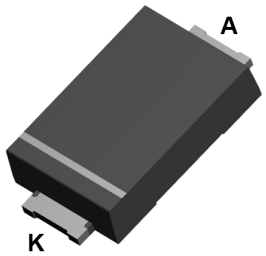
# THE DATASHEET OF

# SMA6F30AY

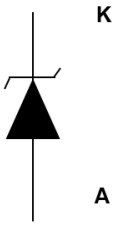
# SMA6FxxAY

Datasheet

## Automotive 600 W TVS in SMA Flat




**SMA Flat**
**(Jedec DO221-AC)**




**Unidirectional**

| Product status link | |
|---|---|
| SMA6FY | SMA6F5.0AY, SMA6F6.0AY, SMA6F6.5AY, SMA6F8.5AY, SMA6F10AY, SMA6F11AY, SMA6F12AY, SMA6F13AY, SMA6F14AY, SMA6F15AY, SMA6F16AY, SMA6F18AY, SMA6F20AY, SMA6F22AY, SMA6F23AY, SMA6F24AY, SMA6F26AY, SMA6F28AY, SMA6F30AY, SMA6F31AY, SMA6F33AY, SMA6F36AY, SMA6F40AY, SMA6F48AY, SMA6F58AY, SMA6F64AY, SMA6F70AY, SMA6F85AY, SMA6F100AY, SMA6F130AY, SMA6F154AY, SMA6F170AY, SMA6F188AY |

## Features

- AEC-Q101 qualified
- Peak pulse power: 600 W (10/1000 µs) and 4 kW (8/20 µs)
- Flat and thin package: 1 mm
- Stand-off voltage range from 5 V to 188 V
- Unidirectional type
- Low leakage current: 0.2 µA at 25 °C and 1 µA at 85 °C
- Operating $T_j$ max: 175 °C
- High power capability at $T_j$ max.: up to 400 W (10/1000 µs)
- 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 kV
- ISO10605, IEC 61000-4-2, C = 150 pF - R = 330 Ω exceeds level 4:
  - 30 kV (contact discharge)
  - 30 kV (air discharge)
- ISO10605, C = 330 pF, R = 330 Ω exceeds level 4:
  - 30 kV (contact discharge)
  - 30 kV (air discharge)
- ISO7637-2 (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
  - Pulse 3b: $V_S$ = +150 V

## Description

The SMA6FY Transil series are designed to protect sensitive automotive circuits against surges defined in ISO 7637 series and against electrostatic discharges according to ISO 10605.

The Planar technology makes it compatible with high-end circuits where low leakage current and high junction temperature are required to provide long term reliability and stability.

# 1 Characteristics

**Table 1. Absolute maximum ratings ($T_{amb}$ = 25 °C)**

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $V_{PP}$ | Peak pulse voltage | ISO10605 (C = 330 pF, R = 330 Ω):<br>Contact discharge<br>Air discharge | <br>30<br>30 | kV |
| | | ISO10605 / IEC 61000-4-2 (C = 150 pF, R = 330 Ω)<br>Contact discharge<br>Air discharge | <br>30<br>30 | |
| $P_{PP}$ | Peak pulse power dissipation | 10/1000 µs, $T_j$ initial = $T_{amb}$ | 600 | W |
| $T_{stg}$ | Storage temperature range | | -65 to +175 | °C |
| $T_j$ | Operating junction temperature range | | -55 to +175 | °C |
| $T_L$ | Maximum lead temperature for soldering during 10 s | | 260 | °C |

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

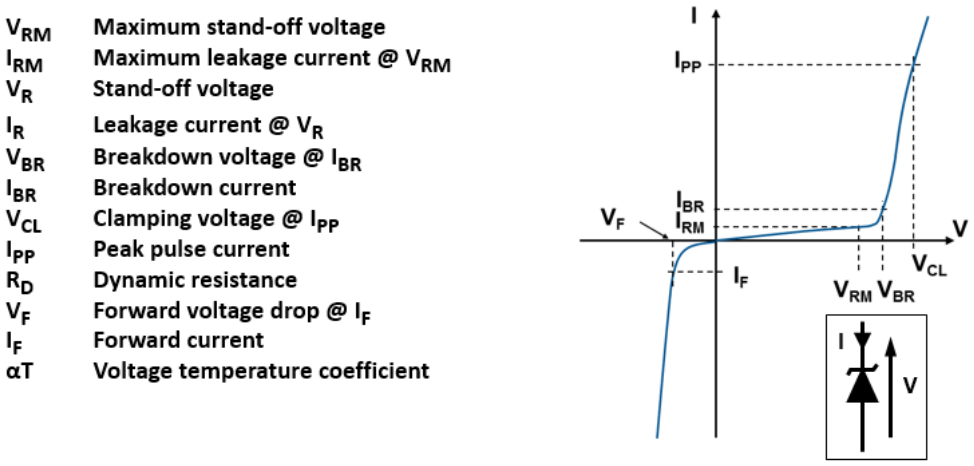



**Figure 2. Pulse definition for electrical characteristics**

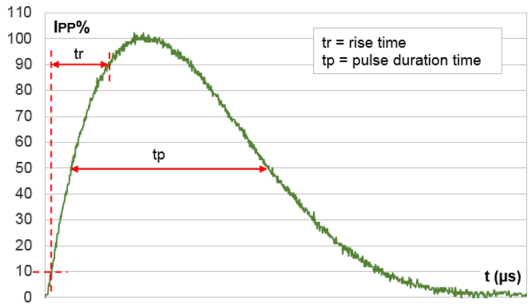


**Table 2. Electrical characteristics - parameter values ($T_{amb}$ = 25 °C, unless otherwise specified)**

| Type | $I_{RM}$ max at $V_{RM}$ | | | $V_{BR}$ at $I_R$ (1) | | | | 10 / 1000 µs | | | 8 / 20 µs | | | αT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | $V_{CL}$ (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. |
| | µA | | V | V | | | mA | V | A | Ω | V | A | Ω | $10^{-4}$/°C |
| SMA6F5.0AY | 20 | 50 | 5.0 | 6.4 | 6.74 | 7.1 | 10 | 9.2 | 68 | 0.031 | 13.4 | 298 | 0.021 | 5.7 |
| SMA6F6.0AY | 20 | 50 | 6.0 | 6.7 | 7.05 | 7.4 | 10 | 10.3 | 61 | 0.048 | 13.7 | 290 | 0.022 | 5.9 |
| SMA6F6.5AY | 20 | 50 | 6.5 | 7.2 | 7.58 | 8 | 10 | 11.2 | 56 | 0.057 | 14.5 | 276 | 0.024 | 6.1 |
| SMA6F8.5AY | 20 | 50 | 8.5 | 9.4 | 9.9 | 10.4 | 1 | 14.4 | 41.7 | 0.096 | 19.5 | 205 | 0.044 | 7.3 |
| SMA6F10AY | 0.2 | 1 | 10 | 11.1 | 11.7 | 12.3 | 1 | 17 | 37 | 0.127 | 21.7 | 184 | 0.051 | 7.8 |
| SMA6F11AY | 0.2 | 1 | 11 | 12.3 | 13 | 13.7 | 1 | 18 | 33.8 | 0.127 | 24.2 | 165 | 0.064 | 8.1 |
| SMA6F12AY | 0.2 | 1 | 12 | 13.3 | 14 | 14.7 | 1 | 19.9 | 31 | 0.168 | 25.3 | 157 | 0.068 | 8.3 |
| SMA6F13AY | 0.2 | 1 | 13 | 14.4 | 15.2 | 16 | 1 | 21.5 | 29 | 0.190 | 27.2 | 147 | 0.076 | 8.4 |
| SMA6F14AY | 0.2 | 1 | 14 | 15.7 | 16.5 | 17.3 | 1 | 23.1 | 26 | 0.223 | 29 | 136 | 0.086 | 8.6 |
| SMA6F15AY | 0.2 | 1 | 15 | 16.7 | 17.6 | 18.5 | 1 | 24.4 | 25.1 | 0.235 | 32.5 | 123 | 0.114 | 8.8 |
| SMA6F16AY | 0.2 | 1 | 16 | 17.9 | 18.8 | 19.8 | 1 | 26 | 23.1 | 0.268 | 34.7 | 115 | 0.130 | 9.0 |
| SMA6F18AY | 0.2 | 1 | 18 | 20 | 21.1 | 22.2 | 1 | 29.2 | 21.5 | 0.326 | 39.3 | 102 | 0.168 | 9.2 |
| SMA6F20AY | 0.2 | 1 | 20 | 22.2 | 23.4 | 24.6 | 1 | 32.4 | 19.4 | 0.402 | 42.8 | 93 | 0.196 | 9.4 |
| SMA6F22AY | 0.2 | 1 | 22 | 24.4 | 25.7 | 27 | 1 | 35.5 | 17.7 | 0.480 | 48.3 | 83 | 0.257 | 9.6 |
| SMA6F23AY | 0.2 | 1 | 23 | 25.7 | 27 | 28.4 | 1 | 37.8 | 16.4 | 0.573 | 49.2 | 81 | 0.257 | 9.6 |
| SMA6F24AY | 0.2 | 1 | 24 | 26.7 | 28.1 | 29.5 | 1 | 38.9 | 16 | 0.588 | 50 | 80 | 0.256 | 9.6 |
| SMA6F26AY | 0.2 | 1 | 26 | 28.9 | 30.4 | 31.9 | 1 | 42.1 | 14.9 | 0.685 | 53.5 | 75 | 0.288 | 9.7 |
| SMA6F28AY | 0.2 | 1 | 28 | 31.1 | 32.7 | 34.3 | 1 | 45.4 | 13.8 | 0.804 | 59 | 68 | 0.363 | 9.8 |
| SMA6F30AY | 0.2 | 1 | 30 | 33.2 | 35 | 36.8 | 1 | 48.4 | 13 | 0.885 | 64.3 | 62 | 0.442 | 9.9 |
| SMA6F31AY | 0.2 | 1 | 31 | 34.2 | 36 | 37.8 | 1 | 50.2 | 12.3 | 1.01 | 65 | 61 | 0.45 | 9.9 |
| SMA6F33AY | 0.2 | 1 | 33 | 36.7 | 38.6 | 40.5 | 1 | 53.3 | 11.8 | 1.08 | 69.7 | 57 | 0.512 | 10 |
| SMA6F36AY | 0.2 | 1 | 36 | 40 | 42.1 | 44.2 | 1 | 58.1 | 10.3 | 1.35 | 76 | 52 | 0.612 | 10 |
| SMA6F40AY | 0.2 | 1 | 40 | 44.4 | 46.7 | 49 | 1 | 64.5 | 9.7 | 1.60 | 84 | 48 | 0.729 | 10.1 |
| SMA6F48AY | 0.2 | 1 | 48 | 53.2 | 56 | 58.8 | 1 | 77.4 | 8.1 | 2.28 | 100 | 40 | 1.03 | 10.3 |
| SMA6F58AY | 0.2 | 1 | 58 | 64.6 | 68 | 71.4 | 1 | 93.6 | 6.7 | 3.34 | 121 | 33 | 1.51 | 10.4 |
| SMA6F64AY | 0.2 | 1 | 64 | 71.1 | 74.8 | 78.6 | 1 | 103 | 5.8 | 4.17 | 134 | 30 | 1.84 | 10.5 |
| SMA6F70AY | 0.2 | 1 | 70 | 77.9 | 82 | 86.1 | 1 | 113 | 5.5 | 4.91 | 146 | 27 | 2.22 | 10.5 |
| SMA6F85AY | 0.2 | 1 | 85 | 95 | 100 | 105 | 1 | 137 | 4.6 | 7.17 | 178 | 22.5 | 3.29 | 10.6 |
| SMA6F100AY | 0.2 | 1 | 100 | 111 | 117 | 123 | 1 | 162 | 3.8 | 10.3 | 212 | 19 | 4.68 | 10.7 |
| SMA6F130AY | 0.2 | 1 | 130 | 144 | 152 | 160 | 1 | 209 | 3 | 16.3 | 265 | 15 | 7 | 10.8 |
| SMA6F154AY | 0.2 | 1 | 154 | 171 | 180 | 189 | 1 | 246 | 2.4 | 23.8 | 317 | 12.6 | 10.2 | 10.8 |
| SMA6F170AY | 0.2 | 1 | 170 | 190 | 200 | 210 | 1 | 275 | 2.2 | 30 | 353 | 11.3 | 12.7 | 10.8 |
| SMA6F188AY | 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 °C x (1 + αT x ($T_j$ - 25))*
2. *To calculate $V_{CLmax}$ versus $I_{PPappli}$: $V_{CLmax}$ = $V_{BR\ max}$ + $R_D$ x $I_{PPappli}$*
3. *To calculate $V_{CL}$ versus $T_j$: $V_{CL}$ at $T_J$ = $V_{CL}$ at 25 °C x (1 + αT x ($T_j$ - 25))*

*4. Surge capability given for both directions*

## 1.1 Characteristics (curves)

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

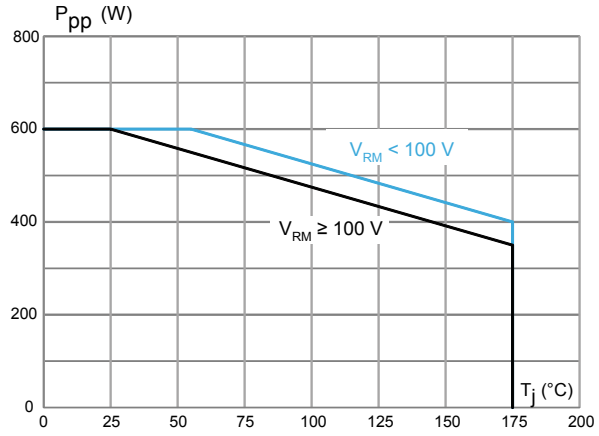



**Figure 4. Maximum peak pulse power versus exponential pulse duration**

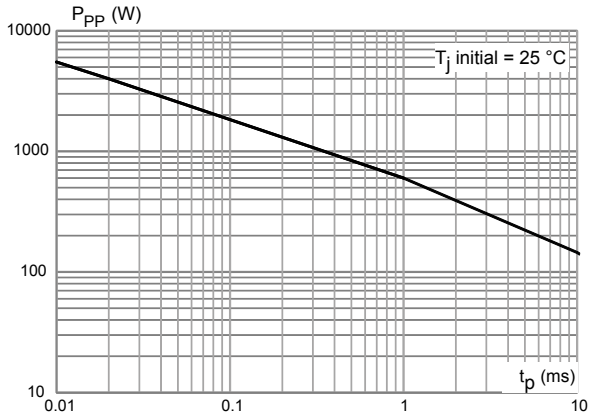



**Figure 5. Maximum clamping voltage versus peak pulse current**

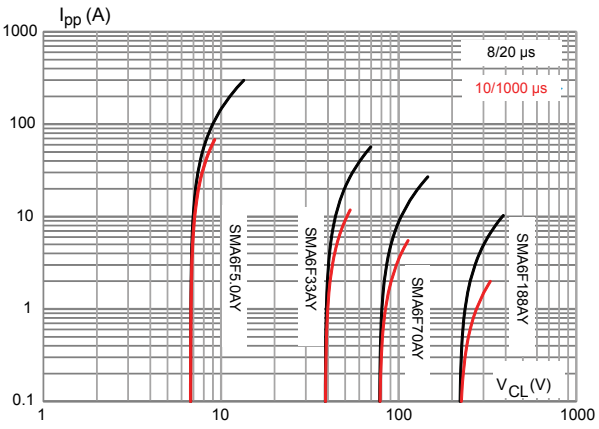



**Figure 6. Dynamic resistance versus pulse duration**

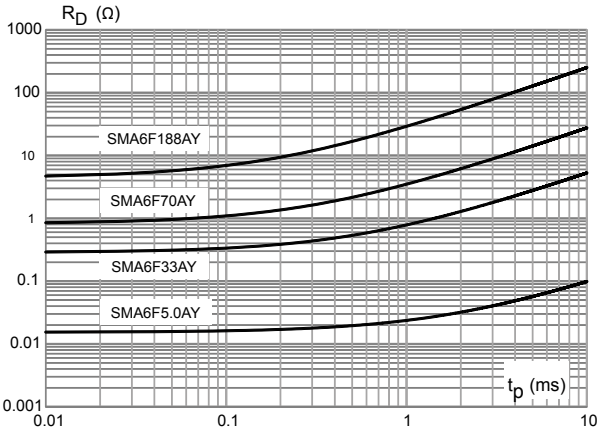


**Figure 7. Junction capacitance versus reverse applied voltage (unidirectional types)**

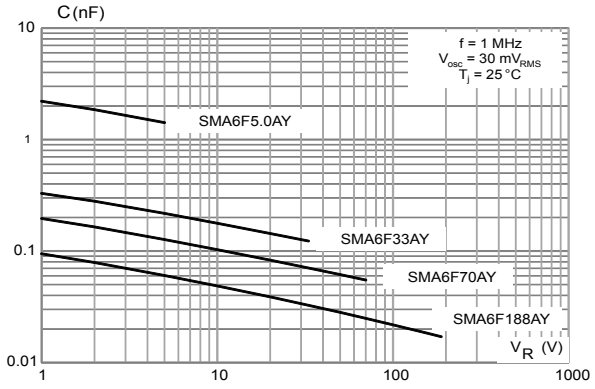



**Figure 8. Leakage current versus junction temperature**

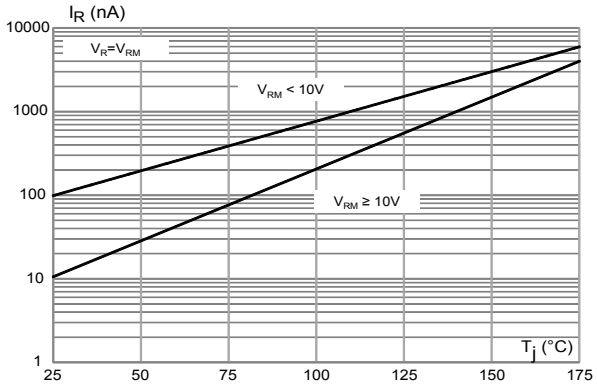



**Figure 9. Peak forward voltage drop versus peak forward current**

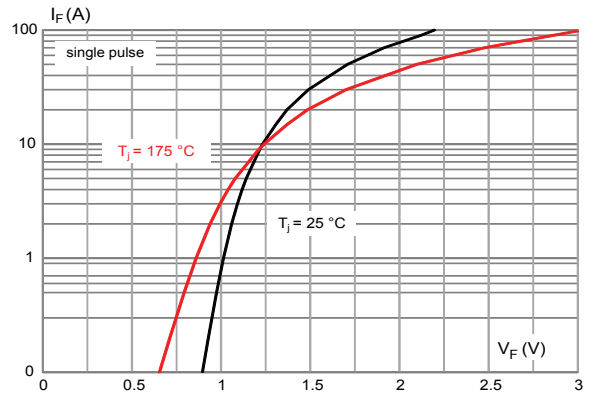



**Figure 10. Thermal impedance junction to ambient versus pulse duration**

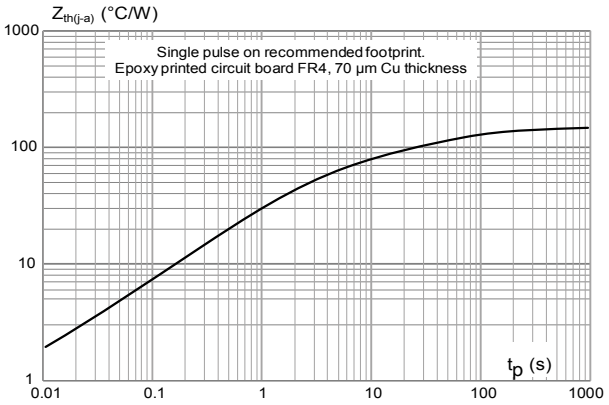



**Figure 11. Thermal resistance junction to ambient versus copper area under each lead**

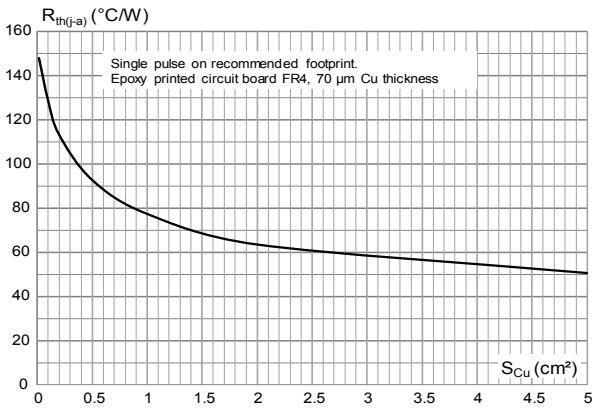



**Figure 12. ISO7637-2 pulse 1: Vs = -150 V with 12 V battery**

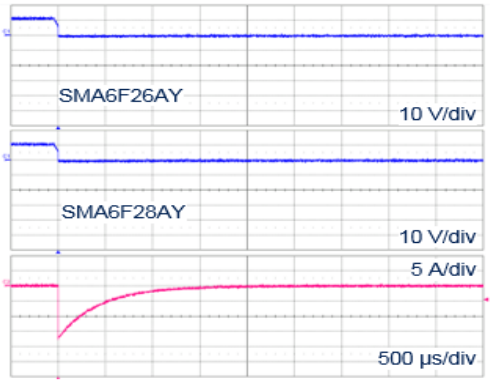


Figure 13. **ISO7637-2 pulse 2a: Vs = +112 V with 12 V battery**

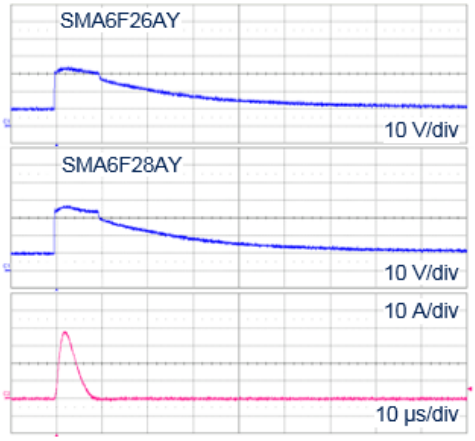



Figure 14. **ISO7637-2 pulse 3a: Vs = -220 V with 12 V battery**

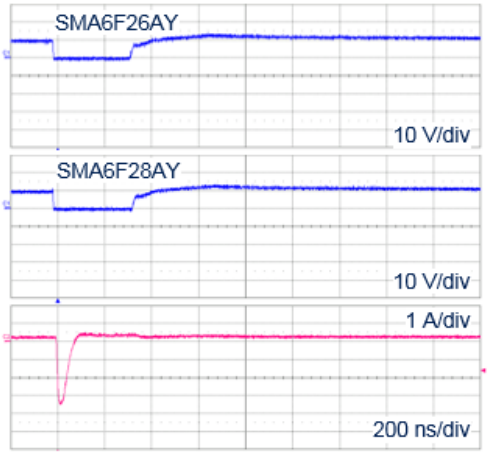
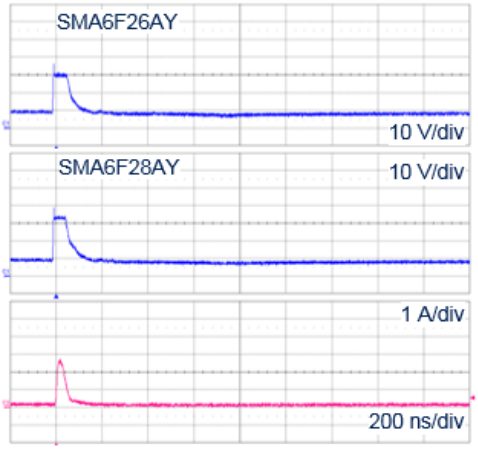



Figure 15. **ISO7637-2 pulse 3b: Vs = +150 V with 12 V battery**



# 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. ECOPACK is an ST trademark.

## 2.1 SMA Flat package information

**Figure 16. SMA Flat package outline**

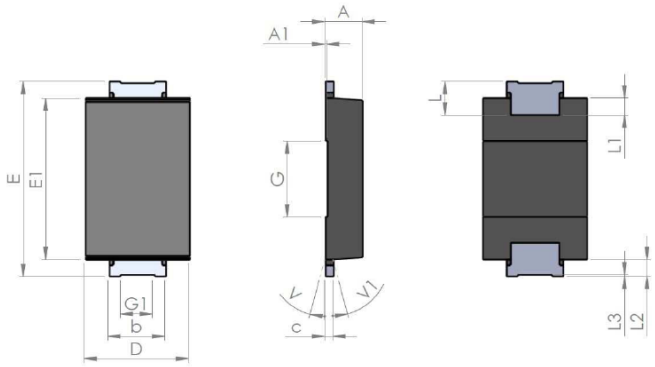



**Table 3. SMA Flat mechanical data**

| Symbol | Millimeters | | | Inches[1] | | |
|---|---|---|---|---|---|---|
| | Min | Typ | Max | Min | Typ | Max |
| A | 0.90 | | 1.10 | 0.035 | | 0.044 |
| A1 | | 0.05 | | | 0.002 | |
| 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 | 5.00 | | 5.35 | 0.196 | | 0.211 |
| E1 | 3.95 | | 4.60 | 0.155 | | 0.182 |
| G | | 2.00 | | | 0.079 | |
| G1 | | 0.85 | | | 0.033 | |
| L | 0.75 | | 1.20 | 0.029 | | 0.048 |
| L1 | | 0.45 | | | 0.018 | |
| L2 | | 0.45 | | | 0.018 | |
| L3 | | 0.05 | | | 0.002 | |
| V | | | 8° | | | 8° |
| V1 | | | 8° | | | 8° |

1. *Values in inches are converted from mm and rounded to 3 decimal digits.*

**Figure 17. SMA Flat recommended footprint in mm (inches)**

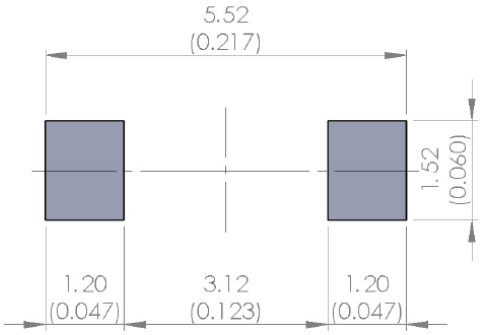
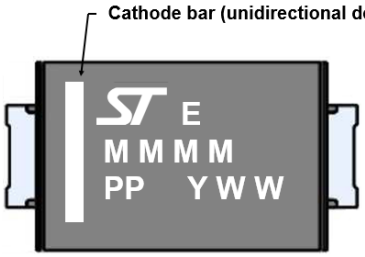
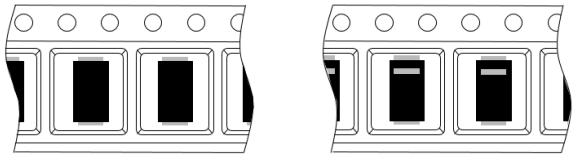



**Figure 18. SMA Flat marking**




**E : ECOPACK grade**
**MMMM : Marking**
**PP : Assembly location**
**Y : Year**
**WW : week**

**Figure 19. 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 20. Tape and reel orientation**

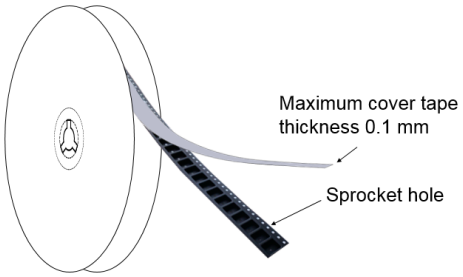



**Figure 21. 13" reel dimension values**

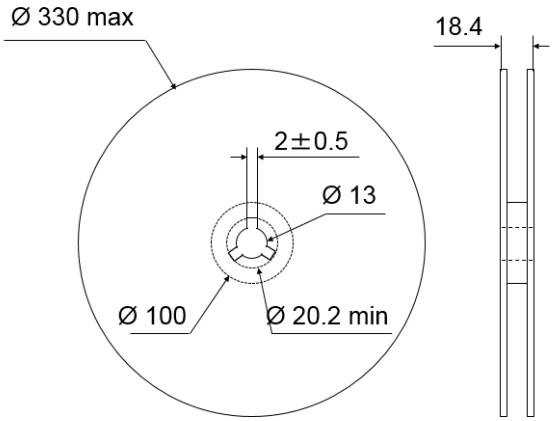



**Figure 22. Inner box dimension values**

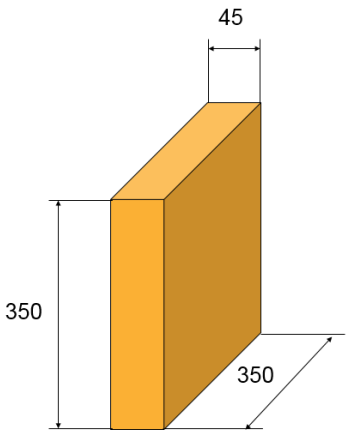
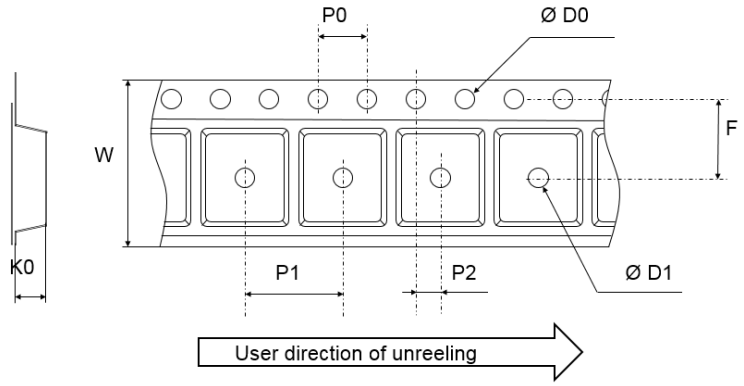


Figure 23. **Tape outline**



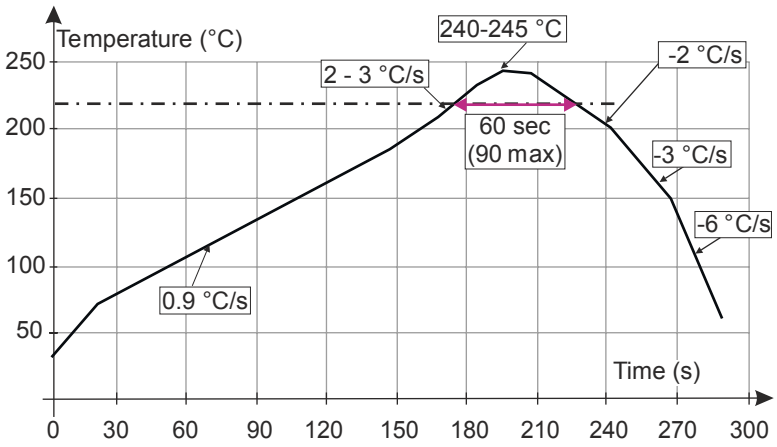

Note: Pocket dimensions are not on scale
Pocket shape may vary depending on package

Table 4. **Tape dimension values**

| Ref. | Dimensions | | |
|---|---|---|---|
| | Millimeters | | |
| | Min. | Typ. | Max. |
| D0 | 1.5 | 1.55 | 1.6 |
| D1 | 1.5 | | |
| F | 5.4 | 5.5 | 5.6 |
| K0 | 1.1 | 1.2 | 1.3 |
| P0 | 3.9 | 4.0 | 4.1 |
| P1 | 3.9 | 4.0 | 4.1 |
| P2 | 1.9 | 2.0 | 2.1 |
| W | 11.7 | 12 | 12.3 |

## 2.2 Reflow profile

Figure 24. **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 Application and design guidelines

More information is available in the application note AN2689 “Protection of automotive electronics from electrical hazards, guidelines for design and component selection”.

# 4 Ordering information

**Figure 25. Ordering information scheme**

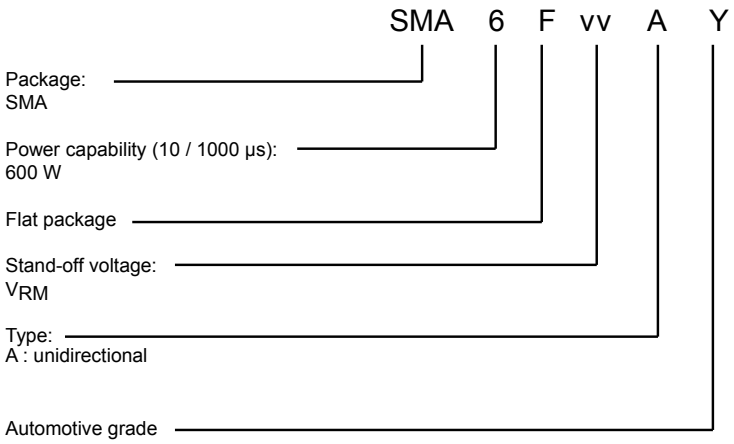



**Table 5. Ordering information**

| Order code | Marking | Package | Weight | Base qty. | Delivery mode |
|---|---|---|---|---|---|
| SMA6FxxxAY | See Table 6. Marking. | SMA Flat | 39 mg | 10000 | Tape and reel |

## 4.1 Marking

Table 6. **Marking**

| Order code | Marking |
|---|---|
| SMA6F5.0AY | 6AIY |
| SMA6F6.0AY | 6AKY |
| SMA6F6.5AY | 6ALY |
| SMA6F8.5AY | 6APY |
| SMA6F10AY | 6ASY |
| SMA6F11AY | 6AUY |
| SMA6F12AY | 6AWY |
| SMA6F13AY | 6AYY |
| SMA6F14AY | 6BAY |
| SMA6F15AY | 6BCY |
| SMA6F16AY | 6BEY |
| SMA6F18AY | 6BIY |
| SMA6F20AY | 6BMY |
| SMA6F22AY | 6BOY |
| SMA6F23AY | 6BPY |
| SMA6F24AY | 6BQY |
| SMA6F26AY | 6BSY |
| SMA6F28AY | 6BUY |
| SMA6F30AY | 6BWY |
| SMA6F31AY | 6BXY |
| SMA6F33AY | 6BZY |
| SMA6F36AY | 6CCY |
| SMA6F40AY | 6CGY |
| SMA6F48AY | 6COY |
| SMA6F58AY | 6CYY |
| SMA6F64AY | 6DEY |
| SMA6F70AY | 6DKY |
| SMA6F85AY | 6DZY |
| SMA6F100AY | 6EOY |
| SMA6F130AY | 6FSY |
| SMA6F154AY | 6GQY |
| SMA6F170AY | 6HGY |
| SMA6F188AY | 6HYY |

## Revision history

**Table 7. Document revision history**

| Date | Version | Changes |
|---|---|---|
| 24-Sep-2018 | 1 | Initial release. |
| 26-Aug-2019 | 2 | Updated Table 1. Absolute maximum ratings ($T_{amb}$ = 25 °C),<br>Figure 10. Thermal impedance junction to ambient versus pulse duration,<br>Figure 11. Thermal resistance junction to ambient versus copper area under each lead. |
| 07-Jan-2020 | 3 | Updated links syntax. |

**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. 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.

## Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

- View SMA6F30AY on WIN SOURCE
- STMicroelectronics Information

## Optimize Your Supply Chain with WIN SOURCE Solutions

- Global Sourcing Solution
- Obsolete Management
- Cost Control Management
- Shortage Management
- Alternative Solution
- Excess Inventory Management