

HF RoHS

## 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 10x1000µs test waveform (Fig.1) (Note 1)              | P <sub>PPM</sub>                  | 5000       | W    |
| Steady State Power Dissipation on infinite heat sink at T <sub>L</sub> =75°C (Fig. 5) | 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>θJL</sub>                  | 8.0        | °C/W |
| Typical Thermal Resistance Junction to Ambient                                        | R <sub>θJA</sub>                  | 40         | °C/W |

#### Notes:

1. Non-repetitive current pulse, per Fig. 3 and derated above T<sub>A</sub> = 25°C per Fig. 2.
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.

### Description

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

### Features

- Halogen-Free
- RoHS compliant
- Typical maximum temperature coefficient  
 $\Delta V_{BR} = 0.1\% \times V_{BR} @ 25^{\circ}\text{C} \times \Delta T$
- Glass passivated chip junction in P600 package
- 5000W peak pulse capability at 10x1000µs waveform, repetition rate (duty cycles):0.01%
- Fast response time: typically less than 1.0ps from 0 Volts to BV min
- Excellent clamping capability
- 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

### 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.

# Transient Voltage Suppression Diodes

## Axial Leaded – 5000W > 5KP series

### Electrical Characteristics

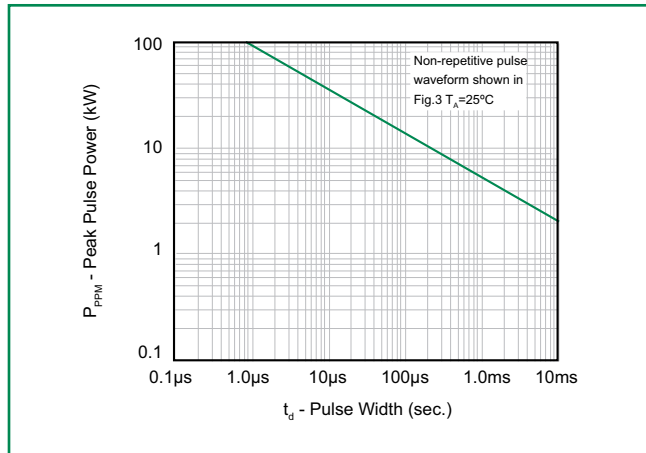
| Part Number (Uni) | Part Number (Bi) | Reverse Stand off Voltage $V_R$ (Volts) | Breakdown Voltage $V_{BR}$ (Volts) @ $I_T$ |        | Test Current $I_T$ (mA) | Maximum Clamping Voltage $V_C$ @ $I_{PP}$ (V) | Maximum Peak Pulse Current $I_{PP}$ (A) | Maximum Reverse Leakage $I_R$ @ $V_R$ ( $\mu A$ ) | 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  $V_R$  of 10 volts and less, the  $I_R$  limit is double.

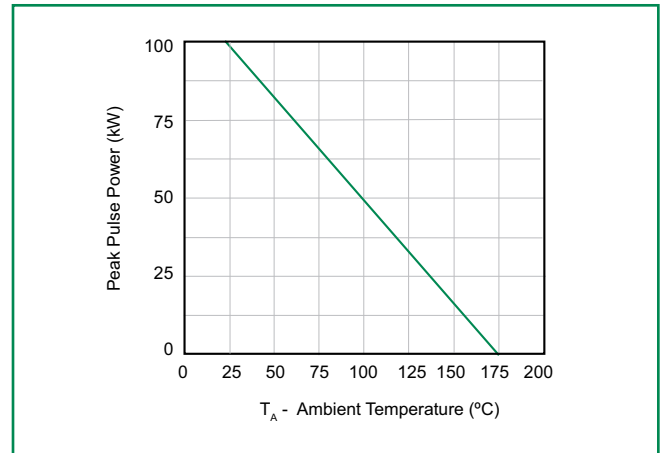
For parts without A, the  $V_{BR}$  is  $\pm 10\%$  and  $V_C$  is 5% higher than with A parts

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

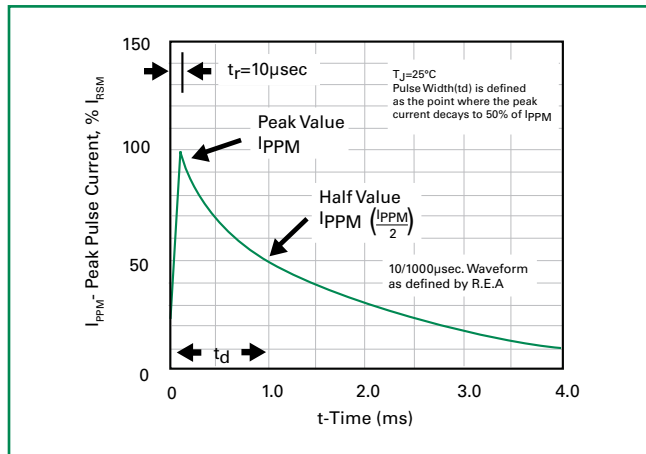
**Figure 1 - Peak Pulse Power Rating Curve**



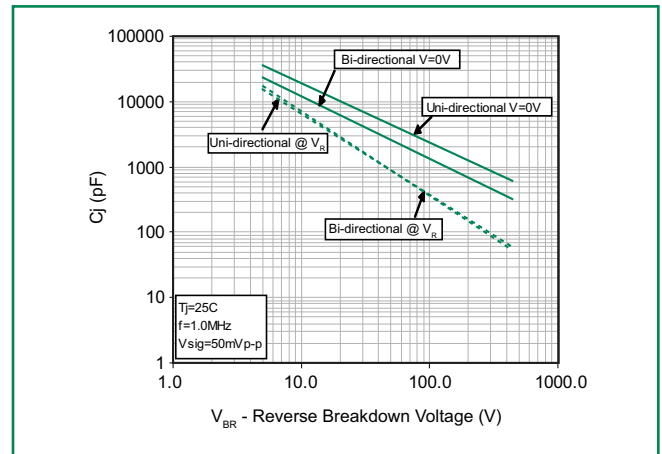
**Figure 2 - Pulse Derating Curve**



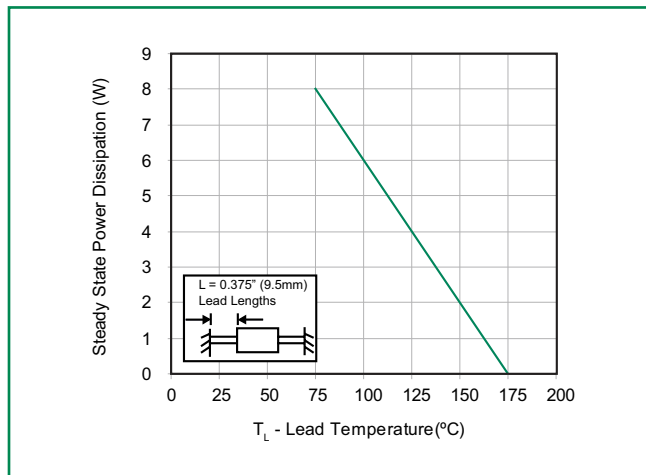
**Figure 3 - Pulse Waveform**



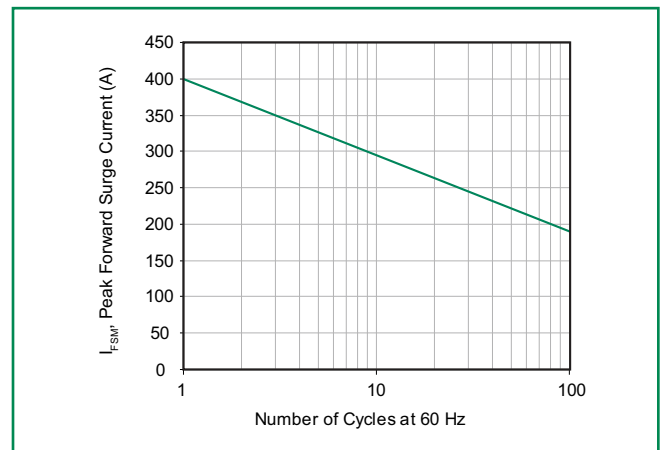
**Figure 4 - Typical Junction Capacitance**



**Figure 5 - Steady State Power Derating Curve**

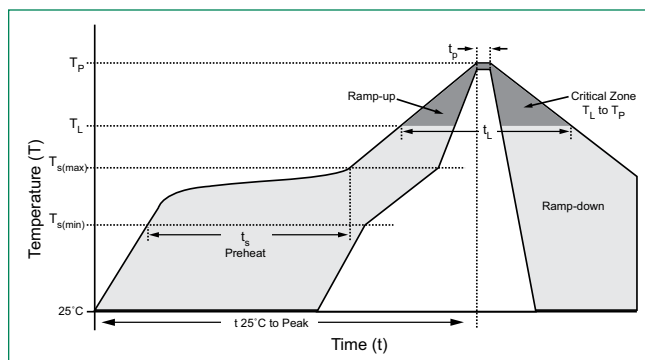


**Figure 6 - Maximum Non-Repetitive Peak Forward Surge Current**



### 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     |

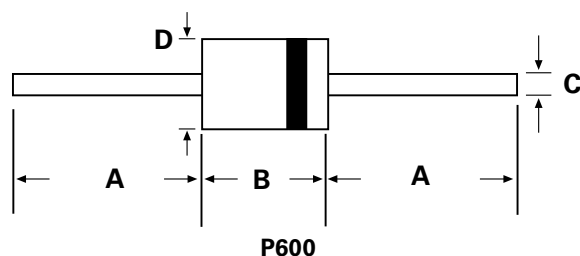
### Physical Specifications

|                 |                                                     |
|-----------------|-----------------------------------------------------|
| <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-B102D. |

### Environmental Specifications

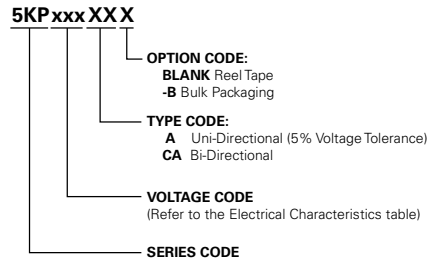
|                           |              |
|---------------------------|--------------|
| <b>Temperature Cycle</b>  | JESD22-A104  |
| <b>Pressure Cooker</b>    | JESD 22-A102 |
| <b>High Temp. Storage</b> | JESD22-A103  |
| <b>HTRB</b>               | JESD22-A108  |
| <b>Thermal Shock</b>      | JESD22-A106  |

### Dimensions

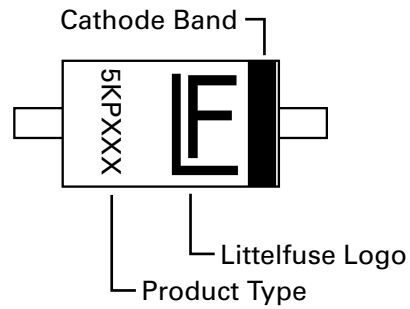


| Dimensions | Inches |       | Millimeters |      |
|------------|--------|-------|-------------|------|
|            | Min    | Max   | Min         | Max  |
| A          | 1.000  | -     | 25.40       | -    |
| B          | 0.340  | 0.360 | 8.60        | 9.10 |
| C          | 0.048  | 0.052 | 1.22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

### Part Numbering System



### Part Marking System



### Packaging

| Part Number | Component Package | Quantity | Packaging Option | Packaging Specification                  |
|-------------|-------------------|----------|------------------|------------------------------------------|
| 5KPxxxXX    | P600              | 800      | Tape & Reel      | EIA STD RS-296E                          |
| 5KPxxxXX-B  | P600              | 500      | BULK             | Littelfuse Concord Packing Spec. DM-0016 |