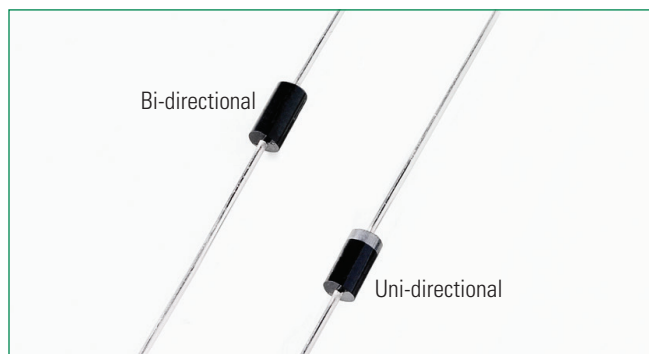


### P6KE Series



#### Agency Approvals

| Agency                                                                            | Agency File Number |
|-----------------------------------------------------------------------------------|--------------------|
|  | E230531            |

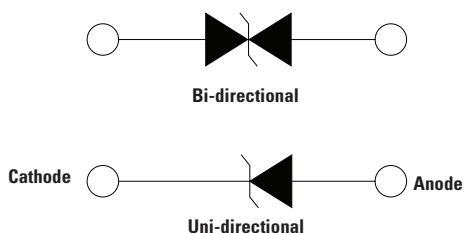
#### Maximum Ratings and Thermal Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| Parameter                                                                                                   | Symbol                            | Value      | Unit |
|-------------------------------------------------------------------------------------------------------------|-----------------------------------|------------|------|
| Peak Pulse Power Dissipation(Fig.2) by 10/1000us Test Waveform(Fig.4)(Note 1)<br>-Single Die Parts          | P <sub>PPM</sub>                  | 600        | W    |
| Peak Pulse Power Dissipation(Fig.2) by 10/1000us Test Waveform(Fig.4)(Note 1)<br>-Stacked Die Parts(Note 4) | P <sub>PPM</sub>                  | 800        | W    |
| Steady State Power Dissipation on Infinite Heat Sink at T <sub>J</sub> =75°C                                | P <sub>D</sub>                    | 5.0        | W    |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave Unidirectional Only (Note 2)                        | I <sub>FSM</sub>                  | 100        | A    |
| Maximum Instantaneous Forward Voltage at 50A 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>                  | 20         | °C/W |
| Typical Thermal Resistance Junction to Ambient                                                              | R <sub>θJA</sub>                  | 75         | °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.
4. For stacked die component details, please refer to part numbers labeled by \* in Electrical Characteristics.

#### Functional Diagram



#### Description

The P6KE Series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

#### Features

- 600W peak pulse capability at 10/1000µs waveform, repetition rate (duty cycles):0.01 %
- Glass passivated chip junction in DO-15 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 conducted based on Table 4a and 4c of JEDEC JESD201A
- 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 1µA when V<sub>BR</sub> min>12V
- Compatible with high temperature reflow soldering (260°C/30 s)
- V<sub>BR</sub> @ T<sub>J</sub> = V<sub>BR</sub> @ 25°C x (1+αT x (T<sub>J</sub> - 25)) (αT: Temperature Coefficient, typical value is 0.1%)
- UL Recognized epoxy meeting flammability classification V-0
- 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-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.

#### Additional Information



**Datasheet**



**Resources**



**Samples**

# TVS Diodes

## Axial Leaded – 600W > P6KE series

### Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

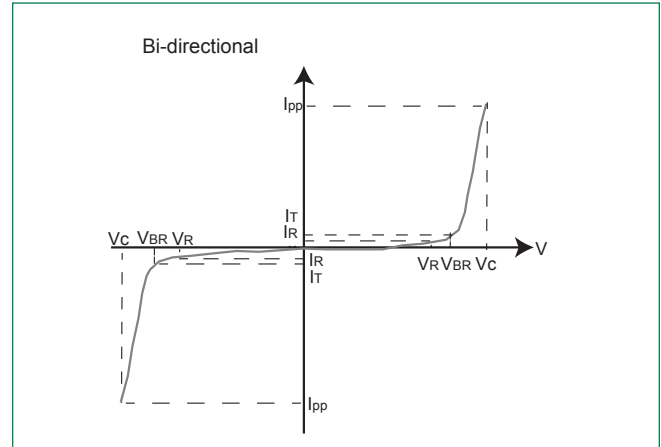
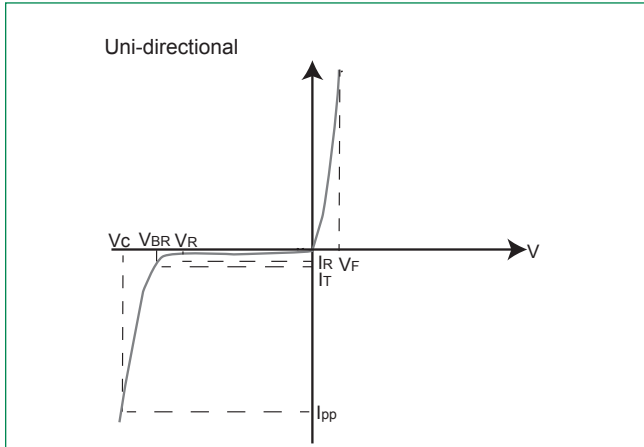
| Part Number (Uni) | Part Number (Bi) | Reverse Stand off Voltage V <sub>R</sub> (Volts) | Breakdown Voltage V <sub>BR</sub> (Volts) @ I <sub>T</sub> |        | Test Current I <sub>T</sub> (mA) | Maximum Clamping Voltage V <sub>C</sub> @ I <sub>pp</sub> (V) | Maximum Peak Pulse Current I <sub>pp</sub> (A) | Maximum Reverse Leakage I <sub>R</sub> @ V <sub>R</sub> (μA) | Agency Approval  |
|-------------------|------------------|--------------------------------------------------|------------------------------------------------------------|--------|----------------------------------|---------------------------------------------------------------|------------------------------------------------|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
|                   |                  |                                                  | Min.                                                       | Max.   |                                  |                                                               |                                                |                                                              |                                                                                                     |
| P6KE6.8A          | P6KE6.8CA        | 5.80                                             | 6.45                                                       | 7.14   | 10                               | 10.5                                                          | 58.1                                           | 1000                                                         | X                                                                                                   |
| P6KE7.5A          | P6KE7.5CA        | 6.40                                             | 7.13                                                       | 7.88   | 10                               | 11.3                                                          | 54.0                                           | 500                                                          | X                                                                                                   |
| P6KE8.2A          | P6KE8.2CA        | 7.02                                             | 7.79                                                       | 8.61   | 10                               | 12.1                                                          | 50.4                                           | 200                                                          | X                                                                                                   |
| P6KE9.1A          | P6KE9.1CA        | 7.78                                             | 8.65                                                       | 9.55   | 1                                | 13.4                                                          | 45.5                                           | 50                                                           | X                                                                                                   |
| P6KE10A           | P6KE10CA         | 8.55                                             | 9.50                                                       | 10.50  | 1                                | 14.5                                                          | 42.1                                           | 10                                                           | X                                                                                                   |
| P6KE11A           | P6KE11CA         | 9.40                                             | 10.50                                                      | 11.60  | 1                                | 15.6                                                          | 39.1                                           | 5                                                            | X                                                                                                   |
| P6KE12A           | P6KE12CA         | 10.20                                            | 11.40                                                      | 12.60  | 1                                | 16.7                                                          | 36.5                                           | 5                                                            | X                                                                                                   |
| P6KE13A           | P6KE13CA         | 11.10                                            | 12.40                                                      | 13.70  | 1                                | 18.2                                                          | 33.5                                           | 1                                                            | X                                                                                                   |
| P6KE15A           | P6KE15CA         | 12.80                                            | 14.30                                                      | 15.80  | 1                                | 21.2                                                          | 28.8                                           | 1                                                            | X                                                                                                   |
| P6KE16A           | P6KE16CA         | 13.60                                            | 15.20                                                      | 16.80  | 1                                | 22.5                                                          | 27.1                                           | 1                                                            | X                                                                                                   |
| P6KE18A           | P6KE18CA         | 15.30                                            | 17.10                                                      | 18.90  | 1                                | 25.2                                                          | 24.2                                           | 1                                                            | X                                                                                                   |
| P6KE20A           | P6KE20CA         | 17.10                                            | 19.00                                                      | 21.00  | 1                                | 27.7                                                          | 22.0                                           | 1                                                            | X                                                                                                   |
| P6KE22A           | P6KE22CA         | 18.80                                            | 20.90                                                      | 23.10  | 1                                | 30.6                                                          | 19.9                                           | 1                                                            | X                                                                                                   |
| P6KE24A           | P6KE24CA         | 20.50                                            | 22.80                                                      | 25.20  | 1                                | 33.2                                                          | 18.4                                           | 1                                                            | X                                                                                                   |
| P6KE27A           | P6KE27CA         | 23.10                                            | 25.70                                                      | 28.40  | 1                                | 37.5                                                          | 16.3                                           | 1                                                            | X                                                                                                   |
| P6KE30A           | P6KE30CA         | 25.60                                            | 28.50                                                      | 31.50  | 1                                | 41.4                                                          | 14.7                                           | 1                                                            | X                                                                                                   |
| P6KE33A           | P6KE33CA         | 28.20                                            | 31.40                                                      | 34.70  | 1                                | 45.7                                                          | 13.3                                           | 1                                                            | X                                                                                                   |
| P6KE36A           | P6KE36CA         | 30.80                                            | 34.20                                                      | 37.80  | 1                                | 49.9                                                          | 12.2                                           | 1                                                            | X                                                                                                   |
| P6KE39A           | P6KE39CA         | 33.30                                            | 37.10                                                      | 41.00  | 1                                | 53.9                                                          | 11.3                                           | 1                                                            | X                                                                                                   |
| P6KE43A           | P6KE43CA         | 36.80                                            | 40.90                                                      | 45.20  | 1                                | 59.3                                                          | 10.3                                           | 1                                                            | X                                                                                                   |
| P6KE47A           | P6KE47CA         | 40.20                                            | 44.70                                                      | 49.40  | 1                                | 64.8                                                          | 9.4                                            | 1                                                            | X                                                                                                   |
| P6KE51A           | P6KE51CA         | 43.60                                            | 48.50                                                      | 53.60  | 1                                | 70.1                                                          | 8.7                                            | 1                                                            | X                                                                                                   |
| P6KE56A           | P6KE56CA         | 47.80                                            | 53.20                                                      | 58.80  | 1                                | 77.0                                                          | 7.9                                            | 1                                                            | X                                                                                                   |
| P6KE62A           | P6KE62CA         | 53.00                                            | 58.90                                                      | 65.10  | 1                                | 85.0                                                          | 7.2                                            | 1                                                            | X                                                                                                   |
| P6KE68A           | P6KE68CA         | 58.10                                            | 64.60                                                      | 71.40  | 1                                | 92.0                                                          | 6.6                                            | 1                                                            | X                                                                                                   |
| P6KE75A           | P6KE75CA         | 64.10                                            | 71.30                                                      | 78.80  | 1                                | 103.0                                                         | 5.9                                            | 1                                                            | X                                                                                                   |
| P6KE82A           | P6KE82CA         | 70.10                                            | 77.90                                                      | 86.10  | 1                                | 113.0                                                         | 5.4                                            | 1                                                            | X                                                                                                   |
| P6KE91A           | P6KE91CA         | 77.80                                            | 86.50                                                      | 95.50  | 1                                | 125.0                                                         | 4.9                                            | 1                                                            | X                                                                                                   |
| P6KE100A          | P6KE100CA        | 85.50                                            | 95.00                                                      | 105.00 | 1                                | 137.0                                                         | 4.5                                            | 1                                                            | X                                                                                                   |
| P6KE110A          | P6KE110CA        | 94.00                                            | 105.00                                                     | 116.00 | 1                                | 152.0                                                         | 4.0                                            | 1                                                            | X                                                                                                   |
| P6KE120A          | P6KE120CA        | 102.00                                           | 114.00                                                     | 126.00 | 1                                | 165.0                                                         | 3.7                                            | 1                                                            | X                                                                                                   |
| P6KE130A          | P6KE130CA        | 111.00                                           | 124.00                                                     | 137.00 | 1                                | 179.0                                                         | 3.4                                            | 1                                                            | X                                                                                                   |
| P6KE150A          | P6KE150CA        | 128.00                                           | 143.00                                                     | 158.00 | 1                                | 207.0                                                         | 2.9                                            | 1                                                            | X                                                                                                   |
| P6KE160A          | P6KE160CA        | 136.00                                           | 152.00                                                     | 168.00 | 1                                | 219.0                                                         | 2.8                                            | 1                                                            | X                                                                                                   |
| P6KE170A          | P6KE170CA        | 145.00                                           | 162.00                                                     | 179.00 | 1                                | 234.0                                                         | 2.6                                            | 1                                                            | X                                                                                                   |
| P6KE180A          | P6KE180CA        | 154.00                                           | 171.00                                                     | 189.00 | 1                                | 246.0                                                         | 2.5                                            | 1                                                            | X                                                                                                   |
| P6KE200A          | P6KE200CA        | 171.00                                           | 190.00                                                     | 210.00 | 1                                | 274.0                                                         | 2.2                                            | 1                                                            | X                                                                                                   |
| P6KE220A          | P6KE220CA        | 185.00                                           | 209.00                                                     | 231.00 | 1                                | 328.0                                                         | 1.9                                            | 1                                                            | X                                                                                                   |
| P6KE250A          | -                | 214.00                                           | 237.00                                                     | 263.00 | 1                                | 344.0                                                         | 1.8                                            | 1                                                            | X                                                                                                   |
|                   | P6KE250CA*       | 214.00                                           | 237.00                                                     | 263.00 | 1                                | 344.0                                                         | 2.4                                            | 1                                                            | X                                                                                                   |
| P6KE300A          | -                | 256.00                                           | 285.00                                                     | 315.00 | 1                                | 414.0                                                         | 1.5                                            | 1                                                            | X                                                                                                   |
|                   | P6KE300CA*       | 256.00                                           | 285.00                                                     | 315.00 | 1                                | 414.0                                                         | 2.0                                            | 1                                                            | X                                                                                                   |
| P6KE350A*         | P6KE350CA*       | 300.00                                           | 332.00                                                     | 368.00 | 1                                | 482.0                                                         | 1.7                                            | 1                                                            | X                                                                                                   |
| P6KE400A*         | P6KE400CA*       | 342.00                                           | 380.00                                                     | 420.00 | 1                                | 548.0                                                         | 1.5                                            | 1                                                            | X                                                                                                   |
| P6KE440A*         | P6KE440CA*       | 376.00                                           | 418.00                                                     | 462.00 | 1                                | 602.0                                                         | 1.4                                            | 1                                                            | X                                                                                                   |
| P6KE480A*         | P6KE480CA*       | 408.00                                           | 456.00                                                     | 504.00 | 1                                | 658.0                                                         | 1.3                                            | 1                                                            | X                                                                                                   |
| P6KE510A*         | P6KE510CA*       | 434.00                                           | 485.00                                                     | 535.00 | 1                                | 698.0                                                         | 1.2                                            | 1                                                            | X                                                                                                   |
| P6KE530A*         | P6KE530CA*       | 451.00                                           | 503.50                                                     | 556.50 | 1                                | 725.0                                                         | 1.2                                            | 1                                                            | X                                                                                                   |
| P6KE540A*         | P6KE540CA*       | 460.00                                           | 513.00                                                     | 567.00 | 1                                | 740.0                                                         | 1.1                                            | 1                                                            | X                                                                                                   |
| P6KE550A*         | P6KE550CA*       | 468.00                                           | 522.50                                                     | 577.50 | 1                                | 760.0                                                         | 1.1                                            | 1                                                            | X                                                                                                   |
| P6KE600A*         | P6KE600CA*       | 512.00                                           | 570.00                                                     | 630.00 | 1                                | 828.0                                                         | 1.0                                            | 1                                                            | -                                                                                                   |

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, the parts without A are currently available, but not recommended for new designs. The parts with A are preferred.

For stack-die parts, use \* to label the part number.

## 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 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

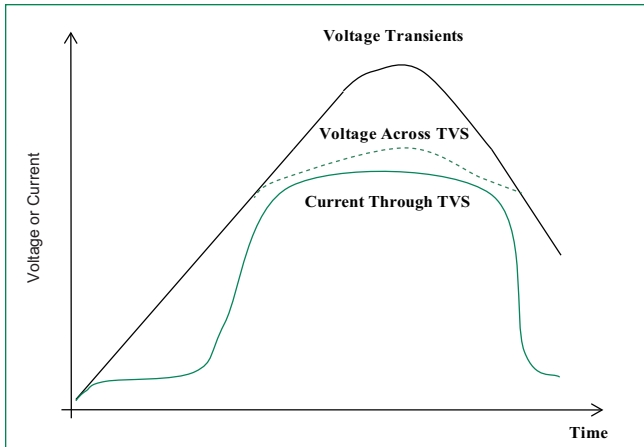
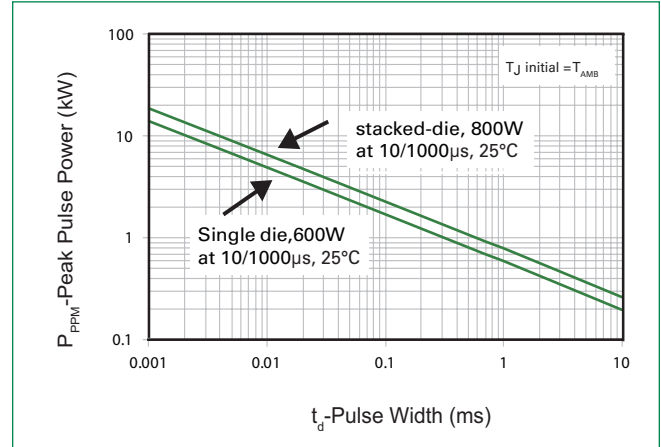
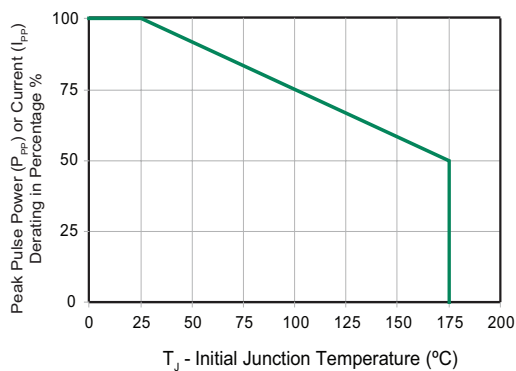


Figure 2 - Peak Pulse Power Rating

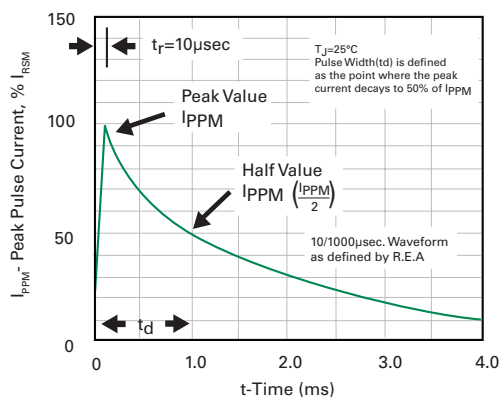


### Ratings and Characteristic Curves ( $T_A=25^\circ\text{C}$ unless otherwise noted) (Continued)

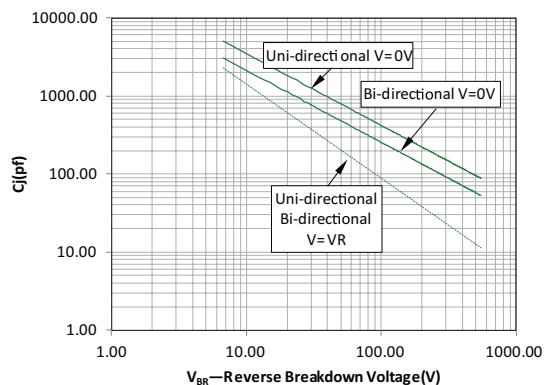
**Figure 3 - Peak Pulse Power Derating Curve**



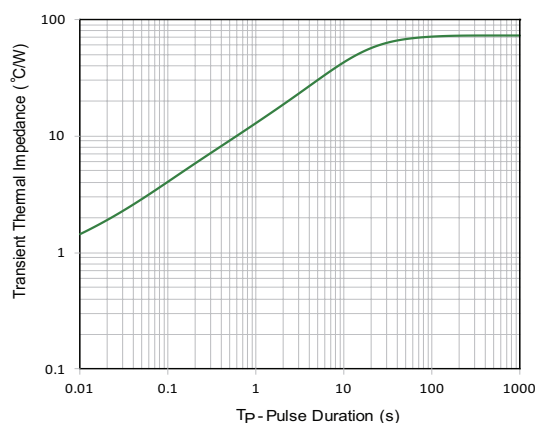
**Figure 4 - Pulse Waveform**



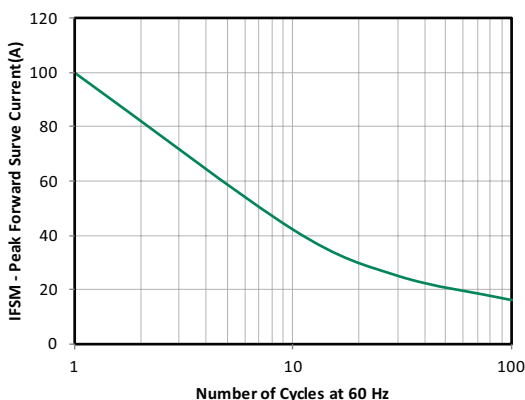
**Figure 5 - Typical Junction Capacitance**



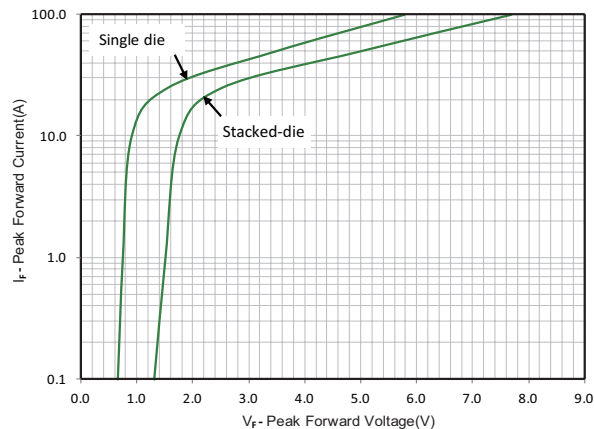
**Figure 6 - Typical Transient Thermal Impedance**



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

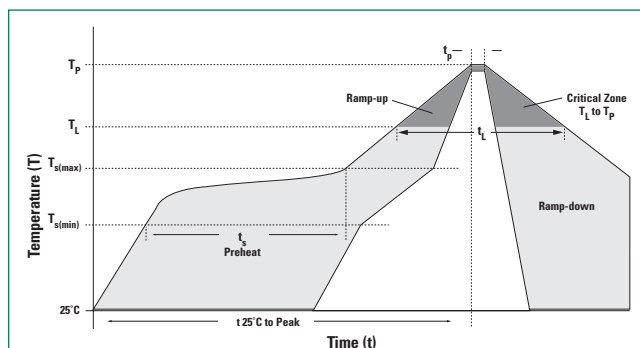


**Figure 8 - Peak Forward Voltage Drop vs Peak Forward Current (Typical Values)**



### Soldering Parameters

|                                                                       |                                    |                         |
|-----------------------------------------------------------------------|------------------------------------|-------------------------|
| <b>Reflow Condition</b>                                               |                                    | Lead-free assembly      |
| <b>Pre Heat</b>                                                       | - Temperature Min ( $T_{s(min)}$ ) | 150°C                   |
|                                                                       | - Temperature Max ( $T_{s(max)}$ ) | 200°C                   |
|                                                                       | - Time (min to max) ( $t_p$ )      | 60 – 120 secs           |
| <b>Average ramp up rate (Liquidus Temp (<math>T_L</math>) to peak</b> |                                    | 3°C/second max          |
| <b><math>T_{s(max)}</math> to <math>T_L</math> - Ramp-up Rate</b>     |                                    | 3°C/second max          |
| <b>Reflow</b>                                                         | - Temperature ( $T_L$ ) (Liquidus) | 217°C                   |
|                                                                       | - Time (min to max) ( $t_L$ )      | 60 – 150 seconds        |
| <b>Peak Temperature (<math>T_p</math>)</b>                            |                                    | 260 <sup>+0/-5</sup> °C |
| <b>Time within 5°C of actual peak Temperature (<math>t_p</math>)</b>  |                                    | 30 Seconds Max          |
| <b>Ramp-down Rate</b>                                                 |                                    | 6°C/second max          |
| <b>Time 25°C to peak Temperature (<math>T_p</math>)</b>               |                                    | 8 minutes Max.          |
| <b>Do not exceed</b>                                                  |                                    | 260°C                   |



### Flow/Wave Soldering (Solder Dipping)

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

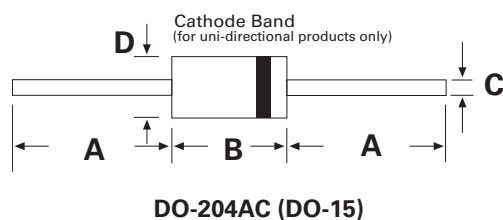
### Physical Specificationst C

|                 |                                                                      |
|-----------------|----------------------------------------------------------------------|
| <b>Weight</b>   | 0.015oz., 0.4g                                                       |
| <b>Case</b>     | JEDEC DO-204AC (DO-15) 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

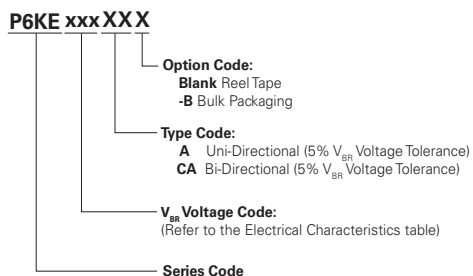
|                            |             |
|----------------------------|-------------|
| <b>High Temp. Storage</b>  | JESD22-A103 |
| <b>HTRB</b>                | JESD22-A108 |
| <b>Temperature Cycling</b> | JESD22-A104 |
| <b>H3TRB</b>               | JESD22-A101 |
| <b>RSH</b>                 |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

### Dimensions

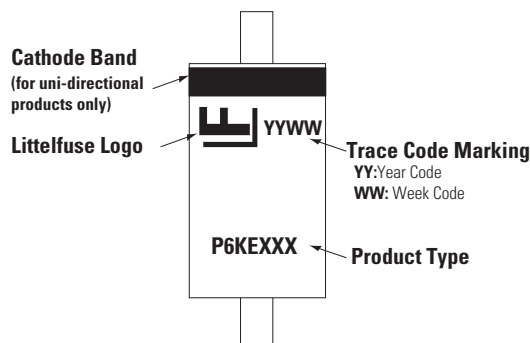


| Dimensions | Inches |       | Millimeters |      |
|------------|--------|-------|-------------|------|
|            | Min    | Max   | Min         | Max  |
| <b>A</b>   | 1.000  | -     | 25.40       | -    |
| <b>B</b>   | 0.230  | 0.300 | 5.80        | 7.60 |
| <b>C</b>   | 0.028  | 0.034 | 0.71        | 0.86 |
| <b>D</b>   | 0.104  | 0.140 | 2.60        | 3.60 |

### Part Numbering System



### Part Marking System



### Packaging

| Part Number | Component Package | Quantity | Packaging Option | Packaging Specification |
|-------------|-------------------|----------|------------------|-------------------------|
| P6KExxxXX   | DO-204AC          | 4000     | Tape & Reel      | EIA STD RS-296          |
| P6KExxxXX-B | DO-204AC          | 1000     | BULK             | Littelfuse Spec.        |

### Tape and Reel Specification

