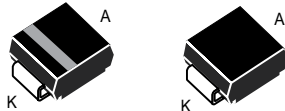


## High junction temperature Transil™



Unidirectional Bidirectional  
SMA  
(JEDEC DO-214AA)

### Features

- Peak pulse power:
  - 600 W (10/1000  $\mu$ s)
  - 4 kW (8/20  $\mu$ s)
- Stand-off voltage range: from 5 V to 188 V
- Unidirectional and bidirectional types
- Low leakage current:
  - 0.2  $\mu$ A at 25 °C
  - 1  $\mu$ A at 85 °C
- Operating  $T_j$  max: 175 °C
- JEDEC registered package outline
- Complies with the following standard: IEC 61000-4-2 level 4:
  - $\pm$ 15 kV (air discharge)
  - $\pm$ 8 kV (contact discharge)
- Complies with the following standard: MIL STD 883G, method 3015-7, class 3B:
  - $\pm$ 25 kV HBM (human body model)

### Description

The SMA6J Transil series has been designed to protect sensitive equipment against electro-static 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 generally for surges below 600 W 10/1000  $\mu$ s.

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. Their low clamping voltages provide a better safety margin to protect sensitive circuits with extended life time expectancy.

Packaged in SMA, which minimizes PCB space consumption (SMA footprint in accordance with IPC 7531 standard).

Transil™ is a trademark of STMicroelectronics.

Product status link

[SMA6J](#)

# 1 Characteristics

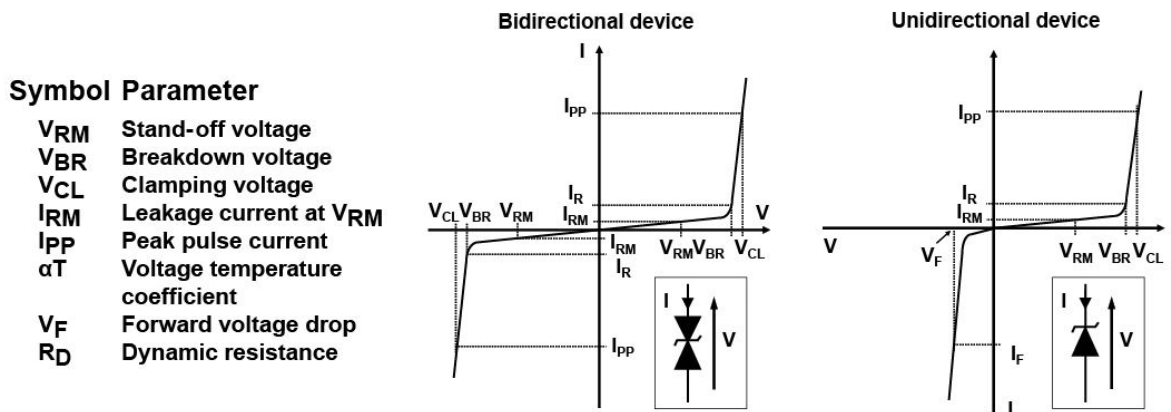
**Table 1. Absolute maximum ratings ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )**

| Symbol    | Parameter  |  | Value       | Unit               |
|-----------|--|--|-------------|--------------------|
| $P_{PP}$  | Peak pulse power dissipation                       | $T_j \text{ initial} = T_{amb}$        | 600         | W                  |
| $P$       | Power dissipation on infinite heatsink             | $T_{amb} = 55\text{ }^{\circ}\text{C}$ | 4           | W                  |
| $T_{stg}$ | Storage temperature range                          |  | -65 to +175 | $^{\circ}\text{C}$ |
| $T_j$     | Operating junction temperature range               |  | -55 to +175 | $^{\circ}\text{C}$ |
| $T_L$     | Maximum lead temperature for soldering during 10 s |  | 260         | $^{\circ}\text{C}$ |

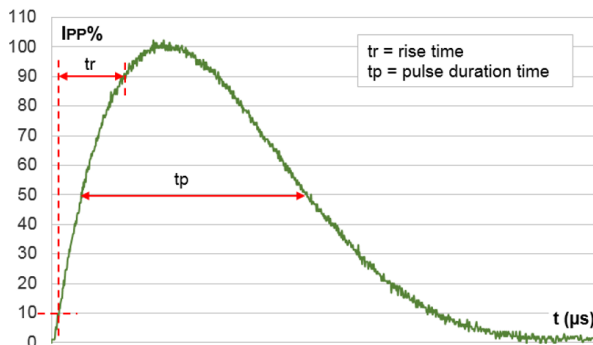
**Table 2. Thermal resistance**

| Symbol        | Parameter  | Value | Unit                        |
|---------------|--|-------|-----------------------------|
| $R_{th(j-l)}$ | Junction to leads  | 30    | $^{\circ}\text{C}/\text{W}$ |
| $R_{th(j-a)}$ | Junction to ambient on printed circuit on recommended pad layout | 120   | $^{\circ}\text{C}/\text{W}$ |

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



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



**Table 3. Electrical characteristics parameter values ( $T_{amb} = 25\text{ °C}$ , unless otherwise specified)**

| Order code   | $I_{RM}$ max at $V_{RM}$ |       |     | $V_{BR}$ at $I_R^{(1)}$ |      |      |    | 10 / 1000 $\mu s$ |           |          | 8 / 20 $\mu s$ |          |          | $\alpha T^{(2)}$    |
|--------------|--------------------------|-------|-----|-------------------------|------|------|----|-------------------|-----------|----------|----------------|----------|----------|---------------------|
|              |                          |       |     |                         |      |      |    | $V_{CL}$          | $I_{PP}$  | $R_D$    | $V_{CL}$       | $I_{PP}$ | $R_D$    |                     |
|              | 25 °C                    | 85 °C |     | Min.                    | Typ. | Max. |    | Max.              |           | Max.     | Max.           |          |          | Max.                |
|              | $\mu A$                  |       | V   | V                       |      |      | mA | $V^{(3)}$         | $A^{(4)}$ | $\Omega$ | V              | A        | $\Omega$ | $10^{-4}/\text{°C}$ |
| SMA6J5.0A/CA | 20                       | 50    | 5.0 | 6.40                    | 6.74 | 7.07 | 10 | 9.1               | 68        | 0.029    | 14.4           | 275      | 0.027    | 5.7                 |
| SMA6J6.0A/CA | 20                       | 50    | 6.0 | 6.70                    | 7.05 | 7.41 | 10 | 9.5               | 61        | 0.034    | 14.8           | 270      | 0.027    | 5.9                 |
| SMA6J6.5A/CA | 20                       | 50    | 6.5 | 7.20                    | 7.58 | 7.96 | 10 | 10.2              | 56        | 0.040    | 15.2           | 266      | 0.027    | 6.1                 |
| SMA6J8.5A/CA | 20                       | 50    | 8.5 | 9.4                     | 9.9  | 10.4 | 1  | 13.3              | 41.7      | 0.070    | 19.5           | 205      | 0.044    | 7.3                 |
| SMA6J10A/CA  | 0.2                      | 1     | 10  | 11.1                    | 11.7 | 12.3 | 1  | 15.7              | 37        | 0.093    | 21.7           | 184      | 0.051    | 7.8                 |
| SMA6J12A/CA  | 0.2                      | 1     | 12  | 13.3                    | 14.0 | 14.7 | 1  | 18.8              | 31        | 0.133    | 25.3           | 157      | 0.068    | 8.3                 |
| SMA6J13A/CA  | 0.2                      | 1     | 13  | 14.4                    | 15.2 | 15.9 | 1  | 20.4              | 29        | 0.154    | 27.2           | 147      | 0.076    | 8.4                 |
| SMA6J15A/CA  | 0.2                      | 1     | 15  | 16.7                    | 17.6 | 18.5 | 1  | 23.6              | 25.1      | 0.206    | 32.5           | 123      | 0.114    | 8.8                 |
| SMA6J18A/CA  | 0.2                      | 1     | 18  | 20.0                    | 21.1 | 22.1 | 1  | 28.3              | 21.5      | 0.288    | 39.3           | 102      | 0.168    | 9.2                 |
| SMA6J20A/CA  | 0.2                      | 1     | 20  | 22.2                    | 23.4 | 24.5 | 1  | 31.4              | 19.4      | 0.354    | 42.8           | 93       | 0.196    | 9.4                 |
| SMA6J24A/CA  | 0.2                      | 1     | 24  | 26.7                    | 28.1 | 29.5 | 1  | 37.8              | 16        | 0.516    | 50             | 80       | 0.256    | 9.6                 |
| SMA6J26A/CA  | 0.2                      | 1     | 26  | 28.9                    | 30.4 | 31.9 | 1  | 40.9              | 14.9      | 0.600    | 53.5           | 75       | 0.288    | 9.7                 |
| SMA6J28A/CA  | 0.2                      | 1     | 28  | 31.1                    | 32.7 | 34.4 | 1  | 44.0              | 13.8      | 0.697    | 59             | 68       | 0.363    | 9.8                 |
| SMA6J33A/CA  | 0.2                      | 1     | 33  | 36.7                    | 38.6 | 40.6 | 1  | 51.9              | 11.8      | 0.963    | 69             | 57       | 0.512    | 10.0                |
| SMA6J40A/CA  | 0.2                      | 1     | 40  | 44.4                    | 46.7 | 49.1 | 1  | 62.8              | 9.7       | 1.42     | 84             | 48       | 0.728    | 10.1                |
| SMA6J48A/CA  | 0.2                      | 1     | 48  | 53.3                    | 56.1 | 58.9 | 1  | 75.4              | 8.1       | 2.04     | 100            | 40       | 1.03     | 10.3                |
| SMA6J58A/CA  | 0.2                      | 1     | 58  | 64.4                    | 67.8 | 71.2 | 1  | 91.1              | 6.7       | 2.97     | 121            | 33       | 1.51     | 10.4                |
| SMA6J70A/CA  | 0.2                      | 1     | 70  | 77.8                    | 81.9 | 86.0 | 1  | 110               | 5.5       | 4.38     | 146            | 27       | 2.22     | 10.5                |
| SMA6J85A/CA  | 0.2                      | 1     | 85  | 94                      | 99   | 104  | 1  | 134               | 4.6       | 6.45     | 178            | 22.5     | 3.29     | 10.6                |
| SMA6J100A/CA | 0.2                      | 1     | 100 | 111                     | 117  | 123  | 1  | 157               | 3.8       | 9.03     | 212            | 19       | 4.69     | 10.7                |
| SMA6J130A/CA | 0.2                      | 1     | 130 | 144                     | 152  | 159  | 1  | 204               | 3         | 14.9     | 265            | 15       | 7.03     | 10.8                |
| SMA6J154A/CA | 0.2                      | 1     | 154 | 171                     | 180  | 189  | 1  | 242               | 2.4       | 22.1     | 317            | 12.6     | 10.2     | 10.8                |
| SMA6J170A/CA | 0.2                      | 1     | 170 | 189                     | 199  | 209  | 1  | 275               | 2.2       | 30.0     | 353            | 11.3     | 12.7     | 10.8                |
| SMA6J188A/CA | 0.2                      | 1     | 188 | 209                     | 220  | 231  | 1  | 328               | 2         | 48.5     | 388            | 10.3     | 15.2     | 10.8                |

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

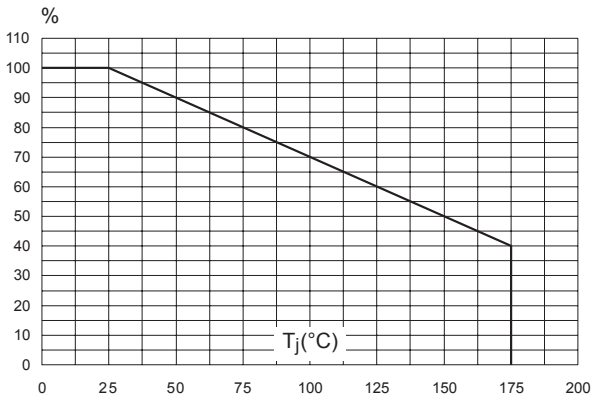
3. To calculate maximum clamping voltage at other surge level, use the following formula:

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

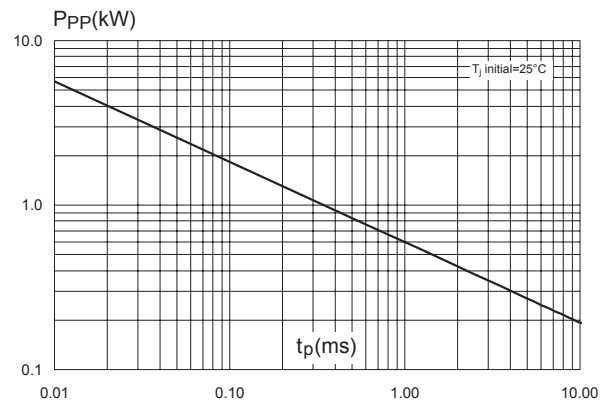
4. Surge capability given for both directions for unidirectional and bidirectional types.

## 1.1 Characteristics (curves)

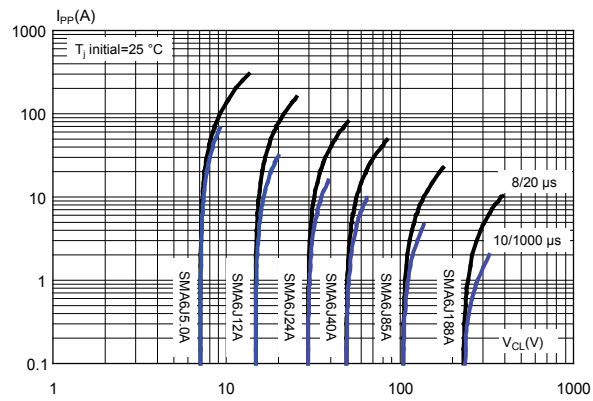
**Figure 3. Peak power dissipation versus initial junction temperature**

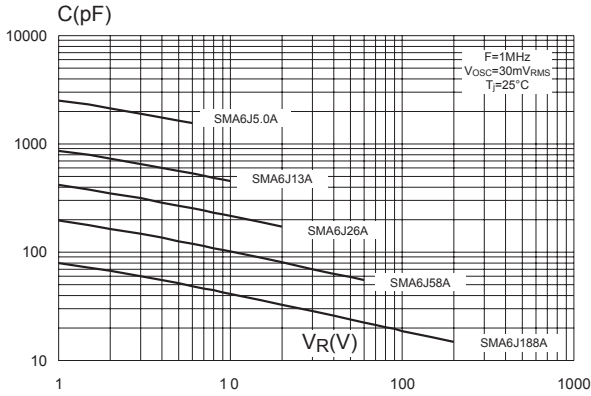
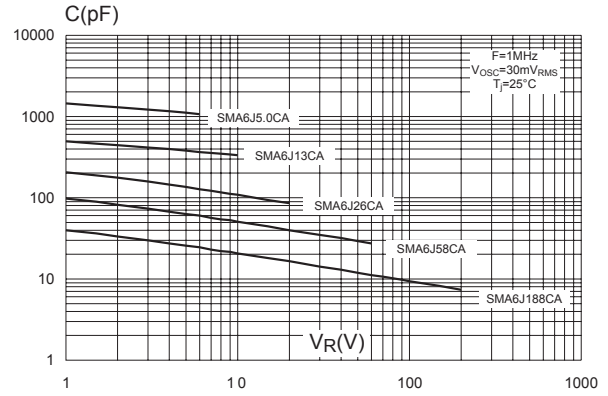
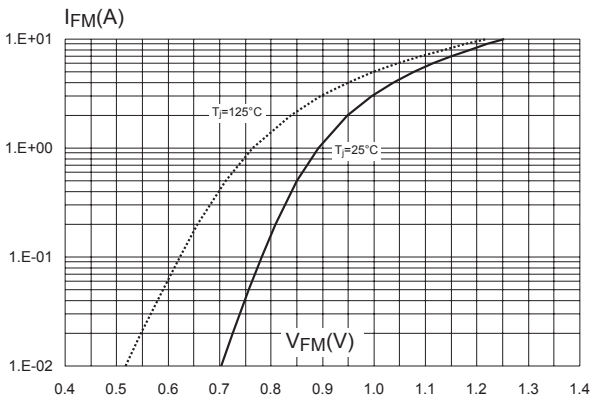
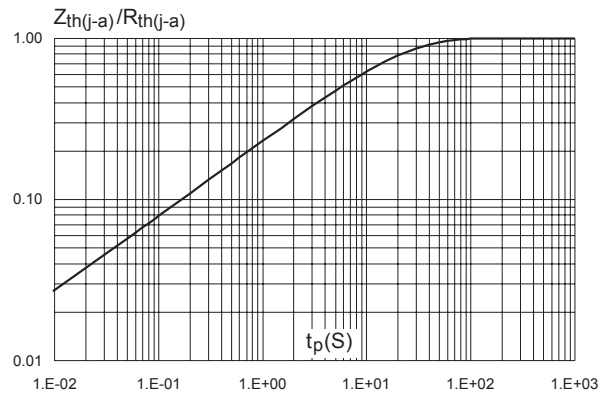


**Figure 4. Peak pulse power versus exponential pulse duration ( $T_{amb} = 25\text{ °C}$ )**

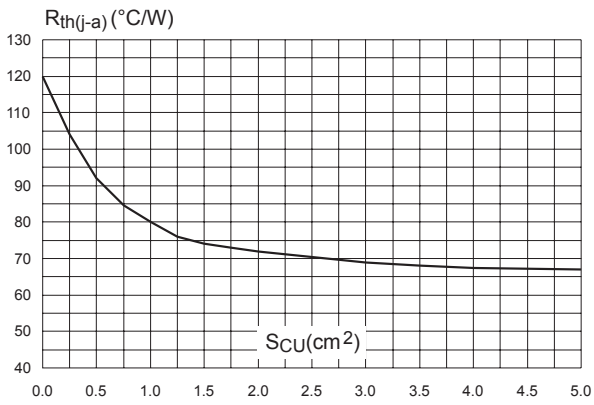


**Figure 5. Clamping voltage versus peak pulse current (exponential waveform, maximum values)**

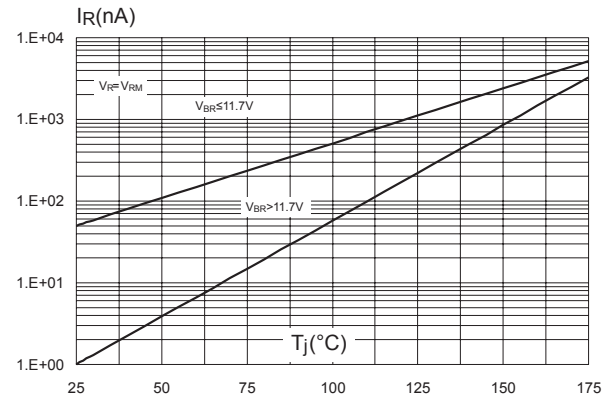


**Figure 6. Junction capacitance versus reverse applied voltage (typical values) (SMA6JxxA)**

**Figure 7. Junction capacitance versus reverse applied voltage (typical values) (SMA6JxxCA)**

**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 (printed circuit board FR4,  $S_{\text{Cu}} = 1 \text{ cm}^2$ )**


**Figure 10. Thermal resistance junction to ambient versus copper surface under each lead (printed circuit board FR4,  $e_{Cu} = 35 \mu m$ )**



**Figure 11. Leakage current versus junction temperature (typical values)**



## 2 Package information

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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

- 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

Figure 12. SMA package outline

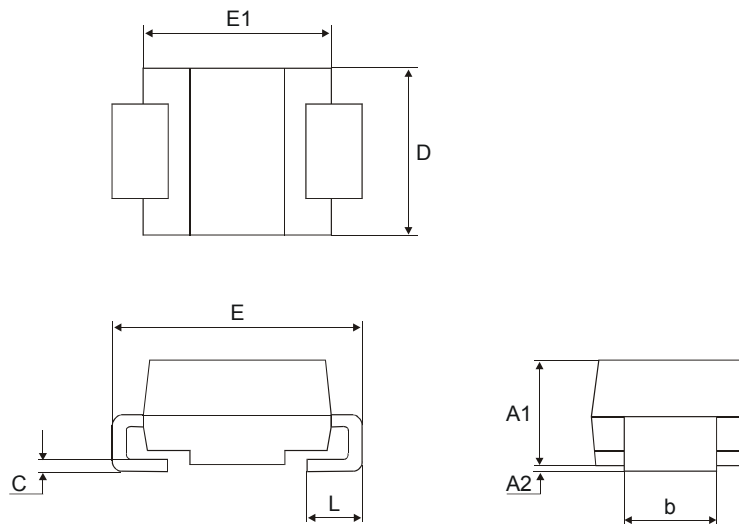
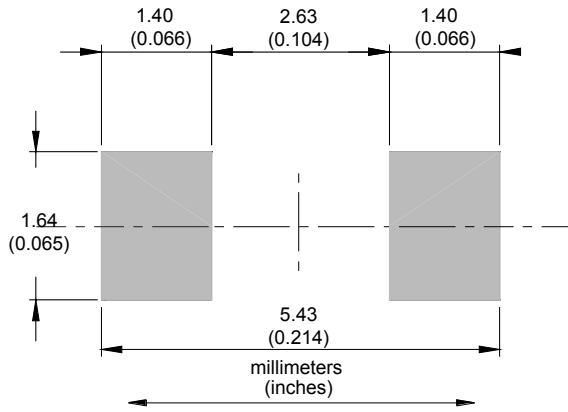
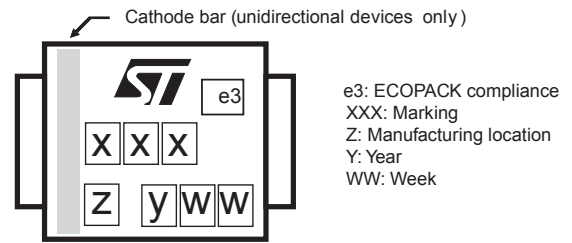


Table 4. SMA package mechanical data

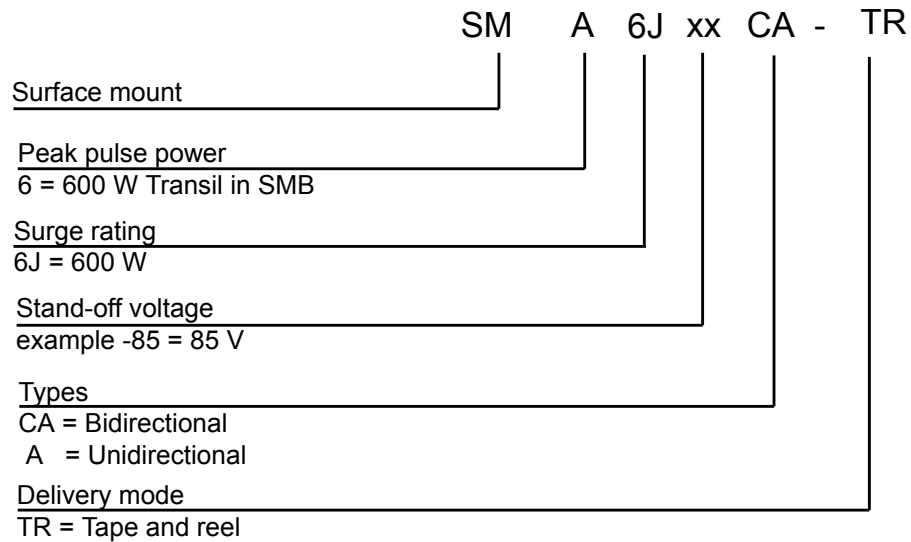
| Ref. | Dimensions  |      |        |        |
|------|-------------|------|--------|--------|
|      | Millimeters |      | Inches |        |
|      | Min.        | Max. | Min.   | Max.   |
| A1   | 1.90        | 2.45 | 0.0748 | 0.0964 |
| A2   | 0.05        | 0.20 | 0.0020 | 0.0079 |
| b    | 1.25        | 1.65 | 0.0492 | 0.0649 |
| c    | 0.15        | 0.40 | 0.0059 | 0.0157 |
| D    | 2.25        | 2.90 | 0.0885 | 0.1141 |
| E    | 4.80        | 5.35 | 0.1889 | 0.2106 |
| E1   | 3.95        | 4.60 | 0.1555 | 0.1811 |
| L    | 0.75        | 1.50 | 0.0295 | 0.0591 |



**Figure 13. SMA recommended footprint**

**Figure 14. Marking layout**


Note: Marking layout can vary according to assembly location.

### 3 Ordering information

**Figure 15. Ordering information scheme**

**Table 5. Ordering information**

| Order code <sup>(1)</sup> | Marking                | Package | Weight  | Base qty. | Delivery mode |
|---------------------------|------------------------|---------|---------|-----------|---------------|
| SMA6JxxA-TR               | See Table 6. Marking . | SMA     | 0.072 g | 5000      | Tape and reel |
| SMA6JxxCA-TR              |                        |         |         |           |               |

1. xx indicates stand-off voltage

**Table 6. Marking**

| Type         | Marking | Type          | Marking |
|--------------|---------|---------------|---------|
| SMA6J5.0A-TR | 6UA     | SMA6J5.0CA-TR | 6BA     |
| SMA6J6.0A-TR | 6UB     | SMA6J6.0CA-TR | 6BB     |
| SMA6J6.5A-TR | 6UC     | SMA6J6.5CA-TR | 6BC     |
| SMA6J8.5A-TR | 6UD     | SMA6J8.5CA-TR | 6BD     |
| SMA6J10A-TR  | 6UE     | SMA6J10CA-TR  | 6BE     |
| SMA6J12A-TR  | 6UF     | SMA6J12CA-TR  | 6BF     |
| SMA6J13A-TR  | 6UG     | SMA6J13CA-TR  | 6BG     |
| SMA6J15A-TR  | 6UH     | SMA6J15CA-TR  | 6BH     |
| SMA6J18A-TR  | 6UJ     | SMA6J18CA-TR  | 6BJ     |
| SMA6J20A-TR  | 6UK     | SMA6J20CA-TR  | 6BK     |

| Type         | Marking | Type          | Marking |
|--------------|---------|---------------|---------|
| SMA6J24A-TR  | 6UM     | SMA6J24CA-TR  | 6BM     |
| SMA6J26A-TR  | 6UN     | SMA6J26CA-TR  | 6BN     |
| SMA6J28A-TR  | 6UO     | SMA6J28CA-TR  | 6BO     |
| SMA6J33A-TR  | 6UQ     | SMA6J33CA-TR  | 6BQ     |
| SMA6J40A-TR  | 6UR     | SMA6J40CA-TR  | 6BR     |
| SMA6J48A-TR  | 6US     | SMA6J48CA-TR  | 6BS     |
| SMA6J58A-TR  | 6UT     | SMA6J58CA-TR  | 6BT     |
| SMA6J70A-TR  | 6UU     | SMA6J70CA-TR  | 6BU     |
| SMA6J85A-TR  | 6UV     | SMA6J85CA-TR  | 6BV     |
| SMA6J100A-TR | 6UW     | SMA6J100CA-TR | 6BW     |
| SMA6J130A-TR | 6UX     | SMA6J130CA-TR | 6BX     |
| SMA6J154A-TR | 6UY     | SMA6J154CA-TR | 6BY     |
| SMA6J170A-TR | 6UZ     | SMA6J170CA-TR | 6BZ     |
| SMA6J188A-TR | 6UAA    | SMA6J188CA-TR | 6BAA    |

## Revision history

**Table 7. Document revision history**

| Date        | Revision | Changes   |
|-------------|----------|---|
| 21-Feb-2007 | 1        | First issue.  |
| 7-Nov-2007  | 2        | Updated Description. Improved readability of Ordering information scheme. Reformatted to current standards. |
| 04-Aug-2014 | 3        | Updated weight in Table 7.  |
| 28-Oct-2015 | 4        | Updated Table 4 and Figure 3.   |
| 04-Jul-2017 | 5        | Updated Table 4.  |
| 22-Jan-2018 | 6        | Updated Table3.   |
| 30-Aug-2018 | 7        | Updated <a href="#">Table 6. Marking</a> .  |

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