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RF power transistor, the LdmoST family

Features

- Excellent thermal stability
- Common source configuration Push-pull
- $P_{OUT} = 100\text{ W}$ with 14 dB gain @ 860 MHz
- BeO-free package

Description

The SD56120C is a common source N-Channel enhancement-mode lateral Field-Effect RF power transistor designed for broadband commercial and industrial applications at frequencies up to 1.0 GHz. The SD56120C is designed for high gain and broadband performance operating in common source mode at 28 V. It is ideal for broadcast applications from 470 to 860 MHz requiring high linearity.

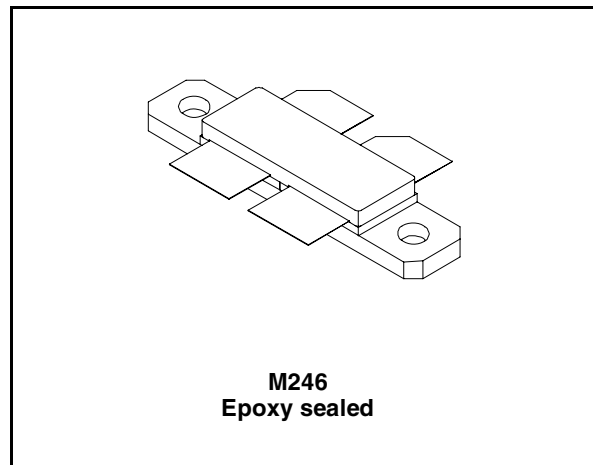


Figure 1. Pin connections

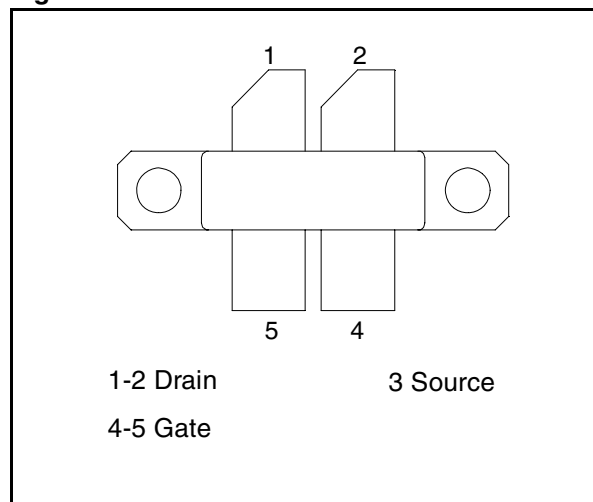


Table 1. Device summary

Order code	Package	Branding
SD56120C	M246	SD56120

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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	72	V
V_{GS}	Gate-source voltage	± 20	V
I_D	Drain current	14	A
P_{DISS}	Power dissipation (@ $T_c = 70\text{ °C}$)	217	W
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	0.6	$^{\circ}\text{C}/\text{W}$

2 Electrical characteristics

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

2.1 Static

Table 4. Static (per section)

Symbol	Test conditions		Min	Typ	Max	Unit
$V_{(\text{BR})\text{DSS}}$	$V_{\text{GS}} = 0\text{ V}$	$I_{\text{DS}} = 1\text{ mA}$	72			V
I_{DSS}	$V_{\text{GS}} = 0\text{ V}$	$V_{\text{DS}} = 28\text{ V}$			1	μA
I_{GSS}	$V_{\text{GS}} = 20\text{ V}$	$V_{\text{DS}} = 0\text{ V}$			1	μA
$V_{\text{GS(Q)}}$	$V_{\text{DS}} = 28\text{ V}$	$I_{\text{D}} = 200\text{ mA}$	3.0		5.0	V
$V_{\text{DS(ON)}}$	$V_{\text{GS}} = 10\text{ V}$	$I_{\text{D}} = 3\text{ A}$		0.7	0.8	V
G_{FS}	$V_{\text{DS}} = 10\text{ V}$	$I_{\text{D}} = 3\text{ A}$		3		mho
C_{ISS}	$V_{\text{GS}} = 0\text{ V}$	$V_{\text{DS}} = 28\text{ V}$		82		pF
C_{OSS}	$V_{\text{GS}} = 0\text{ V}$	$V_{\text{DS}} = 28\text{ V}$		48		pF
C_{RSS}	$V_{\text{GS}} = 0\text{ V}$	$V_{\text{DS}} = 28\text{ V}$		2.8		pF

Note: REF. 7194566A

2.2 Dynamic

Table 5. Dynamic

Symbol	Test conditions		Min	Typ	Max	Unit
P_{OUT}	$V_{\text{DD}} = 28\text{ V}$	$I_{\text{DQ}} = 400\text{ mA}$ $f = 860\text{ MHz}$	100			W
G_{PS}	$V_{\text{DD}} = 28\text{ V}$	$I_{\text{DQ}} = 400\text{ mA}$ $P_{\text{OUT}} = 100\text{ W}$ $f = 860\text{ MHz}$	14	16		dB
η_{D}	$V_{\text{DD}} = 28\text{ V}$	$I_{\text{DQ}} = 400\text{ mA}$ $P_{\text{OUT}} = 100\text{ W}$ $f = 860\text{ MHz}$	50	60		%
IMD (1)	$V_{\text{DD}} = 28\text{ V}$	$I_{\text{DQ}} = 400\text{ mA}$ $P_{\text{OUT}} = 100\text{ W PEP}$		-28		dB _C
Load mismatch	$V_{\text{DD}} = 28\text{ V}$	$I_{\text{DQ}} = 400\text{ mA}$ $P_{\text{OUT}} = 100\text{ W}$ $f = 860\text{ MHz}$ All phase angles	5:1			VSWR
Input overdrive (2)	$V_{\text{DD}} = 28\text{ V}$	$I_{\text{DQ}} = 400\text{ mA}$ $P_{\text{IN}} = 10\text{ W}$ $f = 860\text{ MHz}$	Must survive			

Note: 1 PEP $f_1 = 860\text{ MHz}$ $f_2 = 860.1\text{ MHz}$

2 Overdrive test done at wafer sampling only.

3 Impedances

Figure 2. Current conventions

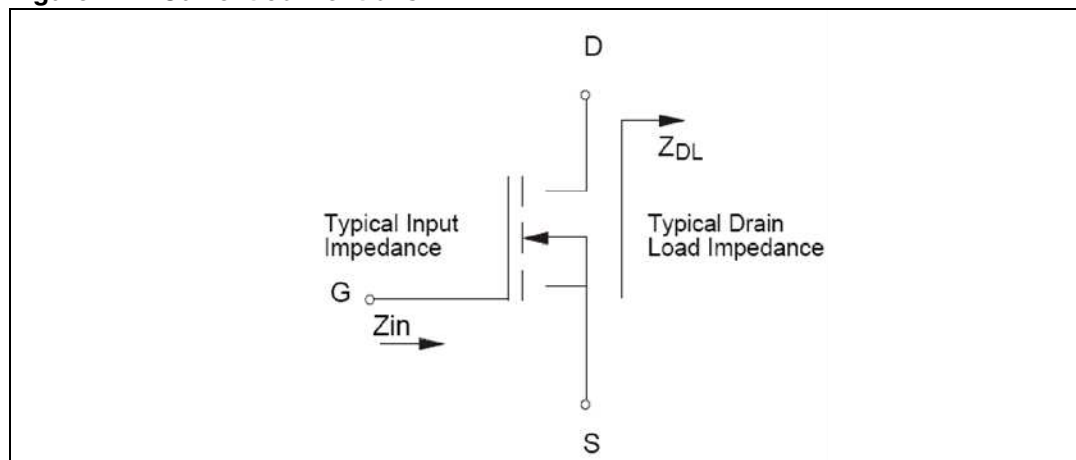


Table 6. Impedance data

Freq. (MHz)	$Z_{IN} (\Omega)$	$Z_{DL}(\Omega)$
860 MHz	$1.11 - j 2.63$	$3.01 + j 5.34$

Measured drain to drain and gate to gate respectively.

4 Typical performances

Figure 3. Capacitance vs drain voltage (per section)

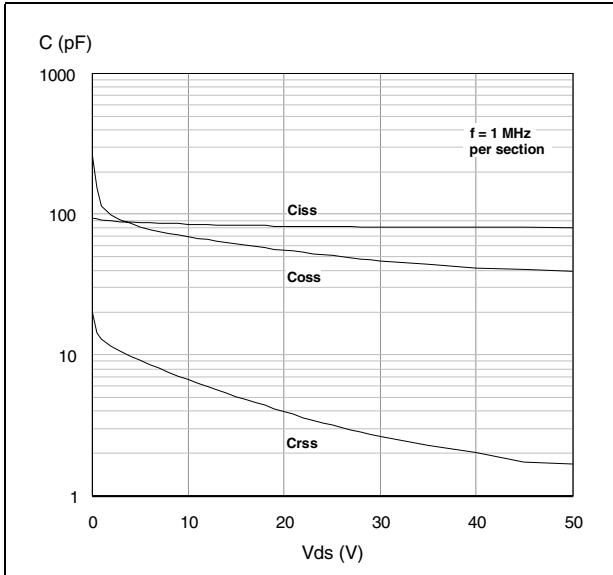


Figure 4. Gate-source voltage vs case temperature

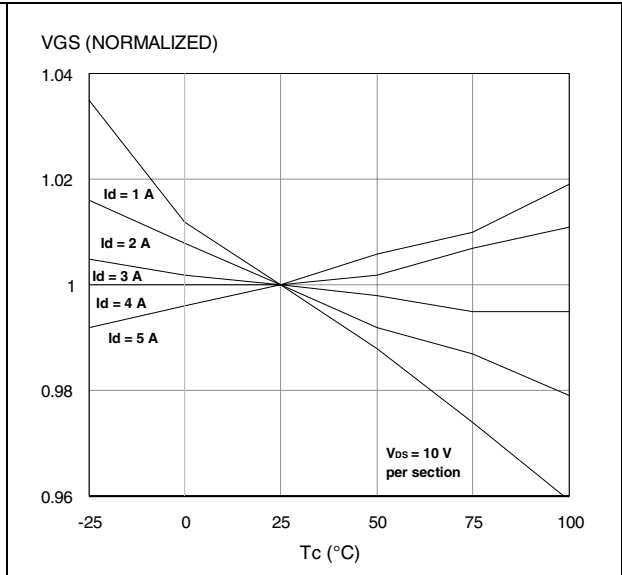


Figure 5. Drain current vs gate voltage

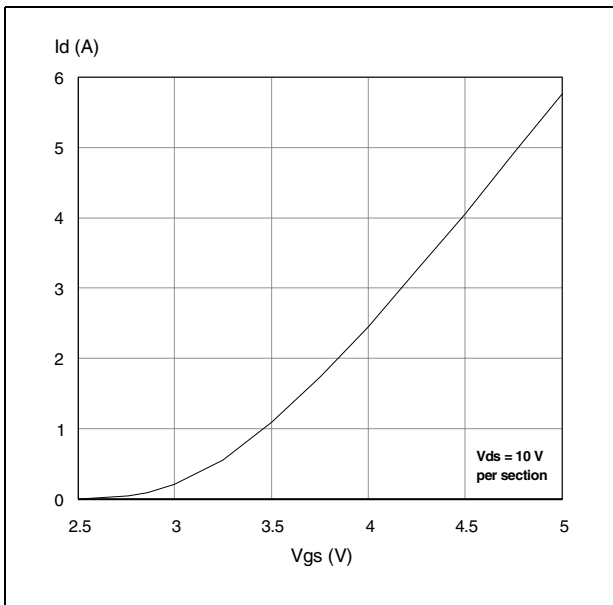


Figure 6. Output power vs input power

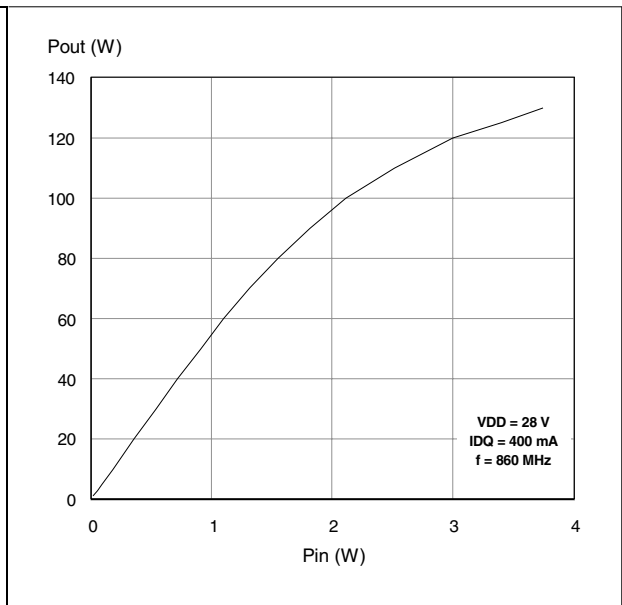


Figure 7. Power gain vs input power

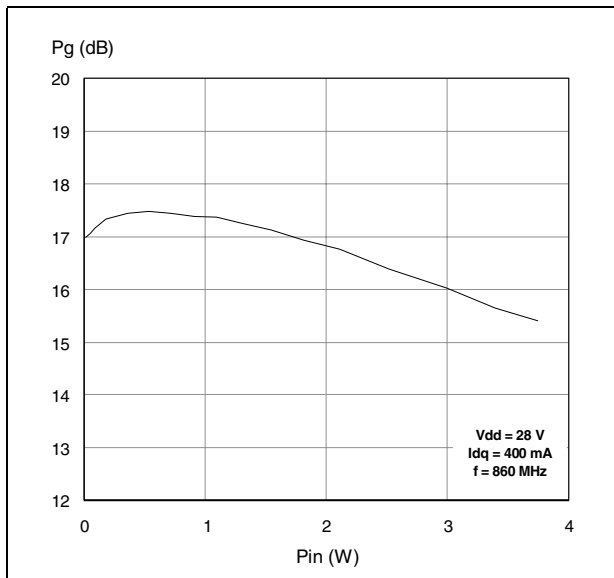


Figure 8. Efficiency vs output power

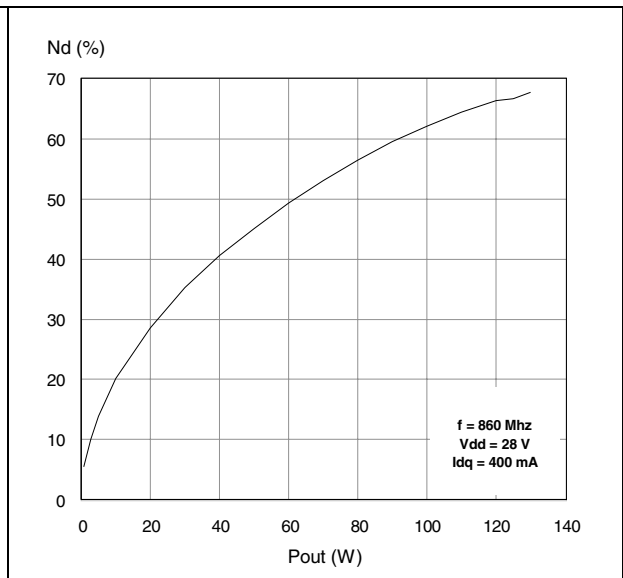


Figure 9. Power gain vs output power

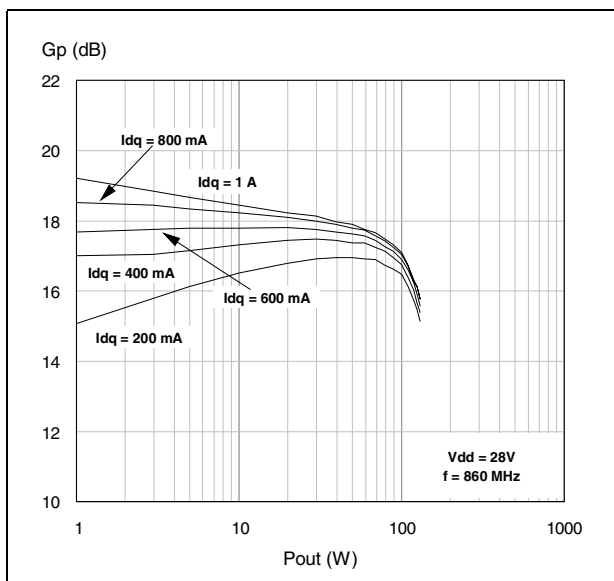


Figure 10. Intermodulation distortion vs output power

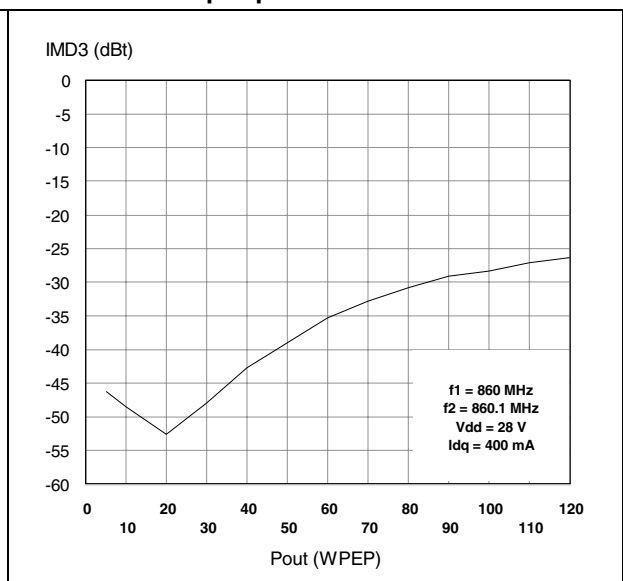


Figure 11. Output power vs drain voltage

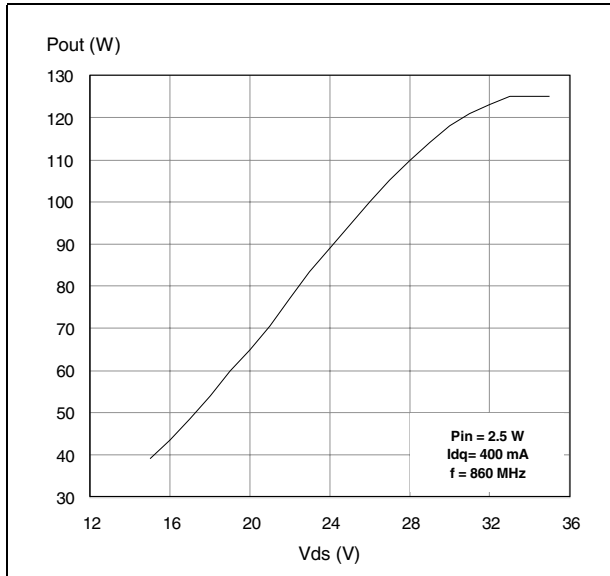


Figure 12. Output power vs bias current

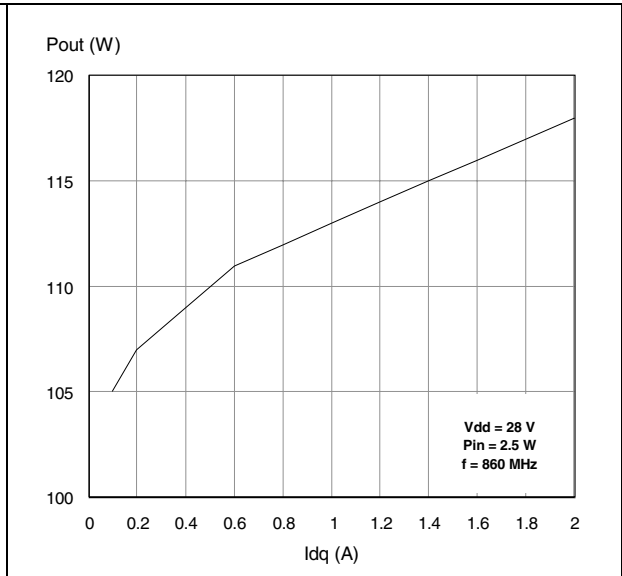
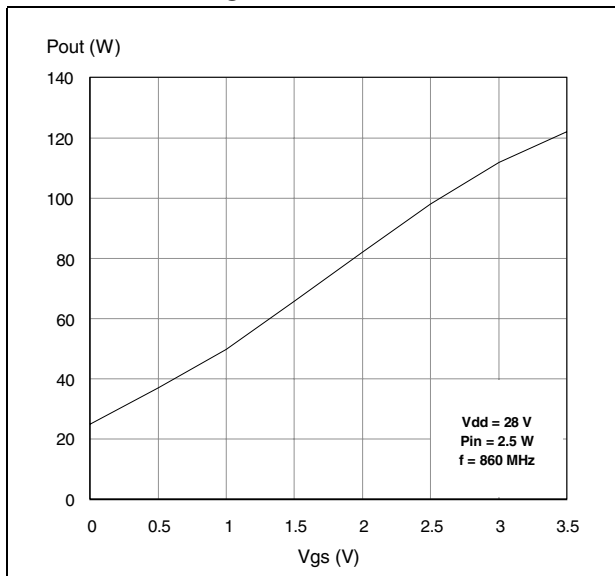
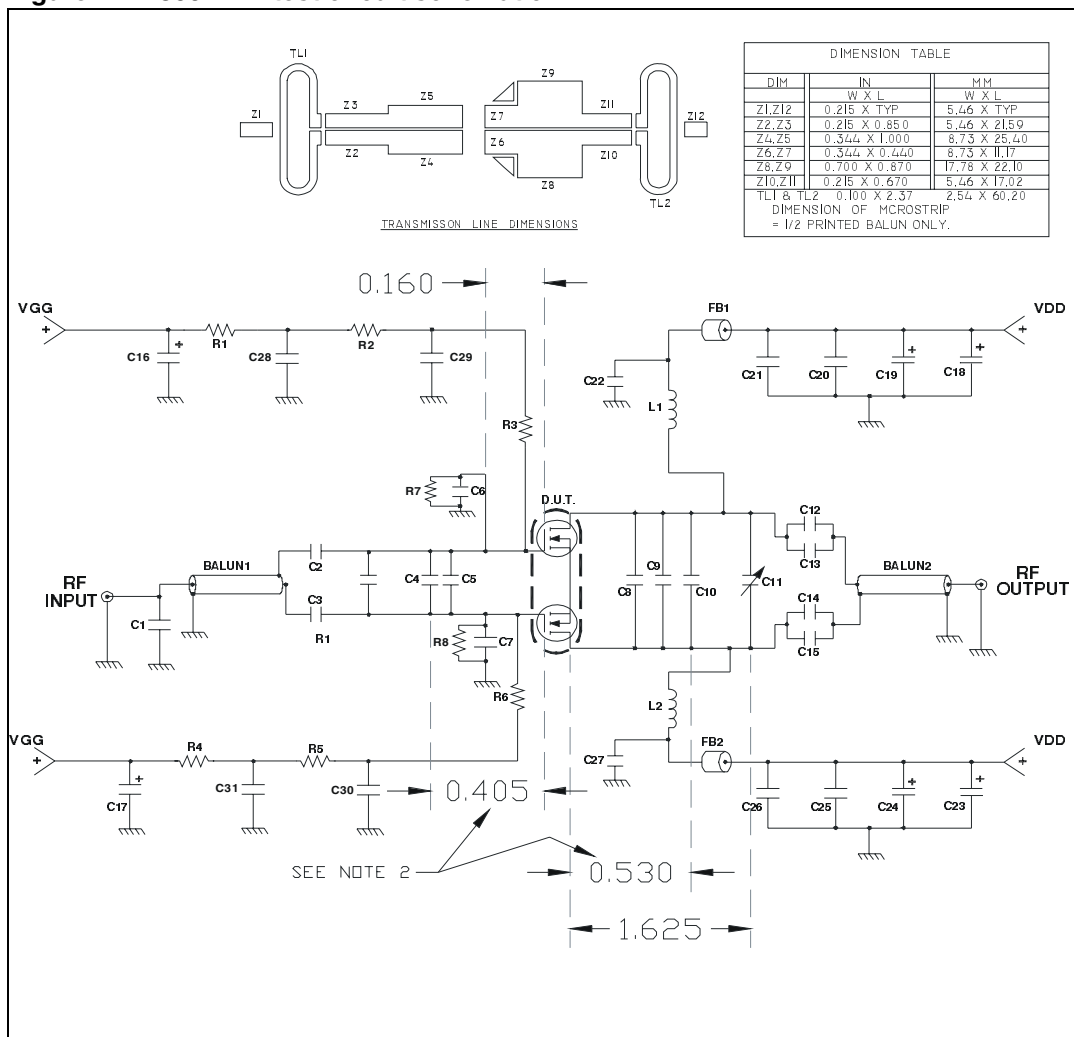


Figure 13. Output power vs gate-source voltage



5 Test circuit

Figure 14. 860 MHz test circuit schematic



- Note: 1 Dimensions at component symbols are reference for component placement.
 2 Gap between ground & transmission line = 0.056 [1.42] +0.002 [0.05] -0.000 [0.00] typ.

Table 7. 860 MHz test circuit component part list

Component	Description
C32	0.6 - 4.5 pF variable capacitor
C31, C28	0.01 μ F ATC 200B surface-mount ceramic chip capacitor
C29, C30	62 pF ATC 100B surface-mount ceramic chip capacitor
C27, C22	270 pF ATC 100B surface-mount ceramic chip capacitor
C26, C21	1200 pF ATC 700B surface-mount ceramic chip capacitor
C25, C20	0.1 μ F 500V surface-mount ceramic chip capacitor
C24, C19, C17, C16	10 μ F 50V aluminum electrolytic radial lead surface-mount capacitor
C23, C18	100 μ F 63V aluminum electrolytic radial lead capacitor
C15, C14, C13, C12	47 pF ATC 100B surface-mount ceramic chip capacitor
C11	0.8 - 8 pF Gigatrim variable capacitor
C10	3.0 pF ATC 100B surface-mount ceramic chip capacitor
C9, C8	4.3 pF ATC 100B surface-mount ceramic chip capacitor
C7, C6, C5	10 pF ATC 100B surface-mount ceramic chip capacitor
C4	2.0 pF ATC 100B surface-mount ceramic chip capacitor
C3, C2	20 pF ATC 100B surface-mount ceramic chip capacitor
C1	1.3 pF ATC 100B surface-mount ceramic chip capacitor
R7, R8	100 Ohm 1/4 W surface-mount chip resistor
R6, R3	22 Ohm 1/4 W carbon leaded resistor
R5, R2	4.7 Ohm 1/4 W carbon leaded resistor
R4, R1	82 Ohm 1/4 W carbon leaded resistor
B2, B1	Balun, 50 Ohm Sucoform, OD 0.141 2.37 LG coaxial cable or equivalent
L2, L1	Inductor, 6 Turn Air-wound #18AWG ID=0.130[3,30] magnet wire
FB2, FB1	Surface-mount EMI shield bead
PCB	Ultralam 2000. 0.030" thk $\epsilon_r = 2.55$, 2 Oz ED Cu both sides

Figure 15. 860 MHz production test fixture

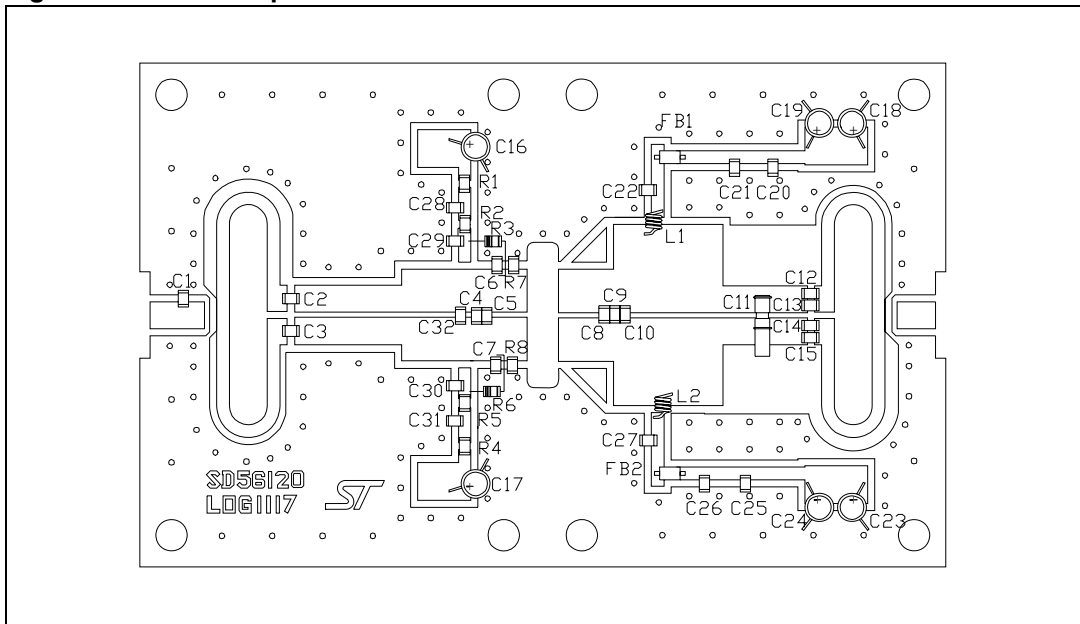
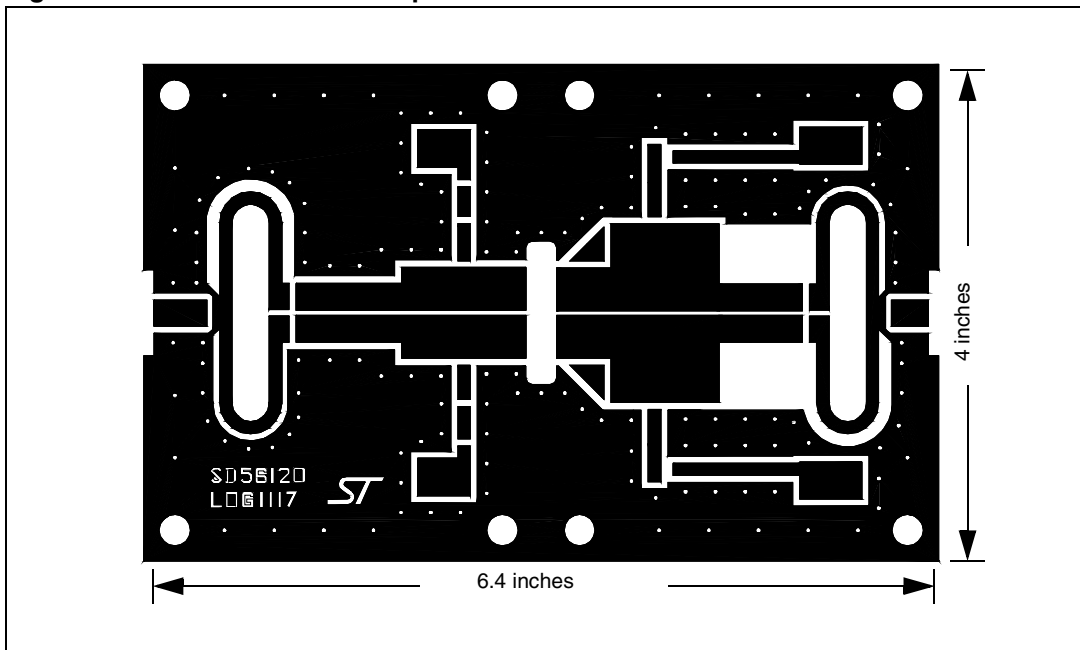


Figure 16. 860 MHz test circuit photomaster



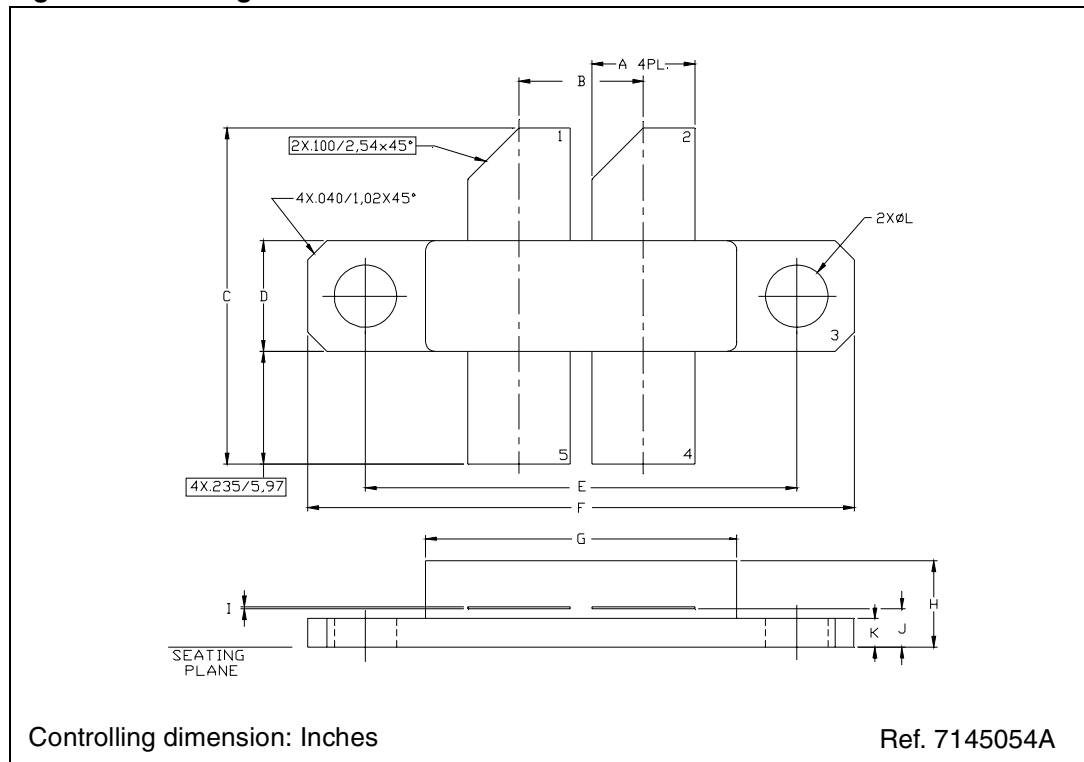
6 Package mechanical data

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Table 8. M246 (.230 x .650 WIDE 4/L BAL N/HERM W/FLG) mechanical data

Dim.	mm.			Inch		
	Min	Typ	Max	Min	Typ	Max
A	5.33		5.59	.210		.220
B	6.48		6.73	.255		.265
C	17.27		18.29	.680		.720
D	5.72		5.97	.225		.235
E		22.86			.900	
F	28.83		29.08	1.135		1.145
G	16.26		16.76	.640		.660
H	4.19		5.08	.165		.200
I	0.08		0.15	.003		.006
J	1.83		2.24	.072		.088
K	1.40		1.65	.055		.065
L	3.18		3.43	.125		.135

Figure 17. Package dimensions



7 Revision history

Table 9. Document revision history

Date	Revision	Changes
25-May-2009	1	Initial release
15-Jul-2009	2	Added note (2) on table 5
01-Sep-2009	3	Updated document's title

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