

## RF power transistor, LdmoST plastic family N-channel enhancement-mode lateral MOSFETs

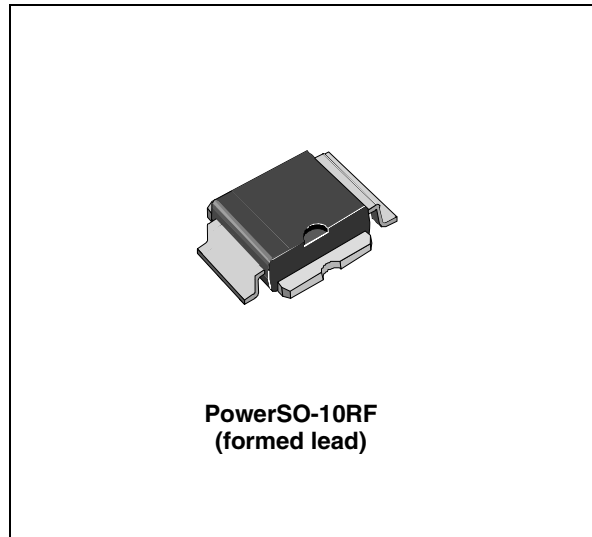
### Features

- Excellent thermal stability
- Common source configuration
- Broadband performances:  
 $P_{OUT} = 6\text{ W}$  with 15 dB gain @ 870 MHz/13.6 V
- Plastic package
- ESD protection
- In compliance with the 2002/95/EC european directive

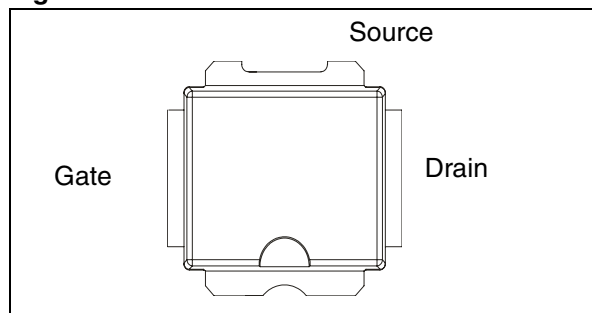
### Description

The PD85006-E is a common source N-channel, enhancement-mode lateral field-effect RF power transistor. It is designed for high gain, broadband commercial and industrial applications. It operates at 13.6 V in common source mode at frequencies of up to 1 GHz. PD85006-E boasts the excellent gain, linearity and reliability of ST's latest LDMOS technology mounted in the first true SMD plastic RF power package. PowerSO-10RF's superior linearity performance makes it an ideal solution for mobile radio applications.

The PowerSO-10 plastic package, designed to offer high reliability, is the first ST JEDEC approved, high power SMD package. It has been specially optimized for RF needs and offers excellent RF performance and ease of assembly. Mounting recommendations are available in [www.st.com/rf](http://www.st.com/rf) (search for AN1294).



**Figure 1. Pin connections**



**Table 1. Device summary**

| Order codes | Packages                   | Packaging     |
|-------------|----------------------------|---------------|
| PD85006-E   | PowerSO-10RF (formed lead) | Tube          |
| PD85006TR-E | PowerSO-10RF (formed lead) | Tape and reel |

# Contents

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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                        | 40          | V    |
| $V_{GS}$      | Gate-source voltage                         | -0.5 to +15 | V    |
| $I_D$         | Drain current                               | 2           | A    |
| $P_{DISS}$    | Power dissipation (@ $T_C = 70\text{ °C}$ ) | 36.5        | W    |
| $T_J$         | Max. operating junction temperature         | 165         | °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 | 2.6   | °C/W |

## 2 Electrical characteristics

$T_{CASE} = +25\text{ }^{\circ}\text{C}$

### 2.1 Static

**Table 4. Static**

| Symbol       | Test conditions   |                       | Min | Typ                | Max  | Unit    |    |
|--------------|-------------------|-----------------------|-----|--------------------|------|---------|----|
| $I_{DSS}$    | $V_{GS} = 0V$     | $V_{DS} = 25 V$       | -   |                    | 1    | $\mu A$ |    |
| $I_{GSS}$    | $V_{GS} = 5 V$    | $V_{DS} = 0 V$        |     |                    | 1    | $\mu A$ |    |
| $V_{GS(Q)}$  | $V_{DS} = 13.6 V$ | $I_D = 200\text{ mA}$ |     |                    | 4    | V       |    |
| $V_{DS(ON)}$ | $V_{GS} = 10 V$   | $I_D = 0.25 A$        |     |                    | 0.27 | V       |    |
| $C_{ISS}$    | $V_{GS} = 0V$     | $V_{DS} = 13.6 V$     |     | $f = 1\text{ MHz}$ | 16   |         | pF |
| $C_{OSS}$    | $V_{GS} = 0V$     | $V_{DS} = 13.6 V$     |     | $f = 1\text{ MHz}$ | 14   |         | pF |
| $C_{RSS}$    | $V_{GS} = 0V$     | $V_{DS} = 13.6 V$     |     | $f = 1\text{ MHz}$ | 1.1  |         | pF |

### 2.2 Dynamic

**Table 5. Dynamic**

| Symbol        | Test conditions   | Min  | Typ | Max | Unit |
|---------------|---|------|-----|-----|------|
| $P_{OUT}$     | $V_{DD} = 13.6 V, I_{DQ} = 200\text{ mA}, P_{IN} = 0.1\text{ W}, f = 870\text{ MHz}$                    | 5    | 6   | -   | W    |
| $G_P$         | $V_{DD} = 13.6 V, I_{DQ} = 200\text{ mA}, P_{OUT} = 5\text{ W}, f = 870\text{ MHz}$                     | 15   | 17  |     | dB   |
| $h_D$         | $V_{DD} = 13.6 V, I_{DQ} = 200\text{ mA}, P_{OUT} = 5\text{ W}, f = 870\text{ MHz}$                     | 55   | 63  |     | %    |
| Load mismatch | $V_{DD} = 13.6 V, I_{DQ} = 200\text{ mA}, P_{OUT} = 5\text{ W}, f = 870\text{ MHz}$<br>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    |

### 3 Impedances

Figure 2. Impedances

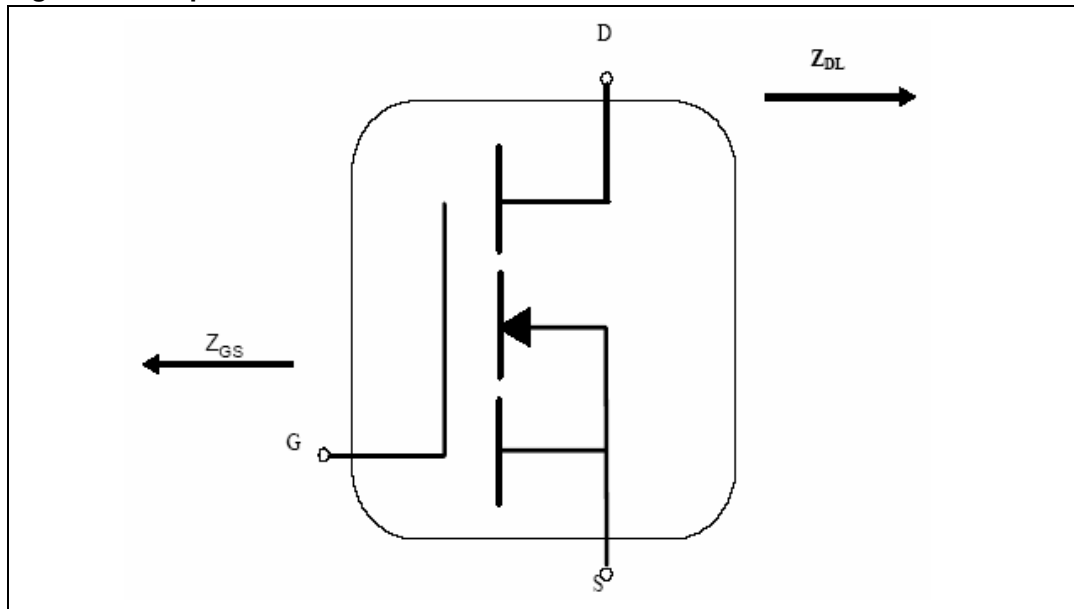
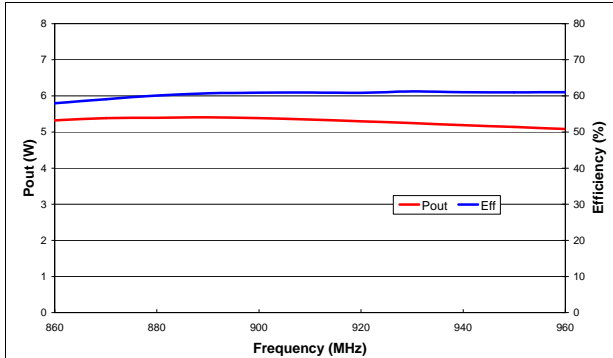


Table 7. Broadband impedances

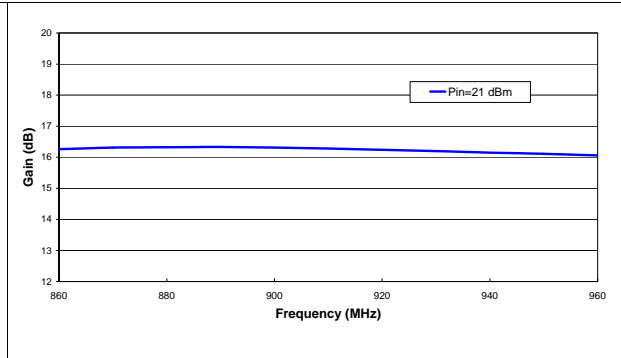
| F(MHz) | $Z_{GS}$     | $Z_{DL}$      |
|--------|--------------|---------------|
| 860    | 2.66+ j 4.28 | 6.23+ j 5.71  |
| 880    | 2.81+ j 4.35 | 6.46+ j 6.20  |
| 900    | 2.88+ j 4.34 | 6.73 + j 6.66 |
| 920    | 2.87+ j 4.25 | 7.06+ j 7.06  |
| 940    | 2.68+ j 4.20 | 7.40+ j 7.45  |
| 960    | 2.39+ j 4.20 | 7.80+ j 7.75  |

# 4 DC curves

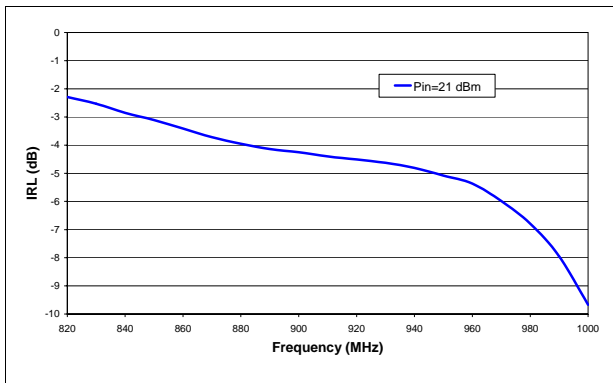
**Figure 3. Output power and efficiency vs. frequency**  
13.6 V / 200 mA / Pin = 21 dBm



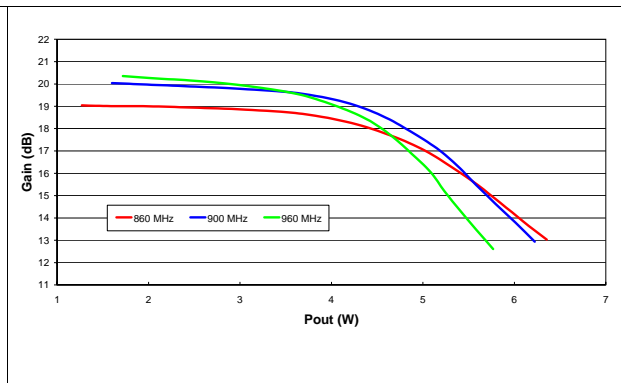
**Figure 4. Gain vs. frequency 13.6 V / 200 mA**



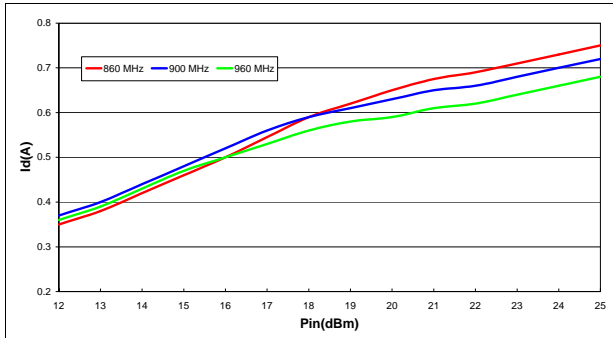
**Figure 5. Input return loss vs. frequency**  
13.6 V / 200 mA



**Figure 6. Gain vs. pout 13.6 V / 200 mA**



**Figure 7. Id vs. pin 13.6 V / 200 mA**



**Figure 8. Pout vs. pin 13.6 V / 200 mA**

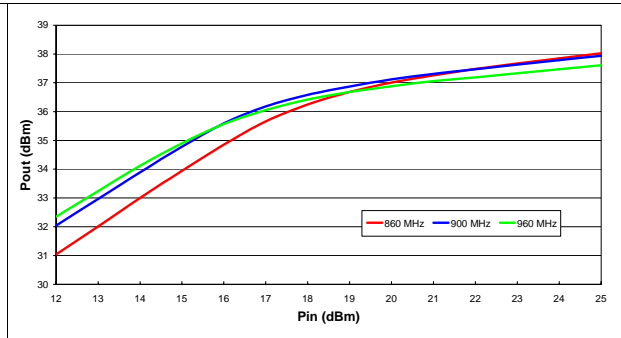


Figure 9. DC output characteristics

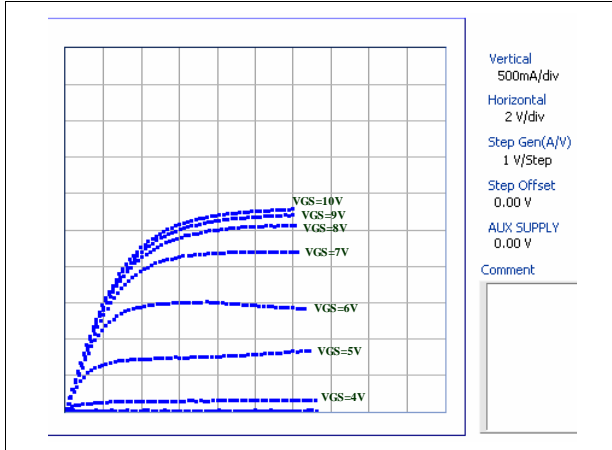


Figure 10.  $I_D$  vs.  $V_{GS}$

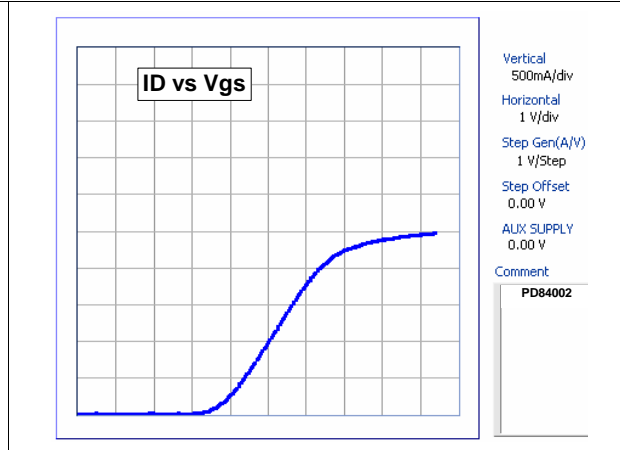
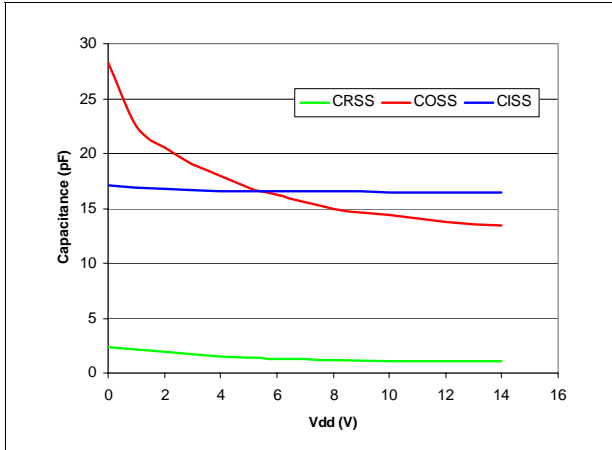
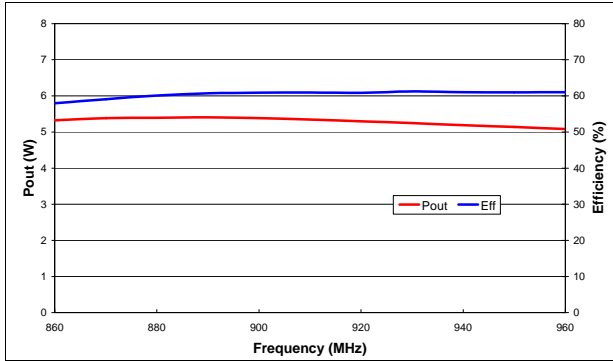


Figure 11. Capacitances vs. drain voltage

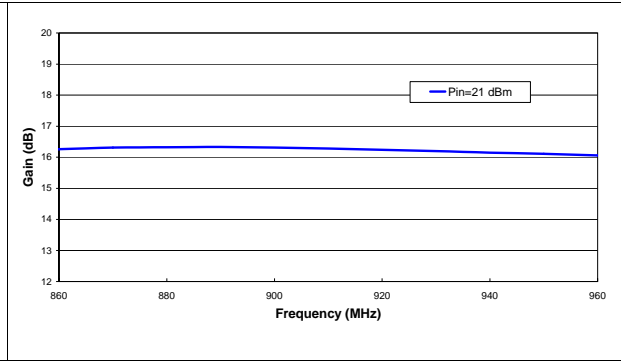


# 5 RF curves

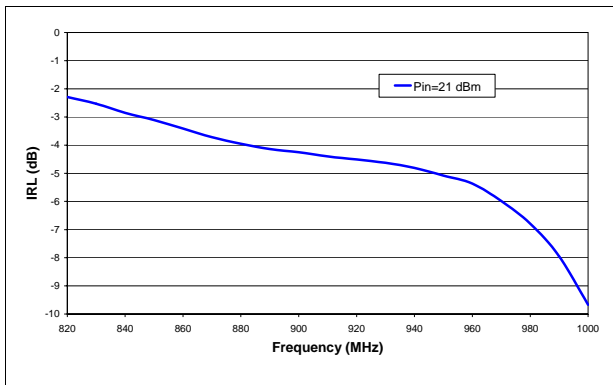
**Figure 12. Output power and efficiency vs. frequency**  
 13.6 V / 200 mA / Pin = 21 dBm



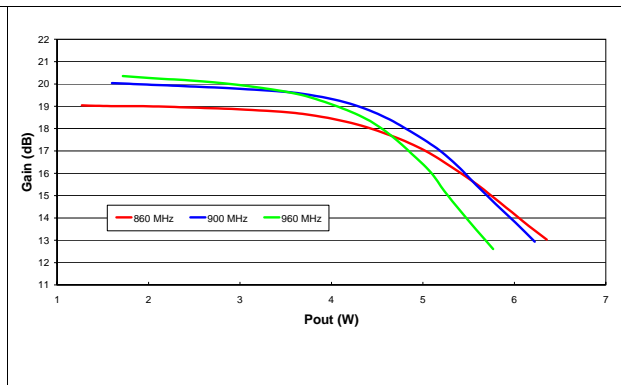
**Figure 13. Gain vs. frequency 13.6 V / 200 mA**



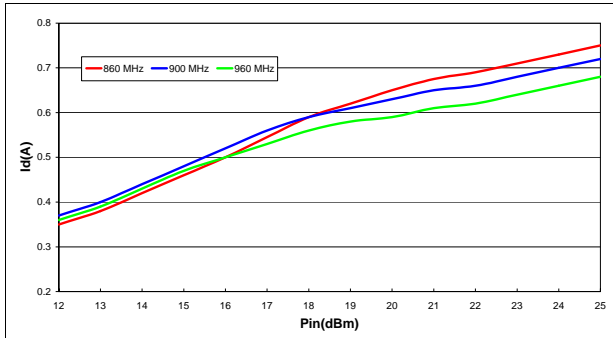
**Figure 14. Input return loss vs. frequency**  
 13.6 V / 200 mA



**Figure 15. Gain vs. pout 13.6 V / 200 mA**



**Figure 16. Id vs. pin 13.6 V / 200 mA**



**Figure 17. Pout vs. pin 13.6 V / 200 mA**

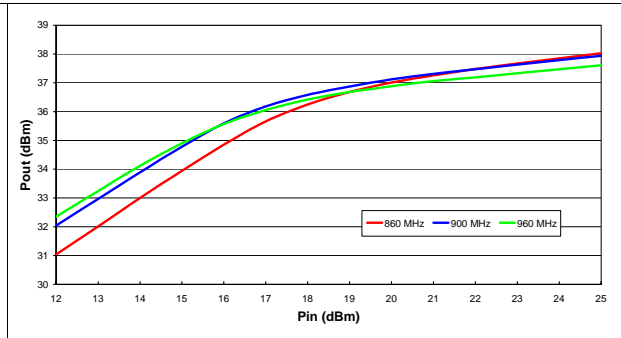
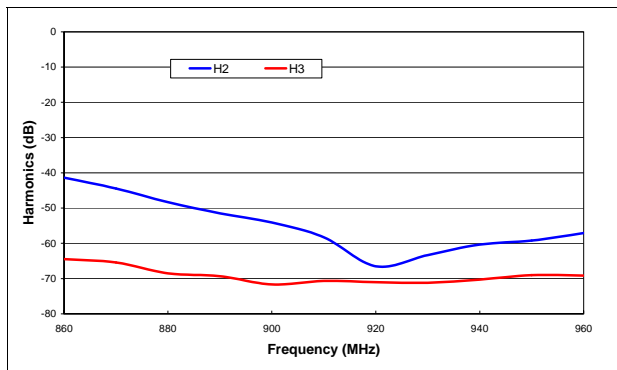




Figure 18. Harmonics vs. frequency  
13.6 V / 200 mA



## 6 Schematic and bill of material

Figure 19. Schematic and bill of material

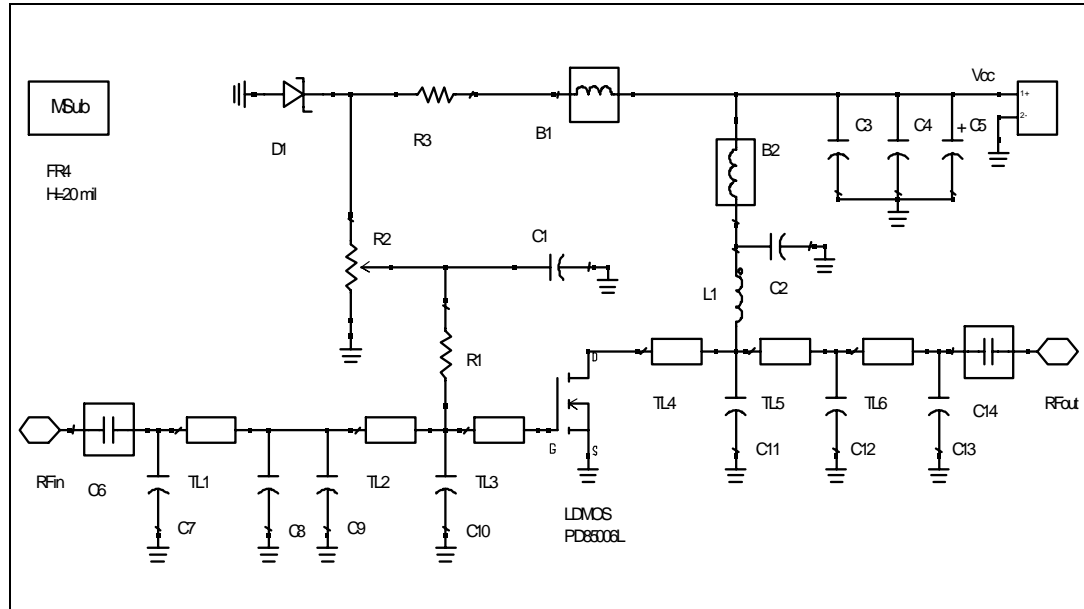


Table 8. Components part list

| Component ID | Description  | Value    | Case size | Manufacturer     | Part code           |
|--------------|--------------|----------|-----------|------------------|---------------------|
| B1           | Ferrite Bead |          |           | Panasonic        | EXCELDR35C          |
| B2           | Ferrite Bead |          |           | Panasonic        | EXCELDR35C          |
| C1, C2       | Capacitor    | 120 pF   | 0603      | Murata           | GRM39-C0G121J50D500 |
| C3           | Capacitor    | 1 nF     | 0603      | Murata           | GRM39-X7R102K50C560 |
| C4           | Capacitor    | 10 nF    | 0603      | Murata           | GRM39-X7R103K50C560 |
| C5           | Capacitor    | 10 μF    | SMT       | Panasonic        | EEVHB1V100P         |
| C6, C14      | Capacitor    | 39 pF    | 0603      | Murata           | GRM39-C0G390J50D500 |
| C7           | Capacitor    | 3.3 pF   | 0603      | Murata           | GRM39-C0G3R3C50Z500 |
| C8           | Capacitor    | 2.7 pF   | 0603      | Murata           | GRM39-C0G2R7C50Z500 |
| C9           | Capacitor    | 12 pF    | 0603      | Murata           | GRM39-C0G120J50D500 |
| C10          | Capacitor    | 22 pF    | 0603      | Murata           | GRM39-C0G220J50D500 |
| C11          | Capacitor    | 8.2 pF   | 0603      | Murata           | GRM39-C0G8R2D50Z500 |
| C12          | Capacitor    | 6,8 pF   | 0603      | Murata           | GRM39-C0G6R8D50Z500 |
| C13          | Capacitor    | 3.9 pF   | 0603      | Murata           | GRM39-C0G3R9C50Z500 |
| D1           | Zener Diode  | 5.1 V    | SOD110    | Philips          | BZX284C5V1          |
| L1           | Inductor     | 12.55 nH |           | Coilcraft        | 1606-10             |
| R1           | Resistor     | 510 Ω    | 0603      | Tyco electronics |                     |

**Table 8. Components part list (continued)**

| Component ID  | Description                       | Value      | Case size   | Manufacturer       | Part code    |
|---------------|-----------------------------------|------------|-------------|--------------------|--------------|
| R2            | Potentiometer                     | 10 kΩ      |             | Bourns electronics | 3214W-1-103E |
| R3            | Resistor                          | 1 k        | 0603        | Tyco electronics   | 01623440-1   |
| TL1           | Transmission line                 | W=0.92mm   | L = 12.1 mm |                    |              |
| TL2           | Transmission line                 | W=0.92mm   | L = 3.2 mm  |                    |              |
| TL3           | Transmission line                 | W=0.92mm   | L = 3.0 mm  |                    |              |
| TL4           | Transmission line                 | W= 0.92 mm | L = 3.2 mm  |                    |              |
| TL5           | Transmission line                 | W= 0.92 mm | L = 3.9 mm  |                    |              |
| TL6           | Transmission line                 | W=0.92mm   | L=11.0 mm   |                    |              |
| RF in, RF out | SMA-CONN                          | 50 Ω       | 60 mils     | Johnson            | 142-0701-801 |
| PD85006       | LDMOS                             |            |             | STMicroelectronics | PD85006      |
| Board         | FR-4 THk=0.020" 2OZ Cu both sides |            |             |                    |              |

## 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<sup>®</sup> is an ST trademark.

**Table 9. PowerSO-10RF formed lead (gull wing) mechanical data**

| Dim. | mm    |        |       | Inch  |        |        |
|------|-------|--------|-------|-------|--------|--------|
|      | Min   | Typ    | Max   | Min   | Typ    | Max    |
| A1   | 0     | 0.05   | 0.1   | 0.    | 0.0019 | 0.0038 |
| A2   | 3.4   | 3.5    | 3.6   | 0.134 | 0.137  | 0.142  |
| A3   | 1.2   | 1.3    | 1.4   | 0.046 | 0.05   | 0.054  |
| A4   | 0.15  | 0.2    | 0.25  | 0.005 | 0.007  | 0.009  |
| a    |       | 0.2    |       |       | 0.007  |        |
| b    | 5.4   | 5.53   | 5.65  | 0.212 | 0.217  | 0.221  |
| c    | 0.23  | 0.27   | 0.32  | 0.008 | 0.01   | 0.012  |
| D    | 9.4   | 9.5    | 9.6   | 0.370 | 0.374  | 0.377  |
| D1   | 7.4   | 7.5    | 7.6   | 0.290 | 0.295  | 0.298  |
| E    | 13.85 | 14.1   | 14.35 | 0.544 | 0.555  | 0.565  |
| E1   | 9.3   | 9.4    | 9.5   | 0.365 | 0.37   | 0.375  |
| E2   | 7.3   | 7.4    | 7.5   | 0.286 | 0.292  | 0.294  |
| E3   | 5.9   | 6.1    | 6.3   | 0.231 | 0.24   | 0.247  |
| F    |       | 0.5    |       |       | 0.019  |        |
| G    |       | 1.2    |       |       | 0.047  |        |
| L    | 0.8   | 1      | 1.1   | 0.030 | 0.039  | 0.042  |
| R1   |       |        | 0.25  |       |        | 0.01   |
| R2   |       | 0.8    |       |       | 0.031  |        |
| T    | 2 deg | 5 deg  | 8 deg | 2 deg | 5 deg  | 8 deg  |
| T1   |       | 6 deg  |       |       | 6 deg  |        |
| T2   |       | 10 deg |       |       | 10 deg |        |

*Note: Resin protrusions not included (max value: 0.15 mm per side)*

Figure 20. Package dimensions

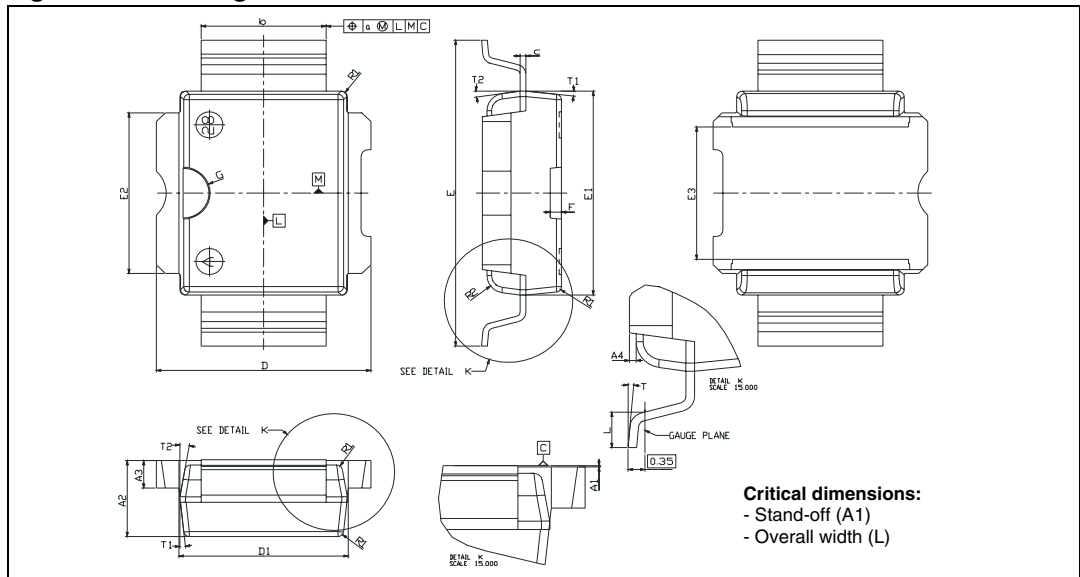


Figure 21. Tube information

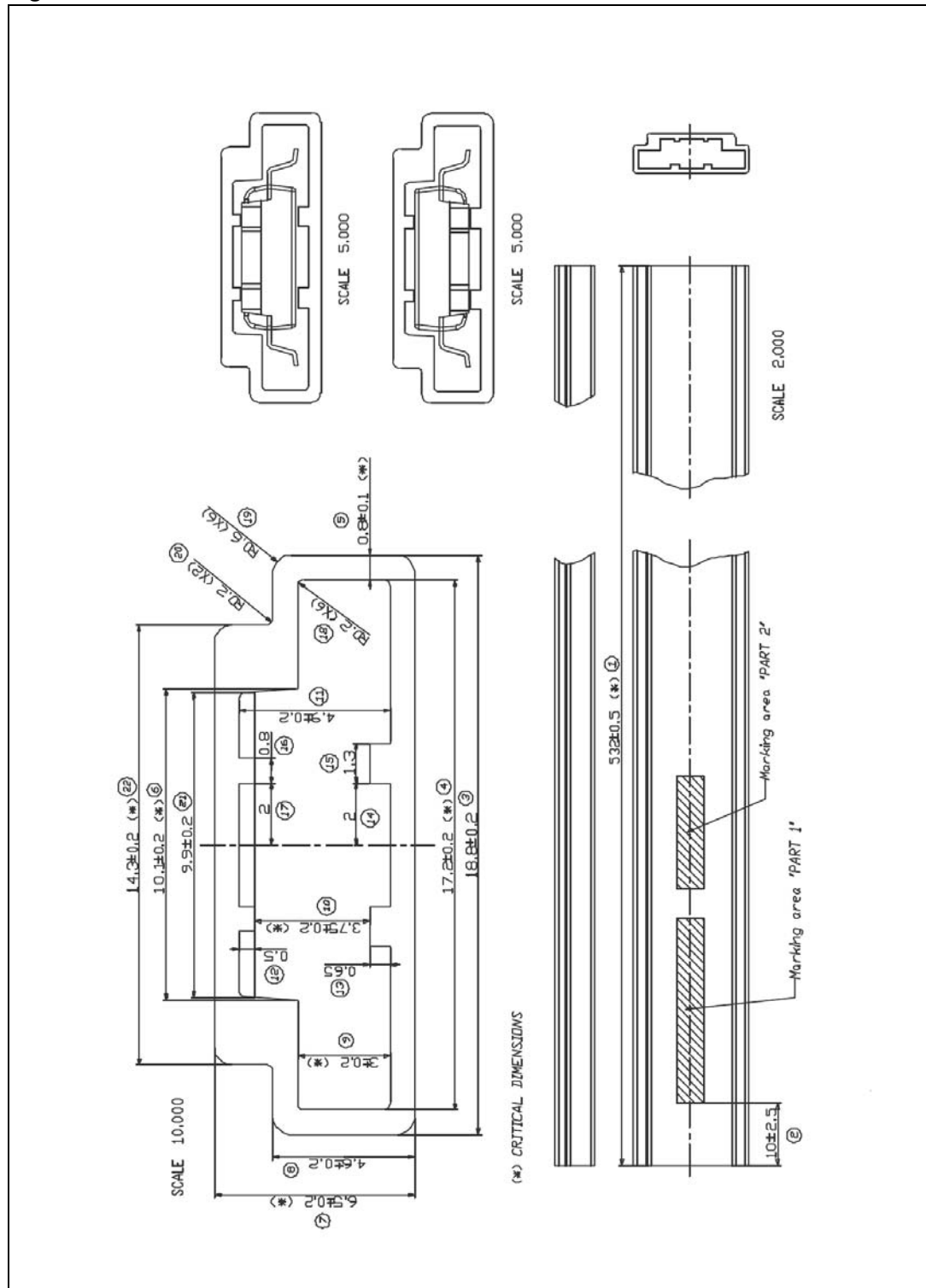
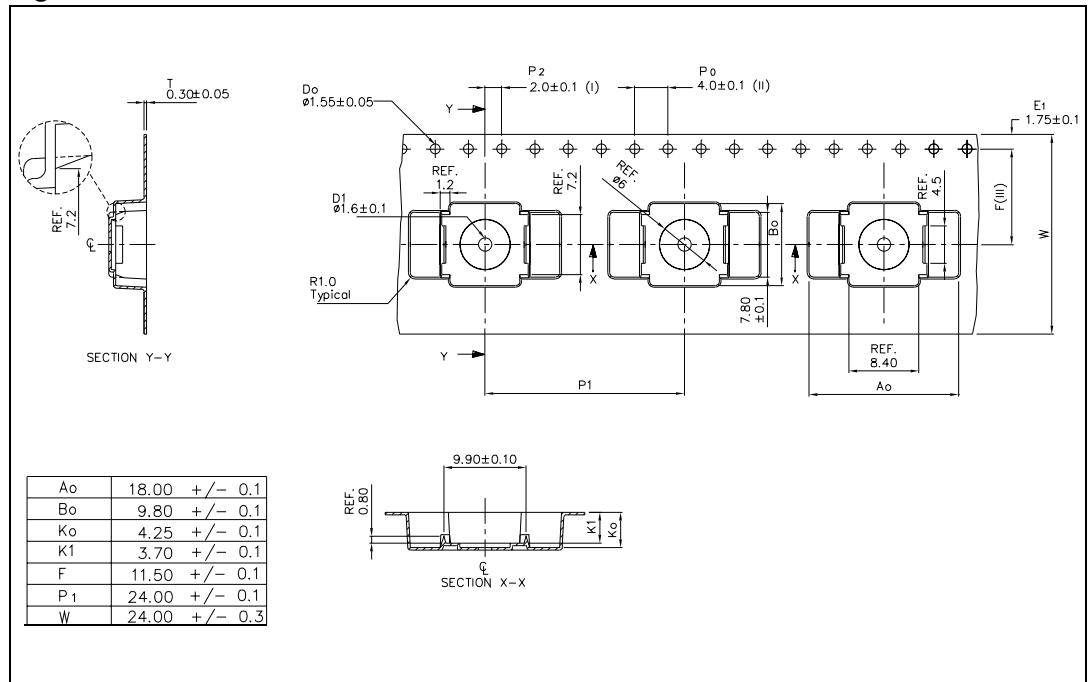


Figure 22. Reel information



## 8 Revision history

**Table 10. Document revision history**

| Date        | Revision | Changes  |
|-------------|----------|--|
| 03-Sep-2009 | 1        | Initial release.   |
| 29-Oct-2009 | 2        | Updated figure on cover page.  |
| 04-Aug-2010 | 3        | Added device shipped in tape and reel, see <a href="#">Table 1: Device summary</a> . |



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