

# RF Power Field Effect Transistors

## N-Channel Enhancement-Mode Lateral MOSFETs

Designed for CDMA base station applications with frequencies from 1930 to 1990 MHz. Can be used in Class AB and Class C for all typical cellular base station modulation formats.

- Typical Single-Carrier W-CDMA Performance:  $V_{DD} = 28$  Volts,  $I_{DQ} = 1400$  mA,  $P_{out} = 50$  Watts Avg.,  $f = 1987.5$  MHz, IQ Magnitude Clipping, Channel Bandwidth = 3.84 MHz, Input Signal PAR = 7.5 dB @ 0.01% Probability on CCDF.  
Power Gain — 17.2 dB  
Drain Efficiency — 32%  
Device Output Signal PAR — 6.2 dB @ 0.01% Probability on CCDF  
ACPR @ 5 MHz Offset — -37.5 dBc in 3.84 MHz Channel Bandwidth
- Capable of Handling 5:1 VSWR, @ 32 Vdc, 1960 MHz, 170 Watts CW Output Power
- $P_{out}$  @ 1 dB Compression Point  $\approx 170$  Watts CW

### Features

- 100% PAR Tested for Guaranteed Output Power Capability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Internally Matched for Ease of Use
- Integrated ESD Protection
- Greater Negative Gate-Source Voltage Range for Improved Class C Operation
- Designed for Digital Predistortion Error Correction Systems
- RoHS Compliant
- In Tape and Reel. R3 Suffix = 250 Units, 56 mm Tape Width, 13 inch Reel.

**MRF7S19170HR3**  
**MRF7S19170HSR3**

**1930-1990 MHz, 50 W AVG., 28 V**  
**SINGLE W-CDMA**  
**LATERAL N-CHANNEL**  
**RF POWER MOSFETs**

**CASE 465B-03, STYLE 1**  
**NI-880**  
**MRF7S19170HR3**

**CASE 465C-02, STYLE 1**  
**NI-880S**  
**MRF7S19170HSR3**

**Table 1. Maximum Ratings**

| Rating                               | Symbol    | Value       | Unit |
|--------------------------------------|-----------|-------------|------|
| Drain-Source Voltage                 | $V_{DSS}$ | -0.5, +65   | Vdc  |
| Gate-Source Voltage                  | $V_{GS}$  | -6.0, +10   | Vdc  |
| Operating Voltage                    | $V_{DD}$  | 32, +0      | Vdc  |
| Storage Temperature Range            | $T_{stg}$ | -65 to +150 | °C   |
| Case Operating Temperature           | $T_C$     | 150         | °C   |
| Operating Junction Temperature (1,2) | $T_J$     | 225         | °C   |

**Table 2. Thermal Characteristics**

| Characteristic                                                                                            | Symbol          | Value (2,3)  | Unit |
|-----------------------------------------------------------------------------------------------------------|-----------------|--------------|------|
| Thermal Resistance, Junction to Case<br>Case Temperature 80°C, 170 W CW<br>Case Temperature 72°C, 25 W CW | $R_{\theta JC}$ | 0.25<br>0.31 | °C/W |

1. Continuous use at maximum temperature will affect MTTF.
2. MTTF calculator available at <http://www.freescale.com/rf>. Select Software & Tools/Development Tools/Calculators to access MTTF calculators by product.
3. Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers*. Go to <http://www.freescale.com/rf>. Select Documentation/Application Notes - AN1955.

**Table 3. ESD Protection Characteristics**

| Test Methodology                      | Class        |
|---------------------------------------|--------------|
| Human Body Model (per JESD22-A114)    | 1A (Minimum) |
| Machine Model (per EIA/JESD22-A115)   | B (Minimum)  |
| Charge Device Model (per JESD22-C101) | IV (Minimum) |

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

**Off Characteristics**

|                                                                                                   |           |   |   |    |                 |
|---------------------------------------------------------------------------------------------------|-----------|---|---|----|-----------------|
| Zero Gate Voltage Drain Leakage Current<br>( $V_{DS} = 65\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ ) | $I_{DSS}$ | — | — | 10 | $\mu\text{Adc}$ |
| Zero Gate Voltage Drain Leakage Current<br>( $V_{DS} = 28\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ ) | $I_{DSS}$ | — | — | 1  | $\mu\text{Adc}$ |
| Gate-Source Leakage Current<br>( $V_{GS} = 5\text{ Vdc}$ , $V_{DS} = 0\text{ Vdc}$ )              | $I_{GSS}$ | — | — | 1  | $\mu\text{Adc}$ |

**On Characteristics**

|                                                                                                                            |              |     |      |     |     |
|----------------------------------------------------------------------------------------------------------------------------|--------------|-----|------|-----|-----|
| Gate Threshold Voltage<br>( $V_{DS} = 10\text{ Vdc}$ , $I_D = 372\text{ }\mu\text{Adc}$ )                                  | $V_{GS(th)}$ | 1.2 | 2    | 2.7 | Vdc |
| Gate Quiescent Voltage<br>( $V_{DS} = 28\text{ Vdc}$ , $I_D = 1400\text{ mAdc}$ )                                          | $V_{GS(Q)}$  | —   | 2.7  | —   | Vdc |
| Fixture Gate Quiescent Voltage (1)<br>( $V_{DD} = 28\text{ Vdc}$ , $I_D = 1400\text{ mAdc}$ , Measured in Functional Test) | $V_{GG(Q)}$  | 4   | 5.4  | 7.6 | Vdc |
| Drain-Source On-Voltage<br>( $V_{GS} = 10\text{ Vdc}$ , $I_D = 3.72\text{ Adc}$ )                                          | $V_{DS(on)}$ | 0.1 | 0.15 | 0.3 | Vdc |

**Dynamic Characteristics (2)**

|                                                                                                                       |           |   |     |   |    |
|-----------------------------------------------------------------------------------------------------------------------|-----------|---|-----|---|----|
| Reverse Transfer Capacitance<br>( $V_{DS} = 28\text{ Vdc} \pm 30\text{ mV(rms)ac}$ @ 1 MHz, $V_{GS} = 0\text{ Vdc}$ ) | $C_{rss}$ | — | 0.9 | — | pF |
| Output Capacitance<br>( $V_{DS} = 28\text{ Vdc} \pm 30\text{ mV(rms)ac}$ @ 1 MHz, $V_{GS} = 0\text{ Vdc}$ )           | $C_{oss}$ | — | 703 | — | pF |

**Functional Tests** (In Freescale Test Fixture, 50 ohm system)  $V_{DD} = 28\text{ Vdc}$ ,  $I_{DQ} = 1400\text{ mA}$ ,  $P_{out} = 50\text{ W Avg.}$ ,  $f = 1987.5\text{ MHz}$ , Single-Carrier W-CDMA, IQ Magnitude Clipping,  $PAR = 7.5\text{ dB}$  @ 0.01% Probability on CCDF. ACPR measured in 3.84 MHz Channel Bandwidth @  $\pm 5\text{ MHz}$  Offset.

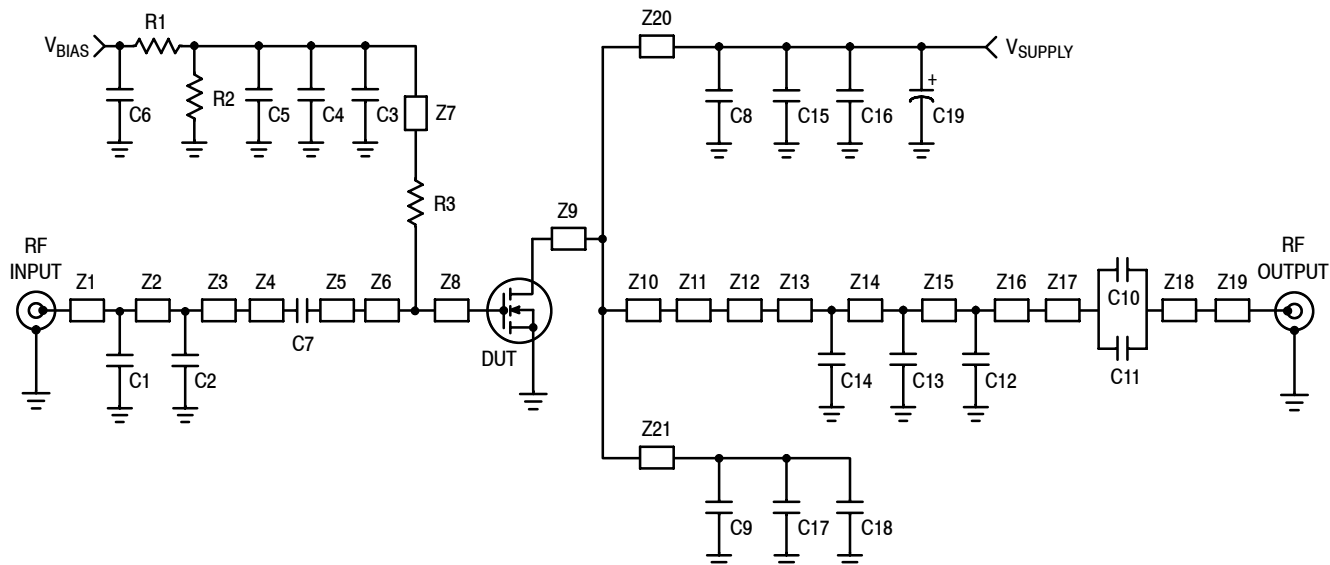
|                                                          |          |     |       |     |     |
|----------------------------------------------------------|----------|-----|-------|-----|-----|
| Power Gain                                               | $G_{ps}$ | 16  | 17.2  | 19  | dB  |
| Drain Efficiency                                         | $\eta_D$ | 29  | 32    | —   | %   |
| Output Peak-to-Average Ratio @ 0.01% Probability on CCDF | PAR      | 5.7 | 6.2   | —   | dB  |
| Adjacent Channel Power Ratio                             | ACPR     | —   | -37.5 | -35 | dBc |
| Input Return Loss                                        | IRL      | —   | -16   | -9  | dB  |

- $V_{GG} = 2 \times V_{GS(Q)}$ . Parameter measured on Freescale Test Fixture, due to resistive divider network on the board. Refer to Test Circuit schematic.
- Part internally matched both on input and output.

(continued)

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

| Characteristic                                                                                                                                                                                                  | Symbol           | Min | Typ   | Max | Unit  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----|-------|-----|-------|
| <b>Typical Performances</b> (In Freescale Test Fixture, 50 ohm system) $V_{DD} = 28\text{ Vdc}$ , $I_{DQ} = 1400\text{ mA}$ , 1930–1990 MHz Bandwidth                                                           |                  |     |       |     |       |
| Video Bandwidth @ 170 W PEP $P_{out}$ where $IM3 = -30\text{ dBc}$<br>(Tone Spacing from 100 kHz to VBW)<br>$\Delta IMD3 = IMD3 @ \text{VBW frequency} - IMD3 @ 100\text{ kHz} < 1\text{ dBc}$ (both sidebands) | VBW              | —   | 25    | —   | MHz   |
| Gain Flatness in 60 MHz Bandwidth @ $P_{out} = 170\text{ W CW}$                                                                                                                                                 | $G_F$            | —   | 0.5   | —   | dB    |
| Average Deviation from Linear Phase in 60 MHz Bandwidth<br>@ $P_{out} = 170\text{ W CW}$                                                                                                                        | $\Phi$           | —   | 2.06  | —   | °     |
| Average Group Delay @ $P_{out} = 170\text{ W CW}$ , $f = 1960\text{ MHz}$                                                                                                                                       | Delay            | —   | 4.7   | —   | ns    |
| Part-to-Part Insertion Phase Variation @ $P_{out} = 170\text{ W CW}$ ,<br>$f = 1960\text{ MHz}$ , Six Sigma Window                                                                                              | $\Delta\Phi$     | —   | 16    | —   | °     |
| Gain Variation over Temperature<br>( $-30^\circ\text{C}$ to $+85^\circ\text{C}$ )                                                                                                                               | $\Delta G$       | —   | 0.015 | —   | dB/°C |
| Output Power Variation over Temperature<br>( $-30^\circ\text{C}$ to $+85^\circ\text{C}$ )                                                                                                                       | $\Delta P_{1dB}$ | —   | 0.01  | —   | dB/°C |



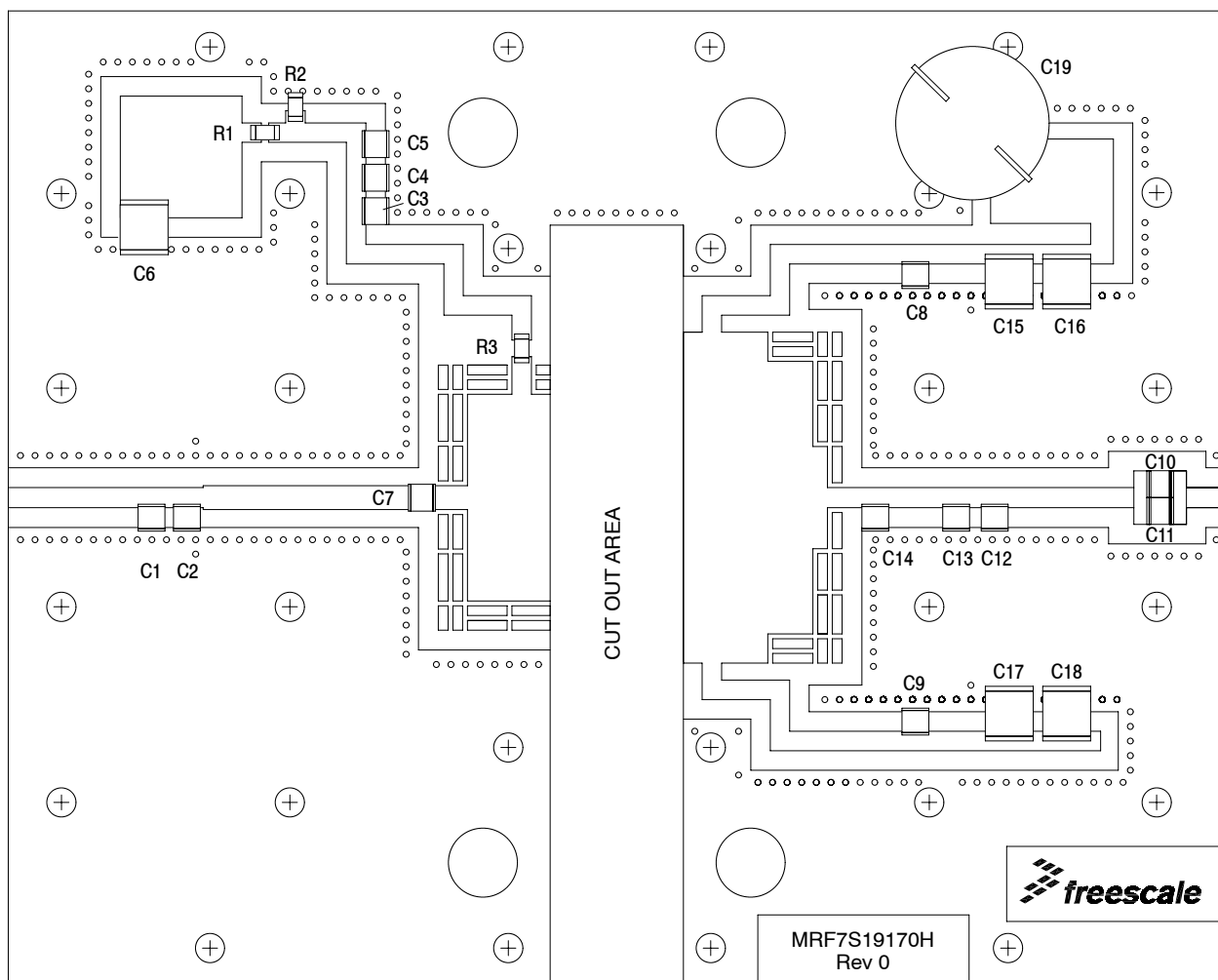
|     |                            |          |                                              |
|-----|----------------------------|----------|----------------------------------------------|
| Z1* | 0.588" x 0.083" Microstrip | Z12      | 0.060" x 0.420" Microstrip                   |
| Z2* | 0.146" x 0.083" Microstrip | Z13*     | 0.197" x 0.083" Microstrip                   |
| Z3* | 0.068" x 0.083" Microstrip | Z14*     | 0.332" x 0.083" Microstrip                   |
| Z4  | 0.865" x 0.098" Microstrip | Z15*     | 0.158" x 0.083" Microstrip                   |
| Z5  | 0.154" x 0.098" Microstrip | Z16*     | 0.572" x 0.083" Microstrip                   |
| Z6  | 0.271" x 0.787" Microstrip | Z17, Z18 | 0.063" x 0.220" Microstrip                   |
| Z7  | 1.410" x 0.080" Microstrip | Z19      | 0.160" x 0.083" Microstrip                   |
| Z8  | 0.194" x 0.787" Microstrip | Z20, Z21 | 1.120" x 0.080" Microstrip                   |
| Z9  | 0.115" x 1.360" Microstrip | PCB      | Taconic TLX-0300, 0.030", $\epsilon_r = 2.5$ |
| Z10 | 0.230" x 1.360" Microstrip |          |                                              |
| Z11 | 0.185" x 1.120" Microstrip |          |                                              |

\* Variable for tuning

**Figure 1. MRF7S19170HR3(HSR3) Test Circuit Schematic**

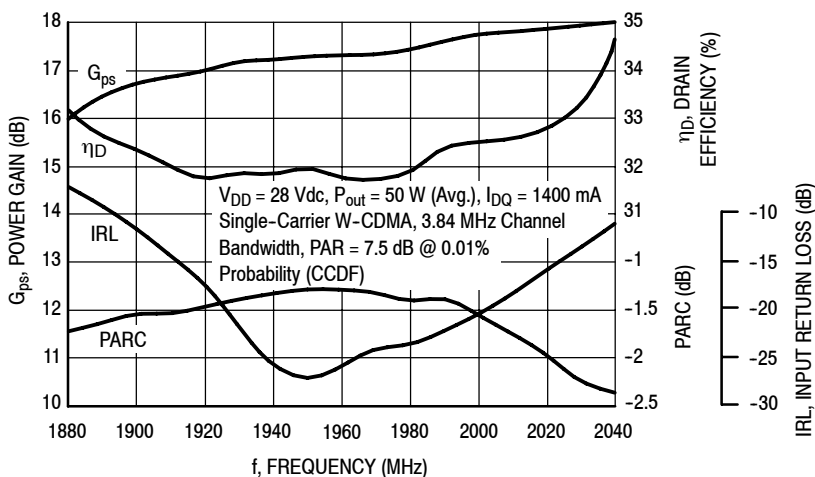
**Table 5. MRF7S19170HR3(HSR3) Test Circuit Component Designations and Values**

| Part                   | Description                                     | Part Number           | Manufacturer     |
|------------------------|-------------------------------------------------|-----------------------|------------------|
| C1, C2                 | 1.8 pF Chip Capacitors                          | ATC100B1R8BT500XT     | ATC              |
| C3, C8, C9, C10, C11   | 8.2 pF Chip Capacitors                          | ATC100B8R2CT500XT     | ATC              |
| C4                     | 100 pF Chip Capacitor                           | ATC100B101JT500XT     | ATC              |
| C5                     | 100 nF Chip Capacitor                           | 200B104MT             | ATC              |
| C6, C15, C16, C17, C18 | 10 $\mu$ F Chip Capacitors                      | C5750X5R1H106MT       | TDK              |
| C7                     | 0.5 pF Chip Capacitor                           | ATC100B0R5BT500XT     | ATC              |
| C12                    | 1.5 pF Chip Capacitor                           | ATC100B1R5BT500XT     | ATC              |
| C13                    | 0.3 pF Chip Capacitor                           | ATC100B0R3BT500XT     | ATC              |
| C14                    | 0.8 pF Chip Capacitor                           | ATC100B0R8BT500XT     | ATC              |
| C19                    | 470 $\mu$ F, 63 V Electrolytic Capacitor, Axial | EKME630ELL471M12X25LL | United Chemi-Con |
| R1, R2                 | 10 k $\Omega$ , 1/4 W Chip Resistors            | CRCW12061002FKEA      | Vishay           |
| R3                     | 10 $\Omega$ , 1/4 W Chip Resistor               | CRCW120610R0FKEA      | Vishay           |

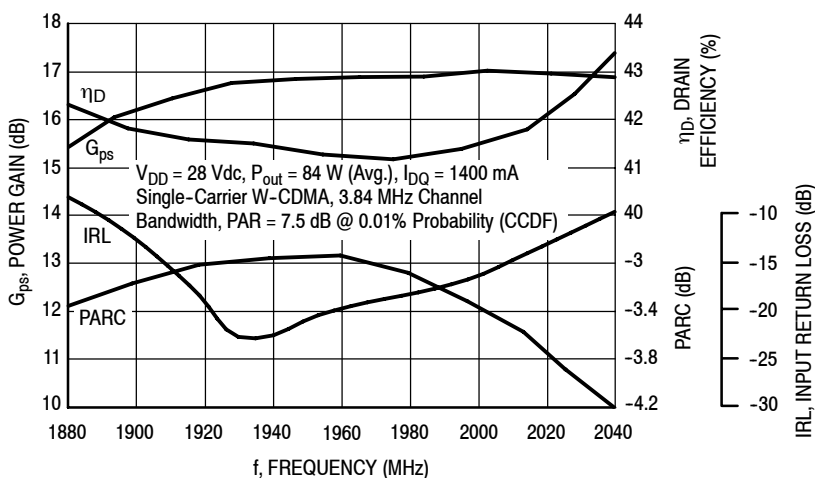


**Figure 2. MRF7S19170HR3(HSR3) Test Circuit Component Layout**

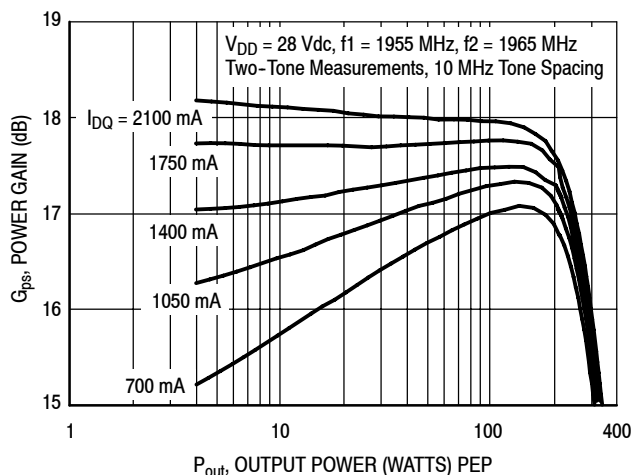
## TYPICAL CHARACTERISTICS



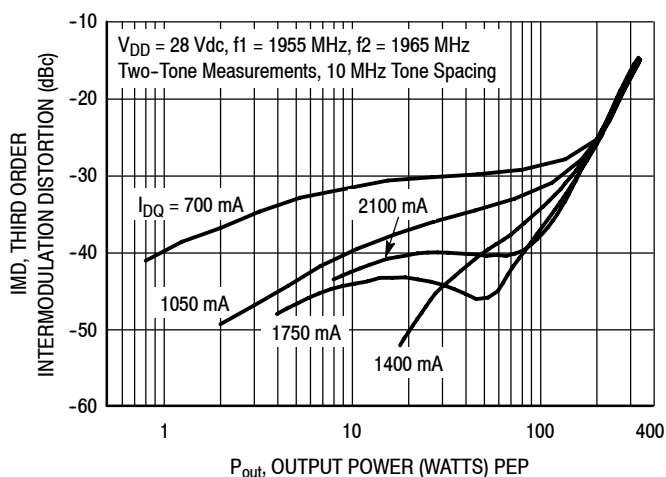
**Figure 3. Output Peak-to-Average Ratio Compression (PARC) Broadband Performance @  $P_{out} = 50$  Watts Avg.**



**Figure 4. Output Peak-to-Average Ratio Compression (PARC) Broadband Performance @  $P_{out} = 84$  Watts Avg.**

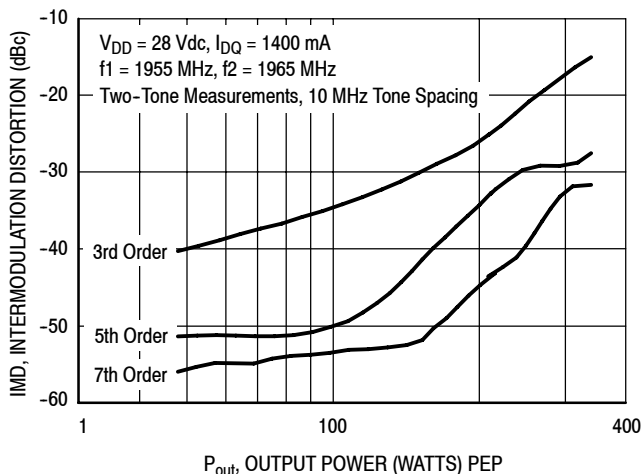


**Figure 5. Two-Tone Power Gain versus Output Power**

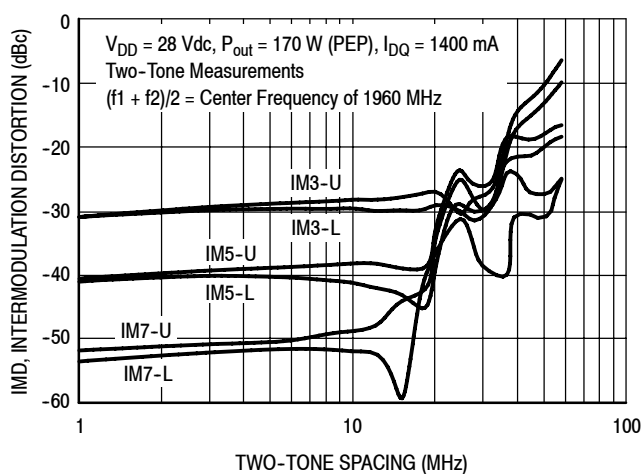


**Figure 6. Third Order Intermodulation Distortion versus Output Power**

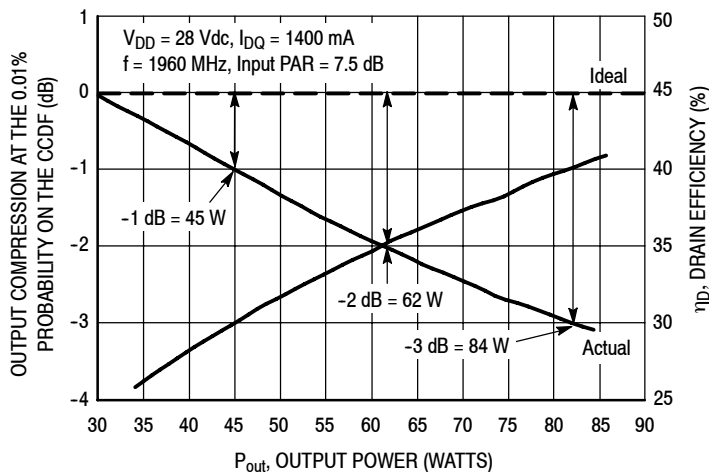
## TYPICAL CHARACTERISTICS



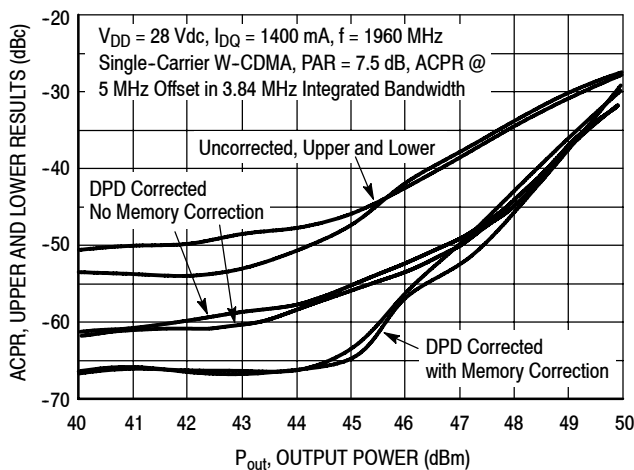
**Figure 7. Intermodulation Distortion Products versus Output Power**



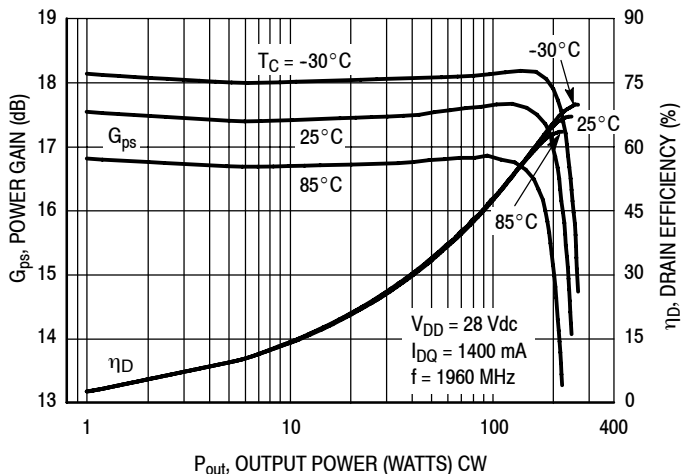
**Figure 8. Intermodulation Distortion Products versus Tone Spacing**



**Figure 9. Output Peak-to-Average Ratio Compression (PARC) versus Output Power**



**Figure 10. Digital Predistortion Correction versus ACPR and Output Power**



**Figure 11. Power Gain and Drain Efficiency versus CW Output Power**

## TYPICAL CHARACTERISTICS

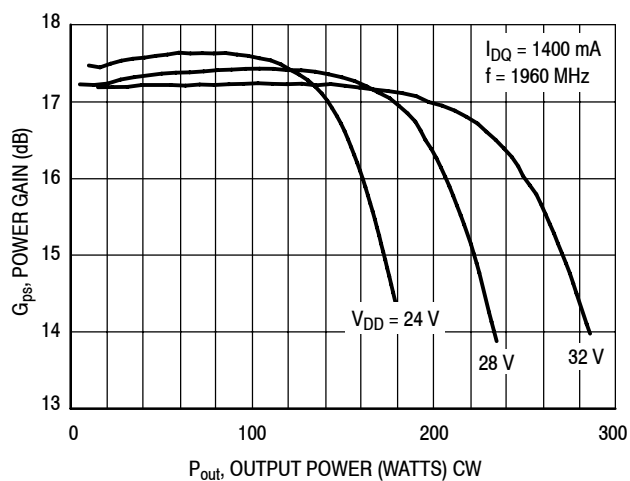


Figure 12. Power Gain versus Output Power

## W-CDMA TEST SIGNAL

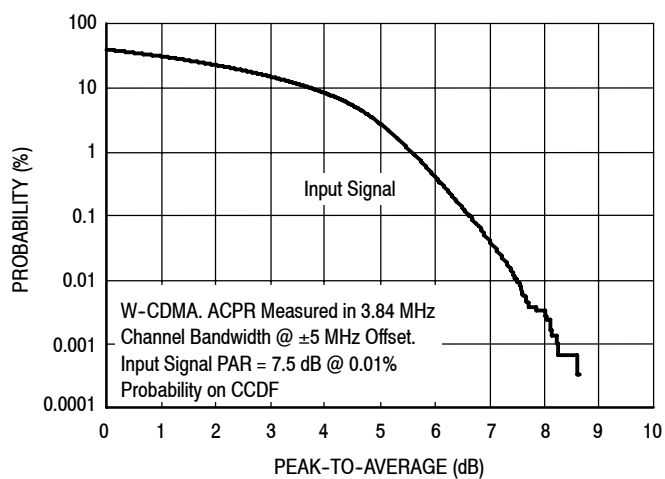


Figure 13. CCDF W-CDMA IQ Magnitude Clipping, Single-Carrier Test Signal

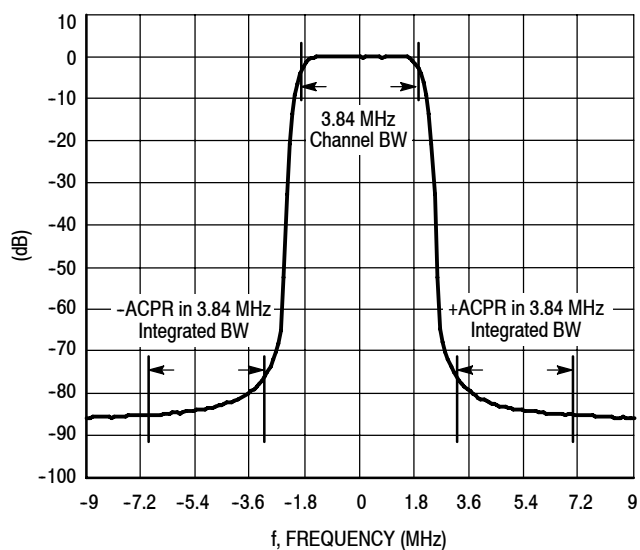
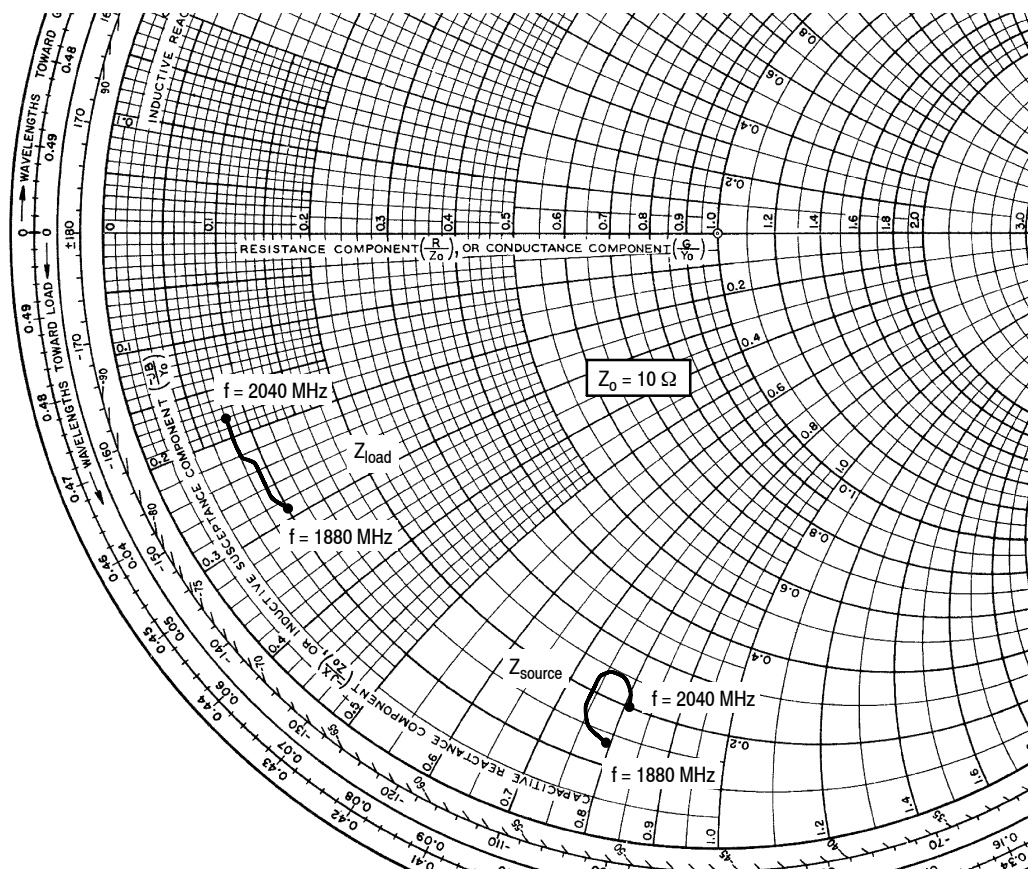


Figure 14. Single-Carrier W-CDMA Spectrum





$V_{DD} = 28 \text{ Vdc}$ ,  $I_{DQ} = 1400 \text{ mA}$ ,  $P_{out} = 50 \text{ W Avg.}$

| f<br>MHz | $Z_{source}$<br>$\Omega$ | $Z_{load}$<br>$\Omega$ |
|----------|--------------------------|------------------------|
| 1880     | $1.338 - j7.859$         | $0.967 - j2.868$       |
| 1900     | $1.515 - j7.609$         | $0.942 - j2.725$       |
| 1920     | $1.743 - j7.432$         | $0.920 - j2.585$       |
| 1940     | $2.007 - j7.352$         | $0.893 - j2.449$       |
| 1960     | $2.249 - j7.393$         | $0.865 - j2.313$       |
| 1980     | $2.410 - j7.553$         | $0.841 - j2.192$       |
| 2000     | $2.411 - j7.788$         | $0.820 - j2.073$       |
| 2020     | $2.244 - j7.995$         | $0.802 - j1.957$       |
| 2040     | $1.966 - j8.101$         | $0.779 - j1.834$       |

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

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

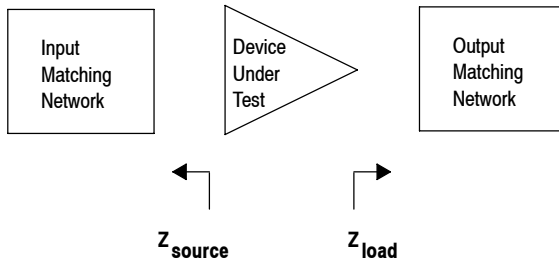
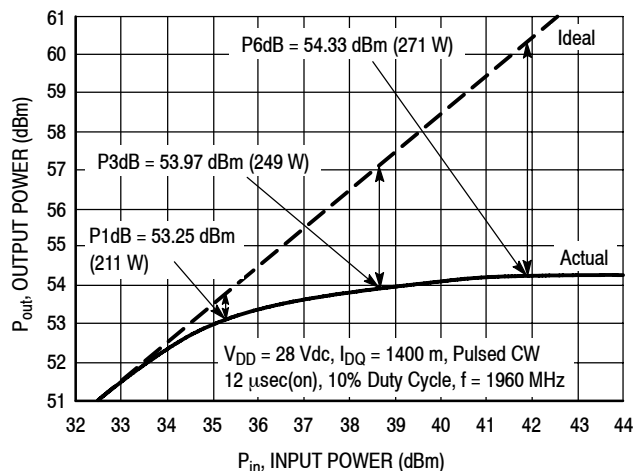


Figure 15. Series Equivalent Source and Load Impedance

## ALTERNATIVE PEAK TUNE LOAD PULL CHARACTERISTICS

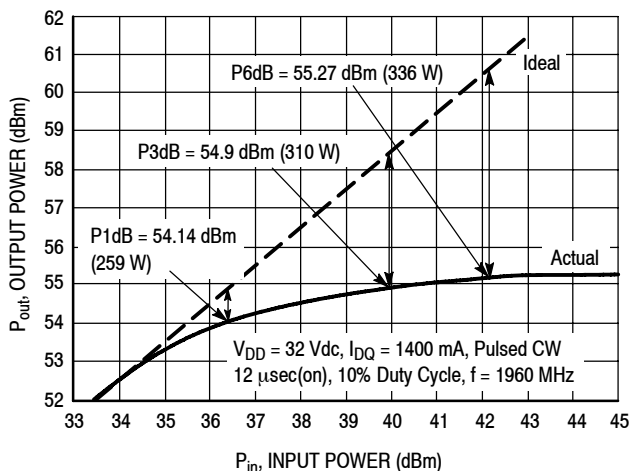


NOTE: Measured in a Peak Tuned Load Pull Fixture

Test Impedances per Compression Level

|      | $Z_{source}$<br>$\Omega$ | $Z_{load}$<br>$\Omega$ |
|------|--------------------------|------------------------|
| P3dB | $2.34 - j9.24$           | $0.79 - j2.94$         |

**Figure 16. Pulsed CW Output Power versus Input Power**



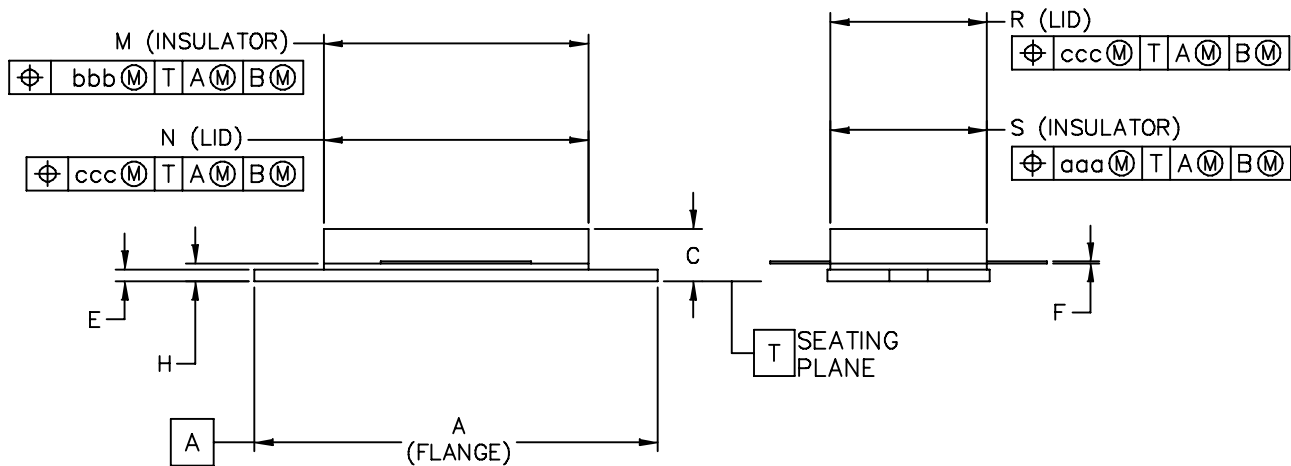
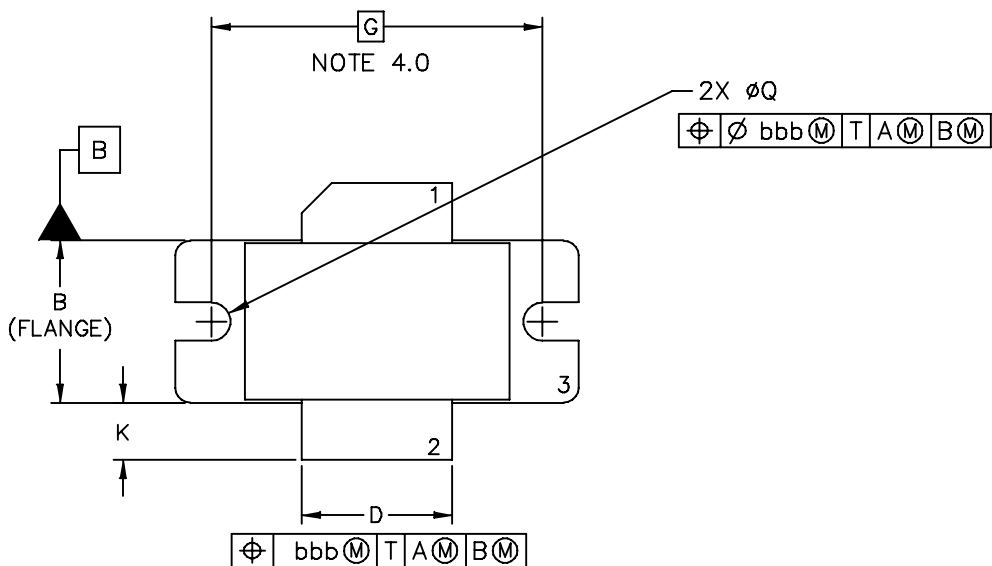
NOTE: Measured in a Peak Tuned Load Pull Fixture

Test Impedances per Compression Level

|      | $Z_{source}$<br>$\Omega$ | $Z_{load}$<br>$\Omega$ |
|------|--------------------------|------------------------|
| P3dB | $2.34 - j9.24$           | $0.79 - j2.94$         |

**Figure 17. Pulsed CW Output Power versus Input Power**

# PACKAGE DIMENSIONS



|                                                         |  |                          |                            |
|---------------------------------------------------------|--|--------------------------|----------------------------|
| © FREESCALE SEMICONDUCTOR, INC.<br>ALL RIGHTS RESERVED. |  | MECHANICAL OUTLINE       | PRINT VERSION NOT TO SCALE |
| TITLE:<br><br>NI-880                                    |  | DOCUMENT NO: 98ARB18493C | REV: E                     |
|                                                         |  | CASE NUMBER: 465B-03     | 10 SEP 2007                |
|                                                         |  | STANDARD: NON-JEDEC      |                            |

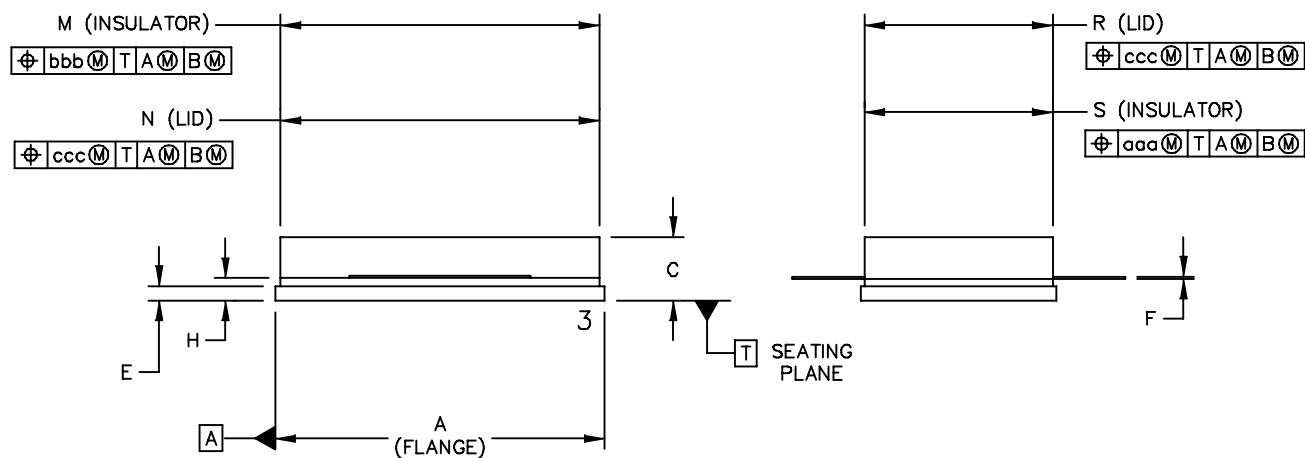
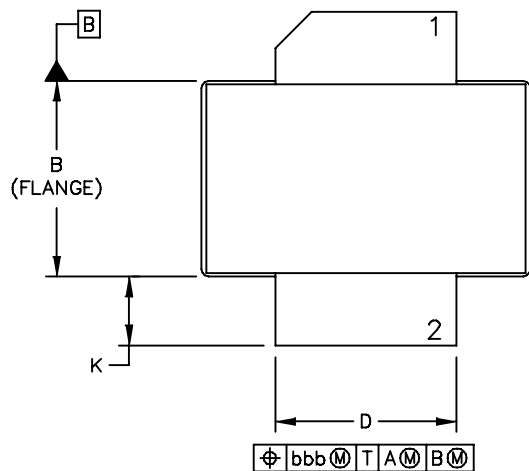
NOTES:

- 1.0 DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.
- 2.0 CONTROLLING DIMENSION: INCH.
- 3.0 DIMENSION H IS MEASURED .030 (0.762) AWAY FROM PACKAGE BODY.
- 4.0 RECOMMENDED BOLT CENTER DIMENSION OF 1.16 (29.57) BASED ON M3 SCREW.

STYLE 1:

- PIN 1. DRAIN
2. GATE
3. SOURCE

| INCH                                                    |           |       | MILLIMETER         |       | INCH                     |                            |        | MILLIMETER  |        |  |
|---------------------------------------------------------|-----------|-------|--------------------|-------|--------------------------|----------------------------|--------|-------------|--------|--|
| DIM                                                     | MIN       | MAX   | MIN                | MAX   | DIM                      | MIN                        | MAX    | MIN         | MAX    |  |
| A                                                       | 1.335     | 1.345 | 33.91              | 34.16 | R                        | .515                       | — .525 | 13.1        | — 13.3 |  |
| B                                                       | .535      | .545  | 13.6               | 13.8  | S                        | .515                       | — .525 | 13.1        | — 13.3 |  |
| C                                                       | .147      | .200  | 3.73               | 5.08  | aaa                      | — .007                     | —      | — 0.178     | —      |  |
| D                                                       | .495      | .505  | 12.57              | 12.83 | bbb                      | — .010                     | —      | — 0.254     | —      |  |
| E                                                       | .035      | .045  | 0.89               | 1.14  | ccc                      | — .015                     | —      | — 0.381     | —      |  |
| F                                                       | .003      | .006  | 0.08               | 0.15  | —                        | —                          | —      | —           | —      |  |
| G                                                       | 1.100 BSC |       | 27.94 BSC          |       | —                        | —                          | —      | —           | —      |  |
| H                                                       | .057      | .067  | 1.45               | 1.7   | —                        | —                          | —      | —           | —      |  |
| K                                                       | .175      | .205  | 4.44               | 5.21  | —                        | —                          | —      | —           | —      |  |
| M                                                       | .872      | .888  | 22.15              | 22.55 | —                        | —                          | —      | —           | —      |  |
| N                                                       | .871      | .889  | 19.3               | 22.6  | —                        | —                          | —      | —           | —      |  |
| Q                                                       | ø.118     | ø.138 | ø3                 | ø3.51 | —                        | —                          | —      | —           | —      |  |
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| TITLE:<br><br>NI—880                                    |           |       |                    |       | DOCUMENT NO: 98ARB18493C |                            |        | REV: E      |        |  |
|                                                         |           |       |                    |       | CASE NUMBER: 465B—03     |                            |        | 10 SEP 2007 |        |  |
|                                                         |           |       |                    |       | STANDARD: NON—JEDEC      |                            |        |             |        |  |



|                                                         |  |                          |                            |
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| TITLE:<br><br>NI-880S                                   |  | DOCUMENT NO: 98ARB18660C | REV: D                     |
|                                                         |  | CASE NUMBER: 465C-02     | 09 JUN 2005                |
|                                                         |  | STANDARD: NON-JEDEC      |                            |

NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M–1994.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION H IS MEASURED .030 (0.762) AWAY FROM PACKAGE BODY.

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

| DIM | INCH |        | MILLIMETER |         | DIM | INCH   |     | MILLIMETER |     |
|-----|------|--------|------------|---------|-----|--------|-----|------------|-----|
|     | MIN  | MAX    | MIN        | MAX     |     | MIN    | MAX | MIN        | MAX |
| A   | .905 | – .915 | 22.99      | – 23.24 | aaa | – .007 | –   | – 0.178    | –   |
| B   | .535 | – .545 | 13.6       | – 13.8  | bbb | – .010 | –   | – 0.254    | –   |
| C   | .147 | – .200 | 3.73       | – 5.08  | ccc | – .015 | –   | – 0.381    | –   |
| D   | .495 | – .505 | 12.57      | – 12.83 | –   | –      | –   | –          | –   |
| E   | .035 | – .045 | 0.89       | – 1.14  | –   | –      | –   | –          | –   |
| F   | .003 | – .006 | 0.08       | – 0.15  | –   | –      | –   | –          | –   |
| H   | .057 | – .067 | 1.45       | – 1.7   | –   | –      | –   | –          | –   |
| K   | .170 | – .210 | 4.32       | – 5.33  | –   | –      | –   | –          | –   |
| M   | .872 | – .888 | 22.15      | – 22.55 | –   | –      | –   | –          | –   |
| N   | .871 | – .889 | 19.3       | – 22.6  | –   | –      | –   | –          | –   |
| R   | .515 | – .525 | 13.1       | – 13.3  | –   | –      | –   | –          | –   |
| S   | .515 | – .525 | 13.1       | – 13.3  | –   | –      | –   | –          | –   |

|                                                         |  |                          |                            |             |
|---------------------------------------------------------|--|--------------------------|----------------------------|-------------|
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|                                                         |  | CASE NUMBER: 465C–02     |                            | 09 JUN 2005 |
|                                                         |  | STANDARD: NON–JEDEC      |                            |             |

## PRODUCT DOCUMENTATION AND SOFTWARE

Refer to the following documents and software to aid your design process.

### Application Notes

- AN1955: Thermal Measurement Methodology of RF Power Amplifiers

### Engineering Bulletins

- EB212: Using Data Sheet Impedances for RF LDMOS Devices

### Software

- Electromigration MTTF Calculator
- RF High Power Model

For Software, do a Part Number search at <http://www.freescale.com>, and select the “Part Number” link. Go to the Software & Tools tab on the part’s Product Summary page to download the respective tool.

## REVISION HISTORY

The following table summarizes revisions to this document.

| Revision | Date      | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0        | Oct. 2006 | <ul style="list-style-type: none"> <li>• Initial Release of Data Sheet</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 1        | Dec. 2008 | <ul style="list-style-type: none"> <li>• Corrected <math>V_{DS}</math> to <math>V_{DD}</math> in the RF test condition voltage callout for <math>V_{GS(Q)}</math>, and added “Measured in Functional Test”, On Characteristics table, p. 2</li> <li>• Updated Typical Performance table to provide better definition of characterization attributes, p. 3</li> <li>• Updated Part Numbers in Table 5, Component Designations and Values, to latest RoHS compliant part numbers, p. 4</li> <li>• Adjusted scale for Fig. 8, Intermodulation Distortion Products versus Tone Spacing, to show wider dynamic range, p. 7</li> <li>• Replaced Fig. 13, MTTF versus Junction Temperature with updated graph. Removed Amps<sup>2</sup> and listed operating characteristics and location of MTTF calculator for device, p. 8</li> <li>• Deleted output signal data from Fig. 14, CCDF W-CDMA 3GPP, Test Model 1, 64 DPCH, 50% Clipping, Single-Carrier Test Signal, p. 8</li> </ul> |
| 2        | Mar. 2011 | <ul style="list-style-type: none"> <li>• Modified data sheet to reflect RF Test Reduction described in Product and Process Change Notification number, PCN13628, p. 1, 2</li> <li>• Fig. 13, MTTF versus Junction Temperature removed, p. 8. Refer to the device’s MTTF Calculator available at <a href="http://freescale.com/RFpower">freescale.com/RFpower</a>. Go to Design Resources &gt; Software and Tools.</li> <li>• Fig. 14, CCDF W-CDMA IQ Magnitude Clipping, Single-Carrier Test Signal and Fig. 15, Single-Carrier W-CDMA Spectrum updated to show the undistorted input test signal, p. 8 (renumbered as Figs. 13 and 14 respectively after Fig. 13 removed)</li> <li>• Added Electromigration MTTF Calculator and RF High Power Model availability to Product Software, p. 15</li> </ul>                                                                                                                                                                       |

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