Evaluation Board for the AD7273/AD7274
3 MSPS, 10-/12-Bit ADCs
EVAL-AD7273/AD7274

FEATURES

Full-featured evaluation board for the AD7273/AD7274
EVAL-CONTROL-BRD2 compatible
Standalone capability
On-board analog buffering and voltage reference
Various linking options
PC software for control and data analysis when used with
  EVAL-CONTROL-BRD2

GENERAL DESCRIPTION

This data sheet describes the evaluation board for the AD7273/ AD7274. The AD7273/AD7274 are, respectively, 12-bit and 10-bit, high speed, low power successive approximation ADCs. The parts operate from a single +2.35 V to +5.25 V power supply and feature throughput rates up to 1 MSPS. The parts contain a low noise, wide bandwidth track/hold amplifier that can handle input frequencies in excess of 6 MHz. Full data on the AD7273/AD7274 is available in the AD7273/AD7274 data sheet, which is available from Analog Device, Inc., and should be consulted in conjunction with this data sheet when using the evaluation board.

On-board components include:

- One AD780, a pin programmable +2.5 V or +3 V ultra high precision band gap reference
- One REF195 precision band gap, voltage reference, providing a 5 V reference voltage
- One OP467 quad op amp used to buffer the analog inputs

Because of its standard pinout, the AD780 reference can be swapped for the AD680, a +2.5 V low power reference. In the same way, the REF195 can be easily interchanged for another one from the same REF19x family, always bearing in mind the voltage range of the part. There is also an option to supply an external voltage to the part. Various link options are explained in detail in the Link and Switch Options section.

Interfacing to this board is through a 96-way connector. This 96-way connector is compatible with the EVAL-CONTROL-BRD2, which is also available from Analog Devices. External sockets are provided for the AIN input, the VIN input, and the VBIASED input.
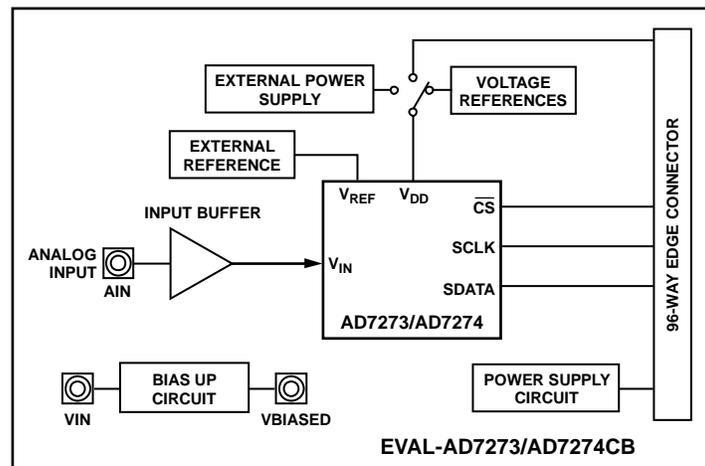
FUNCTIONAL BLOCK DIAGRAM

Figure 1.

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REVISION HISTORY

6/07—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

POWER SUPPLIES

When using this evaluation board with the EVAL-CONTROL-BRD2, all supplies are provided from the EVAL-CONTROL-BRD2 through the 96-way connector.

When using the board as a standalone unit, external supplies must be provided. This evaluation board has nine power supply inputs:

- EXT_VDD
- AGND
- +12 V
- −12 V
- AGND
- EXT_VREF
- AGND
- DVDD
- DGND

The VDD for the AD7273/AD7274 can be supplied either from the EXT_VDD external supply or from the selected reference chip. The +12 V and −12 V inputs are used to supply the AD780, the REF195, and the OP467 quad op amp. The 0 V input is connected to one or both of the AGND inputs. The

reference voltage can be applied externally via EXT_VREF. The DVDD input can be used to supply a separate +5 V for the 74LS04 DVDD pin. The DGND input must be tied to 0 V.

The supplies are decoupled to the relevant ground plane with 10 μF tantalum and 0.1 μF multilayer ceramic capacitors at the pin where they enter the board. The supply pins of the quad op amp and the references are also decoupled to AGND with 10 μF tantalum and 0.1 μF ceramic capacitors. The AD7273/AD7274 V_{DD} supply pin is decoupled to AGND with 10 μF tantalum and 0.1 μF multilayer ceramic capacitors. Extensive ground planes are used on this board to minimize the effect of high frequency noise interference. There are two ground planes, AGND and DGND. These are connected at one location close to the AD7273/AD7274.

SETUP CONDITIONS

Care should be taken before applying power and signals to the evaluation board to ensure that all link positions are as per the required operating mode.

Table 1 shows the position in which all the links are set when the evaluation board is shipped. The board is compatible with the EVAL-CONTROL-BRD2 when shipped.

Table 1. Initial Link and Switch Positions

Link No.	Position	Function
LK1	Removed	50 Ω termination resistor is not applied to the input of the VIN circuit.
LK2	Inserted	AD780 is set to provide a +3 V reference.
LK3	Removed	50 Ω termination resistor is not applied to the input of the bias-up circuit.
LK4	B	V_{REF} is supplied from the REF195.
LK5	A	VDD is selected as the dc bias voltage for the bias-up circuit.
LK6	A	+12 V is supplied from the EVAL-CONTROL-BRD2 via J4.
LK7	A	−12 V is supplied from the EVAL-CONTROL-BRD2 via J4.
LK8	B	SCLK signal from the EVAL-CONTROL-BRD2 is not inverted (for faster values of SCLK).
LK9	A	VCC is equal to that of VDD.
LK10	A	AIN SMB is connected to the input of the analog input buffer.
LK11	C	VDD for the AD7273/AD7274 is supplied from the EVAL-CONTROL-BRD2 via J4.
LK12	A	$\overline{CS}$ is supplied by the EVAL-CONTROL-BRD2.
LK13	A	SDATA is supplied by the EVAL-CONTROL-BRD2.
LK14	A	SCLK is supplied by the EVAL-CONTROL-BRD2.

LINK AND SWITCH OPTIONS

There are 14 link options that must be set for the required operating setup before using the evaluation board. The functions of these options are outlined Table 2.

Table 2. Link Option Functions

Link No.	Function
LK1	This link option is used to select a 50 Ω termination on the analog input buffer circuit, the AIN socket.
	When this link is inserted, the 50 Ω termination is applied.
	When this link is removed, the 50 Ω termination is removed.
LK2	This link option controls the program pin of the AD780 voltage reference.
	When this link is inserted, the AD780 output voltage is set to +3 V.
	When this link is removed, the AD780 output voltage is set to +2.5 V.
LK3	This link option is used to select a 50 Ω termination on the input of the bias-up circuit, the VIN socket.
	When this link is inserted, the 50 Ω termination is applied.
	When this link is removed, the 50 Ω termination is removed.
LK4	This link option is used to select the reference voltage for AD7273/AD7274.
	When this link is in Position A, the AD780 supplies the V_{REF} voltage for the AD7273/AD7274.
	When this link is in Position B, the REF195 supplies the V_{REF} voltage for the AD7273/AD7274.
	When this link is in Position C, V_{REF} is supplied externally via J10.
LK5	This link option sets the dc bias voltage that is applied to the optional bias-up circuit.
	When this link is in Position A, the bias voltage is set to the same level as the voltage that is applied to the AD7273/AD7274 VDD pin. In this configuration, a bipolar analog input applied to the VIN SMB socket is biased up by the bias circuit and is presented at the VBIASED SMB as an unipolar signal biased around VDD/2.
	When this link is in Position B, the bias voltage is set to AGND. In this configuration, the bias-up circuit is not used.
LK6	This link option is used to select the source of the +12 V supply.
	In Position A, the +12 V is supplied from the EVAL-CONTROL-BRD2 through the 96-way connector.
	In Position B, the +12 V is supplied from an external source through the power connector, J6.
LK7	This link option is used to select the source of the −12 V supply.
	In Position A, the −12 V is supplied from the EVAL-CONTROL-BRD2 through the 96-way connector.
	In Position B, the −12 V is supplied from an external source through the power connector, J6.
LK8	This link controls the transfer of data from the AD7273/AD7274 during a conversion for various frequencies of SCLK.
	These links should be in Position A for slower SCLK frequencies, giving valid data on the rising edge.
	These links should be in Position B for fast SCLK frequencies, giving valid data on the falling edge.
LK9	This link selects the source of the VCC +5 V supply for the 74LS04.
	When this link is in Position A, VCC power is supplied from the same power source supplying the AD7273/AD7274 V_{DD} pin.
	When this link is in Position B, VCC power must be supplied from an external source via the power connector, J5.
LK10	This link option is used to connect the input of the V_{IN} analog buffer to the AIN input socket or to AGND.
	When this link is in Position A, the AIN socket is tied to the input of the V_{IN} buffer. In this configuration, an analog signal applied to the AIN input socket is buffered and presented at the AD7273/AD7274 V_{IN} input.
	When this link is in Position B, the V_{IN} buffer input is tied to AGND.
LK11	This link selects the source of the VDD supplied to the AD7273/AD7274.
	When this link is in Position A, the VDD must be supplied from an external source via J5.
	When this link is in Position B, the VDD is supplied from the EVAL-CONTROL-BRD2.
	When this link is in Position C, the VDD is supplied from one of the voltage references, the AD780 or the REF195.
LK12	This link selects the source of the $\overline{CS}$ input to the ADC.
	In Position A, $\overline{CS}$ is supplied by the EVAL-CONTROL-BRD2.
	In Position B, $\overline{CS}$ must be supplied from an external source via P12.
LK13	This link selects the source of the SDATA input to the ADC.
	In Position A, SDATA is supplied by the EVAL-CONTROL-BRD2.
	In Position B, SDATA must be supplied from an external source via P12.
LK14	This link selects the source of the SCLK input to the ADC.
	In Position A, SCLK is supplied by the EVAL-CONTROL-BRD2.
	In Position B, SCLK must be supplied from an external source via P12.

EVALUATION BOARD INTERFACING

Interfacing to the evaluation board is via a 96-way connector, J4. J4 is used to connect the evaluation board to the EVAL-CONTROL-BRD2 or other system. The pinout for the J4 connector is shown in Figure 2 and its pin designations are given in Table 3.
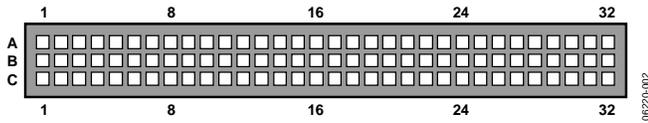

Figure 2. Pin Configuration for the 96-Way Connector, J4

Table 3. 96-Way Connector Pin Description

Signal	Description
DR0	Data Receive Zero. This input is connected to the SDATA pin of the AD7273/7274
TFS0/RFS0	Transmit/Receive Frame Sync Zero. These two outputs are connected to the $\overline{CS}$ pin of the AD7273/AD7274.
SCK0	Serial Clock Zero. This serial clock is connected to the SCLK pin of the AD7273/AD7274, with the option of an inverting buffer.
DGND	Digital Ground. These lines are connected to the digital ground plane on the evaluation board. It allows the user to provide the digital supply via the connector along with the other digital signals.
AGND	Analog Ground. These lines are connected to the analog ground plane on the evaluation board.
AVDD	Analog +5 V Supply. These lines are connected to the AV_{DD} supply line on the board.
+12 V	+12 V Supply. This line is connected to the +12 V supply line on the board via LK6.
−12 V	−12 V Supply. This line is connected to the −12 V supply line on the board via LK7.

Table 4. 96-Way Connector Pin Functions[1]

Pin	ROW A	ROW B	ROW C
1			
2			
3			
4	DGND	DGND	DGND
5			DR0
6	TFS0		RFS0
7	SCLK0		SCLK0
8			
9			
10			
11			
12	DGND	DGND	DGND
13			
14			
15			
16	DGND	DGND	DGND
17			
18			
19			
20	DGND	DGND	DGND
21	AGND	AGND	AGND
22	AGND	AGND	AGND
23	AGND	AGND	AGND
24	AGND	AGND	AGND
25	AGND	AGND	AGND
26	AGND	AGND	AGND
27		AGND	
28		AGND	
29	AGND	AGND	AGND
30	−12 V	AGND	+12 V
31			
32	AVDD	AVDD	AVDD

[1] The unused pins of the 96-way connector are not shown.

SOCKETS

There are six input sockets relevant to the operation of the AD7273/AD7274 on this evaluation board. The functions of these sockets are outlined in Table 5.

Table 5. Socket Functions

Socket	Function
J1	Subminiature BNC socket for AIN analog input.
J2	Subminiature BNC socket for analog input to bias-up circuit, VIN.
J3	Subminiature BNC socket for AIN analog output from bias-up circuit, VBIASED.
J7	Subminiature BNC socket for analog input to SDATA pin on ADC.
J8	Subminiature BNC socket for analog input to SCLK pin on ADC.
J9	Subminiature BNC socket for analog input to $\overline{CS}$ pin on ADC.

CONNECTORS

There are four connectors on the AD7273/AD7274 evaluation board, as outlined in Table 6.

Table 6. Connector Functions

Connector	Function
J4	96-way connector used to interface to the EVAL-CONTROL-BRD2.
J5	External VDD and AGND power connector.
J6	External +12 V, −12 V and AGND power connector.
J10	External V_{REF} power connector.

OPERATING WITH THE EVAL-CONTROL-BRD2

The evaluation board can be operated in a standalone mode or operated in conjunction with the EVAL-CONTROL BOARD, which is available from Analog Devices under the order entry EVAL-CONTROL-BRD2. When operated with this control board, all supplies and control signals to operate the AD7273/AD7274 are provided by the EVAL-CONTROL-BRD2. Software to communicate with the Control Board and AD7273/AD7274 is provided with the AD7273/AD7274 evaluation board package. This EVAL-CONTROL-BRD2 also operates with all Analog Devices evaluation boards that end with the letters CB.

The 96-way connector on the EVAL-AD7273/AD7274CB plugs directly into the 96-way connector on the EVAL-CONTROL-BRD2. The EVAL-CONTROL-BRD2 provides all the supplies for the evaluation board. It is powered from a 12 V ac transformer. This is a standard 12 V ac transformer capable of supplying 1 A current and is available as an accessory from Analog Devices under the following part numbers:

EVAL-110VAC-US (for use in the U.S. or Japan)
EVAL-220VAC-UK (for use in the U.K.)
EVAL-220VAC-EU (for use in Europe)

These transformers are also available from other suppliers, including Digi-Key Corporation (U.S.) and Campbell Collins, Ltd. (U.K.).

Connection between the EVAL-CONTROL-BRD2 and the serial port of a PC is via a standard printer port cable, which is provided as part of the EVAL-CONTROL-BRD2 package. Refer to the manual that accompanies the EVAL-CONTROL-BRD2 for more details on the EVAL-CONTROL-BRD2 package.

EVALUATION BOARD SOFTWARE

INSTALLING THE SOFTWARE

The EVAL-AD7273/AD7274CB evaluation board package includes a CD-ROM that contains software for controlling and evaluating the performance of the AD7273/AD7274 when it is operated with the EVAL-CONTROL-BRD2.

When the CD is inserted into a PC, an installation program automatically begins. This program installs the evaluation software, the data sheet for the AD7273/AD7274 evaluation board, as well as the data sheet for the AD7273/AD7274. All literature on the CD is in Adobe's portable documentation format (PDF) and requires Acrobat® Reader™ to be viewed or printed. The user interface on the PC is a dedicated program written especially for the AD7273/AD7274.

SETTING UP THE EVAL-CONTROL-BRD2

This section describes how the evaluation board, the EVAL-CONTROL-BRD2, and the software should be set up to begin using the complete system.

1. Connect the EVAL-CONTROL-BRD2 and evaluation board together via the 96-way connector.
2. Apply the power to the EVAL-CONTROL-BRD2 via a 12 V ac transformer. At this stage, the red LED on the EVAL-CONTROL-BRD2 should be flashing, which indicates that the EVAL-CONTROL-BRD2 is functional and ready to receive instructions.

Note that the software should be installed before the printer port cable is connected between the EVAL-CONTROL-BRD2 and the PC. This ensures that the printer port initializes properly. The printer port can then be connected between the PC and the EVAL-CONTROL-BRD2.

CONFIGURING THE EVALUATION BOARD

The **Load Configuration** dialog box allows you to load the required configuration file for the evaluation board. A screenshot is shown in Figure 3. The configuration gives the software detailed information about the AD7273/AD7274 evaluation board and the part connected to the EVAL-CONTROL-BRD2, such as the number of bits, the maximum sampling rate, output coding, maximum sampling rate, and power supply requirements.

The list box at the top left corner of the **Load Configuration** window lists the available configuration files. Software configuration files give the evaluation control board software information on how the software and hardware should perform. The configuration files are text based files that contain information about the particular evaluation board to be tested. The information covers the part name, number of samples to be taken, default and maximum sampling frequency, and power supply settings. The configuration file also contains the name of the DSP that is to be downloaded to the EVAL-CONTROL-BRD2.

Figure 3. Load Configuration Window

To load the required configuration files, follow these steps:

1. When the software is run, click the **Device Select** control button. This displays the **Load Configuration** window (as shown in Figure 3).
2. In the **Select a Configuration File** list box, select the relevant configuration file (**ad7273.cfg** for AD7273, or **ad7274.cfg** for AD7274) and click the **OK** button.
3. This resets the EVAL-CONTROL-BRD2 and downloads the DSP program. When the download is complete, the power supply settings indicated in the configuration file are set and you may hear some of the relays clicking. The drop-down list boxes (for example, **Num Sample**s and **Sample Frequency**) are set to the default values specified by the configuration file. You are free to change these at will.

Typical Configuration File

The following is a typical software configuration file (*.cfg).

```
[EVAL-CONTROL BOARD]
partname:AD7274

programname:ad727x.PRG
samplefrequency:100000
maxsamplefrequency:1000000
samples:2048

+/-15V:on
dvdd:5:on
avdd:5:on
bus:on
;options 2scomp, binary
dataformat:binary
numberofbits:12
inputVmax:5
inputVmin:0
[endofconfig]
```

USING THE SOFTWARE

With the hardware set up, you can now use the software to control the EVAL-CONTROL-BRD2 and the AD7273/AD7274 evaluation board.

The software that controls the EVAL-CONTROL-BRD2 and, therefore, the AD7273/AD7274 evaluation board has two main windows. The window shown in Figure 4 appears when the software is run. The main function of this window is to allow you to read a predetermined number of samples from the evaluation board and display them in both the time and frequency domain. The window can be divided into three sections.

The top portion of the screen contains the control buttons, the menu bar, the busy status, and selection drop-down list boxes. The control buttons allow you to take samples, reset the board, or exit the program. To load a configuration file, click the **Device Select** button, which opens the **Load Configuration** window. There are also **Power Down** and **Power Up** options in the control buttons. These buttons allow you to power down the part, and power the part up again. There are two power-down modes associated with the AD7273/AD7274, partial power-down and full power-down.

To enter partial power-down mode, click the **Power Down** button once. To enter full power-down mode, click the **Power Down** button twice (see the AD7273/AD7274 data sheet for further details on the modes of operation).

Menu Bar

The menu bar consists of **File** and **About**.

File Menu

The **File** menu offers the following options:

Load Raw Data. Selecting this option allows you to load data that had been saved by the software during a previous session.

Save Raw Data. Selecting this option allows you to save the current set of sample data points. The data can be reloaded to the EVAL-CONTROL-BRD2 software later or can be used by other programs for further analysis.

Save Binary Data. Selecting this option allows you to save the current set of sample data points. The data is saved in binary format as a text file. This method can be useful for examining code flicker and looking for stuck bits.

Exit. Quits the program.

About Menu

The **About** drop-down menu gives you information about the version of the software.

The **Busy Status** indicates when the evaluation board is busy.

The **Frequency** spin box and **Num Samples** drop-down list box allow you to change the sampling frequency and the number of samples to upload, respectively. The **Frequency** spin box also displays the speed at which the part is running.

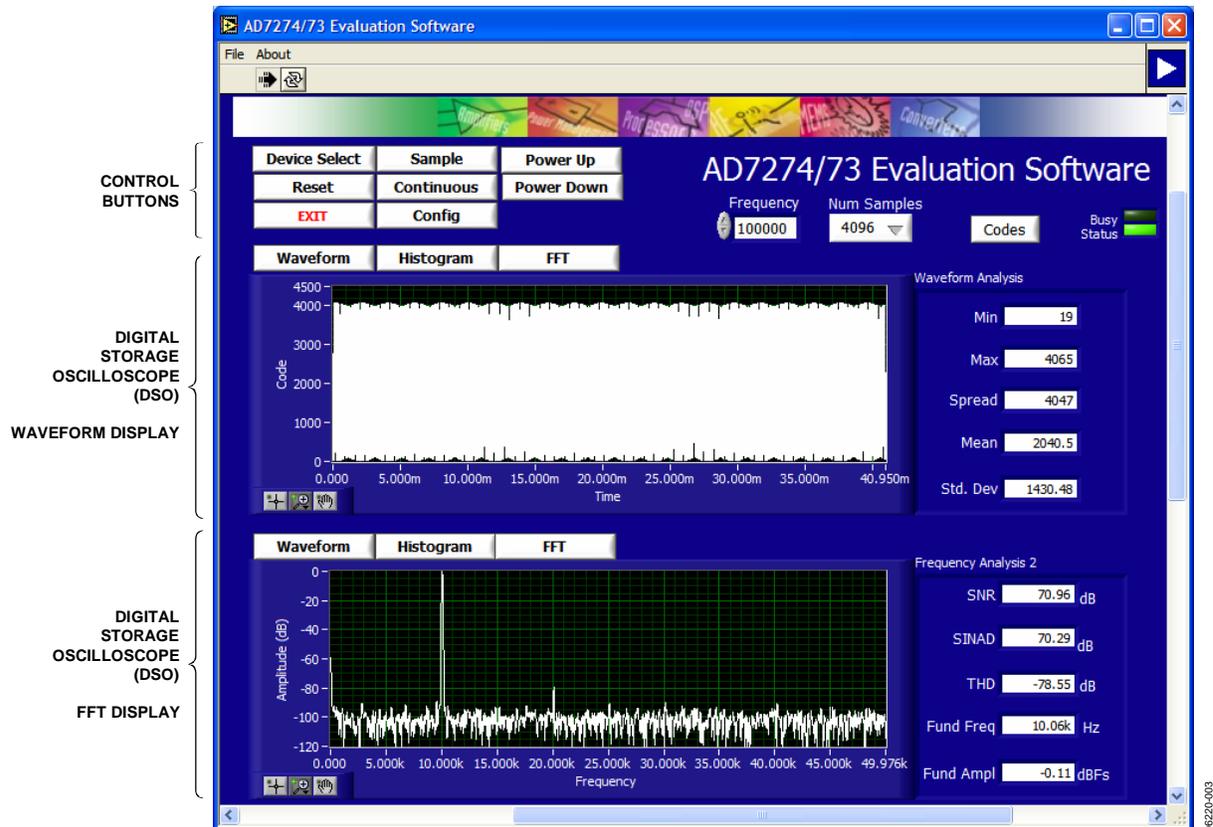The **Codes/Volts** button determines whether the data is displayed in volts or codes.

Figure 4. AD7273/AD7274 Main Window

Digital Storage Oscilloscope

The middle section of the screen is a digital storage oscilloscope (DSO) that allows you to display a waveform, a histogram or a fast Fourier transform (FFT). When samples are uploaded from the EVAL-CONTROL-BRD2, they are displayed here. The samples can be displayed either as integer values or as voltages. At the bottom left corner of the graph are the zoom options. These allow you to zoom in and out to get a closer look at a sample, if required. The right-hand side of the middle section contains information about the samples taken, for example, minimum/maximum position or velocity, the spread, the standard deviation, and the mean.

Fast Fourier Transform or Histogram

The lower section of the window is also a digital storage oscilloscope (DSO) that allows you to display a waveform, a histogram, or an FFT. The FFT (the default option) is typically used for examining the ADC's performance in the frequency domain while the histogram gives an indication of the ADC's performance in response to dc inputs. The option displayed can

be changed by clicking on the **Waveform**, **Histogram**, and **FFT** buttons. The right-hand side of the lower section contains information about the samples taken, for example, ac specifications. Figure 4 shows a screen shot of the main window.

TAKING SAMPLES

When you click the **Sample** button, the software instructs the EVAL-CONTROL-BRD2 to take the required number of samples at the required frequency from the evaluation board.

The samples taken are then uploaded and displayed. An FFT and histogram are also calculated and displayed. If you click the **Continuous** button, the software repeats the process indefinitely until you click the **Stop** button (the **Continuous** button switches to **Stop** when clicked).

EVAL-AD7273/AD7274 SCHEMATIC, SILKSCREEN, AND LAYOUT

These can be found in Figure 5, Figure 6, Figure 7, Figure 8, and Figure 9.
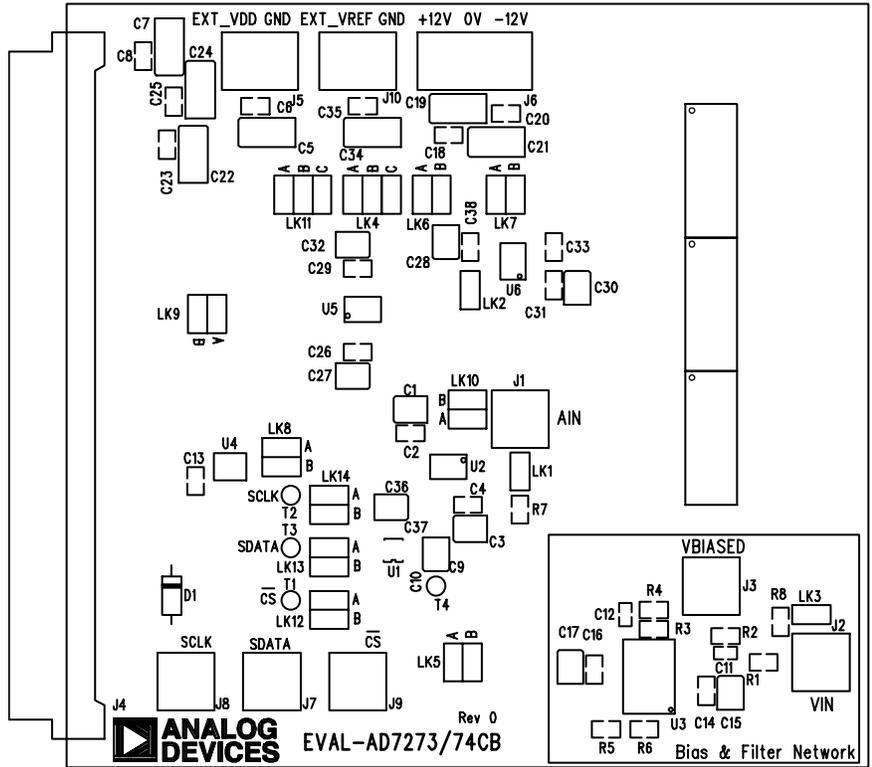
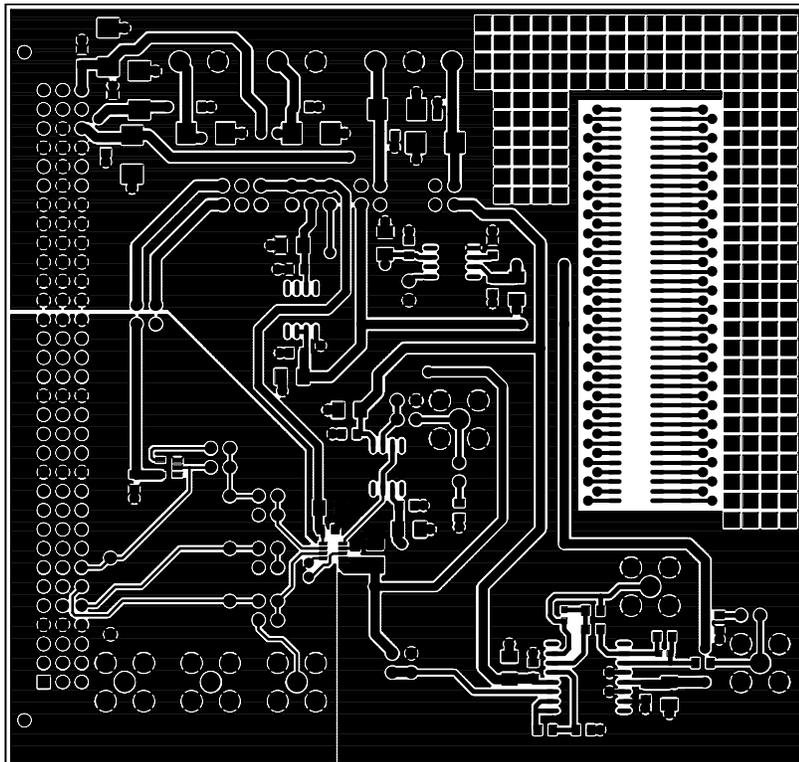# EVALUATION BOARD SCHEMATICS AND ARTWORK

Figure 5. Silkscreen, Top Side
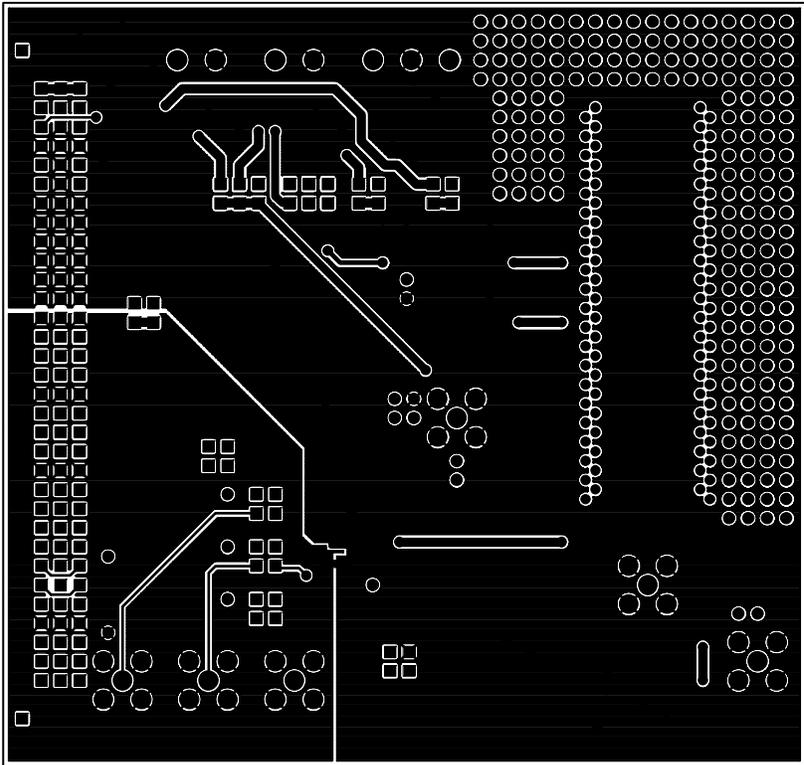

Figure 6. Top View, Component Side

Figure 7. Top View, Solder Side

06220-008

1. **Material:** Two layer, FR4 glass epoxy laminate, 0.062' +/-.007' thick. 1 oz. copper clad - external layers.
2. Plated thru holes and the conductive pattern electroplated with 0.001' min. thick copper. Terminal areas and plated thru holes to be coated with 60/40 tin lead and hot air levelled. (Soldermask over bare copper).
3. Datum for (x,y) co-ordinate drill files at LLH corner.
4. Processing tolerances:
   A. Conductive pattern front to back registration within .005' total.
   B. Minimum annular ring surrounding holes: 0.002'
   C. Finished conductive pattern within .002' of true size.
5. Warp and twist within .010 inch per inch
6. Dimensions are for the finished part.
7. **Solder Mask:** Liquid photo imagable solder mask over bare copper (smobc), colour green, both sides using the patterns provided. No mask is permitted on the terminal areas. Soldermask to etch registration within .005' total.
8. **Screening:** Screen component outlines and nomenclature using indelible white ink on the primary and secondary sides (as required). Nomenclature shall be legible. Screen to etch registration within .020' total.
9. **Surfaces:** Punched or machined surfaces 125 micro inches rms max.
10. Break all sharp edges .015' R max.

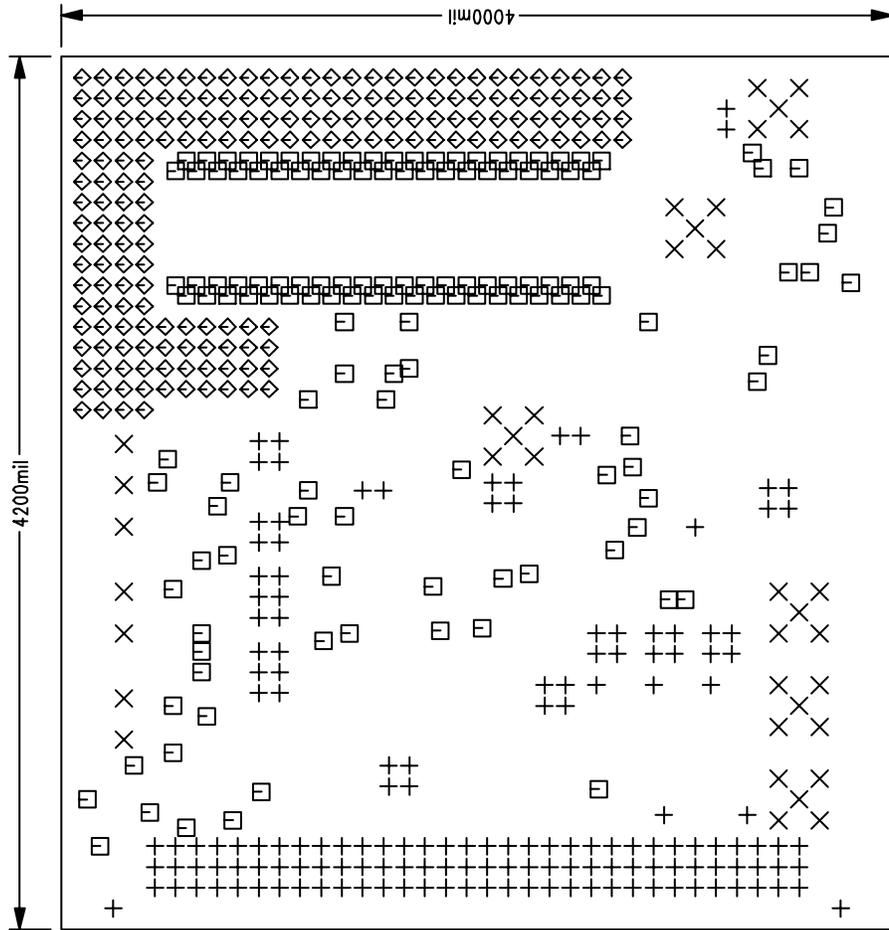| SIZE	QTY	SYM	PLTD	TOL
41	158	+	YES	+/-2.0
60	37	×	YES	+/-2.0
31	143	□	YES	+/-2.0
35	184	◇	YES	+/-2.0

4000mil

4200mil

Figure 8. Drill Drawing, Component Side View

06220-009
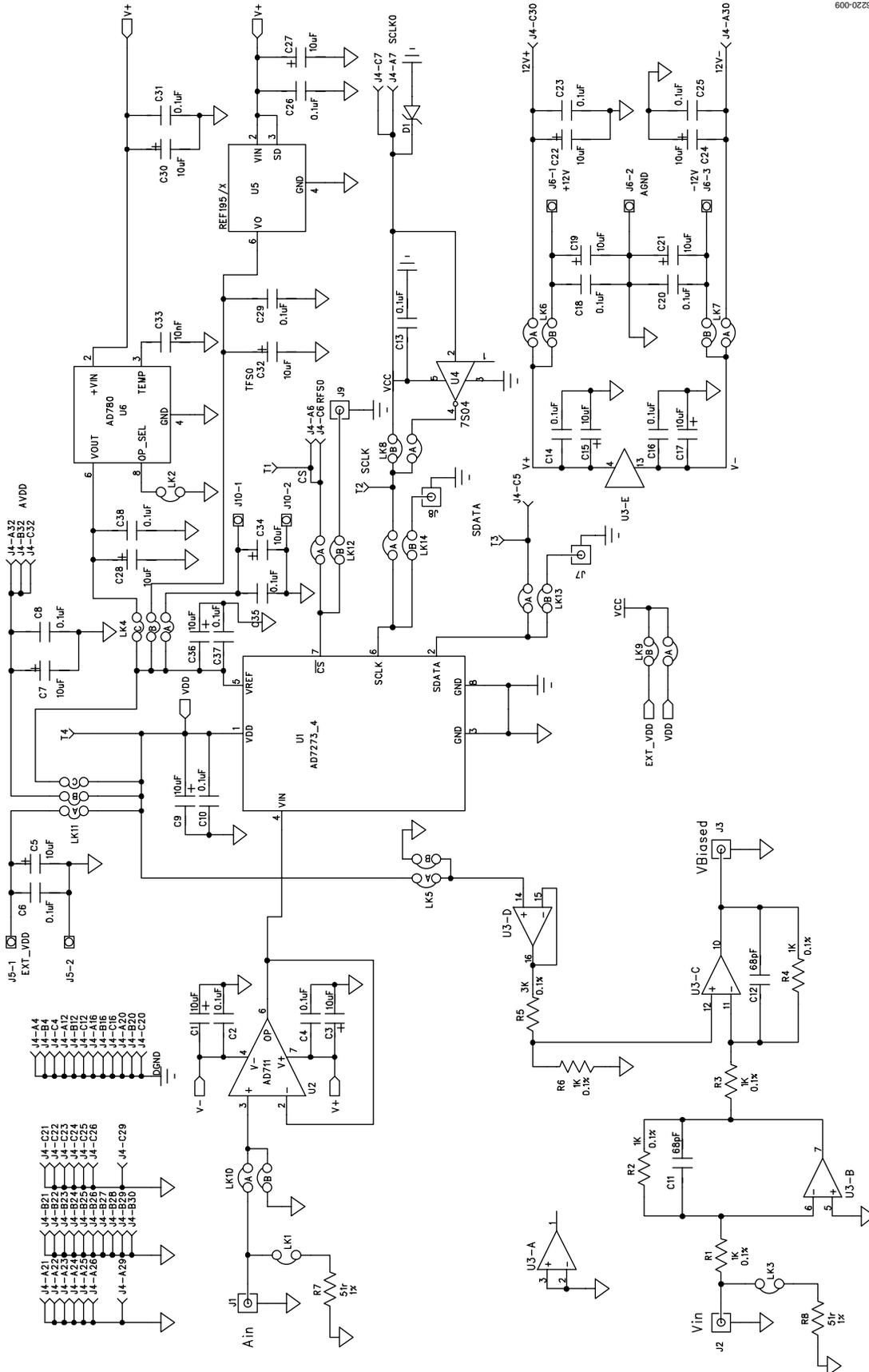
Figure 9. Schematic

ORDERING INFORMATION

ORDERING GUIDE

Model	Description
EVAL-AD7273CB	AD7273 Evaluation Board
EVAL-AD7274CB	AD7274 Evaluation Board

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

NOTES

NOTES

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