



**THE DATASHEET OF**  
**1752146**



# 1SMB10CAT3 Series

## 600 Watt Peak Power Zener Transient Voltage Suppressors

### Bidirectional\*

The SMB series is designed to protect voltage sensitive components from high voltage, high energy transients. They have excellent clamping capability, high surge capability, low zener impedance and fast response time. The SMB series is supplied in ON Semiconductor's exclusive, cost-effective, highly reliable Surmetic™ package and is ideally suited for use in communication systems, automotive, numerical controls, process controls, medical equipment, business machines, power supplies and many other industrial/consumer applications.

#### Specification Features:

- Working Peak Reverse Voltage Range – 10 V to 78 V
- Standard Zener Breakdown Voltage Range – 11.7 V to 91.3 V
- Peak Power – 600 Watts @ 1 ms
- ESD Rating of Class 3 (> 16 KV) per Human Body Model
- Maximum Clamp Voltage @ Peak Pulse Current
- Low Leakage < 5  $\mu$ A Above 10 V
- UL 497B for Isolated Loop Circuit Protection
- Response Time is Typically < 1 ns

#### Mechanical Characteristics:

**CASE:** Void-free, transfer-molded, thermosetting plastic

**FINISH:** All external surfaces are corrosion resistant and leads are readily solderable

**MAXIMUM CASE TEMPERATURE FOR SOLDERING PURPOSES:** 260°C for 10 Seconds

**LEADS:** Modified L-Bend providing more contact area to bond pads

**POLARITY:** Polarity band will not be indicated

**MOUNTING POSITION:** Any

#### MAXIMUM RATINGS

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

1. 10 X 1000  $\mu$ s, 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.



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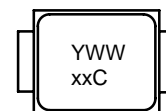
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**PLASTIC SURFACE MOUNT  
ZENER OVERVOLTAGE  
TRANSIENT SUPPRESSORS  
10–78 VOLTS  
600 WATT PEAK POWER**



**SMB  
CASE 403A  
PLASTIC**

#### MARKING DIAGRAM



Y = Year  
WW = Work Week  
xxC = Specific Device Code  
(See Table Next Page)

#### ORDERING INFORMATION

Device †	Package	Shipping
1SMBxxCAT3	SMB	2500/Tape & Reel

Devices listed in **bold, italic** are ON Semiconductor **Preferred** devices. Preferred devices are recommended choices for future use and best overall value.

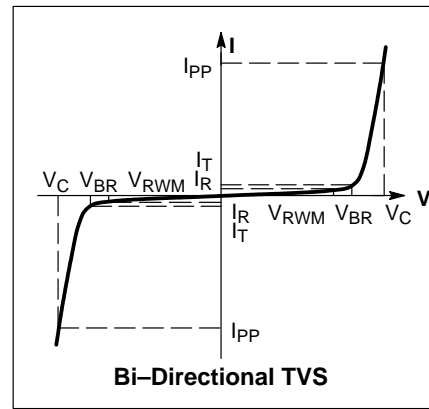
†The "T3" suffix refers to a 13 inch reel.

# 1SMB10CAT3 Series

## ELECTRICAL CHARACTERISTICS

(T<sub>A</sub> = 25°C unless otherwise noted)

Symbol	Parameter
I <sub>PP</sub>	Maximum Reverse Peak Pulse Current
V <sub>C</sub>	Clamping Voltage @ I <sub>PP</sub>
V <sub>RWM</sub>	Working Peak Reverse Voltage
I <sub>R</sub>	Maximum Reverse Leakage Current @ V <sub>RWM</sub>
V <sub>BR</sub>	Breakdown Voltage @ I <sub>T</sub>
I <sub>T</sub>	Test Current



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

Device	Device Marking	V <sub>RWM</sub> (Note 4.) Volts	I <sub>R</sub> @ V <sub>RWM</sub> μA	Breakdown Voltage				V <sub>C</sub> @ I <sub>PP</sub> (Note 6.)	
				V <sub>BR</sub> (Note 5.) Volts			@ I <sub>T</sub>	V <sub>C</sub>	I <sub>PP</sub>
				Min	Nom	Max	mA	Volts	Amps
1SMB10CAT3	KXC	10	5.0	11.1	11.69	12.27	1.0	17.0	35.3
1SMB11CAT3	KZC	11	5.0	12.2	12.84	13.5	1.0	18.2	33.0
1SMB12CAT3	LEC	12	5.0	13.3	14.00	14.7	1.0	19.9	30.2
1SMB13CAT3	LGC	13	5.0	14.4	15.16	15.9	1.0	21.5	27.9
1SMB14CAT3	LKC	14	5.0	15.6	16.42	17.2	1.0	23.2	25.8
<b>1SMB15CAT3</b>	<b>LMC</b>	<b>15</b>	<b>5.0</b>	<b>16.7</b>	<b>17.58</b>	<b>18.5</b>	<b>1.0</b>	<b>24.4</b>	<b>24.0</b>
1SMB16CAT3	LPC	16	5.0	17.8	18.74	19.7	1.0	26.0	23.1
1SMB17CAT3	LRC	17	5.0	18.9	19.90	20.9	1.0	27.6	21.7
1SMB18CAT3	LTC	18	5.0	20.0	21.06	22.1	1.0	29.2	20.5
1SMB20CAT3	LVC	20	5.0	22.2	23.37	24.5	1.0	32.4	18.5
1SMB22CAT3	LXC	22	5.0	24.4	25.69	27.0	1.0	35.5	16.9
1SMB24CAT3	LZC	24	5.0	26.7	28.11	29.5	1.0	38.9	15.4
1SMB26CAT3	MEC	26	5.0	28.9	30.42	31.9	1.0	42.1	14.2
1SMB28CAT3	MGC	28	5.0	31.1	32.74	34.4	1.0	45.4	13.2
1SMB30CAT3	MKC	30	5.0	33.3	35.06	36.8	1.0	48.4	12.4
1SMB33CAT3	MMC	33	5.0	36.7	38.63	40.6	1.0	53.3	11.3
1SMB36CAT3	MPC	36	5.0	40.0	42.11	44.2	1.0	58.1	10.3
1SMB40CAT3	MRC	40	5.0	44.4	46.74	49.1	1.0	64.5	9.3
1SMB43CAT3	MTC	43	5.0	47.8	50.32	52.8	1.0	69.4	8.6
1SMB45CAT3	MVC	45	5.0	50.0	52.63	55.3	1.0	72.2	8.3
1SMB48CAT3	MXC	48	5.0	53.3	56.11	58.9	1.0	77.4	7.7
1SMB51CAT3	MZC	51	5.0	56.7	59.69	62.7	1.0	82.4	7.3
1SMB54CAT3	NEC	54	5.0	60.0	63.16	66.32	1.0	87.1	6.9
1SMB58CAT3	NGC	58	5.0	64.4	67.79	71.18	1.0	93.6	6.4
1SMB60CAT3	NKC	60	5.0	66.7	70.21	73.72	1.0	96.8	6.2
1SMB64CAT3	NMC	64	5.0	71.1	74.84	78.58	1.0	103	5.8
1SMB70CAT3	NPC	70	5.0	77.8	81.90	85.99	1.0	113	5.3
1SMB75CAT3	NRC	75	5.0	83.3	91.65	92.07	1.0	121	4.9
1SMB78CAT3	NTC	78	5.0	86.7	91.26	95.83	1.0	126	4.7

4. A transient suppressor is normally selected according to the working peak reverse voltage (V<sub>RWM</sub>), which should be equal to or greater than the DC or continuous peak operating voltage level.

5. V<sub>BR</sub> measured at pulse test current I<sub>T</sub> 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.

# 1SMB10CAT3 Series

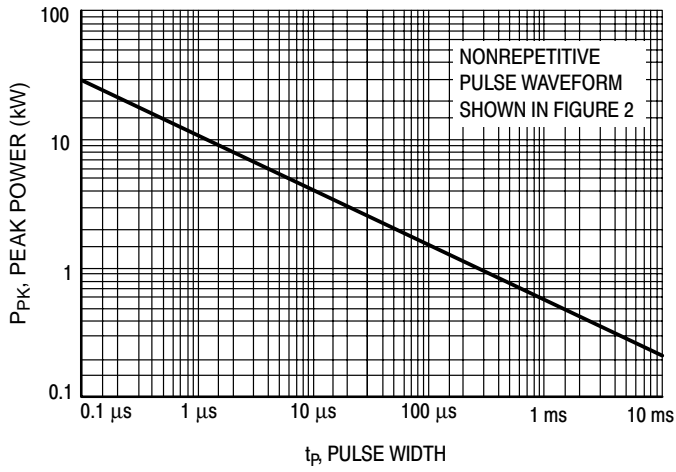


Figure 1. Pulse Rating Curve

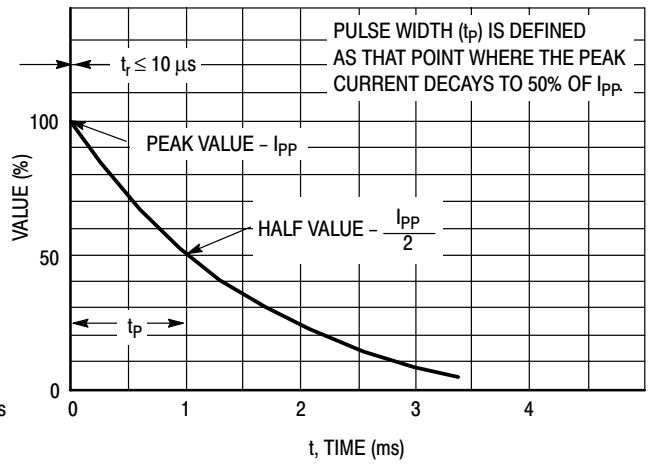


Figure 2. Pulse Waveform

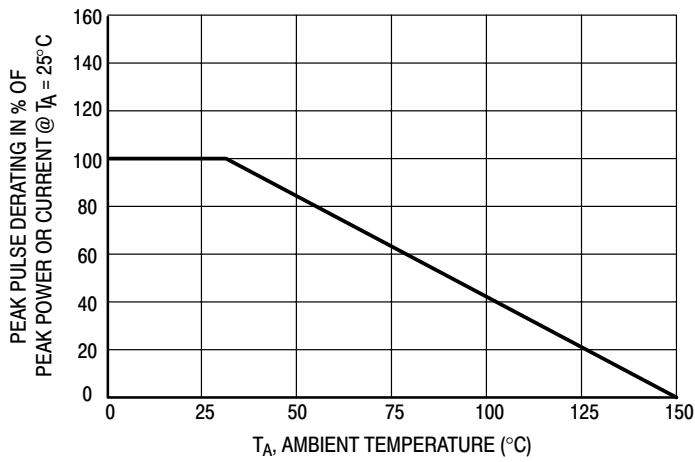
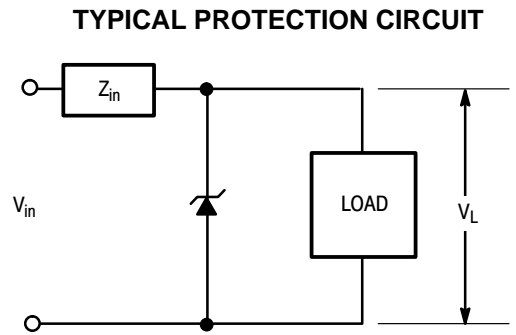


Figure 3. Pulse Derating Curve



# 1SMB10CAT3 Series

## 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 4.

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 5. 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 6. 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 6 appear to be in error as the 10 ms pulse has a higher derating factor than the 10  $\mu$ s pulse. However, when the derating factor for a given pulse of Figure 6 is multiplied by the peak power value of Figure 1 for the same pulse, the results follow the expected trend.

# 1SMB10CAT3 Series

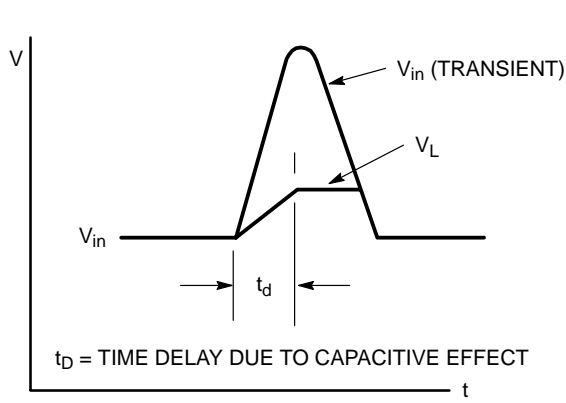


Figure 4.

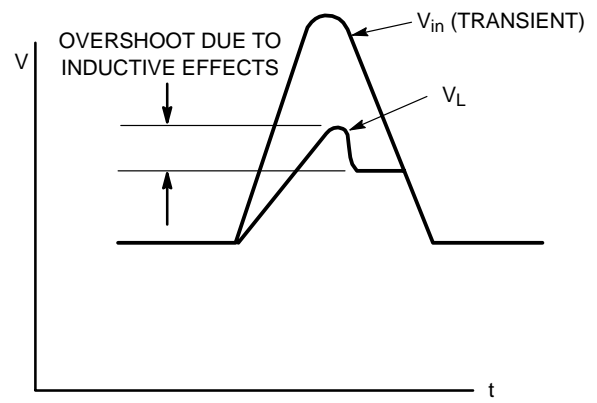


Figure 5.

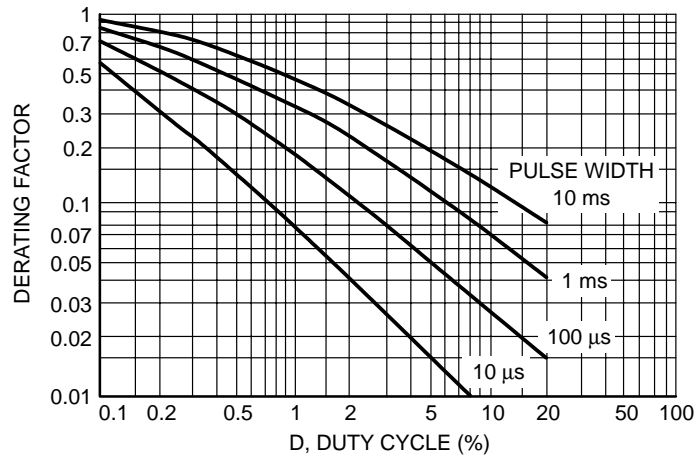


Figure 6. Typical Derating Factor for Duty Cycle

## UL RECOGNITION

The entire series has *Underwriters Laboratory Recognition* for the classification of protectors (QVGV2) under the UL standard for safety 497B and File #116110. 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

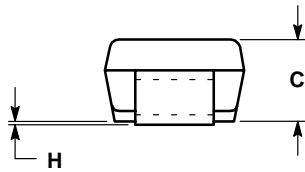
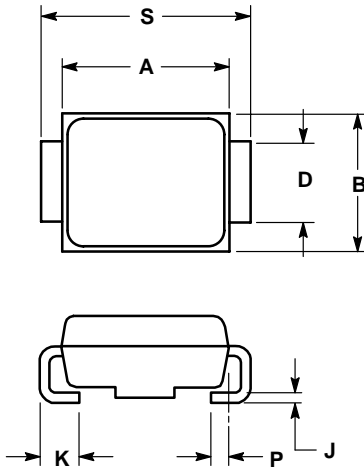
including Strike Voltage Breakdown test, Endurance Conditioning, Temperature test, Dielectric Voltage-Withstand test, Discharge test and several more.

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.

# Transient Voltage Suppressors – Surface Mounted

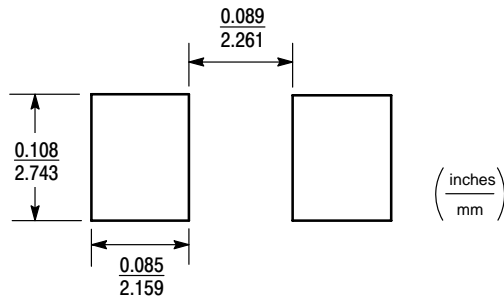
## 600 Watt Peak Power

SMB  
DO-214AA  
CASE 403A-03  
ISSUE D



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

DIM	INCHES		MILLIMETERS	
	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




SMB Footprint

**Notes**

# 1SMB10CAT3 Series

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