

The RF Sub-Micron MOSFET Line

RF Power Field Effect Transistors

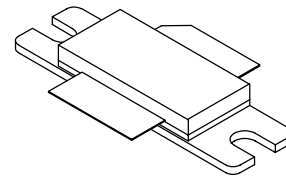
N-Channel Enhancement-Mode Lateral MOSFETs

MRF9080LR3
MRF9080LSR3

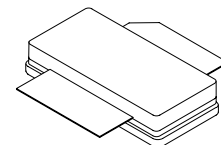
Designed for GSM 900 MHz frequency band, the high gain and broadband performance of these devices make them ideal for large-signal, common-source amplifier applications in 26 volt base station equipment.

- 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 40μ" Nominal.
- In Tape and Reel. R3 Suffix = 250 Units per 56 mm, 13 inch Reel.

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



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



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

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°C Derate above 25°C	P _D	250 1.43	Watts W/°C
Storage Temperature Range	T _{stg}	- 65 to +150	°C
Operating Junction Temperature	T _J	200	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case	R _{θJC}	0.7	°C/W

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.

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Zero Gate Voltage Drain Leakage Current (V _{DS} = 65 Vdc, V _{GS} = 0)	I _{DSS}	—	—	10	μAdc
Zero Gate Voltage Drain Leakage Current (V _{DS} = 26 Vds, V _{GS} = 0)	I _{DSS}	—	—	1	μAdc
Gate-Source Leakage Current (V _{GS} = 5 Vdc, V _{DS} = 0)	I _{GSS}	—	—	1	μAdc

ON CHARACTERISTICS

Gate Threshold Voltage (V _{DS} = 10 Vdc, I _D = 300 μAdc)	V _{GS(th)}	2.0	—	4.0	Vdc
Gate Quiescent Voltage (V _{DS} = 26 Vdc, I _D = 700 mAdc)	V _{GS(Q)}	—	3.7	—	Vdc
Drain-Source On-Voltage (V _{GS} = 10 Vdc, I _D = 2 Adc)	V _{DS(on)}	—	0.19	0.4	Vdc
Forward Transconductance (V _{DS} = 10 Vdc, I _D = 6 Adc)	g _{fs}	—	8.0	—	S

DYNAMIC CHARACTERISTICS (1)

Output Capacitance (V _{DS} = 26 Vdc, V _{GS} = 0, f = 1 MHz)	C _{oss}	—	73	—	pF
Reverse Transfer Capacitance (V _{DS} = 26 Vdc, V _{GS} = 0, f = 1 MHz)	C _{rss}	—	2.9	—	pF

FUNCTIONAL TESTS (In Motorola Test Fixture, 50 ohm system) (2)

Power Output, 1 dB Compression Point (V _{DD} = 26 Vdc, I _{DQ} = 600 mA, f = 921 and 960 MHz)	P _{1dB}	68	75	—	W
Common-Source Amplifier Power Gain @ 70 W (Min) (V _{DD} = 26 Vdc, I _{DQ} = 600 mA, f = 921 and 960 MHz)	G _{ps}	17	18.5	20	dB
Drain Efficiency @ P _{out} = 70 W (V _{DD} = 26 Vdc, I _{DQ} = 600 mA, f = 921 and 960 MHz)	η ₁	47	52	—	%
Drain Efficiency @ P _{1dB} (V _{DD} = 26 Vdc, I _{DQ} = 600 mA, f = 921 and 960 MHz)	η ₂	—	55	—	%
Input Return Loss (V _{DD} = 26 Vdc, P _{out} = 70 W, I _{DQ} = 600 mA, f = 921 and 960 MHz)	IRL	9.5	12.5	—	dB
Output Mismatch Stress (V _{DD} = 26 Vdc, P _{out} = 90 W CW, I _{DQ} = 600 mA, f = 921 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 input matched.

(2) To meet application requirements, Motorola test fixtures are designed to cover full GSM 900 band ensuring batch to batch consistency

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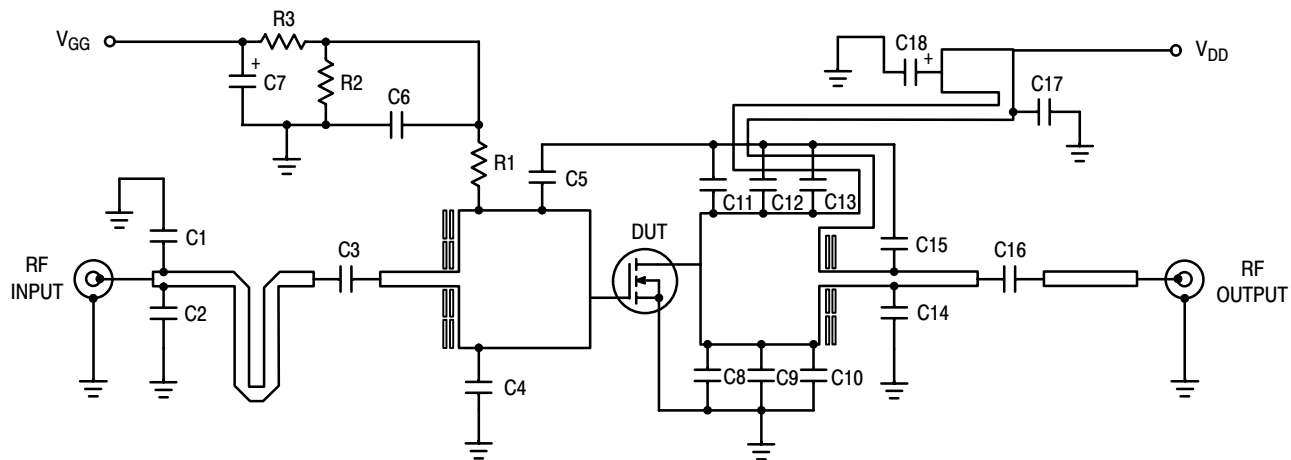


Figure 1. Broadband GSM 900 Test Circuit Schematic

Table 1. Broadband GSM 900 Test Circuit Component Designations and Values

Part	Description	Value, P/N or DWG	Manufacturer
C1	4.7 pF Chip Capacitor, B Case	100B4R7BW	ATC
C2	2.7 pF Chip Capacitor, B Case	100B2R7BW	ATC
C3	1.5 pF Chip Capacitor, B Case	100B1R5BW	ATC
C4, C5, C9, C10, C12, C13	5.6 pF Chip Capacitors, B Case	100B5R6CW	ATC
C6, C16, C17	22 pF Chip Capacitors, B Case	100B220GW	ATC
C7, C18	10 μ F, 35 V Tantalum Chip Capacitors	293D106X9035D2T	Sprague-Vishay
C8, C11	10 pF Chip Capacitors, B Case	100B100JW	ATC
C14	0.8 pF Chip Capacitor, B Case	100B0R8BW	ATC
C15	8.2 pF Chip Capacitor, B Case	100B8R2GW	ATC
R1, R2, R3	1.0 k Ω , ??? 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 [®] , $\epsilon_r = 2.55$	TLX8-0300	Taconic
PCB	Etched Circuit Board	C-GY-00-001-02	Cibel

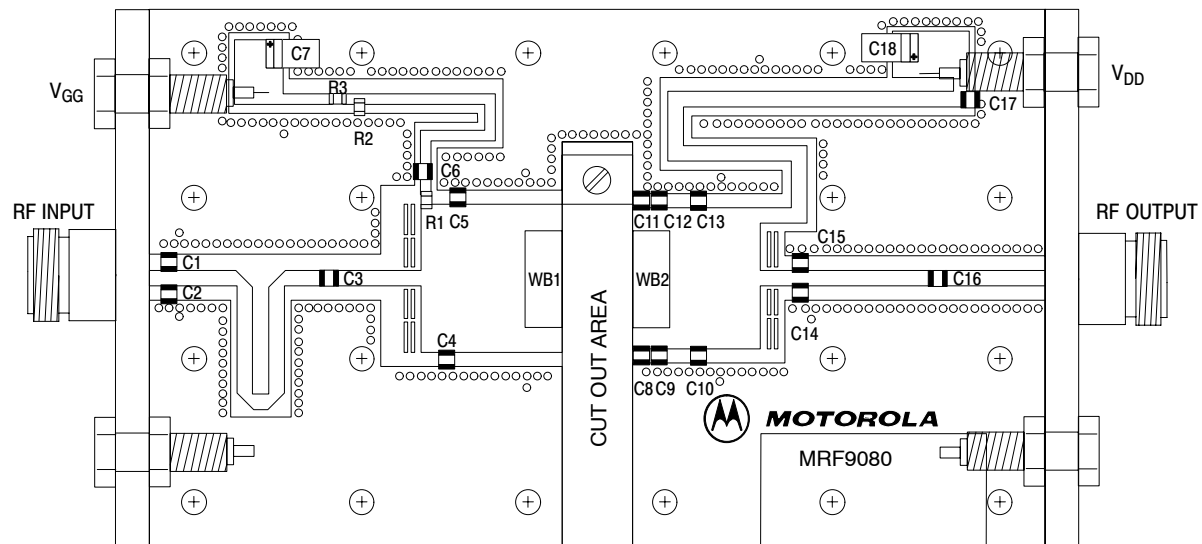


Figure 2. Broadband GSM 900 Test Circuit Component Layout

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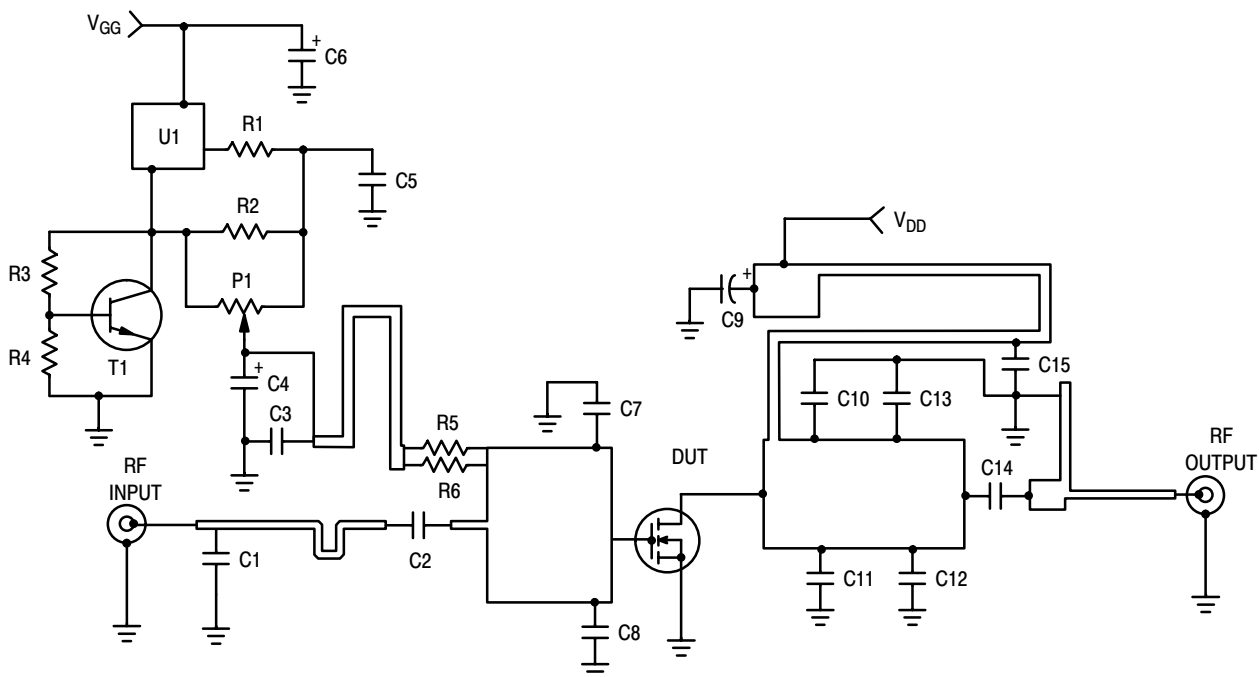


Figure 3. Broadband GSM 900 Optimized Demo Board Schematic

Table 2. Broadband GSM 900 Optimized Demo Board Component Designations and Values

Part	Description	Value, P/N or DWG	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 μ F, 35 V Tantalum Chip Capacitors	#T491X226K035AS4394	Kemet
C5	1.0 μ F Chip Capacitor, ACCU-P (0805)	#08053G105ZATEA	AVX
C7, C8	5.6 pF Chip Capacitors, ACCU-P (0805)	#08051J5R18CBT	AVX
C9	220 μ 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 Ω Potentiometer CMS Cermet Multi-turn	#3224W	Bourns
R1	10 Ω , 1/8 W Chip Resistor (0805)		
R2	1.0 k Ω , 1/8 W Chip Resistor (0805)		
R3	1.2 k Ω , 1/8 W Chip Resistor (0805)		
R4	2.2 k Ω , 1/8 W Chip Resistor (0805)		
R5, R6	1.0 k Ω , 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		

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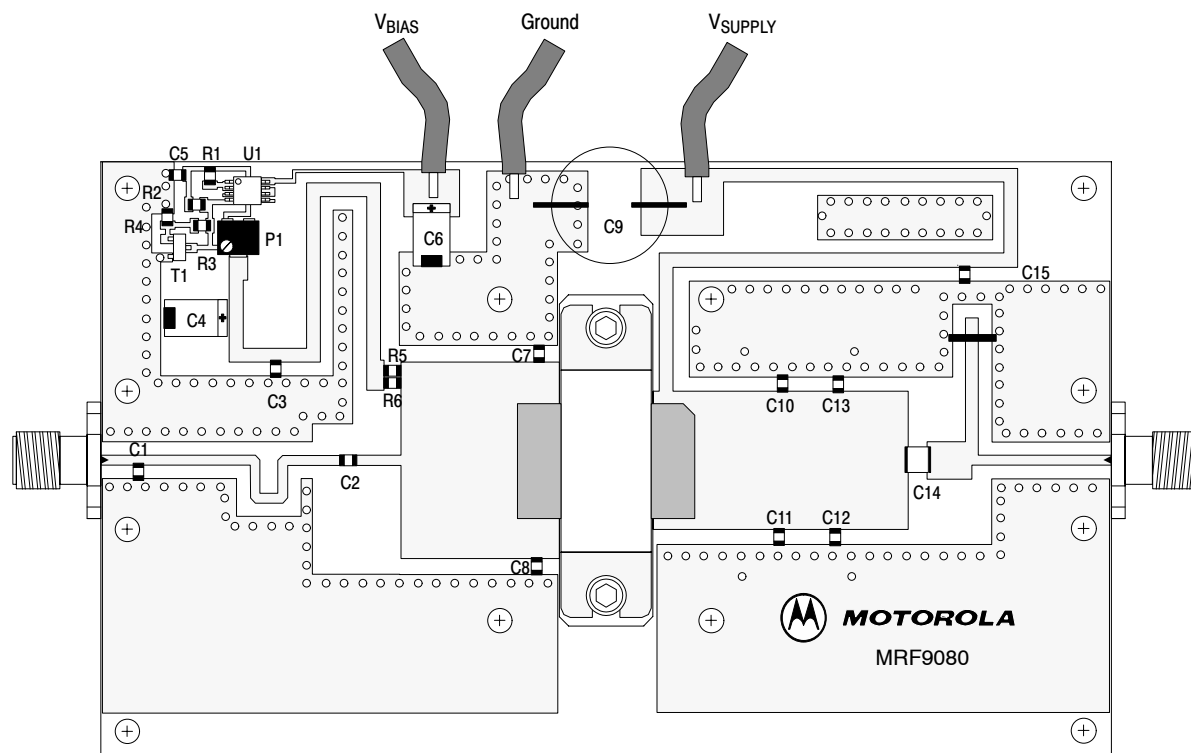


Figure 4. Broadband GSM 900 Optimized Demo Board Component Layout

Freescale Semiconductor, Inc.

TYPICAL CHARACTERISTICS (IN MOTOROLA BROADBAND GSM 900 OPTIMIZED DEMO BOARD)

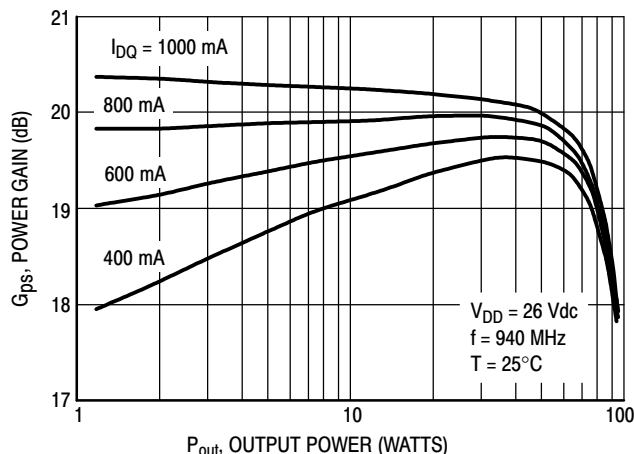


Figure 5. Power Gain versus Output Power

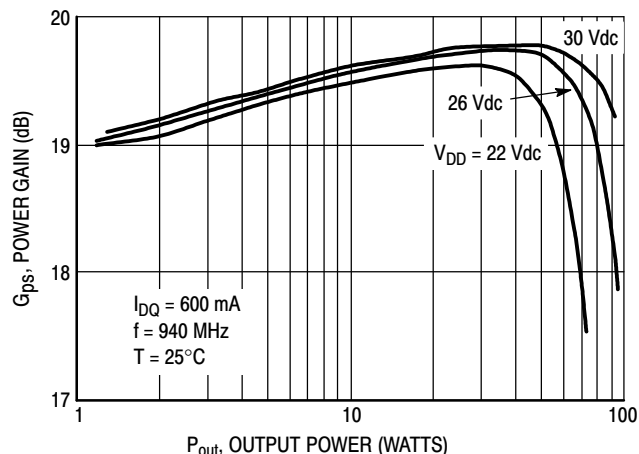


Figure 6. Power Gain versus Output Power

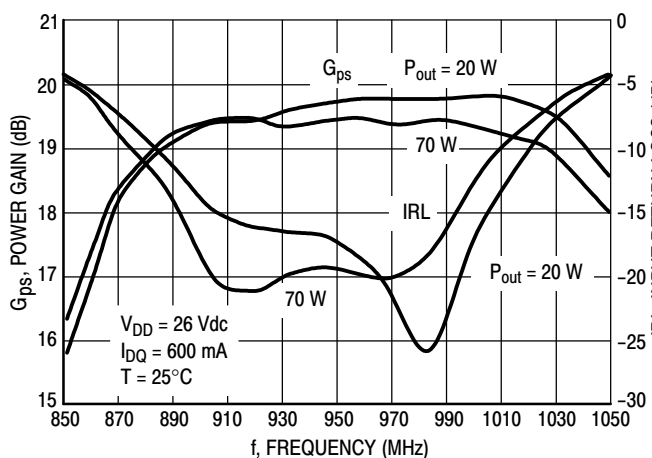


Figure 7. Power Gain and Input Return Loss versus Frequency

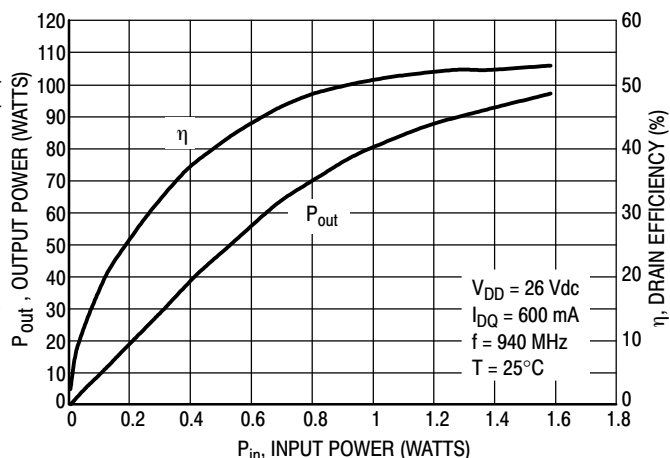


Figure 8. Output Power and Efficiency versus Input Power

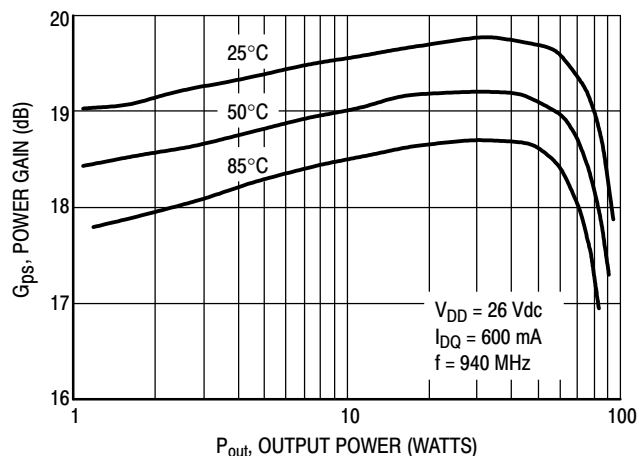


Figure 9. Power Gain versus Output Power

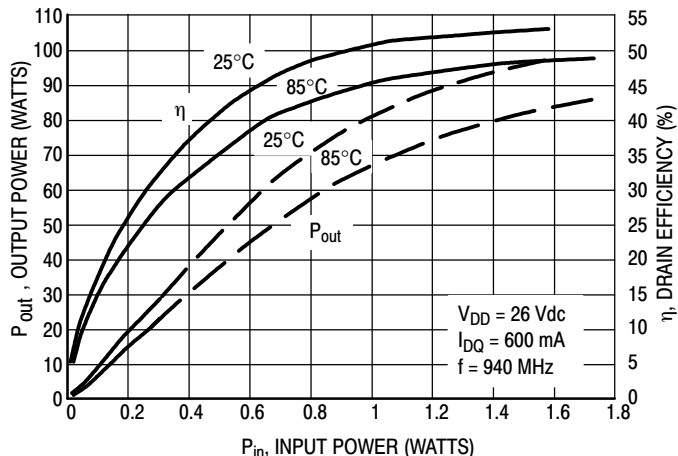
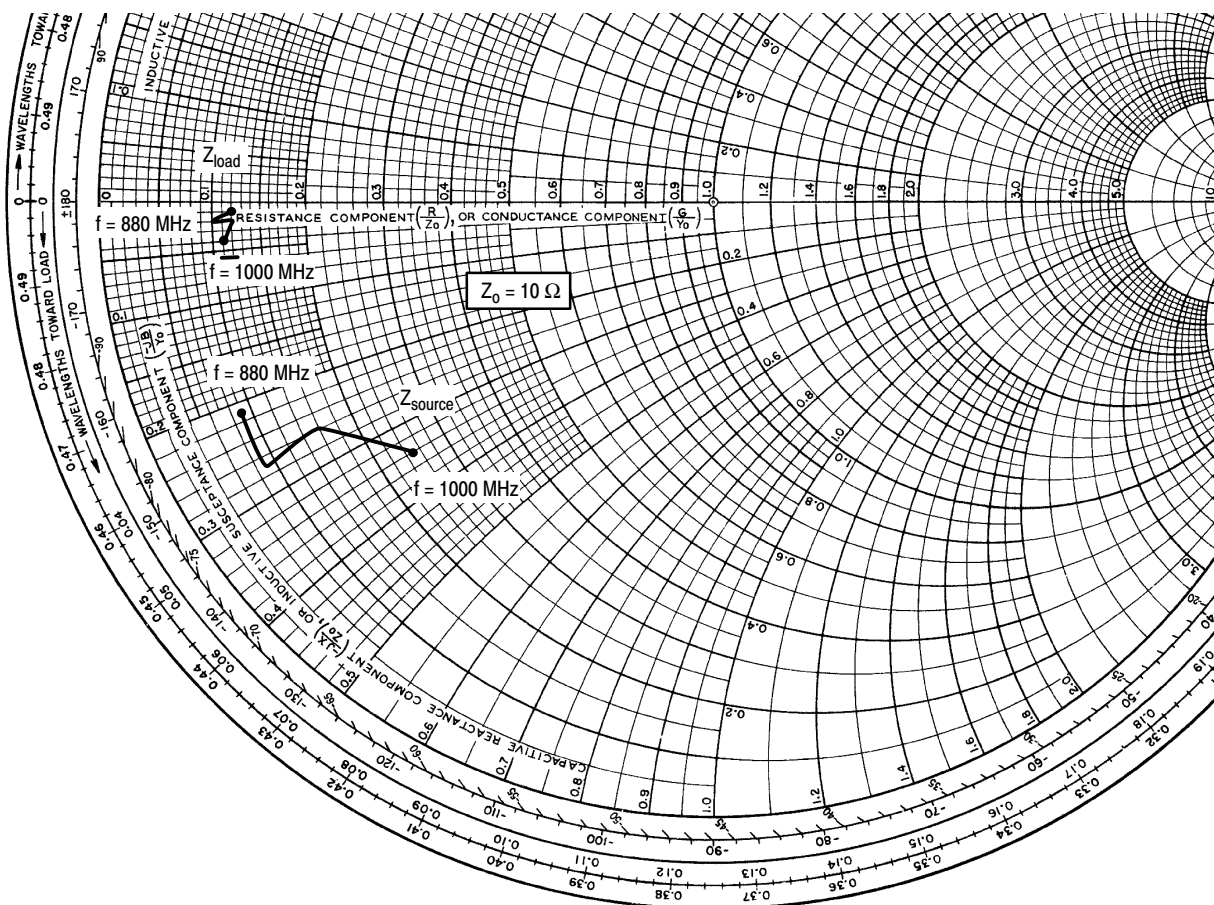


Figure 10. Output Power and Efficiency versus Input Power



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

f MHz	Z_{source} Ω	Z_{load} Ω
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.

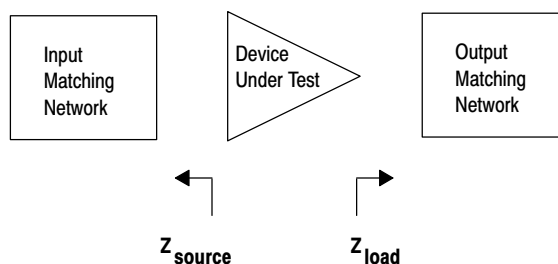


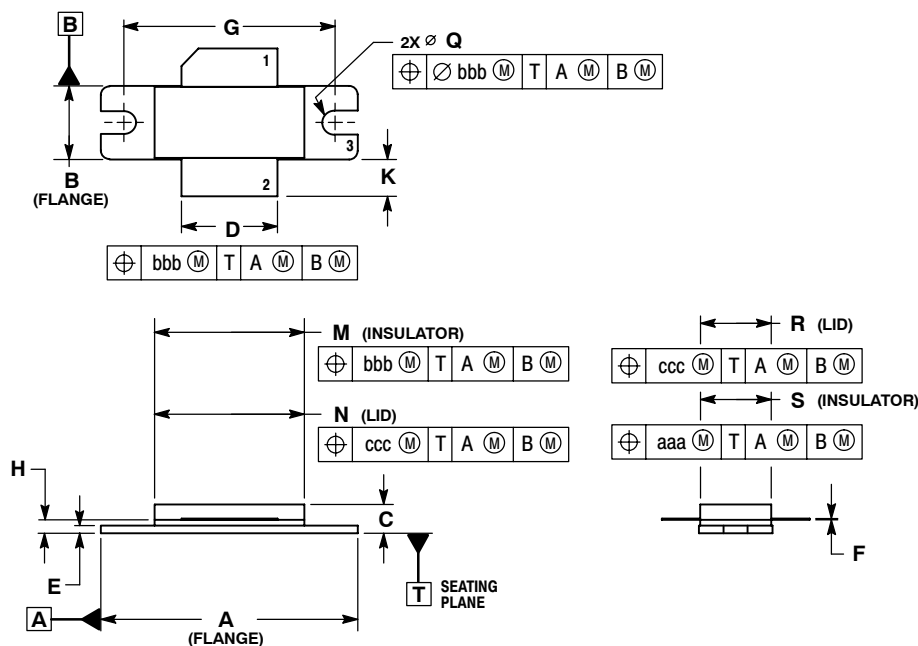
Figure 11. Series Equivalent Source and Load Impedance

NOTES

NOTES

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PACKAGE DIMENSIONS



NOTES:

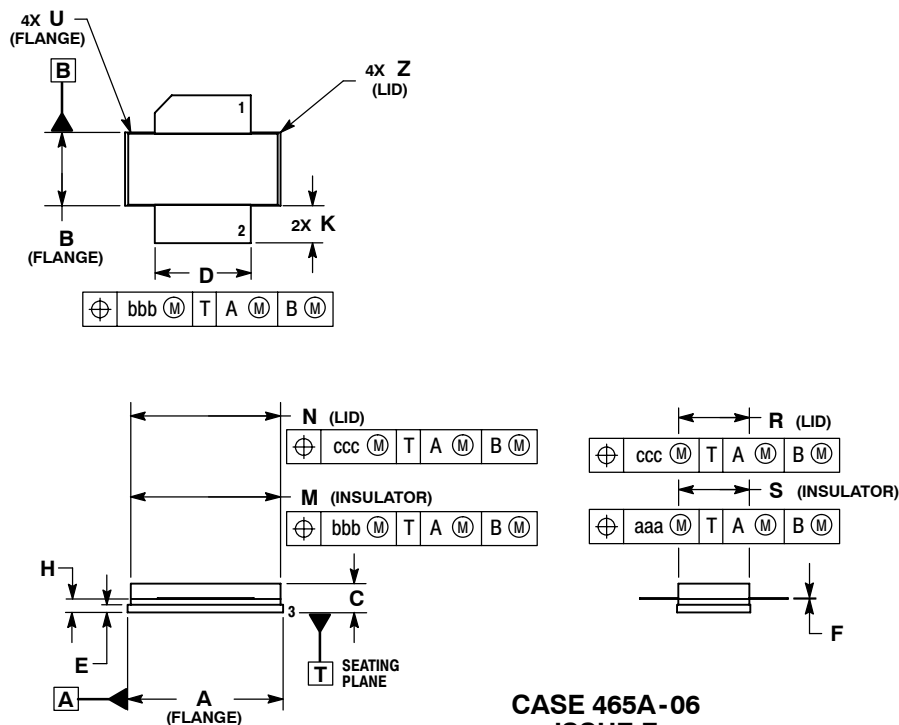
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.
2. CONTROLLING DIMENSION: INCH.
3. DELETED
4. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.

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	Ø.118	Ø.138	Ø3.00	Ø3.51
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:

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:

1. DRAIN
2. GATE
5. SOURCE

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

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