

Surface Mount Transient Voltage Suppressors (TVS)

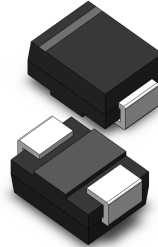
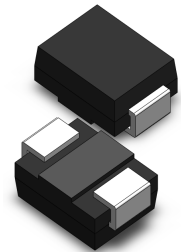
P6SMB Series 6.8 To 600 V 600W

Description

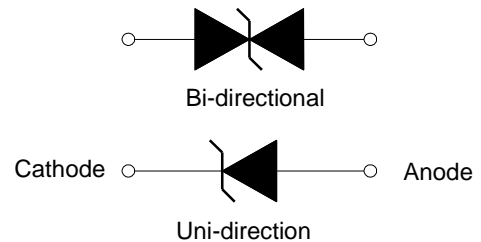
The P6SMB series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

Features

- u For surface mounted applications in order to optimize board space
- u Low leakage
- u Uni and Bidirectional unit
- u Glass passivated junction
- u Low inductance
- u Excellent clamping capability
- u 600W Peak power capability at 10 × 1000μs waveform Repetition rate (duty cycle):0.01%
- u Fast response time: typically less than 1.0ps from 0 Volts to V_{BR} min
- u Typical I_R less than 5μA above 12V.
- u High Temperature soldering: 260°C/40 seconds at terminals
- u Typical maximum temperature coefficient $\Delta V_{BR} = 0.1\% \times V_{BR}@25^\circ\text{C} \times \Delta T$
- u Plastic package has Underwriters Laboratory Flammability 94V-0
- u Matte tin lead-free Plated
- u Halogen free and RoHS compliant
- u Typical failure mode is short from over-specified voltage or current
- u Whisker test is conducted based on JEDEC JESD201A per its table 4a and 4c
- u IEC-61000-4-2 ESD 15kV(Air), 8kV (Contact)
- u ESD protection of data lines in accordance with IEC 61000-4-2 (IEC801-2)
- u EFT protection of data lines in accordance with IEC 61000-4-4 (IEC801-4)

Uni-directional

Bi-directional


Functional Diagram



Applications

TVS devices are ideal for the protection of I/O interfaces, V_{CC} bus and other vulnerable circuits used in Telecom, Computer, Industrial and Consumer electronic applications.

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

| Parameter | Symbol | Value | Unit |
|--|----------------|----------------|------------------|
| Peak Pulse Power Dissipation with a 10/1000μs waveform (Fig.1)(Note 1), (Note 2) | P_{PPM} | 600 | Watts |
| Peak Pulse Current with a 10/1000μs waveform.(Note1, Fig.3) | I_{PP} | See Next Table | Amps |
| Power Dissipation on Infinite Heat Sink at $T_L=75^\circ\text{C}$ | $P_{M(AV)}$ | 5.0 | Watt |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3) | I_{FSM} | 100 | Amps |
| Maximum Instantaneous Forward Voltage at 25A for Unidirectional Only (Note 4) | V_F | 3.5/5.0 | Voltage |
| Operating junction and Storage Temperature Range. | T_J, T_{STG} | -55 to +150 | $^\circ\text{C}$ |

Notes:

1. Non-repetitive current pulse, per Fig. 3 and derated above $T_A = 25^\circ\text{C}$ per Fig. 2.
2. Mounted on 5.0mm x 5.0mm (0.03mm thick) Copper Pads to each terminal.
3. 8.3ms single half sine-wave, or equivalent square wave, Duty cycle = 4 pulses per minutes maximum.
4. $V_F < 3.5\text{V}$ for $V_{BR} < 200\text{V}$ and $V_F < 6.5\text{V}$ for $V_{BR} > 201\text{V}$.

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Electrical Characteristics (T_A=25°C unless otherwise noted)

| Part Number | | Marking | | Reverse Stand-Off Voltage V _{RWM} (V) | Breakdown Voltage V _{BR} (V) @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 _{RWM} (μA) |
|-------------|------------|---------|------|--|---|--------|----------------------------------|--|--|---|
| Uni | Bi | Uni | Bi | | MIN | MAX | | | | |
| P6SMB6.8A | P6SMB6.8CA | 6V8A | 6V8C | 5.8 | 6.46 | 7.14 | 10 | 10.5 | 57.14 | 1000 |
| P6SMB7.5A | P6SMB7.5CA | 7V5A | 7V5C | 6.4 | 7.13 | 7.88 | 10 | 11.3 | 53.10 | 500 |
| P6SMB8.2A | P6SMB8.2CA | 8V2A | 8V2C | 7.0 | 7.79 | 8.61 | 10 | 12.1 | 49.59 | 200 |
| P6SMB9.1A | P6SMB9.1CA | 9V1A | 9V1C | 7.8 | 8.65 | 9.56 | 1 | 13.4 | 44.78 | 50 |
| P6SMB10A | P6SMB10CA | 10A | 10C | 8.6 | 9.50 | 10.50 | 1 | 14.5 | 41.38 | 10 |
| P6SMB11A | P6SMB11CA | 11A | 11C | 9.4 | 10.45 | 11.55 | 1 | 15.6 | 38.46 | 5 |
| P6SMB12A | P6SMB12CA | 12A | 12C | 10.2 | 11.40 | 12.60 | 1 | 16.7 | 35.93 | 5 |
| P6SMB13A | P6SMB13CA | 13A | 13C | 11.1 | 12.35 | 13.65 | 1 | 18.2 | 32.97 | 5 |
| P6SMB15A | P6SMB15CA | 15A | 15C | 12.8 | 14.25 | 15.75 | 1 | 21.2 | 28.30 | 5 |
| P6SMB16A | P6SMB16CA | 16A | 16C | 13.6 | 15.20 | 16.80 | 1 | 22.5 | 26.67 | 5 |
| P6SMB18A | P6SMB18CA | 18A | 18C | 15.3 | 17.10 | 18.90 | 1 | 25.2 | 23.81 | 5 |
| P6SMB20A | P6SMB20CA | 20A | 20C | 17.1 | 19.00 | 21.00 | 1 | 27.7 | 21.66 | 5 |
| P6SMB22A | P6SMB22CA | 22A | 22C | 18.8 | 20.90 | 23.10 | 1 | 30.6 | 19.61 | 5 |
| P6SMB24A | P6SMB24CA | 24A | 24C | 20.5 | 22.80 | 25.20 | 1 | 33.2 | 18.07 | 5 |
| P6SMB27A | P6SMB27CA | 27A | 27C | 23.1 | 25.65 | 28.35 | 1 | 37.5 | 16.00 | 5 |
| P6SMB30A | P6SMB30CA | 30A | 30C | 25.6 | 28.50 | 31.50 | 1 | 41.4 | 14.49 | 5 |
| P6SMB33A | P6SMB33CA | 33A | 33C | 28.2 | 31.35 | 34.65 | 1 | 45.7 | 13.13 | 5 |
| P6SMB36A | P6SMB36CA | 36A | 36C | 30.8 | 34.20 | 37.80 | 1 | 49.9 | 12.02 | 5 |
| P6SMB39A | P6SMB39CA | 39A | 39C | 33.3 | 37.05 | 40.95 | 1 | 53.9 | 11.13 | 5 |
| P6SMB43A | P6SMB43CA | 43A | 43C | 36.8 | 40.85 | 45.15 | 1 | 59.3 | 10.12 | 5 |
| P6SMB47A | P6SMB47CA | 47A | 47C | 40.2 | 44.65 | 49.35 | 1 | 64.8 | 9.26 | 5 |
| P6SMB51A | P6SMB51CA | 51A | 51C | 43.6 | 48.45 | 53.55 | 1 | 70.1 | 8.56 | 5 |
| P6SMB56A | P6SMB56CA | 56A | 56C | 47.8 | 53.20 | 58.80 | 1 | 77.0 | 7.79 | 5 |
| P6SMB62A | P6SMB62CA | 62A | 62C | 53.0 | 58.90 | 65.10 | 1 | 85.0 | 7.06 | 5 |
| P6SMB68A | P6SMB68CA | 68A | 68C | 58.1 | 64.60 | 71.40 | 1 | 92.0 | 6.52 | 5 |
| P6SMB75A | P6SMB75CA | 75A | 75C | 64.1 | 71.25 | 78.75 | 1 | 103.0 | 5.83 | 5 |
| P6SMB82A | P6SMB82CA | 82A | 82C | 70.1 | 77.90 | 86.10 | 1 | 113.0 | 5.31 | 5 |
| P6SMB91A | P6SMB91CA | 91A | 91C | 77.8 | 86.45 | 95.55 | 1 | 125.0 | 4.80 | 5 |
| P6SMB100A | P6SMB100CA | 100A | 100C | 85.5 | 95.00 | 105.00 | 1 | 137.0 | 4.38 | 5 |
| P6SMB110A | P6SMB110CA | 110A | 110C | 94.0 | 104.50 | 115.50 | 1 | 152.0 | 3.95 | 5 |
| P6SMB120A | P6SMB120CA | 120A | 120C | 102.0 | 114.00 | 126.00 | 1 | 165.0 | 3.64 | 5 |
| P6SMB130A | P6SMB130CA | 130A | 130C | 111.0 | 123.50 | 136.50 | 1 | 179.0 | 3.35 | 5 |
| P6SMB150A | P6SMB150CA | 150A | 150C | 128.0 | 142.50 | 157.50 | 1 | 207.0 | 2.90 | 5 |
| P6SMB160A | P6SMB160CA | 160A | 160C | 136.0 | 152.00 | 168.00 | 1 | 219.0 | 2.74 | 5 |
| P6SMB170A | P6SMB170CA | 170A | 170C | 145.0 | 161.50 | 178.50 | 1 | 234.0 | 2.56 | 5 |
| P6SMB180A | P6SMB180CA | 180A | 180C | 154.0 | 171.00 | 189.00 | 1 | 246.0 | 2.44 | 5 |
| P6SMB200A | P6SMB200CA | 200A | 200C | 171.0 | 190.00 | 210.00 | 1 | 274.0 | 2.19 | 5 |
| P6SMB220A | P6SMB220CA | 220A | 220C | 185.0 | 209.00 | 231.00 | 1 | 328.0 | 1.83 | 5 |
| P6SMB250A | P6SMB250CA | 250A | 250C | 214.0 | 237.50 | 262.50 | 1 | 344.0 | 1.74 | 5 |
| P6SMB300A | P6SMB300CA | 300A | 300C | 256.0 | 285.00 | 315.00 | 1 | 414.0 | 1.45 | 5 |
| P6SMB350A | P6SMB350CA | 350A | 350C | 299.3 | 332.50 | 367.50 | 1 | 482.0 | 1.24 | 5 |
| P6SMB380A | P6SMB380CA | 380A | 380C | 324.9 | 361.00 | 399.00 | 1 | 524.4 | 1.14 | 5 |
| P6SMB400A | P6SMB400CA | 400A | 400C | 342.0 | 380.00 | 420.00 | 1 | 552.0 | 1.09 | 5 |
| P6SMB440A | P6SMB440CA | 440A | 440C | 376.2 | 418.00 | 462.00 | 1 | 607.2 | 0.99 | 5 |
| P6SMB500A | P6SMB500CA | 500A | 500C | 427.5 | 475.00 | 525.00 | 1 | 690.0 | 0.87 | 5 |
| P6SMB520A | P6SMB520CA | 520A | 520C | 444.6 | 494.00 | 546.00 | 1 | 717.6 | 0.84 | 5 |
| P6SMB550A | P6SMB550CA | 550A | 550C | 470.3 | 522.50 | 577.50 | 1 | 759.0 | 0.79 | 5 |
| P6SMB600A | P6SMB600CA | 600A | 600C | 513.0 | 570.00 | 630.00 | 1 | 828.0 | 0.72 | 5 |

Note:

1. Suffix 'A' denotes 5% tolerance device. Without 'A' denotes 10% tolerance device
2. Add suffix 'C' or 'CA' after part number to specify Bi-directional devices
3. For Bi-Directional devices having V_R of 10 volts and under, the I_R limit is double

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

Figure 1 - Peak Pulse Power Rating Curve

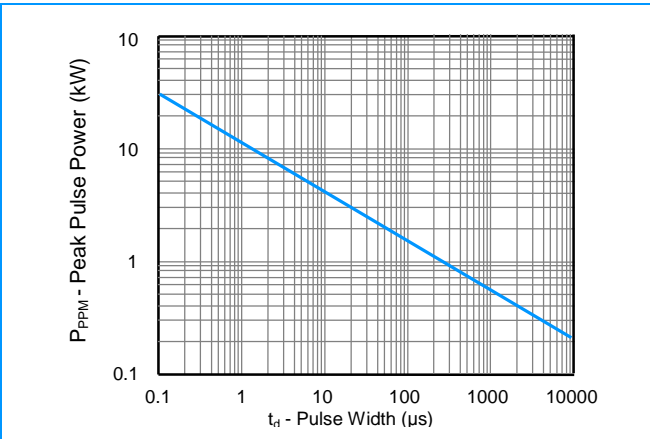


Figure 2 - Pulse Derating Curve

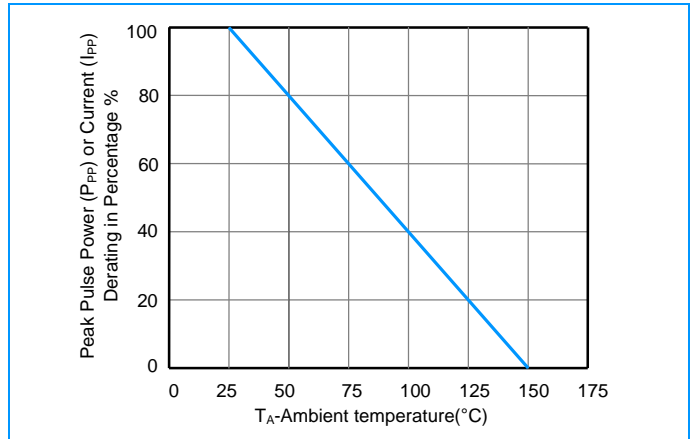


Figure 3 - Pulse Waveform

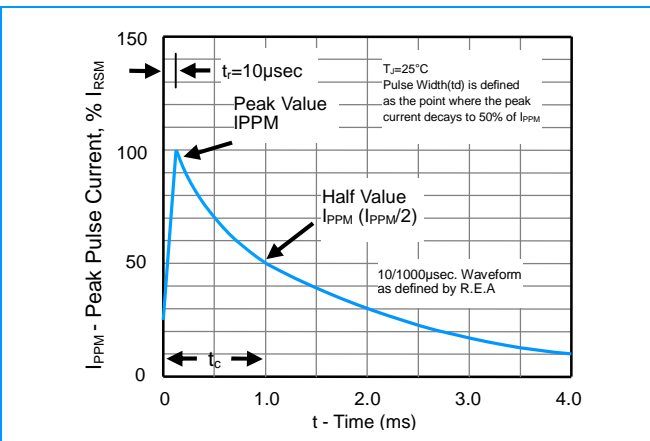


Figure 4 - Typical Junction Capacitance

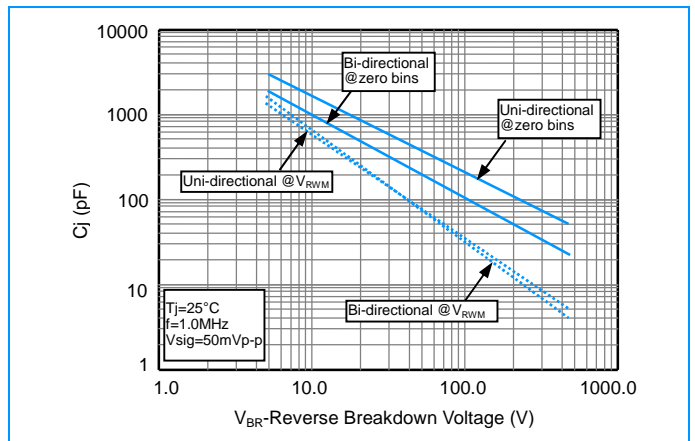


Figure 5 - Steady State Power Derating Curve

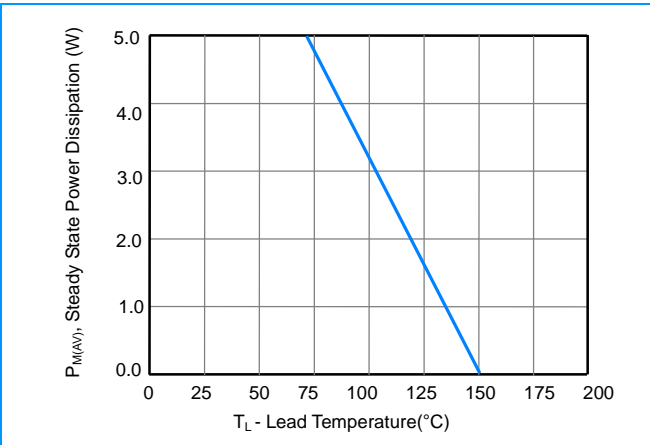
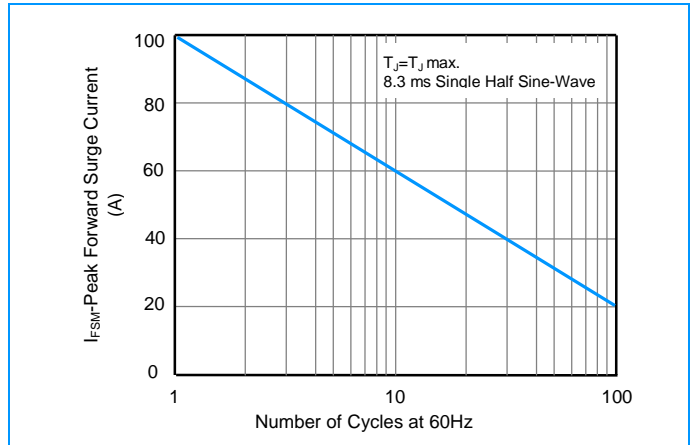


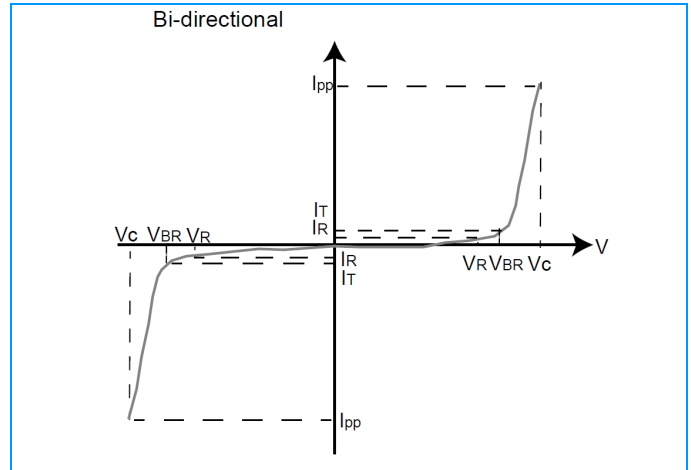
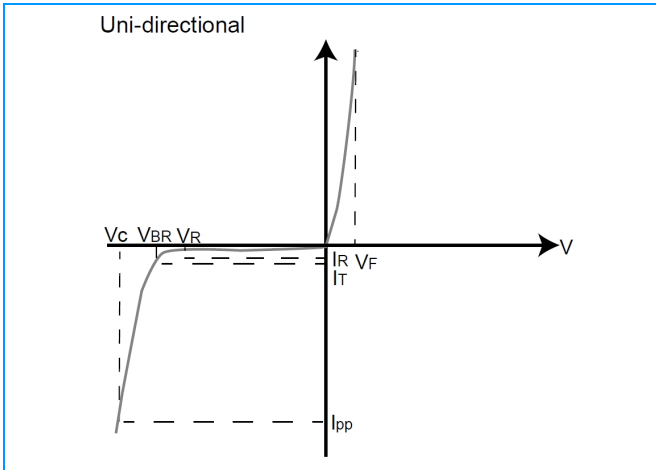
Figure 6 - Maximum Non-Repetitive Surge Current



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I-V Curve Characteristics



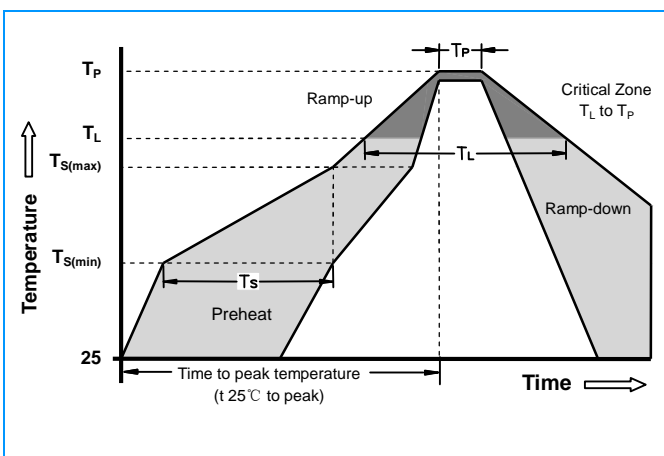
Physical Specifications

| | |
|-----------------|--|
| Weight | 0.003 ounce, 0.093 gram |
| Case | JEDEC DO-214AA Molded Plastic over glass passivated junction |
| Polarity | Color band denotes cathode except Bipolar |
| Terminal | Matte Tin-plated leads, Solderable per JESD22-B102D |

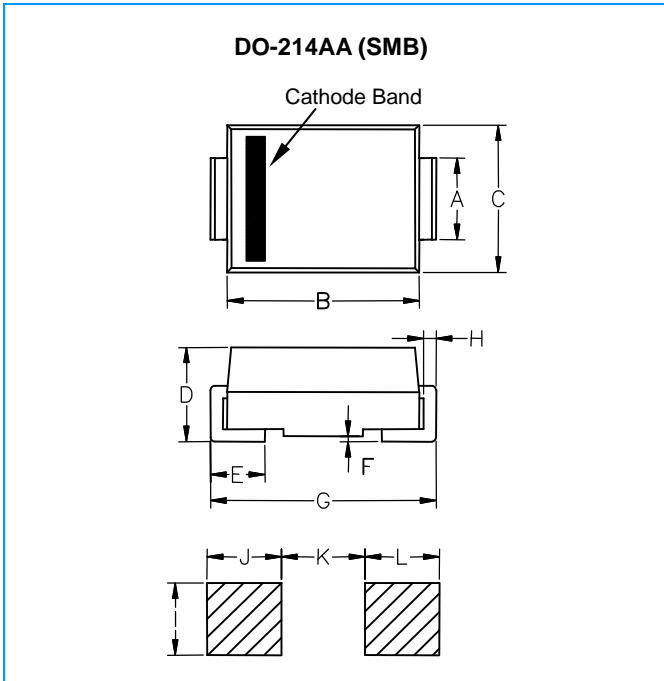
Environmental Specifications

| | |
|---------------------------|-------------|
| Temperature Cycle | JESD22-A104 |
| Pressure Cooker | JESD22-A102 |
| High Temp. Storage | JESD22-A103 |
| HTRB | JESD22-A108 |
| Thermal Shock | JESD22-A106 |

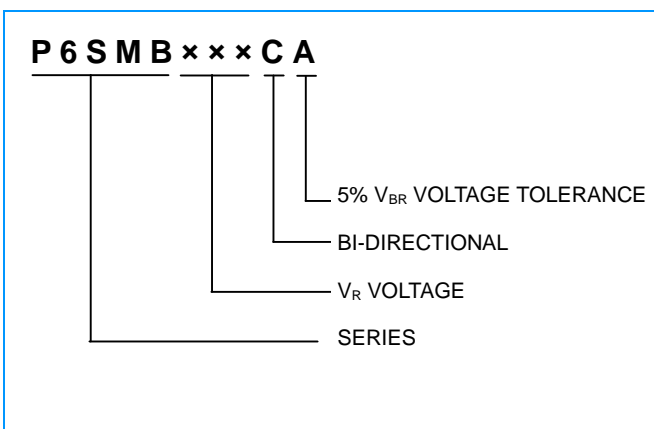
Soldering Parameters



| 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 Seconds |
| 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 +0/-5°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 |

Surface Mount Transient Voltage Suppressors (TVS)
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Dimensions


| Dimensions | Inches | | Millimeters | |
|------------|--------|-------|-------------|-------|
| | Min | Max | Min | Max |
| A | 0.077 | 0.087 | 1.960 | 2.200 |
| B | 0.171 | 0.191 | 4.350 | 4.850 |
| C | 0.130 | 0.155 | 3.300 | 3.940 |
| D | 0.084 | 0.096 | 2.130 | 2.440 |
| E | 0.030 | 0.060 | 0.750 | 1.520 |
| F | - | 0.008 | - | 0.203 |
| G | 0.201 | 0.216 | 5.100 | 5.500 |
| 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


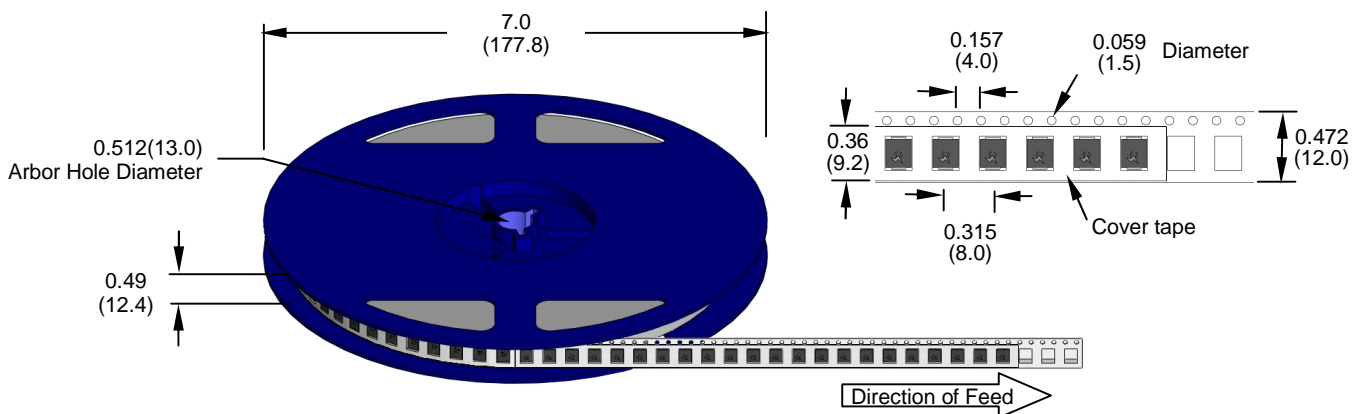
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Packaging

| Part Number | Component Package | Quantity | Packaging Option | Packaging Specification |
|-------------|-------------------|----------|--------------------------|-------------------------|
| P6SMBXXXXX | DO-214AA | 500 | Tape & Reel -12mm/7"tape | EIA STD RS-481 |

Tape and Reel Specifications



Dimensions are in inches
(and millimeters)