

Evaluating the **AD7791** 24-Bit, Low Power, Sigma-Delta ADC

FEATURES

Full featured evaluation board for the **AD7791**
 Standalone USB interface
 Various linking options
 PC software for control of **AD7791**

EVALUATION KIT CONTENTS

EVAL-AD7791EBZ board
 USB cable
 Evaluation software CD

ONLINE RESOURCES

AD7791 data sheet

GENERAL DESCRIPTION

This user guide describes the evaluation board for the **AD7791**, which is a low power, 24-bit Σ - Δ analog-to-digital converter (ADC). The **AD7791** is a complete analog front end for low frequency measurement applications. It is a low power device, consuming 65 μ A typically with a 3 V power supply. It has an on-chip clock, which eliminates the need for an external clock. It employs a Σ - Δ conversion technique to realize up to 24 bits of no missing codes performance. The input signal is applied to an analog modulator. The modulator output is processed by an on-chip digital filter. The analog input channel of the **AD7791** accepts analog input signals of $\pm V_{REF}$. At an output data rate of 16.6 Hz, the **AD7791** has a peak-to-peak resolution of 19 bits. Simultaneous 50 Hz/60 Hz rejection is also available at this output data rate.

Full data on the **AD7791** is available in the **AD7791** data sheet from Analog Devices, Inc. It is recommended that the **AD7791** data sheet be consulted in conjunction with this user guide when using the evaluation board.

The evaluation board interfaces to the USB port of a PC. Software that allows users to easily communicate with the **AD7791** is available with the evaluation board.

The **AD7791** evaluation board software must be installed before connecting the **AD7791** evaluation board to the PC.

Another component on the **AD7791** evaluation board is the **ADP3303** high precision, low power, 3.3 V output voltage regulator, which powers the USB/serial peripheral interface (SPI).

EVALUATION BOARD CONNECTION DIAGRAM

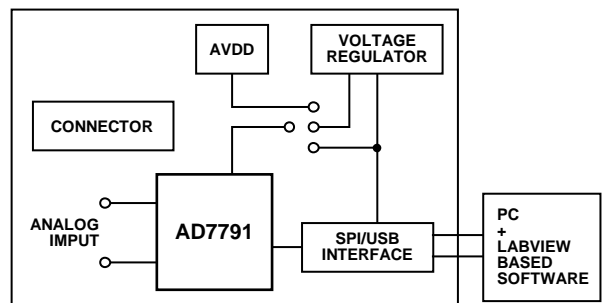


Figure 1.

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REVISION HISTORY

5/15—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

POWER SUPPLIES

The [AD7791](#) evaluation board is powered via the 5 V supply from the USB connector, J1. To supply power to the [AD7791](#), either use the 5 V supply directly, use a 3.3 V regulated voltage from the on-board [ADP3303](#) (a high precision, low power, 3.3 V output voltage regulator), or use an external 3 V or 5 V power supply via J2.

LINKS

Before using the evaluation board, there are nine groups of link options that must be set for the required operating setup. Table 1 outlines the functions of these link settings.

Table 1. [AD7791](#) Evaluation Board Link Settings

Link	Default Position	Description
LK1, LK2	Inserted	These links connect the AIN(\pm) inputs to $V_{DD}/2$. A noise analysis can be performed with this configuration. After these links are removed, an external voltage can be applied to AIN(\pm) using the subminiature BNC (SMB) connectors.
LK3	A	LK3 selects the reference source for the AD7791 . In Position A, the ADR381 supplies a 2.5 V reference. In Position B, V_{DD} is used as the reference source.
LK4	Inserted	With LK4 in place, REFIN(–) is connected to GND.
LK5	3.3 V	LK5 selects the power source for V_{DD} on the AD7791 . In Position A, LK5 selects an external power supply, supplied via J2. In Position B, LK5 selects the 3.3 V regulated output from the on-board ADP3303 voltage regulator. In Position C, LK5 selects the 5 V supply from the USB connector, J1.
LK6 to LK8, LK11	Inserted	These links connect the serial interface pins of the AD7791 to the SPI of the microcontroller and are inserted when using the AD7791 evaluation board software. After these links are removed, the AD7791 can be interfaced to an external microcontroller.

Table 2. Initial Link Positions

Link	Default Position	Description
LK1, LK2	Inserted	AIN(+) and AIN(–) are shorted to $V_{DD}/2$.
LK3	A	REFIN(+) is tied to the ADR381 , giving a 2.5 V reference.
LK4	Inserted	REFIN(–) is tied to GND.
LK5	B	The 3.3 V supply functions as V_{DD} for the AD7791 .
LK6 to LK8, LK11	Inserted	The AD7791 interfaces to the on-board microcontroller.

Table 3. Socket Functions

Socket	Description
AIN(+)	SMB connector. The analog input signal for the AIN(+) input of the AD7791 is applied to this socket.
AIN(–)	SMB connector. The analog input signal for the AIN(–) input of the AD7791 is applied to this socket.
REF(+)	SMB connector. In conjunction with REF(–), this socket applies an external reference to the AD7791 . The voltage for the REFIN(+) input of the AD7791 is applied to this socket.
REF(–)	SMB connector. In conjunction with REF(+), this socket applies an external reference to the AD7791 . The voltage for the REFIN(–) input of the AD7791 is applied to this socket.
J3	6-pin terminal block. This connector connects an external sensor to the AD7791 evaluation board.

SETUP CONDITIONS

Before applying power and signals to the evaluation board, ensure all link positions are set per the required operating mode. Table 2 shows the position in which all the links are initially set.

SOCKETS

On this evaluation board, there are five sockets that are relevant to the operation of the [AD7791](#). Table 3 outlines the functions of these sockets.

INTERFACING TO THE EVALUATION BOARD

Interface to the evaluation board via a standard USB connector, J1. J1 connects the evaluation board to the USB port of a PC. A standard USB connector cable is included with the AD7791 evaluation board to allow the evaluation board to interface with the USB port of the PC. Because the board is powered via the USB connector, there is no need for an external power supply, although if preferred, one can be connected via J2.

Communicate between the AD7791 and the PC via the USB/SPI interface. The on-board USB controller (U2) handles this communication.

To set up the USB/SPI interface, follow these steps:

1. Before connecting the board to the PC, install the AD7791 evaluation board software using the supplied AD7791 evaluation board CD.
2. After the AD7791 evaluation board software is installed, connect the AD7791 board to the PC via J1 and via the USB port on the PC using the supplied USB connector cable. The PC automatically finds the new USB device and identifies it as the **AD779x Evaluation Board**.
3. Follow the on-screen instructions that appear automatically as part of the install. During the installation process, if the **Hardware Installation** window appears as shown in Figure 2, click **Continue Anyway** to complete the installation of the AD7791 evaluation board.



Figure 2. **Hardware Installation** Window

EVALUATION BOARD SOFTWARE

SOFTWARE DESCRIPTION

The AD7791 evaluation board is shipped with a CD containing software that can be installed onto a standard PC to control the AD7791. The software communicates with the AD7791 through the USB cable that is supplied with the board. The software reads conversion data from the AD7791. The AD7791 reads the data and displays or stores it for later analysis. For further information, see the AD7791 data sheet available from Analog Devices.

INSTALLING THE SOFTWARE

Follow these steps to install the software:

1. Start Windows® XP or later and insert the CD.
2. The installation software launches automatically. If it does not launch automatically, use Windows Explorer to locate the **setup.exe** file on the CD. Double click this file to start the installation procedure.
3. At the prompt, select the destination directory, which is **C:\Program Files\Analog Devices\AD7791** by default.

After the directory is selected, the installation procedure copies the files into the relevant directories on the hard drive. The installation program creates a program group called **Analog Devices** with the subgroup **AD7791** in the **Start** menu of the taskbar.

4. After the installation procedure is complete, double click the **AD7791** icon to start the program.

USING THE SOFTWARE

Figure 3 shows the main window of the **AD7791 Evaluation Software** that is displayed when the program starts. The Main Window section briefly describes the various menu and button options in the main window.

The read data can be exported to other packages, such as MathCAD® or Microsoft® Excel, for further analysis.

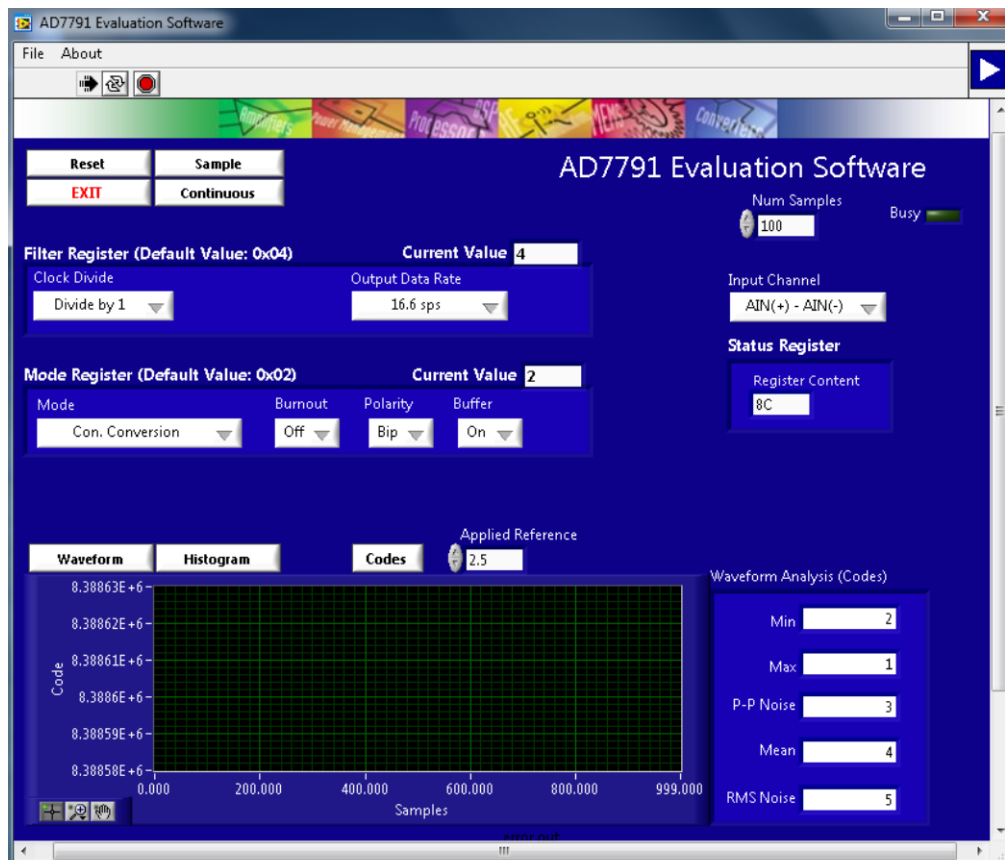


Figure 3. AD7791 Evaluation Software Main Window

MAIN WINDOW

Menu Bar

File

The **File** menu allows the user to read previously stored data for display or analysis, write the current set of data to a file for later use, and exit the program.

About

The **About** menu provides information on the revision of software used.

Buttons

Reset

The **Reset** button resets the [AD7791](#) software.

EXIT

The **EXIT** button exits the software. It serves the same purpose as **Quit** in the **File** pull down menu.

Sample

The **Sample** button prompts the software to read a number of samples from the [AD7791](#). Noise analysis is then performed on the samples. These samples can be stored for further analysis. The sample size is entered in the **Num Samples** text box.

Continuous

The **Continuous** button allows a number of samples to be read continuously. The software gathers a number of samples as specified by the **Num Samples** text box, performs noise analysis on the samples, and gathers the next group of samples.

Waveform

The gathered conversions are displayed in graph form.

Histogram

The gathered samples are used to generate a histogram.

Codes

The gathered samples can be displayed in codes or in voltage format. Click **Codes** to display the value as code. The **Codes** button can change to volts. To display the information in volts, click **Volts**.

Controls

Filter Register

The **Filter Register** control allows the user to alter the output data rate and the clock divide function.

Mode Register

The **Mode Register** control gives access to the mode register, which allows the user to enable/disable the buffer and the burnout currents and to alter the polarity and the mode of operation.

Input Channel

Use the **Input Channel** control to select which input channel the [AD7791](#) uses.

Status Register

The **Status Register** text box displays the status bits of the [AD7791](#).

Applied Reference

Enter the value of the external reference in the **Applied Reference** text box.

EVALUATION BOARD SCHEMATIC AND ARTWORK

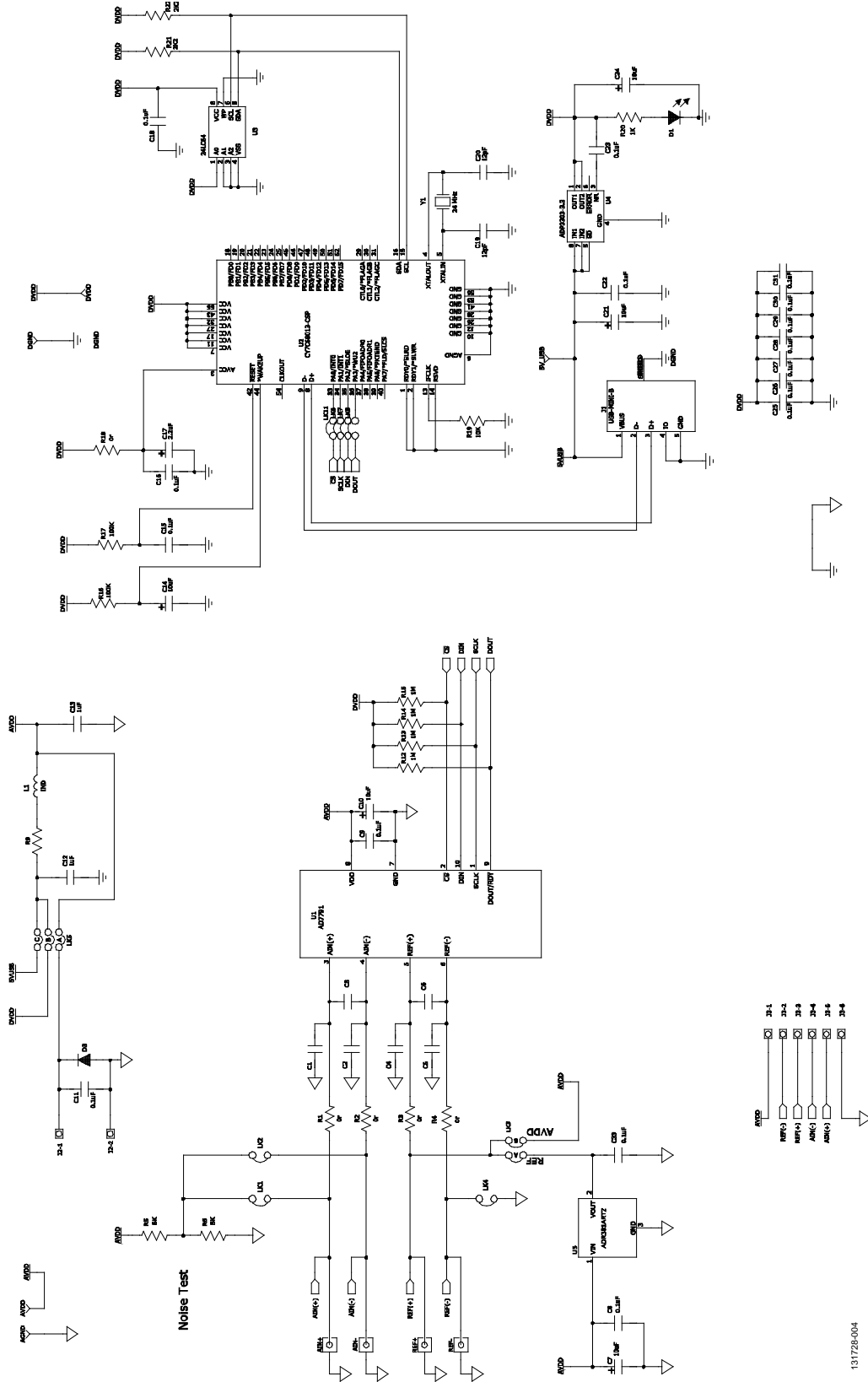


Figure 4. AD7791 Evaluation Board Schematic

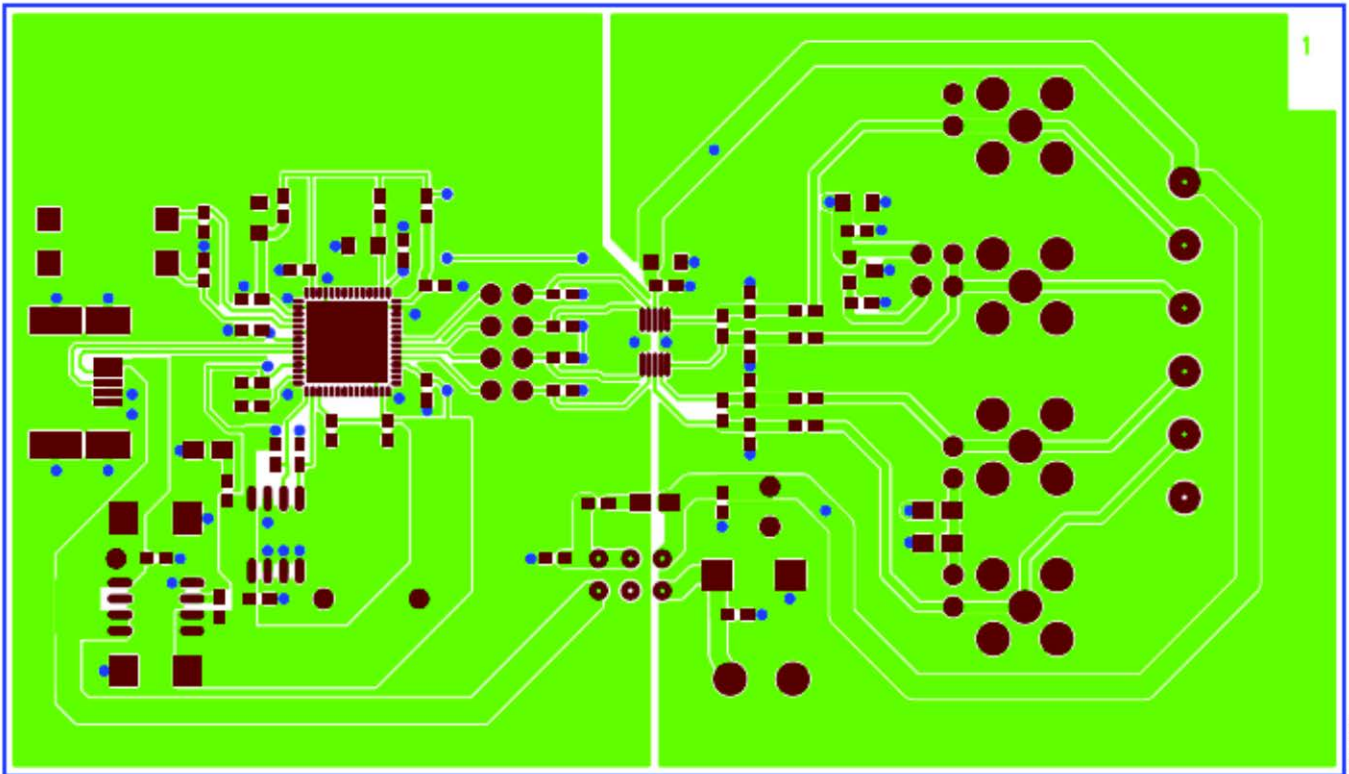


Figure 5. AD7791 Evaluation Board—Solder Side View

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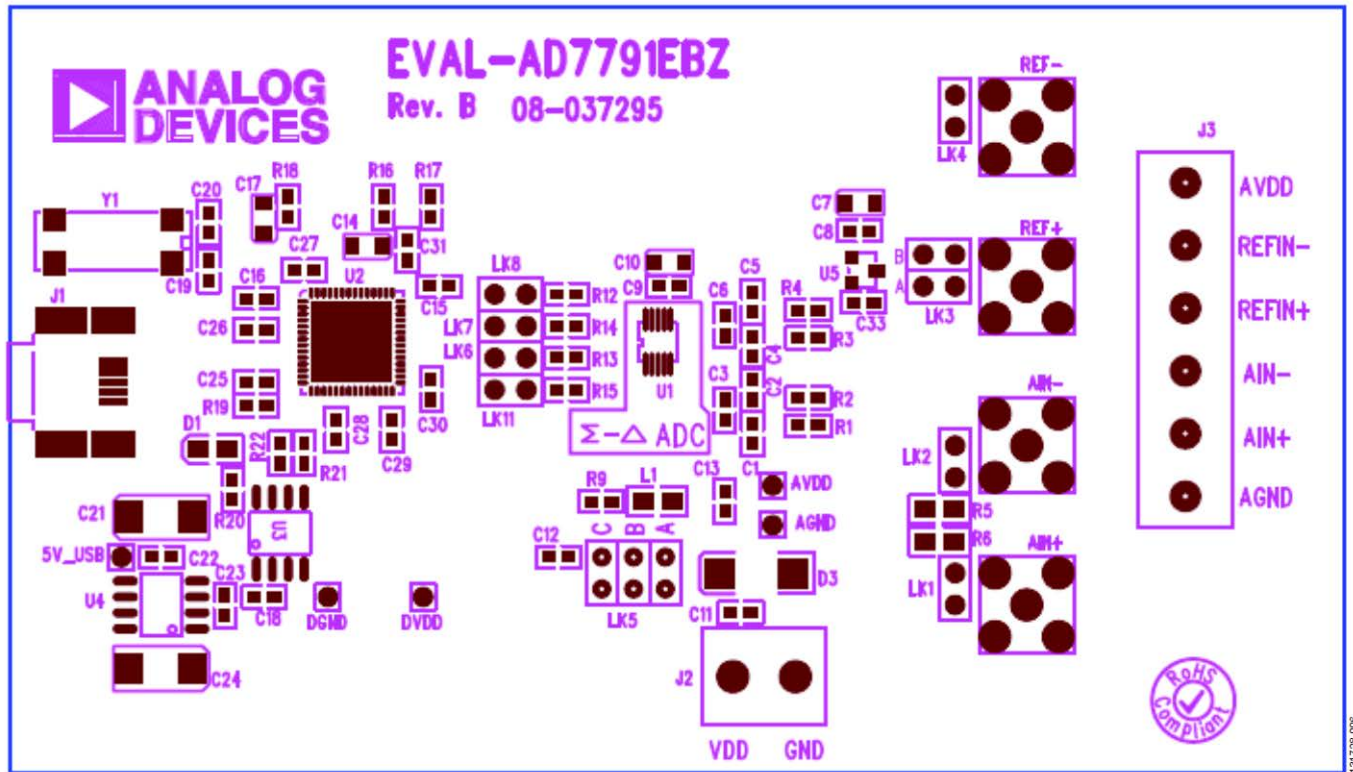


Figure 6. AD7791 Evaluation Board—Component Side View

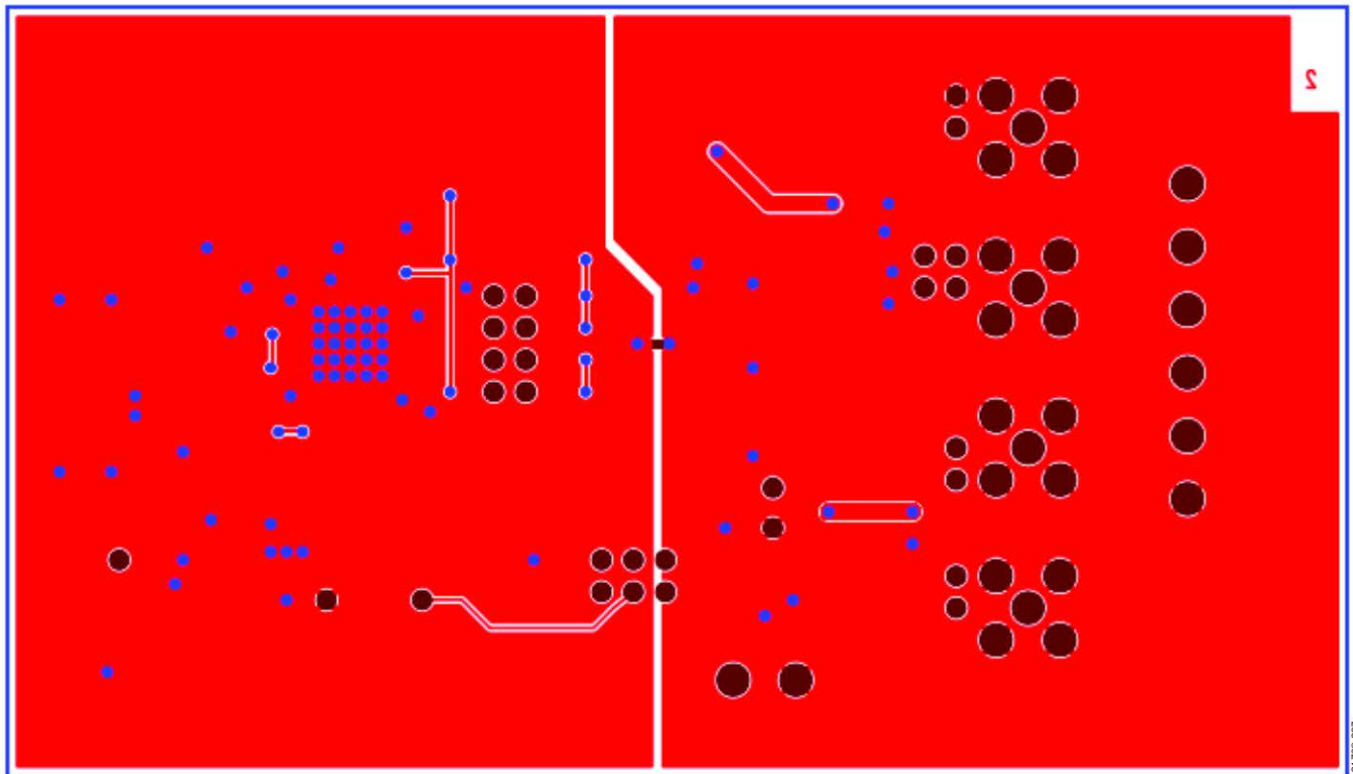


Figure 7. AD7791 Evaluation Board—Component Layout Diagram

ORDERING INFORMATION

BILL OF MATERIALS

Table 4.

Quantity	Reference Designator	Description	Manufacturer	Part Number
1	U1	24-bit Σ - Δ ADC	Analog Devices	AD7791BRMZ
1	U2	USB controller	Cypress Semiconductor Corp.	CY7C68013A-56LFXC
1	U3	EEPROM	Microchip Technology, Inc.	24LC64-I/SN
1	U4	3.3 V regulator	Analog Devices	ADP3303ARZ-3.3
1	U5	2.5 V reference	Analog Devices	ADR381ARTZ
1	Y1	24 MHz crystal	AEL Crystals	X24M000000S244
1	D1	Red LED	Avago Technologies	HSMS-C191
1	L1	Ferrite bead	Meggitt Sigma	BMB2A0300AN1
1	D3	Diode	Micro Commercial Components Corp.	DL4001-TP
6	C1 to C6	Capacitor	Do not insert	Do not insert
5	C7, C10, C14, C21, C24	10 μ F tantalum capacitor	AVX Corporation	TAJA106M016R
17	C8, C9, C11, C15, C16, C18, C22, C23, C25 to C33	0.1 μ F \pm 10% ceramic capacitor	AVX Corporation	CM105X7R104K16AT
2	C12, C13	1 μ F ceramic capacitor	Kemet	C0603C105K8PACTU
1	C17	2.2 μ F tantalum capacitor	Kemet	T491A225K016AT
2	C19, C20	12 pF ceramic capacitor	AVX Corporation	06031A120JAT2A
6	R1 to R4, R9, R18	0 Ω resistor	Multicomp	MC0063W06030R
2	R5, R6	5 k Ω resistor	Vishay	PNM0805E5001BST5
4	R12 to R15	1 M Ω resistor	Multicomp	MC0063W060311M
2	R16, R17	100 k Ω resistor	Multicomp	MC0063W06031100K
1	R19	10 k Ω resistor	Multicomp	MC0063W0603110K
1	R20	1 k Ω resistor	Multicomp	MC0063W060311K
2	R21, R22	2.2 k Ω resistor	Multicomp	MC0063W060312K2
7	LK1, LK2, LK4, LK6 to LK8, LK11 (2 \times 1 way)	Pin header	Harwin	M20-9990246
1	LK3 (2 \times 2 way)	Pin header	Harwin	M20-9983646
1	LK5 (3 \times 2 way)	Pin header	Harwin	M20-9983646
9	At LK1 to LK11	Shorting plug	Harwin	M7566-05
4	AIN+, AIN-, REF+, REF-	SMB connector	Do not insert	Do not insert
1	J1	USB SMB connector	Molex	565790576
1	J2	2-way terminal block	Camden Boss	CTB5000/2
1	J3	6-way terminal block	Camden Boss	1725698

NOTES



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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