THE DATASHEET OF

MRF19125R3

Freescale Semiconductor
Technical Data

Document Number: MRF19125
Rev. 6, 4/2006

RoHS

RF Power Field Effect Transistors

N-Channel Enhancement-Mode Lateral MOSFETs

MRF19125R3
MRF19125SR3

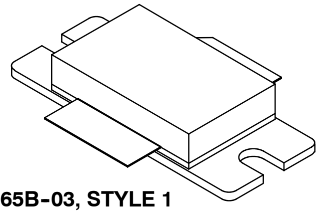
Designed for PCN and PCS base station applications with frequencies from 1900 to 2000 MHz. Suitable for TDMA, CDMA and multicarrier amplifier applications.

- Typical 2-Carrier N-CDMA Performance for V_{DD} = 26 Volts, I_{DQ} = 1300 mA, f1 = 1958.75 MHz, f2 = 1961.25 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

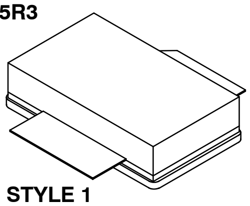
Features

- 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.

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



CASE 465B-03, STYLE 1
NI-880
MRF191225R3



CASE 465C-02, STYLE 1
NI-880S
MRF19125SR3

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)

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

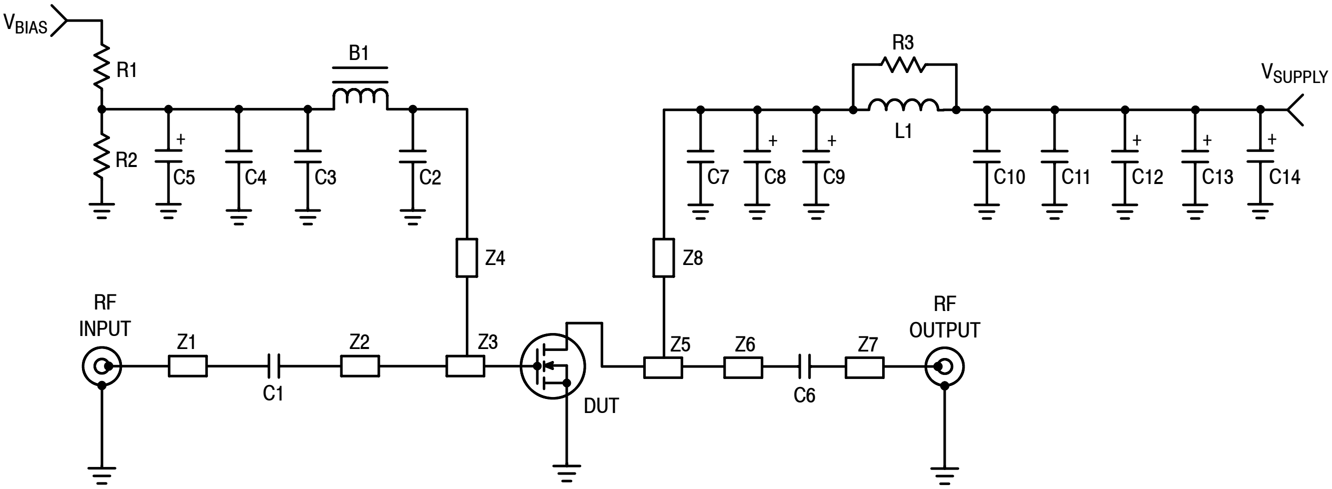
Characteristic	Symbol	Min	Typ	Max	Unit
Off Characteristics					
Drain-Source Breakdown Voltage (V_{GS} = 0 Vdc, I_D = 100 µAdc)	$V_{(BR)DSS}$	65	—	—	Vdc
Gate-Source Leakage Current (V_{GS} = 5 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	—	—	1	µAdc
Zero Gate Voltage Drain Leakage Current (V_{DS} = 26 Vdc, V_{GS} = 0 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 and f1 = 1987.5 MHz, f2 = 1990 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 and f1 = 1987.5 MHz, f2 = 1990 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 and f1 = 1987.5 MHz, f2 = 1990 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 and f1 = 1987.5 MHz, f2 = 1990 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 and f1 = 1987.5 MHz, f2 = 1990 MHz)	IRL	—	-13	-9	dB

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

(continued)

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



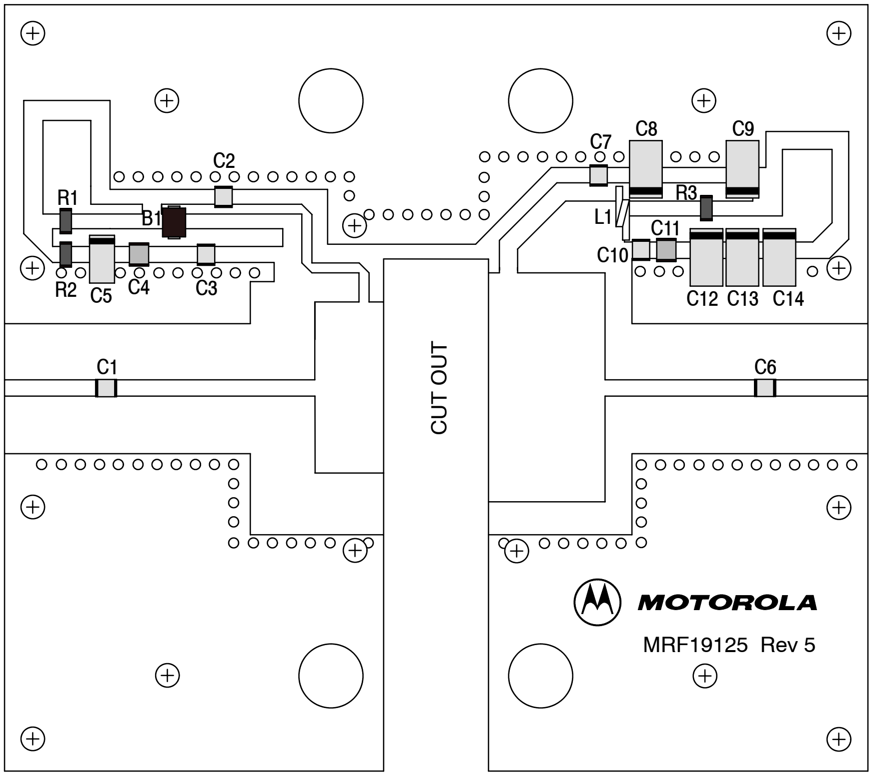
Z1, Z7	0.500″ x 0.084″ Microstrip
Z2	1.105″ x 0.084″ Microstrip
Z3	0.360″ x 0.895″ Microstrip
Z4	0.920″ x 0.048″ Microstrip
Z5	0.605″ x 1.195″ Microstrip
Z6	0.800″ x 0.084″ Microstrip
Z8	0.660″ x 0.095″ Microstrip

Board	0.030″ Glass Teflon®, Keene GX-0300-55-22, ε_r = 2.55
PCB	Etched Circuit Boards MRF19125 Rev. 5, CMR

Figure 1. MRF19125R3(SR3) Test Circuit Schematic

Table 5. MRF19125R3(SR3) 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



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(SR3) Test Circuit Component Layout

TYPICAL CHARACTERISTICS

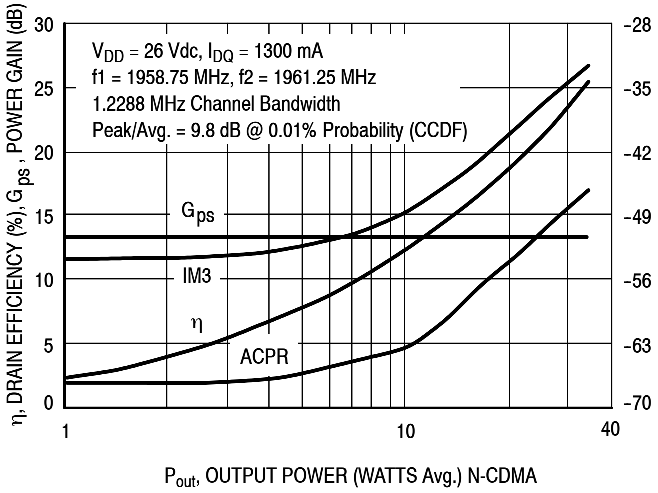


Figure 3. 2-Carrier CDMA ACPR, IM3, Power Gain and Drain Efficiency versus Output Power

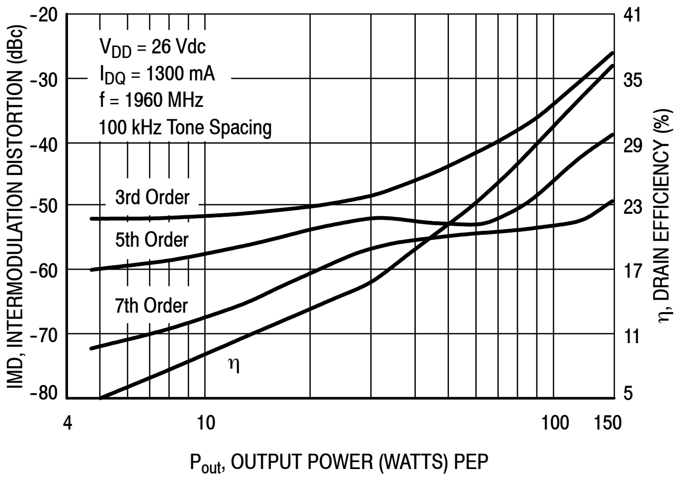


Figure 4. Intermodulation Distortion Products versus Output Power

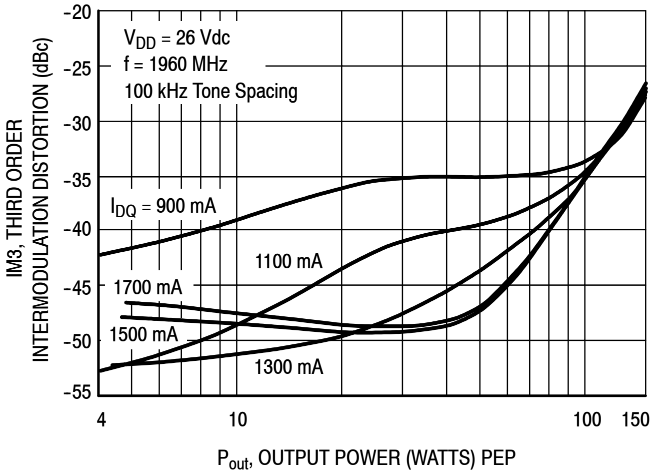


Figure 5. Third Order Intermodulation Distortion versus Output Power

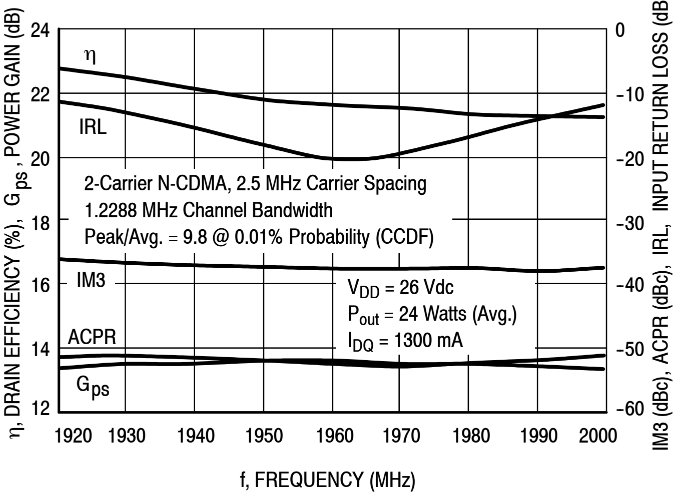


Figure 6. 2-Carrier N-CDMA Broadband Performance

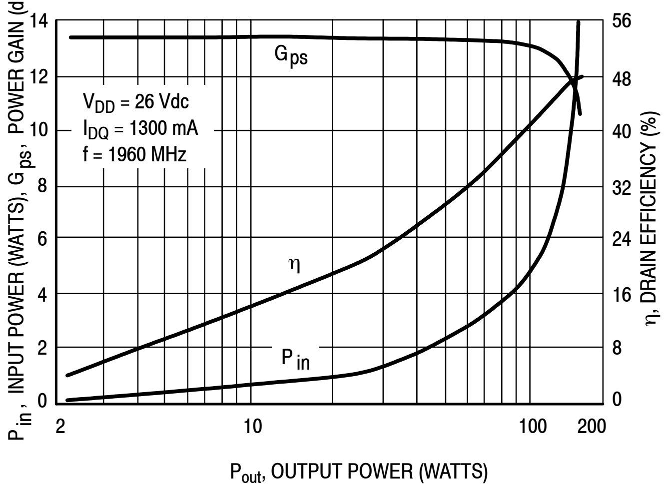


Figure 7. CW Performance

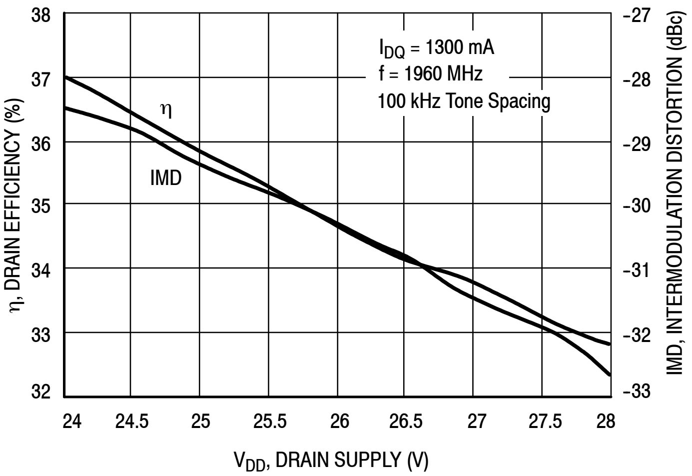


Figure 8. Two-Tone Intermodulation Distortion and Drain Efficiency versus Drain Supply

TYPICAL CHARACTERISTICS

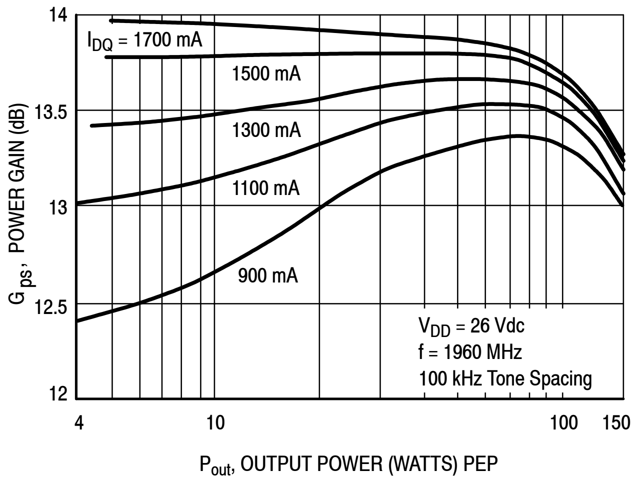


Figure 9. Two-Tone Power Gain versus Output Power

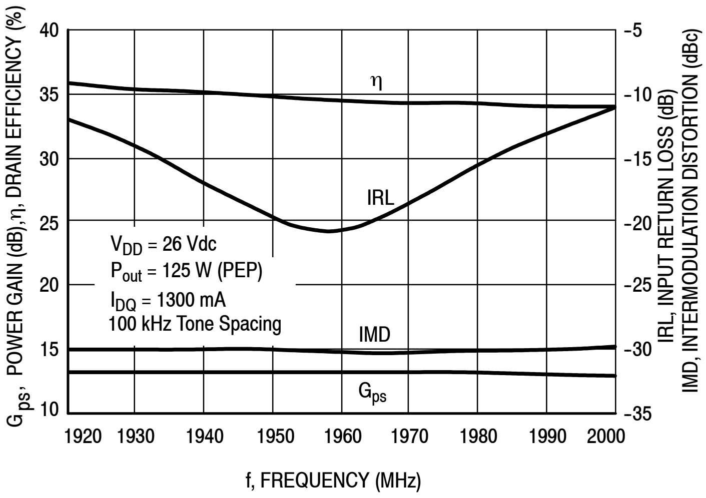


Figure 10. Two-Tone Broadband Performance

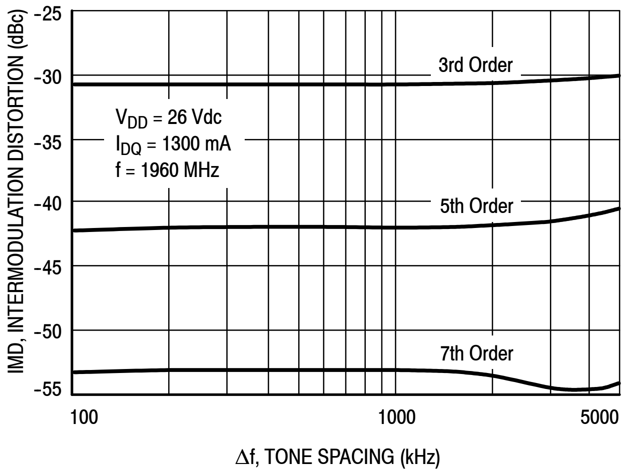
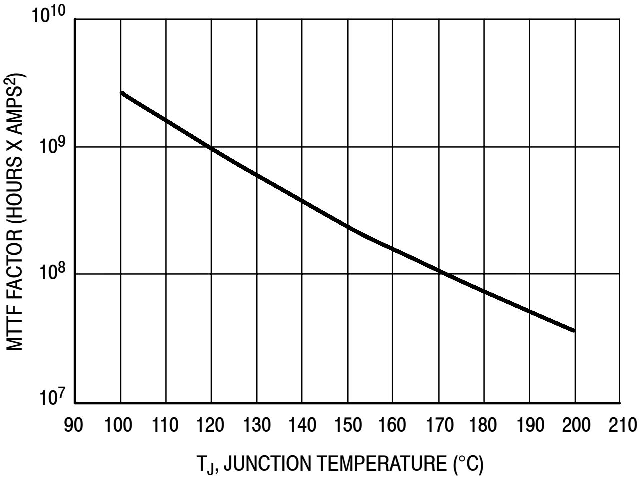


Figure 11. Intermodulation Distortion Products versus Two-Tone Tone Spacing



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

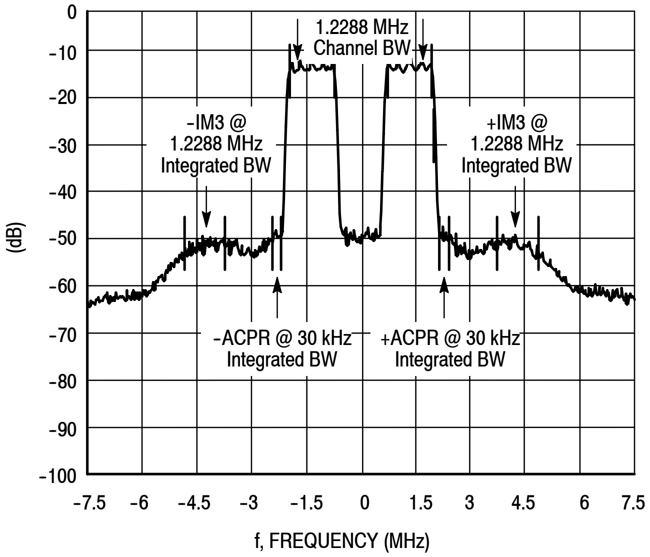
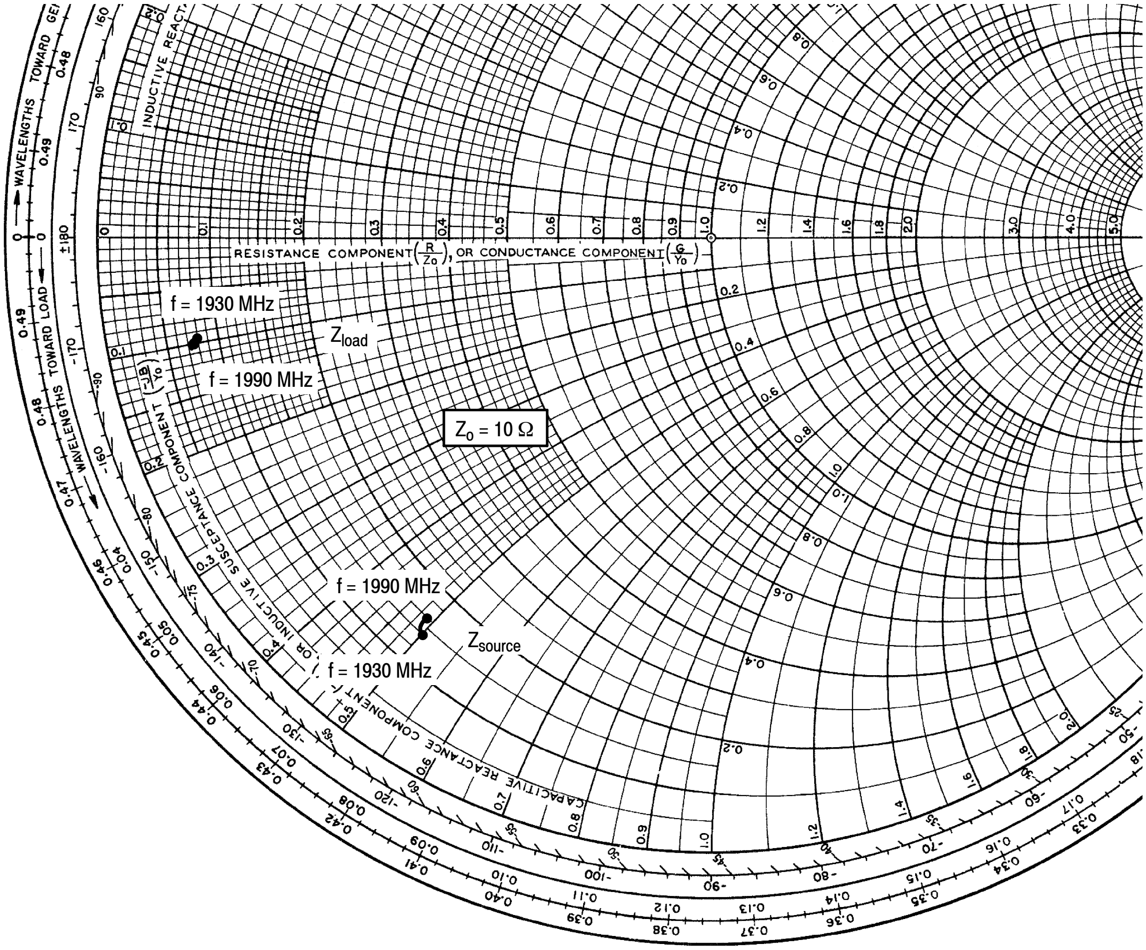


Figure 14. 2-Carrier N-CDMA Spectrum



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.

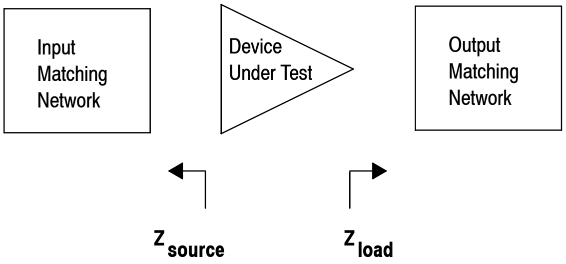
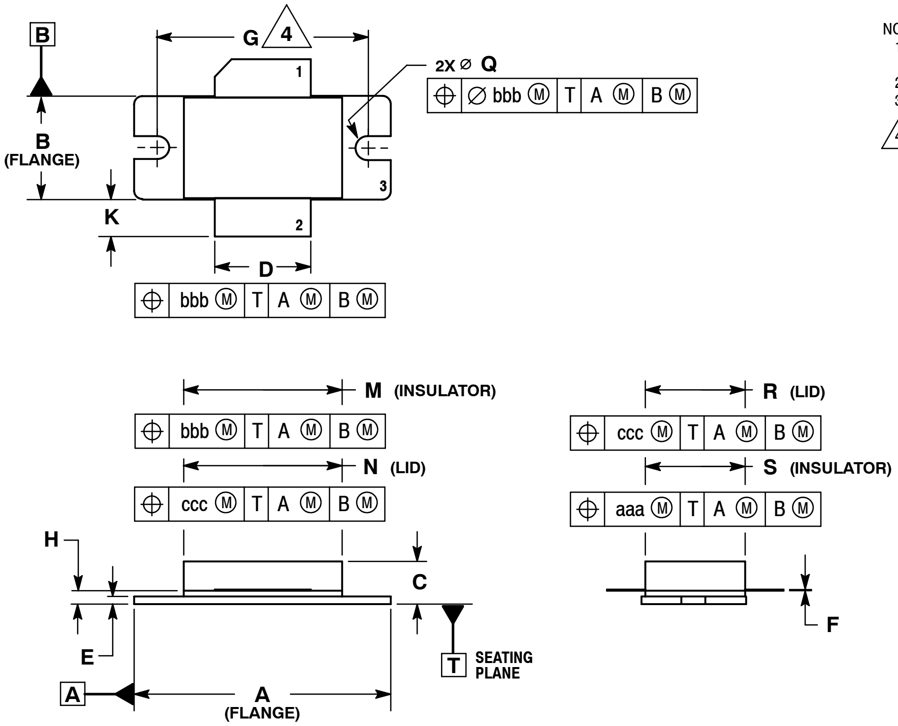


Figure 13. Series Equivalent Source and Load Impedance

NOTES

PACKAGE DIMENSIONS

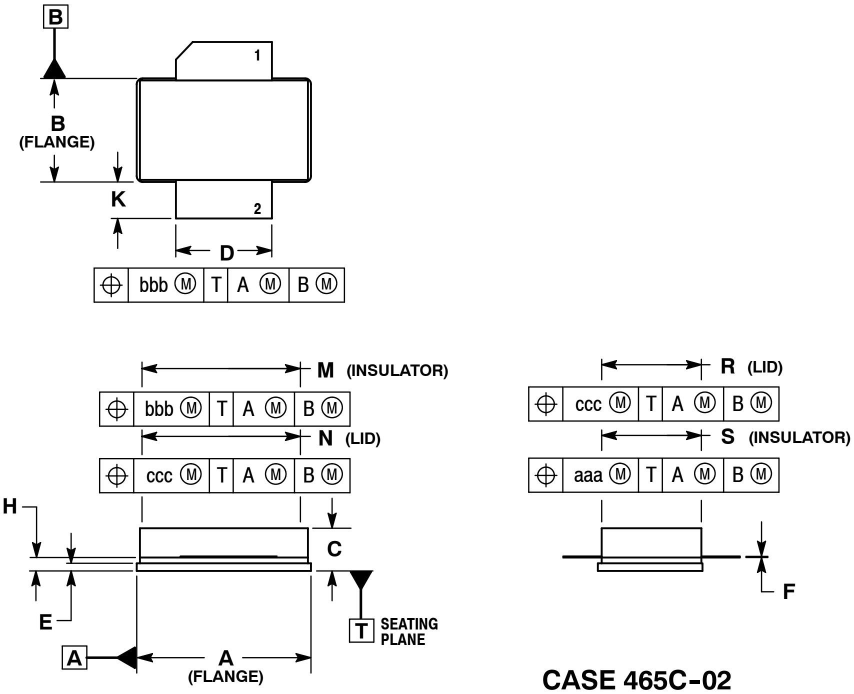


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.
4. RECOMMENDED BOLT CENTER DIMENSION OF 1.16 (29.57) BASED ON M3 SCREW.

	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	⌀.118	⌀.138	⌀3.00	⌀3.51
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



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.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.905	0.915	22.99	23.24
B	0.535	0.545	13.60	13.80
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
H	0.057	0.067	1.45	1.70
K	0.170	0.210	4.32	5.33
M	0.872	0.888	22.15	22.55
N	0.871	0.889	19.30	22.60
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 465C-02
ISSUE D
NI-880S
MRF19125SR3

REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
6	Dec. 2010	• MRF19125 Rev. 6 data sheet archived. Data sheet split due to change in part life cycle. See MRF19125-1 Rev. 7 for MRF19125SR3 and MRF19125-2 Rev. 8 for MRF19125R3.

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

Information in this document is provided solely to enable system and software implementers to use Freescale Semiconductor products. There are no express or implied copyright licenses granted hereunder to design or fabricate any integrated circuits or integrated circuits based on the information in this document.

Freescale Semiconductor reserves the right to make changes without further notice to any products herein. Freescale Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Freescale Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. “Typical” parameters that may be provided in Freescale Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including “Typicals”, must be validated for each customer application by customer’s technical experts. Freescale Semiconductor does not convey any license under its patent rights nor the rights of others. Freescale Semiconductor products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Freescale Semiconductor product could create a situation where personal injury or death may occur. Should Buyer purchase or use Freescale Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold Freescale Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Freescale Semiconductor was negligent regarding the design or manufacture of the part.

Launched by Motorola
freescale™
semiconductor