

## FEATURES

- Full featured evaluation board for the AD7321 and AD7322 devices
- Evaluation control board (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 AD7321/AD7322 devices. These devices are software selectable bipolar input 13-bit analog-to-digital converters (ADCs). These parts operate from single 2.7 V to 5.25 V and dual  $\pm 12$  V power

supplies and feature throughput rates of up to 500 kSPS/1 MSPS. Full details on these ADCs are available in the AD7321/AD7322 data sheet, available from Analog Devices, Inc., and should be consulted in conjunction with this data sheet.

On-board components include one AD780, a pin programmable 2.5 V or 3 V ultrahigh precision band gap reference, and one AD797 op amp.

Various link options are provided in Table 2.

This evaluation board is equipped with a 96-way connector. This 96-way connector is compatible with the EVAL-CONTROL BRD2, also available from Analog Devices, Inc. Note that the EVAL-CONTROL-BRD2 operates with all Analog Devices evaluation boards with part numbers ending with the letters CB in the Ordering Guide section of this data sheet.

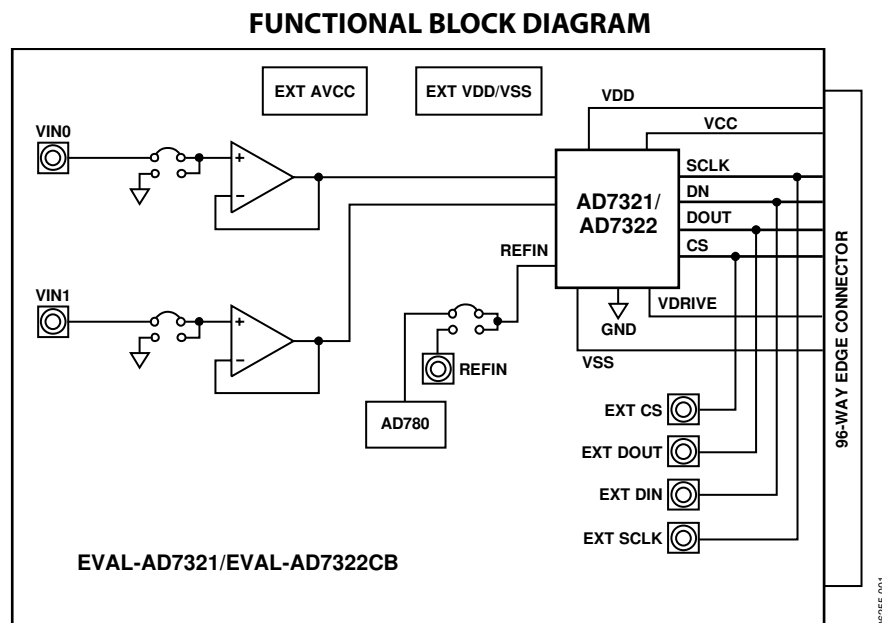


Figure 1. Evaluation Board Block Diagram

### Rev. 0

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## REVISION HISTORY

12/07—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 controller board through the 96-way connector.

When using the board as a standalone unit, external supplies must be provided. This evaluation board has five power supply inputs: EXT\_V<sub>DD</sub>, AGND, +12 V, -12 V, and AGND. If the evaluation board is used in standalone mode, a 2.7 V to 5.5 V supply must be connected to the EXT\_V<sub>DD</sub> input. The +12 V and -12 V supplies are required for the high voltage analog input on the AD7321/AD7322 and for the AD797 op amps. The supplies are decoupled to the ground plane with 10  $\mu$ F tantalum and 0.1  $\mu$ F multilayer ceramic capacitors at the point where they enter the board. The supply pins of all the op amps and the

reference are also decoupled with 10  $\mu$ F tantalum and 0.1  $\mu$ F ceramic capacitors as are the V<sub>DD</sub>, V<sub>SS</sub>, and V<sub>CC</sub> pins of the AD7321/AD7322.

### INITIAL 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. Failure to do so could result in damage to the evaluation board.

Table 1 outlines the default positions off all links when the board is shipped. All links are set so that all power supplies and control signals are supplied by the EVAL-CONTROL BRD2.

**Table 1. Initial Link Positions**

Link No.	Position	Function
LK1	Uninstalled	AD780 supplies a 2.5 V reference to the AD7321/AD7322.
LK2	A	AD780 supplies the reference to the AD7321/AD7322.
LK3	A	V <sub>CC</sub> supply is taken from the EVAL-CONTROL BRD2.
LK4	C	V <sub>DRIVE</sub> supply is taken from the V <sub>CC</sub> supply.
LK5	A	$\overline{CS}$ is taken from the EVAL-CONTROL BRD2.
LK6	C	SCLK signal is taken from the EVAL-CONTROL BRD2.
LK7	A	DIN signal is taken from the EVAL-CONTROL BRD2.
LK8	A	DOUT signal is sent to the EVAL-CONTROL BRD2.
LK9, LK11	Uninstalled	No 51 $\Omega$ termination on the inputs.
LK10	A	SMB Connector J9 connected to input of AD797.
LK12	B	Input to AD797 set to AGND.
LK25	A	+12 V is supplied from the EVAL-CONTROL BRD2.
LK26	A	-12 V is supplied from the EVAL-CONTROL BRD2.
LK27	Installed	-12 V is supplied from the EVAL-CONTROL BRD2.

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## LINK OPTIONS

Link options which must be set for the required operating setup before using the evaluation board. The functions of these options are outlined in Table 2.

Table 2.

Link No.	Function
LK1	Controls the program pin of the AD780 voltage reference.
LK2	Selects the source of the REFIN voltage to be applied to the REFIN pin of the AD7321/AD7322. In Position A, the AD780 supplies the 2.5 V reference to the AD7321/AD7322. In Position B, the REFIN is supplied through the J4 SMB connector.
LK3	Selects the source of the $V_{CC}$ supply for the AD7321/AD7322. In Position A, the $V_{CC}$ supply is taken from the 96-way connector to the EVAL-CONTROL BRD2. In Position B, the $V_{CC}$ supply is taken from the external J2 connector.
LK4	Selects the source of the $V_{DRIVE}$ voltage for the AD7321/AD7322. In Position A, the $V_{DRIVE}$ voltage is taken from the external J3 V drive socket. In Position B, the $V_{DRIVE}$ voltage is taken from the 96-way connector to the EVAL-CONTROL BRD2. In Position C, the $V_{DRIVE}$ voltage is tied to the $V_{CC}$ voltage.
LK5	Selects the source of the $\overline{CS}$ signal. In Position A, $\overline{CS}$ is taken from the 96-way connector to the EVAL-CONTROL BRD2. In Position B, the $\overline{CS}$ signal is taken from the J5 $\overline{CS}$ SMB socket.
LK6	Selects the source of the SCLK signal for the AD7321/AD7322. In Position A, the SCLK signal comes from J6 SMB socket. In Position B, the SCLK signal comes from 7S04 inverter, which is an inverted SCLK signal from the 96-way connector. In Position C, the SCLK signal is taken directly from EVAL-CONTROL-BRD2 through the 96-way connector.
LK7	Selects the source of the DIN signal to the AD7321/AD7322. In Position A, DIN is taken from the 96-way connector to the EVAL-CONTROL BRD2. In Position B, the DIN signal is taken from the J7 DIN SMB socket.
LK8	Selects the destination of the DOUT signal from the AD7321/AD7322. In Position A, DOUT goes to the 96-way connector to the EVAL-CONTROL BRD2. In Position B, the DOUT signal goes to the DOUT J8 SMB socket.
LK9, LK11	Adds a 51 $\Omega$ termination resistor to AGND at the VIN0 to VIN1 input sockets.
LK10, LK12	Selects the input to the AD797 op amps. In Position A, the AD797 noninverting input is tied to the SMB socket. In Position B, the AD797 noninverting input is tied to AGND.
LK25	Selects the source of the +12 V supply for the EVAL-AD7321/AD7322. In Position A, the +12 V supply is sourced from the EVAL-CONTROL BRD2 via the 96-way connector. In Position B, the +12 V supply is sourced externally via the J17 connector.
LK26	Selects the source of the -12 V supply for the EVAL-AD7321/AD7322. In Position A, the -12 V supply is sourced from the EVAL-CONTROL BRD2 via the 96-way connector. In Position B, the -12 V supply is sourced externally via the J17 connector.
LK27	Select the configuration of the noninverting input to U5. The configuration of this link depends on whether the board is being used in single-ended or differential mode. For single-ended mode, this link should be installed. For true differential mode, this link should be uninstalled.

## INTERFACING THE EVALUATION BOARDS

Interfacing to the EVAL-CONTROL BRD2 is accomplished via a 96-way connector, J1.

J1 is used to connect the EVAL-AD7321/AD7322 to the EVAL-CONTROL BRD2 or to another system.

The pinout for the J1 connector is shown in Figure 2 and its pin designations and descriptions are given in Table 3 and Table 4. The unused pins of the 96-way connector are not shown.

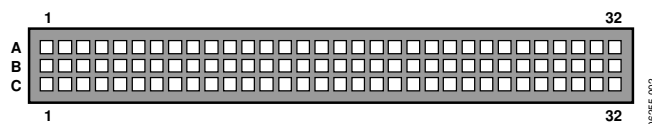


Figure 2. Pin Configuration for the 96-Way Connector J1

Table 3.

Signal	Description
TFS0, RFS0	Transmit/Receive Frame Sync 0. These two outputs are connected to the CS pin of the AD7321/AD7322.
SCLK	Serial Clock 0. This serial clock is connected to the SCLK pin on the AD7321/AD7322.
DR0	Data Receive 0. This input is connected to the SDATA pin of the AD7321/AD7322.
DT0	Data Transmit 0. This output is connected to the DIN pin on the AD7321/AD7322.
AGND	Analog Ground. These lines are connected to the analog ground plane on the evaluation board.
DGND	Digital Ground. These lines are connected to the digital ground plane on the evaluation board.
AV <sub>DD</sub>	Analog +5 V Supply. These lines are connected to the V <sub>CC</sub> supply line on the board via LK3.
-12 V	-12 V Supply. This line is connected to the -12 V supply line on the board via LK26.
+12 V	+12 V Supply. This line is connected to the +12 V supply line on the board via LK25.

Table 4. Pin Designations for 96-Way Connector J1<sup>1</sup>

Pin	Row A	Row B	Row C
1			
2			
3			
4	DGND	DGND	DGND
5	DT0		DR0
6	TFS0		RFS0
7	SCLK0		
8	DVDD	DVDD	DVDD
9	RD		
10			$\overline{CS}$
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	
30	-12 V	AGND	+12 V
31			
32	AV <sub>DD</sub>	AV <sub>DD</sub>	AV <sub>DD</sub>

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

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## SOCKETS

Input/output sockets are relevant to the operation of the AD7321/AD7322 on this evaluation board. The functions of these sockets are outlined in Table 5.

Table 5.

Socket	Function
J1	96-way connector for serial interface and power supply connections.
J2	External $V_{DD}$ and AGND power connector.
J3	External $V_{DRIVE}$ connector.
J17	External +12 V, -12 V, and AGND power connector.
VIN0, VIN1	2 SMB sockets for bipolar input signal to op amps.
REFIN	SMB socket for REFIN voltage.
SCLK	SMB socket for external SCLK input.
$\overline{CS}$	SMB socket for external $\overline{CS}$ input.
DOUT	SMB socket for DOUT signal.
DIN	SMB socket for external DIN signal.

## OPERATING THE EVAL-AD7321/AD7322

The evaluation board can be operated in a standalone mode or in conjunction with the EVAL-CONTROL BRD2. When operated with the EVAL-CONTROL BRD2, all supplies and control signals to operate the AD7321/AD7322 are provided by the EVAL-CONTROL BRD2. Software to communicate between the controller board and the AD7321/AD7322 is provided with the AD7321/AD7322 evaluation board kit. The EVAL-CONTROL BRD2 operates with all Analog Devices evaluation boards with model numbers ending in the letters CB.

The 96-way connector 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 Digi-Key Corp. (U.S.) and Campbell Collins, Ltd. (U.K.)

Connection between the EVAL-CONTROL BRD2 and the parallel port of a PC is via an IEEE 1284-compliant cable, provided as part of the EVAL-CONTROL BRD2 kit.

## EVALUATION BOARD SOFTWARE

### INSTALLING THE SOFTWARE

Included in the EVAL-AD7321/AD7322CB evaluation kit is a CD-ROM, which contains software for controlling and evaluating the performance of the AD7321/AD7322 when it is operated with the EVAL-CONTROL BRD2.

When the CD is inserted into the PC, an installation program automatically begins. This program installs the evaluation software onto the PC as well as electronic versions of the evaluation board data sheets, the AD7321/AD7322 data sheet, and EVAL-CONTROL BRD2 data sheet. All literature on the CD is in the Adobe Systems, Inc. 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 AD7321/AD7322 when operated with the EVAL-CONTROL BRD2.

### CHECKING THE EVAL-CONTROL BRD2

The EVAL-CONTROL BRD2 and evaluation board should be connected together as described in the Interfacing the Evaluation Boards section. The power is applied 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. This 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 has been initialized properly.

### THE MAIN SCREEN

The software that controls the EVAL-CONTROL BRD2 and, thus, the AD7321/AD7322 consists of two screens. The main screen, shown in Figure 3, allows you to read a predetermined number of samples from the evaluation board and display them in both the time and frequency domain. The screen can be divided into three sections.

The upper portion of the screen contains the control buttons, the menu bar, busy status indicators, and selection windows.

#### Control Buttons

Use the control buttons to take samples (**Sample**), reset the board (**Reset**), to exit the program (**EXIT**) and to load a configuration file (**Device Select**).

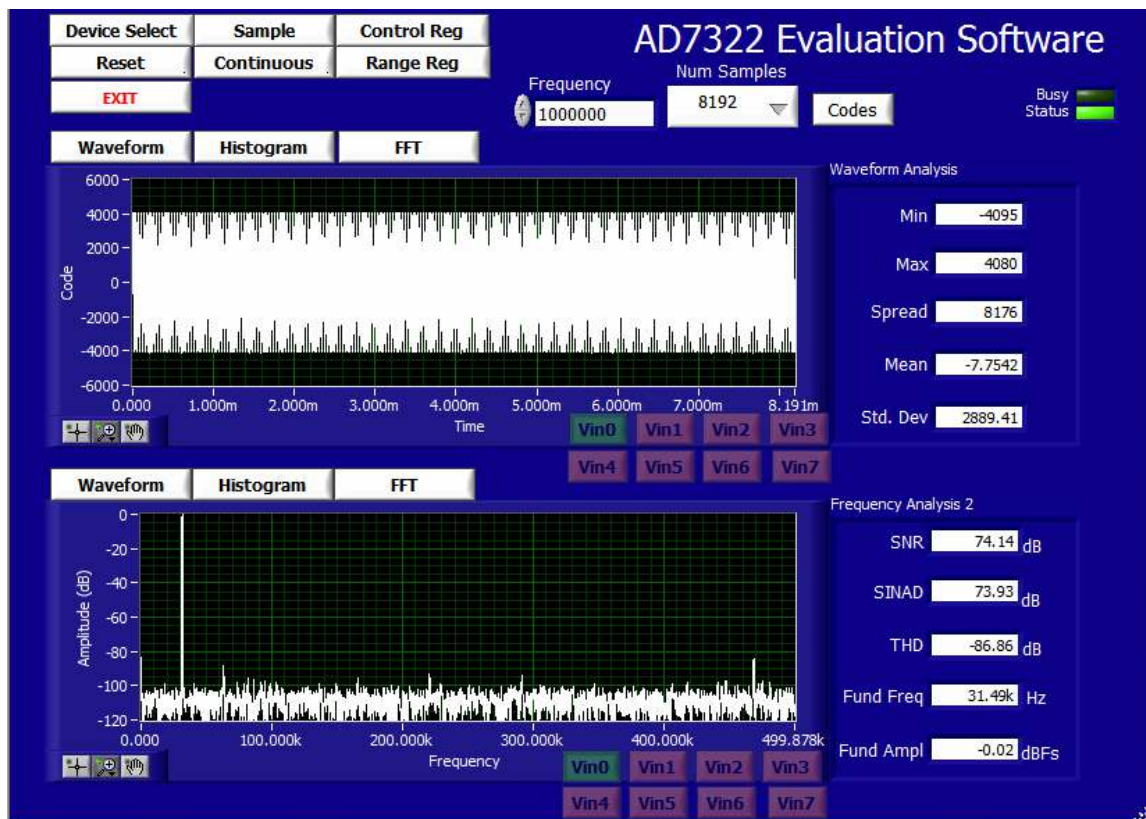


Figure 3. Main Screen

## Menu Bar

The menu bar (not visible in Figure 3) consists of the **File** and **About** menus.

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

- **Load Raw Data.** Select this option to load data saved by the software during a previous session.
- **Save Raw Data.** Select this option to save the current set of sample data points. The data can be reloaded to the EVAL-CONTROL BRD2 at a later date or can be used by other programs for further analysis.
- **Save Binary Data.** Select this option 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.

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

## Busy Status and Frequency/Num Samples Indicators

- The **Busy Status** indicates when the evaluation board is busy.
- The **Frequency** indicator shows the sample rate and **Num Samples** to be taken.

## Oscilloscope

The middle portion of the main screen is a digital storage oscilloscope (DSO). Samples uploaded from the EVAL-CONTROL BRD2 are displayed here.

Zoom handles, which appear at the bottom left of the graph, allow you to zoom in and out to get a closer look at a sample, if

desired. The right side of the middle portion of the screen contains information about the samples taken, such as the minimum (**Min**) and maximum (**Max**) position or velocity, the spread (**Spread**), and the standard deviation (**Std. Dev**) and the mean (**Mean**).

## Fast Fourier Transform/Histogram

The lower portion of the main screen shows either a fast Fourier transform (FFT) of the data or a histogram. The FFT (the default option) is typically used to with examine the performance in the frequency domain while the histogram gives an indication of the performance in response to dc inputs. The option displayed can be changed by clicking on the **Waveform**, **Histogram** or **FFT** buttons, the right side of the lower portion of the screen contains information about the samples taken.

## LOAD CONFIGURATION SCREEN

The **Load Configuration** screen, shown in Figure 4, loads the configuration file for the evaluation board. Once the configuration file is loaded, the software acquires detailed information about the AD7321/AD7322 evaluation board and the device connected to the EVAL-CONTROL BRD2. This includes information such as the number of bits, the maximum sampling rate, output coding, maximum sampling rate, and power supply requirements.

The configuration file also communicates to the software the name of the DSP program file to download to the EVAL-CONTROL BRD2.

The **Load Configuration** screen also allows you to choose the sampling frequency and the number of samples to take.



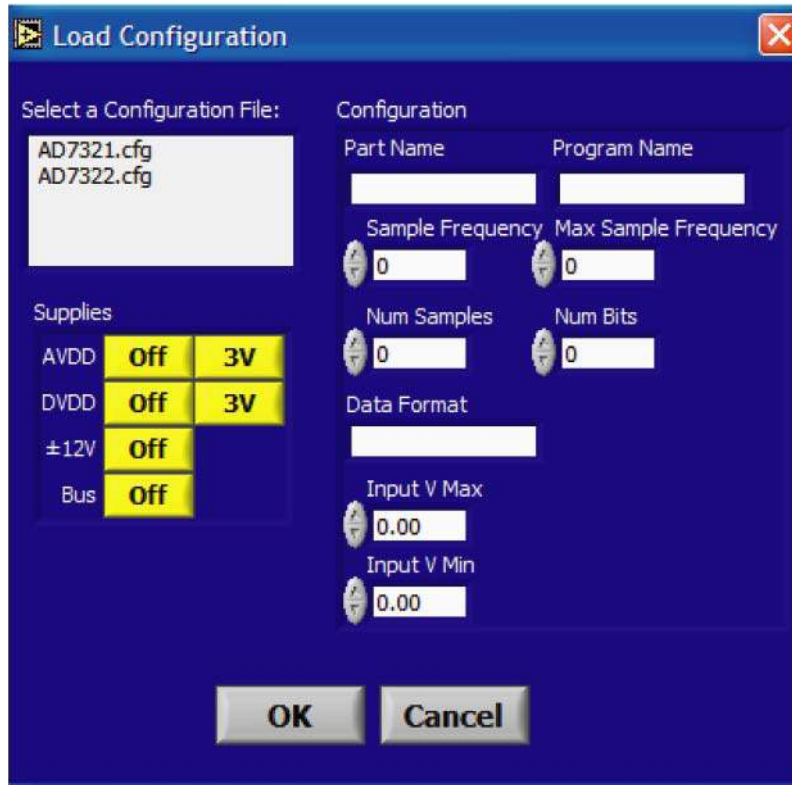


Figure 4. Load Configuration Screen

## RUNNING THE SOFTWARE

With the hardware set up, the user is now in a position to use the software to control the EVAL-CONTROL BRD2 and the AD7321/AD7322 evaluation board.

When the software is run, the user should click on the **Device Select** control button. This will display the **Load Configuration** window (as shown in Figure 4). The window on the top left of the set up window lists the available configuration files. 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, power supply settings etc. The configuration file also contains the names of the DSP that is to be downloaded to the EVAL-CONTROL BRD2. The user should select the relevant configuration file and click **OK**. The EVAL-CONTROL BRD2 will be reset and the DSP program will be downloaded. When the download has been completed, the power supply settings indicated in the configuration file are set and the user may hear some of the relays clicking. The selection windows (for example, **Num Samples** and **Sample Frequency**) will have been set to the default values specified by the configuration file. The user is free to change these at will.

## Taking Samples

To instruct the EVAL-CONTROL BRD2 to take the required number of samples at the required frequency, follow these steps beginning at the Main Screen (Figure 3):

1. Click **Sample**.  
Select a Sample Frequency at the **Load Configuration** screen (Figure 4).  
Samples are uploaded and displayed.
2. Click **Continuous** to continue taking samples.
3. Click **STOP**.

Though not visible in Figure 4, the **STOP** button becomes available when **Continuous** is clicked.

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## SOFTWARE CONFIGURATION FILES

Software configuration files provide the EVAL-CONTROL BRD2 software with information on how the software and hardware should perform. These files contain information, such as the name of the DSP program to download, the default and maximum sample frequencies, the number of samples to take, and the power supply settings to use.

### Typical Configuration Files

A typical software configuration file (\*.cfg) for the AD7321 is shown here.

```
[EVAL-CONTROL BOARD]
partname:AD7321
programname:AD7321.PRG

samplefrequency:100000
maxsamplefrequency:500000
samples:2048

+/-12V:on
dvdd:5:on
avdd:5:on
bus:on
;options 2scomp, binary
dataformat:2scomp
numberofbits:13
inputVmax:+10V
inputVmin: -10V
[endofconfig]
```

A typical software configuration file (\*.cfg) for the AD7322 is shown here.

```
[EVAL-CONTROL BOARD]
partname:AD7322
programname:AD7322.PRG

samplefrequency:100000
maxsamplefrequency:1000000
samples:2048

+/-12V:on
dvdd:5:on
avdd:5:on
bus:on
;options 2scomp, binary
dataformat:2scomp
numberofbits:13
inputVmax:+10V
inputVmin: -10V
[endofconfig]
```

## CONFIGURING THE ANALOG INPUTS FOR SINGLE-ENDED AND DIFFERENTIAL OPERATION

To select between single-ended and differential, select the **Control Reg** button on the main screen and set **ADD0**, and the **Mode1** and **Mode0** bits (as shown in Figure 5 and Table 6). The power-up default setting is single-ended mode. The analog input on the evaluation board are set for this mode.



Figure 5.

Table 6. Analog Input Configuration Selection

Channel Address Bit	Mode 1 = 1, Mode 0 = 1		Mode 1 = 1, Mode 0 = 0		Mode 1 = 0, Mode 0 = 1		Mode 1 = 0, Mode 0 = 0	
	Not Allowed		1 Fully Differential I/P		1 Pseudo Differential I/P		2 Single-Ended I/Ps	
ADD0	V <sub>IN+</sub>	V <sub>IN-</sub>	V <sub>IN+</sub>	V <sub>IN-</sub>	V <sub>IN+</sub>	V <sub>IN-</sub>	V <sub>IN+</sub>	V <sub>IN-</sub>
0	-	-	V <sub>IN0</sub>	V <sub>IN1</sub>	V <sub>IN0</sub>	V <sub>IN1</sub>	V <sub>IN0</sub>	AGND
1	-	-	V <sub>IN0</sub>	V <sub>IN1</sub>	V <sub>IN0</sub>	V <sub>IN1</sub>	V <sub>IN1</sub>	AGND

EVALUATION BOARD SCHEMATICS AND ARTWORK

900-55290

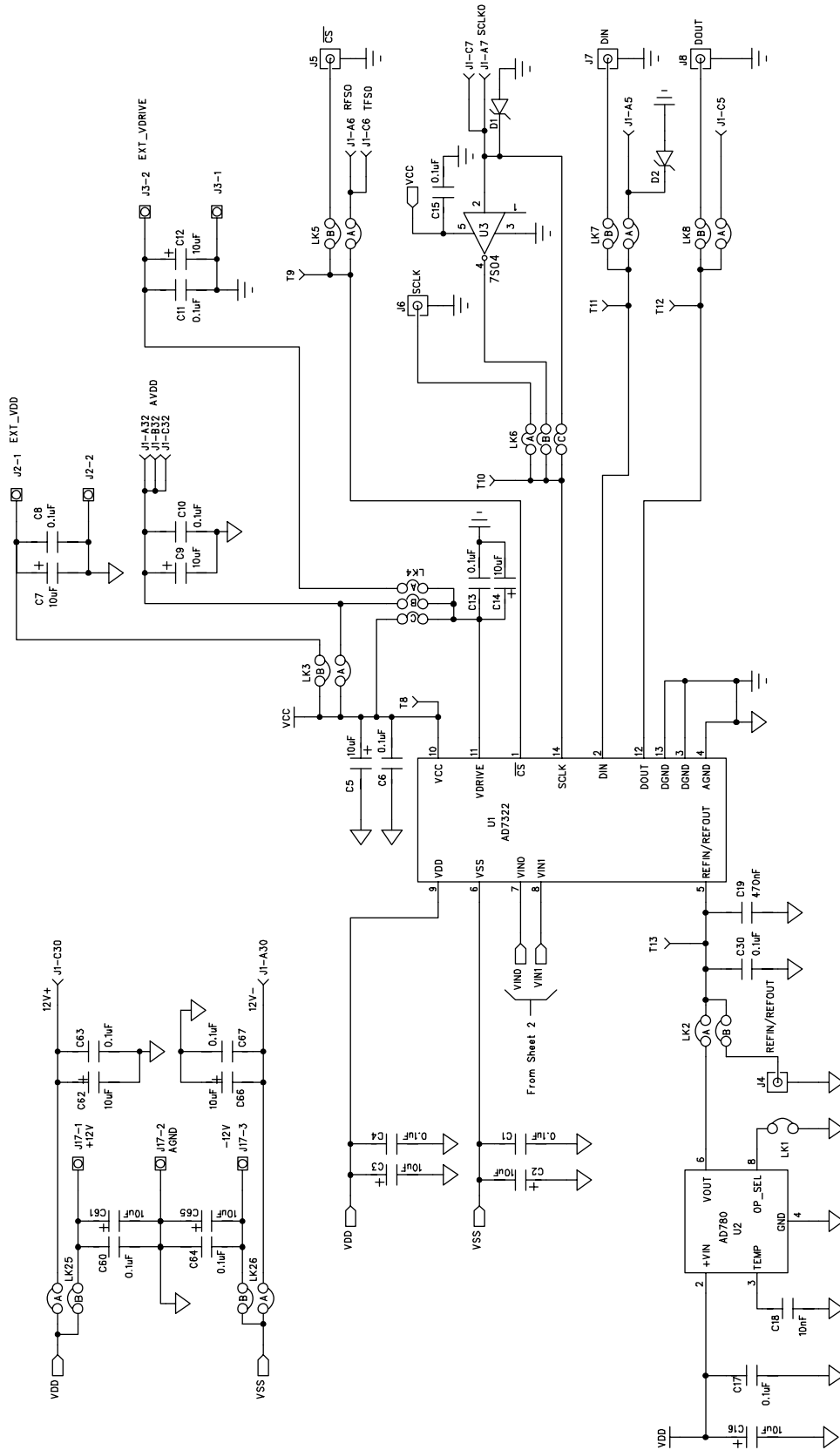


Figure 6.

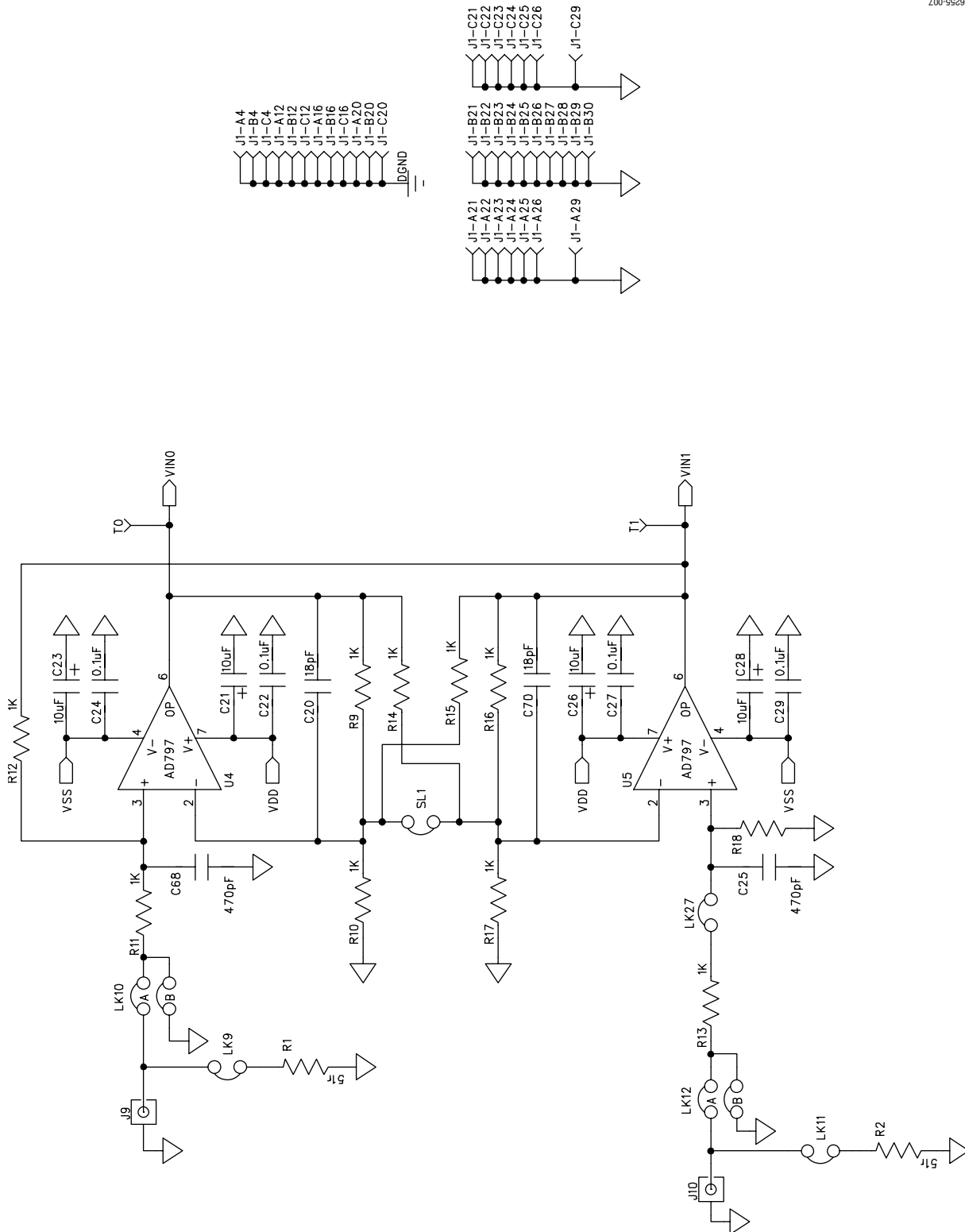


Figure 7.

**BILL OF MATERIALS**

Table 7.

Qty.	Reference Designator	Part Type	Value	Supplier/Part Number
17	C1, C4, C6, C8, C10, C11, C13, C15, C17, C22, C24, C27, C29, C30, C60, C63, C64, C67	Capacitor 0603, 100 nF, 25 V	0.1 $\mu$ F	AVX 06033G104ZAT2A
5	C5, C7, C9, C12, C14	Capacitor, Case A, 6.3 V	10 $\mu$ F	AVX TAJA106K006R
11	C2, C3, C16, C21, C23, C26, C27, C28, C61, C62, C65, C66	Capacitor, Case B, 20 V	10 $\mu$ F	AVX TAJB106K020R
1	C18	Capacitor 0603, 25 V	10 nF	Phycomp 2238 916 15636
1	C19	Capacitor 0603, 16 V	470 nF	Phycomp 2238 786 19758
2	C20 and C70	Capacitor 0603, 50 V	18 pF	Phycomp 2238 867 15189
2	C25 and C68	Capacitor 0606, 50 V	470 pF	EPCOS B37930K5471J60
2	D1 and D2	Schottky diode 20 V 400 MW DO-35	62 V	Diodes Inc. SD103C-A-F
1	J1	Connector		FCI 86093967113745E1LF
2	J2 and J3	2-way terminal block		Lumberg KRM 02
7	J4, J5, J6, J7, J8, J9, J10	SMB jack		Amphenol SMB1251B1-3GT30G-50
1	J17	3-way terminal block		Lumberg KRM 03
4	LK1, LK9, LK11, LK27	2-way jumper		Harwin M20-9990246 and M7566-05
9	LK2, LK3, LK5, LK7, LK8, LK10, LK12, LK25, LK26	4-way jumper		Harwin M20-9980446 and M7566-05
2	LK4 and LK6	3-way jumper		Harwin M20-9980346 and M7566-05
2	R1 and R2	Resistor	51 $\Omega$	Digi-Key P51GCT-ND
3	R9, R10, R11, R12, R13, R16, R17, R18	Resistor	1 k $\Omega$	Digi-Key 311-1.00KHRCT-ND
8	T0, T1, T8, T9, T10, T11, T12, and T13	Testpoint		Vero 20-2137
1	U1	AD7321/AD7322		Analog Devices AD73121BRUZ/ AD7322BRUZ
1	U2	AD780		Analog Devices AD780ARZ
1	U3	7S04		Fairchild NC 7S04 M5
2	U4 and U5	AD797		Analog Devices AD797

# EVAL-AD7321/AD7322

## ORDERING INFORMATION

### ORDERING GUIDE

Model	Description
EVAL-AD7321CBZ <sup>1</sup>	AD7321 Evaluation Board
EVAL-AD7322CBZ <sup>1</sup>	AD7322 Evaluation Board

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

### ESD CAUTION



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

**NOTES**

**NOTES**