.33 |
| D | 0.048 | 0.052 | 1.22 | 1.32 |
| K | 1.000 | --- | 25.40 | --- |

STYLE 1:
PIN 1. CATHODE (POLARITY BAND)
2. ANODE

STYLE 2:
NO POLARITY

**AXIAL LEAD**
CASE 267–05
ISSUE G




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

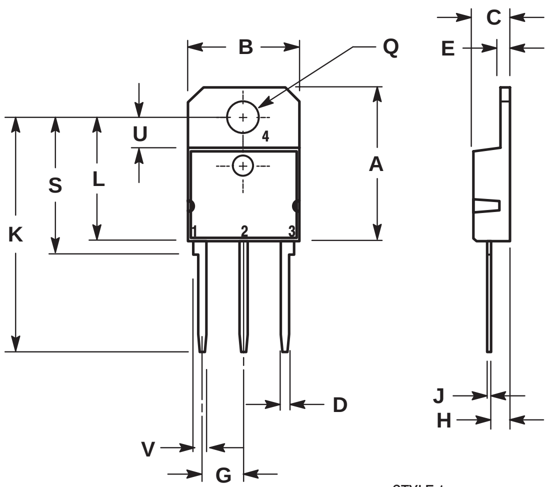
| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.287 | 0.374 | 7.30 | 9.50 |
| B | 0.189 | 0.209 | 4.80 | 5.30 |
| D | 0.047 | 0.051 | 1.20 | 1.30 |
| K | 1.000 | --- | 25.40 | --- |

STYLE 1:
PIN 1. CATHODE (POLARITY BAND)
2. ANODE

STYLE 2:
NO POLARITY

## PACKAGE OUTLINE DIMENSIONS (continued)

**TO–218 THREE LEAD**
**TO–218**
CASE 340D–02
ISSUE B




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | --- | 20.35 | --- | 0.801 |
| B | 14.70 | 15.20 | 0.579 | 0.598 |
| C | 4.70 | 4.90 | 0.185 | 0.193 |
| D | 1.10 | 1.30 | 0.043 | 0.051 |
| E | 1.17 | 1.37 | 0.046 | 0.054 |
| G | 5.40 | 5.55 | 0.213 | 0.219 |
| H | 2.00 | 3.00 | 0.079 | 0.118 |
| J | 0.50 | 0.78 | 0.020 | 0.031 |
| K | 31.00 REF | | 1.220 REF | |
| L | --- | 16.20 | --- | 0.638 |
| Q | 4.00 | 4.10 | 0.158 | 0.161 |
| S | 17.80 | 18.20 | 0.701 | 0.717 |
| U | 4.00 REF | | 0.157 REF | |
| V | 1.75 REF | | 0.069 | |

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 2:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

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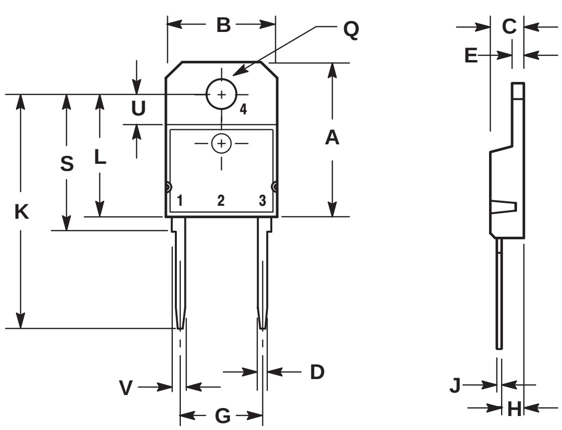
**TO–218 TWO LEAD**
**TO–218**
CASE 340E–02
ISSUE A



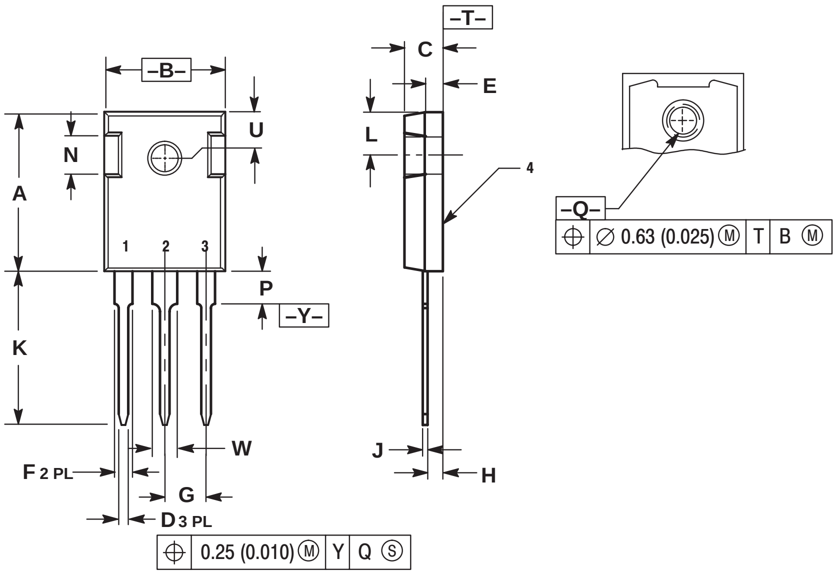

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982
2. CONTROLLING DIMENSION: MILLIMETER.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | --- | 20.35 | --- | 0.801 |
| B | 14.70 | 15.20 | 0.579 | 0.598 |
| C | 4.70 | 4.90 | 0.185 | 0.193 |
| D | 1.10 | 1.30 | 0.043 | 0.051 |
| E | 1.17 | 1.37 | 0.046 | 0.054 |
| G | 10.80 | 11.10 | 0.425 | 0.437 |
| H | 2.00 | 3.00 | 0.079 | 0.118 |
| J | 0.50 | 0.78 | 0.020 | 0.031 |
| K | 31.00 REF | | 1.220 REF | |
| L | --- | 16.20 | --- | 0.638 |
| Q | 4.00 | 4.10 | 0.158 | 0.161 |
| S | 17.80 | 18.20 | 0.701 | 0.717 |
| U | 4.00 REF | | 0.157 REF | |
| V | 1.75 REF | | 0.069 | |

STYLE 1:
PIN 1. CATHODE
3. ANODE
4. CATHODE

## PACKAGE OUTLINE DIMENSIONS (continued)

**TO–247**
CASE 340L–02
ISSUE D




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

| DIM | MILLIMETERS MIN | MILLIMETERS MAX | INCHES MIN | INCHES MAX |
|---|---|---|---|---|
| A | 20.32 | 21.08 | 0.800 | 8.30 |
| B | 15.75 | 16.26 | 0.620 | 0.640 |
| C | 4.70 | 5.30 | 0.185 | 0.209 |
| D | 1.00 | 1.40 | 0.040 | 0.055 |
| E | 2.20 | 2.60 | 0.087 | 0.102 |
| F | 1.65 | 2.13 | 0.065 | 0.084 |
| G | 5.45 BSC | | 0.215 BSC | |
| H | 1.50 | 2.49 | 0.059 | 0.098 |
| J | 0.40 | 0.80 | 0.016 | 0.031 |
| K | 20.06 | 20.83 | 0.790 | 0.820 |
| L | 5.40 | 6.20 | 0.212 | 0.244 |
| N | 4.32 | 5.49 | 0.170 | 0.216 |
| P | --- | 4.50 | --- | 0.177 |
| Q | 3.55 | 3.65 | 0.140 | 0.144 |
| U | 6.15 BSC | | 0.242 BSC | |
| W | 2.87 | 3.12 | 0.113 | 0.123 |

STYLE 1:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

STYLE 2:
PIN 1. ANODE
2. CATHODE (S)
3. ANODE 2
4. CATHODES (S)

STYLE 3:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 4:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

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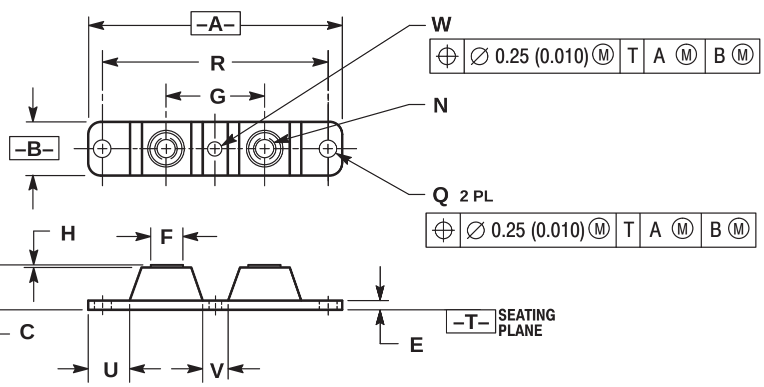
**POWERTAP II**
CASE 357C–03
ISSUE E

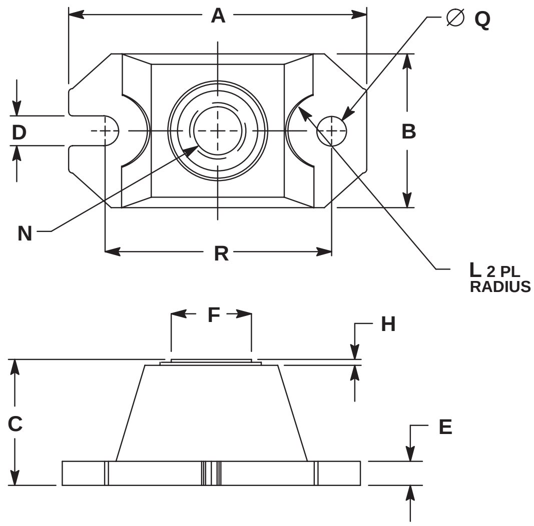



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. TERMINAL PENETRATION: 5.97 (0.235) MAXIMUM.

| DIM | INCHES MIN | INCHES MAX | MILLIMETERS MIN | MILLIMETERS MAX |
|---|---|---|---|---|
| A | 3.450 | 3.635 | 87.63 | 92.33 |
| B | 0.700 | 0.810 | 17.78 | 20.57 |
| C | 0.615 | 0.640 | 15.63 | 16.26 |
| E | 0.120 | 0.130 | 3.05 | 3.30 |
| F | 0.435 | 0.445 | 11.05 | 11.30 |
| G | 1.370 | 1.380 | 34.80 | 35.05 |
| H | 0.007 | 0.030 | 0.18 | 0.76 |
| N | 1/4–20UNC–2B | | 1/4–20UNC–2B | |
| Q | 0.270 | 0.285 | 6.86 | 7.23 |
| R | 31.50 BSC | | 80.01 BSC | |
| U | 0.600 | 0.630 | 15.24 | 16.00 |
| V | 0.330 | 0.375 | 8.39 | 9.52 |
| W | 0.170 | 0.190 | 4.32 | 4.82 |

## PACKAGE OUTLINE DIMENSIONS (continued)

**POWERTAP II**
CASE 357D–01
ISSUE A




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. TERMINAL PENETRATION: 5.97 (0.235) MAXIMUM.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 1.520 | 1.560 | 38.61 | 39.62 |
| B | 0.783 | 0.813 | 19.89 | 20.65 |
| C | 0.615 | 0.635 | 15.62 | 16.13 |
| D | 0.152 | 0.162 | 3.86 | 4.11 |
| E | 0.120 | 0.130 | 3.05 | 3.30 |
| F | 0.435 | 0.445 | 11.05 | 11.30 |
| H | 0.007 | 0.030 | 0.18 | 0.76 |
| L | 0.210 | 0.230 | 5.33 | 5.84 |
| N | 1/4–20UNC–2B | | 1/4–20UNC–2B | |
| Q | 0.152 | 0.162 | 3.86 | 4.11 |
| R | 1.175 | 1.195 | 29.85 | 30.35 |

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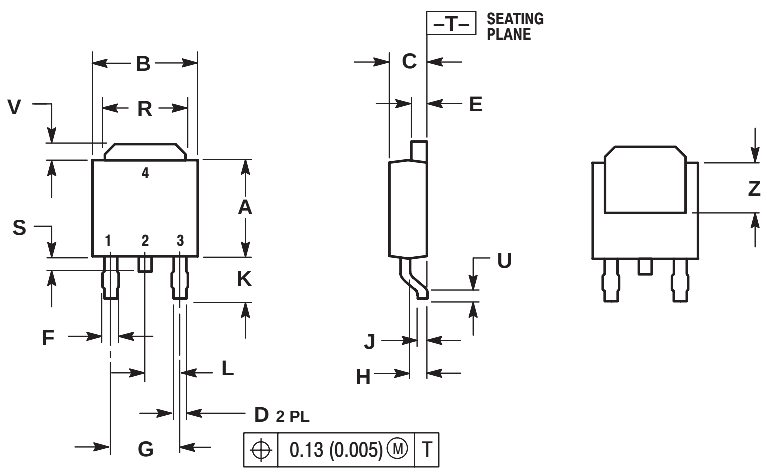
**DPAK**
CASE 369A–13
ISSUE AA




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.235 | 0.250 | 5.97 | 6.35 |
| B | 0.250 | 0.265 | 6.35 | 6.73 |
| C | 0.086 | 0.094 | 2.19 | 2.38 |
| D | 0.027 | 0.035 | 0.69 | 0.88 |
| E | 0.033 | 0.040 | 0.84 | 1.01 |
| F | 0.037 | 0.047 | 0.94 | 1.19 |
| G | 0.180 BSC | | 4.58 BSC | |
| H | 0.034 | 0.040 | 0.87 | 1.01 |
| J | 0.018 | 0.023 | 0.46 | 0.58 |
| K | 0.102 | 0.114 | 2.60 | 2.89 |
| L | 0.090 BSC | | 2.29 BSC | |
| R | 0.175 | 0.215 | 4.45 | 5.46 |
| S | 0.020 | 0.050 | 0.51 | 1.27 |
| U | 0.020 | --- | 0.51 | --- |
| V | 0.030 | 0.050 | 0.77 | 1.27 |
| Z | 0.138 | --- | 3.51 | --- |

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 2:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

STYLE 3:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

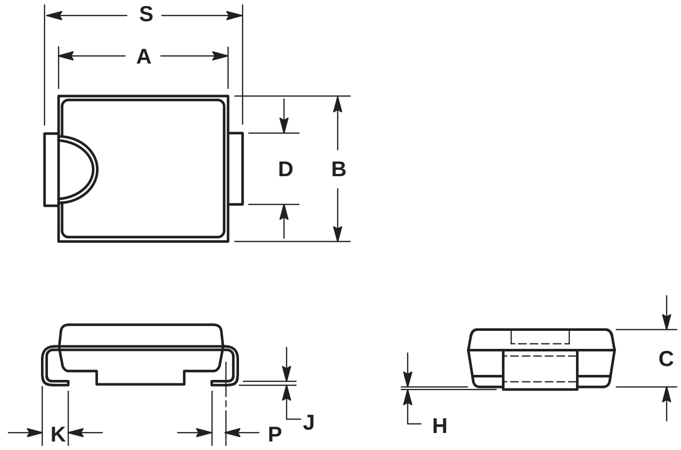
STYLE 4:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

STYLE 5:
PIN 1. GATE
2. ANODE
3. CATHODE
4. ANODE

STYLE 6:
PIN 1. MT1
2. MT2
3. GATE
4. MT2

## PACKAGE OUTLINE DIMENSIONS (continued)

**SMC**
CASE 403–03
ISSUE B




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. D DIMENSION SHALL BE MEASURED WITHIN DIMENSION P.

| DIM | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 0.260 | 0.280 | 6.60 | 7.11 |
| B | 0.220 | 0.240 | 5.59 | 6.10 |
| C | 0.075 | 0.095 | 1.90 | 2.41 |
| D | 0.115 | 0.121 | 2.92 | 3.07 |
| H | 0.0020 | 0.0060 | 0.051 | 0.152 |
| J | 0.006 | 0.012 | 0.15 | 0.30 |
| K | 0.030 | 0.050 | 0.76 | 1.27 |
| P | 0.020 REF | | 0.51 REF | |
| S | 0.305 | 0.320 | 7.75 | 8.13 |

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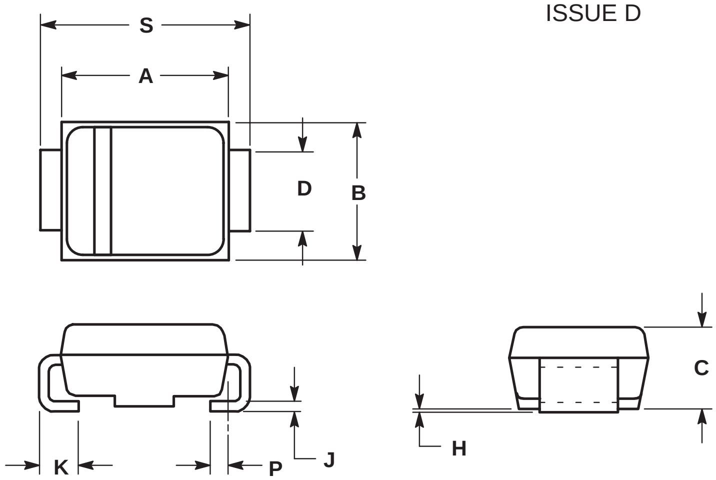
**SMB**
**D0–214AA**
CASE 403A–03
ISSUE D

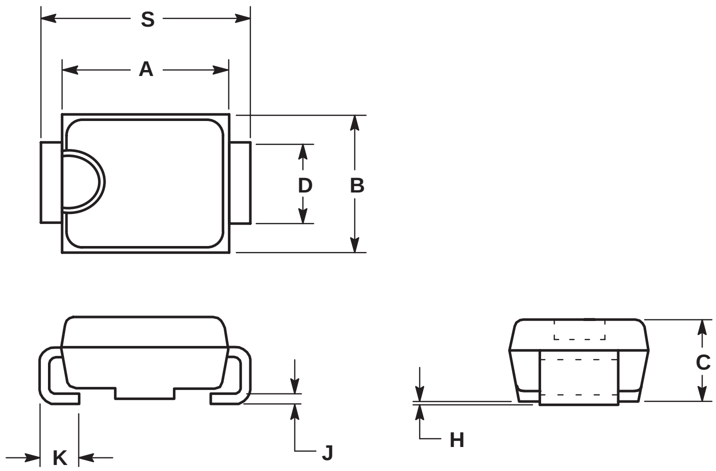



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. D DIMENSION SHALL BE MEASURED WITHIN DIMENSION P.

| DIM | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 0.160 | 0.180 | 4.06 | 4.57 |
| B | 0.130 | 0.150 | 3.30 | 3.81 |
| C | 0.075 | 0.095 | 1.90 | 2.41 |
| D | 0.077 | 0.083 | 1.96 | 2.11 |
| H | 0.0020 | 0.0060 | 0.051 | 0.152 |
| J | 0.006 | 0.012 | 0.15 | 0.30 |
| K | 0.030 | 0.050 | 0.76 | 1.27 |
| P | 0.020 REF | | 0.51 REF | |
| S | 0.205 | 0.220 | 5.21 | 5.59 |

## PACKAGE OUTLINE DIMENSIONS (continued)

**SMB**
CASE 403B–01
ISSUE O




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES MIN | INCHES MAX | MILLIMETERS MIN | MILLIMETERS MAX |
|---|---|---|---|---|
| A | 0.160 | 0.180 | 4.06 | 4.57 |
| B | 0.090 | 0.115 | 2.29 | 2.92 |
| C | 0.075 | 0.105 | 1.91 | 2.67 |
| D | 0.050 | 0.064 | 1.27 | 1.63 |
| H | 0.004 | 0.008 | 0.10 | 0.20 |
| J | 0.006 | 0.016 | 0.15 | 0.41 |
| K | 0.030 | 0.060 | 0.76 | 1.52 |
| S | 0.190 | 0.220 | 4.83 | 5.59 |

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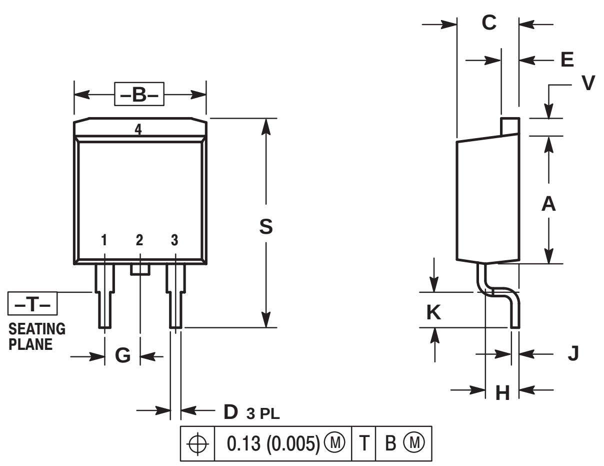
**D$^2$PAK**
CASE 418B–03
ISSUE D




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES MIN | INCHES MAX | MILLIMETERS MIN | MILLIMETERS MAX |
|---|---|---|---|---|
| A | 0.340 | 0.380 | 8.64 | 9.65 |
| B | 0.380 | 0.405 | 9.65 | 10.29 |
| C | 0.160 | 0.190 | 4.06 | 4.83 |
| D | 0.020 | 0.035 | 0.51 | 0.89 |
| E | 0.045 | 0.055 | 1.14 | 1.40 |
| G | 0.100 BSC | | 2.54 BSC | |
| H | 0.080 | 0.110 | 2.03 | 2.79 |
| J | 0.018 | 0.025 | 0.46 | 0.64 |
| K | 0.090 | 0.110 | 2.29 | 2.79 |
| S | 0.575 | 0.625 | 14.60 | 15.88 |
| V | 0.045 | 0.055 | 1.14 | 1.40 |

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 2:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

STYLE 3:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

# CHAPTER 10
# AR598: Avalanche Capability of Today's Power Semiconductors

# AR598

# Avalanche Capability of Today's Power Semiconductors

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**ARTICLE REPRINT**


Abstract. Power semiconductors are used to switch high currents in fractions of a second and therefore belong inherently to a world of voltage spikes. To avoid unnecessary breakdown voltage guardbands, new generations of semiconductors are now avalanche rugged and characterized in avalanche energy.

This characterization is often far from application conditions and thus quite useless to the designer. It is easy to verify that an energy rating is not the best approach to a ruggedness quantification because of avalanche energy fluctuations with test conditions.

A physical and thermal analysis of the failure mechanisms leads to a new characterization method generating easy–to–use data for safe designs. The short–term avalanche capability will be discussed with an insight of the different technologies developed to meet these new ruggedness requirements.



Keywords. Avalanche, breakdown, unclamped inductive switching energy, safe operating areas.


## INTRODUCTION

One obvious trend for new power electronic designs is to work at very high switching frequencies in order to reduce the volume and weight of all the capacitive and inductive elements. The consequence is that most applications today require switching very high currents in fractions of a microsecond and therefore generate L x dI/dt voltage spikes due to parasitic inductance. Unfortunately these undesirable voltage levels sometimes reach the breakdown voltage of power semiconductors that are not intended to be used in avalanche.

The necessity for avalanche rugged power semiconductors has clearly been perceived by many semiconductor manufacturers who have come up with avalanche–energy rated devices.

This paper will show the limits of an energy–based characterization model. It will concentrate on three different devices: Ultra Fast recovery Rectifiers, Schottky Barrier Rectifiers and MOSFETs. It will study their main failure mechanisms and show the technological improvements that guarantee an enhanced ruggedness.

This will lead to a new characterization that will help the designer choose correctly between overall cost and reliability.

## LIMITS OF AN AVALANCHE ENERGY CHARACTERIZATION

Practically all the characterizations are based on the following Unclamped Inductive Switching (UIS) test circuit (Fig 1).

The energy is first stored in inductor L by turning on transistor Q for a period of time proportional to the peak current desired in the inductor. When Q is turned off, the inductor reverses its voltage and avalanches the Device Under Test until all its energy is transferred. The DUT can be a rectifier or a MOSFET (the gate should always be shorted to the source).

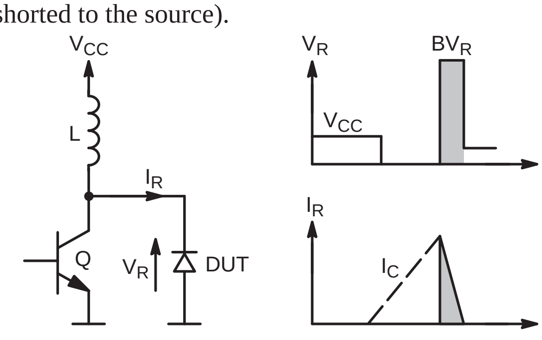


**Figure 1. Standard UIS Characterization Circuit.**

The standard characterization method consists in increasing the peak current in the inductor until the device fails. The energy that the device can sustain without failing becomes a figure of merit of the ruggedness to avalanche:

$$Waval = 1/2\ L\ I_{peak}^2\ BV_{(DUT)} / (BV_{(DUT)} - V_{CC}) \qquad [1]$$

The main limit of this method is that the energy level that causes a failure in the DUT is not a constant but a function of L and $V_{CC}$. This results of the fact that the avalanche duration is function of the current decay slope $(BV_{(DUT)}–V_{CC})/L$:


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**Table 1. Peak Current and Energy Causing Failures in a 1 A, 1000 V Ultra Fast Recovery Rectifier.**

| Inductor Value: | 10 mH | 50 mH | 100 mH |
|---|---|---|---|
| Peak Current: | 1.7 A | 0.9 A | 0.8 A |
| Energy: | 14 mJ | 20 mJ | 32 mJ |

Table 1 indicates that the failure is not caused by an energy (i.e. it is not independent of the avalanche duration) but rather by a current level that has to be derated versus time: the devices can sustain a low current for a long period of time (high energy) but at high avalanche currents they will fail after a few microseconds (low energy).

Therefore, unless the designer has a parasitic inductance of value L in his circuit, the standard characterization data will be useless, or worse, it might lead to an overestimate of the ruggedness of his application: because parasitic inductances are often an order of magnitude less than the test circuit inductance, the expected energy capability leads to excessive current levels.

The UIS test circuit is very easy to implement: the only important point is that the transistor has to have a breakdown voltage higher than the DUT. For low breakdown voltage devices, a MOSFET might be preferred to the bipolar transistor.

The advantages of using a MOSFET are multiple: it is a more rugged device, it is much easier to drive and its switching characteristics can be controlled by adding a resistor in series with the gate. It is mandatory to limit this switching speed to avoid having an avalanche energy measurement dependent on the gate drive (i.e. gate resistor and gate to source voltage values).

Anyhow, it is possible to generate very useful information with this UIS test circuit by varying the inductor value. It is also very important to present the data independently of the values of $V_{CC}$ and L. One solution can be to plot the maximum peak current versus the avalanche duration (Fig 2):

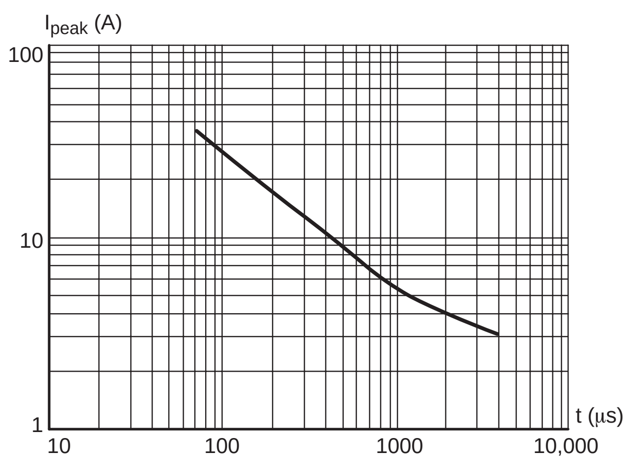


**Figure 2. Maximum Peak Current versus Avalanche Duration for a 15 A, 60 V MOSFET in an UIS Test Circuit.**

The advantage of this new graph is that the designer can easily calculate the safety margin of his application and he will not be mislead by an energy value that depends on too many different parameters. If he knows the value of the parasitic inductance in his circuit he will be able to determine its maximum peak current.

For instance, let us assume that the designer uses the 15 A, 60 V MOSFET characterized in Figure 2. This device sustains 500 mJ with an inductor of 75 mH according to equation [1]. Its typical breakdown voltage is 80 V.

If the supply voltage $V_{DD}$ is 12 V and the parasitic inductance L is 250 μH, then the avalanche duration and maximum peak current are related by

$$I_{peak} = t\,(BV_{DSS} - V_{DD}) / L \qquad [2]$$

This relationship can be added to Figure 2 (see Fig 3):

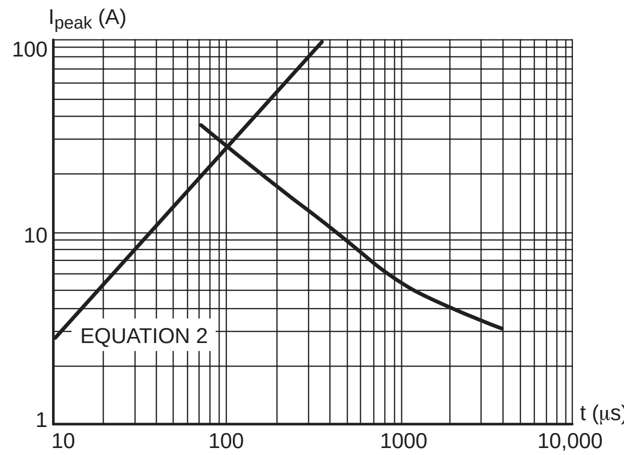


**Figure 3. Figure 2 + equation [2].**

Thus the maximum peak current that can flow through the parasitic inductance L is approximately 28 A instead of 58 A that would have resulted of using equation [1].

## UNDERSTANDING THE FAILURE MECHANISMS

### Physical Approach

The following microscope photographs show the failure locations for an Ultra Fast Recovery Rectifier (UFR), a Schottky Barrier Rectifier (SBR) and a MOSFET:

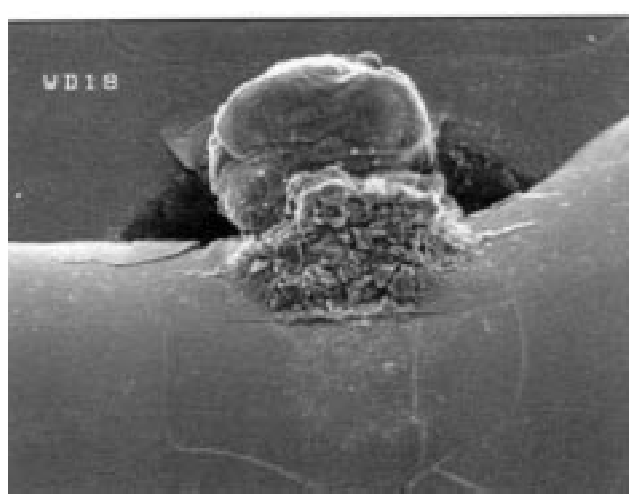


**Figure 4. 4 A, 1000 V UFR Avalanche Failure.**

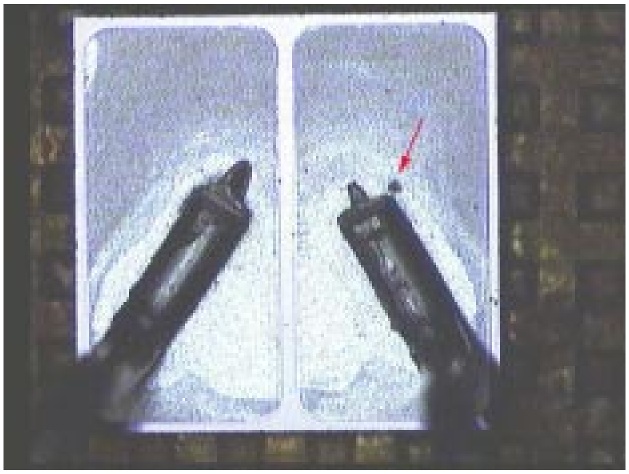

Figure 5. 25 A, 35 V SBR Avalanche Failure.

Figure 6. 20 A, 500 V MOSFET Avalanche Failure.

These photographs show that the failure is generally a punchthrough. The melt–through hole dimensions depend on the current level and avalanche duration.

A close look at the electrical characteristics of failed rectifiers on a curve tracer show three levels of degradation: low stressed diodes have a normal forward characteristic but show an unusual leakage current before entering breakdown as if they had a high–value resistor in parallel: this resistance can be explained by a small punchthrough. For medium degradation levels, the value of this pseudo–resistance decreases and becomes visible in the forward characteristic of the diode. Finally, when the punchthrough reaches considerable dimensions, the device looks very similar to a low value resistor.

The failure does not always appear in the same region of the die. For instance, high voltage UFRs have their punch-through always located in a corner, MOSFETs often fail in the corners or on the sides whereas SBRs have randomly located failures.

**Thermal Approach**

Transient thermal response graphs generated by a standard $\Delta V_{DS}$ method show the junction temperature evolution for forward and avalanche constant current conduction in a MOSFET. These graphs (Fig 7) prove that the silicon efficiency during avalanche and forward currents are similar.

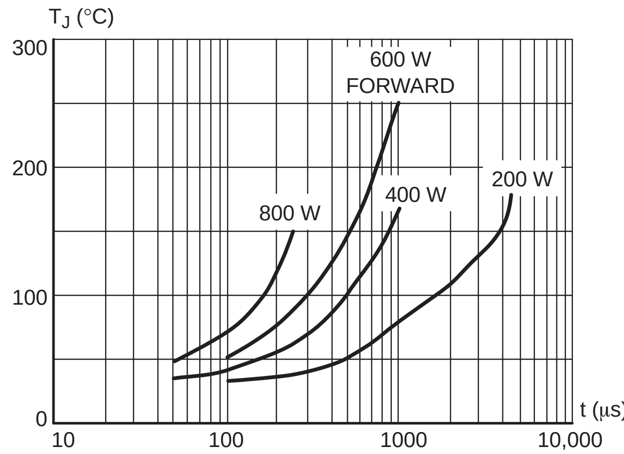


**Figure 7. 15 A, 60 V MOSFET Transient Thermal Response for 800 W, 400 W, 200 W Avalanche and 600 W Forward Conduction.**

Figure 7 can be used to generate a transient thermal resistance graph by plotting the temperature divided by the power: the four graphs should then normally match. Some slight differences show that the transient thermal resistance increases with the current level: i.e. the 800 W curve (10 A constant avalanche current) has a higher transient thermal resistance than the 200 W (2.5 A). Therefore the thermal efficiency in a MOSFET is not perfectly homogeneous versus the avalanche current.

A similar analysis on an UFR or an SBR shows poor thermal efficiency in avalanche. This can be shown by comparing the temperature rise after 1 ms for forward and avalanche conduction pulses of same power (400 W):

| | | | |
|---|---|---|---|
| MOSFET | $\Delta T_{direct}$=160°C | $\Delta T_{avalanche}$=180°C | ratio=0.9 |
| UFR | $\Delta T_{direct}$=120°C | $\Delta T_{avalanche}$=175°C | ratio=0.7 |
| SBR | $\Delta T_{direct}$=100°C | $\Delta T_{avalanche}$=150°C | ratio=0.7 |

**Electrical Approach**

Considering the transient thermal responses of a device, it is possible to simulate the instantaneous junction temperature for any sort of power pulse.

Conducting this simulation on the data generated by the UIS test it is possible to show that all the parts fail when they reach a "critical temperature" (Fig 8):

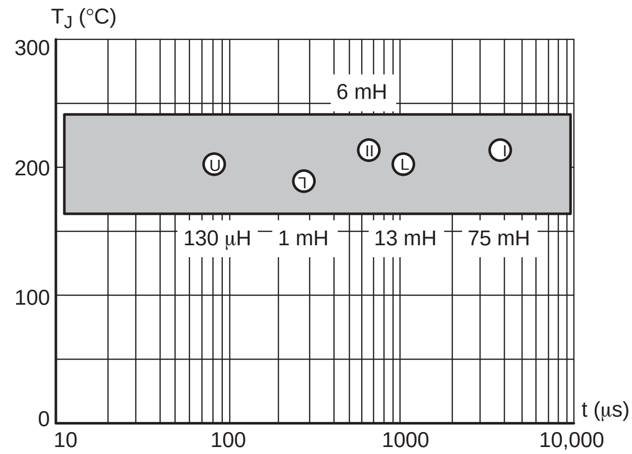


**Figure 8. 15A, 60V MOSFET Failure Points and Critical Temperature for different Inductor Values.**

At these critical temperatures the intrinsic carrier concentration, ni, reaches levels close to those of the doping concentrations:

ni is proportional to $T^{3/2} e^{-Eg/2kT}$ [3]

where T is the absolute temperature, Eg the energy bandgap and k is Boltzmann's constant.

At 200°C, ni exceeds 2 $10^{14}$ $cm^{-3}$ which corresponds to a 1000 V material epitaxy concentration level. This means that when the junction temperature reaches 300°C, the rectifier looks more like a resistor than a diode. A local thermal runaway then generates a hot spot and a punchthrough as can be seen in Figures 4, 5 and 6.

This failure analysis has shown that the failure mechanism is essentially thermal: the devices are heated by the $BV_R$ x $I_R$ power dissipation. Unfortunately, this power does not remain constant because the UIS circuit generates a linear current decay and also the breakdown voltage varies with the current level and with the junction temperature.

In order to have a complete characterization of the device it is interesting to see how it reacts to a constant avalanche current and different ambient temperatures.

## NEW CHARACTERIZATION METHOD PROPOSAL

During the prototype phase, it is easier for the designer to measure the avalanche current and duration than the circuit's parasitic inductance. Therefore, the characterization should be based on easy to measure parameters. The failure analysis proves that the main cause of degradation is the inability to handle an excessive power (avalanche current $I_R$ multiplied by breakdown voltage $BV_R$). A proper characterization should present the maximum power capability versus time.

As the avalanche voltage varies only slightly with the current level, the proposed method is based on avalanching a device at a constant current and presenting the maximum current capability versus time:

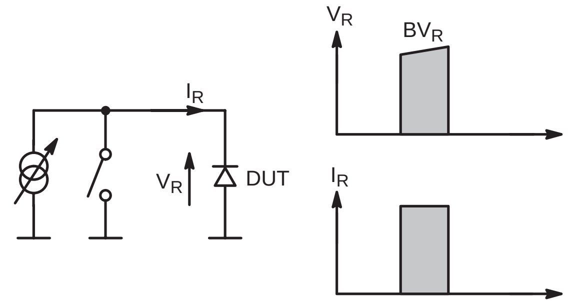


**Figure 9. Constant Current Characterization Circuit.**

Different test circuits similar to Figure 9 have been proposed by Gauen (1) and Pshaenich (2). Some unexpected failures in MOSFETs suggest that the DUT should always be referenced to ground. Unlike UFRs and SBRs, MOSFETs react differently whether they are tied to ground or floating around a fluctuating voltage. Many floating transistors fail at very low stress levels probably due to capacitive coupled currents that turn–on the internal parasitic transistor.

The test circuit shown in Figure 9 sets a constant avalanche current through the device until it fails, this duration can then be plotted for different current levels. This generates a graph similar to the UIS method, except that the current is constant instead of decreasing linearly.

This leads to the definition of a "Safe Avalanching Area" (Fig 10) that will guarantee a short–term reliability if the device is used within this clearly defined area.

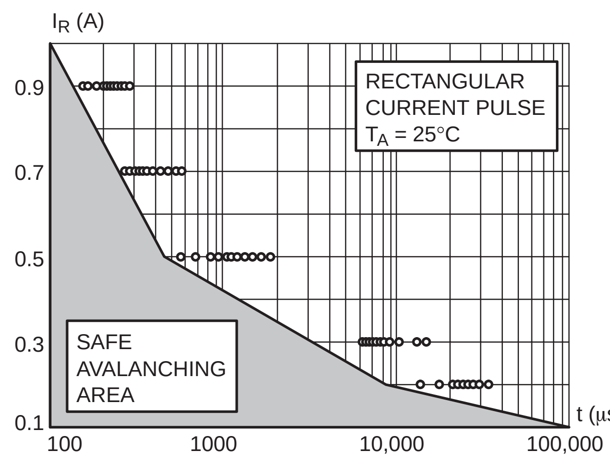


**Figure 10. 1 A, 30 V SBR Save Avalanching Area.**

This graph gives the maximum avalanche duration for any value of avalanche current.

The Safe Avalanching Area is generated by taking a safety margin from the failure points. Another approach would be to dynamically measure the temperature as in Figure 7 and generate an area defined by a maximum allowable junction temperature.

As the failure mechanism is related to a peak junction temperature, it is necessary to give Safe Avalanching Areas for different ambient temperatures (Fig 11):

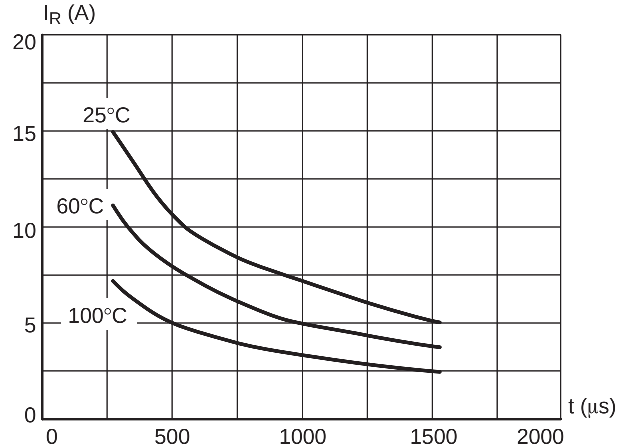


**Figure 11. 25 A, 35 V SBR Safe Avalanching Areas for different ambient temperatures.**

When the data in Figures 10 and 11 is plotted on log/log axes instead of lin/log or lin/lin, an interesting feature appears (Fig 12):

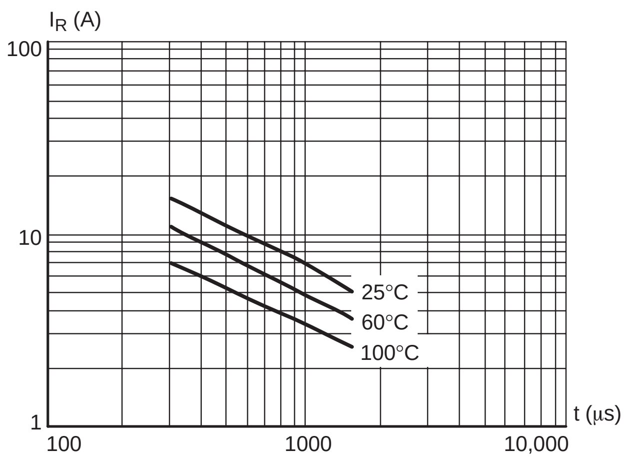


**Figure 12. Figure 12 on log/log axes.**

Figure 12 shows a linear relationship between current and time on a log/log plot. This means that:

so $\log(I_R) = A \log(t) + B,$
$I_R = k\,T^A$ [4]

where k is a constant function of the die size, the breakdown voltage and other parameters. Constant A can be extracted from Figure 12 and similar figures for UFRs and MOSFETs:

$I_R = k\,T^{-0.55}$ [5]

Relation [5] is a consequence of heat propagation laws which explain that the temperature in a semiconductor rises proportionally to $t^{0.5}$ (for a constant current pulse and as long as the temperature remains within the silicon die). This can be seen in any transient thermal resistance graph.

A standard thermal calculation shows that:

$T_J = T_A + P_D\,Rth_{JA}(t),$
or [6]
$P_D = (T_J–T_A) / Rth_{JA}(t)$

where:

$T_J$, $T_A$ are the junction and ambient temperatures,
$P_D$ is the power dissipation,
$Rth_{JA}(t)$ is the transient thermal resistance.

Given a constant power pulse and for values of t less than 1 ms, [6] is equivalent to:

$I_R\,B_{VR} = (T_J–T_A) / (k\,t^{0.5})$
so [7]
$I_R = k\,t^{-0.5}$

This relation is similar to [5]. For avalanche durations of less than 500 μs the heat propagates within the silicon only. For longer durations the heat reaches the solder and the package so the propagation characteristics are modified. The devices heat faster or slower and therefore the $I_R$=f(t) slope changes. Empirical data shows that A in relation [4] remains within –0.5 to –0.6.

Relation [7] can also be expressed by:

$I_R^2\,t = k$ (k:constant) [7bis]

This rule of thumb works out much better than the, unfortunately too common, 1/2 L $I^2$ law.

For example, when applied to the example following Figure 2 (which is UIS and not Constant Current generated) to determine the maximum peak current in a 250 μH inductor and by choosing for instance the 9 A, 500 μs point, relation [7bis] can be written:

$9A^2\,500\,\mu s = Ipeak^2\,100\mu s$

This gives a conservative value of 20 A instead of a real value of 28 A whereas the 1/2 L $I^2$ method generates a catastrophic 58 A value.

## TECHNOLOGY TRADEOFFS

### Ultra Fast Recovery Rectifiers

The UFR devices are based on a Mesa technology (Fig 13) with a Phosphorus doped (n–type) substrate. The heavily doped N+ substrate is followed by a lighter N– epitaxial layer. The P+ is diffused into the epitaxy to form the P–N junction. The passivation follows the perimeter of the die.

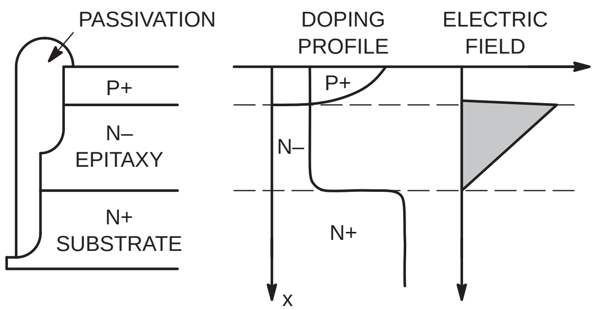


**Figure 13. UFR Technology, Profile and Electric Field.**

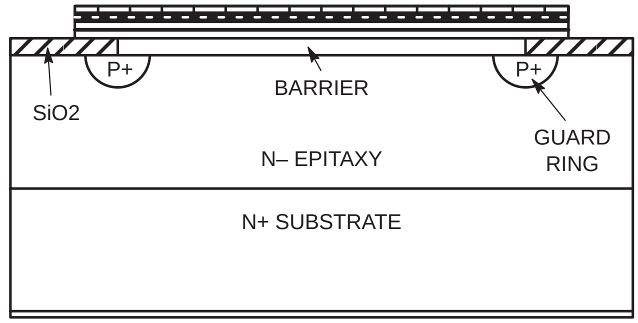


**Figure 14. SBR Technology with P–N Guard Rings**

The epitaxy characteristics determine the major electrical parameters of the device. A designed experiment was conducted varying the epitaxy thickness and resistivity. The output responses were the forward voltage, the breakdown voltage, the leakage current and the avalanche capability. A wide range of epitaxy materials was chosen to determine the general trends for all the effects.

Although the results were predictable for the static parameters, the avalanche capability results were not.

A key issue is the electric field extension. If it terminates before the substrate the avalanche capability increases by increasing the epitaxy resistivity. If the field extends into the N+ region (reach–through) the avalanche capability is considerably reduced.

The avalanche capability is proportional to the die size and not to the perimeter. This confirms that the avalanche current is vertical and not only a surface or passivation related phenomenon.

The failures always occur in the corners where the electric field is most critical. These failures are essentially function of the thermal characteristics of the device when conducting avalanche currents. Therefore the avalanche capability decreases when the ambient temperature increases and the failures can normally be predicted by Safe Avalanching Areas such as Figure 12.

Some unexpected defects though can radically degrade the avalanche capability. Defects in the epi such as pipes cause premature failures but can often be screened by a leakage current test that eliminates soft breakdown devices. Defects in the passivation can generate parasitic oscillations during breakdown.

### Schottky Rectifiers

Due to P–N junction guard rings, SBR devices are very similar to UFRs when conducting avalanche currents. These rectifiers have very low breakdown voltages and therefore very thin epitaxy layers. This probably explains that the avalanche–related failures occur anywhere on the die surface: the thin N– region is relatively more heterogeneous with respect to avalanche capability and thermal dissipation than a thick UFR epitaxy.

### MOSFETs

MOSFETs can also be compared to UFRs as long as the internal parasitic bipolar transistor (due to the P–tub) does not turn–on. The latest MOSFET generations reduce the P– resistance to avoid biasing this NPN.

While analyzing different constant current test circuits, it appeared that devices used in a floating configuration can have very poor avalanche capabilities.

Due to their cellular technology, MOSFETs conduct very efficiently avalanche currents. They can sustain avalanche power levels close to those of forward conduction ratings.

## CONCLUSION

The necessity of characterizing the avalanche capability of power semiconductors has been explained. An analysis of the standard UIS test circuit has shown the limits of a characterization based on energy ratings. Throughout a discussion of the main failure mechanisms, a new thermal approach has been proposed to help designers set safety levels in their designs. This paper sets new standards for characterizing avalanche ruggedness.

### Acknowledgements

The authors would like to thank Jean–Michel REYNES, design engineer at ON Semiconductor Toulouse, for his help in understanding the failure mechanisms.

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# CHAPTER 11
# Index and Cross Reference

## Index and Cross Reference

The following table represents an index and cross reference guide for all rectifier devices which are either manufactured directly by ON Semiconductor or for which ON Semiconductor manufactures a suitable equivalent. Where the ON Semiconductor part number differs from the industry part number, the ON Semiconductor device is a form, fit and function replacement for the industry type number – however, subtle differences in characteristics and/or specifications may exist. The part numbers listed in this Cross Reference are in computer sort.

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| 1N4004 | 1N4004 | | 447 |
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| 1N4005 | 1N4005 | | 447 |
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