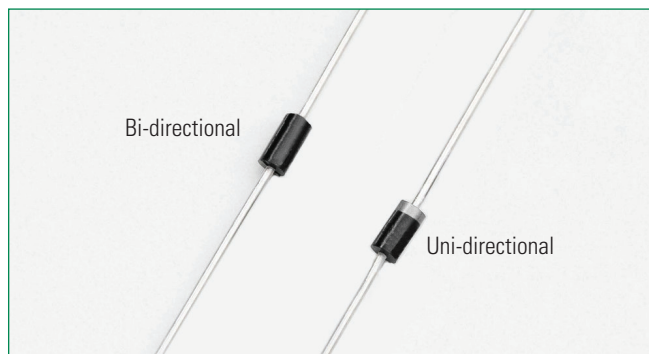


### P4KE Series



#### Agency Approvals

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

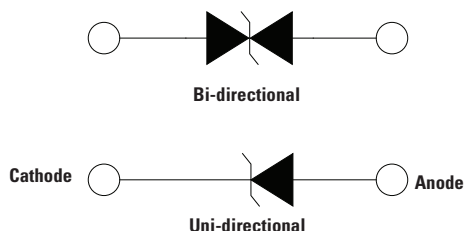
#### Maximum Ratings and Thermal Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| Parameter                                                                                                  | Symbol                            | Value      | Unit |
|------------------------------------------------------------------------------------------------------------|-----------------------------------|------------|------|
| Peak Pulse Power Dissipation(Fig.2) by 10/1000us Test Waveform(Fig.4) (Note 1) -Single Die Parts           | P <sub>PPM</sub>                  | 400        | W    |
| Peak Pulse Power Dissipation(Fig.2) by 10/1000us Test Waveform(Fig.4) (Note 1) -Stacked Die Parts (Note 4) | P <sub>PPM</sub>                  | 600        | W    |
| Steady State Power Dissipation on Infinite Heat Sink at T <sub>L</sub> =75°C                               | P <sub>D</sub>                    | 1.5        | W    |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave Unidirectional Only (Note 2)                       | I <sub>FSM</sub>                  | 60         | A    |
| Maximum Instantaneous Forward Voltage at 25A 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>                  | 60         | °C/W |
| Typical Thermal Resistance Junction to Ambient                                                             | R <sub>θJA</sub>                  | 100        | °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 P4KE Series is designed specifically to protect sensitive electronic equipment from EFTs, ESD, and induced lightning transients.

#### Features

- 400W peak pulse capability at 10/1000μs waveform, repetition rate (duty cycles):0.01%
- Glass passivated chip junction in DO-41 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 a short circuit
- Whisker test is conducted per Table 4a/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 IR ≤ 1 μA for VBR min > 12.6 V
- High temperature reflow soldering guaranteed: 260°C/30sec / 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+αT x (T<sub>J</sub> - 25)) (αT:Temperature Coefficient, typical value is 0.1%)
- UL Recognized compound meeting flammability rating V-0
- 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 ICT equipment and consumer electronic applications.

#### Additional Information



Datasheet



Resources



Samples

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

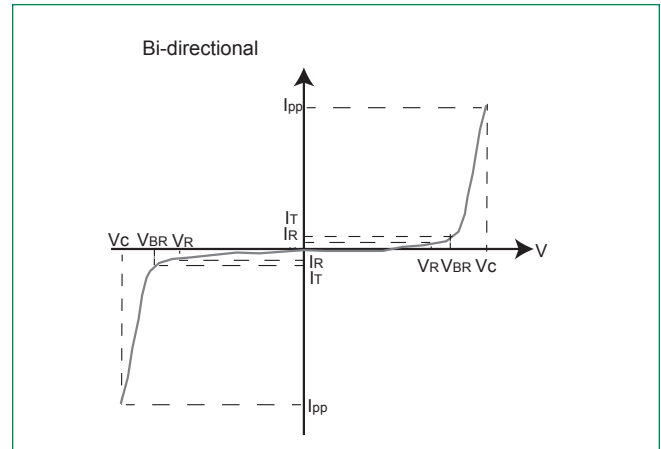
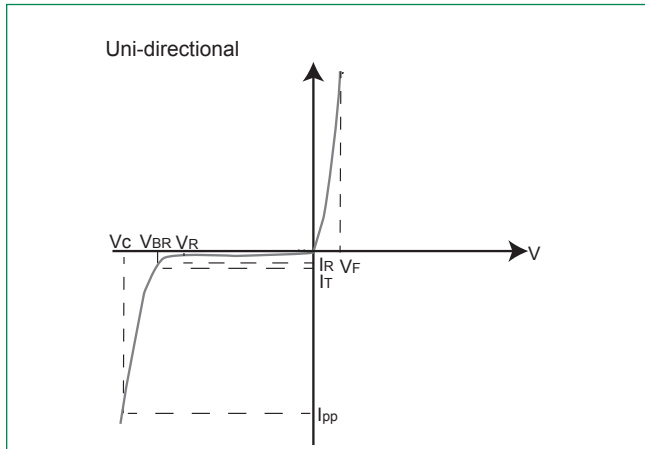
| Part Number (Uni) | Part Number (Bi) | Reverse Stand off Voltage V <sub>R</sub> (Volts) | Breakdown Voltage V <sub>BR</sub> @ I <sub>T</sub> (V) |        | Test Current I <sub>T</sub> (mA) | Maximum Clamping Voltage V <sub>C</sub> @ I <sub>PP</sub> (V) | Maximum Peak Pulse Current I <sub>PP</sub> (A) | Maximum Reverse Leakage I <sub>R</sub> @ V <sub>R</sub> (μA) | Agency Approval  |
|-------------------|------------------|--------------------------------------------------|--------------------------------------------------------|--------|----------------------------------|---------------------------------------------------------------|------------------------------------------------|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
|                   |                  |                                                  | Min.                                                   | Max.   |                                  |                                                               |                                                |                                                              |                                                                                                     |
| P4KE6.8A          | P4KE6.8CA        | 5.80                                             | 6.45                                                   | 7.14   | 10                               | 10.5                                                          | 39.00                                          | 1000                                                         | X                                                                                                   |
| P4KE7.5A          | P4KE7.5CA        | 6.40                                             | 7.13                                                   | 7.88   | 10                               | 11.3                                                          | 36.30                                          | 500                                                          | X                                                                                                   |
| P4KE8.2A          | P4KE8.2CA        | 7.02                                             | 7.79                                                   | 8.61   | 10                               | 12.1                                                          | 33.90                                          | 200                                                          | X                                                                                                   |
| P4KE9.1A          | P4KE9.1CA        | 7.78                                             | 8.65                                                   | 9.55   | 1                                | 13.4                                                          | 30.60                                          | 50                                                           | X                                                                                                   |
| P4KE10A           | P4KE10CA         | 8.55                                             | 9.50                                                   | 10.50  | 1                                | 14.5                                                          | 28.30                                          | 10                                                           | X                                                                                                   |
| P4KE11A           | P4KE11CA         | 9.40                                             | 10.50                                                  | 11.60  | 1                                | 15.6                                                          | 26.30                                          | 5                                                            | X                                                                                                   |
| P4KE12A           | P4KE12CA         | 10.20                                            | 11.40                                                  | 12.60  | 1                                | 16.7                                                          | 24.60                                          | 5                                                            | X                                                                                                   |
| P4KE13A           | P4KE13CA         | 11.10                                            | 12.40                                                  | 13.70  | 1                                | 18.2                                                          | 22.50                                          | 1                                                            | X                                                                                                   |
| P4KE15A           | P4KE15CA         | 12.80                                            | 14.30                                                  | 15.80  | 1                                | 21.2                                                          | 19.30                                          | 1                                                            | X                                                                                                   |
| P4KE16A           | P4KE16CA         | 13.60                                            | 15.20                                                  | 16.80  | 1                                | 22.5                                                          | 18.20                                          | 1                                                            | X                                                                                                   |
| P4KE18A           | P4KE18CA         | 15.30                                            | 17.10                                                  | 18.90  | 1                                | 25.5                                                          | 16.10                                          | 1                                                            | X                                                                                                   |
| P4KE20A           | P4KE20CA         | 17.10                                            | 19.00                                                  | 21.00  | 1                                | 27.7                                                          | 14.80                                          | 1                                                            | X                                                                                                   |
| P4KE22A           | P4KE22CA         | 18.80                                            | 20.90                                                  | 23.10  | 1                                | 30.6                                                          | 13.40                                          | 1                                                            | X                                                                                                   |
| P4KE24A           | P4KE24CA         | 20.50                                            | 22.80                                                  | 25.20  | 1                                | 33.2                                                          | 12.30                                          | 1                                                            | X                                                                                                   |
| P4KE27A           | P4KE27CA         | 23.10                                            | 25.70                                                  | 28.40  | 1                                | 37.5                                                          | 10.90                                          | 1                                                            | X                                                                                                   |
| P4KE30A           | P4KE30CA         | 25.60                                            | 28.50                                                  | 31.50  | 1                                | 41.4                                                          | 9.90                                           | 1                                                            | X                                                                                                   |
| P4KE33A           | P4KE33CA         | 28.20                                            | 31.40                                                  | 34.70  | 1                                | 45.7                                                          | 9.00                                           | 1                                                            | X                                                                                                   |
| P4KE36A           | P4KE36CA         | 30.80                                            | 34.20                                                  | 37.80  | 1                                | 49.9                                                          | 8.20                                           | 1                                                            | X                                                                                                   |
| P4KE39A           | P4KE39CA         | 33.30                                            | 37.10                                                  | 41.00  | 1                                | 53.9                                                          | 7.60                                           | 1                                                            | X                                                                                                   |
| P4KE43A           | P4KE43CA         | 36.80                                            | 40.90                                                  | 45.20  | 1                                | 59.3                                                          | 6.90                                           | 1                                                            | X                                                                                                   |
| P4KE47A           | P4KE47CA         | 40.20                                            | 44.70                                                  | 49.40  | 1                                | 64.8                                                          | 6.30                                           | 1                                                            | X                                                                                                   |
| P4KE51A           | P4KE51CA         | 43.60                                            | 48.50                                                  | 53.60  | 1                                | 70.1                                                          | 5.80                                           | 1                                                            | X                                                                                                   |
| P4KE56A           | P4KE56CA         | 47.80                                            | 53.20                                                  | 58.80  | 1                                | 77.0                                                          | 5.30                                           | 1                                                            | X                                                                                                   |
| P4KE62A           | P4KE62CA         | 53.00                                            | 58.90                                                  | 65.10  | 1                                | 85.0                                                          | 4.80                                           | 1                                                            | X                                                                                                   |
| P4KE68A           | P4KE68CA         | 58.10                                            | 64.60                                                  | 71.40  | 1                                | 92.0                                                          | 4.50                                           | 1                                                            | X                                                                                                   |
| P4KE75A           | P4KE75CA         | 64.10                                            | 71.30                                                  | 78.80  | 1                                | 103.0                                                         | 4.00                                           | 1                                                            | X                                                                                                   |
| P4KE82A           | P4KE82CA         | 70.10                                            | 77.90                                                  | 86.10  | 1                                | 113.0                                                         | 3.60                                           | 1                                                            | X                                                                                                   |
| P4KE91A           | P4KE91CA         | 77.80                                            | 86.50                                                  | 95.50  | 1                                | 125.0                                                         | 3.30                                           | 1                                                            | X                                                                                                   |
| P4KE100A          | P4KE100CA        | 85.50                                            | 95.00                                                  | 105.00 | 1                                | 137.0                                                         | 3.00                                           | 1                                                            | X                                                                                                   |
| P4KE110A          | -                | 94.00                                            | 105.00                                                 | 116.00 | 1                                | 152.0                                                         | 2.70                                           | 1                                                            | X                                                                                                   |
| -                 | P4KE110CA*       | 94.00                                            | 105.00                                                 | 116.00 | 1                                | 152.0                                                         | 4.00                                           | 1                                                            | X                                                                                                   |
| P4KE120A          | -                | 102.00                                           | 114.00                                                 | 126.00 | 1                                | 165.0                                                         | 2.50                                           | 1                                                            | X                                                                                                   |
| -                 | P4KE120CA*       | 102.00                                           | 114.00                                                 | 126.00 | 1                                | 165.0                                                         | 3.70                                           | 1                                                            | X                                                                                                   |
| P4KE130A          | -                | 111.00                                           | 124.00                                                 | 137.00 | 1                                | 179.0                                                         | 2.30                                           | 1                                                            | X                                                                                                   |
| -                 | P4KE130CA*       | 111.00                                           | 124.00                                                 | 137.00 | 1                                | 179.0                                                         | 3.40                                           | 1                                                            | X                                                                                                   |
| P4KE150A          | -                | 128.00                                           | 143.00                                                 | 158.00 | 1                                | 207.0                                                         | 2.00                                           | 1                                                            | X                                                                                                   |
| -                 | P4KE150CA*       | 128.00                                           | 143.00                                                 | 158.00 | 1                                | 207.0                                                         | 2.90                                           | 1                                                            | X                                                                                                   |
| P4KE160A          | -                | 136.00                                           | 152.00                                                 | 168.00 | 1                                | 219.0                                                         | 1.90                                           | 1                                                            | X                                                                                                   |
| -                 | P4KE160CA*       | 136.00                                           | 152.00                                                 | 168.00 | 1                                | 219.0                                                         | 2.80                                           | 1                                                            | X                                                                                                   |
| P4KE170A          | -                | 145.00                                           | 162.00                                                 | 179.00 | 1                                | 234.0                                                         | 1.80                                           | 1                                                            | X                                                                                                   |
| -                 | P4KE170CA*       | 145.00                                           | 162.00                                                 | 179.00 | 1                                | 234.0                                                         | 2.60                                           | 1                                                            | X                                                                                                   |
| P4KE180A          | -                | 154.00                                           | 171.00                                                 | 189.00 | 1                                | 246.0                                                         | 1.70                                           | 1                                                            | X                                                                                                   |
| -                 | P4KE180CA*       | 154.00                                           | 171.00                                                 | 189.00 | 1                                | 246.0                                                         | 2.50                                           | 1                                                            | X                                                                                                   |
| P4KE200A          | -                | 171.00                                           | 190.00                                                 | 210.00 | 1                                | 274.0                                                         | 1.50                                           | 1                                                            | X                                                                                                   |
| -                 | P4KE200CA*       | 171.00                                           | 190.00                                                 | 210.00 | 1                                | 274.0                                                         | 2.20                                           | 1                                                            | X                                                                                                   |
| P4KE220A          | -                | 185.00                                           | 209.00                                                 | 231.00 | 1                                | 328.0                                                         | 1.30                                           | 1                                                            | -                                                                                                   |
| -                 | P4KE220CA*       | 185.00                                           | 209.00                                                 | 231.00 | 1                                | 328.0                                                         | 1.90                                           | 1                                                            | -                                                                                                   |
| P4KE250A          | -                | 214.00                                           | 237.00                                                 | 263.00 | 1                                | 344.0                                                         | 1.20                                           | 1                                                            | -                                                                                                   |
| -                 | P4KE250CA*       | 214.00                                           | 237.00                                                 | 263.00 | 1                                | 344.0                                                         | 1.80                                           | 1                                                            | -                                                                                                   |
| P4KE300A          | -                | 256.00                                           | 285.00                                                 | 315.00 | 1                                | 414.0                                                         | 1.00                                           | 1                                                            | -                                                                                                   |
| -                 | P4KE300CA*       | 256.00                                           | 285.00                                                 | 315.00 | 1                                | 414.0                                                         | 1.50                                           | 1                                                            | -                                                                                                   |
| P4KE350A*         | P4KE350CA*       | 300.00                                           | 332.00                                                 | 368.00 | 1                                | 482.0                                                         | 1.30                                           | 1                                                            | -                                                                                                   |
| P4KE400A*         | P4KE400CA*       | 342.00                                           | 380.00                                                 | 420.00 | 1                                | 548.0                                                         | 1.10                                           | 1                                                            | -                                                                                                   |
| P4KE440A*         | P4KE440CA*       | 376.00                                           | 418.00                                                 | 462.00 | 1                                | 602.0                                                         | 1.00                                           | 1                                                            | -                                                                                                   |
| P4KE480A*         | P4KE480CA*       | 408.00                                           | 456.00                                                 | 504.00 | 1                                | 658.0                                                         | 0.92                                           | 1                                                            | -                                                                                                   |
| P4KE510A*         | P4KE510CA*       | 434.00                                           | 485.00                                                 | 535.00 | 1                                | 698.0                                                         | 0.86                                           | 1                                                            | -                                                                                                   |
| P4KE530A*         | P4KE530CA*       | 451.00                                           | 503.50                                                 | 556.50 | 1                                | 725.0                                                         | 0.83                                           | 1                                                            | -                                                                                                   |
| P4KE540A*         | P4KE540CA*       | 460.00                                           | 513.00                                                 | 567.00 | 1                                | 740.0                                                         | 0.82                                           | 1                                                            | -                                                                                                   |
| P4KE550A*         | P4KE550CA*       | 468.00                                           | 522.50                                                 | 577.50 | 1                                | 760.0                                                         | 0.79                                           | 1                                                            | -                                                                                                   |

For bidirectional type having V<sub>R</sub> of 10 volts and less, the I<sub>R</sub> value 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

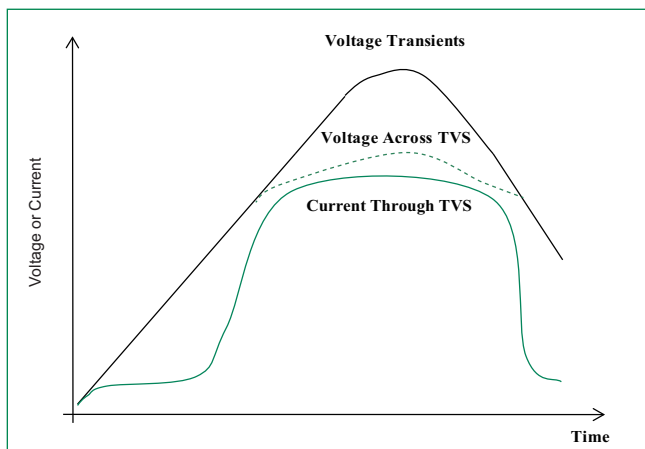
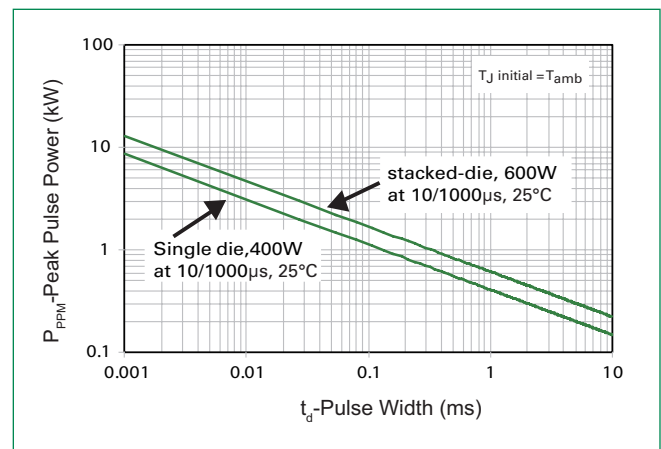
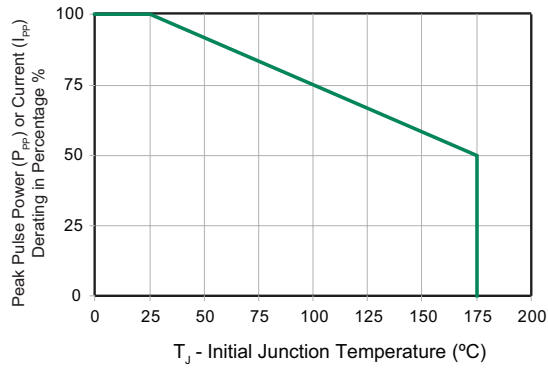


Figure 2 - Peak Pulse Power Rating Curve

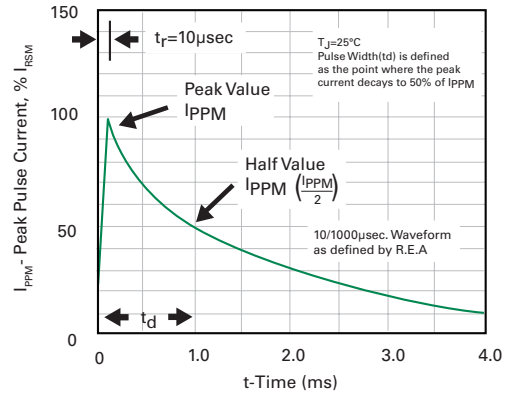


**Ratings and Characteristic Curves** ( $T_A=25^\circ\text{C}$  unless otherwise noted) (Continued)

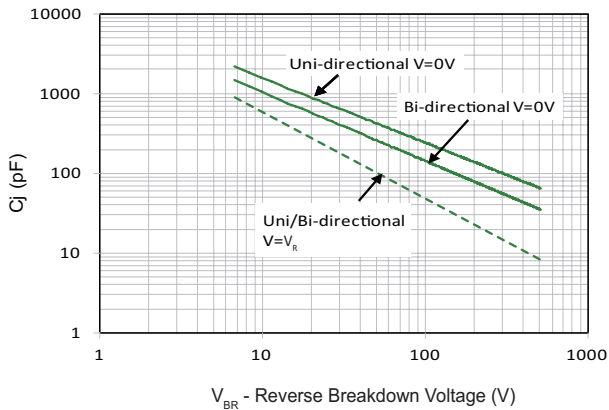
**Figure 3 - Peak Pulse Power Derating Curve**



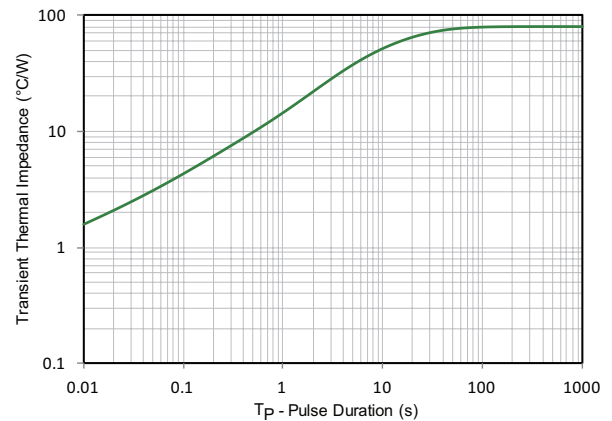
**Figure 4 - Pulse Waveform**



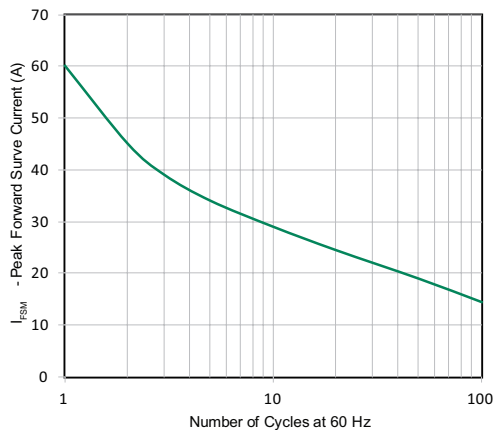
**Figure 5 - Typical Junction Capacitance**



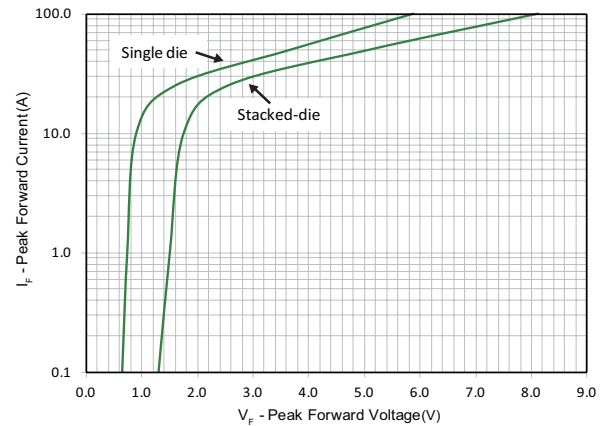
**Figure 6 - Typical Transient Thermal Impedance**



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

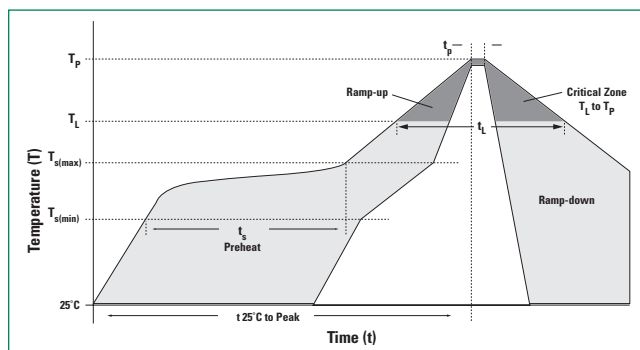


**Figure 8 - Peak Forward Voltage Drop vs Peak Forward Current (Typical Values)**



### 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) ( $t_s$ )      | 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> | 260°C     |
| <b>Dipping Time :</b>     | 5 seconds |
| <b>Soldering :</b>        | 1 time    |

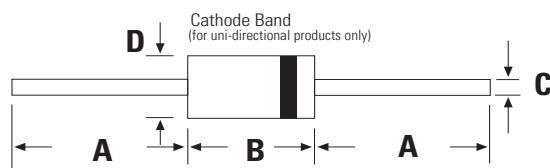
### Physical Specifications

|                 |                                                                      |
|-----------------|----------------------------------------------------------------------|
| <b>Weight</b>   | 0.012oz., 0.3g                                                       |
| <b>Case</b>     | JEDEC DO-204AL (DO-41) molded plastic body over passivated junction. |
| <b>Polarity</b> | Colored band indicates unidirectional component's cathode end        |
| <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 |

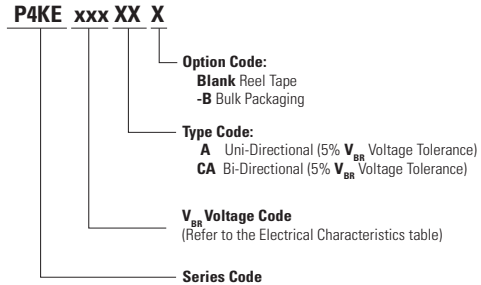
### Dimensions



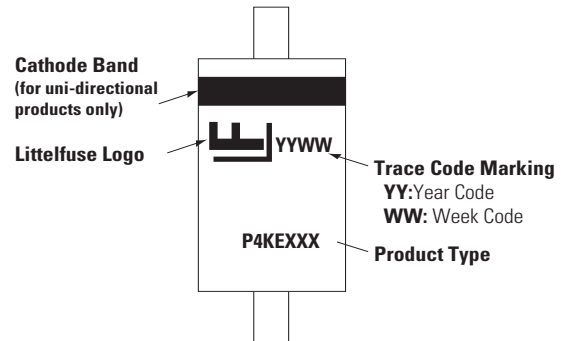
DO-204AL (DO-41)

| Dimensions | Inches |       | Millimeters |      |
|------------|--------|-------|-------------|------|
|            | Min    | Max   | Min         | Max  |
| A          | 1.000  | -     | 25.40       | -    |
| B          | 0.160  | 0.205 | 4.10        | 5.20 |
| C          | 0.028  | 0.034 | 0.71        | 0.86 |
| D          | 0.080  | 0.107 | 2.00        | 2.70 |

### Part Numbering System



### Part Marking System



### Packaging

| Part Number | Component Package | Quantity | Packaging Option | Packaging Specification |
|-------------|-------------------|----------|------------------|-------------------------|
| P4KExxxXX   | DO-204AL          | 5000     | Tape & Reel      | EIA STD RS-296          |
| P4KExxxXX-B | DO-204AL          | 500      | BOX              | Littelfuse Spec.        |

### Tape and Reel Specification

