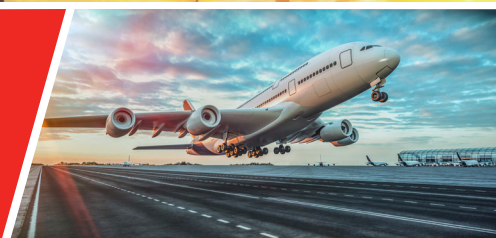




## High-Reliability Non-Hermetic TVS Products Portfolio



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## High-Reliability Non-Hermetic Transient Voltage Suppressor (TVS) Products

Standard commercial-grade semiconductor testing may not detect some types of problems such as cracked die or ionic contamination. These and other defects lead to early life failures, and screening for them is particularly important in large-die devices. Microchip's high-reliability non-hermetic/plastic products under go through an up-screening program modeled on JANxxx Military Qualification Procedures uncover these defects and reduce or eliminate the region of early life failures. The tests are defined in MIL-PRF-19500, Appendix E, Table IV.



Microchip's high-reliability program also provides for date coding and lot traceability of all devices, continuous reliability monitoring, and controlled foundry, assembly, and test locations. Customers are also provided a full Certificate of Conformance with every lot. Any product changes are made only under a process/product change notification process with the customer.

We offer 3 levels of cost effective up-screening for more robust applications, such as avionics flight hardware, where even a very low level of device mortality is unacceptable. The available screening processes are described in the accompanying tables and are defined as MA, MXL and MX screening processes. These screening processes are recommended for all robust or harsh environmental applications, and for all power levels. You do not need to create source control drawings nor define screening flows to specify these up-screening options.

**Examples: MA1.5KE48CA or MXMSMLJ43CA**

Custom flows are always available from Microchip to support application specific requirements.

Within the metal and composite shell of every jetliner, tens of thousands of sensitive semiconductor components perform critical functions from navigation to engine control. Since aircraft are struck by lightning on average once every thousand flying hours, protection of sensitive electronic devices is essential.

| Process, Screen or Test Description     | Product Assurance Level Requirement |                       |                       |                       |
|---|-------------------------------------|-----------------------|-----------------------|-----------------------|
|   | M                                   | MA                    | MXL                   | MX                    |
| 100% DC Electrical Test, Go/No-Go       | R                                   | R                     | R                     | R                     |
| 3 Sigma lot norm of key parameters      | R                                   | R                     | R                     | R                     |
| Initial Surge Test                      | 1x                                  | 1x                    | 1x                    | 1x                    |
| Post-Surge Electrical Testing           | R                                   | R                     | R                     | R                     |
| Temperature Cycling Testing             | 10 Cycles <sup>1</sup>              | 10 Cycles             | 20 Cycles             | 20 Cycles             |
| Post Temperature Cycling Surge          | 1x <sup>1</sup>                     | 3x                    | 10x                   | 10x                   |
| Pre-HTRB Electrical Test, Read & Record |                                     |                       | R                     | R                     |
| HTRB                                    |                                     | 24 hours <sup>2</sup> | 96 hours <sup>3</sup> | 96 hours <sup>3</sup> |
| Interim Electrical Test, Read & Record  |                                     |                       | R                     | R                     |
| Final Electrical Test, Read & Record    | go/no-go <sup>1</sup>               | go/no-go              | R                     | R                     |
| Delta Calculations                      |                                     |                       | R                     | R                     |
| PDA Evaluation                          |                                     |                       | R                     | R                     |
| Group A Conformance Inspection          |                                     |                       | R                     | R                     |
| Group B Conformance Inspection          |                                     |                       |                       | R                     |
| Group C Conformance Inspection          |                                     |                       |                       | R                     |
| Certificate of Conformance              | R                                   | R                     | R                     | R                     |

R - Required and performed based on MIL-PRF-19500 conditions and limits

1 - Tests performed on PLAD18KP, PLAD36KP, PLAD6.5KP and PLAD7.5KP only

2 - 24 hours for unidirectional. 24 hours each side for bidirectional.

3 - 96 hours for unidirectional. 48 hours each side for bidirectional.

# High-Reliability Non-Hermetic TVS

## TVS Diodes for Transient Voltage Protection for Avionics and Robust Environments or Applications

Microchip is a world leader in the design, fabrication, qualification and supply of Transient Voltage Suppressors (TVS). Applications include military and medical equipment, telecommunications, computers and their peripherals. Microchip also provides protection to the electronics of engine control systems in the sophisticated avionics and aerospace industries. The company offers a broad portfolio of both uni- and bi-directional discreet plastic TVS devices with power levels from 600W to 130 kW. The qualification test plans and reliability monitoring provided for all these products are in line with the best industry standard practices.

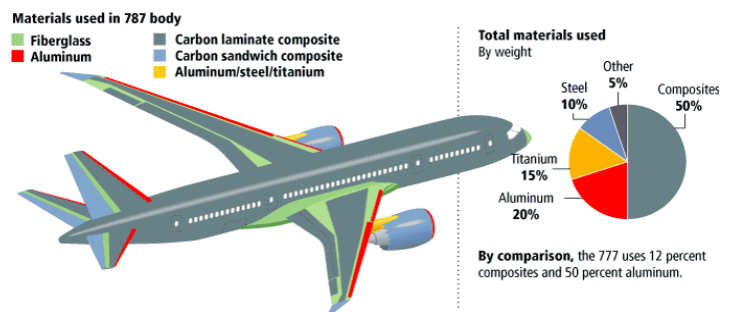


PLAD provides large exposed metal pads on the bottom of the package with excellent direct internal connection to the die.

This catalog includes an exciting expansion in Microchip's industry leading Plastic Large Area Device (PLAD) surface mount package offerings for TVS devices. PLADs provide large exposed metal pads on the bottom of the package with excellent direct internal connection to the die—there are no wire bonds. This provides a very low resistance thermal path, which is much superior to axial leaded devices and is critical in meeting the expanding requirements for multi-stroke and multi-burst event protection in composite body aircraft.

## Multi-Stroke and Multi-Burst TVS Protection

Increasing emphasis is being placed on multi-stroke and multi-burst lightning protection, particularly (but not exclusively) in the protection of the growing proportion of new aircraft being built with largely composite bodies. Test standards for these hazards are defined by RTCA standard DO-160. Microchip's high-reliability plastic PLAD packaged TVS devices are uniquely suited to address these requirements.



## Multi-Burst Test Specification



## Tutorial on TVS Component Selection

To use the TVS selection tables in this brochure, you must be able to answer the following questions:

**1. What is the continuous or repetitive peak operating voltage at the circuit location where the TVS will be placed to protect a sensitive load?**

This will determine the Working Standoff Voltage ( $V_{WM}$ ) and minimum Breakdown Voltage ( $V_{BR}$ ) required of the TVS.  $V_{WM}$  is the voltage across the TVS in its off, non-conducting state. You typically match this to the nominal working voltage of the circuit you are protecting.  $V_{BR}$  is the voltage at which avalanche breakdown begins and the TVS starts conducting.  $V_{BR}$  must be greater than the high end of the tolerance range of the operating voltage of the circuit you are protecting.

**2. What is the worst case transient waveform in peak impulse current and pulse shape the TVS needs to divert around the sensitive load?**

This will determine the Peak Surge Current ( $I_{PP}$ ) the TVS must handle, and the correct de-rating factor (if any) required due to the pulse shape. See MicroNote 120.

**3. What is the worst case peak voltage the sensitive load can withstand for the pulse duration in item #2 above?**

This will determine the minimum Clamping Voltage ( $V_C$ ) required of the TVS. This is the voltage across the TVS at the Peak Surge Current ( $I_{PP}$ ).

**4. What is the repetitive peak pulse power dissipation required?**

This will determine the Peak Pulse Power ( $P_{PP}$ ) required of the TVS. It is equal to  $I_{PP} \times V_C$ .

**5. Is the required  $V_C$  lower in value than available on the data sheet for the  $V_{WM}$  described in item #1?**

If the answer is yes, oversizing the  $P_{PP}$  selection for a given pulse condition will reduce  $V_C$  and bring it closer to  $V_{BR}$  and  $V_{WM}$ . Also see MicroNote 108.

**6. Is the pulse shape and duration different than that for which  $P_{PP}$  is specified, or is the waveform of the threat difficult to define?**

$P_{PP}$  is typically rated for one of two standard exponential waveforms – 8/20  $\mu s$  (8  $\mu s$  rise time, 20  $\mu s$  fall time to 50% of peak current) or 10/1000  $\mu s$ . Shorter or longer pulses or different pulse shapes will increase or decrease the peak power the TVS can safely dissipate. See MicroNote 125 for general recommendations regarding industry standards on protection, and MicroNote 120 for advice on adjusting for various waveforms.

# High-Reliability Non-Hermetic TVS

## Symbols and Definitions

| Symbol   | Definition   |
|----------|--|
| $V_{WM}$ | <b>Working Standoff Voltage:</b> The voltage across the TVS in its off, non-conducting state.                    |
| $V_{BR}$ | <b>Breakdown Voltage:</b> The minimum voltage at which avalanche breakdown begins and the TVS starts conducting. |
| $P_{PP}$ | <b>Peak Pulse Power:</b> The peak power that can be applied for a specific pulse width and waveform.             |
| $I_D$    | <b>Standby Current:</b> The maximum current that will flow at $V_{WM}$ .   |
| $I_{PP}$ | <b>Peak Pulse Current:</b> The peak current that can be applied for a specified pulse width and waveform.        |
| $C$      | <b>Capacitance:</b> The capacitance in picofarads of the TVS as defined and at 0V at a frequency of 1 MHz.       |

## High-Reliability TVS Component Summary

The table below summarizes the Microchip range of high-reliability TVS devices, while the images illustrate the package sizes. New families and packages will shortly be added to the product range.

| Product Family | Rated Standoff Voltage $V_{WM}$ | Minimum Breakdown Voltage $V_{BR}$ | Peak Pulse Power Rating | SMD/Axial | Package            |
|----------------|---------------------------------|------------------------------------|-------------------------|-----------|--------------------|
| MUPT           | 5.0 V–48 V                      | 6.0 V–40 V                         | 150 W                   | SMD       | DO-216AA           |
| MSMB           | 5.0 V–170 V                     | 6.4 V–189 V                        | 600 W                   | SMD       | DO-214AA, DO-215AA |
| MSMC           | 5.0 V–170 V                     | 6.4 V–189 V                        | 1.5 kW                  | SMD       | DO-214AB, DO-215AB |
| MSMCxLCE       | 6.5 V–170 V                     | 7.22 V–189 V                       | 1.5 kW                  | SMD       | DO-214AB, DO-215AB |
| MSML           | 5.0 V–170 V                     | 6.4 V–189 V                        | 3 kW                    | SMD       | DO-214AB, DO-215AB |
| MPLAD6.5KP     | 10 V–48 V                       | 11.1 V–189 V                       | 6.5 kW                  | SMD       | mini-PLAD          |
| MPLAD7.5KP     | 10 V–48 V                       | 11.1 V–189 V                       | 7.5 kW                  | SMD       | mini-PLAD          |
| MPLAD18KP      | 7.0 V–200 V                     | 7.78 V–222 V                       | 18 kW                   | SMD       | PLAD               |
| MPLAD36KP      | 14 V–400 V                      | 15.6 V–444 V                       | 36 kW                   | SMD       | PLAD               |
| MP4KE          | 5.8 V–342 V                     | 6.45 V–380 V                       | 400 W                   | Axial     | DO-41 [DO-04AL]    |
| MP6KE          | 5.8 V–171 V                     | 6.45 V–190 V                       | 600 W                   | Axial     | T-18               |
| M1.5KE         | 5.8 V–324 V                     | 6.45 V–380 V                       | 1.5 kW                  | Axial     | Case 1             |
| MLCE           | 6.5 V–170 V                     | 7.22 V–189 V                       | 1.5 kW                  | Axial     | Case 1             |
| M5KP           | 5 V–110 V                       | 6.4 V–122 V                        | 5 kW                    | Axial     | Case 5A [DO-204AR] |
| M15KP          | 22 V–280 V                      | 24.4 V–311 V                       | 15 kW                   | Axial     | Case 5A [DO-204AR] |
| MRT100KP       | 40 V–400 V                      | 44.4 V–444 V                       | 100 kW                  | Axial     | Case 5A [DO-204AR] |
| MSMBJSAC       | 5.0 V–75 V                      | 7.60 V–83.3 V                      | 500 W                   | SMD       | DO-214AA           |
| MRT130KP       | 275 V–295 V                     | 300 V                              | 130 kW                  | Axial     | Case 5A [DO-204AR] |
| MRT65KP        | 48 V–75 V                       | 53.3 V–83.3 V                      | 65 kW                   | Axial     | Case 5A [DO-204AR] |
| MDA            | 6–40 V                          | 6.67–44.4 V                        | 3000 W                  | SMD       | 16-pin Dual SIP    |

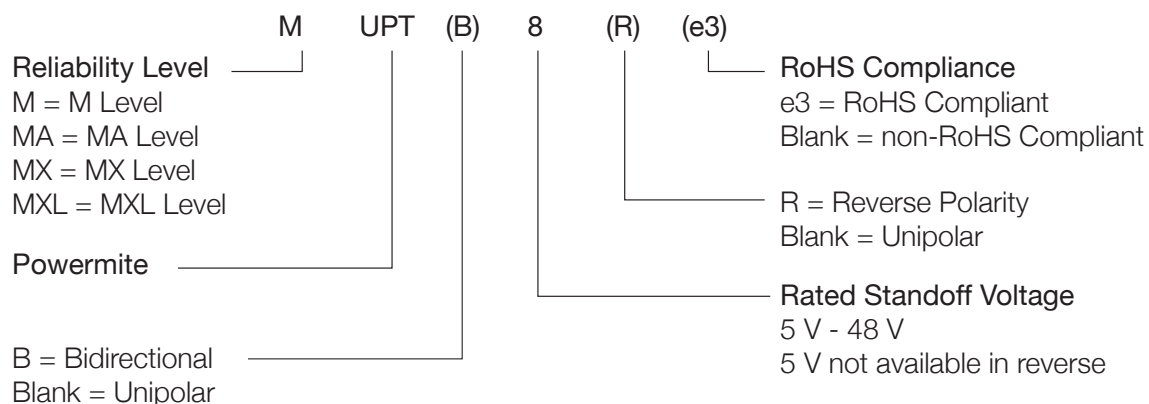


## MUPT 5V–48V Powermite1, Surface-Mount Transient Voltage Suppressors

### Features

- Powermite package with standoff voltages 5 V to 48 V.
- Both unidirectional and bidirectional polarities:
  - Anode to case bottom (MUPT5e3 thru MUPT48e3)
  - Bidirectional (MUPTB5e3 thru MUPTB48e3)
  - Reverse polarity (MUPT8Re3 thru MUPT48Re3)
- Operational and storage temperature of –55°C to +150°C
- 100% surge current testing of all parts.
- Moisture classification is Level 1 with no dry pack required per IPC/JEDEC J-STD-020B.
- Both RoHS and non-RoHS compliant versions available.

### Part Nomenclature



| Device Type     |                | Rated Standoff Voltage<br>V <sub>WM</sub> | Minimum Breakdown Voltage<br>V <sub>(BR)</sub> @ 1 mA | Maximum Standby Current<br>I <sub>D</sub> @ V <sub>WM</sub> | Maximum Peak Pulse Current*<br>I <sub>PP</sub> @ 10/1000 μS | Maximum Clamping Voltage V <sub>C</sub> @ I <sub>PP</sub> | Maximum Temperature Coefficient of V <sub>(BR)</sub><br>aV <sub>(BR)</sub> /°C |
|-----------------|----------------|---|---|---|---|---|--|
| Uni-directional | Bi-directional | V   | V   | μA  | A   | V   | %/°C   |
| MUPT5           | MUPTB5         | 5   | 6.0   | 50  | 15.7  | 9.5   | 0.030  |
| MUPT8           | MUPTB8         | 8   | 9.0   | 2   | 10.9  | 13.7  | 0.040  |
| MUPT10          | MUPTB10        | 10  | 11.0  | 2   | 8.33  | 18.0  | 0.045  |
| MUPT12          | MUPTB12        | 12  | 13.8  | 1   | 6.94  | 21.6  | 0.050  |
| MUPT15          | MUPTB15        | 15  | 16.7  | 1   | 5.77  | 26.0  | 0.055  |
| MUPT17          | MUPTB17        | 17  | 19.0  | 1   | 5.14  | 29.2  | 0.060  |
| MUPT24          | MUPTB24        | 24  | 28.4  | 1   | 3.47  | 43.2  | 0.070  |
| MUPT28          | MUPTB28        | 28  | 31.0  | 1   | 3.13  | 47.8  | 0.075  |
| MUPT33          | MUPTB33        | 33  | 36.8  | 1   | 2.65  | 56.7  | 0.080  |
| MUPT48          | MUPTB48        | 48  | 54.0  | 1   | 1.78  | 84.3  | 0.090  |

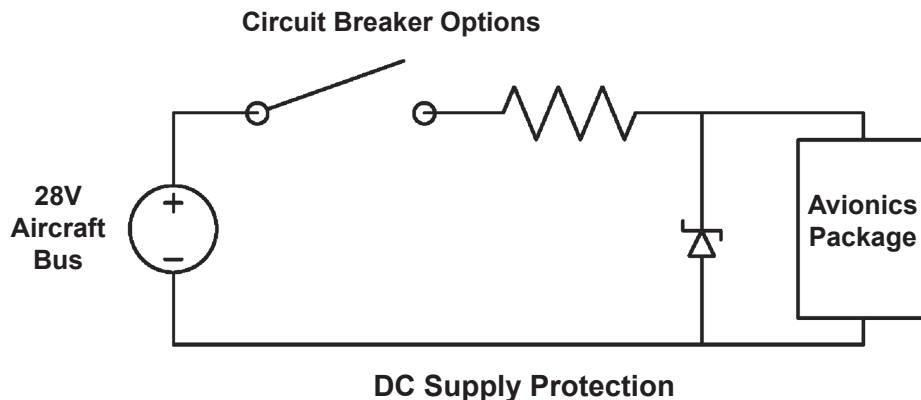
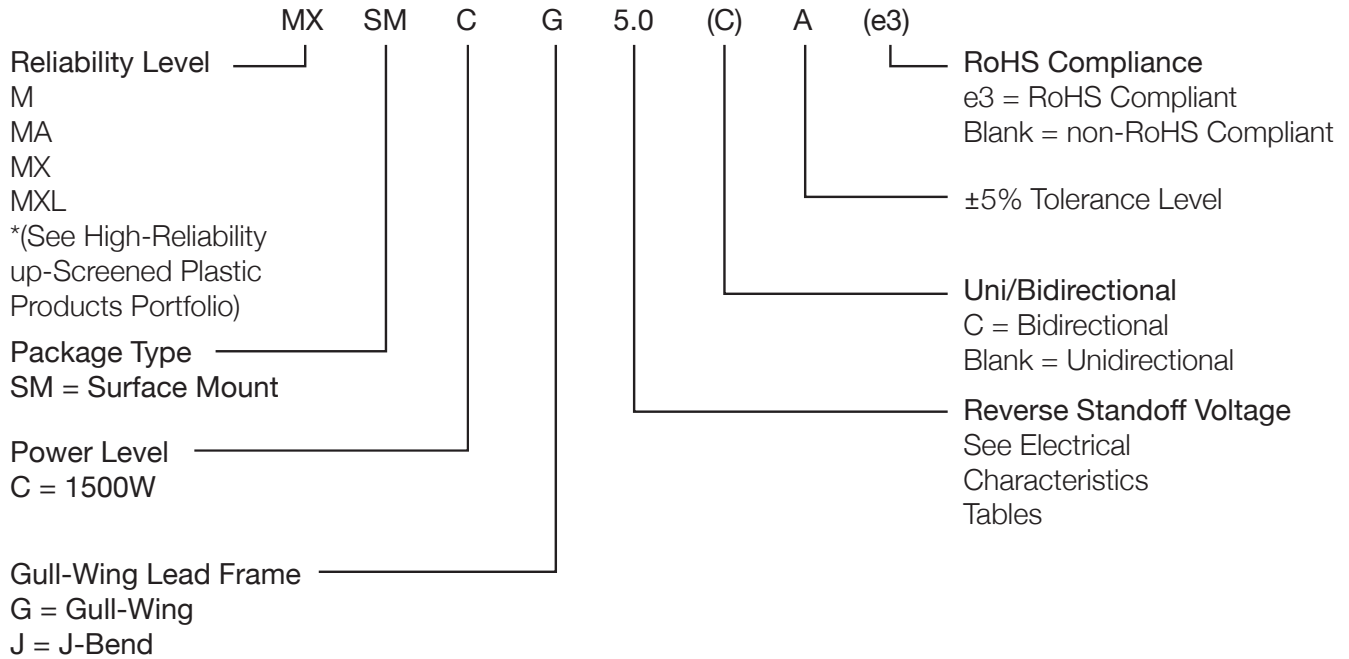


# MSMB/MSMC/MSML Surface-Mount Devices (SMDs)

## MSMx Surface-Mount Devices

| Features   | Appearance  |
|--|---|
| <ul style="list-style-type: none"> <li>Both RoHS and non-RoHS compliant versions available</li> <li>Peak pulse power at 10/1000 <math>\mu</math>S                             <ul style="list-style-type: none"> <li>MSMB series – 600 W</li> <li>MSMC series – 1500 W</li> <li>MSML series – 3000 W</li> </ul> </li> <li>100% surge current testing of all parts</li> <li>Standoff voltages of 5 V to 170 V</li> <li>Operational and storage temperature of <math>-55^{\circ}\text{C}</math> to <math>+150^{\circ}\text{C}</math></li> <li>Unidirectional and bidirectional versions available</li> <li>Available in gull-wing and modified J-lead lead forming designs</li> <li>Moisture classification is Level 1 with no dry pack required per IPC/JEDEC J-STD-020B</li> </ul> |  |

## Part Nomenclature



## MSMB 600 Watt, All Electrical Characteristics @ 25°C

| Type Number | Reverse Stand-Off Voltage<br>$V_{WM}$<br>Volts | Minimum Breakdown Voltage<br>$V_{BR}$ Min @ $I_{BR}$<br>Volts | Breakdown Current<br>$I_{BR}$<br>mA | Maximum Clamping Voltage @ $I_{PP}$ Vc<br>Volts | Peak Pulse Current<br>$I_{PP}$ Amps | Maximum Standby Current @ $V_{WM}$ Id<br>$\mu$ A |
|-------------|--|---|-------------------------------------|---|-------------------------------------|--|
| MSMBx5.0A   | 5.0  | 6.40  | 10                                  | 9.2   | 65.2                                | 800  |
| MSMBx6.0A   | 6.0  | 6.67  | 10                                  | 10.3  | 58.3                                | 800  |
| MSMBx6.5A   | 6.5  | 7.22  | 10                                  | 11.2  | 53.6                                | 500  |
| MSMBx7.0A   | 7.0  | 7.78  | 10                                  | 12.0  | 50.0                                | 200  |
| MSMBx7.5A   | 7.5  | 8.33  | 1                                   | 12.9  | 46.5                                | 100  |
| MSMBx8.0A   | 8.0  | 8.89  | 1                                   | 13.6  | 44.1                                | 50   |
| MSMBx8.5A   | 8.5  | 9.44  | 1                                   | 14.4  | 41.7                                | 10   |
| MSMBx9.0A   | 9.0  | 10.0  | 1                                   | 15.4  | 39.0                                | 5  |
| MSMBx10A    | 10   | 11.1  | 1                                   | 17.0  | 35.3                                | 5  |
| MSMBx11A    | 11   | 12.2  | 1                                   | 18.2  | 33.0                                | 5  |
| MSMBx12A    | 12   | 13.3  | 1                                   | 19.9  | 30.2                                | 5  |
| MSMBx13A    | 13   | 14.4  | 1                                   | 21.5  | 27.9                                | 1  |
| MSMBx14A    | 14   | 15.6  | 1                                   | 23.2  | 25.8                                | 1  |
| MSMBx15A    | 15   | 16.7  | 1                                   | 24.4  | 24.0                                | 1  |
| MSMBx16A    | 16   | 17.8  | 1                                   | 26.0  | 23.1                                | 1  |
| MSMBx17A    | 17   | 18.9  | 1                                   | 27.6  | 21.7                                | 1  |
| MSMBx18A    | 18   | 20.0  | 1                                   | 29.2  | 20.5                                | 1  |
| MSMBx20A    | 20   | 22.2  | 1                                   | 32.4  | 18.5                                | 1  |
| MSMBx22A    | 22   | 24.4  | 1                                   | 35.5  | 16.9                                | 1  |
| MSMBx24A    | 24   | 26.7  | 1                                   | 38.9  | 15.4                                | 1  |
| MSMBx26A    | 26   | 28.9  | 1                                   | 42.1  | 14.2                                | 1  |
| MSMBx28A    | 28   | 31.1  | 1                                   | 45.4  | 13.2                                | 1  |
| MSMBx30A    | 30   | 33.3  | 1                                   | 48.4  | 12.4                                | 1  |
| MSMBx33A    | 33   | 36.7  | 1                                   | 53.3  | 11.3                                | 1  |
| MSMBx36A    | 36   | 40.0  | 1                                   | 58.1  | 10.3                                | 1  |
| MSMBx40A    | 40   | 44.4  | 1                                   | 64.5  | 9.3                                 | 1  |
| MSMBx43A    | 43   | 47.8  | 1                                   | 69.4  | 8.6                                 | 1  |
| MSMBx45A    | 45   | 50.0  | 1                                   | 72.7  | 8.3                                 | 1  |
| MSMBx48A    | 48   | 53.3  | 1                                   | 77.4  | 7.7                                 | 1  |
| MSMBx51A    | 51   | 56.7  | 1                                   | 82.4  | 7.3                                 | 1  |
| MSMBx54A    | 54   | 60.0  | 1                                   | 87.1  | 6.9                                 | 1  |
| MSMBx58A    | 58   | 64.4  | 1                                   | 93.6  | 6.4                                 | 1  |
| MSMBx60A    | 60   | 66.7  | 1                                   | 96.8  | 6.2                                 | 1  |
| MSMBx64A    | 64   | 71.1  | 1                                   | 103   | 5.8                                 | 1  |
| MSMBx70A    | 70   | 77.8  | 1                                   | 113   | 5.3                                 | 1  |
| MSMBx75A    | 75   | 83.3  | 1                                   | 121   | 4.9                                 | 1  |
| MSMBx78A    | 78   | 86.7  | 1                                   | 126   | 4.7                                 | 1  |
| MSMBx85A    | 85   | 94.4  | 1                                   | 137   | 4.4                                 | 1  |
| MSMBx90A    | 90   | 100   | 1                                   | 146   | 4.1                                 | 1  |
| MSMBx100A   | 100  | 111   | 1                                   | 162   | 3.7                                 | 1  |
| MSMBx110A   | 110  | 122   | 1                                   | 177   | 3.4                                 | 1  |
| MSMBx120A   | 120  | 133   | 1                                   | 193   | 3.1                                 | 1  |
| MSMBx130A   | 130  | 144   | 1                                   | 209   | 2.9                                 | 1  |
| MSMBx150A   | 150  | 167   | 1                                   | 243   | 2.5                                 | 1  |
| MSMBx160A   | 160  | 178   | 1                                   | 259   | 2.3                                 | 1  |
| MSMBx170A   | 170  | 189   | 1                                   | 275   | 2.2                                 | 1  |

### Pad Layout



| MSMBJ (DO-214AA) |        |      |
|------------------|--------|------|
|                  | Inches | mm   |
| <b>A</b>         | 0.260  | 6.60 |
| <b>B</b>         | 0.085  | 2.16 |
| <b>C</b>         | 0.110  | 2.79 |

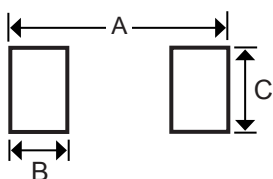
| MSMBG (DO-215AA) |        |      |
|------------------|--------|------|
|                  | Inches | mm   |
| <b>A</b>         | 0.320  | 8.13 |
| <b>B</b>         | 0.085  | 2.16 |
| <b>C</b>         | 0.110  | 2.79 |

# MSMC Surface-Mount Devices

## MSMC 1.5 kW, All Electrical Characteristics @ 25°C

| Type Number | Reverse Stand-Off Voltage<br>$V_{WM}$<br>Volts | Minimum Breakdown Voltage<br>$V_{BR}$ Min. @ I <sub>BR</sub><br>Volts | Breakdown Current<br>I <sub>BR</sub><br>mA | Maximum Clamping Voltage<br>@ I <sub>PP</sub> V <sub>C</sub><br>Volts | Peak Pulse Current<br>I <sub>PP</sub><br>Amps | Maximum Standby Current<br>@ $V_{WM}$ I <sub>D</sub><br>mA |
|-------------|--|---|--|---|---|--|
| MSMCx5.0A   | 5.0  | 6.40  | 10   | 9.2   | 163.0   | 1000   |
| MSMCx6.0A   | 6.0  | 6.67  | 10   | 10.3  | 145.6   | 1000   |
| MSMCx6.5A   | 6.5  | 7.22  | 10   | 11.2  | 133.9   | 500  |
| MSMCx7.0A   | 7.0  | 7.78  | 10   | 12.0  | 125.0   | 200  |
| MSMCx7.5A   | 7.5  | 8.33  | 1  | 12.9  | 116.3   | 100  |
| MSMCx8.0A   | 8.0  | 8.89  | 1  | 13.6  | 110.3   | 50   |
| MSMCx8.5A   | 8.5  | 9.44  | 1  | 14.4  | 104.2   | 20   |
| MSMCx9.0A   | 9.0  | 10.0  | 1  | 15.4  | 97.4  | 10   |
| MSMCx10A    | 10   | 11.1  | 1  | 17.0  | 88.2  | 5  |
| MSMCx11A    | 11   | 12.2  | 1  | 18.2  | 82.4  | 5  |
| MSMCx12A    | 12   | 13.3  | 1  | 19.9  | 75.3  | 5  |
| MSMCx13A    | 13   | 14.4  | 1  | 21.5  | 69.7  | 1  |
| MSMCx14A    | 14   | 15.6  | 1  | 23.2  | 64.7  | 1  |
| MSMCx15A    | 15   | 16.7  | 1  | 24.4  | 61.5  | 1  |
| MSMCx16A    | 16   | 17.8  | 1  | 26.0  | 57.7  | 1  |
| MSMCx17A    | 17   | 18.9  | 1  | 27.6  | 53.3  | 1  |
| MSMCx18A    | 18   | 20.0  | 1  | 29.2  | 51.4  | 1  |
| MSMCx20A    | 20   | 22.2  | 1  | 32.4  | 46.3  | 1  |
| MSMCx22A    | 22   | 24.4  | 1  | 35.5  | 42.2  | 1  |
| MSMCx24A    | 24   | 26.7  | 1  | 38.9  | 38.6  | 1  |
| MSMCx26A    | 26   | 28.9  | 1  | 42.1  | 35.6  | 1  |
| MSMCx28A    | 28   | 31.1  | 1  | 45.4  | 33.0  | 1  |
| MSMCx30A    | 30   | 33.3  | 1  | 48.4  | 31.0  | 1  |
| MSMCx33A    | 33   | 36.7  | 1  | 53.3  | 28.1  | 1  |
| MSMCx36A    | 36   | 40.0  | 1  | 58.1  | 25.8  | 1  |
| MSMCx40A    | 40   | 44.4  | 1  | 64.5  | 23.2  | 1  |
| MSMCx43A    | 43   | 47.8  | 1  | 69.4  | 21.6  | 1  |
| MSMCx45A    | 45   | 50.0  | 1  | 72.7  | 20.6  | 1  |
| MSMCx48A    | 48   | 53.3  | 1  | 77.4  | 19.4  | 1  |
| MSMCx51A    | 51   | 56.7  | 1  | 82.4  | 18.2  | 1  |
| MSMCx54A    | 54   | 60.0  | 1  | 87.1  | 17.2  | 1  |
| MSMCx58A    | 58   | 64.4  | 1  | 93.6  | 16.0  | 1  |
| MSMCx60A    | 60   | 66.7  | 1  | 96.8  | 15.5  | 1  |
| MSMCx64A    | 64   | 71.1  | 1  | 103.0   | 14.6  | 1  |
| MSMCx70A    | 70   | 77.8  | 1  | 113   | 13.3  | 1  |
| MSMCx75A    | 75   | 83.3  | 1  | 121   | 12.4  | 1  |
| MSMCx78A    | 78   | 86.7  | 1  | 126   | 11.4  | 1  |
| MSMCx85A    | 85   | 94.4  | 1  | 137   | 10.4  | 1  |
| MSMCx90A    | 90   | 100   | 1  | 146   | 10.3  | 1  |
| MSMCx100A   | 100  | 111   | 1  | 162   | 9.3   | 1  |
| MSMCx110A   | 110  | 122   | 1  | 177   | 8.4   | 1  |
| MSMCx120A   | 120  | 133   | 1  | 193   | 7.8   | 1  |
| MSMCx130A   | 130  | 144   | 1  | 209   | 7.2   | 1  |
| MSMCx150A   | 150  | 167   | 1  | 243   | 6.2   | 1  |
| MSMCx160A   | 160  | 178   | 1  | 259   | 5.8   | 1  |
| MSMCx170A   | 170  | 189   | 1  | 275   | 5.5   | 1  |

## PAD Layout



| MSMCJ (DO-214AB) |        |      |
|------------------|--------|------|
|                  | Inches | mm   |
| A                | 0.390  | 9.90 |
| B                | 0.110  | 2.79 |
| C                | 0.150  | 3.81 |

| MSMCG (DO-215AB) |        |       |
|------------------|--------|-------|
|                  | Inches | mm    |
| A                | 0.510  | 12.95 |
| B                | 0.110  | 2.79  |
| C                | 0.150  | 3.81  |

**MSML 3 kW, All Electrical Characteristics @ 25°C**

| Type Number | Reverse Stand-Off Voltage<br>$V_{WM}$<br>Volts | Minimum Breakdown Voltage<br>$V_{BR}$ Min. @ $I_{BR}$<br>Volts | Breakdown Current<br>$I_{BR}$<br>mA | Maximum Clamping Voltage<br>@ $I_{PP}$ $V_C$<br>Volts | Peak Pulse Current<br>$I_{PP}$<br>Amps | Maximum Standby Current<br>@ $V_{WM}$ $I_D$<br>mA |
|-------------|--|--|-------------------------------------|---|--|---|
| MSMLx5.0A   | 5.0  | 6.40   | 10                                  | 9.2   | 326.0                                  | 1000  |
| MSMLx6.0A   | 6.0  | 6.67   | 10                                  | 10.3  | 291.3                                  | 1000  |
| MSMLx6.5A   | 6.5  | 7.22   | 10                                  | 11.2  | 267.9                                  | 500   |
| MSMLx7.0A   | 7.0  | 7.78   | 10                                  | 12.0  | 250.0                                  | 200   |
| MSMLx7.5A   | 7.5  | 8.33   | 1                                   | 12.9  | 232.6                                  | 100   |
| MSMLx8.0A   | 8.0  | 8.89   | 1                                   | 13.6  | 220.6                                  | 50  |
| MSMLx8.5A   | 8.5  | 9.44   | 1                                   | 14.4  | 208.4                                  | 25  |
| MSMLx9.0A   | 9.0  | 10.0   | 1                                   | 15.4  | 194.8                                  | 10  |
| MSMLx10A    | 10   | 11.1   | 1                                   | 17.0  | 176.4                                  | 5   |
| MSMLx11A    | 11   | 12.2   | 1                                   | 18.2  | 164.8                                  | 5   |
| MSMLx12A    | 12   | 13.3   | 1                                   | 19.9  | 150.6                                  | 5   |
| MSMLx13A    | 13   | 14.4   | 1                                   | 21.5  | 139.4                                  | 5   |
| MSMLx14A    | 14   | 15.6   | 1                                   | 23.2  | 129.4                                  | 2   |
| MSMLx15A    | 15   | 16.7   | 1                                   | 24.4  | 123.0                                  | 2   |
| MSMLx16A    | 16   | 17.8   | 1                                   | 26.0  | 115.4                                  | 2   |
| MSMLx17A    | 17   | 18.9   | 1                                   | 27.6  | 106.6                                  | 2   |
| MSMLx18A    | 18   | 20.0   | 1                                   | 29.2  | 102.8                                  | 2   |
| MSMLx20A    | 20   | 22.2   | 1                                   | 32.4  | 92.6                                   | 2   |
| MSMLx22A    | 22   | 24.4   | 1                                   | 35.5  | 84.4                                   | 2   |
| MSMLx24A    | 24   | 26.7   | 1                                   | 38.9  | 77.2                                   | 2   |
| MSMLx26A    | 26   | 28.9   | 1                                   | 42.1  | 71.2                                   | 2   |
| MSMLx28A    | 28   | 31.1   | 1                                   | 45.4  | 66.0                                   | 2   |
| MSMLx30A    | 30   | 33.3   | 1                                   | 48.4  | 62.0                                   | 2   |
| MSMLx33A    | 33   | 36.7   | 1                                   | 53.3  | 56.2                                   | 2   |
| MSMLx36A    | 36   | 40.0   | 1                                   | 58.1  | 51.6                                   | 2   |
| MSMLx40A    | 40   | 44.4   | 1                                   | 64.5  | 46.4                                   | 2   |
| MSMLx43A    | 43   | 47.8   | 1                                   | 69.4  | 43.2                                   | 2   |
| MSMLx45A    | 45   | 50.0   | 1                                   | 72.7  | 41.2                                   | 2   |
| MSMLx48A    | 48   | 53.3   | 1                                   | 77.4  | 38.8                                   | 2   |
| MSMLx51A    | 51   | 56.7   | 1                                   | 82.4  | 36.4                                   | 2   |
| MSMLx54A    | 54   | 60.0   | 1                                   | 87.1  | 34.4                                   | 2   |
| MSMLx58A    | 58   | 64.4   | 1                                   | 93.6  | 32.0                                   | 2   |
| MSMLx60A    | 60   | 66.7   | 1                                   | 96.8  | 31.0                                   | 2   |
| MSMLx64A    | 64   | 71.1   | 1                                   | 103   | 29.2                                   | 2   |
| MSMLx70A    | 70   | 77.8   | 1                                   | 113   | 26.6                                   | 2   |
| MSMLx75A    | 75   | 83.3   | 1                                   | 121   | 24.8                                   | 2   |
| MSMLx78A    | 78   | 86.7   | 1                                   | 126   | 22.8                                   | 2   |
| MSMLx85A    | 85   | 94.4   | 1                                   | 137   | 20.8                                   | 2   |
| MSMLx90A    | 90   | 100  | 1                                   | 146   | 20.6                                   | 2   |
| MSMLx100A   | 100  | 111  | 1                                   | 162   | 18.6                                   | 2   |
| MSMLx110A   | 110  | 122  | 1                                   | 177   | 16.8                                   | 2   |
| MSMLx120A   | 120  | 133  | 1                                   | 193   | 15.6                                   | 2   |
| MSMLx130A   | 130  | 144  | 1                                   | 209   | 14.4                                   | 2   |
| MSMLx150A   | 150  | 167  | 1                                   | 243   | 12.4                                   | 2   |
| MSMLx160A   | 160  | 178  | 1                                   | 259   | 11.6                                   | 2   |
| MSMLx170A   | 170  | 189  | 1                                   | 275   | 11.0                                   | 2   |

**PAD Layout**


| MSMLJ (DO-214AB) |        |      |
|------------------|--------|------|
|                  | Inches | mm   |
| A                | 0.390  | 9.90 |
| B                | 0.110  | 2.79 |
| C                | 0.150  | 3.81 |

| MSMLG (DO-215AB) |        |       |
|------------------|--------|-------|
|                  | Inches | mm    |
| A                | 0.510  | 12.95 |
| B                | 0.110  | 2.79  |
| C                | 0.150  | 3.81  |

# MSMCxLCE Surface-Mount Devices

## MSMCxLCE Low Capacitance 1.5 kW SMDs

| Features   | Appearance  |
|--|---|
| <ul style="list-style-type: none"> <li>Both RoHS and non-RoHS compliant versions available</li> <li>1500W peak pulse power at 10/1000 <math>\mu</math>S</li> <li>Standoff voltages of 6.5 V to 170 V</li> <li>Operational and storage temperature of <math>-55^{\circ}\text{C}</math> to <math>+150^{\circ}\text{C}</math></li> <li>Unidirectional versions only</li> <li>Available in Gull-Wing and modified J-lead lead forming designs</li> <li>Uses a rectifier diode in series and in the opposite direction of the protection diode to lower device capacitance</li> <li>Moisture classification is Level 1 with no dry pack required per IPC/JEDEC J-STD-020B</li> <li>100% surge current testing of all parts</li> </ul> |  |

## Part Nomenclature



## Sample Part Number

MXSMCJLCE6.5Ae3 - MX screened surface mount 1.5 kW device, J bend, 6.5 V stand-off, unidirectional low capacitance, 5% tolerance and RoHS compliant.



TVS with internal low-capacitance rectifier diode



Optional Unidirectional configuration (TVS and separate rectifier diode in parallel)



Optional Bidirectional configuration (two TVS devices in parallel)

## MSMCxLCE 1.5 kW, All Electrical Characteristics @ 25°C

| Type Number  | Reverse Stand-Off Voltage $V_{WM}$ Volts | Minimum Breakdown Voltage $V_{BR}$ Min @ $I_{BR}$ Volts | Breakdown Current $I_{BR}$ mA | Maximum Clamping Voltage @ $I_{PP}$ $V_c$ Volts | Peak Pulse Current $I_{PP}$ Amps | Maximum Standby Current @ $V_{WM}$ $I_d$ mA | Max Cap @ 0 Volts $F=1$ MHz pF | Working Inverse Blocking Voltage $V_{WIB}$ Volts | Inverse Blocking Leakage Current $I_{IB}$ mA | Peak Inverse Blocking Voltage $V_{PIB}$ Volts |
|--------------|--|---|-------------------------------|---|----------------------------------|---|--------------------------------|--|--|---|
| MSMCxLCE6.5A | 6.5                                      | 7.22  | 10                            | 11.2  | 100                              | 1000  | 100                            | 75   | 10   | 100   |
| MSMCxLCE7.0A | 7.0                                      | 7.78  | 10                            | 12.0  | 100                              | 500   | 100                            | 75   | 10   | 100   |
| MSMCxLCE7.5A | 7.5                                      | 8.33  | 10                            | 12.9  | 100                              | 250   | 100                            | 75   | 10   | 100   |
| MSMCxLCE8.0A | 8.0                                      | 8.89  | 1                             | 13.6  | 100                              | 100   | 100                            | 75   | 10   | 100   |
| MSMCxLCE8.5A | 8.5                                      | 9.44  | 1                             | 14.4  | 100                              | 50  | 100                            | 75   | 10   | 100   |
| MSMCxLCE9.0A | 9.0                                      | 10.0  | 1                             | 15.4  | 97                               | 10  | 100                            | 75   | 10   | 100   |
| MSMCxLCE10A  | 10                                       | 11.1  | 1                             | 17.0  | 88                               | 5   | 100                            | 75   | 10   | 100   |
| MSMCxLCE11A  | 11                                       | 12.2  | 1                             | 18.2  | 82                               | 5   | 100                            | 75   | 10   | 100   |
| MSMCxLCE12A  | 12                                       | 13.3  | 1                             | 19.9  | 75                               | 5   | 100                            | 75   | 10   | 100   |
| MSMCxLCE13A  | 13                                       | 14.4  | 1                             | 21.5  | 70                               | 5   | 100                            | 75   | 10   | 100   |
| MSMCxLCE14A  | 14                                       | 15.6  | 1                             | 23.2  | 65                               | 5   | 100                            | 75   | 10   | 100   |
| MSMCxLCE15A  | 15                                       | 16.7  | 1                             | 24.4  | 61                               | 5   | 100                            | 75   | 10   | 100   |
| MSMCxLCE16A  | 16                                       | 17.8  | 1                             | 26.0  | 57                               | 5   | 100                            | 75   | 10   | 100   |
| MSMCxLCE17A  | 17                                       | 18.9  | 1                             | 27.6  | 49                               | 5   | 100                            | 75   | 10   | 100   |
| MSMCxLCE18A  | 18                                       | 20.0  | 1                             | 29.2  | 51                               | 5   | 100                            | 75   | 10   | 100   |
| MSMCxLCE20A  | 20                                       | 22.2  | 1                             | 32.4  | 46                               | 5   | 100                            | 75   | 10   | 100   |
| MSMCxLCE22A  | 22                                       | 24.4  | 1                             | 35.5  | 42                               | 5   | 100                            | 75   | 10   | 100   |
| MSMCxLCE24A  | 24                                       | 26.7  | 1                             | 38.9  | 39                               | 5   | 100                            | 75   | 10   | 100   |
| MSMCxLCE26A  | 26                                       | 28.9  | 1                             | 42.1  | 36                               | 5   | 100                            | 75   | 10   | 100   |
| MSMCxLCE28A  | 28                                       | 31.1  | 1                             | 45.5  | 33                               | 5   | 100                            | 75   | 10   | 100   |
| MSMCxLCE30A  | 30                                       | 33.3  | 1                             | 48.4  | 31                               | 5   | 100                            | 75   | 10   | 100   |
| MSMCxLCE33A  | 33                                       | 36.7  | 1                             | 53.3  | 28.1                             | 5   | 100                            | 75   | 10   | 100   |
| MSMCxLCE36A  | 36                                       | 40.0  | 1                             | 58.1  | 25.8                             | 5   | 100                            | 75   | 10   | 100   |
| MSMCxLCE40A  | 40                                       | 44.4  | 1                             | 64.5  | 23.3                             | 5   | 100                            | 75   | 10   | 100   |
| MSMCxLCE43A  | 43                                       | 47.8  | 1                             | 69.4  | 21.6                             | 5   | 100                            | 150  | 10   | 200   |
| MSMCxLCE45A  | 45                                       | 50.0  | 1                             | 72.7  | 20.6                             | 5   | 100                            | 150  | 10   | 200   |
| MSMCxLCE48A  | 48                                       | 53.3  | 1                             | 77.4  | 19.4                             | 5   | 100                            | 150  | 10   | 200   |
| MSMCxLCE51A  | 51                                       | 56.7  | 1                             | 82.4  | 18.2                             | 5   | 100                            | 150  | 10   | 200   |
| MSMCxLCE54A  | 54                                       | 60.0  | 1                             | 87.1  | 17.2                             | 5   | 100                            | 150  | 10   | 200   |
| MSMCxLCE58A  | 58                                       | 64.4  | 1                             | 93.6  | 16.0                             | 5   | 100                            | 150  | 10   | 200   |
| MSMCxLCE60A  | 60                                       | 66.7  | 1                             | 96.8  | 15.5                             | 5   | 90                             | 150  | 10   | 200   |
| MSMCxLCE64A  | 64                                       | 71.1  | 1                             | 103   | 14.6                             | 5   | 90                             | 150  | 10   | 200   |
| MSMCxLCE70A  | 70                                       | 77.8  | 1                             | 113   | 13.3                             | 5   | 90                             | 150  | 10   | 200   |
| MSMCxLCE75A  | 75                                       | 83.3  | 1                             | 121   | 12.4                             | 5   | 90                             | 150  | 10   | 200   |
| MSMCxLCE80A  | 80                                       | 88.7  | 1                             | 129   | 11.6                             | 5   | 90                             | 150  | 10   | 200   |
| MSMCxLCE90A  | 90                                       | 100   | 1                             | 146   | 10.3                             | 5   | 90                             | 300  | 10   | 200   |
| MSMCxLCE100A | 100                                      | 111   | 1                             | 162   | 9.3                              | 5   | 90                             | 300  | 10   | 200   |
| MSMCxLCE110A | 110                                      | 122   | 1                             | 178   | 8.4                              | 5   | 90                             | 300  | 10   | 400   |
| MSMCxLCE120A | 120                                      | 133   | 1                             | 193   | 7.8                              | 5   | 90                             | 300  | 10   | 400   |
| MSMCxLCE130A | 130                                      | 144   | 1                             | 209   | 7.2                              | 5   | 90                             | 300  | 10   | 400   |
| MSMCxLCE150A | 150                                      | 167   | 1                             | 243   | 6.2                              | 5   | 90                             | 300  | 10   | 400   |
| MSMCxLCE160A | 160                                      | 178   | 1                             | 259   | 5.8                              | 5   | 90                             | 300  | 10   | 400   |
| MSMCxLCE170A | 170                                      | 189   | 1                             | 275   | 5.4                              | 5   | 90                             | 300  | 10   | 400   |

### PAD Layout



| MSMCJ (DO-214AB) |        |      |
|------------------|--------|------|
|                  | Inches | mm   |
| A                | .390   | 9.90 |
| B                | .110   | 2.79 |
| C                | .150   | 3.81 |

| MSMCG (DO-215AB) |        |       |
|------------------|--------|-------|
|                  | Inches | mm    |
| A                | .510   | 12.95 |
| B                | .110   | 2.79  |
| C                | .150   | 3.81  |

# MSMBSAC Surface-Mount Devices

## MSMBSAC Low-Capacitance 600W SMDs

| Features   | Appearance  |
|--|---|
| <ul style="list-style-type: none"> <li>100% surge tested devices</li> <li>Operational and storage temperature of <math>-55^{\circ}\text{C}</math> to <math>+150^{\circ}\text{C}</math>"</li> <li>Low-capacitance performance of 30 pF</li> <li>Suppresses transients up to 600 W peak pulse power @ 10/1000</li> <li>Moisture classification is Level 1 with no dry pack required per IPC/JEDEC J-STD-020B</li> <li>RoHS-compliant devices available by adding an e3 suffix</li> </ul> |  |

## MSMBSAC5.0 Thru MSMBSAC75, e3, All Electrical Characteristics @ 25°C

| Part Number | Reverse Stand-Off Voltage (Note 1) $V_{WM}$ Volts | Breakdown Voltage @ $I_{BR}$ 1.0 mA $V_{BR}$ Volts Min. | Maximum Standby Current @ $V_{WM}$ $I_D$ $\mu\text{A}$ | Maximum Clamping Voltage $I_P = 5.0A^* V_C$ Volts | Maximum Peak Pulse Current* Rating $I_{PP}$ Amps | Maximum Capacitance @ 0 Volts, $F = 1$ MHz $P_F$ | Working Inverse Blocking Voltage $V_{WIB}$ Volts | Inverse Blocking Leakage Current $I_{IB}$ @ $V_{WIB}$ mA | Peak Inverse Blocking Voltage $V_{PIB}$ Volts |
|-------------|---|---|--|---|--|--|--|--|---|
| MSMBSAC5.0  | 5.0   | 7.60  | 300  | 10.0  | 44   | 30   | 75   | 10   | 100   |
| MSMBSAC6.0  | 6.0   | 7.90  | 300  | 11.2  | 41   | 30   | 75   | 10   | 100   |
| MSMBSAC7.0  | 7.0   | 8.33  | 300  | 12.6  | 38   | 30   | 75   | 10   | 100   |
| MSMBSAC8.0  | 8.0   | 8.89  | 100  | 13.4  | 36   | 30   | 75   | 10   | 100   |
| MSMBSAC8.5  | 8.5   | 9.44  | 50   | 14.0  | 34   | 30   | 75   | 10   | 100   |
| MSMBSAC10   | 10  | 11.10   | 5.0  | 16.3  | 29   | 30   | 75   | 10   | 100   |
| MSMBSAC12   | 12  | 13.30   | 5.0  | 19.0  | 25   | 30   | 75   | 10   | 100   |
| MSMBSAC15   | 15  | 16.70   | 5.0  | 23.6  | 20   | 30   | 75   | 10   | 100   |
| MSMBSAC18   | 18  | 20.00   | 5.0  | 28.8  | 15   | 30   | 75   | 10   | 100   |
| MSMBSAC22   | 22  | 24.40   | 5.0  | 35.4  | 14   | 30   | 75   | 10   | 100   |
| MSMBSAC26   | 26  | 28.90   | 5.0  | 42.3  | 11.1   | 30   | 75   | 10   | 100   |
| MSMBSAC36   | 36  | 40.0  | 5.0  | 60.0  | 8.6  | 30   | 75   | 10   | 100   |
| MSMBSAC45   | 45  | 50.00   | 5.0  | 77.0  | 6.8  | 30   | 150  | 10   | 200   |
| MSMBSAC50   | 50  | 55.50   | 5.0  | 88.0  | 5.8  | 30   | 150  | 10   | 200   |
| MSMBSAC75   | 75  | 83.3  | 5.0  | 121   | 4.1  | 30   | 150  | 10   | 200   |

\*See Figure 3. For the MSMBSAC75, the maximum clamping voltage  $V_C$  is at the maximum rated Peak Pulse Current ( $I_{PP}$ ) of 4.1 Amps.

Clamping Factor: The ratio of the numerical value of  $V_C$  to  $V_{BR}$  is typically 1.4 @ full rated power, 1.20 @ 50% rated power. Also see MicroNote 108.

Note 1: A transient voltage suppressor is normally selected according to voltage ( $V_{WM}$ ), that should be equal to or greater than the dc or continuous peak operating voltage level.


Note 2: When pulse testing, test in TVS avalanche direction. Do not pulse in forward direction. See section for Schematic Applications herein.

## PAD Layout

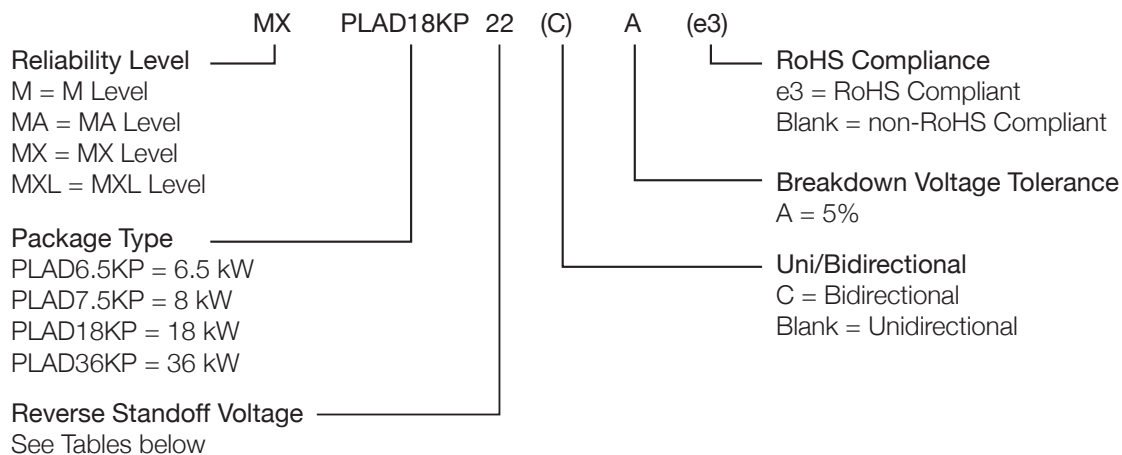


| MSMBSAC (DO-214AA) |        |      |
|--------------------|--------|------|
|                    | Inches | mm   |
| A                  | .390   | 9.90 |
| B                  | .110   | 2.79 |
| C                  | .150   | 3.81 |

## MPLAD Surface-Mount Devices

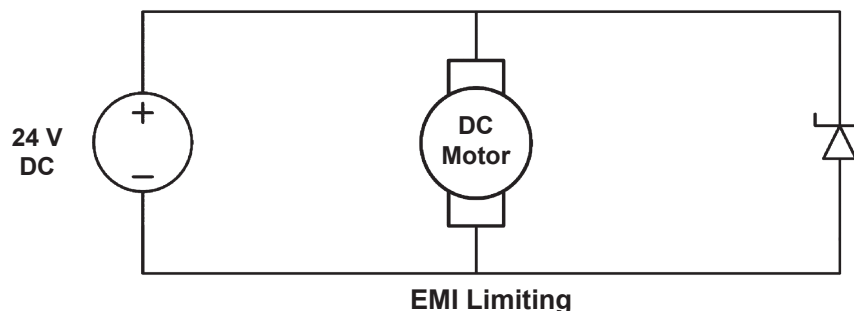
| Features   | Appearance  |
|--|---|
| <ul style="list-style-type: none"> <li>Peak pulse power at 10/1000 <math>\mu</math>S               <ul style="list-style-type: none"> <li>PLAD6.5KP series – 6.5 kW</li> <li>PLAD7.5KP series – 7.5 kW</li> <li>PLAD18KP series – 15 kW</li> <li>PLAD36KP series – 30 kW</li> </ul> </li> <li>Standoff voltage               <ul style="list-style-type: none"> <li>PLAD6.5KP – 10 V to 48 V</li> <li>PLAD7.5KP – 10 V to 48 V</li> <li>PLAD18KP – 7 V to 200 V</li> <li>PLAD36KP – 14 V to 400 V</li> </ul> </li> <li>100% surge tested devices</li> <li>Both RoHS and non-RoHS compliant versions available.</li> <li>Moisture classification is Level 1 with no dry pack required per IPC/JEDEC J-STD-020B</li> <li>Unidirectional and bidirectional versions available</li> <li>Replaces high-power through-hole devices for surface-mount applications</li> <li>Operational and storage temperature of <math>-55^{\circ}\text{C}</math> to <math>+150^{\circ}\text{C}</math></li> </ul> |  <p style="text-align: center;">PLAD</p> |

## Part Nomenclature



### Sample Part Number

MXPLAD18KP9.0Ae3 – MX screened 18 kW device, 9 V reverse stand-off, unidirectional, 5% tolerance and RoHS compliant





# MPLAD Surface-Mount Devices

## MPLAD6.5KP 6.5 kW, All Electrical Characteristics @ 25°C

| Type Number   | Reverse Stand-Off Voltage<br>$V_{WM}$<br>Volts | Minimum Breakdown Voltage<br>$V_{BR}$ Min @ $I_{BR}$<br>Volts | Breakdown Current<br>$I_{BR}$<br>mA | Maximum Clamping Voltage<br>@ $I_{PP}$ $V_C$<br>Volts | Peak Pulse Current<br>$I_{PP}$<br>Amps | Maximum Standby Current<br>@ $V_{WM}$ $I_D$<br>mA |
|---------------|--|---|-------------------------------------|---|--|---|
| MPLAD6.5KP10A | 10   | 11.1–12.3   | 5                                   | 17.0  | 383                                    | 15  |
| MPLAD6.5KP11A | 11   | 12.2–13.5   | 5                                   | 18.2  | 358                                    | 10  |
| MPLAD6.5KP12A | 12   | 13.3–14.7   | 5                                   | 19.9  | 327                                    | 10  |
| MPLAD6.5KP13A | 13   | 14.4–15.9   | 5                                   | 21.5  | 302                                    | 10  |
| MPLAD6.5KP14A | 14   | 15.6–17.2   | 5                                   | 23.2  | 280                                    | 10  |
| MPLAD6.5KP15A | 15   | 16.7–18.5   | 5                                   | 24.4  | 267                                    | 10  |
| MPLAD6.5KP16A | 16   | 17.8–19.7   | 5                                   | 26.0  | 250                                    | 10  |
| MPLAD6.5KP17A | 17   | 18.9–20.9   | 5                                   | 27.6  | 236                                    | 10  |
| MPLAD6.5KP18A | 18   | 20.0–22.1   | 5                                   | 29.2  | 223                                    | 10  |
| MPLAD6.5KP20A | 20   | 22.2–24.5   | 5                                   | 32.4  | 202                                    | 10  |
| MPLAD6.5KP22A | 22   | 24.4–26.9   | 5                                   | 35.5  | 183                                    | 10  |
| MPLAD6.5KP24A | 24   | 26.7–29.5   | 5                                   | 38.9  | 167                                    | 10  |
| MPLAD6.5KP26A | 26   | 28.9–31.9   | 5                                   | 42.1  | 154                                    | 10  |
| MPLAD6.5KP28A | 28   | 31.1–34.4   | 5                                   | 45.5  | 143                                    | 10  |
| MPLAD6.5KP30A | 30   | 33.3–36.8   | 5                                   | 48.4  | 135                                    | 10  |
| MPLAD6.5KP33A | 33   | 36.7–40.6   | 5                                   | 53.3  | 123                                    | 10  |
| MPLAD6.5KP36A | 36   | 40.0–44.2   | 5                                   | 58.1  | 111                                    | 10  |
| MPLAD6.5KP40A | 40   | 44.4–49.1   | 5                                   | 64.5  | 101                                    | 10  |
| MPLAD6.5KP43A | 43   | 47.8–52.8   | 5                                   | 69.4  | 93                                     | 10  |
| MPLAD6.5KP45A | 45   | 50.0–55.3   | 5                                   | 72.7  | 89                                     | 10  |
| MPLAD6.5KP48A | 48   | 53.3–58.9   | 5                                   | 77.4  | 85                                     | 10  |

## MPLAD7.5KP 7.5 kW, All Electrical Characteristics @ 25°C

| Type Number   | Reverse Stand-Off Voltage<br>V <sub>WM</sub><br>Volts | Minimum Breakdown Voltage<br>V <sub>BR</sub> Min @ I <sub>BR</sub><br>Volts | Breakdown Current<br>I <sub>BR</sub><br>mA | Maximum Clamping Voltage<br>@ I <sub>PP</sub> V <sub>C</sub><br>Volts | Peak Pulse Current<br>I <sub>PP</sub><br>Amps | Maximum Standby Current<br>@ V <sub>WM</sub> I <sub>D</sub><br>mA |
|---------------|---|---|--|---|---|---|
| MPLAD7.5KP10A | 10  | 11.1–12.3   | 5  | 17.0  | 383   | 15  |
| MPLAD7.5KP11A | 11  | 12.2–13.5   | 5  | 18.2  | 358   | 10  |
| MPLAD7.5KP12A | 12  | 13.3–14.7   | 5  | 19.9  | 327   | 10  |
| MPLAD7.5KP13A | 13  | 14.4–15.9   | 5  | 21.5  | 302   | 10  |
| MPLAD7.5KP14A | 14  | 15.6–17.2   | 5  | 23.2  | 280   | 10  |
| MPLAD7.5KP15A | 15  | 16.7–18.5   | 5  | 24.4  | 267   | 10  |
| MPLAD7.5KP16A | 16  | 17.8–19.7   | 5  | 26.0  | 250   | 10  |
| MPLAD7.5KP17A | 17  | 18.9–20.9   | 5  | 27.6  | 236   | 10  |
| MPLAD7.5KP18A | 18  | 20.0–22.1   | 5  | 29.2  | 223   | 10  |
| MPLAD7.5KP20A | 20  | 22.2–24.5   | 5  | 32.4  | 202   | 10  |
| MPLAD7.5KP22A | 22  | 24.4–26.9   | 5  | 35.5  | 183   | 10  |
| MPLAD7.5KP24A | 24  | 26.7–29.5   | 5  | 38.9  | 167   | 10  |
| MPLAD7.5KP26A | 26  | 28.9–31.9   | 5  | 42.1  | 154   | 10  |
| MPLAD7.5KP28A | 28  | 31.1–34.4   | 5  | 45.5  | 143   | 10  |
| MPLAD7.5KP30A | 30  | 33.3–36.8   | 5  | 48.4  | 135   | 10  |
| MPLAD7.5KP33A | 33  | 36.7–40.6   | 5  | 53.3  | 123   | 10  |
| MPLAD7.5KP36A | 36  | 40.0–44.2   | 5  | 58.1  | 111   | 10  |
| MPLAD7.5KP40A | 40  | 44.4–49.1   | 5  | 64.5  | 101   | 10  |
| MPLAD7.5KP43A | 43  | 47.8–52.8   | 5  | 69.4  | 93  | 10  |
| MPLAD7.5KP45A | 45  | 50.0–55.3   | 5  | 72.7  | 89  | 10  |
| MPLAD7.5KP48A | 48  | 53.3–58.9   | 5  | 77.4  | 85  | 10  |

# MPLAD Surface-Mount Devices

## MPLAD18KP 18 kW, All Electrical Characteristics @ 25°C

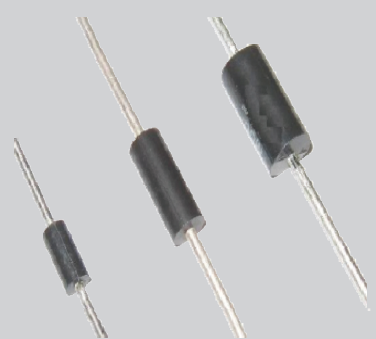
| Type Number   | Reverse Stand-Off Voltage<br>$V_{WM}$<br>Volts | Minimum Breakdown Voltage<br>$V_{BR}$ Min. @ $I_{BR}$<br>Volts | Breakdown Current<br>$I_{BR}$<br>mA | Maximum Clamping Voltage<br>@ $I_{PP}$ $V_C$<br>Volts | Peak Pulse Current<br>$I_{PP}$<br>Amps | Maximum Standby Current<br>@ $V_{WM}$ $I_D$<br>$\mu A$ |
|---------------|--|--|-------------------------------------|---|--|--|
| MPLAD18KP7.0A | 7.0  | 7.78   | 150                                 | 12.0  | 1500                                   | 3000   |
| MPLAD18KP7.5A | 7.5  | 8.33   | 5                                   | 12.9  | 1396                                   | 750  |
| MPLAD18KP8.0A | 8.0  | 8.89   | 5                                   | 13.6  | 1324                                   | 450  |
| MPLAD18KP8.5A | 8.5  | 9.44   | 5                                   | 14.4  | 1250                                   | 150  |
| MPLAD18KP9.0A | 9.0  | 10.0   | 5                                   | 15.4  | 1169                                   | 60   |
| MPLAD18KP10A  | 10   | 11.1   | 5                                   | 17.0  | 1059                                   | 45   |
| MPLAD18KP11A  | 11   | 12.2   | 5                                   | 18.2  | 989                                    | 10   |
| MPLAD18KP12A  | 12   | 13.3   | 5                                   | 19.9  | 905                                    | 10   |
| MPLAD18KP13A  | 13   | 14.4   | 5                                   | 21.5  | 836                                    | 10   |
| MPLAD18KP14A  | 14   | 15.6   | 5                                   | 23.2  | 776                                    | 10   |
| MPLAD18KP15A  | 15   | 16.7   | 5                                   | 24.4  | 738                                    | 10   |
| MPLAD18KP16A  | 16   | 17.8   | 5                                   | 26.0  | 693                                    | 10   |
| MPLAD18KP17A  | 17   | 18.9   | 5                                   | 27.6  | 653                                    | 10   |
| MPLAD18KP18A  | 18   | 20.0   | 5                                   | 29.2  | 617                                    | 10   |
| MPLAD18KP20A  | 20   | 22.2   | 5                                   | 32.4  | 516                                    | 10   |
| MPLAD18KP22A  | 22   | 24.4   | 5                                   | 35.5  | 508                                    | 10   |
| MPLAD18KP24A  | 24   | 26.7   | 5                                   | 38.9  | 463                                    | 10   |
| MPLAD18KP26A  | 26   | 28.9   | 5                                   | 42.1  | 428                                    | 10   |
| MPLAD18KP28A  | 28   | 31.1   | 5                                   | 45.5  | 396                                    | 10   |
| MPLAD18KP30A  | 30   | 33.3   | 5                                   | 48.4  | 372                                    | 10   |
| MPLAD18KP33A  | 33   | 36.7   | 5                                   | 53.3  | 338                                    | 10   |
| MPLAD18KP36A  | 36   | 40.0   | 5                                   | 58.1  | 310                                    | 10   |
| MPLAD18KP40A  | 40   | 44.4   | 5                                   | 64.5  | 280                                    | 10   |
| MPLAD18KP43A  | 43   | 47.8   | 5                                   | 69.4  | 260                                    | 10   |
| MPLAD18KP45A  | 45   | 50.0   | 5                                   | 72.7  | 248                                    | 10   |
| MPLAD18KP48A  | 48   | 53.3   | 5                                   | 77.4  | 233                                    | 10   |
| MPLAD18KP51A  | 51   | 56.7   | 5                                   | 82.4  | 219                                    | 10   |
| MPLAD18KP54A  | 54   | 60.0   | 5                                   | 87.1  | 207                                    | 10   |
| MPLAD18KP58A  | 58   | 64.4   | 5                                   | 93.6  | 193                                    | 10   |
| MPLAD18KP60A  | 60   | 66.7   | 5                                   | 96.8  | 186                                    | 10   |
| MPLAD18KP64A  | 64   | 71.1   | 5                                   | 103   | 175                                    | 10   |
| MPLAD18KP70A  | 70   | 77.8   | 5                                   | 113   | 160                                    | 10   |
| MPLAD18KP75A  | 75   | 83.3   | 5                                   | 121   | 149                                    | 10   |
| MPLAD18KP78A  | 78   | 86.7   | 5                                   | 126   | 143                                    | 10   |
| MPLAD18KP85A  | 85   | 94.4   | 5                                   | 137   | 132                                    | 10   |
| MPLAD18KP90A  | 90   | 100  | 5                                   | 146   | 124                                    | 10   |
| MPLAD18KP100A | 100  | 111  | 5                                   | 162   | 112                                    | 10   |
| MPLAD18KP110A | 110  | 122  | 5                                   | 177   | 102                                    | 10   |
| MPLAD18KP120A | 120  | 133  | 5                                   | 193   | 94                                     | 10   |
| MPLAD18KP130A | 130  | 144  | 5                                   | 209   | 87                                     | 10   |
| MPLAD18KP150A | 150  | 167  | 5                                   | 243   | 75                                     | 10   |
| MPLAD18KP160A | 160  | 178  | 5                                   | 259   | 70                                     | 10   |
| MPLAD18KP170A | 170  | 189  | 5                                   | 275   | 66                                     | 10   |
| MPLAD18KP180A | 180  | 200  | 5                                   | 291   | 62                                     | 10   |
| MPLAD18KP200A | 200  | 222  | 5                                   | 322   | 56                                     | 10   |

**MPLAD36KP 36 kW, All Electrical Characteristics @ 25°C**

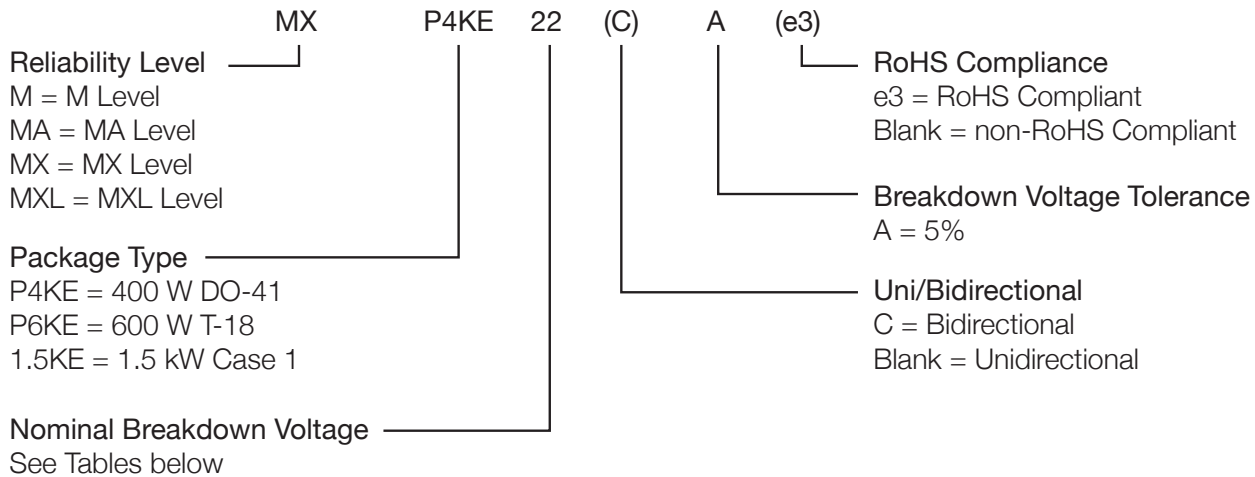
| Type Number                    | Reverse Stand-Off Voltage<br>V <sub>WM</sub><br>Volts | Minimum Breakdown Voltage<br>V <sub>BR</sub> Min. @ I <sub>BR</sub><br>Volts | Breakdown Current<br>I <sub>BR</sub><br>mA | Maximum Clamping Voltage<br>@ I <sub>PP</sub> V <sub>C</sub><br>Volts | Peak Pulse Current<br>I <sub>PP</sub><br>Amps | Maximum Standby Current<br>@ V <sub>WM</sub> I <sub>D</sub><br>µA |
|--------------------------------|---|--|--|---|---|---|
| MPLAD36KP14A<br>MPLAD36KP15A   | 14<br>15  | 15.6<br>16.7   | 150<br>5                                   | 24.0<br>25.8  | 1500<br>1396                                  | 3000<br>750   |
| MPLAD36KP16A<br>MPLAD36KP17A   | 16<br>17  | 17.8<br>18.9   | 5<br>5                                     | 27.2<br>28.8  | 1324<br>1250                                  | 450<br>150  |
| MPLAD36KP18A<br>MPLAD36KP20A   | 18<br>20  | 20.0<br>22.2   | 5<br>5                                     | 30.8<br>34.0  | 1169<br>1059                                  | 60<br>45  |
| MPLAD36KP22A<br>MPLAD36KP24A   | 22<br>24  | 24.4<br>26.7   | 5<br>5                                     | 36.4<br>39.8  | 990<br>905                                    | 10<br>10  |
| MPLAD36KP26A<br>MPLAD36KP28A   | 26<br>28  | 28.9<br>31.1   | 5<br>5                                     | 43.0<br>46.4  | 838<br>776                                    | 10<br>10  |
| MPLAD36KP30A<br>MPLAD36KP33A   | 30<br>33  | 33.3<br>36.7   | 5<br>5                                     | 48.8<br>53.3  | 738<br>676                                    | 10<br>10  |
| MPLAD36KP36A<br>MPLAD36KP40A   | 36<br>40  | 40.0<br>44.4   | 5<br>5                                     | 58.1<br>64.5  | 620<br>559                                    | 10<br>10  |
| MPLAD36KP43A<br>MPLAD36KP45A   | 43<br>45  | 47.8<br>50.0   | 5<br>5                                     | 69.4<br>72.7  | 519<br>496                                    | 10<br>10  |
| MPLAD36KP48A<br>MPLAD36KP51A   | 48<br>51  | 53.3<br>56.7   | 5<br>5                                     | 77.4<br>82.4  | 466<br>437                                    | 10<br>10  |
| MPLAD36KP54A<br>MPLAD36KP58A   | 54<br>58  | 60.0<br>64.4   | 5<br>5                                     | 87.1<br>93.6  | 414<br>385                                    | 10<br>10  |
| MPLAD36KP60A<br>MPLAD36KP64A   | 60<br>64  | 66.7<br>71.1   | 5<br>5                                     | 96.8<br>103.0   | 372<br>350                                    | 10<br>10  |
| MPLAD36KP70A<br>MPLAD36KP75A   | 70<br>75  | 77.8<br>83.3   | 5<br>5                                     | 113<br>121  | 319<br>298                                    | 10<br>10  |
| MPLAD36KP78A<br>MPLAD36KP85A   | 78<br>85  | 86.7<br>94.4   | 5<br>5                                     | 126<br>137  | 286<br>263                                    | 10<br>10  |
| MPLAD36KP90A<br>MPLAD36KP100A  | 90<br>100   | 100<br>111   | 5<br>5                                     | 146<br>162  | 247<br>223                                    | 10<br>10  |
| MPLAD36KP110A<br>MPLAD36KP120A | 110<br>120  | 122<br>133   | 5<br>5                                     | 177<br>193  | 204<br>187                                    | 10<br>10  |
| MPLAD36KP130A<br>MPLAD36KP150A | 130<br>150  | 144<br>167   | 5<br>5                                     | 209<br>243  | 173<br>149                                    | 10<br>10  |
| MPLAD36KP160A<br>MPLAD36KP170A | 160<br>170  | 178<br>189   | 5<br>5                                     | 259<br>275  | 139<br>131                                    | 10<br>10  |
| MPLAD36KP180A<br>MPLAD36KP200A | 180<br>200  | 200<br>222   | 5<br>5                                     | 291<br>322  | 124<br>112                                    | 10<br>10  |
| MPLAD36KP220A<br>MPLAD36KP260A | 220<br>260  | 245<br>289   | 5<br>5                                     | 356<br>419  | 102<br>86                                     | 10<br>10  |
| MPLAD36KP280A<br>MPLAD36KP300A | 280<br>300  | 311<br>333   | 5<br>5                                     | 451<br>483  | 80<br>75                                      | 10<br>10  |
| MPLAD36KP350A<br>MPLAD36KP400A | 350<br>400  | 389<br>444   | 5<br>5                                     | 564<br>644  | 64<br>56                                      | 10<br>10  |

# MP4KE/MP6KE/M1.5KE Axial Devices

## KE Axial Devices

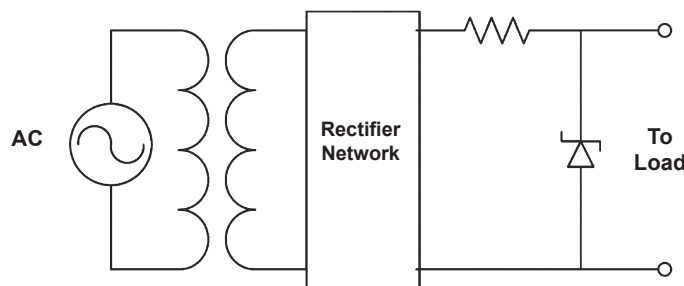
| Features  | Appearance   |
|---|--|
| <ul style="list-style-type: none"> <li>Peak pulse power at 10/1000 <math>\mu</math>S                             <ul style="list-style-type: none"> <li>P4KE series – 400 W</li> <li>P6KE series – 600 W</li> <li>1.5KE series – 1.5 kW</li> </ul> </li> <li>Standoff voltage                             <ul style="list-style-type: none"> <li>P4KE series – 5.8 V to 342 V</li> <li>P6KE series – 5.8 V to 171 V</li> <li>1.5KE series – 5.8 V to 324 V</li> </ul> </li> <li>100% surge-tested devices</li> <li>Both RoHS and non-RoHS compliant versions available.</li> <li>Moisture classification is Level 1 with no dry pack required per IPC/JEDEC J-STD-020B</li> <li>Unidirectional and bidirectional versions available</li> <li>Replaces high-power through-hole devices for surface-mount applications</li> <li>Operational and storage temperature of <math>-55^{\circ}\text{C}</math> to <math>+150^{\circ}\text{C}</math></li> </ul> |  |

## Part Nomenclature



### Sample Part Number

MA1.5KE27Ae3 – MA screened 1.5 KE 15 kW device, 27 V breakdown, unidirectional, 5% tolerance and RoHS compliant.



DC Line Protection

**MP4KE 400 W, All Electrical Characteristics @ 25°C**

| Type Number | Reverse Stand-Off Voltage<br>V <sub>WM</sub><br>Volts | Minimum Breakdown Voltage<br>V <sub>BR</sub> Min. @ I <sub>BR</sub><br>Volts | Breakdown Current<br>I <sub>BR</sub><br>mA | Maximum Clamping Voltage<br>@ I <sub>PP</sub> V <sub>C</sub><br>Volts | Peak Pulse Current<br>I <sub>PP</sub><br>Amps | Maximum Standby Current<br>@ V <sub>WM</sub> I <sub>D</sub><br>μA |
|-------------|---|--|--|---|---|---|
| MP4KE6.8A   | 5.80  | 6.45   | 10   | 10.5  | 38  | 500   |
| MP4KE7.5A   | 6.40  | 7.13   | 10   | 11.3  | 35  | 200   |
| MP4KE8.2A   | 7.02  | 7.79   | 10   | 12.1  | 33  | 100   |
| MP4KE9.1A   | 7.78  | 8.65   | 1  | 13.4  | 30  | 20  |
| MP4KE10A    | 8.55  | 9.50   | 1  | 14.5  | 28  | 5   |
| MP4KE11A    | 9.40  | 10.5   | 1  | 15.6  | 26  | 2   |
| MP4KE12A    | 10.2  | 11.4   | 1  | 16.7  | 24  | 1   |
| MP4KE13A    | 11.1  | 12.4   | 1  | 18.2  | 22  | 1   |
| MP4KE15A    | 12.8  | 14.3   | 1  | 21.2  | 19  | 1   |
| MP4KE16A    | 13.6  | 15.2   | 1  | 22.5  | 18  | 1   |
| MP4KE18A    | 15.3  | 17.1   | 1  | 25.2  | 16  | 1   |
| MP4KE20A    | 17.1  | 19.0   | 1  | 27.7  | 14.5  | 1   |
| MP4KE22A    | 18.8  | 20.9   | 1  | 30.6  | 13  | 1   |
| MP4KE24A    | 20.5  | 22.8   | 1  | 33.2  | 12  | 1   |
| MP4KE27A    | 23.1  | 25.7   | 1  | 37.5  | 11  | 1   |
| MP4KE30A    | 25.6  | 28.5   | 1  | 41.4  | 9.5   | 1   |
| MP4KE33A    | 28.2  | 31.4   | 1  | 45.7  | 9.0   | 1   |
| MP4KE36A    | 30.8  | 34.2   | 1  | 49.9  | 8.0   | 1   |
| MP4KE39A    | 33.3  | 37.1   | 1  | 53.9  | 7.5   | 1   |
| MP4KE43A    | 36.8  | 40.9   | 1  | 59.3  | 7.0   | 1   |
| MP4KE47A    | 40.2  | 44.7   | 1  | 64.8  | 6.2   | 1   |
| MP4KE51A    | 43.6  | 48.5   | 1  | 70.1  | 5.7   | 1   |
| MP4KE56A    | 47.8  | 53.2   | 1  | 77.0  | 5.2   | 1   |
| MP4KE62A    | 53.0  | 58.9   | 1  | 85.0  | 4.7   | 1   |
| MP4KE68A    | 58.1  | 64.6   | 1  | 92.0  | 4.4   | 1   |
| MP4KE75A    | 64.1  | 71.3   | 1  | 103.0   | 3.9   | 1   |
| MP4KE82A    | 70.1  | 77.9   | 1  | 113.0   | 3.5   | 1   |
| MP4KE91A    | 77.8  | 86.5   | 1  | 125.0   | 3.2   | 1   |
| MP4KE100A   | 85.5  | 95.0   | 1  | 137.0   | 2.9   | 1   |
| MP4KE110A   | 94.0  | 105.0  | 1  | 152.0   | 2.6   | 1   |
| MP4KE120A   | 102.0   | 114.0  | 1  | 165.0   | 2.4   | 1   |
| MP4KE130A   | 111.0   | 124.0  | 1  | 179.0   | 2.2   | 1   |
| MP4KE150A   | 128.0   | 143.0  | 1  | 207.0   | 1.95  | 1   |
| MP4KE160A   | 136.0   | 152.0  | 1  | 219.0   | 1.8   | 1   |
| MP4KE170A   | 145.0   | 162.0  | 1  | 234.0   | 1.7   | 1   |
| MP4KE180A   | 154.0   | 171.0  | 1  | 246.0   | 1.6   | 1   |
| MP4KE200A   | 171.0   | 190.0  | 1  | 274.0   | 1.5   | 1   |
| MP4KE220A   | 185.0   | 209.0  | 1  | 328.0   | 1.0   | 1   |
| MP4KE250A   | 214.0   | 237.0  | 1  | 344.0   | 1.0   | 1   |
| MP4KE300A   | 256.0   | 285.0  | 1  | 414.0   | 1.0   | 1   |
| MP4KE350A   | 300.0   | 333.0  | 1  | 482.0   | 1.0   | 1   |
| MP4KE400A   | 342.0   | 380.0  | 1  | 548.0   | 1.0   | 1   |

# MP4KE/MP6KE/1.5KE Axial Devices

## MP6KE 600 W, All Electrical Characteristics @ 25°C

| Type Number            | Reverse Stand-Off Voltage<br>$V_{WM}$<br>Volts | Minimum Breakdown Voltage<br>$V_{BR}$ Min. @ $I_{BR}$<br>Volts | Breakdown Current<br>$I_{BR}$<br>mA | Maximum Clamping Voltage<br>@ $I_{PP}$ $V_C$<br>Volts | Peak Pulse Current<br>$I_{PP}$<br>Amps | Maximum Standby Current<br>@ $V_{WM}$ $I_D$<br>$\mu A$ |
|------------------------|--|--|-------------------------------------|---|--|--|
| MP6KE6.8A<br>MP6KE7.5A | 5.8<br>6.4                                     | 6.45<br>7.13   | 10<br>10                            | 10.5<br>11.3  | 57<br>53                               | 1000<br>500  |
| MP6KE8.2A<br>MP6KE9.1A | 7.02<br>7.78                                   | 7.79<br>8.65   | 10<br>1                             | 12.1<br>13.4  | 50<br>45                               | 200<br>50  |
| MP6KE10A<br>MP6KE11A   | 8.55<br>9.4                                    | 9.5<br>10.5  | 1<br>1                              | 14.5<br>15.6  | 41<br>38                               | 10<br>5  |
| MP6KE12A<br>MP6KE13A   | 10.2<br>11.1                                   | 11.4<br>12.4   | 1<br>1                              | 16.7<br>18.2  | 36<br>33                               | 5<br>5   |
| MP6KE15A<br>MP6KE16A   | 12.8<br>13.6                                   | 14.3<br>15.2   | 1<br>1                              | 21.2<br>22.5  | 28<br>27                               | 1<br>1   |
| MP6KE18A<br>MP6KE20A   | 15.3<br>17.1                                   | 17.1<br>19   | 1<br>1                              | 25.2<br>27.7  | 24<br>22                               | 1<br>1   |
| MP6KE22A<br>MP6KE24A   | 18.8<br>20.5                                   | 20.9<br>22.8   | 1<br>1                              | 30.6<br>33.2  | 20<br>18                               | 1<br>1   |
| MP6KE27A<br>MP6KE30A   | 23.1<br>25.6                                   | 25.7<br>28.5   | 1<br>1                              | 37.5<br>41.4  | 16<br>14.4                             | 1<br>1   |
| MP6KE33A<br>MP6KE36A   | 28.2<br>30.8                                   | 31.4<br>34.2   | 1<br>1                              | 45.7<br>49.9  | 13.2<br>12                             | 1<br>1   |
| MP6KE39A<br>MP6KE43A   | 33.3<br>36.8                                   | 37.1<br>40.9   | 1<br>1                              | 53.9<br>59.3  | 11.2<br>10.1                           | 1<br>1   |
| MP6KE47A<br>MP6KE51A   | 40.2<br>43.6                                   | 44.7<br>48.5   | 1<br>1                              | 64.8<br>70.1  | 9.3<br>8.6                             | 1<br>1   |
| MP6KE56A<br>MP6KE62A   | 47.8<br>53                                     | 53.2<br>58.9   | 1<br>1                              | 77<br>85  | 7.8<br>7.1                             | 1<br>1   |
| MP6KE68A<br>MP6KE75A   | 58.1<br>64.1                                   | 64.6<br>71.3   | 1<br>1                              | 92<br>103   | 6.5<br>5.8                             | 1<br>1   |
| MP6KE82A<br>MP6KE91A   | 70.1<br>77.8                                   | 77.9<br>86.5   | 1<br>1                              | 113<br>125  | 5.3<br>4.8                             | 1<br>1   |
| MP6KE100A<br>MP6KE110A | 85.5<br>94                                     | 95<br>105  | 1<br>1                              | 137<br>152  | 4.4<br>3.4                             | 1<br>1   |
| MP6KE120A<br>MP6KE130A | 102<br>111                                     | 114<br>124   | 1<br>1                              | 165<br>179  | 3.6<br>3.3                             | 1<br>1   |
| MP6KE150A<br>MP6KE160A | 128<br>136                                     | 143<br>152   | 1<br>1                              | 207<br>219  | 2.9<br>2.7                             | 1<br>1   |
| MP6KE170A<br>MP6KE180A | 145<br>154                                     | 161<br>171   | 1<br>1                              | 234<br>246  | 2.6<br>2.4                             | 1<br>1   |
| MP6KE200A              | 171  | 190  | 1                                   | 274   | 2.2                                    | 1  |


**M1.5KE 1.5kW, All Electrical Characteristics @ 25°C**

| Type Number              | Reverse Stand-Off Voltage<br>$V_{WM}$<br>Volts | Minimum Breakdown Voltage<br>$V_{BR}$ Min @ $I_{BR}$<br>Volts | Breakdown Current<br>$I_{BR}$<br>mA | Maximum Clamping Voltage<br>@ $I_{PP}$ $V_C$<br>Volts | Peak Pulse Current<br>$I_{PP}$<br>Amps | Maximum Standby Current<br>@ $V_{WM}$ $I_D$<br>$\mu A$ |
|--------------------------|--|---|-------------------------------------|---|--|--|
| M1.5KE6.8A<br>M1.5KE7.5A | 5.80<br>6.40                                   | 6.45<br>7.13  | 10<br>10                            | 10.5<br>11.3  | 143.0<br>132.0                         | 1000<br>500  |
| M1.5KE8.2A<br>M1.5KE9.1A | 7.02<br>7.78                                   | 7.79<br>8.65  | 10<br>1                             | 12.1<br>13.4  | 124.0<br>112.0                         | 200<br>50  |
| M1.5KE10A<br>M1.5KE11A   | 8.55<br>9.40                                   | 9.50<br>10.50   | 1<br>1                              | 14.5<br>15.6  | 103.0<br>96.0                          | 10<br>5  |
| M1.5KE12A<br>M1.5KE13A   | 10.220<br>11.10                                | 11.40<br>12.40  | 1<br>1                              | 16.7<br>18.2  | 90.0<br>82.0                           | 5<br>5   |
| M1.5KE15A<br>M1.5KE16A   | 12.80<br>13.60                                 | 14.30<br>15.20  | 1<br>1                              | 21.2<br>22.5  | 71.0<br>67.0                           | 1<br>1   |
| M1.5KE18A<br>M1.5KE20A   | 15.30<br>17.10                                 | 17.10<br>19.00  | 1<br>1                              | 25.2<br>27.7  | 59.5<br>54.0                           | 1<br>1   |
| M1.5KE22A<br>M1.5KE24A   | 18.80<br>20.50                                 | 20.90<br>22.80  | 1<br>1                              | 30.6<br>33.2  | 49.0<br>45.0                           | 1<br>1   |
| M1.5KE27A<br>M1.5KE30A   | 23.10<br>25.60                                 | 25.70<br>28.50  | 1<br>1                              | 37.5<br>41.4  | 40.0<br>36.0                           | 1<br>1   |
| M1.5KE33A<br>M1.5KE36A   | 28.20<br>30.80                                 | 31.40<br>34.20  | 1<br>1                              | 45.7<br>49.9  | 33.0<br>30.0                           | 1<br>1   |
| M1.5KE39A<br>M1.5KE43A   | 33.30<br>36.80                                 | 37.10<br>40.90  | 1<br>1                              | 53.9<br>59.3  | 28.0<br>25.3                           | 1  |
| M1.5KE47A<br>M1.5KE51A   | 40.20<br>43.60                                 | 44.70<br>48.50  | 1<br>1                              | 64.8<br>70.1  | 23.2<br>21.4                           | 1<br>1   |
| M1.5KE56A<br>M1.5KE62A   | 47.80<br>53.00                                 | 53.20<br>58.90  | 1<br>1                              | 77.0<br>85.0  | 19.5<br>17.7                           | 1<br>1   |
| M1.5KE68A<br>M1.5KE75A   | 58.10<br>64.10                                 | 64.60<br>71.30  | 1<br>1                              | 92.0<br>103.0   | 16.3<br>14.6                           | 1<br>1   |
| M1.5KE82A<br>M1.5KE91A   | 70.10<br>77.80                                 | 77.90<br>86.50  | 1<br>1                              | 113.0<br>125.0  | 13.3<br>12.0                           | 1<br>1   |
| M1.5KE100A<br>M1.5KE110A | 85.50<br>94.00                                 | 95.00<br>105.00   | 1<br>1                              | 137.0<br>152.0  | 11.0<br>9.9                            | 1<br>1   |
| M1.5KE120A<br>M1.5KE130A | 102.00<br>111.00                               | 114.00<br>124.00  | 1<br>1                              | 165.0<br>179.0  | 9.1<br>8.4                             | 1<br>1   |
| M1.5KE150A<br>M1.5KE160A | 128.00<br>136.00                               | 143.00<br>152.00  | 1<br>1                              | 207.0<br>219.0  | 7.2<br>6.8                             | 1<br>1   |
| M1.5KE170A<br>M1.5KE180A | 145.00<br>154.00                               | 162.00<br>171.00  | 1<br>1                              | 234.0<br>246.0  | 6.4<br>6.1                             | 1<br>1   |
| M1.5KE200A<br>M1.5KE220A | 171.00<br>185.00                               | 190.00<br>209.00  | 1<br>1                              | 274.0<br>328.0  | 5.5<br>4.6                             | 1<br>1   |
| M1.5KE250A<br>M1.5KE300A | 214.00<br>256.00                               | 237.00<br>285.00  | 1<br>1                              | 344.0<br>414.0  | 5.0<br>5.0                             | 1<br>1   |
| M1.5KE350A<br>M1.5KE400A | 300.00<br>324.00                               | 332.00<br>380.00  | 1<br>1                              | 482.0<br>548.0  | 4.0<br>4.0                             | 1<br>1   |

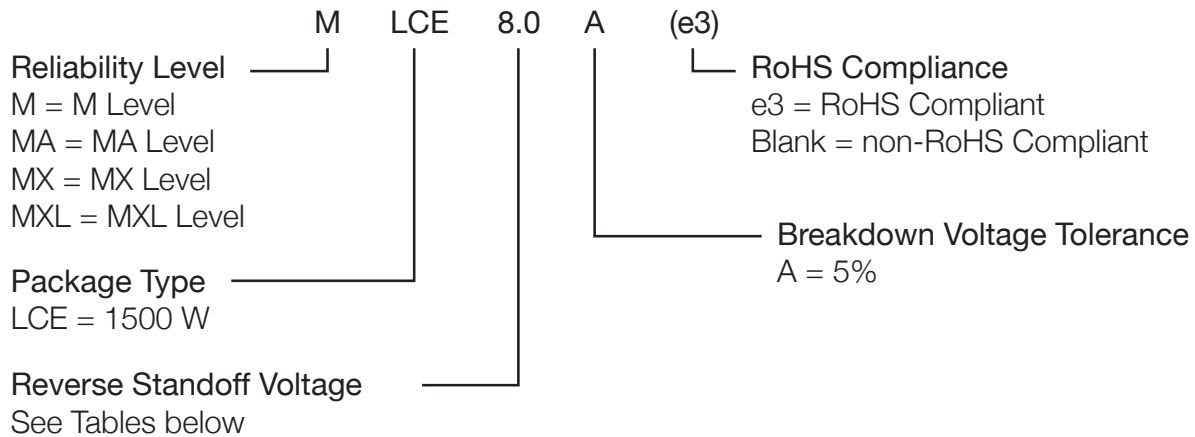


# MLCE Low-Capacitance Axial Devices

## MLCE Axial Devices

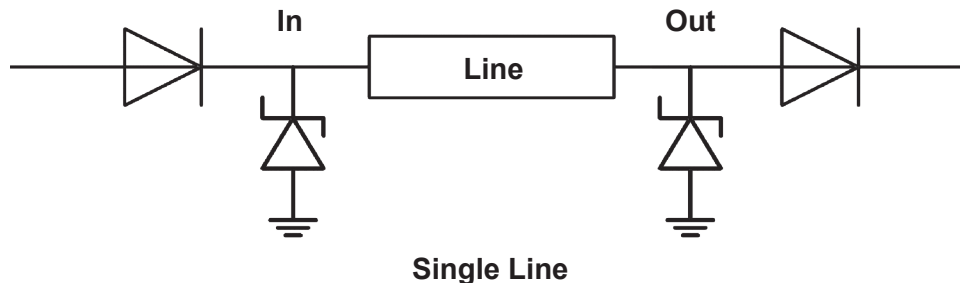
| Features   | Appearance  |
|--|---|
| <ul style="list-style-type: none"> <li>• 1.5 kW peak pulse power at 10/1000 <math>\mu</math>S</li> <li>• Standoff voltage of 6.5 V to 170 V</li> <li>• Operational and storage temperature of <math>-55^{\circ}\text{C}</math> to <math>+150^{\circ}\text{C}</math></li> <li>• Low-capacitance performance <math>\leq 100</math> pF</li> <li>• 100% surge-tested devices</li> <li>• Both RoHS and non-RoHS compliant versions available.</li> <li>• Moisture classification is Level 1 with no dry pack required per IPC/JEDEC J-STD-020B</li> </ul> |  |

## Part Nomenclature



### Sample Part Number


**MALCE48A** – MA screened axial Low Capacitance 1.5 kW device, 48 V stand-off, unidirectional with 5% tolerance



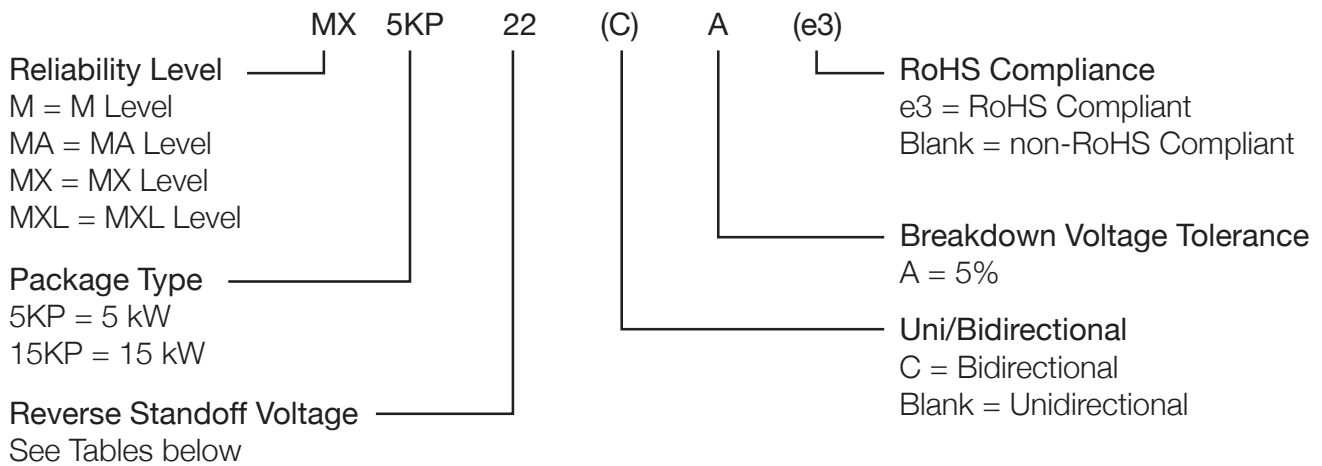
## MLCE 1.5 kW, All Electrical Characteristics @ 25°C

| Type Number | Reverse Stand-Off Voltage $V_{WM}$ Volts | Minimum Breakdown Voltage $V_{BR}$ Min @ $I_{BR}$ Volts | Breakdown Current $I_{BR}$ mA | Maximum Clamping Voltage @ $I_{PP}$ $V_C$ Volts | Peak Pulse Current $I_{PP}$ Amps | Maximum Standby Current $I_D$ @ $V_{WM}$ $\mu A$ | Max Cap @ 0 Volts $F=1$ MHz pF | Working Inverse Blocking Voltage $V_{WIB}$ @ $V_{WIB}$ Volts | Inverse Blocking Leakage Current $I_{IB}$ @ $V_{WIB}$ $\mu A$ | Peak Inverse Blocking Voltage $V_{PIB}$ Volts |
|-------------|--|---|-------------------------------|---|----------------------------------|--|--------------------------------|--|---|---|
| MLCE6.5A    | 6.5                                      | 7.22  | 10                            | 11.2  | 100                              | 1000   | 100                            | 75   | 10  | 100   |
| MLCE7.0A    | 7.0                                      | 7.78  | 10                            | 12.0  | 100                              | 500  | 100                            | 75   | 10  | 100   |
| MLCE7.5A    | 7.5                                      | 8.33  | 10                            | 12.9  | 100                              | 250  | 100                            | 75   | 10  | 100   |
| MLCE8.0A    | 8.0                                      | 8.89  | 1                             | 13.6  | 100                              | 100  | 100                            | 75   | 10  | 100   |
| MLCE8.5A    | 8.5                                      | 9.44  | 1                             | 14.4  | 100                              | 50   | 100                            | 75   | 10  | 100   |
| MLCE9.0A    | 9.0                                      | 10.0  | 1                             | 15.4  | 97                               | 10   | 100                            | 75   | 10  | 100   |
| MLCE10A     | 10                                       | 11.1  | 1                             | 17.0  | 88                               | 5  | 100                            | 75   | 10  | 100   |
| MLCE11A     | 11                                       | 12.2  | 1                             | 18.2  | 82                               | 5  | 100                            | 75   | 10  | 100   |
| MLCE12A     | 12                                       | 13.3  | 1                             | 19.9  | 75                               | 5  | 100                            | 75   | 10  | 100   |
| MLCE13A     | 13                                       | 14.4  | 1                             | 21.5  | 70                               | 5  | 100                            | 75   | 10  | 100   |
| MLCE14A     | 14                                       | 15.6  | 1                             | 23.2  | 65                               | 5  | 100                            | 75   | 10  | 100   |
| MLCE15A     | 15                                       | 16.7  | 1                             | 24.4  | 61                               | 5  | 100                            | 75   | 10  | 100   |
| MLCE16A     | 16                                       | 17.8  | 1                             | 26.0  | 57                               | 5  | 100                            | 75   | 10  | 100   |
| MLCE17A     | 17                                       | 18.9  | 1                             | 27.6  | 54                               | 5  | 100                            | 75   | 10  | 100   |
| MLCE18A     | 18                                       | 20.0  | 1                             | 29.2  | 51                               | 5  | 100                            | 75   | 10  | 100   |
| MLCE20A     | 20                                       | 22.2  | 1                             | 32.4  | 46                               | 5  | 100                            | 75   | 10  | 100   |
| MLCE22A     | 22                                       | 24.4  | 1                             | 35.5  | 42                               | 5  | 100                            | 75   | 10  | 100   |
| MLCE24A     | 24                                       | 26.7  | 1                             | 38.9  | 39                               | 5  | 100                            | 75   | 10  | 100   |
| MLCE26A     | 26                                       | 28.9  | 1                             | 42.1  | 36                               | 5  | 100                            | 75   | 10  | 100   |
| MLCE28A     | 28                                       | 31.1  | 1                             | 45.4  | 33                               | 5  | 100                            | 75   | 10  | 100   |
| MLCE30A     | 30                                       | 33.3  | 1                             | 48.4  | 31                               | 5  | 100                            | 75   | 10  | 100   |
| MLCE33A     | 33                                       | 36.7  | 1                             | 53.3  | 28.1                             | 5  | 100                            | 75   | 10  | 100   |
| MLCE36A     | 36                                       | 40.0  | 1                             | 58.1  | 25.8                             | 5  | 100                            | 75   | 10  | 100   |
| MLCE40A     | 40                                       | 44.4  | 1                             | 64.5  | 23.3                             | 5  | 100                            | 75   | 10  | 100   |
| MLCE43A     | 43                                       | 47.8  | 1                             | 69.4  | 21.6                             | 5  | 100                            | 150  | 10  | 200   |
| MLCE45A     | 45                                       | 50.0  | 1                             | 72.7  | 20.6                             | 5  | 100                            | 150  | 10  | 200   |
| MLCE48A     | 48                                       | 53.3  | 1                             | 77.4  | 19.4                             | 5  | 100                            | 150  | 10  | 200   |
| MLCE51A     | 51                                       | 56.7  | 1                             | 82.4  | 18.2                             | 5  | 100                            | 150  | 10  | 200   |
| MLCE54A     | 54                                       | 60.0  | 1                             | 87.1  | 17.2                             | 5  | 100                            | 150  | 10  | 200   |
| MLCE58A     | 58                                       | 64.4  | 1                             | 93.6  | 16.0                             | 5  | 100                            | 150  | 10  | 200   |
| MLCE60A     | 60                                       | 66.7  | 1                             | 96.8  | 15.5                             | 5  | 90                             | 150  | 10  | 200   |
| MLCE64A     | 64                                       | 71.1  | 1                             | 103   | 14.6                             | 5  | 90                             | 150  | 10  | 200   |
| MLCE70A     | 70                                       | 77.8  | 1                             | 113   | 13.3                             | 5  | 90                             | 150  | 10  | 200   |
| MLCE75A     | 75                                       | 83.3  | 1                             | 121   | 12.4                             | 5  | 90                             | 150  | 10  | 200   |
| MLCE80A     | 80                                       | 88.7  | 1                             | 129   | 11.6                             | 5  | 90                             | 150  | 10  | 200   |
| MLCE90A     | 90                                       | 100   | 1                             | 146   | 10.3                             | 5  | 90                             | 300  | 10  | 200   |
| MLCE100A    | 100                                      | 111   | 1                             | 162   | 9.3                              | 5  | 90                             | 300  | 10  | 200   |
| MLCE110A    | 110                                      | 122   | 1                             | 178   | 8.4                              | 5  | 90                             | 300  | 10  | 400   |
| MLCE120A    | 120                                      | 133   | 1                             | 193   | 7.8                              | 5  | 90                             | 300  | 10  | 400   |
| MLCE130A    | 130                                      | 144   | 1                             | 209   | 7.2                              | 5  | 90                             | 300  | 10  | 400   |
| MLCE150A    | 150                                      | 167   | 1                             | 243   | 6.2                              | 5  | 90                             | 300  | 10  | 400   |
| MLCE160A    | 160                                      | 178   | 1                             | 259   | 5.8                              | 5  | 90                             | 300  | 10  | 400   |
| MLCE170A    | 170                                      | 189   | 1                             | 275   | 5.4                              | 5  | 90                             | 300  | 10  | 400   |

## M5KP/M15KP Axial Devices

| Features   | Appearance  |
|--|---|
| <ul style="list-style-type: none"> <li>Peak pulse power at 10/1000 <math>\mu</math>S                             <ul style="list-style-type: none"> <li>5 KP series – 5 kW</li> <li>15 KP series – 15 kW</li> </ul> </li> <li>Standoff voltage                             <ul style="list-style-type: none"> <li>5 KP series – 5 V to 110 V</li> <li>15 KP series – 22 V to 280 V</li> </ul> </li> <li>Operational and storage temperature of <math>-55^{\circ}\text{C}</math> to <math>+150^{\circ}\text{C}</math></li> <li>Unidirectional and bidirectional versions available</li> <li>Both RoHS and non-RoHS compliant versions available.</li> <li>Moisture classification is Level 1 with no dry pack required per IPC/JEDEC J-STD-020B</li> <li>100% surge-tested devices</li> </ul> |  |

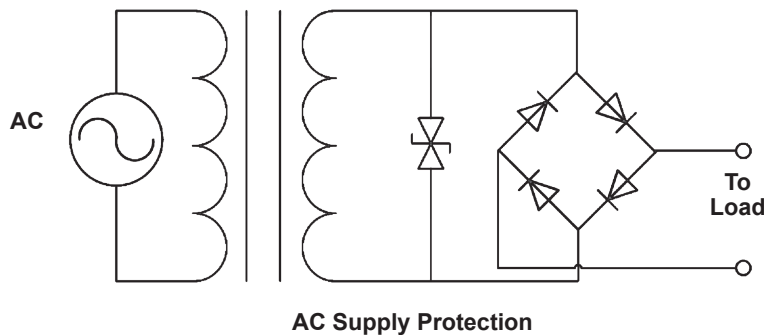
## Part Nomenclature



### Sample Part Number

**MA5KP36Ae3** – MA screened axial 5 kW device, 36 V reverse stand-off, unidirectional, 5% tolerance and RoHS compliant

**MXL15KPA40CA** – MXL screened axial 15 kW device, 40 V breakdown, bidirectional, 5% tolerance and non-RoHS compliant



**M5KP 5kW, All Electrical Characteristics @ 25°C**

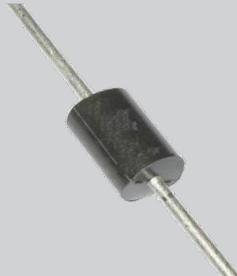
| Type Number          | Reverse Stand-Off Voltage<br>$V_{WM}$<br>Volts | Minimum Breakdown Voltage<br>$V_{BR}$ Min @ $I_{BR}$<br>Volts | Breakdown Current<br>$I_{BR}$<br>mA | Maximum Clamping Voltage<br>@ $I_{PP}$ $V_c$<br>Volts | Peak Pulse Current<br>$I_{PP}$<br>Amps | Maximum Standby Current<br>@ $V_{WM}$ $I_d$<br>$\mu A$ |
|----------------------|--|---|-------------------------------------|---|--|--|
| M5KP5.0A<br>M5KP6.0A | 5.0<br>6.0                                     | 6.40<br>6.67  | 50<br>50                            | 9.2<br>10.3   | 543<br>485                             | 2000*<br>5000  |
| M5KP6.5A<br>M5KP7.0A | 6.5<br>7.0                                     | 7.22<br>7.78  | 50<br>50                            | 11.2<br>12.0  | 447<br>417                             | 2000<br>1000   |
| M5KP7.5A<br>M5KP8.0A | 7.5<br>8.0                                     | 8.33<br>8.89  | 5<br>5                              | 12.9<br>13.6  | 388<br>367                             | 250<br>150   |
| M5KP8.5A<br>M5KP9.0A | 8.5<br>9.0                                     | 9.44<br>10.0  | 5<br>5                              | 14.4<br>15.4  | 347<br>325                             | 50<br>20   |
| M5KP10A<br>M5KP11A   | 10<br>11                                       | 11.1<br>12.2  | 5<br>5                              | 17.0<br>18.2  | 294<br>274                             | 15<br>10   |
| M5KP12A<br>M5KP13A   | 12<br>13                                       | 13.3<br>14.4  | 5<br>5                              | 19.9<br>21.5  | 251<br>232                             | 10<br>10   |
| M5KP14A<br>M5KP15A   | 14<br>15                                       | 15.6<br>16.7  | 5<br>5                              | 23.2<br>24.4  | 215<br>206                             | 10<br>10   |
| M5KP16A<br>M5KP17A   | 16<br>17                                       | 17.8<br>18.9  | 5<br>5                              | 26.0<br>27.6  | 192<br>181                             | 10<br>10   |
| M5KP18A<br>M5KP20A   | 18<br>20                                       | 20.0<br>22.2  | 5<br>5                              | 29.2<br>32.4  | 172<br>154                             | 10<br>10   |
| M5KP22A<br>M5KP24A   | 22<br>24                                       | 24.4<br>26.7  | 5<br>5                              | 35.5<br>38.9  | 141<br>128                             | 10<br>10   |
| M5KP26A<br>M5KP28A   | 26<br>28                                       | 28.9<br>31.1  | 5<br>5                              | 42.1<br>45.5  | 119<br>110                             | 10<br>10   |
| M5KP30A<br>M5KP33A   | 30<br>33                                       | 33.3<br>36.7  | 5<br>5                              | 48.4<br>53.3  | 103<br>94                              | 10<br>10   |
| M5KP36A<br>M5KP40A   | 36<br>40                                       | 40.0<br>44.4  | 5<br>5                              | 58.1<br>64.5  | 86<br>78                               | 10<br>10   |
| M5KP43A<br>M5KP45A   | 43<br>45                                       | 47.8<br>50.0  | 5<br>5                              | 69.4<br>72.7  | 72<br>69                               | 10<br>10   |
| M5KP48A<br>M5KP51A   | 48<br>51                                       | 53.3<br>56.7  | 5<br>5                              | 77.4<br>82.4  | 65<br>61                               | 10<br>10   |
| M5KP54A<br>M5KP58A   | 54<br>58                                       | 60.0<br>64.4  | 5<br>5                              | 87.1<br>93.6  | 57<br>53                               | 10<br>10   |
| M5KP60A<br>M5KP64A   | 60<br>64                                       | 66.7<br>71.1  | 5<br>5                              | 96.8<br>103.0   | 52<br>49                               | 10<br>10   |
| M5KP70A<br>M5KP75A   | 70<br>75                                       | 77.8<br>83.3  | 5<br>5                              | 113<br>121  | 44<br>41                               | 10<br>10   |
| M5KP78A<br>M5KP85A   | 78<br>85                                       | 86.7<br>94.4  | 5<br>5                              | 126<br>137  | 40<br>36                               | 10<br>10   |
| M5KP90A<br>M5KP100A  | 90<br>100                                      | 100<br>111  | 5<br>5                              | 146<br>162  | 34<br>31                               | 10<br>10   |
| M5KP110A             | 110  | 122   | 5                                   | 177   | 28                                     | 10   |

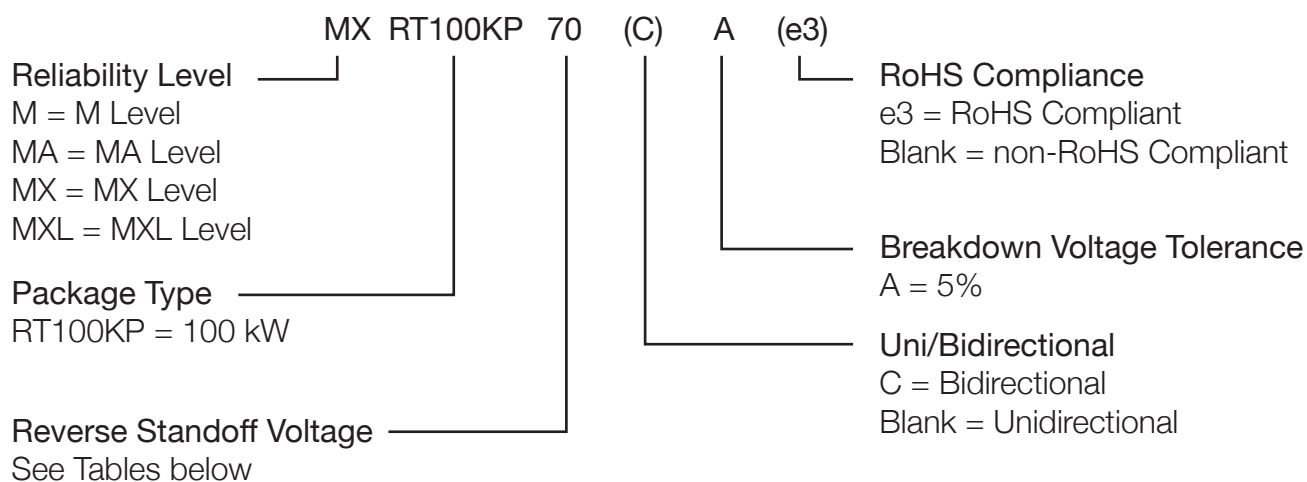
# M5KP/M15KP Axial Devices

## M15KP 15 kW, All Electrical Characteristics @ 25°C

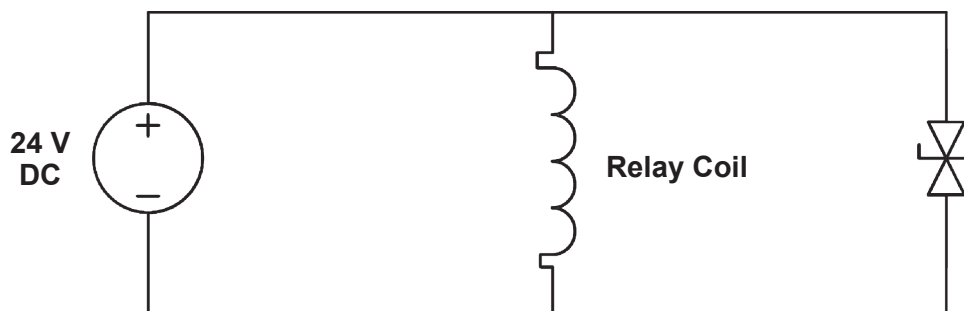
| Type Number | Reverse Stand-Off Voltage<br>$V_{WM}$<br>Volts | Minimum Breakdown Voltage<br>$V_{BR}$ Min @ $I_{BR}$<br>Volts | Breakdown Current<br>$I_{BR}$<br>mA | Maximum Clamping Voltage<br>@ $I_{PP}$ $V_C$<br>Volts | Peak Pulse Current<br>$I_{PP}$<br>Amps | Maximum Standby Current<br>@ $V_{WM}$ $I_D$<br>$\mu A$ |
|-------------|--|---|-------------------------------------|---|--|--|
| M15KP22A    | 22   | 24.4  | 10                                  | 37.1  | 404                                    | 500  |
| M15KP24A    | 24   | 26.7  | 5                                   | 40.7  | 369                                    | 150  |
| M15KP26A    | 26   | 28.9  | 5                                   | 44.0  | 341                                    | 50   |
| M15KP28A    | 28   | 31.1  | 5                                   | 47.5  | 316                                    | 25   |
| M15KP30A    | 30   | 33.3  | 5                                   | 50.7  | 296                                    | 15   |
| M15KP33A    | 33   | 36.7  | 5                                   | 54.8  | 274                                    | 10   |
| M15KP36A    | 36   | 40.0  | 5                                   | 59.7  | 251                                    | 10   |
| M15KP40A    | 40   | 44.4  | 5                                   | 65.8  | 228                                    | 10   |
| M15KP43A    | 43   | 47.8  | 5                                   | 69.7  | 215                                    | 10   |
| M15KP45A    | 45   | 50.0  | 5                                   | 73.0  | 205                                    | 10   |
| M15KP48A    | 48   | 53.3  | 5                                   | 77.7  | 193                                    | 10   |
| M15KP51A    | 51   | 56.7  | 5                                   | 82.8  | 181                                    | 10   |
| M15KP54A    | 54   | 60.0  | 5                                   | 87.5  | 171                                    | 10   |
| M15KP58A    | 58   | 64.4  | 5                                   | 94.0  | 160                                    | 10   |
| M15KP60A    | 60   | 66.7  | 5                                   | 97.3  | 154                                    | 10   |
| M15KP64A    | 64   | 71.7  | 5                                   | 104   | 144                                    | 10   |
| M15KP70A    | 70   | 77.8  | 5                                   | 114   | 132                                    | 10   |
| M15KP75A    | 75   | 83.3  | 5                                   | 122   | 123                                    | 10   |
| M15KP78A    | 78   | 86.7  | 5                                   | 126   | 119                                    | 10   |
| M15KP85A    | 85   | 94.4  | 5                                   | 137   | 109                                    | 10   |
| M15KP90A    | 90   | 100   | 5                                   | 146   | 103                                    | 10   |
| M15KP100A   | 100  | 111   | 5                                   | 162   | 93                                     | 10   |
| M15KP110A   | 110  | 122   | 5                                   | 178   | 84                                     | 10   |
| M15KP120A   | 120  | 133   | 5                                   | 193   | 78                                     | 10   |
| M15KP130A   | 130  | 144   | 5                                   | 209   | 72                                     | 10   |
| M15KP150A   | 150  | 167   | 5                                   | 243   | 62                                     | 10   |
| M15KP160A   | 160  | 178   | 5                                   | 259   | 58                                     | 10   |
| M15KP170A   | 170  | 189   | 5                                   | 275   | 55                                     | 10   |
| M15KP180A   | 180  | 200   | 5                                   | 291   | 52                                     | 10   |
| M15KP200A   | 200  | 222   | 5                                   | 322   | 47                                     | 10   |
| M15KP220A   | 220  | 245   | 5                                   | 356   | 42                                     | 10   |
| M15KP240A   | 240  | 267   | 5                                   | 388   | 39                                     | 10   |
| M15KP260A   | 260  | 289   | 5                                   | 419   | 36                                     | 10   |
| M15KP280A   | 280  | 311   | 5                                   | 452   | 33                                     | 10   |

**MRT100KP Axial Devices**

| Features  | Appearance  |
|---|---|
| <ul style="list-style-type: none"> <li>• 100 kW peak pulse power at 6.4/69 <math>\mu</math>S</li> <li>• Standoff voltage of 40V to 400V</li> <li>• Operational and storage temperature of <math>-55^{\circ}\text{C}</math> to <math>+150^{\circ}\text{C}</math></li> <li>• Unidirectional and bidirectional versions available</li> <li>• 100% surge-tested devices</li> <li>• Both RoHS and non-RoHS compliant versions available.</li> <li>• Moisture classification is Level 1 with no dry pack required per IPC/JEDEC J-STD-020B</li> </ul> |  |

**Part Nomenclature**

**Sample Part Number**

**MXRT100KP70CAe3** – MX screened axial 100 kW device, 70 V stand-off, bidirectional, 5% tolerance and RoHS compliant.


**Relay Transient Protection**

# MRT100KP Axial Devices

## MRT100KP 100 kW @ 6.4/69 $\mu$ S, All Electrical Characteristics @ 25°C

| Type Number  | Reverse Stand-Off Voltage<br>$V_{WM}$<br>Volts | Minimum Breakdown Voltage<br>$V_{BR}$ Min. @ $I_{BR}$<br>Volts | Breakdown Current<br>$I_{BR}$<br>mA | Maximum Clamping Voltage<br>@ $I_{PP}$ $V_C$<br>Volts | Peak Pulse Current<br>$I_{PP}$<br>Amps | Maximum Standby Current<br>@ $V_{WM}$ $I_D$<br>$\mu$ A |
|--------------|--|--|-------------------------------------|---|--|--|
| MRT100KP40A  | 40   | 44.4   | 20                                  | 78.6  | 1273*                                  | 1500   |
| MRT100KP43A  | 43   | 47.8   | 10                                  | 84.5  | 1184 *                                 | 500  |
| MRT100KP45A  | 45   | 50.0   | 5                                   | 88.5  | 1130 *                                 | 150  |
| MRT100KP48A  | 48   | 53.3   | 5                                   | 94.3  | 1061 *                                 | 150  |
| MRT100KP51A  | 51   | 56.7   | 5                                   | 101   | 990 *                                  | 50   |
| MRT100KP54A  | 54   | 60.0   | 5                                   | 106   | 943 *                                  | 25   |
| MRT100KP58A  | 58   | 64.4   | 5                                   | 114   | 878                                    | 15   |
| MRT100KP60A  | 60   | 66.7   | 5                                   | 118   | 848                                    | 15   |
| MRT100KP64A  | 64   | 71.1   | 5                                   | 126   | 795                                    | 10   |
| MRT100KP70A  | 70   | 77.8   | 5                                   | 138   | 725                                    | 10   |
| MRT100KP75A  | 75   | 83.3   | 5                                   | 147   | 680                                    | 10   |
| MRT100KP78A  | 78   | 86.7   | 5                                   | 153   | 655                                    | 10   |
| MRT100KP85A  | 85   | 94.4   | 5                                   | 166   | 602                                    | 10   |
| MRT100KP90A  | 90   | 100  | 5                                   | 178   | 563                                    | 10   |
| MRT100KP100A | 100  | 111  | 5                                   | 197   | 508                                    | 10   |
| MRT100KP110A | 110  | 122  | 5                                   | 216   | 463                                    | 10   |
| MRT100KP120A | 120  | 133  | 5                                   | 235   | 426                                    | 10   |
| MRT100KP130A | 130  | 144  | 5                                   | 254   | 394                                    | 10   |
| MRT100KP150A | 150  | 167  | 5                                   | 296   | 338                                    | 10   |
| MRT100KP160A | 160  | 178  | 5                                   | 315   | 318                                    | 10   |
| MRT100KP170A | 170  | 189  | 5                                   | 334   | 300                                    | 10   |
| MRT100KP180A | 180  | 200  | 5                                   | 354   | 283                                    | 10   |
| MRT100KP200A | 200  | 222  | 5                                   | 392   | 256                                    | 10   |
| MRT100KP220A | 220  | 245  | 5                                   | 434   | 231                                    | 10   |
| MRT100KP250A | 250  | 278  | 5                                   | 493   | 203                                    | 10   |
| MRT100KP260A | 260  | 289  | 5                                   | 512   | 196                                    | 10   |
| MRT100KP280A | 280  | 311  | 5                                   | 552   | 181                                    | 10   |
| MRT100KP300A | 300  | 333  | 5                                   | 590   | 170                                    | 10   |
| MRT100KP350A | 350  | 389  | 5                                   | 690   | 145                                    | 10   |
| MRT100KP400A | 400  | 444  | 5                                   | 787   | 127                                    | 10   |

\*The Maximum Peak Pulse Current ( $I_{PP}$ ) shown represents the performance capabilities by design. Surge test screening is only performed up to 900 Amps (test equipment limitations).

## MRT130KP 130 kW Transient Voltage Suppressor

### Features

- Operational and storage temperature of  $-55\text{ }^{\circ}\text{C}$  to  $+150\text{ }^{\circ}\text{C}$
- 100% surge-tested devices
- Suppresses transients up to 130 kW @ 6.4/69  $\mu\text{s}$
- Available as either low clamp with “CV” suffix or normal clamping features with “CA” suffix
- Moisture classification is Level 1 with no dry pack required per IPC/JEDEC J-STD-020B
- RoHS compliant devices available by adding “e3” suffix

### Electrical Characteristics @ 25°C

| Part Number   | Working Standoff Voltage<br>$V_{WM}$ | Maximum Standby Current<br>$I_D$ @ $V_{WM}$ | Minimum Breakdown Voltage<br>$V_{BR}$ @ $I_{BR}$ | Breakdown Current<br>$I_{BR}$ | Maximum Clamping Voltage<br>$V_C$ @ $I_{PP}$<br>(Note 1) | Peak Pulse Current<br>$I_{PP}$ @ 6.4/69 $\mu\text{s}$<br>(Note 2) |
|---------------|--------------------------------------|---|--|-------------------------------|--|---|
|               | V Max                                | $\mu\text{A}$                               | Volts  | mA                            | Volts  | Amps  |
| MRT130KP275CV | 275                                  | 5   | 300  | 5                             | 400  | 292   |
| MRT130KP275CA | 275                                  | 5   | 300  | 5                             | 445  | 292   |
| MRT130KP295CV | 295                                  | 5   | 300  | 5                             | 410  | 282   |
| MRT130KP295CA | 295                                  | 5   | 300  | 5                             | 460  | 282   |



# MRT65KP Transient Voltage Suppressor

## MRT65KP 65 kW Transient Voltage Suppressor

### Features

- 100% surge-tested devices
- Suppresses transients up to 65 kW @ 6.4/69  $\mu$ s
- Operational and storage temperature of  $-55^{\circ}\text{C}$  to  $+150^{\circ}\text{C}$
- Moisture classification is Level 1 with no dry pack required per IPC/JEDEC J-STD-020B
- RoHS compliant devices available by adding “e3” suffix

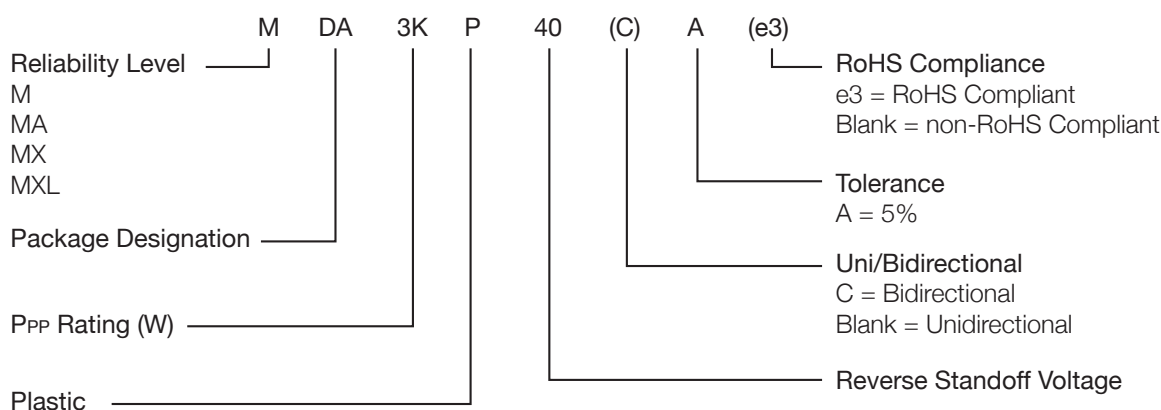
### Electrical Characteristics @ 25°C

| PART NUMBER<br>(replace A suffix with<br>CA for bidirectional) | Working Standoff<br>Voltage<br>$V_{WM}$ | Maximum Standby<br>Current<br>$I_D @ V_{WM}$ | Minimum<br>Breakdown<br>Voltage<br>$V_{BR} @ I_{BR}$ | Breakdown<br>Current<br>$I_{BR}$ | Maximum<br>Clamping Voltage<br>$V_C @ I_{PP}$<br>(Note 1) | Peak Pulse<br>Current<br>$I_{PP} @ 6.4/69 \mu\text{S}$<br>(Note 2) |
|--|---|--|--|----------------------------------|---|--|
|  | V max                                   | $\mu\text{A}$                                | V  | mA                               | V   | A  |
| MRT65KP48A   | 48                                      | 5  | 53.3   | 5                                | 77.7  | 836  |
| MRT65KP54A   | 54                                      | 5  | 60.0   | 5                                | 87.5  | 742  |
| MRT65KP60A   | 60                                      | 5  | 66.7   | 5                                | 97.3  | 668  |
| MRT65KP75A   | 75                                      | 5  | 83.3   | 5                                | 122   | 533  |

## MDA 3 kW Transient Voltage Suppressor Array

| Features   |
|--|
| <ul style="list-style-type: none"> <li>Available in both unidirectional and bidirectional construction</li> <li>Selections for 6.0 to 40 Volts Standoff Voltages (VWM)</li> <li>Operational and storage temperature of -55°C to +150°C</li> <li>RoHS compliant devices available by adding "e3" suffix</li> <li>Suppresses transients up to 3,000 W @ 10/1000 <math>\mu</math>s</li> <li>Moisture classification is Level 1 with no dry pack required per IPC/JEDEC J-STD-020B</li> <li>100% surge-tested devices</li> </ul> |

### Part Nomenclature

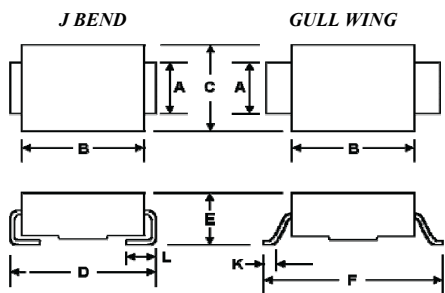


| Part Number | Reverse Stand off Voltage<br>V <sub>WM</sub> | Breakdown Voltage           |                     | Maximum Clamping<br>Voltage V <sub>c</sub><br>@ I <sub>PP</sub> | Maximum Standby Current<br>ID<br>@ V <sub>WM</sub> | Maximum Peak Pulse<br>Current<br>I <sub>PP</sub> |
|-------------|--|-----------------------------|---------------------|---|--|--|
|             |  | V <sub>(br)</sub> (Min-Max) | @ I <sub>(br)</sub> |   |  |  |
|             |  | V                           | mA                  |   |  |  |
| MDA3KP6.0A  | 6  | 6.67-7.37                   | 10                  | 10.3  | 1000   | 291.3  |
| MDA3KP6.5A  | 6.5  | 7.22-7.98                   | 10                  | 11.2  | 500  | 267.9  |
| MDA3KP7.0A  | 7  | 7.78-8.6                    | 10                  | 12.0  | 200  | 250  |
| MDA3KP7.5A  | 7.5  | 8.33-9.21                   | 1                   | 12.9  | 100  | 232.6  |
| MDA3KP8.0A  | 8  | 8.89-9.83                   | 1                   | 13.6  | 50   | 220.6  |
| MDA3KP8.5A  | 8.5  | 9.44-10.4                   | 1                   | 14.4  | 25   | 208.3  |
| MDA3KP9.0A  | 9  | 10.0-11.1                   | 1                   | 15.4  | 10   | 194.8  |
| MDA3KP10A   | 10   | 11.1-12.3                   | 1                   | 17.0  | 5  | 176.5  |
| MDA3KP11A   | 11   | 12.2-13.5                   | 1                   | 18.2  | 5  | 164.8  |
| MDA3KP12A   | 12   | 13.3-14.7                   | 1                   | 19.9  | 5  | 150.8  |
| MDA3KP13A   | 13   | 14.4-15.9                   | 1                   | 21.5  | 5  | 139.5  |
| MDA3KP14A   | 14   | 15.6-17.2                   | 1                   | 23.2  | 2  | 129.3  |
| MDA3KP15A   | 15   | 16.7-18.5                   | 1                   | 24.4  | 2  | 123  |
| MDA3KP16A   | 16   | 17.8-19.7                   | 1                   | 26.0  | 2  | 115.4  |
| MDA3KP17A   | 17   | 18.9-20.9                   | 1                   | 27.6  | 2  | 108.7  |
| MDA3KP18A   | 18   | 20.0-22.1                   | 1                   | 29.2  | 2  | 102.7  |
| MDA3KP20A   | 20   | 22.2-24.5                   | 1                   | 32.4  | 2  | 92.6   |
| MDA3KP22A   | 22   | 24.4-26.9                   | 1                   | 35.5  | 2  | 84.5   |
| MDA3KP24A   | 24   | 26.7-29.5                   | 1                   | 38.9  | 2  | 77.1   |
| MDA3KP26A   | 26   | 28.9-31.9                   | 1                   | 42.1  | 2  | 71.3   |
| MDA3KP28A   | 28   | 31.1-34.4                   | 1                   | 45.4  | 2  | 66.1   |
| MDA3KP30A   | 30   | 33.3-36.8                   | 1                   | 48.8  | 2  | 62   |
| MDA3KP33A   | 33   | 36.7-40.6                   | 1                   | 53.3  | 2  | 56.3   |
| MDA3KP36A   | 36   | 40.0-44.2                   | 1                   | 58.1  | 2  | 51.6   |
| MDA3KP40A   | 40   | 44.4-49.1                   | 1                   | 64.5  | 2  | 46.5   |

NOTE 1: For bidirectional types, indicate a C suffix as shown on page 2 in "Part Nomenclature"  
 Transient Voltage Suppressors are normally selected with reverse standoff voltage VWM, which should be equal to or greater than peak operating voltage.

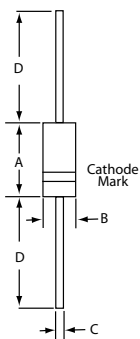
# Package Outline Drawings

## MSMB/MSMC/MSML



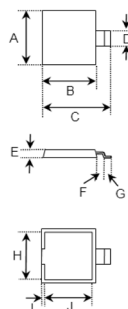
| MSMB PACKAGE DIMENSIONS IN INCHES (DO-214AA/DO-215AA)      |       |       |       |       |       |       |       |       |
|--|-------|-------|-------|-------|-------|-------|-------|-------|
|  | A     | B     | C     | D     | E     | F     | K     | L     |
| MIN  | 0.077 | 0.160 | 0.130 | 0.205 | 0.077 | 0.235 | 0.015 | 0.030 |
| MAX  | 0.083 | 0.180 | 0.155 | 0.220 | 0.104 | 0.255 | 0.030 | 0.060 |
| DIMENSIONS IN MILLIMETERS                                  |       |       |       |       |       |       |       |       |
| MIN  | 1.95  | 4.06  | 3.30  | 5.21  | 1.95  | 5.97  | 0.381 | 0.760 |
| MAX  | 2.10  | 4.57  | 3.94  | 5.59  | 2.65  | 6.48  | 0.762 | 1.520 |
| MSMC/MSML PACKAGE DIMENSIONS IN INCHES (DO-214AB/DO-215AB) |       |       |       |       |       |       |       |       |
|  | A     | B     | C     | D     | E     | F     | K     | L     |
| MIN  | 0.115 | 0.260 | 0.220 | 0.305 | 0.077 | 0.380 | 0.025 | 0.030 |
| MAX  | 0.121 | 0.280 | 0.245 | 0.320 | 0.110 | 0.400 | 0.040 | 0.060 |
| DIMENSIONS IN MILLIMETERS                                  |       |       |       |       |       |       |       |       |
| MIN  | 2.92  | 6.60  | 5.59  | 7.75  | 1.95  | 9.65  | 0.635 | 0.760 |
| MAX  | 3.07  | 7.11  | 6.22  | 8.13  | 2.80  | 10.16 | 1.016 | 1.520 |

## MP4KE, MP6KE, M1.5KE & MLCE



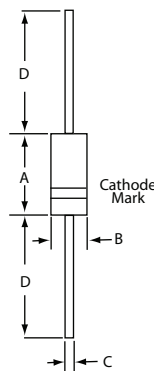
| DIM | P4KE (DO-41) |       |      |       | P6KE (T-18) |       |      |      | 1.5KE & LCE (Case 1) |       |       |       |
|-----|--------------|-------|------|-------|-------------|-------|------|------|----------------------|-------|-------|-------|
|     | INCHES       |       | MM   |       | INCHES      |       | MM   |      | INCHES               |       | MM    |       |
|     | MIN          | MAX   | MIN  | MAX   | MIN         | MAX   | MIN  | MAX  | MIN                  | MAX   | MIN   | MAX   |
| A   | -            | 0.205 | -    | 5.207 | 0.330       | 0.350 | 8.39 | 8.89 | 0.360                | 0.375 | 9.144 | 9.525 |
| B   | -            | 0.107 | -    | 2.72  | 0.130       | 0.145 | 3.31 | 3.68 | 0.190                | 0.205 | 4.826 | 5.207 |
| C   | 0.03         | 0.034 | 0.76 | 0.86  | 0.038       | 0.042 | 0.97 | 1.06 | 0.038                | 0.042 | 0.965 | 1.067 |
| D   | 1.00         | -     | 25.4 | -     | 1.00        | -     | 25.4 | -    | 1.10                 | -     | 27.9  | -     |

## mini-PLAD



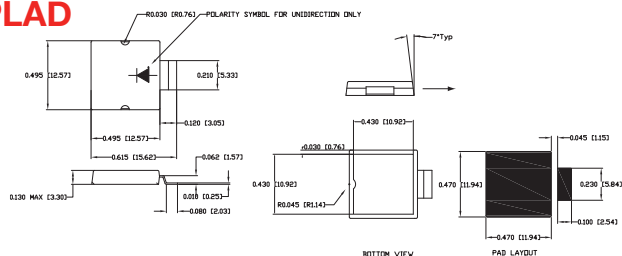
| Ref. | Dimensions |        |
|------|------------|--------|
|      | mm         | Inches |
| A    | 8.76       | 0.345  |
| B    | 8.76       | 0.345  |
| C    | 11.27      | 0.444  |
| D    | 2.54       | 0.100  |
| E    | 3.18       | 0.125  |
| F    | 0.76       | 0.030  |
| G    | 1.78       | 0.070  |
| H    | 7.24       | 0.285  |
| I    | 0.76       | 0.030  |
| J    | 7.24       | 0.285  |

## M5KP, M15KP and MRT100KP Case 5A

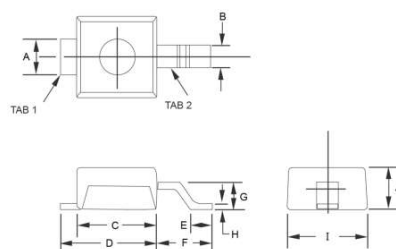


|   | RT100KP (Case 5A) |       |       |       |
|---|-------------------|-------|-------|-------|
|   | INCHES            |       | MM    |       |
|   | MIN               | MAX   | MIN   | MAX   |
| A | 0.365             | 0.385 | 9.271 | 9.779 |
| B | 0.235             | 0.255 | 5.969 | 6.477 |
| C | 0.047             | 0.053 | 1.194 | 1.346 |
| D | 0.75              | -     | 19.05 | -     |

## PLAD



## Powermite1 DO-216AA



| Ltr | Dimensions |             |
|-----|------------|-------------|
|     | Inch       | Millimeters |
| A   | 0.100      | 2.54        |
| B   | 0.105      | 2.67        |
| C   | 0.050      | 1.27        |
| D   | 0.030      | 0.76        |
| E   | 0.025      | 0.64        |