# Zener Transient Voltage Suppressor SOD-123 Flat Lead Package

The SMF5.0A Series is designed to protect voltage sensitive components from high voltage, high energy transients. Excellent clamping capability, high surge capability, low zener impedance and fast response time. Because of its small size, it is ideal for use in cellular phones, portable devices, business machines, power supplies and many other industrial/consumer applications.

#### **Features**

- Stand-off Voltage: 5 170 Volts
- Peak Power 200 Watts @ 1 ms (SMF5.0A SMF58A)
   175 Watts @ 1 ms (SMF60A SMF170A)
- Maximum Clamp Voltage @ Peak Pulse Current
- Low Leakage
- Response Time is Typically < 1 ns
- ESD Rating of Class 3 (> 16 kV) per Human Body Model IEC61000-4-2 Level 4 ESD Protection IEC61000-4-4 40 A ESD Protection
- Low Profile Maximum Height of 1.0 mm
- Small Footprint Footprint Area of 8.45 mm<sup>2</sup>
- Supplied in 8 mm Tape and Reel 3,000 Units per Reel
- Cathode Indicated by Polarity Band
- Lead Orientation in Tape: Cathode Lead to Sprocket Holes
- Pb-Free Packages are Available

#### **Mechanical Characteristics:**

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

Epoxy Meets UL 94 V-0

LEAD FINISH: 100% Matte Sn (Tin)

**MOUNTING POSITION:** Any

QUALIFIED MAX REFLOW TEMPERATURE:  $260^{\circ}\mathrm{C}$ 

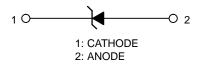
Device Meets MSL 1 Requirements



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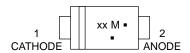
## PLASTIC SURFACE MOUNT ZENER OVERVOLTAGE TRANSIENT SUPPRESSOR 5 – 170 VOLTS 200 WATT PEAK POWER





SOD-123FL CASE 498 PLASTIC

## MARKING DIAGRAM



xx = Device Code (Refer to page 3)

M = Date Code

= Pb-Free Package

(Note: Microdot may be in either location)

## **ORDERING INFORMATION**

Device	Package	Shipping <sup>†</sup>		
SMFxxxAT1	SOD-123FL	3000/Tape & Reel		
SMFxxxAT1G	SOD-123FL (Pb-Free)	3000/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.

## **DEVICE MARKING INFORMATION**

See specific marking information in the device marking column of the Electrical Characteristics table on page 3 of this data sheet.

## **MAXIMUM RATINGS**

Rating	Symbol	Value	Unit
Maximum P <sub>pk</sub> Dissipation (PW-10/1000 μs) (Note 1) SMF60A – SMF170A	P <sub>pk</sub>	175	W
Maximum P <sub>pk</sub> Dissipation (PW-10/1000 μs) (Note 1) SMF5.0A – SMF58A	P <sub>pk</sub>	200	W
Maximum $P_{pk}$ Dissipation @ $T_A = 25$ °C, (PW-8/20 $\mu$ s) (Note 2)	P <sub>pk</sub>	1000	W
DC Power Dissipation @ T <sub>A</sub> = 25°C (Note 3) Derate above 25°C Thermal Resistance, Junction–to–Ambient (Note 3)	P <sub>D</sub>	385 4.0 325	mW mW/°C °C/W
Thermal Resistance, Junction-to-Lead (Note 3)	$R_{\theta J cathode}$	26	°C/W
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C

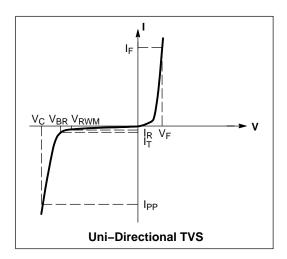
Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur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

- Non-repetitive current pulse at T<sub>A</sub> = 25°C, per waveform of Figure 2.
   Non-repetitive current pulse at T<sub>A</sub> = 25°C, per waveform of Figure 3.
   Mounted with recommended minimum pad size, DC board FR-4.

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^{\circ}C$  unless otherwise noted,  $V_F = 3.5$  V Max. @  $I_F$  (Note 4) = 12 A)

Symbol	Parameter					
I <sub>PP</sub>	Maximum Reverse Peak Pulse Current					
V <sub>C</sub>	Clamping Voltage @ I <sub>PP</sub>					
$V_{RWM}$	Working Peak Reverse Voltage					
I <sub>R</sub>	Maximum Reverse Leakage Current @ V <sub>RWM</sub>					
$V_{BR}$	Breakdown Voltage @ I <sub>T</sub>					
I <sub>T</sub>	Test Current					
IF	Forward Current					
V <sub>F</sub>	Forward Voltage @ I <sub>F</sub>					

<sup>4.</sup> 1/2 sine wave (or equivalent square wave), PW = 8.3 ms, duty cycle = 4 pulses per minute maximum.



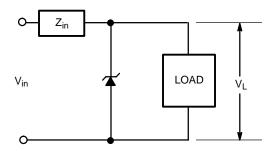
**ELECTRICAL CHARACTERISTICS** ( $T_L = 30^{\circ}C$  unless otherwise noted,  $V_F = 1.25$  Volts @ 200 mA)

		V <sub>RWM</sub> (V)	V <sub>BR</sub>	@ I <sub>T</sub> (V) (No	ote 6)	I <sub>T</sub>	I <sub>R</sub> @ V <sub>RWM</sub>	V <sub>C(Max)</sub>	I <sub>PP(Max)</sub> (A)
Device*	Marking	(Note 5)	Min	Nom	Max	(mA)	(μΑ)	(V)	(Note 7)
SMF5.0A, G	KE	5	6.4	6.7	7	10	400	9.2	21.7
SMF6.0A, G	KG	6	6.67	7.02	7.37	10	400	10.3	19.4
SMF6.5A, G	KK	6.5	7.22	7.6	7.98	10	250	11.2	17.9
SMF7.0A, G	KM	7	7.78	8.2	8.6	10	100	12	16.7
SMF7.5A, G	KP	7.5	8.33	8.77	9.21	1	50	12.9	15.5
SMF8.0A, G	KR	8	8.89	9.36	9.83	1	25	13.6	14.7
SMF8.5A, G	KT	8.5	9.44	9.92	10.4	1	10	14.4	13.9
SMF9.0A, G	K۷	9	10	10.55	11.1	1	5	15.4	13.0
SMF10A, G	KX	10	11.1	11.7	12.3	1	2.5	17	11.8
SMF11A, G	KZ	11	12.2	12.85	13.5	1	2.5	18.2	11.0
SMF12A, G	LE	12	13.3	14	14.7	1	2.5	19.9	10.1
SMF13A, G	LG	13	14.4	15.15	15.9	1	1	21.5	9.3
SMF14A, G	LK	14	15.6	16.4	17.2	1	1	23.2	8.6
SMF15A, G	LM	15	16.7	17.6	18.5	1	1	24.4	8.2
SMF16A, G	LP	16	17.8	18.75	19.7	1	1	26	7.7
SMF17A, G	LR	17	18.9	19.9	20.9	1	1	27.6	7.2
SMF18A, G	LT	18	20	21	22.1	1	1	29.2	6.8
SMF20A, G	LV	20	22.2	23.35	24.5	1	1	32.4	6.2
SMF22A, G	LX	22	24.4	25.6	26.9	1	1	35.5	5.6
SMF24A, G	LZ	24	26.7	28.1	29.5	1	1	38.9	5.1
SMF26A, G	ME	26	28.9	30.4	31.9	1	1	42.1	4.8
SMF28A, G	MG	28	31.1	32.8	34.4	1	1	45.4	4.4
SMF30A, G	MK	30	33.3	35.1	36.8	1	1	48.4	4.1
SMF33A, G	MM	33	36.7	38.7	40.6	1	1	53.3	3.8
SMF36A, G	MP	36	40	42.1	44.2	1	1	58.1	3.4
SMF40A, G	MR	40	44.4	46.8	49.1	1	1	64.5	3.1
SMF43A, G	MT	43	47.8	50.3	52.8	1	1	69.4	2.9
SMF45A, G	MV	45	50	52.65	55.3	1	1	72.7	2.8
SMF48A, G	MX	48	53.3	56.1	58.9	1	1	77.4	2.6
SMF51A, G	MZ	51	56.7	59.7	62.7	1	1	82.4	2.4
SMF54A, G	NE	54	60	63.15	66.3	1	1	87.1	2.3
SMF58A, G	NG	58	64.4	67.8	71.2	1	1	93.6	2.1
SMF60A, G	NK	60	66.7	70.2	73.7	1	1	96.8	1.8
SMF64A, G	NM	64	71.1	74.85	78.6	1	1	103	1.7
SMF70A, G	NP	70	77.8	81.9	86	1	1	113	1.5
SMF75A, G	NR	75	83.3	87.7	92.1	1	1	121	1.4
SMF78A, G	NT	78	86.7	91.25	95.8	1	1	126	1.4
SMF85A, G	NV	85	94.4	99.2	104	1	1	137	1.3
SMF90A, G	NX	90	100	105.5	111	1	1	146	1.2
SMF100A, G	NZ	100	111	117	123	1	1	162	1.1
SMF110A, G	PE	110	122	128.5	135	1	1	177	1.0
SMF120A, G	PG	120	133	140	147	1	1	193	0.9
SMF130A, G	PK	130	144	151.5	159	1	1	209	0.8
SMF150A, G	PM	150	167	176	185	1	1	243	0.7
SMF160A, G	PP	160	178	187.5	197	1	1	259	0.7
SMF170A, G	PR	170	189	199	209	1	1	275	0.6

<sup>5.</sup> 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.
6. V<sub>BR</sub> measured at pulse test current I<sub>T</sub> at ambient temperature of 25°C.
7. Surge current waveform per Figure 2 and derate per Figure 3.

<sup>\*</sup>The "G" suffix indicates Pb-Free package available.

#### TYPICAL PROTECTION CIRCUIT



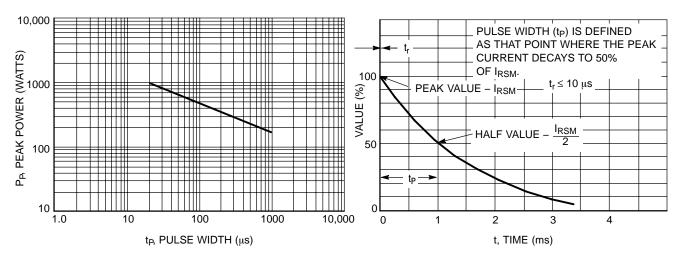


Figure 1. Pulse Rating Curve

Figure 2. 10 X 1000  $\mu s$  Pulse Waveform

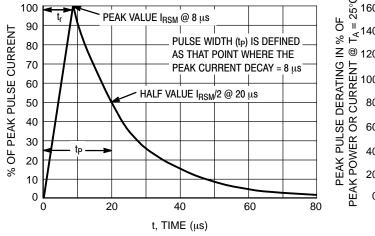


Figure 3. 8 X 20 µs Pulse Waveform

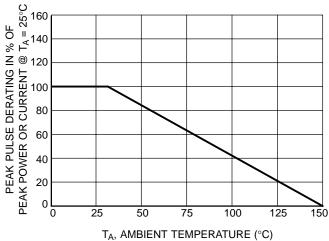


Figure 4. Pulse Derating Curve

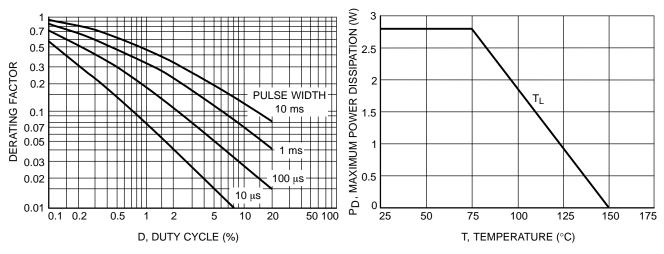


Figure 5. Typical Derating Factor for Duty Cycle

Figure 6. Steady State Power Derating

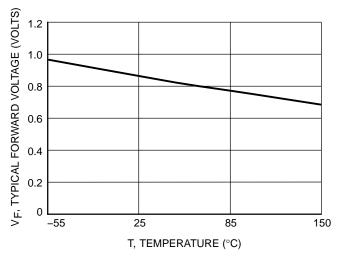


Figure 7. Forward Voltage

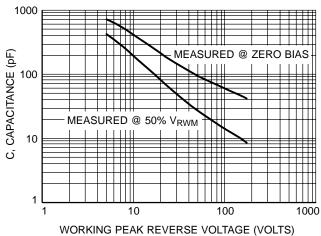
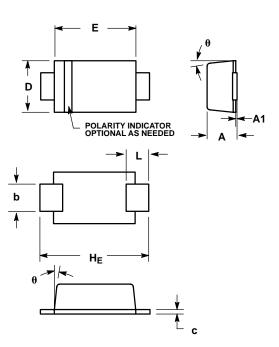


Figure 8. Capacitance versus Working Peak Reverse Voltage

## PACKAGE DIMENSIONS

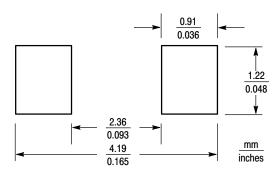
SOD-123FL CASE 498-01 **ISSUE A** 



- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M,
- CONTROLLING DIMENSION: MILLIMETER
- DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH.
  DIMENSIONS D AND J ARE TO BE MEASURED ON FLAT
  SECTION OF THE LEAD: BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.

	М	ILLIMETE	RS	INCHES			
DIM	MIN	NOM	MAX	MIN	NOM	MAX	
Α	0.90	0.95	1.00	0.035	0.037	0.039	
A1	0.00	0.05	0.10	0.000	0.002	0.004	
b	0.70	0.90	1.10	0.028	0.035	0.043	
С	0.10	0.15	0.20	0.004	0.006	0.008	
D	1.50	1.65	1.80	0.059	0.065	0.071	
E	2.50	2.70	2.90	0.098	0.106	0.114	
L	0.55	0.75	0.95	0.022	0.030	0.037	
HE	3.40	3.60	3.80	0.134	0.142	0.150	
θ	0°	_	8°	0°	_	8°	

## **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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