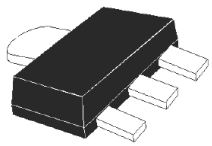
# PD84002

RF power transistor
The LdmoST plastic family

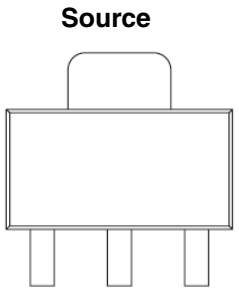
## Features

- Excellent thermal stability
- Common source configuration
- Broadband performances $P_{OUT}$ = 2 W with 13 dB gain @ 870 MHz
- Plastic package
- ESD protection
- Supplied in tape and reel
- In compliance with the 2002/95/EC european directive



SOT-89

**Figure 1. Pin connection**




## Description

The PD84002 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.

PD84002's superior gain and efficiency makes it an ideal solution for portable radio and UHF RFID reader.

**Figure 2. Device summary**

| Order code | Marking | Package | Packaging |
|---|---|---|---|
| PD84002 | 8402 | SOT-89 | Tape and reel |

# Contents

# 1 Electrical data

## 1.1 Maximum ratings

**Table 1. Absolute maximum ratings** ($T_{CASE}$ = 25°C)

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-source voltage | 25 | V |
| $V_{GS}$ | Gate-source voltage | -0.5 to +15 | V |
| $I_D$ | Drain current | 2 | 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 2. Thermal data**

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

# 2 Electrical characteristics

$T_{CASE}$ = +25 °C

## 2.1 Static

**Table 3. Static**

| Symbol | Test conditions | | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $I_{DSS}$ | $V_{GS}$ = 0 V | $V_{DS}$ = 25 V | | | | 1 | µA |
| $I_{GSS}$ | $V_{GS}$ = 5 V | $V_{DS}$ = 0 V | | | | 1 | µA |
| $V_{GS(Q)}$ | $V_{DS}$ = 7.5 V | $I_D$ = 100 mA | | | 3.9 | | V |
| $V_{DS(ON)}$ | $V_{GS}$ = 10 V | $I_D$ = 0.25 A | | | 0.27 | | V |
| $C_{ISS}$ | $V_{GS}$ = 0 V | $V_{DS}$ = 7.5 V | f = 1 MHz | | 16 | | pF |
| $C_{OSS}$ | $V_{GS}$ = 0 V | $V_{DS}$ = 7.5 V | f = 1 MHz | | 16 | | pF |
| $C_{RSS}$ | $V_{GS}$ = 0 V | $V_{DS}$ = 7.5 V | f = 1 MHz | | 1.2 | | pF |

## 2.2 Dynamic

**Table 4. Dynamic**

| Symbol | Test conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| $P_{OUT}$ | $V_{DD}$ = 7.5 V, $I_{DQ}$ = 100 mA, $P_{IN}$ = 0.1 W, f = 870 MHz | 2 | | | W |
| $G_{PS}$ | $V_{DD}$ = 7.5 V, $I_{DQ}$ = 100 mA, $P_{OUT}$ = 2 W, f = 870 MHz | 13 | 15 | | dB |
| $N_D$ | $V_{DD}$ = 7.5 V, $I_{DQ}$ = 100 mA, $P_{OUT}$ = 2 W, f = 870 MHz | 60 | 65 | | % |
| Load mismatch | $V_{DD}$ = 7.5 V, $I_{DQ}$ = 100 mA, $P_{OUT}$ = 2 W, f = 870 MHz All phase angles | 20:1 | | | VSWR |

## 2.3 ESD protection characteristics

**Table 5. ESD protection characteristics**

| Test conditions | Class |
|---|---|
| Human body model | 2 |
| Machine model | M3 |

## 2.4 Moisture sensitivity level

**Table 6. Moisture sensitivity level**

| Test methodology | Rating |
|---|---|
| J-STD-020B | MSL 3 |

# 3 Impedances

**Figure 3. Impedances**

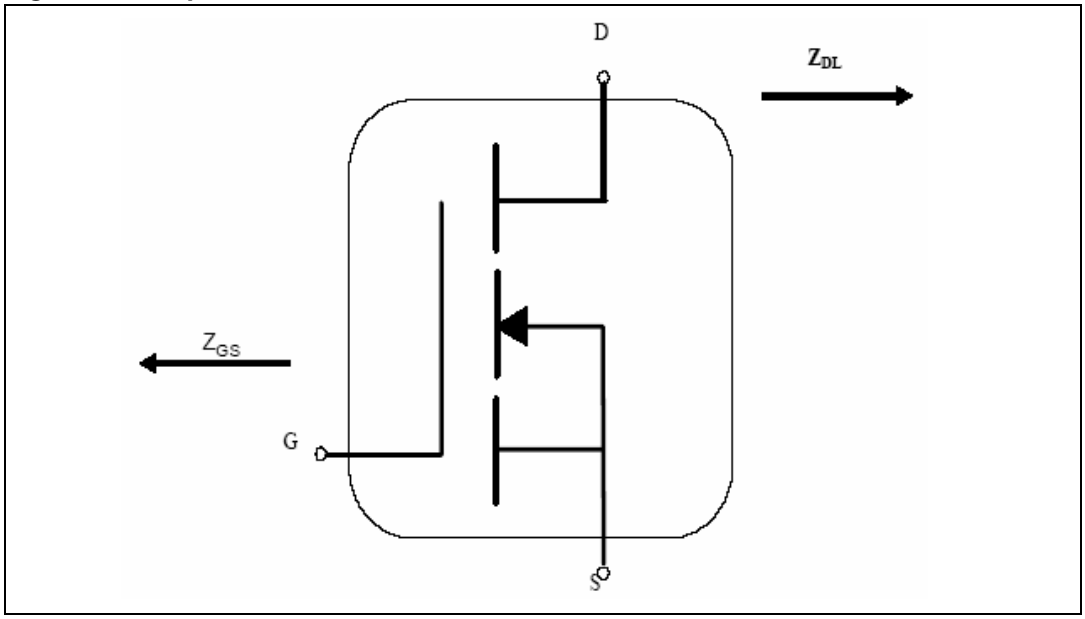



**Table 7. Impedances**

| 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 DC curves

**Figure 4. DC output characteristics**

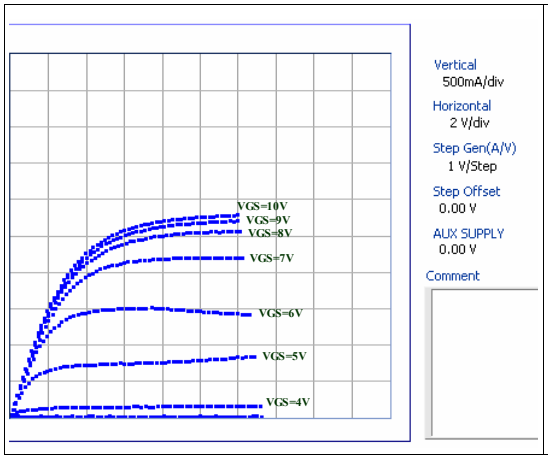



**Figure 5. ID vs $V_{GS}$**

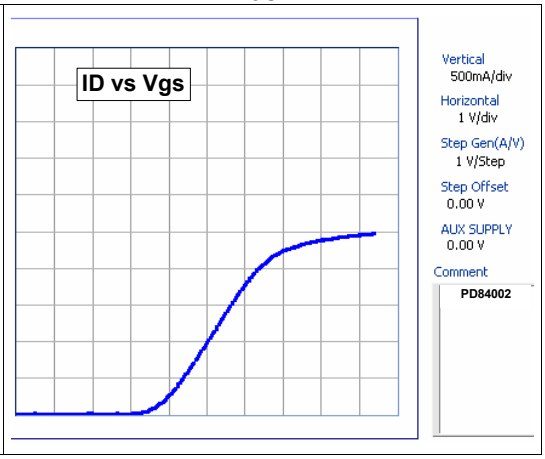
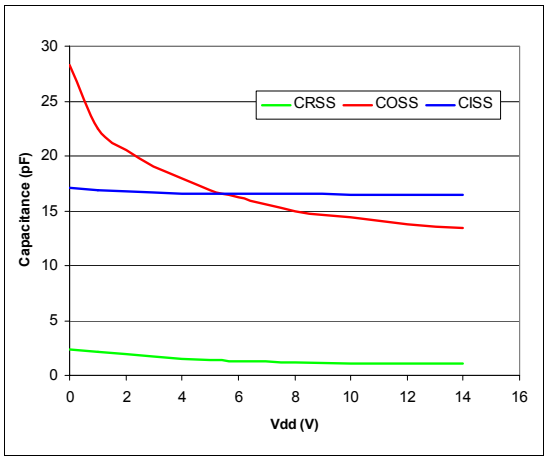



**Figure 6. Capacitances vs drain voltage**



# 5 RF curves

**Figure 7. Output power and efficiency vs frequency 7.2 V / 100 mA / Pin = 19 dBm**

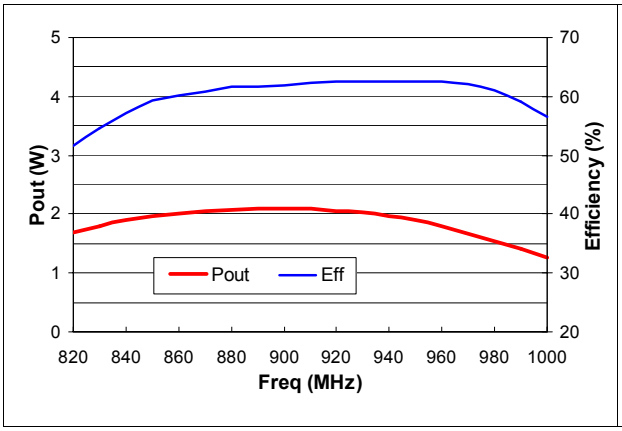



**Figure 8. Gain vs frequency 7.2 V - 100 mA**

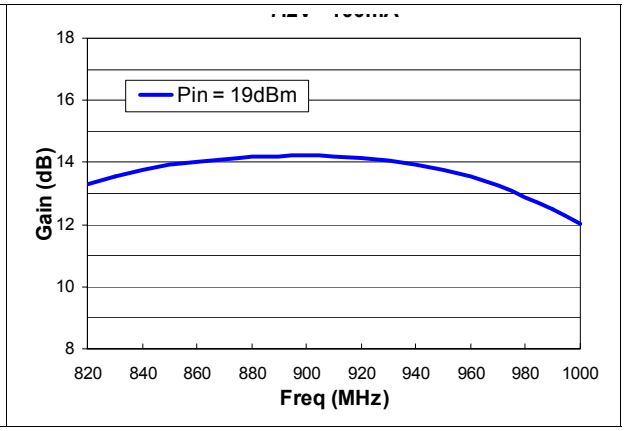



**Figure 9. Input return loss vs frequency 7.2 V / 100 mA**

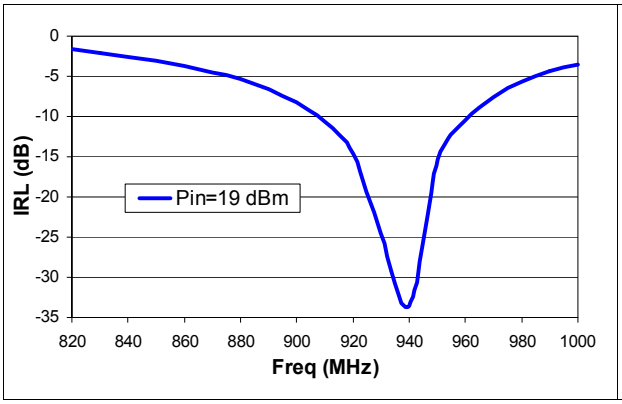



**Figure 10. Harmonics vs frequency 7.2 V / 100 mA**

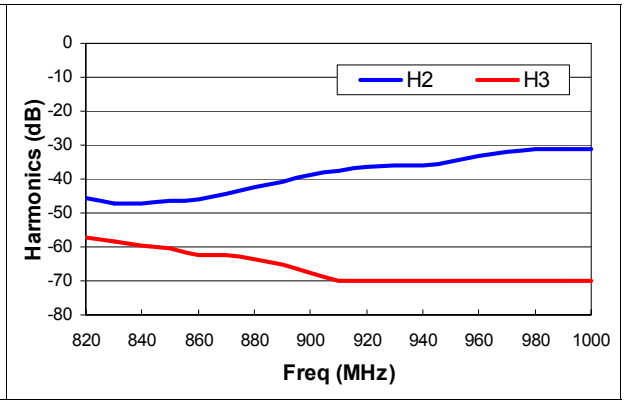
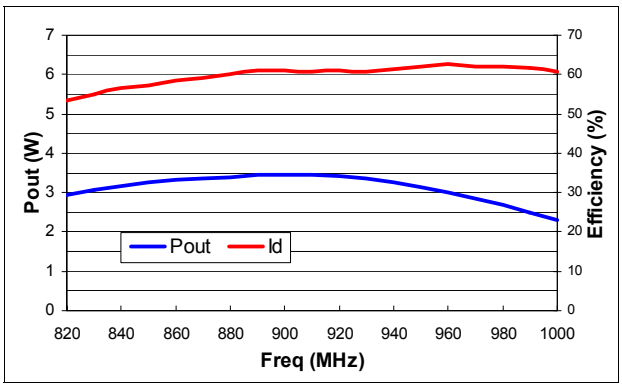



**Figure 11. Output power and efficiency vs frequency 9 V / 100 mA / Pin = 22 dBm**



# 6 Schematic and BOM

**Figure 12. Schematic**

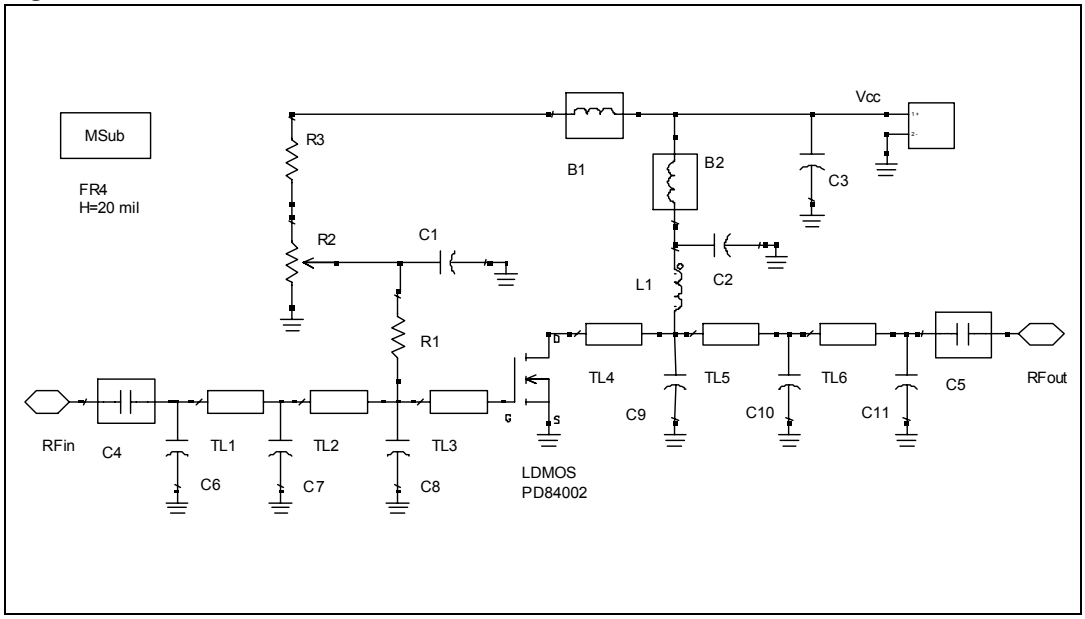



**Table 8. Components part list**

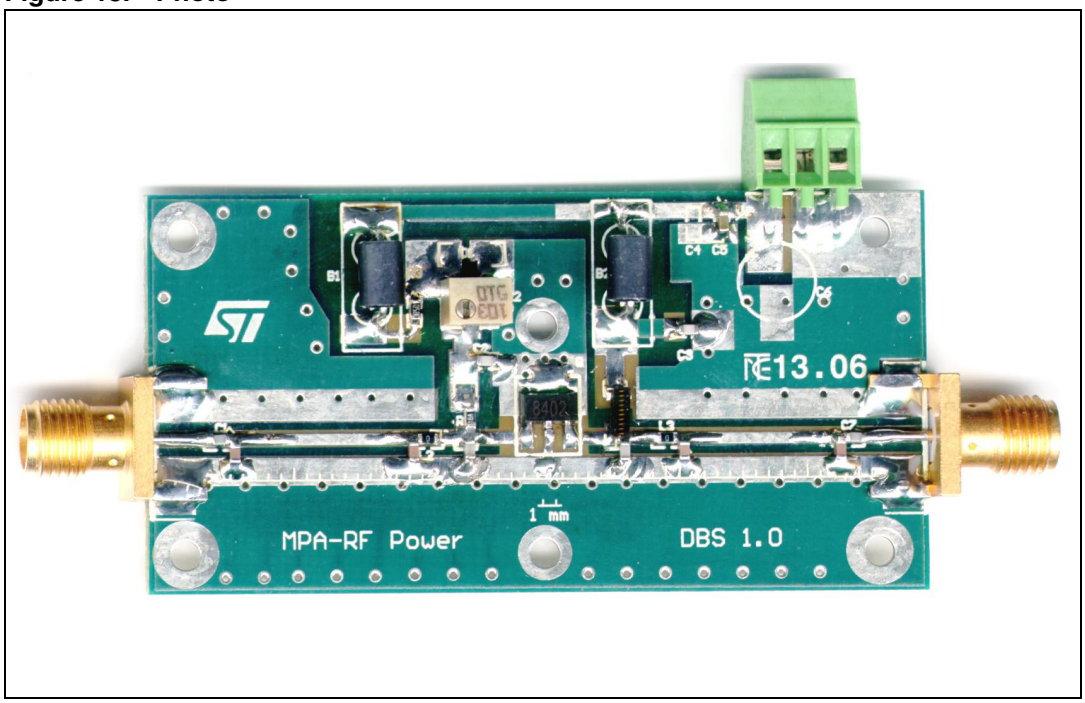
| Component ID | Description | Value | Case size | Manufacturer | Part Code |
|---|---|---|---|---|---|
| B1 | Ferrite Bead | | | Panasonic | EXCELDRC35C |
| B2 | Ferrite Bead | | | Panasonic | EXCELDRC35C |
| C1, C2 | Capacitor | 120 pF | 0603 | Murata | GRM39-C0G121J50D500 |
| C3 | Capacitor | 1 uF | 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 8. Components part list (continued)**

| Component ID | Description | Value | Case size | Manufacturer | Part Code |
|---|---|---|---|---|---|
| TL1 | Transmission line | W=0.92 mm | L=13.6 mm | | |
| TL2 | Transmission line | W=0.92 mm | L=3.5 mm | | |
| TL3 | Transmission line | W=0.92 mm | L=4.2 mm | | |
| TL4 | Transmission line | W=0.92 mm | L=3.8 mm | | |
| TL5 | Transmission line | W=0.92 mm | L=3.7 mm | | |
| TL6 | Transmission line | W=0.92 mm | 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 | | | | |

# 7 Photo

**Figure 13. Photo**



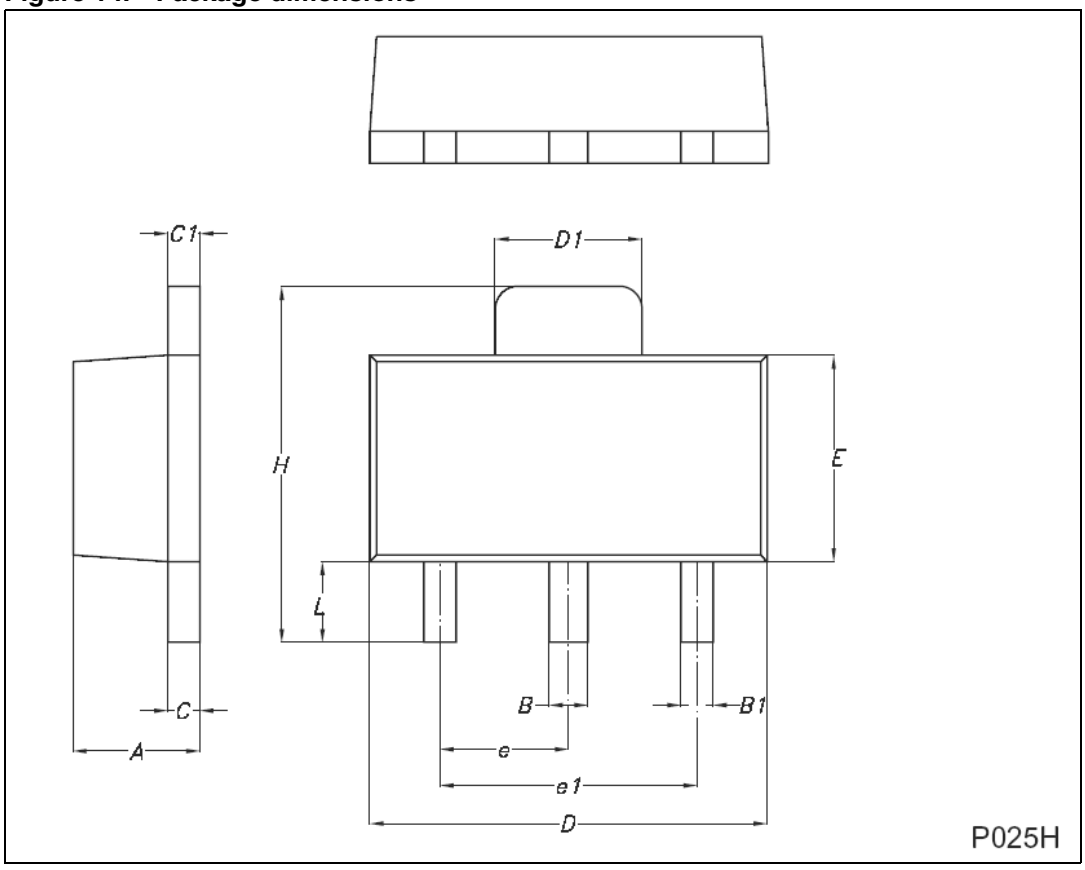
# 8 Package mechanical data

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

**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 14. Package dimensions**

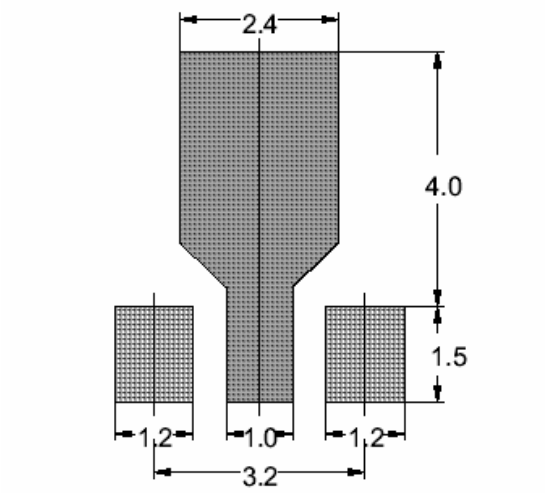


## 8.1 Thermal pad and via design

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 0.203mm 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 15. Pad layout details**




SOT89 pattern.
Minimum Pad Size (dimensions in mm)

## 8.2 Soldering profile

*Figure 16* shows the recommeded solder for devices that have Pb-free terminal plating and where a Pb-free solder is used.

**Figure 16. Recommended solder profile**

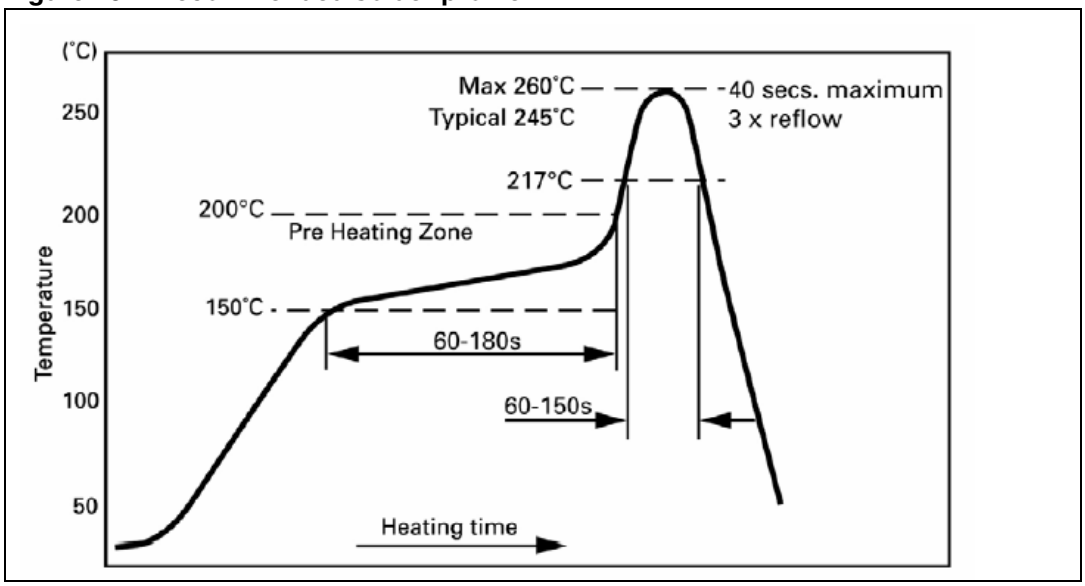



*Figure 17* shows the recommeded solder for devices with Pb-free terminal plating used with leaded solder, or for devices with leaded terminal plating used with a leaded solder.

**Figure 17. Recommended solder profile for leaded devices**

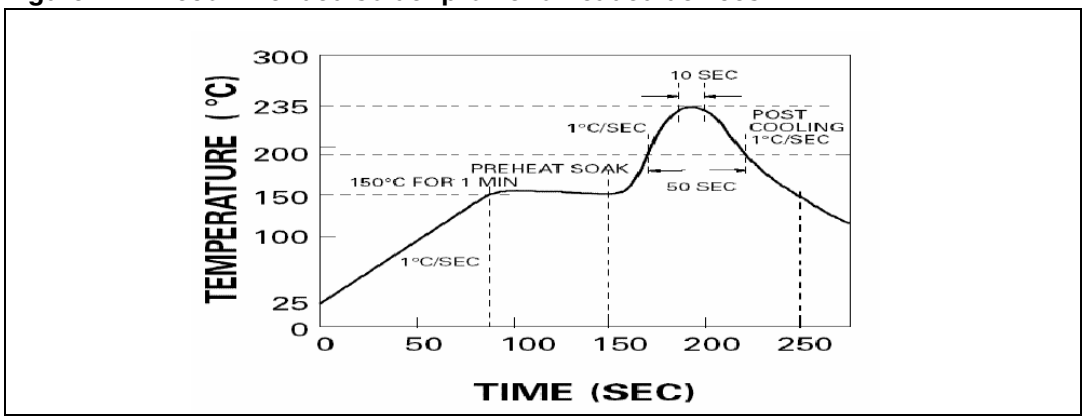
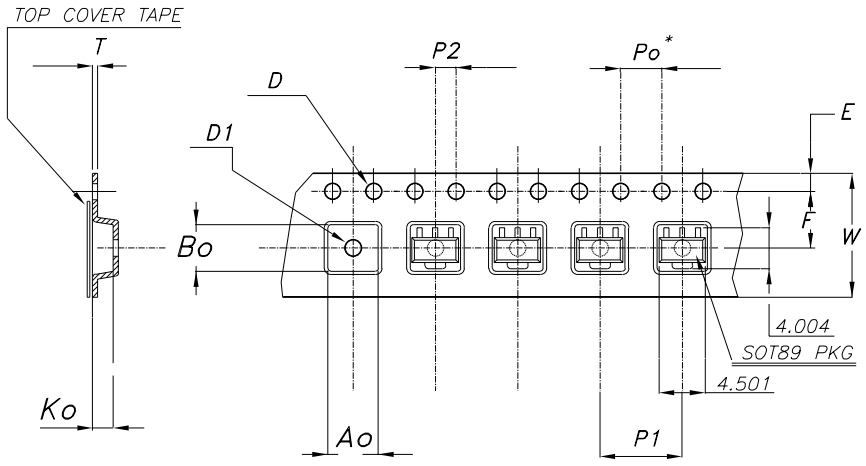


**Figure 18. Reel information**




| | | |
|---|---|---|
| Ao | 4.91 | ±0.10 |
| Bo | 4.52 | ±0.10 |
| Ko | 1.90 | ±0.10 |
| F | 5.50 | ±0.10 |
| E | 1.75 | ±0.10 |
| W | 12 | ±0.30 |
| P2 | 2 | ±0.10 |
| Po | 4 | ±0.10 |
| P1 | 8 | ±0.10 |
| T | 0.30 | ±0.10 |
| D | ø1.55 | ±0.05 |
| D1 | ø1.60 | ±0.10 |

NOTES :

– ACCEPTANCE SPEC. Nr. 0031932

* – CUMULATIVE TOLERANCE OF 10 SPROCKET HOLES IS ±0.20

– UNLESS OTHERWISE SPECIFIED TOLERANCE: ±0.10

– MATERIAL CODE : 3CP90069

# 9 Revision history

Table 10. Document revision history

| Date | Revision | Changes |
|---|---|---|
| 05-Dec-2007 | 1 | Initial release. |

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