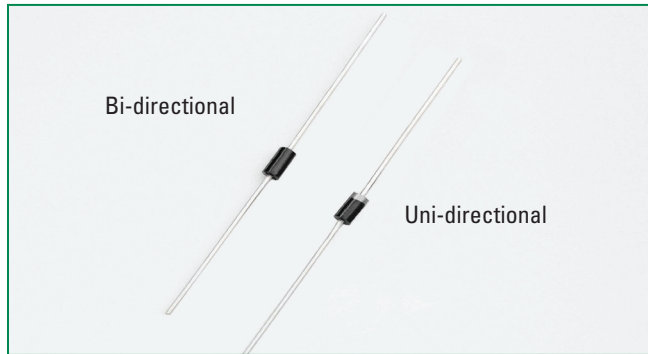


## P4KE Series



### Agency Approvals

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

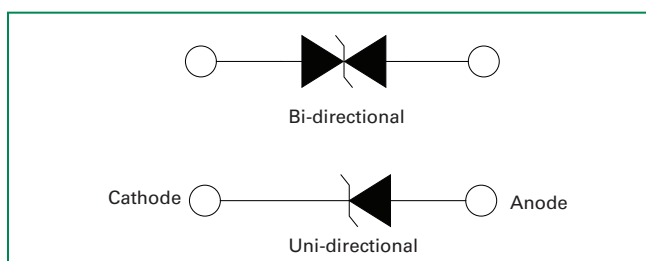
### Maximum Ratings and Thermal Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| Parameter                                                                             | Symbol                            | Value      | Unit |
|---------------------------------------------------------------------------------------|-----------------------------------|------------|------|
| Peak Pulse Power Dissipation by 10/1000µs Test Waveform (Fig.2) (Note 1)              | P <sub>PPM</sub>                  | 400        | W    |
| Steady State Power Dissipation on Infinite Heat Sink at T <sub>L</sub> =75°C (Fig. 6) | 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>                  | 40         | 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>uJL</sub>                  | 60         | °C/W |
| Typical Thermal Resistance Junction to Ambient                                        | R <sub>uJA</sub>                  | 100        | °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.
3. V<sub>F</sub><3.5V for devices of V<sub>BR</sub> ≤ 200V and V<sub>F</sub><5.0V for devices of V<sub>BR</sub> ≥ 201V.

### Functional Diagram



### Description

The P4KE Series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

### Features

- V<sub>BR</sub> @T<sub>J</sub> = V<sub>BR</sub>@25°C × (1 + α × (T<sub>J</sub> - 25))  
(α: Temperature Coefficient)
- Glass passivated chip junction in DO-41 Package
- 400W peak pulse capability at 10/1000µs waveform, repetition rate (duty cycles): 0.01 %
- Fast response time: typically less than 1.0ps from 0 Volts to BV min
- Excellent clamping capability
- Typical failure mode is short from over-specified voltage or current
- Whisker test is conducted based on JEDEC JESD201A per its table 4a and 4c
- IEC-61000-4-2 ESD 15kV(Air), 8kV (Contact)
- ESD protection of data lines in accordance with IEC 61000-4-2 (IEC801-2)
- EFT protection of data lines in accordance with IEC 61000-4-4 (IEC801-4)
- Low incremental surge resistance
- Typical I<sub>R</sub> less than 1µA above 13V
- High temperature soldering guaranteed: 260°C/40 seconds / 0.375"(9.5mm) lead length, 5 lbs., (2.3kg) tension
- Plastic package has underwriters laboratory flammability classification 94V-O
- Matte tin lead-free plated
- Halogen free and RoHS compliant
- 2nd level interconnect is Pb-free per IPC/JEDEC J-STD-609A.01

### Applications

TVS devices are ideal for the protection of I/O interfaces, V<sub>CC</sub> bus and other vulnerable circuits used in telecom, computer, industrial and consumer electronic applications.

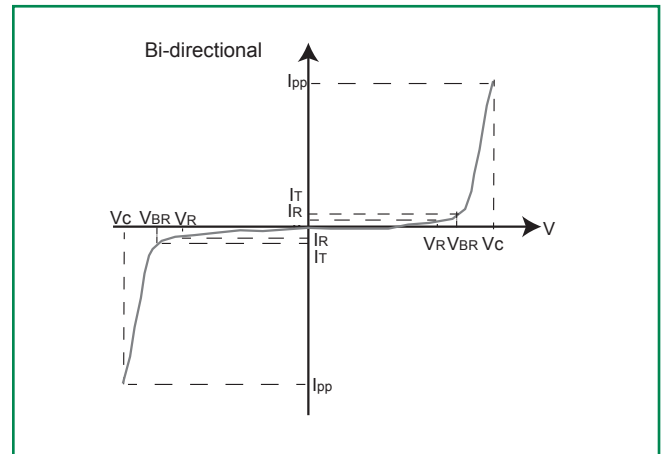
### Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| 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          | P4KE110CA        | 94.00                                            | 105.00                                                 | 116.00 | 1                                | 152.0                                                         | 2.70                                           | 1                                                            | X                                                                                                   |
| P4KE120A          | P4KE120CA        | 102.00                                           | 114.00                                                 | 126.00 | 1                                | 165.0                                                         | 2.50                                           | 1                                                            | X                                                                                                   |
| P4KE130A          | P4KE130CA        | 111.00                                           | 124.00                                                 | 137.00 | 1                                | 179.0                                                         | 2.30                                           | 1                                                            | X                                                                                                   |
| P4KE150A          | P4KE150CA        | 128.00                                           | 143.00                                                 | 158.00 | 1                                | 207.0                                                         | 2.00                                           | 1                                                            | X                                                                                                   |
| P4KE160A          | P4KE160CA        | 136.00                                           | 152.00                                                 | 168.00 | 1                                | 219.0                                                         | 1.90                                           | 1                                                            | X                                                                                                   |
| P4KE170A          | P4KE170CA        | 145.00                                           | 162.00                                                 | 179.00 | 1                                | 234.0                                                         | 1.80                                           | 1                                                            | X                                                                                                   |
| P4KE180A          | P4KE180CA        | 154.00                                           | 171.00                                                 | 189.00 | 1                                | 246.0                                                         | 1.70                                           | 1                                                            | X                                                                                                   |
| P4KE200A          | P4KE200CA        | 171.00                                           | 190.00                                                 | 210.00 | 1                                | 274.0                                                         | 1.50                                           | 1                                                            | X                                                                                                   |
| P4KE220A          | P4KE220CA        | 185.00                                           | 209.00                                                 | 231.00 | 1                                | 328.0                                                         | 1.30                                           | 1                                                            |                                                                                                     |
| P4KE250A          | P4KE250CA        | 214.00                                           | 237.00                                                 | 263.00 | 1                                | 344.0                                                         | 1.20                                           | 1                                                            |                                                                                                     |
| P4KE300A          | P4KE300CA        | 256.00                                           | 285.00                                                 | 315.00 | 1                                | 414.0                                                         | 1.00                                           | 1                                                            |                                                                                                     |
| P4KE350A          | P4KE350CA        | 300.00                                           | 332.00                                                 | 368.00 | 1                                | 482.0                                                         | 0.85                                           | 1                                                            |                                                                                                     |
| P4KE400A          | P4KE400CA        | 342.00                                           | 380.00                                                 | 420.00 | 1                                | 548.0                                                         | 0.75                                           | 1                                                            |                                                                                                     |
| P4KE440A          | P4KE440CA        | 376.00                                           | 418.00                                                 | 462.00 | 1                                | 602.0                                                         | 0.68                                           | 1                                                            |                                                                                                     |
| P4KE480A          | P4KE480CA        | 408.00                                           | 456.00                                                 | 504.00 | 1                                | 658.0                                                         | 0.61                                           | 1                                                            |                                                                                                     |
| P4KE510A          | P4KE510CA        | 434.00                                           | 485.00                                                 | 535.00 | 1                                | 698.0                                                         | 0.57                                           | 1                                                            |                                                                                                     |
| P4KE530A          | P4KE530CA        | 451.00                                           | 503.50                                                 | 556.50 | 1                                | 725.0                                                         | 0.55                                           | 1                                                            |                                                                                                     |
| P4KE540A          | P4KE540CA        | 460.00                                           | 513.00                                                 | 567.00 | 1                                | 740.0                                                         | 0.54                                           | 1                                                            |                                                                                                     |
| P4KE550A          | P4KE550CA        | 468.00                                           | 522.50                                                 | 577.50 | 1                                | 760.0                                                         | 0.52                                           | 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

## 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 ( $I_T$ )

**$V_C$  Clamping Voltage** – Peak voltage measured across the suppressor at a specified  $I_{ppm}$  (peak impulse current)

**$I_R$  Reverse Leakage Current** – Current measured at  $V_R$

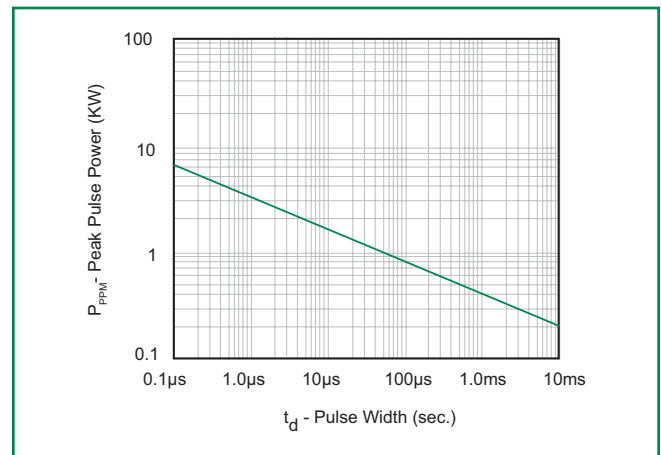
**$V_F$  Forward Voltage Drop for Uni-directional**

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

**Figure 1 - TVS Transients Clamping Waveform**



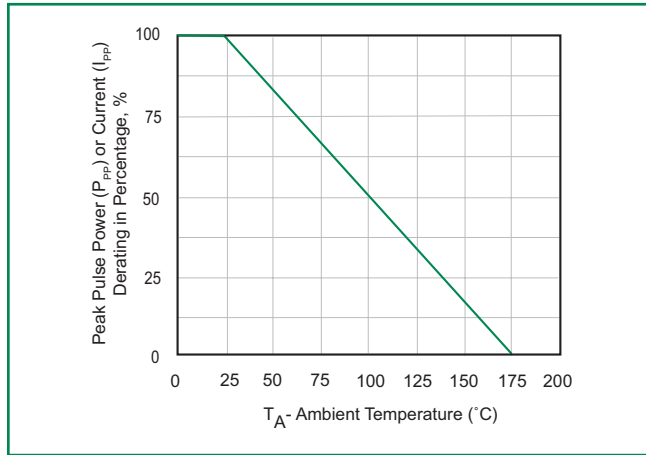
**Figure 2 - Peak Pulse Power Rating**



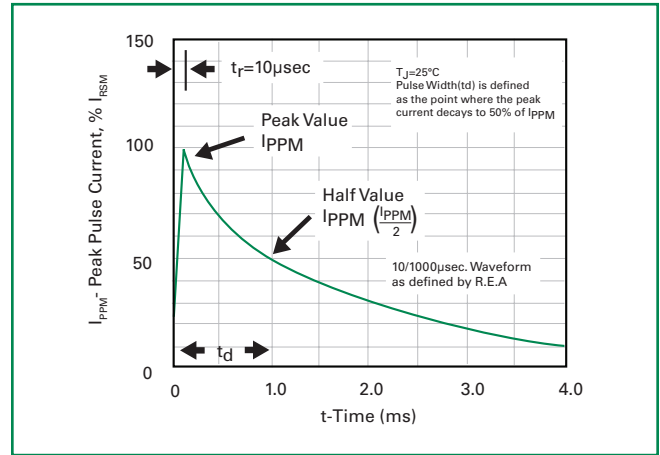
continues on next page.

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

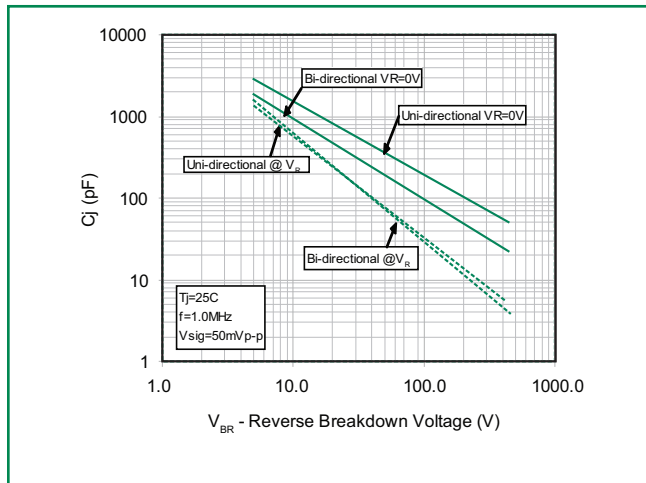
**Figure 3 - Pulse Derating Curve**



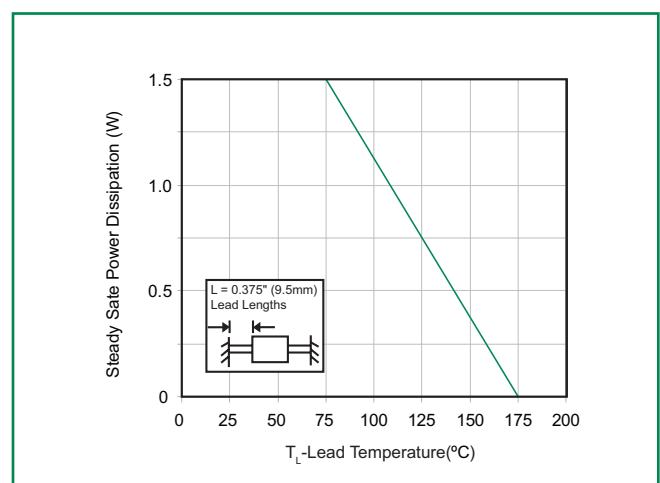
**Figure 4 - Pulse Waveform**



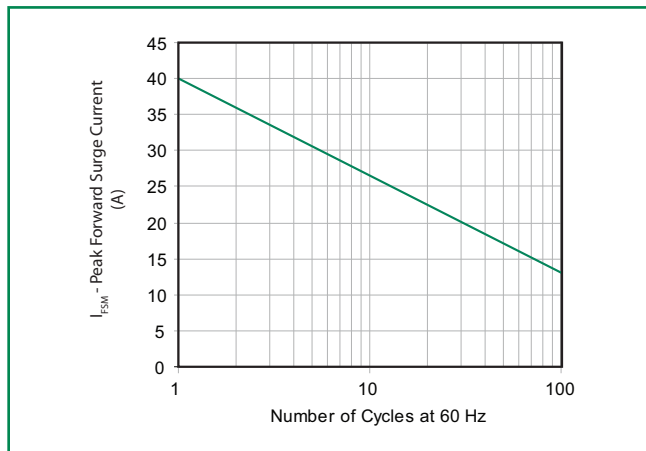
**Figure 5 - Typical Junction Capacitance Uni-Directional**



**Figure 6 - Steady Pulse Derating Curve**



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



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

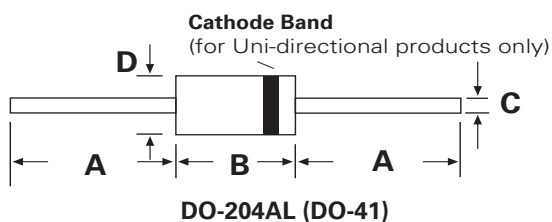
## Physical Specifications

|                 |                                                                      |
|-----------------|----------------------------------------------------------------------|
| <b>Weight</b>   | 0.012oz., 0.3g                                                       |
| <b>Case</b>     | JEDEC DO-204AL (DO-41) molded plastic body over passivated junction. |
| <b>Polarity</b> | Color band denotes the cathode except Bipolar.                       |
| <b>Terminal</b> | Matte Tin axial leads, solderable per JESD22-B102.                   |

## Environmental Specifications

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

## Dimensions



| Dimensions | Inches |       | Millimeters |      |
|------------|--------|-------|-------------|------|
|            | Min    | Max   | Min         | Max  |
| A          | 1.000  | -     | 25.40       | -    |
| B          | 0.160  | 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

**P4KE xxx XXX**

**OPTION CODE:**

**BLANK** Reel Tape

**-B** Bulk Packaging

**TYPE CODE:**

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

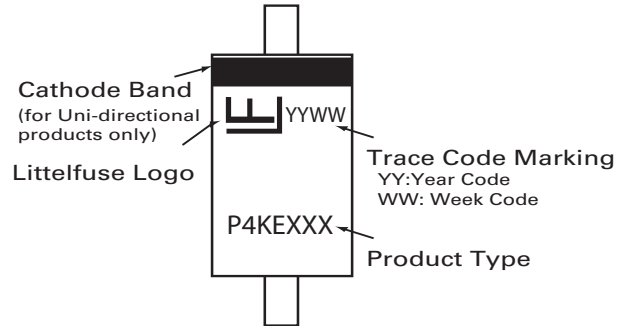
**CA** Bi-Directional (5%  $V_{BR}$  Voltage Tolerance)

**$V_{BR}$  VOLTAGE CODE**

(Refer to the Electrical Characteristics table)

**SERIES CODE**

### 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

