Evaluation Board for AD9278/AD9279

Preliminary Technical Data

UG-0xx

FEATURES

Full featured evaluation board for the AD9278/AD9279
SPI and alternate clock options
Internal and external reference options
VisualAnalog and SPI Controller software interfaces

EQUIPMENT NEEDED

Analog signal source and antialiasing filter
2 switching power supplies (6.0 V, 2.5 A) CUI EPS060250UH-PHP-SZ, provided
Linear bench top dc voltage source (0 V to 1.6 V), not required for CW Doppler mode
PC running Windows 98 (2nd edition), Windows 2000, Windows ME, or Windows XP
USB 2.0 port, recommended (USB 1.1 compatible)
AD9278/AD9279 evaluation board
HSC-ADC-EVALCZ FPGA-based data capture kit
For CW Doppler mode: spectrum analyzer

DOCUMENTS NEEDED

AD9278/AD9279 data sheet
HSC-ADC-EVALCZ data sheet, *High Speed Converter Evaluation Platform* (FPGA-based data capture kit)
AN-905 Application Note, *VisualAnalog Converter Evaluation Tool Version 1.0 User Manual*
AN-878 Application Note, *High Speed ADC SPI Control Software*
AN-877 Application Note, *Interface to High Speed ADCs via SPI*

SOFTWARE NEEDED

VisualAnalog
SPI Controller

GENERAL DESCRIPTION

This document describes the AD9278/AD9279 evaluation board, which provides all of the support circuitry required to operate the AD9278/AD9279 in their various modes and configurations. The application software used to interface with the devices is also described.

The AD9278/AD9279 data sheets, available at www.analog.com, provide additional information and should be consulted when using the evaluation board. All documents and software tools are available at http://www.analog.com/fifo. For any questions, send an email to highspeed.converters@analog.com.

TYPICAL MEASUREMENT SETUP

Figure 1. AD9278-65EBZ/AD9278-80KITZ/AD9279-50EBZ or Evaluation Board and HSC-ADC-EVALCZ Data Capture Board

Rev. PrA

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11/10—Revision PrA: Initial Version

EVALUATION BOARD HARDWARE

The AD9278/AD9279 evaluation board provides all of the support circuitry required to operate the AD9278/AD9279 in its various modes and configurations. Figure 2 shows the typical bench characterization setup used to evaluate the ac performance of the AD9278/AD9279. It is critical that the signal sources used for the analog input and clock have very low phase noise (<1 ps rms jitter) to realize the optimum performance of the signal chain. Proper filtering of the analog input signal to remove harmonics and lower the integrated or broadband noise at the input is necessary to achieve the specified noise performance (see the AD9278 or AD9279 data sheet).

See the Evaluation Board Software Quick Start Procedures section to get started and Figure 20 to Figure 31 for the complete schematics and layout diagrams that demonstrate the routing and grounding techniques that should be applied at the system level.

POWER SUPPLIES

This evaluation board comes with a wall-mountable switching power supply that provides a 6 V, 2 A maximum output. Connect the supply to the rated 100 V ac to 240 V ac wall outlet at 47 Hz to 63 Hz. The other end is a 2.1 mm inner diameter jack that connects to the PCB at P601. Once on the PC board, the 6 V supply is fused and conditioned before connecting to low dropout linear regulators that supply the proper bias to each of the various sections on the board.

When operating the evaluation board in a nondefault condition, L602, L603, L604, L605, L606, L607, L608 and L609 can be removed to disconnect the switching power supply. This enables the user to bias each section of the board individually. Use P602, P603, and P606 to connect a different supply for each section. At least one 1.8 V supply is needed with a 1 A current capability for 1.8 V AVDD and 1.8 V DRVDD; however, it is recommended that separate supplies be used for both analog and digital domains. An additional supply is also required to supply 3.0 V to the DUT, 3.0 V AVDD2. This should also have a 1 A current capability. To operate the evaluation board using the SPI and alternate clock options, a separate 3.3 V analog supply is needed in addition to the other supplies. The 3.3 V supply, or 3.3VAVDD, should have a 1 A current capability. To bias the CW I/Q Demodulator section and differential gain drive circuitry, separate +5 V and −5 V supplies are required at P606. These should each have 1 A current capability.

INPUT SIGNALS

When connecting the clock, 4LO and analog source, use clean signal generators with low phase noise, such as Rohde & Schwarz SMA or HP8644B signal generators or the equivalent. Use a 1 m, shielded, RG-58, 50 Ω coaxial cable for making connections to the evaluation board. Enter the desired frequency and amplitude (refer to the specifications in the AD9278 or AD9279 data sheet). The evaluation board is set up to be clocked from the crystal oscillator, OSC501.

If a different or external clock source is desired, follow the instructions in the Clock section. Typically, most Analog Devices, Inc. evaluation boards can accept ~2.8 V p-p or 13 dBm sine wave input for the clock. When connecting the analog input source, it is recommended to use a multipole, narrow-band band-pass filter with 50 Ω terminations. Analog Devices uses TTE and K&L Microwave, Inc., band-pass filters. The filter should be connected directly to the evaluation board.

OUTPUT SIGNALS

The default TGC setup uses the FIFO5 high speed, dual-channel FIFO data capture board (HSC-ADC-EVALCZ). Two of the eight TGC channels can then be evaluated at the same time. For more information on channel settings on these boards and their optional settings, visit www.analog.com/FIFO.

The default I/Q demodulator setup uses two ADA4841 amplifiers for I-V conversion and two ADA4841 amplifiers for gain and filtering. The analog outputs can be evaluated using an oscilloscope or spectrum analyzer.

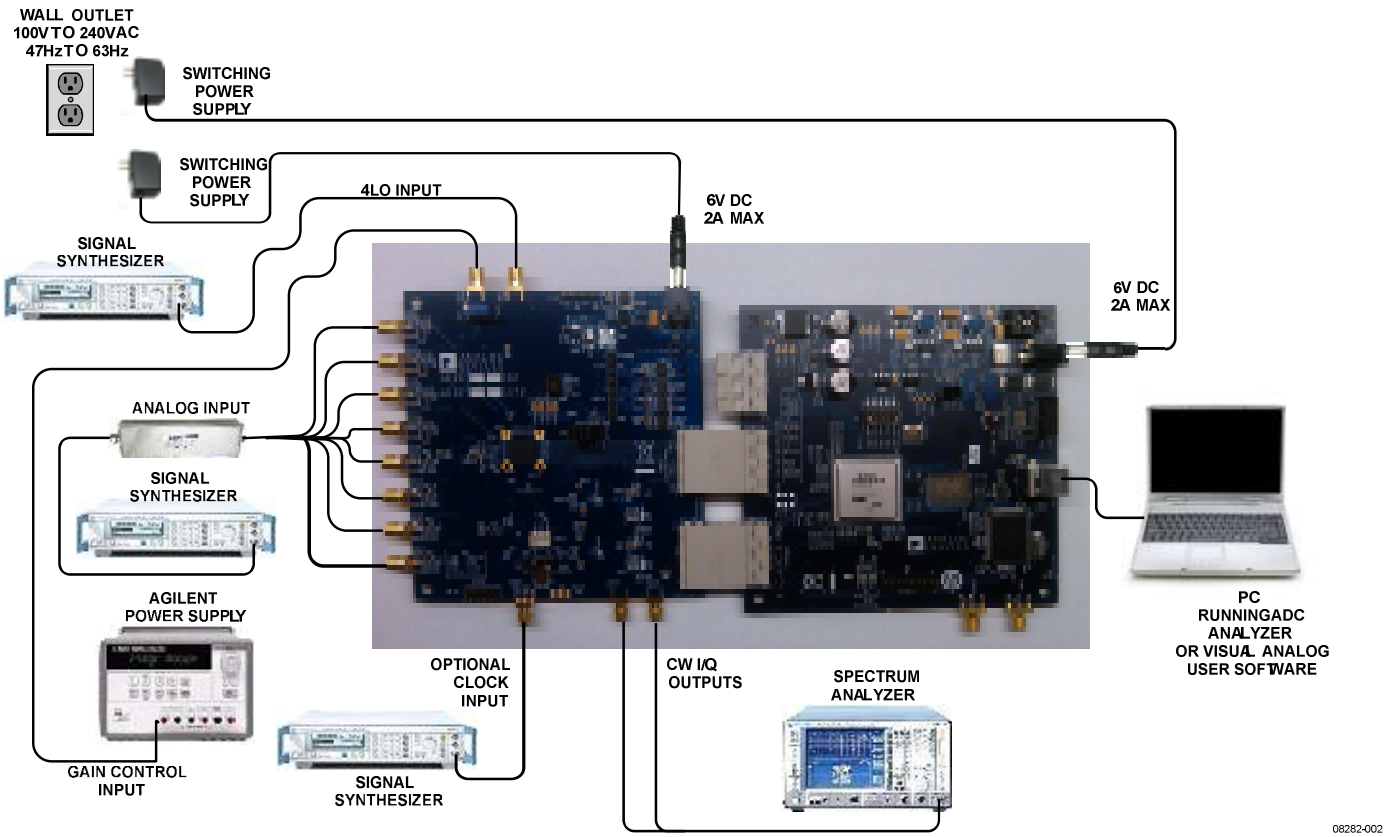

Figure 2. Evaluation Board Connection

DEFAULT OPERATION AND JUMPER SELECTION SETTINGS

This section explains the default and optional settings or modes allowed on the AD9278/AD9279 Rev. B evaluation board.

Power Circuitry

Connect the switching power supply that is supplied in the evaluation kit between a rated 100 V ac to 240 V ac wall outlet at 47 Hz to 63 Hz and P601.

Analog Input Front-End Circuit

The evaluation board is set up for single ended Kelvin connection analog input with an optimum 50 Ω impedance match of 18 MHz of bandwidth. For a different bandwidth response, use the "manual tune" feature and antialiasing filter settings.

VREF

VREF is set to 1.0 V. This causes the ADC to operate with the internal reference in the 2.0 V p-p full-scale range. A separate external reference option using the ADR130 is also included on the evaluation board. Populate R320 with a 0 Ω resistor and remove C301. Note that ADC full-scale ranges less than 2.0 V p-p are not supported by the AD9278/AD9279.

RBIAS

RBIAS has a default setting of 10 kΩ (R304) to ground and is used to set the ADC core bias current. However, note that using other than a 10 kΩ, 1% resistor for RBIAS may degrade the performance of the device, depending on the resistor chosen.

Clock Circuitry

The default clock input circuitry is derived from a sim ple transformer-coupled circuit using a high bandwidth 1:1 impedance ratio transformer (T501) that adds a very low amount of jitter to the clock path. The clock input is 50 Ω terminated and ac-coupled to handle single-ended sine wave types of inputs. The transformer converts the single-ended input to a differential signal that is clipped before entering the ADC clock inputs.

The evaluation board is already set up to be clocked from the crystal oscillator, OSC501. This oscillator is a low phase noise oscillator from Valpey Fisher (VFAC3HL-40MHz). If a different clock source is desired, remove R503, set Jumper J501 to disable the oscillator from running, and connect the external clock source to the SMA connector, J503.

A differential LVPECL clock driver can also be used to clock the ADC input using the AD9516 (U501). Populate C528 and C529 with 0.1 μF capacitors and remove C506 and C507 to disconnect the default clock path inputs. In addition, populate C511 and C512 with a 0.1 μF capacitor. The AD9516 has many SPI-selectable options that are set to a default mode of operation. Consult the AD9516data sheet for more information about these and other options.

PDWN

To enable the power-down feature, short P301 (Pin 3 to Pin 4) to the on position (AVDD) on the PDWN pin.

STBY

To enable the standby feature, short P301 (Pin 1 to Pin 2) to the on position (AVDD) on the STBY pin.

GAIN+, GAIN–

To change the VGA attenuation, drive the GAIN+ pin from 0 V to 1.6 V on J401 using a linear supply, and use a single-ended method to change the VGA gain from 0 dB to 45 dB. U411 is available for users who wish to drive the gain pins (GAIN±) differentially. Install R426, R435, and R436 and remove C456, C457, and R440 to connect the amplifier correctly. In differential mode, a linear supply from −0.8 V to +0.8 V on J401 is required to change the VGA gain from 0 dB to 42 dB.

If an external source is not available, remove R425, and install R438 to use the on-board resistive divider (R439) for gain adjustment in either the single-ended case.

CWI/Q+, CWI/Q–

To view the CWI+/CWI– and/or CWQ+/CWQ– outputs, configure the AD9278/AD9279 to be in CW Mode and enable each channel via the SPI Controller program. Apply a 13dBm, 20MHz reference clock on J303. Each enabled channel will be summed and will be available through J402/J403.

DOUTx+, DOUTx–

If an alternative data capture method to the setup described in Figure 2 is used, optional receiver terminations, R604 to R613, can be installed next to the high-speed backplane connector, P604.

EVALUATION BOARD SOFTWARE QUICK START PROCEDURES

This section provides quick start procedures for using the AD9278/AD9279, either on the evaluation board or at the system level design. Both the default and optional settings are described.

CONFIGURING THE BOARD FOR TGC MODE

Before using the software for testing, configure the evaluation board as follows:

1. Connect the boards to each other as shown in Figure 1 and Figure 2.
2. Connect one 6 V, 2.5 A switching power supply (such as the CUI Inc. EPS060250UH-PHP-SZ supplied) to the AD9278/AD9279 board.
3. Connect one 6 V, 2.5 A switching power supply (such as the CUI EPS060250UH-PHP-SZ supplied) to the HSC-ADC-EVALCZ board.
4. Connect the HSC-ADC-EVALCZ board to the PC with a USB cable. Connect to J6.
5. On the AFE evaluation board, place jumpers on all five pin pairs of J404 to connect the SPI bus.
6. On the AFE evaluation board, ensure that J501 (OSC_EN) is jumpered to the OFF setting to use the on-board 40 MHz Valpey Fisher VFAC3 oscillator.
7. On the AFE evaluation board, use a clean signal generator with low phase noise to provide an input signal to the desired channel. Use a 1 m, shielded, RG-58, 50 Ω coaxial cable to connect the signal generator. For best results, use a narrow-band band-pass filter with 50 Ω terminations and an appropriate center frequency (Analog Devices uses TTE, Allen Avionics, and K&L band-pass filters).

USING THE SOFTWARE FOR TESTING

Set Up the ADC Data Capture Block

After configuring the board, set up the ADC data capture block using the following steps:

1. Open VisualAnalog™ on a PC. AD9278 or AD9279 should be listed in the status bar of the **New Canvas** window. Select the template that corresponds to the type of testing to be performed (see Figure 3).

Figure 3. VisualAnalog, New Canvas Window

2. After the template is selected, a dialog box opens, asking if the default configuration can be used to program the FPGA (see Figure 4). Click **Yes**, and the window closes.

   If a different program is desired, follow Step 3.

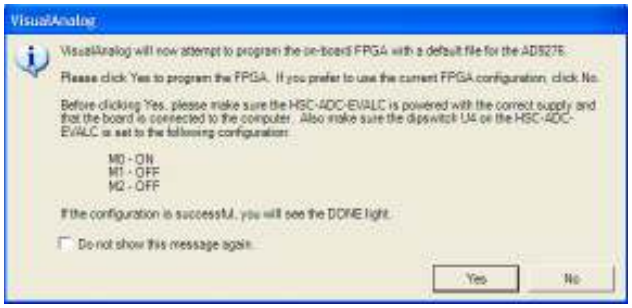

Figure 4. VisualAnalog, New Canvas Window

3. To view different channels or change features to settings other than the default settings, click the **Expand Display** button. This is located on the bottom right corner of the window, as shown in Figure 5.

   This process is described in the AN-905 Application Note, *VisualAnalog Converter Evaluation Tool Version 1.0 User Manual*. After you are finished, click the **Collapse Display** button (see Figure 6).

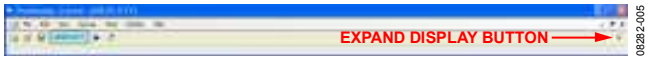

Figure 5. VisualAnalog Window Toolbar, Collapsed Display

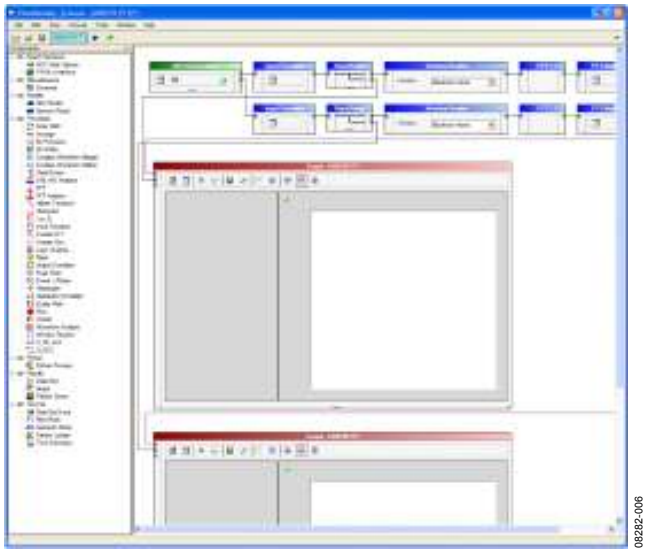

Figure 6. VisualAnalog, Main Window

4. Program the HSC-ADC-EVALCZ board's FPGA to a setting other than the default setting as described in Step 3. Then expand the VisualAnalog display and click the **Settings** button in the **ADC Data Capture** block (see Figure 6). The **ADC Data Capture Settings** box opens (see Figure 7).

Figure 7. ADC Data Capture Settings Window, Board Settings Tab

5. Select the **Board Settings** tab and browse to the appropriate programming file. If you are using an encode rate <28 MSPS, select **Octal_Low_Speed.bin**. If you are using an encode rate >28 MSPS, select **Octal_High_Speed.bin**. Next, click **Program**; the **DONE** LED in the HSC-ADC-EVALCZ board should then turn on. If more than two channels are required to be displayed, select **Octal_High_8-Channel_synchronous Capture.bin**. This canvas allows the user to display all the channels at once. The drawback is that each FFT display is only 8k points.

   Exit the **ADC Data Capture Settings** box by clicking **OK**.

Set up the SPI Controller

Once the ADC data capture board setup has been completed, set up the SPI Controller:

1. Open the SPI Controller software by going to the **Start** menu or double-clicking the SPI Controller software desktop icon. If prompted for a configuration file, select the appropriate one. If not, check the title bar of the window to determine which configuration is loaded. If necessary, choose **Cfg Open** from the **File** menu and select the appropriate one. Note that the **CHIP ID(1)** field should be filled to indicate whether the correct SPI Controller configuration file is loaded or not (see Figure 8).

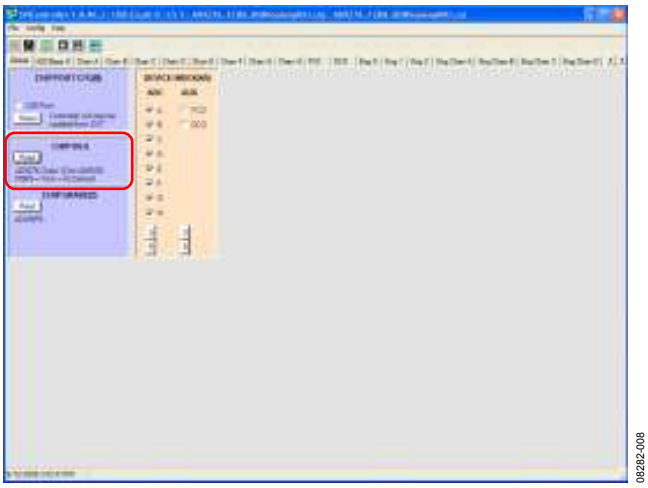

Figure 8. SPI Controller, CHIP ID(1) Box

2. Click the **New DUT** button in SPI Controller.

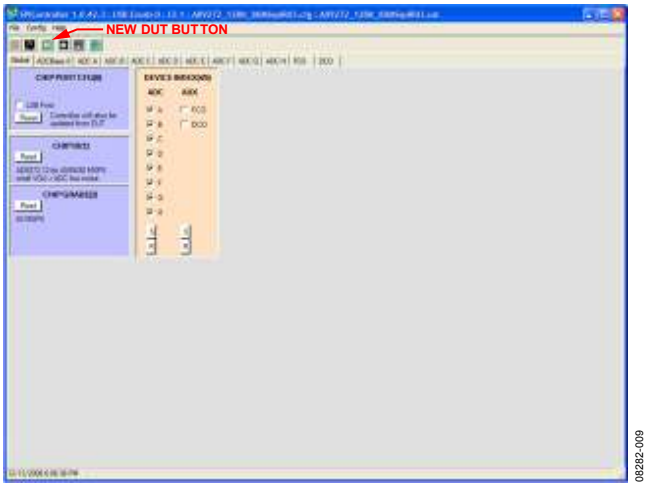

Figure 9. SPI Controller, New DUT Button

3. In the **Global** tab of SPI Controller, find the **CHIP GRADE(2)** box. Use the drop-down select box to select the correct speed mode, if necessary. See the AD9278 or AD9279 data sheet, the AN-878 Application Note, and the AN-877 Application Note for reference.

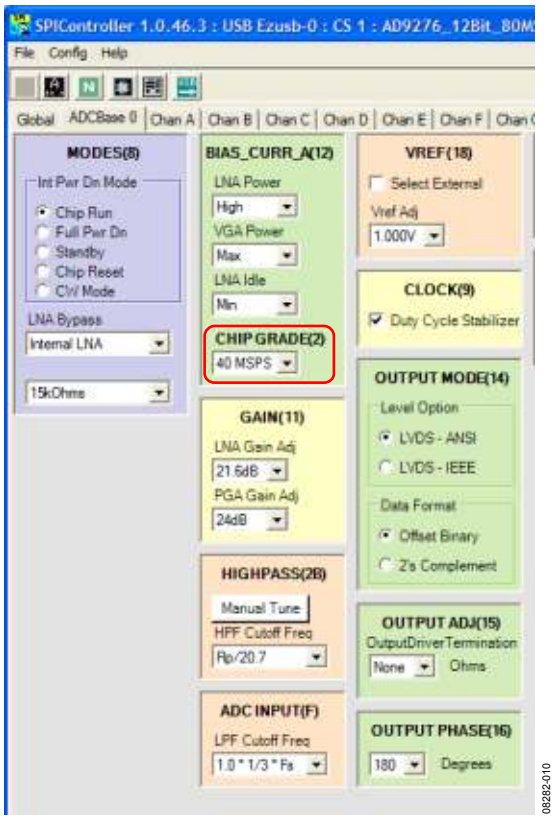

Figure 10. SPI Controller, ADCBase 0 Tab

4. In the **ADCBase 0** tab of SPI Controller, find the **HIGHPASS(2B)** box. Click the **Manual Tune** button to calibrate the antialiasing filter. See the AD9278 or AD9279 data sheet, the AN-878 Application Note, and the AN-877 Application Note for reference.

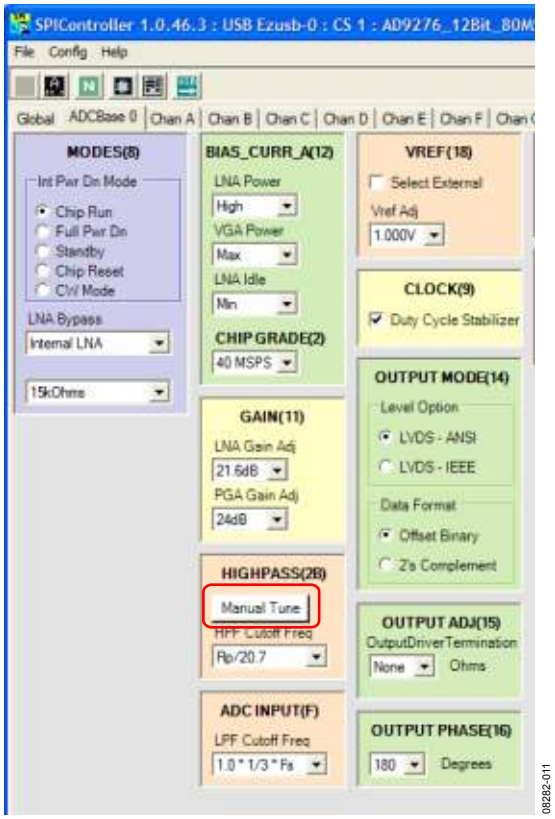

Figure 11. SPI Controller, ADCBase 0 Tab

5. In the **ADC A** tab of SPI Controller, find the **OFFSET(10)** box. Use the drop-down select box labeled **Offset Adj** to perform an offset correction to the LNA if the LNA power setting **BIAS_CURR_A(12)** has been set low. The default value is 32.

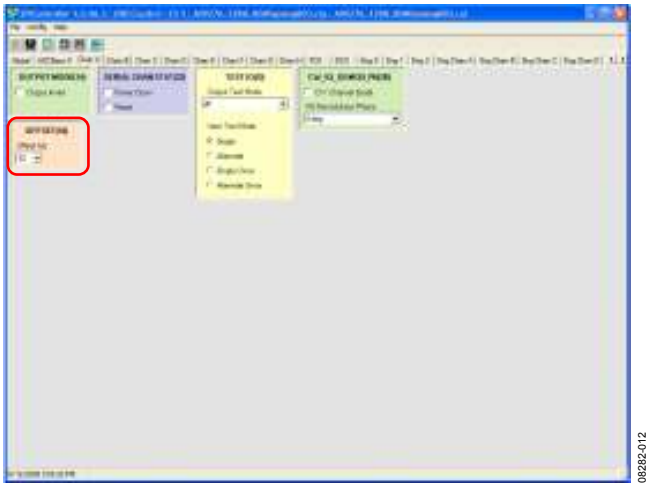

Figure 12. SPI Controller, OFFSET(10) Box

6. Click the **Run** button in the VisualAnalog toolbar.

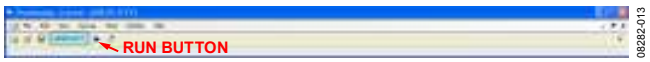

Figure 13. VisualAnalog Window Toolbar, Collapsed Display

Adjust the Amplitude of the Input Signal

Next, adjust the amplitude of the input signal for each channel as follows:

1. Adjust the amplitude of the input signal so that the fundamental is at the desired level. (Examine the **Fund Power** reading in the left panel of the **VisualAnalog FFT** window.) If the gain pin voltage is too low, it is not possible to reach full scale without distortion. Use a higher gain setting or a lower input level to avoid distortion. This also depends on the PGA gain setting, which can be 30 dB, 27 dB, 24 dB (default), or 21 dB. See Figure 14 and Figure 15.

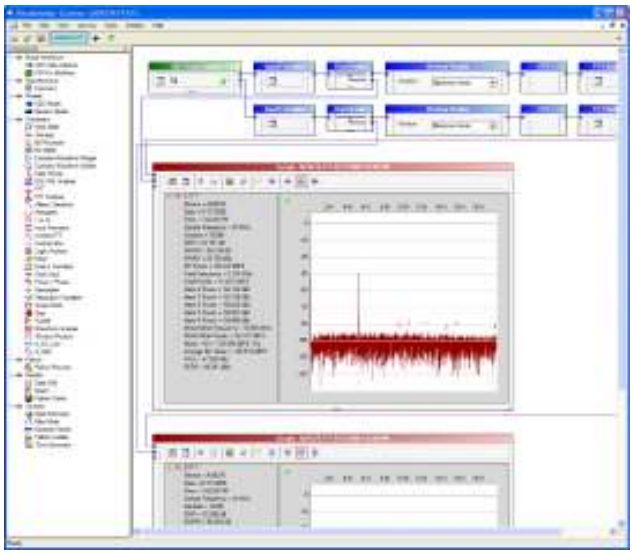

Figure 14. VisualAnalog, Graph Window, Gain = 0V

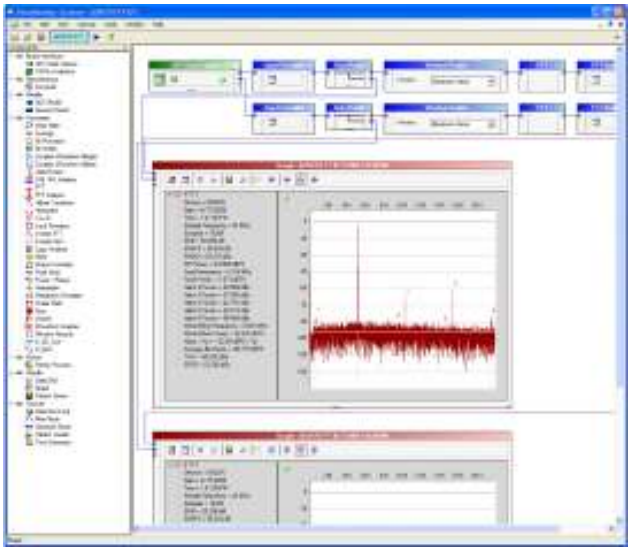

Figure 15. VisualAnalog, Graph Window, Gain = 1.6V

2. Repeat this procedure for the other seven channels.
3. Click the disk icon within the **Graph** window to save the performance plot. See Figure 16.

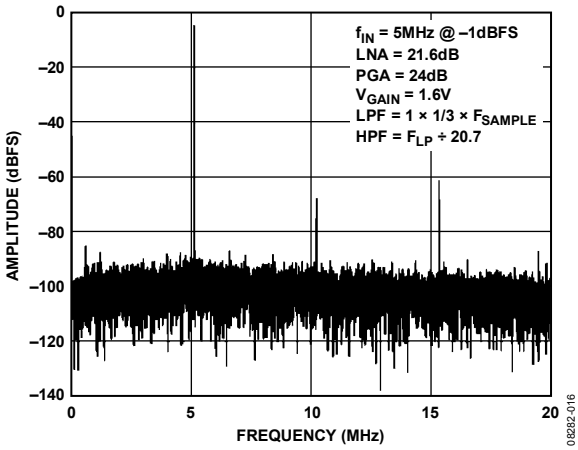

Figure 16. Typical FFT, AD9279/AD9278-50

USING THE INTEGRATED I/Q DEMODULATOR (CW DOPPLER MODE)

To examine the spectrum of the CW Doppler integrated I/Q demodulator output, use the following procedure:

1. Complete the steps in the Configuring the Board and Using the Software for Testing sections to ensure that the board is set up correctly.
2. Optionally, remove the voltage source from the gain pin, J401. It does not affect the CW Doppler output.
3. Use a 1 m, shielded, RG-58, 50 Ω coaxial cable to connect the spectrum analyzer to J402 and/or J403.
8. Connect a 20 MHz signal source to J303, 4LO input. Use a clean signal generator with low phase noise to provide an input clock signal. Use a 1 m, shielded, RG-58, 50 Ω coaxial cable to connect the signal generator.
9. Connect a 5.0123 MHz signal source to ChA, J101. Use a clean signal generator with low phase noise to provide an input signal to the desired channel. Use a 1 m, shielded, RG-58, 50 Ω coaxial cable to connect the signal generator. For best results, use a narrow-band band-pass filter with 50 Ω terminations and an appropriate center frequency (Analog Devices uses TTE, Allen Avionics, and K&L band-pass filters).
4. In the **ADCBase 0** tab of SPI Controller, find the **MODES(8)** box. Select the **CW Mode** option.

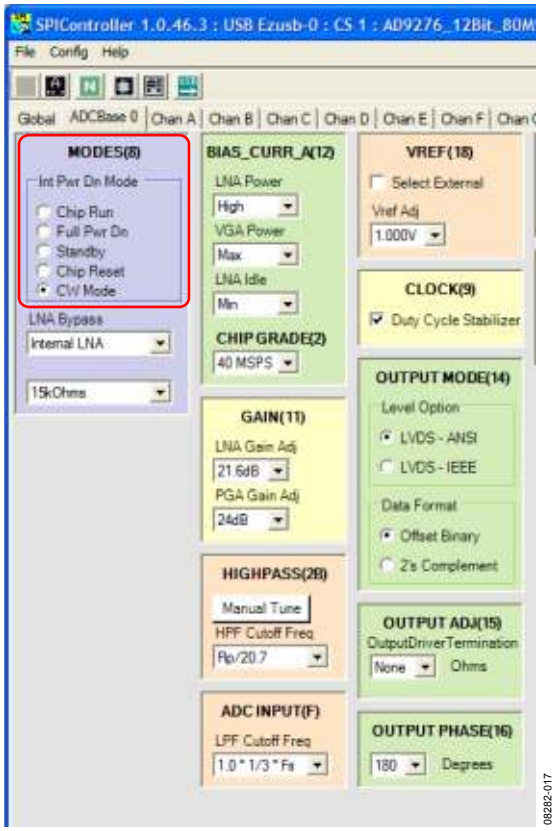

Figure 17. SPI Controller, MODES(8) Box

5. In the **ADC x** tab of SPI Controller, where x is the channel to which an analog input is applied, find the **CW_IQ_DEMOD_PH(2D)** box. Select the **CW Channel Enabl** check box to enable the channel. Then select the phase rotation of the channel using the **I/Q Demoduator Phase** pull-down menu.

Figure 18. SPI Controller, CW_IQ_DEMOD_PH(2D) Box

6. Examine the spectrum analyzer for the CW Doppler output (see Figure 19 for an example).

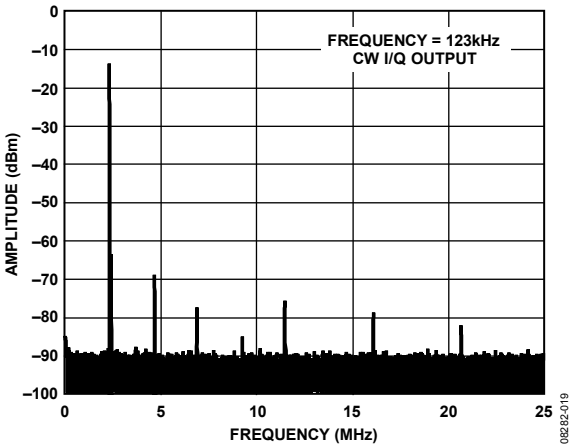

Figure 19. Typical Spectrum Analyzer Display of CWD Output

EVALUATION BOARD SCHEMATICS AND ARTWORK

Figure 20. Evaluation Board Schematic, DUT Analog Input Circuits

Figure 21. Evaluation Board Schematic, DUT Analog Input Circuits (Continued)

Figure 22. Evaluation Board Schematic, DUT, VREF, and Decoupling

Figure 23. Evaluation Board Schematic, I/Q Demodulator, SPI, and Gain Drive Circuitry

Figure 24. Evaluation Board Schematic, Clock Circuitry

Figure 25. Evaluation Board Schematic, Power Supply, Digital Output Interface

Figure 26. Evaluation Board Layout, Top Side

Figure 27. Evaluation Board Layout, Ground Plane (Layer 2)

Figure 28. Evaluation Board Layout, Power Plane (Layer 3)

Figure 29. Evaluation Board Layout, Power Plane (Layer 4)

Figure 30. Evaluation Board Layout, Ground Plane (Layer 5)

Figure 31. Evaluation Board Layout, Bottom Side

ORDERING INFORMATION

BILL OF MATERIALS

Table 1.

Item	Qty	Reference Designator	Description	Manufacturer	Part Number	Install?	ADI Supply	Alternative?
1		C101, C102, C106, C110, C111, C115, C120, C121, C125, C130, C131, C136, C201, C202, C206, C210, C211, C215, C220, C221, C225, C230, C231, C236, C302, C303, C304, C305, C306, C307, C308, C309, C310, C311, C312, C313, C314, C315, C316, C317, C318, C319, C320, C326, C327, C328, C329, C330, C404, C413, C415, C418, C419, C420, C421, C422, C423, C424, C431, C437, C439, C442, C443, C444, C445, C446, C447, C448, C450, C451, C453, C454, C455, C456, C457, C458, C459, C462, C463, C501, C502, C503, C504, C505, C506, C507, C510, C518, C519, C513, C514, C518, C519, C520, C521, C522, C523, C527, C532, C533, C615, C617, C619, C621, C627, C629	Capacitor, 0.1 µF, 0402, X5R, Ceramic, 10 V	Panasonic	ECJ-0EB1A104K	Yes	No	Yes
2	2	C624, C625	Capacitor, 1 µF, 0402, 6.3 V, ceramic, X5R	Panasonic	ECJ-0EB0J105M	Yes	No	Yes
3	1	C509	Capacitor, 0.22 µF, 0402, 6.3 V, ceramic	Panasonic	ECJ-0EB0J224K	Yes	No	Yes
5	2	C449, C452	Capacitor, 1000 pF, 0402, 50 V, ceramic, X7R	Panasonic	ECJ-0EB1H102K	Yes	No	Yes
6	4	C401, C407, C425, C430, C630	Capacitor, 1500 pF, 0402, 25 V, ceramic, X7R	Panasonic	ECJ-0EB1E152K	Yes	No	Yes
7	6	C408, C409, C410, C432, C433, C434	Capacitor, 150 pF, 0402, 50 V, ceramic, X7R	Panasonic	ECJ-0EB1H151K	Yes	No	Yes
8	4	C411, C412, C435, C436	Capacitor, 2700 pF, 0402, 25 V, ceramic, X7R	Panasonic	ECJ-0EB1E272K	Yes	No	Yes
9	1	C515	Capacitor, 900 pF, 0402, 25 V ceramic, X7R	Panasonic	ECJ-0EB1E392K	Yes	No	Yes
10	1	C631	Capacitor, 33 pF, 0402, 50 V ceramic, X7R	Panasonic	ECJ-0EC1H330J	Yes	No	Yes
11	4	C403, C405, C427, C428	Capacitor, 5 pF, 0603, 25 V, ceramic, X7R	Philips	0603CG609C9B200	Yes	No	Yes
12	4	C603, C606, C609, C612	Capacitor, 10000 pF, 0402, 16 V, ceramic, X7R	Panasonic	ECJ-0EB1C103K	Yes	No	Yes

Item	Qty	Reference Designator	Description	Manufacturer	Part Number	Install?	ADI Supply	Alternative?
13	1	C516	Capacitor, 22000 pF, 0402, 25 V, ceramic, Y5V	Panasonic	ECJ-0EF1E223Z	Yes	No	Yes
14	1	C301	Capacitor, 1 µF, 0603, 16 V, ceramic, X5R	Panasonic	ECJ-BVB1C105M	Yes	No	Yes
15	10	C602, C604, C605, C607, C608, C610, C611, C613, C622, C623	Capacitor, 4.7 µF, 0603, 6.3 V, ceramic, X5R	Panasonic	ECJ-1VB0J475M	Yes	No	Yes
16	10	C414, C416, C438, C440, C614, C616, C618, C620, C626, C628	Capacitor, 10 µF, 0603, 6.3 V, ceramic, X5R	Panasonic	ECJ-1VB0J106M	Yes	No	Yes
17	1	C632	Capacitor, 4.7 µF, 0805, 25 V, ceramic, X5R	Murata	GRM21BR61E475KA12L	Yes	No	Yes
68	1	C633	Capacitor, 47 µF, 0805, 6.3 V, ceramic, X5R	Taiyo Yuden	JMK212BJ476MG-T	Yes	No	Yes
18	6	C402, C406, C426, C429, C460, C461	Capacitor, 22 µF, 0805, 6.3 V, ceramic, X5R	Panasonic	ECJ-2FB0J226M	Yes	No	Yes
19	1	C601	Capacitor, 10 µF, 6032-28, tantalum, SMD, 16 V, 10%	Kemet	T491C106K016AT	Yes	No	Yes
20	5	CR301, CR302, CR303, CR304, CR601	LED, 0603, green	Panasonic	LNJ314G8TRA	Yes	No	Yes
21	10	D101, D102, D103, D104, D201, D202, D203, D204, D301, D501	Diode schottky GP LN 20 V SOT-23 200 mA SS	FAIRCHILD	MMBD4148SE	Yes	No	No
22	5	D601, D602, D603, D604, D605	Diode, silicon rectifier, SMBJ, 2 A, 50 V	Microcommercial	S2A-TP	Yes	No	Yes
69	1	D606	Diode, dual surface mount	Diodes Inc	MMBZ15VAL-7	Yes	No	Yes
70	1	D607	Diode, Zener	Diodes Inc	SMAZ9V1-13	Yes	No	Yes
23	1	F601	Polyswitch 1.10 A reset fuse SMD	Tyco/Raychem	NANOSMDC110F-2	Yes	No	No
24	14	J101, J102, J103, J104, J201, J202, J203, J204, J401, J402, J403, P303, P501, P503	SMA, end launch, coax	Samtec	SMA-J-P-H-ST-EM1	Yes	Yes	Yes
25	2	P305, J502	Header, 4-pin double row, male, 100 mil, straight	Samtec	TSW-104-07-G-D	Yes	Yes	Yes
71	1	J404	Header, 5-pin double row, male, 100 mil, straight	Samtec	TSW-105-07-G-D	Yes	Yes	Yes
26	1	J501	Header, 3-pin single row, male, 100 mil, straight	Samtec	TSW-103-07-G-S	Yes	Yes	Yes
27	2	P301, TP501	Header, 2-pin double row, male, 100 mil, straight	Samtec	TSW-102-07-G-D	Yes	No	Yes
28	1	P304	Header, 2-pin single row, male, 100 mil, straight	Samtec	TSW-102-07-G-S	Yes	Yes	Yes
29	1	P601	Power supply connector	Switchcraft	RAPC722X	Yes	No	No

Item	Qty	Reference Designator	Description	Manufacturer	Part Number	Install?	ADI Supply	Alternative?
30	2	P604, P605	Connector, 60-pin RA	Tyco	6469169-1	Yes	Yes	No
31	3	P602, P603, P606	Terminal block, 4-pin, ST	Weiland	Z5.531.3425.0	Yes	Yes	Yes
32	14	L401, L402, L602, L603, L604, L605, L606, L607, L608, L609, L610, L611, L612, L613	Inductor, ferrite bead, 50 Ω 3 A 1206	Murata	BLM31PG500SN1L	Yes	No	Yes
33	1	L601	EMI filter LC block choke coil	Murata	BNX016-01	Yes	Yes	No
72	1	L614	Inductor, 4.7 µH, shielded power	Coilcraft	LPS4018-472L	Yes	No	No
34	1	OSC501	Clock oscillator, ACMOS/LSTTL compatible	Valpey Fisher	VFAC3HL80	Yes	Yes	No
35	15	R101, R115, R130, R145, R201, R215, R230, R245, R319, R425, R498, R499, R504, R531, R532	Resistor, 49.9 Ω, 0402, 1/16 W, 1%	Panasonic	ERJ-2RKF49R9X	Yes	No	Yes
36	20	R102, R116, R131, R146, R202, R216, R231, R246, R503, R505, R506, R507, R508, R509, R510, R519, R526, R527, R451, R453	Resistor, 0 Ω, 0402, 1/10 W, 1%	Panasonic	ERJ-2GE0R00X	Yes	No	Yes
37	8	R107, R121, R136, R151, R207, R221, R236, R251	Resistor, 348 Ω, 0402, 1/16W, 1%	Panasonic	ERJ-2RKF3480X	Yes	No	Yes
38	10	R301, R302, R305, R441, R442, R443, R405, R417, R449, R450	Resistor, 1.00 kΩ, 0402, 1/16 W, 1%	PANASONIC	ERJ-2RKF1001X	Yes	No	Yes
39	18	R303, R304, R402, R403, R414, R415, R444, R445, R446, R501, R502, R514, R515, R516, R538, R539, R602, R615	Resistor, 10.0 kΩ, 0402, 1/16 W, 1%	Panasonic	ERJ-2RKF1002X	Yes	No	Yes
73	5	R407, R409, R410, R419, R421, R422	Resistor, 20.0 kΩ, 0402, 1/10 W, 5%	Panasonic	ERJ-2GEJ203X	Yes	No	Yes
40	7	R306, R307, R308, R309, R310, R321, R517	Resistor, 5.1 kΩ, 0402, 1/10 W, 5%	Panasonic	ERJ-2GEJ512X	Yes	No	Yes
41	5	R427, R429, R520, R521, R528	Resistor, 200 Ω, 0402, 1/16 W, 1%	Panasonic	ERJ-2RKF2000X	Yes	No	Yes
42	2	R428, R430	Resistor, 221 Ω, 0402, 1/16 W, 1%	Panasonic	ERJ-2RKF2210X	Yes	No	Yes
42	4	R329, R440, R522, R523	Resistor, 100 Ω, 0402, 1/10 W, 1%	Panasonic	ERJ-2GEJ101X	Yes	No	Yes
43	2	R431, R432	Resistor, 24 Ω, 0402, 1/16 W, 1%	Panasonic	ERJ-2RKF24R0X	Yes	No	Yes
74	2	R534, R536	Resistor, 24.9 Ω, 0402, 1/16 W, 1%	Panasonic	ERJ-2RKF24R9X	Yes	No	Yes
44	4	R401, R404, R413, R416	Resistor, 2.00 kΩ, 0402, 1/16 W, 1%	Panasonic	ERJ-2RKF2001X	Yes	No	Yes
46	1	R447	Resistor, 27 Ω, 0402, 1/16 W, 1%	Panasonic	ERJ-2RKF27R0X	Yes	No	Yes
47	1	R433	Resistor, 33 kΩ, 0402, 1/10 W, 5%	Panasonic	ERJ-2GEJ333X	Yes	No	Yes
48	1	R434	Resistor, 10.5 kΩ, 0402, 1/16 W, 1%	Panasonic	ERJ-2RKF1052X	Yes	No	Yes
49	1	R437	Resistor, 8.66 kΩ, 0402, 1/16 W, 1%	Panasonic	ERJ-2RKF8661X	Yes	No	Yes
50	1	R439	Potentiometer, 10 kΩ sq cermet top	COPAL	CT94EW103	Yes	No	Yes
51	1	R518	Resistor, 4.12 kΩ, 0402, 1/16 W, 1%	Panasonic	ERJ-2RKF4121X	Yes	No	Yes
52	3	R540, R541, R601	Resistor, 249 Ω, 0402, 1/16 W, 1%	Panasonic	ERJ-2RKF2490X	Yes	No	Yes
53	1	R603	Resistor, 1.91 kΩ, 0402, 1/16 W, 1%	Panasonic	ERJ-2RKF1911X	Yes	No	Yes
75	1	R614	Resistor, 64.9 kΩ, 0402, 1/16 W	Panasonic	ERJ-2RKF6492X	Yes	No	Yes

Item	Qty	Reference Designator	Description	Manufacturer	Part Number	Install?	ADI Supply	Alternative?
76	1	R616	Resistor, 0.047 Ω, 0805, ¼ W, 2%	Susumu	RL1220T-R047	Yes	No	Yes
77	1	R617	Resistor, 16.9 kΩ, 0402, 1/16 W	Panasonic	ERJ-2RKF1692X	Yes	No	Yes
54	2	T301, T501	Transformer, RF, 1:1	Minicircuits	ADT1-1WT+	Yes	No	No
78	1	U302	IC-ADI ultrafast SIGe ECL clock/data buffers	ADI	ADCLK905	Yes	Yes - FedEx	No
55	2	U403, U408	IC, amp, low pwr,noise, distortion, SO8	ADI	ADA4841-2YRZ	Yes	Yes	No
56	1	U304	IC, voltage ref, precision series, SOT23_6	ADI	ADR130BUJZ	Yes	Yes	No
57	4	U401, U402, U406, U407	IC, amp, low noise high speed, SO8	ADI	AD8021ARZ	Yes	Yes	No
58	2	U404, U409	IC, ADC, 18-bit, 1 MSPS PuLSAR 7.0 mW, RM10	ADI	AD7982BRMZ	Yes	Yes	No
59	2	U405, U410	IC, VREF, prec micropwr, low dropout, SO8	ADI	ADR433BRZ	Yes	Yes	No
60	1	U411	IC, ADC driver, ultralow distortion diff, LFCSP16	ADI	ADA4938-1ACPZ-R7	Yes	Yes	No
61	1	U501	IC, clock gen, 14-output, 2.8 GHZ VCO, QFN64	ADI	AD9516-0BCPZ	Yes	Yes	No
62	1	U601	IC, regulator 3.3 V, low dropout CMOS, SO8	ADI	ADP1706ARDZ-3.3-R7	Yes	Yes	No
63	1	U602	IC, regulator 3.0 V, low dropout CMOS, SO8	ADI	ADP1706ARDZ-3.0-R7	Yes	Yes	No
64	2	U603, U604	IC, regulator 1.8 V, low dropout CMOS, SO8	ADI	ADP1706ARDZ-1.8-R7	Yes	Yes	No
65	1	U605	IC, regulator 0.8-5.0 V, low dropout CMOS, SO8	ADI	ADP1708ARDZ-R7	Yes	Yes	No
66	1	U412	IC, buffer, tinylogic UHS dual, SC70-6	Fairchild	NC7WZ07P6X	Yes	No	No
67	1	U413	IC, buffer, tinylogic UHS dual, SC70-6	Fairchild	NC7WZ16P6X	Yes	No	No
79	1	U606	IC, regulator, 500 mA neg LDO	Linear Technology	LT1175CST-5#PBF	Yes	No	No
80	1	U607	IC-ADI current-mode step-down dc-to-dc controller	ADI	ADP1864AUJZ-R7	Yes	Yes - FedEx	No

Item	Qty	Reference Designator	Description	Manufacturer	Part Number	Install?	ADI Supply	Alternative?
Do Not Install								
1	6	C413, C414, C511, C512, C528, C529	Capacitor, 0.1 µF, 0402, X5R, ceramic, 10 V	Panasonic	ECJ-0EB1A104K	No		
2	3	C524, C525, C526	Capacitor, 100 pF, 0402, 50 V, ceramic, X7R	Panasonic	ECJ-0EB1H101K	No		
4	8	C105, C114, C124, C135, C205, C214, C224, C235	Capacitor, 47 pF, 0402, X5R, ceramic, 50 V	Panasonic	ECJ-0EC1H470J	No		
3	3	L501, L502, L503	Inductor, 10 nH, SMT L7144	Coilcraft	0603CS-10NXJLW	No		
4	1	P502	SMA, end launch, coax	Samtec	SMA-J-P-H-ST-EM1	No		
5	8	R106, R120, R135, R150, R213, R220, R235, R250, R408, R420, R452, R454	Resistor, 1.00 kΩ, 0402, 1/16 W, 1%	Panasonic	ERJ-2RKF1001X	No		
6	5	R320, R426, R435, R436, R438	Resistor, 0 Ω, 0402, 1/10 W, 1%	Panasonic	ERJ-2GE0R00X	No		
7	10	R604, R605, R606, R607, R608, R609, R610, R611, R612, R613	Resistor, 100 Ω, 0402, 1/10 W, 1%	Panasonic	ERJ-2GEJ101X	No		
81		R406, R418	Resistor, 10.0 kΩ, 0402, 1/16 W, 1%					
83	8	TP401, TP402, TP403, TP404, TP405, TP406, TP407, TP408	Conn-PCB test point white	Components Corporation	TP-105-01-09			
8	2	C417,C441	Capacitor, 1 µF, 0805, 16 V, ceramic, Y5V	Panasonic	ECJ-2VF1C105Z	No	No	Yes
45	4	R411, R412, R423, R424	Resistor, 20 Ω, 0402, 1/16 W, 1%	Panasonic	ERJ-2RKF20R0X	No	No	Yes
10	1	U301	IC	ADI	AD9278	No		

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.

NOTES

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