

RF Power Field Effect Transistors

N-Channel Enhancement-Mode Lateral MOSFETs

Designed for PCN and PCS base station applications with frequencies from 2000 to 2200 MHz. Suitable for FM, TDMA, CDMA and multicarrier amplifier applications. To be used in Class AB for PCN-PCS/cellular radio and WLL applications.

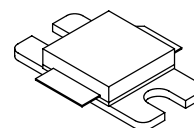
- Wideband CDMA Performance: -45 dB ACPR @ 4.096 MHz, 28 Volts Output Power — 3.5 Watts
 Power Gain — 14 dB
 Efficiency — 15%
- Capable of Handling 10:1 VSWR, @ 28 Vdc, 2110 MHz, 30 Watts CW Output Power

Features

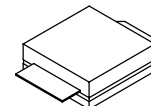
- High Gain, High Efficiency and High Linearity
- Integrated ESD Protection
- Designed for Maximum Gain and Insertion Phase Flatness
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Low Gold Plating Thickness on Leads, 40μ" Nominal.
- RoHS Compliant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

MRF21030LR3
MRF21030LSR3

2200 MHz, 30 W, 28 V
LATERAL N-CHANNEL
RF POWER MOSFETs



CASE 465E-04, STYLE 1
NI-400
MRF21030LR3



CASE 465F-04, STYLE 1
NI-400S
MRF21030LSR3

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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°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 _{θJC} | 2.1 | °C/W |

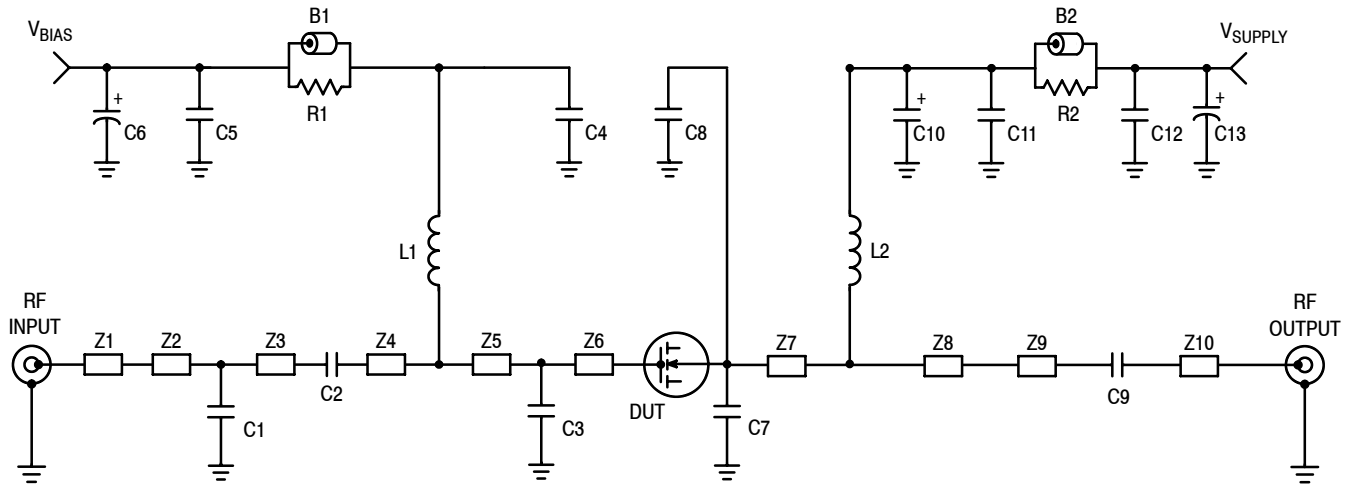
Table 3. ESD Protection Characteristics

| 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)

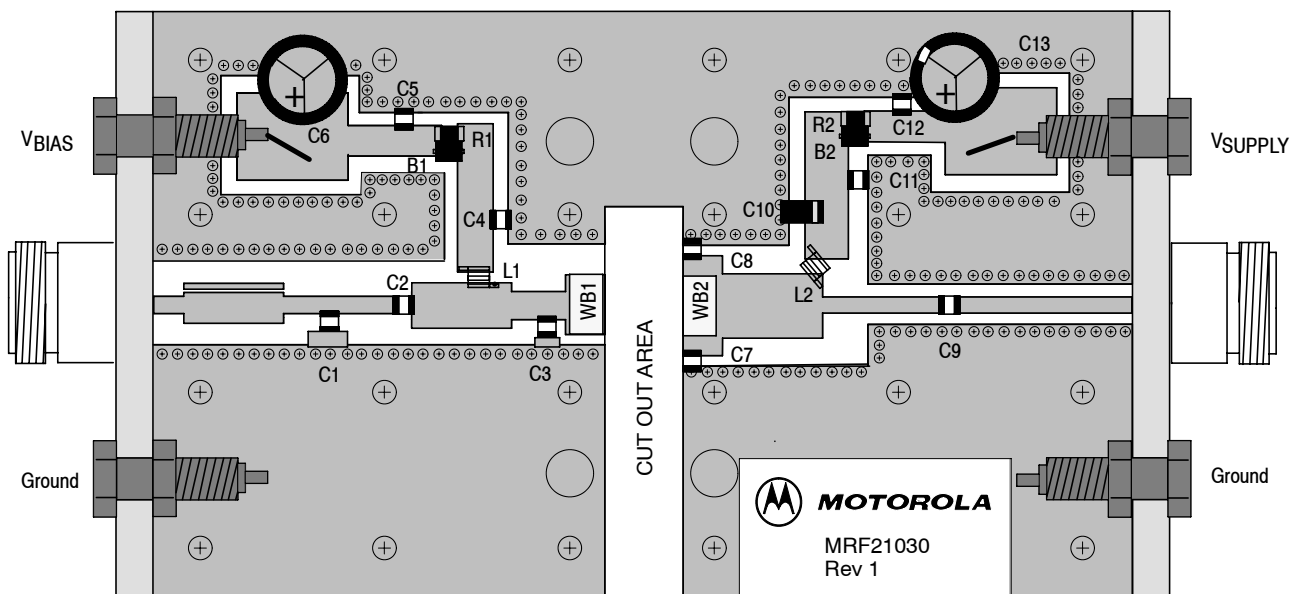
| Characteristic | Symbol | Min | Typ | Max | Unit |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----|------|-------|-----------------|
| 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 ($V_{DS} = 28\text{ Vdc}$, $I_D = 250\text{ mA}$) | $V_{GS(Q)}$ | 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⁾ ($V_{DS} = 28\text{ Vdc}$, $V_{GS} = 0$, $f = 1\text{ MHz}$) | C_{iss} | — | 98.5 | — | pF |
| Output Capacitance ⁽¹⁾ ($V_{DS} = 28\text{ Vdc}$, $V_{GS} = 0$, $f = 1\text{ MHz}$) | C_{oss} | — | 37 | — | pF |
| Reverse Transfer Capacitance ($V_{DS} = 28\text{ Vdc}$, $V_{GS} = 0$, $f = 1\text{ MHz}$) | C_{rss} | — | 1.3 | — | pF |
| Functional Tests (In Freescale Test Fixture, 50 ohm system) | | | | | |
| Two-Tone Common-Source Amplifier Power Gain ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 30\text{ W PEP}$, $I_{DQ} = 250\text{ mA}$, $f_1 = 2140.0\text{ MHz}$, $f_2 = 2140.1\text{ MHz}$) | G_{ps} | — | 13 | — | dB |
| Two-Tone Drain Efficiency ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 30\text{ W PEP}$, $I_{DQ} = 250\text{ mA}$, $f_1 = 2140.0\text{ MHz}$, $f_2 = 2140.1\text{ MHz}$) | η | — | 33 | — | % |
| 3rd Order Intermodulation Distortion ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 30\text{ W PEP}$, $I_{DQ} = 250\text{ mA}$, $f_1 = 2140.0\text{ MHz}$, $f_2 = 2140.1\text{ MHz}$) | IMD | — | -30 | — | dBc |
| Input Return Loss ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 30\text{ W PEP}$, $I_{DQ} = 250\text{ mA}$, $f_1 = 2140.0\text{ MHz}$, $f_2 = 2140.1\text{ MHz}$) | IRL | — | -13 | — | dB |
| Two-Tone Common-Source Amplifier Power Gain ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 30\text{ W PEP}$, $I_{DQ} = 250\text{ mA}$, $f_1 = 2110.0\text{ MHz}$, $f_2 = 2110.1\text{ MHz}$ and $f_1 = 2170.0\text{ MHz}$, $f_2 = 2170.1\text{ MHz}$) | G_{ps} | 12 | 13 | — | dB |
| Two-Tone Drain Efficiency ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 30\text{ W PEP}$, $I_{DQ} = 250\text{ mA}$, $f_1 = 2110.0\text{ MHz}$, $f_2 = 2110.1\text{ MHz}$ and $f_1 = 2170.0\text{ MHz}$, $f_2 = 2170.1\text{ MHz}$) | η | 31 | 33 | — | % |
| 3rd Order Intermodulation Distortion ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 30\text{ W PEP}$, $I_{DQ} = 250\text{ mA}$, $f_1 = 2110.0\text{ MHz}$, $f_2 = 2110.1\text{ MHz}$ and $f_1 = 2170.0\text{ MHz}$, $f_2 = 2170.1\text{ MHz}$) | IMD | — | -30 | -27.5 | dBc |
| Input Return Loss ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 30\text{ W PEP}$, $I_{DQ} = 250\text{ mA}$, $f_1 = 2110.0\text{ MHz}$, $f_2 = 2110.1\text{ MHz}$ and $f_1 = 2170.0\text{ MHz}$, $f_2 = 2170.1\text{ MHz}$) | IRL | — | -13 | -9 | dB |

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



| | | | |
|---------|------------------------------------------------|-----|--------------------------------------------|
| B1, B2 | Short Ferrite Beads | Z1 | 0.153" x 0.087" Microstrip |
| C1 | 1 pF Chip Capacitor | Z2 | 0.509" x 0.156" Microstrip |
| C2 | 4.7 pF Chip Capacitor | Z3 | 0.572" x 0.087" Microstrip |
| C3 | 0.5 pF Chip Capacitor | Z4 | 0.509" x 0.232" Microstrip |
| C4 | 3.9 pF Chip Capacitor | Z5 | 0.277" x 0.143" Microstrip |
| C5, C12 | 0.1 μ F Chip Capacitors | Z6 | 0.200" x 0.305" Microstrip |
| C6, C13 | 470 μ F, 63 V Electrolytic Chip Capacitors | Z7 | 0.200" x 0.511" Microstrip |
| C7, C8 | 0.3 pF Chip Capacitors | Z8 | 0.510" x 0.328" Microstrip |
| C9 | 3.6 pF Chip Capacitor | Z9 | 0.608" x 0.081" Microstrip |
| C10 | 22 μ F Tantalum Chip Capacitor | PCB | Taconic TLX8, 30 mils, $\epsilon_r = 2.55$ |
| C11 | 5.1 pF Chip Capacitor | | |
| L1, L2 | 12.5 nH Inductors | | |
| R1, R2 | 12 Ω Chip Resistors (1206) | | |

Figure 1. MRF21030LR3(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. MRF21030LR3(SR3) Test Circuit Component Layout

TYPICAL CHARACTERISTICS

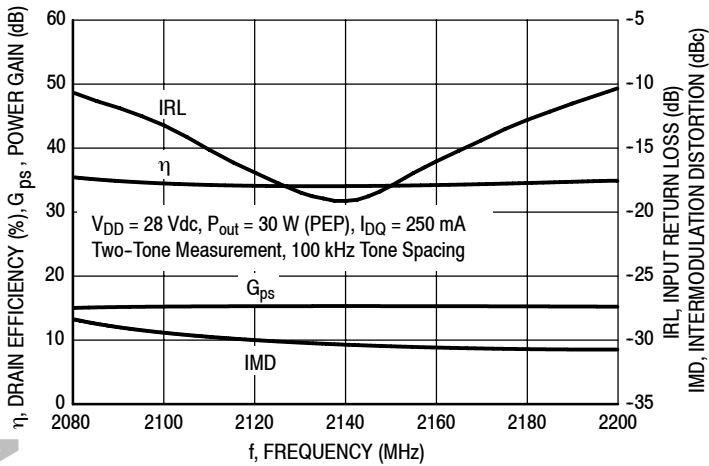


Figure 3. Class AB Broadband Circuit Performance

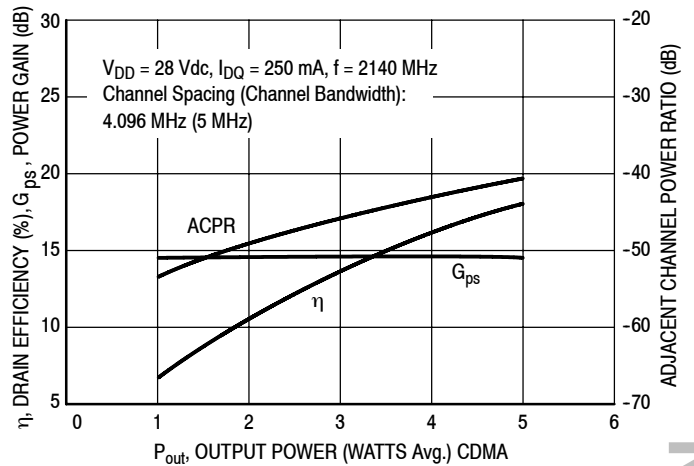


Figure 4. CDMA ACPR, Power Gain and Drain Efficiency versus Output Power

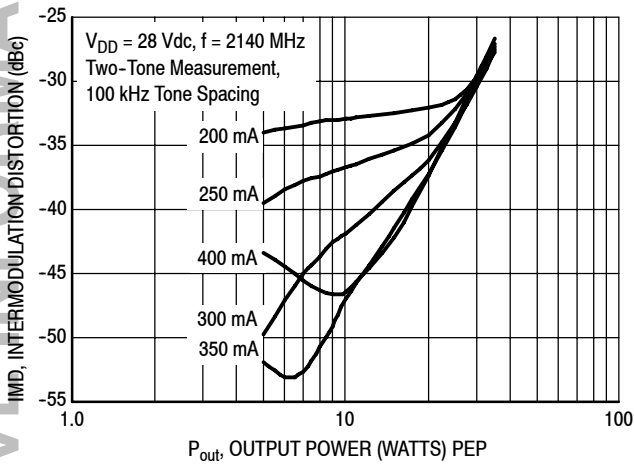


Figure 5. Intermodulation Distortion versus Output Power

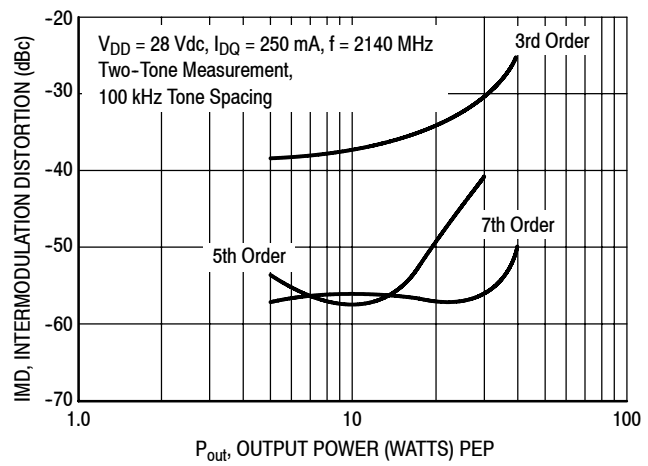


Figure 6. Intermodulation Distortion Products versus Output Power

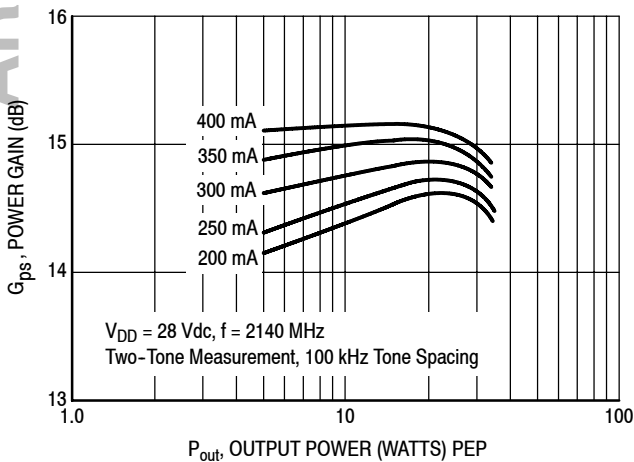


Figure 7. Power Gain versus Output Power

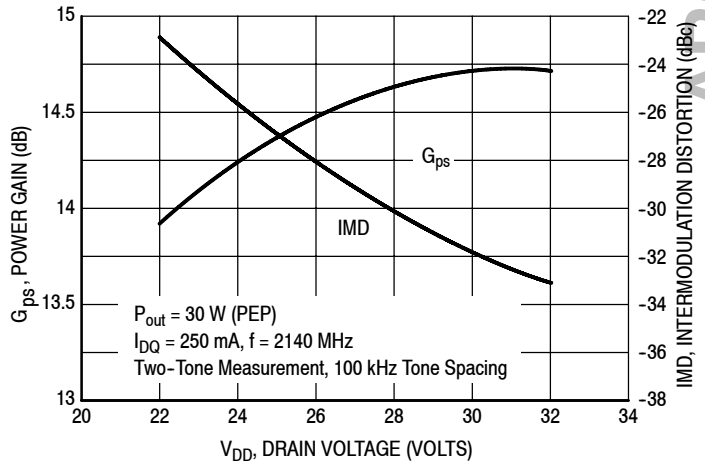
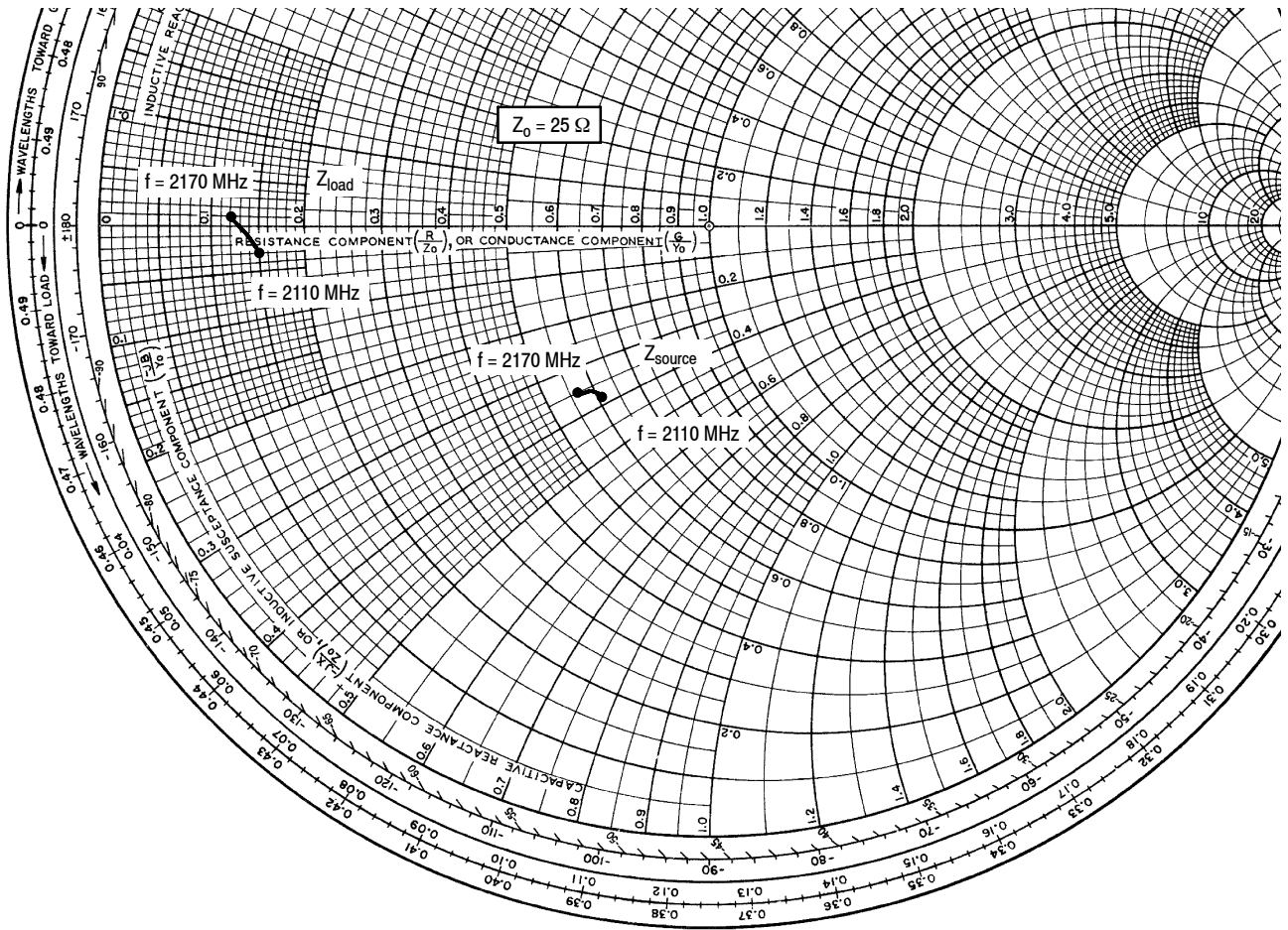


Figure 8. Power Gain and Intermodulation Distortion versus Supply Voltage



$V_{DD} = 28\text{ V}$, $I_{DQ} = 250\text{ mA}$, $P_{out} = 30\text{ W PEP}$

| f MHz | Z_{source} Ω | Z_{load} Ω |
|----------|--------------------------|------------------------|
| 2110 | $15.3 - j9.4$ | $3.7 - j0.78$ |
| 2140 | $14.6 - j9.4$ | $3.4 - j0.37$ |
| 2170 | $14.3 - j8.8$ | $3.0 + j0.13$ |

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

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

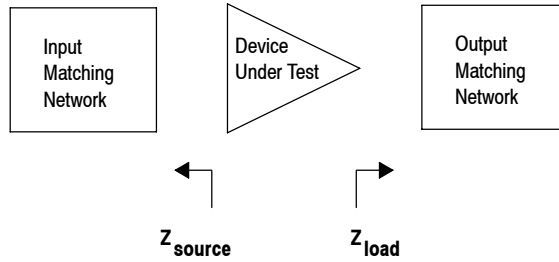
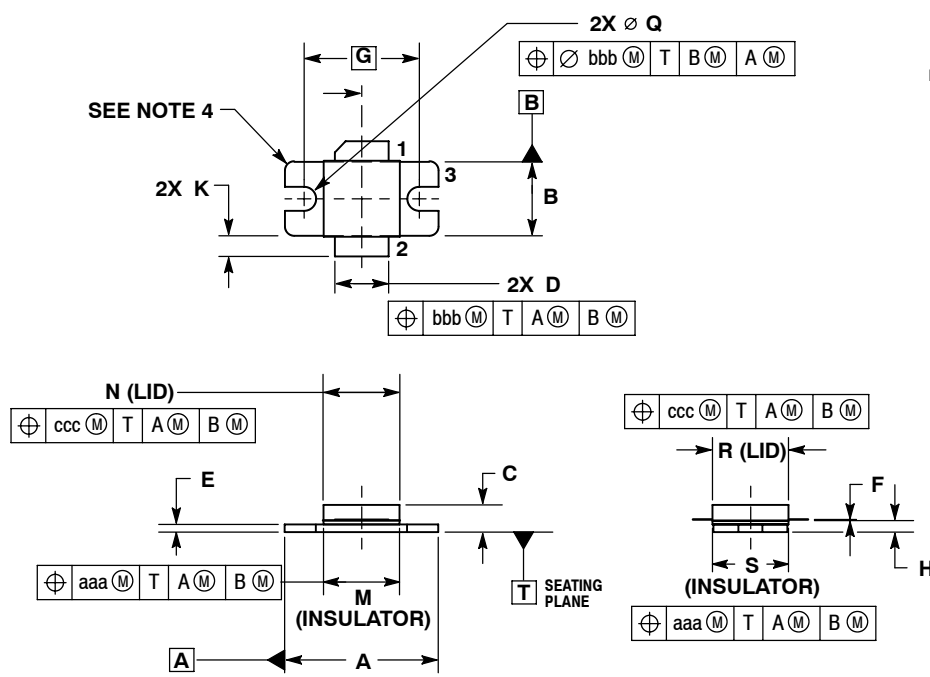


Figure 9. Series Equivalent Source and Load Impedance

ARCHIVE INFORMATION

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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 $.060 \pm .005$ (1.52 ± 0.13) RADIUS OR $.06 \pm .005$ (1.52 ± 0.13) x 45° CHAMFER.

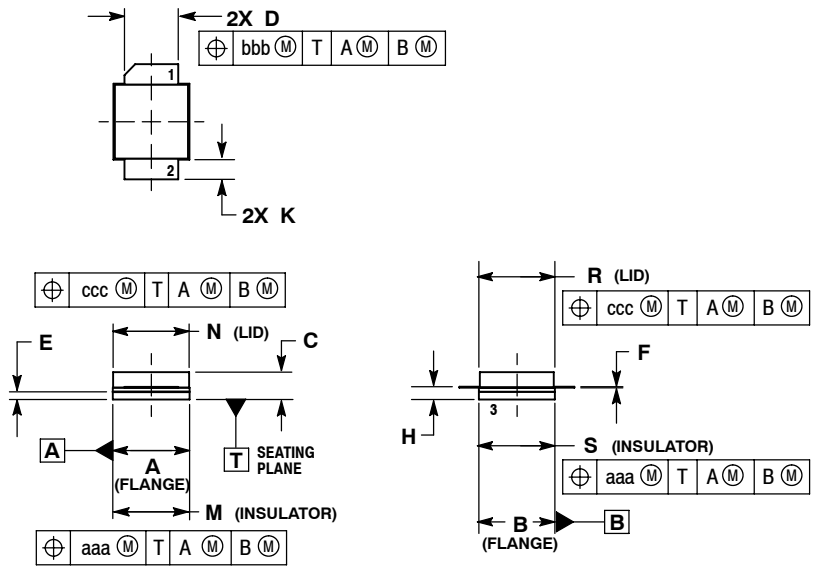
| DIM | INCHES | | MILLIMETERS | |
|-----|--------------------|--------------------|--------------------|-------------------|
| | MIN | MAX | MIN | MAX |
| A | .795 | .805 | 20.19 | 20.44 |
| B | .380 | .390 | 9.65 | 9.9 |
| C | .125 | .163 | 3.17 | 4.14 |
| D | .275 | .285 | 6.98 | 7.24 |
| E | .035 | .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 | $\varnothing .120$ | $\varnothing .130$ | $\varnothing 3.05$ | $\varnothing 3.3$ |
| 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
 MRF21030LR3**

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- 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
 MRF21030LSR3**

REVISION HISTORY

The following table summarizes revisions to this document.

| Revision | Date | Description |
|----------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12 | Dec. 2010 | <ul style="list-style-type: none"> • MRF21030 Rev. 12 data sheet archived. Data sheet split due to change in part life cycle. See MRF21030-1 Rev. 13 for MRF21030LSR3 and MRF21030-2 Rev. 14 for MRF21030LR3. |

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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

For Literature Requests Only:
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