



RF Power Field Effect Transistors

N-Channel Enhancement-Mode Lateral MOSFETs

Designed for W-CDMA base station applications with frequencies from 2110 to 2170 MHz. Suitable for FM, TDMA, CDMA and multicarrier amplifier applications.

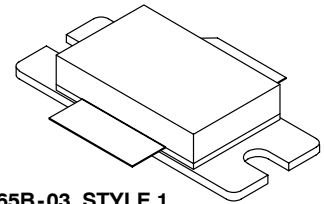
- Typical W-CDMA Performance for 2140 MHz, 28 Volts
 4.096 MHz BW @ 5 MHz offset, 1 PERCH 15 DTCH:
 Output Power — 11.5 Watts
 Efficiency — 16%
 Gain — 12.2 dB
 ACPR — -45 dBc
- Capable of Handling 10:1 VSWR, @ 28 Vdc, 2140 MHz, 90 Watts CW Output Power

Features

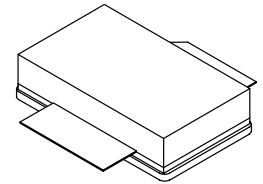
- Internally Matched for Ease of Use
- High Gain, High Efficiency and High Linearity
- Integrated ESD Protection
- Designed for Maximum Gain and Insertion Phase Flatness
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- RoHS Compliant
- In Tape and Reel. R3 Suffix = 250 Units per 56 mm, 13 inch Reel.

MRF21090R3
MRF21090SR3

2110-2170 MHz, 90 W, 28 V
LATERAL N-CHANNEL
RF POWER MOSFETs



CASE 465B-03, STYLE 1
NI-880
MRF21090R3



CASE 465C-02, STYLE 1
NI-880S
MRF21090SR3

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 | 270 1.54 | W W/ $^\circ\text{C}$ |
| Storage Temperature Range | T_{stg} | - 65 to +150 | $^\circ\text{C}$ |
| Case Operating Temperature | T_C | 150 | $^\circ\text{C}$ |
| Operating Junction Temperature | T_J | 200 | $^\circ\text{C}$ |

Table 2. Thermal Characteristics

| Characteristic | Symbol | Value | Unit |
|--------------------------------------|-----------------|-------|---------------------------|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 0.65 | $^\circ\text{C}/\text{W}$ |

Table 3. ESD Protection Characteristics

| Test Conditions | | Class |
|------------------|---------------------------|------------------------------|
| Human Body Model | MRF21090R3 MRF21090SR3 | 2 (Minimum) 1 (Minimum) |
| Machine Model | MRF21090R3 MRF21090SR3 | M3 (Minimum) M4 (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 ($V_{GS} = 0\text{ Vdc}$, $I_D = 100\ \mu\text{Adc}$) | $V_{(BR)DSS}$ | 65 | — | — | Vdc |
| Gate-Source Leakage Current ($V_{GS} = 5\text{ Vdc}$, $V_{DS} = 0\text{ Vdc}$) | I_{GSS} | — | — | 1 | μAdc |
| Zero Gate Voltage Drain Leakage Current ($V_{DS} = 28\text{ Vdc}$, $V_{GS} = 0\text{ Vdc}$) | I_{DSS} | — | — | 10 | μAdc |
| On Characteristics | | | | | |
| Forward Transconductance ($V_{DS} = 10\text{ Vdc}$, $I_D = 3\text{ Adc}$) | g_{fs} | — | 7.2 | — | S |
| Gate Threshold Voltage ($V_{DS} = 10\text{ V}$, $I_D = 300\ \mu\text{A}$) | $V_{GS(th)}$ | 2 | 3 | 4 | Vdc |
| Gate Quiescent Voltage ($V_{DS} = 28\text{ V}$, $I_D = 750\text{ mA}$) | $V_{GS(Q)}$ | 3 | 3.8 | 5 | Vdc |
| Drain-Source On-Voltage ($V_{GS} = 10\text{ V}$, $I_D = 1\text{ A}$) | $V_{DS(on)}$ | — | 0.1 | 0.6 | Vdc |
| Dynamic Characteristics | | | | | |
| Reverse Transfer Capacitance ⁽¹⁾ ($V_{DS} = 28\text{ Vdc}$, $V_{GS} = 0$, $f = 1\text{ MHz}$) | C_{rss} | — | 4.2 | — | pF |
| Functional Tests (In Freescale Test Fixture) | | | | | |
| Common-Source Amplifier Power Gain ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 90\text{ W PEP}$, $I_{DQ} = 750\text{ mA}$, $f_1 = 2110.0\text{ MHz}$, $f_2 = 2110.1\text{ MHz}$ and $f_1 = 2170.0\text{ MHz}$, $f_2 = 2170.1\text{ MHz}$) | G_{ps} | 10 | 11.7 | — | dB |
| Drain Efficiency ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 90\text{ W PEP}$, $I_{DQ} = 750\text{ mA}$, $f_1 = 2110.0\text{ MHz}$, $f_2 = 2110.1\text{ MHz}$ and $f_1 = 2170.0\text{ MHz}$, $f_2 = 2170.1\text{ MHz}$) | η | 30 | 33 | — | % |
| Intermodulation Distortion ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 90\text{ W PEP}$, $I_{DQ} = 750\text{ mA}$, $f_1 = 2110.0\text{ MHz}$, $f_2 = 2110.1\text{ MHz}$ and $f_1 = 2170.0\text{ MHz}$, $f_2 = 2170.1\text{ MHz}$) | IMD | — | -30 | -27.5 | dBc |
| Input Return Loss ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 90\text{ W PEP}$, $I_{DQ} = 750\text{ mA}$, $f_1 = 2110.0\text{ MHz}$, $f_2 = 2110.1\text{ MHz}$ and $f_1 = 2170.0\text{ MHz}$, $f_2 = 2170.1\text{ MHz}$) | IRL | — | -12 | -9.0 | dB |
| Common-Source Amplifier Power Gain ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 75\text{ W CW}$, $I_{DQ} = 750\text{ mA}$, $f = 2170\text{ MHz}$) | G_{ps} | — | 11.7 | — | dB |
| Drain Efficiency ($V_{DD} = 28\text{ Vdc}$, $P_{out} = 75\text{ W CW}$, $I_{DQ} = 750\text{ mA}$, $f = 2170\text{ MHz}$) | η | — | 41 | — | % |

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

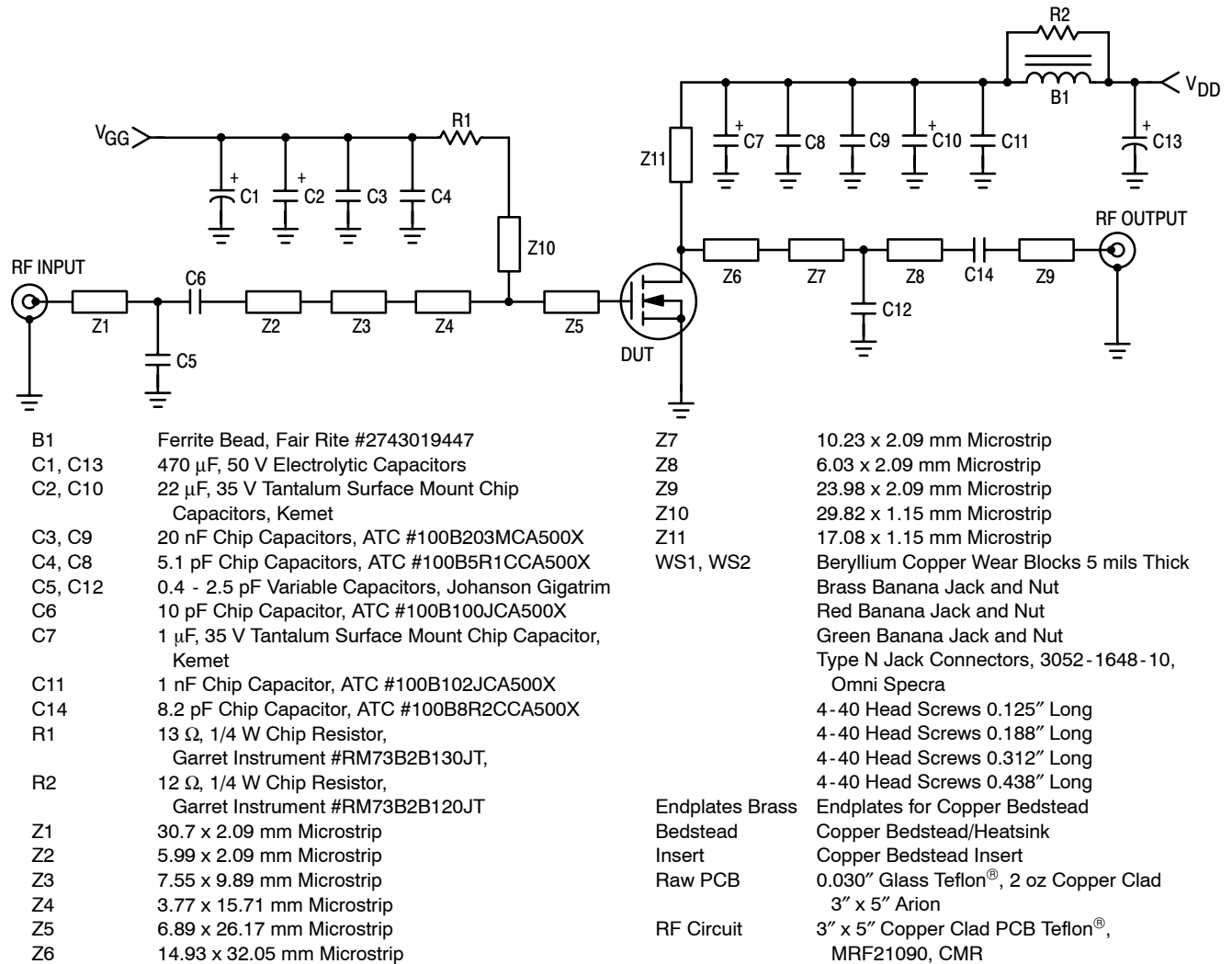
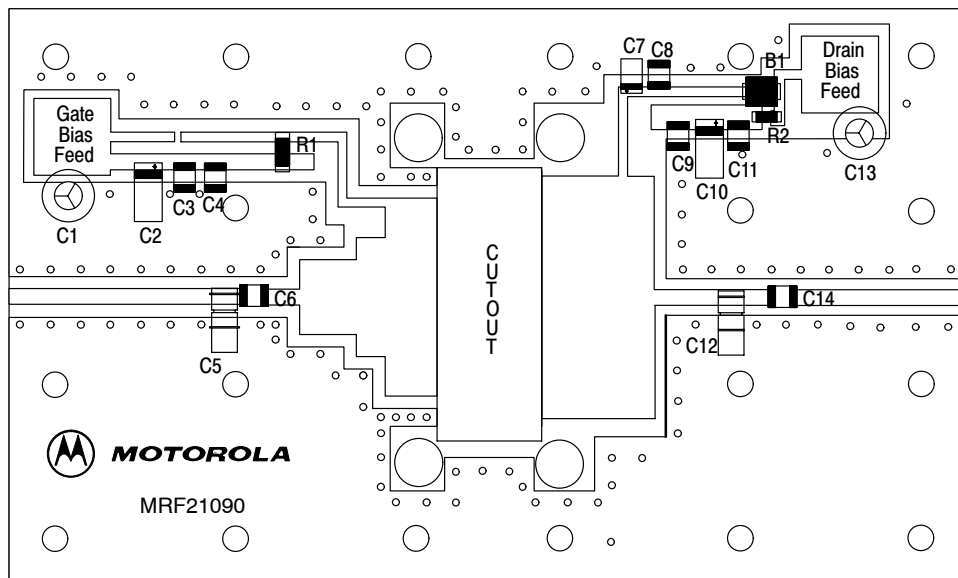


Figure 1. MRF21090R3(SR3) Test Circuit Schematic



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. MRF21090R3(SR3) Test Circuit Component Layout

MRF21090R3 MRF21090SR3

TYPICAL PERFORMANCE (IN FREESCALE TEST FIXTURE)

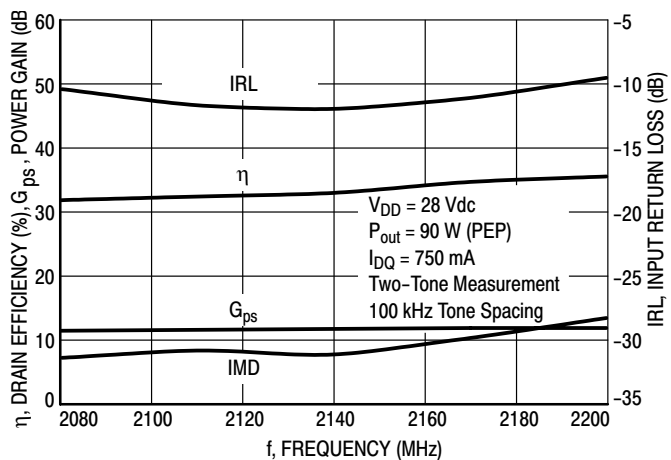


Figure 3. Class AB Broadband Circuit Performance

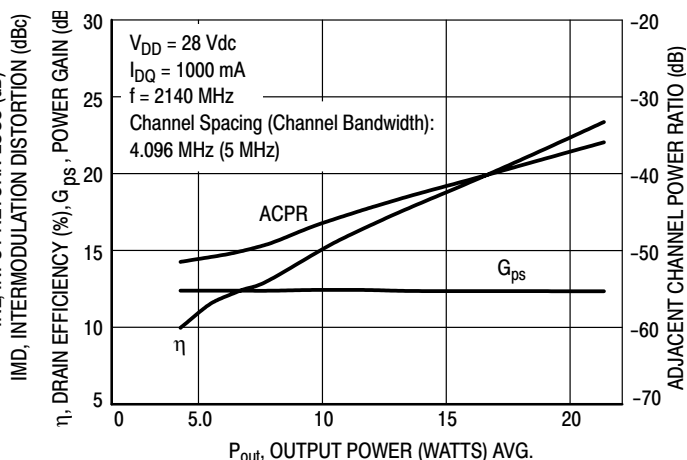


Figure 4. CDMA ACPR, Power Gain and Drain Efficiency versus Output Power

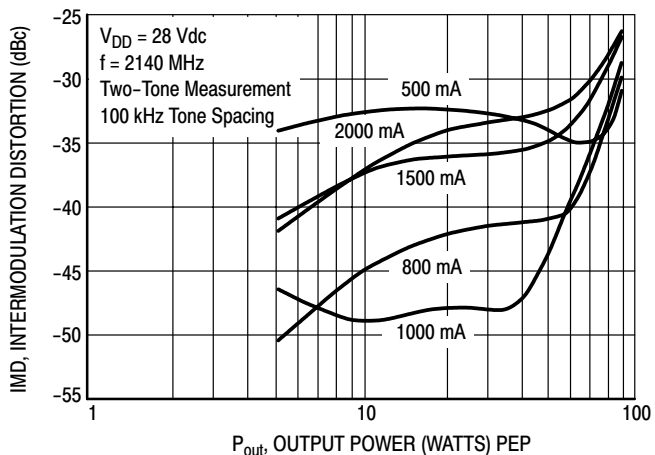


Figure 5. Intermodulation Distortion versus Output Power

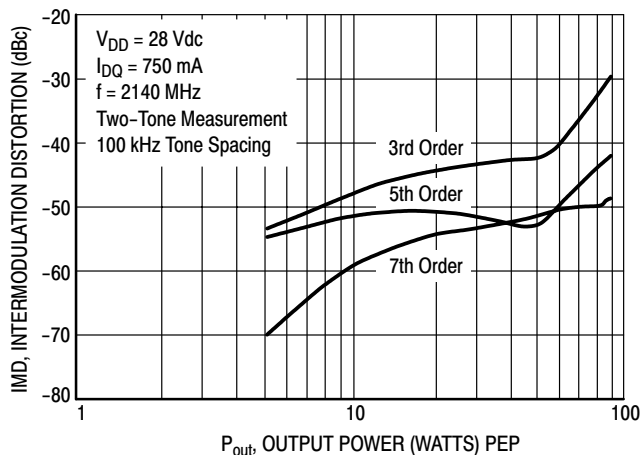


Figure 6. Intermodulation Distortion Products versus Output Power

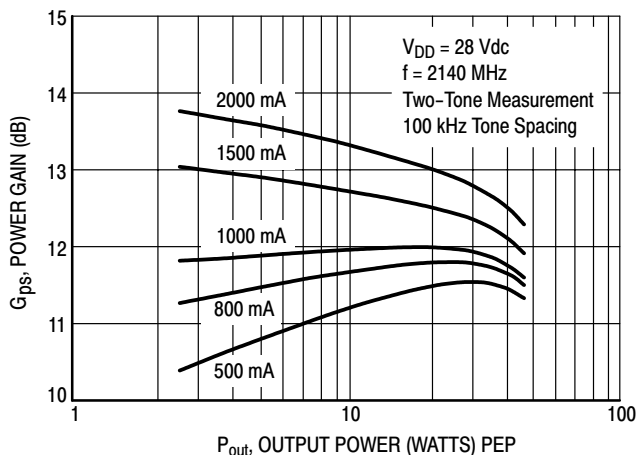


Figure 7. Power Gain versus Output Power

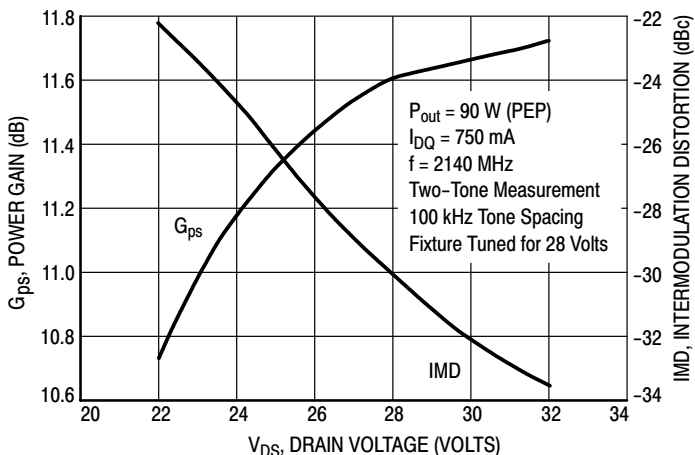
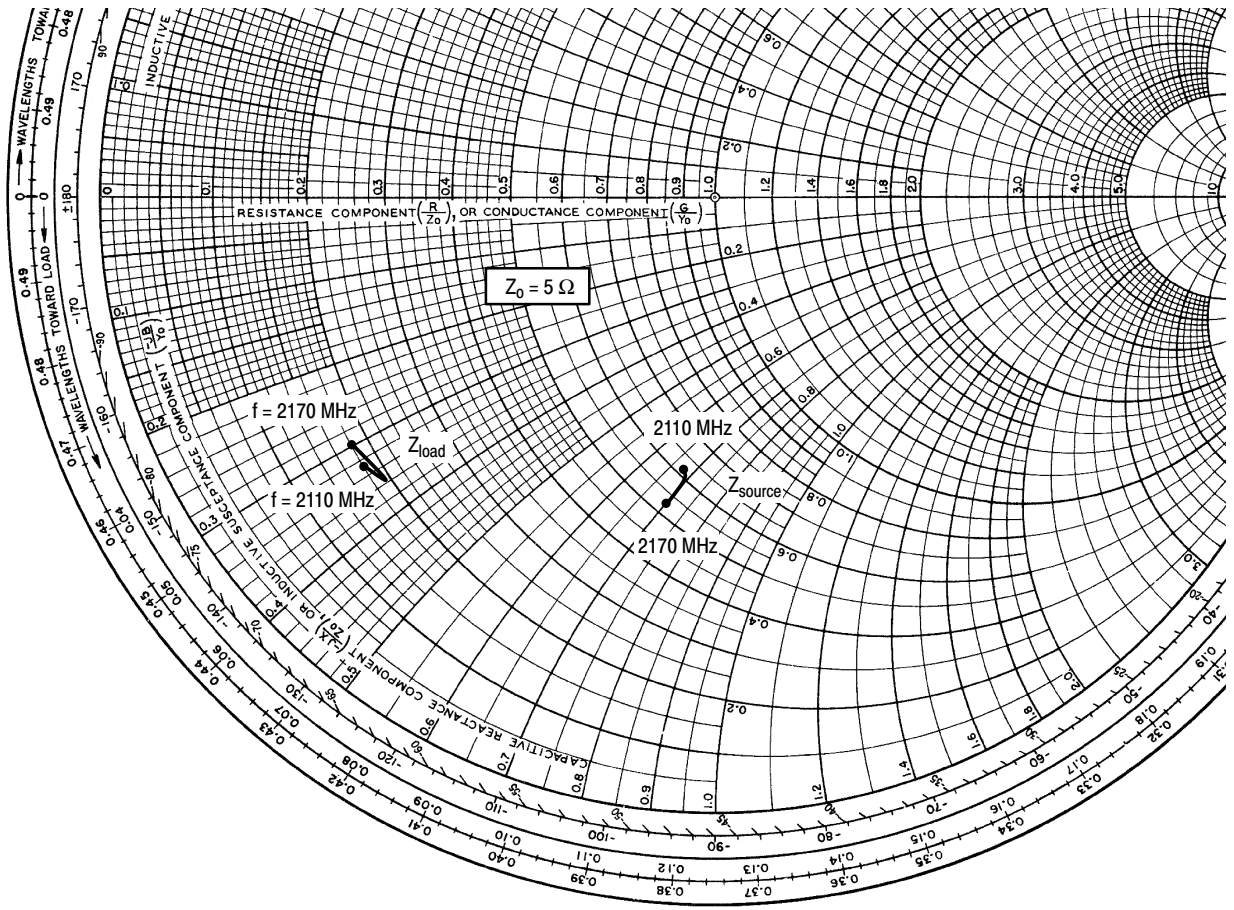


Figure 8. Power Gain and Intermodulation Distortion versus Supply Voltage



$V_{DD} = 28 \text{ V}$, $I_{DQ} = 750 \text{ mA}$, $P_{\text{out}} = 90 \text{ W (PEP)}$

| f MHz | Z_{source} Ω | Z_{load} Ω |
|----------|---------------------------------|-------------------------------|
| 2110 | $3.03 - j3.40$ | $0.92 - j1.67$ |
| 2140 | $3.02 - j3.46$ | $0.97 - j1.80$ |
| 2170 | $2.60 - j3.50$ | $0.90 - j1.52$ |

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

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

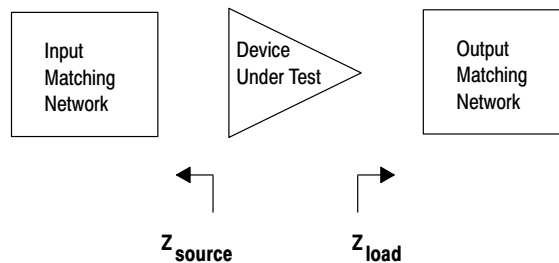
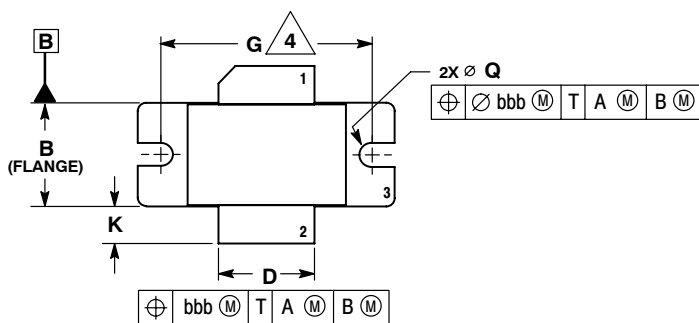


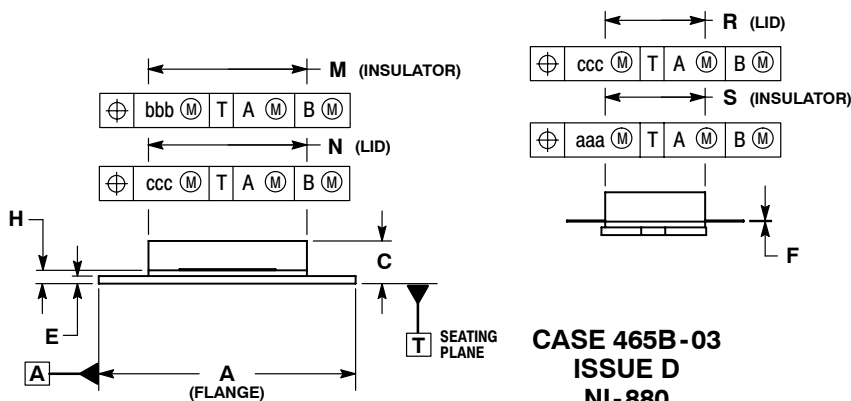
Figure 9. Series Equivalent Source and Load Impedance

NOTES

PACKAGE DIMENSIONS



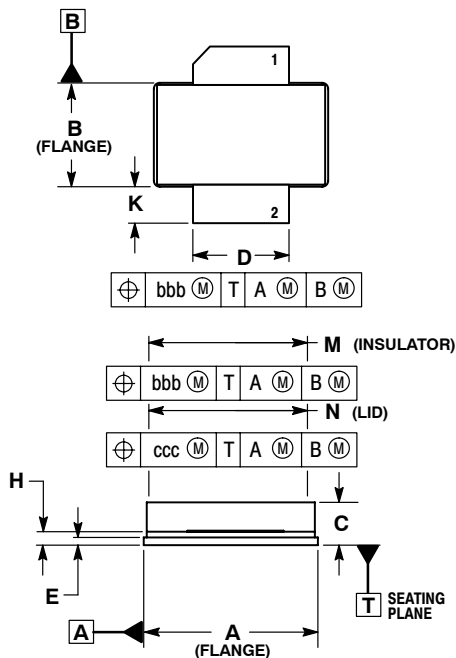
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.
 2. CONTROLLING DIMENSION: INCH.
 3. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.
 4. RECOMMENDED BOLT CENTER DIMENSION OF 1.16 (29.57) BASED ON M3 SCREW.



| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 1.335 | 1.345 | 33.91 | 34.16 |
| B | 0.535 | 0.545 | 13.6 | 13.8 |
| C | 0.147 | 0.200 | 3.73 | 5.08 |
| 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 | 0.175 | 0.205 | 4.44 | 5.21 |
| M | 0.872 | 0.888 | 22.15 | 22.55 |
| N | 0.871 | 0.889 | 19.30 | 22.60 |
| Q | ∅.118 | ∅.138 | ∅3.00 | ∅3.51 |
| R | 0.515 | 0.525 | 13.10 | 13.30 |
| S | 0.515 | 0.525 | 13.10 | 13.30 |
| aaa | 0.007 REF | | 0.178 REF | |
| bbb | 0.010 REF | | 0.254 REF | |
| ccc | 0.015 REF | | 0.381 REF | |

**CASE 465B-03
ISSUE D
NI-880
MRF21090R3**

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



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.
 2. CONTROLLING DIMENSION: INCH.
 3. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.905 | 0.915 | 22.99 | 23.24 |
| B | 0.535 | 0.545 | 13.60 | 13.80 |
| C | 0.147 | 0.200 | 3.73 | 5.08 |
| 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 | 0.872 | 0.888 | 22.15 | 22.55 |
| N | 0.871 | 0.889 | 19.30 | 22.60 |
| R | 0.515 | 0.525 | 13.10 | 13.30 |
| S | 0.515 | 0.525 | 13.10 | 13.30 |
| aaa | 0.007 REF | | 0.178 REF | |
| bbb | 0.010 REF | | 0.254 REF | |
| ccc | 0.015 REF | | 0.381 REF | |

**CASE 465C-02
ISSUE D
NI-880S
MRF21090SR3**

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

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