

SMF Series

Surface Mount – 200W



Additional Information



Resources



Accessories



Samples

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 $T_A=25^{\circ}\text{C}$ ¹ | P_{PPM} | 1000 | W |
| 8/20 μs | | 200 | |
| 10/1000 μs ² | | | |
| Power Dissipation On Infinite Heat Sink at $T_L=50^{\circ}\text{C}$ | P_D | 1 | W |
| Thermal Resistance Junction- to- Ambient | $R_{\theta JA}$ | 220 | $^{\circ}\text{C}/\text{W}$ |
| Thermal Resistance Junction- to- Lead | $R_{\theta JL}$ | 100 | $^{\circ}\text{C}/\text{W}$ |
| Operating Temperature Range | T_J | -65 to 150 | $^{\circ}\text{C}$ |
| Storage Temperature Range | T_{STG} | -65 to 175 | $^{\circ}\text{C}$ |

Notes:

- Non-repetitive current pulse, per Fig. 4 and derated above T_J (initial) $=25^{\circ}\text{C}$ per Fig. 3.
- SMF90A-SMF100A Peak Pulse Power Dissipation is 170W min, 200W typical @ 10/1000 μs

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 10/1000 μs 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: $260^{\circ}\text{C}/30\text{sec}$
- 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 maximum 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.

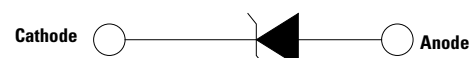
Applications

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



Bi-directional




Uni-directional

SMF Series

Surface Mount – 200W

Electrical Characteristics ($T_A=25^\circ\text{C}$ 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:

- V_{BR} measured after I_T applied for 300 μs , I_T = square wave pulse or equivalent.
- Surge current waveform per 10/1000 μs exponential wave and derated per Fig.2.

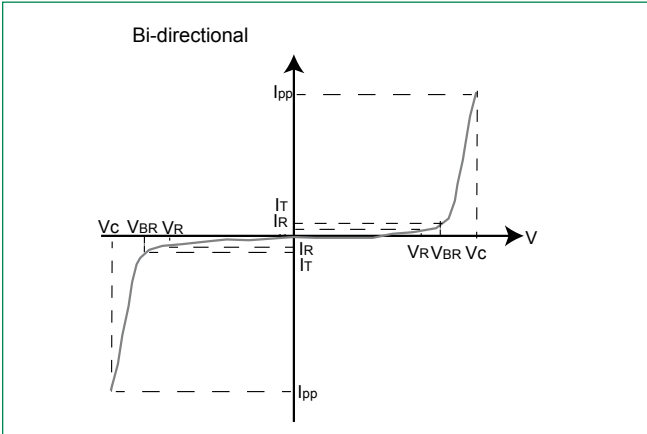
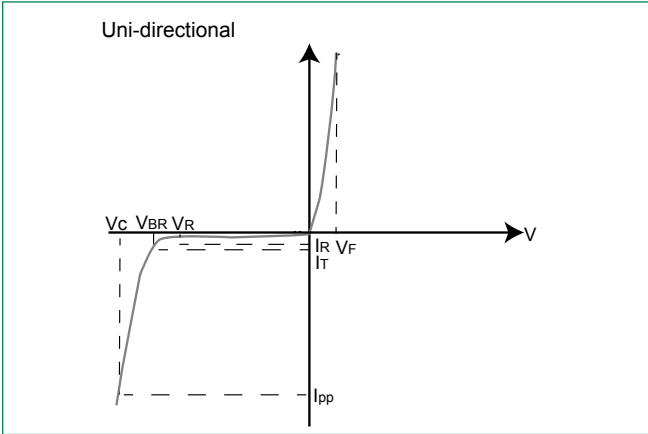
3. All terms and symbols are consistent with ANSI/IEEE C62.35.

- 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 (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

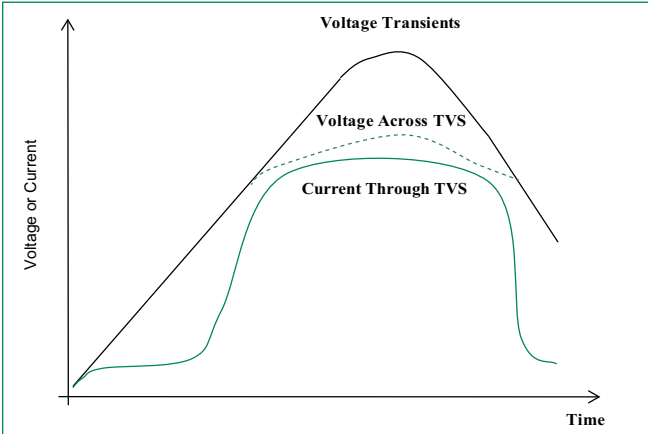
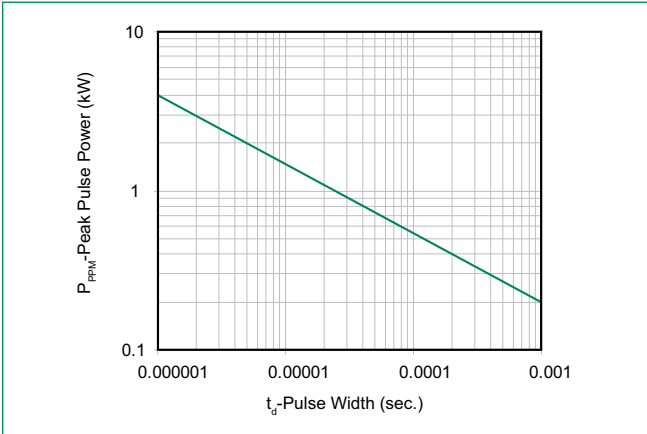


Figure 2: Peak Pulse Power Rating Curve



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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

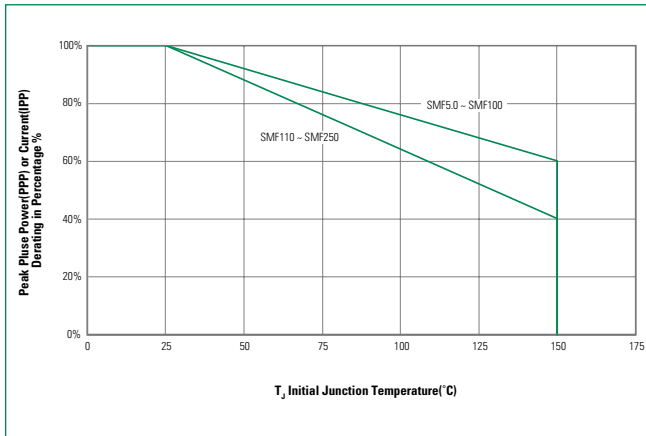


Figure 4: Pulse Waveform - 10/1000 μs

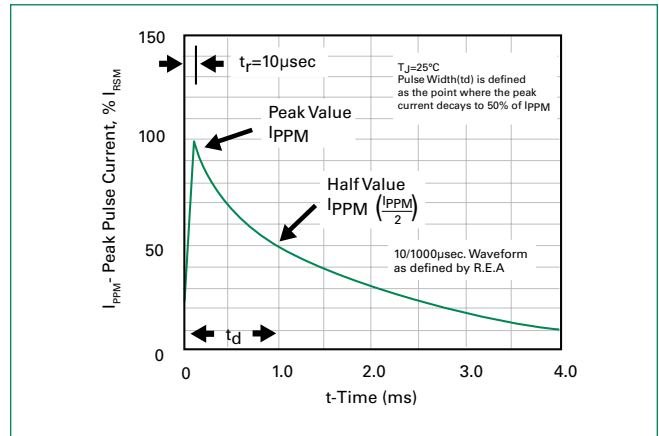


Figure 5: Forward Voltage

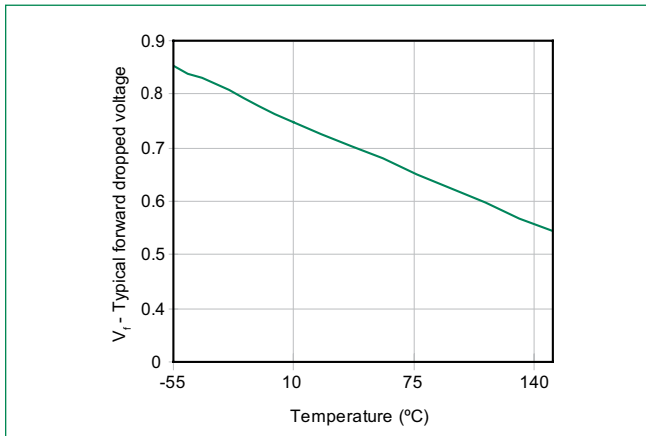


Figure 6: Typical Junction Capacitance

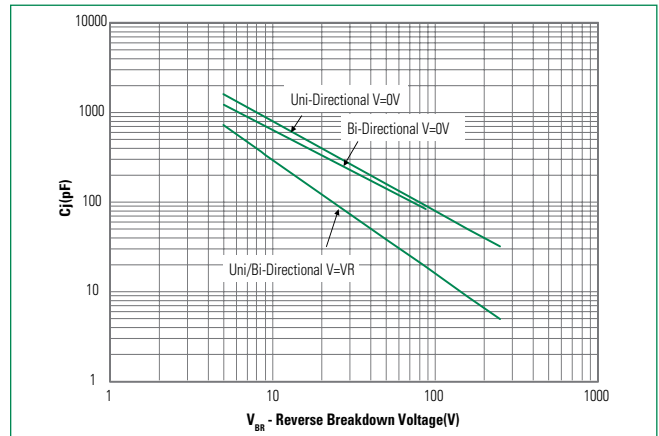


Figure 7: Peak Forward Voltage Drop vs. Peak Forward Current

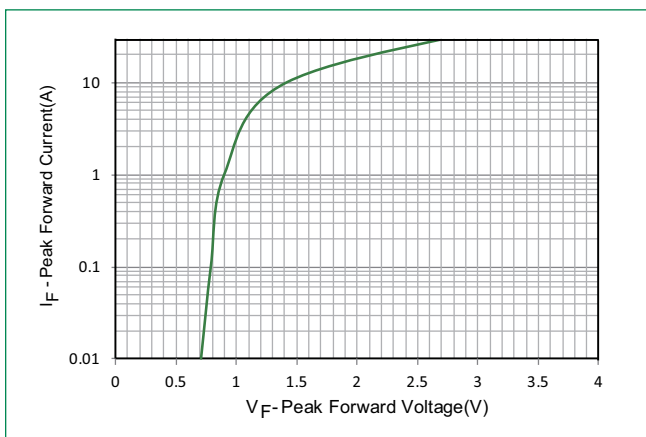
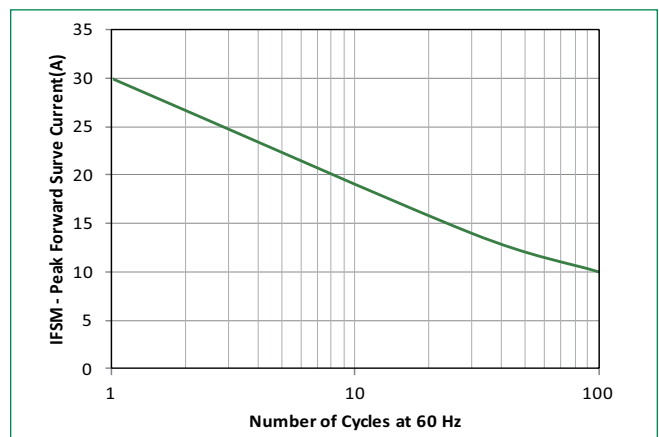


Figure 8: Maximum Non-Repetitive Forward Surge Current Uni-Directional Only

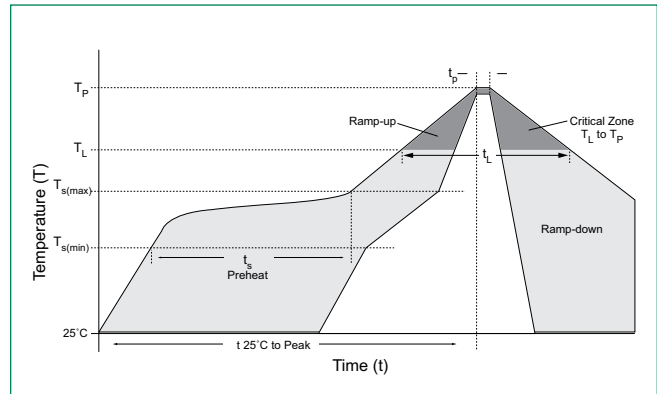


SMF Series

Surface Mount – 200W

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 |



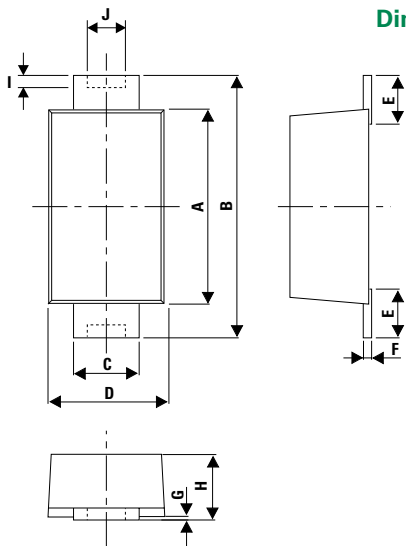
Physical Specifications

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

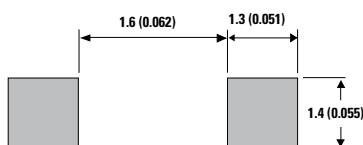
Environmental Specifications

| | |
|----------------------------|--------------------------|
| 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



Mounting Pad Layout

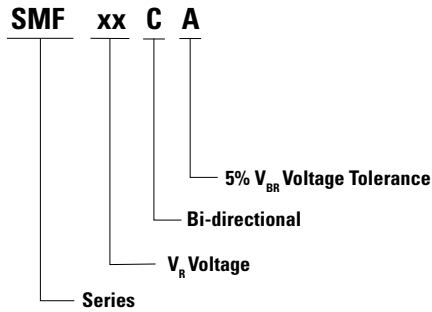


| Dimensions | Millimeters | | Inches | |
|------------|-------------|------|--------|--------|
| | Min | Max | Min | Max |
| A | 2.50 | 3.10 | 0.0984 | 0.1220 |
| B | 3.40 | 3.90 | 0.1339 | 0.1535 |
| C | 0.70 | 1.20 | 0.0275 | 0.0472 |
| D | 1.50 | 2.00 | 0.0591 | 0.0787 |
| E | 0.35 | 0.90 | 0.0138 | 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 |

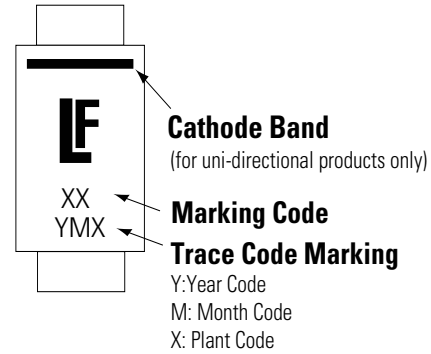
SMF Series

Surface Mount – 200W

Part Numbering System



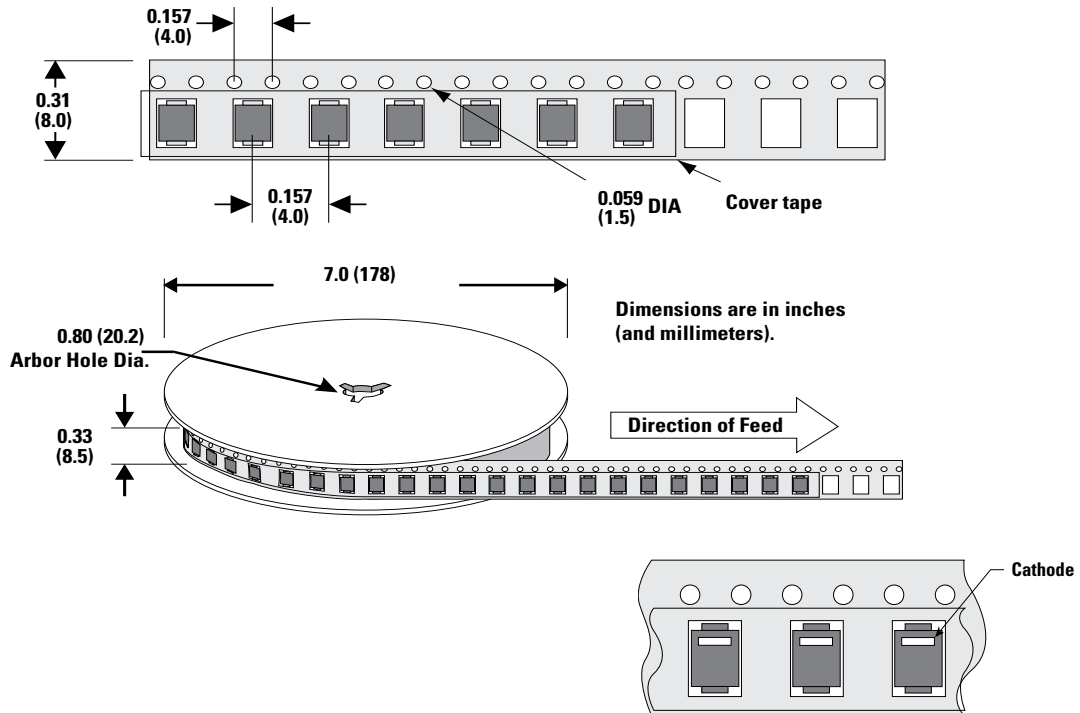
Part Marking System



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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