

### FEATURES

- Fixed gain of 18.4 dB
- Broad operation from 30 MHz to 6 GHz
- High dynamic range gain block
- Input and output internally matched to 50  $\Omega$
- Integrated bias circuit
- OIP3 of 38.8 dBm at 900 MHz
- P1dB of 20.4 dBm at 900 MHz
- Noise figure of 2.2 dB at 900 MHz
- Single 5 V power supply
- Low quiescent current of 92 mA
- Wide operating temperature range of  $-40^{\circ}\text{C}$  to  $+105^{\circ}\text{C}$
- Thermally efficient SOT-89 package
- ESD rating of  $\pm 1.5$  kV (Class 1C)

### GENERAL DESCRIPTION

The **ADL5610** is a single-ended RF/IF gain block amplifier that provides broadband operation from 30 MHz to 6 GHz. The **ADL5610** provides a low noise figure of 2.2 dB with a very high OIP3 of more than 38 dBm simultaneously, which delivers a high dynamic range.

The **ADL5610** provides a gain of 18 dB, which is stable over frequency, temperature, and power supply, and from device to device. The amplifier is offered in the industry-standard SOT-89 package and is internally matched to 50  $\Omega$  at the input and

### FUNCTIONAL BLOCK DIAGRAM

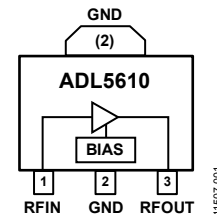


Figure 1.

output, making the **ADL5610** easy to implement in a wide variety of applications. The only external parts required are the input and output ac coupling capacitors, power supply decoupling capacitors, and bias inductor.

The **ADL5610** has a high ESD rating of  $\pm 1.5$  kV (Class 1C) and is fully specified for operation across a wide temperature range of  $-40^{\circ}\text{C}$  to  $+105^{\circ}\text{C}$ .

A fully populated RoHS-compliant evaluation board is available.

# ADL5610\* PRODUCT PAGE QUICK LINKS

Last Content Update: 11/29/2017

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## COMPARABLE PARTS

View a parametric search of comparable parts.

## EVALUATION KITS

- ADL5610 Evaluation Board
- TX/RX channel, tuned to 2450MHz to boost the signal

## DOCUMENTATION

### Application Notes

- AN-1363: Meeting Biasing Requirements of Externally Biased RF/Microwave Amplifiers with Active Bias Controllers

### Data Sheet

- ADL5610: 30 MHz to 6 GHz RF/IF Gain Block Data Sheet

## TOOLS AND SIMULATIONS

- ADI RF Amplifier Library for Agilent ADS
- ADL5610 S-Parameters

## REFERENCE MATERIALS

### Press

- Analog Devices Unveils New Industry-Leading Broadband RF Gain Blocks

### Product Selection Guide

- RF Source Booklet
- RF, Microwave, and Millimeter Wave IC Selection Guide 2017

## DESIGN RESOURCES

- ADL5610 Material Declaration
- PCN-PDN Information
- Quality And Reliability
- Symbols and Footprints

## DISCUSSIONS

View all ADL5610 EngineerZone Discussions.

## SAMPLE AND BUY

Visit the product page to see pricing options.

## TECHNICAL SUPPORT

Submit a technical question or find your regional support number.

## DOCUMENT FEEDBACK

Submit feedback for this data sheet.

## TABLE OF CONTENTS

|                                                    |   |                                           |    |
|----------------------------------------------------|---|-------------------------------------------|----|
| Features .....                                     | 1 | 500 MHz to 6 GHz Frequency Band .....     | 9  |
| Functional Block Diagram .....                     | 1 | 30 MHz to 500 MHz Frequency Band.....     | 10 |
| General Description .....                          | 1 | General.....                              | 11 |
| Revision History .....                             | 2 | Applications Information .....            | 13 |
| Specifications.....                                | 3 | Basic Connections .....                   | 13 |
| Typical Scattering Parameters (S-Parameters) ..... | 5 | Soldering Information and Recommended PCB |    |
| Absolute Maximum Ratings.....                      | 7 | Land Pattern.....                         | 14 |
| Thermal Resistance .....                           | 7 | W-CDMA ACPR Performance .....             | 14 |
| ESD Caution.....                                   | 7 | Evaluation Board .....                    | 15 |
| Pin Configuration and Function Descriptions.....   | 8 | Outline Dimensions .....                  | 16 |
| Typical Performance Characteristics .....          | 9 | Ordering Guide .....                      | 16 |

## REVISION HISTORY

### 12/15—Rev. A to Rev. B

|                                  |    |
|----------------------------------|----|
| Updated Outline Dimensions ..... | 16 |
|----------------------------------|----|

### 9/13—Rev. 0 to Rev. A

|                                                |    |
|------------------------------------------------|----|
| Added Figure 19; Renumbered Sequentially ..... | 11 |
| Changes to Figure 29.....                      | 14 |
| Updated Outline Dimensions .....               | 16 |

### 7/13—Revision 0: Initial Version

## SPECIFICATIONS

$V_{POS} = 5\text{ V}$  and  $T_A = 25^\circ\text{C}$ , unless otherwise noted.

Table 1.

| Parameter                            | Test Conditions/Comments                                                | Min  | Typ        | Max  | Unit |
|--------------------------------------|-------------------------------------------------------------------------|------|------------|------|------|
| OVERALL FUNCTION                     |                                                                         |      |            |      |      |
| Frequency Range                      |                                                                         | 30   |            | 6000 | MHz  |
| FREQUENCY = 30 MHz                   |                                                                         |      |            |      |      |
| Gain                                 |                                                                         |      | 18.1       |      | dB   |
| Output 1 dB Compression Point (P1dB) |                                                                         |      | 16.1       |      | dBm  |
| Output Third-Order Intercept (OIP3)  | $\Delta f = 1\text{ MHz}$ , output power ( $P_{OUT}$ ) = 3 dBm per tone |      | 30.8       |      | dBm  |
| Noise Figure <sup>1</sup>            |                                                                         |      | 2.8        |      | dB   |
| FREQUENCY = 140 MHz                  |                                                                         |      |            |      |      |
| Gain                                 |                                                                         |      | 15.0       |      | dB   |
| vs. Frequency                        | $\pm 10\text{ MHz}$                                                     |      | $\pm 0.43$ |      | dB   |
| vs. Temperature                      | $-40^\circ\text{C} \leq T_A \leq +105^\circ\text{C}$                    |      | $\pm 0.33$ |      | dB   |
| vs. Supply                           | 4.75 V to 5.25 V                                                        |      | $\pm 0.04$ |      | dB   |
| Output 1 dB Compression Point        |                                                                         |      | 16.0       |      | dBm  |
| Output Third-Order Intercept         | $\Delta f = 1\text{ MHz}$ , $P_{OUT} = 3\text{ dBm}$ per tone           |      | 29.3       |      | dBm  |
| Noise Figure <sup>1</sup>            |                                                                         |      | 2.6        |      | dB   |
| FREQUENCY = 350 MHz                  |                                                                         |      |            |      |      |
| Gain                                 |                                                                         |      | 18.1       |      | dB   |
| vs. Frequency                        | $\pm 10\text{ MHz}$                                                     |      | $\pm 0.04$ |      | dB   |
| vs. Temperature                      | $-40^\circ\text{C} \leq T_A \leq +105^\circ\text{C}$                    |      | $\pm 0.29$ |      | dB   |
| vs. Supply                           | 4.75 V to 5.25 V                                                        |      | $\pm 0.02$ |      | dB   |
| Output 1 dB Compression Point        |                                                                         |      | 20.2       |      | dBm  |
| Output Third-Order Intercept         | $\Delta f = 1\text{ MHz}$ , output power ( $P_{OUT}$ ) = 3 dBm per tone |      | 34.6       |      | dBm  |
| Noise Figure <sup>1</sup>            |                                                                         |      | 2.1        |      | dB   |
| FREQUENCY = 700 MHz                  |                                                                         |      |            |      |      |
| Gain                                 |                                                                         |      | 18.4       |      | dB   |
| vs. Frequency                        | $\pm 50\text{ MHz}$                                                     |      | $\pm 0.02$ |      | dB   |
| vs. Temperature                      | $-40^\circ\text{C} \leq T_A \leq +105^\circ\text{C}$                    |      | $\pm 0.23$ |      | dB   |
| vs. Supply                           | 4.75 V to 5.25 V                                                        |      | $\pm 0.04$ |      | dB   |
| Output 1 dB Compression Point        |                                                                         |      | 20.4       |      | dBm  |
| Output Third-Order Intercept         | $\Delta f = 1\text{ MHz}$ , $P_{OUT} = 3\text{ dBm}$ per tone           |      | 38.4       |      | dBm  |
| Noise Figure <sup>1</sup>            |                                                                         |      | 2.2        |      | dB   |
| FREQUENCY = 900 MHz                  |                                                                         |      |            |      |      |
| Gain                                 |                                                                         | 17.4 | 18.4       | 19.4 | dB   |
| vs. Frequency                        | $\pm 50\text{ MHz}$                                                     |      | $\pm 0.01$ |      | dB   |
| vs. Temperature                      | $-40^\circ\text{C} \leq T_A \leq +105^\circ\text{C}$                    |      | $\pm 0.22$ |      | dB   |
| vs. Supply                           | 4.75 V to 5.25 V                                                        |      | $\pm 0.05$ |      | dB   |
| Output 1 dB Compression Point        |                                                                         |      | 20.4       |      | dBm  |
| Output Third-Order Intercept         | $\Delta f = 1\text{ MHz}$ , $P_{OUT} = 3\text{ dBm}$ per tone           |      | 38.8       |      | dBm  |
| Noise Figure                         |                                                                         |      | 2.2        |      | dB   |
| FREQUENCY = 1900 MHz                 |                                                                         |      |            |      |      |
| Gain                                 |                                                                         | 16.9 | 17.9       | 18.9 | dB   |
| vs. Frequency                        | $\pm 50\text{ MHz}$                                                     |      | $\pm 0.05$ |      | dB   |
| vs. Temperature                      | $-40^\circ\text{C} \leq T_A \leq +105^\circ\text{C}$                    |      | $\pm 0.23$ |      | dB   |
| vs. Supply                           | 4.75 V to 5.25 V                                                        |      | $\pm 0.11$ |      | dB   |
| Output 1 dB Compression Point        |                                                                         |      | 20.1       |      | dBm  |
| Output Third-Order Intercept         | $\Delta f = 1\text{ MHz}$ , $P_{OUT} = 3\text{ dBm}$ per tone           |      | 38.7       |      | dBm  |
| Noise Figure <sup>1</sup>            |                                                                         |      | 2.5        |      | dB   |

| Parameter                     | Test Conditions/Comments                                 | Min | Typ        | Max | Unit |
|-------------------------------|----------------------------------------------------------|-----|------------|-----|------|
| FREQUENCY = 2140 MHz          |                                                          |     |            |     |      |
| Gain                          |                                                          |     | 17.8       |     | dB   |
| vs. Frequency                 | $\pm 50$ MHz                                             |     | $\pm 0.03$ |     | dB   |
| vs. Temperature               | $-40^{\circ}\text{C} \leq T_A \leq +105^{\circ}\text{C}$ |     | $\pm 0.25$ |     | dB   |
| vs. Supply                    | 4.75 V to 5.25 V                                         |     | $\pm 0.13$ |     | dB   |
| Output 1 dB Compression Point |                                                          |     | 19.9       |     | dBm  |
| Output Third-Order Intercept  | $\Delta f = 1$ MHz, $P_{\text{OUT}} = 3$ dBm per tone    |     | 36.8       |     | dBm  |
| Noise Figure <sup>1</sup>     |                                                          |     | 2.7        |     | dB   |
| FREQUENCY = 2600 MHz          |                                                          |     |            |     |      |
| Gain                          |                                                          |     | 17.5       |     | dB   |
| vs. Frequency                 | $\pm 50$ MHz                                             |     | $\pm 0.03$ |     | dB   |
| vs. Temperature               | $-40^{\circ}\text{C} \leq T_A \leq +105^{\circ}\text{C}$ |     | $\pm 0.28$ |     | dB   |
| vs. Supply                    | 4.75 V to 5.25 V                                         |     | $\pm 0.15$ |     | dB   |
| Output 1 dB Compression Point |                                                          |     | 18.7       |     | dBm  |
| Output Third-Order Intercept  | $\Delta f = 1$ MHz, $P_{\text{OUT}} = 3$ dBm per tone    |     | 33.5       |     | dBm  |
| Noise Figure <sup>1</sup>     |                                                          |     | 2.8        |     | dB   |
| FREQUENCY = 3500 MHz          |                                                          |     |            |     |      |
| Gain                          |                                                          |     | 17.6       |     | dB   |
| vs. Frequency                 | $\pm 50$ MHz                                             |     | $\pm 0.04$ |     | dB   |
| vs. Temperature               | $-40^{\circ}\text{C} \leq T_A \leq +105^{\circ}\text{C}$ |     | $\pm 0.45$ |     | dB   |
| vs. Supply                    | 4.75 V to 5.25 V                                         |     | $\pm 0.19$ |     | dB   |
| Output 1 dB Compression Point |                                                          |     | 17.4       |     | dBm  |
| Output Third-Order Intercept  | $\Delta f = 1$ MHz, $P_{\text{OUT}} = 3$ dBm per tone    |     | 29.4       |     | dBm  |
| Noise Figure <sup>1</sup>     |                                                          |     | 3.0        |     | dB   |
| FREQUENCY = 4000 MHz          |                                                          |     |            |     |      |
| Gain                          |                                                          |     | 17.9       |     | dB   |
| vs. Frequency                 | $\pm 50$ MHz                                             |     | $\pm 0.04$ |     | dB   |
| vs. Temperature               | $-40^{\circ}\text{C} \leq T_A \leq +105^{\circ}\text{C}$ |     | $\pm 0.84$ |     | dB   |
| vs. Supply                    | 4.75 V to 5.25 V                                         |     | $\pm 0.24$ |     | dB   |
| Output 1 dB Compression Point |                                                          |     | 16.4       |     | dBm  |
| Output Third-Order Intercept  | $\Delta f = 1$ MHz, $P_{\text{OUT}} = 3$ dBm per tone    |     | 27.6       |     | dBm  |
| Noise Figure <sup>1</sup>     |                                                          |     | 3.2        |     | dB   |
| FREQUENCY = 5000 MHz          |                                                          |     |            |     |      |
| Gain                          |                                                          |     | 15.3       |     | dB   |
| vs. Frequency                 | $\pm 50$ MHz                                             |     | $\pm 0.11$ |     | dB   |
| vs. Temperature               | $-40^{\circ}\text{C} \leq T_A \leq +105^{\circ}\text{C}$ |     | $\pm 1.27$ |     | dB   |
| vs. Supply                    | 4.75 V to 5.25 V                                         |     | $\pm 0.33$ |     | dB   |
| Output 1 dB Compression Point |                                                          |     | 15.7       |     | dBm  |
| Output Third-Order Intercept  | $\Delta f = 1$ MHz, $P_{\text{OUT}} = 3$ dBm per tone    |     | 26.1       |     | dBm  |
| Noise Figure                  |                                                          |     | 4.4        |     | dB   |
| FREQUENCY = 5800 MHz          |                                                          |     |            |     |      |
| Gain                          |                                                          |     | 13.2       |     | dB   |
| vs. Frequency                 | $\pm 50$ MHz                                             |     | $\pm 0.08$ |     | dB   |
| vs. Temperature               | $-40^{\circ}\text{C} \leq T_A \leq +105^{\circ}\text{C}$ |     | $\pm 1.36$ |     | dB   |
| vs. Supply                    | 4.75 V to 5.25 V                                         |     | $\pm 0.33$ |     | dB   |
| Output 1 dB Compression Point |                                                          |     | 12.5       |     | dBm  |
| Output Third-Order Intercept  | $\Delta f = 1$ MHz, $P_{\text{OUT}} = 3$ dBm per tone    |     | 21.2       |     | dBm  |
| Noise Figure <sup>1</sup>     |                                                          |     | 6.1        |     | dB   |

| Parameter         | Test Conditions/Comments        | Min  | Typ    | Max  | Unit |
|-------------------|---------------------------------|------|--------|------|------|
| POWER INTERFACE   |                                 |      |        |      |      |
| Supply Voltage    | V <sub>POS</sub>                | 4.75 | 5      | 5.25 | V    |
| Supply Current    |                                 |      | 92     | 118  | mA   |
| vs. Temperature   | −40°C ≤ T <sub>A</sub> ≤ +105°C |      | −6/+14 |      | mA   |
| Power Dissipation |                                 |      | 460    |      | mW   |

<sup>1</sup> Noise figure specified includes printed circuit board (PCB) traces losses.

## TYPICAL SCATTERING PARAMETERS (S-PARAMETERS)

V<sub>POS</sub> = 5 V and T<sub>A</sub> = 25°C.

Table 2.

| Frequency<br>(MHz) | S11            |           | S21            |           | S12            |           | S22            |           |
|--------------------|----------------|-----------|----------------|-----------|----------------|-----------|----------------|-----------|
|                    | Magnitude (dB) | Angle (°) | Magnitude (dB) | Angle (°) | Magnitude (dB) | Angle (°) | Magnitude (dB) | Angle (°) |
| 30                 | −19.575        | −21.758   | 18.186         | +167.401  | −23.536        | +0.034    | −12.040        | −154.592  |
| 50                 | −13.194        | +17.280   | +16.748        | +158.342  | −24.873        | −11.954   | −8.336         | −158.609  |
| 100                | −8.023         | −17.286   | +13.552        | +168.911  | −27.865        | −5.368    | −5.677         | −189.790  |
| 200                | −10.635        | −67.774   | +16.801        | +171.154  | −24.787        | −2.040    | −8.176         | −225.737  |
| 300                | −13.978        | −93.402   | +17.960        | +154.322  | −23.679        | −16.582   | −10.953        | −237.962  |
| 400                | −16.890        | −111.950  | +18.355        | +138.243  | −23.336        | −29.568   | −12.818        | −242.287  |
| 500                | −14.057        | −140.270  | +18.204        | −229.198  | −23.467        | −33.884   | −10.083        | +104.308  |
| 600                | −15.303        | −160.894  | +18.339        | −243.615  | −23.322        | −45.046   | −10.629        | +98.947   |
| 700                | −17.025        | −180.268  | +18.416        | −258.515  | −23.214        | −56.945   | −11.317        | +95.056   |
| 800                | −18.532        | −198.771  | +18.434        | −272.822  | −23.143        | −68.374   | −11.700        | +91.300   |
| 900                | −19.926        | −216.383  | +18.425        | −286.779  | −23.102        | −79.290   | −11.891        | +87.191   |
| 1000               | −21.266        | −233.373  | +18.401        | −300.434  | −23.099        | −90.132   | −11.967        | +82.648   |
| 1100               | −22.659        | −248.512  | +18.366        | −313.941  | −23.071        | −100.705  | −11.951        | +77.917   |
| 1200               | −24.210        | −262.937  | +18.320        | −327.244  | −23.068        | −111.189  | −11.897        | +72.400   |
| 1300               | −26.057        | −274.666  | +18.272        | −340.437  | −23.063        | −121.632  | −11.812        | +66.929   |
| 1400               | −28.536        | −282.527  | +18.220        | −353.552  | −23.065        | −131.946  | −11.702        | +61.131   |
| 1500               | −31.933        | −279.454  | +18.166        | −366.576  | −23.063        | −142.239  | −11.599        | +55.505   |
| 1600               | −34.750        | −255.300  | +18.106        | −379.548  | −23.067        | −152.499  | −11.467        | +49.533   |
| 1700               | −32.172        | −220.241  | +18.046        | −392.387  | −23.070        | −162.725  | −11.381        | +43.914   |
| 1800               | −27.781        | −211.620  | +17.977        | −405.225  | −23.085        | −173.046  | −11.275        | +38.152   |
| 1900               | −24.468        | −218.185  | +17.916        | −418.174  | −23.047        | −183.266  | −11.132        | +32.216   |
| 2000               | −21.613        | −222.836  | +17.843        | −430.638  | −23.111        | −193.454  | −11.136        | +27.227   |
| 2100               | −19.342        | −232.483  | +17.783        | −443.294  | −23.127        | −203.629  | −11.017        | +21.933   |
| 2200               | −17.343        | −243.288  | +17.740        | −455.878  | −23.141        | −213.605  | −10.826        | +16.768   |
| 2300               | −15.863        | −253.959  | +17.682        | −468.509  | −23.139        | −223.746  | −10.670        | +10.889   |
| 2400               | −14.592        | −264.759  | +17.629        | −481.088  | −23.129        | −233.823  | −10.488        | +4.907    |
| 2500               | −13.521        | −275.854  | +17.583        | −493.684  | −23.123        | −243.825  | −10.295        | −1.461    |
| 2600               | −12.680        | −286.432  | +17.533        | −506.169  | −23.114        | −254.026  | −10.160        | −8.539    |
| 2700               | −11.965        | −296.744  | +17.494        | −518.608  | −23.122        | −264.148  | −10.022        | −15.582   |
| 2800               | −11.364        | −307.385  | +17.466        | −531.068  | −23.105        | −274.109  | −9.909         | −23.543   |
| 2900               | −10.983        | −318.098  | +17.441        | −543.539  | −23.013        | −284.190  | −9.885         | −32.338   |
| 3000               | −10.683        | −328.063  | +17.448        | −555.886  | −22.967        | −294.664  | −9.958         | −41.038   |
| 3100               | −10.470        | −338.914  | +17.468        | −568.495  | −22.910        | −304.790  | −10.016        | −50.760   |
| 3200               | −10.377        | −349.594  | +17.503        | −581.114  | −22.848        | −315.180  | −10.207        | −61.042   |
| 3300               | −10.454        | −360.106  | +17.556        | −593.755  | −22.757        | −325.637  | −10.506        | −72.485   |
| 3400               | −10.733        | −371.185  | +17.609        | −606.730  | −22.674        | −336.157  | −10.842        | −85.064   |
| 3500               | −11.222        | −381.299  | +17.683        | −619.682  | −22.581        | −346.908  | −11.291        | −98.903   |

| Frequency<br>(MHz) | S11            |           | S21            |           | S12            |           | S22            |           |
|--------------------|----------------|-----------|----------------|-----------|----------------|-----------|----------------|-----------|
|                    | Magnitude (dB) | Angle (°) | Magnitude (dB) | Angle (°) | Magnitude (dB) | Angle (°) | Magnitude (dB) | Angle (°) |
| 3600               | -11.851        | -392.155  | +17.768        | -633.032  | -22.457        | -358.060  | -11.908        | -114.642  |
| 3700               | -12.849        | -403.342  | +17.830        | -646.607  | -22.372        | -369.044  | -12.522        | -132.684  |
| 3800               | -14.417        | -413.805  | +17.904        | -660.333  | -22.234        | -380.712  | -13.184        | -153.495  |
| 3900               | -16.531        | -425.971  | +17.938        | -674.447  | -22.200        | -392.377  | -13.538        | -177.923  |
| 4000               | -19.249        | -436.011  | +18.010        | -689.430  | -22.085        | -405.026  | -13.882        | -202.196  |
| 4100               | -24.999        | -460.302  | +17.915        | -704.472  | -22.195        | -417.459  | -13.296        | -228.659  |
| 4200               | -32.089        | -556.369  | +17.769        | -719.835  | -22.338        | -430.127  | -12.342        | -252.450  |
| 4300               | -21.011        | -617.527  | +17.448        | -735.470  | -22.655        | -442.759  | -11.165        | -273.722  |
| 4440               | -14.797        | -639.680  | +16.876        | -750.505  | -23.014        | -453.711  | -9.840         | -292.336  |
| 4500               | -10.740        | -661.435  | +16.212        | -763.011  | -23.353        | -463.267  | -8.338         | -310.540  |
| 4600               | -8.451         | -681.844  | +15.849        | -773.947  | -23.431        | -472.943  | -7.134         | -329.131  |
| 4700               | -7.237         | -698.863  | +15.707        | -785.709  | -23.418        | -483.451  | -6.336         | -346.718  |
| 4800               | -6.447         | -713.011  | +15.581        | -798.441  | -23.453        | -494.525  | -5.808         | -362.618  |
| 4900               | -5.907         | -724.933  | +15.413        | -811.388  | -23.569        | -505.774  | -5.457         | -377.358  |
| 5000               | -5.507         | -735.570  | +15.210        | -824.332  | -23.748        | -516.626  | -5.207         | -391.101  |
| 5100               | -5.147         | -745.147  | +14.998        | -837.253  | -23.929        | -527.665  | -5.106         | -404.171  |
| 5200               | -4.964         | -754.155  | +14.767        | -850.018  | -23.998        | -538.788  | -5.099         | -416.123  |
| 5300               | -4.929         | -762.147  | +14.507        | -862.399  | -24.155        | -548.537  | -5.180         | -428.050  |
| 5400               | -4.758         | -770.468  | +14.376        | -874.651  | -24.220        | -559.477  | -5.313         | -440.141  |
| 5500               | -4.735         | -779.351  | +14.216        | -887.558  | -24.481        | -568.644  | -5.672         | -453.016  |
| 5600               | -4.686         | -786.735  | +14.109        | -900.141  | -24.355        | -579.878  | -6.142         | -464.297  |
| 5700               | -4.708         | -793.953  | +13.986        | -913.048  | -24.406        | -589.889  | -6.809         | -476.641  |
| 5800               | -4.782         | -800.356  | +13.873        | -925.986  | -24.277        | -599.855  | -7.749         | -488.815  |
| 5900               | -4.821         | -807.419  | +13.750        | -939.485  | -24.360        | -611.222  | -8.867         | -501.594  |
| 6000               | -4.831         | -812.689  | +13.663        | -952.755  | -24.108        | -622.580  | -10.361        | -513.719  |

## ABSOLUTE MAXIMUM RATINGS

Table 3.

| Parameter                                                   | Rating          |
|-------------------------------------------------------------|-----------------|
| Supply Voltage, $V_{POS}$                                   | 6.5 V           |
| Input Power (50 $\Omega$ Impedance)                         | 20 dBm          |
| Internal Power Dissipation (Pad Soldered to Ground)         | 800 mW          |
| ESD Human Body Model (HBM) Rating (ESDA/ JEDEC JS-001-2011) | $\pm 1.5$ kV    |
| Maximum Junction Temperature                                | 150°C           |
| Operating Temperature Range                                 | –40°C to +105°C |
| Storage Temperature Range                                   | –65°C to +150°C |

Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product reliability.

## THERMAL RESISTANCE

Table 4 lists the junction-to-air thermal resistance ( $\theta_{JA}$ ) and the junction-to-case thermal resistance ( $\theta_{JC}$ ) for the ADL5610.

Table 4. Thermal Resistance

| Package Type         | $\theta_{JA}$ <sup>1</sup> | $\theta_{JC}$ <sup>2</sup> | Unit |
|----------------------|----------------------------|----------------------------|------|
| 3-Lead SOT-89 (RK-3) | 52                         | 9                          | °C/W |

<sup>1</sup> Measured on the ADL5610 evaluation board. For more information about board layout, see the Soldering Information and Recommended PCB Land Pattern section.

<sup>2</sup> Based on simulation with a standard JEDEC board per JESD51.

## ESD CAUTION



**ESD (electrostatic discharge) sensitive device.** Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

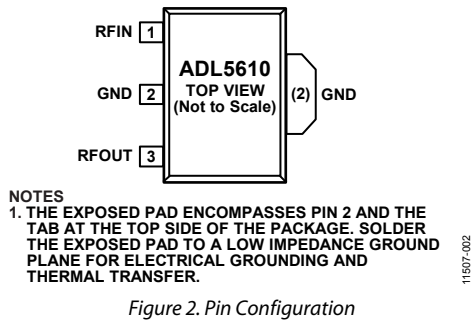


Figure 2. Pin Configuration

Table 5. Pin Function Descriptions

| Pin No. | Mnemonic | Description                                                                                                                                                                                      |
|---------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | RFIN     | RF Input. This pin requires a dc blocking capacitor.                                                                                                                                             |
| 2       | GND      | Ground. Connect this pin to a low impedance ground plane.                                                                                                                                        |
| 3       | RFOUT    | RF Output and Supply Voltage. DC bias is provided to this pin through an inductor that is connected to the external power supply. The RF path requires a dc blocking capacitor.                  |
|         | EPAD     | Exposed Pad. The exposed pad encompasses Pin 2 and the tab at the top side of the package. Solder the exposed pad to a low impedance ground plane for electrical grounding and thermal transfer. |

# TYPICAL PERFORMANCE CHARACTERISTICS

## 500 MHz TO 6 GHz FREQUENCY BAND

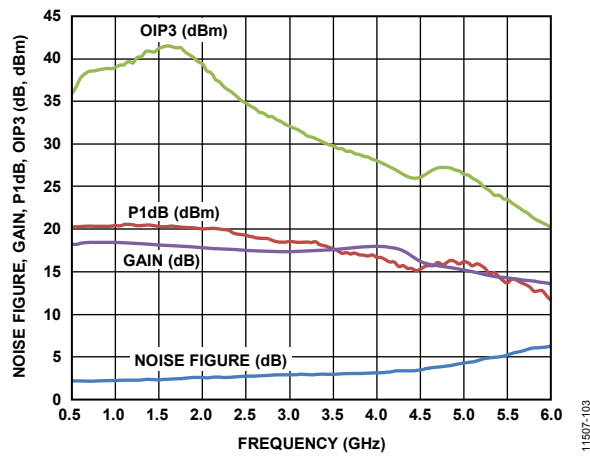


Figure 3. Noise Figure, Gain, P1dB, and OIP3 vs. Frequency

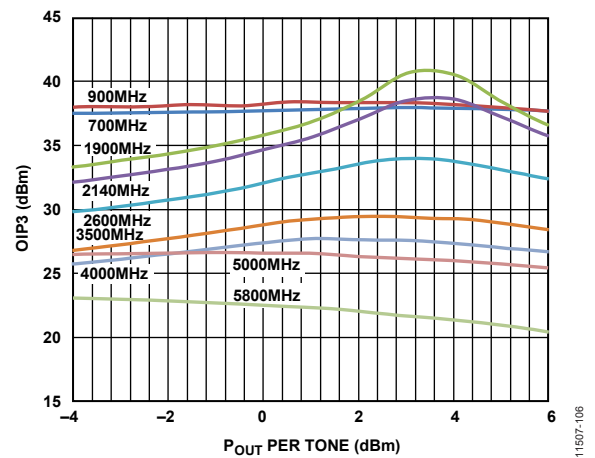
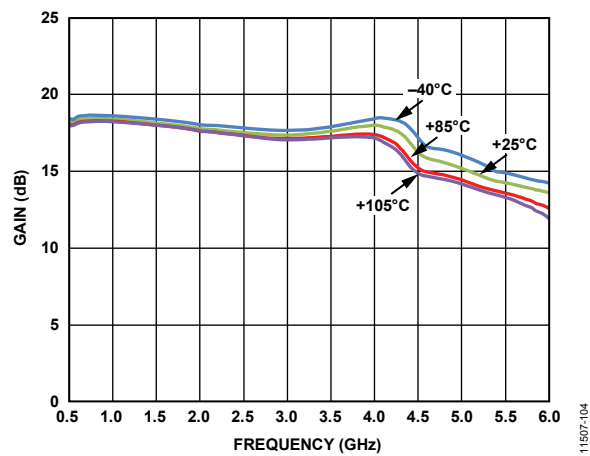
Figure 6. OIP3 vs. Output Power ( $P_{OUT}$ ) and Frequency

Figure 4. Gain vs. Frequency and Temperature

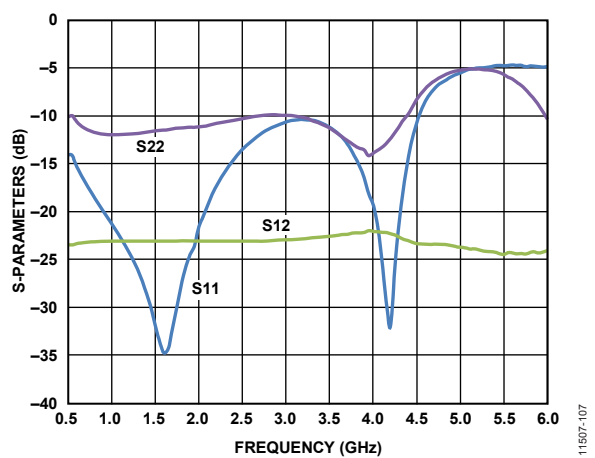
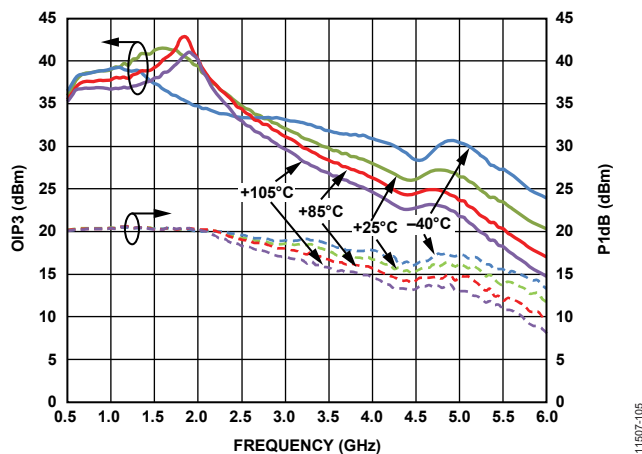
Figure 7. Output Return Loss ( $S_{22}$ ), Input Return Loss ( $S_{11}$ ), and Reverse Isolation ( $S_{12}$ ) vs. Frequency

Figure 5. OIP3 and P1dB vs. Frequency and Temperature

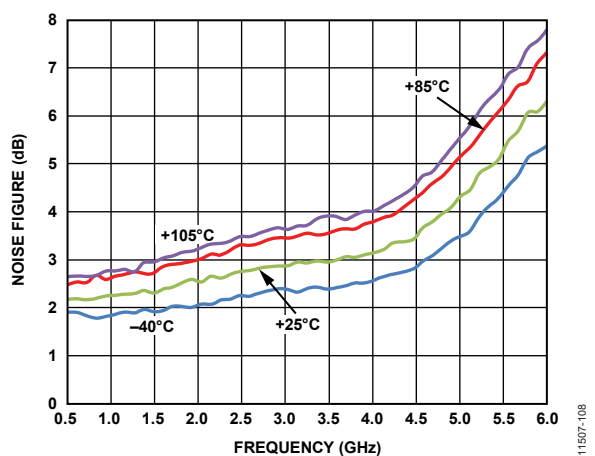


Figure 8. Noise Figure vs. Frequency and Temperature

## 30 MHz TO 500 MHz FREQUENCY BAND

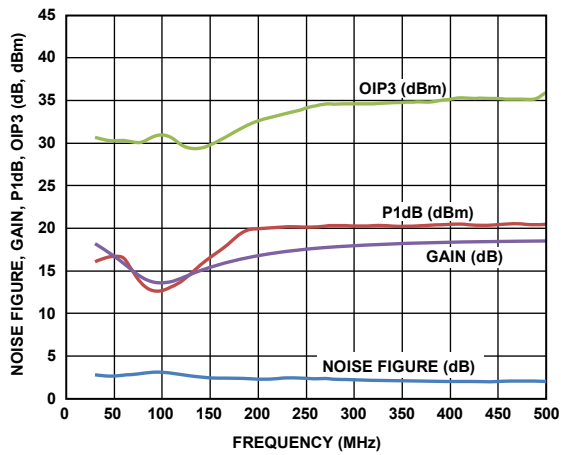


Figure 9. Noise Figure, Gain, P1dB, and OIP3 vs. Frequency, Low Frequency Configuration

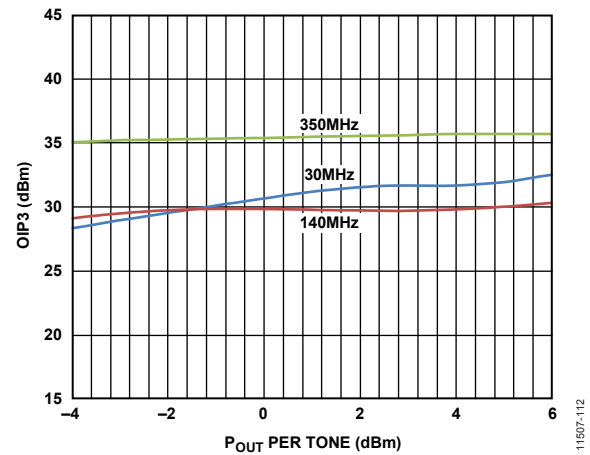


Figure 12. OIP3 vs. Output Power ( $P_{OUT}$ ) and Frequency, Low Frequency Configuration

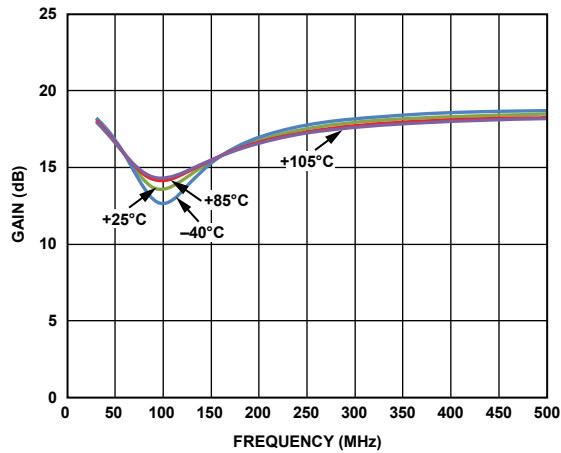


Figure 10. Gain vs. Frequency and Temperature, Low Frequency Configuration

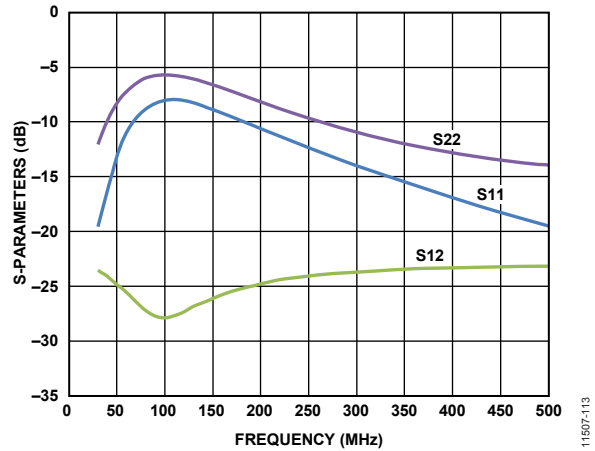


Figure 13. Output Return Loss (S22), Input Return Loss (S11), and Reverse Isolation (S12) vs. Frequency, Low Frequency Configuration

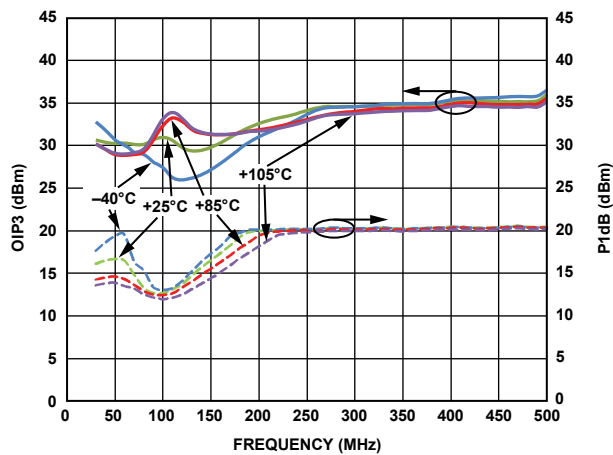


Figure 11. OIP3 and P1dB vs. Frequency and Temperature, Low Frequency Configuration

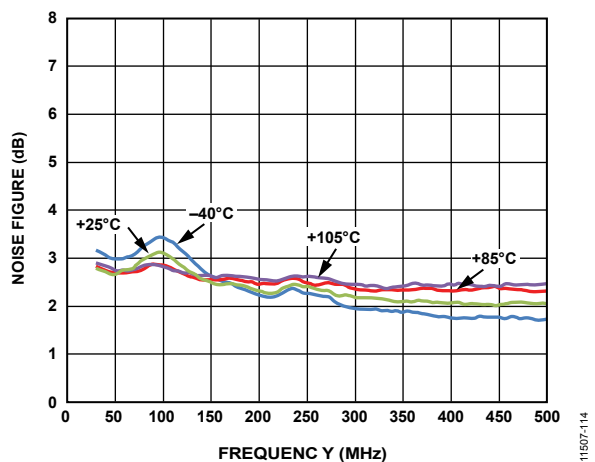


Figure 14. Noise Figure vs. Frequency and Temperature, Low Frequency Configuration

## GENERAL

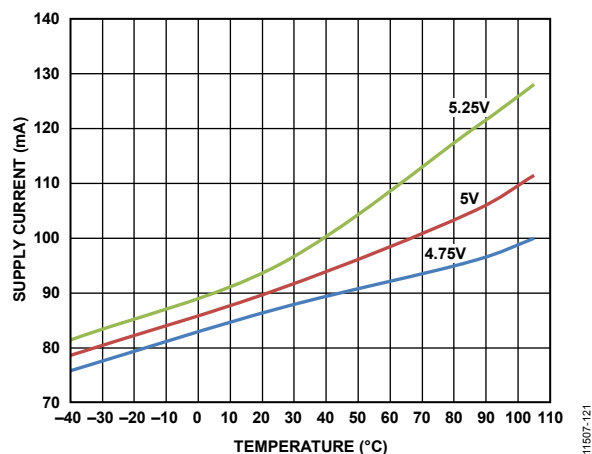


Figure 15. Supply Current vs. Temperature

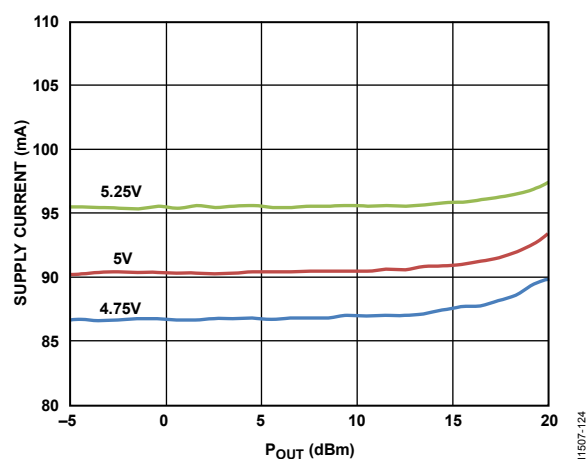
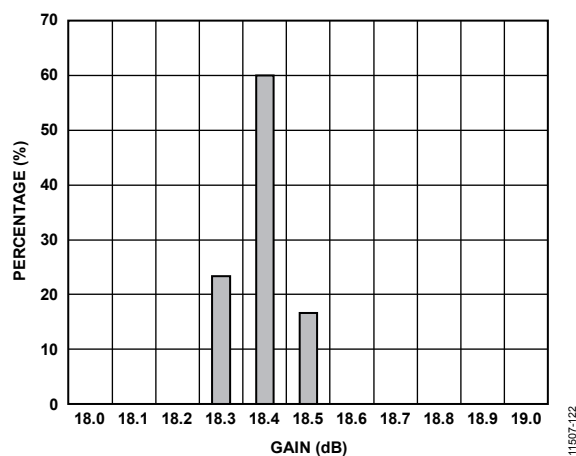
Figure 18. Supply Current vs.  $P_{OUT}$  at 900 MHz

Figure 16. Gain Distribution at 900 MHz

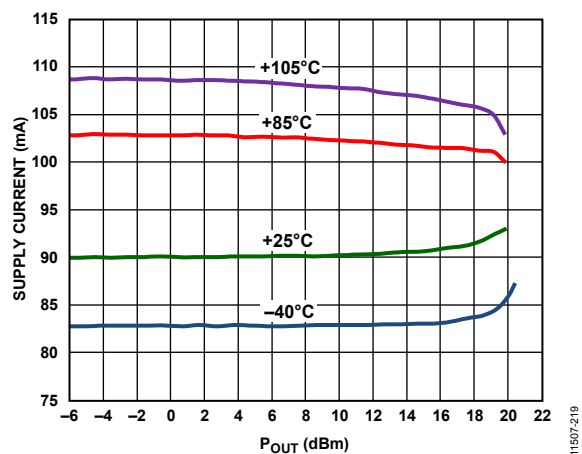
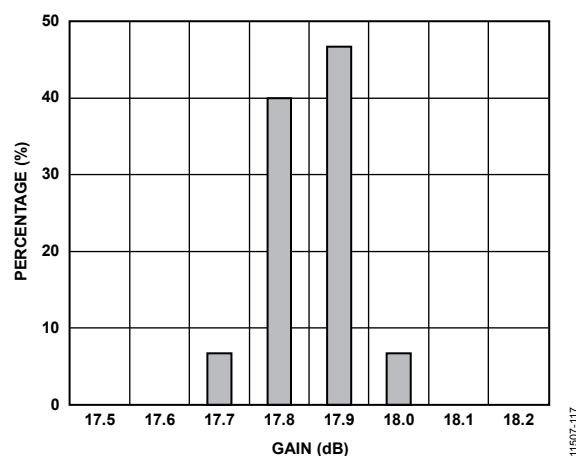
Figure 19. Supply Current vs.  $P_{OUT}$  and Temperature,  $V_{CC} = 5$  V at 900 MHz

Figure 17. Gain Distribution at 1900 MHz

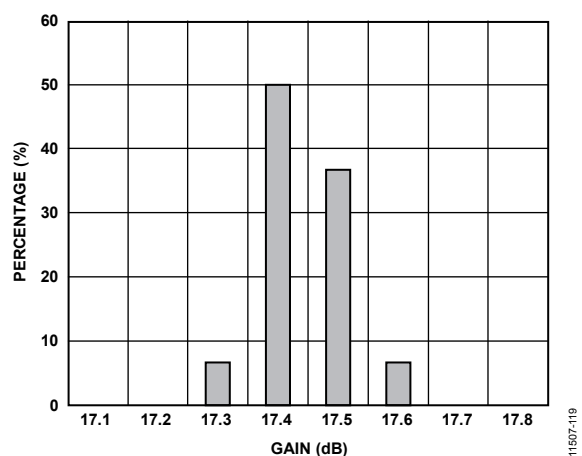


Figure 20. Gain Distribution at 2600 MHz

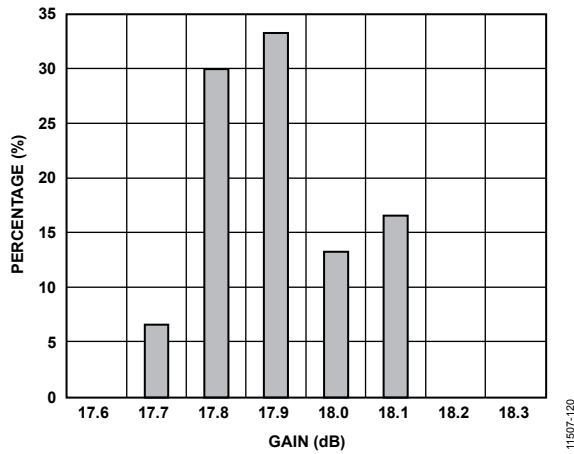


Figure 21. Gain Distribution at 4000 MHz

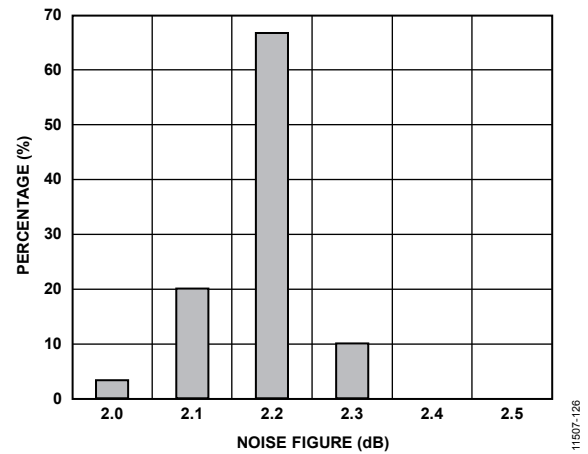


Figure 24. Noise Figure Distribution at 900 MHz

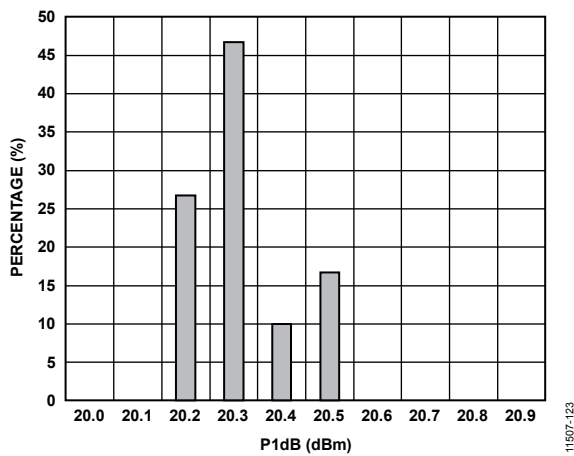
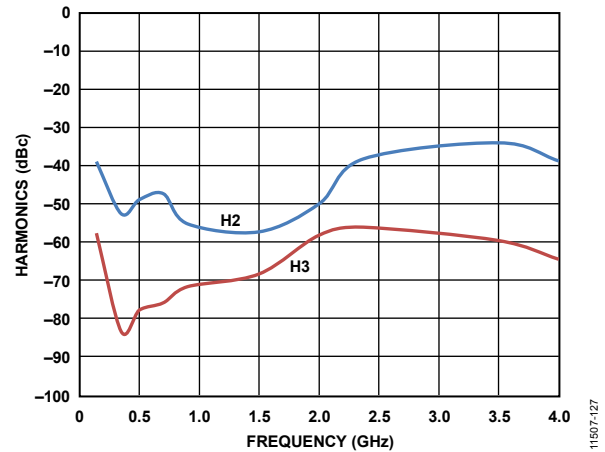
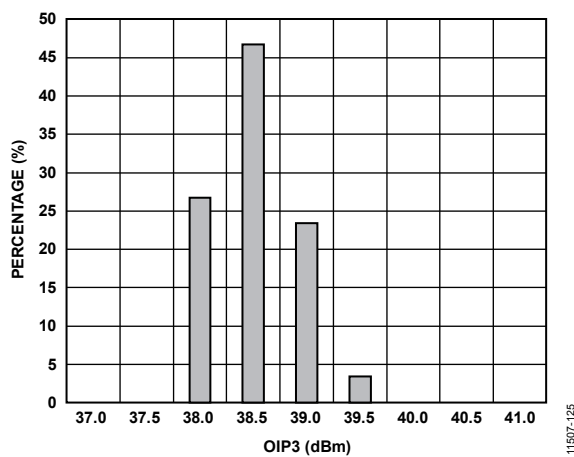


Figure 22. P1dB Distribution at 900 MHz

Figure 25. Single-Tone Harmonics vs. Frequency,  $P_{OUT} = 0$  dBmFigure 23. OIP3 Distribution at 900 MHz,  $P_{OUT} = 3$  dBm per Tone

## APPLICATIONS INFORMATION

### BASIC CONNECTIONS

Figure 26 shows the basic connections for operating the ADL5610. The device supports operation from 30 MHz to 6 GHz. However, for optimal performance at lower frequency bands, the board configuration must be adjusted. Table 6 lists the recommended board configuration to operate the device at various frequency bands.

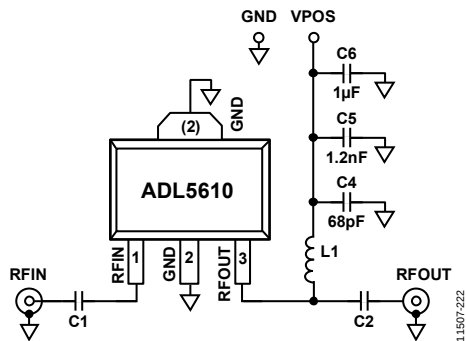


Figure 26. Basic Connections

A 5 V dc bias is supplied to the amplifier through the bias inductor connected to RFOUT (Pin 3). Decouple the bias voltage using 68 pF, 1.2 nF, and 1 μF power supply decoupling capacitors. The typical current consumption for the ADL5610 is 92 mA.

At low frequencies, the device exhibits improved performance with the suggested setup configuration listed in Table 6. Figure 27 and Figure 28 provide a comparison of the performance of the device at the 30 MHz to 500 MHz band when driven with the optimal setup configuration and the default setup configuration.

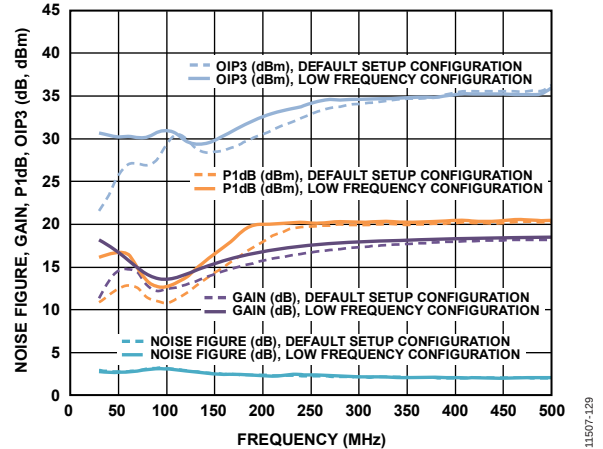


Figure 27. Noise Figure, Gain, P1dB, and OIP3 vs. Frequency, 30 MHz to 500 MHz, Comparison of Performance with the Optimized Settings and the Default Configuration

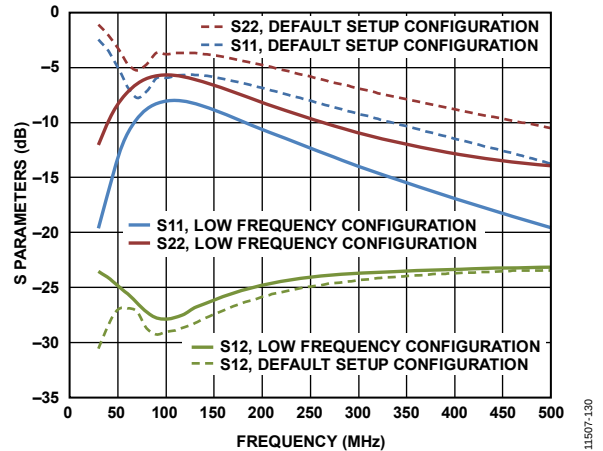


Figure 28. Output Return Loss (S22), Input Return Loss (S11), and Reverse Isolation (S12), 30 MHz to 500 MHz, Comparison of Performance with the Optimized Settings and the Default Configuration

Table 6. Recommended Components for Basic Connections

| Frequency Band    | AC Coupling Capacitors (0402) |         | DC Bias Inductor (0603HP) |
|-------------------|-------------------------------|---------|---------------------------|
|                   | C1 (nF)                       | C2 (nF) | L1 (nH)                   |
| 500 MHz to 6 GHz  | 100                           | 100     | 43                        |
| 30 MHz to 500 MHz | 100                           | 100     | 1000                      |

## SOLDERING INFORMATION AND RECOMMENDED PCB LAND PATTERN

Figure 29 shows the recommended land pattern for the [ADL5610](#). To minimize thermal impedance, the exposed pad on the underside of the SOT-89 package is soldered to a ground plane, along with Pin 2. If multiple ground layers exist, stitch the layers together using vias.

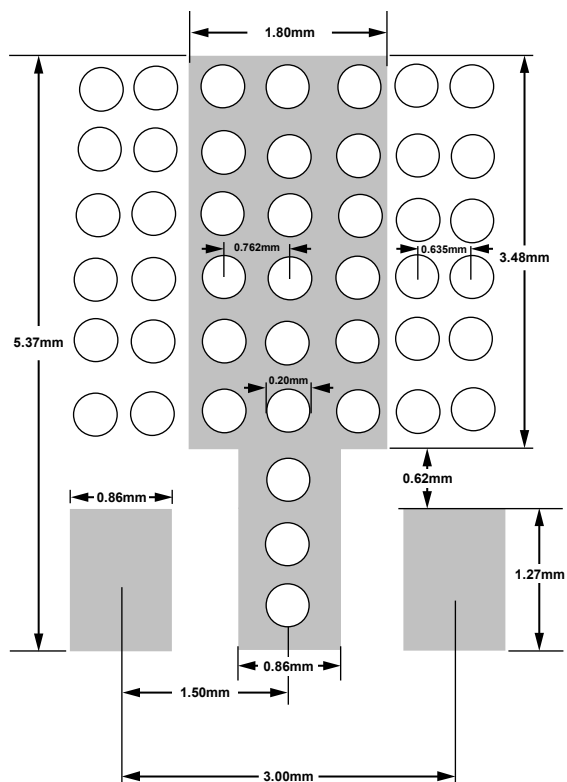


Figure 29. Recommended Land Pattern

The land pattern on the [ADL5610](#) evaluation board provides a measured thermal resistance ( $\theta_{JA}$ ) of 52°C/W. To measure  $\theta_{JA}$ , the temperature at the top of the SOT-89 package is sensed with an IR temperature gun. Thermal simulation suggests a

junction temperature that is 10°C higher than the top-of-package temperature. With additional measurements of the ambient temperature and input/output (I/O) power,  $\theta_{JA}$  can be determined.

## W-CDMA ACPR PERFORMANCE

Figure 30 shows a plot of the adjacent channel power ratio (ACPR) vs.  $P_{OUT}$  for the [ADL5610](#). The signal type used is a single wideband code division multiple access (W-CDMA) carrier (Test Model 1-64) at 2140 MHz. This signal is generated by a very low ACPR source. ACPR is measured at the output by a high dynamic range spectrum analyzer that incorporates an instrument noise correction function.

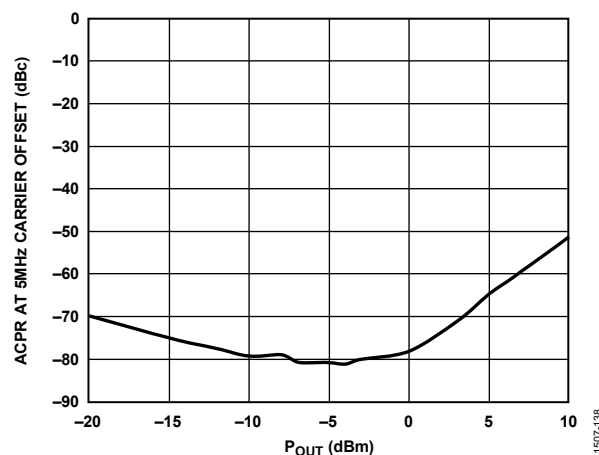


Figure 30. ACPR vs.  $P_{OUT}$ , Single W-CDMA Carrier (Test Model 1-64) at 2140 MHz

The [ADL5610](#) achieves an ACPR of -81 dBc at an output power level of -5 dBm, at which point the device noise and not distortion begins to dominate the power in the adjacent channels. At an output power level of 5 dBm, ACPR is still very low at -65 dBc.

## EVALUATION BOARD

Figure 31 shows the ADL5610 evaluation board layout. Figure 32 shows the schematic for the evaluation board. The board is powered by a single 5 V supply. Table 7 lists the components used on the evaluation board. Power can be applied to the board through clip-on terminals (VCC and GND).

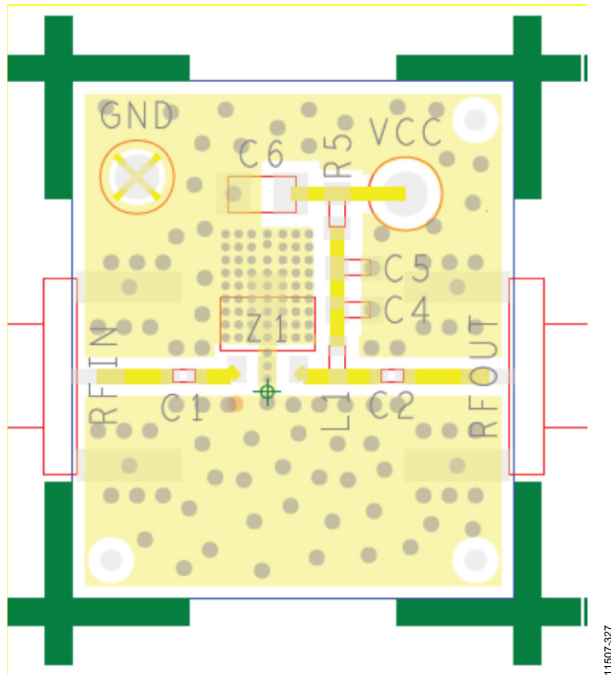


Figure 31. Evaluation Board Layout (Top)

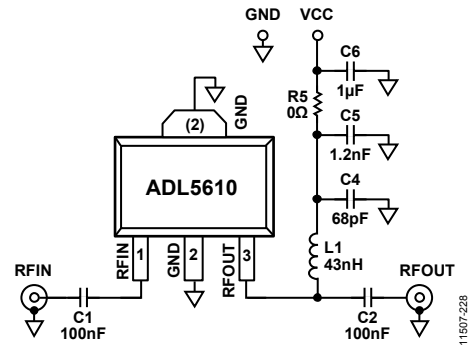
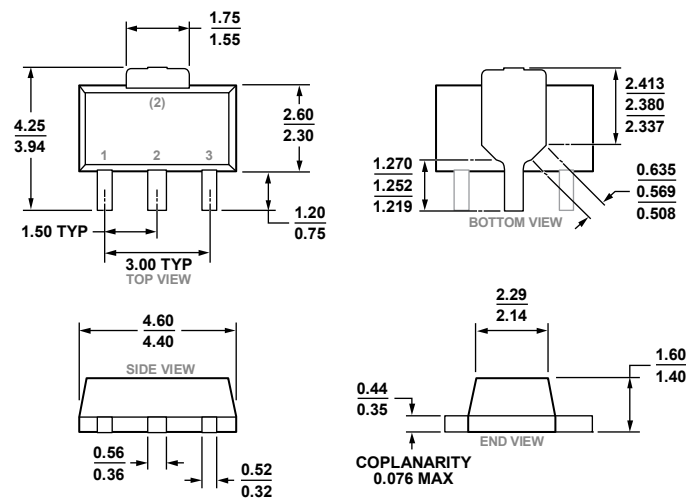


Figure 32. Evaluation Board Schematic

Table 7. Evaluation Board Configuration Options

| Component   | Description                        | Default Value                                        |
|-------------|------------------------------------|------------------------------------------------------|
| C1, C2      | AC coupling capacitors             | C1, C2 = 100 nF, 0402                                |
| L1          | DC bias inductor                   | L1 = 43 nH, 0603 (Coilcraft 0603HP or equivalent)    |
| R5          | Bias resistor                      | R5 = 0 Ω, 0402                                       |
| VCC and GND | Clip-on terminals for power supply | Not applicable                                       |
| C4, C5, C6  | Power supply decoupling capacitors | C4 = 68 pF, 0603; C5 = 1.2 nF, 0603; C6 = 1 μF, 1206 |

## OUTLINE DIMENSIONS



COMPLIANT TO JEDEC STANDARDS TO-243

Figure 33. 3-Lead Small Outline Transistor Package [SOT-89]  
(RK-3)

Dimensions shown in millimeters

## ORDERING GUIDE

| Model <sup>1</sup> | Temperature Range | Package Description             | Package Option |
|--------------------|-------------------|---------------------------------|----------------|
| ADL5610ARKZ-R7     | −40°C to +105°C   | 3-Lead SOT-89, 7" Tape and Reel | RK-3           |
| ADL5610-EVALZ      |                   | Evaluation Board                |                |

<sup>1</sup> Z = RoHS Compliant Part.