

RF Power Field Effect Transistor

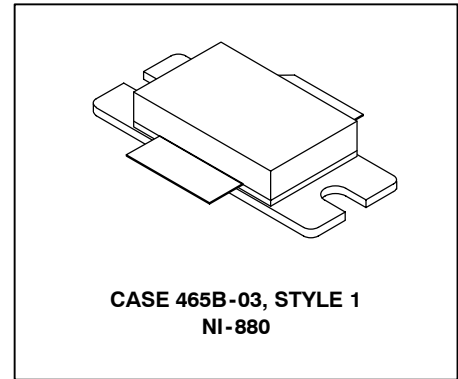
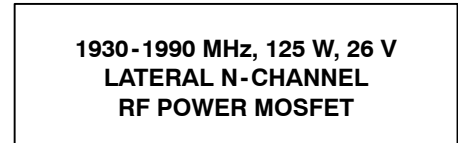
N-Channel Enhancement-Mode Lateral MOSFET

Designed for PCN and PCS base station applications with frequencies from 1900 to 2000 MHz. Suitable for TDMA, CDMA and multicarrier amplifier applications.

- Typical 2-Carrier N-CDMA Performance for $V_{DD} = 26$ Volts, $I_{DQ} = 1300$ mA, $f = 1930$ MHz, IS-95 CDMA (Pilot, Sync, Paging, Traffic Codes 8 Through 13) 1.2288 MHz Channel Bandwidth Carrier. Adjacent Channels Measured over a 30 kHz Bandwidth at $f_1 - 885$ kHz and $f_2 + 885$ kHz. Distortion Products Measured over 1.2288 MHz Bandwidth at $f_1 - 2.5$ MHz and $f_2 + 2.5$ MHz. Peak/Avg. = 9.8 dB @ 0.01% Probability on CCDF.
Output Power — 24 Watts Avg.
Power Gain — 13.6 dB
Efficiency — 22%
ACPR — -51 dB
IM3 — -37.0 dBc
- Capable of Handling 5:1 VSWR, @ 26 Vdc, 1960 MHz, 125 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.



ARCHIVE INFORMATION

ARCHIVE INFORMATION

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 | 330 1.89 | 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 | $R_{\theta JC}$ | 0.53 | $^\circ\text{C/W}$ |

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)

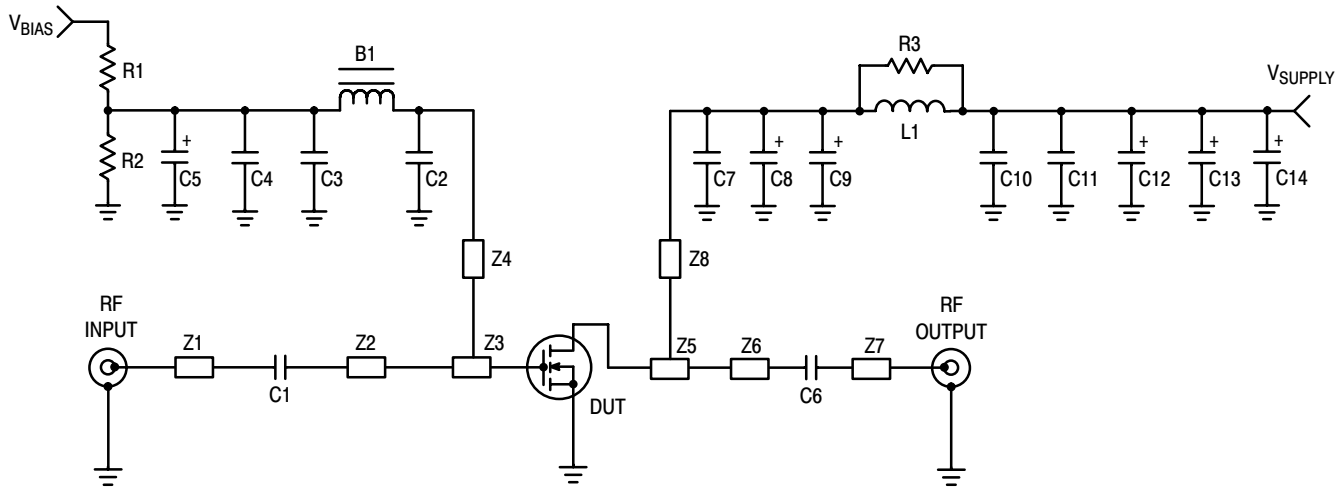
| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---------------|-----|-------|------|-----------------|
| Off Characteristics | | | | | |
| Drain-Source Breakdown Voltage ($V_{GS} = 0 \text{ Vdc}$, $I_D = 100 \mu\text{Adc}$) | $V_{(BR)DSS}$ | 65 | — | — | Vdc |
| Gate-Source Leakage Current ($V_{GS} = 5 \text{ Vdc}$, $V_{DS} = 0 \text{ Vdc}$) | I_{GSS} | — | — | 1 | μAdc |
| Zero Gate Voltage Drain Leakage Current ($V_{DS} = 26 \text{ Vdc}$, $V_{GS} = 0 \text{ Vdc}$) | I_{DSS} | — | — | 10 | μAdc |
| On Characteristics | | | | | |
| Forward Transconductance ($V_{DS} = 10 \text{ Vdc}$, $I_D = 3 \text{ Adc}$) | g_{fs} | — | 9 | — | S |
| Gate Threshold Voltage ($V_{DS} = 10 \text{ Vdc}$, $I_D = 300 \mu\text{Adc}$) | $V_{GS(th)}$ | 2 | — | 4 | Vdc |
| Gate Quiescent Voltage ($V_{DS} = 26 \text{ Vdc}$, $I_D = 1300 \text{ mAdc}$) | $V_{GS(Q)}$ | 2.5 | 3.9 | 4.5 | Vdc |
| Drain-Source On-Voltage ($V_{GS} = 10 \text{ Vdc}$, $I_D = 3 \text{ Adc}$) | $V_{DS(on)}$ | — | 0.185 | 0.21 | Vdc |
| Dynamic Characteristics | | | | | |
| Reverse Transfer Capacitance (1) ($V_{DS} = 26 \text{ Vdc}$, $V_{GS} = 0$, $f = 1 \text{ MHz}$) | C_{rss} | — | 5.4 | — | pF |
| Functional Tests (In Freescale Test Fixture) 2-Carrier N-CDMA, 1.2288 MHz Channel Bandwidth Carriers. Peak/Avg = 9.8 dB @ 0.01% Probability on CCDF. | | | | | |
| Common-Source Amplifier Power Gain ($V_{DD} = 26 \text{ Vdc}$, $P_{out} = 24 \text{ W Avg}$, $I_{DQ} = 1300 \text{ mA}$, $f_1 = 1930 \text{ MHz}$, $f_2 = 1932.5 \text{ MHz}$) | G_{ps} | 12 | 13.5 | — | dB |
| Drain Efficiency ($V_{DD} = 26 \text{ Vdc}$, $P_{out} = 24 \text{ W Avg}$, $I_{DQ} = 1300 \text{ mA}$, $f_1 = 1930 \text{ MHz}$, $f_2 = 1932.5 \text{ MHz}$) | η | 19 | 22 | — | % |
| Intermodulation Distortion ($V_{DD} = 26 \text{ Vdc}$, $P_{out} = 24 \text{ W Avg}$, $I_{DQ} = 1300 \text{ mA}$, $f_1 = 1930 \text{ MHz}$, $f_2 = 1932.5 \text{ MHz}$; IM3 measured over 1.2288 MHz Bandwidth at $f_1 - 2.5 \text{ MHz}$ and $f_2 + 2.5 \text{ MHz}$) | IM3 | — | -37 | -35 | dBc |
| Adjacent Channel Power Ratio ($V_{DD} = 26 \text{ Vdc}$, $P_{out} = 24 \text{ W Avg}$, $I_{DQ} = 1300 \text{ mA}$, $f_1 = 1930 \text{ MHz}$, $f_2 = 1932.5 \text{ MHz}$; ACPR measured over 30 kHz Bandwidth at $f_1 - 885 \text{ MHz}$ and $f_2 + 885 \text{ MHz}$) | ACPR | — | -51 | -47 | dBc |
| Input Return Loss ($V_{DD} = 26 \text{ Vdc}$, $P_{out} = 24 \text{ W Avg}$, $I_{DQ} = 1300 \text{ mA}$, $f_1 = 1930 \text{ MHz}$, $f_2 = 1932.5 \text{ MHz}$) | IRL | — | -13 | -9 | dB |

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

(continued)

Table 4. Electrical Characteristics ($T_C = 25^\circ\text{C}$ unless otherwise noted) (continued)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|-----------|-----|------|-----|------|
| Functional Tests (In Freescale Test Fixture) | | | | | |
| Two-Tone Common-Source Amplifier Power Gain ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 125\text{ W PEP}$, $I_{DQ} = 1300\text{ mA}$, $f_1 = 1930\text{ MHz}$, $f_2 = 1990\text{ MHz}$, Tone Spacing = 100 kHz) | G_{ps} | — | 13.5 | — | dB |
| Two-Tone Drain Efficiency ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 125\text{ W PEP}$, $I_{DQ} = 1300\text{ mA}$, $f_1 = 1930\text{ MHz}$, $f_2 = 1990\text{ MHz}$, Tone Spacing = 100 kHz) | η | — | 35 | — | % |
| Third Order Intermodulation Distortion ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 125\text{ W PEP}$, $I_{DQ} = 1300\text{ mA}$, $f_1 = 1930\text{ MHz}$, $f_2 = 1990\text{ MHz}$, Tone Spacing = 100 kHz) | IMD | — | -30 | — | dBc |
| Input Return Loss ($V_{DD} = 26\text{ Vdc}$, $P_{out} = 125\text{ W PEP}$, $I_{DQ} = 1300\text{ mA}$, $f_1 = 1930\text{ MHz}$, $f_2 = 1990\text{ MHz}$, Tone Spacing = 100 kHz) | IRL | — | -13 | — | dB |
| $P_{out, 1\text{ dB Compression Point}}$ ($V_{DD} = 26\text{ Vdc}$, $I_{DQ} = 1300\text{ mA}$, $f = 1990\text{ MHz}$) | P_{1dB} | — | 130 | — | W |

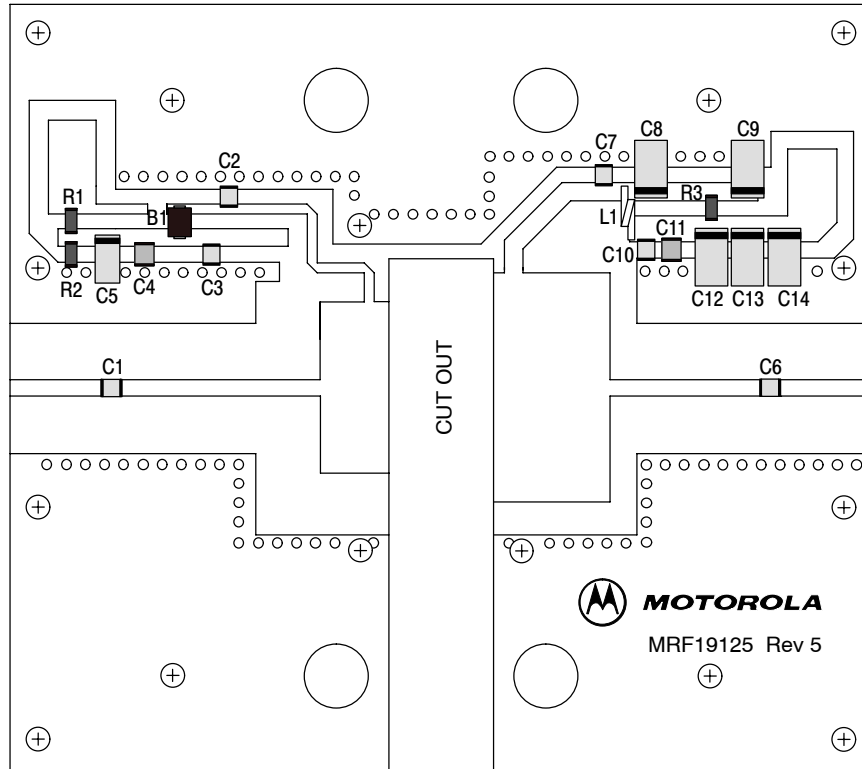


| | | | |
|--------|----------------------------|-------|--|
| Z1, Z7 | 0.500" x 0.084" Microstrip | Board | 0.030" Glass Teflon [®] , |
| Z2 | 1.105" x 0.084" Microstrip | | Keene GX-0300-55-22, $\epsilon_r = 2.55$ |
| Z3 | 0.360" x 0.895" Microstrip | PCB | Etched Circuit Boards |
| Z4 | 0.920" x 0.048" Microstrip | | MRF19125 Rev. 5, CMR |
| Z5 | 0.605" x 1.195" Microstrip | | |
| Z6 | 0.800" x 0.084" Microstrip | | |
| Z8 | 0.660" x 0.095" Microstrip | | |

Figure 1. MRF19125R3 Test Circuit Schematic

Table 5. MRF19125R3 Test Circuit Component Designations and Values

| Designators | Description |
|-------------------|--|
| B1 | Short Ferrite Bead, Fair Rite #2743019447 |
| C1 | 51 pF Chip Capacitor, ATC #100B510JCA500X |
| C2, C7 | 5.1 pF Chip Capacitors, ATC #100B5R1JCA500X |
| C3, C10 | 1000 pF Chip Capacitors, ATC #100B102JCA500X |
| C4, C11 | 0.1 μ F Chip Capacitors, Kemet #CDR33BX104AKWS |
| C5 | 0.1 μ F Tantalum Chip Capacitor, Kemet #T491C105M050 |
| C6 | 10 pF Chip Capacitor, ATC #100B100JCA500X |
| C8 | 10 μ F Tantalum Chip Capacitor, Kemet #T491X106K035AS4394 |
| C9, C12, C13, C14 | 22 μ F Tantalum Chip Capacitors, Kemet #T491X226K035AS4394 |
| L1 | 1 Turn, #20 AWG, 0.100" ID |
| N1, N2 | Type N Flange Mounts, Omni Spectra #3052-1648-10 |
| R1 | 1.0 k Ω , 1/8 W Chip Resistor |
| R2 | 220 k Ω , 1/8 W Chip Resistor |
| R3 | 10 Ω , 1/8 W Chip Resistor |



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. MRF19125R3 Test Circuit Component Layout

TYPICAL CHARACTERISTICS

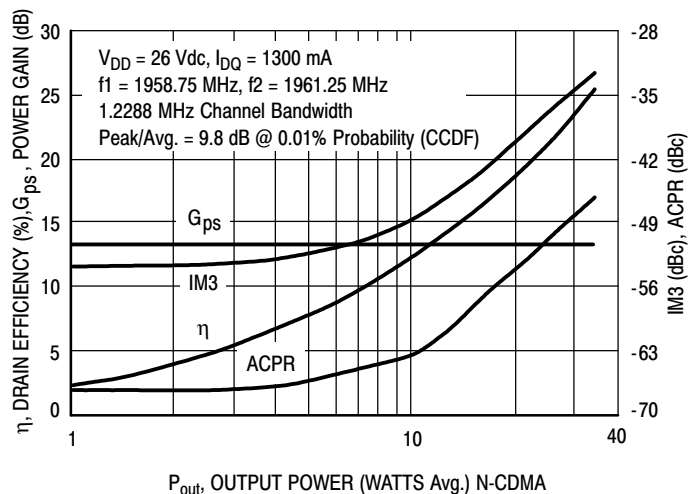


Figure 3. 2-Carrier CDMA ACPR, IM3, Power Gain and Drain Efficiency versus Output Power

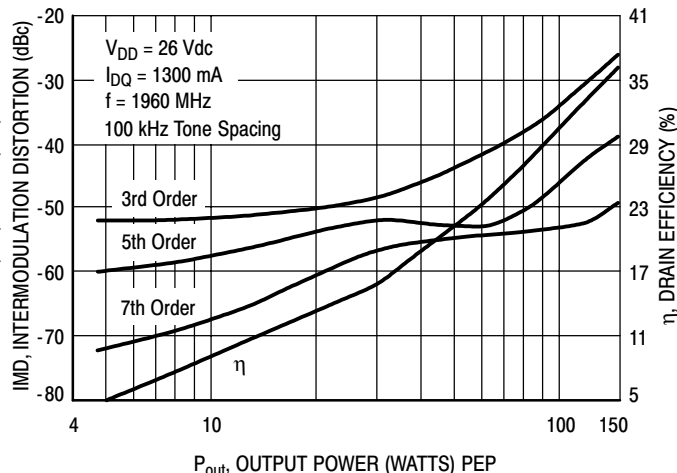


Figure 4. Intermodulation Distortion Products versus Output Power

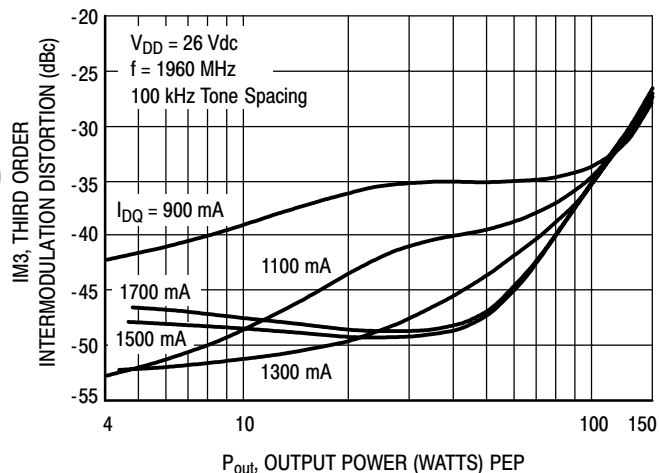


Figure 5. Third Order Intermodulation Distortion versus Output Power

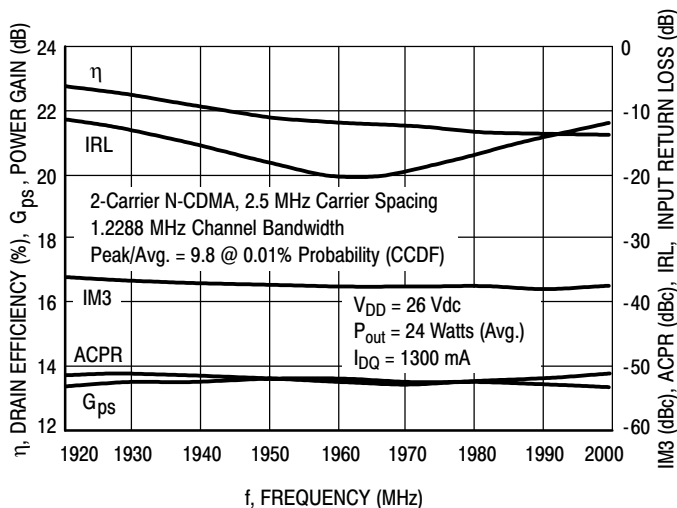


Figure 6. 2-Carrier N-CDMA Broadband Performance

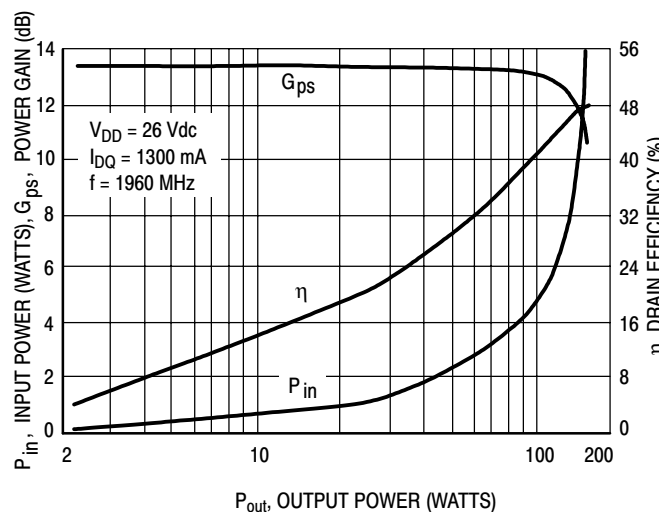


Figure 7. CW Performance

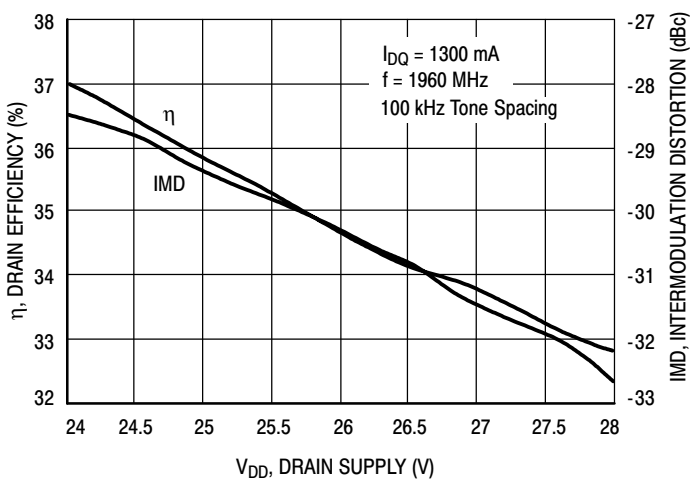


Figure 8. Two-Tone Intermodulation Distortion and Drain Efficiency versus Drain Supply

TYPICAL CHARACTERISTICS

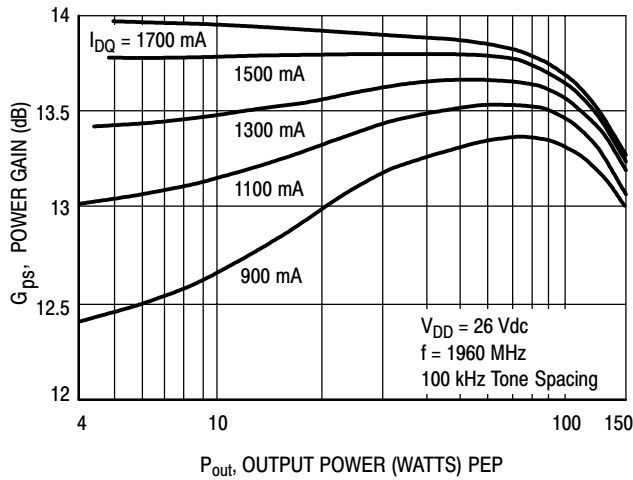


Figure 9. Two-Tone Power Gain versus Output Power

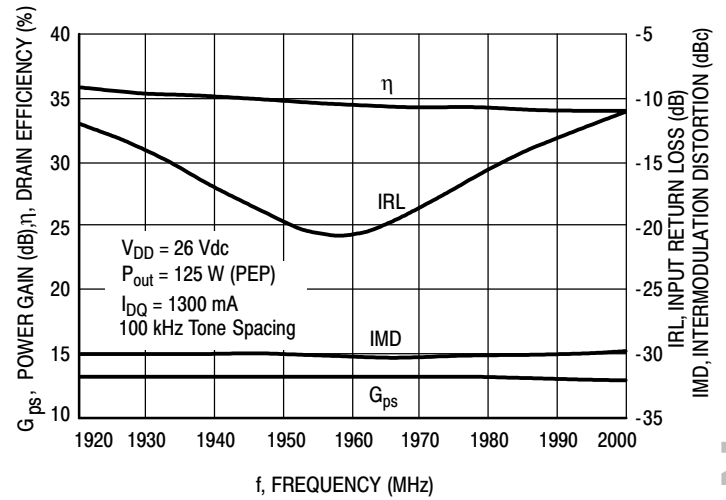


Figure 10. Two-Tone Broadband Performance

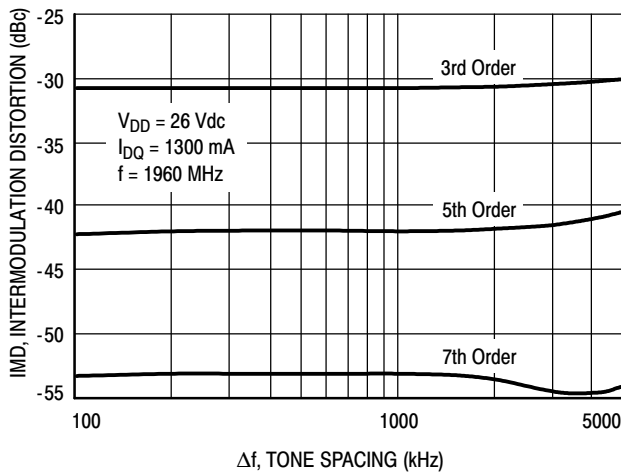
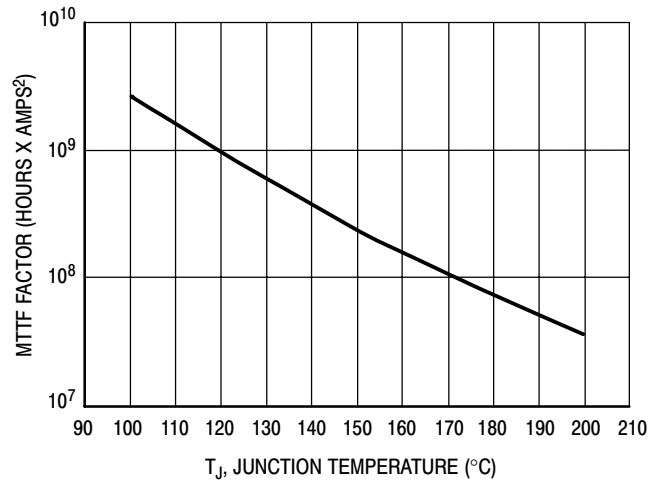


Figure 11. Intermodulation Distortion Products versus Two-Tone Tone Spacing



This above graph displays calculated MTTF in hours x ampere² drain current. Life tests at elevated temperatures have correlated to better than $\pm 10\%$ of the theoretical prediction for metal failure. Divide MTTF factor by I_D^2 for MTTF in a particular application.

Figure 12. MTTF Factor versus Junction Temperature

N-CDMA TEST SIGNAL

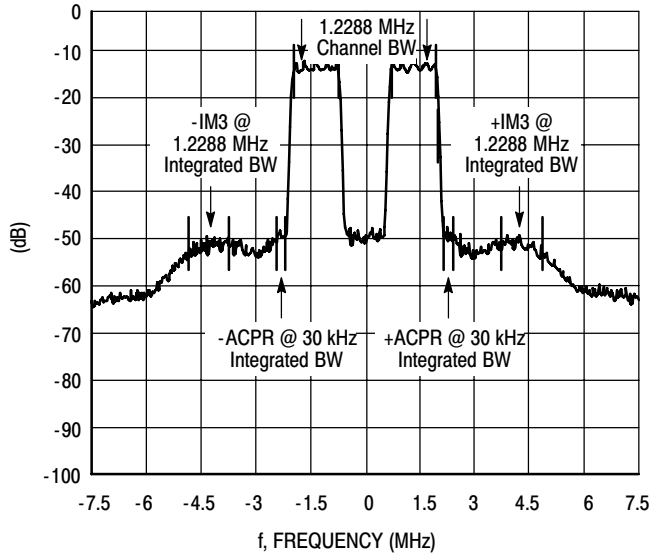
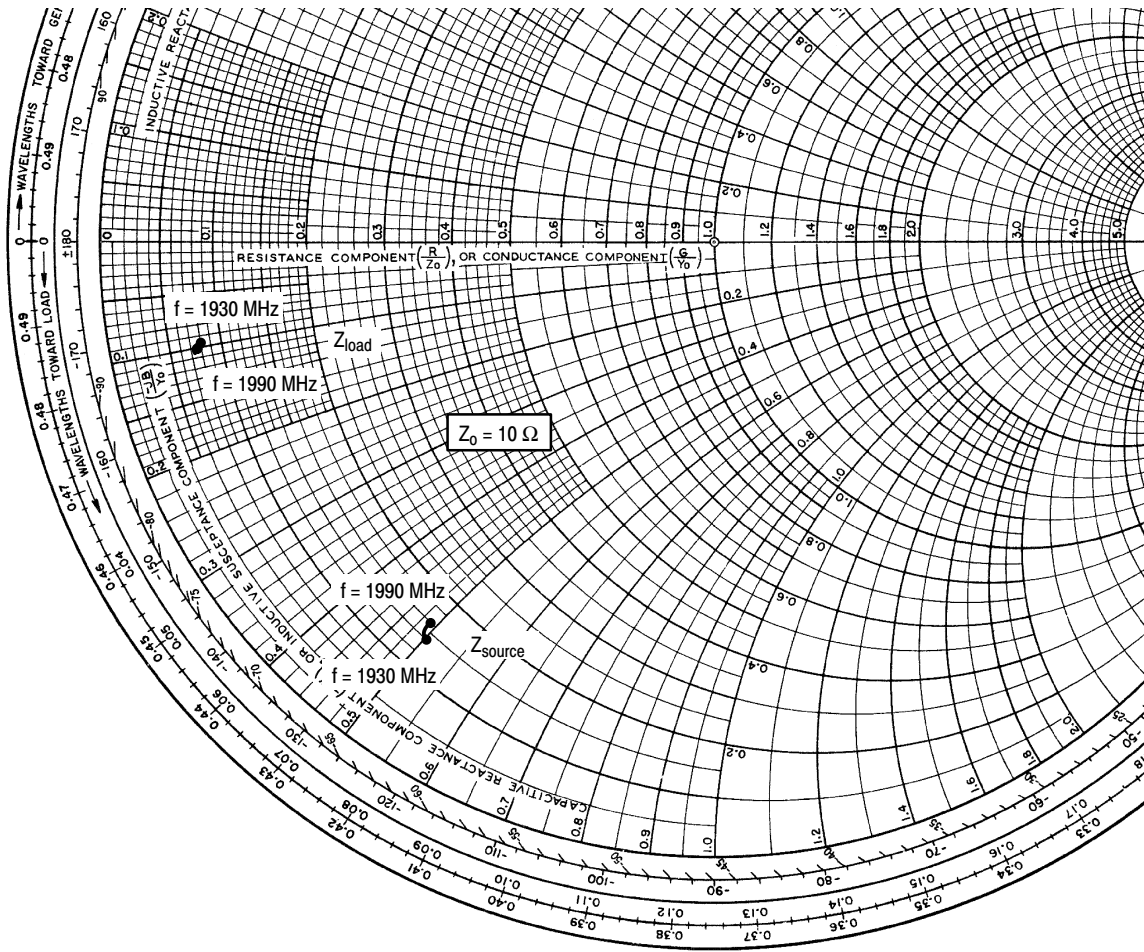


Figure 14. 2-Carrier N-CDMA Spectrum



$V_{DD} = 26\text{ V}$, $I_{DQ} = 1300\text{ mA}$, $P_{out} = 24\text{ W (Avg.)}$

| f MHz | Z_{source} Ω | Z_{load} Ω |
|----------|-------------------|-----------------|
| 1930 | $1.43 - j5.01$ | $0.75 - j0.93$ |
| 1960 | $1.51 - j4.88$ | $0.71 - j0.89$ |
| 1990 | $1.56 - j4.93$ | $0.68 - j1.02$ |

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

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

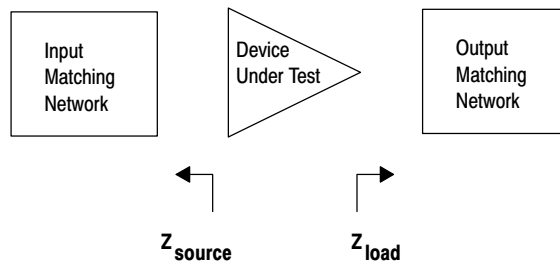
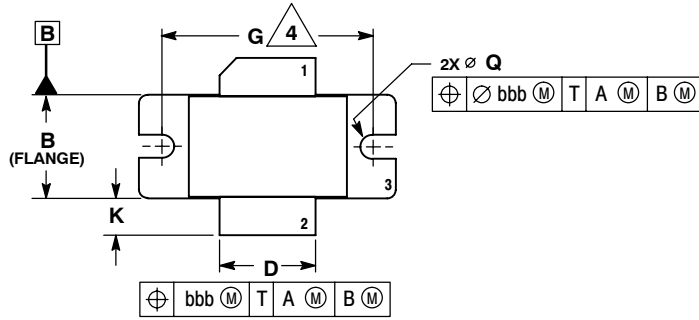


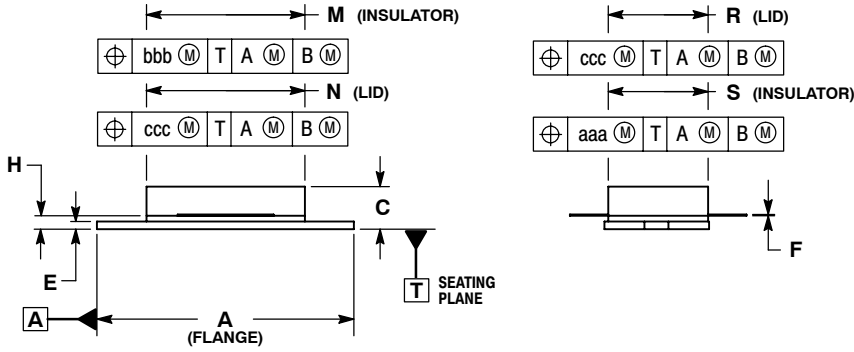
Figure 13. Series Equivalent Source and Load Impedance

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 | Ø.118 | Ø.138 | Ø3.00 | Ø3.51 |
| 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 | |



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

**CASE 465B-03
 ISSUE D
 NI-880
 MRF19125R3**

PRODUCT DOCUMENTATION

Refer to the following documents to aid your design process.

Engineering Bulletins

- EB212: Using Data Sheet Impedances for RF LDMOS Devices

REVISION HISTORY

The following table summarizes revisions to this document.

| Revision | Date | Description |
|----------|-----------|---|
| 8 | Oct. 2008 | <ul style="list-style-type: none">• Data sheet revised to reflect part status change, p. 1, 4-5, including use of applicable overlay.• Modified data sheet to reflect RF Test Reduction described in Product and Process Change Notification number, PCN12779, p. 1, 2• Data sheet archived. Part no longer manufactured.• Added Product Documentation and Revision History, p. 11 |

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