

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.

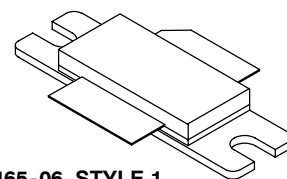
- GSM Performance, Full Frequency Band (1930 - 1990 MHz)
Power Gain — 13 dB (Typ) @ 60 Watts CW
Efficiency — 45% (Typ) @ 60 Watts CW
- Capable of Handling 10:1 VSWR, @ 26 Vdc, 1960 MHz, 60 Watts CW Output Power

Features

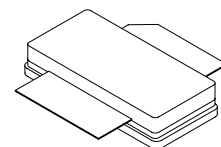
- Internally Matched for Ease of Use
- High Gain, High Efficiency and High Linearity
- Integrated ESD Protection
- Designed for Maximum Gain and Insertion Phase Flatness
- Excellent Thermal Stability
- Available with Low Gold Plating Thickness on Leads. L Suffix Indicates 40μ" Nominal.
- RoHS Compliant
- 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

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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 |

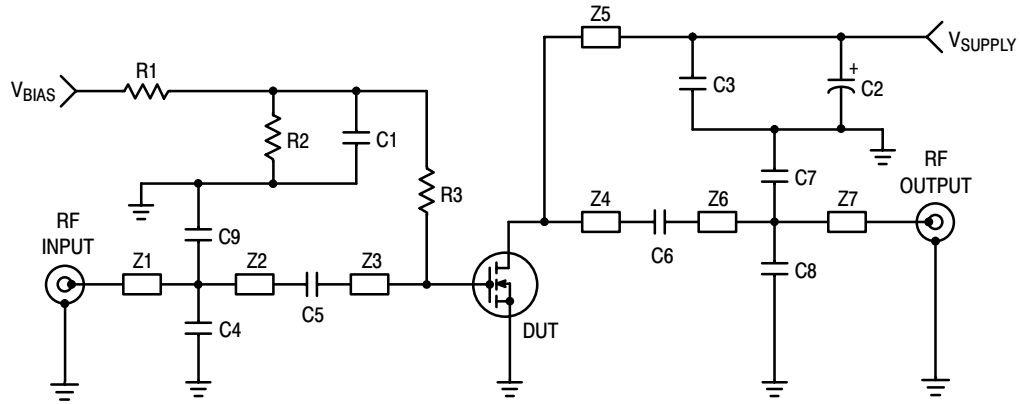
Table 3. ESD Protection Characteristics

| 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)

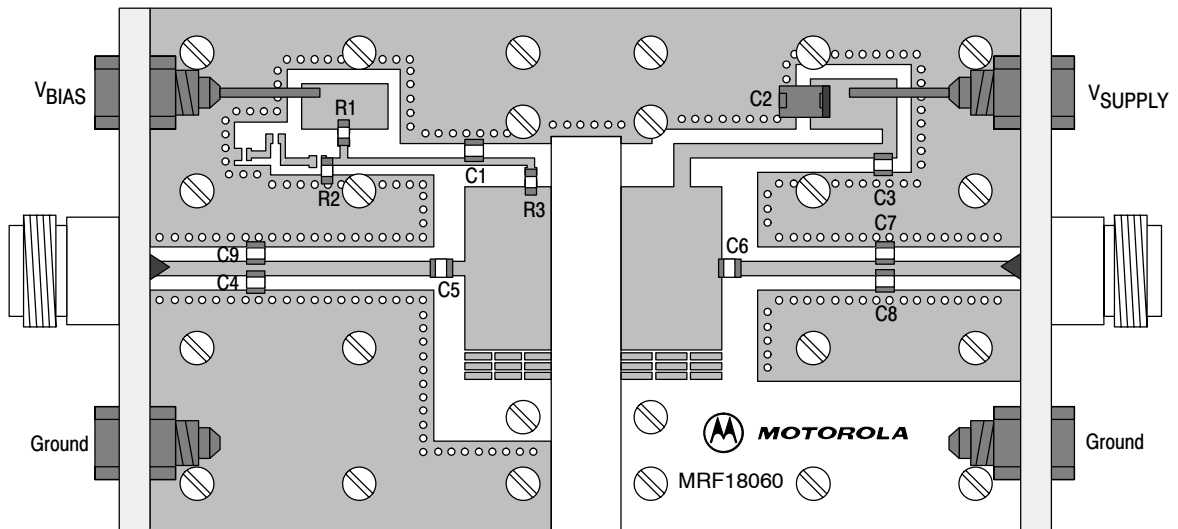
| Characteristic | Symbol | Min | Typ | Max | Unit |
|--|---------------|------|------|-----|-----------------|
| Off Characteristics | | | | | |
| Drain-Source Breakdown Voltage ($V_{GS} = 0\text{ Vdc}$, $I_D = 10\ \mu\text{Adc}$) | $V_{(BR)DSS}$ | 65 | — | — | Vdc |
| Zero Gate Voltage Drain Current ($V_{DS} = 26\text{ Vdc}$, $V_{GS} = 0\text{ Vdc}$) | I_{DSS} | — | — | 6 | μAdc |
| Gate-Source Leakage Current ($V_{GS} = 5\text{ Vdc}$, $V_{DS} = 0\text{ Vdc}$) | I_{GSS} | — | — | 1 | μAdc |
| On Characteristics | | | | | |
| 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 |
| Dynamic Characteristics | | | | | |
| 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 |
| Functional Tests (In Freescale Test Fixture, 50 ohm system) | | | | | |
| Common-Source Amplifier Power Gain @ 60 W ⁽²⁾ ($V_{DD} = 26\text{ Vdc}$, $I_{DQ} = 500\ \text{mA}$, $f = 1930 - 1990\ \text{MHz}$) | G_{ps} | 11.5 | 13 | — | dB |
| Drain Efficiency @ 60 W ⁽²⁾ ($V_{DD} = 26\text{ Vdc}$, $I_{DQ} = 500\ \text{mA}$, $f = 1930 - 1990\ \text{MHz}$) | η | 40 | 45 | — | % |
| Input Return Loss ⁽²⁾ ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 60\ \text{W CW}$, $I_{DQ} = 500\ \text{mA}$, $f = 1930 - 1990\ \text{MHz}$) | 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 GSM1900 band, ensuring batch-to-batch consistency.



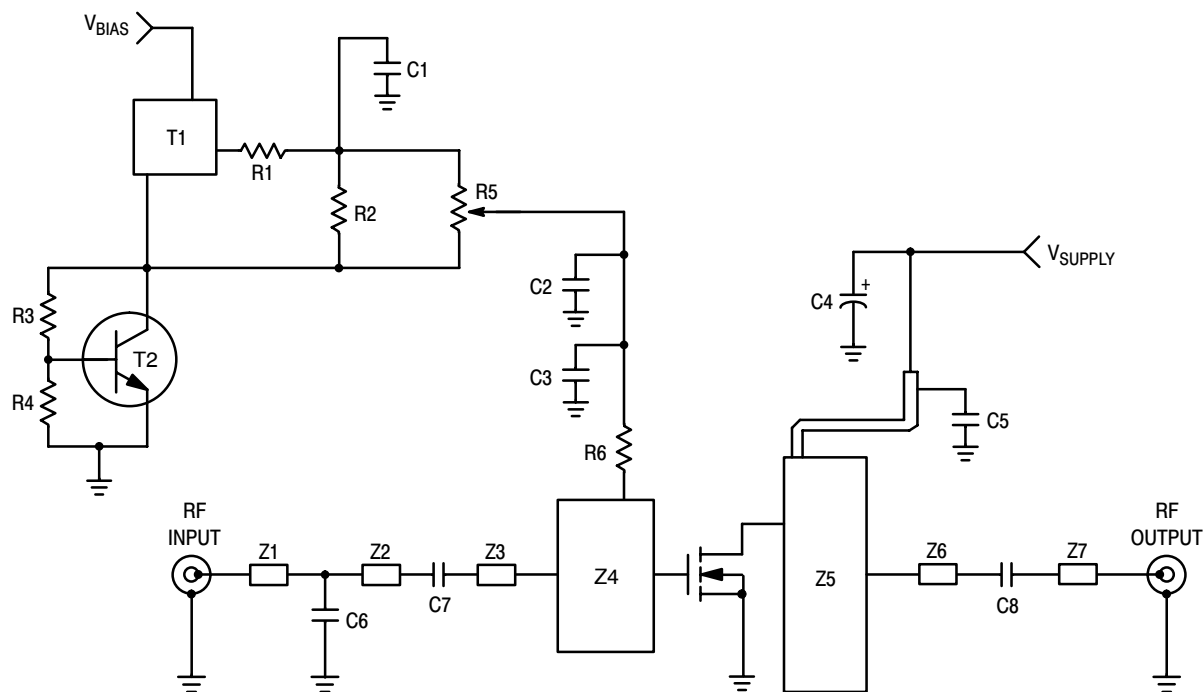
| | | | |
|--------|--|-----|---------------------------|
| C1, C3 | 10 pF, 100B Chip Capacitors | Z1 | 0.60" x 0.09" Microstrip |
| C2 | 10 μ F, 35 V Electrolytic Tantalum Capacitor | Z2 | 1.00" x 0.09" Microstrip |
| C4, C8 | 1.2 pF, 100B Chip Capacitors | Z3 | 0.51" x 0.94" Microstrip |
| C5 | 1.0 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 Ω Chip Resistors (0805) | Z7 | 0.79" x 0.09" Microstrip |
| R3 | 1.0 k Ω Chip Resistor (0805) | PCB | Teflon [®] Glass |

Figure 1. 1930 - 1990 MHz Test Fixture Schematic



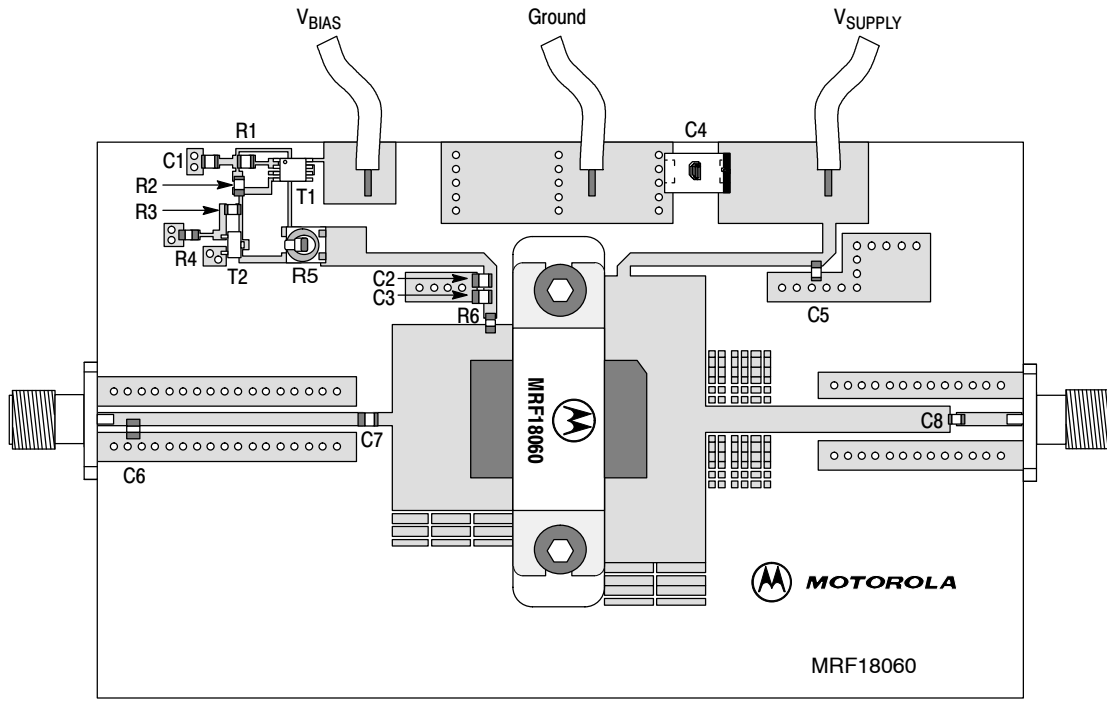
Freescale has begun the transition of marking Printed Circuit Boards (PCBs) with the Freescale Semiconductor signature/logo. PCBs may have either Motorola or Freescale markings during the transition period. These changes will have no impact on form, fit or function of the current product.

Figure 2. 1930 - 1990 MHz Test Fixture Component Layout



| | | | |
|------------|--|---|----------------------------------|
| C1 | 1 μ 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 μ 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 Ω Chip Resistor (0805) | Z5 | 0.433" x 1.220" Microstrip |
| R2, R6 | 1 k Ω Chip Resistors (0805) | Z6 | 1.039" x 0.118" Microstrip |
| R3 | 1.2 k Ω Chip Resistor (0805) | Z7 | 0.268" x 0.055" Microstrip |
| R4 | 2.2 k Ω Chip Resistor (0805) | Substrate = 0.5 mm Teflon [®] Glass, $\epsilon_r = 2.55$ | |
| R5 | 5 k Ω , 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)

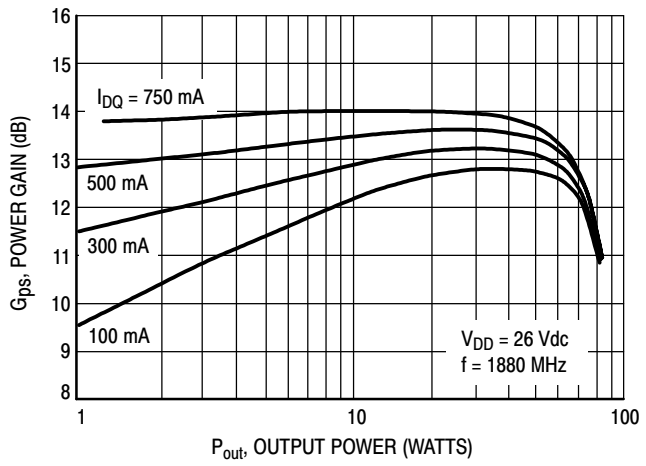


Figure 5. Power Gain versus Output Power

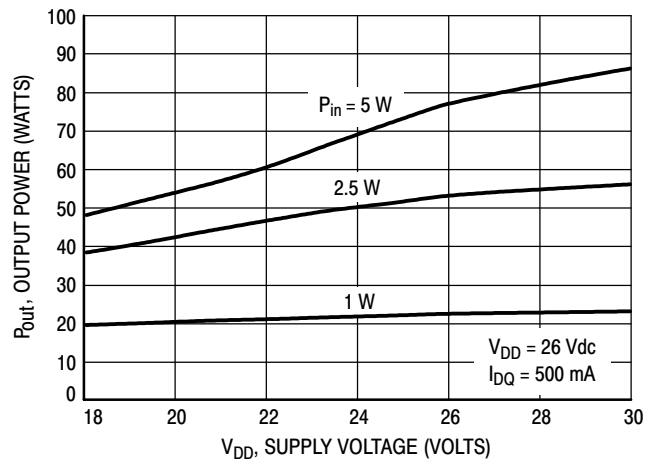


Figure 6. Output Power versus Supply Voltage

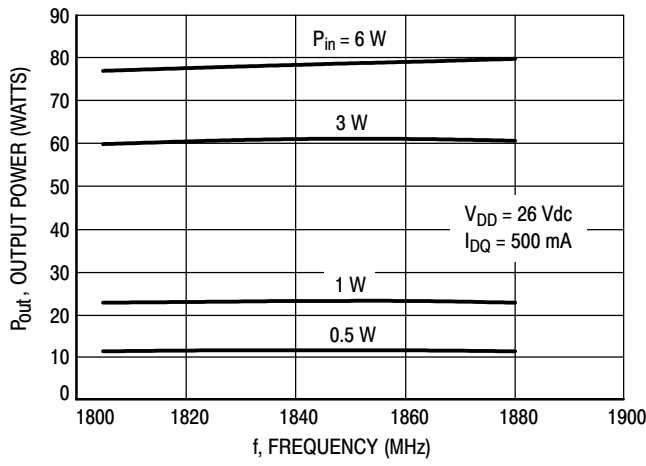


Figure 7. Output Power versus Frequency

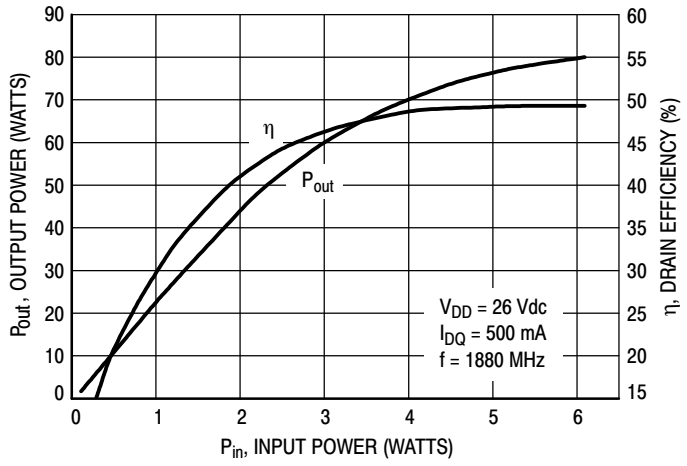


Figure 8. Output Power and Efficiency versus Input Power

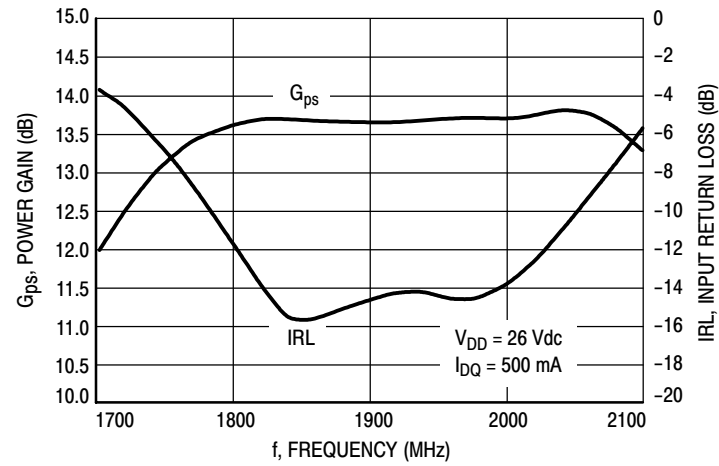
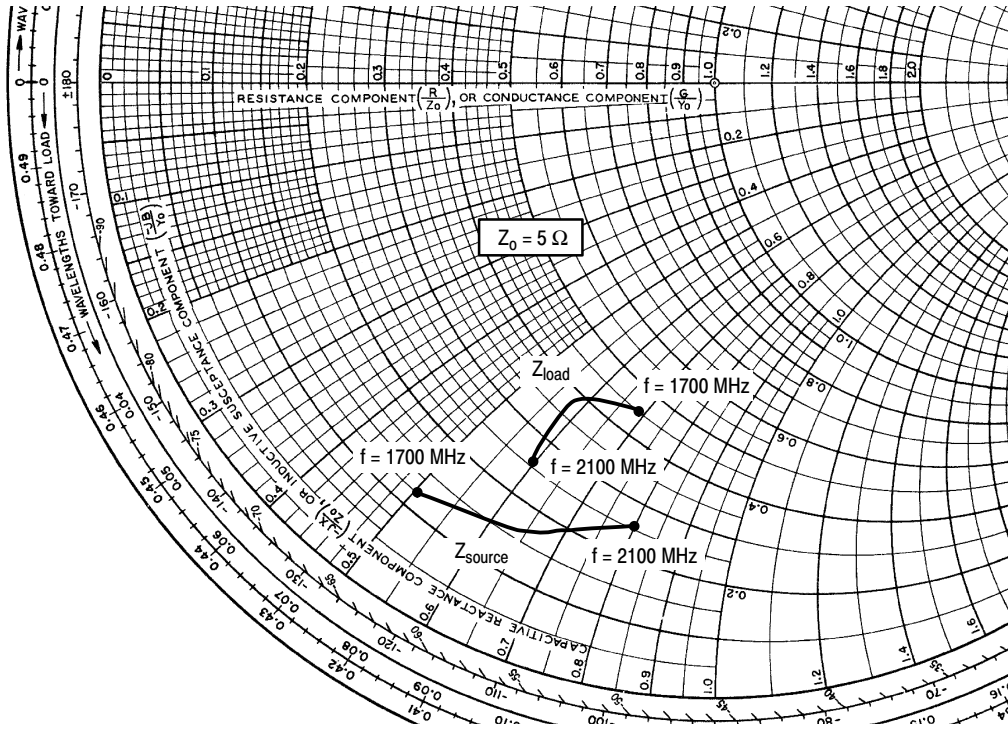


Figure 9. Wideband Gain and IRL (at Small Signal)

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

| f MHz | Z_{source} Ω | Z_{load} Ω |
|----------|--------------------------|------------------------|
| 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.

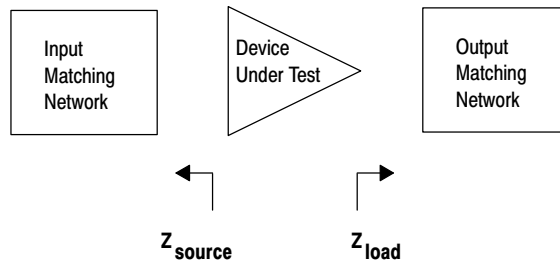


Figure 10. Series Equivalent Source and Load Impedance

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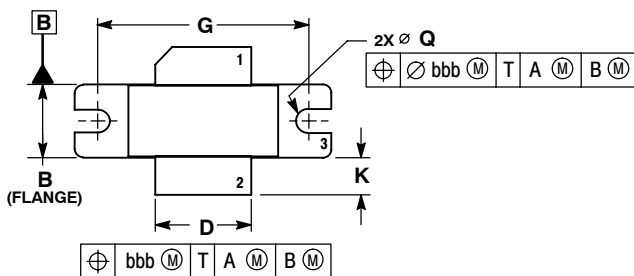
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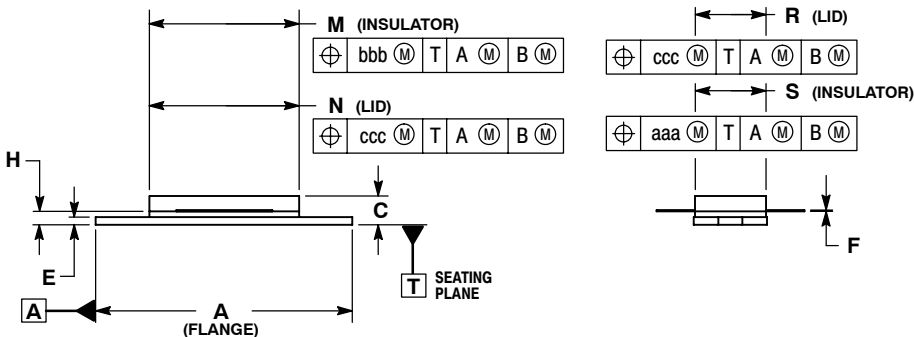
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PACKAGE DIMENSIONS



- 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 | |

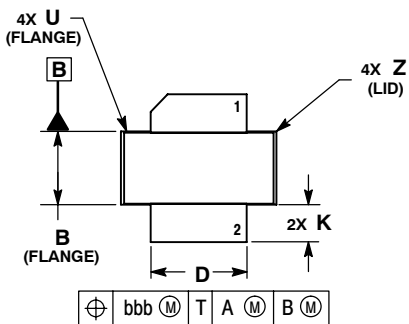


- STYLE 1:
 PIN 1. DRAIN
 2. GATE
 3. SOURCE

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

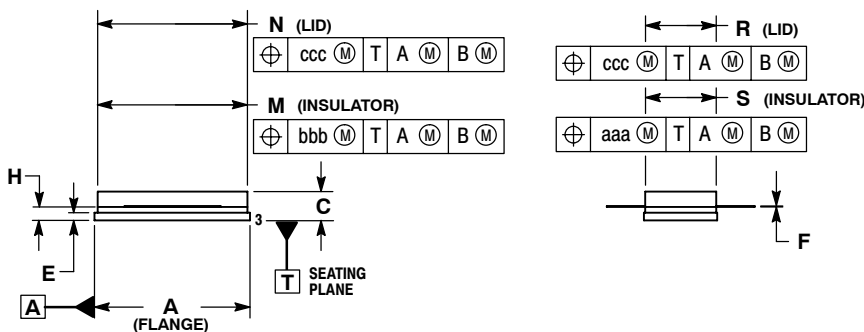
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| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.805 | 0.815 | 20.45 | 20.70 |
| B | 0.380 | 0.390 | 9.65 | 9.91 |
| C | 0.125 | 0.170 | 3.18 | 4.32 |
| D | 0.495 | 0.505 | 12.57 | 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**

How to Reach Us:

Home Page:
www.freescale.com

E-mail:
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

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
2 Dai King Street
Tai Po Industrial Estate
Tai Po, N.T., Hong Kong
+800 2666 8080
support.asia@freescale.com

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