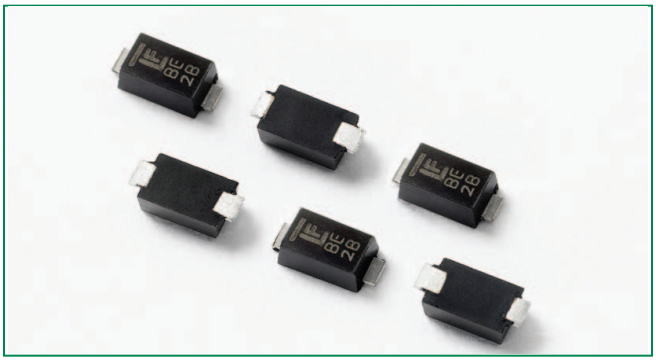
# SMF Series

HF RoHS



## 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 deliverying one of the lowest height profiles (1.1mm) in the industry.

## 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 by 10x1000µs (Note 1) | $P_{PPM}$ | 200 | W |
| Thermal Resistance Junction- to-Ambient | $R_{THJ-A}$ | 220 | °C/W |
| Thermal Resistance Junction- to-Lead | $R_{THJ-L}$ | 100 | °C/W |
| Operating and Storage Temperature Range | $T_J$, $T_{STG}$ | -55 to 150 | °C |

**Notes:**
1. Non-repetitive current pulse, per Fig. 4 and derated above $T_A$=25°C per Fig. 3.

## 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 15kV(Air), 8kV (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 x 1000µs 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°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.

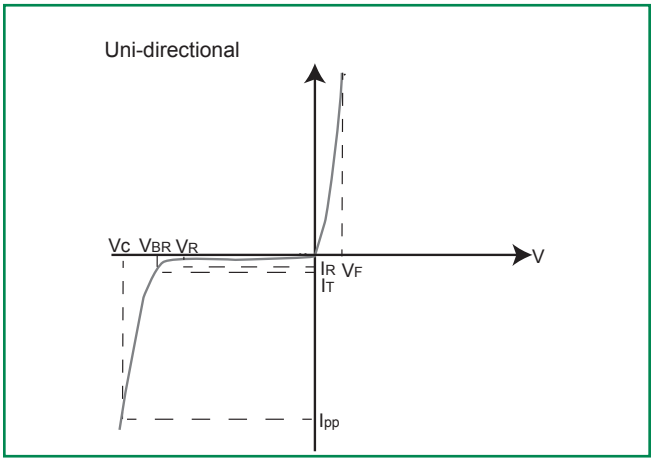
## Electrical Characteristics ($T_A$=25°C unless otherwise noted)

| 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, $I_T$ = sequare wave pulse or equivalent.
2. Surge current waveform per 10 x 1000µs exponential wave and derated per Fig.2.
3. All terms and symbols are consistent with ANSI/IEEE C62.35.

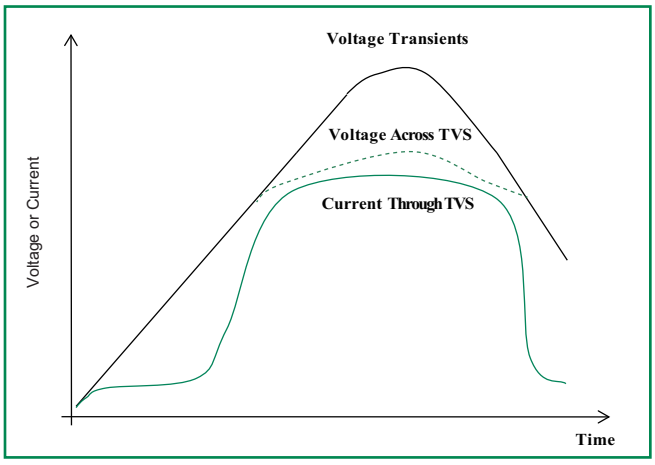
## I-V Curve Characteristics



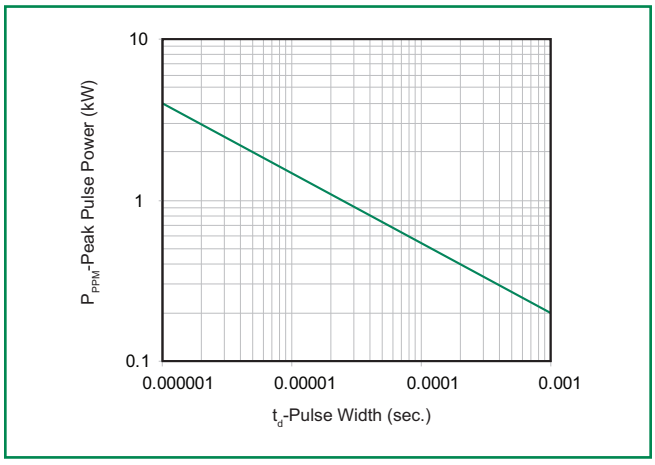

**$P_{PPM}$ Peak Pulse Power Dissipation** – Max power dissipation
**$V_R$ Stand-off Voltage** -- Maximum voltage that can be applied to the TVS without operation
**$V_{BR}$ Breakdown Voltage** -- Maximum current that flows though the TVS at a specified test current ($I_T$)
**$V_C$ Clamping Voltage** -- Peak voltage measured across the suppressor at a specified Ippm (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°C unless otherwise noted)

### Figure 1 - TVS Transients Clamping Waveform




### Figure 2 - Peak Pulse Power Rating Curve

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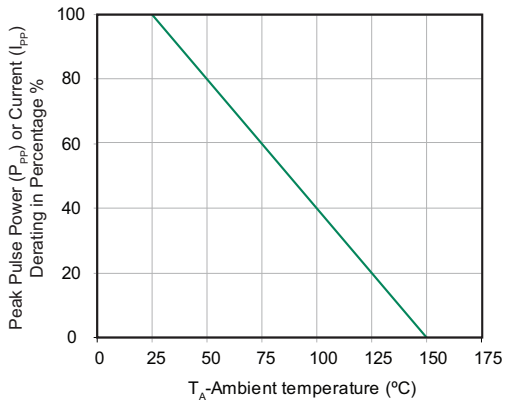
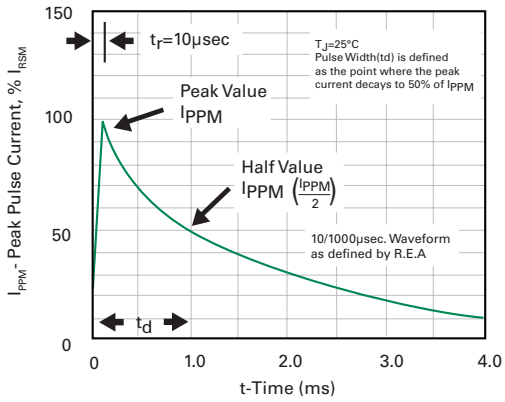
## Ratings and Characteristic Curves ($T_A$=25°C unless otherwise noted) (Continued)

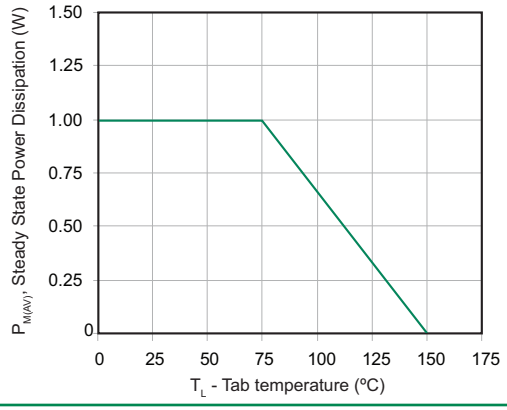
### Figure 3 - Pulse Derating Curve



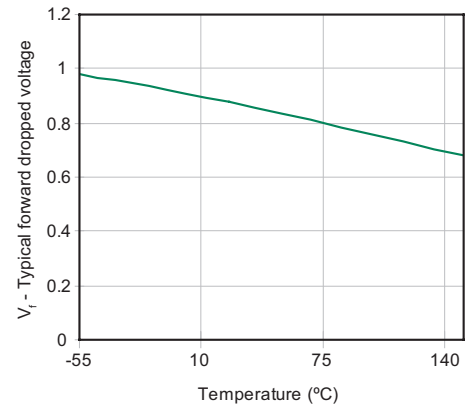

### Figure 4 - Pulse Waveform - 10x1000µS



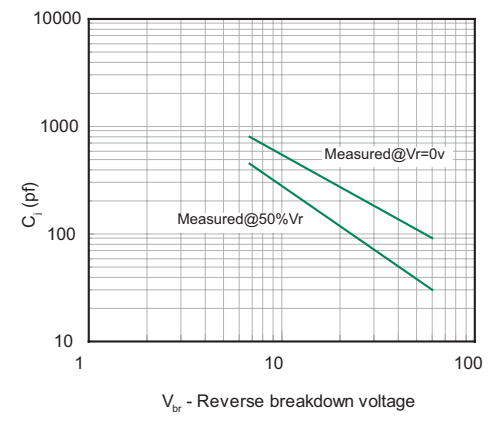

### Figure 5 - Steady State Power Dissipation Derating Curve




### Figure 6 - Forward Voltage

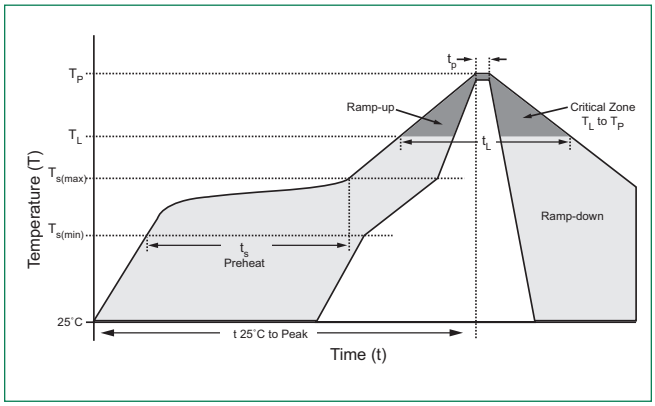



### Figure 7 - $C_j$ vs. Working Peak Reverse Voltage



## 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 |



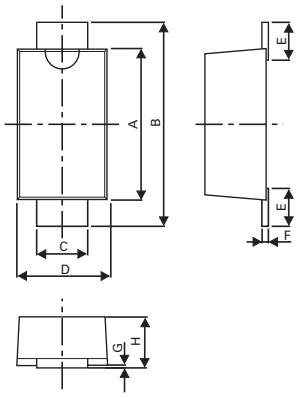

## Physical Specifications

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

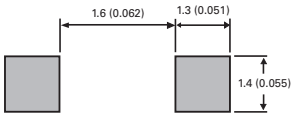
## Environmental Specifications

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

## Dimensions - SOD-123 Package

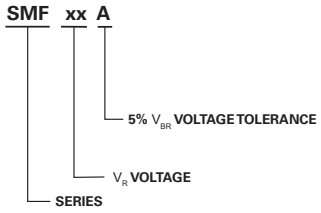



**Mounting Pad Layout**

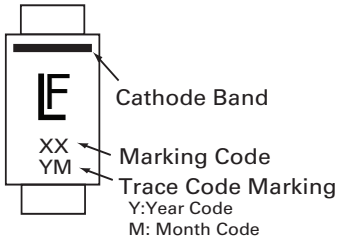



| Dimensions | Millimeters | | Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 2.50 | 2.90 | 0.0984 | 0.1142 |
| B | 3.40 | 3.90 | 0.1339 | 0.1535 |
| C | 0.70 | 1.20 | 0.0275 | 0.0472 |
| D | 1.50 | 2.00 | 0.0591 | 0.0787 |
| E | 0.35 | 0.90 | 0.0138 | 0.0354 |
| F | 0.05 | 0.26 | 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