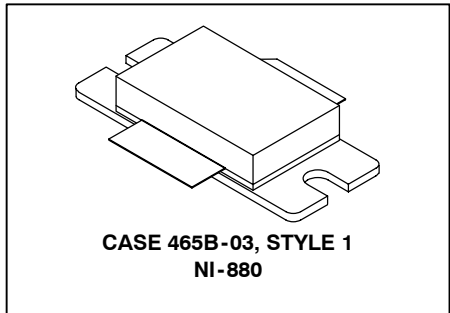


The RF Sub-Micron MOSFET Line
RF Power Field Effect Transistor
N-Channel Enhancement-Mode Lateral MOSFET

MRF19125R3

1990 MHz, 125 W, 26 V
LATERAL N-CHANNEL
RF POWER MOSFET



Designed for PCN and PCS base station applications with frequencies from 1.9 to 2.0 GHz. Suitable for TDMA, CDMA and multicarrier amplifier applications.

- Typical 2-Carrier N-CDMA Performance for $V_{DD} = 26$ Volts, $I_{DQ} = 1300$ mA, $f_1 = 1958.75$ MHz, $f_2 = 1961.25$ 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
- 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 5:1 VSWR, @ 26 Vdc, 1990 MHz, 125 Watts (CW) Output Power
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- In Tape and Reel. R3 Suffix = 250 Units per 56 mm, 13 inch Reel.

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 @ $T_C = 25^\circ\text{C}$ Derate above 25°C | P_D | 330 1.89 | Watts $\text{W}/^\circ\text{C}$ |
| 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 (1) | Unit |
|--------------------------------------|-----------------|-----------|---------------------------|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 0.53 | $^\circ\text{C}/\text{W}$ |

ESD PROTECTION CHARACTERISTICS

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

(1) Refer to AN1955/D, *Thermal Measurement Methodology of RF Power Amplifiers*. Go to <http://www.motorola.com/semiconductors/rf>. Select Documentation/Application Notes - AN1955.

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

ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ 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 |
|--|-----------|---|-----|---|----|

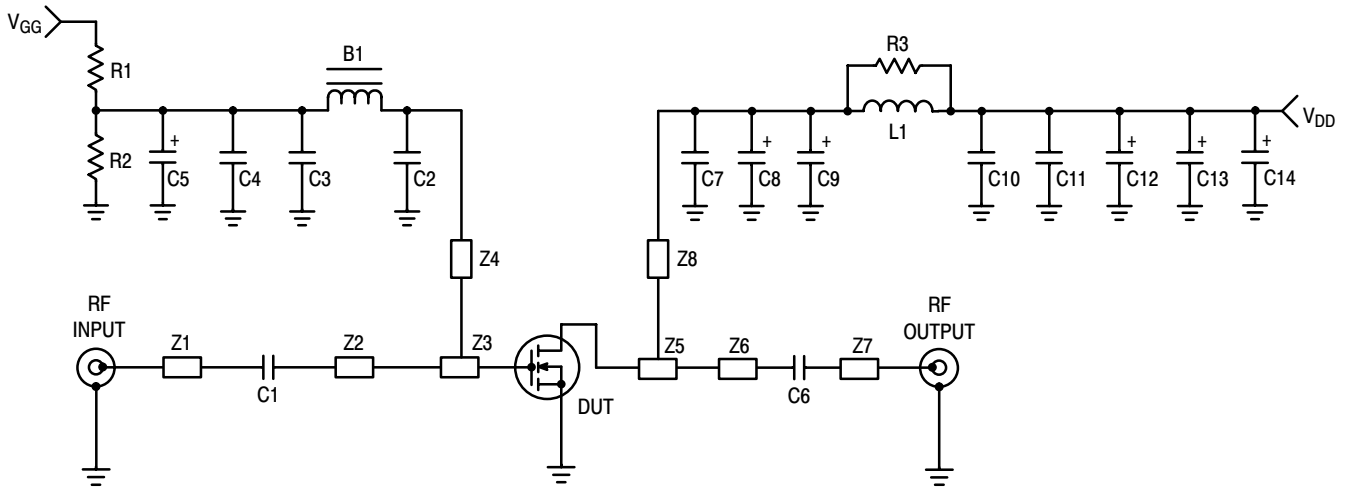
FUNCTIONAL TESTS (In Motorola Test Fixture) 2-Carrier N-CDMA, 1.2288 MHz Channel Bandwidth Carriers. Peak/Avg = 9.8 dB @ 0.01% Probability on CCDF.

| | | | | | |
|---|----------|--|------|-----|-----|
| Common-Source Amplifier Power Gain ($V_{DD} = 26 \text{ Vdc}$, $P_{out} = 24 \text{ W Avg}$, $I_{DQ} = 1300 \text{ mA}$, $f_1 = 1930 \text{ MHz}$, $f_2 = 1932.5 \text{ MHz}$ and $f_1 = 1987.5 \text{ MHz}$, $f_2 = 1990 \text{ MHz}$) | G_{ps} | 12 | 13.5 | — | dB |
| Drain Efficiency ($V_{DD} = 26 \text{ Vdc}$, $P_{out} = 24 \text{ W Avg}$, $I_{DQ} = 1300 \text{ mA}$, $f_1 = 1930 \text{ MHz}$, $f_2 = 1932.5 \text{ MHz}$ and $f_1 = 1987.5 \text{ MHz}$, $f_2 = 1990 \text{ MHz}$) | η | 19 | 22 | — | % |
| Intermodulation Distortion ($V_{DD} = 26 \text{ Vdc}$, $P_{out} = 24 \text{ W Avg}$, $I_{DQ} = 1300 \text{ mA}$, $f_1 = 1930 \text{ MHz}$, $f_2 = 1932.5 \text{ MHz}$ and $f_1 = 1987.5 \text{ MHz}$, $f_2 = 1990 \text{ MHz}$; IM3 measured over 1.2288 MHz Bandwidth at $f_1 - 2.5 \text{ MHz}$ and $f_2 + 2.5 \text{ MHz}$) | IMD | — | -37 | -35 | dBc |
| Adjacent Channel Power Ratio ($V_{DD} = 26 \text{ Vdc}$, $P_{out} = 24 \text{ W Avg}$, $I_{DQ} = 1300 \text{ mA}$, $f_1 = 1930 \text{ MHz}$, $f_2 = 1932.5 \text{ MHz}$ and $f_1 = 1987.5 \text{ MHz}$, $f_2 = 1990 \text{ MHz}$; 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 ($V_{DD} = 26 \text{ Vdc}$, $P_{out} = 24 \text{ W Avg}$, $I_{DQ} = 1300 \text{ mA}$, $f_1 = 1930 \text{ MHz}$, $f_2 = 1932.5 \text{ MHz}$ and $f_1 = 1987.5 \text{ MHz}$, $f_2 = 1990 \text{ MHz}$) | IRL | — | -13 | -9 | dB |
| Output Mismatch Stress ($V_{DD} = 26 \text{ Vdc}$, $P_{out} = 125 \text{ W CW}$, $I_{DQ} = 1300 \text{ mA}$, $f = 1930 \text{ MHz}$, VSWR = 5:1, All Phase Angles at Frequency of Test) | Ψ | No Degradation In Output Power Before and After Test | | | |

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

ELECTRICAL CHARACTERISTICS — continued ($T_C = 25^\circ\text{C}$ unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|----------|-----|------|-----|------|
| FUNCTIONAL TESTS (In Motorola 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 ($V_{DD} = 26\text{ Vdc}$, $I_{DQ} = 1300\text{ mA}$, $f = 1990\text{ MHz}$) | P1dB | — | 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. MRF19125 Test Circuit Schematic

Table 1. MRF19125 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, Motorola |
| 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 |

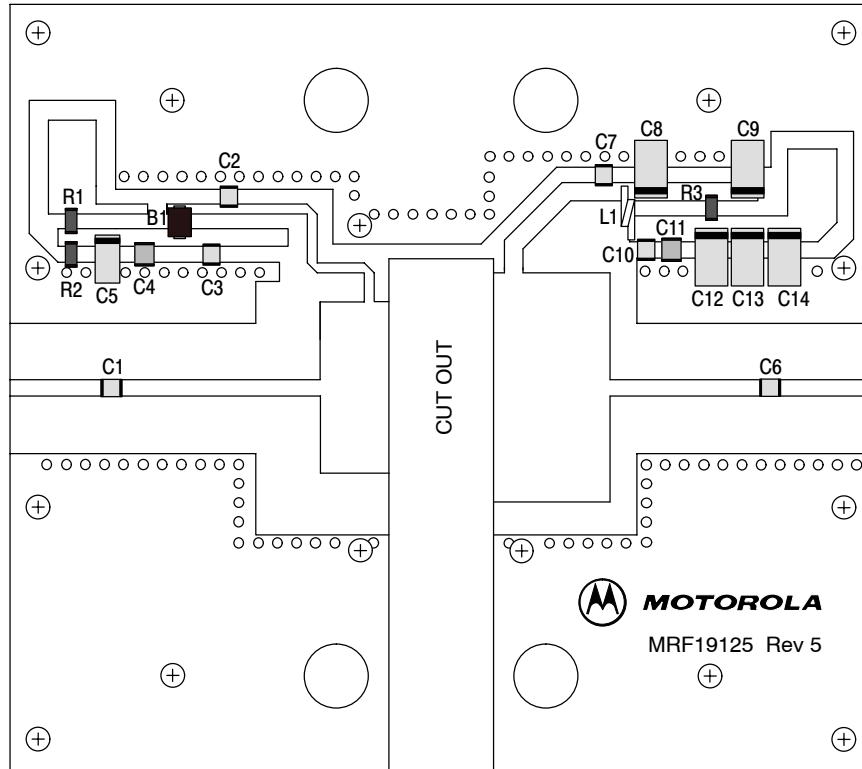


Figure 2. MRF19125 Test Circuit Component Layout

TYPICAL CHARACTERISTICS

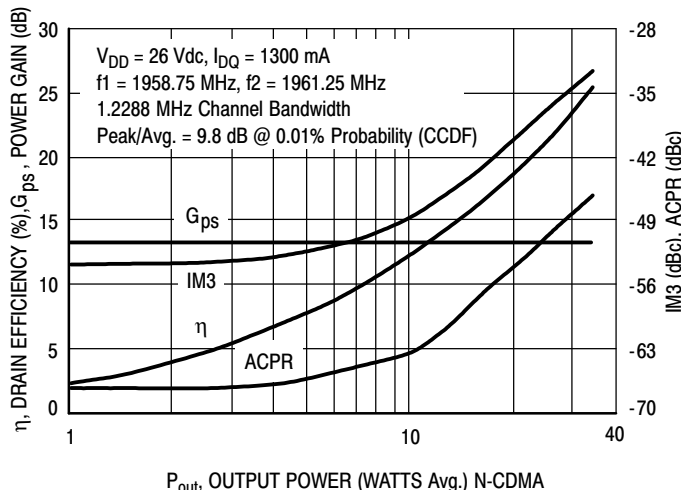


Figure 3. 2-Carrier CDMA ACPR, IM3, Power Gain and Drain Efficiency versus Output Power

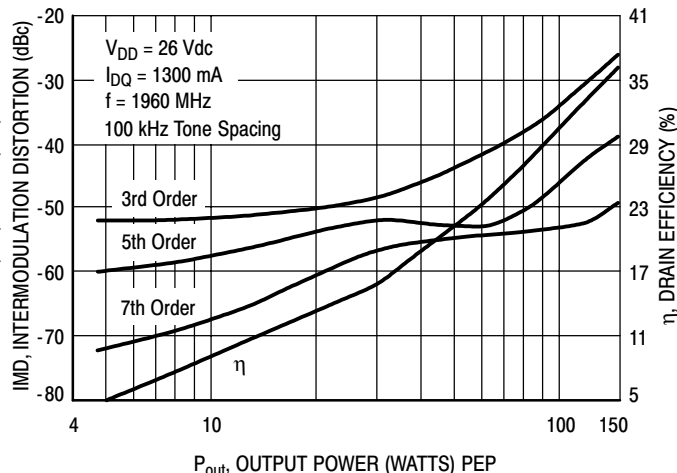


Figure 4. Intermodulation Distortion Products versus Output Power

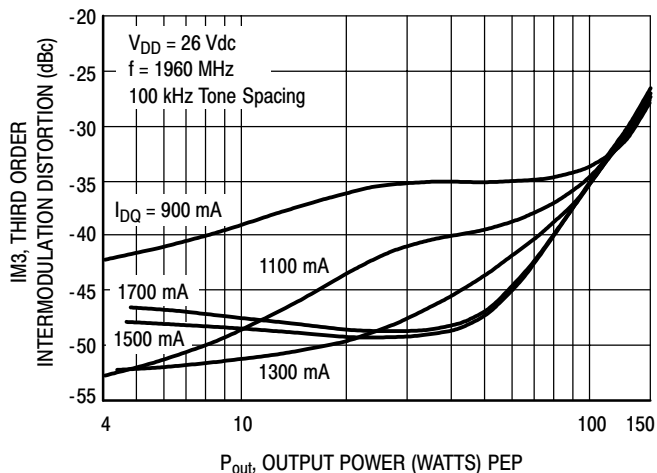


Figure 5. Third Order Intermodulation Distortion versus Output Power

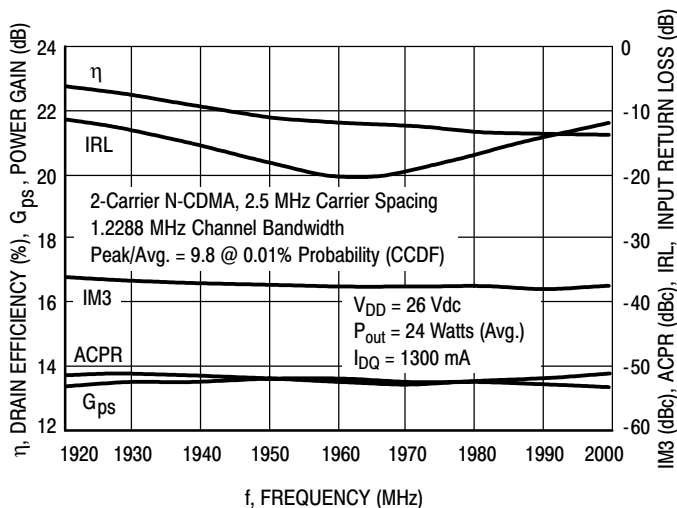


Figure 6. 2-Carrier N-CDMA Broadband Performance

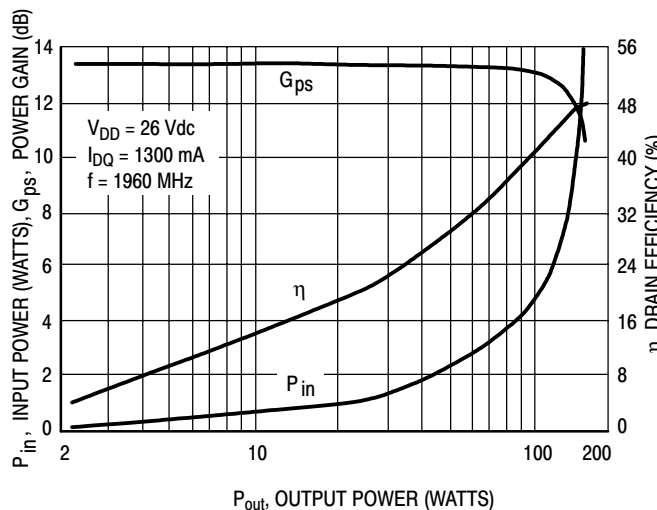


Figure 7. CW Performance

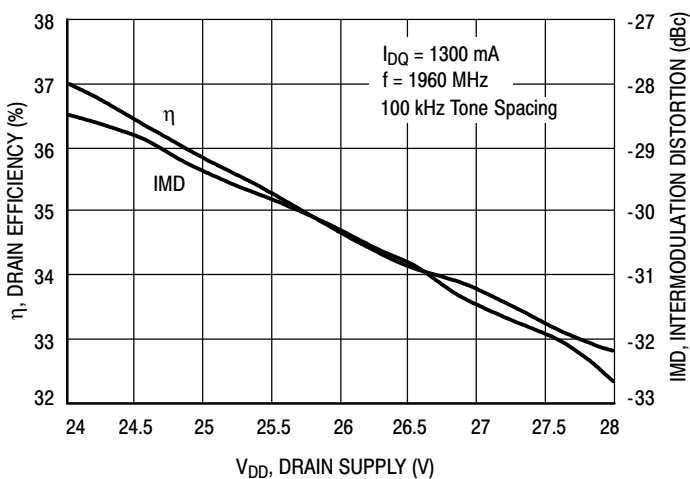


Figure 8. Two-Tone Intermodulation Distortion and Drain Efficiency versus Drain Supply

TYPICAL CHARACTERISTICS

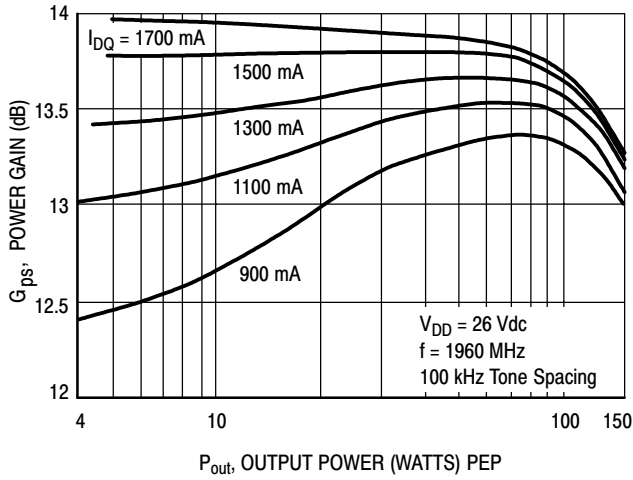


Figure 9. Two-Tone Power Gain versus Output Power

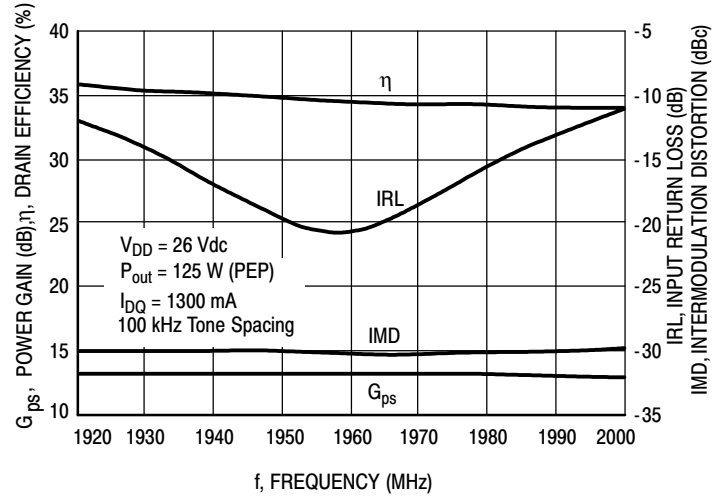


Figure 10. Two-Tone Broadband Performance

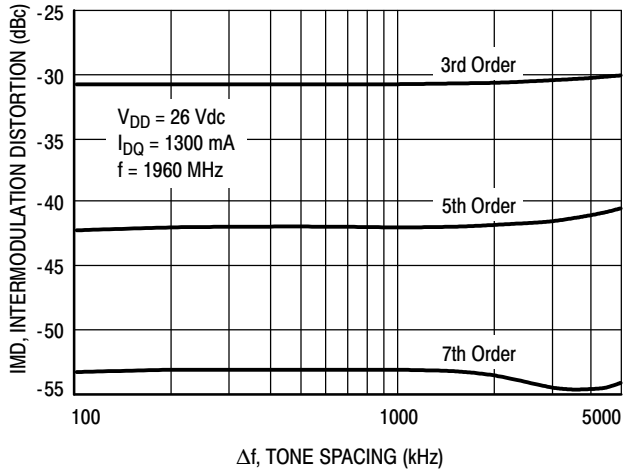


Figure 11. Intermodulation Distortion Products versus Two-Tone Tone Spacing

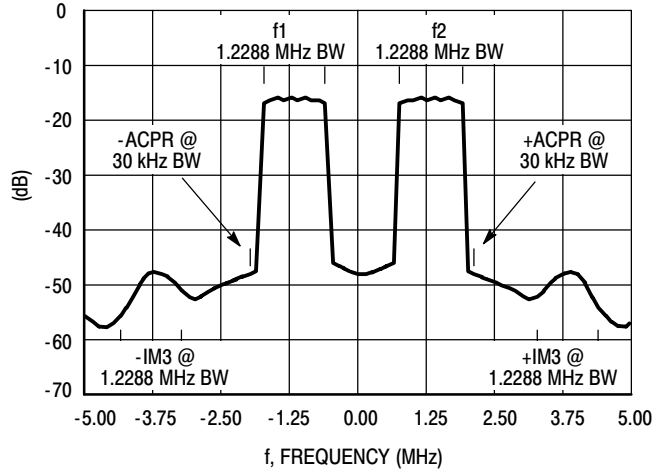
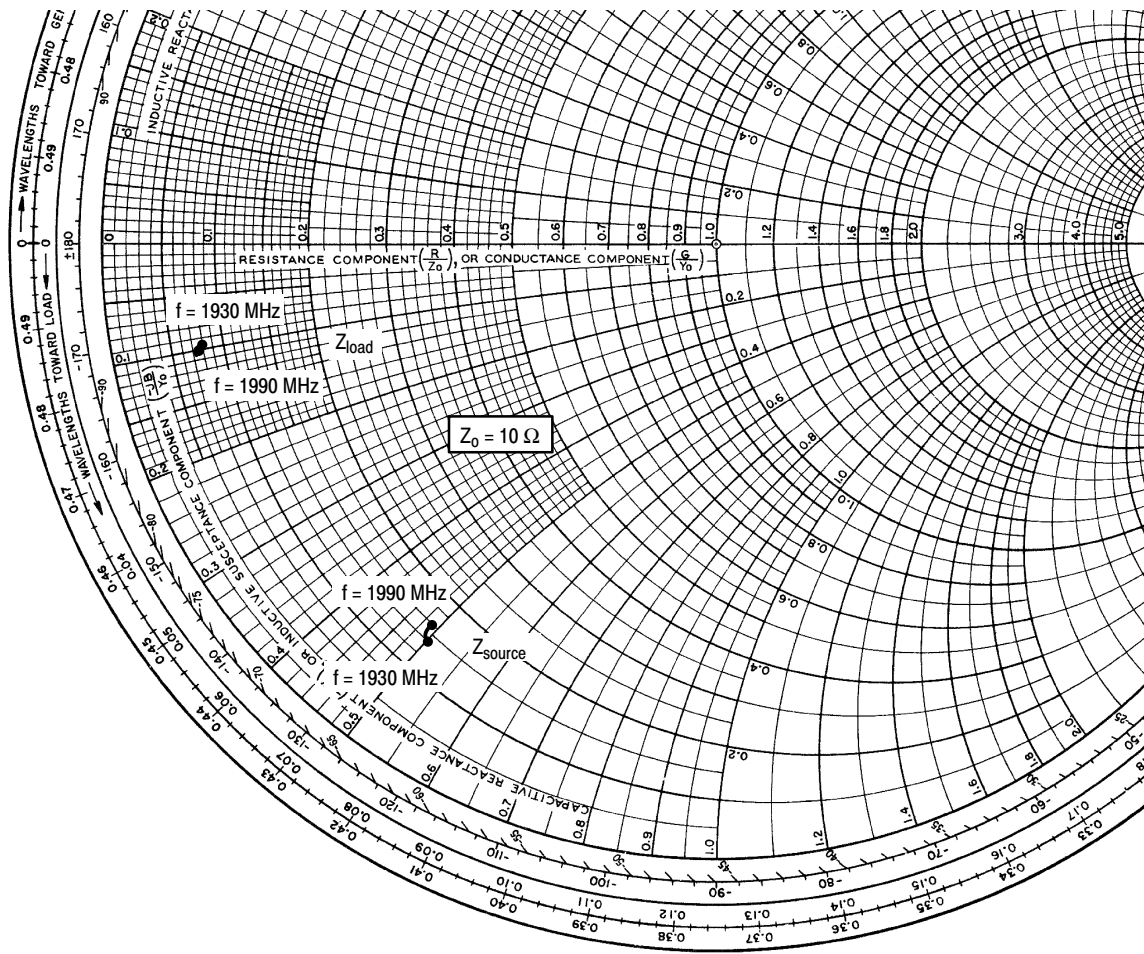


Figure 12. 2-Carrier N-CDMA Spectrum



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

| 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.

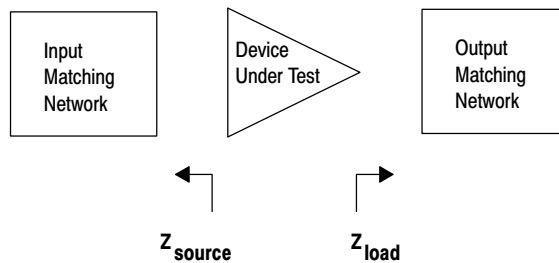


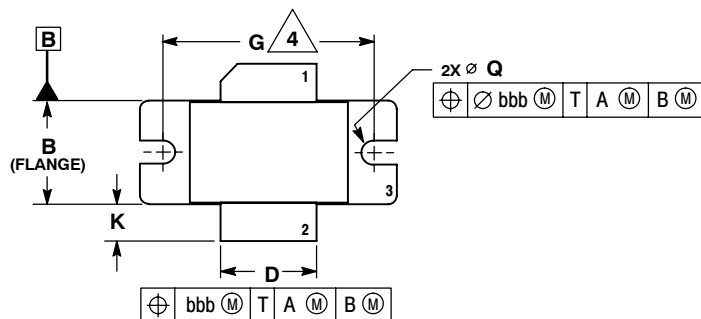
Figure 13. Series Equivalent Input and Output Impedance

NOTES

NOTES

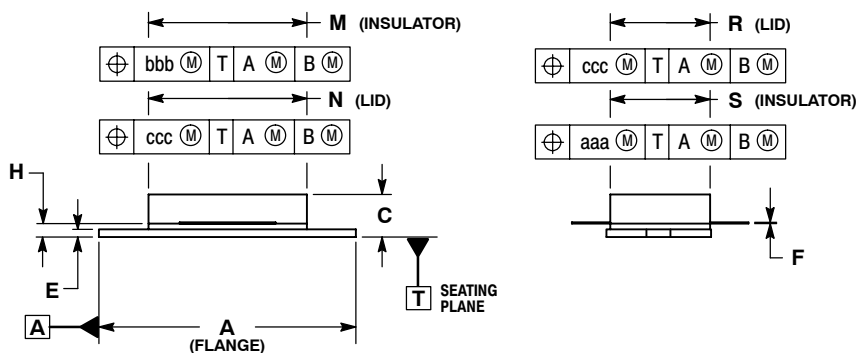
NOTES

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 C
NI-880**

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

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