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

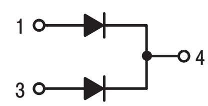
Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	30	V
Average Rectified Forward Current (At Rated V_R, T_C = 115°C) Per Device	I_O	15 30	A
Peak Repetitive Forward Current (At Rated V_R, Square Wave, 20 kHz, T_C = 115°C)	I_{FRM}	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

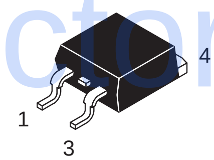
This document contains information on a new product. Specifications and information herein are subject to change without notice.

ON Semiconductor™

http://onsemi.com

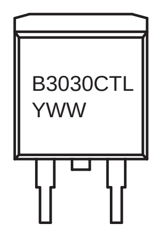
SCHOTTKY BARRIER RECTIFIER 30 AMPERES 30 VOLTS





D²PAK CASE 418B PLASTIC

MARKING DIAGRAM



B3030CTL = Device Code
Y = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping
MBRB3030CTL	D²PAK	50/Rail
MBRB3030CTLT4	D²PAK	800/Tape & Reel

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.) (I_F = 15 A, T_J = 25°C) (I_F = 30 A, T_J = 25°C)	V_F	 0.44 0.51	V
Maximum Instantaneous Reverse Current (Note 2.) (Rated V_R, T_J = 25°C) (Rated V_R, T_J = 125°C)	I_R	 2.0 195	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.

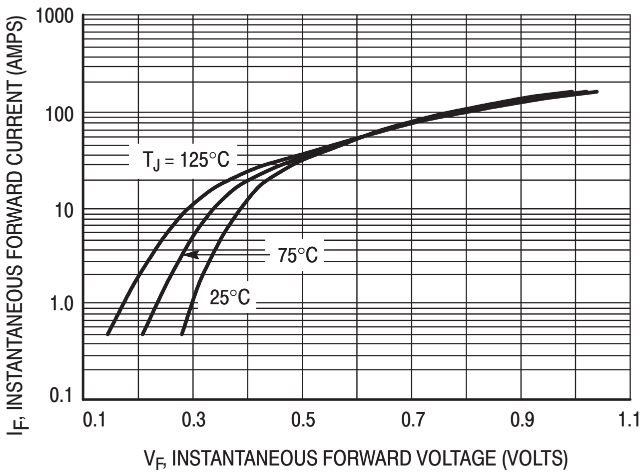


Figure 1. Typical Forward Voltage

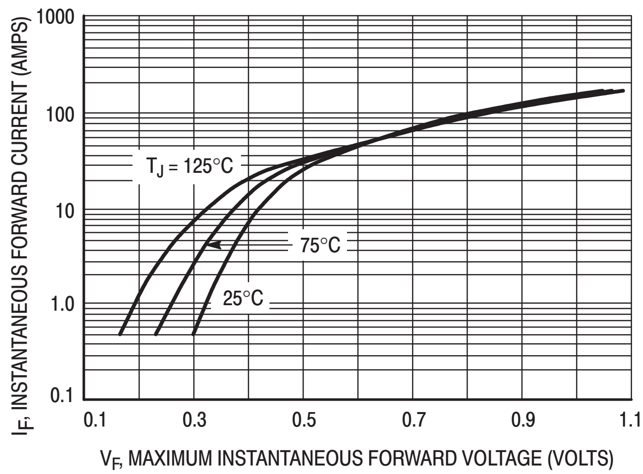


Figure 2. Maximum Forward Voltage

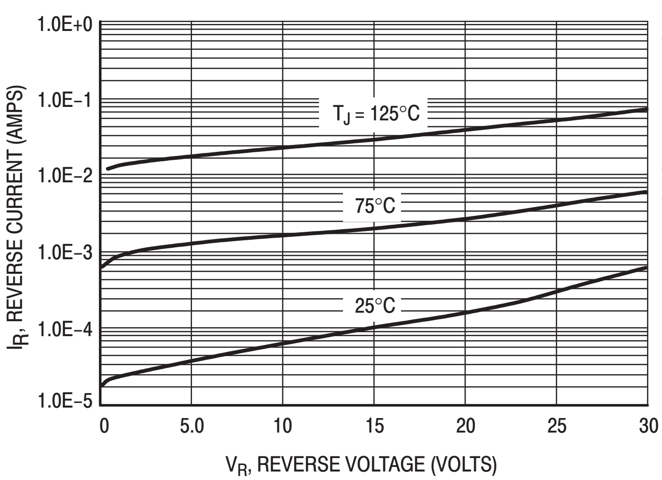


Figure 3. Typical Reverse Current

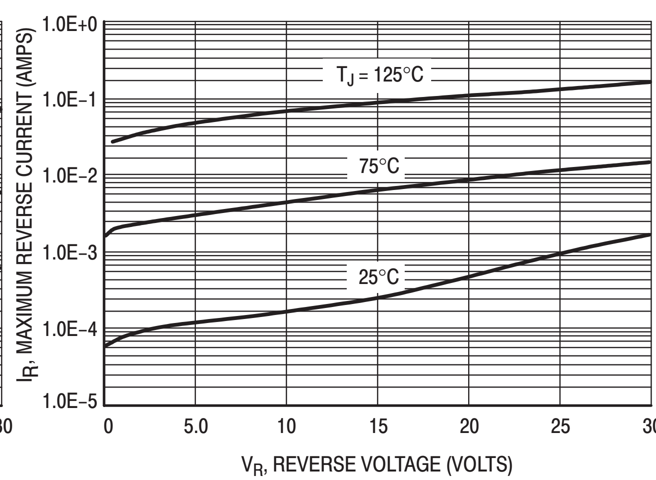


Figure 4. Maximum Reverse Current

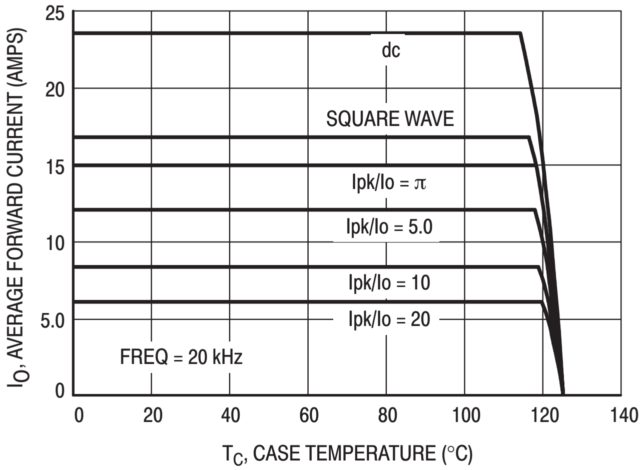


Figure 5. Current Derating

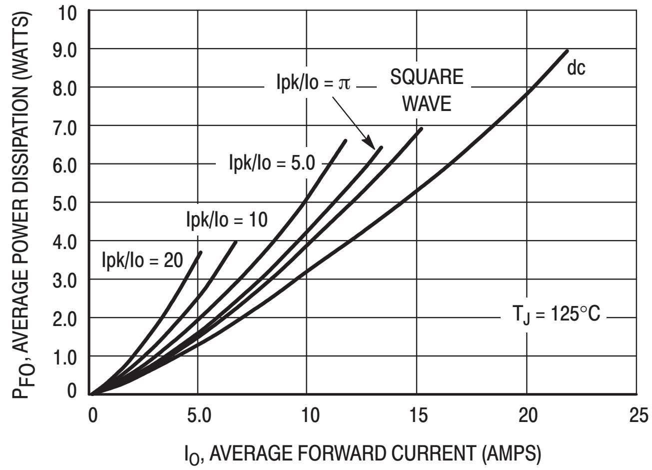


Figure 6. Forward Power Dissipation

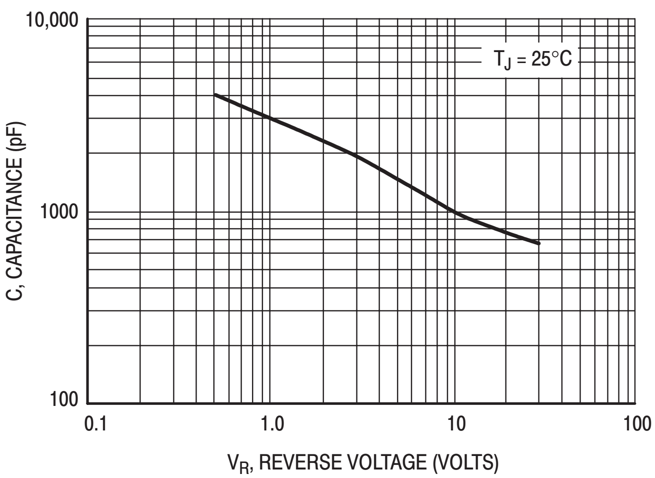


Figure 7. Typical Capacitance

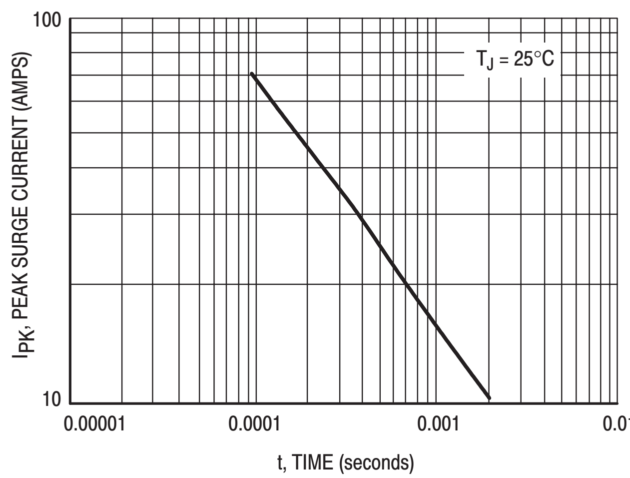


Figure 8. Typical Unclamped Inductive Surge

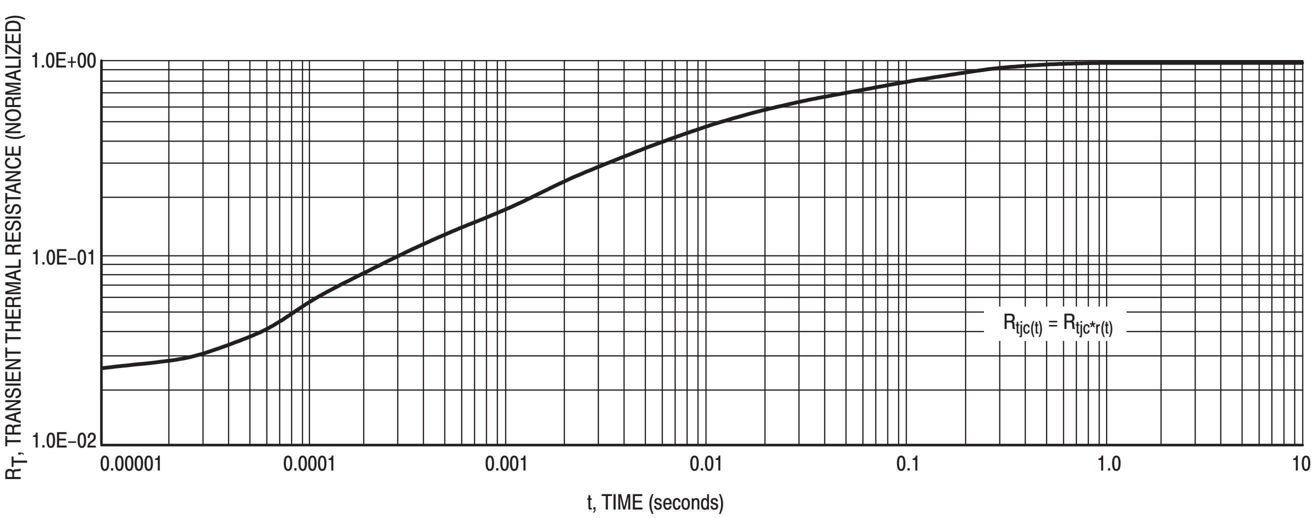


Figure 9. Typical Thermal Response

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.

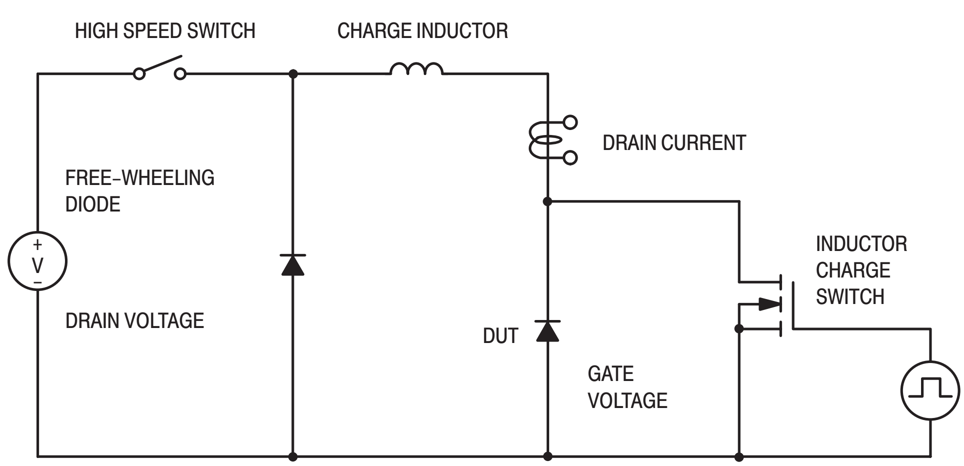


Figure 10. Simplified UIS Test Circuit

Suggested Method of Characterization

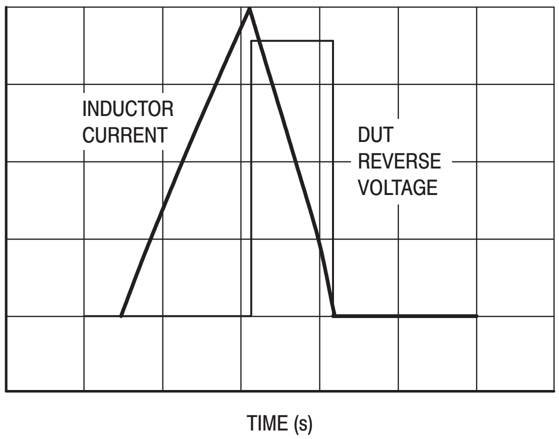


Figure 11. Typical Voltage and Current UIS Waveforms

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.

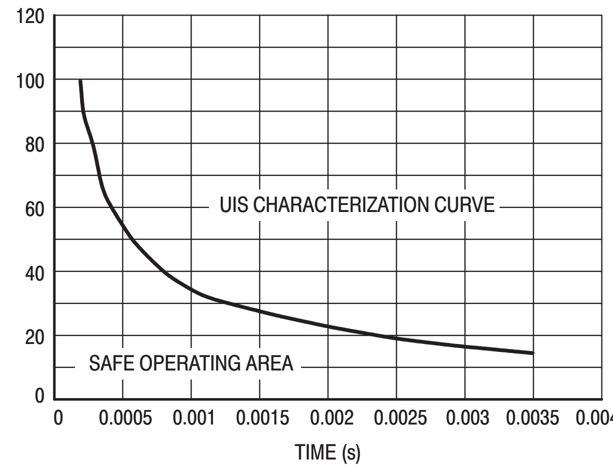


Figure 12. Peak Reverse Current versus Time for DUT

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.

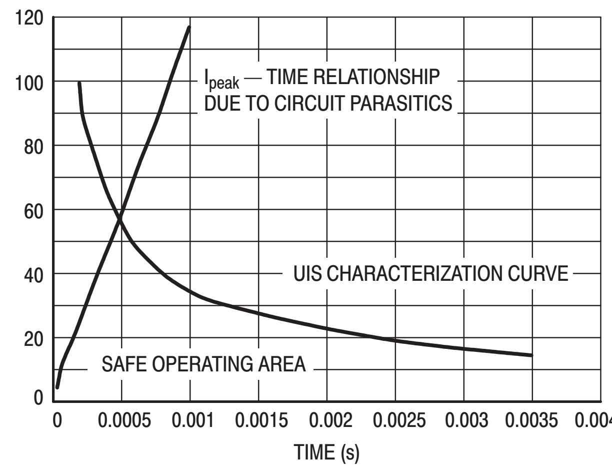


Figure 13. DUT Peak Reverse and Circuit Parasitic Inductance Current versus Time

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

RECTIFIER NUMBERING SYSTEM

PART NUMBER KEY XXX X XX XX XX X XX

PREFIX (TYPE DESIGNATOR) — XXX

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

XX: I_O

XX: V_R (X10 EXCEPT SCHOTTKY)

XX: SUFFIX (DUAL DESIGNATOR)

X:
- R = REVERSE
- L = LOW V_F
- E = ENERGY

XX: 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^2PAK
MBR2535CTL	25	35	0.41	5	TO-220
MBRB2515L	25	15	0.42	15	D^2PAK
MBR2515L	25	15	0.42	15	TO-220
MBRB3030CTL	30	30	0.51	5	D^2PAK
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_JMax (°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

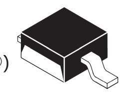
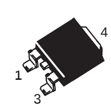
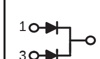
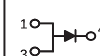
Device	I_O (Amps)	V_{RRM} (Volts)	Max V_F @ Rated unless Noted (Volts)	I_R @ V_{RRM} (mAmps)	Waval (M_J)
MUR180E	1.0	800	1.75	10	10
MUR1100E	1.0	1000	1.75	10	10
MUR480E	4.0	800	1.75	25	20
MUR4100E	4.0	1000	1.75	25	20
MUR880E	8.0	800	1.8	25	20
MUR8100E	8.0	1000	1.8	25	20
MUR10120E	10	1200	2.2 @ 6.5 A	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_JMax (°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

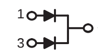
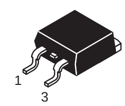
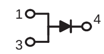
SCHOTTKY Rectifiers

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

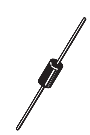
Table 6. Surface Mount Schottky Rectifiers (continued)

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		
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 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	**CASE 418B-03** (D^2PAK)	“CT” Suffix
35	25	T_C = 110°C	***MBRB2535CTL***	0.47 @ 12.5 A 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 0.67 @ 30 A	300	150	1.2	145 @ 150°C 46 @ 10 V, 150°C		Non-“CT” Suffix
30	30	T_C = 95°C	***MBRB3030CTL***	0.45 @ 15 A 0.51 @ 30 A	150	125	2	195 @ 125°C 75 @ 10 V, 125°C		
30	40	T_C = 110°C	***MBRB4030***	0.46 @ 20 A 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

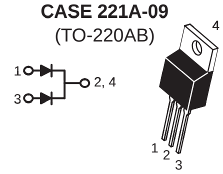
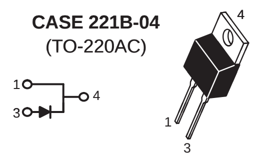
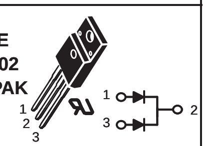
All devices listed are ON Semiconductor preferred devices

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 $R_{\theta JA}$ = 80°C/W	***1N5817***	0.45 @ 1.0 A	25	125	1	10	
30	1	T_A = 55°C $R_{\theta JA}$ = 80°C/W	***1N5818***	0.55 @ 1.0 A	25	125	1	10	**CASE 59–04 Plastic**
40	1	T_A = 55°C $R_{\theta JA}$ = 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 $R_{\theta JA}$ = 80°C/W	***MBR160***	0.75 @ 1.0 A	25	150	0.5	5	Cathode = Polarity Band
100	1	T_A = 120°C $R_{\theta JA}$ = 50°C/W	***MBR1100***	0.79 @ 1.0 A	50	150	0.5	5	
20	3	T_A = 76°C $R_{\theta JA}$ = 28°C/W	***1N5820***	0.457 @ 3.0 A	80	125	2	20	
30	3	T_A = 71°C $R_{\theta JA}$ = 28°C/W	***1N5821***	0.500 @ 3.0 A	80	125	2	20	**CASE 267-03 Plastic**
40	3	T_A = 61°C $R_{\theta JA}$ = 28°C/W	***1N5822***	0.525 @ 3.0 A	80	125	2	20	
40	3	T_A = 65°C $R_{\theta JA}$ = 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 $R_{\theta JA}$ = 28°C/W	***MBR360RL***	0.740 @ 3.0 A	80	150	0.6	20	Cathode = Polarity Band
100	3	T_A = 100°C $R_{\theta JA}$ = 28°C/W	***MBR3100***	0.79 @ 3.0 A	150	150	0.6	20	

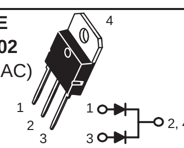
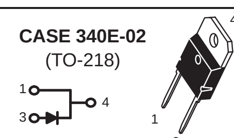
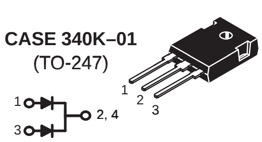
[2] V_{RRM} unless noted
[3] V_{RRM}, T_J = 100°C unless noted

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 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 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 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	UL ***MBRF2060CT***	0.95 @ 20 A	150	150	0.15	15 @ 125°C	**CASE 221D-02 FULL PAK** 
100	20	T_C = 133°C	UL ***MBRF20100CT***	0.95 @ 20 A	150	150	0.15	15 @ 125°C	
200	20	T_C = 125°C	UL ***MBRF20200CT***	1.0 @ 20 A	150	150	1	50 @ 125°C	
45	25	T_C = 125°C	UL ***MBRF2545CT***	0.82 @ 25 A	150	150	0.2	40 @ 125°C	

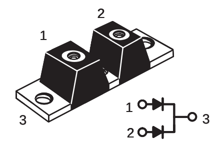
[(2)]V_{RRM} unless noted
[(3)]V_{RRM}, T_J = 100°C unless noted
UL Indicates UL Recognized – File #E69369

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 0.80 @ 40 A	400	150	1	50	
45	60	T_C = 125°C	***MBR6045PT***	0.62 @ 30 A 0.75 @ 60 A	500	150	1	50	
25	50	T_C = 125°C	***MBR5025L***	0.54 @ 30 A 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 0.50 @ 40 A	400	100	5	150 @ 75°C	
45	40	T_C = 125°C	***MBR4045WT***	0.70 @ 20 A 0.80 @ 40 A	400	150	1	50	
45	60	T_C = 125°C	***MBR6045WT***	0.62 @ 30 A 0.75 @ 60 A	500	150	1	50	

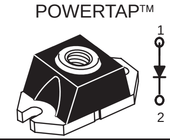
[(2)]V_{RRM} unless noted
[(3)]V_{RRM}, T_J = 100°C unless noted

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 0.60 @ 200 A	1500	150	5	–	**CASE 357C-03** POWERTAP™  Cathode = Mounting Plate 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 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 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

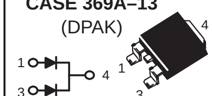
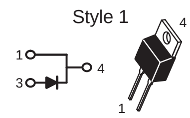
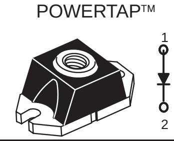
Table 11. POWERTAP III Schottky Rectifiers

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** POWERTAP™ 
	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

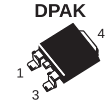
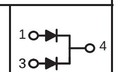
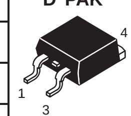
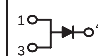
Table 12. UltraSoft Rectifiers (For High Speed Rectification)

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** (DPAK) 
600	8	T_C = 125°C	***MSR860***	1.7 @ 8.0 A	120	150	10 μA	1000	**CASE 221B–04** Style 1 
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** POWERTAP™ 

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

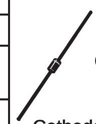
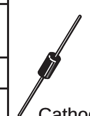
Ultrafast Rectifiers

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		

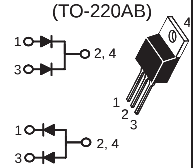
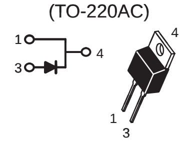
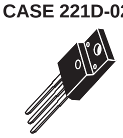
(1)I_O is total device current capability.
(2)V_{RRM} unless noted
(4)V_{RRM}, $T_J = 150°C$ unless noted
★New Product

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** Plastic 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	$T_A = 130°C$ $R_{θJA} = 50°C/W$	***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	$T_A = 120°C$ $R_{θJA} = 50°C/W$	***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	$T_A = 95°C$ $R_{θJA} = 50°C/W$	***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** Plastic 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	$T_A = 80°C$ $R_{θJA} = 28°C/W$	***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	$T_A = 40°C$ $R_{θJA} = 28°C/W$	***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	$T_A = 35°C$ $R_{θJA} = 28°C/W$	***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

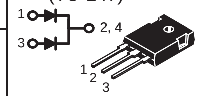
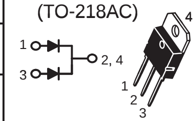
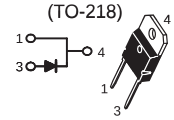
Table 15. TO-220 Ultrafast and MEGAHERTZ™ Rectifiers

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)
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	**MUR1620CTR Only**
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	Ⓤ ***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

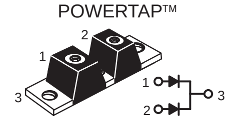
Ⓤ Indicates UL Recognized – File #E69369
★ New Product

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

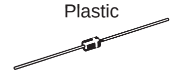
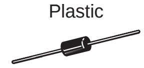
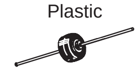
Table 17. POWERTAP II Ultrafast Rectifiers

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

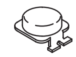
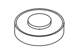
Fast Recovery Rectifiers/General-Purpose Rectifiers

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

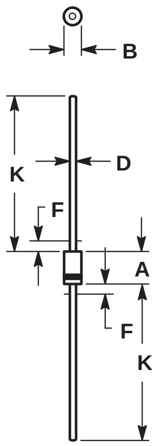
Table 19. Overvoltage Transient Suppressors

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 $T_L = 125°C$	***MR2520L***	1.25 $I_F = 100A$	400	175	58[5]	10	**CASE 194–04** Plastic  Cathode = Diode Symbol
20	24–32	40[2]	6 $T_C = 125°C$	***MR2535L***	1.1 $I_F = 100A$	400	175	62[5]	0.2	
20	24–32	40[3]	32 $T_C = 150°C$	***TRA2532***	1.18 $I_F = 100A$	500	175	80[5]	10	**CASE 193-04** Plastic  Cathode = Polarity Band
23	24–32	40[3]	32 $T_C = 150°C$	***MR2835S***	1.1 $I_F = 100A$	400	175	62[5]	5 @ 20 V	**CASE 460–02** Top Can  Cathode = Terminal
18	20–27	37[3] 35[4]	32 $T_C = 185°C$	***MR3227N*** and ***MR3227P***	1.18 $I_F = 100A$	400	200	90[5] 40[6]	1 @ 16 V	**CASE 193A–02** Button Can  N = Anode to Case P = Cathode to Case
18	20–27	37[3] 35[4]	40 $T_C = 185°C$	***MR4027N*** and ***MR4027P***	1.1 $I_F = 100A$	500	200	110[5] 50[6]	1 @ 16 V	
30	34–45	55[3] 53[4]	40 $T_C = 185°C$	***MR4045N*** and ***MR4045P***	1.1 $I_F = 100A$	500	200	55[5] 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

Package Outline Dimensions

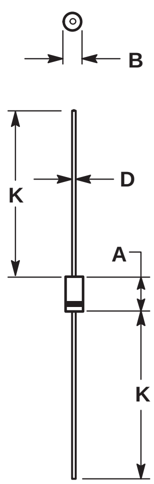
GLASS/PLASTIC
DO–41
CASE 59–03
ISSUE M



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.

DIM	MILLIMETERS		INCHES	
	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

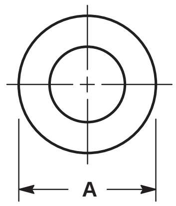


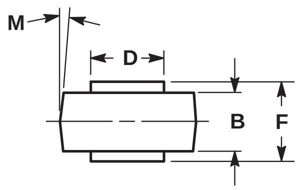
NOTES:
1. ALL RULES AND NOTES ASSOCIATED WITH JEDEC DO–41 OUTLINE SHALL APPLY.
2. POLARITY DENOTED BY CATHODE BAND.
3. LEAD DIAMETER NOT CONTROLLED WITHIN F DIMENSION.

DIM	MILLIMETERS		INCHES	
	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)

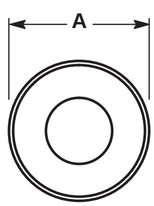
MICRODE BUTTON
CASE 193–04
ISSUE J

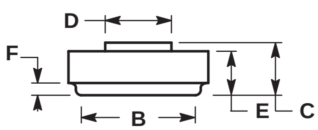




DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	8.43	8.69	0.332	0.342
B	4.19	4.45	0.165	0.175
D	5.54	5.64	0.218	0.222
F	5.94	6.25	0.234	0.246
M	5°NOM		5°NOM	

CAN BUTTON
CASE 193A–02
ISSUE A



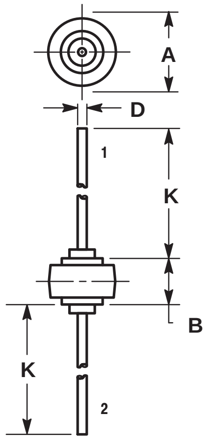


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

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

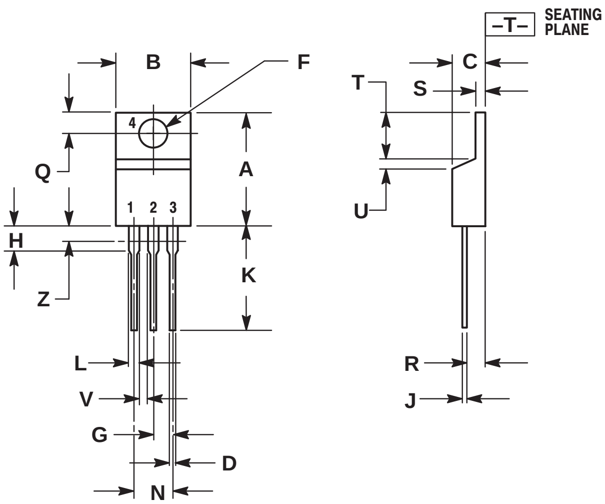


NOTES:
1. CATHODE SYMBOL ON PACKAGE.

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES 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 MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS 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

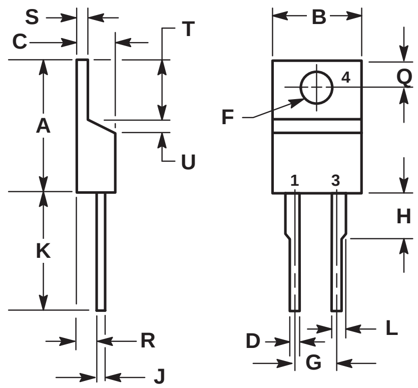
STYLE 9:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

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.

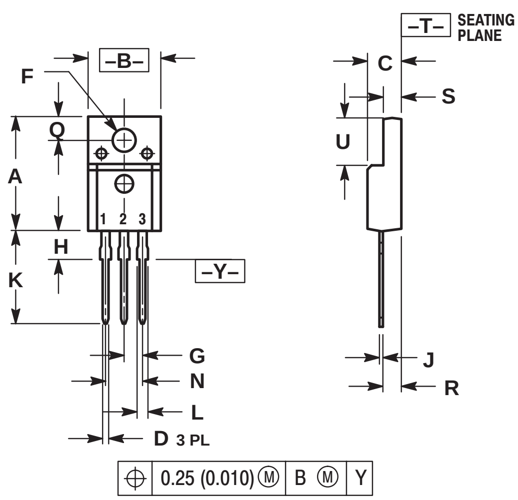
DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	0.595	0.620	15.11	15.75
B	0.380	0.405	9.65	10.29
C	0.160	0.190	4.06	4.82
D	0.025	0.035	0.64	0.89
F	0.142	0.147	3.61	3.73
G	0.190	0.210	4.83	5.33
H	0.110	0.130	2.79	3.30
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.14	1.52
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

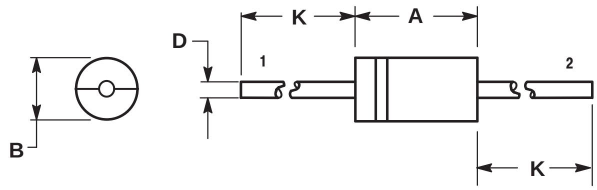
STYLE 3:
PIN 1. ANODE
2. CATHODE
3. ANODE

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

AXIAL LEAD
CASE 267–03
ISSUE G



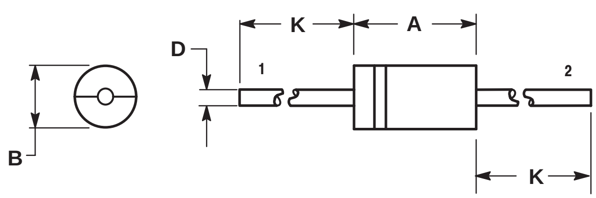
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

	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.

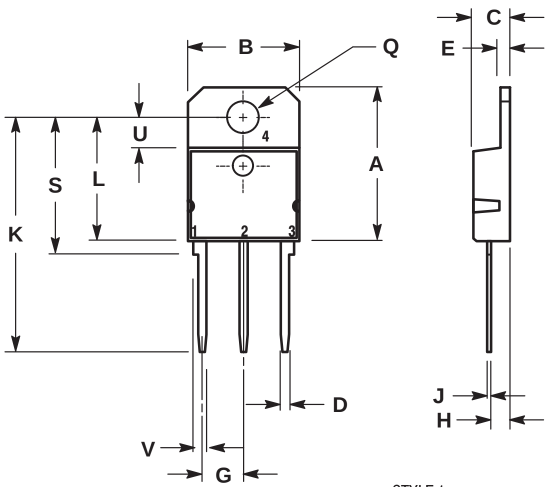
	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.287	0.374	7.30	9.50
B	0.189	0.209	4.80	5.30
D	0.047	0.051	1.20	1.30
K	1.000	---	25.40	---

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



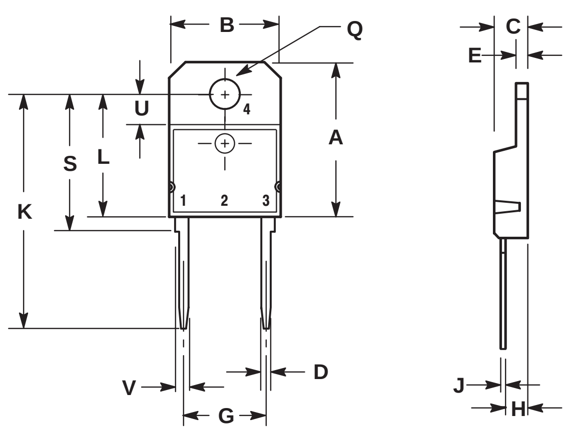
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.

	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

TO–218 TWO LEAD
TO–218
CASE 340E–02
ISSUE A



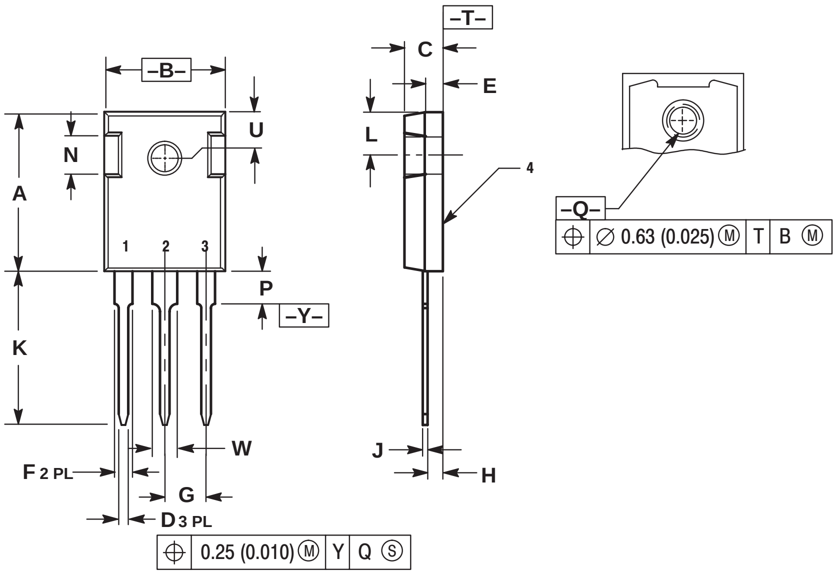
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982
2. CONTROLLING DIMENSION: MILLIMETER.

	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

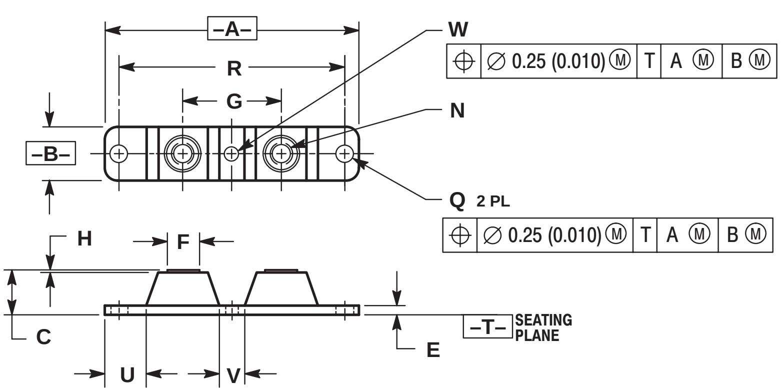
STYLE 1:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

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

POWERTAP II
CASE 357C–03
ISSUE E

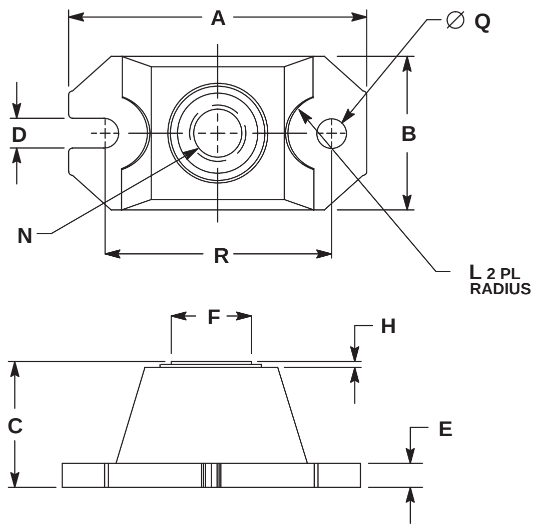


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. TERMINAL PENETRATION: 5.97 (0.235) MAXIMUM.

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)

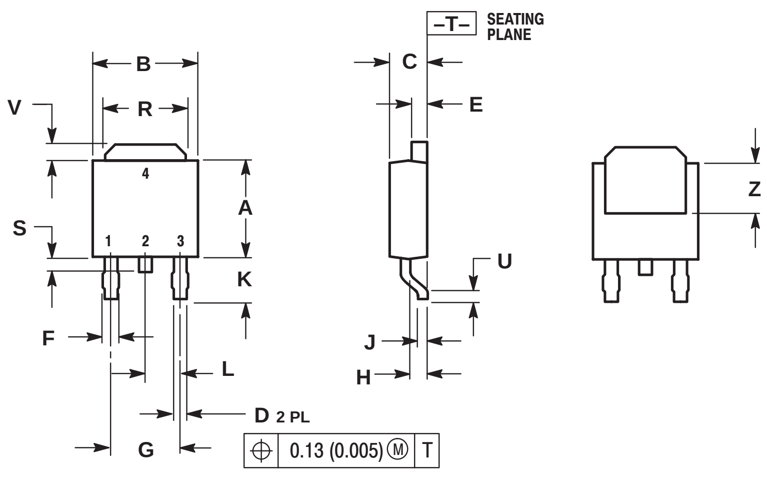
POWERTAP III
CASE 357D–01
ISSUE A



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. TERMINAL PENETRATION: 5.97 (0.235) MAXIMUM.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS 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

DPAK
CASE 369A–13
ISSUE AA



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	0.235	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

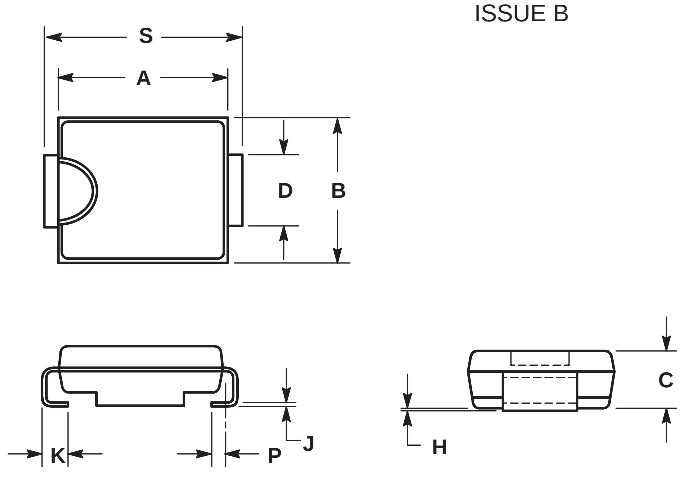
STYLE 4:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

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)

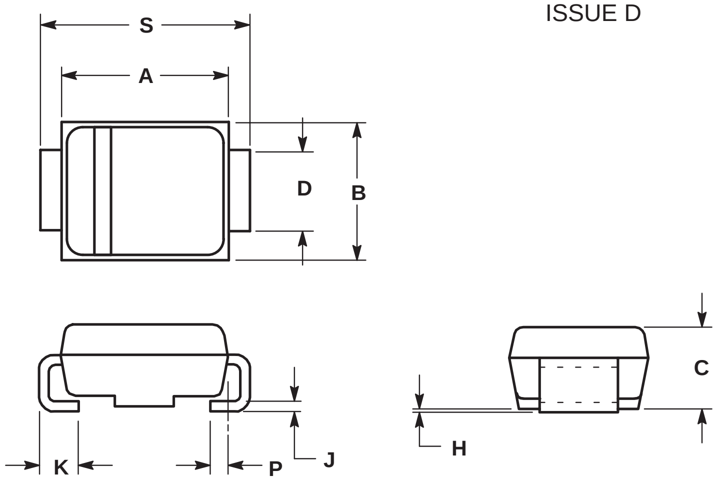
SMC
CASE 403–03
ISSUE B



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 MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS 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

SMB
D0–214AA
CASE 403A–03
ISSUE D

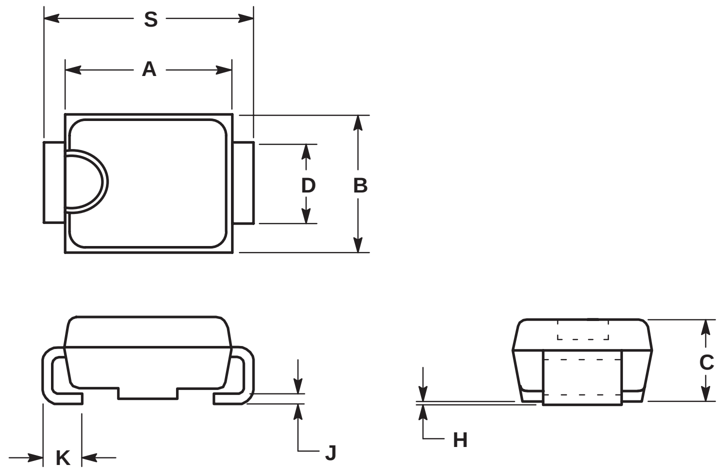


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. D DIMENSION SHALL BE MEASURED WITHIN DIMENSION P.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS 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)

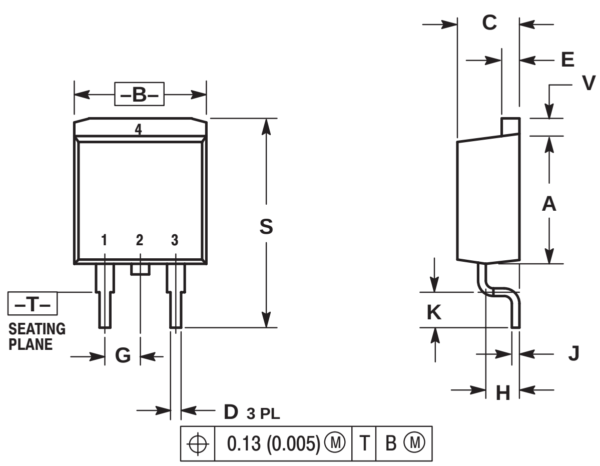
SMB
CASE 403B–01
ISSUE O



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	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

D^{2}PAK
CASE 418B–03
ISSUE D



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	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

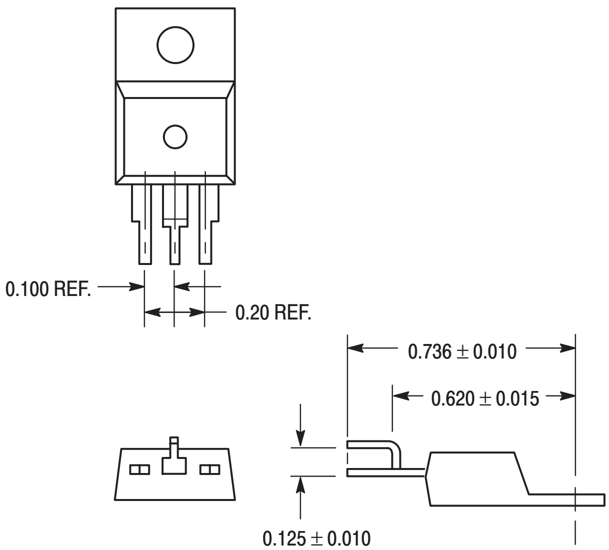
STYLE 2:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

STYLE 3:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

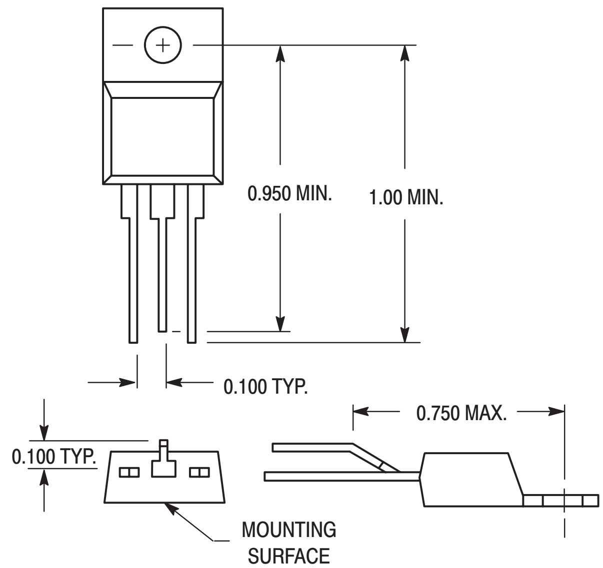
Leadform Options — TO-220 (Case 221A)

- 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.

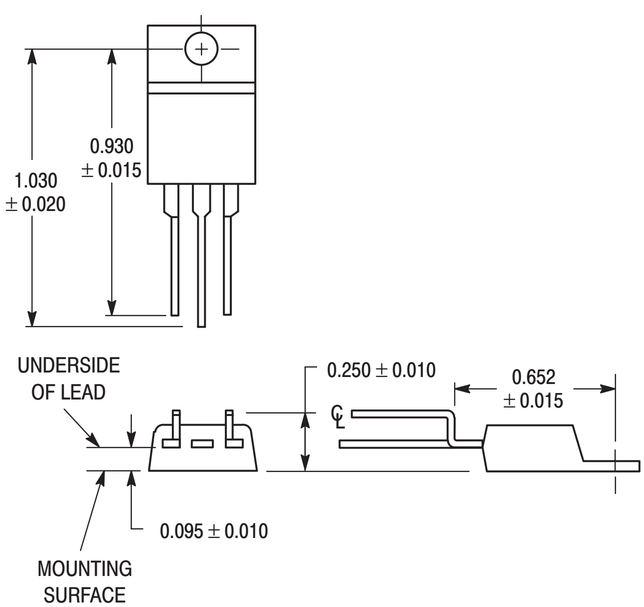
LEADFORM AS



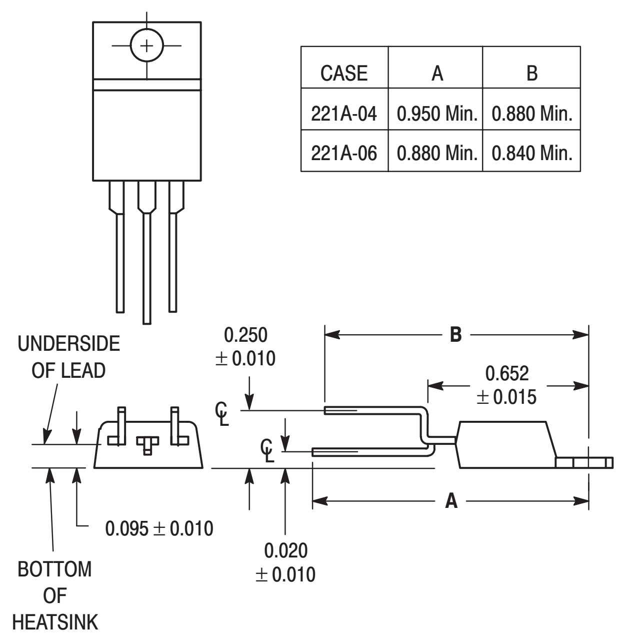
LEADFORM BC



LEADFORM AC



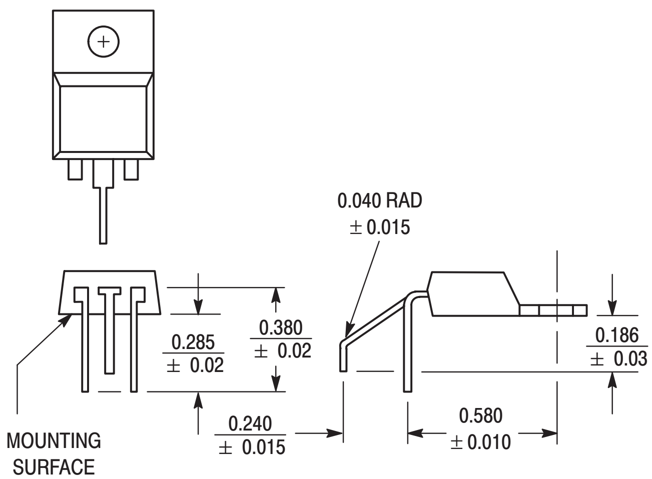
LEADFORM AD



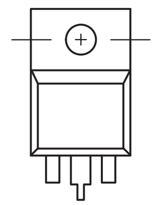
CASE	A	B
221A-04	0.950 Min.	0.880 Min.
221A-06	0.880 Min.	0.840 Min.

TO-220 Leadform Options (continued)

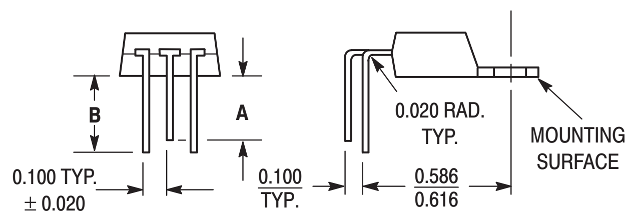
LEADFORM AN



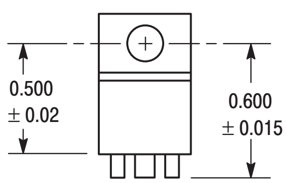
LEADFORM BA



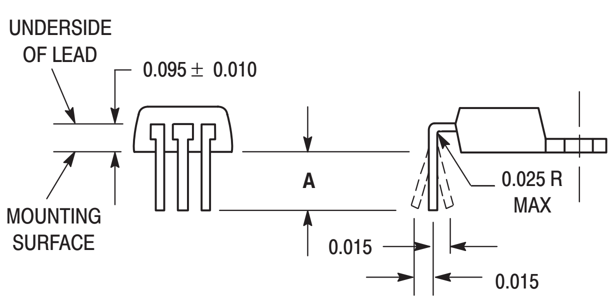
CASE	A	B
221A-04	0.220 Min.	0.325 Min.
221A-06	0.190 Min.	0.290 Min.



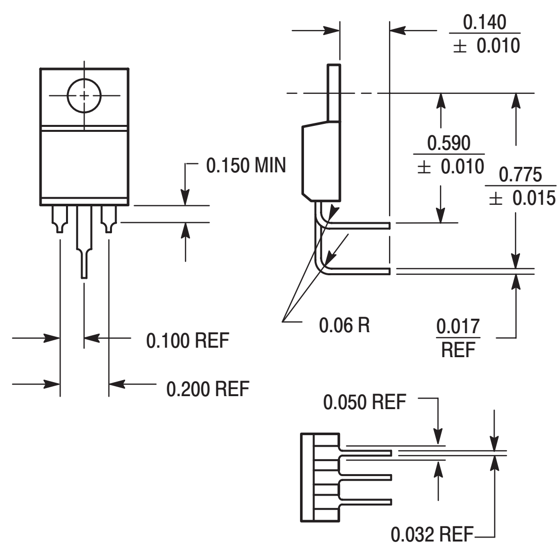
LEADFORM BL



CASE	A
221A-04	0.325 Min.
221A-06	0.290 Min.

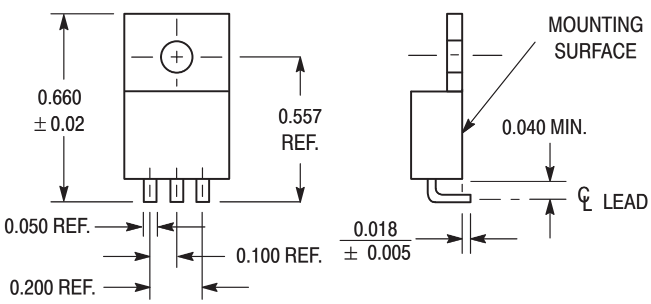


LEADFORM AK

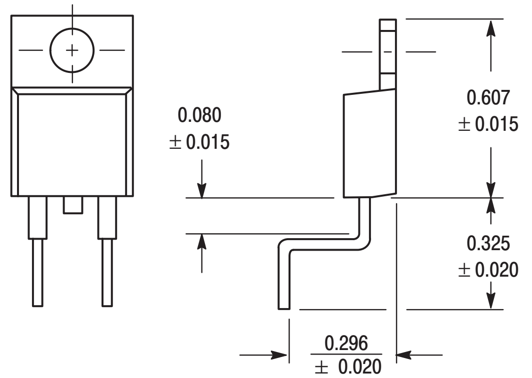


TO-220 Leadform Options (continued)

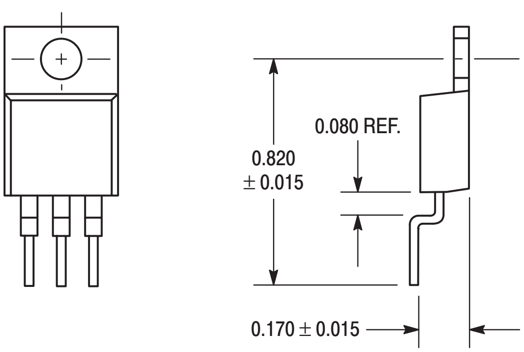
LEADFORM AF



LEADFORM BS

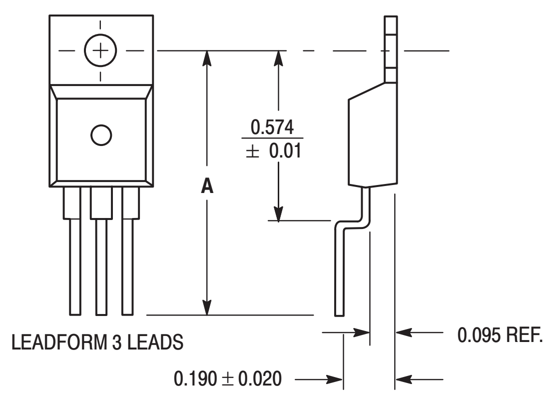


LEADFORM BR



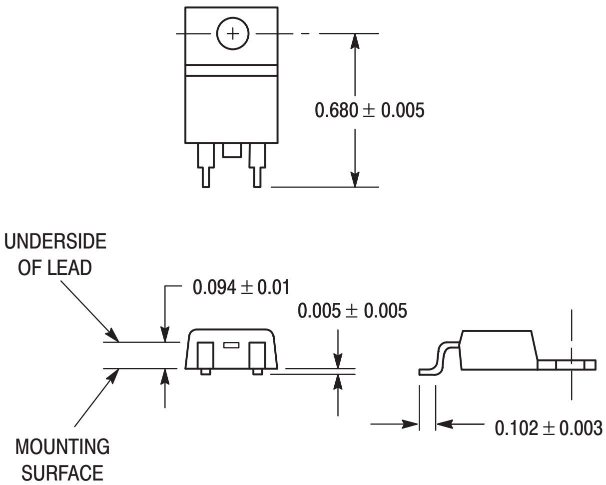
LEADFORM AU

CASE	A
221A-04	0.920 Min.
221A-06	0.885 Min.

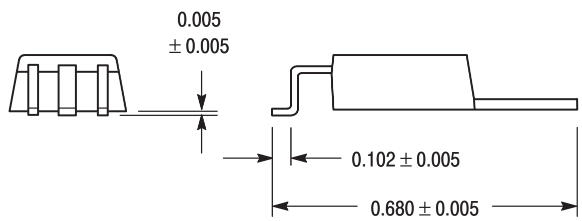


TO-220 Leadform Options (continued)

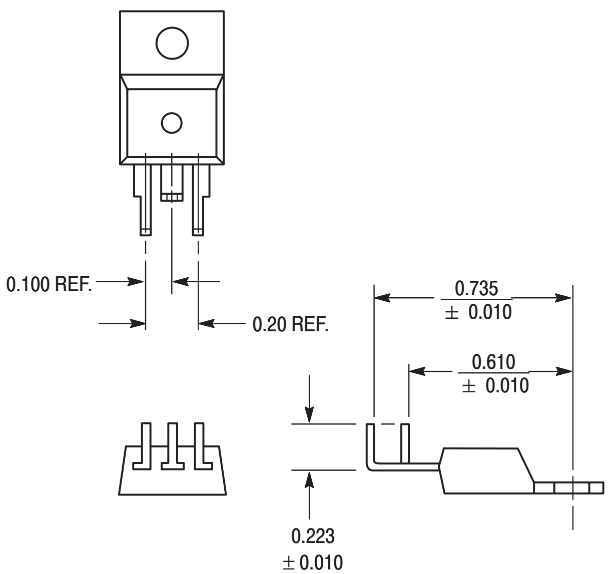
LEADFORM BU



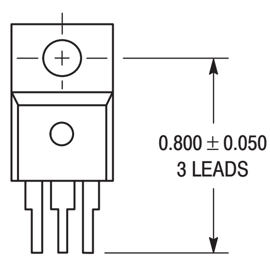
LEADFORM BV



LEADFORM BD

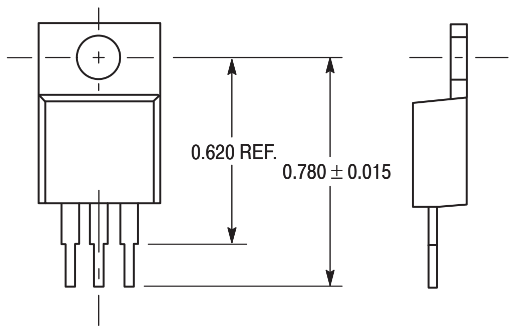


LEADFORM DW

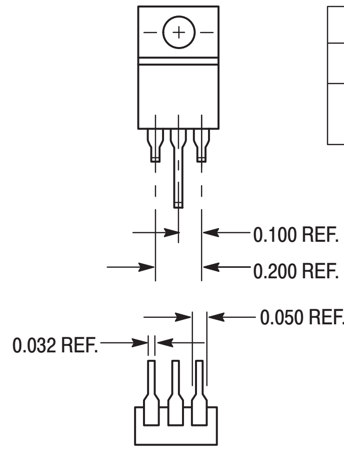


TO-220 Leadform Options (continued)

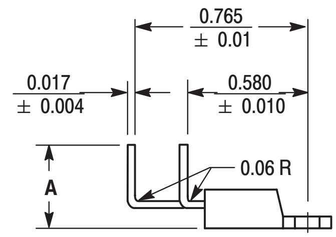
LEADFORM BG



LEADFORM AJ



CASE	A
221A-04	0.360 ± 0.010
221A-06	Lead Not Trimmed 0.300 Min.



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.

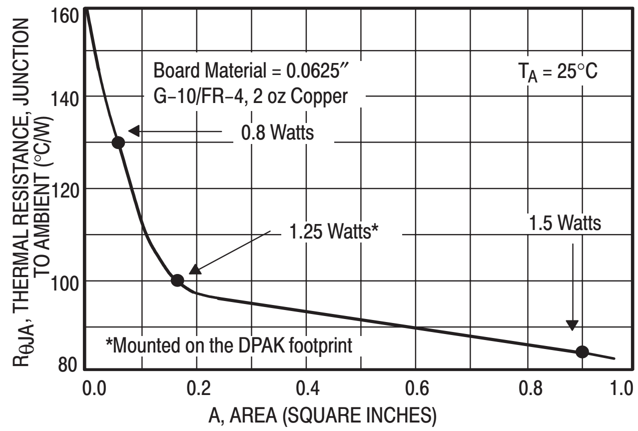


Figure 1. Thermal Resistance versus Drain Pad Area for the SOT–223 Package (Typical)

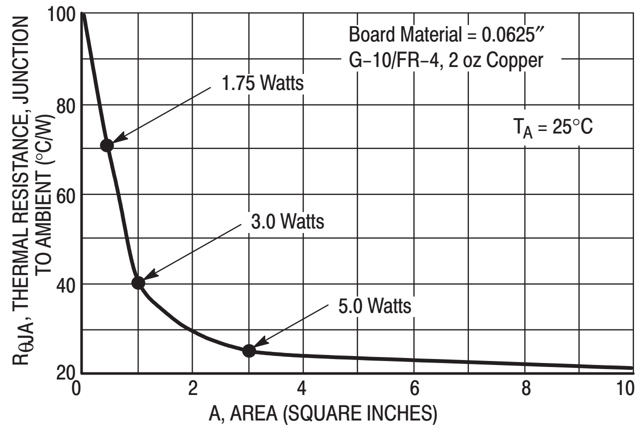


Figure 2. Thermal Resistance versus Drain Pad Area for the DPAK Package (Typical)

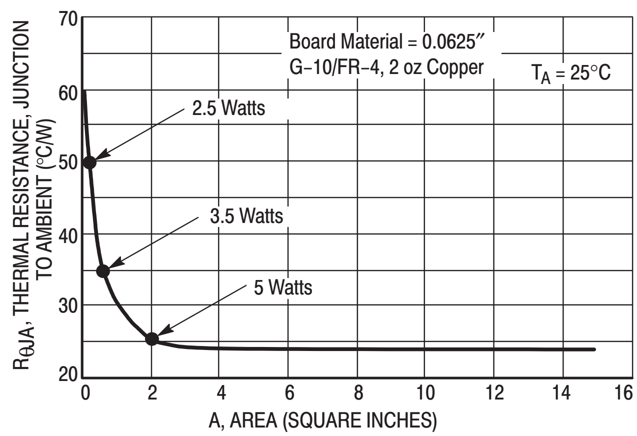


Figure 3. Thermal Resistance versus Drain Pad Area for the D^2PAK Package (Typical)

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^2PAK 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^2PAK 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.

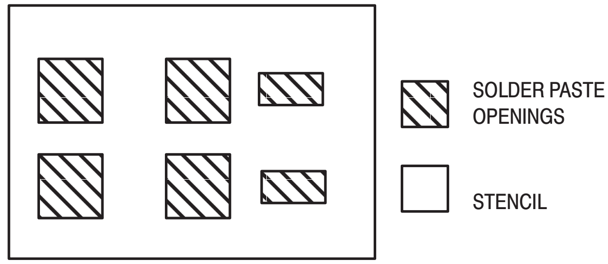


Figure 4. Typical Stencil for DPAK and D^2PAK Packages

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^2PAK 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.

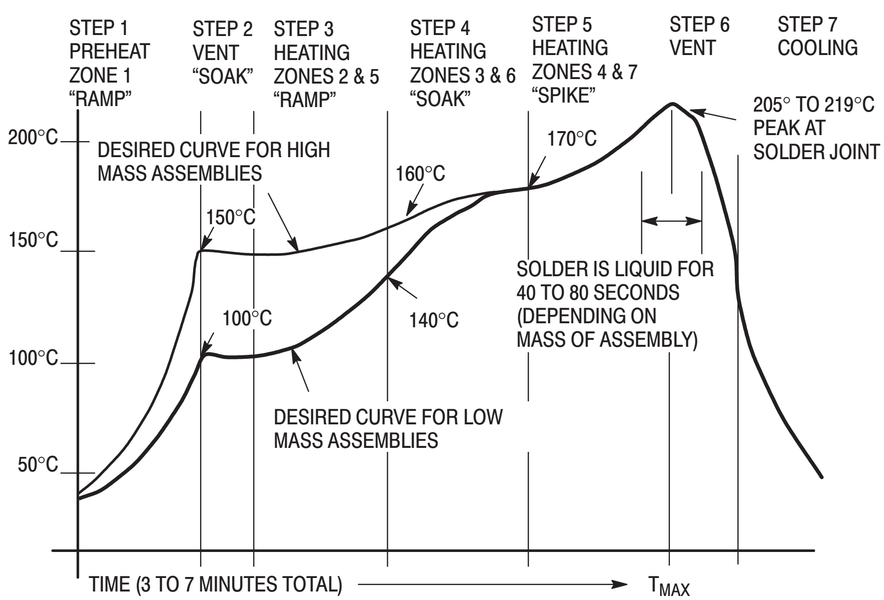
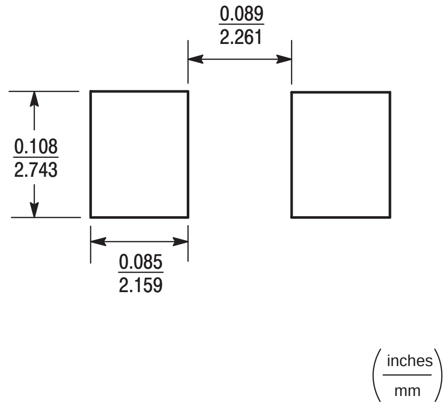
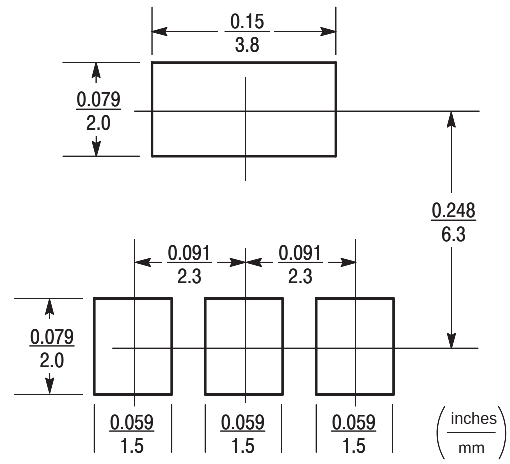


Figure 5. Typical Solder Heating Profile

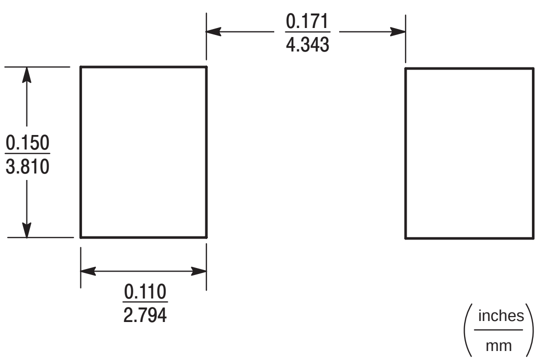
Footprints for Soldering



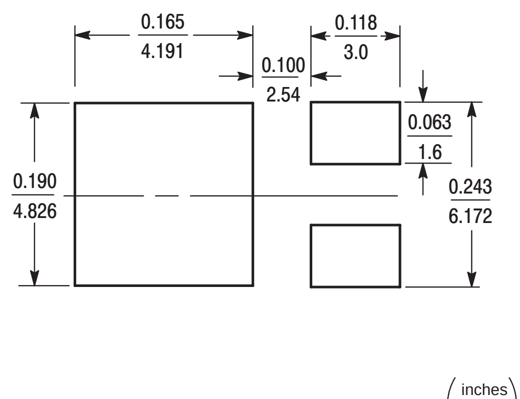
SMB



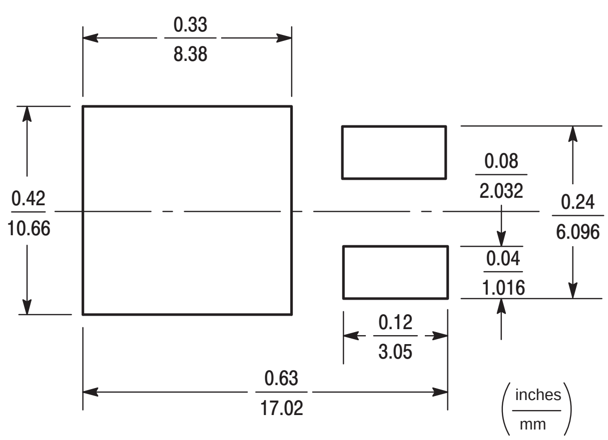
SOT–223



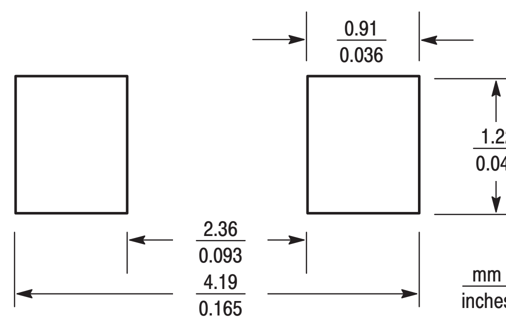
SMC



DPAK

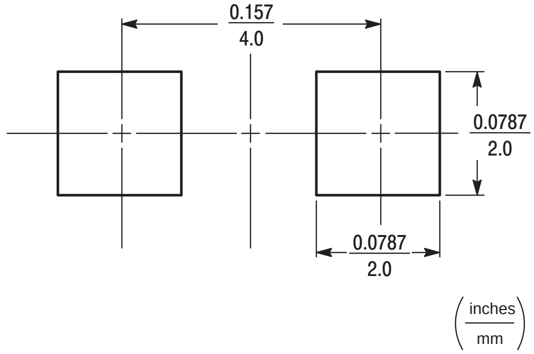


D^2PAK

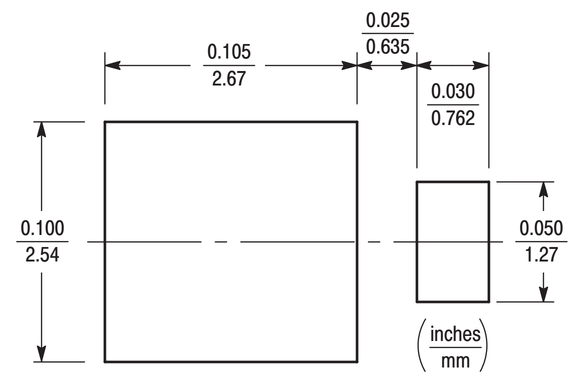


SOD–123

Footprints for Soldering



SMA



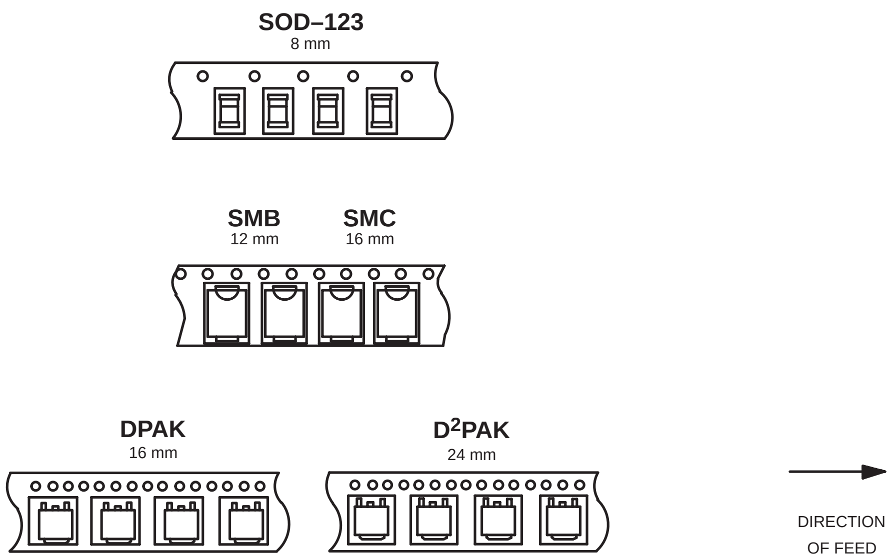
POWERMITE

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^2PAK 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.

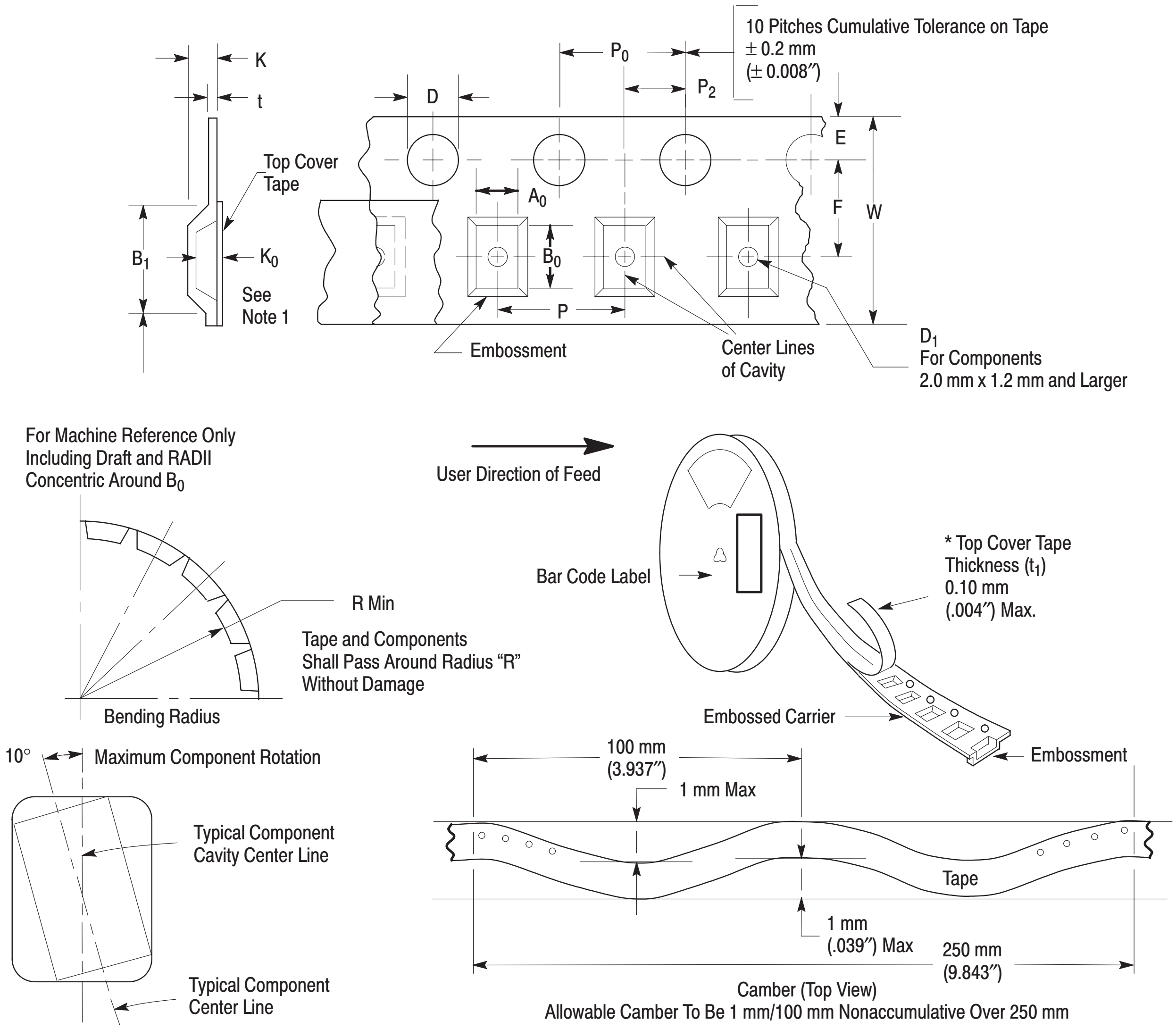


EMBOSSED TAPE AND REEL ORDERING INFORMATION

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^2PAK	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 8	4.0 ± 0.1 (.157 ± .004)	178 (7) 330 (13)	3,000 10,000	T1 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.

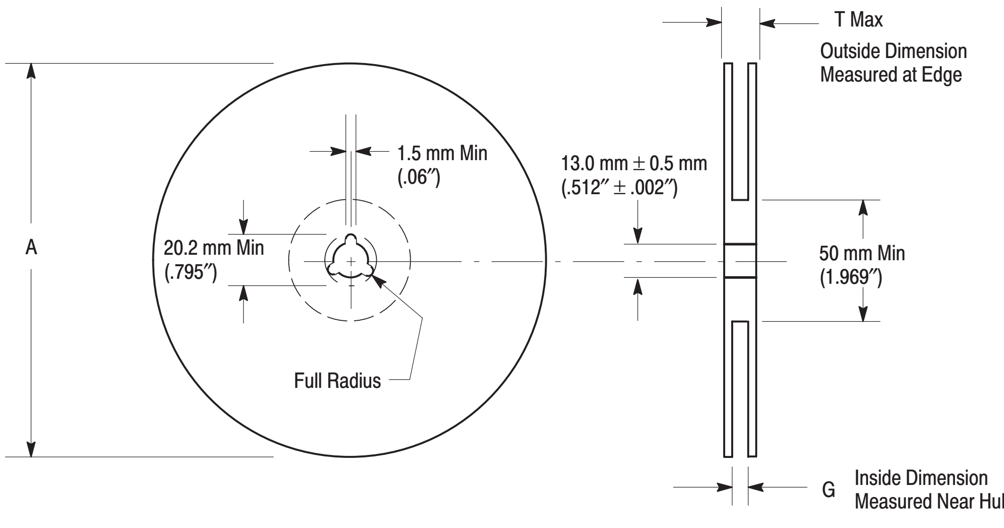
NOTE 1: A_0, B_0, and K_0 are determined by component size. The clearance between the components and the cavity must be within .05 mm min. to .50 mm max.,

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.

EMBOSSED TAPE AND REEL DATA FOR DISCRETES



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)

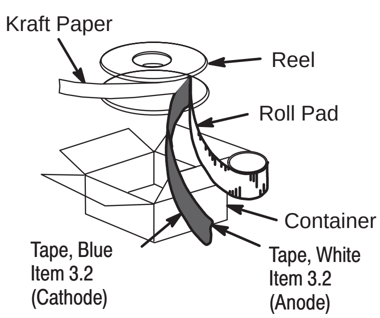


Figure 1. Reel Packing

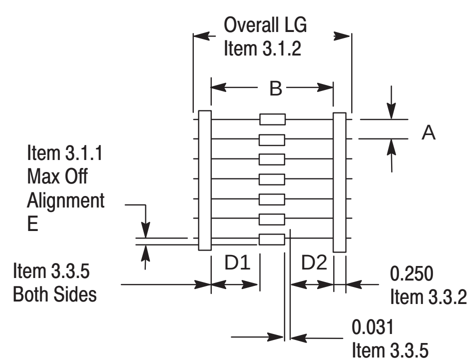


Figure 2. Component Spacing

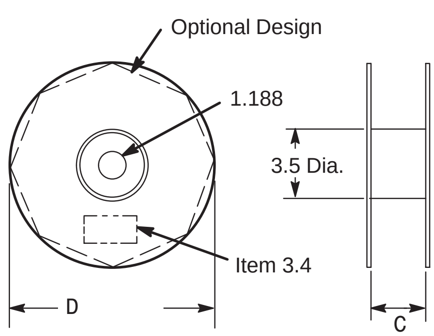


Figure 3. Reel Dimensions

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.

Industry Part Number	ON Semiconductor Nearest Replacement	ON Semiconductor Similar Replacement	Page
10BF10	MURS110T3		286
10BF20	MURS120T3		286
10BF40	MURS140T3		286
10BF60	MURS160T3		286
10BF80		MURS160T3	286
10BQ015		MBRS120T3	64
10BQ030	MBRS130T3		70
10BQ040	MBRS140T3		73
10BQ060		MBRS1100T3	80
10BQ100	MBRS1100T3		80
10CTF10		MUR840	370
10CTF20		MUR840	370
10CTF30		MUR840	370
10CTF40		MUR840	370
10DL1		1N4934	452
10DL2		1N4935	452
10MQ040N	MBRA140T3		61
10TQ030		MBR1035	207
10TQ035	MBR1035		207
10TQ040		MBR1045	207
10TQ045	MBR1045		207
11DQ03		1N5818	146
11DQ04		1N5819	146
11DQ05		MBR150	152
11DQ06		MBR160	152
11DQ09		MBR1100	156
11DQ10		MBR1100	156
12CTQ030		MBR1535CT	174
12CTQ035		MBR1535CT	174
12CTQ035S		MBRB1545CT	116
12CTQ040		MBR1545CT	174
12CTQ040S		MBRB1545CT	116
12CTQ045		MBR1545CT	174
12CTQ045S		MBRB1545CT	116
12CWQ03FN		MBRD1035CTL	108
12TQ035		MBR1635	215
12TQ035S		MBRB1545CT	116
12TQ040		MBR1645	215
12TQ040S		MBRB1545CT	116
12TQ045		MBR1645	215
12TQ045S		MBRB1545CT	116
15CTQ035	MBR1535CT		174
15CTQ035S		MBRB1545CT	116
15CTQ040		MBR1545CT	174
15CTQ040S		MBRB1545CT	116
15CTQ045	MBR1545CT		174
15CTQ045S	MBRB1545CT		116
180NQ035		MBRP20035L	280
181NQ035		MBRP20035L	280
182NQ030		MBRP20035L	280
182NQ030R		MBRP20035L	280
1N2069,A	1N4003		447
1N2070,A	1N4004		447
1N2071,A	1N4005		447
1N3611		1N4003	447
1N3611GP		1N4003	447
1N3612		1N4004	447
1N3612GP		1N4004	447
1N3613		1N4005	447
1N3613GP		1N4005	447
1N3614		1N4006	447
1N3614GP		1N4006	447
1N3957		1N4007	447
1N3957GP		1N4007	447
1N4001	1N4001		447
1N4001GP		1N4001	447
1N4002	1N4002		447
1N4002GP		1N4002	447
1N4003	1N4003		447
1N4003GP		1N4003	447
1N4004	1N4004		447
1N4004GP		1N4004	447
1N4005	1N4005		447
1N4005GP		1N4005	447
1N4006	1N4006		447
1N4006GP		1N4006	447
1N4007	1N4007		447
1N4007GP		1N4007	447
1N4245		1N4003	447
1N4245GP		1N4003	447
1N4246		1N4004	447
1N4246GP		1N4004	447
1N4247		1N4005	447
1N4247GP		1N4005	447
1N4248		1N4006	447
1N4248GP		1N4006	447
1N4249		1N4007	447
1N4249GP		1N4007	447
1N4383GP		1N4003RL	447
1N4384GP		1N4004RL	447
1N4385GP		1N4005RL	447
1N4585GP		1N4006RL	447
1N4586GP		1N4007RL	447
1N4934	1N4934		452
1N4934GP		1N4934	452
1N4935	1N4935		452
1N4935GP		1N4935	452
1N4936	1N4936		452

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1N4936GP		1N4936	452
1N4937	1N4937		452
1N4937GP		1N4937	452
1N4942		1N4935	452
1N4942GP		1N4935	452
1N4943		1N4936	452
1N4944		1N4936	452
1N4944GP		1N4936	452
1N4945		1N4937	452
1N4946		1N4937	452
1N4946GP		1N4937	452
1N5185		MR852	454
1N5185GP		MR852	454
1N5186		MR852	454
1N5186GP		MR852	454
1N5187		MR852	454
1N5187GP		MR852	454
1N5188		MR856	454
1N5188GP		MR856	454
1N5189		MR856	454
1N5189GP		MR856	454
1N5190		MR856	454
1N5190GP		MR856	454
1N5391		1N4001RL	447
1N5391GP		1N4001RL	447
1N5391S		1N4001RL	447
1N5392		1N4002RL	447
1N5392GP		1N4002RL	447
1N5392S		1N4002RL	447
1N5393		1N4003RL	447
1N5393GP		1N4003RL	447
1N5393S		1N4003RL	447
1N5394		1N4004RL	447
1N5394GP		1N4004RL	447
1N5395		1N4004RL	447
1N5395GP		1N4004RL	447
1N5395S		1N4004RL	447
1N5396		1N4005RL	447
1N5396GP		1N4005RL	447
1N5397		1N4005RL	447
1N5397GP		1N4005RL	447
1N5397S		1N4005RL	447
1N5398		1N4006RL	447
1N5398GP		1N4006RL	447
1N5398S		1N4006RL	447
1N5399		1N4007RL	447
1N5399GP		1N4007RL	447
1N5399S		1N4007RL	447
1N5401	1N5401		449
1N5402	1N5402		449
1N5403		1N5404	449
1N5404	1N5404		449
1N5405		1N5406	449
1N5406	1N5406		449
1N5415		MR852	454
1N5416		MR852	454

Industry Part Number	ON Semiconductor Nearest Replacement	ON Semiconductor Similar Replacement	Page
1N5417		MR852	454
1N5418		MR856	454
1N5419		MR856	454
1N5420		MR856	454
1N5614		1N4003	447
1N5615		1N4935	452
1N5615GP		1N4935	452
1N5616		1N4004	447
1N5617		1N4936	452
1N5617GP		1N4936	452
1N5618		1N4005	447
1N5619		1N4937	452
1N5619GP		1N4937	452
1N5620		1N4006	447
1N5802		MUR420	350
1N5803		MUR420	350
1N5804		MUR420	350
1N5805		MUR420	350
1N5806		MUR420	350
1N5807		MUR420	350
1N5808		MUR420	350
1N5809		MUR420	350
1N5810		MUR420	350
1N5811		MUR420	350
1N5817	1N5817		146
1N5818	1N5818		146
1N5819	1N5819		146
1N5820	1N5820		159
1N5821	1N5821		159
1N5822	1N5822		159
200CNQ020		MBRP20030CTL	252
200CNQ030	MBRP20030CTL		252
200CNQ035		MBRP20030CTL	252
200CNQ040		MBRP20045CT	262
200CNQ045	MBRP20045CT		262
201CNQ020		MBRP20030CTL	252
201CNQ030	MBRP20030CTL		252
201CNQ035		MBRP20030CTL	252
201CNQ040		MBRP20045CT	262
201CNQ045	MBRP20045CT		262
208CMQ060	MBRP20060CT		270
208CNQ060	MBRP20060CT		270
20CTQ030	MBR2030CTL		180
20CTQ035		MBR2030CTL	180
20CTQ040		MBR2045CT	184
20CTQ045	MBR2045CT		184
21DQ03		1N5821	159
21DQ04		1N5822	159
220CNQ030	MBRP20030CTL		252
25CTQ035		MBR2535CTL	195
25CTQ035S		MBRB2535CTL	127
25CTQ040		MBR2545CT	198
25CTQ040S		MBRB2545CT	130
25CTQ045		MBR2545CT	198
25CTQ045S		MBRB2545CT	130
28CPQ030		MBR3045PT	232

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28CPQ040		MBR3045PT	232
301CNQ040		MBRP30045CT	265
301CNQ045		MBRP30045CT	265
301CNQ050		MBRP30060CT	275
30BF20	MURS320T3		299
30BF40	MURS340T3		299
30BF60	MURS360T3		299
30BQ015		MBRS320T3	94
30BQ040	MBRS340T3		94
30BQ060	MBRS360T3		94
30CPQ035		MBR3045WT	241
30CPQ040		MBR3045WT	241
30CPQ045	MBR3045WT		241
30CPQ050		MBR3045WT	241
30CTQ030		MBR2545CT	198
30CTQ035	MBR2535CTL		195
30CTQ035S		MBRB2535CTL	127
30CTQ040		MBR2545CT	198
30CTQ040S		MBRB2545CT	130
30CTQ045	MBR2545CT		198
30CTQ045S		MBRB2545CT	130
30CTQ050		MBR2545CT	198
30CTQ050S		MBRB2545CT	130
30DL1	MR852		454
30DL2	MR852		454
30WQ03FN	MBRD330T4		97
30WQ04FN		MBRD350T4	97
30WQ06FN	MBRD360T4		97
31DQ03		1N5821	159
31DQ04		1N5822	159
31DQ05		MBR350	168
31DQ06		MBR360	168
31DQ09		MBR3100	171
31DQ10		MBR3100	171
32CTQ030		MBR2535CTL	195
32CTQ030S	MBRB3030CT		132
400CNQ040		MBRP40045CTL	268
400CNQ045		MBRP40045CTL	268
400DMQ045		MBRP40045CTL	268
401CMQ045		MBRP40045CTL	268
401CNQ040		MBRP40045CTL	268
401CNQ045		MBRP40045CTL	268
403CMQ100		MBRP400100CTL	278
403CNQ100		MBRP400100CTL	278
40CPQ035		MBR4045WT	248
40CPQ040		MBR4045WT	248
40CPQ045	MBR4045WT		248
40D1		MR754	484
40D2		MR754	484
40D4		MR754	484
40D6		MR760	484
40D8		MR760	484
40L15CQ	MBR4015LWT		244
40L40CW		MBR4045WT	248
40L45CW		MBR4045WT	248
42CTQ030S	MBRB4030		142

Industry Part Number	ON Semiconductor Nearest Replacement	ON Semiconductor Similar Replacement	Page
50WQ03FN		MBRD630CTT4	101
50WQ04FN		MBRD650CTT4	101
50WQ06FN		MBRD660CTT4	101
6A05		MR754	484
6A1		MR754	484
6A10		MR760	484
6A2		MR754	484
6A4		MR754	484
6A6		MR760	484
6A8		MR760	484
6CWQ03FN	MBRD630CTT4		101
6CWQ04FN		MBRD650CTT4	101
6CWQ06FN	MBRD660CTT4		101
6TQ035	MBR735		204
6TQ040		MBR745	204
6TQ045	MBR745		204
72CPQ030	MBR7030WT		NA
8TQ080		MBR1090	212
8TQ100		MBR10100	212
A114A		1N4934	452
A114B		1N4935	452
A114C		1N4936	452
A114D		1N4936	452
A114E		1N4937	452
A114F		1N4933	452
A114M		1N4937	452
A115A		MR852	454
A115B		MR852	454
A115C		MR856	454
A115D		MR856	454
A115E		MR856	454
A115F		MR852	454
A115M		MR856	454
A14A		1N4002	447
A14C		1N4004	447
A14D		1N4004	447
A14E		1N4005	447
A14F		1N4001	447
A14M		1N4005	447
A14N		1N4006	447
A14P		1N4007	447
AR25A		MR2504	463
AR25B		MR2504	463
AR25D		MR2504	463
AR25G		MR2504	463
AR25J		MR2510	463
AR25K		MR2510	463
AR25M		MR2510	463
ARS25A		MR2504	463
ARS25B		MR2504	463
ARS25D		MR2504	463
ARS25G		MR2504	463
ARS25J		MR2510	463
ARS25K		MR2510	463
ARS25M		MR2510	463
B0520LW	MBR0520LT1,T3		28

Industry Part Number	ON Semiconductor Nearest Replacement	ON Semiconductor Similar Replacement	Page
B0520W	MBR0520LT1,T3		28
B0530W	MBR0530T1,T3		31
B0540W	MBR0540T1,T3		34
B1100B	MBRS1100T3		80
B1100LB	MBRS1100T3		80
B120		MBRA130LT3	58
B120B	MBRS120T3		64
B130	MBRA130LT3		58
B130B	MBRS130LT3		67
B140	MBRA140T3		61
B140B	MBRS140LT3		76
B150		MBRA140T3	61
B150B		MBRS140T3	73
B160		MBRA140T3	61
B160B		MBRS1100T3	80
B170B		MBRS1100T3	80
B180B		MBRS1100T3	80
B190B		MBRS1100T3	80
B220A		MBRA130LT3	58
B230A		MBRA130LT3	58
B240		MBRS240LT3	87
B240A		MBRA130LT3	58
B250		MBRS240LT3	87
B250A		MBRA140T3	61
B260		MBRS1100T3	80
B260A		MBRA140T3	61
B320	MBRS320T3		94
B320A		MBRA130LT3	58
B330	MBRS330T3		94
B330A		MBRA130LT3	58
B340	MBRS340T3		94
B340A		MBRA140T3	61
B340B		MBRS240LT3	87
B350		MBRS360T3	94
B350A		MBRA140T3	61
B350B		MBRS240LT3	87
B360		MBRS360T3	94
B360A		MBRA140T3	61
B360B		MBRS1100T3	80
B520C		MBRS320T3	94
B530C		MBRS330T3	94
B540C		MBRS340T3	94
B550C		MBRS360T3	94
B560C		MBRS360T3	94
BA157	1N4936RL		452
BA158	1N4937RL		452
BY229–200	MUR820		370
BY229–400	MUR840		370
BY229–600	MUR860		370
BYP21–100		MUR820	370
BYP21–150		MUR820	370
BYP21–200		MUR820	370
BYP21–50		MUR820	370
BYP22–100		MUR3020PT	425
BYP22–150		MUR3020PT	425
BYP22–200		MUR3020PT	425

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BYP22–50		MUR3020PT	425
BY251GP	1N5402RL		449
BY252GP	1N5404RL		449
BY253GP	1N5406RL		449
BY254GP	1N5407RL		449
BYQ28–100		MUR1620CT	402
BYQ28–150		MUR1620CT	402
BYQ28–200		MUR1620CT	402
BYQ28–50		MUR1620CT	402
BYR29–600	MUR860		370
BYS92–40		MBRP20045CT	262
BYS92–45		MBRP20045CT	262
BYS92–50		MBRP20060CT	270
BYS93–40		MBRP30045CT	265
BYS93–45		MBRP30045CT	265
BYS93–50		MBRP30060CT	275
BYS95–40		MBRP20045CT	262
BYS95–45		MBRP20045CT	262
BYS95–50		MBRP20060CT	270
BYS97–40		MBRP20045CT	262
BYS97–45		MBRP20045CT	262
BYS97–50		MBRP20060CT	270
BYS98–40		MBRP20045CT	262
BYS98–45		MBRP20045CT	262
BYS98–50		MBR1545CT	174
BYT08P–1000	MUR8100E		376
BYT08P–400	MUR840		370
BYT12P–1000		MUR10120E	387
BYT28–300		MUR1660CT	402
BYT28–400		MUR1660CT	402
BYT28–500		MUR1660CT	402
BYT6P–400	MUR1640CT		402
BYT79–300		MUR1560	393
BYT79–400		MUR1560	393
BYT79–500		MUR1560	393
BYV18–35		MBR1545CT	174
BYV18–45		MBR1545CT	174
BYV19–35	MBR1045		207
BYV19–45	MBR1045		207
BYV26A		MUR120	324
BYV26B		MUR140	324
BYV26C		MUR160	324
BYV27–100		MUR120	324
BYV27–150		MUR120	324
BYV27–50		MUR120	324
BYV28–100		MUR420	350
BYV28–150		MUR420	350
BYV28–50		MBR2045CT	184
BYV29–300		MUR1560	393
BYV29–400		MUR1560	393
BYV29–500		MUR1560	393
BYV32–100		MUR1620CT	402
BYV32–150		MUR1620CT	402
BYV32–200		MUR1620CT	402
BYV32–50		MUR1620CT	402
BYV33–35	MBR2045CT		184

Industry Part Number	ON Semiconductor Nearest Replacement	ON Semiconductor Similar Replacement	Page
BYV33–40	MBR2045CT		184
BYV33–45	MBR2045CT		184
BYV39–35	MBR1645		215
BYV39–40	MBR1645		215
BYV39–45	MBR1645		215
BYV43–35		MBR2545CT	198
BYV43–40		MBR2545CT	198
BYV43–45		MBR2545CT	198
BYVB32–100		MURB1620CT	313
BYVB32–150		MURB1620CT	313
BYVB32–200		MURB1620CT	313
BYVB32–50		MURB1620CT	313
BYW29–100	MUR820		370
BYW29–150	MUR820		370
BYW29–200	MUR820		370
BYW29–50	MUR820		370
BYW4200B		MURD620CT	306
BYW51–200		MUR1620CT	402
BYW51F–200		MURF1620CT	411
BYW80–100	MUR820		370
BYW80–150	MUR820		370
BYW80–200	MUR820		370
BYW80–50	MUR820		370
BYW81P–200		MUR1520	393
BYW98–200		MUR420	350
BYW99W–200		MUR3020WT	431
CPT12035	MBRP20045CT		262
CPT12045	MBRP20045CT		262
CPT12050	MBRP20060CT		270
CPT20035	MBRP20045CT		262
CPT20045	MBRP20045CT		262
CPT20050	MBRP20060CT		270
CPT20120	MBRP20030CTL		252
CPT20125	MBRP20030CTL		252
CPT30035	MBRP30045CT		265
CPT30045	MBRP30045CT		265
CPT30050	MBRP30060CT		275
EGP10A	MUR120		324
EGP10B	MUR120		324
EGP10C	MUR120		324
EGP10D	MUR120		324
EGP10F		MUR160	324
EGP10G		MUR160	324
EGP10J		MUR160	324
EGP10K		MUR180E	329
EGP20A		MUR420	350
EGP20B		MUR420	350
EGP20C		MUR420	350
EGP20D		MUR420	350
EGP20F		MUR460	350
EGP20G		MUR460	350
EGP20J		MUR460	350
EGP20K		MUR480E	355
EGP30A	MUR420		350
EGP30B	MUR420		350
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STPS20H100CT	MBR20100CT		189
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STPS20L60CT	MBR2060CT		189
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