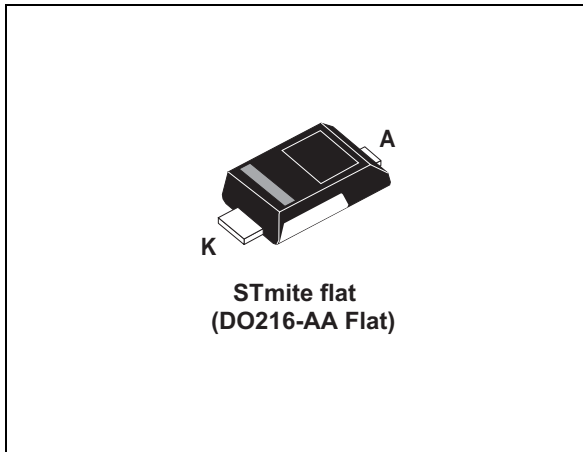


High junction temperature Transil™

Datasheet - production data

**Description**

The SMM4F Transil series has been designed to protect sensitive equipment against electro-static discharges according to IEC 61000-4-2, MIL STD 883 Method 3015, and electrical over stress such as IEC 61000-4-4 and 5. They are generally for surges below 400 W 10/1000 μ s.

This planar technology makes it compatible with high-end equipment and SMPS where low leakage current and high junction temperature are required to provide reliability and stability over time. Their low clamping voltages provide a better safety margin to protect sensitive circuits with extended life time expectancy.

Packaged in STmite flat, this minimizes PCB space consumption (footprint in accordance with IPC 7531 standard). Transil is a trademark of STMicroelectronics.

Features

- Typical peak pulse power:
 - 400 W (10/1000 μ s)
 - 2.4 kW (8/20 μ s)
- Stand off voltage range: from 5 V to 33 V
- Unidirectional types
- Low leakage current:
 - 0.2 μ A at 25 °C
 - 1 μ A at 85 °C
- Operating T_j max: 175 °C
- JEDEC registered package outline
- RoHS package
- Halogen free molding compound

Complies with the following standards

- IEC 61000-4-2 level 4:
 - 15 kV (air discharge)
 - 8 kV (contact discharge)
- MIL STD 883G-Method 3015-7: class3
 - 25 kV (human body model)

1 Characteristics

Table 1. Absolute ratings ($T_{amb} = 25\text{ }^{\circ}\text{C}$)

| Symbol | Parameter | | Value | Unit |
|-----------|--|---|-------------|--------------------|
| V_{PP} | Peak pulse voltage (IEC 61000-4-2 contact discharge) | | 30 | kV |
| P_{PP} | Peak pulse power dissipation ⁽¹⁾ | T_j initial = T_{amb} | 400 | W |
| P | Power dissipation on infinite heatsink | $T_{amb} = 125\text{ }^{\circ}\text{C}$ | 2.5 | W |
| I_{FSM} | Non repetitive surge peak forward current for unidirectional types | $t_p = 10\text{ ms}$ T_j initial = T_{amb} | 30 | A |
| T_{stg} | Storage temperature range | | -65 to +175 | $^{\circ}\text{C}$ |
| T_j | Operating junction temperature range | | -55 to +175 | $^{\circ}\text{C}$ |
| T_L | Maximum lead temperature for soldering during 10 s | | 260 | $^{\circ}\text{C}$ |

1. For a surge greater than the maximum values, the diode will fail in short-circuit.

Table 2. Thermal resistances

| Symbol | Parameter | Value | Unit |
|---------------|--|-------|----------------------|
| $R_{th(j-l)}$ | Junction to leads | 20 | $^{\circ}\text{C/W}$ |
| $R_{th(j-a)}$ | Junction to ambient on PCB with recommended pad layout | 250 | |

Table 3. Electrical characteristics - parameter definitions ($T_{amb} = 25\text{ }^{\circ}\text{C}$)

| Symbol | Parameter |
|------------|---------------------------------|
| V_{RM} | Stand-off voltage |
| V_{BR} | Breakdown voltage |
| I_R | Breakdown current |
| V_{CL} | Clamping voltage |
| I_{RM} | Leakage current @ V_{RM} |
| I_{PP} | Peak pulse current |
| αT | Voltage temperature coefficient |
| V_F | Forward voltage drop |
| R_D | Dynamic resistance |

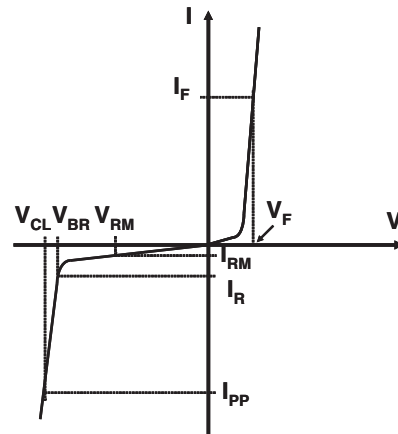


Table 4. Electrical characteristics - parameter values (T_{amb} = 25 °C)

| Type | I _{RM} max@V _{RM} | | V _{BR} @I _R ⁽¹⁾ | | | | V _{CL} @I _{PP} 10/1000 μs | | R _D ⁽²⁾ 10/1000 μs | | V _{CL} @I _{PP} 8/20 μs | | R _D ⁽²⁾ 8/20 μs | | αT ⁽³⁾ |
|-----------|-------------------------------------|-------|--|------|-------|------|--|------|---|-------|---|-----|--|------|-------------------|
| | 25 °C | 85 °C | min | typ | max | max | | max | | max | | | | max | |
| | μA | V | V | | | mA | V | A | Ω | V | A | Ω | 10-4/°C | | |
| SMM4F5.0A | 10 | 50 | 5.0 | 6.46 | 6.80 | 7.14 | 10 | 9.2 | 43.5 | 0.047 | 13.4 | 174 | 0.04 | 5.7 | |
| SMM4F6.0A | 10 | 50 | 6.0 | 6.65 | 7.00 | 7.35 | 10 | 10.3 | 38.8 | 0.076 | 13.7 | 170 | 0.04 | 5.9 | |
| SMM4F6.5A | 10 | 50 | 6.5 | 7.13 | 7.50 | 7.88 | 10 | 11.2 | 37.5 | 0.093 | 14.5 | 160 | 0.04 | 6.1 | |
| SMM4F8.5A | 10 | 50 | 8.5 | 9.5 | 10.0 | 10.5 | 1 | 14.4 | 27.7 | 0.141 | 19.5 | 124 | 0.07 | 7.3 | |
| SMM4F10A | 0.2 | 1 | 10 | 11.4 | 12.0 | 12.6 | 1 | 17.0 | 23.5 | 0.187 | 21.7 | 106 | 0.09 | 7.8 | |
| SMM4F12A | 0.2 | 1 | 12 | 13.3 | 14.0 | 14.7 | 1 | 19.9 | 20.1 | 0.259 | 25.3 | 91 | 0.12 | 8.3 | |
| SMM4F13A | 0.2 | 1 | 13 | 14.3 | 15.0 | 15.8 | 1 | 21.5 | 18.6 | 0.309 | 27.2 | 85 | 0.13 | 8.4 | |
| SMM4F15A | 0.2 | 1 | 15 | 17.1 | 18.0 | 18.9 | 1 | 24.4 | 16.4 | 0.335 | 32.5 | 71 | 0.19 | 8.8 | |
| SMM4F18A | 0.2 | 1 | 18 | 20.9 | 22.0 | 23.1 | 1 | 29.2 | 14.0 | 0.436 | 39.3 | 59 | 0.27 | 9.2 | |
| SMM4F20A | 0.2 | 1 | 20 | 22.8 | 24.0 | 25.2 | 1 | 32.4 | 12.0 | 0.600 | 42.8 | 54 | 0.33 | 9.4 | |
| SMM4F24A | 0.2 | 1 | 24 | 26.6 | 28.01 | 29.4 | 1 | 38.9 | 9.5 | 1.00 | 50 | 46 | 0.47 | 9.6 | |
| SMM4F26A | 0.2 | 1 | 26 | 28.5 | 30.0 | 31.5 | 1 | 42.1 | 9.0 | 1.18 | 53.5 | 43 | 0.51 | 9.7 | |
| SMM4F28A | 0.2 | 1 | 28 | 31.4 | 33.0 | 34.7 | 1 | 45.4 | 8.0 | 1.34 | 59.0 | 39 | 0.62 | 9.8 | |
| SMM4F33A | 0.2 | 1 | 33 | 37.1 | 39.0 | 41.0 | 1 | 53.3 | 7.0 | 1.76 | 69.7 | 33 | 0.87 | 10.0 | |

1. Pulse test: t_p <50ms.
2. To calculate maximum clamping voltage at other surge currents, use the following formula V_{CLmax} = R_D × I_{PP} + V_{BRmax}
3. To calculate V_{BR} versus junction temperature, use the following formula: V_{BR} @ T_j = V_{BR} @ 25 °C × (1 + αT × (T_j - 25))

Figure 1. Definition of I_{PP} pulse

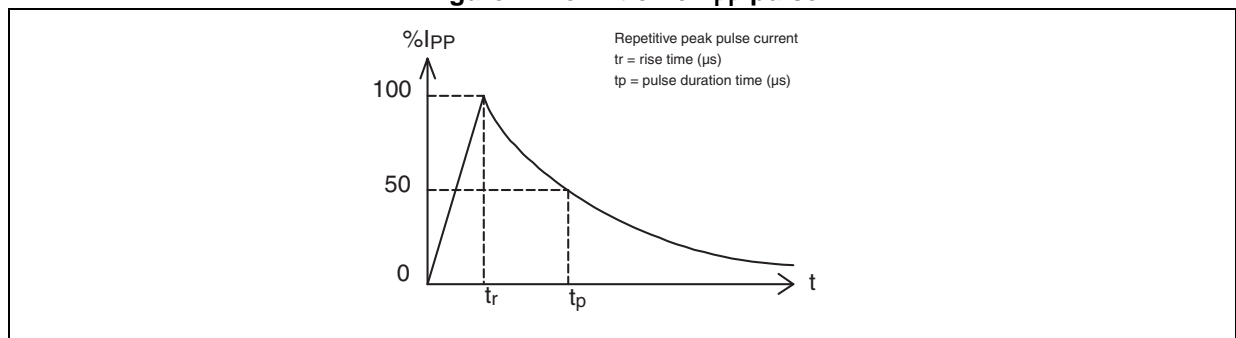


Figure 2. Peak power dissipation versus initial junction temperature

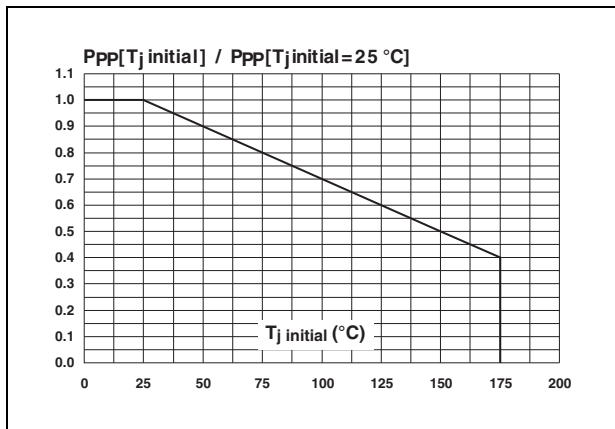


Figure 3. Peak pulse power versus exponential pulse duration (T_{j initial} = 25 °C)

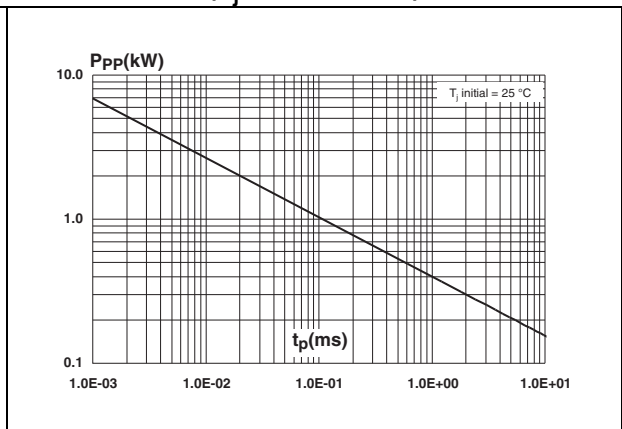


Figure 4. Clamping voltage versus peak pulse current (exponential waveform, maximum values)

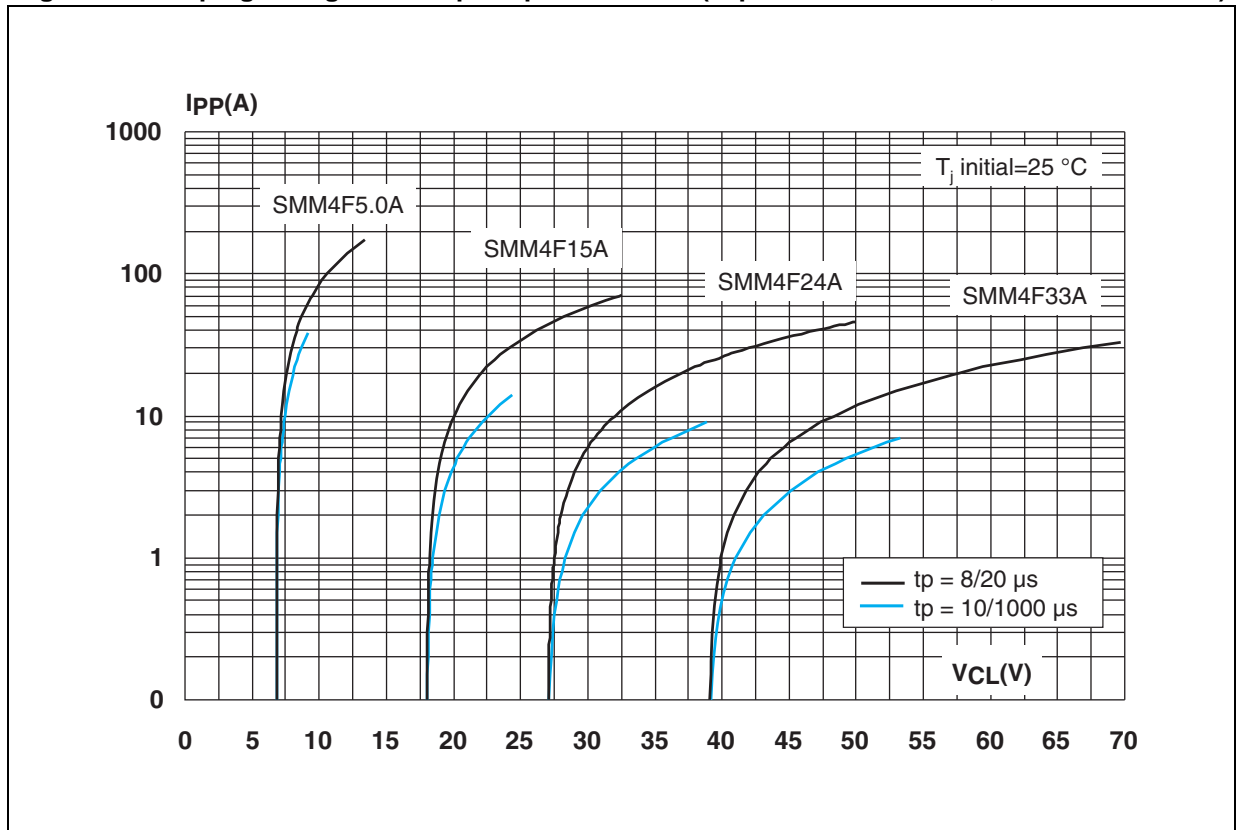


Figure 5. Junction capacitance versus reverse applied voltage (typical values)

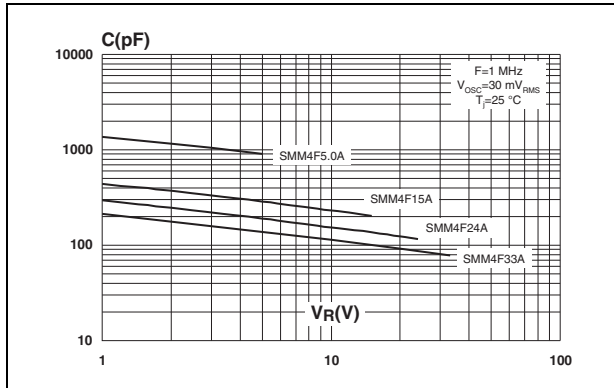


Figure 6. Peak forward voltage drop versus peak forward current (typical values)

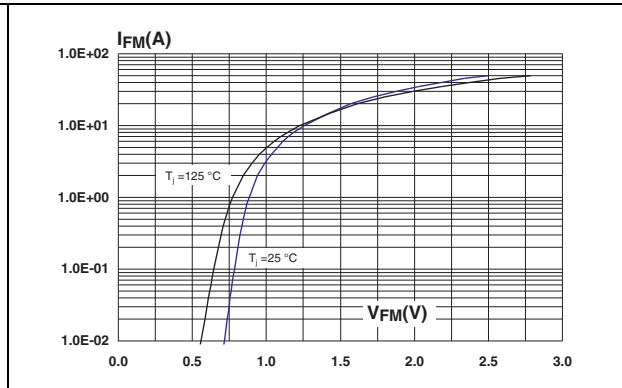


Figure 7. Relative variation of thermal impedance junction to ambient versus pulse duration (printed circuit board FR4, $S_{Cu} = 1$ cm²)

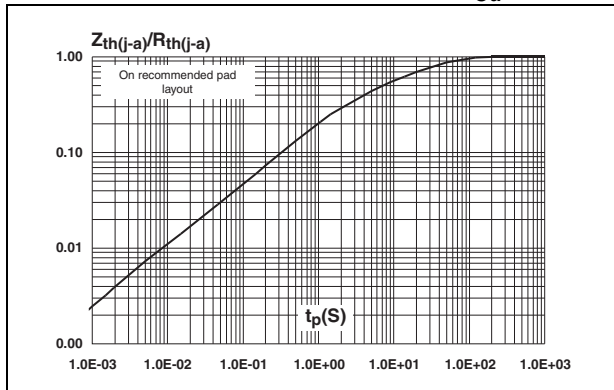


Figure 8. Thermal resistance junction to ambient versus copper surface under each lead (printed circuit board FR4, $e_{Cu} = 35$ μm)

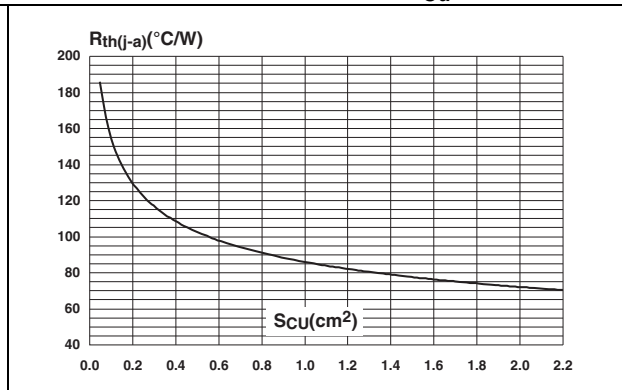
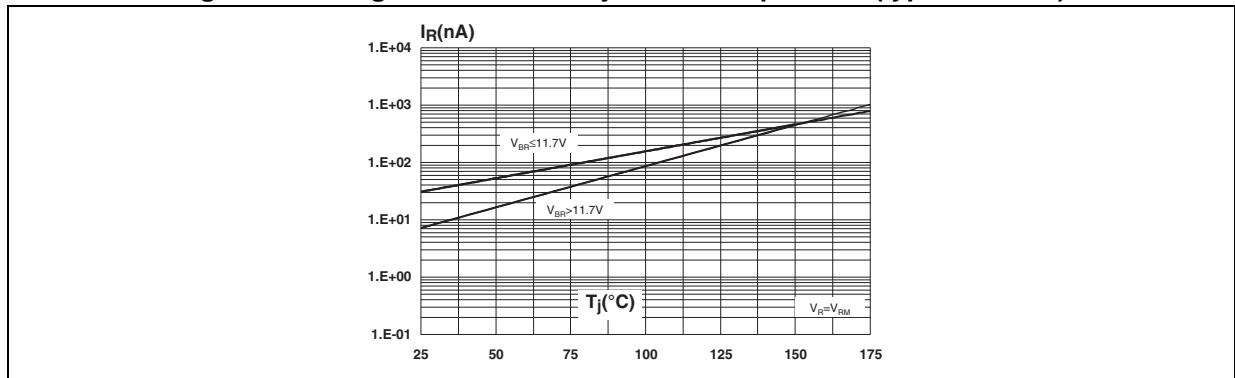
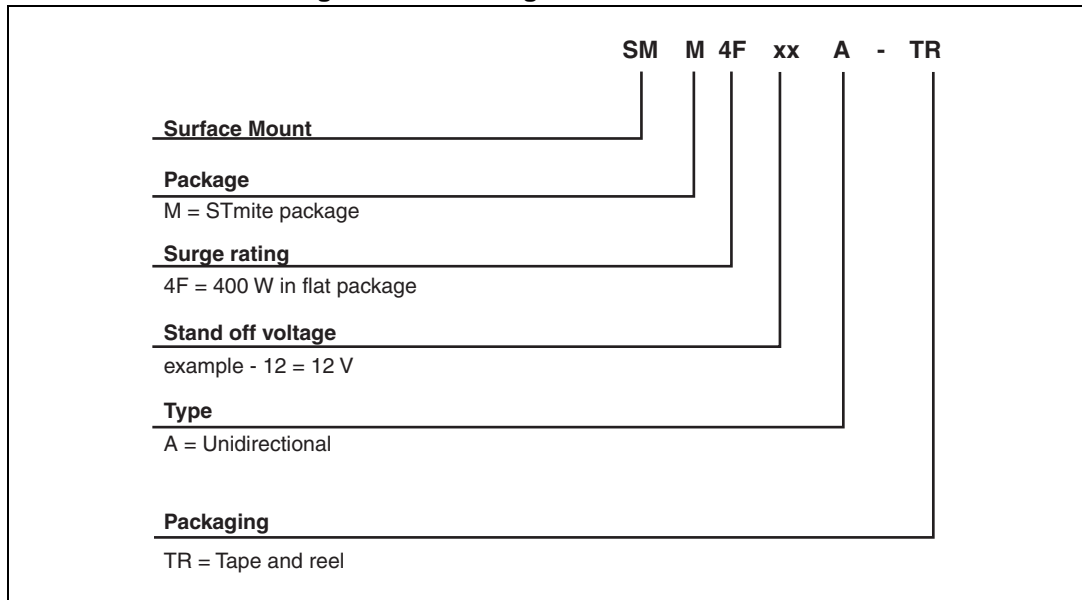


Figure 9. Leakage current versus junction temperature (typical values)



2 Ordering information scheme

Figure 10. Ordering information scheme



3 Package information

- Case: JEDEC DO216-AA Flat molded plastic over Planar junction
- Terminals: Solder plated, solderable per MIL-STD-750, Method 2026
- Polarity: For unidirectional types the band indicates cathode.
- Flammability: Epoxy is rated UL94V-0
- RoHS package

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

Table 5. STmite flat dimensions

| Ref. | Dimensions | | | | | |
|------|-------------|------|------|--------|-------|-------|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 0.80 | 0.85 | 0.95 | 0.031 | 0.033 | 0.037 |
| b | 0.40 | 0.55 | 0.65 | 0.016 | 0.022 | 0.026 |
| b2 | 0.70 | 0.85 | 1.00 | 0.027 | 0.033 | 0.039 |
| c | 0.10 | 0.15 | 0.25 | 0.004 | 0.006 | 0.009 |
| D | 1.75 | 1.90 | 2.05 | 0.069 | 0.075 | 0.081 |
| E | 3.60 | 3.80 | 3.90 | 0.142 | 0.150 | 0.154 |
| E1 | 2.80 | 2.95 | 3.10 | 0.110 | 0.116 | 0.122 |
| L | 0.50 | 0.55 | 0.80 | 0.020 | 0.022 | 0.031 |
| L1 | 2.10 | 2.40 | 2.60 | 0.083 | 0.094 | 0.102 |
| L2 | 0.45 | 0.60 | 0.75 | 0.018 | 0.024 | 0.030 |
| L3 | 0.20 | 0.35 | 0.50 | 0.008 | 0.014 | 0.020 |

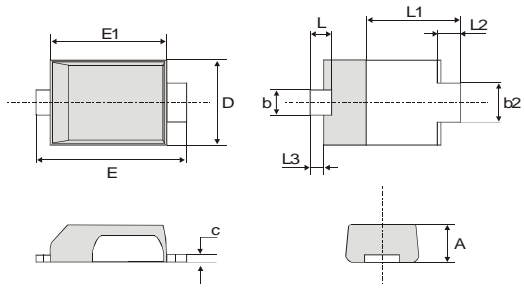


Figure 11. STmite flat footprint dimensions

Figure 12. Marking information

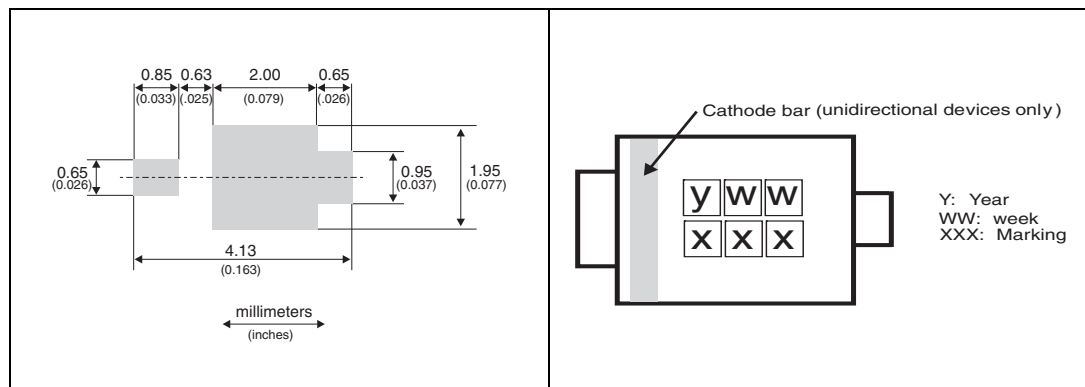


Table 6. Marking

| Type | Marking |
|--------------|---------|
| SMM4F5.0A-TR | 4UA |
| SMM4F6.0A-TR | 4UB |
| SMM4F6.5A-TR | 4UC |
| SMM4F8.5A-TR | 4UD |
| SMM4F10A-TR | 4UE |
| SMM4F12A-TR | 4UF |
| SMM4F13A-TR | 4UG |
| SMM4F15A-TR | 4UH |
| SMM4F18A-TR | 4UJ |
| SMM4F20A-TR | 4UK |
| SMM4F24A-TR | 4UM |
| SMM4F26A-TR | 4UN |
| SMM4F28A-TR | 4UO |
| SMM4F33A-TR | 4UQ |

4 Ordering information

Table 7. Ordering information

| Order code ⁽¹⁾ | Marking | Package | Weight | Base qty | Delivery mode |
|---------------------------|-------------------------------|-------------|---------|----------|---------------|
| SMM4FxxA-TR | See Table 6 . | STmite flat | 16.7 mg | 12000 | Tape and reel |

1. xx indicates stand-off voltage

5 Revision history

Table 8. Document revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 29-Nov-2007 | 1 | First issue. |
| 19-Dec-2007 | 2 | Updated I_{PP} and R_D parameters in columns 10 and 11 of Table 4 . |
| 20-Aug-2014 | 3 | Updated package name. |

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