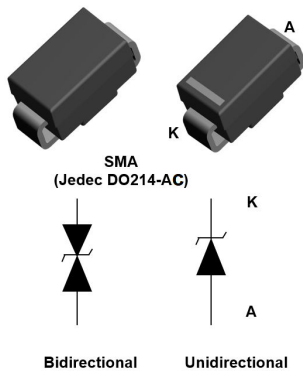


## Automotive 600 W TVS in SMA



### 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.

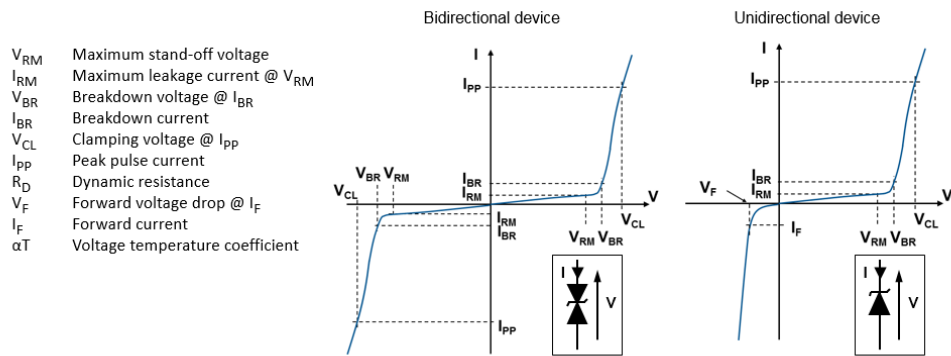
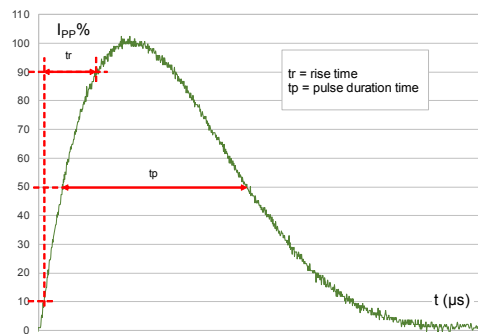
The planar technology makes this device compatible with high-end circuits where low leakage current and high junction temperature are required to provide reliability and stability over time. SMA6TY are packaged in SMA.

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

# 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 ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)**

| Order code     | $I_{RM}$ max at $V_{RM}$ |                       |      | $V_{BR}$ at $I_{BR}$ |      |      |    | 10 / 1000 $\mu\text{s}$ |                |          | 8 / 20 $\mu\text{s}$ |                |          | $\alpha T^{(1)}$           |
|----------------|--------------------------|-----------------------|------|----------------------|------|------|----|-------------------------|----------------|----------|----------------------|----------------|----------|----------------------------|
|                |                          |                       |      |                      |      |      |    | $V_{CL}^{(2)}$          | $I_{PP}^{(3)}$ | $R_D$    | $V_{CL}^{(2)}$       | $I_{PP}^{(3)}$ | $R_D$    |                            |
|                | 25 $^{\circ}\text{C}$    | 85 $^{\circ}\text{C}$ |      | Min.                 | Typ. | Max. |    | Max.                    |                | Max.     | Max.                 |                | Max.     | Max.                       |
|                | $\mu\text{A}$            |                       | V    | V                    |      |      | mA | V                       | A              | $\Omega$ | V                    | A              | $\Omega$ | $10^{-4}/^{\circ}\text{C}$ |
| 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  $V_{BR}$  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  $25\text{ }^{\circ}\text{C} \times (1 + \alpha T \times (T_J - 25))$

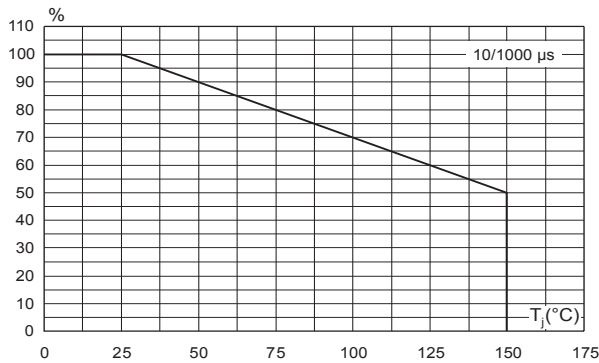
2. To calculate maximum clamping voltage at other surge level, use the following formula:

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

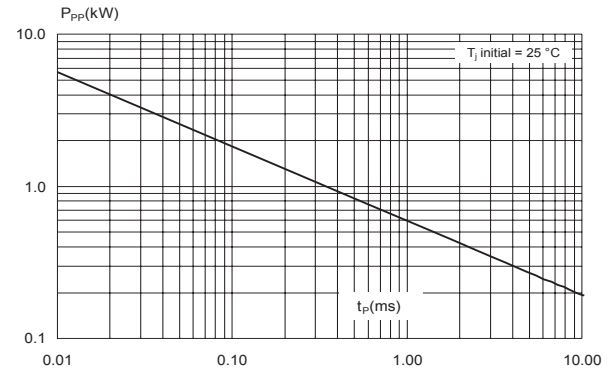
3. Surge capability given for both directions for unidirectional and bidirectional types.

## 1.1 Characteristics (curves)

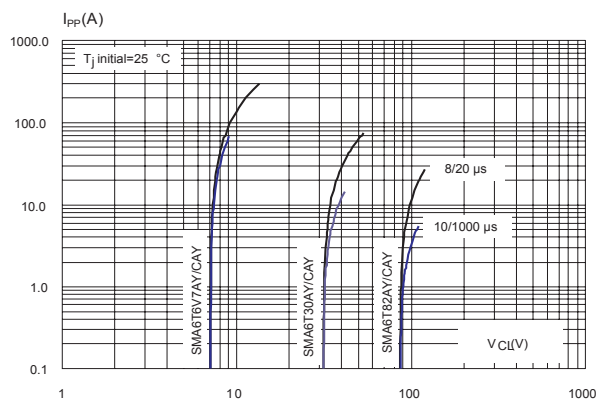
**Figure 3. Relative variation of peak power versus initial junction temperature**



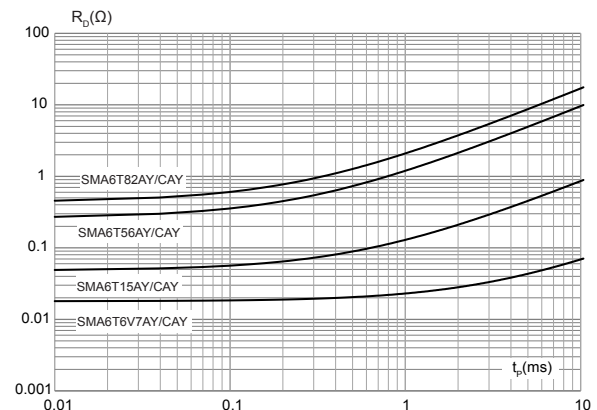
**Figure 4. Maximum peak pulse power versus exponential pulse duration**



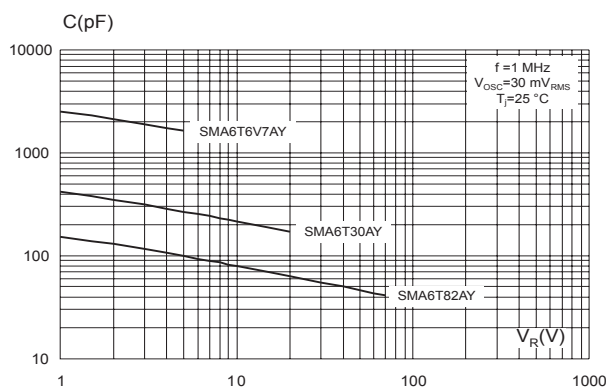
**Figure 5. Maximum clamping voltage versus peak pulse current exponential waveform**



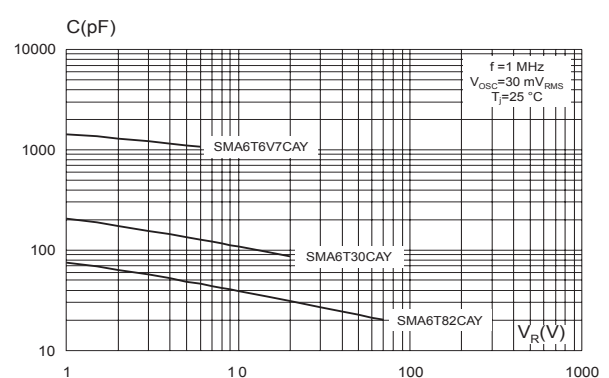
**Figure 6. Dynamic resistance versus pulse duration**



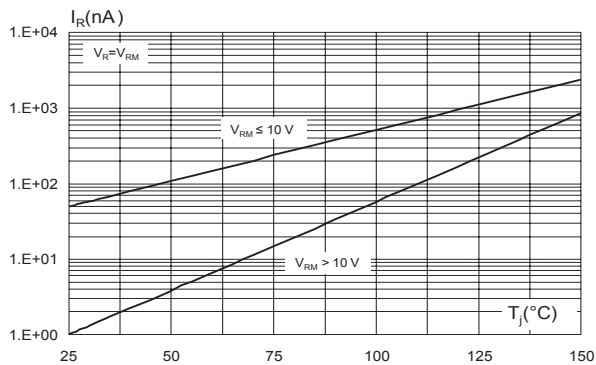
**Figure 7. Junction capacitance versus reverse applied voltage for unidirectional types**



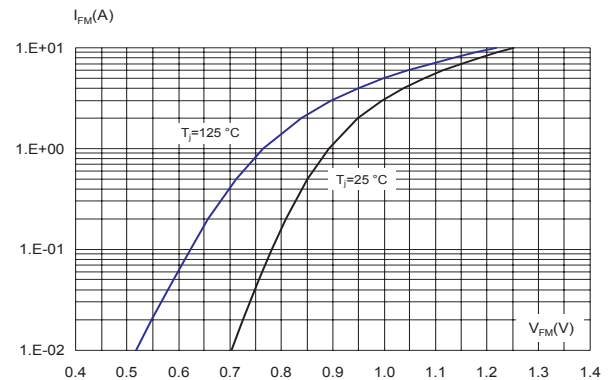
**Figure 8. Junction capacitance versus reverse applied voltage for bidirectional types**



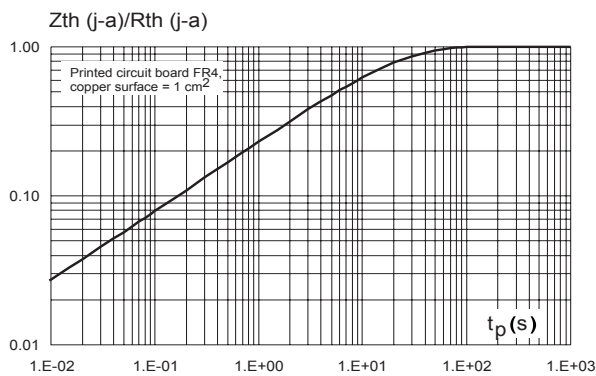
**Figure 9. Leakage current versus junction temperature**



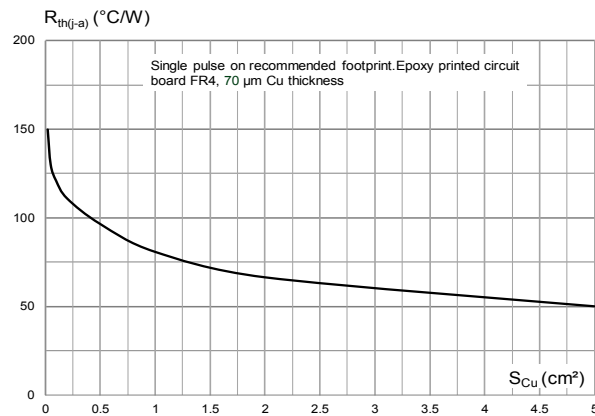
**Figure 10. Peak forward voltage drop versus peak forward current**



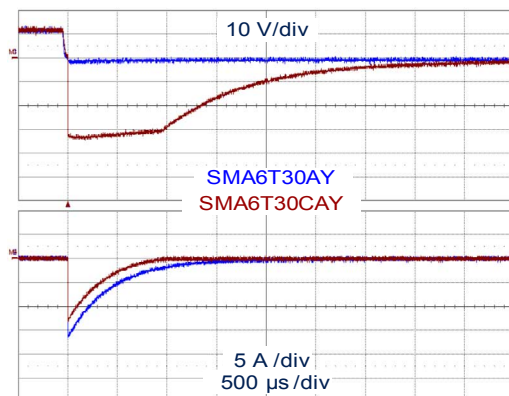
**Figure 11. Relative variation of thermal impedance, junction to ambient, versus pulse duration**



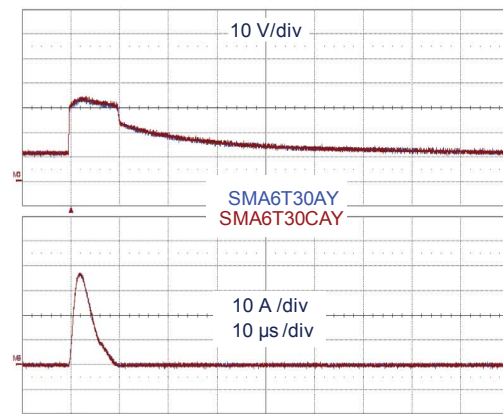
**Figure 12. Thermal resistance junction to ambient versus copper surface under each lead**



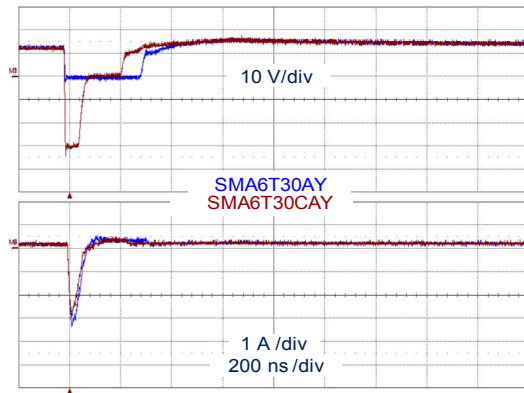
**Figure 13. ISO7637-2 pulse 1: V\_s = -150 V with 12 V battery**



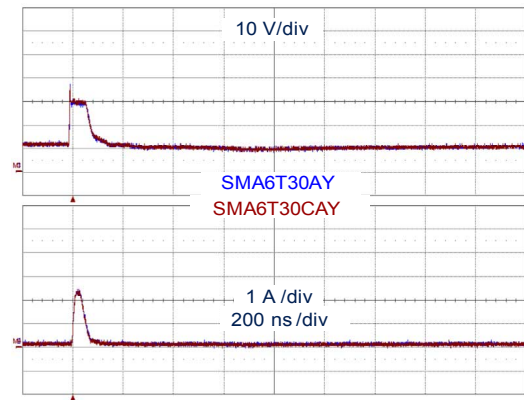
**Figure 14. ISO7637-2 pulse 2a: V\_s = +112 V with 12 V battery**



**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**

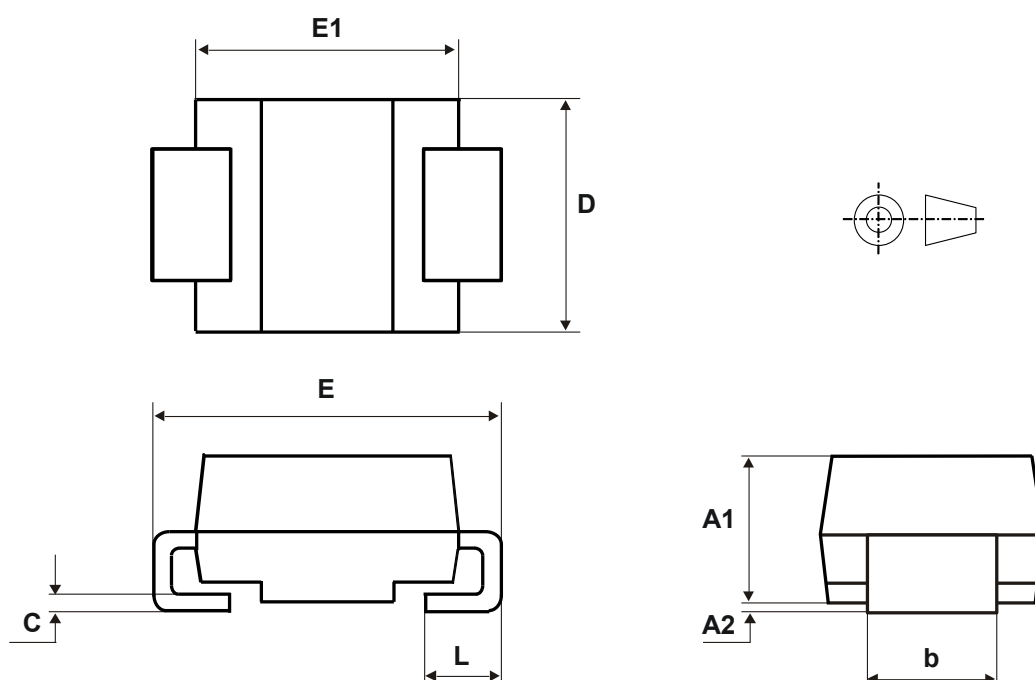


## 2 Package information

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

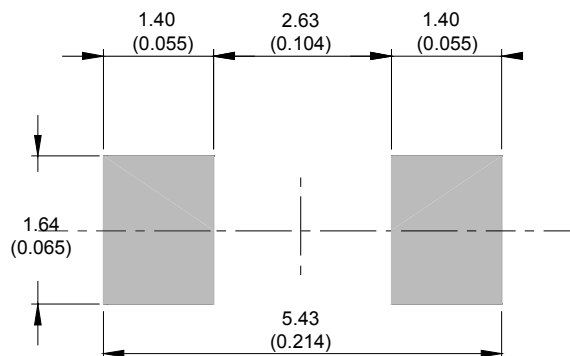
**Figure 17. SMA package outline**



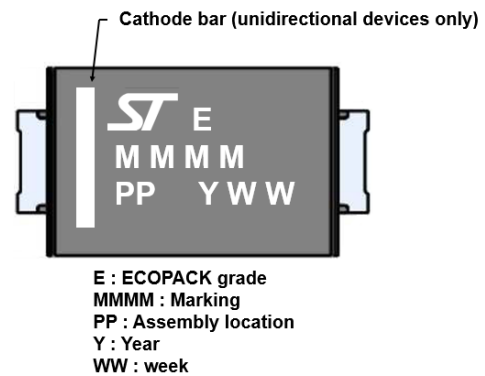
**Table 3. SMA package mechanical data**

| 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 |

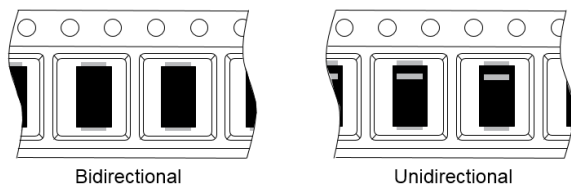
**Figure 18. SMA recommended footprint in mm (inches)**



**Figure 19. SMA marking**

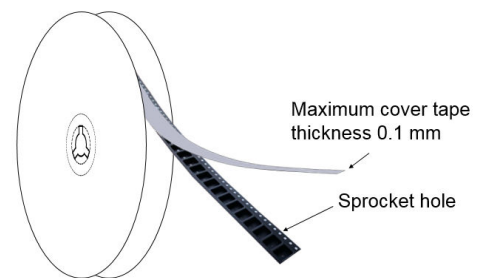


**Figure 20. Package orientation in reel**

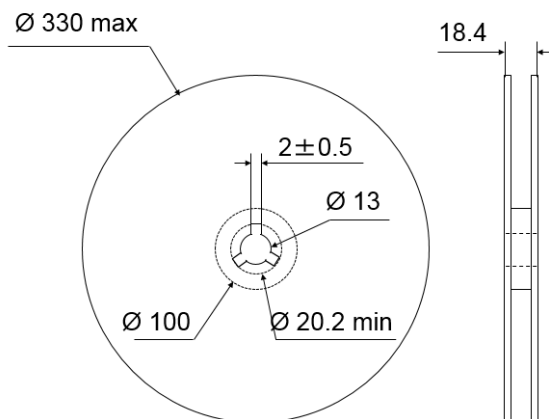


Taped according to EIA-481  
Pocket dimensions are not on scale.  
Pocket shape may vary depending on package  
On bidirectional devices, marking and logo may not be always in the same direction.

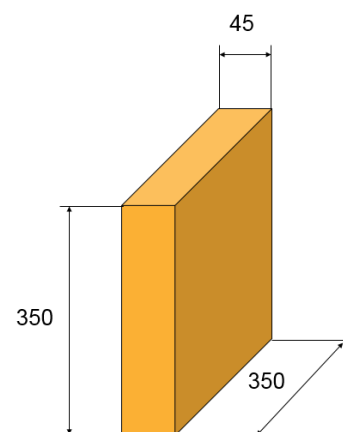
**Figure 21. Tape and reel orientation**



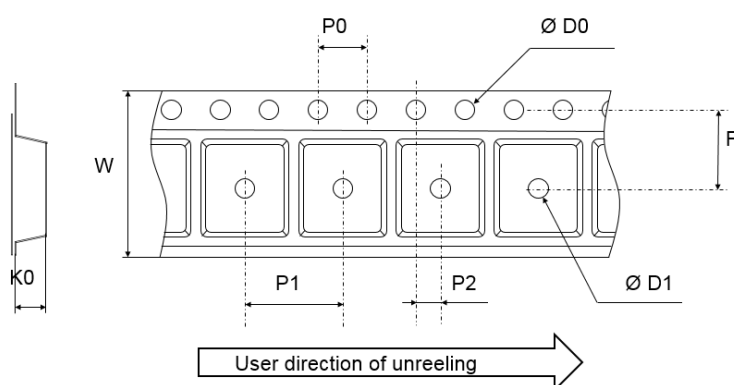
**Figure 22. 13" reel dimension values**



**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

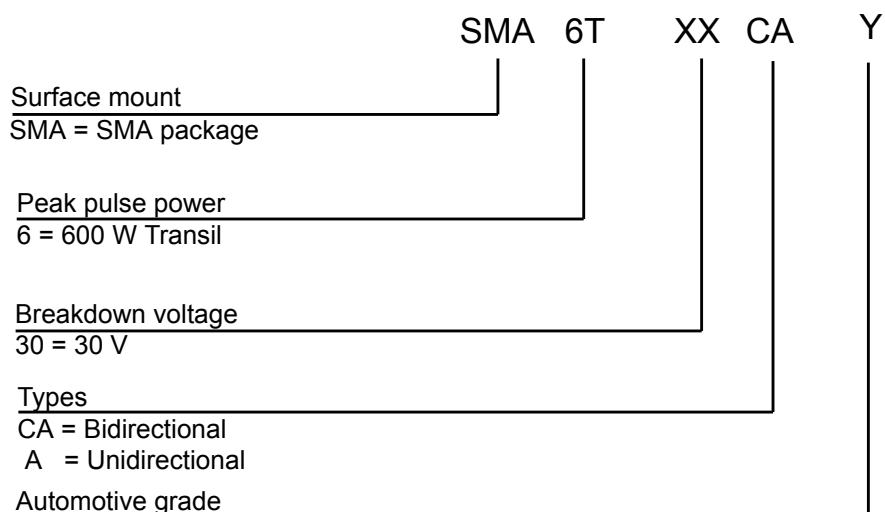


Table 5. Ordering information

| 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 <i>Table 2. Thermal parameter</i> . Updated <i>Table 2</i> and added order codes in <i>Table 4</i> . Updated <i>Figure 5</i> , <i>Figure 10</i> and <i>Figure 11</i> . |
| 27-Mar-2012 | 3        | Added footnote on page 1.                                                                                                                                                          |
| 25-Jan-2018 | 4        | Updated <i>Table 2. Electrical characteristics (Tamb = 25 °C, unless otherwise specified)</i> .                                                                                    |
| 07-Dec-2018 | 5        | Updated <i>Table 5. Ordering information</i> .                                                                                                                                     |
| 04-Sep-2020 | 6        | Updated <i>Table 2</i> , <i>Figure 7</i> , <i>Figure 8</i> and <i>Table 6</i> . Added <i>Figure 6</i> .                                                                            |
| 26-Oct-2020 | 7        | Updated <i>Table 2</i> .                                                                                                                                                           |
| 28-Oct-2020 | 8        | Updated product status link.                                                                                                                                                       |
| 03-Jul-2023 | 9        | Changed "Jedec DO214-AA" to "Jedec DO214-AC".                                                                                                                                      |

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