

FEATURES

Full-Featured Evaluation board for the AD7328

Eval-Board Controller Compatible

Stand alone Capability

Various Linking Options

INTRODUCTION

This Technical Note describes the evaluation board for the AD7328 which is a Software Selectable Bipolar Input 13-Bit ADC. This parts operate from a single 2.7V to 5.5V and Dual $\pm 12V$ power supply and feature throughput rates of up to 1 MSPS. Full details on the AD7328 are available in the AD7328 datasheet which is available from Analog Devices and should be consulted in conjunction with this Technical Note when using the Evaluation Board.

On-board components include an AD780 which is a pin programmable +2.5V or +3V ultra high precision bandgap reference, the AD8021 op-amp.

OPERATING THE AD7328 EVALUATION BOARD

Power Supplies:

When using this evaluation board with the evaluation board controller, all supplies are provided from the controller board through the 96-Way connector.

When using the board as a stand alone unit, external supplies must be provided. This evaluation board has five power supply inputs: EXT_V_{DD} , AGND, +12V, -12V, AGND. If the evaluation board is used in stand-alone mode, a 2.7V to 5.5V supply must be connected to the EXT_V_{DD} input. The +12V and -12V supplies are required for the high voltage Analog Input section on the AD7328 and the op-amps. The supplies are decoupled to the ground plane with 10 μ F tantalum and 0.1 μ 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 μ F tantalum and 0.1 μ F ceramic capacitors as are the V_{DD} , V_{SS} and V_{CC} pins of the AD7328.

FUNCTIONAL BLOCK DIAGRAM

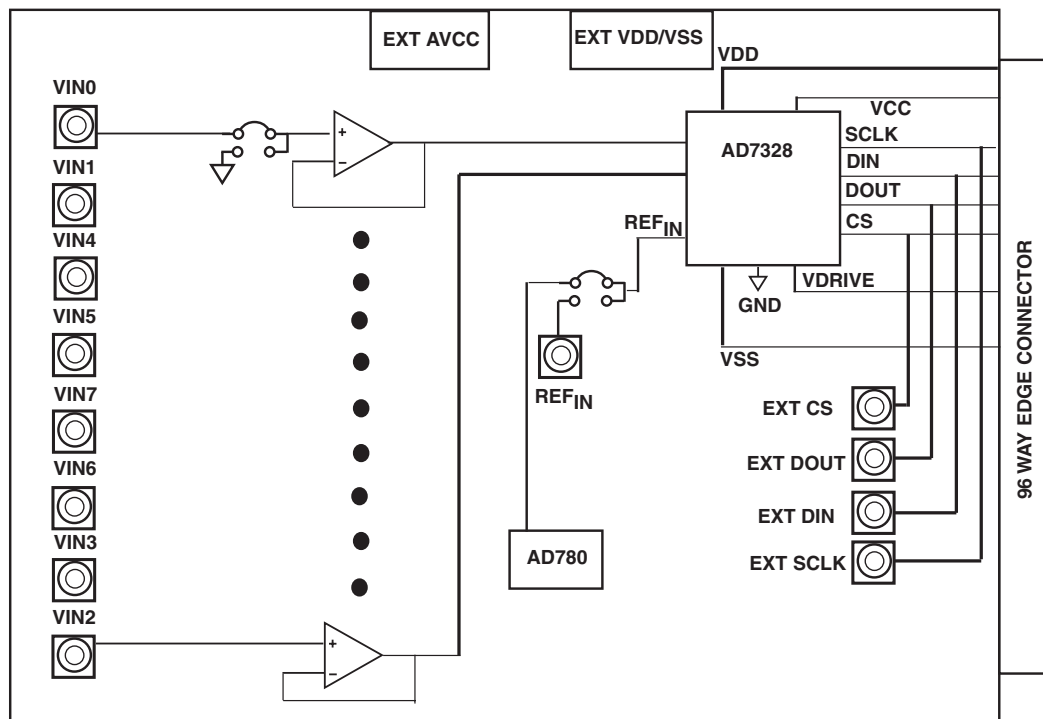


Figure 1

Rev. A

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EVAL-AD7328CB

Link Options:

There are 26 link options which must be set for the required operating setup before using the evaluation board. The functions of the options are outlined below.

Table 1.

Link No.	Function
LK1	This link option controls the program pin of the AD780 Voltage Reference.
LK2	This link selects the source of the REF _{IN} voltage to be applied to the REF _{IN} pin of the AD7328. When in position A, the AD780 supplies the +2.5V reference to the AD7328. When in position B, the REF in is supplied through the J4 SMB connector..
LK3	This link selects the source of the Vcc supply for the AD7328. When in position A the Vcc supply is taken from the 96-Way connector to the Evaluation Controller Board. When in position B the Vcc supply is taken from the external J2 connector.
LK4	This link option selects the source of the Vdrive Voltage for the AD7328. When in position A the Vdrive voltage is taken from the external J3 Vdrive socket. When in position B the Vdrive voltage is taken from the 96-Way connector to the Evaluation Controller Board. When in position C the Vdrive voltage is tied to the Vcc voltage
LK5	This link option selects the source of the CS signal When in position A CS is taken from the 96-Way connector to the Evaluation Controller Board. When in position B the CS signal is taken from the J5 CS SMB socket.
LK6	This link selects the source of the SCLK signal for the AD7328. When in position A the SCLK signal comes from J6 SMB socked When in position B the SCLK signal comes from 7S04 inverter, which is an inverted SCLK signal from the 96-Way connector. When in position C the SCLK signal is taken directly from Evaluation controller board through the 96-Way connector.
LK7	This link option selects the source of the DIN signal to the AD7328. When in position A DIN is taken from the 96-Way connector to the Evaluation Controller Board. When in position B the DIN signal is taken from the J7 DIN SMB socket.
LK8	This link option selects the destination of the DOUT signal from the AD7328. When in position A DOUT goes to the 96-Way connector to the Evaluation Controller Board. When in position B the DOUT signal goes to the DOUT j8 SMB socket.
LK9,11,13,15,17,19,21,23	These link options add a 51 Ω termination resistor to AGND at the Vin0 to Vin7Input sockets.
LK10,12,14,16,18,20,22,24	These link options select the input to the AD8021 op-amps. When in position A the AD8021 non-inverting input it tied to the SMB socket.

	When in position B the AD8021 non-inverting input is tied to AGND.
LK25	<p>This link option is used to select the source of the +12 V supply for the EVAL AD7998/7997CB.</p> <p>When in position A, the +12 V Supply is sourced from the Evaluation Board Controller via the 96-Way Connector.</p> <p>When in position B, the +12 V supply is sourced externally via the J17 connector.</p>
LK26	<p>This link option is used to select the source of the -12 V supply for the EVAL AD7998/7997CB.</p> <p>When in position A, the -12 V Supply is sourced from the Evaluation Board Controller via the 96-Way Connector.</p> <p>When in position B, the -12 V supply is sourced externally via the J17 connector.</p>

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 2 below shows the position in which all the links are set when the evaluation board is packaged.

Table 2. Initial Link Positions

Link No.	Position	Function
LK1	OUT	AD780 supplies a 2.5V reference to the AD7328
LK2	A	AD780 supplies the Reference to the AD7328
LK3	A	Vcc supply is taken from the Evaluation Controller Board.
LK4	C	Vdrive supply is taken from the Vcc supply
LK5	A	CS is taken from the Evaluation Controller Board.
LK6	C	SCLK signal is taken from the Evaluation Controller Board
LK7	A	DIN signal is taken from the Evaluation Controller Board
LK8	A	DOUT signal is sent to the Evaluation Controller Board
LK9,11,13,15,17,19,21,23	OUT	No 51 V termination on the Inputs.
LK10	A	Von0 SMB connected to input of AD8021
LK12,14,16,18,20,22,24	B	Inputs to AD8021 set to AGND
LK25	A	+12V is supplied from the Evaluation Controller Board
LK26	A	-12V is supplied from the Evaluation Controller Board

EVAL-AD7328CB

EVALUATION BOARD INTERFACING:

Interfacing to the Evaluation board is via a 96-way connector, J1. J1 is used to connect the EVAL-AD2S1200CB Evaluation Board to the EVAL-CONTROL BRD2 or another system. The pinout for the J1 connector is shown in Figure 2 and its pin designations are given in Table 3.

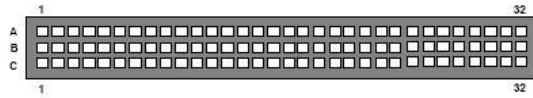


Figure 2. Pin Configuration for the 96-Way Connector J1

Pin	Description
TFS0, RFS)	Transmit/Receive Frame Sync 0 : These two outputs are connected to the \overline{CS} pin of the AD7328.
SCLK	Serial Clock 0 : This serial clock is connected to the SCLK pin on the AD7328.
DR0	Data Receive 0 : This input is connected to the SDATA pin of the AD7328
DT0	Data Transmit 0: This output is connected to the DIN pin on the AD7328.
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.
AVDD	Analog +5V Supply : These lines are connected to the VCC supply line on the board via LK3.
-12V	-12V Supply : This line is connected to the -12V supply line on the board via LK26.
+12V	+12V Supply : This line is connected to the +12V supply line on the board via LK25.

Table 3. Pin designations for 96-Way Connector J1

	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	\overline{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	-12V	AGND	+12V
31			
32	AVDD	AVDD	AVDD

Note: The unused pins of the 96-way connector are not shown.

SOCKETS:

There are 17 input/output sockets relevant to the operation of the AD7998/7997 on this evaluation board. The functions of these sockets are outlined below.

Socket	Function
J1	96 Way Connector for Serial Interface & Power Supply connections.
J2	External V_{DD} and AGND power connector.
J3	External Vdrive connector
J17	External +12V, -12V & AGND power connector.
VIN0-8	8 SMB socketsfor bipolar input signal to op-amps
REF _{IN}	SMB socket for REFIN voltage.
SCLK	SMB socket for External SCLK input to the
CS	SMB Socket for an External CS input.
DOUT	SMB socket for DOUT signal
DIN	SMB socket for external DIN signal

OPERATING WITH THE EVAL-CONTROL BOARD:

The evaluation board can be operated in a stand alone mode or operated in conjunction with the EVAL-CONTROL BOARD. This Evaluation Controller Board is available from Analog Devices under the order entry “EVAL-CONTROL BOARD”. When operated with this control board, all supplies and control signals to operate the AD2S1200 are provided by the EVAL-CONTROL BOARD when it is run under the control of the AD7328 software which is provided with the AD7328 Evaluation board package. This EVAL-CONTROL BOARD will also operate with all Analog Devices evaluation boards with the letters CB in their title.

The 96-way connector on the EVAL-AD7328CB plugs directly into the 96-Way on the EVAL-CONTROL BOARD. No power supplies are required in the system. The EVAL-CONTROL BOARD generates all the required supplies for itself and the AD2S1200CB. The EVAL-CONTROL BOARD is powered from a 12V ac transformer. This is a standard 12V ac transformer capable of supplying 1A 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 Digikey (U.S.) and Campbell Collins (U.K.)

Connection between the EVAL-CONTROL BOARD and the parallel port of a PC is via IEEE 1284 compliant cable which is provided as part of the EVAL-CONTROL BOARD package. Please refer to the manual which accompanies the EVAL-CONTROL BOARD for more details on the EVAL-CONTROL BOARD package.

EVAL-AD7328CB

AD7328 SOFTWARE:

Included in the EVAL-AD7328CB evaluation kit is a CD ROM which contains software for controlling and evaluating the performance of the AD7328 when it is operated with the Eval-Control board. When the CD is inserted into the PC, an installation program will automatically begin. This program will install the evaluation software onto the users machine and also install the technical note for the evaluation board as well as the datasheet for the AD7328 and the technical note for the Eval-Control board. All literature on the CD is in Adobe's Portable Documentation Format (PDF) and will require Acrobat Reader™ to be viewed or printed. The user interface on the PC is a dedicated program written especially for the AD7328 when operated with the Eval-Control Board.

SOFTWARE DESCRIPTION:

The software that controls the Eval-Control Board and hence the AD7328 has two main screens. The screen shown in Figure 3 is the screen which appears when the software is run. The main function of this screen is to allow the user to read a pre-determined 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 third** of the screen contains the control buttons, the menu bar, the busy status and selection windows. The **Control buttons** allow the user to take samples, reset board, to **exit** the program and to open the **Load Configuration window** to load a configuration file by clicking on **Device Select**.

The **menu bar** consists of **File** and **About**. The File menu allows the following:

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

Save Raw Data: Selecting this option allows the user to save the current set of sample data points. The data can be reloaded to the Eval-Control Board at a later date or can be used by other programs for further analysis.

Save Binary Data: Selecting this option allows the user 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, looking for stuck bits etc.

Exit: Quits the program.

The About drop down menu gives the user information about the version of the software.

The **Busy status** indicates to the user when the evaluation board is busy.

The **Selections Window** allows the user to change the sampling frequency and the number of samples to upload.

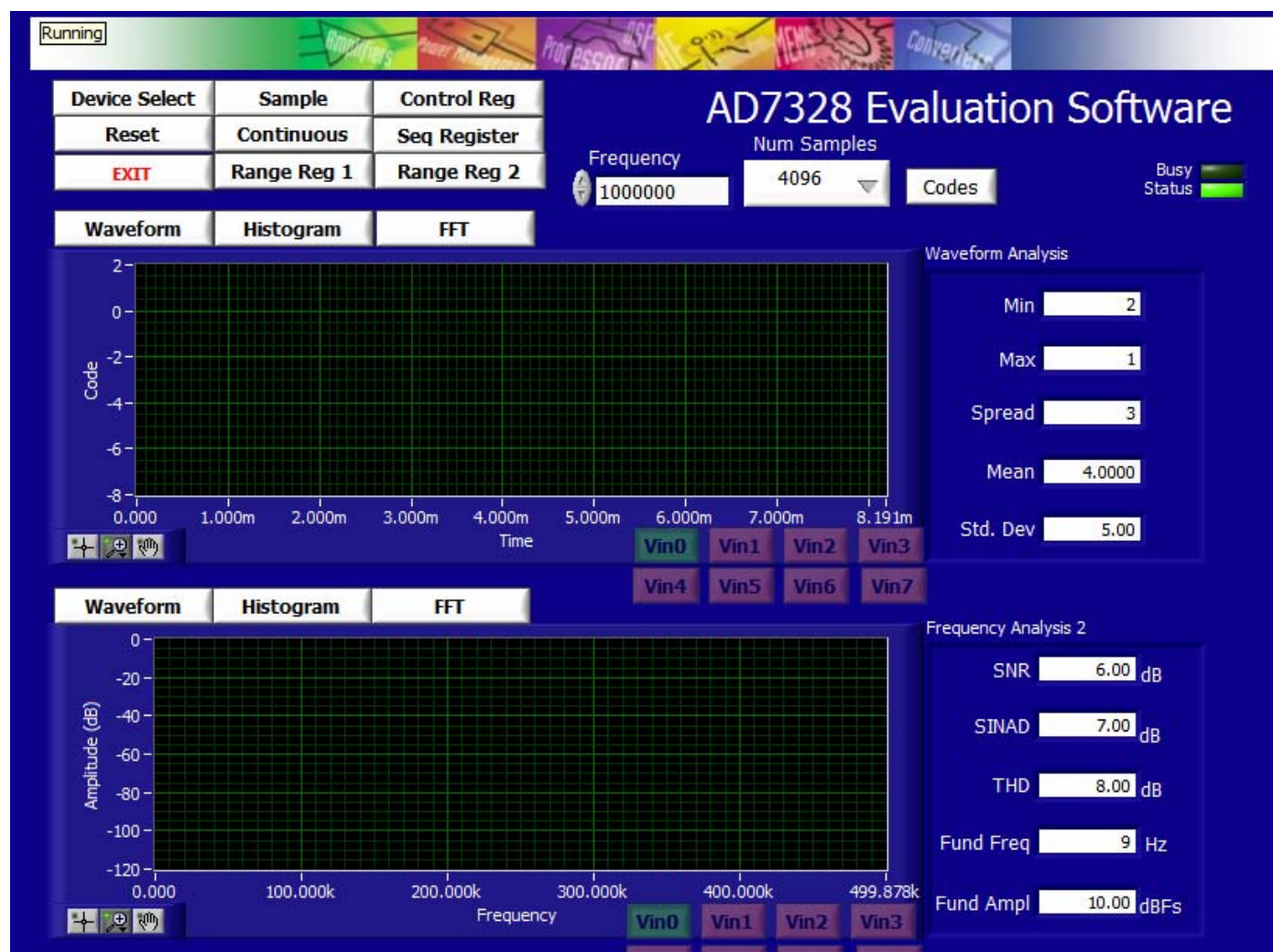


Figure 3. AD7328 Main Scree

The **middle third** of the screen is a Digital Storage Oscilloscope (DSO) which allows the user to display either a **Waveform**, a **Histogram** or an **FFT**. When samples are uploaded from the Eval-Control Board they are displayed here. At the bottom left of the graph are the zoom options. These allow the user 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 like min/max position or velocity, the spread, the standard deviation and the mean.

The **lower third** of the screen is also a Digital Storage Oscilloscope (DSO) which allows the user to display either a **Waveform**, a **Histogram** or an **FFT**. The FFT (the default option) is typically used when the user is concerned with examining the performance in the frequency domain while the Histogram will give an indication of the 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 e.g. ac specifications. Figure 3 shows a screen shot of the main screen.

Load Configuration Screen

The Load Configuration Screen is responsible for allowing the user to load the required configuration file for the evaluation board. A screenshot is shown in Figure 4. The configuration gives the software detailed information about the AD7328 Evaluation Board and the part connected to the Eval-Control Board such as the number of bits, the maximum sampling rate, output coding, maximum sampling rate, power supply requirements etc.

The configuration file also tells the software the names of the DSP program file which it should download to the Eval-Control Board. The Load Configuration Screen also allows the user to choose the sampling frequency and the number of samples to take.

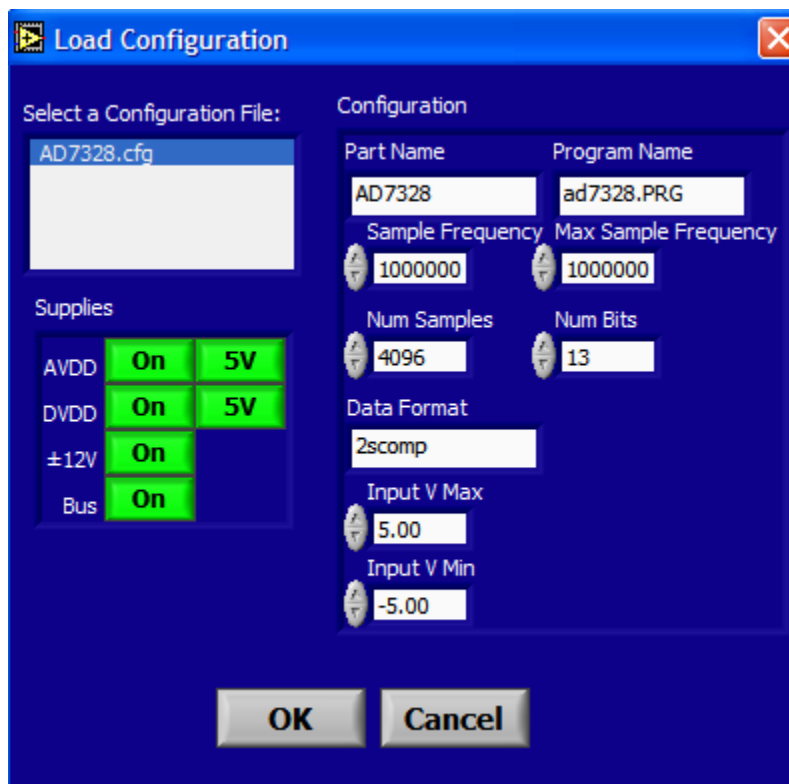


Figure 4AD7328 Load Configuration Screen

SETTING UP THE EVAL-CONTROL BOARD:

This section describes how the evaluation board, the Eval-Control Board and the software should be set up for the user to begin using the complete system.

The Eval-Control Board and Evaluation board should be connected together (via the 96-way connector). The power should be applied to the Eval-Control Board via a 12V AC Transformer. At this stage the red LED on the Eval-Control Board should be flashing which indicates that that Eval-Control Board is functional and ready to receive instructions. The software, which should have been installed should be loaded before the printer port cable is connected between the Eval-Control Board and the PC. This will ensure that the printer port has been initialized properly. The printer port can then be connected between the PC and the Eval-Control Board.

Running the software

With the hardware set up the user is now in a position to use the software to control the Eval-Control Board and the AD7328 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 which 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 which is to be downloaded to the Eval-Control Board. The user should select the relevant configuration file and click **OK**. The Eval-Control Board 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 (e.g. 'number of samples' and 'sampling 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

When the user clicks Sample, the software will instruct the Eval-Control Board 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 the user clicks **Continuous** the software will repeat the process indefinitely until the user clicks **STOP**.

SOFTWARE CONFIGURATION FILES:

Software Configuration Files give the Eval-Control Board software information on how the software and hardware should perform. They 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. A typical Software Configuration File (*.cfg) is shown in Listing 1.

```
[EVAL-CONTROL BOARD]
```

```
partname:AD7328
```

```
programname:ad7328.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
```

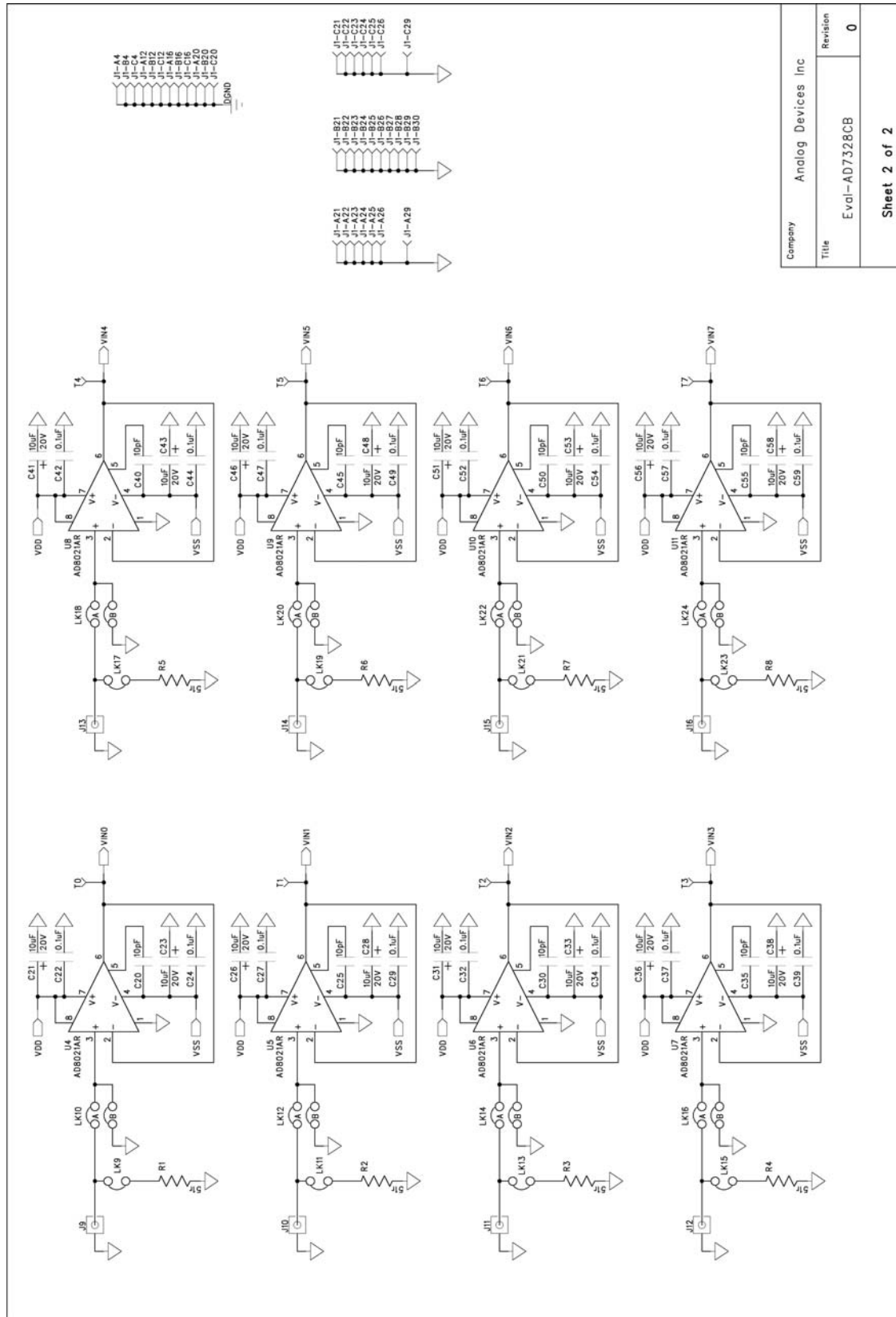
```
inputVmin: -10V
```

```
[endofconfig]
```

Listing 1. Typical Configuration File

EVAL-AD7328CB Schematic, Silkscreen, Layout and Bill of Materials





Company	Analog Devices Inc
Title	Eval-AD7328CB
Revision	0