

**SMAJ-E Series**



**OBSOLETE** DATE: 08/21/2020 PCN/ECN# 41356  
REPLACED BY: SMAJ Series



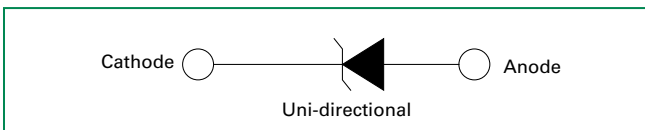
**Maximum Ratings and Thermal Characteristics**  
(T<sub>A</sub>=25°C unless otherwise noted)

| 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> | 400        | 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                                 | V <sub>F</sub>   | 3.5        | 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.

**Functional Diagram**



**Description**

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

**Features**

- Excellent clamping capability
- 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)
- EFT protection of data lines in accordance with IEC 61000-4-4
- Built-in strain relief
- 400W Peak pulse power capability at 10/1000µs waveform, repetition rate (duty cycle): 0.01 %
- 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/40sec
- V<sub>BR</sub> @ T<sub>J</sub>=V<sub>BR</sub>@25°C x (1+αT x (T<sub>J</sub> - 25)) (α:Temperature Coefficient, typical value is 0.1%)
- EPI silicon technology
- Meet MSL level1, per J-STD-020C, 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**

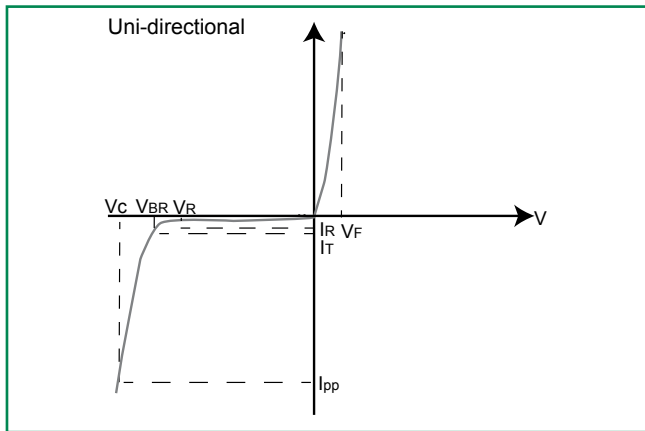
TVS devices are ideal for the protection of I/O Interfaces, V<sub>CC</sub> bus and other vulnerable circuits used in Telecom, Computer, Industrial and Consumer electronic applications.

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

| Part Number (Uni) | 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) |
|-------------------|---------|--|--|--------|----------------------------------|---|--|--|
|                   |         |  | MIN  | MAX    |                                  |   |  |  |
| SMAJ300A-E        | XE      | 300  | 335.0  | 371.0  | 1                                | 486.0   | 0.80   | 1  |
| SMAJ350A-E        | XG      | 350  | 391.0  | 432.0  | 1                                | 567.0   | 0.70   | 1  |
| SMAJ400A-E*       | XK      | 400  | 447.0  | 494.0  | 1                                | 648.0   | 0.60   | 1  |
| SMAJ450A-E*       | XM      | 440  | 492.0  | 543.0  | 1                                | 713.0   | 0.60   | 1  |
| SMAJ500A-E*       | XN      | 500  | 558.0  | 618.0  | 1                                | 810.0   | 0.50   | 1  |
| SMAJ550A-E*       | XP      | 550  | 614.0  | 680.0  | 1                                | 891.0   | 0.46   | 1  |
| SMAJ600A-E*       | XR      | 600  | 670.0  | 741.0  | 1                                | 971.0   | 0.42   | 1  |
| SMAJ650A-E*       | XS      | 650  | 726.0  | 803.0  | 1                                | 1052.0  | 0.39   | 1  |
| SMAJ700A-E*       | XT      | 700  | 782.0  | 865.0  | 1                                | 1133.0  | 0.36   | 1  |
| SMAJ750A-E*       | XU      | 750  | 837.0  | 927.0  | 1                                | 1213.0  | 0.33   | 1  |
| SMAJ850A-E*       | XV      | 850  | 950.0  | 1050.0 | 1                                | 1365.0  | 0.30   | 1  |

Note: for parts with \* are still under development

### 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>)

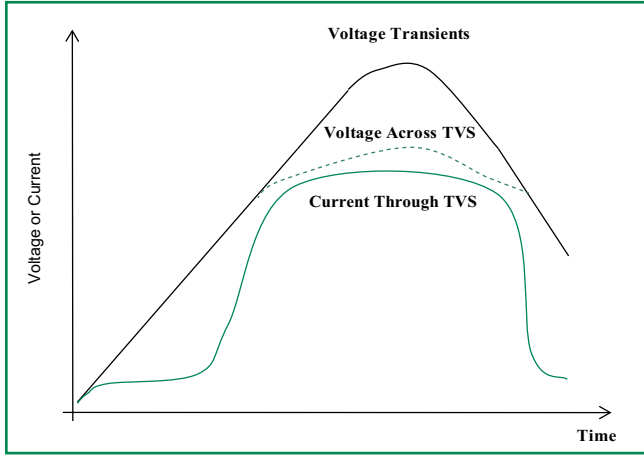
**V<sub>c</sub>** Clamping Voltage – Peak voltage measured across the TVS at a specified I<sub>ppm</sub> (peak impulse current)

**I<sub>r</sub>** Reverse Leakage Current – Current measured at V<sub>r</sub>

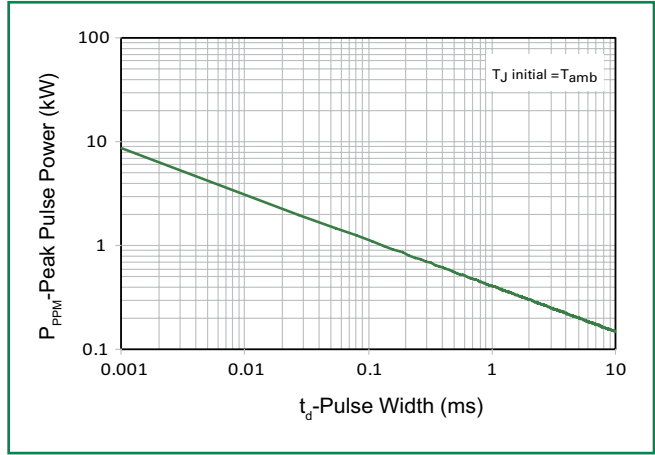
**V<sub>f</sub>** Forward Voltage Drop for Uni-directional

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

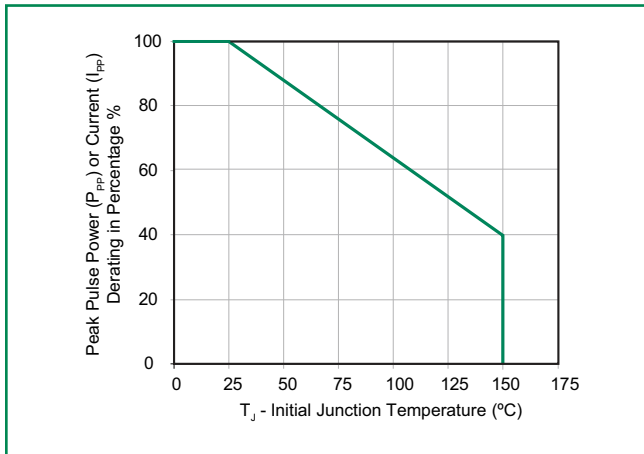
**Figure 1 - TVS Transients Clamping Waveform**



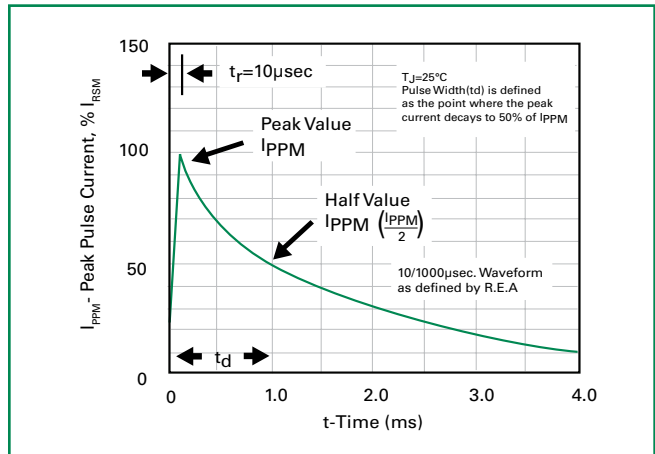
**Figure 2 - Peak Pulse Power Rating Curve**



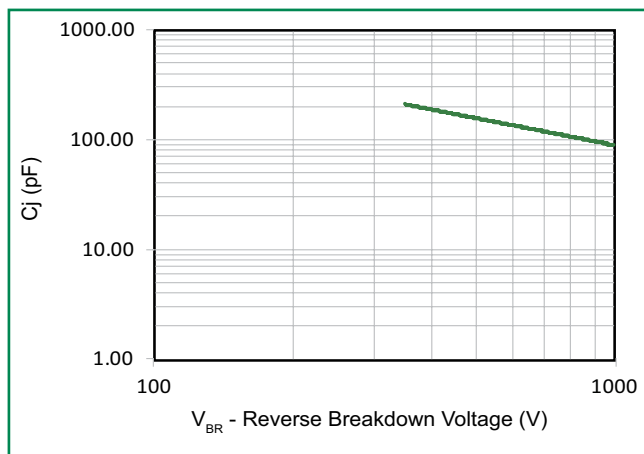
**Figure 3 - Peak Pulse Power Derating Curve**



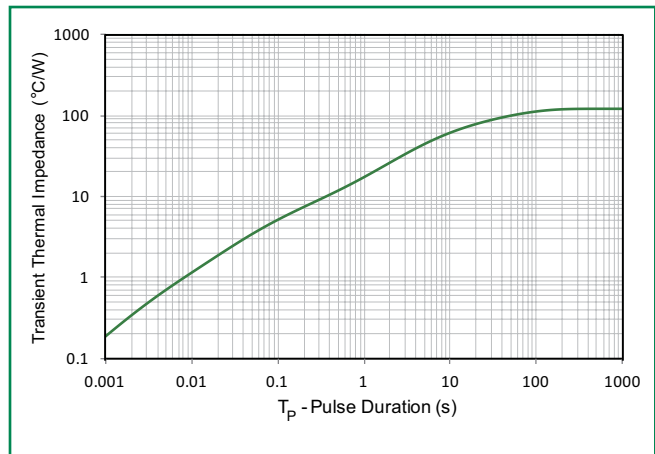
**Figure 4 - Pulse Waveform**



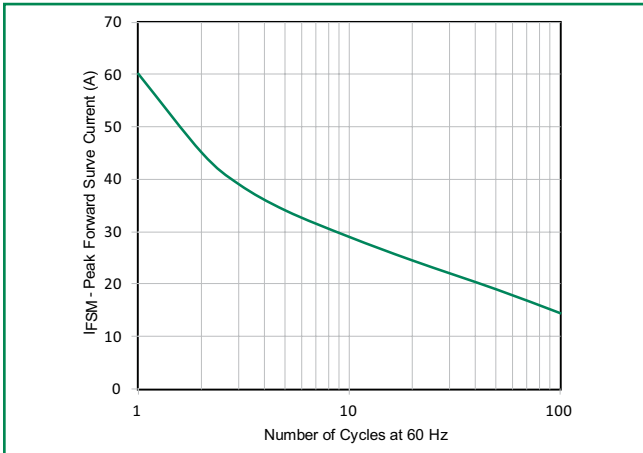
**Figure 5 - Typical Junction Capacitance**



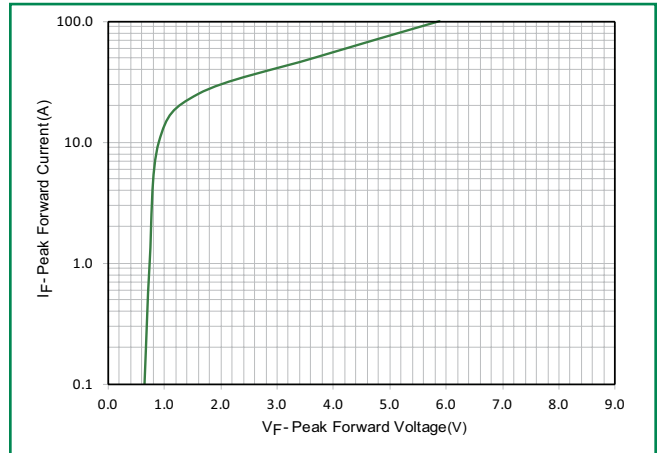
**Figure 6 - Typical Transient Thermal Impedance**



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

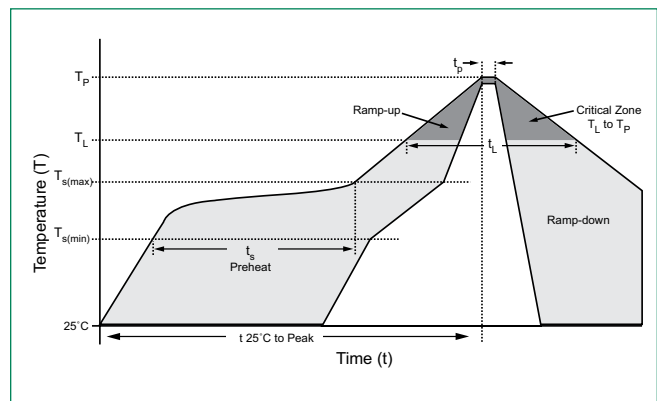


**Figure 8 - Peak Forward Voltage Drop vs Peak Forward Current (Typical Values)**



**Soldering Parameters**

|  |                                    |                         |
|--|------------------------------------|-------------------------|
| 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 ( $T_A$ ) to peak) |                                    | 3°C/second max          |
| $T_{s(max)}$ to $T_A$ - Ramp-up Rate                   |                                    | 3°C/second max          |
| Reflow   | - Temperature ( $T_A$ ) (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                   |



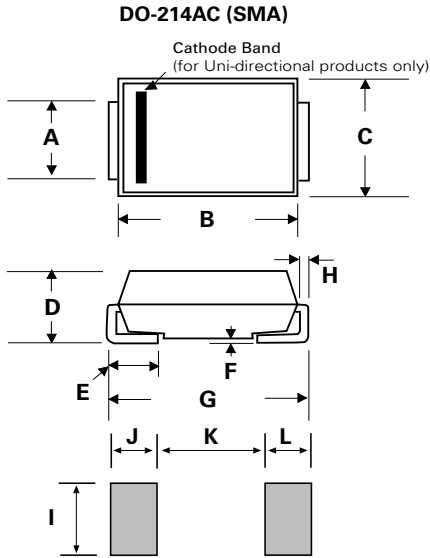
**Physical Specifications**

|                 |  |
|-----------------|--|
| <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**

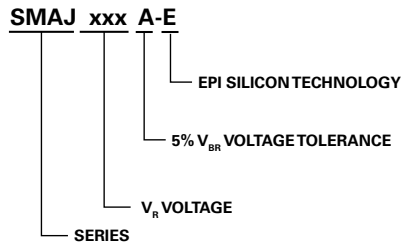
|                            |                          |
|----------------------------|--------------------------|
| <b>High Temp. Storage</b>  | JESD22-A103              |
| <b>HTRB</b>                | JESD22-A108              |
| <b>Temperature Cycling</b> | JESD22-A104              |
| <b>MSL</b>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

**Dimensions**

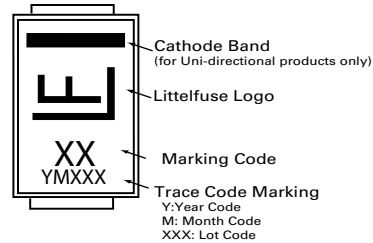


| Dimensions | Inches |       | Millimeters |       |
|------------|--------|-------|-------------|-------|
|            | Min    | Max   | Min         | Max   |
| A          | 0.049  | 0.065 | 1.250       | 1.650 |
| B          | 0.157  | 0.181 | 3.990       | 4.600 |
| C          | 0.095  | 0.110 | 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       | -     |

**Part Numbering System**



**Part Marking System**



**Packaging**

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

**Tape and Reel Specification**

