

1SMC5.0AT3 Series

1500 Watt Peak Power Zener Transient Voltage Suppressors

Unidirectional*

The SMC 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 SMC 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 – 5.0 V to 78 V
- Standard Zener Breakdown Voltage Range – 6.7 V to 91.25 V
- Peak Power – 1500 Watts @ 1 ms
- ESD Rating of Class 3 (>16 KV) per Human Body Model
- Maximum Clamp Voltage @ Peak Pulse Current
- Low Leakage < 5 μ A Above 10 V
- UL 497B for Isolated Loop Circuit Protection
- Maximum Temperature Coefficient Specified
- 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: Cathode indicated by molded polarity notch

MOUNTING POSITION: Any

MAXIMUM RATINGS

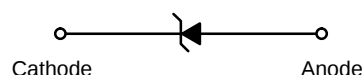
Please See the Table on the Following Page



ON Semiconductor™

<http://onsemi.com>

PLASTIC SURFACE MOUNT ZENER TRANSIENT VOLTAGE SUPPRESSORS 5.0–78 VOLTS 1500 WATT PEAK POWER



SMC
CASE 403
PLASTIC

MARKING DIAGRAM



Y = Year
WW = Work Week
Gxx = Specific Device Code
(See Table on Page 3)

ORDERING INFORMATION

Device †	Package	Shipping
1SMCxxxAT3	SMC	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.

*Bidirectional devices will not be available in this series.

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

1SMC5.0AT3 Series

MAXIMUM RATINGS

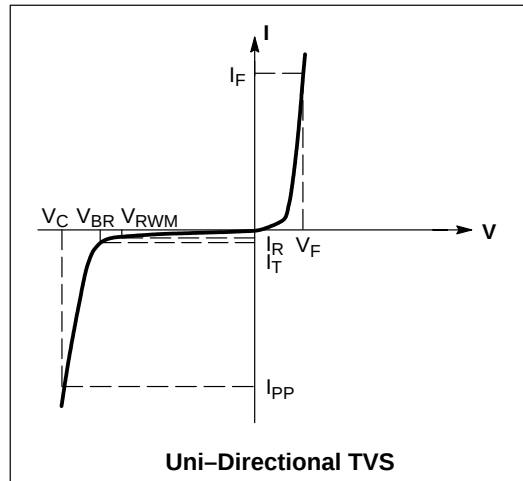
Rating	Symbol	Value	Unit
Peak Power Dissipation (Note 1.) @ $T_L = 25^\circ\text{C}$, Pulse Width = 1 ms	P_{PK}	1500	W
DC Power Dissipation @ $T_L = 75^\circ\text{C}$ Measured Zero Lead Length (Note 2.) Derate Above 75°C	P_D	4.0	W
Thermal Resistance from Junction to Lead	$R_{\theta JL}$	54.6 18.3	mW/ $^\circ\text{C}$ $^\circ\text{C}/\text{W}$
DC Power Dissipation (Note 3.) @ $T_A = 25^\circ\text{C}$ Derate Above 25°C	P_D	0.75 6.1	W mW/ $^\circ\text{C}$
Thermal Resistance from Junction to Ambient	$R_{\theta JA}$	165	$^\circ\text{C}/\text{W}$
Forward Surge Current (Note 4.) @ $T_A = 25^\circ\text{C}$	I_{FSM}	200	A
Operating and Storage Temperature Range	T_J, T_{stg}	-65 to +150	$^\circ\text{C}$

- 10 X 1000 μs , non-repetitive
- 1" square copper pad, FR-4 board
- FR-4 board, using ON Semiconductor minimum recommended footprint, as shown in 403 case outline dimensions spec.
- 1/2 sine wave (or equivalent square wave), PW = 8.3 ms, duty cycle = 4 pulses per minute maximum.

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted, $V_F = 3.5\text{ V Max @ } I_F = 100\text{ A}$) (Note 5.)

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
I_F	Forward Current
V_F	Forward Voltage @ I_F

- 1/2 sine wave or equivalent, PW = 8.3 ms non-repetitive duty cycle



1SMC5.0AT3 Series

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Device	Device Marking	V _{RWM} (Note 6.)	I _R @ V _{RWM}	Breakdown Voltage				V _C @ I _{PP} (Note 8.)	
				V _{BR} Volts (Note 7.)			@ I _T	V _C	I _{PP}
		Volts	μA	Min	Nom	Max	mA	Volts	Amps
1SMC5.0AT3	GDE	5.0	1000	6.4	6.7	7.0	10	9.2	163
1SMC6.0AT3	GDG	6.0	1000	6.67	7.02	7.37	10	10.3	145.6
1SMC6.5AT3	GDK	6.5	500	7.22	7.6	7.98	10	11.2	133.9
1SMC7.0AT3	GDM	7.0	200	7.78	8.19	8.6	10	12	125
1SMC7.5AT3	GDP	7.5	100	8.33	8.77	9.21	1	12.9	116.3
1SMC8.0AT3	GDR	8.0	50	8.89	9.36	9.83	1	13.6	110.3
1SMC8.5AT3	GDT	8.5	25	9.44	9.92	10.4	1	14.4	104.2
1SMC9.0AT3	GDV	9.0	10	10	10.55	11.1	1	15.4	97.4
1SMC10AT3	GDX	10	5	11.1	11.7	12.3	1	17	88.2
1SMC11AT3	GDZ	11	5	12.2	12.85	13.5	1	18.2	82.4
1SMC12AT3	GEE	12	5	13.3	14	14.7	1	19.9	75.3
1SMC13AT3	GEG	13	5	14.4	15.15	15.9	1	21.5	69.7
1SMC14AT3	GEK	14	5	15.6	16.4	17.2	1	23.2	64.7
1SMC15AT3	GEM	15	5	16.7	17.6	18.5	1	24.4	61.5
1SMC16AT3	GEP	16	5	17.8	18.75	19.7	1	26	57.7
1SMC17AT3	GER	17	5	18.9	19.9	20.9	1	27.6	53.3
1SMC18AT3	GET	18	5	20	21.05	22.1	1	29.2	51.4
1SMC20AT3	GEV	20	5	22.2	23.35	24.5	1	32.4	46.3
1SMC22AT3	GEX	22	5	24.4	25.65	26.9	1	35.5	42.2
1SMC24AT3	GEZ	24	5	26.7	28.1	29.5	1	38.9	38.6
1SMC26AT3	GFE	26	5	28.9	30.4	31.9	1	42.1	35.6
1SMC28AT3	GFG	28	5	31.1	32.75	34.4	1	45.4	33
1SMC30AT3	GFK	30	5	33.3	35.05	36.8	1	48.4	31
1SMC33AT3	GFM	33	5	36.7	38.65	40.6	1	53.3	28.1
1SMC36AT3	GFP	36	5	40	42.1	44.2	1	58.1	25.8
1SMC40AT3	GFR	40	5	44.4	46.75	49.1	1	64.5	32.2
1SMC43AT3	GFT	43	5	47.8	50.3	52.8	1	69.4	21.6
1SMC45AT3	GFV	45	5	50	52.65	55.3	1	72.2	20.6
1SMC48AT3	GFX	48	5	53.3	56.1	58.9	1	77.4	19.4
1SMC51AT3	GFZ	51	5	56.7	59.7	62.7	1	82.4	18.2
1SMC54AT3	GGE	54	5	60	63.15	66.3	1	87.1	17.2
1SMC58AT3	GGG	58	5	64.4	67.8	71.2	1	93.6	16
1SMC60AT3	GGK	60	5	66.7	70.2	73.7	1	96.8	15.5
1SMC64AT3	GGM	64	5	71.1	74.85	78.6	1	103	14.6
1SMC70AT3	GGP	70	5	77.8	81.9	86	1	113	13.3
1SMC75AT3	GGR	75	5	83.3	87.7	92.1	1	121	12.4
1SMC78AT3	GGT	78	5	86.7	91.25	95.8	1	126	11.4

6. A transient suppressor is normally selected according to the maximum working peak reverse voltage (V_{RWM}), which should be equal to or greater than the DC or continuous peak operating voltage level.

7. V_{BR} measured at pulse test current I_T at an ambient temperature of 25°C.

8. Surge current waveform per Figure 2 and derate per Figure 3 of the General Data – 1500 Watt at the beginning of this group.

1SMC5.0AT3 Series

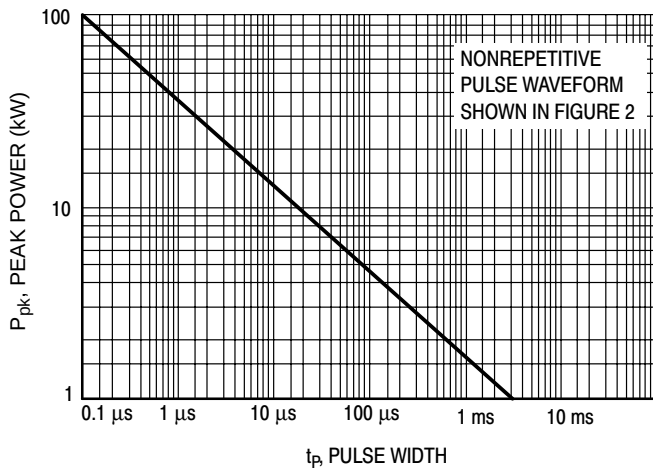


Figure 1. Pulse Rating Curve

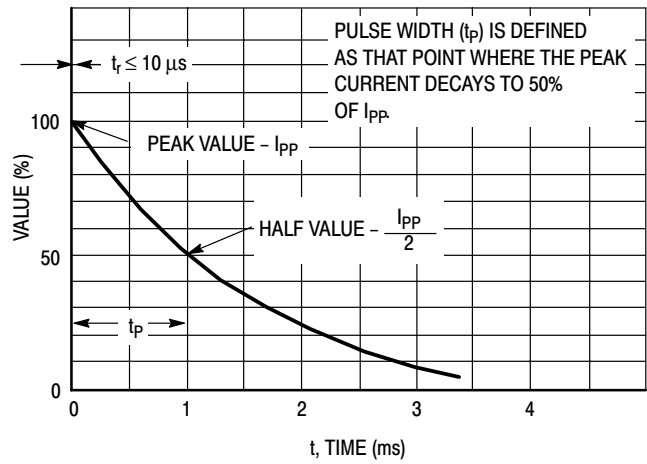


Figure 2. Pulse Waveform

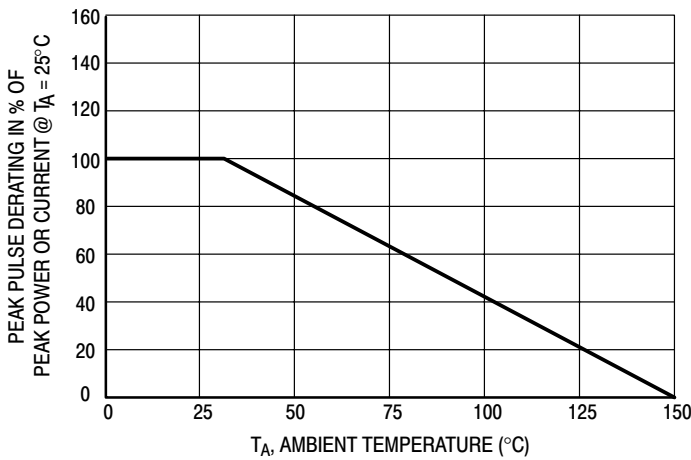


Figure 3. Pulse Derating Curve

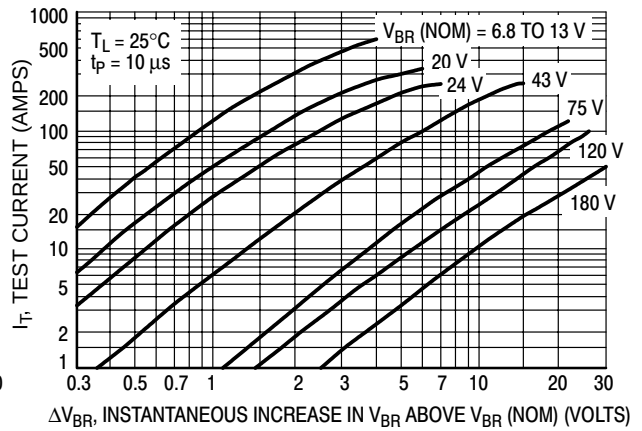


Figure 4. Dynamic Impedance

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.

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 SMC 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 μ s 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.

1SMC5.0AT3 Series

TYPICAL PROTECTION CIRCUIT

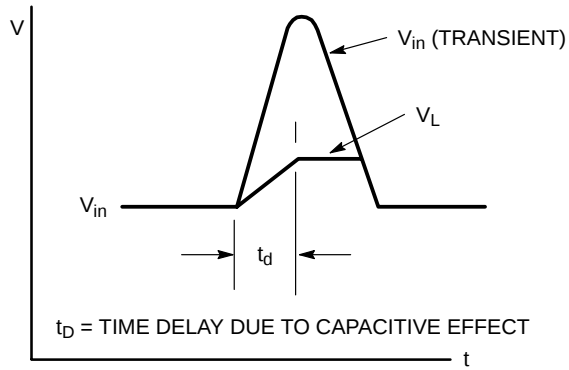
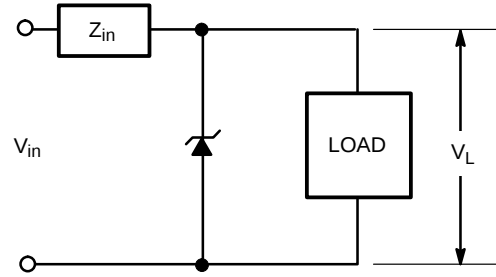


Figure 5.

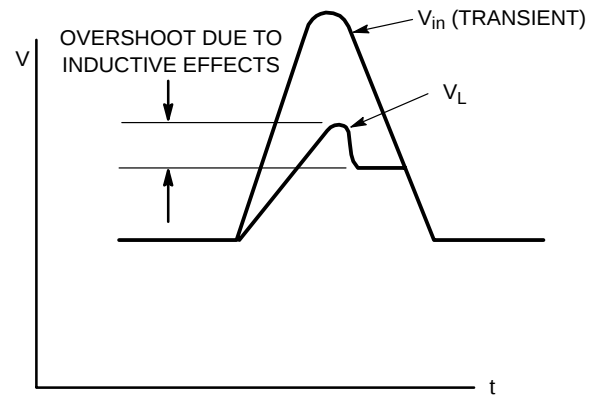


Figure 6.

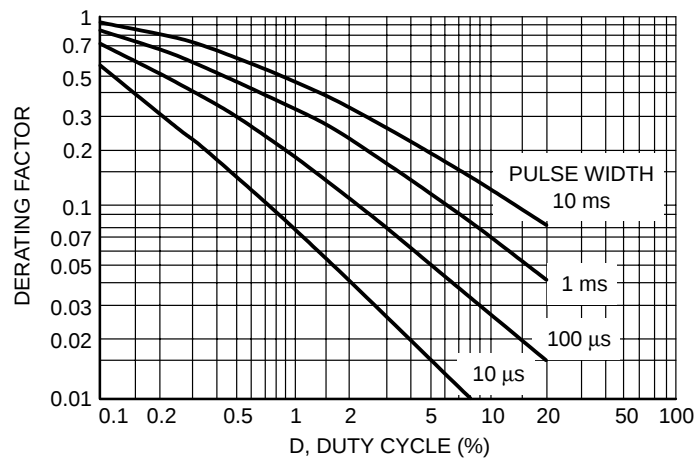


Figure 7. Typical Derating Factor for Duty Cycle

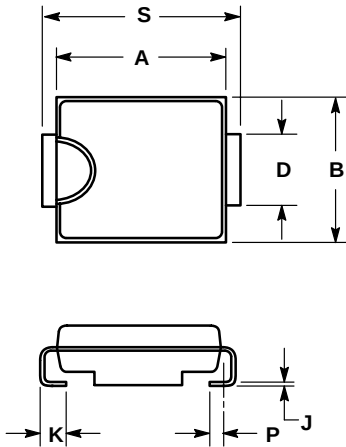
1SMC5.0AT3 Series

OUTLINE DIMENSIONS

Transient Voltage Suppressors – Surface Mounted

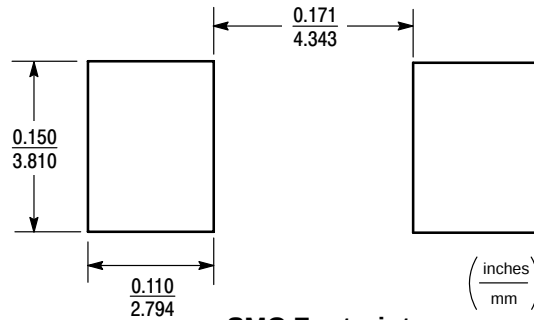
1500 Watt Peak Power

SMC
CASE 403-03
ISSUE B



- 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	0.260	0.280	6.60	7.11
B	0.220	0.240	5.59	6.10
C	0.075	0.095	1.90	2.41
D	0.115	0.121	2.92	3.07
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	0.305	0.320	7.75	8.13



SMC Footprint

1SMC5.0AT3 Series

Surmetic is a trademark of Semiconductor Components Industries, LLC.

ON Semiconductor and  are 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.

PUBLICATION ORDERING INFORMATION

NORTH AMERICA Literature Fulfillment:

Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: ONlit@hibbertco.com
Fax Response Line: 303-675-2167 or 800-344-3810 Toll Free USA/Canada

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

EUROPE: LDC for ON Semiconductor – European Support

German Phone: (+1) 303-308-7140 (Mon-Fri 2:30pm to 7:00pm CET)
Email: ONlit-german@hibbertco.com
French Phone: (+1) 303-308-7141 (Mon-Fri 2:00pm to 7:00pm CET)
Email: ONlit-french@hibbertco.com
English Phone: (+1) 303-308-7142 (Mon-Fri 12:00pm to 5:00pm GMT)
Email: ONlit@hibbertco.com

EUROPEAN TOLL-FREE ACCESS*: 00-800-4422-3781

*Available from Germany, France, Italy, UK, Ireland

CENTRAL/SOUTH AMERICA:

Spanish Phone: 303-308-7143 (Mon-Fri 8:00am to 5:00pm MST)
Email: ONlit-spanish@hibbertco.com
Toll-Free from Mexico: Dial 01-800-288-2872 for Access –
then Dial 866-297-9322

ASIA/PACIFIC: LDC for ON Semiconductor – Asia Support

Phone: 1-303-675-2121 (Tue-Fri 9:00am to 1:00pm, Hong Kong Time)
Toll Free from Hong Kong & Singapore:
001-800-4422-3781
Email: ONlit-asia@hibbertco.com

JAPAN: ON Semiconductor, Japan Customer Focus Center

4-32-1 Nishi-Gotanda, Shinagawa-ku, Tokyo, Japan 141-0031
Phone: 81-3-5740-2700
Email: r14525@onsemi.com

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

For additional information, please contact your local Sales Representative.