

### SMF Series



#### Agency Approvals

AGENCY	AGENCY FILE NUMBER
	E230531

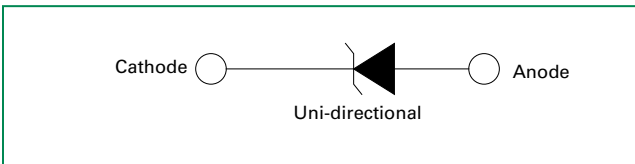
#### Maximum Ratings and Thermal Characteristics ( $T_A=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Peak Pulse Power Dissipation at $T_A=25^\circ\text{C}$ by 10/1000 $\mu\text{s}$ (Note 1)	$P_{PPM}$	200	W
Thermal Resistance Junction- to-Ambient	$R_{\theta JA}$	220	$^\circ\text{C/W}$
Thermal Resistance Junction- to-Lead	$R_{\theta JL}$	100	$^\circ\text{C/W}$
Operating Temperature Range	$T_J$	-65 to 150	$^\circ\text{C}$
Storage Temperature Range	$T_{STG}$	-65 to 175	$^\circ\text{C}$

**Notes:**

1. Non-repetitive current pulse, per Fig. 4 and derated above  $T_J$  (initial)  $=25^\circ\text{C}$  per Fig. 3.

#### Functional Diagram



#### Description

The SMF series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

SMF package is 50% smaller in footprint when compare to SMA package and delivering one of the low height profiles (1.1mm) in the industry.

#### Features

- 200W peak pulsepower capability at 10/1000 $\mu\text{s}$  waveform, repetition rate (duty cycle): 0.01 %
- Compatible with industrial standard package SOD-123FL
- Low profile: maximum height of 1.1mm.
- Low inductance, excellent clamping capability
- For surface mounted applications to optimize board space
- High temperature to reflow soldering guaranteed: 260 $^\circ\text{C}$ /40sec
- Typical failure mode is short from over-specified voltage or current
- Whisker test is conducted based on JEDEC JESD201A per its table 4a and 4c
- IEC-61000-4-2 ESD 30kV(Air), 30kV (Contact)
- ESD protection of data lines in accordance with IEC 61000-4-2
- EFT protection of data lines in accordance with IEC 61000-4-4
- Fast response time: typically less than 1.0ns from 0 Volts to  $V_{BR}$  min
- Glass passivated junction
- Built-in strain relief
- Plastic package is flammability rated V-0 per Underwriters Laboratories
- Meet MSL level1, per J-STD-020, LF maximum peak of 260 $^\circ\text{C}$
- Matte tin lead-free plated
- Halogen-free and RoHS compliant
- Pb-free E3 means 2nd level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/ JEDEC J-STD-609A.01)

#### Applications

SMF devices are ideal for the protection of I/O interfaces,  $V_{CC}$  bus and other vulnerable circuit used in cellular phones, portable devices, business machines, power supplies and other consumer applications.

#### Additional Information



Datasheet




Resources



Samples

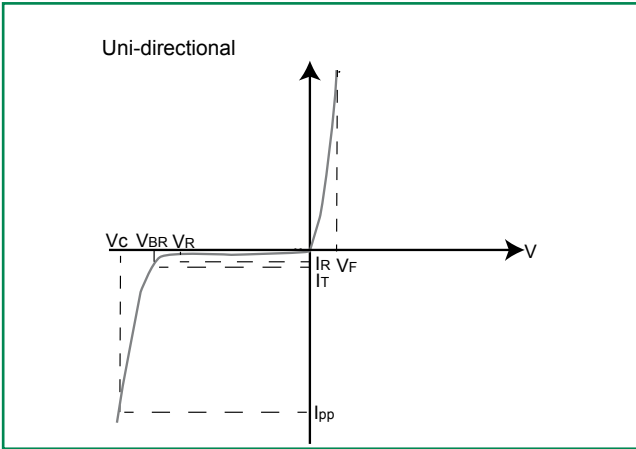
### Electrical Characteristics ( $T_A=25^{\circ}\text{C}$ unless otherwise noted)

Part Number	Marking Code	Breakdown Voltage $V_{BR}$ (Volts) @ $I_T$		Test Current $I_T$ (mA)	Reverse Stand off Voltage $V_R$ (V)	Maximum Reverse Leakage @ $V_R$ $I_R$ ( $\mu\text{A}$ )	Maximum Peak Pulse Current $I_{PP}$ (A)	Maximum Clamping Voltage @ $I_{PP}$ $V_C$ (V)	Agency Approval 
		MIN	MAX						
SMF5.0A	AE	6.40	7.00	10	5.0	400	21.7	9.2	X
SMF6.0A	AG	6.67	7.37	10	6.0	400	19.4	10.3	X
SMF6.5A	AK	7.22	7.98	10	6.5	250	17.9	11.2	X
SMF7.0A	AM	7.78	8.60	10	7.0	100	16.7	12.0	X
SMF7.5A	AP	8.33	9.21	1	7.5	50	15.5	12.9	X
SMF8.0A	AR	8.89	9.83	1	8.0	25	14.7	13.6	X
SMF8.5A	AT	9.44	10.40	1	8.5	10	13.9	14.4	X
SMF9.0A	AV	10.00	11.10	1	9.0	5	13.0	15.4	X
SMF10A	AX	11.10	12.30	1	10	2.5	11.8	17.0	X
SMF11A	AZ	12.20	13.50	1	11	2.5	11.0	18.2	X
SMF12A	BE	13.30	14.70	1	12	2.5	10.1	19.9	X
SMF13A	BG	14.40	15.90	1	13	1.0	9.3	21.5	X
SMF14A	BK	15.60	17.20	1	14	1.0	8.6	23.2	X
SMF15A	BM	16.70	18.50	1	15	1.0	8.2	24.4	X
SMF16A	BP	17.80	19.70	1	16	1.0	7.7	26.0	X
SMF17A	BR	18.90	20.90	1	17	1.0	7.2	27.6	X
SMF18A	BT	20.00	22.10	1	18	1.0	6.8	29.2	X
SMF20A	BV	22.20	24.50	1	20	1.0	6.2	32.4	X
SMF22A	BX	24.40	26.90	1	22	1.0	5.6	35.5	X
SMF24A	BZ	26.70	29.50	1	24	1.0	5.1	38.9	X
SMF26A	CE	28.90	31.90	1	26	1.0	4.8	42.1	X
SMF28A	CG	31.10	34.40	1	28	1.0	4.4	45.4	X
SMF30A	CK	33.30	36.80	1	30	1.0	4.1	48.4	X
SMF33A	CM	36.70	40.60	1	33	1.0	3.8	53.3	X
SMF36A	CP	40.00	44.20	1	36	1.0	3.4	58.1	X
SMF40A	CR	44.40	49.10	1	40	1.0	3.1	64.5	X
SMF43A	CT	47.80	52.80	1	43	1.0	2.9	69.4	X
SMF45A	CV	50.00	55.30	1	45	1.0	2.8	72.7	X
SMF48A	CX	53.30	58.90	1	48	1.0	2.6	77.4	X
SMF51A	CZ	56.70	62.70	1	51	1.0	2.4	82.4	X
SMF54A	DE	60.00	66.30	1	54	1.0	2.3	87.1	X
SMF58A	RG	64.40	71.20	1	58	1.0	2.1	93.6	
SMF60A	RK	66.70	73.70	1	60	1.0	1.8	96.8	
SMF64A	RM	71.10	78.60	1	64	1.0	1.7	103.0	
SMF70A	RP	77.80	86.00	1	70	1.0	1.5	113.0	
SMF75A	RR	83.30	92.10	1	75	1.0	1.4	121.0	
SMF78A	RT	86.70	95.80	1	78	1.0	1.4	126.0	
SMF85A	RV	94.40	104.00	1	85	1.0	1.3	137.0	
SMF90A	RW	100.00	111.00	1	90	1.0	1.2	146.0	
SMF100A	RX	111.00	123.00	1	100	1.0	1.1	162.0	

**Notes:**

- $V_{BR}$  measured after  $I_T$  applied for 300 $\mu\text{s}$ ,  $I_T$  = square wave pulse or equivalent.
- Surge current waveform per 10/1000 $\mu\text{s}$  exponential wave and derated per Fig.2.
- All terms and symbols are consistent with ANSI/IEEE C62.35.

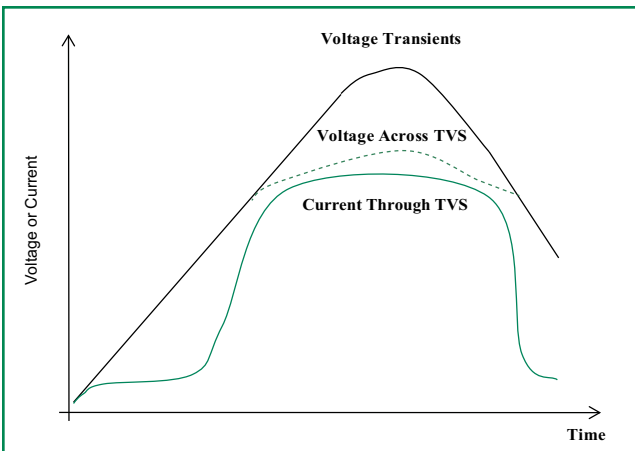
**I-V Curve Characteristics**



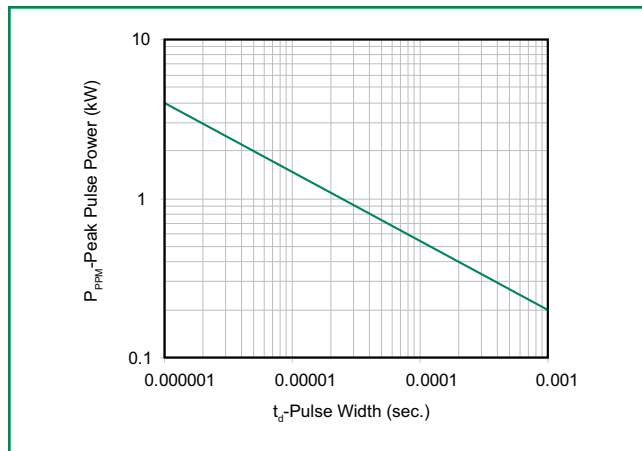
- $P_{PPM}$  Peak Pulse Power Dissipation** – Max power dissipation
- $V_R$  Stand-off Voltage** – Maximum voltage that can be applied to the TVS without operation
- $V_{BR}$  Breakdown Voltage** – Maximum voltage that flows through the TVS at a specified test current ( $I_T$ )
- $V_C$  Clamping Voltage** – Peak voltage measured across the TVS at a specified  $I_{ppm}$  (peak impulse current)
- $I_R$  Reverse Leakage Current** – Current measured at  $V_R$
- $V_F$  Forward Voltage Drop for Uni-directional**

**Ratings and Characteristic Curves** ( $T_A=25^\circ\text{C}$  unless otherwise noted)

**Figure 1 - TVS Transients Clamping Waveform**



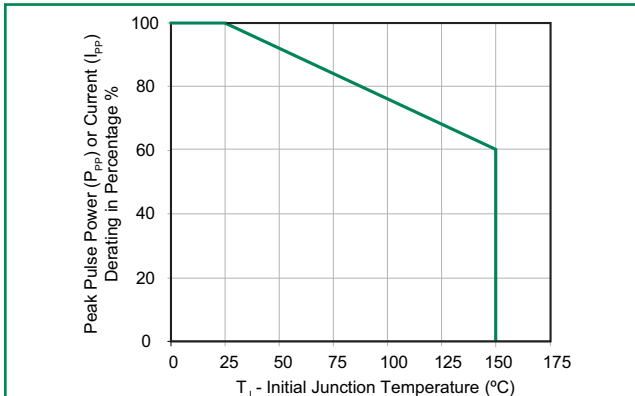
**Figure 2 - Peak Pulse Power Rating Curve**



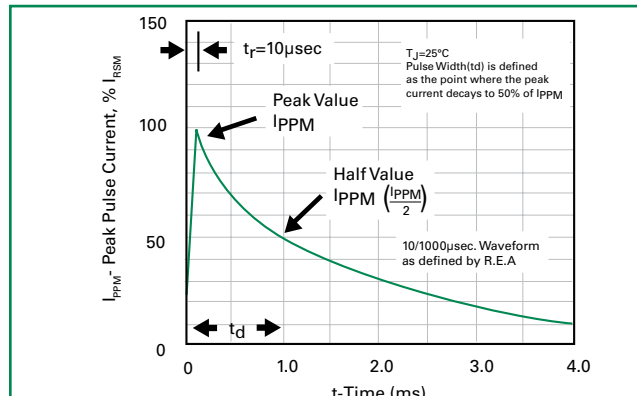
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### Ratings and Characteristic Curves ( $T_A=25^\circ\text{C}$ unless otherwise noted) (Continued)

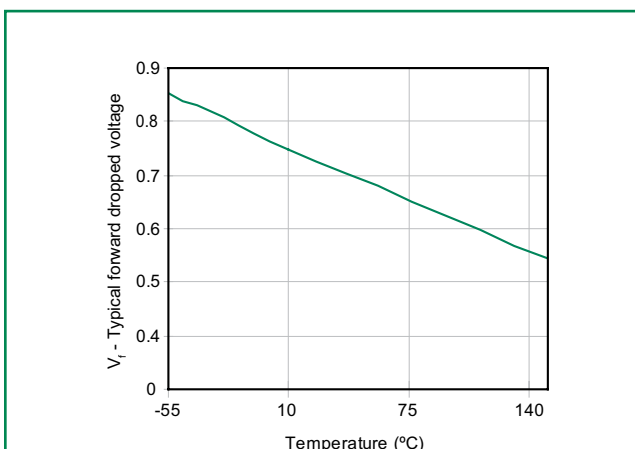
**Figure 3 - Peak Pulse Power Derating Curve**



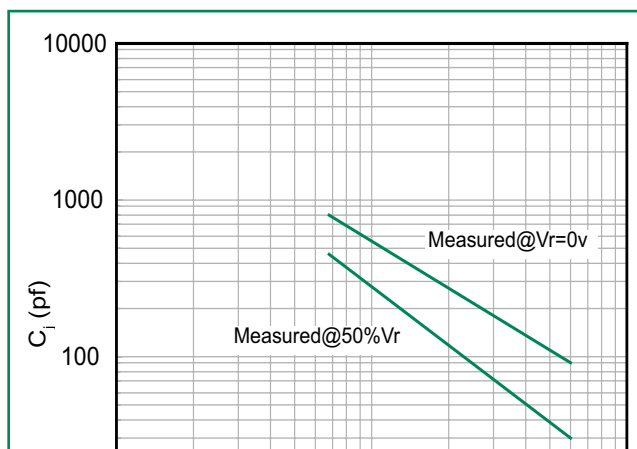
**Figure 4 - Pulse Waveform - 10/1000 $\mu\text{S}$**



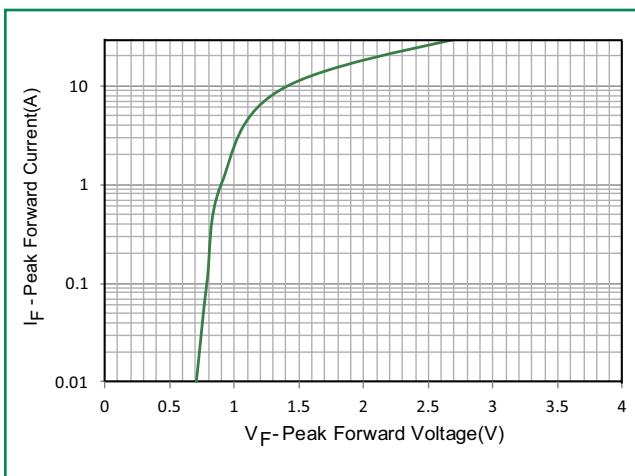
**Figure 5 - Forward Voltage**



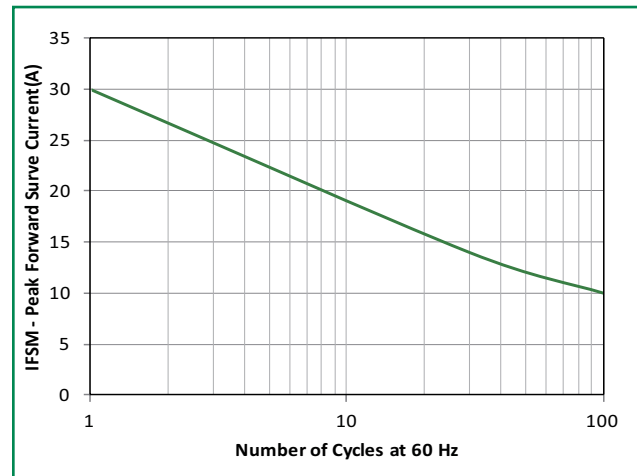
**Figure 6 - Typical Junction Capacitance**



**Figure 7 - Peak Forward Voltage Drop vs. Peak Forward Current**

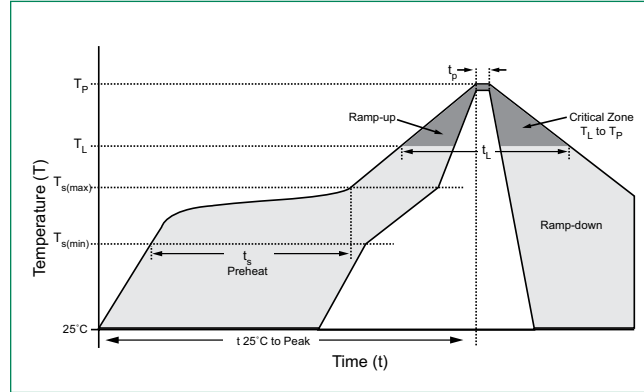


**Figure 8 - Maximum Non-Repetitive Forward Surge Current Uni-Directional Only**



### Soldering Parameters

Reflow Condition		Lead-free assembly
Pre Heat	- Temperature Min ( $T_{s(min)}$ )	150°C
	- Temperature Max ( $T_{s(max)}$ )	200°C
	- Time (min to max) ( $t_s$ )	60 – 180 secs
Average ramp up rate (Liquidus Temp ( $T_A$ ) to peak)		3°C/second max
$T_{s(max)}$ to $T_A$ - Ramp-up Rate		3°C/second max
Reflow	- Temperature ( $T_A$ ) (Liquidus)	217°C
	- Time (min to max) ( $t_s$ )	60 – 150 seconds
Peak Temperature ( $T_p$ )		260 <sup>+0/-5</sup> °C
Time within 5°C of actual peak Temperature ( $t_p$ )		20 – 40 seconds
Ramp-down Rate		6°C/second max
Time 25°C to peak Temperature ( $T_p$ )		8 minutes Max.
Do not exceed		260°C



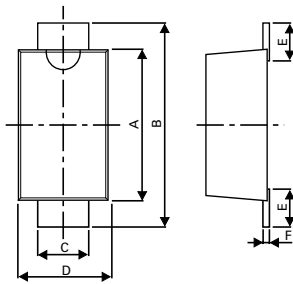
### Physical Specifications

<b>Case</b>	SOD-123FL plastic over glass passivated junction
<b>Polarity</b>	Color band denotes cathode except bipolar
<b>Terminal</b>	Matte tin-plated leads, solderable per JESD22-B102

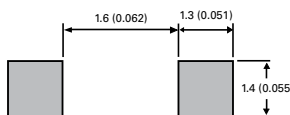
### Environmental Specifications

<b>High Temp. Storage</b>	JESD22-A103
<b>HTRB</b>	JESD22-A108
<b>Temperature Cycling</b>	JESD22-A104
<b>MSL</b>	JEDEC-J-STD-020, Level 1
<b>H3TRB</b>	JESD22-A101
<b>RSH</b>	JESD22-A111

### Dimensions - SOD-123FL Package

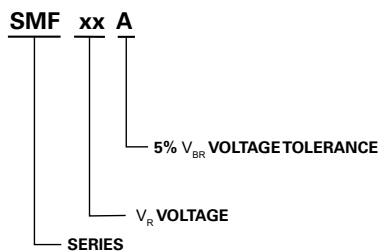


Mounting Pad Layout

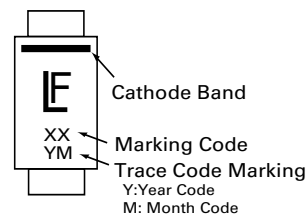


Dimensions	Millimeters		Inches	
	Min	Max	Min	Max
A	2.50	2.90	0.0984	0.1142
B	3.40	3.90	0.1339	0.1535
C	0.70	1.20	0.0275	0.0472
D	1.50	2.00	0.0591	0.0787
E	0.35	0.90	0.0138	0.0354
F	0.05	0.26	0.0020	0.0102
G	0.00	0.10	0.000	0.0039
H	0.95	1.10	0.0374	0.0433

### Part Numbering System



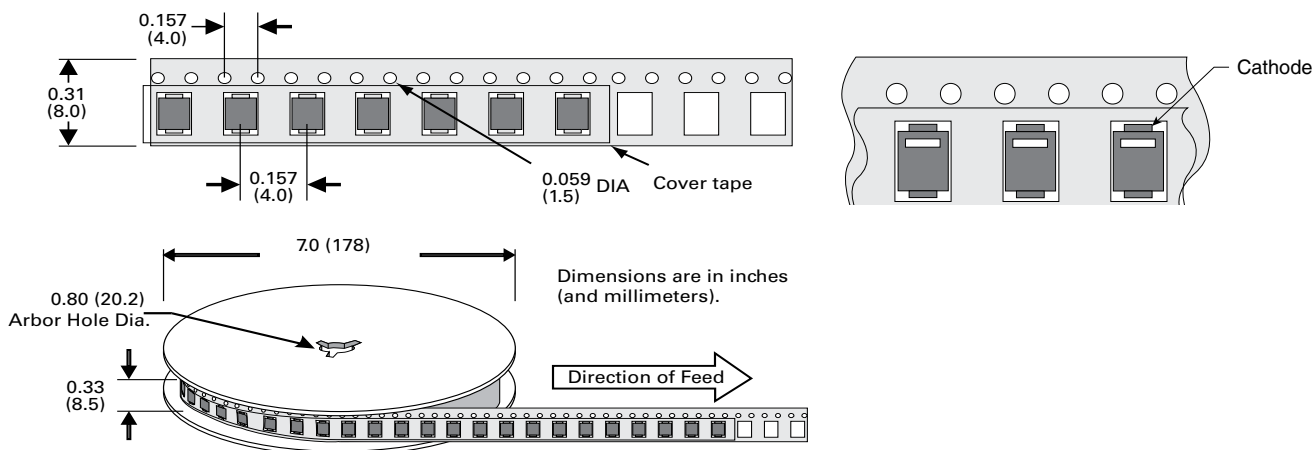
### Part Marking System



### Packaging Options

Part number	Component Package	Quantity	Packaging Option	Packaging Specification
SMFXXX	SOD-123FL	3000	Tape & Reel – 8mm tape/7" reel	EIA RS-481
SMFXXX-T13	SOD-123FL	10000	Tape & Reel – 8mm tape/13" reel	EIA RS-481

### Tape and Reel Specification



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