

# 1 Characteristics

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

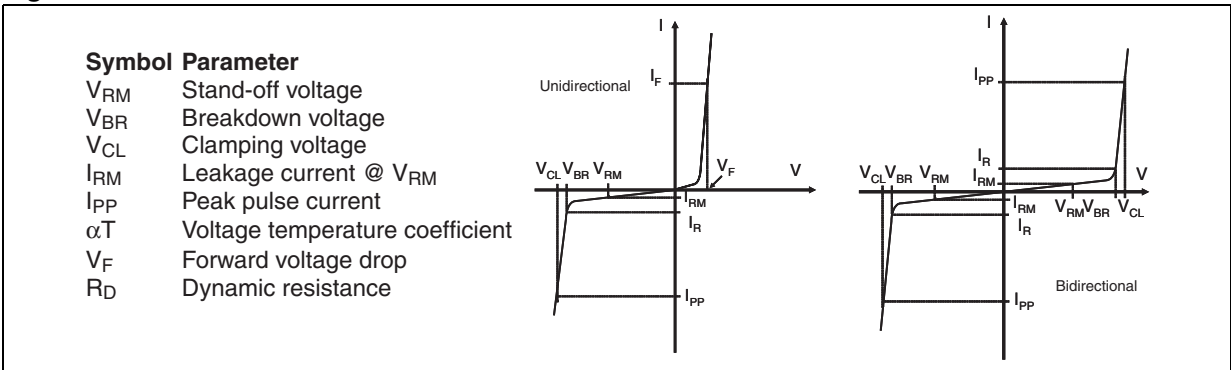
| Symbol    | Parameter                                           | Value                                  | Unit               |
|-----------|-----------------------------------------------------|----------------------------------------|--------------------|
| $P_{PP}$  | Peak pulse power dissipation <sup>(1)</sup>         | $T_j \text{ initial} = T_{amb}$<br>400 | W                  |
| $T_{stg}$ | Storage temperature range                           | -65 to +150                            | $^{\circ}\text{C}$ |
| $T_j$     | Operating junction temperature range                | -55 to +150                            | $^{\circ}\text{C}$ |
| $T_L$     | Maximum lead temperature for soldering during 10 s. | 260                                    | $^{\circ}\text{C}$ |

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

**Figure 1. Electrical characteristics - definitions**



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

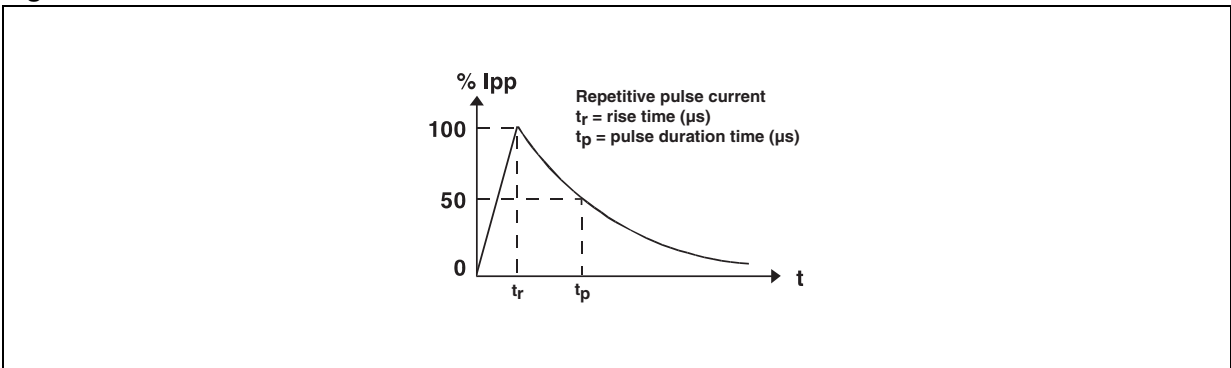


Table 3. Electrical characteristics - parameter values ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

| Order code  | $I_{RM} \text{ max}@V_{RM}$ |                       |     | $V_{BR} @I_R^{(1)}$ |      |    | $V_{CL} @I_{PP}$<br>10/1000 $\mu\text{s}$ |                  | $R_D^{(2)}$<br>10/1000 $\mu\text{s}$ | $V_{CL} @I_{PP}$<br>8/20 $\mu\text{s}$ |                  | $R_D^{(2)}$<br>8/20 $\mu\text{s}$ | $\alpha T^{(3)}$         |
|-------------|-----------------------------|-----------------------|-----|---------------------|------|----|-------------------------------------------|------------------|--------------------------------------|----------------------------------------|------------------|-----------------------------------|--------------------------|
|             | 25 $^{\circ}\text{C}$       | 85 $^{\circ}\text{C}$ |     | min                 | typ  |    | max                                       |                  |                                      | max                                    |                  |                                   | max                      |
|             | $\mu\text{A}$               |                       | V   | V                   |      | mA | V                                         | A <sup>(4)</sup> | $\Omega$                             | V                                      | A <sup>(4)</sup> | $\Omega$                          | 10-4/ $^{\circ}\text{C}$ |
| SMAJ5.0A/CA | 20                          | 50                    | 5   | 6.4                 | 6.74 | 10 | 9.2                                       | 43.5             | 0.049                                | 13.4                                   | 174              | 0.036                             | 5.7                      |
| SMAJ6.0A/CA | 20                          | 50                    | 6   | 6.7                 | 7.05 | 10 | 10.3                                      | 38.8             | 0.075                                | 13.7                                   | 170              | 0.037                             | 5.9                      |
| SMAJ6.5A/CA | 20                          | 50                    | 6.5 | 7.2                 | 7.58 | 10 | 11.2                                      | 35.7             | 0.091                                | 14.5                                   | 160              | 0.041                             | 6.1                      |
| SMAJ8.5A/CA | 20                          | 50                    | 8.5 | 9.4                 | 9.9  | 1  | 14.4                                      | 27.7             | 0.145                                | 19.5                                   | 124              | 0.073                             | 7.3                      |
| SMAJ10A/CA  | 0.2                         | 1                     | 10  | 11.1                | 11.7 | 1  | 17                                        | 23.5             | 0.201                                | 21.7                                   | 106              | 0.089                             | 7.8                      |
| SMAJ12A/CA  | 0.2                         | 1                     | 12  | 13.3                | 14   | 1  | 19.9                                      | 20.1             | 0.259                                | 25.3                                   | 91               | 0.116                             | 8.3                      |
| SMAJ13A/CA  | 0.2                         | 1                     | 13  | 14.4                | 15.2 | 1  | 21.5                                      | 18.6             | 0.298                                | 27.2                                   | 85               | 0.132                             | 8.4                      |
| SMAJ15A/CA  | 0.2                         | 1                     | 15  | 16.7                | 17.6 | 1  | 24.4                                      | 16.4             | 0.361                                | 32.5                                   | 71               | 0.197                             | 8.8                      |
| SMAJ18A/CA  | 0.2                         | 1                     | 18  | 20                  | 21.1 | 1  | 29.2                                      | 13.7             | 0.514                                | 39.3                                   | 59               | 0.291                             | 9.2                      |
| SMAJ20A/CA  | 0.2                         | 1                     | 20  | 22.2                | 23.4 | 1  | 32.4                                      | 12.3             | 0.637                                | 42.8                                   | 54               | 0.338                             | 9.4                      |
| SMAJ22A/CA  | 0.2                         | 1                     | 22  | 24.4                | 25.7 | 1  | 35.5                                      | 11.2             | 0.760                                | 48.3                                   | 48               | 0.444                             | 9.6                      |
| SMAJ24A/CA  | 0.2                         | 1                     | 24  | 26.7                | 28.1 | 1  | 38.9                                      | 10.3             | 0.912                                | 50                                     | 46               | 0.446                             | 9.6                      |
| SMAJ26A/CA  | 0.2                         | 1                     | 26  | 28.9                | 30.4 | 1  | 42.1                                      | 9.5              | 1.07                                 | 53.5                                   | 43               | 0.502                             | 9.7                      |
| SMAJ28A/CA  | 0.2                         | 1                     | 28  | 31.1                | 32.7 | 1  | 45.4                                      | 8.8              | 1.26                                 | 59                                     | 39               | 0.632                             | 9.8                      |
| SMAJ30A/CA  | 0.2                         | 1                     | 30  | 33.3                | 35.1 | 1  | 48.4                                      | 8.3              | 1.39                                 | 64.3                                   | 36               | 0.762                             | 9.9                      |
| SMAJ33A/CA  | 0.2                         | 1                     | 33  | 36.7                | 38.6 | 1  | 53.3                                      | 7.5              | 1.70                                 | 69.7                                   | 33               | 0.884                             | 10                       |
| SMAJ40A/CA  | 0.2                         | 1                     | 40  | 44.4                | 46.7 | 1  | 64.5                                      | 6.2              | 2.49                                 | 84                                     | 27               | 1.30                              | 10.1                     |
| SMAJ43A/CA  | 0.2                         | 1                     | 43  | 47.8                | 50.3 | 1  | 69.4                                      | 5.7              | 2.91                                 | 91                                     | 25               | 1.53                              | 10.2                     |
| SMAJ48A/CA  | 0.2                         | 1                     | 48  | 53.3                | 56.1 | 1  | 77.4                                      | 5.2              | 3.56                                 | 100                                    | 23               | 1.79                              | 10.3                     |
| SMAJ58A/CA  | 0.2                         | 1                     | 58  | 64.4                | 67.8 | 1  | 93.6                                      | 4.3              | 5.21                                 | 121                                    | 19               | 2.62                              | 10.4                     |
| SMAJ70A/CA  | 0.2                         | 1                     | 70  | 77.8                | 81.9 | 1  | 113                                       | 3.5              | 7.72                                 | 146                                    | 16               | 3.75                              | 10.5                     |
| SMAJ85A/CA  | 0.2                         | 1                     | 85  | 94                  | 99   | 1  | 137                                       | 2.9              | 11.4                                 | 178                                    | 13               | 5.70                              | 10.6                     |
| SMAJ100A/CA | 0.2                         | 1                     | 100 | 111                 | 117  | 1  | 162                                       | 2.5              | 15.7                                 | 212                                    | 11               | 8.10                              | 10.7                     |
| SMAJ130A/CA | 0.2                         | 1                     | 130 | 144                 | 152  | 1  | 209                                       | 1.9              | 26.0                                 | 265                                    | 9                | 11.7                              | 10.8                     |
| SMAJ154A/CA | 0.2                         | 1                     | 154 | 171                 | 180  | 1  | 246                                       | 1.6              | 35.6                                 | 317                                    | 7                | 18.3                              | 10.8                     |
| SMAJ170A/CA | 0.2                         | 1                     | 170 | 189                 | 199  | 1  | 275                                       | 1.4              | 47.2                                 | 353                                    | 6.5              | 22.2                              | 10.8                     |
| SMAJ188A/CA | 0.2                         | 1                     | 188 | 209                 | 220  | 1  | 328                                       | 1.4              | 69.3                                 | 388                                    | 6                | 26.2                              | 10.8                     |

1. Pulse test :  $t_p < 50\text{ ms}$
2. To calculate maximum clamping voltage at other surge level, use the following formula:  $V_{CLmax} = V_{CL} - R_D \times (I_{PP} - I_{PPappli})$   
where  $I_{PPappli}$  is the surge current in the application
3. To calculate  $V_{BR}$  or  $V_{CL}$  versus junction temperature, use the following formulas:  
 $V_{BR} @ T_J = V_{BR} @ 25^{\circ}\text{C} \times (1 + \alpha T \times (T_J - 25))$ ,  
 $V_{CL} @ T_J = V_{CL} @ 25^{\circ}\text{C} \times (1 + \alpha T \times (T_J - 25))$
4. Surge capability given for both directions for unidirectional and bidirectional types.

Figure 3. Peak pulse power dissipation versus initial junction temperature

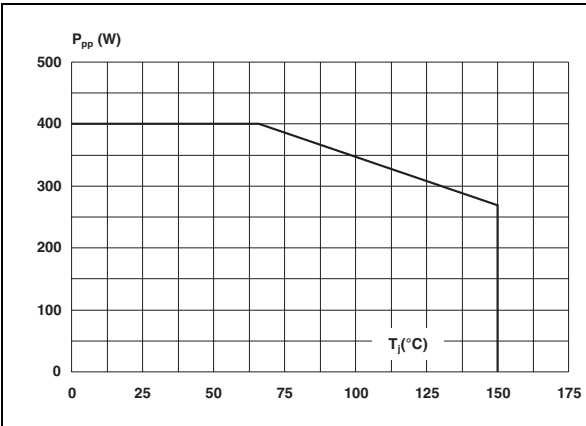


Figure 4. Peak pulse power versus exponential pulse duration ( $T_j$  initial = 25° C)

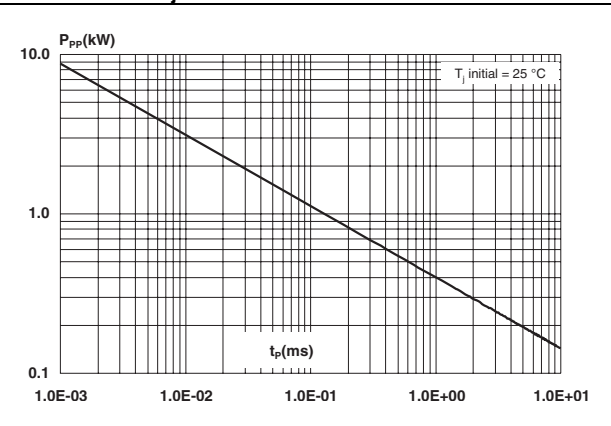
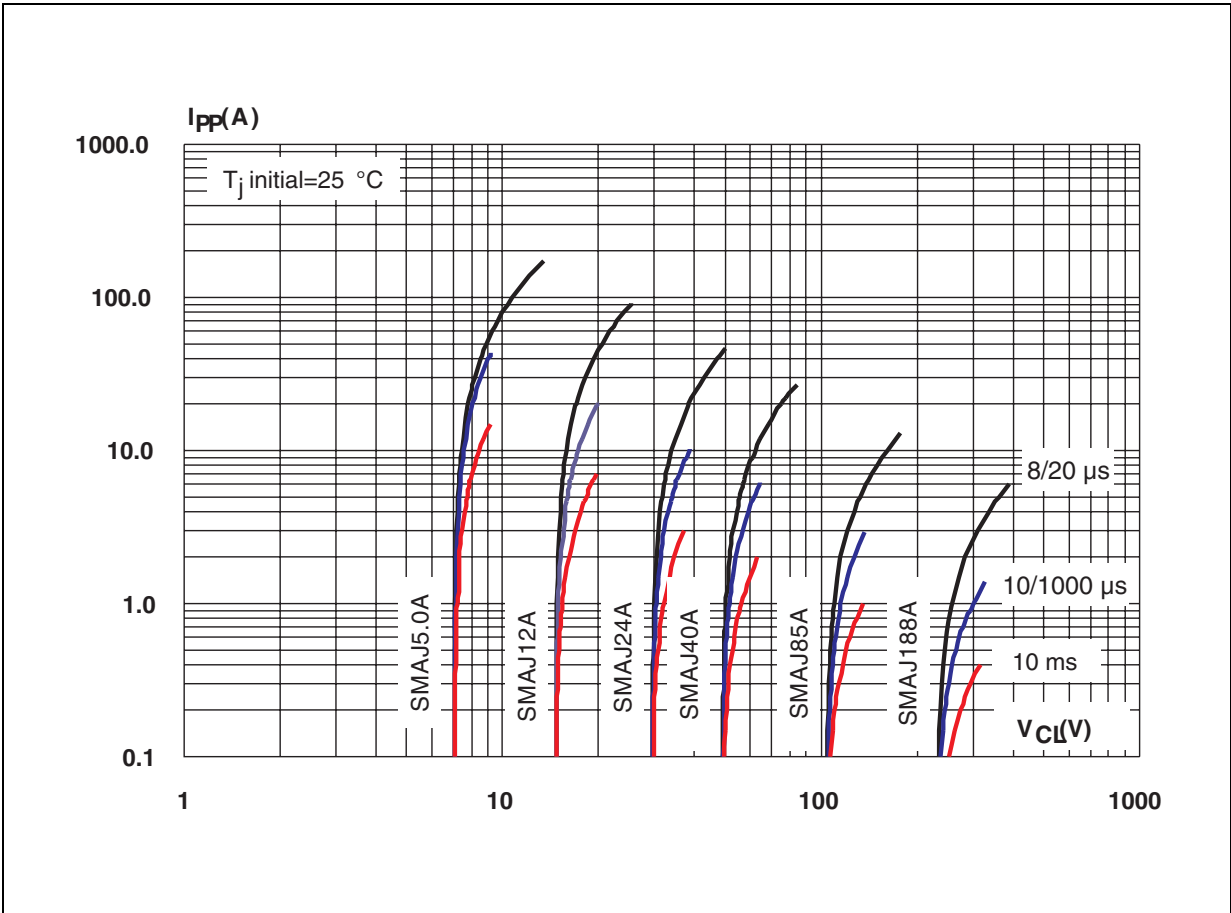
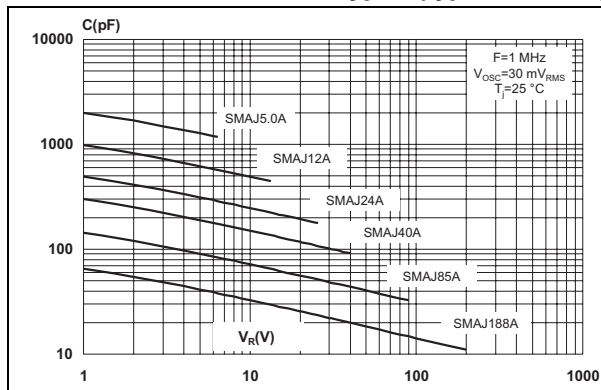


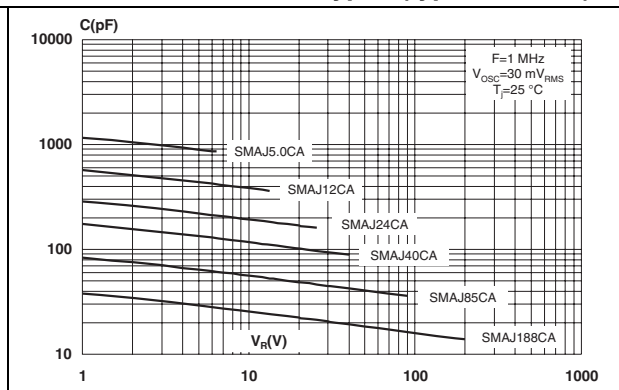
Figure 5. Clamping voltage versus peak pulse current (exponential waveform, maximum values)



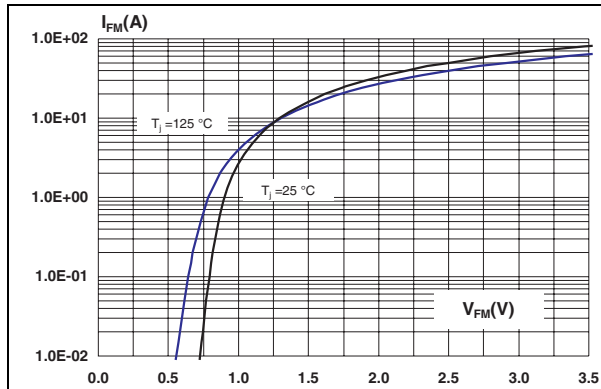
**Figure 6. Junction capacitance versus reverse applied voltage for unidirectional types (typical values)**



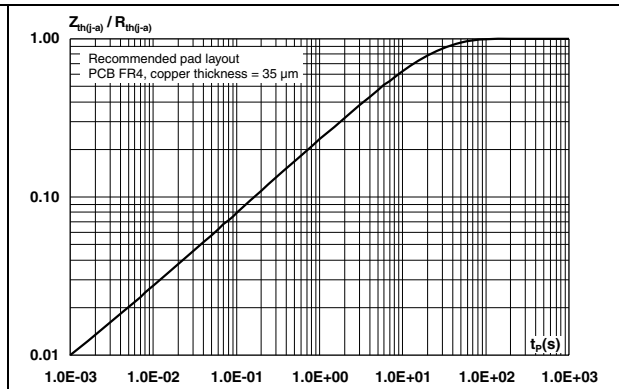
**Figure 7. Junction capacitance versus reverse applied voltage for bidirectional types (typical values)**



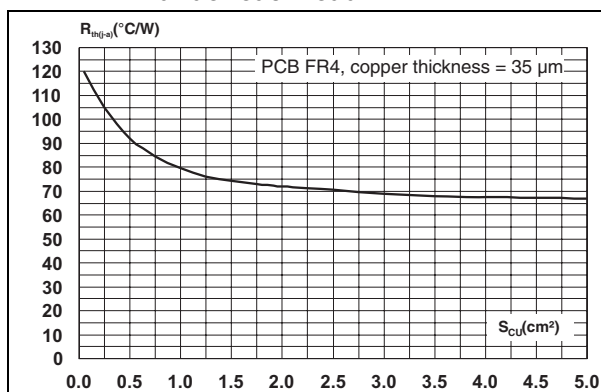
**Figure 8. Peak forward voltage drop versus peak forward current (typical values)**



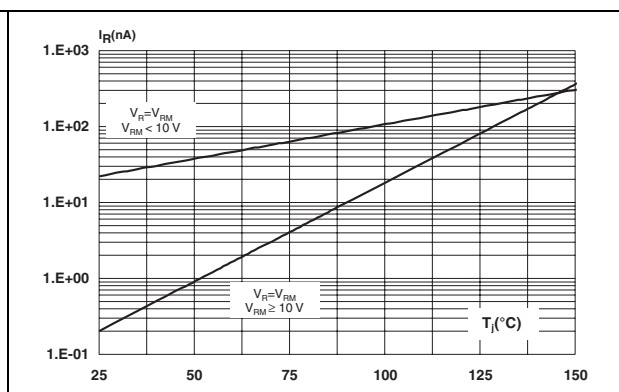
**Figure 9. Relative variation of thermal impedance, junction to ambient, versus pulse duration**



**Figure 10. Thermal resistance, junction to ambient, versus copper surface under each lead**

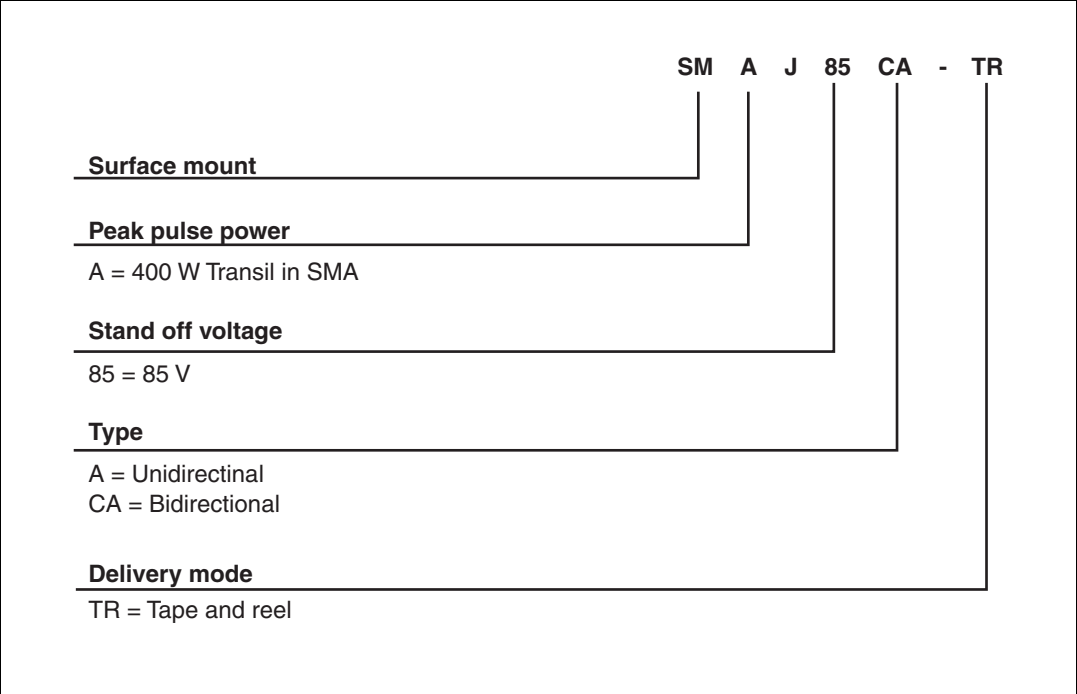


**Figure 11. Leakage current versus junction temperature (typical values)**



## 2 Ordering information scheme

Figure 12. Ordering information scheme



### 3 Package information

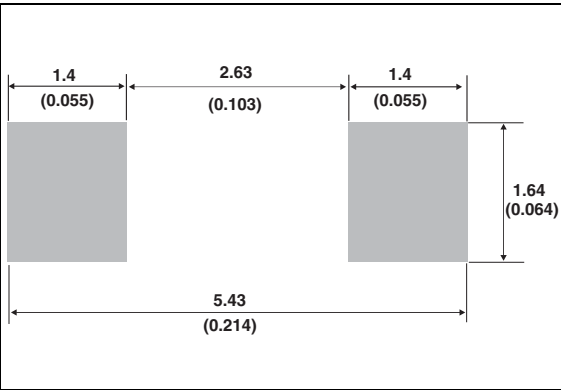
- Case: JEDEC DO-214AC molded plastic over planar junction
- Terminals: solder plated, solderable per MIL-STD-750, Method 2026
- Polarity: for unidirectional types the band indicates cathode.
- Flammability: epoxy is rated UL94V-0
- RoHS package

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.

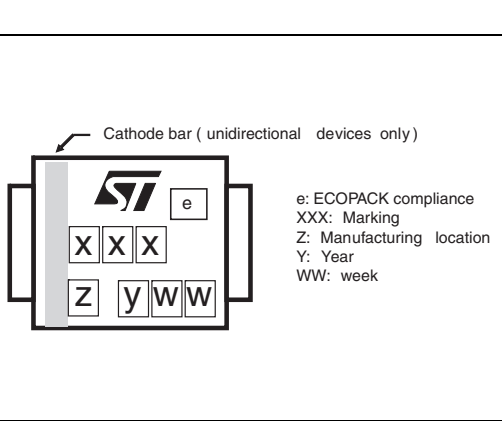
**Table 4. SMA dimensions**

| Ref. | Dimensions  |      |        |       |
|------|-------------|------|--------|-------|
|      | Millimeters |      | Inches |       |
|      | Min.        | Max. | Min.   | Max.  |
| A1   | 1.90        | 2.45 | 0.075  | 0.094 |
| 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 13. Footprint dimensions in mm (inches)**



**Figure 14. Marking layout<sup>(1)</sup>**



1. Marking layout can vary according to assembly location.

Table 5. Marking

| Order code  | Marking | Order code   | Marking |
|-------------|---------|--------------|---------|
| SMAJ5.0A-TR | AE      | SMAJ5.0CA-TR | AA      |
| SMAJ6.0A-TR | DUB     | SMAJ6.0CA-TR | DBB     |
| SMAJ6.5A-TR | DUC     | SMAJ6.5CA-TR | DBC     |
| SMAJ8.5A-TR | DUH     | SMAJ8.5CA-TR | DBH     |
| SMAJ10A-TR  | AX      | SMAJ10CA-TR  | AC      |
| SMAJ12A-TR  | DUK     | SMAJ12CA-TR  | DBK     |
| SMAJ13A-TR  | BG      | SMAJ13CA-TR  | BH      |
| SMAJ15A-TR  | BM      | SMAJ15CA-TR  | AJ      |
| SMAJ18A-TR  | DUQ     | SMAJ18CA-TR  | DBQ     |
| SMAJ20A-TR  | DUR     | SMAJ20CA-TR  | DBR     |
| SMAJ22A-TR  | DUS     | SMAJ22CA-TR  | DBS     |
| SMAJ24A-TR  | DUT     | SMAJ24CA-TR  | DBT     |
| SMAJ26A-TR  | DUU     | SMAJ26CA-TR  | DBU     |
| SMAJ28A-TR  | CG      | SMAJ28CA-TR  | CH      |
| SMAJ30A-TR  | CK      | SMAJ30CA-TR  | CL      |
| SMAJ33A-TR  | CM      | SMAJ33CA-TR  | CN      |
| SMAJ40A-TR  | DUZ     | SMAJ40CA-TR  | DBZ     |
| SMAJ43A-TR  | EUA     | SMAJ43CA-TR  | EBA     |
| SMAJ48A-TR  | CX      | SMAJ48CA-TR  | CY      |
| SMAJ58A-TR  | EUF     | SMAJ58CA-TR  | EBF     |
| SMAJ70A-TR  | EUI     | SMAJ70CA-TR  | EBI     |
| SMAJ85A-TR  | EUL     | SMAJ85CA-TR  | EBL     |
| SMAJ100A-TR | EUN     | SMAJ100CA-TR | EBN     |
| SMAJ130A-TR | EUQ     | SMAJ130CA-TR | EBQ     |
| SMAJ154A-TR | EUT     | SMAJ154CA-TR | EBT     |
| SMAJ170A-TR | SR      | SMAJ170CA-TR | SS      |
| SMAJ188A-TR | EUV     | SMAJ188CA-TR | EBV     |

## 4 Ordering information

**Table 6. Ordering information**

| Order code                    | Marking                               | Package | Weight  | Base qty | Delivery mode |
|-------------------------------|---------------------------------------|---------|---------|----------|---------------|
| SMAJxxxA/CA-TR <sup>(1)</sup> | See <a href="#">Table 5 on page 8</a> | SMA     | 0.071 g | 5000     | Tape and reel |

1. Where xxx is nominal value of  $V_{BR}$  and A or CA indicates unidirectional or bidirectional version. See [Table 3](#) for list of available devices and their order codes

## 5 Revision history

**Table 7. Document revision history**

| Date           | Revision | Changes                                                                                         |
|----------------|----------|-------------------------------------------------------------------------------------------------|
| September-1998 | 5B       | Previous update.                                                                                |
| 02-Aug-2004    | 6        | SMA package dimensions update. Reference A1 max. changed from 2.70mm (0.106) 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.        |
| 14-May-2009    | 9        | Updated ECOPACK statement. Reformatted to current standards.                                    |
| 17-Sep-2009    | 10       | Document updated for low leakage current.                                                       |
| 05-Nov-2009    | 11       | Corrected typographical error in <a href="#">Package information</a> .                          |
| 09-Jul-2010    | 12       | Changed timescale in <a href="#">Figure 9</a> .                                                 |

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