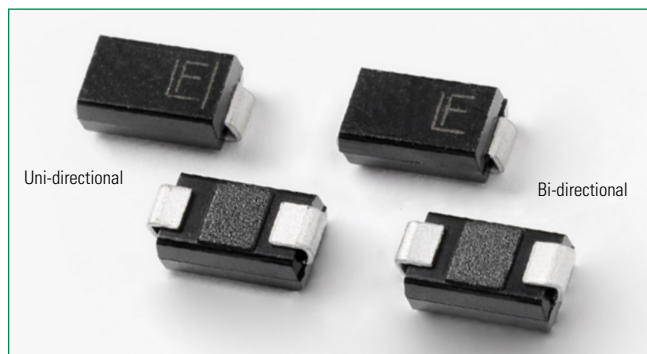


## SMAJ Series



### Agency Approvals

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

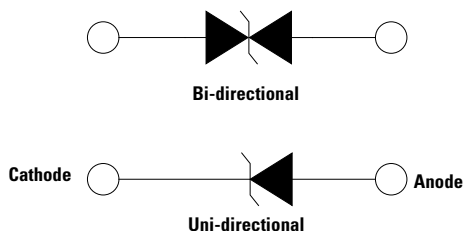
### Maximum Ratings and Thermal Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| Parameter  | Symbol           | Value      | Unit |
|--|------------------|------------|------|
| Peak Pulse Power Dissipation at T <sub>A</sub> =25° by 10/1000us Waveform(Fig.2)(Note 1), (Note 2) -Single Die Parts         | P <sub>PPM</sub> | 400        | W    |
| Peak Pulse Power Dissipation at T <sub>A</sub> =25° by 10/1000us Waveform(Fig.2)(Note 1), (Note 2)-Stacked Die Parts(Note 5) | P <sub>PPM</sub> | 600        | W    |
| Power Dissipation on Infinite Heat Sink at T <sub>L</sub> =50°C  | P <sub>D</sub>   | 3.3        | W    |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3)   | I <sub>FSM</sub> | 60         | A    |
| Maximum Instantaneous Forward Voltage at 25A for Unidirectional Only (Note 4)  | V <sub>F</sub>   | 3.5/5.0    | V    |
| Operating Temperature Range  | T <sub>J</sub>   | -65 to 150 | °C   |
| Storage Temperature Range  | T <sub>STG</sub> | -65 to 175 | °C   |
| Typical Thermal Resistance Junction to Lead  | R <sub>θJL</sub> | 30         | °C/W |
| Typical Thermal Resistance Junction to Ambient   | R <sub>θJA</sub> | 120        | °C/W |

#### Notes:

1. Non-repetitive current pulse, per Fig.4 and derated above T<sub>J</sub> (initial) =25°C per Fig. 3.
2. Mounted on 5.0x5.0mm copper pad to each terminal.
3. Measured on 8.3ms single half sine wave or equivalent square wave for unidirectional device only.
4. V<sub>F</sub> < 3.5V for single die parts and V<sub>F</sub> < 5.0V for stacked-die parts.
5. For stacked die component details, please refer to part numbers labeled by \* in Electrical Characteristics.

### Functional Diagram



### Description

The SMAJ series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

### Features

- 400W Peak pulse power capability at 10/1000μs waveform, repetition rate (duty cycle): 0.01 %
- Excellent clamping capability
- Typical I<sub>R</sub> less than 1μA when V<sub>BR</sub> min>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 30kV(Air), 30kV (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 0 Volts to V<sub>BR</sub> min
- Glass passivated junction
- Low inductance
- High temperature to reflow soldering guaranteed: 260°C/30sec
- V<sub>BR</sub> @ T<sub>J</sub>= V<sub>BR</sub> @25°C x (1+ α T x (T<sub>J</sub> - 25)) (α T: Temperature Coefficient, typical value is 0.1 %)
- Plastic package is flammability rated V-0 per Underwriters Laboratories
- 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)

### Applications

TVS devices 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.

### Additional Information



Datasheet



Resources



Samples

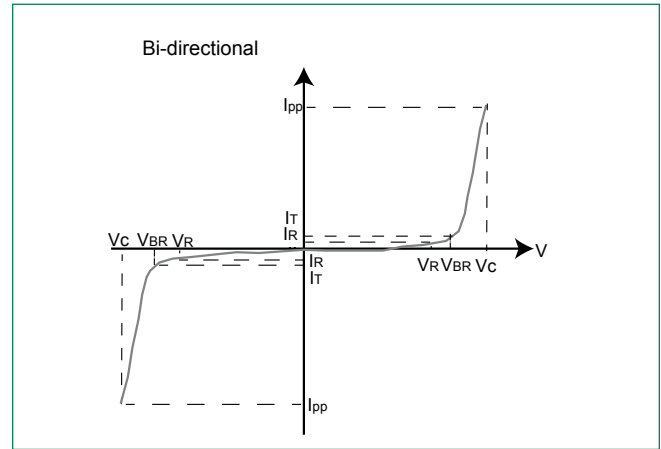
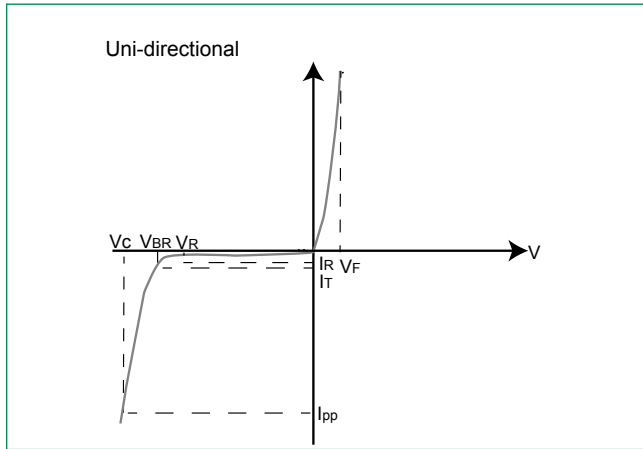
### Electrical Characteristics (T<sub>A</sub> = 25°C unless otherwise noted)

| 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.   |                                  |   |  |  |   |
| SMAJ5.0A          | SMAJ5.0CA        | AE      | WE  | 5.0  | 6.40   | 7.00   | 10                               | 9.2   | 43.5   | 800  | X   |
| SMAJ6.0A          | SMAJ6.0CA        | AG      | WG  | 6.0  | 6.67   | 7.37   | 10                               | 10.3  | 38.8   | 800  | X   |
| SMAJ6.5A          | SMAJ6.5CA        | AK      | WK  | 6.5  | 7.22   | 7.98   | 10                               | 11.2  | 35.7   | 500  | X   |
| SMAJ7.0A          | SMAJ7.0CA        | AM      | WM  | 7.0  | 7.78   | 8.60   | 10                               | 12.0  | 33.3   | 200  | X   |
| SMAJ7.5A          | SMAJ7.5CA        | AP      | WP  | 7.5  | 8.33   | 9.21   | 1                                | 12.9  | 31.0   | 100  | X   |
| SMAJ8.0A          | SMAJ8.0CA        | AR      | WR  | 8.0  | 8.89   | 9.83   | 1                                | 13.6  | 29.4   | 50   | X   |
| SMAJ8.5A          | SMAJ8.5CA        | AT      | WT  | 8.5  | 9.44   | 10.40  | 1                                | 14.4  | 27.8   | 20   | X   |
| SMAJ9.0A          | SMAJ9.0CA        | AV      | WV  | 9.0  | 10.00  | 11.10  | 1                                | 15.4  | 26.0   | 10   | X   |
| SMAJ10A           | SMAJ10CA         | AX      | WX  | 10.0   | 11.10  | 12.30  | 1                                | 17.0  | 23.5   | 5  | X   |
| SMAJ11A           | SMAJ11CA         | AZ      | WZ  | 11.0   | 12.20  | 13.50  | 1                                | 18.2  | 22.0   | 1  | X   |
| SMAJ12A           | SMAJ12CA         | BE      | XE  | 12.0   | 13.30  | 14.70  | 1                                | 19.9  | 20.1   | 1  | X   |
| SMAJ13A           | SMAJ13CA         | BG      | XG  | 13.0   | 14.40  | 15.90  | 1                                | 21.5  | 18.6   | 1  | X   |
| SMAJ14A           | SMAJ14CA         | BK      | XK  | 14.0   | 15.60  | 17.20  | 1                                | 23.2  | 17.2   | 1  | X   |
| SMAJ15A           | SMAJ15CA         | BM      | XM  | 15.0   | 16.70  | 18.50  | 1                                | 24.4  | 16.4   | 1  | X   |
| SMAJ16A           | SMAJ16CA         | BP      | XP  | 16.0   | 17.80  | 19.70  | 1                                | 26.0  | 15.4   | 1  | X   |
| SMAJ17A           | SMAJ17CA         | BR      | XR  | 17.0   | 18.90  | 20.90  | 1                                | 27.6  | 14.5   | 1  | X   |
| SMAJ18A           | SMAJ18CA         | BT      | XT  | 18.0   | 20.00  | 22.10  | 1                                | 29.2  | 13.7   | 1  | X   |
| SMAJ20A           | SMAJ20CA         | BV      | XV  | 20.0   | 22.20  | 24.50  | 1                                | 32.4  | 12.3   | 1  | X   |
| SMAJ22A           | SMAJ22CA         | BX      | XX  | 22.0   | 24.40  | 26.90  | 1                                | 35.5  | 11.3   | 1  | X   |
| SMAJ24A           | SMAJ24CA         | BZ      | XZ  | 24.0   | 26.70  | 29.50  | 1                                | 38.9  | 10.3   | 1  | X   |
| SMAJ26A           | SMAJ26CA         | CE      | YE  | 26.0   | 28.90  | 31.90  | 1                                | 42.1  | 9.5  | 1  | X   |
| SMAJ28A           | SMAJ28CA         | CG      | YG  | 28.0   | 31.10  | 34.40  | 1                                | 45.4  | 8.8  | 1  | X   |
| SMAJ30A           | SMAJ30CA         | CK      | YK  | 30.0   | 33.30  | 36.80  | 1                                | 48.4  | 8.3  | 1  | X   |
| SMAJ33A           | SMAJ33CA         | CM      | YM  | 33.0   | 36.70  | 40.60  | 1                                | 53.3  | 7.5  | 1  | X   |
| SMAJ36A           | SMAJ36CA         | CP      | YP  | 36.0   | 40.00  | 44.20  | 1                                | 58.1  | 6.9  | 1  | X   |
| SMAJ40A           | SMAJ40CA         | CR      | YR  | 40.0   | 44.40  | 49.10  | 1                                | 64.5  | 6.2  | 1  | X   |
| SMAJ43A           | SMAJ43CA         | CT      | YT  | 43.0   | 47.80  | 52.80  | 1                                | 69.4  | 5.8  | 1  | X   |
| SMAJ45A           | SMAJ45CA         | CV      | YV  | 45.0   | 50.00  | 55.30  | 1                                | 72.7  | 5.5  | 1  | X   |
| SMAJ48A           | SMAJ48CA         | CX      | YX  | 48.0   | 53.30  | 58.90  | 1                                | 77.4  | 5.2  | 1  | X   |
| SMAJ51A           | SMAJ51CA         | CZ      | YZ  | 51.0   | 56.70  | 62.70  | 1                                | 82.4  | 4.9  | 1  | X   |
| SMAJ54A           | SMAJ54CA         | RE      | ZE  | 54.0   | 60.00  | 66.30  | 1                                | 87.1  | 4.6  | 1  | X   |
| SMAJ58A           | SMAJ58CA         | RG      | ZG  | 58.0   | 64.40  | 71.20  | 1                                | 93.6  | 4.3  | 1  | X   |
| SMAJ60A           | SMAJ60CA         | RK      | ZK  | 60.0   | 66.70  | 73.70  | 1                                | 96.8  | 4.1  | 1  | X   |
| SMAJ64A           | SMAJ64CA         | RM      | ZM  | 64.0   | 71.10  | 78.60  | 1                                | 103.0   | 3.9  | 1  | X   |
| SMAJ70A           | SMAJ70CA         | RP      | ZP  | 70.0   | 77.80  | 86.00  | 1                                | 113.0   | 3.5  | 1  | X   |
| SMAJ75A           | SMAJ75CA         | RR      | ZR  | 75.0   | 83.30  | 92.10  | 1                                | 121.0   | 3.3  | 1  | X   |
| SMAJ78A           | SMAJ78CA         | RT      | ZT  | 78.0   | 86.70  | 95.80  | 1                                | 126.0   | 3.2  | 1  | X   |
| SMAJ85A           | SMAJ85CA         | RV      | ZV  | 85.0   | 94.40  | 104.00 | 1                                | 137.0   | 2.9  | 1  | X   |
| SMAJ90A           | SMAJ90CA         | RX      | ZX  | 90.0   | 100.00   | 111.00 | 1                                | 146.0   | 2.7  | 1  | X   |
| SMAJ100A          | SMAJ100CA        | RZ      | ZZ  | 100.0  | 111.00   | 123.00 | 1                                | 162.0   | 2.5  | 1  | X   |
| SMAJ110A          | SMAJ110CA        | SE      | VE  | 110.0  | 122.00   | 135.00 | 1                                | 177.0   | 2.3  | 1  | X   |
| SMAJ120A          | SMAJ120CA        | SG      | VG  | 120.0  | 133.00   | 147.00 | 1                                | 193.0   | 2.1  | 1  | X   |
| SMAJ130A          | SMAJ130CA        | SK      | VK  | 130.0  | 144.00   | 159.00 | 1                                | 209.0   | 1.9  | 1  | X   |
| SMAJ150A          | SMAJ150CA        | SM      | VM  | 150.0  | 167.00   | 185.00 | 1                                | 243.0   | 1.6  | 1  | X   |
| SMAJ160A          | SMAJ160CA        | SP      | VP  | 160.0  | 178.00   | 197.00 | 1                                | 259.0   | 1.5  | 1  | X   |
| SMAJ170A          | SMAJ170CA        | SR      | VR  | 170.0  | 189.00   | 209.00 | 1                                | 275.0   | 1.5  | 1  | X   |
| SMAJ180A          | SMAJ180CA        | ST      | VT  | 180.0  | 201.00   | 222.00 | 1                                | 292.0   | 1.4  | 1  | -   |
| SMAJ188A          | SMAJ188CA        | SB      | VB  | 188.0  | 209.00   | 231.00 | 1                                | 304.0   | 1.4  | 1  | -   |
| SMAJ200A          | SMAJ200CA        | SV      | VV  | 200.0  | 224.00   | 247.00 | 1                                | 324.0   | 1.2  | 1  | -   |
| SMAJ220A          | -                | SX      | -   | 220.0  | 246.00   | 272.00 | 1                                | 356.0   | 1.1  | 1  | -   |
| -                 | SMAJ220CA*       | -       | VX  | 220.0  | 246.00   | 272.00 | 1                                | 356.0   | 1.7  | 1  | -   |
| SMAJ250A          | -                | SZ      | -   | 250.0  | 279.00   | 309.00 | 1                                | 405.0   | 1.0  | 1  | -   |
| -                 | SMAJ250CA*       | -       | VZ  | 250.0  | 279.00   | 309.00 | 1                                | 405.0   | 1.5  | 1  | -   |
| SMAJ300A*         | SMAJ300CA*       | TE      | UE  | 300.0  | 335.00   | 371.00 | 1                                | 486.0   | 1.3  | 1  | -   |
| SMAJ350A*         | SMAJ350CA*       | TG      | UG  | 350.0  | 391.00   | 432.00 | 1                                | 567.0   | 1.1  | 1  | -   |
| SMAJ400A*         | SMAJ400CA*       | TK      | UK  | 400.0  | 447.00   | 494.00 | 1                                | 648.0   | 1.0  | 1  | -   |
| SMAJ440A*         | SMAJ440CA*       | TM      | UM  | 440.0  | 492.00   | 543.00 | 1                                | 713.0   | 0.9  | 1  | -   |

#### Notes:

For bidirectional type having V<sub>R</sub> of 10 volts and less, the I<sub>R</sub> limit is double.  
 For stack-die parts, use \* to label the part number.

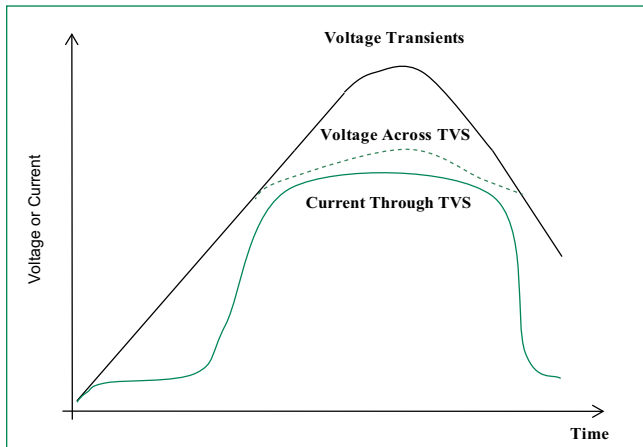
## I-V Curve Characteristics



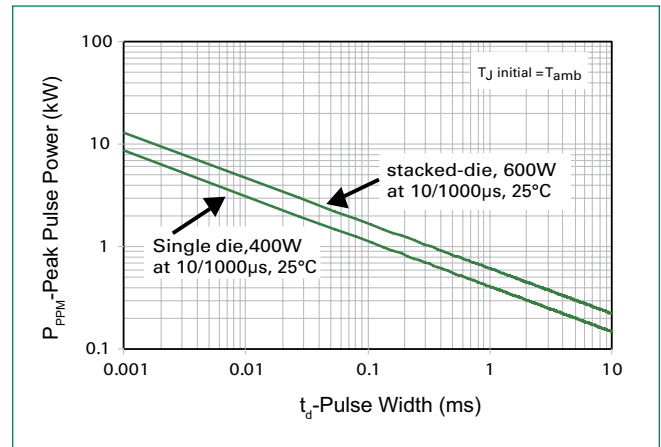
**$P_{PPM}$**  Peak Pulse Power Dissipation – Max power dissipation  
 **$V_R$**  Stand-off Voltage – Maximum voltage that can be applied to the TVS without operation  
 **$V_{BR}$**  Breakdown Voltage – Maximum voltage that flows through the TVS at a specified test current ( $I_T$ )  
 **$V_C$**  Clamping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

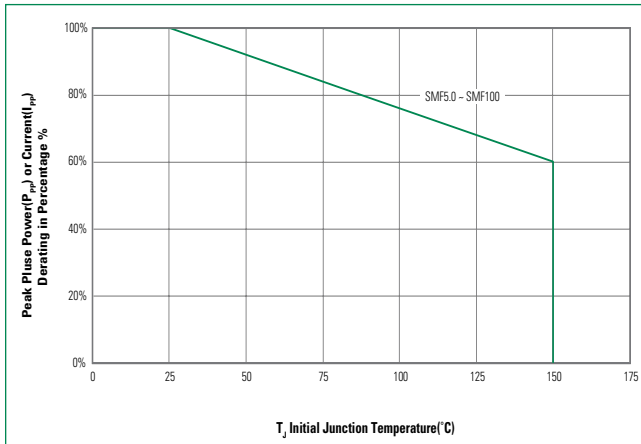


**Figure 2 - Peak Pulse Power Rating Curve**

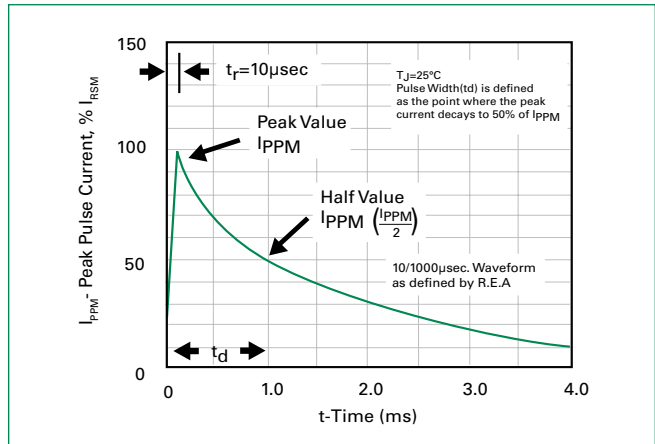


**Ratings and Characteristic Curves** ( $T_A=25^\circ\text{C}$  unless otherwise noted) (Continued)

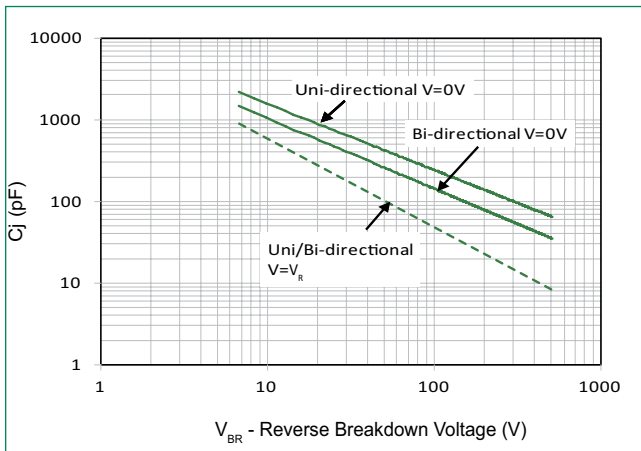
**Figure 3 - Peak Pulse Power Derating Curve**



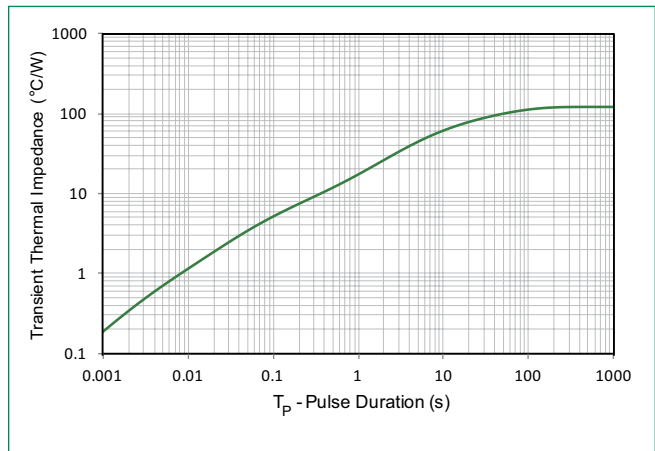
**Figure 4 - Pulse Waveform**



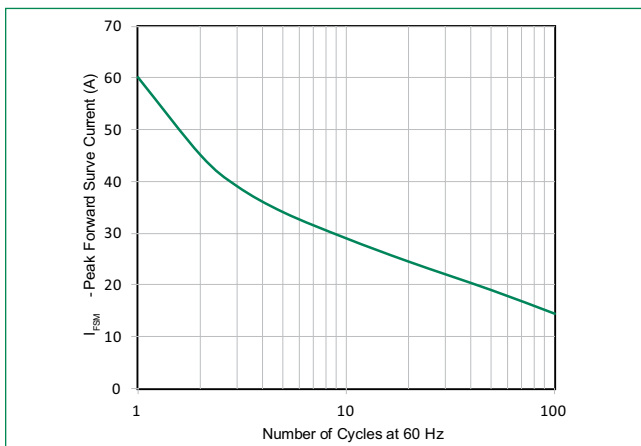
**Figure 5 - Typical Junction Capacitance**



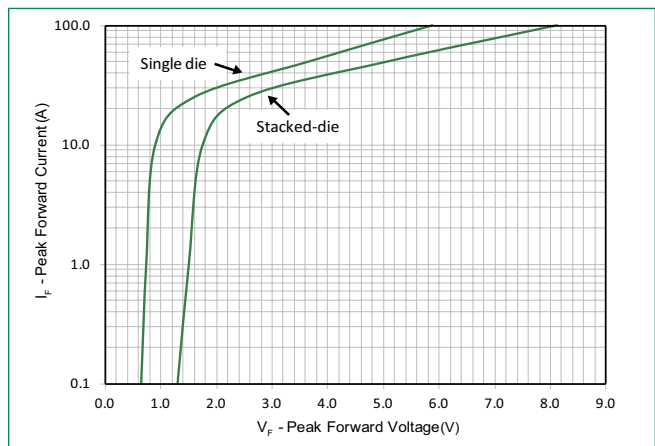
**Figure 6 - Typical Transient Thermal Impedance**



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

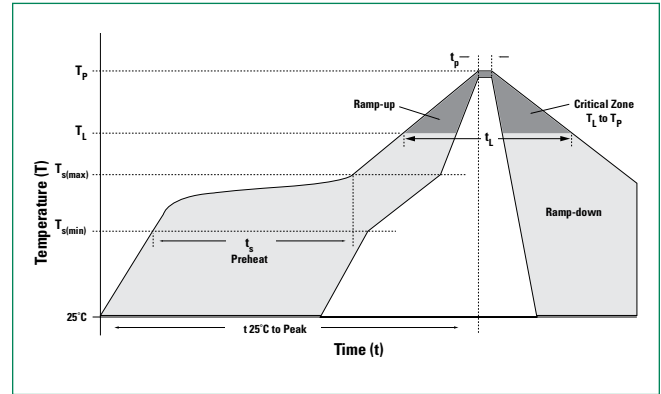


**Figure 8 - Peak Forward Voltage Drop vs Peak Forward Current (Typical Values)**



### Soldering Parameters

|   |                                    |                         |
|---|------------------------------------|-------------------------|
| <b>Reflow Condition</b>   |                                    | Lead-free assembly      |
| <b>Pre Heat</b>   | - Temperature Min ( $T_{s(min)}$ ) | 150°C                   |
|   | - Temperature Max ( $T_{s(max)}$ ) | 200°C                   |
|   | - Time (min to max) ( $t_s$ )      | 60 – 120 secs           |
| <b>Average ramp up rate (Liquidus Temp (<math>T_L</math>) to peak</b> |                                    | 3°C/second max          |
| <b><math>T_{s(max)}</math> to <math>T_L</math> - Ramp-up Rate</b>     |                                    | 3°C/second max          |
| <b>Reflow</b>   | - Temperature ( $T_L$ ) (Liquidus) | 217°C                   |
|   | - Time (min to max) ( $t_L$ )      | 60 – 150 seconds        |
| <b>Peak Temperature (<math>T_p</math>)</b>                            |                                    | 260 <sup>+0/-5</sup> °C |
| <b>Time within 5°C of actual peak Temperature (<math>t_p</math>)</b>  |                                    | 30 seconds Max          |
| <b>Ramp-down Rate</b>   |                                    | 6°C/second Max          |
| <b>Time 25°C to peak Temperature (<math>T_p</math>)</b>               |                                    | 8 minutes Max.          |
| <b>Do not exceed</b>  |                                    | 260°C                   |



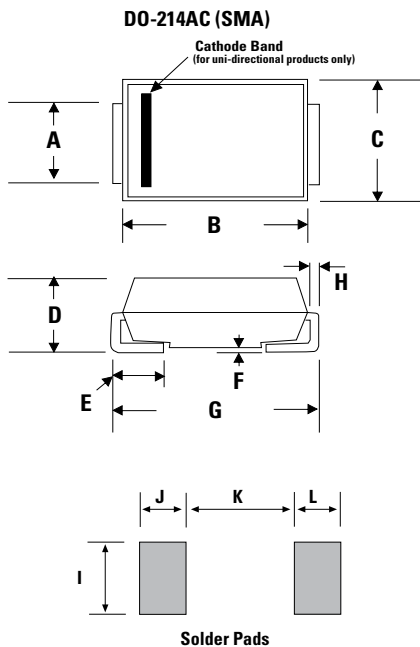
### Physical Specifications

|                 |  |
|-----------------|--|
| <b>Weight</b>   | 0.002 ounce, 0.061 gram                                      |
| <b>Case</b>     | JEDEC DO-214AC Molded Plastic over glass passivated junction |
| <b>Polarity</b> | Color band denotes cathode except Bipolar                    |
| <b>Terminal</b> | Matte Tin-plated leads, Solderable per JESD22-B102           |

### Environmental Specifications

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

### Dimensions



| Dimensions | Inches |       | Millimeters |       |
|------------|--------|-------|-------------|-------|
|            | Min    | Max   | Min         | Max   |
| A          | 0.049  | 0.065 | 1.250       | 1.650 |
| B          | 0.157  | 0.181 | 3.990       | 4.600 |
| C          | 0.095  | 0.110 | 2.400       | 2.790 |
| D          | 0.075  | 0.090 | 1.900       | 2.290 |
| E          | 0.030  | 0.060 | 0.780       | 1.520 |
| F          | -      | 0.008 | -           | 0.203 |
| G          | 0.189  | 0.208 | 4.800       | 5.280 |
| H          | 0.006  | 0.012 | 0.152       | 0.305 |
| I          | 0.070  | -     | 1.800       | -     |
| J          | 0.082  | -     | 2.100       | -     |
| K          | -      | 0.090 | -           | 2.300 |
| L          | 0.082  | -     | 2.100       | -     |

**SMAJ XXX C A**

- SMAJ**: Series
- XXX**:  $V_R$  Voltage
- C**: Bi-directional
- A**: 5%  $V_{BR}$  Voltage Tolerance

**Cathode Band**  
(for uni-directional products only)

**Littelfuse Logo**

**Marking Code**  
**XX**

**Trace Code Marking**  
**YMXXX**

**Y:** Year Code  
**M:** Month Code  
**XXX:** Lot Code

| Part number | Component Package | Quantity | Packaging Option                 | Packaging Specification |
|-------------|-------------------|----------|----------------------------------|-------------------------|
| SMAJ-xxxXX  | DO-214AC          | 5000     | Tape & Reel - 12mm tape/13" reel | EIA STD RS-481          |

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

## Littelfuse:

[SMAJ130CA](#) [SMAJ5.0](#) [SMAJ8.0A](#) [SMAJ110A](#) [SMAJ40C](#) [SMAJ16CA](#) [SMAJ20](#) [SMAJ22A](#) [SMAJ36A](#) [SMAJ51](#)  
[SMAJ110CA](#) [SMAJ170](#) [SMAJ200C](#) [SMAJ22CA](#) [SMAJ30](#) [SMAJ300CA](#) [SMAJ58CA](#) [SMAJ7.0A](#) [SMAJ12CA](#)  
[SMAJ26C](#) [SMAJ28A](#) [SMAJ48](#) [SMAJ100A](#) [SMAJ110](#) [SMAJ170CA](#) [SMAJ22](#) [SMAJ48C](#) [SMAJ11CA](#) [SMAJ160](#)  
[SMAJ160CA](#) [SMAJ220C](#) [SMAJ28CA](#) [SMAJ6.5A](#) [SMAJ75](#) [SMAJ7.5A](#) [SMAJ100CA](#) [SMAJ48CA](#) [SMAJ6.0](#)  
[SMAJ64A](#) [SMAJ70A](#) [SMAJ15A](#) [SMAJ220A](#) [SMAJ8.5](#) [SMAJ90A](#) [SMAJ10C](#) [SMAJ13C](#) [SMAJ14CA](#) [SMAJ51CA](#)  
[SMAJ75C](#) [SMAJ43CA](#) [SMAJ43A](#) [SMAJ300A](#) [SMAJ36CA](#) [SMAJ440A](#) [SMAJ100](#) [SMAJ30C](#) [SMAJ5.0C](#) [SMAJ58A](#)  
[SMAJ78A](#) [SMAJ9.0CA](#) [SMAJ150A](#) [SMAJ250CA](#) [SMAJ300](#) [SMAJ36](#) [SMAJ48A](#) [SMAJ8.0CA](#) [SMAJ20CA](#)  
[SMAJ54C](#) [SMAJ54CA](#) [SMAJ130C](#) [SMAJ18CA](#) [SMAJ220CA](#) [SMAJ33A](#) [SMAJ5.0A](#) [SMAJ78](#) [SMAJ8.5A](#) [SMAJ15C](#)  
[SMAJ8.5C](#) [SMAJ26CA](#) [SMAJ8.0C](#) [SMAJ10A](#) [SMAJ200](#) [SMAJ51C](#) [SMAJ60C](#) [SMAJ7.5CA](#) [SMAJ18C](#) [SMAJ64](#)  
[SMAJ9.0C](#) [SMAJ7.5C](#) [SMAJ85](#) [SMAJ9.0A](#) [SMAJ5.0CA](#) [SMAJ12](#) [SMAJ130](#) [SMAJ17](#) [SMAJ24](#) [SMAJ8.0](#)  
[SMAJ250C](#) [SMAJ30A](#) [SMAJ45A](#)