

# SMAJ Series

Surface Mount – 400W



## Additional Information



Resources



Accessories



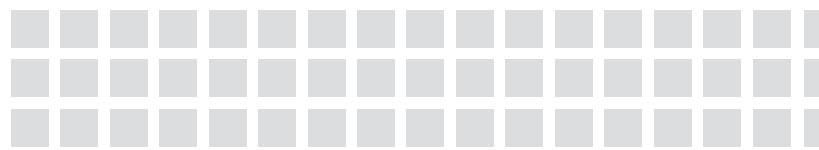
Samples

### 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 10/1000us Waveform(Fig.2)(Note 1), (Note 2)-Single Die Parts	$P_{PPM}$	400	W
Peak Pulse Power Dissipation at $T_A=25^\circ\text{C}$ by 10/1000us Waveform(Fig.2)(Note 1), (Note 2)-Stacked Die Parts(Note 5)	$P_{PPM}$	600	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 (Note 4)	$V_F$	3.5/5.0	V
Operating Temperature Range	$T_J$	-65 to 150	°C
Storage Temperature Range	$T_{STG}$	-65 to 175	°C
Typical Thermal Resistance Junction to Lead	$R_{\theta JL}$	30	°C/W
Typical Thermal Resistance Junction to Ambient	$R_{\theta JA}$	120	°C/W

#### Notes:

1. Non-repetitive current pulse, per Fig.4 and derated above  $T_j$  (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.  $V_F < 3.5\text{V}$  for single die parts and  $V_F < 5.0\text{V}$  for stacked-die parts.
5. For stacked die component details, please refer to part numbers labeled by \* in Electrical Characteristics.



## Description

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

## Features & Benefits

- 400 W peak pulse power capability at 10/1000  $\mu\text{s}$  waveform, repetition rate (duty cycles): 0.01%
- SMD low-profile surface-mount package minimizing PCB footprint
- Typical failure mode is short from over-specified voltage or current
- Whisker test conducted based on JEDEC JESD201A (Table 4a and 4c) – pass class 1 and 2
- IEC 61000-4-2 ESD protection: 30 kV (Air), 30 kV (Contact)
- Glass passivated chip junction
- Low dynamic resistance
- $V_{BR} @ T_j = V_{BR} @ 25^\circ\text{C} \times (1 + \alpha T \times (T_j - 25))$ ,  $\alpha T$  (Temperature Coefficient) typical value: 0.1%
- Recognized compound meeting flammability rating UL94 V-0
- Halogen-free and RoHS-compliant
- Pb-free E3: 2nd level interconnect is Pb-free; terminal finish material is tin (Sn) (IPC/JEDEC J-STD-609A.01)
- Recognized to UL 497B as an Isolated Loop Circuit Protector
- Products manufactured outside China available (parts with an E suffix)

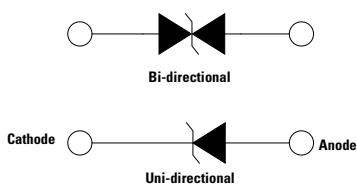
## Applications

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.

## Agency Approvals

Agency	Agency File Number
	E230531

## Functional Diagram



**SMAJ Series**

Surface Mount – 400W

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

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 $I_R$ @ $V_R$ ( $\mu\text{A}$ )	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	X
SMAJ188A	SMAJ188CA	SB	VB	188.0	209.00	231.00	1	304.0	1.4	1	X
SMAJ200A	SMAJ200CA	SV	VV	200.0	224.00	247.00	1	324.0	1.2	1	X
SMAJ220A	-	SX	-	220.0	246.00	272.00	1	356.0	1.1	1	X
-	SMAJ220CA*	-	VX	220.0	246.00	272.00	1	356.0	1.7	1	X
SMAJ250A	-	SZ	-	250.0	279.00	309.00	1	405.0	1.0	1	X
-	SMAJ250CA*	-	VZ	250.0	279.00	309.00	1	405.0	1.5	1	X
SMAJ300A*	SMAJ300CA*	TE	UE	300.0	335.00	371.00	1	486.0	1.3	1	X
SMAJ350A*	SMAJ350CA*	TG	UG	350.0	391.00	432.00	1	567.0	1.1	1	X
SMAJ400A*	SMAJ400CA*	TK	UK	400.0	447.00	494.00	1	648.0	1.0	1	X
SMAJ440A*	SMAJ440CA*	TM	UM	440.0	492.00	543.00	1	713.0	0.9	1	X

**Notes:**For bidirectional type having  $V_c$  of 10 volts and less, the  $I_R$  limit is double.

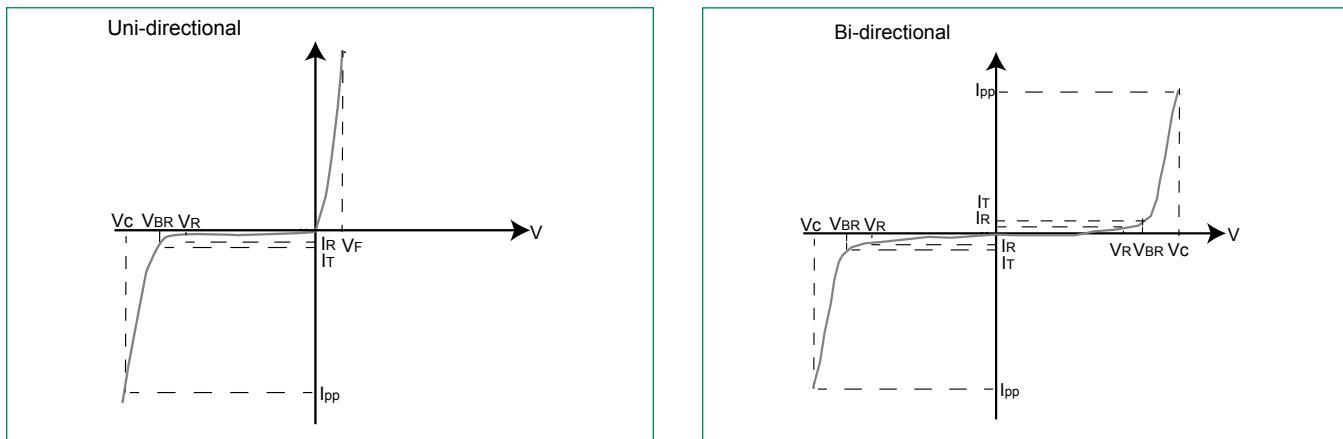
For stack-die parts, use \* to label the part number.

For uni-directional 5 V to 250 V, bi-directional 5 V to 200 V, add "-E" to the part number for COO Ex-China Site.

# SMAJ Series

## Surface Mount – 400W

### 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 though the TVS at a specified test current ( $I_T$ )

**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

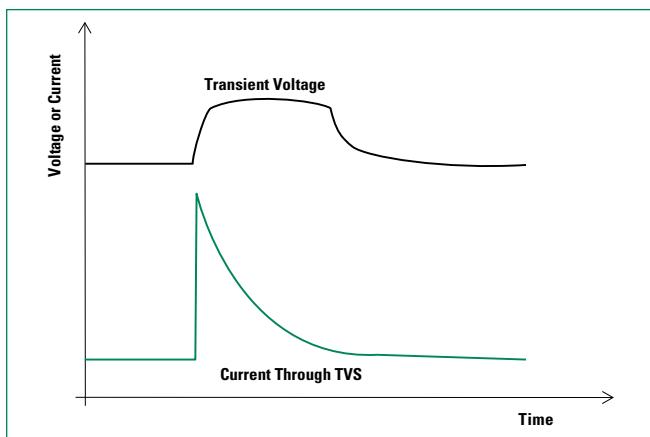
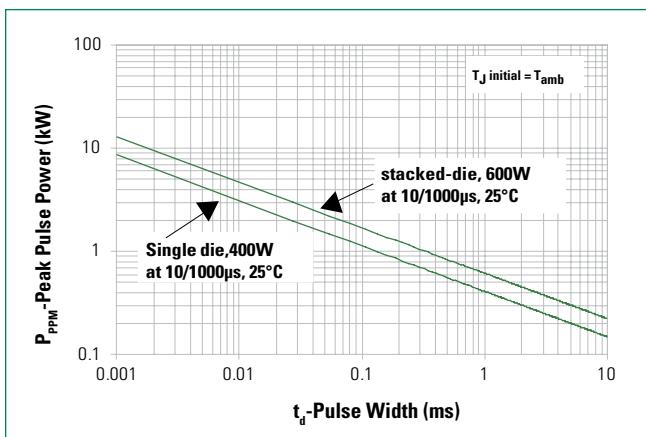


Figure 2:

Typical Peak Pulse Power Rating Curve



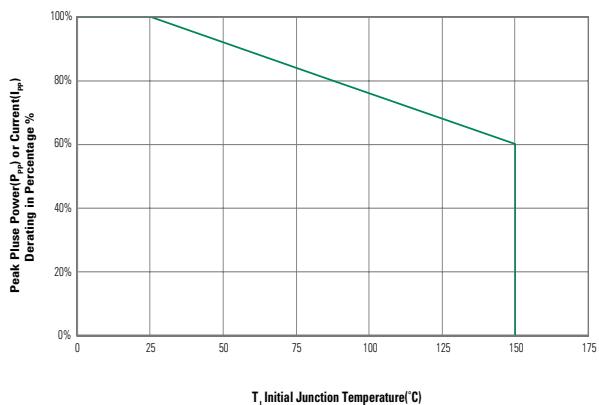
# SMAJ Series

## Surface Mount – 400W

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

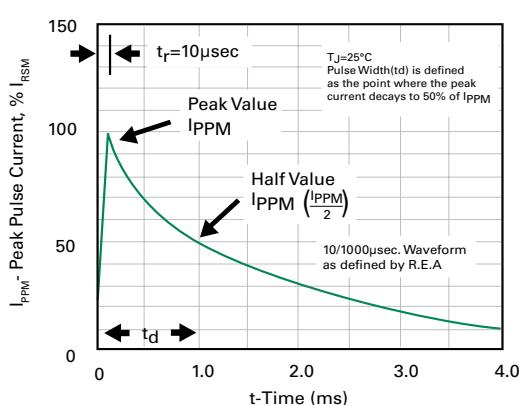
**Figure 3:**

Peak Pulse Power Derating Curve



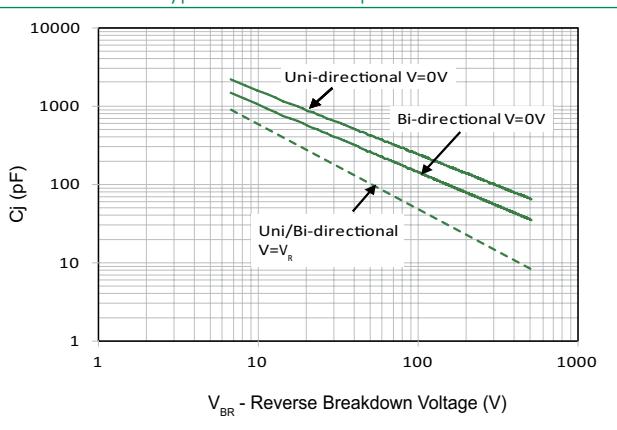
**Figure 4:**

Pulse Waveform



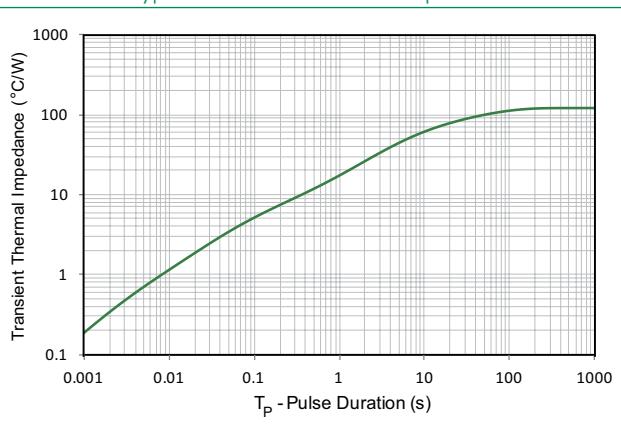
**Figure 5:**

Typical Junction Capacitance



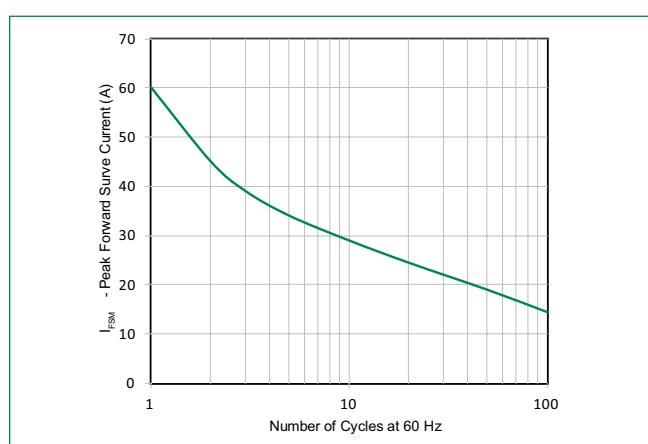
**Figure 6:**

Typical Transient Thermal Impedance



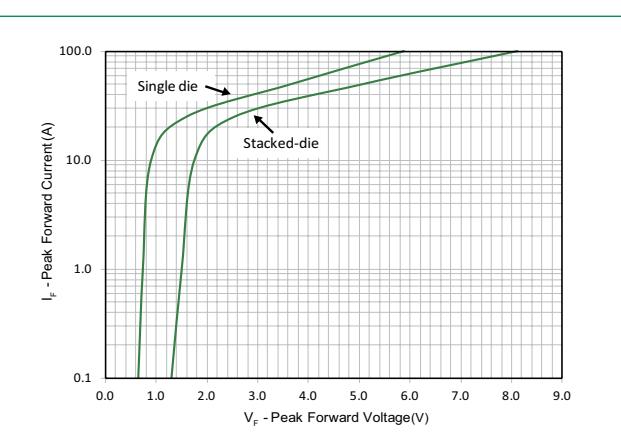
**Figure 7:**

Maximum Non-Repetitive Forward Surge Current  
Uni-Directional Only



**Figure 8:**

Peak Forward Voltage Drop vs Peak Forward Current  
(Typical Values)

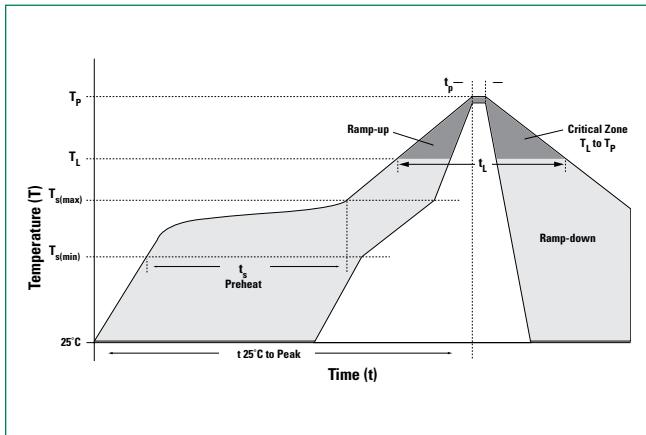


# SMAJ Series

Surface Mount – 400W

## 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 – 120 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) ( $t_L$ )	60 – 150 seconds
Peak Temperature ( $T_p$ )		260 <sup>+0/-5</sup> °C
Time within 5°C of actual peak Temperature ( $t_p$ )		30 seconds Max
Ramp-down Rate		6°C/second Max
Time 25°C to peak Temperature ( $T_p$ )		8 minutes Max.
Do not exceed		260°C



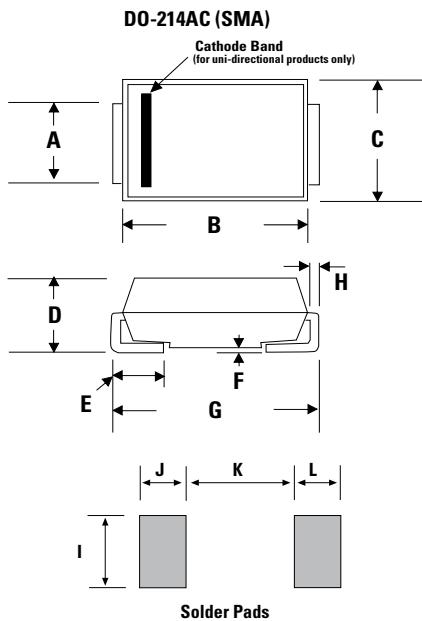
## Physical Specifications

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

## Environmental Specifications

High Temp Voltage Blocking (HTRB)	100 % DC reverse voltage rated 150 °C, 1008 hours JEDEC, JESD22-A-108
Biased Temp & Humidity (H3TRB)	80 % breakdown voltage (+85 °C) 85 % RH, 1008 hours JEDEC, JESD22-A-101
Unbiased Highly Accelerated Stress Test (UHAST)	96 hours at TA = 130 °C/85 % RH. JEDEC, JESD22-A-118
Temp Cycling (TC)	-55 °C to +150 °C, 15 min. dwell, 1000 cycles. JEDEC, JESD22-A104
Moisture Sensitivity Level (MSL)	85 %RH, +85 °C, 168 hours, 3 reflow cycles (+260 °C Peak). JEDEC, JEDEC-J-STD-020, Level 1
Resistance to Solder Heat (RSH)	+260 °C, 30 seconds JEDEC, JESD22-A-111

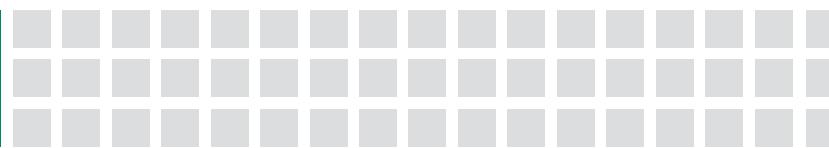
## Dimensions



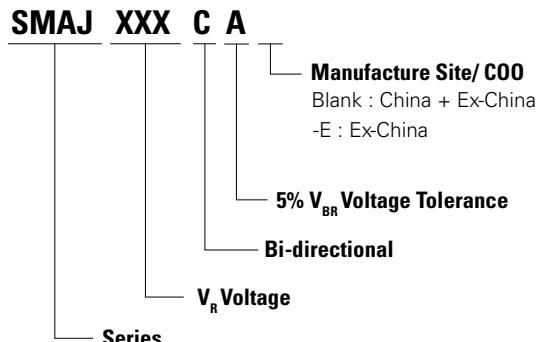
Dimensions	Inches		Millimeters	
	Min	Max	Min	Max
A	0.049	0.065	1.250	1.650
B	0.157	0.181	3.990	4.600
C	0.095	0.110	2.400	2.790
D	0.075	0.090	1.900	2.290
E	0.030	0.060	0.780	1.520
F	-	0.008	-	0.203
G	0.189	0.208	4.800	5.280
H	0.006	0.012	0.152	0.305
I	0.070	-	1.800	-
J	0.082	-	2.100	-
K	-	0.090	-	2.300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

# SMAJ Series

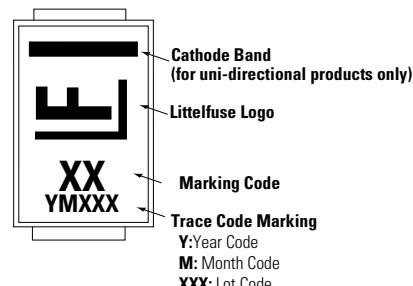
Surface Mount – 400W



## Part Numbering System



## Part Marking System



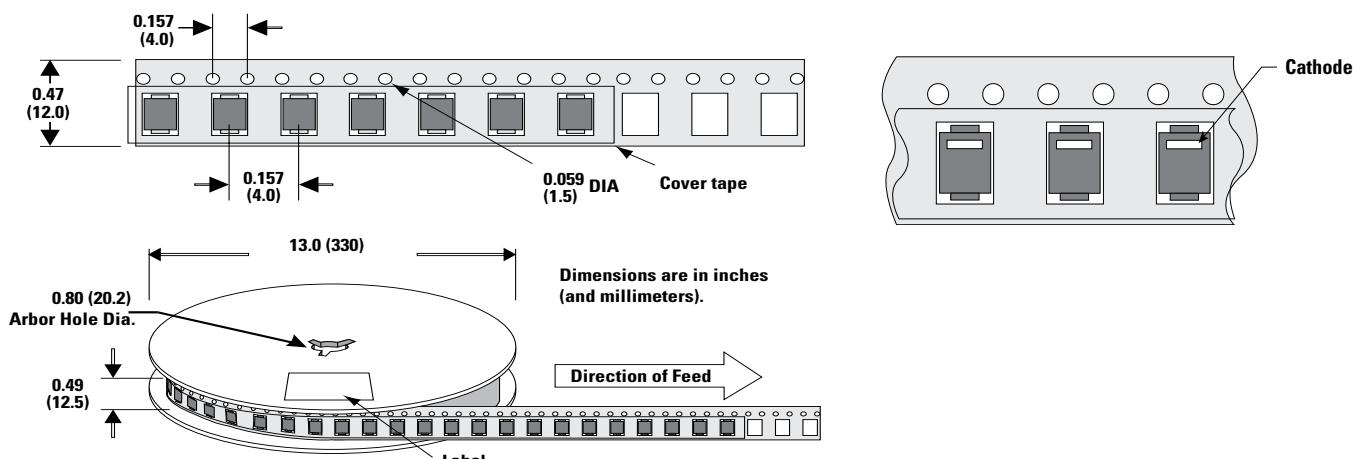
## Packaging

Part number	Component Package	Quantity	Packaging Option	Packaging Specification	Manufacture Site/COO
SMAJxxxXX	DO-214AC	5000	Tape & Reel - 12mm tape/13" reel	EIA STD RS-481	China + Ex-China
SMAJxxxXX-E <sup>1,2</sup>	DO-214AC	5000	Tape & Reel - 12mm tape/13" reel	EIA STD RS-481	Ex-China

### Notes:

1. Uni-directional products voltage range from 5 V to 250 V.
2. Bi-directional products voltage range from 5 V to 200 V.

## Tape and Reel Specification



**Disclaimer Notice** - Information furnished is believed to be accurate and reliable. However, users should independently evaluate the suitability of and test each product selected for their own applications. Littelfuse products are not designed for, and may not be used in, all applications. Read complete Disclaimer Notice at [www.littelfuse.com/disclaimer-electronics](http://www.littelfuse.com/disclaimer-electronics).