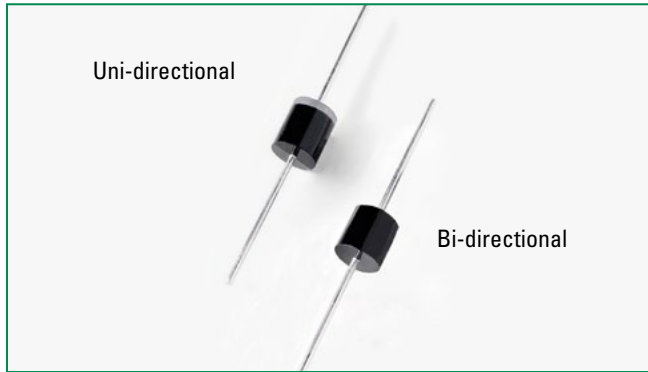



## 20KPA Series



### Agency Approvals

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

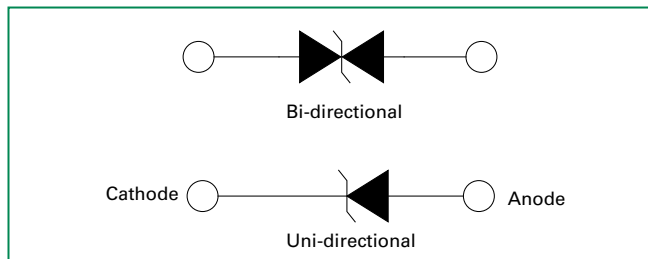
### Maximum Ratings and Thermal Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| Parameter   | Symbol                            | Value      | Unit |
|---|-----------------------------------|------------|------|
| Peak Pulse Power Dissipation by 10x1000µs Test Waveform (Fig.2) (Note 1)              | P <sub>PPM</sub>                  | 20000      | 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



### Description

The 20KPA Series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.


### Features

- Typical maximum temperature coefficient  $\Delta V_{BR} = 0.1\% \times V_{BR@25^\circ C} \times \Delta T$
- Glass passivated chip junction in P600 package
- 20000W 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
- 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 49V
- 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-0
- Matte tin lead-free plated
- Halogen free and RoHS compliant

### 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.

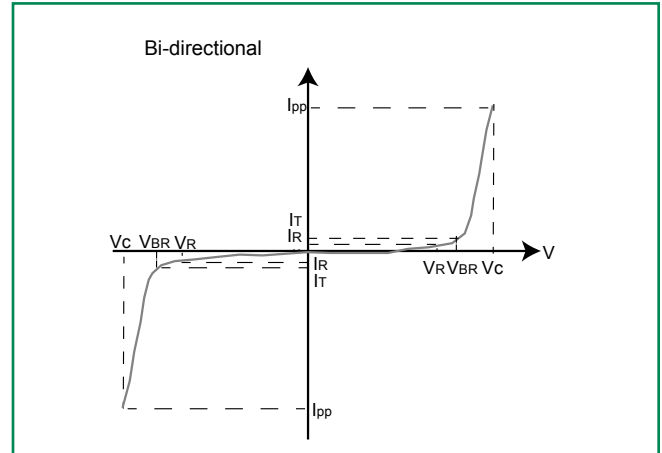
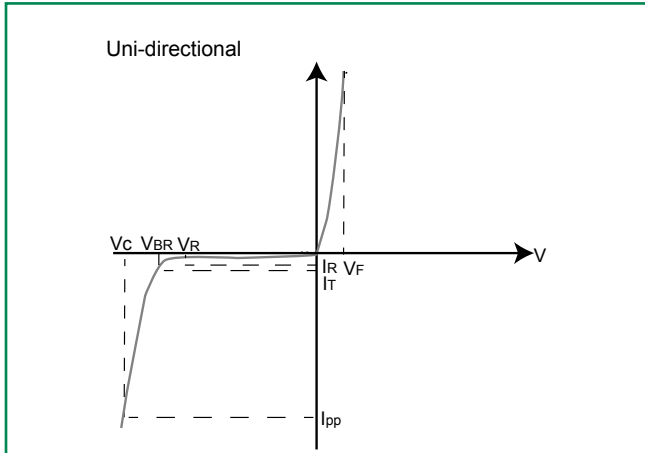
### Electrical Characteristics ( $T_A=25^\circ\text{C}$ unless otherwise noted)

| 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  |                         |   |   |   |   |
| 20KPA20A          | 20KPA20CA        | 20                                      | 22.34                                      | 50                      | 548.9                                   | 5000  | 36.8  | X   |
| 20KPA24A          | 20KPA24CA        | 24                                      | 26.81                                      | 50                      | 490.3                                   | 5000  | 41.2  | X   |
| 20KPA26A          | 20KPA26CA        | 26                                      | 29.04                                      | 50                      | 451.9                                   | 2000  | 44.7  | X   |
| 20KPA28A          | 20KPA28CA        | 28                                      | 31.28                                      | 50                      | 420.8                                   | 1000  | 48.0  | X   |
| 20KPA30A          | 20KPA30CA        | 30                                      | 33.51                                      | 5                       | 392.2                                   | 250   | 51.5  | X   |
| 20KPA32A          | 20KPA32CA        | 32                                      | 35.74                                      | 5                       | 372.0                                   | 150   | 54.3  | X   |
| 20KPA34A          | 20KPA34CA        | 34                                      | 38.00                                      | 5                       | 351.3                                   | 50  | 57.5  | X   |
| 20KPA36A          | 20KPA36CA        | 36                                      | 40.20                                      | 5                       | 328.5                                   | 20  | 61.5  | X   |
| 20KPA40A          | 20KPA40CA        | 40                                      | 44.70                                      | 5                       | 297.9                                   | 15  | 67.8  | X   |
| 20KPA44A          | 20KPA44CA        | 44                                      | 49.10                                      | 5                       | 277.9                                   | 2   | 72.7  | X   |
| 20KPA48A          | 20KPA48CA        | 48                                      | 53.60                                      | 5                       | 254.4                                   | 2   | 79.4  | X   |
| 20KPA52A          | 20KPA52CA        | 52                                      | 58.10                                      | 5                       | 235.4                                   | 2   | 85.8  | X   |
| 20KPA56A          | 20KPA56CA        | 56                                      | 62.60                                      | 5                       | 218.1                                   | 2   | 92.6  | X   |
| 20KPA60A          | 20KPA60CA        | 60                                      | 67.00                                      | 5                       | 207.0                                   | 2   | 97.6  | X   |
| 20KPA64A          | 20KPA64CA        | 64                                      | 71.50                                      | 5                       | 194.2                                   | 2   | 104.0   | X   |
| 20KPA68A          | 20KPA68CA        | 68                                      | 76.00                                      | 5                       | 183.6                                   | 2   | 110.0   | X   |
| 20KPA72A          | 20KPA72CA        | 72                                      | 80.40                                      | 5                       | 174.1                                   | 2   | 116.0   | X   |
| 20KPA80A          | 20KPA80CA        | 80                                      | 89.40                                      | 5                       | 155.4                                   | 2   | 130.0   | X   |
| 20KPA88A          | 20KPA88CA        | 88                                      | 98.30                                      | 5                       | 142.3                                   | 2   | 142.0   | X   |
| 20KPA96A          | 20KPA96CA        | 96                                      | 107.20                                     | 5                       | 130.3                                   | 2   | 155.0   | X   |
| 20KPA104A         | 20KPA104CA       | 104                                     | 116.20                                     | 5                       | 120.2                                   | 2   | 168.0   | X   |
| 20KPA112A         | 20KPA112CA       | 112                                     | 125.10                                     | 5                       | 111.0                                   | 2   | 182.0   | X   |
| 20KPA120A         | 20KPA120CA       | 120                                     | 134.00                                     | 5                       | 104.1                                   | 2   | 194.0   | X   |
| 20KPA132A         | 20KPA132CA       | 132                                     | 147.40                                     | 5                       | 94.8                                    | 2   | 213.0   | X   |
| 20KPA144A         | 20KPA144CA       | 144                                     | 160.80                                     | 5                       | 87.1                                    | 2   | 232.0   | X   |
| 20KPA160A         | 20KPA160CA       | 160                                     | 178.70                                     | 5                       | 78.3                                    | 2   | 258.0   | X   |
| 20KPA172A         | 20KPA172CA       | 172                                     | 192.10                                     | 5                       | 72.9                                    | 2   | 277.0   | X   |
| 20KPA180A         | 20KPA180CA       | 180                                     | 201.10                                     | 5                       | 69.4                                    | 2   | 291.0   | X   |
| 20KPA192A         | 20KPA192CA       | 192                                     | 214.50                                     | 5                       | 65.4                                    | 2   | 309.0   | X   |
| 20KPA204A         | 20KPA204CA       | 204                                     | 227.90                                     | 5                       | 61.4                                    | 2   | 329.0   | X   |
| 20KPA216A         | 20KPA216CA       | 216                                     | 241.30                                     | 5                       | 58.0                                    | 2   | 348.0   | X   |
| 20KPA232A         | 20KPA232CA       | 232                                     | 259.10                                     | 5                       | 54.0                                    | 2   | 374.0   | X   |
| 20KPA240A         | 20KPA240CA       | 240                                     | 268.10                                     | 5                       | 52.2                                    | 2   | 387.0   | X   |
| 20KPA256A         | 20KPA256CA       | 256                                     | 286.00                                     | 5                       | 49.0                                    | 2   | 412.0   | X   |
| 20KPA280A         | 20KPA280CA       | 280                                     | 312.80                                     | 5                       | 44.8                                    | 2   | 451.0   | X   |
| 20KPA300A         | 20KPA300CA       | 300                                     | 335.10                                     | 5                       | 41.8                                    | 2   | 483.0   | X   |

For bidirectional type having  $V_{RWM}$  of 40 volts and less, the  $I_R$  limit is double.

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

## I-V Curve Characteristics



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

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

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

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

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

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

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

Figure 1 - TVS Transients Clamping Waveform

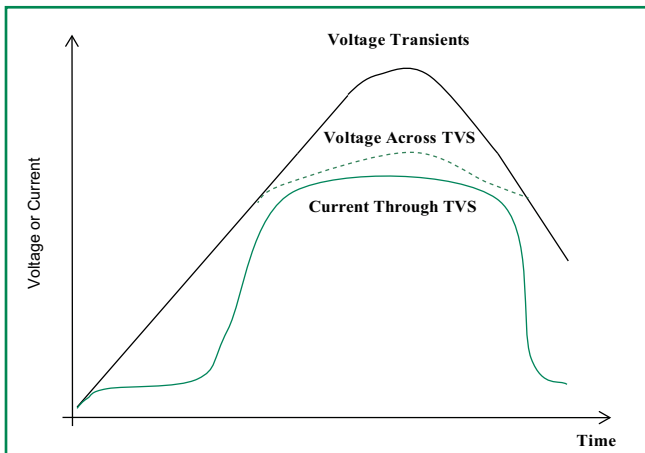
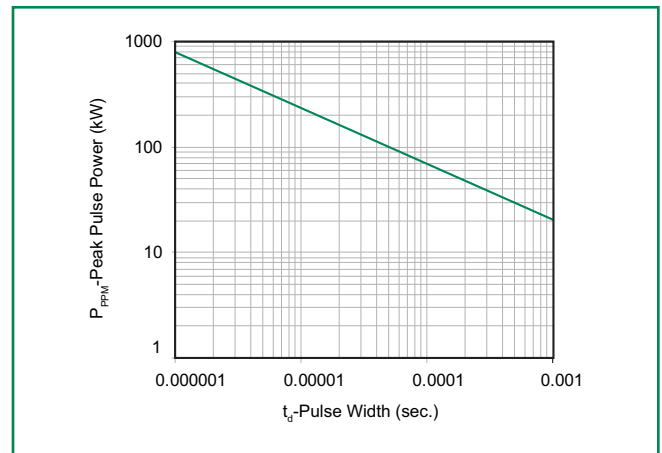


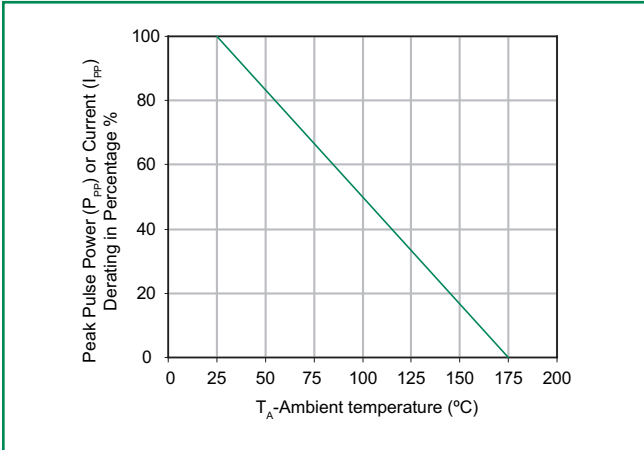
Figure 2 - Peak Pulse Power Rating Curve



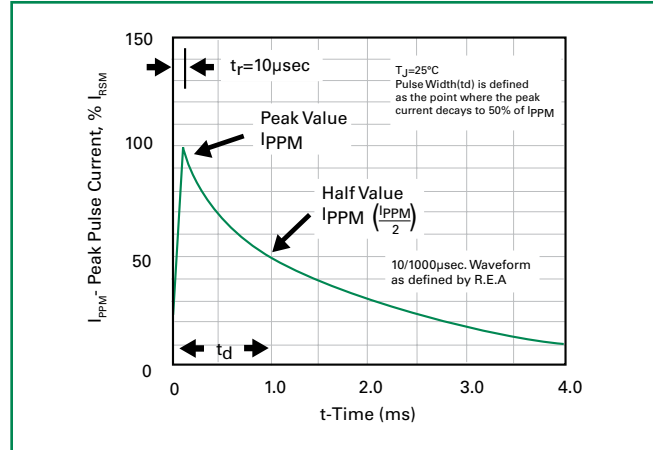
continues on next page.

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

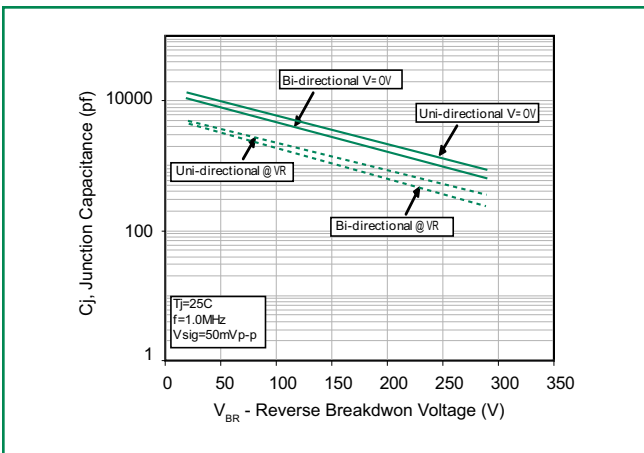
**Figure 3 - Pulse Derating Curve**



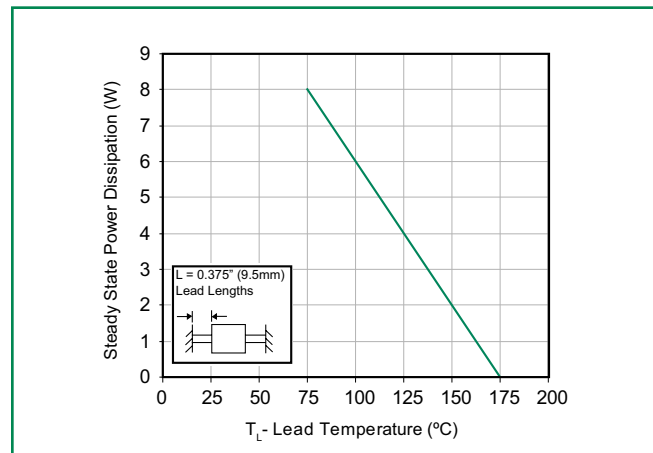
**Figure 4 - Pulse Waveform**



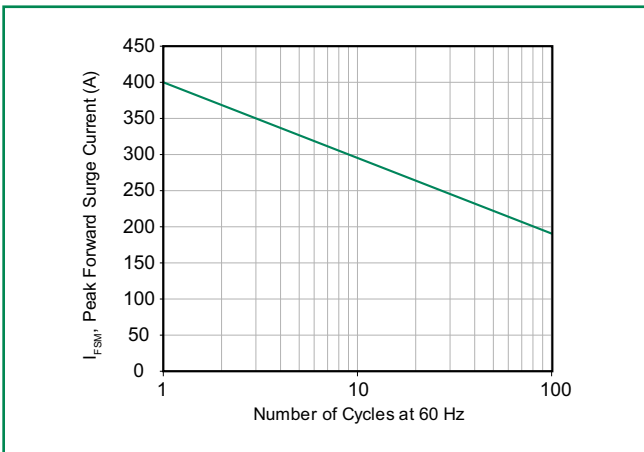
**Figure 5 - Typical Junction Capacitance**



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

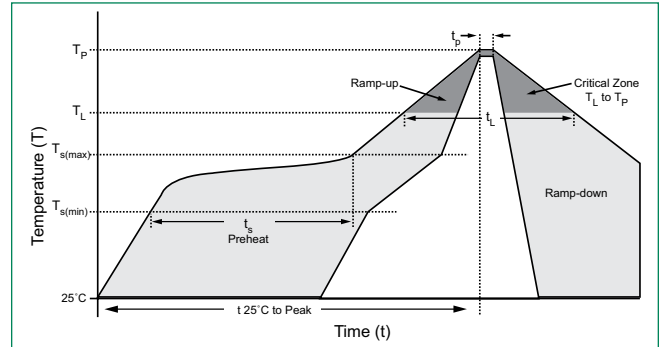


**Figure 7 - Maximum Non-Repetitive Peak Forward Surge Current**



## Soldering Parameters

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



## Flow/Wave Soldering (Solder Dipping)

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

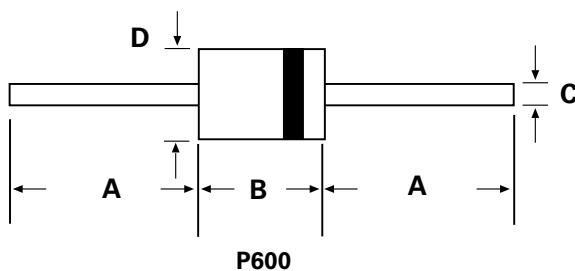
## Physical Specifications

|                 |   |
|-----------------|---|
| <b>Weight</b>   | 0.07oz., 2.5g                                       |
| <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-B102D. |

## Environmental Specifications

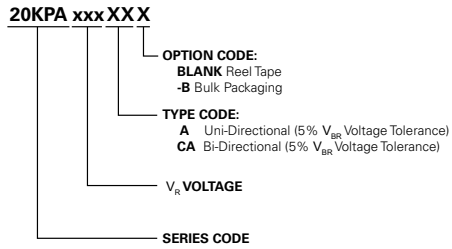
|                           |              |
|---------------------------|--------------|
| <b>Temperature Cycle</b>  | JESD22-A104  |
| <b>Pressure Cooker</b>    | JESD 22-A102 |
| <b>High Temp. Storage</b> | JESD22-A103  |
| <b>HTRB</b>               | JESD22-A108  |
| <b>Thermal Shock</b>      | JESD22-A106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

## Dimensions

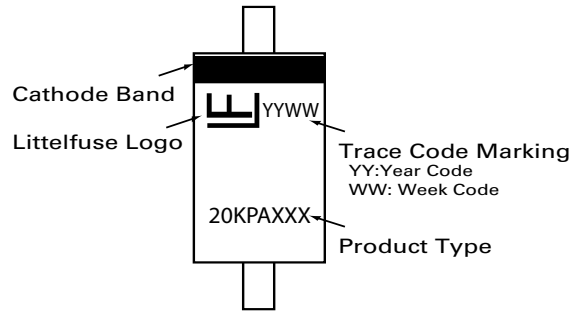


| Dimensions | Inches |       | Millimeters |      |
|------------|--------|-------|-------------|------|
|            | Min    | Max   | Min         | Max  |
| A          | 1.000  | -     | 25.40       | -    |
| B          | 0.340  | 0.360 | 8.60        | 9.10 |
| C          | 0.048  | 0.052 | 1.22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

### Part Numbering System



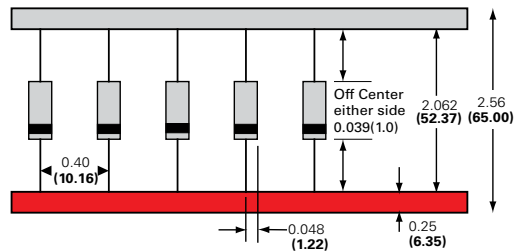
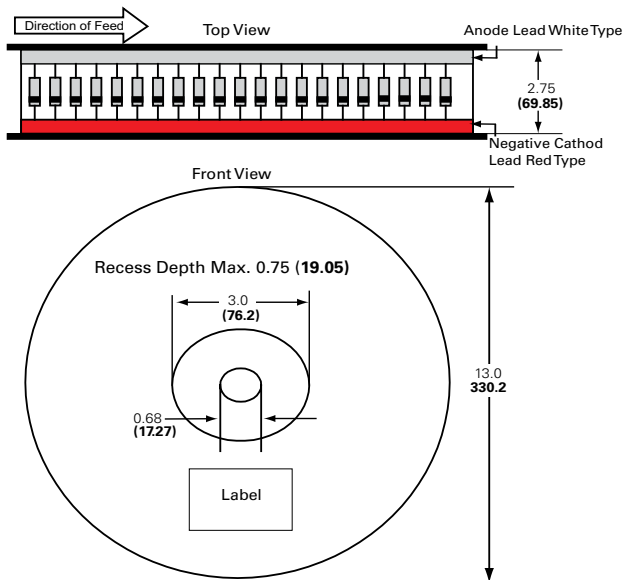
### Part Marking System



### Packing Options

| Part Number  | Component Package | Quantity | Packaging Option | Packaging Specification                  |
|--------------|-------------------|----------|------------------|--|
| 20KPAxxxXX   | P600              | 800      | Tape & Reel      | EIA STD RS-296E                          |
| 20KPAxxxXX-B | P600              | 100      | Bulk             | Littelfuse Concord Packing Spec. DM-0016 |

### Tape and Reel Specification



Dimensions are in inches/mm

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