

# RF Power Field Effect Transistor

## N-Channel Enhancement-Mode Lateral MOSFET

Designed for PCN and PCS base station applications with frequencies from 2000 to 2200 MHz. Suitable for FM, TDMA, CDMA and multicarrier amplifier applications. To be used in Class AB for PCN-PCS/cellular radio and WLL applications.

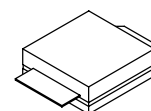
- Wideband CDMA Performance: -45 dB ACPR @ 4.096 MHz, 28 Volts  
Output Power — 3.5 Watts  
Power Gain — 14 dB  
Efficiency — 15%
- Capable of Handling 10:1 VSWR, @ 28 Vdc, 2110 MHz, 30 Watts CW Output Power

### Features

- 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.

**MRF21030LSR3**

**2200 MHz, 30 W, 28 V  
LATERAL N-CHANNEL  
RF POWER MOSFET**



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

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**Table 1. Maximum Ratings**

Rating	Symbol	Value	Unit
Drain-Source Voltage	V <sub>DSS</sub>	-0.5, +65	Vdc
Gate-Source Voltage	V <sub>GS</sub>	-0.5, +15	Vdc
Total Device Dissipation @ T <sub>C</sub> = 25°C Derate above 25°C	P <sub>D</sub>	83.3 0.48	W W/°C
Storage Temperature Range	T <sub>stg</sub>	- 65 to +150	°C
Case Operating Temperature	T <sub>C</sub>	150	°C
Operating Junction Temperature	T <sub>J</sub>	200	°C

**Table 2. Thermal Characteristics**

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case	R <sub>θJC</sub>	2.1	°C/W

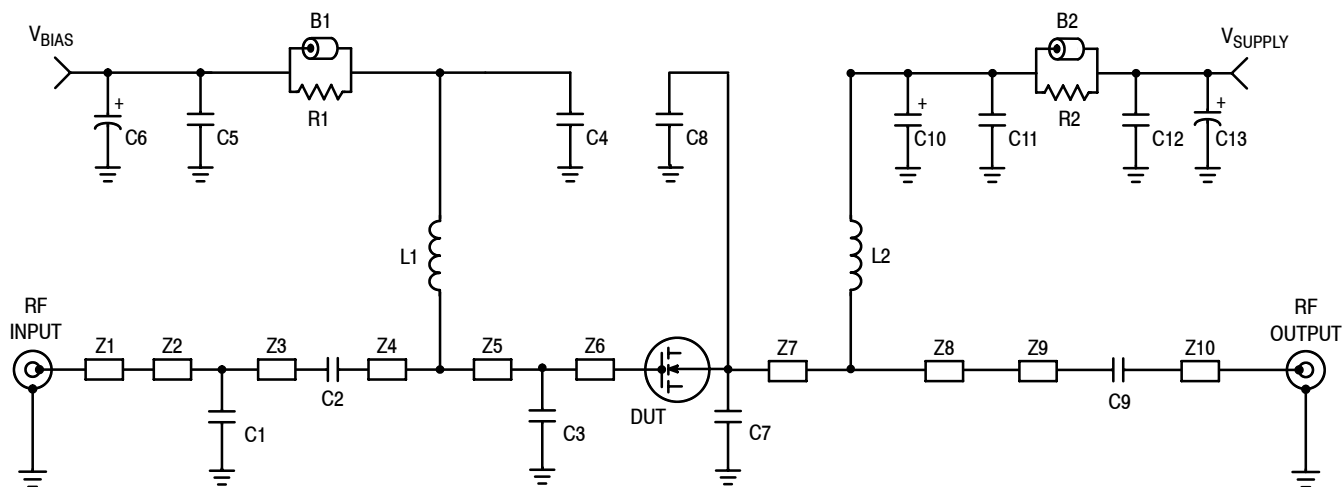
**Table 3. ESD Protection Characteristics**

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

**Table 4. Electrical Characteristics** ( $T_C = 25^\circ\text{C}$  unless otherwise noted)

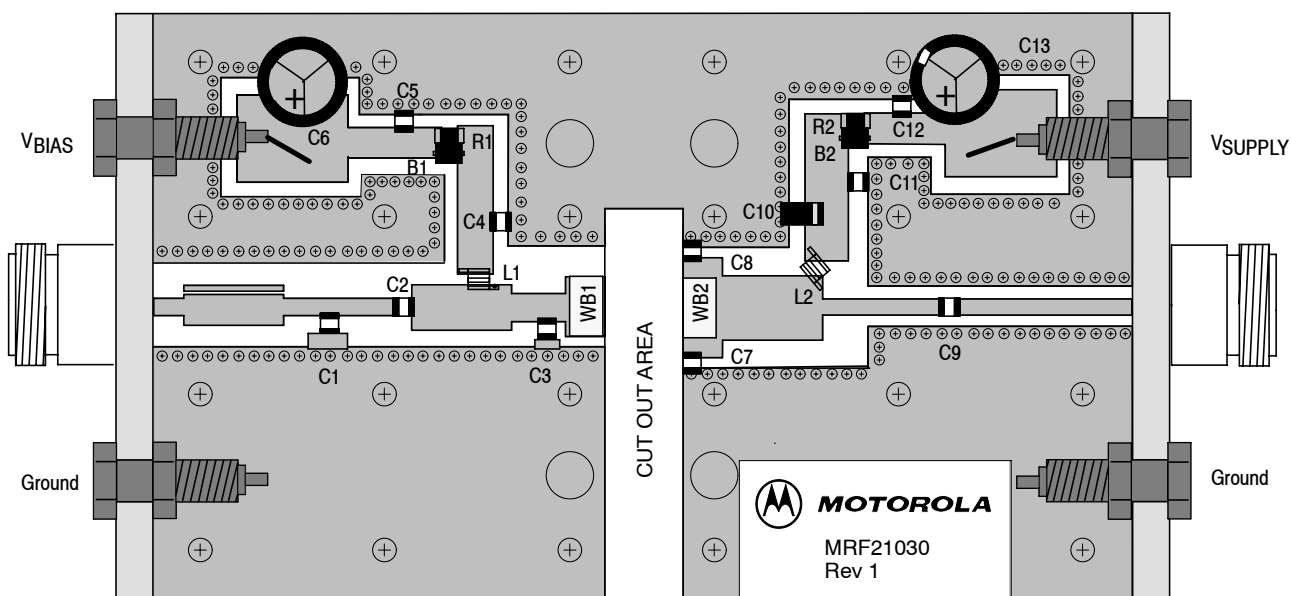
Characteristic	Symbol	Min	Typ	Max	Unit
<b>Off Characteristics</b>					
Drain-Source Breakdown Voltage ( $V_{GS} = 0\text{ Vdc}$ , $I_D = 20\ \mu\text{A}$ )	$V_{(BR)DSS}$	65	—	—	Vdc
Zero Gate Voltage Drain Current ( $V_{DS} = 28\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ )	$I_{DSS}$	—	—	1	$\mu\text{Adc}$
Gate-Source Leakage Current ( $V_{GS} = 5\text{ Vdc}$ , $V_{DS} = 0\text{ Vdc}$ )	$I_{GSS}$	—	—	1	$\mu\text{Adc}$
<b>On Characteristics</b>					
Gate Threshold Voltage ( $V_{DS} = 10\text{ Vdc}$ , $I_D = 100\ \mu\text{Adc}$ )	$V_{GS(th)}$	2	3	4	Vdc
Gate Quiescent Voltage ( $V_{DS} = 28\text{ Vdc}$ , $I_D = 250\text{ mA}$ )	$V_{GS(Q)}$	2	3.3	4.5	Vdc
Drain-Source On-Voltage ( $V_{GS} = 10\text{ Vdc}$ , $I_D = 1\text{ Adc}$ )	$V_{DS(on)}$	—	0.29	0.4	Vdc
Forward Transconductance ( $V_{DS} = 10\text{ Vdc}$ , $I_D = 1\text{ Adc}$ )	$g_{fs}$	—	2	—	S
<b>Dynamic Characteristics</b>					
Input Capacitance (Including Input Matching Capacitor in Package) <sup>(1)</sup> ( $V_{DS} = 28\text{ Vdc}$ , $V_{GS} = 0$ , $f = 1\text{ MHz}$ )	$C_{iss}$	—	98.5	—	pF
Output Capacitance <sup>(1)</sup> ( $V_{DS} = 28\text{ Vdc}$ , $V_{GS} = 0$ , $f = 1\text{ MHz}$ )	$C_{oss}$	—	37	—	pF
Reverse Transfer Capacitance ( $V_{DS} = 28\text{ Vdc}$ , $V_{GS} = 0$ , $f = 1\text{ MHz}$ )	$C_{rss}$	—	1.3	—	pF
<b>Functional Tests</b> (In Freescale Test Fixture, 50 ohm system)					
Two-Tone Common-Source Amplifier Power Gain ( $V_{DD} = 28\text{ Vdc}$ , $P_{out} = 30\text{ W PEP}$ , $I_{DQ} = 250\text{ mA}$ , $f_1 = 2140.0\text{ MHz}$ , $f_2 = 2140.1\text{ MHz}$ )	$G_{ps}$	—	13	—	dB
Two-Tone Drain Efficiency ( $V_{DD} = 28\text{ Vdc}$ , $P_{out} = 30\text{ W PEP}$ , $I_{DQ} = 250\text{ mA}$ , $f_1 = 2140.0\text{ MHz}$ , $f_2 = 2140.1\text{ MHz}$ )	$\eta$	—	33	—	%
3rd Order Intermodulation Distortion ( $V_{DD} = 28\text{ Vdc}$ , $P_{out} = 30\text{ W PEP}$ , $I_{DQ} = 250\text{ mA}$ , $f_1 = 2140.0\text{ MHz}$ , $f_2 = 2140.1\text{ MHz}$ )	IMD	—	-30	—	dBc
Input Return Loss ( $V_{DD} = 28\text{ Vdc}$ , $P_{out} = 30\text{ W PEP}$ , $I_{DQ} = 250\text{ mA}$ , $f_1 = 2140.0\text{ MHz}$ , $f_2 = 2140.1\text{ MHz}$ )	IRL	—	-13	—	dB
Two-Tone Common-Source Amplifier Power Gain ( $V_{DD} = 28\text{ Vdc}$ , $P_{out} = 30\text{ W PEP}$ , $I_{DQ} = 250\text{ mA}$ , $f_1 = 2110.0\text{ MHz}$ , $f_2 = 2110.1\text{ MHz}$ and $f_1 = 2170.0\text{ MHz}$ , $f_2 = 2170.1\text{ MHz}$ )	$G_{ps}$	12	13	—	dB
Two-Tone Drain Efficiency ( $V_{DD} = 28\text{ Vdc}$ , $P_{out} = 30\text{ W PEP}$ , $I_{DQ} = 250\text{ mA}$ , $f_1 = 2110.0\text{ MHz}$ , $f_2 = 2110.1\text{ MHz}$ and $f_1 = 2170.0\text{ MHz}$ , $f_2 = 2170.1\text{ MHz}$ )	$\eta$	31	33	—	%
3rd Order Intermodulation Distortion ( $V_{DD} = 28\text{ Vdc}$ , $P_{out} = 30\text{ W PEP}$ , $I_{DQ} = 250\text{ mA}$ , $f_1 = 2110.0\text{ MHz}$ , $f_2 = 2110.1\text{ MHz}$ and $f_1 = 2170.0\text{ MHz}$ , $f_2 = 2170.1\text{ MHz}$ )	IMD	—	-30	-27.5	dBc
Input Return Loss ( $V_{DD} = 28\text{ Vdc}$ , $P_{out} = 30\text{ W PEP}$ , $I_{DQ} = 250\text{ mA}$ , $f_1 = 2110.0\text{ MHz}$ , $f_2 = 2110.1\text{ MHz}$ and $f_1 = 2170.0\text{ MHz}$ , $f_2 = 2170.1\text{ MHz}$ )	IRL	—	-13	-9	dB

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



B1, B2	Short Ferrite Beads	Z1	0.153" x 0.087" Microstrip
C1	1 pF Chip Capacitor	Z2	0.509" x 0.156" Microstrip
C2	4.7 pF Chip Capacitor	Z3	0.572" x 0.087" Microstrip
C3	0.5 pF Chip Capacitor	Z4	0.509" x 0.232" Microstrip
C4	3.9 pF Chip Capacitor	Z5	0.277" x 0.143" Microstrip
C5, C12	0.1 $\mu$ F Chip Capacitors	Z6	0.200" x 0.305" Microstrip
C6, C13	470 $\mu$ F, 63 V Electrolytic Chip Capacitors	Z7	0.200" x 0.511" Microstrip
C7, C8	0.3 pF Chip Capacitors	Z8	0.510" x 0.328" Microstrip
C9	3.6 pF Chip Capacitor	Z9	0.608" x 0.081" Microstrip
C10	22 $\mu$ F Tantalum Chip Capacitor	PCB	Taconic TLX8, 30 mils, $\epsilon_r = 2.55$
C11	5.1 pF Chip Capacitor		
L1, L2	12.5 nH Inductors		
R1, R2	12 $\Omega$ Chip Resistors (1206)		

Figure 1. MRF21030LSR3 Test Circuit Schematic



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. MRF21030LSR3 Test Circuit Component Layout

### TYPICAL CHARACTERISTICS

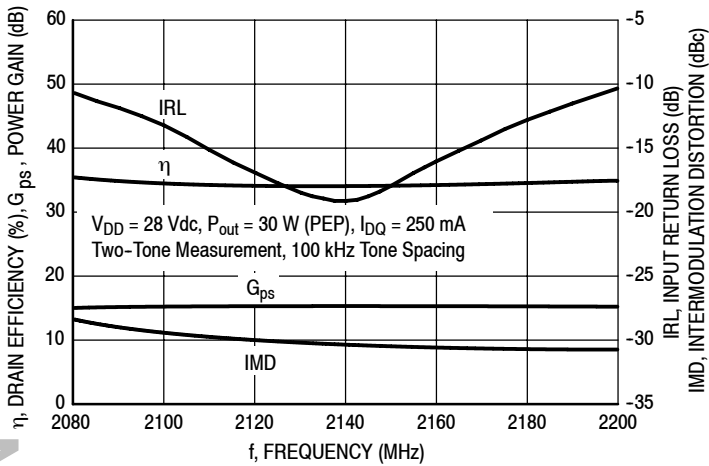


Figure 3. Class AB Broadband Circuit Performance

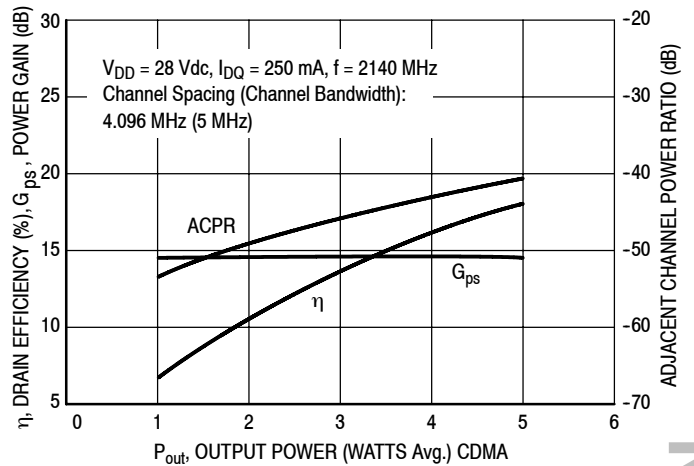


Figure 4. CDMA ACPR, Power Gain and Drain Efficiency versus Output Power

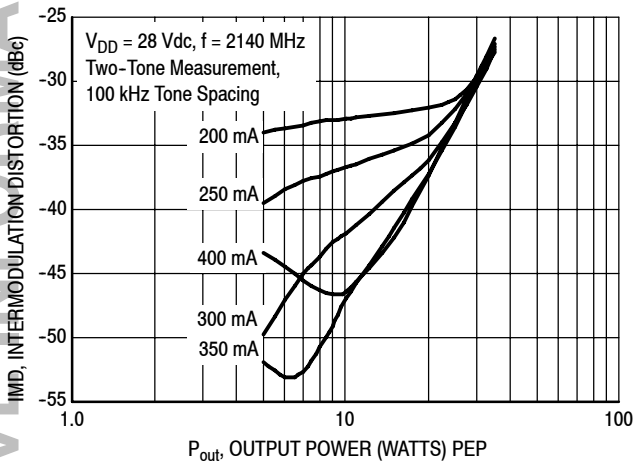


Figure 5. Intermodulation Distortion versus Output Power

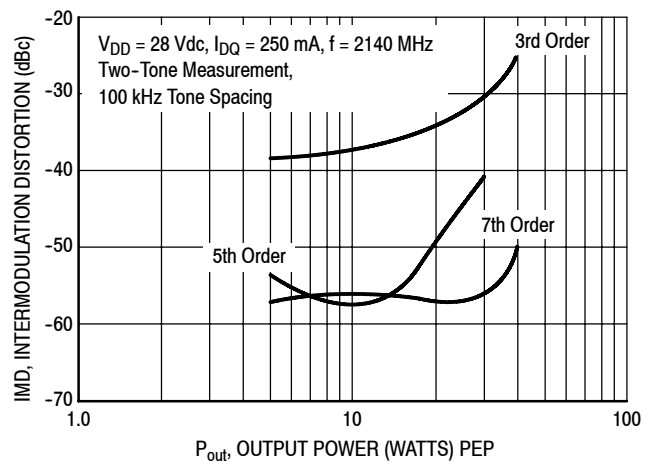


Figure 6. Intermodulation Distortion Products versus Output Power

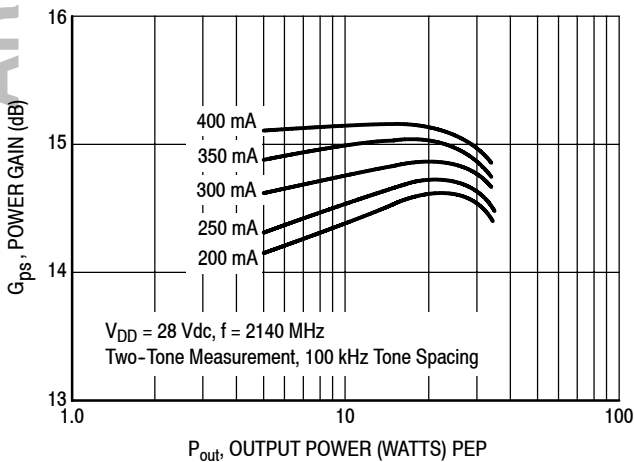


Figure 7. Power Gain versus Output Power

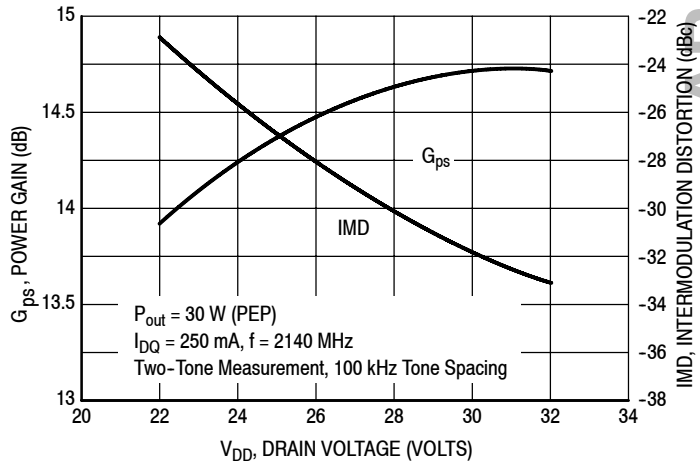
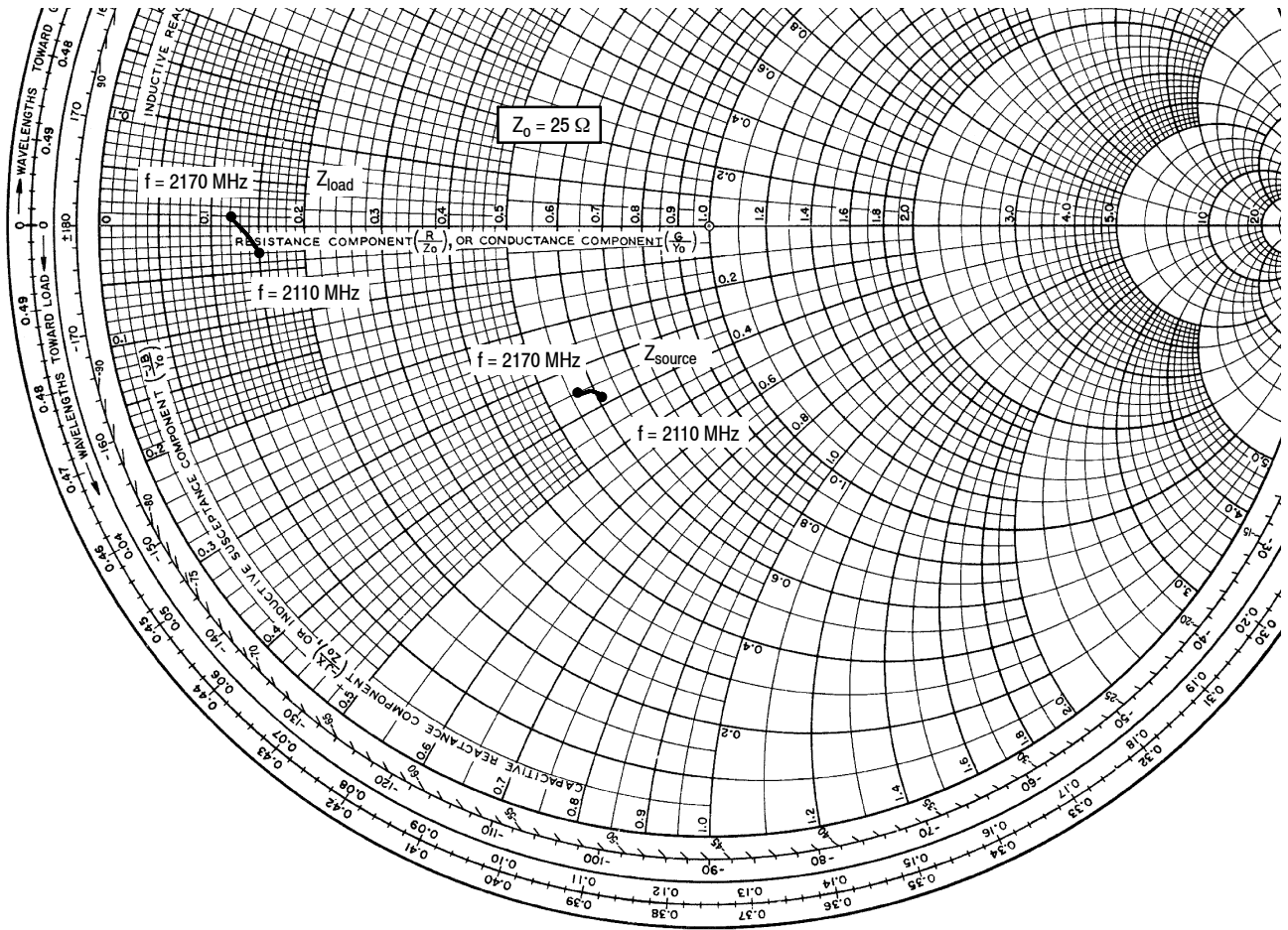


Figure 8. Power Gain and Intermodulation Distortion versus Supply Voltage



$V_{DD} = 28\text{ V}, I_{DQ} = 250\text{ mA}, P_{out} = 30\text{ W PEP}$

f MHz	$Z_{source}$ $\Omega$	$Z_{load}$ $\Omega$
2110	$15.3 - j9.4$	$3.7 - j0.78$
2140	$14.6 - j9.4$	$3.4 - j0.37$
2170	$14.3 - j8.8$	$3.0 + j0.13$

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

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

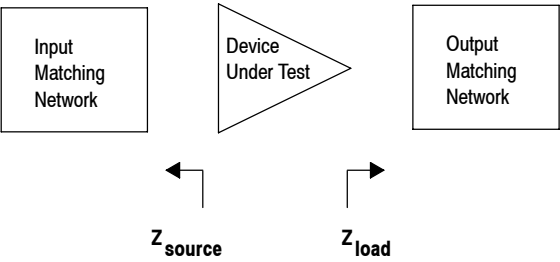
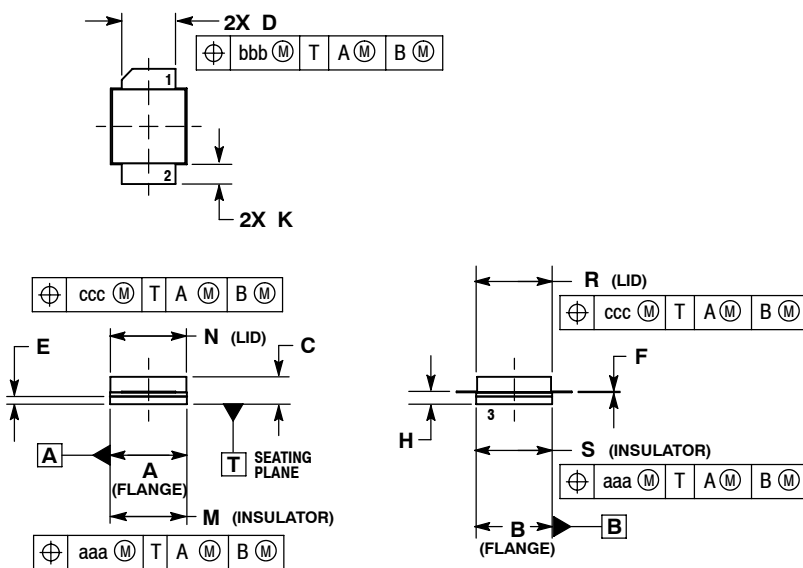


Figure 9. Series Equivalent Source and Load Impedance

### 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.

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

**CASE 465F-04  
 ISSUE E  
 NI-400S  
 MRF21030LSR3**

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## REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
13	Oct. 2008	<ul style="list-style-type: none"> <li>• MRF21030-1 Rev. 13 (MRF21030LSR3) data sheet archived. Part no longer manufactured. See MRF21030-2 Rev. 14 for MRF21030LR3. Data sheet split due to change in part life cycle.</li> </ul>

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