

## FEATURES

- 4 channels of low noise amplifiers (LNAs) followed by programmable gain amplifiers (PGAs)
- Minimum  $-3$  dB bandwidth of 5 MHz
- Typical  $-3$  dB bandwidth of 42.3 MHz
- Typical slew rate of 28 V/ $\mu$ s
- Differential input and output
- Gain of 18 dB to 36 dB in 6 dB steps
- Selectable low noise and low power modes
  - Input referred noise of 4.5 nV/ $\sqrt{\text{Hz}}$  at 18.3 mW per channel
  - Input referred noise of 3.8 nV/ $\sqrt{\text{Hz}}$  at 26.5 mW per channel
  - Input referred noise of 3.6 nV/ $\sqrt{\text{Hz}}$  at 34.8 mW per channel
  - Input referred noise of 3.4 nV/ $\sqrt{\text{Hz}}$  at 54.8 mW per channel
- Channel to channel gain matching of  $\pm 0.25$  dB
- Absolute gain error of  $\pm 0.5$  dB
- SPI programmable
- Power-down mode (SPI selectable)
- 3.1 V p-p differential output swing when using a 3.3 V supply
- 32-lead, 5 mm  $\times$  5 mm LFCSP package
- Specified from  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$
- Qualified for automotive applications

## APPLICATIONS

- Automotive radar
  - Adaptive cruise control
  - Collision avoidance
  - Blind spot detection
  - Self parking
  - Electronic bumpers

## GENERAL DESCRIPTION

The [ADA8282](#) is designed for applications that require low cost, low power, compact size, and flexibility. The [ADA8282](#) has four parallel channels, each including an LNA and a PGA. The LNA and PGA combine to form a signal chain that features a gain range of 18 dB to 36 dB in 6 dB increments with a guaranteed minimum bandwidth of 5 MHz.

Using the highest power settings, the combined input referred voltage noise of the combined LNA and PGA channel is 3.4 nV/ $\sqrt{\text{Hz}}$  at maximum gain.

## FUNCTIONAL BLOCK DIAGRAM

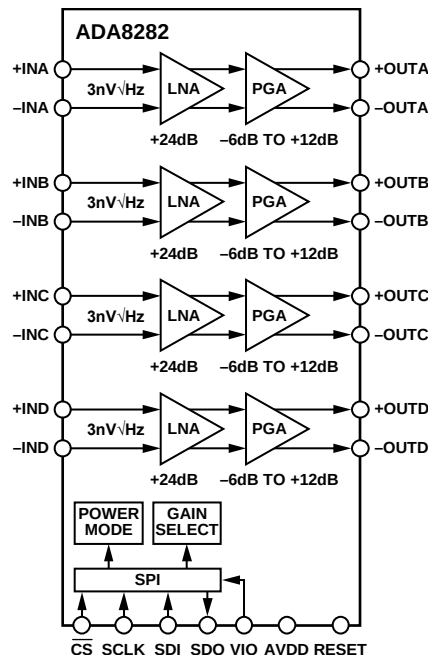


Figure 1.

13132-001

The [ADA8282](#) can be configured in four power modes that trade off power and noise performance to optimize the overall performance according to the end application.

Fabricated in an advanced complementary metal-oxide semiconductor (CMOS) process, the [ADA8282](#) is available in a 5 mm  $\times$  5 mm, RoHS-compliant, 32-lead LFCSP. It is specified over the automotive temperature range of  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ .

# ADA8282\* PRODUCT PAGE QUICK LINKS

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## COMPARABLE PARTS

View a parametric search of comparable parts.

## EVALUATION KITS

- ADA8282 Evaluation Board

## DOCUMENTATION

### Data Sheet

- ADA8282: Radar Receive Path AFE: 4-Channel LNA and PGA Data Sheet

### User Guides

- UG-846: Evaluating the ADA8282 Radar Receive Path AFE

## TOOLS AND SIMULATIONS

- ADA8282 SPICE Macro-Model

## DESIGN RESOURCES

- ADA8282 Material Declaration
- PCN-PDN Information
- Quality And Reliability
- Symbols and Footprints

## DISCUSSIONS

View all ADA8282 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

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## REVISION HISTORY

7/15—Revision 0: Initial Version

## SPECIFICATIONS

AVDD = 3.3 V, LNA + PGA gain = 36 dB (LNA gain = 24 dB, PGA gain = 12 dB),  $T_A = -40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ , PGA\_BIAS\_SEL = b'10, LNA\_BIAS\_SEL = b'10, unless otherwise noted.

Table 1.

| Parameter                                            | Test Conditions/Comments                                                              | Min | Typ         | Max   | Unit    |
|------------------------------------------------------|---------------------------------------------------------------------------------------|-----|-------------|-------|---------|
| ANALOG CHANNEL CHARACTERISTICS                       |                                                                                       |     |             |       |         |
| Gain                                                 |                                                                                       |     | 18/24/30/36 |       | dB      |
| Gain Range                                           |                                                                                       |     | 18          |       | dB      |
| Gain Error                                           |                                                                                       |     |             | ±0.5  | dB      |
| –3 dB Bandwidth                                      | $V_{OUT} = 100\text{ mV p-p}$ , gain = 36 dB                                          |     |             |       |         |
|                                                      | PGA_BIAS_SEL = b'00, LNA_BIAS_SEL = b'00                                              | 5   | 20.5        |       | MHz     |
|                                                      | PGA_BIAS_SEL = b'01, LNA_BIAS_SEL = b'01                                              | 5   | 34.2        |       | MHz     |
|                                                      | PGA_BIAS_SEL = b'01, LNA_BIAS_SEL = b'10                                              | 5   | 42.3        |       | MHz     |
|                                                      | PGA_BIAS_SEL = b'11, LNA_BIAS_SEL = b'11                                              | 5   | 52.3        |       | MHz     |
| Channel to Channel Gain Matching                     | Frequencies up to 5 MHz                                                               |     | 0.1         | ±0.25 | dB      |
| Channel to Channel Phase Matching <sup>1</sup>       | Frequencies up to 5 MHz                                                               |     | 0.1         | ±1    | Degrees |
| Slew Rate                                            |                                                                                       |     | 28          |       | V/μs    |
| Input Referred Noise                                 | Gain = 36 dB at 2 MHz                                                                 |     |             |       |         |
|                                                      | PGA_BIAS_SEL = b'00, LNA_BIAS_SEL = b'00                                              |     | 4.5         |       | nV/√Hz  |
|                                                      | PGA_BIAS_SEL = b'01, LNA_BIAS_SEL = b'01                                              |     | 3.8         |       | nV/√Hz  |
|                                                      | PGA_BIAS_SEL = b'01, LNA_BIAS_SEL = b'10                                              |     | 3.6         |       | nV/√Hz  |
|                                                      | PGA_BIAS_SEL = b'11, LNA_BIAS_SEL = b'11                                              |     | 3.4         |       | nV/√Hz  |
|                                                      | 50 Ω impedance used for voltage to power conversion                                   |     | –156        |       | dBm/Hz  |
| Output Referred Noise                                | Gain = 18 dB                                                                          |     | 36          |       | nV/√Hz  |
|                                                      | Gain = 24 dB                                                                          |     | 61          |       | nV/√Hz  |
|                                                      | Gain = 30 dB                                                                          |     | 115         |       | nV/√Hz  |
|                                                      | Gain = 36 dB                                                                          |     | 218         |       | nV/√Hz  |
| Offset Voltage                                       |                                                                                       |     |             |       |         |
| Referred to Input                                    | Gain = 36 dB                                                                          |     | ±0.8        | ±3    | mV      |
| Referred to Output                                   | Gain = 36 dB                                                                          |     | ±50         | ±200  | mV      |
| SPI Offset Adjustment Resolution (Relative to Input) | LNA_BIAS_SEL = b'00                                                                   |     | 113         |       | μV      |
|                                                      | LNA_BIAS_SEL = b'01                                                                   |     | 186         |       | μV      |
|                                                      | LNA_BIAS_SEL = b'10                                                                   |     | 250         |       | μV      |
|                                                      | LNA_BIAS_SEL = b'11                                                                   |     | 440         |       | μV      |
| SPI Offset Adjustment Range (Relative to Input)      | LNA_BIAS_SEL = b'00                                                                   |     | ±4          |       | mV      |
|                                                      | LNA_BIAS_SEL = b'01                                                                   |     | ±6          |       | mV      |
|                                                      | LNA_BIAS_SEL = b'10                                                                   |     | ±8          |       | mV      |
|                                                      | LNA_BIAS_SEL = b'11                                                                   |     | ±14         |       | mV      |
| Harmonic Distortion                                  |                                                                                       |     |             |       |         |
| Second Harmonic (HD2)                                | $V_{OUT} = 2\text{ V p-p}$ , $f_{IN} = 100\text{ kHz}$                                |     | –70         |       | dBc     |
|                                                      | $V_{OUT} = 100\text{ mV p-p}$ , $f_{IN} = 2\text{ MHz}$                               |     | –85         |       | dBc     |
| Third Harmonic (HD3)                                 | $V_{OUT} = 2\text{ V p-p}$ , $f_{IN} = 100\text{ kHz}$                                |     | –85         |       | dBc     |
|                                                      | $V_{OUT} = 100\text{ mV p-p}$ , $f_{IN} = 2\text{ MHz}$                               |     | –95         |       | dBc     |
| Intermodulation Distortion                           | $V_{OUT} = 2\text{ V p-p}$ , $f_{IN1} = 100\text{ kHz}$ , $f_{IN2} = 150\text{ kHz}$  |     | –72         |       | dBc     |
|                                                      | $V_{OUT} = 100\text{ mV p-p}$ , $f_{IN1} = 2\text{ MHz}$ , $f_{IN2} = 2.1\text{ MHz}$ |     | –83         |       | dBc     |
| Common-Mode Rejection Ratio (CMRR)                   |                                                                                       |     | –80         |       | dB      |
| Crosstalk                                            |                                                                                       |     | –105        |       | dBc     |

| Parameter                           | Test Conditions/Comments                                                                                                                                                                             | Min        | Typ                      | Max                     | Unit                 |
|-------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|--------------------------|-------------------------|----------------------|
| <b>POWER SUPPLY</b>                 |                                                                                                                                                                                                      |            |                          |                         |                      |
| Total Power Dissipation             | PGA_BIAS_SEL = b'00, LNA_BIAS_SEL = b'00<br>PGA_BIAS_SEL = b'01, LNA_BIAS_SEL = b'01<br>PGA_BIAS_SEL = b'01, LNA_BIAS_SEL = b'10<br>PGA_BIAS_SEL = b'11, LNA_BIAS_SEL = b'11                         |            |                          | 73<br>106<br>139<br>219 | mW<br>mW<br>mW<br>mW |
| Power Dissipation per Channel       |                                                                                                                                                                                                      |            | 31                       |                         | mW                   |
| AVDD                                |                                                                                                                                                                                                      | 3.0        |                          | 3.6                     | V                    |
| VIO                                 |                                                                                                                                                                                                      | 1.8        |                          | 3.6                     | V                    |
| I <sub>AVDD</sub>                   | Four channels active<br>PGA_BIAS_SEL = b'00, LNA_BIAS_SEL = b'00<br>PGA_BIAS_SEL = b'01, LNA_BIAS_SEL = b'01<br>PGA_BIAS_SEL = b'01, LNA_BIAS_SEL = b'10<br>PGA_BIAS_SEL = b'11, LNA_BIAS_SEL = b'11 |            | 19.6<br>29<br>37.7<br>60 | 22<br>32<br>42<br>66.3  | mA<br>mA<br>mA<br>mA |
| I <sub>VIO</sub>                    | One channel active                                                                                                                                                                                   |            | 9.8<br>10                | 11<br>12                | mA<br>μA             |
| Power-Down Current                  | I <sub>AVDD</sub> and I <sub>VIO</sub>                                                                                                                                                               |            | 20                       | 100                     | μA                   |
| Power-Down Dissipation              |                                                                                                                                                                                                      |            | 0.07                     | 0.33                    | mW                   |
| Power-Up Time                       | Time to operational after chip is enabled                                                                                                                                                            |            | 5                        |                         | μs                   |
| Power Supply Rejection Ratio (PSRR) | At dc<br>At 1 MHz                                                                                                                                                                                    | −80        | −80                      |                         | dB<br>dB             |
| <b>INPUT</b>                        |                                                                                                                                                                                                      |            |                          |                         |                      |
| Input Resistance                    |                                                                                                                                                                                                      |            |                          |                         |                      |
| Differential Input Resistance       |                                                                                                                                                                                                      | 1.45       | 1.57                     | 1.7                     | kΩ                   |
| Common-Mode Input Resistance        |                                                                                                                                                                                                      | 0.37       | 0.39                     | 0.42                    | kΩ                   |
| Differential Input Capacitance      |                                                                                                                                                                                                      | 10.8       | 12                       | 13.2                    | pF                   |
| <b>OUTPUT</b>                       |                                                                                                                                                                                                      |            |                          |                         |                      |
| Output Voltage Swing                | +OUTx (−OUTx), gain = 18 dB<br>+OUTx (−OUTx), gain = 24 dB, 30 dB, or 36 dB                                                                                                                          | 3.1<br>6.3 |                          |                         | V p-p<br>V p-p       |
| Output Balance                      | f <sub>IN</sub> = 100 kHz                                                                                                                                                                            |            | −70                      |                         | dB                   |
| Short-Circuit Current               | Per output at 25°C                                                                                                                                                                                   |            | 205                      |                         | mA                   |
| Capacitive Load                     | 20% overshoot                                                                                                                                                                                        |            | 30                       |                         | pF                   |

<sup>1</sup> Normalized to 0° phase matching at 25°C; see the Theory of Operation section for details.

## DIGITAL SPECIFICATIONS

AVDD = 3.3 V, T<sub>A</sub> = −40°C to +125°C, unless otherwise noted.

Table 2.

| Parameter                                       | Temperature | Min       | Typ | Max       | Unit |
|-------------------------------------------------|-------------|-----------|-----|-----------|------|
| <b>LOGIC INPUT (<math>\overline{CS}</math>)</b> |             |           |     |           |      |
| Logic 1 Voltage                                 | Full        | 1.2       |     | VIO + 0.3 | V    |
| Logic 0 Voltage                                 | Full        |           |     | 0.3       | V    |
| Input Resistance                                | 25°C        |           | 15  |           | kΩ   |
| Input Capacitance                               | 25°C        |           | 0.5 |           | pF   |
| <b>LOGIC INPUTS (SDI, SCLK, RESET)</b>          |             |           |     |           |      |
| Logic 1 Voltage                                 | Full        | 1.2       |     | VIO + 0.3 | V    |
| Logic 0 Voltage                                 | Full        | 0         |     | 0.3       | V    |
| Input Resistance                                | 25°C        |           | 2.5 |           | kΩ   |
| Input Capacitance                               | 25°C        |           | 2   |           | pF   |
| Maximum SCLK Frequency                          |             |           |     | 10        | MHz  |
| <b>LOGIC OUTPUT (SDO)</b>                       |             |           |     |           |      |
| Logic 1 Voltage (I <sub>OH</sub> = 800 μA)      | Full        | VIO − 0.3 |     |           | V    |
| Logic 0 Voltage (I <sub>OL</sub> = 50 μA)       | Full        |           |     | 0.3       | V    |

## ABSOLUTE MAXIMUM RATINGS

Table 3.

| Parameter                                                                             | Rating                |
|---------------------------------------------------------------------------------------|-----------------------|
| Electrical                                                                            |                       |
| AVDD to EPAD                                                                          | −0.3 V to +3.9 V      |
| +INx, −INx, SCLK, SDI, SDO, $\overline{\text{CS}}$ , VIO, RESET, −OUTx, +OUTx to EPAD | −0.3V to AVDD + 0.3 V |
| ESD Ratings                                                                           |                       |
| Human Body Model (HBM)                                                                | ±4000 V               |
| Charged Device Model (CDM)                                                            | ±2000 V               |
| Environmental                                                                         |                       |
| Operating Temperature Range (Ambient)                                                 | −40°C to +125°C       |
| Storage Temperature Range (Ambient)                                                   | −65°C to +150°C       |
| Maximum Junction Temperature                                                          | 150°C                 |
| Lead Temperature (Soldering, 10 sec)                                                  | 300°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

$\theta_{JA}$  is specified for the worst case conditions, that is, a device soldered in a circuit board for surface-mount packages.

Table 4. Thermal Resistance

| Package Type               | $\theta_{JA}$ | $\theta_{JC}$ | Unit |
|----------------------------|---------------|---------------|------|
| 32-Lead, 5 mm × 5 mm LFCSP | 33.51         | 4.1           | °C/W |

## 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

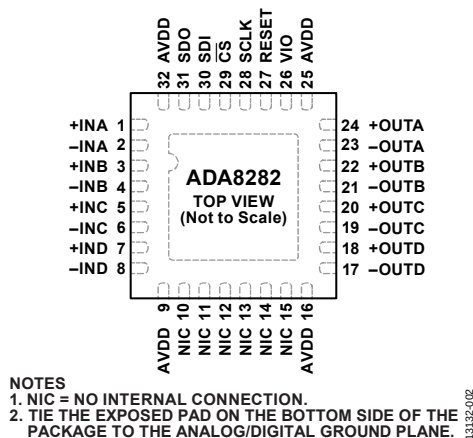


Figure 2. Pin Configuration

Table 5. Pin Function Descriptions

| Pin No. | Mnemonic               | Description                                                                                                                                                                      |
|---------|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0       | EPAD                   | Exposed Pad. Tie the exposed pad on the bottom side of the package to the analog/digital ground plane.                                                                           |
| 1       | +INA                   | Positive LNA Analog Input for Channel A.                                                                                                                                         |
| 2       | -INA                   | Negative LNA Analog Input for Channel A.                                                                                                                                         |
| 3       | +INB                   | Positive LNA Analog Input for Channel B.                                                                                                                                         |
| 4       | -INB                   | Negative LNA Analog Input for Channel B.                                                                                                                                         |
| 5       | +INC                   | Positive LNA Analog Input for Channel C.                                                                                                                                         |
| 6       | -INC                   | Negative LNA Analog Input for Channel C.                                                                                                                                         |
| 7       | +IND                   | Positive LNA Analog Input for Channel D.                                                                                                                                         |
| 8       | -IND                   | Negative LNA Analog Input for Channel D.                                                                                                                                         |
| 9       | AVDD                   | 3.3 V Analog Supply.                                                                                                                                                             |
| 10      | NIC                    | No Internal Connection. Leave this pin floating.                                                                                                                                 |
| 11      | NIC                    | No Internal Connection. Leave this pin floating.                                                                                                                                 |
| 12      | NIC                    | No Internal Connection. Leave this pin floating.                                                                                                                                 |
| 13      | NIC                    | No Internal Connection. Leave this pin floating.                                                                                                                                 |
| 14      | NIC                    | No Internal Connection. Leave this pin floating.                                                                                                                                 |
| 15      | NIC                    | No Internal Connection. Leave this pin floating.                                                                                                                                 |
| 16      | AVDD                   | 3.3 V Analog Supply.                                                                                                                                                             |
| 17      | -OUTD                  | Negative Analog Output for Channel D.                                                                                                                                            |
| 18      | +OUTD                  | Positive Analog Output for Channel D.                                                                                                                                            |
| 19      | -OUTC                  | Negative Analog Output for Channel C.                                                                                                                                            |
| 20      | +OUTC                  | Positive Analog Output for Channel C.                                                                                                                                            |
| 21      | -OUTB                  | Negative Analog Output for Channel B.                                                                                                                                            |
| 22      | +OUTB                  | Positive Analog Output for Channel B.                                                                                                                                            |
| 23      | -OUTA                  | Negative Analog Output for Channel A.                                                                                                                                            |
| 24      | +OUTA                  | Positive Analog Output for Channel A.                                                                                                                                            |
| 25      | AVDD                   | 3.3 V Analog Supply.                                                                                                                                                             |
| 26      | VIO                    | Digital Level Select for SPI and RESET. This pin can accept 1.8 V to 3.3 V.                                                                                                      |
| 27      | RESET                  | Reset Input. RESET overrides the SPI and powers down the device and returns all settings back to default. RESET is pulled to ground by default. A logic high triggers the reset. |
| 28      | SCLK                   | Serial Clock.                                                                                                                                                                    |
| 29      | $\overline{\text{CS}}$ | Chip Select Bar.                                                                                                                                                                 |
| 30      | SDI                    | Serial Data Input.                                                                                                                                                               |
| 31      | SDO                    | Serial Data Output.                                                                                                                                                              |
| 32      | AVDD                   | 3.3 V Analog Supply.                                                                                                                                                             |

## TYPICAL PERFORMANCE CHARACTERISTICS

AVDD = 3.3 V, LNA + PGA gain = 36 dB (LNA gain = 24 dB, PGA gain = 12 dB),  $T_A = 25^\circ\text{C}$ , PGA\_BIAS\_SEL = b'10, LNA\_BIAS\_SEL = b'10, unless otherwise noted.

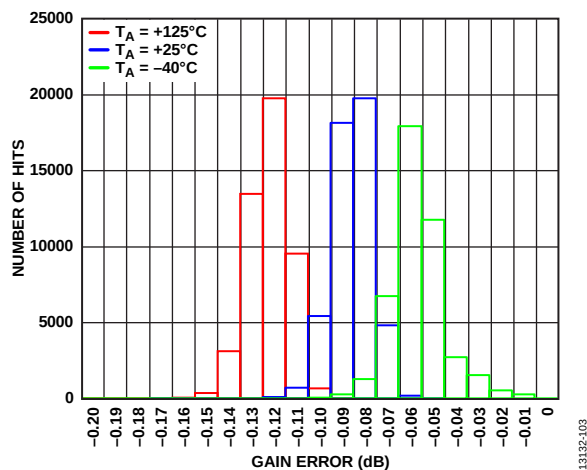


Figure 3. Gain Accuracy Distribution

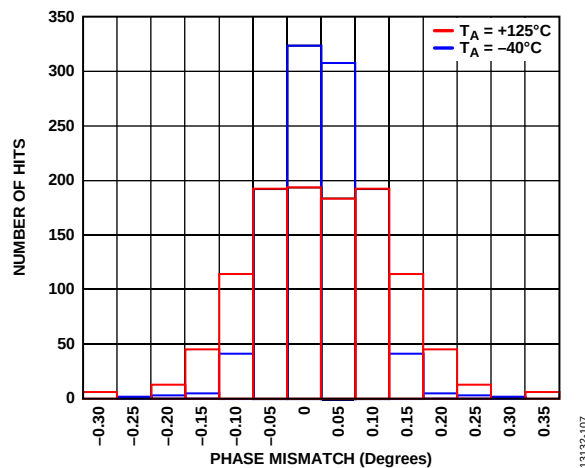


Figure 6. Distribution of Channel to Channel Phase Matching

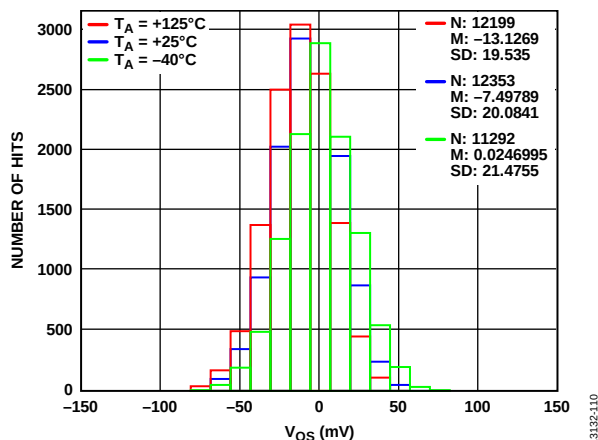


Figure 4. Output Offset Voltage Distribution

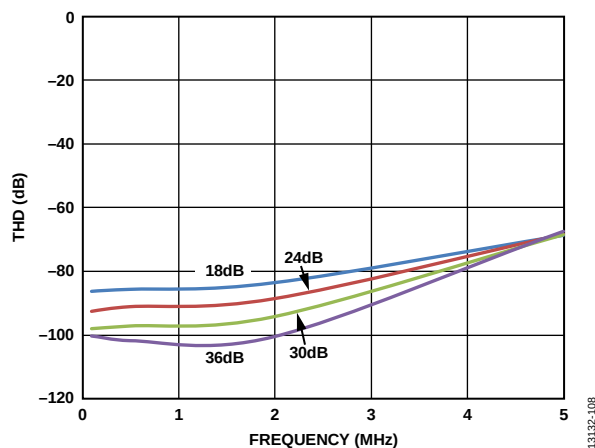


Figure 7. Total Harmonic Distortion (THD) vs. Frequency for Various Gains,  $V_{OUT} = -10\text{ dBm}$

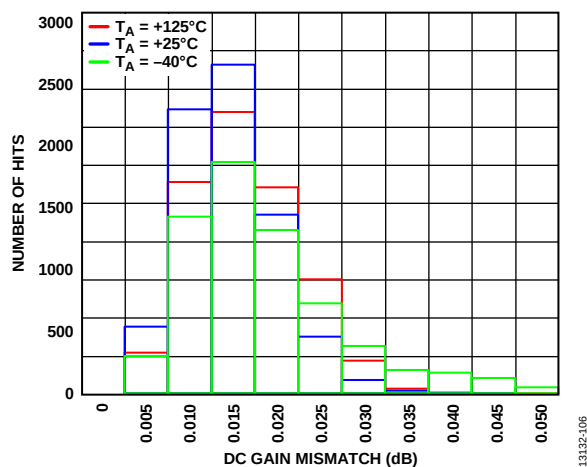


Figure 5. Distribution of Channel to Channel Gain Matching

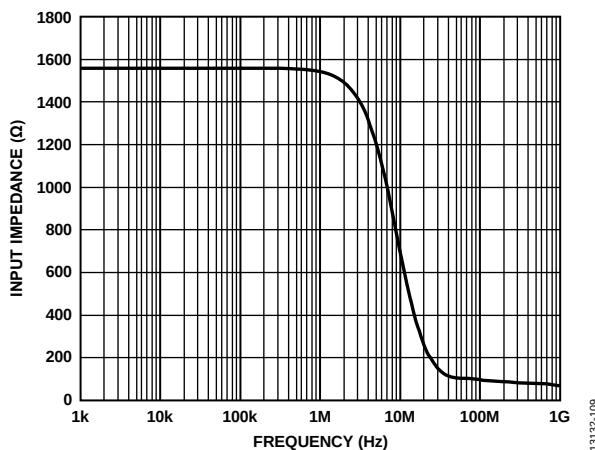


Figure 8. Input Impedance vs. Frequency



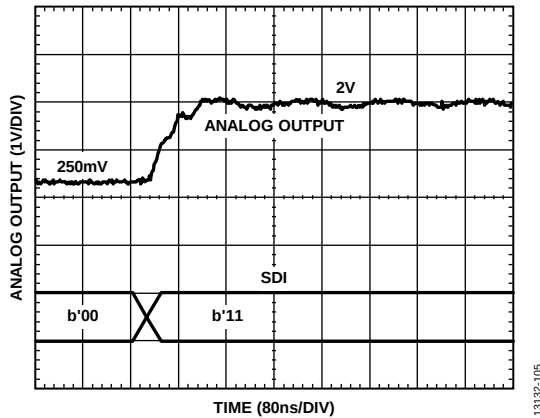


Figure 9. Gain Step Transient Response

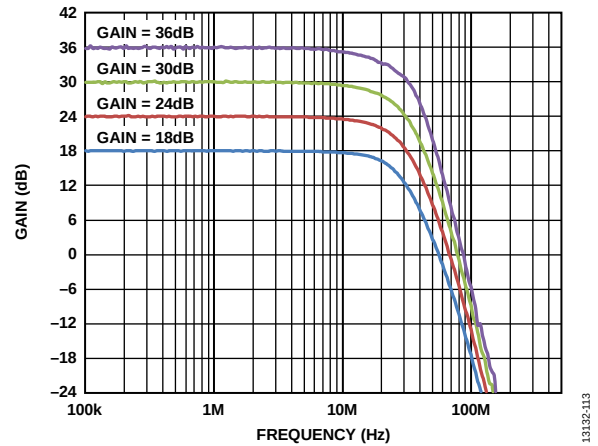


Figure 12. Frequency Response at All Gains (Bias Mode 0)

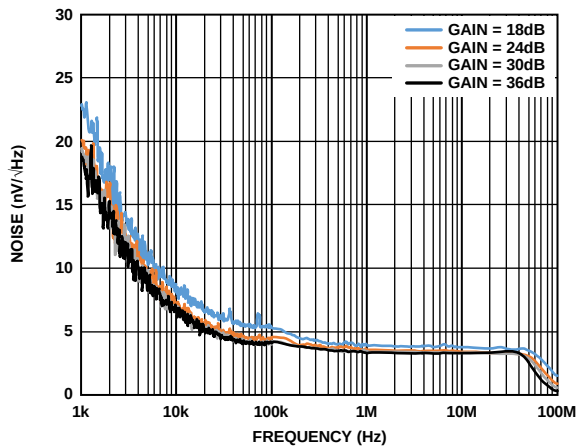


Figure 10. Input Referred Noise vs. Frequency

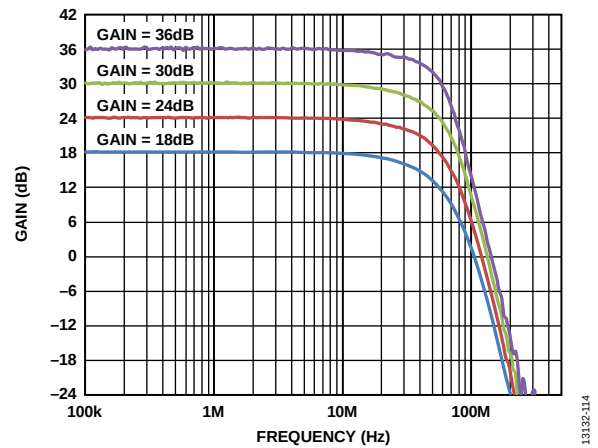


Figure 13. Frequency Response at All Gains (Bias Mode 2)

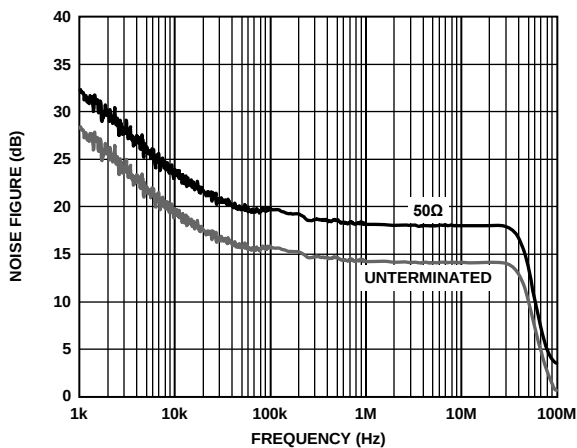


Figure 11. Noise Figure vs. Frequency

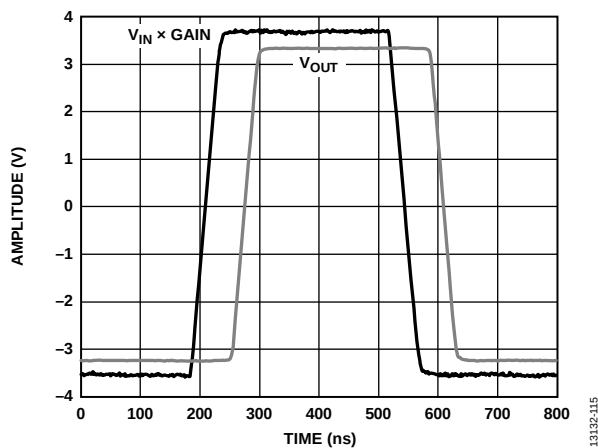


Figure 14. Overdrive Recovery

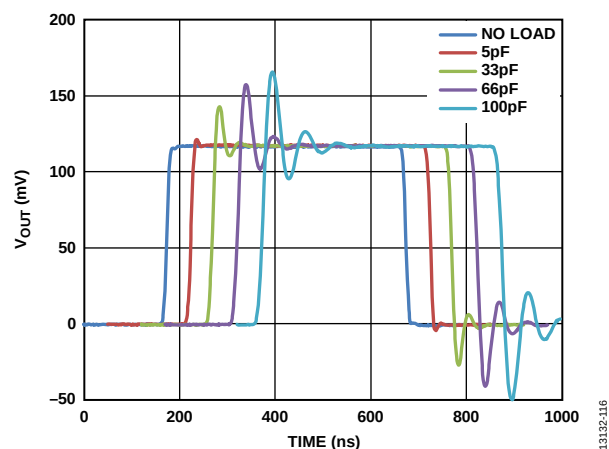


Figure 15. Pulse Response at Various Output Capacitive Loads

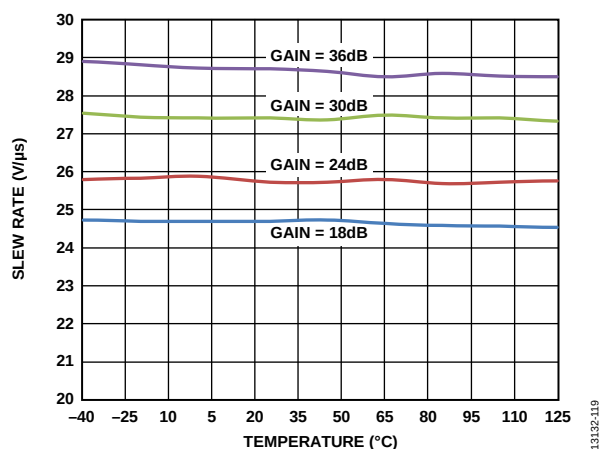


Figure 18. Output Slew Rate vs. Temperature

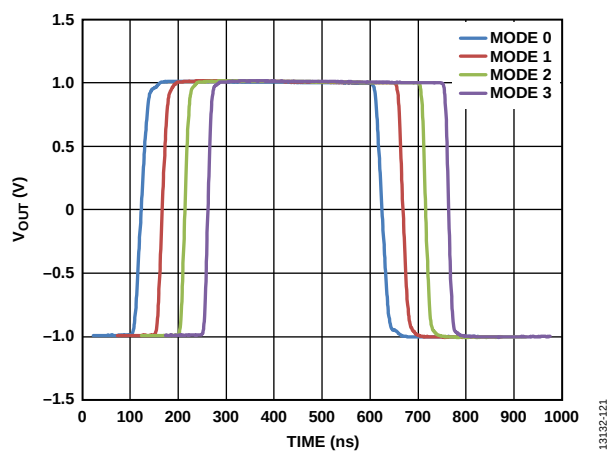


Figure 16. Large Signal Pulse Response for Various LNA and PGA Bias Modes

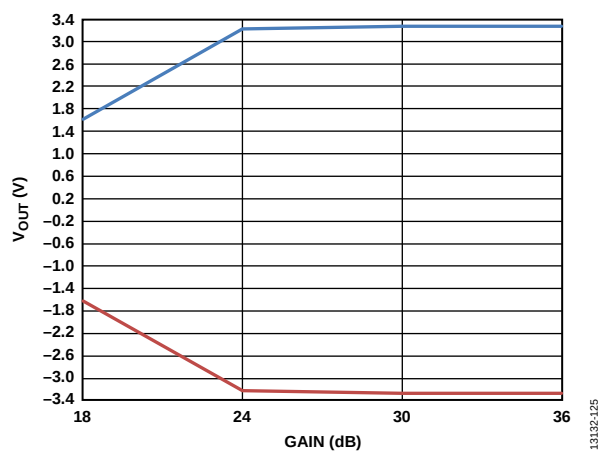
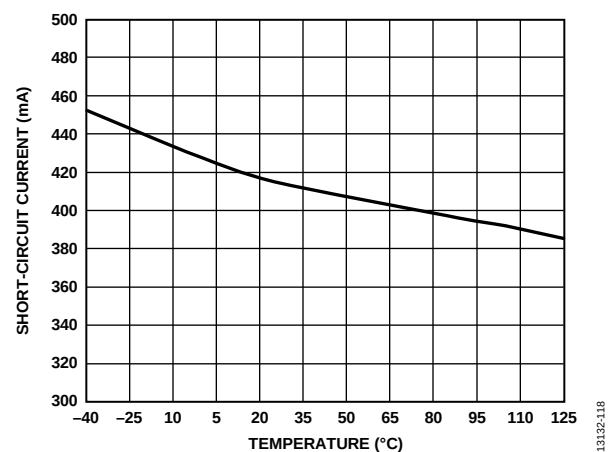
Figure 19. Maximum and Minimum Differential  $V_{OUT}$  vs. Gain

Figure 17. Short-Circuit Current vs. Temperature Per Channel

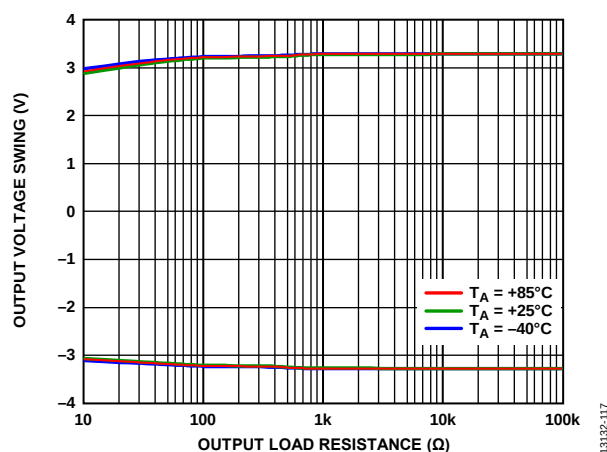


Figure 20. Differential Output Voltage Swing vs. Output Load Resistance

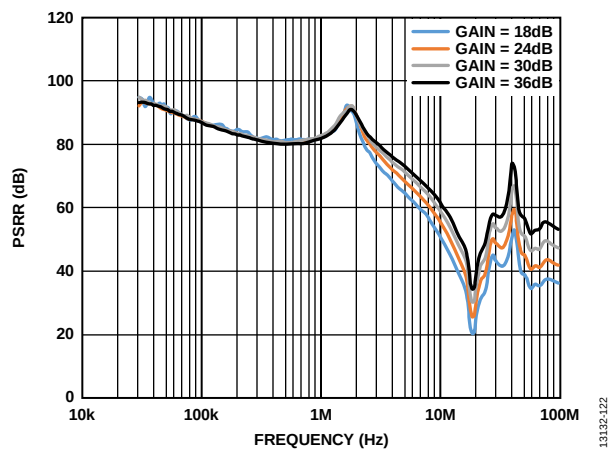


Figure 21. PSRR vs. Frequency at Various Gains

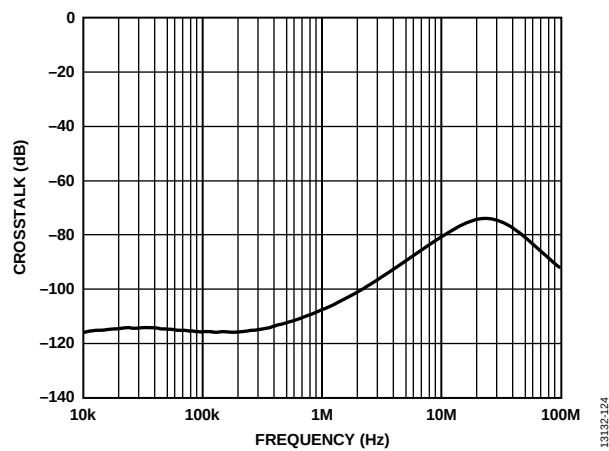


Figure 23. Crosstalk vs. Frequency

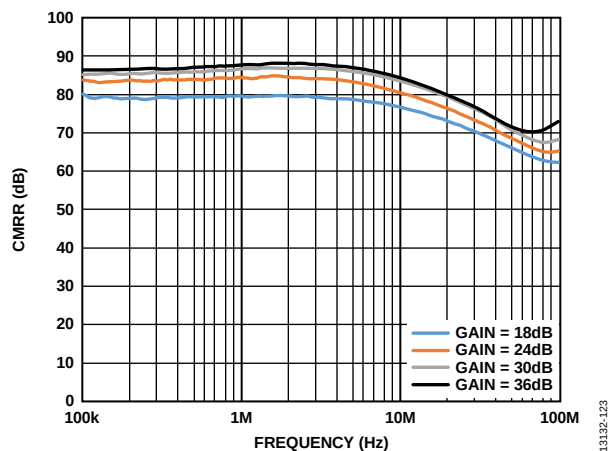


Figure 22. CMRR vs. Frequency at Various Gains

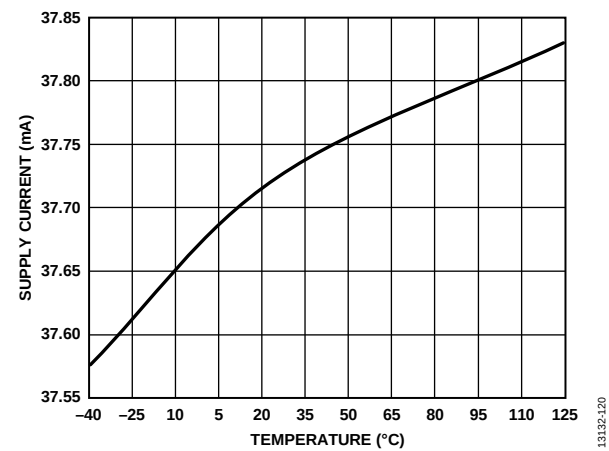


Figure 24. Quiescent Supply Current vs. Temperature

## THEORY OF OPERATION

### RADAR RECEIVE PATH AFE

The primary application for the ADA8282 is a high speed ramp, frequency modulated, continuous wave radar (HSR-FMCW radar). Figure 25 shows a simplified block diagram of an HSR-FMCW radar system. The signal chain requires multiple channels, each including an LNA and a PGA. The ADA8282 provides these key components in a single 5 mm × 5 mm LFCSP.

The performance of each component is designed to meet the demands of an HSR-FMCW radar system. Some examples of these performance metrics are the LNA noise, PGA gain range, and signal chain bandwidth and power. The ADA8282 also has adjustable power modes to adjust the power and performance level to accommodate a wide variety of applications.

The ADA8282 is programmable via the SPI. Channel gain, power mode, and offset voltage can be adjusted using the SPI port.

### DEFAULT SPI SETTINGS

When initially powered, the ADA8282 defaults to a setting of 0x00 in Register 0x17, which disables all channels. The device is enabled by writing 0x0F to Register 0x17.

### INPUT IMPEDANCE

The input impedance to the ADA8282 is set by an internal 785  $\Omega$  resistance at each input, biased to midsupply by an internal voltage buffer. Both the positive and negative inputs are biased with the same network, creating a differential input impedance of 1.57 k $\Omega$ .

The input to the ADA8282 is typically ac-coupled. The ac coupling capacitors operate with the input impedance of the ADA8282 to create a high-pass filter with a pole at  $1/(2\pi RC)$ , where  $R = 785 \Omega$  with a typical tolerance of  $\pm 15\%$ .

### POWER MODES

The ADA8282 has four power modes that can be controlled through Register 0x14 (BIAS\_SEL). The power modes allow a user to adjust the power and performance tradeoffs to suit the end application. Use the low power mode when power savings are in demand, and use the high power mode in applications that require increased bandwidth and low noise.

Table 6 shows the power performance trade-offs of the various SPI settings.

Table 6. Power Mode Trade-Offs

| Mode Setting | Power per Channel (mW) | Input Referred Noise at 2 MHz (nV/ $\sqrt{\text{Hz}}$ ) | Typical Bandwidth (MHz), Gain = 36 dB |
|--------------|------------------------|---------------------------------------------------------|---------------------------------------|
| b'00         | 18.3                   | 4.5                                                     | 20.5                                  |
| b'01         | 26.5                   | 3.8                                                     | 34.2                                  |
| b'10         | 34.8                   | 3.6                                                     | 42.3                                  |
| b'11         | 54.8                   | 3.4                                                     | 52.3                                  |

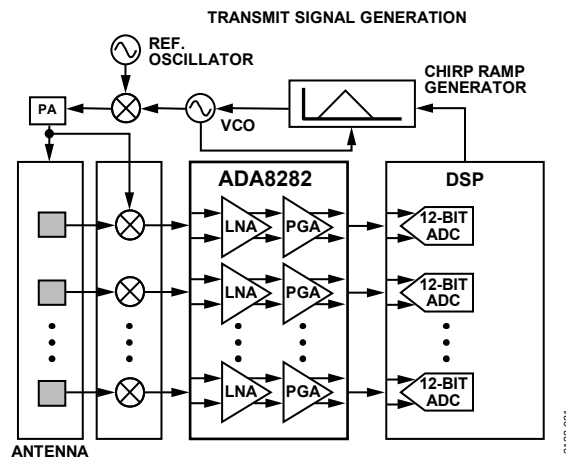


Figure 25. Typical Signal Chain Overview

## PROGRAMMABLE GAIN RANGE

The ADA8282 has a programmable gain to allow adjusting of the output amplitudes of signals to accommodate a variety of applications. The gain of the ADA8282 is programmable in 6 dB increments from 18 dB to 36 dB. The gain is controlled using Register 0x15. The same register controls all four channels, but each channel can be independently controlled by utilizing the appropriate bits in the register. Channel A is controlled with the two LSBs of Register 0x15 (Bits[1:0]), Channel B uses Bits[3:2], Channel C uses Bits[5:4], and Channel D uses the two MSBs, Bits[7:6].

The gain setting and gains are listed in Table 7.

Table 7. Gain Settings

| Register 0x15 Setting | Gain (dB) | Gain (V/V) |
|-----------------------|-----------|------------|
| b'00                  | 18        | 7.9        |
| b'01                  | 24        | 15.9       |
| b'10                  | 30        | 31.6       |
| b'11                  | 36        | 63.1       |

## OUTPUT SWING VARIATION WITH GAIN

The ADA8282 gain is implemented using two internal gain stages. The first stage is an LNA with a gain of 24 dB, and the second stage is a PGA with a gain that varies from -6 dB to +12 dB. The output of the LNA has a fixed output swing range, and is the limiting factor when the channel gain is 18 dB. Because of the limitations of the LNA swing range, the ADA8282 has an output swing that is dependent on gain, as shown in Table 8.

Table 8. Output Swing at Various Gains

| Gain (dB) | Output Swing (V p-p) |
|-----------|----------------------|
| 18        | 3.1                  |
| 24        | 6.3                  |
| 30        | 6.3                  |
| 36        | 6.3                  |

## OFFSET VOLTAGE ADJUSTMENTS

Register 0x10 through Register 0x13 adjust the dc offset voltage of each channel. The default value of 0x20 is intended to be the setting for the offset closest to 0 V, but adjustments can be made as required by the application.

The default setting (0x20) applies a zero offset, 0x00 applies the maximum negative offset, and 0x3F applies the maximum positive offset.

The range and resolution of the LNA\_OFFSETx adjustments are dependent on the LNA bias mode as described in Table 9.

Table 9. Offset Voltage Adjustments

| LNA_BIAS_SEL Setting | Referred to Input (RTI) Offset Resolution ( $\mu$ V) | RTI Offset Range (mV) |
|----------------------|------------------------------------------------------|-----------------------|
| b'00                 | 113                                                  | $\pm 4$               |
| b'01                 | 186                                                  | $\pm 6$               |
| b'10                 | 250                                                  | $\pm 8$               |
| b'11                 | 440                                                  | $\pm 14$              |

## VIO Pin

The VIO pin sets the voltage levels used by the SPI interface. If the VIO pin is tied to the 3.3 V supply, the SPI port functions on 3.3 V logic.

## SINGLE-ENDED OR DIFFERENTIAL INPUT

The ADA8282 operates with either a differential or single-ended signal source. The maximum input voltage swing is the same in either configuration. When using a single-ended signal source, connect the unused input to ground with a capacitor. Matching the ac coupling capacitor to the ac grounding capacitor optimizes CMRR performance.

## SHORT-CIRCUIT CURRENTS

The ADA8282 typically has a 205 mA short-circuit current per output pin. The thermal implications of this current during unintended shorting of these outputs must be taken into account when designing boards with this device.

## SPI INTERFACE

The ADA8282 SPI interface uses a 4-wire interface to deliver a 16-bit instruction header, followed by 8 bits of data. The first bit is a read/write bit. W1 and W0 determine how many bytes are transferred, and must both be zeros for the ADA8282 to write to a single register. Then, a 13-bit address and an 8-bit data byte follow.

The SPI port operates at SCLK frequencies of up to 10 MHz. For additional SPI timing information, see the [AN-877 Application Note](#).

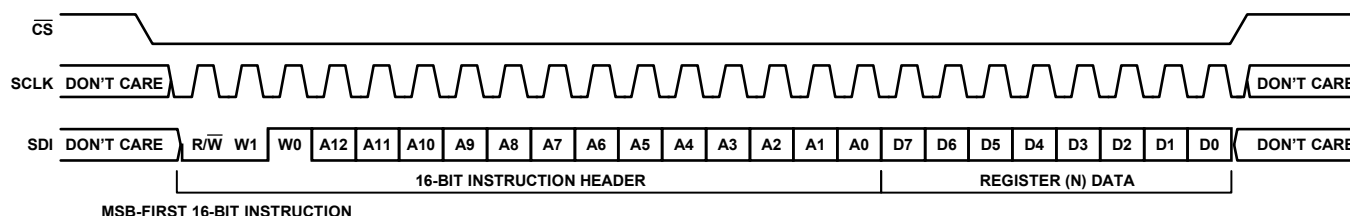


Figure 26. Serial Instruction Details

## CHANNEL TO CHANNEL PHASE MATCHING

In a multichannel radar application, matching the ac performance between channels improves the distance and angle resolution of a detected object, particularly the phase matching in the band of interest for the application. The ADA8282 layout and design are optimized to increase phase matching. The ADA8282 also has sufficient bandwidth to minimize any channel to channel phase variation for up to 5 MHz input signals.

The phase mismatch between channels can be calibrated at a single temperature. However, any variation in phase matching over temperature can still degrade system performance. The ADA8282 is characterized to capture the maximum channel to channel phase mismatch as the temperature varies from a calibration temperature of 25°C.

Figure 27 shows a distribution of channel to channel phase mismatch for signal frequencies up to 5 MHz. When the initial phase mismatch between channels is normalized to 0° at +25°C, the 6 $\sigma$  mismatch is 0.43° at –40°C and 0.6° at +125°C.

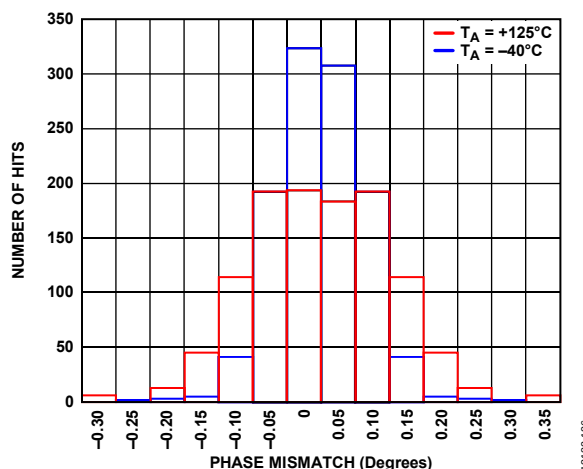


Figure 27. Channel to Channel Phase Mismatch, Normalized to 0° at 25°C, LNA\_BIAS\_SEL = PGA\_BIAS\_SEL = b'00, PGA\_GAIN = b'11

The amount of channel to channel phase mismatch varies with the power mode. Table 10 shows the 6 $\sigma$  phase mismatch up to 5 MHz over the full temperature range for all gain settings in different power modes, when normalized to 0° at 25°C in each power mode.

Table 10. Maximum Channel to Channel Phase Mismatch over Temperature After 25°C Calibration

| PGA_BIAS_SEL | LNA_BIAS_SEL | 6 $\sigma$ Channel to Channel Phase Mismatch over Temperature (Degrees) | Maximum Channel to Channel Phase Mismatch (Degrees) |
|--------------|--------------|-------------------------------------------------------------------------|-----------------------------------------------------|
| b'00         | b'00         | 0.60                                                                    | $\pm 1$                                             |
| b'01         | b'01         | 0.41                                                                    | $\pm 1$                                             |
| b'10         | b'10         | 0.33                                                                    | $\pm 1$                                             |
| b'11         | b'11         | 0.60                                                                    | $\pm 1$                                             |

APPLICATIONS INFORMATION

INCREASED GAIN USING TWO ADA8282 DEVICES IN SERIES

For applications that require gains greater than 36 dB, two ADA8282 devices can be used in series with each other. To optimize the signal swing for the path, increment the gains according to Table 11.

Table 11. Gain Settings for Two Devices in Series

| Total Gain (dB) | A1 (Input Side ADA8282) Gain (dB) | A2 (Output Side ADA8282) Gain (dB) |
|-----------------|-----------------------------------|------------------------------------|
| 36              | 18                                | 18                                 |
| 42              | 18                                | 24                                 |
| 48              | 24                                | 24                                 |
| 54              | 30                                | 24                                 |
| 60              | 30                                | 30                                 |
| 66              | 36                                | 30                                 |
| 72              | 36                                | 36                                 |

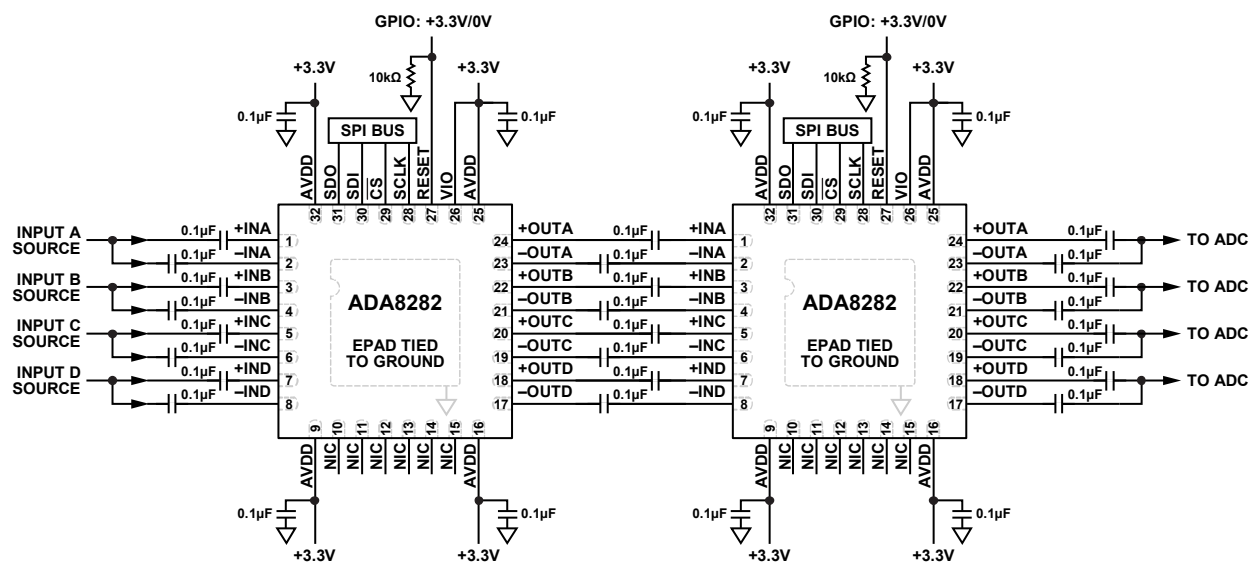


Figure 28. Using Two ADA8282 Devices in Series to Increase Gain

13132-023

## MULTIPLEXING INPUTS USING MULTIPLE ADA8282 DEVICES

It is possible to multiplex eight differential inputs down to four differential outputs by using two ADA8282 devices. The devices can be connected such that the outputs are connected (see

Figure 29) as long as only one device is enabled at a time. When an ADA8282 is disabled, the outputs present a 6 k $\Omega$  load on the output bus.

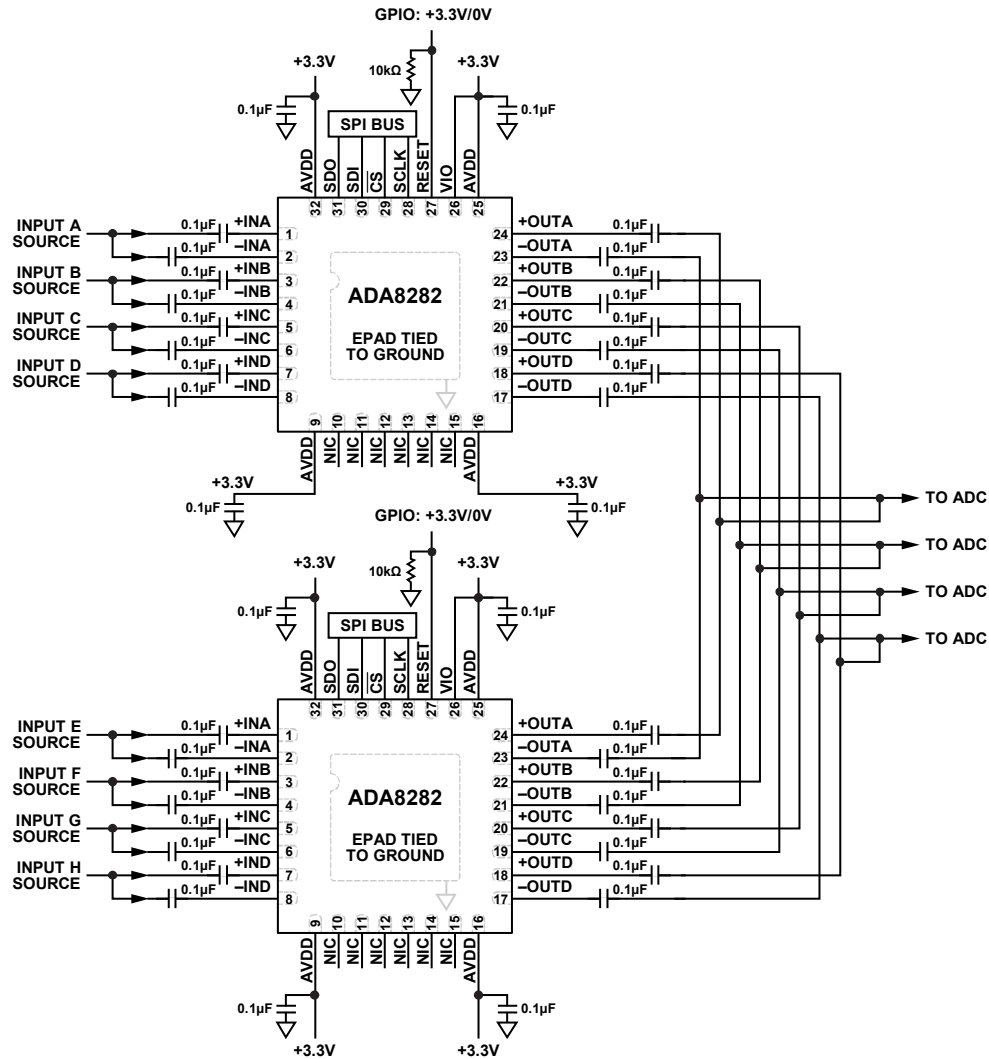


Figure 29. Multiplexing by Connecting Two ADA8282 Outputs to One Output Bus

13132-024



## BASIC CONNECTIONS FOR A TYPICAL APPLICATION

The ADA8282 is typically configured to operate with a nominal 3.3 V power supply, using the EPAD as the analog ground connection. Place the bypass capacitors as close as possible to the power supply pins to minimize the length of metal traces in

series with the bypassing paths. AC couple the inputs and outputs for each channel as shown in Figure 30. Pull the RESET pin low with a 10 kΩ resistor and drive it with 3.3 V GPIO logic. The SPI pins can be directly connected to the SPI bus.

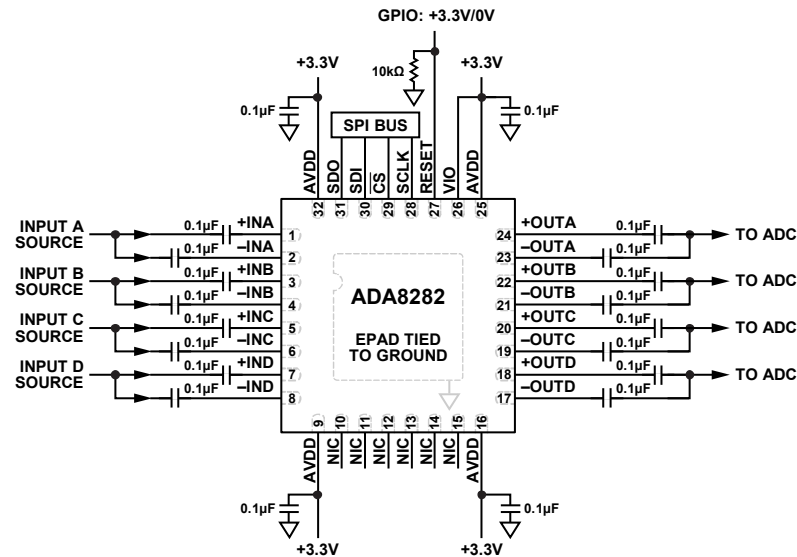


Figure 30. Typical Component Connections

13132-025

## REGISTER MAP

### REGISTER SUMMARY

Table 12. Register Summary

| Reg. | Name        | Bits  | Bit 7       | Bit 6 | Bit 5       | Bit 4       | Bit 3        | Bit 2       | Bit 1        | Bit 0       | Reset        | RW   |    |
|------|-------------|-------|-------------|-------|-------------|-------------|--------------|-------------|--------------|-------------|--------------|------|----|
| 0x00 | INTF_CONFA  | [7:0] | INTF_CONFA2 |       | LSBFIRST1   | INTF_CONFA1 |              | LSBFIRST0   | INTF_CONFA0  |             | 0x00         | RW   |    |
| 0x01 | SOFT_RESET  | [7:0] | Unused      |       |             |             |              |             |              |             | SOFT_RESET   | 0x00 | R  |
| 0x04 | CHIP_ID1    | [7:0] | CHIP_IDLOW  |       |             |             |              |             |              |             |              | 0x82 | R  |
| 0x05 | CHIP_ID2    | [7:0] | CHIP_IDHI   |       |             |             |              |             |              |             |              | 0x82 | R  |
| 0x06 | Revision    | [7:0] | Revision    |       |             |             |              |             |              |             |              | 0x00 | R  |
| 0x10 | LNA_OFFSET0 | [7:0] | Unused      |       | LNA_OFFSET0 |             |              |             |              |             |              | 0x20 | RW |
| 0x11 | LNA_OFFSET1 | [7:0] | Unused      |       | LNA_OFFSET1 |             |              |             |              |             |              | 0x20 | RW |
| 0x12 | LNA_OFFSET2 | [7:0] | Unused      |       | LNA_OFFSET2 |             |              |             |              |             |              | 0x20 | RW |
| 0x13 | LNA_OFFSET3 | [7:0] | Unused      |       | LNA_OFFSET3 |             |              |             |              |             |              | 0x20 | RW |
| 0x14 | BIAS_SEL    | [7:0] | Unused      |       |             |             | PGA_BIAS_SEL |             | LNA_BIAS_SEL |             | 0x0A         | RW   |    |
| 0x15 | PGA_GAIN    | [7:0] | PGA_GAIN3   |       | PGA_GAIN2   |             | PGA_GAIN1    |             | PGA_GAIN0    |             | 0x00         | RW   |    |
| 0x17 | EN_CHAN     | [7:0] | Unused      |       |             |             | EN_CHANNEL3  | EN_CHANNEL2 | EN_CHANNEL1  | EN_CHANNEL0 | 0x00         | RW   |    |
| 0x18 | EN_BIAS_GEN | [7:0] | Unused      |       |             |             |              |             |              |             | EN_BIAS_GEN  | 0x00 | RW |
| 0x1D | SPAREWR0    | [7:0] | Unused      |       |             |             |              |             | GPIO_WRITE   |             | GPIO_WR_MODE | 0x00 | RW |
| 0x1E | SPARERD0    | [7:0] | Unused      |       |             |             |              |             |              |             | GPIO_READ    | 0x00 | R  |

### REGISTER DETAILS

#### Register 0x00: Interface Configuration Register

| Bit 7       | Bit 6 | Bit 5     | Bit 4       | Bit 3 | Bit 2     | Bit 1       | Bit 0 |
|-------------|-------|-----------|-------------|-------|-----------|-------------|-------|
| INTF_CONFA2 |       | LSBFIRST1 | INTF_CONFA1 |       | LSBFIRST0 | INTF_CONFA0 |       |

The INTF\_CONFA configuration register is symmetric, as it is the first register written and sets the data direction (LSB first or MSB first).

Table 13. INTF\_CONFA Configuration Register Bit Descriptions

| Bits  | Bit Name    | Description                                                                              | Reset | Access |
|-------|-------------|------------------------------------------------------------------------------------------|-------|--------|
| [7:0] | INTF_CONFA2 | INTF_CONFA2 must remain b'00.                                                            | 0x00  | RW     |
| 5     | LSBFIRST1   | LSBFIRST1 must be set to b'1 for LSB first operation and to b'0 for MSB first operation. | 0x00  | RW     |
| [4:3] | INTF_CONFA1 | INTF_CONFA1 must remain b'00.                                                            | 0x00  | RW     |
| 2     | LSBFIRST0   | LSBFIRST0 must be set to b'1 for LSB first operation and to b'0 for MSB first operation. | 0x00  | RW     |
| [1:0] | INTF_CONFA0 | INTF_CONFA0 must remain b'00.                                                            | 0x00  | RW     |

#### Register 0x01: Soft Reset Register

| Bit 7  | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0      |
|--------|-------|-------|-------|-------|-------|-------|------------|
| Unused |       |       |       |       |       |       | SOFT_RESET |

Table 14. SOFT\_RESET Configuration Register Bit Descriptions

| Bits | Bit Name   | Description                                                                                    | Reset | Access |
|------|------------|------------------------------------------------------------------------------------------------|-------|--------|
| 0    | SOFT_RESET | The SOFT_RESET bit resets all registers to their default values when SOFT_RESET is set to b'1. | 0x00  | RW     |

#### Register 0x04: Chip ID Low Register

| Bit 7      | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|------------|-------|-------|-------|-------|-------|-------|-------|
| CHIP_IDLOW |       |       |       |       |       |       |       |

Table 15. CHIP\_IDLOW Configuration Register Bit Descriptions

| Bits  | Bit Name   | Description                                                                | Reset | Access |
|-------|------------|----------------------------------------------------------------------------|-------|--------|
| [7:0] | CHIP_IDLOW | The CHIP_ID1 and CHIP_ID2 registers identify the <a href="#">ADA8282</a> . | 0x82  | R      |

**Register 0x05: Chip ID High Register**

| Bit 7     | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|-----------|-------|-------|-------|-------|-------|-------|-------|
| CHIP_IDHI |       |       |       |       |       |       |       |

Table 16. CHIP\_IDHI Configuration Register Bit Descriptions

| Bits  | Bit Name  | Description                                                                | Reset | Access |
|-------|-----------|----------------------------------------------------------------------------|-------|--------|
| [7:0] | CHIP_IDHI | The CHIP_ID1 and CHIP_ID2 registers identify the <a href="#">ADA8282</a> . | 0x82  | R      |

**Register 0x06: Revision Register**

| Bit 7    | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|----------|-------|-------|-------|-------|-------|-------|-------|
| Revision |       |       |       |       |       |       |       |

Table 17. Revision Configuration Register Bit Descriptions

| Bits  | Bit Name | Description                                                               | Reset | Access |
|-------|----------|---------------------------------------------------------------------------|-------|--------|
| [7:0] | Revision | The revision register identifies the silicon revision of the current die. | 0x00  | R      |

**Register 0x10: LNA Offset 0 Register**

| Bit 7  | Bit 6 | Bit 5       | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|--------|-------|-------------|-------|-------|-------|-------|-------|
| Unused |       | LNA_OFFSET0 |       |       |       |       |       |

Table 18. LNA\_OFFSET0 Configuration Register Bit Descriptions

| Bits  | Bit Name    | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Reset | Access |
|-------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|
| [5:0] | LNA_OFFSET0 | LNA_OFFSET0 controls the offset of Channel A. The default setting (0x20) applies the minimum offset, 0x00 applies the maximum negative offset, and 0x3F applies the maximum positive offset. The resolution of the offset varies with the LNA bias mode as follows:<br>LNA Bias Mode 0: 113 $\mu$ V RTI offset resolution, $\pm 4$ mV range.<br>LNA Bias Mode 1: 186 $\mu$ V RTI offset resolution, $\pm 6$ mV range.<br>LNA Bias Mode 2: 250 $\mu$ V RTI offset resolution, $\pm 8$ mV range.<br>LNA Bias Mode 3: 440 $\mu$ V RTI offset resolution, $\pm 14$ mV range. | 0x20  | RW     |

**Register 0x11: LNA Offset 1 Register**

| Bit 7  | Bit 6 | Bit 5       | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|--------|-------|-------------|-------|-------|-------|-------|-------|
| Unused |       | LNA_OFFSET1 |       |       |       |       |       |

Table 19. LNA\_OFFSET1 Configuration Register Bit Descriptions

| Bits  | Bit Name    | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Reset | Access |
|-------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|
| [5:0] | LNA_OFFSET1 | LNA_OFFSET0 controls the offset of Channel B. The default setting (0x20) applies the minimum offset, 0x00 applies the maximum negative offset, and 0x3F applies the maximum positive offset. The resolution of the offset varies with the LNA bias mode as follows:<br>LNA Bias Mode 0: 113 $\mu$ V RTI offset resolution, $\pm 4$ mV range.<br>LNA Bias Mode 1: 186 $\mu$ V RTI offset resolution, $\pm 6$ mV range.<br>LNA Bias Mode 2: 250 $\mu$ V RTI offset resolution, $\pm 8$ mV range.<br>LNA Bias Mode 3: 440 $\mu$ V RTI offset resolution, $\pm 14$ mV range. | 0x20  | RW     |

**Register 0x12: LNA Offset 2 Register**

| Bit 7  | Bit 6 | Bit 5       | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|--------|-------|-------------|-------|-------|-------|-------|-------|
| Unused |       | LNA_OFFSET2 |       |       |       |       |       |

Table 20. LNA\_OFFSET2 Configuration Register Bit Descriptions

| Bits  | Bit Name    | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Reset | Access |
|-------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|
| [5:0] | LNA_OFFSET2 | LNA_OFFSET0 controls the offset of Channel C. The default setting (0x20) applies the minimum offset, 0x00 applies the maximum negative offset, and 0x3F applies the maximum positive offset.<br>The resolution of the offset varies with the LNA bias mode as follows:<br>LNA Bias Mode 0: 113 $\mu$ V RTI offset resolution, $\pm 4$ mV range.<br>LNA Bias Mode 1: 186 $\mu$ V RTI offset resolution, $\pm 6$ mV range.<br>LNA Bias Mode 2: 250 $\mu$ V RTI offset resolution, $\pm 8$ mV range.<br>LNA Bias Mode 3: 440 $\mu$ V RTI offset resolution, $\pm 14$ mV range. | 0x20  | RW     |

**Register 0x13: LNA Offset 3 Register**

| Bit 7  | Bit 6 | Bit 5       | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|--------|-------|-------------|-------|-------|-------|-------|-------|
| Unused |       | LNA_OFFSET3 |       |       |       |       |       |

Table 21. LNA\_OFFSET3 Configuration Register Bit Descriptions

| Bits  | Bit Name    | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Reset | Access |
|-------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|
| [5:0] | LNA_OFFSET3 | LNA_OFFSET0 controls the offset of Channel D. The default setting (0x20) applies the minimum offset, 0x00 applies the maximum negative offset, and 0x3F applies the maximum positive offset.<br>The resolution of the offset varies with the LNA bias mode as follows:<br>LNA Bias Mode 0: 113 $\mu$ V RTI offset resolution, $\pm 4$ mV range.<br>LNA Bias Mode 1: 186 $\mu$ V RTI offset resolution, $\pm 6$ mV range.<br>LNA Bias Mode 2: 250 $\mu$ V RTI offset resolution, $\pm 8$ mV range.<br>LNA Bias Mode 3: 440 $\mu$ V RTI offset resolution, $\pm 14$ mV range. | 0x20  | RW     |

**Register 0x14: PGA Bias Register**

| Bit 7  | Bit 6 | Bit 5 | Bit 4 | Bit 3        | Bit 2 | Bit 1        | Bit 0 |
|--------|-------|-------|-------|--------------|-------|--------------|-------|
| Unused |       |       |       | PGA_BIAS_SEL |       | LNA_BIAS_SEL |       |

The PGA bias select register allows the user to trade off power and performance (for example, bandwidth and noise).

Table 22. BIAS\_SEL Configuration Register Bit Descriptions

| Bits  | Bit Name     | Description                                                                             | Reset | Access |
|-------|--------------|-----------------------------------------------------------------------------------------|-------|--------|
| [3:2] | PGA_BIAS_SEL | Set PGA_BIAS_SEL to b'00 for the minimum PGA bias and to b'11 for the maximum PGA bias. | 0x00  | RW     |
| [1:0] | LNA_BIAS_SEL | Set LNA_BIAS_SEL to b'00 for the minimum LNA bias and to b'11 for the maximum LNA bias. | 0x00  | RW     |

**Register 0x15: PGA Gain Register**

| Bit 7     | Bit 6 | Bit 5     | Bit 4 | Bit 3     | Bit 2 | Bit 1     | Bit 0 |
|-----------|-------|-----------|-------|-----------|-------|-----------|-------|
| PGA_GAIN3 |       | PGA_GAIN2 |       | PGA_GAIN1 |       | PGA_GAIN0 |       |

The PGA gain register allows independent gain settings for each channel.

Table 23. PGA\_GAIN Configuration Register Bit Descriptions

| Bits  | Bit Name  | Description                                                                                                                    | Reset | Access |
|-------|-----------|--------------------------------------------------------------------------------------------------------------------------------|-------|--------|
| [7:6] | PGA_GAIN3 | Set PGA_GAIN3 to b'00 for 18 dB gain, to b'01 for 24 dB gain, to b'10 for 30 dB gain, and to b'11 for 36 dB gain for Channel D | 0x00  | RW     |
| [5:4] | PGA_GAIN2 | Set PGA_GAIN2 to b'00 for 18 dB gain, to b'01 for 24 dB gain, to b'10 for 30 dB gain, and to b'11 for 36 dB gain for Channel C | 0x00  | RW     |
| [3:2] | PGA_GAIN1 | Set PGA_GAIN1 to b'00 for 18 dB gain, to b'01 for 24 dB gain, to b'10 for 30 dB gain, and to b'11 for 36 dB gain for Channel B | 0x00  | RW     |
| [1:0] | PGA_GAIN0 | Set PGA_GAIN0 to b'00 for 18 dB gain, to b'01 for 24 dB gain, to b'10 for 30 dB gain, and to b'11 for 36 dB gain for Channel A | 0x00  | RW     |

**Register 0x17: Enable Channel Register**

| Bit 7  | Bit 6 | Bit 5 | Bit 4 | Bit 3       | Bit 2       | Bit 1       | Bit 0       |
|--------|-------|-------|-------|-------------|-------------|-------------|-------------|
| Unused |       |       |       | EN_CHANNEL3 | EN_CHANNEL2 | EN_CHANNEL1 | EN_CHANNEL0 |

The enable channel register allows individual channels to be enabled or disabled. The default mode for the channel is disabled. Write 0x0F to the EN\_CHAN register to enable all channels.

When a channel is disabled but the bias generator is still enabled, the channel's current consumption is <100  $\mu$ A. When a channel is disabled, its output pins are high-Z. The enable channel register resets at AVDD power-on to 0x00 to avoid inrush current for fast supply ramps.

**Table 24. EN\_CHAN Register Bit Descriptions**

| Bits | Bit Name    | Description                                                         | Reset | Access |
|------|-------------|---------------------------------------------------------------------|-------|--------|
| 3    | EN_CHANNEL3 | Set to b'1 to enable Channel D, and set to b'0 to disable Channel D | 0x00  | RW     |
| 2    | EN_CHANNEL2 | Set to b'1 to enable Channel C, and set to b'0 to disable Channel C | 0x00  | RW     |
| 1    | EN_CHANNEL1 | Set to b'1 to enable Channel B, and set to b'0 to disable Channel B | 0x00  | RW     |
| 0    | EN_CHANNEL0 | Set to b'1 to enable Channel A, and set to b'0 to disable Channel A | 0x00  | RW     |

**Register 0x18: Enable Bias Generator Register**

| Bit 7  | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0       |
|--------|-------|-------|-------|-------|-------|-------|-------------|
| Unused |       |       |       |       |       |       | EN_BIAS_GEN |

When any channel is enabled, the bias generator is automatically enabled. The EN\_BIAS\_GEN register controls whether the bias generator stays active, even when all channels are disabled. Leaving the bias generator active decreases the enable time of the device.

**Table 25. EN\_BIAS\_GEN Register Bit Descriptions**

| Bits | Bit Name    | Description                                                                                            | Reset | Access |
|------|-------------|--------------------------------------------------------------------------------------------------------|-------|--------|
| 0    | EN_BIAS_GEN | Setting EN_BIAS_GEN to 1 keeps the bias generator active, providing a faster enable time (~2 $\mu$ s). | 0x00  | RW     |

**Register 0x1D: GPIO Write Register**

| Bit 7  | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1      | Bit 0        |
|--------|-------|-------|-------|-------|-------|------------|--------------|
| Unused |       |       |       |       |       | GPIO_WRITE | GPIO_WR_MODE |

The GPIO\_WR\_MODE bit reconfigures the SDO pin to a general-purpose input/output (GPIO) port that can be written by the GPIO\_WRITE register or read by the GPIO\_READ register.

**Table 26. SPAREWR0 Configuration Register Bit Descriptions**

| Bits | Bit Name     | Description                                                      | Reset | Access |
|------|--------------|------------------------------------------------------------------|-------|--------|
| 1    | GPIO_WRITE   | Data bit is put onto the SDO pin when GPIO write mode is active. | 0x00  | RW     |
| 0    | GPIO_WR_MODE | Write b'1 to this register to activate GPIO write mode.          | 0x00  | RW     |

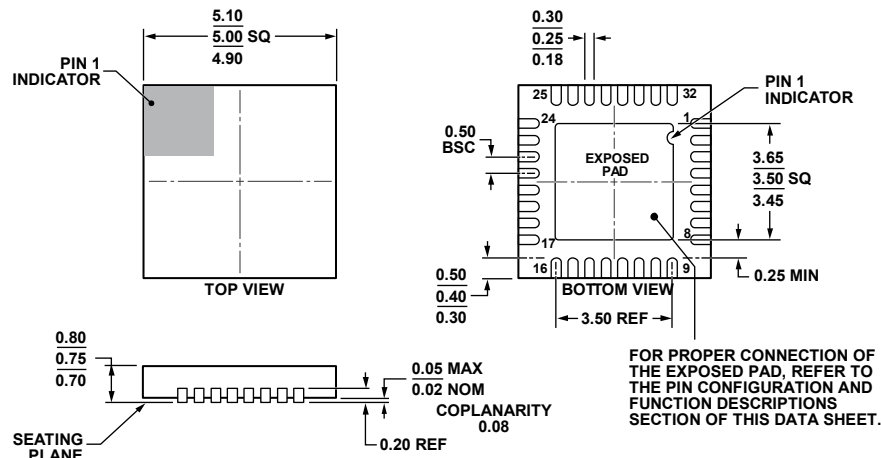
**Register 0x1E: GPIO Read Register**

| Bit 7  | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0     |
|--------|-------|-------|-------|-------|-------|-------|-----------|
| Unused |       |       |       |       |       |       | GPIO_READ |

**Table 27. SPARERD0 Configuration Register Bit Descriptions**

| Bits | Bit Name  | Description                                                                                 | Reset | Access |
|------|-----------|---------------------------------------------------------------------------------------------|-------|--------|
| 0    | GPIO_READ | This register reflects the logic level placed on SDO when a b'0 is written to GPIO_WR_MODE. | 0x00  | R      |

## OUTLINE DIMENSIONS



COMPLIANT TO JEDEC STANDARDS MO-220-WHHD.

Figure 31. 32-Lead Lead Frame Chip Scale Package [LFCSP\_WQ]  
5 mm × 5 mm Body, Very Very Thin Quad  
(CP-32-11)  
Dimensions shown in millimeters

04-02-2012-A

## ORDERING GUIDE

| Model <sup>1, 2</sup> | Temperature Range | Package Description                | Package Option |
|-----------------------|-------------------|------------------------------------|----------------|
| ADA8282WBCPZ-R7       | −40°C to +125°C   | 32-Lead LFCSP_WQ, 7" Tape and Reel | CP-32-11       |
| ADA8282WBCPZ          | −40°C to +125°C   | 32-Lead LFCSP_WQ                   | CP-32-11       |
| ADA8282CP-EBZ         |                   | Evaluation Board                   |                |

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

<sup>2</sup> W = Qualified for Automotive Applications.

## AUTOMOTIVE PRODUCTS

The [ADA8282W](#) models are available with controlled manufacturing to support the quality and reliability requirements of automotive applications. Note that these automotive models may have specifications that differ from the commercial models; therefore, designers should review the Specifications section of this data sheet carefully. Only the automotive grade products shown are available for use in automotive applications. Contact your local Analog Devices account representative for specific product ordering information and to obtain the specific Automotive Reliability reports for these models.