

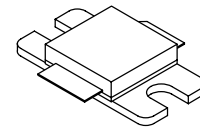
The RF MOSFET Line
RF Power Field Effect Transistors
N-Channel Enhancement-Mode Lateral MOSFETs

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.

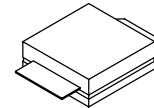
- Typical 2-carrier W-CDMA Performance for $V_{DD} = 28$ Volts, $I_{DQ} = 500$ mA, $f_1 = 2135$ MHz, $f_2 = 2145$ MHz, Channel Bandwidth = 3.84 MHz, Adjacent Channels measured over 3.84 MHz Bandwidth at $f_1 - 5$ MHz and $f_2 + 5$ MHz, Distortion Products measured over a 3.84 MHz Bandwidth at $f_1 - 10$ MHz and $f_2 + 10$ 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, 40 μ m Nominal.
- In Tape and Reel. R3 Suffix = 250 Units per 32 mm, 13 Inch Reel.

MRF21045LR3
MRF21045LSR3

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



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 @ $T_C = 25^\circ\text{C}$ 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	$^\circ\text{C}$

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	$^\circ\text{C}/\text{W}$

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

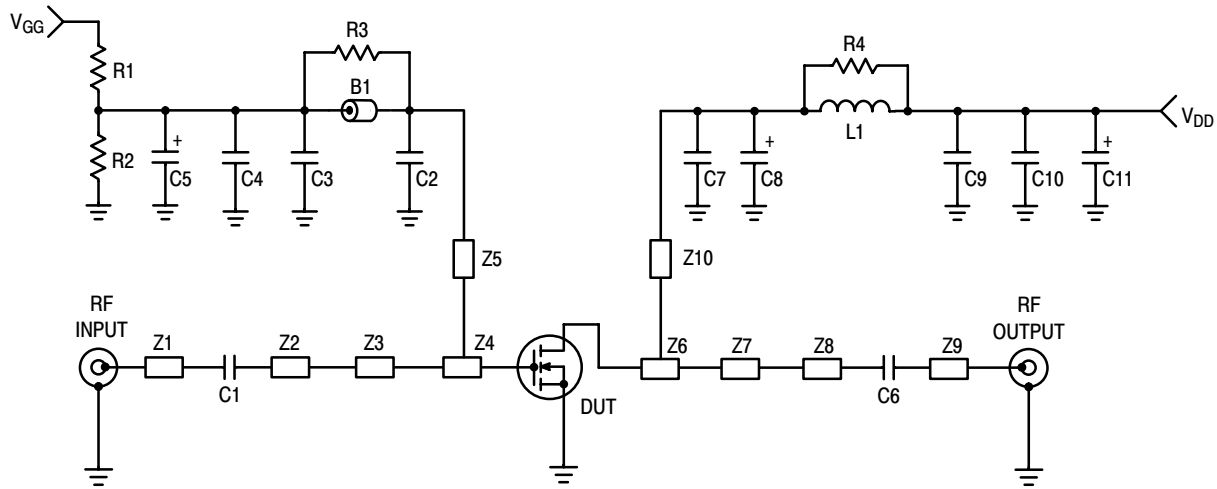
Common-Source Amplifier Power Gain (V _{DD} = 28 Vdc, P _{out} = 10 W Avg., I _{DQ} = 500 mA, f ₁ = 2112.5 MHz, f ₂ = 2122.5 MHz and f ₁ = 2157.5 MHz, f ₂ = 2167.5 MHz)	G _{ps}	13.5	15	—	dB
Drain Efficiency (V _{DD} = 28 Vdc, P _{out} = 10 W Avg., I _{DQ} = 500 mA, f ₁ = 2112.5 MHz, f ₂ = 2122.5 MHz and f ₁ = 2157.5 MHz, f ₂ = 2167.5 MHz)	η	21	23.5	—	%
Third Order Intermodulation Distortion (V _{DD} = 28 Vdc, P _{out} = 10 W Avg., I _{DQ} = 500 mA, f ₁ = 2112.5 MHz, f ₂ = 2122.5 MHz and f ₁ = 2157.5 MHz, f ₂ = 2167.5 MHz; IM3 measured over 3.84 MHz Bandwidth at f ₁ -10 MHz and f ₂ +10 MHz.)	IM3	—	-37.5	-35	dBc
Adjacent Channel Power Ratio (V _{DD} = 28 Vdc, P _{out} = 10 W Avg., I _{DQ} = 500 mA, f ₁ = 2112.5 MHz, f ₂ = 2122.5 MHz and f ₁ = 2157.5 MHz, f ₂ = 2167.5 MHz; ACPR measured over 3.84 MHz Bandwidth at f ₁ -5 MHz and f ₂ +5 MHz.)	ACPR	—	-41	-38	dBc
Input Return Loss (V _{DD} = 28 Vdc, P _{out} = 10 W Avg., I _{DQ} = 500 mA, f ₁ = 2112.5 MHz, f ₂ = 2122.5 MHz and f ₁ = 2157.5 MHz, f ₂ = 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.

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ELECTRICAL CHARACTERISTICS — continued ($T_C = 25^\circ\text{C}$ 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 ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 45\text{ W PEP}$, $I_{DQ} = 500\text{ mA}$, $f_1 = 2110\text{ MHz}$, $f_2 = 2120\text{ MHz}$ and $f_1 = 2160\text{ MHz}$, $f_2 = 2170\text{ MHz}$)	G_{ps}	—	14.9	—	dB
Two-Tone Drain Efficiency ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 45\text{ W PEP}$, $I_{DQ} = 500\text{ mA}$, $f_1 = 2110\text{ MHz}$, $f_2 = 2120\text{ MHz}$ and $f_1 = 2160\text{ MHz}$, $f_2 = 2170\text{ MHz}$)	η	—	36	—	%
Intermodulation Distortion ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 45\text{ W PEP}$, $I_{DQ} = 500\text{ mA}$, $f_1 = 2110\text{ MHz}$, $f_2 = 2120\text{ MHz}$ and $f_1 = 2160\text{ MHz}$, $f_2 = 2170\text{ MHz}$)	IMD	—	-30	—	dBc
Two-Tone Input Return Loss ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 45\text{ W PEP}$, $I_{DQ} = 500\text{ mA}$, $f_1 = 2110\text{ MHz}$, $f_2 = 2120\text{ MHz}$ and $f_1 = 2160\text{ MHz}$, $f_2 = 2170\text{ MHz}$)	IRL	—	-12	—	dB
$P_{out, 1\text{ dB}}$ Compression Point ($V_{DD} = 28\text{ Vdc}$, $I_{DQ} = 500\text{ mA}$, $f = 2170\text{ MHz}$)	P_{1dB}	—	50	—	W



- Z1, Z9 0.750" x 0.084" Transmission Line
- Z2 0.160" x 0.084" Transmission Line
- Z3 1.195" x 0.176" Transmission Line
- Z4 0.125" x 0.320" Transmission Line
- 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

Board 0.030" Glass Teflon®,
Keene GX-0300-55-22, $\epsilon_r = 2.55$
PCB Etched Circuit Boards
MRF21045 Rev. 3, CMR

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 μ F Chip Capacitors, Kemet #CDR33BX104AKWS
C5	1.0 μ F Tantalum Chip Capacitor, Kemet #T491C105M050
C8	10 μ F Tantalum Chip Capacitor, Kemet #T495X106K035AS4394
C11	22 μ F 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 k Ω , 1/8 W Chip Resistor
R2	180 k Ω , 1/8 W Chip Resistor
R3, R4	10 Ω , 1/8 W Chip Resistors

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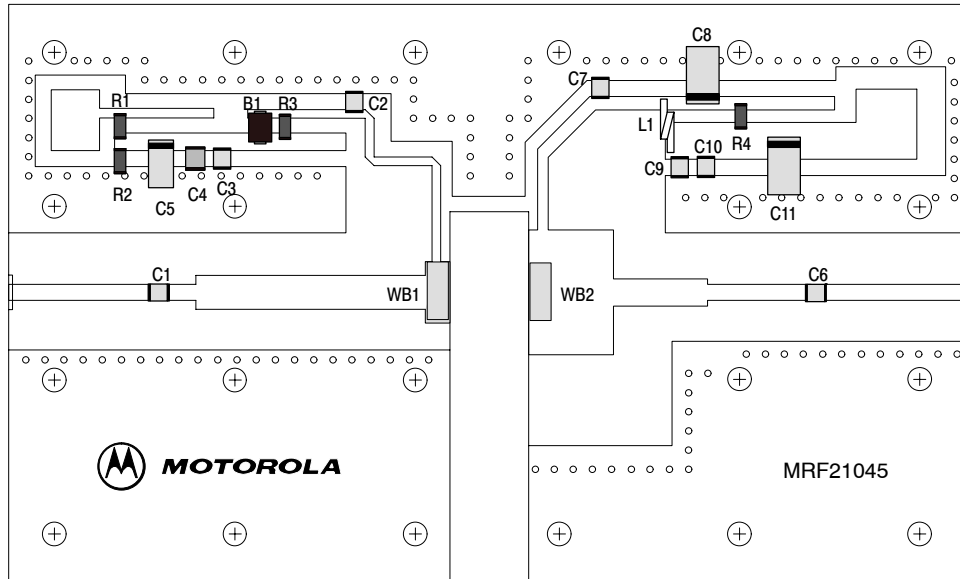


Figure 2. MRF21045LR3(LSR3) Test Circuit Component Layout

TYPICAL CHARACTERISTICS

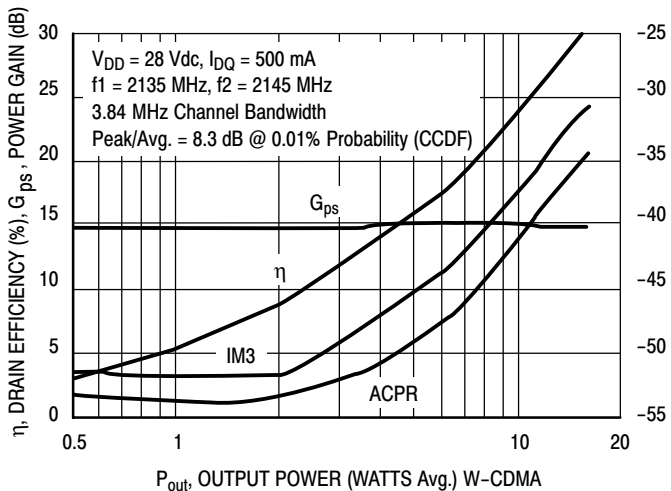


Figure 3. 2-Carrier W-CDMA ACPR, IM3, Power Gain and Drain Efficiency versus Output Power

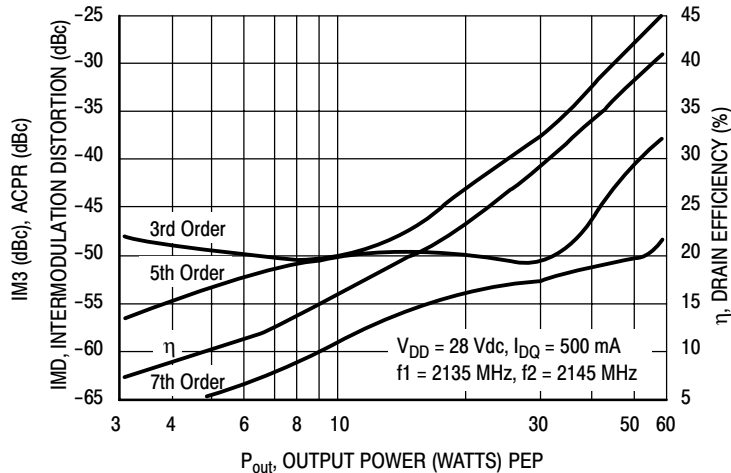


Figure 4. Intermodulation Distortion Products versus Output Power

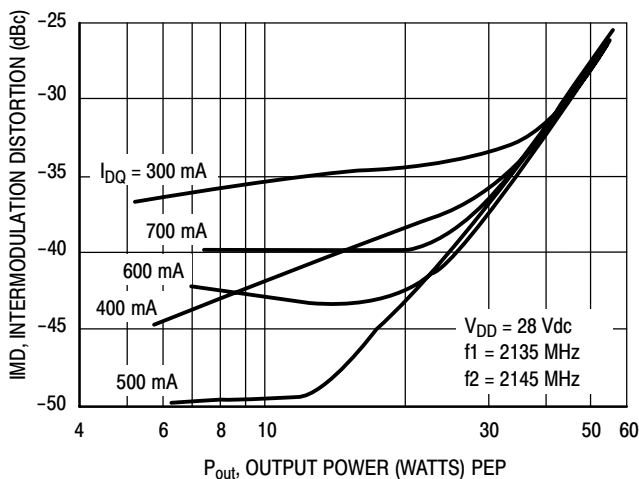


Figure 5. Intermodulation Distortion versus Output Power

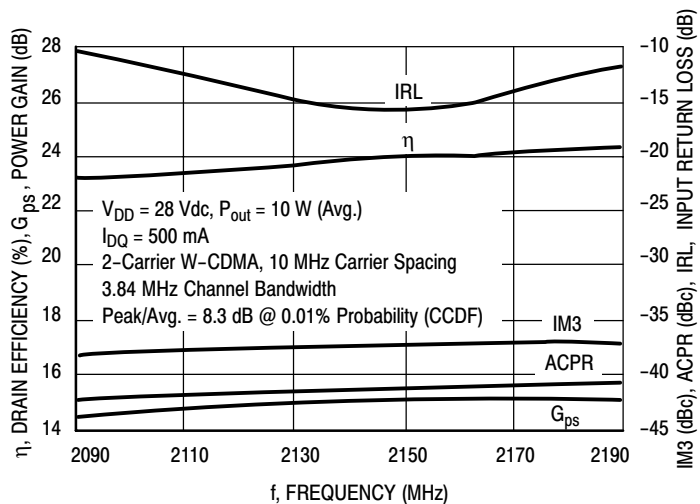


Figure 6. 2-Carrier W-CDMA Broadband Performance

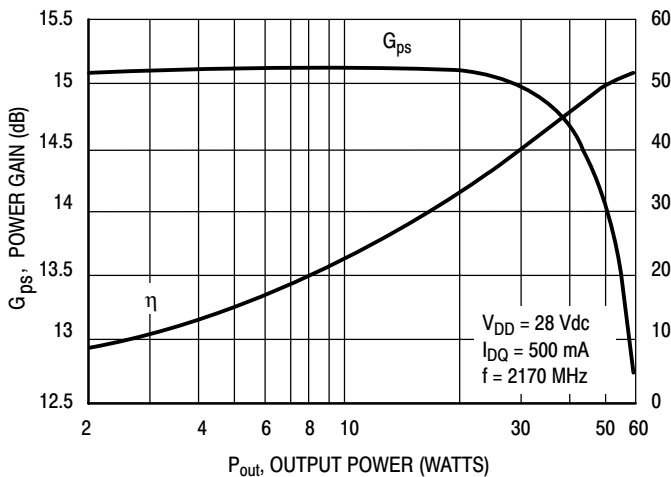


Figure 7. CW Performance

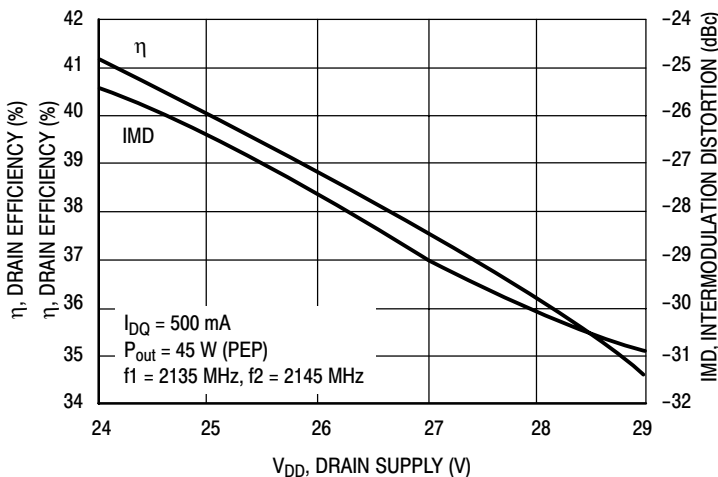


Figure 8. Two-Tone Intermodulation Distortion and Drain Efficiency versus Drain Supply

TYPICAL CHARACTERISTICS

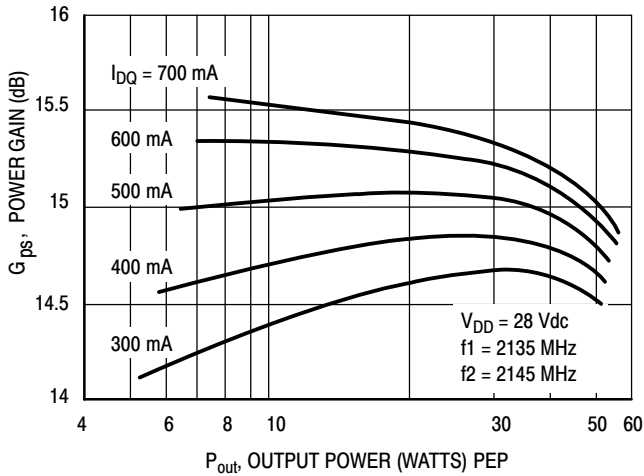


Figure 9. Two-Tone Power Gain versus Output Power

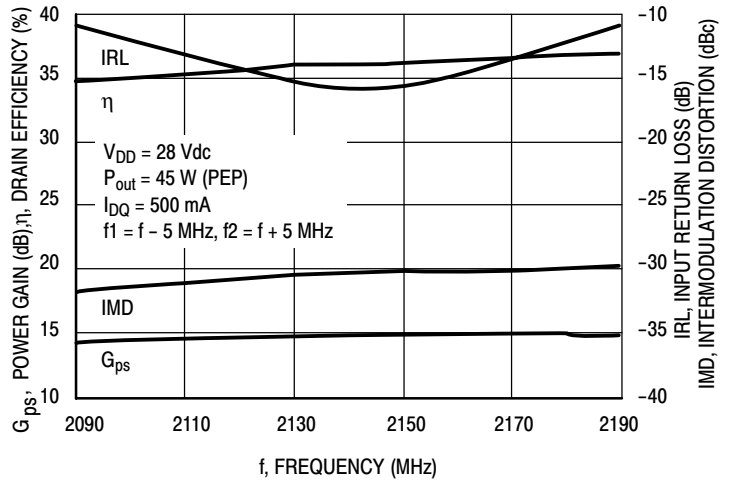


Figure 10. Two-Tone Broadband Performance

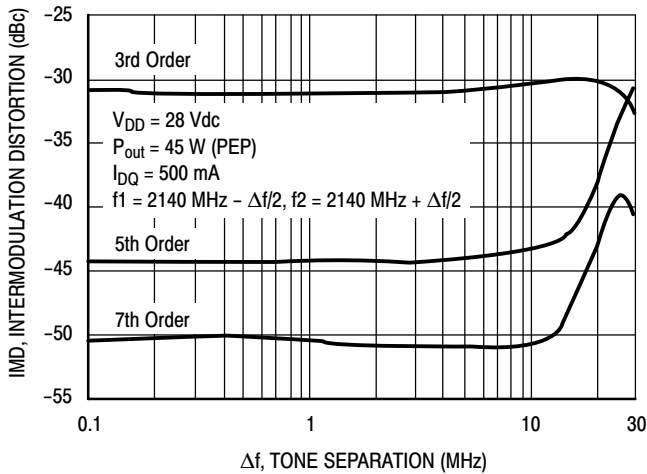


Figure 11. Intermodulation Distortion Products versus Two-Tone Spacing

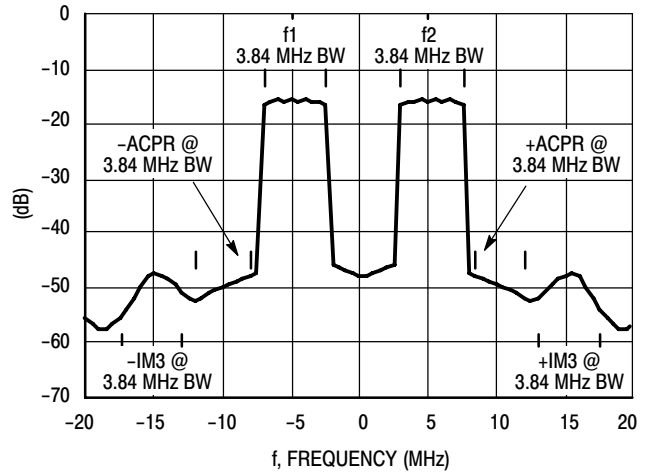
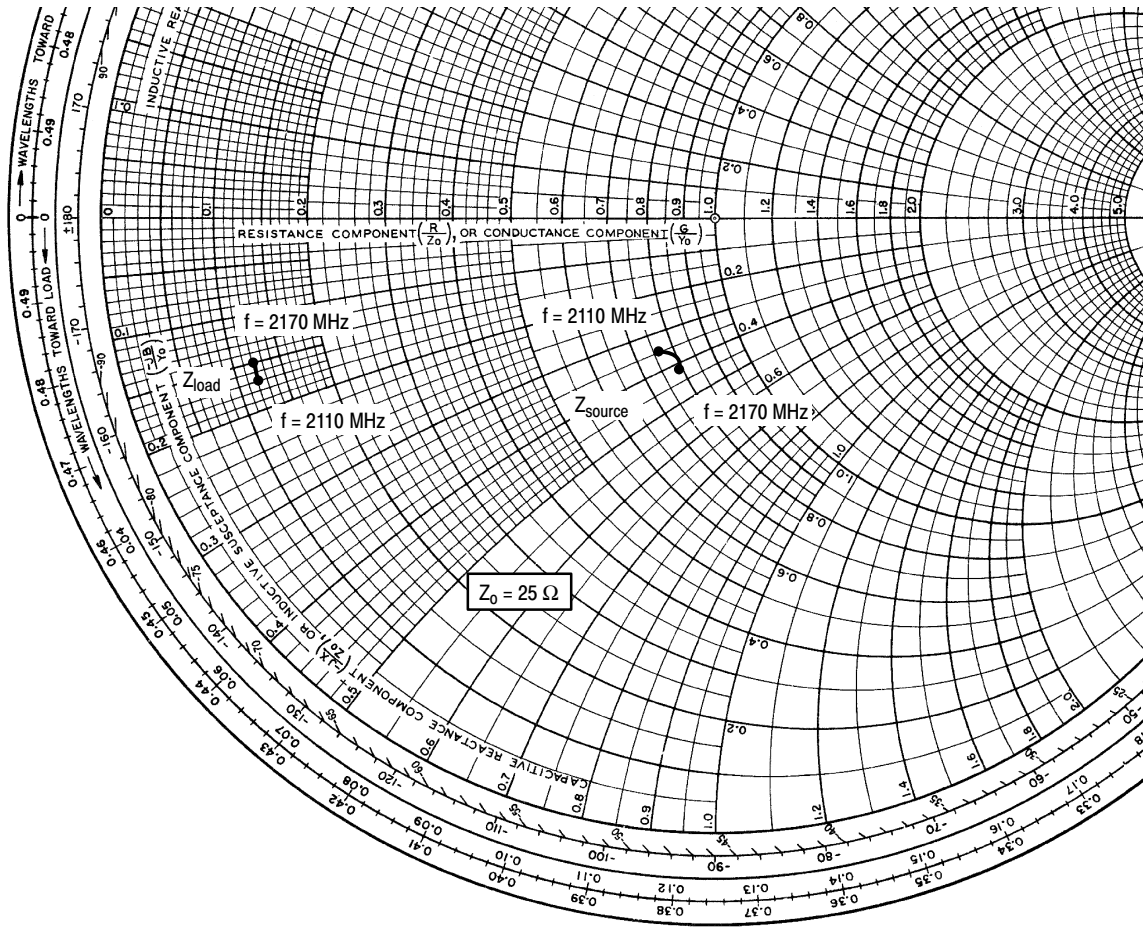


Figure 12. 2-Carrier W-CDMA Spectrum



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

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.

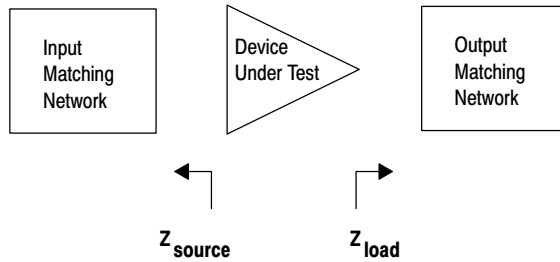


Figure 13. Series Equivalent Source and Load Impedance

NOTES

NOTES

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PACKAGE DIMENSIONS

Freescale Semiconductor, Inc.

SEE NOTE 4

2X \varnothing Q

2X K

2X D

N (LID)

M (INSULATOR)

T SEATING PLANE

R (LID)

S (INSULATOR)

H

**CASE 465E-04
ISSUE E
NI-400
MRF21045LR3**

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 $.060 \pm .005$ (1.52 ± 0.13) RADIUS OR $.06 \pm .005$ (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

N (LID)

M (INSULATOR)

T SEATING PLANE

R (LID)

S (INSULATOR)

H

B (FLANGE)

**CASE 465F-04
ISSUE C
NI-400S
MRF21045LSR3**

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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MRF21045/D