

SMF Series



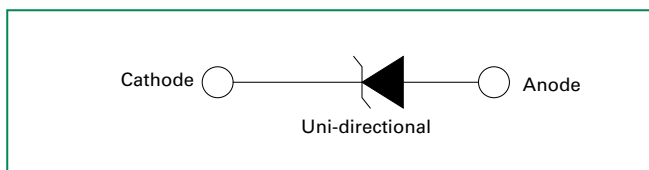
Maximum Ratings and Thermal Characteristics ($T_A=25^\circ\text{C}$ unless otherwise noted)

| Parameter | Symbol | Value | Unit |
|--|----------------|------------|--------------------|
| Peak Pulse Power Dissipation at $T_A=25^\circ\text{C}$ by $10 \times 1000\mu\text{s}$ (Note 1) | P_{PPM} | 200 | W |
| Thermal Resistance Junction- to-Ambient | R_{THJA} | 220 | $^\circ\text{C/W}$ |
| Thermal Resistance Junction- to-Lead | R_{THJL} | 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 $T_A=25^\circ\text{C}$ 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 lowest height profiles (1.1mm) in the industry.

Features

- Compatible with industrial standard package SOD-123
- For surface mounted applications to optimize board space
- Low profile: maximum height of 1.1mm.
- 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 (IEC801-2)
- EFT protection of data lines in accordance with IEC 61000-4-4 (IEC801-4)
- Low inductance, excellent clamping capability
- 200W peak pulsepower capability at $10 \times 1000\mu\text{s}$ waveform, repetition rate (duty cycle): 0.01%
- 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
- Matte tin lead-free plated
- Halogen-free and RoHS compliant

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.

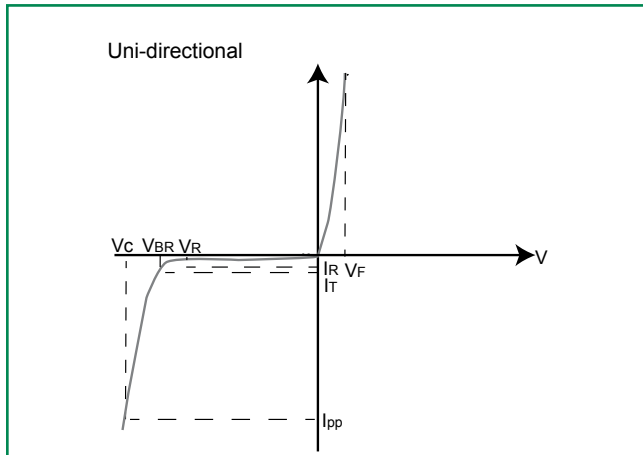
Electrical Characteristics (T_A=25°C unless otherwise noted)

| Part Number | Marking | 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 (μA) | Maximum Peak Pulse Current I _{pp} (A) | Maximum Clamping Voltage @ I _{pp} V _C (V) |
|-------------|---------|--|------|----------------------------------|--|--|--|---|
| | Code | MIN | MAX | | | | | |
| SMF5.0A | AE | 6.4 | 7.0 | 10 | 5.0 | 400 | 21.7 | 9.2 |
| SMF6.0A | AG | 6.67 | 7.37 | 10 | 6.0 | 400 | 19.4 | 10.3 |
| SMF6.5A | AK | 7.22 | 7.98 | 10 | 6.5 | 250 | 17.9 | 11.2 |
| SMF7.0A | AM | 7.78 | 8.6 | 10 | 7.0 | 100 | 16.7 | 12 |
| SMF7.5A | AP | 8.33 | 9.21 | 1 | 7.5 | 50 | 15.5 | 12.9 |
| SMF8.0A | AR | 8.89 | 9.83 | 1 | 8.0 | 25 | 14.7 | 13.6 |
| SMF8.5A | AT | 9.44 | 10.4 | 1 | 8.5 | 10 | 13.9 | 14.4 |
| SMF9.0A | AV | 10.0 | 11.1 | 1 | 9.0 | 5 | 13 | 15.4 |
| SMF10A | AX | 11.1 | 12.3 | 1 | 10 | 2.5 | 11.8 | 17 |
| SMF11A | AZ | 12.2 | 13.5 | 1 | 11 | 2.5 | 11 | 18.2 |
| SMF12A | BE | 13.3 | 14.7 | 1 | 12 | 2.5 | 10.1 | 19.9 |
| SMF13A | BG | 14.4 | 15.9 | 1 | 13 | 1.0 | 9.3 | 21.5 |
| SMF14A | BK | 15.6 | 17.2 | 1 | 14 | 1.0 | 8.6 | 23.2 |
| SMF15A | BM | 16.7 | 18.5 | 1 | 15 | 1.0 | 8.2 | 24.4 |
| SMF16A | BP | 17.8 | 19.7 | 1 | 16 | 1.0 | 7.7 | 26 |
| SMF17A | BR | 18.9 | 20.9 | 1 | 17 | 1.0 | 7.2 | 27.6 |
| SMF18A | BT | 20.0 | 22.1 | 1 | 18 | 1.0 | 6.8 | 29.2 |
| SMF20A | BV | 22.2 | 24.5 | 1 | 20 | 1.0 | 6.2 | 32.4 |
| SMF22A | BX | 24.4 | 26.9 | 1 | 22 | 1.0 | 5.6 | 35.5 |
| SMF24A | BZ | 26.7 | 29.5 | 1 | 24 | 1.0 | 5.1 | 38.9 |
| SMF26A | CE | 28.9 | 31.9 | 1 | 26 | 1.0 | 4.8 | 42.1 |
| SMF28A | CG | 31.1 | 34.4 | 1 | 28 | 1.0 | 4.4 | 45.4 |
| SMF30A | CK | 33.3 | 36.8 | 1 | 30 | 1.0 | 4.1 | 48.4 |
| SMF33A | CM | 36.7 | 40.6 | 1 | 33 | 1.0 | 3.8 | 53.3 |
| SMF36A | CP | 40.0 | 44.2 | 1 | 36 | 1.0 | 3.4 | 58.1 |
| SMF40A | CR | 44.4 | 49.1 | 1 | 40 | 1.0 | 3.1 | 64.5 |
| SMF43A | CT | 47.8 | 52.8 | 1 | 43 | 1.0 | 2.9 | 69.4 |
| SMF45A | CV | 50.0 | 55.3 | 1 | 45 | 1.0 | 2.8 | 72.7 |
| SMF48A | CX | 53.3 | 58.9 | 1 | 48 | 1.0 | 2.6 | 77.4 |
| SMF51A | CZ | 56.7 | 62.7 | 1 | 51 | 1.0 | 2.4 | 82.4 |
| SMF54A | DE | 60.0 | 66.3 | 1 | 54 | 1.0 | 2.3 | 87.1 |

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.

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 current that flows through the TVS at a specified test current (I_T)

V_C Clamping Voltage – Peak voltage measured across the suppressor 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

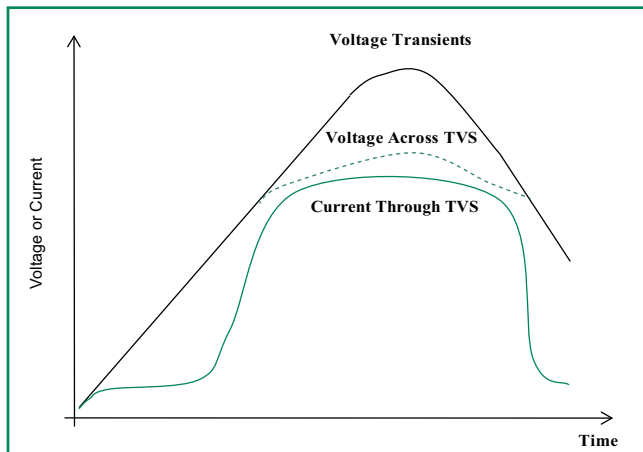
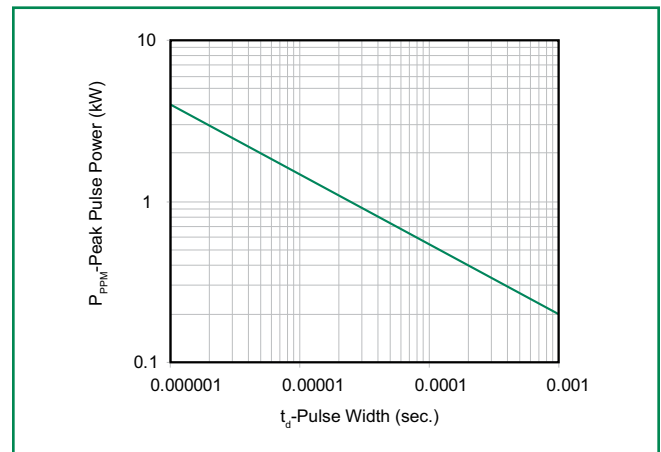


Figure 2 - Peak Pulse Power Rating Curve



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

Figure 3 - Pulse Derating Curve

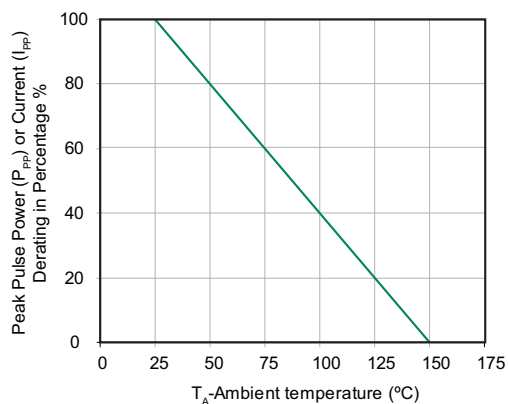


Figure 4 - Pulse Waveform - 10x1000 μS

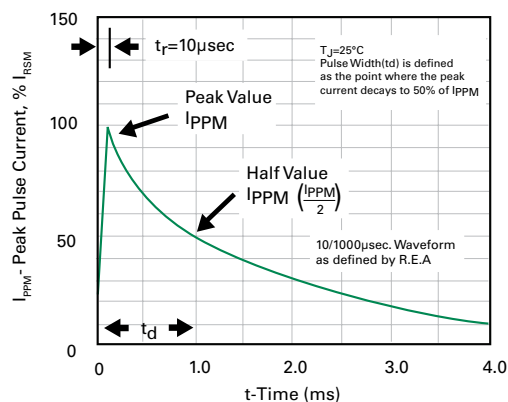


Figure 5 - Steady State Power Dissipation Derating Curve

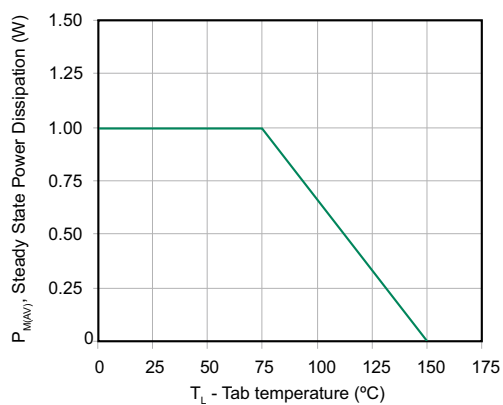


Figure 6 - Forward Voltage

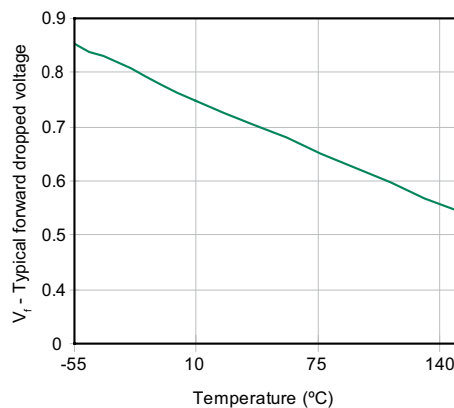
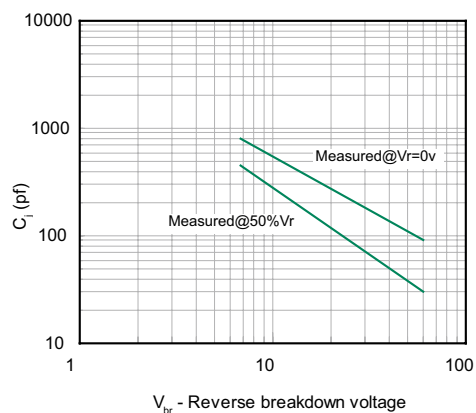
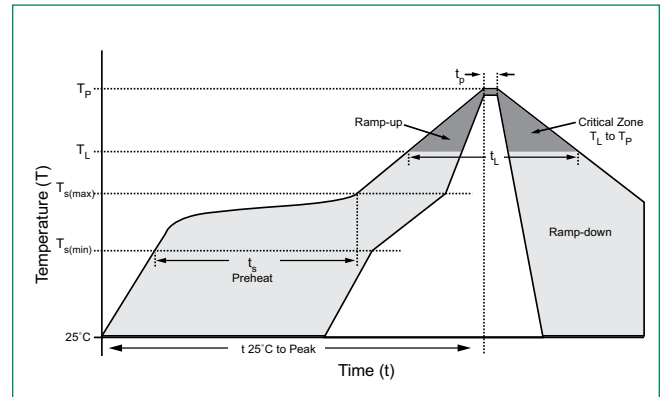


Figure 7 - C_j vs. Working Peak Reverse Voltage



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_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 | | 260°C |



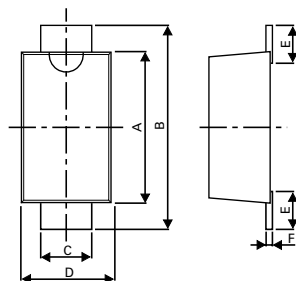
Physical Specifications

| | |
|-----------------|---|
| Case | SOD-123 plastic over glass passivated junction |
| Polarity | Color band denotes cathode except bipolar |
| Terminal | Matte tin-plated leads, solderable per JESD22-B102D |

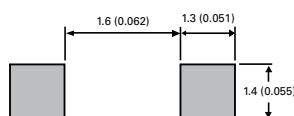
Environmental Specifications

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

Dimensions - SOD-123 Package

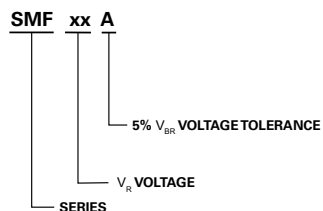


Mounting Pad Layout

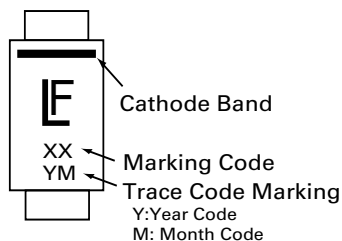


| Dimensions | Millimeters | | Inches | |
|------------|-------------|------|--------|--------|
| | Min | Max | Min | Max |
| A | 2.50 | 2.90 | 0.0984 | 0.1142 |
| B | 3.40 | 3.90 | 0.1339 | 0.1535 |
| C | 0.70 | 1.20 | 0.0275 | 0.0472 |
| D | 1.50 | 2.00 | 0.0591 | 0.0787 |
| E | 0.35 | 0.90 | 0.0138 | 0.0354 |
| F | 0.05 | 0.26 | 0.0020 | 0.0102 |
| G | 0.00 | 0.10 | 0.0000 | 0.0039 |
| H | 0.95 | 1.10 | 0.0374 | 0.0433 |

Part Numbering System



Part Marking System



Packaging

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

Tape and Reel Specification

