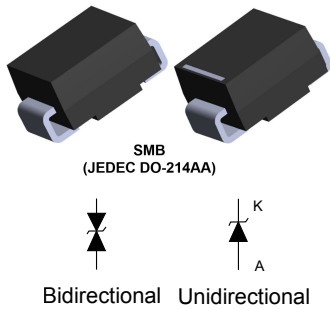


## 600 W TVS in SMB



### Features

- Peak pulse power: 600 W (10/1000  $\mu$ s) and 4 kW (8/20  $\mu$ s)
- Stand-off voltage range from 5 V to 188 V
- Unidirectional and bidirectional types
- Low leakage current: 0.2  $\mu$ A at 25 °C and 1  $\mu$ A at 85 °C
- Operating  $T_j$  max: 150 °C
- High power capability at  $T_j$  max.: up to 350 W (10/1000  $\mu$ s)
- Lead finishing: matte tin plating

### Complies with the following standards

- UL94, V0
- J-STD-020 MSL level 1
- J-STD-002, JESD 22-B102 E3 and MIL-STD-750, method 2026 solderable matte tin plated leads
- JESD-201 class 2 whisker test
- IPC7531 footprint
- JEDEC registered package outline
- IEC 61000-4-4 level 4:
  - 4 kV
- IEC 61000-4-2, C = 150 pF - R = 330  $\Omega$  exceeds level 4:
  - 30 kV (air discharge)
  - 30 kV (contact discharge)

### Description

The SM6T 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. This device is 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.

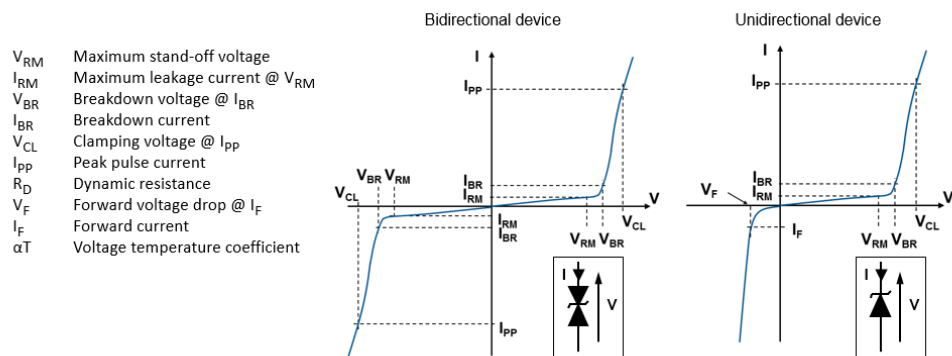
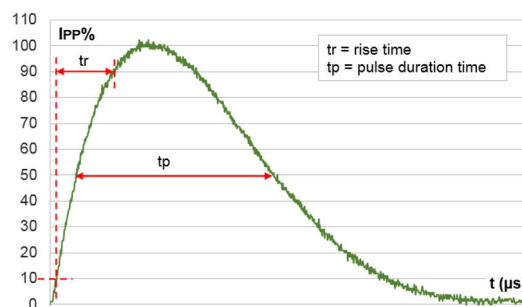
The SM6T series are packaged in SMB.

| Product status link                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Unidirectional                                                                                                                                                                                                                                     | Bidirectional                                                                                                                                                                                                                                                          |
| SM6T6V8A,<br>SM6T7V5A,<br>SM6T10A,<br>SM6T12A,<br>SM6T15A,<br>SM6T18A,<br>SM6T22A,<br>SM6T24A,<br>SM6T27A,<br>SM6T30A,<br>SM6T33A,<br>SM6T36A,<br>SM6T39A,<br>SM6T56A,<br>SM6T68A,<br>SM6T75A,<br>SM6T100A,<br>SM6T150A,<br>SM6T200A,<br>SM6T220A. | SM6T6V8CA,<br>SM6T7V5CA,<br>SM6T10CA,<br>SM6T12CA,<br>SM6T15CA,<br>SM6T18CA,<br>SM6T22CA,<br>SM6T24CA,<br>SM6T27CA,<br>SM6T30CA,<br>SM6T33CA,<br>SM6T36CA,<br>SM6T39CA,<br>SM6T56CA,<br>SM6T68CA,<br>SM6T75CA,<br>SM6T100CA,<br>SM6T150CA,<br>SM6T200CA,<br>SM6T220CA. |

# 1 Characteristics

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

| Symbol    | Parameter                                          | Value                                                           | Unit               |
|-----------|----------------------------------------------------|-----------------------------------------------------------------|--------------------|
| $V_{PP}$  | Peak pulse voltage                                 | IEC 61000-4-2 ( $C = 150\text{ pF}$ , $R = 330\text{ }\Omega$ ) |                    |
|           | Contact discharge                                  | 30                                                              | kV                 |
|           | Air discharge                                      | 30                                                              |                    |
| $P_{PP}$  | Peak pulse power dissipation                       | 10/1000 $\mu\text{s}$ , $T_j\text{ initial} = T_{amb}$          | W                  |
| $T_{stg}$ | Storage temperature range                          | -65 to +150                                                     | $^{\circ}\text{C}$ |
| $T_j$     | Operating junction temperature range               | -55 to +150                                                     | $^{\circ}\text{C}$ |
| $T_L$     | Maximum lead temperature for soldering during 10 s | 260                                                             | $^{\circ}\text{C}$ |

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

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


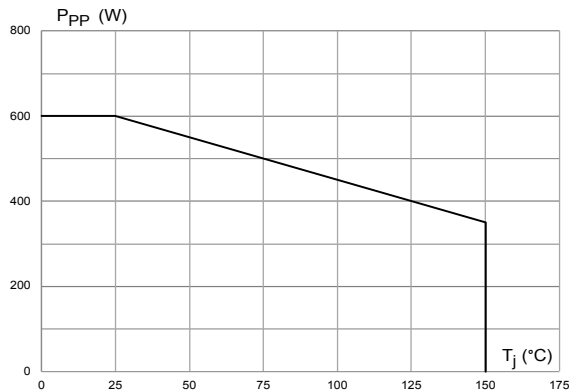
**Table 2. Electrical characteristics - parameter values ( $T_{amb} = 25\text{ °C}$ , unless otherwise specified)**

| Type        | $I_{RM}$ max at $V_{RM}$ |       |      | $V_{BR}$ at $I_{BR}^{(1)}$ |      |      |    | 10 / 1000 $\mu s$ |                |          | 8 / 20 $\mu s$    |                |          | $\alpha T$          |
|-------------|--------------------------|-------|------|----------------------------|------|------|----|-------------------|----------------|----------|-------------------|----------------|----------|---------------------|
|             |                          |       |      |                            |      |      |    | $V_{CL}^{(2)(3)}$ | $I_{PP}^{(4)}$ | $R_D$    | $V_{CL}^{(2)(3)}$ | $I_{PP}^{(4)}$ | $R_D$    |                     |
|             | 25 °C                    | 85 °C |      | Min.                       | Typ. | Max. |    | Max.              |                | Max.     | Max.              |                | Max.     | Max.                |
|             | $\mu A$                  |       | V    | V                          |      |      | mA | V                 | A              | $\Omega$ | V                 | A              | $\Omega$ | $10^{-4}/^{\circ}C$ |
| SM6T6V8A/CA | 20                       | 50    | 5.80 | 6.45                       | 6.8  | 7.14 | 10 | 10.5              | 57             | 0.059    | 14.4              | 275            | 0.027    | 5.7                 |
| SM6T7V5A/CA | 20                       | 50    | 6.40 | 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                |

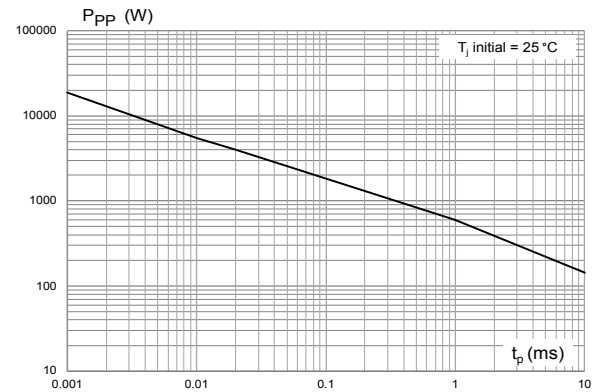
1. To calculate  $V_{BR}$  versus  $T_j$ :  $V_{BR}$  at  $T_j = V_{BR}$  at  $25\text{ °C} \times (1 + \alpha T \times (T_j - 25))$
2. To calculate  $V_{CL}$  versus  $T_j$ :  $V_{CL}$  at  $T_j = V_{CL}$  at  $25\text{ °C} \times (1 + \alpha T \times (T_j - 25))$
3. To calculate  $V_{CL}$  max versus  $I_{PP\text{appli}}$ :  $V_{CL\text{max}} = V_{BR\text{max}} + R_D \times I_{PP\text{appli}}$
4. Surge capability given for both directions for unidirectional and bidirectional devices

## 1.1 Characteristics (curves)

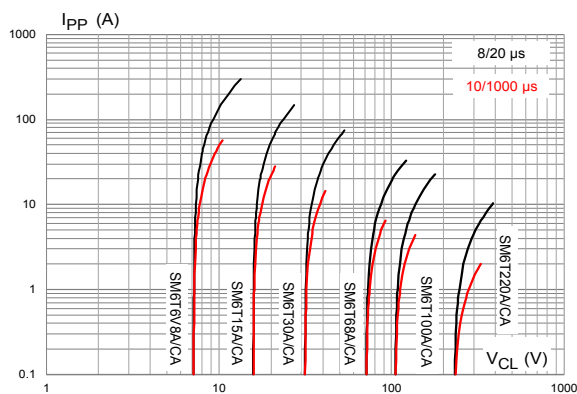
**Figure 3. Maximum peak power dissipation versus initial junction temperature**



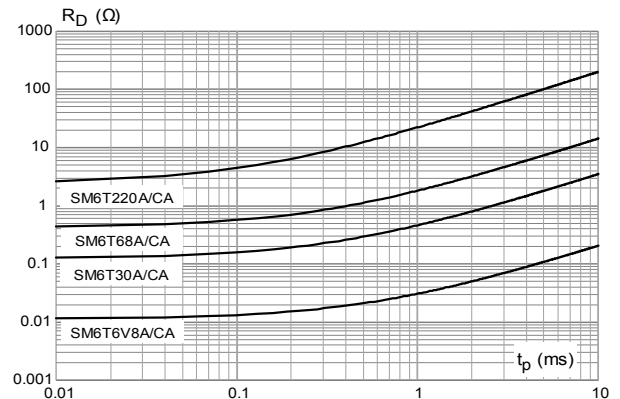
**Figure 4. Maximum peak pulse power versus exponential pulse duration**



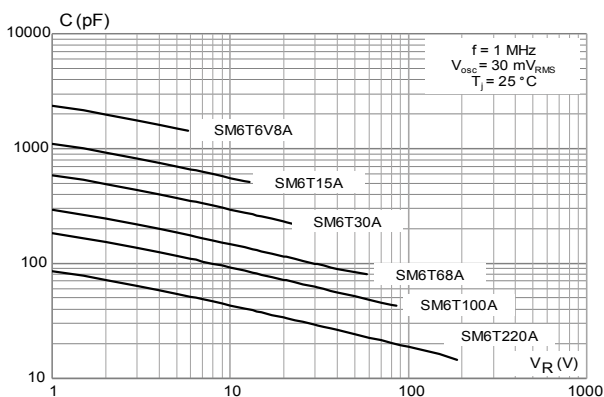
**Figure 5. Maximum peak pulse current versus clamping voltage**



**Figure 6. Dynamic resistance versus pulse duration**



**Figure 7. Junction capacitance versus reverse applied voltage (unidirectional type)**



**Figure 8. Junction capacitance versus applied voltage (bidirectional type)**

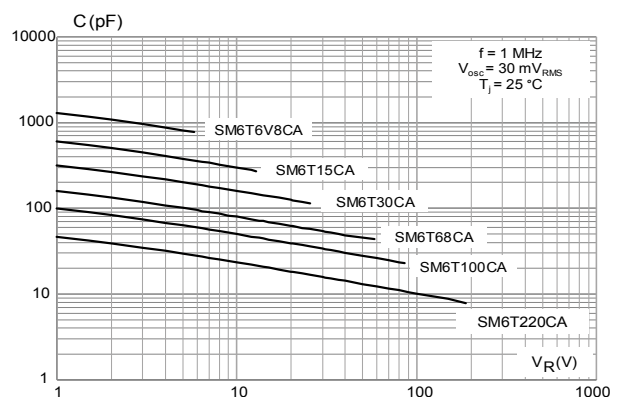


Figure 9. Leakage current versus junction temperature

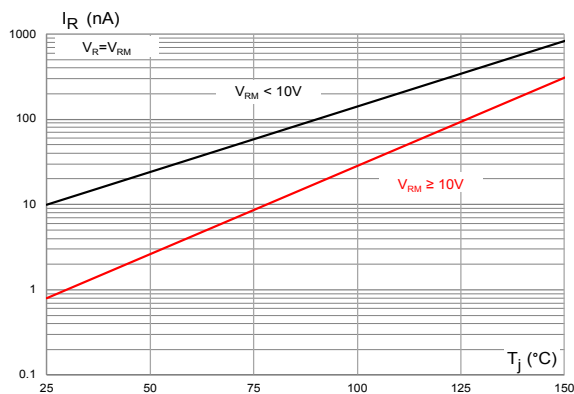


Figure 10. Peak forward voltage drop versus peak forward current

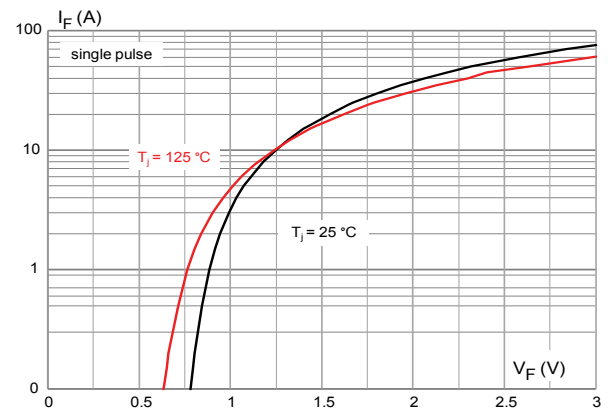


Figure 11. Thermal impedance junction to ambient versus pulse duration

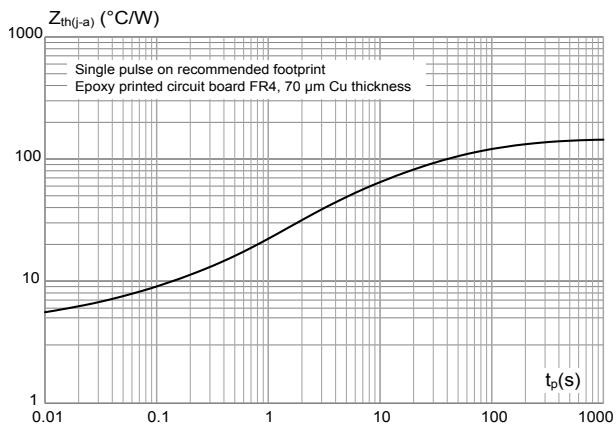
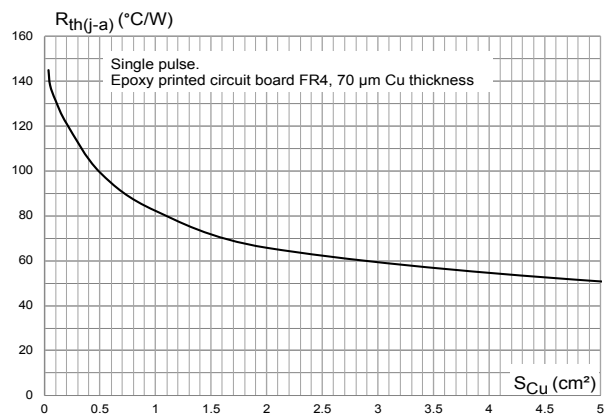


Figure 12. Thermal resistance junction to ambient versus copper area under each lead

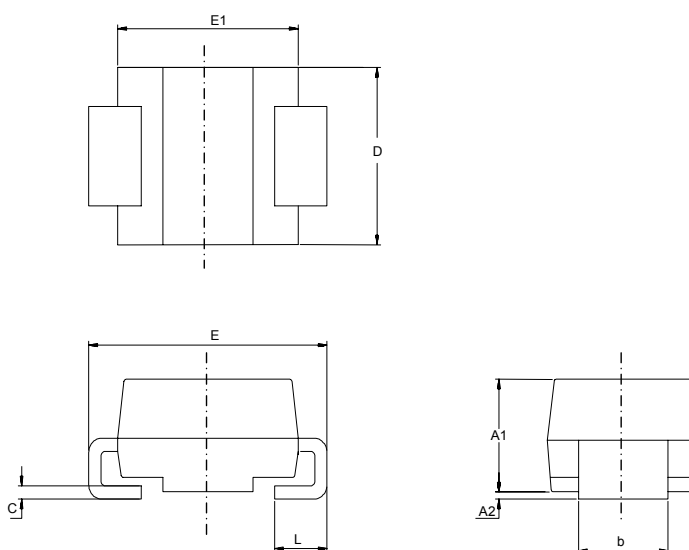


## 2 Package information

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.

### 2.1 SMB package information

**Figure 13. SMB package outline**



**Table 3. SMB package mechanical data**

| Ref. | Dimensions  |      |                       |        |
|------|-------------|------|-----------------------|--------|
|      | Millimeters |      | Inches <sup>(1)</sup> |        |
|      | 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 |

1. Values in inches are converted from mm

Figure 14. SMB recommended footprint

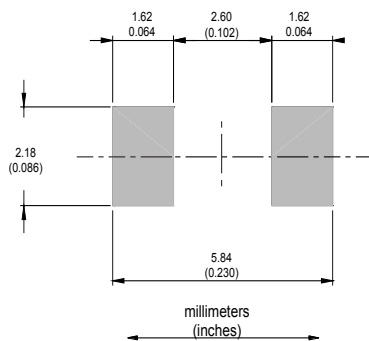


Figure 15. Marking layout

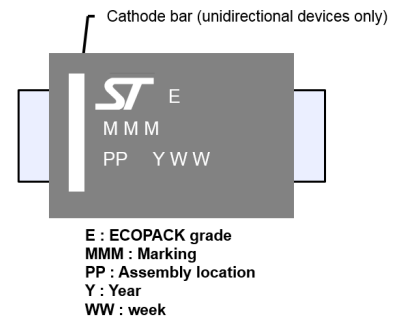
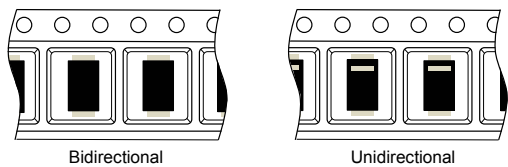


Figure 16. Package orientation in reel



Taped according to EIA-481  
Pocket dimensions are not on scale.  
Pocket shape may vary depending on package  
On bidirectional devices, marking and logo may not be always in the same direction.

Figure 17. Tape and reel orientation

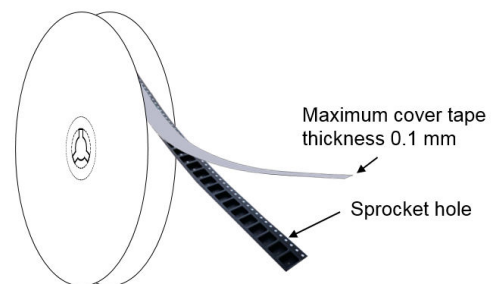


Figure 18. 13" reel dimensions (mm)

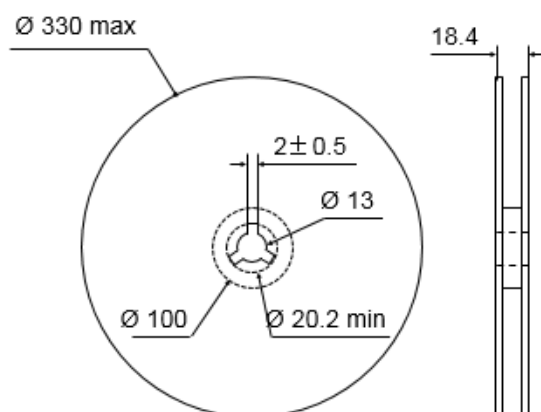
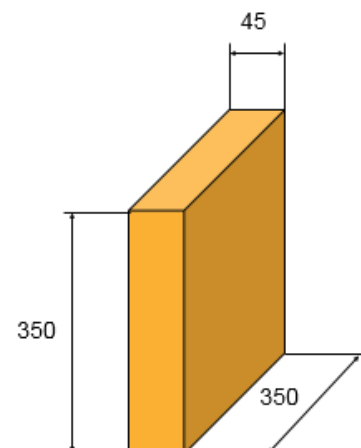
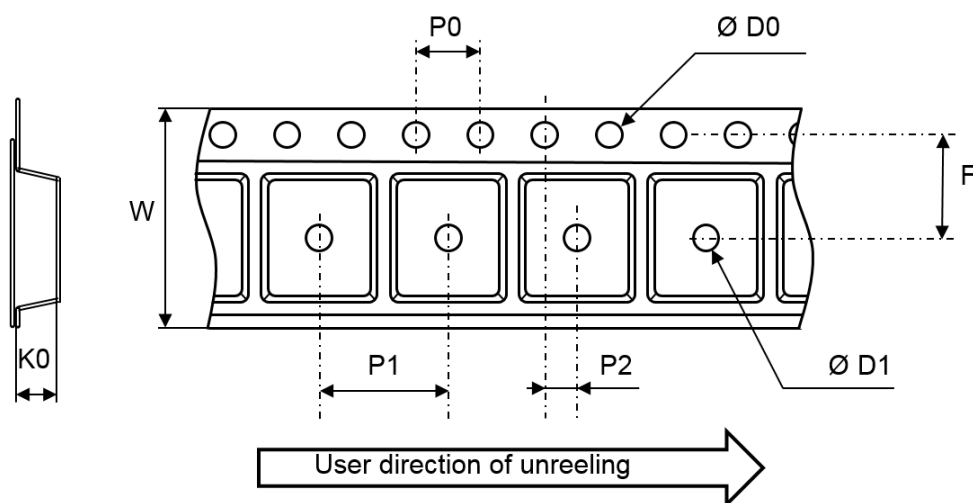


Figure 19. Inner box dimensions (mm)



**Figure 20. Tape and reel outline**


Note: Pocket dimensions are not on scale  
 Pocket shape may vary depending on package

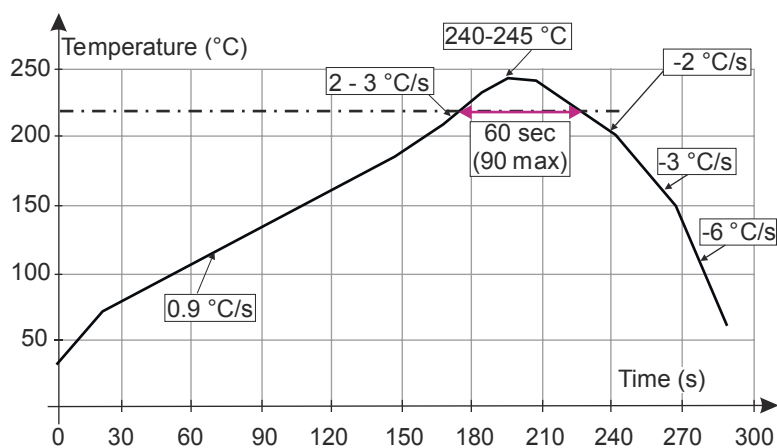
**Table 4. Tape and reel mechanical data**

| Ref.             | Dimensions  |      |      |
|------------------|-------------|------|------|
|                  | Millimeters |      |      |
|                  | Min.        | Typ. | Max. |
| $\varnothing D0$ | 1.5         | 1.55 | 1.6  |
| $\varnothing D1$ | 1.5         |      |      |
| F                | 5.4         | 5.5  | 5.6  |
| K0               | 2.64        | 2.74 | 2.84 |
| P0               | 3.9         | 4.0  | 4.1  |
| P1               | 7.9         | 8.0  | 8.1  |
| P2               | 1.9         | 2.0  | 2.1  |
| W                | 11.7        | 12.0 | 12.3 |



## 2.2 Reflow profile

Figure 21. ST ECOPACK recommended soldering reflow profile for PCB mounting



**Note:** Minimize air convection currents in the reflow oven to avoid component movement. Maximum soldering profile corresponds to the latest IPC/JEDEC J-STD-020.

### 3 Ordering information

**Table 5. Ordering information**

| Order code                  | Marking              | Package | Weight | Base qty. | Delivery mode |
|-----------------------------|----------------------|---------|--------|-----------|---------------|
| SM6TxxA / CA <sup>(1)</sup> | See Table 6. Marking | SMB     | 0.11 g | 2500      | Tape and reel |

1. Where xx is nominal value of  $V_{BR}$  and A or CA indicates unidirectional or bidirectional version.

**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      |

## Revision history

**Table 7. Document revision history**

| Date        | Version | Changes                                                                                                                                                            |
|-------------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Aug-2001    | 4       | Previous update.                                                                                                                                                   |
| 15-Sep-2004 | 5       | 1. Types table parameters on page 2: IRM @ T <sub>j</sub> = 85 °C condition added 2. IRM 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 Table 3: "Electrical characteristics parameter values (T <sub>amb</sub> = 25 °C, unless otherwise specified)".                                             |
| 03-Sep-2020 | 11      | Updated Section 1.1 Characteristics (curves).                                                                                                                      |
| 11-Sep-2020 | 12      | Minor text change.                                                                                                                                                 |
| 02-Jun-2021 | 13      | Updated <i>Figure 12</i> .                                                                                                                                         |
| 24-Sep-2024 | 14      | Updated <a href="#">Figure 3</a> , and <a href="#">Figure 9</a> .<br>Minor text changes.                                                                           |

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