

SMBJ-HRA Series



Agency Approvals

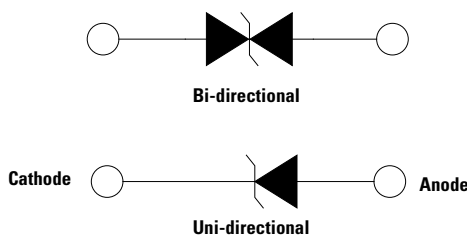
| Agency | Agency File Number |
|--------|--------------------|
| | E230531 |

**Maximum Ratings and Thermal Characteristics
(T_A = 25°C unless otherwise noted)**

| Parameter | Symbol | Value | Unit |
|---|-----------------------------------|------------|------|
| Peak Pulse Power Dissipation at T _A = 25°C by 10/1000µs Waveform (Fig.2)(Note 1), (Note 2) | P _{PPM} | 600 | W |
| Power Dissipation on Infinite Heat Sink at T _A = 50°C | P _{M(AV)} | 5.0 | W |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3) | I _{FSM} | 100 | A |
| Maximum Instantaneous Forward Voltage at 50A for Unidirectional Only | V _F | 3.5V | V |
| Operating Junction and Storage Temperature Range | T _J , T _{STG} | -65 to 150 | °C |
| Typical Thermal Resistance Junction to Lead | R _{θJL} | 20 | °C/W |
| Typical Thermal Resistance Junction to Ambient | R _{θJA} | 100 | °C/W |

Notes:
 1. Non-repetitive current pulse per Fig. 4 and derated above T_A = 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.

Functional Diagram



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_R 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_{BR} @ T_J = V_{BR} @ 25°C x (1 + αT x (T_J - 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."

Applications

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

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

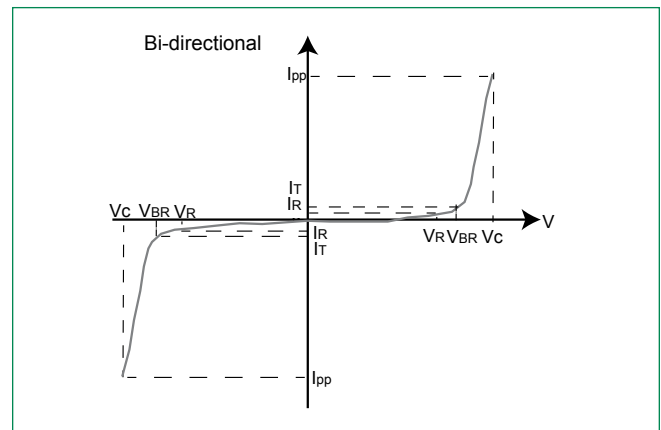
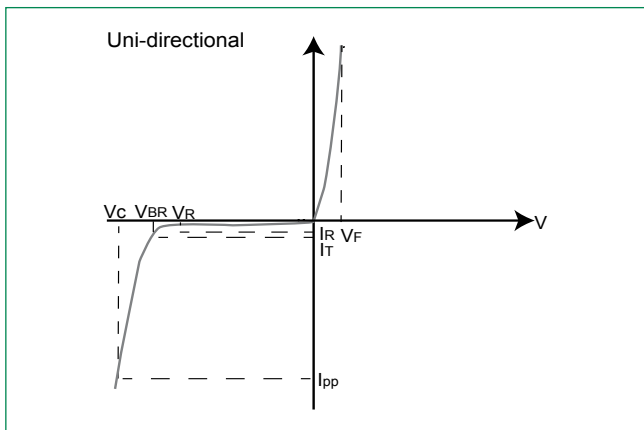
| Part Number (Uni) | Part Number (Bi) | Marking | | Reverse Stand off Voltage V_R (Volts) | Breakdown Voltage V_{BR} (Volts) @ I_T | | Test Current I_T (mA) | Maximum Clamping Voltage V_C @ I_{PP} (V) | Maximum Peak Pulse Current I_{PP} (A) | Maximum Reverse Leakage I_R @ V_R (μA) | Agency Approval  |
|-------------------|------------------|---------|-----|---|--|--------|-------------------------|---|---|---|---|
| | | 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_{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°C unless otherwise noted)

Figure 1 - TVS Transients Clamping Waveform

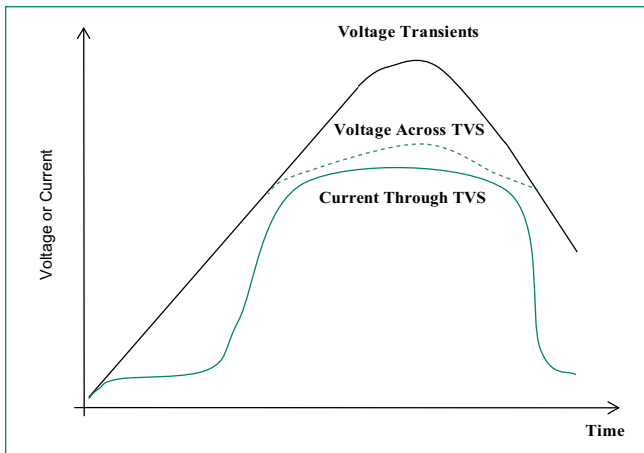
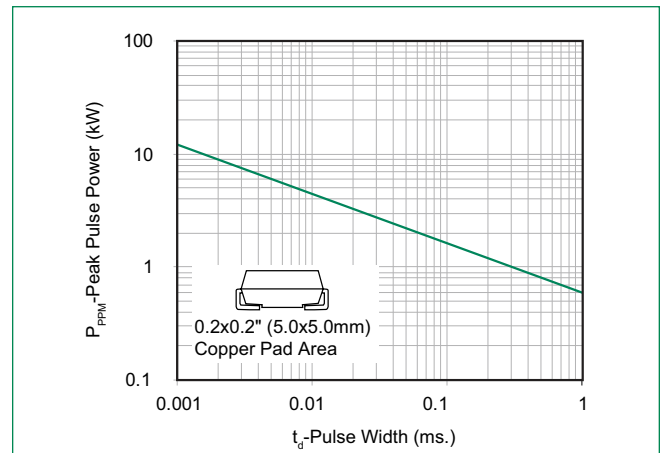


Figure 2 - Peak Pulse Power Rating



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

Figure 3 - Pulse Derating Curve

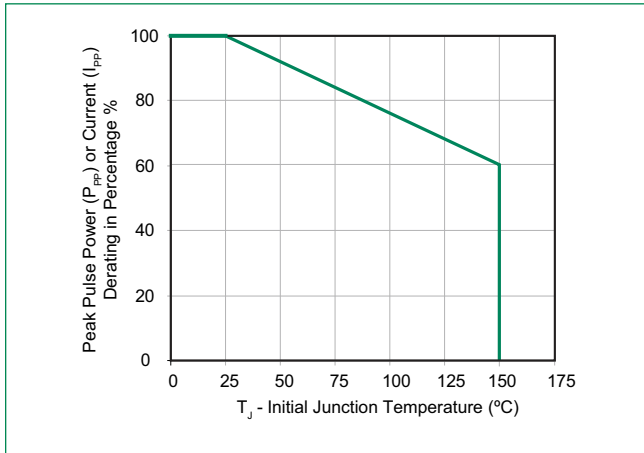


Figure 4 - Pulse Waveform

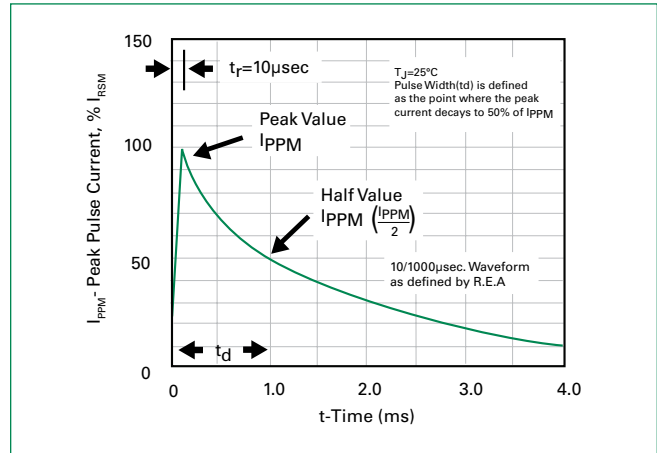


Figure 5 - Typical Junction Capacitance

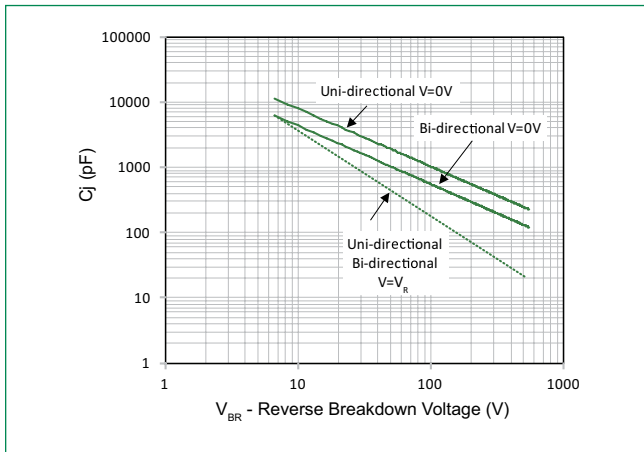


Figure 6 - Steady State Power Dissipation Derating Curve

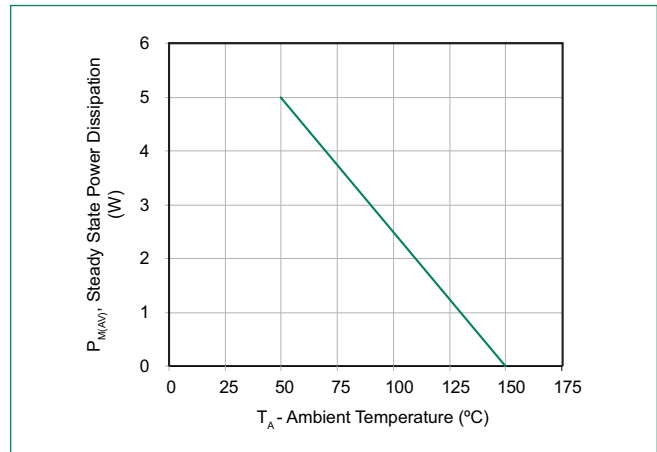
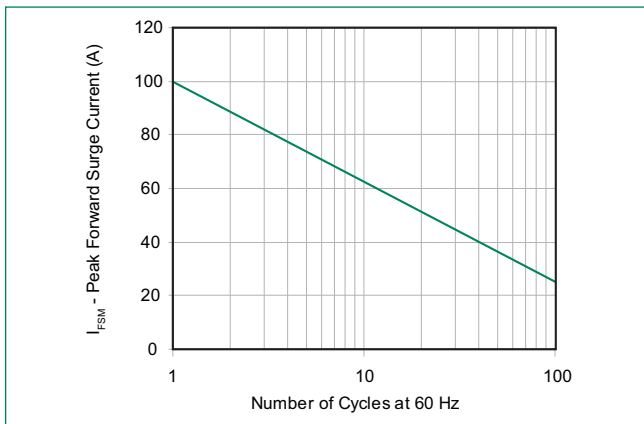
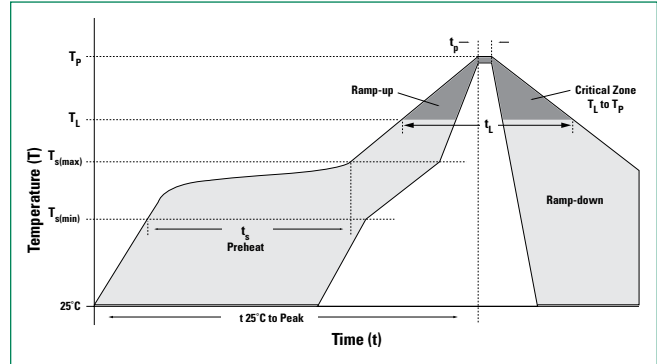


Figure 7 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only



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 ^{+0/-5} °C |
| Time within 5°C of actual peak Temperature (t_p) | | 20 – 40 seconds |
| Ramp-down Rate | | 6°C/second max |
| Time 25°C to peak Temperature (T_p) | | 8 minutes Max. |
| Do not exceed | | 260°C |



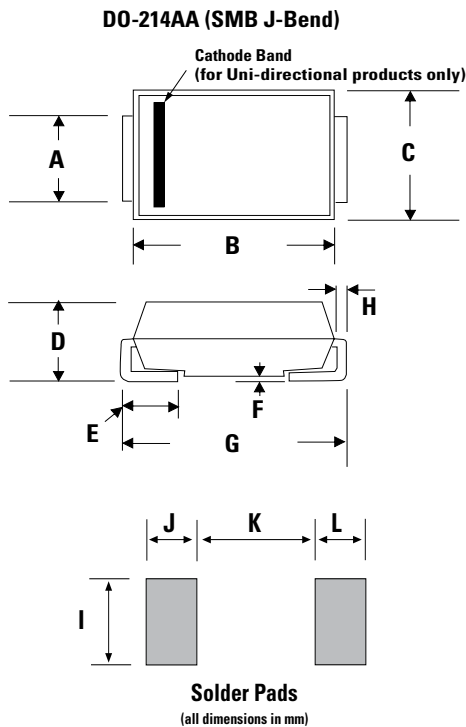
Physical Specifications

| | |
|-----------------|---|
| 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

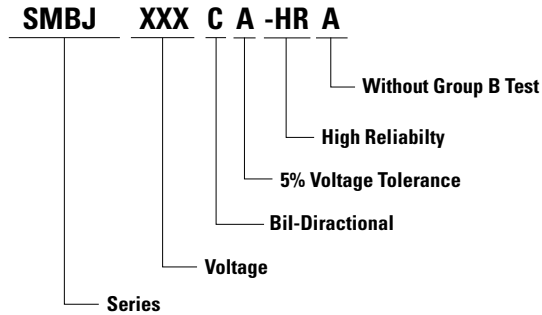
| | |
|----------------------------|--------------------------|
| High Temp. Storage | JESD22-A103 |
| HTRB | JESD22-A108 |
| Temperature Cycling | JESD22-A104 |
| MSL | JEDEC-J-STD-020, Level 1 |
| H3TRB | JESD22-A101 |
| RSH | JESD22-A111 |

Dimensions

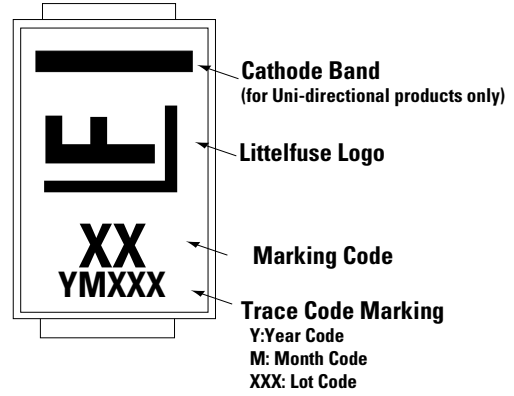


| Dimensions | Inches | | Millimeters | |
|------------|--------|-------|-------------|-------|
| | Min | Max | Min | Max |
| A | 0.077 | 0.086 | 1.950 | 2.200 |
| B | 0.160 | 0.180 | 4.060 | 4.570 |
| C | 0.130 | 0.155 | 3.300 | 3.940 |
| D | 0.084 | 0.096 | 2.130 | 2.440 |
| E | 0.030 | 0.060 | 0.760 | 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

