Evaluation Board for the 4-Channel, 12-Bit/10-Bit ADC with I²C-Compatible Interface

EVAL-AD7991/AD7995

FEATURES

Full featured evaluation board for the AD7991/AD7995
PC software for control and measurement of the AD7991/AD7995
USB interface (cable provided)
Various linking options

GENERAL DESCRIPTION

This data sheet describes the evaluation board for testing the AD7991 and AD7995 devices. These devices are 12-bit and 10-bit, respectively, low power, successive approximation analog-to-digital converters (ADC) with an I²C-compatible interface. These devices operate from a single 2.7 V to 5.5 V power supply and feature a 1 μs conversion time.

The AD7991/AD7995 contain a 4-channel multiplexer and track-and-hold amplifier that can handle input frequencies of up to 14 MHz.

Full details on these devices are provided in the AD7991/AD7995 data sheet available from Analog Devices, Inc., which should be consulted in conjunction with this data sheet.

On-board components for the EVAL-AD7991/AD7995 include four AD8691 operational amplifiers, two AD5245 digital potentiometers, and one AD780, a pin programmable 2.5 V or 3 V ultrahigh precision band gap reference.

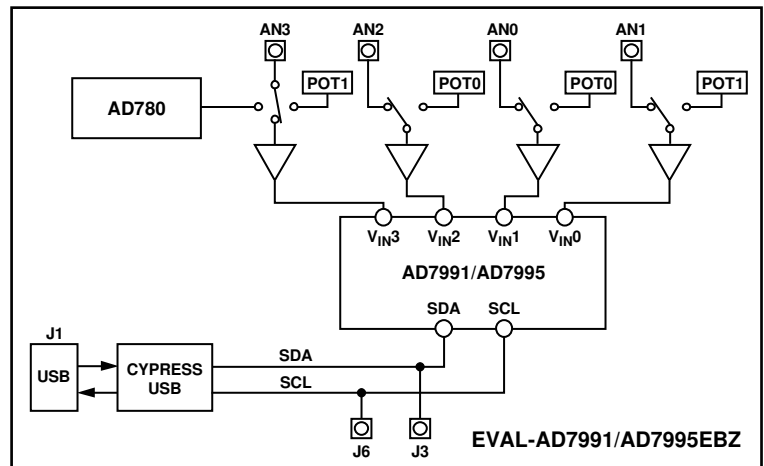Link options are provided in Table 1 and Table 2.

FUNCTIONAL BLOCK DIAGRAM

Figure 1.

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REVISION HISTORY

3/08—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

POWER SUPPLIES

EVAL-AD7991/AD7995 is powered via the 5 V supply from the USB connector, J1. The 5 V supply can be used to power the AD7991/AD7995 directly through the EMC_FILTER. A regulated voltage from the on-board ADP3303, high precision, low power, 3.3 V output voltage regulator can also be used.

Table 1 shows the positions in which all the links are set when the evaluation board is shipped.

To select the power supply for the AD7991/AD7995, choose LK7.

INITIAL SETUP CONDITIONS

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

Table 1. Initial Link Positions

Link No.	Position	Function
LK1	A	$V_{IN}0$ is connected to digital Potentiometer 1.
LK2	A	$V_{IN}1$ is connected to digital Potentiometer 0.
LK3	A	The operational amplifier is used on Channel 0.
LK4	A	The operational amplifier is used on Channel 1.
LK5	A	$V_{IN}2$ is connected to digital Potentiometer 1.
LK6	A	The operational amplifier is used on Channel 2.
LK7	B	Power source of AD7991 is set to DVDD – 3.3 V.
LK8	A	The operational amplifier is used on Channel 3.
LK9	Insert	External reference voltage has a value of 3 V.
LK10	A	$V_{IN}3$ is connected to digital Potentiometer 0.
LK11	A	Operational amplifier is supplied from J1 (Channel 0).
LK12	A	Operational amplifier is supplied from J1 (Channel 1).
LK13	A	Operational amplifier is supplied from J1 (Channel 2).
LK14	A	Operational amplifier is supplied from J1 (Channel 3).

LINK OPTIONS

Fourteen link options must be set to change the configuration of the circuits. The functions of these link options are summarized in Table 2. The positions of the links can be changed when the evaluation board is connected to the power supply.

Table 2.

Link No.	Function
LK1, LK2, LK5	Connects the input of $V_{IN}0$, $V_{IN}1$, and $V_{IN}2$ to the AN0, AN1, and AN2 input sockets, respectively, or to the output of the digital potentiometer AD5245.
	In Position A, $V_{IN}X$ is connected to the digital potentiometer.
	In Position B, $V_{IN}X$ is connected to the ANx input socket.
LK3, LK4, LK6,	Ties the operational amplifiers to the analog inputs of the AD7991/AD7995.
	In Position A, the operational amplifier is used.
	In Position B, the operational amplifier is not used.
LK7	Selects the power source for V_{DD} on the AD7991/AD7995.
	In Position A, selects the 5 V supply from the USB connector.
	In Position B, selects the 3.3 V regulated output from the on-board ADP3303 voltage regulator.
LK 8	Ties the operational amplifiers to the analog inputs of the AD7991/AD7995.
	In Position A, the operational amplifier is used.
	In Position B, the output from LK 9 is connected to A3/VREF input.
LK9	Changes the value of the external reference voltage.
	If link is inserted, the reference voltage is 3 V.
	If link is not inserted, the reference voltage is 2.5 V.
LK10	Connects the input of $V_{IN}3$ to the AN3 input socket to a digital potentiometer or to a high precision reference voltage.
	In Position A, $V_{IN}3$ is connected to a digital potentiometer.
	In Position B, $V_{IN}3$ is connected to the AN3 input socket.
	In Position C, Channel 3 is used as external reference input for the AD7991/AD7995.
LK11, LK12, LK13, LK14	Connects the power supply pins of the operational amplifiers to 3.6 V regulated output from the on-board ADP3330 voltage regulators, or to 5 V supply from J1.
	In Position A, operational amplifier is supplied from J1.
	In Position B, operational amplifier is supplied from ADP3330.

SOCKET

There are six input sockets relevant to the operation of the AD7991/AD7995 on this evaluation board. The functions of these sockets are outlined in Table 3.

Table 3. Socket Functions

Socket	Function
AN0	Subminiature BNC (SMB) Connector. The analog input signal for the $V_{IN}0$ of the AD7991/AD7995 is applied to this socket.
AN1	Subminiature BNC (SMB) Connector. The analog input signal for the $V_{IN}1$ of the AD7991/AD7995 is applied to this socket.
AN2	Subminiature BNC (SMB) Connector. The analog input signal for the $V_{IN}2$ of the AD7991/AD7995 is applied to this socket.
AN3	Subminiature BNC (SMB) Connector. The analog input signal for the $V_{IN}3$ of the AD7991/AD7995 is applied to this socket.
J3	Subminiature BNC (SMB) Connector. This socket is connected to the SDA track on the evaluation board.
J6	Subminiature BNC (SMB) Connector. This socket is connected to the SCL track on the evaluation board.

USB CONNECTOR

A standard USB connector, J1, is used to connect the evaluation board to the USB port of a PC. A standard USB connector cable is included with the AD7991/AD7995 evaluation board kit. Because the USB connector powers the board, there is no need for an external power supply.

Communication between the AD7991/AD7995 evaluation board and the PC is over the USB interface. The on-board USB controller controls this communication.

EVALUATION BOARD SOFTWARE

INSTALLING THE SOFTWARE

Included in the EVAL-AD7991/AD7995 kit is a CD-ROM that contains software for controlling and evaluating the performance of the AD7991/AD7995.

When the CD is inserted into the PC, an installation program automatically begins. This program installs the evaluation software as well as electronic versions of the evaluation board data sheet and the AD7991/AD7995 device data sheet. All literature on the CD is in the Adobe Systems, Inc., portable documentat 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 AD7991/AD7995.

Connect the evaluation board to the PC when the installation process is finished.

USING THE MAIN WINDOW

The software that controls the AD7991/AD7995 consists of one window shown in Figure 2. This window, which appears when the software is run, allows you to display and read samples from the evaluation board.
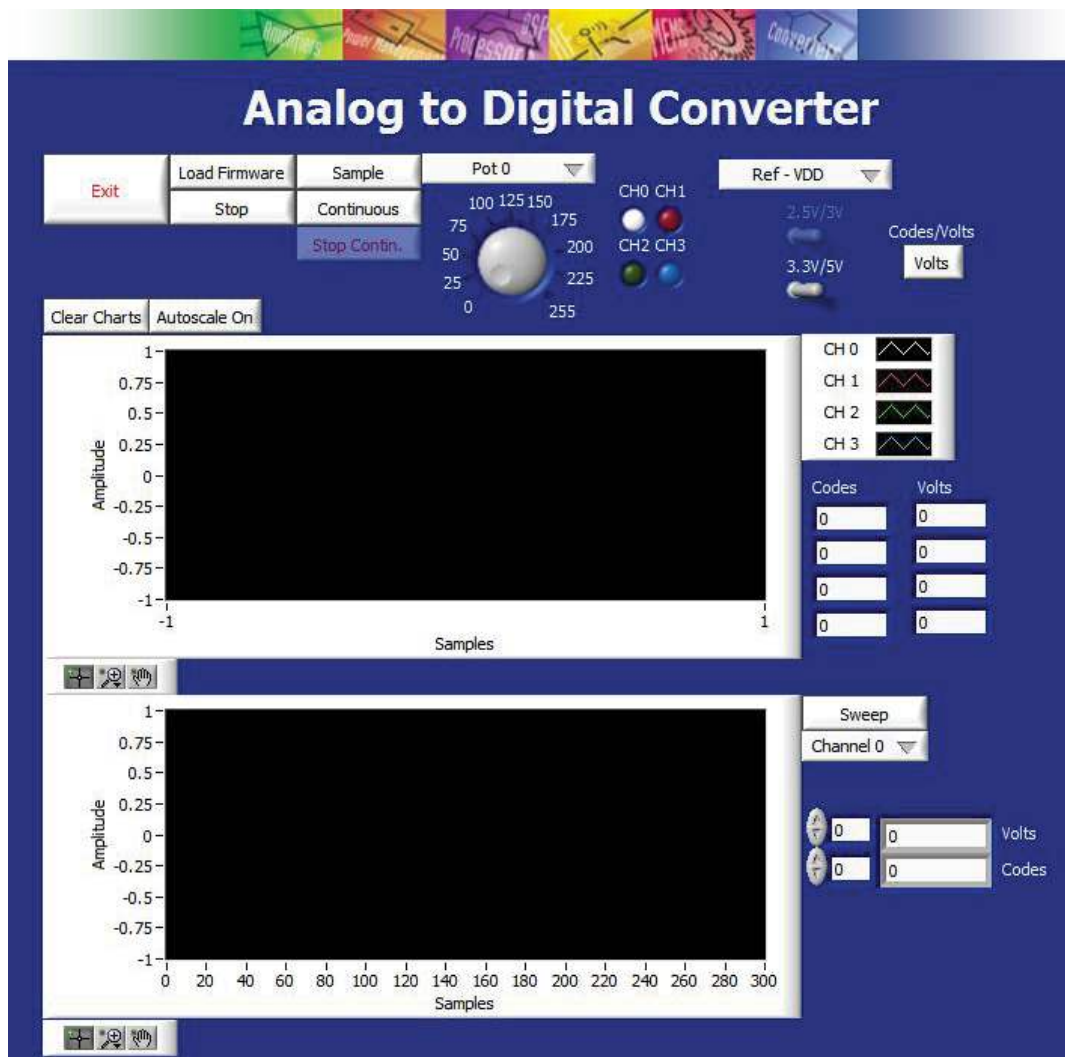

Figure 2. AD7991/AD7995 Evaluation Board Window

The upper portion of the window contains a menu bar and controls. The middle and bottom portions contain digital storage oscilloscopes (DSOs).

Menu Bar

The menu bar (not visible in Figure 2) consists of the **File** and **About** menus.

File Menu

Exit. Exits the program.

About Menu

Displays information about the current version of the software.

Controls

The controls include control buttons, list boxes, and indicators.

Exit. Exits the program.

Load Firmware. Loads the firmware to the Cypress USB device.

Stop. Stops the program.

Sample. Samples selected channels.

Continuous. Repeats the sampling process.

Stop Contin. Stops sampling continuously.

Pot 0/Pot 1. Selects Potentiometer 0 or Potentiometer 1.

Potentiometer Value Selector. Changes the value of the selected digital potentiometer.

LEDs. Selects the input channel of the AD7991/AD7995. When more than one channel is selected, the AD7991/AD7995 works in sequence mode.

Ref-VDD. Selects an external or internal reference voltage.

2.5V/3V. Changes the value of the external reference voltage.

3.3V/5V. Flip the switch to change the value of the internal reference voltage (power supply voltage).

Codes/Volts. Determines whether data is displayed in codes or volts.

Clear Charts. Clears the charts displayed.

Autoscale On/Off. Click this button to turn the auto scale feature on or off.

Sweep. Starts the sweep function.

Channel 0/1/2/3. Selects the input channel (Channel 0, Channel 1, Channel 2, or Channel 3) of the AD7991/AD7995 for the sweep function.

Digital Storage Oscilloscopes

The middle portion of the evaluation board window displays a waveform. When samples are uploaded from the evaluation board, they are displayed here. At the bottom left of the upper DSO are zoom options that allow you to zoom in and out while viewing a sample. To the right of this DSO, information about the sample taken, such as measured values in codes and in volts, is displayed.

The lower portion of the Main window displays a waveform of the sweep function. At the bottom left of the lower DSO are zoom options that allow you to zoom in and out while viewing a sample. To the right of the DSO, information about the sample taken and the value of each point of sweep function is displayed.

Taking Samples

During the sweep function, 256 samples are taken directly from the digital potentiometer output. The output of the digital potentiometer is incremented by 1, from 0 to 255, and for each increment, the AD7991/AD7995 takes a sample. After the measurement, all 256 values are displayed on the digital storage oscilloscope in the lower portion of the Main window (see Figure 2).

To instruct the AD7991 to take samples click either **Sample** or **Continous**.

- Click **Sample** to perform one conversion. The result is uploaded and displayed.

- Click **Continuous** to start taking samples. When **Continuous** is clicked, all other controls except **Stop Contin.**, **Pot 0/Pot 1**, **Stop**, and **Exit** are disabled. The value of the digital potentiometer can be changed while **Continuous** mode is selected.

EVALUATION BOARD SCHEMATICS AND ARTWORK

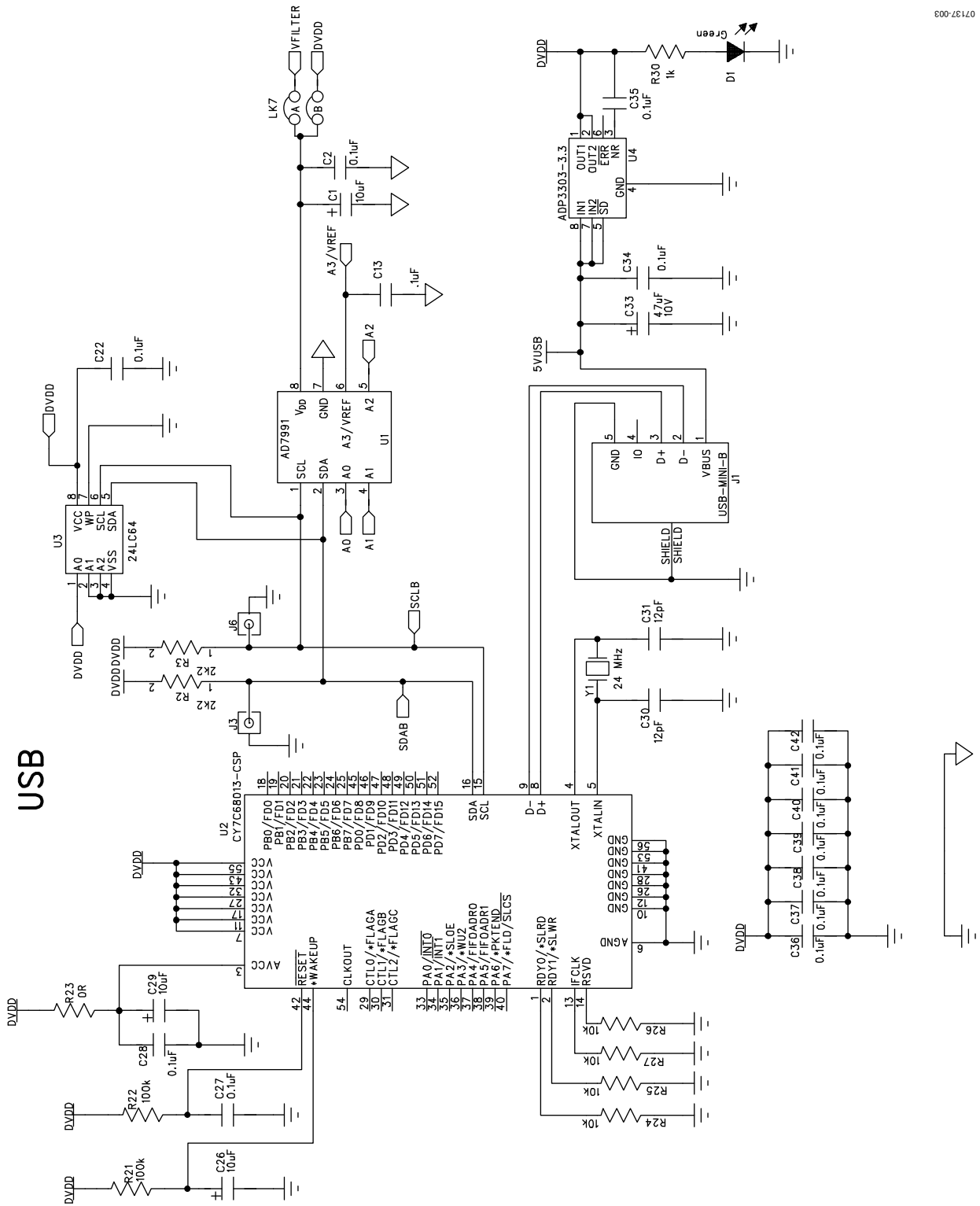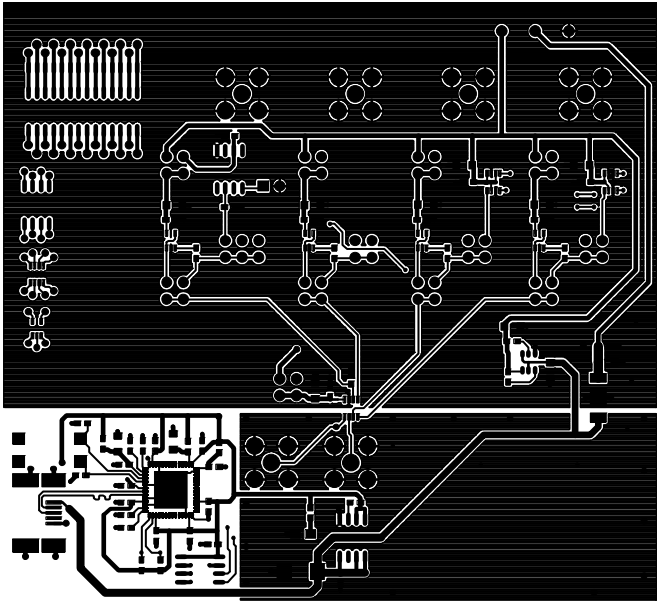Figure 3. AD7991/AD7995 Evaluation Board Schematic 1

07137-004

Figure 4. AD7991/AD7995 Evaluation Board Schematic 2
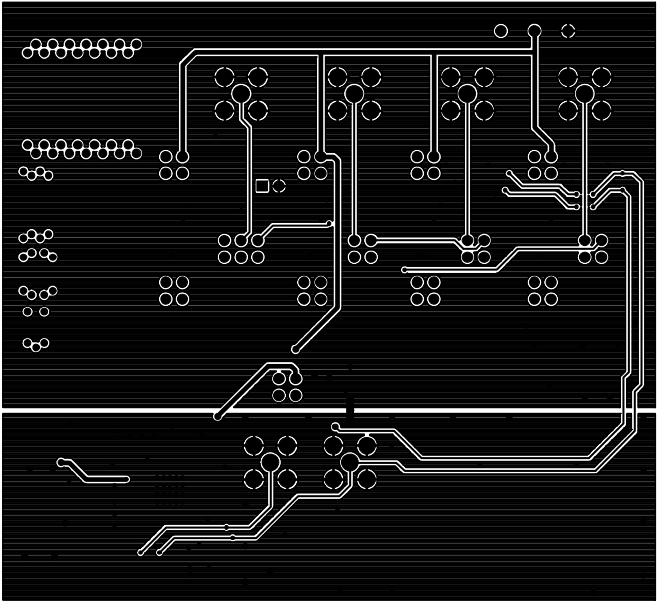
Figure 5. Component Side Artwork

Figure 6. Solder Side Artwork

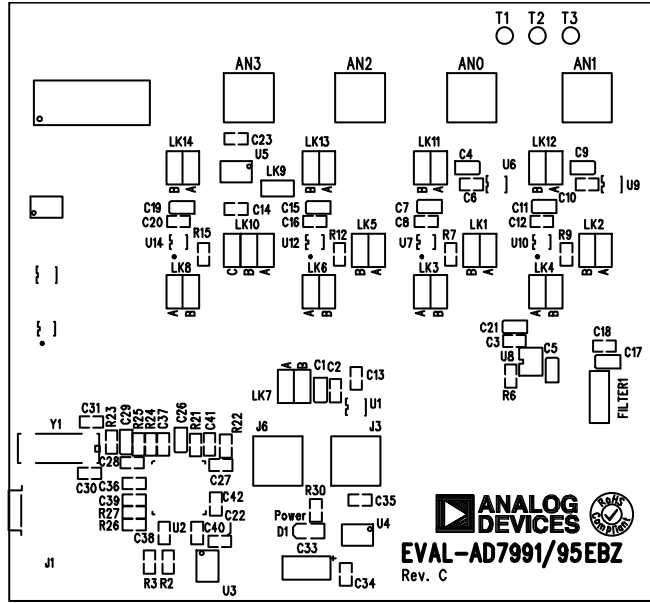Figure 7. Component Placement Drawing

ORDERING INFORMATION

BILL OF MATERIALS

Note that X1, X2, and X3 are spare components and are not visible in the schematic.

Table 4. Components Listing

Qty.	Reference Designator	Description	Supplier/Number
4	AN0, AN1, AN2, AN3	Jack, SMB PCB 50 Ω	FEC 1111349
10	C1, C4, C7, C9, C11, C15, C17, C19, C26, C29	Case A 10 µF, 10 V capacitor	FEC 197130
23	C2 , C6, C8, C10, C12, C13, C14, C16, C18, C20, C22, C23, C27,C28, C34 to C42	0603, 0.1 µF, 16 V capacitor	FEC 9406140
1	C3	0603, 10 pF, 50 V	FEC 721967
2	C5, C21	Case A 0.47 µF, 25 V capacitor	FEC 9753940
2	C30, C31	0603, 12 pF, 50 V capacitor	FEC 721979
1	C33	Case C 47 µF, 10 V capacitor	FEC 570369
1	D1	SMD green LED	FEC 1226373
1	FILTER1	1.0 nF 3-terminal capacitor	FEC 9528202
1	J1	USB mini-AB SMT socket	FEC 9786490
2	J3, J6	Jack, SMB PCB 50 Ω	FEC 1111349
13	LK1 to LK8, LK10 to LK14	2 row 36 + 36 way header and red jumper socket	FEC 1056428 and FEC 150411
2	R2, R3	0603, 2.2 kΩ resistor	FEC 9330810
1	R6	0603, 330 kΩ resistor	FEC 9331042
5	R7, R9, R12, R15, R30	0603, 1 kΩ resistor	FEC 9330380
2	R21, R22	0603, 100 kΩ resistor	FEC 9330402
4	R24 to R27	0603, 10 kΩ resistor	FEC 9330399
3	T1 to T3	Testpoint	FEC 8731144
2	U1,X1	12-bit/10-bit ADC, 4-channel with I^{2}C-compatible interface	Analog Devices AD7991/AD7995
1	U2	Cypress USB microcontroller	Digi-Key 428-1669-ND
1	U3	EEPROM serial 64 kΩ	FEC 9758070
1	U4	High accuracy low dropout regulator	Analog Devices ADP3303AR-3.3
2	U5, X2	Precision band gap voltage reference	Analog Devices AD780ARZ
2	U6, U9	Digital potentiometer	Analog Devices AD5245BRJZ10-RL7
5	U7, U10, U12, U14, X3	Operational amplifier	Analog Devices AD8691AKSZ-R2
1	U8	High accuracy low dropout regulator	Analog Devices ADP3330ARTZ-3.6-R7
1	Y1	24 MHz SMD crystal	FEC 9509658

ORDERING GUIDE

Model	Description
EVAL-AD7991EBZ[1]	AD7991 Evaluation Board
EVAL-AD7995EBZ[1]	AD7995 Evaluation Board

[1] 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.

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