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Evaluation Board for the AD7280A Lithium Ion Battery Monitoring System

FEATURES

Full-featured evaluation board for the AD7280A
EVAL-CED1Z compatible
Standalone capability
Various linking options
Daisy chain capability
PC software for control and data analysis when used with the EVAL-CED1Z

GENERAL DESCRIPTION

This user guide describes the evaluation board kit for the AD7280A (EVAL-AD7280AEDZ), which is a complete, 12-bit resolution lithium ion battery monitoring system, integrating multiple voltage and temperature input channels. Full details about the part are available in the AD7280A data sheet from Analog Devices, Inc., which should be consulted in conjunction with this user guide when using the evaluation board.

On-board components include the ADG3308 and ADG3301 bidirectional logic level translators, the ADG849 switch and the ADuM1201, and the ADuM5401 digital isolators.

Various link options and options for external connectors are explained in Table 1, Table 5, and Table 6.

FUNCTIONAL BLOCK DIAGRAM

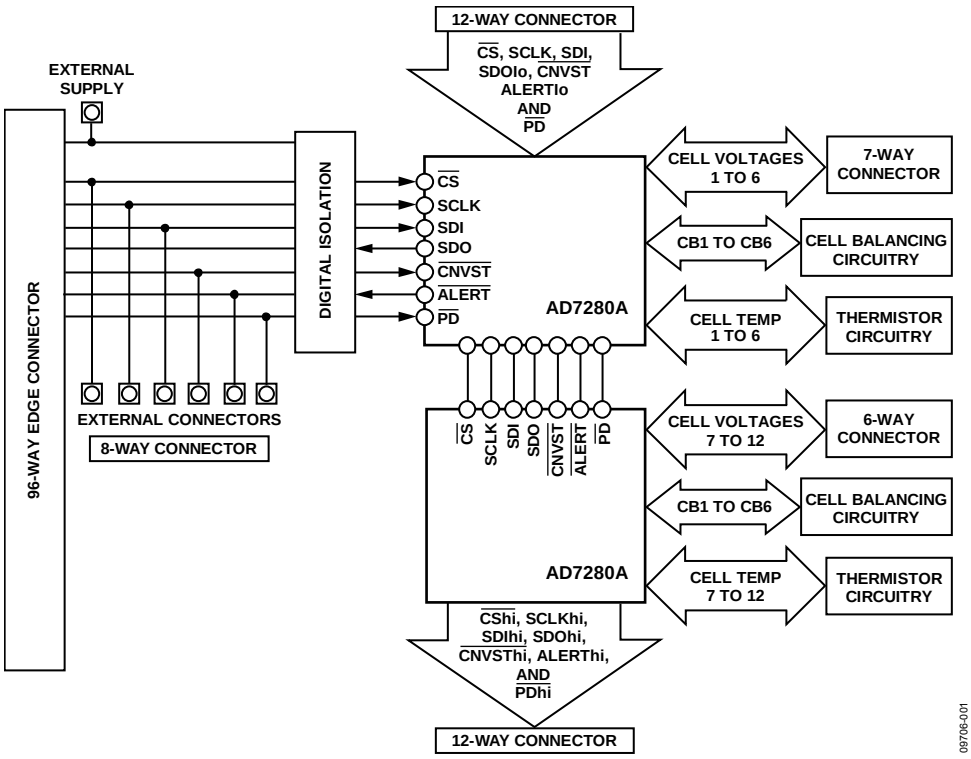


Figure 1.

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REVISION HISTORY

4/11—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

POWER SUPPLIES

When using this evaluation board with the EVAL-CED1Z, all supplies, with the exception of the battery connections, are provided from the EVAL-CED1Z through the 96-way connector. When using the EVAL-AD7280AEDZ board as a standalone unit, external supplies must be provided. This evaluation board has the following four power supply inputs:

- +5 V
- +3.3 V
- DSP/+3V3
- 0 V (DGND)

If the evaluation board is used in standalone mode, 5 V must be connected to the 5 V input to supply the ADG3308, the ADG3301, the ADG849, the ADuM1201, and the ADuM5401. In addition, a suitable voltage should be applied to either the +3.3 V supply pin or the DSP/+3V3 supply pin. This voltage is dependent on the voltage levels of the users external DSP or microprocessor.

The AD7280A evaluation board default is to supply 3.3 V to the +3.3 V supply pin. However, users with an external DSP/microprocessor with voltage levels of either 1.8 V or 5 V should connect the required voltage to the DSP/+3V3 supply pin, remove resistor link R66, and install resistor link R67. Finally, 0 V is connected to the 0 V input.

The 5 V, 3.3 V, and DSP/+3V3 supplies are decoupled to the relevant ground plane with 22 µF tantalum capacitors. The ADG3308, the ADuM1201, and the ADuM5401, are decoupled to the relevant ground plane with 0.1 µF multilayer ceramic capacitors. The ADuM1201 and the ADuM5401 are decoupled to the relevant ground plane with 10 µF tantalum and 0.1 µF multilayer ceramic capacitors.

Power to supply the two AD7280A parts on the evaluation board is taken from the battery inputs. Extensive ground planes are used on this board to minimize the effect of high frequency noise interference. One ground plane, DGND, is provided for the digital input/output, the ADG3308, ADG3301, ADG849, and the low side of the ADuM5401 and ADuM1201 isolator parts. Separate ground planes, isolated from the DGND plane, are provided for each of the AD7280A parts on the evaluation board.

LINK OPTIONS

There are eight link options that must be positioned for the required operating setup before using the evaluation board. The functions of these options are outlined in Table 1.

Table 1. Link Option Functions

Link No.	Function
LK1	Source of the $\overline{CS}$ input signal to the AD7280A. In Position A, the $\overline{CS}$ signal is taken from the externally applied $\overline{CS}$ signal via the J8 SMA socket or the J7 connector. In Position B, the $\overline{CS}$ signal is taken from the CED board via the 96-way connector.
LK2	Source of the SCLK input signal to the AD7280A. In Position A, the SCLK signal is taken from the externally applied $\overline{CS}$ signal via the J9 SMA socket or the J7 connector. In Position B, the SCLK signal is taken from the CED board via the 96-way connector.
LK3	Source of the SDI input signal to the AD7280A. In Position A, the SDI signal is taken from the externally applied $\overline{CS}$ signal via the J10 SMA socket or the J7 connector. In Position B, the SDI signal is taken from the CED board via the 96-way connector.
LK4	Output path of the SDO output signal from the AD7280A. In Position A, the SDO signal is supplied to the J11 SMA socket or to the J7 connector. In Position B, the SDO signal is supplied to the CED board via the 96-way connector.
LK5	Source of the $\overline{CNVST}$ input signal to the AD7280A. In Position A, the $\overline{CNVST}$ signal is taken from the externally applied $\overline{CNVST}$ signal via the J12 SMA socket or the J7 connector. In Position B, the $\overline{CNVST}$ signal is taken from the CED board via the 96-way connector.
LK6	Source of the $\overline{PD}$ input signal to the AD7280A. In Position A, the $\overline{PD}$ signal is taken from the externally applied $\overline{PD}$ signal via the J13 SMA socket or the J7 connector. In Position B, the $\overline{PD}$ signal is taken from the CED board via the 96-way connector.
LK7	Source of the +5 V supply for the EVAL-AD7280AEDZ. In Position A, the +5 V supply is sourced from the evaluation board controller via the 96-way connector. In Position B, the +5 V supply is sourced externally via the J6 connector.
LK8	Source of the +3.3 V supply for the EVAL-AD7280AEDZ. In Position A, the +3.3 V supply is sourced from the evaluation board controller via the 96-way connector. In Position B, the +3.3 V supply is sourced externally via the J6 connector.

SETUP CONDITIONS

Care should be taken before applying power and signals to the evaluation board to ensure that all link positions are as per the required operating mode. There are two different modes in which to operate the evaluation board. The user can operate the evaluation board with the EVAL-CED1Z, or it can be used as a standalone board.

Table 2 shows the position in which all the links are set when the evaluation board is packaged. When the board is shipped, the assumption is that the user will operate with the EVAL-CED1Z board. The links are set so that all power supplies and control signals are supplied by the EVAL-CED1Z.

Table 2. Link Positions on the Packaged EVAL-AD7280AEDZ

Link No.	Position	Function
LK1	B	The logic input to the $\overline{CS}$ pin of the AD7280A is supplied from the EVAL-CED1Z board.
LK2	B	The logic input to the SCLK pin of the AD7280A is supplied from the EVAL-CED1Z board.
LK3	B	The logic input to the SDI pin of the AD7280A is supplied from the EVAL-CED1Z board.
LK4	B	The logic output from the SDO pin of the AD7280A is supplied to the EVAL-CED1Z board.
LK5	B	The logic input to the $\overline{CNVST}$ pin of the AD7280A is supplied from the EVAL-CED1Z board.
LK6	B	The logic input to the $\overline{PD}$ pin of the AD7280A is supplied from the EVAL-CED1Z board.
LK7	A	+5 V is supplied from the EVAL-CED1Z board.
LK8	A	+3.3 V is supplied from the EVAL-CED1Z board.

INTERFACING THE EVALUATION BOARD TO THE EVAL-CED1Z

Interfacing the EVAL-CED1Z board to the evaluation board is via a 96-way connector, J1. The pinout for the J1 connector is shown in Figure 2.

Table 3 provides a description of the pins on the 96-way connector used to interface between the EVAL-CED1Z board and the EVAL-AD7280AEDZ. Table 4 gives the pin designations for the 96-way connector.

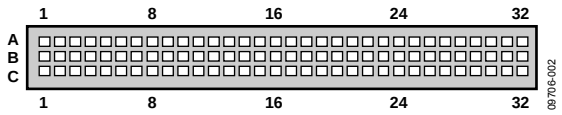


Figure 2. Pin Configuration for the 96-Way Connector, J1

Table 3. 96-Way Connector Pin Description

Signal	Description
TFS	Transmit Frame Sync. This output is connected to the $\overline{CS}$ pin of the AD7280A, via level shift and isolation, to frame the serial data transfer.
RFS	Receive Frame Sync. This input is connected to the TFS pin on the AD7280A evaluation board to frame the serial data read.
TSCLK	Transmit Serial Clock. This output is connected to the SCLK pin of the AD7280A, via level shift and isolation, to clock the serial data transfer.
RSCLK	Receive Serial Clock. This input is connected to the TSCLK pin on the AD7280A evaluation board to frame the serial data read.
DT0PRI	Data Transmit 0 Primary. This output is connected to the SDI pin of the AD7280A via level shift and isolation.
DR0PRI	Data Receive 0 Primary. This input is connected to the SDO pin of the AD7280A via level shift and isolation.
RXINT	Interrupt. This output is connected to the $\overline{CNVST}$ pin of the AD7280A, via level shift and isolation. The $\overline{CNVST}$ signal is used to initiate conversions on the AD7280A.
GPIO 0	General-Purpose Input Output. This output is used to disable the level shift circuitry and to supply the PD signal to the AD7280A.
GPIO 1	General-Purpose Input Output. This output is connected to the ALERT pin of the AD7280A via level shift and isolation.
AV_{CC}	Analog +5 V Supply. This is used to supply the ADuM1201, ADuM5241, ADG3308, ADG3301, and ADG849.
DV_{DD}	Digital +3.3 V supply. This is used to supply the ADG3308 and ADG3301.
DGND	Digital Ground. These lines are connected to the ground plane on the low side of the evaluation board.
AGND	Analog Ground. These lines are connected to the ground plane on the low side of the evaluation board.

Table 4. 96-Way Connector Pin Functions[1]

Pin	ROW A	ROW B	ROW C
1	DTPRI	GPIO3	DR1PRI
2	TFS1		RFS1
3	TSCLK1		RSCLK1
4	DGND	DGND	DGND
5	DT0PRI		DR0PRI
6	TFS0		RFS0
7	TSCLK0		RSCLK0
8	DV_{DD} (+3.3 V)	DV_{DD} (+3.3 V)	DV_{DD} (+3.3 V)
9			
10			
11	DTOSEC		GPIO6
12	DGND	DGND	DGND
13			DROSEC
14	GPIO5		GPIO7
15	GPIO0		GPIO4
16	DGND	DGND	DGND
17			RXINT
18			
19		GPIO1	
20	DGND	DGND	DGND
21	AGND	AGND	AGND
22	AGND	AGND	AGND
23	AGND	AGND	AGND
24	AGND	AGND	AGND
25	AGND	AGND	AGND
26	AGND	AGND	AGND
27		AGND	
28		AGND	
29	AGND	AGND	AGND
30	−12 V	AGND	+12 V
31	AV_{SS} (−5 V)	AV_{SS} (−5 V)	AV_{SS} (−5 V)
32	AV_{CC} (+5 V)	AV_{CC} (+5 V)	AV_{CC} (+5 V)

[1] The unused pins of the 96-way connector are not shown.

OPERATING WITH THE EVAL-CED1Z BOARD

The evaluation board can be operated in a standalone mode or operated in conjunction with the EVAL-CED1Z board. This evaluation board controller is available from Analog Devices under the order entry EVAL-CED1Z. When interfacing the EVAL-AD7280AEDZ directly to the EVAL-CED1Z board, all supplies, with the exception of the battery connections, and control signals to operate the AD7280A board are provided by the EVAL-CED1Z board.

Software to communicate with the EVAL-CED1Z and AD7280A is provided with the AD7280A evaluation board package. The 96-way connector on the EVAL-AD7280AEDZ plugs directly into the 96-way connector on the EVAL-CED1Z board.

The EVAL-CED1Z board provides all the supplies for the evaluation board. It is powered from a +7 V, 15 W power supply that accepts input voltages from 100 V to 240 V ac and contains the relevant adaptors for worldwide use. The power supply is provided with the EVAL-CED1Z.

Connection between the EVAL-CED1Z and the USB port of a PC is via a standard USB 2.0 connection cable that is provided as part of the EVAL-CED1Z package.

INTERFACING TO THE EVALUATION BOARD IN STANDALONE OPERATION

Options for interfacing with the evaluation board are via J1, the 96-way connector to the EVAL-CED1Z board, or via J7, an 8-way connector. The J7 connector is provided to allow the evaluation board to be interfaced with systems other than the Analog Devices EVAL-CED1Z board.

The pin designations for the J7 connector are shown in Table 5. Note that the AD7280A evaluation board is shipped with the assumption that the user will be operating with the EVAL-CED1Z board. For this reason, the J7 connector is not inserted.

Table 5. Pin Designations for 8-Way Connector J7

Pin No.	Function
1	$\overline{CS}$
2	SCLK
3	SDI
4	SDO
5	$\overline{CNVST}$
6	ALERT
7	$\overline{PD}$
8	GND

SOCKETS

There are five input sockets and one output socket relevant to the operation of the AD7280A on the evaluation board. The functions of these sockets are outlined in Table 6. These sockets are used to apply externally generated digital input/output signals to the evaluation board. When operating the board with the EVAL-CED1Z board, these external connections are not required.

Note that the AD7280A evaluation board is shipped with the assumption that the user will be operating with the EVAL-CED1Z board. For this reason, the sockets J8 to J13 are not inserted.

Table 6. Sockets

Socket	Function
J8	SMA socket for external $\overline{CS}$ input.
J9	SMA socket for external SCLK input.
J10	SMA socket for external SDI input.
J11	SMA socket for external SDO output
J12	SMA socket for external $\overline{CNVST}$ input.
J13	SMA socket for external $\overline{PD}$ input.

CONNECTORS

There are ten connectors on the AD7280A evaluation board. The functions of these connectors are outlined in Table 7. Connector J1 is used to interface with the EVAL-CED1Z board. Connectors J2 and J3 are used to connect the AD7280As to the battery cells. Connectors J1, J2, and J3 are inserted on the AD7280A evaluation board when the board is packaged. The remaining connectors, J4 to J7 and J14 to J16, are not inserted.

Table 7.

Connector	Function
J1	96-way connector for CED interface connections
J2	7-way connector for 6 Li-Ion battery cells
J3	6-way connector for additional 6 Li-Ion battery cells
J4	8-way connector for 6 thermistor inputs
J5	8-way connector for 6 additional thermistor inputs
J6	External 5 V, 3.3 V, DSP/3V3, and GND power connector
J7	8-way connector external DSP/microprocessor operation
J14	6-way connector, reserved for Analog Devices test requirements
J15	External 12-way connector to allow daisy-chaining of evaluation boards
J16	External 12-way connector to allow daisy-chaining of evaluation boards

DAISY-CHAINING TWO OR MORE AD7280A EVALUATION BOARDS

The AD7280A evaluation board includes two connectors, J15 and J16, which allow two or more AD7280A evaluation boards to be daisy-chained together. A connection should be made between J16 on the evaluation board connected to the DSP/microprocessor, measuring voltage on battery cells 1 through 12, and connector J15 on the evaluation board connected to battery cells 13 through 24.

The default setting of each AD7280A evaluation board is for the master pin on Device 0 to be tied to V_{DD} through a 10 kΩ resistor, R88. Each board also includes an option to solder a resistor, R89, from the master pin to V_{SS}. When daisy-chaining two or more evaluation boards, the R88 resistor on slave boards should be removed and a 10 kΩ resistor should be included in the R89 footprint. The pin designations for the J15 and J16 connectors are shown in Table 8 and Table 9.

Table 8. Pin Designations for 12-Way Connector J15

Pin No.	Function
1	GND
2	GND
3	$\overline{PD}$
4	$\overline{CS}$
5	SCLK
6	SDI
7	$\overline{CNVST}$
8	SDO
9	ALERT
10	GND
11	GND
12	GND

Table 9. Pin Designations for 12-Way Connector J16

Pin No.	Function
1	V_{DD}
2	V_{DD}
3	$\overline{PDhi}$
4	$\overline{CShi}$
5	SCLKhi
6	SDOhi
7	$\overline{CNVSThi}$
8	SDIhi
9	ALERThi
10	V_{DD}
11	V_{DD}
12	V_{DD}

TEST POINTS

There are numerous test points on the AD7280A evaluation board. These enable the user to have easy access to these signals for probing, evaluation, and debugging.

EVALUATION BOARD SOFTWARE

INSTALLING THE SOFTWARE

The EVAL-AD7280AEDZ evaluation kit includes self-installing software on a CD ROM for controlling and evaluating the performance of the AD7280A when it is operated with the EVAL-CED1Z board. If the setup file does not run automatically, setup.exe can be run from the CD-ROM.

When the CD is inserted into the PC, an installation program automatically begins. This program installs the evaluation software. The user interface on the PC is a dedicated program written especially for the AD7280A when operating with the EVAL-CED1Z board.

The software should be installed before the USB cable is connected between the EVAL-CED1Z and the PC. This ensures that the appropriate USB driver files have been properly installed before the EVAL-CED1Z is connected to the PC.

When the software is run for the first time with the EVAL-CED1Z board connected to the PC, the PC automatically finds the new device and identifies it.

Follow the on-screen instructions that appear automatically to install the drivers for the EVAL-CED1Z board on the PC. If an error appears when the software is opened, the PC does not recognize the USB device. This error is corrected by

1. Opening the Device Manager. The Device Manager is accessed by right clicking on the **My Computer** icon, and selecting **Properties**. When the **System Properties** Window opens, select the **Hardware** tab.
2. Click on **Device Manager** in the **Hardware** tab of the System Properties window.
3. Examine the devices listed under the **Universal Serial Bus Controller** heading.
4. If an unknown device is listed, right-click this option and select **Update Driver**.
5. The **New Hardware Wizard** runs twice, and under the **ADI Development Tools** the following hardware is listed: **ADI Converter Evaluation and Development Board (WF)**
6. Reboot the PC.

SETTING UP THE EVAL-CED1Z

This section describes how the evaluation board, the EVAL-CED1Z board, and the software should be set up to begin using the complete system.

- Install the AD7280A evaluation board software.
- Connect the AD7280A evaluation board to the battery via connectors J2 and J3.
- Connect the EVAL-CED1Z board and the evaluation board together via the 96-way connector. Apply power to the EVAL-CED1Z via the +7 V, 15 W power supply provided. At this stage, the green LED labeled Power on the EVAL-CED1Z should be lit, which indicates that the EVAL-CED1Z is receiving power.
- Connect the USB cable between the PC and the EVAL-CED1Z. A green LED positioned beside the USB connector on the EVAL-CED1Z board lights up, indicating that the USB connection has been established.
- The EVAL-AD7280AEDZ is detected. Proceed through any dialog boxes that may appear (use the recommended options) to finalize the installation.
- Start the EVAL-AD7280AEDZ software. The FPGA code is automatically downloaded to the EVAL-CED1Z. The red LED, D14, on the EVAL-CED1Z is now lit. This indicates that the EVAL-CED1Z is functional and ready to receive instructions.
- The software can now be operated.

When completing conversions on the AD7280A evaluation board using the EVAL-CED1Z board, the red LED, D14, on the EVAL-CED1Z lights up to indicate that the conversions are occurring.

SOFTWARE OPERATION

With the hardware set up, you can now use the software to control the EVAL-CED1Z and the AD7280A evaluation board. To launch the software, from the **Analog Devices** menu, click the **AD7280A** submenu, then click on the AD7280A icon.

Figure 3 displays the main window. If an error message appears, click **OK** and restart the application after checking the connection between the adapter board and the USB port on the PC. Also, check that the USB device is identified by the Device Manager as detailed in the Installing the Software section.

The software that controls the EVAL-CED1Z and, therefore, the AD7280A evaluation board has one main window. Figure 3 shows the window that appears when the software runs. The main function of this window is to allow you to read samples from the evaluation board and display them. The screen can be divided into three main sections as follows:

- Menu bar
- Control buttons
- Data capture display

USING THE SOFTWARE

Menu Bar

The menu bar consists of the following menus:

Save (Conversion Data). Saves the conversion data to a spreadsheet file.

Print Front Panel Picture. Prints the software screen displayed.

Save as Picture. Saves the displayed screen plot, that is, voltage or VT waveforms.

Exit. Closes the AD7280A evaluation software.

Control Buttons

The AD7280A software includes the following user-controlled buttons on the front panel:

Single AD7280A Eval Board/2 AD7280A Eval Boards. This drop-down menu selects whether the EVAL-CED1Z interfaces to a single AD7280A evaluation board or to two daisy-chained AD7280A evaluation boards.

Initialize. Resends the AD7280A FPGA code to the EVAL-CED1Z and writes to all the AD7280A devices in the chain to set up their device addresses correctly.

Real Time. Initiates continuous conversions on the AD7280A evaluation board. The default conversion loop interval is 2 ms and can be changed by accessing the **Configure AD7280A** button.

Read/Write Registers. Allows the user to read from and write to the registers on both AD7280As on the evaluation board. Figure 4 shows the window that appears when this button is pressed.

Configure AD7280A. Allows the user to configure the number of voltage and temperature channels converted and read back on each AD7280A on the evaluation board; also allows the user to set up averaging and acquisition time, specify the SCLK frequency, and set the conversion loop interval. Figure 5 shows the window that appears when this button is pressed.

Software Reset. Executes a software reset on all AD7280As on the evaluation board.

Software PD. Places all AD7280A devices into software power-down mode.

Self Test. Allows the user to execute the self-test functionality on any AD7280A device on the board.

Hardware PD. Places all AD7280A devices into hardware power-down mode. This button must be pressed again in order to power up the devices again.

STOP. Closes the AD7280A evaluation software.

Other items are also included on the front panel, such as the **CED Buffer** indicator. The AD7280A evaluation board allows conversions on all or selected channels to be initiated at periodic intervals. The default conversion loop interval is 2 ms, but can be increased to 5 ms, 10 ms, or 30 ms through the **Configure AD7280A** button.

The AD7280A evaluation software and hardware are designed such that all conversion results are written to external memory on the EVAL-CED1Z, and blocks of samples are then uploaded through the USB port to the PC. The CED buffer indicator provides an indication of the available memory remaining. If there is a lot of activity on the USB port, the transfer of data may be slowed down, which may cause the external memory to fill before the data can be uploaded to the PC. In this case, the CED buffer indicator shows that the buffer is full. The user should either disconnect other external devices which may be using the USB port, or increase the conversion loop interval to decrease the number of samples to upload to ease the requirement on the USB port. Note that the transfer of data from the EVAL-CED1Z to the PC is slower when connecting to a USB 1.1 port then it is when connecting to a USB 2.0 port.

Underneath the CED buffer indicator there are two CRC indicators. The numeric displays the number of CRC errors that have occurred to date for the particular data capure. The light flashes each instant that a CRC error occurs.

Data Capture Display

In the data capture display, the user can select the format to view the cell voltage or cell temperature conversion results. For both cell voltage and temperature conversions, the data can be displayed either in digital output code format or as an equivalent voltage.

The desired display options are selected by clicking the **Voltage(Codes)**, **Voltage(Volts)**, V**T output(Codes),** and V**T output (Volts)** tab buttons. If a second EVAL-AD7280AEDZ evaluation board is connected, there is a seperate set of tabs for the results from this board.

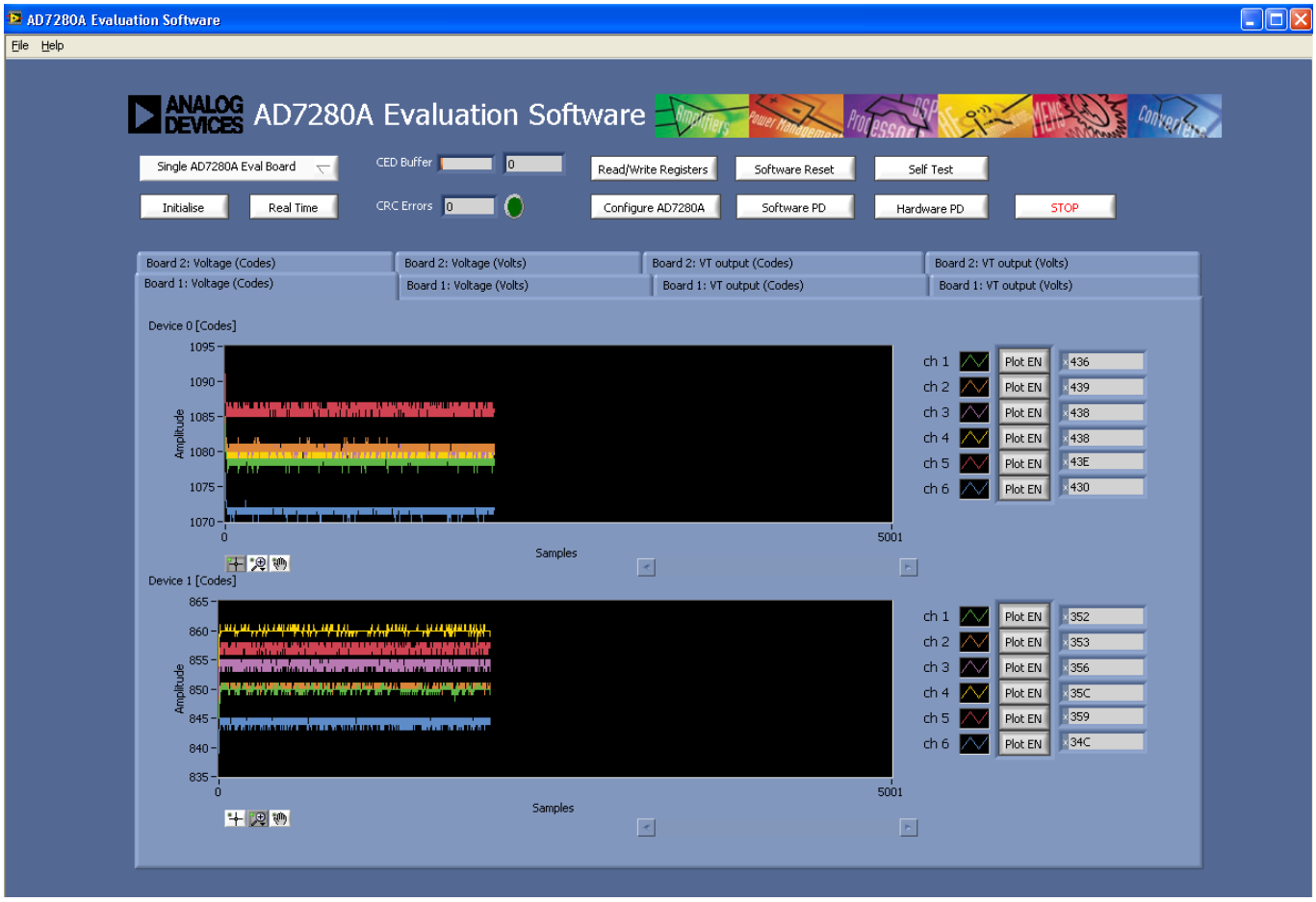


Figure 3. AD7280A Main Window

Voltage(Codes) Tab

The **Voltage(Codes)** tab displays the conversion results of the VIN inputs of the two AD7280A devices on each AD7280A evaluation board. The conversion results are displayed, on the running chart, as integer code values.

The upper chart refers to the conversion results from Device 0 or Device 2 on the AD7280A evaluation board. The lower chart refers to the conversion results from Device 1 or Device 3. The instantaneous value of each conversion result is displayed, in hexadecimal format, on the individual indicators to the right of each chart. If the user would like to focus only on the results of certain channels, the conversion results input to the chart from the remaining channels may be individually removed from the plot using the **Plot EN** buttons to the right of each chart.

At the bottom left of the graph are the zoom options. These allow you to zoom in and out to get a closer look at a sample, if required.

Voltage(Volts) Tab

The **Voltage(Volts)** tab displays the conversion results of the VIN inputs of the two AD7280A devices on each AD7280A evaluation board. The conversion results are displayed on the running chart in units of voltage. Note that the voltage output is calculated using an LSB size of 977 μV, that is, 4 V/4096 and offset by 1 V to allow for the 1 V to 5 V input range specified on the AD7280A cell voltage measurement channels.

The upper chart refers to the conversion results from Device 0 or Device 2 on the AD7280A evaluation board. The lower chart refers to the conversion results from Device 1 or Device 3. The instantaneous value of each conversion result is displayed, in voltage format, on the individual indicators to the right of each chart. If the user would like to focus only on the results of certain channels, the conversion results input to the chart from the remaining channels can be individually removed from the plot using the **Plot EN** buttons to the right of each chart.

At the bottom left of the graph are the zoom options. These allow you to zoom in and out to get a closer look at a sample, if required.

VT output (Codes) Tab

The **VT output (Codes)** tab displays the conversion results of the VT inputs of the two AD7280A devices on each AD7280A evaluation board. The conversion results are displayed on the running chart as integer code values.

The upper chart refers to the conversion results from Device 0 or Device 2 on the AD7280A evaluation board. The lower chart refers to the conversion results from Device 1 or Device 3. The instantaneous value of each conversion result is displayed in hexadecimal format on the individual indicators to the right of each chart. If the user would like to focus only on the results of certain channels, the conversion results input to the chart from the remaining channels can be individually removed from the plot using the **Plot EN** buttons to the right of each chart.

At the bottom left of the graph are the zoom options. These allow you to zoom in and out to get a closer look at a sample, if required.

VT output (Volts) Tab

The **VT output (Volts)** tab displays the conversion results of the VT inputs of the two AD7280A devices on each AD7280A evaluation board. The conversion results are displayed on the running chart in units of voltage. Note that the voltage output is calculated using an LSB size of 1.22 mV, that is 5 V/4096.

The upper chart refers to the conversion results from Device 0 or Device 2 on the AD7280A evaluation board. The lower chart refers to the conversion results from Device 1 or Device 3. The instantaneous value of each conversion result is displayed in hexadecimal format on the individual indicators to the right of each chart. If the user would like to focus only on the results of certain channels, the conversion results input to the chart from the remaining channels can be individually removed from the plot using the **Plot EN** buttons to the right of each chart.

At the bottom left of the graph are the zoom options. These allow you to zoom in and out to get a closer look at a sample, if required.

TAKING SAMPLES

Initiating Conversions

To initiate conversions and capture the sample data, click the **Real Time** button. When you click the **Real Time** button, the software instructs the EVAL-CED1Z board to continuously initiate conversions and read back the conversion data from the AD7280A evaluation board.

The AD7280A evaluation board allows conversions on all or selected channels to be initiated at periodic intervals. The default conversion loop interval is 2 ms, but this can be increased to 5 ms, 10 ms, or 30 ms through the **Configure AD7280A** button. The samples taken are then uploaded and displayed on the **Data Capture** tabs. To stop conversions, click the **Real Time** button again

Reading From and Writing to Registers

To read from and write to the registers on the two AD7280A devices on the AD7280A evaluation board, click the **Read/Write Registers** button.

When you click the **Read/Write Registers** button, the software instructs the EVAL-CED1Z board to read the data in each of the AD7280A registers and displays this information on the screen, as shown in Figure 4.

The register data for Device 0 is on the top left of the screen, the register data for Device 1 is on the top right, the register data for Device 2 is on the bottom left of the screen and the register data for Device 3 is on the bottom right of the screen. The register data is presented in binary format.

To change the settings of any of the displayed registers, overwrite the displayed binary value with the new value and then click the **Update** button. Note that one or all of the registers can be written to with a single update.

CONFIGURING THE AD7280A EVALUATION BOARD

The default configuration of the AD7280A on power-up converts on all voltage and VT channels following a convert start request. The AD7280A allows the option of converting and reading back conversion data from

- 6 voltage and 6 VT channels
- 6 voltage and 3 VT channels
- 6 voltage channels only

The user can select the desired configuration by clicking the **Configure AD7280A** button. Clicking this button opens a new window (see Figure 5), which allows the numbers of channels to convert and read back to be selected using the pull-down menus.

This window also provides a pull-down menu to allow you to select which averaging to use for the conversions as well as to select the acquisition time, the conversion loop interval, and the SCLK frequency for the data capture.

Increasing the conversion loop interval is recommended in the event that activity on the USB port is slowing down the transfer of data from the EVAL-CED1Z board to the PC. For more information, refer to the Using the Software section.

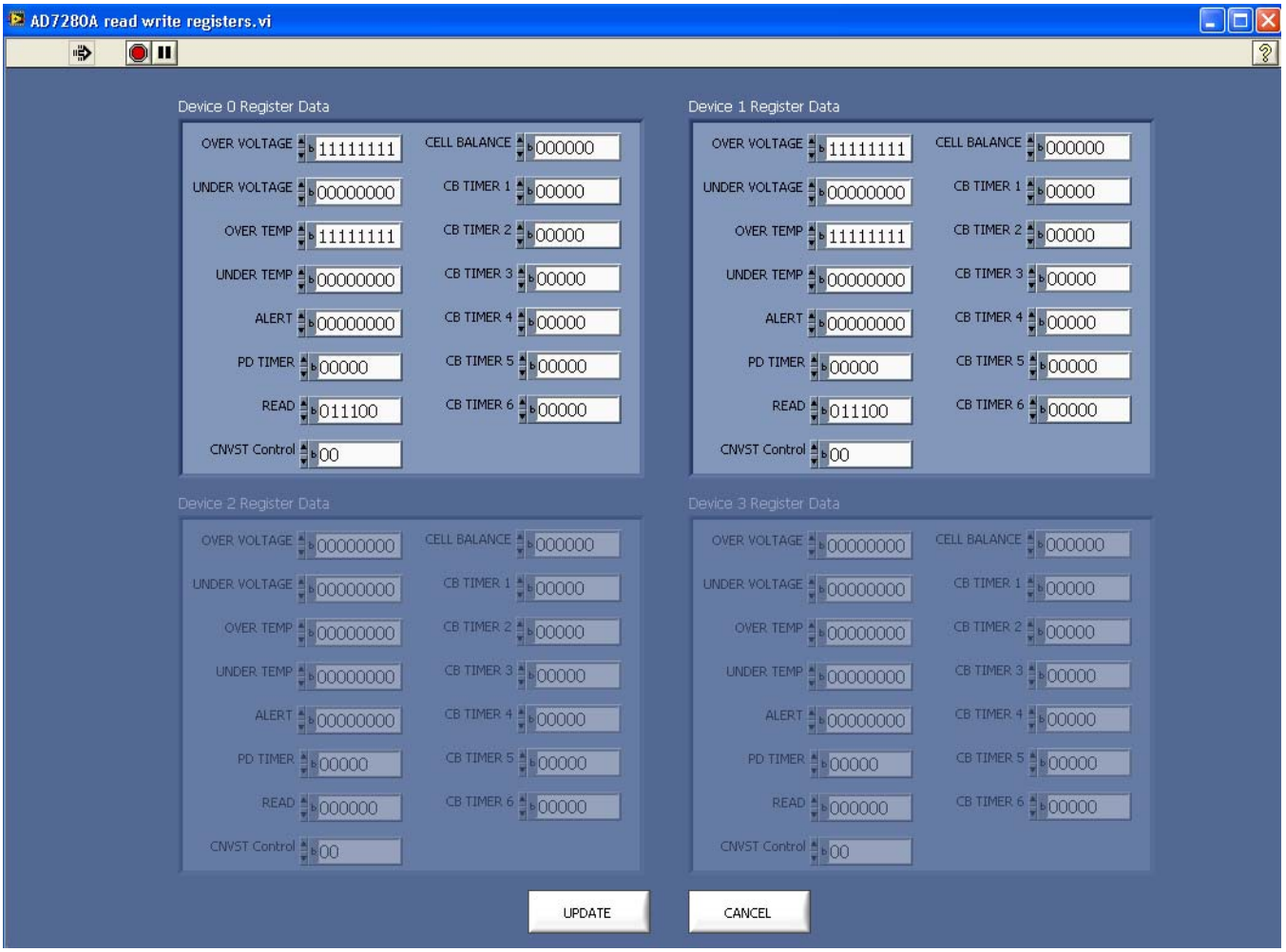


Figure 4. AD7280A Read/Write Register Window

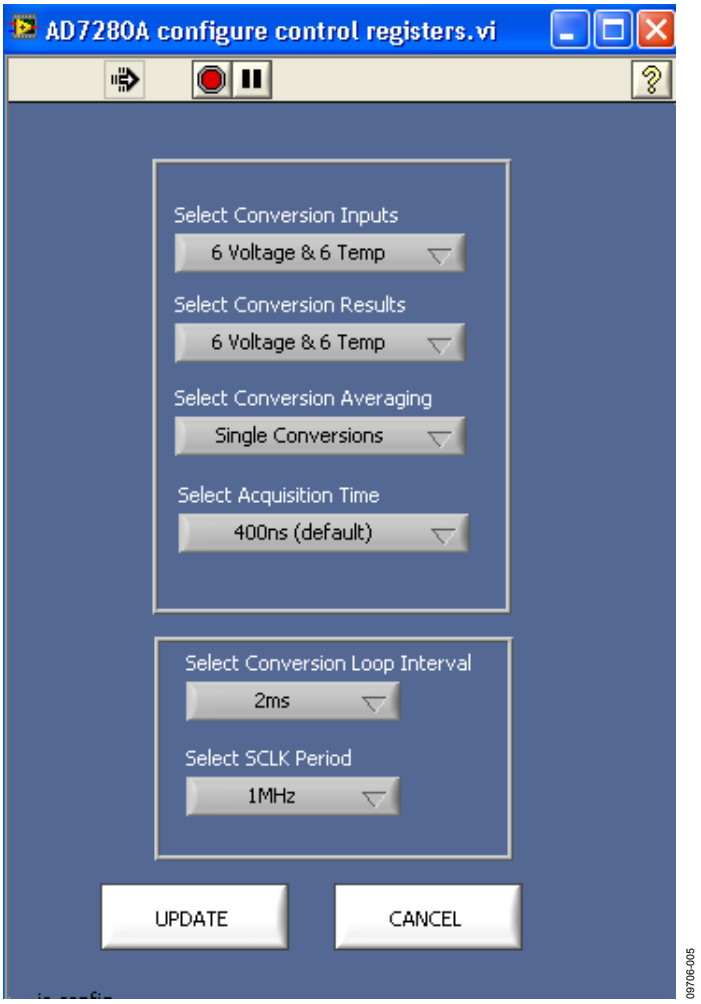


Figure 5. Configure AD7280A Window

EVALUATION BOARD SCHEMATICS AND ARTWORK

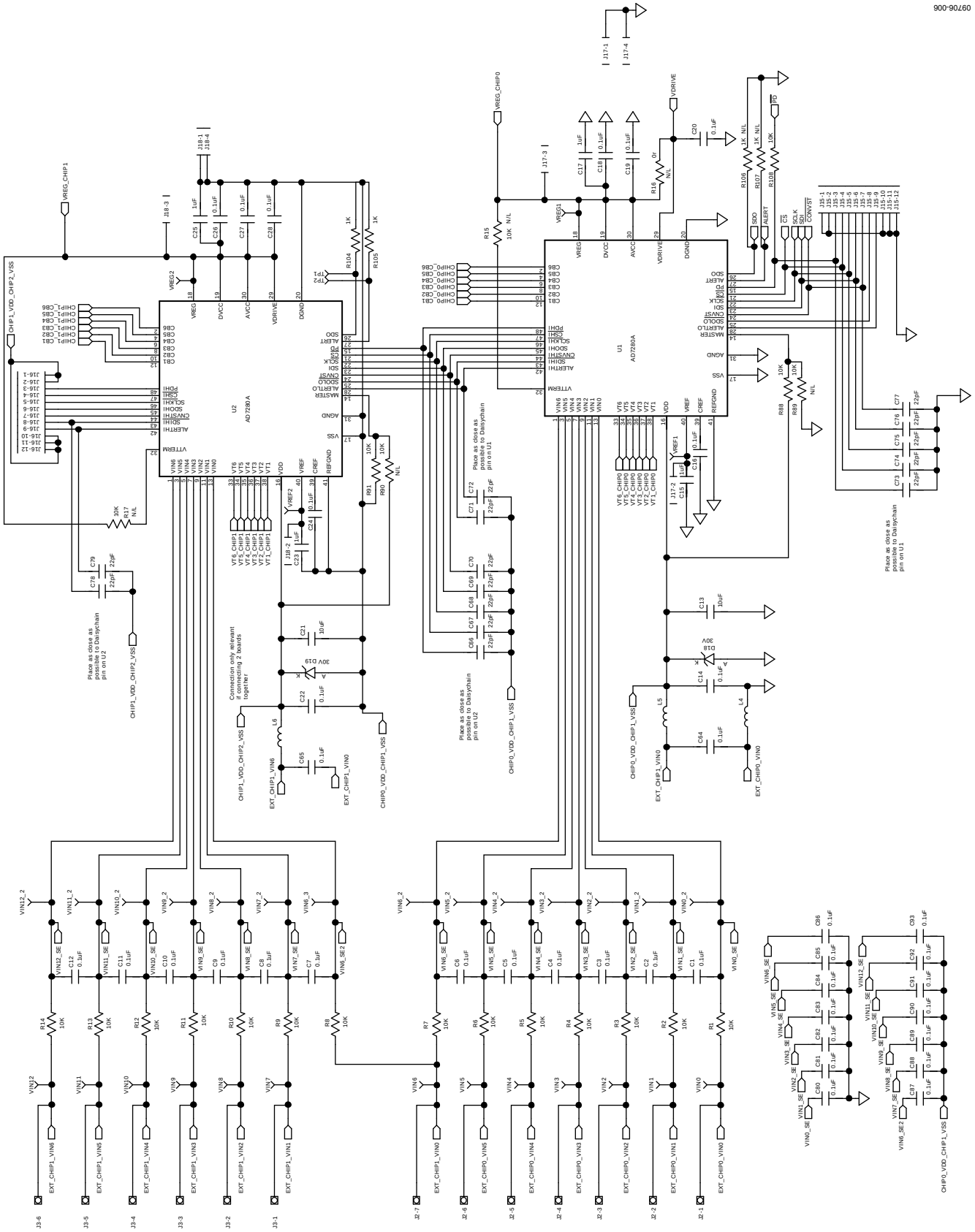


Figure 6. EVAL-AD7280AEDZ Schematic—Page 1

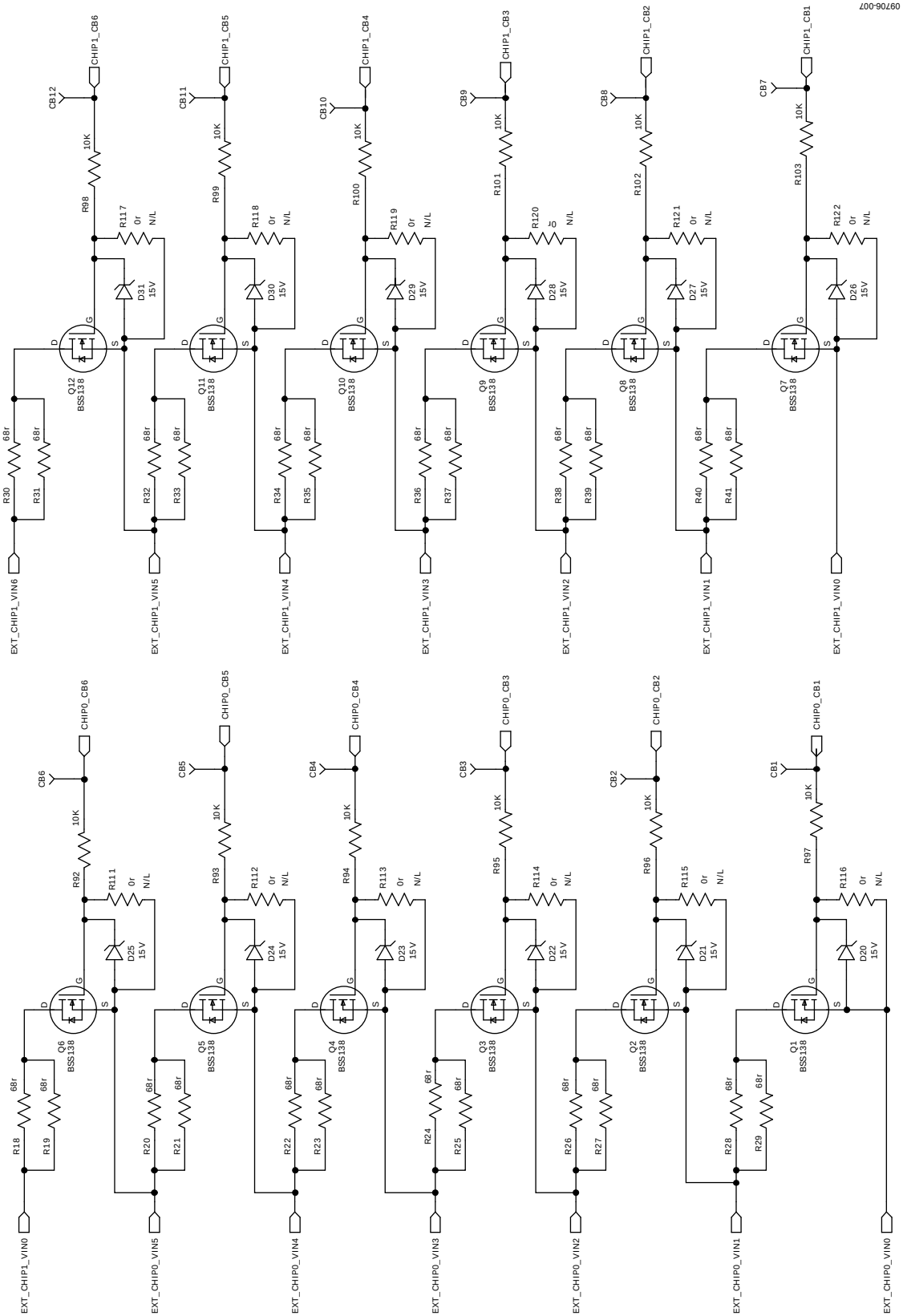


Figure 7. EVAL-AD7280AEDZ Schematic—Page 2

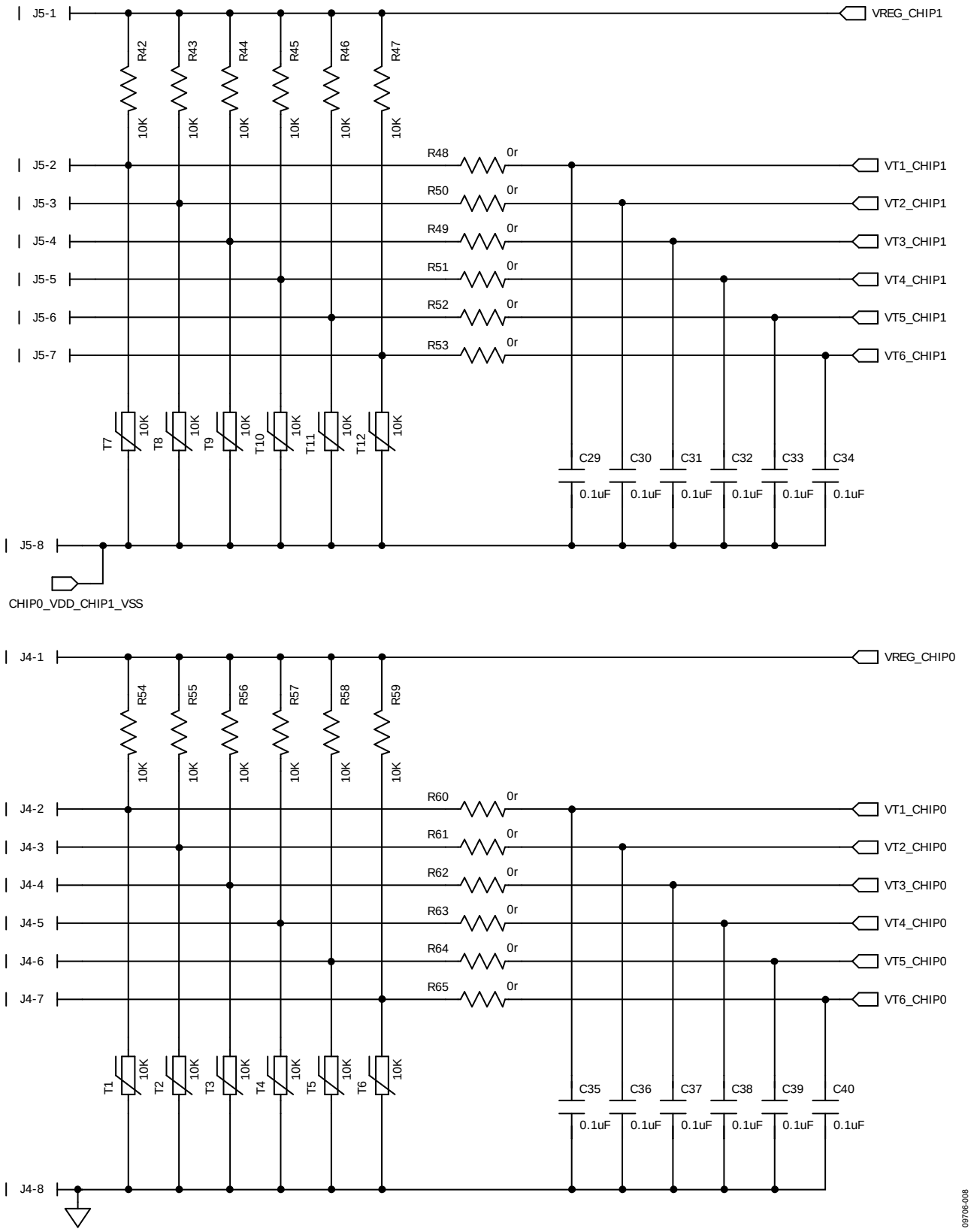


Figure 8. EVAL-AD7280AEDZ Schematic—Page 3

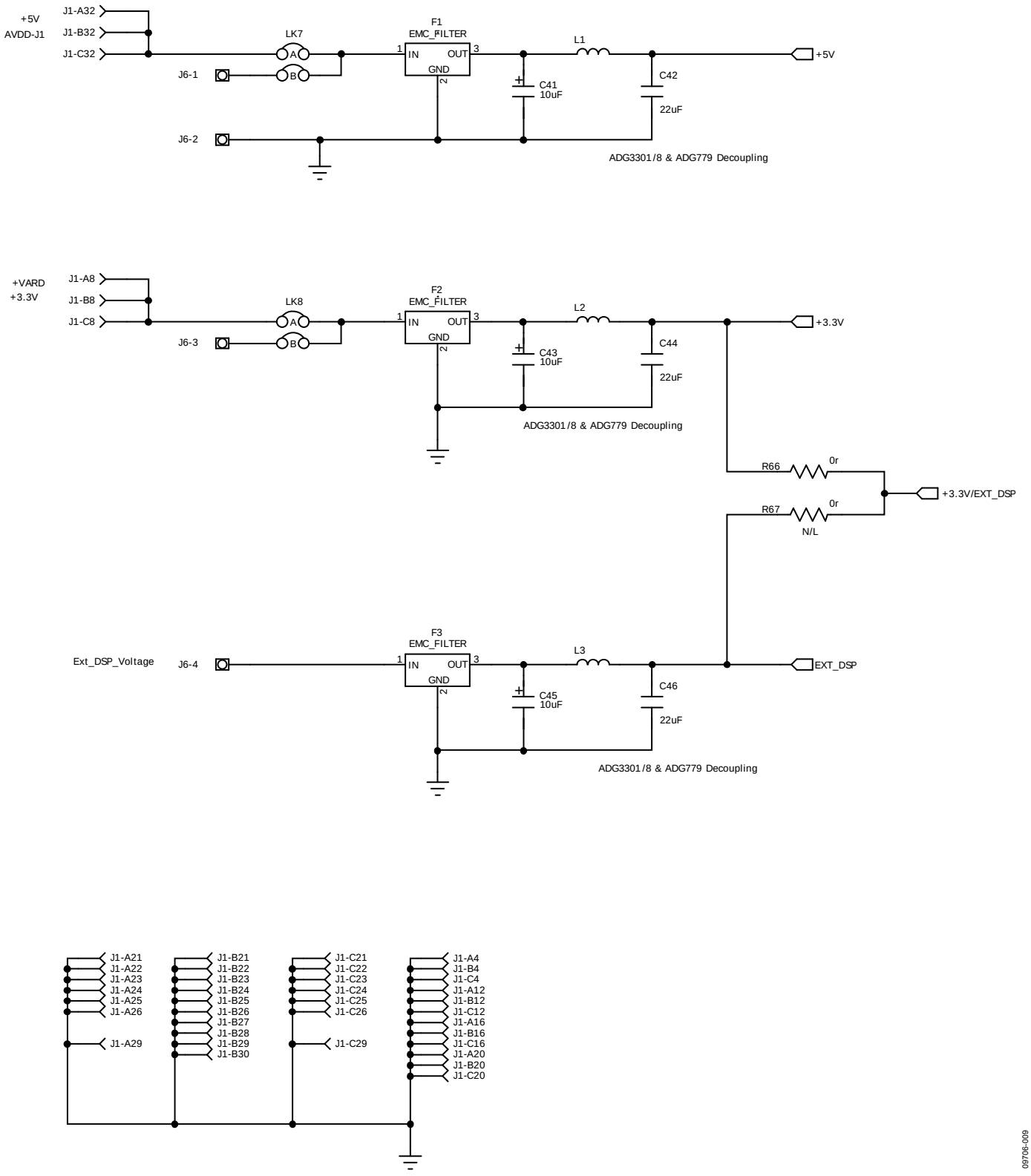


Figure 9. EVAL-AD7280EDZ Schematic—Page 4

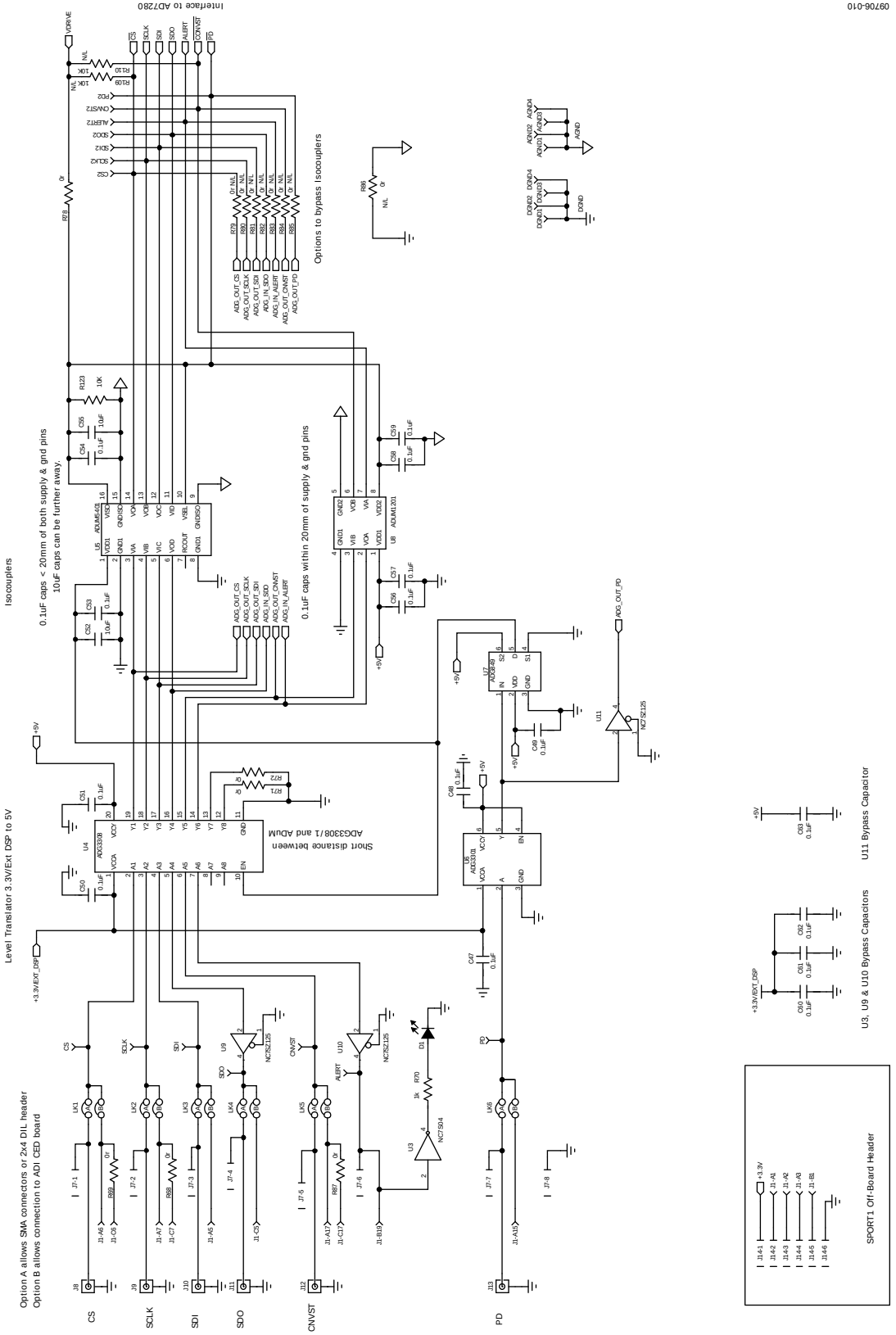


Figure 10. EVAL-AD7280EDZ Schematic—Page 5

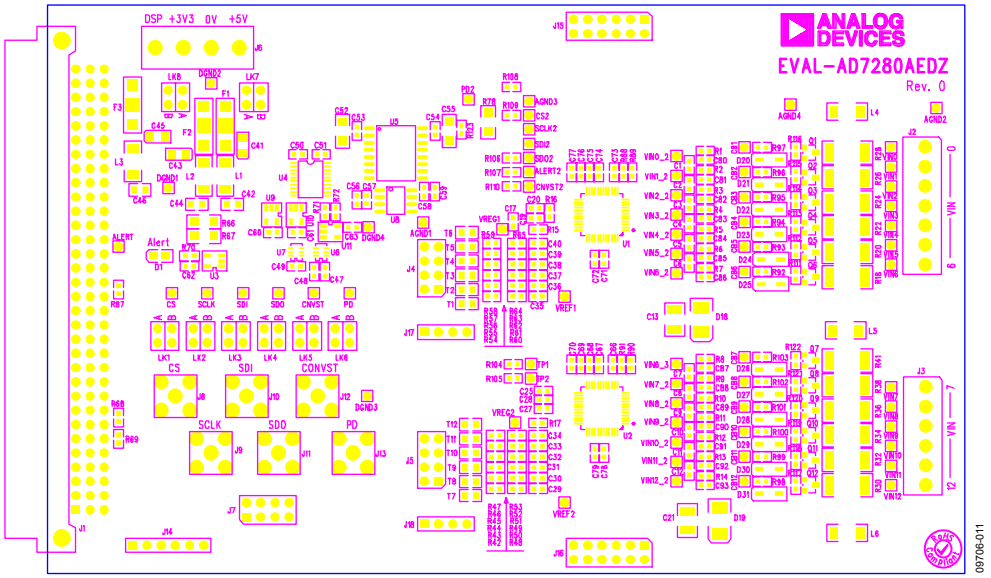


Figure 11. Silkscreen-Top Image

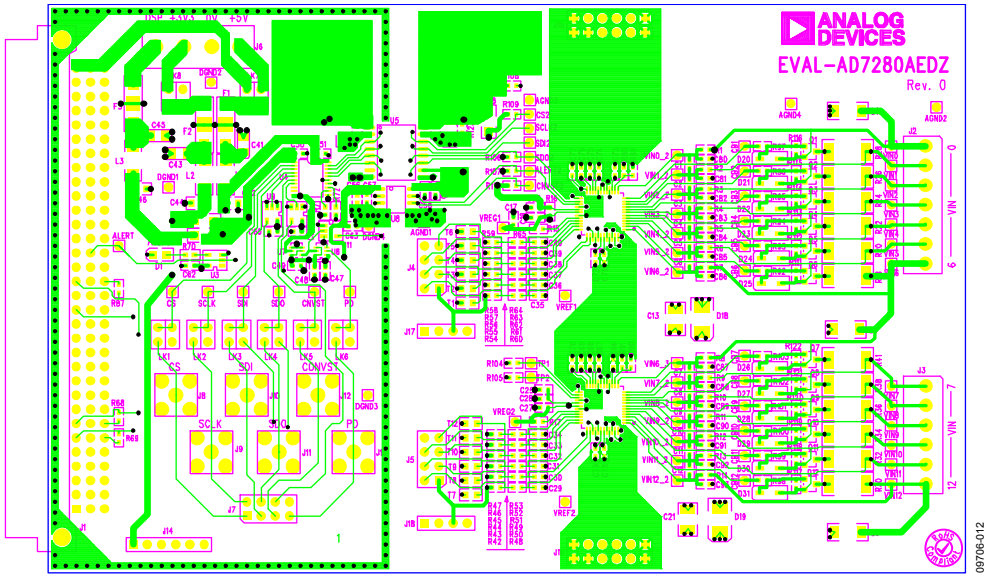


Figure 12. Layer 1

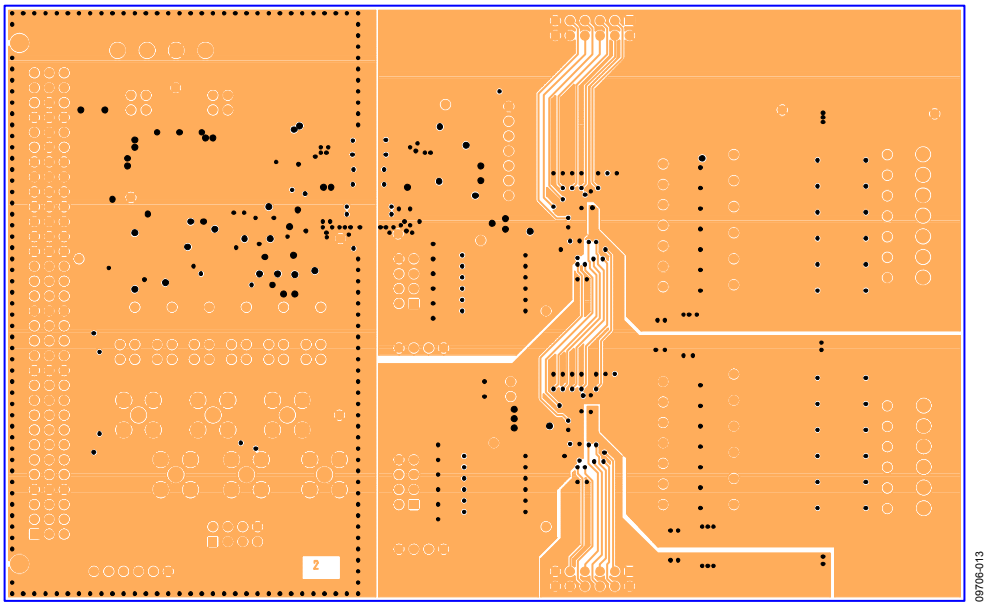


Figure 13. Layer 2

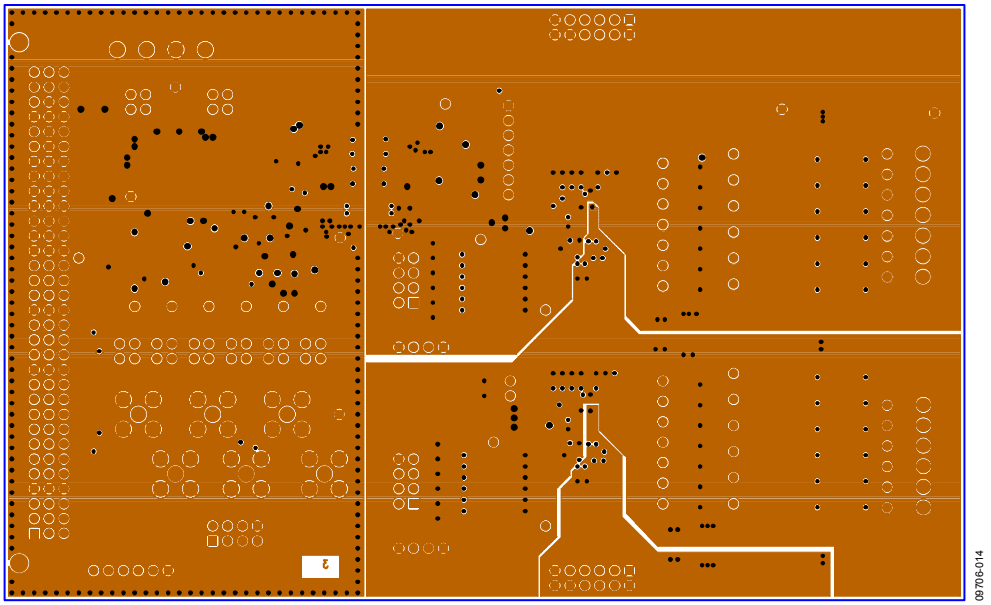


Figure 14. Layer 3

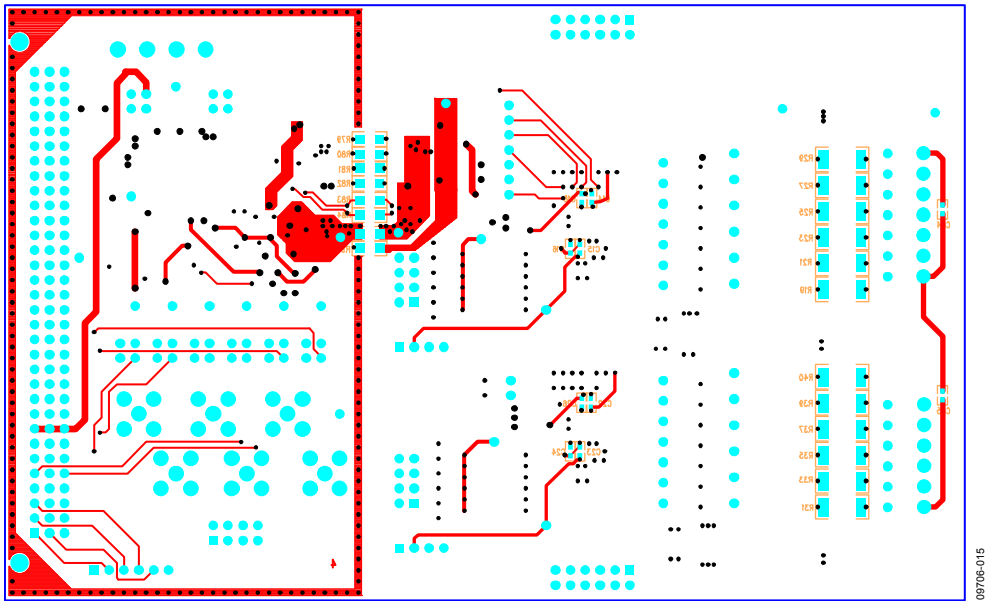


Figure 15. Layer 4

BILL OF MATERIALS

Table 10.

Qty	Part Description	Reference Designator	Stock Code[1]
2	12-Bit ADC	U1, U2	AD7280AWBSTZ
1	NC7S04	U3	FEC 101-4133
1	ADG3308	U4	ADG3308BRUZ
1	ADuM5401	U5	ADuM5401CRWZ
1	ADG3301	U6	ADG3301BKSZ
1	ADG849	U7	ADG849YKSZ
1	ADuM1201	U8	ADuM1201WTRZ
3	NC7SZ125	U9, U10, U11	FEC 101-3811
50	0.1 µF Ceramic Capacitor, 50 V, SMD0603	C1 to C12, C14, C16, C18 to C20, C22, C24, C26 to C40, C64 to 65, C80 to 93	FEC 8820023
4	10 µF Ceramic Capacitor, 35 V, SMD1812	C13, C21, C52, C55	FEC 1463373
4	10 µF Ceramic Capacitor, 16 V, SMD1210	C15, C17, C23, C25	FEC 165-0837
3	10 µF Tantalum Capacitor, 10 V	C41, C43, C45	FEC 197-130
3	22 µF Tantalum Capacitor, 6.3 V, SMD0805	C42, C44, C46	Digi-Key 490-1719-1-ND
15	0.1 µF Ceramic Capacitor, 16 V, SMD0603	C47 to C49, C50, C51, C53, C54, C56 to C59, C60 to C63	FEC 432210
14	22 pF Ceramic Capacitor, 50 V SMD0603	C66 to C79	FEC 498-543
1	Red SMD 0805 Chip LED	D1	FEC 105-8373
2	SMBJ30, TVS, 30 V, 600 W	D18, D19	FEC 955-1050
12	Zener Diode, 15 V, 0.5 W	D20 to D31	FEC 143-1282
3	Surface-Mount EMC Filters	F1 to F3	FEC 952-8202
1	96-Way Connector	J1	FEC 1096832
1	7-Pin Terminal Block	J2	FEC 388-2615 (x2) and FEC 388-2627
1	6-Pin Terminal Block	J3	FEC 388-2627 (x2)
3	8-Way Connector	J4, J5, J7	FEC 1022233 [Do not insert]
1	3-Pin Terminal Block	J6	FEC 151-790
6	Gold 50 SMA Jack	J8 to J13	FEC 1169631 [Do not insert]
1	6-Way Connector	J14	FEC 1022255 [Do not insert]
2	12-Way Connector	J15 to J16	FEC 1022238 [Do not insert]
2	4-Way Connector	J17 to J18	FEC 1022251 [Do not insert]
6	Ferrite Beads	L1 to L6	FEC 952-6900
8	1-Way Jumper (1 × 2)	LK1 to LK8	FEC 1022244 (36-pin strip) and FEC 150411
12	BSS138	Q1 to Q12	FEC 984-5330
42	10 kΩ SMD0603 Resistor	R1 to R14, R2 to R47, R54 to R59, R88, R90 to R103, R108, R123	FEC 933-0399
13	0 Ω SMD0603 Resistor	R16, R111 to R122	FEC 933-1662 [Do not insert]
24	68 Ω SMD2512 Resistor	R18 to R41	FEC 128-3154
6	10 kΩ SMD0603 Resistor	R15, R17, R89, R90, R109, R110	FEC 933-0399 [Do not insert]
2	0 Ω SMD1206 Resistor	R66, R78	FEC 933-6974
9	0 Ω SMD1206 Resistor	R67, R79 to R86	FEC 933-6974 [Do not insert]
17	0 Ω SMD0603 Resistor	R48 to R53, R60 to R65, R68, R69, R71, R72, R87	FEC 933-1662
3	1 kΩ SMD0603 Resistor	R70, R104, R105	FEC 933-0380
2	1 kΩ SMD0603 Resistor	R106, R107	FEC 933-0380 [Do not insert]
1	100 kΩ SMD0603 Resistor	R108	FEC 933-0402
12	10 kΩ SMD0603 Thermistor	T1 to T12	FEC 118-7088
67	Test Points		FEC 873-1144 (pack)

[1] FEC = Farnell.

NOTES

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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