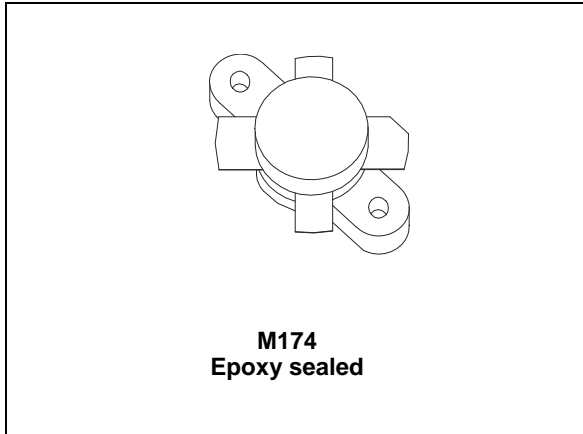


## RF power transistor: HF/VHF/UHF N-channel power MOSFETs

Datasheet - production data



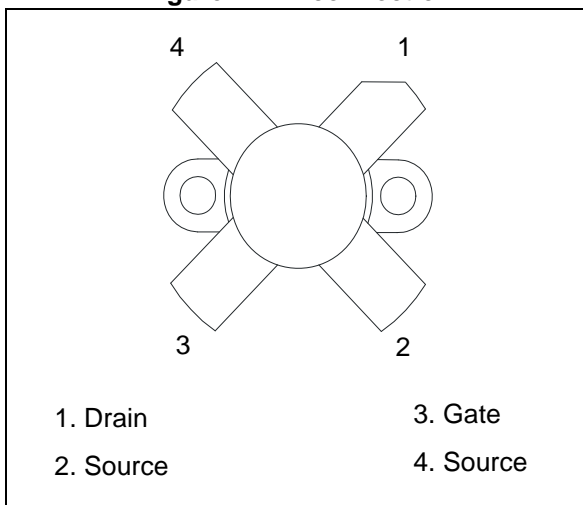
- $P_{OUT} = 150\text{ W}$  min. with 14 dB gain @ 175 MHz
- Thermally enhanced packaging for lower junction temperatures

### Description

The SD2931-10 is a gold metalized N-channel MOS field-effect RF power transistor. Being electrically identical to the standard SD2931 MOSFET, it is intended for use in 50 V dc large signal applications up to 230 MHz.

The SD2931-10 is mechanical compatible to the SD2931 but offers in addition a better thermal capability (25% lower thermal resistance), representing the best-in-class transistors for ISM applications, where reliability and ruggedness are critical factors.

**Figure 1. Pin connection**



### Features

- Gold metalization
- Excellent thermal stability
- Common source configuration

**Table 1. Device summary**

Order code	Marking	Base qty.	Package	Packaging <sup>(1)</sup>
SD2931-10W	SD2931-10	25 pcs	M174	Plastic tray

1. For more details please refer to [Chapter 11: 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
$V_{(BR)DSS}^{(1)}$	Drain source voltage	125	V
$V_{DGR}$	Drain-gate voltage ( $R_{GS} = 1\text{ M}\Omega$ )	125	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	$^{\circ}\text{C}$
$T_{STG}$	Storage temperature	-65 to +150	$^{\circ}\text{C}$

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

## 1.2 Thermal data

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thJC}$	Junction - case thermal resistance	0.45	$^{\circ}\text{C/W}$

## 2 Electrical characteristics

( $T_{CASE} = 25\text{ °C}$ ).

### 2.1 Static

Table 4. Static (per side)

Symbol	Test conditions			Min	Typ	Max	Unit
$V_{(BR)DSS}$	$V_{GS} = 0$	$I_{DS} = 100\text{ mA}$		125			V
$I_{DSS}$	$V_{GS} = 0$	$V_{DS} = 50\text{ V}$				50	$\mu\text{A}$
$I_{GSS}$	$V_{GS} = 20$	$V_{DS} = 0$				250	nA
$V_{GS(Q)}^{(1)}$	$V_{DS} = 10\text{ V}$	$I_D = 250\text{ mA}$		See table below			V
$V_{DS(ON)}$	$V_{GS} = 10\text{ V}$	$I_D = 10\text{ A}$				3.0	V
$G_{FS}$	$V_{DS} = 10\text{ V}$	$I_D = 5\text{ A}$		5	6		mho
$C_{ISS}$	$V_{GS} = 0$	$V_{DS} = 50\text{ V}$	$f = 1\text{ MHz}$		480		pF
$C_{OSS}$	$V_{GS} = 0$	$V_{DS} = 50\text{ V}$	$f = 1\text{ MHz}$		190		pF
$CR_{SS}$	$V_{GS} = 0$	$V_{DS} = 50\text{ V}$	$f = 1\text{ MHz}$		18		pF

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

### 2.2 Dynamic

Table 5. Dynamic

Symbol	Test conditions			Min	Typ	Max	Unit
$P_{OUT}$	$V_{DD} = 50\text{ V}$	$I_{DQ} = 250\text{ mA}$	$f = 175\text{ MHz}$	150			W
$G_{PS}$	$V_{DD} = 50\text{ V}$	$I_{DQ} = 250\text{ mA}$	$P_{OUT} = 150\text{ W}$	14	15		dB
$\eta_D$	$V_{DD} = 50\text{ V}$	$I_{DQ} = 250\text{ mA}$	$P_{OUT} = 150\text{ W}$	55	65		%
Load mismatch	$V_{DD} = 50\text{ V}$	$I_{DQ} = 250\text{ mA}$	$P_{OUT} = 150\text{ W}$	10:1			VSWR
	All phase angles						

Table 6.  $V_{GS}$  sorts

Symbol	Value	Symbol	Value
A	2.0 - 2.1	K	2.9 - 3.0
B	2.1 - 2.2	L	3.0 - 3.1
C	2.2 - 2.3	M	3.1 - 3.2
D	2.3 - 2.4	N	3.2 - 3.3
E	2.4 - 2.5	P	3.3 - 3.4
F	2.5 - 2.6	Q	3.4 - 3.5
G	2.6 - 2.7	R	3.5 - 3.6
H	2.7 - 2.8	S	3.6 - 3.7
J	2.8 - 2.9		

### 3 Transient thermal impedance

Figure 2. Transient thermal impedance

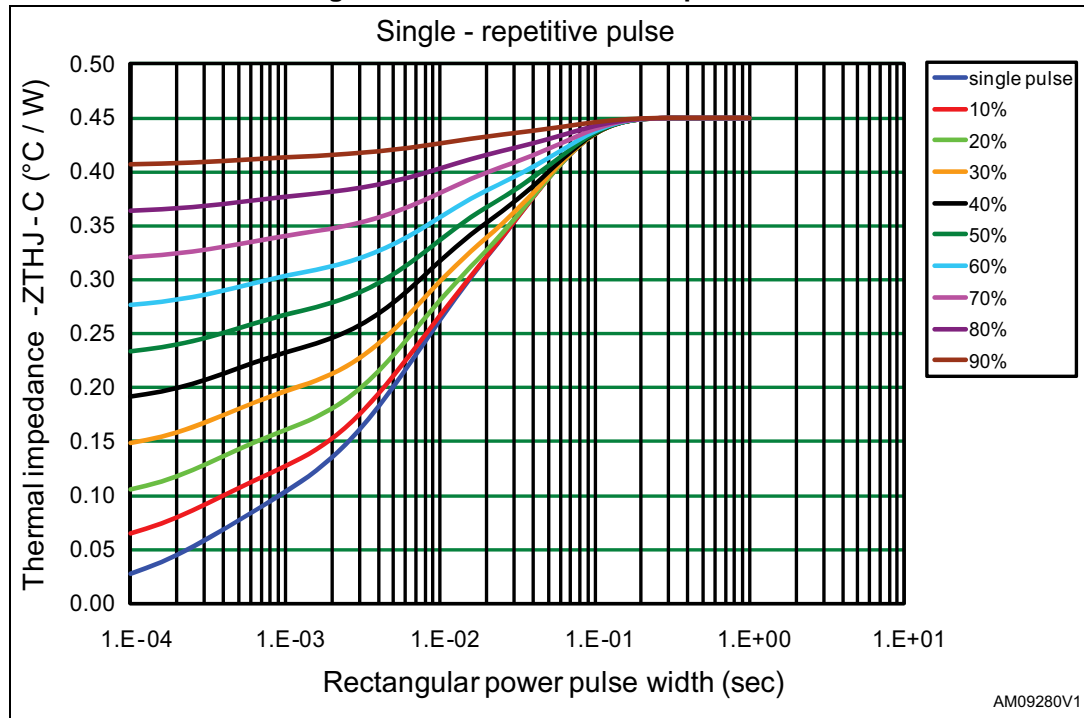
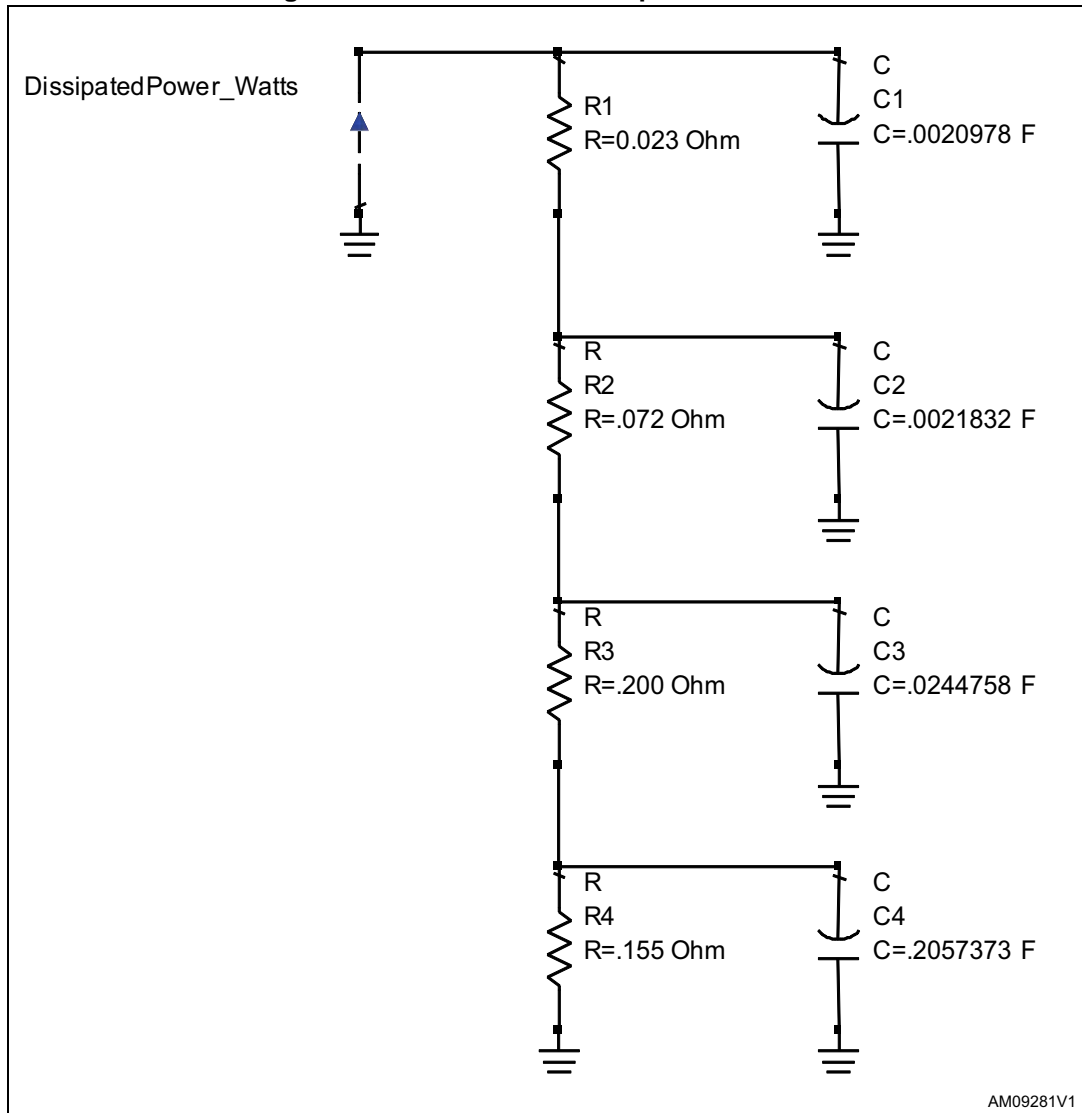


Figure 3. Transient thermal impedance model



## 4 Impedance data

Figure 4. Impedance data

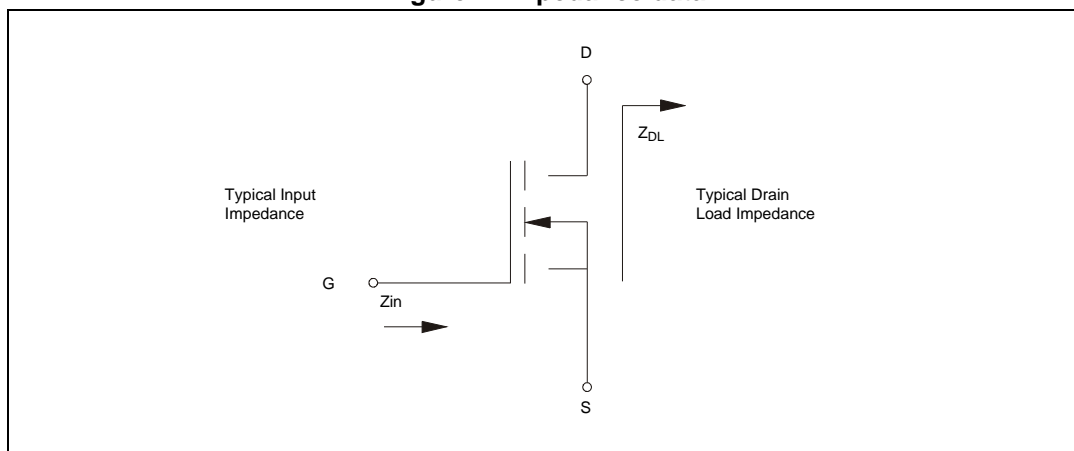


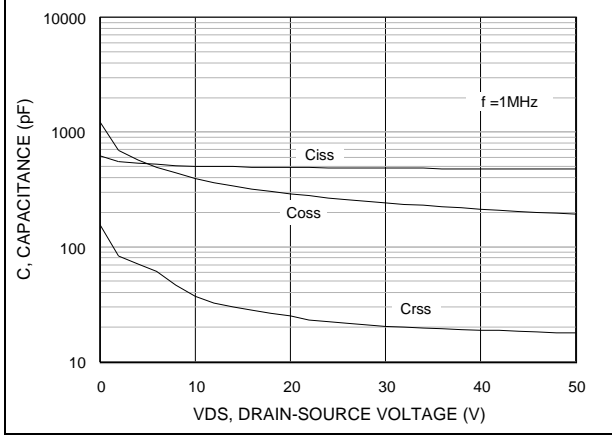
Table 7. Impedance data

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

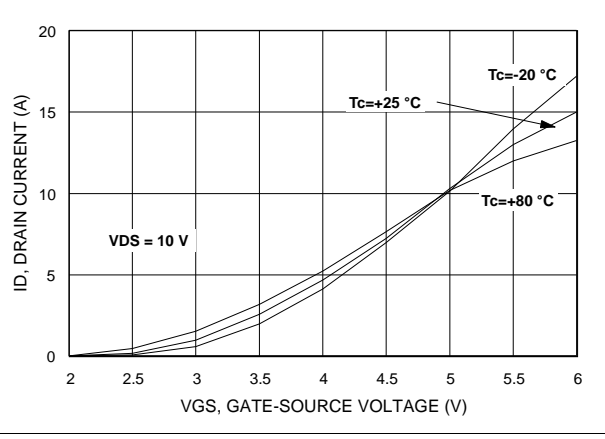


# 5 Typical performance

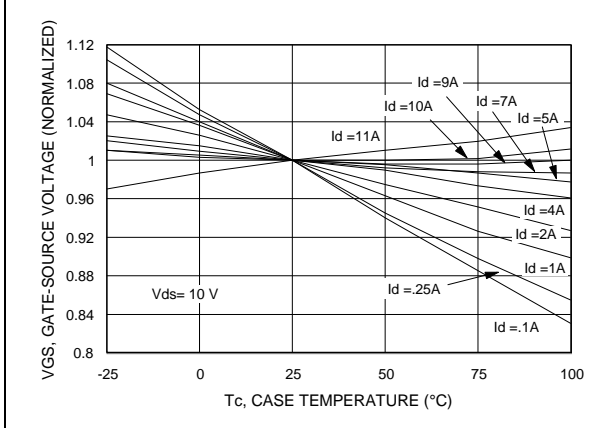
**Figure 5. Capacitance vs drain-source voltage**



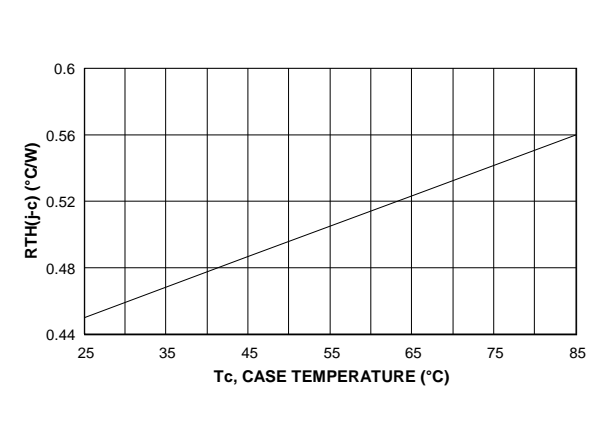
**Figure 6. Drain current vs gate voltage**



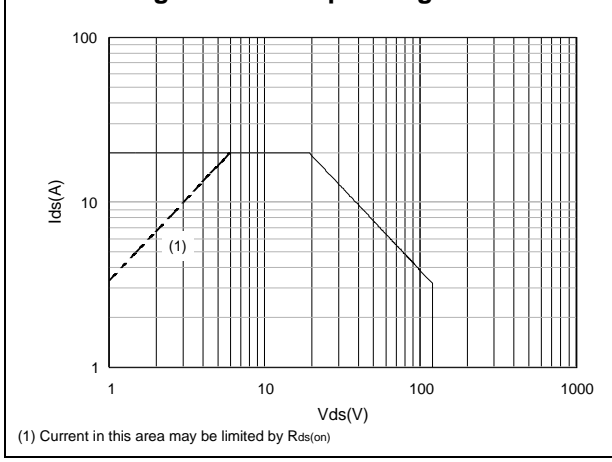
**Figure 7. Gate-source voltage vs case temperature**



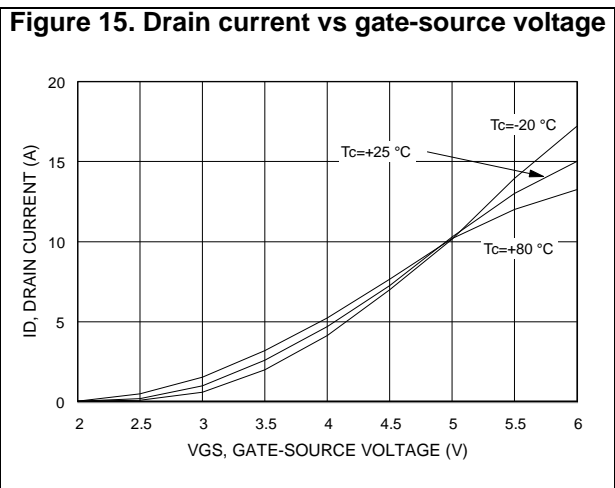
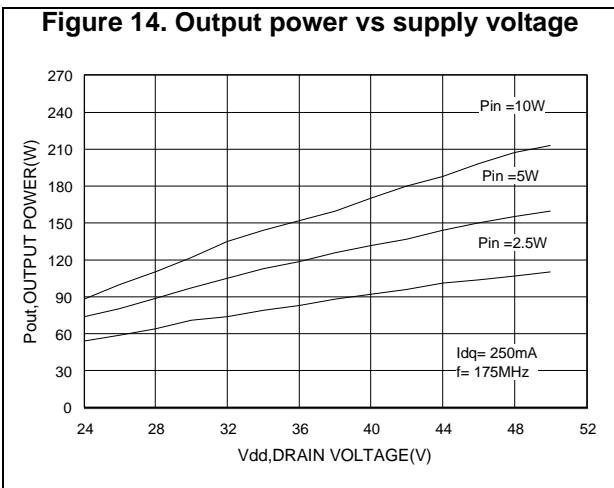
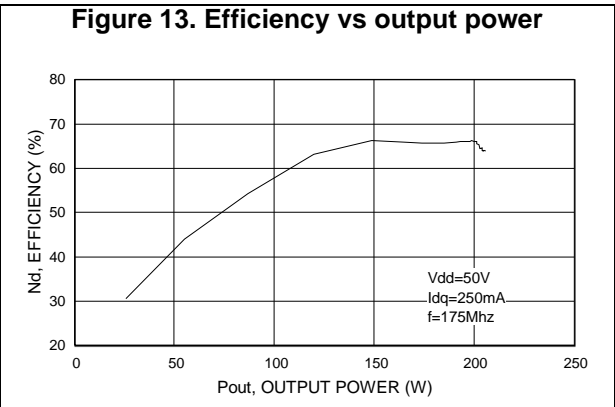
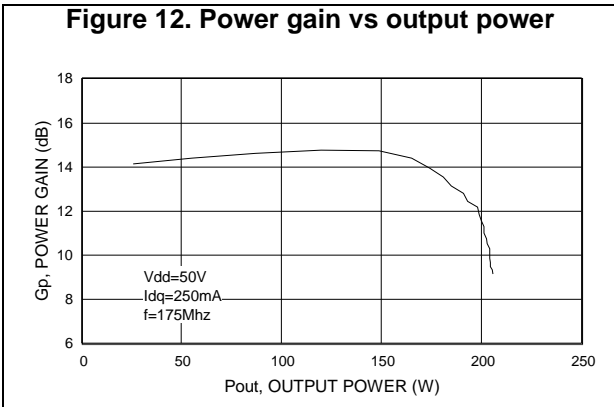
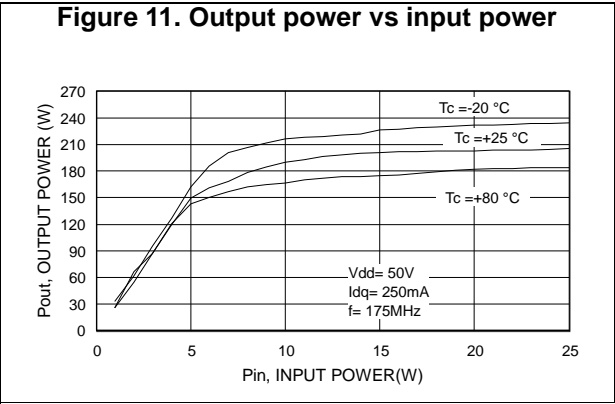
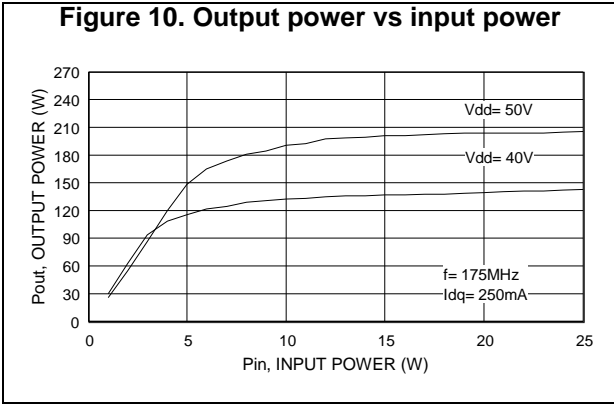
**Figure 8. Maximum thermal resistance vs case temperature**



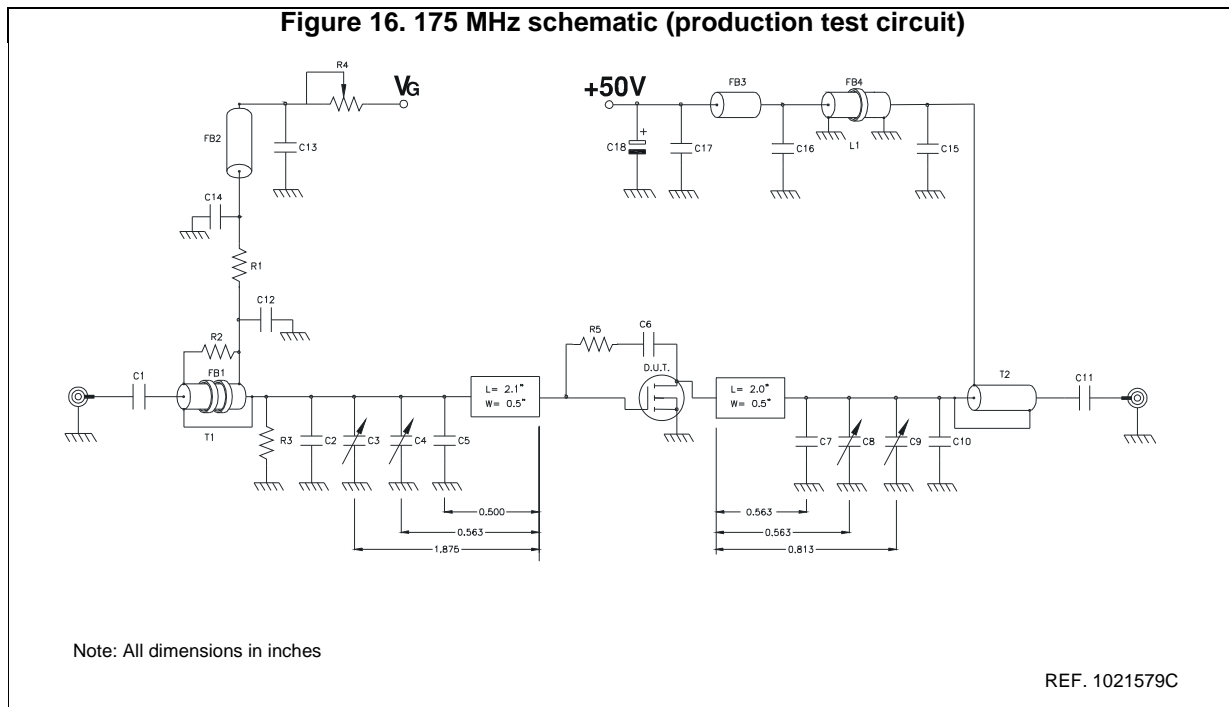
**Figure 9. Safe operating area**



# 6 Typical performance @ 175 MHz



# 7 Test circuit



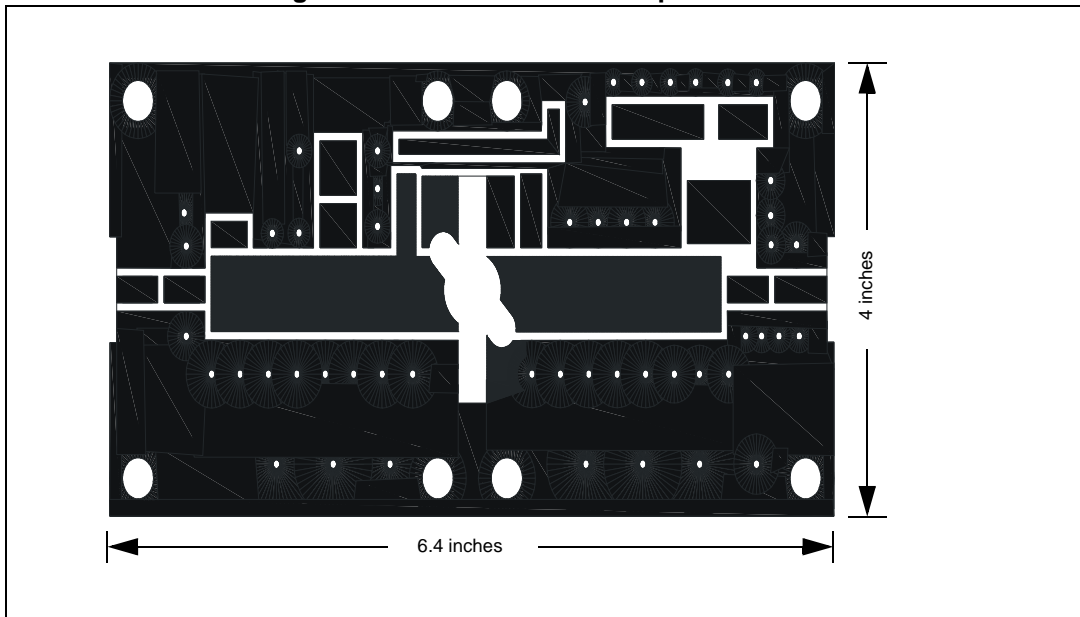
**Table 8. Component part list**

Component	Description
T1	4:1 transformer, 25 ohm flexible coax .090 OD 6" long
T2	1:4 transformer, 25 ohm semi-rigid coax .141 OD 6" long
FB1	Toroid X 2, 0.5" OD .312" ID 850μ 2 turns
FB2, FB3	VK200
FB4	Shield bead, 1" OD 0.5" ID 850μ 3 turns
L1	1/4 wave choke, 50 ohm semi-rigid coax .141 OD 12" Long
PCB	0.62" woven fiberglass, 1 oz. copper, 2 sides, $\epsilon_r = 2.55$
R1, R3	470 ohm 1 W chip resistor
R2	360 ohm 1/2 W resistor
R4	20 Kohm 10 turn potentiometer
R5	560 ohm 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

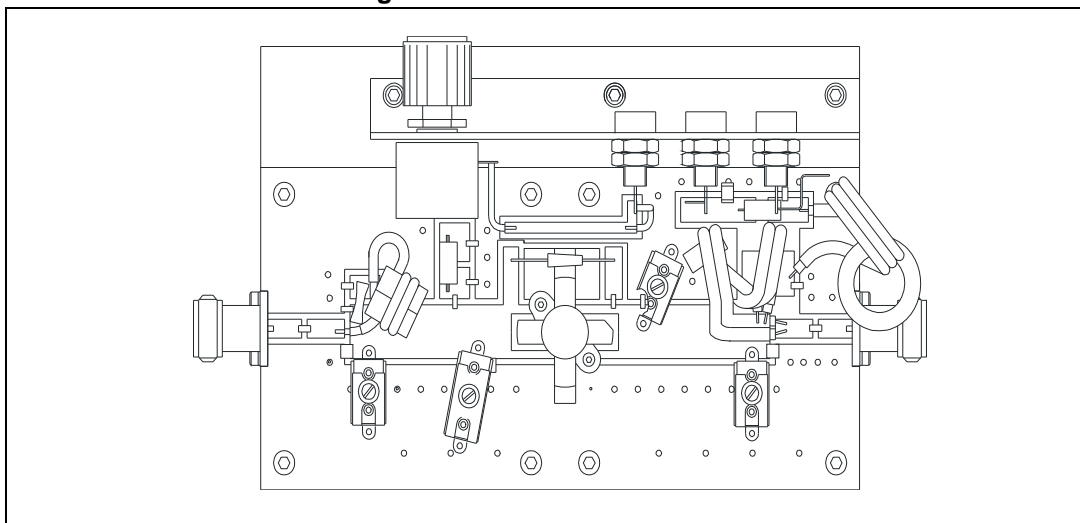
**Table 8. Component part list (continued)**

Component	Description
C5	120 pF ATC chip cap
C6	0.01 $\mu$ F ATC chip cap
C7	30 pF ATC chip cap
C10	91 pF ATC chip cap
C12, C15	1200 pF ATC chip cap
C13, C14, C16, C17	0.01 $\mu$ F / 500 V chip cap
C18	10 $\mu$ F 63 V electrolytic capacitor

**Figure 17. 175 MHz test circuit photomaster**

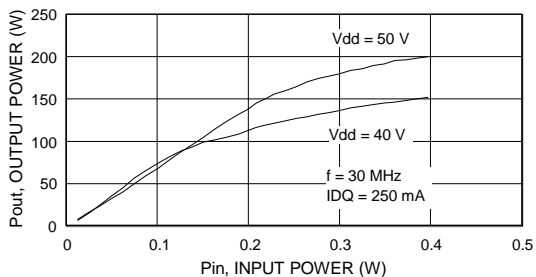


**Figure 18. 175 MHz test circuit**

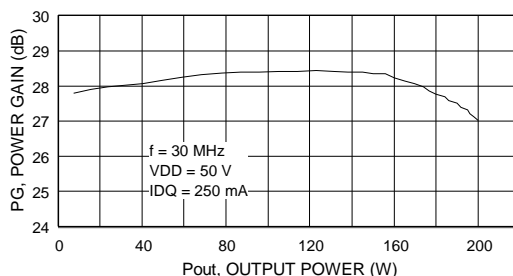


# 8 Typical performance @ 30 MHz

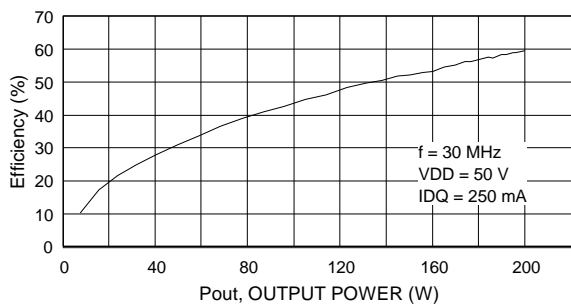
**Figure 19. Output power vs input power**



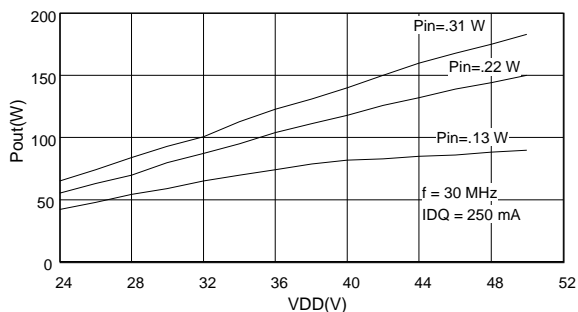
**Figure 20. Power gain vs output power**



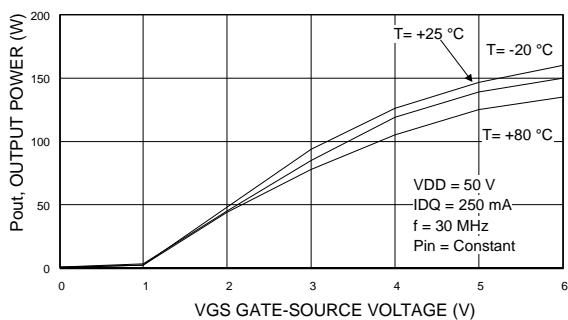
**Figure 21. Efficiency vs output power**



**Figure 22. Output power vs supply voltage**



**Figure 23. Output power vs gate voltage**



## 9 Test circuit @ 30 MHz

Figure 24. 30 MHz test circuit schematic (engineering test circuit)

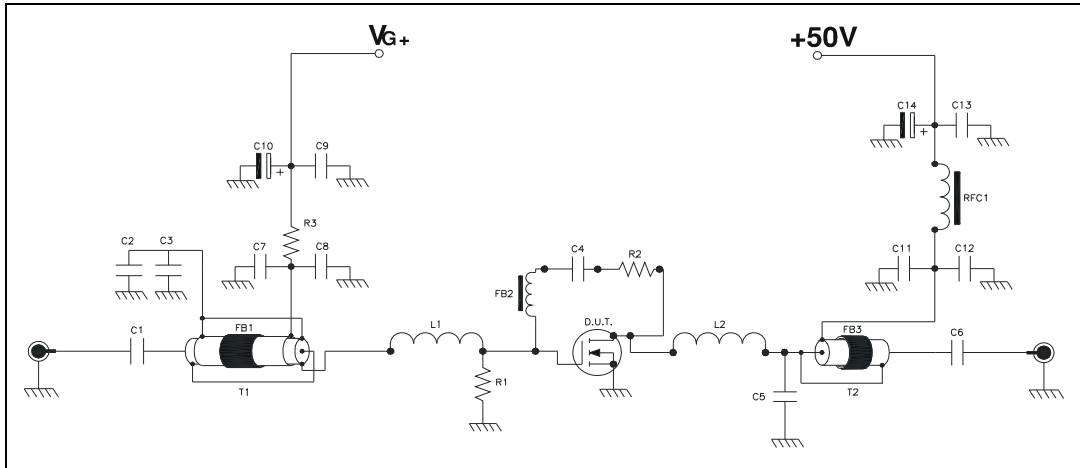


Figure 25. 30 MHz test circuit part list

Symbol	Description
T1	9:1 transformer, 25 $\Omega$ flexible coax with extra shield .090 OD 15" long
T2	1:4 transformer, 50 $\Omega$ flexible coax .225 OD 15" long
FB1	Toroid 1.7" OD .30" ID 220 $\mu$ 4 turns
FB2	Surface mount EMI shield bead
FB3	Toroid 1.7" OD .300" ID 220 $\mu$ 3 turns
RFC1	Toroid 0.5" OD 0.30" ID 125 $\mu$ 4 turns 12 awg wire
PCB	0.62" woven fiberglass, 1 oz. Copper, 2 Sides, $\epsilon_r = 2.55$
R1, R3	1 K $\Omega$ 1 W chip resistor
R2	680 $\Omega$ 3 W wirewound resistor
C1,C4,C6,C7,C8, C9, C11,C12,C13	0.1 $\mu$ F ATC chip cap
C2, C3	750 pF ATC chip cap
C5	470 pF ATC chip cap
C10	10 $\mu$ F 63 V electrolytic capacitor
C14	100 $\mu$ F 63 V electrolytic capacitor

# 10 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 26. M174 (0.500 DIA 4/L N/HERM W/FLG) package outline

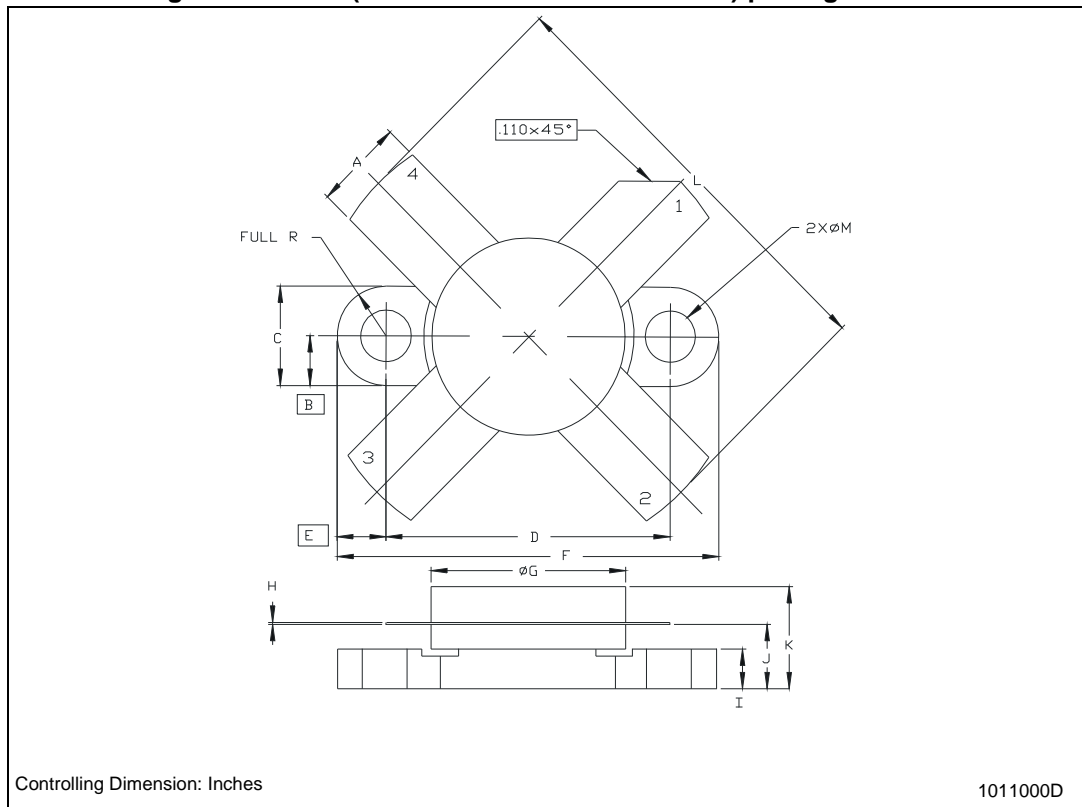


Table 9. M174 (0.500 DIA 4/L N/HERM W/FLG) package mechanical data

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

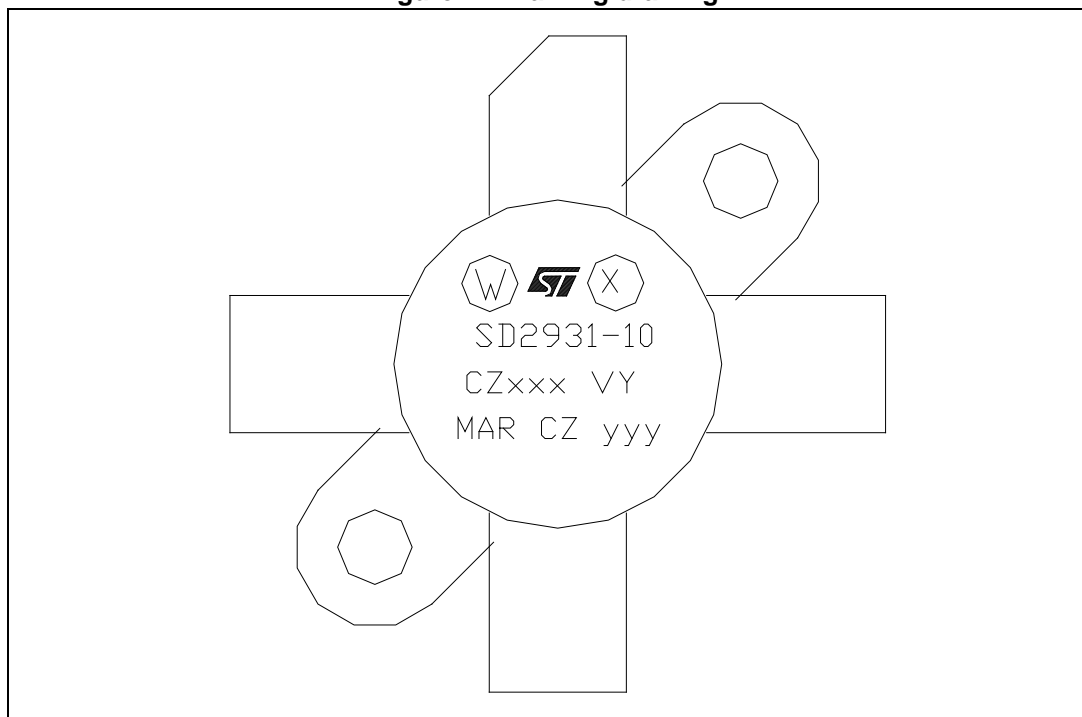


# 11 Marking, packing and shipping specifications

**Table 10. Packing and shipping specifications**

Order code	Packaging	Pcs per tray	Dry pack humidity	V <sub>GS</sub>	Lot code
SD2931-10W	Plastic tray	25	< 10 %	Not mixed	Not mixed

**Figure 27. Marking drawing**



**Table 11. 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	County of origin
CZ	Test and finishing plant
y	Assembly year
yy	Assembly week

## 12 Revision history

**Table 12. Document revision history**

Date	Revision	Changes
09-Sep-2004	4	
17-Jun-2004	5	Updated <i>Table 5: Dynamic</i> on page 4
04-Mar-2008	6	Updated <i>Table 4: Static (per side)</i> , <i>Table 5: Dynamic</i> and <i>Table 6: VGS sorts</i> on page 5
08-Feb-2011	7	Inserted <i>Chapter 11: Marking, packing and shipping specifications</i> .
12-Jan-2012	8	Inserted <i>Chapter 3: Transient thermal impedance</i> .
19-Dec-2012	9	Updated <i>Table 10: Packing and shipping specifications</i>
14-Jul-2016	10	Updated $V_{GS}$ value in <a href="#">Table 2: Absolute maximum ratings</a> .

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