

# P4SMA Series

## Surface Mount – 400W



### Additional Information



Resources



Accessories



Samples

### Maximum Ratings and Thermal Characteristics

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

| Parameter                                                                                                                         | Symbol          | Value      | Unit               |
|-----------------------------------------------------------------------------------------------------------------------------------|-----------------|------------|--------------------|
| Peak Pulse Power Dissipation at $T_A = 25^\circ\text{C}$ by 10/1000us Waveform(Fig.2)(Note 1), (Note 2)Single Die Parts           | $P_{PPM}$       | 400        | W                  |
| Peak Pulse Power Dissipation at $T_A = 25^\circ\text{C}$ by 10/1000us Waveform(Fig.2)(Note 1), (Note 2) Stacked Die Parts(Note 5) | $P_{PPM}$       | 600        | W                  |
| Power Dissipation on Infinite Heat Sink at $T_L = 50^\circ\text{C}$                                                               | $P_D$           | 3.3        | W                  |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3)                                                                  | $I_{FSM}$       | 60         | A                  |
| Maximum Instantaneous Forward Voltage at 25A for Unidirectional Only (Note 4)                                                     | $V_F$           | 3.5/5.0    | V                  |
| Operating Temperature Range                                                                                                       | $T_J$           | -65 to 150 | $^\circ\text{C}$   |
| Storage Temperature Range                                                                                                         | $T_{STG}$       | -65 to 175 | $^\circ\text{C}$   |
| Typical Thermal Resistance Junction to Lead                                                                                       | $R_{\theta JL}$ | 30         | $^\circ\text{C/W}$ |
| Typical Thermal Resistance Junction to Ambient                                                                                    | $R_{\theta JA}$ | 120        | $^\circ\text{C/W}$ |

#### Notes:

1. Non-repetitive current pulse, per Fig.4 and derated above  $T_J$  (initial)  $= 25^\circ\text{C}$  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.  $V_F < 3.5\text{V}$  for single die parts and  $V_F < 5.0\text{V}$  for stacked-die parts.
5. For stacked die component details, please refer to part numbers labeled by \* in Electrical Characteristics.

### 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 10/1000us waveform, repetition rate (duty cycles):0.01%
- Excellent clamping capability
- Typical IR less than  $1\mu\text{A}$  when  $V_{BR} \text{ min} > 12\text{V}$
- Surface mount footprint for compact PCB layout
- 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)
- Built-in strain relief
- Fast response time: typically less than 1.0ps from 0V to BV min
- $260^\circ\text{C}/40\text{sec}$  change to  $260^\circ\text{C}/30\text{sec}$
- $V_{BR} @ T_J = V_{BR} @ 25^\circ\text{C} \times (1 + \alpha_T \times (T_J - 25))$  ( $\alpha_T$ : Temperature Coefficient, typical value is 0.1%)
- UL Recognized epoxy meeting flammability classification V-0 change to Plastic package is flammability rated V-0 per UL94.
- Meet MSL level1, per J-STD-020, LF maximum peak of  $260^\circ\text{C}$
- 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)

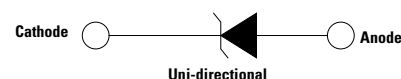
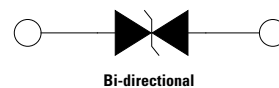
### Applications

TVS devices are ideal for the protection of I/O Interfaces, VCC bus and other vulnerable circuits used in Telecom, Computer, Industrial and Consumer electronic applications.

### Agency Approvals

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

### Functional Diagram



# P4SMA Series

## Surface Mount – 400W

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

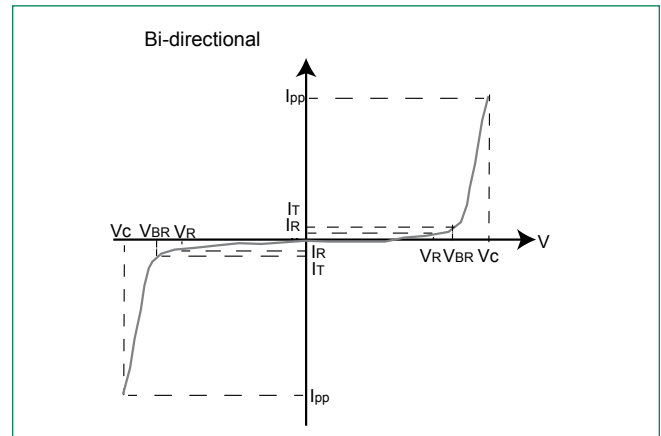
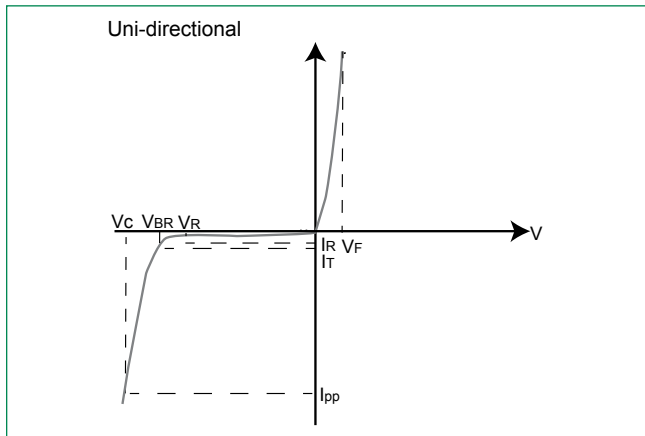
| Part Number (Uni) | Part Number (Bi) | Marking |      | Reverse Stand off Voltage $V_R$ (Volts) | Breakdown Voltage $V_{BR}$ (Volts) @ $I_T$ |        | Test Current $I_T$ (mA) | Maximum Clamping Voltage $V_C$ @ $I_{PP}$ (V) | Maximum Peak Pulse Current $I_{PP}$ (A) | Maximum Reverse Leakage $I_R$ @ $V_R$ ( $\mu\text{A}$ ) | Maximum Temperature Coefficient of $V_{BR}$ (%/°C) | Agency Approval |
|-------------------|------------------|---------|------|-----------------------------------------|--------------------------------------------|--------|-------------------------|-----------------------------------------------|-----------------------------------------|---------------------------------------------------------|----------------------------------------------------|-----------------|
|                   |                  | Uni     | Bi   |                                         | Min                                        | Max    |                         |                                               |                                         |                                                         |                                                    |                 |
| P4SMA6.8A         | P4SMA6.8CA       | 6V8A    | 6V8C | 5.80                                    | 6.45                                       | 7.14   | 10                      | 10.5                                          | 39.0                                    | 1000                                                    | 0.041                                              | X               |
| 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                                              | X               |
| P4SMA250A         | -                | 250A    | -    | 214.00                                  | 237.00                                     | 263.00 | 1                       | 344.0                                         | 1.2                                     | 1                                                       | 0.110                                              | X               |
| -                 | P4SMA250CA*      | -       | 250C | 214.00                                  | 237.00                                     | 263.00 | 1                       | 344.0                                         | 1.8                                     | 1                                                       | 0.110                                              | X               |
| P4SMA300A         | -                | 300A    | -    | 256.00                                  | 285.00                                     | 315.00 | 1                       | 414.0                                         | 1.0                                     | 1                                                       | 0.110                                              | X               |
| -                 | P4SMA300CA*      | -       | 300C | 256.00                                  | 285.00                                     | 315.00 | 1                       | 414.0                                         | 1.5                                     | 1                                                       | 0.110                                              | X               |
| P4SMA350A*        | P4SMA350CA*      | 350A    | 350C | 300.00                                  | 332.00                                     | 368.00 | 1                       | 482.0                                         | 1.3                                     | 1                                                       | 0.112                                              | X               |
| P4SMA400A*        | P4SMA400CA*      | 400A    | 400C | 342.00                                  | 380.00                                     | 420.00 | 1                       | 548.0                                         | 1.1                                     | 1                                                       | 0.112                                              | X               |
| P4SMA440A*        | P4SMA440CA*      | 440A    | 440C | 376.00                                  | 418.00                                     | 462.00 | 1                       | 602.0                                         | 1.0                                     | 1                                                       | 0.112                                              | X               |
| P4SMA480A*        | P4SMA480CA*      | 480A    | 480C | 408.00                                  | 456.00                                     | 504.00 | 1                       | 658.0                                         | 1.0                                     | 1                                                       | 0.112                                              | X               |
| P4SMA510A*        | P4SMA510CA*      | 510A    | 510C | 434.00                                  | 485.00                                     | 535.00 | 1                       | 698.0                                         | 0.9                                     | 1                                                       | 0.112                                              | X               |
| P4SMA530A*        | P4SMA530CA*      | 530A    | 530C | 451.00                                  | 503.50                                     | 556.50 | 1                       | 725.0                                         | 0.9                                     | 1                                                       | 0.112                                              | X               |
| P4SMA540A*        | P4SMA540CA*      | 540A    | 540C | 460.00                                  | 513.00                                     | 567.00 | 1                       | 740.0                                         | 0.9                                     | 1                                                       | 0.112                                              | X               |
| P4SMA550A*        | P4SMA550CA*      | 550A    | 550C | 468.00                                  | 522.50                                     | 577.50 | 1                       | 760.0                                         | 0.8                                     | 1                                                       | 0.112                                              | X               |

For bidirectional type having  $V_R$  of 10 volts and less, the  $I_R$  limit is double.  
 $V_{BR} @ T_J = V_{BR} @ 25^\circ\text{C} \times (1 + \alpha_T \times (T_J - 25))$  ( $\alpha_T$ : Temperature Coefficient)  
 For stack-die parts, use \* to label the part number.

# P4SMA Series

## Surface Mount – 400W

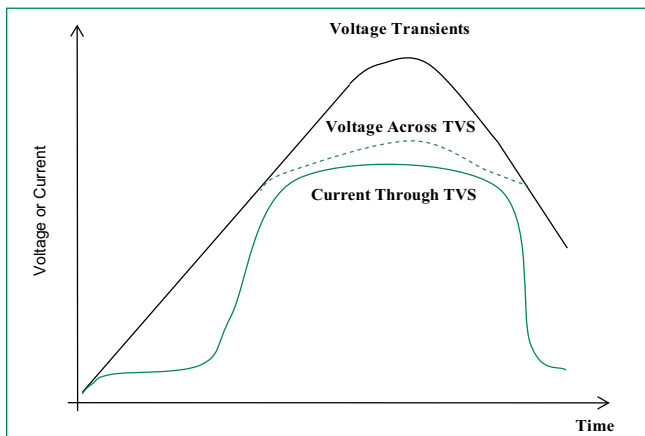
### I-V Curve Characteristics



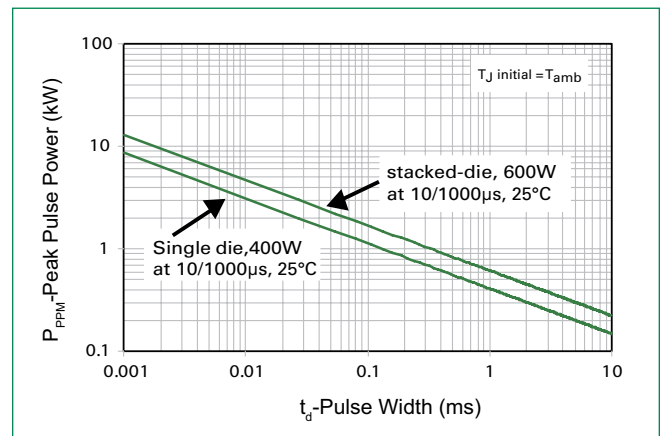
**P<sub>PPM</sub>** Peak Pulse Power Dissipation – Max power dissipation  
**V<sub>R</sub>** Stand-off Voltage – Maximum voltage that can be applied to the TVS without operation  
**V<sub>BR</sub>** Breakdown Voltage – Maximum voltage that flows through the TVS at a specified test current (I<sub>T</sub>)  
**V<sub>C</sub>** Clamping Voltage – Peak voltage measured across the TVS at a specified I<sub>ppm</sub> (peak impulse current)  
**I<sub>R</sub>** Reverse Leakage Current – Current measured at V<sub>R</sub>  
**V<sub>F</sub>** Forward Voltage Drop for Uni-directional

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

**Figure 1:**  
TVS Transients Clamping Waveform



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

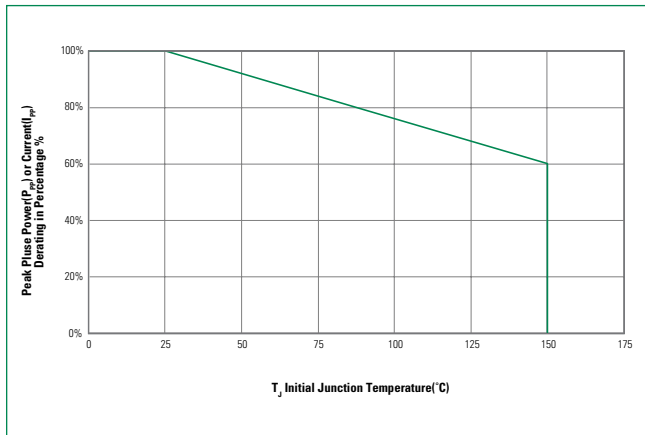


# P4SMA Series

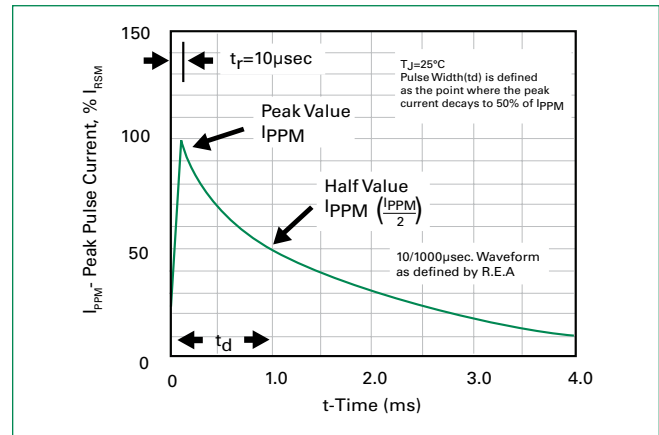
## Surface Mount – 400W

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

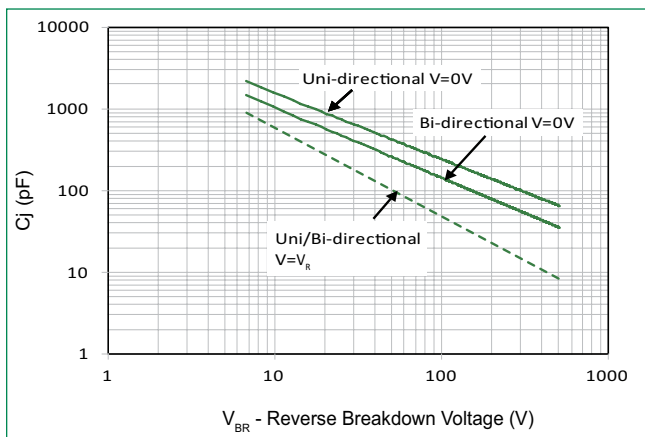
**Figure 3:**  
Peak Pulse Power Derating Curve



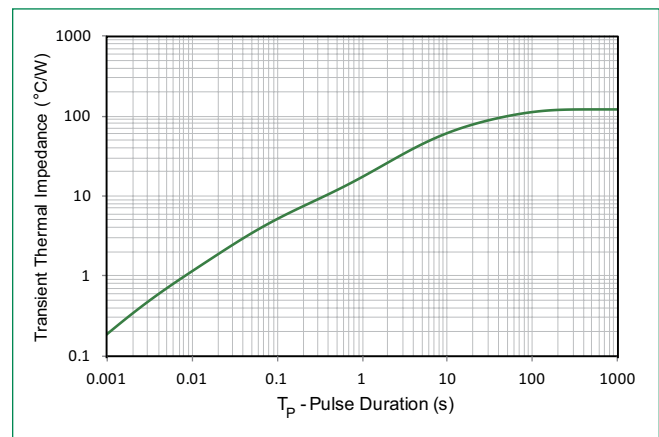
**Figure 4:**  
Pulse Waveform



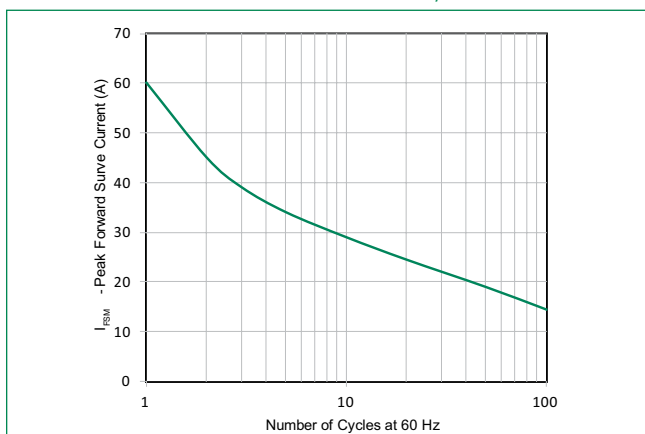
**Figure 5:**  
Typical Junction Capacitance



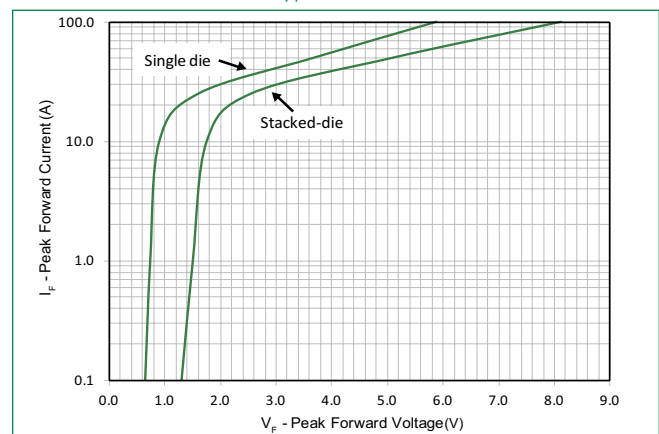
**Figure 6:**  
Typical Transient Thermal Impedance



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



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

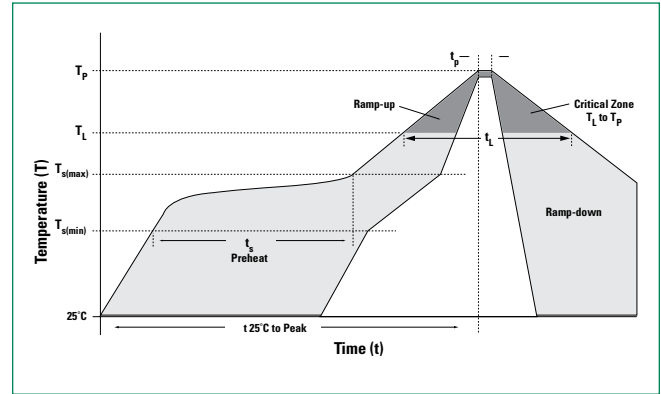


# P4SMA Series

## Surface Mount – 400W

### 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                   |



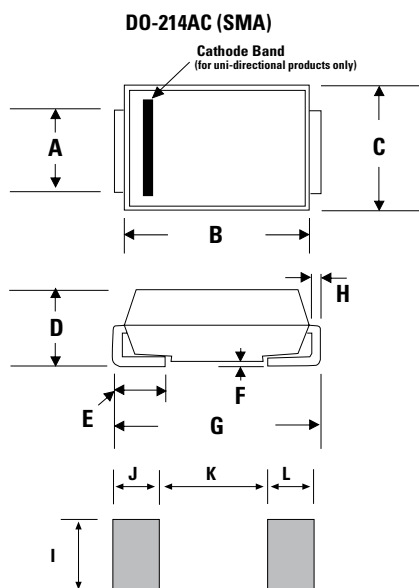
### Physical Specifications

|                 |                                                                    |
|-----------------|--------------------------------------------------------------------|
| <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

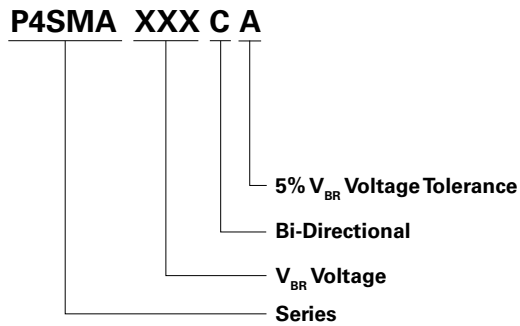


| Dimensions | Inches |       | Millimeters |       |
|------------|--------|-------|-------------|-------|
|            | Min    | Max   | Min         | Max   |
| <b>A</b>   | 0.049  | 0.065 | 1.250       | 1.650 |
| <b>B</b>   | 0.157  | 0.181 | 3.990       | 4.600 |
| <b>C</b>   | 0.095  | 0.110 | 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       | -     |

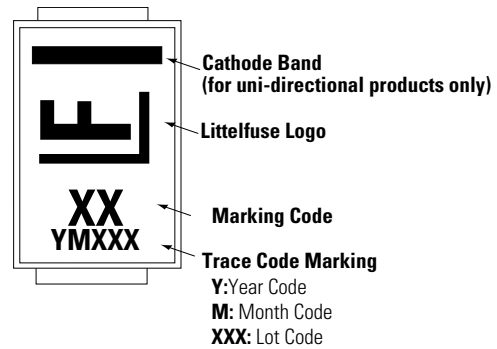
# P4SMA Series

## Surface Mount – 400W

### Part Numbering System



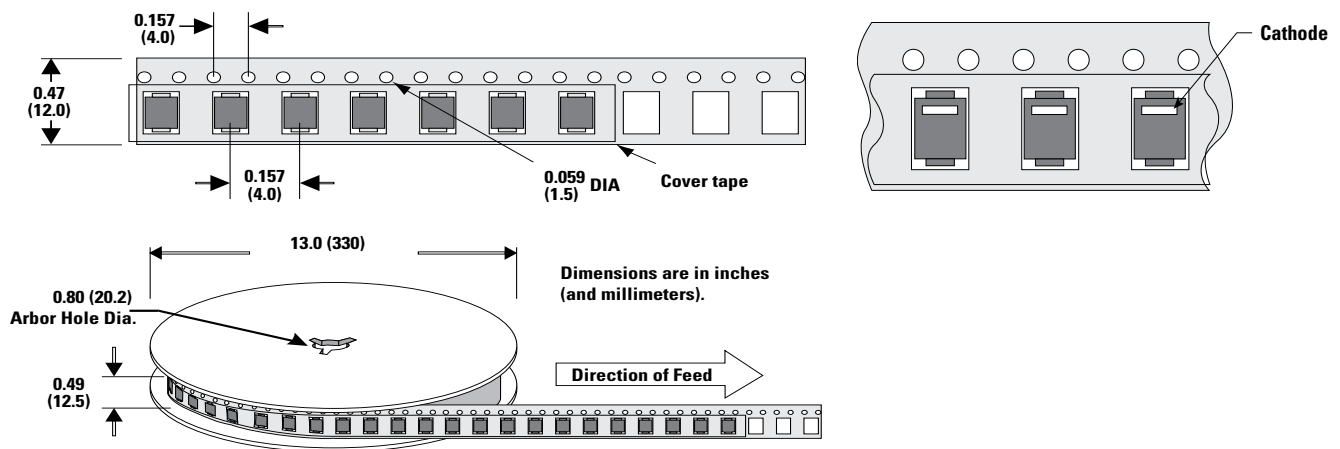
### Part Marking System



### 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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