



# Evaluation Board for 10-Bit to 16-Bit R/D Converter with Reference Oscillator

## EVAL-AD2S1210

### FEATURES

Full-featured evaluation board for the AD2S1210

EVAL-CED1Z compatible

Standalone capability

Various linking options

PC software for control and data analysis when used with the EVAL-CED1Z

### GENERAL DESCRIPTION

This data sheet describes the evaluation board for the AD2S1210, which is a complete, 10-bit to 16-bit resolution tracking resolver-to-digital converter, integrating an on-board programmable

sinusoidal oscillator that provides sine wave excitation for resolvers. Full details about the part are available in the AD2S1210 data sheet from Analog Devices, Inc., which should be consulted in conjunction with this data sheet when using the evaluation board.

On-board components include the AD8664 quad op amp, the ADM6315 voltage monitor, the PI74ALVTC16245AE bidirectional transceiver, and the 74HC573 Octal D-type transparent latch.

Various link options are explained in Table 1 and Table 2.

### FUNCTIONAL BLOCK DIAGRAM

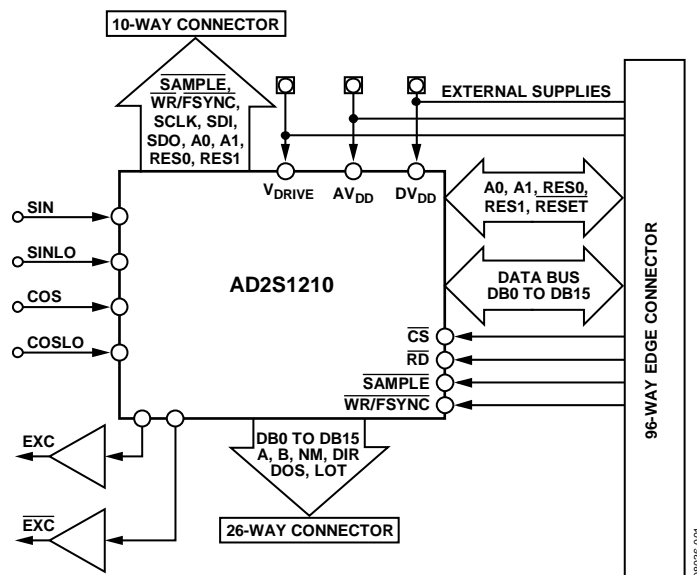


Figure 1.

#### Rev. 0

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**REVISION HISTORY**

5/09—Revision 0: Initial Version

## EVALUATION BOARD HARDWARE

### POWER SUPPLIES

When using the EVAL-AD2S1210 with the EVAL-CED1Z, all supplies are provided from the controller board through the 96-way connector.

When using the EVAL-AD2S1210 board as a standalone unit, external supplies must be provided. This evaluation board has the following six power supply inputs:

- $AV_{DD}$
- $DV_{DD}$
- $V_{DRIVE}$
- +12 V
- AGND
- DGND

If the evaluation board is used in standalone mode, 5 V must be connected to the  $AV_{DD}$  input to supply the AD2S1210  $AV_{DD}$  pin. In addition, 5 V must be connected to the  $DV_{DD}$  input to supply

the AD2S1210  $DV_{DD}$  pin, the PI74ALVTC16245AE, and the 74HC573. To supply the AD8664 quad op amp, 12 V should be used. Lastly, 0 V is connected to one or both of the AGND inputs and to the DGND input.

The  $AV_{DD}$ ,  $DV_{DD}$  and  $V_{DRIVE}$  supplies are decoupled to the relevant ground plane with 4.7  $\mu$ F tantalum and 0.01  $\mu$ F multi-layer ceramic capacitors. The AD8664, the PI74ALVTC16245AE, and the 74HC573 are decoupled to the relevant ground plane with 10  $\mu$ F tantalum and 0.1  $\mu$ F multilayer ceramic capacitors.

Extensive ground planes are used on this board to minimize the effect of high frequency noise interference. There are two ground planes, AGND and DGND. These are connected at one location close to the AD2S1210.

### LINK OPTIONS

There are 16 link options that must be positioned for the required operating setup before using the evaluation board. The functions of these options are outlined in Table 1.

**Table 1. Link Option Functions**

Link No.	Function
LK1	This link selects the source of the $\overline{SAMPLE}$ input signal for the AD2S1210. In Position A, the $\overline{SAMPLE}$ signal is received from the externally applied $\overline{SAMPLE}$ signal via the J8 SMB socket or the J20 connector. In Position B, the $\overline{SAMPLE}$ signal is received from the evaluation board controller via the 96-way connector. In Position C, the $\overline{SAMPLE}$ signal is received from the S2 push-button switch.
LK2	This link selects the source of the $\overline{CS}$ input signal for the AD2S1210. In Position A, the $\overline{CS}$ signal is received from the externally applied $\overline{CS}$ signal via the J9 SMB socket. In Position B, the $\overline{CS}$ signal is received from the evaluation board controller via the 96-way connector. In Position C, the $\overline{CS}$ signal is received from the S3 push button switch.
LK3	This link selects the source of the $\overline{RD}$ input signal for the AD2S1210. In Position A, the $\overline{RD}$ signal is received from the externally applied $\overline{RD}$ signal via the J10 SMB socket. In Position B, the $\overline{RD}$ signal is received from the evaluation board controller via the 96-way connector. In Position C, the $\overline{RD}$ signal is received from the S3 push-button switch.
LK4	This link selects the source of the $\overline{WR/FSYNC}$ input signal for the AD2S1210. In Position A, the $\overline{WR/FSYNC}$ signal is received from the externally applied $\overline{WR/FSYNC}$ signal via the J11 SMB socket or the J20 connector. In Position B, the $\overline{WR/FSYNC}$ signal is received from the evaluation board controller via the 96-way connector.
LK5	This link selects the source of the $\overline{SOE}$ input signal for the AD2S1210. In Position A, the $\overline{SOE}$ signal is tied to $V_{DRIVE}$ (parallel mode). In Position B, the $\overline{SOE}$ signal is tied to DGND (serial mode).
LK6	This link selects the source of the A0 input signal for the AD2S1210. In Position A, the A0 signal is received from the externally applied A0 signal via the J15 SMB socket or the J20 connector. In Position B, the A0 signal is received from the evaluation board controller via the 96-way connector. In Position C, the A0 signal is tied to $V_{DRIVE}$ . In Position D, the A0 signal is tied to DGND.
LK7	This link selects the source of the A1 input signal for the AD2S1210. In Position A, the A1 signal is received from the externally applied A0 signal via the J16 SMB socket or the J20 connector. In Position B, the A1 signal is received from the evaluation board controller via the 96-way connector. In Position C, the A1 signal is tied to $V_{DRIVE}$ . In Position D, the A1 signal is tied to DGND.

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Link No.	Function
LK8	<p>This link selects the source of RES0 signal for the AD2S1210.</p> <p>In Position A, the RES0 signal is received from the externally applied RES0 signal via the J17 SMB socket or the J20 connector.</p> <p>In Position B, the RES0 signal is received from the evaluation board controller via the 96-way connector.</p> <p>In Position C, the RES0 signal is tied to <math>V_{DRIVE}</math>.</p> <p>In Position D, the RES0 signal is tied to DGND.</p>
LK9	<p>This link selects the source of RES1 signal for the AD2S1210.</p> <p>In Position A, the RES1 signal is received from the externally applied RES0 signal via the J18 SMB socket or the J20 connector.</p> <p>In Position B, the RES1 signal is received from the evaluation board controller via the 96-way connector.</p> <p>In Position C, the RES1 signal is tied to <math>V_{DRIVE}</math>.</p> <p>In Position D, the RES1 signal is tied to DGND.</p>
LK10, LK11	<p>These links select the gain of the EXC and <math>\overline{EXC}</math> amplifier circuits.</p> <p>In Position A, the gain can be set by the user. Gain = <math>R/10\text{ k}\Omega</math>, where <math>R = R1 = R4</math>.</p> <p>In Position B, a gain of 1.54 is applied.</p> <p>In Position C, a gain of 0.866 is applied.</p>
LK12	<p>This link is used to select the source of the <math>\overline{OE}</math> signal for the PI74ALVTC16245AE.</p> <p>In Position A, the <math>\overline{OE}</math> signal is tied to <math>\overline{CS}</math>.</p> <p>In Position B, the <math>\overline{OE}</math> signal is tied to NC7S04 output (inversion of the <math>\overline{OE}</math> signal).</p>
LK13	<p>This link is used to select the source of the <math>AV_{DD}</math> supply for the EVAL-AD2S1210.</p> <p>In Position A, the <math>AV_{DD}</math> supply is sourced from the evaluation board controller via the 96-way connector.</p> <p>In Position B, the <math>AV_{DD}</math> supply is sourced externally via the J5 connector.</p>
LK14	<p>This link is used to select the source of the <math>DV_{DD}</math> supply for the EVAL-AD2S1210.</p> <p>In Position A, the <math>DV_{DD}</math> supply is sourced from the evaluation board controller via the 96-way connector.</p> <p>In Position B, the <math>DV_{DD}</math> supply is sourced externally via the J6 connector.</p>
LK15	<p>This link is used to select the source of the <math>V_{DRIVE}</math> supply for the EVAL-AD2S1210.</p> <p>In Position A, the <math>V_{DRIVE}</math> supply is sourced from the evaluation board controller via the 96-way connector.</p> <p>In Position B, The <math>V_{DRIVE}</math> supply is sourced externally via the J6 connector.</p>
LK16	<p>This link is used to select the source of the 12 V supply for the EVAL-AD2S1210.</p> <p>In Position A, the 12 V supply is sourced from the evaluation board controller via the 96-way connector.</p> <p>In Position B, the 12 V supply is sourced externally via the J7 connector.</p>

## SETUP CONDITIONS

Take care before applying power and signals to the evaluation board to ensure that all link positions are set according to the required operating mode. There are two different modes in which to operate the evaluation board. Either the user can operate the board with the EVAL-CED1Z or it can be used as a standalone board. Table 2 shows the position in which all the links are set when the evaluation board is packaged. When the board is shipped, the assumption is that the user will be operating with the EVAL-CED1Z. The links are set so that all power supplies and control signals are supplied by the EVAL-CED1Z.

## INTERFACING THE EVALUATION BOARD TO THE EVAL-CED1Z

Interfacing the EVAL-CED1Z to the evaluation board is via a 96-way connector, J1. The pinout for the J1 connector is shown in Figure 2. Table 3 gives a description of the pins on the 96-way connector that are used to interface the EVAL-CED1Z board to the EVAL-AD2S1210. Table 4 gives the pin designations for the 96-way connector.

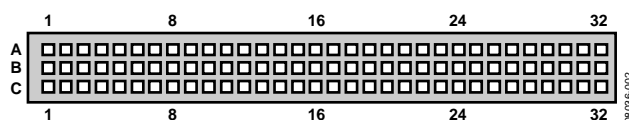


Figure 2. Pin Configuration for the 96-Way Connector, J1

Table 2. Link Position on the Packaged EVAL-AD2S1210

Link No.	Position	Function
LK1	B	$\overline{\text{SAMPLE}}$ signal is received from the evaluation board controller via the 96-way connector.
LK2	B	$\overline{\text{CS}}$ signal is received from the evaluation board controller via the 96-way connector.
LK3	B	$\overline{\text{RD}}$ signal is received from the evaluation board controller via the 96-way connector.
LK4	B	$\overline{\text{WR/FSYNC}}$ signal is received from the evaluation board controller via the 96-way connector.
LK5	A	$\overline{\text{SOE}}$ signal is tied to $\text{V}_{\text{DRIVE-}}$ .
LK6	B	A0 signal is received from the evaluation board controller via the 96-way connector.
LK7	B	A1 signal is received from the evaluation board controller via the 96-way connector.
LK8	B	RES0 signal is received from the evaluation board controller via the 96-way connector.
LK9	B	RES1 signal is received from the evaluation board controller via the 96-way connector.
LK10, LK11	B	Gain of 1.54 is selected.
LK12	A	$\overline{\text{OE}}$ signal of PI74ALVTC16245AE is tied to the $\overline{\text{CS}}$ signal.
LK13	A	$\text{AV}_{\text{DD}}$ supply is sourced from the evaluation board controller via the 96-way connector.
LK14	A	$\text{DV}_{\text{DD}}$ supply is sourced from the evaluation board controller via the 96-way connector.
LK15	A	$\text{V}_{\text{DRIVE}}$ supply is sourced from the evaluation board controller via the 96-way connector.
LK16	A	12 V supply is sourced from the evaluation board controller via the 96-way connector.

Table 3. 96-Way Connector Pin Description

Pin	Description
PAR_D0 to PAR_D15	Parallel Data Bit 0 (LSB) to Parallel Data Bit 15 (MSB).
PAR_RD	Parallel read strobe. This output is connected to the $\overline{\text{RD}}$ pin of the AD2S1210 via LK3. This signal is used as a frame synchronization signal and output enable for the parallel data outputs.
PAR_CS	Parallel chip select. This output is connected to the $\overline{\text{CS}}$ pin of the AD2S1210 via LK2 to enable the device.
PAR_WR	Parallel write strobe. This output is connected to the $\overline{\text{WR/FSYNC}}$ pin of the AD2S1210 via LK4. This signal is used as a frame synchronization signal and input enable for the parallel data inputs.
TMR0/PPI_FS2	Timer 0/Parallel Peripheral Interface Frame Sync 2. This output is connected to the $\overline{\text{SAMPLE}}$ pin of the AD2S1210 via LK1. This signal is used to transfer data from the position and velocity integrators to the position and velocity registers of the AD2S1210.
GPIO4/PAR_A0	General-Purpose Input/Output Bit 4/Parallel Address Bit 0. This output is connected to the A0 pin of the AD2S1210. Is used in conjunction with GPIO5/PAR_A1 to select the mode of the AD2S1210.
GPIO5/PAR_A1	General-Purpose Input/Output Bit 5/Parallel Address Bit 1. This output is connected to the A1 pin of the AD2S1210, and is used in conjunction with GPIO4/PAR_A0 to select the mode of the AD2S1210.
GPIO0	General-Purpose Input/Output Bit 0. This signal is connected to the RES0 pin of the AD2S1210, and is used in conjunction with GPIO1 to select the resolution of the AD2S1210.
GPIO1	General-Purpose Input/Output Bit 1. This signal is connected to the RES1 pin of the AD2S1210, and is used in conjunction with GPIO0 to select the resolution of the AD2S1210.
AGND	Analog ground. These lines are connected to the analog ground plane on the evaluation board.
DGND	Digital ground. These lines are connected to the digital ground plane on the evaluation board.
$\text{AV}_{\text{CC}}$ (+5 V)	Analog 5 V supply. This is used to supply analog circuitry on the AD2S1210.
$\text{DV}_{\text{DD}}$ (+5 V)	Digital 5 V supply. This is used to supply the PI74ALVTC16245AE, 74HC573, NC7S04, ADM6315, and digital circuitry on the AD2S1210.
+VarA (+3.3 V)	Digital 3.3 V supply connected to the $\text{V}_{\text{DRIVE}}$ pin of the AD2S1210.
+12 V	12 V supply. This line is connected to the 12 V supply line on the evaluation board via LK16 and is used to supply the AD8664.

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**Table 4. 96-Way Connector Pin Designations<sup>1</sup>**

Pin	Row A	Row B	Row C
1			
2		PAR_D0	
3		PAR_D1	
4	DGND	DGND	DGND
5		PAR_D2	
6		PAR_D3	
7		PAR_D4	
8	DV <sub>DD</sub> (+5 V)	DV <sub>DD</sub> (+5 V)	DV <sub>DD</sub> (+5 V)
9	PAR_RD	PAR_D5	PAR_WR
10		PAR_D6	PAR_CS
11		PAR_D7	
12	DGND	DGND	DGND
13		PAR_D8	
14	GPIO5/PAR_A1	PAR_D9	
15	GPIO0	PAR_D10	GPIO4/PAR_A0
16	DGND	DGND	DGND
17	TMRO/PPI_FS2	PAR_D11	
18	PAR_D12	PAR_D13	PAR_D14
19		GPIO1	PAR_D15
20	DGND	DGND	DGND
21	AGND	AGND	AGND
22	AGND	AGND	AGND
23	AGND	AGND	AGND
24	AGND	AGND	AGND
25	AGND	AGND	AGND
26	AGND	AGND	AGND
27	+VarA (+3.3 V)	AGND	+VarA (+3.3 V)
28		AGND	
29	AGND	AGND	AGND
30	–12 V	AGND	+12 V
31	AV <sub>SS</sub> (–5 V)	AV <sub>SS</sub> (–5 V)	AV <sub>SS</sub> (–5 V)
32	AV <sub>CC</sub> (+5 V)	AV <sub>CC</sub> (+5 V)	AV <sub>CC</sub> (+5 V)

<sup>1</sup> The unused pins of the 96-way connector are not shown.

## OPERATING WITH THE EVAL-CED1Z

The evaluation board can be operated in a standalone mode or operated in conjunction with the EVAL-CED1Z. This evaluation board controller is available from Analog Devices under the order entry EVAL-CED1Z.

When interfacing the EVAL-AD2S1210 directly to the EVAL-CED1Z, all supplies and control signals to operate the AD2S1210 evaluation board are provided by the EVAL-CED1Z.

Software to communicate between the EVAL-CED1Z and AD2S1210 is provided with the AD2S1210 evaluation board package.

The 96-way connector on the EVAL-AD2S1210 plugs directly into the 96-way connector on the EVAL-CED1Z. The EVAL-CED1Z provides all the supplies for the evaluation board. It is powered from a 7 V, 15 W power supply that accepts input voltages from 100 V to 240 V ac and contains the relevant

adaptors for worldwide use. The power supply is provided with the EVAL-CED1Z.

Connection between the EVAL-CED1Z and the USB port of a PC is via a standard USB 2.0 connection cable that is provided as part of the EVAL-CED1Z package.

## INTERFACING TO THE EVALUATION BOARD IN STANDALONE OPERATION

Options for interfacing with the evaluation board are via J4, a 26-way connector, via J20, a 10-way connector, or via external Socket J8 to Socket J19. These connectors and sockets are provided to allow the evaluation board to be interfaced with systems other than the Analog Devices EVAL-CED1Z. The 26-way connector, J4, is provided for use in parallel mode. The 10-way connector, J20, is provided for use in serial mode. The pin designations for both J4 and J20 are shown in Table 5 and Table 6, respectively.

**Table 5. Pin Designations for 26-Way Connector J4**

Pin No.	Row A	Row B
1	D0	D1
2	D2	D3
3	D4	D5
4	D6	D7
5	D8	D9
6	D10	D11
7	D12	D13
8	D14	D15
9	DIR	NM
10	B	A
11	LOT	DOS
12	DGND	DGND
13	VDRIVE	VDRIVE

**Table 6. Pin Designations for 10-Way Connector J20**

Pin No.	Row A	Row B
1	SAMPLE	WR/FSYNC
2	SCLK	SDI
3	SDO	A0
4	A1	RES0
5	RES1	DGND

## SOCKETS

There are 12 input/output sockets relevant to the operation of the [AD2S1210](#) on the evaluation board. The functions of these sockets are outlined in Table 7. These sockets are used to apply externally generated digital I/O signals to the evaluation board. When operating the board with the EVAL-CED1Z, these external connections are not required. Note that the AD2S1210 evaluation board is shipped with the assumption that the user will be operating with the EVAL-CED1Z. For this reason, Socket J8 to Socket J19 are not inserted.

**Table 7. Socket Functions**

Socket	Function
J8	SMB socket for external $\overline{\text{SAMPLE}}$ input
J9	SMB socket for external $\overline{\text{CS}}$ input
J10	SMB socket for external $\overline{\text{RD}}$ input
J11	SMB socket for external $\overline{\text{WR/FSYNC}}$ input
J12	SMB socket for external SCLK input for serial operation
J13	SMB socket for external SDI input for serial operation
J14	SMB socket for external SDO output for serial operation
J15	SMB socket for external A0 input
J16	SMB socket for external A1 input
J17	SMB socket for external RES0 input
J18	SMB socket for external RES1 input
J19	SMB socket for external CLKIN input

## CONNECTORS

There are eight connectors on the AD2S1210 evaluation board. The functions of these sockets are outlined in Table 8. Connector J1 is used to interface with the EVAL-CED1Z.

**Table 8. Connector Functions**

Connector	Function
J1	96-way connector for parallel interface connections
J2	SIN, COS, SINLO, COSLO inputs
J3	Excitation outputs
J4	External 26-way connector for parallel operation
J5	External AV <sub>DD</sub> and AGND power connector
J6	External DV <sub>DD</sub> , V <sub>DRIVE</sub> , and DGND power connector
J7	External 12 V and AGND power connector
J20	External 10-way connector for serial operation

## TEST POINTS

There are numerous test points on the AD2S1210 evaluation board. These test points enable the user to have easy access to the signals from the evaluation board, the external sensor, and the controller board for probing, evaluation, and debugging.

## EVALUATION BOARD SOFTWARE

### INSTALLING THE SOFTWARE

The EVAL-AD2S1210 evaluation kit includes self-installing software on a CD-ROM for controlling and evaluating the performance of the AD2S1210 when it is operated with the EVAL-CED1Z. The software is compatible with Windows® 2000/XP®. If the setup file does not run automatically, **setup.exe** can be run from the CD-ROM.

When the CD is inserted into the PC, an installation program automatically begins. This program installs the evaluation software. The user interface on the PC is a dedicated program written especially for the AD2S1210 when operating with the EVAL-CED1Z.

Install the software before connecting the USB cable between the EVAL-CED1Z and the PC. This ensures that the appropriate USB driver files have been properly installed before the EVAL-CED1Z is connected to the PC.

When the software is run for the first time with the EVAL-CED1Z connected to the PC, the PC automatically finds the new device and identifies it. Follow the onscreen instructions that appear automatically. This installs the drivers for the EVAL-CED1Z on the PC. If an error appears on screen when the software is first opened, then the PC is not recognizing the USB device. To correct this error,

1. Right-click the **My Computer** icon, then select **Properties**. When the **System Properties** window opens, select the **Hardware** tab.
2. Click **Device Manager** in the **Hardware** tab of the **System Properties** window.
3. Examine the devices listed under the **Universal Serial Bus Controller** heading.
4. If an unknown device is listed, right-click this option and select **Update Driver**.
5. The **New Hardware Wizard** runs twice, and under the **ADI Development Tools**, the hardware is listed as **ADI Converter Evaluation and Development Board (WF)**.
6. Reboot your PC.

### SETTING UP THE EVAL-CED1Z

This section describes how the evaluation board, the EVAL-CED1Z, and the software should be set up to begin using the complete system.

1. Install the AD2S1210 evaluation board software.
2. Connect the EVAL-CED1Z and the evaluation board together via the 96-way connector. Apply power to the EVAL-CED1Z via the provided +7 V, 15 W power supply. At this stage, the green **Power** LED on the EVAL-CED1Z should light up, which indicates that the EVAL-CED1Z is receiving power.
3. The USB cable can then be connected between the PC and the EVAL-CED1Z. A green LED positioned beside the USB connector on the EVAL-CED1Z lights up indicating that the USB connection has been established. The EVAL-CED1Z is detected.
4. Proceed through any dialog boxes that may appear (use the recommended options) to finalize the installation.
5. Start the EVAL-AD2S1210 software. The FPGA code is automatically downloaded to the EVAL-CED1Z. The red LED, D14, on the EVAL-CED1Z now lights up. This indicates that the EVAL-CED1Z is functional and ready to receive instructions.

The software can now be operated as described in the following sections.

Note that when completing conversions on the AD2S1210 evaluation board while using the EVAL-CED1Z board, D14, the red LED on the EVAL-CED1Z, lights up to indicate that the USB transmission is occurring.



## SOFTWARE OPERATION

With the hardware set up, you can now use the software to control the EVAL-CED1Z and the AD2S1210 evaluation board. To launch the software, from the **Analog Devices** menu, select the **AD2S1210 Evaluation Software** submenu, and then **AD2S1210 Ver0**. Figure 3 displays the main window that is opened. If an error message appears, click **Continue** and restart the application after checking the connection between the adapter board and the USB port on the PC. Also check that the USB device is identified by the **Device Manager** as detailed in the Installing the Software section.

The software that controls the EVAL-CED1Z and, therefore, the AD2S1210 evaluation board, has one main window. Figure 3 shows the window that appears when the software is run. The main function of this window is to allow you to read samples from the evaluation board and display them. The window can be divided into three main sections.

The menu bar is located at the top of the window. The control buttons are below the menu bar, followed by a data capture display.

The data capture display section consists of the following subtabs:

- **Acquisition (Codes)**
- **Acquisition (Degrees/RPS)**
- **Stream (Codes)**
- **Stream (Degrees/RPS)**
- **Histogram Position**
- **Histogram Velocity**

Note that the AD2S1210 evaluation software has two modes of operation, normal mode and stream mode. In normal mode, the software is designed to gather a defined number of samples and display those results on the data capture display. In stream mode, the software is designed to continuously sample the AD2S1210 in defined measurement intervals, and display the results as a continuous stream of data on the data capture display. The **Acquisition (Codes)**, **Acquisition (Degrees/RPS)**, **Histogram Position**, and **Histogram Velocity** tabs operate in normal mode. The **Stream (Codes)** and **Stream (Degrees/RPS)** tabs operate in stream mode. These modes of operation are outlined in more detail in the Taking Samples section.

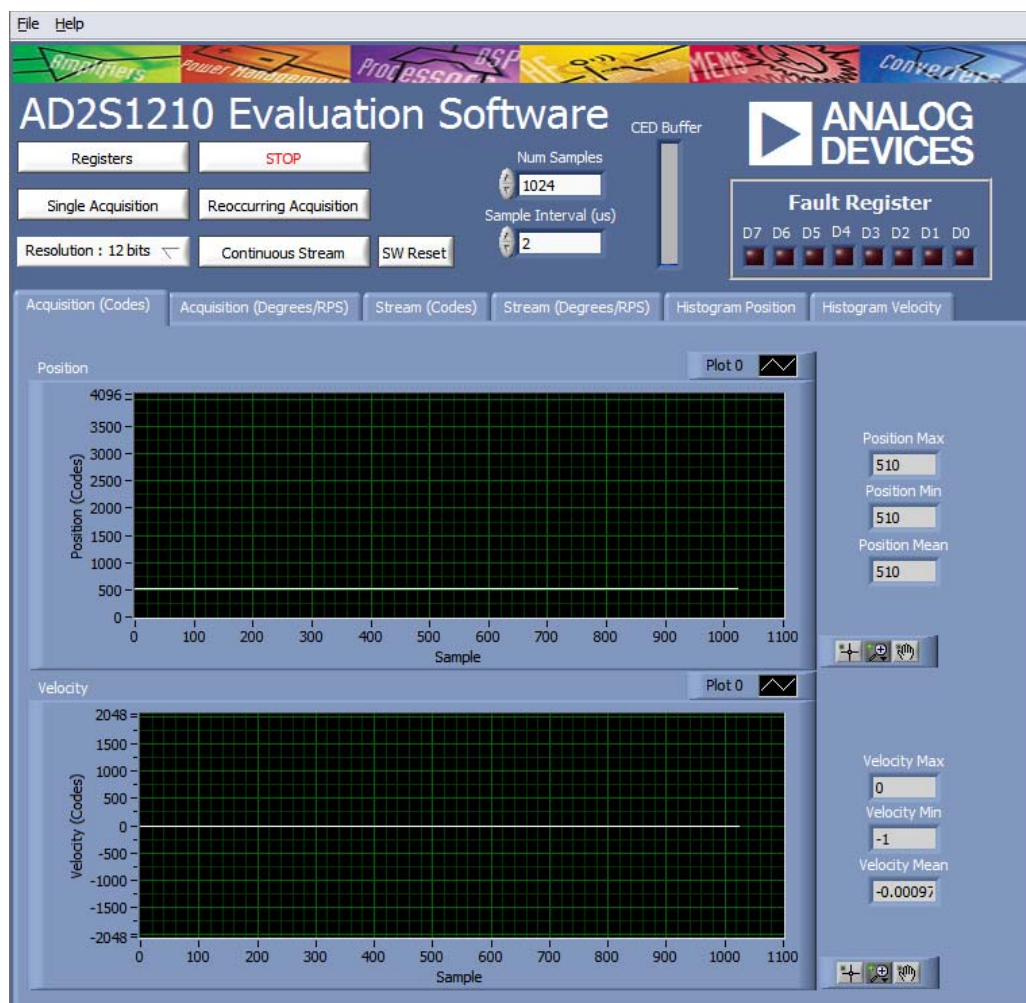


Figure 3. AD2S1210 Evaluation Software, Main Window

## USING THE SOFTWARE

### Menu Bar

The menu bar consists of the **File** and **Help** submenus.

### File Menu

**Save Data (Acquisition).** Saves position, velocity, and fault data of a defined number of samples in normal mode into a spreadsheet file.

**Save Data (Stream).** Saves position, velocity, and fault data of a defined number of samples in stream mode into a spreadsheet file.

**Print Front Panel.** Prints the software window displayed.

**Save as Picture.** Saves the front panel as a JPEG file.

**Exit.** Exits the program.

### Help Menu

**Analog.com.** Opens [www.analog.com](http://www.analog.com).

### Control Buttons

The AD2S1210 software includes the following control buttons, drop-down boxes, and indicators.

**Registers.** Allows you to read from and write to the registers of the AD2S1210.

**Single Acquisition.** Initiates the sampling and readback of the defined number of resolver-to-digital converter (RDC) measurements.

**Resolution : 10/12/14/16 bits.** Selects the hardware resolution on the RES0 and RES1 pins of the AD2S1210.

**STOP.** Stops the program.

**Reoccurring Acquisition.** Repeats single acquisition until the button is released (normal mode).

**Continuous Stream.** Takes samples in stream mode.

**SW Reset.** Executes a software reset of the AD2S1210.

**Num Samples.** Selects the number of samples to be completed in a single acquisition.

**Sample Interval ( $\mu$ s).** Selects the interval between each sample in microseconds.

**Fault Register.** This indicator combines the fault register information from each sample gathered during a single acquisition sequence.

**ON/OFF.** Enables or disables the histogram option. (This button appears on the **Histogram Position** and **Histogram Velocity** tabs only.)

This section also includes a **CED Buffer** indicator that is relevant only in stream mode. The AD2S1210 evaluation board allows conversion to be initiated at periodic intervals. The default conversion loop interval is 2  $\mu$ s but can be increased up to 500  $\mu$ s through the **Sample Interval ( $\mu$ s)** box. The AD2S1210 evaluation software and hardware is designed such that all conversion results are written to external memory on the EVAL-CED1Z, and blocks of samples are then uploaded

through the USB port to the PC. The **CED Buffer** indicator provides an indication of the available memory remaining. If there is increased activity on the USB port, the transfer of data may be slowed down, which may cause the external memory to fill before the data can be uploaded to the PC. In this case, the **CED Buffer** indicator shows that the buffer is full. You should either disconnect other external devices that may be using the USB port, or you can increase the conversion loop interval to decrease the number of samples to upload, which eases the requirement on the USB port. Note also that the transfer of data from the EVAL-CED1Z to the PC is slower when connected to a USB 1.1 port than when connected to a USB 2.0 port.

### Data Capture Display

In the data capture display, you can select the format in which to view the position and velocity conversion results. The position data can be displayed in digital output code format or in degrees. The velocity data can be displayed in digital output code format or in rotations per second (RPS). The desired display options are selected by clicking on the **Acquisition (Codes)**, **Acquisition (Degrees/RPS)**, **Stream (Codes)**, **Stream (Degrees/RPS)**, **Histogram Position**, and **Histogram Velocity** tabs.

#### Acquisition (Codes) Tab

The **Acquisition (Codes)** tab displays the conversion results taken in normal mode of the position and velocity of the resolver connected to the AD2S1210 evaluation board. The number of conversions results displayed is defined by the **Num Samples** box. The conversion results are displayed as waveforms in digital code on two graphs. The upper graph displays the position conversion results. The lower graph displays the velocity conversion results. The maximum, minimum, and mean values of the sample set are displayed on indicators to the right of each graph.

At the bottom right of each graph are the zoom options. These allow you to zoom in and out to obtain a closer look at a sample if required.

#### Acquisition (Degrees/RPS) Tab

The **Acquisition (Degrees/RPS)** tab displays the conversion results taken in normal mode of the position and velocity of the resolver connected to the AD2S1210 evaluation board. The number of conversions results displayed is defined by the **Num Samples** box. The position conversion result is displayed in degrees on the upper graph. The lower graph displays the velocity conversion results in RPS. The maximum, minimum, and mean values of the sample set are displayed on indicators to the right of each graph.

At the bottom right of each graph are the zoom options. These allow you to zoom in and out to obtain a closer look at a sample if required.

#### Stream (Codes) Tab

The **Stream (Codes)** tab displays the conversion results taken in stream mode of the position and velocity of the resolver

connected to the AD2S1210 evaluation board. The conversion results are displayed as waveforms in digital code on two graphs. The upper graph displays the position conversion results. The lower graph displays the velocity conversion results.

At the bottom right of each graph are the zoom options. These allow you to zoom in and out to obtain a closer look at a sample if required.

### Stream (Degrees/RPS) Tab

The **Stream (Degrees/RPS)** tab displays the conversion results taken in stream mode of the position and velocity of the resolver connected to the AD2S1210 evaluation board. The position conversion result is displayed in degrees on the upper graph. The lower graph displays the velocity conversion results in RPS.

At the bottom right of each graph are the zoom options. These allow you to zoom in and out to obtain a closer look at a sample if required.

### Histogram Position Tab

The **Histogram Position** tab displays the histogram of the position conversion results taken in normal mode of the resolver connected to the AD2S1210 evaluation board. To enable this option, you must set the **ON/OFF** button to the on position. The histogram is displayed only when the output code varies for the one block of samples; that is, if the same conversion result is returned for all samples, the histogram is not displayed.

At the bottom right of each graph are the zoom options. These allow you to zoom in and out to obtain a closer look at a sample if required.

### Histogram Velocity Tab

The **Histogram Velocity** tab displays the histogram of the velocity conversion results taken in normal mode of the resolver connected to the AD2S1210 evaluation board. To enable this option, you must set the **ON/OFF** button to the on position. The histogram is displayed only when the output code varies for the one block of samples; that is, if the same conversion result is returned for all samples, the histogram is not displayed.

At the bottom left of each graph are the zoom options. These allow you to zoom in and out to obtain a closer look at a sample if required.

## TAKING SAMPLES

### Initiating Conversions on the AD2S1210 Evaluation Board

To initiate conversions and to capture the sample data, you must click the **Single Acquisition**, **Reoccurring Acquisition**, or **Continuous Stream** button.

When the **Single Acquisition** or **Reoccurring Acquisition** button is clicked, the AD2S1210 evaluation software takes samples in normal mode. When the **Continuous Stream** button is clicked, the AD2S1210 evaluation software takes samples in stream mode.

When the **Single Acquisition** button is clicked, the software instructs the EVAL-CED1Z to read back the conversion results from the AD2S1210 evaluation board. The number of samples is selected via the **Num Samples** box. After each conversion, data from the AD2S1210 is written to external memory on the EVAL-CED1Z. The required set of samples is uploaded through the USB port to the PC when the all conversions are completed.

When you click the **Reoccurring Acquisition** button, the software instructs the EVAL-CED1Z to read back the conversion results from the AD2S1210 evaluation board in a repeating loop. The number of samples is selected via the **Num Samples** box. After each conversion, data from the AD2S1210 is written to external memory on the EVAL-CED1Z. The required set of samples is uploaded through the USB port to the PC when all the conversions are completed. If the **Reoccurring Acquisition** button is not clicked again to release the loop, the conversion loop repeats. While the data is being uploaded to the PC, the AD2S1210 device is not converting; therefore, there is a time delay between two blocks of samples.

When the **Continuous Stream** button is clicked, the software instructs the EVAL-CED1Z to read back the conversion results from the AD2S1210 evaluation board. After each conversion, data from the AD2S1210 is written to external memory on the EVAL-CED1Z. At regular intervals, blocks of samples results are uploaded through the USB port to the PC. In **Continuous Stream** mode, while the data are uploaded to the PC, the AD2S1210 device is still converting. Therefore, there is no additional time delay between samples.

In single acquisition, reoccurring acquisition, and continuous stream mode, the data is displayed on the data capture display. When the **Single Acquisition** or the **Reoccurring Acquisition** button is clicked, the data is displayed on the **Acquisition (Codes)**, **Acquisition (Degrees/RPS)**, **Histogram Position**, and **Histogram Velocity** tabs only. When the user clicks the **Continuous Stream** button, the data is displayed on the **Stream (Codes)** and **Stream (Degrees/RPS)** tabs only.

## EVAL-AD2S1210

### READING FROM AND WRITING TO REGISTERS ON THE AD2S1210

To read from and write to the registers on the AD2S1210, click the **Registers** button (see Figure 3). When you click the **Registers** button, the software instructs the EVAL-CED1Z to read the data in the AD2S1210 registers and displays this information in another window (see Figure 4). The register data is presented in decimal format. All registers are displayed on the right side of the window.

To change the settings of any displayed register other than the control register, you must overwrite the displayed decimal value by typing or selecting the new value, and then click the **Send** button. To overwrite the control register, use the four drop-down boxes on the left side of the window.

**Resolution.** Selects the software resolution of the RDC in the control register. This value must match the hardware resolution

set by the **Resolution : 10/12/14/16 bits** drop-down box on the main window (see Figure 3).

**Hysteresis.** Enables or disables the hysteresis features of the AD2S1210.

**Phase Lock Range.** Selects one of two phase lock ranges of the AD2S1210.

**Encoder Resolution.** Selects the encoder resolution of the AD2S1210.

**Actual value sent to Control Register.** Indicates the value that is written to the control register after clicking the **Send** button.

Note that one or all of the registers can be written to with a single update.

If you do not want to send any data to the registers, click the **Cancel** button.



Figure 4. AD2S1210 Evaluation Software, Registers Window

## EVALUATION BOARD SCHEMATICS AND ARTWORK

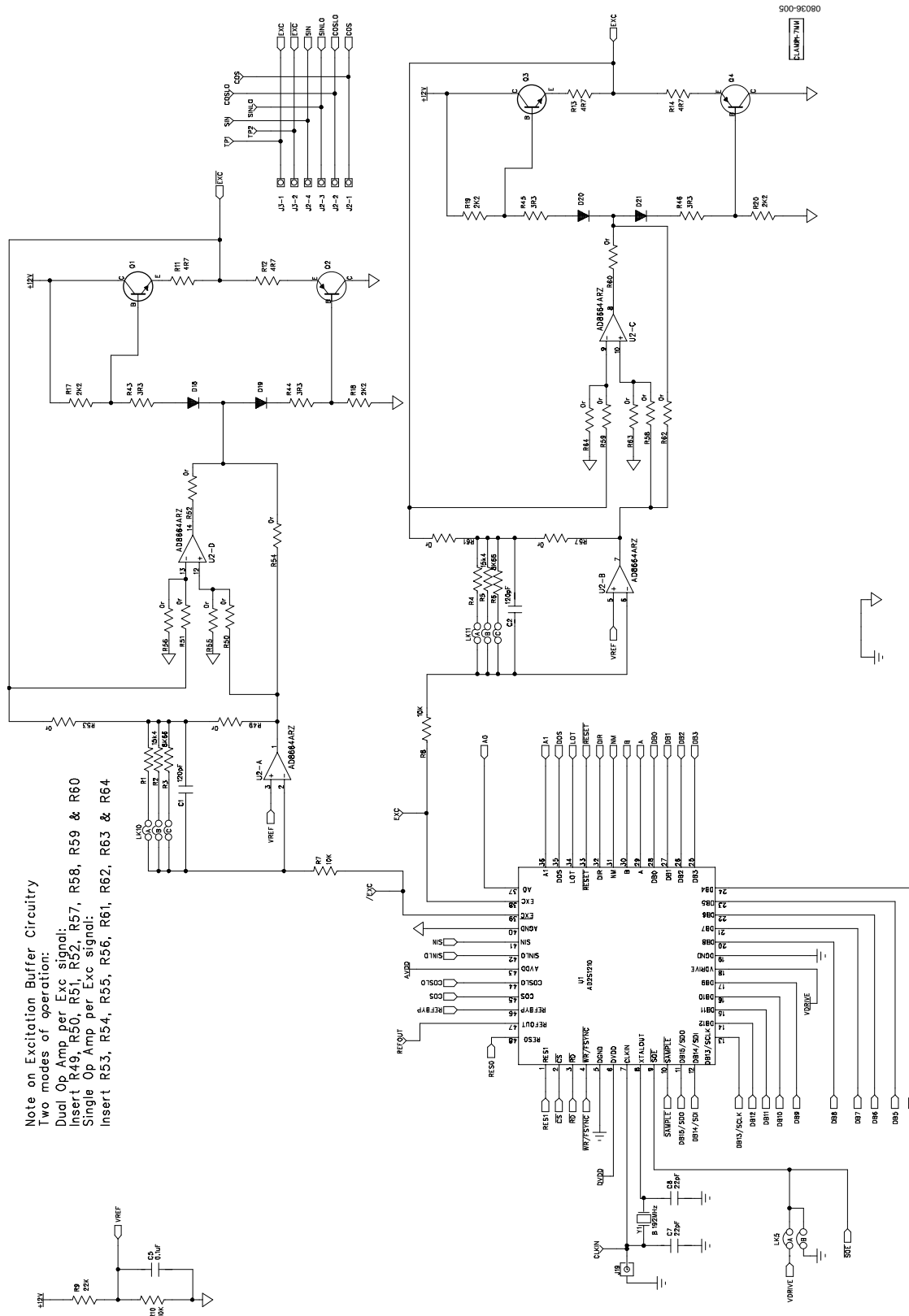


Figure 5. EVAL-AD2S1210 Schematic—Page 1

## Logic Decoupling

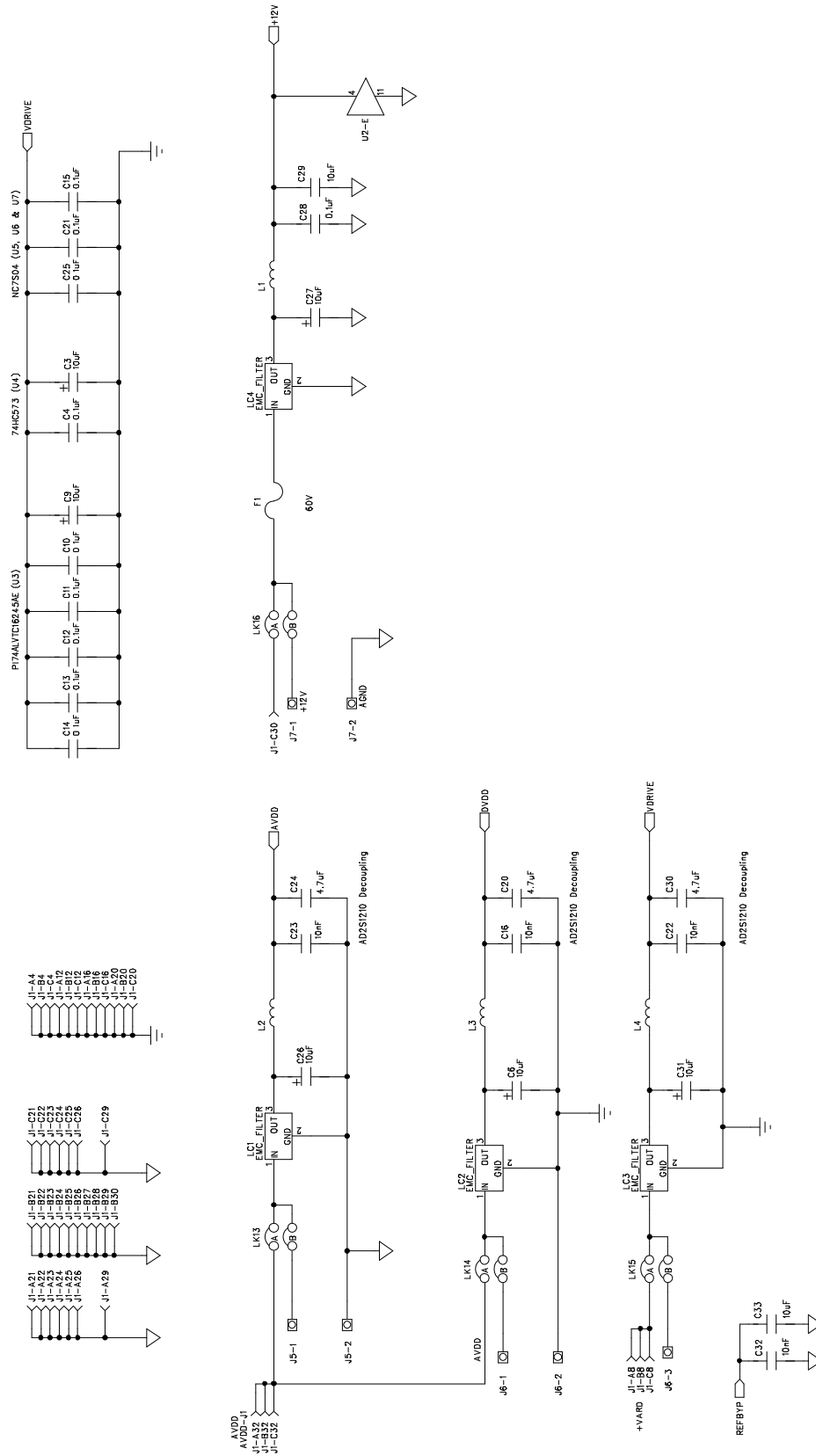


Figure 6. EVAL-AD2S1210 Schematic—Page 2

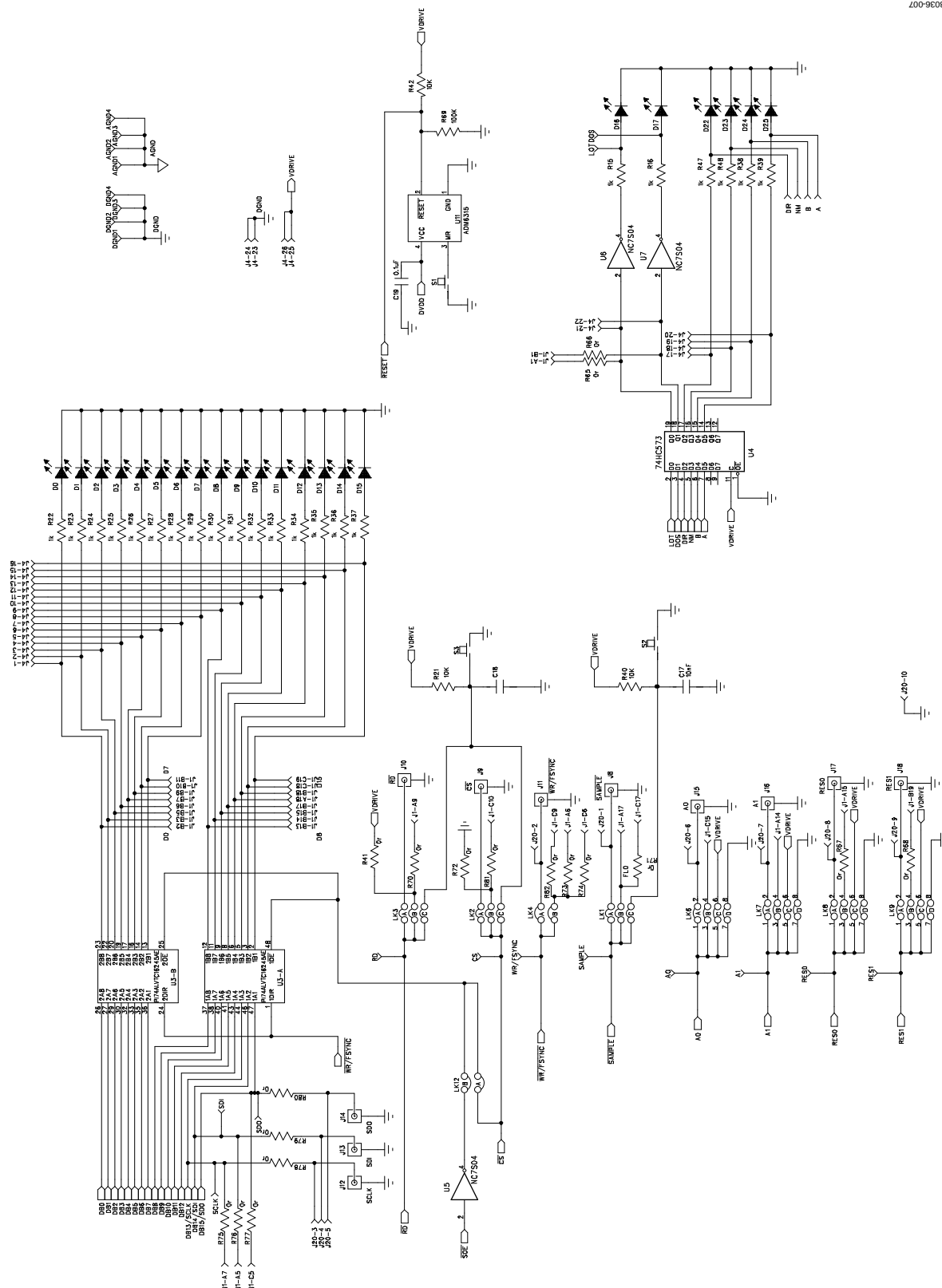


Figure 7. EVAL-AD2S1210 Schematic—Page 3

# EVAL-AD2S1210

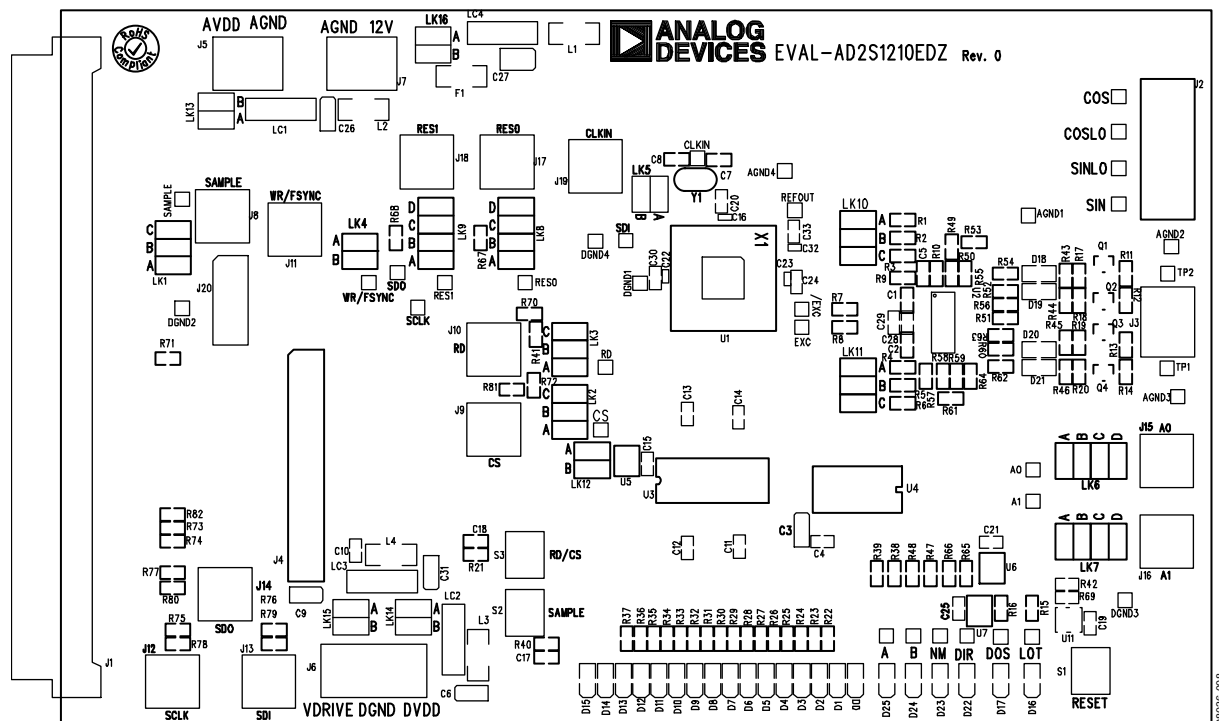


Figure 8. Silkscreen Image

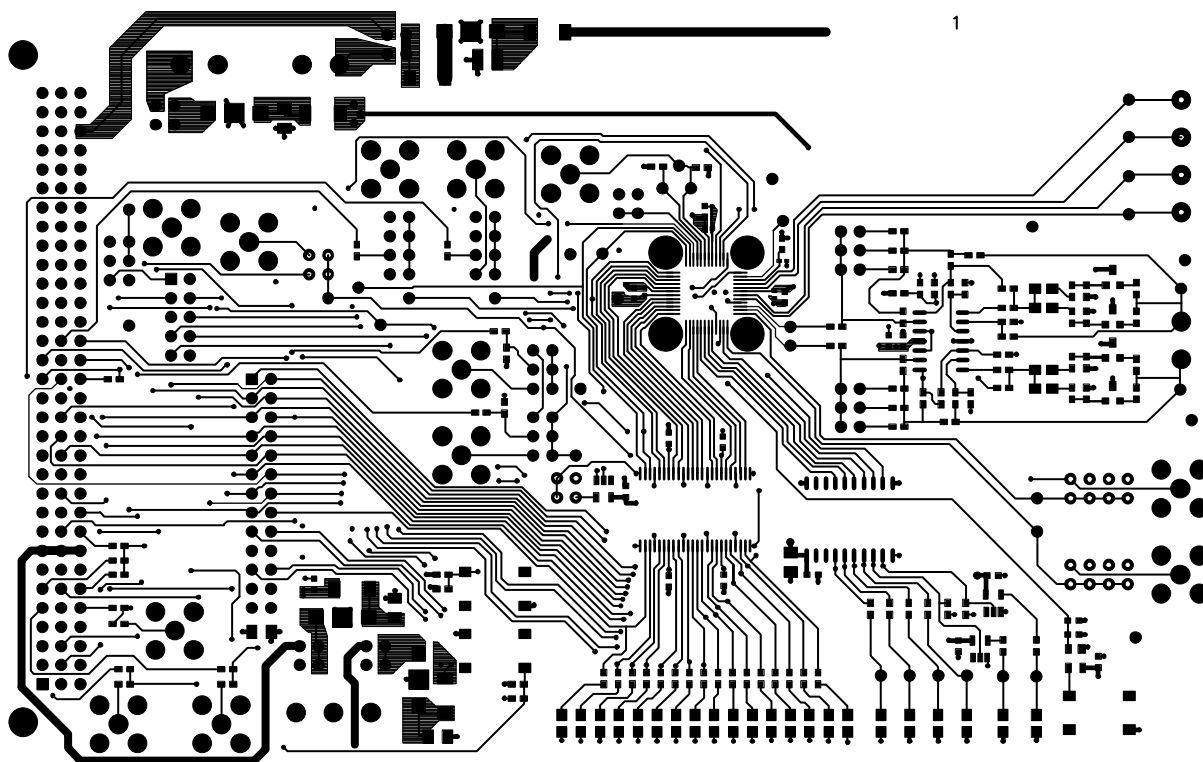


Figure 9. Component Side



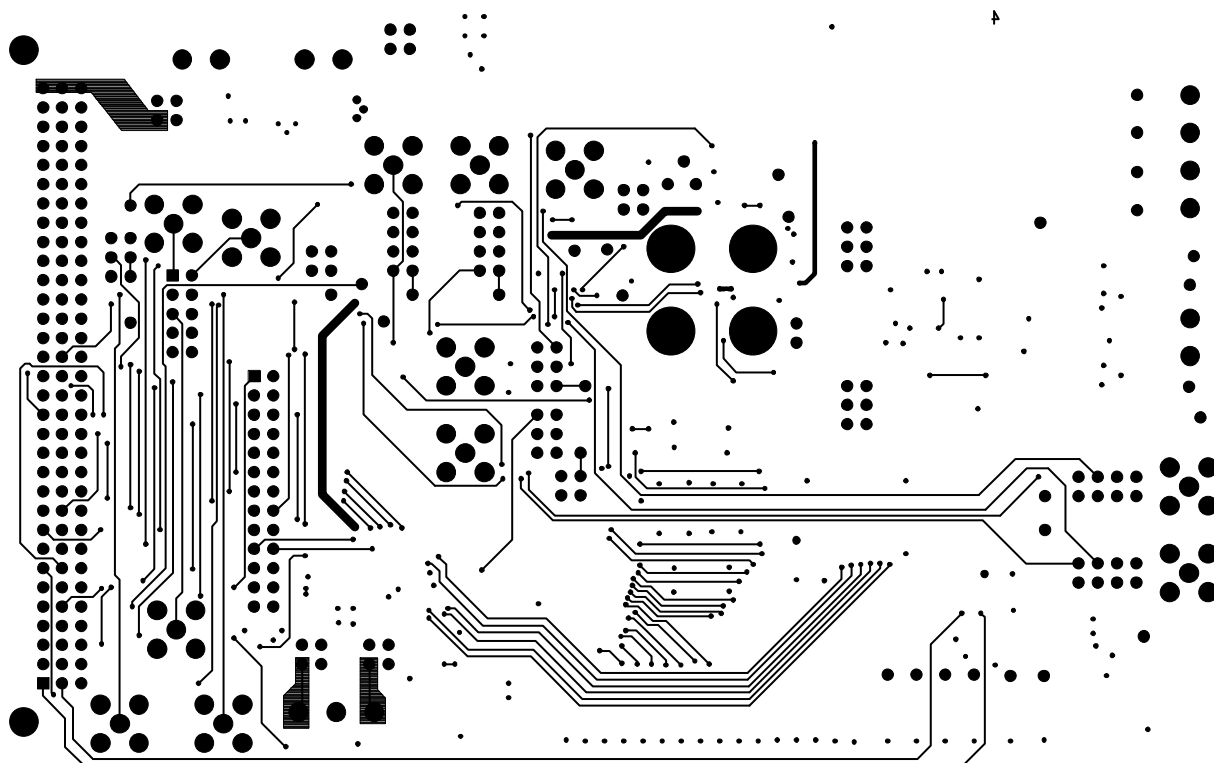


Figure 10. Solder Side

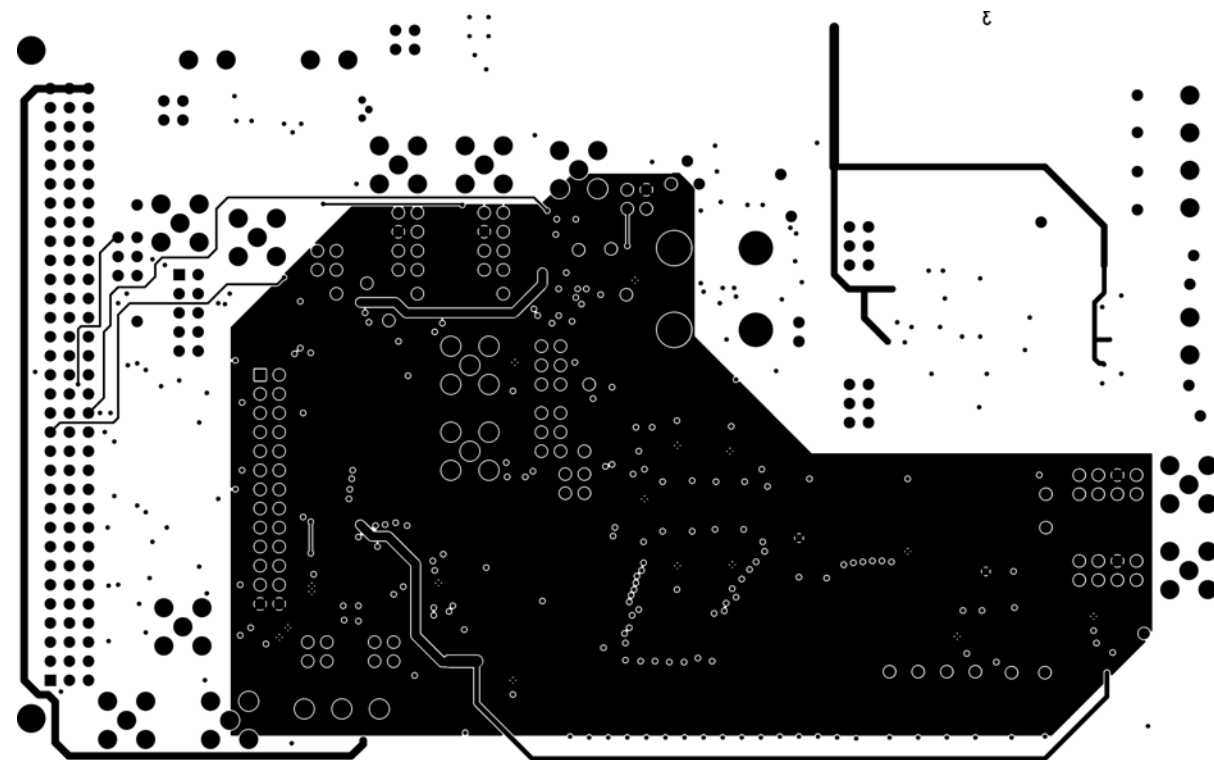


Figure 11. Power Planes



Figure 12. Ground Planes

## ORDERING INFORMATION

### BILL OF MATERIALS

Table 9.

Qty	Reference Designator	Part Description	Stock Code <sup>1</sup>
1	U1	10-bit to 16-bit RDC	Analog Devices <a href="#">AD2S1210DSTZ</a>
1	U2	AD8664	Analog Devices <a href="#">AD8664ARZ</a>
1	U3	PI74ALVTC16245AE	PI74ALVTC16245AE <sup>2</sup>
1	U4	74HC573	FEC 958-9384
3	U5, U6, U7	NC7S04 HS inverter	FEC 101-4133
1	U11	ADM6315	Analog Devices <a href="#">ADM6315-45D1ARTZ</a>
1	Y1	8.192 MHz quartz crystal	FEC 950-9453
2	C1, C2	120 pF ceramic capacitor SMD 0603	FEC 722-091
5	C3, C6, C9, C26, C31	10 µF tantalum capacitor, 10 V	FEC 197-130
12	C4, C5, C10, C11 to C15, C19, C21, C25, C28	0.1 µF ceramic capacitor SMD0603	FEC 432-210
2	C7, C8	22 pF ceramic capacitor SMD0603	FEC 722-005
4	C16, C22, C23, C32	10 nF ceramic capacitor SMD 0402	FEC 301-9275
2	C17, C18	10 nF ceramic capacitor SMD 0603	FEC 753-622
3	C20, C24, C30	4.7 µF tantalum capacitor	Digi-Key 490-3302-1-ND
2	C27, C29	10 µF tantalum capacitor, 20 V	FEC 197-427
1	C33	10 µF tantalum capacitor, 6.3 V SMD0603	Digi-Key PCC2395CT-ND
1	F1	SMD fuse	FEC 935-0284
22	D0 to D17, D22 to D25	Red SMD 0805 chip LED	FEC 105-8373
4	D18 to D21	TS4148 RY small signal diode	FEC 815-0206
1	J1	96-pin 90° DIN41612 connector	FEC 109-7929
3	J3, J5, J7	2-pin terminal block	FEC 151-789
1	J4	26-pin header	FEC 102-2244
1	J6	3-pin terminal block	FEC 151-790
1	J20	10-pin header	FEC 102-2242
1	J2	4-pin terminal block	FEC 151-791
4	L1 to L4	Ferrite beads	FEC 952-6900
4	LC1 to LC4	Surface-mount EMC filters	FEC 952-8202
5	LK1 to LK3, LK10, LK11	3-way jumper (3 × 2)	FEC 102-2231, FEC 150-410
4	LK6 to LK9	4-way jumper (4 × 2)	FEC 102-2233, FEC 150-410
7	LK4, LK5, LK12 to LK16	2-way jumper (2 × 2)	FEC 102-2244, FEC 150-410
2	Q1, Q3	BC846B NPN small signal transistor	FEC 108-1229
2	Q2, Q4	BC856B PNP small signal transistor	FEC 108-1243
2	R2, R5	15.4 kΩ SMD 0603 resistor	FEC 117-0904
6	R7, R8, R10, R21, R40, R42	10 kΩ SMD 0805 resistor	FEC 933-0399
1	R9	22 kΩ SMD 0603 resistor	FEC 911392
2	R3, R6	8.66 kΩ SMD 0603 resistor	FEC 117-0884
22	R15, R16, R22 to R39, R47, R48	1 kΩ SMD 0603 resistor	FEC 933-0380
4	R11 to R14	4.7 Ω SMD 0603 resistor	FEC 3571142
1	R69	100 kΩ SMD 0603 resistor	FEC 933-0402
4	R17 to R20	2.2 kΩ SMD 0603 resistor	FEC 911276
4	R43 to R46	3.3 Ω SMD 0603 resistor	FEC 3571130
15	R41, R53 to R56, R61 to R64, R72 to R77	0 Ω SMD 0603 resistor	FEC 933-1662/FEC 923-3130
19	R49 to R52, R57 to R60, R65 to R68, R70, R71, R78 to R82	0 Ω SMD 0603 resistor	FEC 933-1662/FEC 923-3130 (not inserted)

# EVAL-AD2S1210

Qty	Reference Designator	Part Description	Stock Code <sup>1</sup>
3	S1 to S3	SMD push-button switch	FEC 177-807
26	$\overline{\text{EXC}}$ , A, A1, A0, B, CLKIN, $\overline{\text{COS}}$ , COSLO, $\overline{\text{CS}}$ , DIR, DOS, EXC, LOT, NM, $\overline{\text{RD}}$ , REFOUT, RES0, RES1, $\overline{\text{SAMPLE}}$ , SIN, SINLO, TP1, TP2, $\overline{\text{WR}}$ / $\overline{\text{FSYNC}}$ , SDI, SDO	Test points	FEC 873-1144
8	AGND1 to AGND4, DGND1 to DGND4	Black test points	FEC 873-1128
10	J8 to J19	Straight PCB mount SMB	FEC 1206013 (not inserted)
4		Stick-on feet at each corner	FEC 116-5061

<sup>1</sup> FEC = Farnell Electronics.

<sup>2</sup> P = Pericom Semiconductor Corporation.

## ORDERING GUIDE

Model	Description
EVAL-AD2S1210EDZ <sup>1</sup>	Evaluation Board

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

## 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.