

### Description

TVS diodes can be used in a wide range of applications which like consumer electronic products, automotive industries, munitions, telecommunications, aerospace industries, and intelligent control systems.

### Features

- For surface mounted applications
- Excellent clamping capability
- 4500 W peak pulse power capability with a 8/20  $\mu$ s Waveform.
- $V_{RWM}$  5.0-28V
- Low profile package and low inductance
- Typical IR less than 1uA above 10V
- Fast response time: typically less than 1.0ps from 0V to  $V_{BR}$  min.

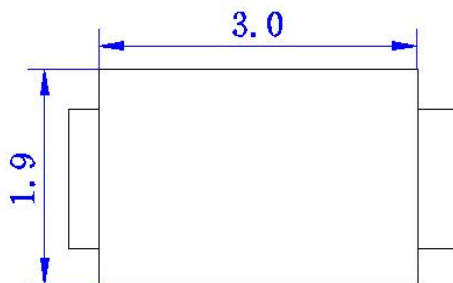
### Applications

- computer system
- domestic appliance
- video input

### Mechanical Characteristics

- Package: SMF/SOD123FL
  - Case Material: Molded Plastic. UL Flammability Classification Rating 94V-0
  - Moisture Sensitivity: Meet MSL 1
  - Terminal: Solder plated, solderable per MIL-STD-750, Method 2026
  - Polarity: Color band denotes cathode except bi-directional models
- Weight: 0.07g(Approximate)

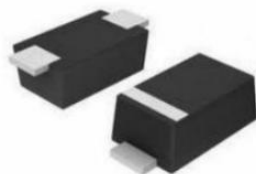
### Dimensions & Symbol (Unit: mm Max)



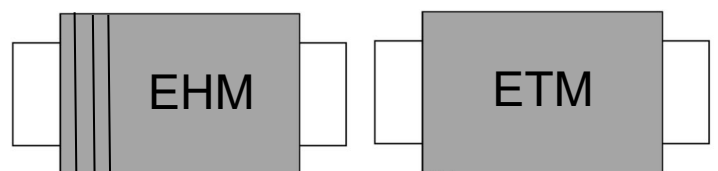
Bi-directional



Un-directional



### Marking Information



EHM: M4SMF7.0A Marking code

ETM: M4SMF7.0CA Marking code

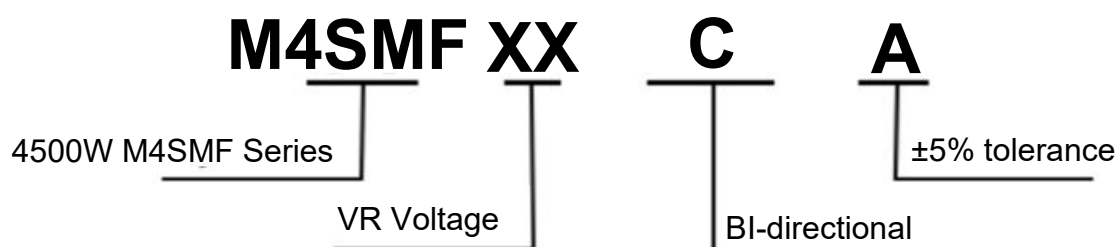
## Electrical Characteristics (T=25°C)

| Part Number | Marking | V <sub>R</sub> | I <sub>R</sub> @V <sub>R</sub> | V <sub>BR</sub> @I <sub>T</sub> |        | I <sub>T</sub> | V <sub>C</sub> @I <sub>PP</sub> | I <sub>PP</sub> <sup>①</sup> | Co <sup>②</sup> |
|-------------|---------|----------------|--------------------------------|---------------------------------|--------|----------------|---------------------------------|------------------------------|-----------------|
|             |         | V              | μA                             | min(V)                          | max(V) | mA             | max(V)                          | A                            | Max(pF)         |
| M4SMF5.0A   | EHE     | 5              | 300                            | 6.4                             | 7.0    | 10             | 15                              | 220                          | 1400            |
| M4SMF5.0CA  | ETE     | 5              | 300                            | 6.4                             | 7.0    | 10             | 15                              | 220                          | 1000            |
| M4SMF6.0A   | EHG     | 6              | 100                            | 6.7                             | 7.4    | 10             | 16                              | 220                          | 1400            |
| M4SMF6.0CA  | ETG     | 6              | 100                            | 6.7                             | 7.4    | 10             | 16                              | 220                          | 1000            |
| M4SMF6.5A   | EHK     | 6.5            | 50                             | 7.2                             | 8.0    | 10             | 16                              | 200                          | 1400            |
| M4SMF6.5CA  | ETK     | 6.5            | 50                             | 7.2                             | 8.0    | 10             | 16                              | 200                          | 1000            |
| M4SMF7.0A   | EHM     | 7              | 50                             | 7.7                             | 8.6    | 10             | 17                              | 220                          | 1400            |
| M4SMF7.0CA  | ETM     | 7              | 50                             | 7.7                             | 8.6    | 10             | 17                              | 220                          | 1000            |
| M4SMF9.0A   | EHV     | 9              | 2                              | 10                              | 11.1   | 1              | 20                              | 200                          | 1400            |
| M4SMF9.0CA  | ETV     | 9              | 2                              | 10                              | 11.1   | 1              | 20                              | 200                          | 1000            |
| M4SMF12A    | EIE     | 12             | 1                              | 13.3                            | 14.7   | 1              | 24                              | 200                          | 1200            |
| M4SMF12CA   | EUE     | 12             | 1                              | 13.3                            | 14.7   | 1              | 24                              | 190                          | 600             |
| M4SMF15A    | EIM     | 15             | 1                              | 16.7                            | 18.5   | 1              | 26                              | 220                          | 1000            |
| M4SMF15CA   | EUM     | 15             | 1                              | 16.7                            | 18.5   | 1              | 26                              | 180                          | 500             |
| M4SMF18A    | EIT     | 18             | 1                              | 20                              | 22.1   | 1              | 30                              | 160                          | 700             |
| M4SMF18CA   | EUT     | 18             | 1                              | 20                              | 22.1   | 1              | 30                              | 160                          | 500             |
| M4SMF20A    | EIV     | 20             | 1                              | 22.2                            | 24.5   | 1              | 35                              | 160                          | 700             |
| M4SMF20CA   | EUV     | 20             | 1                              | 22.2                            | 24.5   | 1              | 35                              | 160                          | 500             |
| M4SMF24A    | EIZ     | 24             | 1                              | 26.7                            | 29.5   | 1              | 40                              | 200                          | 700             |
| M4SMF24CA   | EUZ     | 24             | 1                              | 26.7                            | 29.5   | 1              | 40                              | 200                          | 500             |
| M4SMF26A    | EJE     | 26             | 1                              | 28.9                            | 31.9   | 1              | 44                              | 80                           | 1000            |
| M4SMF26CA   | EVE     | 26             | 1                              | 28.9                            | 31.9   | 1              | 44                              | 80                           | 1000            |
| M4SMF28A    | EJG     | 28             | 1                              | 31.1                            | 34.4   | 1              | 48                              | 80                           | 960             |
| M4SMF28CA   | EVG     | 28             | 1                              | 31.1                            | 34.4   | 1              | 48                              | 80                           | 960             |

### Notes:

- ① Surge waveform: 8/20μs
- ② Off-state capacitance (Co) is measured at 1 MHz with a 0 V bias and is typical value
- V<sub>R</sub> : Stand-off Voltage -- Maximum voltage that can be applied
- V<sub>BR</sub>: Breakdown Voltage
- V<sub>C</sub>: Clamping Voltage -- Peak voltage measured across the suppressor at a specified I<sub>pp</sub>
- I<sub>R</sub>: Reverse Leakage Current

## Part number code

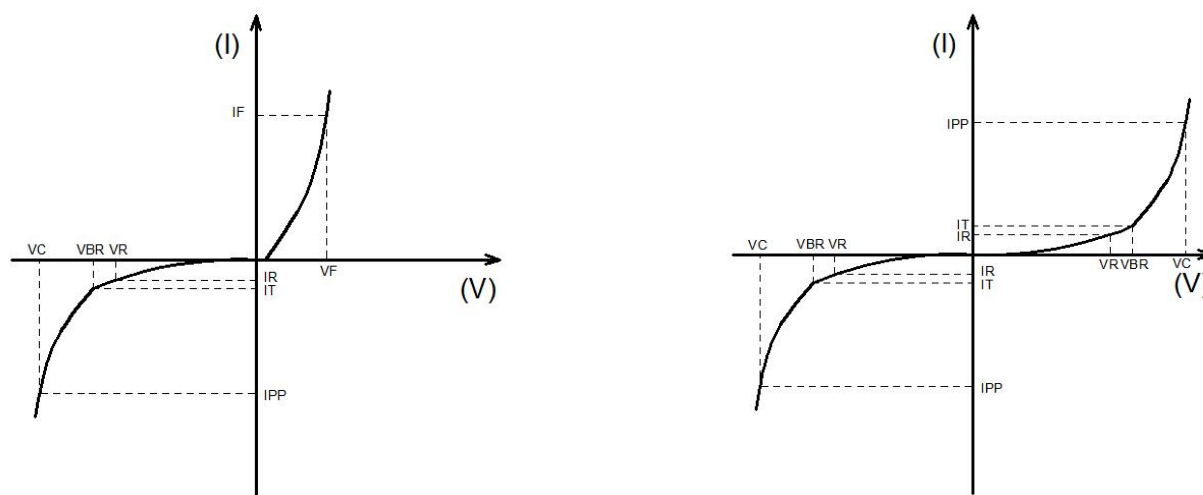


## Absolute Maximum Ratings(T=25°C, RH=45%-75%, unless otherwise noted)

| Parameter                                              | Symbol             | Value       | Unit |
|--------------------------------------------------------|--------------------|-------------|------|
| Peak pulse power dissipation on 8/20μs waveform        | P <sub>PP</sub>    | 4500        | W    |
| Steady state power dissipation at T <sub>L</sub> =75°C | P <sub>M(AV)</sub> | 1.0         | W    |
| Operating junction temperature range                   | T <sub>j</sub>     | -55 to +125 | °C   |
| Storage temperature range                              | T <sub>stg</sub>   | -55 to +150 | °C   |

## Ratings And V-I Characteristics Curves (T=25°C, unless otherwise noted)

FIG1: V-I cure characteristics



| Symbol   | Parameter                          |
|----------|------------------------------------|
| $I_F$    | Mean Forward Current               |
| $V_F$    | Maximum Forward Voltage @ $I_F$    |
| $V_R$    | Peak Reverse Working Voltage       |
| $I_R$    | Reverse Leakage Current @ $V_R$    |
| $V_{BR}$ | Breakdown Voltage @ $I_T$          |
| $I_T$    | Test Current                       |
| $I_{PP}$ | Maximum Reverse Peak Pulse Current |
| $V_C$    | Clamping Voltage @ $I_{PP}$        |

## Typical Characteristics

FIG2: Pulse Derating Curve

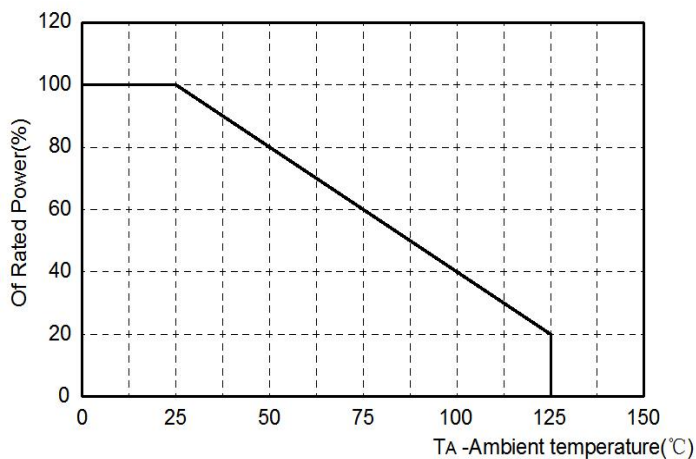


FIG3: Pulse Waveform

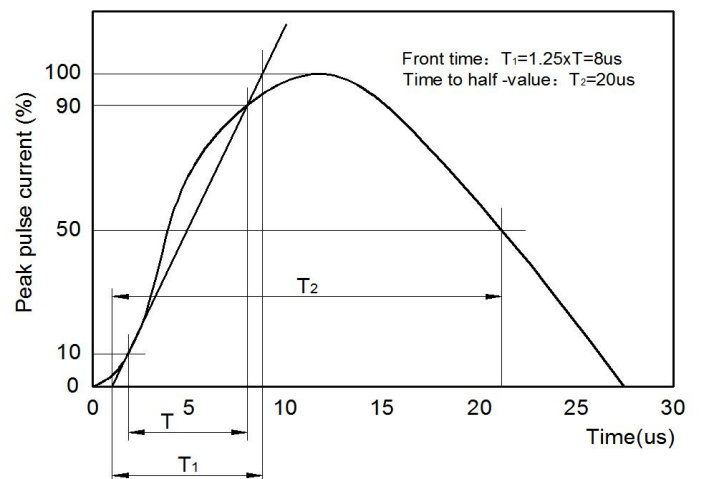


FIG4: Peak Pulse Power Rating Curve

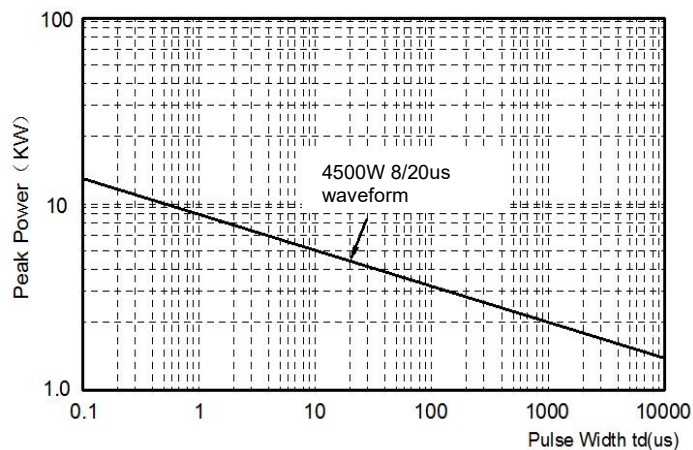
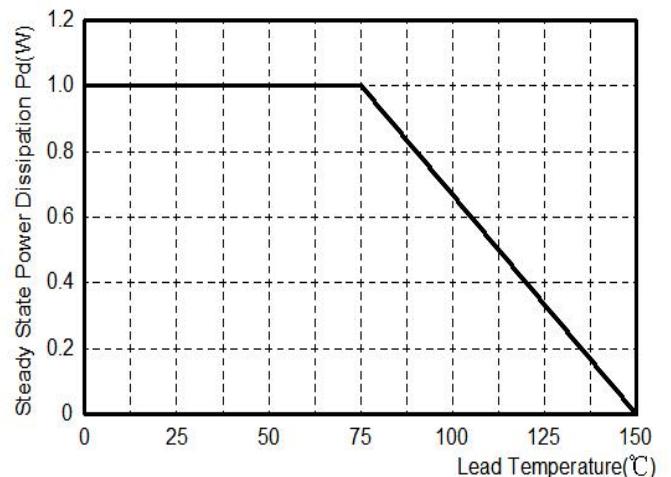
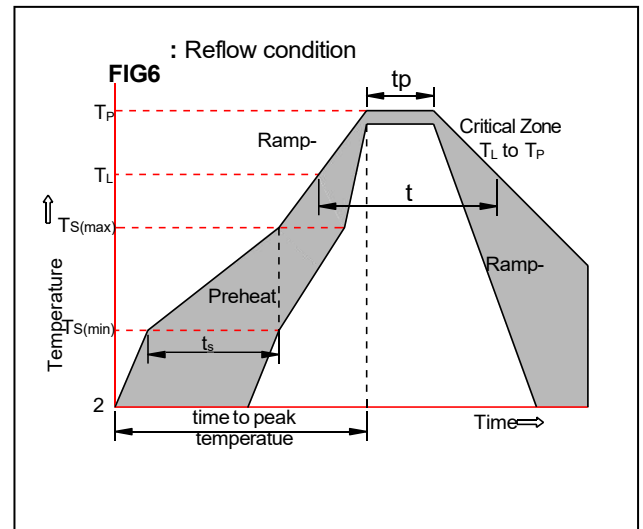


FIG5: Steady State Power Dissipation

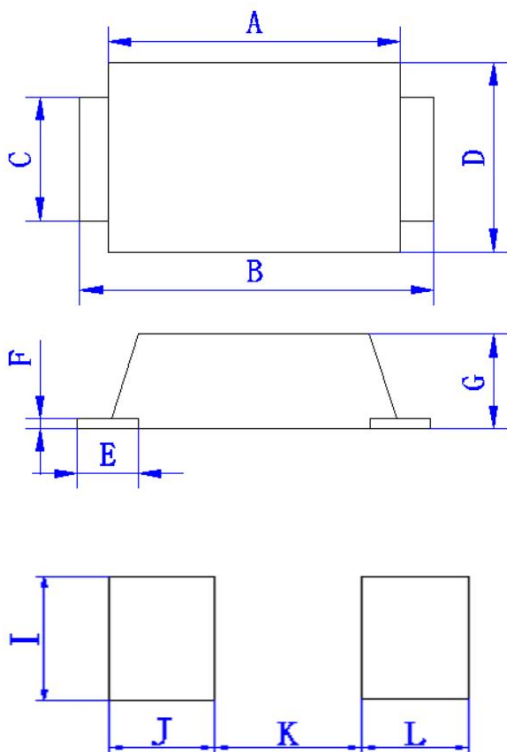


## Soldering parameters

| Reflow Condition                                        |                                   | Pb-Free assembly<br>(see as below) |
|---------------------------------------------------------|-----------------------------------|------------------------------------|
| Pre Heat                                                | -Temperature Min ( $T_{s(min)}$ ) | +150°C                             |
|                                                         | -Temperature Max( $T_{s(max)}$ )  | +200°C                             |
|                                                         | -Time (Min to Max) (ts)           | 60-180 secs.                       |
| Average ramp up rate (Liquid us Temp ( $T_L$ ) to peak) |                                   | 3°C/sec. Max                       |
| $T_{s(max)}$ to $T_L$ - Ramp-up Rate                    |                                   | 3°C/sec. Max                       |
| Reflow                                                  | -Temperature( $T_L$ )(Liquid us)  | +217°C                             |
|                                                         | -Temperature( $t_L$ )             | 60-150 secs.                       |
| Peak Temp ( $T_P$ )                                     |                                   | +260(+0/-5)°C                      |
| Time within 5°C of actual Peak Temp ( $t_p$ )           |                                   | 30 secs. Max                       |
| Ramp-down Rate                                          |                                   | 6°C/sec. Max                       |
| Time 25°C to Peak Temp ( $T_P$ )                        |                                   | 8 min. Max                         |
| Do not exceed                                           |                                   | +260°C                             |

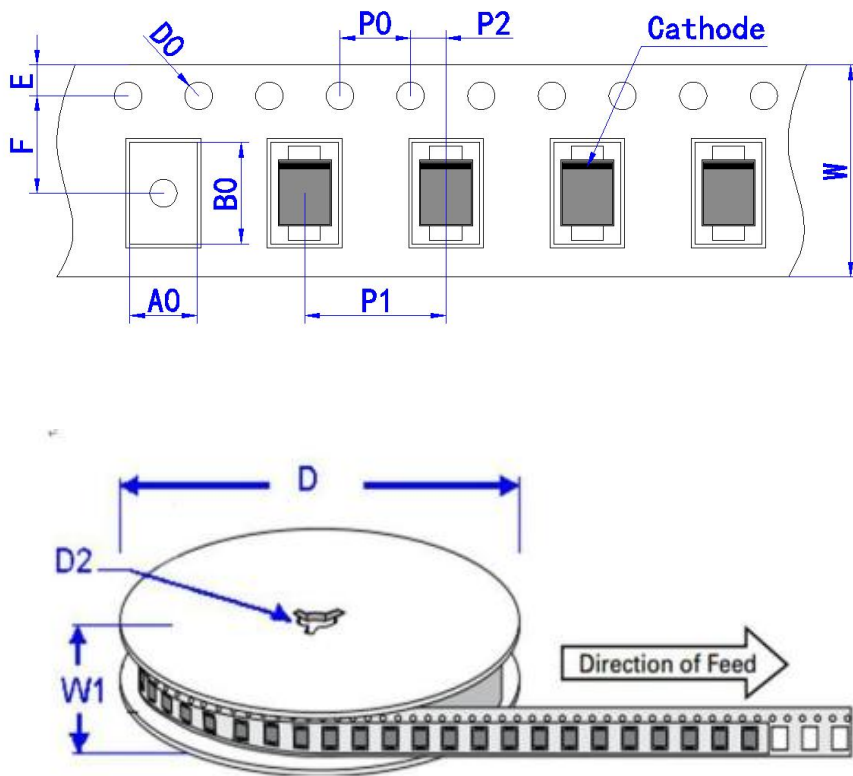


## Package mechanical data & Suggested Land Pattern



| Ref.(mm) | Millimeters |      |
|----------|-------------|------|
|          | Min.        | Max. |
| A        | 2.5         | 3.0  |
| B        | 3.4         | 4.0  |
| C        | 0.7         | 1.1  |
| D        | 1.5         | 1.9  |
| E        | 0.45        | 0.95 |
| F        | 0.05        | 0.26 |
| G        | 0.9         | 1.1  |
| I        | 1.2         |      |
| J        | 0.85        |      |
| K        |             | 2.3  |
| L        | 0.85        |      |

## Tape & reel specification - SOD-123FL



| Ref. | Millimeters      |
|------|------------------|
| A0   | $2.15 \pm 0.20$  |
| B0   | $3.95 \pm 0.20$  |
| C    | 178.00           |
| D0   | $1.55 \pm 0.10$  |
| E    | $1.75 \pm 0.20$  |
| E1   | $13.50 \pm 1.00$ |
| F    | $3.50 \pm 0.10$  |
| P0   | $4.00 \pm 0.20$  |
| P1   | $4.00 \pm 0.20$  |
| P2   | $2.00 \pm 0.20$  |
| W    | $8.00 \pm 0.30$  |
| W1   | $9.00 \pm 4.00$  |
| D    | $177.8 \pm 4.00$ |
| D2   | $13.5 \pm 0.2$   |