

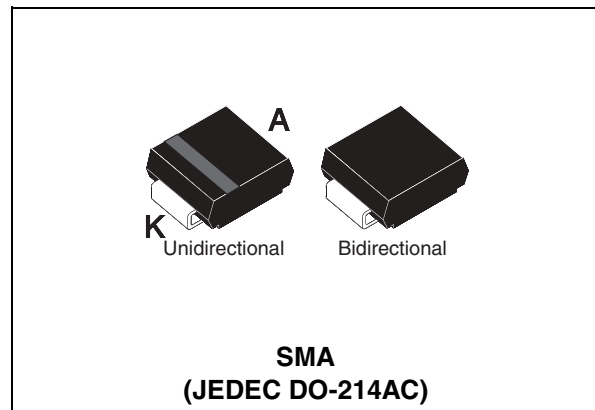
### FEATURES

- Peak Pulse Power : 400 W (10/1000µs)
- Stand off voltage range:  
From 5V to 188V
- Uni and Bidirectional types
- Low clamping factor
- Fast response time
- JEDEC registered package outline

### DESCRIPTION

The SMAJ series are TRANSIL™ diodes designed specifically for protecting sensitive equipment against transient overvoltages. The SMA package allows save spacing on high density printed circuit boards.

Transil diodes provide high overvoltage protection by clamping action. Their instantaneous response to transient overvoltages makes them particularly suited to protect voltage sensitive devices such as MOS Technology and low voltage supplied IC's.



**Table 1: Order Codes**

| Part Number  | Marking    |
|--------------|------------|
| SMAJxxxA-TR  | See page 2 |
| SMAJxxxCA-TR | See page 2 |

**Table 2: Absolute Maximum Rating** ( $T_{amb} = 25^{\circ}\text{C}$ )

| Symbol             | Parameter  |  | Value             | Unit               |
|--------------------|--|--|-------------------|--------------------|
| $P_{PP}$           | Peak pulse power dissipation (see note 1)                          | $T_j \text{ initial} = T_{amb}$                          | 400               | W                  |
| $P$                | Power dissipation on infinite heatsink                             | $T_{amb} = 50^{\circ}\text{C}$                           | 3.3               | W                  |
| $I_{FSM}$          | Non repetitive surge peak forward current for unidirectional types | $t_p = 10 \text{ ms}$<br>$T_j \text{ initial} = T_{amb}$ | 40                | A                  |
| $T_{stg}$<br>$T_j$ | Storage temperature range<br>Maximum junction temperature          |  | -65 to 175<br>150 | $^{\circ}\text{C}$ |
| $T_L$              | Maximum lead temperature for soldering during 10 s.                |  | 260               | $^{\circ}\text{C}$ |

**Note 1:** for a surge greater than the maximum values, the diode will fail in short-circuit.

**Table 3: Thermal Resistances**

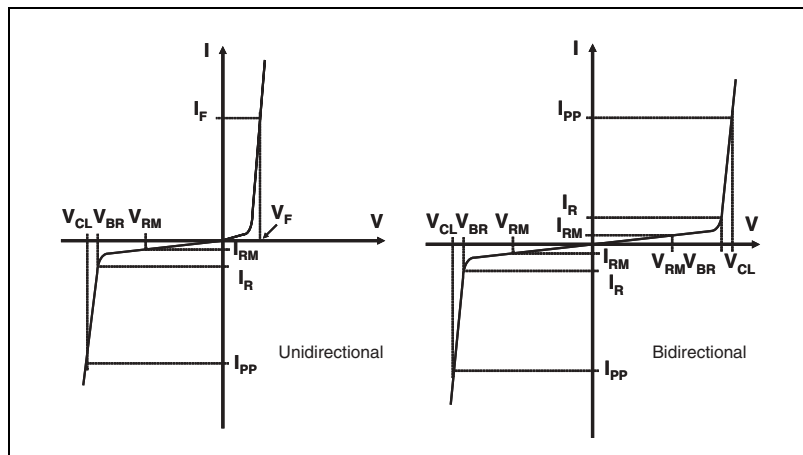
| Symbol        | Parameter  | Value | Unit                        |
|---------------|--|-------|-----------------------------|
| $R_{th(j-l)}$ | Junction to leads  | 30    | $^{\circ}\text{C}/\text{W}$ |
| $R_{th(j-a)}$ | Junction to ambient on printed circuit on recommended pad layout | 120   | $^{\circ}\text{C}/\text{W}$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

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**Table 4: Electrical Characteristics**

( $T_{amb} = 25^{\circ}C$ )

| Symbol     | Parameter                       |
|------------|---------------------------------|
| $V_{RM}$   | Stand-off voltage               |
| $V_{BR}$   | Breakdown voltage               |
| $V_{CL}$   | Clamping voltage                |
| $I_{RM}$   | Leakage current                 |
| $I_{PP}$   | Peak pulse current              |
| $\alpha T$ | Voltage temperature coefficient |
| $V_F$      | Forward voltage drop            |



| Types          |       |               |       | $I_{RM} @ V_{RM}$ |     | $V_{BR} @ I_R$ |       | $V_{CL} @ I_{PP}$ |                 | $V_{CL} @ I_{PP}$ |              | $\alpha T$          | <b>C</b> |
|----------------|-------|---------------|-------|-------------------|-----|----------------|-------|-------------------|-----------------|-------------------|--------------|---------------------|----------|
|                |       |               |       | max               |     | min            | note2 | max               | 10/1000 $\mu s$ | max               | 8/20 $\mu s$ | max                 | note3    |
| Unidirectional | Mark. | Bidirectional | Mark. | $\mu A$           | V   | V              | mA    | V                 | A               | V                 | A            | $10^{-4}/^{\circ}C$ | pF       |
| SMAJ5.0A-TR    | AE    | SMAJ5.0CA-TR  | AA    | 800               | 5.0 | 6.4            | 10    | 9.2               | 43.5            | 13.4              | 174          | 5.7                 | 3500     |
| SMAJ6.0A-TR    | DUB   | SMAJ6.0CA-TR  | DBB   | 800               | 6.0 | 6.7            | 10    | 10.3              | 38.8            | 13.7              | 170          | 5.9                 | 3300     |
| SMAJ6.5A-TR    | DUC   | SMAJ6.5CA-TR  | DBC   | 500               | 6.5 | 7.2            | 10    | 11.2              | 35.7            | 14.5              | 160          | 6.1                 | 3100     |
| SMAJ8.5A-TR    | DUH   | SMAJ8.5CA-TR  | DBH   | 10                | 8.5 | 9.44           | 1     | 14.4              | 27.7            | 18.6              | 124          | 7.3                 | 2000     |
| SMAJ10A-TR     | AX    | SMAJ10CA-TR   | AC    | 5                 | 10  | 11.1           | 1     | 17                | 23.5            | 21.7              | 106          | 7.8                 | 1550     |
| SMAJ12A-TR     | DUK   | SMAJ12CA-TR   | DBK   | 5                 | 12  | 13.3           | 1     | 19.9              | 20.1            | 25.3              | 91           | 8.3                 | 1325     |
| SMAJ13A-TR     | BG    | SMAJ13CA-TR   | BH    | 1                 | 13  | 14.4           | 1     | 21.5              | 18.6            | 27.2              | 85           | 8.4                 | 1200     |
| SMAJ15A-TR     | BM    | SMAJ15CA-TR   | AJ    | 1                 | 15  | 16.7           | 1     | 24.4              | 16.4            | 32.5              | 71           | 8.8                 | 975      |
| SMAJ18A-TR     | DUQ   | SMAJ18CA-TR   | DBQ   | 1                 | 18  | 20             | 1     | 29.2              | 13.7            | 39.3              | 59           | 9.2                 | 800      |
| SMAJ20A-TR     | DUR   | SMAJ20CA-TR   | DBR   | 1                 | 20  | 22.2           | 1     | 32.4              | 12.3            | 42.8              | 54           | 9.4                 | 725      |
| SMAJ22A-TR     | DUS   | SMAJ22CA-TR   | DBS   | 1                 | 22  | 24.4           | 1     | 35.5              | 11.2            | 48.3              | 48           | 9.6                 | 625      |
| SMAJ24A-TR     | DUT   | SMAJ24CA-TR   | DBT   | 1                 | 24  | 26.7           | 1     | 38.9              | 10.3            | 50                | 46           | 9.6                 | 600      |
| SMAJ26A-TR     | DUU   | SMAJ26CA-TR   | DBU   | 1                 | 26  | 28.9           | 1     | 42.1              | 9.5             | 53.5              | 43           | 9.7                 | 575      |
| SMAJ28A-TR     | CG    | SMAJ28CA-TR   | CH    | 1                 | 28  | 31.1           | 1     | 45.4              | 8.8             | 59                | 39           | 9.8                 | 510      |
| SMAJ30A-TR     | CK    | SMAJ30CA-TR   | CL    | 1                 | 30  | 33.3           | 1     | 48.4              | 8.3             | 64.3              | 36           | 9.9                 | 480      |
| SMAJ33A-TR     | CM    | SMAJ33CA-TR   | CN    | 1                 | 33  | 36.7           | 1     | 53.3              | 7.5             | 69.7              | 33           | 10.0                | 450      |
| SMAJ40A-TR     | DUZ   | SMAJ40CA-TR   | DBZ   | 1                 | 40  | 44.4           | 1     | 64.5              | 6.2             | 84                | 27           | 10.1                | 370      |
| SMAJ43A-TR     | EUA   | SMAJ43CA-TR   | EBA   | 1                 | 43  | 47.8           | 1     | 69.4              | 5.7             | 91                | 25           | 10.2                | 350      |
| SMAJ48A-TR     | CX    | SMAJ48CA-TR   | CY    | 1                 | 48  | 53.3           | 1     | 77.4              | 5.2             | 100               | 23           | 10.3                | 320      |
| SMAJ58A-TR     | EUF   | SMAJ58CA-TR   | EBF   | 1                 | 58  | 64.4           | 1     | 93.6              | 4.3             | 121               | 19           | 10.4                | 270      |
| SMAJ70A-TR     | EUI   | SMAJ70CA-TR   | EBI   | 1                 | 70  | 77.8           | 1     | 113               | 3.5             | 146               | 16           | 10.5                | 230      |
| SMAJ85A-TR     | EUL   | SMAJ85CA-TR   | EBL   | 1                 | 85  | 94.4           | 1     | 137               | 2.9             | 178               | 13           | 10.6                | 200      |
| SMAJ100A-TR    | EUN   | SMAJ100CA-TR  | EBN   | 1                 | 100 | 111            | 1     | 162               | 2.5             | 212               | 11           | 10.7                | 170      |
| SMAJ130A-TR    | EUQ   | SMAJ130CA-TR  | EBQ   | 1                 | 130 | 144            | 1     | 209               | 1.9             | 265               | 9            | 10.8                | 145      |
| SMAJ154A-TR    | EUT   | SMAJ154CA-TR  | EBT   | 1                 | 154 | 171            | 1     | 246               | 1.6             | 317               | 7            | 10.8                | 125      |
| SMAJ170A-TR    | SR    | SMAJ170CA-TR  | SS    | 1                 | 170 | 189            | 1     | 275               | 1.4             | 353               | 6.5          | 10.8                | 120      |
| SMAJ188A-TR    | EUV   | SMAJ188CA-TR  | EBV   | 1                 | 188 | 209            | 1     | 328               | 1.4             | 388               | 6            | 10.8                | 110      |

**Note 2:** Pulse test :  $t_p < 50$  ms.

**Note 3:**  $\Delta V_{BR} = \alpha T * (T_{amb} - 25) * V_{BR}(25^{\circ}C)$ .

**Note 4:**  $V_R = 0$  V,  $F = 1$  MHz. For bidirectional types, capacitance value is divided by 2.

Figure 1: Pulse waveform (10/1000µs)

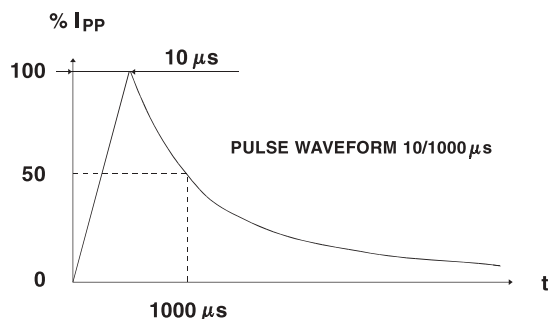


Figure 2: Peak power dissipation versus initial junction temperature

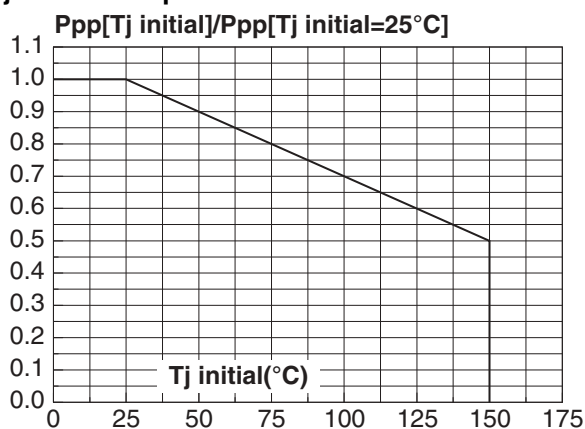


Figure 3: Peak pulse power versus exponential pulse duration (Tj initial=25°C)

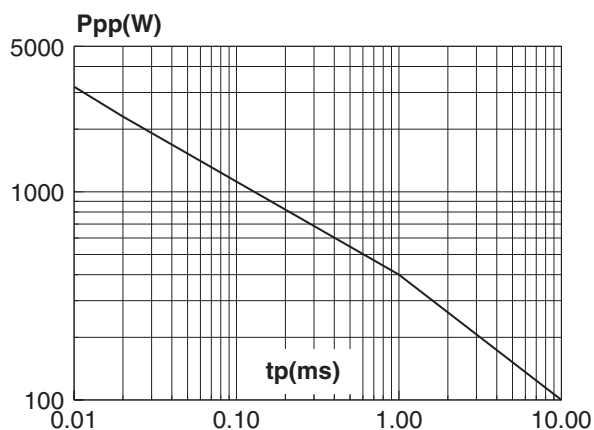


Figure 4: Clamping voltage versus peak pulse current (Tj initial=25°C)

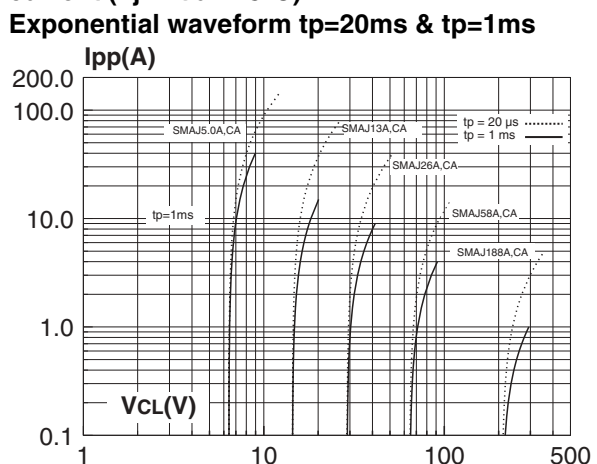


Figure 5: Capacitance versus reverse applied voltage (typical values) (SMAJxxA)

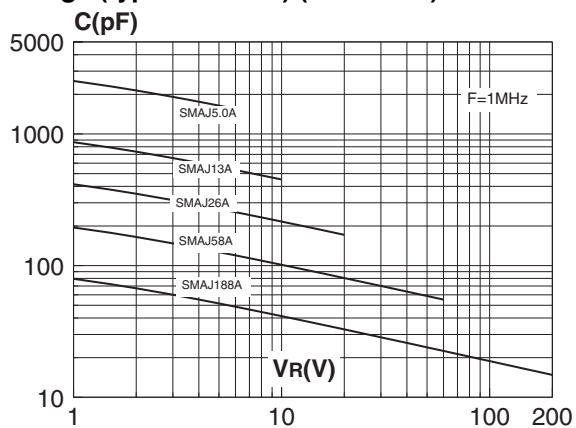
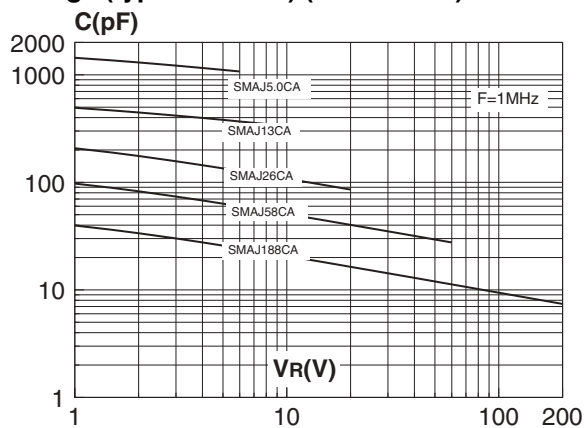
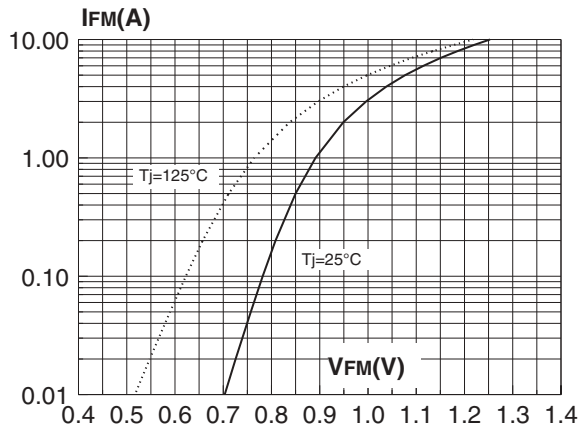


Figure 6: Capacitance versus reverse applied voltage (typical values) (SMAJxxCA)

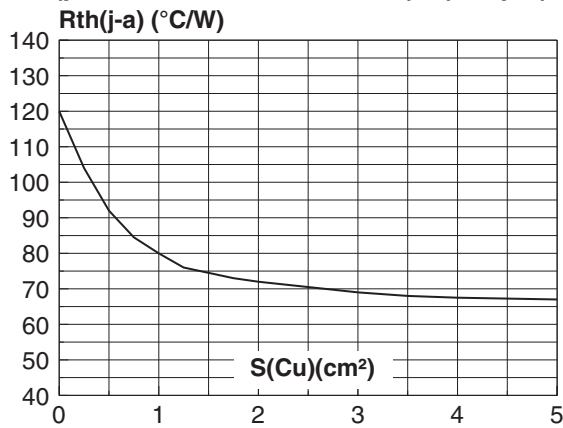


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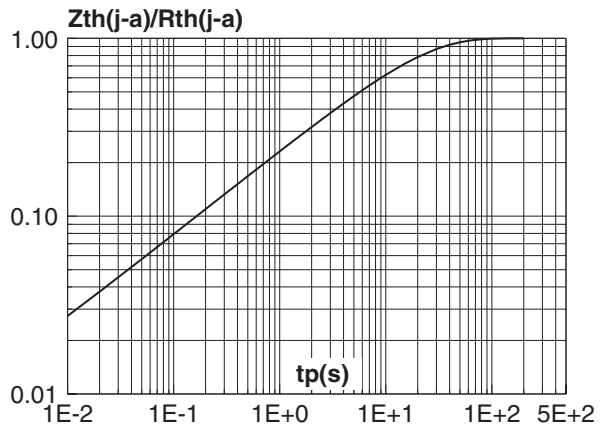
**Figure 7: Peak forward voltage drop versus peak forward current (typical values)**



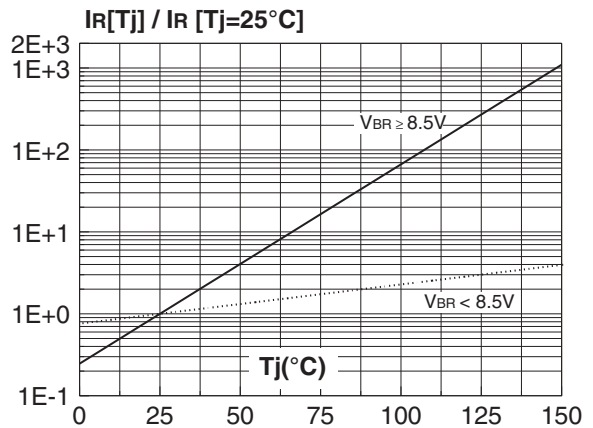
**Figure 9: Thermal resistance junction to ambient versus copper surface under each lead (printed circuit board FR4 e(Cu)=35µm)**



**Figure 8: Relative variation of thermal impedance junction to ambient versus pulse duration**



**Figure 10: Relative variation of leakage current versus junction temperature**



**Figure 11: Ordering Information Scheme**

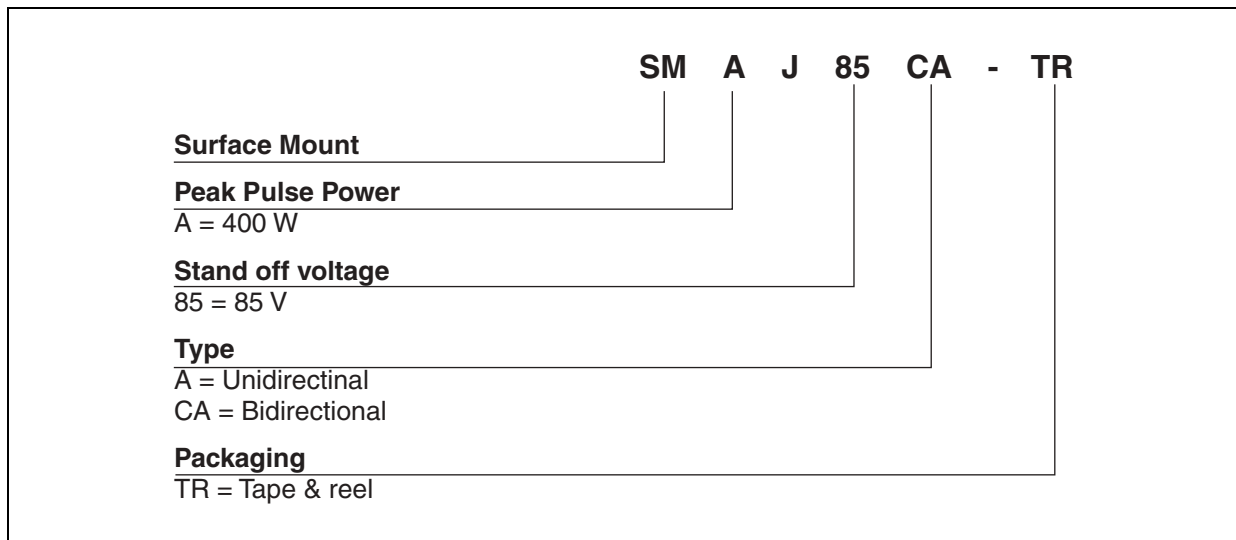


Figure 12: SMA Package Mechanical Data

| REF. | DIMENSIONS  |      |        |       |
|------|-------------|------|--------|-------|
|      | Millimeters |      | Inches |       |
|      | Min.        | Max. | Min.   | Max.  |
| A1   | 1.90        | 2.03 | 0.075  | 0.080 |
| A2   | 0.05        | 0.20 | 0.002  | 0.008 |
| b    | 1.25        | 1.65 | 0.049  | 0.065 |
| c    | 0.15        | 0.41 | 0.006  | 0.016 |
| E    | 4.80        | 5.60 | 0.189  | 0.220 |
| E1   | 3.95        | 4.60 | 0.156  | 0.181 |
| D    | 2.25        | 2.95 | 0.089  | 0.116 |
| L    | 0.75        | 1.60 | 0.030  | 0.063 |

Figure 13: Foot print dimensions (millimeters)

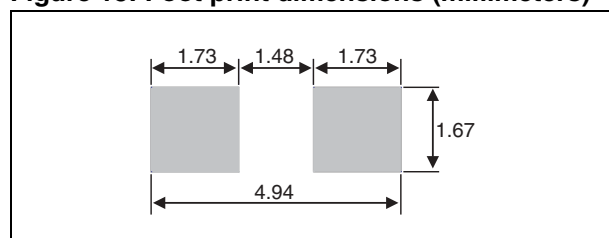
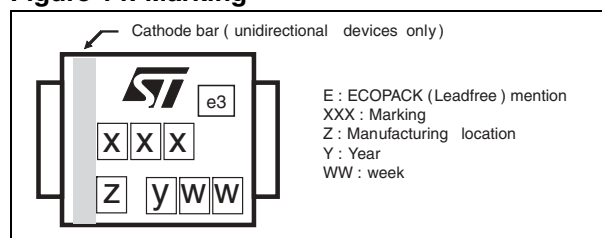


Figure 14: Marking



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](http://www.st.com).

Table 5: Ordering Information

| Part Number  | Marking    | Package | Weight  | Base qty | Delivery mode |
|--------------|------------|---------|---------|----------|---------------|
| SMAJxxxA-TR  | See page 2 | SMA     | 0.068 g | 5000     | Tape & reel   |
| SMAJxxxCA-TR | See page 2 | SMA     | 0.068 g | 5000     | Tape & reel   |

Table 6: Revision History

| Date           | Revision | Description of Changes  |
|----------------|----------|---|
| September-1998 | 5B       | Previous update.  |
| 02-Aug-2004    | 6        | SMA package dimensions update. Reference A1 max. changed from 2.70mm (0.106inc.) to 2.03mm (0.080). |
| 10-Dec-2004    | 7        | Template layout update. No content change.  |
| 10-Feb-2006    | 8        | Added unidirectional marking on cover page and Figure 14. Changed Figure 13. Foot print.            |

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