

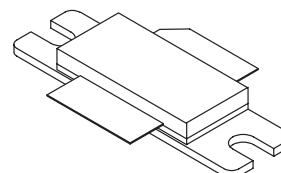
## RF Power Field Effect Transistors N-Channel Enhancement-Mode Lateral MOSFETs

Designed for GSM 900 MHz frequency band, the high gain and broadband performance of these devices make them ideal for large-signal, common-source amplifier applications in 26 volt base station equipment.

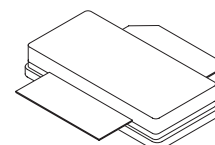
- Typical Performance for GSM Frequencies, 921 to 960 MHz, 26 Volts  
 Output Power @ P1db: 75 Watts  
 Power Gain @ P1db: 18.5 dB  
 Efficiency @ P1db: 55%
- Internally Matched, Controlled Q, for Ease of Use
- High Gain, High Efficiency and High Linearity
- Integrated ESD Protection
- Designed for Maximum Gain and Insertion Phase Flatness
- Capable of Handling 5:1 VSWR, @ 26 Vdc, 921 MHz, 90 Watts CW Output Power
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Available with Low Gold Plating Thickness on Leads. L Suffix Indicates 40 $\mu$ " Nominal.
- In Tape and Reel. R3 Suffix = 250 Units per 56 mm, 13 inch Reel.

**MRF9080LR3**  
**MRF9080LSR3**

**GSM 900 MHz FREQUENCY BAND,  
 75 W, 26 V  
 LATERAL N-CHANNEL  
 RF POWER MOSFETs**



**CASE 465-06, STYLE 1  
 NI-780  
 MRF9080LR3**



**CASE 465A-06, STYLE 1  
 NI-780S  
 MRF9080LSR3**

**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>	250 1.43	W W/°C
Storage Temperature Range	T <sub>stg</sub>	-65 to +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>	0.7	°C/W

**Table 3. ESD Protection Characteristics**

Test Conditions	Class
Human Body Model	1 (Minimum)
Machine Model	M1 (Minimum)

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

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>Off Characteristics</b>					
Zero Gate Voltage Drain Leakage Current ( $V_{DS} = 65\text{ Vdc}$ , $V_{GS} = 0$ )	$I_{DSS}$	—	—	10	$\mu\text{Adc}$
Zero Gate Voltage Drain Leakage Current ( $V_{DS} = 26\text{ Vds}$ , $V_{GS} = 0$ )	$I_{DSS}$	—	—	1	$\mu\text{Adc}$
Gate–Source Leakage Current ( $V_{GS} = 5\text{ Vdc}$ , $V_{DS} = 0$ )	$I_{GSS}$	—	—	1	$\mu\text{Adc}$
<b>On Characteristics</b>					
Gate Threshold Voltage ( $V_{DS} = 10\text{ Vdc}$ , $I_D = 300\ \mu\text{Adc}$ )	$V_{GS(th)}$	2.0	—	4.0	Vdc
Gate Quiescent Voltage ( $V_{DS} = 26\text{ Vdc}$ , $I_D = 700\ \text{mAdc}$ )	$V_{GS(Q)}$	—	3.7	—	Vdc
Drain–Source On–Voltage ( $V_{GS} = 10\text{ Vdc}$ , $I_D = 2\ \text{Adc}$ )	$V_{DS(on)}$	—	0.19	0.4	Vdc
Forward Transconductance ( $V_{DS} = 10\text{ Vdc}$ , $I_D = 6\ \text{Adc}$ )	$g_{fs}$	—	8.0	—	S
<b>Dynamic Characteristics</b> (1)					
Output Capacitance ( $V_{DS} = 26\text{ Vdc}$ , $V_{GS} = 0$ , $f = 1\ \text{MHz}$ )	$C_{oss}$	—	73	—	pF
Reverse Transfer Capacitance ( $V_{DS} = 26\text{ Vdc}$ , $V_{GS} = 0$ , $f = 1\ \text{MHz}$ )	$C_{rss}$	—	2.9	—	pF
<b>Functional Tests</b> (In Freescale Test Fixture, 50 ohm system) (2)					
Power Output, 1 dB Compression Point ( $V_{DD} = 26\text{ Vdc}$ , $I_{DQ} = 600\ \text{mA}$ , $f = 921$ and $960\ \text{MHz}$ )	$P_{1dB}$	68	75	—	W
Common–Source Amplifier Power Gain @ 70 W (Min) ( $V_{DD} = 26\text{ Vdc}$ , $I_{DQ} = 600\ \text{mA}$ , $f = 921$ and $960\ \text{MHz}$ )	$G_{ps}$	17	18.5	20	dB
Drain Efficiency @ $P_{out} = 70\ \text{W}$ ( $V_{DD} = 26\text{ Vdc}$ , $I_{DQ} = 600\ \text{mA}$ , $f = 921$ and $960\ \text{MHz}$ )	$\eta_1$	47	52	—	%
Drain Efficiency @ P1dB ( $V_{DD} = 26\text{ Vdc}$ , $I_{DQ} = 600\ \text{mA}$ , $f = 921$ and $960\ \text{MHz}$ )	$\eta_2$	—	55	—	%
Input Return Loss ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 70\ \text{W}$ , $I_{DQ} = 600\ \text{mA}$ , $f = 921$ and $960\ \text{MHz}$ )	IRL	9.5	12.5	—	dB
Output Mismatch Stress ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 90\ \text{W CW}$ , $I_{DQ} = 600\ \text{mA}$ , $f = 921\ \text{MHz}$ , VSWR = 5:1, All Phase Angles at Frequency of Tests)	$\Psi$	No Degradation In Output Power Before and After Test			

1. Part is internally input matched.

2. To meet application requirements, Freescale test fixtures are designed to cover full GSM 900 band ensuring batch to batch consistency

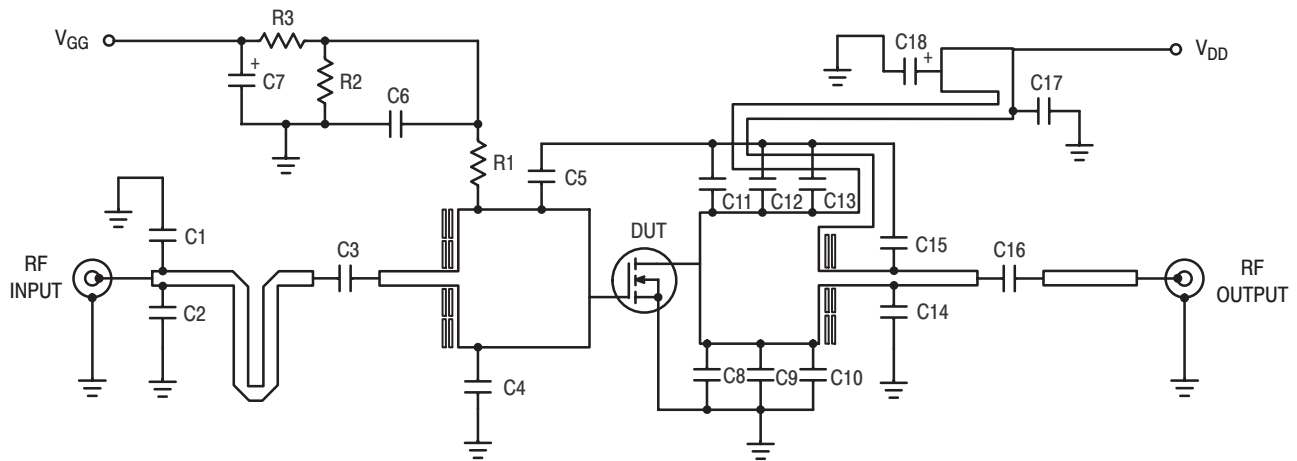
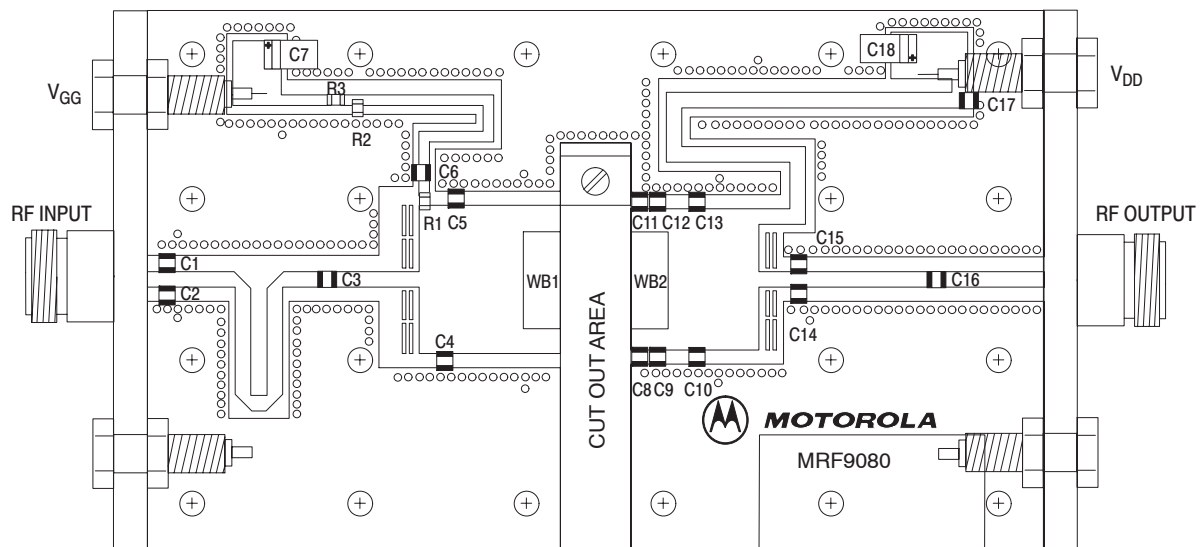


Figure 1. Broadband GSM 900 Test Circuit Schematic

Table 5. Broadband GSM 900 Test Circuit Component Designations and Values

Part	Description	Part Number	Manufacturer
C1	4.7 pF Chip Capacitor	100B4R7BW	ATC
C2	2.7 pF Chip Capacitor	100B2R7BW	ATC
C3	1.5 pF Chip Capacitor	100B1R5BW	ATC
C4, C5, C9, C10, C12, C13	5.6 pF Chip Capacitors	100B5R6CW	ATC
C6, C16, C17	22 pF Chip Capacitors	100B220GW	ATC
C7, C18	10 $\mu$ F, 35 V Tantalum Chip Capacitors	293D106X9035D2T	Sprague-Vishay
C8, C11	10 pF Chip Capacitors	100B100JW	ATC
C14	0.8 pF Chip Capacitor	100B0R8BW	ATC
C15	8.2 pF Chip Capacitor	100B8R2GW	ATC
R1, R2, R3	1.0 k $\Omega$ , 1/8 W Chip Resistors (0805)		
WB1, WB2	Beryllium Copper Wear Blocks	0.004" x 0.210" x 0.520"	
Raw PCB Material	30 mil Glass Teflon <sup>®</sup> , $\epsilon_r = 2.55$	TLX8-0300	Taconic
PCB	Etched Circuit Board	C-GY-00-001-02	Cibel



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. Broadband GSM 900 Test Circuit Component Layout**

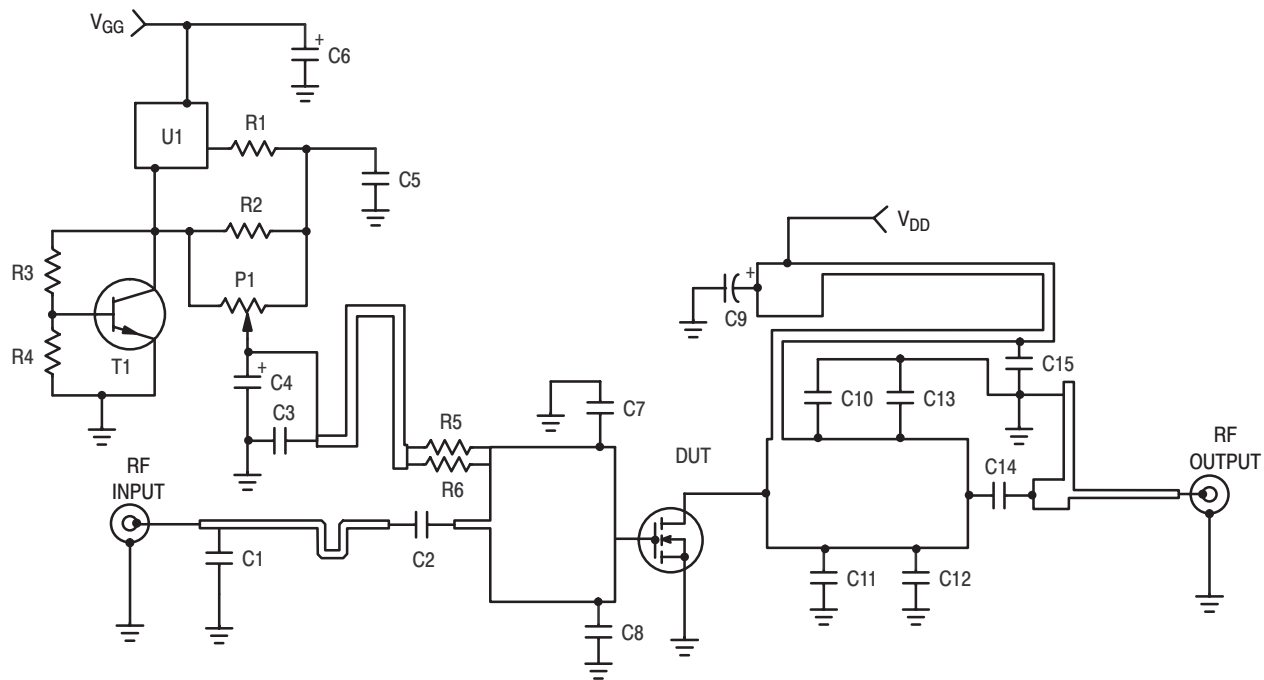
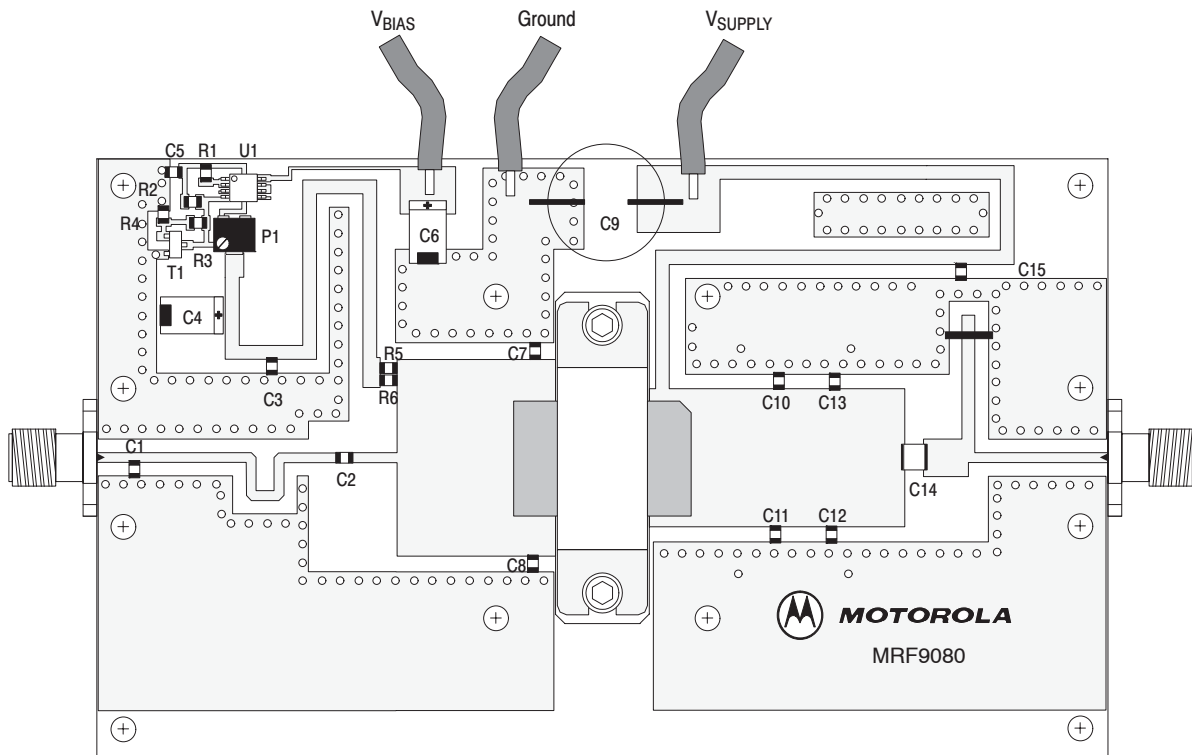


Figure 3. Broadband GSM 900 Optimized Demo Board Schematic

Table 6. Broadband GSM 900 Optimized Demo Board Component Designations and Values

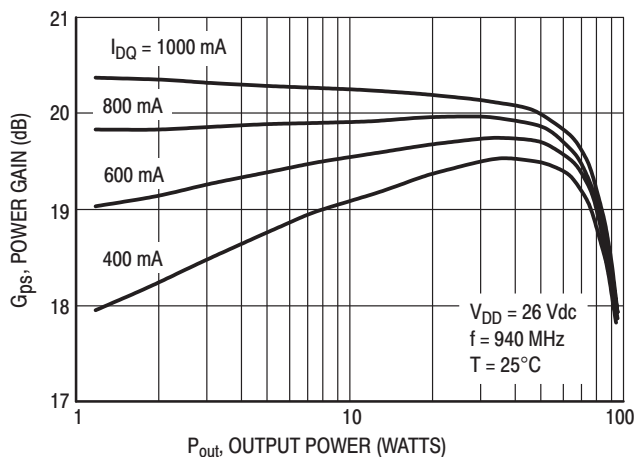
Part	Description	Part Number	Manufacturer
C1	4.7 pF Chip Capacitor, ACCU-P (0805)	#08051J3R9CBT	AVX
C2	3.9 pF Chip Capacitor, ACCU-P (0805)	#08051J3R9CBT	AVX
C3, C15	22 pF Chip Capacitors, ACCU-P (0805)	#08051J221	AVX
C4, C6	22 $\mu$ F, 35 V Tantalum Chip Capacitors	#T491X226K035AS4394	Kemet
C5	1.0 $\mu$ F Chip Capacitor, ACCU-P (0805)	#08053G105ZATEA	AVX
C7, C8	5.6 pF Chip Capacitors, ACCU-P (0805)	#08051J5R18CBT	AVX
C9	220 $\mu$ F, 63 V Electrolytic Capacitor		
C10, C11	3.3 pF Chip Capacitors, ACCU-P (0805)	#08051J8R2CBT	AVX
C12, C13	2.2 pF Chip Capacitors, ACCU-P (0805)	#08051J2R2CBT	AVX
C14	4.7 pF Chip Capacitor	#100B	ATC
P1	5.0 k $\Omega$ Potentiometer CMS Cermet Multi-turn	#3224W	Bourns
R1	10 $\Omega$ , 1/8 W Chip Resistor (0805)		
R2	1.0 k $\Omega$ , 1/8 W Chip Resistor (0805)		
R3	1.2 k $\Omega$ , 1/8 W Chip Resistor (0805)		
R4	2.2 k $\Omega$ , 1/8 W Chip Resistor (0805)		
R5, R6	1.0 k $\Omega$ , 1/8 W Chip Resistors (0805)		
T1	Bipolar NPN Transistor, SOT-23	#BC847ALT1	ON Semiconductor
U1	Voltage Regulator, Micro-8	#LP2951ACDM-5.0R2	ON Semiconductor
	RF Connectors, Type SMA	#R125510001	Radial
	Substrate = Taconic RF35, Thickness 0.5 mm		



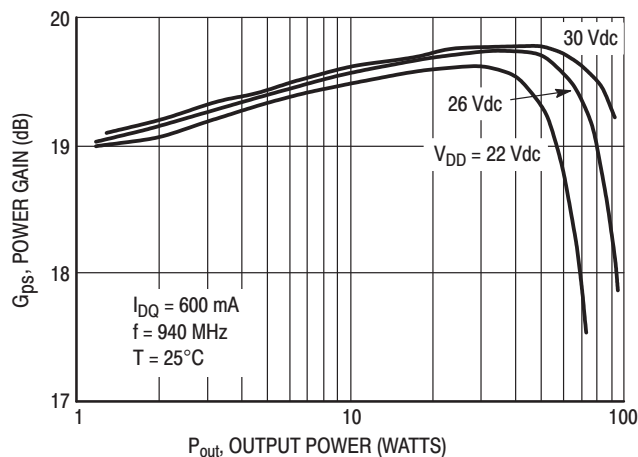
Freescale has begun the transition of marking Printed Circuit Boards (PCBs) with the Freescale Semiconductor signature/logo. PCBs may have either Motorola or Freescale markings during the transition period. These changes will have no impact on form, fit or function of the current product.

**Figure 4. Broadband GSM 900 Optimized Demo Board Component Layout**

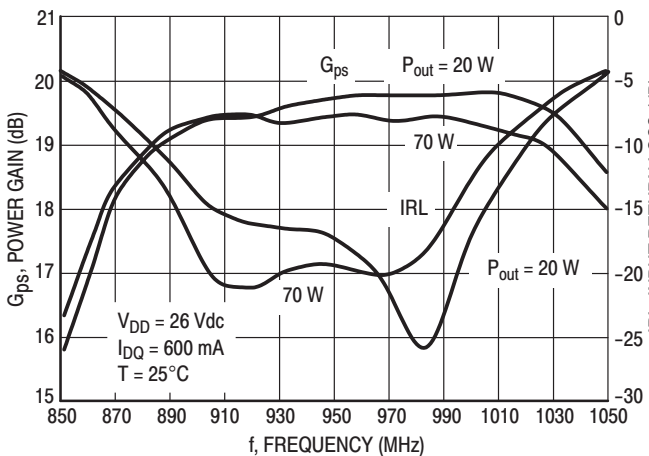
**TYPICAL CHARACTERISTICS  
(IN FREESCALE BROADBAND GSM 900 OPTIMIZED DEMO BOARD)**



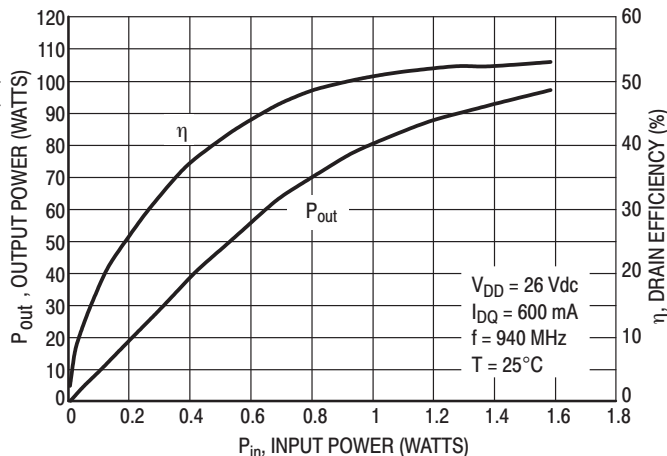
**Figure 5. Power Gain versus Output Power**



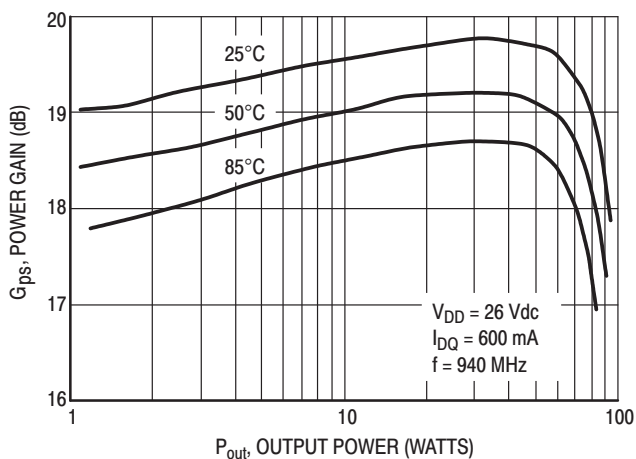
**Figure 6. Power Gain versus Output Power**



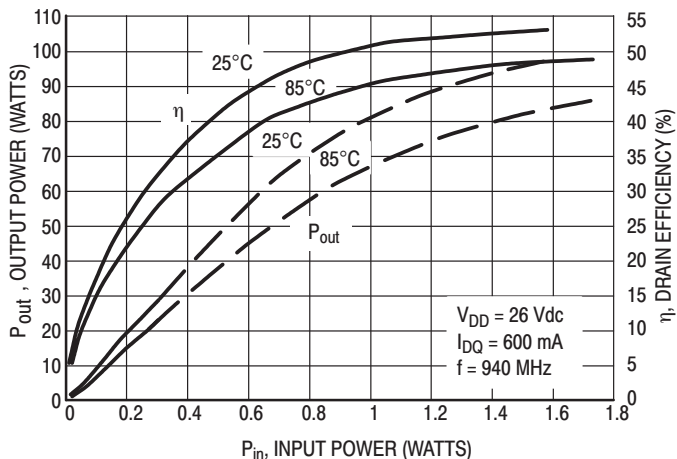
**Figure 7. Power Gain and Input Return Loss versus Frequency**



**Figure 8. Output Power and Efficiency versus Input Power**

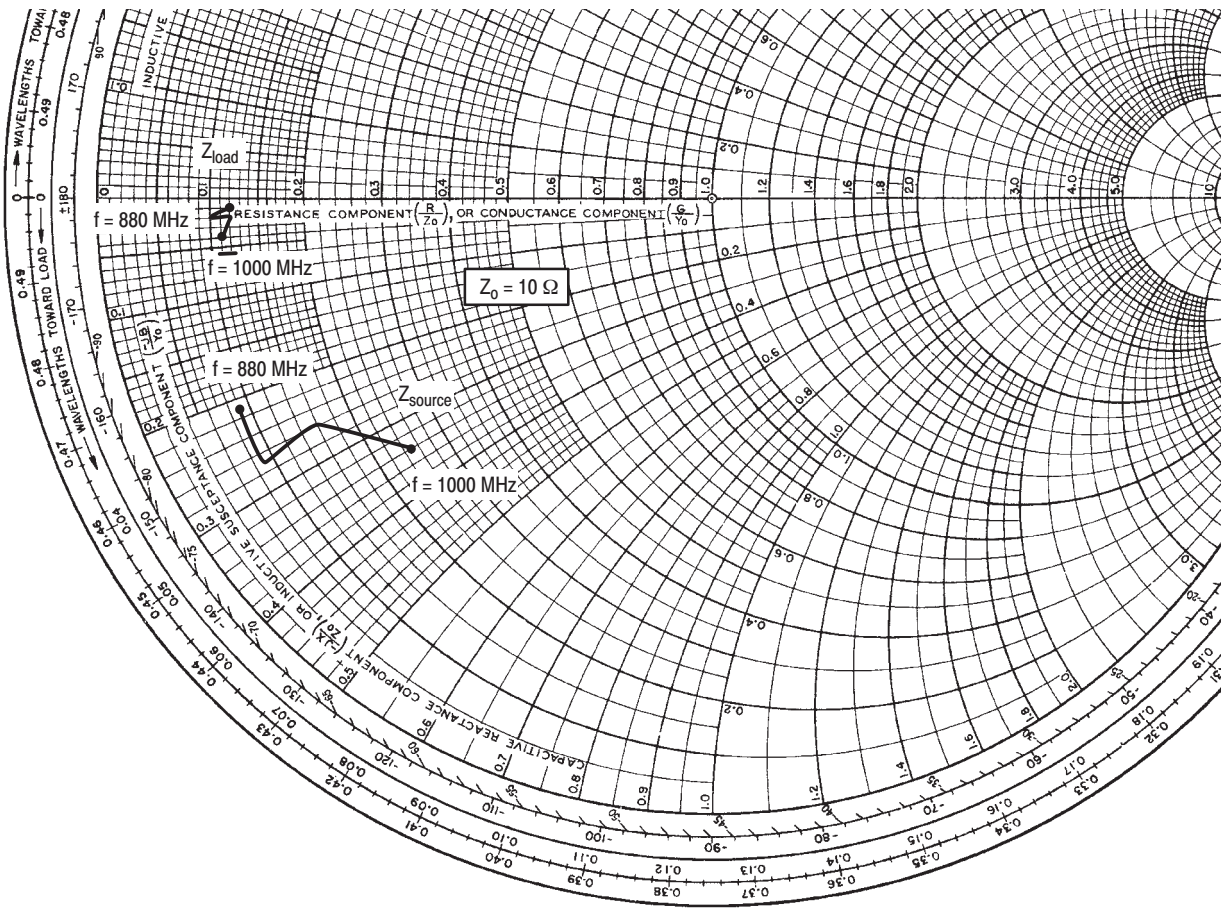


**Figure 9. Power Gain versus Output Power**



**Figure 10. Output Power and Efficiency versus Input Power**

**MRF9080LR3 MRF9080LSR3**



$V_{DD} = 26\text{ V}$ ,  $I_{DQ} = 600\text{ mA}$ ,  $P_{out} = 90\text{ W CW}$

f MHz	$Z_{source}$ $\Omega$	$Z_{load}$ $\Omega$
880	$0.91 - j2.11$	$1.22 - j0.12$
920	$0.88 - j2.65$	$1.00 - j0.16$
960	$1.6 - j2.61$	$1.22 - j0.22$
1000	$2.45 - j3.38$	$1.14 - j0.41$

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

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

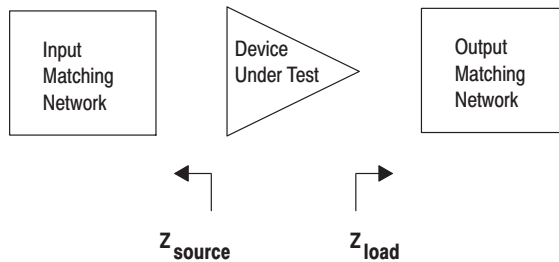


Figure 11. Series Equivalent Source and Load Impedance



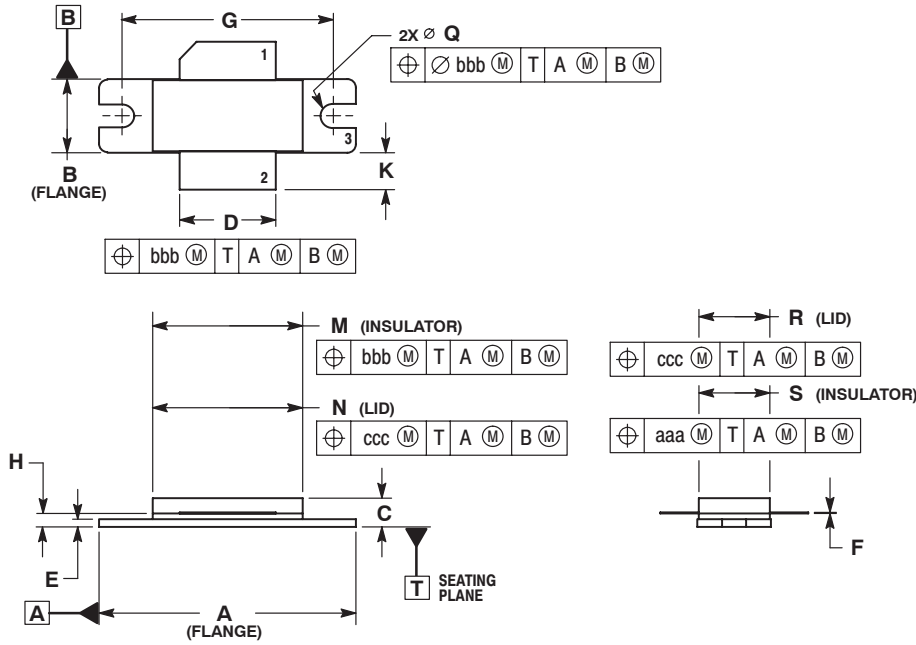


# NOTES



## NOTES

## PACKAGE DIMENSIONS

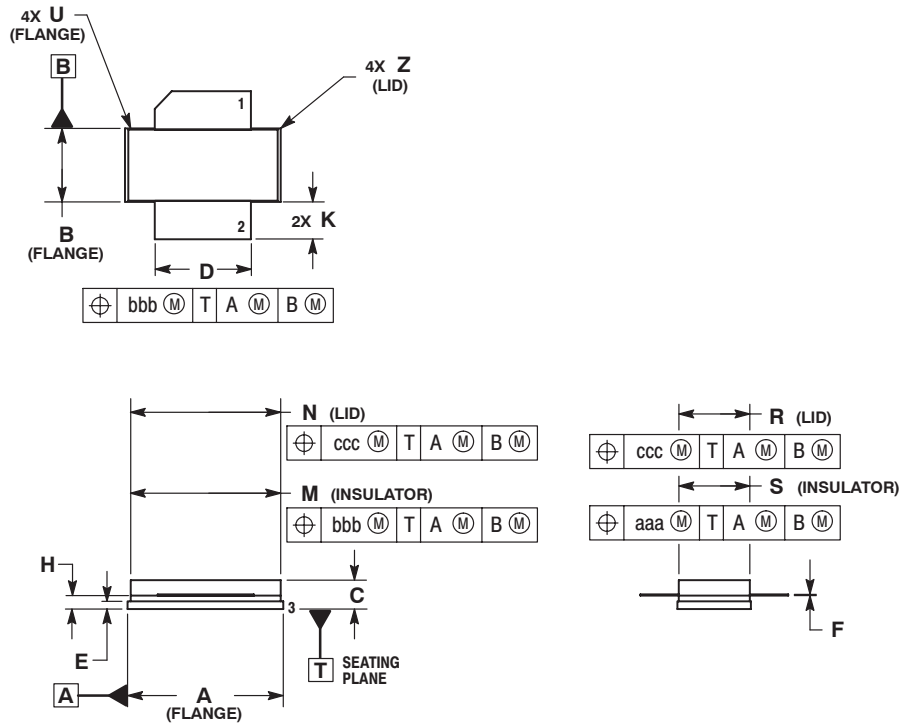


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.
  2. CONTROLLING DIMENSION: INCH.
  3. DELETED
  4. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.335	1.345	33.91	34.16
B	0.380	0.390	9.65	9.91
C	0.125	0.170	3.18	4.32
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
G	1.100 BSC	27.94 BSC		
H	0.057	0.067	1.45	1.70
K	0.170	0.210	4.32	5.33
M	0.774	0.786	19.66	19.96
N	0.772	0.788	19.60	20.00
Q	∅ 1.118	∅ 1.138	∅ 3.00	∅ 3.51
R	0.365	0.375	9.27	9.53
S	0.365	0.375	9.27	9.52
aaa	0.005 REF	0.127 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 465-06  
 ISSUE F  
 NI-780  
 MRF9080LR3**



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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.805	0.815	20.45	20.70
B	0.380	0.390	9.65	9.91
C	0.125	0.170	3.18	4.32
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	0.774	0.786	19.61	20.02
N	0.772	0.788	19.61	20.02
R	0.365	0.375	9.27	9.53
S	0.365	0.375	9.27	9.52
U	---	0.040	---	1.02
Z	---	0.030	---	0.76
aaa	0.005 REF	0.127 REF		
bbb	0.010 REF	0.254 REF		
ccc	0.015 REF	0.381 REF		

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

**CASE 465A-06  
 ISSUE F  
 NI-780S  
 MRF9080LSR3**

**MRF9080LR3 MRF9080LSR3**

## **How to Reach Us:**

### **Home Page:**

[www.freescale.com](http://www.freescale.com)

### **E-mail:**

[support@freescale.com](mailto:support@freescale.com)

### **USA/Europe or Locations Not Listed:**

Freescale Semiconductor  
Technical Information Center, CH370  
1300 N. Alma School Road  
Chandler, Arizona 85224  
+1-800-521-6274 or +1-480-768-2130  
[support@freescale.com](mailto:support@freescale.com)

### **Europe, Middle East, and Africa:**

Freescale Halbleiter Deutschland GmbH  
Technical Information Center  
Schatzbogen 7  
81829 Muenchen, Germany  
+44 1296 380 456 (English)  
+46 8 52200080 (English)  
+49 89 92103 559 (German)  
+33 1 69 35 48 48 (French)  
[support@freescale.com](mailto:support@freescale.com)

### **Japan:**

Freescale Semiconductor Japan Ltd.  
Headquarters  
ARCO Tower 15F  
1-8-1, Shimo-Meguro, Meguro-ku,  
Tokyo 153-0064  
Japan  
0120 191014 or +81 3 5437 9125  
[support.japan@freescale.com](mailto:support.japan@freescale.com)

### **Asia/Pacific:**

Freescale Semiconductor Hong Kong Ltd.  
Technical Information Center  
2 Dai King Street  
Tai Po Industrial Estate  
Tai Po, N.T., Hong Kong  
+800 2666 8080  
[support.asia@freescale.com](mailto:support.asia@freescale.com)

### **For Literature Requests Only:**

Freescale Semiconductor Literature Distribution Center  
P.O. Box 5405  
Denver, Colorado 80217  
1-800-441-2447 or 303-675-2140  
Fax: 303-675-2150  
[LDCForFreescaleSemiconductor@hibbertgroup.com](mailto:LDCForFreescaleSemiconductor@hibbertgroup.com)

Information in this document is provided solely to enable system and software implementers to use Freescale Semiconductor products. There are no express or implied copyright licenses granted hereunder to design or fabricate any integrated circuits or integrated circuits based on the information in this document.

Freescale Semiconductor reserves the right to make changes without further notice to any products herein. Freescale Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Freescale Semiconductor 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 that may be provided in Freescale Semiconductor 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. Freescale Semiconductor does not convey any license under its patent rights nor the rights of others. Freescale Semiconductor 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 Freescale Semiconductor product could create a situation where personal injury or death may occur. Should Buyer purchase or use Freescale Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold Freescale Semiconductor 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 Freescale Semiconductor was negligent regarding the design or manufacture of the part.

Freescale™ and the Freescale logo are trademarks of Freescale Semiconductor, Inc. All other product or service names are the property of their respective owners.  
© Freescale Semiconductor, Inc. 2004. All rights reserved.

