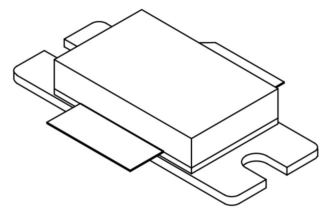
RF Power Field Effect Transistor

N-Channel Enhancement-Mode Lateral MOSFET

MRF19125R3

1930-1990 MHz, 125 W, 26 V
LATERAL N-CHANNEL
RF POWER MOSFET



CASE 465B-03, STYLE 1
NI-880

Designed for PCN and PCS base station applications with frequencies from 1900 to 2000 MHz. Suitable for TDMA, CDMA and multicarrier amplifier applications.

- Typical 2-Carrier N-CDMA Performance for V_{DD} = 26 Volts, I_{DQ} = 1300 mA, f = 1930 MHz, IS-95 CDMA (Pilot, Sync, Paging, Traffic Codes 8 Through 13) 1.2288 MHz Channel Bandwidth Carrier. Adjacent Channels Measured over a 30 kHz Bandwidth at f1 -885 kHz and f2 +885 kHz. Distortion Products Measured over 1.2288 MHz Bandwidth at f1 -2.5 MHz and f2 +2.5 MHz. Peak/Avg. = 9.8 dB @ 0.01% Probability on CCDF.
  Output Power — 24 Watts Avg.
  Power Gain — 13.6 dB
  Efficiency — 22%
  ACPR — -51 dB
  IM3 — -37.0 dBc
- Capable of Handling 5:1 VSWR, @ 26 Vdc, 1960 MHz, 125 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. 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	330 1.89	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	$R_{\theta JC}$	0.53	°C/W

Table 3. ESD Protection Characteristics

Test Conditions	Class
Human Body Model	2 (Minimum)
Machine Model	M3 (Minimum)

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

Characteristic	Symbol	Min	Typ	Max	Unit
Off Characteristics					
Drain-Source Breakdown Voltage (V_{GS} = 0 Vdc, I_D = 100 μAdc)	$V_{(BR)DSS}$	65	—	—	Vdc
Gate-Source Leakage Current (V_{GS} = 5 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	—	—	1	μAdc
Zero Gate Voltage Drain Leakage Current (V_{DS} = 26 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	10	μAdc
On Characteristics					
Forward Transconductance (V_{DS} = 10 Vdc, I_D = 3 Adc)	g_{fs}	—	9	—	S
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 300 μAdc)	$V_{GS(th)}$	2	—	4	Vdc
Gate Quiescent Voltage (V_{DS} = 26 Vdc, I_D = 1300 mAdc)	$V_{GS(Q)}$	2.5	3.9	4.5	Vdc
Drain-Source On-Voltage (V_{GS} = 10 Vdc, I_D = 3 Adc)	$V_{DS(on)}$	—	0.185	0.21	Vdc
Dynamic Characteristics					
Reverse Transfer Capacitance [1] (V_{DS} = 26 Vdc, V_{GS} = 0, f = 1 MHz)	C_{rss}	—	5.4	—	pF
Functional Tests (In Freescale Test Fixture) 2-Carrier N-CDMA, 1.2288 MHz Channel Bandwidth Carriers. Peak/Avg = 9.8 dB @ 0.01% Probability on CCDF.					
Common-Source Amplifier Power Gain (V_{DD} = 26 Vdc, P_{out} = 24 W Avg, I_{DQ} = 1300 mA, f1 = 1930 MHz, f2 = 1932.5 MHz)	G_{ps}	12	13.5	—	dB
Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 24 W Avg, I_{DQ} = 1300 mA, f1 = 1930 MHz, f2 = 1932.5 MHz)	η	19	22	—	%
Intermodulation Distortion (V_{DD} = 26 Vdc, P_{out} = 24 W Avg, I_{DQ} = 1300 mA, f1 = 1930 MHz, f2 = 1932.5 MHz; IM3 measured over 1.2288 MHz Bandwidth at f1 -2.5 MHz and f2 +2.5 MHz)	IM3	—	-37	-35	dBc
Adjacent Channel Power Ratio (V_{DD} = 26 Vdc, P_{out} = 24 W Avg, I_{DQ} = 1300 mA, f1 = 1930 MHz, f2 = 1932.5 MHz; ACPR measured over 30 kHz Bandwidth at f1 -885 MHz and f2 +885 MHz)	ACPR	—	-51	-47	dBc
Input Return Loss (V_{DD} = 26 Vdc, P_{out} = 24 W Avg, I_{DQ} = 1300 mA, f1 = 1930 MHz, f2 = 1932.5 MHz)	IRL	—	-13	-9	dB

1. Part is internally matched both on input and output.

(continued)

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

Characteristic	Symbol	Min	Typ	Max	Unit
Functional Tests (In Freescale Test Fixture)					
Two-Tone Common-Source Amplifier Power Gain (V_{DD} = 26 Vdc, P_{out} = 125 W PEP, I_{DQ} = 1300 mA, f1 = 1930 MHz, f2 = 1990 MHz, Tone Spacing = 100 kHz)	G_{ps}	—	13.5	—	dB
Two-Tone Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 125 W PEP, I_{DQ} = 1300 mA, f1 = 1930 MHz, f2 = 1990 MHz, Tone Spacing = 100 kHz)	η	—	35	—	%
Third Order Intermodulation Distortion (V_{DD} = 26 Vdc, P_{out} = 125 W PEP, I_{DQ} = 1300 mA, f1 = 1930 MHz, f2 = 1990 MHz, Tone Spacing = 100 kHz)	IMD	—	-30	—	dBc
Input Return Loss (V_{DD} = 26 Vdc, P_{out} = 125 W PEP, I_{DQ} = 1300 mA, f1 = 1930 MHz, f2 = 1990 MHz, Tone Spacing = 100 kHz)	IRL	—	-13	—	dB
P_{out}, 1 dB Compression Point (V_{DD} = 26 Vdc, I_{DQ} = 1300 mA, f = 1990 MHz)	P1dB	—	130	—	W

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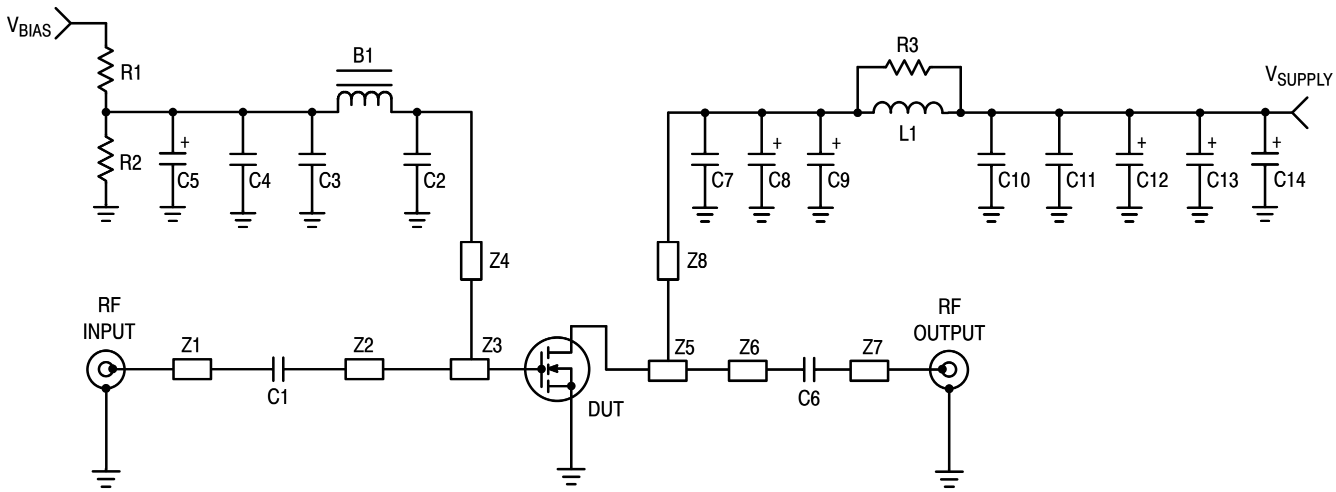

Z1, Z7	0.500″ x 0.084″ Microstrip	Board	0.030″ Glass Teflon®, Keene GX-0300-55-22, ε_r = 2.55
Z2	1.105″ x 0.084″ Microstrip	PCB	Etched Circuit Boards MRF19125 Rev. 5, CMR
Z3	0.360″ x 0.895″ Microstrip		
Z4	0.920″ x 0.048″ Microstrip		
Z5	0.605″ x 1.195″ Microstrip		
Z6	0.800″ x 0.084″ Microstrip		
Z8	0.660″ x 0.095″ Microstrip		

Figure 1. MRF19125R3 Test Circuit Schematic

Table 5. MRF19125R3 Test Circuit Component Designations and Values

Designators	Description
B1	Short Ferrite Bead, Fair Rite #2743019447
C1	51 pF Chip Capacitor, ATC #100B510JCA500X
C2, C7	5.1 pF Chip Capacitors, ATC #100B5R1JCA500X
C3, C10	1000 pF Chip Capacitors, ATC #100B102JCA500X
C4, C11	0.1 μF Chip Capacitors, Kemet #CDR33BX104AKWS
C5	0.1 μF Tantalum Chip Capacitor, Kemet #T491C105M050
C6	10 pF Chip Capacitor, ATC #100B100JCA500X
C8	10 μF Tantalum Chip Capacitor, Kemet #T491X106K035AS4394
C9, C12, C13, C14	22 μF Tantalum Chip Capacitors, Kemet #T491X226K035AS4394
L1	1 Turn, #20 AWG, 0.100″ ID
N1, N2	Type N Flange Mounts, Omni Spectra #3052-1648-10
R1	1.0 kΩ, 1/8 W Chip Resistor
R2	220 kΩ, 1/8 W Chip Resistor
R3	10 Ω, 1/8 W Chip Resistor

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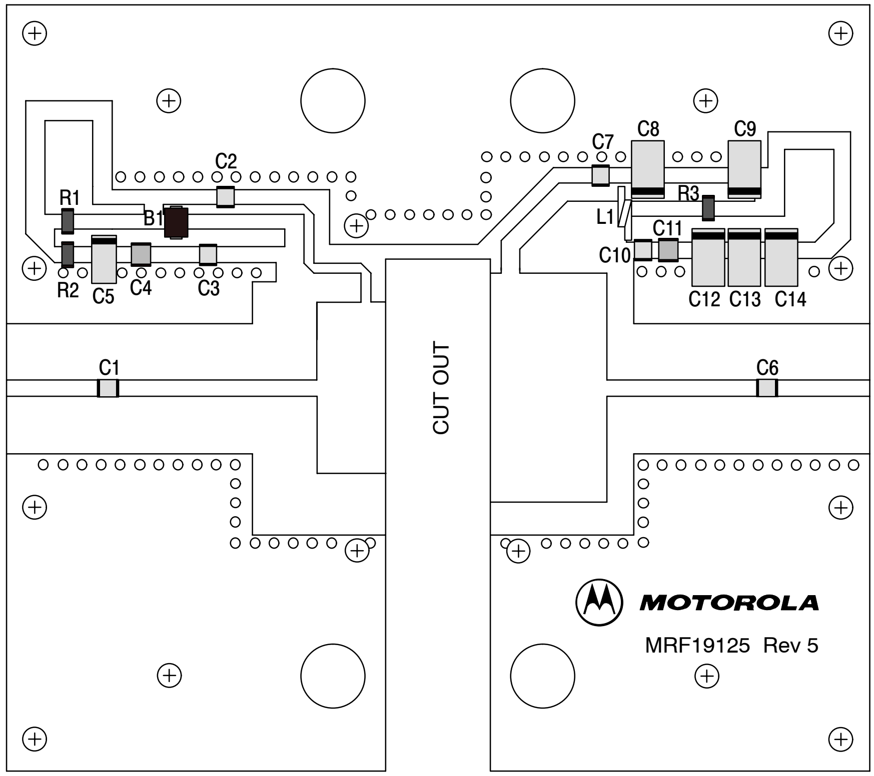

Freescale has begun the transition of marking Printed Circuit Boards (PCBs) with the Freescale Semiconductor signature/logo. PCBs may have either Motorola or Freescale markings during the transition period. These changes will have no impact on form, fit or function of the current product.

Figure 2. MRF19125R3 Test Circuit Component Layout

TYPICAL CHARACTERISTICS

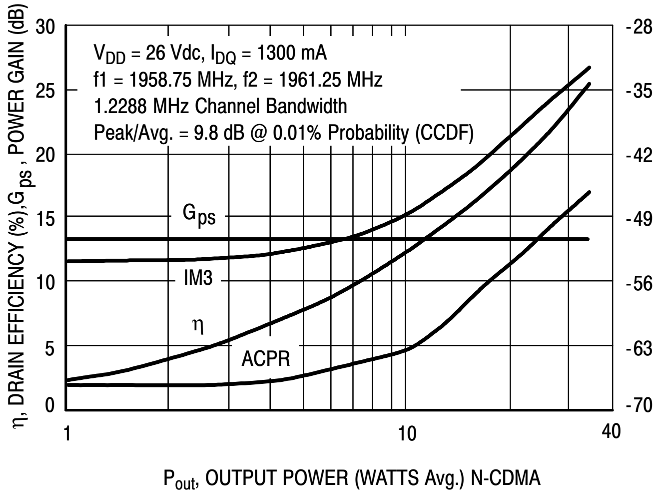

Figure 3. 2-Carrier CDMA ACPR, IM3, Power Gain and Drain Efficiency versus Output Power

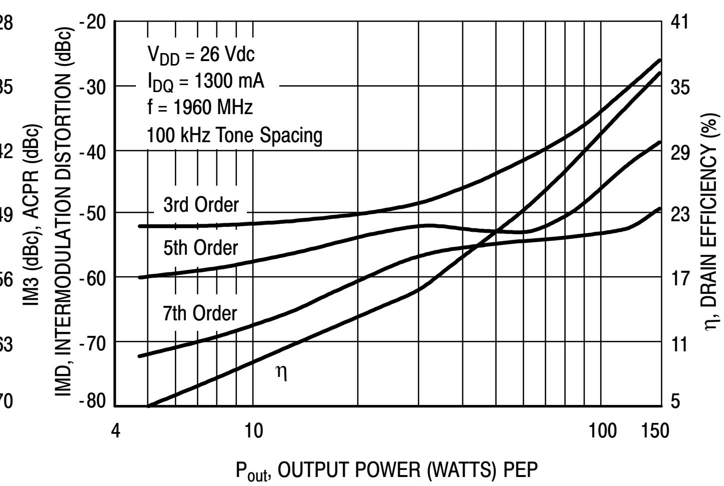

Figure 4. Intermodulation Distortion Products versus Output Power

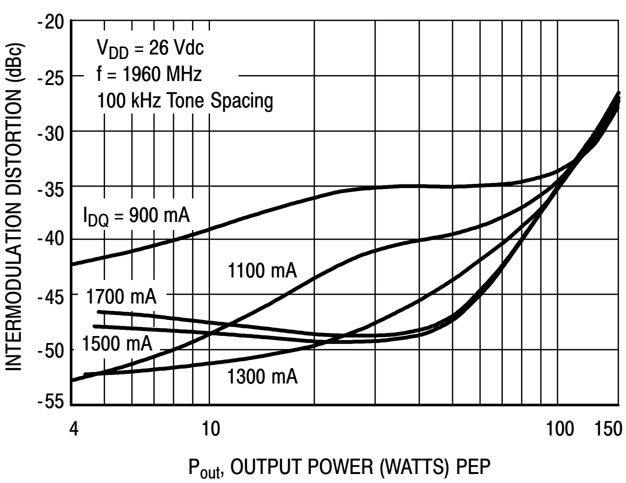

Figure 5. Third Order Intermodulation Distortion versus Output Power

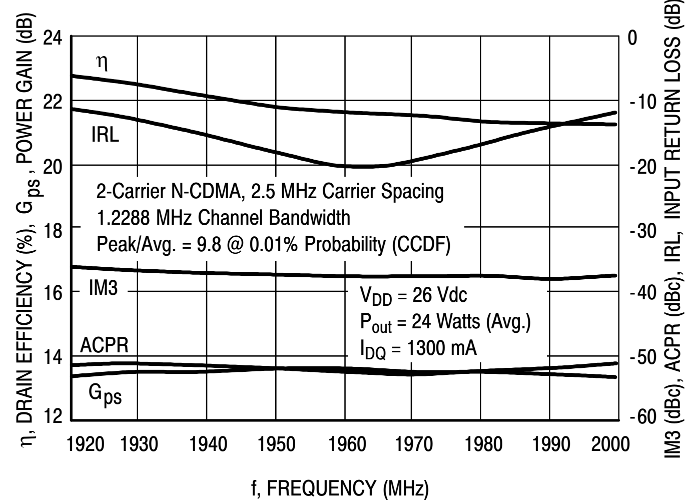

Figure 6. 2-Carrier N-CDMA Broadband Performance

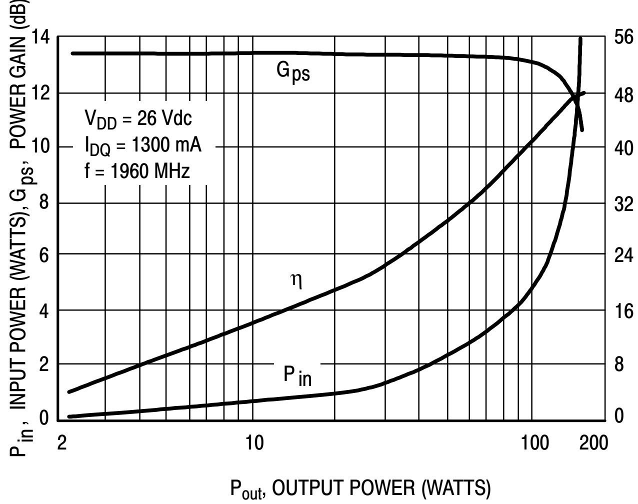

Figure 7. CW Performance

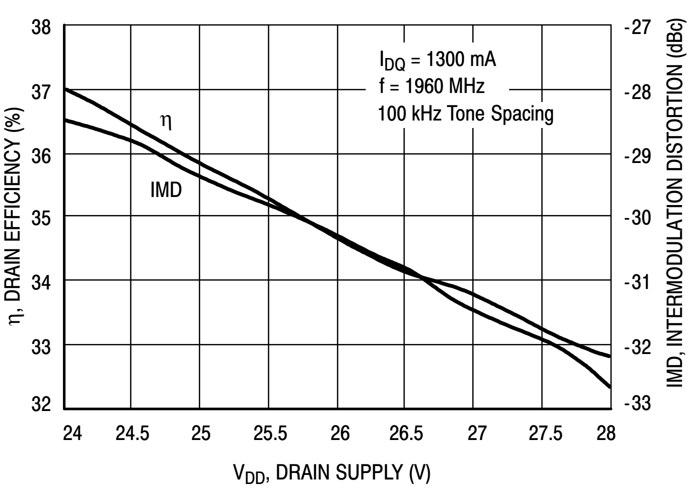

Figure 8. Two-Tone Intermodulation Distortion and Drain Efficiency versus Drain Supply

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TYPICAL CHARACTERISTICS

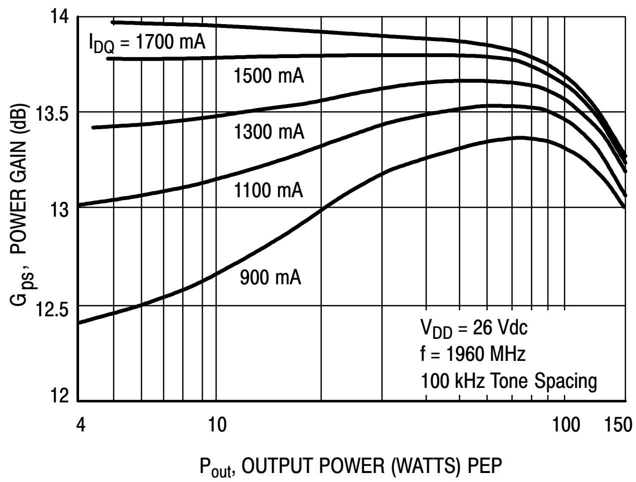


Figure 9. Two-Tone Power Gain versus Output Power

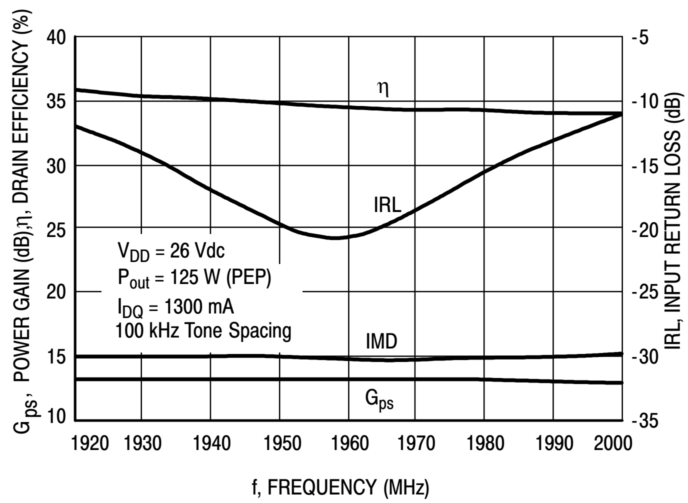


Figure 10. Two-Tone Broadband Performance

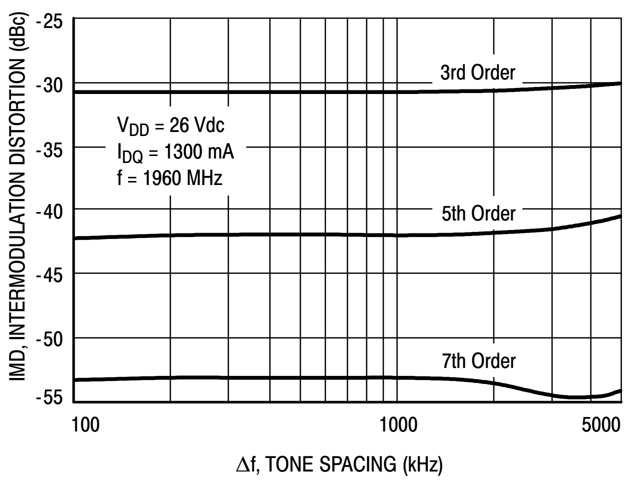
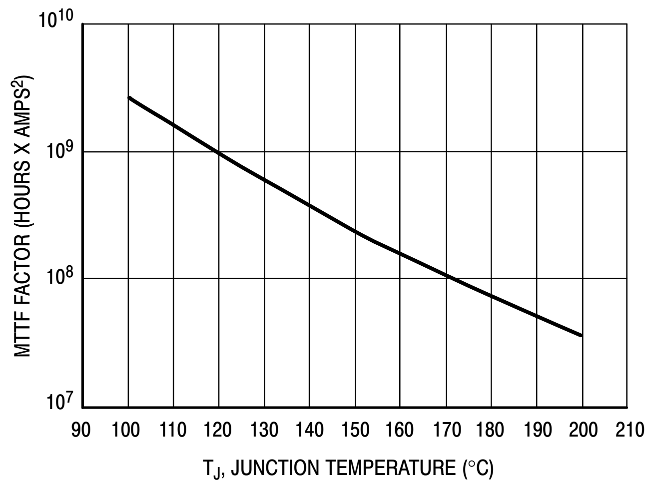


Figure 11. Intermodulation Distortion Products versus Two-Tone Tone Spacing



This above graph displays calculated MTTF in hours x ampere^2 drain current. Life tests at elevated temperatures have correlated to better than ±10% of the theoretical prediction for metal failure. Divide MTTF factor by I_D^2 for MTTF in a particular application.

Figure 12. MTTF Factor versus Junction Temperature

N-CDMA TEST SIGNAL

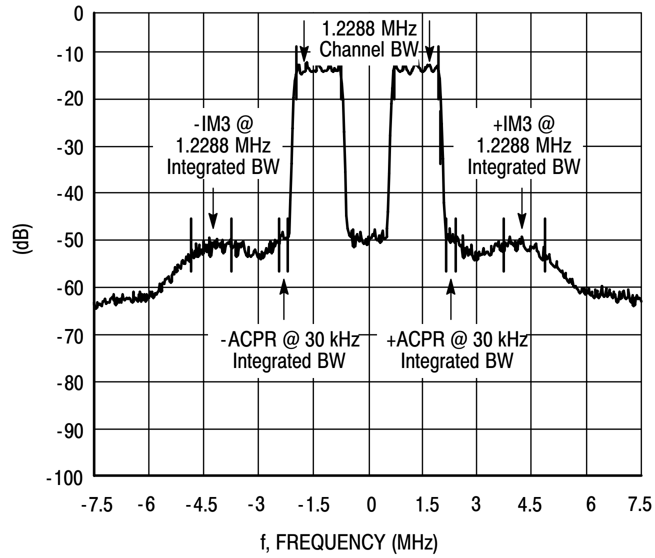


Figure 14. 2-Carrier N-CDMA Spectrum

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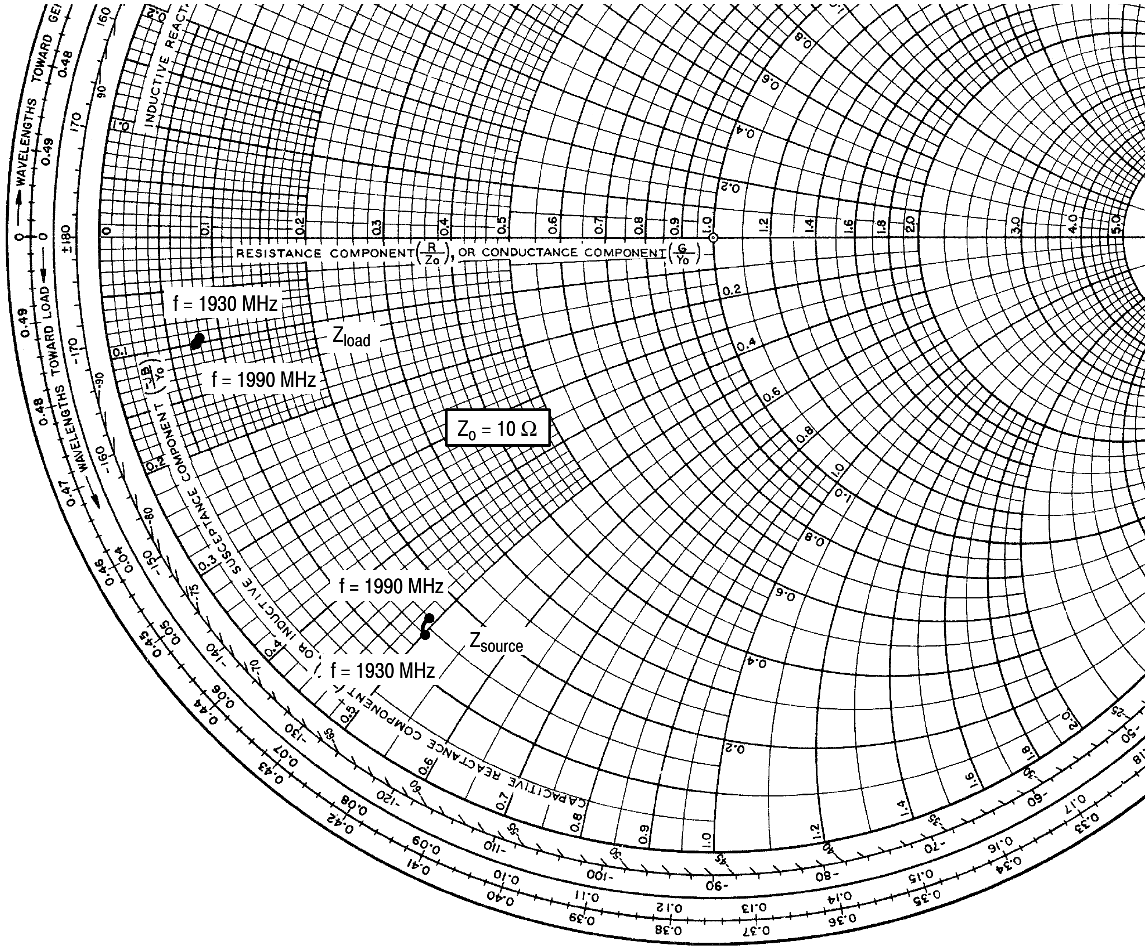


V_{DD} = 26 V, I_{DQ} = 1300 mA, P_{out} = 24 W (Avg.)

f MHz	Z_{source} Ω	Z_{load} Ω
1930	1.43 - j5.01	0.75 - j0.93
1960	1.51 - j4.88	0.71 - j0.89
1990	1.56 - j4.93	0.68 - j1.02

Z_{source} = Test circuit impedance as measured from gate to ground.

Z_{load} = Test circuit impedance as measured from drain to ground.

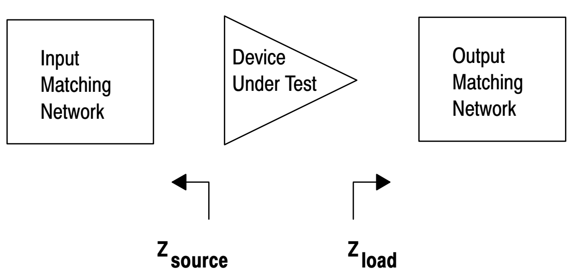
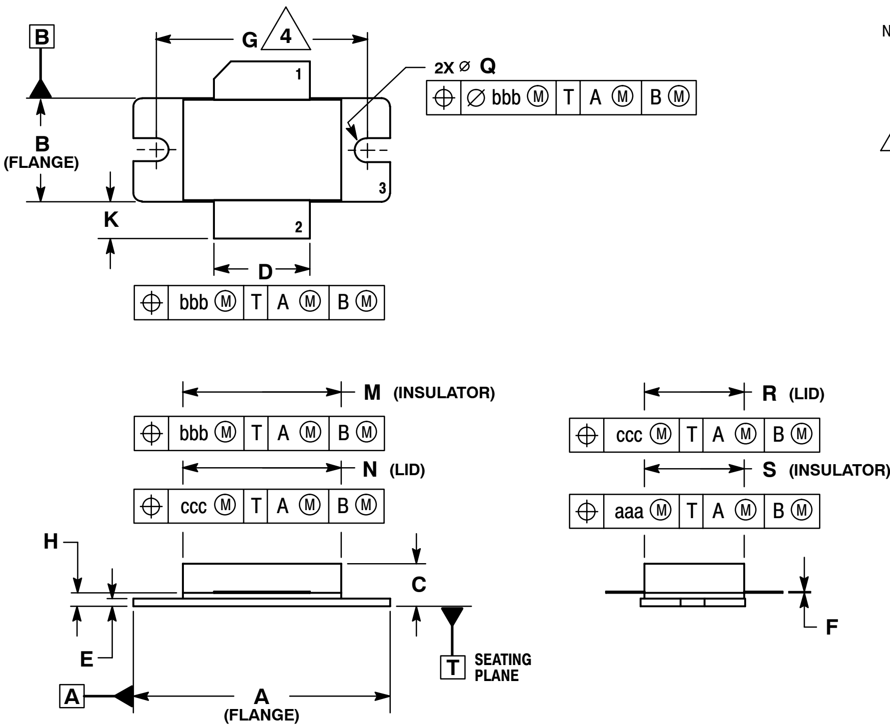


Figure 13. Series Equivalent Source and Load Impedance

PACKAGE DIMENSIONS



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI 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 1.16 (29.57) BASED ON M3 SCREW.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	1.335	1.345	33.91	34.16
B	0.535	0.545	13.6	13.8
C	0.147	0.200	3.73	5.08
D	0.495	0.505	12.57	12.83
E	0.035	0.045	0.89	1.14
F	0.003	0.006	0.08	0.15
G	1.100 BSC		27.94 BSC	
H	0.057	0.067	1.45	1.70
K	0.175	0.205	4.44	5.21
M	0.872	0.888	22.15	22.55
N	0.871	0.889	19.30	22.60
Q	Ø.118	Ø.138	Ø3.00	Ø3.51
R	0.515	0.525	13.10	13.30
S	0.515	0.525	13.10	13.30
aaa	0.007 REF		0.178 REF	
bbb	0.010 REF		0.254 REF	
ccc	0.015 REF		0.381 REF	

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

CASE 465B-03
ISSUE D
NI-880
MRF19125R3

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
8	Oct. 2008	• Data sheet revised to reflect part status change, p. 1, 4-5, including use of applicable overlay. • Modified data sheet to reflect RF Test Reduction described in Product and Process Change Notification number, PCN12779, p. 1, 2 • Data sheet archived. Part no longer manufactured. • Added Product Documentation and Revision History, p. 11

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