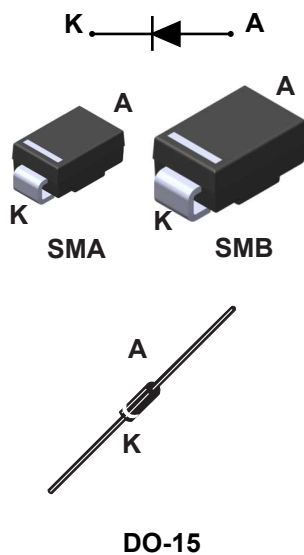


## 1 A - 400 V ultrafast recovery diode



### Features

- Negligible switching losses
- Low forward voltage drop
- High junction temperature
- **ECOPACK** compliant

### Applications

- Switching diode
- Telecom power

### 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 SMA, SMB and DO-15, the **STTH1R04** is ideal for use low voltage, high frequency inverters, free wheeling and polarity protection

Product status	
STTH1R04	
Product summary	
Symbol	Value
$I_{F(AV)}$	1 A
$V_{RRM}$	400 V
$T_{j(max.)}$	175 °C
$V_{F(typ.)}$	0.9 V
$t_{rr(typ.)}$	14 ns

# 1 Characteristics

**Table 1. 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 $\delta = 0.5$ , square wave	SMA	$T_L = 125\text{ °C}$	1	A
		SMB	$T_L = 140\text{ °C}$		
		DO-15	$T_L = 105\text{ °C}$		
$I_{FSM}$	Surge non repetitive forward current		$t_p = 10\text{ ms}$ sinusoidal	30	A
$T_{stg}$	Storage temperature range		-65 to +175	°C	
$T_j$	Operating junction temperature		+175	°C	

**Table 2. Thermal resistance parameter**

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

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	$T_j = 25\text{ °C}$	$V_R = V_{RRM}$	-		5	$\mu\text{A}$
		$T_j = 125\text{ °C}$		-	5	50	$\mu\text{A}$
$V_F^{(2)}$	Forward voltage drop	$T_j = 25\text{ °C}$	$I_F = 1\text{ A}$	-		1.50	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:

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

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

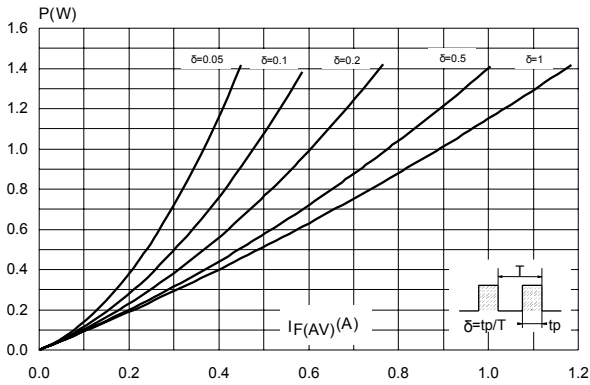
- AN604: Calculation of conduction losses in a power rectifier
- AN4021: Calculation of reverse losses on a power diode

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

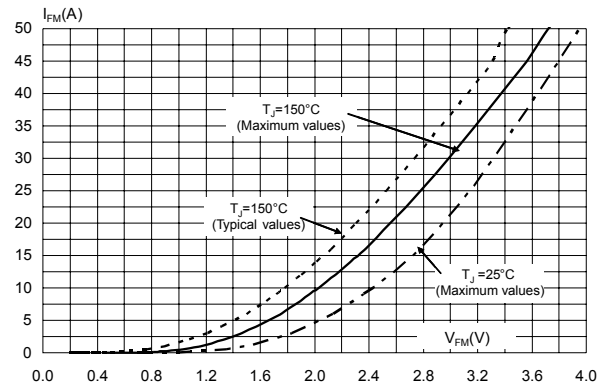
Symbol	Parameters	Test conditions	Min.	Typ.	Max.	Unit
$t_{rr}$	Reverse recovery time	$I_F = 1\text{ A}$ , $di_F/dt = -50\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$	-		30	ns
		$I_F = 1\text{ A}$ , $di_F/dt = -100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$	-	14	20	
$I_{RM}$	Reverse recovery current	$I_F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

## 1.1 Characteristics (curves)

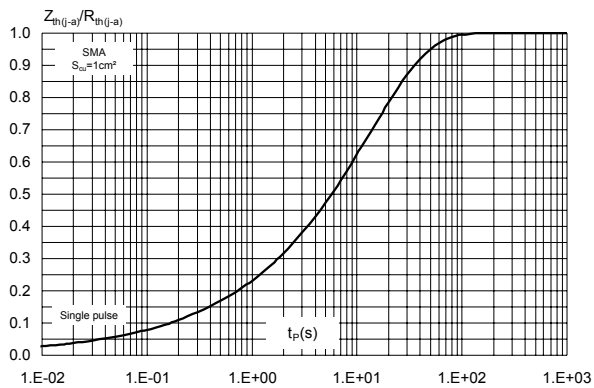
**Figure 1. Average forward power dissipation versus average forward current**



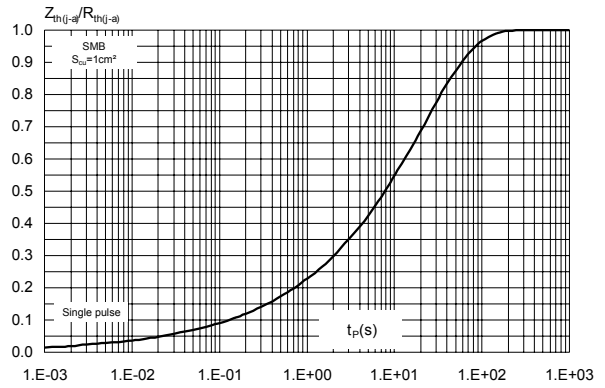
**Figure 2. Forward voltage drop versus forward current**



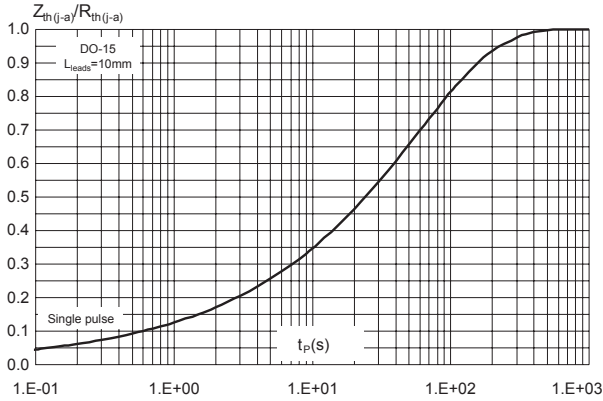
**Figure 3. Relative variation of thermal impedance junction to lead versus pulse duration (SMA)**



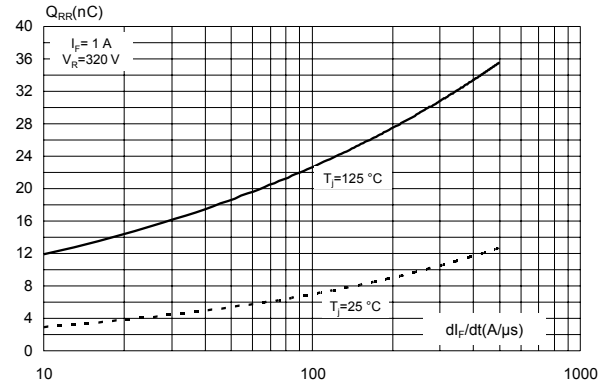
**Figure 4. Relative variation of thermal impedance junction to lead versus pulse duration (SMB)**



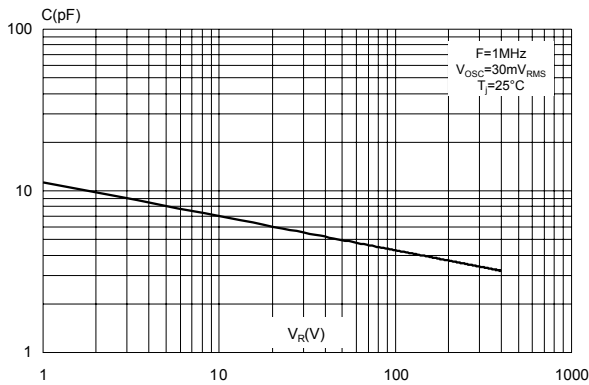
**Figure 5. Relative variation of thermal impedance junction to lead versus pulse duration (DO-15)**



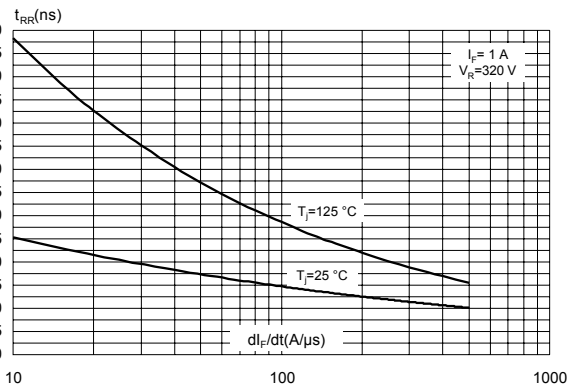
**Figure 6. Reverse recovery charges versus  $di_F/dt$  (typical values)**



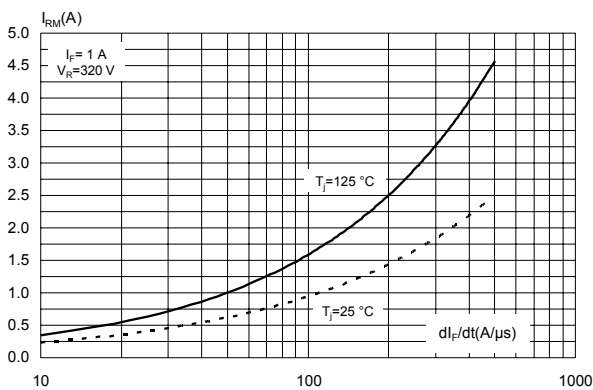
**Figure 7. Junction capacitance versus reverse voltage applied (typical values)**



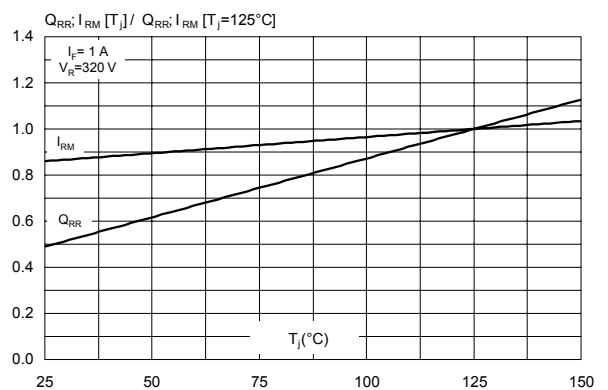
**Figure 8. Reverse recovery time versus  $di_F/dt$  (typical values)**



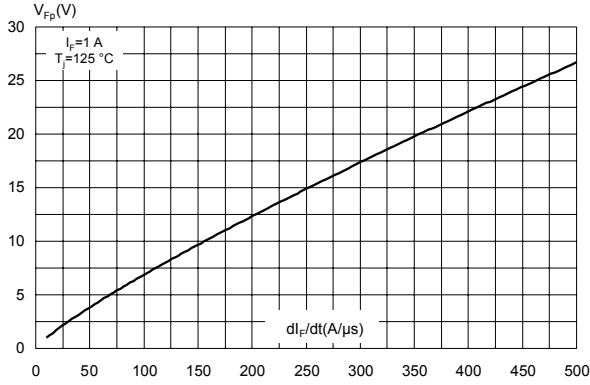
**Figure 9. Peak reverse recovery current versus  $di_F/dt$  (typical values)**



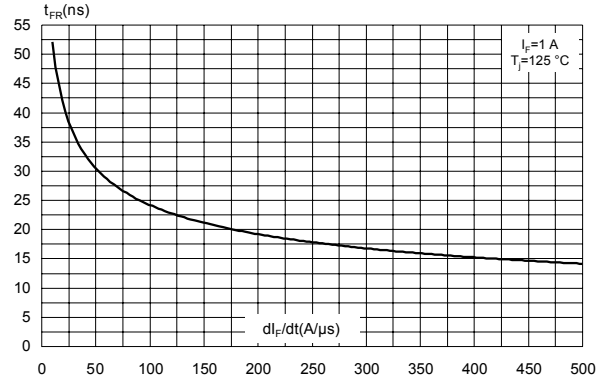
**Figure 10. Relative variations of dynamic parameters versus junction temperature**



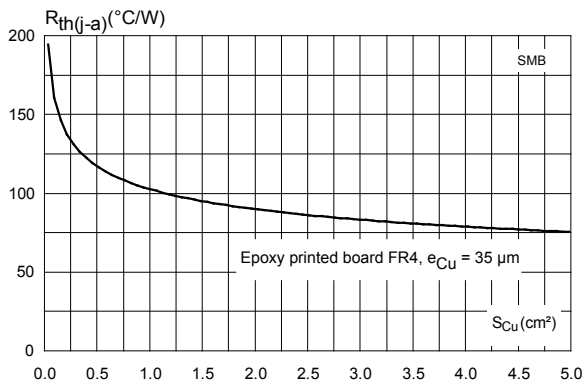
**Figure 11. Transient peak forward voltage versus  $di_F/dt$  (typical values)**



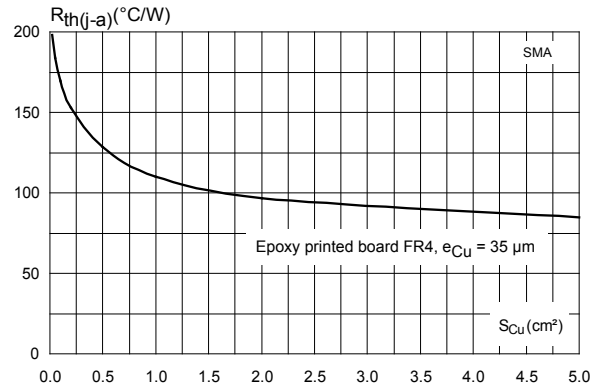
**Figure 12. Forward recovery time versus  $di_F/dt$  (typical values)**



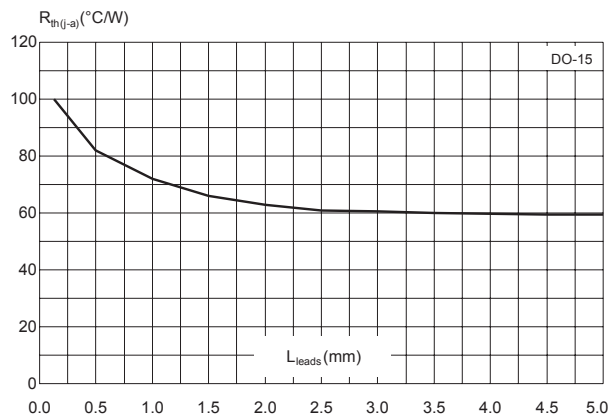
**Figure 13. Thermal resistance junction to ambient versus copper surface under each lead (typical values)**



**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-15**



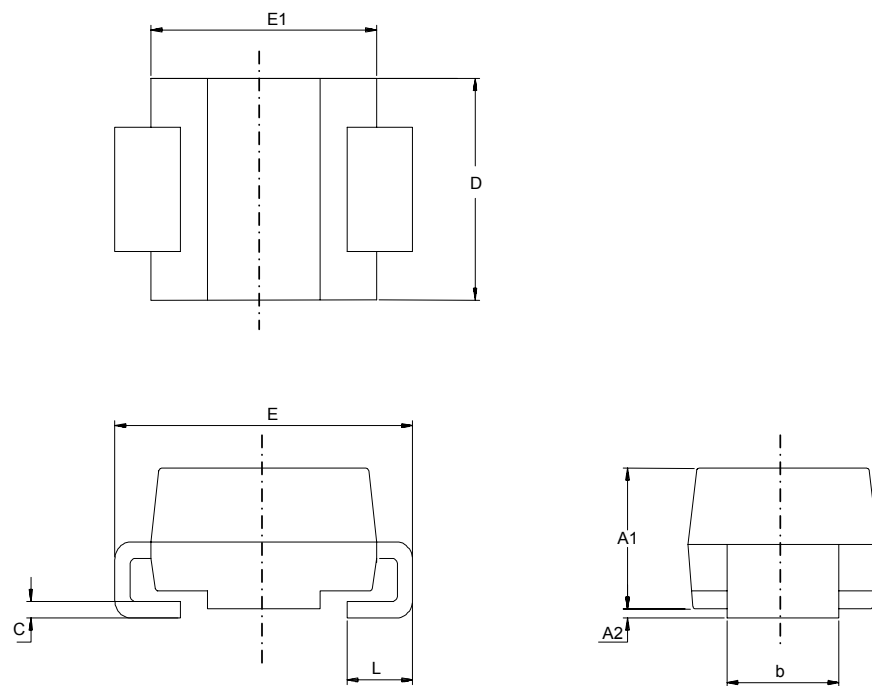
## 2 Package information

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

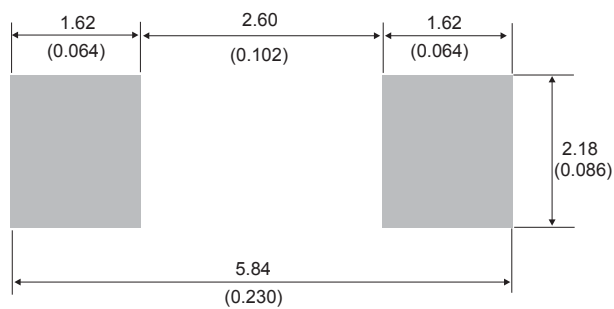
Figure 16. SMB package outline



**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 17. SMB recommended footprint**

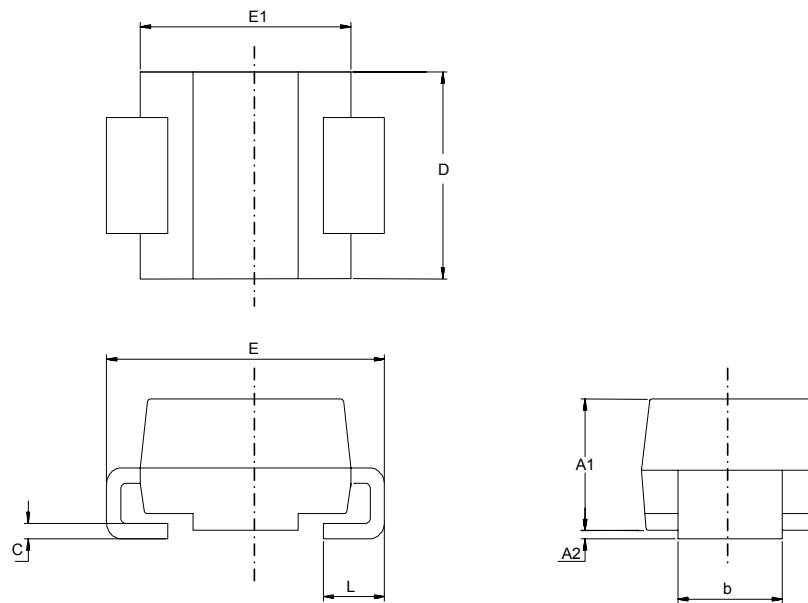




## 2.2 SMA package information

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

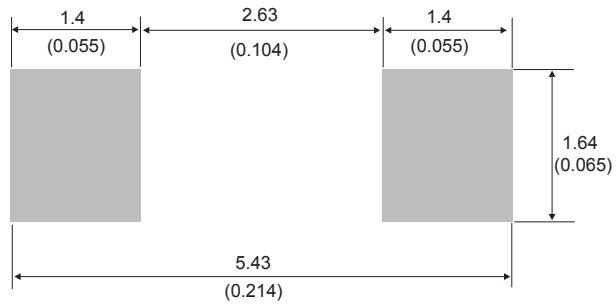
**Figure 18. SMA package outline**



**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 19. SMA recommended footprint in mm (inches)**



### 2.3 DO-15 package information

- Epoxy meets UL 94, V0

Figure 20. DO-15 package outline

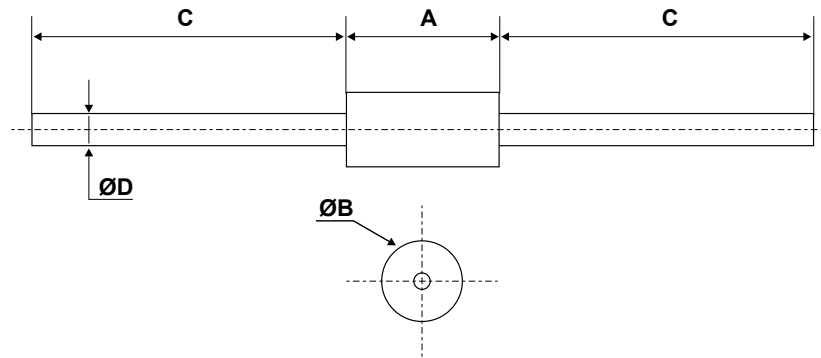


Table 7. DO-15 package mechanical data

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 8. Ordering information**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
STTH1R04A	HR4	SMA	0.068 g	5000	Tape and reel
STTH1R04U	BR4	SMB	0.107 g	2500	Tape and reel
STTH1R04QRL	STTH1R04Q	DO-15	0.400 g	6000	Tape and reel

## Revision history

**Table 9. Document revision history**

Date	Revision	Changes
30-May-2008	1	First issue.
12-Nov-2015	2	Updated Figure 3, Figure 4, Figure 5 and Figure 6. Minor text changes.
13-Nov-2018	3	Removed DO-41 package information.
15-Mar-2019	4	Updated <a href="#">Table 3. Static electrical characteristics</a> .

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