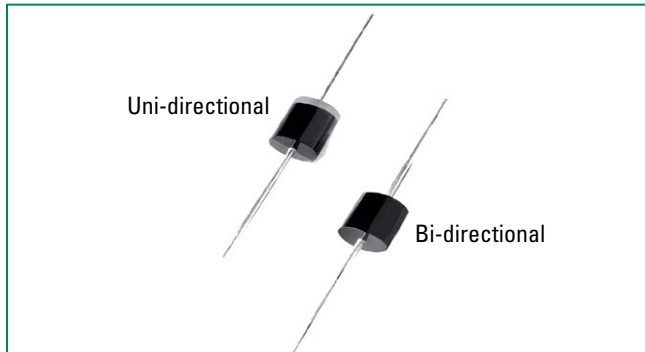


**5KP-HRA Series**



**Agency Approvals**

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

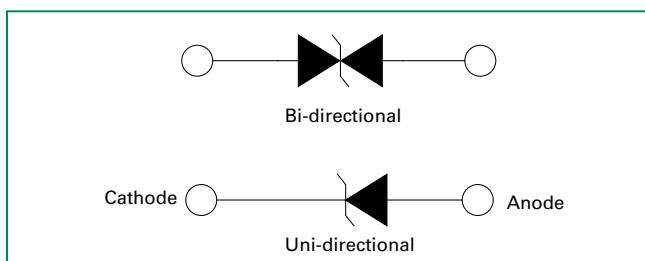
**Maximum Ratings and Thermal Characteristics  
(T<sub>A</sub>=25°C unless otherwise noted)**

| Parameter  | Symbol                            | Value      | Unit |
|--|-----------------------------------|------------|------|
| Peak Pulse Power Dissipation by 10/1000µs Test Waveform (Fig.2) (Note 1)             | P <sub>PPM</sub>                  | 5          | kW   |
| Steady State Power Dissipation on Infinite Heat Sink at T <sub>L</sub> =75°C         | 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. 4 and derated above T<sub>J</sub> (initial) =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 single die parts and V<sub>F</sub> < 5.0V for stacked-die parts.

**Functional Diagram**



**Description**

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

**Features**

- 5 kW peak pulse capability at 10/1000µs 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 V<sub>BR</sub> 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)
- EFT protection of data lines in accordance with IEC 61000-4-4
- Low incremental surge resistance
- Typical I<sub>R</sub> less than 2µA when V<sub>BR</sub> min>12V
- High temperature to reflow soldering guaranteed: 260°C/10sec / 0.375" (9.5mm) lead length, 5 lbs., (2.3kg) tension
- V<sub>BR</sub> @ T<sub>J</sub> = V<sub>BR</sub> @ 25°C x (1 + α T x (T<sub>J</sub> - 25)) (α T: Temperature Coefficient, typical value is 0.1 %)
- UL Recognized compound meeting flammability rating V-0
- Lead-free matte tin plated package
- Halogen free and RoHS compliant
- Pb-free E3 indicates that 2nd level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/JEDEC J-STD-609A.01)

**Applications**

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

Note:

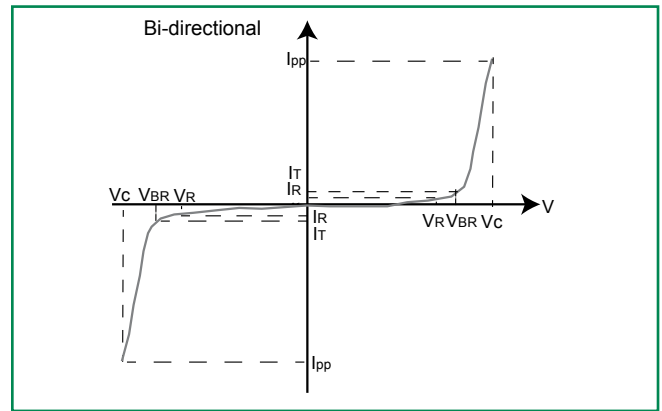
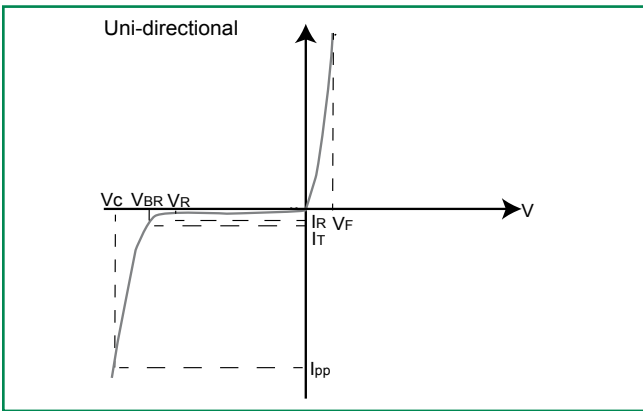
1. For bidirectional type having V<sub>R</sub> of 10 volts and less, the I<sub>T</sub> limit is double.

**Screen Process**

|  |                                   |
|--|-----------------------------------|
| <b>100% Vision Inspection</b>  | MIL-STD-750 method 2074           |
| <b>100% High Temperature Storage Life (168hrs,175°C)</b>   | MIL-STD-750 method 1031           |
| <b>100% Temperature Cycle Test (-55 to 150°C, 20 cycles, dwell time 15 min)</b>                                    | MIL-STD-750 method 1051           |
| <b>100% Surge Test (2x)</b>  | MIL-STD-750 method 4066           |
| <b>100% HTRB 150°C Bias=VR(80% breakdown voltage, 96hrs, and each direction 96hrs for Bi-directional products)</b> | MIL-STD-750 method 1038           |
| <b>Final Electrical Test( 100% 3 sigma limit, 100% dynamic test and PAT limit)</b>                                 | MIL-STD-750 method 4016.4021.4011 |

Note: Up-screen program can be specified by customer's request via contacting Littelfuse service

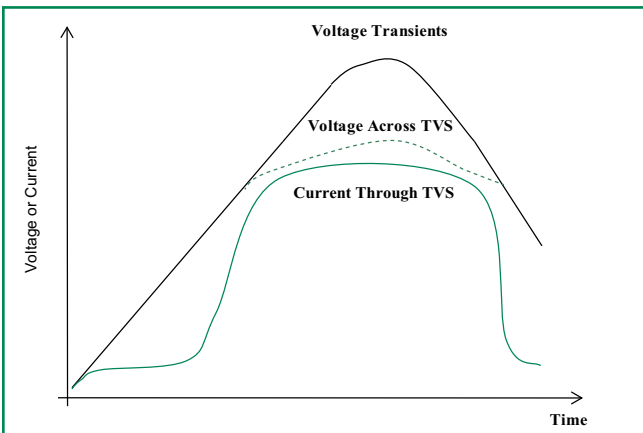
**I-V Curve Characteristics**



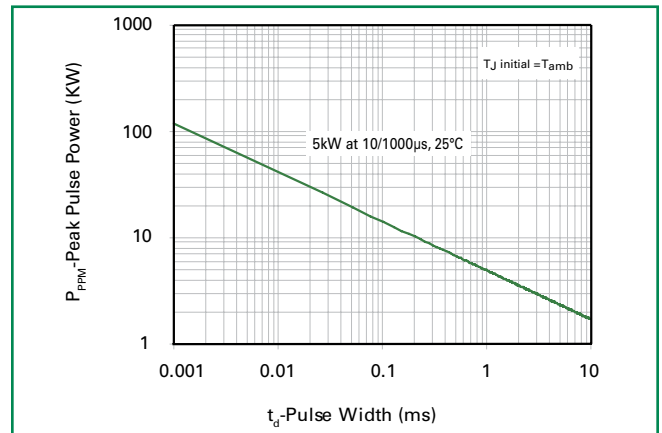
- P<sub>ppm</sub> Peak Pulse Power Dissipation** – Max power dissipation
- V<sub>R</sub> Stand-off Voltage** – Maximum voltage that can be applied to the TVS without operation
- V<sub>BR</sub> Breakdown Voltage** – Maximum voltage that flows though the TVS at a specified test current (I<sub>T</sub>)
- V<sub>C</sub> Clamping Voltage** – Peak voltage measured across the TVS at a specified Ippm (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)**

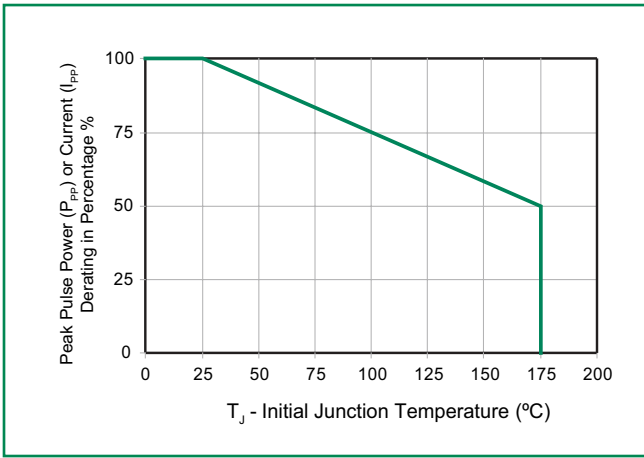
**Figure 1 - TVS Transients Clamping Waveform**



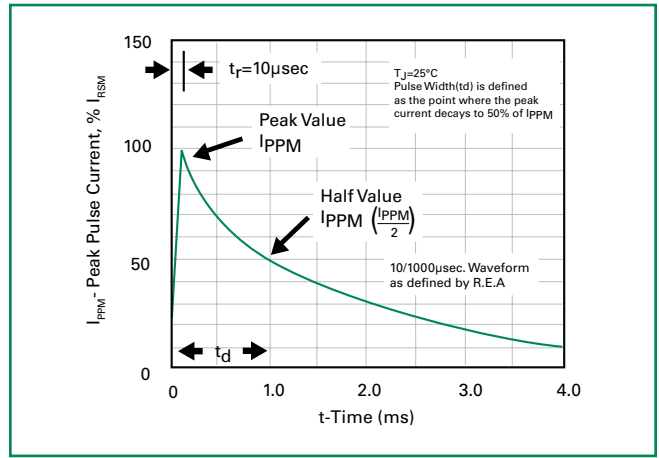
**Figure 2 - Peak Pulse Power Rating Curve**



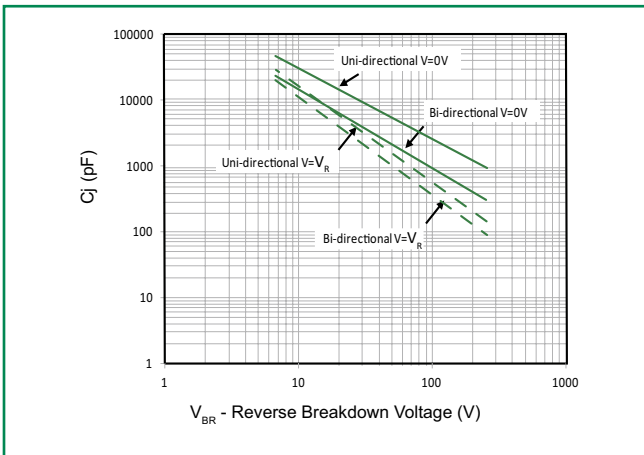
**Figure 3 - Peak Pulse Power Derating Curve**



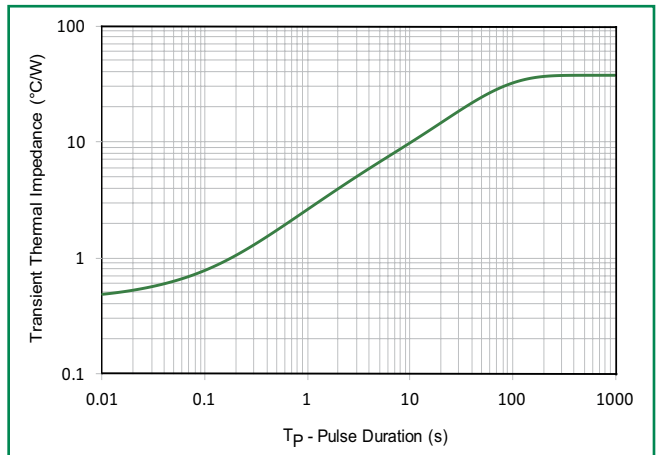
**Figure 4 - Pulse Waveform**



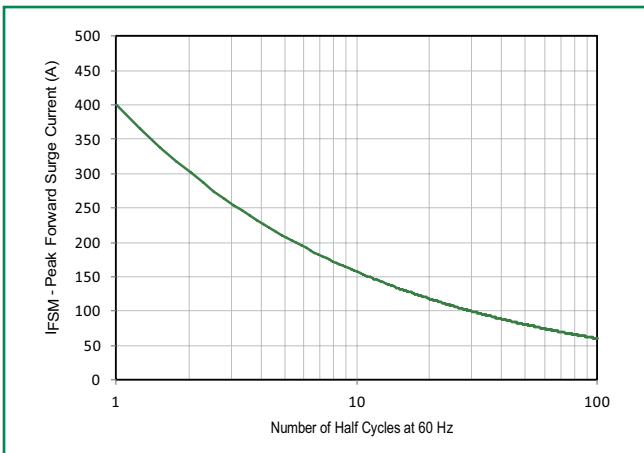
**Figure 5 - Typical Junction Capacitance**



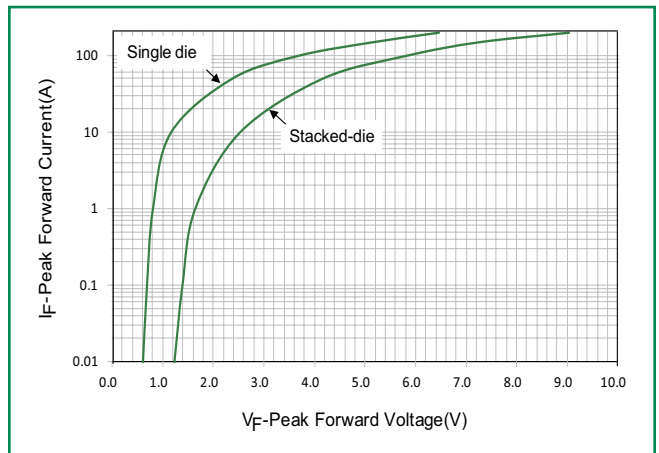
**Figure 6 - Typical Transient Thermal Impedance**



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



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



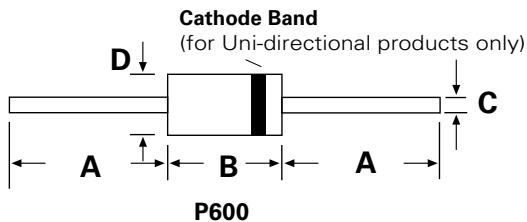
**Physical Specifications**

|                 |  |
|-----------------|--|
| <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**

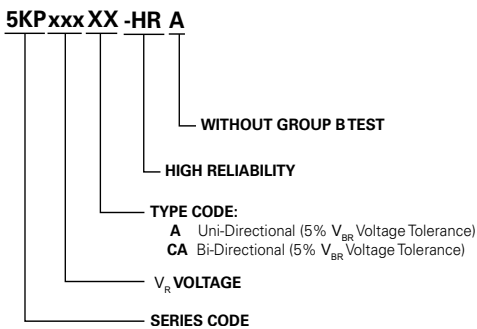
|                            |             |
|----------------------------|-------------|
| <b>High Temp. Storage</b>  | JESD22-A103 |
| <b>HTRB</b>                | JESD22-A108 |
| <b>Temperature Cycling</b> | JESD22-A104 |
| <b>H3TRB</b>               | JESD22-A101 |
| <b>RSH</b>                 |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

**Dimensions**

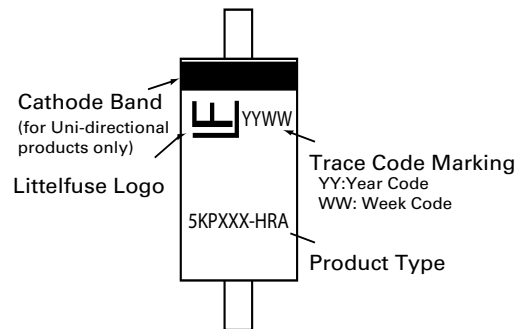


| Dimensions | Inches |       | Millimeters |      |
|------------|--------|-------|-------------|------|
|            | Min    | Max   | Min         | Max  |
| A          | 1.000  | -     | 25.40       | -    |
| B          | 0.340  | 0.360 | 8.60        | 9.10 |
| C          | 0.048  | 0.054 | 1.22        | 1.36 |
| D          | 0.340  | 0.360 | 8.60        | 9.10 |

**Part Numbering System**



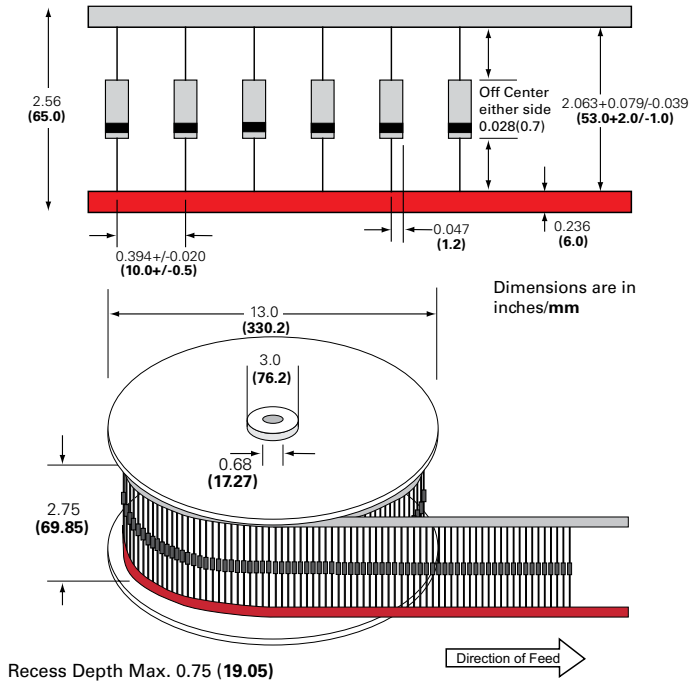
**Part Marking System**



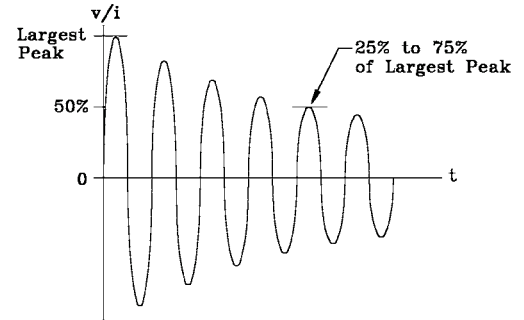
**Packing Options**

| Part Number  | Component Package | Quantity | Packaging Option | Packaging Specification |
|--------------|-------------------|----------|------------------|-------------------------|
| 5KPxxxXX-HRA | P600              | 800      | Tape & Reel      | EIA STD RS-296          |

**Tape and Reel Specification**



**RTCA/DO-160G Wave 3**



- Notes:  
1. Voltage and current are not required to be in phase.  
2. The waveshape may have either a damped sine or cosine waveshape.

**RTCA/DO-160G Wave 4 and Wave 5**

