

Surface Mount Transient Voltage Suppressors (TVS)

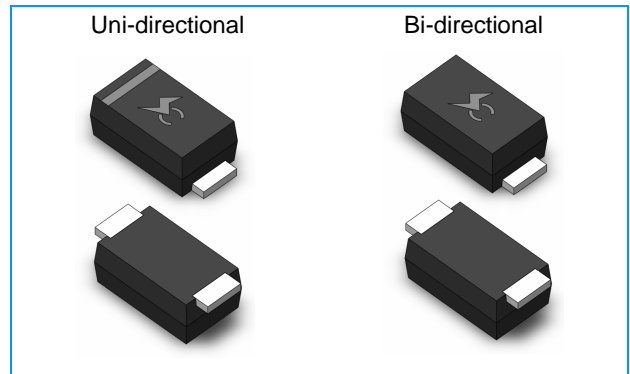
SMF Series 5.0 To 190 V 200W

Description

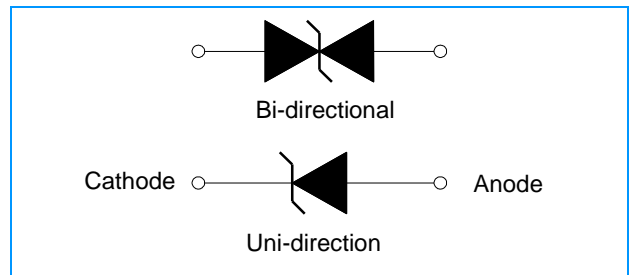
The SMF series is designed specifically to protect sensitive electronic equipment from voltage transients induced by lightning and other transient voltage events.

Features

- u Compatible with industrial standard package SOD-123
- u For surface mounted applications in order to optimize board space
- u Low leakage
- u Uni and Bidirectional unit
- u Glass passivated junction
- u Low inductance
- u Excellent clamping capability
- u 200W Peak power capability at 10 × 1000µs waveform Repetition rate (duty cycle):0.01%
- u Fast response time: typically less than 1.0ps from 0 Volts to V_{BR} min
- u High Temperature soldering: 260°C/40 seconds at terminals
- u Typical maximum temperature coefficient $\Delta V_{BR} = 0.1\% \times V_{BR}@25^{\circ}\text{C} \times \Delta T$
- u Plastic package has Underwriters Laboratory Flammability 94V-0
- u Matte tin lead-free Plated
- u Halogen free and RoHS compliant
- u Typical failure mode is short from over-specified voltage or current
- u Whisker test is conducted based on JEDEC JESD201A per its table 4a and 4c
- u IEC-61000-4-2 ESD 15kV(Air), 8kV (Contact)
- u ESD protection of data lines in accordance with IEC 61000-4-2 (IEC801-2)
- u EFT protection of data lines in accordance with IEC 61000-4-4 (IEC801-4)



Functional Diagram



Applications

TVS devices are ideal for the protection of I/O interfaces, V_{CC} bus and other vulnerable circuits used in Telecom, Computer, Industrial and Consumer electronic applications.

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

| Parameter | Symbol | Value | Unit |
|--|----------------|----------------|--------------------|
| Peak Pulse Power Dissipation with a 10/1000µs waveform (Fig.1)(Note 1), (Note 2) | P_{PPM} | 200 | Watts |
| Peak Pulse Power Dissipation with a 8/20µs waveform (Fig.1)(Note 1), (Note 2) | P_{PPM} | 1000 | Watts |
| Peak Pulse Current with a 10/1000µs waveform.(Note1, Fig.3) | I_{PP} | See Next Table | Amps |
| Power Dissipation on Infinite Heat Sink at $T_L=75^{\circ}\text{C}$ | $P_{M(AV)}$ | 0.4 | Watt |
| Peak Forward Surge Current, 8.3ms Single Half Sine Wave (Note 3) | I_{FSM} | 20 | Amps |
| Maximum Instantaneous Forward Voltage at 25A for Unidirectional Only (Note 4) | V_F | 3.5 | Voltage |
| Operating junction and Storage Temperature Range. | T_J, T_{STG} | -55 to +150 | $^{\circ}\text{C}$ |

Notes:

1. Non-repetitive current pulse, per Fig. 3 and derated above $T_A = 25^{\circ}\text{C}$ per Fig. 2.
2. Mounted on 5.0mm x 5.0mm (0.03mm thick) Copper Pads to each terminal.
3. 8.3ms single half sine-wave, or equivalent square wave, Duty cycle = 4 pulses per minutes maximum.
4. $V_F < 3.5\text{V}$ for $V_{BR} < 200\text{V}$ and $V_F < 6.5\text{V}$ for $V_{BR} > 201\text{V}$.

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

| Part Number | | Marking | | Reverse Stand-Off Voltage V _{RWM} (V) | Breakdown Voltage V _{BR} (V) @I _T | | Test Current I _T (mA) | Maximum Clamping Voltage V _C @I _{PP} (V) | Maximum Peak Pulse Current I _{PP} (A) | Maximum Reverse Leakage I _R @V _{RWM} (μA) |
|-------------|----------|---------|----|--|---|--------|----------------------------------|--|--|---|
| Uni | Bi | Uni | Bi | | MIN | MAX | | | | |
| SMF5.0A | SMF5.0CA | FE | KE | 5.0 | 6.40 | 7.00 | 10 | 9.2 | 21.74 | 400 |
| SMF6.0A | SMF6.0CA | FG | KG | 6.0 | 6.67 | 7.37 | 10 | 10.3 | 19.42 | 400 |
| SMF6.5A | SMF6.5CA | FK | KK | 6.5 | 7.22 | 7.98 | 10 | 11.2 | 17.86 | 250 |
| SMF7.0A | SMF7.0CA | FM | KM | 7.0 | 7.78 | 8.60 | 10 | 12.0 | 16.67 | 100 |
| SMF7.5A | SMF7.5CA | FP | KP | 7.5 | 8.33 | 9.21 | 1 | 12.9 | 15.50 | 50 |
| SMF8.0A | SMF8.0CA | FR | KR | 8.0 | 8.89 | 9.83 | 1 | 13.6 | 14.71 | 25 |
| SMF8.5A | SMF8.5CA | FT | KT | 8.5 | 9.44 | 10.40 | 1 | 14.4 | 13.89 | 10 |
| SMF9.0A | SMF9.0CA | FV | KV | 9.0 | 10.00 | 11.10 | 1 | 15.4 | 12.99 | 5 |
| SMF10A | SMF10CA | FX | KX | 10.0 | 11.10 | 12.30 | 1 | 17.0 | 11.76 | 2.5 |
| SMF11A | SMF11CA | FZ | KZ | 11.0 | 12.20 | 13.50 | 1 | 18.2 | 10.99 | 2.5 |
| SMF12A | SMF12CA | HE | LE | 12.0 | 13.30 | 14.70 | 1 | 19.9 | 10.05 | 2.5 |
| SMF13A | SMF13CA | HG | LG | 13.0 | 14.40 | 15.90 | 1 | 21.5 | 9.30 | 1 |
| SMF14A | SMF14CA | HK | LK | 14.0 | 15.60 | 17.20 | 1 | 23.2 | 8.62 | 1 |
| SMF15A | SMF15CA | HM | LM | 15.0 | 16.70 | 18.50 | 1 | 24.4 | 8.20 | 1 |
| SMF16A | SMF16CA | HP | LP | 16.0 | 17.80 | 19.70 | 1 | 26.0 | 7.69 | 1 |
| SMF17A | SMF17CA | HR | LR | 17.0 | 18.90 | 20.90 | 1 | 27.6 | 7.25 | 1 |
| SMF18A | SMF18CA | HT | LT | 18.0 | 20.00 | 22.10 | 1 | 29.2 | 6.85 | 1 |
| SMF19A | SMF19CA | HB | LB | 19.0 | 21.10 | 23.30 | 1 | 30.6 | 6.54 | 1 |
| SMF20A | SMF20CA | HV | LV | 20.0 | 22.20 | 24.50 | 1 | 32.4 | 6.17 | 1 |
| SMF22A | SMF22CA | HX | LX | 22.0 | 24.40 | 26.90 | 1 | 35.5 | 5.63 | 1 |
| SMF24A | SMF24CA | HZ | LZ | 24.0 | 26.70 | 29.50 | 1 | 38.9 | 5.14 | 1 |
| SMF26A | SMF26CA | JE | ME | 26.0 | 28.90 | 31.90 | 1 | 42.1 | 4.75 | 1 |
| SMF28A | SMF28CA | JG | MG | 28.0 | 31.10 | 34.40 | 1 | 45.4 | 4.41 | 1 |
| SMF30A | SMF30CA | JK | MK | 30.0 | 33.30 | 36.80 | 1 | 48.4 | 4.13 | 1 |
| SMF33A | SMF33CA | JM | MM | 33.0 | 36.70 | 40.60 | 1 | 53.3 | 3.75 | 1 |
| SMF36A | SMF36CA | JP | MP | 36.0 | 40.00 | 44.20 | 1 | 58.1 | 3.44 | 1 |
| SMF40A | SMF40CA | JR | MR | 40.0 | 44.40 | 49.10 | 1 | 64.5 | 3.10 | 1 |
| SMF43A | SMF43CA | JT | MT | 43.0 | 47.80 | 52.80 | 1 | 69.4 | 2.88 | 1 |
| SMF45A | SMF45CA | JV | MV | 45.0 | 50.00 | 55.30 | 1 | 72.7 | 2.75 | 1 |
| SMF48A | SMF48CA | JX | MX | 48.0 | 53.30 | 58.90 | 1 | 77.4 | 2.58 | 1 |
| SMF51A | SMF51CA | JZ | MZ | 51.0 | 56.70 | 62.70 | 1 | 82.4 | 2.43 | 1 |
| SMF54A | SMF54CA | XE | NE | 54.0 | 60.00 | 66.30 | 1 | 87.1 | 2.30 | 1 |
| SMF58A | SMF58CA | XG | NG | 58.0 | 64.40 | 71.20 | 1 | 93.6 | 2.14 | 1 |
| SMF60A | SMF60CA | XK | NK | 60.0 | 66.70 | 73.70 | 1 | 96.8 | 2.07 | 1 |
| SMF64A | SMF64CA | XM | NM | 64.0 | 71.10 | 78.60 | 1 | 103.0 | 1.94 | 1 |
| SMF70A | SMF70CA | XP | NP | 70.0 | 77.80 | 86.00 | 1 | 113.0 | 1.77 | 1 |
| SMF75A | SMF75CA | XR | NR | 75.0 | 83.30 | 92.10 | 1 | 121.0 | 1.65 | 1 |
| SMF78A | SMF78CA | XT | NT | 78.0 | 86.70 | 95.80 | 1 | 126.0 | 1.59 | 1 |
| SMF80A | SMF80CA | XB | NB | 80.0 | 88.80 | 97.60 | 1 | 129.0 | 1.55 | 1 |
| SMF85A | SMF85CA | XV | NV | 85.0 | 94.40 | 104.00 | 1 | 137.0 | 1.46 | 1 |
| SMF90A | SMF90CA | XX | NX | 90.0 | 100.00 | 111.00 | 1 | 146.0 | 1.37 | 1 |
| SMF100A | SMF100CA | XZ | NZ | 100.0 | 111.00 | 123.00 | 1 | 162.0 | 1.23 | 1 |
| SMF110A | SMF110CA | TE | PE | 110.0 | 122.00 | 135.00 | 1 | 177.0 | 1.13 | 1 |
| SMF120A | SMF120CA | TG | PG | 120.0 | 133.00 | 147.00 | 1 | 193.0 | 1.04 | 1 |
| SMF130A | SMF130CA | TK | PK | 130.0 | 144.00 | 159.00 | 1 | 209.0 | 0.96 | 1 |
| SMF140A | SMF140CA | TB | PB | 140.0 | 155.00 | 171.00 | 1 | 224.0 | 0.89 | 1 |
| SMF150A | SMF150CA | TM | PM | 150.0 | 167.00 | 185.00 | 1 | 243.0 | 0.82 | 1 |
| SMF160A | SMF160CA | TP | PP | 160.0 | 178.00 | 197.00 | 1 | 259.0 | 0.77 | 1 |
| SMF170A | SMF170CA | TR | PR | 170.0 | 189.00 | 209.00 | 1 | 275.0 | 0.73 | 1 |
| SMF180A | SMF180CA | TT | PT | 180.0 | 200.00 | 220.00 | 1 | 292.0 | 0.69 | 1 |
| SMF190A | SMF190CA | TV | PV | 190.0 | 211.00 | 232.00 | 1 | 308.0 | 0.69 | 1 |

Note:

1. Suffix 'A' denotes 5% tolerance device. Without 'A' denotes 10% tolerance device
2. Add suffix 'C' or 'CA' after part number to specify Bi-directional devices
3. For Bi-Directional devices having V_R of 10 volts and under, the I_R limit is double

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

Figure 1 - Peak Pulse Power Rating Curve

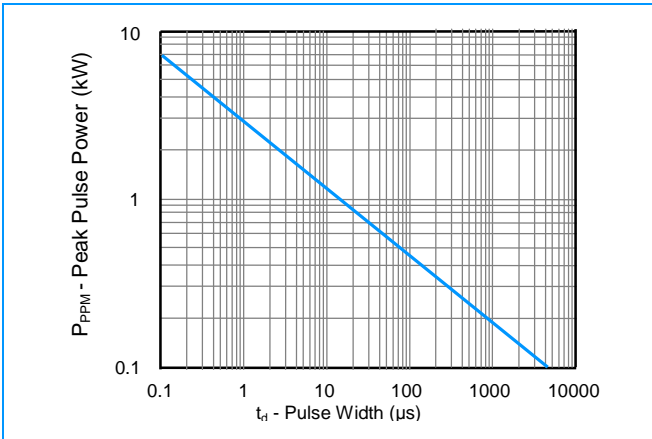


Figure 2 - Pulse Derating Curve

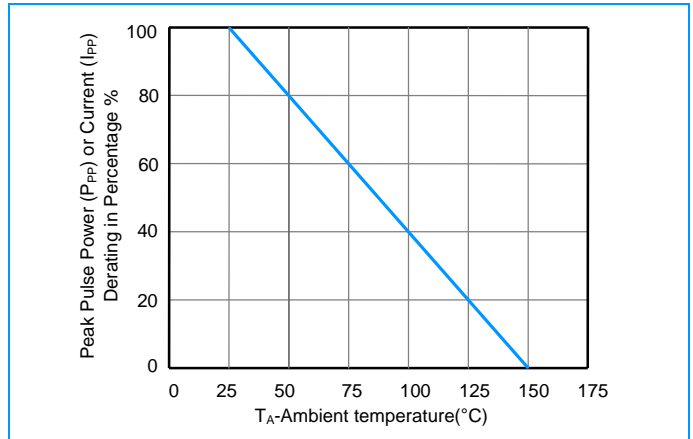


Figure 3 - Pulse Waveform

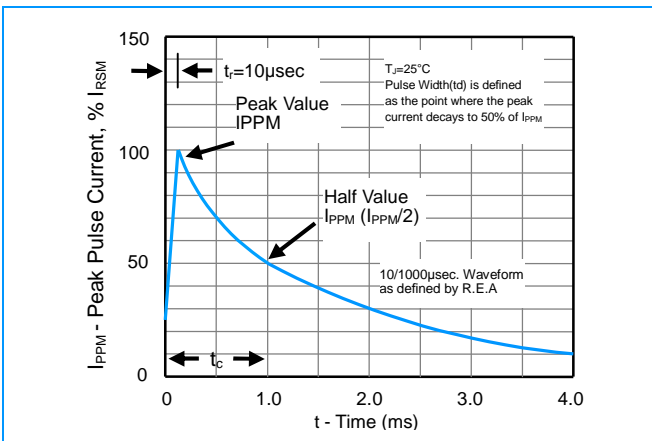


Figure 4 - Typical Junction Capacitance

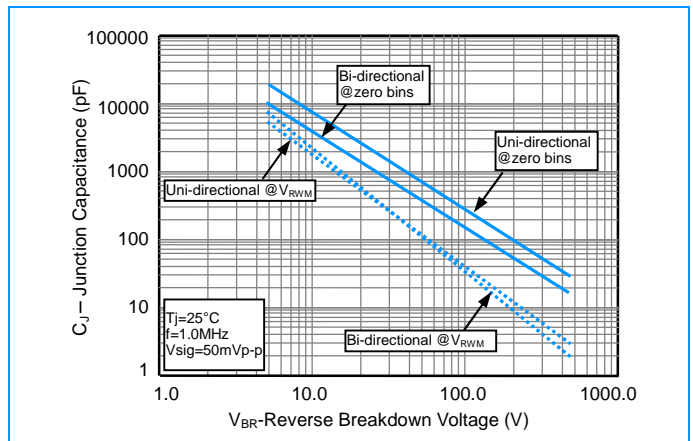


Figure 5 - Steady State Power Derating Curve

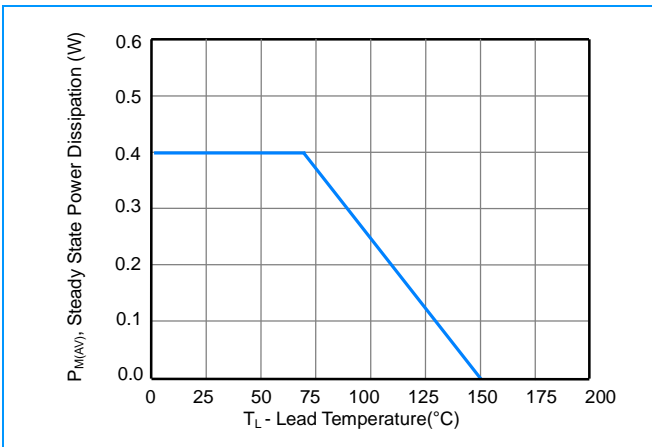
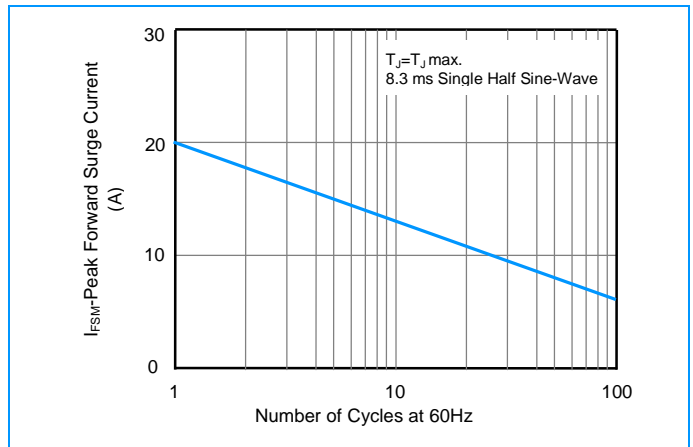


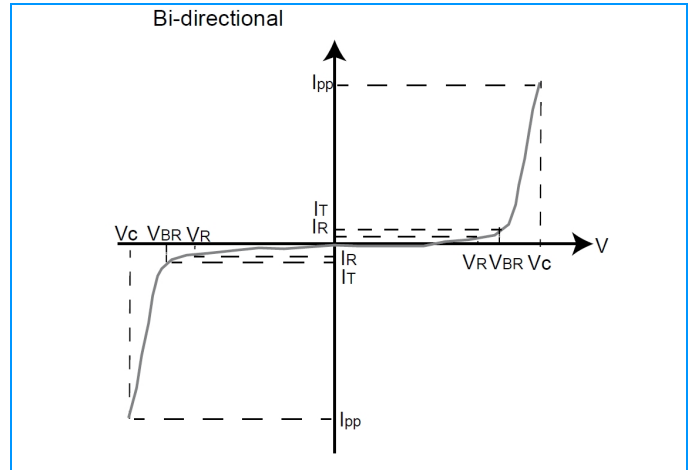
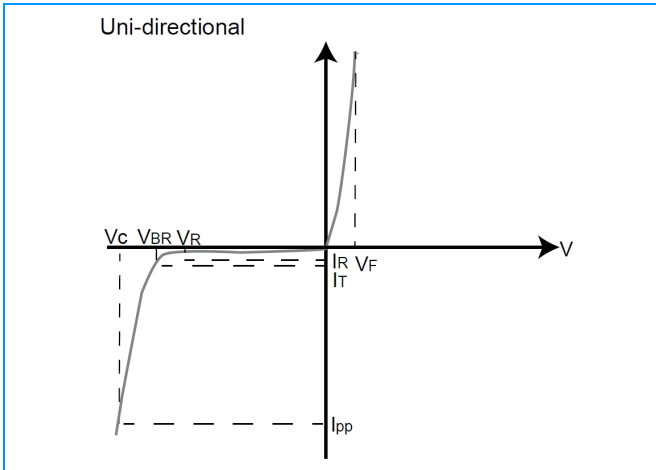
Figure 6 - Maximum Non-Repetitive Surge Current



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I-V Curve Characteristics



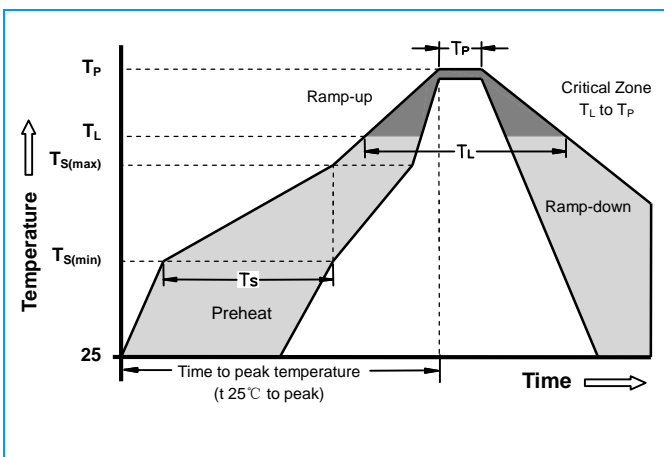
Physical Specifications

| | |
|-----------------|---|
| Case | SOD-123 Molded Plastic over glass passivated junction |
| Polarity | Color band denotes cathode except Bipolar |
| Terminal | Matte Tin-plated leads, Solderable per JESD22-B102D |

Environmental Specifications

| | |
|---------------------------|-------------|
| Temperature Cycle | JESD22-A104 |
| Pressure Cooker | JESD22-A102 |
| High Temp. Storage | JESD22-A103 |
| HTRB | JESD22-A108 |
| Thermal Shock | JESD22-A106 |

Soldering Parameters

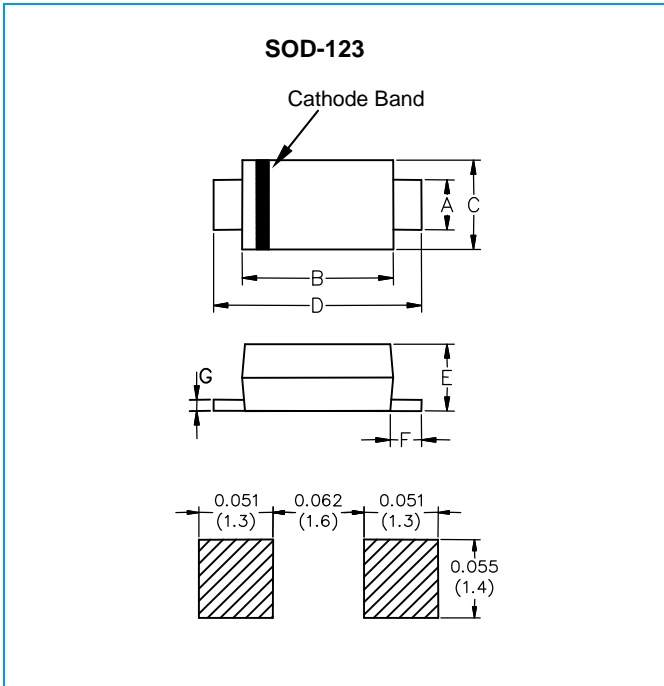


| Reflow Condition | | Lead-free assembly |
|--|------------------------------------|--------------------|
| Pre Heat | -Temperature Min ($T_{s(min)}$) | 150°C |
| | -Temperature Max ($T_{s(max)}$) | 200°C |
| | - Time (min to max) (t_s) | 60 -180 Seconds |
| Average ramp up rate (Liquidus Temp T_L) 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_s) | 60 -150 Seconds |
| Peak Temperature (T_P) | | 260 +0/-5°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 | | 280°C |

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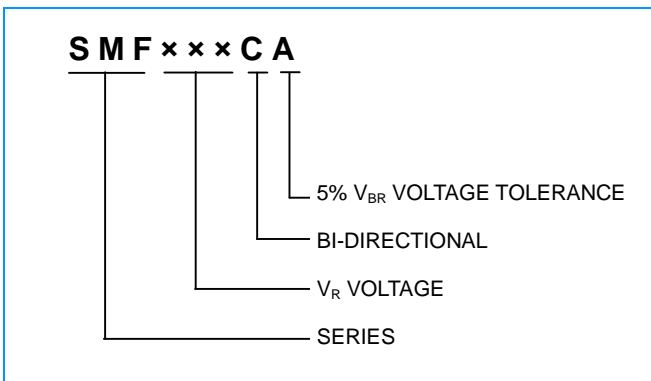
SMF Series 5.0 To 190 V 200W

Dimensions

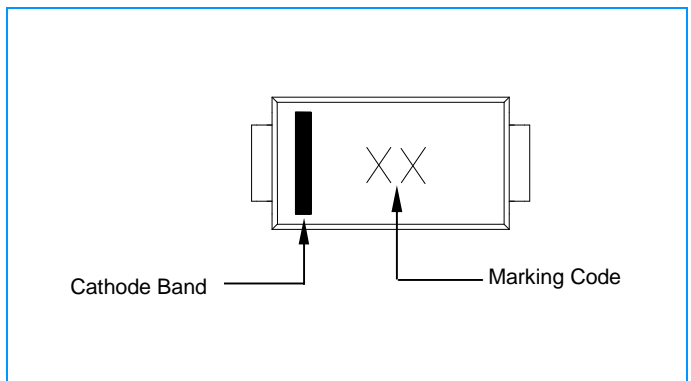


| Dimensions | Inches | | Millimeters | |
|------------|--------|-------|-------------|------|
| | Min | Max | Min | Max |
| A | 0.031 | 0.044 | 0.77 | 1.09 |
| B | 0.1 | 0.112 | 2.51 | 2.81 |
| C | 0.055 | 0.071 | 1.38 | 1.78 |
| D | 0.140 | 0.152 | 3.51 | 3.82 |
| E | 0.037 | 0.053 | 0.93 | 1.33 |
| F | 0.01 | - | 0.25 | - |
| G | - | 0.008 | - | 0.20 |

Part Numbering



Part Marking



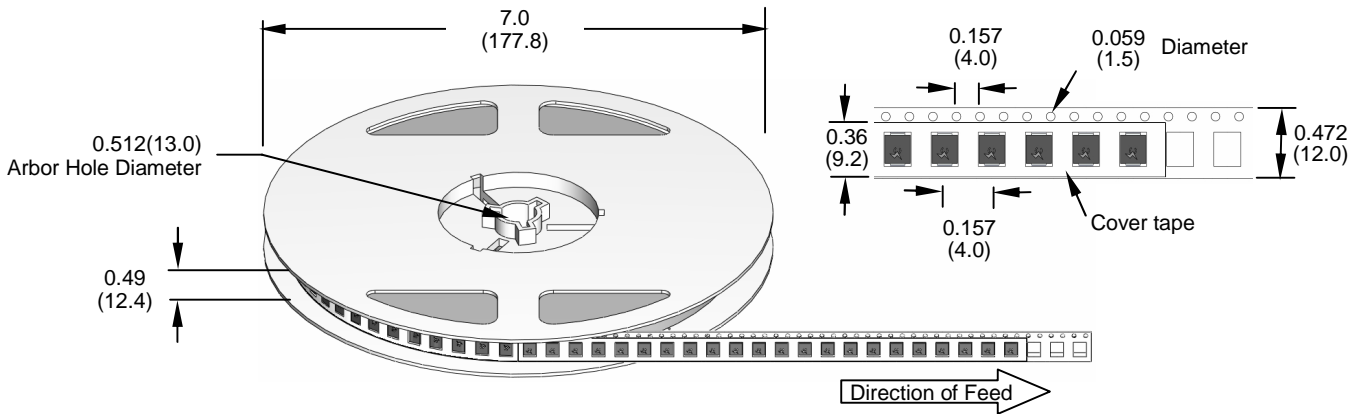
Packaging

| Part Number | Component Package | Quantity | Packaging Option | Packaging Specification |
|-------------|-------------------|----------|--------------------------|-------------------------|
| SMFXXXXXX | SOD-123 | 3000 | Tape & Reel -12mm/7"tape | EIA STD RS-481 |

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Tape and Reel Specifications



Dimensions are in inches
(and millimeters)