

High junction temperature Transil™

Features

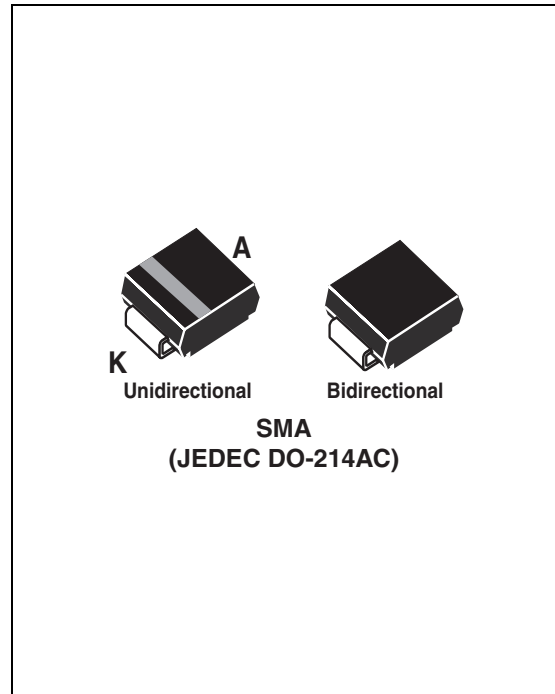
- Peak pulse power:
 - 600 W (10/1000 μ s)
 - 4 kW (8/20 μ s)
- Stand off voltage range: from 5 V to 188 V
- Unidirectional and bidirectional types
- Low clamping voltage versus standard series
- Low leakage current:
 - 0.2 μ A at 25° C
 - 1 μ A at 85° C
- Operating T_j max: 175° C
- JEDEC registered package outline

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 over stress such as IEC 61000-4-4 & 5. They are also in accordance with ISO TR 7637-2, SAE J 113 and DIN 40839 for automotive applications and more generally for surges below 600 W 10/1000 μ s

This Planar technology makes it compatible with high-end equipment like automotive, medical equipment or SMPS where low leakage current and high junction temperature are required to provide reliability and stability over time. Their low clamping voltages provides a better safety margin to protect sensitive circuits with extended life time expectancy.

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



Order code

| Part number | Marking |
|--------------|-------------------------------|
| SMA6JxxA-TR | See Table 6 . |
| SMA6JxxCA-TR | See Table 6 . |

Complies with the following standards:

IEC 61000-4-2 level 4:

15 kV(air discharge)
8 kV(contact discharge)

MIL STD 893G-Method 3015-7: class3B

25 kV HBM (Human Body Model)

TM: TRANSIL is a trademark of STMicroelectronics

1 Characteristics

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

| Symbol | Parameter | | Value | Unit |
|-----------|--|--|-------------|--------------|
| P_{PP} | Peak pulse power dissipation ⁽¹⁾ | $T_j \text{ initial} = T_{amb}$ | 600 | W |
| P | Power dissipation on infinite heatsink | $T_{amb} = 55^{\circ} C$ | 4 | W |
| I_{FSM} | Non repetitive surge peak forward current for unidirectional types | $t_p = 10 \text{ ms}$ $T_j \text{ initial} = T_{amb}$ | 60 | A |
| T_{stg} | Storage temperature range | | -65 to +175 | $^{\circ} C$ |
| T_j | Operating junction temperature range | | -55 to +175 | $^{\circ} C$ |
| T_L | Maximum lead temperature for soldering during 10 s | | 260 | $^{\circ} C$ |

1. For a surge greater than the maximum values, the diode will fail in short-circuit.

Table 2. Thermal resistances

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

Table 3. Electrical characteristics - definitions ($T_{amb} = 25^{\circ} C$)

| Symbol | Parameter | |
|------------|---------------------------------|--|
| V_{RM} | Stand-off voltage | |
| V_{BR} | Breakdown voltage | |
| V_{CL} | Clamping voltage | |
| I_{RM} | Leakage current @ V_{RM} | |
| I_{PP} | Peak pulse current | |
| αT | Voltage temperature coefficient | |
| V_F | Forward voltage drop | |
| R_D | Dynamic resistance | |

Table 4. Electrical characteristics - values ($T_{amb} = 25^{\circ}C$)

| Type | $I_{RM} \text{ max}@V_{RM}$ | | | $V_{BR} @I_R^{(1)}$ | | | $V_{CL} @I_{PP}$ 10/1000 μs | | | $R_D^{(2)}$ 10/1000 μs | $V_{CL} @I_{PP}$ 8/20 μs | | $R_D^{(2)}$ 8/20 μs | $\alpha T^{(3)}$ |
|--------------|-----------------------------|-------|-----|---------------------|------|------|-------------------------------------|------|------|--------------------------------|----------------------------------|------|-----------------------------|------------------|
| | 25° C | 85° C | | min | typ | max | | max | | | max | | | max |
| | μA | | V | V | | | mA | V | A | Ω | V | A | Ω | 10-4°C |
| SMA6J5.0A/CA | 10 | 50 | 5.0 | 6.40 | 6.74 | 7.07 | 10 | 9.1 | 68 | 0.029 | 13.4 | 298 | 0.021 | 5.7 |
| SMA6J6.0A/CA | 10 | 50 | 6.0 | 6.70 | 7.05 | 7.41 | 10 | 9.5 | 61 | 0.034 | 13.7 | 290 | 0.022 | 5.9 |
| SMA6J6.5A/CA | 10 | 50 | 6.5 | 7.20 | 7.58 | 7.96 | 10 | 10.2 | 56 | 0.040 | 14.5 | 276 | 0.024 | 6.1 |
| SMA6J8.5A/CA | 10 | 50 | 8.5 | 9.4 | 9.9 | 10.4 | 1 | 13.3 | 41.7 | 0.070 | 18.7 | 205 | 0.041 | 7.3 |
| SMA6J10A/CA | 0.2 | 1 | 10 | 11.1 | 11.7 | 12.3 | 1 | 15.7 | 37 | 0.093 | 19.6 | 184 | 0.040 | 7.8 |
| SMA6J12A/CA | 0.2 | 1 | 12 | 13.3 | 14.0 | 14.7 | 1 | 18.8 | 31 | 0.133 | 23.5 | 157 | 0.056 | 8.3 |
| SMA6J13A/CA | 0.2 | 1 | 13 | 14.4 | 15.2 | 15.9 | 1 | 20.4 | 29 | 0.154 | 23.9 | 147 | 0.054 | 8.4 |
| SMA6J15A/CA | 0.2 | 1 | 15 | 16.7 | 17.6 | 18.5 | 1 | 23.6 | 25.1 | 0.206 | 27.7 | 123 | 0.075 | 8.8 |
| SMA6J18A/CA | 0.2 | 1 | 18 | 20.0 | 21.1 | 22.1 | 1 | 28.3 | 21.5 | 0.288 | 33.2 | 102 | 0.108 | 9.2 |
| SMA6J20A/CA | 0.2 | 1 | 20 | 22.2 | 23.4 | 24.5 | 1 | 31.4 | 19.4 | 0.354 | 36.8 | 93 | 0.132 | 9.4 |
| SMA6J24A/CA | 0.2 | 1 | 24 | 26.7 | 28.1 | 29.5 | 1 | 37.8 | 16 | 0.516 | 44.3 | 80 | 0.184 | 9.6 |
| SMA6J26A/CA | 0.2 | 1 | 26 | 28.9 | 30.4 | 31.9 | 1 | 40.9 | 14.9 | 0.600 | 47.9 | 75 | 0.213 | 9.7 |
| SMA6J28A/CA | 0.2 | 1 | 28 | 31.1 | 32.7 | 34.4 | 1 | 44.0 | 13.8 | 0.697 | 51.6 | 68 | 0.253 | 9.8 |
| SMA6J33A/CA | 0.2 | 1 | 33 | 36.7 | 38.6 | 40.6 | 1 | 51.9 | 11.8 | 0.963 | 60.8 | 57 | 0.356 | 10.0 |
| SMA6J40A/CA | 0.2 | 1 | 40 | 44.4 | 46.7 | 49.1 | 1 | 62.8 | 9.7 | 1.42 | 73.6 | 48 | 0.511 | 10.1 |
| SMA6J48A/CA | 0.2 | 1 | 48 | 53.3 | 56.1 | 58.9 | 1 | 75.4 | 8.1 | 2.04 | 88.4 | 40 | 0.736 | 10.3 |
| SMA6J58A/CA | 0.2 | 1 | 58 | 64.4 | 67.8 | 71.2 | 1 | 91.1 | 6.7 | 2.97 | 100 | 33 | 0.863 | 10.4 |
| SMA6J70A/CA | 0.2 | 1 | 70 | 77.8 | 81.9 | 86.0 | 1 | 110 | 5.5 | 4.38 | 120 | 27 | 1.27 | 10.5 |
| SMA6J85A/CA | 0.2 | 1 | 85 | 94 | 99 | 104 | 1 | 134 | 4.6 | 6.45 | 146 | 22.5 | 1.85 | 10.6 |
| SMA6J100A/CA | 0.2 | 1 | 100 | 111 | 117 | 123 | 1 | 157 | 3.8 | 9.03 | 172 | 19 | 2.58 | 10.7 |
| SMA6J130A/CA | 0.2 | 1 | 130 | 144 | 152 | 159 | 1 | 204 | 3 | 14.9 | 223 | 15 | 4.24 | 10.8 |
| SMA6J154A/CA | 0.2 | 1 | 154 | 171 | 180 | 189 | 1 | 242 | 2.4 | 22.1 | 265 | 12.6 | 6.00 | 10.8 |
| SMA6J170A/CA | 0.2 | 1 | 170 | 189 | 199 | 209 | 1 | 275 | 2.2 | 30.0 | 292 | 11.3 | 7.39 | 10.8 |
| SMA6J188A/CA | 0.2 | 1 | 188 | 209 | 220 | 231 | 1 | 328 | 2 | 48.5 | 323 | 10.3 | 8.97 | 10.8 |

1. Pulse test: $t_p < 50ms$.

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

$$V_{CLmax} = R_D \times I_{PP} + V_{BRmax}$$

3. To calculate V_{BR} versus junction temperature, use the following formula:

$$V_{BR} @ T_j = V_{BR} @ 25^{\circ}C \times (1 + \alpha T \times (T_j - 25))$$

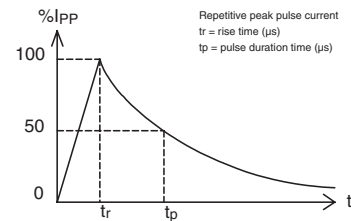


Figure 1. Peak power dissipation versus initial junction temperature

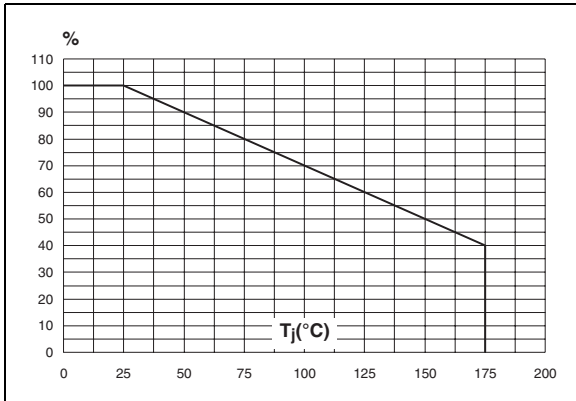


Figure 2. Peak pulse power versus exponential pulse duration (T_j initial = 25° C)

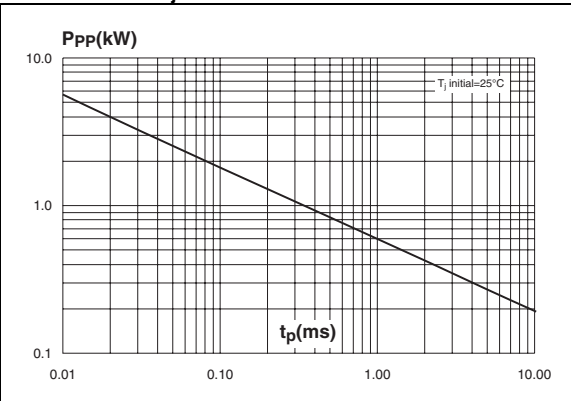


Figure 3. Clamping voltage versus peak pulse current (exponential waveform, maximum values)

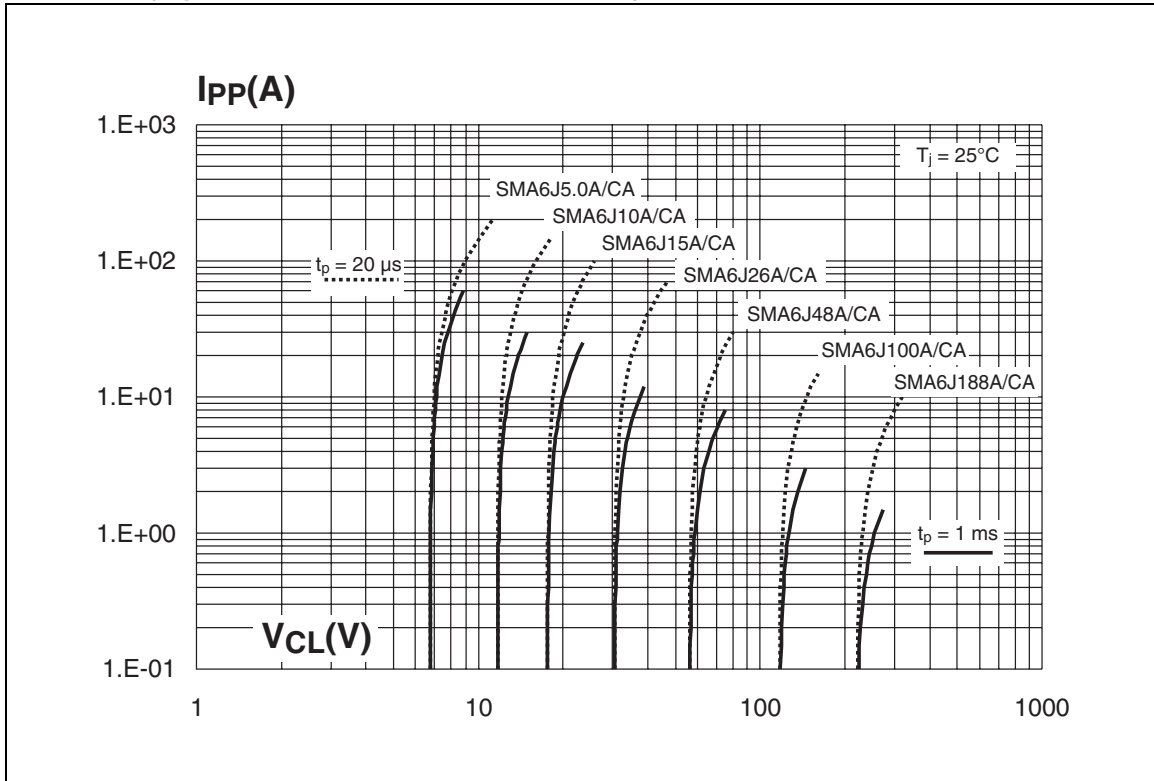


Figure 4. Junction capacitance versus reverse applied voltage (typical values) (SMA6JxxA)

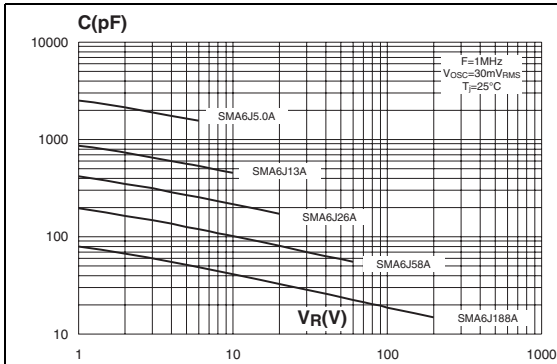


Figure 5. Junction capacitance versus reverse applied voltage (typical values) (SMA6JxxCA)

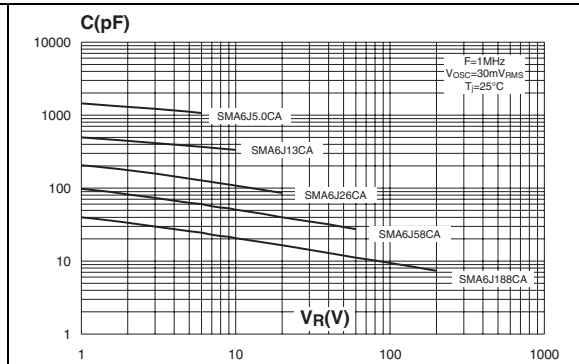


Figure 6. Peak forward voltage drop versus peak forward current (typical values)

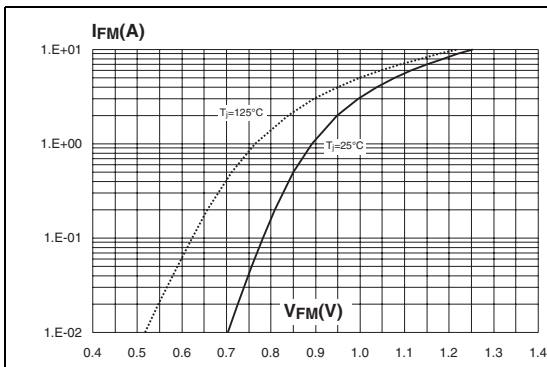


Figure 7. Relative variation of thermal impedance junction to ambient versus pulse duration (printed circuit board FR4, S_{Cu} = 1 cm²)

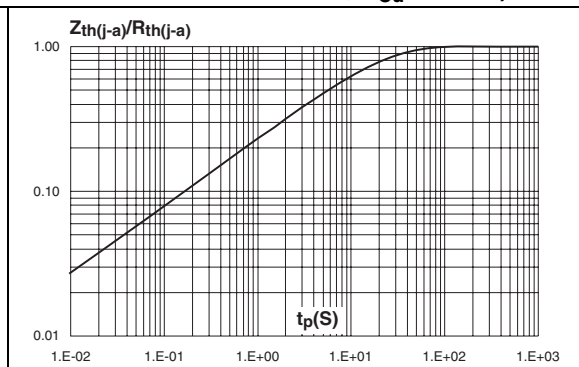


Figure 8. Thermal resistance junction to ambient versus copper surface under each lead (printed circuit board FR4, e_{Cu} = 35 μm)

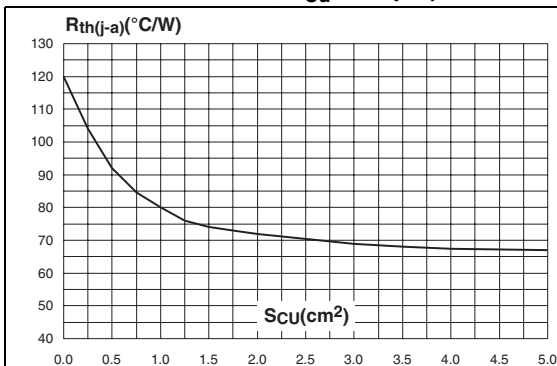
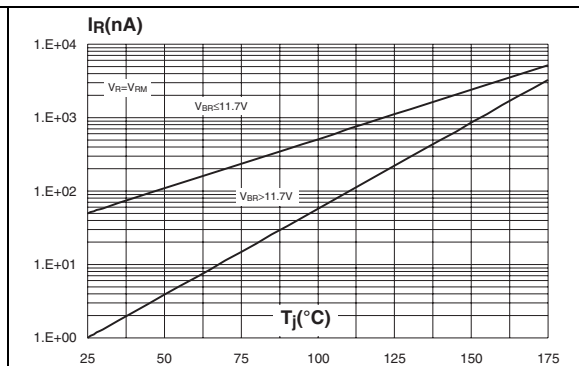
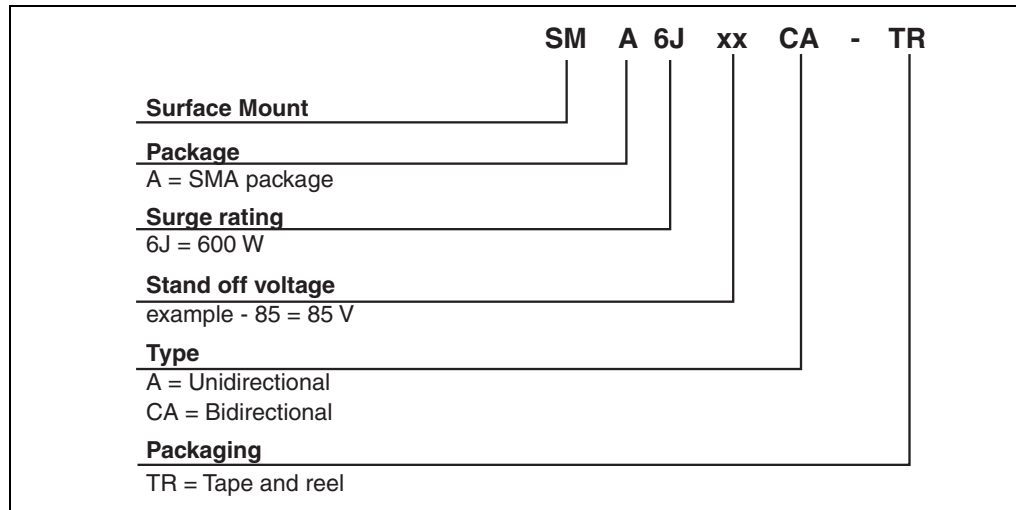


Figure 9. Leakage current versus junction temperature (typical values)



2 Order information scheme



3 Package information

- Case: JEDEC DO-214AC 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

Table 5. SMA Dimensions

| Ref. | Dimensions | | | |
|------|-------------|------|--------|-------|
| | Millimeters | | Inches | |
| | Min. | Max. | Min. | Max. |
| A1 | 1.90 | 2.03 | 0.075 | 0.08 |
| A2 | 0.05 | 0.20 | 0.002 | 0.008 |
| b | 1.25 | 1.65 | 0.049 | 0.065 |
| c | 0.15 | 0.40 | 0.006 | 0.016 |
| D | 2.25 | 2.90 | 0.089 | 0.114 |
| E | 4.80 | 5.35 | 0.189 | 0.211 |
| E1 | 3.95 | 4.60 | 0.156 | 0.181 |
| L | 0.75 | 1.50 | 0.030 | 0.059 |

Figure 10. SMA footprint dimensions

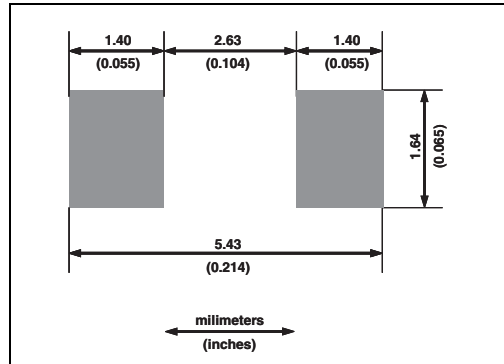


Figure 11. Marking information

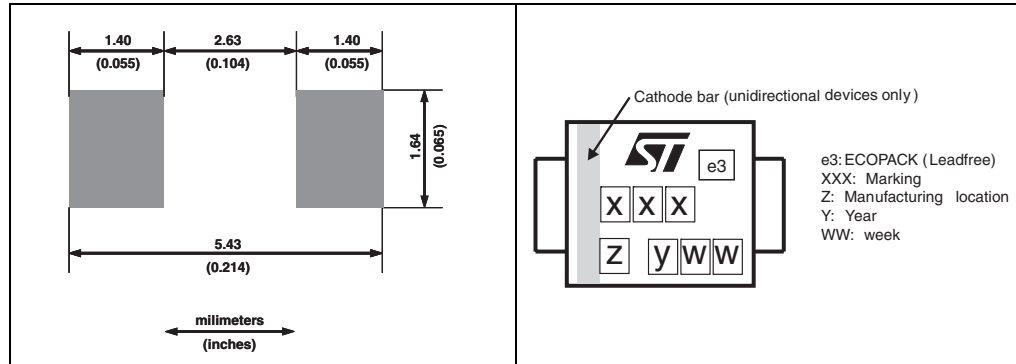


Table 6. Marking

| 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 |
| 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 |

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com.

4 Ordering information

| Part number | Marking | Package | Weight | Base qty | Delivery mode |
|--------------|-------------------------------|---------|---------|----------|---------------|
| SMA6JxxA-TR | See Table 6 . | SMA | 0.068 g | 5000 | Tape and reel |
| SMA6JxxCA-TR | See Table 6 . | SMA | 0.068 g | 5000 | Tape and reel |

5 Revision history

| Date | Revision | Changes |
|-------------|----------|--------------|
| 21-Feb-2007 | 1 | First issue. |

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