



RF Power Field Effect Transistors

N-Channel Enhancement-Mode Lateral MOSFETs

Designed for class AB PCN and PCS base station applications with frequencies from 1800 to 2000 MHz. Suitable for FM, TDMA, CDMA and multicarrier amplifier applications.

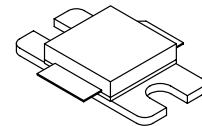
- CDMA Performance @ 1990 MHz, 26 Volts
 IS-95 CDMA Pilot, Sync, Paging, Traffic Codes 8 Thru 13
 885 kHz — -47 dBc in 30 kHz BW
 1.25 MHz — -55 dBc in 12.5 kHz BW
 2.25 MHz — -55 dBc in 1 MHz BW
 Output Power — 4.5 Watts Avg.
 Power Gain — 13.5 dB
 Efficiency — 17%
- Capable of Handling 10:1 VSWR, @ 26 Vdc, 1960 MHz, 30 Watts CW Output Power

Features

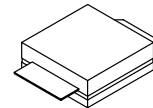
- Internally Matched for Ease of Use
- High Gain, High Efficiency and High Linearity
- Integrated ESD Protection
- Designed for Maximum Gain and Insertion Phase Flatness
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Low Gold Plating Thickness on Leads, 40μ" Nominal.
- RoHS Compliant
- In Tape and Reel. R3 Suffix = 250 Units per 32 mm, 13 Inch Reel.

MRF19030LR3
MRF19030LSR3

1930-1990 MHz, 30 W, 26 V
LATERAL N-CHANNEL
RF POWER MOSFETs



CASE 465E-04, STYLE 1
NI-400
MRF19030LR3



CASE 465F-04, STYLE 1
NI-400S
MRF19030LSR3

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 | 83.3 0.48 | 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 | $R_{\theta JC}$ | 2.1 | °C/W |

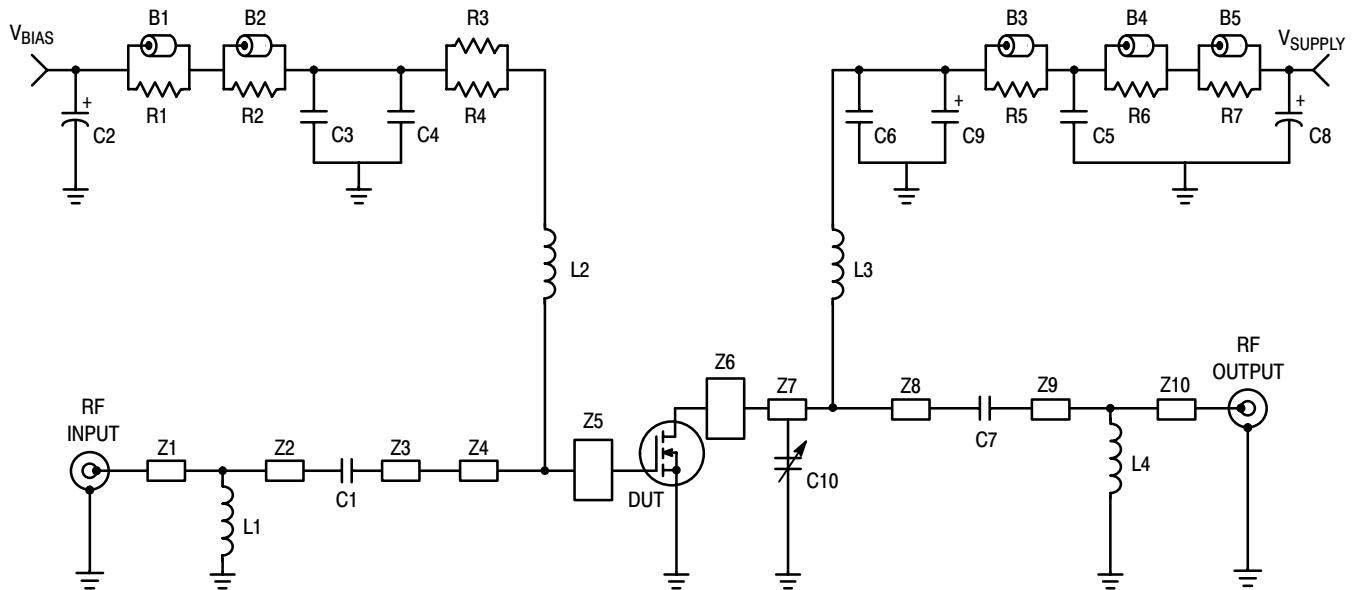
Table 3. ESD Protection Characteristics

| 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)

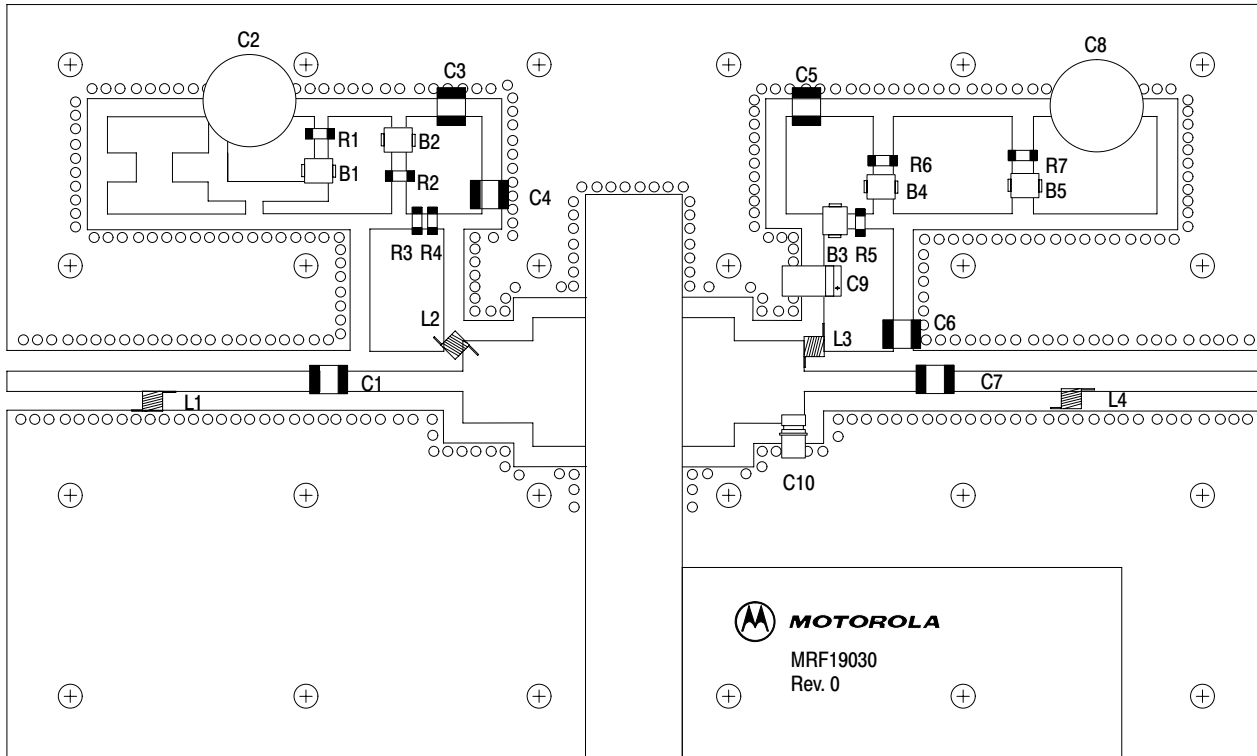
| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---------------|-----|------|-----|-----------------|
| Off Characteristics | | | | | |
| Drain-Source Breakdown Voltage ($V_{GS} = 0\text{ Vdc}$, $I_D = 20\ \mu\text{A}$) | $V_{(BR)DSS}$ | 65 | — | — | Vdc |
| Zero Gate Voltage Drain Current ($V_{DS} = 28\text{ Vdc}$, $V_{GS} = 0\text{ Vdc}$) | I_{DSS} | — | — | 1 | μAdc |
| Gate-Source Leakage Current ($V_{GS} = 5\text{ Vdc}$, $V_{DS} = 0\text{ Vdc}$) | I_{GSS} | — | — | 1 | μAdc |
| On Characteristics | | | | | |
| Gate Threshold Voltage ($V_{DS} = 10\text{ Vdc}$, $I_D = 100\ \mu\text{Adc}$) | $V_{GS(th)}$ | 2 | 3 | 4 | Vdc |
| Gate Quiescent Voltage ($V_{DS} = 28\text{ Vdc}$, $I_D = 300\text{ mA}$) | $V_{GS(Q)}$ | 2 | 3.3 | 4.5 | Vdc |
| Drain-Source On-Voltage ($V_{GS} = 10\text{ Vdc}$, $I_D = 1\text{ Adc}$) | $V_{DS(on)}$ | — | 0.29 | 0.4 | Vdc |
| Forward Transconductance ($V_{DS} = 10\text{ Vdc}$, $I_D = 1\text{ Adc}$) | g_{fs} | — | 2 | — | S |
| Dynamic Characteristics | | | | | |
| Input Capacitance (Including Input Matching Capacitor in Package) (1) ($V_{DS} = 26\text{ Vdc}$, $V_{GS} = 0$, $f = 1\text{ MHz}$) | C_{iss} | — | 98.5 | — | pF |
| Output Capacitance (1) ($V_{DS} = 26\text{ Vdc}$, $V_{GS} = 0$, $f = 1\text{ MHz}$) | C_{oss} | — | 37 | — | pF |
| Reverse Transfer Capacitance ($V_{DS} = 26\text{ Vdc}$, $V_{GS} = 0$, $f = 1\text{ MHz}$) | C_{rss} | — | 1.3 | — | pF |
| Functional Tests (In Freescale Test Fixture, 50 ohm system) | | | | | |
| Two-Tone Common-Source Amplifier Power Gain ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 30\text{ W PEP}$, $I_{DQ} = 300\text{ mA}$, $f_1 = 1960.0\text{ MHz}$, $f_2 = 1960.1\text{ MHz}$) | G_{ps} | — | 13 | — | dB |
| Two-Tone Drain Efficiency ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 30\text{ W PEP}$, $I_{DQ} = 300\text{ mA}$, $f_1 = 1960.0\text{ MHz}$, $f_2 = 1960.1\text{ MHz}$) | η | — | 36 | — | % |
| 3rd Order Intermodulation Distortion ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 30\text{ W PEP}$, $I_{DQ} = 300\text{ mA}$, $f_1 = 1960.0\text{ MHz}$, $f_2 = 1960.1\text{ MHz}$) | IMD | — | -31 | — | dBc |
| Input Return Loss ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 30\text{ W PEP}$, $I_{DQ} = 300\text{ mA}$, $f_1 = 1960.0\text{ MHz}$, $f_2 = 1960.1\text{ MHz}$) | IRL | — | -13 | — | dB |
| Two-Tone Common-Source Amplifier Power Gain ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 30\text{ W PEP}$, $I_{DQ} = 300\text{ mA}$, $f_1 = 1930.0\text{ MHz}$, $f_2 = 1930.1\text{ MHz}$ and $f_1 = 1990.0\text{ MHz}$, $f_2 = 1990.1\text{ MHz}$) | G_{ps} | 12 | 13 | — | dB |
| Two-Tone Drain Efficiency ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 30\text{ W PEP}$, $I_{DQ} = 300\text{ mA}$, $f_1 = 1930.0\text{ MHz}$, $f_2 = 1930.1\text{ MHz}$ and $f_1 = 1990.0\text{ MHz}$, $f_2 = 1990.1\text{ MHz}$) | η | 33 | 36 | — | % |
| 3rd Order Intermodulation Distortion ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 30\text{ W PEP}$, $I_{DQ} = 300\text{ mA}$, $f_1 = 1930.0\text{ MHz}$, $f_2 = 1930.1\text{ MHz}$ and $f_1 = 1990.0\text{ MHz}$, $f_2 = 1990.1\text{ MHz}$) | IMD | — | -31 | -28 | dBc |
| Input Return Loss ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 30\text{ W PEP}$, $I_{DQ} = 300\text{ mA}$, $f_1 = 1930.0\text{ MHz}$, $f_2 = 1930.1\text{ MHz}$ and $f_1 = 1990.0\text{ MHz}$, $f_2 = 1990.1\text{ MHz}$) | IRL | — | -13 | -9 | dB |

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



| | | | |
|---------|--|-----------|--|
| B1 - B5 | Short Ferrite Beads | Z3 | 0.080" x 0.480" Microstrip |
| C1, C7 | 10 pF Chip Capacitors | Z4 | 0.325" x 0.280" Microstrip |
| C2, C8 | 470 μ F, 35 V Electrolytic Capacitors | Z5 | 0.510" x 0.200" Microstrip |
| C3, C5 | 0.1 μ F Chip Capacitors | Z6 | 0.510" x 0.200" Microstrip |
| C4, C6 | 5.1 pF Chip Capacitors | Z7 | 0.325" x 0.280" Microstrip |
| C9 | 22 μ F Tantalum Chip Capacitor | Z8 | 0.080" x 0.480" Microstrip |
| C10 | 0.4 - 2.5 pF Variable Capacitor, Johanson Gigatrim | Z9 | 0.080" x 0.530" Microstrip |
| L1 - L4 | 12.5 nH Inductors | Z10 | 0.080" x 0.671" Microstrip |
| R1 - R7 | 12 Ω Chip Resistors (0805) | Substrate | 0.030" x 3.00" x 5.00" Glass Teflon [®] , Arlon |
| Z1 | 0.080" x 0.595" Microstrip | | |
| Z2 | 0.080" x 0.600" Microstrip | | |

Figure 1. MRF19030LR3(SR3) 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. MRF19030LR3(SR3) Test Circuit Component Layout

TYPICAL CHARACTERISTICS

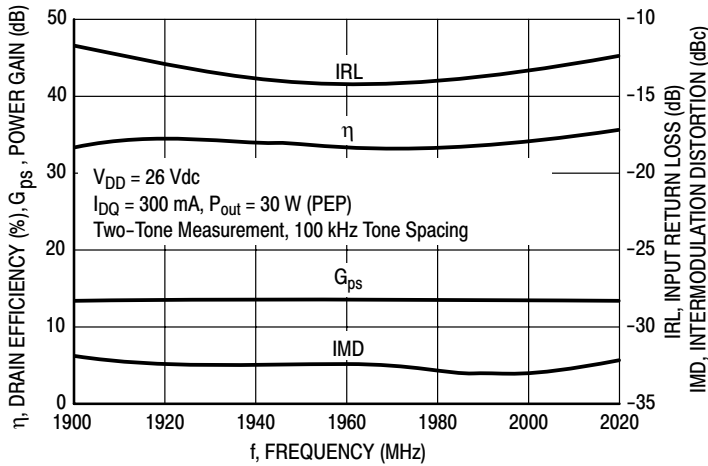


Figure 3. Class AB Broadband Circuit Performance

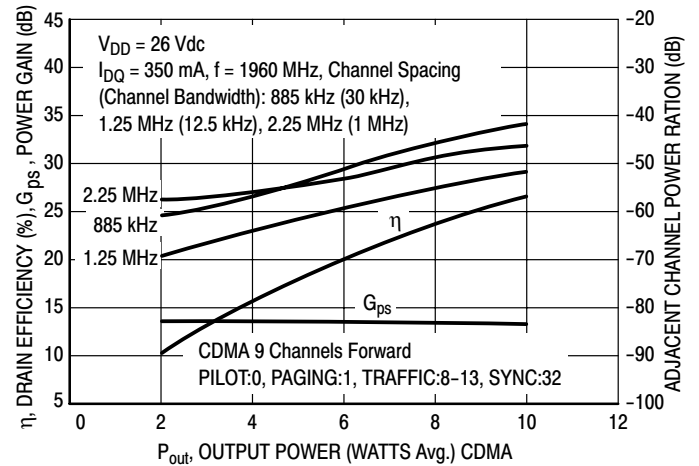


Figure 4. CDMA ACPR, Power Gain and Drain Efficiency versus Output Power

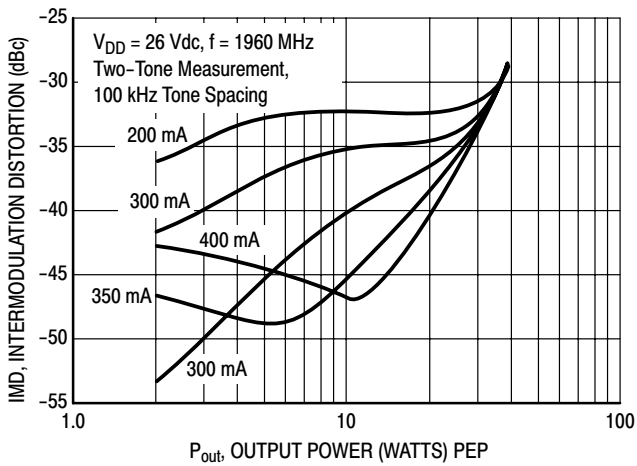


Figure 5. Intermodulation Distortion versus Output Power

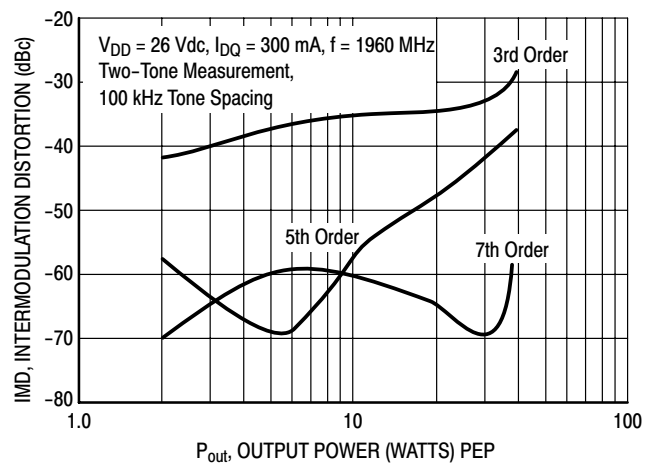


Figure 6. Intermodulation Distortion Products versus Output Power

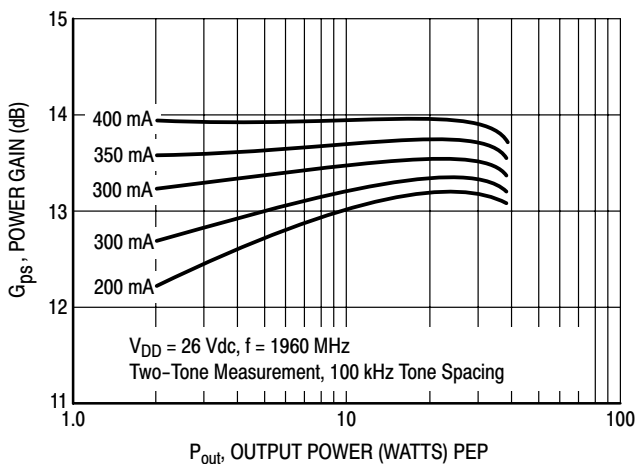


Figure 7. Power Gain versus Output Power

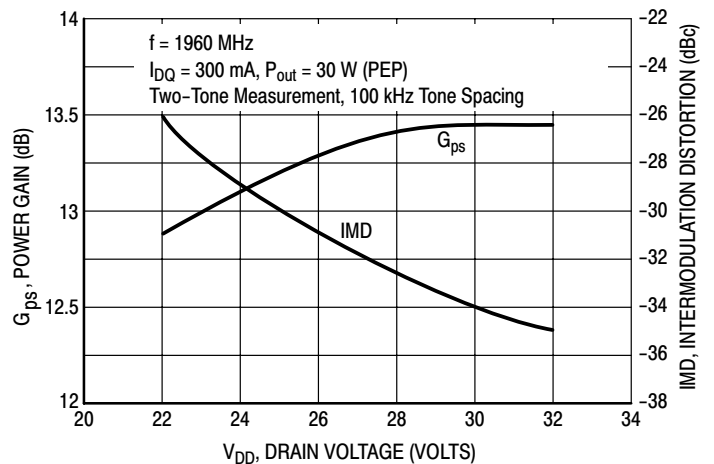
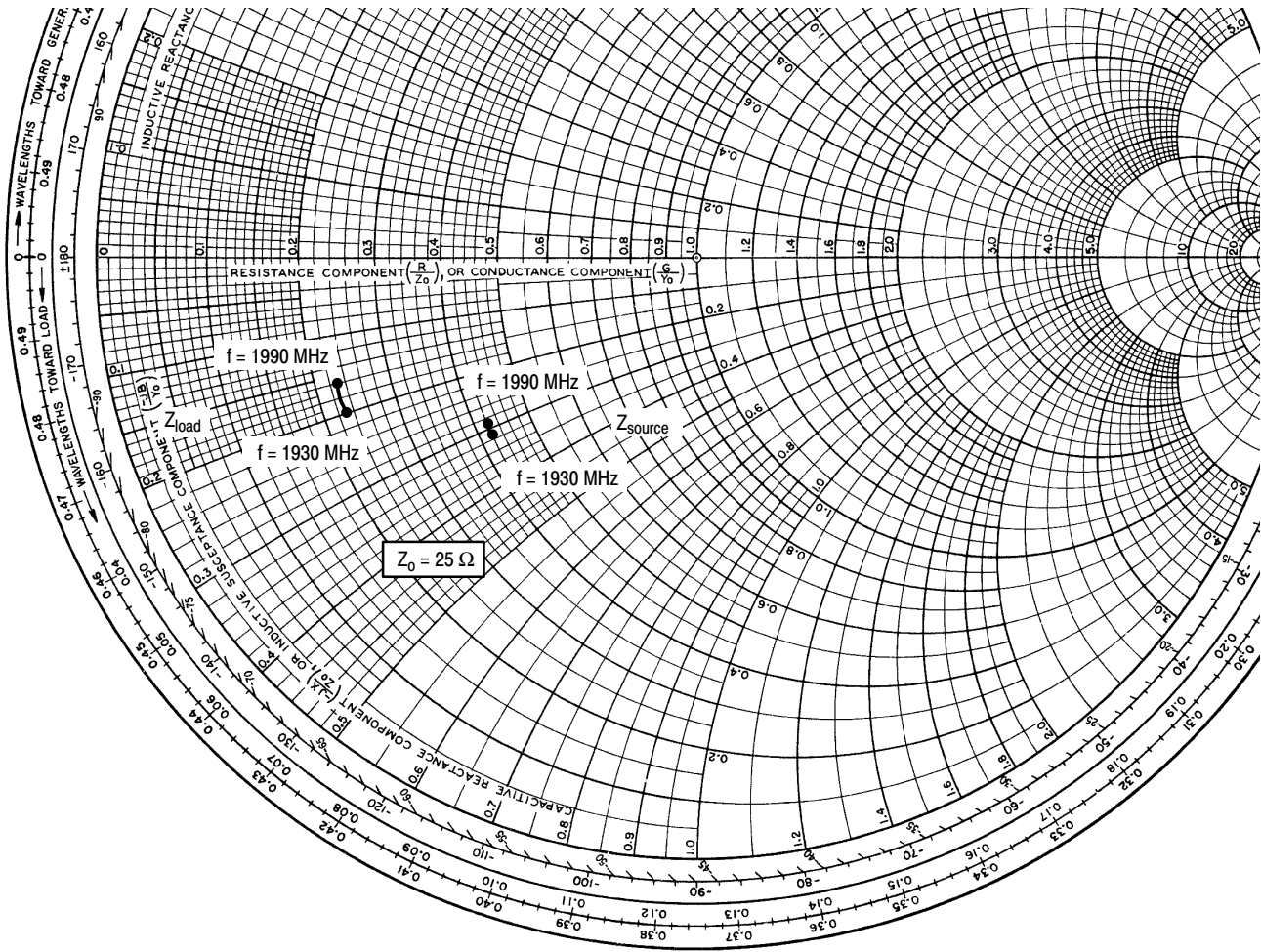


Figure 8. Power Gain and Intermodulation Distortion versus Supply Voltage



$V_{DD} = 26 \text{ V}$, $I_{DQ} = 300 \text{ mA}$, $P_{\text{out}} = 30 \text{ W PEP}$

| f MHz | Z_{source} Ω | Z_{load} Ω |
|----------|---------------------------------|-------------------------------|
| 1930 | $10.57 - j7.69$ | $5.81 - j5.01$ |
| 1960 | $10.54 - j7.43$ | $5.84 - j4.67$ |
| 1990 | $10.47 - j7.21$ | $5.84 - j4.35$ |

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

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

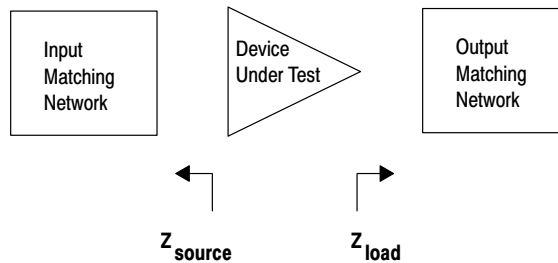
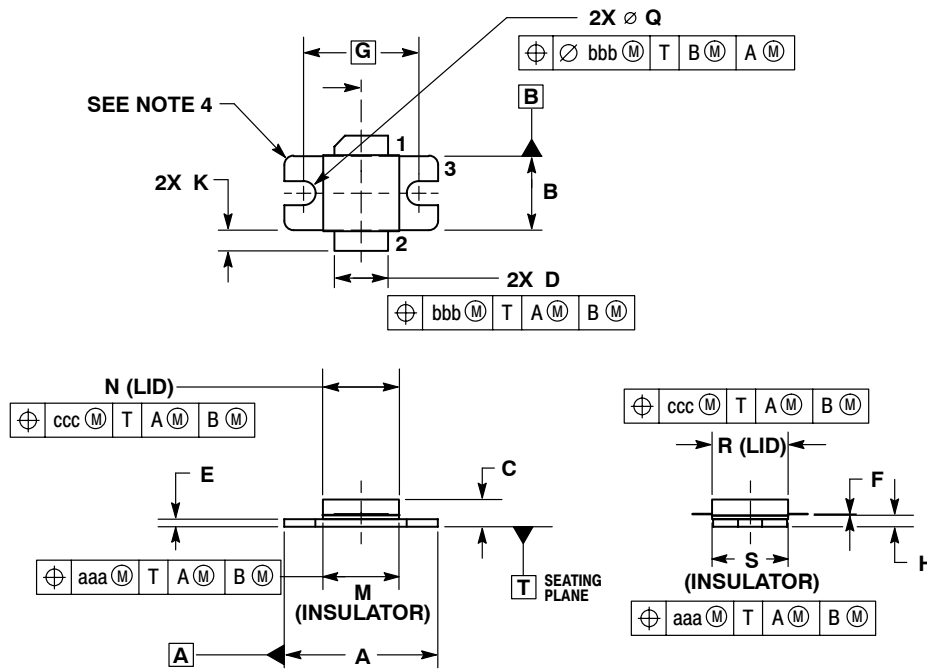


Figure 9. Series Equivalent Source and Load Impedance

PACKAGE DIMENSIONS

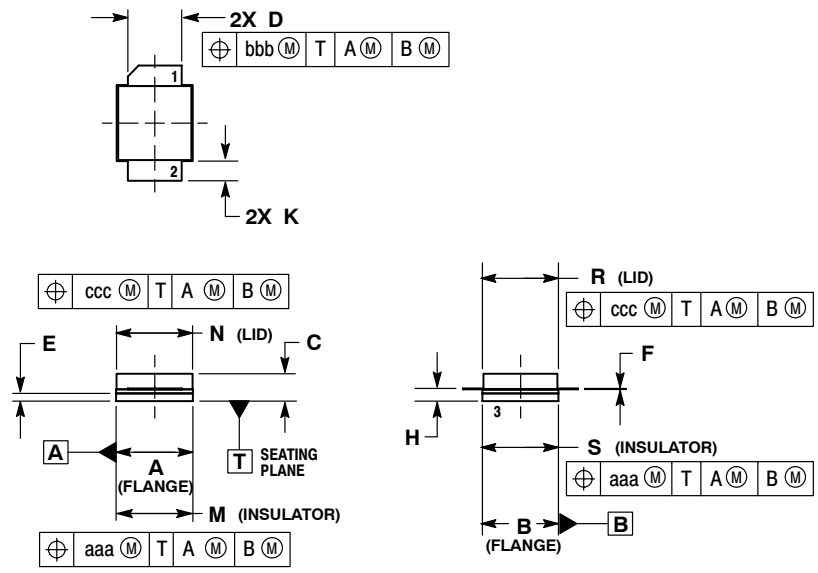


- NOTES:
1. CONTROLLING DIMENSION: INCH.
 2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
 3. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.
 4. INFORMATION ONLY: CORNER BREAK (4X) TO BE .060±.005 (1.52±0.13) RADIUS OR .06±.005 (1.52±0.13) x 45° CHAMFER.

| DIM | INCHES | | MILLIMETERS | |
|-----|----------|--------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | .795 | .805 | 20.19 | 20.44 |
| B | .380 | .390 | 9.65 | 9.9 |
| C | .125 | .163 | 3.17 | 4.14 |
| D | .275 | .285 | 6.98 | 7.24 |
| E | .035 | .045 | 0.89 | 1.14 |
| F | .004 | .006 | 0.10 | 0.15 |
| G | .600 BSC | | 15.24 BSC | |
| H | .057 | .067 | 1.45 | 1.7 |
| K | .092 | .122 | 2.33 | 3.1 |
| M | .395 | .405 | 10 | 10.3 |
| N | .395 | .405 | 10 | 10.3 |
| Q | ∅ .120 | ∅ .130 | ∅ 3.05 | ∅ 3.3 |
| R | .395 | .405 | 10 | 10.3 |
| S | .395 | .405 | 10 | 10.3 |
| aaa | .005 BSC | | 0.127 BSC | |
| bbb | .010 BSC | | 0.254 BSC | |
| ccc | .015 BSC | | 0.381 BSC | |

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

**CASE 465E-04
 ISSUE F
 NI-400
 MRF19030LR3**



- NOTES:
1. CONTROLLING DIMENSION: INCH.
 2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.
 3. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.

| DIM | INCHES | | MILLIMETERS | |
|-----|----------|------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | .395 | .405 | 10.03 | 10.29 |
| B | .395 | .405 | 10.03 | 10.29 |
| C | .125 | .163 | 3.18 | 4.14 |
| D | .275 | .285 | 6.98 | 7.24 |
| E | .035 | .045 | 0.89 | 1.14 |
| F | .004 | .006 | 0.10 | 0.15 |
| H | .057 | .067 | 1.45 | 1.70 |
| K | .092 | .122 | 2.34 | 3.10 |
| M | .395 | .405 | 10.03 | 10.29 |
| N | .395 | .405 | 10.03 | 10.29 |
| R | .395 | .405 | 10.03 | 10.29 |
| S | .395 | .405 | 10.03 | 10.29 |
| aaa | .005 REF | | 0.127 REF | |
| bbb | .010 REF | | 0.254 REF | |
| ccc | .015 REF | | 0.38 REF | |

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

**CASE 465F-04
 ISSUE E
 NI-400S
 MRF19030LSR3**

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