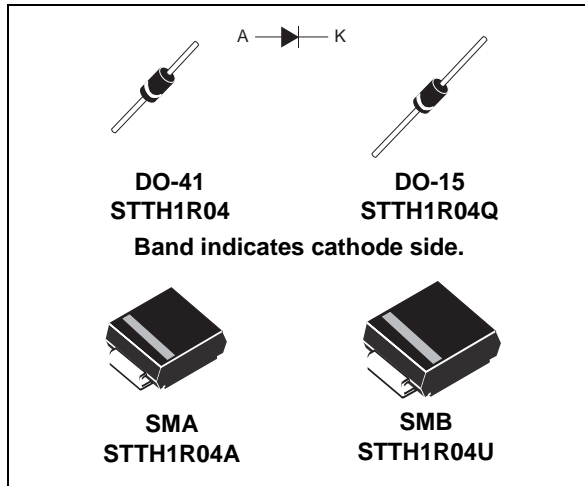


## Ultrafast recovery diode

Datasheet - production data



### Description

The STTH1R04 series uses ST's new 400 V planar Pt doping technology. The STTH1R04 is specially suited for switching mode base drive and transistor circuits.

Packaged in axial and surface mount packages, this device is intended for use in low voltage, high frequency inverters, free wheeling and polarity protection.

Table 1. Device summary

$I_{F(AV)}$	1 A
$V_{RRM}$	400 V
$T_j (max)$	175 °C
$V_F (typ)$	0.9 V
$t_{rr} (typ)$	14 ns

### Features

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

# 1 Characteristics

**Table 2. Absolute ratings (limiting values at 25 °C, unless otherwise specified)**

Symbol	Parameter		Value	Unit	
$V_{RRM}$	Repetitive peak reverse voltage		400	V	
$I_{F(AV)}$	Average forward current, $\delta = 0.5$	DO-41	$T_{lead} = 100\text{ °C}$	1.0	A
		DO-15	$T_{lead} = 105\text{ °C}$		
		SMA	$T_{lead} = 125\text{ °C}$		
		SMB	$T_{lead} = 140\text{ °C}$		
$I_{FSM}$	Surge non repetitive forward current	$t_p = 10\text{ ms}$ Sinusoidal	30	A	
$T_{stg}$	Storage temperature range		-65 to +175	°C	
$T_j$	Maximum operating junction temperature <sup>(1)</sup>		175	°C	

1. On infinite heatsink with 10 mm lead length

**Table 3. Thermal parameters**

Symbol	Parameter		Value	Unit	
$R_{th(j-l)}$	Junction to lead	Lead length = 10 mm on infinite heatsink	DO-41	55	°C/W
			DO-15	50	
$R_{th(j-l)}$	Junction to lead		SMA	35	
			SMB	25	

**Table 4. Static electrical characteristics**

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$I_R^{(1)}$	Reverse leakage current	$T_j = 25\text{ °C}$	$V_R = V_{RRM}$		5	$\mu\text{A}$
		$T_j = 125\text{ °C}$		5	50	
$V_F^{(2)}$	Forward voltage drop	$T_j = 25\text{ °C}$	$I_F = 1.0\text{ A}$		1.5	V
		$T_j = 100\text{ °C}$		1.0	1.25	
		$T_j = 150\text{ °C}$		0.9	1.15	

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:

$$P = 0.9 \times I_{F(AV)} + 0.250 \times I_{F(RMS)}^2$$

Table 5. Dynamic characteristics ( $T_j = 25\text{ }^\circ\text{C}$  unless otherwise stated)

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$t_{rr}$	Reverse recovery time	$I_F = 1\text{ A}$ , $di_F/dt = -50\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$ , $T_j = 25\text{ }^\circ\text{C}$			30	ns
		$I_F = 1\text{ A}$ , $di_F/dt = -100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$ , $T_j = 25\text{ }^\circ\text{C}$		14	20	
$I_{RM}$	Reverse recovery current	$I_F = 1\text{ A}$ , $di_F/dt = -200\text{ A}/\mu\text{s}$ , $V_R = 320\text{ V}$ , $T_j = 125\text{ }^\circ\text{C}$		2.5	3.5	A
$t_{fr}$	Forward recovery time	$I_F = 1\text{ A}$ $di_F/dt = 100\text{ A}/\mu\text{s}$ $V_{FR} = 1.1 \times V_{Fmax}$ , $T_j = 25\text{ }^\circ\text{C}$			50	ns
$V_{FP}$	Forward recovery voltage	$I_F = 1\text{ A}$ $di_F/dt = 100\text{ A}/\mu\text{s}$		3.5		V

Figure 1. Conduction losses versus average forward current

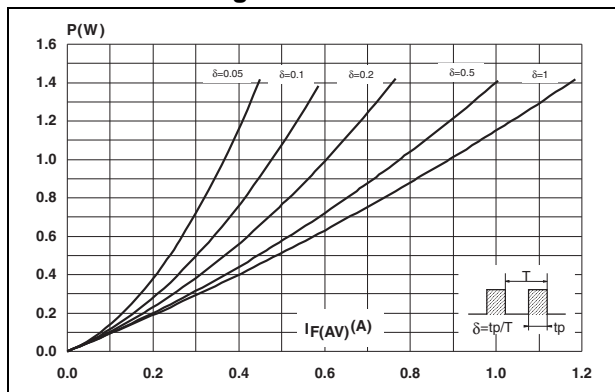


Figure 2. Forward voltage drop versus forward current

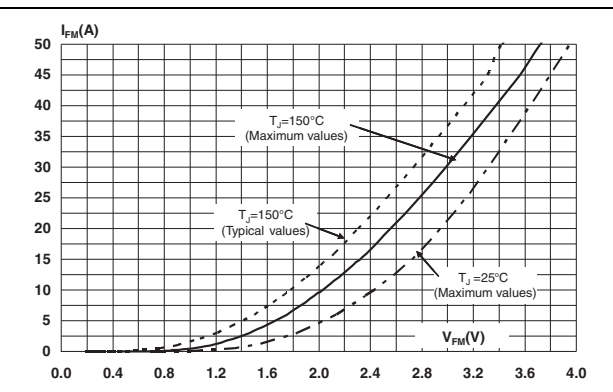


Figure 3. Relative variation of thermal impedance junction to lead versus pulse duration (DO-41)

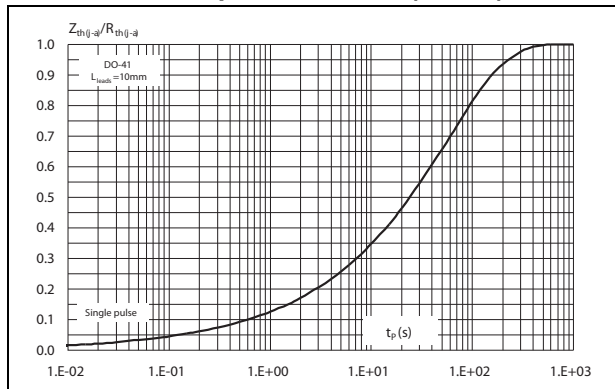


Figure 4. Relative variation of thermal impedance junction to lead versus pulse duration (DO-15)

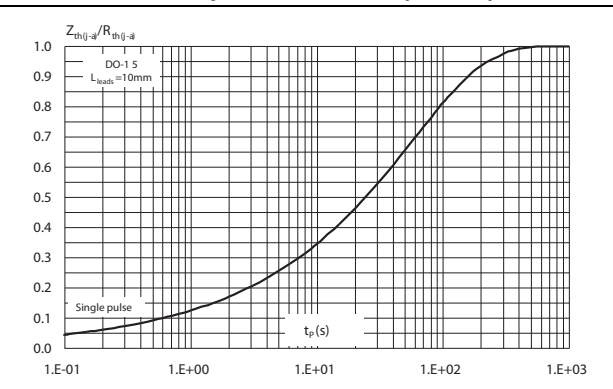


Figure 5. Relative variation of thermal impedance junction to lead versus pulse duration, SMA

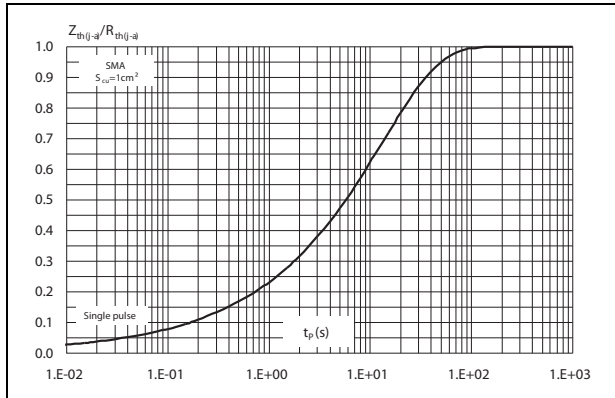


Figure 6. Relative variation of thermal impedance junction to lead versus pulse duration, SMB

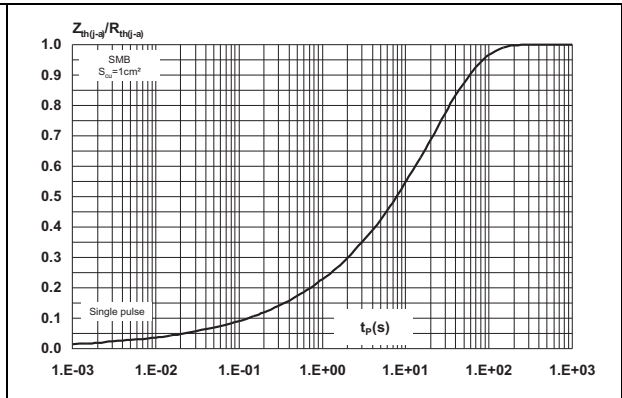


Figure 7. Junction capacitance versus reverse voltage applied (typical values)

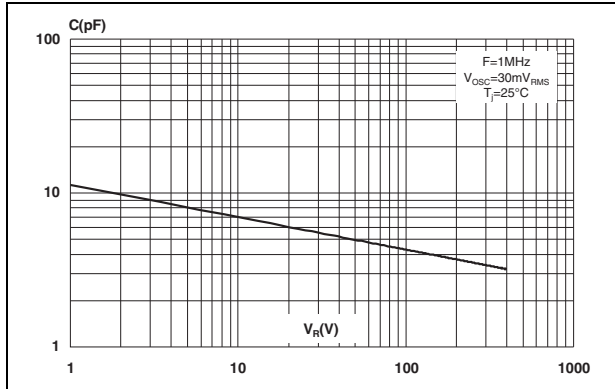


Figure 8. Reverse recovery charges versus  $di_F/dt$  (typical values)

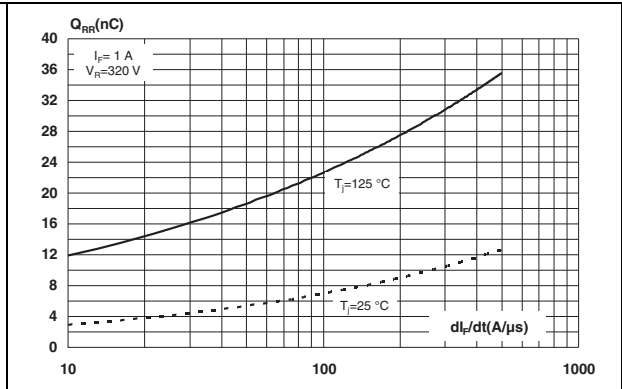


Figure 9. Reverse recovery time versus  $di_F/dt$  (typical values)

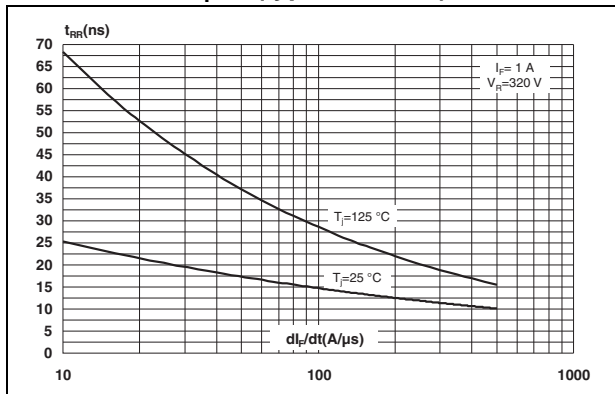


Figure 10. Peak reverse recovery current versus  $di_F/dt$  (typical values)

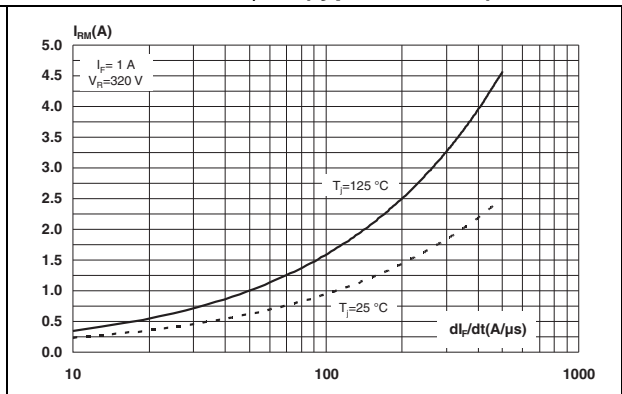


Figure 11. Relative variations of dynamic parameters versus junction temperature

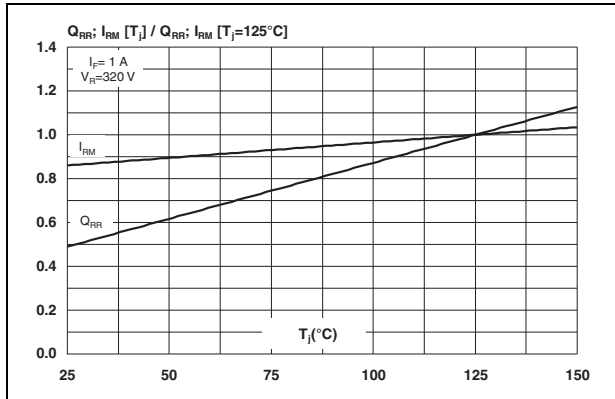


Figure 12. Transient peak forward voltage versus  $di_F/dt$  (typical values)

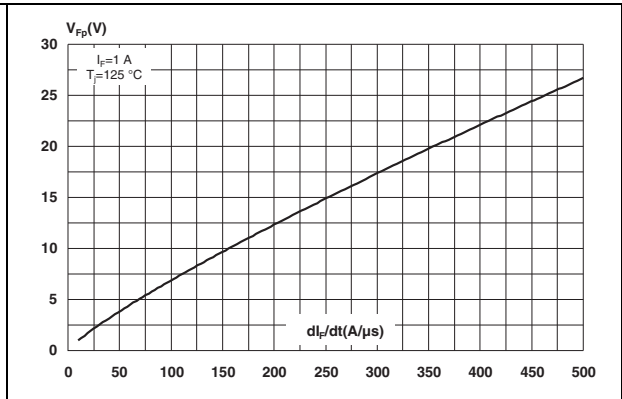


Figure 13. Forward recovery time versus  $di_F/dt$  (typical values)

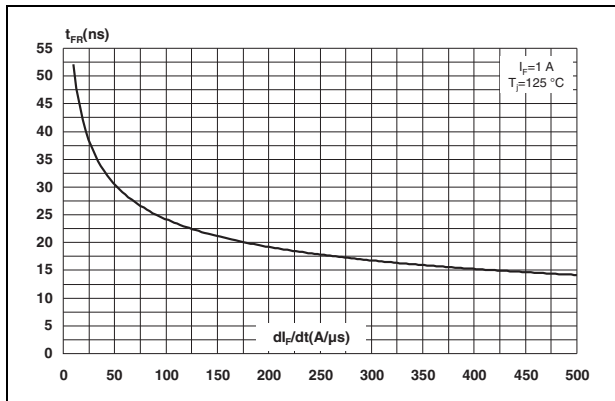


Figure 14. Thermal resistance versus lead length (DO-41)

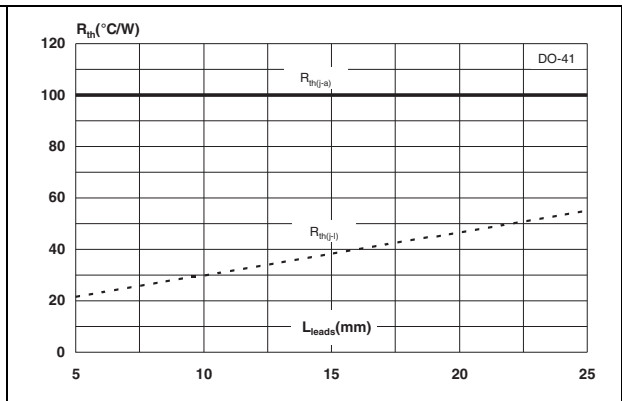


Figure 15. Thermal resistance junction to ambient versus lead length, DO-15

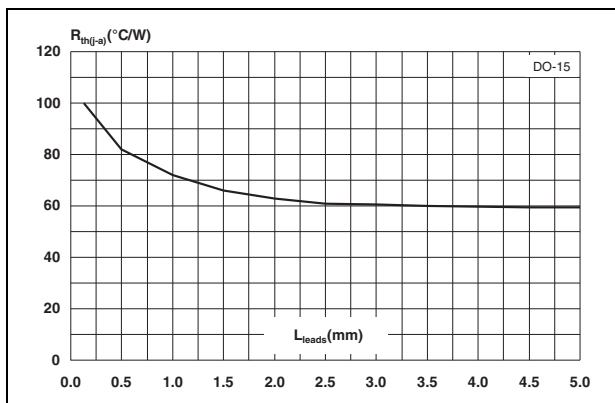
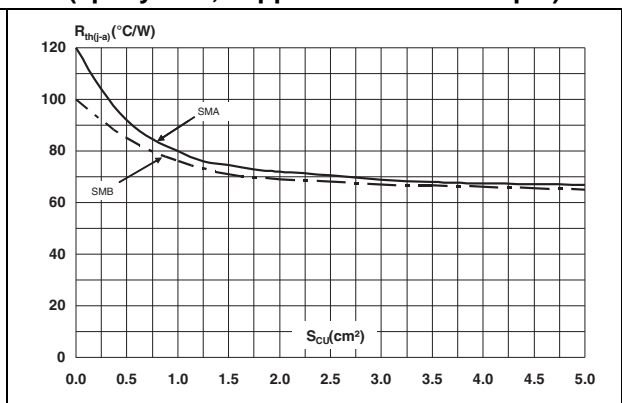


Figure 16. Thermal resistance junction to ambient versus copper surface under each lead, SMA, SMB, (epoxy FR4, copper thickness = 35 μm)



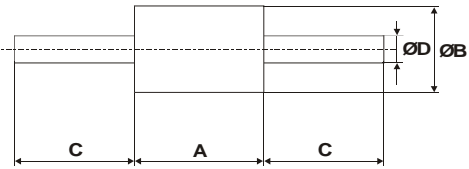
## 2 Package information

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

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.

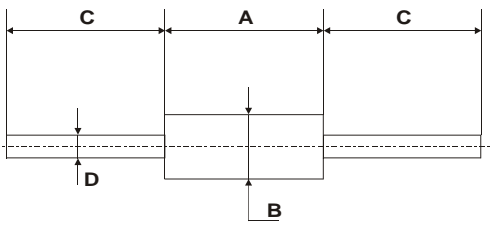
### 2.1 DO-14 (plastic) package information

Table 6. DO-41 (plastic) 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	

### 2.2 DO-15 package information

Table 7. 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	

## 2.3 SMA package information

Table 8. 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

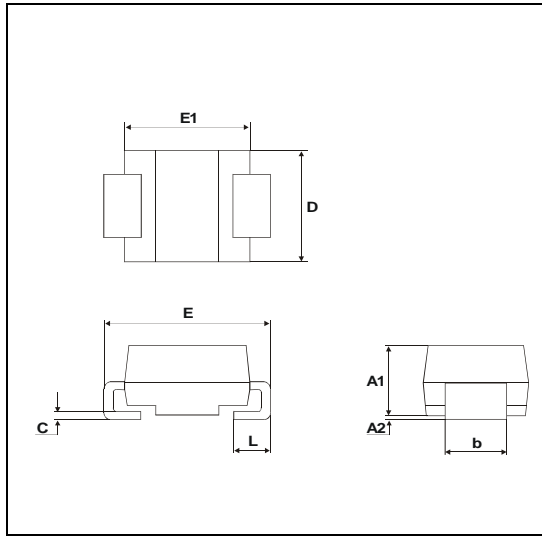
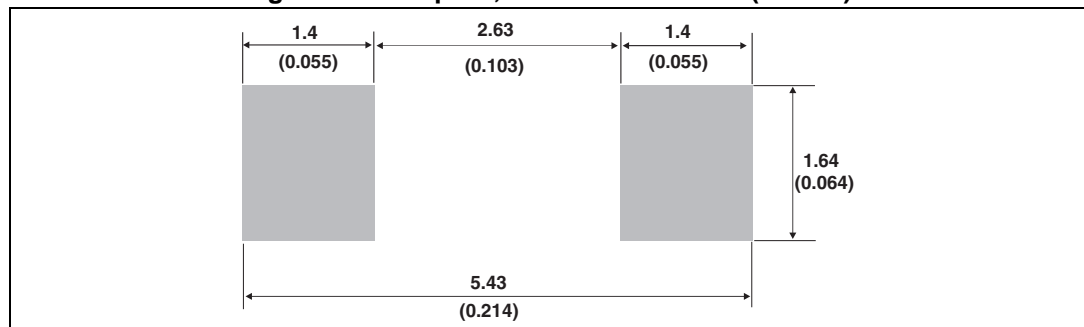


Figure 17. Footprint, dimensions in mm (inches)

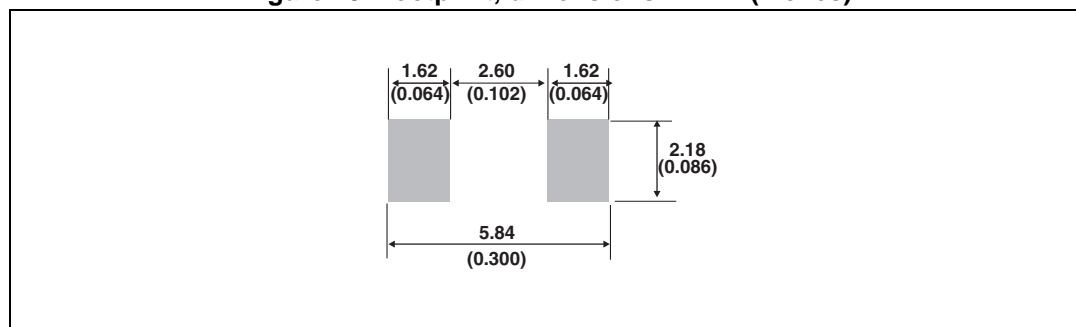


## 2.4 SMB package information

Table 9. 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	0.40	0.006	0.016
D	3.30	3.95	0.130	0.156
E	5.10	5.60	0.201	0.220
E1	4.05	4.60	0.159	0.181
L	0.75	1.50	0.030	0.059

Figure 18. Footprint, dimensions in mm (inches)





### 3 Ordering information

**Table 10. Ordering information**

Order code	Marking	Package	Weight	Base qty	Delivery mode
STTH1R04	STTH1R04	DO-41	0.34 g	1000	Ammopack
STTH1R04RL	STTH1R04	DO-41	0.34 g	5000	Tape and reel
STTH1R04Q	STTH1R04Q	DO-15	0.4 g	1000	Ammopack
STTH1R04QRL	STTH1R04Q	DO-15	0.4 g	6000	Tape and reel
STTH1R04A	HR4	SMA	0.068 g	5000	Tape and reel
STTH1R04U	BR4	SMB	0.12 g	2500	Tape and reel

### 4 Revision history

**Table 11. Document revision history**

Date	Revision	Description of changes
30-May-2008	1	First issue
12-Nov-2015	2	Updated <a href="#">Figure 3</a> , <a href="#">Figure 4</a> , <a href="#">Figure 5</a> and <a href="#">Figure 6</a> . Minor text changes.

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