

400W Transient Voltage Suppressor (TVS) protection device

Main product characteristics

V_{WM}	5.0V – 440V
$V_{BR(min)} - V_{BR(max)}$	6.40V – 543V
I_{PP}	41.7A – 0.6A
$V_{CL(MAX)}$	9.6V – 713V
P_{PP}	400W



Description and applications

This device has the ability to clamp dangerous high voltage, short term transients such as produced by directed or radiated electrostatic discharge phenomena before entering sensitive component regions of a circuit design. Response time of clamping action is virtually instantaneous. As a result, they may also be used effectively for protection from ESD or EFT per IEC61000-4-2 and IEC61000-4-4 or for inductive switching environments and induced RF. They can also be used for protecting other sensitive components from secondary lightning effects per IEC61000-4-5 and class levels defined herein. Microsemi also offers numerous other TVS products to meet higher and lower power demands and special applications.

- RoHS compliant (2002/95/EC), MSL level 1 (J-STD-020)
- Qualified to automotive grade – AEC Q101
- Bi-directional devices are denoted by the suffixes C or CA, electrical characteristics apply in both directions.

Maximum ratings and characteristics⁽¹⁾

Symbol	Parameter	Value	Unit
P_{PPM}	Peak power dissipation with a 10/1000 μ s waveform ⁽²⁾⁽³⁾ (fig.1)	400	W
I_{PPM}	Peak pulse current with a 10/1000 μ s waveform ⁽²⁾ (fig. 3)	See next table	A
$P_{M(AV)}$	Steady state power dissipation at $T_L = 75^\circ\text{C}$, lead lengths 0.375" (9.5mm) ⁽³⁾	1.0	W
I_{FSM}	Non repetitive peak forward surge current (8.3ms single half sine wave) unidirectional only ⁽⁴⁾	40	A
V_F	Maximum instantaneous forward voltage at 25A for unidirectional only ⁽⁵⁾	3.5 / 5.0	V
$R_{\theta JL}$	Typical thermal resistance junction to lead	30	$^\circ\text{C/W}$
$R_{\theta JA}$	Typical thermal resistance junction to ambient	120	$^\circ\text{C/W}$
T_{STG}	Storage temperature	-55 to +150	$^\circ\text{C}$
T_J	Junction temperature	-55 to +150	$^\circ\text{C}$

(1) All ratings at 25 $^\circ\text{C}$ unless specified otherwise

(2) Non-repetitive current pulse, per Fig. 3 and derated above $T_A = 25^\circ\text{C}$ per Fig. 2. rating is 300W above 78V.

(3) Mounted on copper pad area of 0.2" x 0.2" (5.0mm x 5.0mm)

(4) Mounted on minimum recommended pad layout

(5) $V_F=3.5\text{V}$ for devices of $V_{BR} < 220\text{V}$ and $V_F=5.0\text{V}$ maximum for devices of $V_{BR} > 220\text{V}$

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Electrical characteristics⁽¹⁾

DEVICE	Device marking code		BREAKDOWN VOLTAGE ⁽²⁾ , V _{BR} V _{BR} (V) @ I _T (mA)		TEST CURRENT I _T (mA)	STAND-OFF VOLTAGE V _{WM} (V)	MAXIMUM STANDBY CURRENT ⁽⁴⁾ I _D (μA) @ V _{WM}	MAXIMUM PEAK PULSE CURRENT ⁽³⁾ I _{PP} (A)	MAXIMUM CLAMPING VOLTAGE V _C (V) @ I _{PP}
	UNI	BI	Min	Max					
SMAJ5.0e3 / SMAJ5.0Ce3	MAD	MWD	6.40	7.82	10	5.0	800	41.7	9.6
SMAJ5.0Ae3 / SMAJ5.0CAe3 ⁽⁵⁾	MAE	MWE	6.40	7.07	10	5.0	800	43.5	9.2
SMAJ6.0e3 / SMAJ6.0Ce3	MAF	MWF	6.67	8.15	10	6.0	800	35.1	11.4
SMAJ6.0Ae3 / SMAJ6.0CAe3	MAG	MWG	6.67	7.37	10	6.0	800	38.8	10.3
SMAJ6.5e3 / SMAJ6.5Ce3	MAH	MWH	7.22	8.82	10	6.5	500	32.5	12.3
SMAJ6.5Ae3 / SMAJ6.5CAe3	MAK	MWK	7.22	7.98	10	6.5	500	35.7	11.2
SMAJ7.0e3 / SMAJ7.0Ce3	MAL	MWL	7.78	9.51	10	7.0	200	30.1	13.3
SMAJ7.0Ae3 / SMAJ7.0CAe3	MAM	MWM	7.78	8.60	10	7.0	200	33.3	12.0
SMAJ7.5e3 / SMAJ7.5Ce3	MAN	MWN	8.33	10.2	1.0	7.5	100	28.0	14.3
SMAJ7.5Ae3 / SMAJ7.5CAe3	MAP	MWP	8.33	9.21	1.0	7.5	100	31.0	12.9
SMAJ8.0e3 / SMAJ8.0Ce3	MAQ	MWQ	8.89	10.9	1.0	8.0	50	26.7	15.0
SMAJ8.0Ae3 / SMAJ8.0CAe3	MAR	MWR	8.89	9.83	1.0	8.0	50	29.4	13.6
SMAJ8.5e3 / SMAJ8.5Ce3	MAS	MWS	9.44	11.5	1.0	8.5	10	25.2	15.9
SMAJ8.5Ae3 / SMAJ8.5CAe3	MAT	MWT	9.44	10.4	1.0	8.5	10	27.8	14.4
SMAJ9.0e3 / SMAJ9.0Ce3	MAU	MWU	10.0	12.2	1.0	9.0	5.0	23.7	16.9
SMAJ9.0Ae3 / SMAJ9.0CAe3	MAV	MWV	10.0	11.1	1.0	9.0	5.0	26.0	15.4
SMAJ10e3 / SMAJ10Ce3	MAW	MWW	11.1	13.6	1.0	10	1.0	21.3	18.8
SMAJ10Ae3 / SMAJ10CAe3	MAX	MWX	11.1	12.3	1.0	10	1.0	23.5	17.0
SMAJ11e3 / SMAJ11Ce3	MAY	MWY	12.2	14.9	1.0	11	1.0	19.9	20.1
SMAJ11Ae3 / SMAJ11CAe3	MAZ	MWZ	12.2	13.5	1.0	11	1.0	22.0	18.2
SMAJ12e3 / SMAJ12Ce3	MBD	MXD	13.3	16.3	1.0	12	1.0	18.2	22.0
SMAJ12Ae3 / SMAJ12CAe3	MBE	MXE	13.3	14.7	1.0	12	1.0	20.1	19.9
SMAJ13e3 / SMAJ13Ce3	MBF	MXF	14.4	17.6	1.0	13	1.0	16.8	23.8
SMAJ13Ae3 / SMAJ13CAe3	MBG	MXG	14.4	15.9	1.0	13	1.0	18.6	21.5
SMAJ14e3 / SMAJ14Ce3	MBH	MXH	15.6	19.1	1.0	14	1.0	15.5	25.8
SMAJ14Ae3 / SMAJ14CAe3	MBK	MXK	15.6	17.2	1.0	14	1.0	17.2	23.2
SMAJ15e3 / SMAJ15Ce3	MBL	MXL	16.7	20.4	1.0	15	1.0	14.9	26.9
SMAJ15Ae3 / SMAJ15CAe3	MBM	MXM	16.7	18.5	1.0	15	1.0	16.4	24.4
SMAJ16e3 / SMAJ16Ce3	MBN	MXN	17.8	21.8	1.0	16	1.0	13.9	28.8
SMAJ16Ae3 / SMAJ16CAe3	MBP	MXP	17.8	19.7	1.0	16	1.0	15.4	26.0
SMAJ17e3 / SMAJ17Ce3	MBQ	MXQ	18.9	23.1	1.0	17	1.0	13.1	30.5
SMAJ17Ae3 / SMAJ17CAe3	MBR	MXR	18.9	20.9	1.0	17	1.0	14.5	27.6
SMAJ18e3 / SMAJ18Ce3	MBS	MXS	20.0	24.4	1.0	18	1.0	12.4	32.2
SMAJ18Ae3 / SMAJ18CAe3	MBT	MXT	20.0	22.1	1.0	18	1.0	13.7	29.2
SMAJ20e3 / SMAJ20Ce3	MBU	MXU	22.2	27.1	1.0	20	1.0	11.2	35.8
SMAJ20Ae3 / SMAJ20CAe3	MBV	MXV	22.2	24.5	1.0	20	1.0	12.3	32.4
SMAJ22e3 / SMAJ22Ce3	MBW	MXW	24.4	29.8	1.0	22	1.0	10.2	39.4
SMAJ22Ae3 / SMAJ22CAe3	MBX	MXX	24.4	26.9	1.0	22	1.0	11.3	35.5

(1) All ratings at 25°C unless specified otherwise

(2) V_{BR} measured after I_T applied for 300μs, I_T=square wave pulse or equivalent

(3) Surge current waveform per Fig.3 and derated per Fig.2

(4) For bidirectional types with V_{WM} of 10 volts and less, the I_D limit is doubled

(5) For the bidirectional SMAJ5.0CA, the maximum V_{BR} is 7.25V

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Electrical characteristics (cont.)⁽¹⁾

DEVICE	Device marking code		BREAKDOWN VOLTAGE ⁽²⁾ , V _{BR} V _{BR} (V) @ I _T (mA)		TEST CURRENT I _T (mA)	STAND-OFF VOLTAGE V _{WM} (V)	MAXIMUM STANDBY CURRENT ⁽⁴⁾ I _D (μA) @ V _{WM}	MAXIMUM PEAK PULSE CURRENT ⁽³⁾ I _{PP} (A)	MAXIMUM CLAMPING VOLTAGE V _C (V) @ I _{PP}
	UNI	BI	Min	Max					
SMAJ24e3 / SMAJ24Ce3	MBY	MXY	26.7	32.6	1.0	24	1.0	9.3	43.0
SMAJ24Ae3 / SMAJ24CAe3	MBZ	MXZ	26.7	29.5	1.0	24	1.0	10.3	38.9
SMAJ26e3 / SMAJ26Ce3	MCD	MYD	28.9	35.3	1.0	26	1.0	8.6	46.6
SMAJ26Ae3 / SMAJ26CAe3	MCE	MYE	28.9	31.9	1.0	26	1.0	9.5	42.1
SMAJ28e3 / SMAJ28Ce3	MCF	MYF	31.1	38.0	1.0	28	1.0	8.0	50.0
SMAJ28Ae3 / SMAJ28CAe3	MCG	MYG	31.1	34.4	1.0	28	1.0	8.8	45.4
SMAJ30e3 / SMAJ30Ce3	MCH	MYH	33.3	40.7	1.0	30	1.0	7.5	53.5
SMAJ30Ae3 / SMAJ30CAe3	MCK	MYK	33.3	36.8	1.0	30	1.0	8.3	48.4
SMAJ33e3 / SMAJ33Ce3	MCL	MYL	36.7	44.9	1.0	33	1.0	6.8	59.0
SMAJ33Ae3 / SMAJ33CAe3	MCM	MYM	36.7	40.6	1.0	33	1.0	7.5	53.3
SMAJ36e3 / SMAJ36Ce3	MCN	MYN	40.0	48.9	1.0	36	1.0	6.2	64.3
SMAJ36Ae3 / SMAJ36CAe3	MCP	MYP	40.0	44.2	1.0	36	1.0	6.9	58.1
SMAJ40e3 / SMAJ40Ce3	MCQ	MYQ	44.4	54.3	1.0	40	1.0	5.6	71.4
SMAJ40Ae3 / SMAJ40CAe3	MCR	MYR	44.4	49.1	1.0	40	1.0	6.2	64.5
SMAJ43e3 / SMAJ43Ce3	MCS	MYS	47.8	58.4	1.0	43	1.0	5.2	76.7
SMAJ43Ae3 / SMAJ43CAe3	MCT	MYT	47.8	52.8	1.0	43	1.0	5.8	69.4
SMAJ45e3 / SMAJ45Ce3	MCU	MYU	50.0	61.1	1.0	45	1.0	5.0	80.3
SMAJ45Ae3 / SMAJ45CAe3	MCV	MYV	50.0	55.3	1.0	45	1.0	5.5	72.7
SMAJ48e3 / SMAJ48Ce3	MCW	MYW	53.3	65.1	1.0	48	1.0	4.7	85.5
SMAJ48Ae3 / SMAJ48CAe3	MCX	MYX	53.3	58.9	1.0	48	1.0	5.2	77.4
SMAJ51e3 / SMAJ51Ce3	MCY	MYY	56.7	69.3	1.0	51	1.0	4.4	91.1
SMAJ51Ae3 / SMAJ51CAe3	MCZ	MYZ	56.7	62.7	1.0	51	1.0	4.9	82.4
SMAJ54e3 / SMAJ54Ce3	MRD	MZD	60.0	73.3	1.0	54	1.0	4.2	96.3
SMAJ54Ae3 / SMAJ54CAe3	MRE	MZE	60.0	66.3	1.0	54	1.0	4.6	87.1
SMAJ58e3 / SMAJ58Ce3	MRF	MZF	64.4	78.7	1.0	58	1.0	3.9	103
SMAJ58Ae3 / SMAJ58CAe3	MRG	MZG	64.4	71.2	1.0	58	1.0	4.3	93.6
SMAJ60e3 / SMAJ60Ce3	MRH	MZH	66.7	81.5	1.0	60	1.0	3.7	107
SMAJ60Ae3 / SMAJ60CAe3	MRK	MZK	66.7	73.7	1.0	60	1.0	4.1	96.8
SMAJ64e3 / SMAJ64Ce3	MRL	MZL	71.1	86.9	1.0	64	1.0	3.5	114
SMAJ64Ae3 / SMAJ64CAe3	MRM	MZM	71.1	78.6	1.0	64	1.0	3.9	103
SMAJ70e3 / SMAJ70Ce3	MRN	MZN	77.8	95.1	1.0	70	1.0	3.2	125
SMAJ70Ae3 / SMAJ70CAe3	MRP	MZP	77.8	86.0	1.0	70	1.0	3.5	113
SMAJ75e3 / SMAJ75Ce3	MRQ	MZQ	83.3	102	1.0	75	1.0	3.0	134
SMAJ75Ae3 / SMAJ75CAe3	MRR	MZR	83.3	92.1	1.0	75	1.0	3.3	121
SMAJ78e3 / SMAJ78Ce3	MRS	MZS	86.7	106	1.0	78	1.0	2.9	139
SMAJ78Ae3 / SMAJ78CAe3	MRT	MZT	86.7	95.8	1.0	78	1.0	3.2	126
SMAJ85e3 / SMAJ85Ce3	MRU	MZU	94.4	115	1.0	85	1.0	2.0	151
SMAJ85Ae3 / SMAJ85CAe3	MRV	MZV	94.4	104	1.0	85	1.0	2.2	137

(1) All ratings at 25°C unless specified otherwise

(2) V_{BR} measured after I_T applied for 300μs, I_T=square wave pulse or equivalent

(3) Surge current waveform per Fig.3 and derated per Fig.2

(4) For bidirectional types with V_{WM} of 10 volts and less, the I_D limit is doubled

400W Transient Voltage Suppressor (TVS) protection device

Electrical characteristics (cont.)⁽¹⁾

DEVICE	Device marking code		BREAKDOWN VOLTAGE ⁽²⁾ , V _{BR} V _{BR} (V) @ I _T (mA)		TEST CURRENT I _T (mA)	STAND-OFF VOLTAGE V _{WM} (V)	MAXIMUM STANDBY CURRENT ⁽⁴⁾ I _D (μA) @ V _{WM}	MAXIMUM PEAK PULSE CURRENT ⁽³⁾ I _{PP} (A)	MAXIMUM CLAMPING VOLTAGE V _C (V) @ I _{PP}
	UNI	BI	Min	Max					
SMAJ90e3 / SMAJ90Ce3	MRW	MZW	100	122	1.0	90	1.0	1.9	160
SMAJ90Ae3 / SMAJ90CAe3	MRX	MZX	100	111	1.0	90	1.0	2.1	146
SMAJ100e3 / SMAJ100Ce3	MRY	MZY	111	136	1.0	100	1.0	1.7	179
SMAJ100Ae3 / SMAJ100CAe3	MRZ	MZZ	111	123	1.0	100	1.0	1.9	162
SMAJ110e3 / SMAJ110Ce3	MSD	MVD	122	149	1.0	110	1.0	1.5	196
SMAJ110Ae3 / SMAJ110CAe3	MSE	MVE	122	135	1.0	110	1.0	1.7	177
SMAJ120e3 / SMAJ120Ce3	MSF	MVF	133	163	1.0	120	1.0	1.4	214
SMAJ120Ae3 / SMAJ120CAe3	MSG	MVG	133	147	1.0	120	1.0	1.6	193
SMAJ130e3 / SMAJ130Ce3	MSH	MVH	144	176	1.0	130	1.0	1.3	231
SMAJ130Ae3 / SMAJ130CAe3	MSK	MVK	144	159	1.0	130	1.0	1.4	209
SMAJ150e3 / SMAJ150Ce3	MSL	MVL	167	204	1.0	150	1.0	1.1	268
SMAJ150Ae3 / SMAJ150CAe3	MSM	MVM	167	185	1.0	150	1.0	1.2	243
SMAJ160e3 / SMAJ160Ce3	MSN	MVN	178	218	1.0	160	1.0	1.0	287
SMAJ160Ae3 / SMAJ160CAe3	MSP	MVP	178	197	1.0	160	1.0	1.2	259
SMAJ170e3 / SMAJ170Ce3	MSQ	MVQ	189	231	1.0	170	1.0	0.99	304
SMAJ170Ae3 / SMAJ170CAe3	MSR	MVR	189	209	1.0	170	1.0	1.09	275
SMAJ180Ae3 / SMAJ180CAe3	MST	MVT	201	222	1.0	180	1.0	1.4	292
SMAJ200Ae3 / SMAJ200CAe3	MSV	MVV	224	247	1.0	200	1.0	1.2	324
SMAJ220Ae3 / SMAJ220CAe3	MSX	MVX	246	272	1.0	220	1.0	1.1	356
SMAJ250Ae3 / SMAJ250CAe3	MSZ	MVZ	279	309	1.0	250	1.0	1.0	405
SMAJ300Ae3 / SMAJ300CAe3	MTE	MUE	335	371	1.0	300	1.0	0.8	486
SMAJ350Ae3 / SMAJ350CAe3	MTG	MUG	391	432	1.0	350	1.0	0.7	567
SMAJ400Ae3 / SMAJ400CAe3	MTK	MUK	447	494	1.0	400	1.0	0.6	648
SMAJ440Ae3 / SMAJ440CAe3	MTM	MUM	492	543	1.0	440	1.0	0.6	713

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(2) V_{BR} measured after I_T applied for 300μs, I_T=square wave pulse or equivalent

(3) Surge current waveform per Fig.3 and derated per Fig.2

(4) For bidirectional types with V_{WM} of 10 volts and less, the I_D limit is doubled

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Fig. 1 – Peak Pulse Power Rating Curve

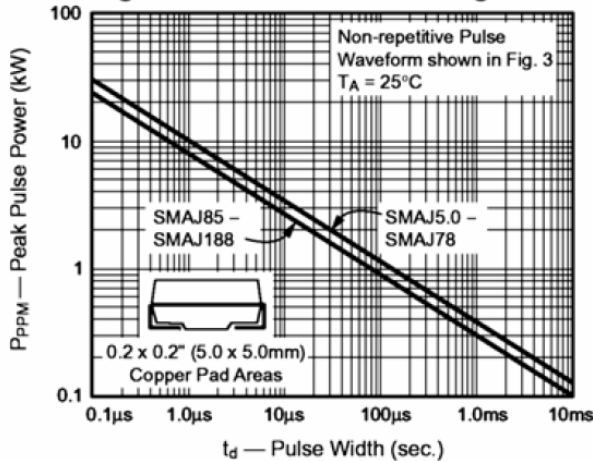


Fig. 2 – Pulse Derating Curve

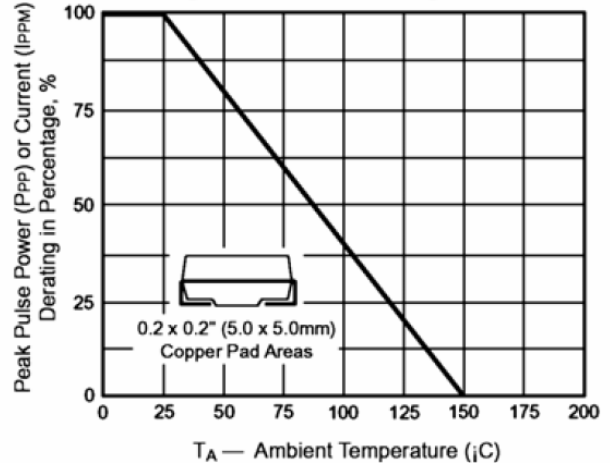


Fig. 3 – Pulse Waveform

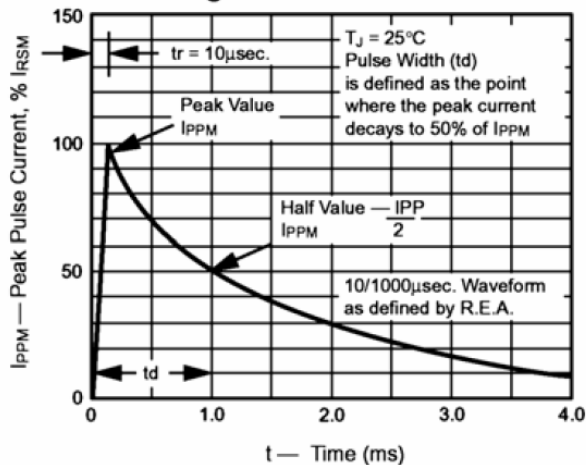


Fig. 4 – Typical Junction Capacitance

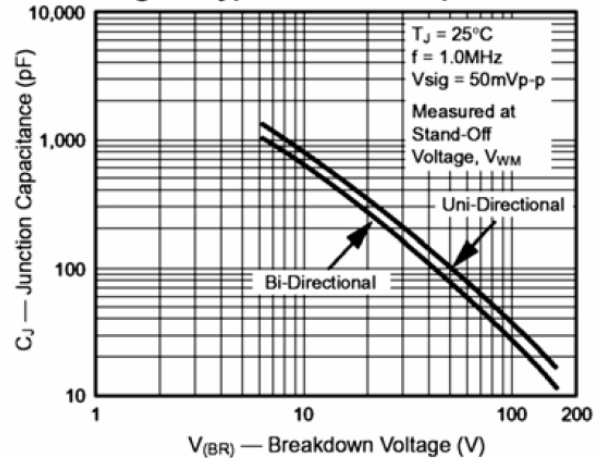


Fig. 5 – Typical Transient Thermal Impedance

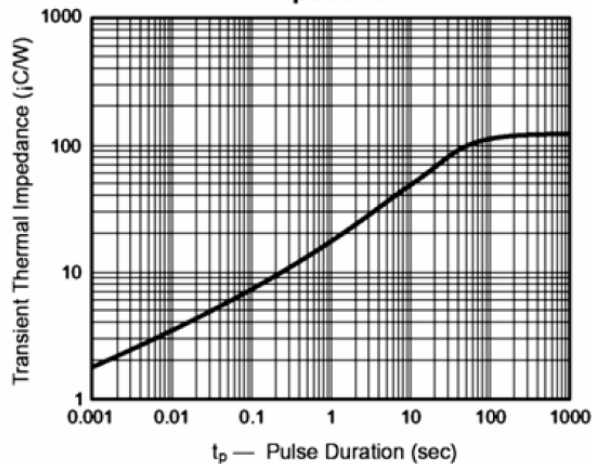
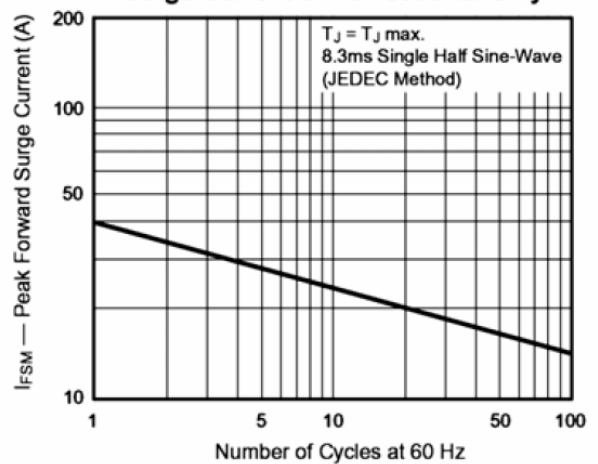
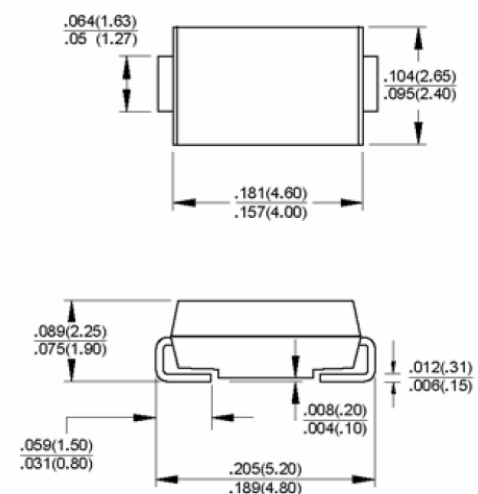
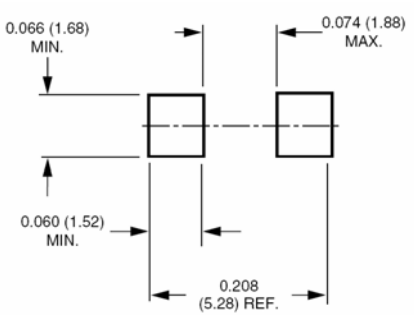


Fig. 6 - Maximum Non-Repetitive Forward Surge Current Uni-Directional Only



400W Transient Voltage Suppressor (TVS) protection device

Mechanical Characteristics

Physical dimensions	Footprint dimensions	Package materials & information
 Dimensions in inches and (millimeters)		Case : Epoxy meets UL94V-0 Electrode finish : Matte Sn plating - fully RoHS compliant Terminals : solderable per MIL-STD-750, Method 2026 Marking code : See electrical characteristics table and example below: XXX D/C

POLARITY : For unidirectional types the color band denotes the cathode, which is positive with respect to the anode under normal TVS operation.

Ordering information

Product order code	Package	Weight	Base qty	Delivery mode
SMAJxxxxe3/TR13 For example : SMAJ18CAe3/TR13 or SMAJ6.8Ae3/TR13	DO-214AC (SMA)	0.002oz. 0.064g	5000	Tape and reel (13 inch)

Commercial Business Unit
Microsemi Corporation

Microsemi Commercial Offshore de Macau Limitada
Avenida Doutor Mario Soares
Bank of China Building, 18/F, Unit D
Macau SAR

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[SMAJ90CAe3/TR13](#) [SMAJ40CAe3/TR13](#) [SMAJ7.0Ce3/TR13](#) [SMAJ75e3/TR13](#) [SMAJ120Ae3/TR13](#)
[SMAJ9.0CAe3/TR13](#) [SMAJ440CAe3/TR13](#) [SMAJ150e3/TR13](#) [SMAJ6.5e3/TR13](#) [SMAJ51Ce3/TR13](#)
[SMAJ22Ce3/TR13](#) [SMAJ170Ce3/TR13](#) [SMAJ7.5Ae3/TR13](#) [SMAJ160e3/TR13](#) [SMAJ33e3/TR13](#) [SMAJ28CAe3/TR13](#)
[SMAJ220Ae3/TR13](#) [SMAJ70e3/TR13](#) [SMAJ180Ce3/TR13](#) [SMAJ180CAe3/TR13](#) [SMAJ33CAe3/TR13](#)
[SMAJ70Ce3/TR13](#) [SMAJ26Ce3/TR13](#) [SMAJ90e3/TR13](#) [SMAJ120Ce3/TR13](#) [SMAJ7.5Ce3/TR13](#) [SMAJ400Ae3/TR13](#)
[SMAJ12CAe3/TR13](#) [SMAJ60Ce3/TR13](#) [SMAJ8.5e3/TR13](#) [SMAJ75Ce3/TR13](#) [SMAJ26e3/TR13](#)
[SMAJ160Ce3/TR13](#) [SMAJ11Ae3/TR13](#) [SMAJ22Ae3/TR13](#) [SMAJ22e3/TR13](#) [SMAJ11CAe3/TR13](#) [SMAJ78e3/TR13](#)
[SMAJ250Ae3/TR13](#) [SMAJ40Ae3/TR13](#) [SMAJ12Ce3/TR13](#) [SMAJ160Ae3/TR13](#) [SMAJ120CAe3/TR13](#)
[SMAJ150Ae3/TR13](#) [SMAJ220e3/TR13](#) [SMAJ16CAe3/TR13](#) [SMAJ100CAe3/TR13](#) [SMAJ100Ce3/TR13](#)
[SMAJ170Ae3/TR13](#) [SMAJ16Ce3/TR13](#) [SMAJ28Ce3/TR13](#) [SMAJ6.0Ce3/TR13](#) [SMAJ350e3/TR13](#) [SMAJ15Ae3/TR13](#)
[SMAJ17Ce3/TR13](#) [SMAJ10Ce3/TR13](#) [SMAJ58Ce3/TR13](#) [SMAJ60CAe3/TR13](#) [SMAJ11Ce3/TR13](#)
[SMAJ180Ae3/TR13](#) [SMAJ120e3/TR13](#) [SMAJ15Ce3/TR13](#) [SMAJ250Ce3/TR13](#) [SMAJ40Ce3/TR13](#) [SMAJ6.0e3/TR13](#)
[SMAJ300Ae3/TR13](#) [SMAJ60Ae3/TR13](#) [SMAJ64Ce3/TR13](#) [SMAJ26CAe3/TR13](#) [SMAJ150CAe3/TR13](#)
[SMAJ36CAe3/TR13](#) [SMAJ16Ae3/TR13](#) [SMAJ90Ce3/TR13](#) [SMAJ28Ae3/TR13](#) [SMAJ12Ae3/TR13](#) [SMAJ64e3/TR13](#)
[SMAJ13CAe3/TR13](#) [SMAJ51Ae3/TR13](#) [SMAJ90Ae3/TR13](#) [SMAJ60e3/TR13](#) [SMAJ5.0e3/TR13](#) [SMAJ300Ce3/TR13](#)
[SMAJ6.0Ae3/TR13](#) [SMAJ440Ce3/TR13](#) [SMAJ24Ce3/TR13](#) [SMAJ10Ae3/TR13](#) [SMAJ48CAe3/TR13](#)
[SMAJ58Ae3/TR13](#) [SMAJ14CAe3/TR13](#) [SMAJ170e3/TR13](#) [SMAJ170CAe3/TR13](#) [SMAJ8.0Ae3/TR13](#)
[SMAJ26Ae3/TR13](#) [SMAJ18CAe3/TR13](#)