Freescale Semiconductor
Technical Data

Document Number: MRF19045
Rev. 9, 10/2008

RoHS

RF Power Field Effect Transistors

N-Channel Enhancement-Mode Lateral MOSFETs

MRF19045LR3
MRF19045LSR3

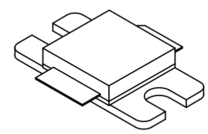
1930-1990 MHz, 45 W, 26 V
LATERAL N-CHANNEL
RF POWER MOSFETs

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

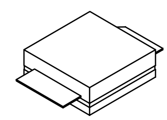
- Typical CDMA Performance @ 1930 MHz, 26 Volts, I_{DQ} = 550 mA
  Multi-carrier IS-95 CDMA Pilot, Sync, Paging, Traffic Codes 8 Through 13
    Output Power — 9.5 Watts Avg.
    Power Gain — 14.9 dB
    Efficiency — 23.5%
    Adjacent Channel Power —
      885 kHz: -50 dBc @ 30 kHz BW
    IM3 — -37 dBc
- Capable of Handling 5:1 VSWR, @ 26 Vdc, 1960 MHz, 45 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
- Low Gold Plating Thickness on Leads, 40µ″ Nominal.
- RoHS Compliant
- In Tape and Reel. R3 Suffix = 250 Units per 32 mm, 13 Inch Reel.



CASE 465E-04, STYLE 1
NI-400
MRF19045LR3



CASE 465F-04, STYLE 1
NI-400S
MRF19045LSR3

ARCHIVE INFORMATION

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	105 0.60	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	$R_{\theta JC}$	1.65	°C/W

Table 3. ESD Protection Characteristics

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

1. Refer to AN1955/D, *Thermal Measurement Methodology of RF Power Amplifiers.* Go to http://www.freescale.com/rf. Select Documentation/Application Notes - AN1955.

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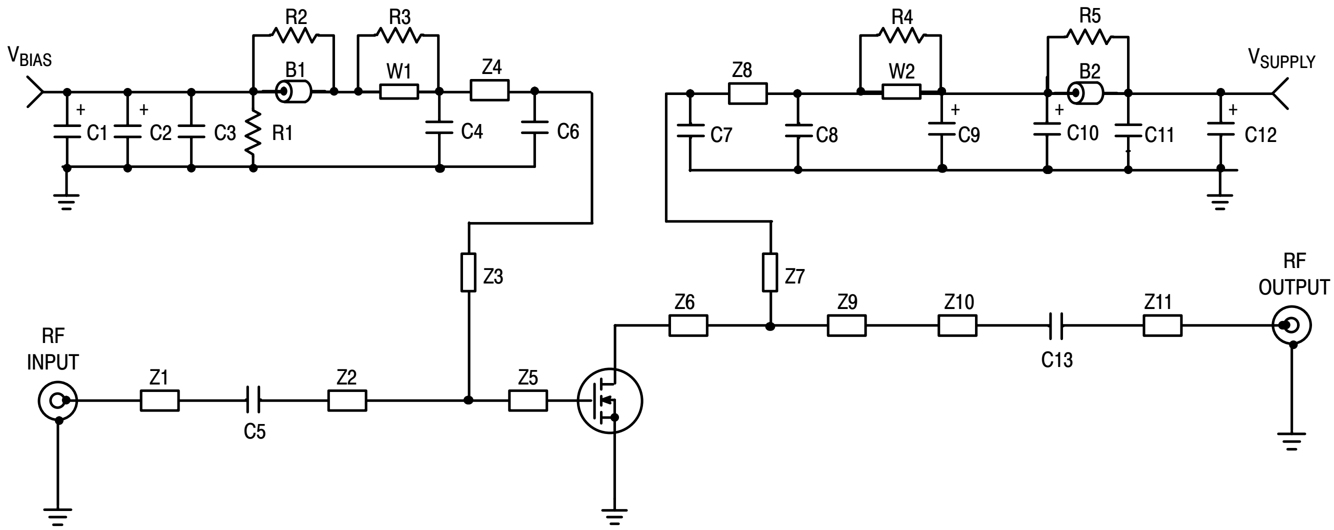
Table 4. Electrical Characteristics (T_C = 25°C unless otherwise noted)

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
Zero Gate Voltage Drain Current (V_{DS} = 26 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	10	μAdc
Gate-Source Leakage Current (V_{GS} = 5 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	—	—	1	μAdc
On Characteristics (DC)					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 100 μAdc)	$V_{GS(th)}$	2	—	4	Vdc
Gate Quiescent Voltage (V_{DS} = 26 Vdc, I_D = 550 mAdc)	$V_{GS(Q)}$	3	3.8	5	Vdc
Drain-Source On-Voltage (V_{GS} = 10 Vdc, I_D = 1 Adc)	$V_{DS(on)}$	—	0.19	0.21	Vdc
Forward Transconductance (V_{DS} = 10 Vdc, I_D = 2 Adc)	g_{fs}	—	4.2	—	S
Dynamic Characteristics					
Reverse Transfer Capacitance (1) (V_{DS} = 26 Vdc, V_{GS} = 0, f = 1.0 MHz)	C_{rss}	—	1.8	—	pF
Functional Tests (In Freescale Test Fixture, 50 ohm system) 2-carrier N-CDMA, 1.2288 MHz Channel Bandwidth, IM3 measured in 1.2288 MHz Integrated Bandwidth. ACPR measured in 30 kHz Integrated Bandwidth.					
Common-Source Amplifier Power Gain (V_{DD} = 26 Vdc, P_{out} = 9.5 W Avg, 2-Carrier N-CDMA, I_{DQ} = 550 mA, f1 = 1930 MHz, f2 = 1932.5 MHz)	G_{ps}	13	14.5	—	dB
Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 9.5 W Avg, 2-Carrier N-CDMA, I_{DQ} = 550 mA, f1 = 1930 MHz, f2 = 1932.5 MHz)	η	21	23.5	—	%
3rd Order Intermodulation Distortion (V_{DD} = 26 Vdc, P_{out} = 9.5 W Avg, 2-Carrier N-CDMA, I_{DQ} = 550 mA, f1 = 1930 MHz, f2 = 1932.5 MHz; IM3 Measured in a 1.2288 MHz Integrated Bandwidth Centered at f1 -2.5 MHz and f2 +2.5 MHz, Referenced to the Carrier Channel Power)	IM3	—	-37	-35	dBc
Adjacent Channel Power Ratio (V_{DD} = 26 Vdc, P_{out} = 9.5 W Avg, 2-carrier N-CDMA, I_{DQ} = 550 mA, f1 = 1930 MHz, f2 = 1932.5 MHz; ACPR measured in a 30 kHz Integrated Bandwith Centered at f1 -885 kHz and f2 +885 kHz)	ACPR	—	-51	-45	dBc
Input Return Loss (V_{DD} = 26 Vdc, P_{out} = 9.5 W Avg, 2-Carrier N-CDMA, I_{DQ} = 550 mA, f1 = 1930 MHz, f2 = 1932.5 MHz)	IRL	—	-16	-9	dB
P_{out}, 1 dB Compression Point (V_{DD} = 26 Vdc, I_{DQ} = 550 mA, f = 1930 MHz)	P1dB	—	45	—	W

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



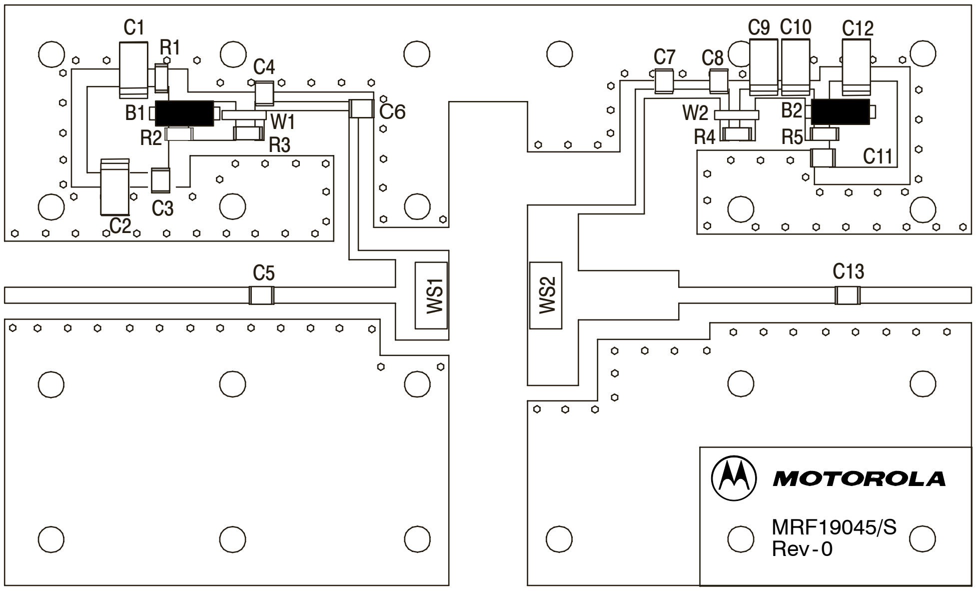
Z1	1.336″ x 0.081″ Microstrip	Z8	0.216″ x 0.047″ Microstrip
Z2	0.693″ x 0.081″ Microstrip	Z9	0.519″ x 0.254″ Microstrip
Z3	1.033″ x 0.047″ Microstrip	Z10	0.874″ x 0.081″ Microstrip
Z4	0.468″ x 0.047″ Microstrip	Z11	0.645″ x 0.081″ Microstrip
Z5	0.271″ x 0.460″ Microstrip	PCB	Arlon GX0300-55-22, 30 mils, ε_r = 2.55
Z6	0.263″ x 0.930″ Microstrip		
Z7	1.165″ x 0.047″ Microstrip		

NOTE: Z3, Z4, Z7, Z8 lengths and component placement tolerances are ±0.050″.
Zx lengths are microstrip lengths between components, center-line to center-line.
All component and z-length tolerances are ±0.015″, except as noted.

Figure 1. 1930 - 1990 MHz 2-Carrier N-CDMA Test Circuit Schematic

Table 5. 1930 - 1990 MHz 2-Carrier N-CDMA Test Circuit Component Designations and Values

Designators	Description
B1, B2	0.120″ x 0.333″ x 0.100″, Surface Mount Ferrite Beads, Fair Rite #2743019446
C1, C2	10 μF, 35 V Tantalum Surface Mount Chip Capacitors, Kemet #T495X106K035AS4394
C3, C11	0.1 μF Chip Capacitors, Kemet #CDR33BX104AKWS
C4, C8	24 pF Chip Capacitors, ATC #100B240JP500X
C5	470 pF Chip Capacitor, ATC #100B471JP200X
C6, C7	11 pF Chip Capacitors, ATC #100B110JP500X
C9, C10, C12	22 μF, 35 V Tantalum Surface Mount Chip Capacitors, Kemet #T491X226K035AS4394
C13	8.2 pF Chip Capacitor, ATC #100B8R2CP500X
R1	560 kΩ, 1/4 W Chip Resistor (0.08″ x 0.13″)
R2, R3, R4, R5	8.2 Ω, 1/4 W Chip Resistors (0.08″ x 0.13″), Garrett Instruments #RM73B2B110JT
W1, W2	Solid Copper Buss Wire, 16 AWG
WS1, WS2	Beryllium Copper Wear Blocks (0.005″ x 0.150″ x 0.350″) Nominal



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. 1930 - 1990 MHz 2-Carrier N-CDMA Test Circuit Component Layout

ARCHIVE INFORMATION

TYPICAL CHARACTERISTICS

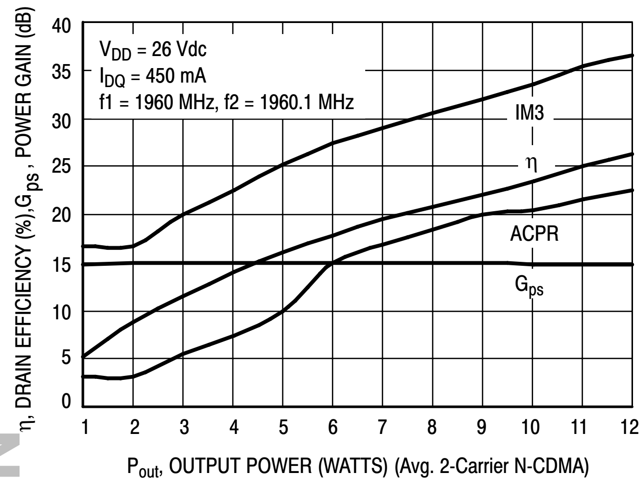


Figure 3. 2-Carrier N-CDMA ACPR, IM3, Power Gain and Drain Efficiency versus Output Power

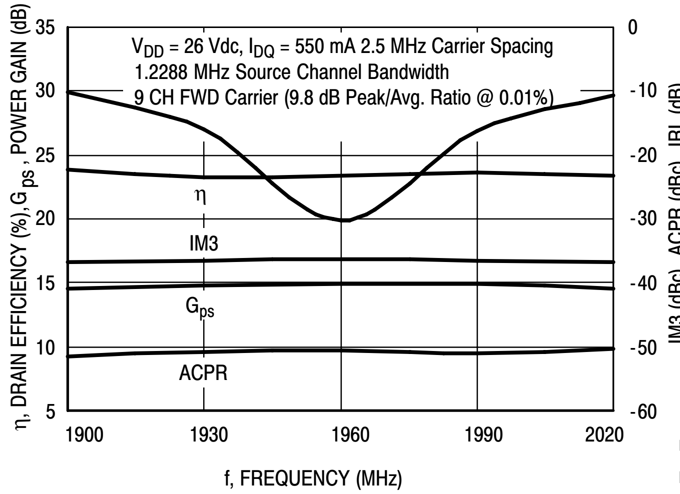


Figure 4. 2-Carrier N-CDMA ACPR, IM3, Power Gain, IRL and Drain Efficiency versus Output Power

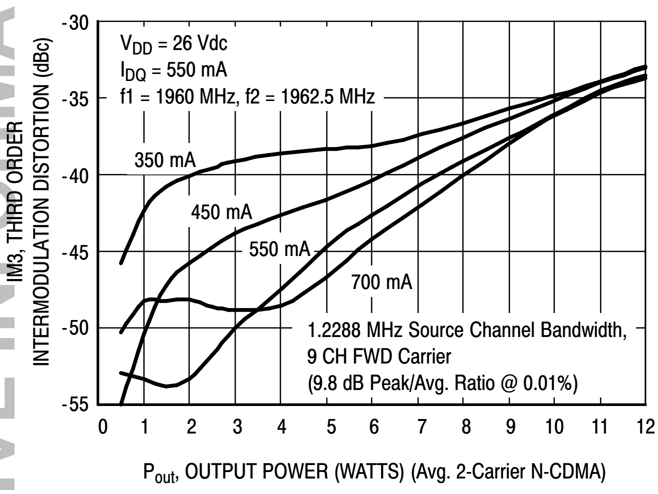


Figure 5. 2-Carrier N-CDMA IM3 versus Output Power

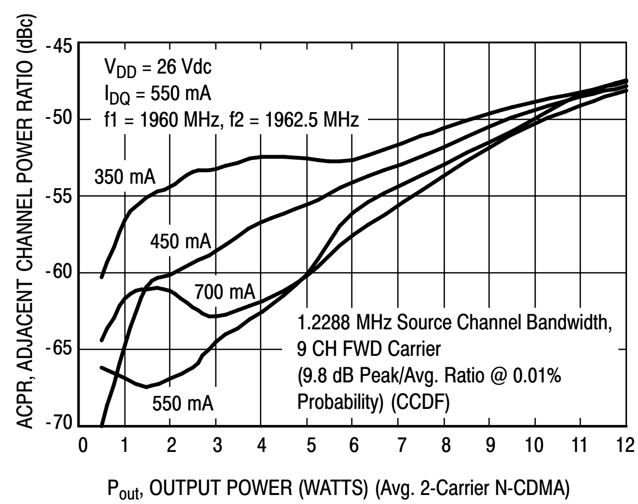


Figure 6. 2-Carrier N-CDMA ACPR versus Output Power

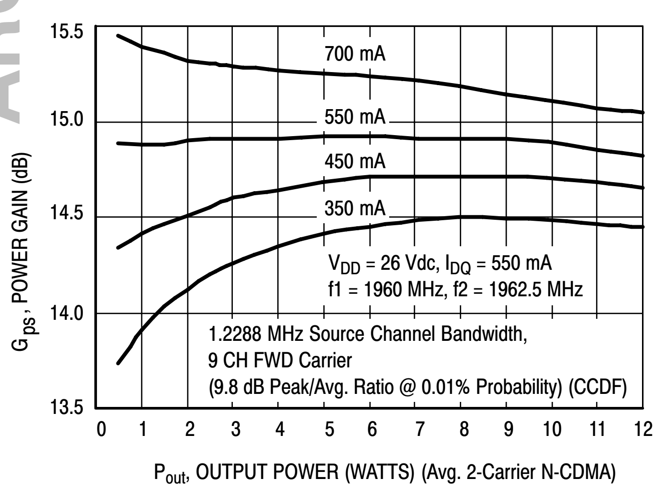


Figure 7. 2-Carrier N-CDMA Power Gain versus Output Power

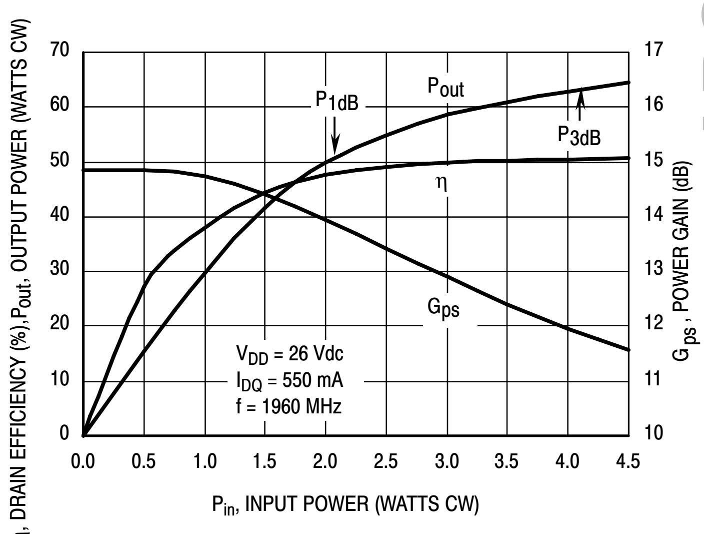


Figure 8. CW Output Power, Power Gain and Drain Efficiency versus Input Power

TYPICAL CHARACTERISTICS

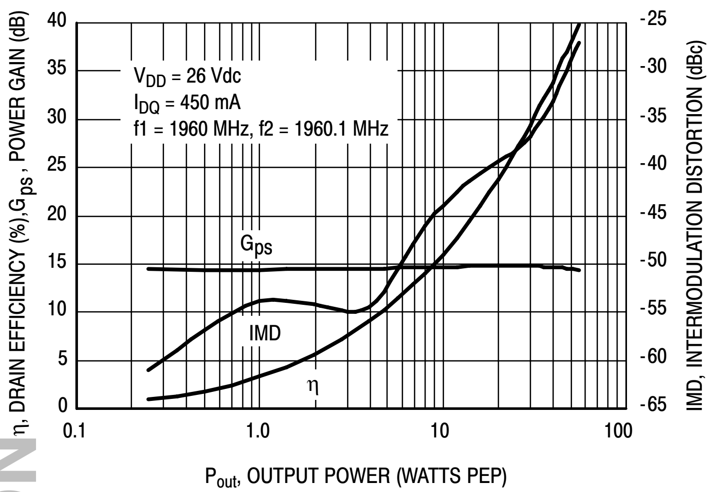


Figure 9. CW Two-Tone Power Gain, IMD and Drain Efficiency versus Output Power

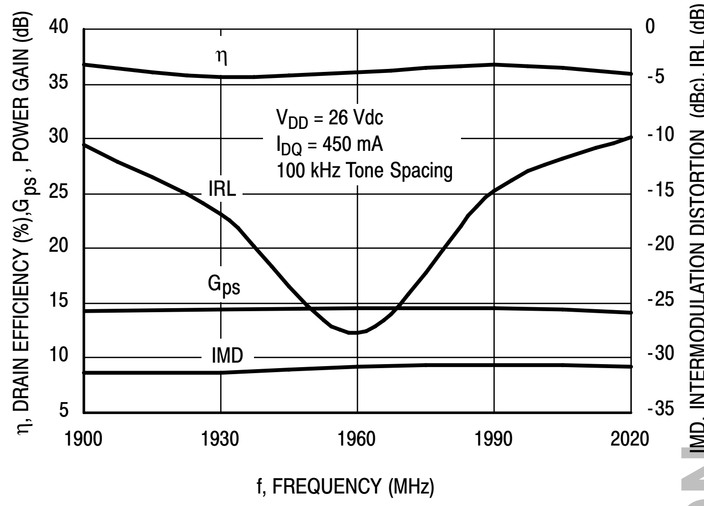


Figure 10. CW Two-Tone Power Gain, Input Return Loss, IMD and Drain Efficiency versus Frequency

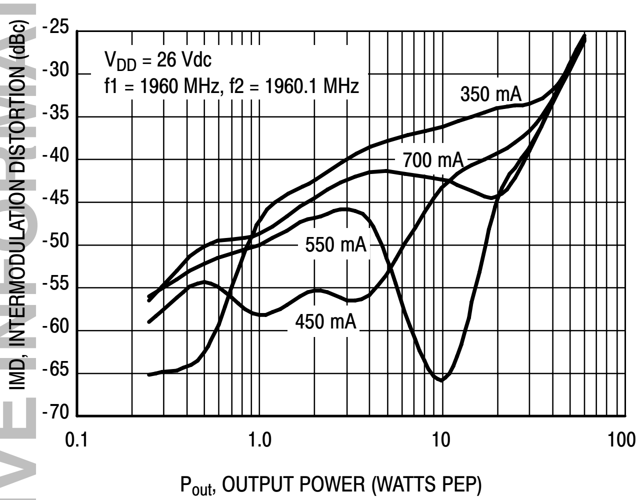


Figure 11. CW Two-Tone Intermodulation Distortion versus Output Power

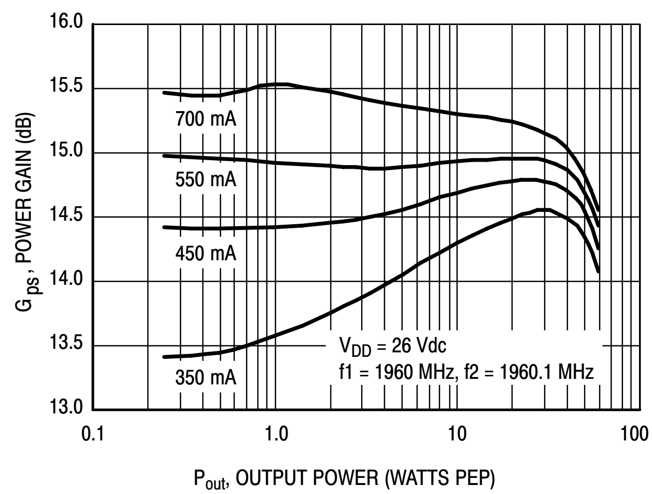


Figure 12. CW Two-Tone Power Gain versus Output Power

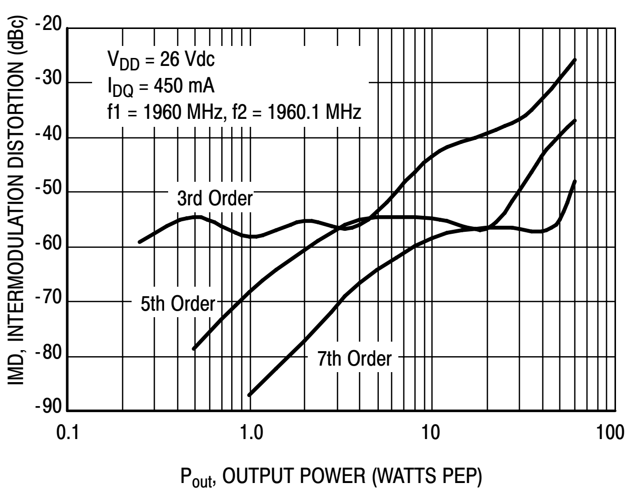


Figure 13. CW Two-Tone Intermodulation Distortion Products versus Output Power

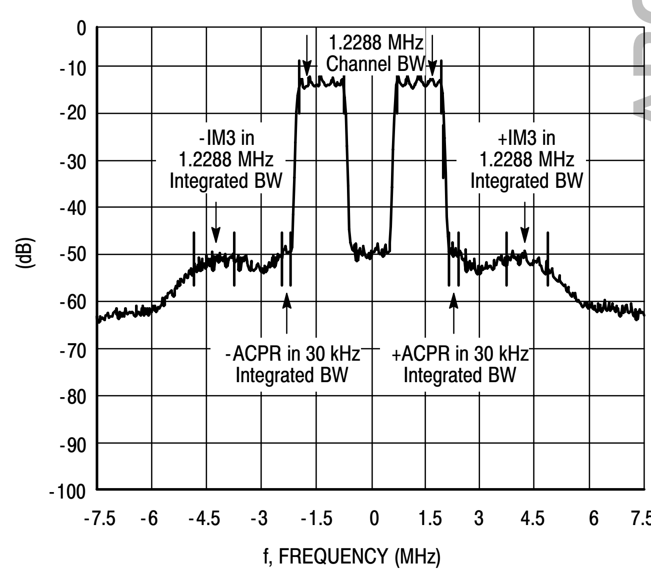
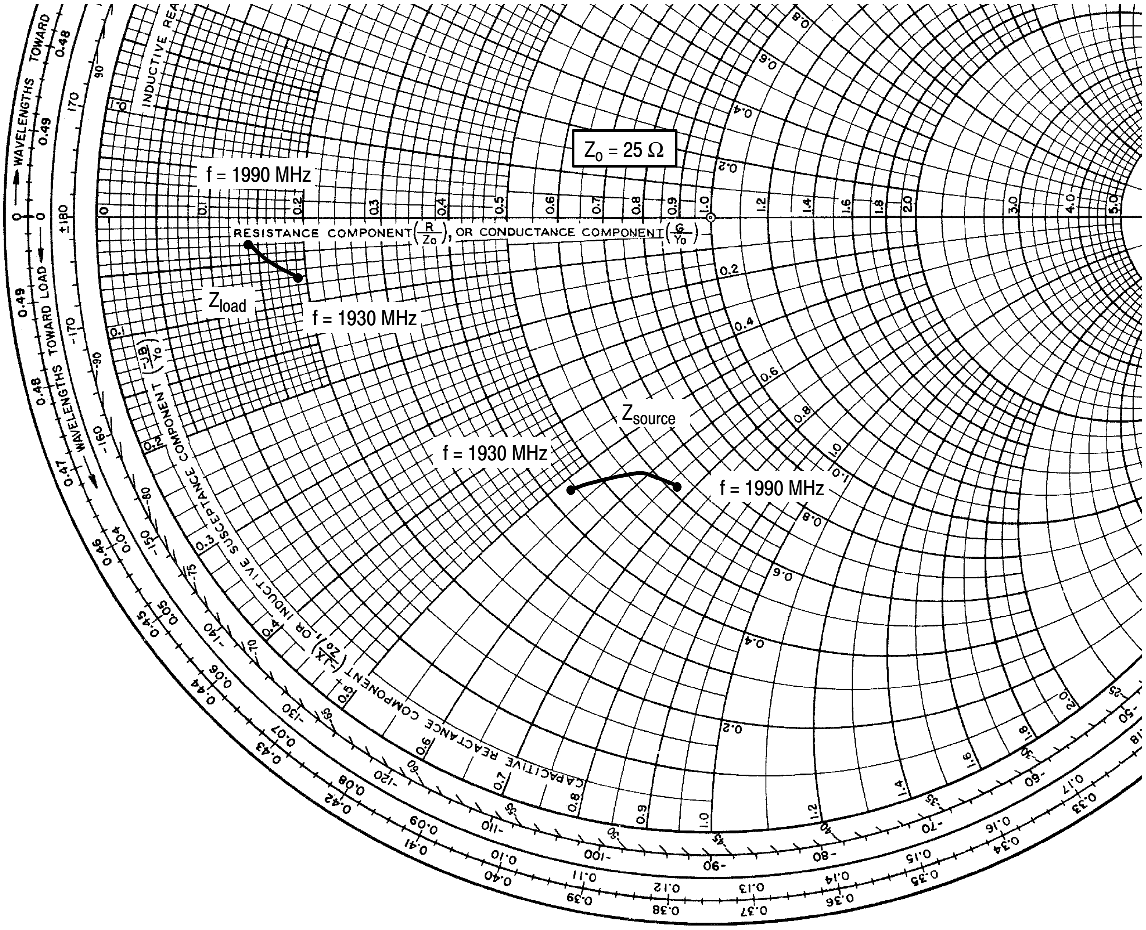


Figure 14. 2-Carrier N-CDMA Spectrum



V_{DD} = 26 V, I_{DQ} = 550 mA, P_{out} = 9.5 W Avg.

f MHz	Z_{source} Ω	Z_{load} Ω
1930	15.52 - j16.5	4.52 - j1.86
1960	14.24 - j14.44	3.85 - j1.04
1990	11.11 - j13.01	3.44 - j0.69

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

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

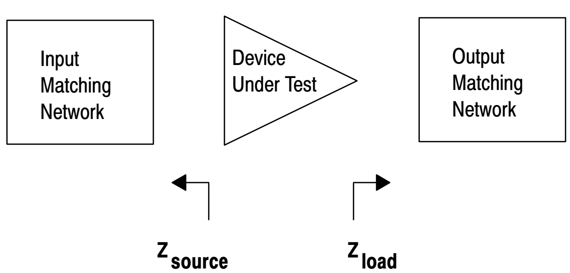
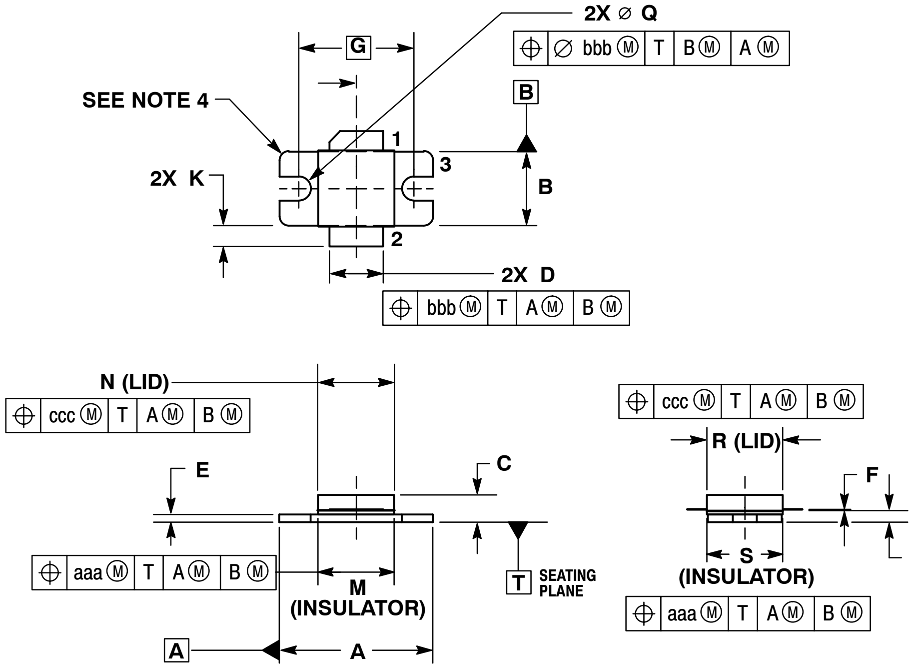


Figure 15. Series Equivalent Source and Load Impedance

PACKAGE DIMENSIONS

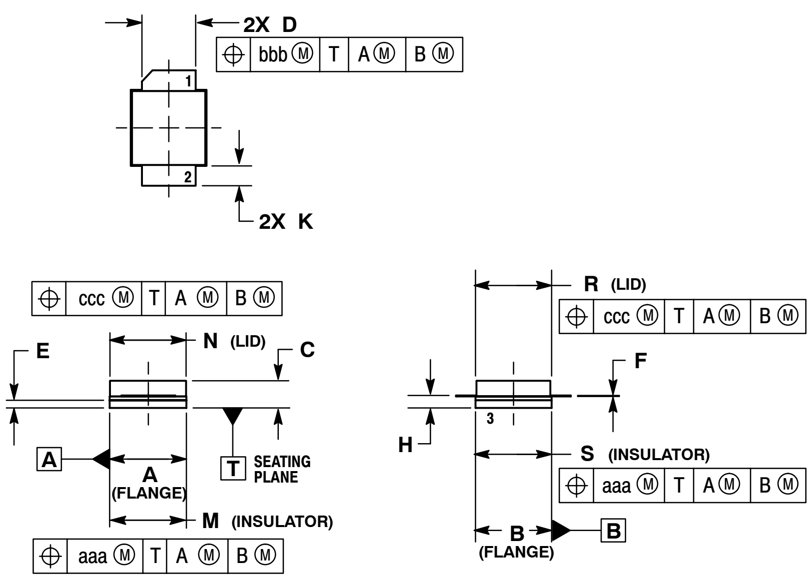


NOTES:
1. CONTROLLING DIMENSION: INCH.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.
4. INFORMATION ONLY: CORNER BREAK (4X) TO BE .060±.005 (1.52±0.13) RADIUS OR .06±.005 (1.52±0.13) x 45° CHAMFER.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	.795	.805	20.19	20.44
B	.380	.390	9.65	9.9
C	.125	.163	3.17	4.14
D	.275	.285	6.98	7.24
E	.035	.045	0.89	1.14
F	.004	.006	0.10	0.15
G	.600 BSC		15.24 BSC	
H	.057	.067	1.45	1.7
K	.092	.122	2.33	3.1
M	.395	.405	10	10.3
N	.395	.405	10	10.3
Q	⌀ .120	⌀ .130	⌀ 3.05	⌀ 3.3
R	.395	.405	10	10.3
S	.395	.405	10	10.3
aaa	.005 BSC		0.127 BSC	
bbb	.010 BSC		0.254 BSC	
ccc	.015 BSC		0.381 BSC	

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

CASE 465E-04
ISSUE F
NI-400
MRF19045LR3



NOTES:
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	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	.395	.405	10.03	10.29
B	.395	.405	10.03	10.29
C	.125	.163	3.18	4.14
D	.275	.285	6.98	7.24
E	.035	.045	0.89	1.14
F	.004	.006	0.10	0.15
H	.057	.067	1.45	1.70
K	.092	.122	2.34	3.10
M	.395	.405	10.03	10.29
N	.395	.405	10.03	10.29
R	.395	.405	10.03	10.29
S	.395	.405	10.03	10.29
aaa	.005 REF		0.127 REF	
bbb	.010 REF		0.254 REF	
ccc	.015 REF		0.38 REF	

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

CASE 465F-04
ISSUE E
NI-400S
MRF19045LSR3

ARCHIVE INFORMATION

PRODUCT DOCUMENTATION

Refer to the following documents to aid your design process.

Application Notes

- AN1955: Thermal Measurement Methodology of RF Power Amplifiers

Engineering Bulletins

- EB212: Using Data Sheet Impedances for RF LDMOS Devices

REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
9	Oct. 2008	• 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. 9

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