Surface Mount – 600W > P6SMB series
TVS Diodes

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_{th} less than 1μA when V_{br} 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
- High temperature to reflow soldering guaranteed: 260°C/30sec
- \( V_{br} @ T_J = V_{br} @ 25°C \times (1 + \alpha T x (T_J - 25)) \)
  \( \alpha \) : Temperature Coefficient, typical value is 0.1%
- UL Recognized compound meeting flammability classification V-0
- Meet MSL level 1, 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)
- UL Recognized to ANSI/UL 497B: Protectors for Data Communications and Fire-Alarm Circuits.

Maximum Ratings and Thermal Characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Pulse Power Dissipation by 10/1000μs Waveform</td>
<td>( P_{PM} )</td>
<td>600</td>
<td>W</td>
</tr>
<tr>
<td>Power Dissipation on Infinite Heat Sink at ( T_J = 50°C )</td>
<td>( P_D )</td>
<td>5.0</td>
<td>W</td>
</tr>
<tr>
<td>Peak Forward Surge Current, 8.3ms Single Half Sine Wave</td>
<td>( I_{FSM} )</td>
<td>100</td>
<td>A</td>
</tr>
<tr>
<td>Maximum Instantaneous Forward Voltage at 50A for Unidirectional Only</td>
<td>( V_F )</td>
<td>3.5/5.0</td>
<td>V</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>( T_J )</td>
<td>-65 to 150</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>( T_{STG} )</td>
<td>-65 to 175</td>
<td>°C</td>
</tr>
<tr>
<td>Typical Thermal Resistance Junction to Lead</td>
<td>( R_{JL} )</td>
<td>20</td>
<td>°C/W</td>
</tr>
<tr>
<td>Typical Thermal Resistance Junction to Ambient</td>
<td>( R_{JA} )</td>
<td>100</td>
<td>°C/W</td>
</tr>
</tbody>
</table>

Notes:
1. Non-repetitive current pulse, per Fig. 4 and derated above \( T_J \) (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. \( V_F \) < 3.5V for single die parts and \( V_F \) < 5.0V for stacked-die parts.
5. For stacked die component details, please refer to part numbers labeled by “ in Electrical Characteristics.

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.

Functional Diagram

Agency Approvals

<table>
<thead>
<tr>
<th>Agency</th>
<th>Agency File Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>UL</td>
<td>E230531</td>
</tr>
</tbody>
</table>

Additional Information

- Datasheet
- Resources
- Samples
For bidirectional type having $V_{R}$ of 10 volts and less, the $I_{P}$ limit is double.
For stack die parts, use * to label the part number.
I-V Curve Characteristics

<table>
<thead>
<tr>
<th>Uni-directional</th>
<th>Bi-directional</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="uni-directional.png" alt="I-V Curve Diagram" /></td>
<td><img src="bi-directional.png" alt="I-V Curve Diagram" /></td>
</tr>
</tbody>
</table>

- **P_{ppm}** Peak Pulse Power Dissipation – Max power dissipation (V_c * I_pp)
- **V_c** 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_{r}** 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_c
- **V_F** Forward Voltage Drop for Uni-directional

Ratings and Characteristic Curves (T_J=25°C unless otherwise noted)

**Figure 1 - TVS Transients Clamping Waveform**

- Voltage Transients
- Voltage Across TVS
- Current Through TVS

**Figure 2 - Peak Pulse Power Rating**

- Stacked-die, 800W at 10/1000µs, 25°C
- Single die, 600W at 10/1000µs, 25°C

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Ratings and Characteristic Curves (T_J=25°C unless otherwise noted) (Continued)

Figure 3 - Peak Pulse Power Derating Curve

![Graph showing peak pulse power derating curve with T_J as initial junction temperature in degrees Celsius.]

Figure 4 - Pulse Waveform

![Graph showing pulse waveform with time (ms) on the x-axis and peak pulse current, % I_RSM on the y-axis.]

Figure 5 - Typical Junction Capacitance

![Graph showing typical junction capacitance with V_{BR} as reverse breakdown voltage in volts.]

Figure 6 - Typical Transient Thermal Impedance

![Graph showing typical transient thermal impedance with T_p as pulse duration in seconds and power (W) on the y-axis.]

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

![Graph showing maximum non-repetitive peak forward surge current with number of cycles at 60 Hz on the x-axis and peak forward surge current (A) on the y-axis.]

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

![Graph showing peak forward voltage drop vs peak forward current with V_f as peak forward voltage drop (V) on the x-axis and peak forward current (A) on the y-axis.]

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### Soldering Parameters

- **Pre Heat**
  - Temperature Min \( T_{\text{min}} \)
  - Temperature Max \( T_{\text{max}} \)
  - Time (min to max) \( t_{T} \)
  - 60 – 120 secs

- **Average ramp up rate** (Liquidus Temp \( T_{L} \) to peak)
  - 3°C/second max

- **\( T_{\text{min}} \) to \( T_{L} \)** - Ramp-up Rate
  - 3°C/second max

- **Reflow**
  - Temperature (\( T_{L} \)) (Liquidus)
  - Temperature (\( T_{S} \)) (Min)
  - Temperature (\( T_{S} \)) (Max)
  - Time (min to max) \( t_{T} \)
  - 60 – 150 seconds

- **Peak Temperature (\( T_{P} \))**
  - 260°C

- **Time within 5°C of actual peak Temperature (\( t_{P} \))**
  - 30 seconds Max

- **Ramp-down Rate**
  - 6°C/second Max

- **Time 25°C to peak Temperature (\( T_{P} \))**
  - 8 minutes Max.

- **Do not exceed**
  - 260°C

### Physical Specifications

- **Weight**
  - 0.003 ounce, 0.093 grams

- **Case**
  - JEDEC DO214AA. Molded plastic body over glass passivated junction

- **Polarity**
  - Color band denotes cathode except for bidirectional versions

- **Terminal**
  - Matte Tin-plated leads, Solderable per JEsd22-B102

### Environmental Specifications

- **High Temp. Storage**
  - JESD22-A103

- **HTRB**
  - JESD22-A108

- **Temperature Cycling**
  - JESD22-A104

- **MSL**
  - JEDEC-J-STD-020, Level 1

- **H3TRB**
  - JESD22-A101

- **RSH**
  - JESD22-A111

### Dimensions

**DO-214AA (SMB J-Bend)**

- **A** 0.076 – 0.086
- **B** 0.160 – 0.187
- **C** 0.130 – 0.155
- **D** 0.078 – 0.103
- **E** 0.030 – 0.060
- **F** - 0.008
- **G** 0.205 – 0.220
- **H** 0.006 – 0.012
- **I** 0.089 – 0.107
- **J** 0.085 – 0.107
- **K** 0.085 – 0.107
- **L** 0.085 – 0.107

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Part Numbering System

**P6SMB**

- **XXX**: Series
- **CA**: Voltage Tolerance
- **V_{br}**: Bi-Directional
- **5% V_{br}**: Voltage Tolerance

Part Marking System

- **XX YMXXX**: Marking Code
- **Littelfuse Logo**: For uni-directional products only
- **Trace Code**: Year Code, Month Code, Lot Code

Packaging

<table>
<thead>
<tr>
<th>Part number</th>
<th>Component Package</th>
<th>Quantity</th>
<th>Packaging Option</th>
<th>Packaging Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>P6SMBxxxXX</td>
<td>DO-214AA</td>
<td>3000</td>
<td>Tape &amp; Reel - 12mm tape/13” reel</td>
<td>EIA STD RS-481</td>
</tr>
</tbody>
</table>

Tape and Reel Specification

- **0.47 (12.0)**
- **0.157 (4.0)**
- **0.315 (8.0)**
- **0.059 (1.5)**
- **0.80 (20.2)**

Dimensions are in inches (and millimeters).

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