

# RF Power Field Effect Transistors

## 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 1805 - 1880 MHz.

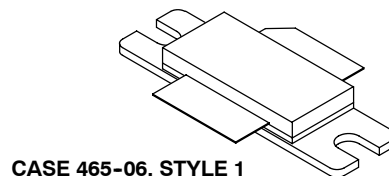
- Typical GSM Performance, Full Frequency Band (1805 - 1880 MHz)  
Power Gain — 13 dB @ 60 Watts  
Efficiency — 45% @ 60 Watts
- Capable of Handling 10:1 VSWR, @ 26 Vdc, 1840 MHz, 60 Watts CW Output Power

### Features

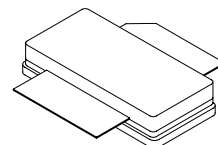
- Internally Matched for Ease of Use
- High Gain, High Efficiency and High Linearity
- Integrated ESD Protection
- Designed for Maximum Gain and Insertion Phase Flatness
- Excellent Thermal Stability
- Available with Low Gold Plating Thickness on Leads. L Suffix Indicates 40μ" Nominal.
- RoHS Compliant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

**MRF18060ALR3**  
**MRF18060ALSR3**

**1805-1880 MHz, 60 W, 26 V**  
**LATERAL N-CHANNEL**  
**RF POWER MOSFETs**



**CASE 465-06, STYLE 1**  
**NI-780**  
**MRF18060ALR3**



**CASE 465A-06, STYLE 1**  
**NI-780S**  
**MRF18060ALSR3**

**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 @ $T_C \geq 25^\circ\text{C}$ 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

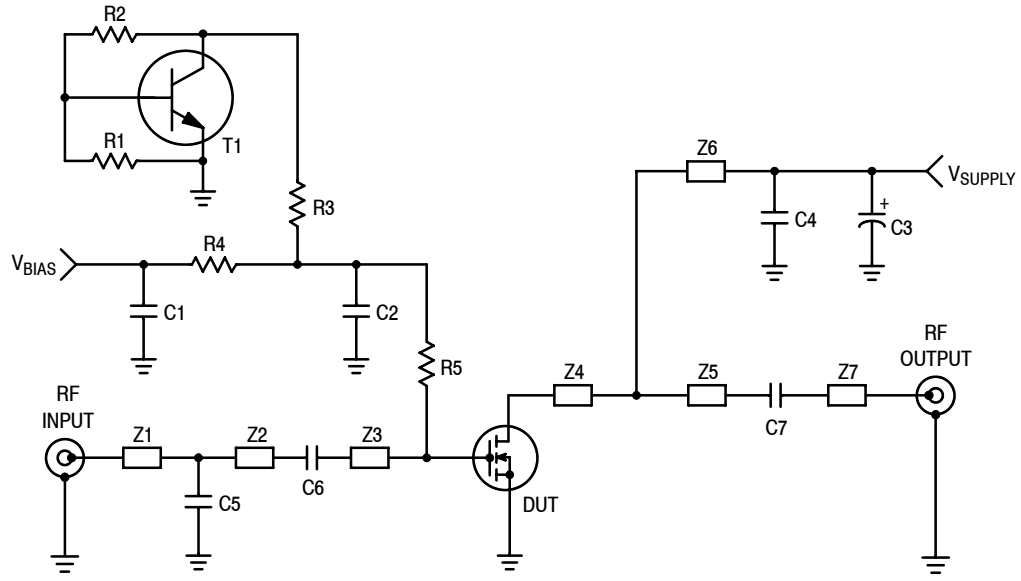
**Table 3. ESD Protection Characteristics**

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)

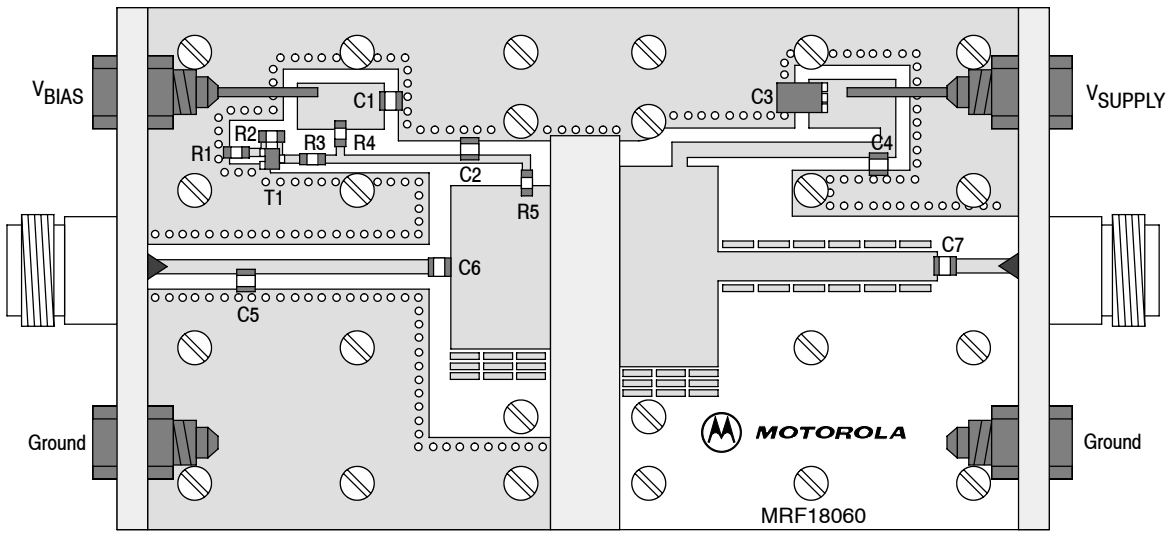
Characteristic	Symbol	Min	Typ	Max	Unit
<b>Off Characteristics</b>					
Drain-Source Breakdown Voltage ( $V_{GS} = 0\text{ Vdc}$ , $I_D = 10\ \mu\text{Adc}$ )	$V_{(BR)DSS}$	65	—	—	Vdc
Zero Gate Voltage Drain Current ( $V_{DS} = 26\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ )	$I_{DSS}$	—	—	6	$\mu\text{Adc}$
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) (1) ( $V_{DS} = 26\text{ Vdc} \pm 30\text{ mV(rms)ac}$ @ 1 MHz, $V_{GS} = 0\text{ Vdc}$ )	$C_{iss}$	—	160	—	pF
Output Capacitance (1) ( $V_{DS} = 26\text{ Vdc} \pm 30\text{ mV(rms)ac}$ @ 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 (2) ( $V_{DD} = 26\text{ Vdc}$ , $I_{DQ} = 500\text{ mA}$ , $f = 1805 - 1880\text{ MHz}$ )	$G_{ps}$	11.5	13	—	dB
Drain Efficiency @ 60 W (2) ( $V_{DD} = 26\text{ Vdc}$ , $I_{DQ} = 500\text{ mA}$ , $f = 1805 - 1880\text{ MHz}$ )	$\eta$	43	45	—	%
Input Return Loss (2) ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 60\text{ W CW}$ , $I_{DQ} = 500\text{ mA}$ , $f = 1805 - 1880\text{ MHz}$ )	IRL	—	—	-10	dB

- Part is internally matched both on input and output.
- To meet application requirements, Freescale test fixtures have been designed to cover the full GSM1800 band, ensuring batch-to-batch consistency.



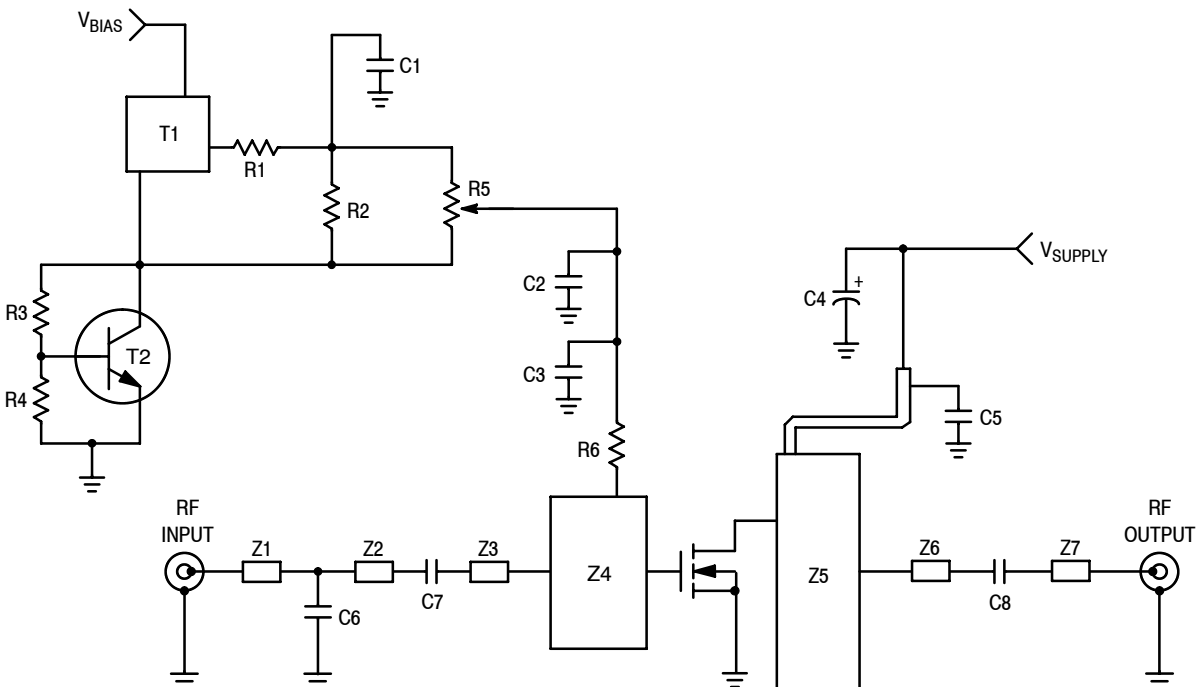
C1	100 nF Chip Capacitor (1203)	Z1	0.47" x 0.09" Microstrip
C2, C4, C7	10 pF Chip Capacitors	Z2	1.16" x 0.09" Microstrip
C3	10 $\mu$ F, 35 V Electrolytic Tantalum Capacitor	Z3	0.57" x 0.95" Microstrip
C5	1.2 pF Chip Capacitor	Z4	0.59" x 1.18" Microstrip
C6	1.0 pF Chip Capacitor	Z5	1.26" x 0.15" Microstrip
R1, R3	2.2 k $\Omega$ Chip Resistors (0805)	Z6	1.15" x 0.09" Microstrip
R2, R4	2.7 k $\Omega$ Chip Resistors (0805)	Z7	0.37" x 0.09" Microstrip
R5	1.1 k $\Omega$ Chip Resistor (0805)		
T1	BC847 Transistor SOT-23		

**Figure 1. 1805 - 1880 MHz Test Fixture Schematic**



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

**Figure 2. 1805 - 1880 MHz Test Fixture Component Layout**

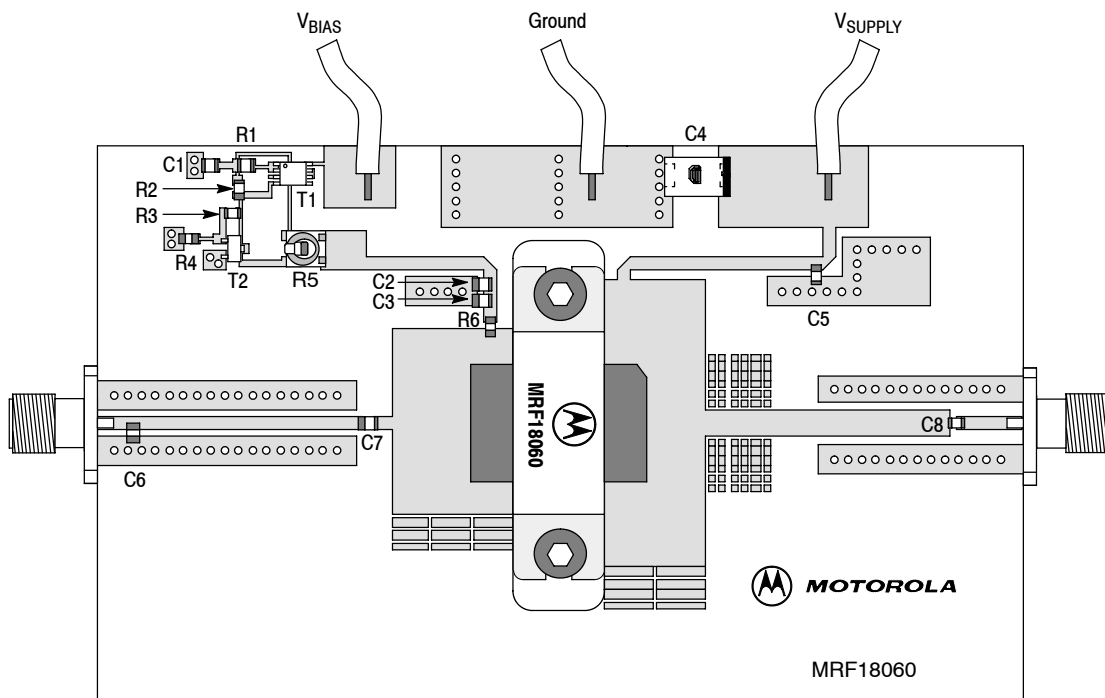


C1	1 $\mu$ F Chip Capacitor (0805)	T1	LP2951 Micro-8 Voltage Regulator
C2	100 nF Chip Capacitor (0805)	T2	BC847 SOT-23 NPN Transistor
C3, C5, C8	10 pF Chip Capacitors, ACCU-P (0805)	Z1	0.159" x 0.055" Microstrip
C4	10 $\mu$ F, 35 V Tantalum Electrolytic Capacitor	Z2	0.982" x 0.055" Microstrip
C6	1.8 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

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

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TYPICAL CHARACTERISTICS (DATA TAKEN USING WIDEBAND DEMONSTRATION BOARD)

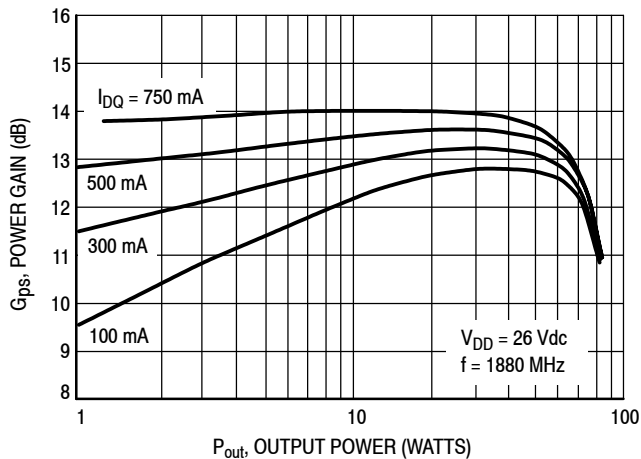


Figure 5. Power Gain versus Output Power

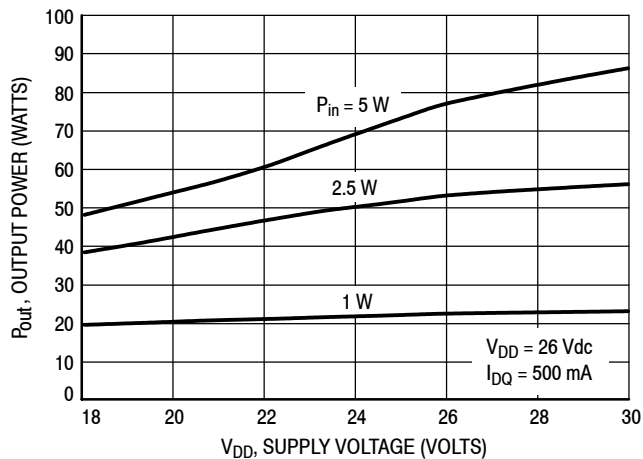


Figure 6. Output Power versus Supply Voltage

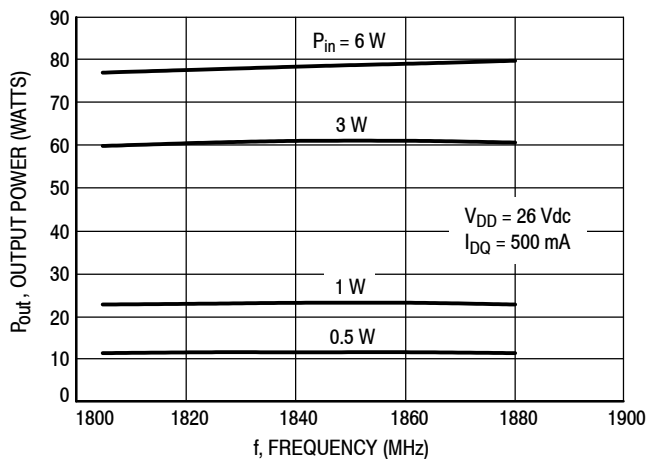


Figure 7. Output Power versus Frequency

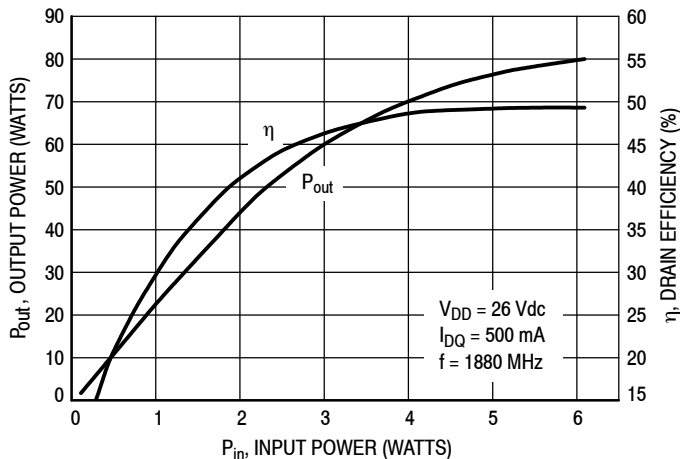


Figure 8. Output Power and Efficiency versus Input Power

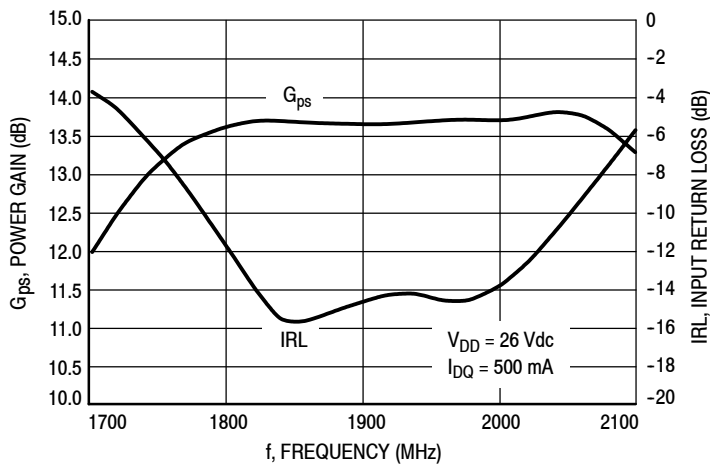
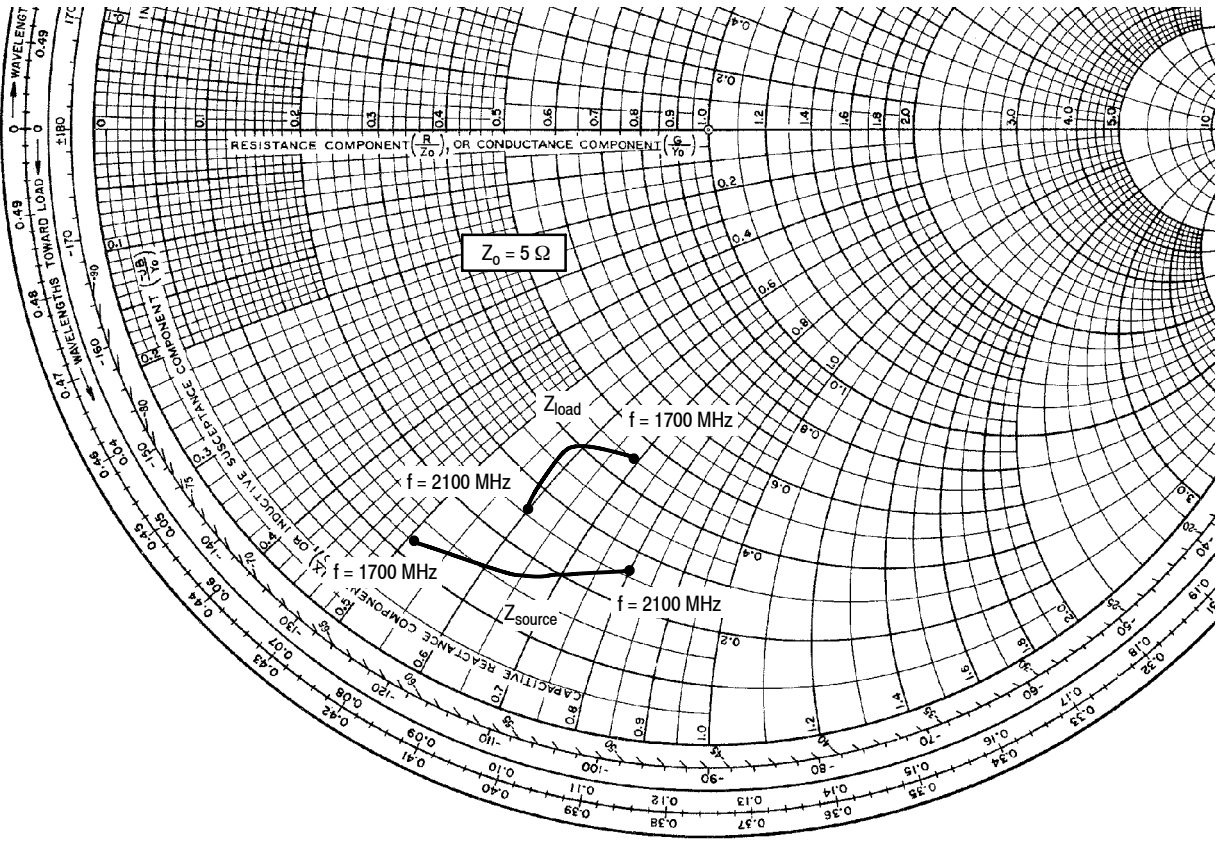


Figure 9. Wideband Gain and IRL (at Small Signal)

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

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.

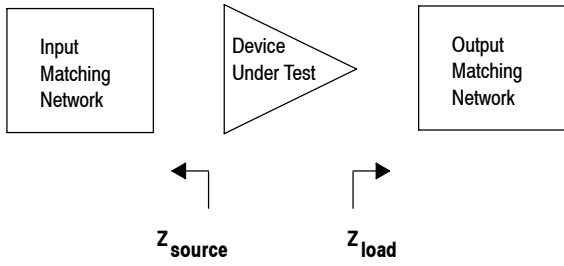


Figure 10. Series Equivalent Source and Load Impedance

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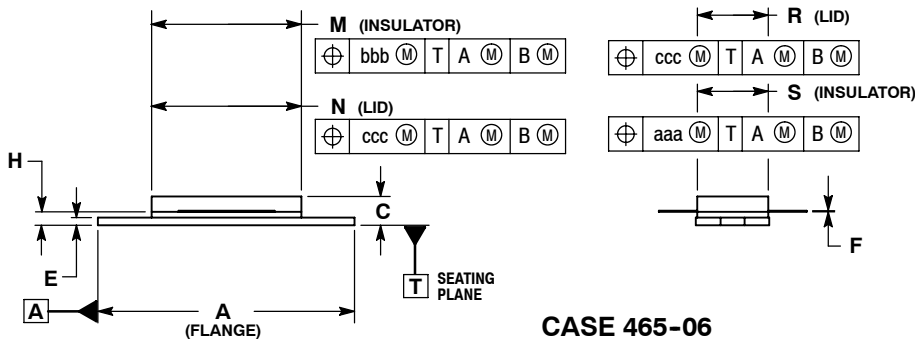
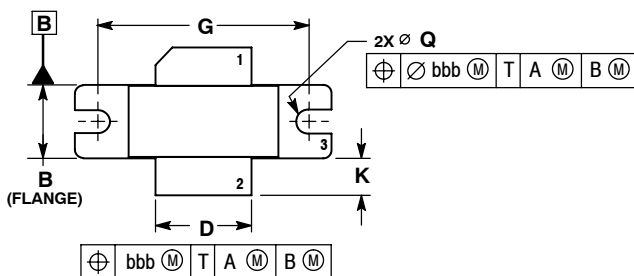
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### PACKAGE DIMENSIONS



**CASE 465-06  
ISSUE G  
NI-780  
MRF18060ALR3**

**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.

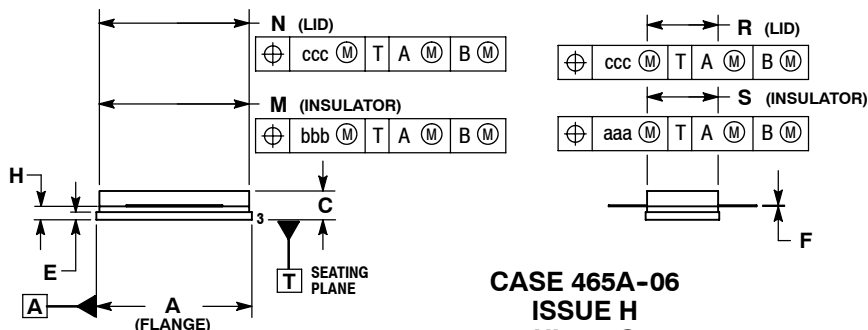
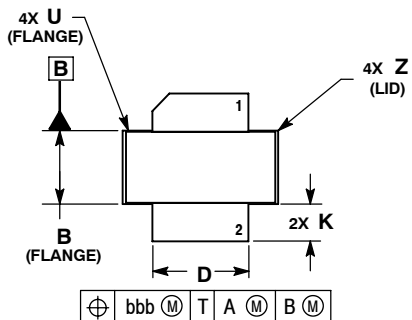
DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.335	1.345	33.91	34.16
B	0.380	0.390	9.65	9.91
C	0.125	0.170	3.18	4.32
D	0.495	0.505	12.57	12.83
E	0.035	0.045	0.89	1.14
F	0.003	0.006	0.08	0.15
G	1.100 BSC 27.94			
H	0.057	0.067	1.45	1.70
K	0.170	0.210	4.32	5.33
M	0.774	0.786	19.66	19.96
N	0.772	0.788	19.60	20.00
Q	Ø.118	Ø.138	Ø.300	Ø.351
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

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**CASE 465A-06  
ISSUE H  
NI-780S  
MRF18060ALSR3**

**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

## REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
9	Dec. 2010	<ul style="list-style-type: none"> <li>• MRF18060A Rev. 9 data sheet archived. Data sheet split due to change in part life cycle. See MRF18060A-1 Rev. 10 for MRF18060ALSR3 and MRF18060A-2 Rev. 11 for MRF18030ALR3.</li> </ul>

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Freescale Semiconductor  
Technical Information Center, CH370  
1300 N. Alma School Road  
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+1-800-521-6274 or +1-480-768-2130  
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**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

**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

**Asia/Pacific:**  
Freescale Semiconductor Hong Kong Ltd.  
Technical Information Center  
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