



# THE DATASHEET OF P4SMA7.5CA



**P4SMA 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 at T <sub>A</sub> =25°C by 10/1000us Waveform(Fig.2)(Note 1), (Note 2) Single Die Parts          | P <sub>PPM</sub> | 400        | W    |
| Peak Pulse Power Dissipation at T <sub>A</sub> =25°C by 10/1000us Waveform(Fig.2)(Note 1), (Note 2) Stacked Die Parts(Note 5) | P <sub>PPM</sub> | 600        | W    |
| Power Dissipation on Infinite Heat Sink at T <sub>L</sub> =50°C   | P <sub>D</sub>   | 3.3        | W    |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3)  | I <sub>FSM</sub> | 60         | A    |
| Maximum Instantaneous Forward Voltage at 25A for Unidirectional Only (Note 4)   | V <sub>F</sub>   | 3.5/5.0    | V    |
| Operating Temperature Range   | T <sub>J</sub>   | -65 to 150 | °C   |
| Storage Temperature Range   | T <sub>STG</sub> | -65 to 175 | °C   |
| Typical Thermal Resistance Junction to Lead   | R <sub>θJL</sub> | 30         | °C/W |
| Typical Thermal Resistance Junction to Ambient  | R <sub>θJA</sub> | 120        | °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. Mounted on 5.0x5.0mm copper pad to each terminal.
  3. Measured on 8.3ms single half sine wave or equivalent square wave for unidirectional device only.
  4. V<sub>F</sub> < 3.5V for single die parts and V<sub>F</sub> < 5.0V for stacked-die parts.
  5. For stacked die component details, please refer to part numbers labeled by \* in Electrical Characteristics.

**Functional Diagram**



**Description**

The P4SMA series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

**Features**

- 400W peak pulse power capability at 10/1000µs waveform, repetition rate (duty cycles):0.01%
- Excellent clamping capability
- Low incremental surge resistance
- Typical I<sub>R</sub> less than 1µA when V<sub>BR</sub> min>12V
- Optimized surface mount footprint for minimal PCB space impact
- Low profile package
- Typical failure mode due to exceeding maximum ratings is a short circuit condition
- 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
- Built-in strain relief
- Fast response time: typically less than 1.0ps from 0V to BV min
- High temperature to reflow soldering guaranteed: 260°C/40sec
- V<sub>BR</sub> @ T<sub>J</sub> = V<sub>BR</sub> @25°C x (1 + α T × (T<sub>J</sub> - 25)) (α T: Temperature Coefficient, typical value is 0.1%)
- UL Recognized epoxy meeting flammability classification V-0
- Meet MSL level1, per J-STD-020, LF maximum peak of 260°C
- 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 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.

**Additional Information**

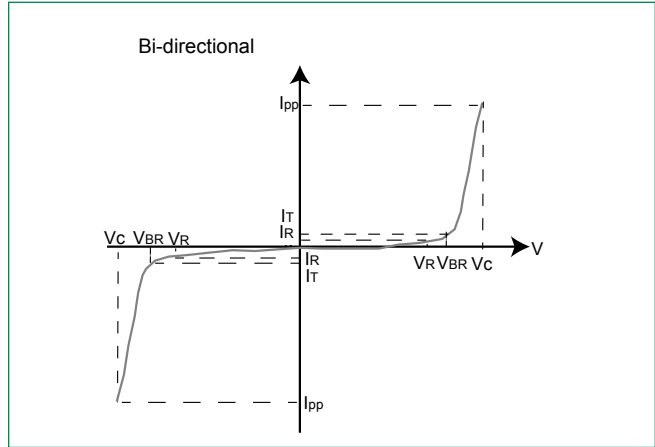
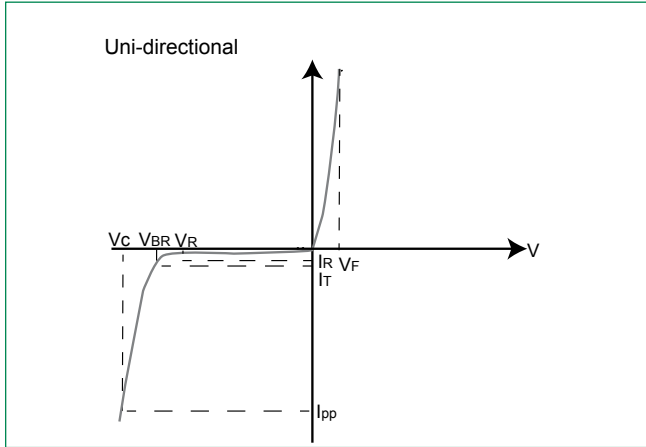


### Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| Part Number (Uni) | Part Number (Bi) | Marking   |            | 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) | Maximum Temperature Coefficient of V <sub>BR</sub> (%/°C) | Agency Approval  |
|-------------------|------------------|-----------|------------|--|--|--------|----------------------------------|---|--|--|---|---|
|                   |                  | Uni       | Bi         |  | Min  | Max    |                                  |   |  |  |   |   |
|                   |                  | P4SMA6.8A | P4SMA6.8CA |  | 6V8A   | 6V8C   |                                  |   |  |  |   |   |
| P4SMA7.5A         | P4SMA7.5CA       | 7V5A      | 7V5C       | 6.40   | 7.13   | 7.88   | 10                               | 11.3  | 36.3   | 500  | 0.052   | X   |
| P4SMA8.2A         | P4SMA8.2CA       | 8V2A      | 8V2C       | 7.02   | 7.79   | 8.61   | 10                               | 12.1  | 33.9   | 200  | 0.058   | X   |
| P4SMA9.1A         | P4SMA9.1CA       | 9V1A      | 9V1C       | 7.78   | 8.65   | 9.55   | 1                                | 13.4  | 30.6   | 50   | 0.063   | X   |
| P4SMA10A          | P4SMA10CA        | 10A       | 10C        | 8.55   | 9.50   | 10.50  | 1                                | 14.5  | 28.3   | 10   | 0.066   | X   |
| P4SMA11A          | P4SMA11CA        | 11A       | 11C        | 9.40   | 10.50  | 11.60  | 1                                | 15.6  | 26.3   | 5  | 0.069   | X   |
| P4SMA12A          | P4SMA12CA        | 12A       | 12C        | 10.20  | 11.40  | 12.60  | 1                                | 16.7  | 24.6   | 5  | 0.071   | X   |
| P4SMA13A          | P4SMA13CA        | 13A       | 13C        | 11.10  | 12.40  | 13.70  | 1                                | 18.2  | 22.5   | 1  | 0.074   | X   |
| P4SMA15A          | P4SMA15CA        | 15A       | 15C        | 12.80  | 14.30  | 15.80  | 1                                | 21.2  | 19.3   | 1  | 0.076   | X   |
| P4SMA16A          | P4SMA16CA        | 16A       | 16C        | 13.60  | 15.20  | 16.80  | 1                                | 22.5  | 18.2   | 1  | 0.080   | X   |
| P4SMA18A          | P4SMA18CA        | 18A       | 18C        | 15.30  | 17.10  | 18.90  | 1                                | 25.5  | 16.1   | 1  | 0.083   | X   |
| P4SMA20A          | P4SMA20CA        | 20A       | 20C        | 17.10  | 19.00  | 21.00  | 1                                | 27.7  | 14.8   | 1  | 0.085   | X   |
| P4SMA22A          | P4SMA22CA        | 22A       | 22C        | 18.80  | 20.90  | 23.10  | 1                                | 30.6  | 13.4   | 1  | 0.088   | X   |
| P4SMA24A          | P4SMA24CA        | 24A       | 24C        | 20.50  | 22.80  | 25.20  | 1                                | 33.2  | 12.3   | 1  | 0.091   | X   |
| P4SMA27A          | P4SMA27CA        | 27A       | 27C        | 23.10  | 25.70  | 28.40  | 1                                | 37.5  | 10.9   | 1  | 0.092   | X   |
| P4SMA30A          | P4SMA30CA        | 30A       | 30C        | 25.60  | 28.50  | 31.50  | 1                                | 41.4  | 9.9  | 1  | 0.093   | X   |
| P4SMA33A          | P4SMA33CA        | 33A       | 33C        | 28.20  | 31.40  | 34.70  | 1                                | 45.7  | 9.0  | 1  | 0.094   | X   |
| P4SMA36A          | P4SMA36CA        | 36A       | 36C        | 30.80  | 34.20  | 37.80  | 1                                | 49.9  | 8.2  | 1  | 0.096   | X   |
| P4SMA39A          | P4SMA39CA        | 39A       | 39C        | 33.30  | 37.10  | 41.00  | 1                                | 53.9  | 7.6  | 1  | 0.097   | X   |
| P4SMA43A          | P4SMA43CA        | 43A       | 43C        | 36.80  | 40.90  | 45.20  | 1                                | 59.3  | 6.9  | 1  | 0.098   | X   |
| P4SMA47A          | P4SMA47CA        | 47A       | 47C        | 40.20  | 44.70  | 49.40  | 1                                | 64.8  | 6.3  | 1  | 0.099   | X   |
| P4SMA51A          | P4SMA51CA        | 51A       | 51C        | 43.60  | 48.50  | 53.60  | 1                                | 70.1  | 5.8  | 1  | 0.100   | X   |
| P4SMA56A          | P4SMA56CA        | 56A       | 56C        | 47.80  | 53.20  | 58.80  | 1                                | 77.0  | 5.3  | 1  | 0.101   | X   |
| P4SMA62A          | P4SMA62CA        | 62A       | 62C        | 53.00  | 58.90  | 65.10  | 1                                | 85.0  | 4.8  | 1  | 0.102   | X   |
| P4SMA68A          | P4SMA68CA        | 68A       | 68C        | 58.10  | 64.60  | 71.40  | 1                                | 92.0  | 4.5  | 1  | 0.103   | X   |
| P4SMA75A          | P4SMA75CA        | 75A       | 75C        | 64.10  | 71.30  | 78.80  | 1                                | 103.0   | 4.0  | 1  | 0.104   | X   |
| P4SMA82A          | P4SMA82CA        | 82A       | 82C        | 70.10  | 77.90  | 86.10  | 1                                | 113.0   | 3.6  | 1  | 0.105   | X   |
| P4SMA91A          | P4SMA91CA        | 91A       | 91C        | 77.80  | 86.50  | 95.50  | 1                                | 125.0   | 3.3  | 1  | 0.106   | X   |
| P4SMA100A         | P4SMA100CA       | 100A      | 100C       | 85.50  | 95.00  | 105.00 | 1                                | 137.0   | 3.0  | 1  | 0.106   | X   |
| P4SMA110A         | P4SMA110CA       | 110A      | 110C       | 94.00  | 105.00   | 116.00 | 1                                | 152.0   | 2.7  | 1  | 0.107   | X   |
| P4SMA120A         | P4SMA120CA       | 120A      | 120C       | 102.00   | 114.00   | 126.00 | 1                                | 165.0   | 2.5  | 1  | 0.107   | X   |
| P4SMA130A         | P4SMA130CA       | 130A      | 130C       | 111.00   | 124.00   | 137.00 | 1                                | 179.0   | 2.3  | 1  | 0.107   | X   |
| P4SMA150A         | P4SMA150CA       | 150A      | 150C       | 128.00   | 143.00   | 158.00 | 1                                | 207.0   | 2.0  | 1  | 0.108   | X   |
| P4SMA160A         | P4SMA160CA       | 160A      | 160C       | 136.00   | 152.00   | 168.00 | 1                                | 219.0   | 1.9  | 1  | 0.108   | X   |
| P4SMA170A         | P4SMA170CA       | 170A      | 170C       | 145.00   | 162.00   | 179.00 | 1                                | 234.0   | 1.8  | 1  | 0.108   | X   |
| P4SMA180A         | P4SMA180CA       | 180A      | 180C       | 154.00   | 171.00   | 189.00 | 1                                | 246.0   | 1.7  | 1  | 0.108   | X   |
| P4SMA200A         | P4SMA200CA       | 200A      | 200C       | 171.00   | 190.00   | 210.00 | 1                                | 274.0   | 1.5  | 1  | 0.108   | X   |
| P4SMA220A         | P4SMA220CA       | 220A      | 220C       | 185.00   | 209.00   | 231.00 | 1                                | 328.0   | 1.3  | 1  | 0.110   | -   |
| P4SMA250A         | -                | 250A      | -          | 214.00   | 237.00   | 263.00 | 1                                | 344.0   | 1.2  | 1  | 0.110   | -   |
| -                 | P4SMA250CA*      | -         | 250C       | 214.00   | 237.00   | 263.00 | 1                                | 344.0   | 1.8  | 1  | 0.110   | -   |
| P4SMA300A         | -                | 300A      | -          | 256.00   | 285.00   | 315.00 | 1                                | 414.0   | 1.0  | 1  | 0.110   | -   |
| -                 | P4SMA300CA*      | -         | 300C       | 256.00   | 285.00   | 315.00 | 1                                | 414.0   | 1.5  | 1  | 0.110   | -   |
| P4SMA350A*        | P4SMA350CA*      | 350A      | 350C       | 300.00   | 332.00   | 368.00 | 1                                | 482.0   | 1.3  | 1  | 0.112   | -   |
| P4SMA400A*        | P4SMA400CA*      | 400A      | 400C       | 342.00   | 380.00   | 420.00 | 1                                | 548.0   | 1.1  | 1  | 0.112   | -   |
| P4SMA440A*        | P4SMA440CA*      | 440A      | 440C       | 376.00   | 418.00   | 462.00 | 1                                | 602.0   | 1.0  | 1  | 0.112   | -   |
| P4SMA480A*        | P4SMA480CA*      | 480A      | 480C       | 408.00   | 456.00   | 504.00 | 1                                | 658.0   | 1.0  | 1  | 0.112   | -   |
| P4SMA510A*        | P4SMA510CA*      | 510A      | 510C       | 434.00   | 485.00   | 535.00 | 1                                | 698.0   | 0.9  | 1  | 0.112   | -   |
| P4SMA530A*        | P4SMA530CA*      | 530A      | 530C       | 451.00   | 503.50   | 556.50 | 1                                | 725.0   | 0.9  | 1  | 0.112   | -   |
| P4SMA540A*        | P4SMA540CA*      | 540A      | 540C       | 460.00   | 513.00   | 567.00 | 1                                | 740.0   | 0.9  | 1  | 0.112   | -   |
| P4SMA550A*        | P4SMA550CA*      | 550A      | 550C       | 468.00   | 522.50   | 577.50 | 1                                | 760.0   | 0.8  | 1  | 0.112   | -   |

For bidirectional type having V<sub>C</sub> of 10 volts and less, the I<sub>R</sub> limit is double.  
 V<sub>PP</sub> @ T<sub>J</sub> = V<sub>PP</sub> @ 25°C x (1 + αT x (T<sub>J</sub> - 25)) (αT: Temperature Coefficient)  
 For stack-die parts, use \* to label the part number.

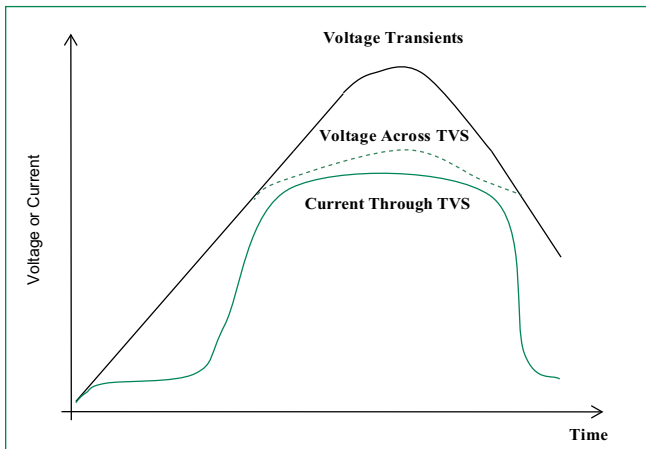
**I-V Curve Characteristics**



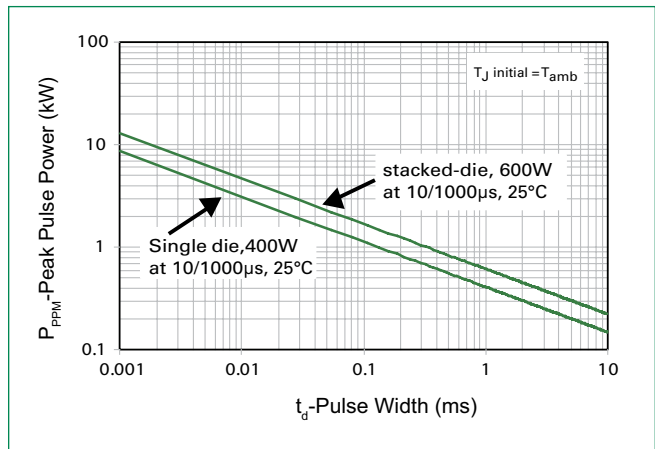
- $P_{PPM}$  Peak Pulse Power Dissipation** – Max power dissipation
- $V_R$  Stand-off Voltage** – Maximum voltage that can be applied to the TVS without operation
- $V_{BR}$  Breakdown Voltage** – Maximum voltage that flows though the TVS at a specified test current ( $I_T$ )
- $V_C$  Clamping Voltage** – 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**

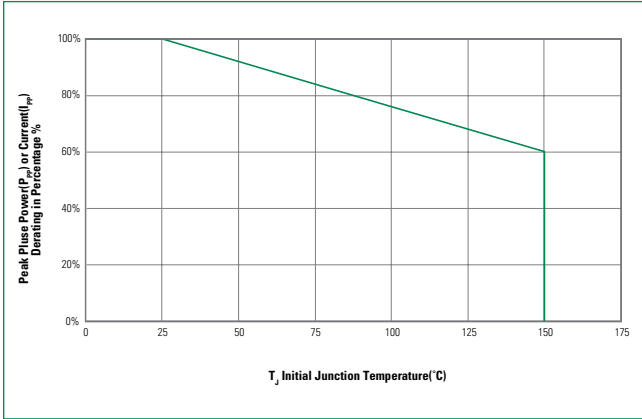


**Figure 2 - Peak Pulse Power Rating Curve**



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

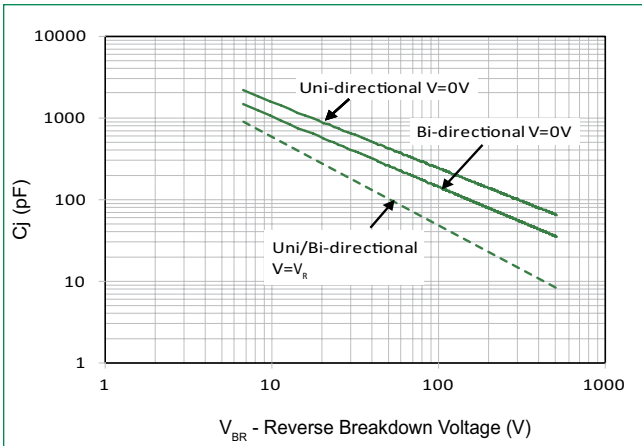
**Figure 3 - Peak Pulse Power Derating Curve**



**Figure 4 - Pulse Waveform**



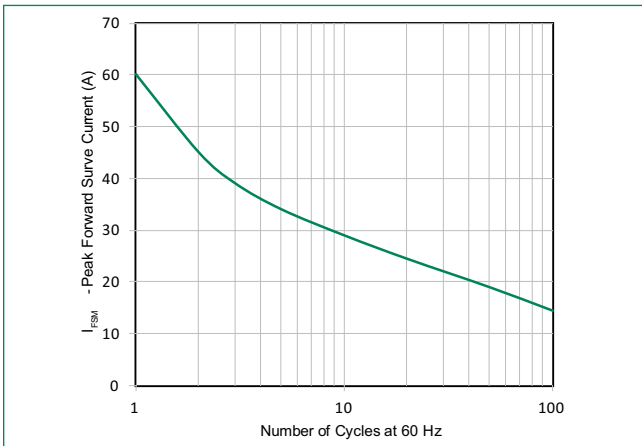
**Figure 5 - Typical Junction Capacitance**



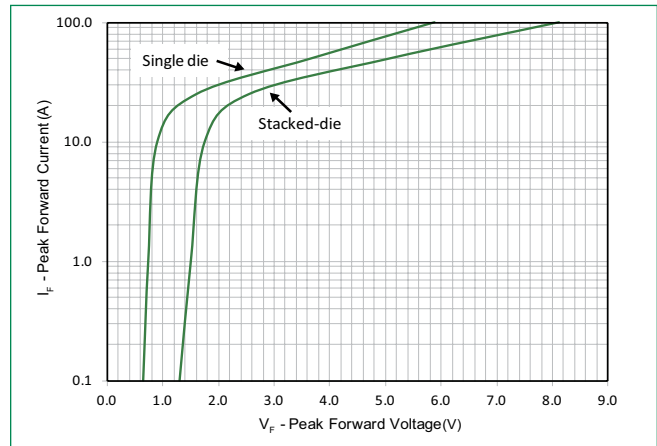
**Figure 6 - Typical Transient Thermal Impedance**



**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                   |



**Physical Specifications**

|                 |  |
|-----------------|--|
| <b>Weight</b>   | 0.002 ounce, 0.061 gram  |
| <b>Case</b>     | JEDEC DO-214AC. Molded plastic body over glass passivated junction |
| <b>Polarity</b> | Color band denotes positive end (cathode) except bidirectional     |
| <b>Terminal</b> | Matte Tin-plated 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>MSL</b>                 | JEDEC-J-STD-020, Level 1 |
| <b>H3TRB</b>               | JESD22-A101              |
| <b>RSH</b>                 | JESD22-A111              |

**Dimensions**



| Dimensions | Inches |       | Millimeters |       |
|------------|--------|-------|-------------|-------|
|            | Min    | Max   | Min         | Max   |
| <b>A</b>   | 0.049  | 0.065 | 1.250       | 1.650 |
| <b>B</b>   | 0.157  | 0.181 | 3.990       | 4.600 |
| <b>C</b>   | 0.095  | 0.110 | 2.400       | 2.790 |
| <b>D</b>   | 0.075  | 0.090 | 1.900       | 2.290 |
| <b>E</b>   | 0.030  | 0.060 | 0.780       | 1.520 |
| <b>F</b>   | -      | 0.008 | -           | 0.203 |
| <b>G</b>   | 0.189  | 0.208 | 4.800       | 5.280 |
| <b>H</b>   | 0.006  | 0.012 | 0.152       | 0.305 |
| <b>I</b>   | 0.070  | -     | 1.800       | -     |
| <b>J</b>   | 0.082  | -     | 2.100       | -     |
| <b>K</b>   | -      | 0.090 | -           | 2.300 |
| <b>L</b>   | 0.082  | -     | 2.100       | -     |

**Part Numbering System**



**Part Marking System**



**Packaging**

| Part number | Component Package | Quantity | Packaging Option                 | Packaging Specification |
|-------------|-------------------|----------|----------------------------------|-------------------------|
| P4SMAxxxXX  | DO-214AC          | 5000     | Tape & Reel - 12mm tape/13" reel | EIA STD RS-481          |

**Tape and Reel Specification**



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