

### SMBJ-HR 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 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>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>                    | 3.5V       | 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>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 device only, duty cycle=4 per minute maximum.

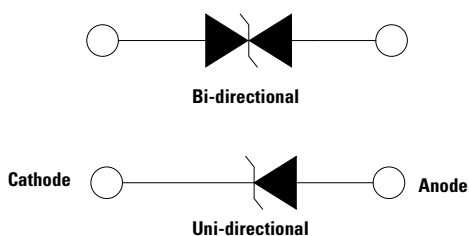
#### Description

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

- 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 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
- 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 BV min
- 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%)
- Glass passivated chip junction
- High temperature soldering guaranteed: 260°C/40 seconds at terminals
- Plastic package is flammability rated V-0 per UL 94
- 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 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.

#### Functional Diagram



#### Applications

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

| Part Number (Uni) | Part Number (Bi) | Marking |    | Reverse Stand off Voltage $V_R$ (Volts) | Breakdown Voltage $V_{BR}$ (Volts) @ $I_T$ |        | Test Current $I_T$ (mA) | Maximum Clamping Voltage $V_C$ @ $I_{PP}$ (V) | Maximum Peak Pulse Current $I_{PP}$ (A) | Maximum Reverse Leakage $I_R$ @ $V_R$ ( $\mu\text{A}$ ) | 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:

- Each lot of parts will pass group B test requirement.

### Screen Process

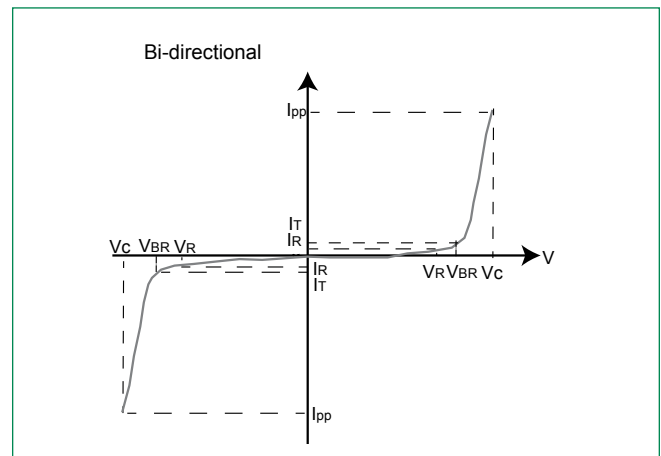
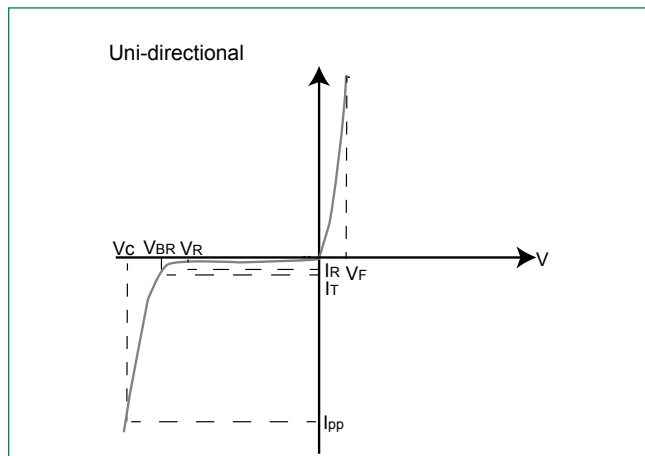
|                                                                                                             |                                   |
|-------------------------------------------------------------------------------------------------------------|-----------------------------------|
| 100% Vision Inspection                                                                                      | MIL-STD-750 method 2074           |
| 100% High Temperature Storage Life (168hrs,175°C)                                                           | MIL-STD-750 method 1031           |
| 100% X-RAY inspection                                                                                       | MIL-STD-750 method 2076           |
| 100% Temperature Cycle Test (-55 to 150°C, 20 cycles, dwell time 15 min)                                    | MIL-STD-750 method 1051           |
| 100% Reflow (2x)                                                                                            | JEDEC J-STD-020                   |
| 100% Surge Test (2x)                                                                                        | MIL-STD-750 method 4066           |
| 100% HTRB 150°C Bias=VR(80% breakdown voltage, 96hrs, and each direction 96hrs for Bi-directional products) | MIL-STD-750 method 1038           |
| Final Electrical Test( 100% 3 sigma limit, 100% dynamic test and PAT limit)                                 | MIL-STD-750 method 4016.4021.4011 |

**Note:** Up-screen program can be specified by customer's request via contacting Littelfuse service

### Group B Test Requirement

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

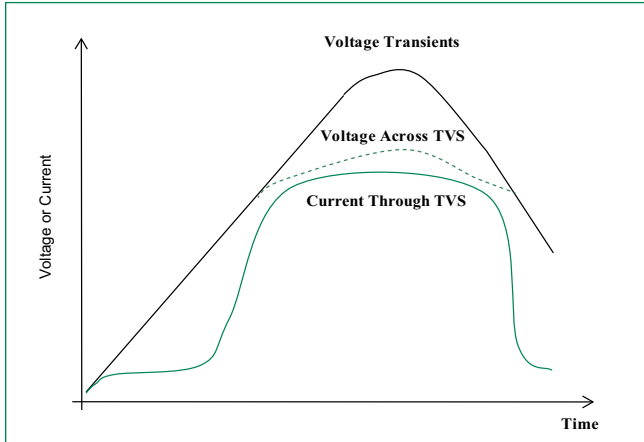
### I-V Curve Characteristics



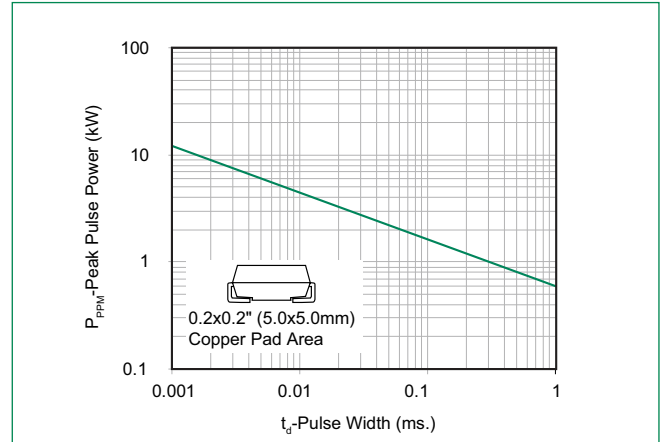
- $P_{PPM}$  Peak Pulse Power Dissipation** – Max power dissipation  
 **$V_R$  Stand-off Voltage** – Maximum voltage that can be applied to the TVS without operation  
 **$V_{BR}$  Breakdown Voltage** – Maximum voltage that flows through the TVS at a specified test current ( $I_T$ )  
 **$V_C$  Clamping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

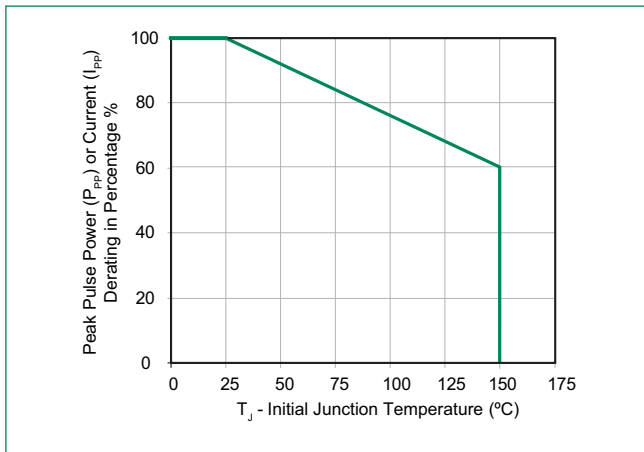
**Figure 1 - TVS Transients Clamping Waveform**



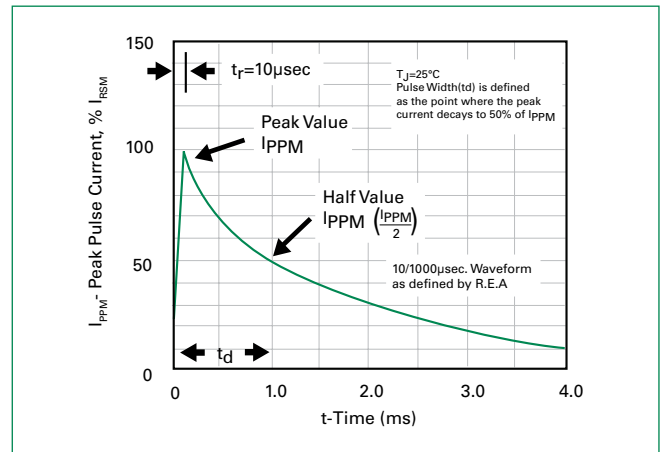
**Figure 2 - Peak Pulse Power Rating**



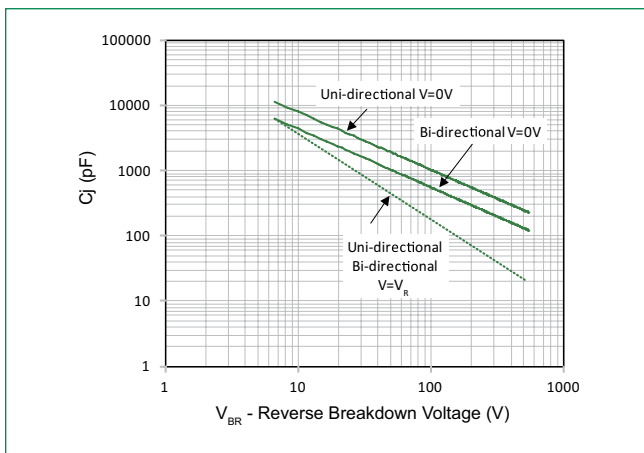
**Figure 3 - Pulse Derating Curve**



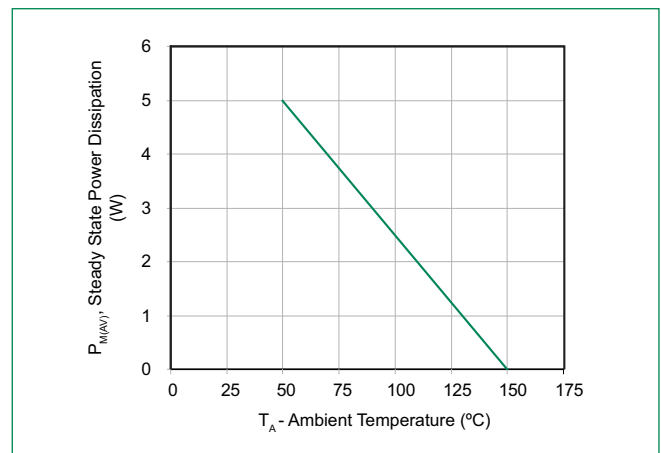
**Figure 4 - Pulse Waveform**



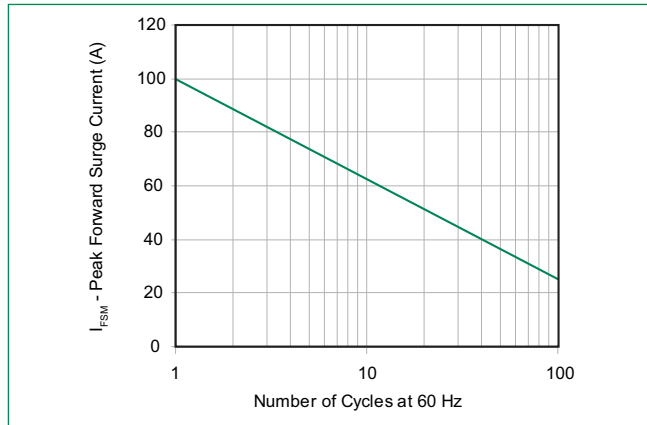
**Figure 5 - Typical Junction Capacitance**



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

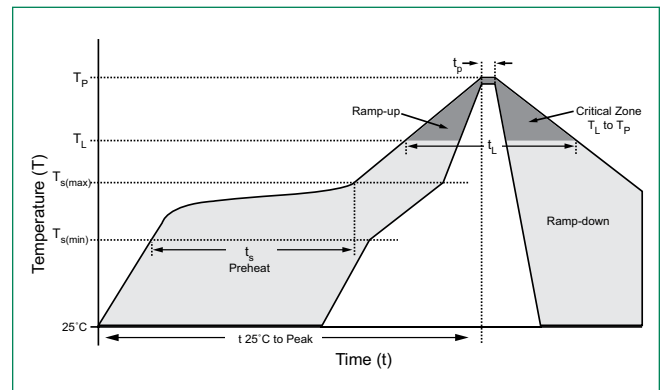


**Figure 7 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only**



## Soldering Parameters

|                                                                        |                                    |                    |
|------------------------------------------------------------------------|------------------------------------|--------------------|
| <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 – 180 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 $^{+0/-5}$ °C  |
| <b>Time within 5°C of actual peak Temperature (<math>t_p</math>)</b>   |                                    | 20 – 40 seconds    |
| <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              |



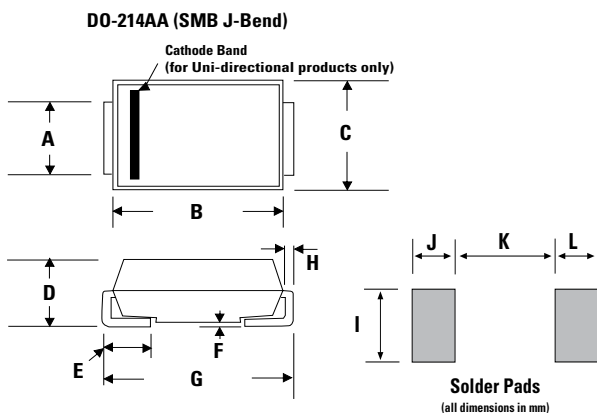
## Physical Specifications

|                 |                                                                   |
|-----------------|-------------------------------------------------------------------|
| <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 Bidirectional                   |
| <b>Terminal</b> | Matte Tin-plated leads, Solderable per JESD22-B102                |

## Environmental Specifications

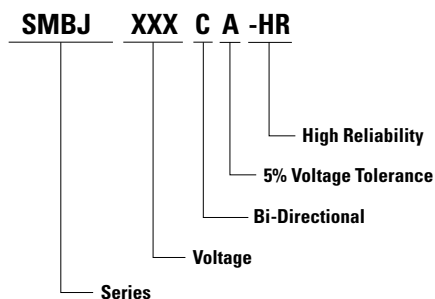
|                            |                          |
|----------------------------|--------------------------|
| <b>High Temp. Storage</b>  | JESD22-A103              |
| <b>HTRB</b>                | JESD22-A108              |
| <b>Temperature Cycling</b> | JESD22-A104              |
| <b>MSL</b>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

### Dimensions

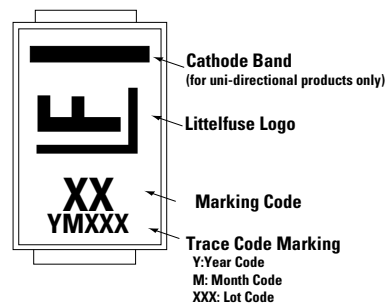


| Dimensions | Inches |       | Millimeters |       |
|------------|--------|-------|-------------|-------|
|            | Min    | Max   | Min         | Max   |
| A          | 0.077  | 0.086 | 1.950       | 2.200 |
| B          | 0.160  | 0.180 | 4.060       | 4.570 |
| C          | 0.130  | 0.155 | 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



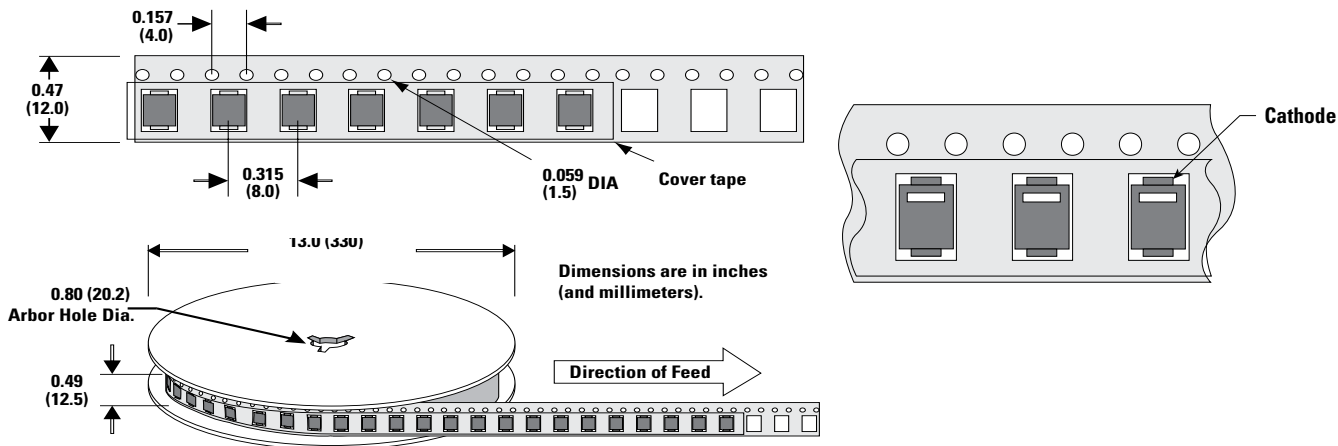
### Part Marking System



### 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



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