



# RF Power LDMOS Transistor

## N-Channel Enhancement-Mode Lateral MOSFET

This 72 W asymmetrical Doherty RF power LDMOS transistor is designed for cellular base station applications covering the frequency range of 2110 to 2170 MHz.

### 2100 MHz

- Typical Doherty Single-Carrier W-CDMA Performance:  $V_{DD} = 28$  Vdc,  $I_{DQA} = 600$  mA,  $V_{GSB} = 0.4$  Vdc,  $P_{out} = 72$  W Avg., Input Signal PAR = 9.9 dB @ 0.01% Probability on CCDF.

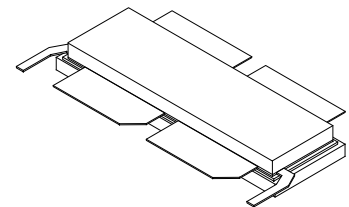
| Frequency | $G_{ps}$ (dB) | $\eta_D$ (%) | Output PAR (dB) | ACPR (dBc) |
|-----------|---------------|--------------|-----------------|------------|
| 2110 MHz  | 15.7          | 49.1         | 7.9             | -34.0      |
| 2140 MHz  | 15.7          | 49.0         | 7.8             | -33.6      |
| 2170 MHz  | 15.6          | 48.9         | 7.6             | -32.1      |

### Features

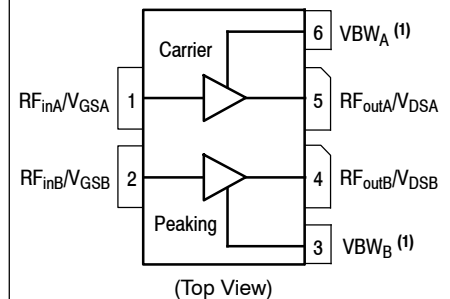
- Advanced High Performance In-Package Doherty
- Greater Negative Gate-Source Voltage Range for Improved Class C Operation
- Designed for Digital Predistortion Error Correction Systems

**A2T21H410-24SR6**

**2110–2170 MHz, 72 W AVG., 28 V  
AIRFAST RF POWER LDMOS  
TRANSISTOR**



**NI-1230S-4L2L**



**Figure 1. Pin Connections**

- Device cannot operate with  $V_{DD}$  current supplied through pin 3 and pin 6.

**Table 1. Maximum Ratings**

| Rating                                                                     | Symbol    | Value       | Unit      |
|----------------------------------------------------------------------------|-----------|-------------|-----------|
| Drain-Source Voltage                                                       | $V_{DS}$  | -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 Range                                           | $T_C$     | -40 to +150 | °C        |
| Operating Junction Temperature Range (1,2)                                 | $T_J$     | -40 to +225 | °C        |
| CW Operation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | CW        | 269<br>0.95 | W<br>W/°C |

**Table 2. Thermal Characteristics**

| Characteristic                                                                                                                                                                | Symbol          | Value (2,3) | Unit |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------|------|
| Thermal Resistance, Junction to Case<br>Case Temperature $73^\circ\text{C}$ , 72 W Avg., W-CDMA, 28 Vdc, $I_{DQA} = 600\text{ mA}$ , $V_{GSB} = 0.4\text{ Vdc}$ ,<br>2140 MHz | $R_{\theta JC}$ | 0.24        | °C/W |

**Table 3. ESD Protection Characteristics**

| Test Methodology                      | Class |
|---------------------------------------|-------|
| Human Body Model (per JESD22-A114)    | 2     |
| Machine Model (per EIA/JESD22-A115)   | B     |
| Charge Device Model (per JESD22-C101) | IV    |

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

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

**Off Characteristics (4)**

|                                                                                                   |           |   |   |    |                 |
|---------------------------------------------------------------------------------------------------|-----------|---|---|----|-----------------|
| 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>( $V_{DS} = 32\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ ) | $I_{DSS}$ | — | — | 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 - Side A, Carrier**

|                                                                                                               |              |     |     |     |     |
|---------------------------------------------------------------------------------------------------------------|--------------|-----|-----|-----|-----|
| Gate Threshold Voltage<br>( $V_{DS} = 10\text{ Vdc}$ , $I_D = 160\text{ }\mu\text{Adc}$ )                     | $V_{GS(th)}$ | 1.2 | 1.2 | 2.4 | Vdc |
| Gate Quiescent Voltage<br>( $V_{DD} = 28\text{ Vdc}$ , $I_D = 600\text{ mAdc}$ , Measured in Functional Test) | $V_{GSA(Q)}$ | 2.3 | 2.6 | 3.1 | Vdc |
| Drain-Source On-Voltage<br>( $V_{GS} = 10\text{ Vdc}$ , $I_D = 1.6\text{ Adc}$ )                              | $V_{DS(on)}$ | 0.1 | 0.2 | 0.3 | Vdc |

**On Characteristics - Side B, Peaking**

|                                                                                           |              |     |     |     |     |
|-------------------------------------------------------------------------------------------|--------------|-----|-----|-----|-----|
| Gate Threshold Voltage<br>( $V_{DS} = 10\text{ Vdc}$ , $I_D = 270\text{ }\mu\text{Adc}$ ) | $V_{GS(th)}$ | 0.8 | 1.2 | 1.6 | Vdc |
| Drain-Source On-Voltage<br>( $V_{GS} = 10\text{ Vdc}$ , $I_D = 2.7\text{ Adc}$ )          | $V_{DS(on)}$ | 0.1 | 0.2 | 0.3 | Vdc |

1. Continuous use at maximum temperature will affect MTTF.
2. MTTF calculator available at <http://www.nxp.com/RF/calculators>.
3. Refer to AN1955, *Thermal Measurement Methodology of RF Power Amplifiers*. Go to <http://www.nxp.com/RF> and search for AN1955.
4. 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 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------|-------|-------|------|
| <b>Functional Tests</b> <sup>(1,2)</sup> (In Freescale Doherty Test Fixture, 50 ohm system) $V_{DD} = 28\text{ Vdc}$ , $I_{DQA} = 600\text{ mA}$ , $V_{GSB} = 0.4\text{ Vdc}$ , $P_{out} = 72\text{ W Avg.}$ , $f = 2170\text{ MHz}$ , 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. |          |      |       |       |      |
| Power Gain                                                                                                                                                                                                                                                                                                                                                                                                           | $G_{ps}$ | 14.8 | 15.6  | 17.8  | dB   |
| Drain Efficiency                                                                                                                                                                                                                                                                                                                                                                                                     | $\eta_D$ | 44.0 | 48.9  | —     | %    |
| Output Peak-to-Average Ratio @ 0.01% Probability on CCDF                                                                                                                                                                                                                                                                                                                                                             | PAR      | 6.8  | 7.6   | —     | dB   |
| Adjacent Channel Power Ratio                                                                                                                                                                                                                                                                                                                                                                                         | ACPR     | —    | -32.1 | -28.5 | dBc  |

**Load Mismatch** <sup>(2)</sup> (In Freescale Doherty Test Fixture, 50 ohm system)  $I_{DQA} = 600\text{ mA}$ ,  $V_{GSB} = 0.4\text{ Vdc}$ ,  $f = 2140\text{ MHz}$

|                                                                                                                              |                       |
|------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| VSWR 10:1 at 32 Vdc, 331 W CW <sup>(3)</sup> Output Power<br>(3 dB Input Overdrive from 316 W CW <sup>(3)</sup> Rated Power) | No Device Degradation |
|------------------------------------------------------------------------------------------------------------------------------|-----------------------|

**Typical Performance** <sup>(2)</sup> (In Freescale Doherty Test Fixture, 50 ohm system)  $V_{DD} = 28\text{ Vdc}$ ,  $I_{DQA} = 600\text{ mA}$ ,  $V_{GSB} = 0.4\text{ Vdc}$ , 2110–2170 MHz Bandwidth

|                                                                                                    |                    |   |                    |   |       |
|----------------------------------------------------------------------------------------------------|--------------------|---|--------------------|---|-------|
| $P_{out}$ @ 1 dB Compression Point, CW                                                             | P1dB               | — | 316 <sup>(3)</sup> | — | W     |
| $P_{out}$ @ 3 dB Compression Point <sup>(4)</sup>                                                  | P3dB               | — | 447                | — | W     |
| AM/PM<br>(Maximum value measured at the P3dB compression point across the 2110–2170 MHz bandwidth) | $\Phi$             | — | -5.9               | — | °     |
| VBW Resonance Point<br>(IMD Third Order Intermodulation Inflection Point)                          | VBW <sub>res</sub> | — | 90                 | — | MHz   |
| Gain Flatness in 60 MHz Bandwidth @ $P_{out} = 72\text{ W Avg.}$                                   | $G_F$              | — | 0.3                | — | dB    |
| Gain Variation over Temperature<br>(-30°C to +85°C)                                                | $\Delta G$         | — | 0.006              | — | dB/°C |
| Output Power Variation over Temperature<br>(-30°C to +85°C) <sup>(3)</sup>                         | $\Delta P_{1dB}$   | — | 0.008              | — | dB/°C |

**Table 5. Ordering Information**

| Device          | Tape and Reel Information                             | Package       |
|-----------------|-------------------------------------------------------|---------------|
| A2T21H410-24SR6 | R6 Suffix = 150 Units, 56 mm Tape Width, 13-inch Reel | NI-1230S-4L2L |

1. Part internally matched both on input and output.
2. Measurements made with device in an asymmetrical Doherty configuration.
3. Exceeds recommended operating conditions. See CW operation data in Maximum Ratings table.
4.  $P_{3dB} = P_{avg} + 7.0\text{ dB}$  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.

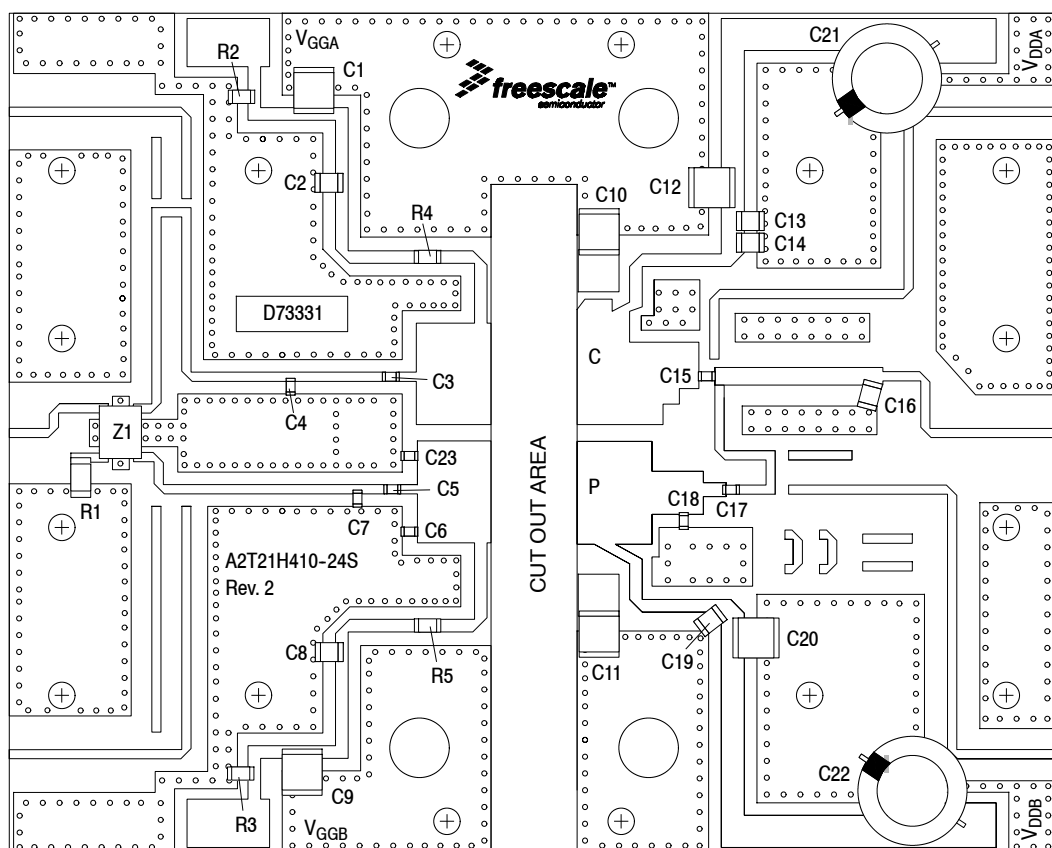


Figure 2. A2T21H410-24SR6 Test Circuit Component Layout

Table 6. A2T21H410-24SR6 Production Test Circuit Component Designations and Values

| Part                       | Description                                       | Part Number          | Manufacturer |
|----------------------------|---------------------------------------------------|----------------------|--------------|
| C1, C9, C10, C11, C12, C20 | 10 $\mu$ F Chip Capacitors                        | C5750X7S2A106M230KB  | TDK          |
| C2, C8, C14, C19           | 9.1 pF Chip Capacitors                            | ATC100B9R1CT500XT    | ATC          |
| C3, C5, C17                | 9.1 pF Chip Capacitors                            | ATC600F9R1BT250XT    | ATC          |
| C4                         | 1.1 pF Chip Capacitor                             | ATC600F1R1BT250XT    | ATC          |
| C6                         | 0.5 pF Chip Capacitor                             | ATC600F0R5BT250XT    | ATC          |
| C7                         | 0.7 pF Chip Capacitor                             | ATC600F0R7BT250XT    | ATC          |
| C13                        | 0.8 pF Chip Capacitor                             | ATC100B0R8BT500XT    | ATC          |
| C15                        | 4.7 pF Chip Capacitor                             | ATC600F4R7BT250XT    | ATC          |
| C16                        | 0.3 pF Chip Capacitor                             | ATC100B0R3BT500XT    | ATC          |
| C18                        | 0.7 pF Chip Capacitor                             | ATC600F0R7BT250XT    | ATC          |
| C21, C22                   | 470 $\mu$ F, 63 V Electrolytic Capacitors         | MCGPR63V477M13X26-RH | Multicomp    |
| C23                        | 0.6 pF Chip Capacitor                             | ATC600F0R6BT250XT    | ATC          |
| R1                         | 50 $\Omega$ , 10 W Chip Resistor                  | C10A50Z4             | Anaren       |
| R2, R3                     | 5.6 k $\Omega$ , 1/4 W Chip Resistors             | CRCW12065K60FKEA     | Vishay       |
| R4, R5                     | 6.2 $\Omega$ , 1/4 W Chip Resistors               | CRCW12066R20FKEA     | Vishay       |
| Z1                         | 2000–2300 MHz Band, 90°, 5 dB Directional Coupler | X3C21P1-05S          | Anaren       |
| PCB                        | Rogers RO4350B, 0.020", $\epsilon_r = 3.66$       | D73331               | MTL          |

## TYPICAL CHARACTERISTICS — 2110–2170 MHz

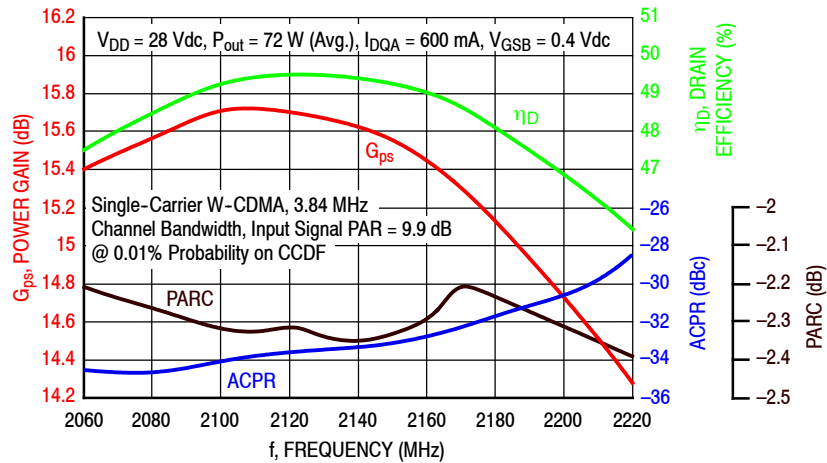


Figure 3. Single-Carrier Output Peak-to-Average Ratio Compression (PARC) Broadband Performance @  $P_{out} = 72$  Watts Avg.

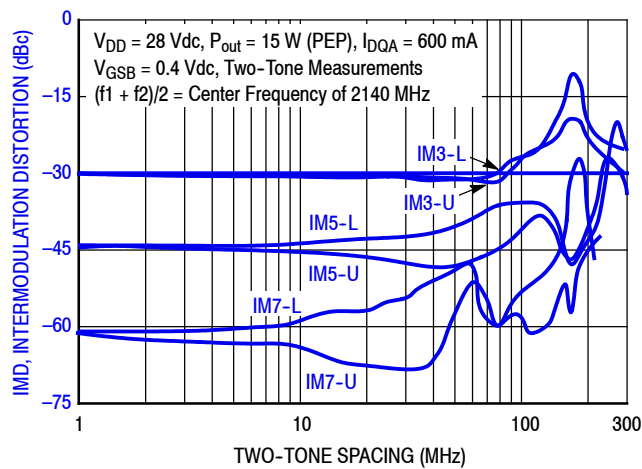


Figure 4. Intermodulation Distortion Products versus Two-Tone Spacing

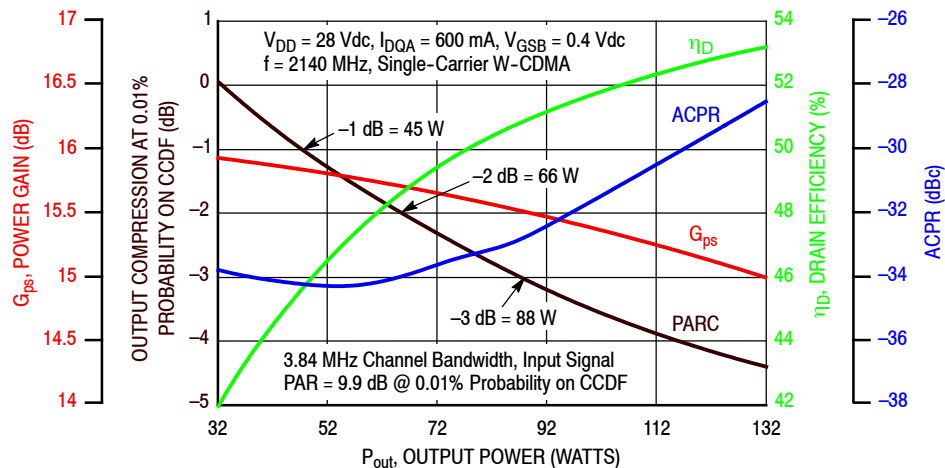
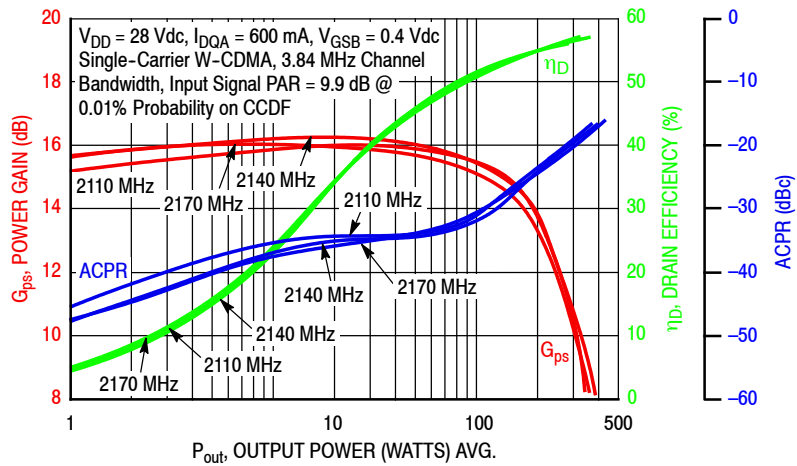
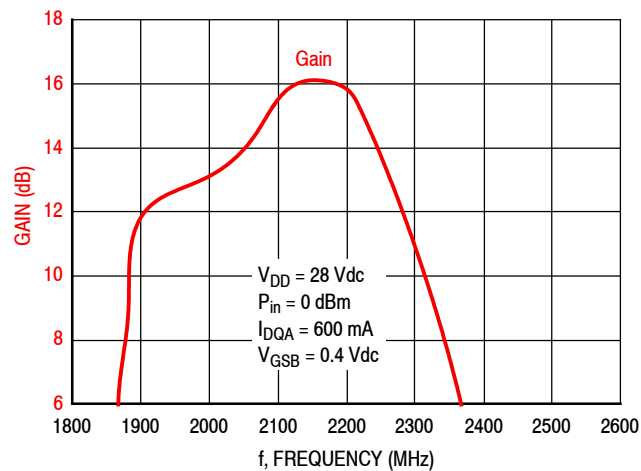


Figure 5. Output Peak-to-Average Ratio Compression (PARC) versus Output Power

## TYPICAL CHARACTERISTICS — 2110–2170 MHz



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



**Figure 7. Broadband Frequency Response**

**Table 7. Carrier Side Load Pull Performance — Maximum Power Tuning**V<sub>DD</sub> = 28 Vdc, I<sub>DQ</sub> = 793 mA, Pulsed CW, 10 μsec(on), 10% Duty Cycle

| f<br>(MHz) | Z <sub>source</sub><br>(Ω) | Z <sub>in</sub><br>(Ω) | Max Output Power                        |           |       |     |                       |              |
|------------|----------------------------|------------------------|-----------------------------------------|-----------|-------|-----|-----------------------|--------------|
|            |                            |                        | P1dB                                    |           |       |     |                       |              |
|            |                            |                        | Z <sub>load</sub> <sup>(1)</sup><br>(Ω) | Gain (dB) | (dBm) | (W) | η <sub>D</sub><br>(%) | AM/PM<br>(°) |
| 2110       | 3.30 – j6.14               | 3.02 + j4.76           | 1.35 – j4.14                            | 18.6      | 52.7  | 186 | 56.7                  | –14          |
| 2140       | 4.34 – j6.54               | 3.93 + j4.80           | 1.37 – j4.16                            | 18.6      | 52.4  | 175 | 54.5                  | –15          |
| 2170       | 5.86 – j6.79               | 5.32 + j4.64           | 1.38 – j3.97                            | 19.0      | 52.5  | 176 | 55.9                  | –15          |

| f<br>(MHz) | Z <sub>source</sub><br>(Ω) | Z <sub>in</sub><br>(Ω) | Max Output Power                        |           |       |     |                       |              |
|------------|----------------------------|------------------------|-----------------------------------------|-----------|-------|-----|-----------------------|--------------|
|            |                            |                        | P3dB                                    |           |       |     |                       |              |
|            |                            |                        | Z <sub>load</sub> <sup>(2)</sup><br>(Ω) | Gain (dB) | (dBm) | (W) | η <sub>D</sub><br>(%) | AM/PM<br>(°) |
| 2110       | 3.30 – j6.14               | 2.89 + j5.13           | 1.32 – j4.26                            | 16.3      | 53.4  | 219 | 58.5                  | –16          |
| 2140       | 4.34 – j6.54               | 3.92 + j5.30           | 1.34 – j4.35                            | 16.2      | 53.2  | 210 | 56.1                  | –17          |
| 2170       | 5.86 – j6.79               | 5.51 + j5.16           | 1.40 – j4.20                            | 16.6      | 53.2  | 209 | 57.8                  | –18          |

(1) Load impedance for optimum P1dB power.

(2) Load impedance for optimum P3dB power.

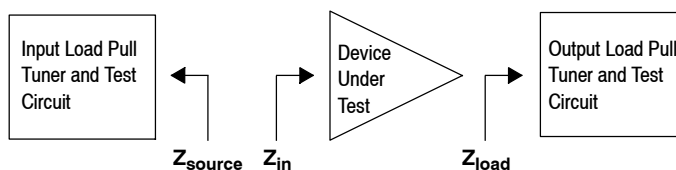
Z<sub>source</sub> = Measured impedance presented to the input of the device at the package reference plane.Z<sub>in</sub> = Impedance as measured from gate contact to ground.Z<sub>load</sub> = Measured impedance presented to the output of the device at the package reference plane.**Table 8. Carrier Load Pull Performance — Maximum Drain Efficiency Tuning**V<sub>DD</sub> = 28 Vdc, I<sub>DQ</sub> = 793 mA, Pulsed CW, 10 μsec(on), 10% Duty Cycle

| f<br>(MHz) | Z <sub>source</sub><br>(Ω) | Z <sub>in</sub><br>(Ω) | Max Drain Efficiency                    |           |       |     |                       |              |
|------------|----------------------------|------------------------|-----------------------------------------|-----------|-------|-----|-----------------------|--------------|
|            |                            |                        | P1dB                                    |           |       |     |                       |              |
|            |                            |                        | Z <sub>load</sub> <sup>(1)</sup><br>(Ω) | Gain (dB) | (dBm) | (W) | η <sub>D</sub><br>(%) | AM/PM<br>(°) |
| 2110       | 3.30 – j6.14               | 3.88 + j5.00           | 2.93 – j3.33                            | 21.6      | 50.8  | 121 | 67.6                  | –19          |
| 2140       | 4.34 – j6.54               | 4.86 + j4.65           | 2.71 – j3.46                            | 21.1      | 50.9  | 124 | 64.7                  | –18          |
| 2170       | 5.86 – j6.79               | 6.35 + j3.90           | 2.65 – j3.16                            | 21.4      | 50.7  | 118 | 64.9                  | –18          |

| f<br>(MHz) | Z <sub>source</sub><br>(Ω) | Z <sub>in</sub><br>(Ω) | Max Drain Efficiency                    |           |       |     |                       |              |
|------------|----------------------------|------------------------|-----------------------------------------|-----------|-------|-----|-----------------------|--------------|
|            |                            |                        | P3dB                                    |           |       |     |                       |              |
|            |                            |                        | Z <sub>load</sub> <sup>(2)</sup><br>(Ω) | Gain (dB) | (dBm) | (W) | η <sub>D</sub><br>(%) | AM/PM<br>(°) |
| 2110       | 3.30 – j6.14               | 3.64 + j5.34           | 2.90 – j3.20                            | 19.7      | 51.5  | 142 | 69.9                  | –25          |
| 2140       | 4.34 – j6.54               | 4.77 + j5.24           | 2.71 – j3.36                            | 19.3      | 51.6  | 146 | 66.5                  | –23          |
| 2170       | 5.86 – j6.79               | 6.60 + j4.41           | 2.65 – j3.10                            | 19.5      | 51.5  | 140 | 66.8                  | –24          |

(1) Load impedance for optimum P1dB efficiency.

(2) Load impedance for optimum P3dB efficiency.

Z<sub>source</sub> = Measured impedance presented to the input of the device at the package reference plane.Z<sub>in</sub> = Impedance as measured from gate contact to ground.Z<sub>load</sub> = Measured impedance presented to the output of the device at the package reference plane.

**Table 9. Peaking Side Load Pull Performance — Maximum Power Tuning**V<sub>DD</sub> = 28 Vdc, V<sub>GSB</sub> = 0.4 Vdc, Pulsed CW, 10 μsec(on), 10% Duty Cycle

| f<br>(MHz) | Z <sub>source</sub><br>(Ω) | Z <sub>in</sub><br>(Ω) | Max Output Power                        |           |       |     |                       |              |
|------------|----------------------------|------------------------|-----------------------------------------|-----------|-------|-----|-----------------------|--------------|
|            |                            |                        | P1dB                                    |           |       |     |                       |              |
|            |                            |                        | Z <sub>load</sub> <sup>(1)</sup><br>(Ω) | Gain (dB) | (dBm) | (W) | η <sub>D</sub><br>(%) | AM/PM<br>(°) |
| 2110       | 2.03 – j5.13               | 1.94 + j5.32           | 1.29 – j4.13                            | 15.1      | 55.2  | 328 | 55.2                  | –30          |
| 2140       | 2.71 – j5.57               | 2.54 + j5.76           | 1.32 – j4.16                            | 15.1      | 55.0  | 319 | 53.8                  | –31          |
| 2170       | 3.89 – j5.89               | 3.46 + j6.28           | 1.33 – j4.13                            | 15.1      | 55.0  | 318 | 54.1                  | –30          |

| f<br>(MHz) | Z <sub>source</sub><br>(Ω) | Z <sub>in</sub><br>(Ω) | Max Output Power                        |           |       |     |                       |              |
|------------|----------------------------|------------------------|-----------------------------------------|-----------|-------|-----|-----------------------|--------------|
|            |                            |                        | P3dB                                    |           |       |     |                       |              |
|            |                            |                        | Z <sub>load</sub> <sup>(2)</sup><br>(Ω) | Gain (dB) | (dBm) | (W) | η <sub>D</sub><br>(%) | AM/PM<br>(°) |
| 2110       | 2.03 – j5.13               | 2.08 + j5.57           | 1.30 – j4.34                            | 12.9      | 55.8  | 383 | 56.8                  | –36          |
| 2140       | 2.71 – j5.57               | 2.80 + j6.07           | 1.32 – j4.37                            | 12.9      | 55.7  | 373 | 54.9                  | –37          |
| 2170       | 3.89 – j5.89               | 3.94 + j6.60           | 1.36 – j4.40                            | 12.9      | 55.7  | 370 | 54.8                  | –36          |

(1) Load impedance for optimum P1dB power.

(2) Load impedance for optimum P3dB power.

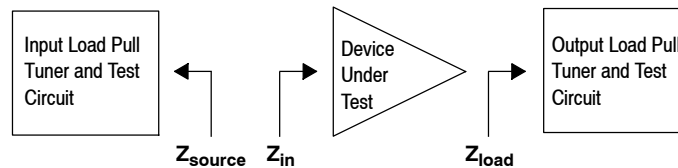
Z<sub>source</sub> = Measured impedance presented to the input of the device at the package reference plane.Z<sub>in</sub> = Impedance as measured from gate contact to ground.Z<sub>load</sub> = Measured impedance presented to the output of the device at the package reference plane.**Table 10. Peaking Side Load Pull Performance — Maximum Drain Efficiency Tuning**V<sub>DD</sub> = 28 Vdc, V<sub>GSB</sub> = 0.4 Vdc, Pulsed CW, 10 μsec(on), 10% Duty Cycle

| f<br>(MHz) | Z <sub>source</sub><br>(Ω) | Z <sub>in</sub><br>(Ω) | Max Drain Efficiency                    |           |       |     |                       |              |
|------------|----------------------------|------------------------|-----------------------------------------|-----------|-------|-----|-----------------------|--------------|
|            |                            |                        | P1dB                                    |           |       |     |                       |              |
|            |                            |                        | Z <sub>load</sub> <sup>(1)</sup><br>(Ω) | Gain (dB) | (dBm) | (W) | η <sub>D</sub><br>(%) | AM/PM<br>(°) |
| 2110       | 2.03 – j5.13               | 1.76 + j5.34           | 3.16 – j3.47                            | 16.4      | 53.5  | 222 | 65.5                  | –37          |
| 2140       | 2.71 – j5.57               | 2.31 + j5.81           | 2.90 – j3.41                            | 16.4      | 53.6  | 227 | 63.6                  | –37          |
| 2170       | 3.89 – j5.89               | 3.16 + j6.35           | 2.92 – j3.19                            | 16.2      | 53.4  | 219 | 63.2                  | –37          |

| f<br>(MHz) | Z <sub>source</sub><br>(Ω) | Z <sub>in</sub><br>(Ω) | Max Drain Efficiency                    |           |       |     |                       |              |
|------------|----------------------------|------------------------|-----------------------------------------|-----------|-------|-----|-----------------------|--------------|
|            |                            |                        | P3dB                                    |           |       |     |                       |              |
|            |                            |                        | Z <sub>load</sub> <sup>(2)</sup><br>(Ω) | Gain (dB) | (dBm) | (W) | η <sub>D</sub><br>(%) | AM/PM<br>(°) |
| 2110       | 2.03 – j5.13               | 1.98 + j5.58           | 2.55 – j4.11                            | 14.1      | 54.8  | 302 | 64.4                  | –42          |
| 2140       | 2.71 – j5.57               | 2.65 + j6.10           | 2.88 – j3.94                            | 14.2      | 54.4  | 274 | 62.5                  | –43          |
| 2170       | 3.89 – j5.89               | 3.74 + j6.66           | 2.86 – j3.80                            | 14.0      | 54.4  | 277 | 62.7                  | –43          |

(1) Load impedance for optimum P1dB efficiency.

(2) Load impedance for optimum P3dB efficiency.

Z<sub>source</sub> = Measured impedance presented to the input of the device at the package reference plane.Z<sub>in</sub> = Impedance as measured from gate contact to ground.Z<sub>load</sub> = Measured impedance presented to the output of the device at the package reference plane.

## P1dB – TYPICAL CARRIER LOAD PULL CONTOURS — 2140 MHz

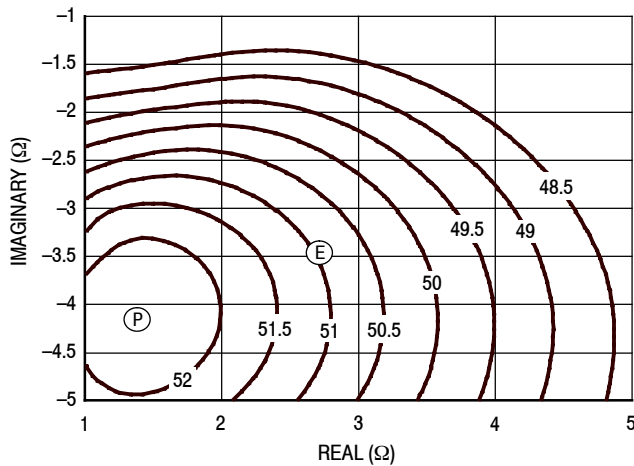


Figure 8. P1dB Load Pull Output Power Contours (dBm)

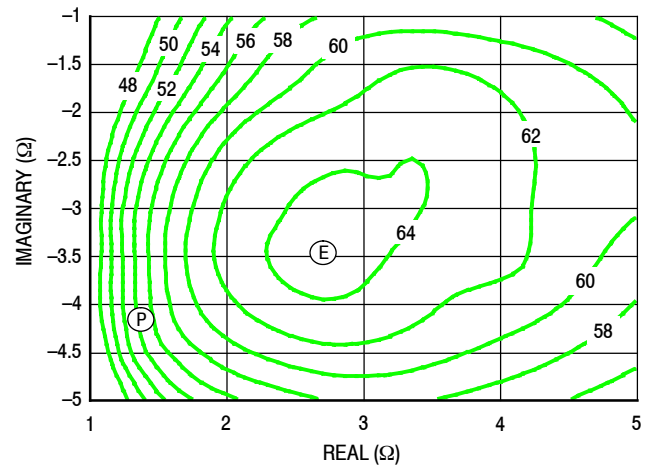


Figure 9. P1dB Load Pull Efficiency Contours (%)

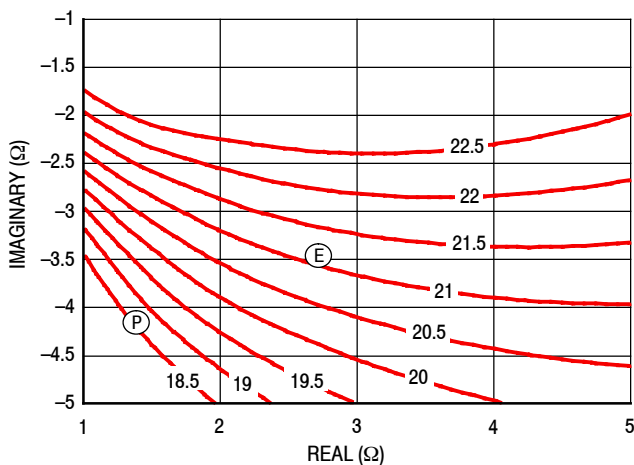


Figure 10. P1dB Load Pull Gain Contours (dB)

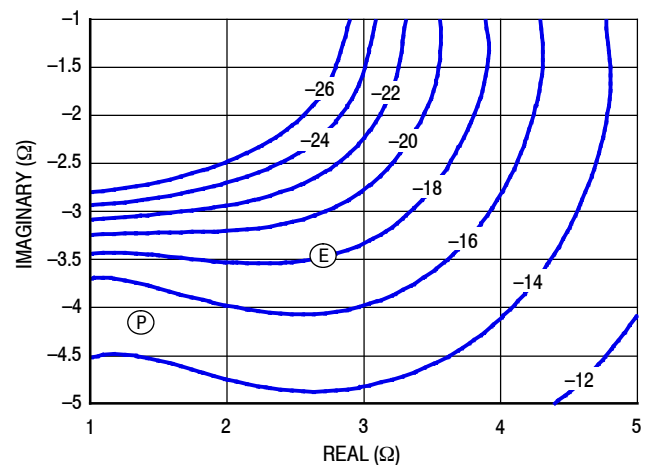


Figure 11. P1dB Load Pull AM/PM Contours (°)

**NOTE:** (P) = Maximum Output Power  
(E) = Maximum Drain Efficiency

- Gain
- Drain Efficiency
- Linearity
- Output Power

## P3dB – TYPICAL CARRIER LOAD PULL CONTOURS — 2140 MHz

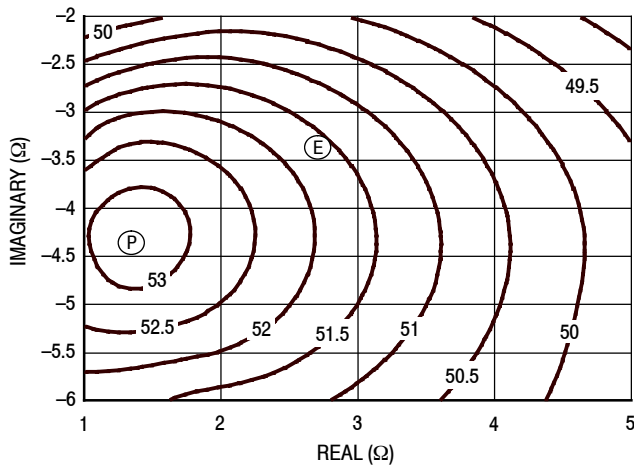


Figure 12. P3dB Load Pull Output Power Contours (dBm)

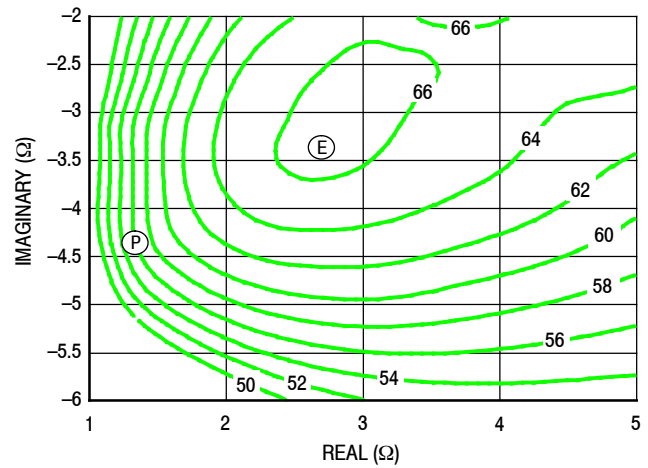


Figure 13. P3dB Load Pull Efficiency Contours (%)

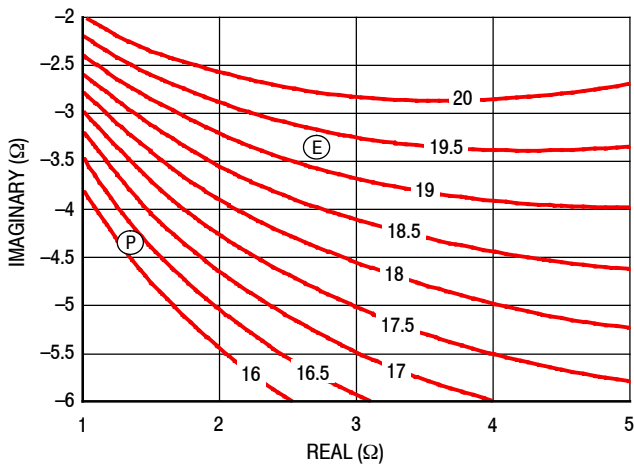


Figure 14. P3dB Load Pull Gain Contours (dB)

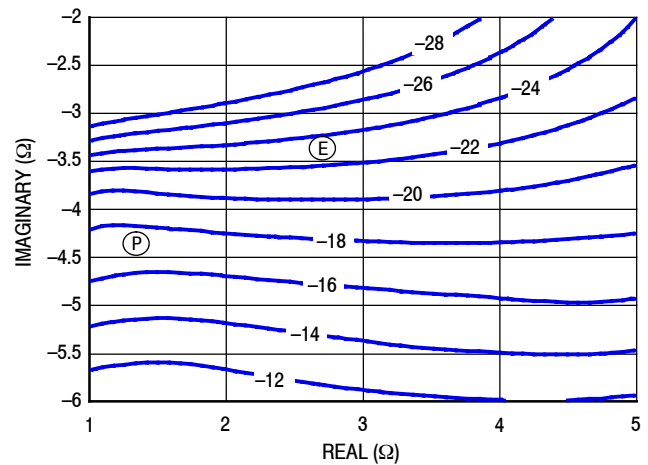


Figure 15. P3dB Load Pull AM/PM Contours (°)

**NOTE:** (P) = Maximum Output Power  
(E) = Maximum Drain Efficiency

- Gain
- Drain Efficiency
- Linearity
- Output Power

## P1dB – TYPICAL PEAKING LOAD PULL CONTOURS — 2140 MHz

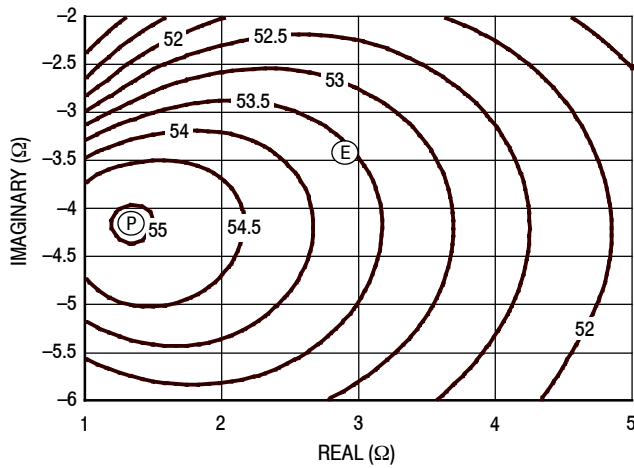


Figure 16. P1dB Load Pull Output Power Contours (dBm)

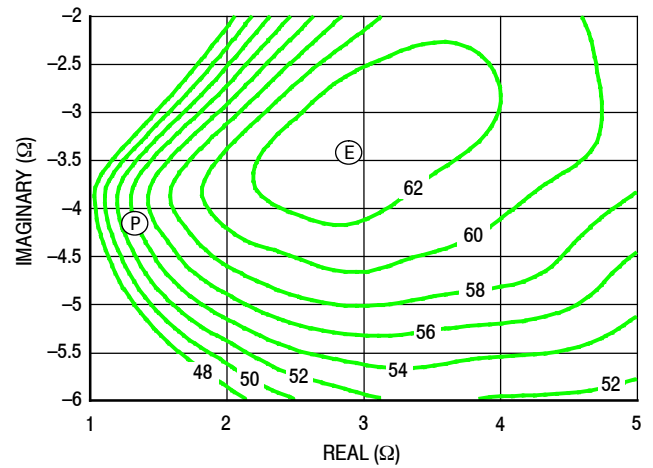


Figure 17. P1dB Load Pull Efficiency Contours (%)

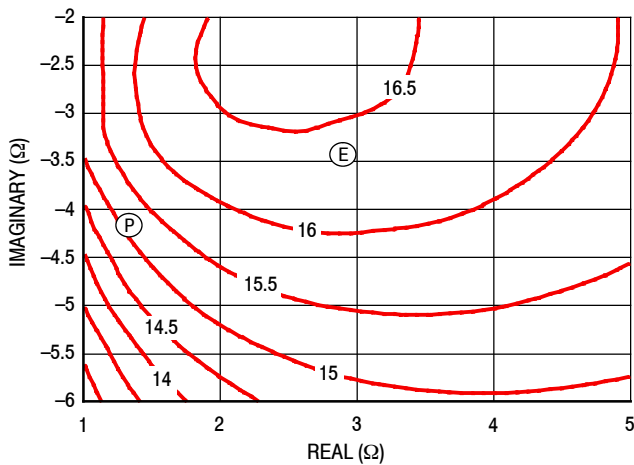


Figure 18. P1dB Load Pull Gain Contours (dB)

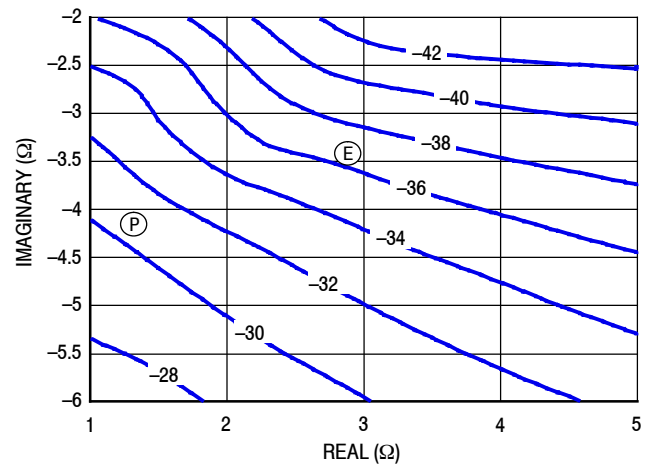


Figure 19. P1dB Load Pull AM/PM Contours (°)

**NOTE:** (P) = Maximum Output Power  
(E) = Maximum Drain Efficiency

— Gain  
— Drain Efficiency  
— Linearity  
— Output Power

## P3dB – TYPICAL PEAKING LOAD PULL CONTOURS — 2140 MHz

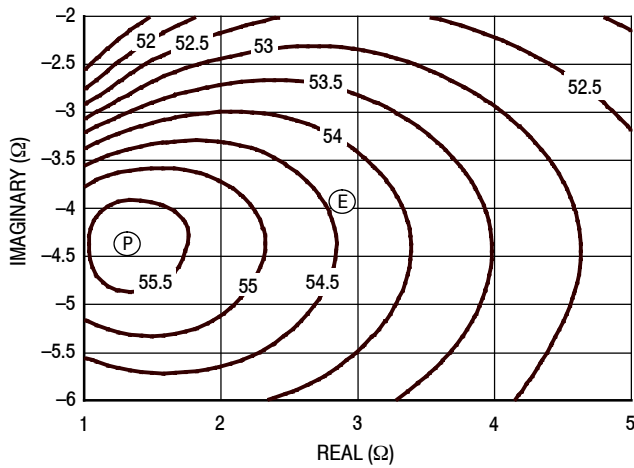


Figure 20. P3dB Load Pull Output Power Contours (dBm)

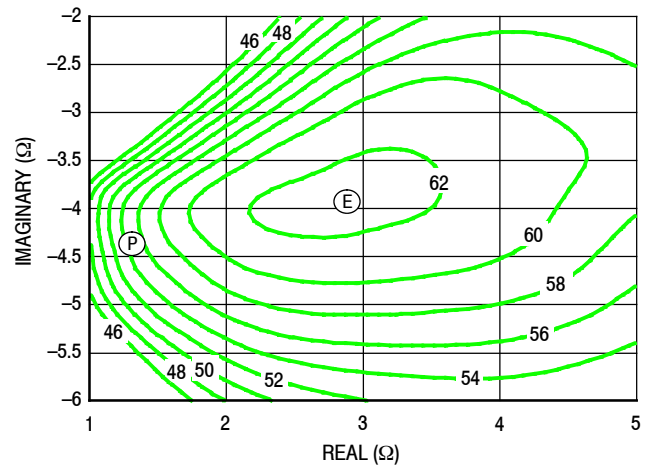


Figure 21. P3dB Load Pull Efficiency Contours (%)

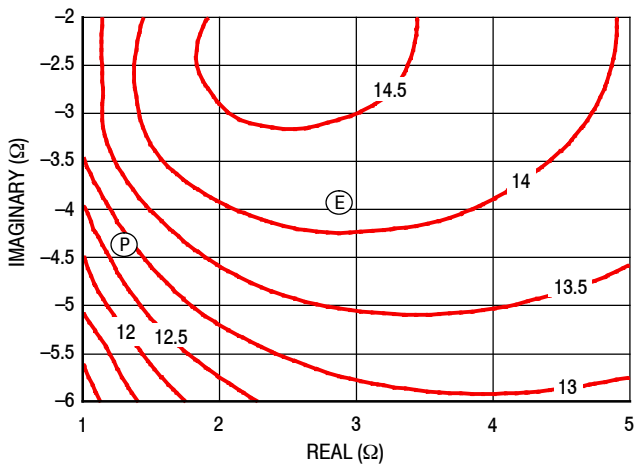


Figure 22. P3dB Load Pull Gain Contours (dB)

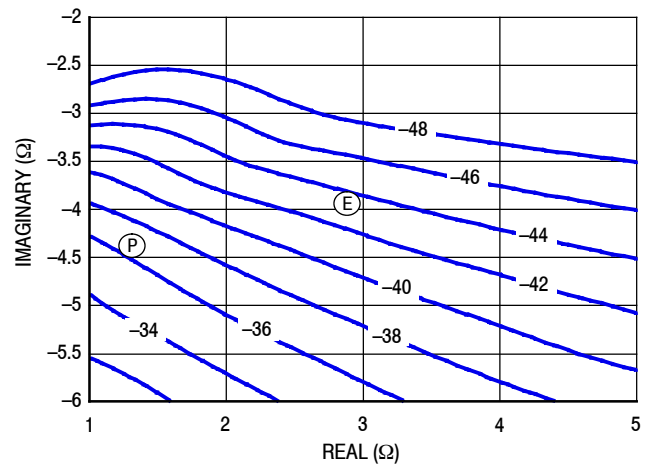
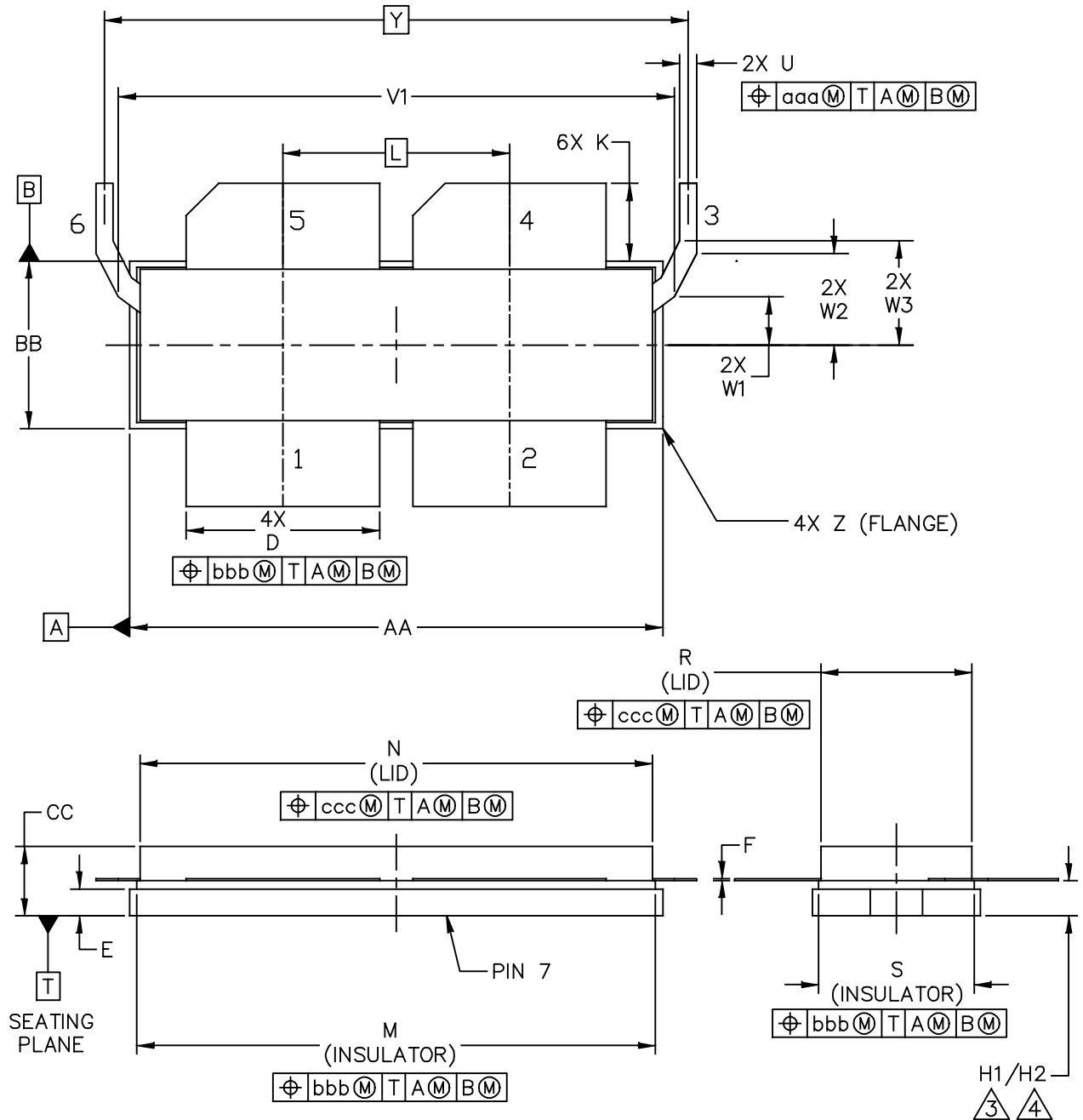


Figure 23. P3dB Load Pull AM/PM Contours (°)

**NOTE:** (P) = Maximum Output Power  
(E) = Maximum Drain Efficiency

- Gain
- Drain Efficiency
- Linearity
- Output Power

# PACKAGE DIMENSIONS



|                                                         |                                 |                            |
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|                                                         | STANDARD: NON-JEDEC             |                            |
|                                                         | 08 MAR 2013                     |                            |

A2T21H410-24SR6

NOTES:

1. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M–1994.

2. CONTROLLING DIMENSION: INCH

3. DIMENSIONS H1 AND H2 ARE MEASURED .030 INCH (0.762 MM) AWAY FROM FLANGE PARALLEL TO DATUM B. H1 APPLIES TO PINS 1, 2, 4 & 5. H2 APPLIES TO PINS 3 & 6.

4. TOLERANCE OF DIMENSION H2 IS TENTATIVE AND COULD CHANGE ONCE SUFFICIENT MANUFACTURING DATA IS AVAILABLE.

| DIM                                                     | INCH     |       | MILLIMETER         |       | DIM                                  | INCH                       |       | MILLIMETER |       |
|---------------------------------------------------------|----------|-------|--------------------|-------|--------------------------------------|----------------------------|-------|------------|-------|
|                                                         | MIN      | MAX   | MIN                | MAX   |                                      | MIN                        | MAX   | MIN        | MAX   |
| AA                                                      | 1.265    | 1.275 | 32.13              | 32.39 | N                                    | 1.218                      | 1.242 | 30.94      | 31.55 |
| BB                                                      | .395     | .405  | 10.03              | 10.29 | R                                    | .365                       | .375  | 9.27       | 9.53  |
| CC                                                      | .170     | .190  | 4.32               | 4.83  | S                                    | .365                       | .375  | 9.27       | 9.53  |
| D                                                       | .455     | .465  | 11.56              | 11.81 | U                                    | .035                       | .045  | 0.89       | 1.14  |
| E                                                       | .062     | .066  | 1.57               | 1.68  | V1                                   | 1.320                      | 1.330 | 33.53      | 33.78 |
| F                                                       | .004     | .007  | 0.10               | 0.18  | W1                                   | .110                       | .120  | 2.79       | 3.05  |
| H1                                                      | .082     | .090  | 2.08               | 2.29  | W2                                   | .213                       | .223  | 5.41       | 5.66  |
| H2                                                      | .078     | .094  | 1.98               | 2.39  | W3                                   | .243                       | .253  | 6.17       | 6.43  |
| K                                                       | .175     | .195  | 4.45               | 4.95  | Y                                    | 1.390 BSC                  |       | 35.31 BSC  |       |
| L                                                       | .540 BSC |       | 13.72 BSC          |       | Z                                    | R.000                      | R.040 | R0.00      | R1.02 |
| M                                                       | 1.219    | 1.241 | 30.96              | 31.52 | aaa                                  | .015                       |       | 0.38       |       |
|                                                         |          |       |                    |       | bbb                                  | .010                       |       | 0.25       |       |
|                                                         |          |       |                    |       | ccc                                  | .020                       |       | 0.51       |       |
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|                                                         |          |       |                    |       | STANDARD: NON-JEDEC                  |                            |       |            |       |
|                                                         |          |       |                    |       | 08 MAR 2013                          |                            |       |            |       |

## PRODUCT DOCUMENTATION, SOFTWARE AND TOOLS

Refer to the following resources 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
- 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        | Feb. 2016 | • Initial Release of Data Sheet |

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