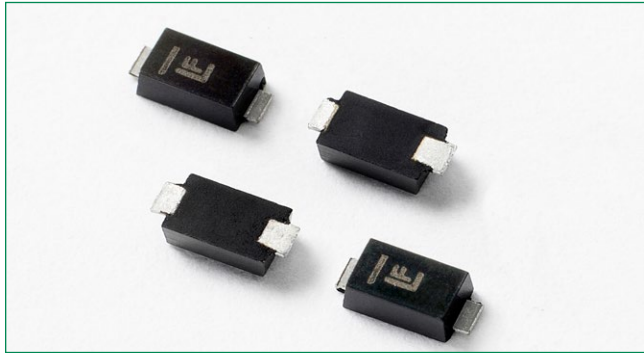


## SMF4L Series



### Agency Approvals

Agency	Agency File Number
	E230531

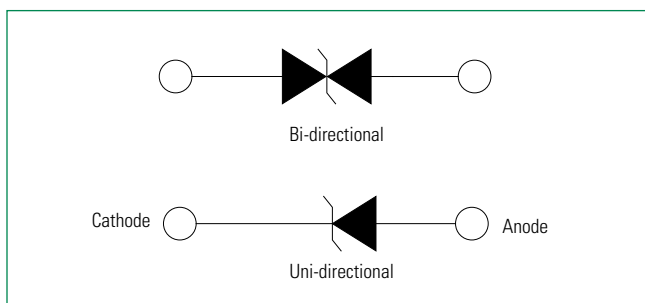
### Maximum Ratings and Thermal Characteristics ( $T_A=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Peak Pulse Power Dissipation at $T_A=25^\circ\text{C}$ by 10/1000 $\mu\text{s}$ (Note 1) 8/20 $\mu\text{s}$ (Note2)	$P_{PPM}$	400	W
Power Dissipation On Infinite Heat Sink at $T_L=50^\circ\text{C}$	$P_D$	1	W
Thermal Resistance Junction to Ambient	$R_{\theta JL}$	220	$^\circ\text{C/W}$
Thermal Resistance Junction to Lead	$R_{\theta JA}$	100	$^\circ\text{C/W}$
Operating and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	$^\circ\text{C}$

**Notes:**

1. Non-repetitive current pulse, per Fig. 4 and derated above  $T_J$  (initial)  $=25^\circ\text{C}$  per Fig. 3.
2. SMF4L5.0A-SMF4L8.5A Peak Pulse Power Dissipation is 1850W min, 2000W typical @ 8/20 $\mu\text{s}$
3. SMF4L5.0A-SMF4L8.5A Peak Pulse Power Dissipation is 370W min, 400W typical @ 10/1000 $\mu\text{s}$ , SMF4L90A-SMF4L250A Peak Pulse Power Dissipation is 200W typical @ 10/1000 $\mu\text{s}$

### Functional Diagram



### Description

The SMF4L series of SOD-123FL small and flat lead low-profile plastic package is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.


### Features

- 400W 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 1mm.
- Low inductance, excellent clamping capability
- For surface mounted applications to optimize board space
- 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
- High temperature soldering: 260 $^\circ\text{C}$ /40 seconds at terminals
- 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 2<sup>nd</sup> level interconnect is Pb-free and the terminal finish material is tin(Sn) (IPC/ JEDEC J-STD-609A.01)
- Recognized to UL 497B as an Isolated Loop Circuit Protector

### Applications

SMF4L 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.

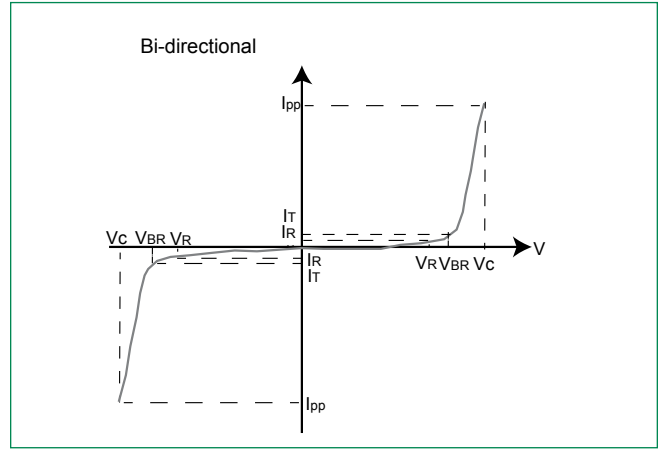
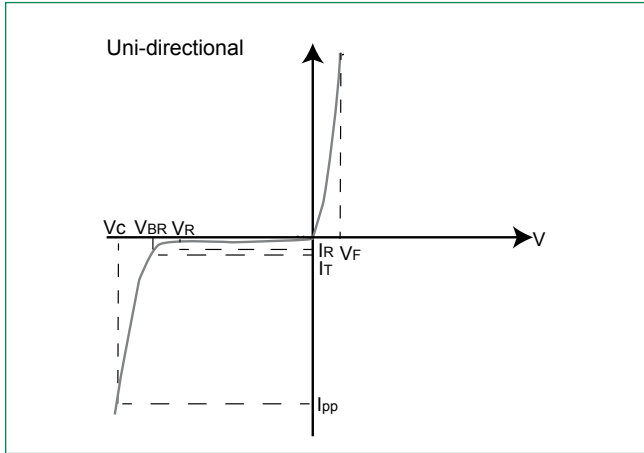
### Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

Part Number		Marking Code		Breakdown Voltage V <sub>BR</sub> (Volts) @ I <sub>T</sub>		Test Current I <sub>T</sub> (mA)	Reverse Stand off Voltage V <sub>R</sub> (V)	Maximum Reverse Leakage @ V <sub>R</sub> I <sub>R</sub> (µA)	Maximum Peak Pulse Current I <sub>PP</sub> (A)	Maximum Clamping Voltage @ I <sub>PP</sub> V <sub>C</sub> (V)	Agency Approval 
Uni-Directional	Bi-Directional	Uni-Directional	Bi-Directional	Min	Max						
SMF4L5.0A	-	KE	-	6.4	7	10	5	800	40.1	9.2	X
SMF4L6.0A	-	KG	-	6.67	7.37	10	6	800	35.9	10.3	X
SMF4L6.5A	-	KK	-	7.22	7.98	10	6.5	500	33.1	11.2	X
SMF4L7.0A	-	KM	-	7.78	8.6	10	7	200	30.9	12	X
SMF4L7.5A	-	KP	-	8.33	9.21	1	7.5	100	28.7	12.9	X
SMF4L8.0A	-	KR	-	8.89	9.83	1	8	50	27.2	13.6	X
SMF4L8.5A	-	KT	-	9.44	10.4	1	8.5	20	25.7	14.4	X
SMF4L9.0A	SMF4L9.0CA	KV	AV	10	11.1	1	9	10	26.4	15.4	X
SMF4L10A	SMF4L10CA	KX	AX	11.1	12.3	1	10	5	23.5	17	X
SMF4L11A	SMF4L11CA	KZ	AZ	12.2	13.5	1	11	1	22	18.2	X
SMF4L12A	SMF4L12CA	LE	BE	13.3	14.7	1	12	1	20.1	19.9	X
SMF4L13A	SMF4L13CA	LG	BG	14.4	15.9	1	13	1	18.6	21.5	X
SMF4L14A	SMF4L14CA	LK	BK	15.6	17.2	1	14	1	17.2	23.2	X
SMF4L15A	SMF4L15CA	LM	BM	16.7	18.5	1	15	1	16.4	24.4	X
SMF4L16A	SMF4L16CA	LP	BP	17.8	19.7	1	16	1	15.4	26	X
SMF4L17A	SMF4L17CA	LR	BR	18.9	20.9	1	17	1	14.5	27.6	X
SMF4L18A	SMF4L18CA	LT	BT	20	22.1	1	18	1	13.7	29.2	X
SMF4L20A	SMF4L20CA	LV	BV	22.2	24.5	1	20	1	12.3	32.4	X
SMF4L22A	SMF4L22CA	LX	BX	24.4	26.9	1	22	1	11.3	35.5	X
SMF4L24A	SMF4L24CA	LZ	BZ	26.7	29.5	1	24	1	10.3	38.9	X
SMF4L26A	SMF4L26CA	ME	CE	28.9	31.9	1	26	1	9.5	42.1	X
SMF4L28A	SMF4L28CA	MG	CG	31.1	34.4	1	28	1	8.8	45.4	X
SMF4L30A	SMF4L30CA	MK	CK	33.3	36.8	1	30	1	8.3	48.4	X
SMF4L33A	SMF4L33CA	MM	CM	36.7	40.6	1	33	1	7.5	53.3	X
SMF4L36A	SMF4L36CA	MP	CP	40	44.2	1	36	1	6.9	58.1	X
SMF4L40A	SMF4L40CA	MR	CR	44.4	49.1	1	40	1	6.2	64.5	X
SMF4L43A	SMF4L43CA	MT	CT	47.8	52.8	1	43	1	5.8	69.4	X
SMF4L45A	SMF4L45CA	MV	CV	50	55.3	1	45	1	5.5	72.7	X
SMF4L48A	SMF4L48CA	MX	CX	53.3	58.9	1	48	1	5.2	77.4	X
SMF4L51A	SMF4L51CA	MZ	CZ	56.7	62.7	1	51	1	4.9	82.4	X
SMF4L54A	-	NE	-	60	66.3	1	54	1	4.6	87.1	X
SMF4L58A	-	NG	-	64.4	71.2	1	58	1	4.3	93.6	X
SMF4L60A	-	NK	-	66.7	73.7	1	60	1	4.1	96.8	X
SMF4L64A	-	NM	-	71.1	78.6	1	64	1	3.9	103	X
SMF4L70A	-	NP	-	77.8	86	1	70	1	3.5	113	X
SMF4L75A	-	NR	-	83.3	92.1	1	75	1	3.3	121	X
SMF4L78A	-	NT	-	86.7	95.8	1	78	1	3.2	126	X
SMF4L85A	-	NV	-	94.4	104	1	85	1	2.9	137	X
SMF4L90A	-	NX	-	100	111	1	90	1	1.4	146	X
SMF4L100A	-	NZ	-	111	123	1	100	1	1.2	162	X
SMF4L110A	-	OE	-	122	135	1	110	1	1.1	177	X
SMF4L120A	-	OG	-	133	147	1	120	1	1.0	193	X
SMF4L130A	-	OK	-	144	159	1	130	1	1.0	209	X
SMF4L150A	-	OM	-	167	185	1	150	1	0.8	243	X
SMF4L160A	-	OP	-	178	197	1	160	1	0.8	259	X
SMF4L170A	-	OR	-	189	209	1	170	1	0.7	275	X
SMF4L180A	-	OT	-	201	222	1	180	1	0.7	292	-
SMF4L188A	-	OV	-	209	231	1	188	1	0.7	304	-
SMF4L200A	-	OX	-	224	247	1	200	1	0.6	324	-
SMF4L220A	-	OZ	-	246	272	1	220	1	0.6	356	-
SMF4L250A	-	PE	-	279	309	1	250	1	0.5	405	-

**Notes:**

1. V<sub>BR</sub> measured after I<sub>T</sub> applied for 300µs. I<sub>T</sub> = square wave pulse or equivalent.
2. Surge current waveform per 10/1000µs exponential wave and derated per Fig.3.
3. All terms and symbols are consistent with ANSI/IEEE C62.35.

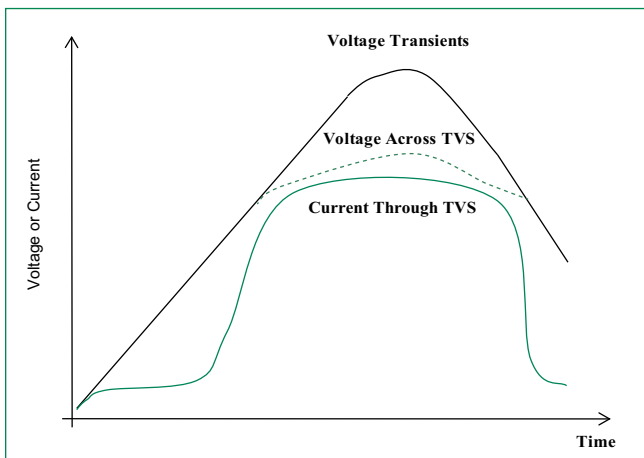
**I-V Curve Characteristics**



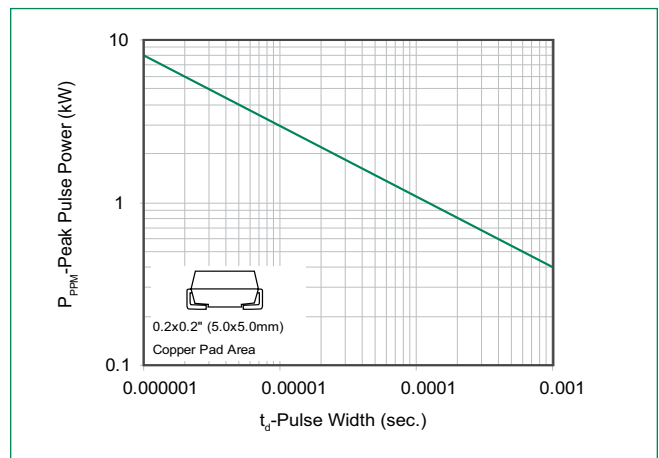
- $P_{PPM}$  Peak Pulse Power Dissipation** -- Max power dissipation
- $V_R$  Stand-off Voltage** -- Maximum voltage that can be applied to the TVS without operation
- $V_{BR}$  Breakdown Voltage** -- Maximum voltage that flows through the TVS at a specified test current ( $I_T$ )
- $V_C$  Clamping Voltage** -- 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**

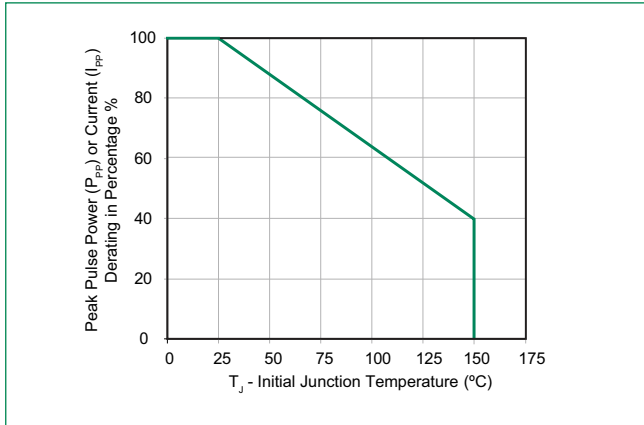


**Figure 2 - Peak Pulse Power Rating Curve**

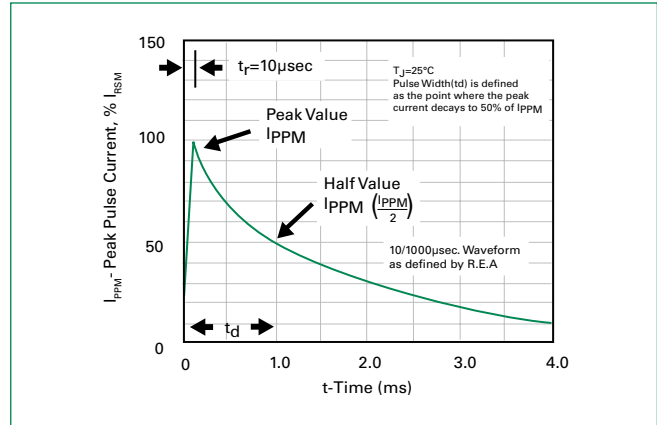


**Ratings and Characteristic Curves** ( $T_A=25^\circ\text{C}$  unless otherwise noted) (Continued)

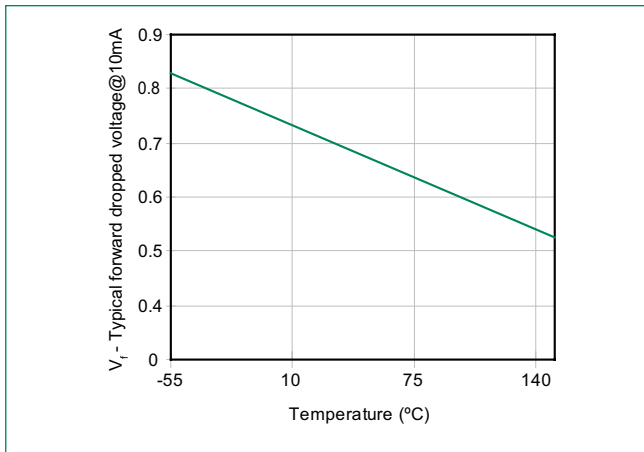
**Figure 3 - Peak Pulse Power Derating Curve**



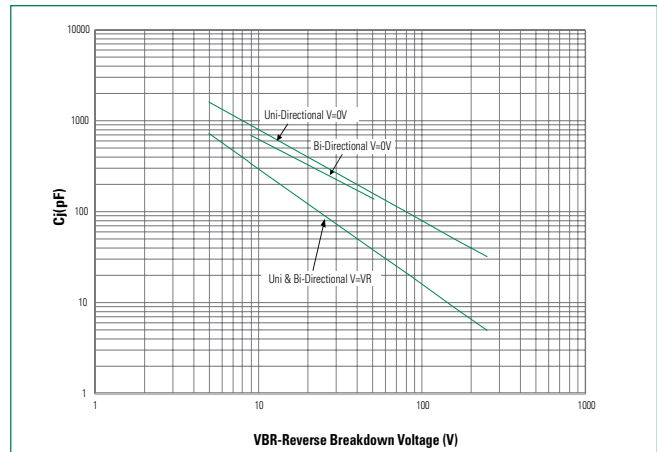
**Figure 4 - Pulse Waveform - 10/1000 $\mu\text{s}$**



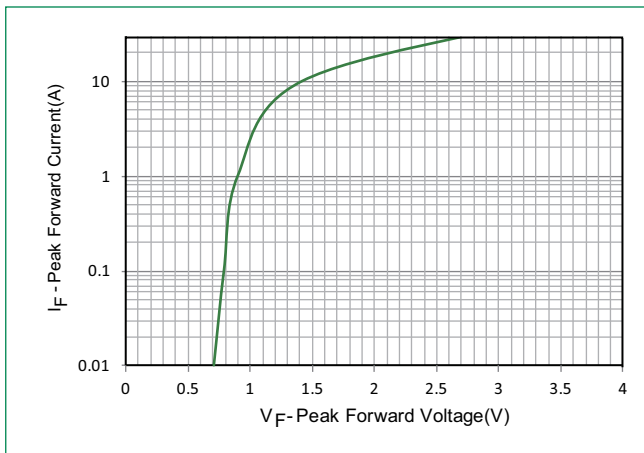
**Figure 5 - Forward Voltage**



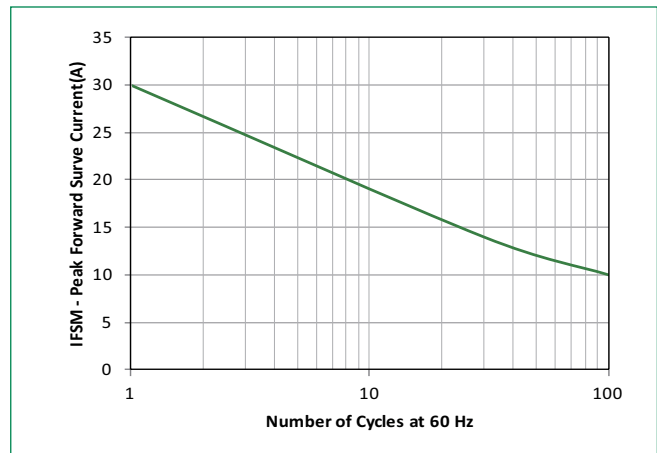
**Figure 6 - Typical Junction Capacitance**



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

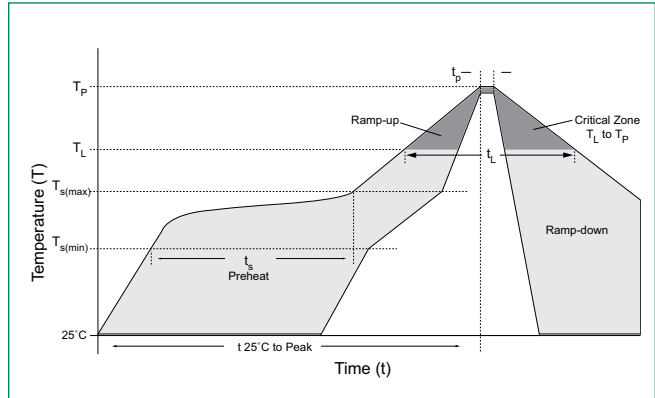


**Figure 8 - Maximum Non-Repetitive Forward Surge Current Uni-Directional Only**



**Soldering Parameters**

<b>Reflow Condition</b>		Lead-free assembly
<b>Pre Heat</b>	- Temperature Min ( $T_{s(min)}$ )	150°C
	- Temperature Max ( $T_{s(max)}$ )	200°C
	- Time (min to max) ( $t_p$ )	60 – 120 secs
<b>Average ramp up rate (Liquidus Temp (<math>T_L</math>) to peak)</b>		3°C/second max
<b><math>T_{s(max)}</math> to <math>T_L</math> - Ramp-up Rate</b>		3°C/second max
<b>Reflow</b>	- Temperature ( $T_L$ ) (Liquidus)	217°C
	- Time (min to max) ( $t_L$ )	60 – 150 seconds
<b>Peak Temperature (<math>T_p</math>)</b>		260 <sup>+0/-5</sup> °C
<b>Time within 5°C of actual peak Temperature (<math>t_p</math>)</b>		30 seconds Max
<b>Ramp-down Rate</b>		6°C/second max
<b>Time 25°C to peak Temperature (<math>T_p</math>)</b>		8 minutes Max.
<b>Do not exceed</b>		260°C



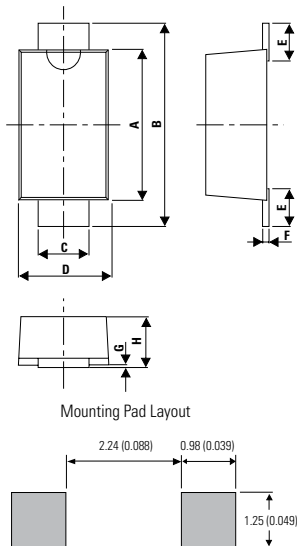
**Physical Specifications**

<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**

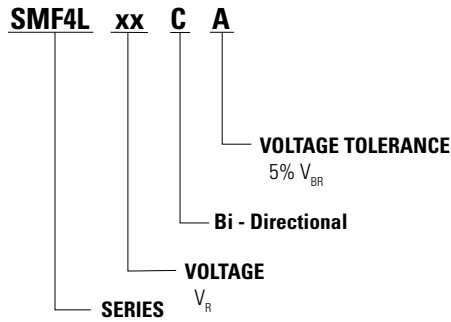
<b>High Temp. Storage</b>	JEDEC22-A103
<b>HTRB</b>	JEDEC22-A108
<b>Temperature Cycling</b>	JEDEC22-A104
<b>MSL</b>	JEDEC-J-STD-020, Level 1
<b>H3TRB</b>	JEDEC22-A101
<b>RSH</b>	JEDEC22-A111

**Dimensions - SOD-123FL Package**

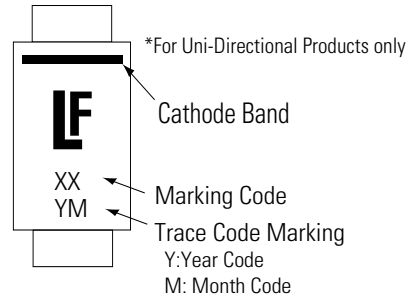


Dimensions	Millimeters		Inches	
	Min	Max	Min	Max
<b>A</b>	2.90	3.10	0.114	0.122
<b>B</b>	3.50	3.90	0.138	0.154
<b>C</b>	0.85	1.05	0.033	0.041
<b>D</b>	1.70	2.00	0.067	0.079
<b>E</b>	0.43	0.83	0.017	0.033
<b>F</b>	0.10	0.25	0.004	0.010
<b>G</b>	0.00	0.10	0.000	0.004
<b>H</b>	0.90	0.98	0.035	0.039

### Part Numbering System



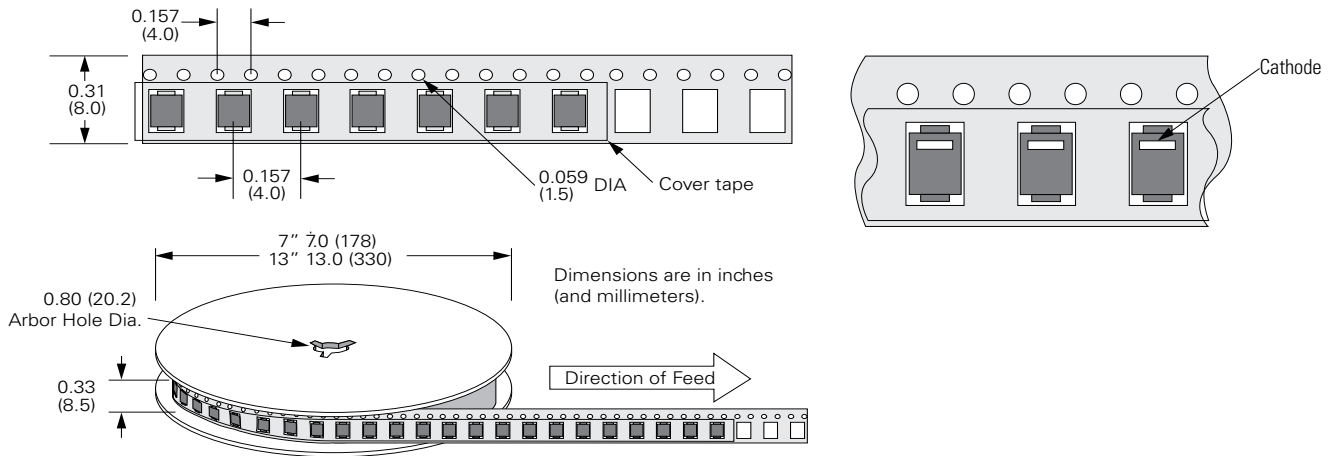
### Part Marking System



### Packaging Options

Part number	Component Package	Quantity	Packaging Option	Packaging Specification
SMF4LXXX	SOD-123FL	3000	Tape & Reel – 8mm tape/7" reel	EIA RS-481

### Tape and Reel Specification



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