



# THE DATASHEET OF P6SMB400A



**P6SMB Series**



**Agency Approvals**

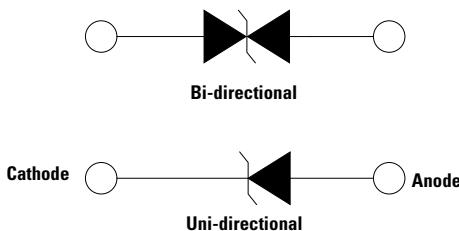
| Agency | Agency File Number |
|--------|--------------------|
|        | E230531            |

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

| Parameter   | Symbol           | Value      | Unit |
|---|------------------|------------|------|
| Peak Pulse Power Dissipation <sup>(Fig.2)</sup> by 10/1000us Test Waveform <sup>(Fig.4)</sup> (Note 1),(Note 2)-Single Die Parts          | P <sub>PPM</sub> | 600        | W    |
| Peak Pulse Power Dissipation <sup>(Fig.2)</sup> by 10/1000us Test Waveform <sup>(Fig.4)</sup> (Note 1, Note 2)-Stacked Die Parts (Note 5) | P <sub>PPM</sub> | 800        | W    |
| Power Dissipation on Infinite Heat Sink at T <sub>L</sub> =50°C   | P <sub>D</sub>   | 5.0        | W    |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3)  | I <sub>FSM</sub> | 100        | A    |
| Maximum Instantaneous Forward Voltage at 50A 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> | 20         | °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. Mounted on copper pad area of 0.2x0.2" (5.0 x 5.0mm) to each terminal.
  3. Measured on 8.3ms single half sine wave or equivalent square wave for unidirectional device only, duty cycle=4 per minute maximum.
  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 P6SMB series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

**Features**

- 600W 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 V<sub>BR</sub> min
- High temperature to reflow soldering guaranteed: 260°C/30sec
- 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 compound 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 2<sup>ND</sup> level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/ JEDEC J-STD-609A.01)
- UL Recognized to ANSI/UL 497B: Protectors for Data Communications and Fire-Alarm Circuits.

**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**



Datasheet



Resources



Samples

### 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    |                                  |   |  |  |   |   |
|                   |                  |         |      |  |  |        |                                  |   |  |  |   |   |
| P6SMB6.8A         | P6SMB6.8CA       | 6V8A    | 6V8C | 5.80   | 6.45   | 7.14   | 10                               | 10.5  | 58.1   | 1000   | 0.041   | X   |
| P6SMB7.5A         | P6SMB7.5CA       | 7V5A    | 7V5C | 6.40   | 7.13   | 7.88   | 10                               | 11.3  | 54.0   | 500  | 0.054   | X   |
| P6SMB8.2A         | P6SMB8.2CA       | 8V2A    | 8V2C | 7.02   | 7.79   | 8.61   | 10                               | 12.1  | 50.4   | 200  | 0.058   | X   |
| P6SMB9.1A         | P6SMB9.1CA       | 9V1A    | 9V1C | 7.78   | 8.65   | 9.55   | 1                                | 13.4  | 45.5   | 50   | 0.063   | X   |
| P6SMB10A          | P6SMB10CA        | 10A     | 10C  | 8.55   | 9.50   | 10.50  | 1                                | 14.5  | 42.1   | 10   | 0.066   | X   |
| P6SMB11A          | P6SMB11CA        | 11A     | 11C  | 9.40   | 10.50  | 11.60  | 1                                | 15.6  | 39.1   | 5  | 0.069   | X   |
| P6SMB12A          | P6SMB12CA        | 12A     | 12C  | 10.20  | 11.40  | 12.60  | 1                                | 16.7  | 36.5   | 5  | 0.071   | X   |
| P6SMB13A          | P6SMB13CA        | 13A     | 13C  | 11.10  | 12.40  | 13.70  | 1                                | 18.2  | 33.5   | 1  | 0.074   | X   |
| P6SMB15A          | P6SMB15CA        | 15A     | 15C  | 12.80  | 14.30  | 15.80  | 1                                | 21.2  | 28.8   | 1  | 0.076   | X   |
| P6SMB16A          | P6SMB16CA        | 16A     | 16C  | 13.60  | 15.20  | 16.80  | 1                                | 22.5  | 27.1   | 1  | 0.080   | X   |
| P6SMB18A          | P6SMB18CA        | 18A     | 18C  | 15.30  | 17.10  | 18.90  | 1                                | 25.5  | 24.2   | 1  | 0.083   | X   |
| P6SMB20A          | P6SMB20CA        | 20A     | 20C  | 17.10  | 19.00  | 21.00  | 1                                | 27.7  | 22.0   | 1  | 0.085   | X   |
| P6SMB22A          | P6SMB22CA        | 22A     | 22C  | 18.80  | 20.90  | 23.10  | 1                                | 30.6  | 19.9   | 1  | 0.088   | X   |
| P6SMB24A          | P6SMB24CA        | 24A     | 24C  | 20.50  | 22.80  | 25.20  | 1                                | 33.2  | 18.4   | 1  | 0.091   | X   |
| P6SMB27A          | P6SMB27CA        | 27A     | 27C  | 23.10  | 25.70  | 28.40  | 1                                | 37.5  | 16.3   | 1  | 0.092   | X   |
| P6SMB30A          | P6SMB30CA        | 30A     | 30C  | 25.60  | 28.50  | 31.50  | 1                                | 41.4  | 14.7   | 1  | 0.093   | X   |
| P6SMB33A          | P6SMB33CA        | 33A     | 33C  | 28.20  | 31.40  | 34.70  | 1                                | 45.7  | 13.3   | 1  | 0.094   | X   |
| P6SMB36A          | P6SMB36CA        | 36A     | 36C  | 30.80  | 34.20  | 37.80  | 1                                | 49.9  | 12.2   | 1  | 0.096   | X   |
| P6SMB39A          | P6SMB39CA        | 39A     | 39C  | 33.30  | 37.10  | 41.00  | 1                                | 53.9  | 11.3   | 1  | 0.097   | X   |
| P6SMB43A          | P6SMB43CA        | 43A     | 43C  | 36.80  | 40.90  | 45.20  | 1                                | 59.3  | 10.3   | 1  | 0.098   | X   |
| P6SMB47A          | P6SMB47CA        | 47A     | 47C  | 40.20  | 44.70  | 49.40  | 1                                | 64.8  | 9.4  | 1  | 0.099   | X   |
| P6SMB51A          | P6SMB51CA        | 51A     | 51C  | 43.60  | 48.50  | 53.60  | 1                                | 70.1  | 8.7  | 1  | 0.100   | X   |
| P6SMB56A          | P6SMB56CA        | 56A     | 56C  | 47.80  | 53.20  | 58.80  | 1                                | 77.0  | 7.9  | 1  | 0.101   | X   |
| P6SMB58A          | P6SMB58CA        | 58A     | 58C  | 52.78  | 55.10  | 60.90  | 1                                | 79.8  | 7.7  | 1  | 0.101   | -   |
| P6SMB62A          | P6SMB62CA        | 62A     | 62C  | 53.00  | 58.90  | 65.10  | 1                                | 85.0  | 7.2  | 1  | 0.102   | X   |
| P6SMB68A          | P6SMB68CA        | 68A     | 68C  | 58.10  | 64.60  | 71.40  | 1                                | 92.0  | 6.6  | 1  | 0.103   | X   |
| P6SMB75A          | P6SMB75CA        | 75A     | 75C  | 64.10  | 71.30  | 78.80  | 1                                | 103.0   | 5.9  | 1  | 0.104   | X   |
| P6SMB82A          | P6SMB82CA        | 82A     | 82C  | 70.10  | 77.90  | 86.10  | 1                                | 113.0   | 5.4  | 1  | 0.105   | X   |
| P6SMB91A          | P6SMB91CA        | 91A     | 91C  | 77.80  | 86.50  | 95.50  | 1                                | 125.0   | 4.9  | 1  | 0.106   | X   |
| P6SMB100A         | P6SMB100CA       | 100A    | 100C | 85.50  | 95.00  | 105.00 | 1                                | 137.0   | 4.5  | 1  | 0.106   | X   |
| P6SMB110A         | P6SMB110CA       | 110A    | 110C | 94.00  | 105.00   | 116.00 | 1                                | 152.0   | 4.0  | 1  | 0.107   | X   |
| P6SMB120A         | P6SMB120CA       | 120A    | 120C | 102.00   | 114.00   | 126.00 | 1                                | 165.0   | 3.7  | 1  | 0.107   | X   |
| P6SMB130A         | P6SMB130CA       | 130A    | 130C | 111.00   | 124.00   | 137.00 | 1                                | 179.0   | 3.4  | 1  | 0.107   | X   |
| P6SMB150A         | P6SMB150CA       | 150A    | 150C | 128.00   | 143.00   | 158.00 | 1                                | 207.0   | 2.9  | 1  | 0.108   | X   |
| P6SMB160A         | P6SMB160CA       | 160A    | 160C | 136.00   | 152.00   | 168.00 | 1                                | 219.0   | 2.8  | 1  | 0.108   | X   |
| P6SMB170A         | P6SMB170CA       | 170A    | 170C | 145.00   | 162.00   | 179.00 | 1                                | 234.0   | 2.6  | 1  | 0.108   | X   |
| P6SMB180A         | P6SMB180CA       | 180A    | 180C | 154.00   | 171.00   | 189.00 | 1                                | 246.0   | 2.5  | 1  | 0.108   | X   |
| P6SMB200A         | P6SMB200CA       | 200A    | 200C | 171.00   | 190.00   | 210.00 | 1                                | 274.0   | 2.2  | 1  | 0.108   | X   |
| P6SMB220A         | P6SMB220CA       | 220A    | 220C | 185.00   | 209.00   | 231.00 | 1                                | 328.0   | 1.9  | 1  | 0.110   | X   |
| P6SMB250A         | P6SMB250CA       | 250A    | 250C | 214.00   | 237.00   | 263.00 | 1                                | 344.0   | 1.8  | 1  | 0.110   | X   |
| P6SMB300A         | P6SMB300CA       | 300A    | 300C | 256.00   | 285.00   | 315.00 | 1                                | 414.0   | 1.5  | 1  | 0.110   | X   |
| P6SMB350A*        | P6SMB350CA*      | 350A    | 350C | 300.00   | 332.00   | 368.00 | 1                                | 482.0   | 1.7  | 1  | 0.112   | X   |
| P6SMB400A*        | P6SMB400CA*      | 400A    | 400C | 342.00   | 380.00   | 420.00 | 1                                | 548.0   | 1.5  | 1  | 0.112   | X   |
| P6SMB440A*        | P6SMB440CA*      | 440A    | 440C | 376.00   | 418.00   | 462.00 | 1                                | 602.0   | 1.4  | 1  | 0.112   | X   |
| P6SMB480A*        | P6SMB480CA*      | 480A    | 480C | 408.00   | 456.00   | 504.00 | 1                                | 658.0   | 1.3  | 1  | 0.112   | X   |
| P6SMB510A*        | P6SMB510CA*      | 510A    | 510C | 434.00   | 485.00   | 535.00 | 1                                | 698.0   | 1.2  | 1  | 0.112   | X   |
| P6SMB530A*        | P6SMB530CA*      | 530A    | 530C | 451.00   | 503.50   | 556.50 | 1                                | 725.0   | 1.2  | 1  | 0.112   | X   |
| P6SMB540A*        | P6SMB540CA*      | 540A    | 540C | 460.00   | 513.00   | 567.00 | 1                                | 740.0   | 1.1  | 1  | 0.112   | X   |
| P6SMB550A*        | P6SMB550CA*      | 550A    | 550C | 468.00   | 522.50   | 577.50 | 1                                | 760.0   | 1.1  | 1  | 0.112   | X   |
| P6SMB600A*        | P6SMB600CA*      | 600A    | 600C | 512.00   | 570.00   | 630.00 | 1                                | 828.0   | 1.0  | 1  | 0.112   | -   |

For bidirectional type having V<sub>R</sub> of 10 volts and less, the I<sub>R</sub> limit is double.  
 For stack-die parts, use \* to label the part number.

**I-V Curve Characteristics**



- $P_{PPM}$  Peak Pulse Power Dissipation** – Max power dissipation ( $V_C * I_{pp}$ )
- $V_R$  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 TVS at a specified  $I_{ppm}$  (peak impulse current)
- $I_R$  Reverse Leakage Current** – Current measured at  $V_R$
- $V_F$  Forward Voltage Drop for Uni-directional**

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

**Figure 1 - TVS Transients Clamping Waveform**



**Figure 2 - Peak Pulse Power Rating**

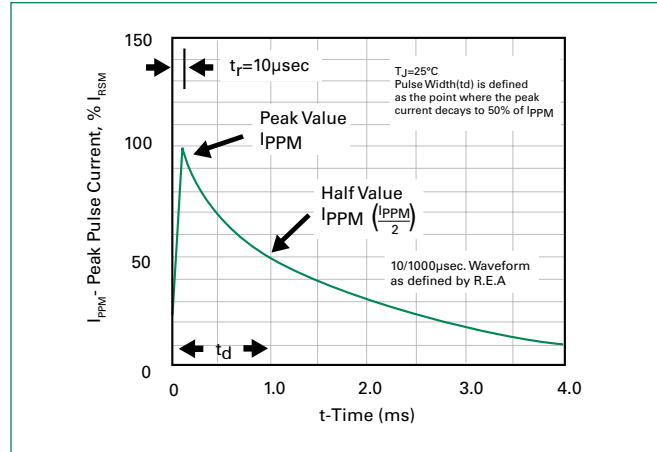


**Ratings and Characteristic Curves** ( $T_A=25^{\circ}\text{C}$  unless otherwise noted) (Continued)

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



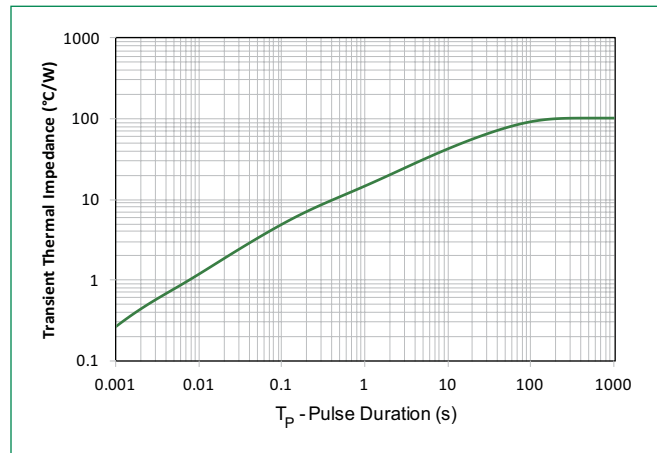
**Figure 4 - Pulse Waveform**



**Figure 5 - Typical Junction Capacitance**



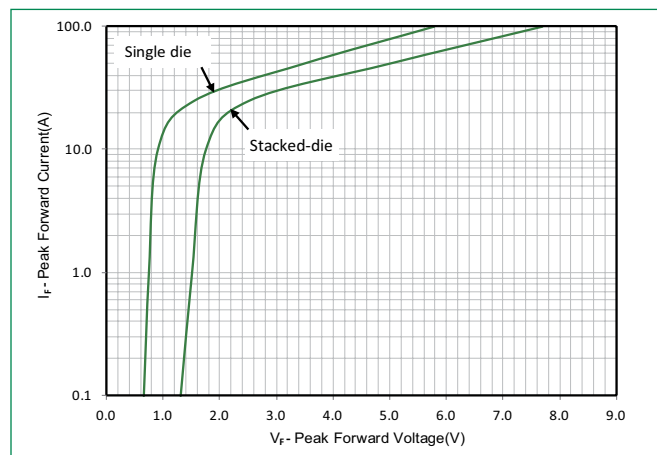
**Figure 6 - Typical Transient Thermal Impedance**



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



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



**Soldering Parameters**

|  |                                    |                         |
|--|------------------------------------|-------------------------|
| <b>Reflow Condition</b>  |                                    | Pb-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>   | 0.003 ounce, 0.093 grams  |
| <b>Case</b>     | JEDEC DO214AA. Molded plastic body over glass passivated junction |
| <b>Polarity</b> | Color band denotes cathode except for bidirectional versions      |
| <b>Terminal</b> | Matte Tin-plated leads, Solderable per JESD22-B102                |

**Environmental Specifications**

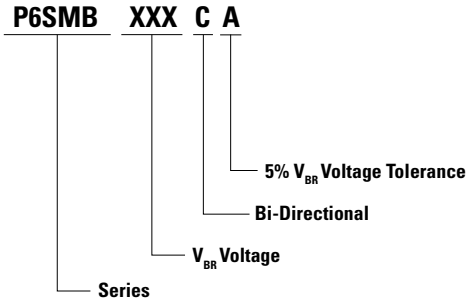
|                            |                          |
|----------------------------|--------------------------|
| <b>High Temp. Storage</b>  | JESD22-A103              |
| <b>HTRB</b>                | JESD22-A108              |
| <b>Temperature Cycling</b> | JESD22-A104              |
| <b>MSL</b>                 | JEDEC-J-STD-020, Level 1 |
| <b>H3TRB</b>               | JESD22-A101              |
| <b>RSH</b>                 | JESD22-A111              |

**Dimensions**

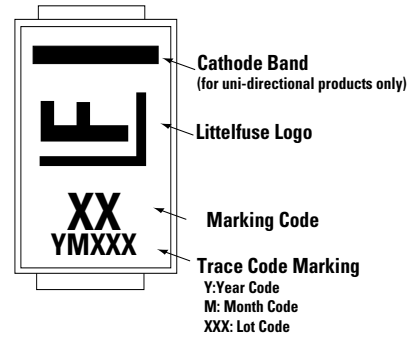


| Dimensions | Inches |       | Millimeters |       |
|------------|--------|-------|-------------|-------|
|            | Min    | Max   | Min         | Max   |
| A          | 0.076  | 0.086 | 1.930       | 2.200 |
| B          | 0.160  | 0.187 | 4.060       | 4.750 |
| C          | 0.130  | 0.155 | 3.300       | 3.940 |
| D          | 0.078  | 0.103 | 1.990       | 2.610 |
| E          | 0.030  | 0.060 | 0.760       | 1.520 |
| F          | -      | 0.008 | -           | 0.203 |
| G          | 0.205  | 0.220 | 5.210       | 5.590 |
| H          | 0.006  | 0.012 | 0.152       | 0.305 |
| I          | 0.089  | -     | 2.260       | -     |
| J          | 0.085  | -     | 2.160       | -     |
| K          | -      | 0.107 | -           | 2.740 |
| L          | 0.085  | -     | 2.160       | -     |

### Part Numbering System



### Part Marking System



### Packaging

| Part number | Component Package | Quantity | Packaging Option                 | Packaging Specification |
|-------------|-------------------|----------|----------------------------------|-------------------------|
| P6SMBxxxXX  | DO-214AA          | 3000     | Tape & Reel - 12mm tape/13" reel | EIA STD RS-481          |

### Tape and Reel Specification



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