RoHS Available

# 400 Watt
# Transient Voltage Suppressors

*Screening in reference to MIL-PRF-19500 available*

## DESCRIPTION

This family of high-reliability, plastic packaged Transient Voltage Suppressors offer high reliability at an affordable price. Standoff voltage values range from 5.8 to 342 volts and 5% or 10% tolerance options are available. Source control is standard and three increasingly stringent screening options for enhanced reliability are available.

**Important:** For the latest information, visit our website http://www.microsemi.com.

## FEATURES

- High reliability controlled devices with wafer fabrication and assembly lot traceability.
- All devices 100% surge tested.
- Optional screening in reference to MIL-PRF-19500 is also available. Refer to High Reliability Non-Hermetic Product portfolio for more details on Microsemi screening options.
- Moisture classification is level 1 with no dry pack required per IPC/JEDEC J-STD-020B.
- 3σ lot norm screening performed on standby current ($I_D$).
- RoHS compliant versions available.

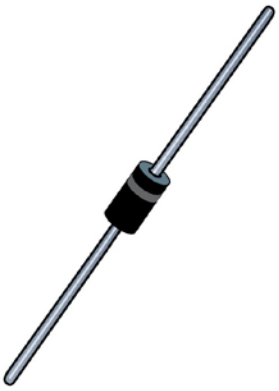
## APPLICATIONS / BENEFITS

- Suppresses transients up to 400 watts @ 10/1000 μs (see Figure 1).
- Protects sensitive components such as IC's, CMOS, Bipolar, BiCMOS, ECL, DTL, $T^2L$, etc.
- Protection from switching transients & induced RF.
- Compliant to IEC 61000-4-2 and IEC 61000-4-4 for ESD and EFT protection respectively.
- Secondary lightning protection per IEC 61000-4-5 with 42 ohms source impedance:
  - Class 1: MP4KE5.0A to MP4KE91CA
  - Class 2: MP4KE5.0A to MP4KE47ACA
  - Class 3: MP4KE5.0A to MP4KE24CA
  - Class 4: MP4KE5.0A to MP4KE12CA
- Secondary lightning protection per IEC 61000-4-5 with 12 ohms source impedance:
  - Class 1: MP4KE5.0A to MP4KE30CA
  - Class 2: MP4KE5.0A to MP4KE15CA

## MAXIMUM RATINGS

| Parameters/Test Conditions | Symbol | Value | Unit |
|---|---|---|---|
| Junction and Storage Temperature | $T_J$ and $T_{STG}$ | -65 to +150 | °C |
| Thermal Resistance, Junction to Leads @ 3/8 inch (10 mm) from body (1) | $R_{\Theta JL}$ | 50 | °C/W |
| Peak Pulse Power Dissipation @ 10/1000 μs (2) | $P_{PP}$ | 400 | W |
| Off-State Power Dissipation @ $T_L$ = +25 °C (3)<br>@ $T_A$ = +25 °C (4) | $P_D$ | 2.5<br>1.13 | W |
| Forward Voltage @ 25 °C with 8.3 ms half-sine wave (unidirectional only) | $V_F$ | 3.5 | V |
| Solder Temperature @ 10 s | $T_{SP}$ | 260 | °C |

**Notes:**
1. Or 110 °C/W junction to ambient when mounted on FR4 PC board with 4 $mm^2$ copper pads (1 oz) and track width 1 mm, length 25 mm.
2. With impulse repetition rate (duty factor) of 0.01 % or less (see Figures 1, 2 and 3 for $t_W$, waveform and derating effects).
3. At 3/8 (10 mm) lead length from body.
4. On FR4 PC board with 110C/W junction to ambient with 4 mm2 copper pads (1 oz) and track width 1 mm and length 25 mm.



**DO-41 (DO-204AL) Package**

Also available in:

**J-bend Package**
(surface mount)
MSMBJ5.0A – MSMBJ170A

**Gull-wing Package**
(surface mount)
MSMBG5.0A – MSMBG170A

**MSC – Lawrence**
6 Lake Street,
Lawrence, MA 01841
Tel: 1-800-446-1158 or
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Fax: (978) 689-0803

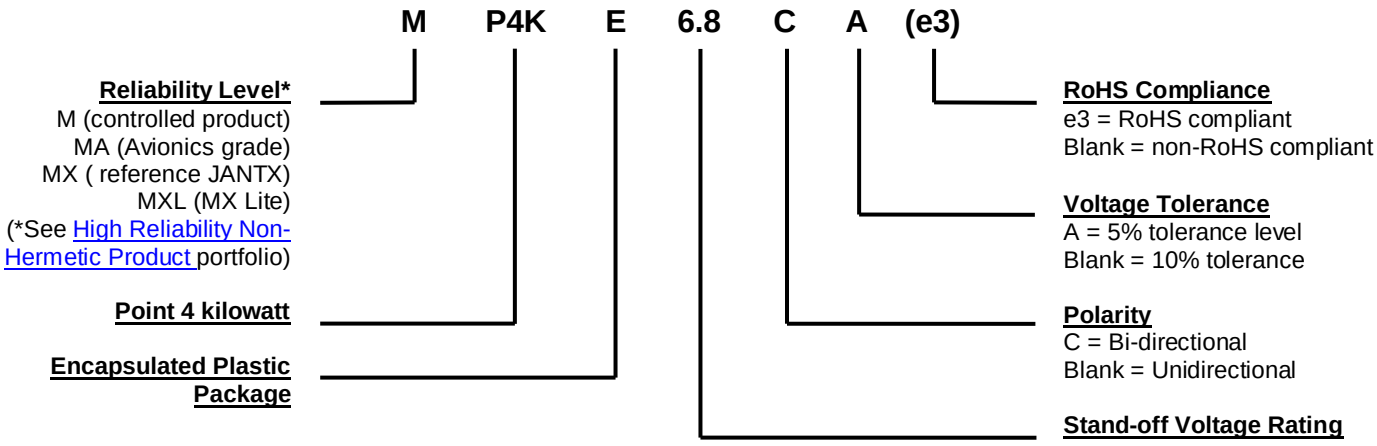
**MSC – Ireland**
Gort Road Business Park,
Ennis, Co. Clare, Ireland
Tel: +353 (0) 65 6840044
Fax: +353 (0) 65 6822298

**Website:**
www.microsemi.com

## MECHANICAL and PACKAGING

- CASE: Void-free transfer molded thermosetting epoxy body meeting UL94V-0.
- TERMINALS: Tin-lead or RoHS compliant annealed matte-tin plating. Solderable per MIL-STD-750, method 2026.
- MARKING: Part number.
- POLARITY: Cathode indicated by band. Bi-directional not marked.
- TAPE & REEL option: Standard per EIA-296 (add "TR" suffix to part number). Consult factory for quantities.
- WEIGHT: Approximately 0.3 grams.
- See Package Dimensions on last page.

## PART NOMENCLATURE




## SYMBOLS & DEFINITIONS

| Symbol | Definition |
|---|---|
| $\alpha_{V(BR)}$ | Temperature Coefficient of Breakdown Voltage: The change in breakdown voltage divided by the change in temperature that caused it expressed in %/°C or mV/°C. |
| C | Capacitance: The capacitance in pF at a frequency of 1 MHz and specified voltage |
| $I_{(BR)}$ | Breakdown Current: The current used for measuring Breakdown Voltage $V_{(BR)}$. |
| $I_D$ | Standby Current: The current through the device at rated stand-off voltage. |
| $I_{PP}$ | Peak Impulse Current: The maximum rated random recurring peak impulse current or nonrepetitive peak impulse current that may be applied to a device. A random recurring or nonrepetitive transient current is usually due to an external cause, and it is assumed that its effect will have completely disappeared before the next transient arrives. |
| $P_{PP}$ | Peak Pulse Power. The rated random recurring peak impulse power or rated nonrepetitive peak impulse power. The impulse power is the maximum-rated value of the product of $I_{PP}$ and $V_C$. |
| $V_{(BR)}$ | Breakdown Voltage: The voltage across the device at a specified current $I_{(BR)}$ in the breakdown region. |
| $V_C$ | Clamping Voltage: The voltage across the device in a region of low differential resistance during the application of an impulse current ($I_{PP}$) for a specified waveform. |
| $V_{WM}$ | Working Standoff Voltage: The maximum-rated value of dc or repetitive peak positive cathode-to-anode voltage that may be continuously applied over the standard operating temperature. |

## ELECTRICAL CHARACTERISTICS @ 25 °C

| PART NUMBER (Note 2) | WORKING STAND OFF VOLTAGE $V_{WM}$ | BREAKDOWN VOLTAGE $V_{(BR)}$ @ $I_{(BR)}$ | | | MAXIMUM CLAMPING VOLTAGE $V_C$ @ $I_{PP}$ | MAXIMUM STANDBY CURRENT $I_D$ @ $V_{WM}$ | PEAK PULSE CURRENT (see Fig. 2) $I_{PP}$ | MAXIMUM TEMPERATURE COEFFICIENT of $V_{(BR)}$ $\alpha V_{(BR)}$ |
|---|---|---|---|---|---|---|---|---|
| | Volts | MIN | MAX | mA | Volts | µA | Amps | % / °C |
| MP4KE6.8A | 5.80 | 6.45 | 7.14 | 10 | 10.5 | 500 | 38 | 0.057 |
| MP4KE7.5A | 6.40 | 7.13 | 7.88 | 10 | 11.3 | 200 | 35 | 0.061 |
| MP4KE8.2A | 7.02 | 7.79 | 8.61 | 10 | 12.1 | 100 | 33 | 0.065 |
| MP4KE9.1A | 7.78 | 8.65 | 9.55 | 1 | 13.4 | 20 | 30 | 0.068 |
| MP4KE10A | 8.55 | 9.50 | 10.5 | 1 | 14.5 | 5 | 28 | 0.073 |
| MP4KE11A | 9.40 | 10.5 | 11.6 | 1 | 15.6 | 2 | 26 | 0.075 |
| MP4KE12A | 10.2 | 11.4 | 12.6 | 1 | 16.7 | 1 | 24 | 0.078 |
| MP4KE13A | 11.1 | 12.4 | 13.7 | 1 | 18.2 | 1 | 22 | 0.081 |
| MP4KE15A | 12.8 | 14.3 | 15.8 | 1 | 21.2 | 1 | 19 | 0.084 |
| MP4KE16A | 13.6 | 15.2 | 16.8 | 1 | 22.5 | 1 | 18 | 0.086 |
| MP4KE18A | 15.3 | 17.1 | 18.0 | 1 | 25.2 | 1 | 16 | 0.088 |
| MP4KE20A | 17.1 | 19.0 | 21.0 | 1 | 27.7 | 1 | 14.5 | 0.090 |
| MP4KE22A | 18.8 | 20.9 | 23.1 | 1 | 30.6 | 1 | 13 | 0.092 |
| MP4KE24A | 20.5 | 22.8 | 25.2 | 1 | 33.2 | 1 | 12 | 0.094 |
| MP4KE27A | 23.1 | 25.7 | 28.4 | 1 | 37.5 | 1 | 11 | 0.096 |
| MP4KE30A | 25.6 | 28.5 | 31.5 | 1 | 41.4 | 1 | 9.5 | 0.097 |
| MP4KE33A | 28.2 | 31.4 | 34.7 | 1 | 45.7 | 1 | 9.0 | 0.098 |
| MP4KE36A | 30.8 | 34.2 | 37.8 | 1 | 49.9 | 1 | 8.0 | 0.099 |
| MP4KE39A | 33.3 | 37.1 | 41.0 | 1 | 53.9 | 1 | 7.5 | 0.100 |
| MP4KE43A | 36.8 | 40.9 | 45.2 | 1 | 59.3 | 1 | 7.0 | 0.101 |
| MP4KE47A | 40.2 | 44.7 | 49.4 | 1 | 64.8 | 1 | 6.2 | 0.101 |
| MP4KE51A | 43.6 | 48.5 | 53.6 | 1 | 70.1 | 1 | 5.7 | 0.102 |
| MP4KE56A | 47.8 | 53.2 | 58.8 | 1 | 77.0 | 1 | 5.2 | 0.103 |
| MP4KE62A | 53.0 | 58.9 | 65.1 | 1 | 85.0 | 1 | 4.7 | 0.104 |
| MP4KE68A | 58.1 | 64.6 | 71.4 | 1 | 92.0 | 1 | 4.4 | 0.104 |
| MP4KE75A | 64.1 | 71.3 | 78.8 | 1 | 103.0 | 1 | 3.9 | 0.105 |
| MP4KE82A | 70.1 | 77.9 | 86.1 | 1 | 113.0 | 1 | 3.5 | 0.105 |
| MP4KE91A | 77.8 | 86.5 | 95.5 | 1 | 125.0 | 1 | 3.2 | 0.106 |
| MP4KE100A | 85.5 | 95.0 | 105.0 | 1 | 137.0 | 1 | 2.9 | 0.106 |
| MP4KE110A | 94.0 | 105.0 | 116.0 | 1 | 152.0 | 1 | 2.6 | 0.107 |
| MP4KE120A | 102.0 | 114.0 | 126.0 | 1 | 165.0 | 1 | 2.4 | 0.107 |
| MP4KE130A | 111.0 | 124.0 | 137.0 | 1 | 179.0 | 1 | 2.2 | 0.107 |
| MP4KE150A | 128.0 | 143.0 | 158.0 | 1 | 207.0 | 1 | 1.95 | 0.108 |
| MP4KE160A | 136.0 | 152.0 | 168.0 | 1 | 219.0 | 1 | 1.8 | 0.108 |
| MP4KE170A | 145.0 | 162.0 | 179.0 | 1 | 234.0 | 1 | 1.7 | 0.108 |
| MP4KE180A | 154.0 | 171.0 | 189.0 | 1 | 246.0 | 1 | 1.6 | 0.108 |
| MP4KE200A | 171.0 | 190.0 | 210.0 | 1 | 274.0 | 1 | 1.5 | 0.108 |
| MP4KE220A | 185.0 | 209.0 | 231.0 | 1 | 328.0 | 1 | 1.0 | 0.110 |
| MP4KE250A | 214.0 | 237.0 | 263.0 | 1 | 344.0 | 1 | 1.0 | 0.110 |
| MP4KE300A | 256.0 | 285.0 | 315.0 | 1 | 414.0 | 1 | 1.0 | 0.110 |
| MP4KE350A | 300.0 | 333.0 | 368.0 | 1 | 482.0 | 1 | 1.0 | 0.110 |
| MP4KE400A | 342.0 | 380.0 | 420.0 | 1 | 548.0 | 1 | 1.0 | 0.110 |

**NOTE 1:** Forward Voltage ($V_F$) @ 30 amps peak, 8.3 ms sine wave equal to 3.5 volts maximum for MP4KE6.8A to 200A (excluding bidirectional).

**NOTE 2:** For bidirectional construction, indicate a CA suffix after part number. Bidirectional capacitance is half that shown in Figure 4 at zero volts.

## GRAPHS

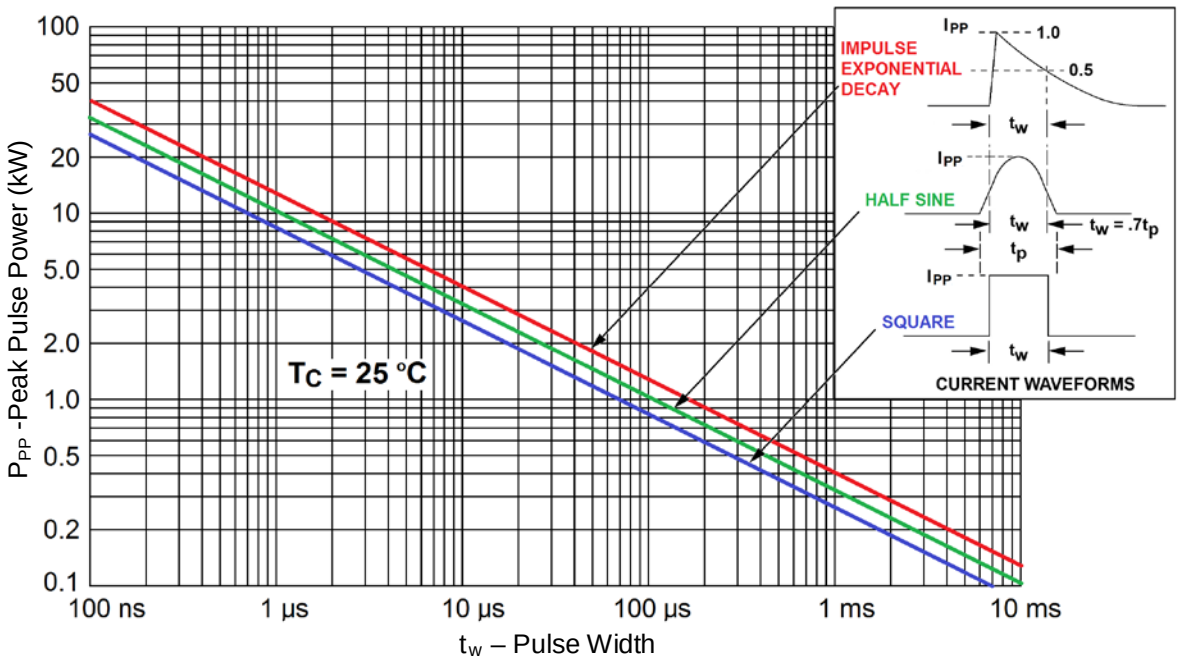



**FIGURE 1**
Peak Pulse Power vs. Pulse Time

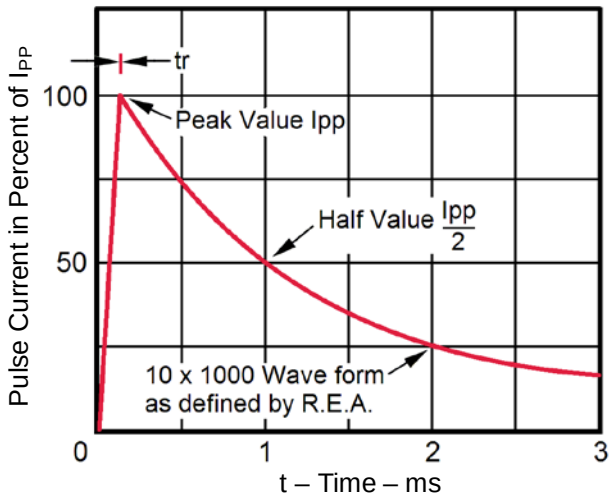



**FIGURE 2**
Pulse Waveform for Exponential Surge

## GRAPHS

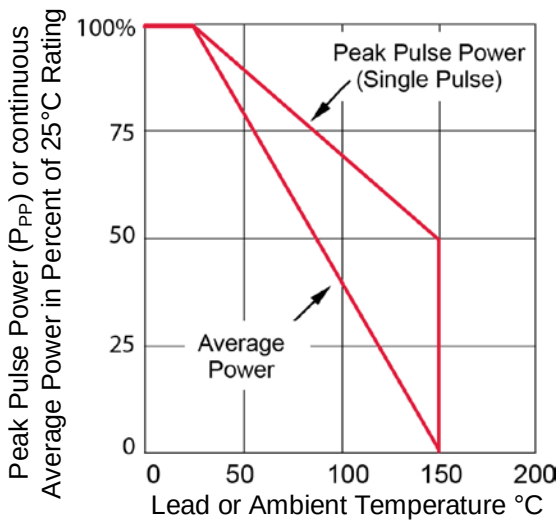



**FIGURE 3**
Derating Curve

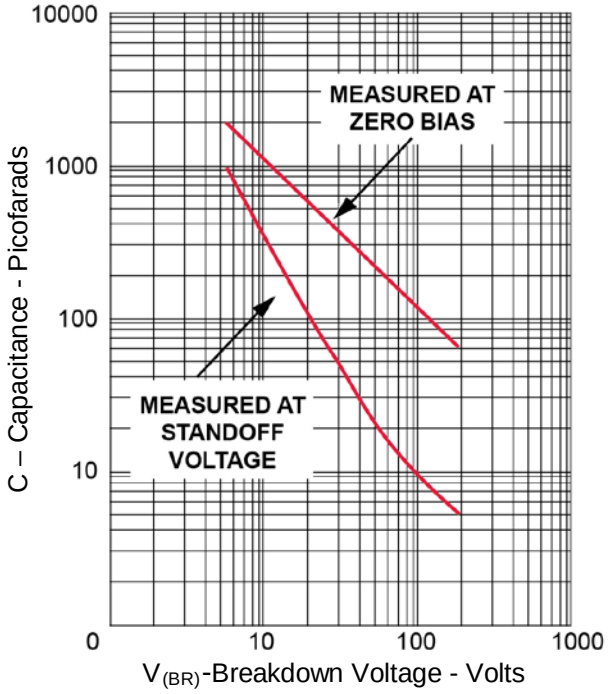
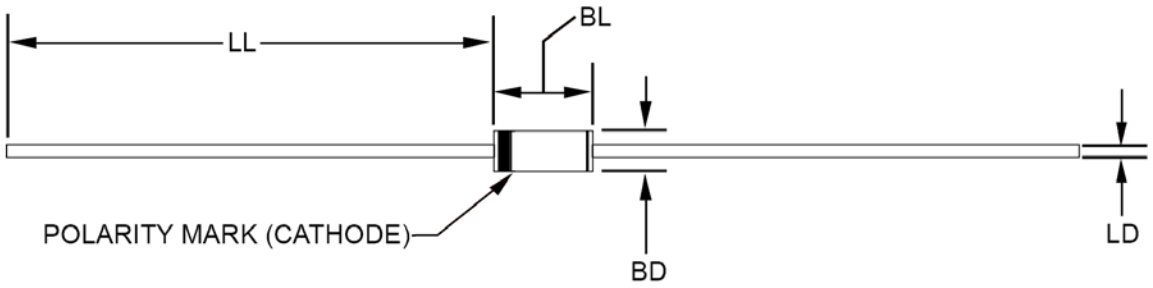



**FIGURE 4**
MP4KE Typical Capacitance vs. Breakdown Voltage (Unipolar)

## PACKAGE DIMENSIONS




**NOTES:** Cathode indicated by band.

| Dim | Dimensions | | | |
|---|---|---|---|---|
| | Inches | | Millimeters | |
| | Min | Max | Min | Max |
| **LL** | 1.00 | - | 25.4 | - |
| **BL** | - | 0.205 | - | 5.207 |
| **BD** | - | 0.107 | - | 2.72 |
| **LD** | 0.030 | 0.034 | 0.76 | 0.86 |