ANALOG DEVICES

EVAL-AD7124-8SDZ User Guide
UG-856

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Evaluation Board for the AD7124-8 8-Channel, Low Noise, Low Power, 24-bit Σ-Δ ADC with In-Amp and Reference

FEATURES

Full featured evaluation board for the AD7124-8
PC control in conjunction with Analog Devices, Inc. System Demonstration Platform (EVAL-SDP-CB1Z)
PC software for control and data analysis (time domain)
Standalone capability

EVALUATION KIT CONTENTS

EVAL-AD7124-8SDZ evaluation board
Evaluation software CD for the AD7124-8

ONLINE RESOURCES

Documents Needed
AD7124-8 data sheet
EVAL-AD7124-8SDZ user guide
Required Software
AD7124-8 EVAL+ Software

EQUIPMENT NEEDED

EVAL-AD7124-8SDZ evaluation board
EVAL-SDP-CB1Z System Demonstration Platform
DC signal source
USB cable
PC running Windows with USB 2.0 port

GENERAL DESCRIPTION

The EVAL-AD7124-8SDZ evaluation kit features the AD7124-8 24-bit, low power, low noise analog-to-digital converter (ADC).

A 7 V to 9 V external supply is regulated to 3.3 V to supply the AD7124-8 and support all necessary components. The EVAL-AD7124-8SDZ board connects to the USB port of the PC by connecting to the EVAL-SDP-CB1Z motherboard.

The AD7124-8 EVAL+ Software fully configures the AD7124-8 device register functionality and provides dc time domain analysis in the form of waveform graphs, histograms, and associated noise analysis for ADC performance evaluation.

The EVAL-AD7124-8SDZ is an evaluation board that allows the user to evaluate the features of the ADC. The user PC software executable controls the AD7124-8 over the USB through the EVAL-SDP-CB1Z System Demonstration Platform (SDP) board.

Full specifications on the AD7124-8 are available in the product data sheet, which should be consulted in conjunction with this user guide when working with the evaluation board.

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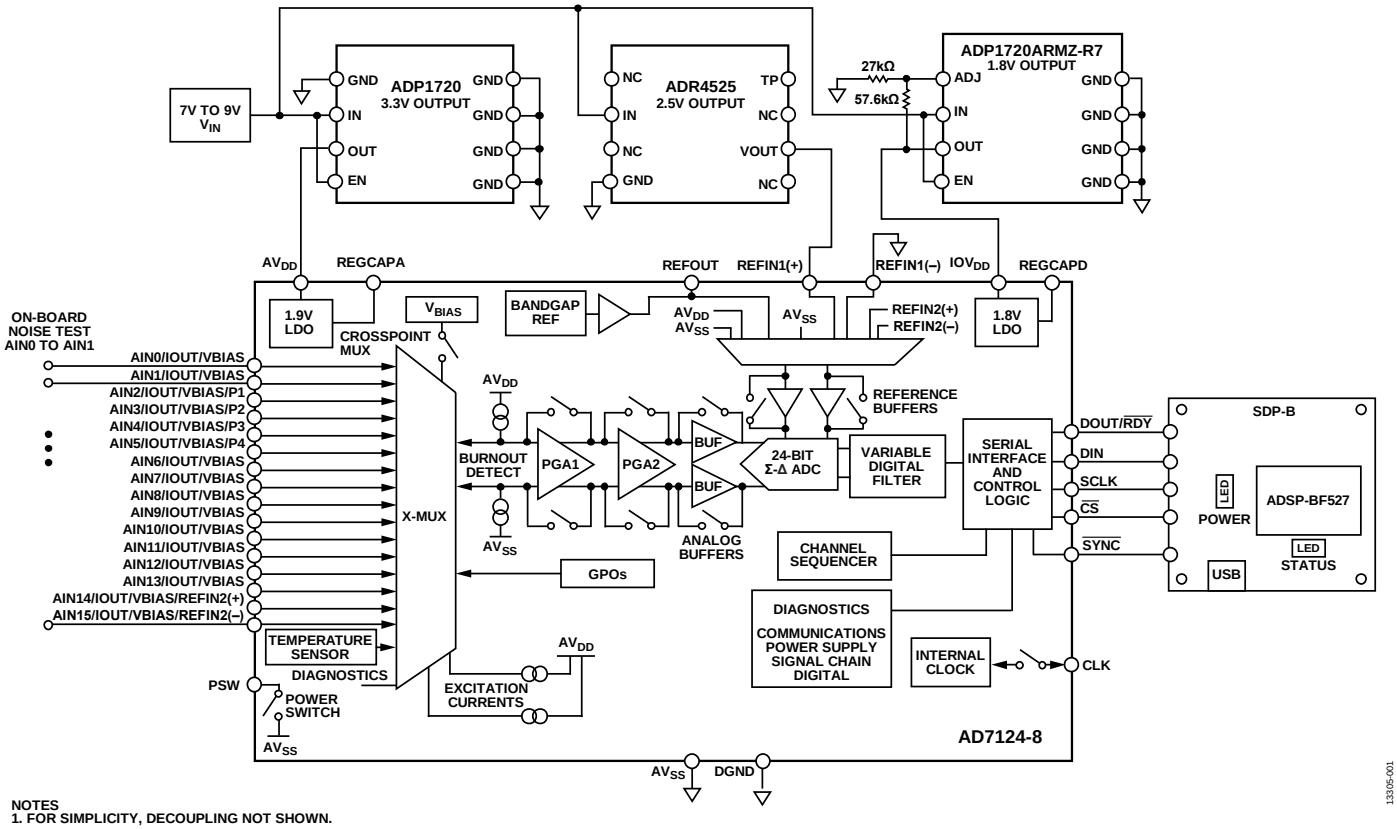
REVISION HISTORY

7/15—Revision 0: Initial Version

EVAL-AD7124-8SDZ BLOCK DIAGRAM



NOTES
1. FOR SIMPLICITY, DECOUPLING NOT SHOWN.

Figure 1.

EVAL-AD7124-8SDZ QUICK START GUIDE

To begin using the evaluation board, do the following:

1. With the EVAL-SDP-CB1Z board disconnected from the USB port of the PC, install the AD7124-8 EVAL+ Software (the software is included on the CD in the evaluation board kit and can be downloaded online). Restart the PC after the software installation is complete. (For complete software installation instructions, see the Software Installation Procedures section.)
2. Connect the EVAL-SDP-CB1Z board to the EVAL-AD7124-8SDZ board.
3. Screw the two boards together using the plastic screw and washer set included in the evaluation board kit to connect the boards firmly together.
4. Apply an external voltage in the range of 7 V to 9 V to the J3 or J5 connecter of the EVAL-AD7124-8SDZ board. This provides the power supply for the board.
5. Connect the EVAL-SDP-CB1Z board to the PC using the supplied USB cable. If you are using Windows® XP, you may need to search for the EVAL-SDP-CB1Z drivers. Choose to automatically search for the drivers for the EVAL-SDP-CB1Z board if prompted by the operating system.
6. From the **Programs** menu, go to the **Analog Devices** subfolder, and click **AD7124 Eval+** to launch the AD7124-8 EVAL+ Software (see the Launching the Software section).

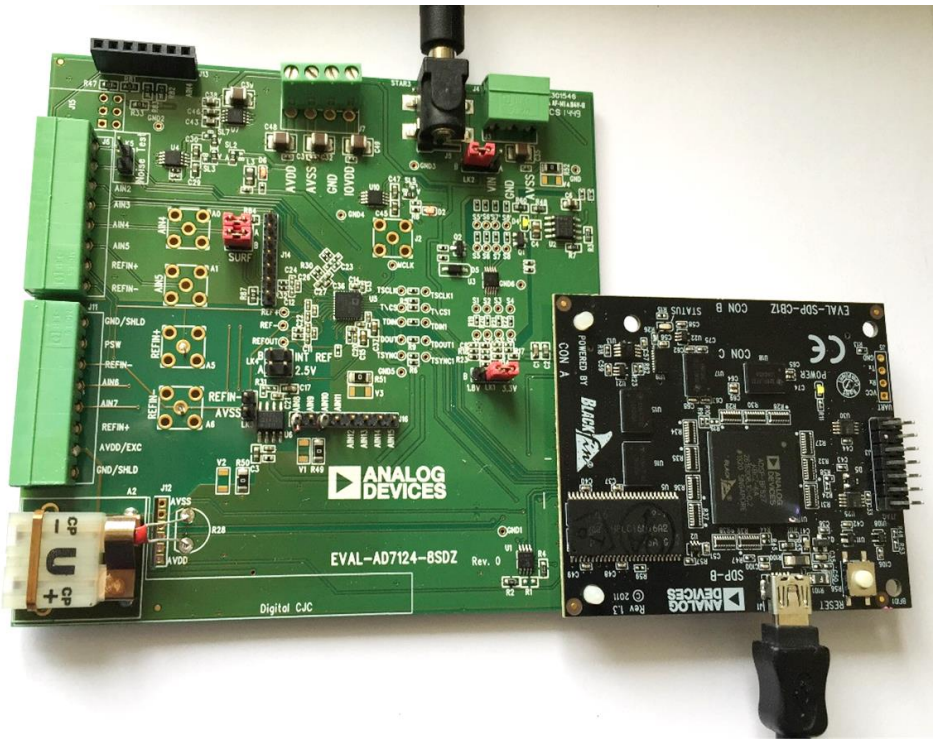


Figure 2. Hardware Configuration, Setting up the EVAL-AD7124-8SDZ Evaluation Board

EVALUATION BOARD HARDWARE

DEVICE DESCRIPTION

The AD7124-8 is a low power, low noise, complete analog front end for high precision measurement applications. It contains a low noise, 24-bit Σ-Δ ADC. It can be configured to have eight differential inputs or 15 single-ended or pseudo-differential inputs. The on-chip low noise instrumentation amplifier means that signals of small amplitude can interface directly to the ADC. Other on-chip features include a low drift 2.5 V reference, excitation currents, reference buffers, multiple filter options, and many diagnostic features.

Complete specifications for the AD7124-8 are provided in the product data sheet and must be consulted in conjunction with this user guide when using the evaluation board. Full details about the EVAL-SDP-CB1Z are available at analog.com.

HARDWARE LINK OPTIONS

The default link options are listed in Table 1. By default, the board operates from a wall wart (dc plug) power supply via Connector J5. The supply required for the AD7124-8 comes from the on-board ADP1720 low dropout regulators (LDOs), which generate their voltage from Connector J5.

Table 1. Default Link and Solder Link Options

Link No.	Default Option	Description
LK1	A	Connects the AV_{DD} voltage to the power supply sequencer, ADM1185. When AV_{DD} equals 3.3 V, LK1 must be in Position A. When AV_{DD} equals 1.8 V, LK1 must be in Position B.
LK2	B	Selects the connector for the external 7 V to 9 V power supply. In Position A, this link selects the external 7 V to 9 V power supply to come from Connector J3. In Position B, this link selects the external 7 V to 9 V power supply to come from Connector J5.
LK3	Inserted	Inserting this link connects REFIN(−) to AV_{SS}.
LK4	2.5 V	Selects the reference source for the ADC. In position 2.5 V, REFIN1(+) is connected to the external 2.5 V reference (ADR4525). In position INT REF, REFIN1(+) is connected to the REFOUT pin of the AD7124-8. This allows the internal reference of the AD7124-8 to connect as an external reference.
LK5	Inserted	This link shorts AIN0 to AIN1. This is useful to perform noise tests on the AD7124-8. It is possible to enable the internal bias on AIN0 or AIN1 so that AIN0 and AIN1 are at an appropriate voltage for the noise test.
LK6	Inserted	LK6 can be used to connect the AIN4 and AIN5 channels to external components such as an external amplifier. Jumpers in position A and B at LK6 must be opened to include the external component on the front end. Jumper A and Jumper B of this link can be used to connect the AIN4 and AIN5 channels to external components such as an external amplifier. For this, the jumpers must be open. When Jumper A and Jumper B are in place, connect AIN4 and AIN5 to the on-board thermistor used for cold junction measurements.
SL2	A	Sets the voltage applied to the AV_{DD} pin. In Position A, this link sets the voltage applied to the AV_{DD} pin to be a 3.3 V supply from the ADP1720-3.3 (U7) regulator or a 1.8 V supply from the ADP1720 (U4) regulator. In Position B, this link supplies the voltage to the AV_{DD} pin from an external voltage source via Connector J9.
SL3, SL7	A, A	With SL3 and SL7 in Position A, the ADP1720-3.3 (U7) regulator supplies AV_{DD} with 3.3 V. With SL3 and SL7 in Position B, the ADP1720 (U4) regulator supplies AV_{DD} with 1.8 V.
SL5	B	With this link in Position A, the IOV_{DD} supply is provided from an external source via Connector J9. With this link in Position B, the 3.3 V supply is generated by the ADP1720-3.3 (U10) regulator. The evaluation system operates with 3.3 V logic.
AV_{SS} to AGND		Inserting these links ties AV_{SS} to AGND. When setting AV_{SS} to −1.8 V, remove these links.

On-Board Connectors

Table 2 provides information about the external connectors on the EVAL-AD7124-8SDZ.

Table 2. On-Board Connectors

Connector	Function
J1	A 120-pin connector that mates with the EVAL-SDP-CB1Z (black colored controller board).
J2	Straight PCB mount SMB/SMA jack for master clock (not inserted). The EVAL-AD7124-8SDZ has the footprint to include an SMA/SMB connector, if using an external clock source to provide the master clock to the ADC.
J3	Bench top power supply voltage input. Apply 7 V to 9 V and GND (0 V) to this connector to power the evaluation board.
J5	Wall wart (dc plug) power supply voltage input. Apply 7 V to 9 V and GND (0 V) to this connector to power the evaluation board.
J6	Analog input connector. Connections to AIN0 to AIN5 are available along with REFIN1(±) connections. Use this connector to connect an RTD to the AD7124-8.
J9	Optional external connector, allowing external bench top or alternative supply for AV_{DD} and IOV_{DD}. Connector J9 supplies AV_{SS} externally when split supplies are used.
J11	Analog input connector. Connections to AIN6 to AIN7 are available along with REFIN1(±) and analog power supply connections. Use this connector to connect a load cell to the AD7124-8.
J12	6-pin connector. Provides an I^2C interface to allow the SDP to interface with a digital temperature sensor. This is required if a thermocouple is interfaced with the AD7124-8 using connector A2.
J13	7-pin connector. Connects an external amplifier to channel AIN4/AIN5.
J14	7-pin connector. Allows connection to pins AIN4 and AIN5.
A0	Straight PCB mount SMB/SMA jack. The footprint for an SMA/SMB connector is included on the evaluation board to provide the signal to analog input AIN4.
A1	Straight PCB mount SMB/SMA jack. The footprint for an SMA/SMB connector is included on the evaluation board to provide the signal to analog input AIN5.
A2	Thermocouple connector. This connector is required if a thermocouple is being interfaced to the evaluation board.
A5	Straight PCB mount SMB/SMA jack. The footprint for an SMA/SMB connector is included on the evaluation board to provide the signal REFIN1(+).
A6	Straight PCB mount SMB/SMA jack. The footprint for an SMA/SMB connector is included on the evaluation board to provide the signal REFIN1(–).

POWER SUPPLIES

The evaluation board requires applying an external power supply—either a bench top supply or a wall wart (dc plug) supply—to J3 or J5 (see Table 3). Linear regulators generate the required power supply levels from the applied V_{IN} rail. The regulators used are the ADP1720-3.3 (U7) and the ADP1720 (U4), which supply 3.3 V and 1.8 V, respectively, to AV_{DD} of the ADC. The 3.3 V ADP1720 (U10) delivers 3.3 V to the IOV_{DD} pin of the AD7124-8.

When a split power supply is used, apply the AV_{SS} voltage from an external source via Connector J9. Connector J9 can also provide AV_{DD} and IOV_{DD}. However, the 7 V to 9 V supply is still required because the on-board reference (ADR4525) is supplied from this power supply.

Each supply is decoupled at the point where it enters the board and again at the point where it connects to each device (see the schematics shown in Figure 26 to Figure 34 to identify decoupling points).

SERIAL INTERFACE

The EVAL-AD7124-8SDZ evaluation board connects via the serial peripheral interface (SPI) to the Blackfin® ADSP-BF527 on the EVAL-SDP-CB1Z.

There are four primary signals: CS, SCLK, DIN, and DOUT/$\overline{RDY}$ (all are inputs, except for DOUT/$\overline{RDY}$, which is an output).

To operate the EVAL-AD7124-8SDZ in standalone mode, the AD7124-8 serial interface lines can be disconnected from the 120-pin header by removing the 0 Ω links, R9 through R13. The test points can then be used to fly-wire the signals to an alternative digital capture setup.

ANALOG INPUTS

Apply the EVAL-AD7124-8SDZ primary analog inputs voltages in two ways:

- Using J6 and J11, the green, screw-in terminal connectors.
- Using the A0 and A1 SMB/SMA footprints on the evaluation board that connect to AIN4 and AIN5 analog inputs.

The AD7124-8 EVAL+ Software is set up to analyze dc inputs to the ADC.

Table 3. Required External Power Supply[1]

Power Supply (V_{IN}) Applied To	Voltage Range	Function
J3	7 V to 9 V	Bench top supply to the evaluation board. Supplies LDOs that create the 3.3 V and 1.8 V rails. It also supplies the ADR4525 external reference. Ensure that LK2 is set to Position A when the external power supply is applied to this connector.
J5	7 V to 9 V	Wall wart (dc plug) supply to the evaluation board. Supplies LDOs that create the 3.3 V and 1.8 V rails. It also supplies the ADR4525 external reference. Set LK2 to Position B when the external power supply is applied to this connector.

[1]Only a single supply is required, for either J3 or J5. This can be selected using LK2.

REFERENCE OPTIONS

The EVAL-AD7124-8SDZ includes an external 2.5 V reference (the ADR4525) and an internal 2.5 V reference. The default operation uses the external reference input, which accepts the 2.5 V ADR4525 on the evaluation board.

Select the reference used for a conversion by choosing the reference in the configuration registers associated with Setup 0 to Setup 7. Switch between using the internal reference and external reference by accessing the AD7124-8 registers through the pop-up windows (discussed in more detail in the following sections) via the evaluation software. Figure 3 shows how to select the reference source for Setup 0 to Setup 7. Figure 4 shows the ADC Control register setting that enables the internal reference.

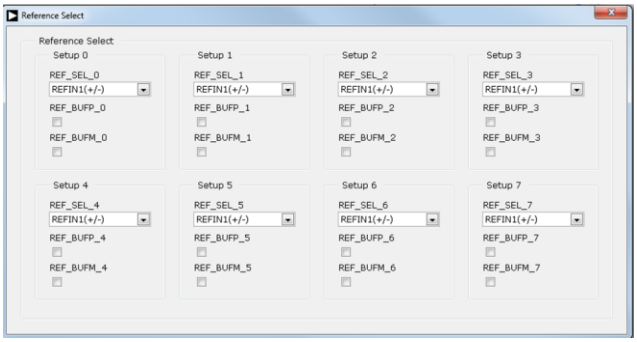


Figure 3. Selecting the Reference Source Using Pop-Up Windows

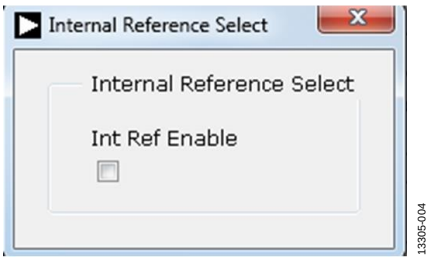


Figure 4. Enabling the Internal 2.5 V Reference Using Pop-Up Windows

EVALUATION BOARD SETUP PROCEDURE

After following the instructions in the Software Installation Procedures section, set up the evaluation and SDP boards as detailed in this section.

Warning

The evaluation software and drivers must be installed before connecting the EVAL-AD7124-8SDZ evaluation board and EVAL-SDP-CB1Z board to the USB port of the PC to ensure the PC correctly recognizes the evaluation system.

Configuring the Evaluation and SDP Boards

1. Connect the EVAL-SDP-CB1Z board to Connector A or Connector B on the EVAL-AD7124-8SDZ board. Screw the two boards together using the plastic screw and washer set included in the evaluation board kit to connect the boards firmly together.
2. Connect the power supplies to the EVAL-AD7124-8SDZ board. The EVAL-AD7124-8SDZ board, by default, uses the wall wart (dc plug) supply that accompanies the evaluation kit. Connect the wall wart (dc plug) supply to Connector J5 on the EVAL-AD7124-8SDZ board. (For more information about the required connections and available options, refer to the Power Supplies section.)
3. Connect the EVAL-SDP-CB1Z board to the PC using the supplied USB cable.

EVALUATION BOARD SOFTWARE

SOFTWARE INSTALLATION PROCEDURES

The EVAL-AD7124-8SDZ evaluation kit includes a CD containing software that needs to be installed before using the EVAL-AD7124-8SDZ evaluation board.

There are two parts to the installation:

- AD7124-8 EVAL+ Software installation
- EVAL-SDP-CB1Z SDP board drivers installation

Warning

The evaluation software and drivers must be installed before connecting the EVAL-AD7124-8SDZ evaluation board and EVAL-SDP-CB1Z board to the USB port of the PC to ensure the PC correctly recognizes the evaluation system.

Installing the AD7124-8 EVAL+ Software

To install the AD7124-8 EVAL+ Software:

1. With the EVAL-SDP-CB1Z disconnected from the USB port of the PC, insert the installation CD into the CD-ROM drive.
2. Double-click the **setup.exe** file to begin the evaluation board software installation. The software then installs to the following default location: **C:\Program Files\Analog Devices\AD7124 EVAL+.**
3. A dialog box appears asking for permission to allow the program to make changes to your PC. Click **Yes**.

Figure 5. AD7124-8 EVAL+ Software Installation: Granting Permission for the Program to Make Changes to Your PC

4. Select a location to install the software and then click **Next**. (Figure 6 shows the default locations, which are displayed when the dialogue box opens, but you can select another location by clicking **Browse**.)

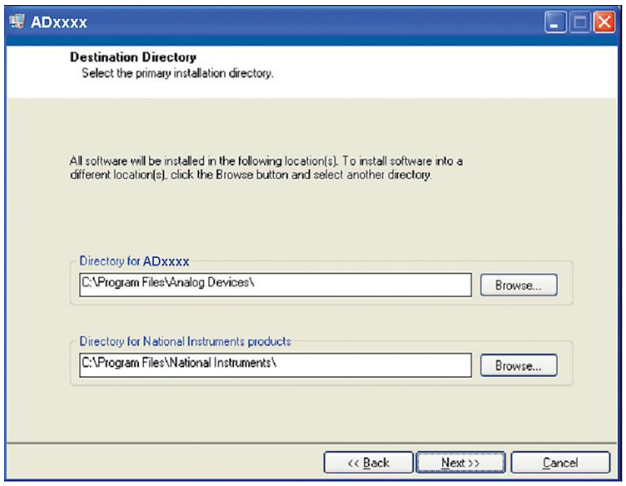


Figure 6. AD7124-8 EVAL+ Software Installation: Selecting the Location for Software Installation

5. A license agreement appears. Read the agreement and then select **I accept the License Agreement** and click **Next**.

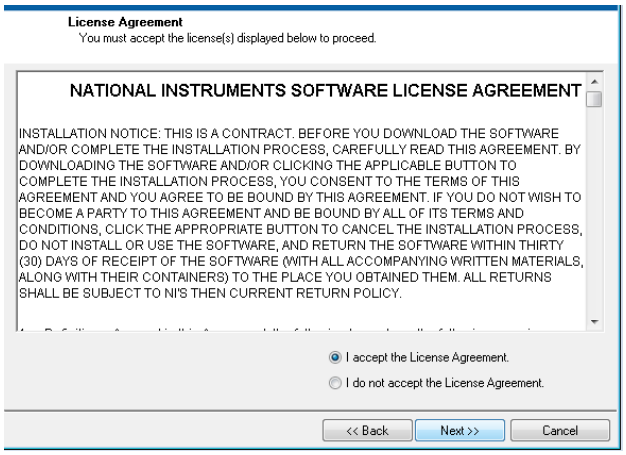


Figure 7. AD7124-8 EVAL+ Software Installation: Accepting the License Agreement

6. A summary of the installation displays. Click **Next** to continue.

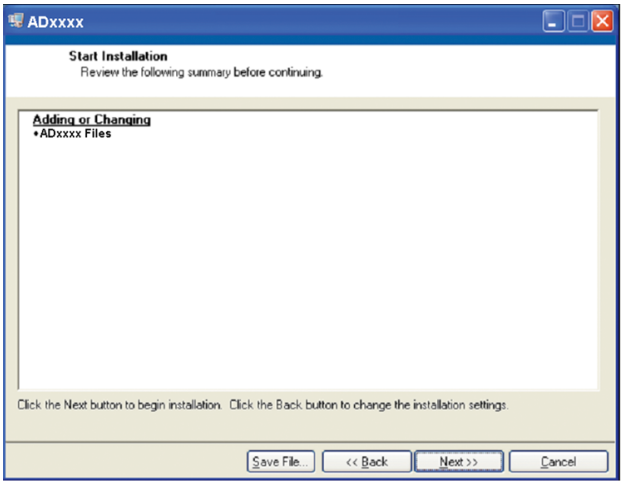


Figure 8. AD7124-8 EVAL+ Software Installation: Reviewing a Summary of the Installation

7. The message in Figure 9 appears when the installation is complete. Click **Next**.

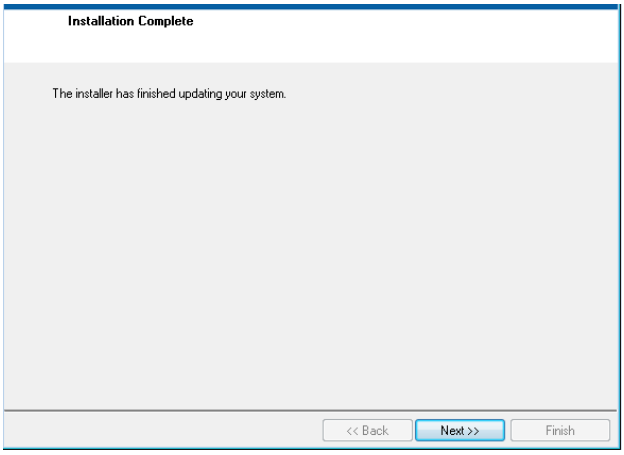


Figure 9. AD7124-8 EVAL+ Software Installation: Indicating When the Installation Is Complete

Installing the EVAL-SDP-CB1Z System Demonstration Platform Board Drivers

After the installation of the evaluation software is complete, a welcome window displays for the installation of the EVAL-SDP-CB1Z SDP board drivers.

1. With the EVAL-SDP-CB1Z board still disconnected from the USB port of the PC, make sure that all other applications are closed, and then click **Next**.

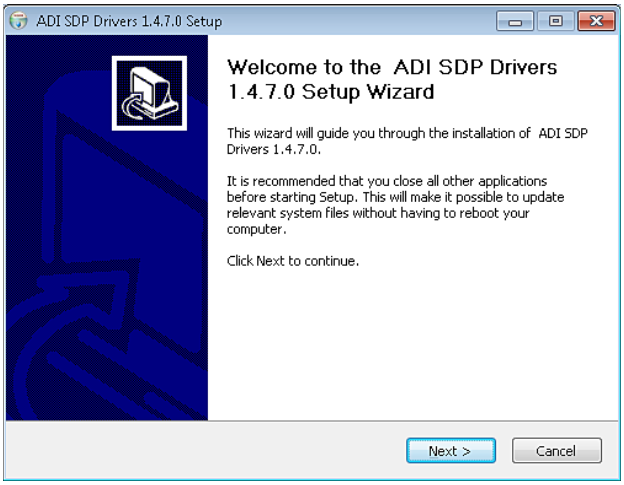


Figure 10. EVAL-SDP-CB1Z Drivers Setup: Beginning the Drivers Installation

2. Select the location to install the drivers and then click **Next**.

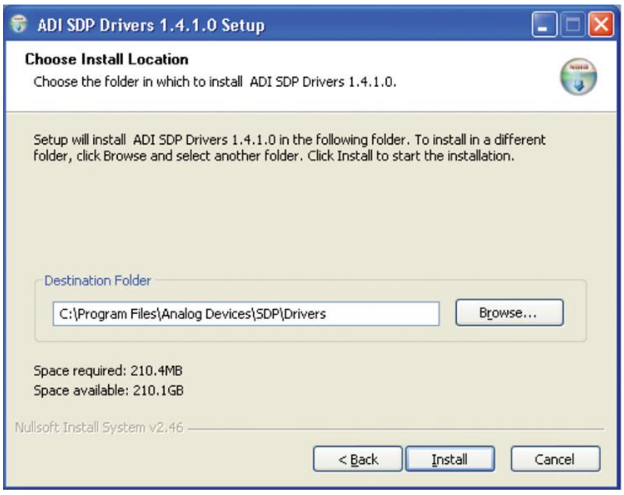


Figure 11. EVAL-SDP-CB1Z Drivers Setup: Selecting the Location for Drivers Installation

3. Click **Install** to install the drivers.

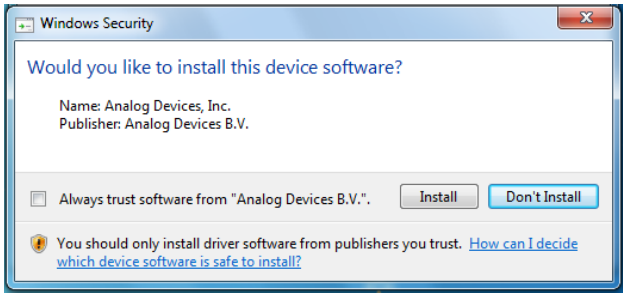


Figure 12. EVAL-SDP-CB1Z Drivers Setup: Granting Permission to Install Drivers

4. To complete the drivers installation, click **Finish**, which closes the installation Setup Wizard.

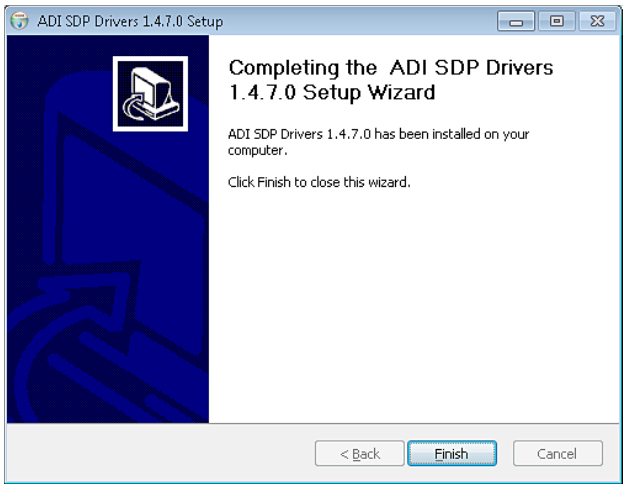


Figure 13. EVAL-SDP-CB1Z Drivers Setup: Completing the Drivers Setup Wizard

5. Before using the evaluation board, you must restart the PC.

Figure 14. EVAL-SDP-CB1Z Drivers Setup: Restarting the PC

Setting Up the System for Data Capture

After completing the steps in the Software Installation Procedures section and the Evaluation Board Hardware section, set up the system for data capture as follows:

1. Allow the Found New Hardware Wizard to run after you connect the EVAL-SDP-CB1Z board to your PC. (If you are using Windows XP, you may need to search for the EVAL-SDP-CB1Z drivers. Choose to automatically search for the drivers for the EVAL-SDP-CB1Z board if prompted by the operating system.)
2. Check the board is connecting to the PC correctly using the **Device Manager** of the PC.
3. Access the **Device Manager** as follows:
   a. Right-click **My Computer** and then click **Manage**.
   b. A dialog box appears asking for permission to allow the program to make changes to your PC. Click **Yes**.
   c. The **Computer Management** box appears. Click **Device Manager** from the list of System Tools (see Figure 15).
   d. The EVAL-SDP-CB1Z board then appears under **ADI Development Tools**. This indicates the driver software is installed and the board is connecting to the PC correctly.

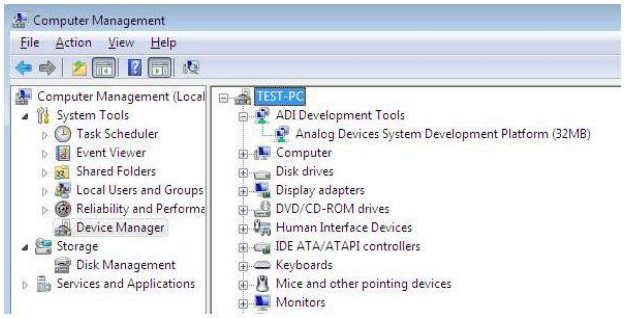


Figure 15. Device Manager: Checking the Board Is Connected to the PC Correctly

Launching the Software

After completing the steps in the Setting Up the System for Data Capture section, launch the AD7124-8 EVAL+ Software as follows:

1. From the Start menu, click **Programs** > **Analog Devices** > **AD7124 Eval+** > **AD7124 Eval+**. The dialog box in Figure 19 appears; select **EVAL-AD7124-8SDZ**, and the main window of the software then displays as shown in Figure 20.
2. If the AD7124-8 evaluation system is not connected to the USB port via the EVAL-SDP-CB1Z when the software is launched, a connectivity error displays (see Figure 16). Connect the evaluation board to the USB port of the PC, wait a few seconds, click **Rescan**, and then follow the on-screen instructions.

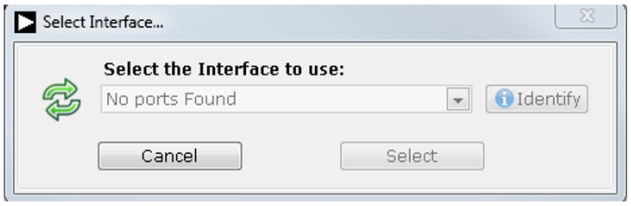


Figure 16. Connectivity Error Alert

When the software starts running, it searches for hardware connected to the PC. A dialog box indicates when the generic SDP attached to the PC is detected; the main window appears (see Figure 18). Press the RESET button on the SDP board as highlighted in Figure 17.

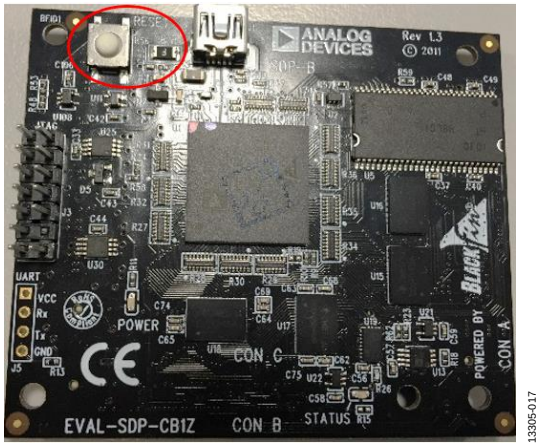


Figure 17. SDP Connectivity Board—RESET Button

Clicking the RESET button enables the software to rescan for a connected SDP board. If found, the message shown in Figure 18 displays.

Figure 18. Connectivity when SDP and Evaluation Boards are Found

SOFTWARE OPERATION

Overview of the Main Window

The evaluation software supports both the AD7124-4 and the AD7124-8 devices.

When running the software, the specific evaluation board connected to the pc can be selected as shown in Figure 19. For the AD7124-8, select EVAL-AD7124-8SDZ from the drop-down menu as shown in Figure 19.

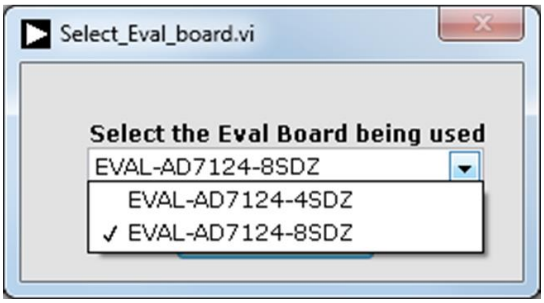


Figure 19. AD7124 Evaluation Board Selection

When selecting EVAL-AD7124-8SDZ, the main window of the evaluation software displays, as shown in Figure 20. Figure 20 shows the control buttons and analysis indicators of the AD7124-8 EVAL+ Software. The main window of the AD7124-8 EVAL+ Software contains four tabs:

- Configuration
- Waveform
- Histogram
- Register Map

CONFIGURATION TAB

The **Configuration** tab shows a block diagram of the AD7124-8. It allows the user to set up the ADC, reset the ADC, read the diagnostics to view errors present, as well as configure the device for different demo modes. Figure 20 shows the **Configuration** tab in more detail, and the following sections discuss the different elements on the **Configuration** tab of the software window.

ADC Reset

Click **ADC RESET** (Label 2) to perform a software reset of the AD7124-8. There is no hardware reset pin on the AD7124-8.

To perform a hard reset, remove power from the board. However, the software reset has the same effect as a hard reset.

Selecting External Reference

There are two options to select the external reference on the AD7124-8 EVAL+ Software: **AVdd** and **Refin1(+/−)** (Label 3). The **Refin1(+/−)** field sets the external reference voltage that is connected between REFIN1+ and REFIN1−. The **AVdd** field sets the AV_{DD} voltage level for the AD7124-8. Using EVAL-AD7124-8SDZ evaluation board, the AV_{DD} voltage is 3.3 V. Either of these voltage levels can be used to calculate the results on the **Waveform** and **Histogram** tabs. The evaluation board has an external 2.5 V ADR4525 reference; this reference selection can be bypassed on the evaluation board. If bypassing the ADR4525 on board, change the external reference voltage value in **Refin1(+/−)** to ensure correct calculation of results in the **Waveform** and **Histogram** tabs.

Tutorial Button

Click the **TUTORIAL** button (Label 4) to open a tutorial on using the software and additional information on using the AD7124-8 EVAL+ Software.

Functional Block Diagram

The functional block diagram of the ADC (Label 5) shows each of the functional blocks within the ADC. Clicking a configuration button on this graph opens the configuration pop-up window for that block.

Configuration Pop-Up Button

Each configuration pop-up button (Label 6) opens a different window to configure the relevant functional block.

Config Summary

Clicking the **CONFIG SUMMARY** button (Label 7) displays the channel configuration information on each of the individual setups as well as information on any error present. These tabs can be used to quickly check how the ADC channels are configured, as well as any errors that are present.

Demo Modes

The AD7124-8 EVAL+ Software supports a number of demo modes (Label 8); these demo modes configure the AD7124-8 for each of the modes shown. A help file is available for each demo mode; to access this help file, click the question mark button.

Status Bar

The status bar (Label 9) displays status updates such as **Analysis Completed**, **Reset Completed**, and **Configuring Demo Mode** during software use, as well as the software version and the **Busy** indicator.

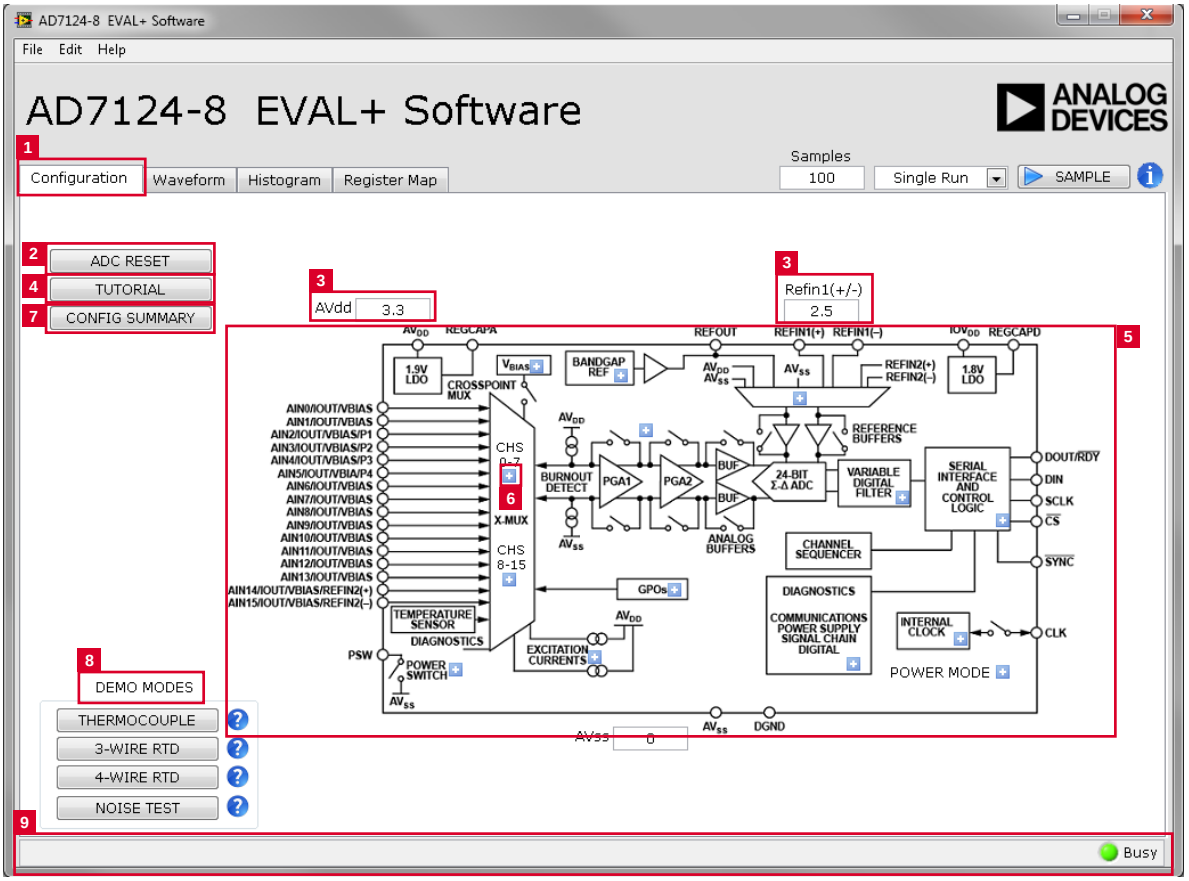


*Figure 20. **Configuration** Tab of the AD7124-8 EVAL+ Software*

WAVEFROM TAB

The **Waveform** tab graphs the conversions gathered and processes the data, calculating the peak-to-peak noise, rms noise, and resolution (see Figure 21).

Waveform Graph and Controls

The data waveform graph (Label 1) shows each successive sample of the ADC output. Zoom in on the data in the graph using the control toolbar (Label 2). Change the scales on the graph by typing values into the x-axis and y-axis.

Analysis Channel

The **Noise Analysis** section and histogram graph show the analysis of the channel selected via the **Analysis Channel** control (Label 3).

Samples

The **Samples** numeric control (Label 4) and batch control (Label 5) set the number of samples gathered per batch. Batch control sets whether a single batch or multiple batches of samples are gathered. This control is unrelated to the ADC mode. You can capture a defined sample set or continuously gather batches of samples. In both cases, the number of samples set in the **Samples** (Label 4) numeric input dictates the number of samples.

Sample

Click the **SAMPLE** button (Label 6) to start gathering ADC results. Results appear in the waveform graph (Label 1).

Channel Selection

The channel selection control (Label 7) selects which channels display on the data waveform and shows the analog inputs for the channel labeled next to the on and off controls.

These controls only affect the display of the channels and have no effect on the channel settings in the ADC register map.

Display Units and Axis Controls

Click the **Display Units** drop-down menu (Label 8) to select whether the data graph displays in units of voltages or codes. This control affects both the waveform graph and the histogram graph. The axis controls switch between dynamic and fixed. When dynamic is selected, the axis automatically adjusts to show the entire range of the ADC results after each batch of samples. When selecting **Fixed**, the axis ranges can be programmed; however, these ranges do not automatically adjust after each batch of samples.

CRC Error and Overall Error

The **CRC Error** LED indicator (Label 9) illuminates on the **Waveform** tab when a cyclic redundancy check (CRC) error is detected in the communications between the software and the AD7124-8. The CRC functionality on the AD7124-8 is disabled by default and must be enabled for this indicator to work. The **Error Present** LED indicates if an overall error is present in the diagnostics register. For this indicator to work, the check for the different diagnostic errors must be enabled in the Error_EN register.

Noise Analysis

The **Noise Analysis** (Label 10) section displays the results of the noise analysis for the selected analysis channel, including both noise and resolution measurements.

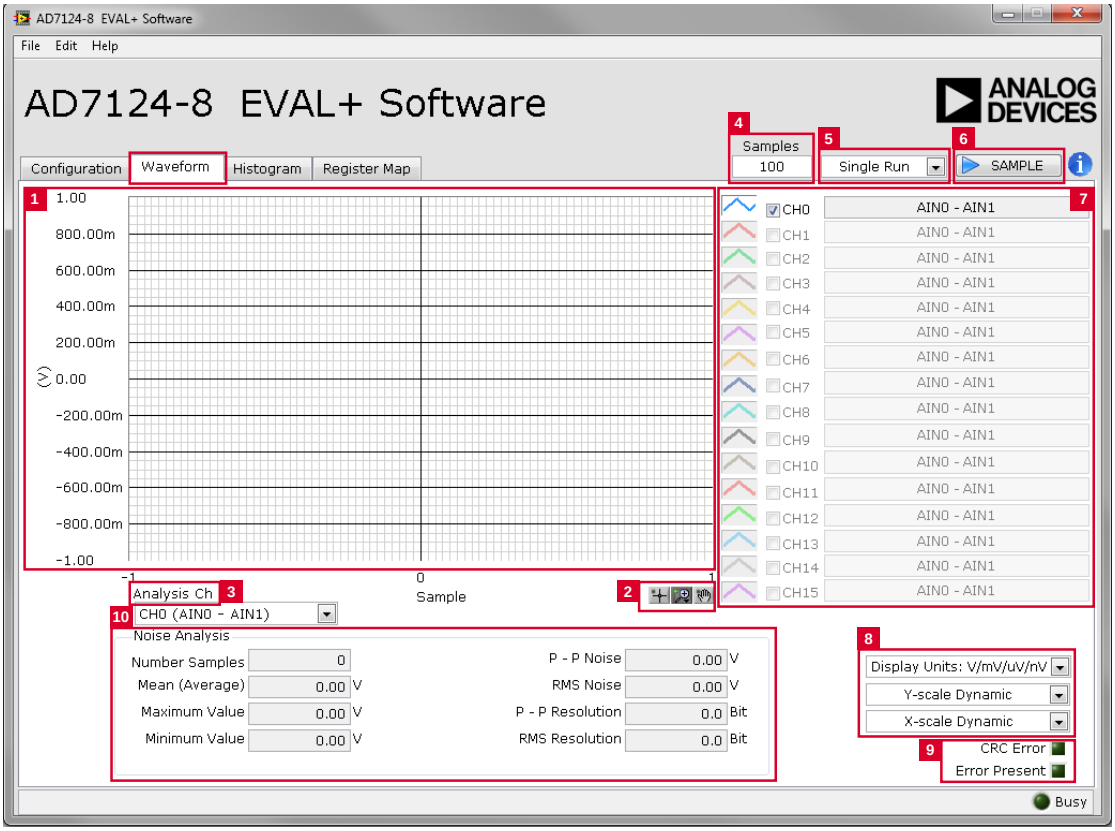


*Figure 21. **Waveform** Tab of the AD7124-8 EVAL+ Software*

HISTOGRAM TAB

The **Histogram** tab generates a histogram using the gathered samples and processes the data, calculating the peak-to-peak noise, rms noise, and resolution (Figure 22).

Histogram Graph and Controls

The data histogram graph (Label 1) shows the number of times each sample of the ADC output occurs. Zoom in on the data using the control toolbar (Label 6) in the graph. Change the scales on the graph by typing values into the x-axis and y-axis.

Analysis Channel

The **Noise Analysis** section and histogram graph show the analysis of the channel selected via the **Analysis Channel** (Label 2) control.

Noise Analysis

The **Noise Analysis** section (Label 3) displays the results of the noise analysis for the selected analysis channel, including both noise and resolution measurements.

Display Units and Axis Controls

Click the **Display Units** drop-down box (Label 4) to select whether the data graph displays in units of voltages or codes.

This control affects both the waveform graph and the histogram graph. The axis controls can be used to switch between dynamic and fixed range. When **Dynamic** is selected, the axis automatically adjusts to show the entire range of the ADC results after each batch of samples. When selecting **Fixed**, the user can program the axis ranges; the axis ranges do not automatically adjust after each batch of samples.

CRC Error and Overall Error

The **CRC Error** LED indicator (Label 5) illuminates when detecting a cyclic redundancy check (CRC) error in the communications between the software and the AD7124-8. The CRC functionality on the AD7124-8 is disabled by default and must be enabled for this indicator to work. The **Error Present** LED (Label 5) indicates if an overall error is present in the diagnostics register. For this indicator to work, the check for the different diagnostic errors must be enabled in the Error_EN register.

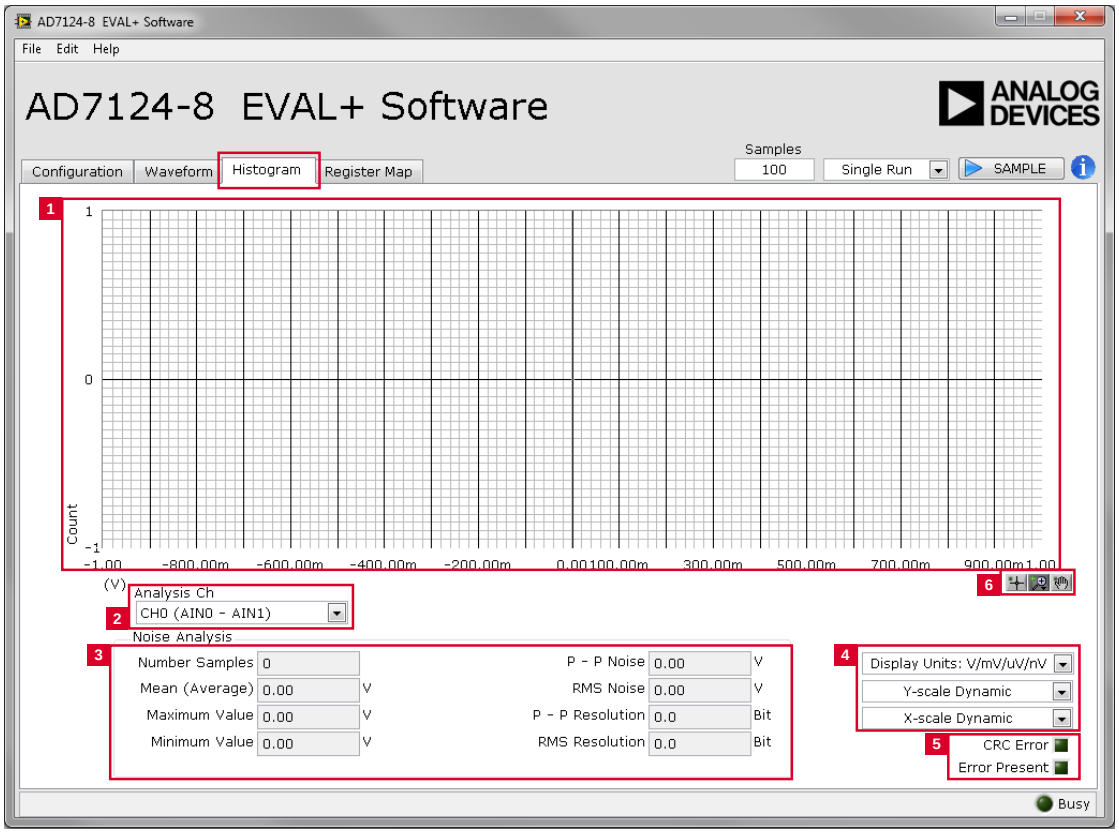


*Figure 22. **Histogram** Tab of the AD7124-8 EVAL+ Software*

REGISTER MAP TAB

Use the **Register Map** tab to access the registers of the AD7124-8. Figure 23 shows the **Register Map** tab. This tab changes register settings and shows additional information about each bit in each individual register.

Register Map

On the top of Figure 23 are the registers of the AD7124-8. Click any register to read the register value. Access each register of the AD7124-8 using the register map (Label 1).

Save and Load Buttons

The **Save** and **Load** buttons (Label 2) on the **Register Map** tab allow the user to save and load register settings. Click **Save** to save all the current register settings to a file for later use. Click **Load** to load a previously saved register map.

Register

The **Register** section (Label 3) shows the value that is set in the selected register. Check the value of the register in this window by clicking on the bits.

Clicking any individual bit changes the bit from 1 to 0 or 0 to 1, depending on the initial state of the bit. The register value can also be changed by writing the hexadecimal value in the input field to the right of the individual bits.

Bitfields

The **Bitfields** section (Label 4) shows the individual bitfield of the selected register. The register is broken by name into its bitfields, name of the bitfields, a description of each bitfield, and access information. View the options for the individual bitfields by clicking on the arrow next to the bitfield. Change the bitfield value through this drop-down menu or by writing the appropriate hexadecimal value in the associated **Value** input field on the far right of the bitfield

Documentation

The **Documentation** section (Label 5) shows information relating to the different bit fields when selected from the register map section on the left. This information is the same information in the AD7124-8 data sheet.

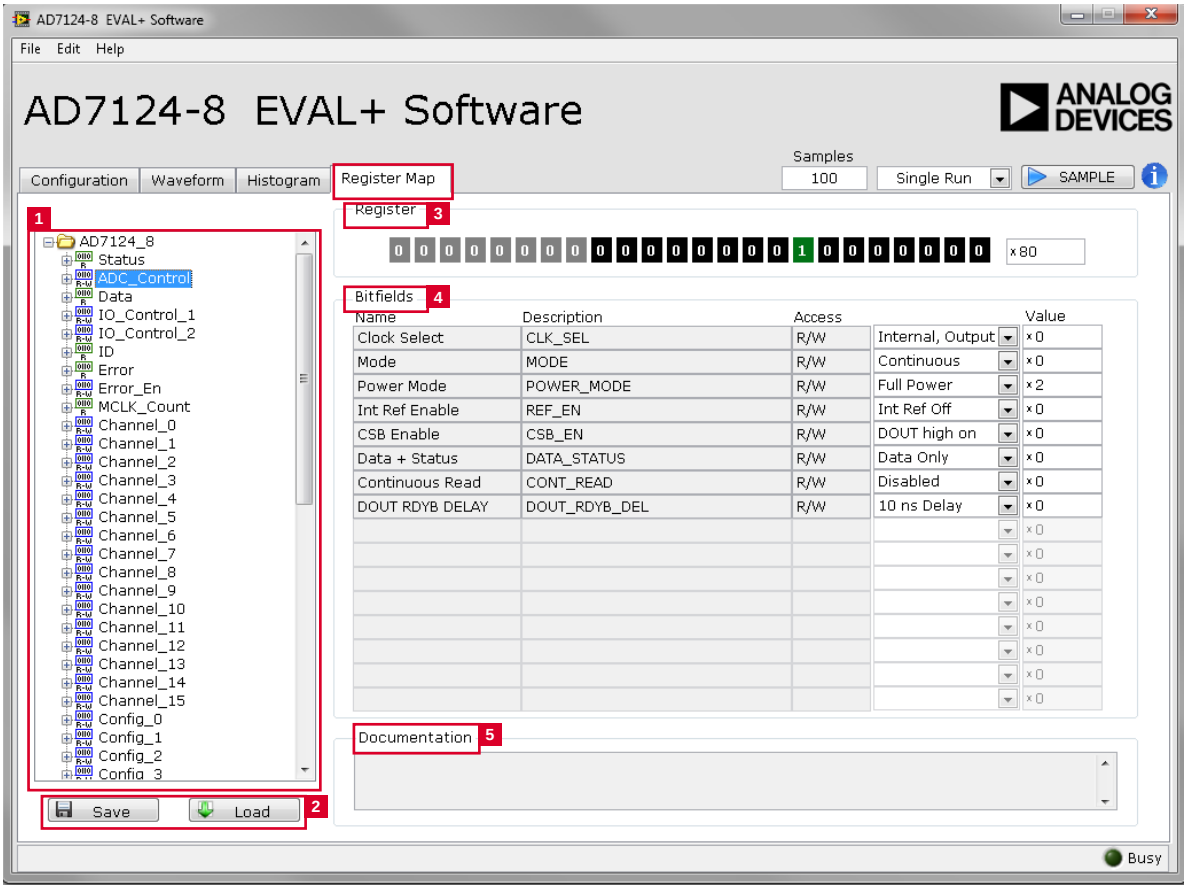


*Figure 23. **Register Map** Tab of the AD7124-8 EVAL+ Software*

NOISE TEST—QUICK START DEMONSTRATION

Click the **NOISE TEST** demo button (Figure 20) to configure the device for the noise test. The AD7124-8 is now configured for the noise test demo, where the output data rate is 9.38 SPS, where the sinc^4 digital filter, full power mode of operation, and external reference REFIN1(±) is selected. Gain and offset are the default factory values following a reset.

To gather samples, change the **Samples** field to the number of samples required, then click the **SAMPLE** button to acquire the samples from the ADC. Figure 24 shows an example of the main window after running a noise test.

Reading Samples from the ADC

The evaluation board is set up to use the external 2.5 V on-board reference (ADR4525). To read samples from the ADC, do the following:

1. The value in the **Refin1(+/−)** field on the **Configuration** tab is set to 2.5 V by default to use the external 2.5 V on-board reference (ADR4525). If a different reference is used to the AD7124-8, the **Refin1(+/−)** field should be updated accordingly. (The analysis results are based on the value set in this input field.)
   a. When selecting **Single Run**, a batch of samples is read when clicking the **SAMPLE** button; the batch size is set by the value in the **Samples** field.
   b. When selecting **Continuous Read**, the software performs a continuous capture from the ADC by clicking the **SAMPLE** button. Click the **SAMPLE** button again to stop capturing data.
2. Use the navigation tools within each graph to control the cursor, zooming, and panning.

Waveform

Find the waveforms resulting from the gathered samples in the **Waveform** tab. The waveform graph shows each successive sample of the ADC output (input referred). The indicators beside this graph show the channels converting. The navigation tools allow you to control the cursor, zooming, and panning. You can also display the conversions as voltages or codes.

Below the graph are parameters, such as peak-to-peak noise and rms noise, in the **Analysis** section for the current batch of samples. If there are several enabled analog input channels, you can select each enabled channel and the conversions through the analyzed channel using the **Analysis Channel**.

Save the conversion data in a text file using File at the top of the window. To save the data into an Excel file, right-click the waveform graph and select **Export Data** from the drop-down menu that appears. A **Save** dialog box is displayed, prompting you to save the data to an appropriate folder location.

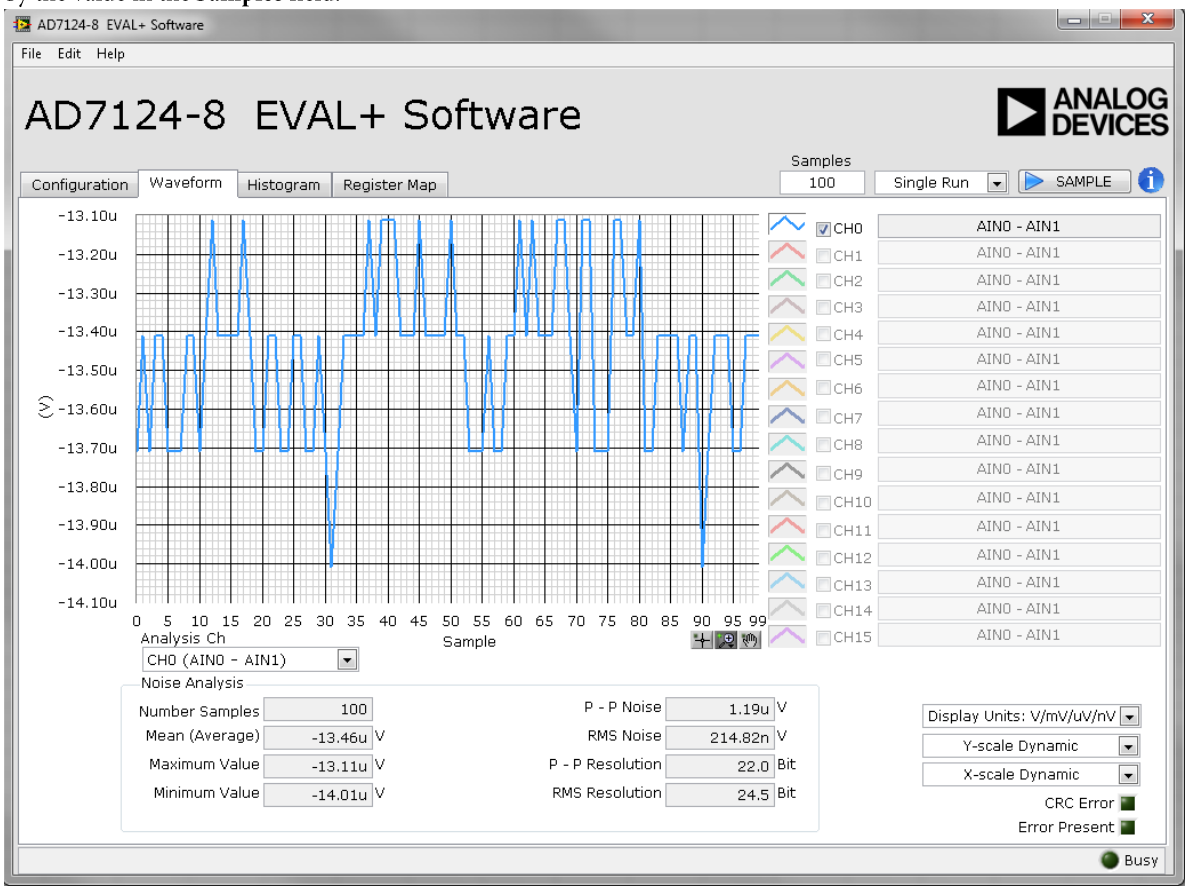


*Figure 24. Example of the **Waveform** Tab After Running a Noise Test*

Histogram

This tab shows the histogram analysis. The indicators beside this graph show the channels converting. The navigation tools allow you to control the cursor, zooming, and panning. You can also display the conversions as voltages or codes.

Parameters such as peak-to-peak noise and rms noise are displayed in the **Analysis Results** section for the current batch of samples.

Save the conversion data in a text file using **File** at the top of the window. To save the data into an Excel file, right-click the waveform graph and select **Export Data** from the drop-down menu that appears. A **Save** dialog box is displayed, prompting you to save the data to an appropriate folder location.

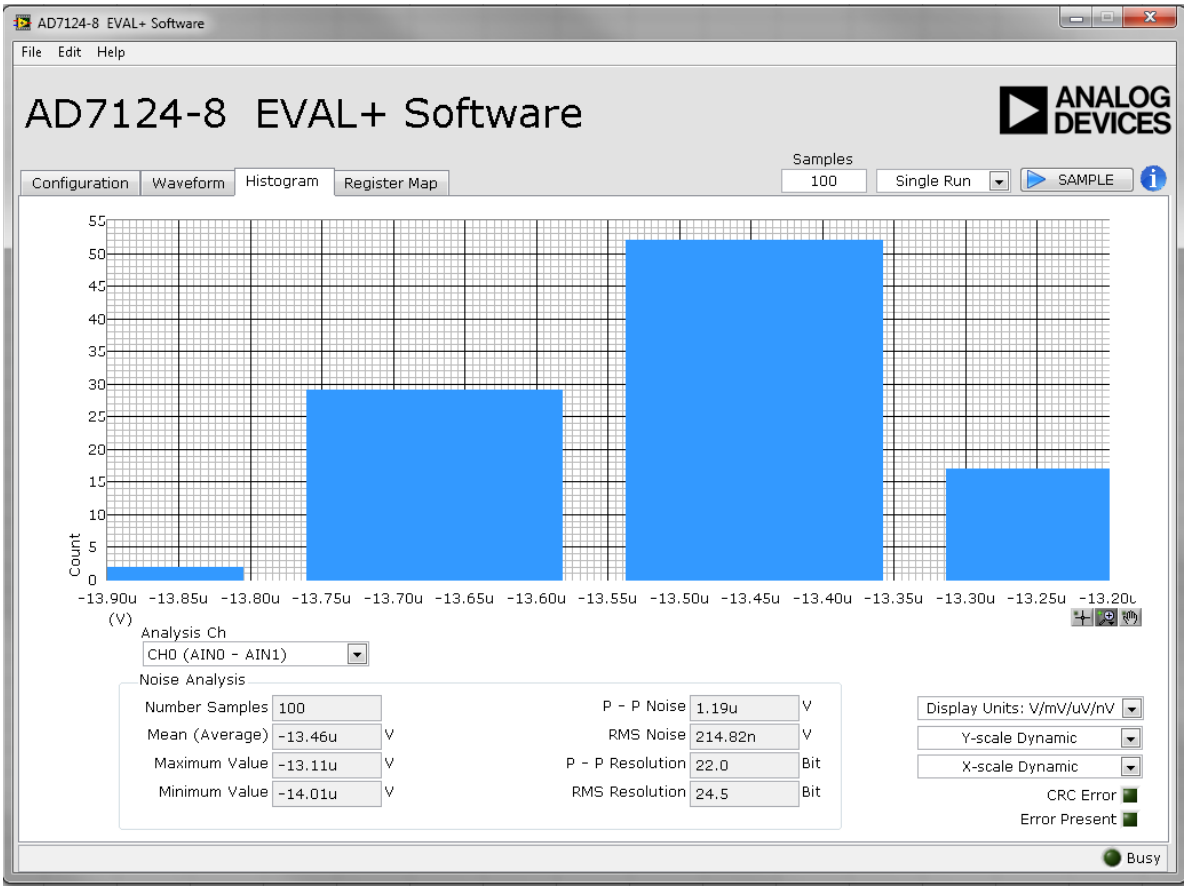


*Figure 25. Example of the **Histogram** Tab After Running a Noise Test*

EVALUATION BOARD SCHEMATICS AND ARTWORK

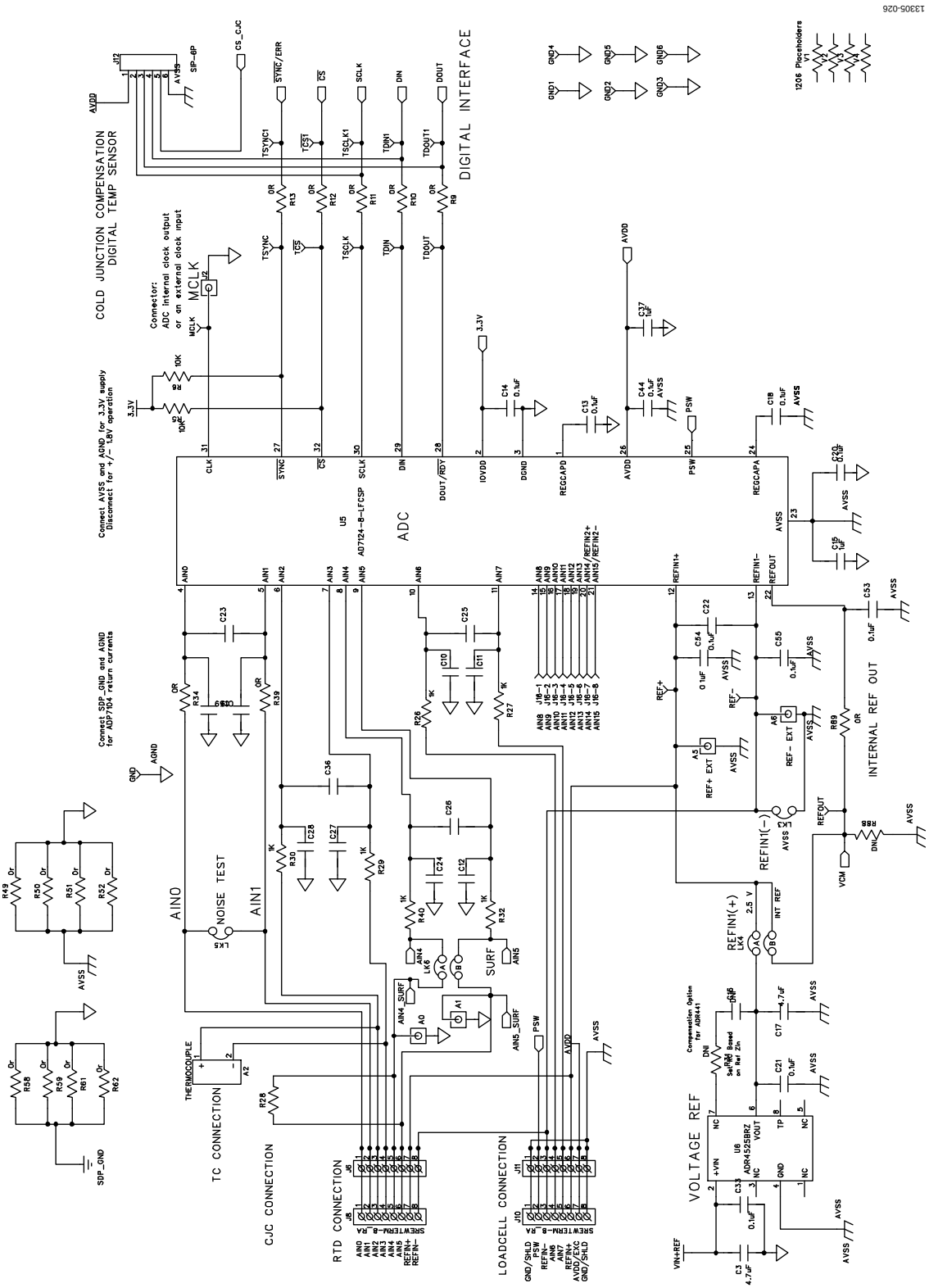


Figure 26. Schematic

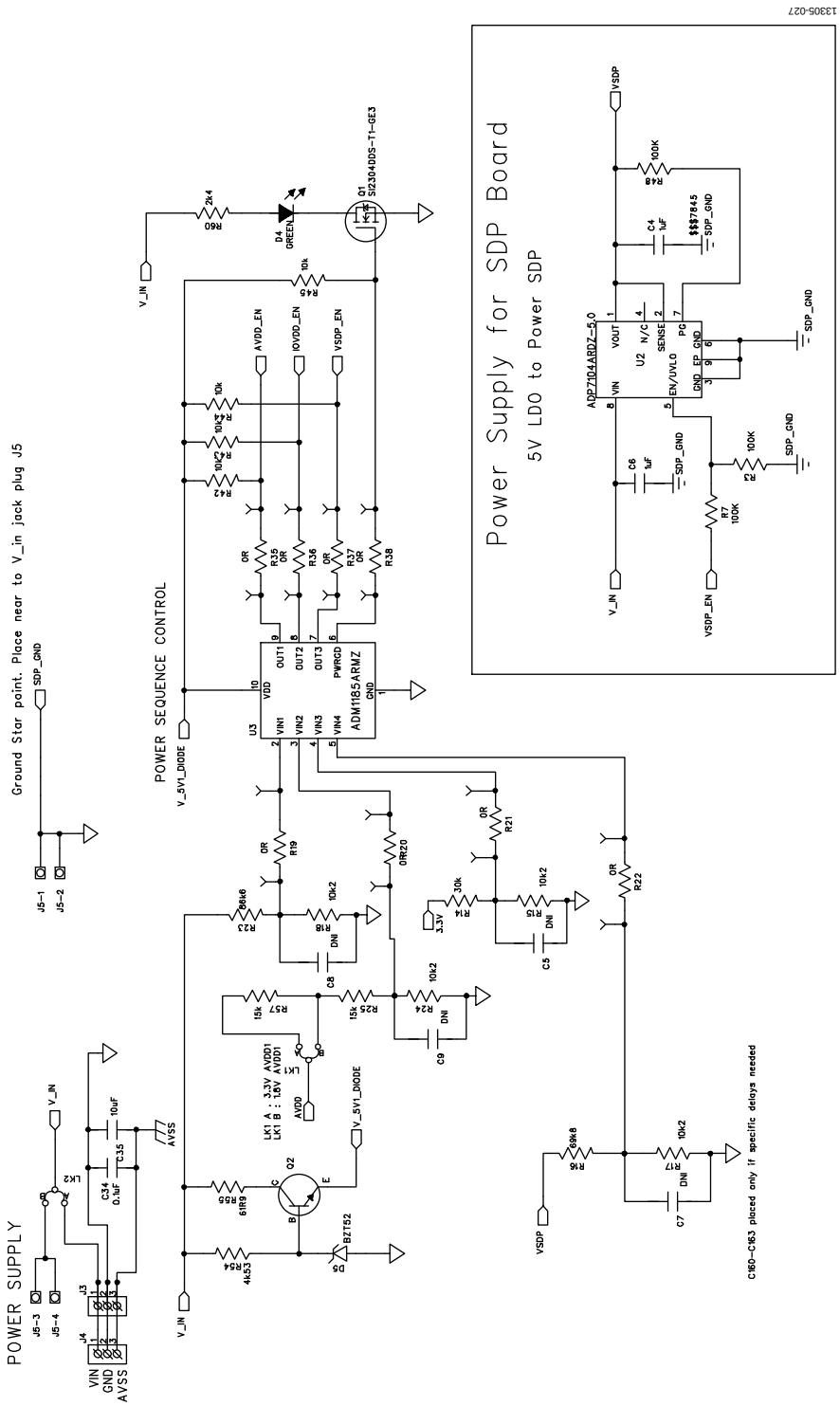


Figure 27. Schematic—Power Supply

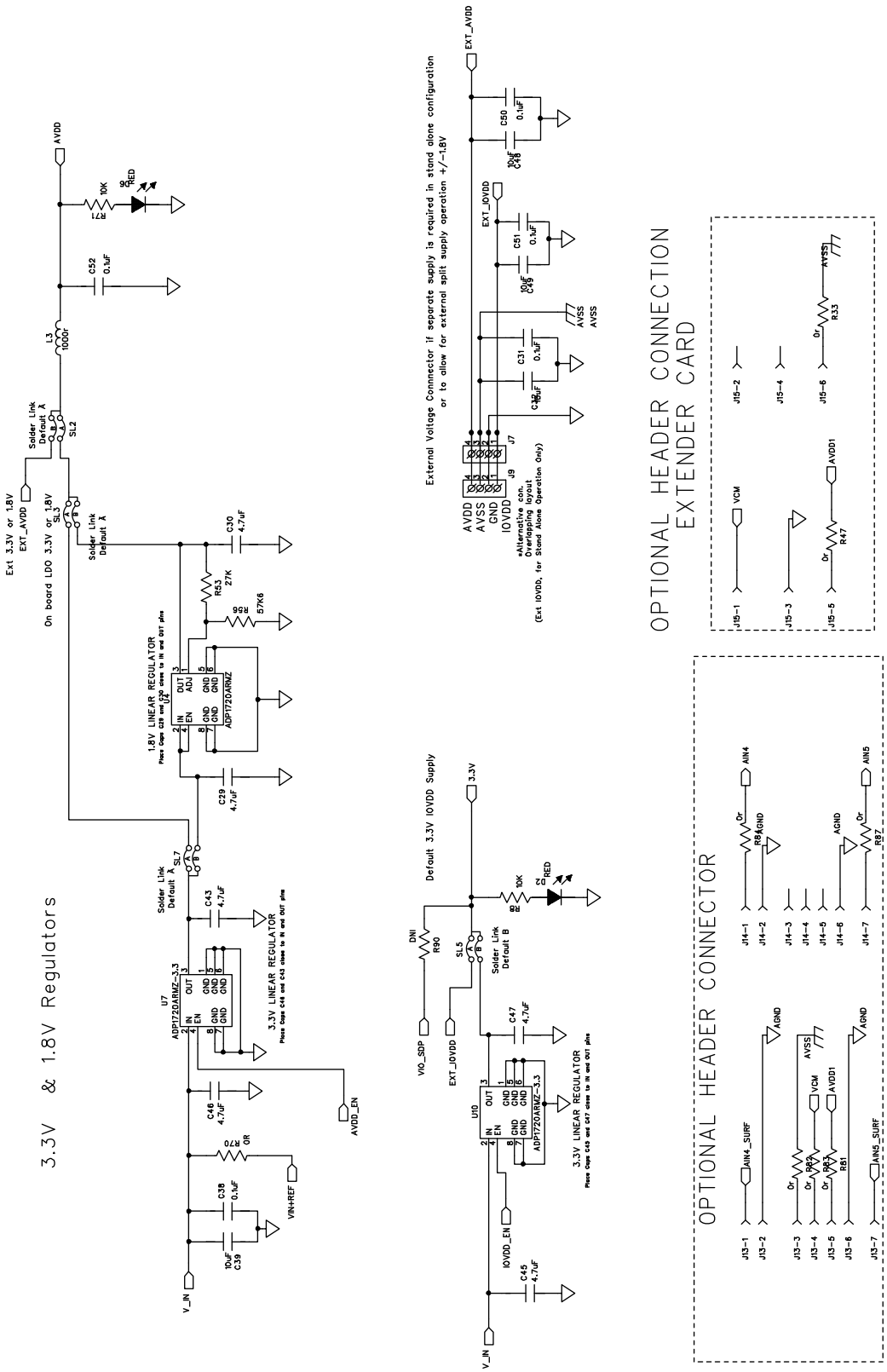


Figure 28. Schematic—Regulators

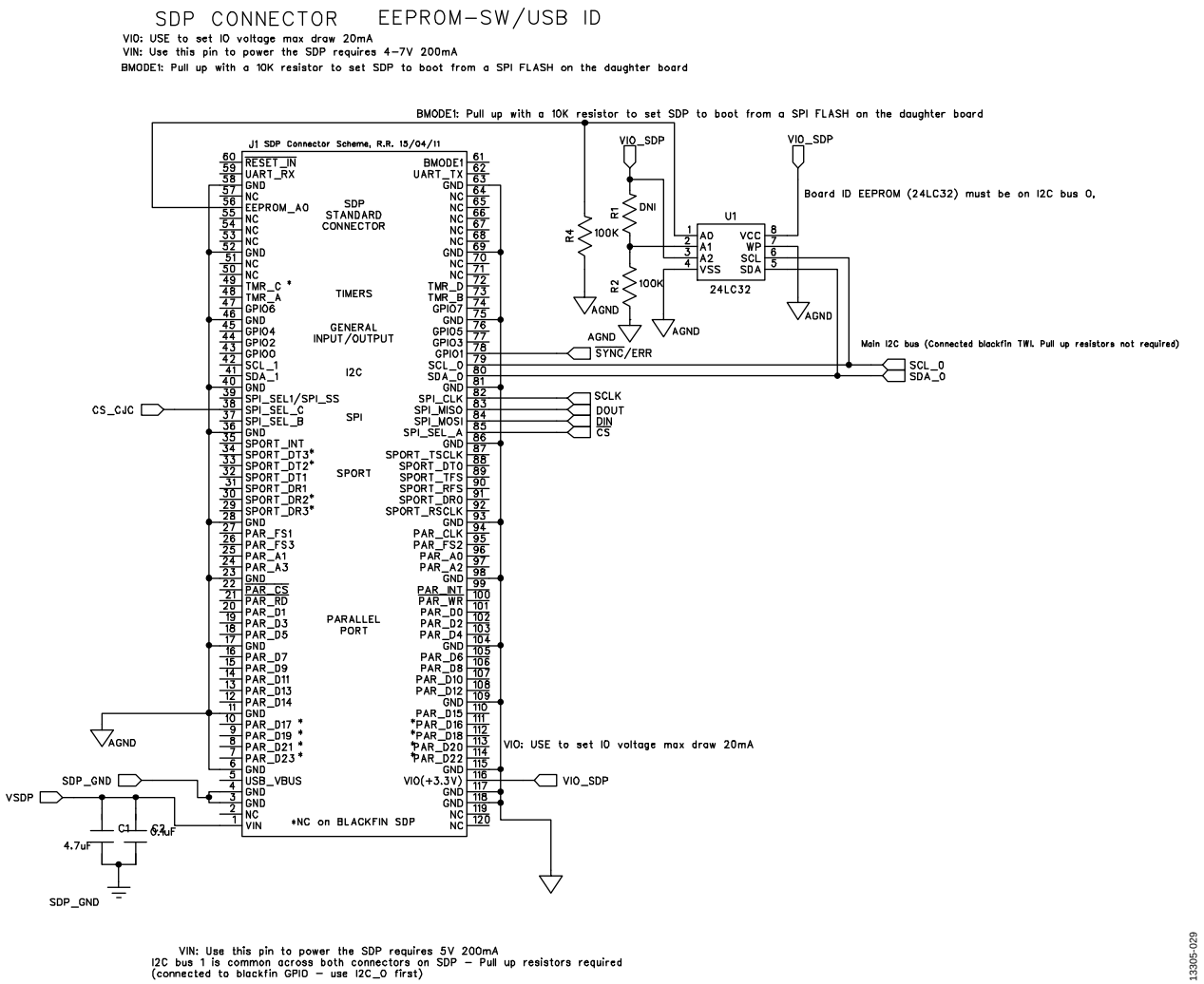


Figure 29. Schematic—SDP

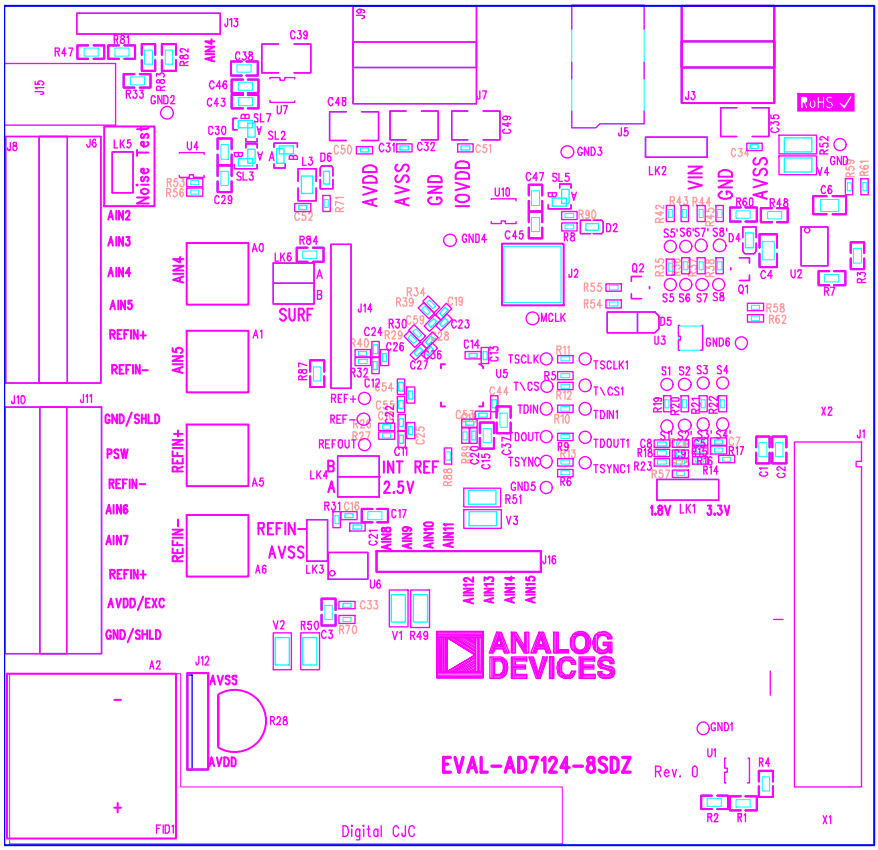


Figure 30. Top Printed Circuit Board (PCB) Silkscreen

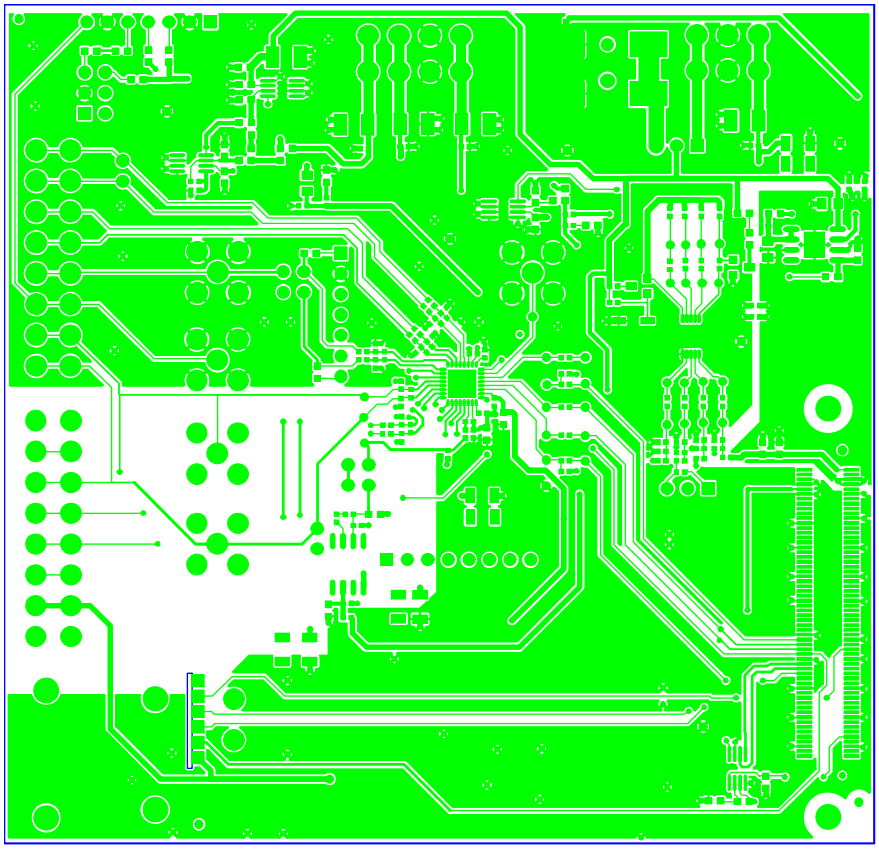


Figure 31. Layer 1 Component Side

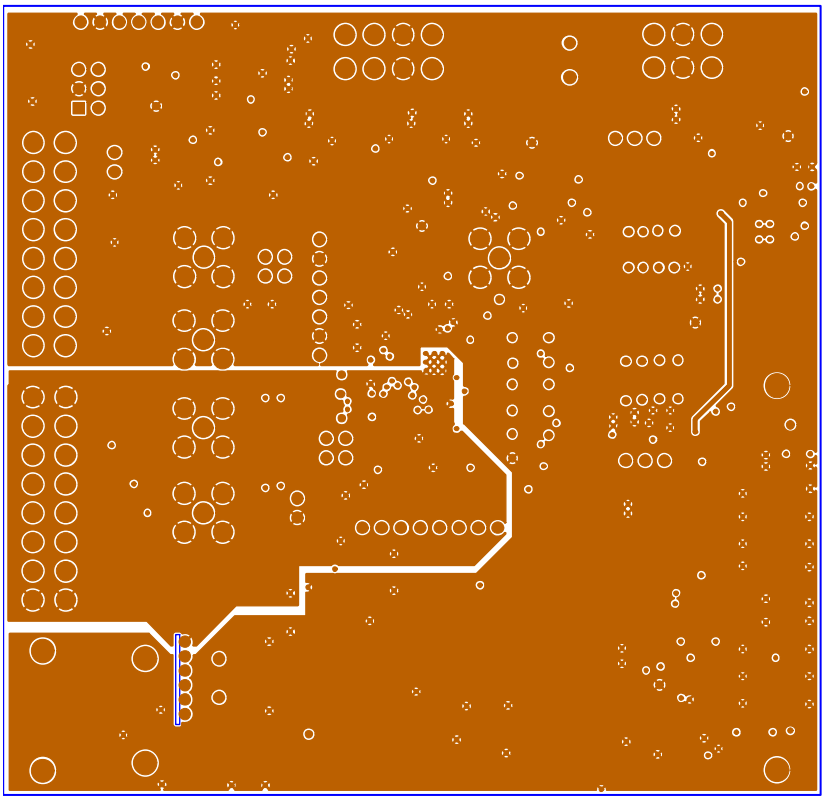


Figure 32. Layer 2 Ground Plane

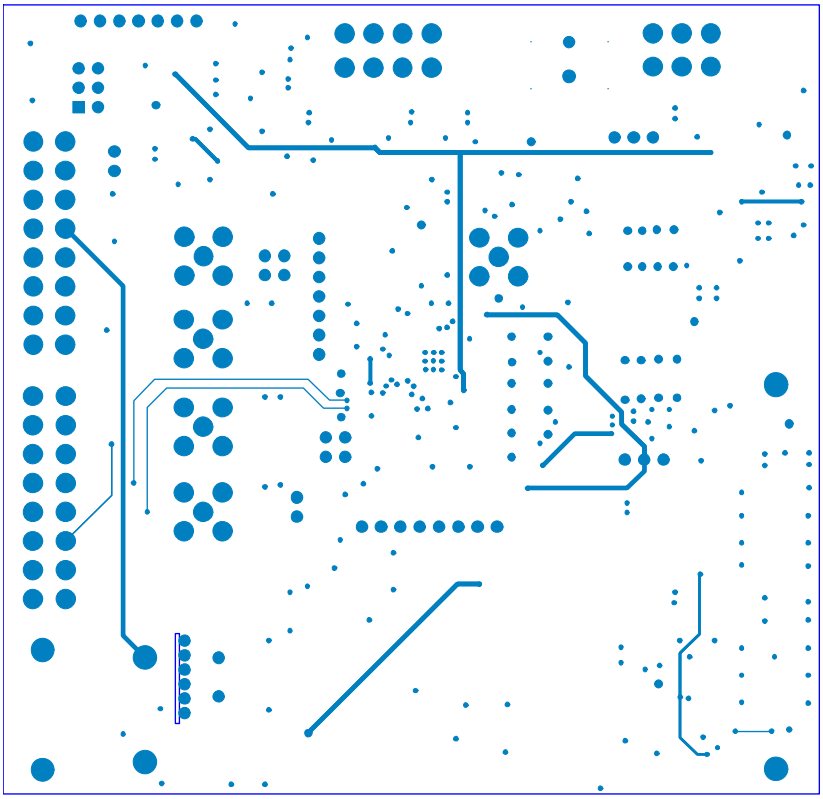


Figure 33. Layer 3 Power/Ground Plane

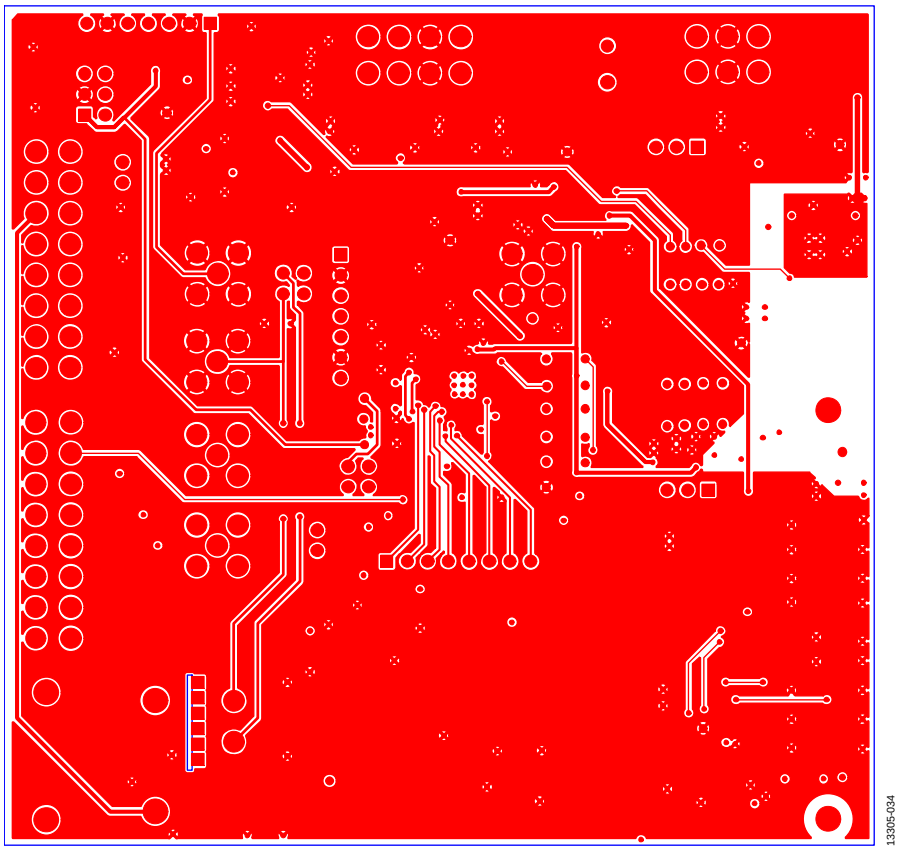


Figure 34. Layer 4 Component Side

BILL OF MATERIALS

Table 4.[1]

Reference Designator	Description	Manufacturer	Part Number	Stock Code
A0, A1, A5, A6, J2	Straight PCB mount SMB jack, keep hole clear of solder	Tyco	1-1337482-0	Do Not Insert
A2	Miniature thermocouple connector	Omega	PCC-SMP-U-50	Do Not Insert
C1, C17, C29, C30, C43, C47	Ceramic capacitor, 6.3 V, X5R, 0603, 4.7 µF, ±10%	Murata	GRM188R60J475K	FEC 173-5527
C2, C22, C25, C26, C36, C38, C54, C55	Ceramic capacitor, 50 V, X7R, 0603, 0.1 µF, ±10%	Murata	GRM188R71H104K	FEC 882-0023
C3, C45, C46	Ceramic capacitor, 10 V, X5R, 0603, 4.7 µF, ±10%	KEMET	C0603C475K8PACTU	FEC 157-2625
C4, C6	Capacitor, 0805, 1 µF, 50 V, X7R, 1 µF, ±10%	Murata	GRM21BR71H105KA12L	FEC 173-5541
C5, C7, C8, C9, C16	Ceramic capacitor, not inserted, 0402	N/A	N/A	Do Not Insert
C10-C12, C24, C27, C28	Ceramic capacitor, 50 V, NPO, 0603, 0.01 µF	Phycomp	2238 586 15636	FEC 722-236
C13, C14, C18, C20, C21, C31, C33, C34, C44, C50 to C53	Ceramic capacitor, 16 V, X7R, 0402, 0.1 µF, ±10%	Murata	GRM155R71C104K	FEC 881-9742
C15, C37	Capacitor, 6.3 V, 1 µF, ±10%	Murata	GRM188R70J105KA01D	FEC 184-5765
C19, C59	Ceramic capacitor, 25 V, NPO, 0603, 0.01 µF	N/A	N/A	Do Not Insert
C23	Ceramic capacitor, 50 V, NPO, 0603, 0.1 µF	N/A	N/A	Do Not Insert
C32, C35, C39, C48, C49	Ceramic capacitor, 50 V, X5R, 1210, 10 µF	Murata	GRM32ER61H106K	FEC 184-5764
D2, D6	Red LED, high intensity (>90 mCd), 0603	Avago Technologies	HSMC-C191	FEC 855-8528
D4	LED, SMD green	OSRAM	LGQ971	Digikey 475-1409-1-ND
D5	Zener diode, 0.5 W, 5.1 V, BZT52	Vishay	BZT52B5V1-V-GS08	FEC 161-7767
GND to GND6, MCLK, REF+, REF−, REFOUT, S1-S8, TDIN, TDIN1, TDOUT, TDOUT1, TSCLK, TSCLK1, TSYNC, TSYNC1, T\CS, T\CS1	Test point, not inserted, keep hole clear of solder	N/A	N/A	Do Not Insert
J1	120-way connector, 0.6 mm pitch	Hirose	FX8-120S-SV(21)	FEC 132-4660
J3	Socket terminal block, pitch 3.81 mm	Phoenix Contact	MC 1.5/3-G-3.81	FEC 370-4737
J4	Screw terminal block, pitch 3.81 mm	Phoenix Contact	1727023	Do Not Insert
J5	DC power connectors 2 mm SMT power jack	Kycon	KLDX-SMT2-0202-A	MOUSER 806-KLDX-SMT20202A
J6, J11	8-pin terminal header, pitch 3.81 mm, vertical	Phoenix Contact	MC 1,5/ 8-G-3,81	FEC 370-4774
J7	Connector, pitch 3.81 mm, right angle, 1 × 4-pin	Phoenix Contact	MC 1,5/ 4-G-3,81 and 180-3594	Do Not Insert
J8, J10	8-pin terminal header, pitch 3.81 mm, vertical	Phoenix Contact	1727078	Do Not Insert
J9	Screw terminal block, pitch 3.81 mm, 1 × 4-pin	Phoenix Contact	1727036	FEC 370-4592
J12	PCB pads, 6-way solder slot for Analog Devices PCB, 6-way	Aragorn	ADT7320-CJC-PCB	ADT7320-CJC-PCB
J13	7-way SSW 2.54 mm vertical socket	Samtec	SSW-107-01-T-S	FEC 180-3478

Reference Designator	Description	Manufacturer	Part Number	Stock Code
J14	7-way sip 2.54 mm TH header	Samtec	TLW-107-05-G-S	FEC 166-8499
J15	Do not insert	N/A	N/A	Do Not Insert
L3	Ferrite bead, 0.3 Ω at DC, 1000 Ω at100 MHz, 350 mA, 0805	Tyco	BMB2A1000LN2	FEC 119-3421
LK1, LK2	3-pin (3 × 1) 0.1" header and shorting block in Position A	Harwin	M20-9990346 and M7566-05	FEC 102-2249 and 150-411
LK3, LK5	2-pin (0.1" pitch) header and shorting shunt	Harwin	M20-9990246	FEC 102-2247 and 150-411
LK4, LK6	4-pin (2 × 2) 0.1" header and shorting block	Harwin	M20-9983646 and M7566-05	FEC 1022244 and 150-411 (36 Pin Strip)
Q1	MOSFET transistor	Vishay Siliconix	SI2304DDS-T1-GE3	FEC 185-8939
Q2	Transistor, NPN, SOT-23	ON Semiconductor	MMBT3904LT1G	FEC 145-9100
R1	Resistor, not inserted, 0603	N/A	N/A	Do Not Insert
R2 to R4, R7, R48	SMD resistor, 100 kΩ, 1%	Multicomp	MC 0.063W 0603 1% 100K	FEC 933-0402
R5, R6, R8, R71	Resistor, 1%, 0402, 10 kΩ	Phycomp	CRCW040210K0 FKEAHP	FEC 173-8864
R9 to R13, R19 to R22, R35 to R38, R58, R59, R61, R62, R70	Resistor, 0402, 0 Ω, 1%	Vishay	CRCW04020000 Z0ED	FEC 146-9661
R14	Resistor, 0402, 1%, 30 kΩ	Multicomp	MC 0.0625W 0402 1% 30K	FEC 135-8082
R15, R17, R18, R24	SMD Resistor, 10.2 kΩ, 1%	Multicomp	MC 0.0625W 0402 1% 10K2	FEC 180-3137
R16	Resistor, 0402, 1%, 69.8 kΩ	Multicomp	MC 0.0625W 0402 1% 69K8	FEC 180-3735
R23	Resistor, 0402, 1%, 86.6 kΩ	Multicomp	MC 0.0625W 0402 1% 86K6	FEC 180-3744
R25, R57	Resistor, 0402, 1%, 15 kΩ	Multicomp	MC 0.0625W 0402 1% 15k	FEC 1358073
R26, R27, R29, R30, R32, R40	Resistor, 0603, 1 Ω, 1%	Multicomp	MC 0.063W 0603 1% 1K	FEC 933-0380
R28	Thermistor, 1950 Ω to 1990 Ω	Infineon	Q62705-K110	Philips (Arrow) KTY81/110
R3, R901	Resistor, not inserted, 0402	N/A	N/A	Do Not Insert
R33, R34, R39, R47, R81 to R84, R87, R89	Resistor, 0603, 0 Ω, 1%	Vishay Draloric	CRCW06030000 Z0EA	FEC 146-9739
R42 to R45	Resistor, thick film, 10 kΩ, 62.5 mW, 5%	Yageo	RC0402JR-1310KL	FEC 179-9316
R49 to R52	Resistor, 1206, 0 R, 5%	Multicomp	MC 0.125W 1206 0R	FEC 933-6974
R53	Resistor, 0402, 27 kΩ, 1%	Multicomp	MC 0.0625W 0402 1% 27K	FEC 135-8081
R54	Resistor, thick film, 4.53 kΩ, 63 mW, 1%	Vishay Dale	CRCW04024K53 FKED	FEC 115-1244
R55	Resistor, 0402, 1%, 61.9 Ω	Multicomp	MC 0.0625W 0402 1% 61R9	FEC 180-2915
R56	Resistor, 0402, 57.6 kΩ, 1%	Multicomp	MC 0.0625W 0402 1% 57K6	FEC 185-1295
R60	Resistor, thick film, 2.4 kΩ, 0603, 100 mW, 1%	Yageo	RC0603FR-072K4L	FEC 179-9329
R88	Resistor, 0603, not inserted	N/A	N/A	Do Not Insert

Reference Designator	Description	Manufacturer	Part Number	Stock Code
SL2, SL3, SL7	2-way solder link (use 0 Ω, 0603 resistor)	N/A	Insert in Link Position "A"	FEC 933-1662
SL5	2-way solder link (use 0 Ω, 0603 resistor)	N/A	Insert in Link Position "B"	FEC 933-1662
STAR3	Ground link	N/A	N/A	N/A
U1	32 k I^2C serial EEPROM	Microchip	24LC32A-I/MS	FEC133-1330
U2	Linear regulator 5 V, 20 V, 500 mA, ultralow noise, CMOS	Analog Devices	ADP7104ARDZ-5.0	ADP7104ARDZ-5.0
U3	Quad voltage monitor and sequencer	Analog Devices	ADM1185ARMZ-1	ADM1185ARMZ-1
U4	50 mA, high voltage, micropower linear regulator, ADJ	Analog Devices	ADP1720ARMZ-R7	ADP1720ARMZ-R7
U5	8-channel, low power, low noise, Σ-Δ ADC	Analog Devices	AD7124-8BCPZ	AD7124-8BCPZ
U6	2.5 V low noise reference	Analog Devices	ADR4525BRZ	ADR4525BRZ
U7, U10	50 mA, high voltage, micropower linear regulator 3.3 V	Analog Devices	ADP1720ARMZ-3.3-R7	ADP1720ARMZ-3.3-R7
V1 to V4	1206, place holder	N/A	N/A	Do Not Insert

[1] N/A means not applicable.

NOTES

I²C refers to a communications protocol originally developed by Philips Semiconductors (now NXP Semiconductors).

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.

UG13305-0-7/15(0)

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