

Additional Information







Resources

Accessories

Samples

Maximum Ratings and Thermal Characteristics

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

Parameter	Symbol	Value	Unit
Peak Pulse Power Dissipation at TA=25° by 10/1000us Waveform(Fig.2)(Note 1), (Note 2) -Single Die Parts	P _{PPM}	400	W
Peak Pulse Power Dissipation at TA=25° 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°C	P _D	3.3	W
Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3)	I _{FSM}	60	А
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 _{eJL}	30	°C/W
Typical Thermal Resistance Junction to Ambient	R _{eJA}	120	°C/W

Notes:

- 1. Non-repetitive current pulse, per Fig.4 and derated above $T_{_{\rm J}}$ (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.** VF < 3.5V for single die parts and VF< 5.0V 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

- 400W Peak Pulse Power capability at 10/1000µs waveform, repetition rate (duty cycle): 0.01%
- Excellent clamping capability
- Typical IR less than 1µA when VBR min>12V
- Surface mount footprint for compact PCB layout
- 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 VBR min

- Glass passivated junction
- Low inductance
- High temperature to reflow soldering guaranteed: 260°C/30sec
- VBR @ TJ= VBR@25°C x (1+αT x (TJ - 25)) (αT:Temperature Coefficient, typical value is 0.1%)
- Plastic package is flammability rated V-0 per UL-94.
- Meet MSL level1, per J-STD-020, LF maximun 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)

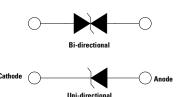
Applications

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

Agency Approvals

Agency	Agency File Number
<i>7</i> 1.	E230531

Functional Diagram





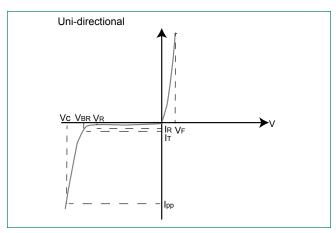
Electrical Characteristics (T_A =25°C unless otherwise noted)

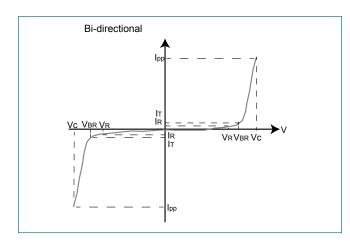
Part Number	Part Number	Mar	king	Reverse Stand off Voltage V _R	Volta	down ge V _{BR} s) @ I _T	Test Current	Maximum Clamping Voltage V _c	Maximum Peak Pulse Current I	Maximum Reverse Leakage I _R @	Agency Approval
(Uni)	(Bi)	Uni.	Bi.	(Volts)	Min.	Max.	I _T (mA)	@ I _{pp} (V)	(A) PP	V _R (µA)	71 °
SMAJ5.0A	SMAJ5.0CA	ΑE	WE	5.0	6.40	7.00	10	9.2	43.5	800	Χ
	SMAJ6.0CA	AG	WG	6.0	6.67	7.37	10	10.3	38.8	800	Χ
	SMAJ6.5CA	AK	WK	6.5	7.22	7.98	10	11.2	35.7	500	Χ
SMAJ7.0A	SMAJ7.0CA	AM	WM	7.0	7.78	8.60	10	12.0	33.3	200	Χ
	SMAJ7.5CA	AP	WP	7.5	8.33	9.21	1	12.9	31.0	100	Χ
	SMAJ8.0CA	AR	WR	8.0	8.89	9.83	1	13.6	29.4	50	Χ
	SMAJ8.5CA	AT	WT	8.5	9.44	10.40	1	14.4	27.8	20	Χ
	SMAJ9.0CA	AV	WV	9.0	10.00	11.10	1	15.4	26.0	10	X
	SMAJ10CA	AX	WX	10.0	11.10	12.30	1	17.0	23.5	5	X
	SMAJ11CA	AZ	WZ	11.0	12.20	13.50	1	18.2	22.0	1	X
	SMAJ12CA	BE	XE	12.0	13.30	14.70	1	19.9	20.1	1	X
	SMAJ13CA	BG	XG	13.0	14.40	15.90	1	21.5	18.6	1	X
	SMAJ14CA	BK	XK	14.0	15.60	17.20	1	23.2	17.2	1	X
	SMAJ15CA	BM	XM	15.0	16.70	18.50	1	24.4	16.4	1	X
	SMAJ16CA	BP	XP	16.0	17.80	19.70	1	26.0	15.4	1	X
	SMAJ17CA	BR	XR	17.0	18.90	20.90	1	27.6	14.5	1	X
	SMAJ18CA	BT	XT	18.0	20.00	22.10	1	29.2	13.7	1	X
	SMAJ20CA	BV	XV	20.0	22.20	24.50	1	32.4	12.3	1	X
	SMAJ22CA	BX BZ	XX	22.0	24.40	26.90	1	35.5	11.3	1	X
	SMAJ24CA	CE	XZ YE	24.0	26.70	29.50	1	38.9	10.3	1	X
	SMAJ26CA	CG	YG	26.0 28.0	28.90	31.90 34.40	1	42.1 45.4	9.5 8.8	1	X
	SMAJ28CA SMAJ30CA	CK	YK	30.0	31.10 33.30	36.80	1	48.4	8.3	1	X
	SMAJ33CA	CM	YM	33.0	36.70	40.60	1	53.3	7.5	1	X
	SMAJ36CA	CP	YP	36.0	40.00	44.20	1	58.1	6.9	1	X
	SMAJ40CA	CR	YR	40.0	44.40	49.10	1	64.5	6.2	1	X
	SMAJ43CA	CT	YT	43.0	47.80	52.80	1	69.4	5.8	1	X
	SMAJ45CA	CV	YV	45.0	50.00	55.30	1	72.7	5.5	1	X
	SMAJ48CA	CX	YX	48.0	53.30	58.90	1	77.4	5.2	1	X
	SMAJ51CA	CZ	YZ	51.0	56.70	62.70	1	82.4	4.9	1	X
	SMAJ54CA	RE	ZE	54.0	60.00	66.30	1	87.1	4.6	1	X
	SMAJ58CA	RG	ZG	58.0	64.40	71.20	1	93.6	4.3	1	X
	SMAJ60CA	RK	ZK	60.0	66.70	73.70	1	96.8	4.1	1	X
	SMAJ64CA	RM	ZM	64.0	71.10	78.60	1	103.0	3.9	1	X
	SMAJ70CA	RP	ZP	70.0	77.80	86.00	1	113.0	3.5	1	X
	SMAJ75CA	RR	ZR	75.0	83.30	92.10	1	121.0	3.3	1	X
	SMAJ78CA	RT	ZT	78.0	86.70	95.80	1	126.0	3.2	1	X
	SMAJ85CA	RV	ZV	85.0	94.40	104.00	1	137.0	2.9	1	X
	SMAJ90CA	RX	ZX	90.0	100.00	111.00	1	146.0	2.7	1	X
	SMAJ100CA	RZ	ZZ	100.0	111.00	123.00	1	162.0	2.5	1	X
	SMAJ110CA	SE	VE	110.0	122.00	135.00	1	177.0	2.3	1	X
SMAJ120A S		SG	VG	120.0	133.00	147.00	1	193.0	2.1	1	X
SMAJ130A S		SK	VK	130.0	144.00	159.00	1	209.0	1.9	1	X
SMAJ150A S		SM	VM	150.0	167.00	185.00	1	243.0	1.6	1	X
SMAJ160A S		SP	VP	160.0	178.00	197.00	1	259.0	1.5	1	X
SMAJ170A S		SR	VR	170.0	189.00	209.00	1	275.0	1.5	1	X
SMAJ180A S		ST	VT	180.0	201.00	222.00	1	292.0	1.4	1	Χ
SMAJ188A S		SB	VB	188.0	209.00	231.00	1	304.0	1.4	1	X
SMAJ200A S		SV	VV	200.0	224.00	247.00	1	324.0	1.2	1	Χ
SMAJ220A	-	SX	-	220.0	246.00	272.00	1	356.0	1.1	1	Χ
	MAJ220CA*	-	VX	220.0	246.00	272.00	1	356.0	1.7	1	Χ
SMAJ250A	-	SZ	-	250.0	279.00	309.00	1	405.0	1.0	1	Χ
- S	SMAJ250CA*	-	VZ	250.0	279.00	309.00	1	405.0	1.5	1	Χ
SMAJ300A* S		TE	UE	300.0	335.00	371.00	1	486.0	1.3	1	Χ
SMAJ350A* S		TG	UG	350.0	391.00	432.00	1	567.0	1.1	1	Χ
SMAJ400A* S		TK	UK	400.0	447.00	494.00	1	648.0	1.0	1	Χ
CNAN IAANA* C	SMAJ440CA*	TM	UM	440.0	492.00	543.00	1	713.0	0.9	1	Χ

For bidirectional type having $V_{\rm R}$ of 10 volts and less, the $I_{\rm R}$ 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
- Stand-off Voltage -- Maximum voltage that can be applied to the TVS without operation
- V_{nR} Breakdown Voltage Maximum voltage that flows though the TVS at a specified test current (I_{T})
- Clamping Voltage Peak voltage measured across the TVS at a specified lppm (peak impulse current)
- Reverse Leakage Current Current measured at V_p
- V Forward Voltage Drop for Uni-directional

Ratings and Characteristic Curves ($T_A = 25$ °C unless otherwise noted)

Figure 1:TVS Transients Clamping Waveform

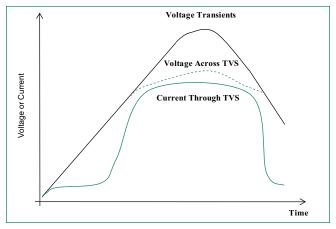
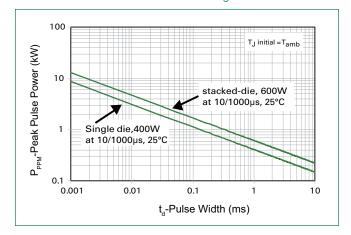


Figure 2: Peak Pulse Power Rating Curve



Ratings and Characteristic Curves (T_A=25°C unless otherwise noted) (Continued)

Figure 3: Peak Pulse Power Derating Curve

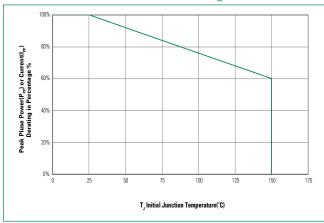


Figure 4: Pulse Waveform

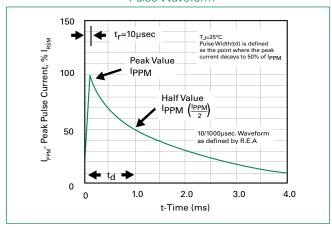


Figure 5:
Typical Junction Capacitance

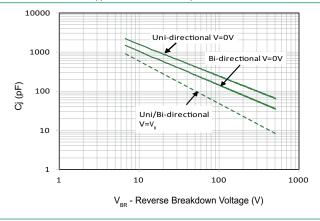


Figure 6: Typical Transient Thermal Impedance

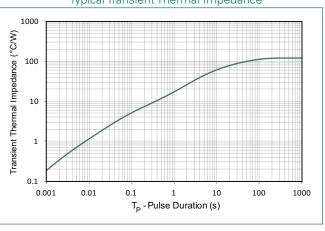


Figure 7:
Maximum Non-Repetitive Forward Surge Current
Uni-Directional Only

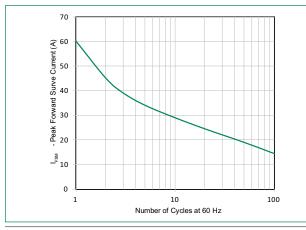
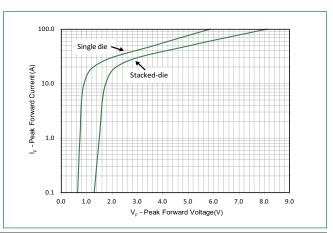


Figure 8:
Peak Forward Voltage Drop vs Peak Forward Current
(Typical Values)

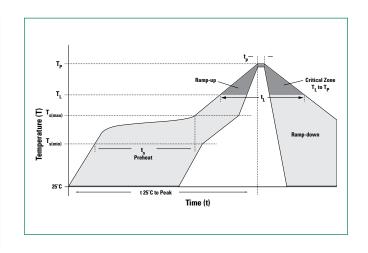




SMAJ Series Surface Mount – 400W

Soldering Parameters

Reflow Cond	Lead-free assembly				
	-Temperature Min (T _{s(min)})	150°C			
Pre Heat	-Temperature Max (T _{s(max)})	200°C			
	-Time (min to max) (t _s)	60 – 120 secs			
Average ram	Average ramp up rate (Liquidus Temp (T _L) to peak				
$T_{\text{S(max)}}$ to T_{L} -	T _{S(max)} to T _L - Ramp-up Rate				
Reflow	-Temperature (T _L) (Liquidus)	217°C			
nellow	-Time (min to max) (t _L)	60 – 150 seconds			
Peak Temper	260 ^{+0/-5} °C				
Time within	30 seconds Max				
Ramp-down	6°C/second Max				
Time 25°C to	8 minutes Max.				
Do not exce	260°C				



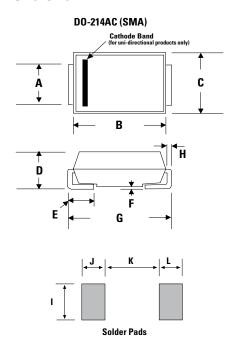
Physical Specifications

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

Environmental Specifications

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

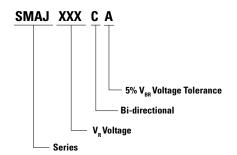
Dimensions



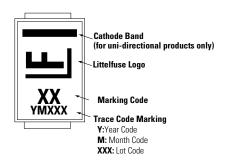
Dimensions	Incl	hes	Millimeters		
Difficusions	Min	Min Max		Max	
Α	0.049	0.065	1.250	1.650	
В	0.157	0.181	3.990	4.600	
С	0.095	0.110	2.400	2.790	
D	0.075	0.090	1.900	2.290	
E	0.030	0.060	0.780	1.520	
F	-	0.008	-	0.203	
G	0.189	0.208	4.800	5.280	
Н	0.006	0.012	0.152	0.305	
1	0.070	-	1.800	-	
J	0.082	-	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
SMAJ-xxxXX	DO-214AC	5000	Tape & Reel - 12mm tape/13" reel	EIA STD RS-481

Tape and Reel Specification

