

## Demonstration board using the PD84002 for UHF RFID reader

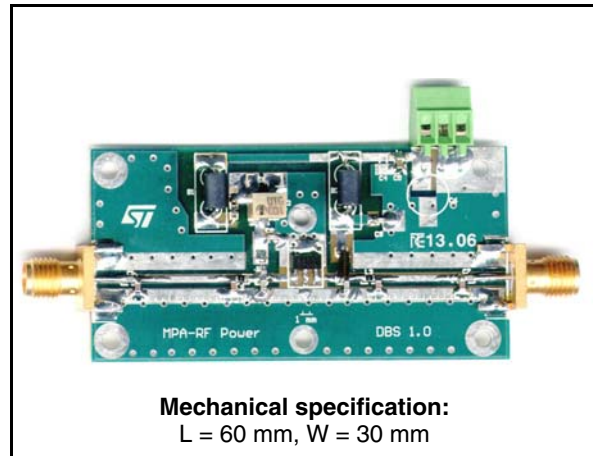
### Features

- Excellent thermal stability
- Frequency: 8
- 860 - 960 MHz
- Supply voltage: 7.2 V
- Output power: 2 W
- Power gain:  $13.9 \pm 0.5$  dB
- Efficiency: 60 % - 63 %
- Load mismatch: 20:1
- BeO-free amplifier

### Description

The STEVAL-TDR013V1 is an evaluation board using PD84002 LDMOS transistor and designed for UHF RFID reader and 2-way radio applications.

For additional information on PD84002, please refer to its datasheet.



**Table 1. Device summary**

Order code
STEVAL-TDR013V1

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# 1 Electrical data

## 1.1 Maximum ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DD}$	Supply voltage	16	V
$I_D$	Drain current	0.75	A
$T_{CASE}$	Operating case temperature	-20 to +85	°C
$T_A$	Maximum ambient temperature	+55	°C

## 2 Electrical characteristics

$T_A = +25\text{ °C}$ ,  $V_{DD} = 7.2\text{ V}$ ,  $I_{dq} = 100\text{ mA}$

**Table 3. Electrical specifications**

Symbol	Test conditions	Min	Typ	Max	Unit
Freq	Frequency range	860		960	MHz
$P_{OUT}$			2		W
Gain	@ $P_{IN} = 19\text{ dBm}$		$13.9 \pm 0.5$		dB
ND	@ $P_{IN} = 19\text{ dBm}$		60 - 63		%
H2	2nd harmonic @ $P_{OUT} = 2\text{ W}$		-31 / -46		dBc
H3	3rd harmonic @ $P_{OUT} = 2\text{ W}$		-62 / -70		dBc
VSWR	Load mismatch all phases @ $P_{OUT} = 2\text{ W}$			20:1	

### 3 Impedance

Figure 1. Impedance illustration

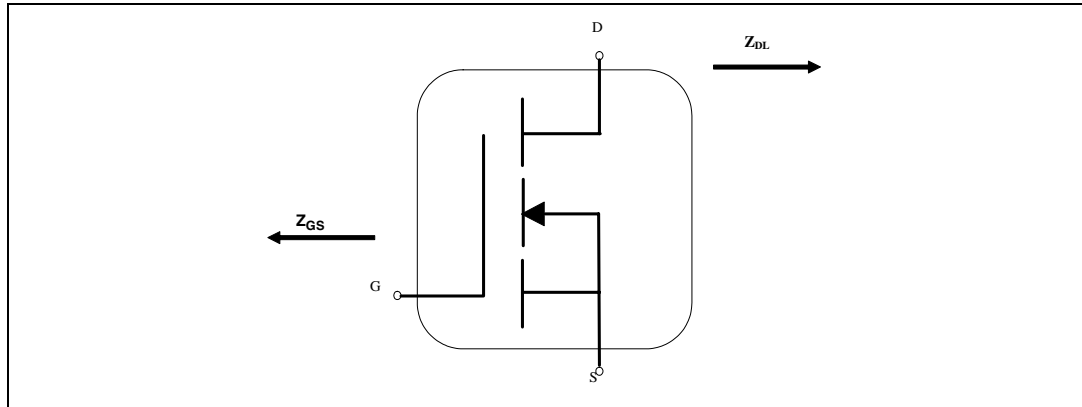
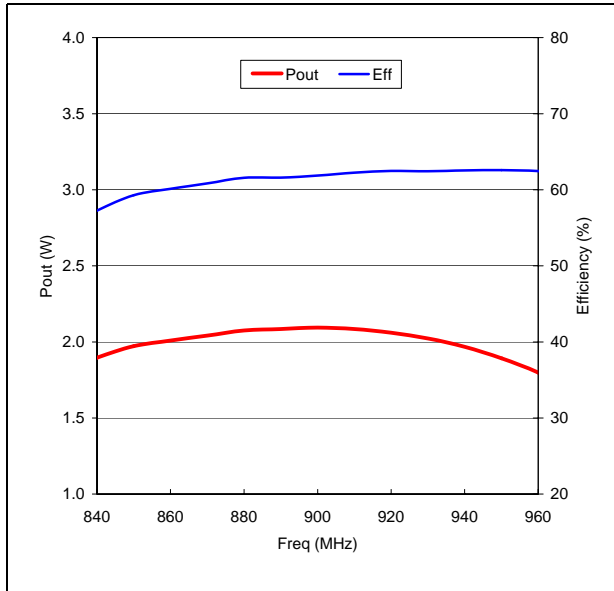


Table 4. Impedance data

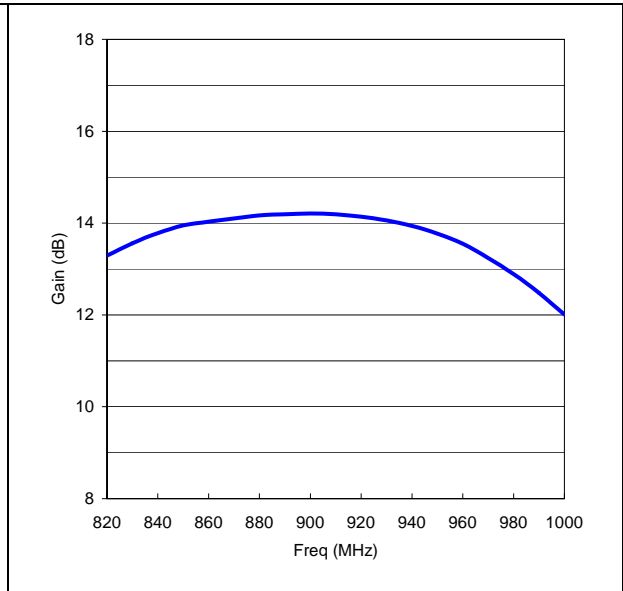
F(MHz)	$Z_{GS}$	$Z_{DL}$
860	1,80 + j 7,79	3,88 + j 2,41
870	1,84 + j 7,96	3,89 + j 2,69
880	1,83 + j 8,01	4,01 + j 2,96
890	1,76 + j 8,11	4,17 + j 3,16
900	1,70 + j 8,20	4,27 + j 3,32
910	1,63 + j 8,30	4,37 + j 3,40
920	1,57 + j 8,48	4,41 + j 3,46
930	1,43 + j 8,64	4,36 + j 3,51
940	1,41 + j 8,83	4,28 + j 3,51

# 4 Typical performance

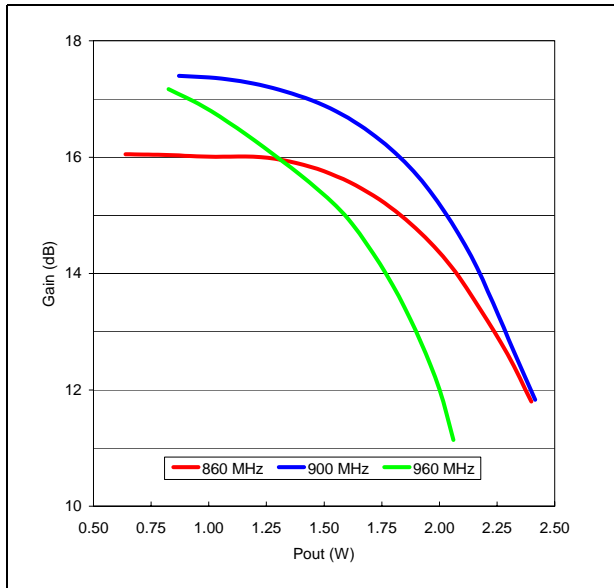
**Figure 2. Output power and efficiency vs frequency**  
7.2 V / 100 mA / Pin = 19 dBm



**Figure 3. Gain vs frequency**  
7.2 V / 100 mA / Pin = 19 dBm



**Figure 4. Gain vs Pout**  
7.2 V / 100 mA



**Figure 5. Harmonics vs frequency**  
7.2 V / 100 mA / Pin = 19 dBm

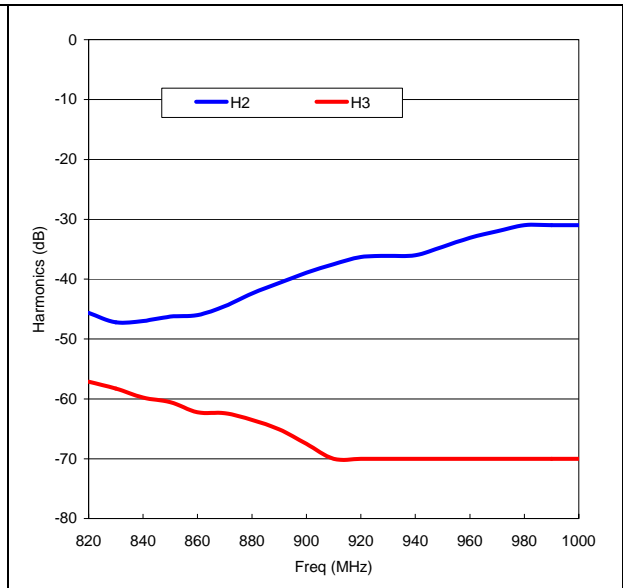
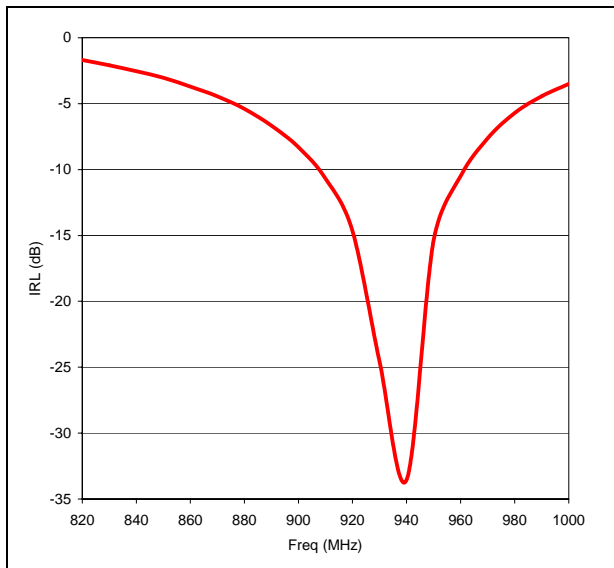


Figure 6. Input return loss vs frequency  
7.2 V / 100 mA / Pin = 19 dBm



## 5 Test circuit

Figure 7. Test circuit schematic

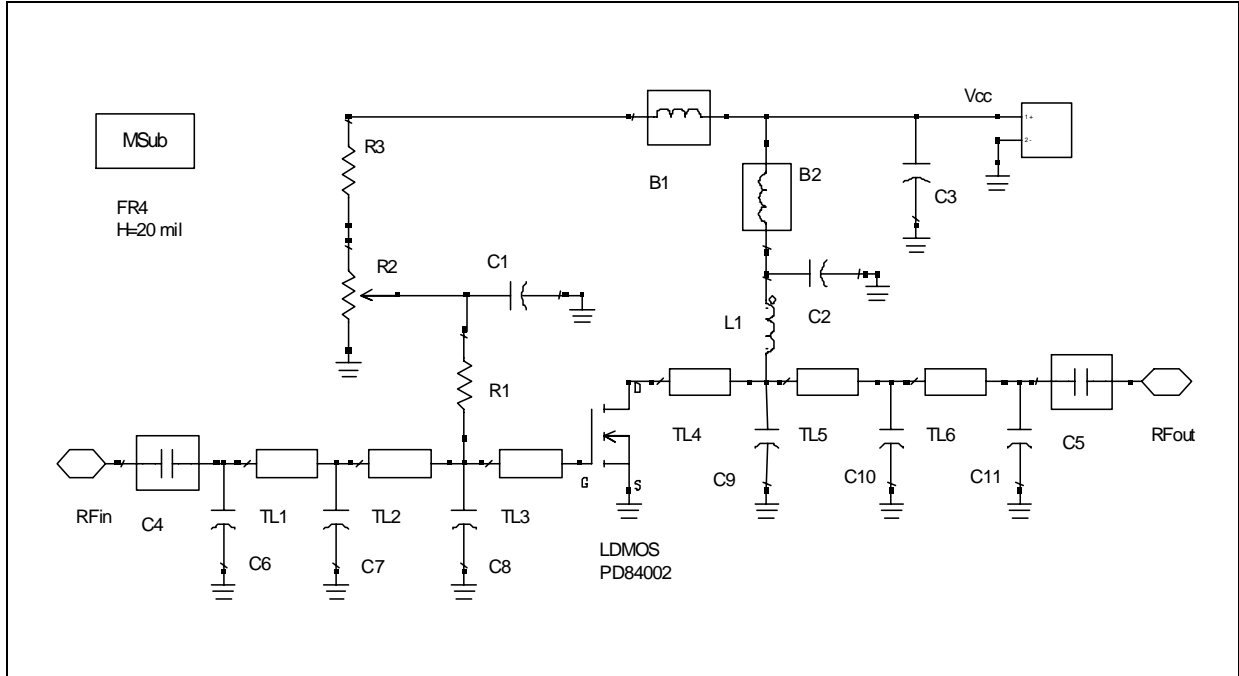


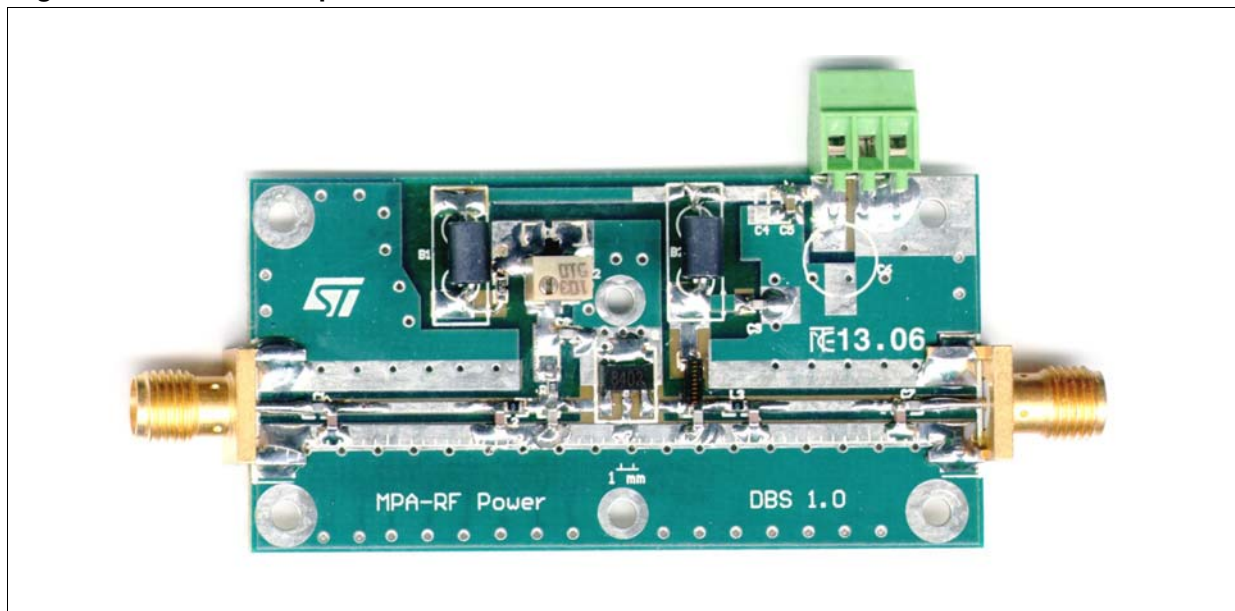
Table 5. Part list

Component ID	Description	Value	Case size	Manufacturer	Part code
B1	Ferrite Bead			Panasonic	EXCELDRC35C
B2	Ferrite Bead			Panasonic	EXCELDRC35C
C1, C2	Capacitor	120 pF	0603	Murata	GRM39-C0G121J50D500
C3	Capacitor	1 uF	0603	Murata	GRM39-X5R105K16D52K
C4, C5	Capacitor	39 pF	0603	Murata	GRM39-C0G390J50D500
C6, C10	Capacitor	3.3 pF	0603	Murata	GRM39-C0G3R3C50Z500
C7	Capacitor	8.2 pF	0603	Murata	GRM39-C0G8R2D50Z500
C8	Capacitor	22 pF	0603	Murata	GRM39-C0G220J50D500
C9	Capacitor	12 pF	0603	Murata	GRM39-C0G120J50D500
C11	Capacitor	2.7 pF	0603	Murata	GRM39-C0G2R7C50Z500
L1	Inductor	12.55 nH		Coilcraft	1606-10
R1	Resistor	150 Ω	0603	Tyco electronics	
R2	Potentiometer	10 KΩ		Bourns electronics	3214W-1-103E
R3	Resistor	1 K	0603	Tyco electronics	01623440-1

**Table 5. Part list (continued)**

Component ID	Description	Value	Case size	Manufacturer	Part code
TL1	Transmission line	W = 0.92mm	L = 13.6 mm		
TL2	Transmission line	W = 0.92mm	L = 3.5 mm		
TL3	Transmission line	W = 0.92mm	L = 4.2 mm		
TL4	Transmission line	W = 0.92mm	L = 3.8 mm		
TL5	Transmission line	W = 0.92mm	L = 3.7 mm		
TL6	Transmission line	W = 0.92mm	L = 11.3 mm		
RF in, RF out	SMA-CONN	50 Ω	60 mils	Johnson	142-0701-801
PD84002	LDMOS			STMicroelectronics	PD84002
Board	FR-4 THk=0.020" 2OZ Cu both sides				

**Figure 8. Demoboard photo**





## 6 Circuit layout

Figure 9. Test fixture component layout

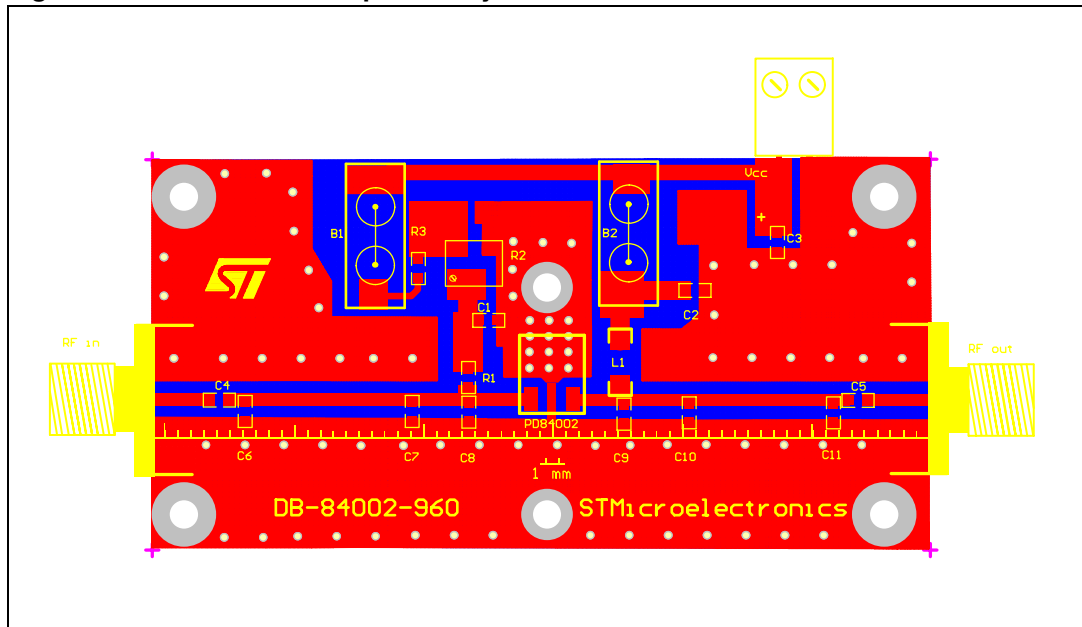
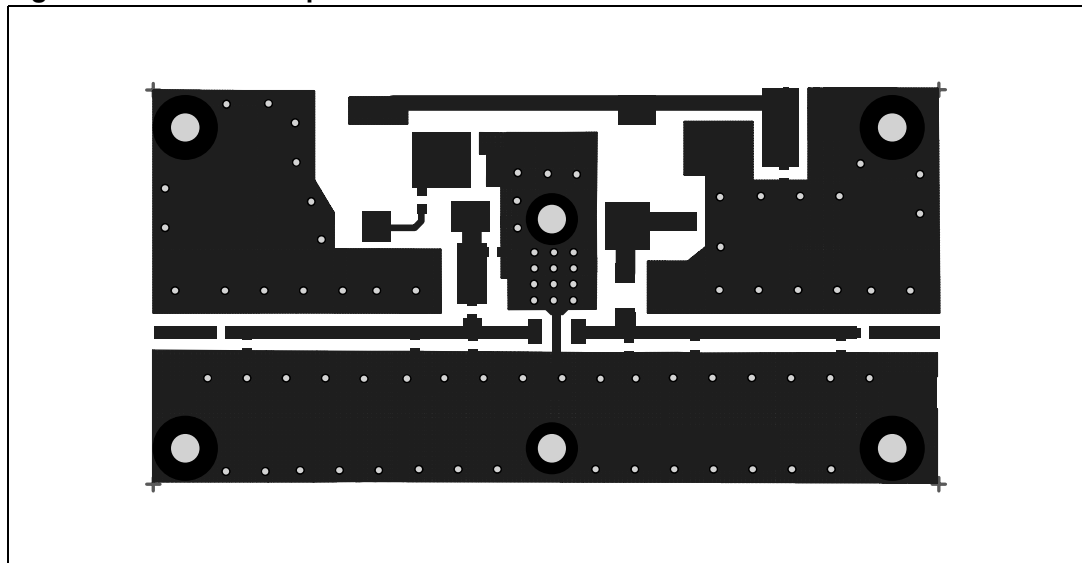


Figure 10. Test circuit photomaster



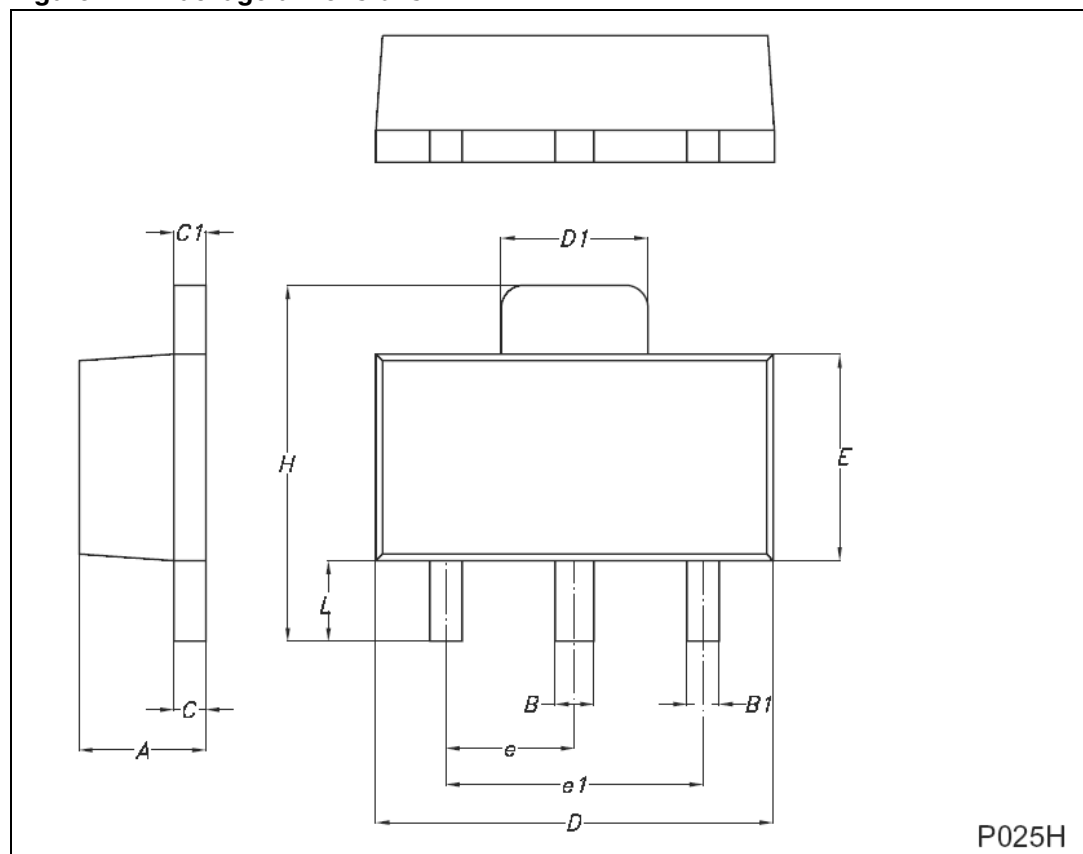
## 7 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

Table 6. SOT-89 mechanical data

Dim.	mm.			Inch		
	Min	Typ	Max	Min	Typ	Max
A	1.4		1.6	55.1		63.0
B	0.44		0.56	17.3		22.0
B1	0.36		0.48	14.2		18.9
C	0.35		0.44	13.8		17.3
C1	0.35		0.44	13.8		17.3
D	4.4		4.6	173.2		181.1
D1	1.62		1.83	63.8		72.0
E	2.29		2.6	90.2		102.4
e	1.42		1.57	55.9		61.8
e1	2.92		3.07	115.0		120.9
H	3.94		4.25	155.1		167.3
L	0.89		1.2	35.0		47.2

Figure 11. Package dimensions



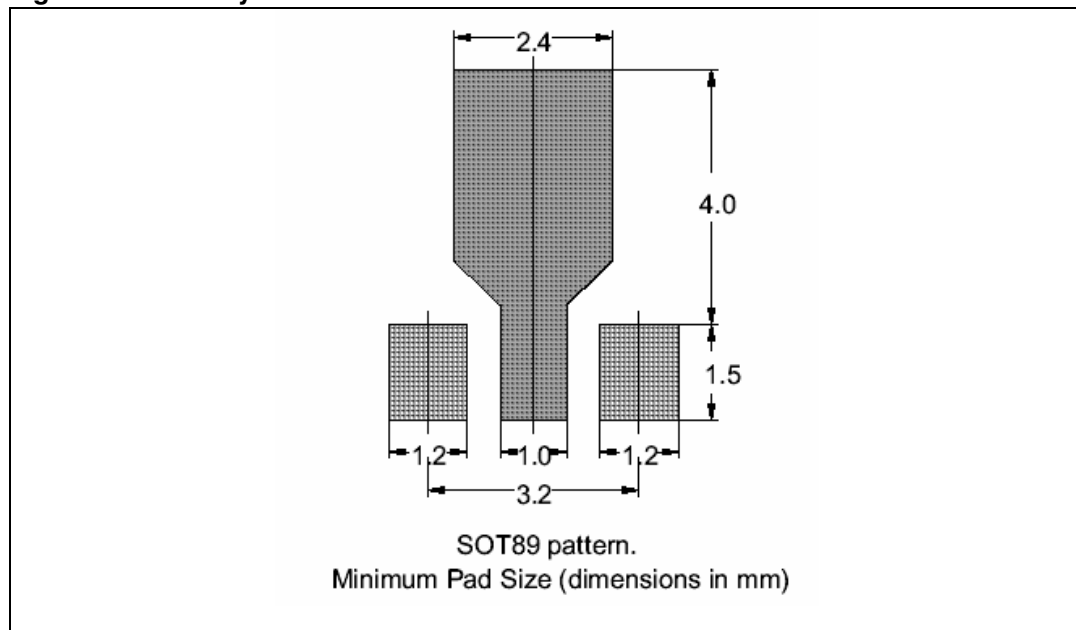
P025H

## 7.1 Thermal pad and via design

Thermal vias are required in the PCB layout to effectively conduct heat away from the package. The via pattern has been designed to address thermal, power dissipation and electrical requirements of the device.

The via pattern is based on thru-hole vias with 0.203mm to 0.330mm finished hole size on a 0.5mm to 1.2mm grid pattern with 0.025 plating on via walls. If micro vias are used in a design, it is suggested that the quantity of vias be increased by a 4:1 ratio to achieve similar results.

**Figure 12. Pad layout details**



## 7.2 Soldering profile

Figure 13 shows the recommended solder for devices that have Pb-free terminal plating and where a Pb-free solder is used.

Figure 13. Recommended solder profile

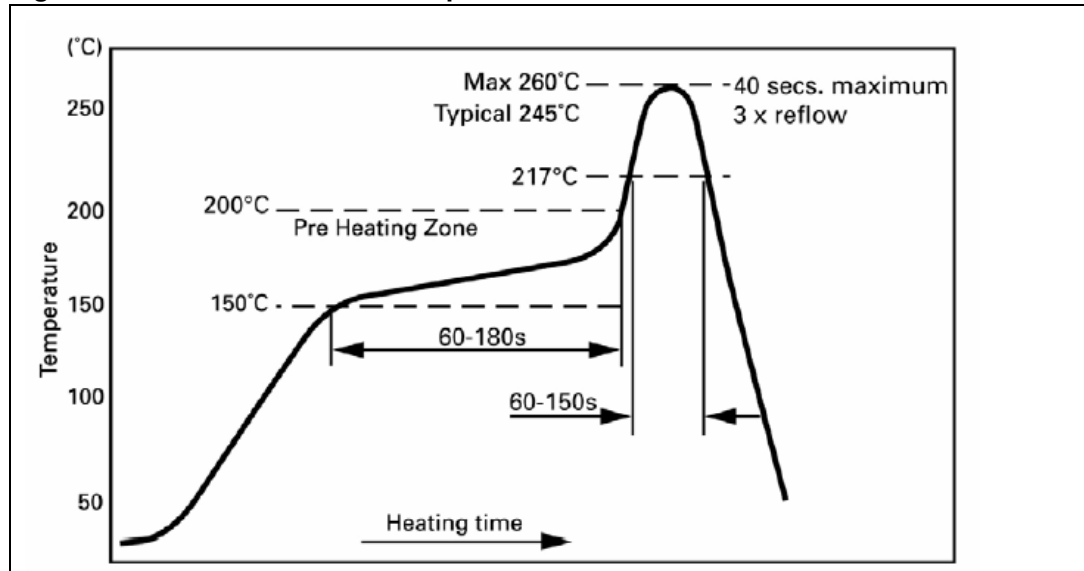


Figure 14 shows the recommended solder for devices with Pb-free terminal plating used with leaded solder, or for devices with leaded terminal plating used with a leaded solder.

Figure 14. Recommended solder profile for leaded devices

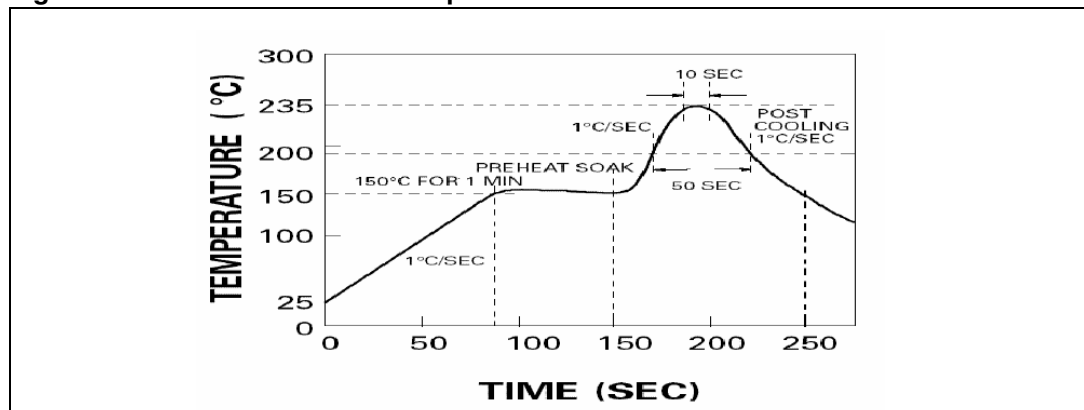
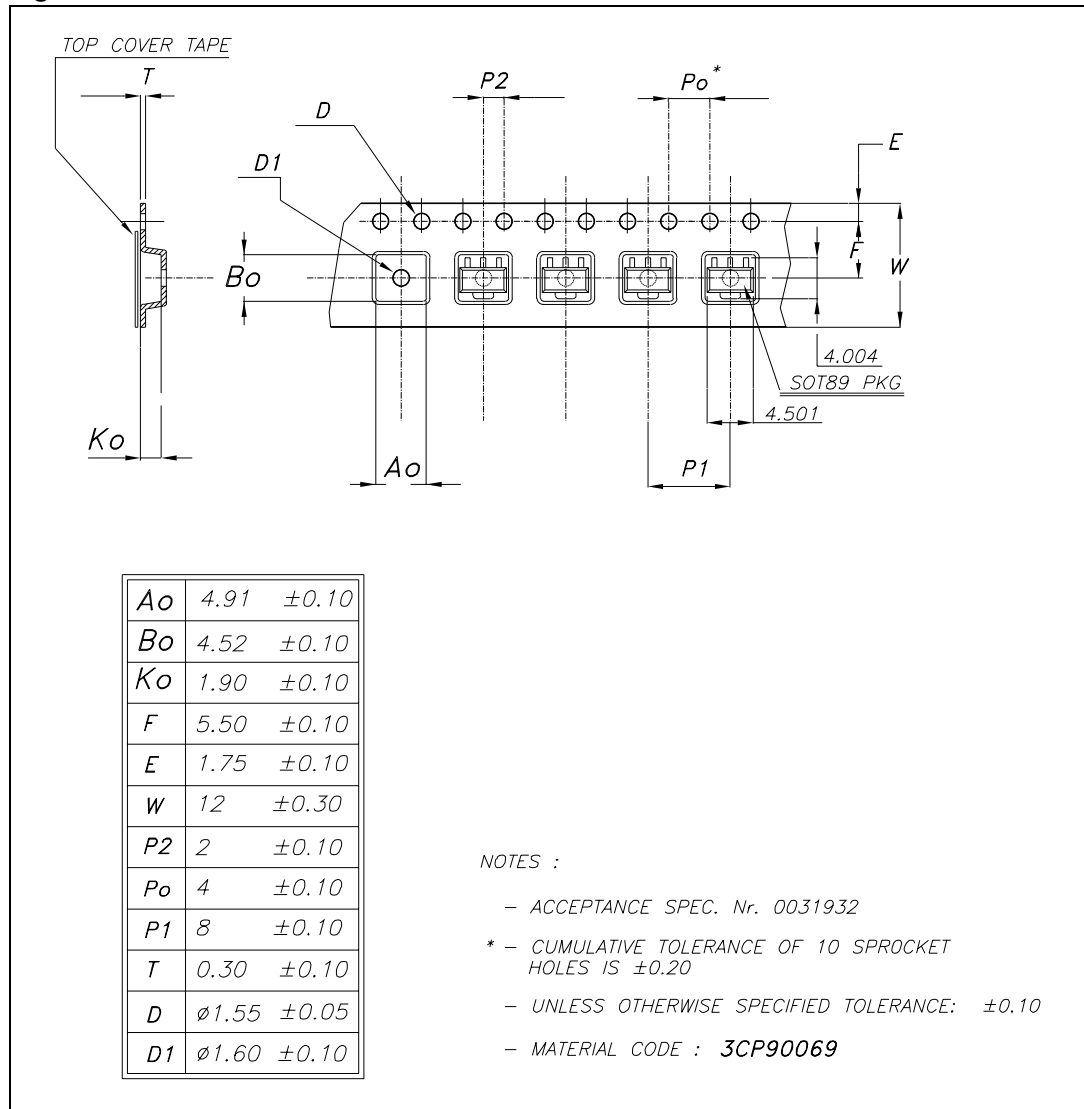


Figure 15. Reel information



## 8 Revision history

Table 7. Document revision history

Date	Revision	Changes
22-Sep-2007	1	Initial release

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