

Evaluation Board for the **AD7176-2**—24-Bit, 250 kSPS Sigma-Delta ADC with 20 μ s Settling

FEATURES

- Full featured evaluation board for the **AD7176-2**
- PC control in conjunction with the system demonstration platform (**EVAL-SDP-CB1Z**)
- PC software for control and data analysis (time domain)
- Standalone capability

ONLINE RESOURCES

- Evaluation Kit Contents
 - EVAL-AD7176-2SDZ** evaluation board
 - Evaluation software CD for the **AD7176-2**
- Documents Needed
 - AD7176-2** data sheet
 - EVAL-AD7176-2SDZ** (UG-478) user guide
- Required Software
 - EVAL-AD7176-2SDZ** evaluation software

EQUIPMENT NEEDED

- EVAL-AD7176-2SDZ** evaluation board
- EVAL-SDP-CB1Z** system demonstration platform
- External 7 V to 9 V power supply
- DC signal source
- USB cable
- PC running Windows with USB 2.0 port

GENERAL DESCRIPTION

The **EVAL-AD7176-2SDZ** evaluation kit features the **AD7176-2** 24-bit, 250 kSPS analog-to-digital converter (ADC). A 7 V to 9 V external bench top supply is regulated to 5 V and 3.3 V to supply the **AD7176-2** and support all necessary components. The **EVAL-AD7176-2SDZ** board connects to the USB port of the PC by connection to the **EVAL-SDP-CB1Z** motherboard.

The **EVAL-AD7176-2SDZ** software fully configures the **AD7176-2** 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-AD7176-2SDZ** is an evaluation board that is designed to allow the user to evaluate the features of the ADC. The user PC software executable controls the **AD7176-2** over the USB through the system demonstration platform board (**EVAL-SDP-CB1Z**).

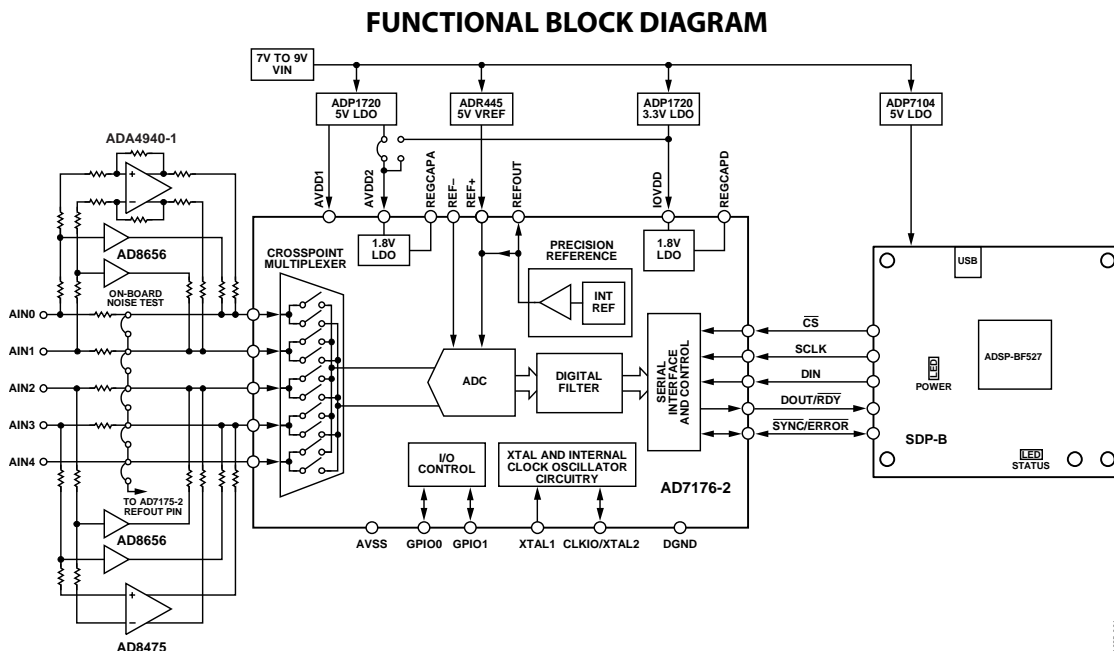


Figure 1. **EVAL-AD7176-2SDZ** Block Diagram

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REVISION HISTORY

4/14—Rev. 0 to Rev. A

Changes to the Reference Options Section..... 8

11/12—Revision 0: Initial Version

EVAL-AD7176-2SDZ 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 **AD7176-2** evaluation board software from the CD included in the evaluation board kit. The PC must be restarted 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-AD7176-2SDZ** board as shown in Figure 2.
 - a. Screw the two boards together using the plastic screw-washer set included in the evaluation board kit to ensure that the boards are connected firmly together.
3. Apply an external voltage in the range of 7 V to 9 V to the J4 or J5 connector of the **EVAL-AD7176-2SDZ** board, as shown in Figure 2 (see Table 3 for more information). This provides the power supply for the board.
4. 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.
5. Launch the **EVAL-AD7176-2SDZ** software from the **Analog Devices** subfolder in the **Programs** menu.

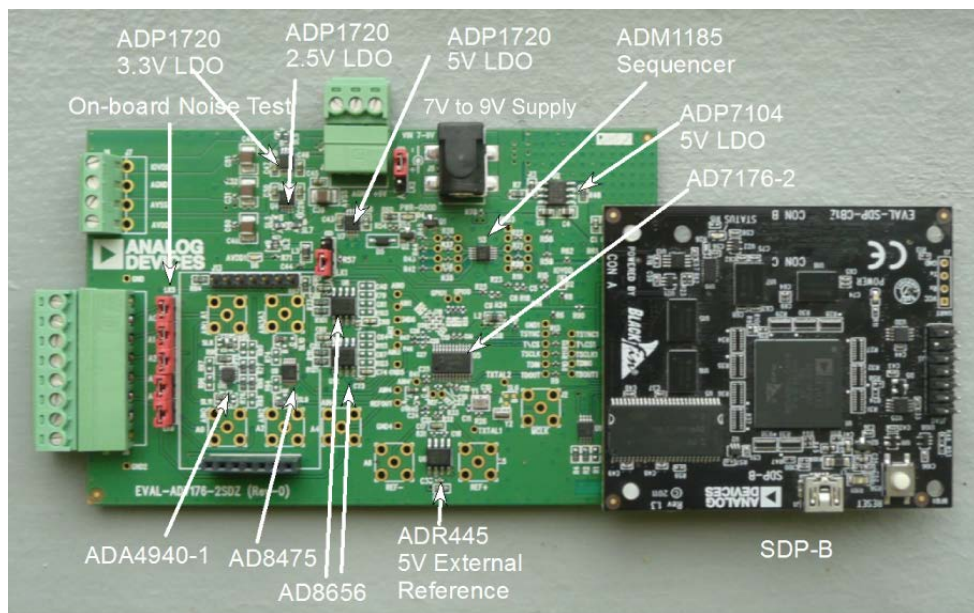


Figure 2. Hardware Configuration—Setting Up the **EVAL-AD7176-2SDZ**

EVALUATION BOARD HARDWARE

DEVICE DESCRIPTION

The [AD7176-2](#) is a low noise, fast settling, multiplexed, 2-/4-channel (fully differential/pseudo differential) Σ - Δ ADC. The [AD7176-2](#) has a maximum channel-to-channel scan rate of 50 kSPS (20 μ s) for fully settled data. The output data rates range from 5 Hz to 250 kHz.

Complete specifications for the [AD7176-2](#) are provided in the product data sheet and should be consulted in conjunction with this user guide when using the evaluation board. Full details

about the [EVAL-SDP-CB1Z](#) are available on the Analog Devices, Inc., website.

HARDWARE LINK OPTIONS

The default link options are listed in Table 1. By default, the board is configured to operate from the external bench top power supply via Connector J4. The supply required for the [AD7176-2](#) comes from the on-board [ADP1720](#) LDOs, which generate their input voltage from J4.

Table 1. Default Link and Solder Link Options

Link No.	Default Option	Description
LK1	A	Connects the AVDD1 voltage to the power supply sequencer, ADM1185 . When AVDD1 equals 5 V, LK1 must be in Position A. When AVDD1 equals 2.5 V, LK1 must be in Position B.
LK2	A	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 J4. In Position B, this link selects the external 7 V to 9 V power supply to come from Connector J5.
LK5 to LK9	Inserted	Inserting LK5 to LK9 sets up the on-board noise test. In this mode, all inputs are shorted to the REFOUT pin.
SL1	A	Sets the voltage applied to the AVDD2 pin. In Position A, this link sets the voltage applied to the AVDD2 pin to be the same voltage applied to the AVDD1 pin. In Position B, this link sets the voltage applied to the AVDD2 pin to be a 3.3 V supply from the ADP1720-3.3 (U10) regulator or from an external voltage. AVDD2 cannot be set to 3.3 V when AVDD1 equals 2.5 V and AVSS equals -2.5 V.
SL2	A	Sets the voltage applied to the AVDD1 pin. In Position A, this link sets the voltage applied to the AVDD1 pin to be a 5 V supply from the ADP1720-5 (U7) regulator or a 2.5 V supply from the ADP1720 (U4) regulator. In Position B, this link sets the voltage applied to the AVDD1 pin to be supplied from an external voltage source via Connector J9. When AVDD1 equals 2.5 V, AVSS can be set to -2.5 V using an external supply connected to Connector J9. The AVSS to AGND solder links must be removed when a split power supply is used.
SL3, SL7	A, A	With SL3 and SL7 in Position A, AVDD1 is supplied with 5 V from ADP1720-5 (U7) regulator. With SL3 and SL7 in Position B, AVDD1 is supplied with 2.5 V from the ADP1720 (U4) regulator.
SL4	A	With this link in Position A, the AIN4 analog input on the AD7176-2 device is connected to Connector J8. With this link in Position B, the AIN4 analog input is connected to the REFOUT pin of the AD7176-2 . With this link in Position C, the AIN4 analog input is connected to ground for use with four pseudo differential inputs, if required.
SL5	B	With this link in Position A, the IOVDD 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.
SL6	Not Inserted	Allows an external crystal or clock to be used as the clock source for the AD7176-2 . With SL6 not inserted, a crystal is connected to the AD7176-2 . With SL6 in Position B, an external clock source can be supplied to the ADC.
SL8	B	With this link in Position A, the AIN1 analog input on the AD7176-2 device is connected to Connector J8. With this link in Position B, the analog input applied via Connector J8 is buffered using the AD8656 before being applied to the AIN1 pin. With this link in Position C, the analog input path includes the ADA4940-1 differential amplifier; therefore, in conjunction with AIN0, a single-ended to differential driver is implemented. With this link in Position D, AIN1 is connected to Header J10.

Link No.	Default Option	Description
SL9	B	With this link in Position A, the AIN2 analog input on the AD7176-2 device is connected to Connector J8. With this link in Position B, the analog input applied via Connector J8 is buffered using the AD8656 before being applied to the AIN2 pin. With this link in Position C, the analog input path includes the AD8475 amplifier; therefore, in conjunction with AIN3, an attenuating single-ended to differential driver is implemented.
SL10	B	With this link in Position A, the AIN3 analog input on the AD7176-2 device is connected to Connector J8. With this link in Position B, the analog input applied via Connector J8 is buffered using the AD8656 before being applied to the AIN3 pin. With this link in Position C, the analog input path includes the AD8475 amplifier; therefore, in conjunction with AIN2, an attenuating single-ended to differential driver is implemented.
SL11	B	With this link in Position A, the AIN0 analog input on the AD7176-2 device is connected to Connector J8. With this link in Position B, the analog input applied via Connector J8 is buffered using the AD8656 before being applied to the AIN0 pin. With this link in Position C, the analog input path includes the ADA4940-1 differential amplifier; therefore, in conjunction with AIN1, a single-ended to differential driver is implemented. With this link in Position D, AIN0 is connected to Header J10.
AVSS to AGND		When these links are inserted, AVSS is tied to AGND. When AVSS is set to -2.5 V, these links must be removed.

On-Board Connectors

Table 2 provides information about the external connectors on the [EVAL-AD7176-2SDZ](#).

Table 2. On-Board Connectors

Connector	Function
J1	A 120-pin connector that mates with the EVAL-SDP-CB1Z (black colored controller board).
J4	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.
J8	Main analog input connector. Connections to AIN0 to AIN4 are available, along with GND connections.
J9	Optional external connector, allowing external bench top or alternative supply for AVDD1, AVDD2, and VIO supplies. When split supplies are used, AVSS is supplied externally via J9.
J10	A 7-pin connector that can be used to connect an external amplifier to Pin AIN0 and Pin AIN1 of the AD7176-2 .
J13	A 7-pin connector that allows connection to Pin AIN0 and Pin AIN1 of the AD7176-2 .

POWER SUPPLIES

The evaluation board requires that an external power supply—either a bench top supply or a wall wart (dc plug) supply—be applied to J4 or J5 (see Table 3 for more information). Linear regulators generate the required power supply levels from the applied V_{IN} rail. The regulators used are the 5 V [ADP1720](#) (U7) and the 2.5 V [ADP1720](#) (U4), which supply 5 V and 2.5 V, respectively, to AVDD1/AVDD2 of the ADC. The 3.3 V [ADP1720](#) (U10) delivers 3.3 V to the IOVDD pin of the [AD7176-2](#).

When a split power supply is used, the AVSS voltage must be applied from an external source via Connector J9. AVDD1/AVDD2 and IOVDD can also be provided via Connector J9. However, the 7 V to 9 V supply is still required because the on-board reference ([ADR445](#)) 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 25 to Figure 28 to identify decoupling points).

SERIAL INTERFACE

The [AD7176-2](#) evaluation board connects via the SPI to the Blackfin® [ADSP-BF527](#) on the [EVAL-SDP-CB1Z](#). There are four

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

If you wish to operate the [EVAL-AD7176-2SDZ](#) in standalone mode, the [AD7176-2](#) 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

The [EVAL-AD7176-2SDZ](#) primary analog inputs can be applied in two ways:

- Using J8, the green screw in terminal connector on the right hand side of the board.
- Using the A0 to A4 SMB/SMA footprints on the evaluation board.

The AIN0 to AIN3 analog inputs are routed via the [AD8656](#) buffers to the associated input pins on the [AD7176-2](#), and the AIN4 analog input is connected to Connector J8 if LK5 to LK9 are removed, disabling the on-board noise test. The buffers are configured for a gain of 2.

The [EVAL-AD7176-2SDZ](#) software is set up to analyze dc inputs to the ADC.

Table 3. Required External Power Supply¹

Power Supply (V_{IN}) Applied To	Voltage Range	Function
J4	7 V to 9 V	Bench top supply to the evaluation board. Supplies LDOs that create 5 V, 2.5 V, and 3.3 V rails. It also supplies the ADR445 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 5 V, 2.5 V, and 3.3 V rails. It also supplies the ADR445 external reference. Ensure that LK2 is set to Position B when the external power supply is applied to this connector.

¹ Only a single supply is required, either J4 or J5. This can be selected using LK2.

SOCKETS/CONNECTORS

Table 4. Connector Details

Connector	Function	Connector Type	Manufacturer/Part No.	Order No.
J1	Connector to EVAL-SDP-CB1Z	120-way connector, 0.6 mm pitch	Hirose FX8-120S-SV(21)	Farnell 1324660
J2	External MCLK (SMA/SMB)	Straight PCB mount SMB/SMA jack	Tyco 1-1337482-0	Not inserted
A0 to A4	Analog inputs to ADC	Straight PCB mount SMB/SMA jack	Tyco 1-1337482-0	Not inserted
J4	External bench top voltage supply for EVAL-AD7176-2SDZ	3-pin socket terminal block, 3.81 mm pitch	Phoenix Contact MC 1,5/ 3-G-3,81	Farnell 3704737
J5	External wall wart voltage supply (7 V to 9V) for EVAL-AD7176-2SDZ	DC power connectors, 2 mm SMT power Jack	Kycon KLDX-SMT2-0202-A	Mouser 806-KLDX-SMT2020A
J8	Analog input screw terminal block; wired connection to external source or sensor	8-pin terminal header, 3.81 mm pitch, vertical	Phoenix Contact MC 1.5/ 8-G-3.81	Farnell 3704774
J9	External bench top voltage supply option for AVDD1/AVDD2 and IOVDD inputs on AD7176-2 device	Screw terminal block, 3.81 mm pitch	Phoenix Contact 1727036	Farnell 370-4592
J10	External amplifier connector	7-pin, SSW, 2.54 mm vertical socket	Samtec SSW-107-01-T-S	Farnell 1803478
J13	Connects to AIN0/AIN1 analog inputs of ADC	7-pin, SIP, 2.54 mm through hole header	Samtec TLW-107-05-G-S	Farnell 1668499

REFERENCE OPTIONS

The EVAL-AD7176-2SDZ includes an external 5 V reference (the ADR445) and an internal 2.5 V reference. The default operation on the AD7176-2 is to use the internal 2.5 V reference.

The reference used for a conversion is selected by choosing the reference in the SETUPCONx registers associated with Setup 1, Setup 2, Setup 3, and Setup 4.

Switch between using the internal reference and external reference by accessing the AD7176-2 register map via the evaluation software. Figure 3 shows how to select the reference source for Setup 1, Setup 2, Setup 3, and Setup 4. Figure 4 shows the ADCMODE register setting that enables the internal reference.

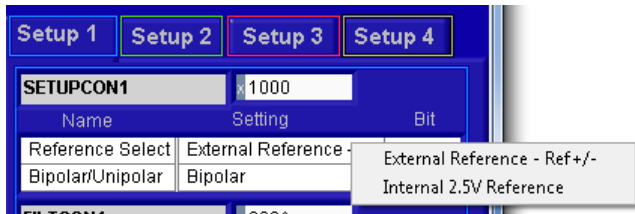


Figure 3. Selecting the Reference Source for Setup 1, Setup 2, Setup 3, and Setup 4

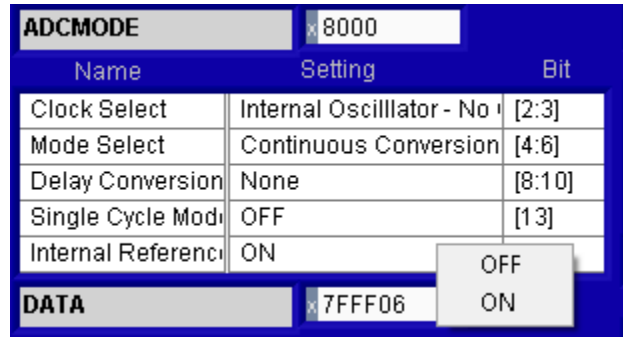


Figure 4. Turning On the Internal 2.5 V Reference

USING THE ON-BOARD AMPLIFIERS

The AD7176-2 evaluation board contains three front-end configurations. The AD8656 is provided for buffering the analog inputs of the AD7176-2. By default, it is configured for a gain of 2, and the front-end is selected on the evaluation board. The ADA4940-1 amplifier provides a single-ended to differential driver, whereas the AD8475 is configured to operate as an attenuating single-ended to differential driver. Figure 5 shows the location of the R and C components on the AD7176-2 evaluation board. Figure 6 and Figure 7 highlight the R and C components that are populated on the board for each amplifier, and Table 5 to Table 7 list the component values.

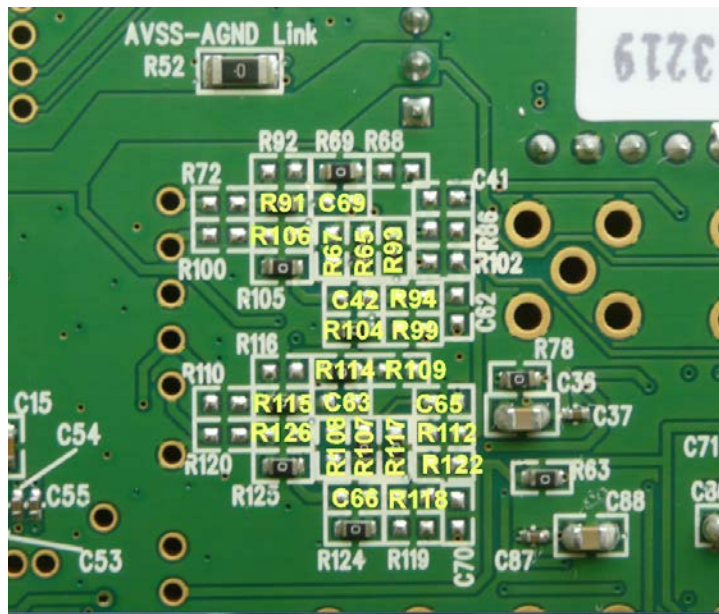
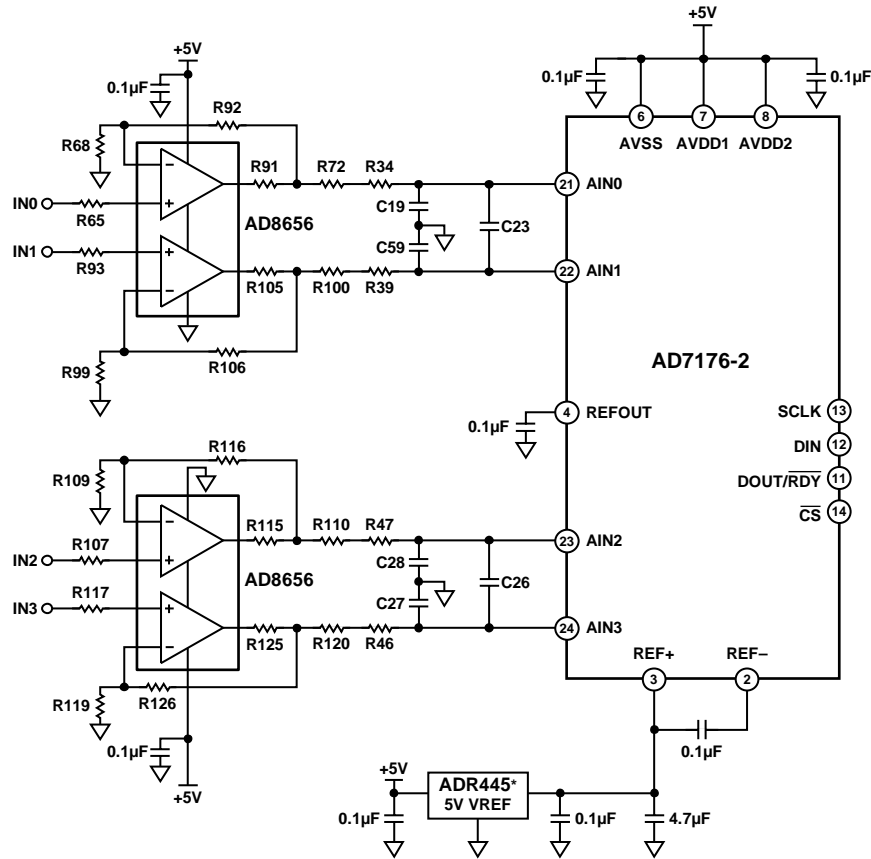


Figure 5. Identification of R/C Components for the Amplifiers



*USING ADR444 (4.096V REFERENCE) IN PLACE OF THE ADR445 ALLOWS THE ENTIRE CCT TO BE OPERATED FROM A SINGLE +5V SUPPLY RAIL.

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Figure 6. Setup for the AD8656 Amplifiers

Table 5. R/C Values Used with AD8656 Amplifiers (Gain = 2)

U8		U12	
Component	Status	Component	Status
R65	0 Ω	R107	0 Ω
R68	1 kΩ, 0.1%	R109	1 kΩ, 0.1%
R72 ¹	0 Ω	R110 ²	0 Ω
R91	10 Ω	R115	10 Ω
R92	1 kΩ, 0.1%	R116	1 kΩ, 0.1%
R93	0 Ω	R117	0 Ω
R99	1 kΩ, 0.1%	R119	1 kΩ, 0.1%
R100 ¹	0 Ω	R120 ²	0 Ω
R105	10 Ω	R125	10 Ω
R106	1 kΩ, 0.1%	R126	1 kΩ, 0.1%
R34	0 Ω	R46	0 Ω
R39	0 Ω	R47	0 Ω
C19	270 pF	C27	270 pF
C59	270 pF	C28	270 pF
C23	680 pF	C26	680 pF

¹ Remove R72 and R100 when connecting the ADA4940-1 to the AD7176-2.

² Remove R110 and R120 when connecting the AD8475 to the AD7176-2.

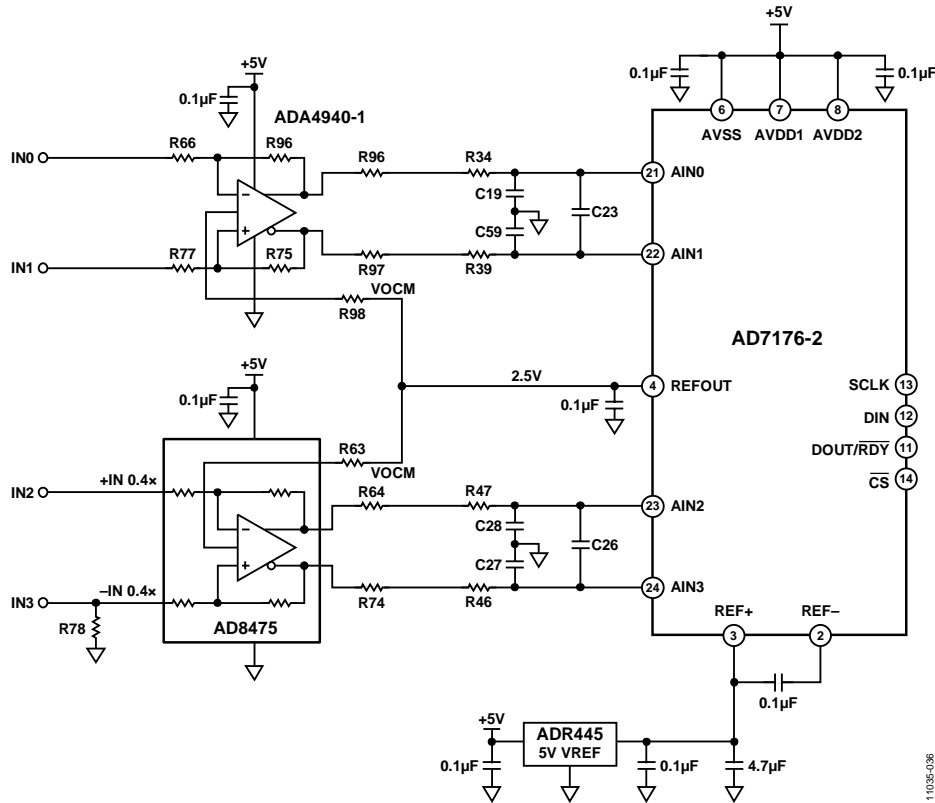


Figure 7. Setup for the ADA4940-1 and AD8475 Amplifiers

Table 6. R/C Components for ADA4940-1 (Single-Ended to Differential Driver)

Component	Status
R66	0 Ω
R75	0 Ω
R76	0 Ω
R77	0 Ω
R96 ¹	Not inserted
R97 ¹	Not inserted
R98	0 Ω
R34	0 Ω
R39	0 Ω
C19	270 pF
C59	270 pF
C23	680 pF

¹ Insert 0 Ω resistors in R96 and R97 to connect the ADA4940-1 to the AD7176-2, and place the SL8 and SL11 solder links in Position C. Ensure that the R72 and R100 resistors are removed.

Table 7. R/C Components for AD8475 (Attenuating Single-Ended to Differential Driver)

Component	Status
R63	0 Ω
R64 ¹	Not inserted
R74 ¹	Not inserted
R78	0 Ω
R46	0 Ω
R47	0 Ω
C27	270 pF
C28	270 pF
C26	680 pF

¹ Populate R64 and R74 with 10 Ω resistors to connect the AD8475 to the AD7176-2, and place the SL9 and SL10 solder links in Position C. Ensure that the R110 and R120 resistors are removed.

EVALUATION BOARD SETUP PROCEDURES

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 evaluation board and [EVAL-SDP-CB1Z](#) board to the USB port of the PC to ensure that the evaluation system is correctly recognized when it is connected to the PC.

Configuring the Evaluation and SDP Boards

1. Connect the [EVAL-SDP-CB1Z](#) board to Connector A or Connector B on the [EVAL-AD7176-2SDZ](#) board. Screw

the two boards together using the plastic screw-washer set included in the evaluation board kit to ensure that the boards are connected firmly together.

2. Connect the power supplies to the [EVAL-AD7176-2SDZ](#) board. The [EVAL-AD7176-2SDZ](#) board requires an external bench top power supply in the range of 7 V to 9 V. Connect this supply to J4 on the [EVAL-AD7176-2SDZ](#) 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-AD7176-2SDZ](#) evaluation kit includes a CD containing software to be installed on your PC before you begin using the evaluation board.

There are two parts to the installation:

- [AD7176-2](#) evaluation board software installation
- [EVAL-SDP-CB1Z](#) system demonstration platform board drivers installation

Warning

The evaluation software and drivers must be installed before connecting the evaluation board and [EVAL-SDP-CB1Z](#) board to the USB port of the PC to ensure that the evaluation system is correctly recognized when it is connected to the PC.

Installing the [AD7176-2](#) Evaluation Board Software

To install the [AD7176-2](#) evaluation board software,

1. With the [EVAL-SDP-CB1Z](#) board 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 is installed to the following default location: **C:\Program Files\Analog Devices\AD7176-2**.
3. A dialog box appears asking for permission to allow the program to make changes to your computer. Click **Yes**.

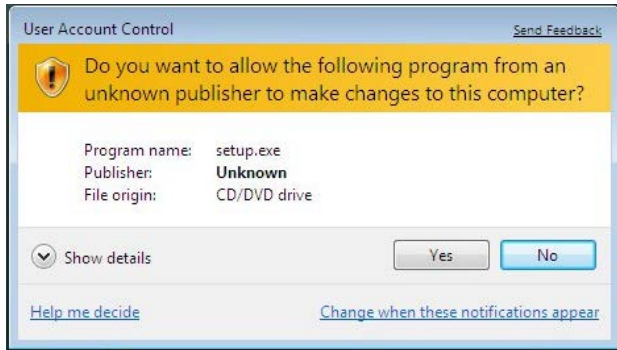


Figure 8. [AD7176-2](#) Evaluation Software Installation: Granting Permission for the Program to Make Changes to Your Computer

4. Select the location to install the software, and then click **Next**. (Figure 9 shows the default locations, which are displayed when the window opens, but you can select another location by clicking **Browse**.)



Figure 9. [AD7176-2](#) Evaluation 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**.

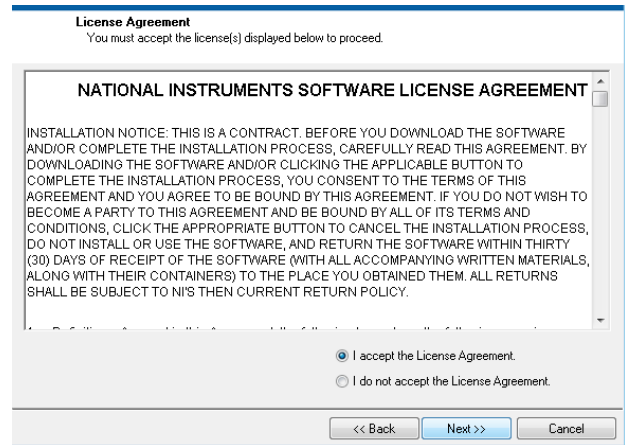


Figure 10. [AD7176-2](#) Evaluation Software Installation: Accepting the License Agreement

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

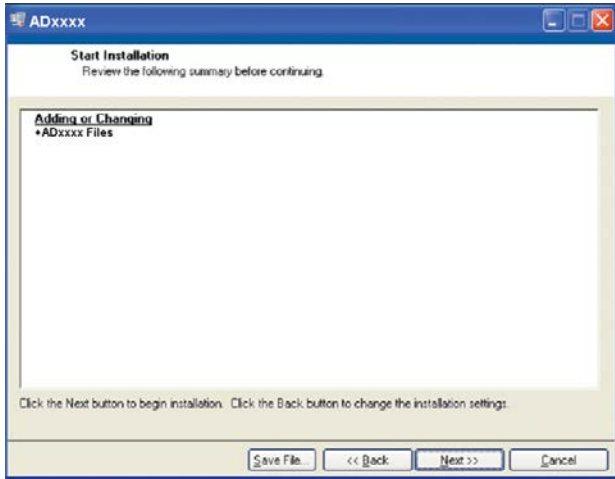


Figure 11. AD7176-2 Evaluation Software Installation: Reviewing a Summary of the Installation

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7. A dialog box informs you when the installation is complete. Click **Next**.

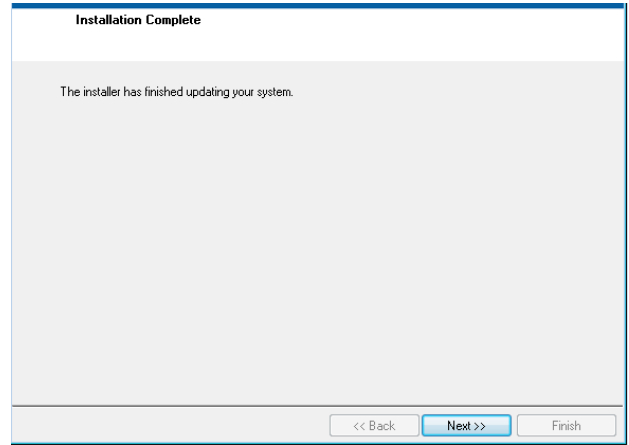


Figure 12. AD7176-2 Evaluation Software Installation: Indicating When the Installation Is Complete

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

After the installation of the evaluation software is complete, a welcome window is displayed for the installation of the EVAL-SDP-CB1Z system demonstration platform 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**.

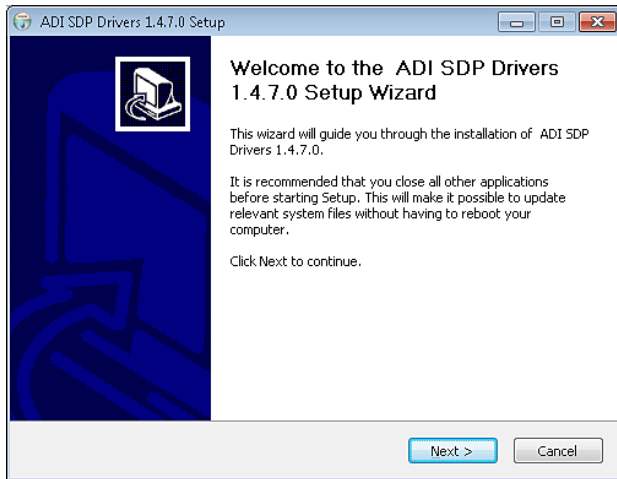


Figure 13. EVAL-SDP-CB1Z Drivers Setup: Beginning the Drivers Installation

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

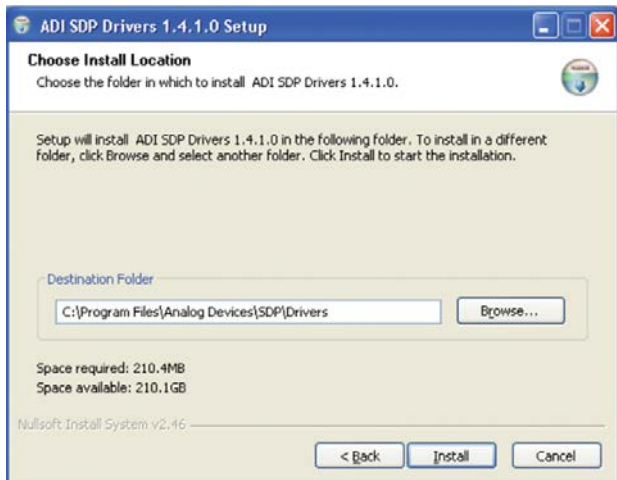


Figure 14. EVAL-SDP-CB1Z Drivers Setup: Selecting the Location for Drivers Installation

3. Click **Install** to confirm that you would like to install the drivers.

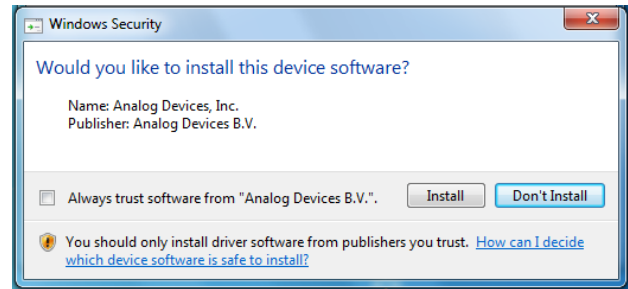


Figure 15. EVAL-SDP-CB1Z Drivers Setup: Granting Permission to Install Drivers

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

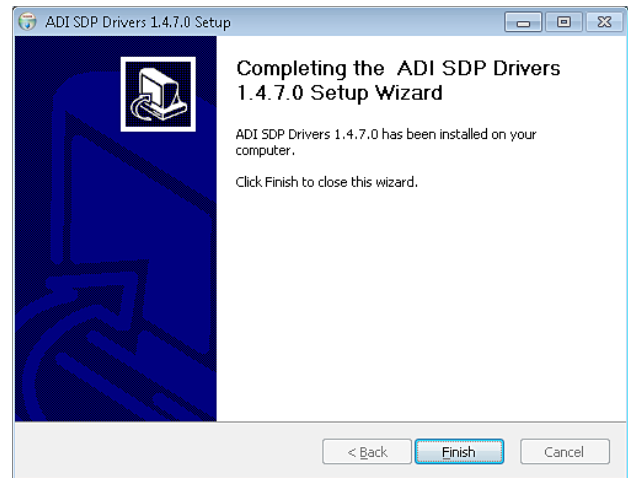


Figure 16. EVAL-SDP-CB1Z Drivers Setup: Completing the Drivers Setup Wizard

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

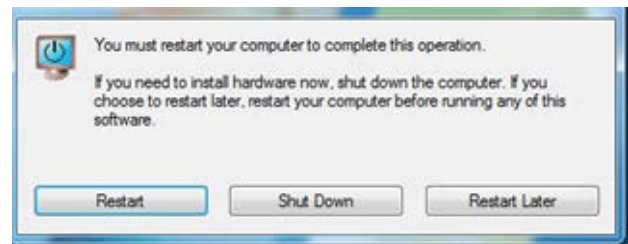


Figure 17. EVAL-SDP-CB1Z Drivers Setup: Restarting the Computer

SETTING UP THE SYSTEM FOR DATA CAPTURE

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

1. Allow the **Found New Hardware Wizard** to run after the **EVAL-SDP-CBIZ** board is plugged into your PC. (If you are using Windows XP, you may need to search for the **EVAL-SDP-CBIZ** drivers. Choose to automatically search for the drivers for the **EVAL-SDP-CBIZ** board if prompted by the operating system.)
2. Check that the board is connecting to the PC correctly using the **Device Manager** of the PC.
 - a. Access the **Device Manager** as follows:
 - i. Right-click **My Computer** and then click **Manage**.
 - ii. A dialog box appears asking for permission to allow the program to make changes to your computer. Click **Yes**.
 - iii. The **Computer Management** box appears. Click **Device Manager** from the list of **System Tools** (see Figure 18).
 - b. The **EVAL-SDP-CBIZ** board should appear under **ADI Development Tools**. This indicates that the driver software is installed and that the board is connecting to the PC correctly.

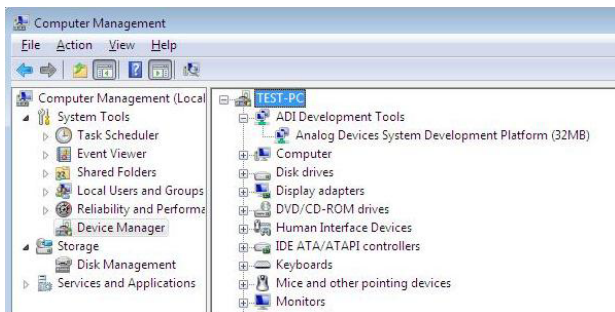


Figure 18. Device Manager: Checking That the Board Is Connected to the PC Correctly

Launching the Software

After completing the steps in the Setting Up the System for Data Capture section, launch the **AD7176-2** software as follows:

1. From the **Start** menu, select **Programs > Analog Devices > AD7176-2 > AD7176-2 Evaluation Board Software**. The main window of the software then displays.
2. If the **AD7176-2** evaluation system is not connected to the USB port via the **EVAL-SDP-CBIZ** when the software is launched, a connectivity error displays (see Figure 19). Connect the evaluation board to the USB port of the PC, wait a few seconds, click **Rescan**, and then follow the on-screen instructions.

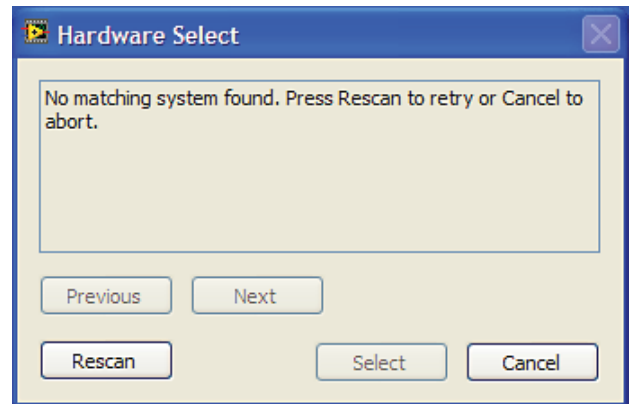


Figure 19. Connectivity Error Alert

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, and then the main window appears (see Figure 20).

SOFTWARE OPERATION

Overview of the Main Window

The main window of the software (see Figure 20) contains the significant control buttons and analysis indicators of the AD7176-2 software.

ADC Setup Button

Clicking **ADC Setup**, located near the top left of the main window (see Figure 20), opens the **AD7176-2 Register Interface** window.

Start Sampling Button

Clicking **Start Sampling**, located near the top right hand corner of the main window (see Figure 20), starts ADC sampling; results are reported in the graphs of the **DATA** and **ANALYSIS** sections of the main window.

Data Graph

The graph in the upper half, or **DATA** section, of the main window, shows each successive sample of the ADC output (input referred).

The indicators beside this graph show the latest data value, the channel being converted, and the flag for the error diagnostics of the AD7176-2. Navigation tools are provided to allow you to control the cursor, zooming, and panning (see Figure 20).

Analysis Graph

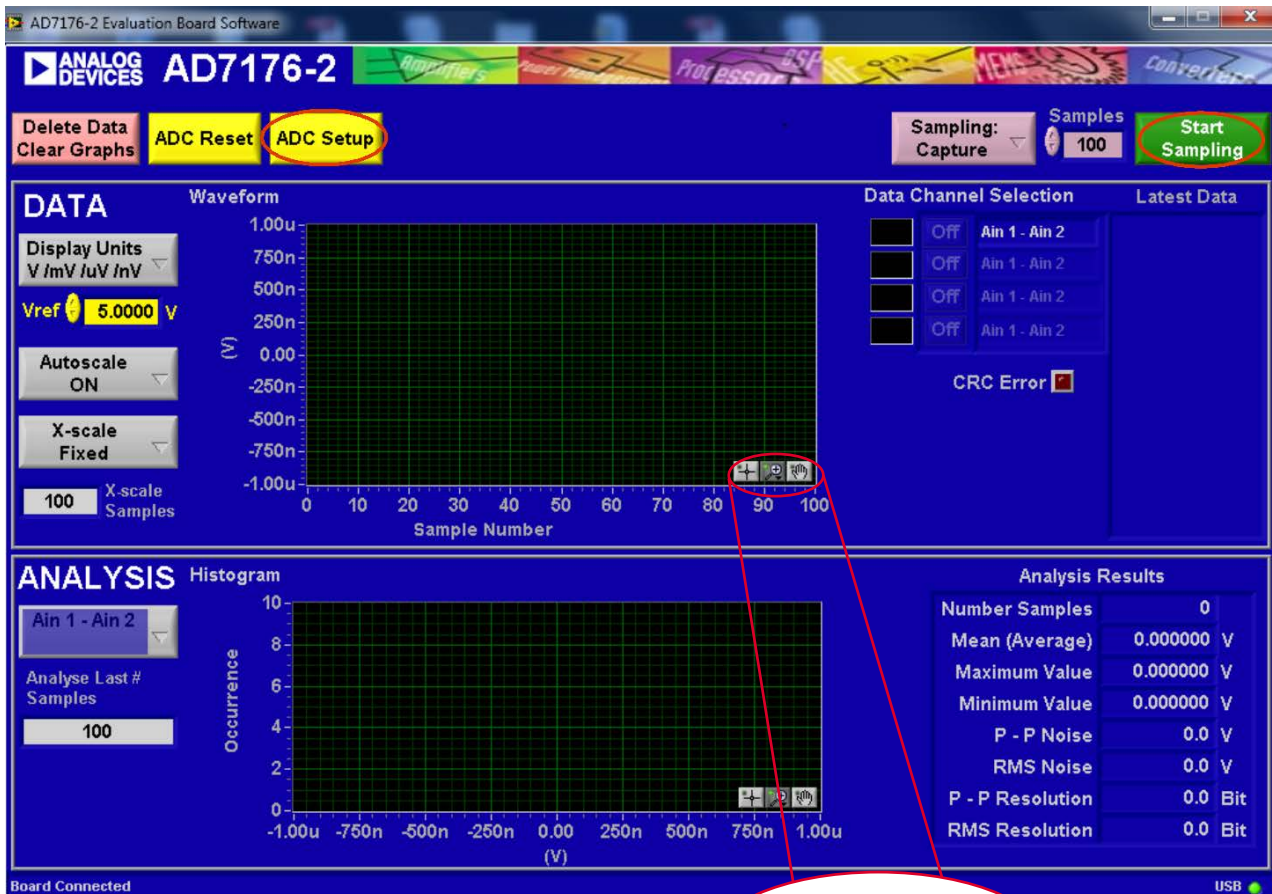
The graph in the bottom half, or **ANALYSIS** section, of the main window, shows the histogram analysis; to the right of the graph, the respective noise analysis on the indicator is shown. Navigation tools are provided to allow you to control the cursor, zooming, and panning (see Figure 20).

CRC Error Indicator

This LED icon illuminates when there has been a CRC error detected in the communications between the software and the AD7176-2. The CRC functionality on the AD7176-2 is disabled by default.

Exiting the Software

To exit the software, click the red X at the top right hand corner of the main window.



- NOTES
 1. FOR DETAILS ABOUT THE AREAS HIGHLIGHTED IN RED, SEE THE OVERVIEW OF THE MAIN WINDOW SECTION.




CONTROL CURSOR **CONTROL ZOOMING** **CONTROL PANNING**

Figure 20. Main Window

Noise Test—Quick Start Demonstration

To perform a noise test using the AD7176-2 evaluation board, LK5 to LK9 should be inserted so that the analog inputs are connected together. The internal reference should be enabled and made available at the REFOUT pin. The internal reference biases the analog inputs to an appropriate voltage.

1. Click **ADC Setup** to open the **AD7176-2 Register Interface** window. The AD7176-2 should be configured as follows:
 - a. In the ADCMODE register, the internal reference is enabled and outputs a buffered 2.5 V to the REFOUT pin.
 - b. In the CHMAP1 register, AIN2 is connected to the positive input, AIN3 is connected to the negative input of the ADC for this channel, and Setup 1 is selected. Therefore, the AIN2 to AIN3 conversion is mapped using the Setup 1 configuration.
 - c. Setup 1 is configured with the following register settings:
 - i. In the SETUPCON1 register, the external reference is selected as the reference source for the ADC conversion.

- ii. In the FILTCON1 register, the output data rate is set to 1 kHz, and the fast settling filter (Sinc5 + Sinc1) is enabled.
 - iii. In the OFFSET1 register, the default offset register value is selected.
 - iv. In the GAIN1 register, the factory trimmed gain error value is selected.
2. Figure 21 shows the contents of this window and the state of the AD7176-2 registers. Click **OK** to return to the main window. Figure 22 shows an example of the main window after running a noise test.
 3. Set the number of samples to be collected in each batch in the **Samples** box, which is located just to the left of **Start Sampling**, near the top right hand corner of the main window.
 4. Click **Start Sampling** to acquire samples from the ADC.



Figure 21. Configuration for Noise Test

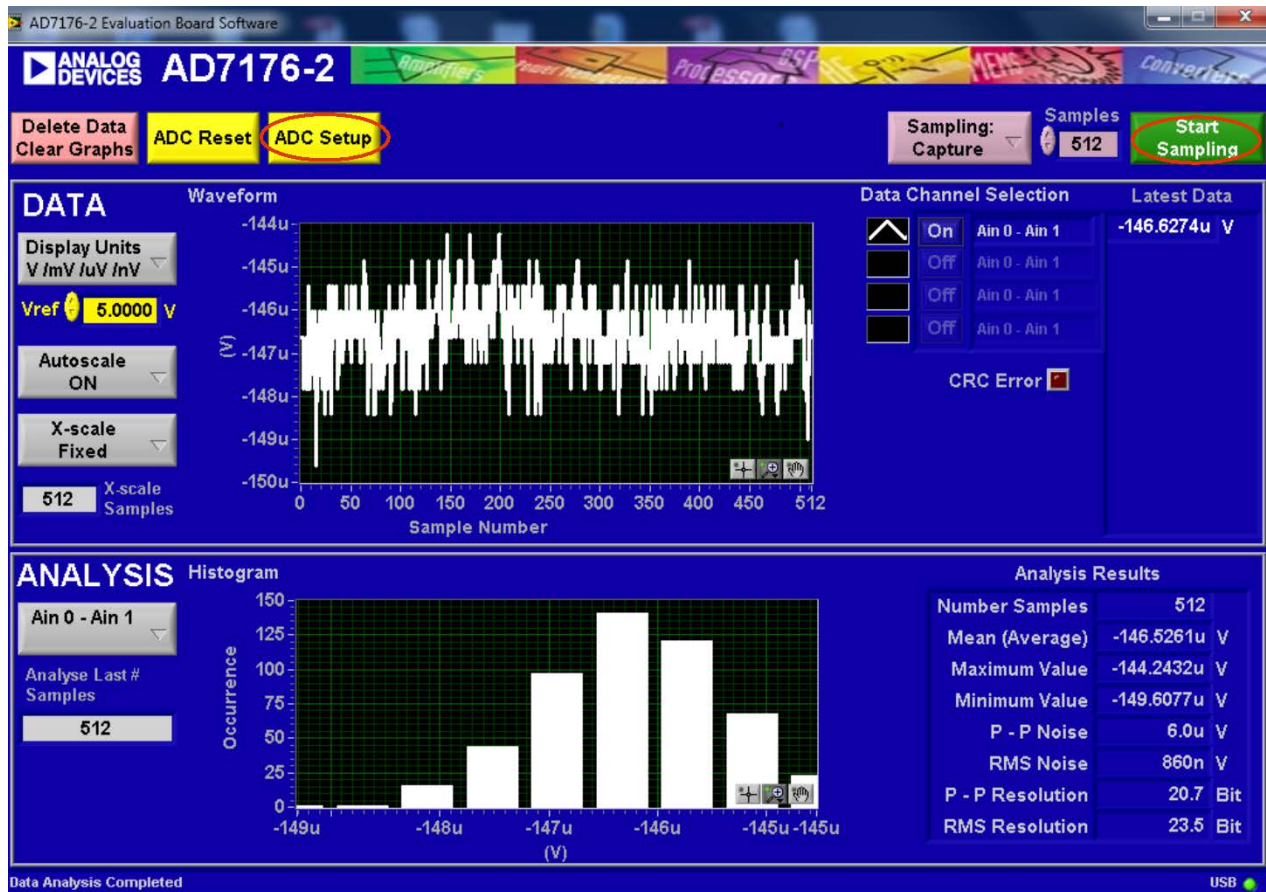


Figure 22. Example of the Main Window After Running a Noise Test

Reading Samples from the ADC

The evaluation board is set up to use the external 5 V on-board reference (ADR445). To read samples from the ADC,

1. The value in the **Vref** box is set to 5.0000 V by default to use the external 5 V on-board reference (ADR445). If a different reference is used, such as the 2.5 V internal reference, set the value in the **Vref** box accordingly. (The analysis results are based on the value set in this box.)
2. Select the number of samples to analyze in the **Samples** box. (Note that when performing a continuous capture, this number is limited to 65,536 samples.)
3. When **Sampling** is set to **Capture**, a batch of samples is read when **Start Sampling** is clicked, with the batch size being set by the value in the **Samples** box. When **Sampling** is set to **Continuous**, the software performs a continuous capture from the ADC when **Start Sampling** is clicked.
4. Click **Stop** to stop streaming data.
5. Use the navigation tools within each graph to control the cursor, zooming, and panning (see Figure 20).
6. If desired, save the current captured data for later analysis (see Figure 24 and the Save File section).

DC Waveform Capture

The waveforms resulting from the gathered samples are shown in the top graph of the window. The right hand side of the window indicates which channel is selected and the value of the last sample of the batch. The conversions can be displayed as codes or as volts.

DC Testing—Histogram

The histogram resulting from the gathered samples is shown in the bottom graph. Parameters such as peak-to-peak noise and rms noise are displayed to the right of the graph in the **Analysis Results** section for the current batch of samples.

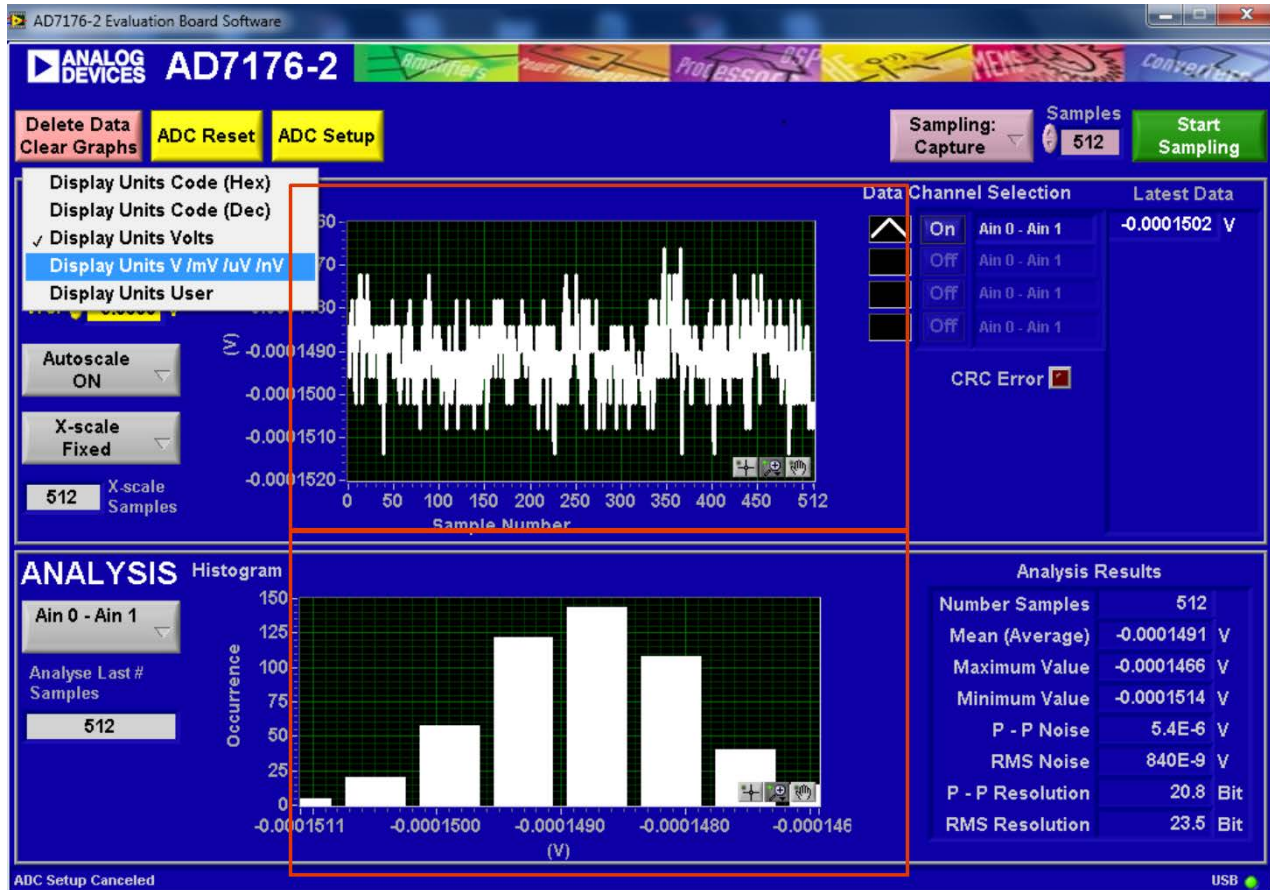


Figure 23. Waveform and Histogram Analysis

Save File

The software can save the current captured data for later analysis (see Figure 24).

1. Right-click on the waveform or histogram graph.

2. 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.

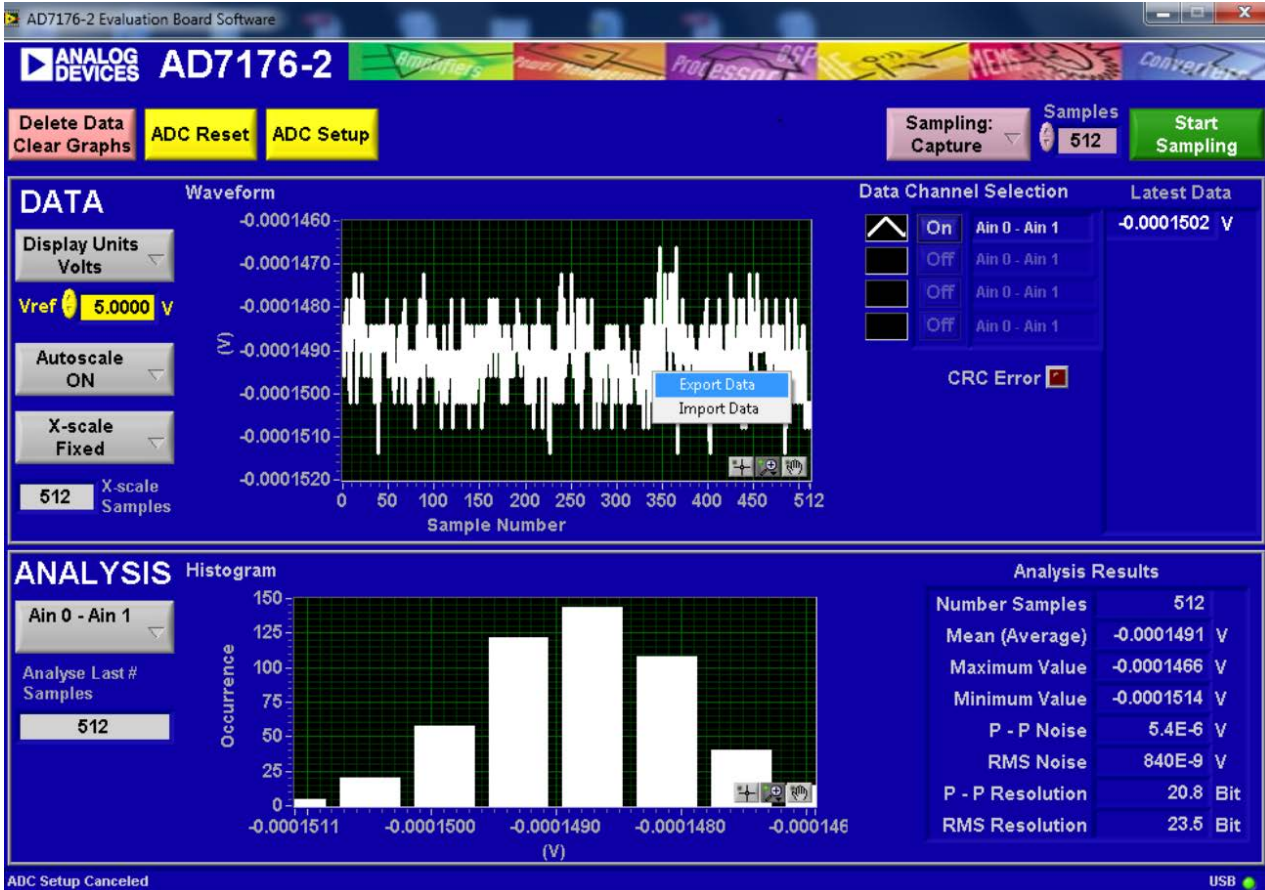


Figure 24. Exporting Data to Save Results

11035-019

EVALUATION BOARD SCHEMATICS AND ARTWORK

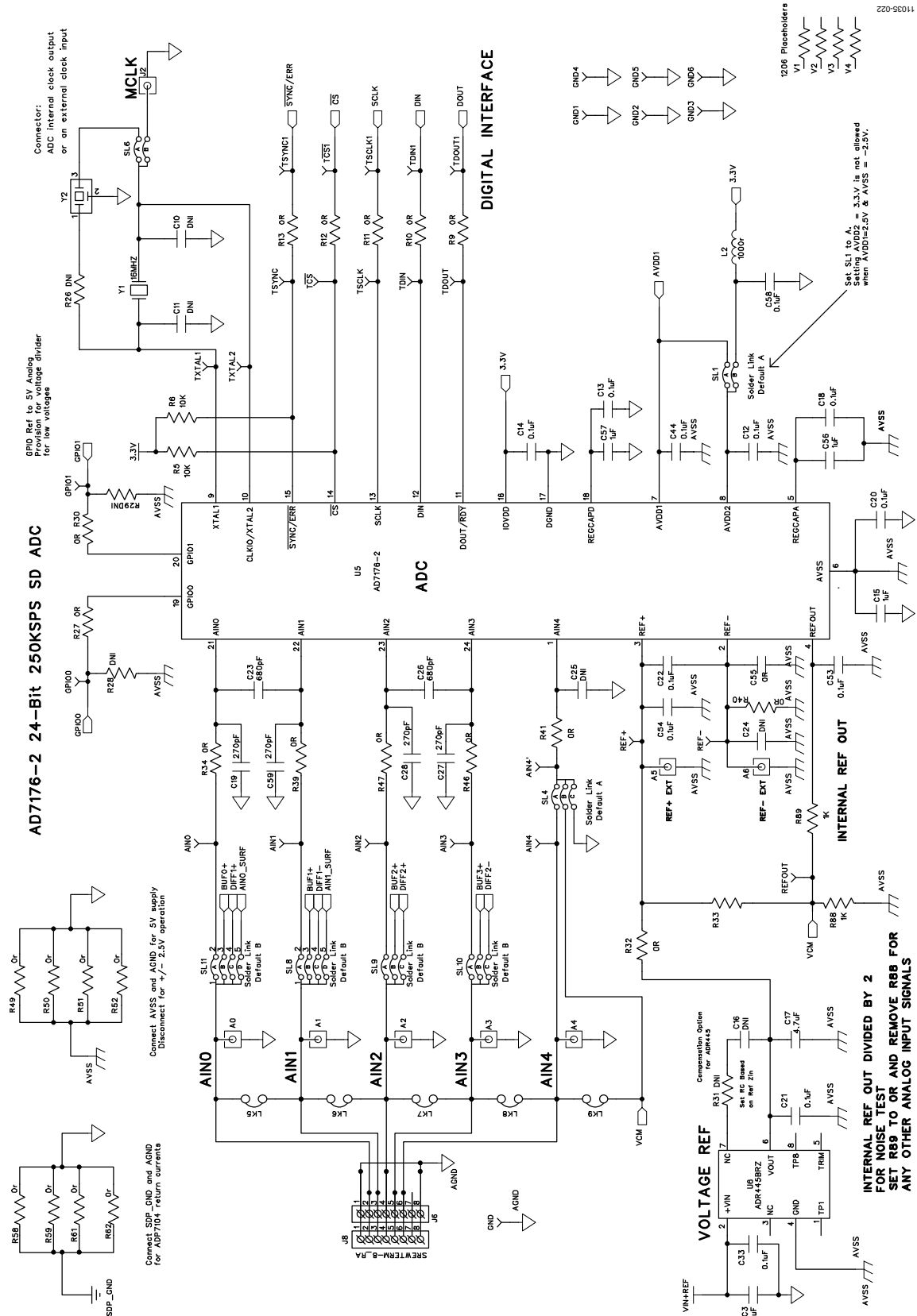


Figure 25. Schematic—AD7176-2

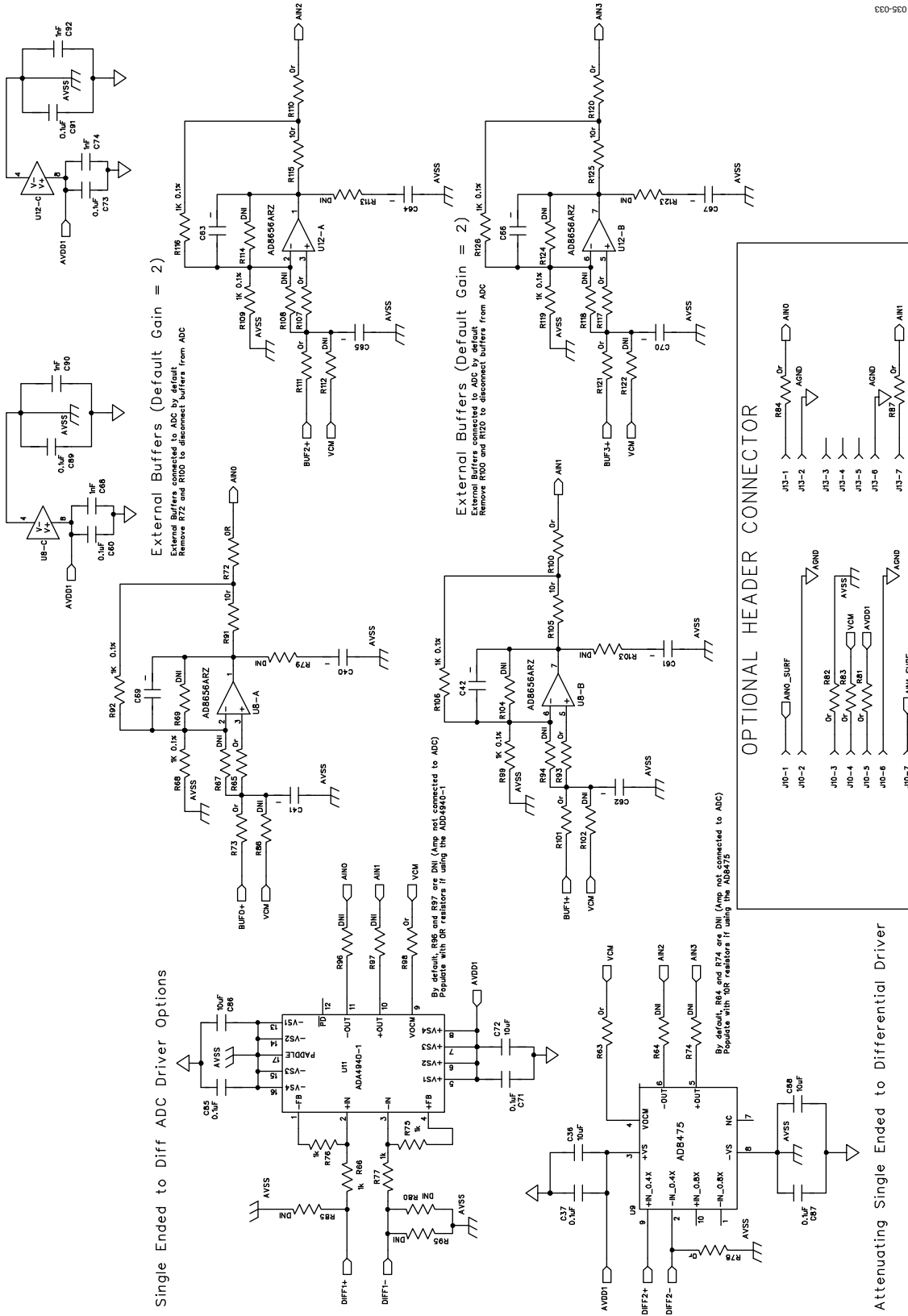


Figure 26. Schematic—Amplifiers

11035-023

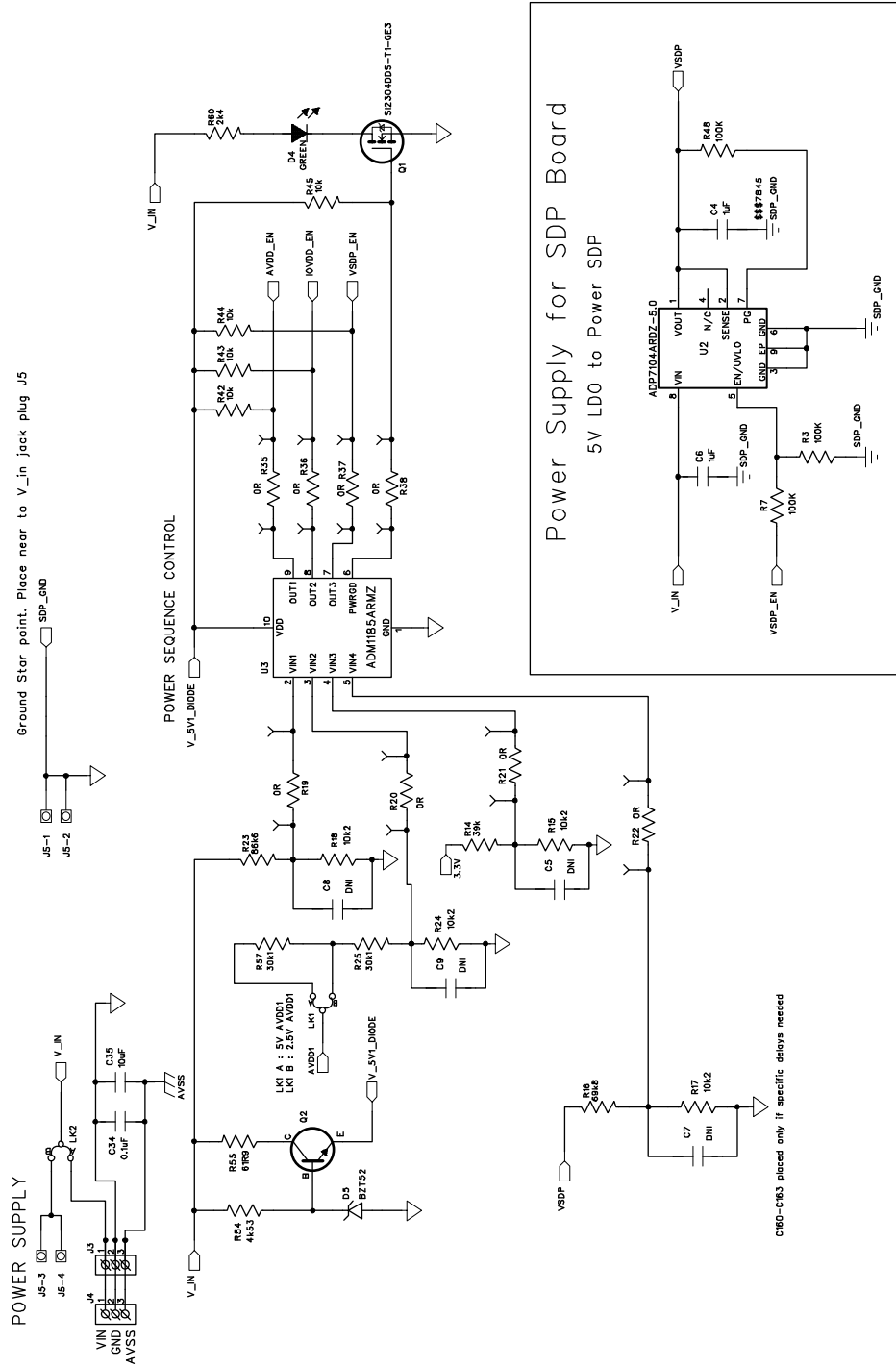


Figure 27. Schematic—Power Supply Sequencing

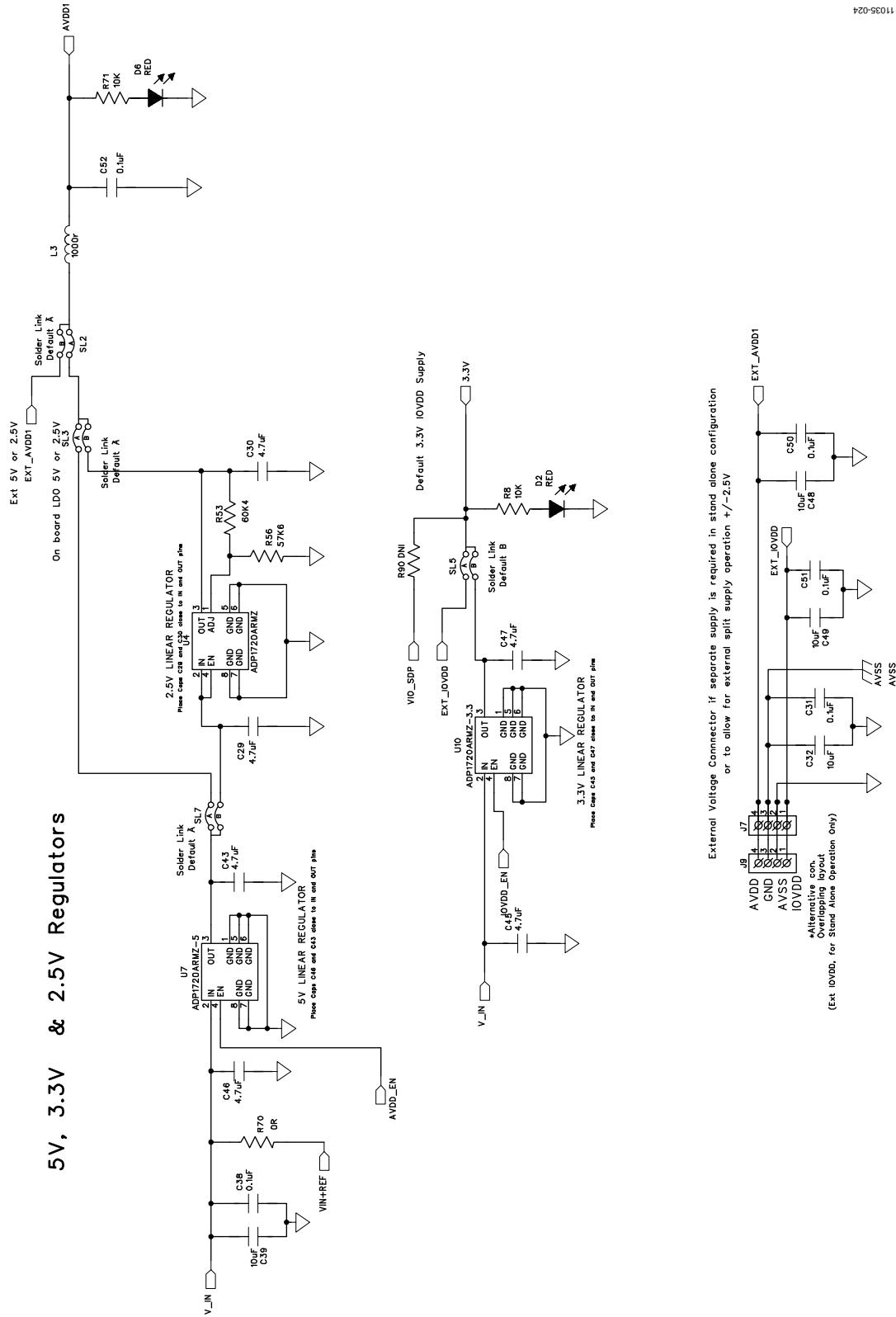


Figure 28. Schematic—Regulators

SDP CONNECTOR EEPROM-SW/USB ID

VIO: USE to set IO voltage max draw 20mA

VIN: Use this pin to power the SDP requires 4-7V 200mA

BMODE1: Pull up with a 10K resistor to set SDP to boot from a SPI FLASH on the daughter board

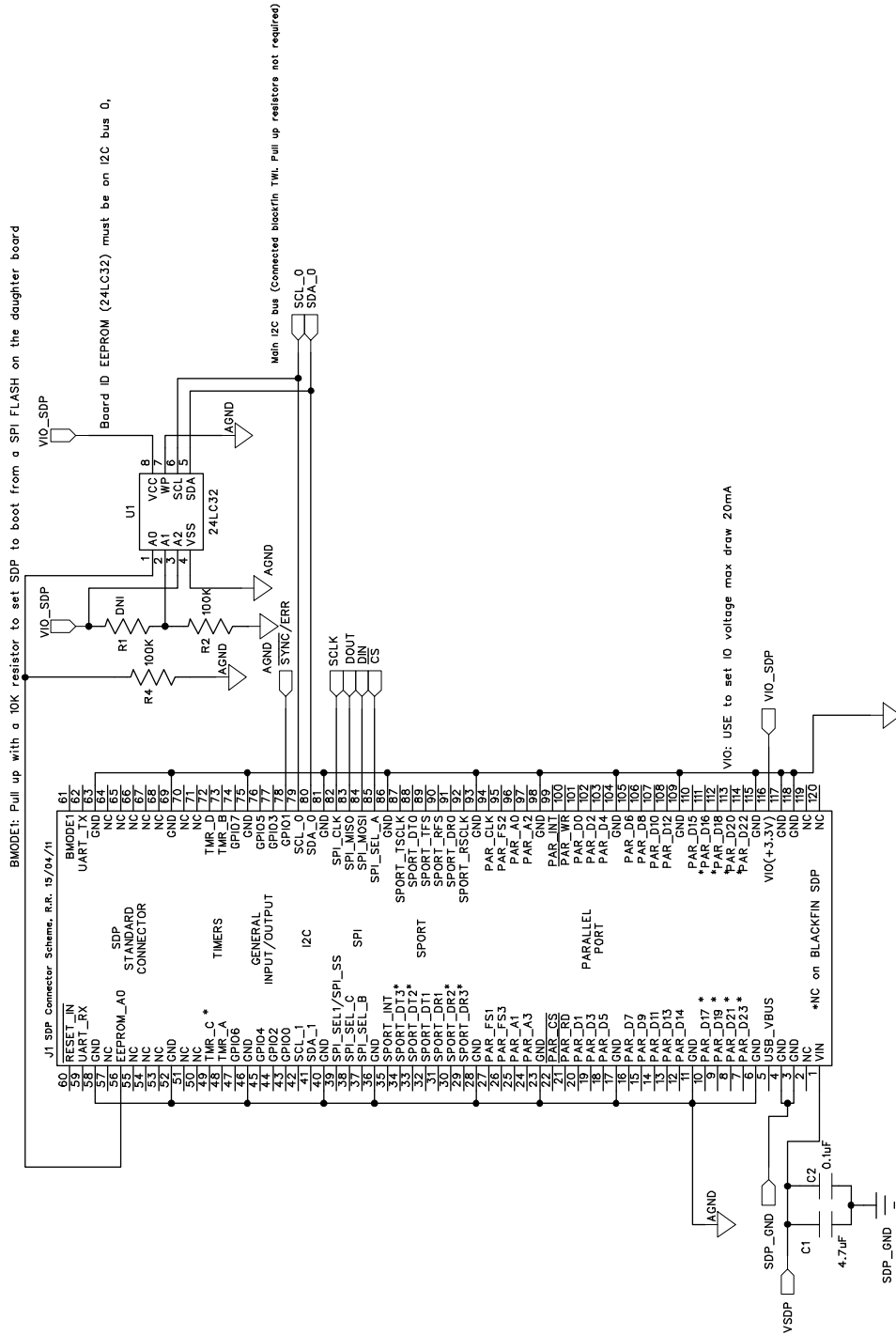
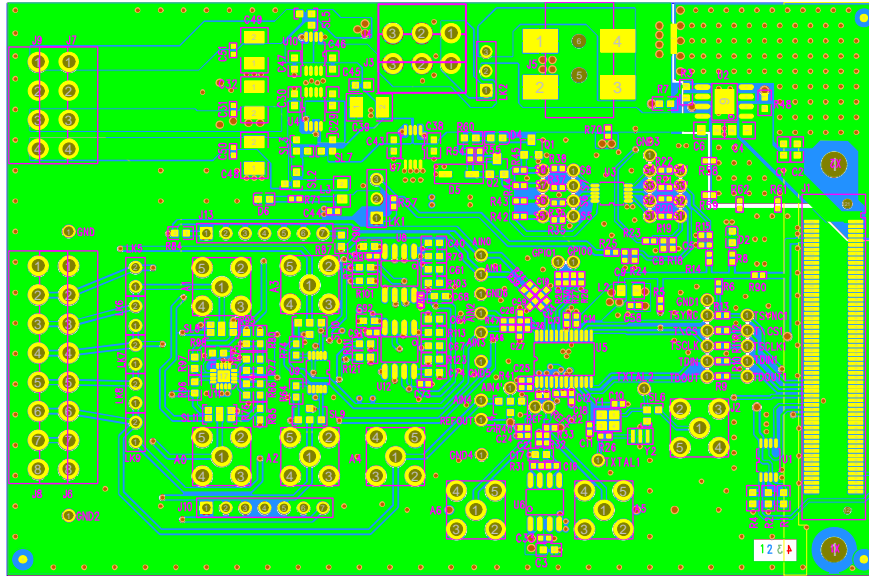


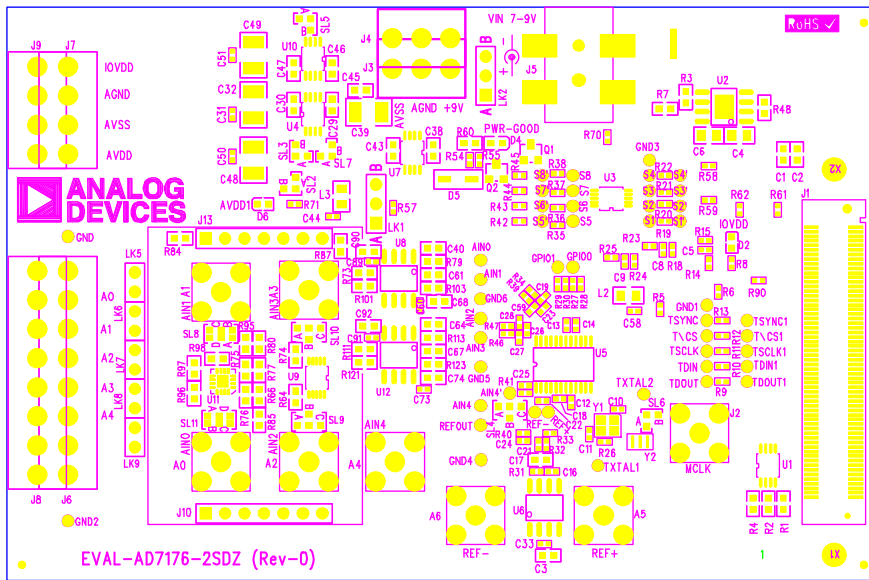
Figure 29. Schematic—SDP Connector

VIN: Use this pin to power the SDP requires 5V 200mA
 I2C bus 1 is common across both connectors on SDP - Pull up resistors required
 (connected to blackfin GPIO - use I2C_0 first)



11035-026

Figure 30. EVAL-AD7176-2SDZ Evaluation Board



11035-027

Figure 31. Top Printed Circuit Board (PCB) Silkscreen

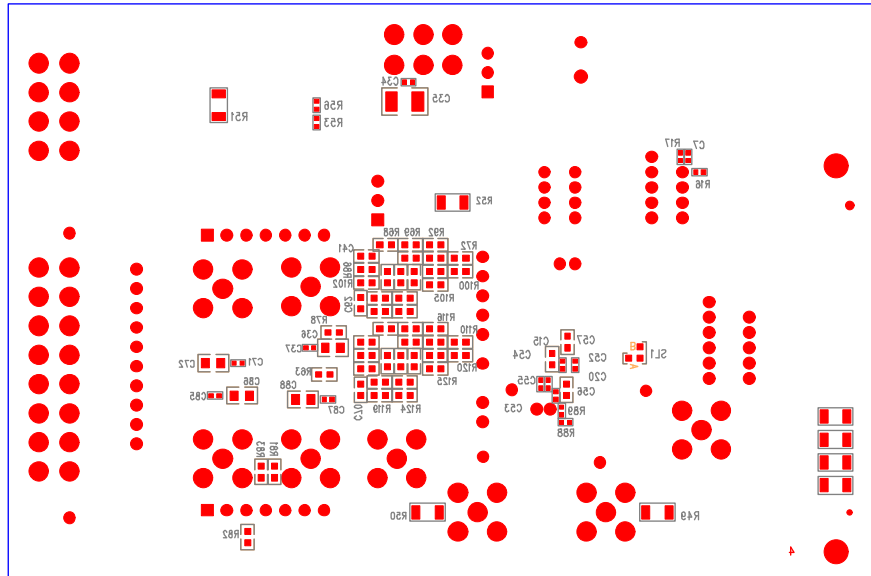


Figure 32. Bottom Printed Circuit Board (PCB) Silkscreen

11035-028

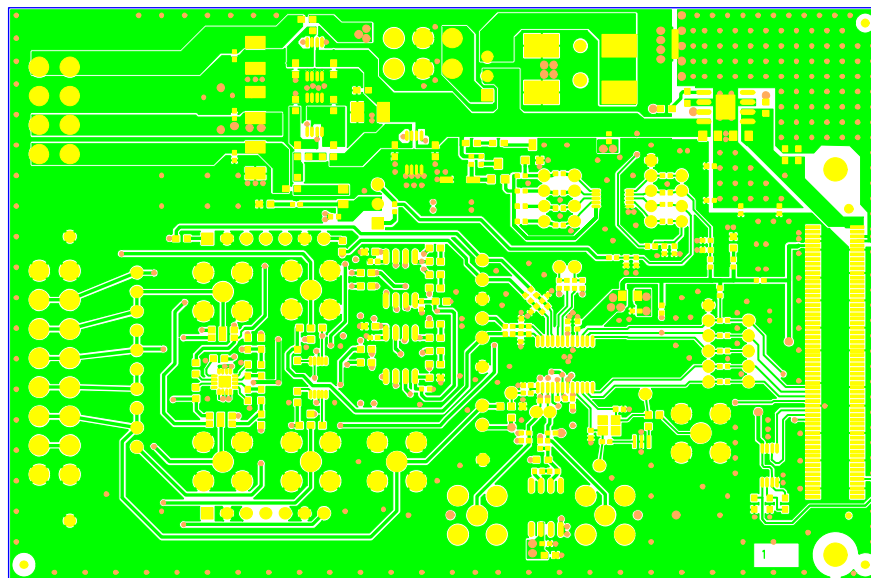


Figure 33. Layer 1 Component Side

11035-029

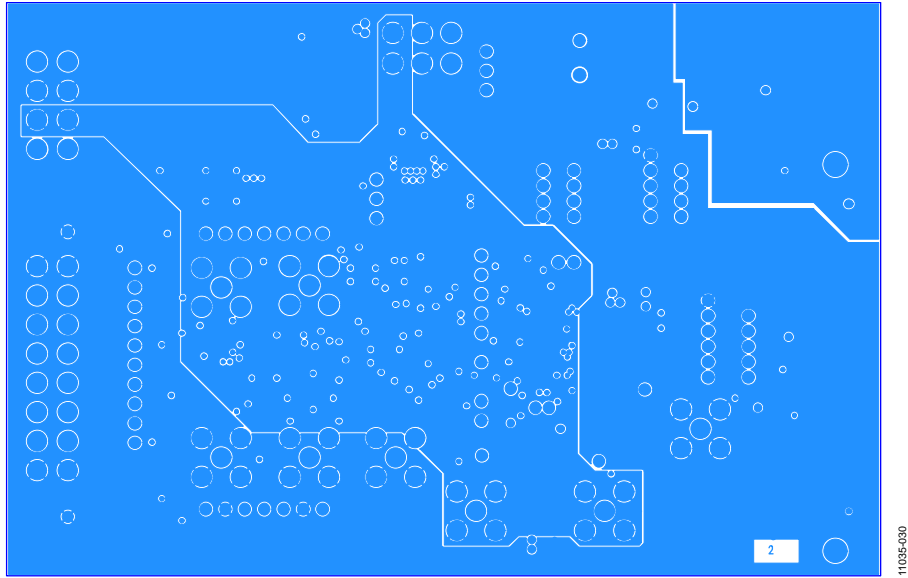


Figure 34. Layer 2 Ground Plane

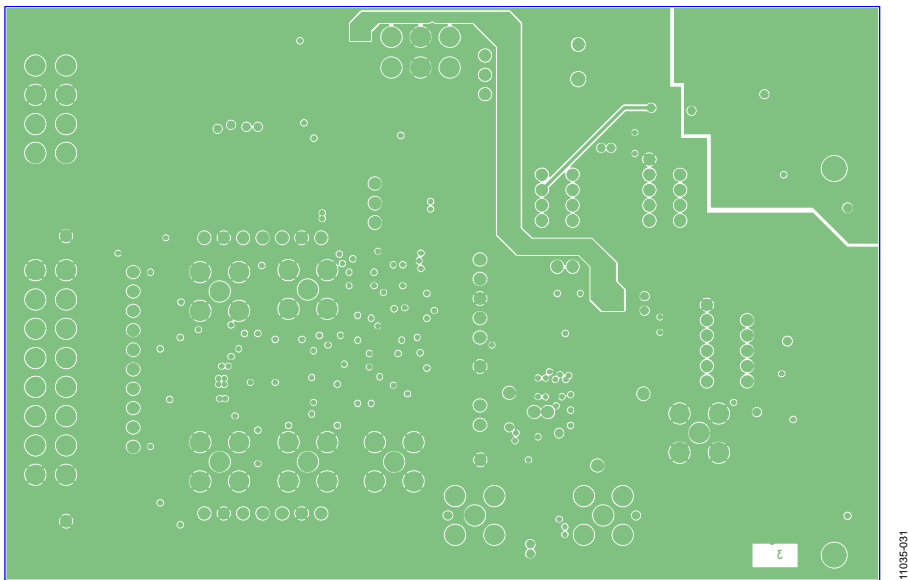


Figure 35. Layer 3 Power/Ground Plane

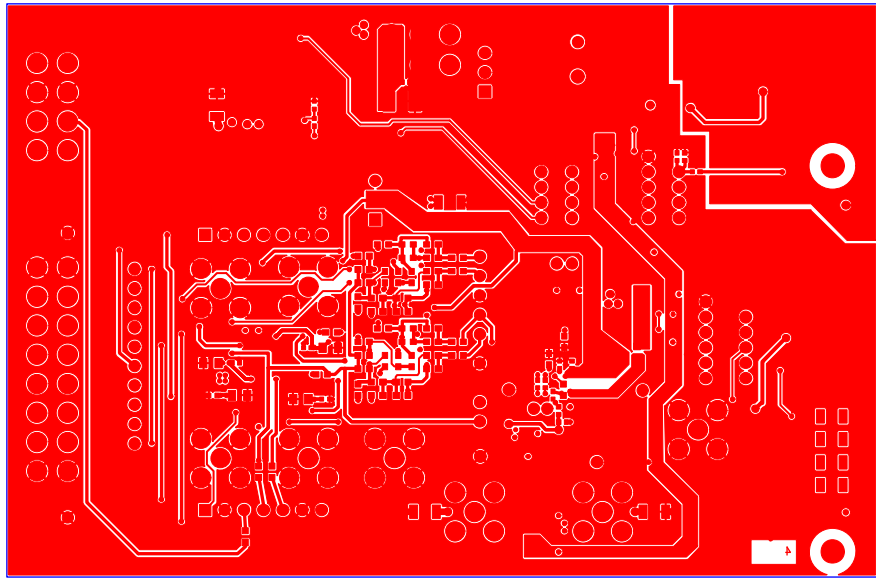


Figure 36. Layer 4 Component Side

11035-03Z

BILL OF MATERIALS

Table 8.

Name	Value ¹	Tolerance	PCB Decal	Description	Manufacturer	Part No.	Stock Code
A0			SMA	Straight PCB mount SMB jack; keep hole clear of solder	Tyco	1-1337482-0	Do not insert
A1			SMA	Straight PCB mount SMB jack; keep hole clear of solder	Tyco	1-1337482-0	Do not insert
A2			SMA	Straight PCB mount SMB jack; keep hole clear of solder	Tyco	1-1337482-0	Do not insert
A3			SMA	Straight PCB mount SMB jack; keep hole clear of solder	Tyco	1-1337482-0	Do not insert
A4			SMA	Straight PCB mount SMB jack; keep hole clear of solder	Tyco	1-1337482-0	Do not insert
A5			SMA	Straight PCB mount SMB jack; keep hole clear of solder	Tyco	1-1337482-0	Do not insert
A6			SMA	Straight PCB mount SMB jack; keep hole clear of solder	Tyco	1-1337482-0	Do not insert
AIN0			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
AIN1			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
AIN2			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
AIN3			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
AIN4			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
AIN4'			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
C1	4.7 μ F	$\pm 10\%$	C0603	Ceramic capacitor, 6.3 V, X5R, 0603	Murata	GRM188R60J475K	FEC 173-5527
C2	0.1 μ F	$\pm 10\%$	C0603	Ceramic capacitor, 50 V, X7R, 0603	Murata	GRM188R71H104K	FEC 882-0023
C3	4.7 μ F	$\pm 10\%$	C0603	Ceramic capacitor, 10 V, X5R, 0603	Kemet	C0603C475K8PACTU	FEC 157-2625
C4	1 μ F	$\pm 10\%$	C0805	Capacitor, 0805, 1 μ F, 50 V, X7R	Murata	GRM21BR71H105KA12L	FEC 1735541
C5	DNI		C0402	Ceramic capacitor, not inserted, 0402	N/A	N/A	Do not insert
C6	1 μ F	$\pm 10\%$	C0805	Capacitor, 0805, 1 μ F, 50 V, X7R	Murata	GRM21BR71H105KA12L	FEC 1735541
C7	DNI		C0402	Ceramic capacitor, not inserted, 0402	N/A	N/A	Do not insert
C8	DNI		C0402	Ceramic capacitor, not inserted, 0402	N/A	N/A	Do not insert
C9	DNI		C0402	Ceramic capacitor, not inserted, 0402	N/A	N/A	Do not insert
C10	DNI		C0402	Ceramic capacitor XTAL, not inserted, 0402	N/A	N/A	Do not insert
C11	DNI		C0402	Ceramic capacitor XTAL, not inserted, 0402	N/A	N/A	Do not insert
C12	0.1 μ F	$\pm 10\%$	C0402	Ceramic capacitor, 16 V, X7R, 0402	Murata	GRM155R71C104K	FEC 881-9742
C13	0.1 μ F	$\pm 10\%$	C0402	Ceramic capacitor, 16 V, X7R, 0402	Murata	GRM155R71C104K	FEC 881-9742
C14	0.1 μ F	$\pm 10\%$	C0402	Ceramic capacitor, 16 V, X7R, 0402	Murata	GRM155R71C104K	FEC 881-9742
C15	1 μ F	$\pm 10\%$	C0603	Ceramic capacitor, 10 V, X5R, 0603	Murata	GRM188R70J105KA01D	FEC 184-5765

Name	Value ¹	Tolerance	PCB Decal	Description	Manufacturer	Part No.	Stock Code
C16	DNI		C0402	Ceramic capacitor, not inserted, 0402	N/A	N/A	Do not insert
C17	4.7 μ F	\pm 10%	C0603	Ceramic capacitor, 6.3 V, X5R, 0603	Murata	GRM188R60J475K	FEC 173-5527
C18	0.1 μ F	\pm 10%	C0402	Ceramic capacitor, 16 V, X7R, 0402	Murata	GRM155R71C104K	FEC 881-9742
C19	270 pF	5%	R0402	Ceramic capacitor, 25 V, NPO, 0402	AVX	04023A271JAT2A	FEC 132-7623
C20	0.1 μ F	\pm 10%	C0402	Ceramic capacitor, 16 V, X7R, 0402	Murata	GRM155R71C104K	FEC 881-9742
C21	0.1 μ F	\pm 10%	C0402	Ceramic capacitor, 16 V, X7R, 0402	Murata	GRM155R71C104K	FEC 881-9742
C22	0.1 μ F	\pm 10%	C0402	Capacitor ceramic, 16 V, X7R, 0402	Murata	GRM155R71C104K	FEC 881-9742
C23	680 pF	5%	R0402	Ceramic capacitor, 50 V, NPO, 0402	Kemet	C0402C681J5GACTU	FEC 153-5557
C24	DNI		C0402	Ceramic capacitor, not inserted, 0402	N/A	N/A	Do not insert
C25	DNI		C0402	Ceramic capacitor, not inserted, 0402	N/A	N/A	Do not insert
C26	680 pF	5%	R0402	Ceramic capacitor, 50 V, NPO, 0402	Kemet	C0402C681J5GACTU	FEC 153-5557
C27	DNI		C0402	Ceramic capacitor, not inserted, 0402	N/A	N/A	Do not insert
C28	270 pF	5%	R0402	Ceramic capacitor, 25 V, NPO, 0402	AVX	04023A271JAT2A	FEC 132-7623
C29	270 pF	5%	R0402	Ceramic capacitor, 25 V, NPO, 0402	AVX	04023A271JAT2A	FEC 132-7623
C30	4.7 μ F	\pm 10%	C0603	Ceramic capacitor, 6.3 V, X5R, 0603	Murata	GRM188R60J475K	FEC 173-5527
C31	0.1 μ F	\pm 10%	C0402	Ceramic capacitor, 16 V, X7R, 0402	Murata	GRM155R71C104K	FEC 881-9742
C32	10 μ F	\pm 10%	1210	Ceramic capacitor, 50 V, X5R, 1210	Murata	GRM32ER61H106K	FEC 184-5764
C33	0.1 μ F	\pm 10%	C0402	Ceramic capacitor, 16 V, X7R, 0402	Murata	GRM155R71C104K	FEC 881-9742
C34	0.1 μ F	\pm 10%	C0402	Ceramic capacitor, 16 V, X7R, 0402	Murata	GRM155R71C104K	FEC 881-9742
C35	10 μ F	\pm 10%	1210	Ceramic capacitor, 50 V, X5R, 1210	Murata	GRM32ER61H106K	FEC 184-5764
C36	10 μ F	\pm 10%	C0805	Ceramic capacitor, 10 μ F, 16 V, X5R, 0805	Murata	GRM21BR61C106KE15L	Digi-Key 490-3886-1-ND
C37	0.1 μ F	\pm 10%	C0402	Ceramic capacitor, 16 V, X7R, 0402	Murata	GRM155R71C104K	FEC 881-9742
C38	0.1 μ F	\pm 10%	C0603	Ceramic capacitor, 50 V, X7R, 0603	Murata	GRM188R71H104K	FEC 882-0023
C39	10 μ F		1210	Ceramic capacitor, 50 V, X5R, 1210	Murata	GRM32ER61H106K	FEC 184-5764
C40			C0603	Ceramic capacitor, not inserted, 0603	N/A	N/A	Do not insert
C41			C0603	Ceramic capacitor, not inserted, 0603	N/A	N/A	Do not insert
C42			C0603	Ceramic capacitor, not inserted, 0603	N/A	N/A	Do not insert
C43	4.7 μ F	\pm 10%	C0603	Ceramic capacitor, 6.3 V, X5R, 0603	Murata	GRM188R60J475K	FEC 173-5527
C44	0.1 μ F	\pm 10%	C0402	Ceramic capacitor, 16 V, X7R, 0402	Murata	GRM155R71C104K	FEC 881-9742
C45	4.7 μ F	\pm 10%	C0603	Ceramic capacitor, 10 V, X5R, 0603	Kemet	C0603C475K8PACTU	FEC 157-2625

Name	Value ¹	Tolerance	PCB Decal	Description	Manufacturer	Part No.	Stock Code
C46	4.7 μ F	\pm 10%	C0603	Ceramic capacitor, 10 V, X5R, 0603	Kemet	C0603C475K8P ACTU	FEC 157-2625
C47	4.7 μ F	\pm 10%	C0603	Ceramic capacitor, 6.3 V, X5R, 0603	Murata	GRM188R60J47 5K	FEC 173-5527
C48	10 μ F		1210	Ceramic capacitor, 50 V, X5R, 1210	Murata	GRM32ER61H1 06K	FEC 184-5764
C49	10 μ F		1210	Ceramic capacitor, 50 V, X5R, 1210	Murata	GRM32ER61H1 06K	FEC 184-5764
C50	0.1 μ F	\pm 10%	C0402	Ceramic capacitor, 16 V, X7R, 0402	Murata	GRM155R71C1 04K	FEC 881-9742
C51	0.1 μ F	\pm 10%	C0402	Ceramic capacitor, 16 V, X7R, 0402	Murata	GRM155R71C1 04K	FEC 881-9742
C52	0.1 μ F	\pm 10%	C0402	Ceramic capacitor, 16 V, X7R, 0402	Murata	GRM155R71C1 04K	FEC 881-9742
C53	0.1 μ F	\pm 10%	C0402	Ceramic capacitor, 16 V, X7R, 0402	Murata	GRM155R71C1 04K	FEC 881-9742
C54	0.1 μ F	\pm 10%	C0402	Ceramic capacitor, 16 V, X7R, 0402	Murata	GRM155R71C1 04K	FEC 881-9742
C55	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	FEC 146-9661
C56	1 μ F	\pm 10%	C0603	Capacitor, 0603, 1 μ F, 6.3 V	Murata	GRM188R70J10 5KA01D	FEC 184-5765
C57	1 μ F	\pm 10%	C0603	Capacitor, 0603, 1 μ F, 6.3 V	Murata	GRM188R70J10 5KA01D	FEC 184-5765
C58	0.1 μ F	\pm 10%	C0402	Ceramic capacitor, 16 V, X7R, 0402	Murata	GRM155R71C1 04K	FEC 881-9742
C59	270 pF	5%	R0402	Ceramic capacitor, 25 V, NPO, 0402	AVX	04023A271JAT 2A	FEC 132-7623
C60	0.1 μ F	\pm 10%	C0402	Ceramic capacitor, 16 V, X7R, 0402	Murata	GRM155R71C1 04K	FEC 881-9742
C61			C0603	Ceramic capacitor, not inserted, 0603	N/A	N/A	Do not insert
C62			C0603	Ceramic capacitor, not inserted, 0603	N/A	N/A	Do not insert
C63			C0603	Ceramic capacitor, not inserted, 0603	N/A	N/A	Do not insert
C64			C0603	Ceramic capacitor, not inserted, 0603	N/A	N/A	Do not insert
C65			C0603	Ceramic capacitor, not inserted, 0603	N/A	N/A	Do not insert
C66			C0603	Ceramic capacitor, not inserted, 0603	N/A	N/A	Do not insert
C67			C0603	Ceramic capacitor, not inserted, 0603	N/A	N/A	Do not insert
C68	1 nF	\pm 10%	C0603	50 V, X7R, multilayer ceramic capacitor	Phycomp	2238 586 15623	FEC 722170
C69			C0603	Ceramic capacitor, not inserted, 0603	N/A	N/A	Do not insert
C70			C0603	Ceramic capacitor, not inserted, 0603	N/A	N/A	Do not insert
C71	0.1 μ F	\pm 10%	C0402	Ceramic capacitor, 16 V, X7R, 0402	Murata	GRM155R71C1 04K	FEC 881-9742
C72	10 μ F	\pm 10%	C0805	Ceramic capacitor, 10 μ F, 16 V, X5R, 0805	Murata	GRM21BR61C1 06KE15L	Digi-Key 490- 3886-1-ND
C73	0.1 μ F	\pm 10%	C0402	Ceramic capacitor, 16 V, X7R, 0402	Murata	GRM155R71C1 04K	FEC 881-9742
C74	1 nF	\pm 10%	C0603	50 V, X7R, multilayer ceramic capacitor	Phycomp	2238 586 15623	FEC 722170
C85	0.1 μ F	\pm 10%	C0402	Ceramic capacitor, 16 V, X7R, 0402	Murata	GRM155R71C1 04K	FEC 881-9742

Name	Value ¹	Tolerance	PCB Decal	Description	Manufacturer	Part No.	Stock Code
C86	10 µF	±10%	C0805	Ceramic capacitor, 10 µF, 16 V, X5R, 0805	Murata	GRM21BR61C106KE15L	Digi-Key 490-3886-1-ND
C87	0.1 µF	±10%	C0402	Ceramic capacitor, 16 V, X7R, 0402	Murata	GRM155R71C104K	FEC 881-9742
C88	10 µF	±10%	C0805	Ceramic capacitor, 10 µF, 16 V, X5R, 0805	Murata	GRM21BR61C106KE15L	Digi-Key 490-3886-1-ND
C89	0.1 µF	±10%	C0402	Ceramic capacitor, 16 V, X7R, 0402	Murata	GRM155R71C104K	FEC 881-9742
C90	1 nF	±10%	C0603	50 V, X7R, multilayer ceramic capacitor	Phycomp	2238 586 15623	FEC 722170
C91	0.1 µF	±10%	C0402	Ceramic capacitor, 16 V, X7R, 0402	Murata	GRM155R71C104K	FEC 881-9742
C92	1 nF	±10%	C0603	50 V, X7R, multilayer ceramic capacitor	Phycomp	2238 586 15623	FEC 722170
D2	Red		LED-0603HSML-C191	Red LED, high intensity (>90 mCd), 0603	Avago Technologies	HSMC-C191	FEC 855-4528
D4	Green		LED-0603	LED, SMD green	OSRAM	LGQ971	Digi-Key 475-1409-1-ND
D5	BZT52		SOD-123	Zener Diode, 0.5 W, 5.1 V	Vishay	BZT52B5V1-V-GS08	FEC 1617767
D6	Red		LED-0603HSML-C191	Red LED, high intensity (>90 mCd), 0603	Avago Technologies	HSMC-C191	FEC 855-4528
GND			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
GND1			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
GND2			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
GND3			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
GND4			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
GND5			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
GND6			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
GPIO0			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
GPIO1			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
J1			CON-120/FX8-1205-SV	120-way connector, 0.6 mm pitch	Hirose	FX8-1205-SV(21)	FEC 1324660
J2			SMB	Straight PCB mount SMB jack; keep hole clear of solder	Tyco	1-1337482-0	Do not insert
J3			CON\POWER3 (3_81PITCH)	Socket terminal block, pitch 3.81 mm	Phoenix Contact	MC 1.5/3-G-3.81	FEC 370-4737
J4			CON\POWER3 (3_81PITCH)	Screw terminal block, pitch 3.81 mm	Phoenix Contact	1727023	Do not insert
J5			CON\BARREL_SMD_2MM_K LDX-SMT2-0202-A	DC power connectors, 2 mm SMT power jack	Kycon	KLDX-SMT2-0202-A	Mouser 806-KLDX-SMT20202A
J6			CON\POWER8 (3_81PITCH)	8-pin terminal header, pitch 3.81 mm, vertical	Phoenix Contact	MC 1,5/ 8-G-3,81	FEC 3704774
J7	1 × 4-pin		CON\POWER4 (3_81PITCH)	Connector, pitch 3.81 mm, right angle	Phoenix Contact	MC 1,5/ 4-G-3,81 and 180-3594	Do not insert

Name	Value ¹	Tolerance	PCB Decal	Description	Manufacturer	Part No.	Stock Code
J8			CON\POWER8 (3_81PITCH)	8-pin terminal header, pitch 3.81 mm, vertical	Phoenix Contact	1727078	Do not insert
J9	1 × 4-pin		CON\POWER4 (3_81PITCH)	Screw terminal block, pitch 3.81 mm	Phoenix Contact	1727036	FEC 370-4592
J10			SIP-7P	7-way, SSW, 2.54 mm vertical socket	Samtec	SSW-107-01-T-S	FEC 1803478
J13			SIP-7P	7-way, SIP, 2.54 mm through hole header	Samtec	TLW-107-05-G-S	FEC 1668499
L2	1000r		805	Ferrite bead, 0.3 Ω at dc, 1000 Ω at 100 MHz, 350 mA, 0805	Tyco	BMB2A1000LN2	FEC 119-3421
L3	1000r		805	Ferrite bead, 0.3 Ω at dc, 1000 Ω at 100 MHz, 350 mA, 0805	Tyco	BMB2A1000LN2	FEC 119-3421
LK1			LINK- 3P_TEXT_INV	3-pin (3 × 1), 0.1" header and shorting block in A	Harwin	M20-9990346 and M7566-05	FEC 1022249 and 150-411
LK2			LINK-3P	3-pin (3 × 1), 0.1" header and shorting block in A	Harwin	M20-9990346 and M7566-05	FEC 1022249 and 150-411
LK5			SIP-2P	2-pin (0.1" pitch) header and shorting shunt	Harwin	M20-9990246	FEC 1022247 and 150-411
LK6			SIP-2P	2-pin (0.1" pitch) header and shorting shunt	Harwin	M20-9990246	FEC 1022247 and 150-411
LK7			SIP-2P	2-pin (0.1" pitch) header and shorting shunt	Harwin	M20-9990246	FEC 1022247 and 150-411
LK8			SIP-2P	2-pin (0.1" pitch) header and shorting shunt	Harwin	M20-9990246	FEC 1022247 and 150-411
LK9			SIP-2P	2-pin (0.1" pitch) header and shorting shunt	Harwin	M20-9990246	FEC 1022247 and 150-411
Q1			SOT23	MOSFET transistor	Vishay Siliconix	SI2304DDS-T1- GE3	FEC 1858939
Q2			SOT23	Transistor, NPN, SOT-23	ON Semiconductor	MMBT3904LT1G	FEC 1459100
R1	DNI	0.01	R0603	Resistor, not inserted, 0603	N/A	N/A	Do not insert
R2	100k	0.01	R0603	SMD resistor	Multicomp	MC 0.063W 0603 1% 100K	FEC 9330402
R3	100k	1%	R0603	SMD resistor	Multicomp	MC 0.063W 0603 1% 100K	FEC 9330402
R4	100k	0.01	R0603	SMD resistor	Multicomp	MC 0.063W 0603 1% 100K	FEC 9330402
R5	10k	0.01	R0402	Resistor, 1%, 0402	Phycomp	CRCW040210K OFKEAHP	FEC 173-8864
R6	10k	0.01	R0402	Resistor, 1%, 0402	Phycomp	CRCW040210K OFKEAHP	FEC 173-8864
R7	100k	1%	R0603	SMD resistor	Multicomp	MC 0.063W 0603 1% 100K	FEC 9330402
R8	10k	0.01	R0402	Resistor, 1%, 0402	Phycomp	CRCW040210K OFKEAHP	FEC 173-8864
R9	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	FEC 146-9661
R10	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	FEC 146-9661
R11	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	FEC 146-9661
R12	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	FEC 146-9661
R13	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	FEC 146-9661
R14	39k	0.01	R0402	Resistor, 0402, 1%, 39k8	Multicomp	MC 0.0625W 0402 1% 69K8	FEC 1358085
R15	10k2	0.01	R0402	SMD resistor	Multicomp	MC 0.0625W 0402 1% 10K2	FEC 1803137
R16	69k8	0.01	R0402	Resistor, 0402, 1%, 69k8	Multicomp	MC 0.0625W 0402 1% 69K8	FEC 1803735

Name	Value ¹	Tolerance	PCB Decal	Description	Manufacturer	Part No.	Stock Code
R17	10k2	0.01	R0402	SMD resistor	Multicomp	MC 0.0625W 0402 1% 10K2	FEC 1803137
R18	10k2	0.01	R0402	SMD resistor	Multicomp	MC 0.0625W 0402 1% 10K2	FEC 1803137
R19	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	FEC 146-9661
R20	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	FEC 146-9661
R21	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	FEC 146-9661
R22	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	FEC 146-9661
R23	86k6	0.01	R0402	Resistor, 0402, 1%, 86k6	Multicomp	MC 0.0625W 0402 1% 86K6	FEC 1803744
R24	10k2	0.01	R0402	SMD resistor	Multicomp	MC 0.0625W 0402 1% 10K2	FEC 1803137
R25	30k1	0.01	R0402	Resistor, 0402, 1%, 30k1	Multicomp	MC 0.0625W 0402 1% 30k1	FEC 1803699
R26	DNI	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	Do not insert
R27	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	FEC 146-9661
R28	DNI	0.01	R0402	Resistor, not inserted, 0402	N/A	N/A	Do not insert
R29	DNI	0.01	R0402	Resistor, not inserted, 0402	N/A	N/A	Do not insert
R30	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	FEC 146-9661
R31	DNI	0.01	R0402	Resistor, not inserted, 0402	N/A	N/A	Do not insert
R32	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	FEC 146-9661
R33	DNI	0.01	R0402	Resistor, not inserted, 0402	Vishay	CRCW0402000 OZ0ED	Do not insert
R34	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	FEC 146-9661
R35	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	FEC 146-9661
R36	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	FEC 146-9661
R37	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	FEC 146-9661
R38	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	FEC 146-9661
R39	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	FEC 146-9661
R40	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	FEC 146-9661
R41	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	FEC 146-9661
R42	10k	0.05	R0402	Resistor, thick film, 10 kΩ, 62.5 mW, 5%	Yageo	RC0402JR- 1310KL	FEC 179-9316
R43	10k	0.05	R0402	Resistor, thick film, 10 kΩ, 62.5 mW, 5%	Yageo	RC0402JR- 1310KL	FEC 179-9316
R44	10k	0.05	R0402	Resistor, thick film, 10 kΩ, 62.5 mW, 5%	Yageo	RC0402JR- 1310KL	FEC 179-9316
R45	10k	0.05	R0402	resistor, thick film, 10 kΩ, 62.5 mW, 5%	Yageo	RC0402JR- 1310KL	FEC 179-9316
R46	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	FEC 146-9661
R47	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	FEC 146-9661

Name	Value ¹	Tolerance	PCB Decal	Description	Manufacturer	Part No.	Stock Code
R48	100k	1%	R0603	SMD resistor	Multicomp	MC 0.063W 0603 1% 100K	FEC 9330402
R49	0R	0.01	1206	Resistor, 1206	Multicomp	MC 0.125W 1206 0R	FEC 9336974
R50	0R	0.01	1206	Resistor, 1206	Multicomp	MC 0.125W 1206 0R	FEC 9336974
R51	0R	0.01	1206	Resistor, 1206	Multicomp	MC 0.125W 1206 0R	FEC 9336974
R52	0R	0.01	1206	Resistor, 1206	Multicomp	MC 0.125W 1206 0R	FEC 9336974
R53	60k4	0.01	R0402	Resistor, 0402, 60k4	Multicomp	MC 0.0625W 0402 1% 60K4	FEC 1803729
R54	4k53	0.01	R0402	Resistor, thick film, 4.53 kΩ, 63 mW, 1%	Vishay Dale	CRCW04024K5 3FKED	FEC 1151244
R55	61R9	0.01	R0402	Resistor, 0402, 1%, 61R9	Multicomp	MC 0.0625W 0402 1% 61R9	FEC 1802915
R60	2k4	0.01	R0603	Resistor, thick film, 2.4 kΩ, 0603, 100 mW, 1%	Yageo	RC0603FR- 072K4L	FEC 1799329
R61	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 0Z0ED	FEC 146-9661
R62	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 0Z0ED	FEC 146-9661
R63	0R	0.01	R0603	Resistor, 0603	Vishay Draloric	CRCW0603000 0Z0EA	FEC 146-9739
R64	DNI	0.01	R0603	Resistor, not inserted, 0603	Vishay Draloric	CRCW0603000 0Z0EA	Do not insert
R65	0R	0.01	R0603	Resistor, 0603	Vishay Draloric	CRCW0603000 0Z0EA	FEC 146-9739
R66	1k	0.01	R0603	Resistor, 0603, thick film, 1%	Vishay Draloric	CRCW06031K0 0FKEA	FEC 1469740
R67	DNI	0.01	R0603	Resistor, not inserted, 0603	Vishay Draloric	CRCW0603000 0Z0EA	Do not insert
R68	1k	0.1%	R0603	Resistor, 0603	Panasonic	ERA3AEB102V	FEC 157-7605
R69	DNI	0.01	R0603	Resistor, not inserted, 0603	N/A	N/A	Do not insert
R70	0R	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 0Z0ED	FEC 146-9661
R71	10k	0.01	R0402	Resistor, 1%, 0402	Phycomp	CRCW040210K 0FKEAHP	FEC 173-8864
R72	0R	0.01	R0603	Resistor, 0603	Vishay Draloric	CRCW0603000 0Z0EA	FEC 146-9739
R73	0R	0.01	R0603	Resistor, 0603	Vishay Draloric	CRCW0603000 0Z0EA	FEC 146-9739
R74	DNI	0.01	R0603	Resistor, not inserted, 0603	Vishay Draloric	CRCW0603000 0Z0EA	Do not insert
R75	1k	0.01	R0603	Resistor, 0603, thick film, 1%	Vishay Draloric	CRCW06031K0 0FKEA	FEC 1469740
R76	1k	0.01	R0603	Resistor, 0603, thick film, 1%	Vishay Draloric	CRCW06031K0 0FKEA	FEC 1469740
R77	1k	0.01	R0603	Resistor, 0603, thick film, 1%	Vishay Draloric	CRCW06031K0 0FKEA	FEC 1469740
R78	0R	0.01	R0603	Resistor, 0603	Vishay Draloric	CRCW0603000 0Z0EA	FEC 146-9739
R79	DNI	0.01	R0603	Resistor, not inserted, 0603	Vishay Draloric	CRCW0603000 0Z0EA	Do not insert
R80	DNI	0.01	R0603	Resistor, not inserted, 0603	Vishay Draloric	CRCW0603000 0Z0EA	Do not insert
R81	0R	0.01	R0603	Resistor, 0603	Vishay Draloric	CRCW0603000 0Z0EA	FEC 146-9739
R82	0R	0.01	R0603	Resistor, 0603	Vishay Draloric	CRCW0603000 0Z0EA	FEC 146-9739

Name	Value ¹	Tolerance	PCB Decal	Description	Manufacturer	Part No.	Stock Code
R83	0R	0.01	R0603	Resistor, 0603	Vishay Draloric	CRCW0603000 OZ0EA	FEC 146-9739
R84	0R	0.01	R0603	Resistor, 0603	Vishay Draloric	CRCW0603000 OZ0EA	FEC 146-9739
R85	DNI	0.01	R0603	Resistor, not inserted, 0603	Vishay Draloric	CRCW0603000 OZ0EA	Do not insert
R86	DNI	0.01	R0603	Resistor, not inserted, 0603	Vishay Draloric	CRCW0603000 OZ0EA	Do not insert
R87	0R	0.01	R0603	Resistor, 0603	Vishay Draloric	CRCW0603000 OZ0EA	FEC 146-9739
R88	1k	0.01	R0204	Resistor, 0402	Multicomp	MC 0.0625W 0402 1% 1K	FEC 135-8043
R89	1k	0.01	R0204	Resistor, 0402	Multicomp	MC 0.0625W 0402 1% 1K	FEC 135-8043
R90	DNI	0.01	R0402	Resistor, 0402	Vishay	CRCW0402000 OZ0ED	Do not insert
R91	10R	0.01	R0603	Resistor, 0603	Bourns	CR0603-FX- 10R0GLF	FEC 200-8331
R92	1k	0.1%	R0603	Resistor, 0603	Panasonic	ERA3AEB102V	FEC 157-7605
R93	0R	0.01	R0603	Resistor, 0603	Vishay Draloric	CRCW0603000 OZ0EA	FEC 146-9739
R94	DNI	0.01	R0603	Resistor, not inserted, 0603	Vishay Draloric	CRCW0603000 OZ0EA	Do not insert
R95	DNI	0.01	R0603	Resistor, not inserted, 0603	Vishay Draloric	CRCW0603000 OZ0EA	Do not insert
R96	DNI	0.01	R0603	Resistor, not inserted, 0603	Vishay Draloric	CRCW0603000 OZ0EA	Do not insert
R97	DNI	0.01	R0603	Resistor, not inserted, 0603	Vishay Draloric	CRCW0603000 OZ0EA	Do not insert
R98	0R	0.01	R0603	Resistor, 0603	Vishay Draloric	CRCW0603000 OZ0EA	FEC 146-9739
R99	1k	0.1%	R0603	Resistor, 0603	Panasonic	ERA3AEB102V	FEC 157-7605
R100	0R	0.01	R0603	Resistor, 0603	Vishay Draloric	CRCW0603000 OZ0EA	FEC 146-9739
R101	0R	0.01	R0603	Resistor, 0603	Vishay Draloric	CRCW0603000 OZ0EA	FEC 146-9739
R102	DNI	0.01	R0603	Resistor, not inserted, 0603	Vishay Draloric	CRCW0603000 OZ0EA	Do not insert
R103	DNI	0.01	R0603	Resistor, not inserted, 0603	Vishay Draloric	CRCW0603000 OZ0EA	Do not insert
R104	DNI	0.01	R0603	Resistor, not inserted, 0603	N/A	N/A	Do not insert
R105	10R	0.01	R0603	Resistor, 0603	Bourns	CR0603-FX- 10R0GLF	FEC 200-8331
R106	1k	0.1%	R0603	Resistor, 0603	Panasonic	ERA3AEB102V	FEC 157-7605
R107	0R	0.01	R0603	Resistor, 0603	Vishay Draloric	CRCW0603000 OZ0EA	FEC 146-9739
R108	DNI	0.01	R0603	Resistor, not inserted, 0603	Vishay Draloric	CRCW0603000 OZ0EA	Do not insert
R109	1k	0.1%	R0603	Resistor, 0603	Panasonic	ERA3AEB102V	FEC 157-7605
R110	0R	0.01	R0603	Resistor, 0603	Vishay Draloric	CRCW0603000 OZ0EA	FEC 146-9739
R111	0R	0.01	R0603	Resistor, 0603	Vishay Draloric	CRCW0603000 OZ0EA	FEC 146-9739
R112	DNI	0.01	R0603	Resistor, not inserted, 0603	Vishay Draloric	CRCW0603000 OZ0EA	Do not insert
R113	DNI	0.01	R0603	Resistor, not inserted, 0603	Vishay Draloric	CRCW0603000 OZ0EA	Do not insert
R114	DNI	0.01	R0603	Resistor, not inserted, 0603	N/A	N/A	Do not insert

Name	Value ¹	Tolerance	PCB Decal	Description	Manufacturer	Part No.	Stock Code
R115	10R	0.01	R0603	Resistor, 0603	Bourns	CR0603-FX-10R0GLF	FEC 200-8331
R116	1k	0.1%	R0603	Resistor, 0603	Panasonic	ERA3AEB102V	FEC 157-7605
R117	0R	0.01	R0603	Resistor, 0603	Vishay Draloric	CRCW06030000Z0EA	FEC 146-9739
R118	DNI	0.01	R0603	Resistor, not inserted, 0603	Vishay Draloric	CRCW06030000Z0EA	Do not insert
R119	1k	0.1%	R0603	Resistor, 0603	Panasonic	ERA3AEB102V	FEC 157-7605
R120	0R	0.01	R0603	Resistor, 0603	Vishay Draloric	CRCW06030000Z0EA	FEC 146-9739
R121	0R	0.01	R0603	Resistor, 0603	Vishay Draloric	CRCW06030000Z0EA	FEC 146-9739
R122	DNI	0.01	R0603	Resistor, not inserted, 0603	Vishay Draloric	CRCW06030000Z0EA	Do not insert
R123	DNI	0.01	R0603	Resistor, not inserted, 0603	Vishay Draloric	CRCW06030000Z0EA	Do not insert
R124	DNI	0.01	R0603	Resistor, not inserted, 0603	N/A	N/A	Do not insert
R125	10R	0.01	R0603	Resistor, 0603	Bourns	CR0603-FX-10R0GLF	FEC 200-8331
R126	1k	0.1%	R0603	Resistor, 0603	Panasonic	ERA3AEB102V	FEC 157-7605
REF+			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
REF-			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
REFOUT			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
SL1			0603-2WAY-BRIDGE	2-way solder link (use 0 Ω, 0603 resistor); insert in Link Position A	N/A		FEC 933-1662
SL2			0603-2WAY-BRIDGE	2-way solder link (use 0 Ω, 0603 resistor); insert in Link Position A	N/A		FEC 933-1662
SL3			0603-2WAY-BRIDGE	2-way solder link (use 0 Ω, 0603 resistor); insert in Link Position A	N/A		FEC 933-1662
SL4			0603-3WAY-BRIDGE	3-way solder link (use 0 Ω, 0603 resistor); insert in Link Position A	N/A		FEC 933-1662
SL5			0603-2WAY-BRIDGE	2-way solder link (use 0 Ω, 0603 resistor); insert in Link Position B	N/A		FEC 933-1662
SL6			0603-2WAY-BRIDGE	2-way solder link (use 0 Ω, 0603 resistor)	N/A		Do not insert
SL7			0603-3WAY-BRIDGE	3-way solder link (use 0 Ω, 0603 resistor); insert in Link Position A	N/A		FEC 933-1662
SL8			0603-4WAY-BRIDGE	4-way solder link (use 0 Ω, 0603 Resistor); insert in Link Position B			FEC 933-1662
SL9			0603-3WAY-BRIDGE	3-way solder link (use 0 Ω, 0603 resistor); insert in Link Position B	N/A		FEC 933-1662
SL10			0603-3WAY-BRIDGE	3-way solder link (use 0 Ω, 0603 resistor); insert in Link Position B	N/A		FEC 933-1662
SL11			0603-4WAY-BRIDGE	4-way solder link (use 0 Ω, 0603 resistor); insert in Link Position B			FEC 933-1662
STAR3			COMPONENT LINKAA	Ground link	N/A	N/A	N/A
TDIN			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
TDIN1			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
TDOUT			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
TDOUT1			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert

Name	Value ¹	Tolerance	PCB Decal	Description	Manufacturer	Part No.	Stock Code
TSCLK			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
TSCLK1			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
TSYNC			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
TSYNC1			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
TXTAL1			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
TXTAL2			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
T\CS			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
T\CS1			TESTPOINT-SMALL	Test point, not inserted; keep hole clear of solder	N/A	N/A	Do not insert
U1			MSO8	32k I ² C serial EEPROM	Microchip	24LC32A-I/MS	FEC1331330
U2			SO8NB_RD8-2	Linear regulator 5 V, 20 V, 500 mA, ultralow noise, CMOS	Analog Devices	ADP7104ARDZ-5.0	ADP7104ARDZ-5.0
U3			MSO10	Quad voltage monitor and sequencer	Analog Devices	ADM1185ARMZ-1	ADM1185ARMZ-1
U4			MSO8	50 mA, high voltage, micropower linear regulator—adjustable	Analog Devices	ADP1720ARMZ-R7	ADP1720ARMZ-R7
U5			TSSOP24	2-/4-channel, 250 kSPS, 24-bit, multiplexed Σ - Δ ADC	Analog Devices	AD7176-2BRUZ	AD7176-2BRUZ
U6			SO8NB	5 V XFET reference	Analog Devices	ADR445BRZ	ADR445BRZ
U7			MSO8	50 mA, high voltage, micropower linear regulator—5 V	Analog Devices	ADP1720ARMZ-5-R7	ADP1720ARMZ-5-R7
U8			SO8NB	Dual op amp	Analog Devices	AD8656ARZ	AD8656ARZ
U9			MSO10	Fully differential funnel amplifier	Analog Devices	AD8475ARMZ	AD8475ARMZ
U10			MSO8	50 mA, high voltage, micropower linear regulator—3.3 V	Analog Devices	ADP1720ARMZ-3.3-R7	ADP1720ARMZ-3.3-R7
U11			LFCSP-16-3MM	Ultralow power, low distortion ADC driver	Analog Devices	ADA4940-1ACPZ	ADA4940-1ACPZ
U12			SO8NB	Dual op amp	Analog Devices	AD8656ARZ	AD8656ARZ
V1			R1206	1206 place holder	N/A	N/A	Do not insert
V2			R1206	1206 place holder	N/A	N/A	Do not insert
V3			R1206	1206 place holder	N/A	N/A	Do not insert
V4			R1206	1206 place holder	N/A	N/A	Do not insert
Y1	16 MHz		XTAL-FA20H	Miniature crystal—SMD	Epson Toyocom	FA-20H, 16 MHz, 10 PPM, 9 PF	FEC 171-2814

¹ DNI = do not insert.

NOTES

**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.

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