

## The RF MOSFET Line

# RF Power Field Effect Transistors

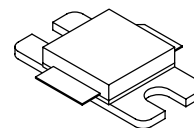
## N-Channel Enhancement-Mode Lateral MOSFETs

**MRF19030LR3**  
**MRF19030LSR3**

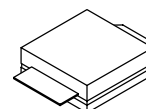
Designed for class AB PCN and PCS base station applications with frequencies from 1.8 to 2.0 GHz. Suitable for FM, TDMA, CDMA and multicarrier amplifier applications.

- CDMA Performance @ 1990 MHz, 26 Volts  
IS-97 CDMA Pilot, Sync, Paging, Traffic Codes 8 Thru 13  
885 kHz — -47 dBc @ 30 kHz BW  
1.25 MHz — -55 dBc @ 12.5 kHz BW  
2.25 MHz — -55 dBc @ 1 MHz BW  
Output Power — 4.5 Watts Avg.  
Power Gain — 13.5 dB  
Efficiency — 17%
- Internally Matched, Controlled Q, for Ease of Use
- High Gain, High Efficiency and High Linearity
- Integrated ESD Protection
- Designed for Maximum Gain and Insertion Phase Flatness
- Capable of Handling 10:1 VSWR, @ 26 Vdc, 1.93 GHz, 30 Watts CW Output Power
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Low Gold Plating Thickness on Leads, 40μ" Nominal.
- In Tape and Reel. R3 Suffix = 250 Units per 32 mm, 13 Inch Reel.

**2.0 GHz, 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**

### MAXIMUM RATINGS

| Rating                                                                                 | Symbol    | Value        | Unit                         |
|----------------------------------------------------------------------------------------|-----------|--------------|------------------------------|
| Drain-Source Voltage                                                                   | $V_{DSS}$ | 65           | Vdc                          |
| Gate-Source Voltage                                                                    | $V_{GS}$  | -0.5, +15    | Vdc                          |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$     | 83.3<br>0.48 | Watts<br>W/ $^\circ\text{C}$ |
| Storage Temperature Range                                                              | $T_{stg}$ | - 65 to +150 | $^\circ\text{C}$             |
| Operating Junction Temperature                                                         | $T_J$     | 200          | $^\circ\text{C}$             |

### THERMAL CHARACTERISTICS

| Characteristic                       | Symbol          | Value | Unit               |
|--------------------------------------|-----------------|-------|--------------------|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 2.1   | $^\circ\text{C/W}$ |

### ESD PROTECTION CHARACTERISTICS

| Test Conditions  | Class        |
|------------------|--------------|
| Human Body Model | 2 (Minimum)  |
| Machine Model    | M3 (Minimum) |

**NOTE - CAUTION** - MOS devices are susceptible to damage from electrostatic charge. Reasonable precautions in handling and packaging MOS devices should be observed.



## ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted)

| Characteristic                                                                                                                                                                                                                                             | Symbol               | Min                                                     | Typ  | Max | Unit |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------------------------------------------------|------|-----|------|
| <b>OFF CHARACTERISTICS</b>                                                                                                                                                                                                                                 |                      |                                                         |      |     |      |
| Drain-Source Breakdown Voltage<br>(V <sub>GS</sub> = 0 Vdc, I <sub>D</sub> = 20 μA)                                                                                                                                                                        | V <sub>(BR)DSS</sub> | 65                                                      | —    | —   | Vdc  |
| Zero Gate Voltage Drain Current<br>(V <sub>DS</sub> = 28 Vdc, V <sub>GS</sub> = 0 Vdc)                                                                                                                                                                     | I <sub>DSS</sub>     | —                                                       | —    | 1   | μAdc |
| Gate-Source Leakage Current<br>(V <sub>GS</sub> = 5 Vdc, V <sub>DS</sub> = 0 Vdc)                                                                                                                                                                          | I <sub>GSS</sub>     | —                                                       | —    | 1   | μAdc |
| <b>ON CHARACTERISTICS</b>                                                                                                                                                                                                                                  |                      |                                                         |      |     |      |
| Gate Threshold Voltage<br>(V <sub>DS</sub> = 10 Vdc, I <sub>D</sub> = 100 μAdc)                                                                                                                                                                            | V <sub>GS(th)</sub>  | 2                                                       | 3    | 4   | Vdc  |
| Gate Quiescent Voltage<br>(V <sub>DS</sub> = 28 Vdc, I <sub>D</sub> = 300 mA)                                                                                                                                                                              | V <sub>GS(Q)</sub>   | 2                                                       | 3.3  | 4.5 | Vdc  |
| Drain-Source On-Voltage<br>(V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 1 Adc)                                                                                                                                                                              | V <sub>DS(on)</sub>  | —                                                       | 0.29 | 0.4 | Vdc  |
| Forward Transconductance<br>(V <sub>DS</sub> = 10 Vdc, I <sub>D</sub> = 1 Adc)                                                                                                                                                                             | g <sub>fs</sub>      | —                                                       | 2    | —   | S    |
| <b>DYNAMIC CHARACTERISTICS</b>                                                                                                                                                                                                                             |                      |                                                         |      |     |      |
| Input Capacitance (Including Input Matching Capacitor in Package) (1)<br>(V <sub>DS</sub> = 26 Vdc, V <sub>GS</sub> = 0, f = 1 MHz)                                                                                                                        | C <sub>iss</sub>     | —                                                       | 98.5 | —   | pF   |
| Output Capacitance (1)<br>(V <sub>DS</sub> = 26 Vdc, V <sub>GS</sub> = 0, f = 1 MHz)                                                                                                                                                                       | C <sub>oss</sub>     | —                                                       | 37   | —   | pF   |
| Reverse Transfer Capacitance<br>(V <sub>DS</sub> = 26 Vdc, V <sub>GS</sub> = 0, f = 1 MHz)                                                                                                                                                                 | C <sub>rss</sub>     | —                                                       | 1.3  | —   | pF   |
| <b>FUNCTIONAL TESTS (In Motorola Test Fixture, 50 ohm system)</b>                                                                                                                                                                                          |                      |                                                         |      |     |      |
| Two-Tone Common-Source Amplifier Power Gain<br>(V <sub>DD</sub> = 26 Vdc, P <sub>out</sub> = 30 W PEP, I <sub>DQ</sub> = 300 mA,<br>f <sub>1</sub> = 1960.0 MHz, f <sub>2</sub> = 1960.1 MHz)                                                              | G <sub>ps</sub>      | —                                                       | 13   | —   | dB   |
| Two-Tone Drain Efficiency<br>(V <sub>DD</sub> = 26 Vdc, P <sub>out</sub> = 30 W PEP, I <sub>DQ</sub> = 300 mA,<br>f <sub>1</sub> = 1960.0 MHz, f <sub>2</sub> = 1960.1 MHz)                                                                                | η                    | —                                                       | 36   | —   | %    |
| 3rd Order Intermodulation Distortion<br>(V <sub>DD</sub> = 26 Vdc, P <sub>out</sub> = 30 W PEP, I <sub>DQ</sub> = 300 mA,<br>f <sub>1</sub> = 1960.0 MHz, f <sub>2</sub> = 1960.1 MHz)                                                                     | IMD                  | —                                                       | -31  | —   | dBc  |
| Input Return Loss<br>(V <sub>DD</sub> = 26 Vdc, P <sub>out</sub> = 30 W PEP, I <sub>DQ</sub> = 300 mA,<br>f <sub>1</sub> = 1960.0 MHz, f <sub>2</sub> = 1960.1 MHz)                                                                                        | IRL                  | —                                                       | -13  | —   | dB   |
| Two-Tone Common-Source Amplifier Power Gain<br>(V <sub>DD</sub> = 26 Vdc, P <sub>out</sub> = 30 W PEP, I <sub>DQ</sub> = 300 mA, f <sub>1</sub> = 1930.0 MHz,<br>f <sub>2</sub> = 1930.1 MHz and f <sub>1</sub> = 1990.0 MHz, f <sub>2</sub> = 1990.1 MHz) | G <sub>ps</sub>      | 12                                                      | 13   | —   | dB   |
| Two-Tone Drain Efficiency<br>(V <sub>DD</sub> = 26 Vdc, P <sub>out</sub> = 30 W PEP, I <sub>DQ</sub> = 300 mA, f <sub>1</sub> = 1930.0 MHz,<br>f <sub>2</sub> = 1930.1 MHz and f <sub>1</sub> = 1990.0 MHz, f <sub>2</sub> = 1990.1 MHz)                   | η                    | 33                                                      | 36   | —   | %    |
| 3rd Order Intermodulation Distortion<br>(V <sub>DD</sub> = 26 Vdc, P <sub>out</sub> = 30 W PEP, I <sub>DQ</sub> = 300 mA, f <sub>1</sub> = 1930.0 MHz,<br>f <sub>2</sub> = 1930.1 MHz and f <sub>1</sub> = 1990.0 MHz, f <sub>2</sub> = 1990.1 MHz)        | IMD                  | —                                                       | -31  | -28 | dBc  |
| Input Return Loss<br>(V <sub>DD</sub> = 26 Vdc, P <sub>out</sub> = 30 W PEP, I <sub>DQ</sub> = 300 mA, f <sub>1</sub> = 1930.0 MHz,<br>f <sub>2</sub> = 1930.1 MHz and f <sub>1</sub> = 1990.0 MHz, f <sub>2</sub> = 1990.1 MHz)                           | IRL                  | —                                                       | -13  | -9  | dB   |
| Output Mismatch Stress<br>(V <sub>DD</sub> = 26 Vdc, P <sub>out</sub> = 30 W CW, I <sub>DQ</sub> = 300 mA,<br>f = 1930 MHz, VSWR = 10:1, All Phase Angles at Frequency of Tests)                                                                           | Ψ                    | No Degradation In Output Power<br>Before and After Test |      |     |      |

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

# Freescale Semiconductor, Inc.

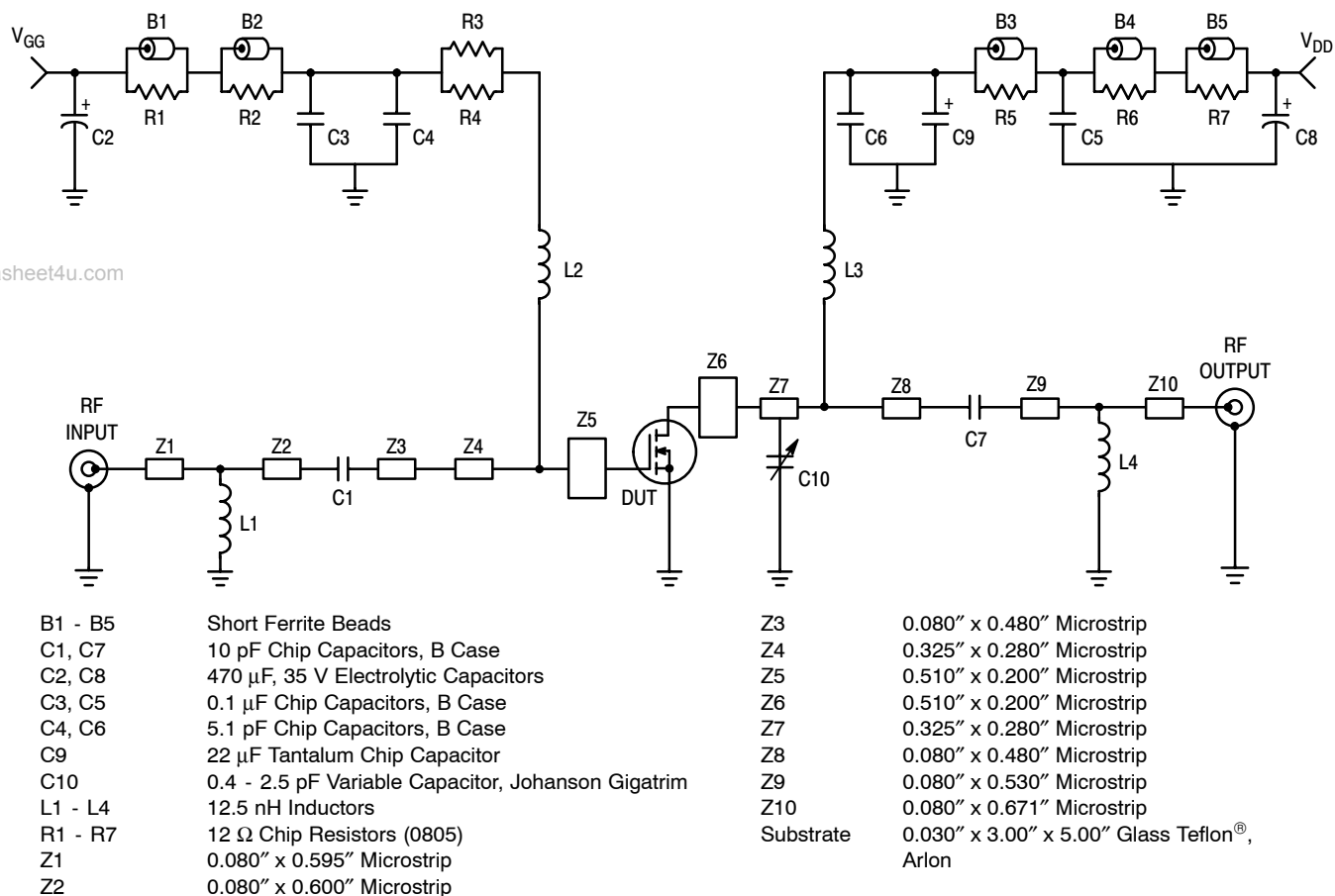


Figure 1. MRF19030LR3(LSR3) Test Circuit Schematic

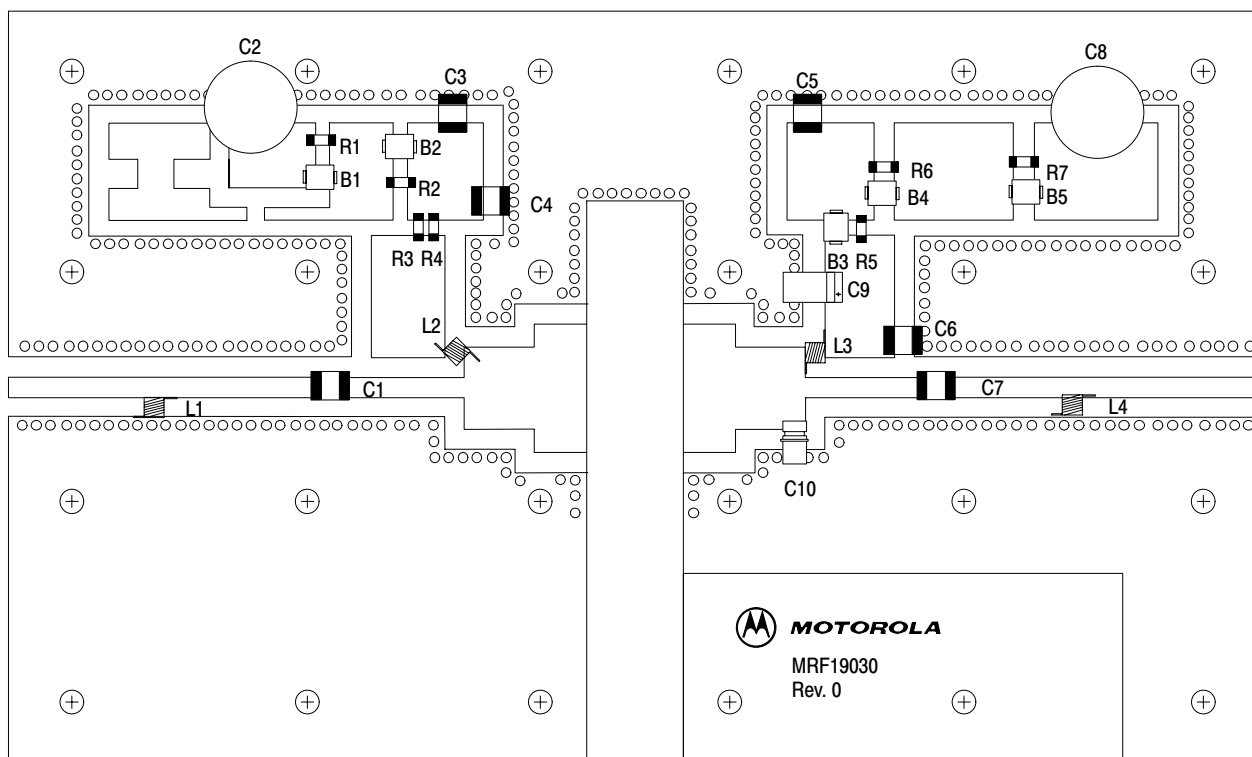


Figure 2. MRF19030LR3(LSR3) Test Circuit Component Layout

## TYPICAL CHARACTERISTICS

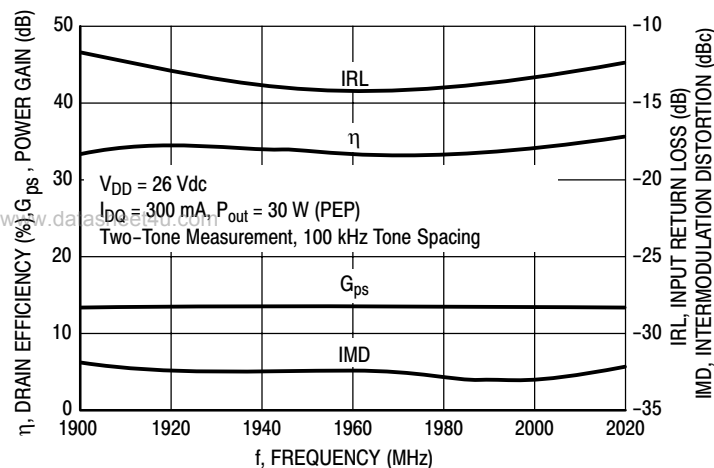


Figure 3. Class AB Broadband Circuit Performance

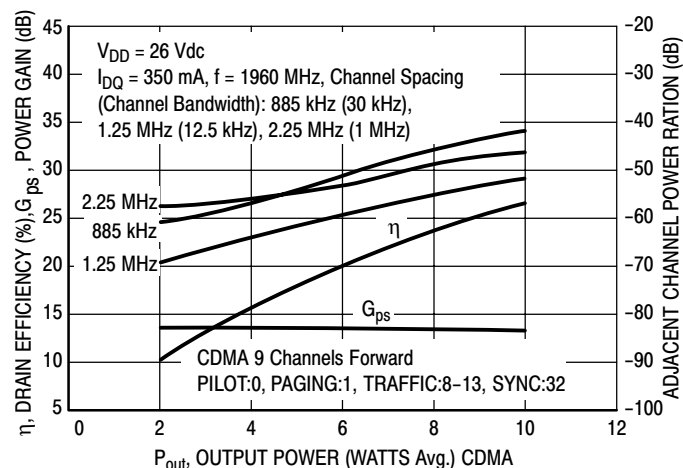


Figure 4. CDMA ACPR, Power Gain and Drain Efficiency versus Output Power

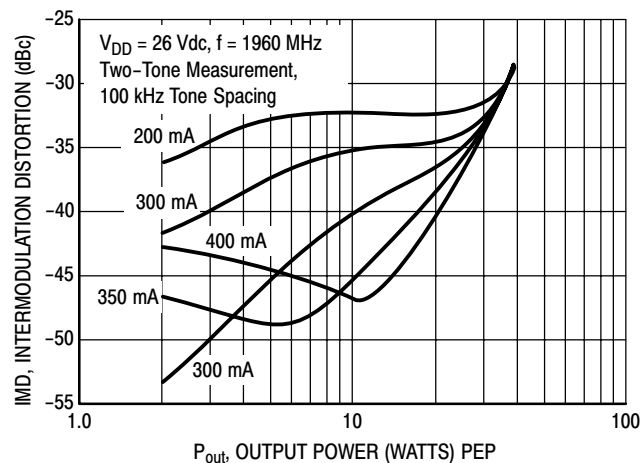


Figure 5. Intermodulation Distortion versus Output Power

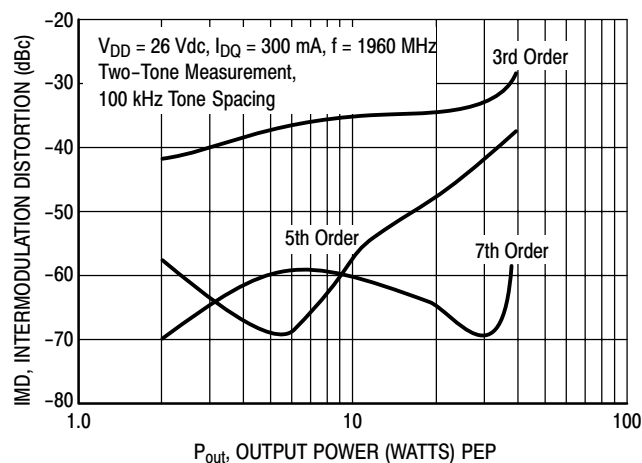


Figure 6. Intermodulation Distortion Products versus Output Power

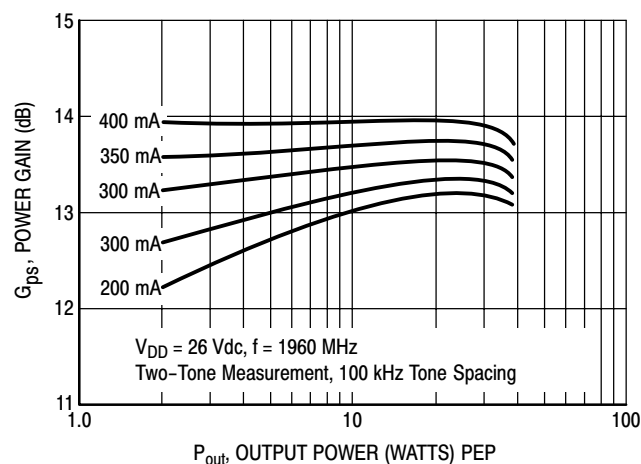


Figure 7. Power Gain versus Output Power

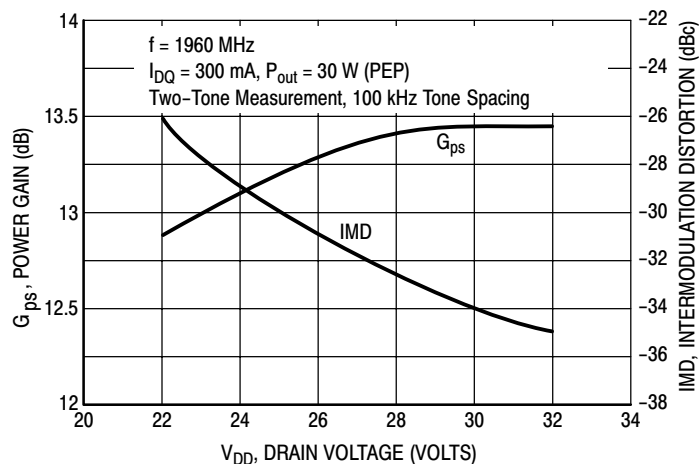
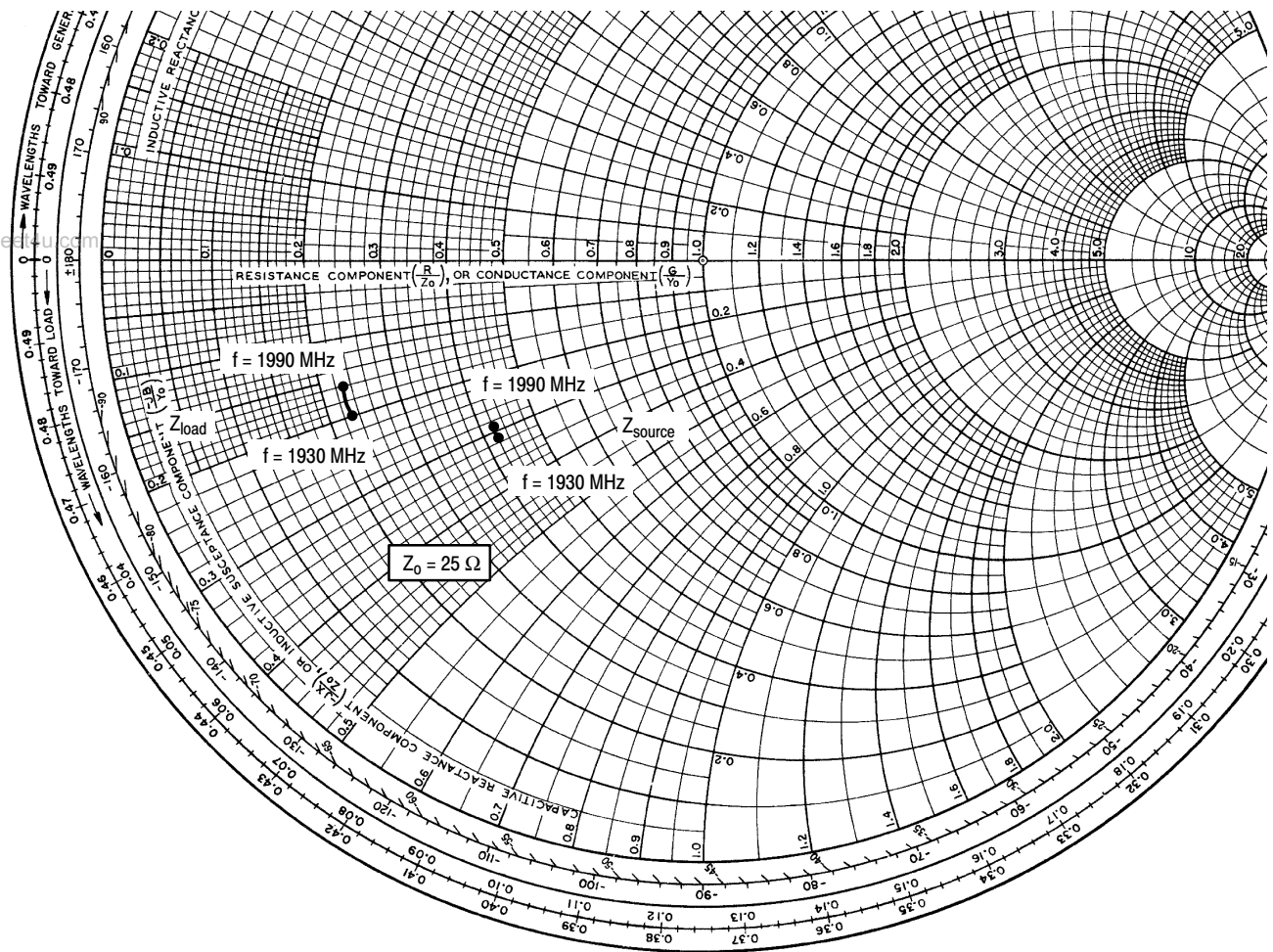


Figure 8. Power Gain and Intermodulation Distortion versus Supply Voltage



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

| 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.

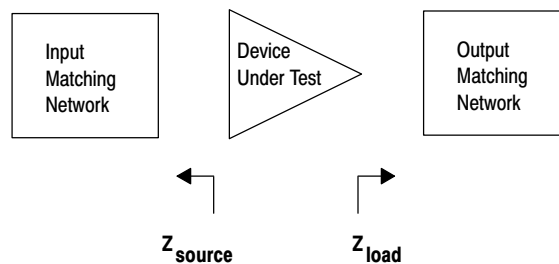


Figure 9. Series Equivalent Source and Load Impedance

# **Freescale Semiconductor, Inc.**

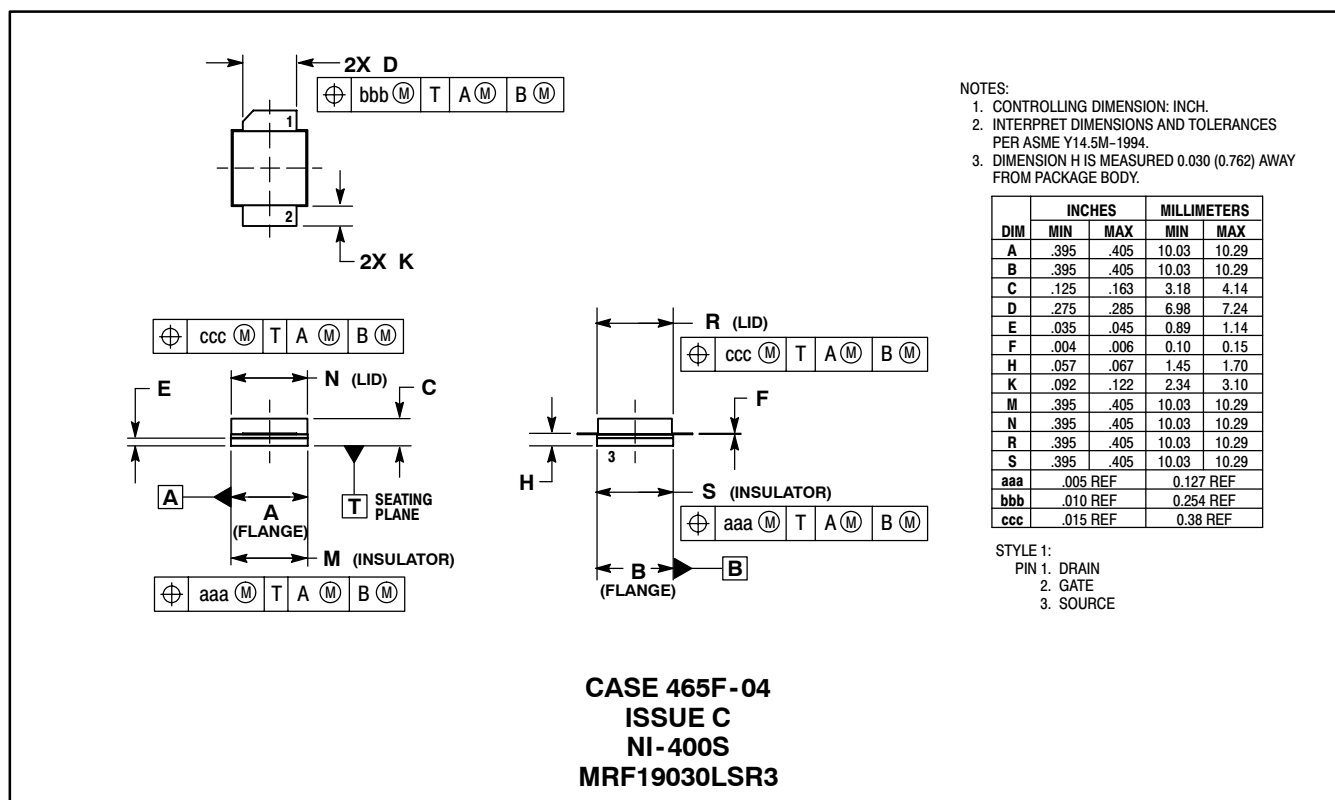
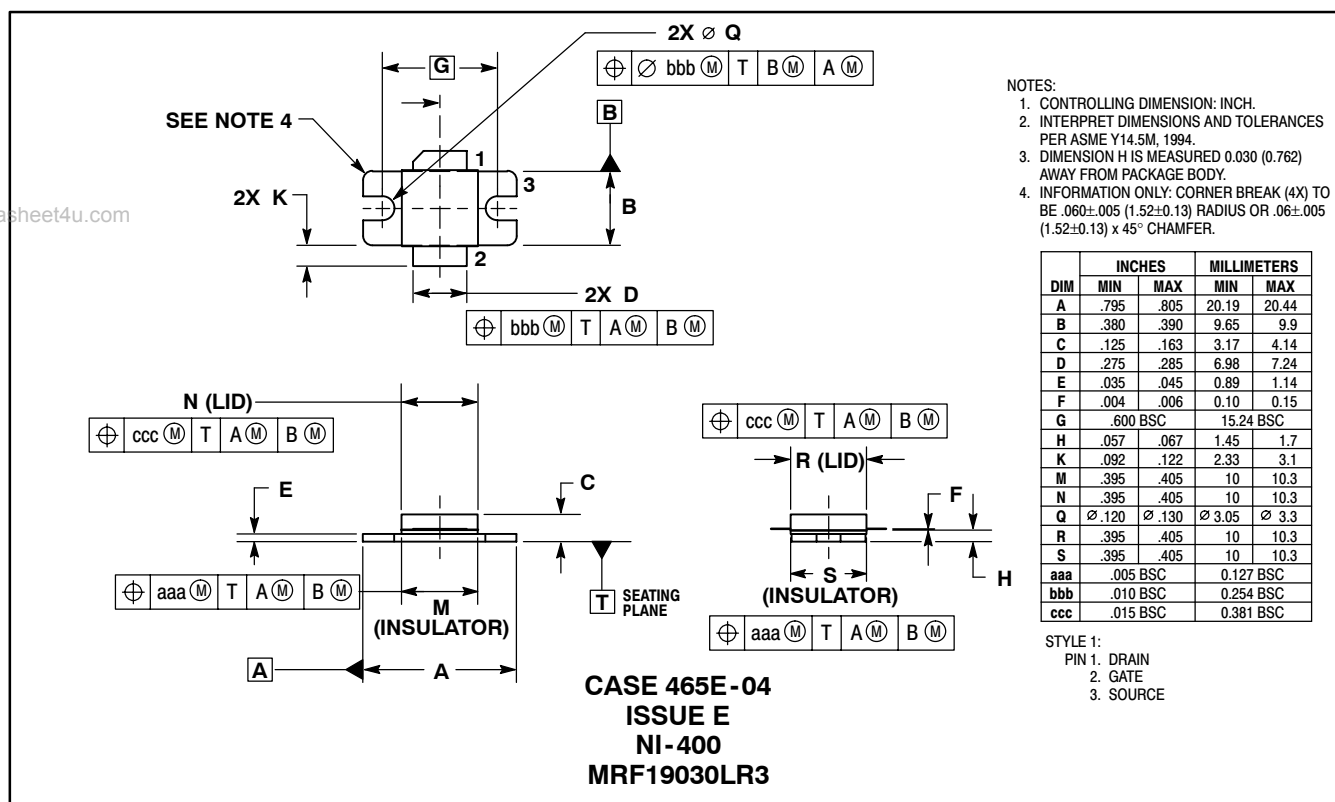
## **NOTES**

[www.datasheet4u.com](http://www.datasheet4u.com)

**Freescale Semiconductor, Inc.**

# Freescall Semiconductor, Inc.

## PACKAGE DIMENSIONS



Information in this document is provided solely to enable system and software implementers to use Motorola products. There are no express or implied copyright licenses granted hereunder to design or fabricate any integrated circuits or integrated circuits based on the information in this document.

Motorola reserves the right to make changes without further notice to any products herein. Motorola makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Motorola assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters that may be provided in Motorola data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals", must be validated for each customer application by customer's technical experts. Motorola does not convey any license under its patent rights nor the rights of others. Motorola products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Motorola was negligent regarding the design or manufacture of the part.

MOTOROLA and the Stylized M Logo are registered in the US Patent and Trademark Office. All other product or service names are the property of their respective owners. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

© Motorola Inc. 2004

#### HOW TO REACH US:

**USA/EUROPE/LOCATIONS NOT LISTED:**  
Motorola Literature Distribution  
P.O. Box 5405, Denver, Colorado 80217  
1-800-521-6274 or 480-768-2130

**JAPAN:** Motorola Japan Ltd.; SPS, Technical Information Center,  
3-20-1, Minami-Azabu, Minato-ku, Tokyo 106-8573, Japan  
81-3-3440-3569

**ASIA/PACIFIC:** Motorola Semiconductors H.K. Ltd.; Silicon Harbour Centre,  
2 Dai King Street, Tai Po Industrial Estate, Tai Po, N.T., Hong Kong  
852-26668334

**HOME PAGE:** <http://motorola.com/semiconductors>



**MOTOROLA**

◆ **For More Information On This Product,  
Go to: [www.freescale.com](http://www.freescale.com)**

[www.DataSheet4U.com](http://www.DataSheet4U.com)

MRF19030/D