Freescale Semiconductor
Technical Data

Document Number: MRF9180
Rev. 10, 5/2006

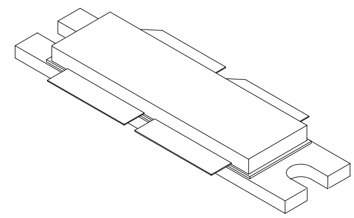
RoHS

RF Power Field Effect Transistor

N-Channel Enhancement-Mode Lateral MOSFET

MRF9180R6

880 MHz, 170 W, 26 V
LATERAL N-CHANNEL
RF POWER MOSFET



CASE 375D-05, STYLE 1
NI-1230

Designed for broadband commercial and industrial applications with frequencies from 865 to 895 MHz. The high gain and broadband performance of this device make it ideal for large-signal, common-source amplifier applications in 26 volt base station equipment.

- Typical CDMA Performance @ 880 MHz, 26 Volts, I_{DQ} = 1400 mA
  IS-95 CDMA Pilot, Sync, Paging, Traffic Codes 8 Through 13
  Output Power — 40 Watts
  Power Gain — 17 dB
  Efficiency — 26%
  Adjacent Channel Power -
  750 kHz: -45.0 dBc in 30 kHz BW
  1.98 MHz: -60.0 dBc in 30 kHz BW
- Capable of Handling 10:1 VSWR, @ 26 Vdc, 880 MHz, 170 Watts CW Output Power

Features

- Internally Matched for Ease of Use
- High Gain, High Efficiency and High Linearity
- Integrated ESD Protection
- Designed for Maximum Gain and Insertion Phase Flatness
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- RoHS Compliant
- In Tape and Reel. R6 Suffix = 150 Units per 56 mm, 13 inch Reel.

Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	-0.5, +65	Vdc
Gate-Source Voltage	V_{GS}	-0.5, +15	Vdc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	388 2.22	W W/°C
Storage Temperature Range	T_{stg}	- 65 to +150	°C
Case Operating Temperature	T_C	150	°C
Operating Junction Temperature	T_J	200	°C

Table 2. Thermal Characteristics

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.45	°C/W

Table 3. ESD Protection Characteristics

Test Conditions	Class
Human Body Model	1 (Minimum)
Machine Model	M1 (Minimum)

NOT RECOMMENDED FOR NEW DESIGN

Table 4. Electrical Characteristics (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Off Characteristics [1]					
Zero Gate Voltage Drain Leakage Current (V_{DS} = 65 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	10	μAdc
Zero Gate Voltage Drain Leakage Current (V_{DS} = 26 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	1	μAdc
Gate-Source Leakage Current (V_{GS} = 5 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	—	—	1	μAdc
On Characteristics					
Gate Threshold Voltage [1] (V_{DS} = 10 Vdc, I_D = 300 μAdc)	$V_{GS(th)}$	2	2.9	4	Vdc
Gate Quiescent Voltage [2] (V_{DS} = 26 Vdc, I_D = 1400 mAdc)	$V_{GS(Q)}$	—	3.7	—	Vdc
Drain-Source On-Voltage [1] (V_{GS} = 10 Vdc, I_D = 2 Adc)	$V_{DS(on)}$	—	0.19	0.5	Vdc
Forward Transconductance [1] (V_{DS} = 10 Vdc, I_D = 6 Adc)	g_{fs}	—	6	—	S
Dynamic Characteristics [1,3]					
Output Capacitance (V_{DS} = 26 Vdc ± 30 mV(rms)ac @ 1 MHz, V_{GS} = 0 Vdc)	C_{oss}	—	77	—	pF
Reverse Transfer Capacitance (V_{DS} = 26 Vdc ± 30 mV(rms)ac @ 1 MHz, V_{GS} = 0 Vdc)	C_{rss}	—	3.8	—	pF
Functional Tests [2] (In Freescale Test Fixture, 50 ohm system)					
Two-Tone Common-Source Amplifier Power Gain (V_{DD} = 26 Vdc, P_{out} = 170 W PEP, I_{DQ} = 1400 mA, f1 = 880.0 MHz, f2 = 880.1 MHz)	G_{ps}	16	17.5	—	dB
Two-Tone Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 170 W PEP, I_{DQ} = 1400 mA, f1 = 880.0 MHz, f2 = 880.1 MHz)	η	35	39	—	%
3rd Order Intermodulation Distortion (V_{DD} = 26 Vdc, P_{out} = 170 W PEP, I_{DQ} = 1400 mA, f1 = 880.0 MHz, f2 = 880.1 MHz)	IMD	—	-31	-28	dBc
Input Return Loss (V_{DD} = 26 Vdc, P_{out} = 170 W PEP, I_{DQ} = 1400 mA, f1 = 880.0 MHz, f2 = 880.1 MHz)	IRL	—	-15	-9	dB
Two-Tone Common-Source Amplifier Power Gain (V_{DD} = 26 Vdc, P_{out} = 170 W PEP, I_{DQ} = 1400 mA, f1 = 865.0 MHz, f2 = 865.1 MHz)	G_{ps}	—	17.5	—	dB
Two-Tone Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 170 W PEP, I_{DQ} = 1400 mA, f1 = 865.0 MHz, f2 = 865.1 MHz)	η	—	38.5	—	%
3rd Order Intermodulation Distortion (V_{DD} = 26 Vdc, P_{out} = 170 W PEP, I_{DQ} = 1400 mA, f1 = 865.0 MHz, f2 = 865.1 MHz)	IMD	—	-31	—	dBc
Input Return Loss (V_{DD} = 26 Vdc, P_{out} = 170 W PEP, I_{DQ} = 1400 mA, f1 = 865.0 MHz, f2 = 865.1 MHz)	IRL	—	-13	—	dB

1. Each side of device measured separately.
2. Measurement made with device in push-pull configuration.
3. Part internally input matched.

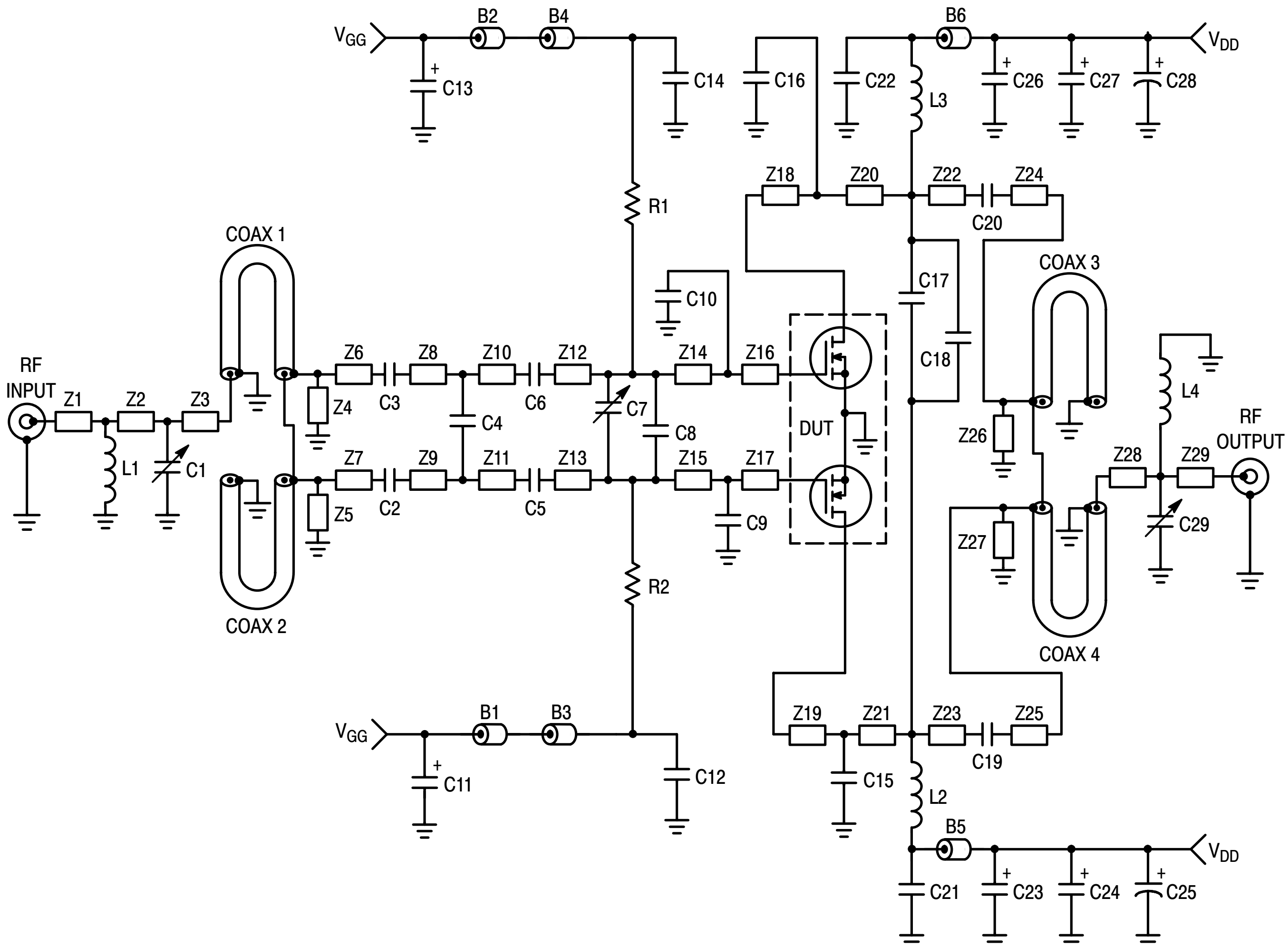
NOT RECOMMENDED FOR NEW DESIGN

Table 4. Electrical Characteristics (T_C = 25°C unless otherwise noted) **(continued)**

Characteristic	Symbol	Min	Typ	Max	Unit
Functional Tests (1) (In Freescale Test Fixture, 50 ohm system) **(continued)**					
Power Output, 1 dB Compression Point (V_{DD} = 26 Vdc, CW, I_{DQ} = 1400 mA, f1 = 880.0 MHz)	P_{1dB}	—	170	—	W
Common-Source Amplifier Power Gain (V_{DD} = 26 Vdc, P_{out} = 170 W CW, I_{DQ} = 1400 mA, f1 = 880.0 MHz)	G_{ps}	—	16.5	—	dB
Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 170 W CW, I_{DQ} = 1400 mA, f1 = 880.0 MHz)	η	—	55	—	%

1. Measurement made with device in push-pull configuration.

NOT RECOMMENDED FOR NEW DESIGN

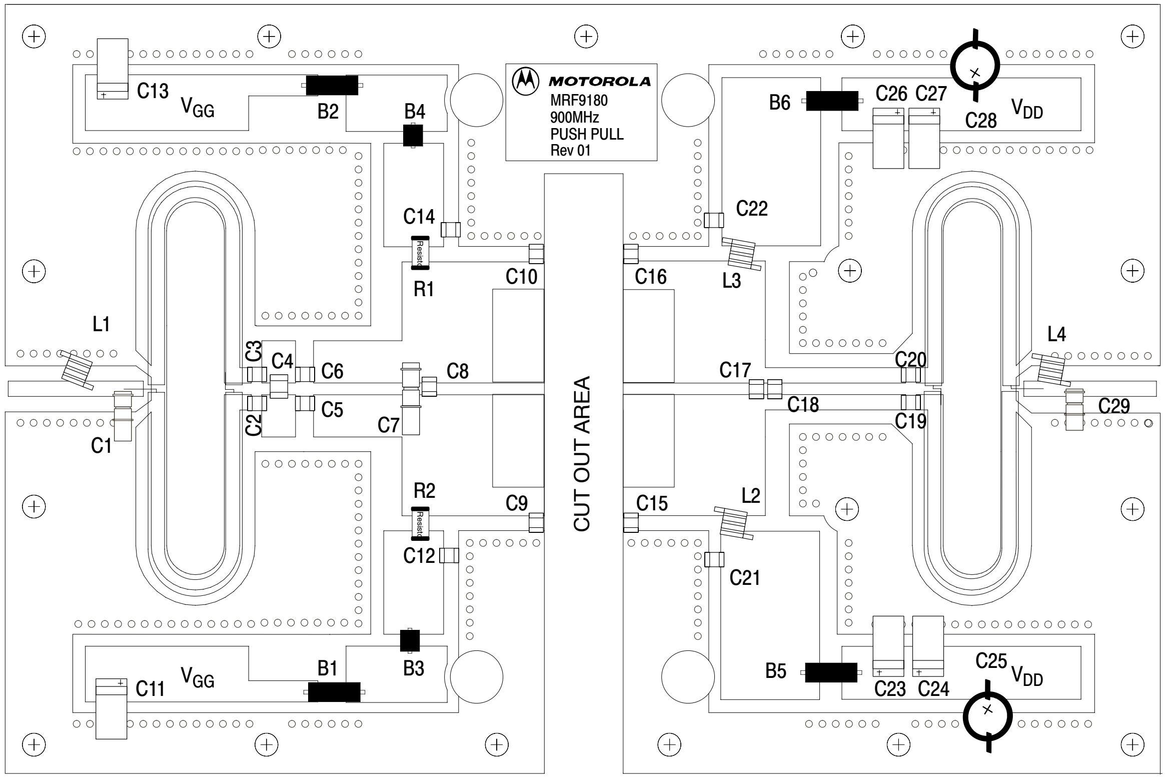


B1, B2, B5, B6	Long Ferrite Beads, Surface Mount
B3, B4	Short Ferrite Beads, Surface Mount
C1	0.6-4.5 pF Variable Capacitor
C2, C3, C5, C6, C12, C14, C19, C20, C21, C22	47 pF Chip Capacitors
C4, C9, C10, C15, C16	12 pF Chip Capacitors
C7	0.8-9.1 pF Variable Capacitor
C8	7.5 pF Chip Capacitor
C11, C13	10 μF, 35 V Tantalum Surface Mount Chip Capacitors
C17	3.6 pF Chip Capacitor
C18	5.1 pF Chip Capacitor
C23, C24, C26, C27	22 μF, 35 V Tantalum Surface Mount Chip Capacitors
C25, C28	220 μF, 50 V Electrolytic Capacitors
C29	0.4-2.5 pF Variable Capacitor
Coax1, Coax2	25 Ω, Semi Rigid Coax, 70 mil OD, 1.05″ Long
Coax3, Coax4	50 Ω, Semi Rigid Coax, 85 mil OD, 1.05″ Long
L1, L2, L3	18.5 nH Mini Spring Inductors, Coilcraft
L4	12.5 nH Mini Spring Inductor, Coilcraft
R1, R2	510 Ω, 1/10 W Chip Resistors

Z1	0.420″ x 0.080″ Microstrip
Z2	0.190″ x 0.080″ Microstrip
Z3	0.097″ x 0.080″ Microstrip
Z4, Z5, Z26, Z27	2.170″ x 0.080″ Microstrip
Z6, Z7	0.075″ x 0.080″ Microstrip
Z8, Z9	0.088″ x 0.220″ Microstrip
Z10, Z11	0.088″ x 0.220″ Microstrip
Z12, Z13	0.460″ x 0.220″ Microstrip
Z14, Z15	0.685″ x 0.625″ Microstrip
Z16, Z17	0.055″ x 0.625″ Microstrip
Z18, Z19	0.055″ x 0.632″ Microstrip
Z20, Z21	0.685″ x 0.632″ Microstrip
Z22, Z23	0.732″ x 0.080″ Microstrip
Z24, Z25	0.060″ x 0.080″ Microstrip
Z28	0.230″ x 0.080″ Microstrip
Z29	0.460″ x 0.080″ Microstrip
Board Material	30 mil Teflon®, εr = 2.55, Copper Clad, 2 oz Cu

Figure 1. 880 MHz Broadband Test Circuit Schematic

NOT RECOMENDED FOR NEW DESIGN



Freescale has begun the transition of marking Printed Circuit Boards (PCBs) with the Freescale Semiconductor signature/logo. PCBs may have either Motorola or Freescale markings during the transition period. These changes will have no impact on form, fit or function of the current product.

Figure 2. 880 MHz Broadband Test Circuit Component Layout

NOT RECOMMENDED FOR NEW DESIGN

TYPICAL CHARACTERISTICS

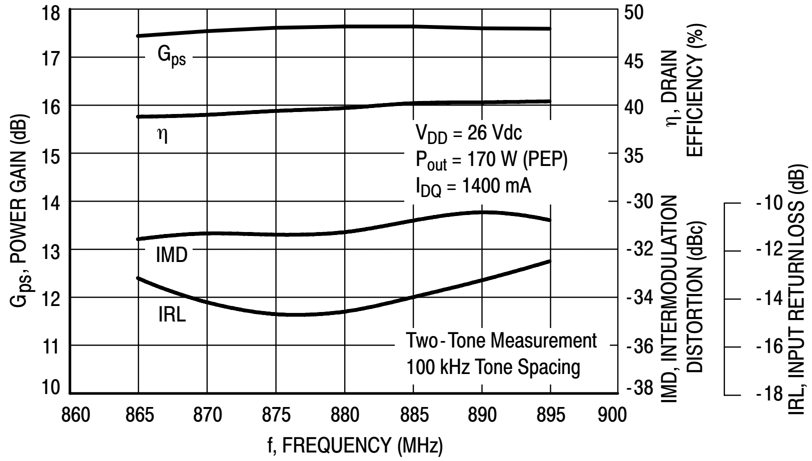


Figure 3. Class AB Broadband Circuit Performance

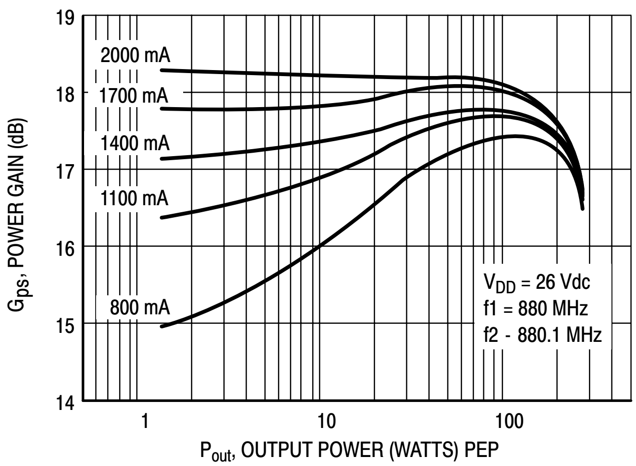


Figure 4. Power Gain versus Output Power

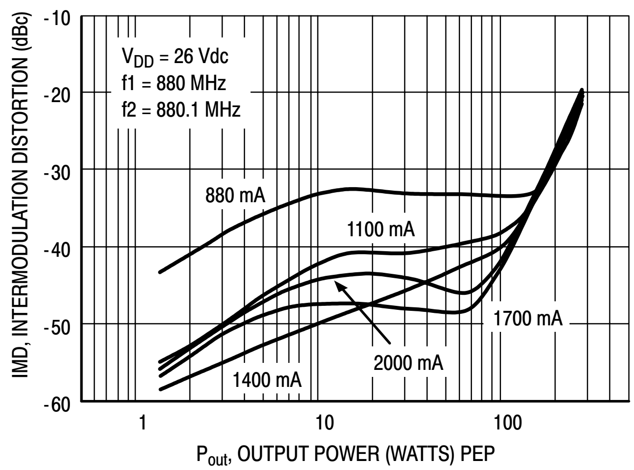


Figure 5. Intermodulation Distortion versus Output Power

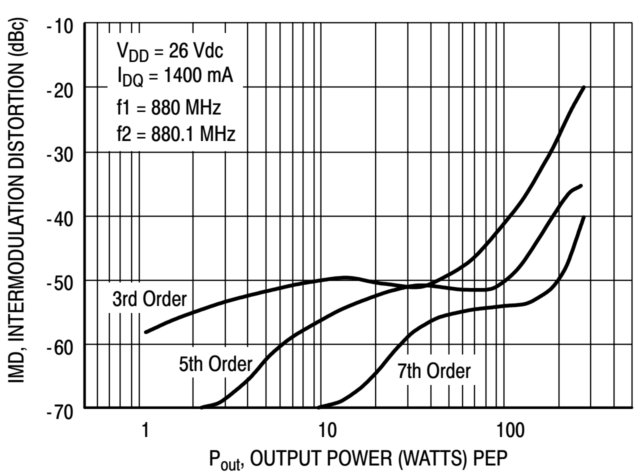


Figure 6. Intermodulation Distortion Products versus Output Power

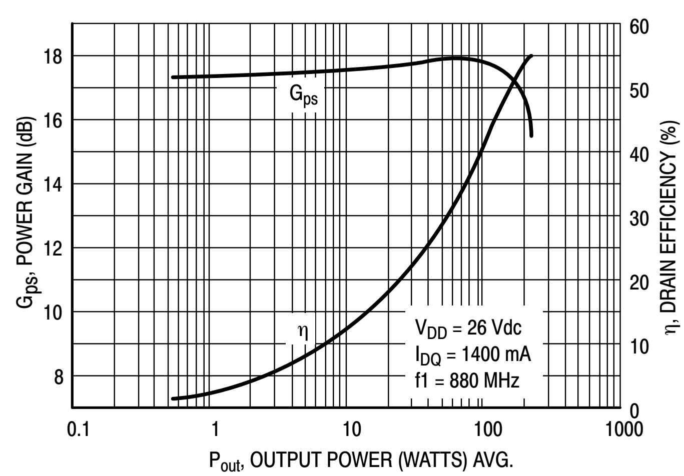


Figure 7. Power Gain and Efficiency versus Output Power

NOT RECOMMENDED FOR NEW DESIGN

TYPICAL CHARACTERISTICS

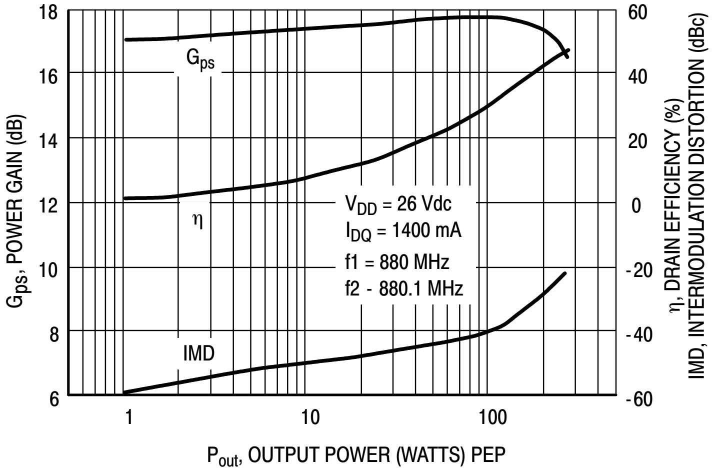


Figure 8. Power Gain, Efficiency and IMD versus Output Power

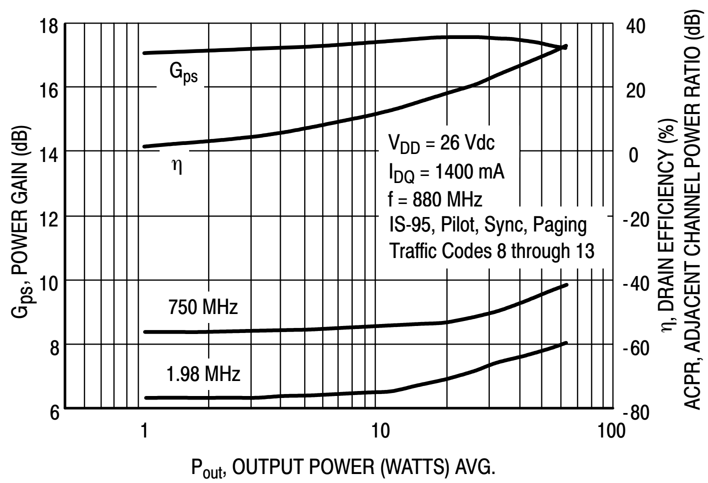
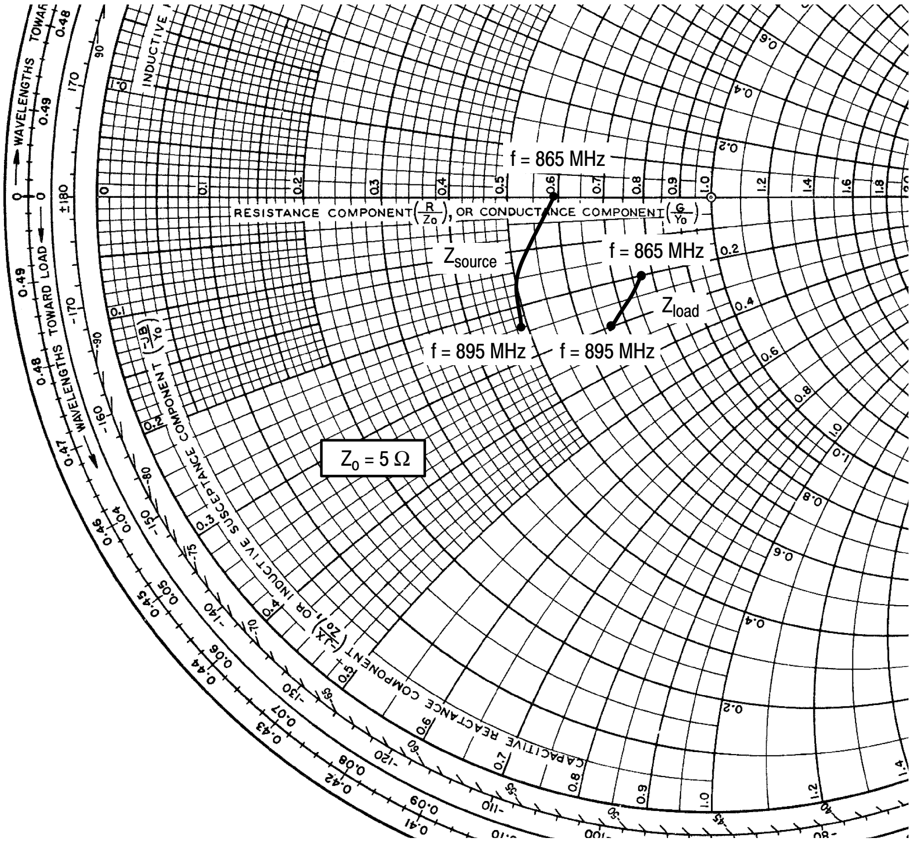


Figure 9. Power Gain, Efficiency and ACPR versus Output Power



V_{DD} = 26 V, I_{DQ} = 1400 mA, P_{out} = 170 W PEP

f MHz	Z_{source} Ω	Z_{load} Ω
865	2.95 - j0.00	3.83 - j1.02
880	2.48 - j0.67	3.55 - j1.38
895	2.44 - j1.18	3.34 - j1.51

Z_{source} = Test circuit impedance as measured from gate to gate, balanced configuration.

Z_{load} = Test circuit impedance as measured from drain to drain, balanced configuration.

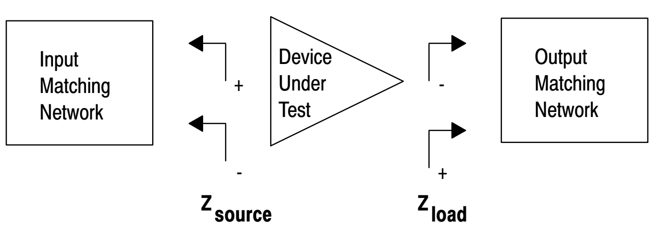
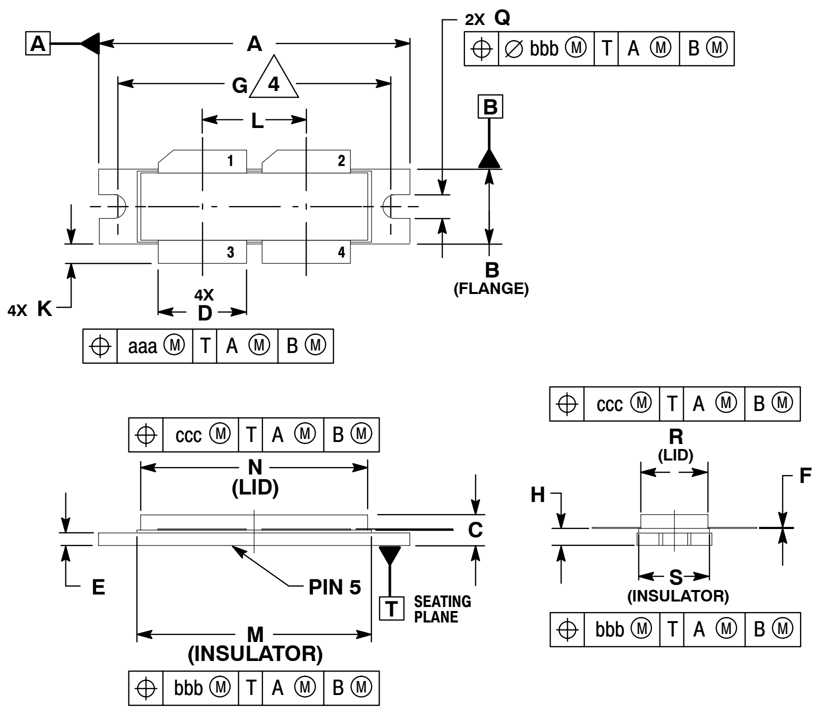


Figure 10. Series Equivalent Source and Load Impedance

PACKAGE DIMENSIONS



NOTES:
1. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.
4. RECOMMENDED BOLT CENTER DIMENSION OF 1.52 (38.61) BASED ON M3 SCREW.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	1.615	1.625	41.02	41.28
B	0.395	0.405	10.03	10.29
C	0.150	0.200	3.81	5.08
D	0.455	0.465	11.56	11.81
E	0.062	0.066	1.57	1.68
F	0.004	0.007	0.10	0.18
G	1.400 BSC		35.56 BSC	
H	0.082	0.090	2.08	2.29
K	0.117	0.137	2.97	3.48
L	0.540 BSC		13.72 BSC	
M	1.219	1.241	30.96	31.52
N	1.218	1.242	30.94	31.55
Q	0.120	0.130	3.05	3.30
R	0.355	0.365	9.01	9.27
S	0.365	0.375	9.27	9.53
aaa	0.013 REF		0.33 REF	
bbb	0.010 REF		0.25 REF	
ccc	0.020 REF		0.51 REF	

STYLE 1:
PIN 1. DRAIN
2. DRAIN
3. GATE
4. GATE
5. SOURCE

CASE 375D-05
ISSUE E
NI-1230

NOT RECOMMENDED FOR NEW DESIGN

How to Reach Us:

Home Page:
www.freescale.com

E-mail:
support@freescale.com

USA/Europe or Locations Not Listed:
Freescale Semiconductor
Technical Information Center, CH370
1300 N. Alma School Road
Chandler, Arizona 85224
+1-800-521-6274 or +1-480-768-2130
support@freescale.com

Europe, Middle East, and Africa:
Freescale Halbleiter Deutschland GmbH
Technical Information Center
Schatzbogen 7
81829 Muenchen, Germany
+44 1296 380 456 (English)
+46 8 52200080 (English)
+49 89 92103 559 (German)
+33 1 69 35 48 48 (French)
support@freescale.com

Japan:
Freescale Semiconductor Japan Ltd.
Headquarters
ARCO Tower 15F
1-8-1, Shimo-Meguro, Meguro-ku,
Tokyo 153-0064
Japan
0120 191014 or +81 3 5437 9125
support.japan@freescale.com

Asia/Pacific:
Freescale Semiconductor Hong Kong Ltd.
Technical Information Center
2 Dai King Street
Tai Po Industrial Estate
Tai Po, N.T., Hong Kong
+800 2666 8080
support.asia@freescale.com

For Literature Requests Only:
Freescale Semiconductor Literature Distribution Center
P.O. Box 5405
Denver, Colorado 80217
1-800-441-2447 or 303-675-2140
Fax: 303-675-2150
LDCForFreescaleSemiconductor@hibbertgroup.com

NOT RECOMMENDED FOR NEW DESIGN

freescale™ semiconductor

Document Number: MRF9180
Rev. 10, 5/2006