



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

EVAL-AD7993EBZ/AD7994EBZ

FEATURES

Full-featured evaluation board for the AD7993/AD7994
PC software for control and measurement of the
AD7993/AD7994
USB interface (cable provided)
Various linking options

GENERAL DESCRIPTION

This data sheet describes the evaluation board for testing the AD7993/AD7994. These devices are 10-/12-bit, low power, successive approximation analog-to-digital converters (ADCs) with I²C-compatible interfaces. The devices operate from a single 2.7 V to 5.5 V power supply and feature a 2 μ s conversion time.

The AD7993/AD7994 contain a 4-channel multiplexer and track-and-hold amplifier that can handle input frequencies up to 11 MHz.

Full details on these devices are provided in the AD7993/AD7994 data sheet available from Analog Devices, Inc., which should be consulted in conjunction with this data sheet.

On-board components for the EVAL-AD7993EBZ/AD7994EBZ include four AD8691 operational amplifiers, two AD5245 digital potentiometers, one AD780, a pin programmable 2.5 V or 3 V ultrahigh precision band gap reference, and one TMP37 precision temperature sensor.

The available link options are provided in Table 2 and Table 3.

FUNCTIONAL BLOCK DIAGRAM

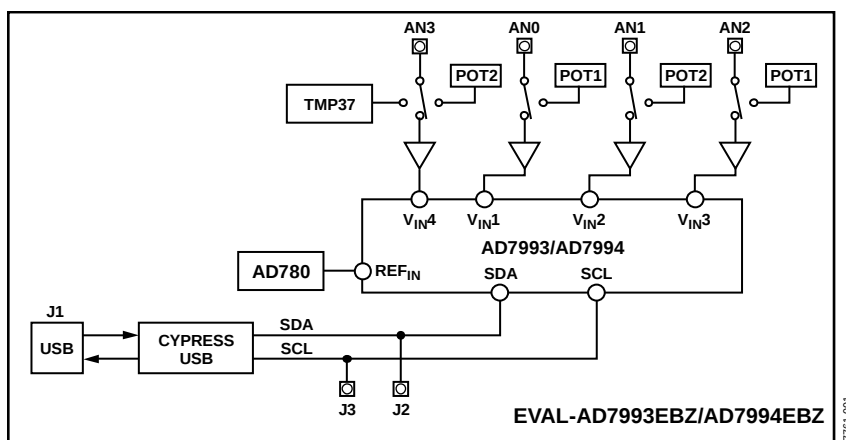


Figure 1.

Rev. 0

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REVISION HISTORY

11/08—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

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.

POWER SUPPLIES

The EVAL-AD7993EBZ/AD7994EBZ are powered via the 5 V supply from the USB connector, J1. The 5 V supply can be used to power the [AD7993/AD7994](#) directly through the EMC_FILTER. A regulated voltage from the on-board [ADP3303](#), a high precision, low power, 3.3 V output voltage regulator, can also be used.

To select the power supply for the AD7993/AD7994, choose LK7 (see the Links section).

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 AD7993/AD7994 evaluation board kit. Because the USB connector powers the board, there is no need for an external power supply.

Communication between the AD7993/AD7994 evaluation boards and the PC is over the USB interface. The on-board USB controller controls this communication.

SOCKETS

There are six input sockets relevant to the operation of the [AD7993/AD7994](#) on these evaluation boards. The functions of these sockets are outlined in Table 1.

Table 1. Socket Functions

Socket	Function
AN0 to AN3	Subminiature BNC (SMB) Connector. The analog input signal for V_{IN1} through V_{IN4} of the AD7993/AD7994 is applied to this socket.
J2	Subminiature BNC (SMB) Connector. This socket is connected to the SDA track on the evaluation board.
J3	Subminiature BNC (SMB) Connector. This socket is connected to the SCL track on the evaluation board.

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LINKS

Link options can be set to change the configuration of the circuits. Table 2 shows the positions in which all the links are set when the evaluation board are shipped. The functions of

these link options are summarized in Table 3. The positions of the links can be changed when the evaluation board is connected to the power supply.

Table 2. Initial Link Positions

Link No.	Position	Function
LK1	A	V_{IN1} is connected to digital Potentiometer 1.
LK2	A	Operational amplifier is supplied from J1 (Channel 1).
LK3	A	Operational amplifier is used on Channel 1.
LK4	A	V_{IN2} is connected to digital Potentiometer 2.
LK5	A	Operational amplifier is supplied from J1 (Channel 2).
LK6	A	The operational amplifier is used on Channel 2.
LK7	A	Power source of AD7993/AD7994 is set to 5 V (J1 connector).
LK8	Insert	External reference voltage has a value of 3 V.
LK9	B	Reference input of AD7993/AD7994 is connected to 5 V.
LK10	A	Operational amplifier is used on Channel 3.
LK11	A	Operational amplifier is supplied from J1 (Channel 3).
LK12	A	V_{IN3} is connected to digital Potentiometer 1.
LK13	A	Operational amplifier is used on Channel 4.
LK14	A	Operational amplifier is supplied from J1 (Channel 4).
LK15	A	V_{IN4} is connected to digital Potentiometer 2.

Table 3. Link Options

Link No.	Function
LK1, LK4, LK12	These links connect the input of V_{IN1} through V_{IN4} to the corresponding AN0 through AN3 socket, where V_{IN1} connects to AN0 and so on. Alternatively, these links connect to an input socket or to a digital potentiometer. In Position A, V_{INX} is connected to the digital potentiometer. In Position B, V_{INX} is connected to the ANx input socket.
LK2, LK5, LK11, LK14	These links connect 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, an operational amplifier is supplied from J1. In Position B, an operational amplifier is supplied from the ADP3330.
LK3, LK6, K10, LK13	These links tie the operational amplifiers to the analog inputs of the AD7993/AD7994. In Position A, the operational amplifier is used. In Position B, the operational amplifier is not used.
LK7	LK7 selects the power source for V_{DD} on the AD7993/AD7994. In Position A, LK7 selects the 5 V supply from the USB connector. In Position B, LK7 selects the 3.3 V regulated output from the on-board ADP3303 voltage regulator.
LK8	LK8 changes the value of the external reference voltage for the AD7993/AD7994. In the link is inserted, the reference voltage is 3 V. If the link is not inserted, the reference voltage is 2.5 V.
LK9	LK9 changes the source of the reference voltage. In Position A, an external reference source is used (AD780). In Position B, the 5 V supply from J1 is used as a reference voltage.
LK15	LK15 connects the input of V_{IN4} to the AN3 input socket, to a digital potentiometer or to a temperature sensor. In Position A, V_{IN4} is connected to digital Potentiometer 2. In Position B, V_{IN4} is connected to the AN3 input socket. In Position C, V_{IN4} is connected to the temperature sensor.

EVALUATION BOARD SOFTWARE

INSTALLING THE SOFTWARE

The EVAL-AD7993EBZ/AD7994EBZ kits include a CD that contains software for controlling and evaluating the functionality of the [AD7993/AD7994](#). To install the software

1. Start the Windows® operating system and insert the CD.
2. Wait while the installation program automatically begins. This program installs the evaluation software as well as electronic versions of the evaluation board data sheet and the AD7993/AD7994 device data sheet. All literature on the CD is in the Adobe® Systems, Inc., portable document-ation 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 AD7993/AD7994.

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

USING THE SOFTWARE

The software that controls the AD7993/AD7994 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. AD7993/AD7994 Evaluation Board Window

MAIN WINDOW

The upper and left portion of the evaluation board window contains a menu bar and controls. The middle-right and bottom-right 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

Print front Panel. Prints front panel on active printer.

Save as Picture. Saves front panel as a .jpg file.

Exit. Exits the program.

About Menu

Analog.com. Opens Analog Devices Web page.

Software Version. Displays information about the current version of the software.

Controls

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

Sample. Samples selected channels.

Continuous. Repeats the sampling process.

Limit. Opens window to configure limit registers (Channel 1 only).

Sweep. Starts the sweep function.

LEDs (CH 1, CH 2, CH3, CH 4). Selects the input channel of the [AD7993/AD7994](#). When more than one channel is selected, the AD7993/AD7994 works in sequence mode.

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

Temperature. Enables temperature measurements.

Potentiometer Value Selector (Pot 1/Pot 2). Changes the value of the selected digital potentiometer.

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

Exit. Exits the program.

Alert LED. Indicates if an alert occurred (Channel 1 only).

Ref – VDD – 5V. Selects reference voltage source (power supply voltage or AD780).

2.5V/3V. Changes the value of the external reference voltage (AD780).

Clear Charts. Clears the charts displayed.

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

Alert. Shows limits on the upper digital storage oscilloscope.

Channel 1/Channel 2/Channel 3/Channel 4. Selects the input channel of the AD7793/AD7794 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 is displayed, such as measured values in codes and in volts.

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 AD7993/AD7994 take 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 AD7993/AD7994 to take samples, click either **Sample** or **Continuous**.

- Click **Sample** to perform one conversion. The result is uploaded and displayed.
- Click **Continuous** to start taking samples. When **Continuous** is selected, other controls can be changed.

EVALUATION BOARD SCHEMATICS AND ARTWORK

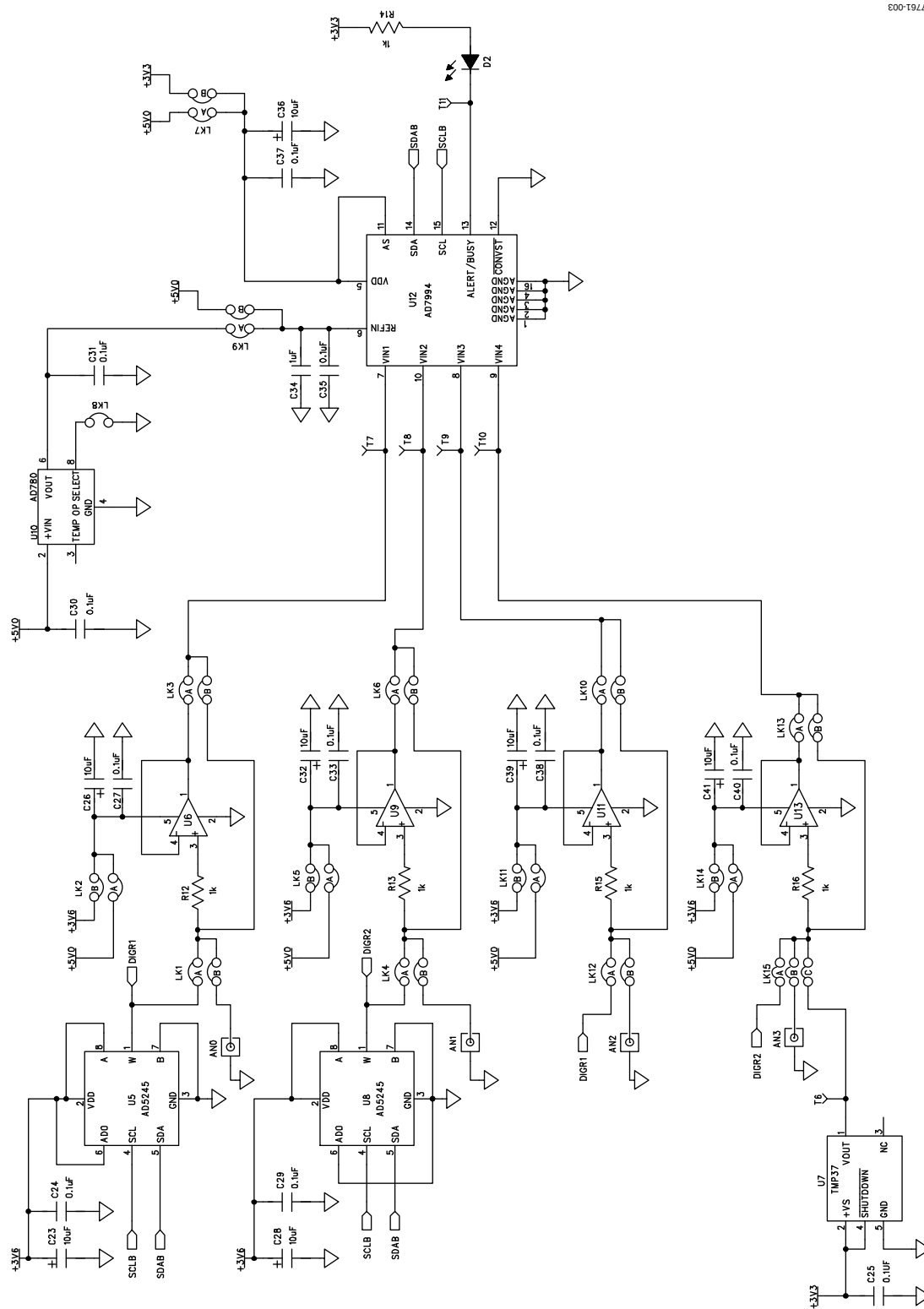


Figure 3. AD7993/AD7994 Evaluation Board Schematic 1

USB

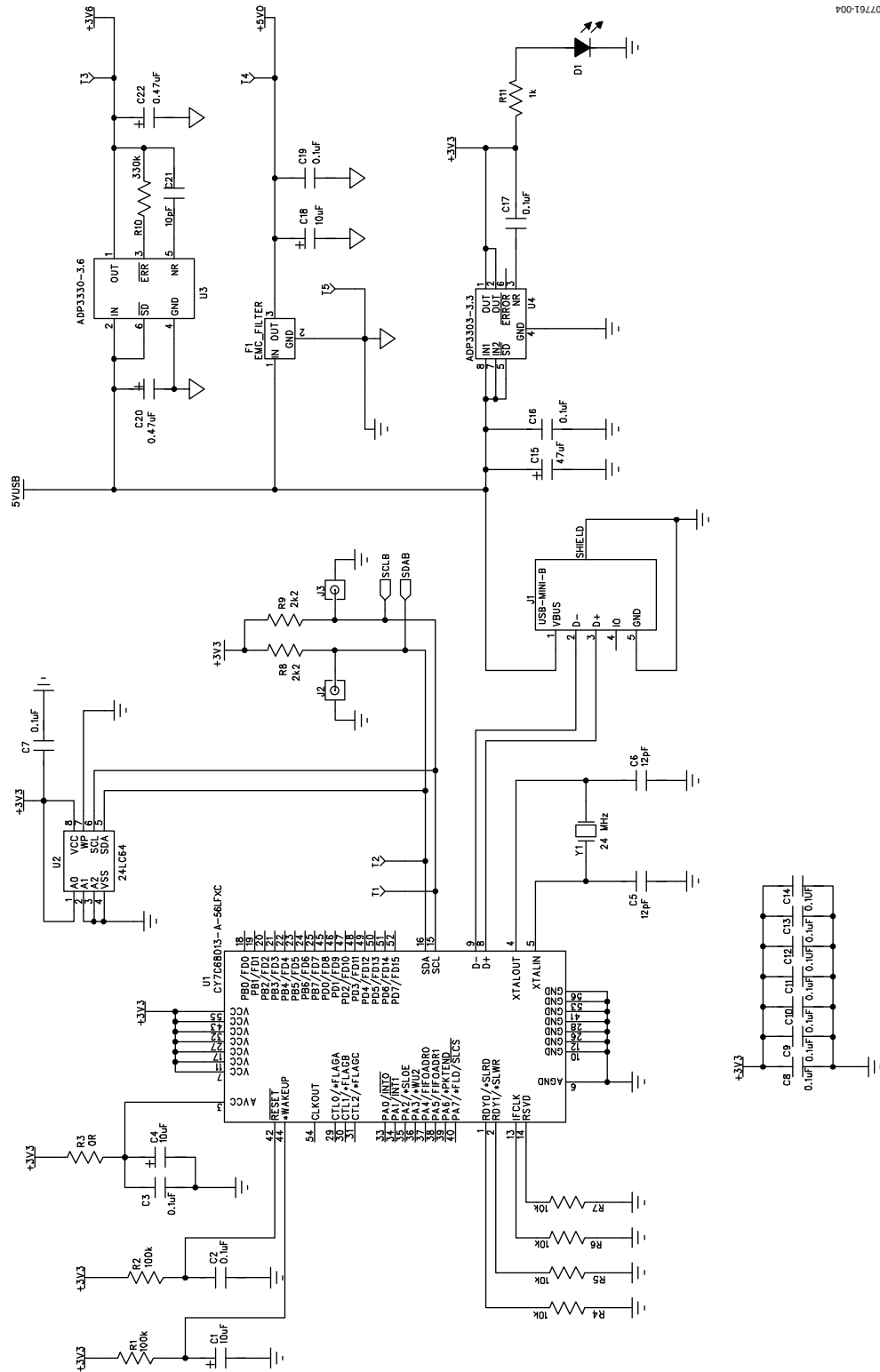


Figure 4. AD7993/AD7994 Evaluation Board Schematic 2

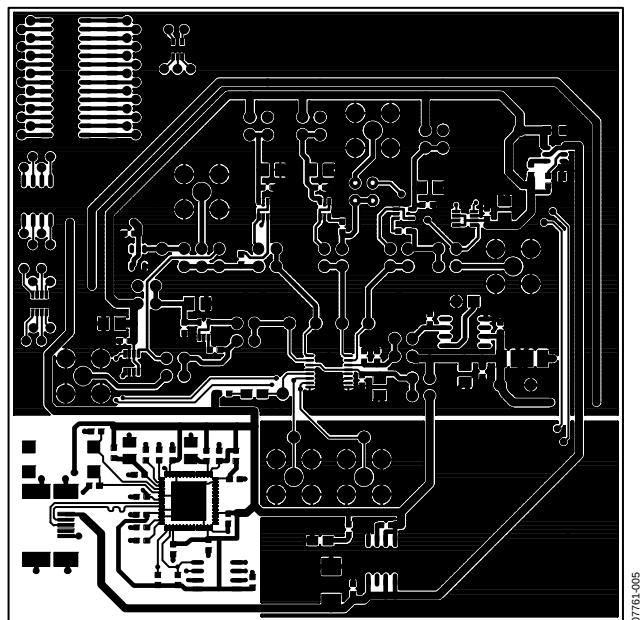


Figure 5. Component Side Artwork

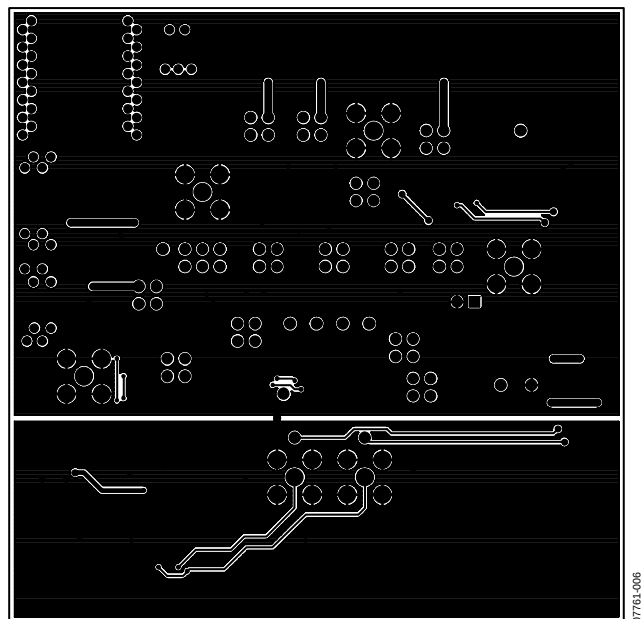


Figure 6. Solder Side Artwork

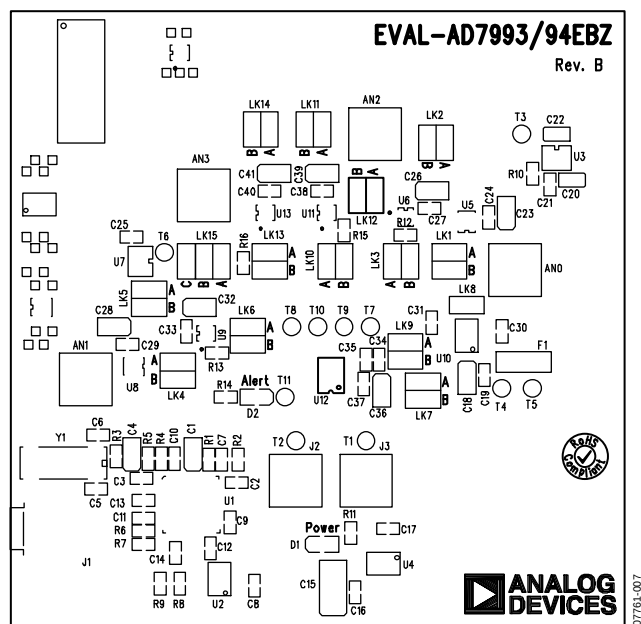


Figure 7. Component Placement Drawing

EVAL-AD7993EBZ/AD7994EBZ

ORDERING INFORMATION

BILL OF MATERIALS

Table 4. Components Listing

Qty.	Reference Designator	Description	Supplier/Part Number ¹
4	AN0 to AN3	Jack, SMB PCB 50 Ω	FEC 1111349
10	C1, C4, C18, C23, C26, C28, C32, C36, C39, C41	Case A, 10 μ F, 10 V capacitor	FEC 197130
24	C2, C3, C7 to C14, C16, C17, C19, C24, C25, C27, C29 to C31, C33, C35, C37, C38, C40	0603, 0.1 μ F, 16 V capacitor	FEC 9406140
2	C5, C6	0603, 12 pF, 50 V capacitor	FEC 721979
1	C15	Case C, 47 μ F, 10 V capacitor	FEC 197324
2	C20, C22	Case A, 0.47 μ F, 25 V capacitor	FEC 498828
1	C21	10 pF, 50 V SMD ceramic capacitor	Phycomp FEV721967
1	C34	10 μ F, 10 V multilayer ceramic capacitor	Digi-Key 490-1542-1-ND
1	D1	SMD green LED	FEC 5790852
1	D2	SMD red LED	FEC 5790840
1	F1	1.0 nF 3-terminal capacitor	FEC 9528202
1	J1	USB mini-B SMT connector	Digi-Key WM2499TR-ND
2	J2, J3	Jack, SMB PCB 50 Ω	FEC 1111349
14	LK1 to LK14	4-pin 2 row 36 + 36 way header and red jumper socket	FEC 1022244/FEC 150411
1	LK15	6-pin 2 row 36 + 36 way header and red jumper socket	FEC 150411
2	R1, R2	0603, 100 k Ω resistor	FEC 9330402
1	R3	0 Ω resistor	FEC 933-1662
4	R4 to R7	0603, 10 k Ω resistor	FEC 9330399
2	R8, R9	0603, 2.2 k Ω resistor	FEC 9330810
1	R10	0603, 330 k Ω resistor	FEC 9331042
6	R11 to R16	0603, 1 k Ω resistor	FEC 9330380
11	T1 to T11	Test point	FEC 8731144
1	U1	Cypress USB microcontroller	Digi-Key 428-1669-ND
1	U2	EEPROM serial 64 kB	FEC 9758070
1	U3	High accuracy low dropout regulator	Analog Devices ADP3330ARTZ-3.6-RL7
1	U4	High accuracy low dropout regulator	Analog Devices ADP3303ARTZ-3.3-RL7
2	U5, U8	Digital potentiometer	Analog Devices AD5245BRJZ10-RL7
4	U6, U9, U11, U13	Operational amplifier	Analog Devices AD8691AKSZ-R2
1	U7	Low voltage temperature sensor	Analog Devices TMP37GRTZ-REEL7
1	U10	Precision band gap voltage reference	Analog Devices AD780ARZ
1	U12	8-channel ADC	Analog Devices AD7993/AD7994BRUZ-0
1	Y1	24 MHz SMD crystal	FEC 9509658

¹ FEC = Farnell Electronics.

ORDERING GUIDE

Model	Description
EVAL-AD7993EBZ ¹	AD7993 Evaluation Board
EVAL-AD7994EBZ ¹	AD7994 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.