

## Ultrafast recovery diode

### Main product characteristics

$I_{F(AV)}$	1.5 A
$V_{RRM}$	200 V
$T_j$ (max)	175° C
$V_F$ (typ)	0.7 V
$t_{rr}$ (typ)	15 ns

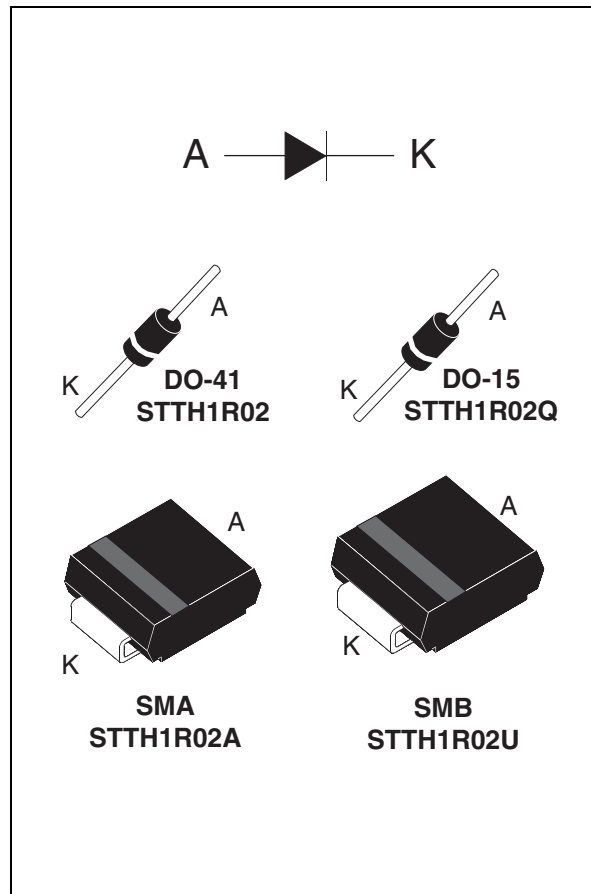
### Features and benefits

- Very low conduction losses
- Negligible switching losses
- Low forward and reverse recovery times
- High junction temperature

### 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 DO-41, DO-15, SMA, and SMB, this device is intended for use in low voltage, high frequency inverters, free wheeling and polarity protection.



### Order codes

Part Number	Marking
STTH1R02	STTH1R02
STTH1R02RL	STTH1R02
STTH1R02A	R1A
STTH1R02Q	STTH1R02Q
STTH1R02QRL	STTH1R02Q
STTH1R02U	1R2S

# 1 Characteristics

**Table 1. Absolute ratings (limiting values at  $T_j = 25^\circ\text{C}$ , unless otherwise specified)**

Symbol	Parameter		Value	Unit	
$V_{RRM}$	Repetitive peak reverse voltage		200	V	
$I_{FRM}$	Repetitive peak forward current	DO-41 <sup>(1)</sup>	$t_p = 5\ \mu\text{s}$ , $F = 5\ \text{kHz}$	30	A
		DO-15 <sup>(1)</sup>			
		SMA / SMB			
$I_{F(RMS)}$	RMS forward current	DO-41 / DO-15	50	A	
		SMA /SMB			
$I_{F(AV)}$	Average forward current, $\delta = 0.5$	DO-41	$T_{lead} = 110^\circ\text{C}$	1.5	A
		DO-15	$T_{lead} = 110^\circ\text{C}$		
		SMA	$T_c = 110^\circ\text{C}$		
		SMB	$T_c = 110^\circ\text{C}$		
$I_{FSM}$	Surge non repetitive forward current	$t_p = 10\ \text{ms}$ Sinusoidal	60	A	
$T_{stg}$	Storage temperature range		-65 to + 175	$^\circ\text{C}$	
$T_j$	Maximum operating junction temperature		175	$^\circ\text{C}$	

1. On infinite heatsink with 10 mm lead length

**Table 2. Thermal parameters**

Symbol	Parameter		Value	Unit	
$R_{th(j-l)}$	Junction to lead	Lead Length = 10 mm on infinite heatsink	DO-41	45	$^\circ\text{C/W}$
			DO-15	45	
$R_{th(j-c)}$	Junction to case	SMA	30		
		SMB	30		

**Table 3. Static electrical characteristics**

Symbol	Parameter	Test conditions		Min.	Typ	Max.	Unit
$I_R^{(1)}$	Reverse leakage current	$T_j = 25^\circ\text{C}$	$V_R = V_{RRM}$			3	$\mu\text{A}$
		$T_j = 125^\circ\text{C}$			2	20	
$V_F^{(2)}$	Forward voltage drop	$T_j = 25^\circ\text{C}$	$I_F = 4.5\ \text{A}$			1.2	V
		$T_j = 25^\circ\text{C}$	$I_F = 1.5\ \text{A}$		0.89	1	
		$T_j = 100^\circ\text{C}$			0.76	0.85	
		$T_j = 150^\circ\text{C}$			0.70	0.80	

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

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

To evaluate the conduction losses use the following equation:

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

Table 4. Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ	Max.	Unit
$t_{rr}$	Reverse recovery time	$I_F = 1\text{ A}$ , $di_F/dt = -50\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$ , $T_j = 25^\circ\text{ C}$		23	30	ns
		$I_F = 1\text{ A}$ , $di_F/dt = -100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$ , $T_j = 25^\circ\text{ C}$		15	20	
$I_{RM}$	Reverse recovery current	$I_F = 1.5\text{ A}$ , $di_F/dt = -200\text{ A}/\mu\text{s}$ , $V_R = 160\text{ V}$ , $T_j = 125^\circ\text{ C}$		3	4	A
$t_{fr}$	Forward recovery time	$I_F = 1.5\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ $V_{FR} = 1.1 \times V_{Fmax}$ , $T_j = 25^\circ\text{ C}$		50		ns
$V_{FP}$	Forward recovery voltage	$I_F = 1.5\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ , $T_j = 25^\circ\text{ C}$		2.1		V

Figure 1. Peak current versus duty cycle

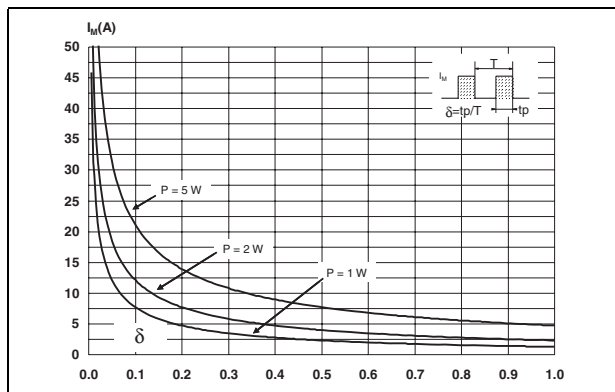


Figure 2. Forward voltage drop versus forward current (typical values)

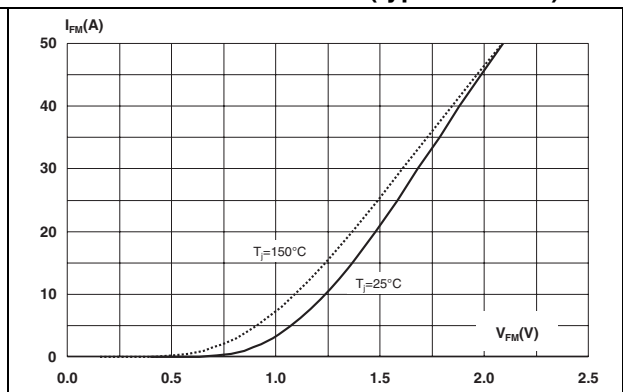


Figure 3. Forward voltage drop versus forward current (maximum values)

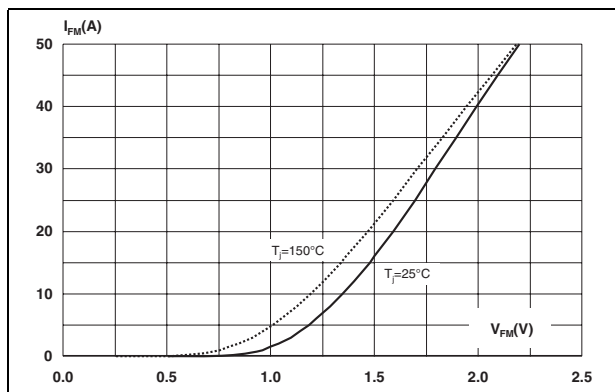
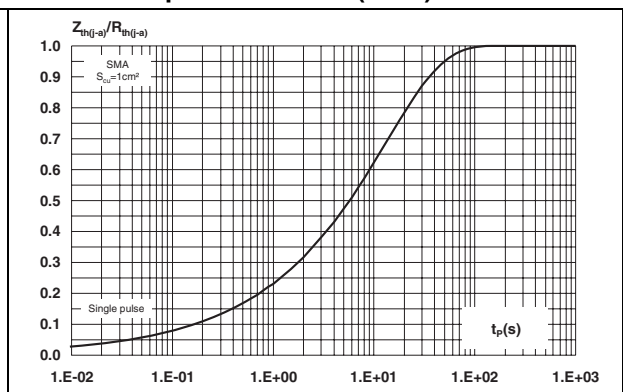
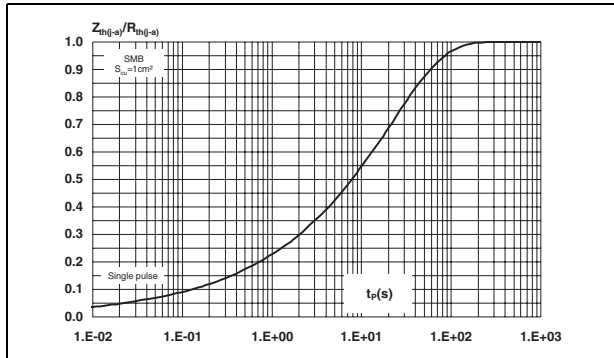


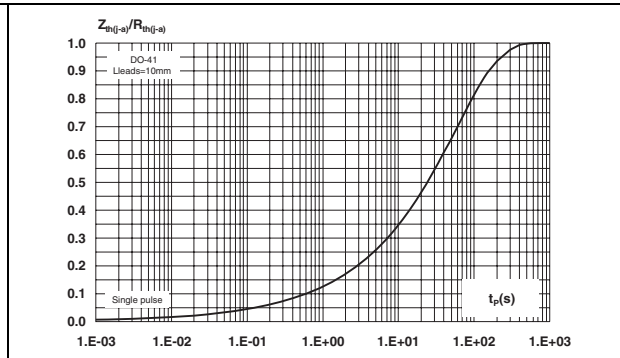
Figure 4. Relative variation of thermal impedance junction to case versus pulse duration (SMA)



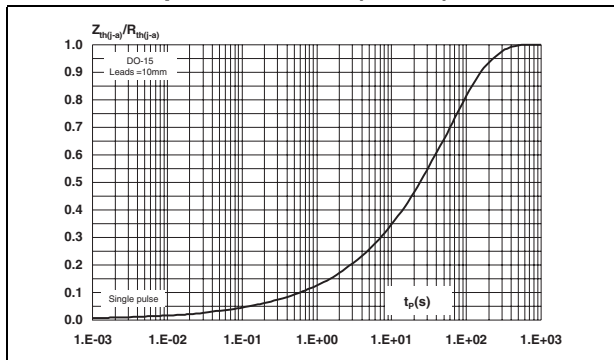
**Figure 5. Relative variation of thermal impedance junction to case versus pulse duration (SMB)**



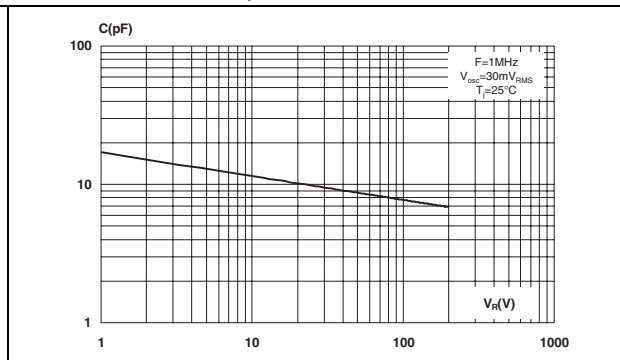
**Figure 6. Relative variation of thermal impedance junction to case versus pulse duration (DO-41)**



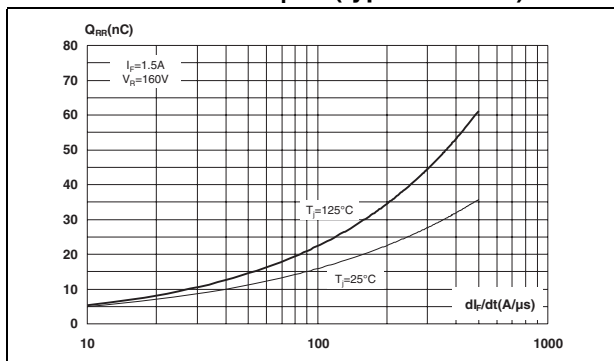
**Figure 7. Relative variation of thermal impedance junction to case versus pulse duration (DO-15)**



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



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



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

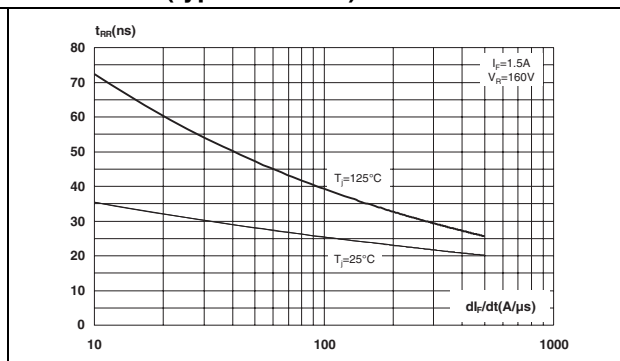


Figure 11. Peak reverse recovery current versus  $di_F/dt$  (typical values)

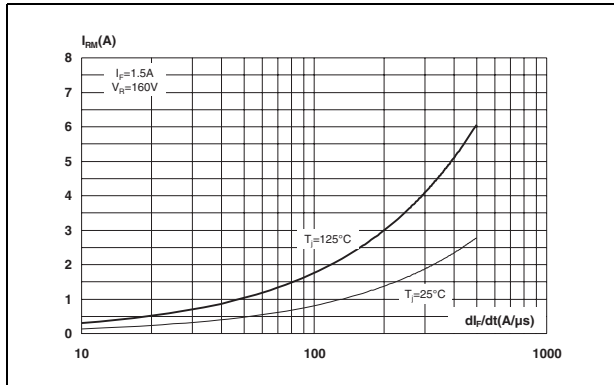


Figure 12. Dynamic parameters versus junction temperature

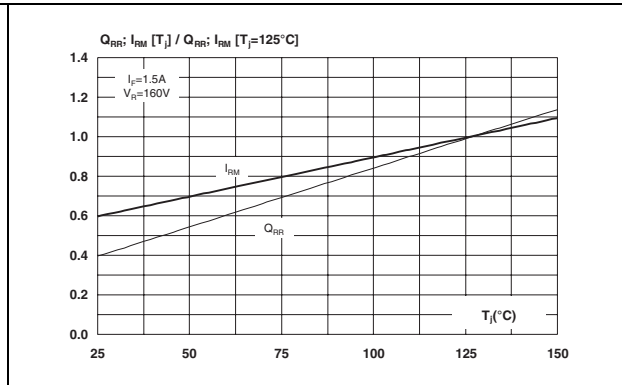


Figure 13. Thermal resistance, junction to ambient, versus copper surface under each lead - SMA (Epoxy FR4, copper thickness = 35 μm)

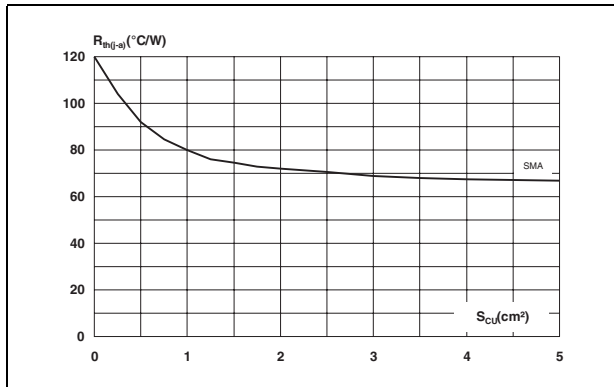


Figure 14. Thermal resistance, junction to ambient, versus copper surface under each lead - SMB (Epoxy FR4, copper thickness = 35 μm)

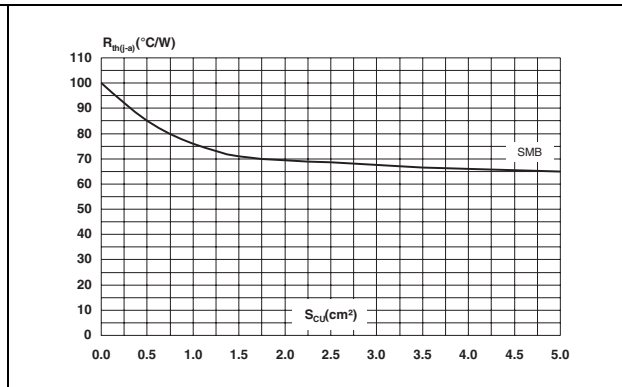


Figure 15. Thermal resistance, junction to ambient, versus copper surface under each lead - DO 15 (Epoxy FR4, copper thickness = 35 μm)

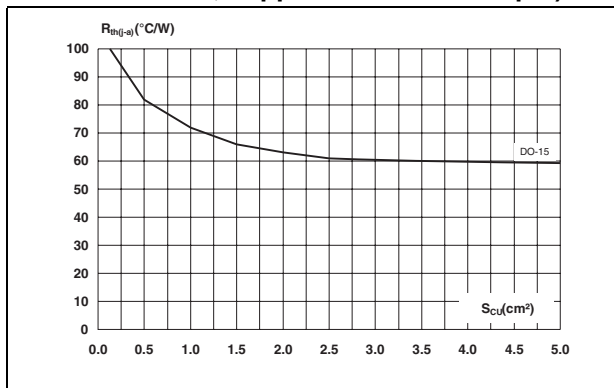
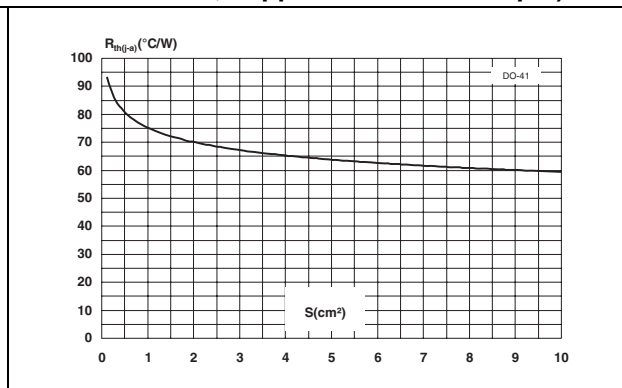
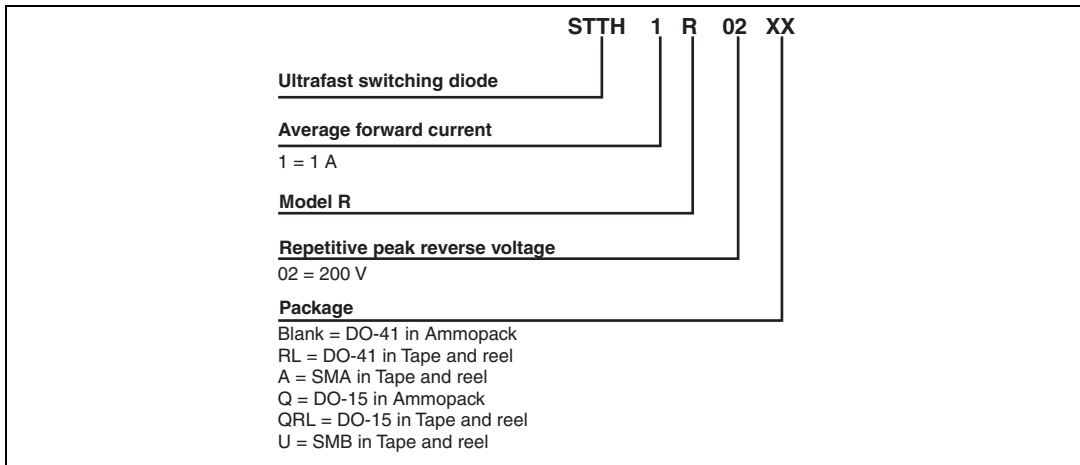


Figure 16. Thermal resistance, junction to ambient, versus copper surface under each lead - DO-41 (Epoxy FR4, copper thickness = 35 μm)



## 2 Ordering information scheme



## 3 Package information

- Epoxy meets UL94, V0

Table 5. DO-41 dimensions

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.1	5.20	0.160	0.205
B	2	2.71	0.080	0.107
C	25.4		1	
D	0.712	0.863	0.028	0.034

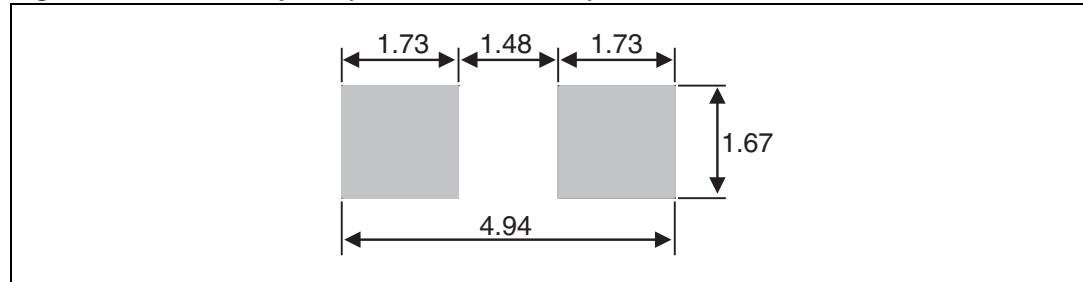
Table 6. DO-15 dimensions

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	6.05	6.75	0.238	0.266
B	2.95	3.53	0.116	0.139
C	26	31	1.024	1.220
D	0.71	0.88	0.028	0.035

Table 7. SMA dimensions

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

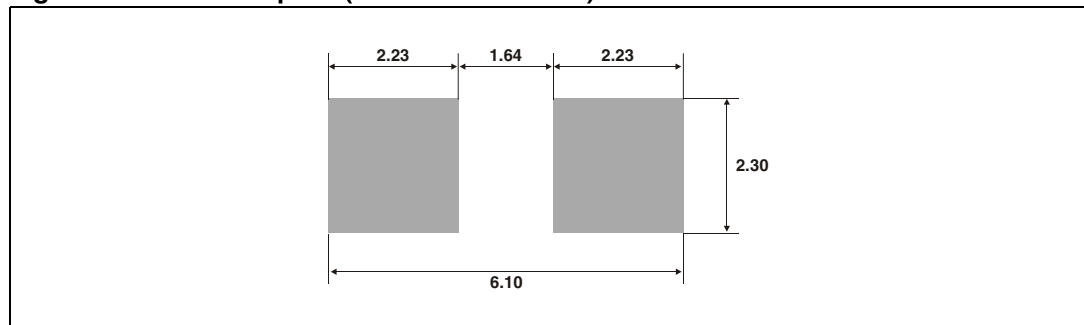
Figure 17. SMA footprint (dimensions in mm)



**Table 8. SMB dimensions**

Ref.	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A1	1.90	2.45	0.075	0.096
A2	0.05	0.20	0.002	0.008
b	1.95	2.20	0.077	0.087
c	0.15	0.41	0.006	0.016
E	5.10	5.60	0.201	0.220
E1	4.05	4.60	0.159	0.181
D	3.30	3.95	0.130	0.156
L	0.75	1.60	0.030	0.063

**Figure 18. SMB footprint (dimensions in mm)**



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).



## 4 Ordering information

Part Number	Marking	Package	Weight	Base qty	Delivery mode
STTH1R02	STTH1R02	DO-41	0.34 g	2000	Ammopack
STTH1R02RL	STTH1R02	DO-41	0.34 g	5000	Tape and reel
STTH1R02A	R1A	SMA	0.068 g	5000	Tape and reel
STTH1R02Q	STTH1R02Q	DO-15	0.49 g	1000	Ammopack
STTH1R02QRL	STTH1R02Q	DO-15	0.49 g	6000	Tape and reel
STTH1R02U	1R2S	SMB	0.11 g	2500	Tape and reel

## 5 Revision history

Date	Revision	Description of 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 $e_{Cu}$ with copper thickness.

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