

### SMDJ-HR Series



Uni-directional



#### Agency Approvals

| AGENCY | AGENCY FILE NUMBER |
|--------|--------------------|
|        | E230531            |

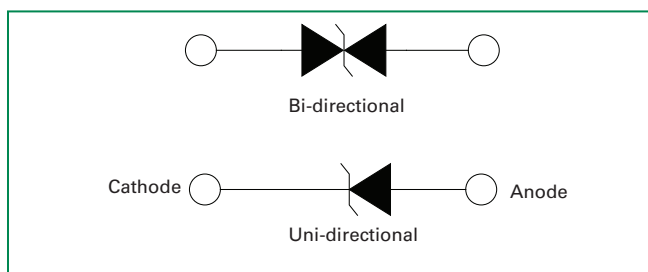
#### Maximum Ratings and Thermal Characteristics ( $T_A=25^\circ\text{C}$ unless otherwise noted)

| Parameter                                                                                                          | Symbol         | Value      | Unit               |
|--------------------------------------------------------------------------------------------------------------------|----------------|------------|--------------------|
| Peak Pulse Power Dissipation at $T_A=25^\circ\text{C}$ by 10/1000 $\mu\text{s}$ waveform (Fig.1)(Note 1), (Note 2) | $P_{PPM}$      | 3000       | W                  |
| Power Dissipation on infinite heat sink at $T_A=50^\circ\text{C}$                                                  | $P_{M(AV)}$    | 6.5        | W                  |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3)                                                   | $I_{FSM}$      | 300        | A                  |
| Maximum Instantaneous Forward Voltage at 100A for Unidirectional only                                              | $V_F$          | 3.5        | V                  |
| Operating Junction and Storage Temperature Range                                                                   | $T_J, T_{STG}$ | -55 to 150 | $^\circ\text{C}$   |
| Typical Thermal Resistance Junction to Lead                                                                        | $R_{JL}$       | 15         | $^\circ\text{C/W}$ |
| Typical Thermal Resistance Junction to Ambient                                                                     | $R_{JA}$       | 75         | $^\circ\text{C/W}$ |

**Notes:**

1. Non-repetitive current pulse, per Fig. 3 and derated above  $T_A = 25^\circ\text{C}$  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.

#### Functional Diagram



#### Description

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

#### Features

- For surface mounted applications in order to optimize board space
- Low profile package
- Built-in strain relief
- $V_{BR} @ T_J = V_{BR} @ 25^\circ\text{C} \times (1 + \alpha T \times (T_J - 25))$   
( $\alpha$ : Temperature Coefficient)
- Glass passivated chip junction
- 3000W peak pulse power capability at 10/1000 $\mu\text{s}$  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 2 $\mu\text{A}$  above 12V
- High temperature soldering guaranteed: 260 $^\circ\text{C}$ /40 seconds at terminals
- Plastic package has underwriters laboratory flammability 94V-O
- Meet MSL level1, per J-STD-020, LF maximum peak of 260 $^\circ\text{C}$
- Matte tin lead-free plated
- Halogen free and RoHS compliant
- 2nd level interconnect is Pb-free per IPC/JEDEC J-STD-609A.01

#### Applications

TVS devices are ideal for the protection of I/O Interfaces,  $V_{CC}$  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 $I_R$ @ $V_R$ ( $\mu A$ ) | Agency Approval  |
|-------------------|------------------|---------|-----|-----------------------------------------|--------------------------------------------|--------|-------------------------|-----------------------------------------------|-----------------------------------------|---------------------------------------------------|-----------------------------------------------------------------------------------------------------|
|                   |                  | UNI     | BI  |                                         | MIN                                        | MAX    |                         |                                               |                                         |                                                   |                                                                                                     |
| SMDJ5.0A-HR       | SMDJ5.0CA-HR     | RDE     | DDE | 5.0                                     | 6.40                                       | 7.00   | 10                      | 9.2                                           | 326.1                                   | 800                                               | X                                                                                                   |
| SMDJ6.0A-HR       | SMDJ6.0CA-HR     | RDG     | DDG | 6.0                                     | 6.67                                       | 7.37   | 10                      | 10.3                                          | 291.3                                   | 800                                               | X                                                                                                   |
| SMDJ6.5A-HR       | SMDJ6.5CA-HR     | RDK     | DDK | 6.5                                     | 7.22                                       | 7.98   | 10                      | 11.2                                          | 267.9                                   | 500                                               | X                                                                                                   |
| SMDJ7.0A-HR       | SMDJ7.0CA-HR     | PDM     | DDM | 7.0                                     | 7.78                                       | 8.60   | 10                      | 12.0                                          | 250.0                                   | 200                                               | X                                                                                                   |
| SMDJ7.5A-HR       | SMDJ7.5CA-HR     | PDP     | DDP | 7.5                                     | 8.33                                       | 9.21   | 1                       | 12.9                                          | 232.6                                   | 100                                               | X                                                                                                   |
| SMDJ8.0A-HR       | SMDJ8.0CA-HR     | PDR     | DDR | 8.0                                     | 8.89                                       | 9.83   | 1                       | 13.6                                          | 220.6                                   | 50                                                | X                                                                                                   |
| SMDJ8.5A-HR       | SMDJ8.5CA-HR     | PDT     | DDT | 8.5                                     | 9.44                                       | 10.40  | 1                       | 14.4                                          | 208.3                                   | 20                                                | X                                                                                                   |
| SMDJ9.0A-HR       | SMDJ9.0CA-HR     | PDV     | DDV | 9.0                                     | 10.00                                      | 11.10  | 1                       | 15.4                                          | 194.8                                   | 10                                                | X                                                                                                   |
| SMDJ10A-HR        | SMDJ10CA-HR      | PDX     | DDX | 10.0                                    | 11.10                                      | 12.30  | 1                       | 17.0                                          | 176.5                                   | 5                                                 | X                                                                                                   |
| SMDJ11A-HR        | SMDJ11CA-HR      | PDZ     | DDZ | 11.0                                    | 12.20                                      | 13.50  | 1                       | 18.2                                          | 164.8                                   | 2                                                 | X                                                                                                   |
| SMDJ12A-HR        | SMDJ12CA-HR      | PEE     | DEE | 12.0                                    | 13.30                                      | 14.70  | 1                       | 19.9                                          | 150.8                                   | 2                                                 | X                                                                                                   |
| SMDJ13A-HR        | SMDJ13CA-HR      | PEG     | DEG | 13.0                                    | 14.40                                      | 15.90  | 1                       | 21.5                                          | 139.5                                   | 2                                                 | X                                                                                                   |
| SMDJ14A-HR        | SMDJ14CA-HR      | PEK     | DEK | 14.0                                    | 15.60                                      | 17.20  | 1                       | 23.2                                          | 129.3                                   | 2                                                 | X                                                                                                   |
| SMDJ15A-HR        | SMDJ15CA-HR      | PEM     | DEM | 15.0                                    | 16.70                                      | 18.50  | 1                       | 24.4                                          | 123.0                                   | 2                                                 | X                                                                                                   |
| SMDJ16A-HR        | SMDJ16CA-HR      | PEP     | DEP | 16.0                                    | 17.80                                      | 19.70  | 1                       | 26.0                                          | 115.4                                   | 2                                                 | X                                                                                                   |
| SMDJ17A-HR        | SMDJ17CA-HR      | PER     | DER | 17.0                                    | 18.90                                      | 20.90  | 1                       | 27.6                                          | 108.7                                   | 2                                                 | X                                                                                                   |
| SMDJ18A-HR        | SMDJ18CA-HR      | PET     | DET | 18.0                                    | 20.00                                      | 22.10  | 1                       | 29.2                                          | 102.7                                   | 2                                                 | X                                                                                                   |
| SMDJ20A-HR        | SMDJ20CA-HR      | PEV     | DEV | 20.0                                    | 22.20                                      | 24.50  | 1                       | 32.4                                          | 92.6                                    | 2                                                 | X                                                                                                   |
| SMDJ22A-HR        | SMDJ22CA-HR      | PEX     | DEX | 22.0                                    | 24.40                                      | 26.90  | 1                       | 35.5                                          | 84.5                                    | 2                                                 | X                                                                                                   |
| SMDJ24A-HR        | SMDJ24CA-HR      | PEZ     | DEZ | 24.0                                    | 26.70                                      | 29.50  | 1                       | 38.9                                          | 77.1                                    | 2                                                 | X                                                                                                   |
| SMDJ26A-HR        | SMDJ26CA-HR      | PFE     | DFE | 26.0                                    | 28.90                                      | 31.90  | 1                       | 42.1                                          | 71.3                                    | 2                                                 | X                                                                                                   |
| SMDJ28A-HR        | SMDJ28CA-HR      | PFG     | DFG | 28.0                                    | 31.10                                      | 34.40  | 1                       | 45.4                                          | 66.1                                    | 2                                                 | X                                                                                                   |
| SMDJ30A-HR        | SMDJ30CA-HR      | PFK     | DFK | 30.0                                    | 33.30                                      | 36.80  | 1                       | 48.4                                          | 62.0                                    | 2                                                 | X                                                                                                   |
| SMDJ33A-HR        | SMDJ33CA-HR      | PFM     | DFM | 33.0                                    | 36.70                                      | 40.60  | 1                       | 53.3                                          | 56.3                                    | 2                                                 | X                                                                                                   |
| SMDJ36A-HR        | SMDJ36CA-HR      | PFV     | DFV | 36.0                                    | 40.00                                      | 44.20  | 1                       | 58.1                                          | 51.6                                    | 2                                                 | X                                                                                                   |
| SMDJ40A-HR        | SMDJ40CA-HR      | PFR     | DFR | 40.0                                    | 44.40                                      | 49.10  | 1                       | 64.5                                          | 46.5                                    | 2                                                 | X                                                                                                   |
| SMDJ43A-HR        | SMDJ43CA-HR      | PFT     | DFT | 43.0                                    | 47.80                                      | 52.80  | 1                       | 69.4                                          | 43.2                                    | 2                                                 | X                                                                                                   |
| SMDJ45A-HR        | SMDJ45CA-HR      | PFV     | DFV | 45.0                                    | 50.00                                      | 55.30  | 1                       | 72.7                                          | 41.3                                    | 2                                                 | X                                                                                                   |
| SMDJ48A-HR        | SMDJ48CA-HR      | PFX     | DFX | 48.0                                    | 53.30                                      | 58.90  | 1                       | 77.4                                          | 38.8                                    | 2                                                 | X                                                                                                   |
| SMDJ51A-HR        | SMDJ51CA-HR      | PFZ     | DFZ | 51.0                                    | 56.70                                      | 62.70  | 1                       | 82.4                                          | 36.4                                    | 2                                                 | X                                                                                                   |
| SMDJ54A-HR        | SMDJ54CA-HR      | RGE     | DGE | 54.0                                    | 60.00                                      | 66.30  | 1                       | 87.1                                          | 34.4                                    | 2                                                 | X                                                                                                   |
| SMDJ58A-HR        | -                | PGG     | -   | 58.0                                    | 64.40                                      | 71.20  | 1                       | 93.6                                          | 32.1                                    | 2                                                 | X                                                                                                   |
| SMDJ60A-HR        | -                | PGK     | -   | 60.0                                    | 66.70                                      | 73.70  | 1                       | 96.8                                          | 31.0                                    | 2                                                 | X                                                                                                   |
| SMDJ64A-HR        | -                | PGM     | -   | 64.0                                    | 71.10                                      | 78.60  | 1                       | 103.0                                         | 29.1                                    | 2                                                 | X                                                                                                   |
| SMDJ70A-HR        | -                | PGP     | -   | 70.0                                    | 77.80                                      | 86.00  | 1                       | 113.0                                         | 26.5                                    | 2                                                 | X                                                                                                   |
| SMDJ75A-HR        | -                | PGR     | -   | 75.0                                    | 83.30                                      | 92.10  | 1                       | 121.0                                         | 24.8                                    | 2                                                 | X                                                                                                   |
| SMDJ78A-HR        | -                | PGT     | -   | 78.0                                    | 86.70                                      | 95.80  | 1                       | 126.0                                         | 23.8                                    | 2                                                 | X                                                                                                   |
| SMDJ85A-HR        | -                | PGV     | -   | 85.0                                    | 94.40                                      | 104.00 | 1                       | 137.0                                         | 21.9                                    | 2                                                 | X                                                                                                   |
| SMDJ90A-HR        | -                | PGX     | -   | 90.0                                    | 100.00                                     | 111.00 | 1                       | 146.0                                         | 20.5                                    | 2                                                 | X                                                                                                   |
| SMDJ100A-HR       | -                | PGZ     | -   | 100.0                                   | 111.00                                     | 123.00 | 1                       | 162.0                                         | 18.5                                    | 2                                                 | X                                                                                                   |
| SMDJ110A-HR       | -                | PHE     | -   | 110.0                                   | 122.00                                     | 135.00 | 1                       | 177.0                                         | 16.9                                    | 2                                                 | X                                                                                                   |
| SMDJ120A-HR       | -                | PHG     | -   | 120.0                                   | 133.00                                     | 147.00 | 1                       | 193.0                                         | 15.5                                    | 2                                                 | X                                                                                                   |
| SMDJ130A-HR       | -                | PHK     | -   | 130.0                                   | 144.00                                     | 159.00 | 1                       | 209.0                                         | 14.4                                    | 2                                                 | X                                                                                                   |

Note:

1. For bidirectional type having  $V_R$  of 10 volts and less, the  $I_R$  limit is double.
2. Each lot of parts will pass group B test requirement.

### Screen Process

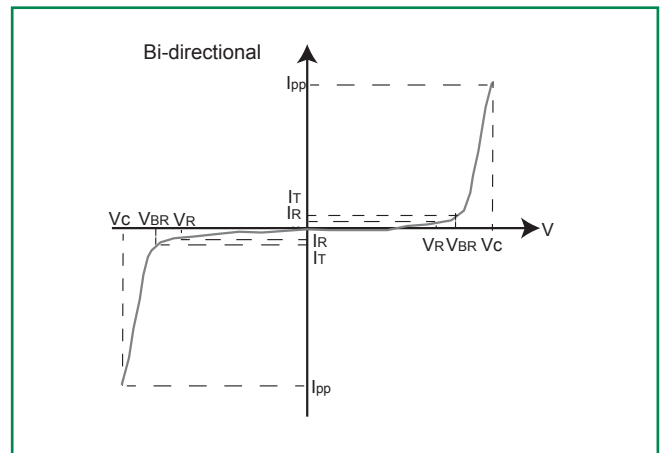
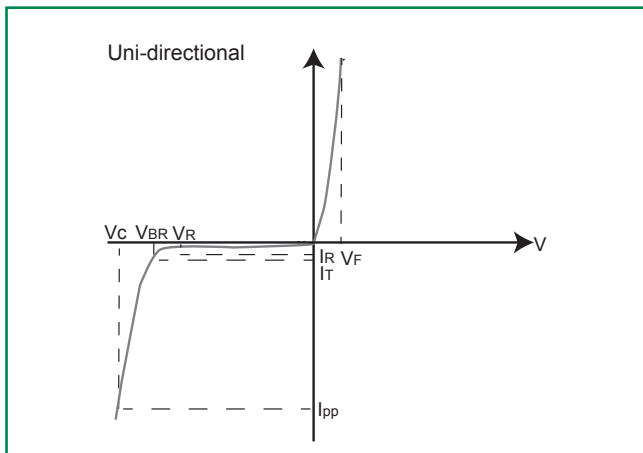
|                                                                                                                 |                                   |
|-----------------------------------------------------------------------------------------------------------------|-----------------------------------|
| 100% Vision Inspection                                                                                          | MIL-STD-750 method 2074           |
| 100% High Temperature Storage Life (168hrs,150°C)                                                               | MIL-STD-750 method 1031           |
| 100% X-RAY inspection                                                                                           | MIL-STD-750 method 2076           |
| 100% Temperature Cycle Test (-55 to150°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 at 96 hrs 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 Pluse Waveform | Maximum clamping Voltage ( $V_C$ ) @ Peak Plus Current ( $I_{pp}$ ) | Sample Size 45 perform 10x<br>Accept 0 failures                                                                  |
| Burn - In (HTRB) | MIL-STD-750, Method 1038.5          | Applied voltage 100% $V_R$ @150°C                                   | Sample size 45<br>340 hours (680 hours for bi-direction products, each direction 340 hours)<br>Accept 0 failures |
| Electrical test  | —                                   | $I_R$ @ $V_R$ , $V_{BR}$ @ $I_T$                                    | Sample size 45<br>Accept 0 failures                                                                              |

### I-V Curve Characteristics



**$P_{PPM}$  Peak Pulse Power Dissipation** – Max power dissipation

**$V_R$  Stand-off Voltage** – Maximum voltage that can be applied to the TVS without operation

**$V_{BR}$  Breakdown Voltage** – Maximum voltage that flows though the TVS at a specified test current ( $I_T$ )

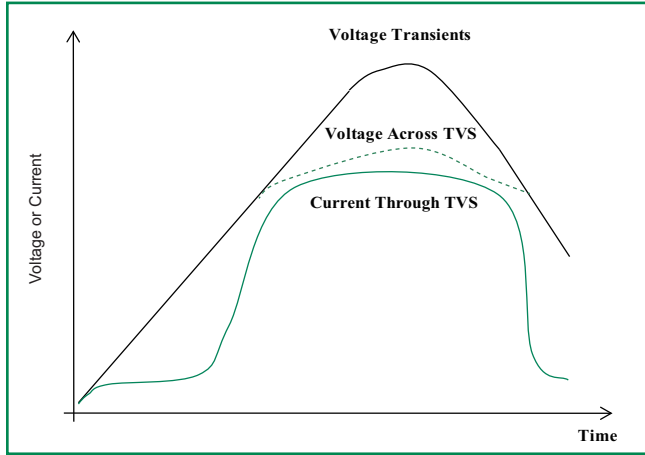
**$V_C$  Clamping Voltage** – Peak voltage measured across the suppressor at a specified  $I_{ppm}$  (peak impulse current)

**$I_R$  Reverse Leakage Current** – Current measured at  $V_R$

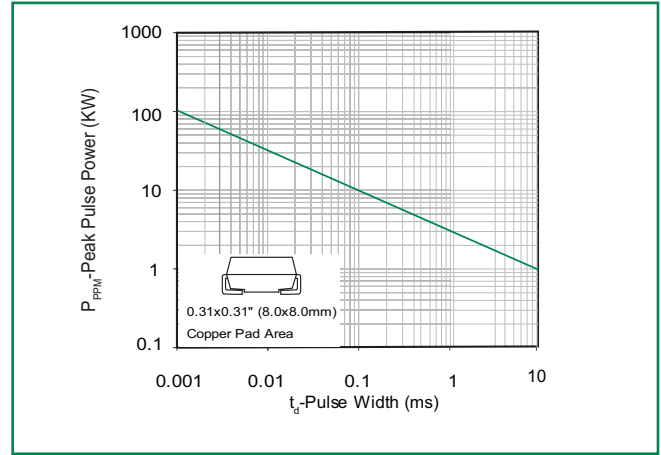
**$V_F$  Forward Voltage Drop for Uni-directional**

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

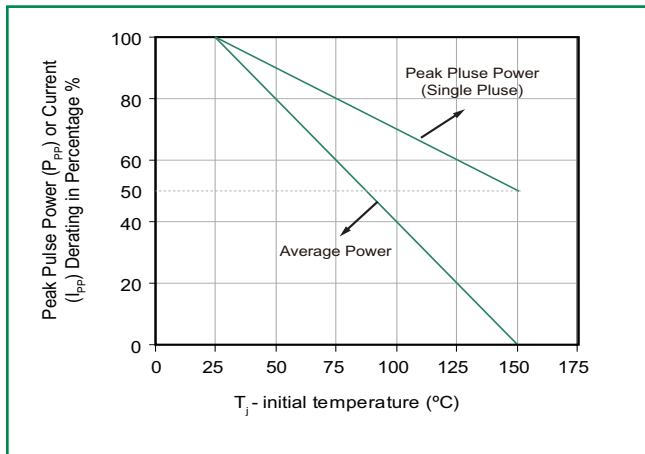
**Figure 1 - TVS Transients Clamping Waveform**



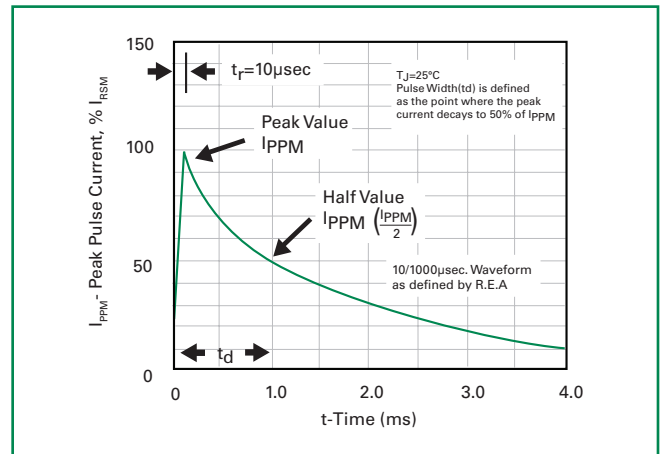
**Figure 2 - Peak Pulse Power Rating**



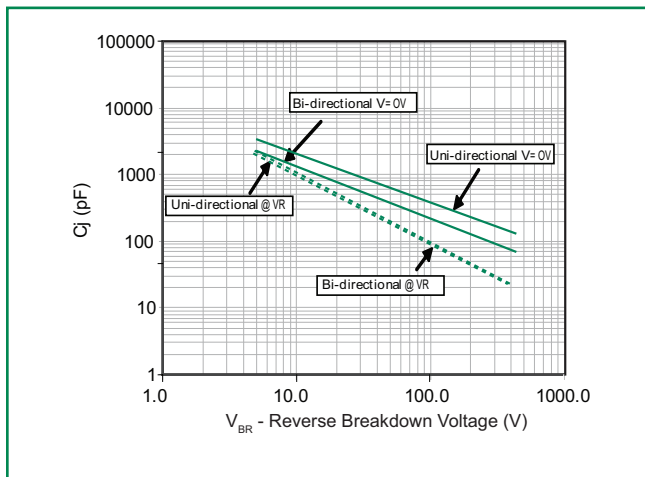
**Figure 3 - Peak Pulse Power**



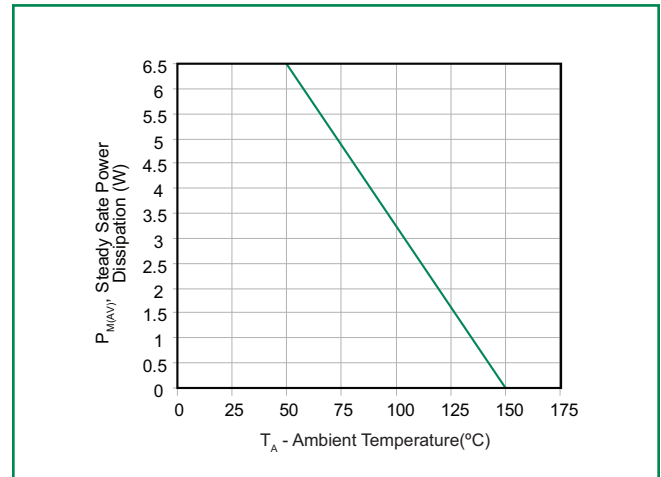
**Figure 4 - Pulse Waveform**



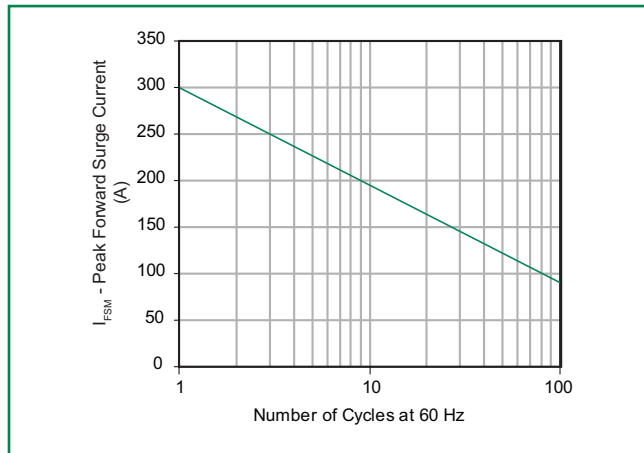
**Figure 5 - Typical Junction Capacitance**



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

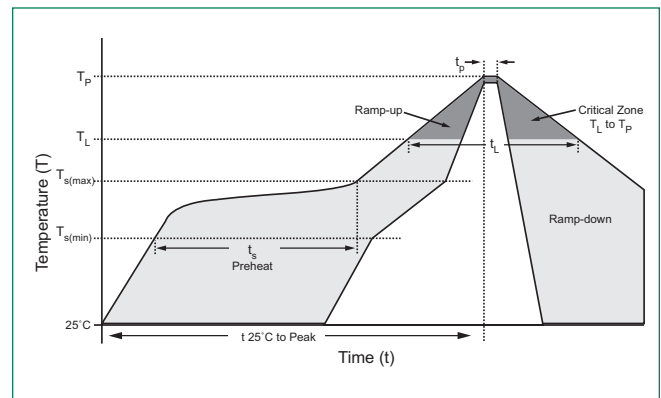


**Figure 7 - Maximum Non-Repetitive Peak Forward Surge Current Uni-Directional only**



### Soldering Parameters

|                                                        |                                    |                         |
|--------------------------------------------------------|------------------------------------|-------------------------|
| Reflow Condition                                       |                                    | Lead-free assembly      |
| Pre Heat                                               | - Temperature Min ( $T_{s(min)}$ ) | 150°C                   |
|                                                        | - Temperature Max ( $T_{s(max)}$ ) | 200°C                   |
|                                                        | - Time (min to max) ( $t_s$ )      | 60 – 180 secs           |
| Average ramp up rate (Liquidus Temp ( $T_L$ ) to peak) |                                    | 3°C/second max          |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                   |                                    | 3°C/second max          |
| Reflow                                                 | - Temperature ( $T_L$ ) (Liquidus) | 217°C                   |
|                                                        | - Time (min to max) ( $t_s$ )      | 60 – 150 seconds        |
| Peak Temperature ( $T_p$ )                             |                                    | 260 <sup>+0/-5</sup> °C |
| Time within 5°C of actual peak Temperature ( $t_p$ )   |                                    | 20 – 40 seconds         |
| Ramp-down Rate                                         |                                    | 6°C/second max          |
| Time 25°C to peak Temperature ( $T_p$ )                |                                    | 8 minutes Max.          |
| Do not exceed                                          |                                    | 280°C                   |



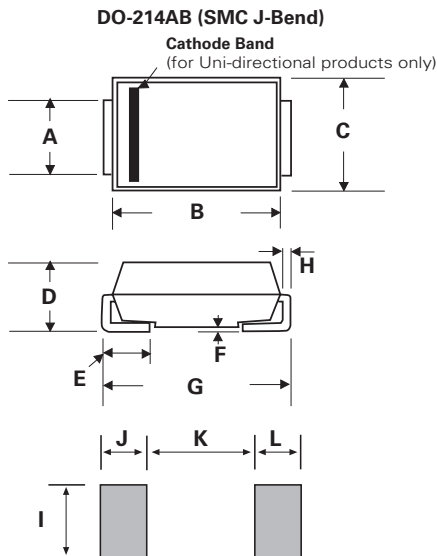
### Physical Specifications

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

### Environmental Specifications

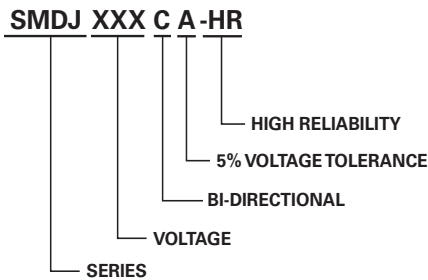
|                           |                          |
|---------------------------|--------------------------|
| <b>High Temp. Storage</b> | JESD22-A103              |
| <b>HTRB</b>               | JESD22-A108              |
| <b>Thermal Shock</b>      | JESD22-A106              |
| <b>MSL</b>   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

### Dimensions

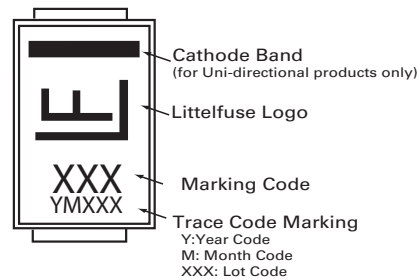


| Dimensions | Inches |       | Millimeters |       |
|------------|--------|-------|-------------|-------|
|            | Min    | Max   | Min         | Max   |
| A          | 0.114  | 0.126 | 2.900       | 3.200 |
| B          | 0.260  | 0.280 | 6.600       | 7.110 |
| C          | 0.220  | 0.245 | 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 |
|--------------|-------------------|----------|---------------------------------|-------------------------|
| SMDJxxxXX-HR | DO-214AB          | 500      | Tape & Reel – 16mm tape/7" reel | EIA STD RS-481          |

### Tape and Reel Specification

