

Description

The SMBJ Transil series has been designed to protect sensitive equipment against electrostatic discharges according to IEC 61000-4-2, and MIL STD 883, method 3015, and electrical over stress according to IEC 61000-4-4 and 5. These devices are more generally used against surges below 600 W (10/1000 μ s).

Planar technology makes these devices suitable for high-end equipment and SMPS where low leakage current and high junction temperature are required to provide reliability and stability over time.

SMBJ are packaged in SMB (SMB footprint in accordance with IPC 7531 standard).

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Features

- Peak pulse power:
 - 600 W (10/1000 μ s)
 - 4 kW (8/20 μ s)
- Stand-off voltage range: from 5 V to 188 V
- Unidirectional and bidirectional types
- Low leakage current:
 - 0.2 μ A at 25 °C
 - 1 μ A at 85 °C
- Operating T_j max: 150 °C
- High power capability at T_j max:
 - 515 W (10/1000 μ s)
- JEDEC registered package outline

Complies with the following standards

- IEC 61000-4-2 level 4:
 - 15 kV (air discharge)
 - 8 kV (contact discharge)
- IEC 61000-4-5
- MIL STD 883G, method 3015-7: class 3B:
 - 25 kV HBM (human body model)
- Resin meets UL 94, V0
- MIL-STD-750, method 2026 solderability
- EIA STD RS-481 and IEC 60286-3 packing
- IPC 7531 footprint

1 Characteristics

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

| Symbol | Parameter | Value | Unit |
|-----------|--|---------------------------------|--------------------|
| P_{PP} | Peak pulse power dissipation | $T_j \text{ initial} = T_{amb}$ | 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 | $^{\circ}\text{C}$ |

Table 2: Thermal resistance

| Symbol | Parameter | Value | Unit |
|---------------|--|-------|-----------------------------|
| $R_{th(j-l)}$ | Junction to leads | 20 | $^{\circ}\text{C}/\text{W}$ |
| $R_{th(j-a)}$ | Junction to ambient on printed circuit on recommended pad layout | 100 | $^{\circ}\text{C}/\text{W}$ |

Figure 1: Electrical characteristics - parameter definitions

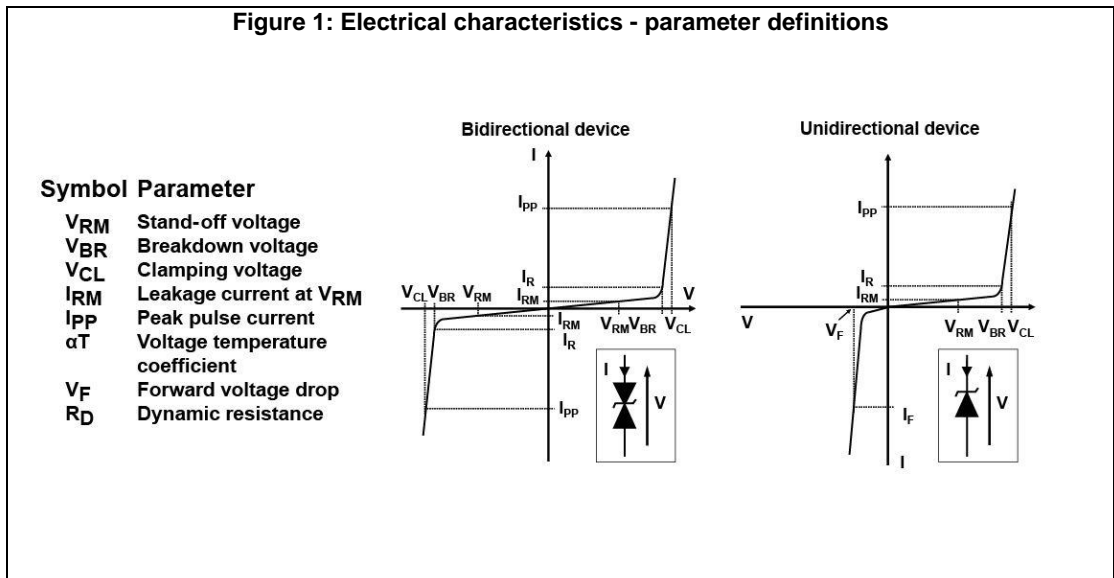


Figure 2: Pulse definition for electrical characteristics

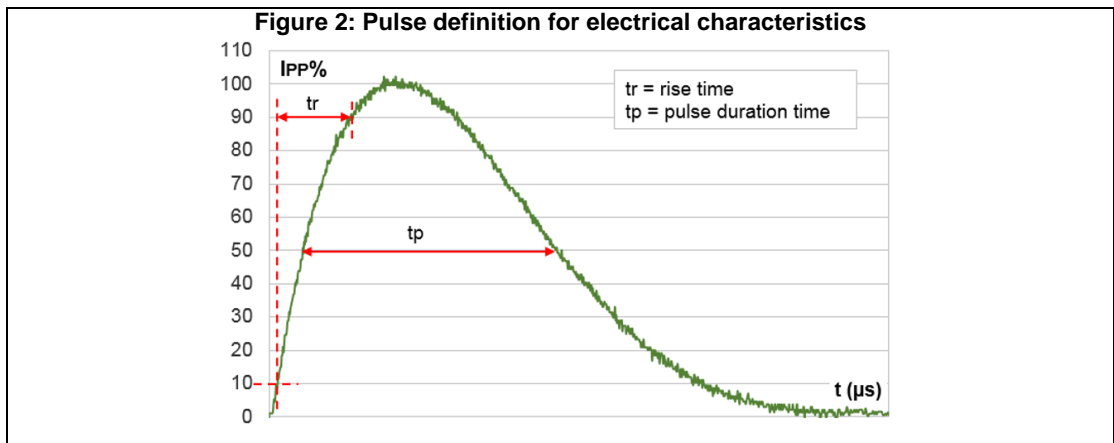


Table 3: Electrical characteristics parameter values ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)

| Order code | I_{RM} max at V_{RM} | | V_{BR} at $I_R^{(1)}$ | | | | 10 / 1000 μs | | | 8 / 20 μs | | | $\alpha T^{(2)}$ |
|-------------|--------------------------|-----------------------|-------------------------|------|------|----|-------------------------|------------------|----------|----------------------|----------|----------|----------------------------|
| | | | | | | | V_{CL} | I_{PP} | R_D | V_{CL} | I_{PP} | R_D | |
| | 25 $^{\circ}\text{C}$ | 85 $^{\circ}\text{C}$ | | Min. | Typ. | | Max. | | Max. | Max. | | | Max. |
| | μA | | V | V | | mA | V ⁽³⁾ | A ⁽⁴⁾ | Ω | V | A | Ω | $10^{-4}/^{\circ}\text{C}$ |
| SMBJ5.A/CA | 20 | 50 | 5.0 | 6.40 | 6.74 | 10 | 9.2 | 68 | 0.031 | 14.4 | 275 | 0.027 | 5.7 |
| SMBJ6.0A/CA | 20 | 50 | 6.0 | 6.70 | 7.05 | 10 | 10.3 | 61 | 0.048 | 14.8 | 270 | 0.027 | 5.9 |
| SMBJ6.5A/CA | 20 | 50 | 6.5 | 7.20 | 7.58 | 10 | 11.2 | 56 | 0.058 | 15.2 | 266 | 0.027 | 6.1 |
| SMBJ8.5A/CA | 20 | 50 | 8.5 | 9.40 | 9.90 | 1 | 14.4 | 41.7 | 0.096 | 19.5 | 205 | 0.044 | 7.3 |
| SMBJ10A/CA | 0.2 | 1 | 10 | 11.1 | 11.7 | 1 | 17 | 37 | 0.127 | 21.7 | 184 | 0.051 | 7.8 |
| SMBJ12A/CA | 0.2 | 1 | 12 | 13.3 | 14.0 | 1 | 19.9 | 31 | 0.168 | 25.3 | 157 | 0.068 | 8.3 |
| SMBJ13A/CA | 0.2 | 1 | 13 | 14.4 | 15.2 | 1 | 21.5 | 29 | 0.191 | 27.2 | 147 | 0.076 | 8.4 |
| SMBJ15A/CA | 0.2 | 1 | 15 | 16.7 | 17.6 | 1 | 24.4 | 25.1 | 0.236 | 32.5 | 123 | 0.114 | 8.8 |
| SMBJ16A/CA | 0.2 | 1 | 16 | 17.8 | 18.7 | 1 | 26 | 23.1 | 0.276 | 34.4 | 116 | 0.127 | 8.8 |
| SMBJ18A/CA | 0.2 | 1 | 18 | 20.0 | 21.1 | 1 | 29.2 | 21.5 | 0.328 | 39.3 | 102 | 0.168 | 9.2 |
| SMBJ20A/CA | 0.2 | 1 | 20 | 22.2 | 23.4 | 1 | 32.4 | 19.4 | 0.404 | 42.8 | 93 | 0.196 | 9.4 |
| SMBJ22A/CA | 0.2 | 1 | 22 | 24.4 | 25.7 | 1 | 35.5 | 17.7 | 0.481 | 48.3 | 83 | 0.257 | 9.6 |
| SMBJ24A/CA | 0.2 | 1 | 24 | 26.7 | 28.1 | 1 | 38.9 | 16 | 0.587 | 50 | 80 | 0.256 | 9.6 |
| SMBJ26A/CA | 0.2 | 1 | 26 | 28.9 | 30.4 | 1 | 42.1 | 14.9 | 0.683 | 53.5 | 75 | 0.288 | 9.7 |
| SMBJ28A/CA | 0.2 | 1 | 28 | 31.1 | 32.7 | 1 | 45.4 | 13.8 | 0.802 | 59 | 68 | 0.363 | 9.8 |
| SMBJ30A/CA | 0.2 | 1 | 30 | 33.3 | 35.1 | 1 | 48.4 | 13 | 0.888 | 64.3 | 62 | 0.443 | 9.9 |
| SMBJ33A/CA | 0.2 | 1 | 33 | 36.7 | 38.6 | 1 | 53.3 | 11.8 | 1.08 | 69.7 | 57 | 0.512 | 10.0 |
| SMBJ36A/CA | 0.2 | 1 | 36 | 40.0 | 42.1 | 1 | 58.1 | 10.3 | 1.35 | 76 | 52 | 0.611 | 10.0 |
| SMBJ40A/CA | 0.2 | 1 | 40 | 44.4 | 46.7 | 1 | 64.5 | 9.7 | 1.59 | 84 | 48 | 0.728 | 10.1 |
| SMBJ48A/CA | 0.2 | 1 | 48 | 53.3 | 56.1 | 1 | 77.4 | 8.1 | 2.28 | 100 | 40 | 1.03 | 10.3 |
| SMBJ58A/CA | 0.2 | 1 | 58 | 64.4 | 67.8 | 1 | 93.6 | 6.7 | 3.34 | 121 | 33 | 1.51 | 10.4 |
| SMBJ70A/CA | 0.2 | 1 | 70 | 77.8 | 81.9 | 1 | 113 | 5.5 | 4.91 | 146 | 27 | 2.22 | 10.5 |
| SMBJ85A/CA | 0.2 | 1 | 85 | 94 | 99 | 1 | 137 | 4.6 | 7.18 | 178 | 22.5 | 3.29 | 10.6 |
| SMBJ100A/CA | 0.2 | 1 | 100 | 111 | 117 | 1 | 162 | 3.8 | 10.3 | 212 | 19 | 4.69 | 10.7 |
| SMBJ130A/CA | 0.2 | 1 | 130 | 144 | 152 | 1 | 209 | 3 | 16.5 | 265 | 15 | 7.03 | 10.8 |
| SMBJ154A/CA | 0.2 | 1 | 154 | 171 | 180 | 1 | 246 | 2.4 | 23.8 | 317 | 12.6 | 10.2 | 10.8 |
| SMBJ170A/CA | 0.2 | 1 | 170 | 189 | 199 | 1 | 275 | 2.2 | 30.0 | 353 | 11.3 | 12.7 | 10.8 |
| SMBJ188A/CA | 0.2 | 1 | 188 | 209 | 220 | 1 | 328 | 2 | 48.5 | 388 | 10.3 | 15.2 | 10.8 |

Notes:(1)Pulse test: $t_p < 50\text{ ms}$ (2)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 $25\text{ }^{\circ}\text{C} \times (1 + \alpha T \times (T_J - 25))$

(3)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

⁽⁴⁾Surge capability given for both directions for unidirectional and bidirectional types.

1.1 Characteristics (curves)

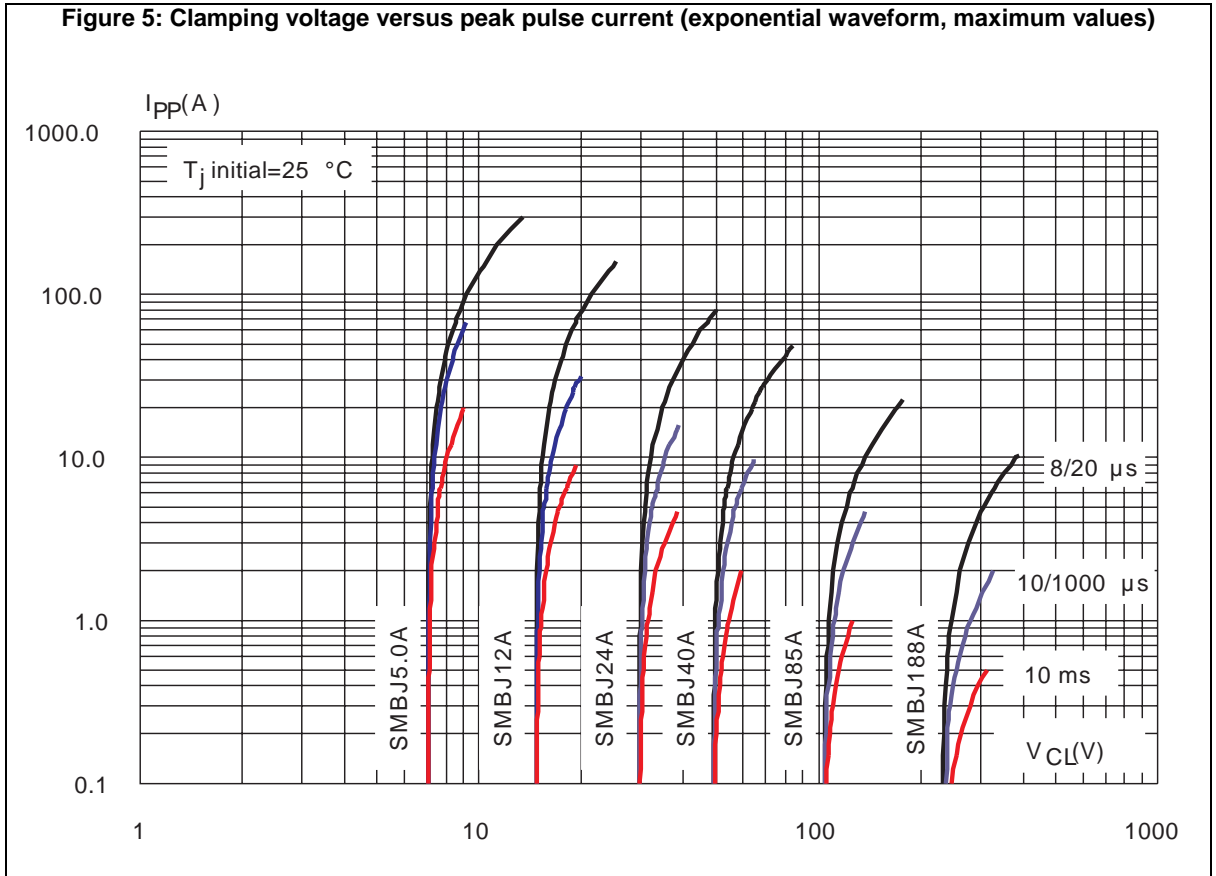
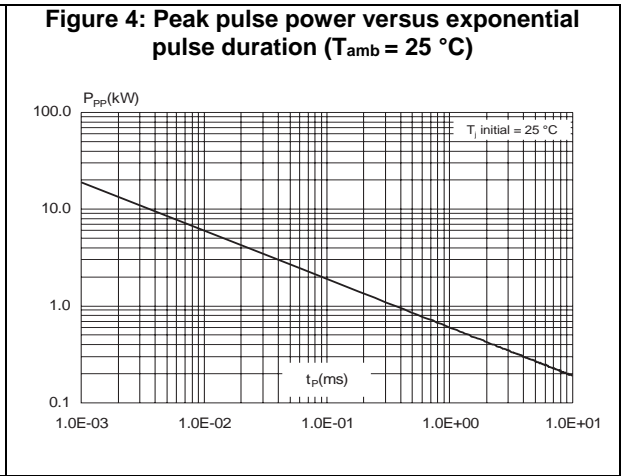
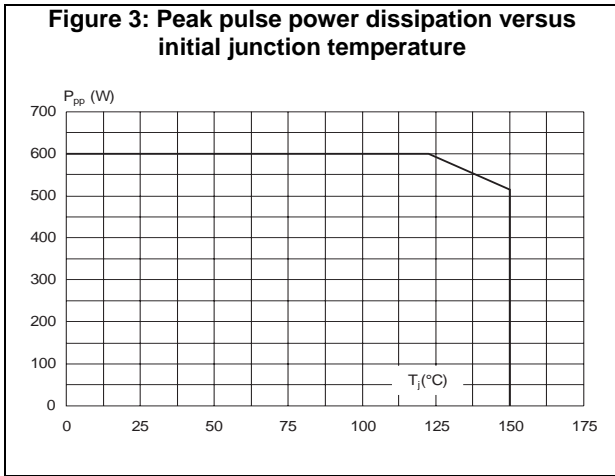


Figure 6: Junction capacitance versus reverse applied voltage (typical values) (SMBJxxA)

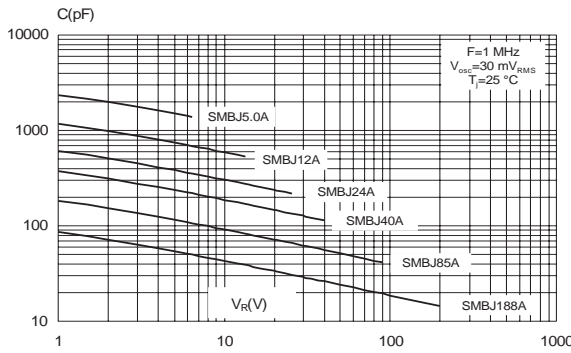


Figure 7: Junction capacitance versus reverse applied voltage (typical values) (SMBJxxCA)

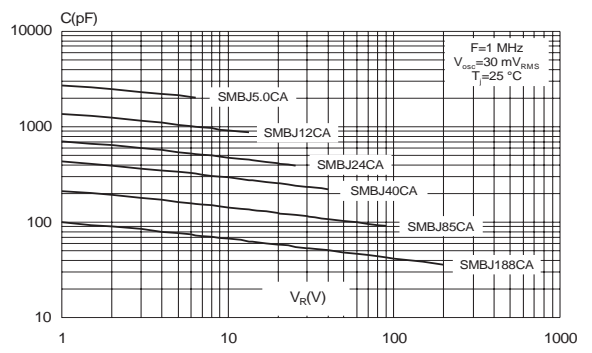


Figure 8: Peak forward voltage drop versus peak forward current (typical values)

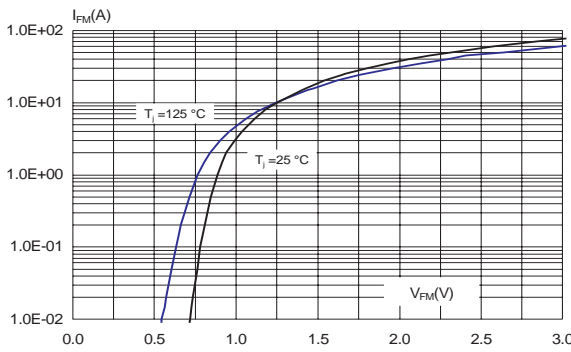


Figure 9: Relative variation of thermal impedance junction to ambient versus pulse duration

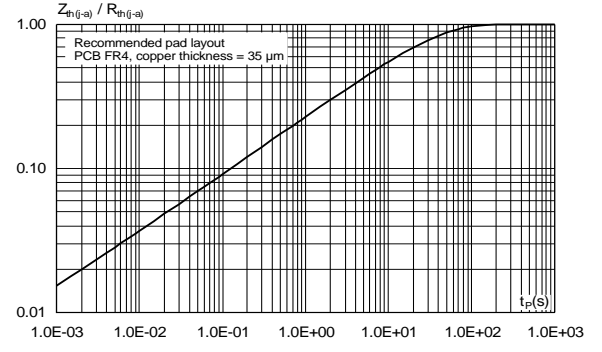


Figure 10: Thermal resistance junction to ambient versus copper surface under each lead (printed circuit board FR4, eCu = 35 μm)

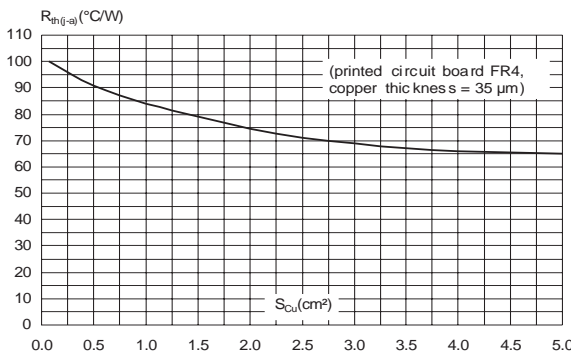
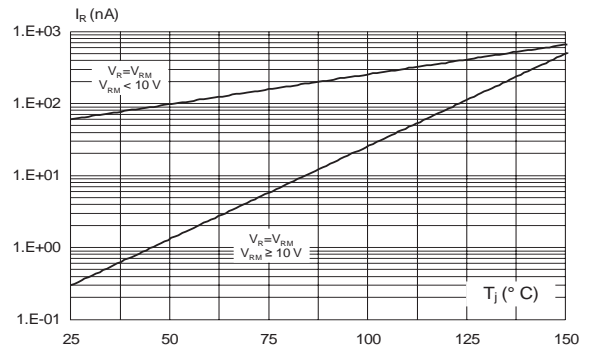


Figure 11: Leakage current versus junction temperature (typical values)



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.

- Case: JEDEC DO214-AA molded plastic over planar junction
- Terminals: solder plated, solderable per MIL-STD-750, method 2026
- Polarity: for unidirectional types the band indicates cathode.
- Flammability: epoxy is rated UL94V-0
- RoHS package

2.1 SMB package information

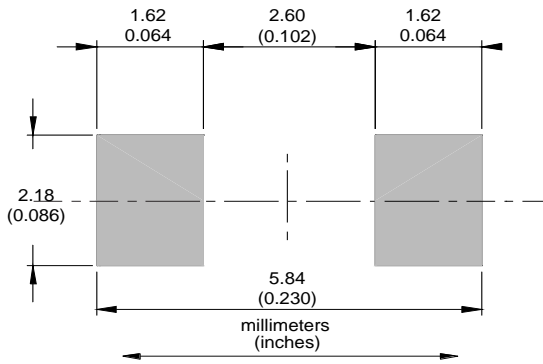
Figure 12: SMB package outline



Table 4: SMB package mechanical data

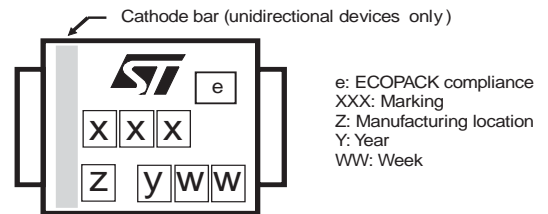
| Ref. | Dimensions | | | |
|------|-------------|------|--------|--------|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A1 | 1.90 | 2.45 | 0.0748 | 0.0965 |
| A2 | 0.05 | 0.20 | 0.0020 | 0.0079 |
| b | 1.95 | 2.20 | 0.0768 | 0.0867 |
| c | 0.15 | 0.40 | 0.0059 | 0.0157 |
| D | 3.30 | 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 |

Figure 13: SMB recommended footprint



Note: Marking layout can vary according to assembly location.

Figure 14: Marking layout



3 Ordering information

Figure 15: Ordering information scheme

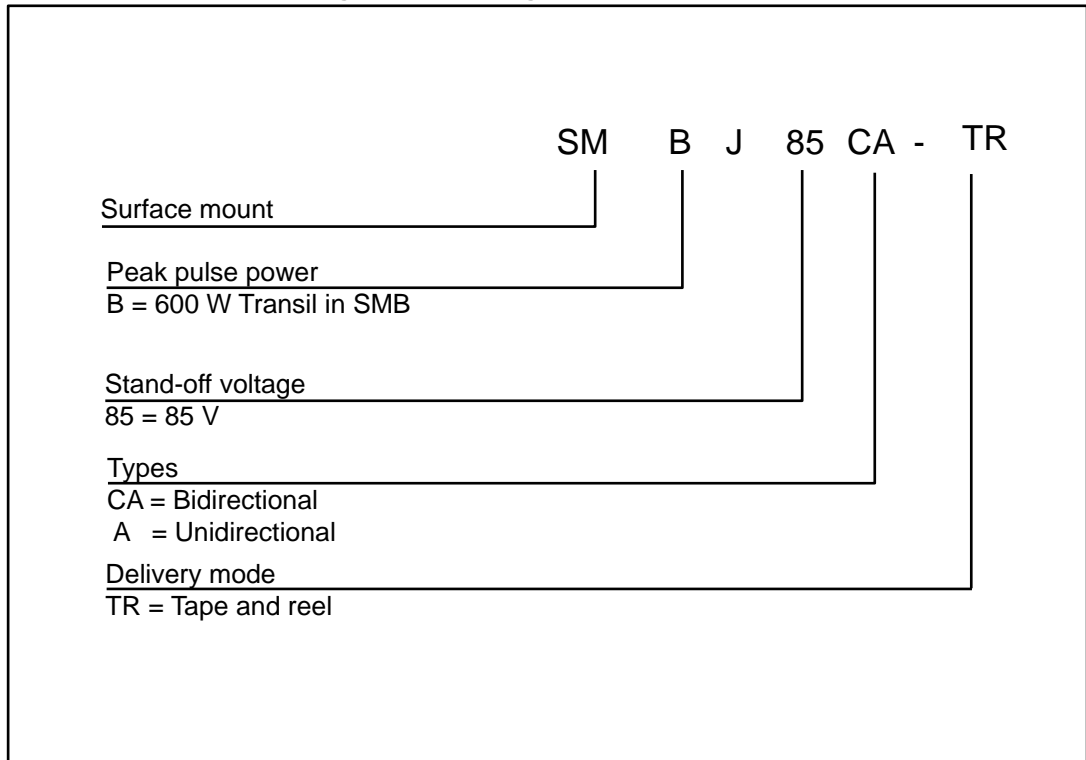


Table 5: Ordering information

| Order code ⁽¹⁾ | Marking | Package | Weight | Base qty. | Delivery mode |
|-------------------------------|--|---------|--------|-----------|---------------|
| SMBJxxxA/CA-TR ⁽²⁾ | See Table 6: "Marking" . | SMB | 0.11 g | 2500 | Tape and reel |

Notes:

⁽¹⁾xx indicates stand-off voltage

⁽²⁾Where xxx is nominal value of VBR and A or CA indicates unidirectional or bidirectional version. See [Table 3: "Electrical characteristics parameter values \(Tamb = 25 °C, unless otherwise specified\)"](#) for list of available devices and their order codes

Table 6: Marking

| Order code | Marking | Order code | Marking |
|------------|---------|------------|---------|
| SMBJ5.0A | BUZ | SMBJ5.0CA | BBZ |
| SMBJ6.0A | BUA | SMBJ6.0CA | BBA |
| SMBJ6.5A | BUB | SMBJ6.5CA | BBB |
| SMBJ8.5A | BUC | SMBJ8.5CA | BBC |
| SMBJ10A | BUD | SMBJ10CA | BBD |
| SMBJ12A | BUE | SMBJ12CA | BBE |
| SMBJ13A | BUF | SMBJ13CA | BBF |
| SMBJ15A | BUG | SMBJ15CA | BBG |
| SMBJ16A | CUG | SMBJ16CA | CBG |
| SMBJ18A | BUH | SMBJ18CA | BBH |
| SMBJ20A | BUI | SMBJ20CA | BBI |
| SMBJ22A | BVA | SMBJ22CA | CBH |
| SMBJ24A | BUJ | SMBJ24CA | BBJ |
| SMBJ26A | BUK | SMBJ26CA | BBK |
| SMBJ28A | BUL | SMBJ28CA | BBL |
| SMBJ30A | BUM | SMBJ30CA | BBM |
| SMBJ33A | BUN | SMBJ33CA | BBN |
| SMBJ36A | CUN | SMBJ36CA | CBN |
| SMBJ40A | CUJ | SMBJ40CA | CBJ |
| SMBJ43A | CUW | SMBJ43CA | CBW |
| SMBJ48A | BUW | SMBJ48CA | BBW |
| SMBJ58A | BUO | SMBJ58CA | BBO |
| SMBJ70A | CUM | SMBJ70CA | CBM |
| SMBJ85A | BUQ | SMBJ85CA | BBQ |
| SMBJ100A | CUQ | SMBJ100CA | CBQ |
| SMBJ130A | BUS | SMBJ130A | BBS |
| SMBJ154A | BUT | SMBJ154A | BBT |
| SMBJ170A | BUU | SMBJ170A | BBU |
| SMBJ188A | BUV | SMBJ188A | BBV |

4 Revision history

Table 7: Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| Oct-2001 | 4 | Previous issue. |
| 10-Feb-2005 | 5 | Reformatted to current template. Added directional (uni and bi) indications to graphics. Added ECOPACK statement. |
| 16-Nov-2006 | 6 | Add part numbers SMBJ36A-TR and SMBJ36CA-TR in Table 3. |
| 14-May-2009 | 7 | Reformatted to current standards. Updated ECOPACK statement. Added part number SMBJ43CA/A. |
| 17-Sep-2009 | 8 | Document updated for low leakage current. |
| 09-Jul-2010 | 9 | Changed timescale in Figure 9. |
| 20-Oct-2010 | 10 | Updated Figure 13. |
| 24-Jan-2018 | 11 | Updated <i>Table 3: "Electrical characteristics parameter values ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)".</i> |

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