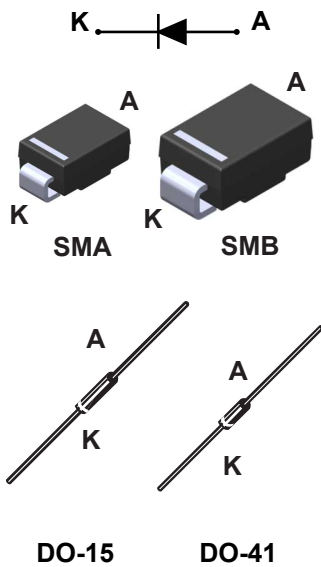


## 200 V - 1.5 A ultrafast recovery diode



### Features

- Very low conduction losses
- Negligible switching losses
- Low forward voltage drop
- High junction temperature
- ECOPACK®2

### Applications

- Switching diode
- LED Lighting
- Auxiliary power supply
- Flyback diode

### Description

The **STTH1R02** uses ST's new 200 V planar Pt doping technology, and it is specially suited for switching mode base drive and transistor circuits.

Packaged in SMA, SMB, DO-41 and DO-15, the **STTH1R02** is ideal for use low voltage, high frequency inverters, free wheeling and polarity protection

| Product status  |        |
|-----------------|--------|
| STTH1R02        |        |
| Product summary |        |
| Symbol          | Value  |
| $I_{F(AV)}$     | 1.5 A  |
| $V_{RRM}$       | 200 V  |
| $T_{j(max.)}$   | 175 °C |
| $V_{F(typ.)}$   | 0.7 V  |
| $t_{rr(typ.)}$  | 15 ns  |

# 1 Characteristics

**Table 1. Absolute ratings (limiting values at 25 °C, unless otherwise specified)**

| Symbol      | Parameter                                            |              |                                 | Value       | Unit |
|-------------|------------------------------------------------------|--------------|---------------------------------|-------------|------|
| $V_{RRM}$   | Repetitive peak reverse voltage                      |              |                                 | 200         | V    |
| $I_{F(AV)}$ | Average forward current $\delta = 0.5$ , square wave | SMA, SMB     | $T_L = 150\text{ °C}$           | 1.5         | A    |
|             |                                                      | DO-41, DO-15 | $T_L = 135\text{ °C}$           |             |      |
| $I_{FSM}$   | Surge non repetitive forward current                 |              | $t_p = 10\text{ ms}$ sinusoidal | 60          | A    |
| $T_{stg}$   | Storage temperature range                            |              |                                 | -65 to +175 | °C   |
| $T_j$       | Operating junction temperature                       |              |                                 | +175        | °C   |

**Table 2. Thermal resistance parameter**

| Symbol        | Parameter        |                                          |              | Max. value | Unit |
|---------------|------------------|------------------------------------------|--------------|------------|------|
| $R_{th(j-l)}$ | Junction to lead |                                          | SMA, SMB     | 30         | °C/W |
| $R_{th(j-l)}$ | Junction to lead | Lead length = 10 mm on infinite heatsink | DO-15, DO-41 | 45         |      |

For more information, please refer to the following application note :

- AN5088 : Rectifiers thermal management, handling and mounting recommendations

**Table 3. Static electrical characteristics**

| Symbol      | Parameter               | Test conditions       |                      | Min. | Typ. | Max. | Unit          |
|-------------|-------------------------|-----------------------|----------------------|------|------|------|---------------|
| $I_R^{(1)}$ | Reverse leakage current | $T_j = 25\text{ °C}$  | $V_R = V_{RRM}$      | -    |      | 3    | $\mu\text{A}$ |
|             |                         | $T_j = 125\text{ °C}$ |                      | -    | 2    | 20   |               |
| $V_F^{(2)}$ | Forward voltage drop    | $T_j = 25\text{ °C}$  | $I_F = 1.5\text{ A}$ | -    | 0.89 | 1.00 | V             |
|             |                         | $T_j = 100\text{ °C}$ |                      | -    | 0.76 | 0.85 |               |
|             |                         | $T_j = 150\text{ °C}$ |                      | -    | 0.70 | 0.80 |               |

1. Pulse test:  $t_p = 5\text{ ms}$ ,  $\delta < 2\%$

2. Pulse test:  $t_p = 380\text{ }\mu\text{s}$ ,  $\delta < 2\%$

To evaluate the conduction losses, use the following equation:

$$P = 0.68 \times I_{F(AV)} + 0.08 \times I_F^2(RMS)$$

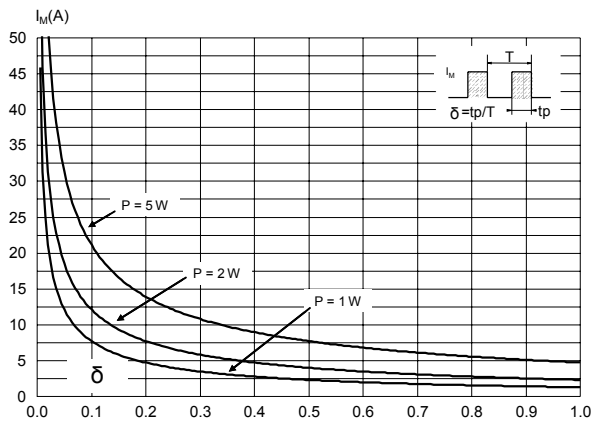
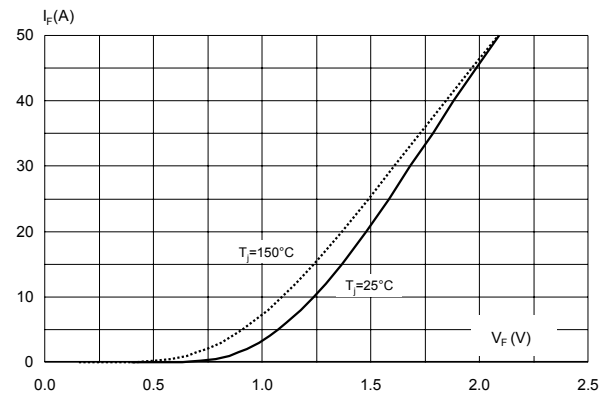
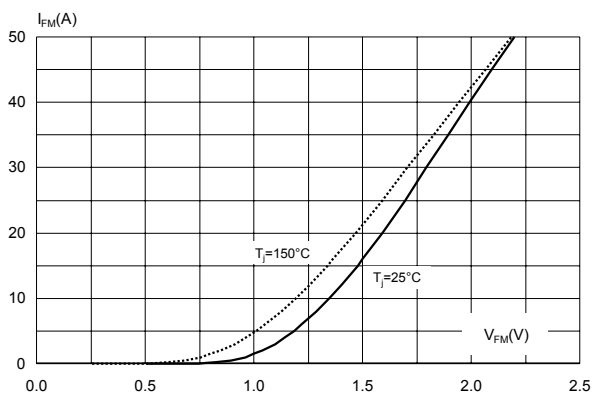
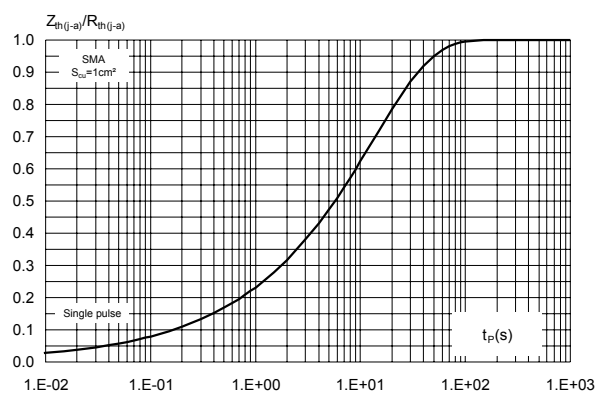
For more information, please refer to the following application notes related to the power losses :

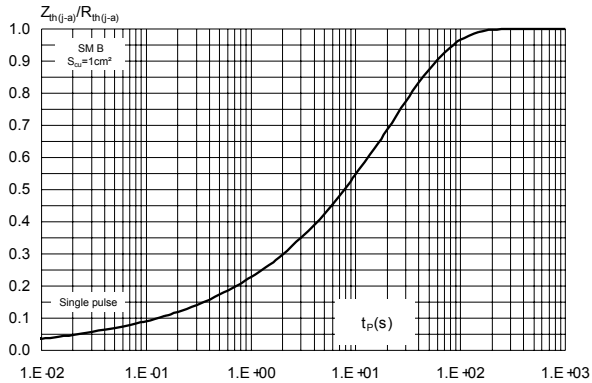
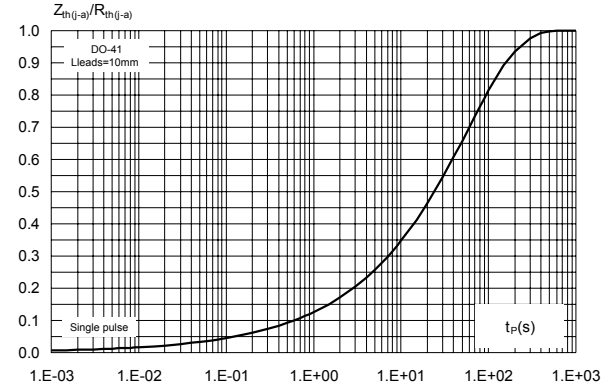
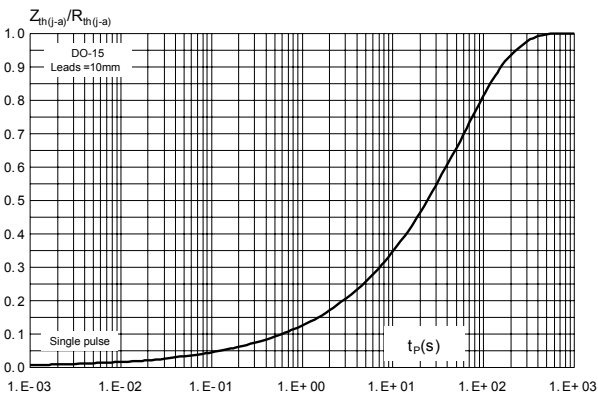
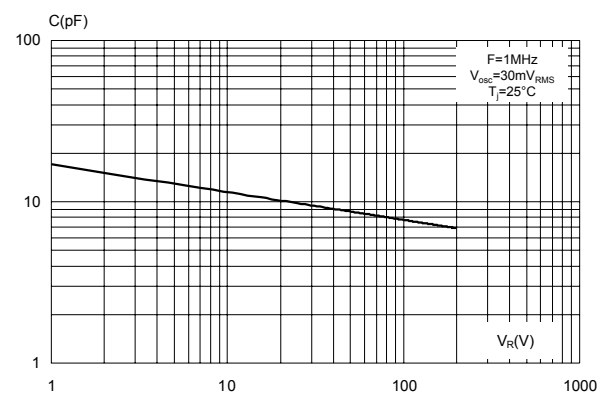
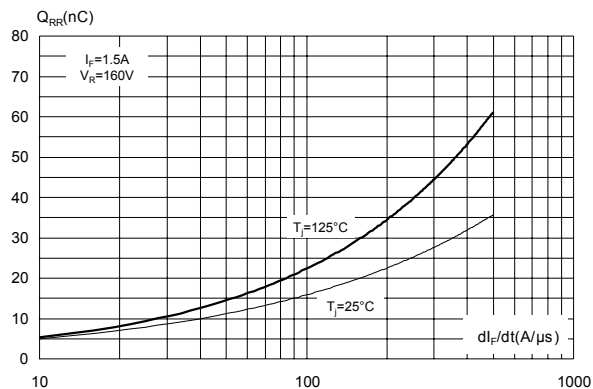
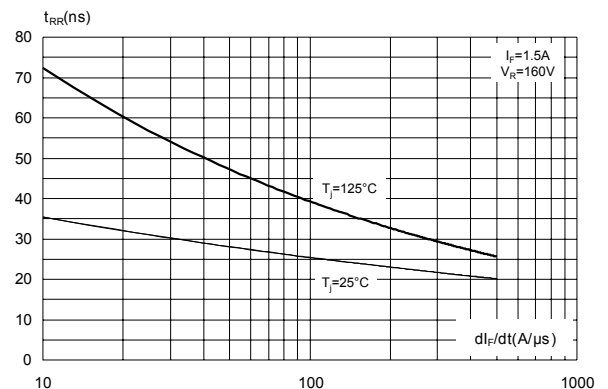
- AN604: Calculation of conduction losses in a power rectifier
- AN4021: Calculation of reverse losses on a power diode

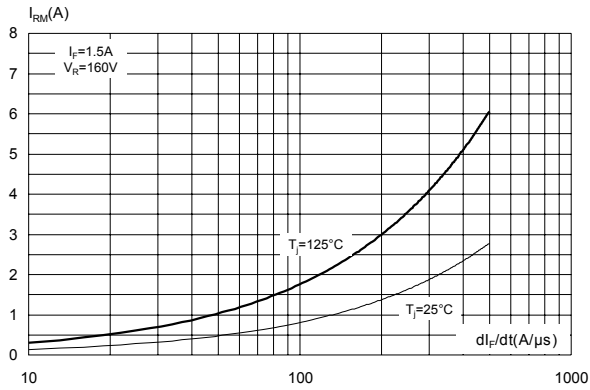
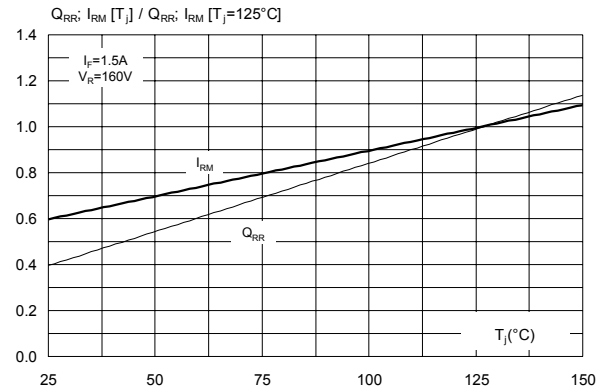
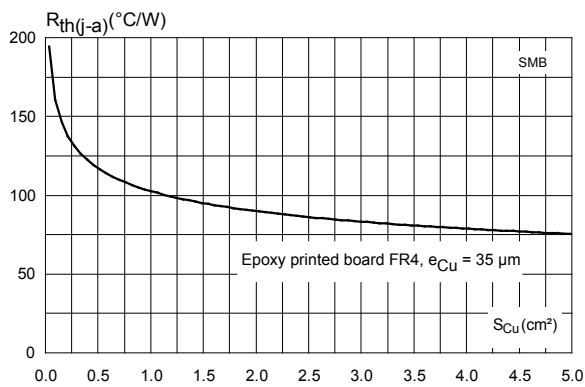
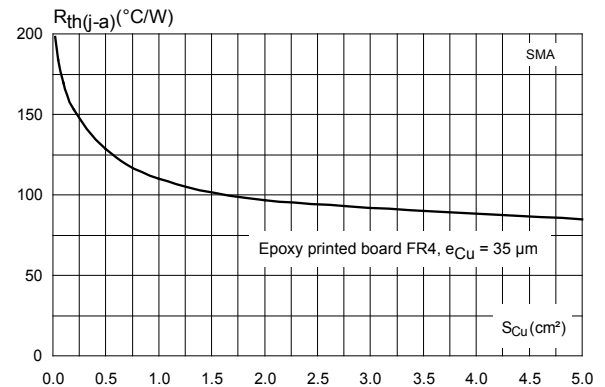
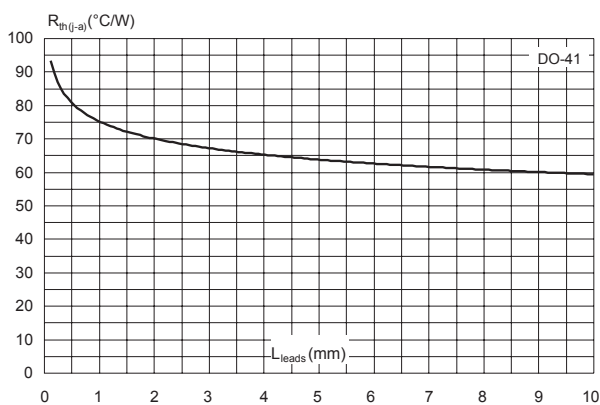
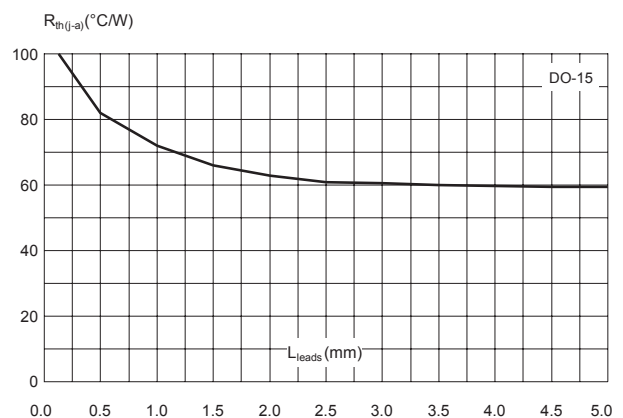
**Table 4. Dynamic characteristics ( $T_j = 25\text{ °C}$  unless otherwise stated)**

| Symbol   | Parameters               | Test conditions                                                                                             | Min. | Typ. | Max. | Unit |
|----------|--------------------------|-------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $t_{rr}$ | Reverse recovery time    | $I_F = 1\text{ A}$ , $dI_F/dt = -50\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$                             | -    | 23   | 30   | ns   |
|          |                          | $I_F = 1\text{ A}$ , $dI_F/dt = -100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$                            | -    | 15   | 20   |      |
| $I_{RM}$ | Reverse recovery current | $I_F = 1.5\text{ A}$ , $dI_F/dt = -200\text{ A}/\mu\text{s}$ , $V_R = 160\text{ V}$ , $T_j = 125\text{ °C}$ | -    | 3    | 4    | A    |
| $t_{fr}$ | Forward recovery time    | $I_F = 1.5\text{ A}$ , $dI_F/dt = 100\text{ A}/\mu\text{s}$ , $V_{FR} = 1.1\text{ V}_{F(max.)}$             | -    | 50   |      | ns   |
| $V_{FP}$ | Forward recovery voltage | $I_F = 1.5\text{ A}$ , $dI_F/dt = 100\text{ A}/\mu\text{s}$                                                 | -    | 2.1  |      | V    |

## 1.1 Characteristics (curves)

**Figure 1. Peak current versus duty cycle**

**Figure 2. Forward voltage drop versus forward current (typical values)**

**Figure 3. Forward voltage drop versus forward current (maximum values)**

**Figure 4. Relative variation of thermal impedance junction to lead versus pulse duration (SMA)**


**Figure 5. Relative variation of thermal impedance junction to lead versus pulse duration (SMB)**

**Figure 6. Relative variation of thermal impedance junction to lead versus pulse duration (DO-41)**

**Figure 7. Relative variation of thermal impedance junction to lead versus pulse duration (DO-15)**

**Figure 8. Junction capacitance versus reverse voltage applied (typical values)**

**Figure 9. Reverse recovery charges versus  $di_F/dt$  (typical values)**

**Figure 10. Reverse recovery time versus  $di_F/dt$  (typical values)**


**Figure 11. Peak reverse recovery current versus  $di_F/dt$  (typical values)**

**Figure 12. Relative variations of dynamic parameters versus junction temperature**

**Figure 13. Thermal resistance junction to ambient versus copper surface under each lead (typical values)**

**Figure 14. Thermal resistance junction to ambient versus copper surface under each lead (typical values)**

**Figure 15. Thermal resistance junction to ambient versus lead length (DO-41)**

**Figure 16. Thermal resistance junction to ambient versus lead length (DO-15)**


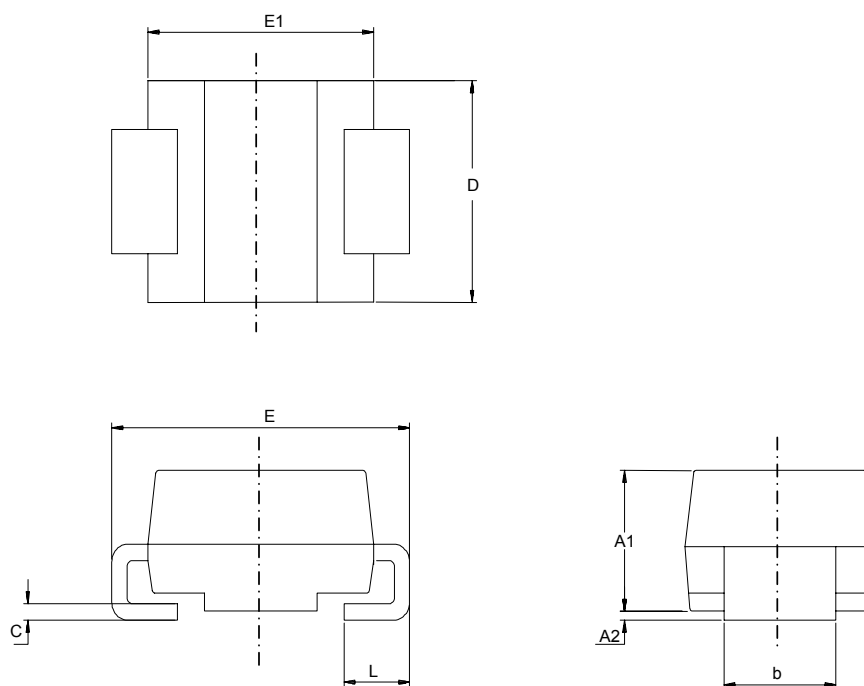
## 2 Package information

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](http://www.st.com). ECOPACK® is an ST trademark.

### 2.1 SMB package information

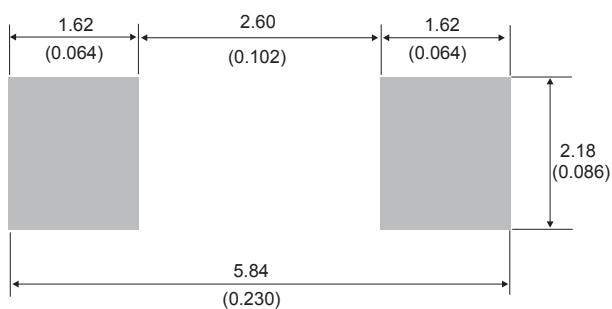
- Epoxy meets UL94, V0
- Lead-free package

**Figure 17. SMB package outline**



**Table 5. SMB package mechanical data**

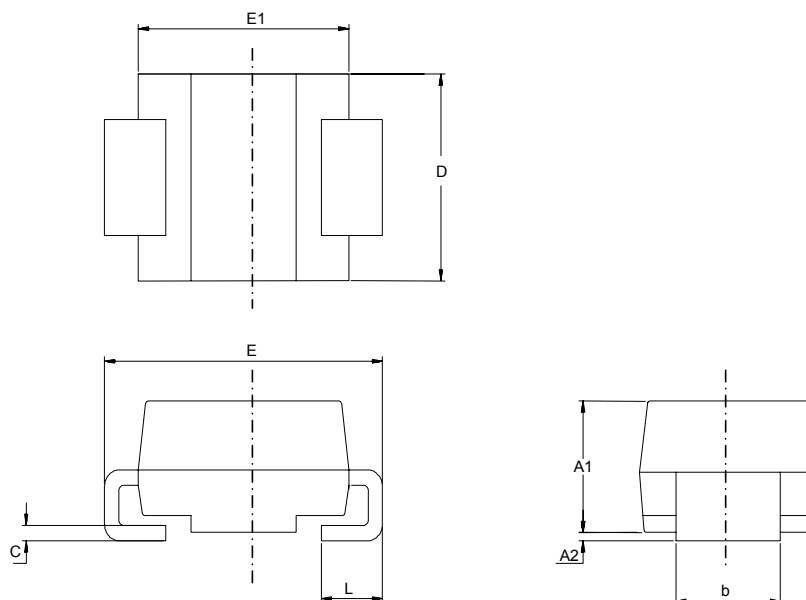
| Ref. | Dimensions  |      |                             |       |
|------|-------------|------|-----------------------------|-------|
|      | Millimeters |      | Inches (for reference only) |       |
|      | Min.        | Max. | Min.                        | Max.  |
| A1   | 1.90        | 2.45 | 0.074                       | 0.097 |
| A2   | 0.05        | 0.20 | 0.001                       | 0.008 |
| b    | 1.95        | 2.20 | 0.076                       | 0.087 |
| c    | 0.15        | 0.40 | 0.005                       | 0.016 |
| D    | 3.30        | 3.95 | 0.129                       | 0.156 |
| E    | 5.10        | 5.60 | 0.200                       | 0.221 |
| E1   | 4.05        | 4.60 | 0.159                       | 0.182 |
| L    | 0.75        | 1.50 | 0.029                       | 0.060 |

**Figure 18. SMB recommended footprint**


## 2.2 SMA package information

- Epoxy meets UL94, V0
- Cooling method : by conduction (C)

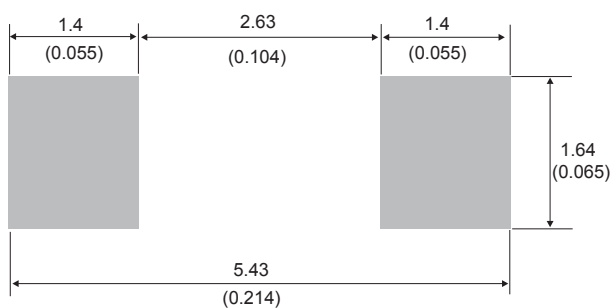
**Figure 19. SMA package outline**



**Table 6. SMA package mechanical data**

| Ref. | Dimensions  |      |                             |       |
|------|-------------|------|-----------------------------|-------|
|      | Millimeters |      | Inches (for reference only) |       |
|      | Min.        | Max. | Min.                        | Max.  |
| A1   | 1.90        | 2.45 | 0.074                       | 0.097 |
| A2   | 0.05        | 0.20 | 0.001                       | 0.008 |
| b    | 1.25        | 1.65 | 0.049                       | 0.065 |
| c    | 0.15        | 0.40 | 0.005                       | 0.016 |
| D    | 2.25        | 2.90 | 0.088                       | 0.115 |
| E    | 4.80        | 5.35 | 0.188                       | 0.211 |
| E1   | 3.95        | 4.60 | 0.155                       | 0.182 |
| L    | 0.75        | 1.50 | 0.029                       | 0.060 |

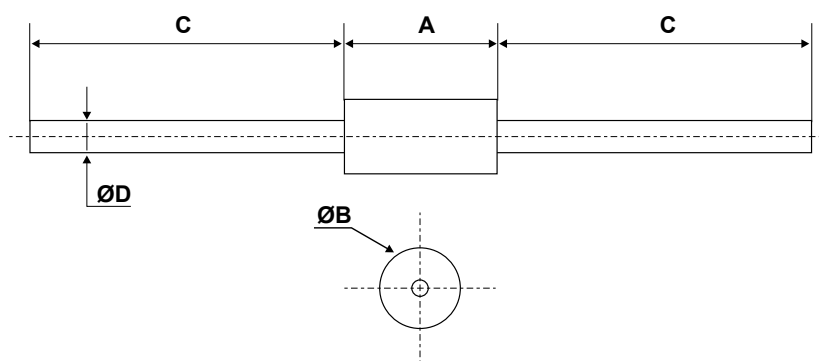
**Figure 20. SMA recommended footprint in mm (inches)**



## 2.3 DO-41 package information

- Epoxy meets UL 94, V0

**Figure 21. DO-41 package outline**



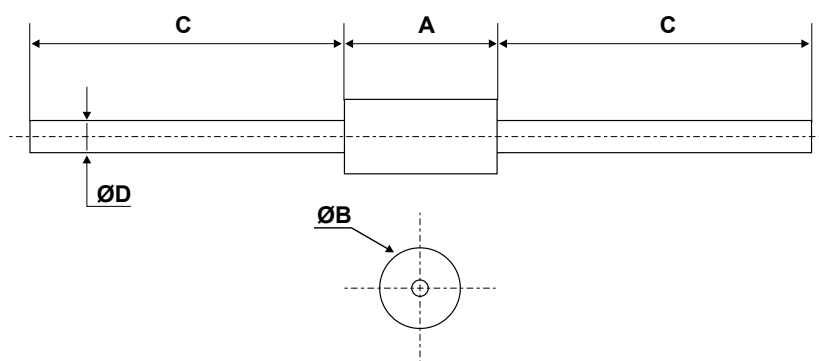
**Table 7. DO-41 package mechanical data**

| Ref. | Dimensions  |      |      |                             |      |        |
|------|-------------|------|------|-----------------------------|------|--------|
|      | Millimeters |      |      | Inches (for reference only) |      |        |
|      | Min.        | Typ. | Max. | Min.                        | Typ. | Max.   |
| A    | 4.07        | -    | 5.20 | 0.160                       | -    | 0.205  |
| B    | 2.04        | -    | 2.71 | 0.080                       | -    | 0.107  |
| C    | 25.40       | -    |      | 1.000                       | -    |        |
| D    | 0.71        | -    | 0.86 | 0.028                       | -    | 0.0034 |

## 2.4 DO-15 package information

- Epoxy meets UL 94, V0

**Figure 22. DO-15 package outline**



**Table 8. DO-15 package mechanical data**

| Ref. | Dimensions  |      |       |                             |      |        |
|------|-------------|------|-------|-----------------------------|------|--------|
|      | Millimeters |      |       | Inches (for reference only) |      |        |
|      | Min.        | Typ. | Max.  | Min.                        | Typ. | Max.   |
| A    | 6.05        | -    | 6.75  | 0.238                       | -    | 0.266  |
| B    | 2.95        | -    | 3.53  | 0.116                       | -    | 0.139  |
| C    | 26.00       | -    | 31.00 | 1.024                       | -    | 1.220  |
| D    | 0.71        | -    | 0.88  | 0.028                       | -    | 0.0035 |

### 3 Ordering information

**Table 9. Ordering information**

| Order code  | Marking   | Package | Weight  | Base qty. | Delivery mode |
|-------------|-----------|---------|---------|-----------|---------------|
| STTH1R02A   | R1A       | SMA     | 0.068 g | 5000      | Tape and reel |
| STTH1R02U   | 1R2S      | SMB     | 0.107 g | 2500      | Tape and reel |
| STTH1R02    | STTH1R02  | DO-41   | 0.34 g  | 2000      | Ammopack      |
| STTH1R02RL  | STTH1R02  | DO-41   | 0.34 g  | 5000      | Tape and reel |
| STTH1R02Q   | STTH1R02Q | DO-15   | 0.40 g  | 1000      | Ammopack      |
| STTH1R02QRL | STTH1R02Q | DO-15   | 0.40 g  | 6000      | Tape and reel |

## Revision history

**Table 10. Document revision history**

| Date        | Revision | Changes                                                            |
|-------------|----------|--------------------------------------------------------------------|
| 03-May-2006 | 1        | First issue.                                                       |
| 13-Oct-2006 | 2        | Added DO-15 and SMB packages.                                      |
| 08-Mar-2007 | 3        | Replaced Figure 8. Replaced ecu with copper thickness.             |
| 05-Dec-2018 | 4        | Updated <a href="#">Section Applications</a> . Minor text changes. |

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