

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

MRF21045R3
MRF21045SR3

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%

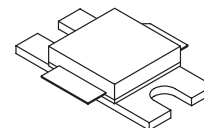
Gain — 15 dB

IM3 — -37.5 dBc

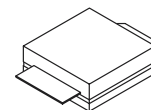
ACPR — -41 dBc

- 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
- In Tape and Reel. R3 Suffix = 250 Units per 32 mm, 13 Inch Reel.

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



CASE 465E-03, STYLE 1
NI-400
MRF21045R3



CASE 465F-03, STYLE 1
NI-400S
MRF21045SR3

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°C	P_D	105 0.60	Watts W/ $^\circ\text{C}$
Storage Temperature Range	T_{stg}	-65 to +200	$^\circ\text{C}$
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.

ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
----------------	--------	-----	-----	-----	------

OFF CHARACTERISTICS

Drain–Source Breakdown Voltage ($V_{GS} = 0\text{ Vdc}$, $I_D = 100\ \mu\text{Adc}$)	$V_{(BR)DSS}$	65	—	—	Vdc
Zero Gate Voltage Drain Current ($V_{DS} = 28\text{ Vdc}$, $V_{GS} = 0\text{ Vdc}$)	I_{DSS}	—	—	10	μAdc
Gate–Source Leakage Current ($V_{GS} = 5\text{ Vdc}$, $V_{DS} = 0\text{ Vdc}$)	I_{GSS}	—	—	1	μAdc

ON CHARACTERISTICS (DC)

Gate Threshold Voltage ($V_{DS} = 10\text{ Vdc}$, $I_D = 100\ \mu\text{Adc}$)	$V_{GS(th)}$	2	—	4	Vdc
Gate Quiescent Voltage ($V_{DS} = 28\text{ Vdc}$, $I_D = 500\ \text{mAdc}$)	$V_{GS(Q)}$	3	3.9	5	Vdc
Drain–Source On–Voltage ($V_{GS} = 10\text{ Vdc}$, $I_D = 1\text{ Adc}$)	$V_{DS(on)}$	—	0.19	0.21	Vdc
Forward Transconductance ($V_{DS} = 10\text{ Vdc}$, $I_D = 1\text{ Adc}$)	g_{fs}	—	3	—	S

DYNAMIC CHARACTERISTICS (1)

Reverse Transfer Capacitance ($V_{DS} = 28\text{ Vdc}$, $V_{GS} = 0$, $f = 1\text{ MHz}$)	C_{rss}	—	1.8	—	pF
--	-----------	---	-----	---	----

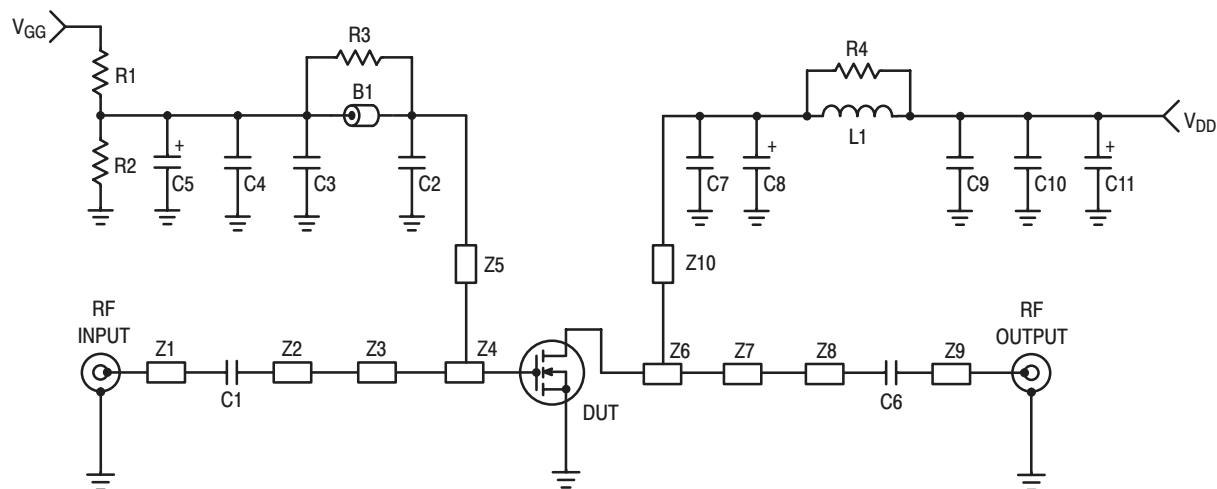
FUNCTIONAL TESTS (In Motorola Test Fixture, 50 ohm system) 2–carrier W–CDMA. Peak/Avg. ratio = 8.3 dB @ 0.01% Probability on CCDF.

Common–Source Amplifier Power Gain ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 10\text{ W Avg.}$, $I_{DQ} = 500\text{ mA}$, $f_1 = 2112.5\text{ MHz}$, $f_2 = 2122.5\text{ MHz}$ and $f_1 = 2157.5\text{ MHz}$, $f_2 = 2167.5\text{ MHz}$)	G_{ps}	13.5	15	—	dB
Drain Efficiency ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 10\text{ W Avg.}$, $I_{DQ} = 500\text{ mA}$, $f_1 = 2112.5\text{ MHz}$, $f_2 = 2122.5\text{ MHz}$ and $f_1 = 2157.5\text{ MHz}$, $f_2 = 2167.5\text{ MHz}$)	η	21	23.5	—	%
Third Order Intermodulation Distortion ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 10\text{ W Avg.}$, $I_{DQ} = 500\text{ mA}$, $f_1 = 2112.5\text{ MHz}$, $f_2 = 2122.5\text{ MHz}$ and $f_1 = 2157.5\text{ MHz}$, $f_2 = 2167.5\text{ MHz}$; IM3 measured over 3.84 MHz Bandwidth at $f_1 - 10\text{ MHz}$ and $f_2 + 10\text{ MHz}$.)	IM3	—	–37.5	–35	dBc
Adjacent Channel Power Ratio ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 10\text{ W Avg.}$, $I_{DQ} = 500\text{ mA}$, $f_1 = 2112.5\text{ MHz}$, $f_2 = 2122.5\text{ MHz}$ and $f_1 = 2157.5\text{ MHz}$, $f_2 = 2167.5\text{ MHz}$; ACPR measured over 3.84 MHz Bandwidth at $f_1 - 5\text{ MHz}$ and $f_2 + 5\text{ MHz}$.)	ACPR	—	–41	–38	dBc
Input Return Loss ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 10\text{ W Avg.}$, $I_{DQ} = 500\text{ mA}$, $f_1 = 2112.5\text{ MHz}$, $f_2 = 2122.5\text{ MHz}$ and $f_1 = 2157.5\text{ MHz}$, $f_2 = 2167.5\text{ MHz}$)	IRL	—	–12	–9	dB
Output Mismatch Stress ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 45\text{ W CW}$, $I_{DQ} = 500\text{ mA}$, $f = 2170\text{ MHz}$, 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 ($T_C = 25^\circ\text{C}$ 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 dB Compression Point ($V_{DD} = 28\text{ Vdc}$, $I_{DQ} = 500\text{ mA}$, $f = 2170\text{ MHz}$)	P1dB	—	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. MRF21045 Test Circuit Schematic

Table 1. MRF21045 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

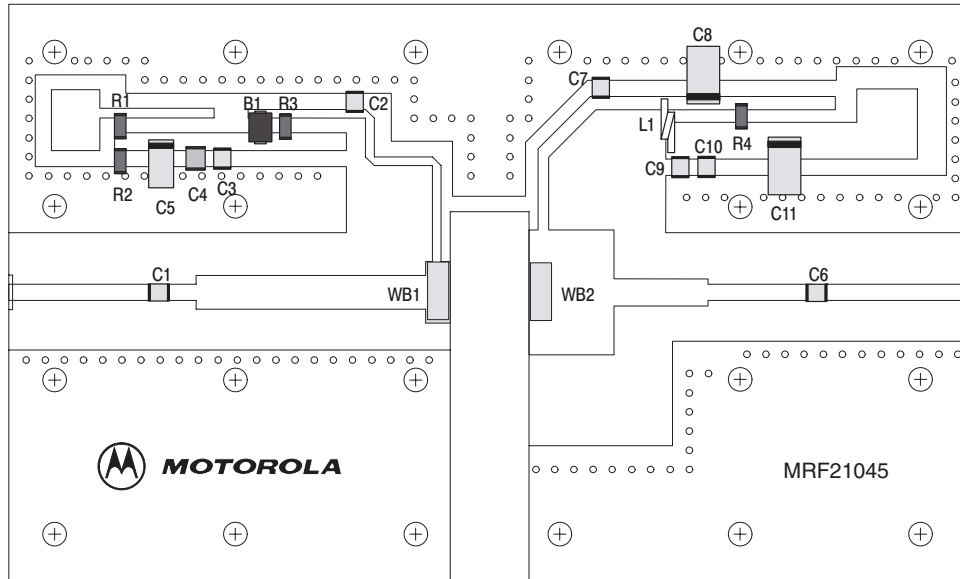


Figure 2. MRF21045 Test Circuit Component Layout

TYPICAL CHARACTERISTICS

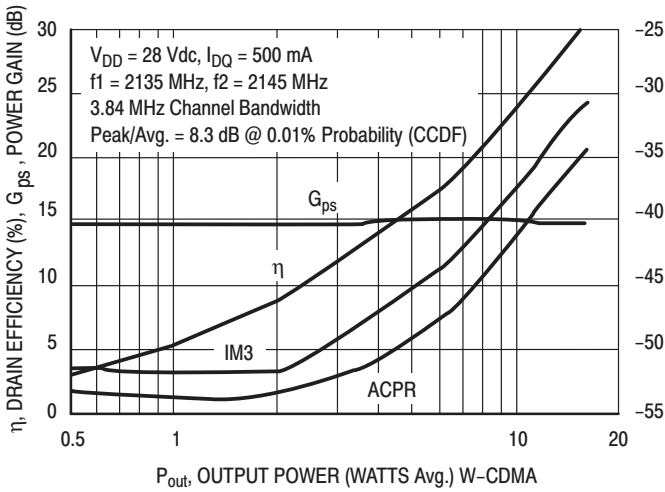


Figure 3. 2-Carrier W-CDMA ACPR, IM3, Power Gain and Drain Efficiency versus Output Power

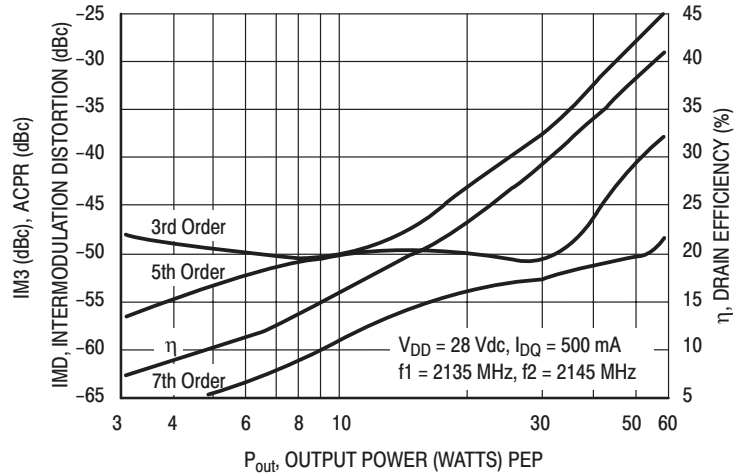


Figure 4. Intermodulation Distortion Products versus Output Power

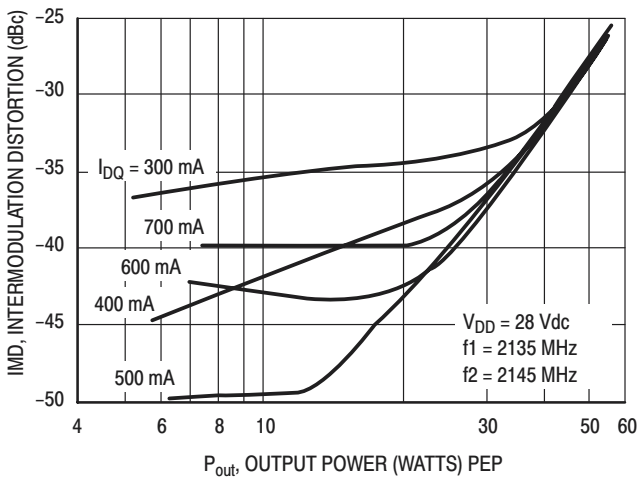


Figure 5. Intermodulation Distortion versus Output Power

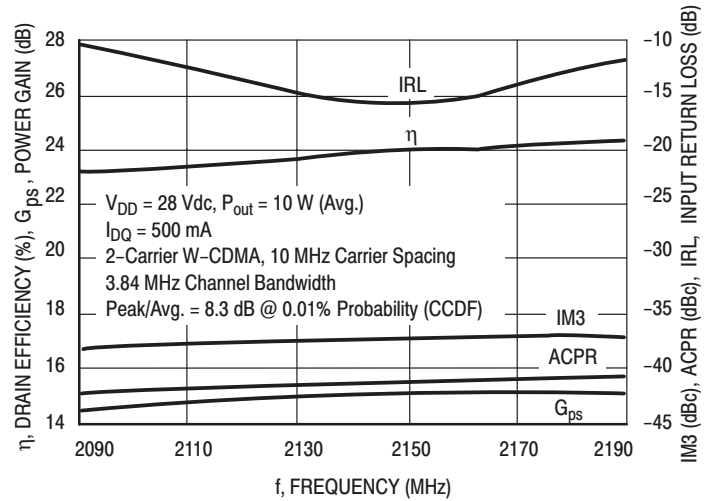


Figure 6. 2-Carrier W-CDMA Broadband Performance

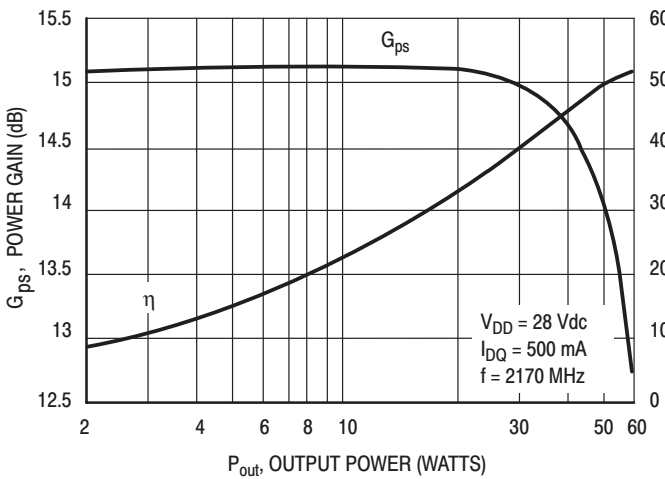


Figure 7. CW Performance

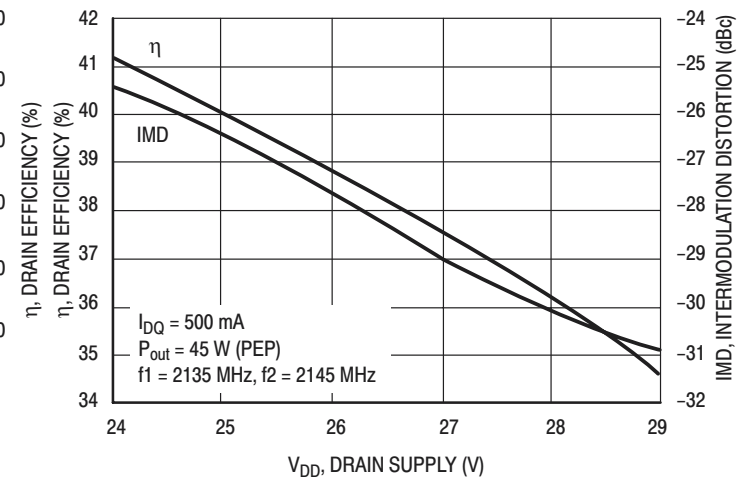


Figure 8. Two-Tone Intermodulation Distortion and Drain Efficiency versus Drain Supply

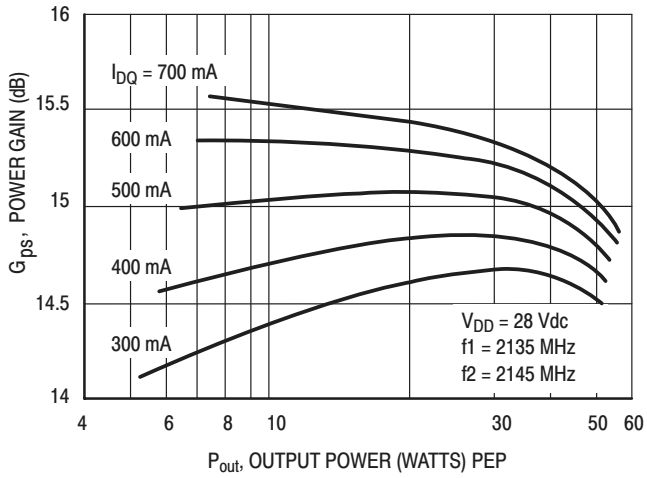


Figure 9. Two-Tone Power Gain versus Output Power

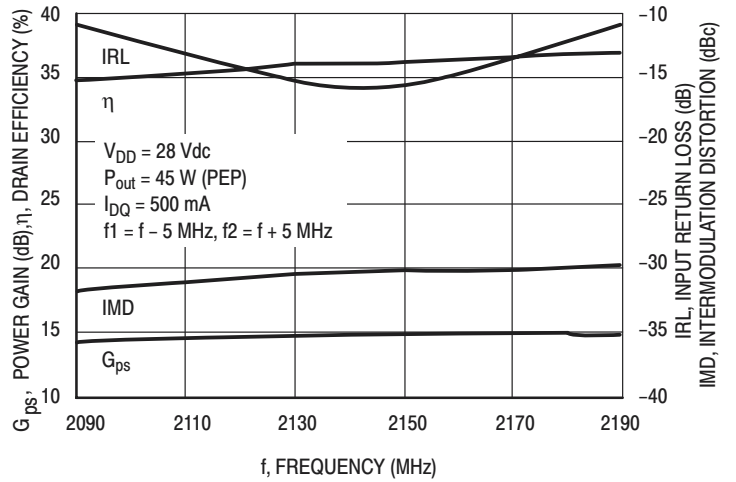


Figure 10. Two-Tone Broadband Performance

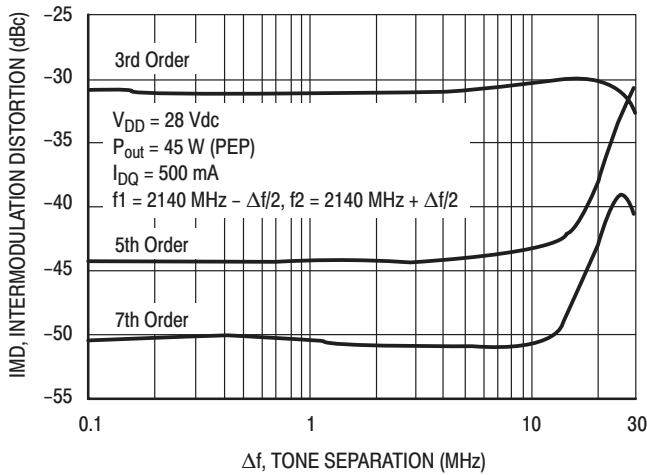


Figure 11. Intermodulation Distortion Products versus Two-Tone Spacing

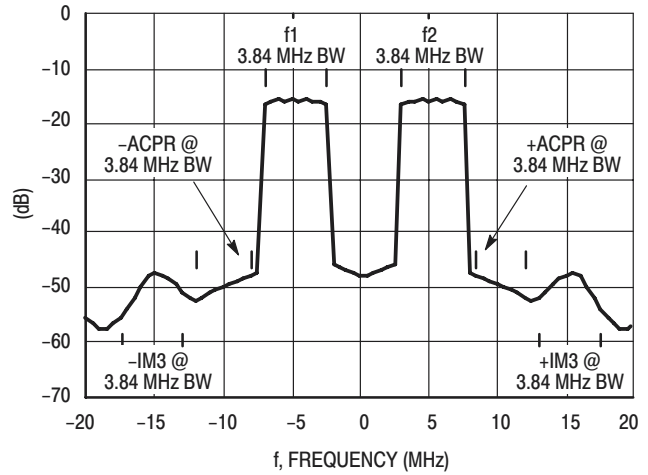
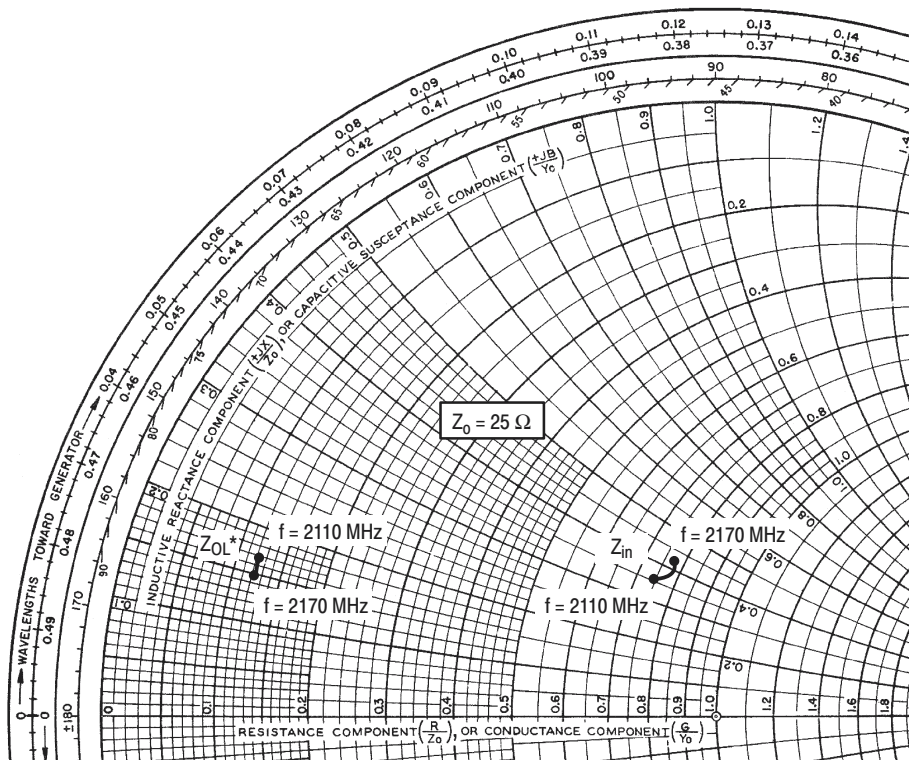


Figure 12. 2-Carrier W-CDMA Spectrum



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

f MHz	Z_{in} Ω	Z_{OL}^* 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_{in} = Complex conjugate of source impedance.

Z_{OL}^* = Complex conjugate of the optimum load impedance at a given output power, voltage, IMD, bias current and frequency.

Note: Z_{OL}^* was chosen based on tradeoffs between gain, output power, drain efficiency and intermodulation distortion.

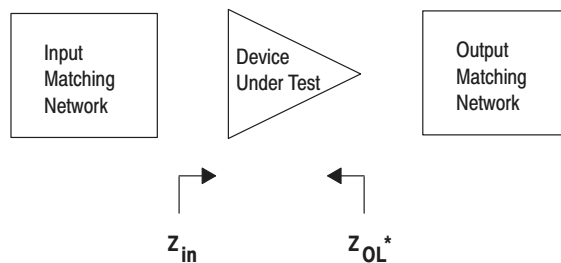
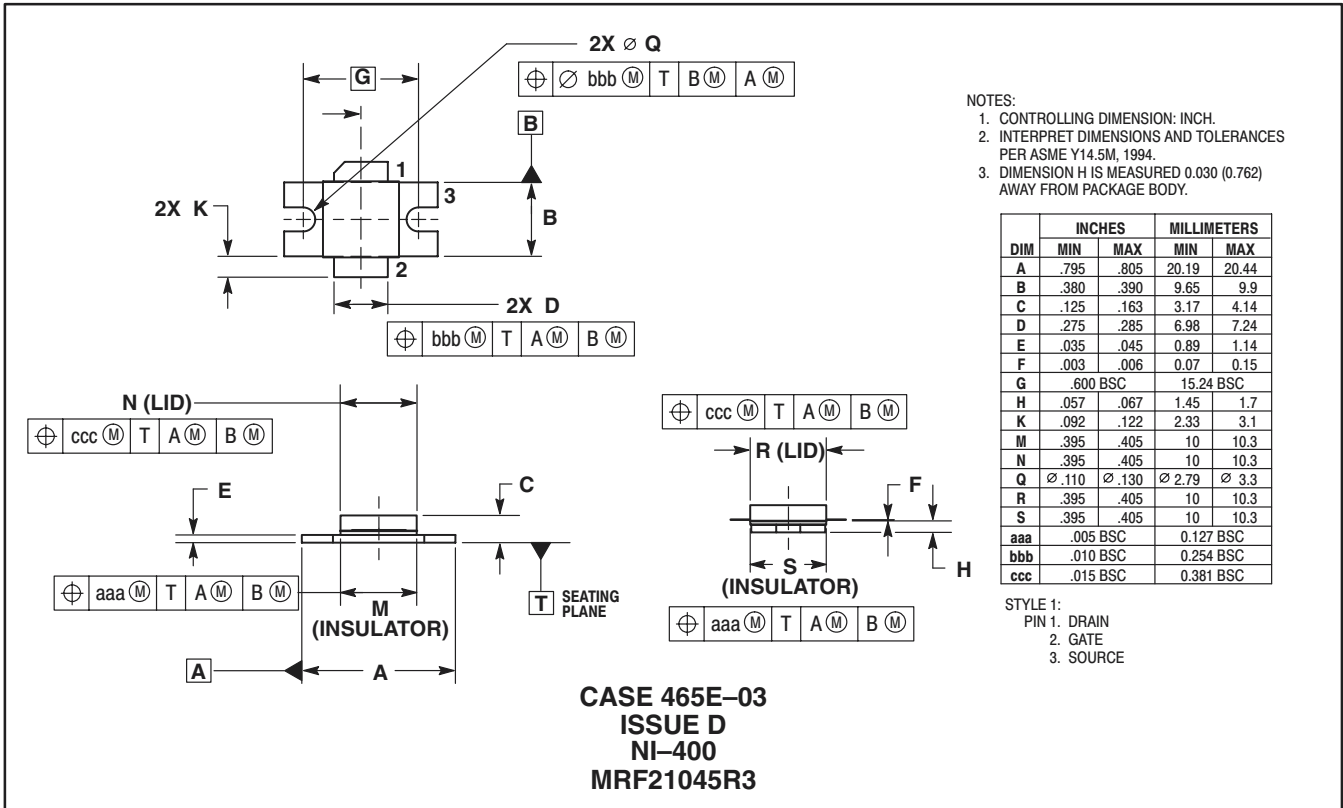


Figure 13. Series Equivalent Input and Output Impedance

NOTES

NOTES

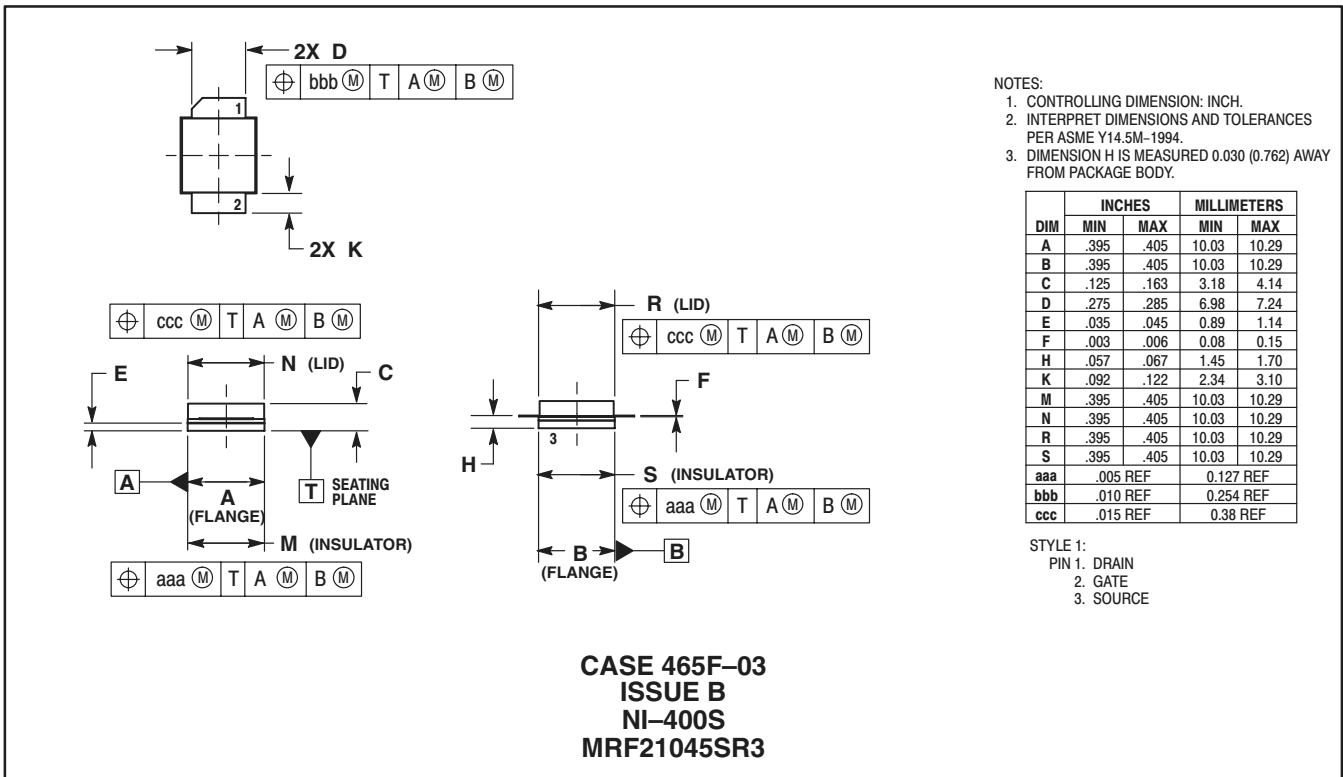
PACKAGE DIMENSIONS



- 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.

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	.003	.006	0.07	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	∅ .110	∅ .130	∅ 2.79	∅ 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



- 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	.003	.006	0.08	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

Motorola reserves the right to make changes without further notice to any products herein. Motorola makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Motorola 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 which may be provided in Motorola 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. Motorola does not convey any license under its patent rights nor the rights of others. Motorola 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 Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola 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 Motorola was negligent regarding the design or manufacture of the part. Motorola, Inc. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer. MOTOROLA and the  logo are registered in the US Patent & Trademark Office. All other product or service names are the property of their respective owners.

© Motorola, Inc. 2002.

How to reach us:

USA/EUROPE/Locations Not Listed: Motorola Literature Distribution; P.O. Box 5405, Denver, Colorado 80217. 1-303-675-2140 or 1-800-441-2447

JAPAN: Motorola Japan Ltd.; SPS, Technical Information Center, 3-20-1, Minami-Azabu. Minato-ku, Tokyo 106-8573 Japan. 81-3-3440-3569

ASIA/PACIFIC: Motorola Semiconductors H.K. Ltd.; Silicon Harbour Centre, 2 Dai King Street, Tai Po Industrial Estate, Tai Po, N.T., Hong Kong. 852-26668334

Technical Information Center: 1-800-521-6274

HOME PAGE: <http://www.motorola.com/semiconductors/>



This datasheet has been download from:

www.datasheetcatalog.com

Datasheets for electronics components.