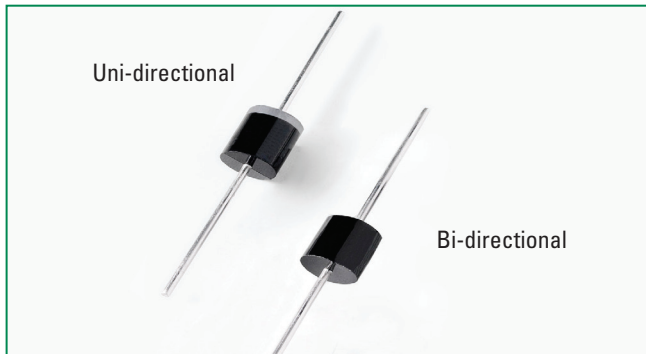


## 15KPA Series



### Agency Approvals

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

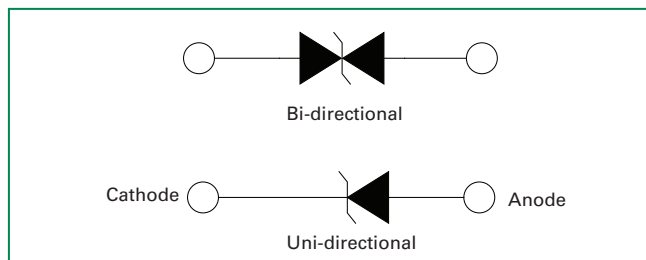
### Maximum Ratings and Thermal Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| Parameter                                                                             | Symbol                            | Value      | Unit |
|---------------------------------------------------------------------------------------|-----------------------------------|------------|------|
| Peak Pulse Power Dissipation by 10/1000µs Test Waveform (Fig.2) (Note 1)              | P <sub>PPM</sub>                  | 15000      | 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    |
| 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>WJL</sub>                  | 8.0        | °C/W |
| Typical Thermal Resistance Junction to Ambient                                        | R <sub>WJA</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.

### Functional Diagram



### Descriptions

The 15KPA 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
- 15000W 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 36V
- 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.

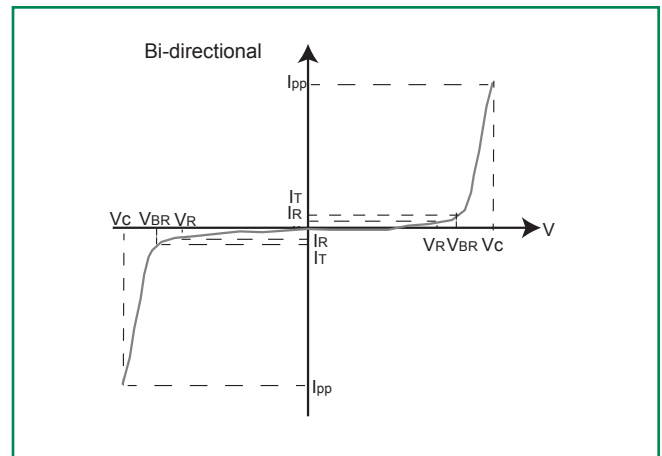
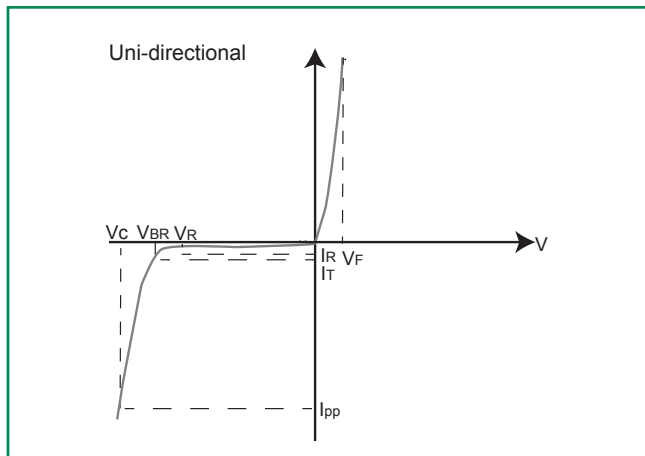
### Electrical Characteristics ( $T_A=25^\circ\text{C}$ unless otherwise noted)

| 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 Peak Pulse Current $I_{PP}$ (A) | Maximum Reverse Leakage $I_R$ @ $V_R$ ( $\mu\text{A}$ ) | Maximum Clamping Voltage $V_C$ @ $I_{PP}$ (V) | Agency Approval  |
|-------------------|------------------|-----------------------------------------|--------------------------------------------|-------|-------------------------|-----------------------------------------|---------------------------------------------------------|-----------------------------------------------|-----------------------------------------------------------------------------------------------------|
|                   |                  |                                         | MIN                                        | MAX   |                         |                                         |                                                         |                                               |                                                                                                     |
| 15KPA17A          | 15KPA17CA        | 17                                      | 18.99                                      | 20.79 | 50                      | 515.4                                   | 5000                                                    | 29.3                                          | X                                                                                                   |
| 15KPA18A          | 15KPA18CA        | 18                                      | 20.11                                      | 22.01 | 50                      | 488.7                                   | 5000                                                    | 30.9                                          | X                                                                                                   |
| 15KPA20A          | 15KPA20CA        | 20                                      | 22.34                                      | 24.46 | 20                      | 440.2                                   | 1500                                                    | 34.3                                          | X                                                                                                   |
| 15KPA22A          | 15KPA22CA        | 22                                      | 24.57                                      | 26.91 | 10                      | 407.0                                   | 500                                                     | 37.1                                          | X                                                                                                   |
| 15KPA24A          | 15KPA24CA        | 24                                      | 26.81                                      | 29.35 | 5                       | 371.0                                   | 150                                                     | 40.7                                          | X                                                                                                   |
| 15KPA26A          | 15KPA26CA        | 26                                      | 29.04                                      | 31.80 | 5                       | 343.2                                   | 50                                                      | 44.0                                          | X                                                                                                   |
| 15KPA28A          | 15KPA28CA        | 28                                      | 31.28                                      | 34.24 | 5                       | 317.9                                   | 25                                                      | 47.5                                          | X                                                                                                   |
| 15KPA30A          | 15KPA30CA        | 30                                      | 33.51                                      | 36.7  | 5                       | 297.8                                   | 15                                                      | 50.7                                          | X                                                                                                   |
| 15KPA33A          | 15KPA33CA        | 33                                      | 36.9                                       | 40.4  | 5                       | 276.1                                   | 2                                                       | 54.7                                          | X                                                                                                   |
| 15KPA36A          | 15KPA36CA        | 36                                      | 40.2                                       | 44.0  | 5                       | 252.5                                   | 2                                                       | 59.8                                          | X                                                                                                   |
| 15KPA40A          | 15KPA40CA        | 40                                      | 44.7                                       | 48.9  | 5                       | 229.5                                   | 2                                                       | 65.8                                          | X                                                                                                   |
| 15KPA43A          | 15KPA43CA        | 43                                      | 48.0                                       | 52.6  | 5                       | 216.3                                   | 2                                                       | 69.8                                          | X                                                                                                   |
| 15KPA45A          | 15KPA45CA        | 45                                      | 50.3                                       | 55.0  | 5                       | 207.4                                   | 2                                                       | 72.8                                          | X                                                                                                   |
| 15KPA48A          | 15KPA48CA        | 48                                      | 53.6                                       | 58.7  | 5                       | 194.3                                   | 2                                                       | 77.7                                          | X                                                                                                   |
| 15KPA51A          | 15KPA51CA        | 51                                      | 57.0                                       | 62.4  | 5                       | 182.1                                   | 2                                                       | 82.9                                          | X                                                                                                   |
| 15KPA54A          | 15KPA54CA        | 54                                      | 60.3                                       | 66.0  | 5                       | 172.2                                   | 2                                                       | 87.7                                          | X                                                                                                   |
| 15KPA58A          | 15KPA58CA        | 58                                      | 64.8                                       | 70.9  | 5                       | 161.0                                   | 2                                                       | 93.8                                          | X                                                                                                   |
| 15KPA60A          | 15KPA60CA        | 60                                      | 67.0                                       | 73.4  | 5                       | 155.0                                   | 2                                                       | 97.4                                          | X                                                                                                   |
| 15KPA64A          | 15KPA64CA        | 64                                      | 71.5                                       | 78.3  | 5                       | 144.9                                   | 2                                                       | 104.2                                         | X                                                                                                   |
| 15KPA70A          | 15KPA70CA        | 70                                      | 78.2                                       | 85.6  | 5                       | 132.9                                   | 2                                                       | 113.6                                         | X                                                                                                   |
| 15KPA75A          | 15KPA75CA        | 75                                      | 83.8                                       | 91.7  | 5                       | 123.8                                   | 2                                                       | 122.0                                         | X                                                                                                   |
| 15KPA78A          | 15KPA78CA        | 78                                      | 87.1                                       | 95.4  | 5                       | 119.7                                   | 2                                                       | 126.1                                         | X                                                                                                   |
| 15KPA85A          | 15KPA85CA        | 85                                      | 94.9                                       | 104.0 | 5                       | 109.7                                   | 2                                                       | 137.6                                         | X                                                                                                   |
| 15KPA90A          | 15KPA90CA        | 90                                      | 100.5                                      | 110.1 | 5                       | 103.7                                   | 2                                                       | 145.6                                         | X                                                                                                   |
| 15KPA100A         | 15KPA100CA       | 100                                     | 111.7                                      | 122.3 | 5                       | 93.6                                    | 2                                                       | 161.3                                         | X                                                                                                   |
| 15KPA110A         | 15KPA110CA       | 110                                     | 122.9                                      | 134.5 | 5                       | 84.5                                    | 2                                                       | 178.6                                         | X                                                                                                   |
| 15KPA120A         | 15KPA120CA       | 120                                     | 134.0                                      | 146.8 | 5                       | 78.5                                    | 2                                                       | 192.3                                         | X                                                                                                   |
| 15KPA130A         | 15KPA130CA       | 130                                     | 145.2                                      | 159.0 | 5                       | 72.5                                    | 2                                                       | 208.3                                         | X                                                                                                   |
| 15KPA150A         | 15KPA150CA       | 150                                     | 167.6                                      | 183.5 | 5                       | 62.4                                    | 2                                                       | 241.9                                         | X                                                                                                   |
| 15KPA160A         | 15KPA160CA       | 160                                     | 178.7                                      | 195.7 | 5                       | 58.4                                    | 2                                                       | 258.6                                         | X                                                                                                   |
| 15KPA170A         | 15KPA170CA       | 170                                     | 189.9                                      | 207.9 | 5                       | 55.4                                    | 2                                                       | 272.7                                         | X                                                                                                   |
| 15KPA180A         | 15KPA180CA       | 180                                     | 201.1                                      | 220.1 | 5                       | 52.3                                    | 2                                                       | 288.5                                         | X                                                                                                   |
| 15KPA200A         | 15KPA200CA       | 200                                     | 223.4                                      | 244.6 | 5                       | 47.3                                    | 2                                                       | 319.1                                         | X                                                                                                   |
| 15KPA220A         | 15KPA220CA       | 220                                     | 245.7                                      | 269.1 | 5                       | 42.4                                    | 2                                                       | 356.0                                         | X                                                                                                   |
| 15KPA240A         | 15KPA240CA       | 240                                     | 268.1                                      | 293.5 | 5                       | 39.3                                    | 2                                                       | 384.6                                         | X                                                                                                   |
| 15KPA260A         | 15KPA260CA       | 260                                     | 290.4                                      | 318.0 | 5                       | 36.2                                    | 2                                                       | 416.7                                         | X                                                                                                   |
| 15KPA280A         | 15KPA280CA       | 280                                     | 312.8                                      | 342.4 | 5                       | 33.2                                    | 2                                                       | 454.5                                         | X                                                                                                   |

For bidirectional type having  $V_R$  of 30 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

## I-V Curve Characteristics



**$P_{PPM}$  Peak Pulse Power 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 suppressor 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**

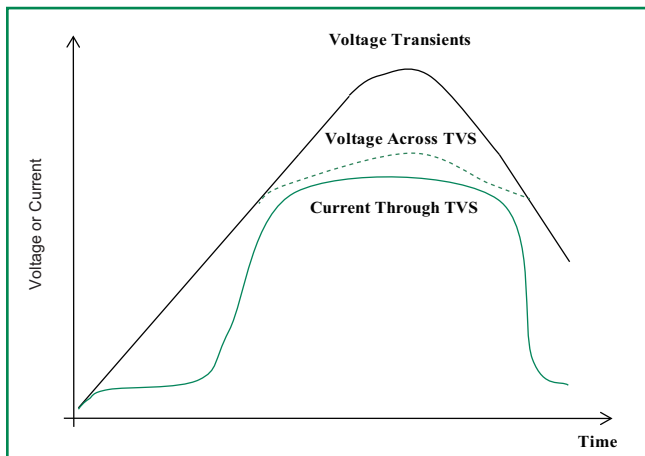
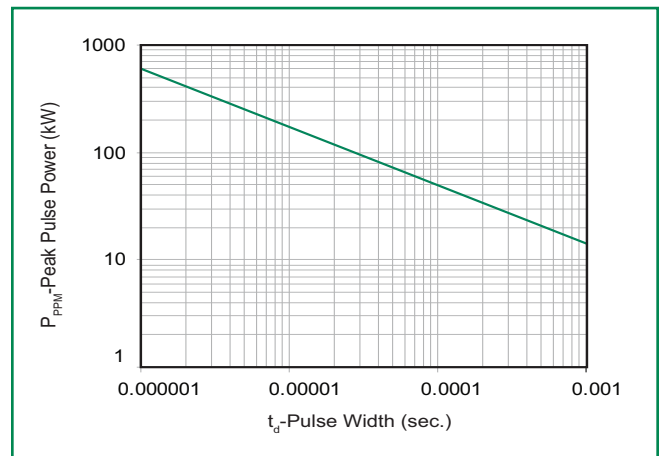


**Figure 2 - Peak Pulse Power Rating Curve**



continues on next page.

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

**Figure 3 - Pulse Derating Curve**

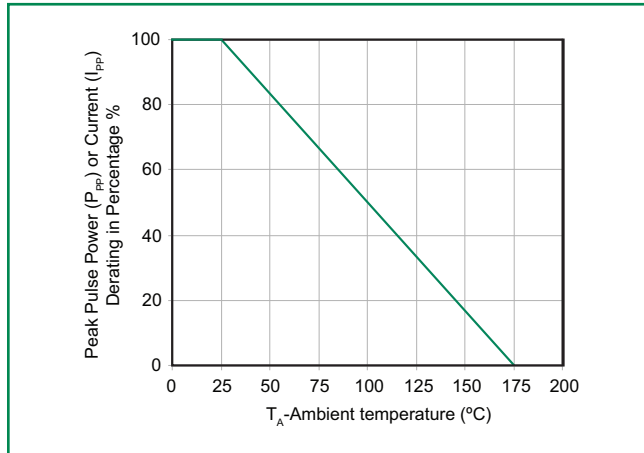


**Figure 4 - Test Pulse Waveform**

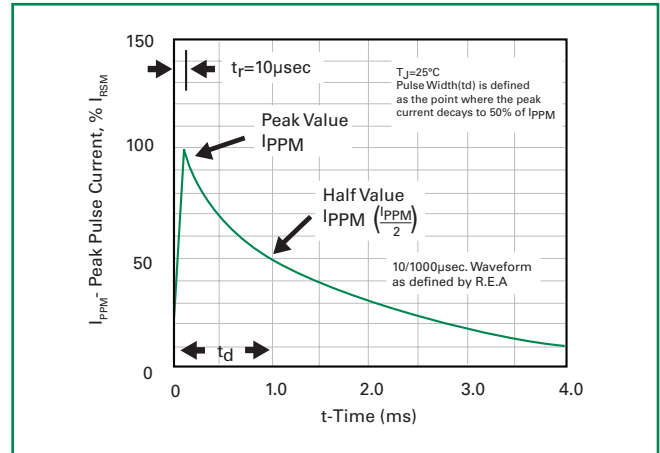


**Figure 5 - Typical Junction Capacitance**

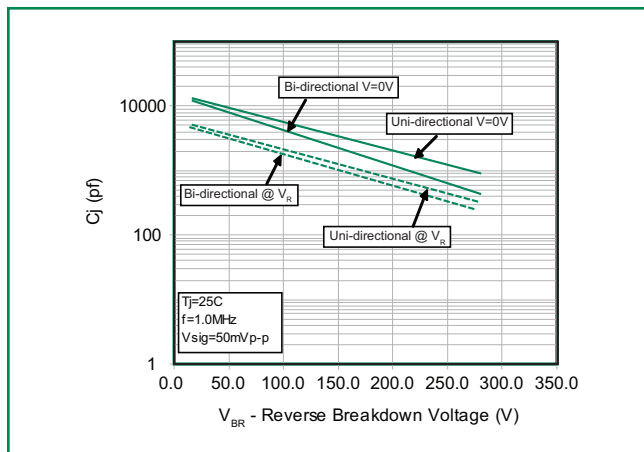


**Figure 6 - Steady State Power Derating Curve**

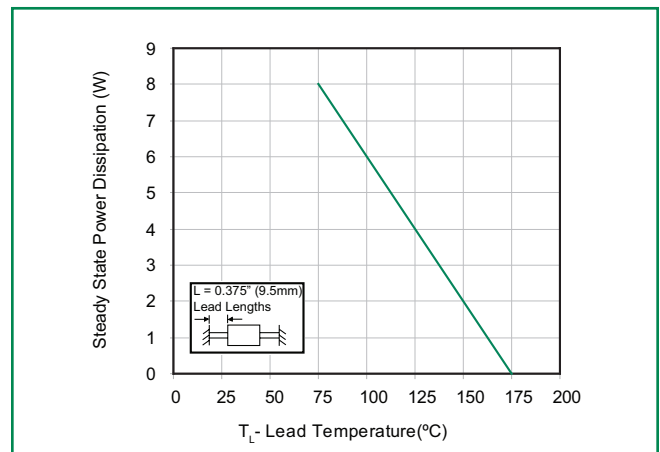
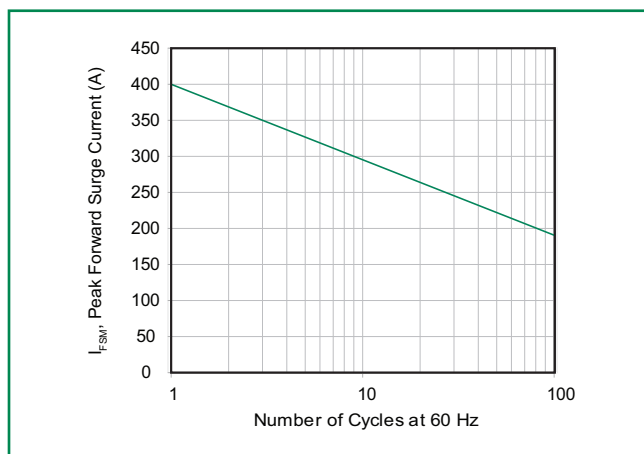
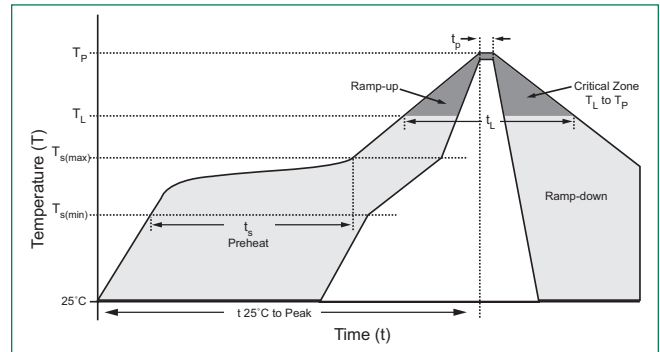


**Figure 7 - Maximum Non-Repetitive Forward Surge Current**



## 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     |

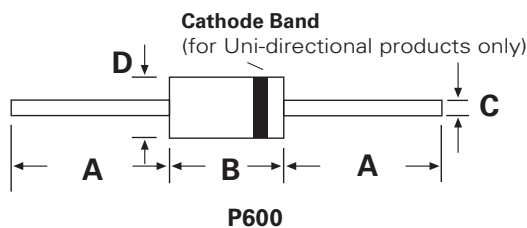
## Physical Specifications

|                 |                                                    |
|-----------------|----------------------------------------------------|
| <b>Weight</b>   | 0.07oz., 2.5g                                      |
| <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

**15KPA xxx XX X**

OPTION CODE:

BLANK Reel Tape

-B Bulk Packaging

TYPE CODE:

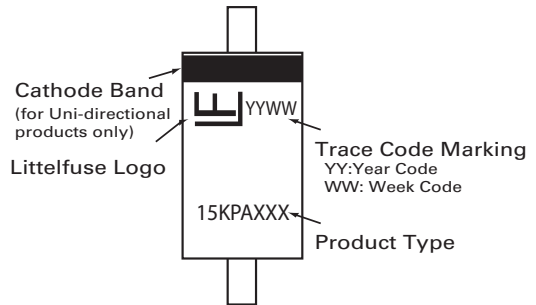
A Uni-Directional (5%  $V_{BR}$  Voltage Tolerance)

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 |
|--------------|-------------------|----------|------------------|-------------------------|
| 15KPAxxxXX   | P600              | 800      | Tape & Reel      | EIA STD RS-296          |
| 15KPAxxxXX-B | P600              | 100      | Bulk             | Littelfuse Spec.        |

## Tape and Reel Specification

