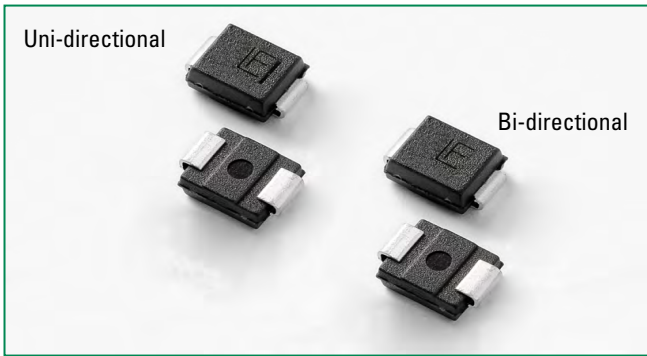


**SMBJ-HR Series**



**Agency Approvals**

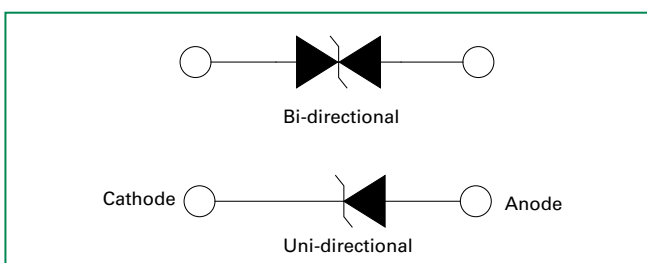
| AGENCY | AGENCY FILE NUMBER |
|--------|--------------------|
|        | E128662/E230531    |

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

| Parameter  | Symbol                            | Value      | Unit |
|--|-----------------------------------|------------|------|
| Peak Pulse Power Dissipation at T <sub>A</sub> =25°C by 10/1000µs Waveform (Fig.2)(Note 1), (Note 2) | P <sub>PPM</sub>                  | 600        | W    |
| Power Dissipation on Infinite Heat Sink at T <sub>A</sub> =50°C                                      | P <sub>MI(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 (Note 4)                        | V <sub>F</sub>                    | 3.5V/5.0   | V    |
| Operating Junction and Storage Temperature Range   | T <sub>J</sub> , T <sub>STG</sub> | -65 to 150 | °C   |
| Typical Thermal Resistance Junction to Lead  | R <sub>WJL</sub>                  | 20         | °C/W |
| Typical Thermal Resistance Junction to Ambient   | R <sub>WJA</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 device only, duty cycle=4 per minute maximum.
  4. V<sub>F</sub><3.5V for V<sub>BR</sub> ≤ 200V and V<sub>F</sub><5.0V for V<sub>BR</sub> ≥ 201V.

**Functional Diagram**



**Description**

The SMBJ-HR High Reliability series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

**Features**

- Excellent clamping capability
- Low incremental surge resistance
- Typical I<sub>r</sub> less than 1µA above 12V
- For surface mounted applications to optimize 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
- IEC-61000-4-2 ESD 15kV(Air), 8kV (Contact)
- ESD protection of data lines in accordance with IEC 61000-4-2 (IEC801-2)
- EFT protection of data lines in accordance with IEC 61000-4-4 (IEC801-4)
- Built-in strain relief
- Fast response time: typically less than 1.0ps from 0V to BV min
- 600W peak pulse power capability at 10/1000µs waveform, repetition rate (duty cycles):0.01 %
- V<sub>BR</sub> @T<sub>J</sub> = V<sub>BR</sub> @25°C x (1 + α T x (T<sub>J</sub> - 25)) (α T:Temperature Coefficient)
- Glass passivated chip junction
- High temperature soldering guaranteed: 260°C/40 seconds at terminals
- Plastic package has underwriters laboratory flammability 94V-O
- Meet MSL level1, per J-STD-020, LF maximum peak of 260°C
- Matte tin lead-free plated
- Halogen free and RoHS compliant
- 2nd level interconnect is Pb-free per IPC/JEDEC J-STD-609A.01

**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.

### 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) | Agency Approval  |
|-------------------|------------------|---------|----|--|--|--------|----------------------------------|---|--|--|---|
|                   |                  | UNI     | BI |  | MIN  | MAX    |                                  |   |  |  |   |
| SMBJ5.0A-HR       | SMBJ5.0CA-HR     | KE      | AE | 5.0  | 6.40   | 7.00   | 10                               | 9.2   | 65.3   | 800  | X   |
| SMBJ6.0A-HR       | SMBJ6.0CA-HR     | KG      | AG | 6.0  | 6.67   | 7.37   | 10                               | 10.3  | 58.3   | 800  | X   |
| SMBJ6.5A-HR       | SMBJ6.5CA-HR     | KK      | AK | 6.5  | 7.22   | 7.98   | 10                               | 11.2  | 53.6   | 500  | X   |
| SMBJ7.0A-HR       | SMBJ7.0CA-HR     | KM      | AM | 7.0  | 7.78   | 8.60   | 10                               | 12.0  | 50.0   | 200  | X   |
| SMBJ7.5A-HR       | SMBJ7.5CA-HR     | KP      | AP | 7.5  | 8.33   | 9.21   | 1                                | 12.9  | 46.6   | 100  | X   |
| SMBJ8.0A-HR       | SMBJ8.0CA-HR     | KR      | AR | 8.0  | 8.89   | 9.83   | 1                                | 13.6  | 44.2   | 50   | X   |
| SMBJ8.5A-HR       | SMBJ8.5CA-HR     | KT      | AT | 8.5  | 9.44   | 10.40  | 1                                | 14.4  | 41.7   | 20   | X   |
| SMBJ9.0A-HR       | SMBJ9.0CA-HR     | KV      | AV | 9.0  | 10.00  | 11.10  | 1                                | 15.4  | 39.0   | 10   | X   |
| SMBJ10A-HR        | SMBJ10CA-HR      | KX      | AX | 10.0   | 11.10  | 12.30  | 1                                | 17.0  | 35.3   | 5  | X   |
| SMBJ11A-HR        | SMBJ11CA-HR      | KZ      | AZ | 11.0   | 12.20  | 13.50  | 1                                | 18.2  | 33.0   | 1  | X   |
| SMBJ12A-HR        | SMBJ12CA-HR      | LE      | BE | 12.0   | 13.30  | 14.70  | 1                                | 19.9  | 30.2   | 1  | X   |
| SMBJ13A-HR        | SMBJ13CA-HR      | LG      | BG | 13.0   | 14.40  | 15.90  | 1                                | 21.5  | 28.0   | 1  | X   |
| SMBJ14A-HR        | SMBJ14CA-HR      | LK      | BK | 14.0   | 15.60  | 17.20  | 1                                | 23.2  | 25.9   | 1  | X   |
| SMBJ15A-HR        | SMBJ15CA-HR      | LM      | BM | 15.0   | 16.70  | 18.50  | 1                                | 24.4  | 24.6   | 1  | X   |
| SMBJ16A-HR        | SMBJ16CA-HR      | LP      | BP | 16.0   | 17.80  | 19.70  | 1                                | 26.0  | 23.1   | 1  | X   |
| SMBJ17A-HR        | SMBJ17CA-HR      | LR      | BR | 17.0   | 18.90  | 20.90  | 1                                | 27.6  | 21.8   | 1  | X   |
| SMBJ18A-HR        | SMBJ18CA-HR      | LT      | BT | 18.0   | 20.00  | 22.10  | 1                                | 29.2  | 20.6   | 1  | X   |
| SMBJ20A-HR        | SMBJ20CA-HR      | LV      | BV | 20.0   | 22.20  | 24.50  | 1                                | 32.4  | 18.6   | 1  | X   |
| SMBJ22A-HR        | SMBJ22CA-HR      | LX      | BX | 22.0   | 24.40  | 26.90  | 1                                | 35.5  | 16.9   | 1  | X   |
| SMBJ24A-HR        | SMBJ24CA-HR      | LZ      | BZ | 24.0   | 26.70  | 29.50  | 1                                | 38.9  | 15.5   | 1  | X   |
| SMBJ26A-HR        | SMBJ26CA-HR      | ME      | CE | 26.0   | 28.90  | 31.90  | 1                                | 42.1  | 14.3   | 1  | X   |
| SMBJ28A-HR        | SMBJ28CA-HR      | MG      | CG | 28.0   | 31.10  | 34.40  | 1                                | 45.4  | 13.3   | 1  | X   |
| SMBJ30A-HR        | SMBJ30CA-HR      | MK      | CK | 30.0   | 33.30  | 36.80  | 1                                | 48.4  | 12.4   | 1  | X   |
| SMBJ33A-HR        | SMBJ33CA-HR      | MM      | CM | 33.0   | 36.70  | 40.60  | 1                                | 53.3  | 11.3   | 1  | X   |
| SMBJ36A-HR        | SMBJ36CA-HR      | MP      | CP | 36.0   | 40.00  | 44.20  | 1                                | 58.1  | 10.4   | 1  | X   |
| SMBJ40A-HR        | SMBJ40CA-HR      | MR      | CR | 40.0   | 44.40  | 49.10  | 1                                | 64.5  | 9.3  | 1  | X   |
| SMBJ43A-HR        | SMBJ43CA-HR      | MT      | CT | 43.0   | 47.80  | 52.80  | 1                                | 69.4  | 8.7  | 1  | X   |
| SMBJ45A-HR        | SMBJ45CA-HR      | MV      | CV | 45.0   | 50.00  | 55.30  | 1                                | 72.7  | 8.3  | 1  | X   |
| SMBJ48A-HR        | SMBJ48CA-HR      | MX      | CX | 48.0   | 53.30  | 58.90  | 1                                | 77.4  | 7.8  | 1  | X   |
| SMBJ51A-HR        | SMBJ51CA-HR      | MZ      | CZ | 51.0   | 56.70  | 62.70  | 1                                | 82.4  | 7.3  | 1  | X   |
| SMBJ54A-HR        | SMBJ54CA-HR      | NE      | DE | 54.0   | 60.00  | 66.30  | 1                                | 87.1  | 6.9  | 1  | X   |
| SMBJ58A-HR        | SMBJ58CA-HR      | NG      | DG | 58.0   | 64.40  | 71.20  | 1                                | 93.6  | 6.5  | 1  | X   |
| SMBJ60A-HR        | SMBJ60CA-HR      | NK      | DK | 60.0   | 66.70  | 73.70  | 1                                | 96.8  | 6.2  | 1  | X   |
| SMBJ64A-HR        | SMBJ64CA-HR      | NM      | DM | 64.0   | 71.10  | 78.60  | 1                                | 103.0   | 5.9  | 1  | X   |
| SMBJ70A-HR        | SMBJ70CA-HR      | NP      | DP | 70.0   | 77.80  | 86.00  | 1                                | 113.0   | 5.3  | 1  | X   |
| SMBJ75A-HR        | SMBJ75CA-HR      | NR      | DR | 75.0   | 83.30  | 92.10  | 1                                | 121.0   | 5.0  | 1  | X   |
| SMBJ78A-HR        | SMBJ78CA-HR      | NT      | DT | 78.0   | 86.70  | 95.80  | 1                                | 126.0   | 4.8  | 1  | X   |
| SMBJ85A-HR        | SMBJ85CA-HR      | NV      | DV | 85.0   | 94.40  | 104.00 | 1                                | 137.0   | 4.4  | 1  | X   |
| -                 | SMBJ90CA-HR      | -       | DX | 90.0   | 100.00   | 111.00 | 1                                | 146.0   | 4.1  | 1  | X   |
| -                 | SMBJ100CA-HR     | -       | DZ | 100.0  | 111.00   | 123.00 | 1                                | 162.0   | 3.7  | 1  | X   |
| -                 | SMBJ110CA-HR     | -       | EE | 110.0  | 122.00   | 135.00 | 1                                | 177.0   | 3.4  | 1  | X   |
| -                 | SMBJ120CA-HR     | -       | EG | 120.0  | 133.00   | 147.00 | 1                                | 193.0   | 3.1  | 1  | X   |
| -                 | SMBJ130CA-HR     | -       | EK | 130.0  | 144.00   | 159.00 | 1                                | 209.0   | 2.9  | 1  | X   |
| -                 | SMBJ150CA-HR     | -       | EM | 150.0  | 167.00   | 185.00 | 1                                | 243.0   | 2.5  | 1  | X   |
| -                 | SMBJ160CA-HR     | -       | EP | 160.0  | 178.00   | 197.00 | 1                                | 259.0   | 2.3  | 1  | X   |
| -                 | SMBJ170CA-HR     | -       | ER | 170.0  | 189.00   | 209.00 | 1                                | 275.0   | 2.2  | 1  | X   |

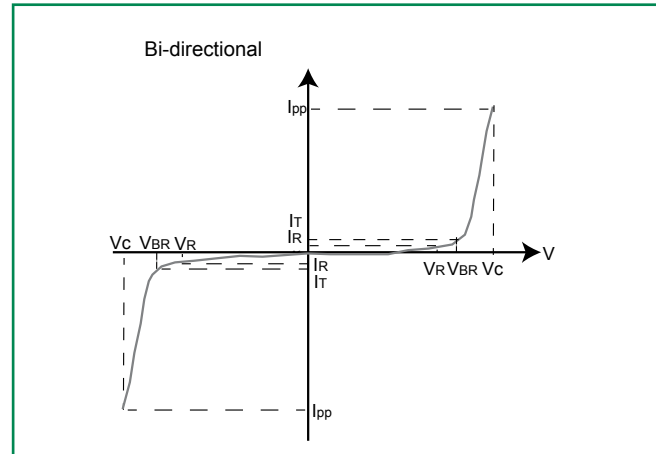
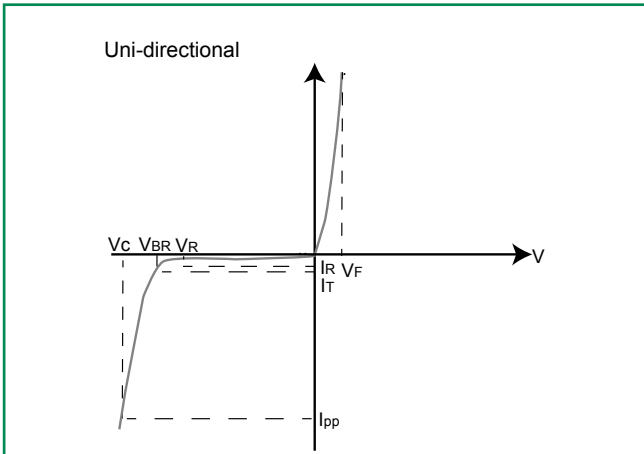
Note:

- For bidirectional type having V<sub>R</sub> of 10 volts and less, the I<sub>R</sub> limit is double.
- 100% High Temperature Storage Life test and Reflow Simulation.
- 100% HTRB(High Temperature Reverse Bias). For Unidirectional, 150°C/100%VR/96hours, for Bidirectional, 150°C/100%VR/192hrs(96hours for each direction for Bidirectional).
- I<sub>R</sub> measured at room temperature +25°C
- Each lot of parts will pass group B test requirement.

**Group B Test Requirement**

| Screen           | Method                              | Condition   | Requirement  |
|------------------|-------------------------------------|---|--|
| Surge test       | 10/1000 $\mu$ s Peak Pluse Waveform | Maximum clamping Voltage ( $V_c$ ) @ Peak Plus Current ( $I_{pp}$ ) | Sample Size 45 perform 10x Accept 0 failures   |
| Burn - In (HTRB) | MIL-STD-750, Method 1038.5          | Applied voltage 100% $V_R$ @ 150°C                                  | Sample size 45<br>340 hours (680 hours for bi-direction products, each direction 340 hours)<br>Accept 0 failures |
| Electrical test  | -                                   | $I_R$ @ $V_R$ , $V_{(BR)}$ @ $I_T$                                  | Sample size 45<br>Accept 0 failures  |

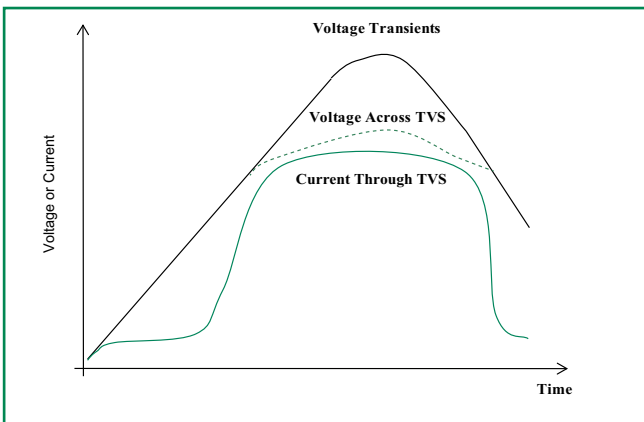
**I-V Curve Characteristics**



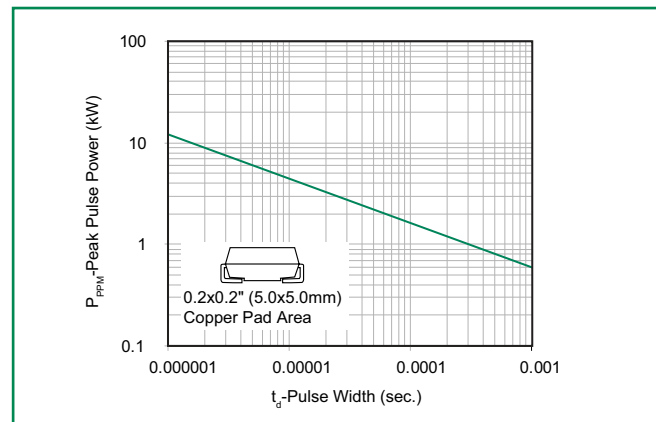
- $P_{PPM}$  Peak Pulse Power Dissipation** – Max power dissipation
- $V_R$  Stand-off Voltage** – Maximum voltage that can be applied to the TVS without operation
- $V_{BR}$  Breakdown Voltage** – Maximum voltage that flows through the TVS at a specified test current ( $I_T$ )
- $V_C$  Clamping Voltage** – Peak voltage measured across the suppressor 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**



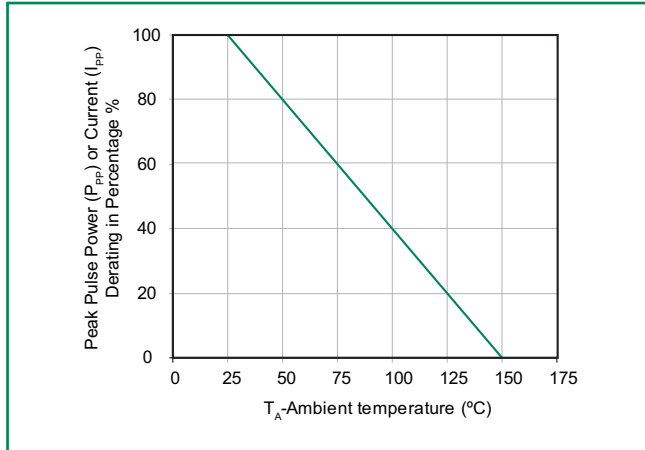
**Figure 2 - Peak Pulse Power Rating**



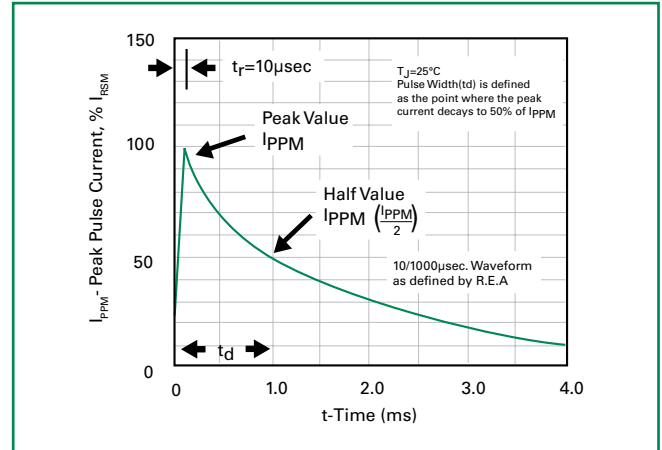
continues on next page.

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

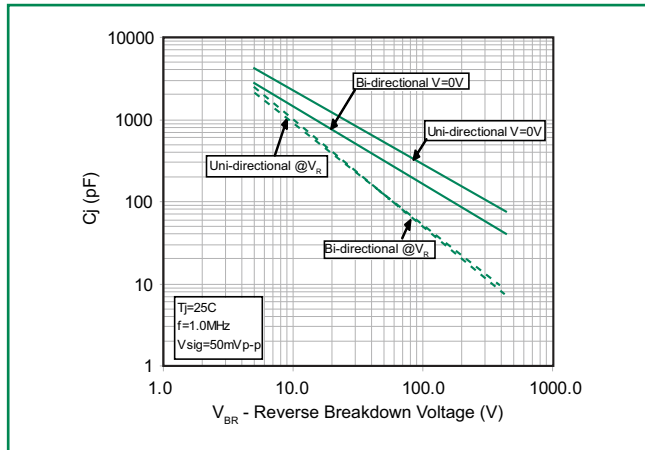
#### Figure 3 - Pulse Derating Curve



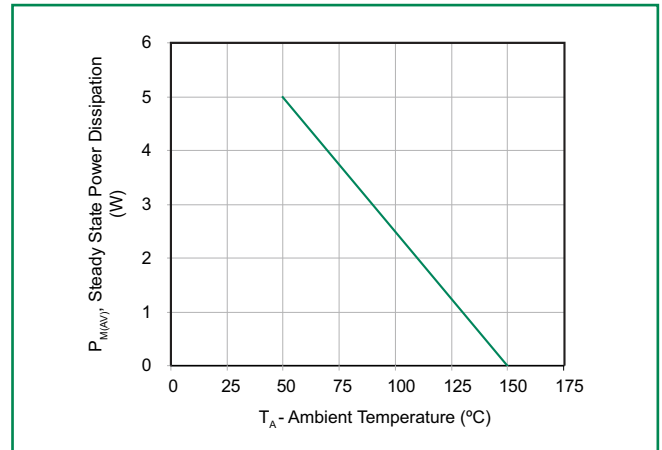
#### Figure 4 - Pulse Waveform



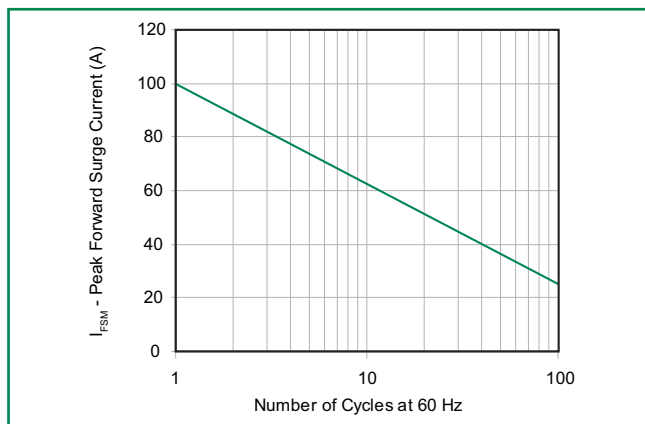
#### Figure 5 - Typical Junction Capacitance



#### Figure 6 - Steady State Power Dissipation Derating Curve

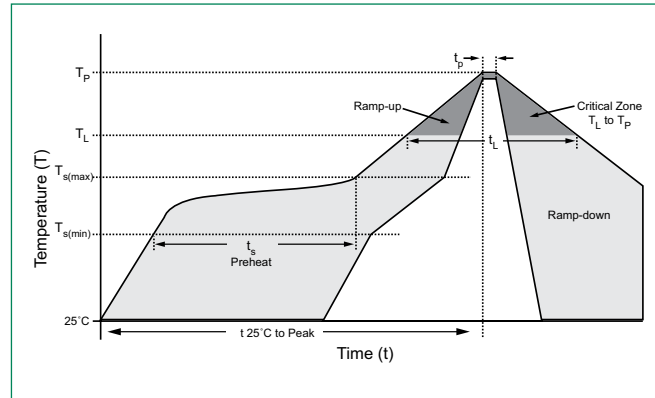


#### Figure 7 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only



**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 secs           |
| 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 <sup>+0/-5</sup> °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                   |



**Physical Specifications**

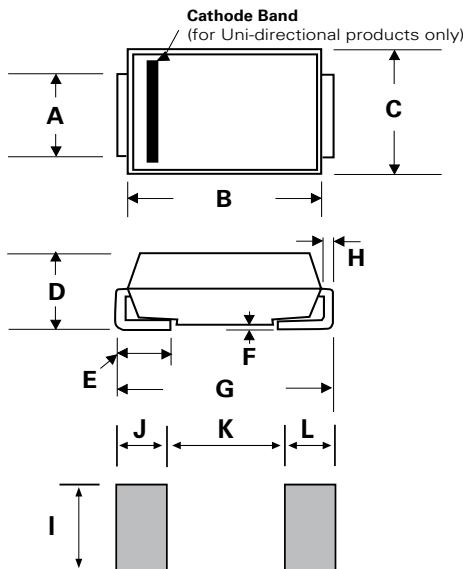
|                 |   |
|-----------------|---|
| <b>Weight</b>   | 0.003 ounce, 0.093 grams  |
| <b>Case</b>     | JEDEC DO214AA. Molded plastic body over glass passivated junction |
| <b>Polarity</b> | Color band denotes cathode except Bidirectional                   |
| <b>Terminal</b> | Matte Tin-plated 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-B106              |

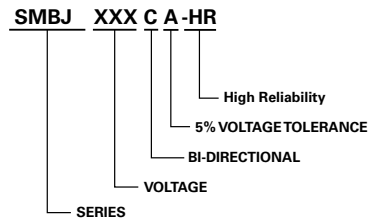
**Dimensions**

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

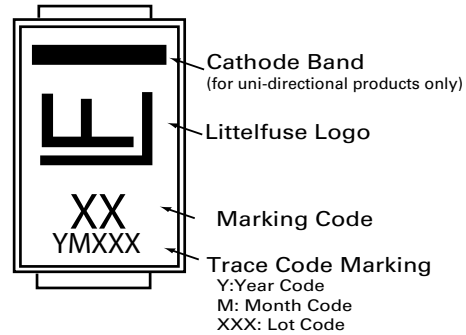


| Dimensions | Inches |       | Millimeters |       |
|------------|--------|-------|-------------|-------|
|            | Min    | Max   | Min         | Max   |
| A          | 0.077  | 0.086 | 1.950       | 2.200 |
| B          | 0.160  | 0.180 | 4.060       | 4.570 |
| C          | 0.130  | 0.155 | 3.300       | 3.940 |
| D          | 0.084  | 0.096 | 2.130       | 2.440 |
| 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 |
|--------------|-------------------|----------|----------------------------------|-------------------------|
| SMBJxxxXX-HR | DO-214AA          | 3000     | Tape & Reel - 12mm tape/13" reel | EIA STD RS-481          |

### Tape and Reel Specification

