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ANALOG DEVICES

EVAL-AD7416/7/8EBZ User Guide
UG-622

Evaluating the AD7416/AD7417/AD7418 10-Bit ADCs with On-Chip Temperature Sensor

FEATURES

Supports the AD7416, AD7417, and AD7418
    10-bit temperature sensors
    AD7417 includes 10-bit, 4-channel ADC
    AD7418 includes 10-bit, single-channel ADC
PC software for control of temperature sensors
Supported operating systems
    Windows XP or Windows 95 (32-bit versions only)

EVALUATION KIT CONTENTS

EVAL-AD7416/7/8EBZ evaluation board (fully fitted PCB
    with USB interface)
Evaluation board CD for the AD7416/AD7417/AD7418
    containing evaluation software, AD7416/AD7417/AD7418
    data sheet, and EVAL-AD7416/7/8EBZ user guide
USB A to mini-B cable

ONLINE RESOURCES

Documents Needed
    AD7416/AD7417/AD7418 data sheet
    EVAL-AD7416/7/8EBZ user guide
Required Software
    AD7416/AD7417/AD7418 evaluation software

GENERAL DESCRIPTION

This user guide describes the EVAL-AD7416/7/8EBZ evaluation board hardware and software and includes detailed schematics and printed circuit board (PCB) layout artwork. This board is a compact, easy to use platform for evaluating all the features of the AD7416, AD7417, and AD7418 temperature sensors.

The EVAL-AD7416/7/8EBZ evaluation board allows the AD7416, AD7417, and AD7418 10-bit analog-to-digital converters (ADCs) with temperature sensor to be quickly and easily evaluated using a PC. Using the evaluation board and its accompanying evaluation software, the AD7416/AD7417/AD7418 can be interfaced to any PC running Windows® 95 or Windows XP. The evaluation software is not currently compatible with 64-bit operating systems.

The evaluation board allows all the input and output functions of the AD7416/AD7417/AD7418 to be exercised without the need for external components. The evaluation software allows control and monitoring of the internal registers of the AD7416/AD7417/AD7418. The software can also be used without the evaluation board to control and monitor AD7416/AD7417/AD7418 devices connected to an SMBus in the PC.

Full specifications for the AD7416/AD7417/AD7418 are available in the AD7416/AD7417/AD7418 data sheet, which should be consulted in conjunction with this user guide when using this evaluation board.
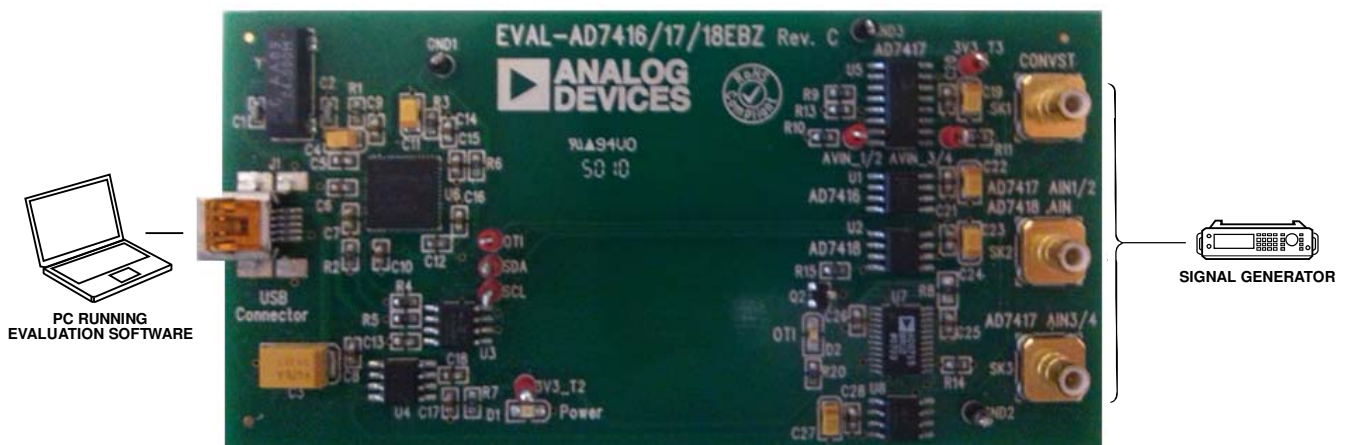
TYPICAL EVALUATION SETUP

Figure 1.

TABLE OF CONTENTS

REVISION HISTORY

12/14—Revision 0: Initial Version

GETTING STARTED

SOFTWARE INSTALLATION PROCEDURES

The EVAL-AD7416/7/8EBZ evaluation kit includes a CD containing software to be installed on your PC before using the evaluation board. The evaluation software is compatible with Windows 95 and Windows XP. The evaluation software must be installed before connecting the evaluation board to the USB port of the PC to ensure that Windows recognizes it and that the driver is installed correctly. To install the software, run the **AD741x Evaluation Software Install.exe** file from the CD.

Installing the Evaluation Software

To install the AD7416/AD7417/AD7418 evaluation software

1. With the evaluation board disconnected from the USB port of the PC, insert the installation CD into the CD drive.
2. Double-click the **AD741x Evaluation Software Install.exe** file to begin the evaluation board software installation. The software is installed to the following default location: **C:\Program Files\Analog Devices\Launch AD741x Evaluation Software**.
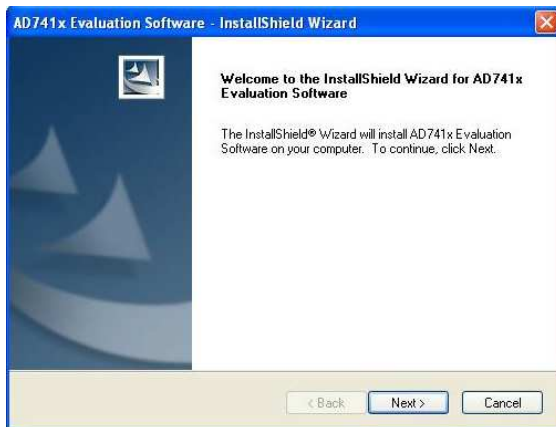3. A dialog box appears asking to start the installation process. Click **Next**.

Figure 2. Evaluation Software Installation: Welcome

4. A license agreement appears. Read the agreement, select **I accept the terms of the license Agreement**, and click **Next**.

Figure 3. Evaluation Software Installation: Accepting the License Agreement

5. When the license agreement is accepted, you will be prompted to begin the installation. Click **Install**.
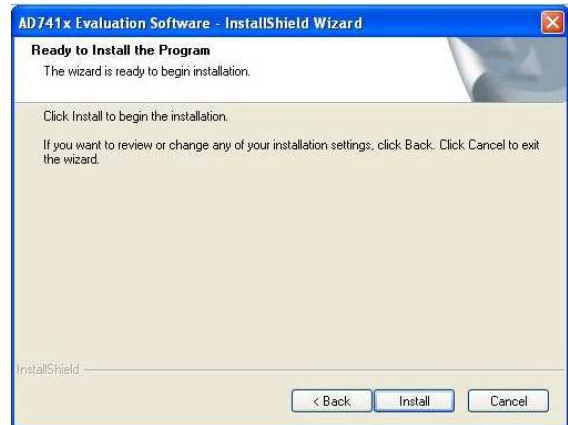

Figure 4. Evaluation Software Installation: Begin the Installation

6. A dialog box informs you when the installation is complete. A restart is required after installation; select whether you want to restart your PC at this time or at a later time. Click **Finish**.

Figure 5. Evaluation Software Installation: Installation Is Complete

EVALUATION BOARD SETUP PROCEDURES

After following the instructions in the Software Installation Procedures section, plug the evaluation board into your PC through the USB cable.

Warning

The evaluation software and drivers must be installed before connecting the evaluation board to the USB port of the PC to ensure that the evaluation system is correctly recognized when it is connected to the PC.

Verifying the Board Connection

1. Allow the **Found New Hardware Wizard** to run after the EVAL-AD7416/7/8EBZ board is plugged into your PC.
2. Check that the evaluation board is connected to the PC correctly using the **Device Manager** of the PC. Access the **Device Manager** as follows:
   a. Right-click **My Computer** and then click **Manage**.
   b. A dialog box may appear asking for permission to allow the program to make changes to your computer. Click **Yes**.
   c. The **Computer Management** box appears. From the list of **System Tools**, click **Device Manager** (see Figure 6).

d. Under **Universal Serial Bus Controllers, Cypress EZ-USB Sample Device** should appear, indicating that the EVAL-AD7416/7/8EBZ driver software is installed and that the board is connected to the PC correctly.
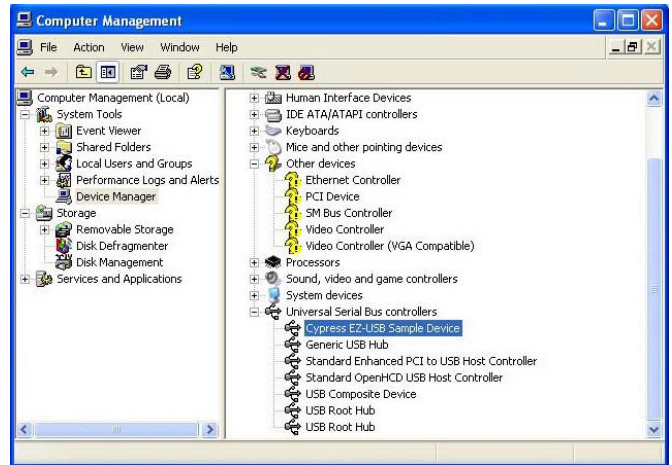

Figure 6. Device Manager: Checking that the Evaluation Board Is Connected to the PC Correctly

EVALUATION BOARD HARDWARE

The EVAL-AD7416/7/8EBZ evaluation board contains the following main components, which can be identified from the block diagram, PCB silkscreen, and schematic diagram of overleaf.

- AD7416, AD7417, and AD7418 ICs
- Power LED
- OTI LED
- CONVST input connector, SK1
- Input connectors, SK2 and SK3

POWER SUPPLIES

The EVAL-AD7416/7/8EBZ is directly supplied through the USB cable connected to J1, and does not require any external power supply.

INPUT SIGNALS

To evaluate the AD7417, which has a 4-channel ADC integrated, use SK2 and SK3 to input the corresponding analog signals. If using the AD7418, because its ADC is single channel, SK2 is used as the analog input. SK2 connects to the single analog input of the AD7418, and to VIN1 and VIN2 of the AD7417. SK3 connects to VIN3 and VIN4 of the AD7417.

SK1 allows user control of the conversion (see the AD7416/AD7417/AD7418 data sheet for more details on CONVST input).

HOW TO USE THE SOFTWARE

STARTING THE SOFTWARE

After completing the steps in the Software Installation Procedures section and Evaluation Board Setup Procedures section, launch the AD7416/AD7417/AD7418 evaluation software as follows:

1. From the **Start** menu, click **Programs** > **Analog Devices** > **Launch AD741x Evaluation Software.** The main window of the software then displays, as shown in Figure 7.
2. If the EVAL-AD7416/7/8EBZ evaluation system is not connected to the USB port when the software is launched, a connectivity error displays. Connect the evaluation system to the USB port of the PC, wait a few seconds, and launch the software again.

When the software starts running, it searches for hardware connected to the PC. A dialog box indicates when the evaluation board attached to the PC is detected, and then the main window appears (see Figure 7).

Figure 7. Evaluation Software Main Window

READ/WRITE

The **Read/Write** tab displays information about the internal registers of the AD7416/AD7417/AD7418, divided into several areas. The **Device** area allows the device type to be selected.
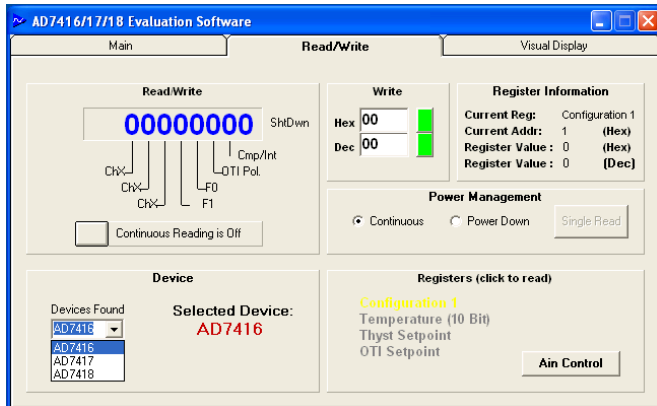

*Figure 8. **Read/Write** Tab*

The **Registers** area allows a register in the device to be selected for display. The available registers vary with the selected device. The AD7416 has only temperature value and overtemperature limit registers. The AD7417 and AD7418 also have an **ADC Value** register, where the result of the conversion is stored. In addition, the T_{OTI} setpoint register (Address 0x03) can be written to set the overtemperature limit by clicking **OTI Setpoint**.

*Figure 9. **Read/Write** Tab for AD7417 or AD7418, **ADC Value** Register Enabled to Read the ADC Conversion Result*

The **Read/Write** area displays the data in the currently selected register in binary format, while the **Register Information** area display the name of the register, its address, and its data contents in hexadecimal and decimal. The device can be set to continuous conversion and reading by clicking the continuous reading button in the **Read/Write** area so that it shows **Continuous Reading is On**. When this button shows **Continuous Reading is Off**, the registers are only updated when a new register is selected.

When the overtemperature limit register is selected, change the register value by clicking on the individual bits to toggle them; alternatively, type a hexadecimal or decimal value in the **Write** area and click the corresponding button. When a new value is entered, the button changes from green to red, and changes back to green when the button is clicked to write the new value to the overtemperature limit register. Note that the overtemperature limit register is only 8 bits, whereas the value registers are 10 bits. For limit comparison, only the 8 MSBs of the temperature value register are compared with the overtemperature limit register; the 2 MSBs are ignored. If the temperature exceeds the set limit, the OTI output of the device goes high.

The device can also be put into power-down mode by selecting **Power Down** in the **Power Management** area. The device can then be made to power up and perform a single conversion by clicking **Single Read** button. If the selected device is the AD7417 or AD7418, the analog inputs can be set up by clicking the **Ain Control** button within the **Registers** area, which calls up a window to enable the analog inputs, select the internal or external reference voltage, and tie the CONVST input to V_{DD} for continuous conversion, or under external control. **Ain Control** is also available from the **Visual Display** tab.
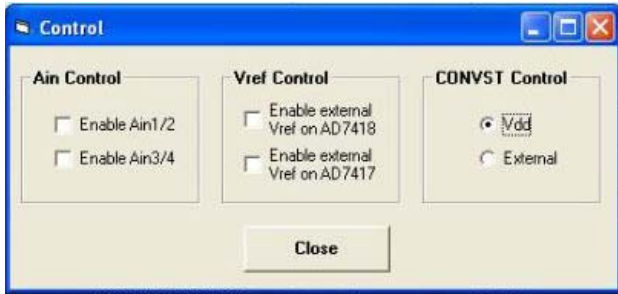
Figure 10. AD7417/AD7418 ADC Control

VISUAL DISPLAY

The **Visual Display** tab allows all the channels of the selected device to be displayed in graphical format. For the AD7416, only temperature is displayed.
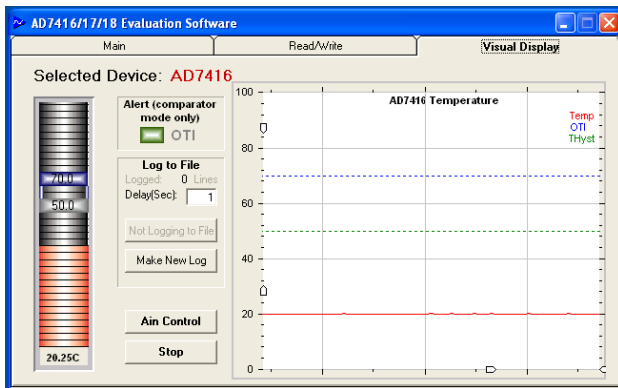

Figure 11. AD7416 Visual Display

For the AD7418, temperature and one analog channel is displayed, while for the AD7417, temperature and four analog channels are displayed. Click the **Easy Setup** button to set the temperature limit to 70°C and the hysteresis to 50°C, and start the graphic display.
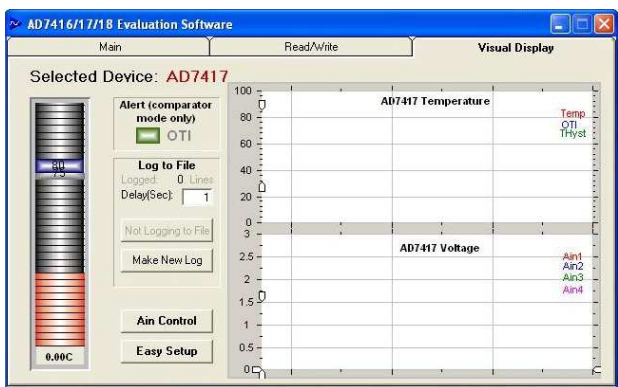

Figure 12. AD7417/AD7418 Visual Display

(Because they are linked on the board, the VIN1 channel is the same as VIN2, and VIN3 is the same as VIN4.) Zoom in or out on the horizontal and vertical axes of the graphic display by moving the arrows on the axes up and down or left and right.

Overtemperature Limit

Set the overtemperature limit and hysteresis using the slider control. The temperature limit and hysteresis are shown on the slider bars, while the actual temperature is shown below the slider. If the temperature exceeds the limit, the OTI alert turns red. The alert turns green again when the temperature falls to the hysteresis value. If OTI is disabled, the alert is invisible.

Data Log

Output data from the device can be logged into an Excel spreadsheet file. To enable this option, enter the update interval in seconds in the **Delay (Sec)** field, and then click **Make New Log**.
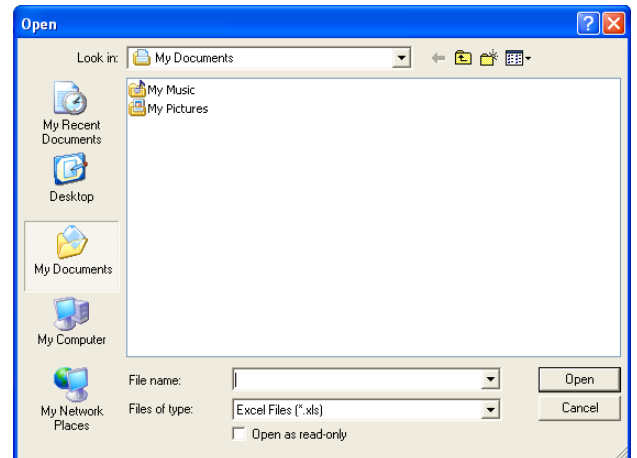

Figure 13. Opening a Data Log File

Select a folder in which to save the data, enter a new file name or select an existing file name into which to save the data, and then click **Open**. If an existing log file is selected, the new data does not overwrite the existing data, but is tagged onto the end. When the data log file is opened, the evaluation software begins to write data to it, and the **Not Logging to File** button changes to **Logging to File**. To end logging, click **Logging to File**, and the button changes to **Not Logging to File**.

When the file is opened in Excel, it contains up to six columns of data:

- Time at which each set of data was logged
- One column of temperature data
- Zero, one, or four columns of analog data
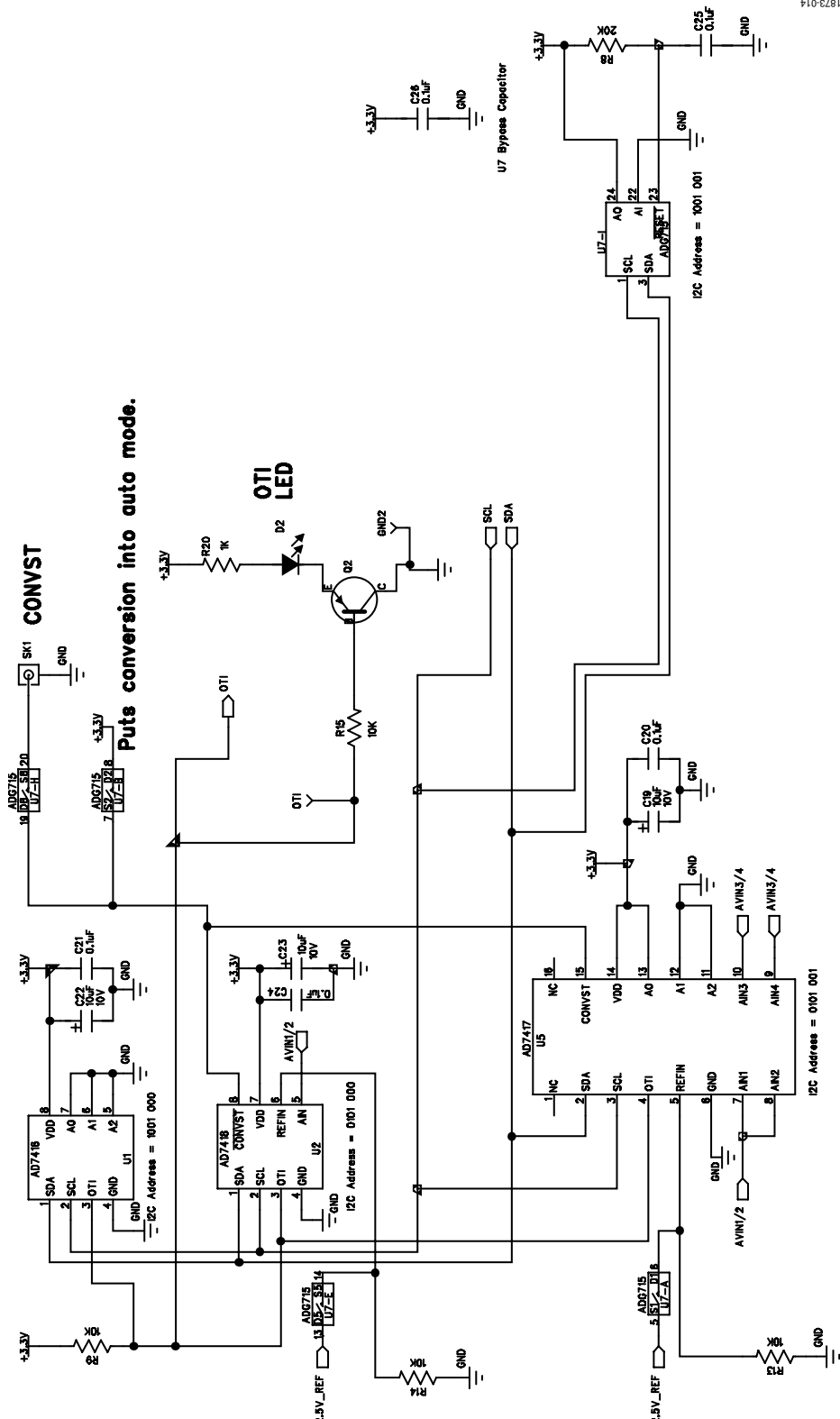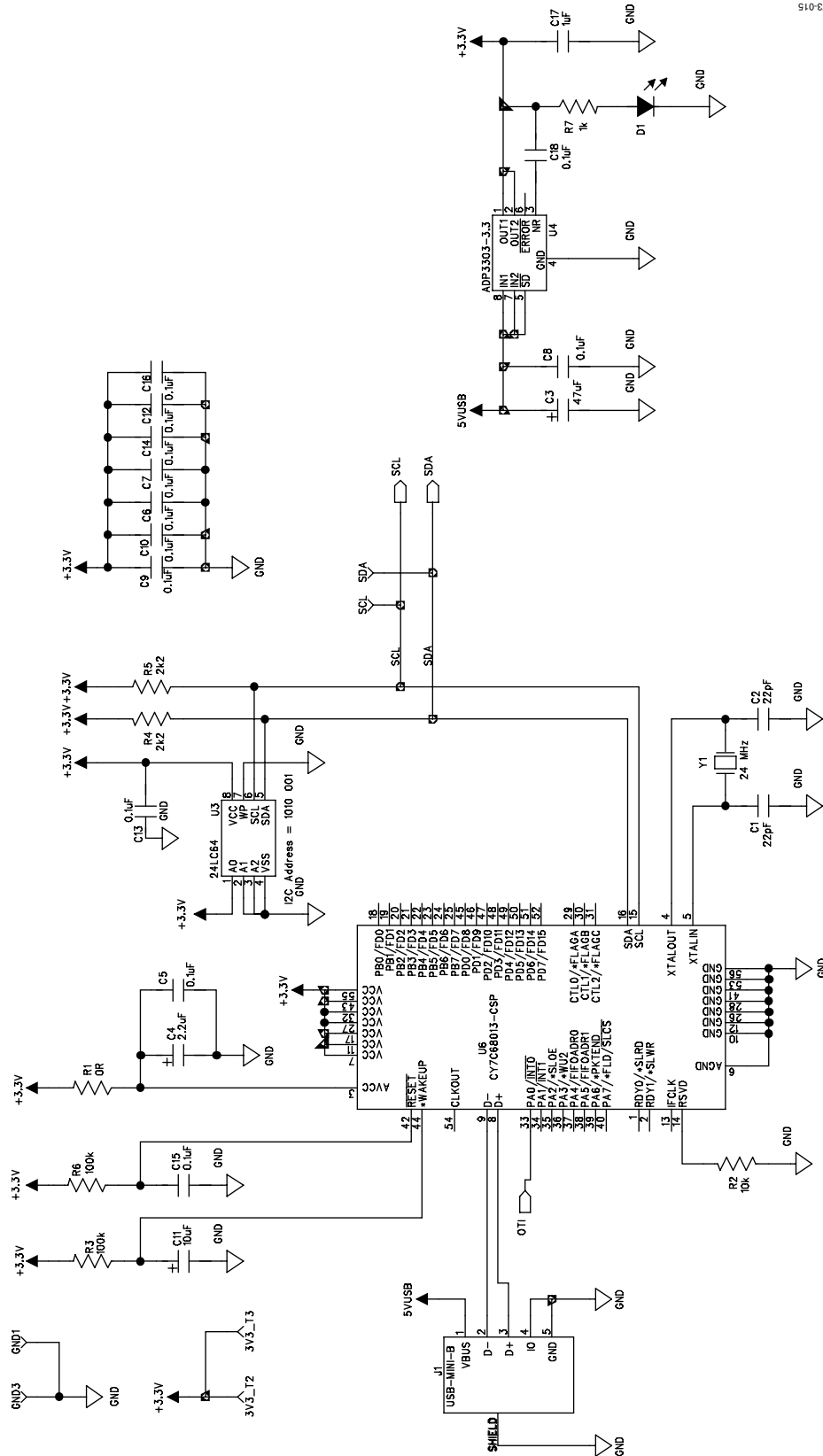
EVALUATION BOARD SCHEMATICS AND ARTWORK

Figure 14. *EVAL-AD7416/7/8EBZ Schematic—AD7416/AD7417/AD7418 Circuit*

Figure 15. *EVAL-AD7416/7/8EBZ Schematic—USB Controller Circuit*

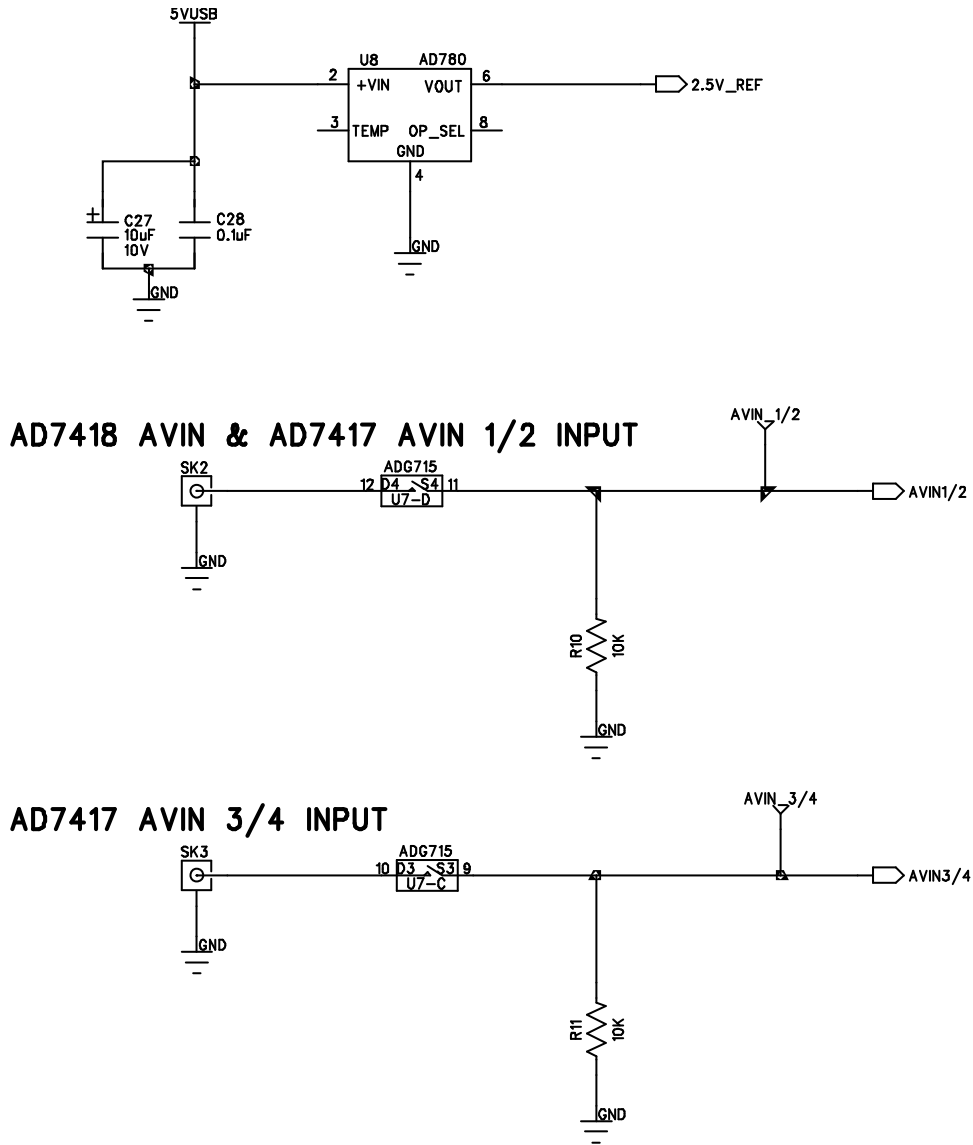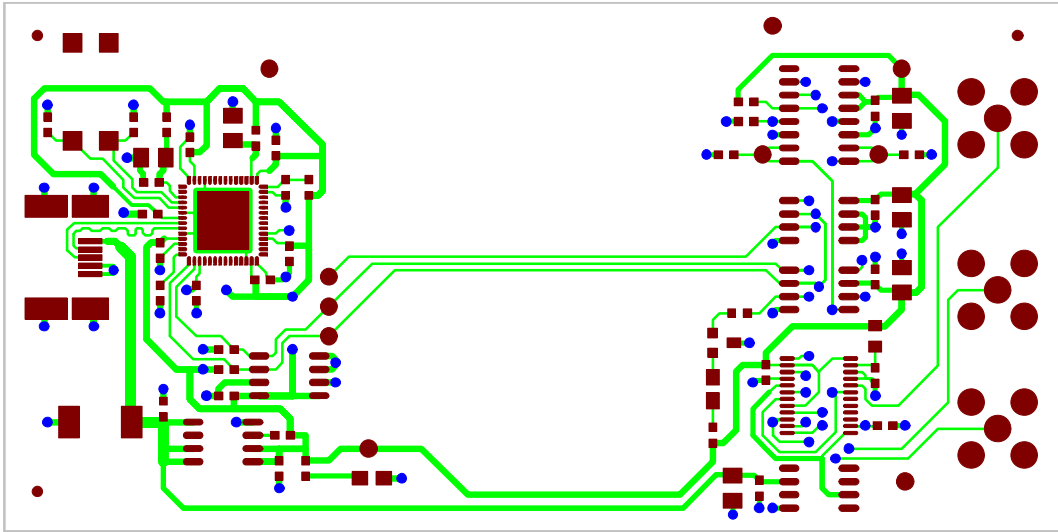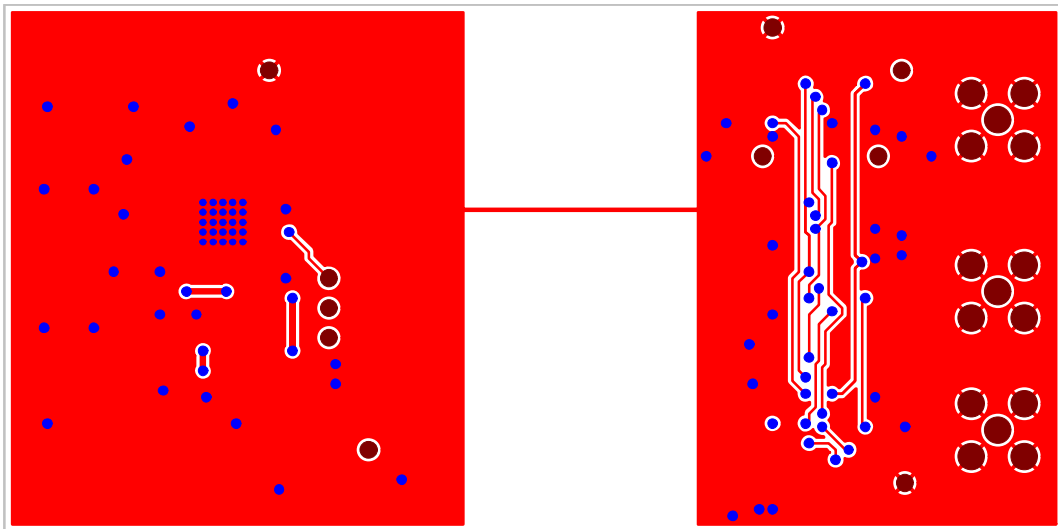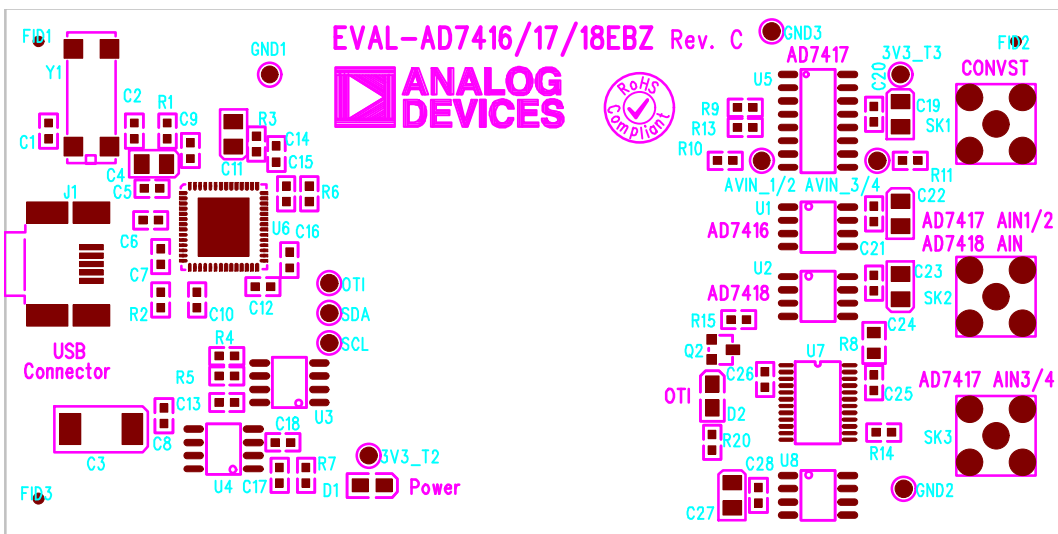*Figure 16. EVAL-AD7416/7/8EBZ Schematic—Analog Inputs Circuit*

Figure 17. EVAL-AD7416/7/8EBZ Board—Component Side (Layer 1)

Figure 18. EVAL-AD7416/7/8EBZ Board—Solder Side (Layer 2)

Figure 19. EVAL-AD7416/7/8EBZ Board—Silkscreen

ORDERING INFORMATION

BILL OF MATERIALS

Table 1.

Qty	Reference Designator	Part Description	Value	Manufacturer	Stock Code
7	3V3_T2, 3V3_T3, AVIN_1/2, AVIN_3/4, OTI, SCL, SDA	Terminal, PCB, red		Vero	FEC 8731144
2	C1, C2	Capacitor, 0603, 22 pF, 50 V	22 pF	Phycomp	FEC 722005
1	C3	Capacitor, Case D, 47 µF, 10 V	47 µF	EPCOS	FEC 9753842
1	C4	Capacitor, Case A, 2.2 µF, 10 V	2.2 µF	AVX	FEC 498646
18	C5 to C10, C12 to C16, C18, C20, C21, C24 to C26, C28	Capacitor, 0603, 100 nF, 25 V	0.1 µF	AVX	FEC 317287
5	C11, C19, C22, C23, C27	Capacitor, Case A, 10 µF, 10 V	10 µF	AVX	FEC 197130
1	C17	Capacitor, 0603, 1 µF, 10 V	1 µF	Phycomp	FEC 3188840
1	D1	LED, green, SMD		Kingbright	FEC 1318243
1	D2	LED, red, SMD		Fairchild Semiconductor	FEC 1021302
3	GND1 to GND3	Terminal, PCB, black		Vero	FEC 8731128
1	J1	Socket, USB mini-AB, SMT		Molex	FEC 9786490
1	Q2	Transistor, PNP, SOT-23		Philips	FEC 1081222
1	R1	Resistor, 0603, 0 Ω	0 Ω	Multicomp	FEC 9331662
7	R2, R9 to R11, R13 to R15	Resistor, 0603, 10 kΩ	10 kΩ	Multicomp	FEC 9330399
2	R3, R6	Resistor, 0603, 100 kΩ	100 kΩ	Multicomp	FEC 9330402
2	R4, R5	Resistor, 0603, 2.2 kΩ	2.2 kΩ	Multicomp	FEC 9330810
2	R7, R20	Resistor, 0603, 1 kΩ	1 kΩ	Multicomp	FEC 9330380
	R8	Resistor, 0603, 20 kΩ	20 kΩ	Multicomp	FEC 9330771
3	SK1 to SK3	Jack, SMB, PCB, 50R		Tyco/Greenpar	FEC1206013
1	U1	AD7416 temperature sensor		Analog Devices	AD7416ARZ
1	U2	AD7418 temperature sensor		Analog Devices	AD7418ARZ
1	U3	IC, SM EEPROM serial 64k		Microchip	FEC 9758070
1	U4	Precision low dropout voltage regulator		Analog Devices	ADP3303ARZ-3.3
1	U5	AD7417 temperature sensor		Analog Devices	AD7417BRZ
1	U6	IC, MCU USB peripheral high speed 56QFN		Cypress Semiconductor	Digikey 428-1669-ND
1	U7	ADG715 CMOS, octal SPST switches		Analog Devices	ADG715BRUZ
1	U8	AD780 2.5 V/3.0 V voltage reference		Analog Devices	AD780ARZ
1	Y1	Crystal, SMD, 24.000000 MHz	24 MHz	AEL	FEC 9509658

RELATED LINKS

Resource	Description
AD7416	Product page, ±1°C 10-bit temperature sensor
AD7417	Product page, ±1°C 10-bit temperature sensor and 4-channel ADC
AD7418	Product page, ±1°C 10-bit temperature sensor and single-channel ADC

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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