



RF Power Field Effect Transistors

N-Channel Enhancement-Mode Lateral MOSFETs

Designed for PCN and PCS base station applications with frequencies from 1900 to 2000 MHz. Suitable for CDMA, TDMA, GSM and multicarrier amplifier applications.

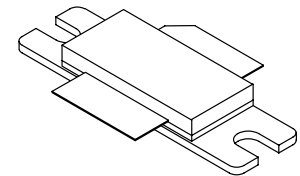
- Typical CDMA Performance: 1960 MHz, 26 Volts
 IS-95 CDMA Pilot, Sync, Paging, Traffic Codes 8 Through 13
 Output Power — 7.5 Watts
 Power Gain — 12.5 dB
 Adjacent Channel Power —
 885 kHz: -47 dBc @ 30 kHz BW
 1.25 MHz: -55 dBc @ 12.5 kHz BW
 2.25 MHz: -55 dBc @ 1 MHz BW
- Capable of Handling 10:1 VSWR, @ 26 Vdc, 1960 MHz, 60 Watts CW Output Power

Features

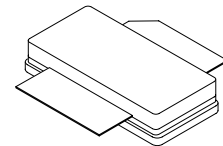
- Internally Matched for Ease of Use
- High Gain, High Efficiency and High Linearity
- Integrated ESD Protection
- Designed for Maximum Gain and Insertion Phase Flatness
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Available with Low Gold Plating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

MRF19060LR3
MRF19060LSR3

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



CASE 465-06, STYLE 1
NI-780
MRF19060LR3



CASE 465A-06, STYLE 1
NI-780S
MRF19060LSR3

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 |

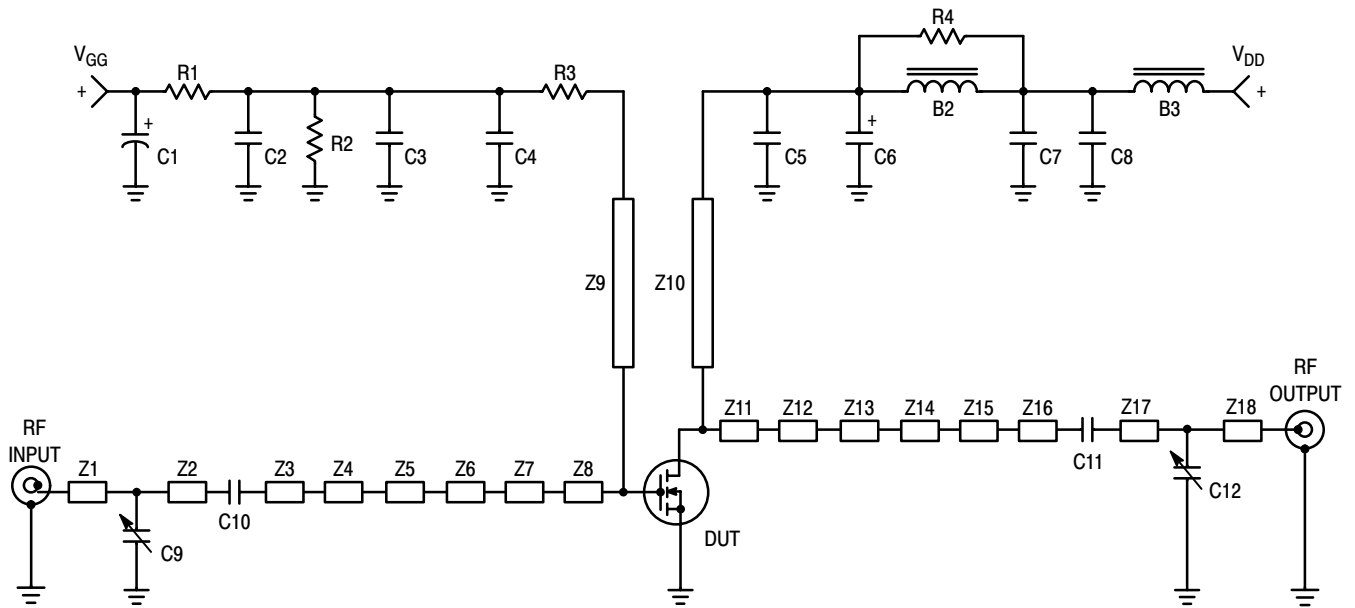
Table 3. ESD Protection Characteristics

| Test Conditions | Class |
|------------------|--------------|
| Human Body Model | 1 (Minimum) |
| Machine Model | M3 (Minimum) |

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

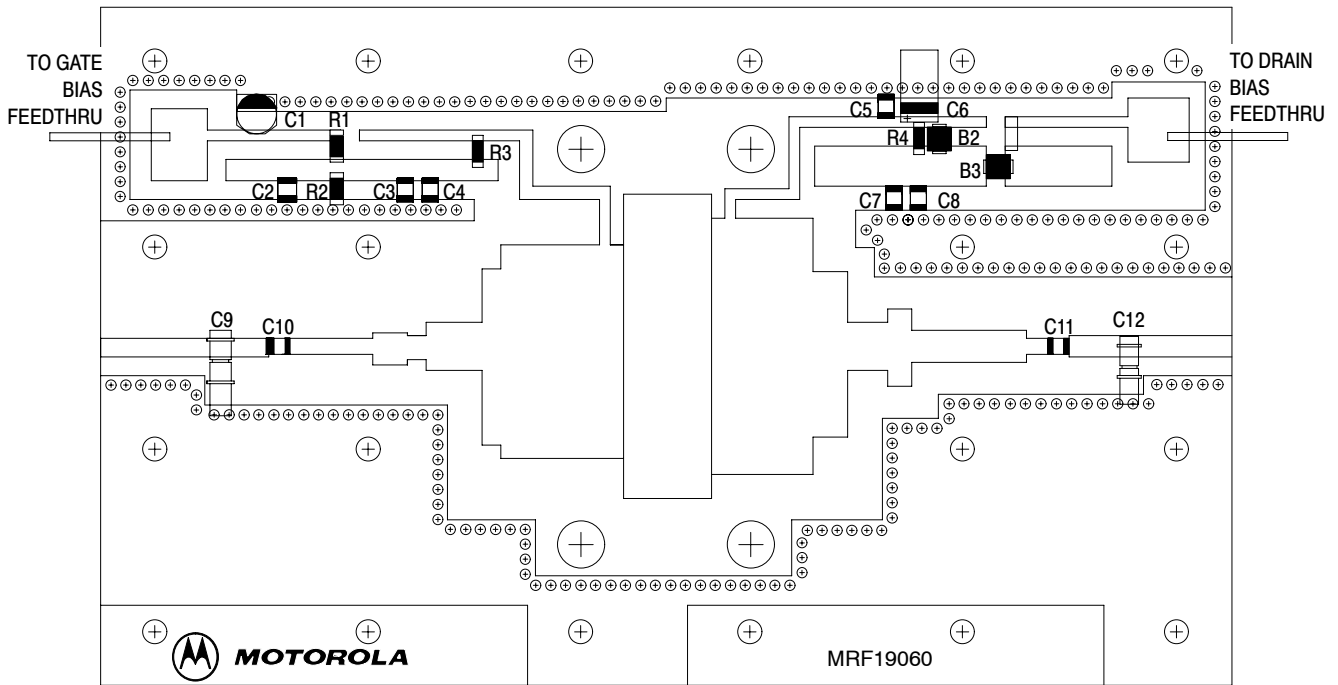
| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---------------|-----|------|-----|-----------------|
| Off Characteristics | | | | | |
| Drain-Source Breakdown Voltage ($V_{GS} = 0\text{ Vdc}$, $I_D = 10\ \mu\text{Adc}$) | $V_{(BR)DSS}$ | 65 | — | — | Vdc |
| Zero Gate Voltage Drain Current ($V_{DS} = 26\text{ Vdc}$, $V_{GS} = 0\text{ Vdc}$) | 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 | V |
| Gate Quiescent Voltage ($V_{DS} = 26\text{ Vdc}$, $I_D = 500\text{ mAdc}$) | $V_{GS(Q)}$ | 2.5 | 3.9 | 4.5 | V |
| Drain-Source On-Voltage ($V_{GS} = 10\text{ Vdc}$, $I_D = 2\text{ Adc}$) | $V_{DS(on)}$ | — | 0.27 | — | V |
| Dynamic Characteristics | | | | | |
| Reverse Transfer Capacitance (1) ($V_{DS} = 26\text{ Vdc}$, $V_{GS} = 0$, $f = 1\text{ MHz}$) | C_{rss} | — | 2.7 | — | pF |
| Functional Tests (In Freescale Test Fixture, 50 ohm system) | | | | | |
| Two-Tone Common-Source Amplifier Power Gain ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 60\text{ W PEP}$, $I_{DQ} = 500\text{ mA}$, $f = 1930\text{ MHz}$ and 1990 MHz , Tone Spacing = 100 kHz) | G_{ps} | 11 | 12.5 | — | dB |
| Two-Tone Drain Efficiency ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 60\text{ W PEP}$, $I_{DQ} = 500\text{ mA}$, $f = 1930\text{ MHz}$ and 1990 MHz , Tone Spacing = 100 kHz) | η | 33 | 36 | — | % |
| 3rd Order Intermodulation Distortion ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 60\text{ W PEP}$, $I_{DQ} = 500\text{ mA}$, $f = 1930\text{ MHz}$ and 1990 MHz , Tone Spacing = 100 kHz) | IMD | — | -31 | -28 | dBc |
| Input Return Loss ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 60\text{ W PEP}$, $I_{DQ} = 500\text{ mA}$, $f = 1930\text{ MHz}$ and 1990 MHz , Tone Spacing = 100 kHz) | IRL | — | -12 | — | dB |
| P_{out} 1 dB Compression Point ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 60\text{ W CW}$, $f = 1990\text{ MHz}$) | P1dB | — | 60 | — | W |

1. Part is internally matched both on input and output.



| | | | |
|----------|---|-------|---|
| B2 - B3 | Ferrite Beads, Fair Rite, 2743019447 | Z4 | 0.152" x 0.140" Microstrip |
| C1 | 10 μ F, 50 V Electrolytic Capacitor, Panasonic #ECEV1HV100R | Z5 | 0.090" x 0.102" Microstrip |
| C2, C7 | 1000 pF Chip Capacitors, ATC #100B102JCA500X | Z6 | 0.245" x 0.217" Microstrip |
| C3, C8 | 0.10 μ F Chip Capacitors, Kemet #CDR33BX104AKWS | Z7 | 0.090" x 0.737" Microstrip |
| C4 | 5.1 pF Chip Capacitor, ATC #100B5R1JCA500X | Z8 | 0.530" x 0.941" Microstrip |
| C5 | 6.2 pF Chip Capacitor, ATC #100B6R2JCA500X | Z9 | 1.010" x 0.050" Microstrip |
| C6 | 22 μ F, 35 V Tantalum Capacitor, SMT, Sprague | Z10 | 1.060" x 0.050" Microstrip |
| C9 | 0.8 pF - 8.0 pF Variable Capacitor, Johanson Gigatrim | Z11 | 0.446" x 1.137" Microstrip |
| C10, C11 | 10 pF Chip Capacitors, ATC #100B100JCA500X | Z12 | 0.152" x 0.567" Microstrip |
| C12 | 0.4 pF - 2.5 pF Variable Capacitor, Johanson Gigatrim | Z13 | 0.183" x 0.220" Microstrip |
| R1 | 1 k Ω , 1/4 W Fixed Film Chip Resistor, 0.08" x 0.13" | Z14 | 0.100" x 0.338" Microstrip |
| R2 | 560 k Ω , 1/4 W Fixed Film Chip Resistor, 0.08" x 0.13" | Z15 | 0.480" x 0.142" Microstrip |
| R3 | 15 Ω , 1/4 W Fixed Film Chip Resistor, 0.08" x 0.13" | Z16 | 0.140" x 0.080" Microstrip |
| R4 | 10 Ω , 1/4 W Fixed Film Chip Resistor, 0.08" x 0.13" | Z17 | 0.173" x 0.080" Microstrip |
| Z1 | 0.580" x 0.074" Microstrip | Z18 | 0.420" x 0.080" Microstrip |
| Z2 | 0.100" x 0.074" Microstrip | Board | 0.030" Glass Teflon [®] Arlon GX-0300-55-22, 2 oz Cu |
| Z3 | 0.384" x 0.074" Microstrip | | |

Figure 1. MRF19060L Test Circuit 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. MRF19060L Test Circuit Component Layout

TYPICAL CHARACTERISTICS

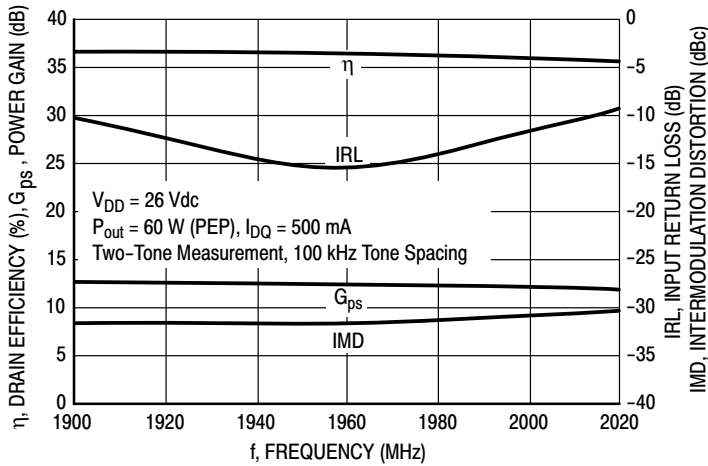


Figure 3. Class AB Broadband Circuit Performance

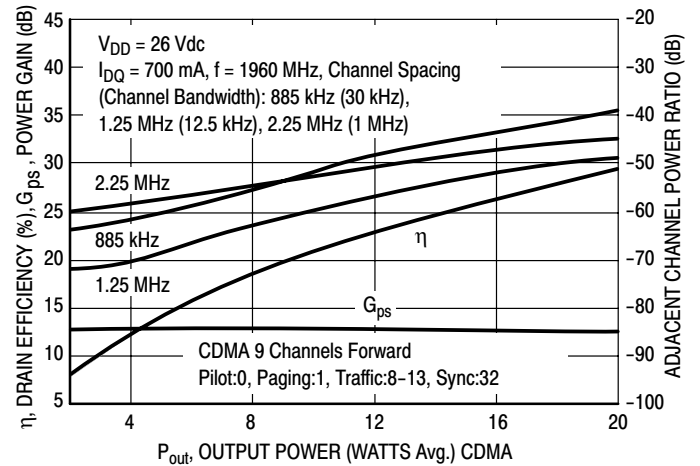


Figure 4. CDMA ACPR, Power Gain and Drain Efficiency versus Output Power

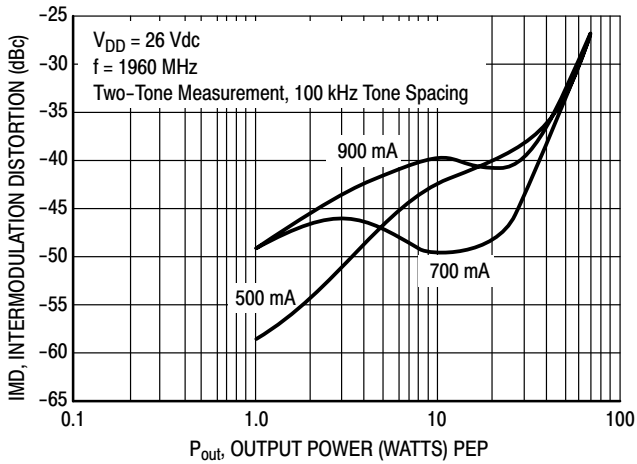


Figure 5. Intermodulation Distortion versus Output Power

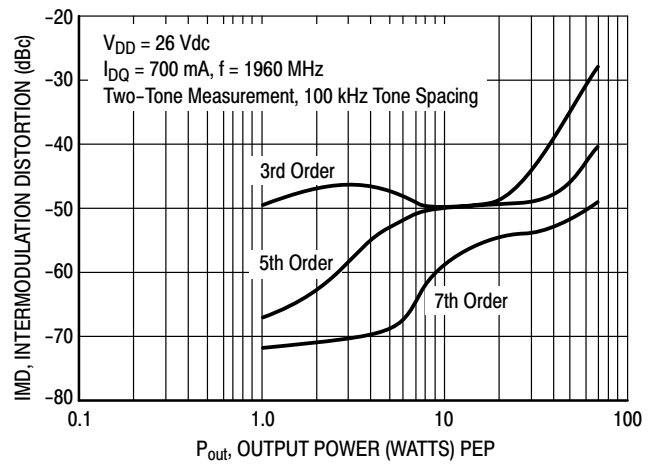


Figure 6. Intermodulation Products versus Output Power

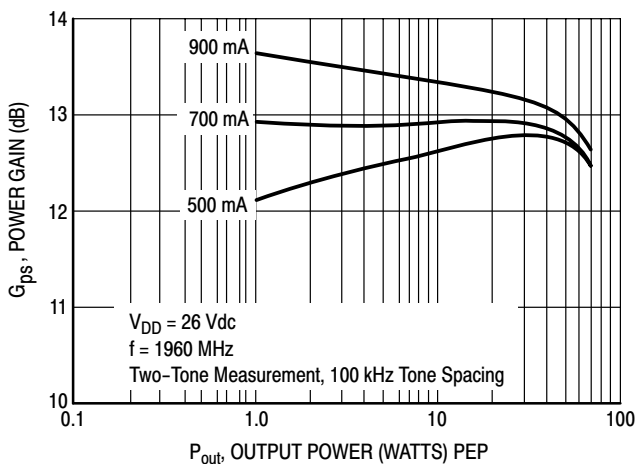


Figure 7. Power Gain versus Output Power

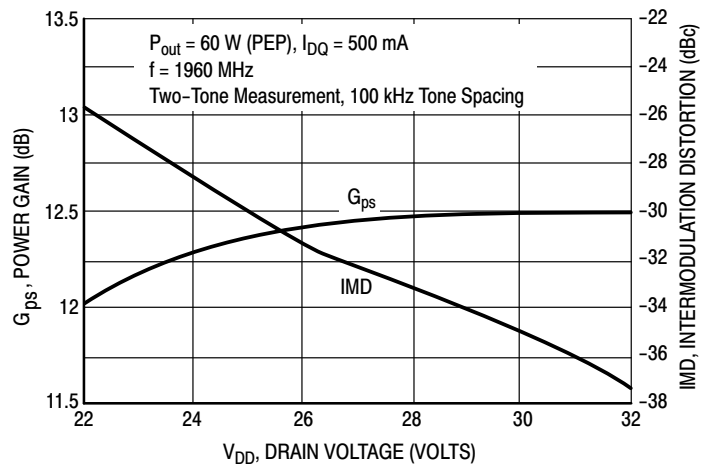
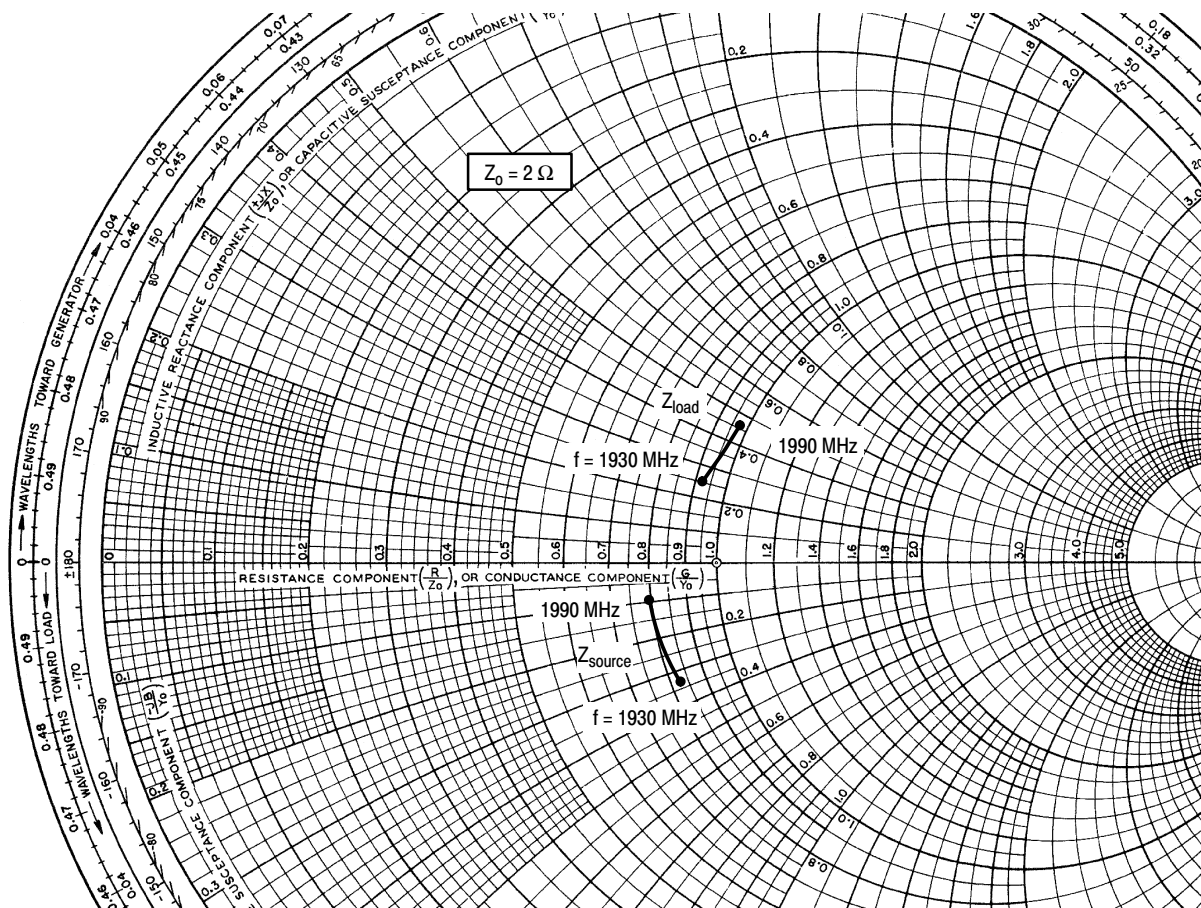


Figure 8. Power Gain and Intermodulation Distortion versus Supply Voltage



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

| f MHz | Z_{source} Ω | Z_{load} Ω |
|----------|--------------------------|------------------------|
| 1930 | $1.65 - j0.67$ | $1.85 + j0.50$ |
| 1960 | $1.64 - j0.45$ | $1.89 + j0.74$ |
| 1990 | $1.60 - j0.20$ | $1.96 + j0.94$ |

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

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

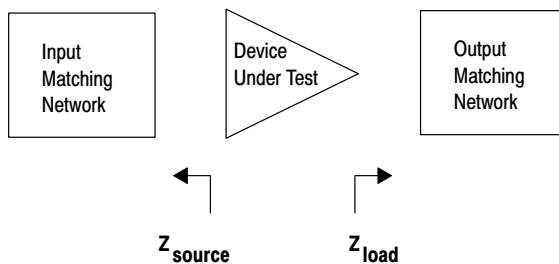
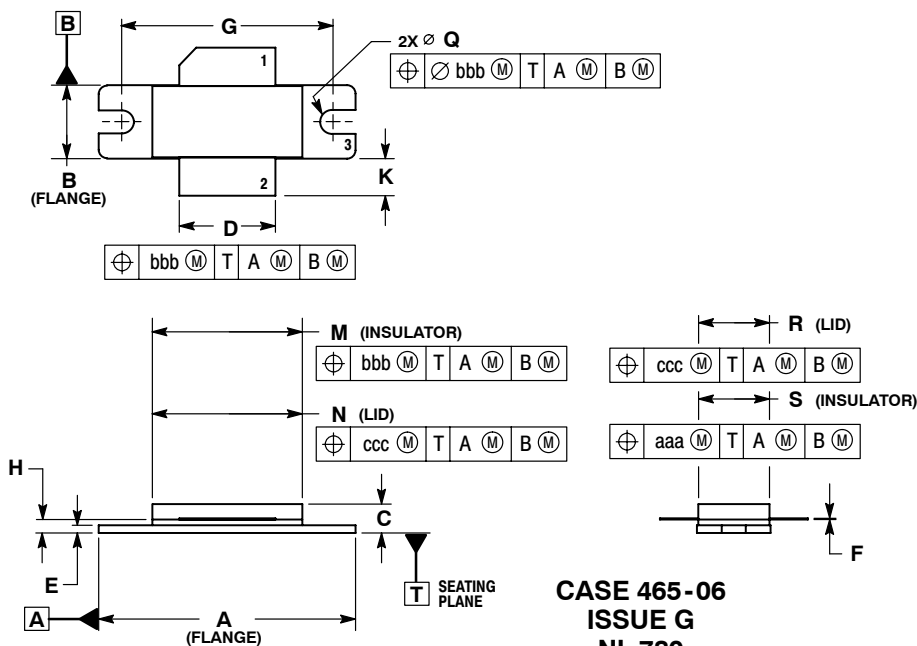


Figure 9. Series Equivalent Source and Load Impedance

PACKAGE DIMENSIONS

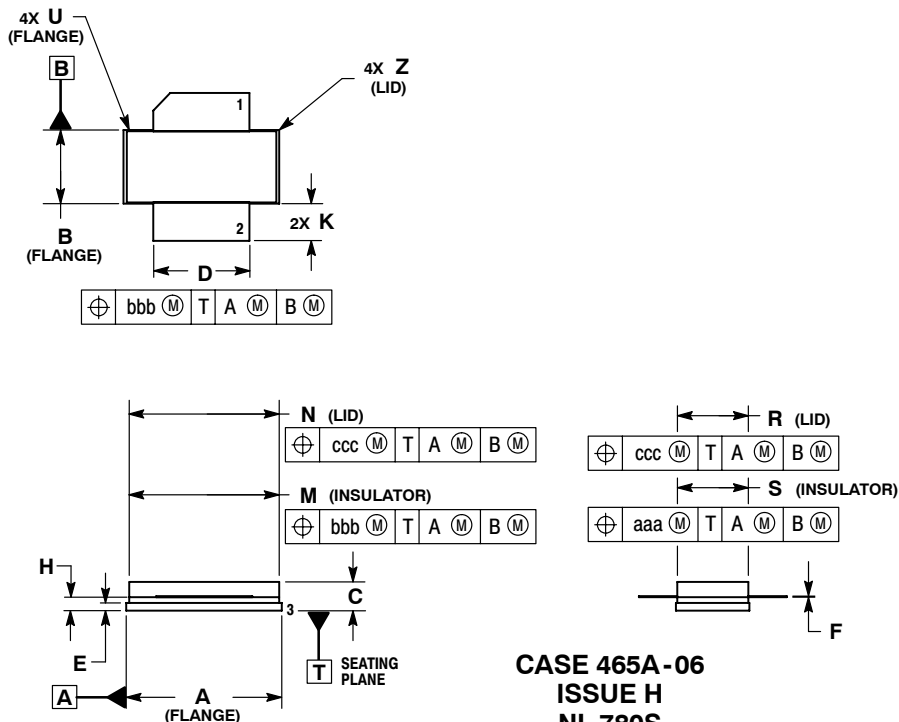


**CASE 465-06
ISSUE G
NI-780
MRF19060LR3**

- 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 465A-06
ISSUE H
NI-780S
MRF19060LSR3**

- 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

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