



# RF Power Field Effect Transistor

## N-Channel Enhancement-Mode Lateral MOSFETs

Designed for PCN and PCS base station applications with frequencies from 1800 to 2000 MHz. Suitable for FM, TDMA, CDMA and multicarrier amplifier applications. To be used in Class AB for PCN-PCS/cellular radio and WLL applications. Specified for GSM 1930 - 1990 MHz.

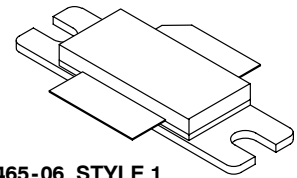
- GSM Performance, Full Frequency Band (1930 - 1990 MHz)  
Power Gain — 13 dB (Typ) @ 60 Watts CW  
Efficiency — 45% (Typ) @ 60 Watts CW
- Capable of Handling 10:1 VSWR, @ 26 Vdc, 1960 MHz, 60 Watts CW Output Power

### Features

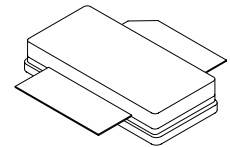
- Internally Matched for Ease of Use
- High Gain, High Efficiency and High Linearity
- Integrated ESD Protection
- Designed for Maximum Gain and Insertion Phase Flatness
- Excellent Thermal Stability
- Available with Low Gold Plating Thickness on Leads. L Suffix Indicates 40μ" Nominal.
- RoHS Compliant
- In Tape and Reel. R3 Suffix = 250 Units per 56 mm, 13 Inch Reel.

**MRF18060BLR3**  
**MRF18060BLSR3**

**1930-1990 MHz, 60 W, 26 V**  
**LATERAL N-CHANNEL**  
**RF POWER MOSFETs**



**CASE 465-06, STYLE 1**  
**NI-780**  
**MRF18060BLR3**



**CASE 465A-06, STYLE 1**  
**NI-780S**  
**MRF18060BLSR3**

**Table 1. Maximum Ratings**

Rating	Symbol	Value	Unit
Drain-Source Voltage	$V_{DSS}$	-0.5, +65	Vdc
Gate-Source Voltage	$V_{GS}$	-0.5, +15	Vdc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	$P_D$	180 1.03	W W/°C
Storage Temperature Range	$T_{stg}$	- 65 to +150	°C
Case Operating Temperature	$T_C$	150	°C
Operating Junction Temperature	$T_J$	200	°C

**Table 2. Thermal Characteristics**

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.97	°C/W

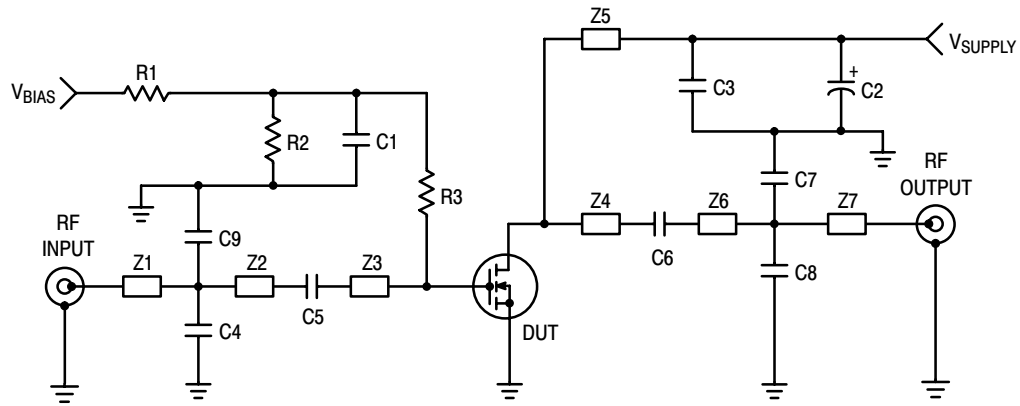
**Table 3. ESD Protection Characteristics**

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)

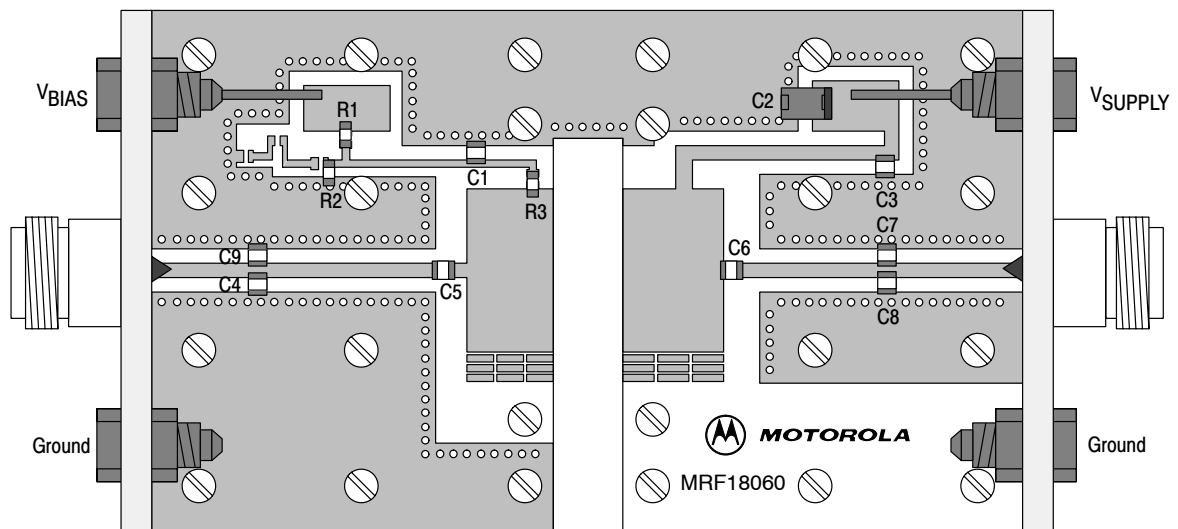
Characteristic	Symbol	Min	Typ	Max	Unit
<b>Off Characteristics</b>					
Drain-Source Breakdown Voltage ( $V_{GS} = 0\text{ Vdc}$ , $I_D = 10\ \mu\text{Adc}$ )	$V_{(BR)DSS}$	65	—	—	Vdc
Zero Gate Voltage Drain Current ( $V_{DS} = 26\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ )	$I_{DSS}$	—	—	6	$\mu\text{Adc}$
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 ( $V_{DS} = 10\text{ Vdc}$ , $I_D = 300\ \mu\text{Adc}$ )	$V_{GS(th)}$	2	—	4	Vdc
Gate Quiescent Voltage ( $V_{DS} = 26\text{ Vdc}$ , $I_D = 500\ \text{mAdc}$ )	$V_{GS(Q)}$	2.5	3.9	4.5	Vdc
Drain-Source On-Voltage ( $V_{GS} = 10\text{ Vdc}$ , $I_D = 2\text{ Adc}$ )	$V_{DS(on)}$	—	0.27	—	Vdc
<b>Dynamic Characteristics</b>					
Input Capacitance (Including Input Matching Capacitor in Package) <sup>(1)</sup> ( $V_{DS} = 26\text{ Vdc} \pm 30\text{ mV(rms)ac}$ @ 1 MHz, $V_{GS} = 0\text{ Vdc}$ )	$C_{iss}$	—	160	—	pF
Output Capacitance <sup>(1)</sup> ( $V_{DS} = 26\text{ Vdc} \pm 30\text{ mV(rms)ac}$ @ 1 MHz, $V_{GS} = 0\text{ Vdc}$ )	$C_{oss}$	—	740	—	pF
Reverse Transfer Capacitance ( $V_{DS} = 26\text{ Vdc} \pm 30\text{ mV(rms)ac}$ @ 1 MHz, $V_{GS} = 0\text{ Vdc}$ )	$C_{rss}$	—	2.7	—	pF
<b>Functional Tests</b> (In Freescale Test Fixture, 50 ohm system)					
Common-Source Amplifier Power Gain @ 60 W <sup>(2)</sup> ( $V_{DD} = 26\text{ Vdc}$ , $I_{DQ} = 500\text{ mA}$ , $f = 1930 - 1990\text{ MHz}$ )	$G_{ps}$	11.5	13	—	dB
Drain Efficiency @ 60 W <sup>(2)</sup> ( $V_{DD} = 26\text{ Vdc}$ , $I_{DQ} = 500\text{ mA}$ , $f = 1930 - 1990\text{ MHz}$ )	$\eta$	40	45	—	%
Input Return Loss <sup>(2)</sup> ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 60\text{ W CW}$ , $I_{DQ} = 500\text{ mA}$ , $f = 1930 - 1990\text{ MHz}$ )	IRL	—	—	-10	dB

1. Part is internally matched both on input and output.
2. To meet application requirements, Freescale test fixtures have been designed to cover the full GSM1900 band, ensuring batch-to-batch consistency.



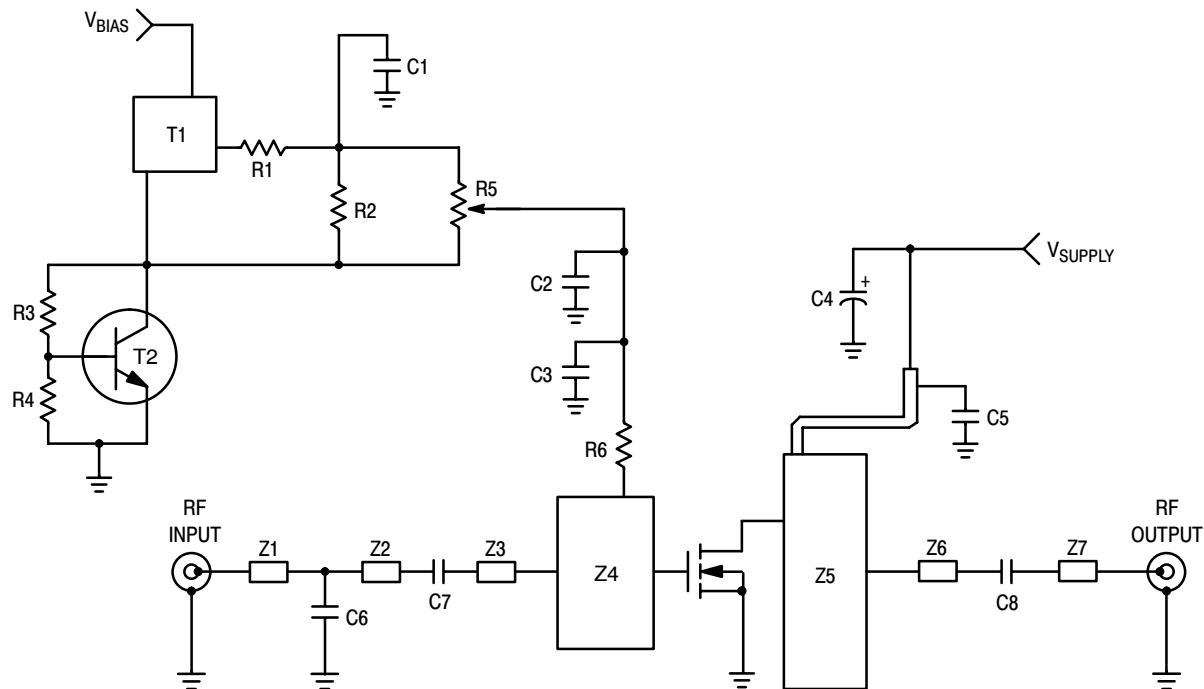
C1, C3	10 pF, 100B Chip Capacitors	Z1	0.60" x 0.09" Microstrip
C2	10 $\mu$ F, 35 V Electrolytic Tantalum Capacitor	Z2	1.00" x 0.09" Microstrip
C4, C8	1.2 pF, 100B Chip Capacitors	Z3	0.51" x 0.94" Microstrip
C5	1.0 pF, 100B Chip Capacitor	Z4	0.59" x 0.98" Microstrip
C6	2.2 pF, 100B Chip Capacitor	Z5	0.79" x 0.09" Microstrip
C7, C9	0.3 pF, 100B Chip Capacitors	Z6	1.38" x 0.09" Microstrip
R1, R2	10 k $\Omega$ Chip Resistors (0805)	Z7	0.79" x 0.09" Microstrip
R3	1.0 k $\Omega$ Chip Resistor (0805)	PCB	Teflon <sup>®</sup> Glass

**Figure 1. 1930 - 1990 MHz Test Fixture Schematic**



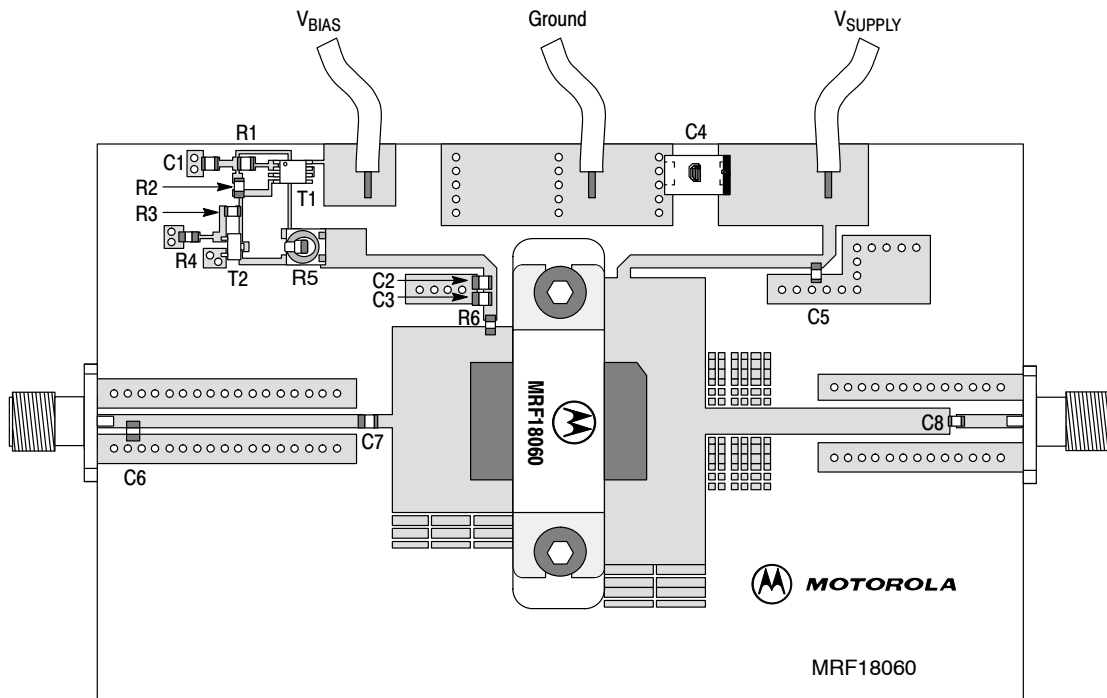
Freescale has begun the transition of marking Printed Circuit Boards (PCBs) with the Freescale Semiconductor signature/logo. PCBs may have either Motorola or Freescale markings during the transition period. These changes will have no impact on form, fit or function of the current product.

**Figure 2. 1930 - 1990 MHz Test Fixture Component Layout**



C1	1 $\mu$ F Chip Capacitor (0805)	T1	LP2951 Micro-8 Voltage Regulator
C2	100 nF Chip Capacitor (0805)	T2	BC847 SOT-23 NPN Transistor
C3, C5, C8	10 pF Chip Capacitors, ACCU-P (0805)	Z1	0.159" x 0.055" Microstrip
C4	10 $\mu$ F, 35 V Tantalum Electrolytic Capacitor	Z2	0.982" x 0.055" Microstrip
C6	1.8 pF Chip Capacitor, ACCU-P (0805)	Z3	0.087" x 0.055" Microstrip
C7	1 pF Chip Capacitor, ACCU-P (0805)	Z4	0.512" x 0.787" Microstrip
R1	10 $\Omega$ Chip Resistor (0805)	Z5	0.433" x 1.220" Microstrip
R2, R6	1 k $\Omega$ Chip Resistors (0805)	Z6	1.039" x 0.118" Microstrip
R3	1.2 k $\Omega$ Chip Resistor (0805)	Z7	0.268" x 0.055" Microstrip
R4	2.2 k $\Omega$ Chip Resistor (0805)	Substrate = 0.5 mm Teflon <sup>®</sup> Glass, $\epsilon_r = 2.55$	
R5	5 k $\Omega$ , SMD Potentiometer		

**Figure 3. 1800 - 2000 MHz Demo Board 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 4. 1800 - 2000 MHz Demo Board Component Layout**

## TYPICAL CHARACTERISTICS (DATA TAKEN USING WIDEBAND DEMONSTRATION BOARD)

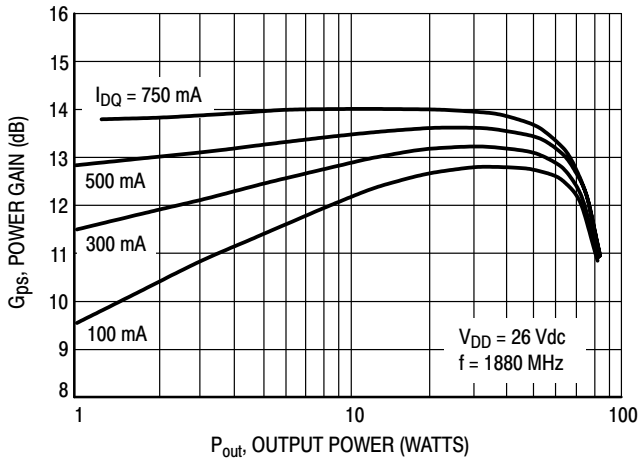


Figure 5. Power Gain versus Output Power

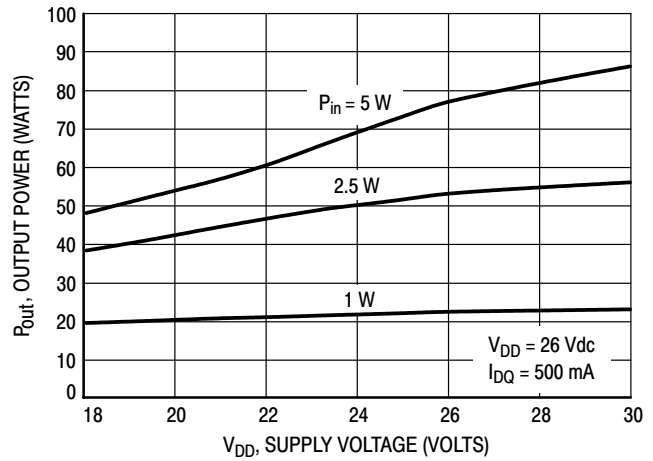


Figure 6. Output Power versus Supply Voltage

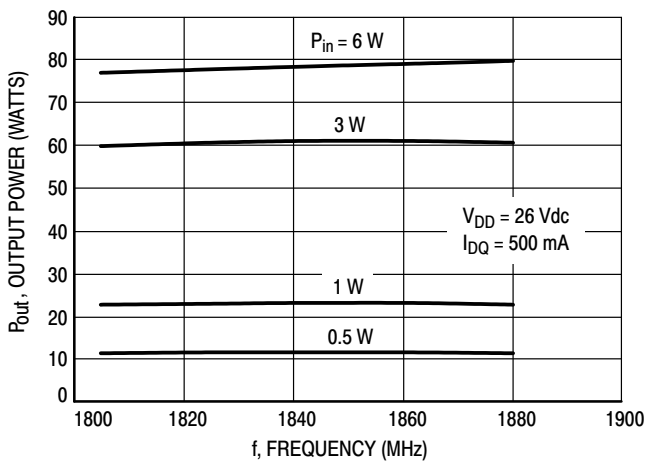


Figure 7. Output Power versus Frequency

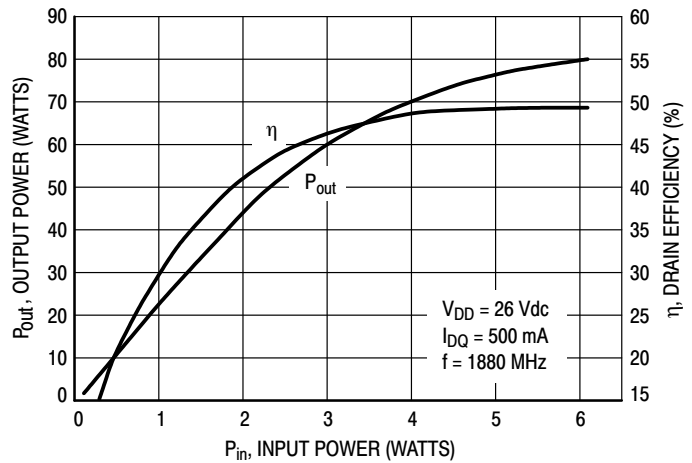


Figure 8. Output Power and Efficiency versus Input Power

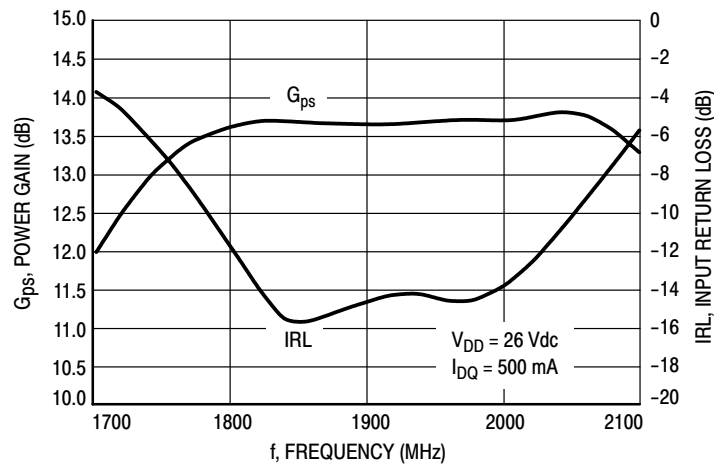
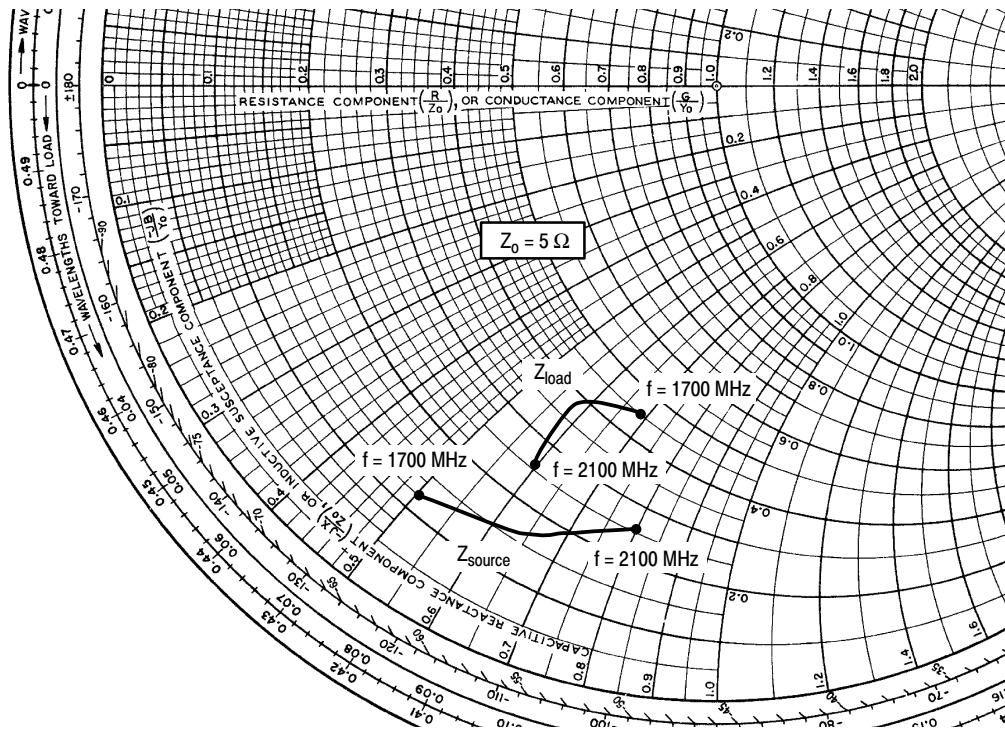


Figure 9. Wideband Gain and IRL (at Small Signal)



$V_{DD} = 26\text{ V}$ ,  $I_{DQ} = 500\text{ mA}$ ,  $P_{out} = 60\text{ W CW}$

f MHz	$Z_{source}$ $\Omega$	$Z_{load}$ $\Omega$
1700	$0.60 - j2.53$	$2.27 - j3.44$
1800	$0.80 - j3.20$	$2.05 - j3.05$
1900	$0.92 - j3.42$	$1.90 - j2.90$
2000	$1.07 - j3.59$	$1.64 - j2.88$
2100	$1.31 - j4.00$	$1.29 - j2.99$

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

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

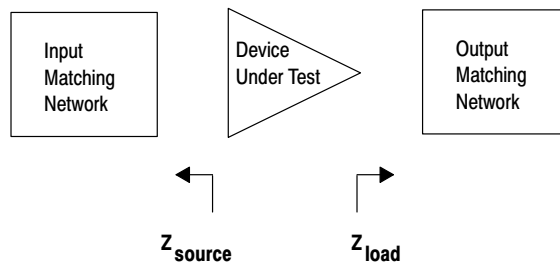


Figure 10. Series Equivalent Source and Load Impedance

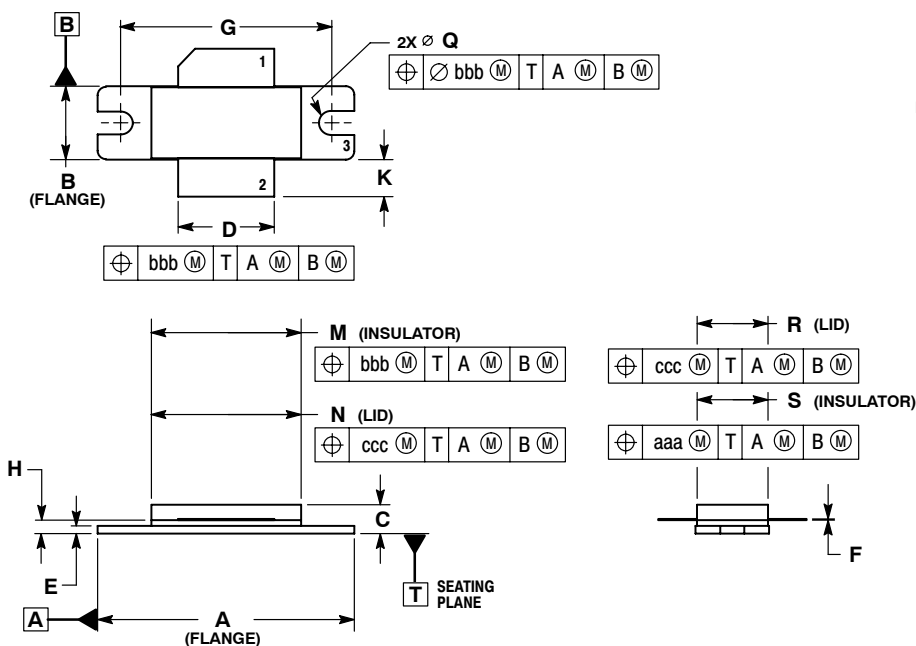
# NOTES



# NOTES

# NOTES

## PACKAGE DIMENSIONS

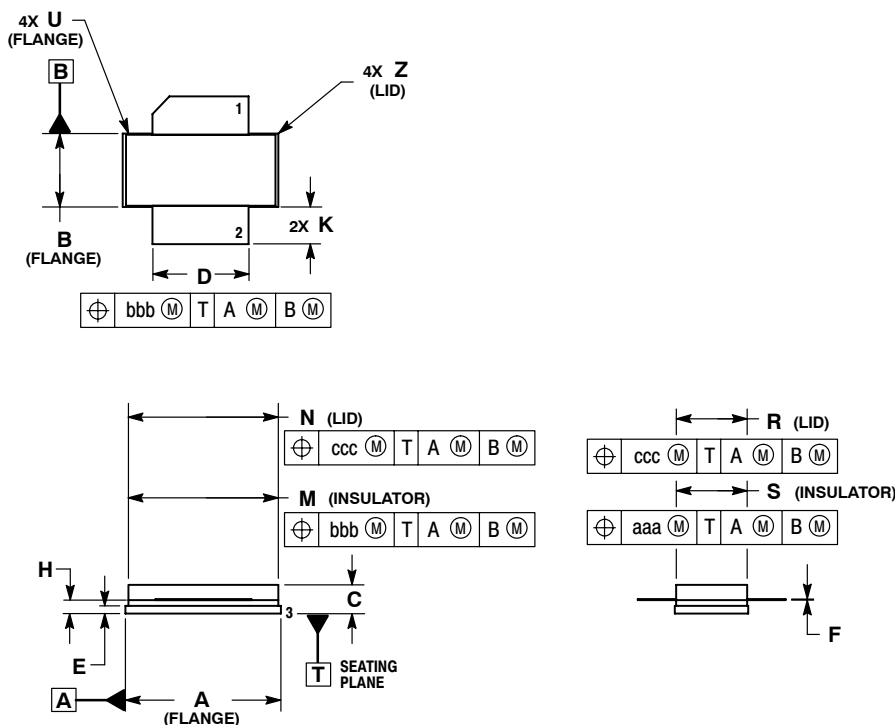


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.
  2. CONTROLLING DIMENSION: INCH.
  3. DELETED
  4. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.

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	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:  
 PIN 1. DRAIN  
 2. GATE  
 3. SOURCE

**CASE 465-06  
 ISSUE G  
 NI-780  
 MRF18060BLR3**



- 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 H  
 NI-780S  
 MRF18060BLSR3**

**MRF18060BLR3 MRF18060BLSR3**

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