



# RF Power Field Effect Transistor

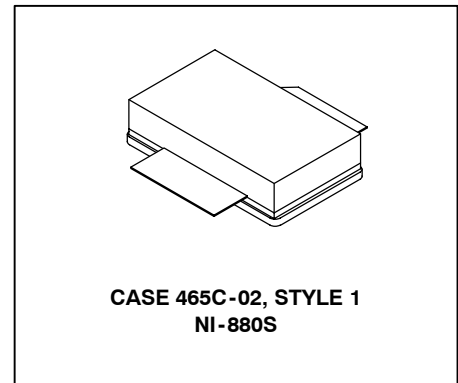
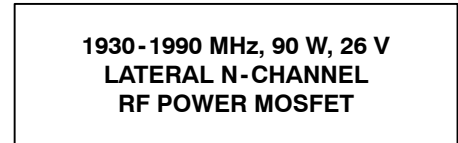
## N-Channel Enhancement-Mode Lateral MOSFET

Designed for Class AB PCN and PCS base station applications with frequencies from 1900 to 2000 MHz. Suitable for CDMA, TDMA, GSM, and multicarrier amplifier applications.

- Typical CDMA Performance: 1930 MHz, 26 Volts  
 IS-95 CDMA Pilot, Sync, Paging, Traffic Codes 8 Through 13  
 Output Power — 9 Watts Avg.  
 Power Gain — 10 dB  
 Adjacent Channel Power —  
     885 kHz: -47 dBc @ 30 kHz BW  
     1.25 MHz: -55 dBc @ 12.5 kHz BW  
     2.25 MHz: -55 dBc @ 1 MHz BW
- Capable of Handling 10:1 VSWR, @ 26 Vdc, 1960 MHz, 90 Watts CW Output Power

### Features

- Internally Matched for Ease of Use
- 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
- RoHS Compliant
- In Tape and Reel. R3 Suffix = 250 Units per 56 mm, 13 inch Reel.



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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>	270 1.54	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>	0.65	°C/W

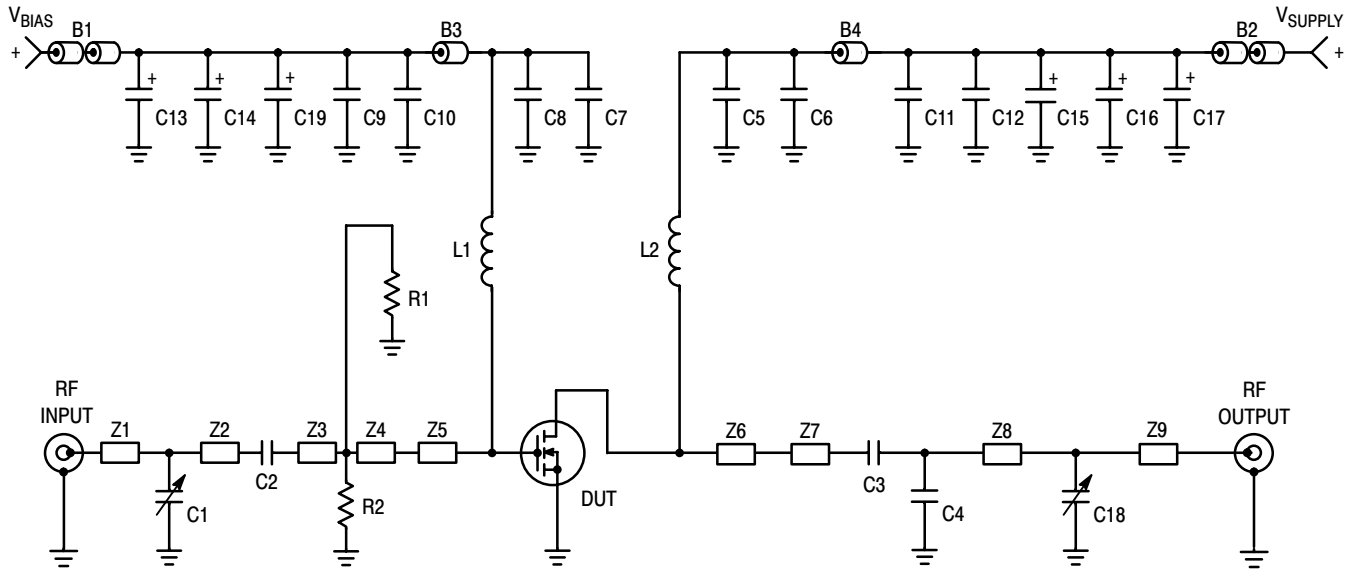
**Table 3. ESD Protection Characteristics**

Test Conditions	Class
Human Body Model	1 (Minimum)
Machine Model	M3 (Minimum)

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

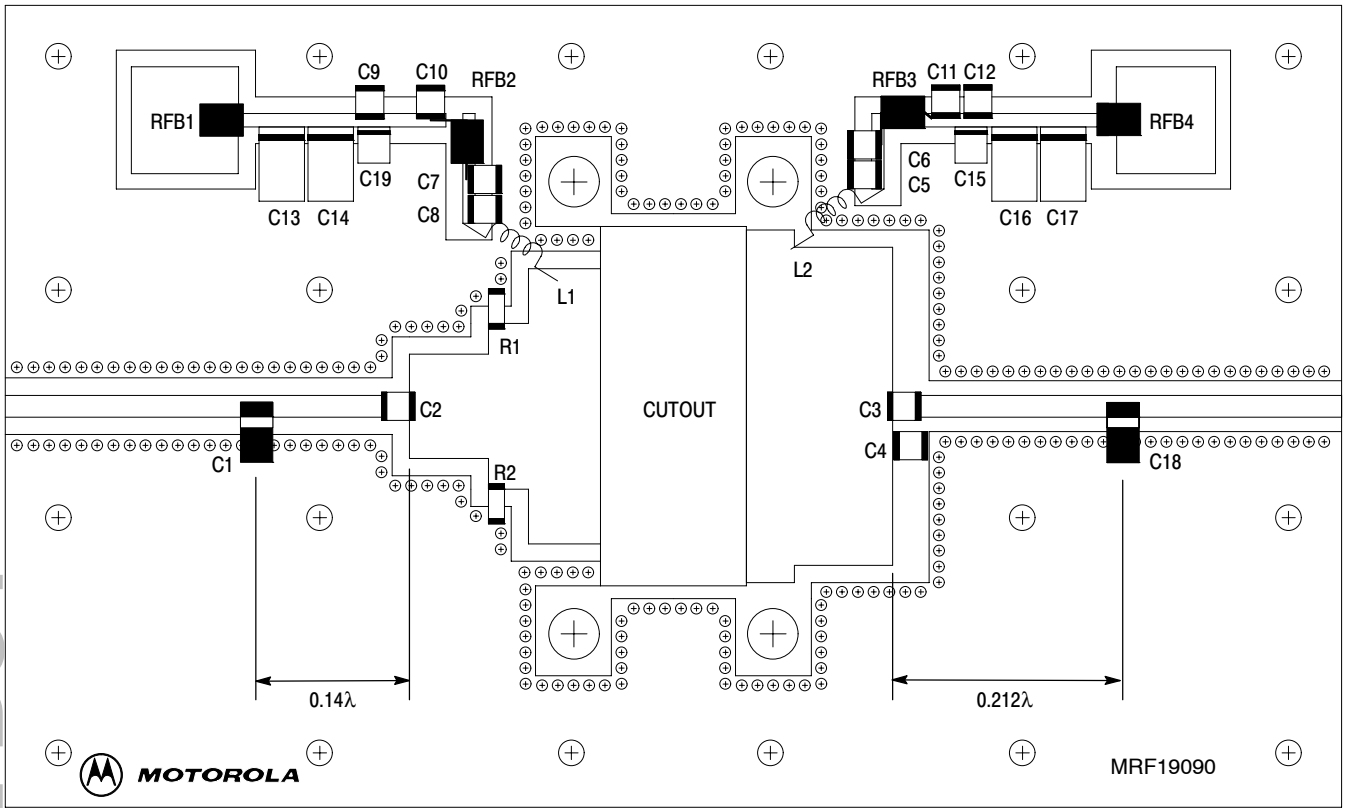
Characteristic	Symbol	Min	Typ	Max	Unit
<b>Off Characteristics</b>					
Drain-Source Breakdown Voltage ( $V_{GS} = 0\text{ Vdc}$ , $I_D = 100\ \mu\text{A}$ )	$V_{(BR)DSS}$	65	—	—	Vdc
Zero Gate Voltage Drain Current ( $V_{DS} = 28\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ )	$I_{DSS}$	—	—	10	$\mu\text{A}$ dc
Gate-Source Leakage Current ( $V_{GS} = 5\text{ Vdc}$ , $V_{DS} = 0\text{ Vdc}$ )	$I_{GSS}$	—	—	1	$\mu\text{A}$ dc
<b>On Characteristics</b>					
Forward Transconductance ( $V_{DS} = 10\text{ Vdc}$ , $I_D = 3\text{ Adc}$ )	$g_{fs}$	—	7.2	—	S
Gate Threshold Voltage ( $V_{DS} = 10\text{ Vdc}$ , $I_D = 300\ \mu\text{A}$ dc)	$V_{GS(th)}$	2.0	—	4.0	Vdc
Gate Quiescent Voltage ( $V_{DS} = 26\text{ Vdc}$ , $I_D = 750\text{ mA}$ dc)	$V_{GS(Q)}$	2.5	3.8	4.5	Vdc
Drain-Source On-Voltage ( $V_{GS} = 10\text{ Vdc}$ , $I_D = 1\text{ Adc}$ )	$V_{DS(on)}$	—	0.10	—	Vdc
<b>Dynamic Characteristics</b>					
Reverse Transfer Capacitance <sup>(1)</sup> ( $V_{DS} = 26\text{ Vdc}$ , $V_{GS} = 0$ , $f = 1\text{ MHz}$ )	$C_{rss}$	—	4.2	—	pF
<b>Functional Tests</b> (In Freescale Test Fixture)					
Two-Tone Common-Source Amplifier Power Gain ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 90\text{ W PEP}$ , $I_{DQ} = 750\text{ mA}$ , $f = 1930\text{ MHz}$ , Tone Spacing = 100 kHz)	$G_{ps}$	10	11.5	—	dB
Two-Tone Drain Efficiency ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 90\text{ W PEP}$ , $I_{DQ} = 750\text{ mA}$ , $f = 1930\text{ MHz}$ , Tone Spacing = 100 kHz)	$\eta$	33	35	—	%
3rd Order Intermodulation Distortion ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 90\text{ W PEP}$ , $I_{DQ} = 750\text{ mA}$ , $f = 1930\text{ MHz}$ , Tone Spacing = 100 kHz)	IMD	—	-30	-28	dBc
Input Return Loss ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 90\text{ W PEP}$ , $I_{DQ} = 750\text{ mA}$ , $f = 1930\text{ MHz}$ , Tone Spacing = 100 kHz)	IRL	—	-12	—	dB
$P_{out}$ 1 dB Compression Point ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 90\text{ W CW}$ , $f = 1930\text{ MHz}$ )	P1dB	—	90	—	W

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



B1, B2	2 Ferrite Beads, Round, Ferroxcube #56-590-65-3B	L1, L2	8 Turns, #26 AWG, 0.085" OD, 0.330" Long, Copper Wire
B3, B34	Ferrite Beads, Surface Mount, Fair-Rite 2743019447	R1, R2	270 $\Omega$ , 1/4 W Chip Resistors, Garrett Instruments #RM73B2B271JT
C1, C18	0.4 - 2.5 pF Variable Capacitors, Johanson Gigatrim #27280	Z1	ZO = 50 Ohms
C2, C5, C8	10 pF Chip Capacitors, ATC #100B100CT500XT	Z2	ZO = 50 Ohms, Lambda = 0.123
C3	12 pF Chip Capacitor, ATC #100B120CT500XT	Z3	ZO = 15.24 Ohms, Lambda = 0.0762
C4	0.3 pF Chip Capacitor, ATC #100B0R3CT500XT	Z4	ZO = 10.11 Ohms, Lambda = 0.0392
C6, C7	120 pF Chip Capacitors, ATC #100B12R1CT500XT	Z5	ZO = 6.34 Ohms, Lambda = 0.0711
C9, C12	0.1 $\mu$ F Chip Capacitors, Kemet #CDR33BX104AKYS	Z6	ZO = 5.02 Ohms, Lambda = 0.0476
C10, C11	1000 pF Chip Capacitors, ATC #100B102JT50XT	Z7	ZO = 5.54 Ohms, Lambda = 0.0972
C13, C17	22 $\mu$ F, 35 V Tantalum Chip Capacitors, Kemet #T491X226K035AT	Z8	ZO = 50.0 Ohms, Lambda = 0.194
C14, C16	10 $\mu$ F, 35 V Tantalum Chip Capacitors, Kemet #T495X106K035AT	Z9	ZO = 50.0 Ohms
C15, C19	1 $\mu$ F, 35 V Tantalum Chip Capacitors, Kemet #T495X105K035AT	Raw PCB Material	0.030" Glass Teflon <sup>®</sup> , $\epsilon_r = 2.55$ , 2 oz Copper, 3" x 5" Dimensions

Figure 1. MRF19090 Test Circuit Schematic



Freescall has begun the transition of marking Printed Circuit Boards (PCBs) with the Freescall Semiconductor signature/logo. PCBs may have either Motorola or Freescall markings during the transition period. These changes will have no impact on form, fit or function of the current product.

Figure 2. MRF19090 Test Circuit Component Layout

# TYPICAL CHARACTERISTICS

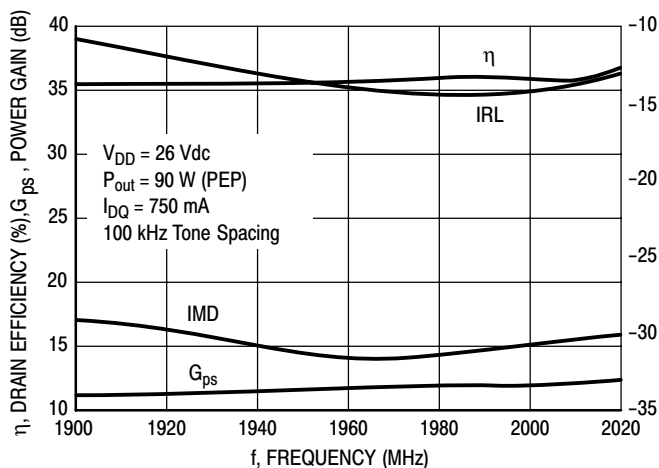


Figure 3. Class AB Performance versus Frequency

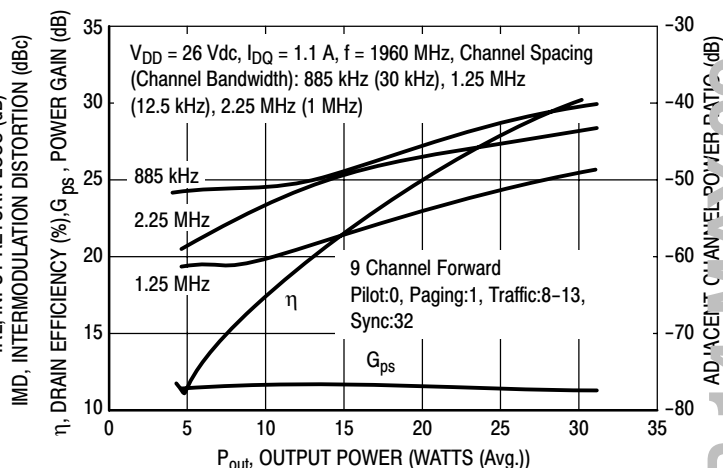


Figure 4. CDMA Performance ACPR, Gain and Drain Efficiency versus Output Power

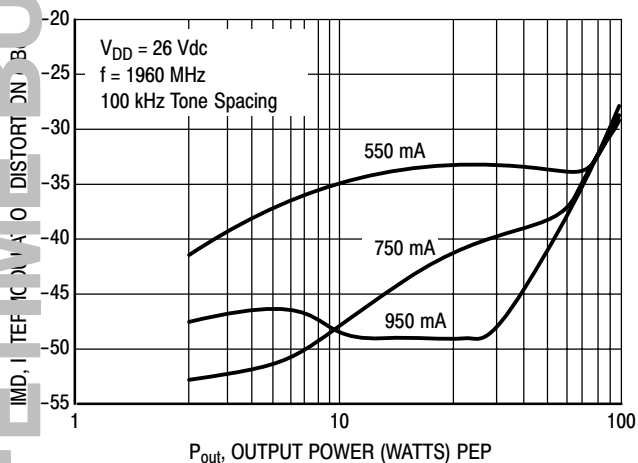


Figure 5. Third Order Intermodulation Distortion versus Output Power

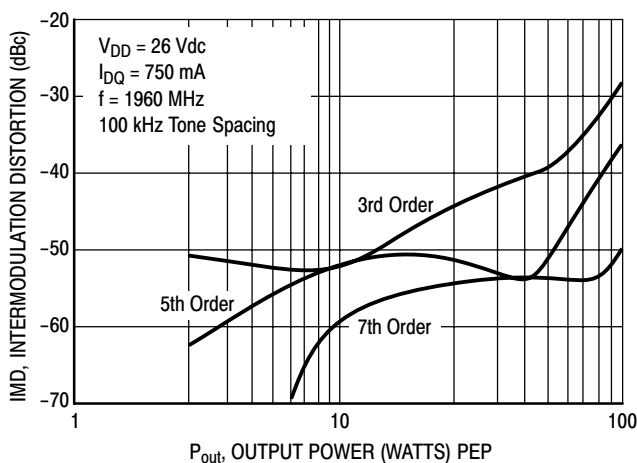


Figure 6. Intermodulation Products versus Output Power

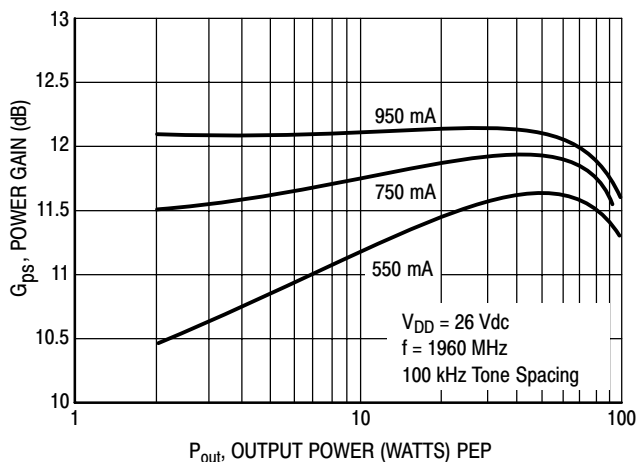


Figure 7. Power Gain versus Output Power

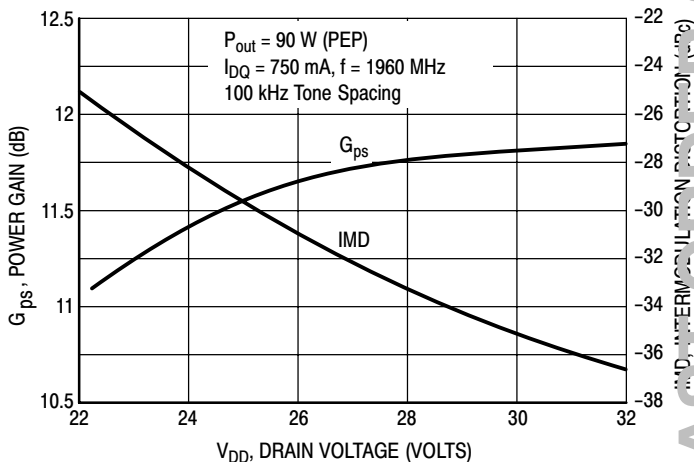
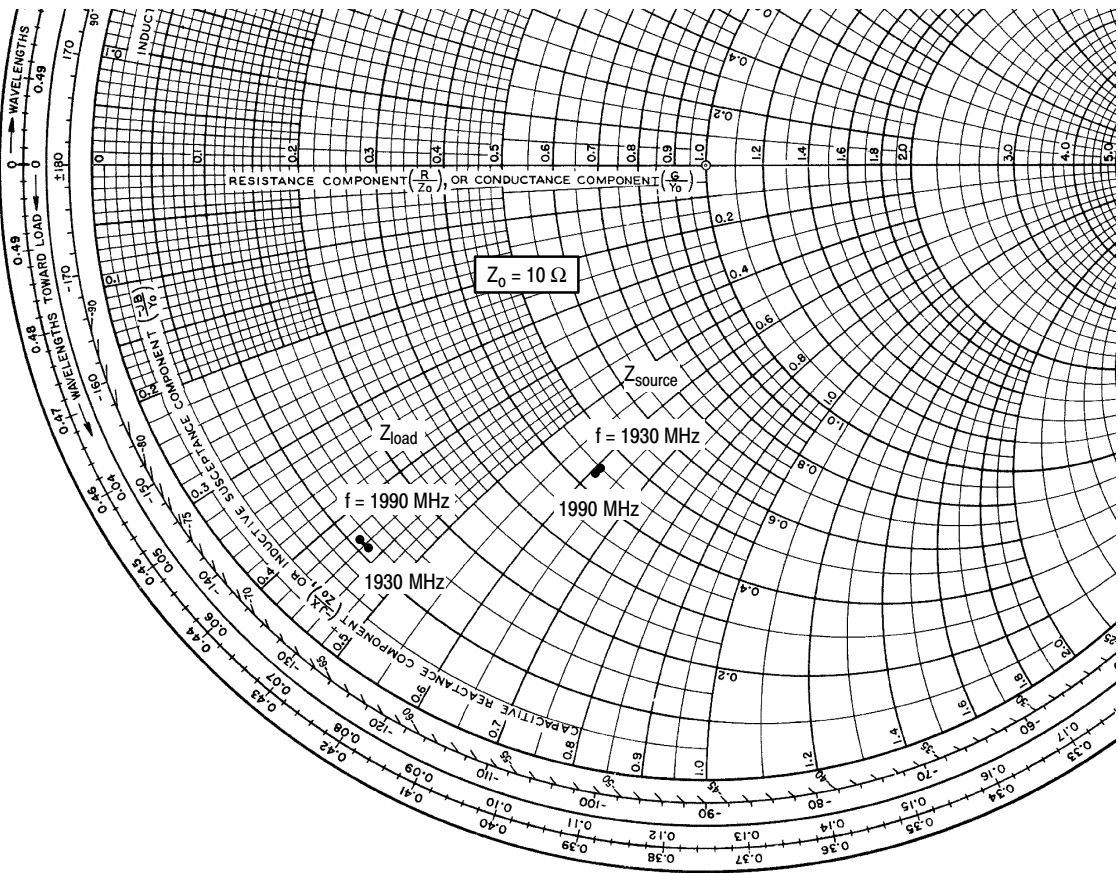


Figure 8. Third Order Intermodulation Distortion and Gain versus Supply Voltage

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$V_{DD} = 26\text{ V}$ ,  $I_{DQ} = 750\text{ mA}$ ,  $P_{out} = 90\text{ Watts (PEP)}$

f MHz	$Z_{source}$ $\Omega$	$Z_{load}$ $\Omega$
1930	$4.5 - j6.1$	$1.1 - j4.5$
1960	$4.4 - j6.0$	$1.1 - j4.4$
1990	$4.3 - j6.1$	$1.1 - j4.3$

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

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

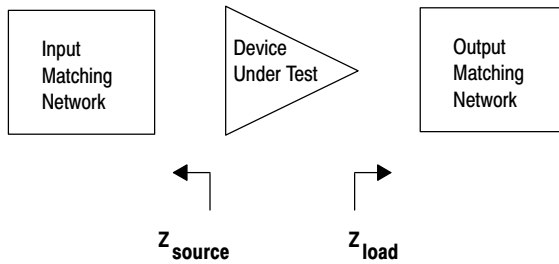
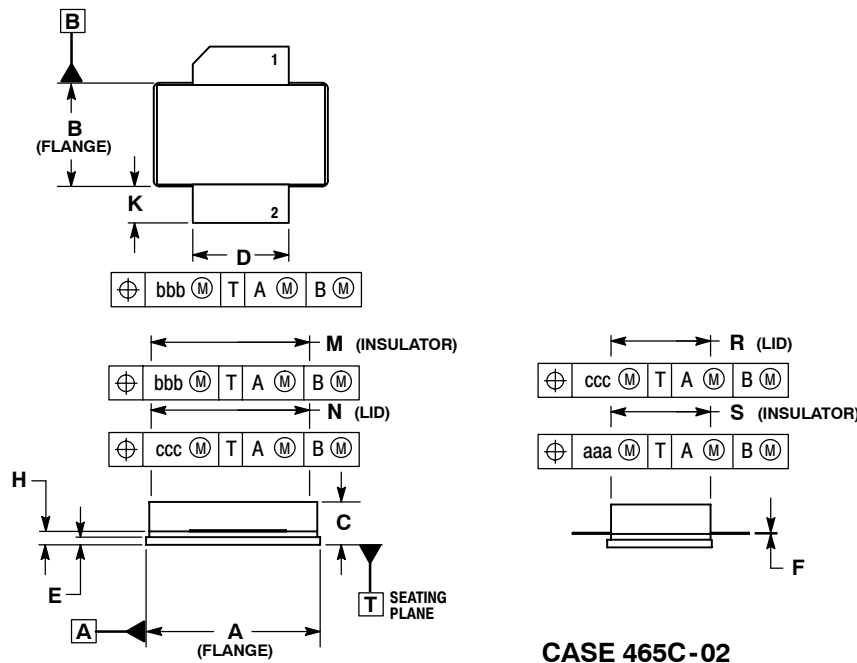


Figure 9. Series Equivalent Source and Load Impedance

## PACKAGE DIMENSIONS



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.
  2. CONTROLLING DIMENSION: INCH.
  3. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.905	0.915	22.99	23.24
B	0.535	0.545	13.60	13.80
C	0.147	0.200	3.73	5.08
D	0.495	0.505	12.57	12.83
E	0.035	0.045	0.89	1.14
F	0.003	0.006	0.08	0.15
H	0.057	0.067	1.45	1.70
K	0.170	0.210	4.32	5.33
M	0.872	0.888	22.15	22.55
N	0.871	0.889	19.30	22.60
R	0.515	0.525	13.10	13.30
S	0.515	0.525	13.10	13.30
aaa	0.007 REF		0.178 REF	
bbb	0.010 REF		0.254 REF	
ccc	0.015 REF		0.381 REF	

- STYLE 1:  
 PIN 1. DRAIN  
 2. GATE  
 3. SOURCE

**CASE 465C-02  
 ISSUE D  
 NI-880S  
 MRF19090SR3**

## PRODUCT DOCUMENTATION

Refer to the following documents to aid your design process.

### Engineering Bulletins

- EB212: Using Data Sheet Impedances for RF LDMOS Devices

## REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
8	Oct. 2008	<ul style="list-style-type: none"><li>• Data sheet revised to reflect part status change, p. 1, including use of applicable overlay.</li><li>• Modified data sheet to reflect RF Test Reduction described in Product and Process Change Notification number, PCN12779, p. 1, 2</li><li>• Updated Part Numbers in Figure 1, Test Circuit Schematic, to RoHS compliant part numbers, p. 3</li><li>• Added Product Documentation and Revision History, p. 8</li></ul>



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