The RF MOSFET Line

RF Power Field Effect Transistors

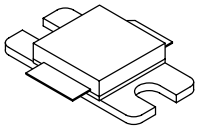
N-Channel Enhancement-Mode Lateral MOSFETs

MRF21045LR3
MRF21045LSR3

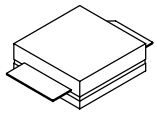
2170 MHz, 45 W, 28 V
LATERAL N-CHANNEL
RF POWER MOSFETs

Designed for W-CDMA base station applications with frequencies from 2110 to 2170 MHz. Suitable for TDMA, CDMA and multicarrier amplifier applications. To be used in Class AB for PCN-PCS/cellular radio and WLL applications.

- Typical 2-carrier W-CDMA Performance for V_{DD} = 28 Volts, I_{DQ} = 500 mA, f1 = 2135 MHz, f2 = 2145 MHz, Channel Bandwidth = 3.84 MHz, Adjacent Channels measured over 3.84 MHz Bandwidth at f1 -5 MHz and f2 +5 MHz, Distortion Products measured over a 3.84 MHz Bandwidth at f1 -10 MHz and f2 +10 MHz, Peak/Avg. = 8.3 dB @ 0.01% Probability on CCDF.
  Output Power — 10 Watts Avg.
  Efficiency — 23.5%
  Gain — 15 dB
  IM3 — -37.5 dBc
  ACPR — -41 dBc
- 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, @ 28 Vdc, 2170 MHz, 45 Watts CW Output Power
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Low Gold Plating Thickness on Leads, 40μ″ Nominal.
- In Tape and Reel. R3 Suffix = 250 Units per 32 mm, 13 Inch Reel.



CASE 465E-04, STYLE 1
NI-400
MRF21045LR3



CASE 465F-04, STYLE 1
NI-400S
MRF21045LSR3

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°C Derate above 25°C	P_D	105 0.60	Watts W/°C
Storage Temperature Range	T_{stg}	-65 to +150	°C
Operating Junction Temperature	T_J	200	°C

ESD PROTECTION CHARACTERISTICS

Test Conditions	Class
Human Body Model	1 (Minimum)
Machine Model	M2 (Minimum)

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.65	°C/W

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

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} = 28 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} = 28 Vdc, I_D = 500 mAdc)	$V_{GS(Q)}$	3	3.9	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 = 1 Adc)	g_{fs}	—	3	—	S
DYNAMIC CHARACTERISTICS (1)					
Reverse Transfer Capacitance (V_{DS} = 28 Vdc, V_{GS} = 0, f = 1 MHz)	C_{rss}	—	1.8	—	pF

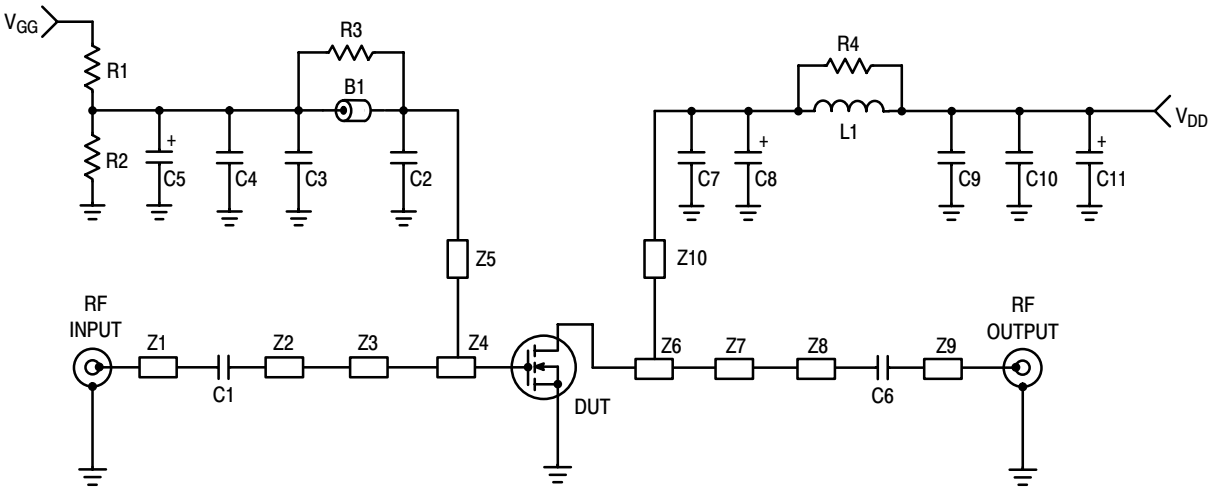
FUNCTIONAL TESTS (In Motorola Test Fixture, 50 ohm system) 2-carrier W-CDMA. Peak/Avg. ratio = 8.3 dB @ 0.01% Probability on CCDF.

Common-Source Amplifier Power Gain (V_{DD} = 28 Vdc, P_{out} = 10 W Avg., I_{DQ} = 500 mA, f1 = 2112.5 MHz, f2 = 2122.5 MHz and f1 = 2157.5 MHz, f2 = 2167.5 MHz)	G_{ps}	13.5	15	—	dB
Drain Efficiency (V_{DD} = 28 Vdc, P_{out} = 10 W Avg., I_{DQ} = 500 mA, f1 = 2112.5 MHz, f2 = 2122.5 MHz and f1 = 2157.5 MHz, f2 = 2167.5 MHz)	η	21	23.5	—	%
Third Order Intermodulation Distortion (V_{DD} = 28 Vdc, P_{out} = 10 W Avg., I_{DQ} = 500 mA, f1 = 2112.5 MHz, f2 = 2122.5 MHz and f1 = 2157.5 MHz, f2 = 2167.5 MHz; IM3 measured over 3.84 MHz Bandwidth at f1 -10 MHz and f2 +10 MHz.)	IM3	—	-37.5	-35	dBc
Adjacent Channel Power Ratio (V_{DD} = 28 Vdc, P_{out} = 10 W Avg., I_{DQ} = 500 mA, f1 = 2112.5 MHz, f2 = 2122.5 MHz and f1 = 2157.5 MHz, f2 = 2167.5 MHz; ACPR measured over 3.84 MHz Bandwidth at f1 -5 MHz and f2 +5 MHz.)	ACPR	—	-41	-38	dBc
Input Return Loss (V_{DD} = 28 Vdc, P_{out} = 10 W Avg., I_{DQ} = 500 mA, f1 = 2112.5 MHz, f2 = 2122.5 MHz and f1 = 2157.5 MHz, f2 = 2167.5 MHz)	IRL	—	-12	-9	dB
Output Mismatch Stress (V_{DD} = 28 Vdc, P_{out} = 45 W CW, I_{DQ} = 500 mA, f = 2170 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.

ELECTRICAL CHARACTERISTICS — continued (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
FUNCTIONAL TESTS (In Motorola Test Fixture, 50 ohm system) — continued					
Two-Tone Common-Source Amplifier Power Gain (V_{DD} = 28 Vdc, P_{out} = 45 W PEP, I_{DQ} = 500 mA, f1 = 2110 MHz, f2 = 2120 MHz and f1 = 2160 MHz, f2 = 2170 MHz)	G_{ps}	—	14.9	—	dB
Two-Tone Drain Efficiency (V_{DD} = 28 Vdc, P_{out} = 45 W PEP, I_{DQ} = 500 mA, f1 = 2110 MHz, f2 = 2120 MHz and f1 = 2160 MHz, f2 = 2170 MHz)	η	—	36	—	%
Intermodulation Distortion (V_{DD} = 28 Vdc, P_{out} = 45 W PEP, I_{DQ} = 500 mA, f1 = 2110 MHz, f2 = 2120 MHz and f1 = 2160 MHz, f2 = 2170 MHz)	IMD	—	-30	—	dBc
Two-Tone Input Return Loss (V_{DD} = 28 Vdc, P_{out} = 45 W PEP, I_{DQ} = 500 mA, f1 = 2110 MHz, f2 = 2120 MHz and f1 = 2160 MHz, f2 = 2170 MHz)	IRL	—	-12	—	dB
P_{out}, 1 dB Compression Point (V_{DD} = 28 Vdc, I_{DQ} = 500 mA, f = 2170 MHz)	P1dB	—	50	—	W



Z1, Z9	0.750″ x 0.084″ Transmission Line	Board	0.030″ Glass Teflon®,
Z2	0.160″ x 0.084″ Transmission Line		Keene GX-0300-55-22, ε_r = 2.55
Z3	1.195″ x 0.176″ Transmission Line	PCB	Etched Circuit Boards
Z4	0.125″ x 0.320″ Transmission Line		MRF21045 Rev. 3, CMR
Z5	1.100″ x 0.045″ Transmission Line		
Z6	0.442″ x 0.650″ Transmission Line		
Z7	0.490″ x 0.140″ Transmission Line		
Z8	0.540″ x 0.084″ Transmission Line		
Z10	0.825″ x 0.055″ Transmission Line		

Figure 1. MRF21045LR3(LSR3) Test Circuit Schematic

Table 1. MRF21045LR3(LSR3) Component Designations and Values

Designators	Description
B1	Short Ferrite Bead, Fair Rite, #2743019447
C1, C2, C6	43 pF Chip Capacitors, ATC #100B430JCA500X
C7	5.6 pF Chip Capacitor, ATC #100B5R6JCA500X
C3, C9	1000 pF Chip Capacitors, ATC #100B102JCA500X
C4, C10	0.1 μF Chip Capacitors, Kemet #CDR33BX104AKWS
C5	1.0 μF Tantalum Chip Capacitor, Kemet #T491C105M050
C8	10 μF Tantalum Chip Capacitor, Kemet #T495X106K035AS4394
C11	22 μF Tantalum Chip Capacitor, Kemet #T491X226K035AS4394
L1	1 Turn, #20 AWG, 0.100″ ID, Motorola
N1, N2	Type N Flange Mounts, Omni Spectra #3052-1648-10
R1	1.0 kΩ, 1/8 W Chip Resistor
R2	180 kΩ, 1/8 W Chip Resistor
R3, R4	10 Ω, 1/8 W Chip Resistors

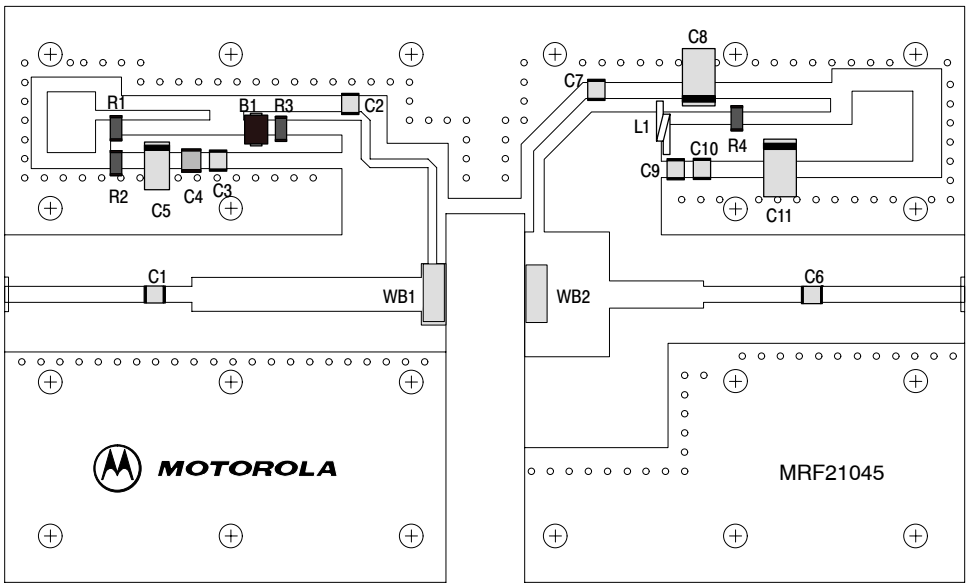


Figure 2. MRF21045LR3(LSR3) Test Circuit Component Layout

TYPICAL CHARACTERISTICS

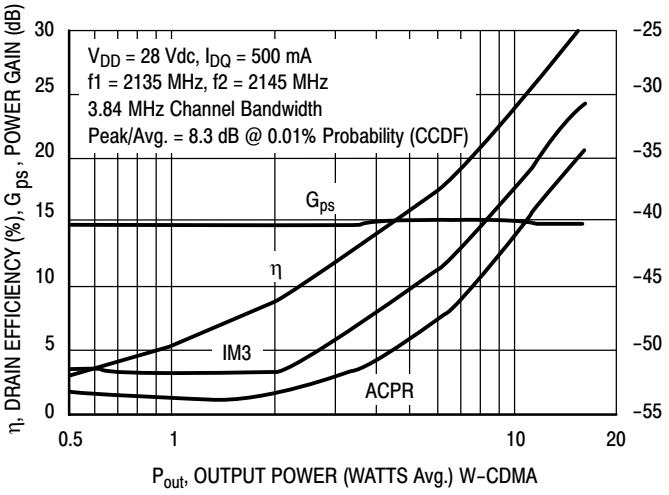


Figure 3. 2-Carrier W-CDMA ACPR, IM3, Power Gain and Drain Efficiency versus Output Power

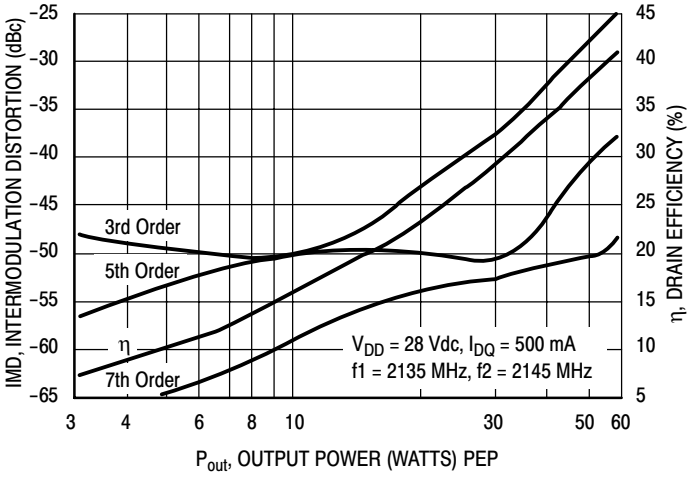


Figure 4. Intermodulation Distortion Products versus Output Power

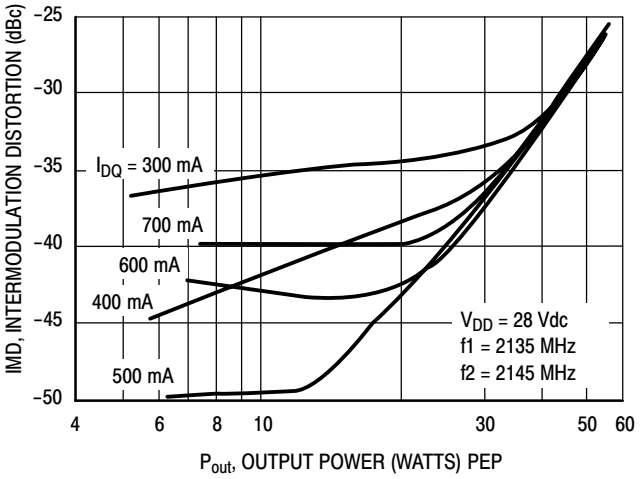


Figure 5. Intermodulation Distortion versus Output Power

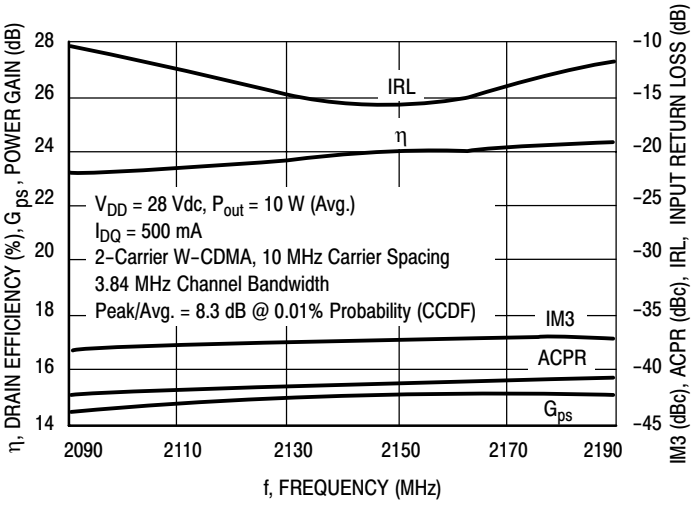


Figure 6. 2-Carrier W-CDMA Broadband Performance

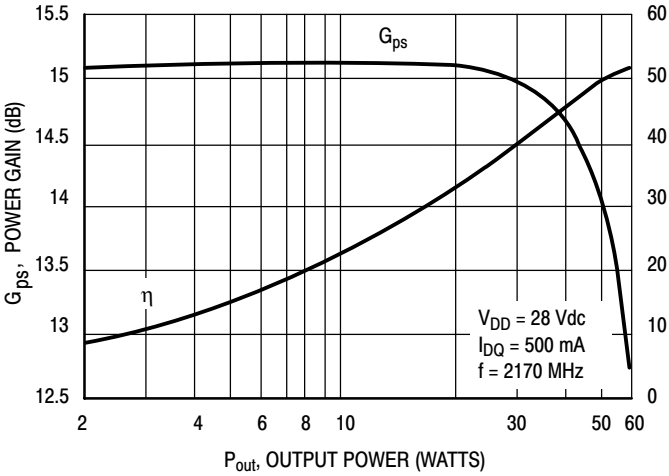


Figure 7. CW Performance

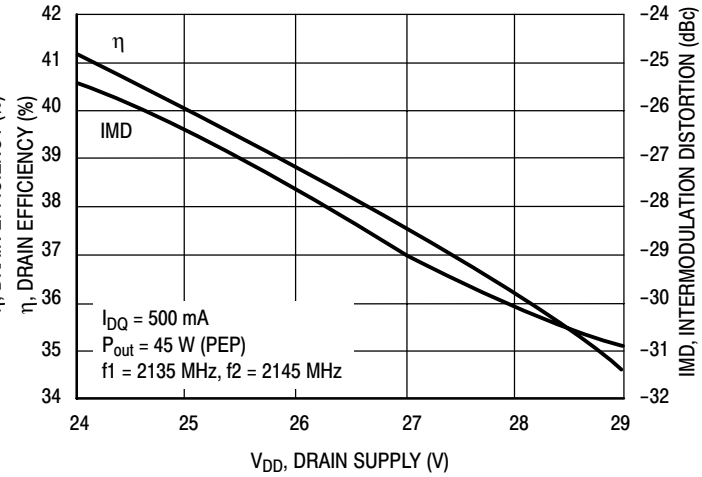


Figure 8. Two-Tone Intermodulation Distortion and Drain Efficiency versus Drain Supply

TYPICAL CHARACTERISTICS

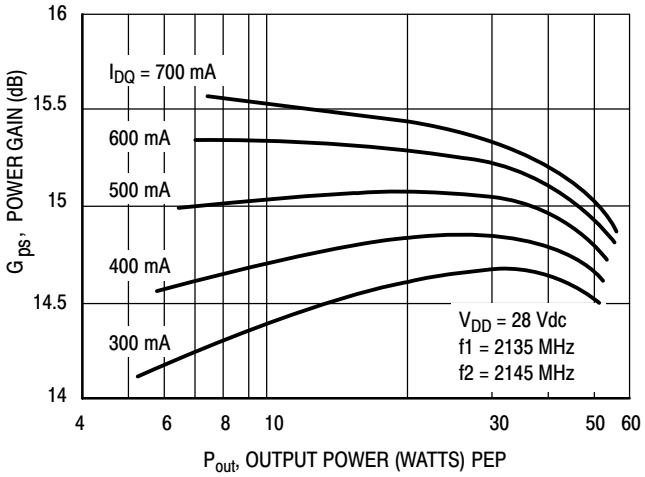


Figure 9. Two-Tone Power Gain versus Output Power

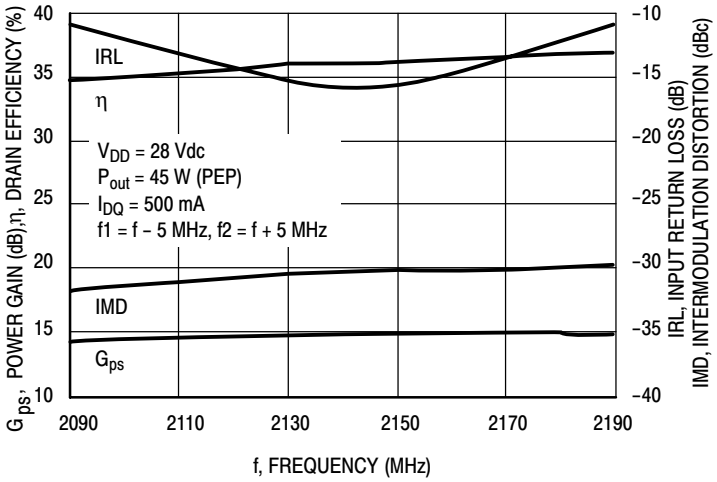


Figure 10. Two-Tone Broadband Performance

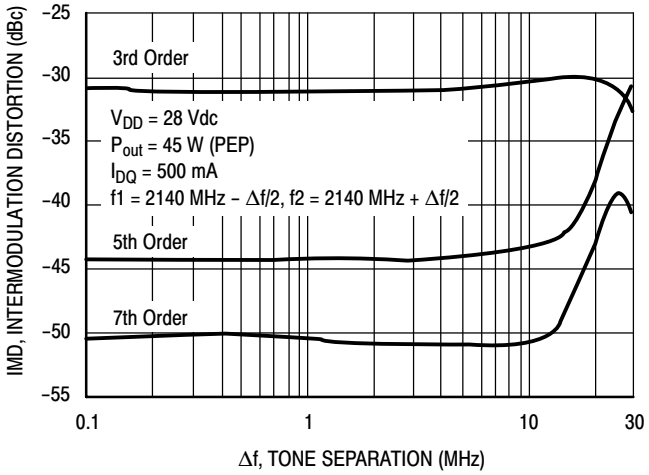


Figure 11. Intermodulation Distortion Products versus Two-Tone Spacing

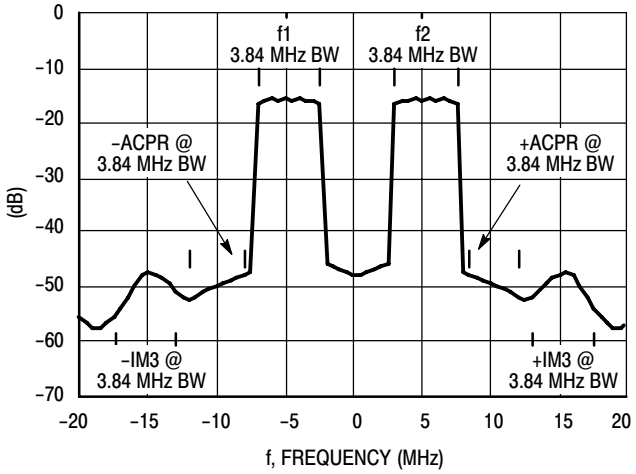
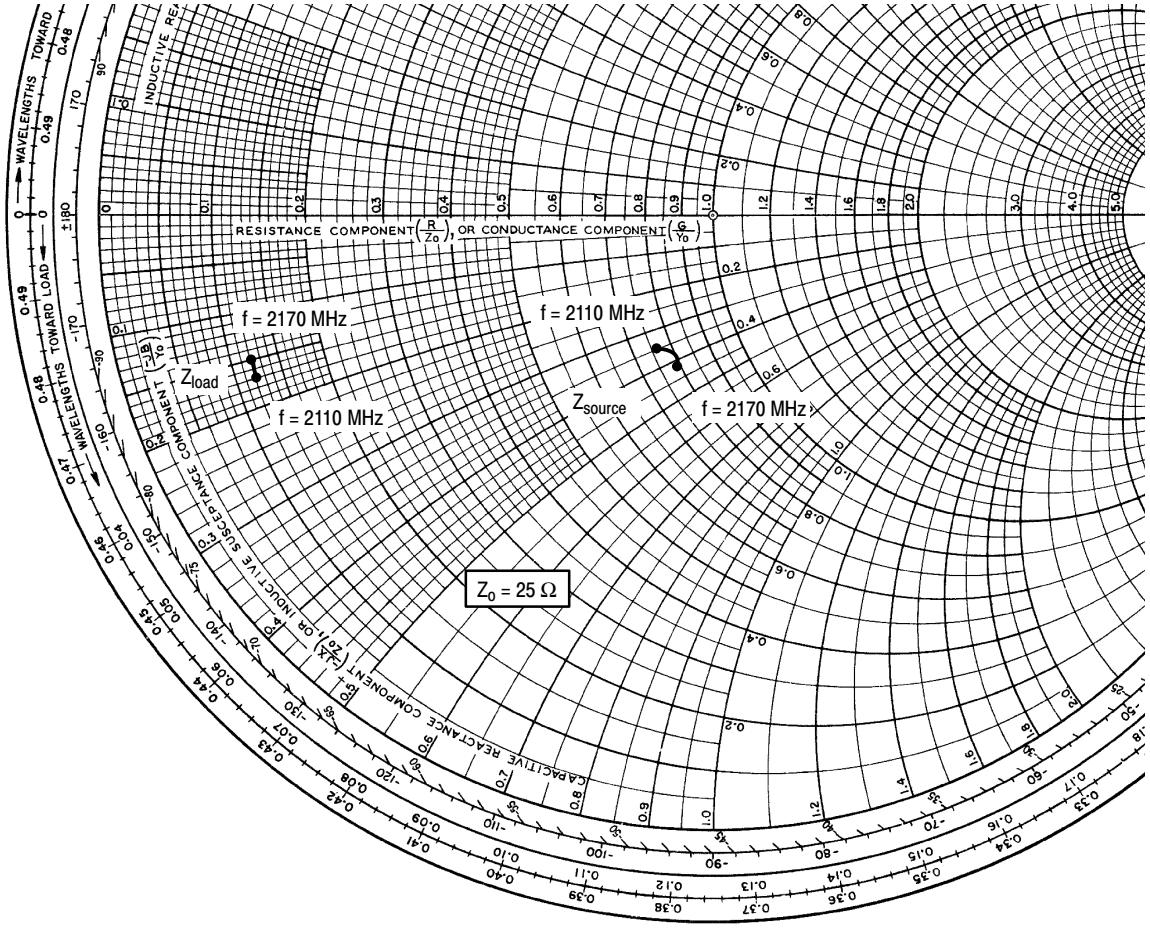


Figure 12. 2-Carrier W-CDMA Spectrum



V_{DD} = 28 Vdc, I_{DQ} = 500 mA, P_{out} = 10 W Avg.

f MHz	Z_{source} Ω	Z_{load} Ω
2110	18.88 - j8.86	3.11 - j4.18
2140	19.80 - j9.93	3.09 - j3.87
2170	19.68 - j10.44	3.12 - j3.72

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

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

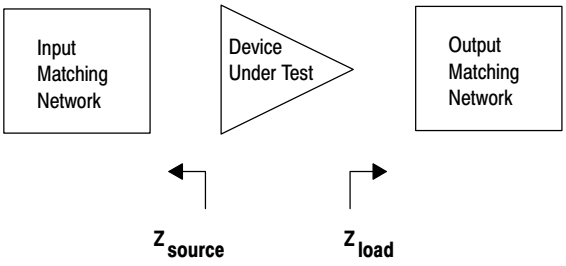
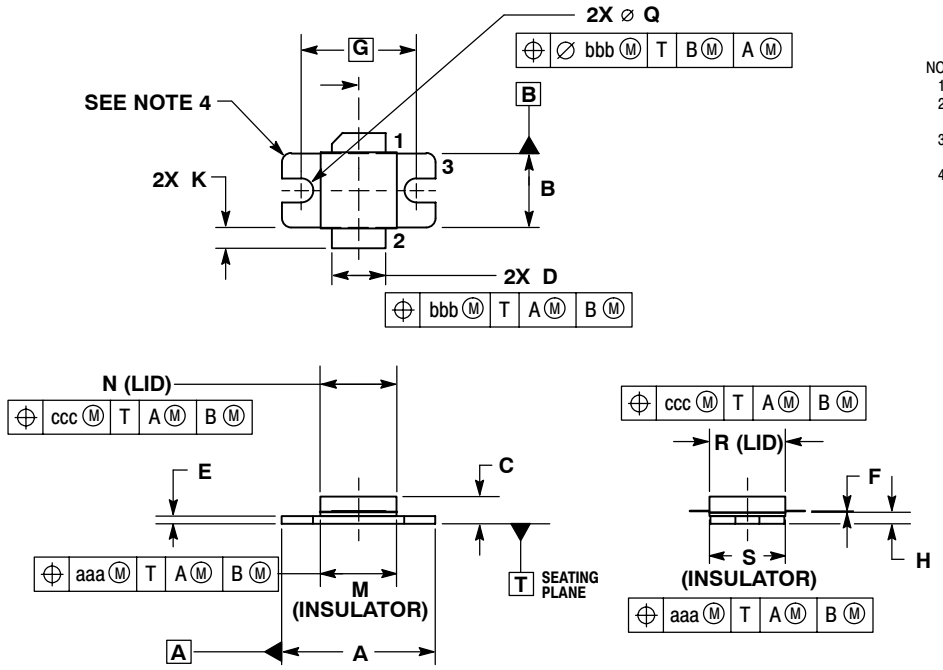


Figure 13. Series Equivalent Source and Load Impedance

NOTES

NOTES

PACKAGE DIMENSIONS

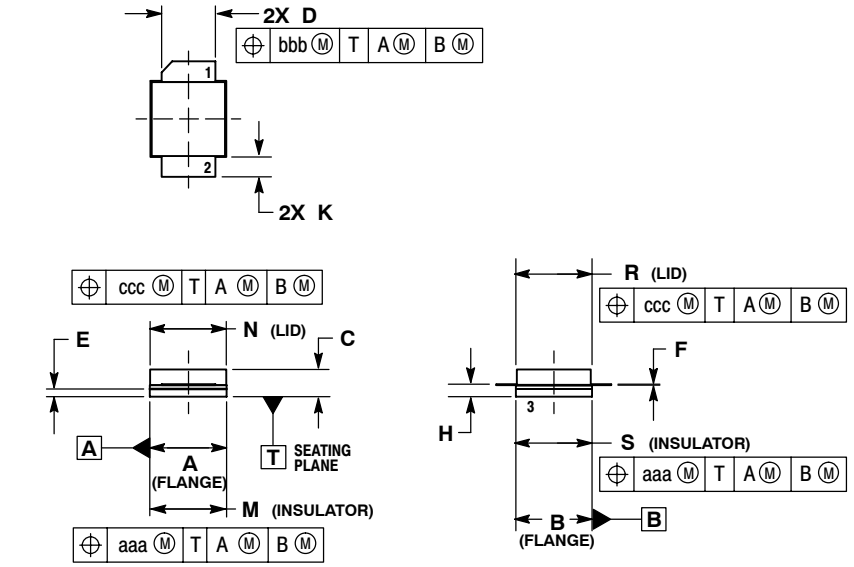


NOTES:
1. CONTROLLING DIMENSION: INCH.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.
4. INFORMATION ONLY: CORNER BREAK (4X) TO BE .060±.005 (1.52±0.13) RADIUS OR .06±.005 (1.52±0.13) x 45° CHAMFER.

	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 E
NI-400
MRF21045LR3



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3. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.

	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 C
NI-400S
MRF21045LSR3

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