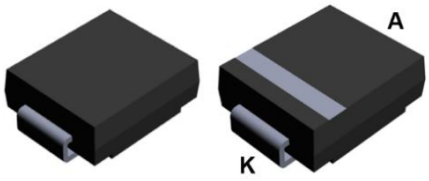
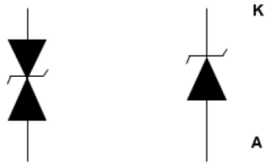
# SMCJxxA, SMCJxxCA

Datasheet

## 1500 W TVS in SMC




SMC
(JEDEC DO-214AB)




Bidirectional
(CA type)

Unidirectional
(A type)

| Product status link | |
|---|---|
| SMCJ | SMCJ5.0A, SMCJ5.0CA, SMCJ6.0A, SMCJ6.0CA, SMCJ6.5A, SMCJ6.5CA, SMCJ8.5A, SMCJ8.5CA, SMCJ10A, SMCJ10CA, SMCJ12A, SMCJ12CA, SMCJ13A, SMCJ13CA, SMCJ15A, SMCJ15CA, SMCJ18A, SMCJ18CA, SMCJ20A, SMCJ20CA, SMCJ22A, SMCJ22CA, SMCJ24A, SMCJ24CA, SMCJ26A, SMCJ26CA, SMCJ28A, SMCJ28CA, SMCJ30A, SMCJ30CA, SMCJ33A, SMCJ33CA, SMCJ40A, SMCJ40CA, SMCJ48A, SMCJ48CA, SMCJ58A, SMCJ58CA, SMCJ70A, SMCJ70CA, SMCJ85A, SMCJ85CA, SMCJ100A, SMCJ100CA, SMCJ130A, SMCJ130CA, SMCJ154A, SMCJ154CA, SMCJ170A, SMCJ170CA, SMCJ188A, SMCJ188CA |

## Features

- Peak pulse power:
  - 1500 W (10/1000 µs)
  - up to 10 kW (8/20 µs)
- Stand-off voltage range from 5 V to 188 V
- Unidirectional and bidirectional types
- Low leakage current: 0.2 µA at 25 °C
- Operating $T_j$ max: 150 °C
- High power capability at $T_j$ max.: up to 1250 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 k V
- IEC 61000-4-2, C = 150 pF, R = 330 Ω exceeds level 4:
  - 30 kV (air discharge)
  - 30 kV (contact discharge)

## Description

The TVS series are designed to protect sensitive equipment against electrostatic discharges according to IEC 61000-4-2, MIL STD 883 Method 3015, and electrical overstress such as IEC 61000-4-4 and 5. They are used for surges below 1500 W 10/1000 µs.

This planar technology makes it compatible with high-end equipment and SMPS where low leakage current and high junction temperature are required to provide reliability and stability over time.

# 1 Characteristics

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

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $V_{PP}$ | Peak pulse voltage | IEC 61000-4-2 (C = 150 pF, R = 330 Ω)<br>Contact discharge<br>Air discharge | <br>30<br>30 | kV |
| $P_{PP}$ | Peak pulse power dissipation | $T_j$ initial = $T_{amb}$ | 1500 | W |
| $T_{stg}$ | Storage temperature range | | -65 to +150 | °C |
| $T_j$ | Operating junction temperature range | | -55 to +150 | °C |
| $T_L$ | Maximum lead temperature for soldering during 10 s | | 260 | °C |

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

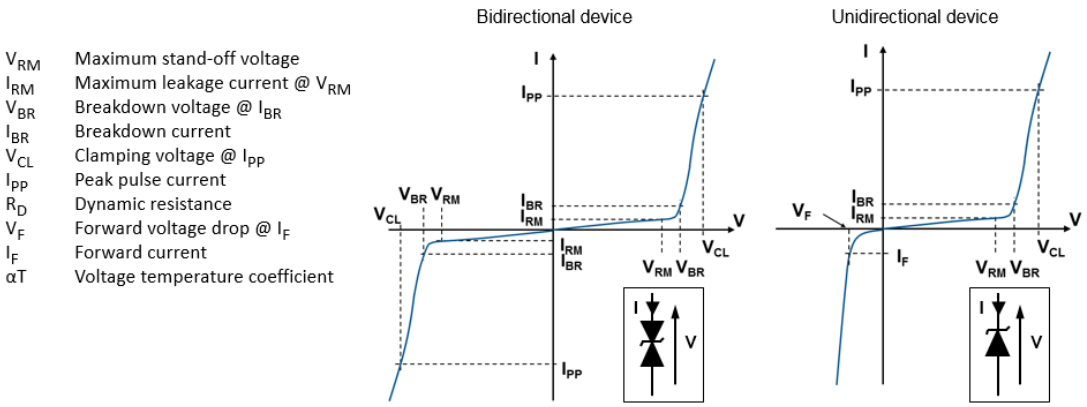



**Figure 2. Pulse definition for electrical characteristics**

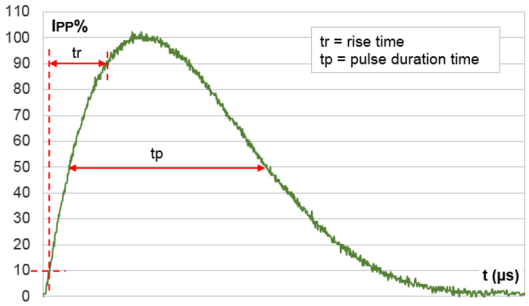


**Table 2. Electrical characteristics - parameter values ($T_{amb}$ = 25 °C, unless otherwise specified)**

| Type | $I_{RM}$ max at $V_{RM}$ | | | $V_{BR}$ at $I_R$ (1) | | | 10 / 1000 µs | | | 8 / 20µs | | | 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. |
| | µA | | V | V | | mA | V | A | Ω | V | A | mΩ | $10^{-4}$/°C |
| SMCJ5.0A/CA | 500 | 2000 | 5 | 6.4 | 6.74 | 10 | 9.20 | 171 | 0.012 | 13.4 | 746 | 8.5 | 5.7 |
| SMCJ6.0A/CA | 500 | 2000 | 6 | 6.7 | 7.05 | 10 | 10.3 | 152 | 0.019 | 13.7 | 730 | 8.6 | 5.9 |
| SMCJ6.5A/CA | 250 | 1000 | 6.5 | 7.2 | 7.58 | 10 | 11.2 | 140 | 0.023 | 14.5 | 690 | 9.5 | 6.1 |
| SMCJ8.5A/CA | 10 | 50 | 8.5 | 9.4 | 9.9 | 1 | 14.4 | 105 | 0.038 | 19.5 | 512 | 18 | 7.3 |
| SMCJ10A/CA | 0.2 | 1 | 10 | 11.1 | 11.7 | 1 | 17 | 92 | 0.051 | 21.7 | 461 | 20 | 7.8 |
| SMCJ12A/CA | 0.2 | 1 | 12 | 13.3 | 14 | 1 | 19.9 | 79 | 0.066 | 25.3 | 394 | 27 | 8.3 |
| SMCJ13A/CA | 0.2 | 1 | 13 | 14.4 | 15.2 | 1 | 21.5 | 73 | 0.076 | 27.2 | 368 | 31 | 8.4 |
| SMCJ15A/CA | 0.2 | 1 | 15 | 16.7 | 17.6 | 1 | 24.4 | 64 | 0.092 | 32.5 | 308 | 46 | 8.8 |
| SMCJ18A/CA | 0.2 | 1 | 18 | 20 | 21.1 | 1 | 29.2 | 53 | 0.133 | 39.3 | 254 | 68 | 9.2 |
| SMCJ20A/CA | 0.2 | 1 | 20 | 22.2 | 23.4 | 1 | 32.4 | 48 | 0.163 | 42.8 | 234 | 78 | 9.4 |
| SMCJ22A/CA | 0.2 | 1 | 22 | 24.4 | 25.7 | 1 | 35.5 | 44 | 0.194 | 48.3 | 207 | 103 | 9.6 |
| SMCJ24A/CA | 0.2 | 1 | 24 | 26.7 | 28.1 | 1 | 38.9 | 40 | 0.235 | 50 | 200 | 102 | 9.6 |
| SMCJ26A/CA | 0.2 | 1 | 26 | 28.9 | 30.4 | 1 | 42.1 | 37 | 0.275 | 53.5 | 187 | 115 | 9.7 |
| SMCJ28A/CA | 0.2 | 1 | 28 | 31.1 | 32.7 | 1 | 45.4 | 34 | 0.325 | 59 | 169 | 146 | 9.8 |
| SMCJ30A/CA | 0.2 | 1 | 30 | 33.3 | 35.1 | 1 | 48.4 | 32 | 0.361 | 64.3 | 156 | 176 | 9.9 |
| SMCJ33A/CA | 0.2 | 1 | 33 | 36.7 | 38.6 | 1 | 53.3 | 29 | 0.440 | 69.7 | 143 | 204 | 10.0 |
| SMCJ40A/CA | 0.2 | 1 | 40 | 44.4 | 46.7 | 1 | 64.5 | 24 | 0.644 | 84 | 119 | 294 | 10.1 |
| SMCJ48A/CA | 0.2 | 1 | 48 | 53.3 | 56.1 | | 77.4 | 20 | 0.925 | 100 | 100 | 411 | 10.3 |
| SMCJ58A/CA | 0.2 | 1 | 58 | 64.4 | 67.8 | 1 | 93.6 | 16 | 1.40 | 121 | 83 | 600 | 10.4 |
| SMCJ70A/CA | 0.2 | 1 | 70 | 77.8 | 81.9 | 1 | 113 | 13.9 | 1.94 | 146 | 69 | 870 | 10.5 |
| SMCJ85A/CA | 0.2 | 1 | 85 | 94 | 99 | 1 | 137 | 11.5 | 2.87 | 178 | 56 | 1322 | 10.6 |
| SMCJ100A/CA | 0.2 | 1 | 100 | 111 | 117 | 1 | 162 | 9.7 | 4.04 | 212 | 47 | 1897 | 10.7 |
| SMCJ130A/CA | 0.2 | 1 | 130 | 144 | 152 | 1 | 209 | 7.5 | 6.59 | 265 | 38 | 2774 | 10.8 |
| SMCJ154A/CA | 0.2 | 1 | 154 | 171 | 180 | 1 | 246 | 6.1 | 9.34 | 317 | 31.5 | 4063 | 10.8 |
| SMCJ170A/CA | 0.2 | 1 | 170 | 189 | 199 | 1 | 274 | 5.5 | 11.8 | 353 | 28 | 5145 | 10.8 |
| SMCJ188A/CA | 0.2 | 1 | 188 | 209 | 220 | 1 | 328 | 4.6 | 21.1 | 388 | 26 | 6038 | 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 $V_{CL}$ versus $T_j$ : $V_{CL}$ at $T_j$ = $V_{CL}$ at 25 °C x (1 + αT x ($T_j$ - 25))*
3. *To calculate $V_{CL}$ max versus $I_{PPappli}$: $V_{CLmax}$ = $V_{CL}$ - RD x ($I_{PP}$ - $I_{PPappli}$) where $I_{PP\ appli}$ is the surge current in the application*
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**

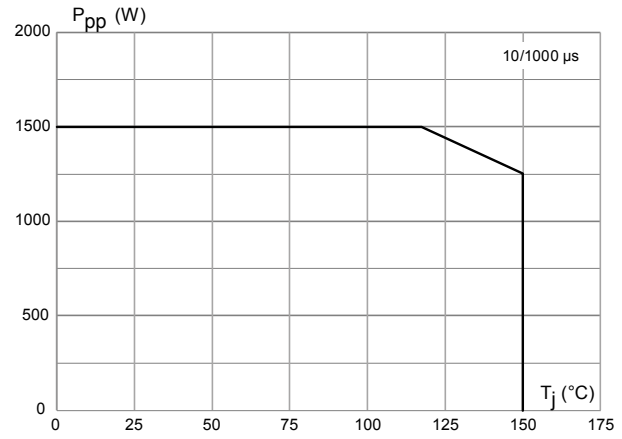



**Figure 4. Maximum peak pulse power versus exponential pulse duration**

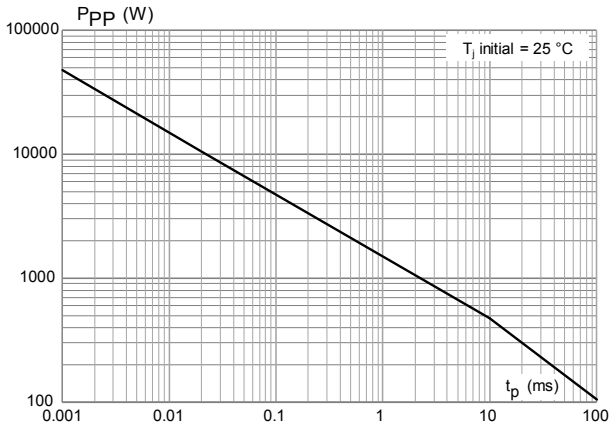



**Figure 5. Maximum peak pulse current versus clamping voltage**

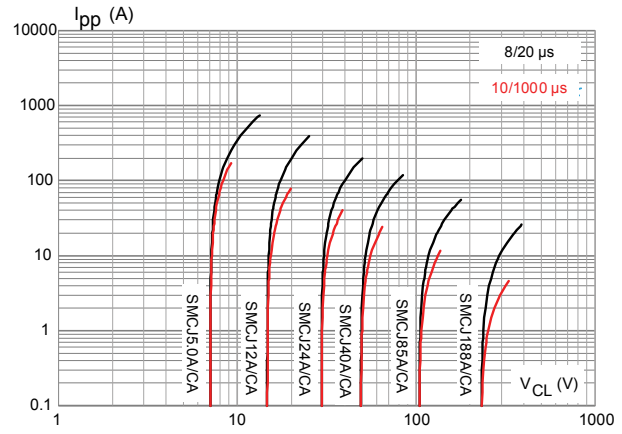



**Figure 6. Dynamic resistance versus pulse duration**

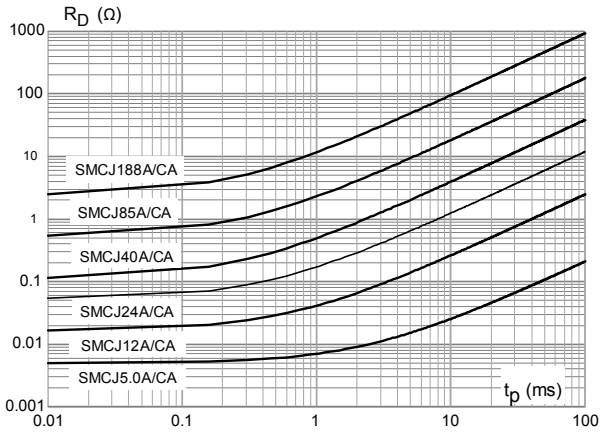


**Figure 7. Junction capacitance versus applied voltage (unidirectional type)**

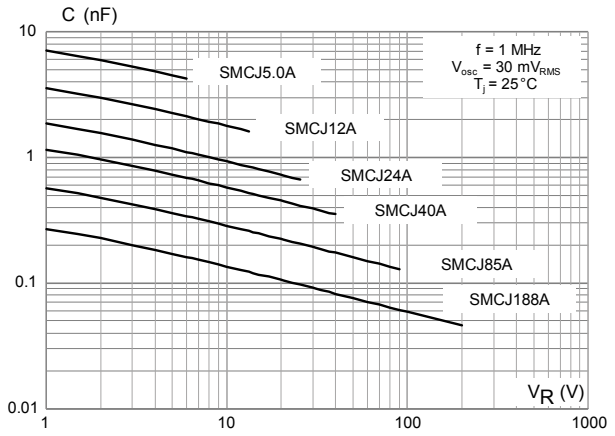



**Figure 8. Junction capacitance versus applied voltage (bidirectional type)**

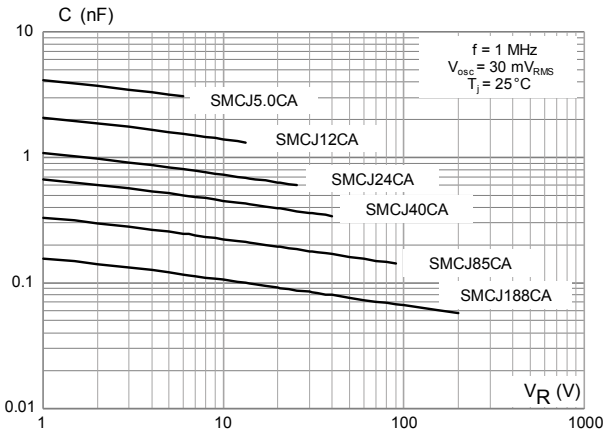



**Figure 9. Leakage current versus junction temperature**

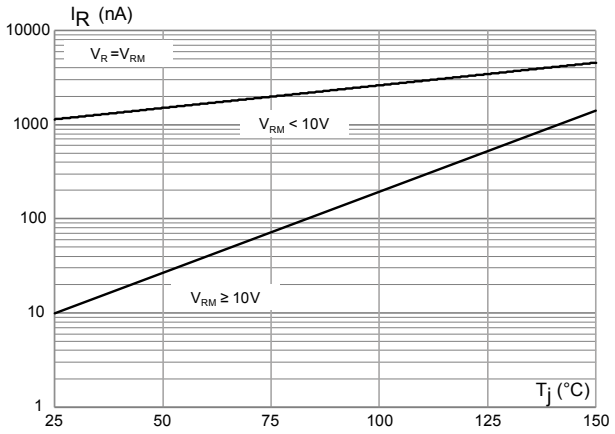



**Figure 10. Peak forward voltage drop versus peak forward current**

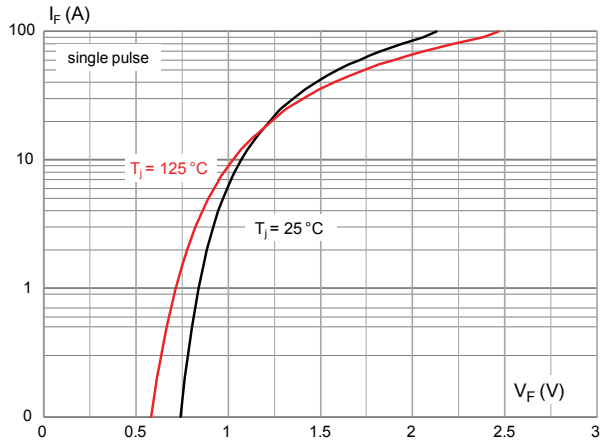



**Figure 11. Thermal impedance junction to ambient versus pulse duration**

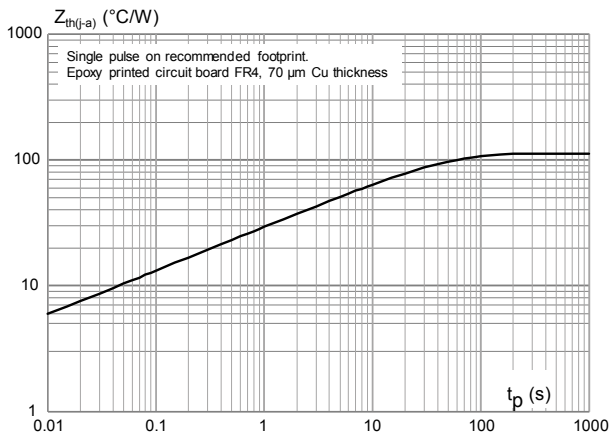
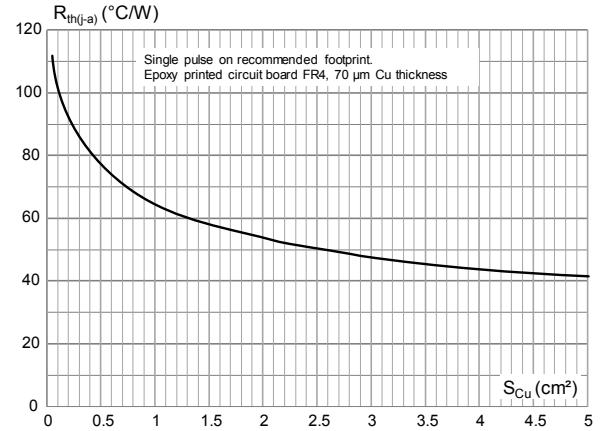



**Figure 12. Thermal resistance junction to ambient versus copper area under each lead**



# 2 Package information

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 SMC package information

- Epoxy meets UL94, V0

**Figure 13. SMC package outline**

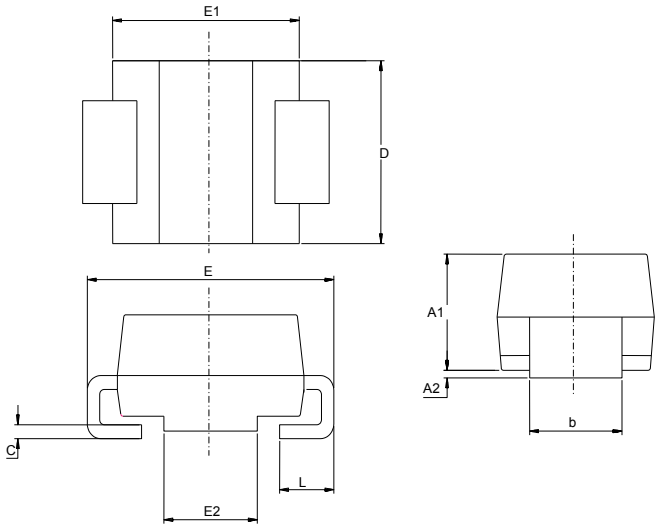



**Table 3. SMC package mechanical data**

| Ref. | Dimensions | | | |
|---|---|---|---|---|
| | Millimeters | | Inches (for reference only) | |
| | Min. | Max. | Min. | Max. |
| A1 | 1.90 | 2.45 | 0.075 | 0.096 |
| A2 | 0.05 | 0.20 | 0.002 | 0.008 |
| b | 2.90 | 3.20 | 0.114 | 0.126 |
| c | 0.15 | 0.40 | 0.006 | 0.016 |
| D | 5.55 | 6.25 | 0.218 | 0.246 |
| E | 7.75 | 8.15 | 0.305 | 0.321 |
| E1 | 6.60 | 7.15 | 0.260 | 0.281 |
| E2 | 4.40 | 4.70 | 0.173 | 0.185 |
| L | 0.75 | 1.50 | 0.030 | 0.060 |

**Figure 14. Footprint recommendation**

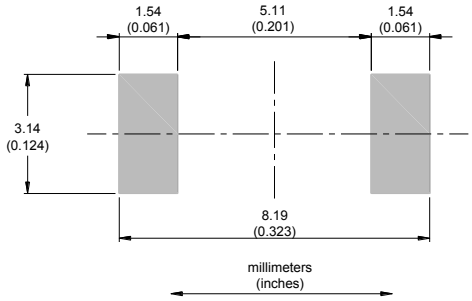



**Figure 15. Marking layout**

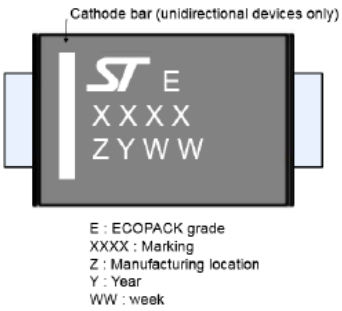
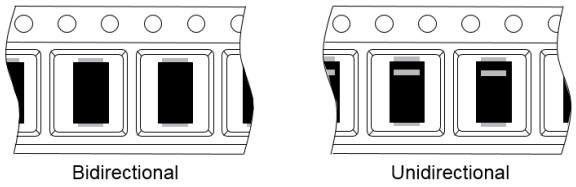



**Figure 16. Package orientation in reel**




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**

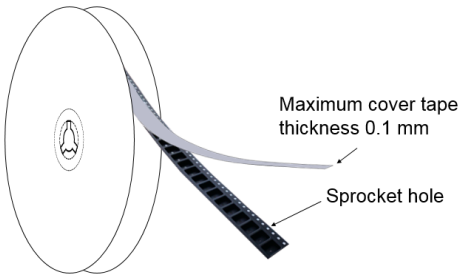



**Figure 18. 13" reel dimension values (mm)**

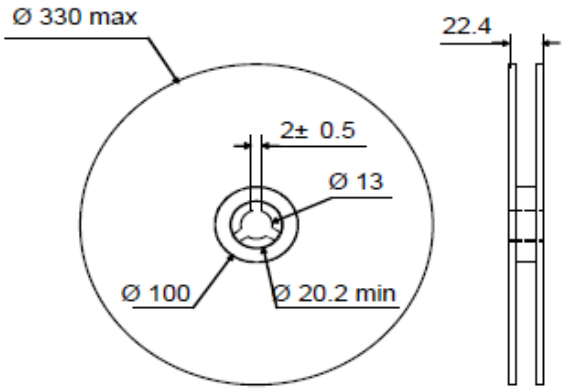



**Figure 19. Inner box dimension values (mm)**

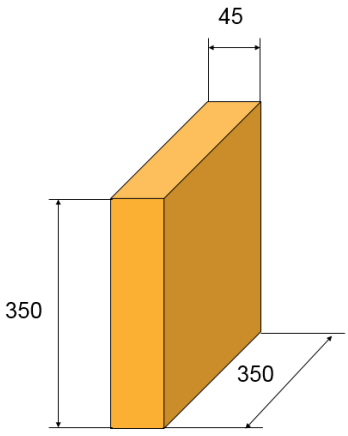
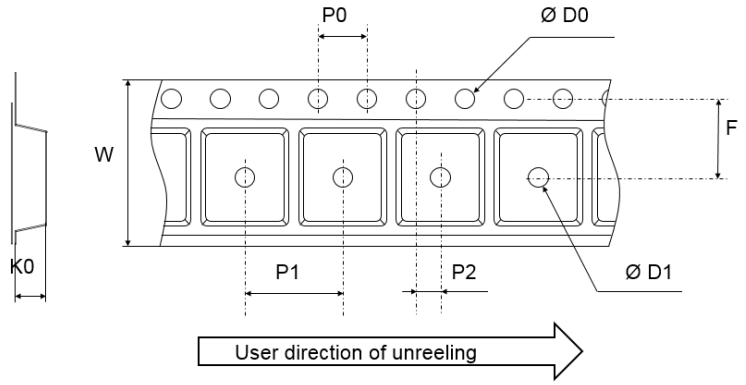


Figure 20. **Tape outline**



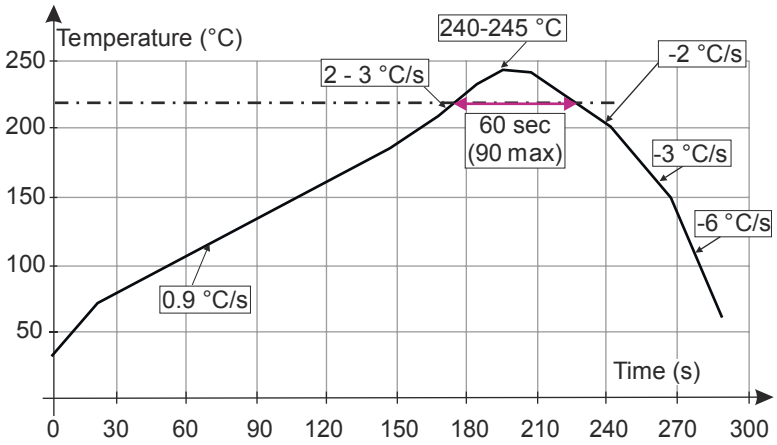

Note: Pocket dimensions are not on scale
Pocket shape may vary depending on package

Table 4. **Tape dimension values**

| Ref. | Dimensions | | |
|---|---|---|---|
| | Millimeters | | |
| | Min. | Typ. | Max. |
| D0 | 1.4 | 1.5 | 1.6 |
| D1 | 1.5 | | |
| F | 7.4 | 7.5 | 7.6 |
| K0 | 2.39 | 2.49 | 2.59 |
| P0 | 3.9 | 4.0 | 4.1 |
| P1 | 7.9 | 8.0 | 8.1 |
| P2 | 1.9 | 2.0 | 2.1 |
| W | 15.7 | 16 | 16.3 |

## 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 |
|---|---|---|---|---|---|
| SMCJxxA/CA-TR(1) | See Table 6. Marking | SMC | 0.25 g | 2500 | Tape and reel |

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

**Table 6. Marking**

| Order code | Marking | Order code | Marking |
|---|---|---|---|
| SMCJ5.0A-TR | FUA | SMCJ5.0CA-TR | FBA |
| SMCJ6.0A-TR | FUB | SMCJ6.0CA-TR | FBB |
| SMCJ6.5A-TR | FUC | SMCJ6.5CA-TR | FBC |
| SMCJ8.5A-TR | FUD | SMCJ8.5CA-TR | FBD |
| SMCJ10A-TR | FUF | SMCJ10CA-TR | FBF |
| SMCJ12A-TR | FUH | SMCJ12CA-TR | FBH |
| SMCJ13A-TR | FUI | SMCJ13CA-TR | FBI |
| SMCJ15A-TR | FUJ | SMCJ15CA-TR | FBJ |
| SMCJ18A-TR | FUL | SMCJ18CA-TR | FBL |
| SMCJ20A-TR | FUM | SMCJ20CA-TR | FBM |
| SMCJ22A-TR | FUN | SMCJ22CA-TR | FBN |
| SMCJ24A-TR | FUO | SMCJ24CA-TR | FBO |
| SMCJ26A-TR | FUP | SMCJ26CA-TR | FBP |
| SMCJ28A-TR | FUQ | SMCJ28CA-TR | FBQ |
| SMCJ30A-TR | FUR | SMCJ30CA-TR | FBR |
| SMCJ33A-TR | FUS | SMCJ33CA-TR | FBS |
| SMCJ40A-TR | FUU | SMCJ40CA-TR | FBU |
| SMCJ48A-TR | FUW | SMCJ48CA-TR | FBW |
| SMCJ58A-TR | FUZ | SMCJ58CA-TR | FBZ |
| SMCJ70A-TR | GUB | SMCJ70CA-TR | GBB |
| SMCJ85A-TR | GUE | SMCJ85CA-TR | GBE |
| SMCJ100A-TR | GUG | SMCJ100CA-TR | GBG |
| SMCJ130A-TR | GUI | SMCJ130CA-TR | GBI |
| SMCJ154A-TR | GUL | SMCJ154CA-TR | GBL |
| SMCJ170A-TR | GUM | SMCJ170CA-TR | GBM |
| SMCJ188A-TR | GUN | SMCJ188CA-TR | GBN |

## Revision history

**Table 7. Document revision history**

| Date | Version | Changes |
|---|---|---|
| August-1999 | 5 | Previous update. |
| 14-May-2009 | 6 | Reformatted to current standards. Updated ECOPACK statement. |
| 17-Sep-2009 | 7 | Document updated for low leakage current. |
| 12-Jul-2010 | 8 | Changed timescale in Figure 9. |
| 03-Feb-2020 | 9 | Minor text changes to improve readability.<br>Updated Table 2. Electrical characteristics - parameter values ($T_{amb}$ = 25 °C, unless otherwise specified) and Section 1.1 Characteristics (curves). |
| 12-Mar-2020 | 10 | Updated title of the document.<br>Removed section 3. Application and design guidelines. |
| 14-Dec-2020 | 11 | Updated Table 2. |

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

STMicroelectronics:

SMCJ15A-TR SMCJ188CA-TR SMCJ22A-TR SMCJ40A-TR SMCJ188A-TR SMCJ33A-TR SMCJ18CA-TR SMCJ48CA-TR SMCJ5.0CA-TR SMCJ30A-TR SMCJ30CA-TR SMCJ40CA-TR SMCJ12A-TR SMCJ26A-TR SMCJ24CA-TR SMCJ130CA-TR SMCJ15CA-TR SMCJ28A-TR SMCJ5.0A-TR SMCJ6.0A-TR SMCJ33CA-TR SMCJ13CA-TR SMCJ85CA-TR SMCJ170A-TR SMCJ70CA-TR SMCJ20A-TR