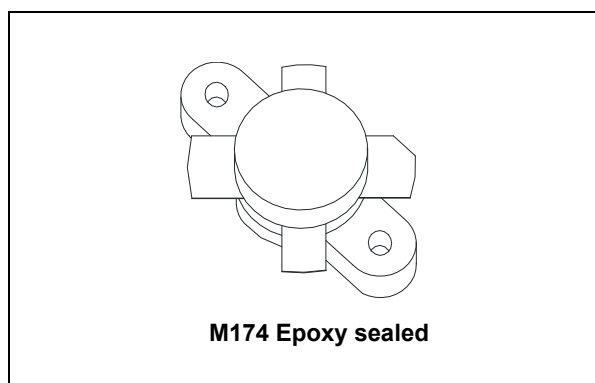
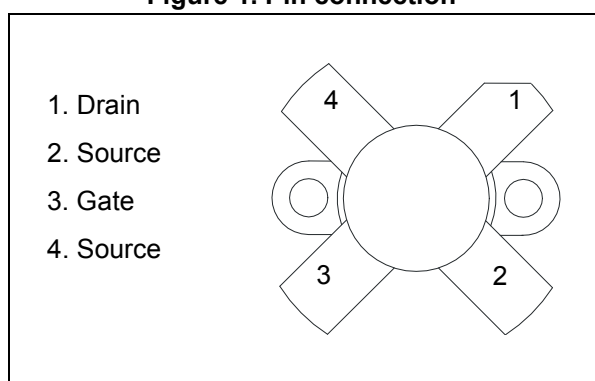


## HF/VHF/UHF RF power N-channel MOSFETs

Datasheet - production data



**Figure 1. Pin connection**



### Features

- Gold metallization
- Excellent thermal stability
- Common source configuration
- $P_{OUT} = 175 \text{ W min. with } 15 \text{ dB gain @ } 175 \text{ MHz, } 50 \text{ V}$
- $P_{OUT} = 135 \text{ W typ. with } 14 \text{ dB gain @ } 123 \text{ MHz, } 28 \text{ V}$
- Low  $R_{DS(on)}$
- Thermally enhanced packaging for lower junction temperatures
- In compliance with the 2002/95/EC1 European directive

### Description

The SD2941-10 is a gold metalized N-channel MOS field-effect RF power transistor, intended for use in 28 V to 50 V dc large signal applications up to 230 MHz. It offers 25% lower  $R_{DS(on)}$  than the industry standard, with 20% higher  $P_{SAT}$  than ST's SD2931-10 device. The SD2941-10 is housed in the low thermal M174 non-pedestal package, offering 25% lower thermal resistance than the industry standard, thus rendering it the "best-in-class" transistor for ISM applications, where reliability and ruggedness are critical factor.

**Table 1. Device summary**

| Order code | Marking                  | Base qty. | Package | Packaging <sup>(1)</sup> |
|------------|--------------------------|-----------|---------|--------------------------|
| SD2941-10W | SD2941-10 <sup>(1)</sup> | 25 pcs    | M174    | Plastic tray             |

1. For more details please refer to [Chapter 7: Marking, packing and shipping specifications](#).

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# 1 Electrical data

## 1.1 Maximum rating

( $T_{CASE} = 25\text{ °C}$ )

**Table 2. Absolute maximum rating**

| Symbol              | Parameter                                  | Value       | Unit |
|---------------------|--------------------------------------------|-------------|------|
| $V_{(BR)DSS}^{(1)}$ | Drain source voltage                       | 130         | V    |
| $V_{DGR}^{(1)}$     | Drain-gate voltage ( $R_{GS} = 1M\Omega$ ) | 130         | V    |
| $V_{GS}$            | Gate-source voltage                        | $\pm 40$    | V    |
| $I_D$               | Drain current                              | 20          | A    |
| $P_{DISS}$          | Power dissipation                          | 389         | W    |
| $T_J$               | Max. operating junction temperature        | 200         | °C   |
| $T_{STG}$           | Storage temperature                        | -65 to +150 | °C   |

1.  $T_J = 150\text{ °C}$

**Table 3. Thermal data**

| Symbol     | Parameter                           | Value | Unit |
|------------|-------------------------------------|-------|------|
| $R_{thJC}$ | Junction to case thermal resistance | 0.45  | °C/W |

## 2 Electrical characteristics

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

**Table 4. Static**

| Symbol              | Test conditions        |                          | Min. | Typ. | Max. | Unit |
|---------------------|------------------------|--------------------------|------|------|------|------|
| $V_{(BR)DSS}^{(1)}$ | $V_{GS} = 0\text{ V}$  | $I_{DS} = 100\text{ mA}$ | 130  |      |      | V    |
| $I_{DSS}$           | $V_{GS} = 0\text{ V}$  | $V_{DS} = 50\text{ V}$   |      |      | 50   | mA   |
| $I_{GSS}$           | $V_{GS} = 20\text{ V}$ | $V_{DS} = 0\text{ V}$    |      |      | 250  | nA   |
| $V_{GS(Q)}^{(2)}$   | $V_{DS} = 10\text{ V}$ | $I_D = 250\text{ mA}$    |      |      |      | V    |
| $V_{DS(ON)}$        | $V_{GS} = 10\text{ V}$ | $I_D = 10\text{ A}$      |      |      | 2.0  | V    |
| $G_{FS}$            | $V_{DS} = 10\text{ V}$ | $I_D = 5\text{ A}$       | 5    | 6    |      | mho  |
| $C_{ISS}$           | $V_{GS} = 0\text{ V}$  | $V_{DS} = 50\text{ V}$   |      | 415  |      | pF   |
| $C_{OSS}$           | $V_{GS} = 0\text{ V}$  | $V_{DS} = 50\text{ V}$   |      | 236  |      | pF   |
| $CRSS$              | $V_{GS} = 0\text{ V}$  | $V_{DS} = 50\text{ V}$   |      | 17   |      | pF   |

1.  $T_J = 150\text{ }^{\circ}\text{C}$

2.  $V_{GS(Q)}$  sorted with alpha/numeric code marked on unit.

**Table 5. Dynamic**

| Symbol        | Test conditions                                                                                                   | Min. | Typ. | Max. | Unit |
|---------------|-------------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $P_{OUT}$     | $V_{DD} = 28\text{ V}$ $I_{DQ} = 250\text{ mA}$ $f = 123\text{ MHz}$                                              |      | 135  | -    | W    |
|               | $V_{DD} = 50\text{ V}$ $I_{DQ} = 250\text{ mA}$ $f = 175\text{ MHz}$                                              | 175  | 200  |      |      |
| $G_{PS}$      | $V_{DD} = 28\text{ V}$ $I_{DQ} = 250\text{ mA}$ $P_{OUT} = 135\text{ W}$ $f = 123\text{ MHz}$                     |      | 14   |      | dB   |
|               | $V_{DD} = 50\text{ V}$ $I_{DQ} = 250\text{ mA}$ $P_{OUT} = 175\text{ W}$ $f = 175\text{ MHz}$                     | 14   | 15.8 |      |      |
| $h_D$         | $V_{DD} = 28\text{ V}$ $I_{DQ} = 250\text{ mA}$ $P_{OUT} = 135\text{ W}$ $f = 123\text{ MHz}$                     |      | 65   |      | %    |
|               | $V_{DD} = 50\text{ V}$ $I_{DQ} = 250\text{ mA}$ $P_{OUT} = 175\text{ W}$ $f = 175\text{ MHz}$                     | 55   | 65   |      |      |
| Load Mismatch | $V_{DD} = 50\text{ V}$ $I_{DQ} = 250\text{ mA}$ $P_{OUT} = 175\text{ W}$ $f = 175\text{ MHz}$<br>All phase angles | 10:1 |      |      | VSWR |
|               | $V_{DD} = 28\text{ V}$ $I_{DQ} = 250\text{ mA}$ $P_{OUT} = 135\text{ W}$ $f = 123\text{ MHz}$<br>All phase angles | 25:1 |      |      |      |

Table 6.  $V_{GS}$  sorts

| Symbol | Value     | Symbol | Value     | Symbol | Value     |
|--------|-----------|--------|-----------|--------|-----------|
| AA     | 1.5 - 1.6 | E      | 2.4 - 2.5 | P      | 3.3 - 3.4 |
| BB     | 1.6 - 1.7 | F      | 2.5 - 2.6 | Q      | 3.4 - 3.5 |
| CC     | 1.7 - 1.8 | G      | 2.6 - 2.7 | R      | 3.5 - 3.6 |
| DD     | 1.8 - 1.9 | H      | 2.7 - 2.8 | S      | 3.6 - 3.7 |
| EE     | 1.9 - 2.0 | J      | 2.8 - 2.9 | T      | 3.7 - 3.8 |
| A      | 2.0 - 2.1 | K      | 2.9 - 3.0 | U      | 3.8 - 3.9 |
| B      | 2.1 - 2.2 | L      | 3.0 - 3.1 | V      | 3.9 - 4.0 |
| C      | 2.2 - 2.3 | M      | 3.1 - 3.2 |        |           |
| D      | 2.3 - 2.4 | N      | 3.2 - 3.3 |        |           |

3 Impedance

Figure 2. Impedance data schematic

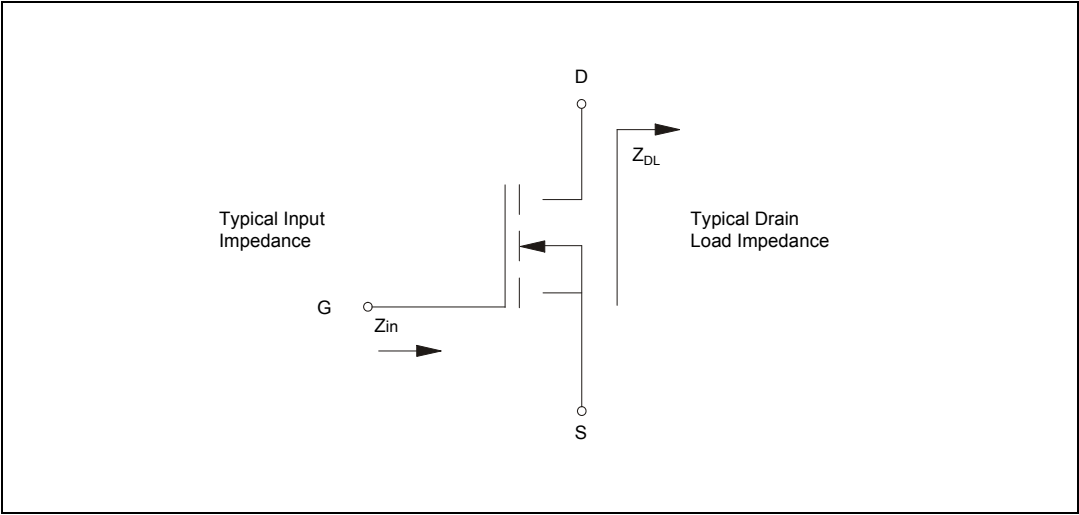


Table 7. Impedance data @ 28 V

| f       | $Z_{IN}$ ( $\Omega$ ) | $Z_{DL}$ (100W) ( $\Omega$ ) | $Z_{DL}$ (140W) ( $\Omega$ ) |
|---------|-----------------------|------------------------------|------------------------------|
| 123 MHz | 1.2 - j 3.3           | 2.0 + j 1.4                  | 2.0 + j 0.73                 |

Table 8. Impedance data @ 50 V

| f       | $Z_{IN}$ ( $\Omega$ ) | $Z_{DL}$ ( $\Omega$ ) |
|---------|-----------------------|-----------------------|
| 30 MHz  | 1.7 - j 5.7           | 6.8 + j 0.9           |
| 175 MHz | 1.2 - j 2.0           | 2.0 + j 2.4           |

4 Typical performance

Figure 3. Capacitance vs drain voltage

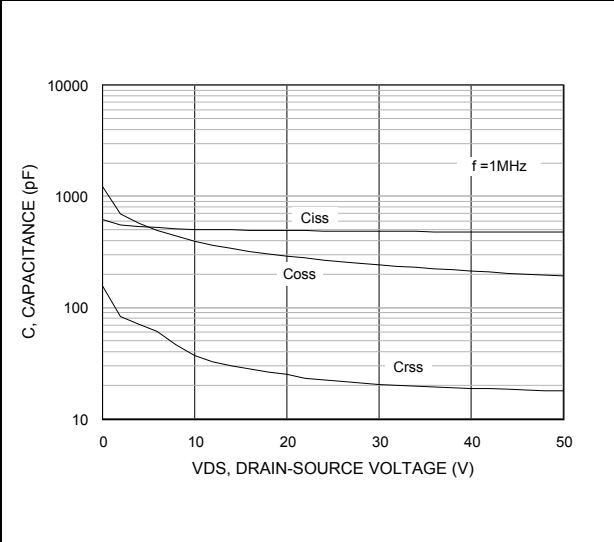


Figure 4. Drain current vs gate voltage

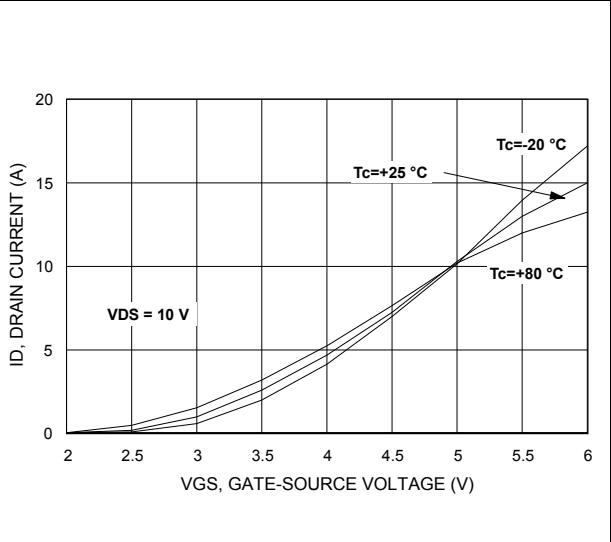


Figure 5. Maximum thermal resistance vs case temperature

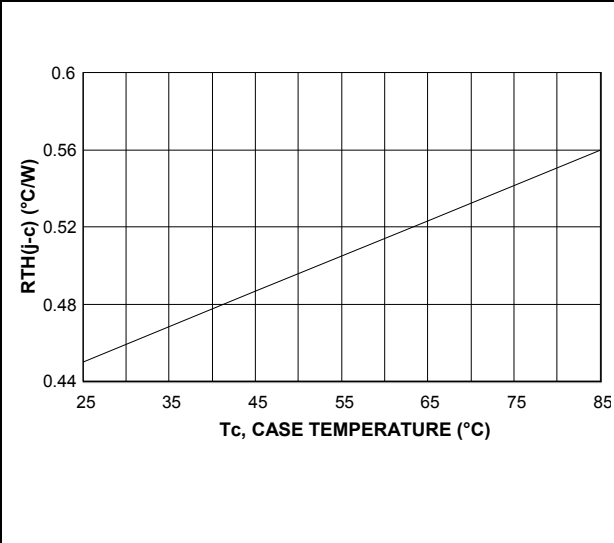


Figure 6. Safe operating area

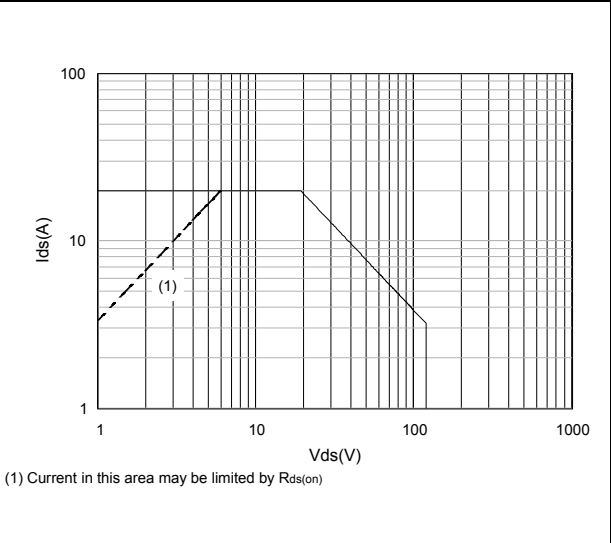


Figure 7. Power gain vs output power

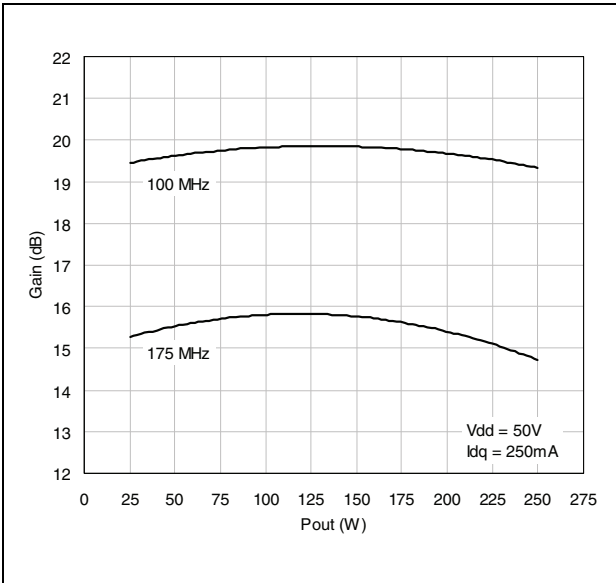


Figure 8. Efficiency vs output power

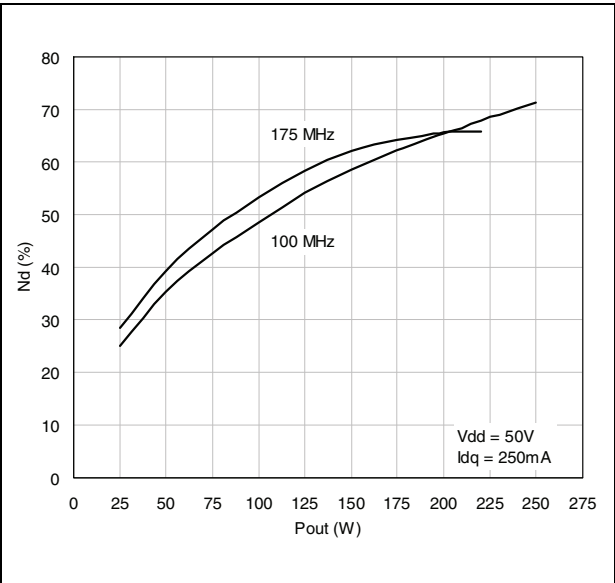


Figure 9. Input return loss vs output power

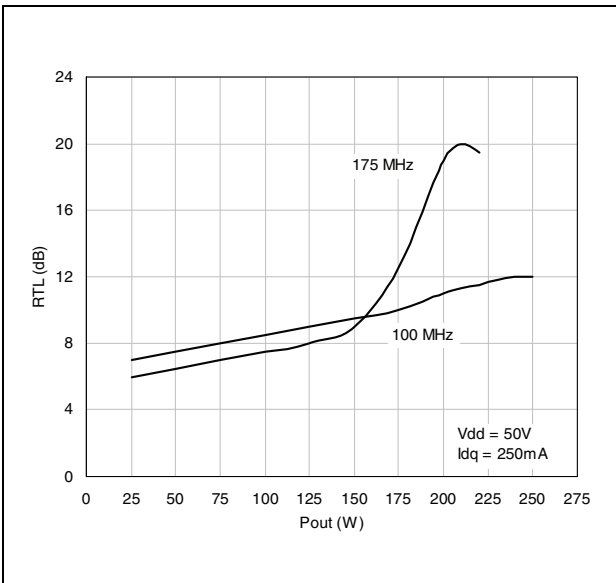


Figure 10. Gain and efficiency vs output power @ 28V and 100W load line

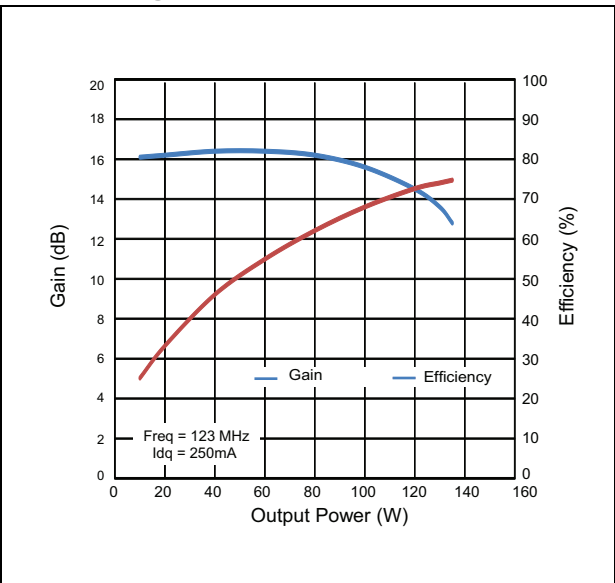
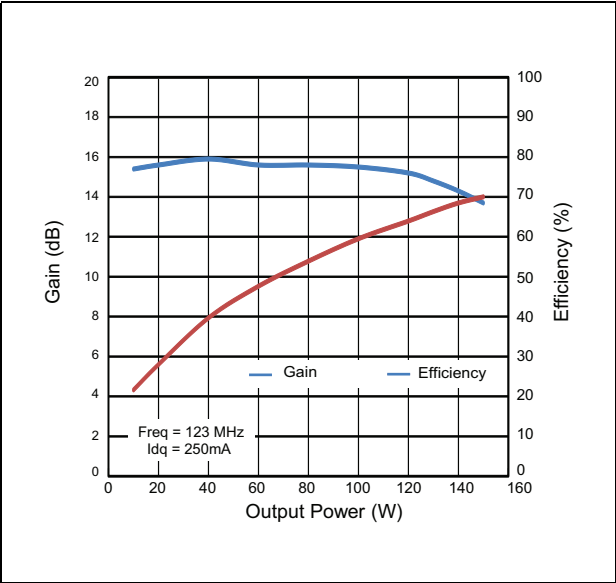


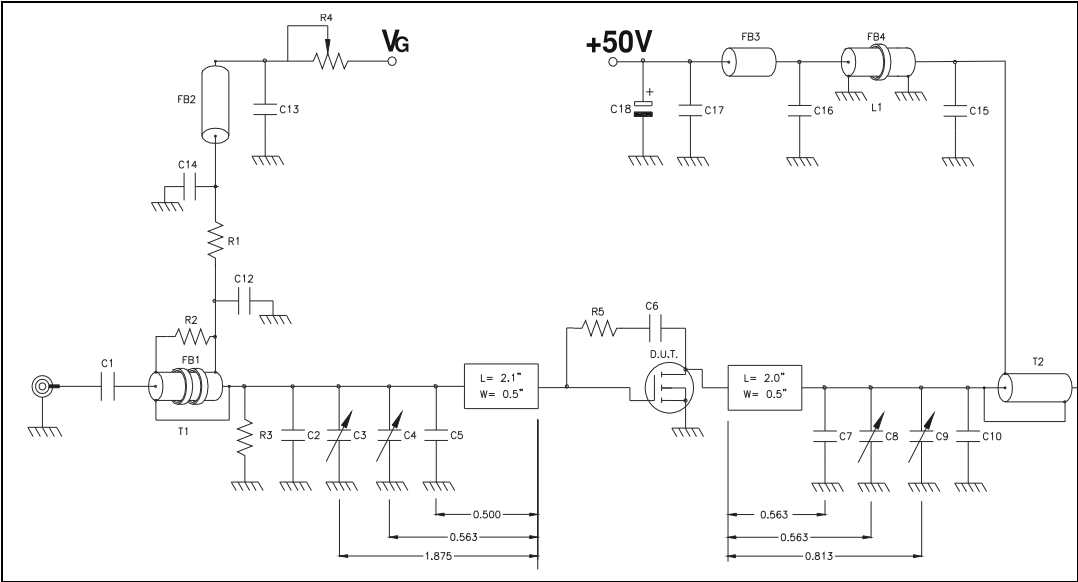


Figure 11. Gain and efficiency vs output power  
@ 28V and 140W load line



# 5 Test circuit

Figure 12. 30 MHz test circuit schematic (engineering test circuit)



Note: All dimension are in inches.

Table 9. 30 MHz test circuit component part list

| Symbol     | Description                                                        |
|------------|--------------------------------------------------------------------|
| T2         | 1:4 transformer, 25 $\Omega$ semi-rigid coax.141 OD 6" Long        |
| FB1        | Toroid X 2, 0.5" OD.312" ID 850 $\mu$ 2 turns                      |
| FB2, FB3   | VK200                                                              |
| FB4        | Shield bead, 1" OD 0.5" ID 850 $\mu$ 3 Turns                       |
| L1         | 1/4 Wave Choke, 50W Semi-rigid coax.141 OD 12" Long                |
| PCB        | 0.62" woven fiberglass, 1 oz. copper, 2 sides, $\epsilon_r = 2.55$ |
| R1, R3     | 470 $\Omega$ 1 W chip resistor                                     |
| R2         | 360 $\Omega$ 1/2 W resistor                                        |
| R4         | 20 K $\Omega$ 10 turn potentiometer                                |
| R5         | 560 $\Omega$ 1 W resistor                                          |
| C1, C11    | 470 pF ATC chip cap                                                |
| C2         | 43 pF ATC chip cap                                                 |
| C3, C8, C9 | Arco 404, 12-65 pF                                                 |
| C4         | Arco 423, 16-100 pF                                                |
| C5         | 120 pF ATC chip cap                                                |
| C6         | 0.01 $\mu$ F ATC chip cap                                          |
| C7         | 30 pF ATC chip cap                                                 |

Table 9. 30 MHz test circuit component part list (continued)

| Symbol            | Description                       |
|-------------------|-----------------------------------|
| C10               | 91 pF ATC chip cap                |
| C12, C15          | 1200 pF ATC chip cap              |
| C13, C14,C16, C17 | 0.01 mF / 500 V chip cap          |
| C18               | 10 mF 63 V electrolytic capacitor |

Figure 13. 175 MHz test circuit photomaster

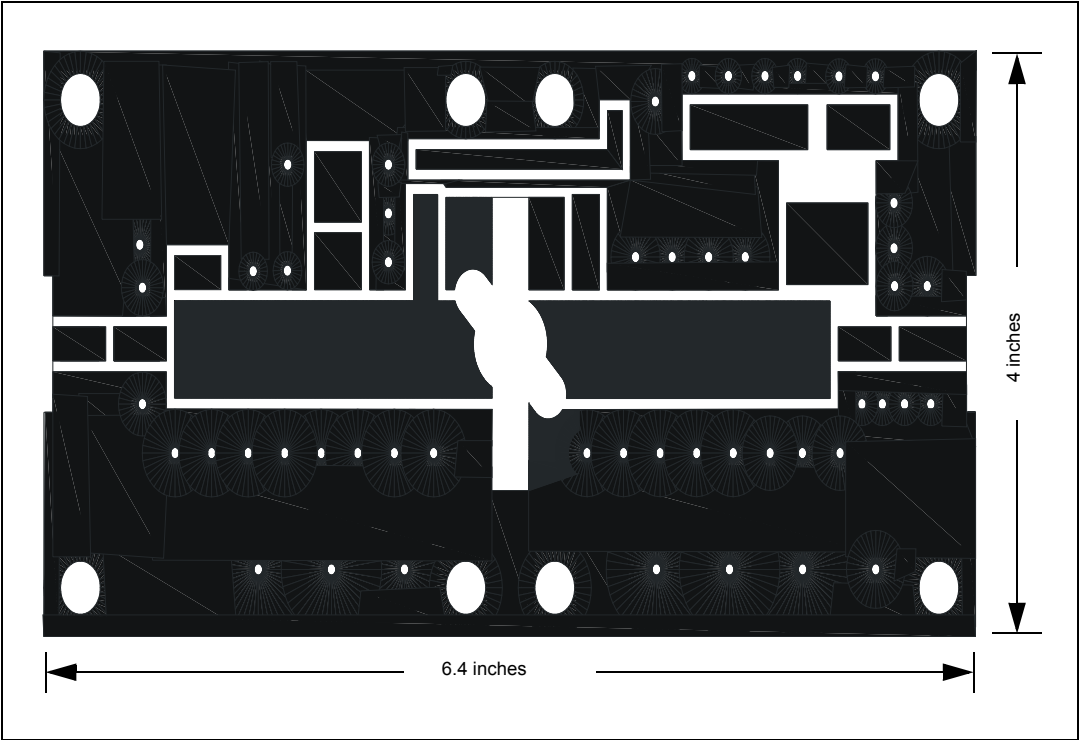
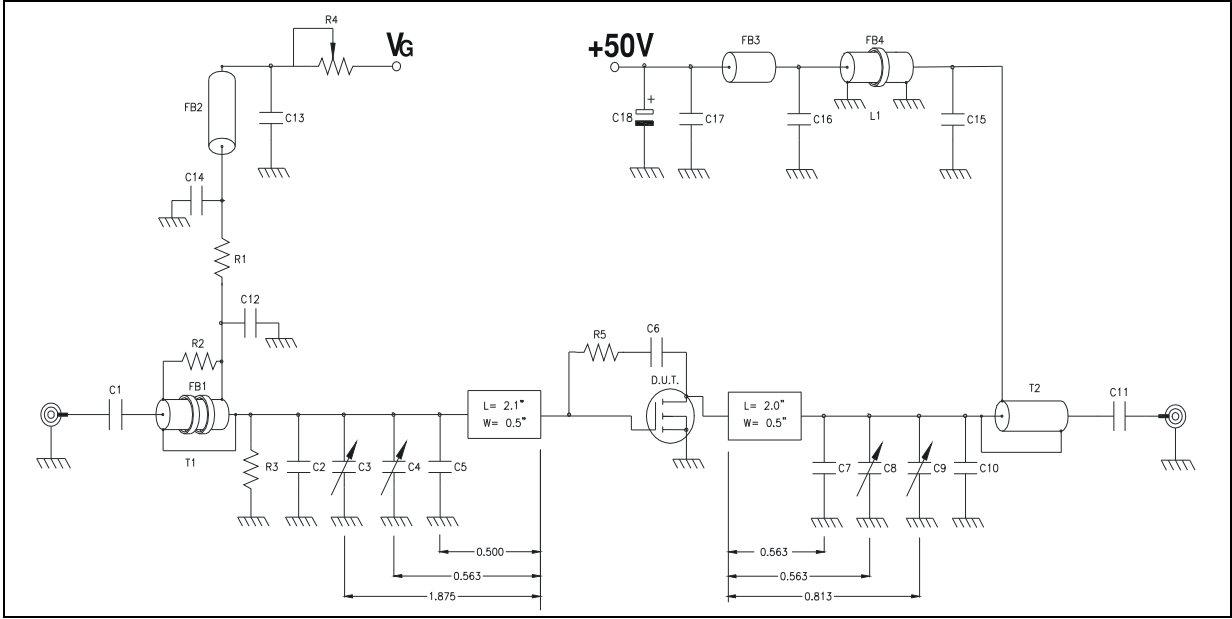


Figure 14. 175 MHz test circuit



## 6 Package information

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](http://www.st.com). ECOPACK® is an ST trademark.

**Figure 15. M174 package dimensions**

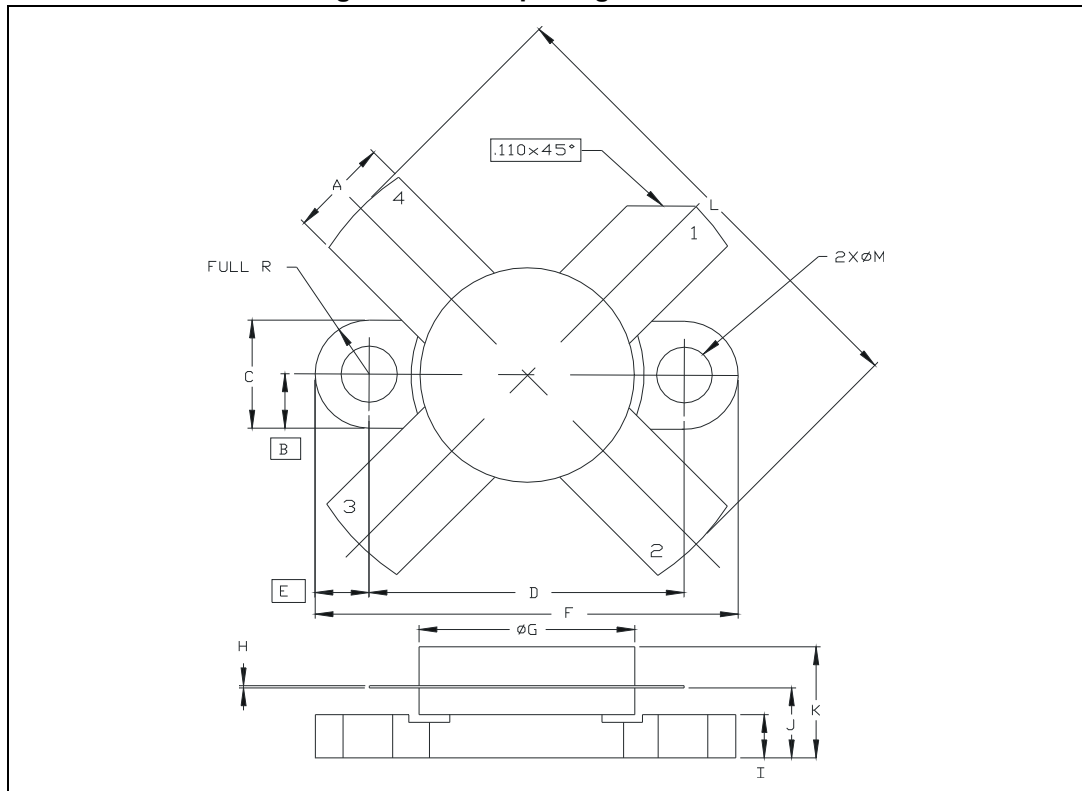


Table 10. M174 (.500 DIA 4/L N/HERM W/FLG)

| DIM. | mm.   |      |       | inch  |       |       |
|------|-------|------|-------|-------|-------|-------|
|      | min.  | typ. | max   | min.  | typ.  | max   |
| A    | 5.56  |      | 5.584 | 0.219 |       | 0.230 |
| B    |       | 3.18 |       |       | 0.125 |       |
| C    | 6.22  |      | 6.48  | 0.245 |       | 0.255 |
| D    | 18.28 |      | 18.54 | 0.720 |       | 0.730 |
| E    |       | 3.18 |       |       | 0.125 |       |
| F    | 24.64 |      | 24.89 | 0.970 |       | 0.980 |
| G    | 12.57 |      | 12.83 | 0.495 |       | 0.505 |
| H    | 0.08  |      | 0.18  | 0.003 |       | 0.007 |
| I    | 2.11  |      | 3.00  | 0.083 |       | 0.118 |
| J    | 3.81  |      | 4.45  | 0.150 |       | 0.175 |
| K    |       |      | 7.11  |       |       | 0.280 |
| L    | 25.53 |      | 26.67 | 1.005 |       | 1.050 |
| M    | 3.05  |      | 3.30  | 0.120 |       | 0.130 |

## 7 Marking, packing and shipping specifications

Table 11. Packing and shipping specifications

| Order code | Packaging    | Pcs per tray | Dry pack humidity | V <sub>GS</sub> code | Lot code  |
|------------|--------------|--------------|-------------------|----------------------|-----------|
| SD2941-10W | Plastic tray | 25           | < 10%             | Not mixed            | Not mixed |

Figure 16. Marking layout

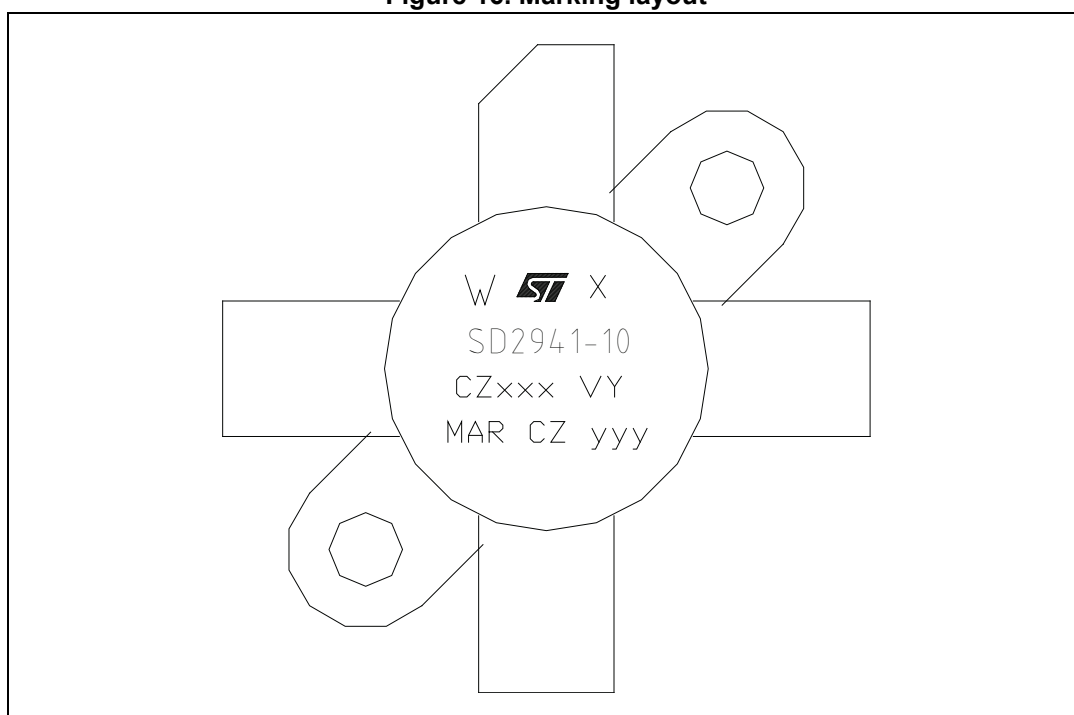


Table 12. Marking specifications

| Symbol | Description                   |
|--------|-------------------------------|
| W      | Wafer process code            |
| X      | V <sub>GS</sub> sort          |
| CZ     | Assembly plant                |
| xxx    | Last 3 digit of diffusion lot |
| VY     | Diffusion plant               |
| MAR    | Country of origin             |
| CZ     | Test and finishing plant      |
| y      | Assembly year                 |
| yy     | Assembly week                 |

## 8 Revision history

**Table 13. Document revision history**

| Date        | Revision | Changes                                                                                                                                                 |
|-------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15-Nov-2005 | 1        | Initial release                                                                                                                                         |
| 06-Apr-2006 | 2        | Complete version                                                                                                                                        |
| 13-Apr-2006 | 3        | V <sub>DS(ON)</sub> updated                                                                                                                             |
| 19-Oct-2011 | 4        | Inserted <a href="#">Section 7: Marking, packing and shipping specifications</a> .<br>Minor text changes in the title and description on the coverpage. |
| 04-Aug-2014 | 5        | Added performances at 28 V.                                                                                                                             |
| 14-Aug-2015 | 6        | Updated <a href="#">Table 2.: Absolute maximum rating</a> .<br>Minor text changes.                                                                      |



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