

## RF power transistor the LdmoST plastic family

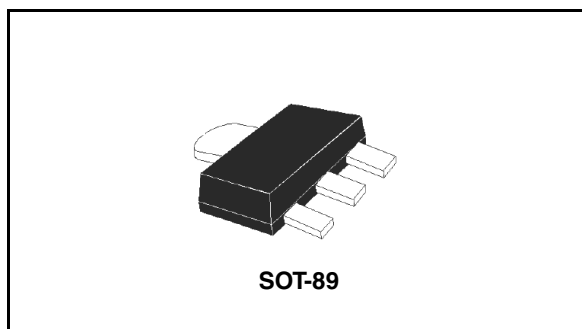
### Features

- Excellent thermal stability
- Common source configuration
- Broadband performances  $P_{OUT} = 1\text{ W}$  with 15 dB gain @ 870 MHz
- Plastic package
- ESD protection
- Supplied in tape and reel
- In compliance with the 2002/95/EC european directive

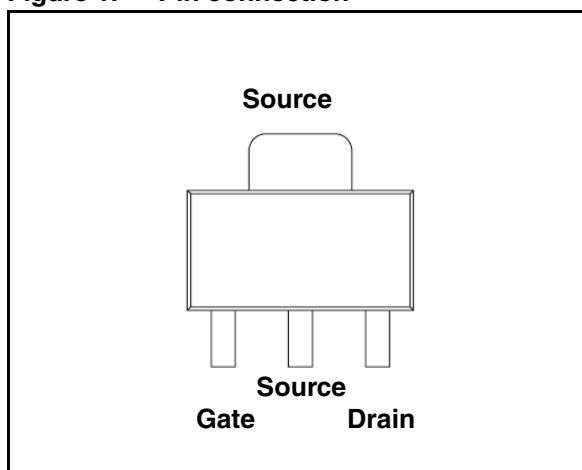
### Description

The PD84001 is a common source N-channel, enhancement-mode lateral field-effect RF power transistor. It is designed for high gain, broad band commercial and industrial applications. It operates at 7 V in common source mode at frequencies of up to 1 GHz.

PD84001's superior gain and efficiency makes it an ideal solution for portable radio and UHF RFID reader.



**Figure 1. Pin connection**



**Table 1. Device summary**

Order code	Marking	Package	Packaging
PD84001	8401	SOT-89	Tape and reel

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# 1 Electrical data

## 1.1 Maximum ratings

**Table 2. Absolute maximum ratings ( $T_{CASE} = +25\text{ °C}$ )**

Symbol	Parameter	Value	Unit
$V_{(BR)DSS}$	Drain-source voltage	18	V
$V_{GS}$	Gate-source voltage	-0.5 to +15	V
$I_D$	Drain current	1.5	A
$P_{DISS}$	Power dissipation	6	W
$T_J$	Max. operating junction temperature	150	°C
$T_{STG}$	Storage temperature	-65 to +150	°C

## 1.2 Thermal data

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Junction - case thermal resistance	21	°C/W

## 2 Electrical characteristics

### 2.1 Static

**Table 4. Static** ( $T_{CASE} = +25\text{ }^{\circ}\text{C}$ )

Symbol	Test conditions			Min.	Typ.	Max.	Unit
$I_{DSS}$	$V_{GS} = 0\text{ V}$	$V_{DS} = 28\text{ V}$				1	$\mu\text{A}$
$I_{GSS}$	$V_{GS} = 5\text{ V}$	$V_{DS} = 0\text{ V}$				1	$\mu\text{A}$
$V_{GS(Q)}$	$V_{DS} = 10\text{ V}$	$I_D = 250\text{ }\mu\text{A}$		2.0	3.0	5.0	V
$V_{DS(ON)}$	$V_{GS} = 10\text{ V}$	$I_D = 0.4\text{ A}$			0.6		V
$C_{ISS}$	$V_{GS} = 0\text{ V}$	$V_{DS} = 7\text{ V}$	$f = 1\text{ MHz}$		14.7		pF
$C_{OSS}$	$V_{GS} = 0\text{ V}$	$V_{DS} = 7\text{ V}$	$f = 1\text{ MHz}$		13.3		pF
$C_{RSS}$	$V_{GS} = 0\text{ V}$	$V_{DS} = 7\text{ V}$	$f = 1\text{ MHz}$		1.3		pF

### 2.2 Dynamic

**Table 5. Dynamic**

Symbol	Test conditions			Min.	Typ.	Max.	Unit
$P_{OUT}$	$V_{DD} = 7.5\text{ V}$ , $I_{DQ} = 50\text{ mA}$ , $P_{IN} = 17\text{ dBm}$ , $f = 870\text{ MHz}$			30	31		dBm
$G_{PS}$	$V_{DD} = 7.5\text{ V}$ , $I_{DQ} = 50\text{ mA}$ , $P_{OUT} = 30\text{ dBm}$ , $f = 870\text{ MHz}$			13	15		dB
$h_D$	$V_{DD} = 7.5\text{ V}$ , $I_{DQ} = 50\text{ mA}$ , $P_{IN} = 17\text{ dBm}$ , $f = 870\text{ MHz}$			55	60		%
Load mismatch	$V_{DD} = 7.5\text{ V}$ , $I_{DQ} = 50\text{ mA}$ , $P_{OUT} = 1\text{ W}$ , $f = 870\text{ MHz}$ All phase angles			20:1			VSWR

### 2.3 ESD protection characteristics

**Table 6. ESD protection characteristics**

Test conditions	Class
Human body model	2
Machine model	M3

### 2.4 Moisture sensitivity level

**Table 7. Moisture sensitivity level**

Test methodology	Rating
J-STD-020B	MSL 3

### 3 Impedance

Figure 2. Current conventions

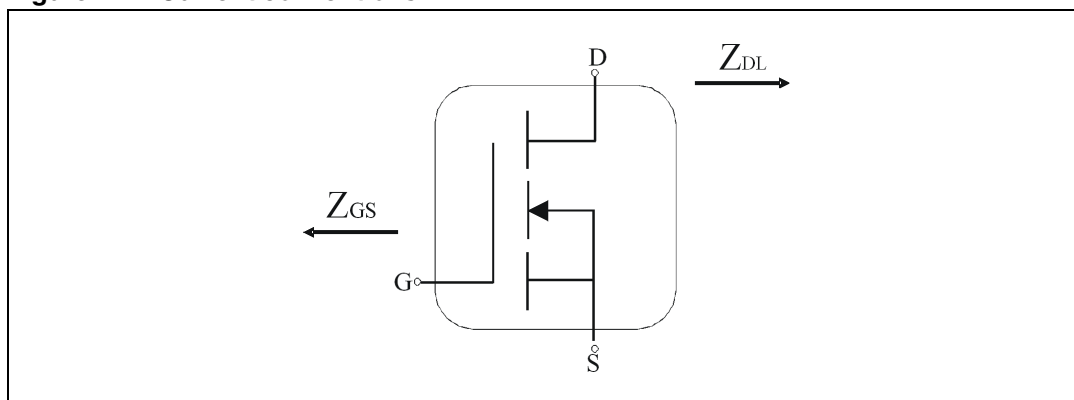


Table 8. Impedance data

Freq. (MHz)	$Z_{GS} (\Omega)$	$Z_{DL} (\Omega)$
920	$4.0 + j4.3$	$3.7 + j6.2$
900	$3.6 + j4.3$	$3.9 + j5.5$
880	$3.3 + j4.1$	$4.1 + j4.7$
860	$3.1 + j3.7$	$4.3 + j4.0$
840	$2.9 + j3.4$	$4.5 + j3.2$
820	$2.8 + j3.0$	$4.8 + j2.4$
800	$2.7 + j2.5$	$5.0 + j1.6$

## 4 Typical performance

Figure 3.  $V_{GS}$  vs  $I_D$

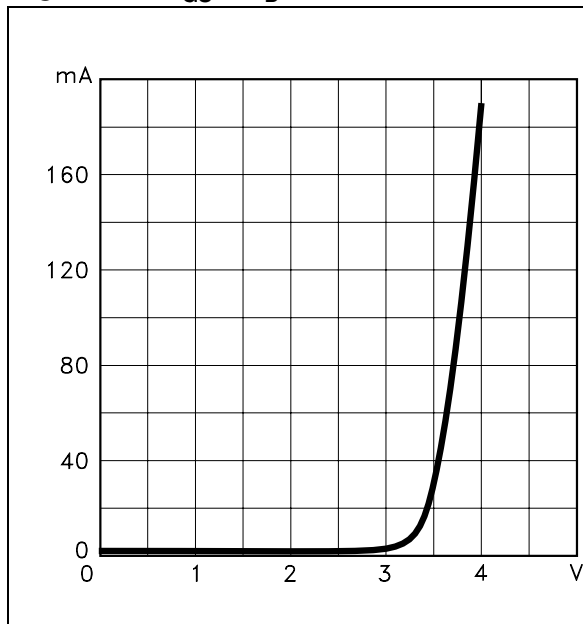


Figure 4. DC output characteristics

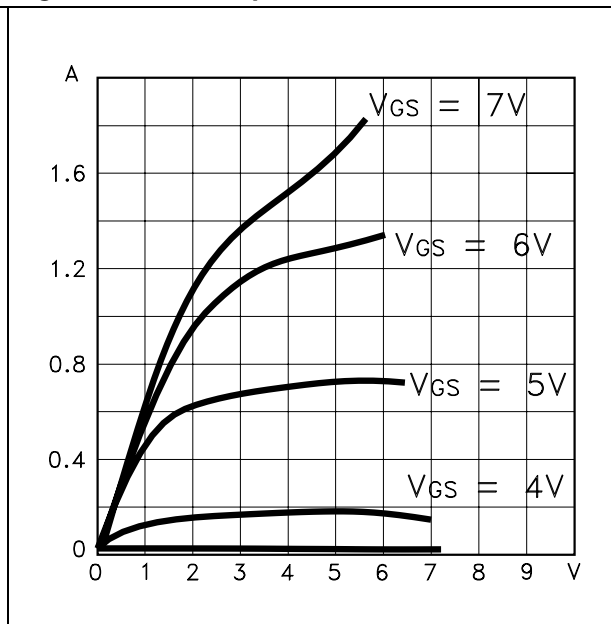


Figure 5.  $C_{RSS}$  vs  $V_{DS}$

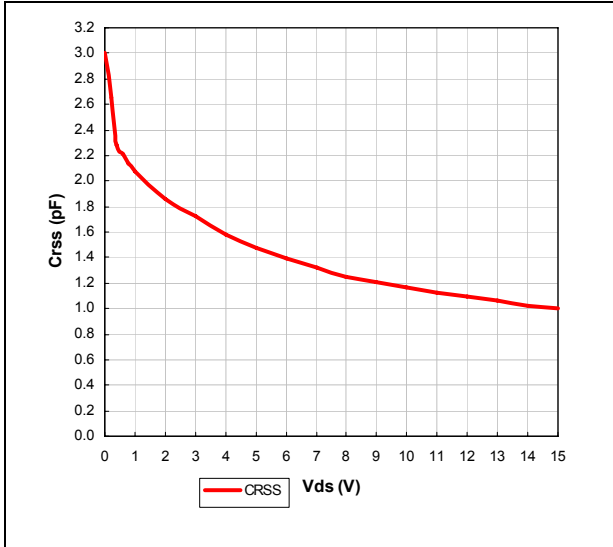


Figure 6.  $C_{ISS}$  vs  $V_{DS}$

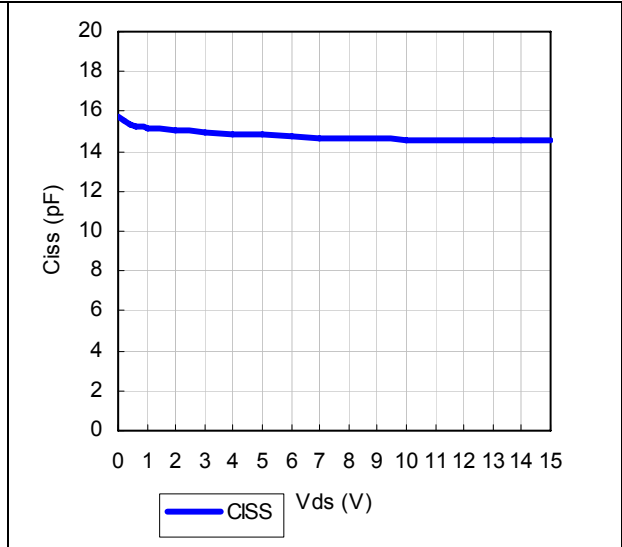
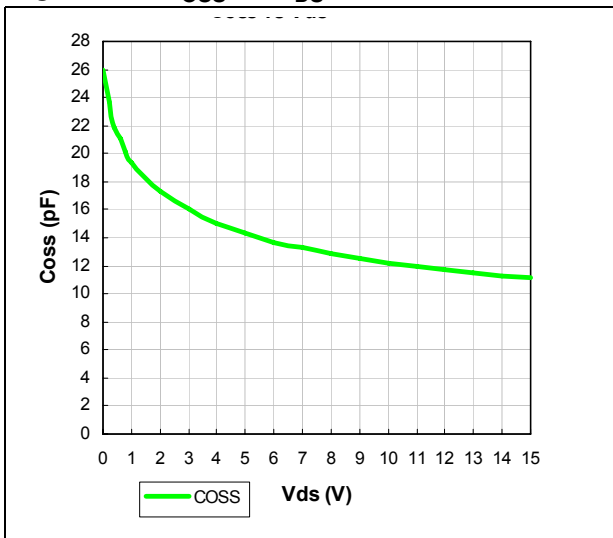
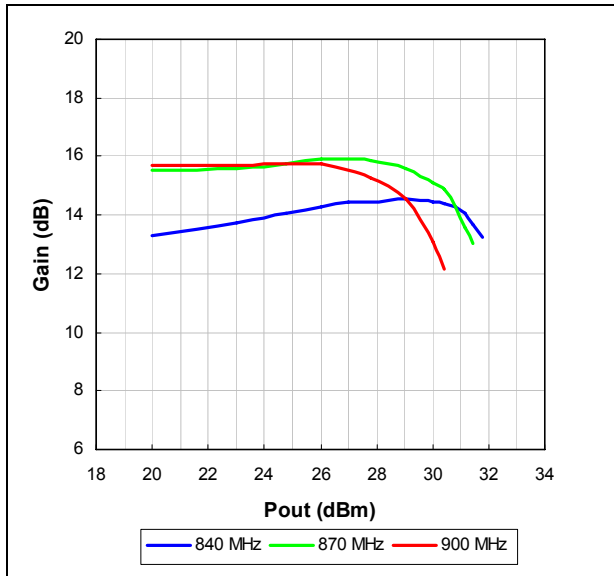


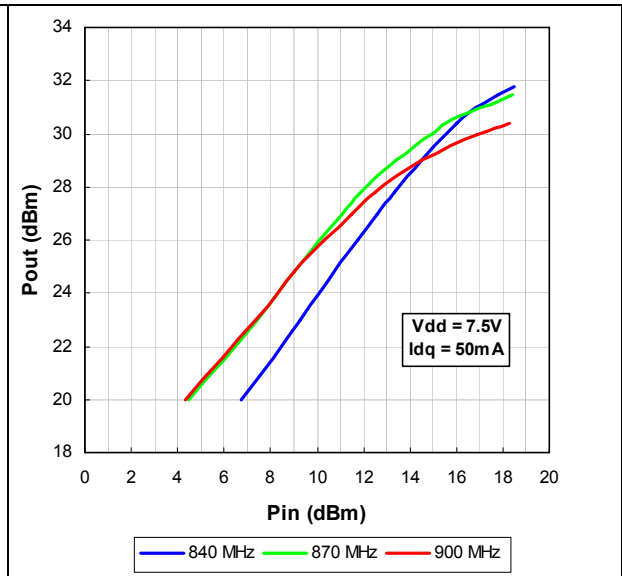
Figure 7.  $C_{OSS}$  vs  $V_{DS}$



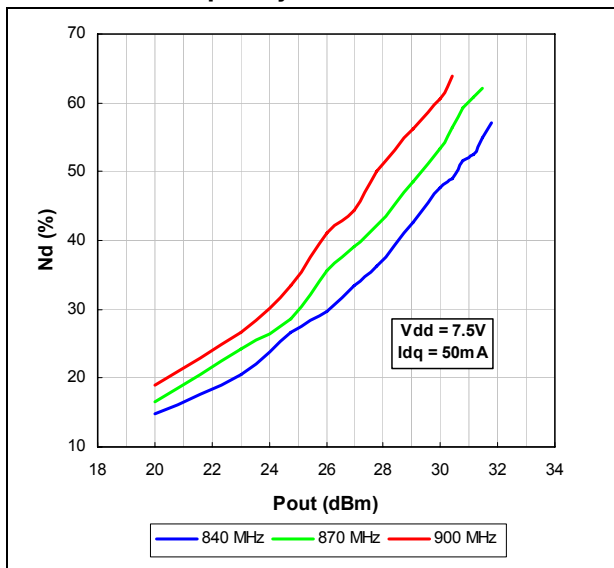
**Figure 8. Gain vs output power and frequency**



**Figure 9. Output power vs input power and frequency**



**Figure 10. Efficiency vs output power and frequency**



**Figure 11. Gain and efficiency vs frequency**

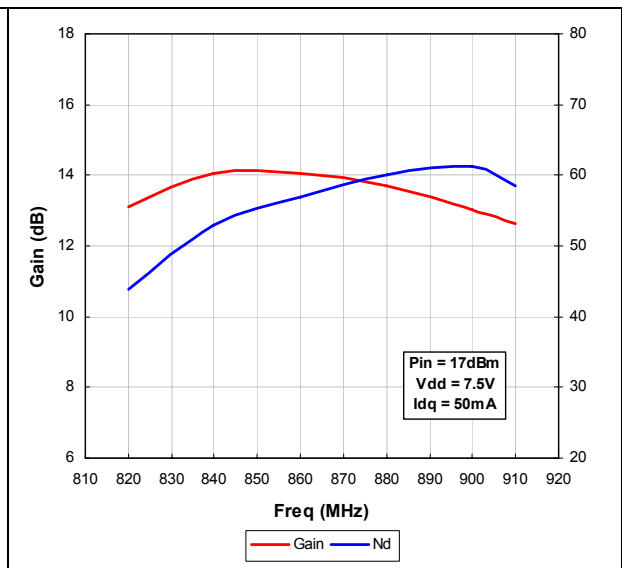




Figure 12. Input return loss vs frequency

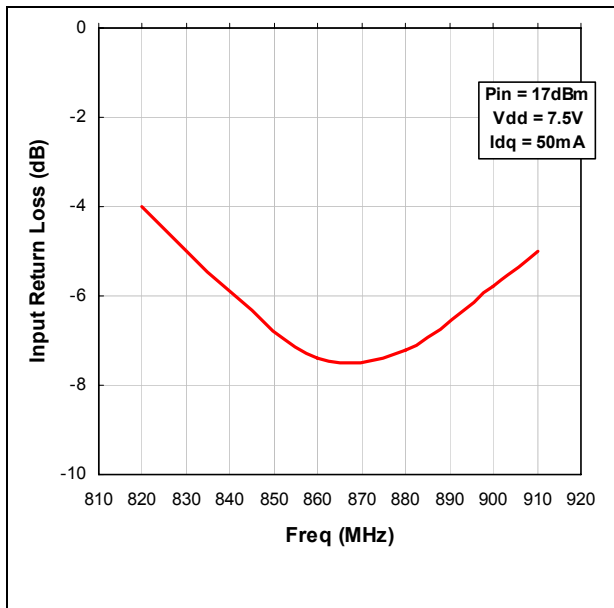


Figure 13. Output power vs input power and V<sub>DD</sub>

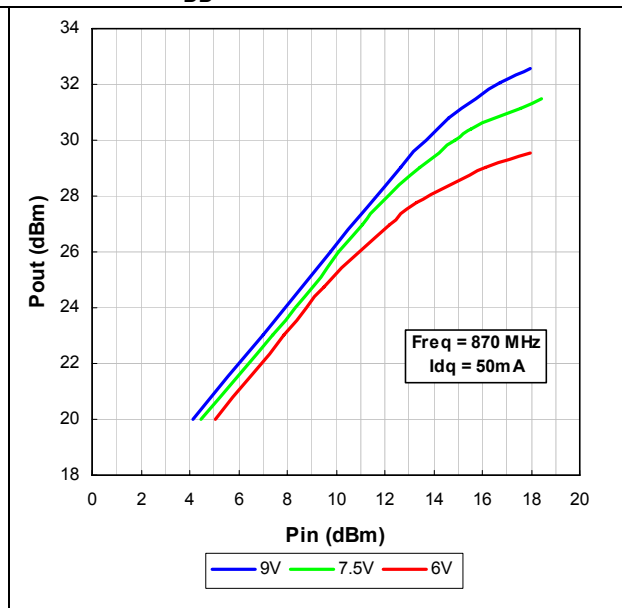


Figure 14. Efficiency vs output power and V<sub>DD</sub>

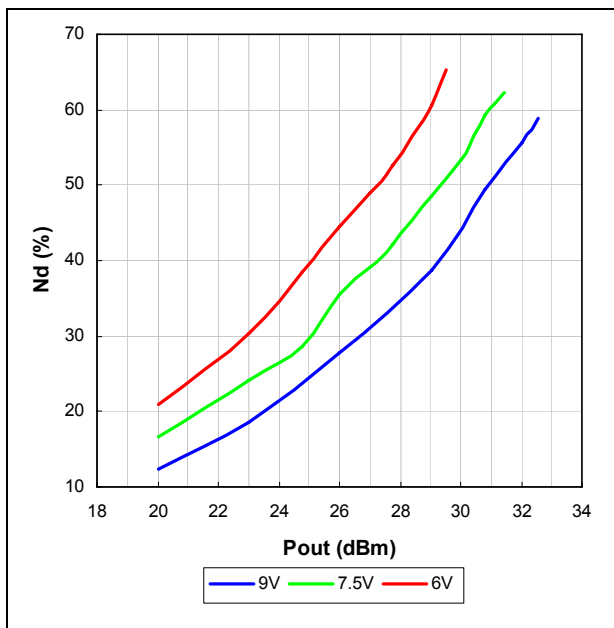


Figure 15. Output power and drain current vs drain supply voltage

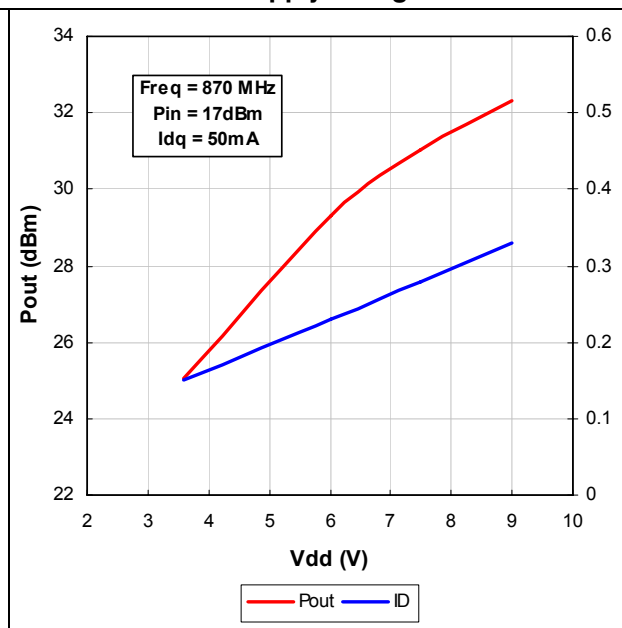
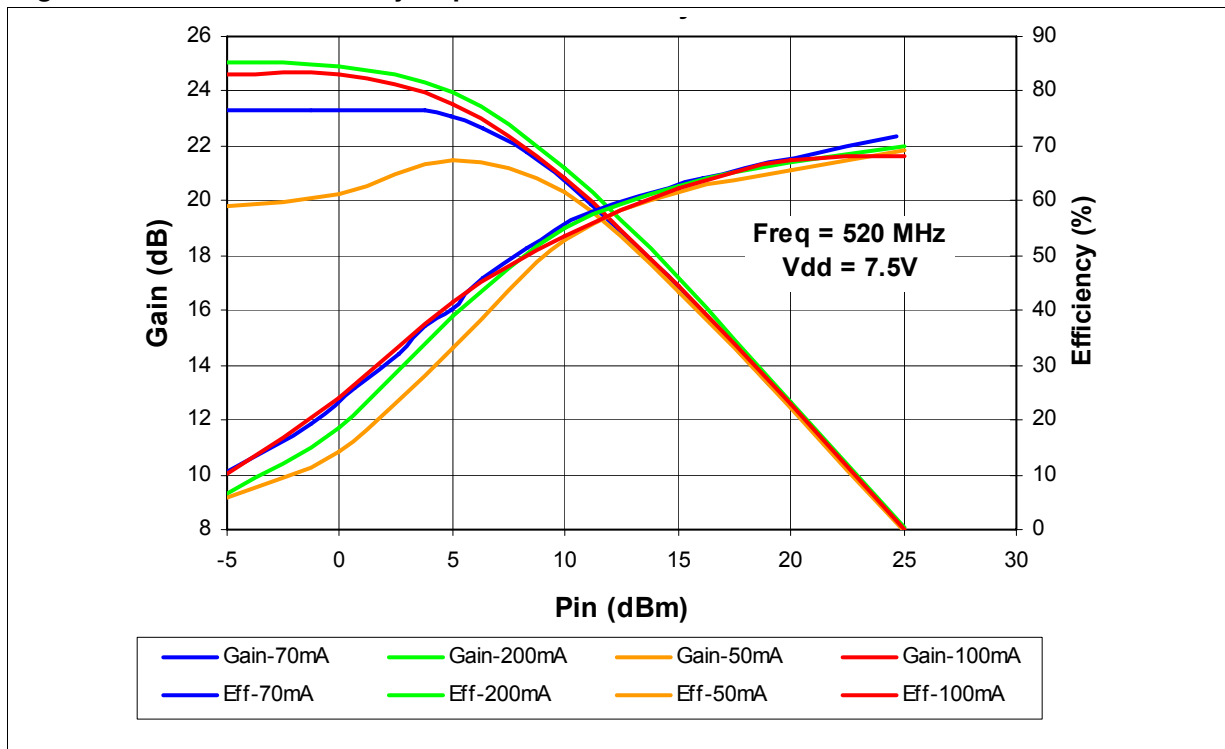
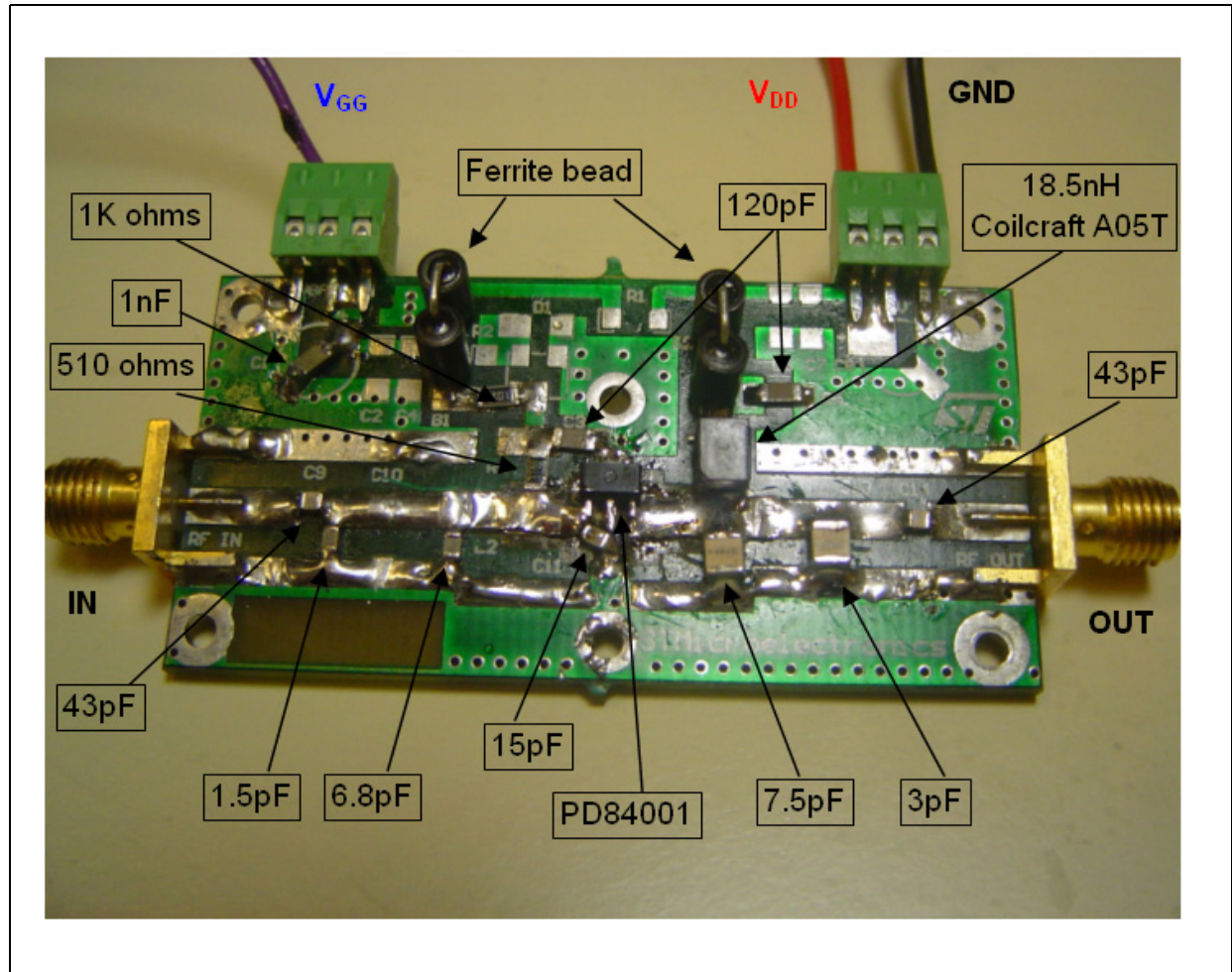


Figure 16. Gain and efficiency vs pin



## 5 Test circuit

Figure 17. Test circuit schematic / 840-900 MHz



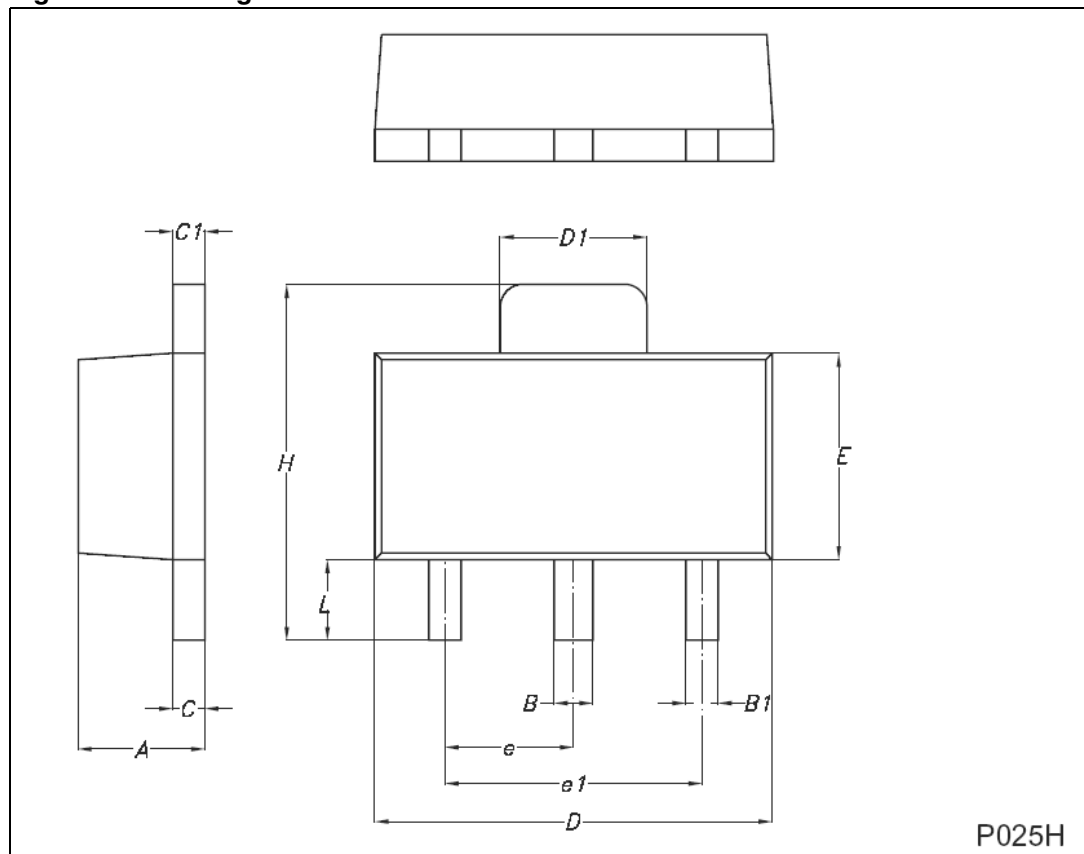
## 6 Package mechanical data

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)

**Table 9. 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 18. Package dimensions**

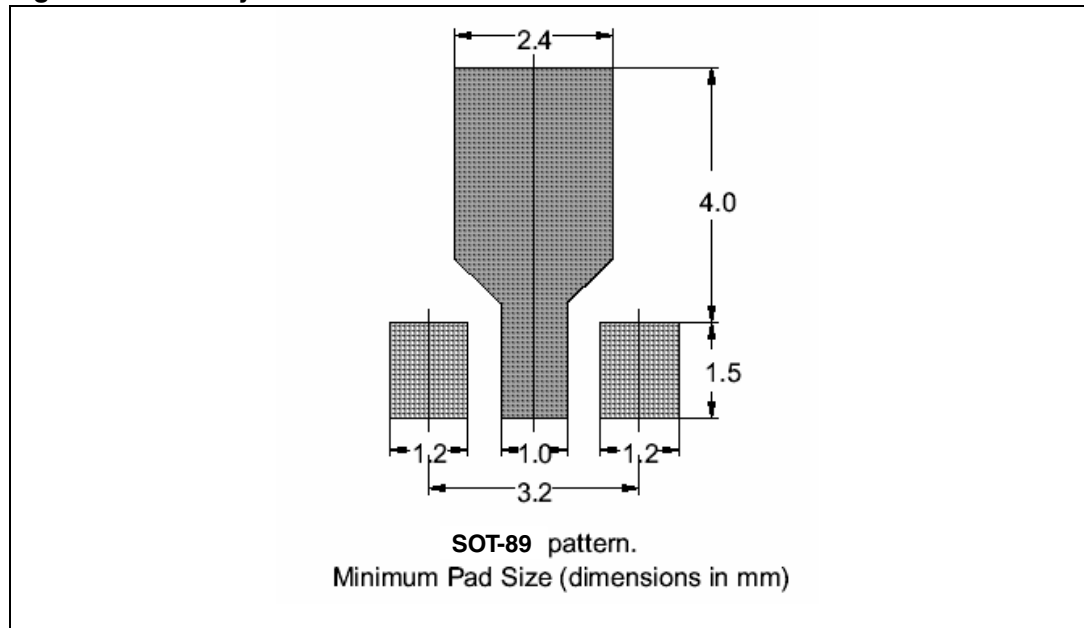


### 6.1 Thermal pad and via design

Thernal 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 0.203 mm to 0.330 mm finished hole size on a 0.5 mm to 1.2 mm 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 19. Pad layout details



## 6.2 Soldering profile

Figure 20 shows the recommended solder for devices that have Pb-free terminal plating and where a Pb-free solder is used.

Figure 20. Recommended solder profile

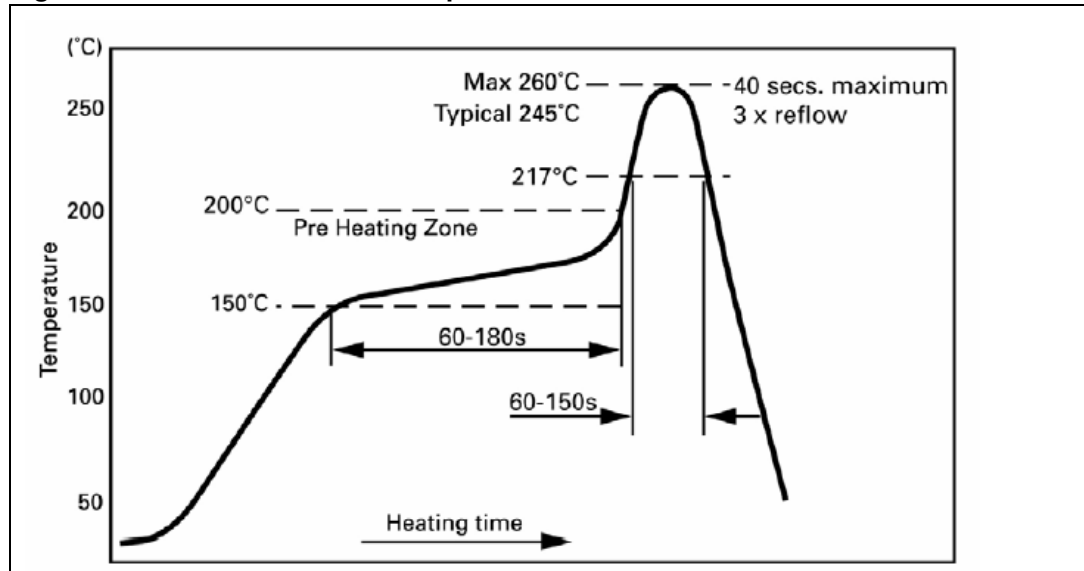


Figure 21 shows the recommended solder for devices with Pb-free terminal plating used with leaded solder, or for devices with leaded terminal plating used with a leaded solder.

Figure 21. Recommended solder profile for leaded devices

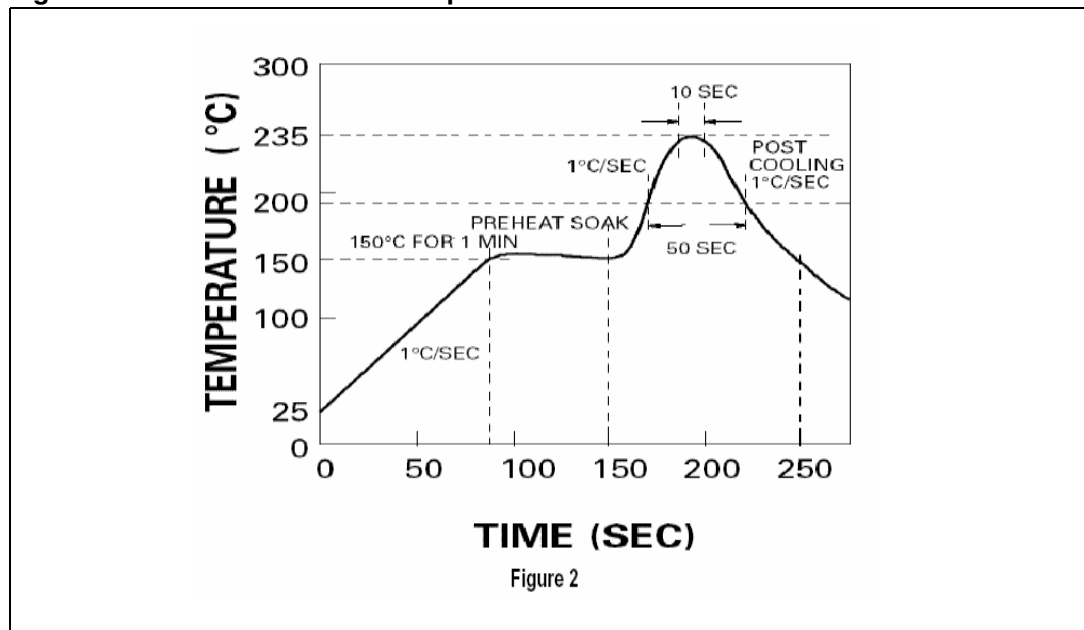
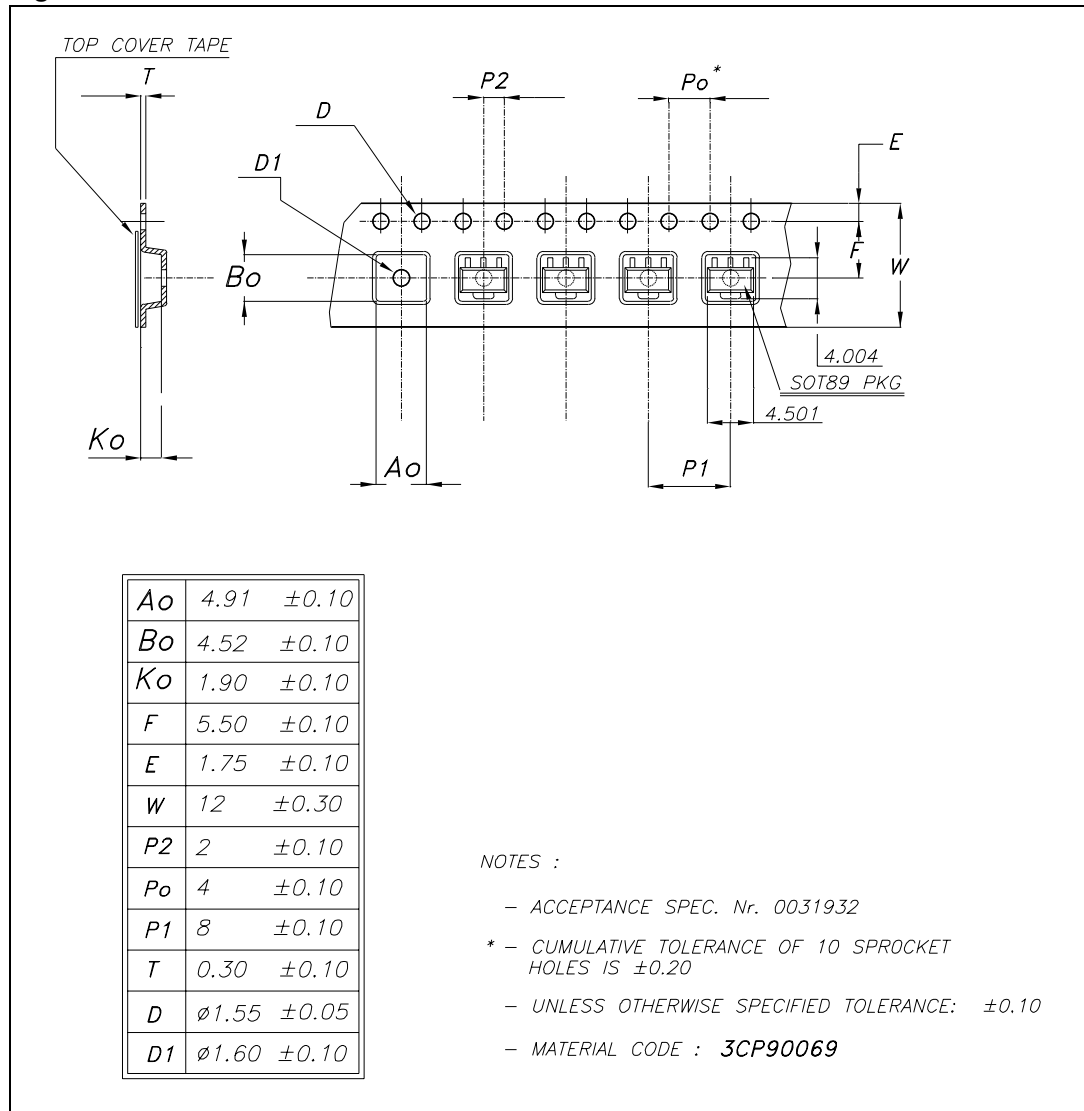


Figure 2

Figure 22. Reel information





## 7 Revision history

**Table 10. Document revision history**

Date	Revision	Changes
06-Dec-2006	1	Initial release
16-May-2007	2	Marking updated
05-Jun-2007	3	Part number update
25-Aug-2008	4	Updated <a href="#">Table 4 on page 4</a>

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