

HF/VHF/UHF RF power N-channel MOSFET

Features

- Improved ruggedness $V_{(BR)DSS} > 200\text{ V}$
- Excellent thermal stability
- 20:1 all phases load mismatch capability
- $P_{OUT} = 300\text{ W}$ min. with 24 dB gain @ 30 MHz
- In compliance with the 2002/95/EEC European directive

Description

The SD4933 is an N-channel MOS field-effect RF power transistor. It is intended for use in 50 V ISM applications up to 100 MHz.

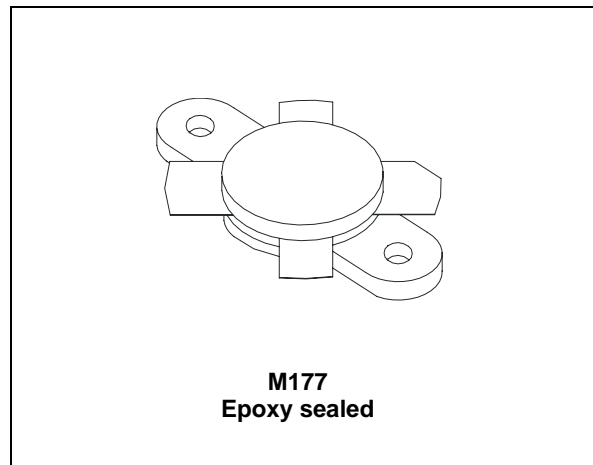


Figure 1. Pin connection

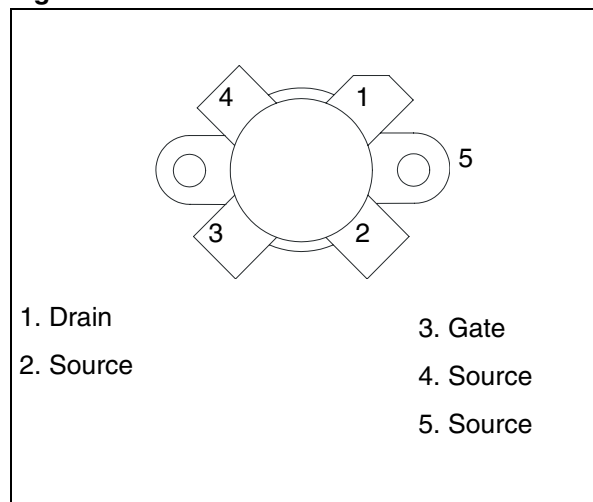


Table 1. Device summary

| Order code | Marking | Base qty. | Package | Packaging |
|------------|-----------------------|-----------|---------|--------------|
| SD4933 | SD4933 ⁽¹⁾ | 25 pcs | M177 | Plastic tray |

1. For more details please refer to [Chapter 9: Marking, packing and shipping specifications](#).

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1 Electrical data

1.1 Maximum ratings

($T_{CASE} = 25\text{ °C}$)

Table 2. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|---------------|---|-------------|--------------------|
| $V_{(BR)DSS}$ | Drain source voltage | 200 | V |
| V_{DGR} | Drain-gate voltage ($R_{GS} = 1\text{ M}\Omega$) | 200 | V |
| V_{GS} | Gate-source voltage | ± 20 | V |
| I_D | Drain current | 40 | A |
| P_{DISS} | Power dissipation | 648 | W |
| E_{AS} | Avalanche energy Single pulse ($I_D = 56\text{ A} - 800\text{ }\mu\text{H}$ coil) | 1200 | mJ |
| T_J | Max. operating junction temperature | 200 | $^{\circ}\text{C}$ |
| T_{STG} | Storage temperature | -65 to +150 | $^{\circ}\text{C}$ |

1.2 Thermal data

Table 3. Thermal data

| Symbol | Parameter | Value | Unit |
|------------|------------------------------------|-------|----------------------|
| R_{thJC} | Junction - case thermal resistance | 0.27 | $^{\circ}\text{C/W}$ |

2 Electrical characteristics

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

2.1 Static

Table 4. Static

| Symbol | Test conditions | | Min | Typ | Max | Unit |
|---------------|------------------------|--------------------------|-----|------|-----|------|
| $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}$ | $I_{DS} = 100\text{ mA}$ | 200 | 240 | | V |
| I_{DSS} | $V_{GS} = 0\text{ V}$ | $V_{DS} = 100\text{ V}$ | | | 2 | mA |
| I_{GSS} | $V_{GS} = 20\text{ V}$ | $V_{DS} = 0\text{ V}$ | | | 500 | nA |
| V_{TH} | $I_D = 250\text{ mA}$ | | 1.5 | 2.5 | 4.0 | V |
| $V_{DS(ON)}$ | $V_{GS} = 10\text{ V}$ | $I_D = 20\text{ A}$ | | 3.5 | 4.0 | V |
| G_{FS} | $V_{DS} = 10\text{ V}$ | $I_D = 5\text{ A}$ | 5 | 8 | | S |
| C_{ISS} | $V_{GS} = 0\text{ V}$ | $V_{DS} = 50\text{ V}$ | | 1000 | | pF |
| C_{OSS} | $V_{GS} = 0\text{ V}$ | $V_{DS} = 50\text{ V}$ | | 400 | | pF |
| C_{RSS} | $V_{GS} = 0\text{ V}$ | $V_{DS} = 50\text{ V}$ | | 16 | | pF |

2.2 Dynamic

Table 5. Dynamic

| Symbol | Test conditions | | Min | Typ | Max | Unit |
|---------------|------------------------|---|------|------|-----|------|
| P_{OUT} | $V_{DD} = 50\text{ V}$ | $I_{DQ} = 250\text{ mA}$ $f = 30\text{ MHz}$ | 300 | | - | W |
| G_{PS} | $V_{DD} = 50\text{ V}$ | $I_{DQ} = 250\text{ mA}$ $P_{OUT} = 300\text{ W}$ $f = 30\text{ MHz}$ | 20 | 24 | - | dB |
| h_D | $V_{DD} = 50\text{ V}$ | $I_{DQ} = 250\text{ mA}$ $P_{OUT} = 300\text{ W}$ $f = 30\text{ MHz}$ | 50 | 58 | - | % |
| Load mismatch | $V_{DD} = 50\text{ V}$ | $I_{DQ} = 250\text{ mA}$ $P_{OUT} = 300\text{ W}$ $f = 30\text{ MHz}$ All phase angles | 10:1 | 20:1 | - | VSWR |

3 Impedance data

Figure 2. Impedance data

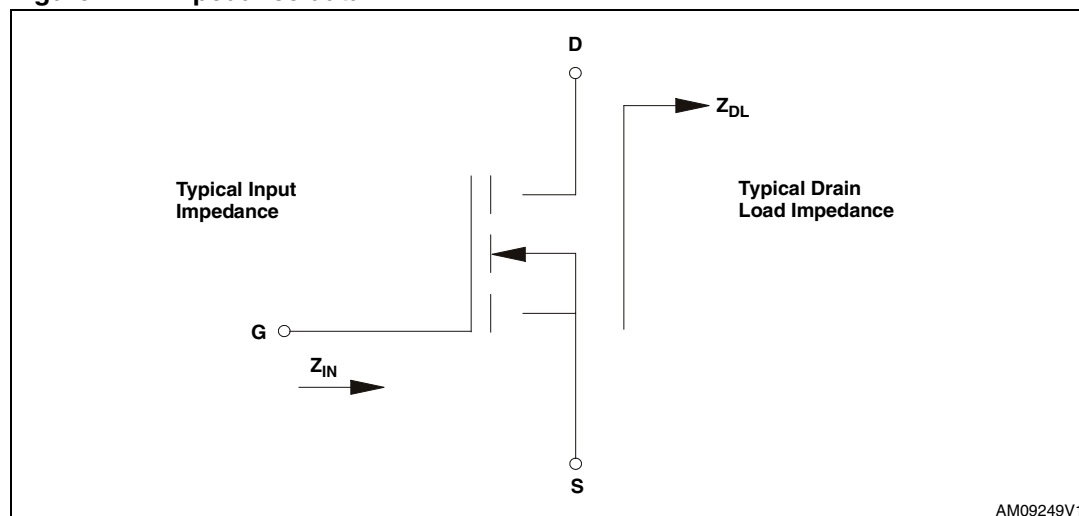


Table 6. Impedance values

| Z_{in} | Z_{dl} |
|-------------|-------------|
| 1.6 - j 5.0 | 3.3 + j 1.0 |

4 Typical performance

Figure 3. Capacitance vs. drain voltage

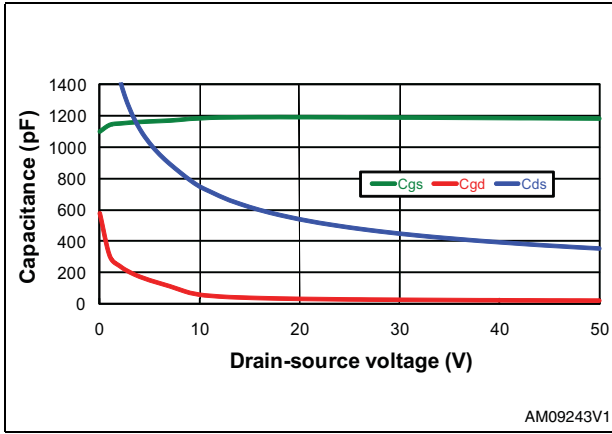


Figure 4. Drain current vs. drain-source voltage

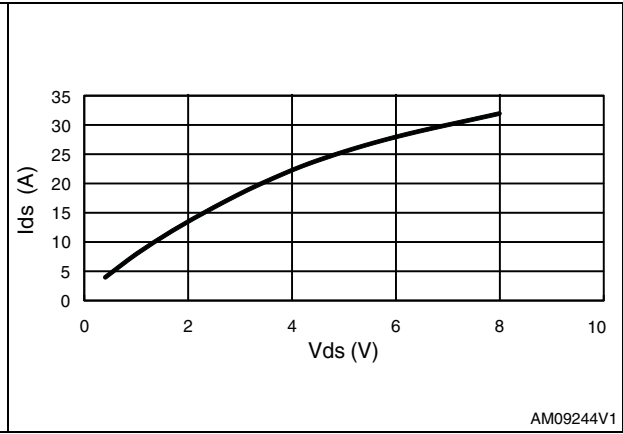


Figure 5. Drain current vs. drain-source voltage at different temperatures

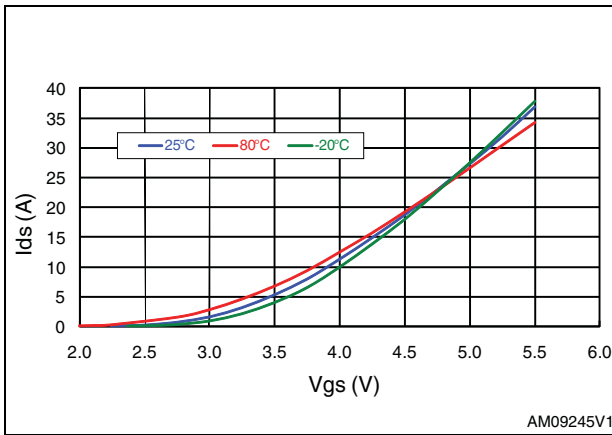


Figure 6. Transient thermal impedance

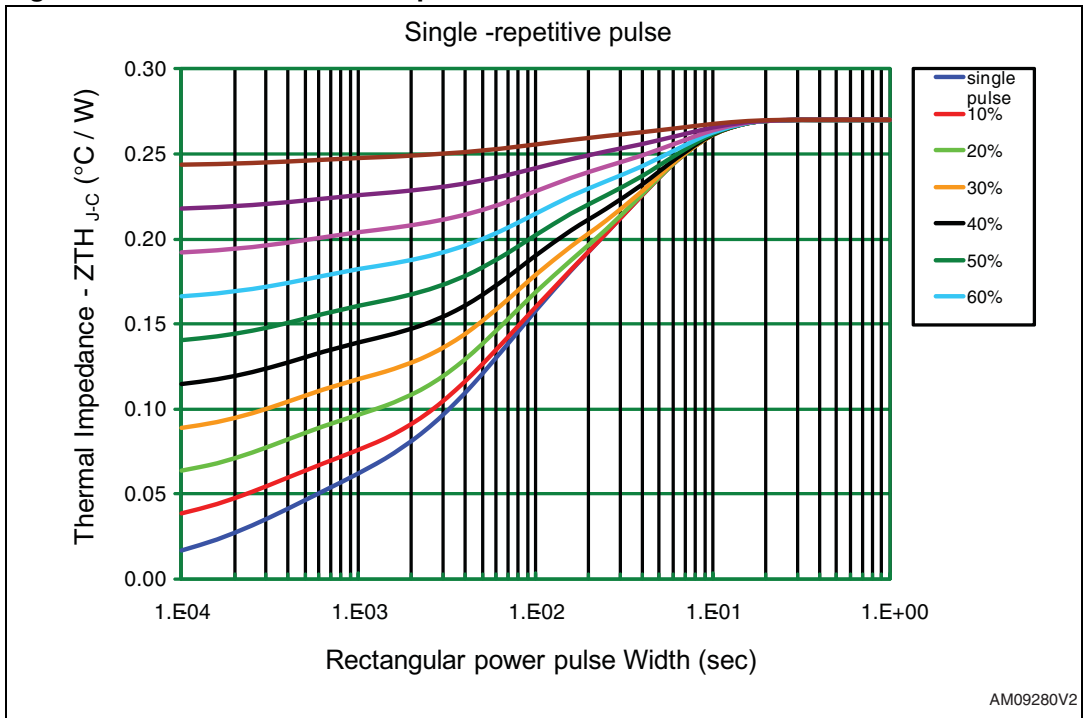
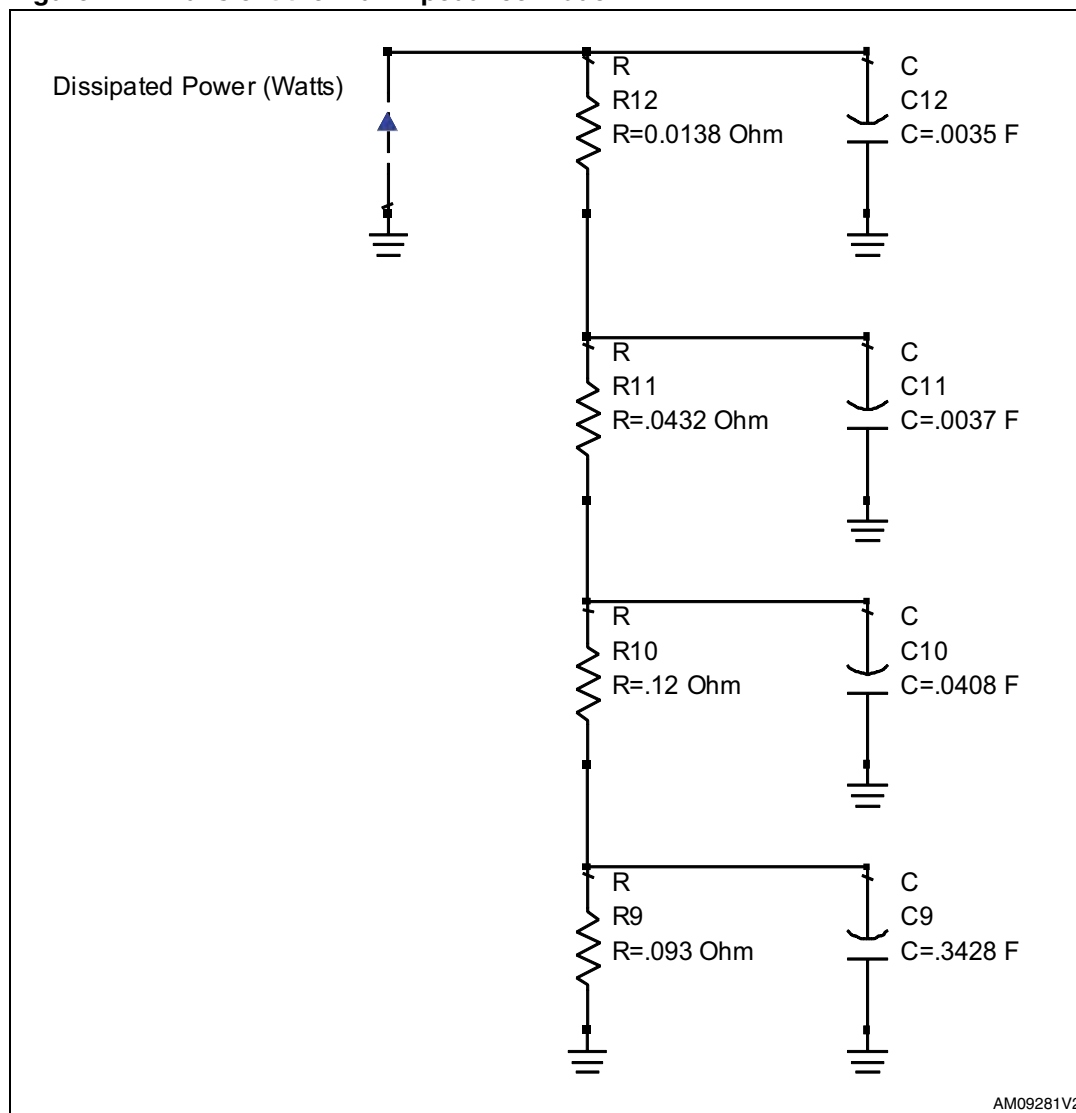


Figure 7. Transient thermal impedance model



5 Typical performance (30 MHz)

Figure 8. Gain and efficiency vs. output power
 power_Vdd = 50 V, Idq = 250 mA,
 freq = 30 MHz

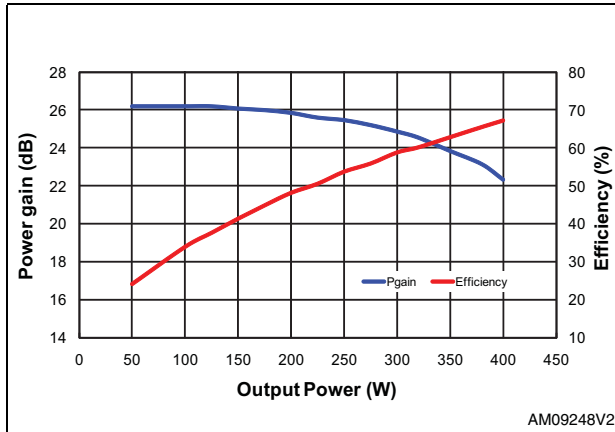


Figure 9. Output power vs. input power

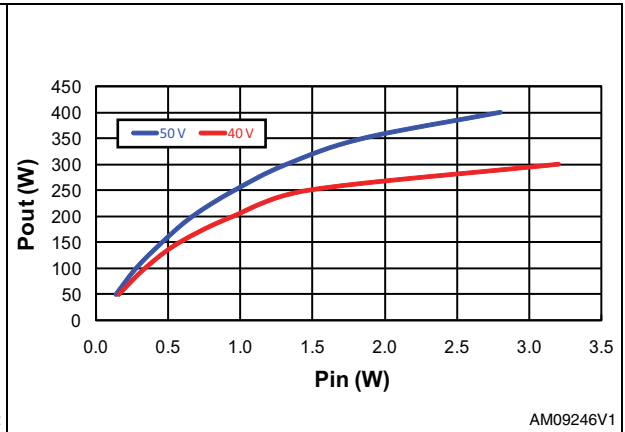


Figure 10. Output power vs. supply voltage

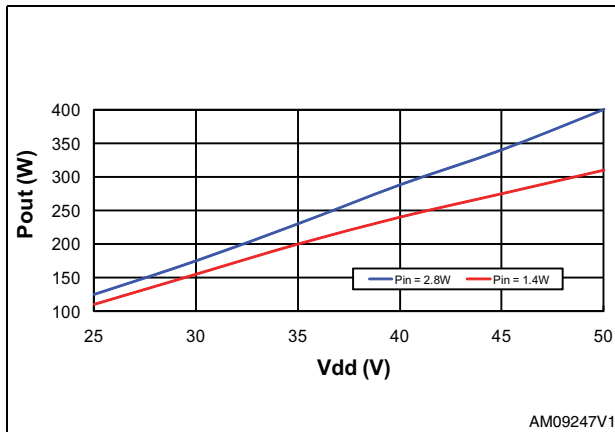
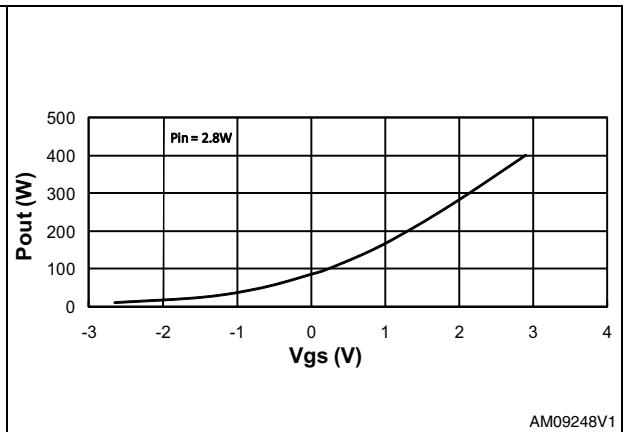


Figure 11. Output power vs. gate voltage



5.1 Test circuit (30 MHz)

Figure 12. 30 MHz test circuit schematic

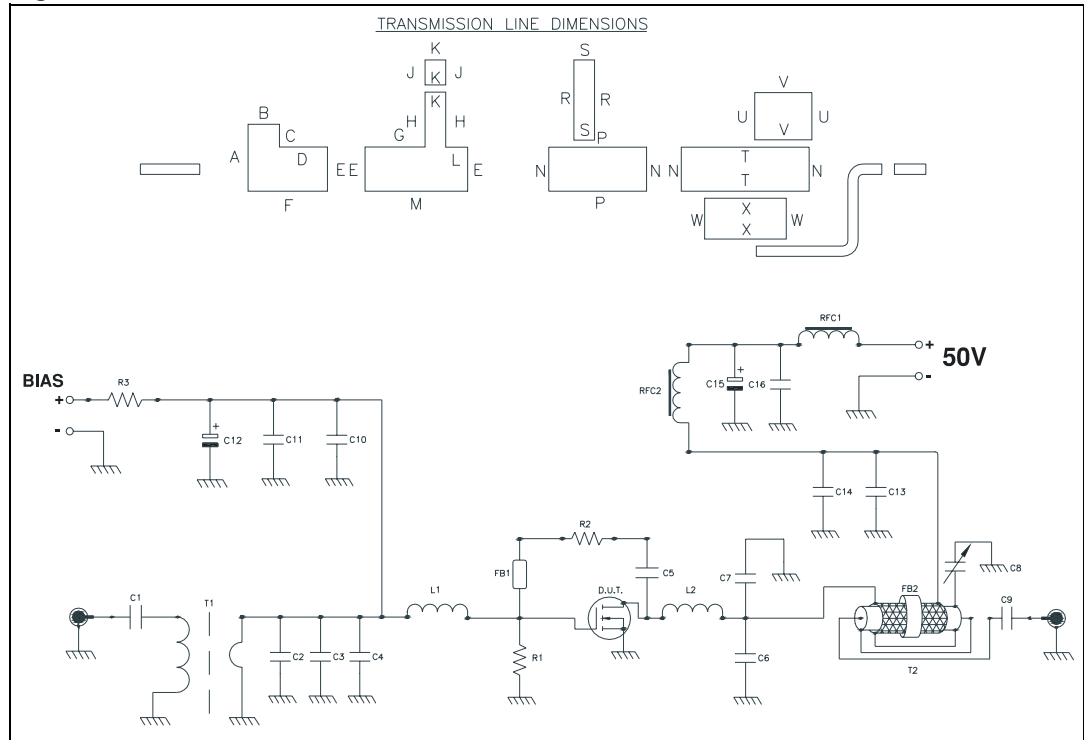


Table 7. Transmission line dimensions

| Dim. | Inch | mm |
|------|-------|-------|
| A | 0.532 | 13.51 |
| B | 0.250 | 6.35 |
| C | 0.181 | 4.59 |
| D | 0.383 | 9.37 |
| E | 0.351 | 8.91 |
| F | 0.633 | 16.08 |
| G | 0.477 | 12.12 |
| H | 0.438 | 11.12 |
| J | 0.200 | 5.08 |
| K | 0.164 | 4.16 |
| L | 0.174 | 4.42 |
| M | 0.817 | 20.75 |
| N | 0.350 | 8.89 |
| P | 0.779 | 19.79 |
| R | 0.639 | 16.23 |

Table 7. Transmission line dimensions (continued)

| Dim. | Inch | mm |
|------|-------|-------|
| S | 0.165 | 4.19 |
| T | 1.017 | 25.84 |
| U | 0.375 | 9.52 |
| V | 0.456 | 11.58 |
| W | 0.325 | 8.24 |
| X | 0.650 | 16.50 |

Table 8. 30 MHz test circuit component list

| Component | Description |
|--------------------|---|
| C1,C9 | 0.01 μ F / 500 V surface mount ceramic chip capacitor |
| C2, C3 | 750 pF ATC 700B surface mount ceramic chip capacitor |
| C4 | 300 pF ATC 700B surface mount ceramic chip capacitor |
| C5,C10,C11,C14,C16 | 10000 pF ATC 200B surface mount ceramic chip capacitor |
| C6 | 510 pF ATC 700B surface mount ceramic chip capacitor |
| C7 | 300 pF ATC 700B surface mount ceramic chip capacitor |
| C8 | 175-680 pF type 46 standard trimmer capacitor |
| C12 | 47 μ F / 63 V aluminum electrolytic radial lead capacitor |
| C13 | 1200 pF ATC 700B surface mount ceramic chip capacitor |
| C15 | 100 μ F / 63 V aluminum electrolytic radial lead capacitor |
| R1,R3 | 1 K OHM 1 W surface mount chip resistor |
| R2 | 560 OHM 2 W wire-wound axils lead resistor |
| T1 | HF 2-30 MHz surface mount 9:1 transformer |
| T2 | RG - 142B/U 50 OHM coaxial cable OD = 0.165[4.18] L 15"[381.00] covered with 15"[381.00] tinned copper tubular brand 13/65" [5.1] width |
| L1 | 1 3/4 turn air-wound 16 AWG ID = 0.219 [5.56] poly-coated magnet wire |
| L2 | 1 3/4 turn air-wound 12 AWG ID = 0.250 [6.34] bus bar wire |
| RFC1,RFC2 | 3 turns 14 AWG wire through ferrite toroid |
| FB1 | Surface mount EMI shield bead |
| FB2 | Toroid |
| PCB | ULTRALAM 2000. 0.030" THK, $\epsilon_r = 2.55$, 2 Oz ED CU both sides |

6 Circuit layout

Figure 13. Test fixture component layout

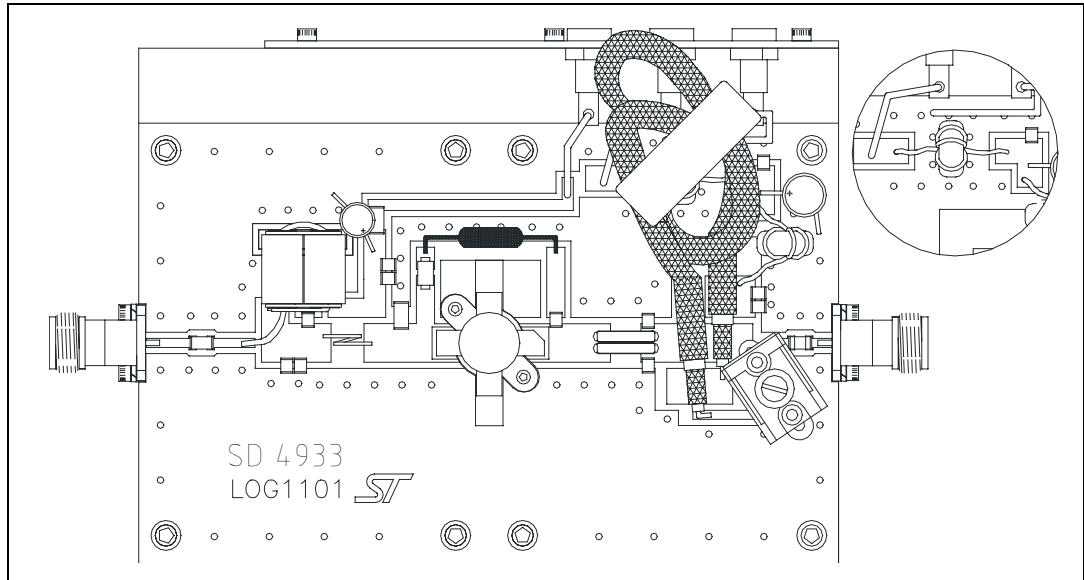
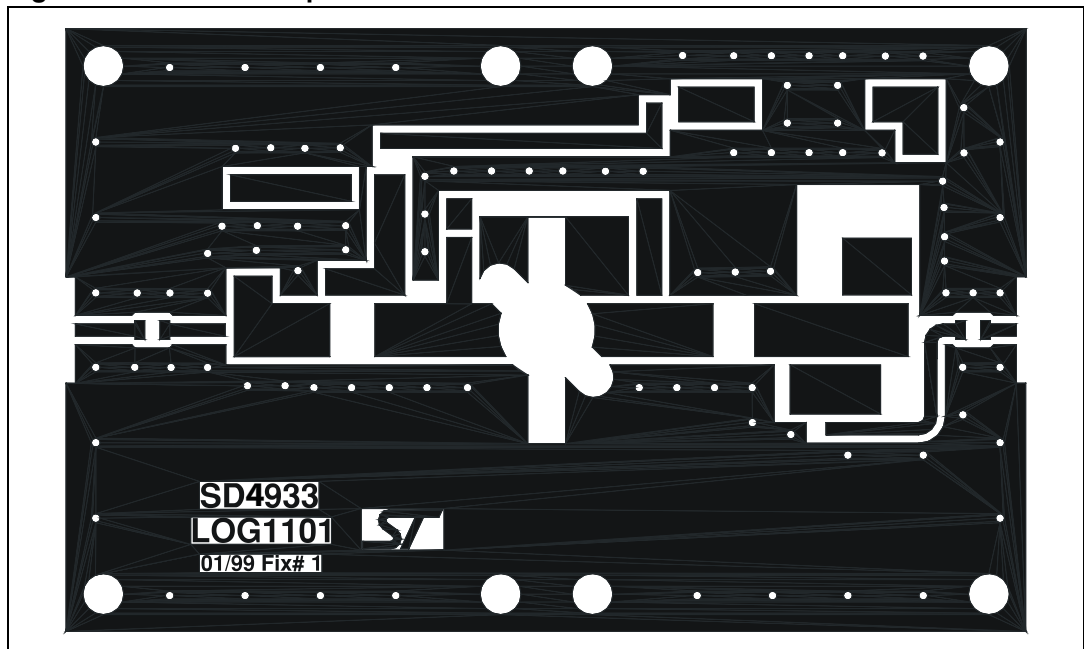


Figure 14. Test circuit photomasters



7 V_{GS}/G_{FS} sorts

Table 9. V_{GS}/G_{FS} sorts

| Marking | Vgs(min) | Vgs(max) | Gfs(min) | Gfs(max) |
|---------|----------|----------|----------|----------|
| A1 | 1.50 | 1.75 | 5 | 6 |
| A2 | 1.50 | 1.75 | 6 | 7 |
| A3 | 1.50 | 1.75 | 7 | 8 |
| A4 | 1.50 | 1.75 | 8 | 9 |
| A5 | 1.50 | 1.75 | 9 | 10 |
| A6 | 1.50 | 1.75 | 10 | 11 |
| A7 | 1.50 | 1.75 | 11 | 12 |
| A8 | 1.50 | 1.75 | 12 | 13 |
| A9 | 1.50 | 1.75 | 13 | 14 |
| B1 | 1.75 | 2.00 | 5 | 6 |
| B2 | 1.75 | 2.00 | 6 | 7 |
| B3 | 1.75 | 2.00 | 7 | 8 |
| B4 | 1.75 | 2.00 | 8 | 9 |
| B5 | 1.75 | 2.00 | 9 | 10 |
| B6 | 1.75 | 2.00 | 10 | 11 |
| B7 | 1.75 | 2.00 | 11 | 12 |
| B8 | 1.75 | 2.00 | 12 | 13 |
| B9 | 1.75 | 2.00 | 13 | 14 |
| C1 | 2.00 | 2.25 | 5 | 6 |
| C2 | 2.00 | 2.25 | 6 | 7 |
| C3 | 2.00 | 2.25 | 7 | 8 |
| C4 | 2.00 | 2.25 | 8 | 9 |
| C5 | 2.00 | 2.25 | 9 | 10 |
| C6 | 2.00 | 2.25 | 10 | 11 |
| C7 | 2.00 | 2.25 | 11 | 12 |
| C8 | 2.00 | 2.25 | 12 | 13 |
| C9 | 2.00 | 2.25 | 13 | 14 |
| D1 | 2.25 | 2.50 | 5 | 6 |
| D2 | 2.25 | 2.50 | 6 | 7 |
| D3 | 2.25 | 2.50 | 7 | 8 |
| D4 | 2.25 | 2.50 | 8 | 9 |
| D5 | 2.25 | 2.50 | 9 | 10 |

Table 9. VGS/GFS sorts (continued)

| Marking | Vgs(min) | Vgs(max) | Gfs(min) | Gfs(max) |
|---------|----------|----------|----------|----------|
| D6 | 2.25 | 2.50 | 10 | 11 |
| D7 | 2.25 | 2.50 | 11 | 12 |
| D8 | 2.25 | 2.50 | 12 | 13 |
| D9 | 2.25 | 2.50 | 13 | 14 |
| E1 | 2.50 | 2.75 | 5 | 6 |
| E2 | 2.50 | 2.75 | 6 | 7 |
| E3 | 2.50 | 2.75 | 7 | 8 |
| E4 | 2.50 | 2.75 | 8 | 9 |
| E5 | 2.50 | 2.75 | 9 | 10 |
| E6 | 2.50 | 2.75 | 10 | 11 |
| E7 | 2.50 | 2.75 | 11 | 12 |
| E8 | 2.50 | 2.75 | 12 | 13 |
| E9 | 2.50 | 2.75 | 13 | 14 |
| F1 | 2.75 | 3.00 | 5 | 6 |
| F2 | 2.75 | 3.00 | 6 | 7 |
| F3 | 2.75 | 3.00 | 7 | 8 |
| F4 | 2.75 | 3.00 | 8 | 9 |
| F5 | 2.75 | 3.00 | 9 | 10 |
| F6 | 2.75 | 3.00 | 10 | 11 |
| F7 | 2.75 | 3.00 | 11 | 12 |
| F8 | 2.75 | 3.00 | 12 | 13 |
| F9 | 2.75 | 3.00 | 13 | 14 |
| G1 | 3.00 | 3.25 | 5 | 6 |
| G2 | 3.00 | 3.25 | 6 | 7 |
| G3 | 3.00 | 3.25 | 7 | 8 |
| G4 | 3.00 | 3.25 | 8 | 9 |
| G5 | 3.00 | 3.25 | 9 | 10 |
| G6 | 3.00 | 3.25 | 10 | 11 |
| G7 | 3.00 | 3.25 | 11 | 12 |
| G8 | 3.00 | 3.25 | 12 | 13 |
| G9 | 3.00 | 3.25 | 13 | 14 |
| H1 | 3.25 | 3.50 | 5 | 6 |
| H2 | 3.25 | 3.50 | 6 | 7 |
| H3 | 3.25 | 3.50 | 7 | 8 |
| H4 | 3.25 | 3.50 | 8 | 9 |

Table 9. VGS/GFS sorts (continued)

| Marking | Vgs(min) | Vgs(max) | Gfs(min) | Gfs(max) |
|---------|----------|----------|----------|----------|
| H5 | 3.25 | 3.50 | 9 | 10 |
| H6 | 3.25 | 3.50 | 10 | 11 |
| H7 | 3.25 | 3.50 | 11 | 12 |
| H8 | 3.25 | 3.50 | 12 | 13 |
| H9 | 3.25 | 3.50 | 13 | 14 |
| I1 | 3.50 | 3.75 | 5 | 6 |
| I2 | 3.50 | 3.75 | 6 | 7 |
| I3 | 3.50 | 3.75 | 7 | 8 |
| I4 | 3.50 | 3.75 | 8 | 9 |
| I5 | 3.50 | 3.75 | 9 | 10 |
| I6 | 3.50 | 3.75 | 10 | 11 |
| I7 | 3.50 | 3.75 | 11 | 12 |
| I8 | 3.50 | 3.75 | 12 | 13 |
| I9 | 3.50 | 3.75 | 13 | 14 |
| J1 | 3.75 | 4.00 | 5 | 6 |
| J2 | 3.75 | 4.00 | 6 | 7 |
| J3 | 3.75 | 4.00 | 7 | 8 |
| J4 | 3.75 | 4.00 | 8 | 9 |
| J5 | 3.75 | 4.00 | 9 | 10 |
| J6 | 3.75 | 4.00 | 10 | 11 |
| J7 | 3.75 | 4.00 | 11 | 12 |
| J8 | 3.75 | 4.00 | 12 | 13 |
| J9 | 3.75 | 4.00 | 13 | 14 |

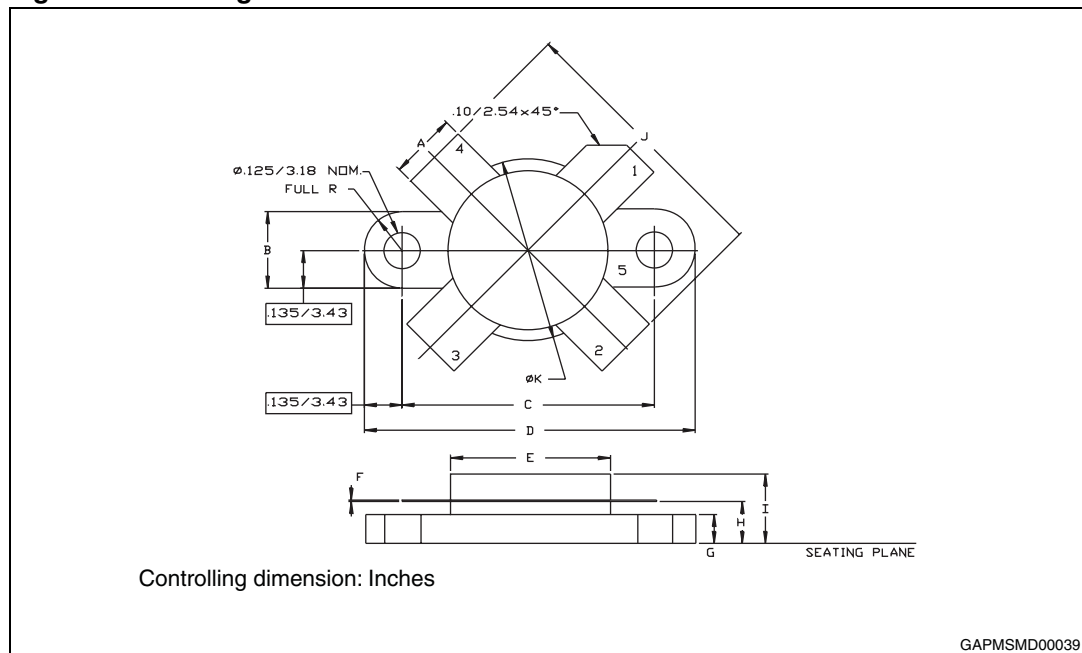
8 Package mechanical data

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

Table 10. M177 (.550 DIA 4/L N/HERM W/FLG) mechanical data

| Dim. | mm. | | | Inch | | |
|------|-------|-----|-------|-------|-----|-------|
| | Min | Typ | Max | Min | Typ | Max |
| A | 5.72 | | 5.97 | 0.225 | | 0.235 |
| B | 6.73 | | 6.96 | 0.265 | | 0.275 |
| C | 21.84 | | 22.10 | 0.860 | | 0.870 |
| D | 28.70 | | 28.96 | 1.130 | | 1.140 |
| E | 13.84 | | 14.10 | 0.545 | | 0.555 |
| F | 0.08 | | 0.18 | 0.003 | | 0.007 |
| G | 2.49 | | 2.74 | 0.098 | | 0.108 |
| H | 3.81 | | 4.32 | 0.150 | | 0.170 |
| I | | | 7.11 | | | 0.280 |
| J | 27.43 | | 28.45 | 1.080 | | 1.120 |
| K | 15.88 | | 16.13 | 0.625 | | 0.635 |

Figure 15. Package dimensions



9 Marking, packing and shipping specifications

Table 11. Packing and shipping specifications

| Order code | Packaging | Pcs per tray | Dry pack humidity | Vgs and Gfs code | Lot code |
|------------|--------------|--------------|-------------------|------------------|-----------|
| SD4933 | Plastic tray | 25 | < 10 % | Not mixed | Not mixed |

Figure 16. Marking layout

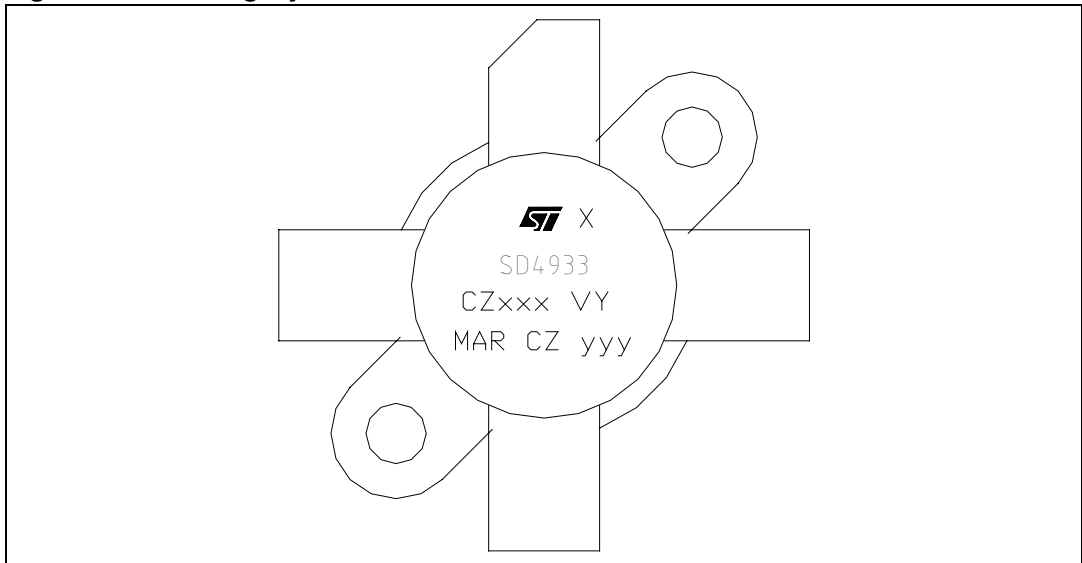


Table 12. Marking specifications

| Symbol | Description |
|--------|--|
| X | V _{GS} and G _{FS} sort |
| CZ | Assembly plant |
| xxx | Last 3 digits of diffusion lot |
| VY | Diffusion plant |
| MAR | Country of origin |
| CZ | Test and finishing plant |
| y | Assembly year |
| yy | Assembly week |

10 Revision history

Table 13. Document revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 11-Mar-2009 | 1 | Initial release |
| 24-Feb-2010 | 2 | Updated Table 9: VGS/GFS sorts on page 13 . |
| 29-Sep-2010 | 3 | Document status promoted from preliminary to datasheet. |
| 06-Apr-2011 | 4 | Inserted Section 3: Impedance data , Section 4: Typical performance , Section 6: Circuit layout and Section 9: Marking, packing and shipping specifications . |
| 24-May-2011 | 5 | Inserted Figure 6: Transient thermal impedance , Figure 7: Transient thermal impedance model and Section 9: Marking, packing and shipping specifications . |
| 11-Aug-2011 | 6 | <ul style="list-style-type: none">– E_{AS} parameter inserted in Table 2: Absolute maximum ratings on page 3.– Minor text changes. |

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