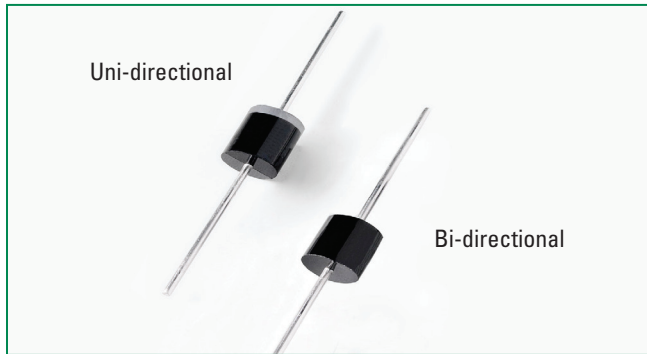


## 5KP Series



### Agency Approvals

| AGENCY | AGENCY FILE NUMBER |
|--------|--------------------|
|        | E128662/E230531    |

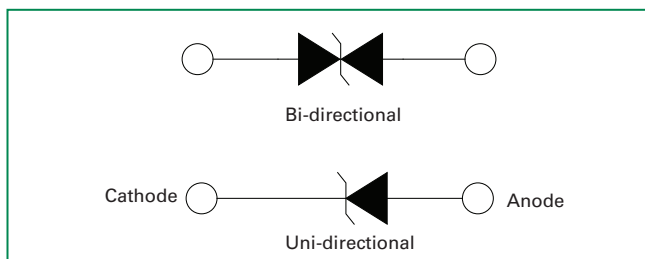
### Maximum Ratings and Thermal Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| Parameter                                                                             | Symbol                            | Value      | Unit |
|---------------------------------------------------------------------------------------|-----------------------------------|------------|------|
| Peak Pulse Power Dissipation by 10/1000µs Test Waveform (Fig. 2) (Note 1)             | P <sub>PPM</sub>                  | 5000       | W    |
| Steady State Power Dissipation on Infinite Heat Sink at T <sub>L</sub> =75°C (Fig. 6) | P <sub>D</sub>                    | 8.0        | W    |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave Unidirectional Only (Note 2)  | I <sub>FSM</sub>                  | 400        | A    |
| Maximum Instantaneous Forward Voltage at 100A for Unidirectional Only (Note 3)        | V <sub>F</sub>                    | 3.5/5.0    | V    |
| Operating Junction and Storage Temperature Range                                      | T <sub>J</sub> , T <sub>STG</sub> | -55 to 175 | °C   |
| Typical Thermal Resistance Junction to Lead                                           | R <sub>uJL</sub>                  | 8.0        | °C/W |
| Typical Thermal Resistance Junction to Ambient                                        | R <sub>uJA</sub>                  | 40         | °C/W |

#### Notes:

1. Non-repetitive current pulse, per Fig. 4 and derated above T<sub>A</sub> = 25°C per Fig. 3.
2. Measured on 8.3ms single half sine wave or equivalent square wave, duty cycle=4 per minute maximum.
3. V<sub>F</sub><3.5V for devices of V<sub>BR</sub> ≤ 200V and V<sub>F</sub><5.0V for devices of V<sub>BR</sub> ≥ 201V.

### Functional Diagram



### Description

The 5KP Series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

### Features

- V<sub>BR</sub> @T<sub>J</sub> = V<sub>BR</sub>@25°C × (1 + α T × (T<sub>J</sub> - 25))  
(α T: Temperature Coefficient)
- Glass passivated chip junction in P600 package
- 5000W peak pulse capability at 10/1000µs waveform, repetition rate (duty cycles): 0.01 %
- Fast response time: typically less than 1.0ps from 0 Volts to BV min
- Excellent clamping capability
- Typical failure mode is short from over-specified voltage or current
- Whisker test is conducted based on JEDEC JESD201A per its table 4a and 4c
- IEC-61000-4-2 ESD 15kV(Air), 8kV (Contact)
- ESD protection of data lines in accordance with IEC 61000-4-2 (IEC801-2)
- EFT protection of data lines in accordance with IEC 61000-4-4 (IEC801-4)
- Low incremental surge resistance
- Typical I<sub>R</sub> less than 2µA above 12V
- High temperature soldering guaranteed: 260°C/40 seconds / 0.375" (9.5mm) lead length, 5 lbs., (2.3kg) tension
- Plastic package has underwriters laboratory flammability classification 94V-O
- Matte tin lead-free plated
- Halogen free and RoHS compliant
- 2nd level interconnect is Pb-free per IPC/JEDEC J-STD-609A.01

### Applications

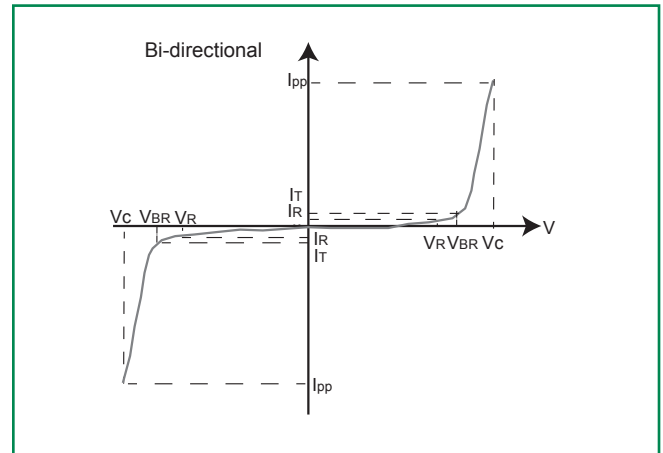
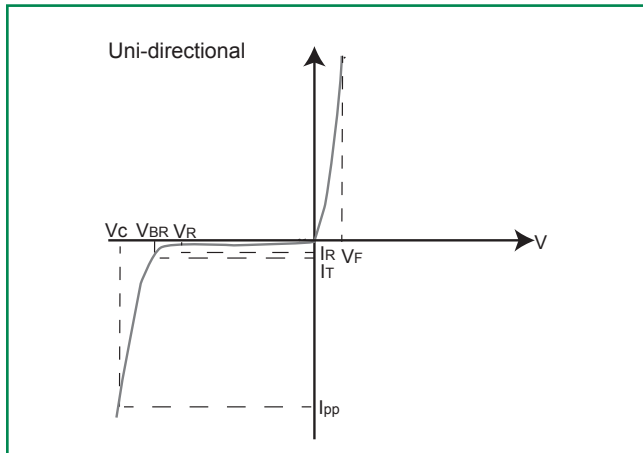
TVS devices are ideal for the protection of I/O interfaces, V<sub>CC</sub> bus and other vulnerable circuits used in telecom, computer, industrial and consumer electronic applications.

### Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| Part Number (Uni) | Part Number (Bi) | Reverse Stand off Voltage V <sub>R</sub> (Volts) | Breakdown Voltage V <sub>BR</sub> (Volts) @ I <sub>T</sub> |        | Test Current I <sub>T</sub> (mA) | Maximum Clamping Voltage V <sub>C</sub> @ I <sub>PP</sub> (V) | Maximum Peak Pulse Current I <sub>PP</sub> (A) | Maximum Reverse Leakage I <sub>R</sub> @ V <sub>R</sub> (μA) | Agency Approval  |
|-------------------|------------------|--------------------------------------------------|------------------------------------------------------------|--------|----------------------------------|---------------------------------------------------------------|------------------------------------------------|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
|                   |                  |                                                  | MIN                                                        | MAX    |                                  |                                                               |                                                |                                                              |                                                                                                     |
| 5KP5.0A           | 5KP5.0CA         | 5.0                                              | 6.40                                                       | 7.00   | 50                               | 9.2                                                           | 554.3                                          | 5000                                                         | X                                                                                                   |
| 5KP6.0A           | 5KP6.0CA         | 6.0                                              | 6.67                                                       | 7.37   | 50                               | 10.3                                                          | 495.1                                          | 5000                                                         | X                                                                                                   |
| 5KP6.5A           | 5KP6.5CA         | 6.5                                              | 7.22                                                       | 7.98   | 50                               | 11.2                                                          | 455.4                                          | 2000                                                         | X                                                                                                   |
| 5KP7.0A           | 5KP7.0CA         | 7.0                                              | 7.78                                                       | 8.60   | 50                               | 12.0                                                          | 425.0                                          | 1000                                                         | X                                                                                                   |
| 5KP7.5A           | 5KP7.5CA         | 7.5                                              | 8.33                                                       | 9.21   | 5                                | 12.9                                                          | 395.3                                          | 250                                                          | X                                                                                                   |
| 5KP8.0A           | 5KP8.0CA         | 8.0                                              | 8.89                                                       | 9.83   | 5                                | 13.6                                                          | 375.0                                          | 150                                                          | X                                                                                                   |
| 5KP8.5A           | 5KP8.5CA         | 8.5                                              | 9.44                                                       | 10.40  | 5                                | 14.4                                                          | 354.2                                          | 50                                                           | X                                                                                                   |
| 5KP9.0A           | 5KP9.0CA         | 9.0                                              | 10.00                                                      | 11.10  | 5                                | 15.4                                                          | 331.2                                          | 20                                                           | X                                                                                                   |
| 5KP10A            | 5KP10CA          | 10.0                                             | 11.10                                                      | 12.30  | 5                                | 17.0                                                          | 300.0                                          | 15                                                           | X                                                                                                   |
| 5KP11A            | 5KP11CA          | 11.0                                             | 12.20                                                      | 13.50  | 5                                | 18.2                                                          | 280.2                                          | 2                                                            | X                                                                                                   |
| 5KP12A            | 5KP12CA          | 12.0                                             | 13.30                                                      | 14.70  | 5                                | 19.9                                                          | 256.3                                          | 2                                                            | X                                                                                                   |
| 5KP13A            | 5KP13CA          | 13.0                                             | 14.40                                                      | 15.90  | 5                                | 21.5                                                          | 237.2                                          | 2                                                            | X                                                                                                   |
| 5KP14A            | 5KP14CA          | 14.0                                             | 15.60                                                      | 17.20  | 5                                | 23.2                                                          | 219.8                                          | 2                                                            | X                                                                                                   |
| 5KP15A            | 5KP15CA          | 15.0                                             | 16.70                                                      | 18.50  | 5                                | 24.4                                                          | 209.0                                          | 2                                                            | X                                                                                                   |
| 5KP16A            | 5KP16CA          | 16.0                                             | 17.80                                                      | 19.70  | 5                                | 26.0                                                          | 196.2                                          | 2                                                            | X                                                                                                   |
| 5KP17A            | 5KP17CA          | 17.0                                             | 18.90                                                      | 20.90  | 5                                | 27.6                                                          | 184.8                                          | 2                                                            | X                                                                                                   |
| 5KP18A            | 5KP18CA          | 18.0                                             | 20.00                                                      | 22.10  | 5                                | 29.2                                                          | 174.7                                          | 2                                                            | X                                                                                                   |
| 5KP20A            | 5KP20CA          | 20.0                                             | 22.20                                                      | 24.50  | 5                                | 32.4                                                          | 157.4                                          | 2                                                            | X                                                                                                   |
| 5KP22A            | 5KP22CA          | 22.0                                             | 24.00                                                      | 26.90  | 5                                | 35.5                                                          | 143.7                                          | 2                                                            | X                                                                                                   |
| 5KP24A            | 5KP24CA          | 24.0                                             | 26.70                                                      | 29.50  | 5                                | 38.9                                                          | 131.1                                          | 2                                                            | X                                                                                                   |
| 5KP26A            | 5KP26CA          | 26.0                                             | 28.90                                                      | 31.90  | 5                                | 42.1                                                          | 121.1                                          | 2                                                            | X                                                                                                   |
| 5KP28A            | 5KP28CA          | 28.0                                             | 31.10                                                      | 34.40  | 5                                | 45.4                                                          | 112.3                                          | 2                                                            | X                                                                                                   |
| 5KP30A            | 5KP30CA          | 30.0                                             | 33.30                                                      | 36.80  | 5                                | 48.4                                                          | 105.4                                          | 2                                                            | X                                                                                                   |
| 5KP33A            | 5KP33CA          | 33.0                                             | 36.70                                                      | 40.60  | 5                                | 53.3                                                          | 95.7                                           | 2                                                            | X                                                                                                   |
| 5KP36A            | 5KP36CA          | 36.0                                             | 40.00                                                      | 44.20  | 5                                | 58.1                                                          | 87.8                                           | 2                                                            | X                                                                                                   |
| 5KP40A            | 5KP40CA          | 40.0                                             | 44.40                                                      | 49.10  | 5                                | 64.5                                                          | 79.1                                           | 2                                                            | X                                                                                                   |
| 5KP43A            | 5KP43CA          | 43.0                                             | 47.80                                                      | 52.80  | 5                                | 69.4                                                          | 73.5                                           | 2                                                            | X                                                                                                   |
| 5KP45A            | 5KP45CA          | 45.0                                             | 50.00                                                      | 55.30  | 5                                | 72.7                                                          | 70.2                                           | 2                                                            | X                                                                                                   |
| 5KP48A            | 5KP48CA          | 48.0                                             | 53.30                                                      | 58.90  | 5                                | 77.4                                                          | 65.9                                           | 2                                                            | X                                                                                                   |
| 5KP51A            | 5KP51CA          | 51.0                                             | 56.70                                                      | 62.70  | 5                                | 82.4                                                          | 61.9                                           | 2                                                            | X                                                                                                   |
| 5KP54A            | 5KP54CA          | 54.0                                             | 60.00                                                      | 66.30  | 5                                | 87.1                                                          | 58.6                                           | 2                                                            | X                                                                                                   |
| 5KP58A            | 5KP58CA          | 58.0                                             | 64.40                                                      | 71.20  | 5                                | 93.6                                                          | 54.5                                           | 2                                                            | X                                                                                                   |
| 5KP60A            | 5KP60CA          | 60.0                                             | 66.70                                                      | 73.70  | 5                                | 96.8                                                          | 52.7                                           | 2                                                            | X                                                                                                   |
| 5KP64A            | 5KP64CA          | 64.0                                             | 71.10                                                      | 78.60  | 5                                | 103.0                                                         | 49.5                                           | 2                                                            | X                                                                                                   |
| 5KP70A            | 5KP70CA          | 70.0                                             | 77.80                                                      | 86.00  | 5                                | 113.0                                                         | 45.1                                           | 2                                                            | X                                                                                                   |
| 5KP75A            | 5KP75CA          | 75.0                                             | 83.30                                                      | 92.10  | 5                                | 121.0                                                         | 42.1                                           | 2                                                            | X                                                                                                   |
| 5KP78A            | 5KP78CA          | 78.0                                             | 86.70                                                      | 95.80  | 5                                | 126.0                                                         | 40.5                                           | 2                                                            | X                                                                                                   |
| 5KP85A            | 5KP85CA          | 85.0                                             | 94.40                                                      | 104.00 | 5                                | 137.0                                                         | 37.2                                           | 2                                                            | X                                                                                                   |
| 5KP90A            | 5KP90CA          | 90.0                                             | 100.00                                                     | 111.00 | 5                                | 146.0                                                         | 34.9                                           | 2                                                            | X                                                                                                   |
| 5KP100A           | 5KP100CA         | 100.0                                            | 110.00                                                     | 123.00 | 5                                | 162.0                                                         | 31.5                                           | 2                                                            | X                                                                                                   |
| 5KP110A           | 5KP110CA         | 110.0                                            | 122.00                                                     | 135.00 | 5                                | 177.0                                                         | 28.8                                           | 2                                                            | X                                                                                                   |
| 5KP120A           | 5KP120CA         | 120.0                                            | 133.00                                                     | 147.00 | 5                                | 193.0                                                         | 26.4                                           | 2                                                            | X                                                                                                   |
| 5KP130A           | 5KP130CA         | 130.0                                            | 144.00                                                     | 159.00 | 5                                | 209.0                                                         | 24.4                                           | 2                                                            | X                                                                                                   |
| 5KP150A           | 5KP150CA         | 150.0                                            | 167.00                                                     | 185.00 | 5                                | 243.0                                                         | 21.0                                           | 2                                                            | X                                                                                                   |
| 5KP160A           | 5KP160CA         | 160.0                                            | 178.00                                                     | 197.00 | 5                                | 259.0                                                         | 19.7                                           | 2                                                            | X                                                                                                   |
| 5KP170A           | 5KP170CA         | 170.0                                            | 189.00                                                     | 209.00 | 5                                | 275.0                                                         | 18.5                                           | 2                                                            | X                                                                                                   |
| 5KP180A           | 5KP180CA         | 180.0                                            | 200.00                                                     | 221.00 | 5                                | 292.0                                                         | 17.5                                           | 2                                                            | X                                                                                                   |
| 5KP190A           | 5KP190CA         | 190.0                                            | 211.00                                                     | 233.00 | 5                                | 310.0                                                         | 16.5                                           | 2                                                            | X                                                                                                   |
| 5KP200A           | 5KP200CA         | 200.0                                            | 222.00                                                     | 246.00 | 5                                | 329.2                                                         | 15.5                                           | 2                                                            | X                                                                                                   |
| 5KP210A           | 5KP210CA         | 210.0                                            | 233.00                                                     | 258.00 | 5                                | 349.5                                                         | 14.6                                           | 2                                                            | X                                                                                                   |
| 5KP220A           | 5KP220CA         | 220.0                                            | 244.00                                                     | 270.00 | 5                                | 371.1                                                         | 13.7                                           | 2                                                            | X                                                                                                   |
| 5KP250A           | 5KP250CA         | 250.0                                            | 277.00                                                     | 306.00 | 5                                | 425.0                                                         | 12.0                                           | 2                                                            | X                                                                                                   |

For bidirectional type having V<sub>R</sub> of 10 volts and less, the I<sub>A</sub> limit is double.  
 For parts without A, the V<sub>BR</sub> is + 10% and V<sub>C</sub> is 5% higher than with A parts

## I-V Curve Characteristics



**P<sub>PPM</sub> Peak Pulse Power Dissipation** – Max power dissipation

**V<sub>R</sub> Stand-off Voltage** – Maximum voltage that can be applied to the TVS without operation

**V<sub>BR</sub> Breakdown Voltage** – Maximum voltage that flows through the TVS at a specified test current (I<sub>T</sub>)

**V<sub>C</sub> Clamping Voltage** – Peak voltage measured across the suppressor at a specified I<sub>ppm</sub> (peak impulse current)

**I<sub>R</sub> Reverse Leakage Current** – Current measured at V<sub>R</sub>

**V<sub>F</sub> Forward Voltage Drop for Uni-directional**

## Ratings and Characteristic Curves (T<sub>A</sub>=25°C unless otherwise noted)

**Figure 1 - TVS Transients Clamping Waveform**

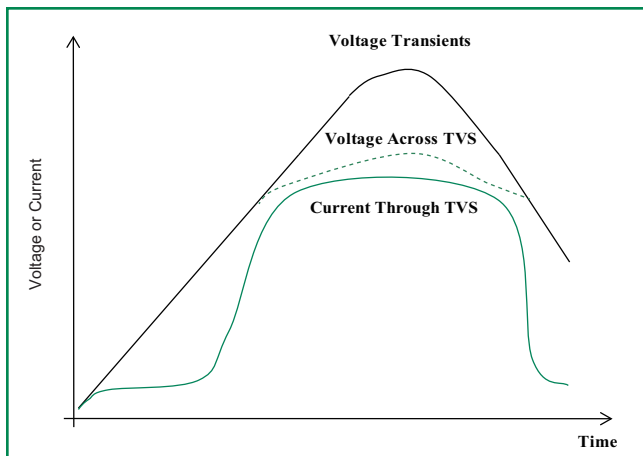
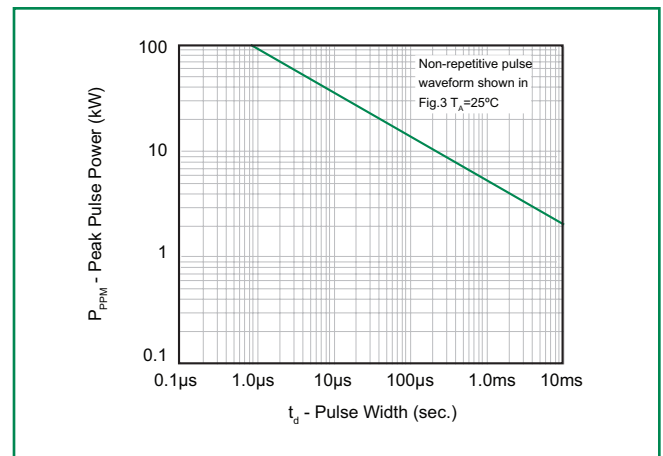


**Figure 2 - Peak Pulse Power Rating Curve**



continues on next page.

**Ratings and Characteristic Curves** ( $T_A=25^\circ\text{C}$  unless otherwise noted) (Continued)

**Figure 3 - Pulse Derating Curve**

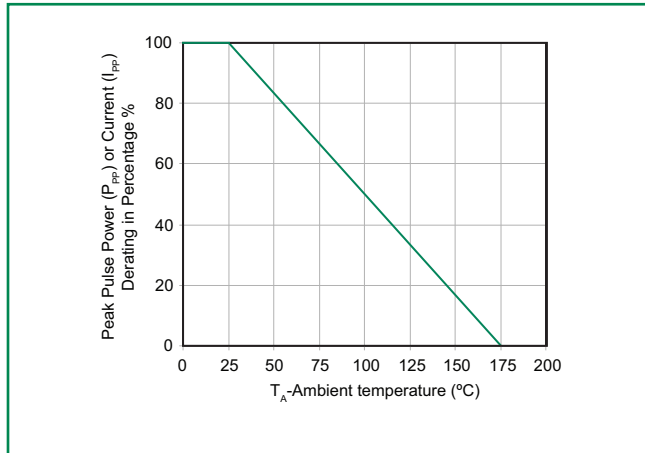


**Figure 4 - Pulse Waveform**

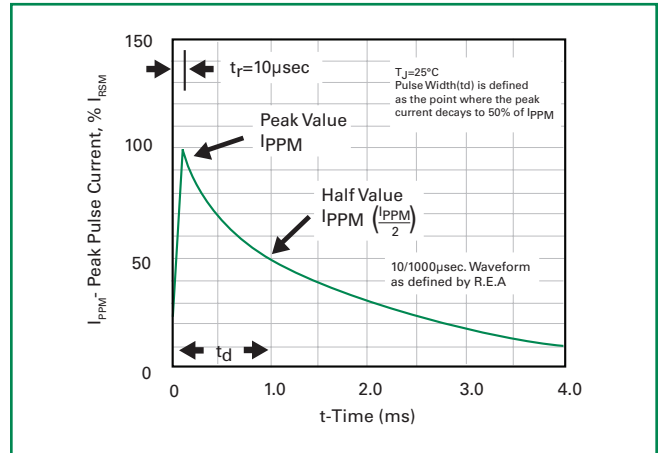


**Figure 5 - Typical Junction Capacitance**

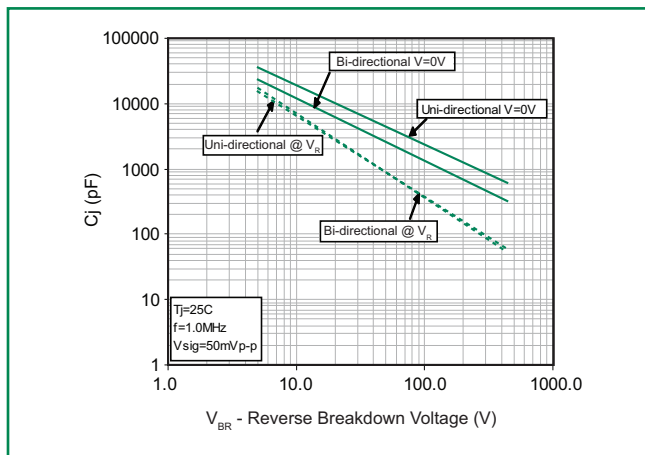


**Figure 6 - Steady State Power Derating Curve**

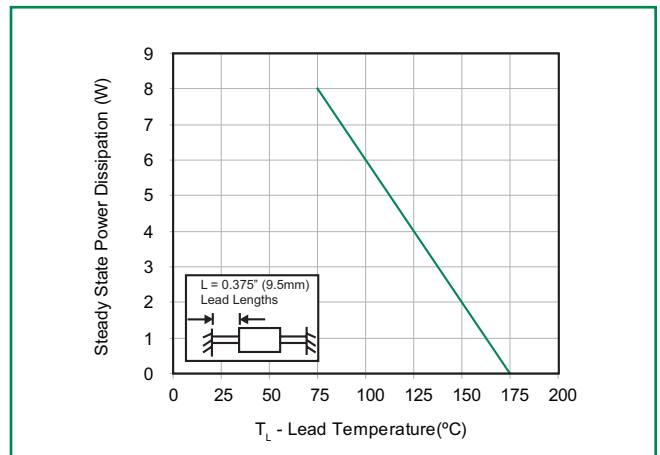
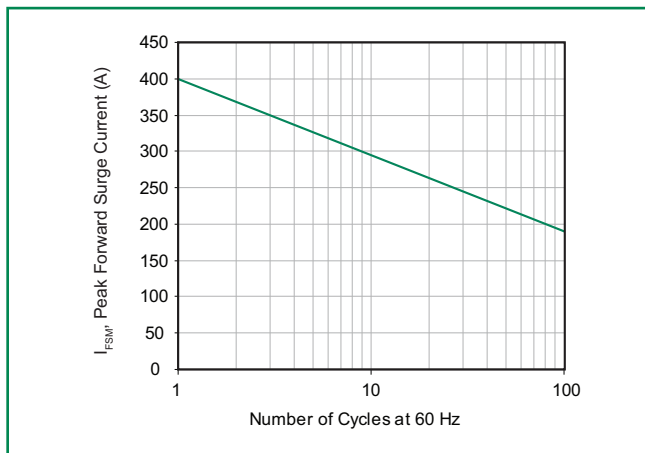
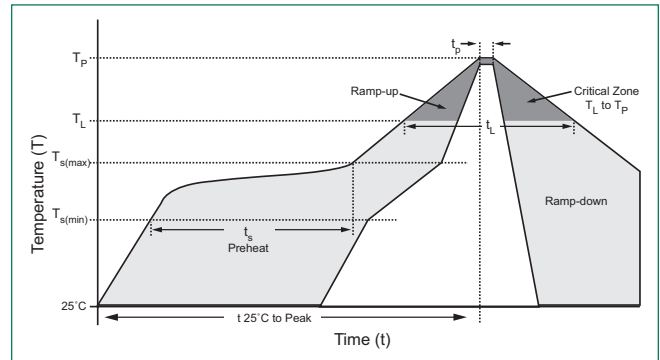


**Figure 7 - Maximum Non-Repetitive Peak Forward Surge Current**



### Soldering Parameters

|                                                       |                                    |                         |
|-------------------------------------------------------|------------------------------------|-------------------------|
| Reflow Condition                                      |                                    | Lead-free assembly      |
| Pre Heat                                              | - Temperature Min ( $T_{s(min)}$ ) | 150°C                   |
|                                                       | - Temperature Max ( $T_{s(max)}$ ) | 200°C                   |
|                                                       | - Time (min to max) ( $t_s$ )      | 60 – 180 secs           |
| Average ramp up rate (Liquidus Temp ( $T_L$ ) to peak |                                    | 3°C/second max          |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                  |                                    | 3°C/second max          |
| Reflow                                                | - Temperature ( $T_L$ ) (Liquidus) | 217°C                   |
|                                                       | - Time (min to max) ( $t_s$ )      | 60 – 150 seconds        |
| Peak Temperature ( $T_P$ )                            |                                    | 260 <sup>+0/-5</sup> °C |
| Time within 5°C of actual peak Temperature ( $t_p$ )  |                                    | 20 – 40 seconds         |
| Ramp-down Rate                                        |                                    | 6°C/second max          |
| Time 25°C to peak Temperature ( $T_P$ )               |                                    | 8 minutes Max.          |
| Do not exceed                                         |                                    | 280°C                   |



### Flow/Wave Soldering (Solder Dipping)

|                           |            |
|---------------------------|------------|
| <b>Peak Temperature :</b> | 265°C      |
| <b>Dipping Time :</b>     | 10 seconds |
| <b>Soldering :</b>        | 1 time     |

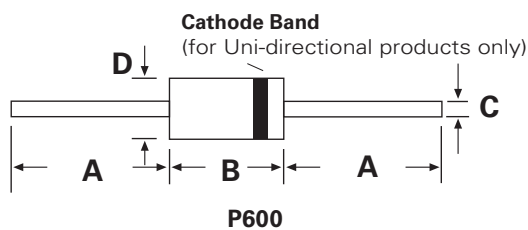
### Physical Specifications

|                 |                                                    |
|-----------------|----------------------------------------------------|
| <b>Weight</b>   | 0.07oz., 2.1g                                      |
| <b>Case</b>     | P600 molded plastic body over passivated junction. |
| <b>Polarity</b> | Color band denotes the cathode except Bipolar.     |
| <b>Terminal</b> | Matte Tin axial leads, solderable per JESD22-B102. |

### Environmental Specifications

|                            |             |
|----------------------------|-------------|
| <b>High Temp. Storage</b>  | JESD22-A103 |
| <b>HTRB</b>                | JESD22-A108 |
| <b>Temperature Cycling</b> | JESD22-A104 |
| <b>H3TRB</b>               | JESD22-A101 |
| <b>RSH</b>                 | JESD22-B106 |

### Dimensions



| Dimensions | Inches |       | Millimeters |      |
|------------|--------|-------|-------------|------|
|            | Min    | Max   | Min         | Max  |
| A          | 1.000  | -     | 25.40       | -    |
| B          | 0.340  | 0.360 | 8.60        | 9.10 |
| C          | 0.048  | 0.052 | 1.22        | 1.32 |
| D          | 0.340  | 0.360 | 8.60        | 9.10 |

### Part Numbering System

**5KPxxxXX**

OPTION CODE:

BLANK Reel Tape  
-B Bulk Packaging

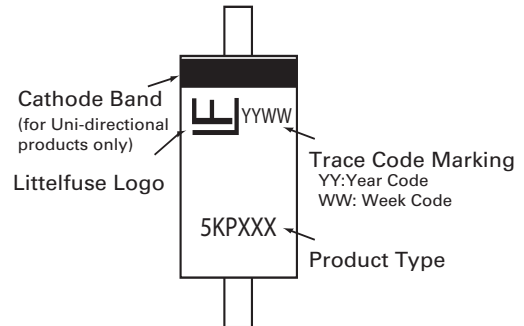
TYPE CODE:

A Uni-Directional (5%  $V_{BR}$  Voltage Tolerance)  
CA Bi-Directional (5%  $V_{BR}$  Voltage Tolerance)

$V_R$  VOLTAGE

SERIES CODE

### Part Marking System



### Packing Options

| Part Number | Component Package | Quantity | Packaging Option | Packaging Specification |
|-------------|-------------------|----------|------------------|-------------------------|
| 5KPxxxXX    | P600              | 800      | Tape & Reel      | EIA STD RS-296          |
| 5KPxxxXX-B  | P600              | 100      | BULK             | Littelfuse Spec.        |

### Tape and Reel Specification

