

# 1SMB10CAT3 Series

## 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.

#### 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
- Pb-Free Packages are Available

#### 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



ON Semiconductor®

<http://onsemi.com>

### PLASTIC SURFACE MOUNT ZENER OVERVOLTAGE TRANSIENT SUPPRESSORS 10–78 V, 600 W 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
1SMBxxCAT3G	SMB (Pb-Free)	2500/Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

Individual devices are listed on page 3 of this data sheet.

\*The "T3" suffix refers to a 13 inch reel.

# 1SMB10CAT3 Series

## 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	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	mW/ $^\circ\text{C}$
		226	$^\circ\text{C}/\text{W}$
Operating and Storage Temperature Range	$T_J, T_{stg}$	-65 to +150	$^\circ\text{C}$

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

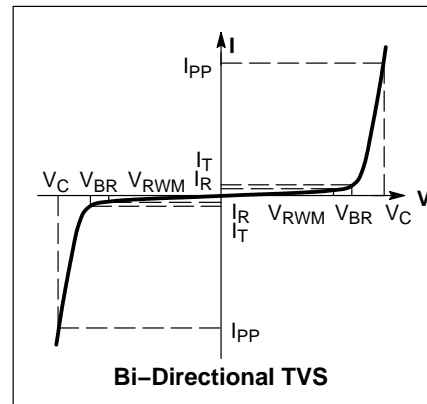
- 10 X 1000  $\mu\text{s}$ , non-repetitive
- 1" square copper pad, FR-4 board
- FR-4 board, using ON Semiconductor minimum recommended footprint, as shown in 403A case outline dimensions spec.

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

## ELECTRICAL CHARACTERISTICS

( $T_A = 25^\circ\text{C}$  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



# 1SMB10CAT3 Series

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

Device	Device Marking	V <sub>RWM</sub> (Note 1) Volts	I <sub>R</sub> @ V <sub>RWM</sub> μA	Breakdown Voltage				V <sub>C</sub> @ I <sub>PP</sub> (Note 3)	
				V <sub>BR</sub> (Note 2) Volts			@ I <sub>T</sub>	V <sub>C</sub>	I <sub>PP</sub>
				Min	Nom	Max	mA	Volts	Amps
1SMB10CAT3, G*	KXC	10	5.0	11.1	11.69	12.27	1.0	17.0	35.3
1SMB11CAT3, G*	KZC	11	5.0	12.2	12.84	13.5	1.0	18.2	33.0
1SMB12CAT3, G*	LEC	12	5.0	13.3	14.00	14.7	1.0	19.9	30.2
1SMB13CAT3, G*	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, G*</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, G*	LVC	20	5.0	22.2	23.37	24.5	1.0	32.4	18.5
1SMB22CAT3, G*	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, G*	MKC	30	5.0	33.3	35.06	36.8	1.0	48.4	12.4
1SMB33CAT3, G*	MMC	33	5.0	36.7	38.63	40.6	1.0	53.3	11.3
1SMB36CAT3, G*	MPC	36	5.0	40.0	42.11	44.2	1.0	58.1	10.3
1SMB40CAT3, G*	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, G*	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, G*	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

1. 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.
2. V<sub>BR</sub> measured at pulse test current I<sub>T</sub> at an ambient temperature of 25°C.
3. Surge current waveform per Figure 2 and derate per Figure 3 of the General Data – 600 Watt at the beginning of this group.

\* The "G" suffix indicates Pb-Free package available.

# 1SMB10CAT3 Series

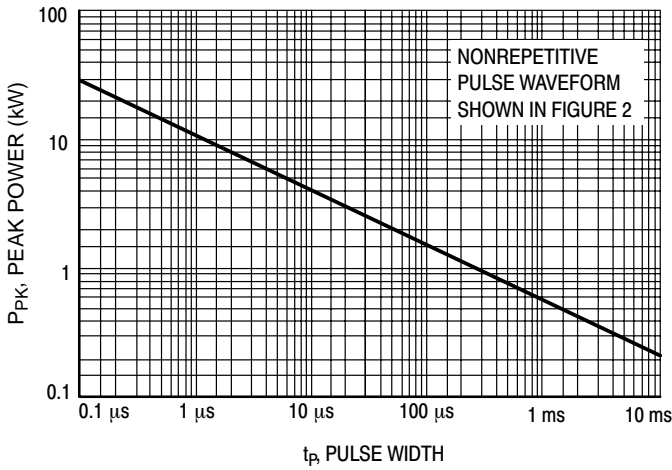


Figure 1. Pulse Rating Curve

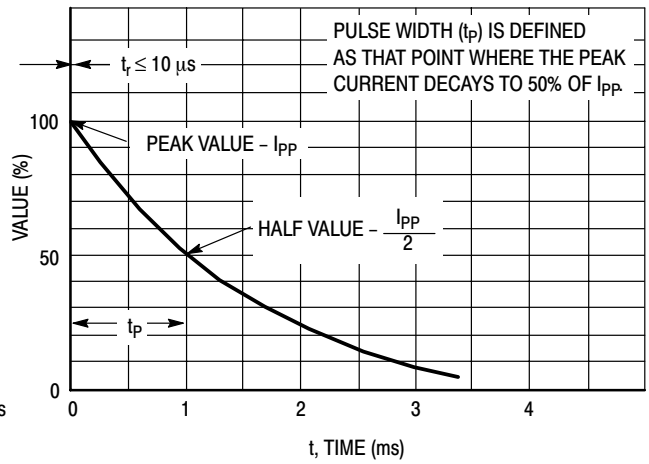


Figure 2. Pulse Waveform

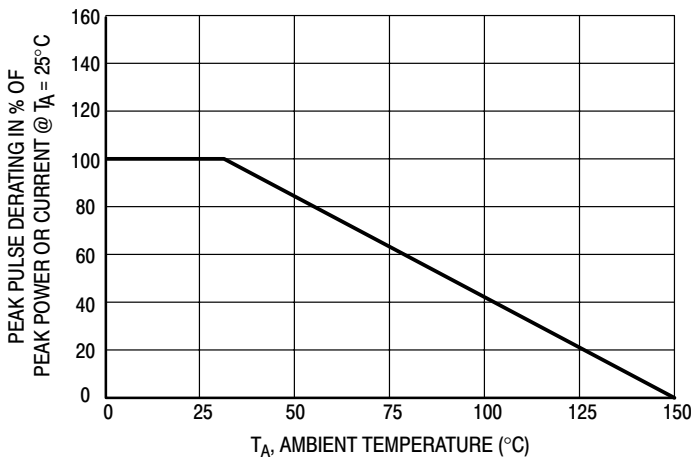
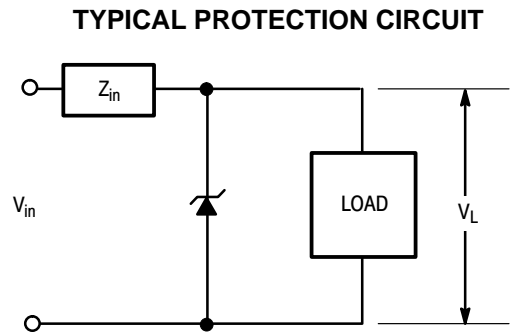


Figure 3. Pulse Derating Curve



## 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 μs 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

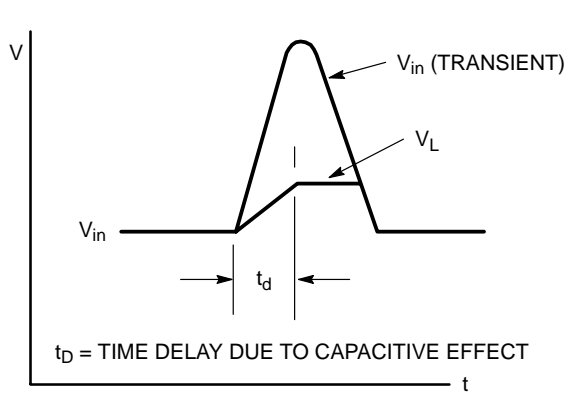


Figure 4.

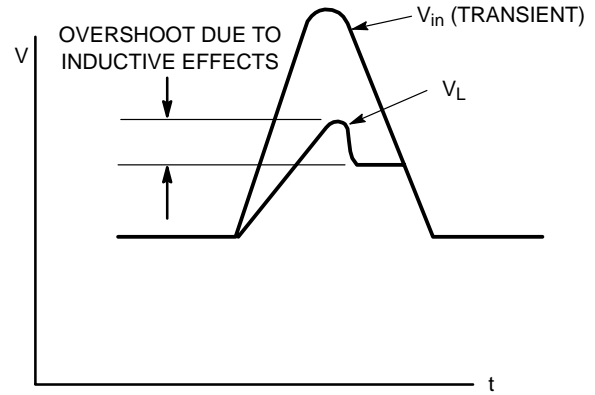


Figure 5.

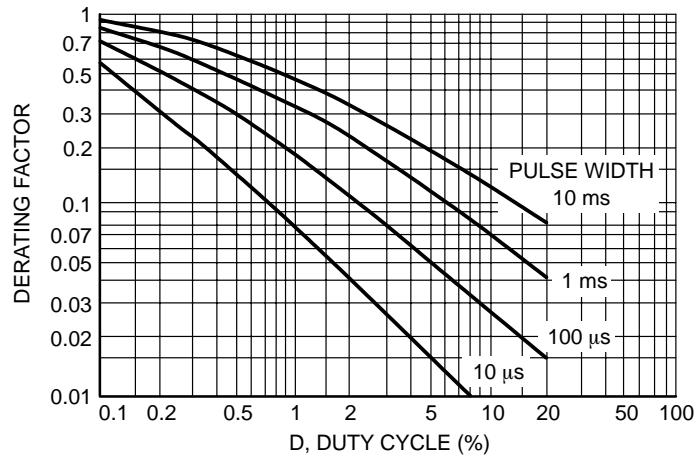


Figure 6. Typical Derating Factor for Duty Cycle

## 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

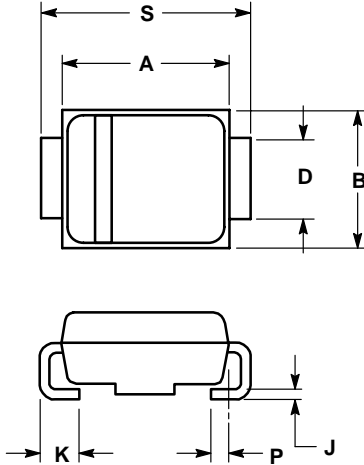
including Strike Voltage Breakdown test, Endurance Conditioning, Temperature test, Dielectric Voltage-Withstand test, Discharge test and several more.

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.

# 1SMB10CAT3 Series

## OUTLINE DIMENSIONS

SMB  
CASE 403A-03  
ISSUE D

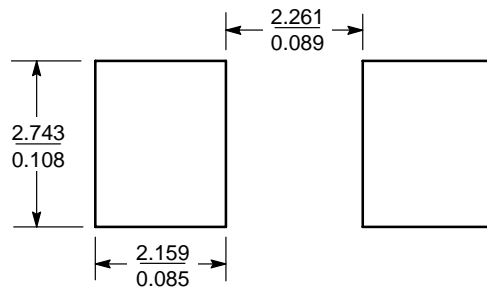


NOTES:

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


### SOLDERING FOOTPRINT\*



SCALE 8:1  $\left(\frac{\text{mm}}{\text{inches}}\right)$

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

SURMETIC is a trademark of Semiconductor Components Industries, LLC.

ON Semiconductor and  are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

### PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT:**  
Literature Distribution Center for ON Semiconductor  
P.O. Box 61312, Phoenix, Arizona 85082-1312 USA  
**Phone:** 480-829-7710 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 480-829-7709 or 800-344-3867 Toll Free USA/Canada  
**Email:** orderlit@onsemi.com

**N. American Technical Support:** 800-282-9855 Toll Free USA/Canada

**Japan:** ON Semiconductor, Japan Customer Focus Center  
2-9-1 Kamimeguro, Meguro-ku, Tokyo, Japan 153-0051  
**Phone:** 81-3-5773-3850

**ON Semiconductor Website:** <http://onsemi.com>

**Order Literature:** <http://www.onsemi.com/litorder>

For additional information, please contact your local Sales Representative.