

## SMAJ-E Series



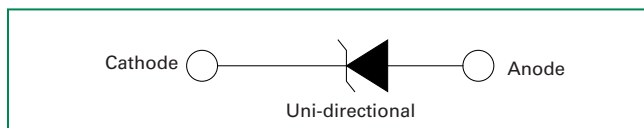
### Maximum Ratings and Thermal Characteristics ( $T_A=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Peak Pulse Power Dissipation at $T_A=25^\circ\text{C}$ by 10/1000 $\mu\text{s}$ Waveform (Fig.2)(Note 1), (Note 2)	$P_{PPM}$	400	W
Power Dissipation on Infinite Heat Sink at $T_L=50^\circ\text{C}$	$P_D$	3.3	W
Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3)	$I_{FSM}$	60	A
Maximum Instantaneous Forward Voltage at 25A for Unidirectional Only	$V_F$	3.5	V
Operating Temperature Range	$T_J$	-65 to 150	$^\circ\text{C}$
Storage Temperature Range	$T_{STG}$	-65 to 175	$^\circ\text{C}$
Typical Thermal Resistance Junction to Lead	$R_{\theta JL}$	30	$^\circ\text{C/W}$
Typical Thermal Resistance Junction to Ambient	$R_{\theta JA}$	120	$^\circ\text{C/W}$

**Notes:**

1. Non-repetitive current pulse, per Fig.4 and derated above  $T_J$  (initial)  $=25^\circ\text{C}$  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)
- 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
- 400W Peak pulse power capability at 10/1000 $\mu\text{s}$  waveform, repetition rate (duty cycle): 0.01 %
- Fast response time: typically less than 1.0ps from 0 Volts to  $V_{BR}$  min
- Glass passivated junction
- Low inductance
- High temperature to reflow soldering guaranteed:  $260^\circ\text{C}/40\text{sec}$
- $V_{BR}$  @  $T_J = V_{BR}$  @  $25^\circ\text{C} \times (1 + \alpha T \times (T_J - 25))$  ( $\alpha$  T: Temperature Coefficient, typical value is 0.1 %)
- EPI silicon technology
- Meet MSL level1, per J-STD-020C, LF maximum peak of  $260^\circ\text{C}$
- 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

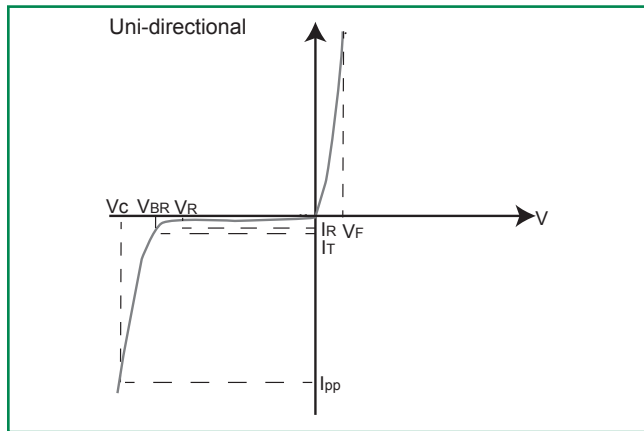
TVS devices are ideal for the protection of I/O Interfaces,  $V_{CC}$  bus and other vulnerable circuits used in Telecom, Computer, Industrial and Consumer electronic applications.

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

Part Number (Uni)	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 $I_R$ @ $V_R$ ( $\mu\text{A}$ )
			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**



**$P_{PPM}$  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 ( $I_T$ )

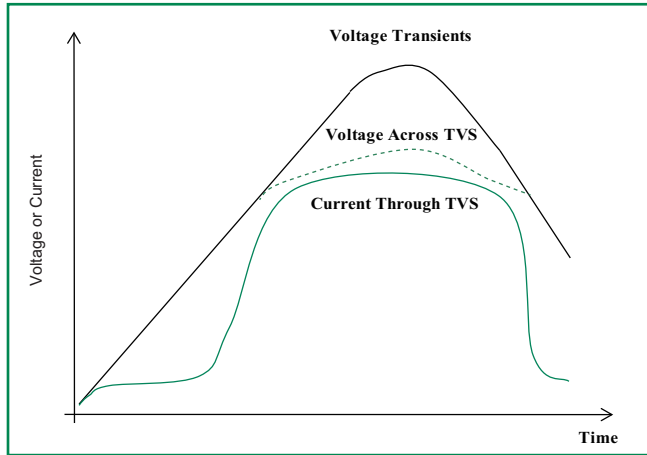
**$V_C$  Clamping Voltage** – Peak voltage measured across the TVS at a specified  $I_{ppm}$  (peak impulse current)

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

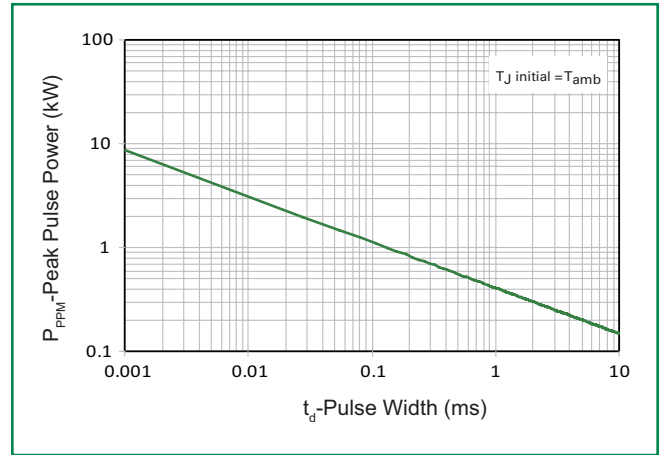
**$V_F$  Forward Voltage Drop for Uni-directional**

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

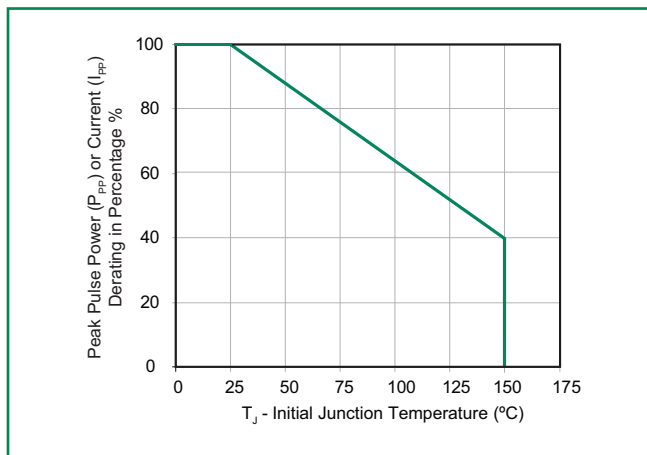
**Figure 1 - TVS Transients Clamping Waveform**



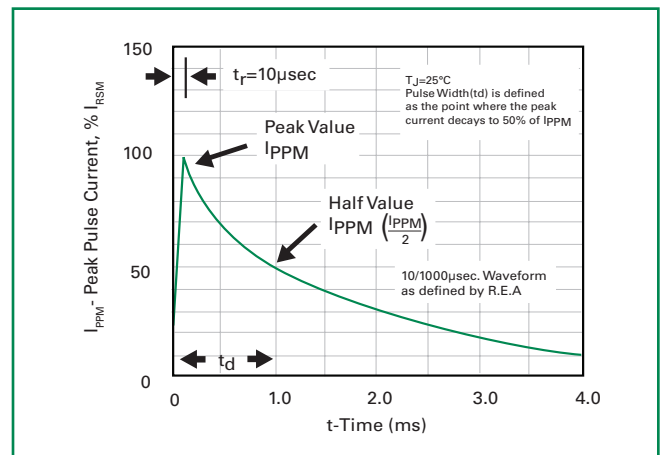
**Figure 2 - Peak Pulse Power Rating Curve**



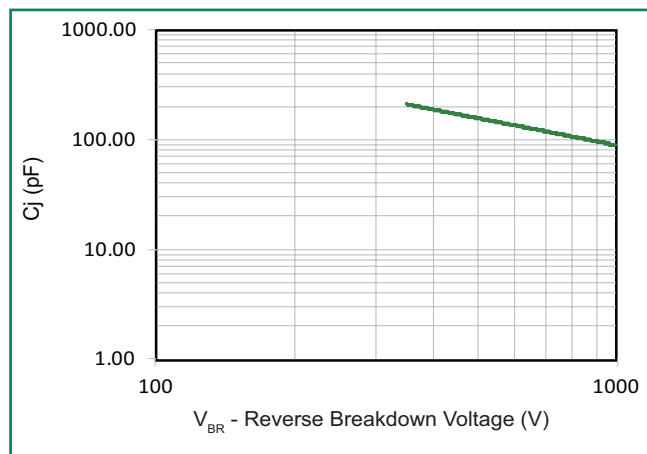
**Figure 3 - Peak Pulse Power Derating Curve**



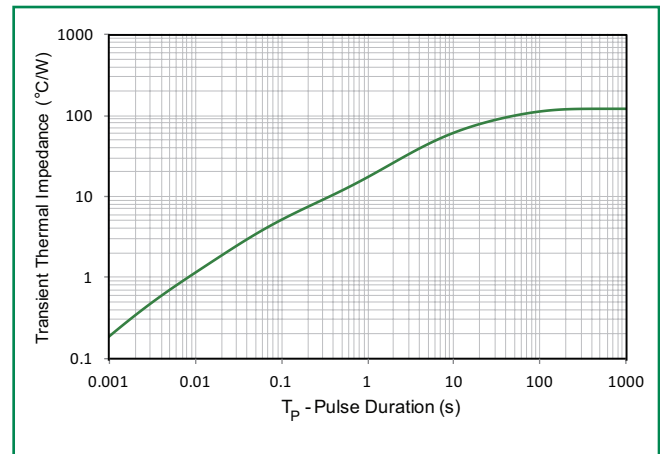
**Figure 4 - Pulse Waveform**



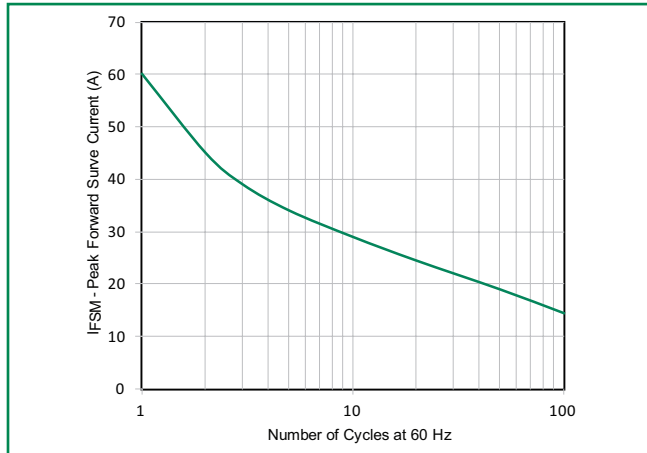
**Figure 5 - Typical Junction Capacitance**



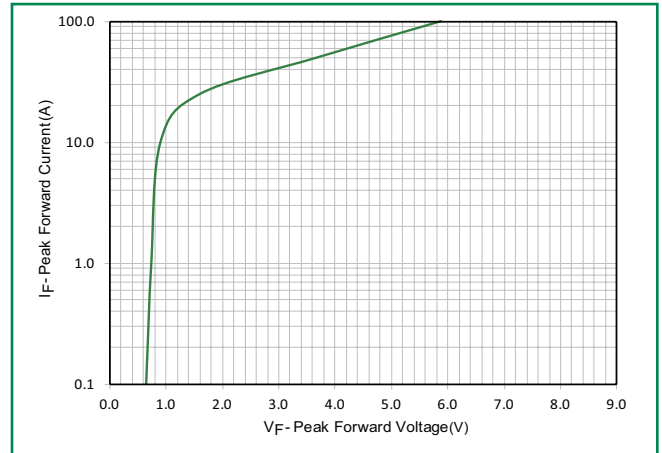
**Figure 6 - Typical Transient Thermal Impedance**



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

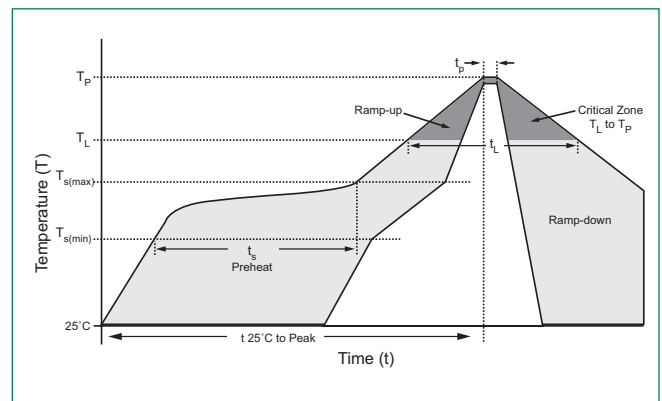


**Figure 8 - Peak Forward Voltage Drop vs Peak Forward Current (Typical Values)**



### 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



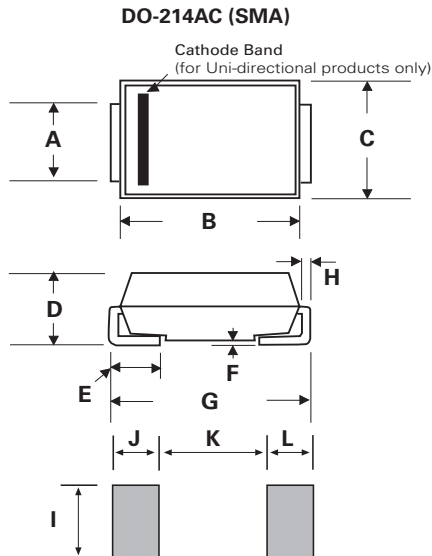
### Physical Specifications

<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

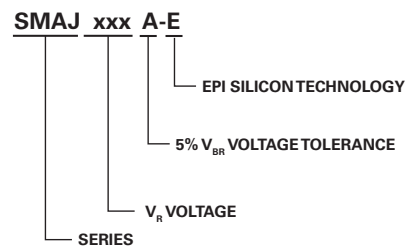
<b>High Temp. Storage</b>	JESD22-A103
<b>HTRB</b>	JESD22-A108
<b>Temperature Cycling</b>	JESD22-A104
<b>MSL</b>	JEDEC-J-STD-020, Level 1
<b>H3TRB</b>	JESD22-A101
<b>RSH</b>	JESD22-A111

## Dimensions

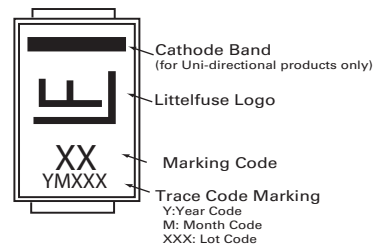


Dimensions	Inches		Millimeters	
	Min	Max	Min	Max
A	0.049	0.065	1.250	1.650
B	0.157	0.181	3.990	4.600
C	0.095	0.110	2.400	2.790
D	0.075	0.090	1.900	2.290
E	0.030	0.060	0.780	1.520
F	-	0.008	-	0.203
G	0.189	0.208	4.800	5.280
H	0.006	0.012	0.152	0.305
I	0.070	-	1.800	-
J	0.082	-	2.100	-
K	-	0.090	-	2.300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

