



## 5,000 Watt Transient Voltage Suppressor (TVS) Protection Device

Screening in reference to MIL-PRF-19500 available

### DESCRIPTION

This Transient Voltage Suppressor series M5KP5.0A – M5KP110CA provides a range of standoff voltage options from 5.0 to 110 V in unidirectional, bidirectional, RoHS compliant, and SnPb solder dipped options. Multiple advanced screening levels are available for enhanced reliability. Clamping action is almost instantaneous. As a result, they provide effective protection from ESD or EFT per IEC61000-4-2 and IEC61000-4-4, as well as transients caused by inductive switching and RFI. They also protect from secondary lightning effects per 61000-4-5 at the class levels specified below.

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

### FEATURES

- Available in both unidirectional and bidirectional configurations
- 3 $\sigma$  lot norm screening performed on standby current  $I_D$
- 100% surge tested devices
- Various screening in reference to MIL-PRF-19500. Refer to [HiRel Non-Hermetic Product Portfolio](#) for more details on the screening options (See [part nomenclature](#) for all options.)
- High reliability controlled devices with wafer fabrication and assembly lot traceability
- Moisture classification is level 1 with no dry pack required per IPC/JEDEC J-STD-020B
- RoHS compliant versions are available

### APPLICATIONS / BENEFITS

- Selections for 5.0 to 110 volts stand-off voltage ( $V_{WM}$ )
- Economical TVS series for thru-hole mounting
- This M5KPxxx series has a significantly reduced body diameter than the 5KPxxx commercial series for a smaller size footprint often required for aviation and other applications
- Pico- to nano-second response time
- Protection from transients due to inductive switching and RFI
- Compliant to IEC 61000-4-2 and IEC 61000-4-4 for ESD and EFT protection respectively
- Secondary lightning protection per IEC61000-4-5 with 42 ohms source impedance:
  - Class 1, 2, 3, 4: M5KP5.0A to M5KP110CA
  - Class 5: M5KP5.0A to M5KP110CA (short distance)
  - Class 5: M5KP5.0A to M5KP36CA (long distance)
- Secondary lightning protection per IEC61000-4-5 with 12 ohms source impedance:
  - Class 1 & 2: M5KP5.0A to M5KP110CA
  - Class 3: M5KP5.0A to M5KP78CA
  - Class 4: M5KP5.0A to M5KP40CA
- Secondary lightning protection per IEC61000-4-5 with 2 ohms source impedance:
  - Class 2: M5KP5.0A to M5KP70CA
  - Class 3: M5KP5.0A to M5KP36CA
  - Class 4: M5KP5.0A to M5KP18CA



**Case 5A  
(DO-204AR)  
Package**

Also available in:

**P600 package**  
(commercial plastic axial-leaded)

 [5KP5.0e3 – 5KP250CAe3](#)

**DO-13 package**  
(metal axial-leaded)

 [LC6.5A – LC170A](#)

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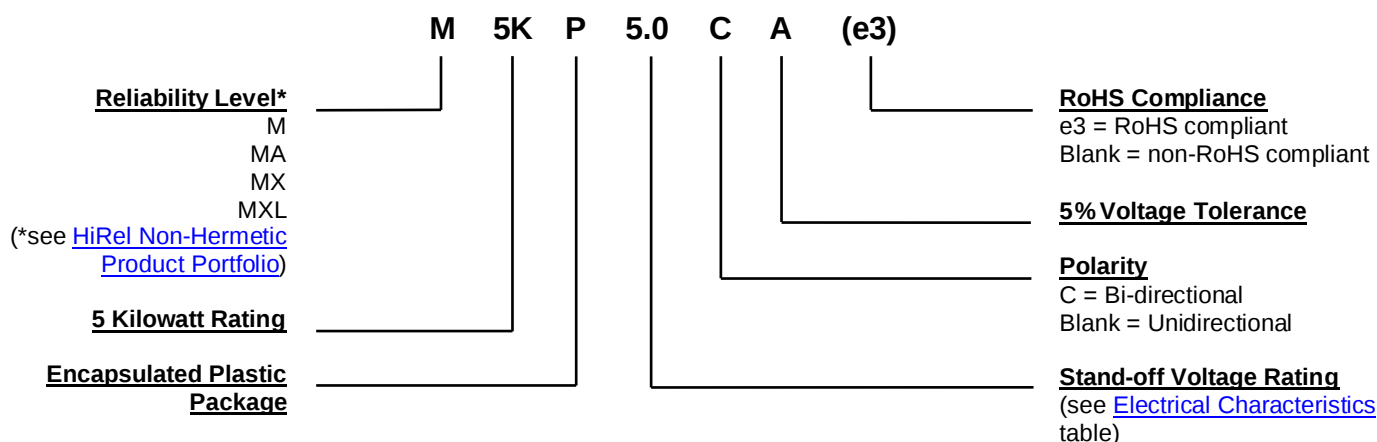
**MAXIMUM RATINGS @ 25 °C unless otherwise noted**

| Parameters/Test Conditions                                                              | Symbol              | Value                    | Unit     |
|-----------------------------------------------------------------------------------------|---------------------|--------------------------|----------|
| Junction and Storage Temperature                                                        | $T_J$ and $T_{STG}$ | -65 to +150              | °C       |
| Thermal Resistance, Junction to Lead @ 0.375 inch (9.5 mm) lead length from body        | $R_{\theta JL}$     | 20                       | °C/W     |
| Thermal Resistance, Junction to Ambient <sup>(1)</sup>                                  | $R_{\theta JA}$     | 80                       | °C/W     |
| Peak Pulse Power Dissipation <sup>(2)</sup> 10/1000 $\mu$ s                             | $P_{PP}$            | 5000                     | W        |
| Steady-State Power Dissipation @ $T_L = 25$ °C<br>0.375 inch (9.5 mm) from body         | $P_D$               | 6<br>1.56 <sup>(1)</sup> | W        |
| $T_{clamping}$ (0 volts to $V_{(BR)}$ min, theoretical) Unidirectional<br>Bidirectional |                     | < 100<br>< 5             | ps<br>ns |
| Forward Voltage <sup>(3)</sup>                                                          | $V_F$               | 3.5                      | V        |
| Solder Temperature @ 10 s                                                               |                     | 260                      | °C       |

- Notes:**
1. When mounted on FR4 PC board with 4 mm<sup>2</sup> copper pads (1 oz) and track width 1 mm, length 25 mm.
  2. With impulse repetition rate (duty factor) of 0.01 % or less (also [Figure 1 and 2](#)).
  3. At 100 amp peak impulse of 8.3 ms half-sine wave (unidirectional only).

**MECHANICAL and PACKAGING**

- CASE: Void-free transfer molded thermosetting epoxy body meeting UL94V-0
- TERMINALS: Tin-lead or RoHS compliant annealed matte-tin plating. Solderable per MIL-STD-750, method 2026.
- MARKING: Part number
- POLARITY: Cathode indicated by band. No cathode band on bidirectional devices.
- TAPE & REEL option: Standard per EIA-296 (add "TR" suffix to part number). Consult factory for quantities.
- WEIGHT: Approximately 1.4 grams
- See [Package Dimensions](#) on last page.

**PART NOMENCLATURE**


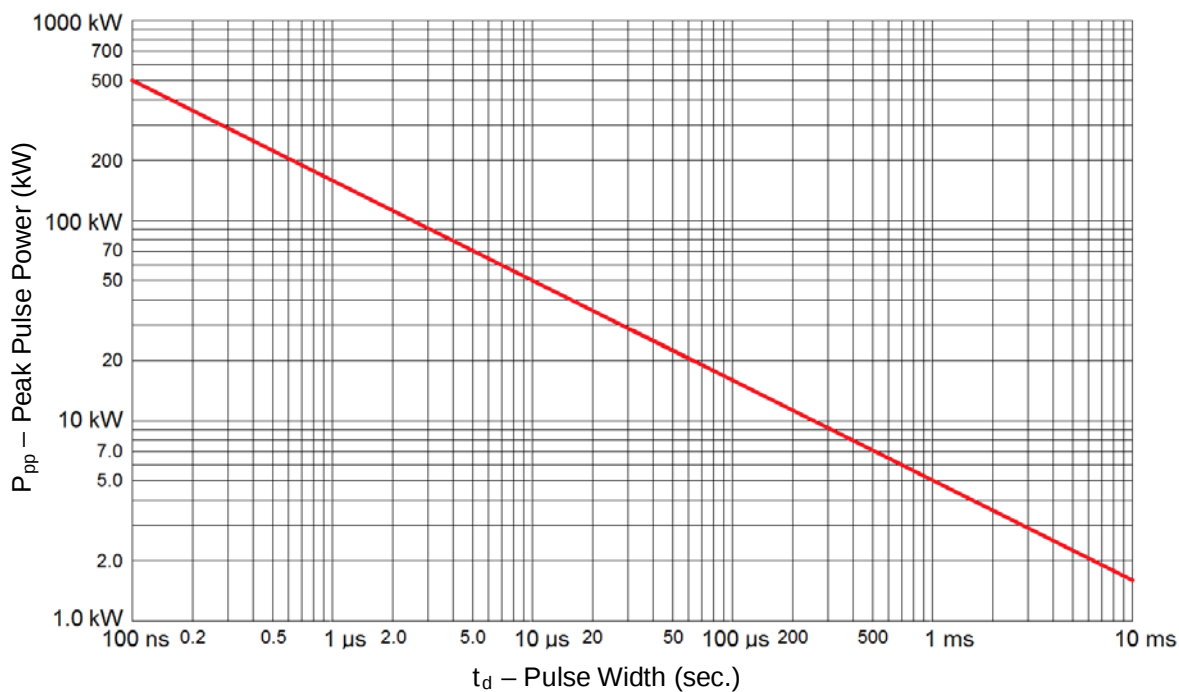
| SYMBOLS & DEFINITIONS |                                                                                                                                                                                                                                                                                   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

**ELECTRICAL CHARACTERISTICS @ 25 °C**

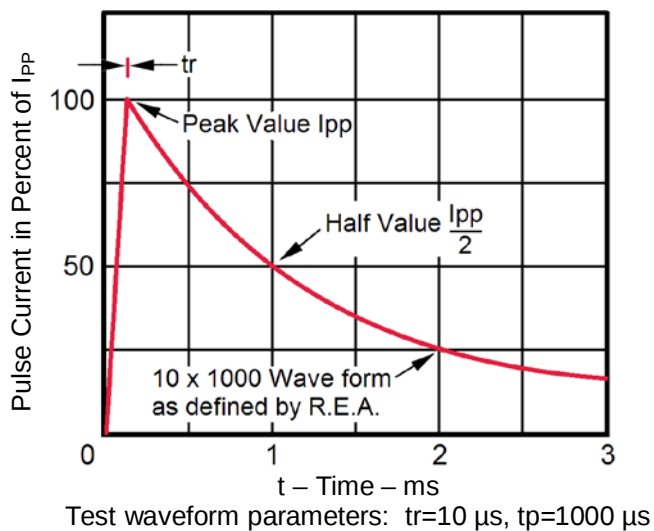
| PART NUMBER<br>(Note 2) | REVERSE<br>STAND-<br>OFF<br>VOLTAGE<br>$V_{WM}$<br>(Note 1) | BREAKDOWN<br>VOLTAGE<br>$V_{(BR)}$ @ $I_{(BR)}$ |    | MAXIMUM<br>CLAMPING<br>VOLTAGE<br>$V_C$ @ $I_{PP}$ | MAXIMUM<br>STANDBY<br>CURRENT $I_D$<br>@ $V_{WM}$ | MAXIMUM<br>PEAK PULSE<br>CURRENT<br>$I_{PP}$<br>(FIG. 2) | MAXIMUM<br>TEMPERATURE<br>COEFFICIENT OF<br>$V_{(BR)}$<br>$\alpha_{V(BR)}$ |
|-------------------------|-------------------------------------------------------------|-------------------------------------------------|----|----------------------------------------------------|---------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------------------------|
|                         | V                                                           | V                                               | mA | V                                                  | $\mu A$                                           | A                                                        | mV/ °C                                                                     |
| M5KP5.0A                | 5.0                                                         | 6.40 – 7.00                                     | 50 | 9.2                                                | 2000*                                             | 543                                                      | 4.0                                                                        |
| M5KP6.0A                | 6.0                                                         | 6.67 – 7.37                                     | 50 | 10.3                                               | 5000                                              | 485                                                      | 4.0                                                                        |
| M5KP6.5A                | 6.5                                                         | 7.22 – 7.98                                     | 50 | 11.2                                               | 2000                                              | 447                                                      | 4.0                                                                        |
| M5KP7.0A                | 7.0                                                         | 7.78 – 8.60                                     | 50 | 12.0                                               | 1000                                              | 417                                                      | 5.0                                                                        |
| M5KP7.5A                | 7.5                                                         | 8.33 – 9.21                                     | 5  | 12.9                                               | 250                                               | 388                                                      | 6.0                                                                        |
| M5KP8.0A                | 8.0                                                         | 8.89 – 9.83                                     | 5  | 13.6                                               | 150                                               | 367                                                      | 6.0                                                                        |
| M5KP8.5A                | 8.5                                                         | 9.44 – 10.4                                     | 5  | 14.4                                               | 50                                                | 347                                                      | 7.0                                                                        |
| M5KP9.0A                | 9.0                                                         | 10.0 – 11.1                                     | 5  | 15.4                                               | 20                                                | 325                                                      | 8.0                                                                        |
| M5KP10A                 | 10                                                          | 11.1 – 12.3                                     | 5  | 17.0                                               | 15                                                | 294                                                      | 9.0                                                                        |
| M5KP11A                 | 11                                                          | 12.2 – 13.5                                     | 5  | 18.2                                               | 10                                                | 274                                                      | 10                                                                         |
| M5KP12A                 | 12                                                          | 13.3 – 14.7                                     | 5  | 19.9                                               | 10                                                | 251                                                      | 11                                                                         |
| M5KP13A                 | 13                                                          | 14.4 – 15.9                                     | 5  | 21.5                                               | 10                                                | 232                                                      | 12                                                                         |
| M5KP14A                 | 14                                                          | 15.6 – 17.2                                     | 5  | 23.2                                               | 10                                                | 215                                                      | 13                                                                         |
| M5KP15A                 | 15                                                          | 16.7 – 18.5                                     | 5  | 24.4                                               | 10                                                | 206                                                      | 15                                                                         |
| M5KP16A                 | 16                                                          | 17.8 – 19.7                                     | 5  | 26.0                                               | 10                                                | 192                                                      | 16                                                                         |
| M5KP17A                 | 17                                                          | 18.9 – 20.9                                     | 5  | 27.6                                               | 10                                                | 181                                                      | 18                                                                         |
| M5KP18A                 | 18                                                          | 20.0 – 22.1                                     | 5  | 29.2                                               | 10                                                | 172                                                      | 19                                                                         |
| M5KP20A                 | 20                                                          | 22.2 – 24.5                                     | 5  | 32.4                                               | 10                                                | 154                                                      | 22                                                                         |
| M5KP22A                 | 22                                                          | 24.4 – 26.9                                     | 5  | 35.5                                               | 10                                                | 141                                                      | 24                                                                         |
| M5KP24A                 | 24                                                          | 26.7 – 29.5                                     | 5  | 38.9                                               | 10                                                | 128                                                      | 27                                                                         |
| M5KP26A                 | 26                                                          | 28.9 – 31.9                                     | 5  | 42.1                                               | 10                                                | 119                                                      | 29                                                                         |
| M5KP28A                 | 28                                                          | 31.1 – 34.4                                     | 5  | 45.5                                               | 10                                                | 110                                                      | 30                                                                         |
| M5KP30A                 | 30                                                          | 33.3 – 36.8                                     | 5  | 48.4                                               | 10                                                | 103                                                      | 35                                                                         |
| M5KP33A                 | 33                                                          | 36.7 – 40.6                                     | 5  | 53.3                                               | 10                                                | 94                                                       | 38                                                                         |
| M5KP36A                 | 36                                                          | 40.0 – 44.2                                     | 5  | 58.1                                               | 10                                                | 86                                                       | 40                                                                         |
| M5KP40A                 | 40                                                          | 44.4 – 49.1                                     | 5  | 64.5                                               | 10                                                | 78                                                       | 45                                                                         |
| M5KP43A                 | 43                                                          | 47.8 – 52.8                                     | 5  | 69.4                                               | 10                                                | 72                                                       | 49                                                                         |
| M5KP45A                 | 45                                                          | 50.0 – 55.3                                     | 5  | 72.7                                               | 10                                                | 69                                                       | 51                                                                         |
| M5KP48A                 | 48                                                          | 53.3 – 58.9                                     | 5  | 77.4                                               | 10                                                | 65                                                       | 55                                                                         |
| M5KP51A                 | 51                                                          | 56.7 – 62.7                                     | 5  | 82.4                                               | 10                                                | 61                                                       | 60                                                                         |
| M5KP54A                 | 54                                                          | 60.0 – 66.3                                     | 5  | 87.1                                               | 10                                                | 57                                                       | 64                                                                         |
| M5KP58A                 | 58                                                          | 64.4 – 71.2                                     | 5  | 93.6                                               | 10                                                | 53                                                       | 69                                                                         |
| M5KP60A                 | 60                                                          | 66.7 – 73.7                                     | 5  | 96.8                                               | 10                                                | 52                                                       | 70                                                                         |
| M5KP64A                 | 64                                                          | 71.1 – 78.6                                     | 5  | 103.0                                              | 10                                                | 49                                                       | 75                                                                         |
| M5KP70A                 | 70                                                          | 77.8 – 86.0                                     | 5  | 113                                                | 10                                                | 44                                                       | 84                                                                         |
| M5KP75A                 | 75                                                          | 83.3 – 92.1                                     | 5  | 121                                                | 10                                                | 41                                                       | 90                                                                         |
| M5KP78A                 | 78                                                          | 86.7 – 95.8                                     | 5  | 126                                                | 10                                                | 40                                                       | 94                                                                         |
| M5KP85A                 | 85                                                          | 94.4 – 104.0                                    | 5  | 137                                                | 10                                                | 36                                                       | 102                                                                        |
| M5KP90A                 | 90                                                          | 100 – 111                                       | 5  | 146                                                | 10                                                | 34                                                       | 109                                                                        |
| M5KP100A                | 100                                                         | 111 – 123                                       | 5  | 162                                                | 10                                                | 31                                                       | 122                                                                        |
| M5KP110A                | 110                                                         | 122 - 135                                       | 5  | 177                                                | 10                                                | 28                                                       | 132                                                                        |

**NOTES:**

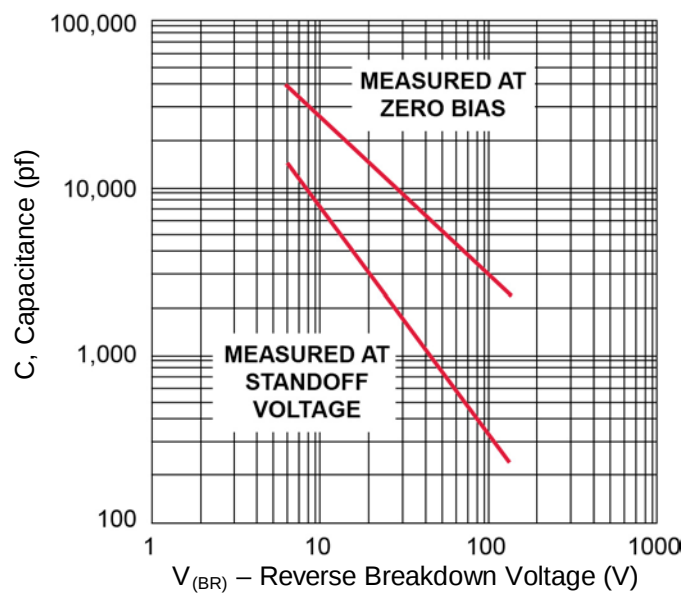
1. Transient voltage suppressors are normally selected with reverse "stand-off voltage" ( $V_{WM}$ ) which should be equal to or greater than the dc or continuous peak operating voltage level.
2. For the bidirectional M5KP5.0CA double the  $I_D$  maximum standby current to 4000  $\mu A$ .

**GRAPHS**


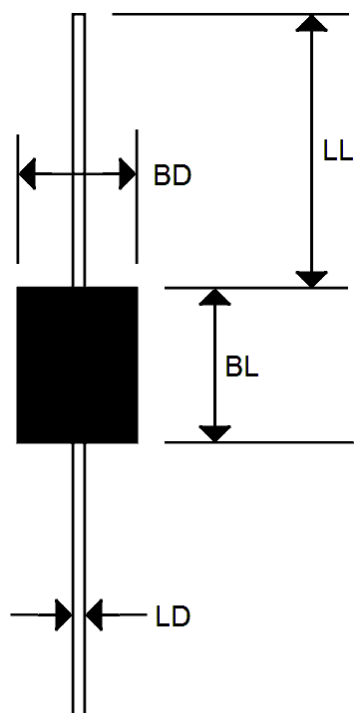
**FIGURE 1**  
Peak Pulse Power Rating Curve



**FIGURE 2**  
Pulse Waveform for 10/1000  $\mu$ s Exponential Surge

**GRAPHS (continued)**


**FIGURE 3**  
Typical Junction Capacitance

**PACKAGE DIMENSIONS**


| Dim       | Dimensions |       |             |       |
|-----------|------------|-------|-------------|-------|
|           | Inch       |       | Millimeters |       |
|           | Min        | Max   | Min         | Max   |
| <b>LL</b> | 0.750      | -     | 19.05       | -     |
| <b>BL</b> | 0.365      | 0.385 | 9.27        | 9.78  |
| <b>BD</b> | 0.235      | 0.255 | 5.97        | 6.48  |
| <b>LD</b> | 0.047      | 0.053 | 1.194       | 1.346 |