



RF Power GaN Transistor

This 50 W asymmetrical Doherty RF power GaN transistor is designed for cellular base station applications requiring very wide instantaneous bandwidth capability covering the frequency range of 2496 to 2690 MHz.

This part is characterized and performance is guaranteed for applications operating in the 2496 to 2690 MHz band. There is no guarantee of performance when this part is used in applications designed outside of these frequencies.

2600 MHz

- Typical Doherty Single-Carrier W-CDMA Characterization Performance:
 $V_{DD} = 48 \text{ Vdc}$, $I_{DQA} = 150 \text{ mA}$, $V_{GSB} = -5.4 \text{ Vdc}$, $P_{out} = 50 \text{ W Avg.}$,
 Input Signal PAR = 9.9 dB @ 0.01% Probability on CCDF. (1)

| Frequency | G_{ps} (dB) | η_D (%) | Output PAR (dB) | ACPR (dBc) |
|-----------|---------------|--------------|-----------------|------------|
| 2575 MHz | 14.3 | 61.9 | 7.2 | -29.1 |
| 2605 MHz | 14.3 | 61.7 | 7.1 | -29.5 |
| 2635 MHz | 14.3 | 60.9 | 6.8 | -30.4 |

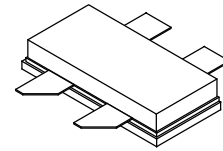
1. All data measured in fixture with device soldered to heatsink.

Features

- High terminal impedances for optimal broadband performance
- Advanced high performance in-package Doherty
- Able to withstand extremely high output VSWR and broadband operating conditions

A2G26H281-04SR3

**2496–2690 MHz, 50 W AVG., 48 V
 AIRFAST RF POWER GaN
 TRANSISTOR**



NI-780S-4L

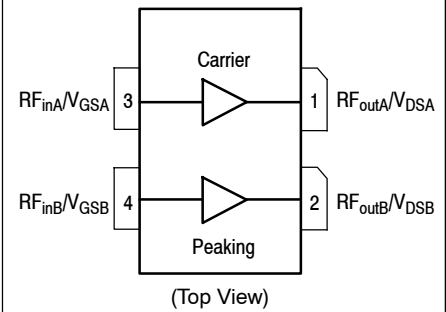


Figure 1. Pin Connections

Table 1. Maximum Ratings

| Rating | Symbol | Value | Unit |
|---|------------|-------------|------------------|
| Drain-Source Voltage | V_{DSS} | 125 | Vdc |
| Gate-Source Voltage | V_{GS} | -8, 0 | Vdc |
| Operating Voltage | V_{DD} | 0 to +55 | Vdc |
| Maximum Forward Gate Current @ $T_C = 25^\circ\text{C}$ | I_{GMAX} | 31 | mA |
| Storage Temperature Range | T_{stg} | -65 to +150 | $^\circ\text{C}$ |
| Case Operating Temperature Range | T_C | -55 to +150 | $^\circ\text{C}$ |
| Operating Junction Temperature Range | T_J | -55 to +225 | $^\circ\text{C}$ |
| Absolute Maximum Junction Temperature (1) | T_{MAX} | 275 | $^\circ\text{C}$ |

Table 2. Thermal Characteristics

| Characteristic | Symbol | Value | Unit |
|---|-----------------------|----------|---------------------------|
| Thermal Resistance by Infrared Measurement, Active Die Surface-to-Case Case Temperature 74°C , $P_D = 38.3\text{ W}$ | $R_{\theta JC}$ (IR) | 1.0 (2) | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance by Finite Element Analysis, Junction-to-Case Case Temperature 72°C , $P_D = 38.3\text{ W}$ | $R_{\theta JC}$ (FEA) | 1.77 (3) | $^\circ\text{C}/\text{W}$ |

Table 3. ESD Protection Characteristics

| Test Methodology | Class |
|---------------------------------------|-------|
| Human Body Model (per JESD22-A114) | 1B |
| Charge Device Model (per JESD22-C101) | C3 |

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

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

Off Characteristics (4)

| | | | | | |
|--|---------------|------------|---|---|-----|
| Drain-Source Breakdown Voltage ($V_{GS} = -8\text{ Vdc}$, $I_D = 12.0\text{ mAdc}$) ($V_{GS} = -8\text{ Vdc}$, $I_D = 18.9\text{ mAdc}$) | $V_{(BR)DSS}$ | 150 150 | — | — | Vdc |
|--|---------------|------------|---|---|-----|

On Characteristics - Side A, Carrier

| | | | | | |
|--|--------------|------|------|------|------|
| Gate Threshold Voltage ($V_{DS} = 10\text{ Vdc}$, $I_D = 12.0\text{ mAdc}$) | $V_{GS(th)}$ | -3.8 | -3.1 | -2.3 | Vdc |
| Gate Quiescent Voltage ($V_{DD} = 48\text{ Vdc}$, $I_{DA} = 150\text{ mAdc}$, Measured in Functional Test) | $V_{GSA(Q)}$ | -3.6 | -2.8 | -2.3 | Vdc |
| Gate-Source Leakage Current ($V_{DS} = 0\text{ Vdc}$, $V_{GS} = -5\text{ Vdc}$) | I_{GSS} | -3.7 | — | — | mAdc |

On Characteristics - Side B, Peaking

| | | | | | |
|---|--------------|------|------|------|------|
| Gate Threshold Voltage ($V_{DS} = 10\text{ Vdc}$, $I_D = 18.9\text{ mAdc}$) | $V_{GS(th)}$ | -3.8 | -3.1 | -2.3 | Vdc |
| Gate-Source Leakage Current ($V_{DS} = 0\text{ Vdc}$, $V_{GS} = -5\text{ Vdc}$) | I_{GSS} | -5.9 | — | — | mAdc |

- Functional operation above 225°C has not been characterized and is not implied. Operation at T_{MAX} (275°C) reduces median time to failure by an order of magnitude; operation beyond T_{MAX} could cause permanent damage.
- Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers*. Go to <http://www.nxp.com/RF> and search for AN1955.
- $R_{\theta JC}$ (FEA) must be used for purposes related to reliability and limitations on maximum junction temperature. MTTF may be estimated by the expression $MTTF$ (hours) = $10^{[A + B/(T + 273)]}$, where T is the junction temperature in degrees Celsius, $A = -10.3$ and $B = 8260$.
- Each side of device measured separately.

(continued)

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|--|----------|------|-------|-------|------|
| Functional Tests ^(1,2) (In NXP Doherty Production Test Fixture, 50 ohm system) $V_{DD} = 48\text{ Vdc}$, $I_{DQA} = 150\text{ mA}$, $V_{GSB} = -5.4\text{ Vdc}$, $P_{out} = 50\text{ W Avg.}$, $f = 2635\text{ MHz}$, Single-Carrier W-CDMA, IQ Magnitude Clipping, Input Signal PAR = 9.9 dB @ 0.01% Probability on CCDF. ACPR measured in 3.84 MHz Channel Bandwidth @ $\pm 5\text{ MHz}$ Offset. [See note on correct biasing sequence.] | | | | | |
| Power Gain | G_{ps} | 12.9 | 14.2 | 16.9 | dB |
| Drain Efficiency | η_D | 55.7 | 58.7 | — | % |
| Output Peak-to-Average Ratio @ 0.01% Probability on CCDF | PAR | 6.5 | 7.1 | — | dB |
| Adjacent Channel Power Ratio | ACPR | — | -31.4 | -27.0 | dBc |

Load Mismatch ⁽²⁾ (In NXP Doherty Characterization Test Fixture, 50 ohm system) $I_{DQA} = 150\text{ mA}$, $V_{GSB} = -5.4\text{ Vdc}$, $f = 2605\text{ MHz}$, 12 μsec (on), 10% Duty Cycle

| | |
|---|-----------------------|
| VSWR 10:1 at 55 Vdc, 275 W Pulsed CW Output Power (3 dB Input Overdrive from 180 W Pulsed CW Rated Power) | No Device Degradation |
|---|-----------------------|

Typical Performance ⁽²⁾ (In NXP Doherty Characterization Test Fixture, 50 ohm system) $V_{DD} = 48\text{ Vdc}$, $I_{DQA} = 150\text{ mA}$, $V_{GSB} = -5.4\text{ Vdc}$, 2575–2635 MHz Bandwidth

| | | | | | |
|--|--------------------|---|------|---|-------|
| P_{out} @ 3 dB Compression Point ⁽³⁾ | P3dB | — | 251 | — | W |
| VBW Resonance Point (IMD Third Order Intermodulation Inflection Point) | VBW _{res} | — | 110 | — | MHz |
| Gain Flatness in 60 MHz Bandwidth @ $P_{out} = 50\text{ W Avg.}$ | G_F | — | 0.35 | — | dB |
| Gain Variation over Temperature (-30°C to +85°C) | ΔG | — | 0.01 | — | dB/°C |
| Output Power Variation over Temperature (-30°C to +85°C) | ΔP_{1dB} | — | 0.01 | — | dB/°C |

Table 5. Ordering Information

| Device | Tape and Reel Information | Package |
|-----------------|---|------------|
| A2G26H281-04SR3 | R3 Suffix = 250 Units, 32 mm Tape Width, 13-inch Reel | NI-780S-4L |

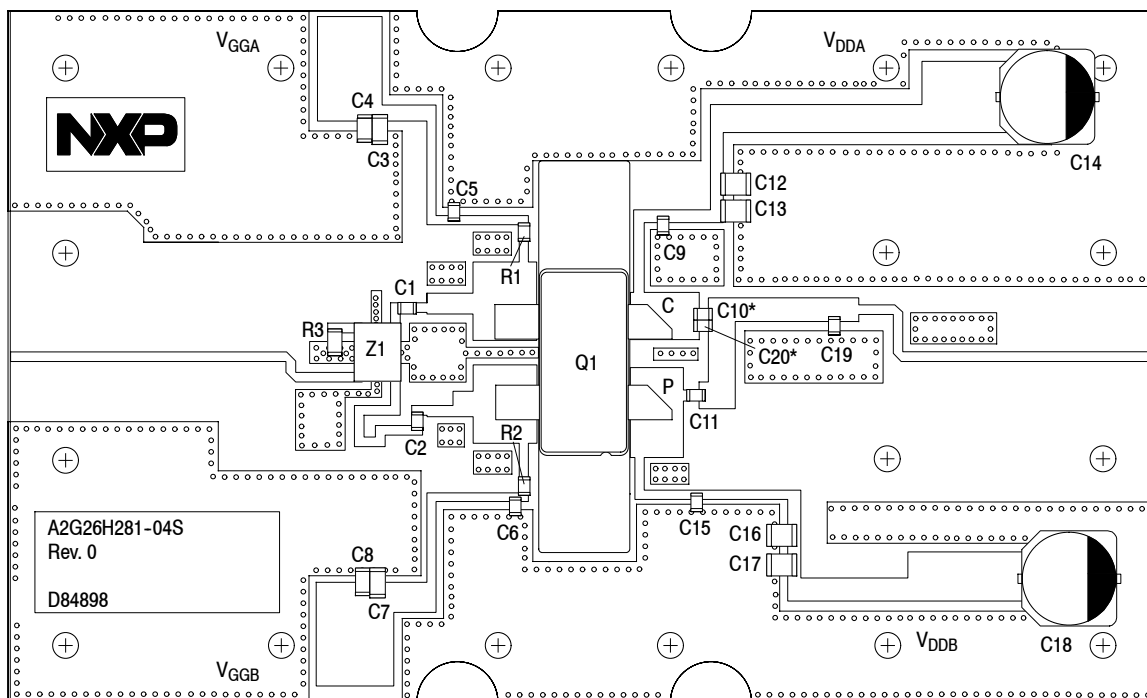
- Part internally input matched.
- Measurements made with device in an asymmetrical Doherty configuration.
- P3dB = $P_{avg} + 7.0\text{ dB}$ where P_{avg} is the average output power measured using an unclipped W-CDMA single-carrier input signal where output PAR is compressed to 7.0 dB @ 0.01% probability on CCDF.

NOTE: Correct Biasing Sequence for GaN Depletion Mode Transistors**Turning the device ON**

- Set V_{GS} to -5 V
- Turn on V_{DS} to nominal supply voltage (48 V)
- Increase V_{GS} until I_{DS} current is attained
- Apply RF input power to desired level

Turning the device OFF

- Turn RF power off
- Reduce V_{GS} down to -5 V
- Reduce V_{DS} down to 0 V (Adequate time must be allowed for V_{DS} to reduce to 0 V to prevent severe damage to device.)
- Turn off V_{GS}



*C10 and C20 are mounted vertically.

Note: All data measured in fixture with device soldered to heatsink. Production fixture does not include device soldered to heatsink.

Figure 2. A2G26H281-04SR3 Characterization Test Circuit Component Layout

Table 6. A2G26H281-04SR3 Characterization Test Circuit Component Designations and Values

| Part | Description | Part Number | Manufacturer |
|-------------------------|--|--------------------|--------------|
| C1, C2, C5, C6, C9, C15 | 6.8 pF Chip Capacitors | ATC600F6R8BT250XT | ATC |
| C3, C7 | 10 μ F Chip Capacitors | GRM31CR61H106KA12L | Murata |
| C4, C8 | 1 μ F Chip Capacitors | GRM31CR72A105KA01L | Murata |
| C10 | 2.0 pF Chip Capacitor | ATC600F2R0BT250XT | ATC |
| C11 | 4.7 pF Chip Capacitor | ATC600F4R7BT250XT | ATC |
| C12, C13, C16, C17 | 2.2 μ F Chip Capacitors | GRM32ER72A225KA35L | Murata |
| C14, C18 | 220 μ F, 100 V Electrolytic Capacitors | EEV-FK2A221M | Panasonic |
| C19 | 0.2 pF Chip Capacitor | ATC600RF0R2BT250XT | ATC |
| C20 | 0.1 pF Chip Capacitor | ATC600RF0R1BT250XT | ATC |
| Q1 | RF Power GaN Transistor | A2G26H281-04S | NXP |
| R1, R2 | 5.6 Ω , 1/4 W Chip Resistors | CRCW12065K60FKEA | Vishay |
| R3 | 50 Ω , 30 W Termination Resistor | RFP-375375N6Z50-2 | Anaren |
| Z1 | 2300–2700 MHz Band, 90°, 2 dB Hybrid Coupler | X3C25P1-02S | Anaren |
| PCB | Rogers RO4350B, 0.020", $\epsilon_r = 3.66$ | D84898 | MTL |

TYPICAL CHARACTERISTICS — 2575–2635 MHz

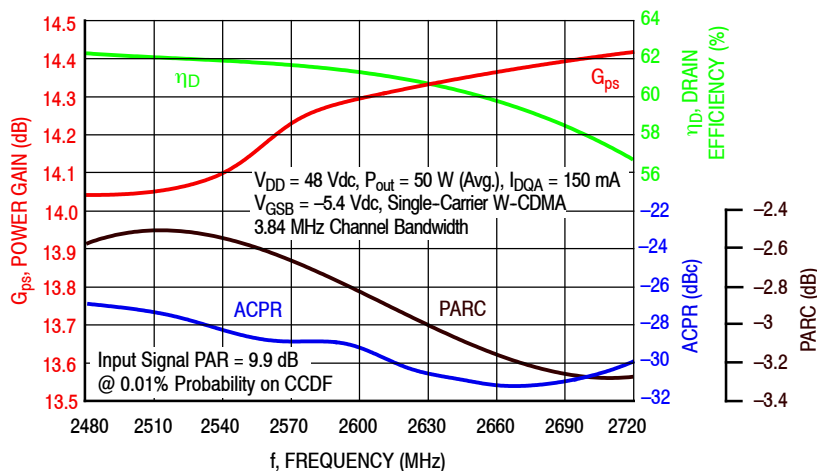


Figure 3. Single-Carrier Output Peak-to-Average Ratio Compression (PARC) Broadband Performance @ $P_{out} = 50$ Watts Avg.

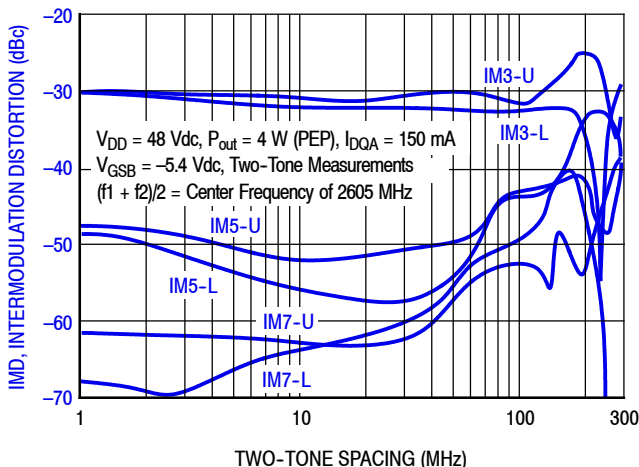


Figure 4. Intermodulation Distortion Products versus Two-Tone Spacing

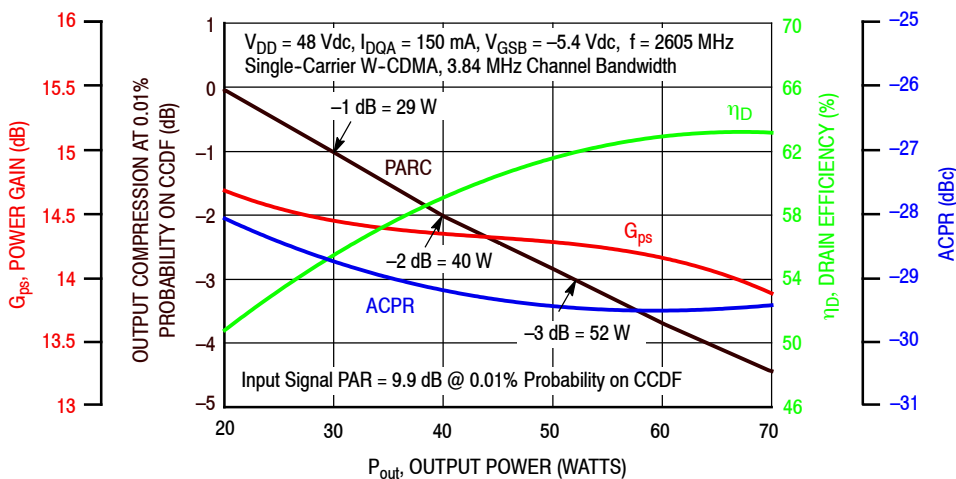


Figure 5. Output Peak-to-Average Ratio Compression (PARC) versus Output Power

TYPICAL CHARACTERISTICS — 2575–2635 MHz

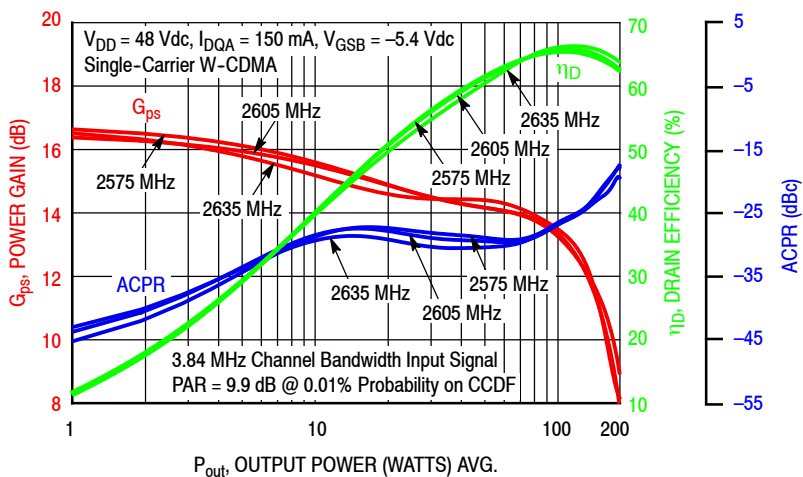


Figure 6. Single-Carrier W-CDMA Power Gain, Drain Efficiency and ACPR versus Output Power

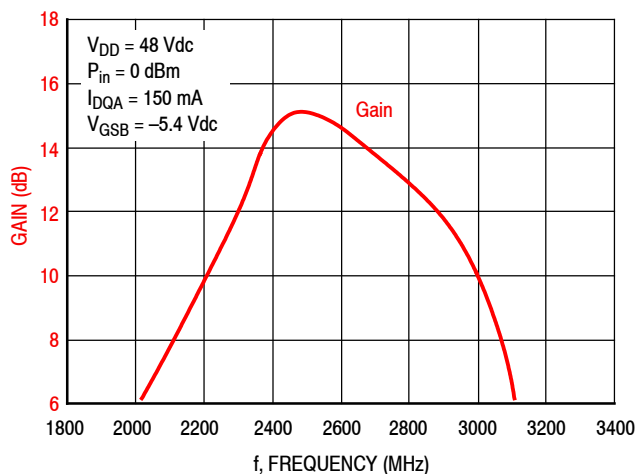
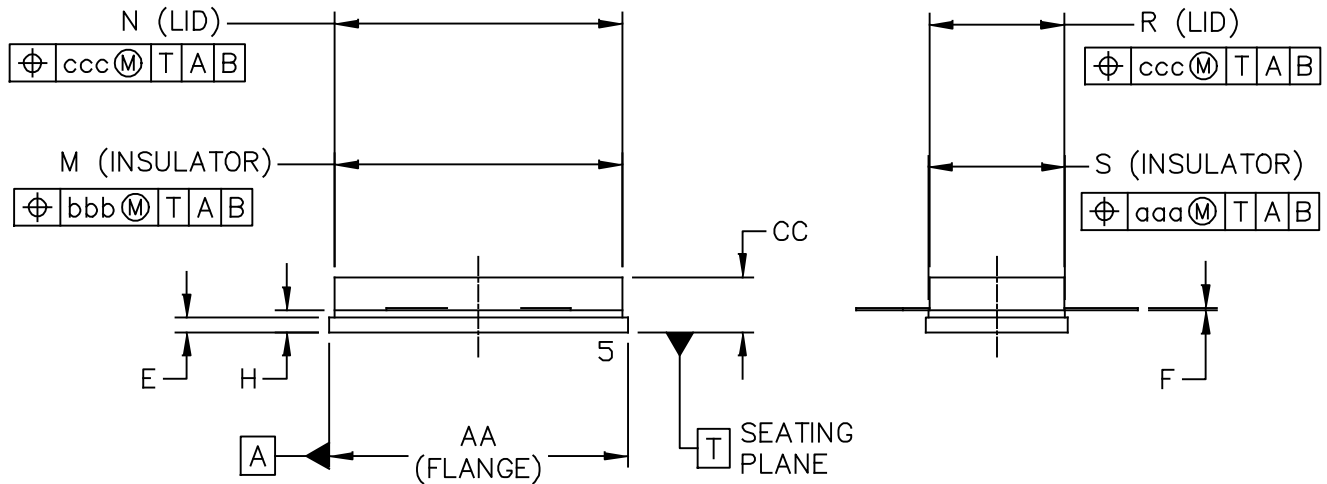
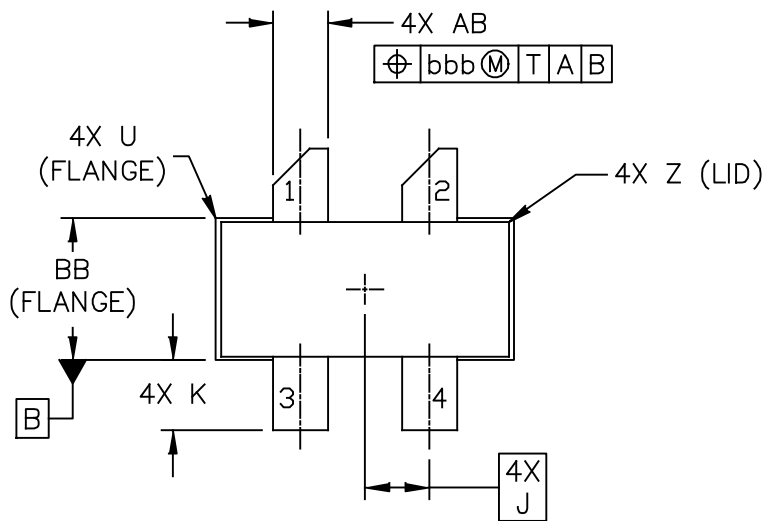


Figure 7. Broadband Frequency Response

PACKAGE DIMENSIONS



| | | |
|--|--------------------------|----------------------------|
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NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1994.
2. CONTROLLING DIMENSION: INCH.
3. DELETED
4. DIMENSION H IS MEASURED .030 (0.762) AWAY FROM FLANGE TO CLEAR EPOXY FLOW OUT PARALLEL TO DATUM B.

| DIM | INCH | | MILLIMETER | | DIM | INCH | | MILLIMETER | |
|---|----------|------|--------------------|-------|--------------------------------------|----------------------------|------|-------------|--------|
| | MIN | MAX | MIN | MAX | | MIN | MAX | MIN | MAX |
| AA | .805 | .815 | 20.45 | 20.70 | U | | .040 | | 1.02 |
| BB | .382 | .388 | 9.70 | 9.86 | Z | | .030 | | 0.76 |
| CC | .125 | .170 | 3.18 | 4.32 | AB | .145 | .155 | 3.68 | - 3.94 |
| E | .035 | .045 | 0.89 | 1.14 | | | | | |
| F | .003 | .006 | 0.08 | 0.15 | aaa | | .005 | | 0.127 |
| H | .057 | .067 | 1.45 | 1.70 | bbb | | .010 | | 0.254 |
| J | .175 BSC | | 4.44 BSC | | ccc | | .015 | | 0.381 |
| K | .170 | .210 | 4.32 | 5.33 | | | | | |
| M | .774 | .786 | 19.61 | 20.02 | | | | | |
| N | .772 | .788 | 19.61 | 20.02 | | | | | |
| R | .365 | .375 | 9.27 | 9.53 | | | | | |
| S | .365 | .375 | 9.27 | 9.52 | | | | | |
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PRODUCT DOCUMENTATION, SOFTWARE AND TOOLS

Refer to the following resources to aid your design process.

Application Notes

- AN1908: Solder Reflow Attach Method for High Power RF Devices in Air Cavity Packages
- AN1955: Thermal Measurement Methodology of RF Power Amplifiers

Engineering Bulletins

- EB212: Using Data Sheet Impedances for RF LDMOS Devices

Software

- .s2p File

Development Tools

- Printed Circuit Boards

To Download Resources Specific to a Given Part Number:

1. Go to <http://www.nxp.com/RF>
2. Search by part number
3. Click part number link
4. Choose the desired resource from the drop down menu

REVISION HISTORY

The following table summarizes revisions to this document.

| Revision | Date | Description |
|----------|------------|--|
| 0 | Sept. 2016 | <ul style="list-style-type: none">• Initial release of data sheet |
| 1 | Feb. 2017 | <ul style="list-style-type: none">• Functional test table: Min, Typ and Max values updated to reflect the true capability of the device, p. 3• Bias Sequencing Note, Turning the device ON, step 2: 50 V changed to 48 V to reflect the functionality of the part, p. 3 |

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