MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Power Dissipation (Note 1) @ T_L = 25°C, Pulse Width = 1 ms	P_{PK}	600	W
DC Power Dissipation @ T_L = 75°C Measured Zero Lead Length (Note 2) Derate Above 75°C Thermal Resistance from Junction−to−Lead	P_D $R_{\theta JL}$	3.0 40 25	W mW/°C °C/W
DC Power Dissipation (Note 3) @ T_A = 25°C Derate Above 25°C Thermal Resistance from Junction−to−Ambient	P_D $R_{\theta JA}$	0.55 4.4 226	W mW/°C °C/W
Operating and Storage Temperature Range	T_J, T_{stg}	−65 to +150	°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

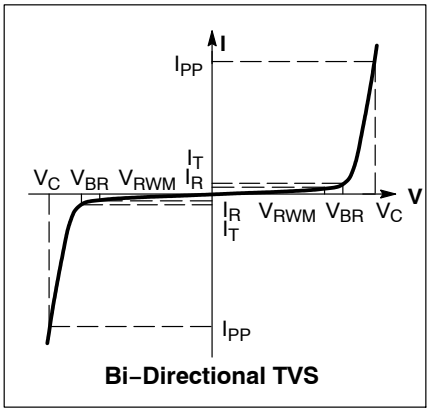
1. 10 X 1000 μs, non−repetitive
2. 1″ square copper pad, FR−4 board
3. FR−4 board, using ON Semiconductor minimum recommended footprint, as shown in 403A case outline dimensions spec

*Please see 1SMB5.0AT3 to 1SMB170AT3 for Unidirectional devices

ELECTRICAL CHARACTERISTICS

(T_A = 25°C unless otherwise noted)

Symbol	Parameter
I_{PP}	Maximum Reverse Peak Pulse Current
V_C	Clamping Voltage @ I_{PP}
V_{RWM}	Working Peak Reverse Voltage
I_R	Maximum Reverse Leakage Current @ V_{RWM}
V_{BR}	Breakdown Voltage @ I_T
I_T	Test Current



Bi−Directional TVS

ELECTRICAL CHARACTERISTICS (Devices listed in ***bold, italic*** are ON Semiconductor Preferred devices.)

Device*	Device Marking	V_{RWM} (Note 4)	I_R @ V_{RWM}	Breakdown Voltage				V_C @ I_{PP} (Note 6)		C_{typ} (Note 7)
				V_{BR} (Note 5) Volts			@ I_T	V_C	I_{PP}	
		Volts	μA	Min	Nom	Max	mA	Volts	Amps	pF
1SMB10CAT3, G	KXC	10	5.0	11.1	11.69	12.27	1.0	17.0	35.3	805
1SMB11CAT3, G	KZC	11	5.0	12.2	12.84	13.5	1.0	18.2	33.0	740
1SMB12CAT3, G	LEC	12	5.0	13.3	14.00	14.7	1.0	19.9	30.2	680
SZ/1SMB13CAT3, G	LGC	13	5.0	14.4	15.16	15.9	1.0	21.5	27.9	630
1SMB14CAT3, G	LKC	14	5.0	15.6	16.42	17.2	1.0	23.2	25.8	590
SZ/1SMB15CAT3, G	***LMC***	***15***	***5.0***	***16.7***	***17.58***	***18.5***	***1.0***	***24.4***	***24.0***	***555***
SZ/1SMB16CAT3, G	LPC	16	5.0	17.8	18.74	19.7	1.0	26.0	23.1	520
1SMB17CAT3, G	LRC	17	5.0	18.9	19.90	20.9	1.0	27.6	21.7	490
1SMB18CAT3, G	LTC	18	5.0	20.0	21.06	22.1	1.0	29.2	20.5	465
1SMB20CAT3, G	LVC	20	5.0	22.2	23.37	24.5	1.0	32.4	18.5	425
1SMB22CAT3, G	LXC	22	5.0	24.4	25.69	27.0	1.0	35.5	16.9	390
SZ/1SMB24CAT3, G	LZC	24	5.0	26.7	28.11	29.5	1.0	38.9	15.4	366
SZ/1SMB26CAT3, G	MEC	26	5.0	28.9	30.42	31.9	1.0	42.1	14.2	330
SZ/1SMB28CAT3, G	MGC	28	5.0	31.1	32.74	34.4	1.0	45.4	13.2	310
SZ/1SMB30CAT3, G	MKC	30	5.0	33.3	35.06	36.8	1.0	48.4	12.4	290
SZ/1SMB33CAT3, G	MMC	33	5.0	36.7	38.63	40.6	1.0	53.3	11.3	265
SZ/1SMB36CAT3, G	MPC	36	5.0	40.0	42.11	44.2	1.0	58.1	10.3	245
1SMB40CAT3, G	MRC	40	5.0	44.4	46.74	49.1	1.0	64.5	9.3	220
1SMB43CAT3, G	MTC	43	5.0	47.8	50.32	52.8	1.0	69.4	8.6	210
1SMB45CAT3, G	MVC	45	5.0	50.0	52.63	55.3	1.0	72.2	8.3	200
1SMB48CAT3, G	MXC	48	5.0	53.3	56.11	58.9	1.0	77.4	7.7	190
1SMB51CAT3, G	MZC	51	5.0	56.7	59.69	62.7	1.0	82.4	7.3	175
1SMB54CAT3, G	NEC	54	5.0	60.0	63.16	66.32	1.0	87.1	6.9	170
SZ/1SMB58CAT3, G	NGC	58	5.0	64.4	67.79	71.18	1.0	93.6	6.4	155
1SMB60CAT3, G	NKC	60	5.0	66.7	70.21	73.72	1.0	96.8	6.2	150
1SMB64CAT3, G	NMC	64	5.0	71.1	74.84	78.58	1.0	103	5.8	145
1SMB75CAT3, G	NRC	75	5.0	83.3	91.65	92.07	1.0	121	4.9	125

4. A transient suppressor is normally selected according to the working peak reverse voltage (V_{RWM}), which should be equal to or greater than the DC or continuous peak operating voltage level.
5. V_{BR} measured at pulse test current I_T at an ambient temperature of 25°C.
6. Surge current waveform per Figure 2 and derate per Figure 3 of the General Data − 600 Watt at the beginning of this group.
7. Bias Voltage = 0 V, F = 1 MHz, T_J = 25°C

*The "G" suffix indicates Pb−Free package available.

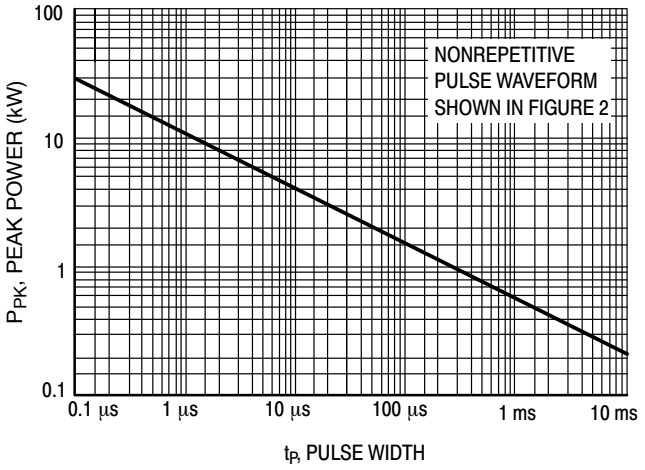


Figure 1. Pulse Rating Curve

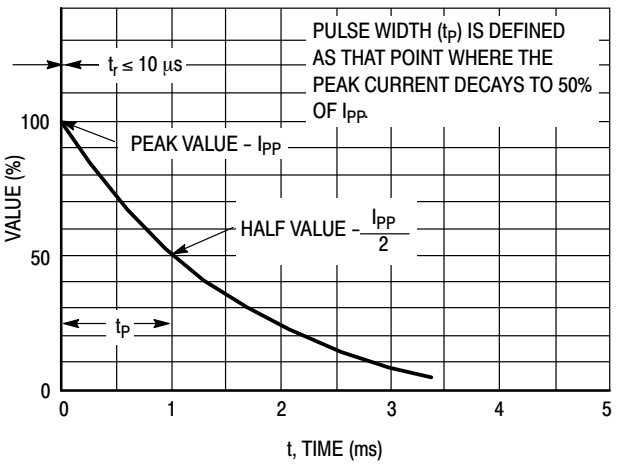


Figure 2. Pulse Waveform

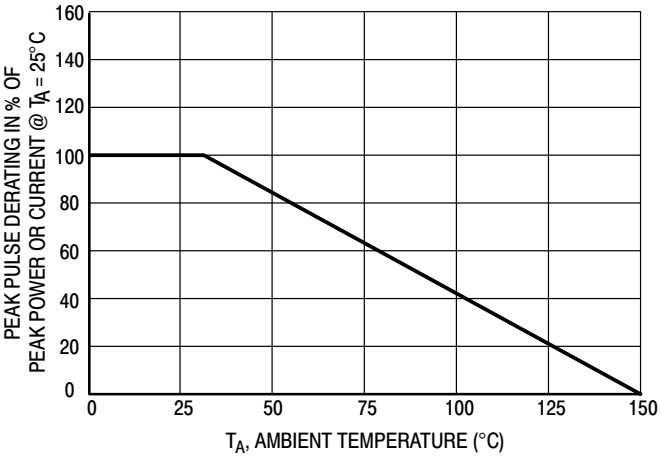


Figure 3. Pulse Derating Curve

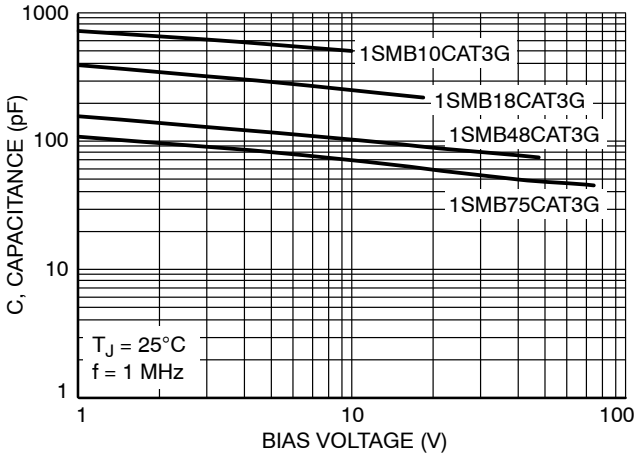
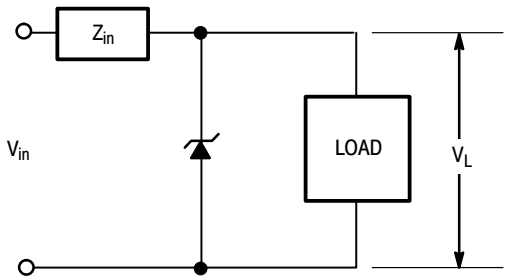


Figure 4. Typical Junction Capacitance vs. Bias Voltage

TYPICAL PROTECTION CIRCUIT



APPLICATION NOTES

RESPONSE TIME

In most applications, the transient suppressor device is placed in parallel with the equipment or component to be protected. In this situation, there is a time delay associated with the capacitance of the device and an overshoot condition associated with the inductance of the device and the inductance of the connection method. The capacitive effect is of minor importance in the parallel protection scheme because it only produces a time delay in the transition from the operating voltage to the clamp voltage as shown in Figure 5.

The inductive effects in the device are due to actual turn-on time (time required for the device to go from zero current to full current) and lead inductance. This inductive effect produces an overshoot in the voltage across the equipment or component being protected as shown in Figure 6. Minimizing this overshoot is very important in the application, since the main purpose for adding a transient suppressor is to clamp voltage spikes. The SMB series have a very good response time, typically < 1 ns and negligible inductance. However, external inductive effects could produce unacceptable overshoot. Proper circuit layout, minimum lead lengths and placing the suppressor device as close as possible to the equipment or components to be protected will minimize this overshoot.

Some input impedance represented by Z_{in} is essential to prevent overstress of the protection device. This impedance should be as high as possible, without restricting the circuit operation.

DUTY CYCLE DERATING

The data of Figure 1 applies for non-repetitive conditions and at a lead temperature of 25°C. If the duty cycle increases, the peak power must be reduced as indicated by the curves of Figure 7. Average power must be derated as the lead or ambient temperature rises above 25°C. The average power derating curve normally given on data sheets may be normalized and used for this purpose.

At first glance the derating curves of Figure 7 appear to be in error as the 10 ms pulse has a higher derating factor than the 10 μs pulse. However, when the derating factor for a given pulse of Figure 7 is multiplied by the peak power value of Figure 1 for the same pulse, the results follow the expected trend.

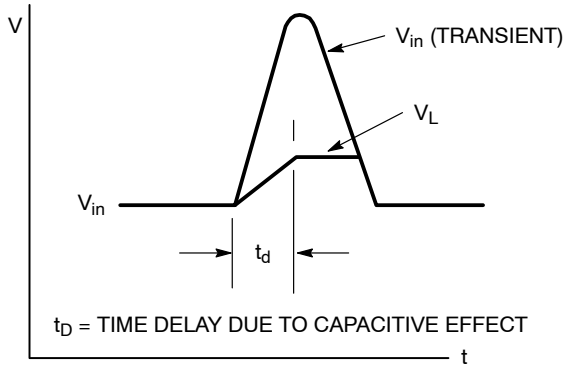


Figure 5.

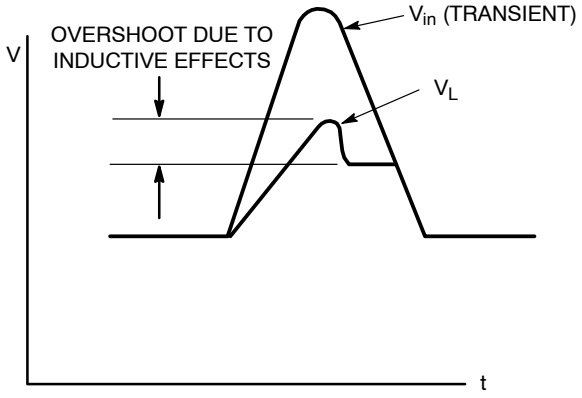


Figure 6.

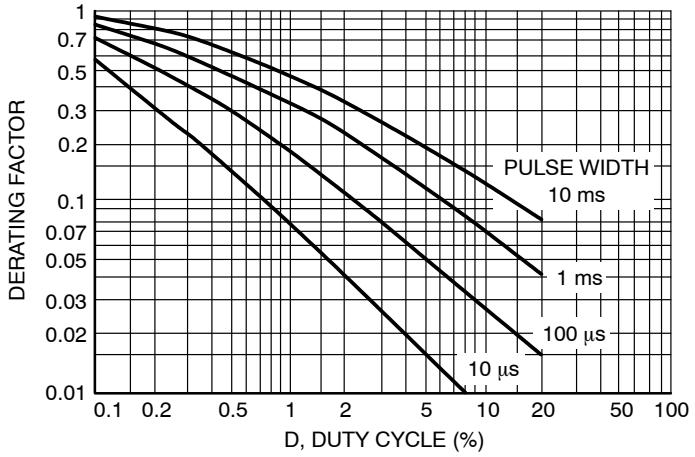


Figure 7. Typical Derating Factor for Duty Cycle

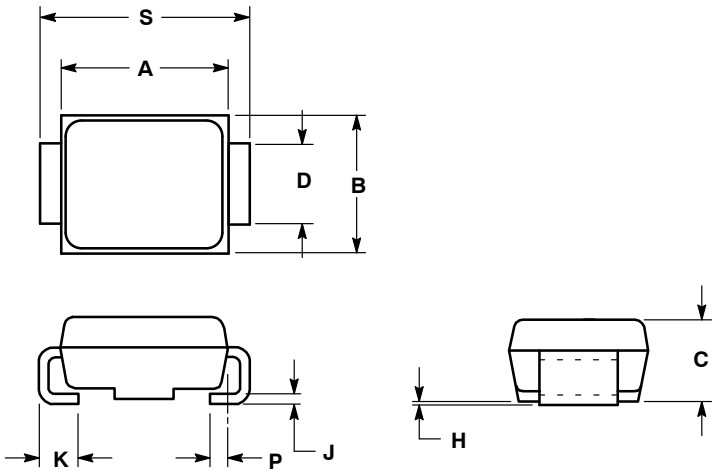
UL RECOGNITION

The entire series has *Underwriters Laboratory Recognition* for the classification of protectors (QVGQ2) under the UL standard for safety 497B and File #E210057. Many competitors only have one or two devices recognized or have recognition in a non-protective category. Some competitors have no recognition at all. With the UL497B recognition, our parts successfully passed several tests including Strike Voltage Breakdown test, Endurance Conditioning, Temperature test, Dielectric Voltage-Withstand test, Discharge test and several more.

Whereas, some competitors have only passed a flammability test for the package material, we have been recognized for much more to be included in their Protector category.

PACKAGE DIMENSIONS

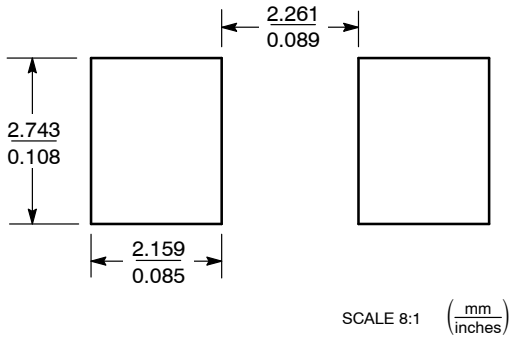
SMB
CASE 403C−01
ISSUE A



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. D DIMENSION SHALL BE MEASURED WITHIN DIMENSION P.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.160	0.180	4.06	4.57
B	0.130	0.150	3.30	3.81
C	0.075	0.095	1.90	2.41
D	0.077	0.083	1.96	2.11
H	0.0020	0.0060	0.051	0.152
J	0.006	0.012	0.15	0.30
K	0.030	0.050	0.76	1.27
P	0.020 REF		0.51 REF	
S	0.205	0.220	5.21	5.59

SOLDERING FOOTPRINT*



*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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