

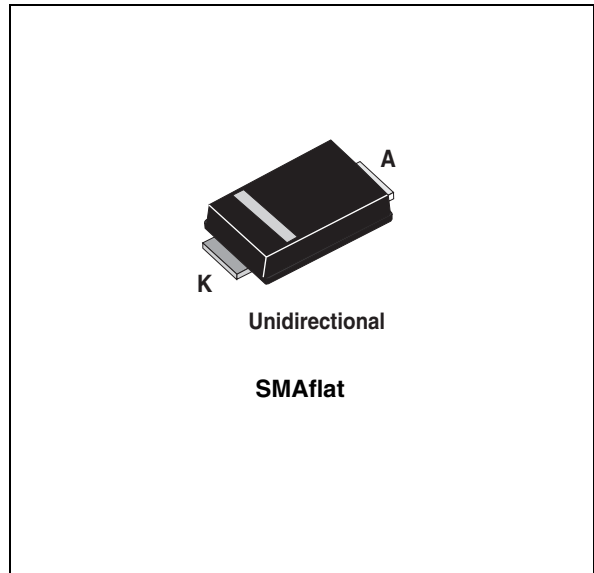
## High junction temperature Transil™

### Features

- ECOPACK2® halogen-free component
- Peak pulse power:
  - 400 W (10/1000  $\mu$ s)
  - 3 kW (8/20  $\mu$ s)
- Stand off voltage: 5 V
- Unidirectional type
- Low clamping voltage versus standard series
- Low leakage current, 10  $\mu$ A at 25 °C
- Operating  $T_j$  max: 175 °C
- JEDEC registered package outline

### 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: class3B
  - 25 kV (human body model)



### Description

The SMA4F Transil series has been designed to protect sensitive equipment against electrostatic 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  $\mu$ 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 provides a better safety margin to protect sensitive circuits with extended life time expectancy.

Packaged in SMAflat non exposed pad, this minimizes PCB space consumption (footprint in accordance with IPC 7531 standard).

TM: Transil is a trademark of STMicroelectronics

# 1 Characteristics

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

| Symbol    | Parameter  |   | Value       | Unit               |
|-----------|--|---|-------------|--------------------|
| $P_{PP}$  | Peak pulse power dissipation <sup>(1)</sup>                        | $T_j \text{ initial} = T_{amb}$                         | 400         | W                  |
| $I_{FSM}$ | Non repetitive surge peak forward current for unidirectional types | $t_p = 10\text{ ms}$<br>$T_j \text{ initial} = T_{amb}$ | 40          | 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 resistance**

| Symbol        | Parameter         | Value | Unit                 |
|---------------|-------------------|-------|----------------------|
| $R_{th(j-l)}$ | Junction to leads | 20    | $^{\circ}\text{C/W}$ |

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

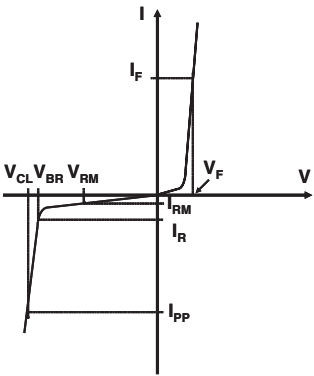
| Symbol     | Parameter                       |  |
|------------|---------------------------------|---|
| $V_{RM}$   | Stand-off voltage               |   |
| $V_{BR}$   | Breakdown voltage               |   |
| $V_{CL}$   | Clamping voltage                |   |
| $I_{RM}$   | Leakage current @ $V_{RM}$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

Table 4. Electrical characteristics - values ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

| Type      | $I_{RM} \text{ max@}V_{RM}$ |                       |     | $V_{BR} \text{ @}I_R^{(1)}$ |      |      |    | $V_{CL} \text{ @}I_{PP}$<br>10/1000 $\mu\text{s}$ |      | $R_D^{(2)}$<br>10/1000 $\mu\text{s}$ | $V_{CL} \text{ @}I_{PP}$<br>8/20 $\mu\text{s}$ |     | $R_D^{(2)}$<br>8/20 $\mu\text{s}$ | $\alpha T^{(3)}$         |
|-----------|-----------------------------|-----------------------|-----|-----------------------------|------|------|----|---|------|--------------------------------------|--|-----|-----------------------------------|--------------------------|
|           | 25 $^{\circ}\text{C}$       | 85 $^{\circ}\text{C}$ |     | min                         | typ  | max  |    | max   |      |                                      | max  |     |                                   | max                      |
|           | $\mu\text{A (Max)}$         |                       | V   | V                           |      |      | mA | V   | A    | $\Omega$                             | V  | A   | $\Omega$                          | 10-4/ $^{\circ}\text{C}$ |
| SMA4F5.0A | 10                          | 50                    | 5.0 | 6.40                        | 6.74 | 7.10 | 10 | 9.2   | 43.5 | 0.048                                | 13.4   | 174 | 0.036                             | 5.7                      |

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

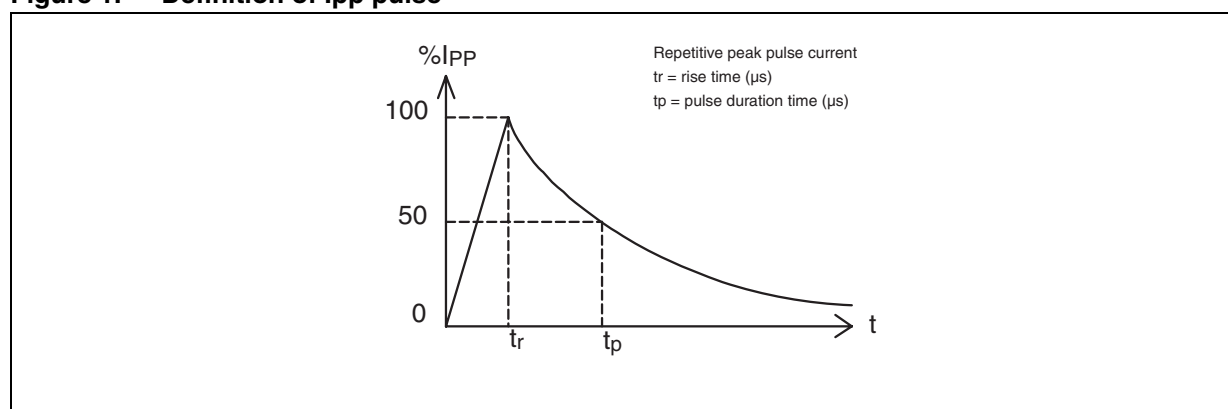
Figure 1. Definition of  $I_{PP}$  pulse

Figure 2. Relative peak power dissipation versus initial junction temperature

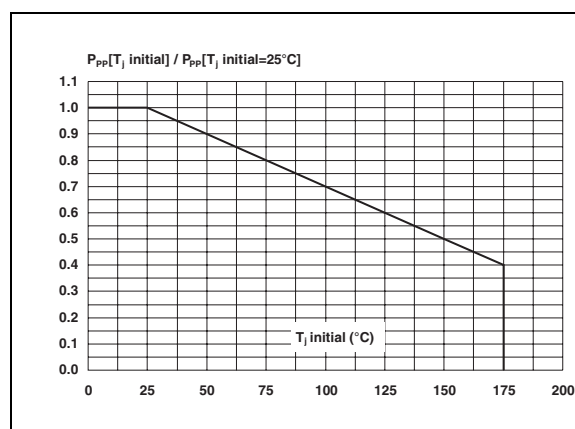
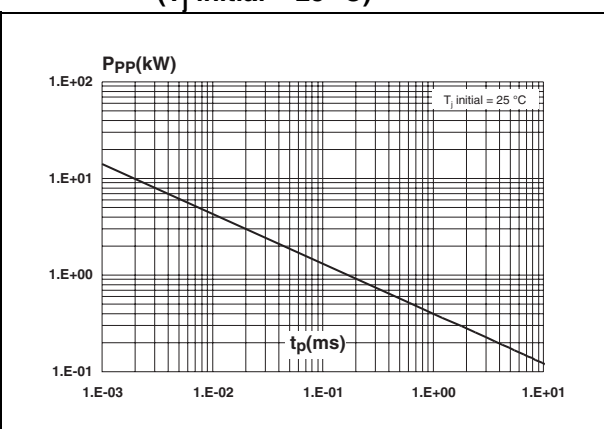
Figure 3. Peak pulse power versus exponential pulse duration ( $T_j \text{ initial} = 25\text{ }^{\circ}\text{C}$ )

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

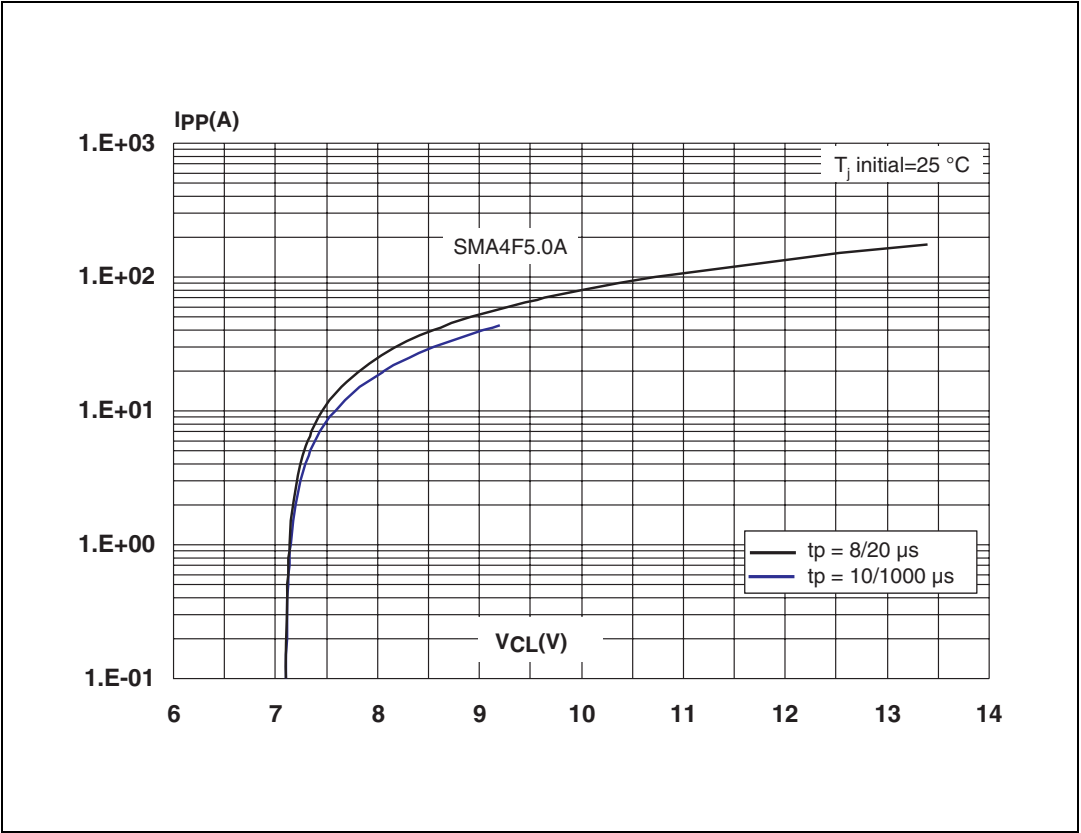
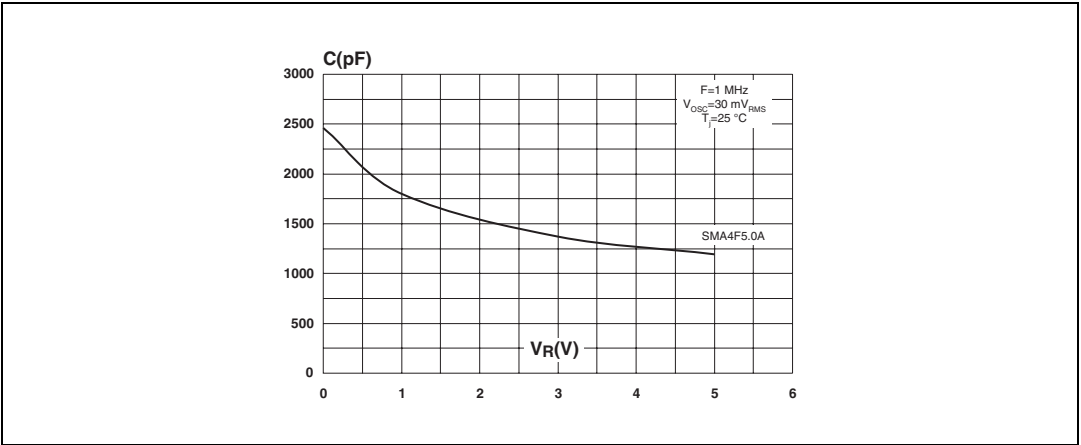
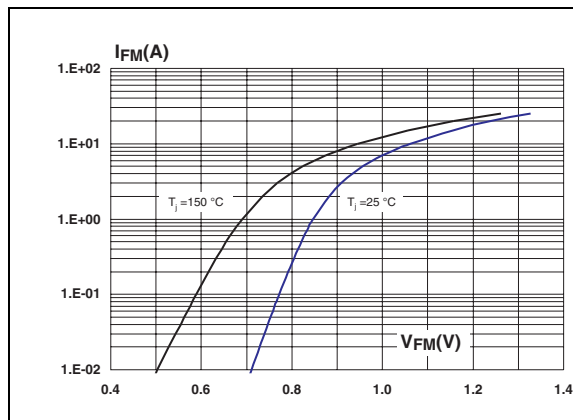


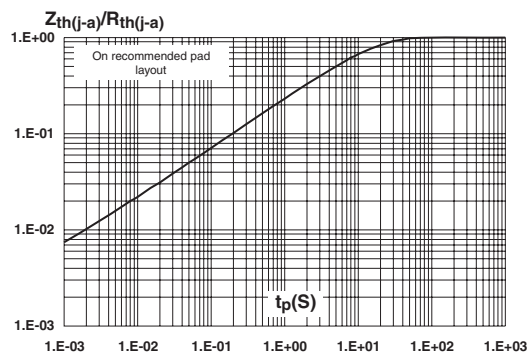
Figure 5. Junction capacitance versus reverse applied voltage (typical values)



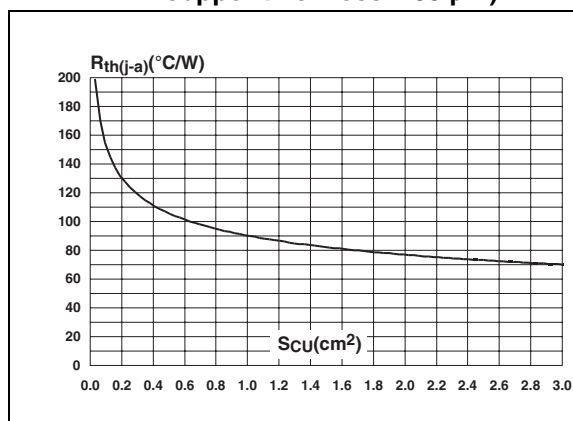
**Figure 6. Peak forward voltage drop versus peak forward current (typical values)**



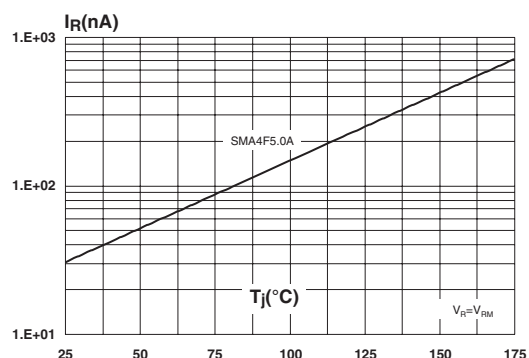
**Figure 7. Relative variation of thermal impedance junction to ambient versus pulse duration (printed circuit board FR4,  $S_{Cu} = 1\text{ cm}^2$ )**



**Figure 8. Thermal resistance junction to ambient versus copper surface under each lead (printed circuit board FR4, copper thickness =  $35\text{ }\mu\text{m}$ )**

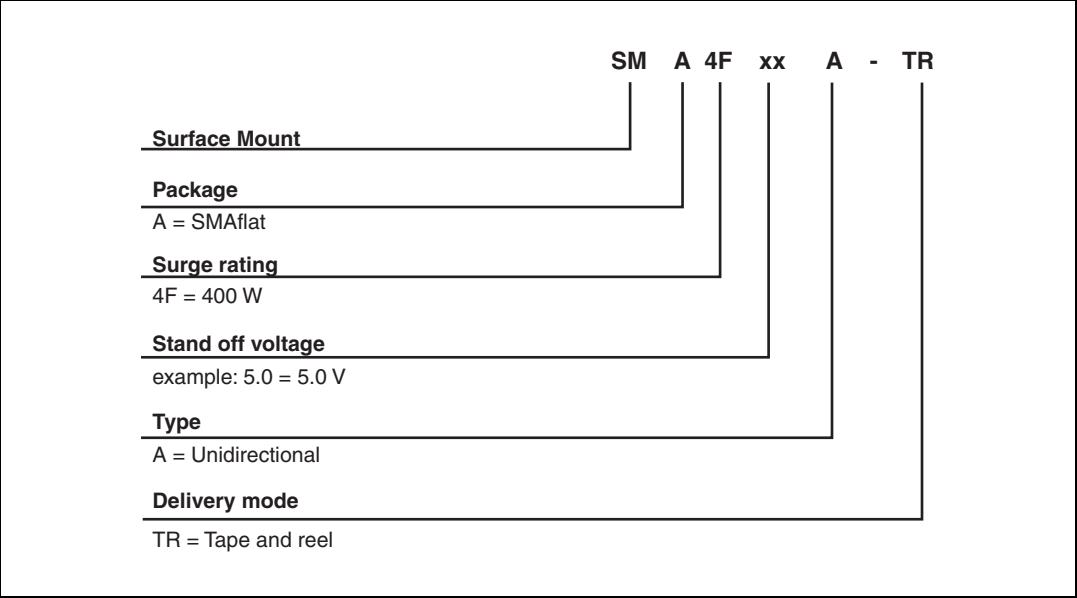


**Figure 9. Leakage current versus junction temperature (typical values)**



## 2      Ordering information scheme

Figure 10.    Ordering information scheme



### 3 Package information

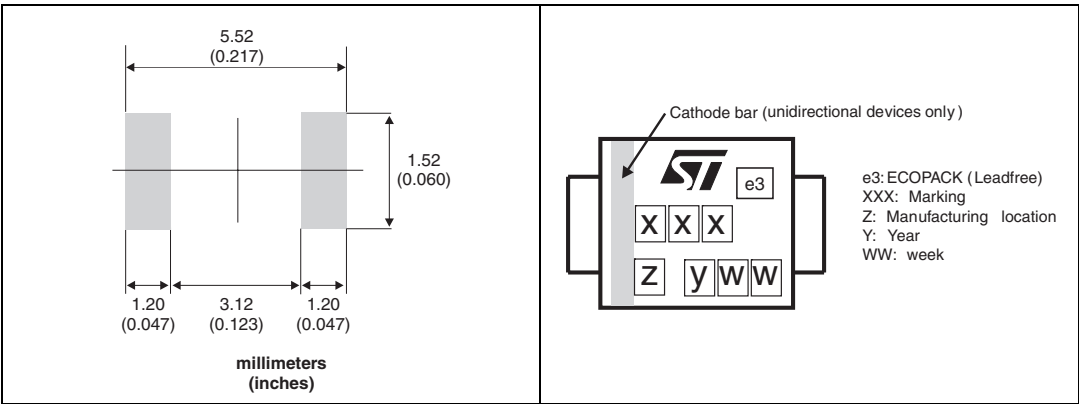
- Case: JEDEC DO-221AC molded plastic over Planar junction
- Terminals: Solder plated, solderable per MIL-STD-750, Method 2026
- Polarity: Band indicates cathode
- Flammability: Epoxy rated UL94V-0
- RoHS package

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at [www.st.com](http://www.st.com).

**Table 5. SMAflat dimensions**

| Ref. | Dimensions  |      |      |        |       |       |
|------|-------------|------|------|--------|-------|-------|
|      | Millimeters |      |      | Inches |       |       |
|      | Min.        | Typ. | Max. | Min.   | Typ.  | Max.  |
| A    | 0.90        |      | 1.10 | 0.035  |       | 0.043 |
| b    | 1.25        |      | 1.65 | 0.049  |       | 0.065 |
| c    | 0.15        |      | 0.40 | 0.006  |       | 0.016 |
| D    | 2.25        |      | 2.95 | 0.088  |       | 0.116 |
| E    | 4.80        |      | 5.60 | 0.189  |       | 0.220 |
| E1   | 3.95        |      | 4.60 | 0.156  |       | 0.181 |
| L    | 0.75        |      | 1.50 | 0.030  |       | 0.059 |
| L1   |             | 0.50 |      |        | 0.019 |       |
| L2   |             | 0.50 |      |        | 0.019 |       |

**Figure 11. SMAflat footprint dimensions** **Figure 12. Marking information optimized for SMAflat<sup>(1)</sup>**



1. SMA footprint may also be used.

## 4 Ordering information

**Table 6. Ordering information**

| Order code   | Marking | Package | Weight  | Base qty | Delivery mode |
|--------------|---------|---------|---------|----------|---------------|
| SMA4F5.0A-TR | SAE     | SMAflat | 0.035 g | 10 000   | Tape and reel |

## 5 Revision history

**Table 7. Document revision history**

| Date        | Revision | Changes      |
|-------------|----------|--------------|
| 04-Sep-2008 | 1        | First issue. |



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