

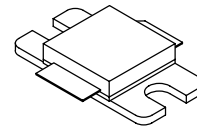
The RF MOSFET Line
RF Power Field Effect Transistors
N-Channel Enhancement-Mode Lateral MOSFETs

MRF19045LR3
MRF19045LSR3

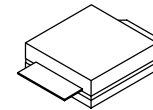
Designed for PCN and PCS base station applications with frequencies from 1.9 to 2.0 GHz. Suitable for TDMA, CDMA and multicarrier amplifier applications.

- Typical CDMA Performance @ 1960 MHz, 26 Volts, $I_{DQ} = 550$ mA
 Multi-carrier 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
- 100% Tested Under 2-Carrier N-CDMA
- Internally Matched, Controlled Q, for Ease of Use
- High Gain, High Efficiency and High Linearity
- Integrated ESD Protection
- Designed for Maximum Gain and Insertion Phase Flatness
- Capable of Handling 5:1 VSWR, @ 26 Vdc, 1.93 GHz, 45 Watts CW Output Power
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Low Gold Plating Thickness on Leads, 40 μ Nominal.
- In Tape and Reel. R3 Suffix = 250 Units per 32 mm, 13 Inch Reel.

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



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



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

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	-0.5, +15	Vdc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25 $^\circ\text{C}$	P_D	105 0.60	Watts W/ $^\circ\text{C}$
Storage Temperature Range	T_{stg}	- 65 to +150	$^\circ\text{C}$
Operating Junction Temperature	T_J	200	$^\circ\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Value (1)	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.65	$^\circ\text{C}/\text{W}$

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.motorola.com/semiconductors/rf>. Select Documentation/Application Notes - AN1955.

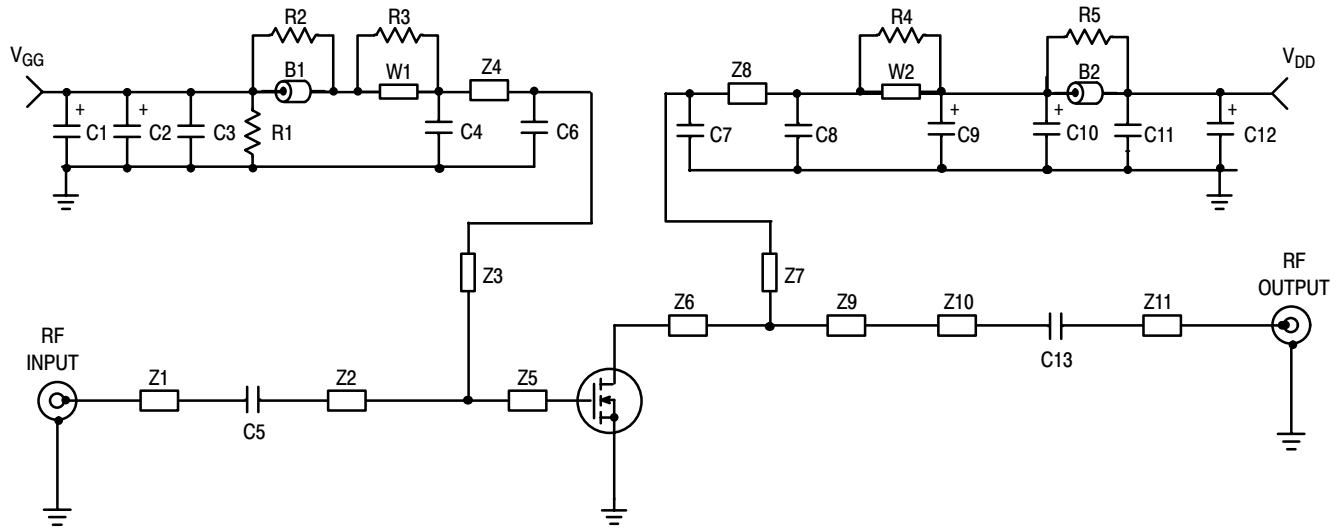
NOTE - CAUTION - MOS devices are susceptible to damage from electrostatic charge. Reasonable precautions in handling and packaging MOS devices should be observed.

Freescale Semiconductor, Inc.

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 Motorola 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, f ₁ = 1930 MHz, f ₂ = 1932.5 MHz and f ₁ = 1987.5 MHz, f ₂ = 1990 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, f ₁ = 1930 MHz, f ₂ = 1932.5 MHz and f ₁ = 1987.5 MHz, f ₂ = 1990 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, f ₁ = 1930 MHz, f ₂ = 1932.5 MHz and f ₁ = 1987.5 MHz, f ₂ = 1990 MHz; IM3 Measured in a 1.2288 MHz Integrated Bandwidth Centered at f ₁ -2.5 Mhz and f ₂ +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, f ₁ = 1930 MHz, f ₂ = 1932.5 MHz and f ₁ = 1987.5 MHz, f ₂ = 1990 MHz; ACPR measured in a 30 kHz Integrated Bandwidth Centered at f ₁ -885 kHz and f ₂ +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, f ₁ = 1930 MHz, f ₂ = 1932.5 MHz and f ₁ = 1987.5 MHz, f ₂ = 1990 MHz)	IRL	—	-16	-9	dB
P _{out} 1 dB Compression Point (V _{DD} = 26 Vdc, I _{DQ} = 550 mA, f = 1990 MHz)	P1dB	—	45	—	W
Output Mismatch Stress (V _{DD} = 26 Vdc, P _{out} = 45 W CW, I _{DQ} = 550 mA, f = 1930 MHz, VSWR = 5:1, All Phase Angles at Frequency of Tests)	Ψ	No Degradation In Output Power Before and After Test			

(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, $\epsilon_r = 2.55$
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 $\pm 0.050''$.
 Zx lengths are microstrip lengths between components, center-line to center-line.
 All component and z-length tolerances are $\pm 0.015''$, except as noted.

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

Table 1. 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 μ F, 35 V Tantalum Surface Mount Chip Capacitors, Kemet #T495X106K035AS4394
C3, C11	0.1 μ F Chip Capacitors, Kemet #CDR33BX104AKWS
C4, C8	24 pF Chip Capacitors, B Case, ATC #100B240JP500X
C5	470 pF Chip Capacitor, B Case, ATC #100B471JP200X
C6, C7	11 pF Chip Capacitors, B Case, ATC #100B110JP500X
C9, C10, C12	22 μ F, 35 V Tantalum Surface Mount Chip Capacitors, Kemet #T491X226K035AS4394
C13	8.2 pF Chip Capacitor, B Case, ATC #100B8R2CP500X
R1	560 k Ω , 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

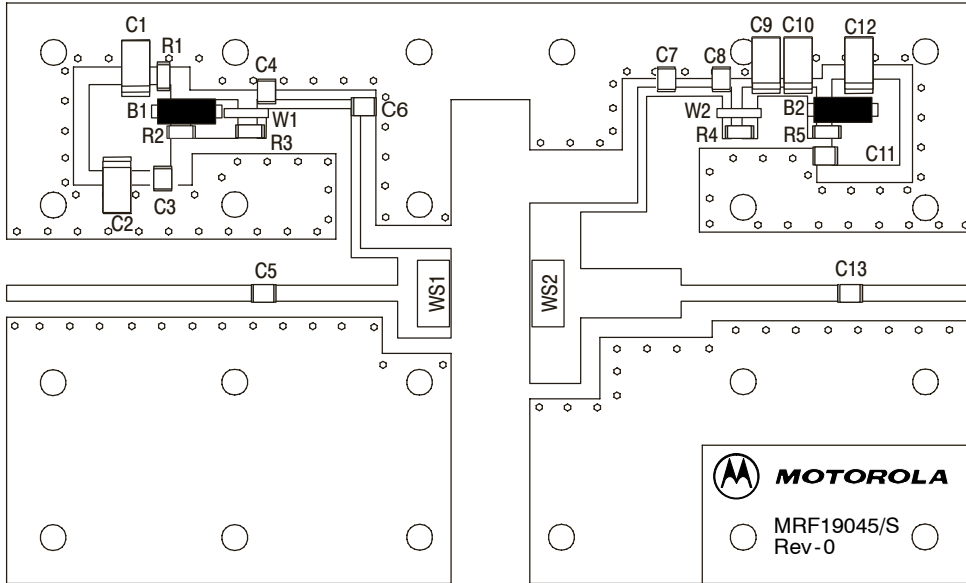


Figure 2. 1930 - 1990 MHz 2-Carrier N-CDMA Test Circuit Component Layout

TYPICAL CHARACTERISTICS

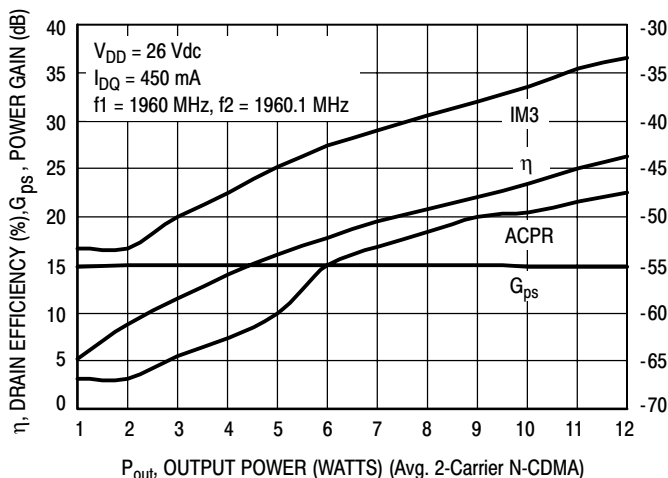


Figure 3. 2-Carrier N-CDMA ACPR, IM3, Power Gain and Drain Efficiency versus Output Power

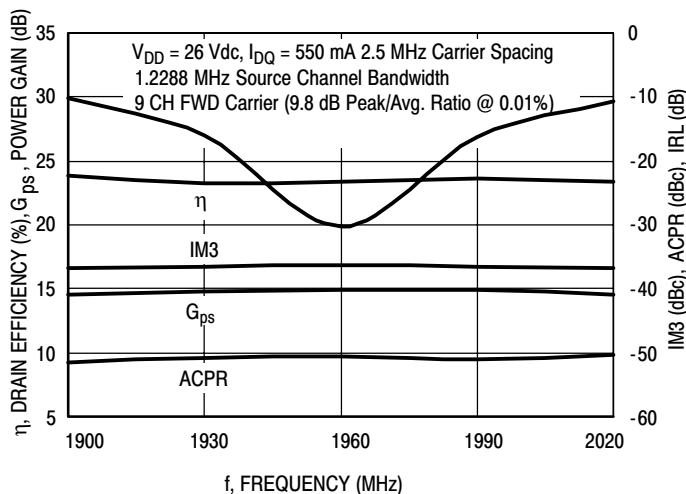


Figure 4. 2-Carrier N-CDMA ACPR, IM3, Power Gain, IRL and Drain Efficiency versus Output Power

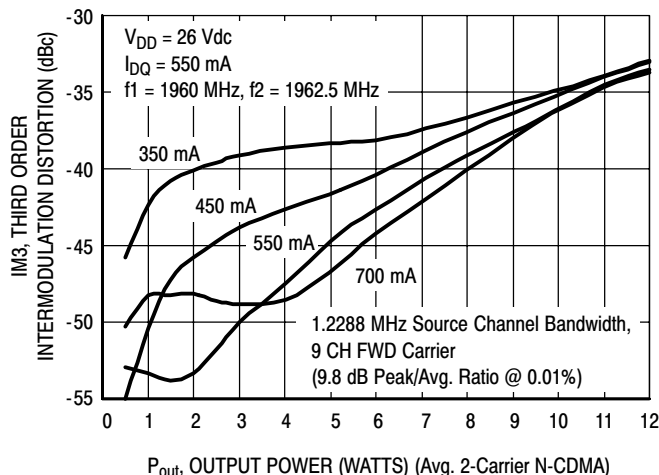


Figure 5. 2-Carrier N-CDMA IM3 versus Output Power

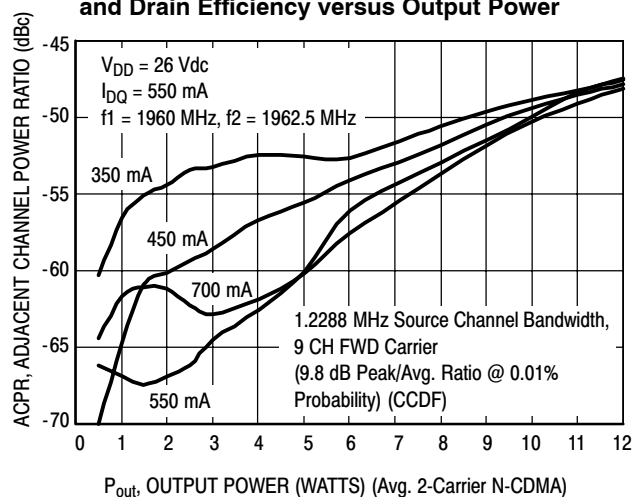


Figure 6. 2-Carrier N-CDMA ACPR versus Output Power

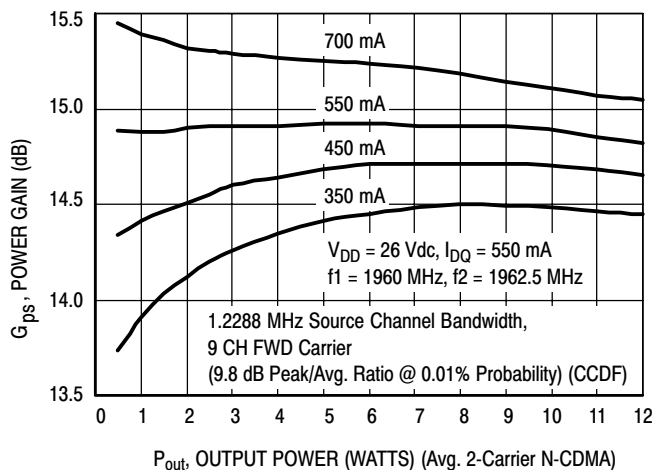


Figure 7. 2-Carrier N-CDMA Power Gain versus Output Power

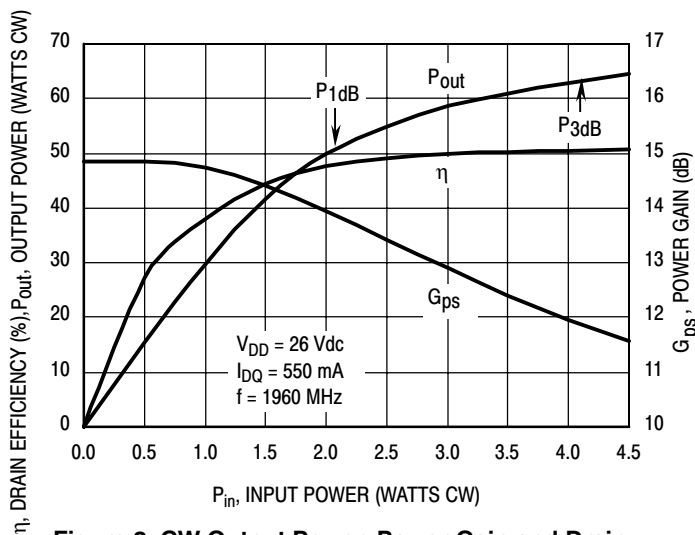


Figure 8. CW Output Power, Power Gain and Drain Efficiency versus Input Power

TYPICAL CHARACTERISTICS

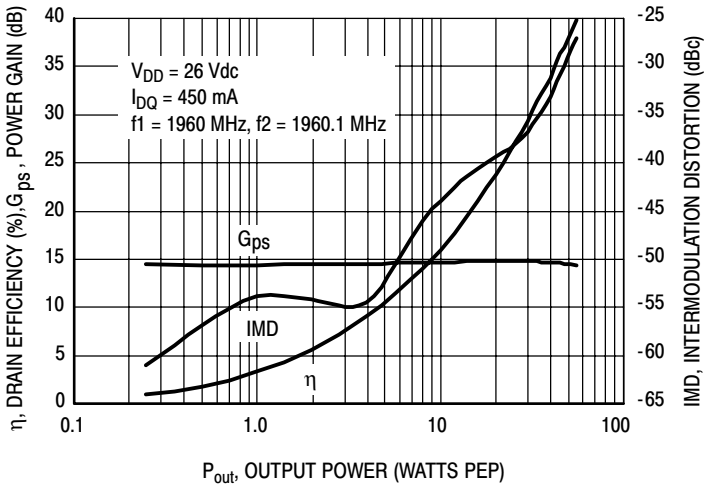


Figure 9. CW Two-Tone Power Gain, IMD and Drain Efficiency versus Output Power

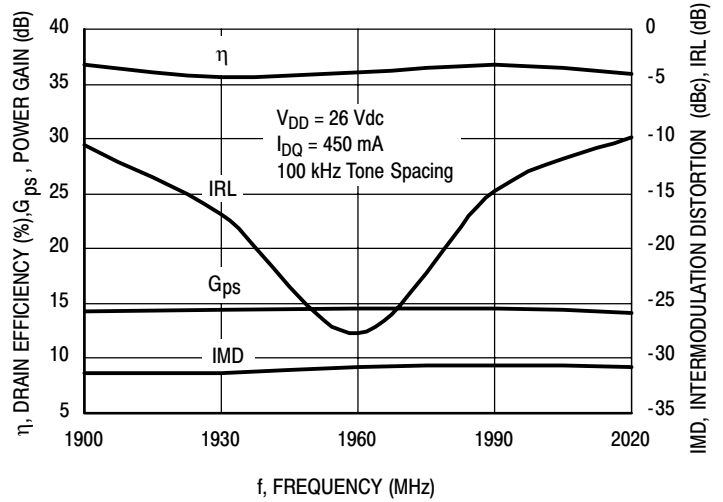


Figure 10. CW Two-Tone Power Gain, Input Return Loss, IMD and Drain Efficiency versus Frequency

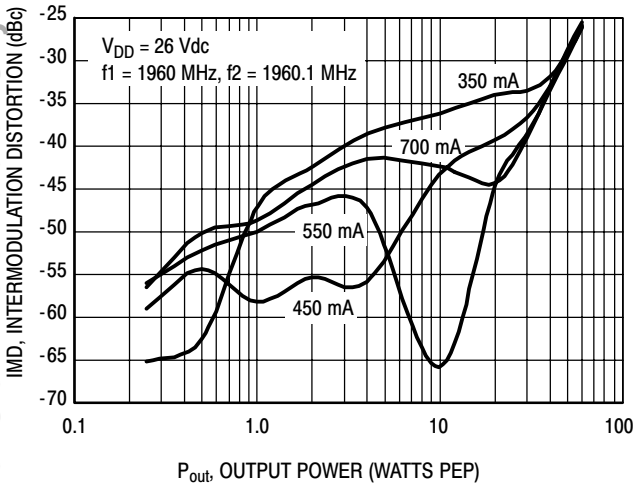


Figure 11. CW Two-Tone Intermodulation Distortion versus Output Power

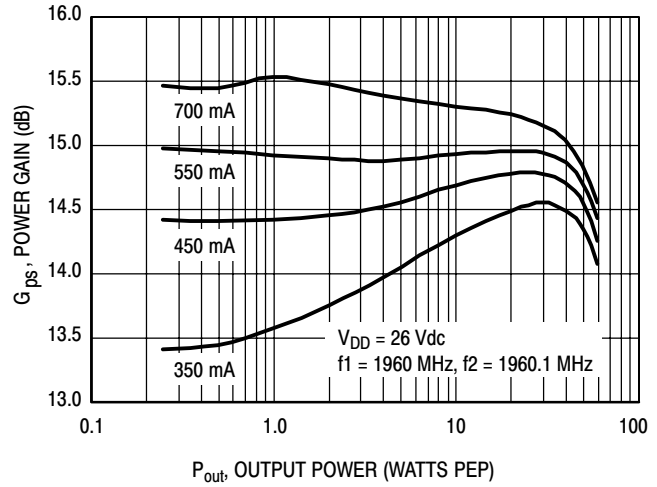


Figure 12. CW Two-Tone Power Gain versus Output Power

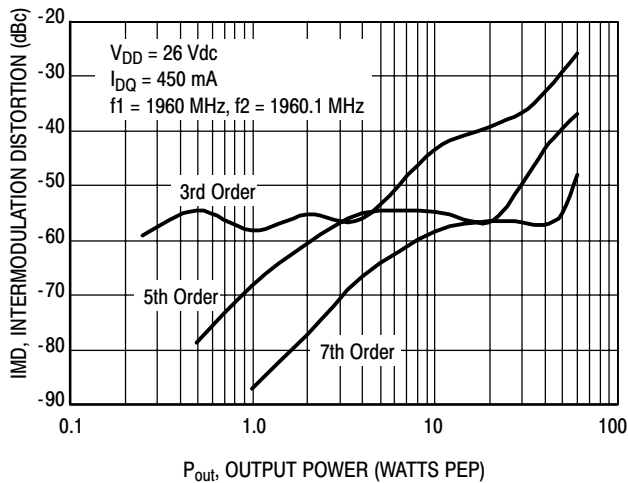


Figure 13. CW Two-Tone Intermodulation Distortion Products versus Output Power

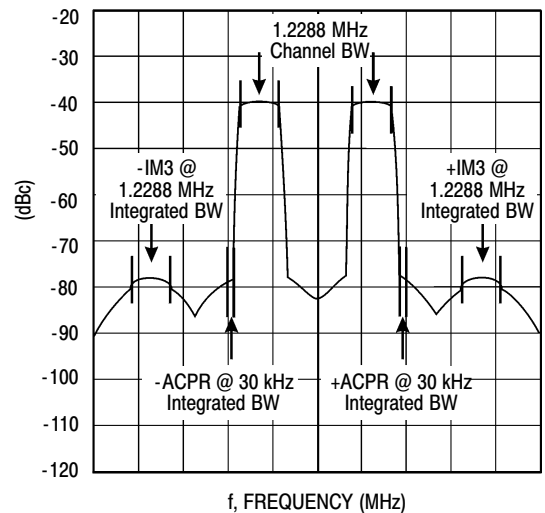
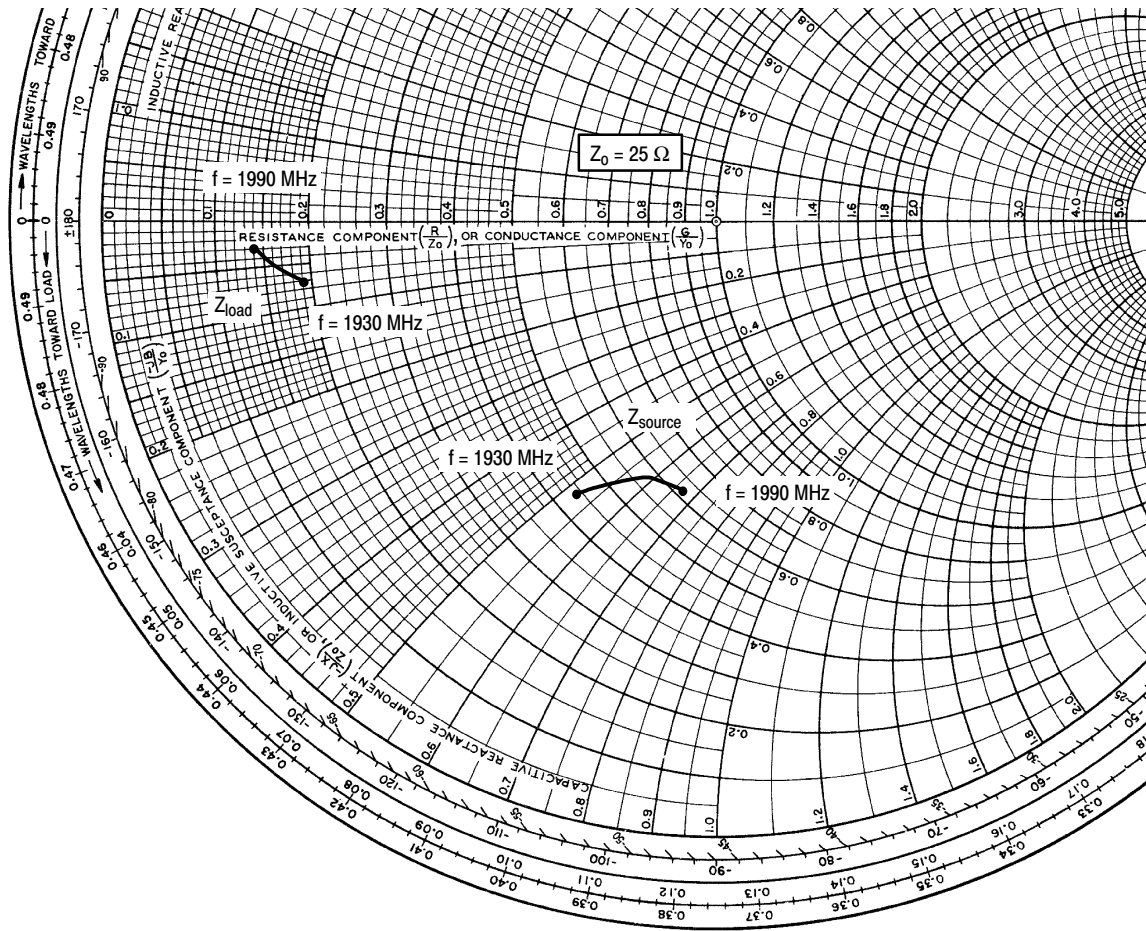


Figure 14. 2-Carrier N-CDMA Spectrum



$V_{DD} = 26\text{ V}$, $I_{DQ} = 550\text{ mA}$, $P_{out} = 9\text{ W Avg.}$, 2-Carrier N-CDMA

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.

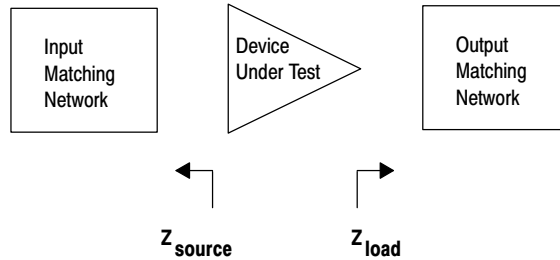


Figure 15. Series Equivalent Source and Load Impedance

NOTES

NOTES

NOTES

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PACKAGE DIMENSIONS

SEE NOTE 4

2X \varnothing Q

2X K

2X D

N (LID)

R (LID)

(INSULATOR)

(INSULATOR)

SEATING PLANE

H

CASE 465E-04
ISSUE E
NI-400
MRF19045LR3

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.

DIM	INCHES		MILLIMETERS	
	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	\varnothing .120	\varnothing .130	\varnothing 3.05	\varnothing 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

2X D

2X K

R (LID)

(INSULATOR)

(INSULATOR)

SEATING PLANE

H

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

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.

DIM	INCHES		MILLIMETERS	
	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

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MRF19045/D