

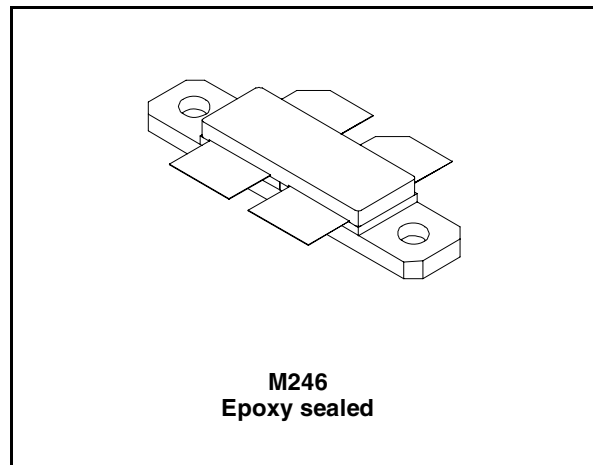
## RF power transistor, the LdmoST family

### Features

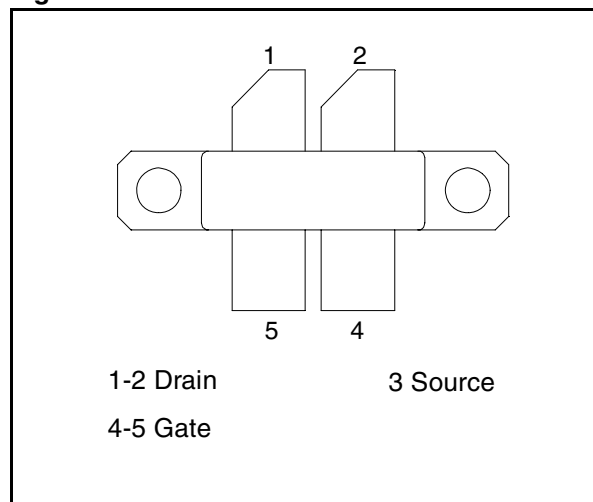
- Excellent thermal stability
- Common source configuration Push-pull
- $P_{OUT} = 100\text{ W}$  with 14 dB gain @ 860 MHz
- BeO-free package

### 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

# Contents

<b>1</b>	<b>Electrical data</b> .....	<b>3</b>
1.1	Maximum ratings .....	3
1.2	Thermal data .....	3
<b>2</b>	<b>Electrical characteristics</b> .....	<b>4</b>
2.1	Static .....	4
2.2	Dynamic .....	4
<b>3</b>	<b>Impedances</b> .....	<b>5</b>
<b>4</b>	<b>Typical performance</b> .....	<b>6</b>
<b>5</b>	<b>Test circuit</b> .....	<b>9</b>
<b>6</b>	<b>Package mechanical data</b> .....	<b>12</b>
<b>7</b>	<b>Revision history</b> .....	<b>14</b>

# 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	$\pm 20$	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
$I_{\text{DSS}}$	$V_{\text{GS}} = 0\text{ V}$	$V_{\text{DS}} = 28\text{ V}$			1	$\mu\text{A}$
$I_{\text{GSS}}$	$V_{\text{GS}} = 20\text{ V}$	$V_{\text{DS}} = 0\text{ V}$			1	$\mu\text{A}$
$V_{\text{GS(Q)}}$	$V_{\text{DS}} = 28\text{ V}$	$I_{\text{D}} = 200\text{ mA}$	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
$G_{\text{FS}}$	$V_{\text{DS}} = 10\text{ V}$	$I_{\text{D}} = 3\text{ A}$		3		mho
$C_{\text{ISS}}$	$V_{\text{GS}} = 0\text{ V}$	$V_{\text{DS}} = 28\text{ V}$		82		pF
$C_{\text{OSS}}$	$V_{\text{GS}} = 0\text{ V}$	$V_{\text{DS}} = 28\text{ V}$		48		pF
$C_{\text{RSS}}$	$V_{\text{GS}} = 0\text{ V}$	$V_{\text{DS}} = 28\text{ V}$		2.8		pF

Note: REF. 7194566A

### 2.2 Dynamic

**Table 5. Dynamic**

Symbol	Test conditions		Min	Typ	Max	Unit
$P_{\text{OUT}}$	$V_{\text{DD}} = 28\text{ V}$	$I_{\text{DQ}} = 400\text{ mA}$ $f = 860\text{ MHz}$	100			W
$G_{\text{PS}}$	$V_{\text{DD}} = 28\text{ V}$	$I_{\text{DQ}} = 400\text{ mA}$ $P_{\text{OUT}} = 100\text{ W}$ $f = 860\text{ MHz}$	14	16		dB
$\eta_{\text{D}}$	$V_{\text{DD}} = 28\text{ V}$	$I_{\text{DQ}} = 400\text{ mA}$ $P_{\text{OUT}} = 100\text{ W}$ $f = 860\text{ MHz}$	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 <sub>C</sub>
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

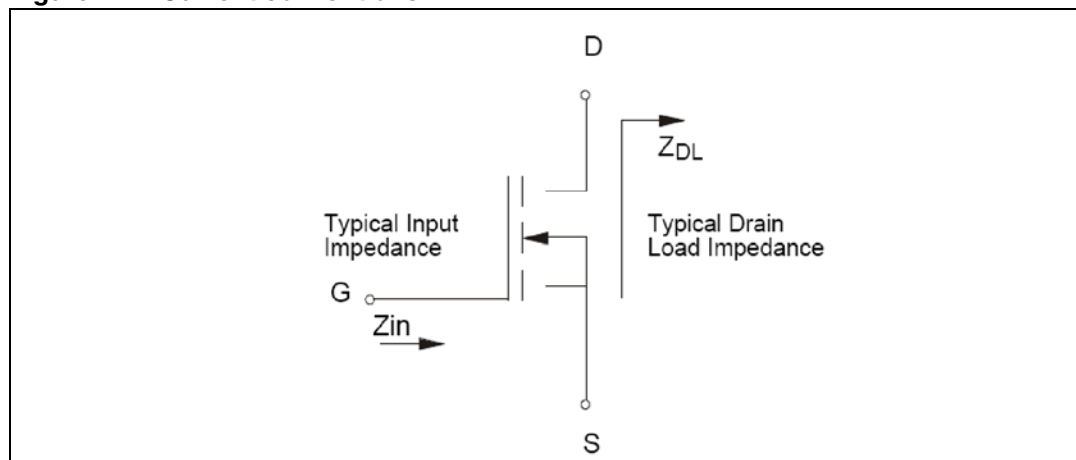


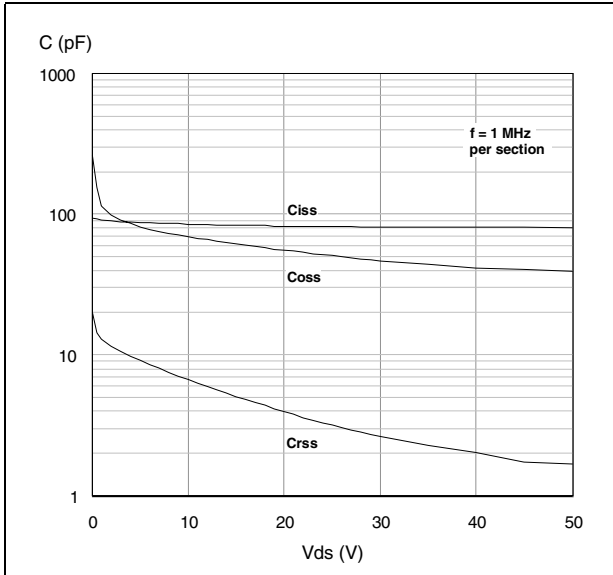
Table 6. Impedance data

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

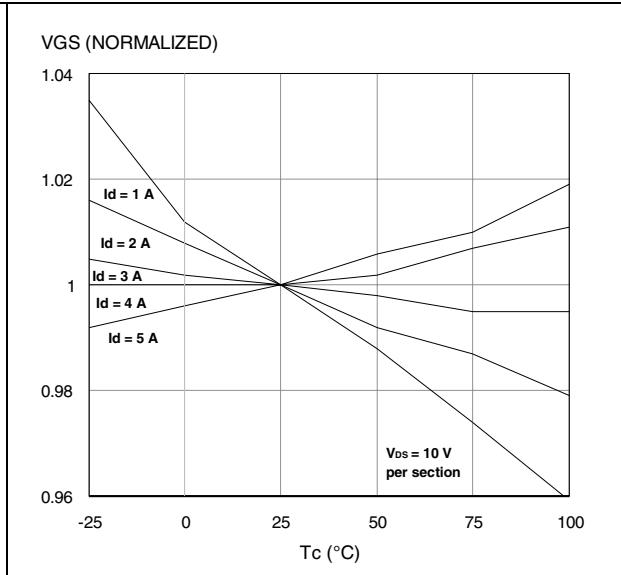
Measured drain to drain and gate to gate respectively.

# 4 Typical performances

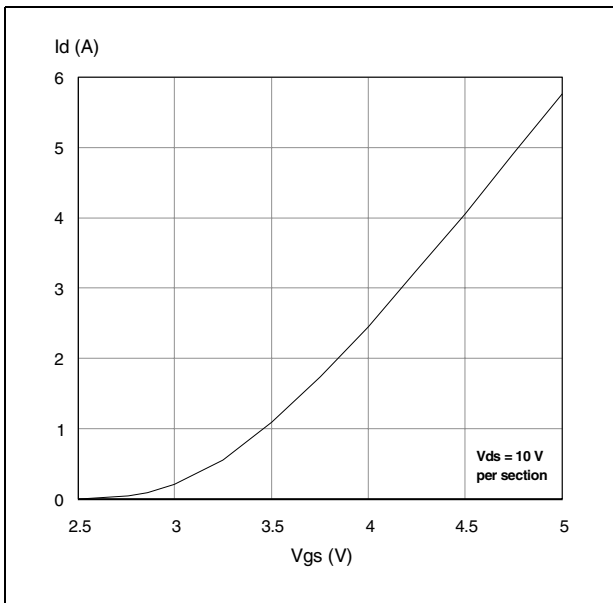
**Figure 3. Capacitance vs drain voltage (per section)**



**Figure 4. Gate-source voltage vs case temperature**



**Figure 5. Drain current vs gate voltage**



**Figure 6. Output power vs input power**

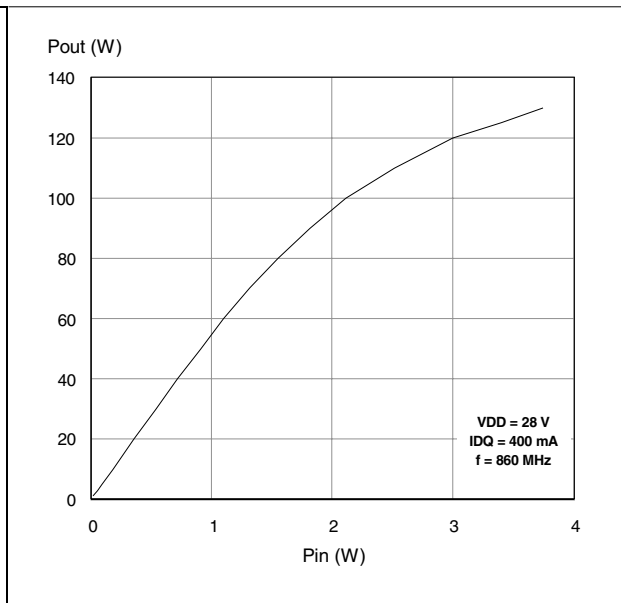


Figure 7. Power gain vs input power

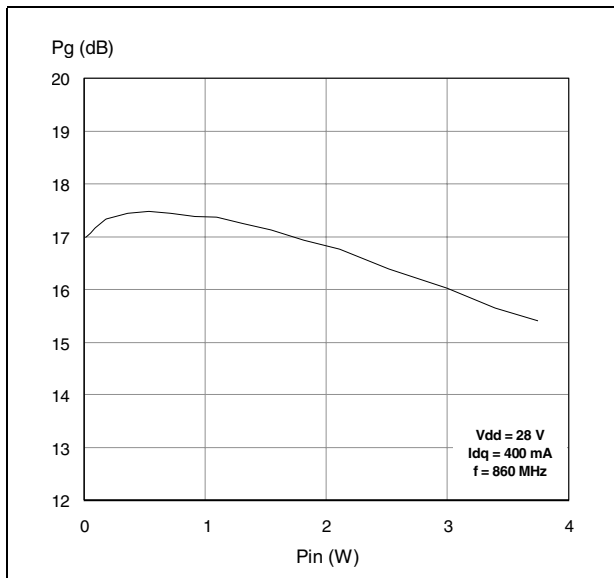


Figure 8. Efficiency vs output power

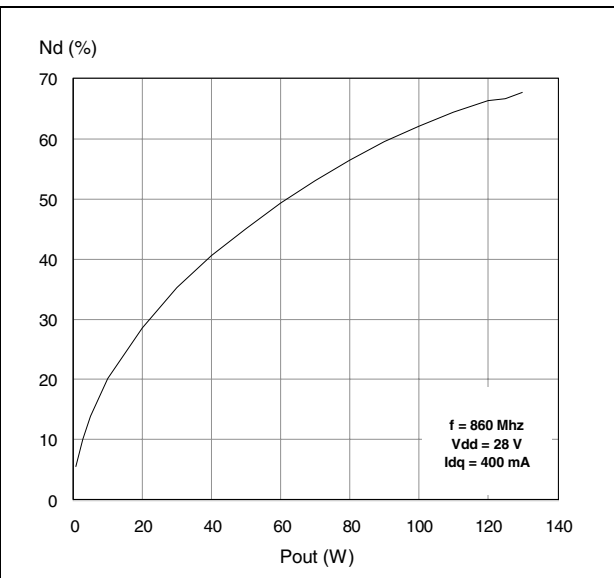


Figure 9. Power gain vs output power

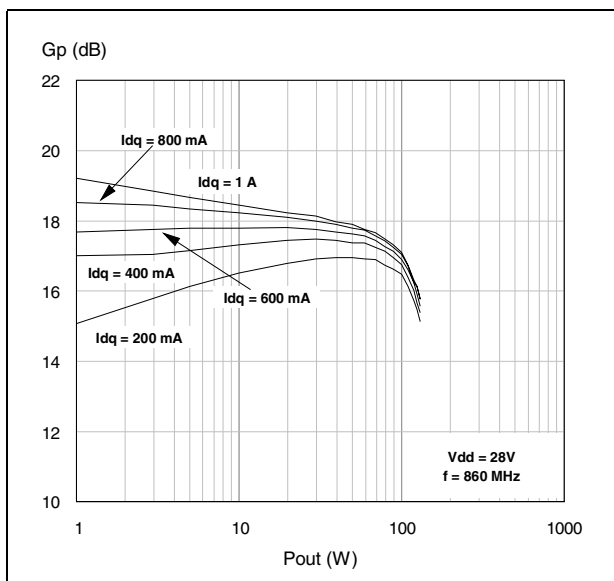


Figure 10. Intermodulation distortion vs output power

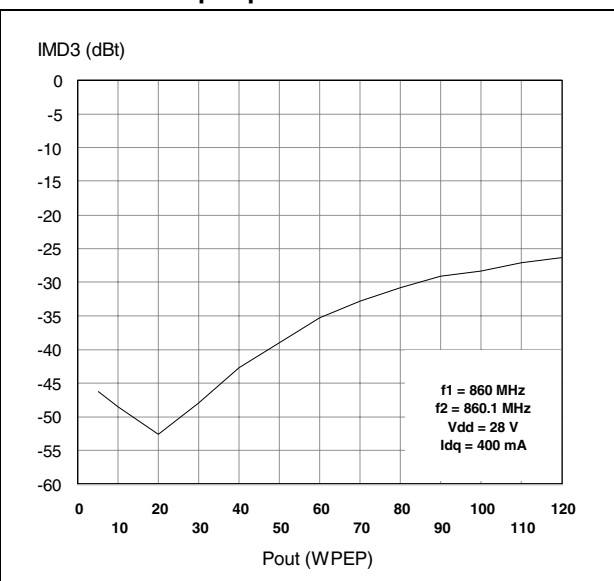


Figure 11. Output power vs drain voltage

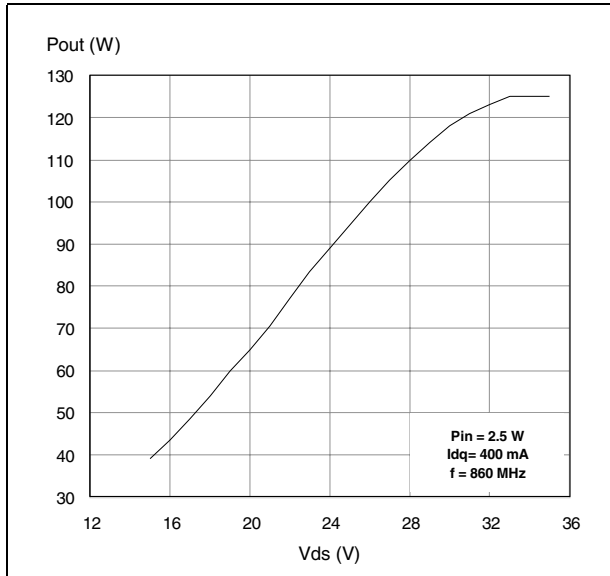


Figure 12. Output power vs bias current

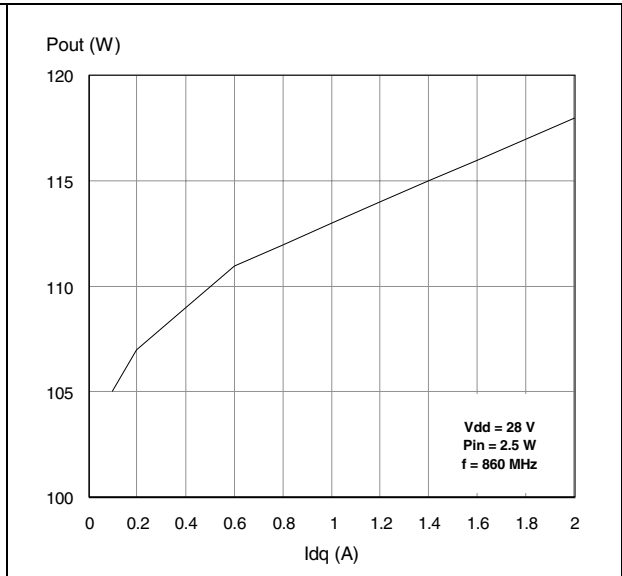
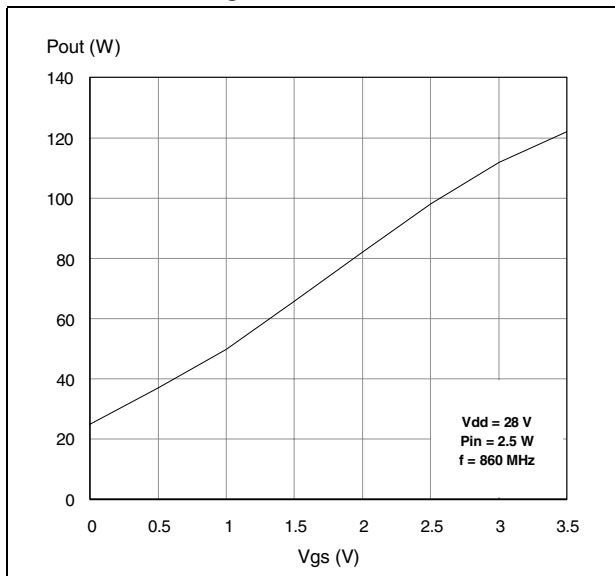


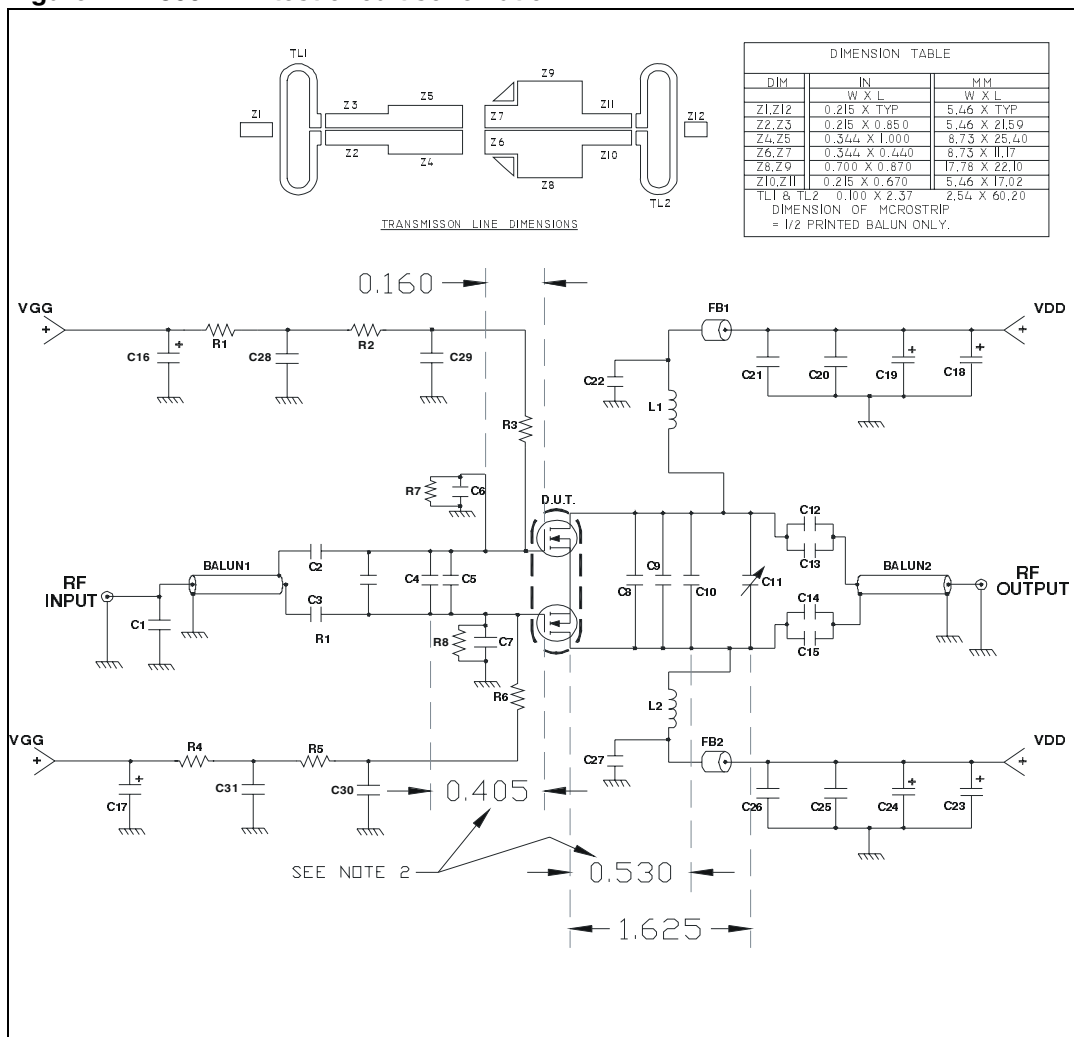
Figure 13. Output power vs gate-source voltage





# 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 $\mu$ 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 $\mu$ F 500V surface-mount ceramic chip capacitor
C24, C19, C17, C16	10 $\mu$ F 50V aluminum electrolytic radial lead surface-mount capacitor
C23, C18	100 $\mu$ 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

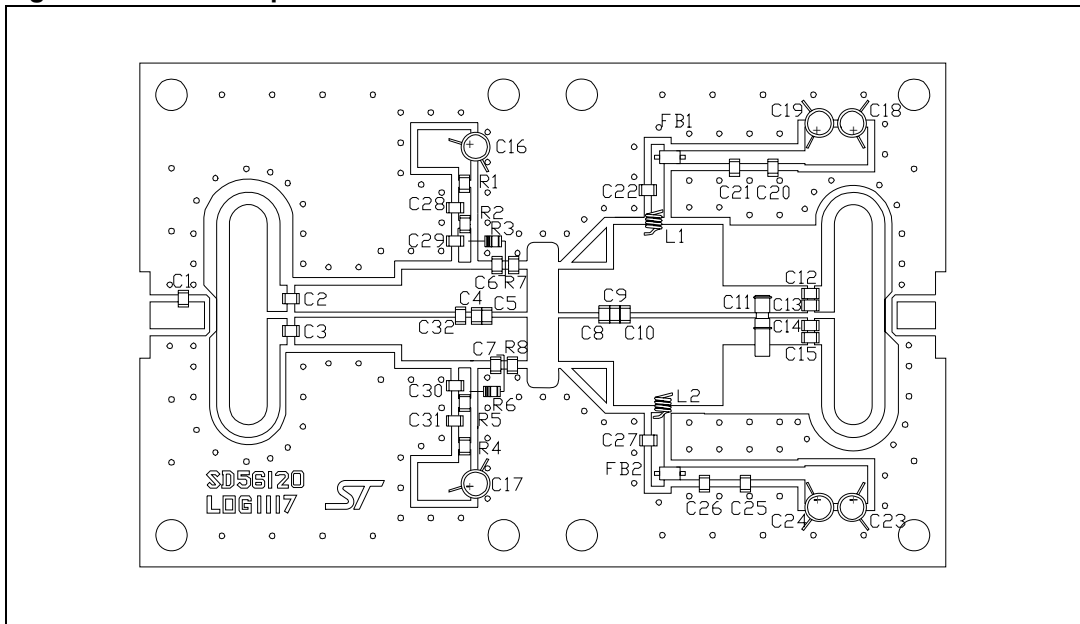
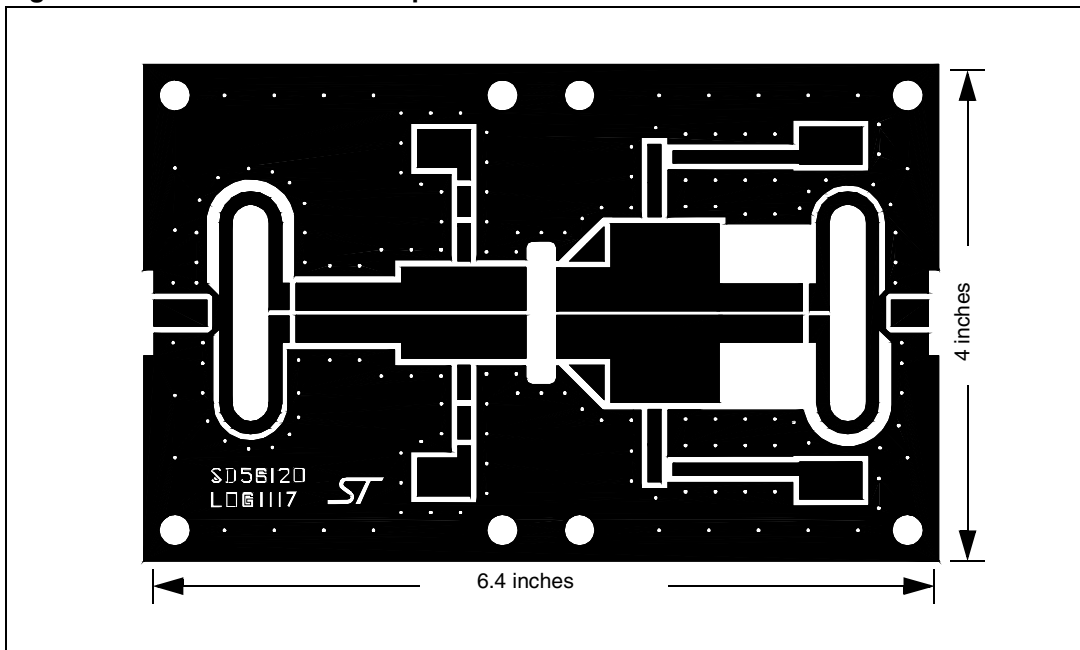


Figure 16. 860 MHz test circuit photomaster



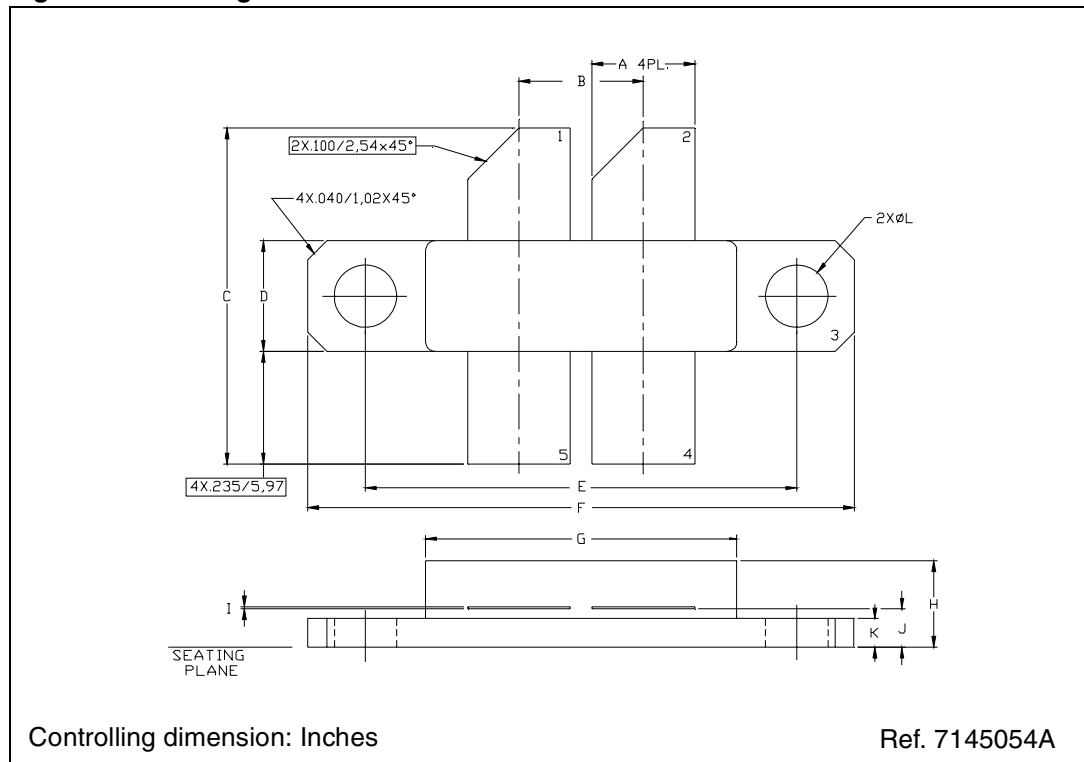
## 6 Package mechanical data

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 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

**Please Read Carefully:**

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

**UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.**

**UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED ST REPRESENTATIVE, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.**

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2009 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

[www.st.com](http://www.st.com)

