ANALOG DEVICES

EVAL-AD5380SDZ/EVAL-AD5382SDZ User Guide
UG-757

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Evaluating the AD5380/AD5382 40-/32-Channel, 14-Bit Voltage Output DACs with On-Chip Reference

FEATURES

Full featured evaluation board for the AD5380/AD5382
On-board reference
Various link options
PC control in conjunction with the Analog Devices, Inc.,
   EVAL-SDP-CB1Z system demonstration platform (SDP)

EVALUATION KIT CONTENTS

EVAL-AD5380SDZ/EVAL-AD5382SDZ evaluation board
CD includes
   Self-installing evaluation software that allows users to
     control the board and exercise all functions of the device
   Electronic version of the EVAL-AD5380SDZ/
     EVAL-AD5382SDZ user guide

ADDITIONAL EQUIPMENT AND SOFTWARE NEEDED

EVAL-SDP-CB1Z system demonstration platform,
   includes a USB cable
PC running Windows XP SP2, Windows Vista, or Windows 7
   with USB 2.0 port

ONLINE RESOURCES

Documents Needed
   AD5380/AD5382 data sheets
   EVAL-AD5380SDZ/EVAL-AD5382SDZ user guide
Required Software
   AD538x evaluation software (download from the
     EVAL-AD5380SDZ/EVAL-AD5382SDZ product pages)
Design and Integration Files
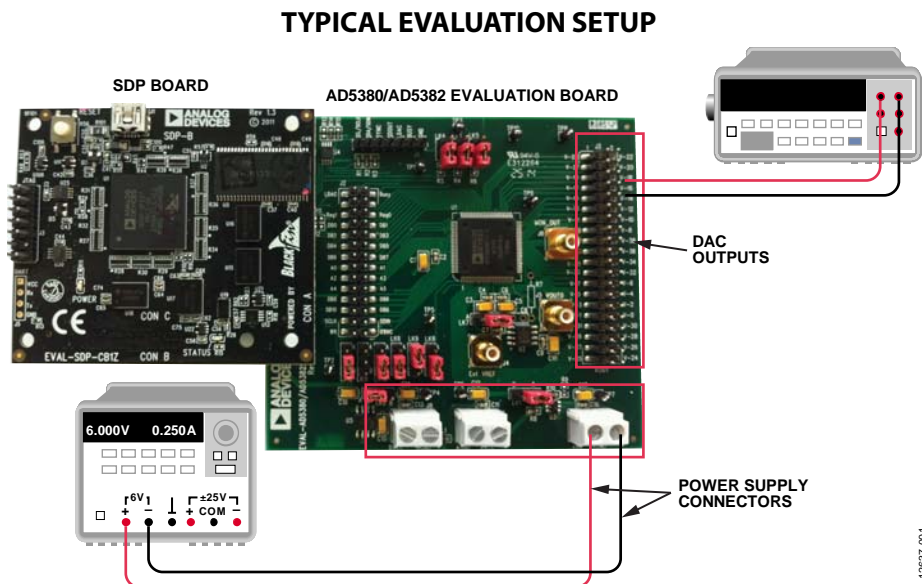   Schematics, layout files, bill of materials

TYPICAL EVALUATION SETUP

Figure 1.

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REVISION HISTORY

GENERAL DESCRIPTION

This user guide details the operation of the evaluation boards for the AD5380/AD5382 40-/32-channel, 14-bit voltage output digital-to-analog converter (DAC) with on-chip reference.

The EVAL-AD5380SDZ/EVAL-AD5382SDZ evaluation boards are designed to help users quickly prototype new AD5380/AD5382 circuits and reduce design time. Each evaluation board is populated with an AD5380BSTZ-5 (EVAL-AD5380SDZ) or an AD5382BSTZ-5 (EVAL-AD5382SDZ). Each AD5380/AD5382 operates from a 4.5 V to 5.5 V analog supply and from a 2.7 V to 5.5 V digital supply. The AD5380/AD5382 incorporate an internal 1.25 V/2.5 V reference to attain an output voltage span of 2.5 V or 5 V. An external reference (a 2.5 V reference is provided on the evaluation board) can also be used to attain an output from 0 V to V_{REF}.

Full data on the AD5380 and AD5382 can be found in the respective product data sheets, which should be consulted in conjunction with this user guide when using the evaluation board.

The evaluation boards interface to the USB port of a PC via the EVAL-SDP-CB1Z SDP-B controller board, which is available for order on the Analog Devices website at www.analog.com. Software is supplied with the evaluation board to allow the user to program the AD5380/AD5382. Only the SPI interface is supported by the software.

The evaluation boards can be used without the SDP-B controller board. Digital control signals can be applied via Connector J1 or Connector J2, and power supplies can be connected to Connector J7 and Connector J8.

GETTING STARTED

INSTALLING THE SOFTWARE

The evaluation kit for the AD5380/AD5382 includes self-installing software on a CD. The software is compatible with Windows® XP, Windows Vista (32-bit version), and Windows 7 (32-bit and 64-bit versions). The software must be installed before connecting the SDP board to the USB port of the PC to ensure that the SDP board is recognized when it is connected to the PC.

To install the software, take the following steps:

1. Start the Windows operating system and insert the CD.
2. The installation software should open automatically. If it does not open automatically, run the **setup.exe** file from the CD.

3. After installation is completed, power up the evaluation board as described in the Power Supplies section.
4. Connect the evaluation board to the SDP board and connect the SDP board to the PC using the USB cable included in the EVAL-SDP-CB1Z kit.
5. When the software detects the evaluation board, proceed through any dialog boxes that appear to finalize the installation.

EVALUATION BOARD SETUP PROCEDURES

To set up the evaluation board, take the following steps:

1. Connect the evaluation board to the SDP board, and connect the USB cable between the SDP board and the PC.
2. Power the SDP and evaluation boards by connecting 6 V to Connector J9.

EVALUATION BOARD HARDWARE

POWER SUPPLIES

To use the evaluation board with the SDP board, a 6 V power supply is required. The supply is connected to Connector J9. Two voltage regulators on the evaluation board generate the 5 V analog and digital supplies. These supplies are applied to the AD5380/AD5382 when the LK1 and LK2 links are in Position A. The digital supply is also used to power the SDP board.

The evaluation board can be used without the SDP board. In this case, Connector J7 is the AVCC power supply input, and Connector J8 is the DVCC power supply input. The LK1 and LK2 links must be in Position B.

AGND and DGND inputs are provided on the board. The AGND and DGND planes are connected at one location close to the AD5380/AD5382. It is recommended that AGND and DGND not be connected elsewhere in the system to avoid ground loop problems.

All supplies are decoupled to ground using 10 μF tantalum and 0.1 μF ceramic capacitors.

Table 1. Power Supply Connectors

Connector Number	Voltage
J7	Analog power supply, AVCC
J8	Digital power supply, DVCC
J9	6 V board positive power supply

INPUT SIGNALS

When the SDP board is used to control the AD5380/AD5382 evaluation board, the digital input signals are applied to Connector J10. When the SDP board is not used, apply the digital signal to Header J1 or Header J2.

OUTPUT SIGNALS

The DAC output voltages are available on the 40-way header, J3. VOUT 0 is also available on J5. MON_OUT is available on J6.
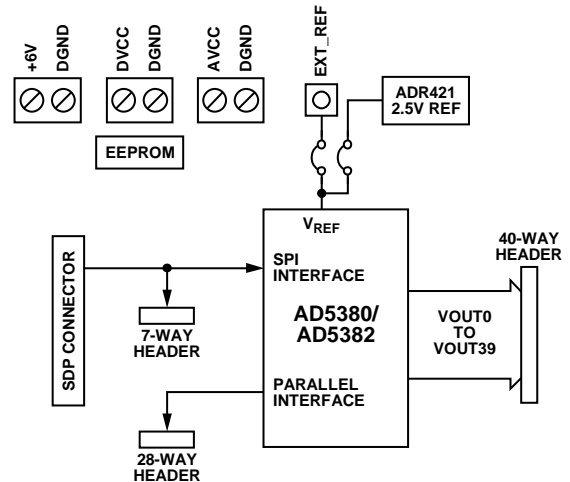

Figure 2. Evaluation Board Block Diagram

LINK CONFIGURATION OPTIONS

Multiple jumper (LKx) options must be set correctly to select the appropriate operating setup before using the evaluation board. The functions of these options are described in Table 2.

SETUP CONDITIONS

Before applying power and signals to the evaluation board, ensure that all link positions are as required by the operating mode. There are two modes in which to operate the evaluation

board. The evaluation board can be operated in SDP controlled mode to be used with the SDP board, or the evaluation board can be used in standalone mode.

The Default Position column of Table 2 shows the default positions in which the links are set when the evaluation board is packaged. When the board is shipped, the evaluation board is set up to operate with the SDP board in SDP controlled mode.

Table 2. Link Functions

Link No.	Function	Default Position
LK1	This link selects the source of the AVCC supply. Position A selects a 5 V supply from the ADP3331 (U3). Position B selects the external power supply connected to J7.	A
LK2	This link selects the source of the DVCC supply. Position A selects a 5 V supply from the ADP3367 (U5). Position B selects the external power supply connected to J8.	A
LK3 to LK5	These links select the logic level for $\overline{LDAC}$, $\overline{CLR}$, and $\overline{RESET}$, respectively. When a link is inserted, the relevant pin is connected to DGND. When the link is removed, the relevant pin is pulled to DVCC. Remove these links when using the SDP controller board.	Removed
LK6	This link sets the logic level of the PD pin. Position A puts the AD5380/AD5382 into power-down mode. Position B puts the AD5380/AD5382 into normal operating mode.	B
LK7	This link selects the source for the REFOUT/REFIN pin. In Position A, an external reference source can be connected to Connector J4. Use this option if the AD5380/AD5382 internal reference is used. In Position B, the reference source comes from the ADR421 2.5 V reference.	B
LK8	This link enables/disables the FIFO function In Position A, the FIFO function is enabled. In Position B, the FIFO function is disabled. The software supplied with the AD5380/AD5382 evaluation board does not support FIFO operation.	B
LK9	This link selects serial or parallel interface operation of the AD5380/AD5382. In Position A, a serial interface is selected. LK10 determines if an SPI or I²C interface is used. The software supplied with the AD5380/AD5382 evaluation board only supports the SPI interface. In Position B, the parallel interface is selected. Parallel interface signals are applied to the AD5380/AD5382 using Connector J2	A
LK10	This link selects the SPI or I²C interface mode of the AD5380/AD5382. Position A selects the I²C interface mode. Position B selects the SPI interface mode. Select this option when the evaluation board is used with the SDP controller board.	B
LK11	This link position is determined by the function of the $\overline{CS}$/$\overline{SYNC}$/A0 pin. When the AD5380/AD5382 are used in I²C mode, this pin determines the state of the A0 address bit. In Position A the address bit is 1 In Position B, the address bit is 0 Remove this link when the AD5380/AD5382 are used in SPI or parallel mode.	Removed
LK12	This link position is determined by the function of the $\overline{WR}$/DCEN/A1 pin. When the AD5380/AD5382 are used in I²C mode, this pin determines the state of the A1 address bit. In Position A, the address bit is 1. In Position B, the address bit is 0. When the AD5380/AD5382 are used in SPI mode, this pin enables/disables daisy-chain mode. In Position A, daisy-chain mode is enabled. The AD5380/AD5382 evaluation software does not support daisy-chain mode. In Position B, daisy-chain mode is disabled. Remove this link when the AD5380/AD5382 are used in parallel mode.	B

EVALUATION BOARD CIRCUITRY

The EVAL-AD5380SDZ/EVAL-AD5382SDZ evaluation boards allow the function and performance of the AD5380/AD5382 to be easily tested. Each evaluation board contains two voltage regulators that generate the analog and digital power supplies and that also power the SDP board if it is connected. The two regulators are powered via a 6 V supply attached to Connector J9. Alternatively, separate analog and digital supplies can be attached via Connector J7 and Connector J8, respectively.

Control of the AD5380/AD5382 is typically performed by the SDP board, which is attached to Connector J10. The SDP board allows the software provided with the kit to be used to load register values, set the voltage of the DAC outputs, and write to the control register of the AD5380/AD5382. When the SDP board is not required, the control signals can be applied to the AD5380/AD5382 by connecting them to the relevant pins on Connector J1 or Connector J2.

In addition to the on-chip reference of the AD5380/AD5382, an external 2.5 V reference is also provided and can be connected to the REFOUT/REFIN pin of the AD5380/AD5382 using Link LK7.

The DAC output voltages are available on the 40-way header, J3.

HOW TO USE THE SOFTWARE

STARTING THE SOFTWARE

To run the program, take the following steps:

1. Connect the evaluation board to the SDP board, and connect the USB cable between the SDP board and the PC.
2. Power the SDP board and the evaluation board by connecting 6 V to Connector J3.
3. Click **Start** > **All Programs** > **Analog Devices** > **AD538x** > **AD538x Evaluation Software**. When the software connects to the evaluation board, the message shown in Figure 3 displays.
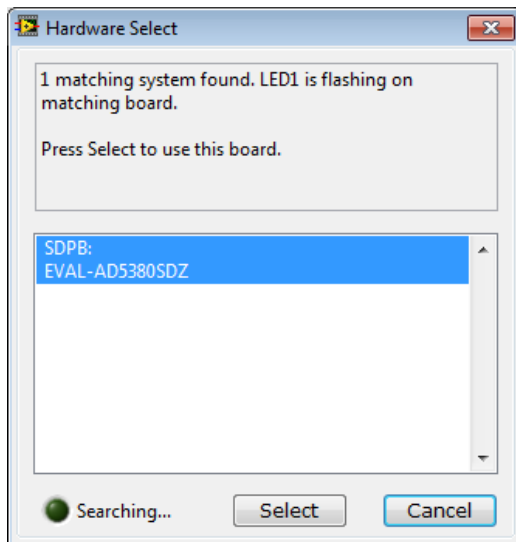
Figure 3. Connection Message

4. If the SDP board is not connected to the USB port when the software is launched, a connectivity error displays (see Figure 4), and the software continues to operate in simulation mode. In simulation mode, the user can exercise all the functionality of the AD5380/AD5382. Expected output voltages are displayed based on the input data, and the 24 bits of data that would have been sent to the AD5380/AD5382 are displayed at the bottom right of the screen.
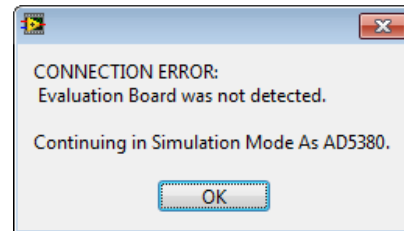
Figure 4. Connectivity Error

OVERVIEW OF THE MAIN WINDOW

The main window of the AD5380/AD5382 evaluation software is shown in Figure 5. The **DAC Registers** tab allows the X, M, and C registers of individual DACs to be programmed. $\overline{LDAC}$ is high by default. Click **Pulse LDAC** to update the outputs. The software displays the expected output voltages based on the register contents and the voltage reference value.

Figure 6 shows the **Control & Special Function Registers** tab. This tab allows the user to select the functions contained in the control register of the AD5380/AD5382. This tab also allows control of the $\overline{LDAC}$ and $\overline{CLR}$ pins.

The user can reset the AD5380/AD5382 by clicking **Hardware Reset** or **Software Reset** from the **File** menu.
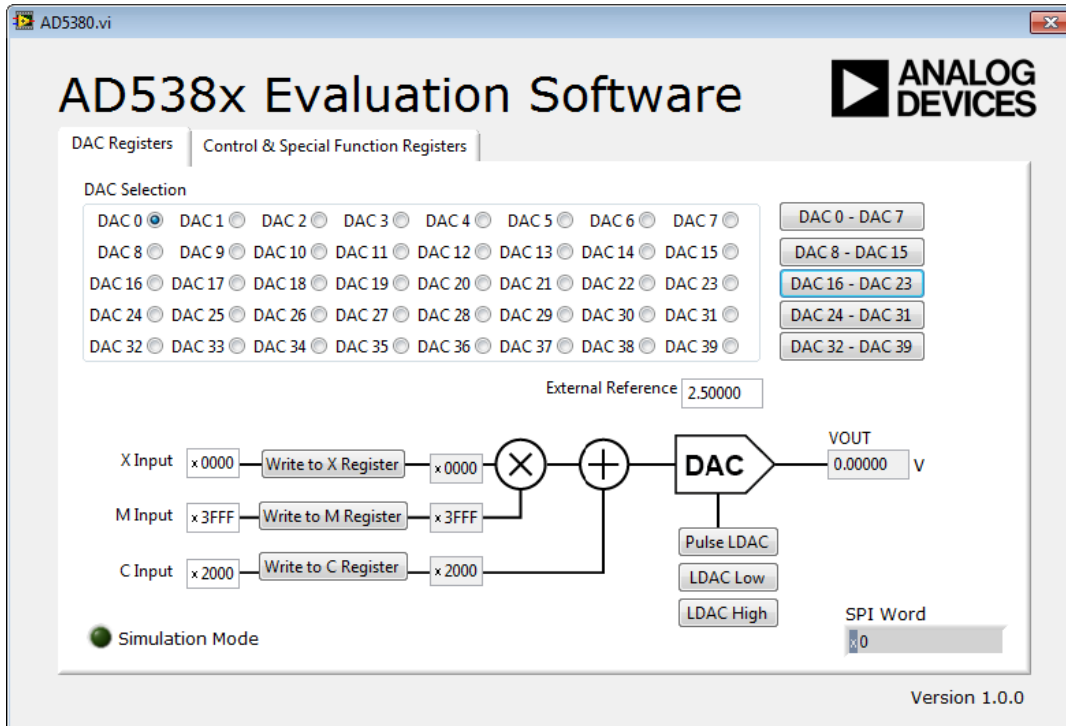
Figure 5. Main Window, **DAC Registers** Tab
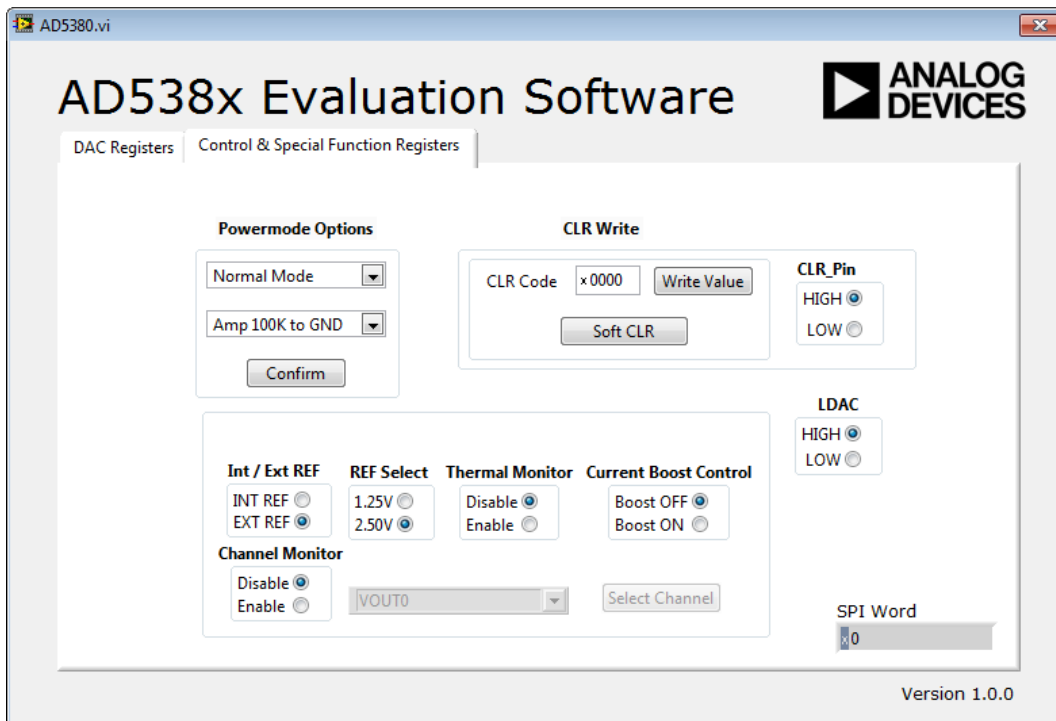
Figure 6. Main Window, **Control & Special Function Registers** Tab

EVALUATION BOARD SCHEMATICS
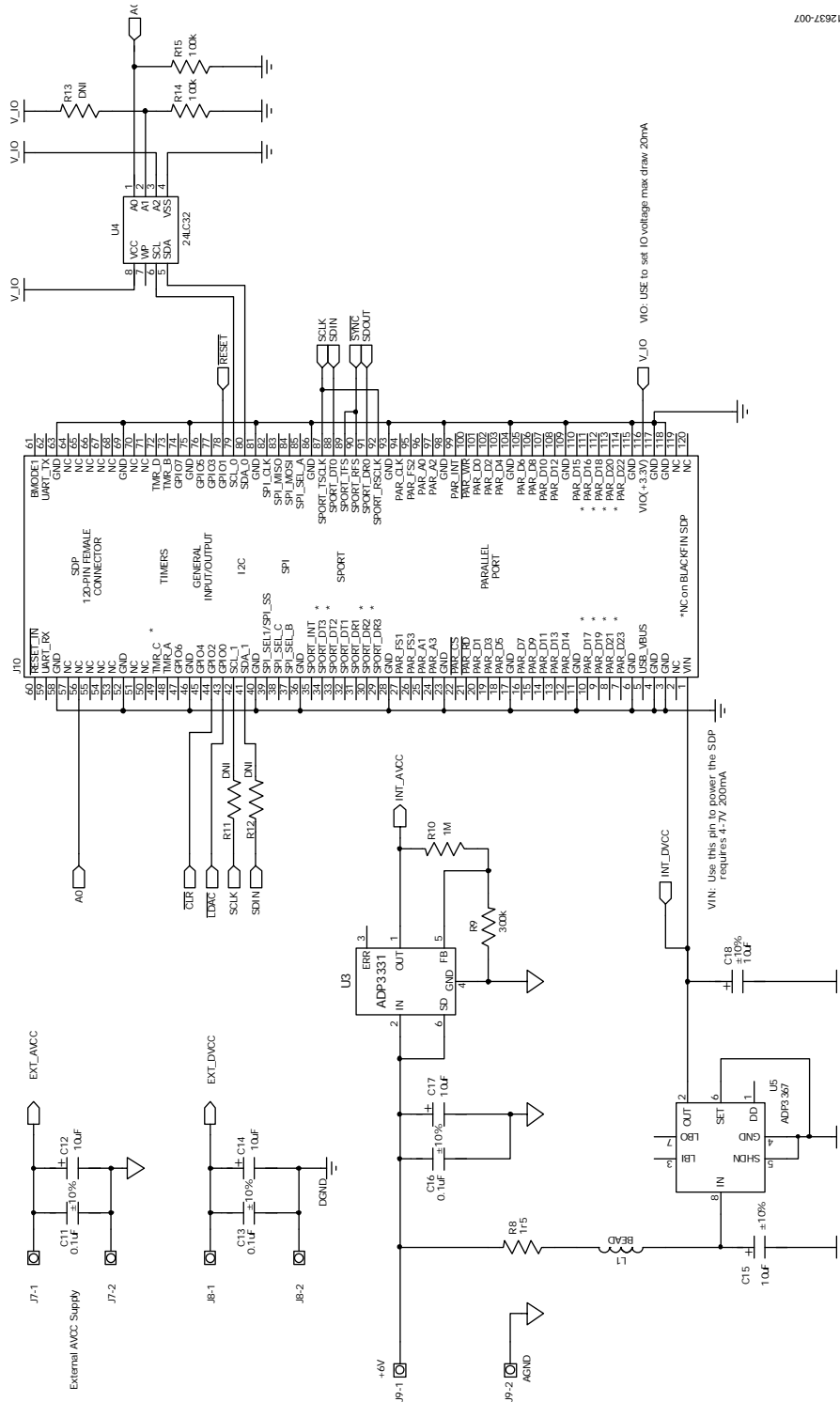
Figure 7. EVAL-AD5380SDZ/EVAL-AD5382SDZ Schematic, Page 1 of 2

Figure 8. EVAL-AD5380SDZ/EVAL-AD5382SDZ Schematic, Page 2 of 2

ORDERING INFORMATION

BILL OF MATERIALS

Table 3.

Qty	Reference Designator	Description	Supplier/Part Number[1]
9	C1, C3, C5, C10, C12, C14, C15, C17, C18	Capacitor, Case A, 10 μF, 10 V	FEC 197-130
8	C2, C4, C6, C7, C9, C11, C13, C16	Capacitor, 100 nF, 50 V, 0603	FEC 8820023
1	C8	Unpopulated capacitor location, keep holes free of solder	Do not insert
1	J1	7-pin (1x7) header, 0.1" pitch	FEC 1022257
1	J2	28-pin (2x14) SMT header, 0.1" pitch	Digi-Key M20-8761446-ND
1	J3	40-pin (2x20), 0.1" pitch, SMT header	Digi-Key M20-8762046-ND
3	J4 to J6	50 Ω, straight SMB jack	FEC 1111349
3	J7 to J9	2-pin terminal block (5 mm pitch)	FEC 151789
1	J10	120-way female connector, 0.6 mm pitch	FEC 1324660 or Digi-Key H1219-ND
1	L1	Ferrite bead	Digi-Key 490-1024-1-ND
9	LK1, LK2, LK6 to 12	3-pin SIL header, 0.1" pitch, and red jumper	FEC 1022248 & 150411
3	LK3, LK4	2-pin SIL header, 0.1" pitch, and red jumper	FEC 1022247 & 150-411
2	R1, R2	Resistor, 0603, 1%, 0 Ω	FEC 9331662
4	R3 to R6	Resistor, 10 kΩ, 0.063 W, 1%, 0603	FEC 9330399
1	R7	Unpopulated resistor location, keep holes free of solder	Do not insert
1	R8	Resistor, 1.5 Ω, 0.063 W, 1%, 0603	FEC 9330640
1	R9	Resistor, 300 kΩ, 0.063 W, 1%, 0603	FEC 9330992
1	R10	Resistor, 1 MΩ, 0.063 W, 1%, 0603	FEC 9330410
3	R11 to R13	SMD resistor, 0603	Do Not insert
2	R14, R15	Resistor, 100 kΩ, 0.063 W, 1%, 0603	FEC 9330402
10	TP1 to TP10	Black test point	FEC 8731128
1	U1	40-/32-channel, 14-bit DAC	AD5380BSTZ-5/AD5382BSTZ-5
1	U2	2.5 V reference	ADR421ARZ
1	U3	Adjustable LDO regulator	ADP3331ARTZ
1	U4	32k I²C serial EEPROM	FEC 1331330
1	U5	5 V fixed, adjustable voltage regulator	ADP3367ARZ
2	Screw1, Screw2	Screw, cheese, nylon, M3X10, PK100	FEC 7070597
2	Nut1, Nut2	Nut/washer, nylon, M3, PK100	FEC 7061857

[1] FEC is Farnell Electronics Components.

NOTES

I²C refers to a communications protocol originally developed by Philips Semiconductors (now NXP Semiconductors).

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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