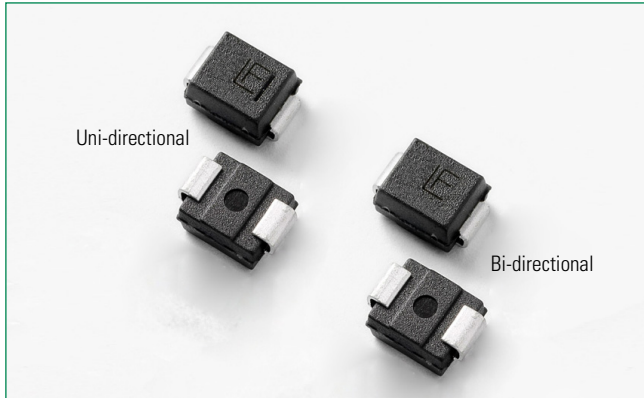




# THE DATASHEET OF TPSMB8.5A-VR



**TPSMB-VR Series**



**Agency Recognitions**

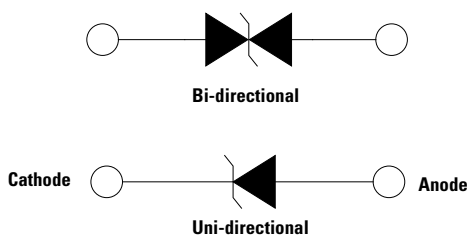
| Agency | Agency File Number |
|--------|--------------------|
|        | E230531            |

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

| Parameter  | Symbol             | Value      | Unit |
|--|--------------------|------------|------|
| Peak Pulse Power Dissipation by 10/1000µs waveform (Fig.1)(Note 1), (Note 2) | P <sub>PPM</sub>   | 600        | W    |
| Power Dissipation on infinite heat sink at T <sub>i</sub> =50°C              | P <sub>M(AV)</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         | V <sub>F</sub>     | 3.5/5      | V    |
| Operating Junction Temperature Range (V <sub>R</sub> ≤ 78V)                  | T <sub>J</sub>     | -65 to 175 | °C   |
| Operating Junction Temperature Range (V <sub>R</sub> > 78V)                  | 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>A</sub> = 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 component only, duty cycle=4 per minute maximum.
  4. VF<3.5V for part number with Vr<250V, VF<5.0V for part numbers with Vr>=250V.

**Functional Diagram**



**Description**

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


**Features**

- High reliability application and automotive grade AEC Q101 qualified
- Surface mount component to minimize board space
- Low profile package
- Typical failure mode is short from over-specified voltage or current
- Whisker test is conducted based on JEDEC JESD201A per its table 4a and 4c
- ESD protection of data lines in accordance with IEC 61000-4-2, 30kV(Air), 30kV (Contact)
- EFT protection of data lines in accordance with IEC 61000-4-4
- Glass passivated chip junction
- 600W peak pulse power capability at 10/1000µs waveform, repetition rate (duty cycles):0.01 %
- Fast response time: typically less than 1.0ns from 0V to V<sub>BR</sub> min
- Excellent clamping capability
- Low incremental surge resistance
- Typical I<sub>r</sub> ≤ 1µA for V<sub>R</sub> > 10V
- High temperature soldering guaranteed: 260°C/10 seconds at terminals
- UL Recognized compound meeting flammability rating V-0.
- Meet MSL level1, per J-STD-020, high temperature soldering guaranteed.
- 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)
- Recognized to UL 497B as an Isolated Loop Circuit Protector

**Applications**

TVS components are ideal for the protection of I/O Interfaces, V<sub>CC</sub> bus and other vulnerable circuits used in Automotive applications.

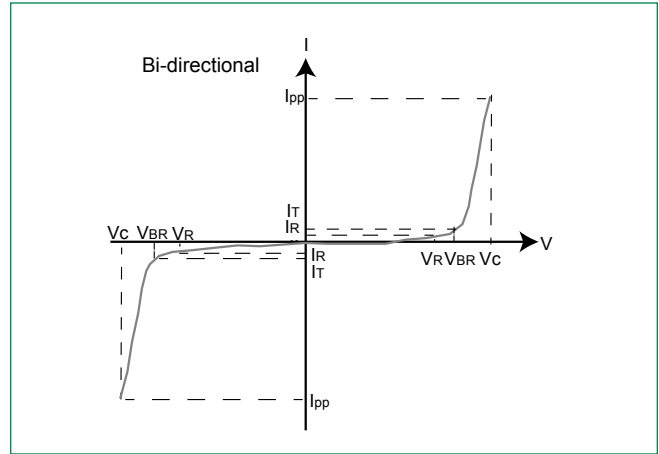
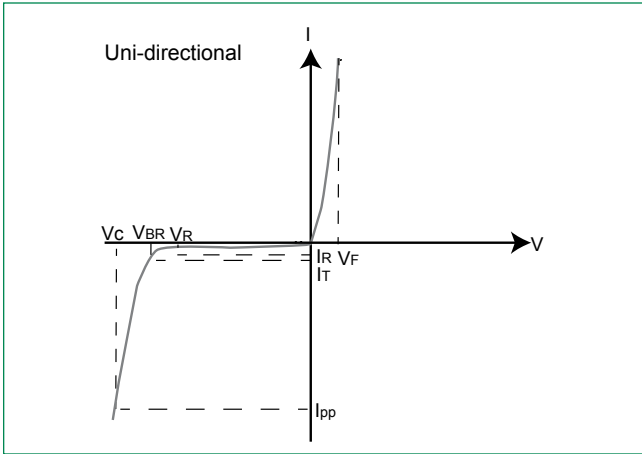
### Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| Part Number (Uni) | Part Number (Bi) | Marking |     | Typical I <sub>R</sub> @ 150°C (μA) | 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) <sup>*</sup> | 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    |                                  |  |  |  |   |   |
| TPSMB6.5A-VR      | -                | KKA     | -   | 500                                 | 6.5  | 7.22   | 7.98   | 10                               | 11.2   | 53.6   | 500  | 0.052   | X   |
| TPSMB70A-VR       | -                | KMA     | -   | 200                                 | 7.0  | 7.78   | 8.60   | 10                               | 12.0   | 50.0   | 200  | 0.058   | X   |
| TPSMB7.5A-VR      | -                | KPA     | -   | 100                                 | 7.5  | 8.33   | 9.21   | 1                                | 12.9   | 46.6   | 100  | 0.061   | X   |
| TPSMB8.0A-VR      | -                | KRA     | -   | 50                                  | 8.0  | 8.89   | 9.83   | 1                                | 13.6   | 44.2   | 50   | 0.064   | X   |
| TPSMB8.5A-VR      | TPSMB8.5CA-VR    | KTA     | ATA | 50                                  | 8.5  | 9.44   | 10.40  | 1                                | 14.4   | 41.7   | 20   | 0.066   | X   |
| TPSMB9.0A-VR      | TPSMB9.0CA-VR    | KVA     | AVA | 20                                  | 9.0  | 10.00  | 11.10  | 1                                | 15.4   | 39.0   | 10   | 0.069   | X   |
| TPSMB10A-VR       | TPSMB10CA-VR     | KXA     | AXA | 8                                   | 10.0   | 11.10  | 12.30  | 1                                | 17.0   | 35.3   | 5  | 0.071   | X   |
| TPSMB11A-VR       | TPSMB11CA-VR     | KZA     | AZA | 8                                   | 11.0   | 12.20  | 13.50  | 1                                | 18.2   | 33.0   | 1  | 0.074   | X   |
| TPSMB12A-VR       | TPSMB12CA-VR     | LEA     | BEA | 8                                   | 12.0   | 13.30  | 14.70  | 1                                | 19.9   | 30.2   | 1  | 0.075   | X   |
| TPSMB13A-VR       | TPSMB13CA-VR     | LGA     | BGA | 8                                   | 13.0   | 14.40  | 15.90  | 1                                | 21.5   | 28.0   | 1  | 0.076   | X   |
| TPSMB14A-VR       | TPSMB14CA-VR     | LKA     | BKA | 8                                   | 14.0   | 15.60  | 17.20  | 1                                | 23.2   | 25.9   | 1  | 0.080   | X   |
| TPSMB15A-VR       | TPSMB15CA-VR     | LMA     | BMA | 8                                   | 15.0   | 16.70  | 18.50  | 1                                | 24.4   | 24.6   | 1  | 0.083   | X   |
| TPSMB16A-VR       | TPSMB16CA-VR     | LPA     | BPA | 8                                   | 16.0   | 17.80  | 19.70  | 1                                | 26.0   | 23.1   | 1  | 0.084   | X   |
| TPSMB17A-VR       | TPSMB17CA-VR     | LRA     | BRA | 8                                   | 17.0   | 18.90  | 20.90  | 1                                | 27.6   | 21.8   | 1  | 0.085   | X   |
| TPSMB18A-VR       | TPSMB18CA-VR     | LTA     | BTA | 8                                   | 18.0   | 20.00  | 22.10  | 1                                | 29.2   | 20.6   | 1  | 0.088   | X   |
| TPSMB20A-VR       | TPSMB20CA-VR     | LVA     | BVA | 8                                   | 20.0   | 22.20  | 24.50  | 1                                | 32.4   | 18.6   | 1  | 0.091   | X   |
| TPSMB22A-VR       | TPSMB22CA-VR     | LXA     | BXA | 8                                   | 22.0   | 24.40  | 26.90  | 1                                | 35.5   | 16.9   | 1  | 0.092   | X   |
| TPSMB24A-VR       | TPSMB24CA-VR     | LZA     | BZA | 8                                   | 24.0   | 26.70  | 29.50  | 1                                | 38.9   | 15.5   | 1  | 0.092   | X   |
| TPSMB26A-VR       | TPSMB26CA-VR     | MEA     | CEA | 8                                   | 26.0   | 28.90  | 31.90  | 1                                | 42.1   | 14.3   | 1  | 0.093   | X   |
| TPSMB28A-VR       | TPSMB28CA-VR     | MGA     | CGA | 8                                   | 28.0   | 31.10  | 34.40  | 1                                | 45.4   | 13.3   | 1  | 0.094   | X   |
| TPSMB30A-VR       | TPSMB30CA-VR     | MKA     | CKA | 8                                   | 30.0   | 33.30  | 36.80  | 1                                | 48.4   | 12.4   | 1  | 0.096   | X   |
| TPSMB33A-VR       | TPSMB33CA-VR     | MMA     | CMA | 8                                   | 33.0   | 36.70  | 40.60  | 1                                | 53.3   | 11.3   | 1  | 0.097   | X   |
| TPSMB36A-VR       | TPSMB36CA-VR     | MPA     | CPA | 8                                   | 36.0   | 40.00  | 44.20  | 1                                | 58.1   | 10.4   | 1  | 0.098   | X   |
| TPSMB40A-VR       | TPSMB40CA-VR     | MRA     | CRA | 8                                   | 40.0   | 44.40  | 49.10  | 1                                | 64.5   | 9.3  | 1  | 0.099   | X   |
| TPSMB43A-VR       | TPSMB43CA-VR     | MTA     | CTA | 8                                   | 43.0   | 47.80  | 52.80  | 1                                | 69.4   | 8.7  | 1  | 0.100   | X   |
| TPSMB45A-VR       | TPSMB45CA-VR     | MVA     | CVA | 8                                   | 45.0   | 50.00  | 55.30  | 1                                | 72.7   | 8.3  | 1  | 0.101   | X   |
| TPSMB48A-VR       | TPSMB48CA-VR     | MXA     | CXA | 8                                   | 48.0   | 53.30  | 58.90  | 1                                | 77.4   | 7.8  | 1  | 0.101   | X   |
| TPSMB51A-VR       | TPSMB51CA-VR     | MZA     | CZA | 8                                   | 51.0   | 56.70  | 62.70  | 1                                | 82.4   | 7.3  | 1  | 0.101   | X   |
| TPSMB54A-VR       | TPSMB54CA-VR     | NEA     | DEA | 8                                   | 54.0   | 60.00  | 66.30  | 1                                | 87.1   | 6.9  | 1  | 0.102   | X   |
| TPSMB58A-VR       | TPSMB58CA-VR     | NGA     | DGA | 8                                   | 58.0   | 64.40  | 71.20  | 1                                | 93.6   | 6.5  | 1  | 0.103   | X   |
| TPSMB60A-VR       | TPSMB60CA-VR     | NKA     | DKA | 8                                   | 60.0   | 66.70  | 73.70  | 1                                | 96.8   | 6.2  | 1  | 0.103   | X   |
| TPSMB64A-VR       | TPSMB64CA-VR     | NMA     | DMA | 8                                   | 64.0   | 71.10  | 78.60  | 1                                | 103.0  | 5.9  | 1  | 0.104   | X   |
| TPSMB70A-VR       | TPSMB70CA-VR     | NPA     | DPA | 8                                   | 70.0   | 77.80  | 86.00  | 1                                | 113.0  | 5.3  | 1  | 0.105   | X   |
| TPSMB75A-VR       | TPSMB75CA-VR     | NRA     | DRA | 8                                   | 75.0   | 83.30  | 92.10  | 1                                | 121.0  | 5.0  | 1  | 0.106   | X   |
| TPSMB78A-VR       | TPSMB78CA-VR     | NTA     | DTA | 8                                   | 78.0   | 86.70  | 95.80  | 1                                | 126.0  | 4.8  | 1  | 0.106   | X   |
| TPSMB85A-VR       | TPSMB85CA-VR     | NVA     | DVA | -                                   | 85.0   | 94.40  | 104.00 | 1                                | 137.0  | 4.4  | 1  | 0.106   | X   |
| TPSMB90A-VR       | TPSMB90CA-VR     | NXA     | DXA | -                                   | 90.0   | 100.00   | 111.00 | 1                                | 146.0  | 4.1  | 1  | 0.107   | X   |
| TPSMB100A-VR      | TPSMB100CA-VR    | NZA     | DZA | -                                   | 100.0  | 111.00   | 123.00 | 1                                | 162.0  | 3.7  | 1  | 0.107   | X   |
| TPSMB110A-VR      | TPSMB110CA-VR    | PEA     | EEA | -                                   | 110.0  | 122.00   | 135.00 | 1                                | 177.0  | 3.4  | 1  | 0.107   | X   |
| TPSMB120A-VR      | TPSMB120CA-VR    | PGA     | EGA | -                                   | 120.0  | 133.00   | 147.00 | 1                                | 193.0  | 3.1  | 1  | 0.108   | X   |
| TPSMB130A-VR      | TPSMB130CA-VR    | PKA     | EKA | -                                   | 130.0  | 144.00   | 159.00 | 1                                | 209.0  | 2.9  | 1  | 0.108   | X   |
| TPSMB150A-VR      | TPSMB150CA-VR    | PMA     | EMA | -                                   | 150.0  | 167.00   | 185.00 | 1                                | 243.0  | 2.5  | 1  | 0.108   | X   |
| TPSMB160A-VR      | TPSMB160CA-VR    | PPA     | EPA | -                                   | 160.0  | 178.00   | 197.00 | 1                                | 259.0  | 2.3  | 1  | 0.108   | X   |
| TPSMB170A-VR      | TPSMB170CA-VR    | PRA     | ERA | -                                   | 170.0  | 189.00   | 209.00 | 1                                | 275.0  | 2.2  | 1  | 0.108   | X   |
| TPSMB180A-VR      | TPSMB180CA-VR    | PTA     | ETA | -                                   | 180.0  | 201.00   | 222.00 | 1                                | 292.0  | 2.1  | 1  | 0.108   | X   |
| TPSMB188A-VR      | TPSMB188CA-VR    | PBA     | EBA | -                                   | 188.0  | 209.00   | 231.00 | 1                                | 304.0  | 2.0  | 1  | 0.110   | X   |
| TPSMB200A-VR      | TPSMB200CA-VR    | PVA     | EVA | -                                   | 200.0  | 224.00   | 247.00 | 1                                | 324.0  | 1.9  | 1  | 0.110   | X   |
| TPSMB220A-VR      | TPSMB220CA-VR    | PXA     | EXA | -                                   | 220.0  | 246.00   | 272.00 | 1                                | 356.0  | 1.7  | 1  | 0.110   | X   |
| TPSMB250A-VR      | TPSMB250CA-VR    | PZA     | EZA | -                                   | 250.0  | 279.00   | 309.00 | 1                                | 405.0  | 1.5  | 1  | 0.110   | X   |
| TPSMB300A-VR      | TPSMB300CA-VR    | QEA     | FEA | -                                   | 300.0  | 335.00   | 371.00 | 1                                | 486.0  | 1.3  | 1  | 0.112   | -   |
| TPSMB350A-VR      | TPSMB350CA-VR    | QGA     | FGA | -                                   | 350.0  | 391.00   | 432.00 | 1                                | 567.0  | 1.1  | 1  | 0.112   | -   |
| TPSMB400A-VR      | TPSMB400CA-VR    | QKA     | FKA | -                                   | 400.0  | 447.00   | 494.00 | 1                                | 648.0  | 0.9  | 1  | 0.112   | -   |
| TPSMB440A-VR      | TPSMB440CA-VR    | QMA     | FMA | -                                   | 440.0  | 492.00   | 543.00 | 1                                | 713.0  | 0.9  | 1  | 0.112   | -   |

**Note:**

For bidirectional type having V<sub>R</sub> of 10 volts and less, the I<sub>R</sub> limit is double.  
 V<sub>BR</sub> @ T<sub>J</sub> = V<sub>BR</sub>@25°C x (1 + αT x (T<sub>J</sub> - 25)) (αT: Temperature Coefficient, typical value is 0.1%)

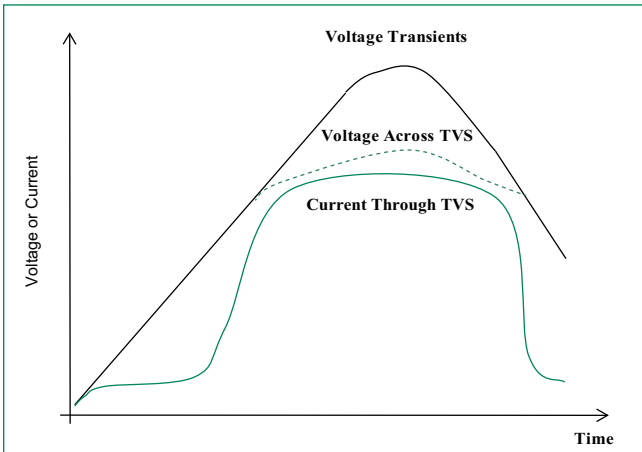
**I-V Curve Characteristics**



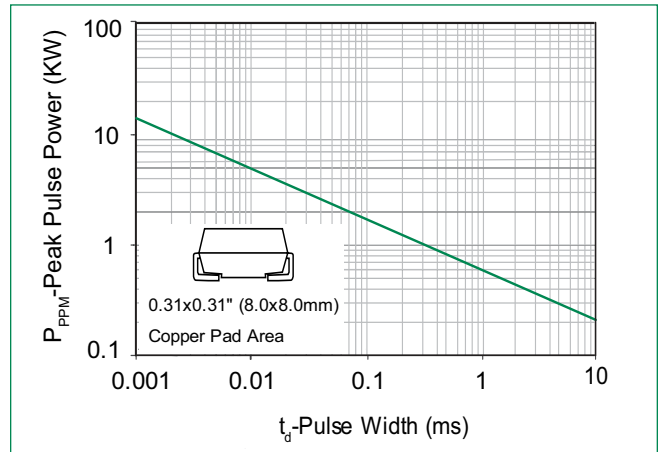
- P<sub>PPM</sub>** Peak Pulse Power Dissipation – Max power dissipation
- V<sub>R</sub>** Stand-off Voltage – Maximum voltage that can be applied to the TVS without operation
- V<sub>BR</sub>** Breakdown Voltage – Maximum voltage that flows thogh the TVS at a specified test current (I<sub>T</sub>)
- 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**



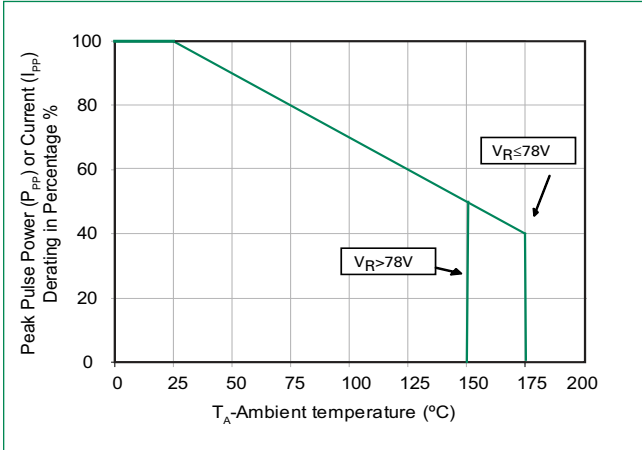
**Figure 2 - Peak Pulse Power Rating Curve**



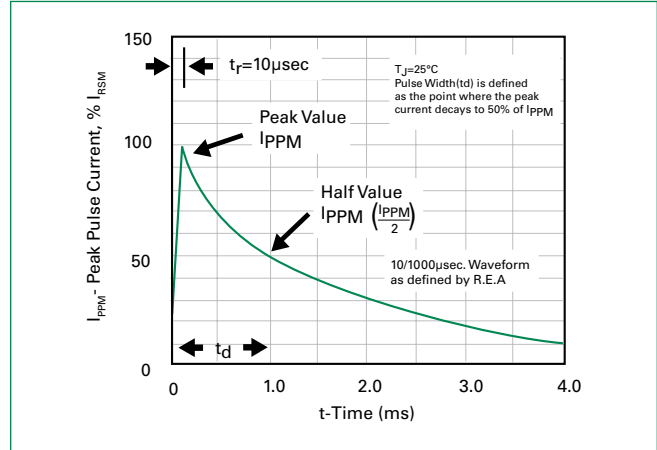
continues on next page.

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

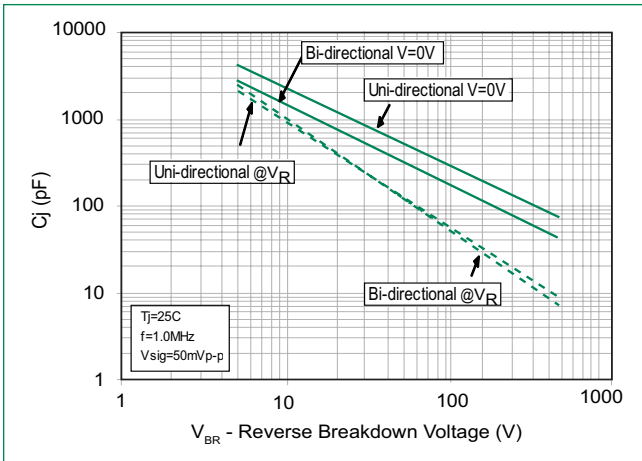
**Figure 3 - Peak Pulse Power Derating Curve**



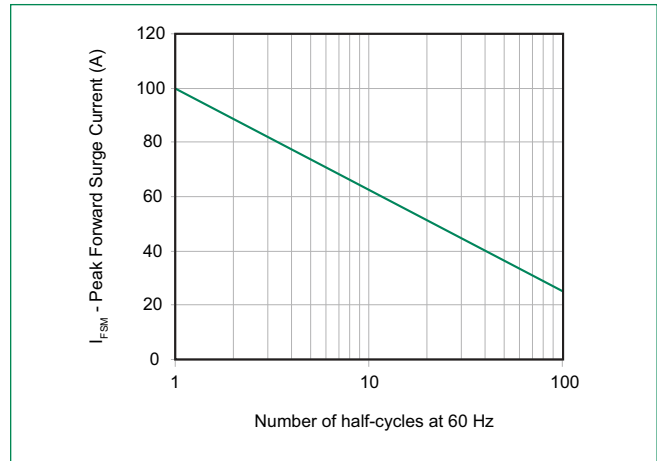
**Figure 4 - Pulse Waveform**



**Figure 5 - Typical Junction Capacitance**

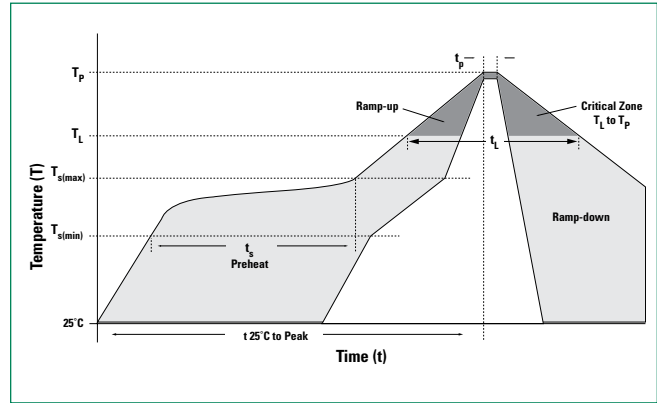


**Figure 6 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only**



**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) ( $t_s$ )      | 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**

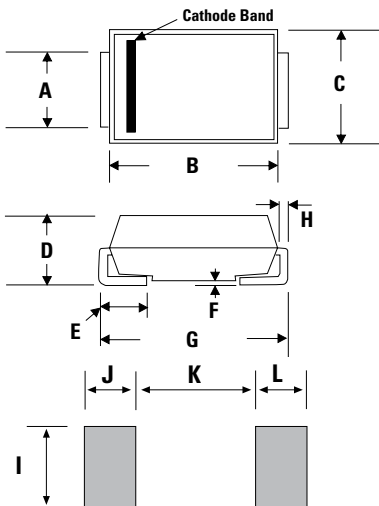
|                 |   |
|-----------------|---|
| <b>Weight</b>   | 0.003 ounce, 0.093 grams  |
| <b>Case</b>     | JEDEC DQ214AA. Molded plastic body over glass passivated junction |
| <b>Polarity</b> | Color band denotes cathode for unidirectional components          |
| <b>Terminal</b> | Matte Tin-plated 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              |

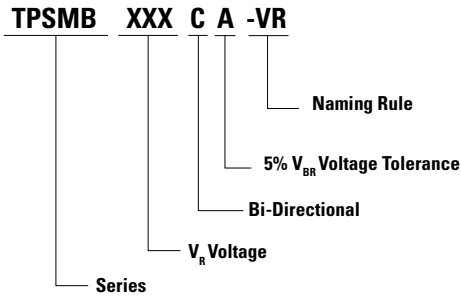
**Dimensions**

D0-214AA (SMB J-Bend)

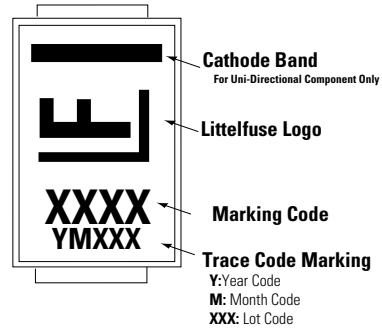


| Dimensions | Inches |       | Millimeters |       |
|------------|--------|-------|-------------|-------|
|            | Min    | Max   | Min         | Max   |
| <b>A</b>   | 0.077  | 0.086 | 1.950       | 2.200 |
| <b>B</b>   | 0.160  | 0.180 | 4.060       | 4.570 |
| <b>C</b>   | 0.130  | 0.155 | 3.300       | 3.940 |
| <b>D</b>   | 0.084  | 0.096 | 2.130       | 2.440 |
| <b>E</b>   | 0.030  | 0.060 | 0.760       | 1.520 |
| <b>F</b>   | -      | 0.008 | -           | 0.203 |
| <b>G</b>   | 0.205  | 0.220 | 5.210       | 5.590 |
| <b>H</b>   | 0.006  | 0.012 | 0.152       | 0.305 |
| <b>I</b>   | 0.089  | -     | 2.260       | -     |
| <b>J</b>   | 0.085  | -     | 2.160       | -     |
| <b>K</b>   | -      | 0.107 | -           | 2.740 |
| <b>L</b>   | 0.085  | -     | 2.160       | -     |

**Part Numbering System**



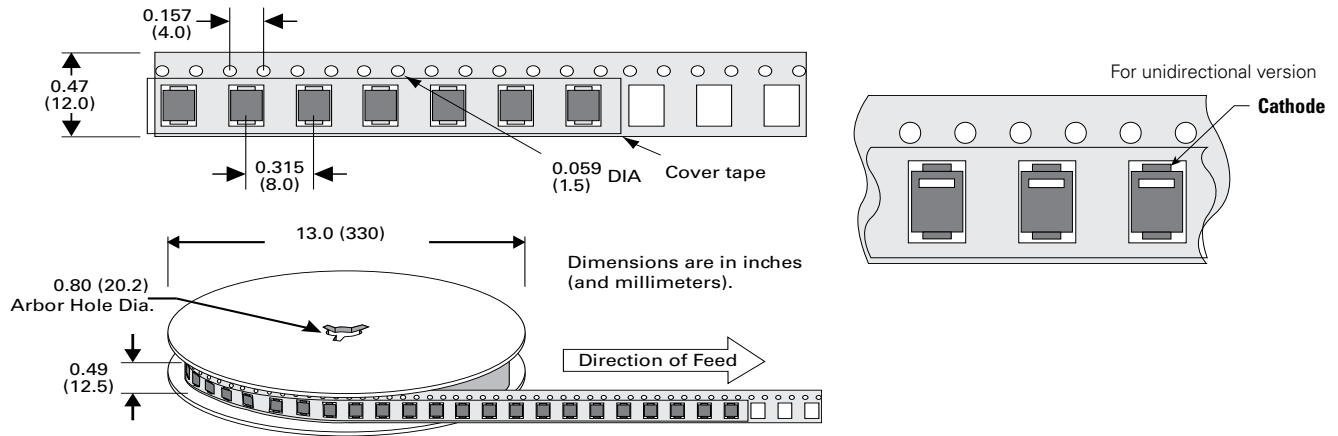
**Part Marking System**



**Packaging**



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

**Tape and Reel Specification**



## Looking for pricing, stock, or lifecycle information?

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