SMF Series
Surface Mount – 200W

Additional Information

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Agency Approvals

Agency	Agnecy File Number
	E230531

Maximum Ratings and Thermal Characteristics
(T_A=25°C unless otherwise noted)

Parameter		Symbol	Value	Unit
Peak Pulse Power Dissipation at T_A=25°C [1]	8/20µs	P_{PPM}	1000	W
	10/1000µs [2]		200	
Power Dissipation On Infinite Heat Sink at TL=50°C		P_D	1	W
Thermal Resistance Junction- to-Ambient		$R_{\Theta JA}$	220	°C/W
Thermal Resistance Junction- to- Lead		$R_{\Theta JL}$	100	°C/W
Operating Temperature Range		T_J	-65 to 150	°C
Storage Temperature Range		T_{STG}	-65 to 175	°C

Notes:
1. Non-repetitive current pulse, per Fig. 4 and derated above T_J (initial) =25°C per Fig. 3.
2. SMF90A~SMF100A Peak Pulse Power Dissipation is 170W min, 200W typical @ 10/1000us

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.

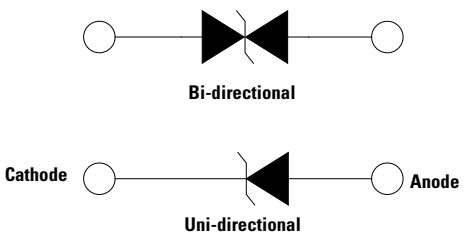
Features & Benefits

- 200W peak pulsepower capability at 10/1000µs 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°C/30sec
- 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 UL 94
- Meet MSL level1, per J-STD-020, LF maximun peak of 260°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)
- UL Recognized to UL 497B as an Isolated Loop Circuit Protector.

Applications

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

Functional Diagram



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Electrical Characteristics (T_A=25°C unless otherwise noted)

Part Number		Marking Code		Breakdown Voltage VBR (Volts) @ IT		Test Current IT (mA)	Reverse Stand off Voltage VR (V)	Maximum Reverse Leakage @ VR IR (µA)	Maximum Peak Pulse Current Ipp (A) 10*1000us	Maximum Clamping Voltage @Ipp VC (V) 10*1000us	Agency Approval	
Uni	Bi	Uni	Bi	MIN	MAX						Uni	Bi
SMF5.0A	SMF5.0CA	AE	HE	6.40	7.00	10	5.0	400	21.7	9.2	X	X
SMF6.0A	SMF6.0CA	AG	HG	6.67	7.37	10	6.0	400	19.4	10.3	X	X
SMF6.5A	SMF6.5CA	AK	HK	7.22	7.98	10	6.5	250	17.9	11.2	X	X
SMF7.0A	SMF7.0CA	AM	HM	7.78	8.60	10	7.0	100	16.7	12.0	X	X
SMF7.5A	SMF7.5CA	AP	HP	8.33	9.21	1	7.5	50	15.5	12.9	X	X
SMF8.0A	SMF8.0CA	AR	HR	8.89	9.83	1	8.0	25	14.7	13.6	X	X
SMF8.5A	SMF8.5CA	AT	HT	9.44	10.40	1	8.5	10	13.9	14.4	X	X
SMF9.0A	SMF9.0CA	AV	HV	10.00	11.10	1	9.0	2.5	13.0	15.4	X	X
SMF10A	SMF10CA	AX	HX	11.10	12.30	1	10	2.5	11.8	17.0	X	X
SMF11A	SMF11CA	AZ	HZ	12.20	13.50	1	11	2.5	11.0	18.2	X	X
SMF12A	SMF12CA	BE	IE	13.30	14.70	1	12	2.5	10.1	19.9	X	X
SMF13A	SMF13CA	BG	IG	14.40	15.90	1	13	1.0	9.3	21.5	X	X
SMF14A	SMF14CA	BK	IK	15.60	17.20	1	14	1.0	8.6	23.2	X	X
SMF15A	SMF15CA	BM	IM	16.70	18.50	1	15	1.0	8.2	24.4	X	X
SMF16A	SMF16CA	BP	IP	17.80	19.70	1	16	1.0	7.7	26.0	X	X
SMF17A	SMF17CA	BR	IR	18.90	20.90	1	17	1.0	7.2	27.6	X	X
SMF18A	SMF18CA	BT	IT	20.0 0	22.10	1	18	1.0	6.8	29.2	X	X
SMF20A	SMF20CA	BV	IV	22.20	24.50	1	20	1.0	6.2	32.4	X	X
SMF22A	SMF22CA	BX	IX	24.40	26.90	1	22	1.0	5.6	35.5	X	X
SMF24A	SMF24CA	BZ	IZ	26.70	29.50	1	24	1.0	5.1	38.9	X	X
SMF26A	SMF26CA	CE	JE	28.90	31.90	1	26	1.0	4.8	42.1	X	X
SMF28A	SMF28CA	CG	JG	31.10	34.40	1	28	1.0	4.4	45.4	X	X
SMF30A	SMF30CA	CK	JK	33.30	36.80	1	30	1.0	4.1	48.4	X	X
SMF33A	SMF33CA	CM	JM	36.70	40.60	1	33	1.0	3.8	53.3	X	X
SMF36A	SMF36CA	CP	JP	40.00	44.20	1	36	1.0	3.4	58.1	X	X
SMF40A	SMF40CA	CR	JR	44.40	49.10	1	40	1.0	3.1	64.5	X	X
SMF43A	SMF43CA	CT	JT	47.80	52.80	1	43	1.0	2.9	69.4	X	X
SMF45A	SMF45CA	CV	JV	50.00	55.30	1	45	1.0	2.8	72.7	X	X
SMF48A	SMF48CA	CX	JX	53.30	58.90	1	48	1.0	2.6	77.4	X	X
SMF51A	SMF51CA	CZ	JZ	56.70	62.70	1	51	1.0	2.4	82.4	X	X
SMF54A	SMF54CA	DE	KE	60.00	66.30	1	54	1.0	2.3	87.1	X	X
SMF58A	SMF58CA	RG	KG	64.40	71.20	1	58	1.0	2.1	93.6	X	X
SMF60A	SMF60CA	RK	KK	66.70	73.70	1	60	1.0	2.1	96.8	X	X
SMF64A	SMF64CA	RM	KM	71.10	78.60	1	64	1.0	1.9	103.0	X	X
SMF70A	SMF70CA	RP	KP	77.80	86.00	1	70	1.0	1.7	113.0	X	X
SMF75A	SMF75CA	RR	KR	83.30	92.10	1	75	1.0	1.6	121.0	X	X
SMF78A	SMF78CA	RT	KT	86.70	95.80	1	78	1.0	1.6	126.0	X	X
SMF85A	SMF85CA	RV	KV	94.40	104.00	1	85	1.0	1.5	137.0	X	X
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	-	-
SMF110A	-	SE	-	122.00	135.00	1	110	1.0	1.1	177.0	-	-
SMF120A	-	SG	-	133.00	147.00	1	120	1.0	1.0	193.0	-	-
SMF130A	-	SK	-	144.00	159.00	1	130	1.0	1.0	209.0	-	-
SMF150A	-	SM	-	167.00	185.00	1	150	1.0	0.8	243.0	-	-
SMF160A	-	SP	-	178.00	197.00	1	160	1.0	0.8	259.0	-	-
SMF170A	-	SR	-	189.00	209.00	1	170	1.0	0.7	275.0	-	-
SMF180A	-	ST	-	201.00	222.00	1	180	1.0	0.7	292.0	-	-
SMF188A	-	SV	-	209.00	231.00	1	188	1.0	0.7	304.0	-	-
SMF200A	-	SX	-	224.00	247.00	1	200	1.0	0.6	324.0	-	-
SMF220A	-	SZ	-	246.00	272.00	1	220	1.0	0.6	356.0	-	-
SMF250A	-	TE	-	279.00	309.00	1	250	1.0	0.5	405.0	-	-

Notes:
1. V_{BR} measured after I_t applied for 300µs, I_t = square wave pulse or equivalent.
2. Surge current waveform per 10/1000µs exponential wave and derated per Fig.2.
3. All terms and symbols are consistent with ANSI/IEEE C62.35.
4. For bidirectional type having VR of 10 volts and less, the IR limit is double.

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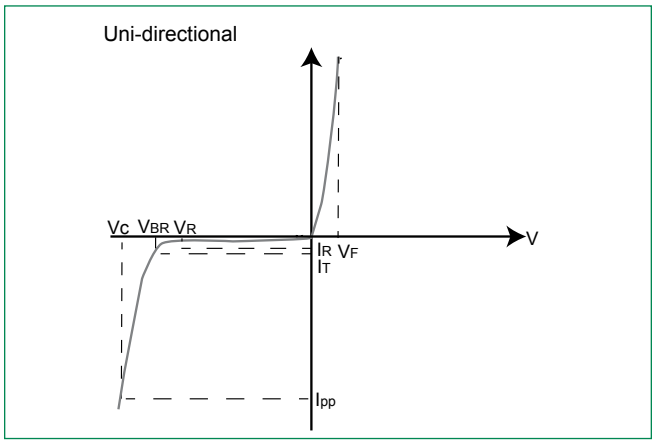
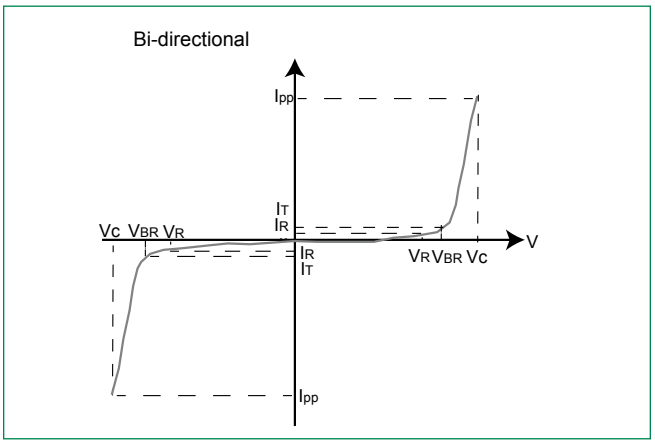
I-V Curve Characteristics





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 though the TVS at a specified test current (IT)
V_C Clamping Voltage -- Peak voltage measured across the TVS at a specified Ippm (peak impulse current)
I_R Reverse Leakage Current -- Current measured at VR
V_F Forward Voltage Drop for Uni-directional

Ratings and Characteristic Curves (T_A=25°C unless otherwise noted)

Figure 1: TVS Transients Clamping Waveform

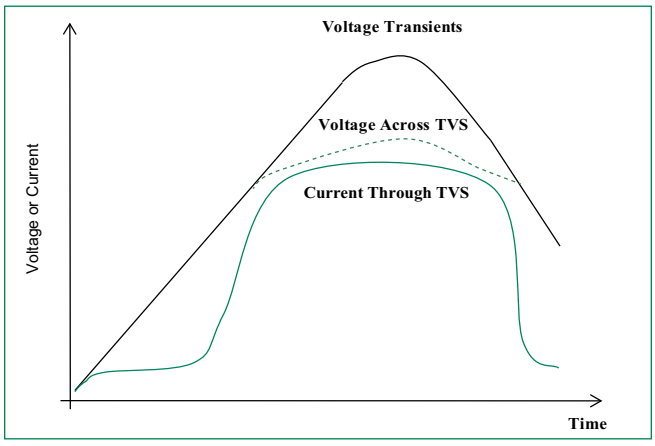
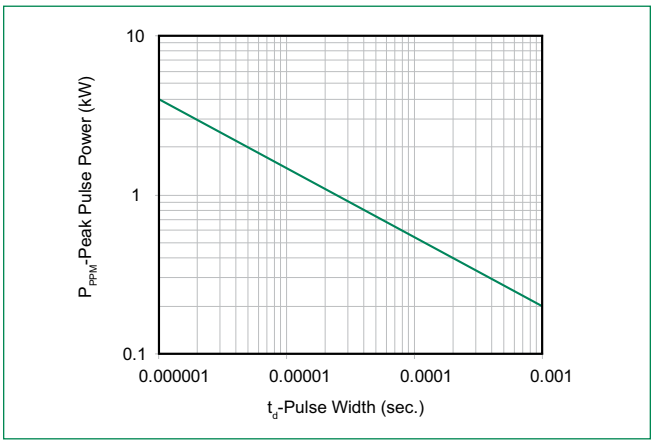


Figure 2: Peak Pulse Power Rating Curve



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Ratings and Characteristic Curves (T_A=25°C unless otherwise noted) (Continued)

Figure 3: Peak Pulse Power Derating Curve

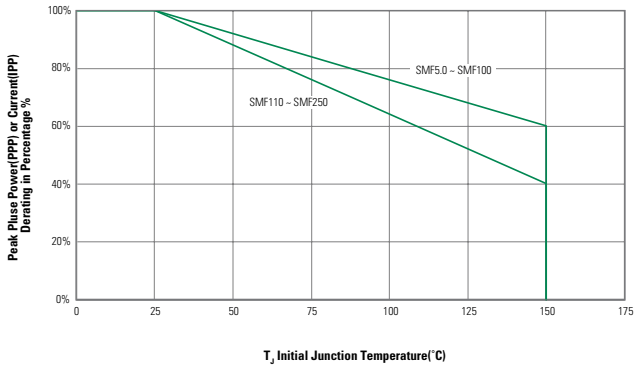


Figure 4: Pulse Waveform - 10/1000µS

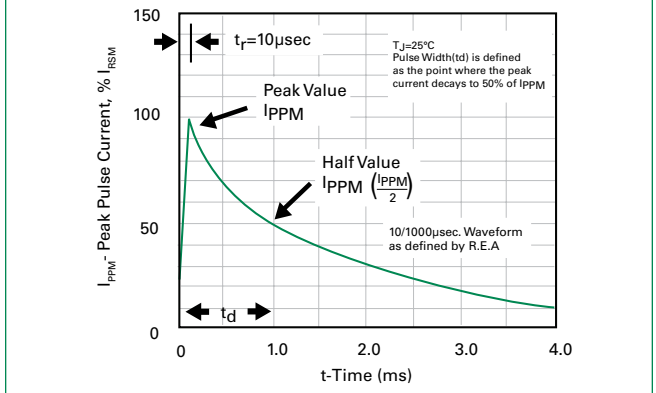


Figure 5: Forward Voltage

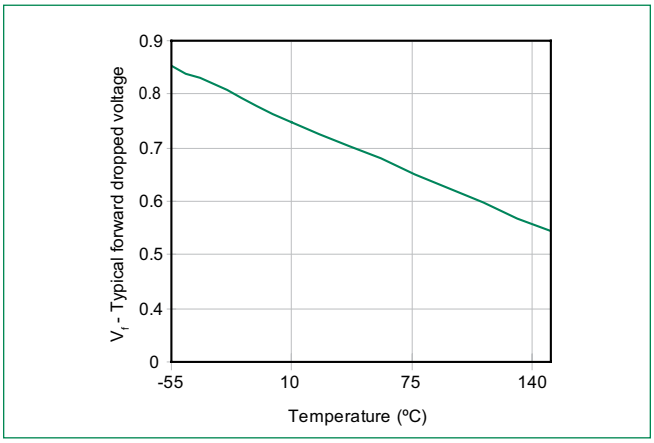


Figure 6: Typical Junction Capacitance

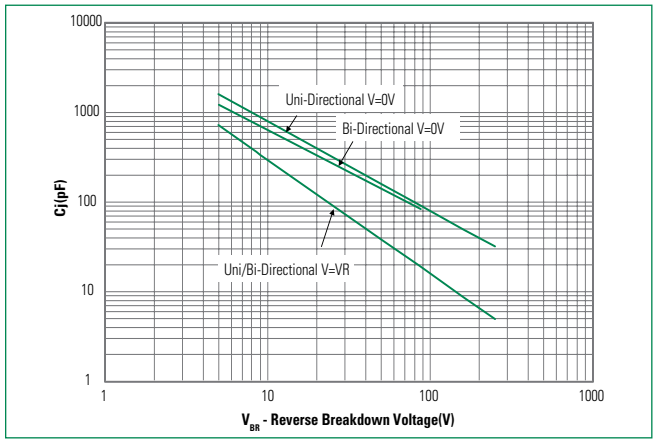


Figure 7: Peak Forward Voltage Drop vs. Peak Forward Current

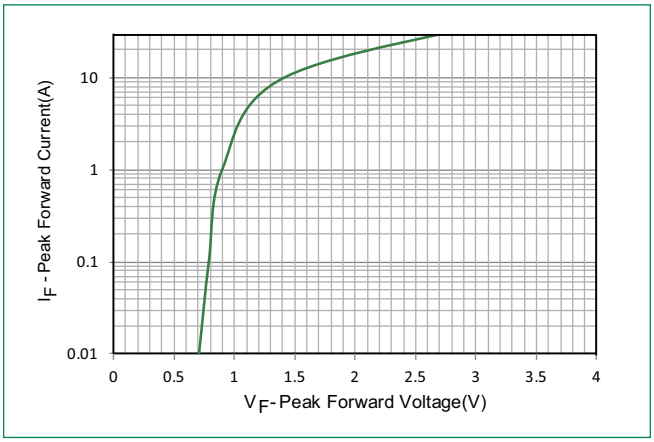
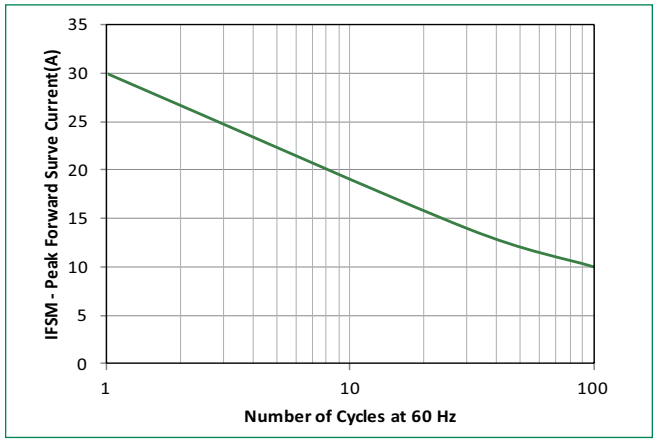


Figure 8: Maximum Non-Repetitive Forward Surge Current Uni-Directional Only



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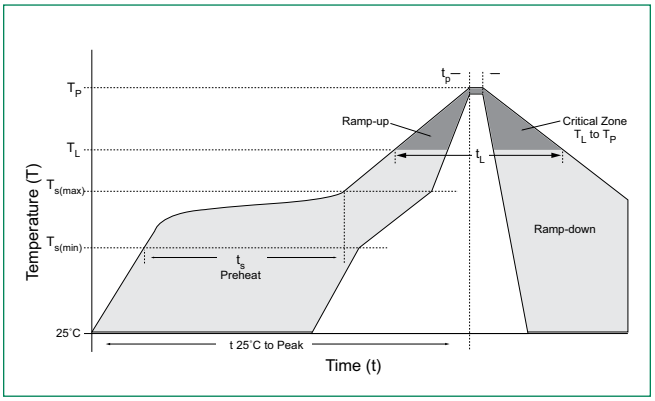
Soldering Parameters

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 – 120 secs
Average ramp up rate (Liquidus Temp (T_L) to peak		3°C/second max
$T_{S(max)}$ to T_L - Ramp-up Rate		3°C/second max
Reflow	**- Temperature (T_L) (Liquidus)**	217°C
	- Time (min to max) (t_L)	60 – 150 seconds
Peak Temperature (T_P)		$260^{+0/-5}$ °C
Time within 5°C of actual peak Temperature (t_p)		30 Seconds Max
Ramp-down Rate		6°C/second Max
Time 25°C to peak Temperature (T_P)		8 minutes Max.
Do not exceed		260°C



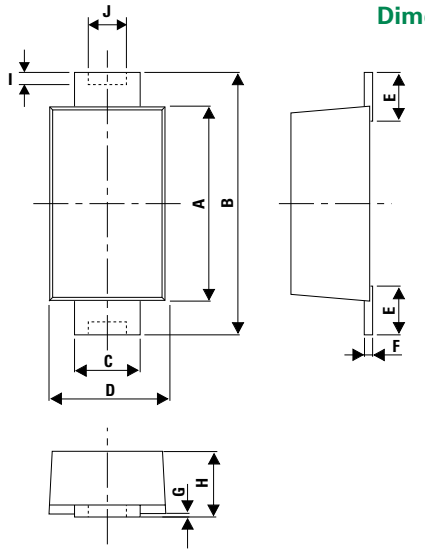
Physical Specifications

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

Environmental Specifications

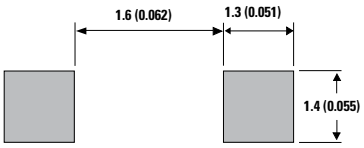
High Temp. Storage	JESD22-A103
HTRB	JESD22-A108
Temperature Cycling	JESD22-A104
MSL	JEDEC-J-STD-020, Level 1
H3TRB	JESD22-A101
RSH	JESD22-A111

Dimensions - SOD-123FL Package



Dimensions	Millimeters		Inches	
	Min	Max	Min	Max
A	2.50	3.10	0.0984	0.1220
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	0.90	1.10	0.0354	0.0433
I	0.00	0.20	0.000	0.008
J	0.40	0.60	0.016	0.024

Mounting Pad Layout



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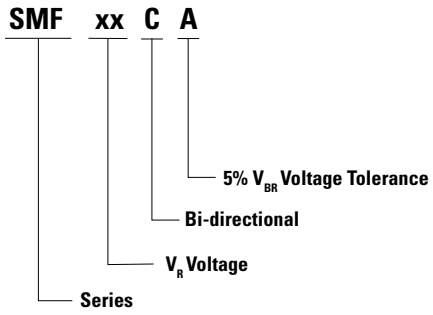
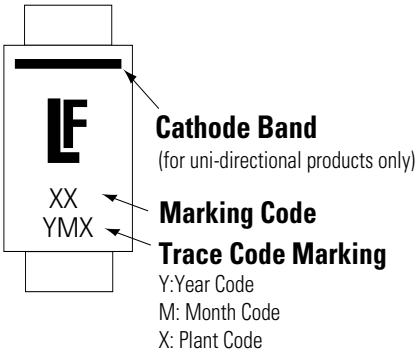
Part Numbering System



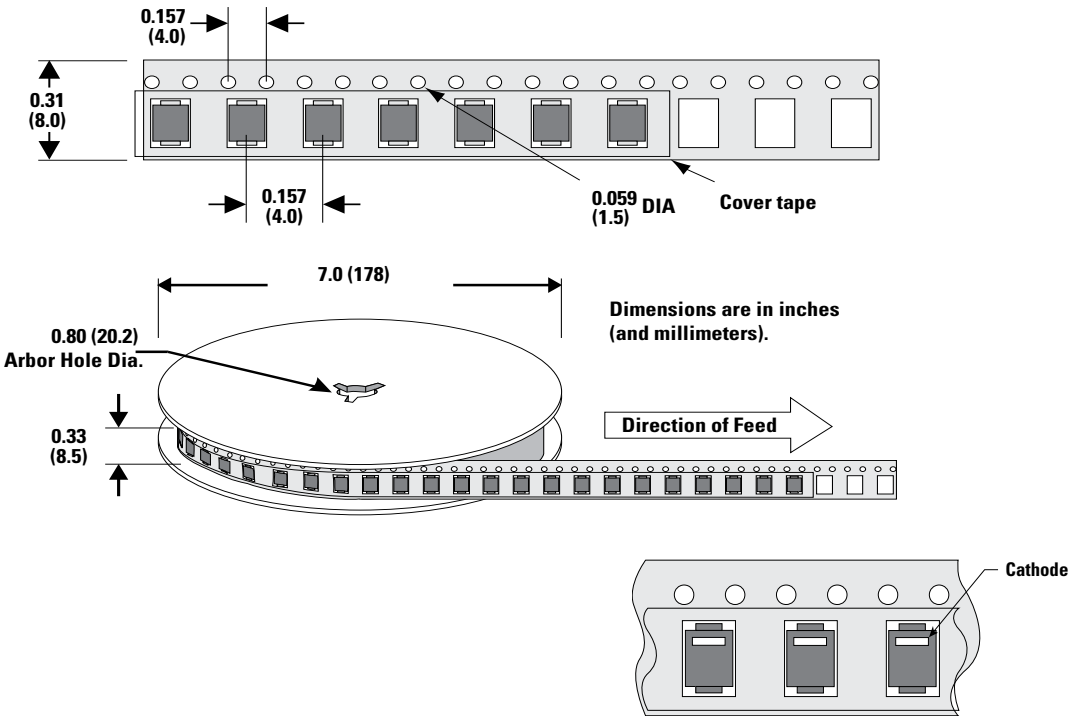
Part Marking System



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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