



## STEVAL-TDR001V1

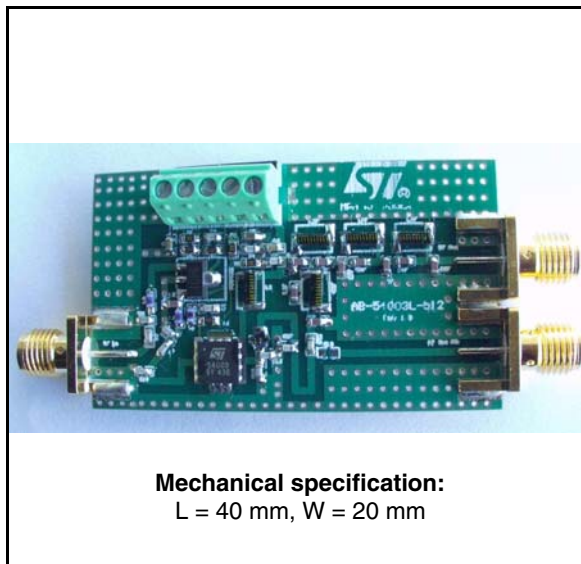
2 stage RF power amp: PD84001 + PD54003L-E + LPF  
N-channel enhancement-mode lateral MOSFETs

### Feature

- Excellent thermal stability
- Frequency: 380 - 512 MHz
- Supply voltage: 7.2 V
- Output power: 4 W
- Current < 1.6 A
- Input power < 10 dBm
- Harmonics level < -70 dBc
- Load mismatch 20:1
- $V_{APC}$  5 V max
- Beo free amplifier
- RoHS compliant

### Description

The STEVAL-TDR001V1 is a two stage RF power amplifier which includes a low pass output filter for harmonics rejection specifically designed for portable two-way UHF radio communication.



**Table 1. Device summary**

| Order code      |
|-----------------|
| STEVAL-TDR001V1 |

## Contents

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# 1 Electrical data

## 1.1 Maximum ratings

**Table 2. Absolute maximum ratings**

| Symbol     | Parameter                  | Value      | Unit |
|------------|----------------------------|------------|------|
| $V_{DD}$   | Supply voltage             | 15         | V    |
| $I_D$      | Drain current              | 2.5        | A    |
| $T_{CASE}$ | Operating case temperature | -20 to +85 | °C   |
| $T_A$      | Max. ambient temperature   | +55        | °C   |

# 2 Electrical characteristics

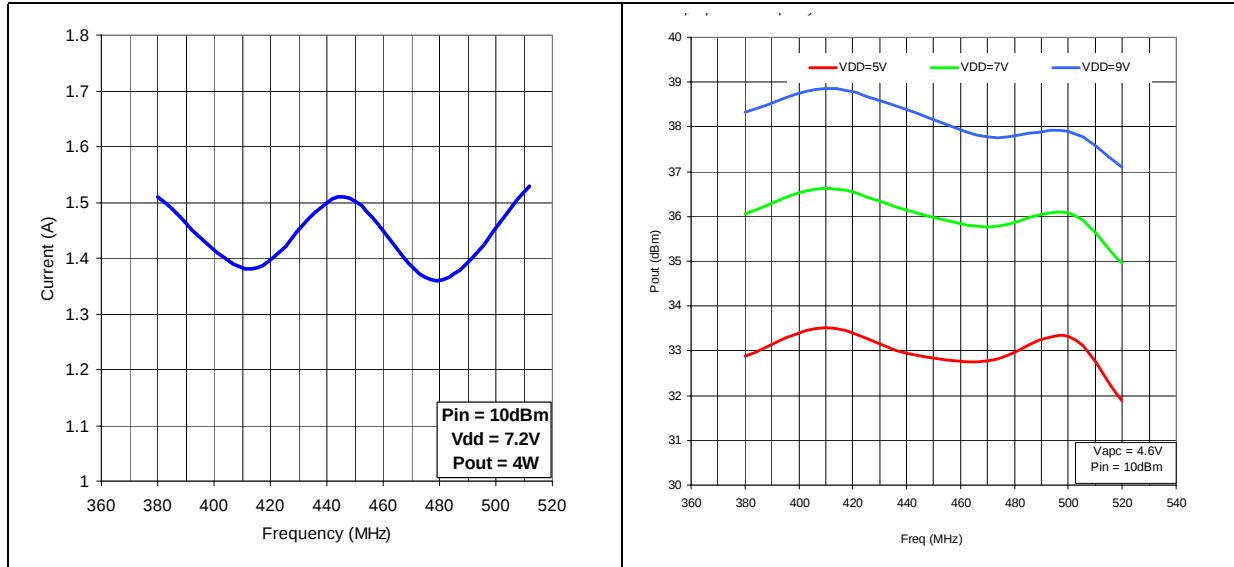
$T_A = +25\text{ °C}$ ,  $V_{DD} = 7.2\text{ V}$ ,  $V_{APC}$  adjusted

**Table 3. Electrical specification**

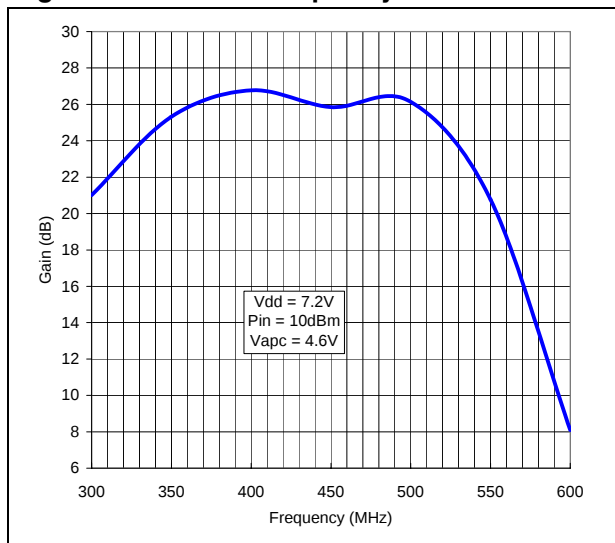
| Symbol      | Test conditions                                       | Min.      | Typ. | Max. | Unit |
|-------------|-------------------------------------------------------|-----------|------|------|------|
| Freq.       | Frequency range                                       | 380       |      | 512  | MHz  |
| $P_{IN}$    | @ $P_{OUT} = 4\text{ W}$                              |           | 10   |      | dBm  |
| $I_{TOTAL}$ | @ $P_{OUT} = 4\text{ W}$ and $P_{IN} = 10\text{ dBm}$ |           |      | 1.6  | A    |
| PAE         | @ $P_{OUT} = 4\text{ W}$ and $P_{IN} = 10\text{ dBm}$ | 36% - 40% |      |      |      |
| VAPC        | @ $P_{OUT} = 4\text{ W}$ and $P_{IN} = 10\text{ dBm}$ |           | 4.5  | 5    | V    |
| Harmonics   | @ $P_{OUT} = 4\text{ W}$                              |           |      | -70  | dBc  |

### 3 Typical performance

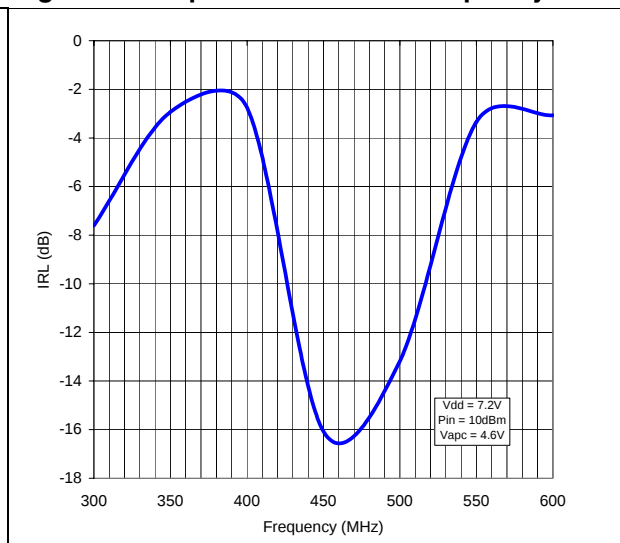
**Figure 1. Current consumption vs frequency** **Figure 2. Output power vs frequency**



**Figure 3. Gain vs frequency**



**Figure 4. Input return loss vs frequency**



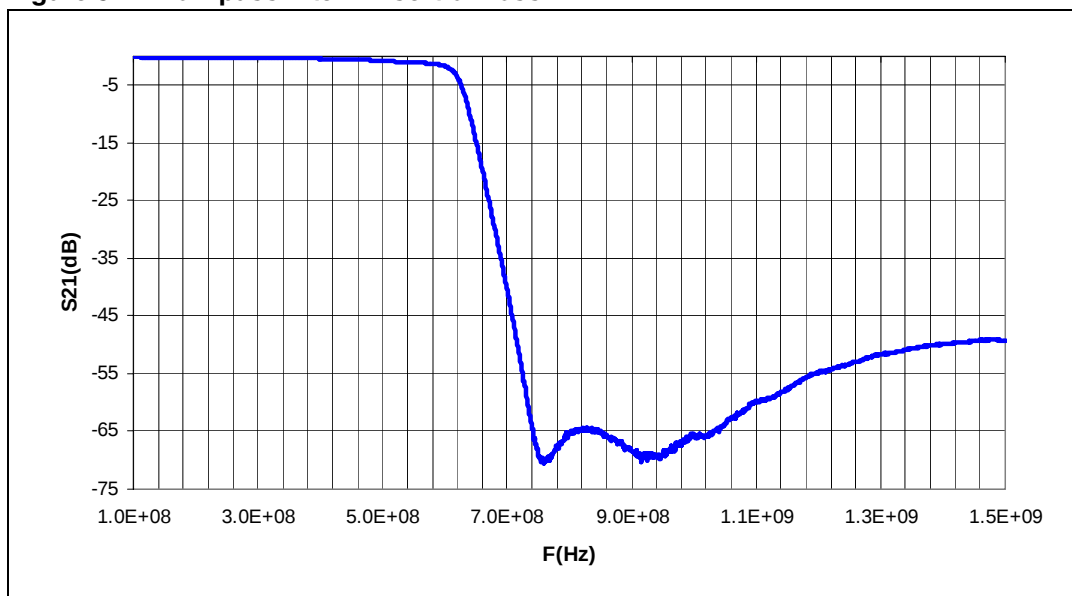
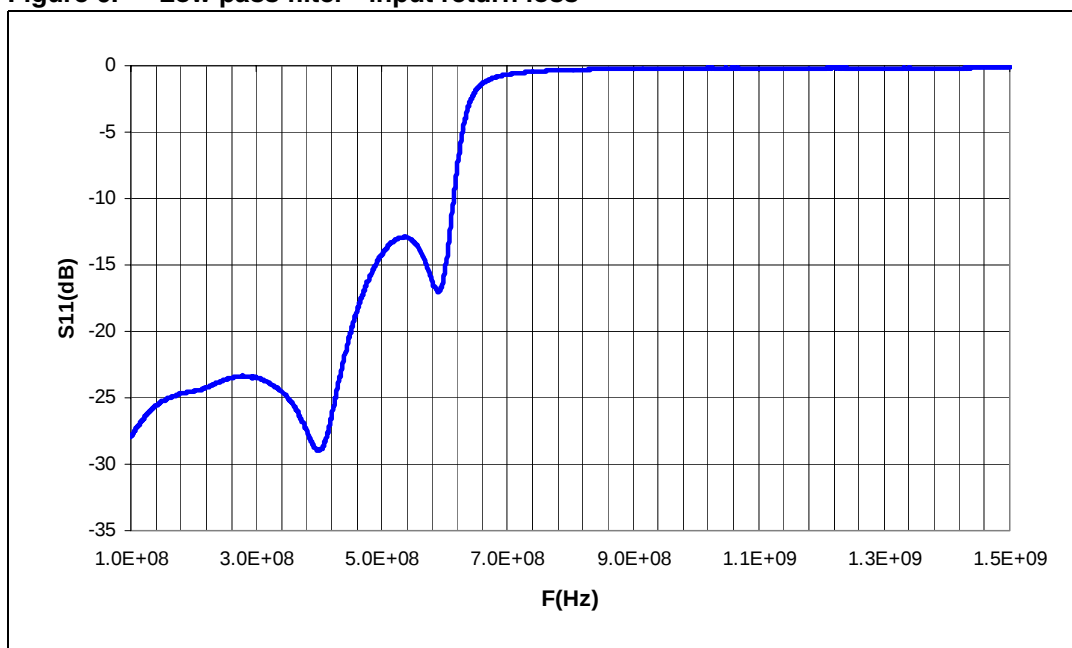
**Figure 5. Low pass filter - insertion loss****Figure 6. Low pass filter - input return loss**

Table 4. Part list

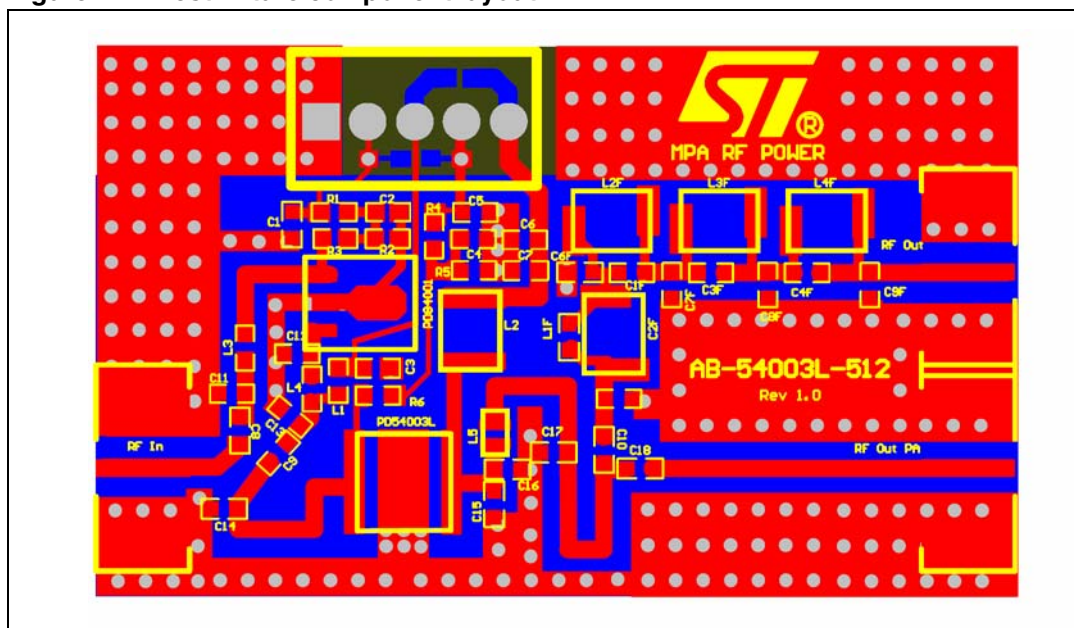
| Designator               | Value          | Quantity | Manufacturer           | Part code                  | Size                |
|--------------------------|----------------|----------|------------------------|----------------------------|---------------------|
| C1                       | 1 $\mu$ F      | 1        | Murata                 | GRM1885F51C105ZA01         | 603                 |
| C1F                      | 2.2 pF         | 1        | Murata                 | GRM1885C1H2R2CZ01          | 603                 |
| C2, C3, C4               | 120 pF         | 3        | Murata                 | GRM1885C1H121JA01          | 603                 |
| C2F, C3F                 | 3.3 pF         | 2        | Murata                 | GRM1885C1H3R3CZ01          | 603                 |
| C4F, C5F                 | 2.2 pF         | 2        | Murata                 | GRM1885C1H2R2CZ01          | 603                 |
| C5, C6                   | 1 $\mu$ F      | 2        | Murata                 | GRM1885F51C105ZA01         | 603                 |
| C6F                      | 4.7 pF         | 1        | Murata                 | GRM1885C1H4R7CZ01          | 603                 |
| C7                       | 120 nF         | 1        | Murata                 | GRM1885C1H121JA01          | 603                 |
| C7F, C8F                 | 3.9 pF         | 2        | Murata                 | GRM1885C1H3R9CZ01          | 603                 |
| C8, C10                  | 470 pF         | 2        | Murata                 | GRM1885C1H471JA01          | 603                 |
| C9                       | 470 pF         | 1        | Murata                 | GRM1885C1H471JA01          | 603                 |
| C9F                      | 1.2 pF         | 1        | Murata                 | GRM1885C1H1R2CZ01          | 603                 |
| C11                      | 15 pF          | 1        | Murata                 | GRM1885C1H150JA01          | 603                 |
| C12                      | 4.7 pF         | 1        | Murata                 | GRM1885C1H4R7CZ01          | 603                 |
| C13                      | 18 pF          | 1        | Murata                 | GRM1885C1H180JA01          | 603                 |
| C14                      | 39 pF          | 1        | Murata                 | GRM1885C1H390JA01          | 603                 |
| C15, C16                 | 18 pF          | 2        | Murata                 | GRM1885C1H180JA01          | 603                 |
| C17                      | 15 pF          | 1        | Murata                 | GRM1885C1H150JA01          | 603                 |
| C18                      | NC             | 1        | Murata                 | GRM1885C1H471JA01          | 603                 |
| DC-Con                   |                | 1        | Phoenix contact        | 1725685                    | 2.54mm, 5 poli      |
| L1                       | 24 nH          | 1        | Coilcraft              | 0603HC-24NX_BW             | 603                 |
| L1F, L2, L2F, L3F, L4F   | 12.55 nH       | 5        | Coilcraft              | 1606-10_, 1606_10          | 1606                |
| L3, L4                   | 3.6 nH         | 2        | Coilcraft              | 0603HC-3N6X_BW             | 603                 |
| L5                       | 2.55 nH        | 1        | Coilcraft              | 0906-3_                    | 906                 |
| PD54003L-E               |                | 1        | STMicroelectronics     | PD54003L-E                 |                     |
| PD84001                  |                | 1        | STMicroelectronics     | PD84001                    |                     |
| R1                       | 300 $\Omega$   | 1        | Tyco/electronics neohn | CRG series thick film chip | 603                 |
| R2, R5                   | 3 k $\Omega$   | 2        | Tyco/electronics neohn | CRG series thick film chip | 603                 |
| R3, R6                   | 15 k $\Omega$  | 2        | Tyco/electronics neohn | CRG series thick film chip | 603                 |
| R4                       | 1.5 k $\Omega$ | 1        | Tyco/electronics neohn | CRG series thick film chip | 603                 |
| RF In, RF Out, RF Out PA |                | 3        |                        |                            |                     |
| SUB                      |                | 1        |                        | FR-4                       | H=20 mil h=10 oz    |
| TL1                      | 50             | 1        |                        |                            | L=6.88 mm W=0.92 mm |

Table 4. Part list (continued)

| Designator | Value | Quantity | Manufacturer | Part code | Size               |
|------------|-------|----------|--------------|-----------|--------------------|
| TL2        | 50    | 1        |              |           | L=9.8 mm W=0.92 mm |
| TL3        |       | 1        |              |           | L=9.8 mm W=0.92 mm |
| TL4        |       | 1        |              |           | 50 $\Omega$        |

## 4 Circuit layout

**Figure 7. Test fixture component layout**



# 5      Circuit schematic

Figure 8.    Circuit schematic

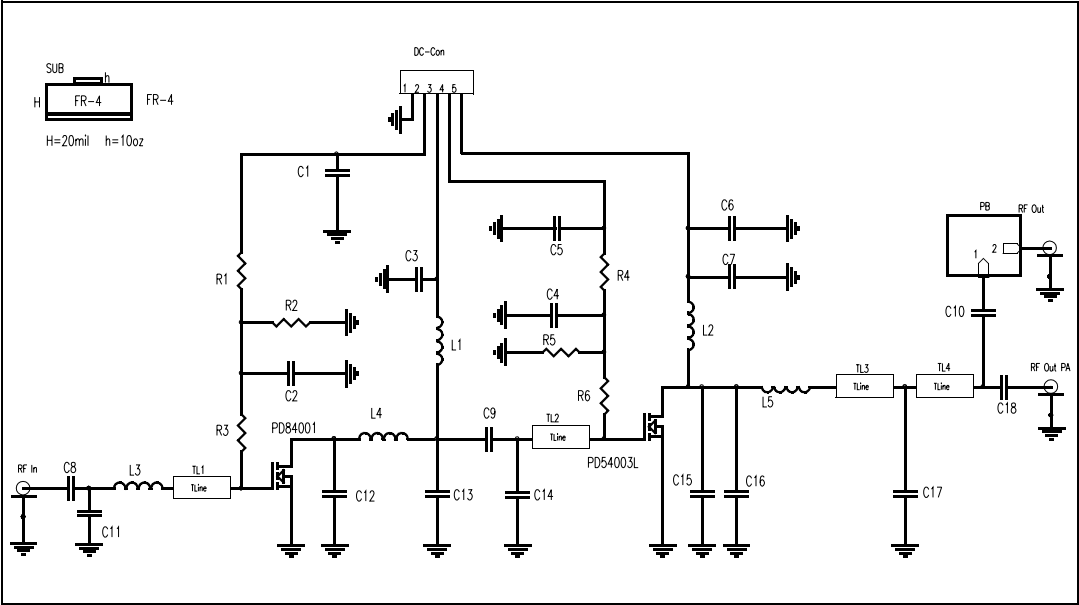
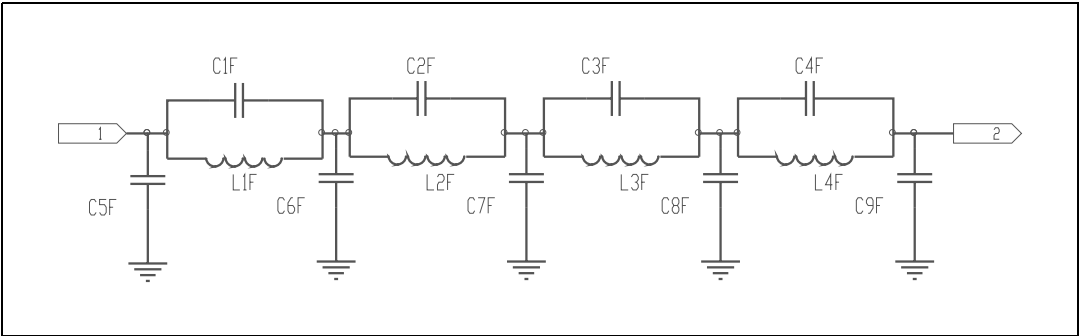


Figure 9.    Filter schematic



## 6 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.

## 6.1 PowerFLAT™ mechanical data

Table 5. PowerFLAT™ mechanical data

| Dim. | mm   |      |      | inch  |       |       |
|------|------|------|------|-------|-------|-------|
|      | Min. | Typ. | Max. | Min.  | Typ.  | Max.  |
| A    |      | 0.90 | 1.00 |       | 0.035 | 0.039 |
| A1   |      | 0.02 | 0.05 |       | 0.001 | 0.002 |
| A3   |      | 0.24 |      |       | 0.009 |       |
| AA   | 0.15 | 0.25 | 0.35 | 0.006 | 0.01  | 0.014 |
| b    | 0.43 | 0.51 | 0.58 | 0.017 | 0.020 | 0.023 |
| c    | 0.64 | 0.71 | 0.79 | 0.025 | 0.028 | 0.031 |
| D    |      | 5.00 |      |       | 0.197 |       |
| d    |      | 0.30 |      |       | 0.011 |       |
| E    |      | 5.00 |      |       | 0.197 |       |
| E2   | 2.49 | 2.57 | 2.64 | 0.098 | 0.101 | 0.104 |
| e    |      | 1.27 |      |       | 0.050 |       |
| f    |      | 3.37 |      |       | 0.132 |       |
| g    |      | 0.74 |      |       | 0.03  |       |
| h    |      | 0.21 |      |       | 0.008 |       |

Figure 10. PowerFLAT™ package dimensions

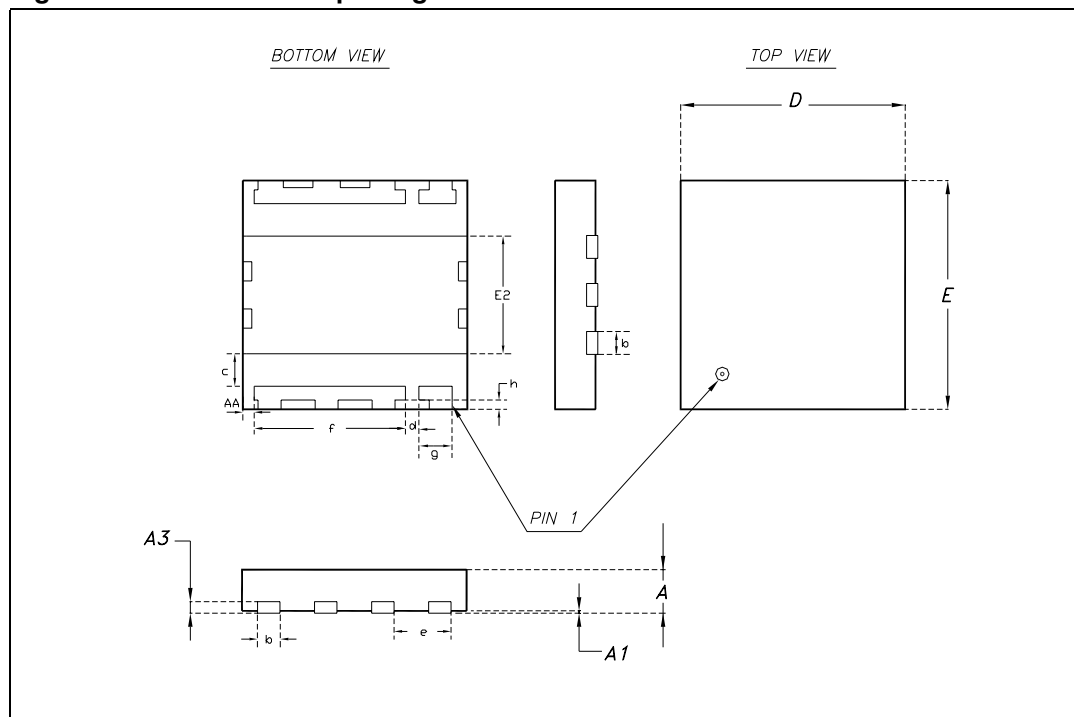
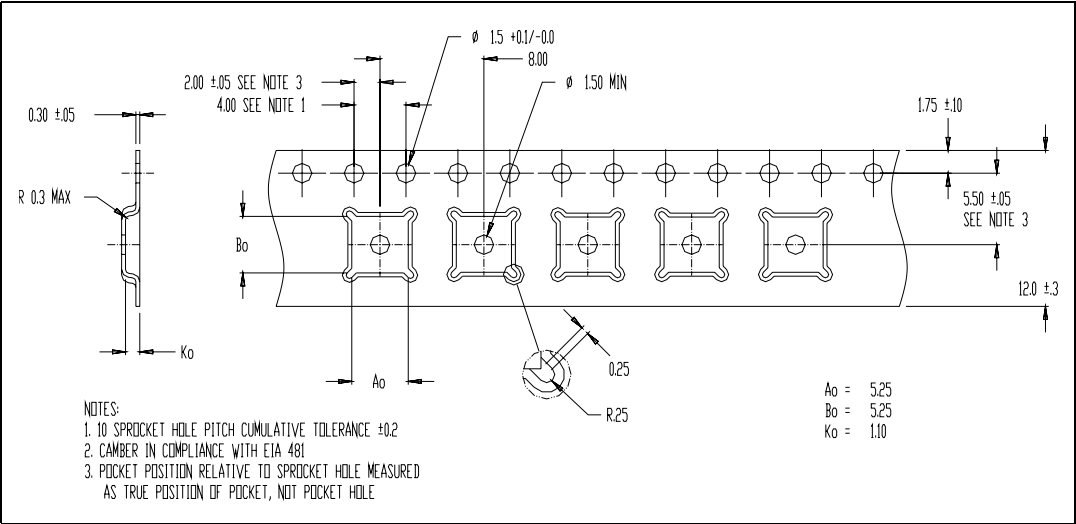


Table 6. PowerFLAT™ tape and reel dimensions

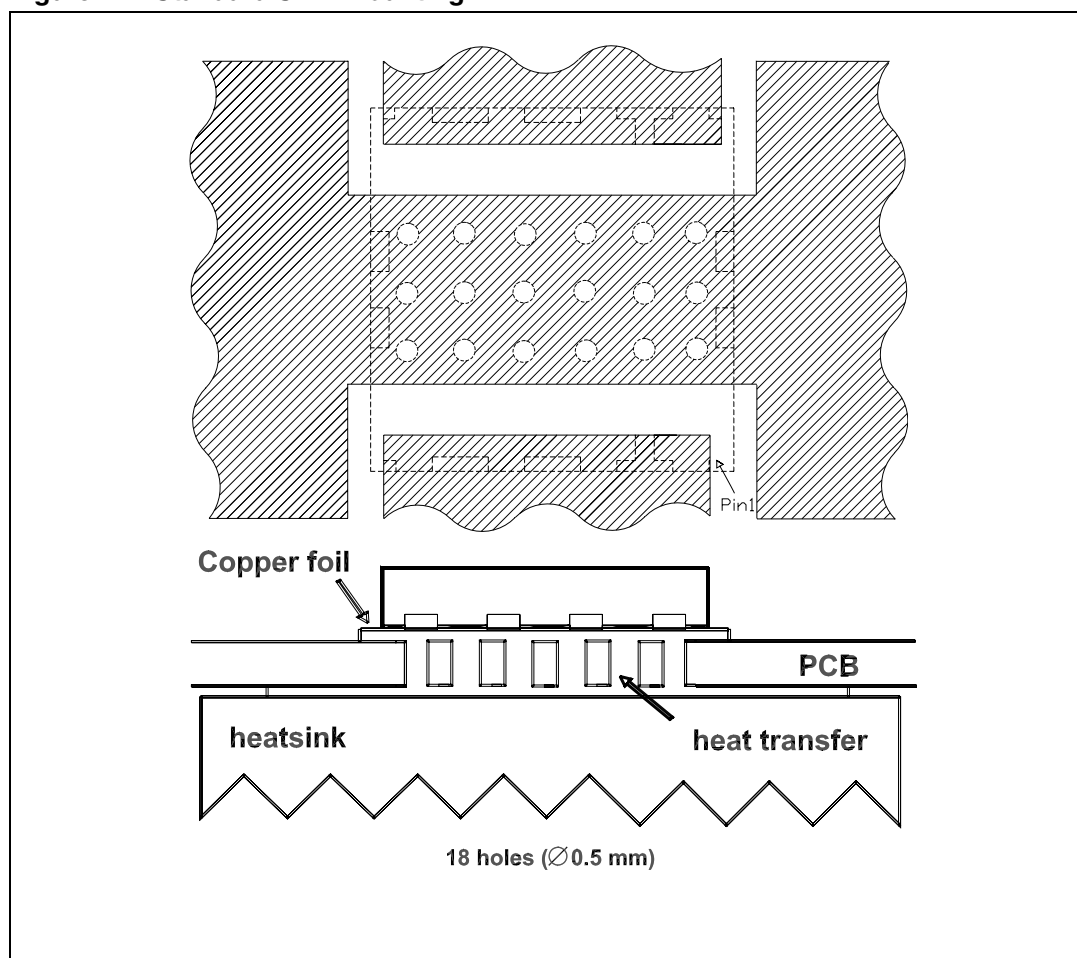
| Dim. | mm.  |      |      | inch |      |      |
|------|------|------|------|------|------|------|
|      | Min. | Typ  | Max. | Min. | Typ  | Max. |
| Ao   | 5.15 | 5.25 | 5.35 | 0.12 | 0.13 | 0.13 |
| Bo   | 5.15 | 5.25 | 5.35 | 0.12 | 0.13 | 0.13 |
| Ko   | 1.0  | 1.1  | 1.2  | 0.02 | 0.02 | 0.02 |

Figure 11. PowerFLAT™ tape and reel



### 6.1.1 Mounting indications

Figure 12. Standard SMD mounting

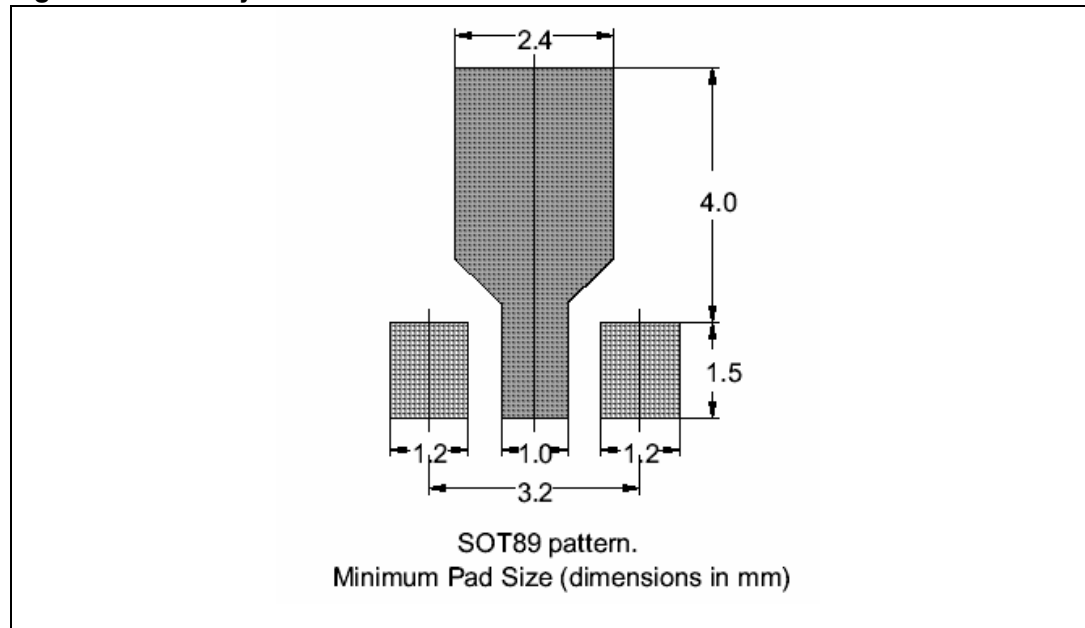


## 6.2 Thermal pad and via design SOT-89

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 0.203 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 13. Pad layout details**



### 6.2.1 Soldering profile

Figure 14 shows the recommended solder for devices that have Pb-free terminal plating and where a Pb-free solder is used.

**Figure 14. Recommended solder profile**

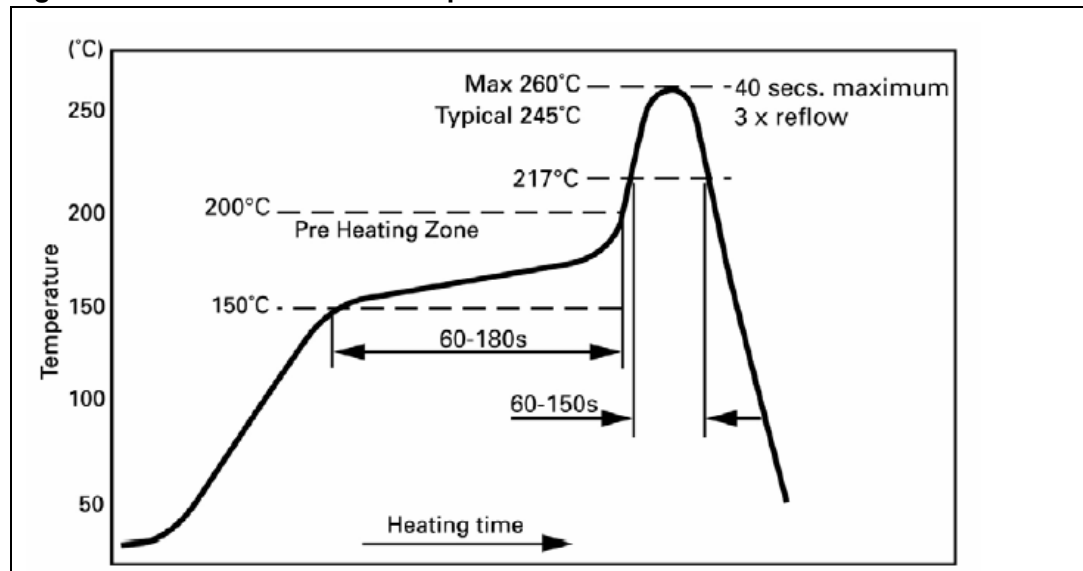


Figure 15 shows the recommended solder for devices with Pb-free terminal plating used with leaded solder, or for devices with leaded terminal plating used with a leaded solder.

**Figure 15. Recommended solder profile for leaded devices**

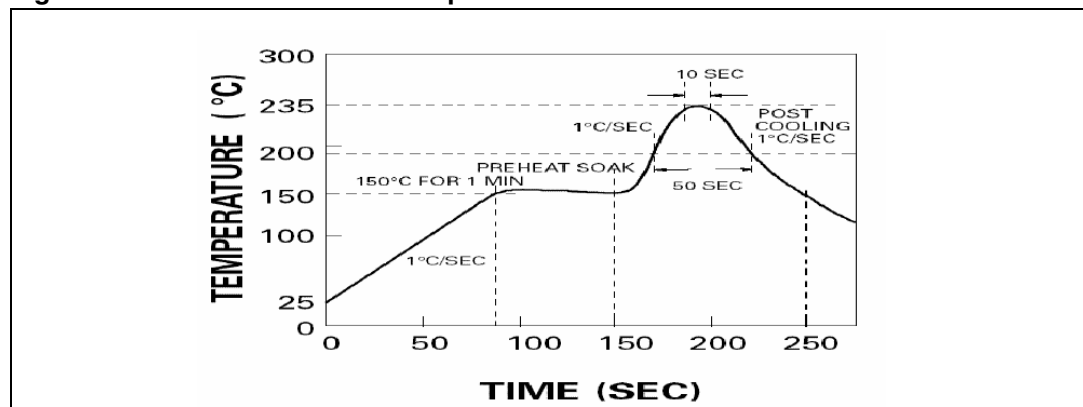
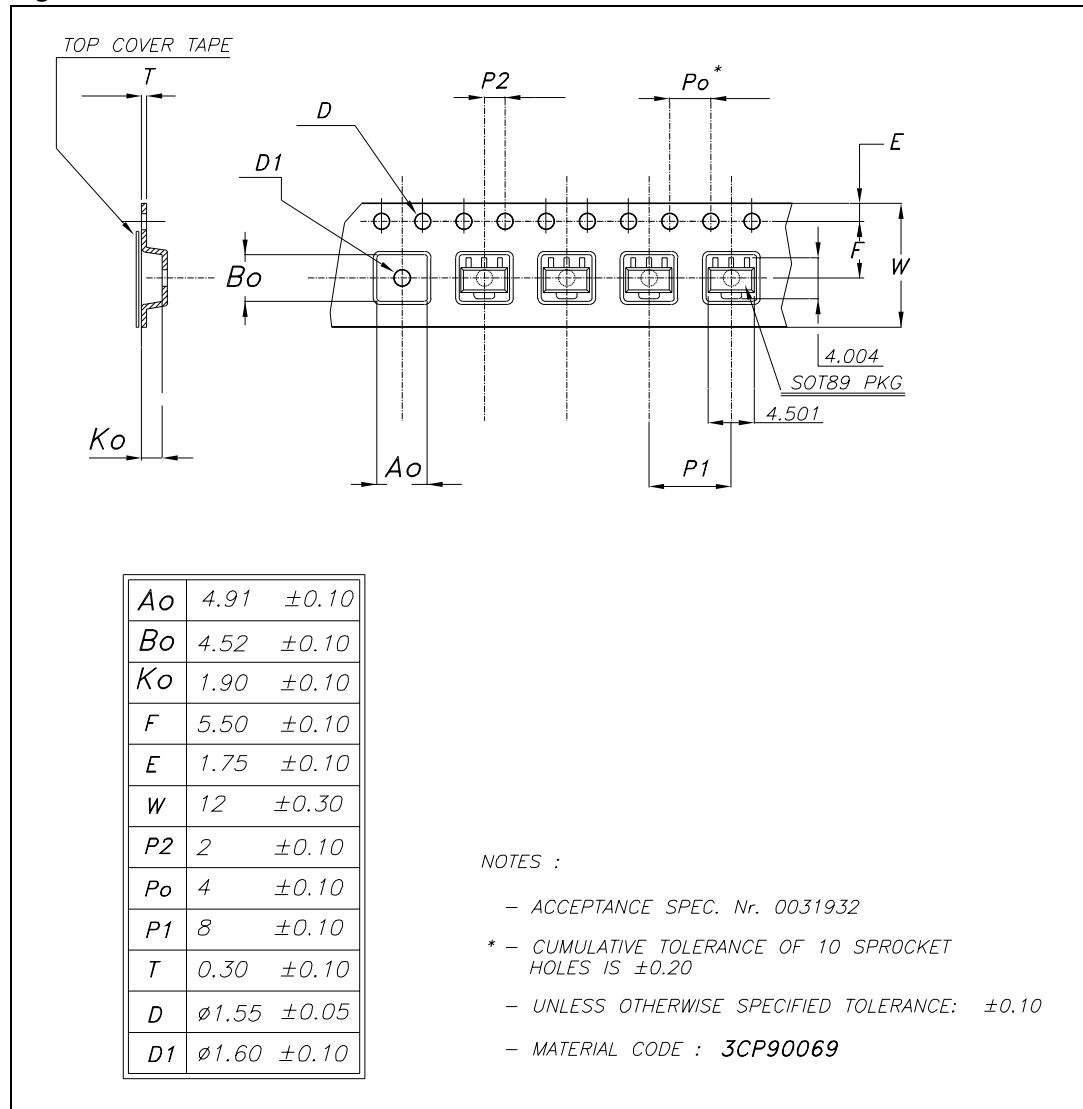


Figure 16. Reel information



## 7 Revision history

**Table 7. Document revision history**

| Date        | Revision | Changes          |
|-------------|----------|------------------|
| 31-Mar-2010 | 1        | Initial release. |

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