

### 5KP Series



#### Agency Approvals

| AGENCY  | AGENCY FILE NUMBER |
|---|--------------------|
|  | E230531            |

#### Maximum Ratings and Thermal Characteristics ( $T_A=25^\circ\text{C}$ unless otherwise noted)

| Parameter  | Symbol          | Value      | Unit               |
|--|-----------------|------------|--------------------|
| Peak Pulse Power Dissipation by 10/1000 $\mu\text{s}$ Test Waveform (Fig.2) (Note 1) | $P_{PPM}$       | 5000       | W                  |
| Steady State Power Dissipation on Infinite Heat Sink at $T_L=75^\circ\text{C}$       | $P_D$           | 8.0        | W                  |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave Unidirectional Only (Note 2) | $I_{FSM}$       | 400        | A                  |
| Maximum Instantaneous Forward Voltage at 100A for Unidirectional Only (Note 3)       | $V_F$           | 3.5/5.0    | V                  |
| Operating Junction and Storage Temperature Range                                     | $T_J, T_{STG}$  | -55 to 175 | $^\circ\text{C}$   |
| Typical Thermal Resistance Junction to Lead  | $R_{\theta JL}$ | 8.0        | $^\circ\text{C/W}$ |
| Typical Thermal Resistance Junction to Ambient                                       | $R_{\theta JA}$ | 40         | $^\circ\text{C/W}$ |

#### Notes:

1. Non-repetitive current pulse, per Fig. 4 and derated above  $T_J$  (initial) =  $25^\circ\text{C}$  per Fig. 3.
2. Measured on 8.3ms single half sine wave or equivalent square wave, duty cycle=4 per minute maximum.
3.  $V_F < 3.5\text{V}$  for single die parts and  $V_F < 5.0\text{V}$  for stacked-die parts.

#### 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

- 5000W peak pulse capability at 10/1000 $\mu\text{s}$  waveform, repetition rate (duty cycles):0.01 %
- Glass passivated chip junction in P600 package
- 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 30kV(Air), 30kV (Contact)
- ESD protection of data lines in accordance with IEC 61000-4-2
- EFT protection of data lines in accordance with IEC 61000-4-4
- Low incremental surge resistance
- Typical  $I_R$  less than  $2\mu\text{A}$  when  $V_{BR} \text{ min} > 12\text{V}$
- High temperature to reflow soldering guaranteed:  $260^\circ\text{C}/40\text{sec}$  / 0.375", (9.5mm) lead length, 5 lbs., (2.3kg) tension
- $V_{BR} @ T_J = V_{BR} @ 25^\circ\text{C} \times (1 + \alpha T \times (T_J - 25))$  ( $\alpha$ : Temperature Coefficient, typical value is 0.1%)
- Plastic package is flammability rated V-0 per Underwriters Laboratories
- Matte tin lead-free plated
- Halogen free and RoHS compliant
- Pb-free E3 means 2nd level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/JEDEC J-STD-

#### Applications

TVS devices are ideal for the protection of I/O interfaces,  $V_{CC}$  bus and other vulnerable circuits used in telecom, computer, industrial and consumer electronic applications.

#### Additional Information



Datasheet



Resources



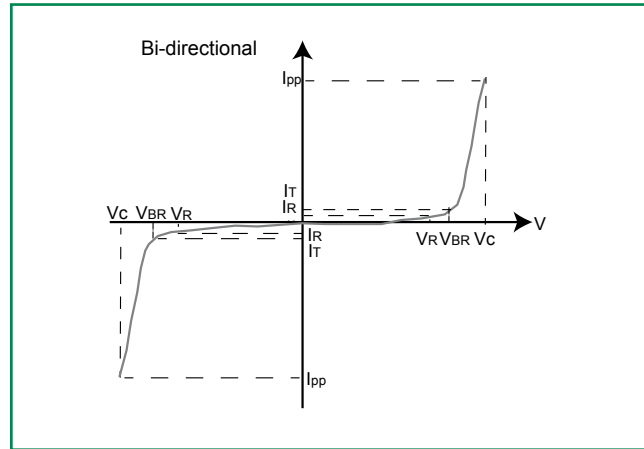
Samples

### 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>R</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

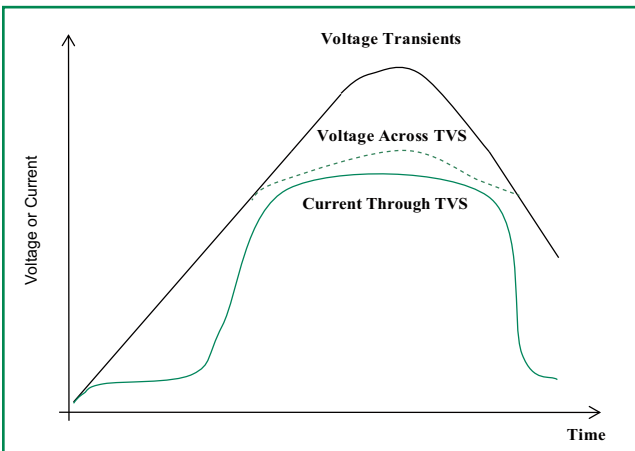
## I-V Curve Characteristics



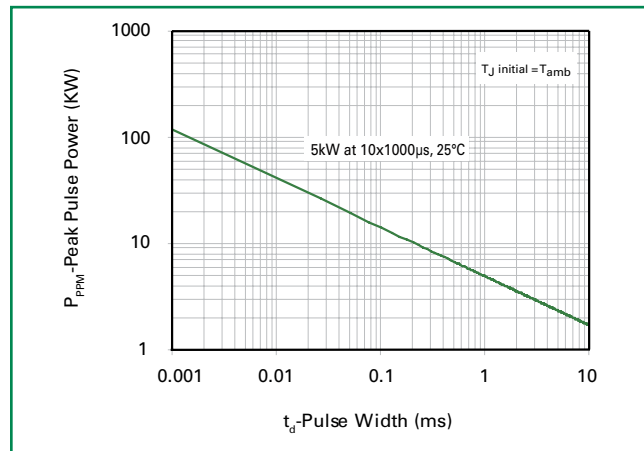
- $P_{PPM}$  Peak Pulse Dissipation** – Max power dissipation
- $V_r$  Stand-off Voltage** – Maximum voltage that can be applied to the TVS without operation
- $V_{BR}$  Breakdown Voltage** – Maximum voltage that flows through the TVS at a specified test current ( $I_r$ )
- $V_c$  Clamping Voltage** – Peak voltage measured across the TVS at a specified  $I_{ppm}$  (peak impulse current)
- $I_r$  Reverse Leakage Current** – Current measured at  $V_r$
- $V_f$  Forward Voltage Drop for Uni-directional**

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

**Figure 1 - TVS Transients Clamping Waveform**



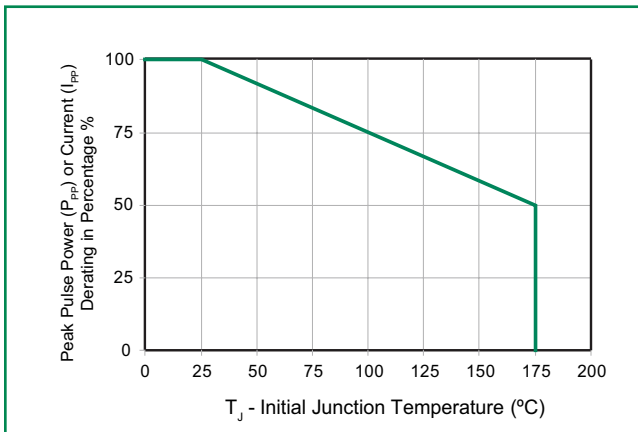
**Figure 2 - Peak Pulse Power Rating Curve**



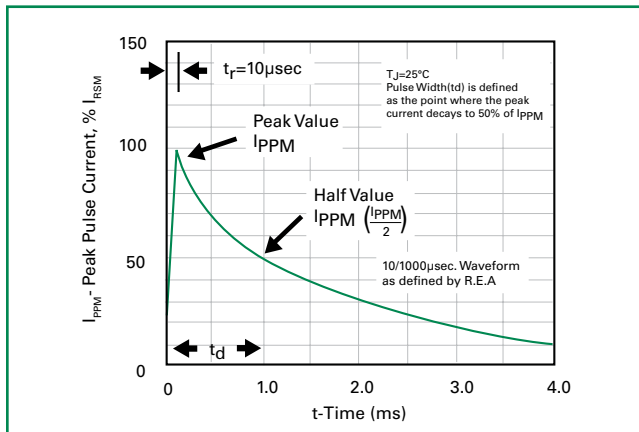
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### Ratings and Characteristic Curves ( $T_A=25^\circ\text{C}$ unless otherwise noted) (Continued)

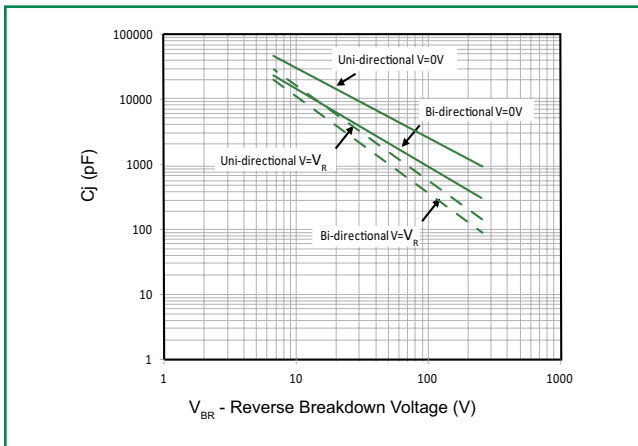
**Figure 3 - Peak Pulse Power Derating Curve**



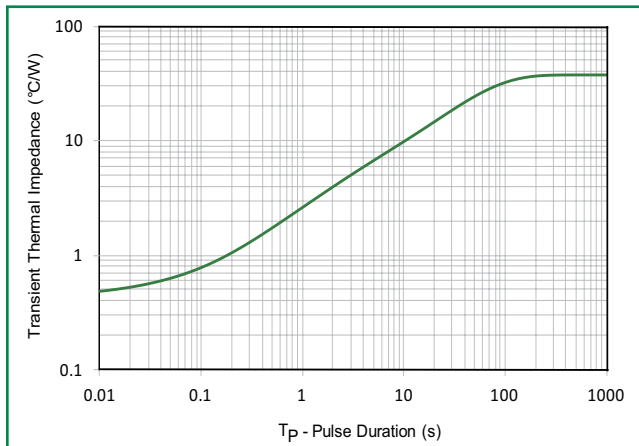
**Figure 4 - Pulse Waveform**



**Figure 5 - Typical Junction Capacitance**



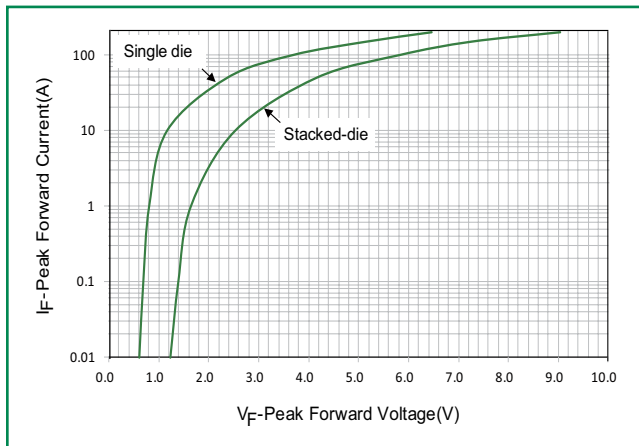
**Figure 6 - Typical Transient Thermal Impedance**



**Figure 7 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only**

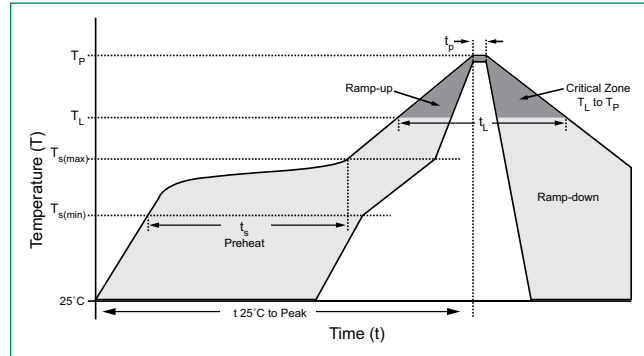


**Figure 8 - Peak Forward Voltage Drop vs Peak Forward Current (Typical Values)**



### 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 ( $T_A$ ) to peak) |                                    | 3°C/second max          |
| $T_{s(max)}$ to $T_A$ - Ramp-up Rate                   |                                    | 3°C/second max          |
| Reflow   | - Temperature ( $T_A$ ) (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  |                                    | 260°C                   |



### Flow/Wave Soldering (Solder Dipping)

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

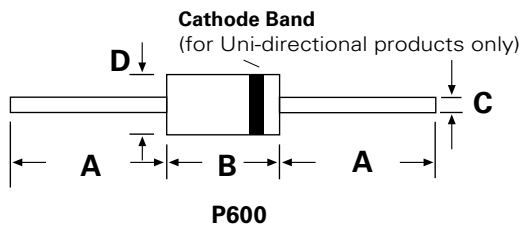
### Physical Specifications

|                 |  |
|-----------------|--|
| <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

**5KPxxxXXX**



### 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

