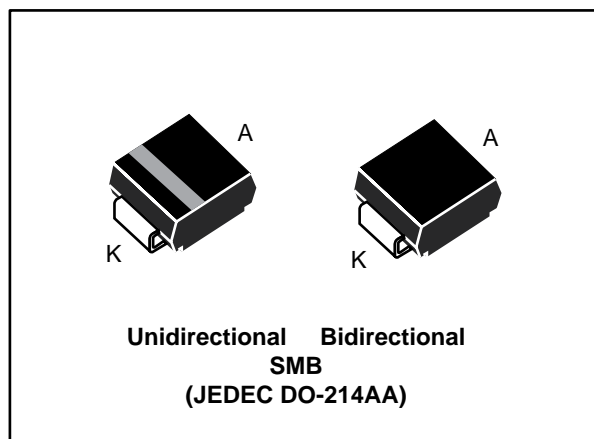




# THE DATASHEET OF SM6T12A





## Complies with the following standards

- IEC 61000-4-2 level 4:
  - 15 kV (air discharge)
  - 8 kV (contact discharge)
- IEC 61000-4-5
- MIL STD 883G, method 3015-7: class 3B:
  - 25 kV HBM (human body model)
- UL 497B, file number: QVGG2.E136224
- Resin meets UL 94, V0
- MIL-STD-750, method 2026 solderability
- EIA STD RS-481 and IEC 60286-3 packing
- IPC 7531 footprint

## Features

- Peak pulse power:
  - 600 W (10/1000  $\mu$ s)
  - 4 kW (8/20  $\mu$ s)
- Stand-off voltage range: from 6.8 V to 220 V
- Unidirectional and bidirectional types
- Low leakage current:
  - 0.2  $\mu$ A at 25 °C
  - 1  $\mu$ A at 85 °C
- Operating  $T_j$  max: 150 °C
- High power capability at  $T_j$  max.:
  - 515 W (10/1000  $\mu$ s)
- JEDEC registered package outline

## Description

The SM6T Transil series are designed to protect sensitive equipment against electrostatic discharges according to IEC 61000-4-2 and MIL STD 883, method 3015, and electrical overstress according to IEC 61000-4-4 and 5. These devices are more generally used against surges below 600 W (10/1000  $\mu$ s).

The Planar technology makes it suitable for high-end equipment and SMPS where low leakage current and high junction temperature are required to provide reliability and stability over time.

SM6T are packaged in SMB (SMB footprint in accordance with IPC 7531 standard).

# 1 Characteristics

**Table 1: Absolute maximum ratings (T<sub>amb</sub> = 25 °C)**

| Symbol           | Parameter  |   | Value       | Unit |
|------------------|--|---|-------------|------|
| P <sub>PP</sub>  | Peak pulse power dissipation <sup>(1)</sup>        | T <sub>j</sub> initial = T <sub>amb</sub> | 600         | W    |
| T <sub>stg</sub> | Storage temperature range                          |   | -65 to +150 | °C   |
| T <sub>j</sub>   | Operating junction temperature range               |   | -55 to +150 | °C   |
| T <sub>L</sub>   | Maximum lead temperature for soldering during 10 s |   | 260         | °C   |

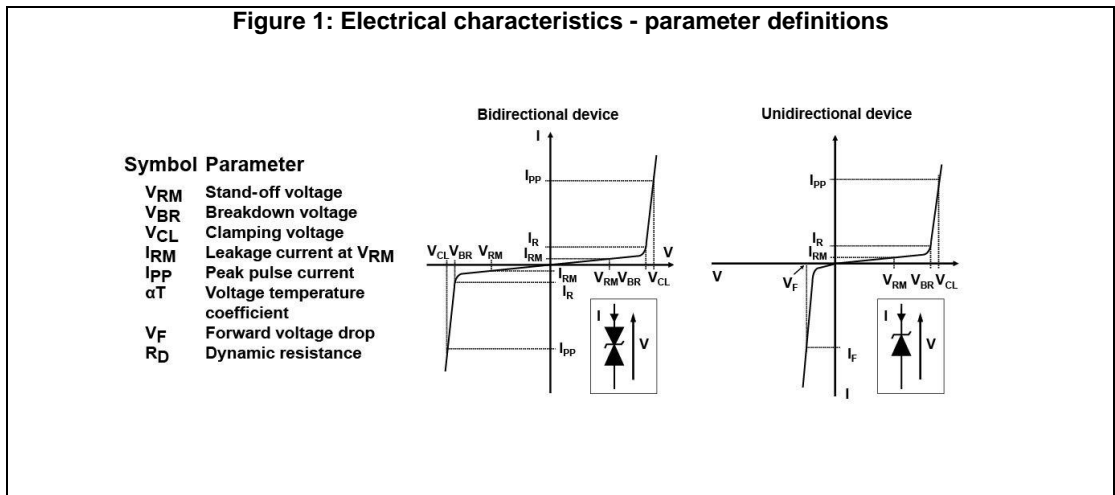
**Notes:**

(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 <sub>th(j-l)</sub> | Junction to leads  | 20    | °C/W |
| R <sub>th(j-a)</sub> | Junction to ambient on printed circuit on recommended pad layout | 100   | °C/W |

**Figure 1: Electrical characteristics - parameter definitions**



**Figure 2: Pulse definition for electrical characteristics**

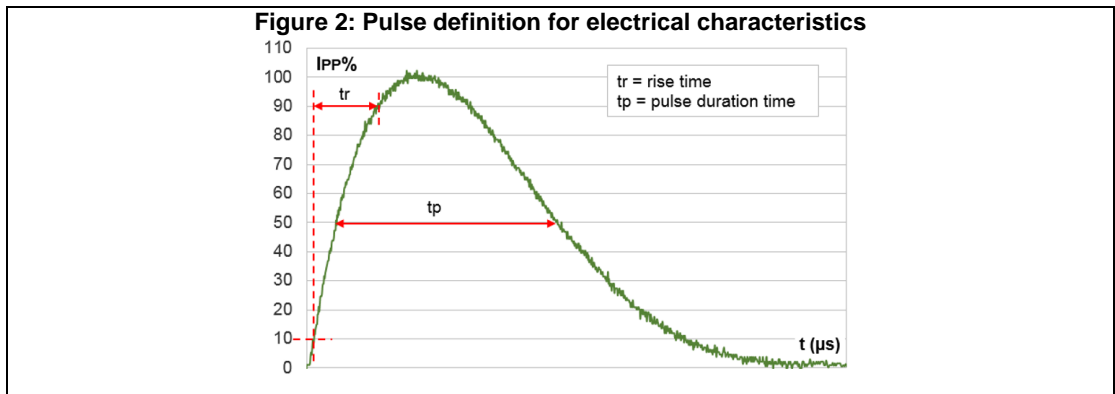


Table 3: Electrical characteristics parameter values ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)

| Order code  | $I_{RM}$ max at $V_{RM}$ |                          |      | $V_{BR}$ at $I_R^{(1)}$ |      |      |    | 10 / 1000 $\mu\text{s}$ |                  |          | 8 / 20 $\mu\text{s}$ |          |          | $\alpha T^{(2)}$                       |
|-------------|--------------------------|--------------------------|------|-------------------------|------|------|----|-------------------------|------------------|----------|----------------------|----------|----------|--|
|             | 25<br>$^{\circ}\text{C}$ | 85<br>$^{\circ}\text{C}$ |      | Min.                    | Typ. | Max. |    | $V_{CL}$                | $I_{PP}$         | $R_D$    | $V_{CL}$             | $I_{PP}$ | $R_D$    |  |
|             |                          |                          |      |                         |      |      |    | Max.                    |                  | Max.     | Max.                 |          |          | Max.                                   |
|             | $\mu\text{A}$            |                          | V    | V                       |      |      | mA | V <sup>(3)</sup>        | A <sup>(4)</sup> | $\Omega$ | V                    | A        | $\Omega$ | 10 <sup>-4</sup><br>$^{\circ}\text{C}$ |
| SM6T6V8A/CA | 20                       | 50                       | 5.8  | 6.45                    | 6.8  | 7.14 | 10 | 10.5                    | 57               | 0.059    | 14.4                 | 275      | 0.027    | 5.7                                    |
| SM6T7V5A/CA | 20                       | 50                       | 6.4  | 7.13                    | 7.5  | 7.88 | 10 | 11.3                    | 53               | 0.065    | 15.2                 | 266      | 0.027    | 6.1                                    |
| SM6T10A/CA  | 20                       | 50                       | 8.55 | 9.5                     | 10.0 | 10.5 | 1  | 14.5                    | 41               | 0.098    | 18.6                 | 215      | 0.038    | 7.3                                    |
| SM6T12A/CA  | 0.2                      | 1                        | 10.2 | 11.4                    | 12   | 12.6 | 1  | 16.7                    | 36               | 0.114    | 21.7                 | 184      | 0.049    | 7.8                                    |
| SM6T15A/CA  | 0.2                      | 1                        | 12.8 | 14.3                    | 15   | 15.8 | 1  | 21.2                    | 28               | 0.193    | 27.2                 | 147      | 0.078    | 8.4                                    |
| SM6T18A/CA  | 0.2                      | 1                        | 15.3 | 17.1                    | 18   | 18.9 | 1  | 25.2                    | 24               | 0.263    | 32.5                 | 123      | 0.111    | 8.8                                    |
| SM6T22A/CA  | 0.2                      | 1                        | 18.8 | 20.9                    | 22   | 23.1 | 1  | 30.6                    | 20               | 0.375    | 39.3                 | 102      | 0.159    | 9.2                                    |
| SM6T24A/CA  | 0.2                      | 1                        | 20.5 | 22.8                    | 24   | 25.2 | 1  | 33.2                    | 18               | 0.444    | 42.8                 | 93       | 0.189    | 9.4                                    |
| SM6T27A/CA  | 0.2                      | 1                        | 23.1 | 25.7                    | 27   | 28.4 | 1  | 37.5                    | 16               | 0.569    | 48.3                 | 83       | 0.240    | 9.6                                    |
| SM6T30A/CA  | 0.2                      | 1                        | 25.6 | 28.5                    | 30   | 31.5 | 1  | 41.5                    | 14.5             | 0.690    | 53.5                 | 75       | 0.293    | 9.7                                    |
| SM6T33A/CA  | 0.2                      | 1                        | 28.2 | 31.4                    | 33   | 34.7 | 1  | 45.7                    | 13.1             | 0.840    | 59.0                 | 68       | 0.357    | 9.8                                    |
| SM6T36A/CA  | 0.2                      | 1                        | 30.8 | 34.2                    | 36   | 37.8 | 1  | 49.9                    | 12               | 1.01     | 64.3                 | 62       | 0.427    | 9.9                                    |
| SM6T39A/CA  | 0.2                      | 1                        | 33.3 | 37.1                    | 39   | 41.0 | 1  | 53.9                    | 11.1             | 1.16     | 69.7                 | 57       | 0.504    | 10.0                                   |
| SM6T56A/CA  | 0.2                      | 1                        | 47.6 | 53.2                    | 56   | 58.8 | 1  | 76.6                    | 7.8              | 2.28     | 100                  | 40       | 1.030    | 10.0                                   |
| SM6T68A/CA  | 0.2                      | 1                        | 58.1 | 64.6                    | 68   | 71.4 | 1  | 92                      | 6.5              | 3.17     | 121                  | 33       | 1.503    | 10.4                                   |
| SM6T75A/CA  | 0.2                      | 1                        | 64.1 | 71.3                    | 75   | 78.8 | 1  | 103                     | 5.8              | 4.17     | 134                  | 30       | 1.84     | 10.5                                   |
| SM6T100A/CA | 0.2                      | 1                        | 85.5 | 95.0                    | 100  | 105  | 1  | 137                     | 4.4              | 7.27     | 178                  | 22.5     | 3.24     | 10.6                                   |
| SM6T150A/CA | 0.2                      | 1                        | 128  | 143                     | 150  | 158  | 1  | 207                     | 2.9              | 16.9     | 265                  | 15       | 7.13     | 10.8                                   |
| SM6T200A/CA | 0.2                      | 1                        | 171  | 190                     | 200  | 210  | 1  | 274                     | 2.2              | 29.1     | 353                  | 11.3     | 12.7     | 10.8                                   |
| SM6T220A/CA | 0.2                      | 1                        | 188  | 209                     | 220  | 231  | 1  | 328                     | 2                | 48.5     | 388                  | 10.3     | 15.2     | 10.8                                   |

**Notes:**

<sup>(1)</sup>Pulse test:  $t_p < 50\text{ ms}$

<sup>(2)</sup>To calculate  $V_{BR}$  or  $V_{CL}$  versus junction temperature, use the following formulas:

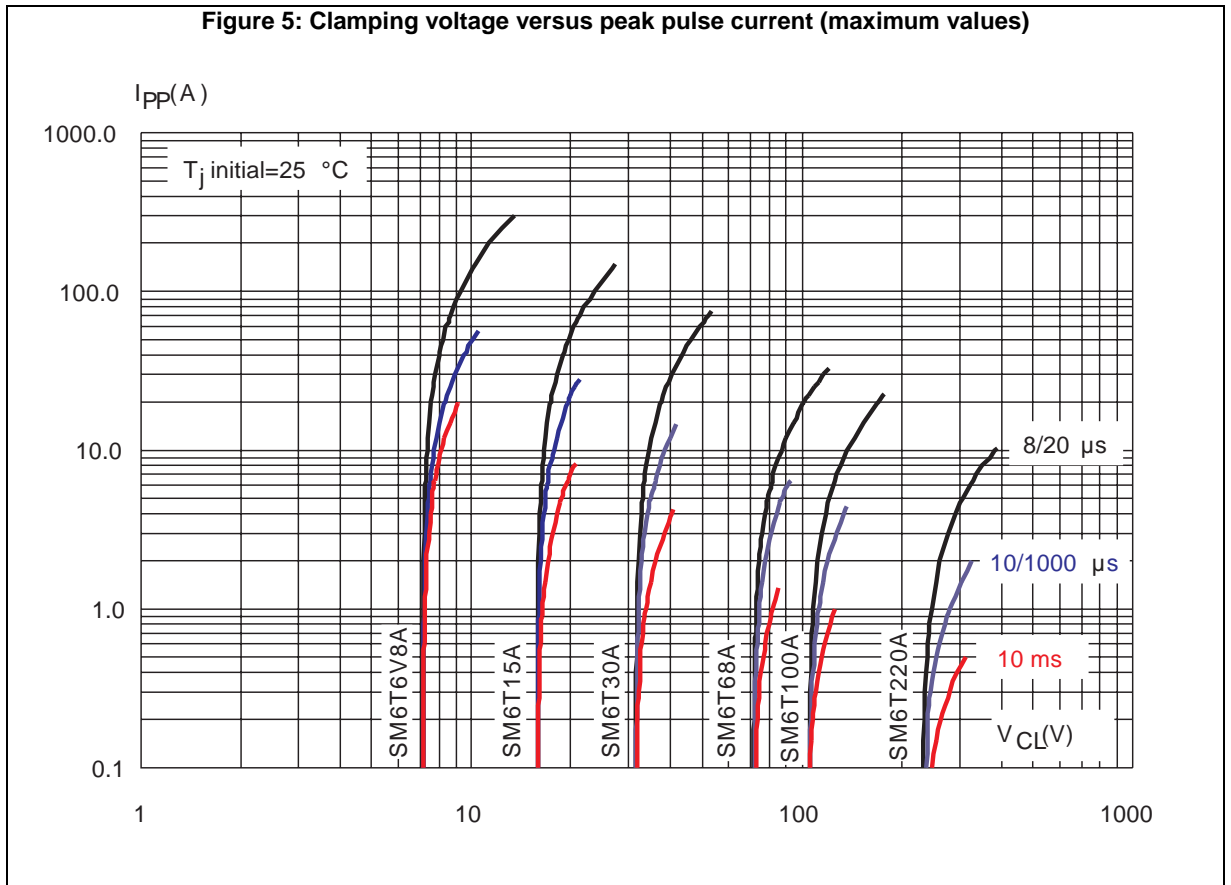
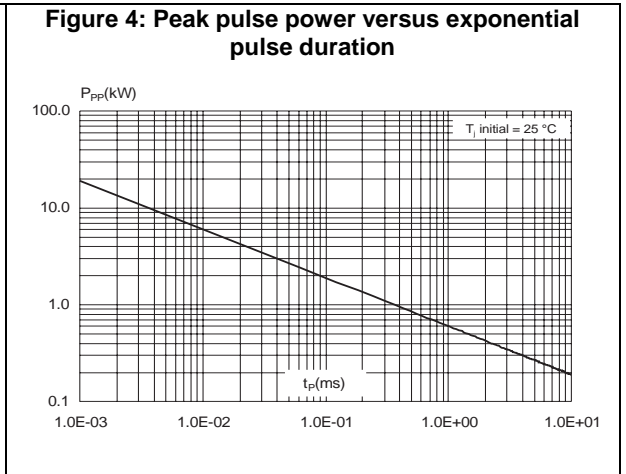
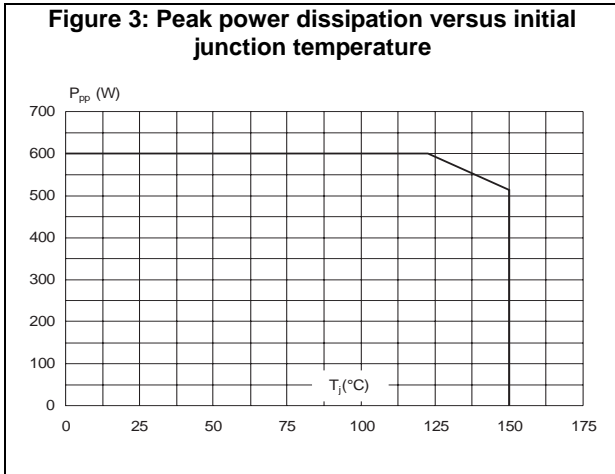
- $V_{BR}$  at  $T_J = V_{BR}$  at  $25\text{ }^{\circ}\text{C} \times (1 + \alpha T \times (T_J - 25))$   $V_{CL}$  at  $T_J = V_{CL}$  at  $25\text{ }^{\circ}\text{C} \times (1 + \alpha T \times (T_J - 25))$

<sup>(3)</sup>To calculate maximum clamping voltage at other surge level, use the following formula:

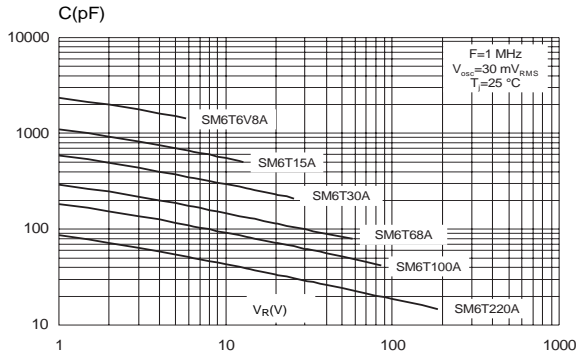
- $V_{CLmax} = V_{BRmax} + R_D \times I_{PPappli}$  where  $I_{PPappli}$  is the surge current in the application

<sup>(4)</sup>Surge capability given for both directions for unidirectional and bidirectional types.

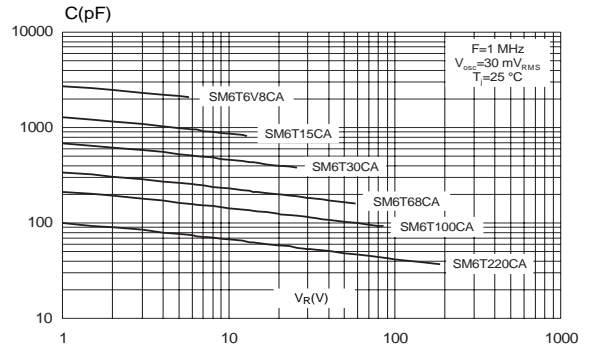
### 1.1 Characteristics (curves)



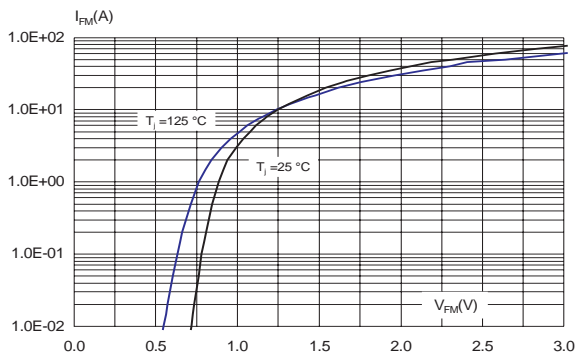
**Figure 6: Capacitance versus reverse applied voltage for unidirectional types (typical values)**



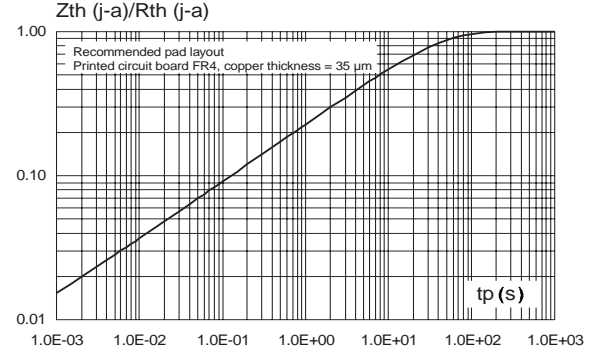
**Figure 7: Capacitance versus reverse applied voltage for bidirectional types (typical values)**



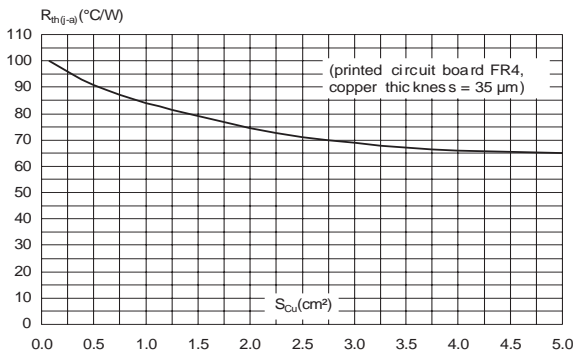
**Figure 8: Peak forward voltage drop versus peak forward current (typical values)**



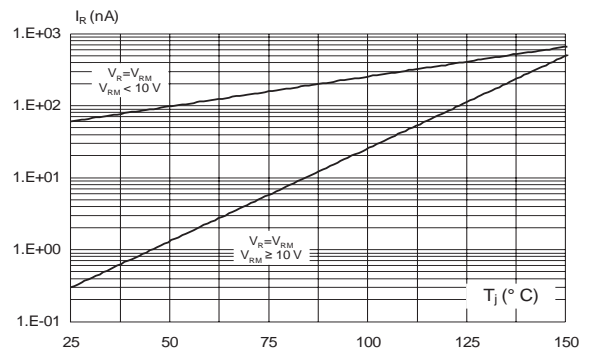
**Figure 9: Relative variation of thermal impedance junction to ambient versus pulse duration**



**Figure 10: Thermal resistance junction to ambient versus copper surface under each lead**



**Figure 11: Leakage current versus junction temperature (typical values)**



## 2 Package information

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](http://www.st.com). ECOPACK® is an ST trademark.

- Case: JEDEC DO214-AA 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

### 2.1 SMB package information

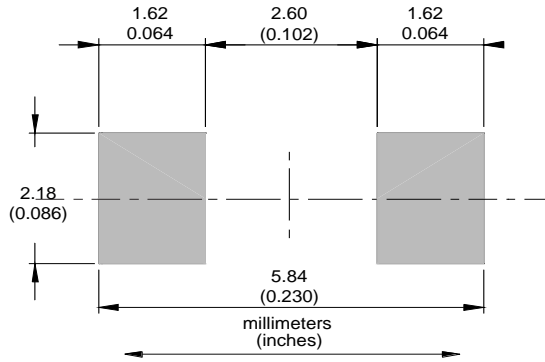
Figure 12: SMB package outline



Table 4: SMB package mechanical data

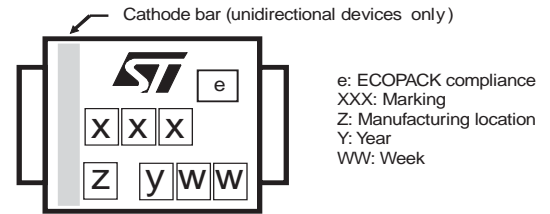
| Ref. | Dimensions  |      |        |        |
|------|-------------|------|--------|--------|
|      | Millimeters |      | Inches |        |
|      | Min.        | Max. | Min.   | Max.   |
| A1   | 1.90        | 2.45 | 0.0748 | 0.0965 |
| A2   | 0.05        | 0.20 | 0.0020 | 0.0079 |
| b    | 1.95        | 2.20 | 0.0768 | 0.0867 |
| c    | 0.15        | 0.40 | 0.0059 | 0.0157 |
| D    | 3.30        | 3.95 | 0.1299 | 0.1556 |
| E    | 5.10        | 5.60 | 0.2008 | 0.2205 |
| E1   | 4.05        | 4.60 | 0.1594 | 0.1811 |
| L    | 0.75        | 1.50 | 0.0295 | 0.0591 |

Figure 13: SMB recommended footprint



Note: Marking layout can vary according to assembly location.

Figure 14: Marking layout



### 3 Ordering information

Figure 15: Ordering information scheme

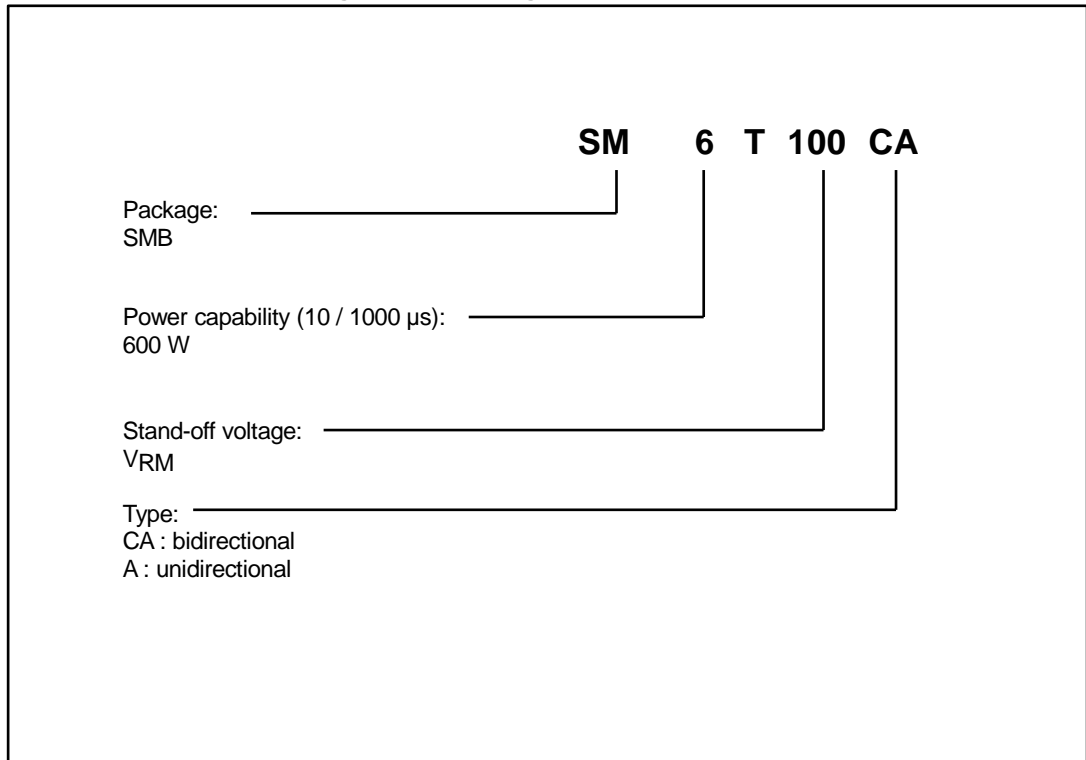


Table 5: Ordering information

| Order code                 | Marking                                  | Package | Weight | Base qty. | Delivery mode |
|----------------------------|--|---------|--------|-----------|---------------|
| SM6TxxxA/CA <sup>(1)</sup> | See <a href="#">Table 6: "Marking"</a> . | SMB     | 0.11 g | 2500      | Tape and reel |

**Notes:**

<sup>(1)</sup>Where xxx is nominal value of V<sub>BR</sub> and A or CA indicates unidirectional or bidirectional version. See [Table 3: "Electrical characteristics parameter values \(T<sub>amb</sub> = 25 °C, unless otherwise specified\)"](#) for list of available devices and their order codes.

Table 6: Marking

| Order code | Marking | Order code | Marking |
|------------|---------|------------|---------|
| SM6T6V8A   | DE      | SM6T6V8CA  | LE      |
| SM6T7V5A   | DG      | SM6T7V5CA  | LG      |
| SM6T10A    | DP      | SM6T10CA   | LP      |
| SM6T12A    | DT      | SM6T12CA   | LT      |
| SM6T15A    | DX      | SM6T15CA   | LX      |
| SM6T18A    | EE      | SM6T18CA   | ME      |
| SM6T22A    | EK      | SM6T22CA   | MK      |
| SM6T24A    | EM      | SM6T24CA   | MM      |
| SM6T27A    | EP      | SM6T27CA   | MP      |
| SM6T30A    | ER      | SM6T30CA   | MR      |
| SM6T33A    | ET      | SM6T33CA   | MT      |
| SM6T36A    | EV      | SM6T36CA   | MV      |
| SM6T39A    | EX      | SM6T39CA   | MX      |
| SM6T56A    | FL      | SM6T56CA   | NL      |
| SM6T68A    | FQ      | SM6T68CA   | NQ      |
| SM6T75A    | FS      | SM6T75CA   | NS      |
| SM6T100A   | FY      | SM6T100CA  | NY      |
| SM6T150A   | GL      | SM6T150CA  | OL      |
| SM6T200A   | GU      | SM6T200CA  | OU      |
| SM6T220A   | GW      | SM6T220CA  | OW      |

## 4 Revision history

**Table 7: Document revision history**

| Date        | Revision | Changes  |
|-------------|----------|--|
| Aug-2001    | 4A       | Previous update.   |
| 15-Sep-2004 | 5        | 1. Types table parameters on page 2: $I_{RM}$ @ $T_j = 85\text{ }^\circ\text{C}$ condition added<br>2. $I_{RM}$ max values changed                                 |
| 26-Mar-2009 | 6        | Reformatted to current standard. SMB dimensions and footprint updated. Maximum junction temperature replaced with operating junction temperature range in Table 1. |
| 25-May-2009 | 7        | Reformatted to current standard. Added standards compliance information on page 1. Added device SM6T56 to Table 3. Updated all characteristic curves.              |
| 17-Sep-2009 | 8        | Document updated for low leakage current.  |
| 20-Oct-2009 | 9        | Updated Figure 13.   |
| 10-Jan-2018 | 10       | Updated <a href="#">Table 3: "Electrical characteristics parameter values (<math>T_{amb} = 25\text{ }^\circ\text{C}</math>, unless otherwise specified)"</a> .     |

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