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Unidirectional and Bidirectional Transient Voltage Suppressor

- High Reliability controlled devices
- Economical series for thru hole mounting
- Unidirectional (A) and Bidirectional (CA) construction
- Selections for 6.8 to 400 V standoff voltages (V_{WM})

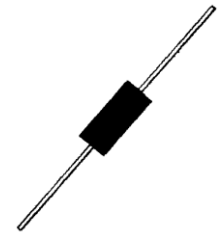
DEVICES

M1.5KE6.8A thru M1.5KE400CA, e3

LEVELS
M, MA, MX, MXL

FEATURES

- High reliability controlled devices with wafer fabrication and assembly lot traceability
- 100 % surge tested devices
- Suppresses transients up to 1500 watts @ 10/1000 μ s
- Optional upscreening available by replacing the M prefix with MA, MX or MXL. These prefixes specify various screening and conformance inspection options based on MIL-PRF-19500. Refer to [MicroNote 129](#) for more details on the screening options.
- Surface mount equivalent packages are available as MSMC(G)(J)5.0A - SMC(G)(J)170CA (consult factory for other surface mount options)
- Moisture classification is Level 1 with no dry pack required per IPC/JEDEC J-STD-020B
- RoHS Compliant devices available by adding "e3" suffix
- 3 σ lot norm screening performed on Standby Current I_D



CASE 1

APPLICATIONS / BENEFITS

- Protection from switching transients and induced RF
- Protection from ESD and EFT per IEC 61000-4-2 and IEC 61000-4-4 with fast response
- Secondary lightning protection per IEC 61000-4-5 with 42 Ohms source impedance:
 - Class 1: M1.5KE6.8A to M1.5KE200CA
 - Class 2: M1.5KE5.0A to M1.5KE180CA
 - Class 3: M1.5KE5.0A to M1.5KE91CA
 - Class 4: M1.5KE5.0A to M1.5KE43CA
- Secondary lightning protection per IEC61000-4-5 with 12 Ohms source impedance:
 - Class 1 : M1.5KE5.0A to M1.5KE110CA
 - Class 2: M1.5KE5.0A to M1.5KE56CA
 - Class 3: M1.5KE5.0A to M1.5KE27ACA
 - Class 4: M1.5KE5.0A to M1.5KE13CA
- Secondary lightning protection per IEC61000-4-5 with 2 Ohms source impedance:
 - Class 2: M1.5KE5.0A to M1.5KE24CA
 - Class 3: M1.5KE5.0A to M1.5KE12CA

MAXIMUM RATINGS

- Peak Pulse Power dissipation at 25 °C: 1500 watts at 10/1000 μ s (also see Figures 1, 2, and 3) with impulse repetition rate (duty factor) of 0.01 % or less
- $t_{clamping}$ (0 volts to V_{BR} min.): < 100 ps theoretical for unidirectional and < 5 ns for bidirectional
- Operating and Storage temperature: -65 °C to +150 °C
- Thermal Resistance: 22 °C/W junction to lead at 3/8 inch (10 mm) from body, or 82 °C/W junction to ambient when mounted on FR4 PC board with 4 mm² copper pads (1oz) and track width 1 mm, length 25 mm
- Steady-State Power dissipation: 5 watts at $T_L = 40$ °C, or 1.52 watts at $T_A = 25$ °C when mounted on FR4 PC board described for thermal resistance
- Forward Surge: 200 Amps peak impulse of 8.3 ms half-sine wave at 25°C (unidirectional only).
- Solder temperatures: 260 °C for 10 s (maximum)

MECHANICAL AND PACKAGING

- Void-free transfer molded thermosetting epoxy body meeting UL94V-0
- Tin-Lead (90 % Sn, 10 % Pb) or RoHS (100% Sn) Compliant annealed matte-Tin plating readily solderable per MIL-STD-750, method 2026
- Body marked with part number
- Cathode indicated by band. No cathode band on bi-directional devices.
- Available in bulk or custom tape-and-reel packaging
- TAPE-AND-REEL standard per EIA-296 (add "TR" suffix to part number)
- WEIGHT: 1.5 gram (approximate)

PACKAGE DIMENSIONS



NOTE: Cathode indicated by band
 All dimensions in inches
 millimeters

SYMBOLS & DEFINITIONS

| Symbol | Definition | Symbol | Definition |
|----------|---------------------------------|----------|--------------------------------|
| V_{WM} | Working Peak (Standoff) Voltage | I_{PP} | Peak Pulse Current |
| P_{PP} | Peak Pulse Power | V_C | Clamping Voltage |
| V_{BR} | Breakdown Voltage | I_{BR} | Breakdown Current for V_{BR} |
| I_D | Standby Current | | |

ELECTRICAL CHARACTERISTICS @ 25°C

| Industry Type Number (Note 2) | JEDEC Type Number | Rated Standoff Voltage V_{WM} (Note 1) | Breakdown Voltage | | Maximum Clamping Voltage V_C @ I_{FP} | Maximum Standby Current I_D @ V_{WM} | Peak Pulse Current (see Fig. 2) I_{PP} | Maximum Temperature Coefficient of V_{BR} ($\alpha_{V(BR)}$) |
|-------------------------------|-------------------|--|-------------------|----------|---|--|--|--|
| | | | V_{BR} @ | I_{BR} | | | | |
| | | | V | mA | | | | |
| M1.5KE6.8A | 1N6267A | 5.80 | 6.45 – 7.14 | 10 | 10.5 | 1000 | 143.0 | .057 |
| M1.5KE7.5A | 1N6268A | 6.40 | 7.13 – 7.88 | 10 | 11.3 | 500 | 132.0 | .061 |
| M1.5KE8.2A | 1N6269A | 7.02 | 7.79 – 8.61 | 10 | 12.1 | 200 | 124.0 | .065 |
| M1.5KE9.1A | 1N6270A | 7.78 | 8.65 – 9.55 | 1 | 13.4 | 50 | 112.0 | .068 |
| M1.5KE10A | 1N6271A | 8.55 | 9.50 – 10.50 | 1 | 14.5 | 10 | 103.0 | .073 |
| M1.5KE11A | 1N6272A | 9.40 | 10.50 – 11.60 | 1 | 15.6 | 5 | 96.0 | .075 |
| M1.5KE12A | 1N6273A | 10.220 | 11.40 – 12.60 | 1 | 16.7 | 5 | 90.0 | .078 |
| M1.5KE13A | 1N6274A | 11.10 | 12.40 – 13.70 | 1 | 18.2 | 5 | 82.0 | .081 |
| M1.5KE15A | 1N6275A | 12.80 | 14.30 – 15.80 | 1 | 21.2 | 1 | 71.0 | .084 |
| M1.5KE16A | 1N6276A | 13.60 | 15.20 – 16.80 | 1 | 22.5 | 1 | 67.0 | .086 |
| M1.5KE18A | 1N6277A | 15.30 | 17.10 – 18.90 | 1 | 25.2 | 1 | 59.5 | .088 |
| M1.5KE20A | 1N6278A | 17.10 | 19.00 – 21.00 | 1 | 27.7 | 1 | 54.0 | .090 |
| M1.5KE22A | 1N6279A | 18.80 | 20.90 – 23.10 | 1 | 30.6 | 1 | 49.0 | .092 |
| M1.5KE24A | 1N6280A | 20.50 | 22.80 – 25.20 | 1 | 33.2 | 1 | 45.0 | .094 |
| M1.5KE27A | 1N6281A | 23.10 | 25.70 – 28.40 | 1 | 37.5 | 1 | 40.0 | .096 |
| M1.5KE30A | 1N6282A | 25.60 | 28.50 – 31.50 | 1 | 41.4 | 1 | 36.0 | .097 |
| M1.5KE33A | 1N6283A | 28.20 | 31.40 – 34.70 | 1 | 45.7 | 1 | 33.0 | .098 |
| M1.5KE36A | 1N6284A | 30.80 | 34.20 – 37.80 | 1 | 49.9 | 1 | 30.0 | .099 |
| M1.5KE39A | 1N6285A | 33.30 | 37.10 – 41.00 | 1 | 53.9 | 1 | 28.0 | .100 |
| M1.5KE43A | 1N6286A | 36.80 | 40.90 – 45.20 | 1 | 59.3 | 1 | 25.3 | .101 |
| M1.5KE47A | 1N6287A | 40.20 | 44.70 – 49.40 | 1 | 64.8 | 1 | 23.2 | .101 |
| M1.5KE51A | 1N6288A | 43.60 | 48.50 – 53.60 | 1 | 70.1 | 1 | 21.4 | .102 |
| M1.5KE56A | 1N6289A | 47.80 | 53.20 – 58.80 | 1 | 77.0 | 1 | 19.5 | .103 |
| M1.5KE62A | 1N6290A | 53.00 | 58.90 – 65.10 | 1 | 85.0 | 1 | 17.7 | .104 |
| M1.5KE68A | 1N6291A | 58.10 | 64.60 – 71.40 | 1 | 92.0 | 1 | 16.3 | .104 |
| M1.5KE75A | 1N6292A | 64.10 | 71.30 – 78.80 | 1 | 103.0 | 1 | 14.6 | .105 |
| M1.5KE82A | 1N6293A | 70.10 | 77.90 – 86.10 | 1 | 113.0 | 1 | 13.3 | .105 |
| M1.5KE91A | 1N6294A | 77.80 | 86.50 – 95.50 | 1 | 125.0 | 1 | 12.0 | .106 |
| M1.5KE100A | 1N6295A | 85.50 | 95.00 – 105.00 | 1 | 137.0 | 1 | 11.0 | .106 |
| M1.5KE110A | 1N6296A | 94.00 | 105.00 – 116.00 | 1 | 152.0 | 1 | 9.9 | .107 |
| M1.5KE120A | 1N6297A | 102.00 | 114.00 – 126.00 | 1 | 165.0 | 1 | 9.1 | .107 |
| M1.5KE130A | 1N6298A | 111.00 | 124.00 – 137.00 | 1 | 179.0 | 1 | 8.4 | .107 |
| M1.5KE150A | 1N6299A | 128.00 | 143.00 – 158.00 | 1 | 207.0 | 1 | 7.2 | .108 |
| M1.5KE160A | 1N6300A | 136.00 | 152.00 – 168.00 | 1 | 219.0 | 1 | 6.8 | .108 |
| M1.5KE170A | 1N6301A | 145.00 | 162.00 – 179.00 | 1 | 234.0 | 1 | 6.4 | .108 |
| M1.5KE180A | 1N6303A | 154.00 | 171.00 – 189.00 | 1 | 246.0 | 1 | 6.1 | .108 |
| M1.5KE200A | - | 171.00 | 190.00 – 210.00 | 1 | 274.0 | 1 | 5.5 | .108 |
| M1.5KE220A | - | 185.00 | 209.00 – 231.00 | 1 | 328.0 | 1 | 4.6 | .110 |
| M1.5KE250A | - | 214.00 | 237.00 – 263.00 | 1 | 344.0 | 1 | 5.0 | .110 |
| M1.5KE300A | - | 256.00 | 285.00 – 315.00 | 1 | 414.0 | 1 | 5.0 | .111 |
| M1.5KE350A | - | 300.00 | 332.00 – 368.00 | 1 | 482.0 | 1 | 4.0 | .111 |
| M1.5KE400A | - | 324.00 | 380.00 – 420.00 | 1 | 548.0 | 1 | 4.0 | .111 |

NOTE 1: Normal selection criteria for TVS devices is by rated stand-off voltage (V_{WM}) and should be equal or greater than dc or continuous peak operating voltage.

NOTE 2: For bidirectional construction, indicate a CA as suffix after part number (e.g. M1.5KE33CA). For Bidirectional types having V_{WM} of 8 volts and under, the I_D leakage current is doubled. Bidirectional capacitance is half that shown in Figure 4 at zero volts.

NOTE 3: For unidirectional, the forward voltage (V_F) is 3.5 volts maximum at 100 Amps peak for 8.3 ms half-sine wave.

GRAPHS



FIGURE 1 – Peak Pulse Power vs. Pulse Time (t_w) in μs

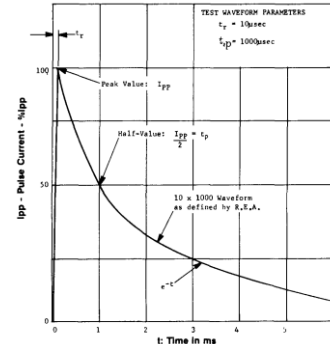


FIGURE 2 Pulse Wave Form



FIGURE 3 Derating Curve



FIGURE 4 Typical Capacitance vs. Breakdown Voltage