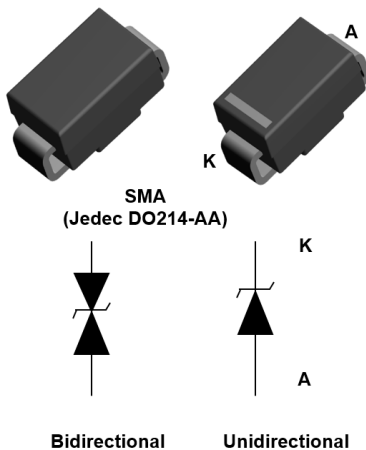



## Automotive 600 W TVS in SMA



## Features

- AEC-Q101 qualified 
- Peak pulse power:
  - 600 W (10/1000  $\mu$ s) and 4 kW (8/20  $\mu$ s)
- Stand-off voltage range: from 5 V to 70 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
- JEDEC registered package outline
- 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
- JESD-201 class 2 whisker test
- IPC7531 footprint and JEDEC registered package outline
- IEC 61000-4-4 level 4
  - 4 k V
- ISO 10605, IEC 61000-4-2, C = 150 pF, R = 330  $\Omega$  exceeds level 4:
  - 30 kV (air discharge)
  - 30 kV (contact discharge)
- ISO 10605, C = 330 pF, R = 330  $\Omega$  exceeds level 4:
  - 30 kV (air discharge)
  - 30 kV (contact discharge)
- ISO 7637-2 (not applicable to parts with  $V_{RM}$  lower than battery voltage)
  - Pulse 1:  $V_S = -150$  V
  - Pulse 2a:  $V_S = +112$  V
  - Pulse 3a:  $V_S = -220$  V
  - Pulse3b:  $V_S = +150$  V

## Description

The SMA6TY Transil series has been designed to protect sensitive automotive circuits against surges defined in ISO 7637-2 and against electrostatic discharges according to ISO 10605.

The planar technology makes this device compatible with high-end circuits where low leakage current and high junction temperature are required to provide reliability and stability over time. SMA6TY are packaged in SMA.

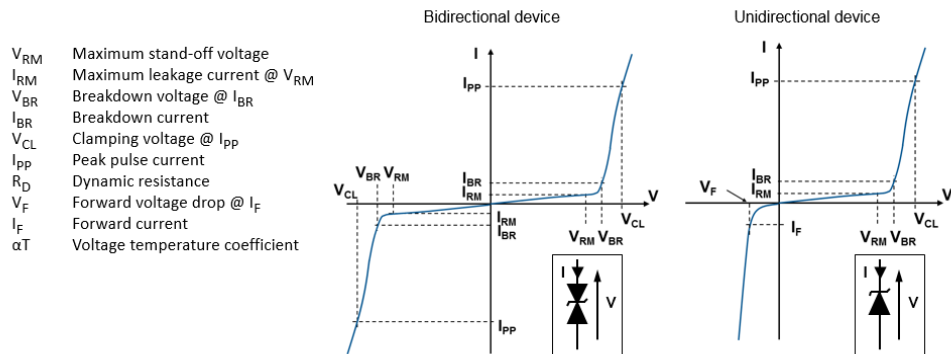
| Product status link |   |
|---------------------|---|
| SMA6TY              | SMA6T6V7AY,<br>SMA6T6V7CAY,<br>SMA6T7V6AY,<br>SMA6T7V6CAY,<br>SMA6T10AY, SMA6T10CAY,<br>SMA6T12AY, SMA6T12CAY,<br>SMA6T14AY, SMA6T14CAY,<br>SMA6T15AY, SMA6T15CAY,<br>SMA6T18AY, SMA6T18CAY,<br>SMA6T22AY, SMA6T22CAY,<br>SMA6T24AY, SMA6T24CAY,<br>SMA6T28AY, SMA6T28CAY,<br>SMA6T30AY, SMA6T30CAY,<br>SMA6T33AY, SMA6T33CAY,<br>SMA6T36AY, SMA6T36CAY,<br>SMA6T39AY, SMA6T39CAY,<br>SMA6T47AY, SMA6T47CAY,<br>SMA6T56AY, SMA6T56CAY,<br>SMA6T68AY, SMA6T68CAY,<br>SMA6T82AY, SMA6T82CAY |

# 1 Characteristics

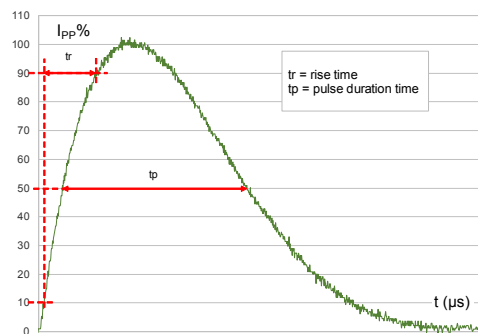
**Table 1. Absolute maximum ratings ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )**

| Symbol            | Parameter  |   | Value       | Unit               |
|-------------------|--|---|-------------|--------------------|
| $V_{PP}$          | Peak pulse voltage                                 | ISO10605 (C = 330 pF, R = 330 $\Omega$ ):                 |             |                    |
|                   |  | Contact discharge   | 30          | kV                 |
|                   |  | Air discharge   | 30          |                    |
|                   |  | ISO10605 / IEC 61000-4-2 (C = 150 pF, R = 330 $\Omega$ ): |             |                    |
| Contact discharge | 30   |   |             |                    |
|                   | Air discharge                                      | 30  |             |                    |
| $P_{PP}$          | Peak pulse power dissipation                       | 10/1000 $\mu\text{s}$ , $T_j$ initial = $T_{amb}$         | 600         | W                  |
| $T_j$             | Operating junction temperature range               |   | -55 to +150 | $^{\circ}\text{C}$ |
| $T_{stg}$         | Storage temperature range                          |   | -65 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 (T<sub>amb</sub> = 25 °C, unless otherwise specified)**

| Order code     | I <sub>RM</sub> max at V <sub>RM</sub> |       |      | V <sub>BR</sub> at I <sub>BR</sub> |      |      |      | 10 / 1000 μs                   |                                |                | 8 / 20μs                       |                                |                | αT <sup>(1)</sup>    |
|----------------|--|-------|------|------------------------------------|------|------|------|--------------------------------|--------------------------------|----------------|--------------------------------|--------------------------------|----------------|----------------------|
|                | 25 °C                                  | 85 °C |      | Min.                               | Typ. | Max. |      | V <sub>CL</sub> <sup>(2)</sup> | I <sub>PP</sub> <sup>(3)</sup> | R <sub>D</sub> | V <sub>CL</sub> <sup>(2)</sup> | I <sub>PP</sub> <sup>(3)</sup> | R <sub>D</sub> |                      |
|                | μA                                     |       | V    | V                                  |      |      | mA   | V                              | A                              | Ω              | V                              | A                              | Ω              | 10 <sup>-4</sup> /°C |
|                | Max.                                   |       | Max. | Max.                               |      | Max. | Max. |                                | Max.                           | Max.           |                                | Max.                           |                |                      |
| SMA6T6V7AY/CAY | 20                                     | 50    | 5.00 | 6.40                               | 6.70 | 7.10 | 10   | 9.10                           | 68.0                           | 0.029          | 14.4                           | 275                            | 0.027          | 5.7                  |
| SMA6T7V6AY/CAY | 20                                     | 50    | 6.50 | 7.20                               | 7.60 | 8.0  | 10   | 10.2                           | 56.0                           | 0.040          | 15.2                           | 266                            | 0.027          | 6.1                  |
| SMA6T10AY/CAY  | 20                                     | 50    | 8.60 | 9.50                               | 10.0 | 10.5 | 1    | 14.5                           | 41.0                           | 0.098          | 18.6                           | 215                            | 0.038          | 7.3                  |
| SMA6T12AY/CAY  | 0.2                                    | 1     | 10.2 | 11.4                               | 12.0 | 12.6 | 1    | 16.7                           | 36.0                           | 0.114          | 21.7                           | 184                            | 0.049          | 7.8                  |
| SMA6T14AY/CAY  | 0.2                                    | 1     | 12.0 | 13.3                               | 14.0 | 14.7 | 1    | 18.8                           | 31.0                           | 0.133          | 23.5                           | 157                            | 0.056          | 8.3                  |
| SMA6T15AY/CAY  | 0.2                                    | 1     | 12.8 | 14.3                               | 15.0 | 15.8 | 1    | 21.2                           | 28.0                           | 0.193          | 27.2                           | 147                            | 0.078          | 8.4                  |
| SMA6T18AY/CAY  | 0.2                                    | 1     | 15.3 | 17.1                               | 18.0 | 18.9 | 1    | 25.2                           | 24.0                           | 0.263          | 32.3                           | 123                            | 0.111          | 8.8                  |
| SMA6T22AY/CAY  | 0.2                                    | 1     | 18.8 | 20.9                               | 22.0 | 23.1 | 1    | 30.6                           | 20.0                           | 0.375          | 39.3                           | 102                            | 0.159          | 9.2                  |
| SMA6T24AY/CAY  | 0.2                                    | 1     | 20.5 | 22.8                               | 24.0 | 25.2 | 1    | 33.2                           | 18.0                           | 0.444          | 42.8                           | 93.0                           | 0.189          | 9.4                  |
| SMA6T28AY/CAY  | 0.2                                    | 1     | 24.0 | 26.7                               | 28.1 | 29.5 | 1    | 37.8                           | 16.0                           | 0.516          | 44.3                           | 80.0                           | 0.184          | 9.6                  |
| SMA6T30AY/CAY  | 0.2                                    | 1     | 25.6 | 28.5                               | 30.0 | 31.5 | 1    | 41.5                           | 14.5                           | 0.690          | 53.5                           | 75.0                           | 0.293          | 9.7                  |
| SMA6T33AY/CAY  | 0.2                                    | 1     | 28.2 | 31.4                               | 33.0 | 34.7 | 1    | 45.7                           | 13.1                           | 0.840          | 59.0                           | 68.0                           | 0.357          | 9.8                  |
| SMA6T36AY/CAY  | 0.2                                    | 1     | 30.8 | 34.2                               | 36.0 | 37.8 | 1    | 49.9                           | 12.0                           | 1.06           | 64.3                           | 62.0                           | 0.437          | 9.9                  |
| SMA6T39AY/CAY  | 0.2                                    | 1     | 33.3 | 37.1                               | 39.0 | 41.0 | 1    | 53.9                           | 11.1                           | 1.16           | 69.7                           | 57.0                           | 0.504          | 10.0                 |
| SMA6T47AY/CAY  | 0.2                                    | 1     | 40.0 | 44.4                               | 46.7 | 49.1 | 1    | 62.8                           | 9.70                           | 1.42           | 73.6                           | 48.0                           | 0.511          | 10.1                 |
| SMA6T56AY/CAY  | 0.2                                    | 1     | 47.6 | 53.2                               | 56.0 | 58.8 | 1    | 76.6                           | 7.80                           | 2.28           | 100                            | 40.0                           | 1.030          | 10.0                 |
| SMA6T68AY/CAY  | 0.2                                    | 1     | 58.1 | 64.6                               | 68.0 | 71.4 | 1    | 92.0                           | 6.50                           | 3.17           | 121                            | 33.0                           | 1.50           | 10.4                 |
| SMA6T82AY/CAY  | 0.2                                    | 1     | 70.0 | 77.8                               | 81.9 | 86.0 | 1    | 110                            | 5.50                           | 4.38           | 146                            | 27.0                           | 2.22           | 10.5                 |

1. To calculate V<sub>BR</sub> or V<sub>CL</sub> versus junction temperature, use the following formulas:

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

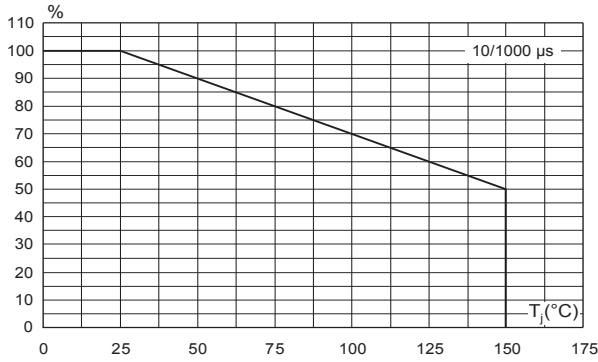
2. To calculate maximum clamping voltage at other surge level, use the following formula:

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

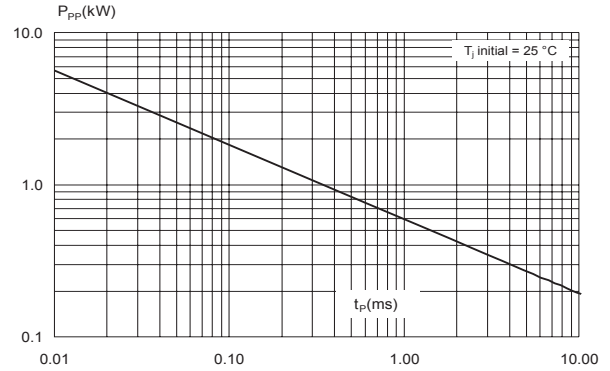
3. Surge capability given for both directions for unidirectional and bidirectional types.

## 1.1 Characteristics (curves)

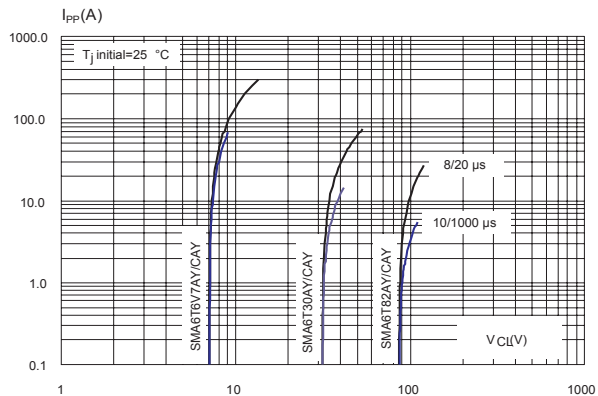
**Figure 3. Relative variation of peak power versus initial junction temperature**



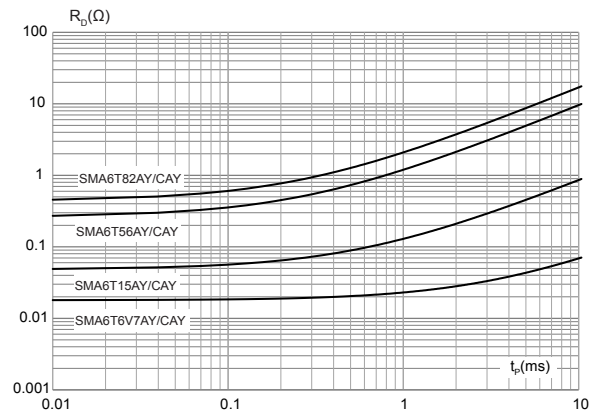
**Figure 4. Maximum peak pulse power versus exponential pulse duration**



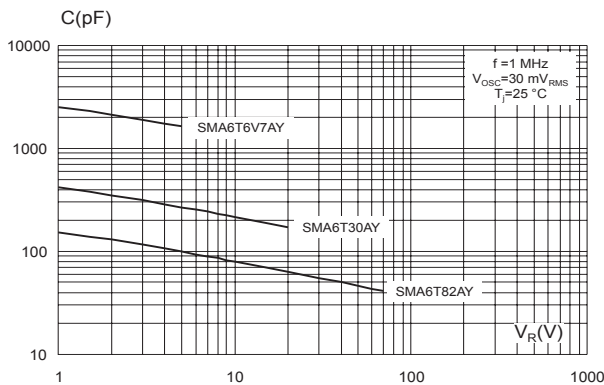
**Figure 5. Maximum clamping voltage versus peak pulse current exponential waveform**



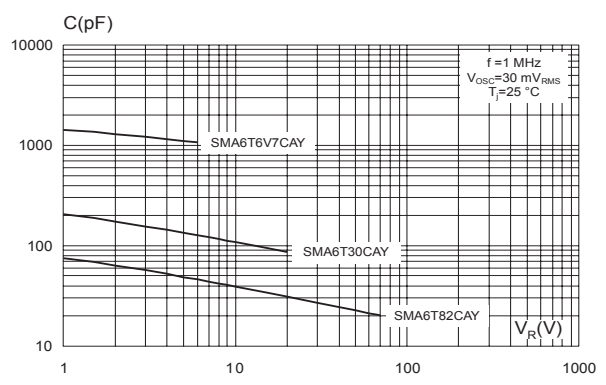
**Figure 6. Dynamic resistance versus pulse duration**



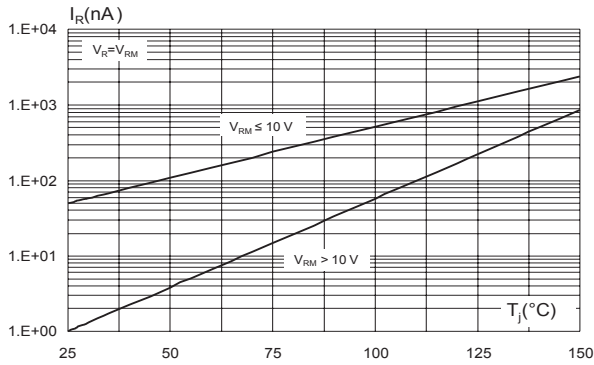
**Figure 7. Junction capacitance versus reverse applied voltage for unidirectional types**



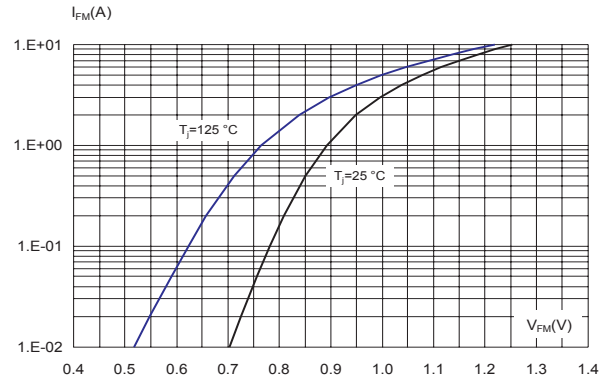
**Figure 8. Junction capacitance versus reverse applied voltage for bidirectional types**



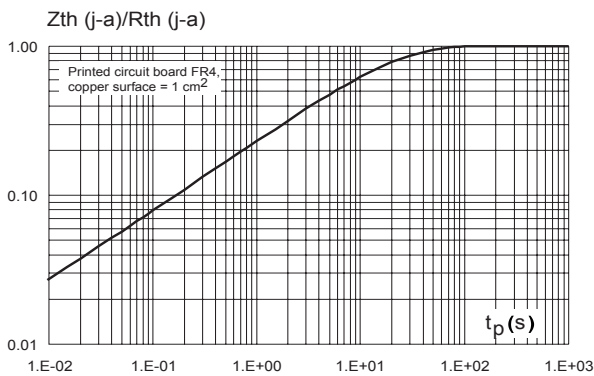
**Figure 9. Leakage current versus junction temperature**



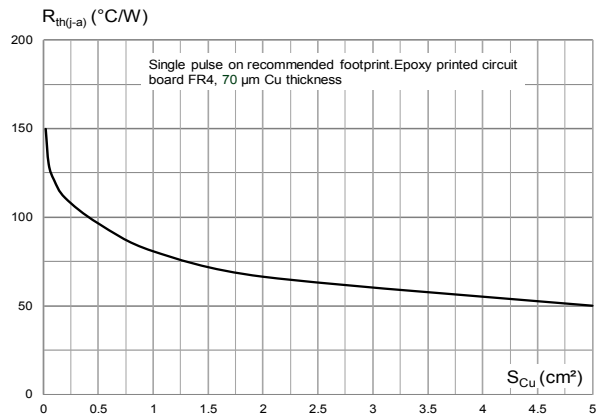
**Figure 10. Peak forward voltage drop versus peak forward current**



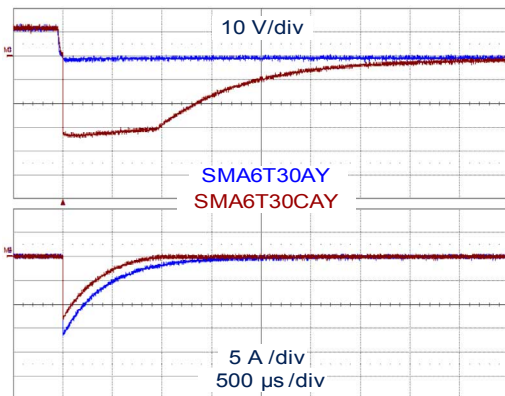
**Figure 11. Relative variation of thermal impedance, junction to ambient, versus pulse duration**



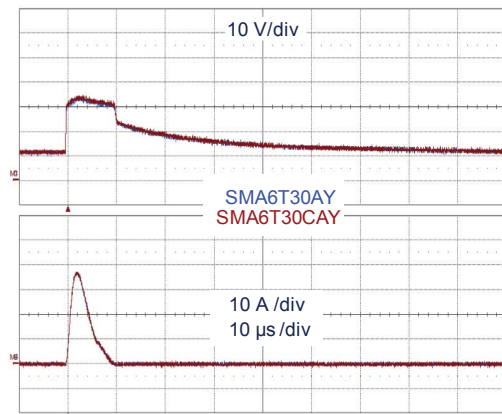
**Figure 12. Thermal resistance junction to ambient versus copper surface under each lead**



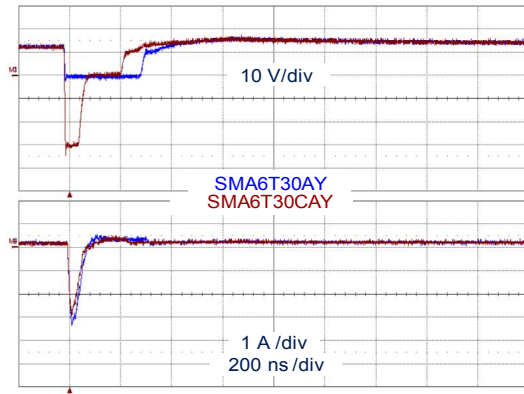
**Figure 13. ISO7637-2 pulse 1: Vs = -150 V with 12 V battery**



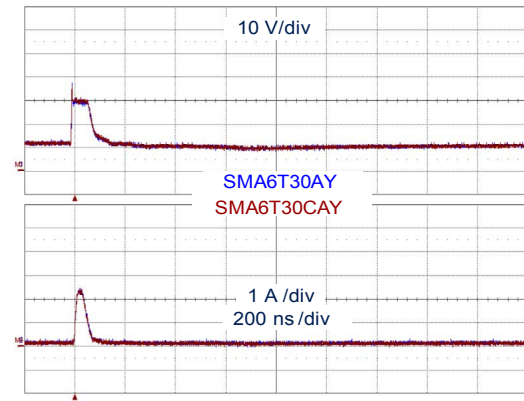
**Figure 14. ISO7637-2 pulse 2a: Vs = +112 V with 12 V battery**



**Figure 15. ISO7637-2 pulse 3a:  $V_s = -220\text{ V}$  with 12 V battery**



**Figure 16. ISO7637-2 pulse 3b:  $V_s = +150\text{ V}$  with 12 V battery**



## 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.

### 2.1 SMA package information

Figure 17. SMA package outline

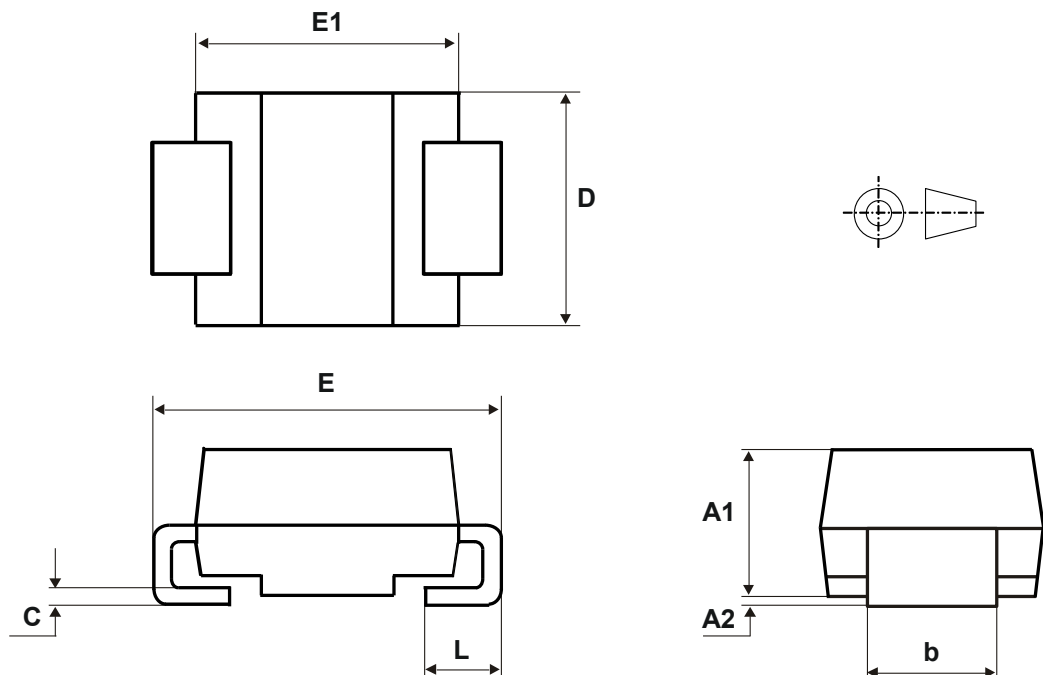
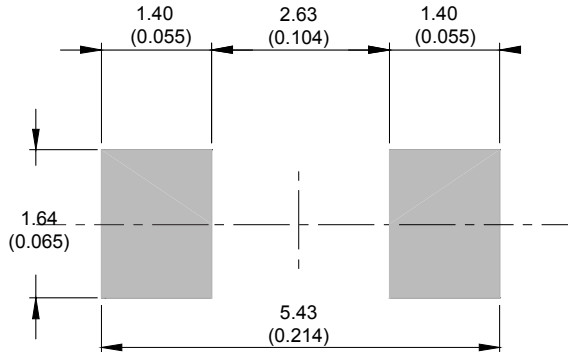


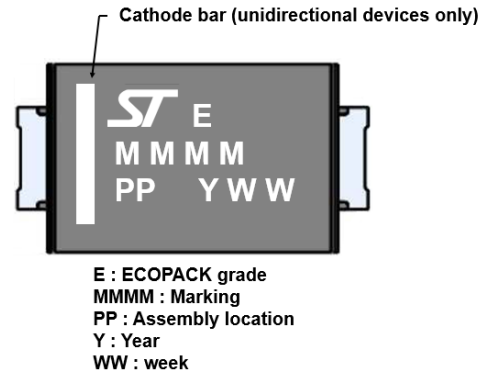
Table 3. SMA package mechanical data

| Ref. | Dimensions  |      |        |       |
|------|-------------|------|--------|-------|
|      | Millimeters |      | Inches |       |
|      | Min.        | Max. | Min.   | Max.  |
| A1   | 1.90        | 2.45 | 0.074  | 0.097 |
| A2   | 0.05        | 0.20 | 0.001  | 0.008 |
| b    | 1.25        | 1.65 | 0.049  | 0.065 |
| c    | 0.15        | 0.40 | 0.005  | 0.016 |
| D    | 2.25        | 2.90 | 0.088  | 0.115 |
| E    | 4.80        | 5.35 | 0.188  | 0.211 |
| E1   | 3.95        | 4.60 | 0.155  | 0.182 |
| L    | 0.75        | 1.50 | 0.029  | 0.060 |

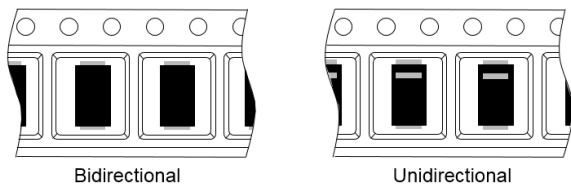
**Figure 18. SMA recommended footprint in mm (inches)**



**Figure 19. SMA marking**

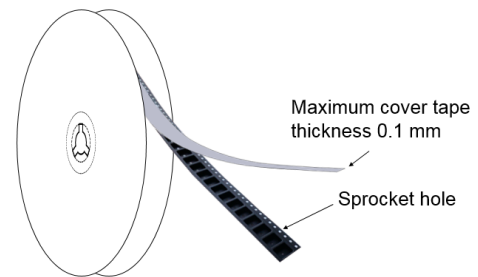


**Figure 20. Package orientation in reel**

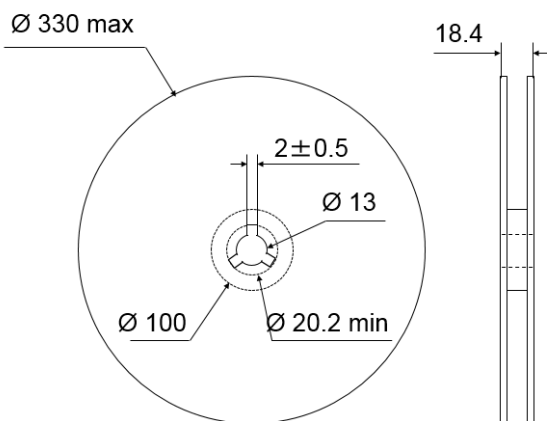


Taped according to EIA-481  
Pocket dimensions are not on scale.  
Pocket shape may vary depending on package  
On bidirectional devices, marking and logo may not be always in the same direction.

**Figure 21. Tape and reel orientation**



**Figure 22. 13" reel dimension values**



**Figure 23. Inner box dimension values**

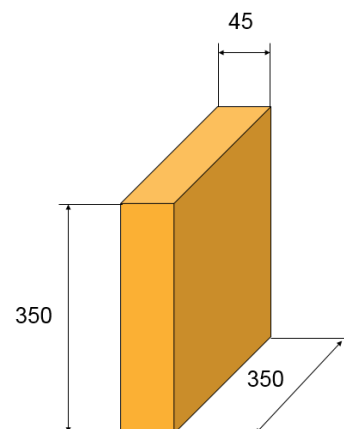
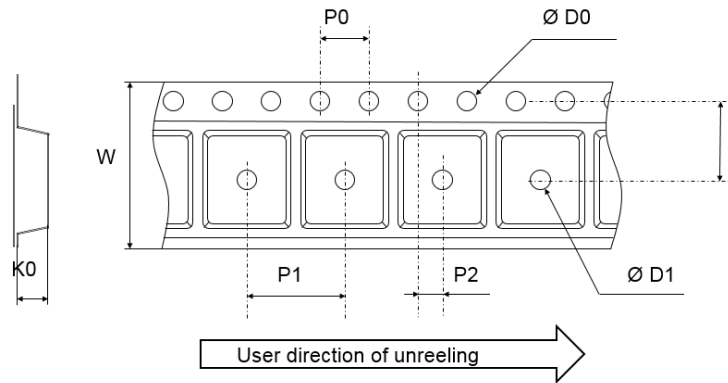




Figure 24. Tape outline



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

Table 4. Tape dimension values

| Ref. | Dimensions  |       |       |
|------|-------------|-------|-------|
|      | Millimeters |       |       |
|      | Min.        | Typ.  | Max.  |
| D0   | 1.40        | 1.50  | 1.60  |
| D1   | 1.50        |       |       |
| F    | 5.40        | 5.50  | 5.60  |
| K0   | 2.26        | 2.36  | 2.46  |
| P0   | 3.90        | 4.00  | 4.10  |
| P1   | 3.90        | 4.00  | 4.10  |
| P2   | 1.95        | 2.00  | 2.05  |
| W    | 11.70       | 12.00 | 12.30 |

### 3 Ordering information

Figure 25. Ordering information scheme

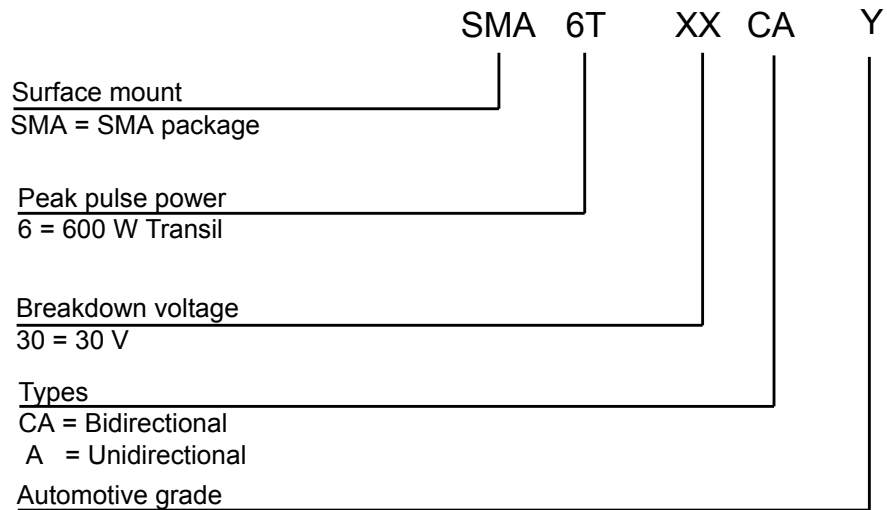


Table 5. Ordering information

| Order code                   | Marking      | Package | Weight  | Base qty. | Delivery mode |
|------------------------------|--------------|---------|---------|-----------|---------------|
| SMA6TxxxAY/CAY (see Table 2) | See Table 6. | SMA     | 0.072 g | 5000      | Tape and reel |

**Table 6. Marking**

| Order code | Marking | Order code  | Marking |
|------------|---------|-------------|---------|
| SMA6T6V7AY | 6UAY    | SMA6T6V7CAY | 6BAY    |
| SMA6T7V6AY | 6UCY    | SMA6T7V6CAY | 6BCY    |
| SMA6T10AY  | 6UDY    | SMA6T10CAY  | 6BDY    |
| SMA6T12AY  | 6UEY    | SMA6T12CAY  | 6BEY    |
| SMA6T14AY  | 6UFY    | SMA6T14CAY  | 6BFY    |
| SMA6T15AY  | 6UGY    | SMA6T15CAY  | 6BGY    |
| SMA6T18AY  | 6UHY    | SMA6T18CAY  | 6BHY    |
| SMA6T22AY  | 6UJY    | SMA6T22CAY  | 6BJY    |
| SMA6T24AY  | 6UKY    | SMA6T24CAY  | 6BKY    |
| SMA6T28AY  | 6UMY    | SMA6T28CAY  | 6BMY    |
| SMA6T30AY  | 6UNY    | SMA6T30CAY  | 6BNY    |
| SMA6T33AY  | 6UOY    | SMA6T33CAY  | 6BOY    |
| SMA6T36AY  | 6UPY    | SMA6T36CAY  | 6BPY    |
| SMA6T39AY  | 6UQY    | SMA6T39CAY  | 6BQY    |
| SMA6T47AY  | 6URY    | SMA6T47CAY  | 6BRY    |
| SMA6T56AY  | 6USY    | SMA6T56CAY  | 6BSY    |
| SMA6T68AY  | 6UTY    | SMA6T68CAY  | 6BTY    |
| SMA6T82AY  | 6UUY    | SMA6T82CAY  | 6BUY    |

## Revision history

**Table 7. Document revision history**

| Date        | Revision | Changes  |
|-------------|----------|--|
| 15-Sep-2010 | 1        | Initial release.   |
| 18-Oct-2011 | 2        | Deleted old Table 2. Thermal parameter. Updated Table 2 and added order codes in Table 4. Updated Figure 5, Figure 10 and Figure 11. |
| 27-Mar-2012 | 3        | Added footnote on page 1.  |
| 25-Jan-2018 | 4        | Updated Table 2. Electrical characteristics ( $T_{amb} = 25\text{ °C}$ , unless otherwise specified).                                |
| 07-Dec-2018 | 5        | Updated Table 5. Ordering information.   |
| 04-Sep-2020 | 6        | Updated Table 2, Figure 7, Figure 8 and Table 6. Added Figure 6.   |
| 26-Oct-2020 | 7        | Updated Table 2.   |
| 28-Oct-2020 | 8        | Updated product status link.   |

**IMPORTANT NOTICE – PLEASE READ CAREFULLY**

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, please refer to [www.st.com/trademarks](http://www.st.com/trademarks). All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2020 STMicroelectronics – All rights reserved