



# 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.

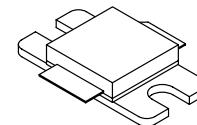
- CDMA Performance @ 1990 MHz, 26 Volts
  - IS-95 CDMA Pilot, Sync, Paging, Traffic Codes 8 Thru 13
  - 885 kHz — -47 dBc in 30 kHz BW
  - 1.25 MHz — -55 dBc in 12.5 kHz BW
  - 2.25 MHz — -55 dBc in 1 MHz BW
  - Output Power — 4.5 Watts Avg.
  - Power Gain — 13.5 dB
  - Efficiency — 17%
- Capable of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

### Features

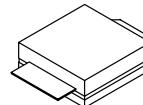
- Internally Matched for Ease of Use
- High Gain, High Efficiency and High Linearity
- Integrated ESD Protection
- Designed for Maximum Gain and Insertion Phase Flatness
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Low Gold Plating Thickness on Leads, 40 $\mu$ " 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 <sub>DSS</sub> | -0.5, +65    | Vdc       |
| Gate-Source Voltage   | V <sub>GS</sub>  | -0.5, +15    | Vdc       |
| Total Device Dissipation @ T <sub>C</sub> = 25°C<br>Derate above 25°C | P <sub>D</sub>   | 83.3<br>0.48 | W<br>W/°C |
| Storage Temperature Range   | T <sub>stg</sub> | -65 to +150  | °C        |
| Case Operating Temperature  | T <sub>C</sub>   | 150          | °C        |
| Operating Junction Temperature  | T <sub>J</sub>   | 200          | °C        |

**Table 2. Thermal Characteristics**

| Characteristic                       | Symbol           | Value | Unit |
|--------------------------------------|------------------|-------|------|
| Thermal Resistance, Junction to Case | R <sub>θJC</sub> | 2.1   | °C/W |

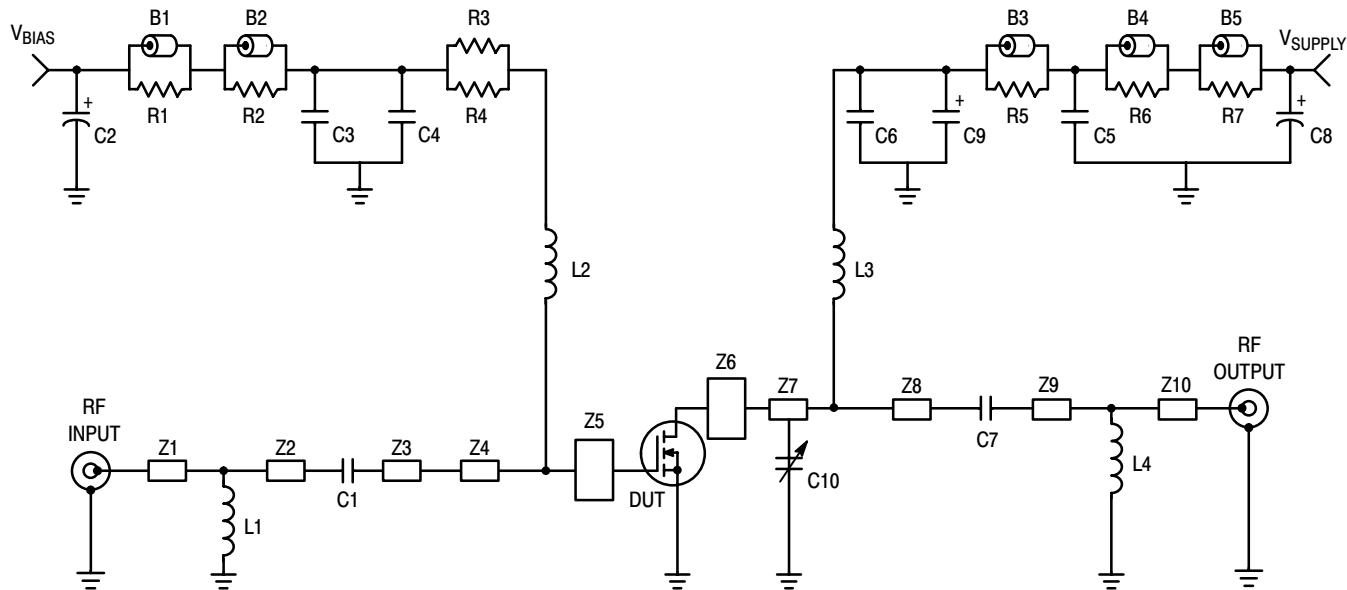
**Table 3. ESD Protection Characteristics**

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

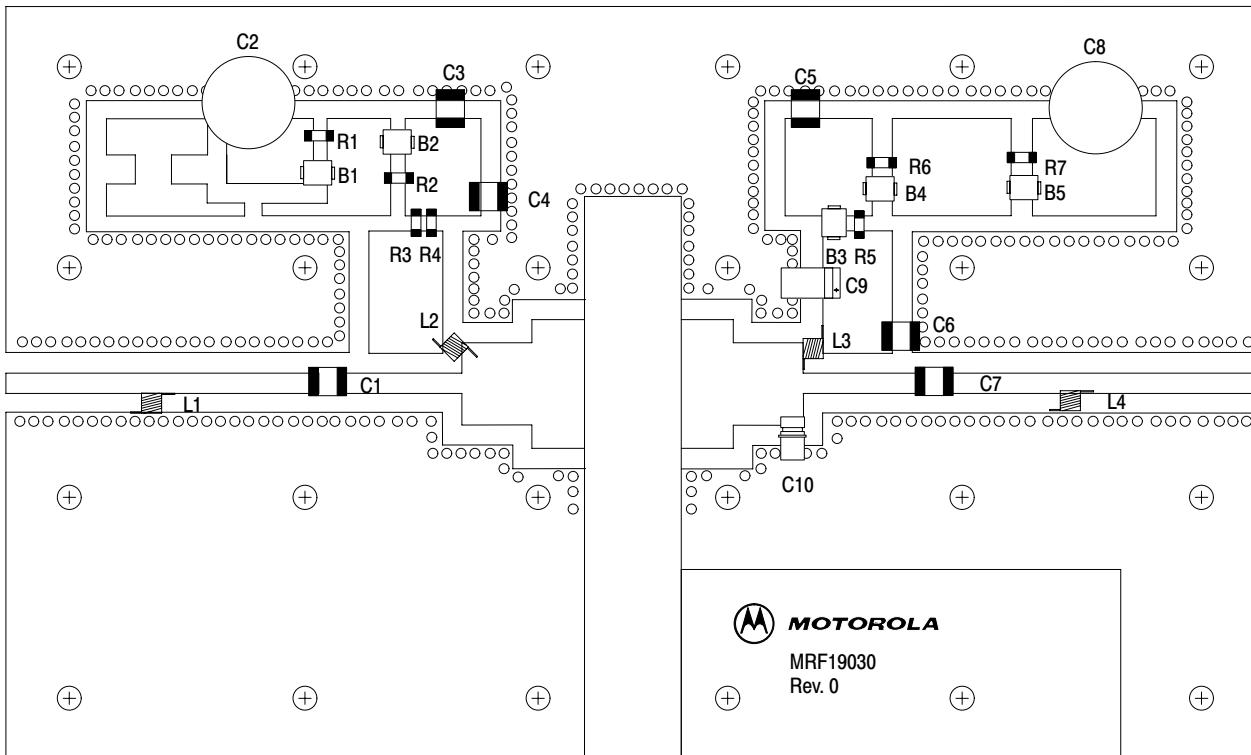
1. Part is internally matched both on input and output.



B1 - B5      Short Ferrite Beads  
 C1, C7      10 pF Chip Capacitors  
 C2, C8      470  $\mu$ F, 35 V Electrolytic Capacitors  
 C3, C5      0.1  $\mu$ F Chip Capacitors  
 C4, C6      5.1  $\mu$ F Chip Capacitors  
 C9      22  $\mu$ F Tantalum Chip Capacitor  
 C10      0.4 - 2.5 pF Variable Capacitor, Johanson Gigatrim  
 L1 - L4      12.5 nH Inductors  
 R1 - R7      12  $\Omega$  Chip Resistors (0805)  
 Z1      0.080" x 0.595" Microstrip  
 Z2      0.080" x 0.600" Microstrip

Z3      0.080" x 0.480" Microstrip  
 Z4      0.325" x 0.280" Microstrip  
 Z5      0.510" x 0.200" Microstrip  
 Z6      0.510" x 0.200" Microstrip  
 Z7      0.325" x 0.280" Microstrip  
 Z8      0.080" x 0.480" Microstrip  
 Z9      0.080" x 0.530" Microstrip  
 Z10      0.080" x 0.671" Microstrip  
 Substrate      0.030" x 3.00" x 5.00" Glass Teflon<sup>®</sup>, Arlon

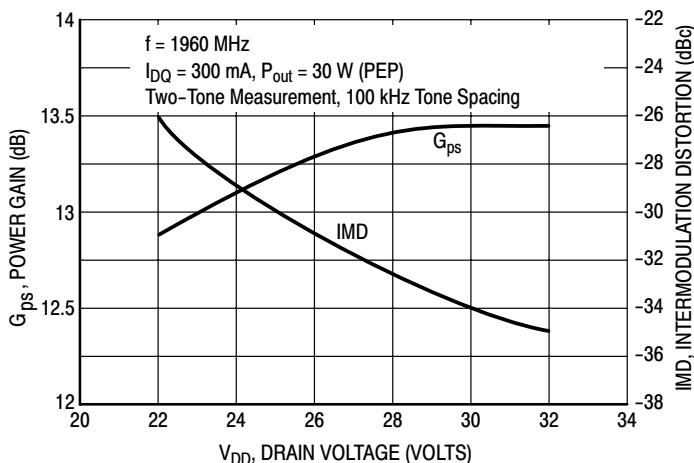
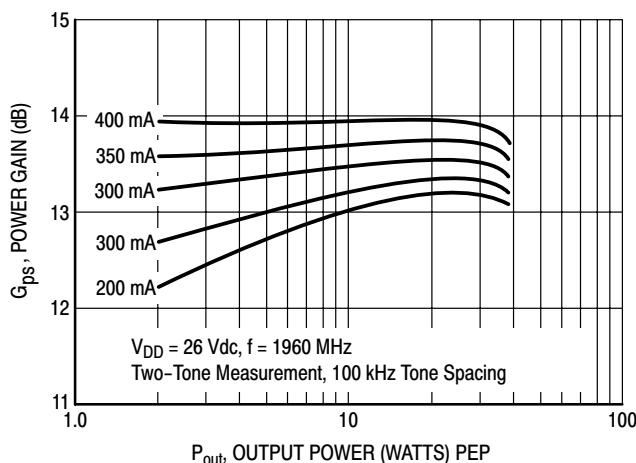
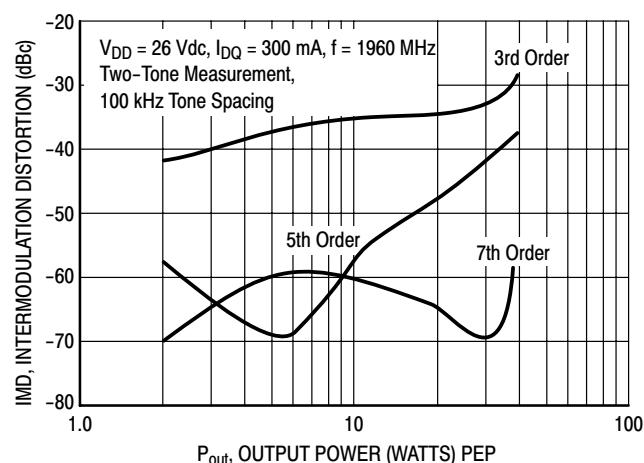
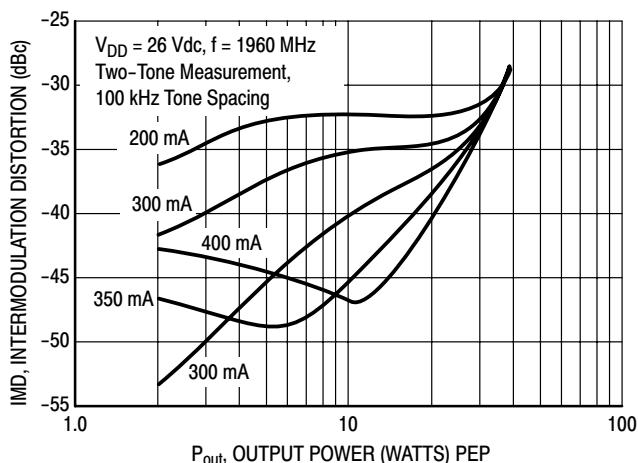
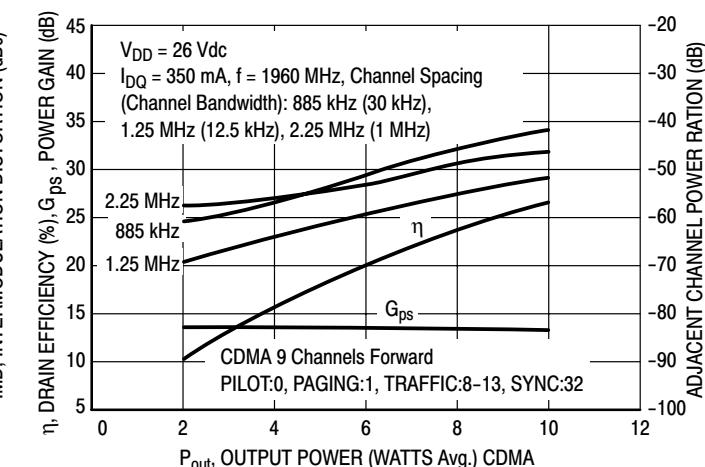
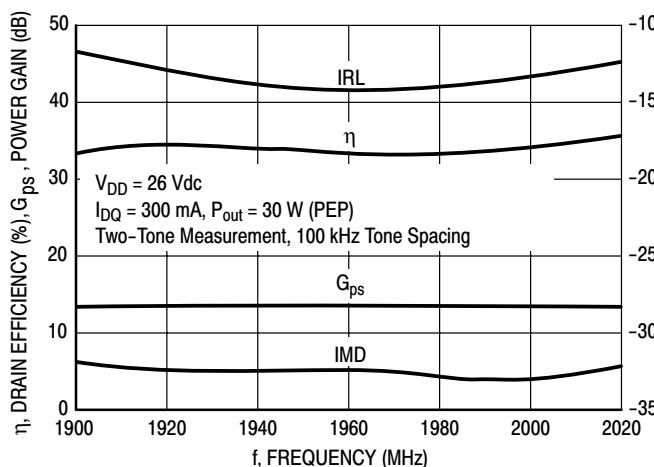
**Figure 1. MRF19030LR3(SR3) Test Circuit Schematic**

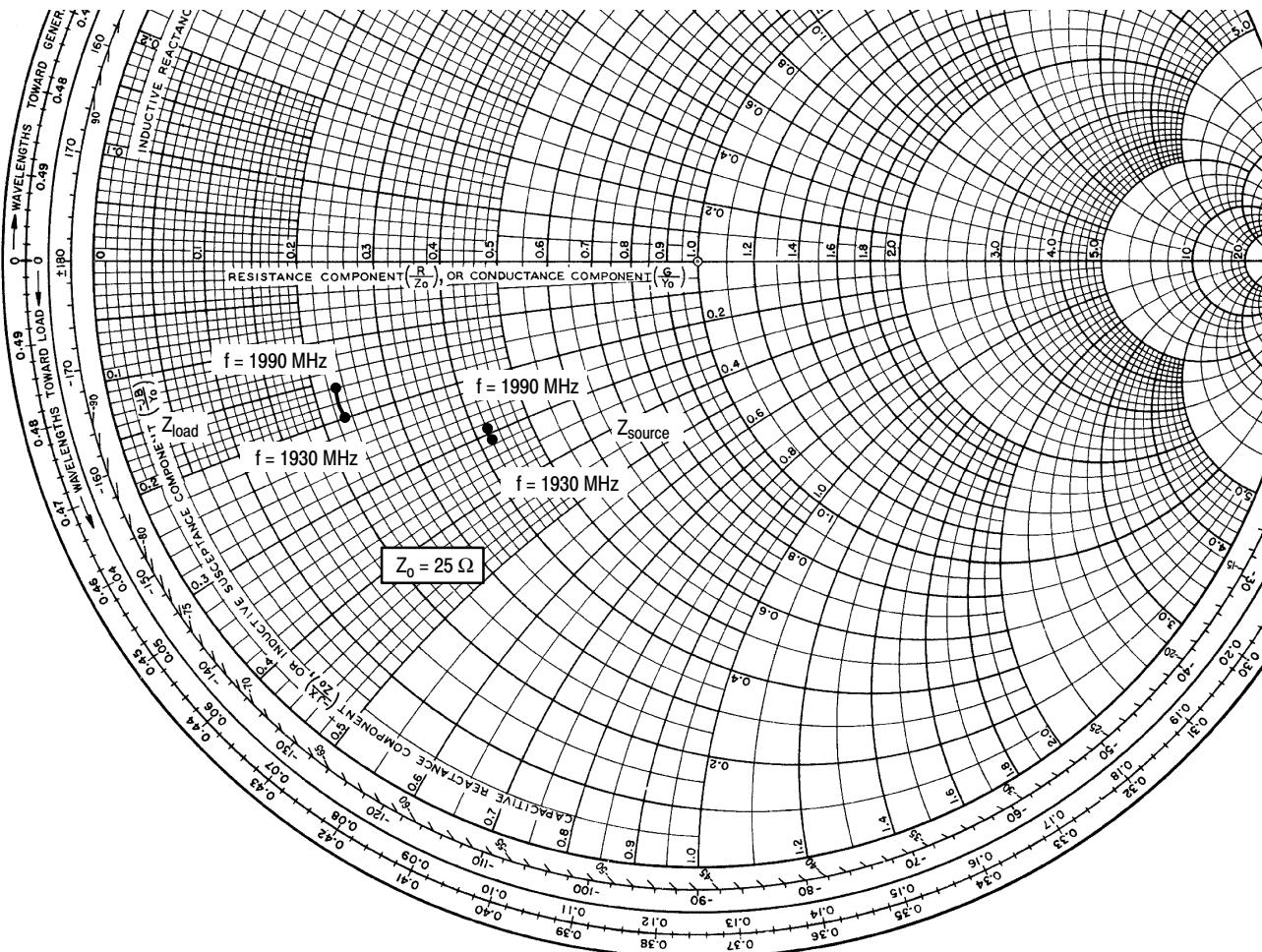


Freescale has begun the transition of marking Printed Circuit Boards (PCBs) with the Freescale Semiconductor signature/logo. PCBs may have either Motorola or Freescale markings during the transition period. These changes will have no impact on form, fit or function of the current product.

**Figure 2. MRF19030LR3(SR3) Test Circuit Component Layout**

## TYPICAL CHARACTERISTICS





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

| $f$<br>MHz | $Z_{source}$<br>$\Omega$ | $Z_{load}$<br>$\Omega$ |
|------------|--------------------------|------------------------|
| 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.

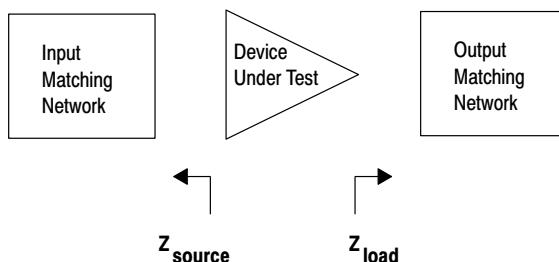
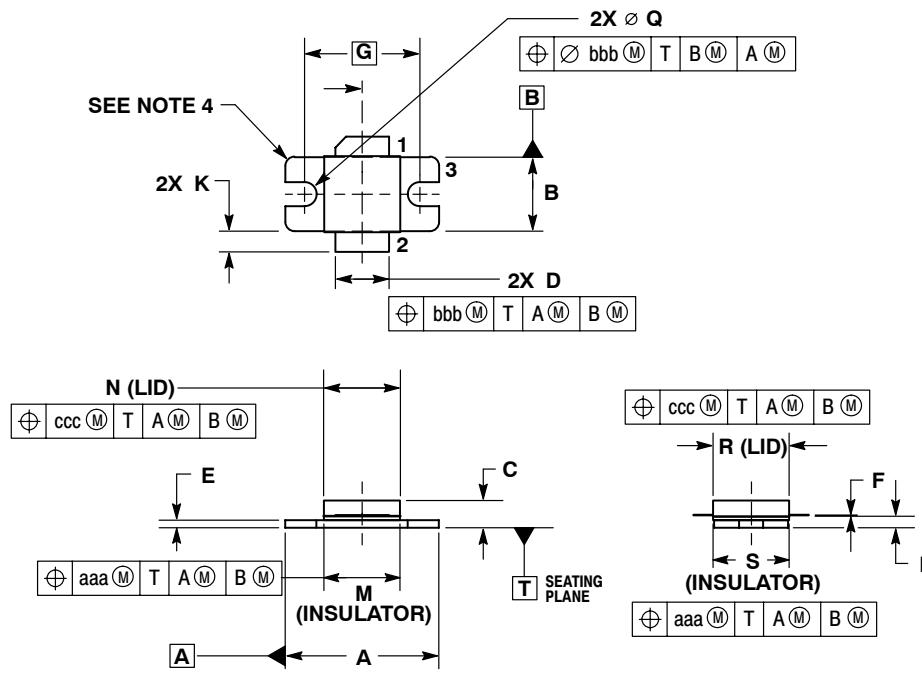


Figure 9. Series Equivalent Source and Load Impedance

## PACKAGE DIMENSIONS



| 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   | Ø .120   | Ø .130 | Ø 3.05      | Ø 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   |       |

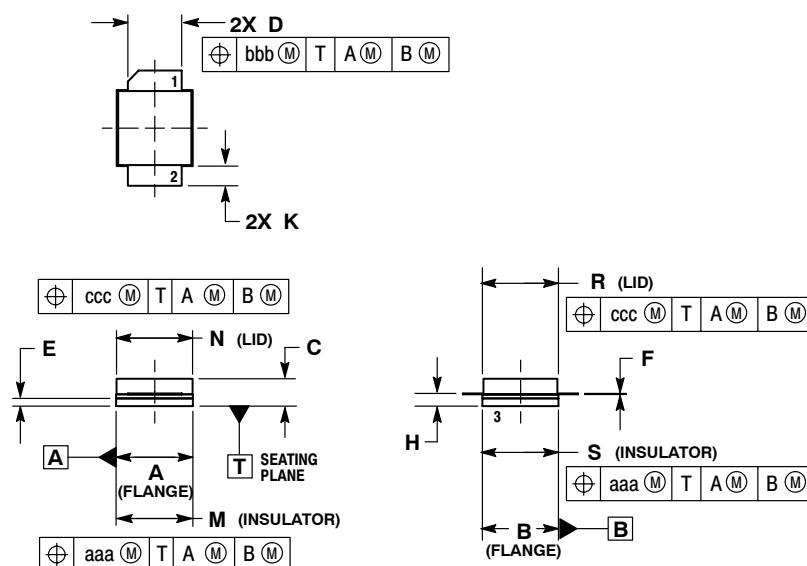
STYLE 1:  
PIN 1. DRAIN  
2. GATE  
3. SOURCE

CASE 465E-04

ISSUE F

NI-400

MRF19030LR3



| NOTES:  |      |        |       |             |     |
|---|------|--------|-------|-------------|-----|
| 1. CONTROLLING DIMENSION: INCH.                                     |      |        |       |             |     |
| 2. INTERPRET DIMENSIONS AND TOLERANCES<br>PER ASME Y14.5M-1994.     |      |        |       |             |     |
| 3. DIMENSION H IS MEASURED 0.030 (0.762) AWAY<br>FROM PACKAGE BODY. |      |        |       |             |     |
|   |      | INCHES |       | MILLIMETERS |     |
| DIM   |      | 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 |
|   |      |        |       | 0.005       | REF |

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**STYLE 1:**

CASE 465F-04

ISSUE E

**NI-400S**

MRF19030LSR3

MRF19030LR3 MRF19030LSR3

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