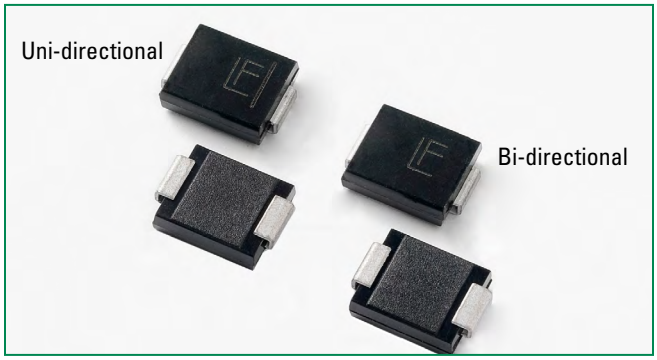
# SMCJ-HRA Series




## Description

The SMCJ-HRA High Reliability series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events. These are available with a variety of up-screening options for enhanced reliability.

## 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.1)(Note 1), (Note 2) | $P_{PPM}$ | 1500 | W |
| Power Dissipation on infinite heat sink at $T_A$=50°C | $P_{M(AV)}$ | 6.5 | W |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3) | $I_{FSM}$ | 200 | A |
| Maximum Instantaneous Forward Voltage at 100A for Unidirectional only (Note 4) | $V_F$ | 3.5/5.0 | V |
| Operating Junction and Storage Temperature Range | $T_J$, $T_{STG}$ | -65 to 150 | °C |
| Typical Thermal Resistance Junction to Lead | $R_{\theta JL}$ | 15 | °C/W |
| Typical Thermal Resistance Junction to Ambient | $R_{\theta JA}$ | 75 | °C/W |

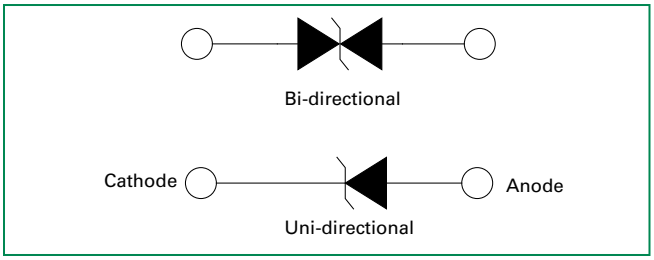
**Notes:**

1. Non-repetitive current pulse , per Fig. 3 and derated above $T_A$ = 25°C per Fig. 2.
2. Mounted on copper pad area of 0.31x0.31" (8.0 x 8.0mm) 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. $V_F$<3.5V for $V_{BR} \leq$ 200V and $V_F$<5.0V for $V_{BR} \geq$ 201V.

## Features

- High reliability devices with fabrication and assembly lots traceability
- Enhanced reliability screening options are available in reference to MIL-PRF-19500. Refer to screen process table for more detail on screening options
- For surface mounted applications to optimize board space
- Low profile package
- Built-in strain relief
- $V_{BR}$ @$T_J$= $V_{BR}$@25°C x (1+ $\alpha$T x ($T_J$ - 25))
  ($\alpha$T:Temperature Coefficient)
- Glass passivated chip junction
- 1500W peak pulse power capability at 10/1000µs waveform, repetition rate (duty cycles):0.01%
- Fast response time: typically less than 1.0ps from 0V to BV min
- Excellent clamping capability
- Low incremental surge resistance
- Typical $I_R$ less than 1µA above 12V
- 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 maximun 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

## Functional Diagram




## Applications

SMCJ-HRA devices are ideal for the high reliability protection of I/O Interfaces, $V_{CC}$ bus and other vulnerable circuits used in Telecom, Computer, Industrial and Consumer electronic applications.

## Electrical Characteristics

| 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 | | | | | |
| SMCJ5.0A-HRA | SMCJ5.0CA-HRA | GDEH | BDEH | 5.0 | 6.40 | 7.00 | 10 | 9.2 | 163.0 | 800 | X |
| SMCJ6.0A-HRA | SMCJ6.0CA-HRA | GDGH | BDGH | 6.0 | 6.67 | 7.37 | 10 | 10.3 | 145.7 | 800 | X |
| SMCJ6.5A-HRA | SMCJ6.5CA-HRA | GDKH | BDKH | 6.5 | 7.22 | 7.98 | 10 | 11.2 | 134.0 | 500 | X |
| SMCJ7.0A-HRA | SMCJ7.0CA-HRA | GDMH | BDMH | 7.0 | 7.78 | 8.60 | 10 | 12.0 | 125.0 | 200 | X |
| SMCJ7.5A-HRA | SMCJ7.5CA-HRA | GDPH | BDPH | 7.5 | 8.33 | 9.21 | 1 | 12.9 | 116.3 | 100 | X |
| SMCJ8.0A-HRA | SMCJ8.0CA-HRA | GDRH | BDRH | 8.0 | 8.89 | 9.83 | 1 | 13.6 | 110.3 | 50 | X |
| SMCJ8.5A-HRA | SMCJ8.5CA-HRA | GDTH | BDTH | 8.5 | 9.44 | 10.40 | 1 | 14.4 | 104.2 | 20 | X |
| SMCJ9.0A-HRA | SMCJ9.0CA-HRA | GDVH | BDVH | 9.0 | 10.00 | 11.10 | 1 | 15.4 | 97.4 | 10 | X |
| SMCJ10A-HRA | SMCJ10CA-HRA | GDXH | BDXH | 10.0 | 11.10 | 12.30 | 1 | 17.0 | 88.3 | 5 | X |
| SMCJ11A-HRA | SMCJ11CA-HRA | GDZH | BDZH | 11.0 | 12.20 | 13.50 | 1 | 18.2 | 82.5 | 1 | X |
| SMCJ12A-HRA | SMCJ12CA-HRA | GEEH | BEEH | 12.0 | 13.30 | 14.70 | 1 | 19.9 | 75.4 | 1 | X |
| SMCJ13A-HRA | SMCJ13CA-HRA | GEGH | BEGH | 13.0 | 14.40 | 15.90 | 1 | 21.5 | 69.8 | 1 | X |
| SMCJ14A-HRA | SMCJ14CA-HRA | GEKH | BEKH | 14.0 | 15.60 | 17.20 | 1 | 23.2 | 64.7 | 1 | X |
| SMCJ15A-HRA | SMCJ15CA-HRA | GEMH | BEMH | 15.0 | 16.70 | 18.50 | 1 | 24.4 | 61.5 | 1 | X |
| SMCJ16A-HRA | SMCJ16CA-HRA | GEPH | BEPH | 16.0 | 17.80 | 19.70 | 1 | 26.0 | 57.7 | 1 | X |
| SMCJ17A-HRA | SMCJ17CA-HRA | GERH | BERH | 17.0 | 18.90 | 20.90 | 1 | 27.6 | 54.4 | 1 | X |
| SMCJ18A-HRA | SMCJ18CA-HRA | GETH | BETH | 18.0 | 20.00 | 22.10 | 1 | 29.2 | 51.4 | 1 | X |
| SMCJ20A-HRA | SMCJ20CA-HRA | GEVH | BEVH | 20.0 | 22.20 | 24.50 | 1 | 32.4 | 46.3 | 1 | X |
| SMCJ22A-HRA | SMCJ22CA-HRA | GEXH | BEXH | 22.0 | 24.40 | 26.90 | 1 | 35.5 | 42.3 | 1 | X |
| SMCJ24A-HRA | SMCJ24CA-HRA | GEZH | BEZH | 24.0 | 26.70 | 29.50 | 1 | 38.9 | 38.6 | 1 | X |
| SMCJ26A-HRA | SMCJ26CA-HRA | GFEH | BFEH | 26.0 | 28.90 | 31.90 | 1 | 42.1 | 35.7 | 1 | X |
| SMCJ28A-HRA | SMCJ28CA-HRA | GFGH | BFGH | 28.0 | 31.10 | 34.40 | 1 | 45.4 | 33.1 | 1 | X |
| SMCJ30A-HRA | SMCJ30CA-HRA | GFKH | BFKH | 30.0 | 33.30 | 36.80 | 1 | 48.4 | 31.0 | 1 | X |
| SMCJ33A-HRA | SMCJ33CA-HRA | GFMH | BFMH | 33.0 | 36.70 | 40.60 | 1 | 53.3 | 28.2 | 1 | X |
| SMCJ36A-HRA | SMCJ36CA-HRA | GFPH | BFPH | 36.0 | 40.00 | 44.20 | 1 | 58.1 | 25.9 | 1 | X |
| SMCJ40A-HRA | SMCJ40CA-HRA | GFRH | BFRH | 40.0 | 44.40 | 49.10 | 1 | 64.5 | 23.3 | 1 | X |
| SMCJ43A-HRA | SMCJ43CA-HRA | GFTH | BFTH | 43.0 | 47.80 | 52.80 | 1 | 69.4 | 21.7 | 1 | X |
| SMCJ45A-HRA | SMCJ45CA-HRA | GFVH | BFVH | 45.0 | 50.00 | 55.30 | 1 | 72.7 | 20.6 | 1 | X |
| SMCJ48A-HRA | SMCJ48CA-HRA | GFXH | BFXH | 48.0 | 53.30 | 58.90 | 1 | 77.4 | 19.4 | 1 | X |
| SMCJ51A-HRA | SMCJ51CA-HRA | GFZH | BFZH | 51.0 | 56.70 | 62.70 | 1 | 82.4 | 18.2 | 1 | X |
| SMCJ54A-HRA | SMCJ54CA-HRA | GGEH | BGEH | 54.0 | 60.00 | 66.30 | 1 | 87.1 | 17.3 | 1 | X |
| SMCJ58A-HRA | SMCJ58CA-HRA | GGGH | BGGH | 58.0 | 64.40 | 71.20 | 1 | 93.6 | 16.1 | 1 | X |
| SMCJ60A-HRA | SMCJ60CA-HRA | GGKH | BGKH | 60.0 | 66.70 | 73.70 | 1 | 96.8 | 15.5 | 1 | X |
| SMCJ64A-HRA | SMCJ64CA-HRA | GGMH | BGMH | 64.0 | 71.10 | 78.60 | 1 | 103.0 | 14.6 | 1 | X |
| SMCJ70A-HRA | SMCJ70CA-HRA | GGPH | BGPH | 70.0 | 77.80 | 86.00 | 1 | 113.0 | 13.3 | 1 | X |
| SMCJ75A-HRA | SMCJ75CA-HRA | GGRH | BGRH | 75.0 | 83.30 | 92.10 | 1 | 121.0 | 12.4 | 1 | X |
| SMCJ78A-HRA | SMCJ78CA-HRA | GGTH | BGTH | 78.0 | 86.70 | 95.80 | 1 | 126.0 | 11.9 | 1 | X |
| SMCJ85A-HRA | SMCJ85CA-HRA | GGVH | BGVH | 85.0 | 94.40 | 104.00 | 1 | 137.0 | 11.0 | 1 | X |
| SMCJ90A-HRA | SMCJ90CA-HRA | GGXH | BGXH | 90.0 | 100.00 | 111.00 | 1 | 146.0 | 10.3 | 1 | X |
| SMCJ100A-HRA | SMCJ100CA-HRA | GGZH | BGZH | 100.0 | 111.00 | 123.00 | 1 | 162.0 | 9.3 | 1 | X |
| SMCJ110A-HRA | SMCJ110CA-HRA | GHEH | BHEH | 110.0 | 122.00 | 135.00 | 1 | 177.0 | 8.5 | 1 | X |
| SMCJ120A-HRA | SMCJ120CA-HRA | GHGH | BHGH | 120.0 | 133.00 | 147.00 | 1 | 193.0 | 7.8 | 1 | X |
| SMCJ130A-HRA | SMCJ130CA-HRA | GHKH | BHKH | 130.0 | 144.00 | 159.00 | 1 | 209.0 | 7.2 | 1 | X |
| SMCJ150A-HRA | SMCJ150CA-HRA | GHMH | BHMH | 150.0 | 167.00 | 185.00 | 1 | 243.0 | 6.2 | 1 | X |
| SMCJ160A-HRA | SMCJ160CA-HRA | GHPH | BHPH | 160.0 | 178.00 | 197.00 | 1 | 259.0 | 5.8 | 1 | X |
| SMCJ170A-HRA | SMCJ170CA-HRA | GHRH | BHRH | 170.0 | 189.00 | 209.00 | 1 | 275.0 | 5.5 | 1 | X |

Note:

1. For bidirectional type having $V_R$ of 10 volts and less, the $I_R$ limit is double.

2.SMCJ-HRA voltage binning can be specified by customer's request via contacting Littelfuse service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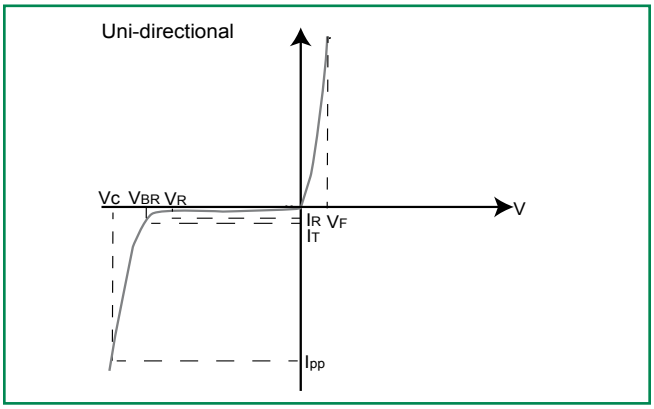
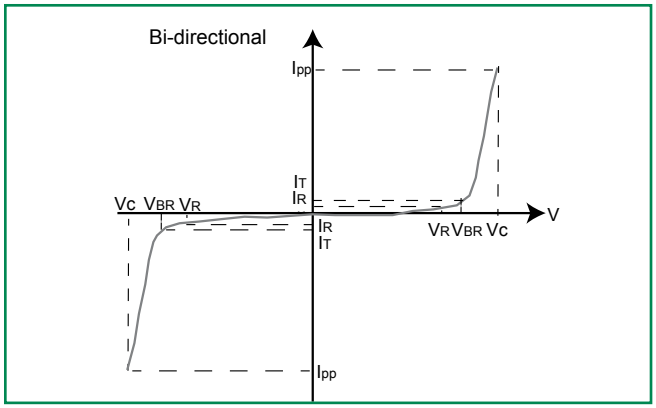
## Screen Process

| | |
|---|---|
| **100% vision inspection** | MIL-STD-750 method 2074 |
| **100%High Temperature Storage Life (168hrs,150C)** | MIL-STD-750 method 1031 |
| **100% X-RAY inspection** | MIL-STD-750 method 2076 |
| **100% Temperature cycle test (-55-150C, 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(150C, Bias=VR(80% breakdown voltage), 96hrs),for Bi-direction products, 96hrs for each direction** | 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

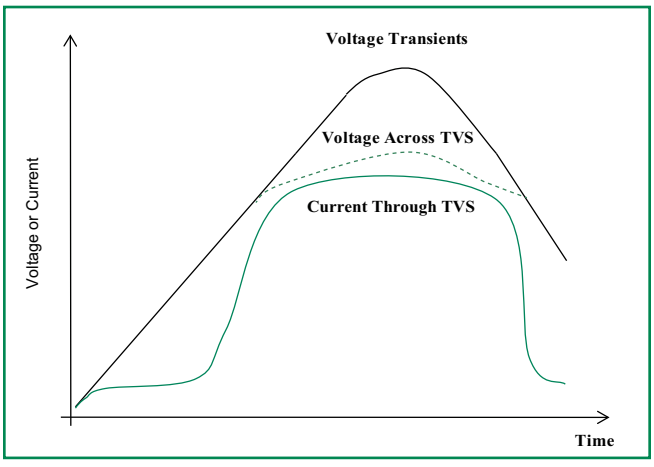


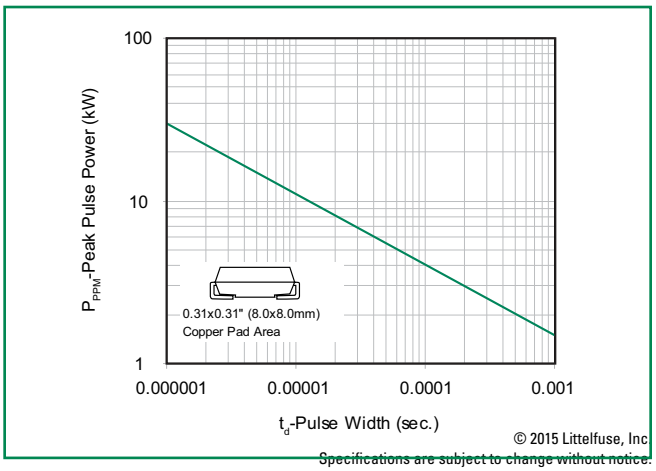

**$P_{PPM}$ Peak Pulse Power Dissipation** – Max power dissipation
**$V_R$ Stand-off Voltage** – Maximum voltage that can be applied to the TVS without operation
**$V_{BR}$ Breakdown Voltage** – Maximum voltagethat flows though the TVS at a specified test current ($I_T$)
**$V_C$ Clamping Voltage** –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

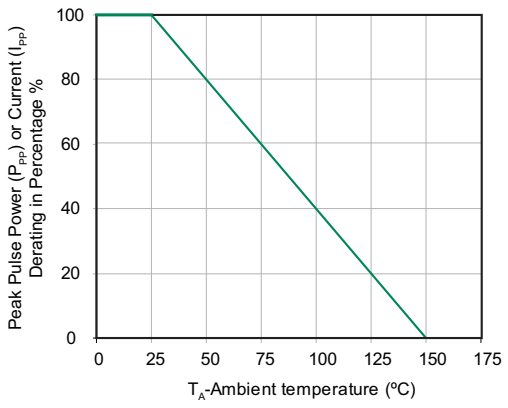



### Figure 2 - Peak Pulse Power Rating

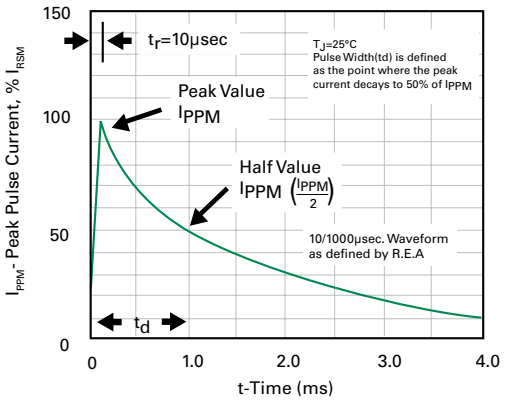


## Ratings and Characteristic Curves ($T_A$=25°C unless otherwise noted) (Continued)

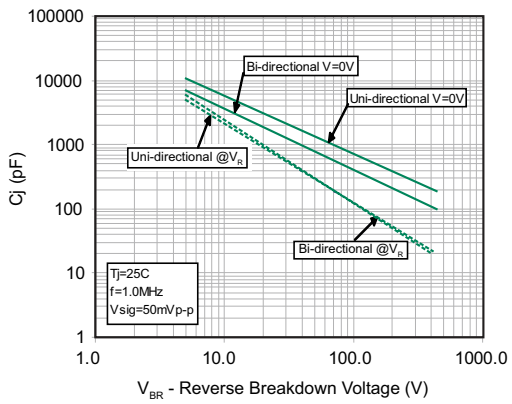
### Figure 3 - Pulse Derating Curve



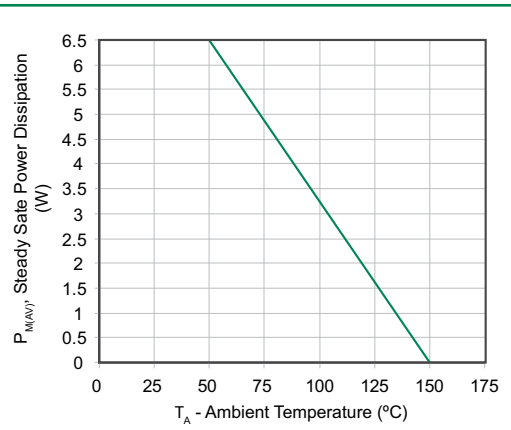

### Figure 4 - Pulse Waveform



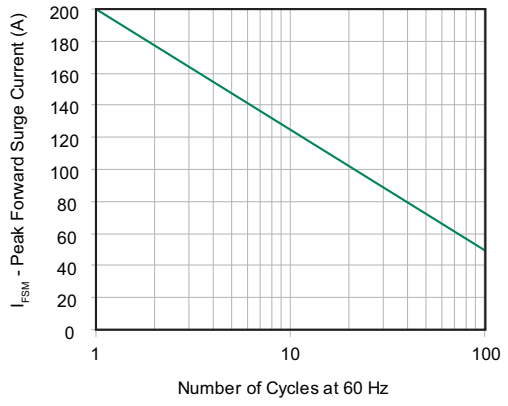

### Figure 5 - Typical Junction Capacitance




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

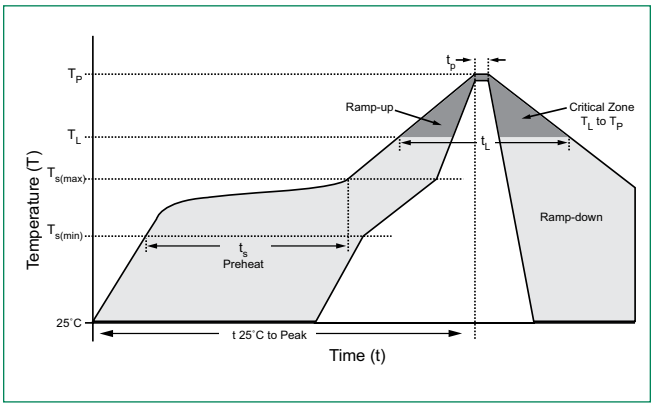



### Figure 7 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional Only



## 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 | | 280°C |



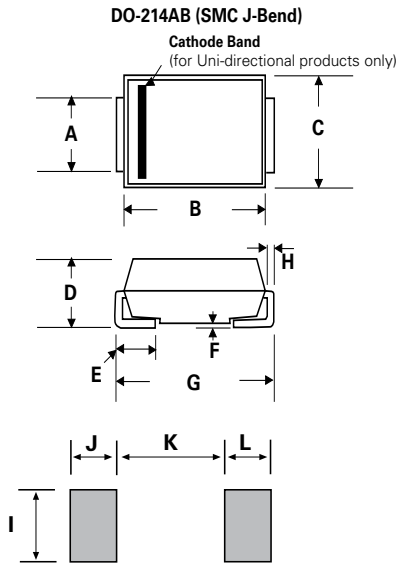

## Physical Specifications

| | |
|---|---|
| **Weight** | 0.007 ounce, 0.21 grams |
| **Case** | JEDEC DO214AB. Molded plastic body over glass passivated junction |
| **Polarity** | Color band denotes positive end (cathode) except Bidirectional. |
| **Terminal** | Matte Tin-plated leads, Solderable per JESD22-B102 |

## Environmental Specifications

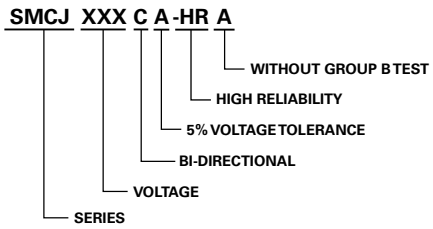
| | |
|---|---|
| **High Temp. Storage** | JESD22-A103 |
| **HTRB** | JESD22-A108 |
| **Thermal Shock** | JESD22-A106 |
| **MSL** | JEDEC-J-STD-020, Level 1 |
| **H3TRB** | JESD22-A101 |
| **RSH** | JESD22-B106 |

## Dimensions

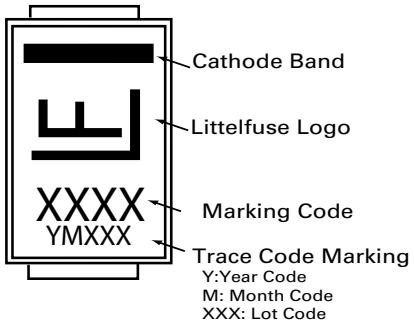



| Dimensions | Inches | | Millimeters | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.114 | 0.126 | 2.900 | 3.200 |
| B | 0.260 | 0.280 | 6.600 | 7.110 |
| C | 0.220 | 0.245 | 5.590 | 6.220 |
| D | 0.079 | 0.103 | 2.060 | 2.620 |
| E | 0.030 | 0.060 | 0.760 | 1.520 |
| F | 0.002 | 0.008 | 0.051 | 0.203 |
| G | 0.305 | 0.320 | 7.750 | 8.130 |
| H | 0.006 | 0.012 | 0.152 | 0.305 |
| I | 0.129 | - | 3.300 | - |
| J | 0.094 | - | 2.400 | - |
| K | - | 0.165 | - | 4.200 |
| L | 0.094 | - | 2.400 | - |

## Part Numbering System



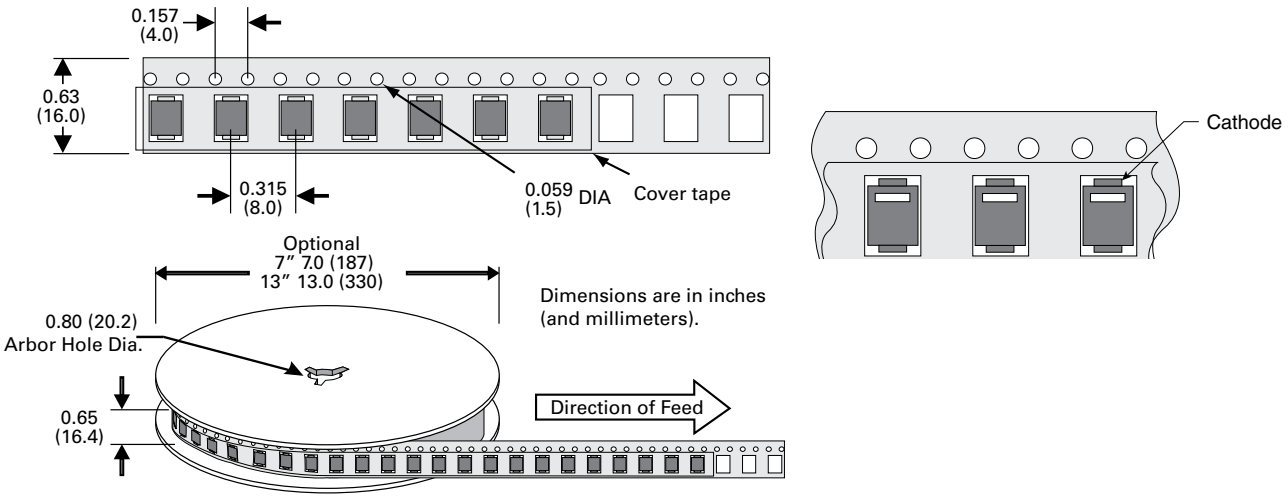

## Part Marking System




## Packaging

| Part number | Component Package | Quantity | Packaging Option | Packaging Specification |
|---|---|---|---|---|
| SMCJxxxXX-HRA | DO-214AB | 3000 | Tape & Reel – 16mm tape /13" reel | EIA STD RS-481 |
| SMCJxxxXX-HRAT7 | DO-214AB | 500 | Tape & Reel – 16mm tape /7" reel | EIA STD RS-481 |

## Tape and Reel Specification





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