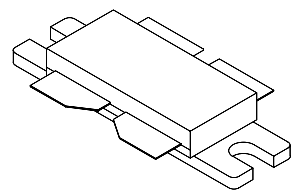
Document Number: MRF9210
Rev. 6, 9/2008

RF Power Field Effect Transistor

N-Channel Enhancement-Mode Lateral MOSFET

MRF9210R3

**880 MHz, 200 W, 26 V
LATERAL N-CHANNEL
RF POWER MOSFET**



**CASE 375G-04, STYLE 1
NI-860C3**

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} = 1900 mA
  IS-95 CDMA Pilot, Sync, Paging, Traffic Codes 8 Through 13
  - Output Power — 40 Watts
  - Power Gain — 16.5 dB
  - Efficiency — 25.5%
  - Adjacent Channel Power —
    - 750 kHz: -46.2 dBc in 30 kHz BW
    - 1.98 MHz: -60 dBc in 30 kHz BW
- Capable of Handling 10:1 VSWR, @ 26 Vdc, 880 MHz, 40 Watts CW Output Power

Features

- Internally Matched for Ease of Use
- Device Designed for Push-Pull Operation Only
- 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. R3 Suffix = 250 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	565 3.2	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 [(1)]	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.31	°C/W

Table 3. ESD Protection Characteristics

Test Conditions	Class
Human Body Model	1 (Minimum)
Machine Model	M3 (Minimum)
Charge Device Model	C5 (Minimum)

1. MTTF calculator available at http://www.freescale.com/rf. Select Software & Tools/Development Tools/Calculators to access MTTF calculators by product.

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

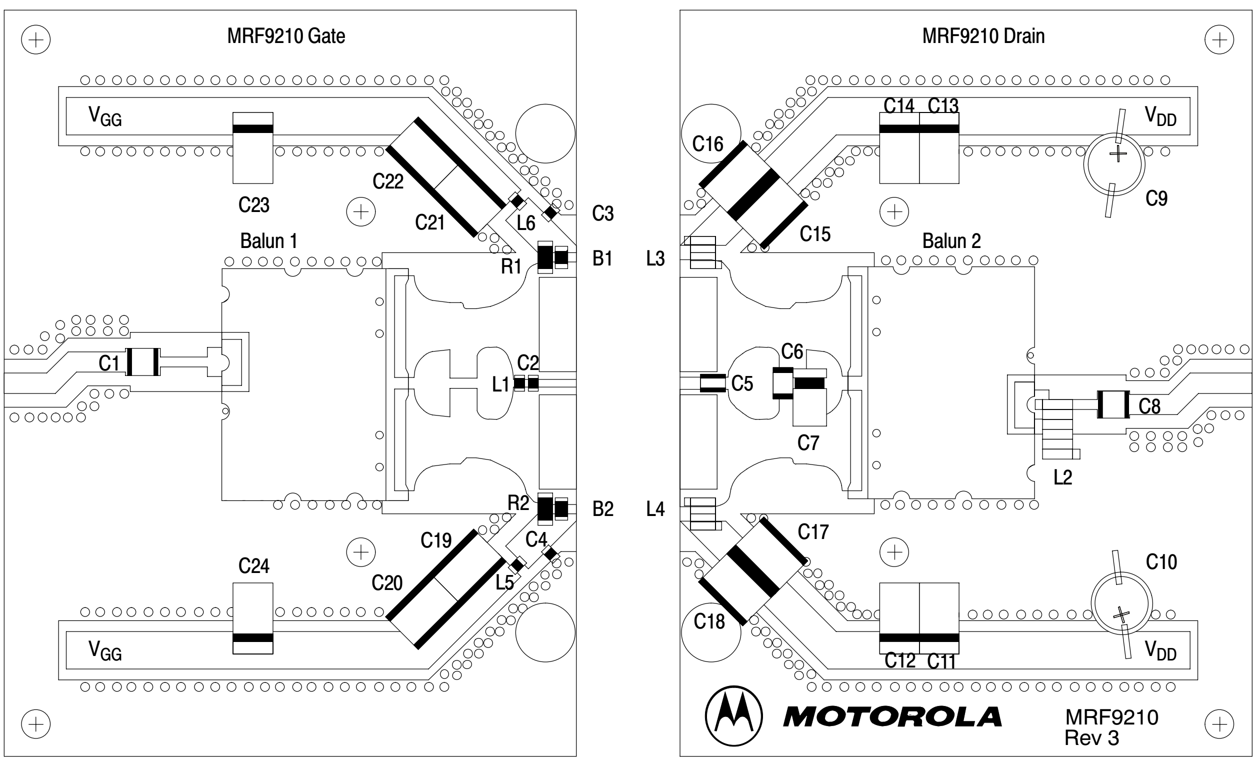
Characteristic	Symbol	Min	Typ	Max	Unit
Off Characteristics [1]					
Zero Gate Voltage Drain Leakage Current [4] (V_{DS} = 65 Vdc, V_{GS} = 0)	I_{DSS}	—	—	10	μAdc
Zero Gate Voltage Drain Leakage Current [4] (V_{DS} = 26 Vdc, V_{GS} = 0)	I_{DSS}	—	—	1	μAdc
Gate-Source Leakage Current (V_{GS} = 5 Vdc, V_{DS} = 0)	I_{GSS}	—	—	1	μAdc
On Characteristics					
Gate Threshold Voltage [1] (V_{DS} = 10 Vdc, I_D = 330 μAdc)	$V_{GS(th)}$	1.5	2.8	4	Vdc
Gate Quiescent Voltage [3] (V_{DS} = 26 Vdc, I_D = 1900 mAdc)	$V_{GS(Q)}$	2.5	3.3	4.5	Vdc
Drain-Source On-Voltage [1] (V_{GS} = 10 Vdc, I_D = 2.2 Adc)	$V_{DS(on)}$	—	0.2	0.4	Vdc
Forward Transconductance [1] (V_{DS} = 10 Vdc, I_D = 6.7 Adc)	g_{fs}	—	8.8	—	S
Dynamic Characteristics [1,2]					
Reverse Transfer Capacitance (V_{DS} = 26 Vdc ± 30 mV(rms)ac @ 1 MHz, V_{GS} = 0 Vdc)	C_{rss}	—	3.6	—	pF
Functional Tests [3] (In Freescale Test Fixture, 50 ohm system) Single-Carrier N-CDMA, 1.2288 MHz Channel Bandwidth Carrier, PAR = 9.8 dB @ 0.01% Probability on CCDF					
N-CDMA Common-Source Amplifier Power Gain (V_{DD} = 26 Vdc, P_{out} = 40 W Avg. N-CDMA, I_{DQ} = 1900 mA, f = 880 MHz)	G_{ps}	15.8	16.5	—	dB
N-CDMA Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 40 W Avg. N-CDMA, I_{DQ} = 1900 mA, f = 880 MHz)	η	23	25.5	—	%
Adjacent Channel Power Ratio (V_{DD} = 26 Vdc, P_{out} = 40 W Avg. N-CDMA, I_{DQ} = 1900 mA, f = 880 MHz; ACPR @ 40 W, 1.23 MHz Bandwidth, 750 kHz Channel Spacing)	ACPR	—	-46.2	-45	dBc
Input Return Loss (V_{DD} = 26 Vdc, P_{out} = 40 W Avg. N-CDMA, I_{DQ} = 1900 mA, f = 880 MHz)	IRL	9	17.5	—	dB
N-CDMA Common-Source Amplifier Power Gain (V_{DD} = 26 Vdc, P_{out} = 40 W Avg. N-CDMA, I_{DQ} = 1900 mA, f = 865 MHz and 895 MHz)	G_{ps}	—	16.5	—	dB
N-CDMA Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 40 W Avg. N-CDMA, I_{DQ} = 1900 mA, f = 865 MHz and 895 MHz)	η	—	25.5	—	%
Adjacent Channel Power Ratio (V_{DD} = 26 Vdc, P_{out} = 40 W Avg. N-CDMA, I_{DQ} = 1900 mA, f = 865 MHz and 895 MHz; ACPR @ 40 W, 1.23 MHz Bandwidth, 750 kHz Channel Spacing)	ACPR	—	-47.5	—	dBc
Input Return Loss (V_{DD} = 26 Vdc, P_{out} = 40 W Avg. N-CDMA, I_{DQ} = 1900 mA, f = 865 MHz and 895 MHz)	IRL	—	15	—	dB

1. Each side of device measured separately.
2. Part internally matched both on input and output.
3. Measurement made with device in push-pull configuration.
4. Drains are tied together internally as this is a total device value.

ARCHIVE INFORMATION

Table 5. 880 MHz Test Circuit Component Designations and Values

Part	Description	Part Number	Manufacturer
B1, B2	11 Ω RF Beads, Surface Mount (0805)	2508051107Y0	Fair-Rite
Balun 1, Balun 2	0.8-1 GHz Xinger Balun	3A412	Anaren
C1	27 pF Chip Capacitor	ATC100B270JT500XT	ATC
C2	12 pF Chip Capacitor (0603)	06035J120GBT	AVX / Kyocera
C3, C4	3.3 pF Chip Capacitors (0603)	06035J3R3BBT	AVX / Kyocera
C5	9.1 pF Chip Capacitor	ATC180R9R1JT500XT	ATC
C6	4.3 pF Chip Capacitor	ATC100B4R3CT500XT	ATC
C7	0.4-2.5 pF Variable Capacitor	27283PC	Gigatronics
C8	12 pF Chip Capacitor	ATC100B120JT500XT	ATC
C9, C10	470 μF, 63 V Electrolytic Capacitors	EMVY630GTR471MMH05	Nippon
C11, C12, C13, C14	22 μF, 35 V Tantalum Chip Capacitors	T491X226K035AT	Kemet
C15, C17, C19, C21	0.01 μF, 100 V Chip Capacitors	C1825C103J1GAC	Kemet
C16, C18	0.56 μF, 50 V Chip Capacitors	C1825C564J5GAC	Kemet
C20, C22	2.2 μF, 50 V Chip Capacitors	C1825C225J5RAC3810	Kemet
C23, C24	47 μF, 16 V Tantalum Chip Capacitors	T491D476K016AT	Kemet
L1	12 nH Inductor (0603)	0603HC-12NHJBU	Coilcraft
L2	22 nH Inductor	B07T-5	Coilcraft
L3, L4	12.5 nH Inductors	A04T-5	Coilcraft
L5, L6	10 nH Inductors (0603)	0603HC-10NHJBU	Coilcraft
R1, R2	24 Ω, 1/4 W Chip Resistors	CRCW120624R0FKEA	Vishay



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 1. 880 MHz Test Circuit Component Layout

TYPICAL CHARACTERISTICS

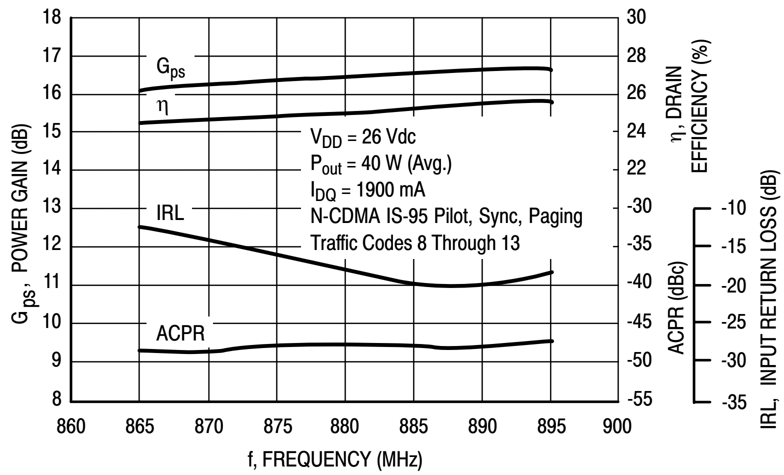


Figure 2. Class AB Broadband Circuit Performance

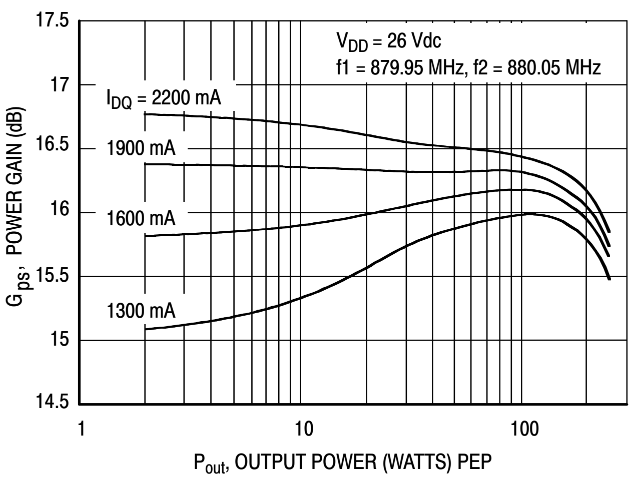


Figure 3. Power Gain versus Output Power

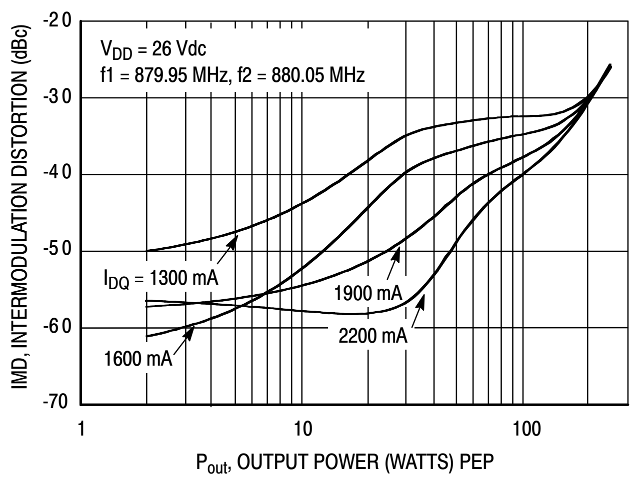


Figure 4. Intermodulation Distortion versus Output Power

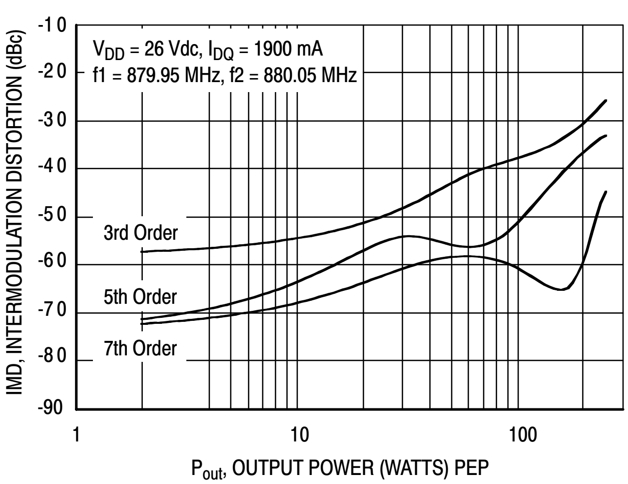


Figure 5. Intermodulation Distortion Products versus Output Power

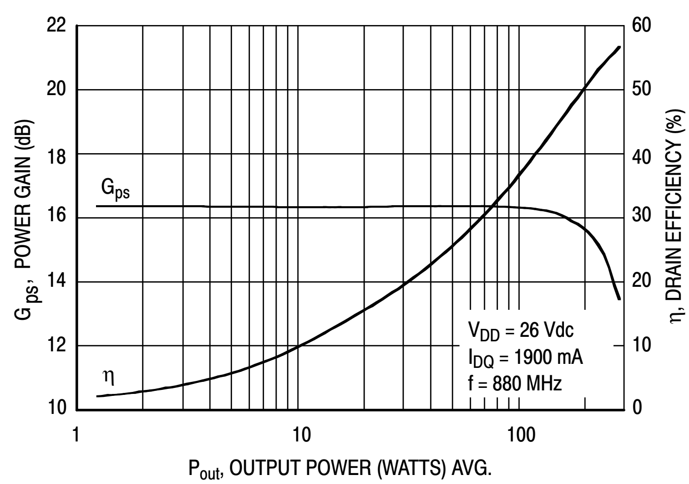


Figure 6. Power Gain and Efficiency versus Output Power

TYPICAL CHARACTERISTICS

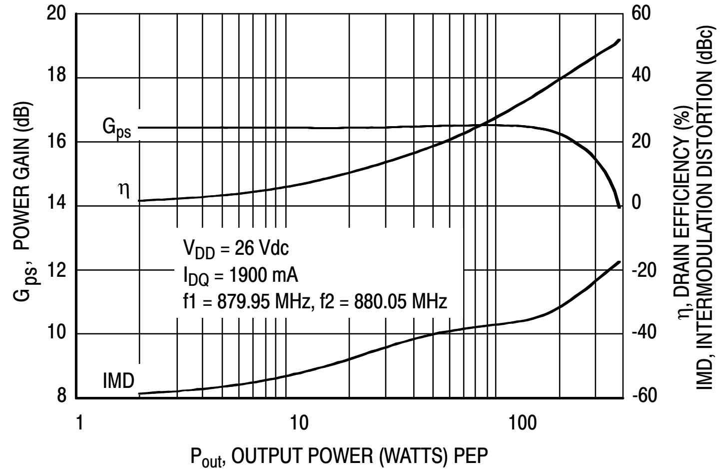


Figure 7. Power Gain, Efficiency and IMD versus Output Power

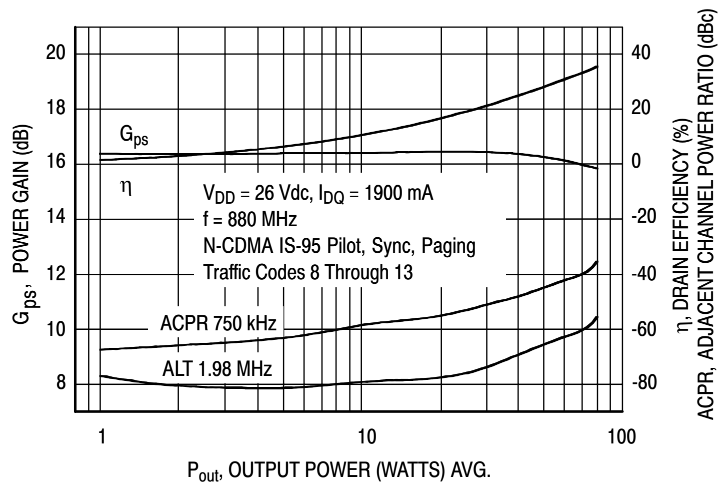


Figure 8. N-CDMA Performance Output Power versus Gain, ACPR, Efficiency

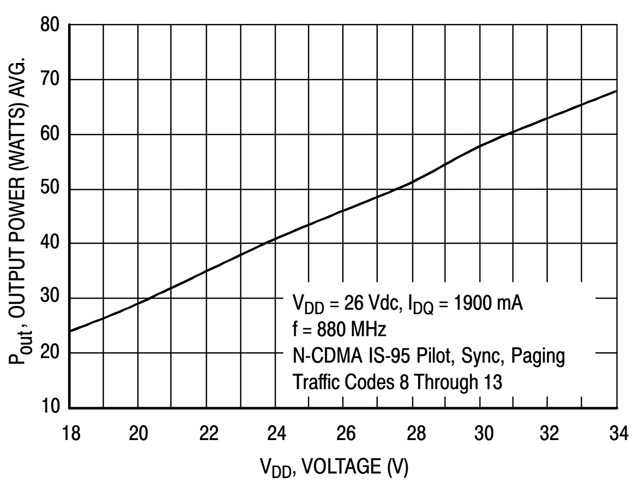


Figure 9. Single-Carrier Maximum N-CDMA Linear Output Power versus Drain Voltage

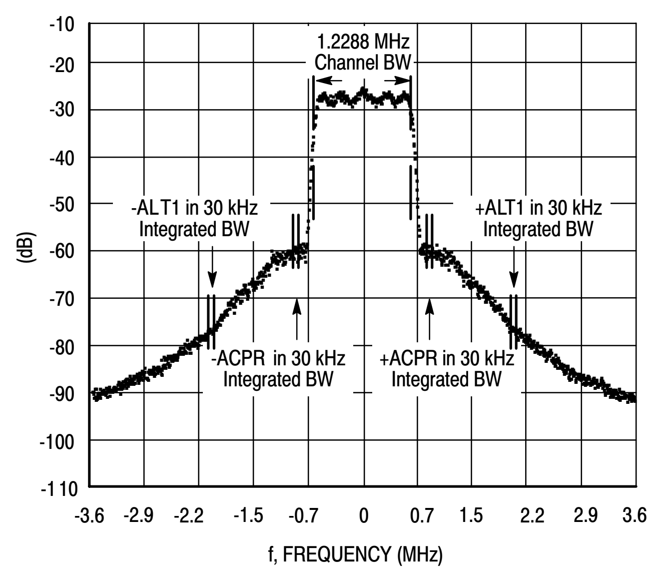
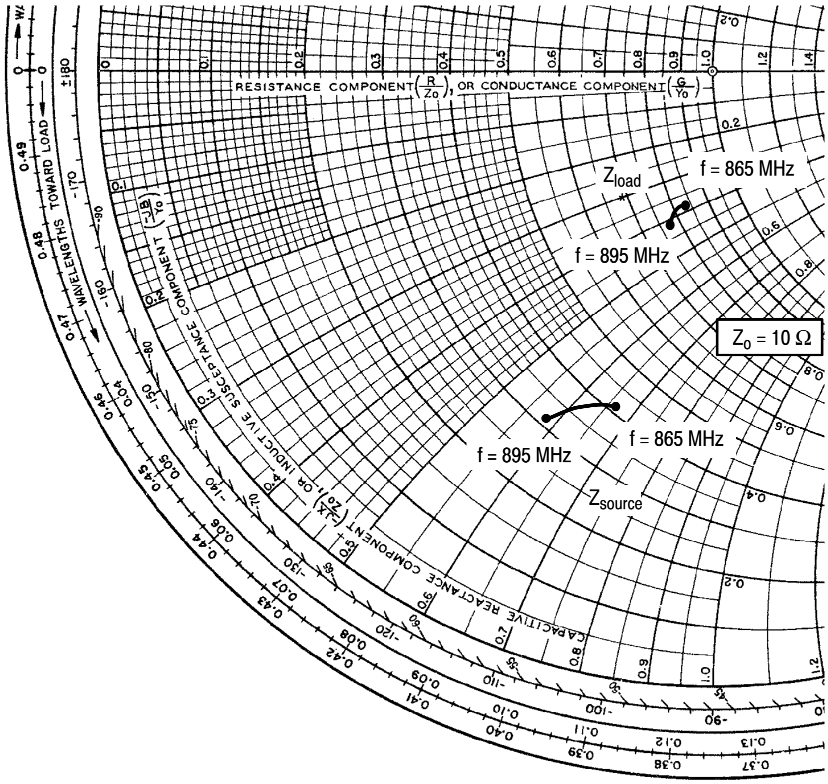


Figure 10. Single-Carrier N-CDMA Spectrum



V_{DD} = 26 V, I_{DQ} = 1900 mA, P_{out} = 40 W Avg.

f MHz	Z_{source} Ω	Z_{load} Ω
865	4.19 - j6.71	8.43 - j3.83
880	3.69 - j6.18	8.12 - j3.85
895	3.17 - j5.85	7.84 - j4.08

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.

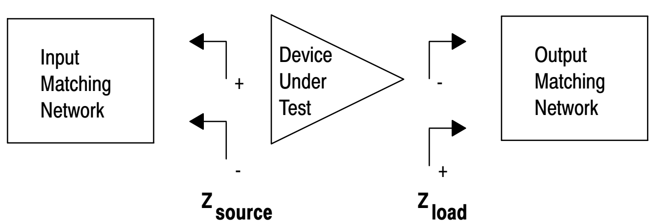
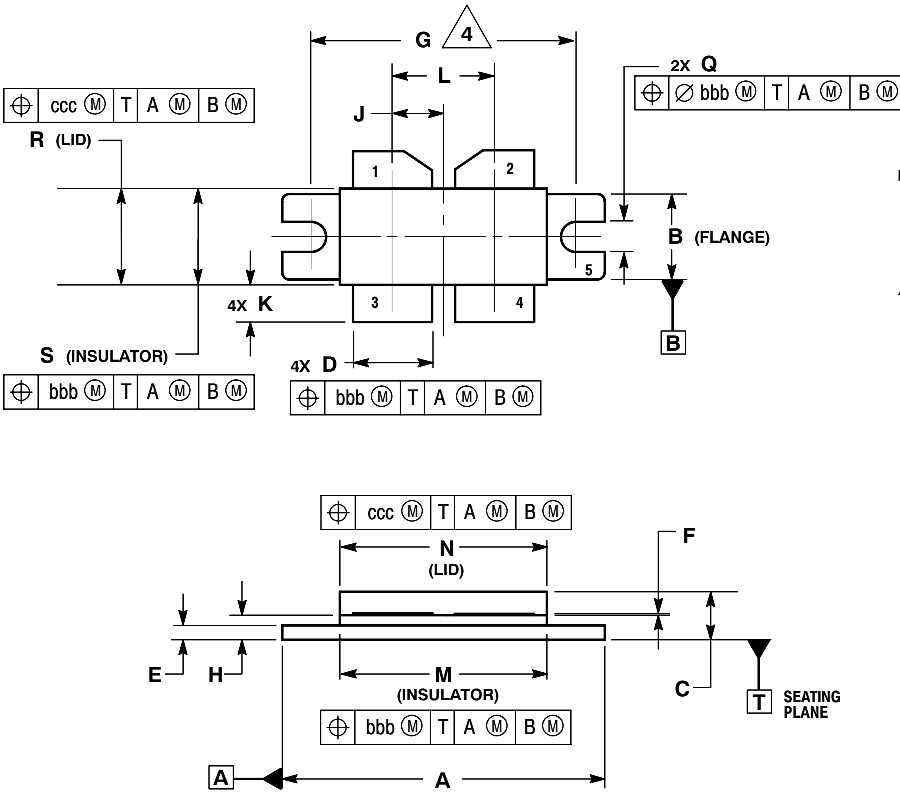


Figure 11. Series Equivalent Source and Load Impedance

PACKAGE DIMENSIONS



NOTES:
1. CONTROLLING DIMENSION: INCH.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.
3. DIMENSION H TO BE MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.
4. RECOMMENDED BOLT CENTER DIMENSION OF 1.140 (28.96) BASED ON 3M SCREW.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	1.335	1.345	33.91	34.16
B	0.380	0.390	9.65	9.91
C	0.180	0.224	4.57	5.69
D	0.325	0.335	8.26	8.51
E	0.060	0.070	1.52	1.78
F	0.004	0.006	0.10	0.15
G	1.100 BSC		27.94 BSC	
H	0.097	0.107	2.46	2.72
J	0.2125 BSC		5.397 BSC	
K	0.135	0.165	3.43	4.19
L	0.425 BSC		10.8 BSC	
M	0.852	0.868	21.64	22.05
N	0.851	0.869	21.62	22.07
Q	0.118	0.138	3.00	3.30
R	0.395	0.405	10.03	10.29
S	0.394	0.406	10.01	10.31
bbb	0.010 REF		0.25 REF	
ccc	0.015 REF		0.38 REF	

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

CASE 375G-04
ISSUE G
NI-860C3

PRODUCT DOCUMENTATION

Refer to the following documents to aid your design process.

Engineering Bulletins

- EB212: Using Data Sheet Impedances for RF LDMOS Devices

REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
6	Dec. 2009	• Data sheet archived. Part no longer manufactured. • Updated Part Numbers in Table 5, Component Designations and Values, to RoHS compliant part numbers, p. 3 • Added Product Documentation and Revision History, p. 8

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