

### SMBJ-HRA 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.

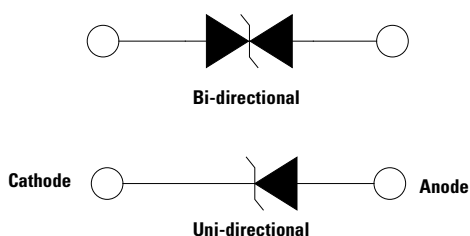
#### Description

The SMBJ-HRA 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<sub>A</sub> = 25°C unless otherwise noted)

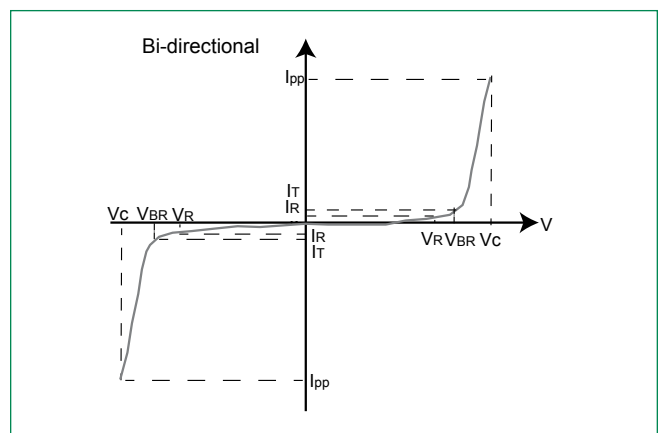
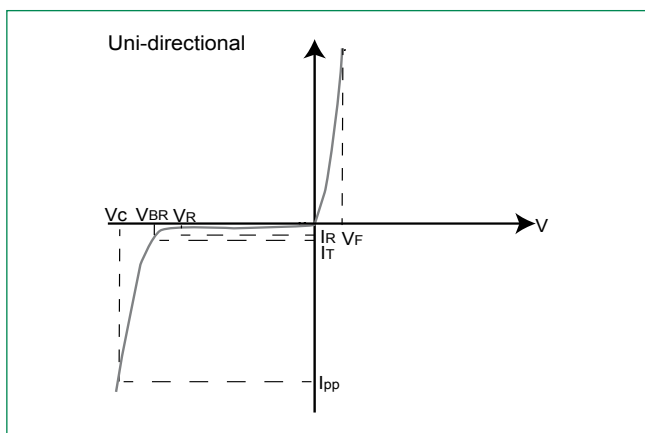
| Part Number (Uni) | Part Number (BI) | Marking |     | Reverse Stand off Voltage V <sub>R</sub> (Volts) | Breakdown Voltage V <sub>BR</sub> (Volts) @ I <sub>T</sub> |        | Test Current I <sub>T</sub> (mA) | Maximum Clamping Voltage V <sub>C</sub> @ I <sub>PP</sub> (V) | Maximum Peak Pulse Current 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-HRA      | SMBJ5.0CA-HRA    | KEH     | AEH | 5.0                                              | 6.40                                                       | 7.00   | 10                               | 9.2                                                           | 65.3                                           | 800                                                          | X                                                                                                   |
| SMBJ6.0A-HRA      | SMBJ6.0CA-HRA    | KGH     | AGH | 6.0                                              | 6.67                                                       | 7.37   | 10                               | 10.3                                                          | 58.3                                           | 800                                                          | X                                                                                                   |
| SMBJ6.5A-HRA      | SMBJ6.5CA-HRA    | KKH     | AKH | 6.5                                              | 7.22                                                       | 7.98   | 10                               | 11.2                                                          | 53.6                                           | 500                                                          | X                                                                                                   |
| SMBJ7.0A-HRA      | SMBJ7.0CA-HRA    | KMH     | AMH | 7.0                                              | 7.78                                                       | 8.60   | 10                               | 12.0                                                          | 50.0                                           | 200                                                          | X                                                                                                   |
| SMBJ7.5A-HRA      | SMBJ7.5CA-HRA    | KPH     | APH | 7.5                                              | 8.33                                                       | 9.21   | 1                                | 12.9                                                          | 46.6                                           | 100                                                          | X                                                                                                   |
| SMBJ8.0A-HRA      | SMBJ8.0CA-HRA    | KRH     | ARH | 8.0                                              | 8.89                                                       | 9.83   | 1                                | 13.6                                                          | 44.2                                           | 50                                                           | X                                                                                                   |
| SMBJ8.5A-HRA      | SMBJ8.5CA-HRA    | KTH     | ATH | 8.5                                              | 9.44                                                       | 10.40  | 1                                | 14.4                                                          | 41.7                                           | 20                                                           | X                                                                                                   |
| SMBJ9.0A-HRA      | SMBJ9.0CA-HRA    | KVH     | AVH | 9.0                                              | 10.00                                                      | 11.10  | 1                                | 15.4                                                          | 39.0                                           | 10                                                           | X                                                                                                   |
| SMBJ10A-HRA       | SMBJ10CA-HRA     | KXH     | AXH | 10.0                                             | 11.10                                                      | 12.30  | 1                                | 17.0                                                          | 35.3                                           | 5                                                            | X                                                                                                   |
| SMBJ11A-HRA       | SMBJ11CA-HRA     | KZH     | AZH | 11.0                                             | 12.20                                                      | 13.50  | 1                                | 18.2                                                          | 33.0                                           | 1                                                            | X                                                                                                   |
| SMBJ12A-HRA       | SMBJ12CA-HRA     | LEH     | BEH | 12.0                                             | 13.30                                                      | 14.70  | 1                                | 19.9                                                          | 30.2                                           | 1                                                            | X                                                                                                   |
| SMBJ13A-HRA       | SMBJ13CA-HRA     | LGH     | BGH | 13.0                                             | 14.40                                                      | 15.90  | 1                                | 21.5                                                          | 28.0                                           | 1                                                            | X                                                                                                   |
| SMBJ14A-HRA       | SMBJ14CA-HRA     | LKH     | BKH | 14.0                                             | 15.60                                                      | 17.20  | 1                                | 23.2                                                          | 25.9                                           | 1                                                            | X                                                                                                   |
| SMBJ15A-HRA       | SMBJ15CA-HRA     | LMH     | BMH | 15.0                                             | 16.70                                                      | 18.50  | 1                                | 24.4                                                          | 24.6                                           | 1                                                            | X                                                                                                   |
| SMBJ16A-HRA       | SMBJ16CA-HRA     | LPH     | BPH | 16.0                                             | 17.80                                                      | 19.70  | 1                                | 26.0                                                          | 23.1                                           | 1                                                            | X                                                                                                   |
| SMBJ17A-HRA       | SMBJ17CA-HRA     | LRH     | BRH | 17.0                                             | 18.90                                                      | 20.90  | 1                                | 27.6                                                          | 21.8                                           | 1                                                            | X                                                                                                   |
| SMBJ18A-HRA       | SMBJ18CA-HRA     | LTH     | BTH | 18.0                                             | 20.00                                                      | 22.10  | 1                                | 29.2                                                          | 20.6                                           | 1                                                            | X                                                                                                   |
| SMBJ20A-HRA       | SMBJ20CA-HRA     | LVH     | BVH | 20.0                                             | 22.20                                                      | 24.50  | 1                                | 32.4                                                          | 18.6                                           | 1                                                            | X                                                                                                   |
| SMBJ22A-HRA       | SMBJ22CA-HRA     | LXH     | BXH | 22.0                                             | 24.40                                                      | 26.90  | 1                                | 35.5                                                          | 16.9                                           | 1                                                            | X                                                                                                   |
| SMBJ24A-HRA       | SMBJ24CA-HRA     | LZH     | BZH | 24.0                                             | 26.70                                                      | 29.50  | 1                                | 38.9                                                          | 15.5                                           | 1                                                            | X                                                                                                   |
| SMBJ26A-HRA       | SMBJ26CA-HRA     | MEH     | CEH | 26.0                                             | 28.90                                                      | 31.90  | 1                                | 42.1                                                          | 14.3                                           | 1                                                            | X                                                                                                   |
| SMBJ28A-HRA       | SMBJ28CA-HRA     | MGH     | CGH | 28.0                                             | 31.10                                                      | 34.40  | 1                                | 45.4                                                          | 13.3                                           | 1                                                            | X                                                                                                   |
| SMBJ30A-HRA       | SMBJ30CA-HRA     | MK H    | CKH | 30.0                                             | 33.30                                                      | 36.80  | 1                                | 48.4                                                          | 12.4                                           | 1                                                            | X                                                                                                   |
| SMBJ33A-HRA       | SMBJ33CA-HRA     | MMH     | CMH | 33.0                                             | 36.70                                                      | 40.60  | 1                                | 53.3                                                          | 11.3                                           | 1                                                            | X                                                                                                   |
| SMBJ36A-HRA       | SMBJ36CA-HRA     | MPH     | CPH | 36.0                                             | 40.00                                                      | 44.20  | 1                                | 58.1                                                          | 10.4                                           | 1                                                            | X                                                                                                   |
| SMBJ40A-HRA       | SMBJ40CA-HRA     | MRH     | CRH | 40.0                                             | 44.40                                                      | 49.10  | 1                                | 64.5                                                          | 9.3                                            | 1                                                            | X                                                                                                   |
| SMBJ43A-HRA       | SMBJ43CA-HRA     | MTH     | CTH | 43.0                                             | 47.80                                                      | 52.80  | 1                                | 69.4                                                          | 8.7                                            | 1                                                            | X                                                                                                   |
| SMBJ45A-HRA       | SMBJ45CA-HRA     | MVH     | CVH | 45.0                                             | 50.00                                                      | 55.30  | 1                                | 72.7                                                          | 8.3                                            | 1                                                            | X                                                                                                   |
| SMBJ48A-HRA       | SMBJ48CA-HRA     | MXH     | CXH | 48.0                                             | 53.30                                                      | 58.90  | 1                                | 77.4                                                          | 7.8                                            | 1                                                            | X                                                                                                   |
| SMBJ51A-HRA       | SMBJ51CA-HRA     | MZH     | CZH | 51.0                                             | 56.70                                                      | 62.70  | 1                                | 82.4                                                          | 7.3                                            | 1                                                            | X                                                                                                   |
| SMBJ54A-HRA       | SMBJ54CA-HRA     | NEH     | DEH | 54.0                                             | 60.00                                                      | 66.30  | 1                                | 87.1                                                          | 6.9                                            | 1                                                            | X                                                                                                   |
| SMBJ58A-HRA       | SMBJ58CA-HRA     | NGH     | DGH | 58.0                                             | 64.40                                                      | 71.20  | 1                                | 93.6                                                          | 6.5                                            | 1                                                            | X                                                                                                   |
| SMBJ60A-HRA       | SMBJ60CA-HRA     | NKH     | DKH | 60.0                                             | 66.70                                                      | 73.70  | 1                                | 96.8                                                          | 6.2                                            | 1                                                            | X                                                                                                   |
| SMBJ64A-HRA       | SMBJ64CA-HRA     | NMH     | DMH | 64.0                                             | 71.10                                                      | 78.60  | 1                                | 103.0                                                         | 5.9                                            | 1                                                            | X                                                                                                   |
| SMBJ70A-HRA       | SMBJ70CA-HRA     | NPH     | DPH | 70.0                                             | 77.80                                                      | 86.00  | 1                                | 113.0                                                         | 5.3                                            | 1                                                            | X                                                                                                   |
| SMBJ75A-HRA       | SMBJ75CA-HRA     | NRH     | DRH | 75.0                                             | 83.30                                                      | 92.10  | 1                                | 121.0                                                         | 5.0                                            | 1                                                            | X                                                                                                   |
| SMBJ78A-HRA       | SMBJ78CA-HRA     | NTH     | DTH | 78.0                                             | 86.70                                                      | 95.80  | 1                                | 126.0                                                         | 4.8                                            | 1                                                            | X                                                                                                   |
| SMBJ85A-HRA       | SMBJ85CA-HRA     | NVH     | DVH | 85.0                                             | 94.40                                                      | 104.00 | 1                                | 137.0                                                         | 4.4                                            | 1                                                            | X                                                                                                   |
| -                 | SMBJ90CA-HRA     | -       | DXH | 90.0                                             | 100.00                                                     | 111.00 | 1                                | 146.0                                                         | 4.1                                            | 1                                                            | X                                                                                                   |
| -                 | SMBJ100CA-HRA    | -       | DZH | 100.0                                            | 111.00                                                     | 123.00 | 1                                | 162.0                                                         | 3.7                                            | 1                                                            | X                                                                                                   |
| -                 | SMBJ110CA-HRA    | -       | EEH | 110.0                                            | 122.00                                                     | 135.00 | 1                                | 177.0                                                         | 3.4                                            | 1                                                            | X                                                                                                   |
| -                 | SMBJ120CA-HRA    | -       | EGH | 120.0                                            | 133.00                                                     | 147.00 | 1                                | 193.0                                                         | 3.1                                            | 1                                                            | X                                                                                                   |
| -                 | SMBJ130CA-HRA    | -       | EKH | 130.0                                            | 144.00                                                     | 159.00 | 1                                | 209.0                                                         | 2.9                                            | 1                                                            | X                                                                                                   |
| -                 | SMBJ150CA-HRA    | -       | EMH | 150.0                                            | 167.00                                                     | 185.00 | 1                                | 243.0                                                         | 2.5                                            | 1                                                            | X                                                                                                   |
| -                 | SMBJ160CA-HRA    | -       | EPH | 160.0                                            | 178.00                                                     | 197.00 | 1                                | 259.0                                                         | 2.3                                            | 1                                                            | X                                                                                                   |
| -                 | SMBJ170CA-HRA    | -       | ERH | 170.0                                            | 189.00                                                     | 209.00 | 1                                | 275.0                                                         | 2.2                                            | 1                                                            | X                                                                                                   |

### 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

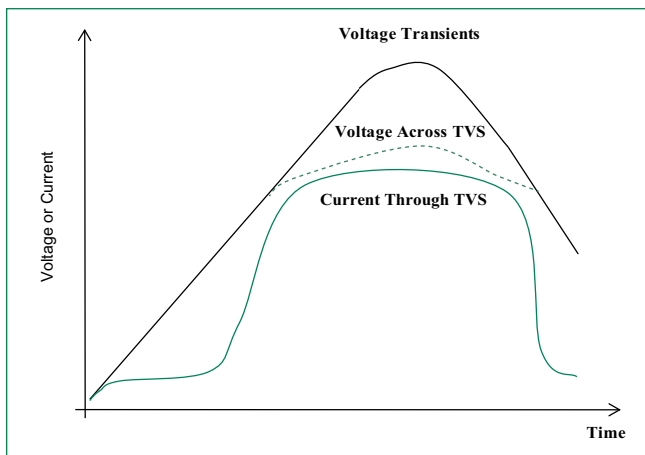
### I-V Curve Characteristics



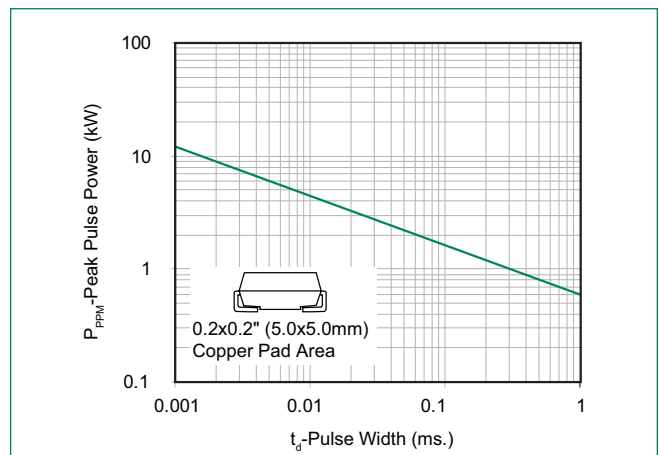
**P<sub>PPM</sub>** Peak Pulse Power Dissipation – Max power dissipation  
**V<sub>R</sub>** Stand-off Voltage – Maximum voltage that can be applied to the TVS without operation  
**V<sub>BR</sub>** Breakdown Voltage – Maximum voltage that flows through the TVS at a specified test current (I<sub>T</sub>)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

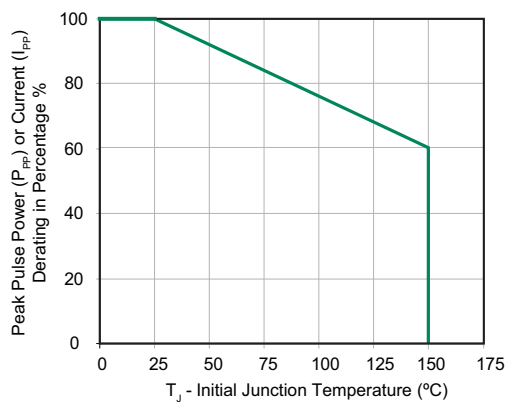


**Figure 2 - Peak Pulse Power Rating**

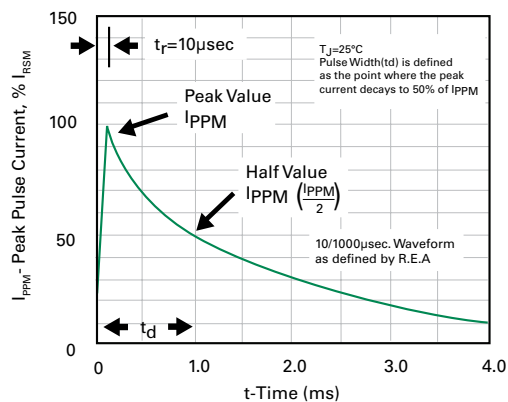


### Ratings and Characteristic Curves ( $T_A=25^\circ\text{C}$ unless otherwise noted) (Continued)

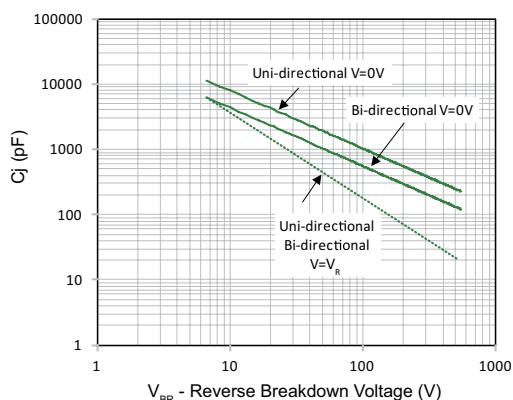
**Figure 3 - Pulse Derating Curve**



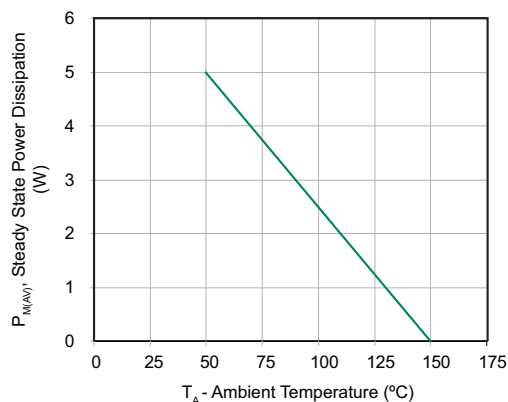
**Figure 4 - Pulse Waveform**



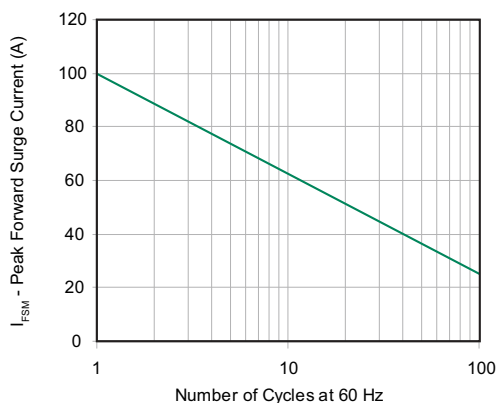
**Figure 5 - Typical Junction Capacitance**



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

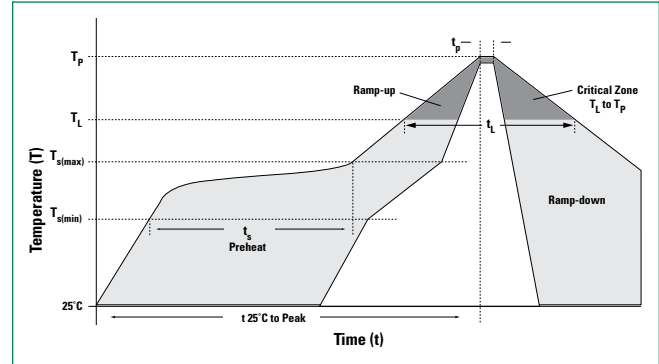


**Figure 7 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only**



### 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                                         |                                    | 260°C                   |



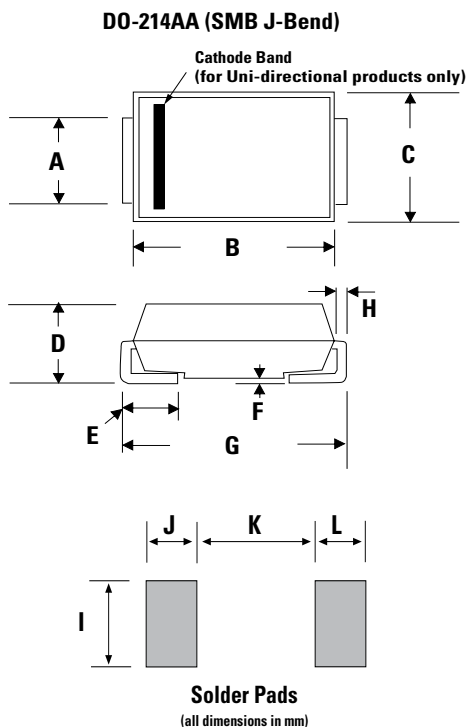
### Physical Specifications

|          |                                                                   |
|----------|-------------------------------------------------------------------|
| Weight   | 0.003 ounce, 0.093 grams                                          |
| Case     | JEDEC DO214AA. Molded plastic body over glass passivated junction |
| Polarity | Color band denotes cathode except Bidirectional                   |
| Terminal | Matte Tin-plated leads, Solderable per JESD22-B102                |

### Environmental Specifications

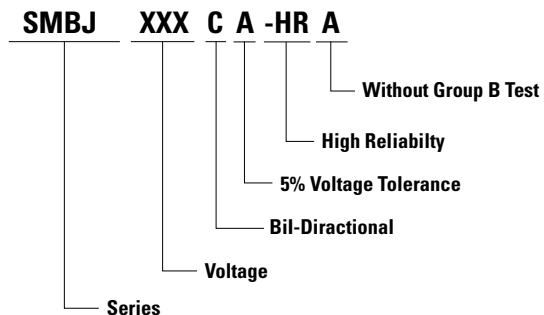
|                     |                          |
|---------------------|--------------------------|
| High Temp. Storage  | JESD22-A103              |
| HTRB                | JESD22-A108              |
| Temperature Cycling | JESD22-A104              |
| MSL                 | JEDEC-J-STD-020, Level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

### Dimensions

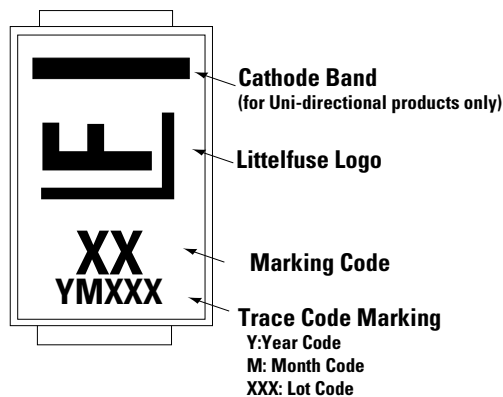


| Dimensions | Inches |       | Millimeters |       |
|------------|--------|-------|-------------|-------|
|            | Min    | Max   | Min         | Max   |
| A          | 0.077  | 0.086 | 1.950       | 2.200 |
| B          | 0.160  | 0.180 | 4.060       | 4.570 |
| C          | 0.130  | 0.155 | 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-HRA | DO-214AA          | 3000     | Tape & Reel - 12mm tape/13" reel | EIA STD RS-481          |

### Tape and Reel Specification

