Evaluating the AD74414H Quad-Channel, Software Configurable Input and Output with HART Modem

FEATURES

- Fully-featured evaluation board for the AD74414H
- Custom power solution utilizing the MAX17691B and a multiwinding transformer
- System isolation provided by the ADuM341E and ADuM342E
- On-board 2.5V ADR4525 reference
- SPI-compatible Arduino and PMOD connector
- PC-based Analysis | Control | Evaluation (ACE) Software for control
- Adaptive power switching (APS) calculator (no physical board required)
- No-OS MBED drivers providing example code in C

EVALUATION KIT CONTENTS

- EV-AD74414H-ARDZ evaluation board

EQUIPMENT NEEDED

- EVAL-SDP-CK1Z (SDP-K1)
- Bench top power supply and connector cables
- PC running Windows® 7 SP1 (32/64-bit), Windows 8.1 (32/64-bit), Windows 10 (32/64-bit)

DOCUMENTS NEEDED

- AD74414H data sheet
- MAX17691B data sheet
- ADuM341E and ADuM342E data sheets
- ADR4525 data sheet

SOFTWARE NEEDED

- ACE Software
- AD74414H ACE plug-in for control

GENERAL DESCRIPTION

The EV-AD74414H-ARDZ is a fully-featured evaluation board that a user can use to evaluate the features of the AD74414H as a full system solution. Power is provided by the MAX17691B isolated flyback solution. Digital channels isolation utilizes the ADuM341E and ADuM342E isolators.

The AD74414H is a quad-channel, software configurable, and input and output device. The device has functionality for current input/output and digital input/output measurements integrated into a single-chip solution with a compatible serial-peripheral interface (SPI).

A user can control the EV-AD74414H-ARDZ by a system demonstration platform (SDP) board. The EVAL-SDP-CK1Z (SDP-K1) board allows the EV-AD74414H-ARDZ to be controlled by the USB port of a PC using the AD74414H ACE Software. The EV-AD74414H-ARDZ requires an operating supply of 24V. The PC provides power to the EVAL-SDP-CK1Z (SDP-K1) board.

Full specifications on the AD74414H, MAX17691B, ADuM341E, and ADuM342E are available in the corresponding data sheets available from Analog Devices, Inc., and must be consulted with this user guide when using the EV-AD74414H-ARDZ board.

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REVISION HISTORY

7/2026—Revision 0: Initial Version

EVALUATION BOARD PHOTOGRAPH

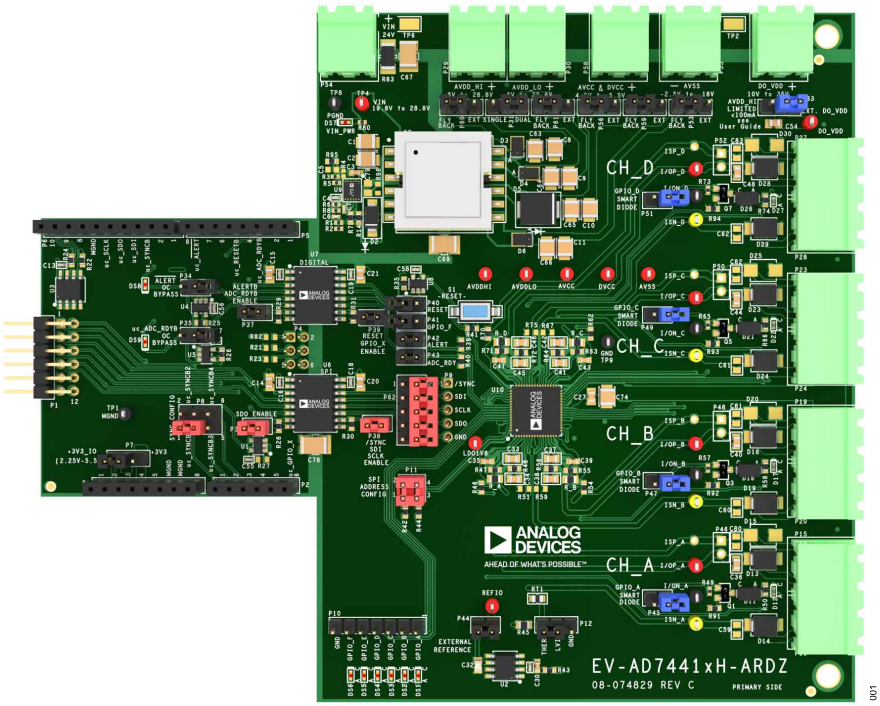

Figure 1. EV-AD74414H-ARDZ Evaluation Board Photograph

EVALUATION BOARD HARDWARE

BOARD LAYOUT

The EV-AD74414H-ARDZ is laid out with the following three isolated zones:

- PGND: The input power supply is applied to the power side of the EV-AD74414H-ARDZ.
- MGND: Communications to the EV-AD74414H-ARDZ are received on the micro side by the SDP Arduino header connection.
- GND: The AD74414H and all related circuitry are on the AD74414H (or field) side of the EV-AD74414H-ARDZ.

Each zone is separated by a 2.2mm isolation barrier. Figure 2 shows the three isolation zones as these zones are laid out on the EV-AD74414H-ARDZ.

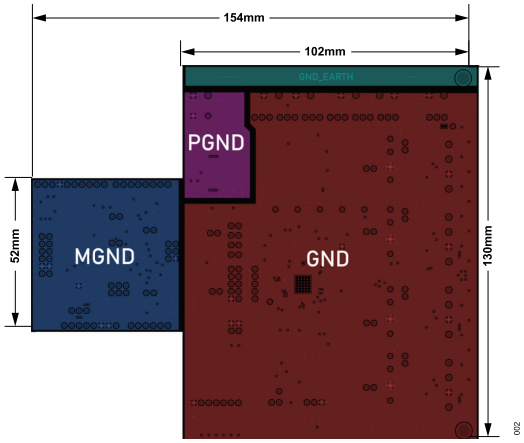

Figure 2. Isolation Zones on the EV-AD74414H-ARDZ

HEADER CONFIGURATION OPTIONS

Configuration headers must be set by the jumpers properly for operation of the EV-AD74414H-ARDZ. The functions and default states of these options are listed in Table 1 and shown in Figure 3. Before applying power and signals to the EV-AD74414H-ARDZ, ensure that all links are set to the default positions, as defined in Table 1.

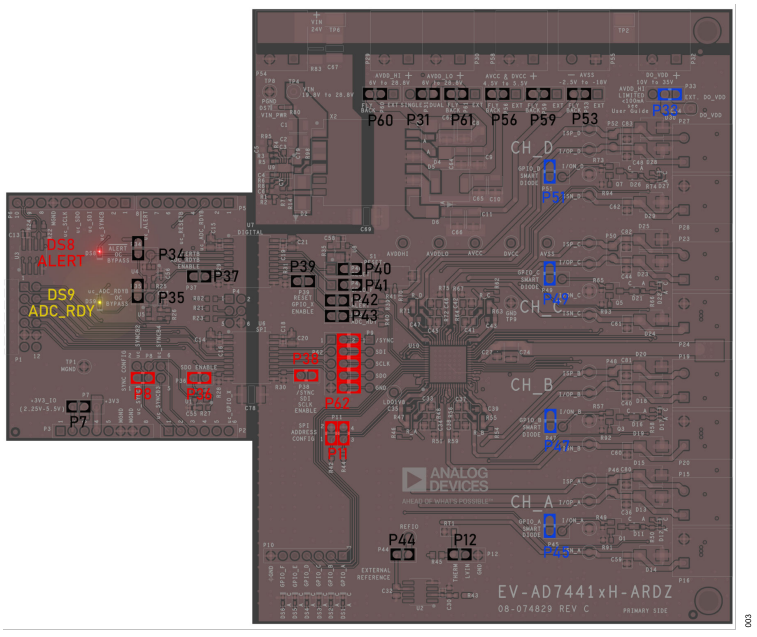

Figure 3. Default Header Configurations

EVALUATION BOARD HARDWARE

Table 1. Header Configurations and Jumper Functionality

Header Group	Header (Jumper)	Function	Description	Default Position
POWER SUPPLIES	P31 (Black)	AD74414H main supply	Dual or single supply configuration.	Dual supply Pin 1 to Pin 2
	P60 (Black)	AVDD_HI power rail	Configure the AVDD_HI power rail input from flyback or external connector.	Flyback Pin 2 to Pin 3
	P61 (Black)	AVDD_LO power rail	Configure the AVDD_LO power rail input from flyback or external connector.	Flyback Pin 2 to Pin 3
	P56 (Black)	AVCC power rail	Configure the AVCC power rail input from flyback or external connector.	Flyback Pin 2 to Pin 3
	P59 (Black)	DVCC power rail	Configure the DVCC power rail input from flyback or external connector.	Flyback Pin 2 to Pin 3
	P53 (Black)	AVSS power rail	Configure the AVSS power rail input from flyback or external connector.	Flyback Pin 2 to Pin 3
POWER SUPPLIES DIGITAL OUTPUT	P33 (Blue)	DO_VDD power rail	Configure the DO_VDD power rail input from external connector or AVDD_HI domain[1].	External connector Pin 1 to Pin 2
DIGITAL OUTPUT	P45 (Blue)	GPIO_A smart diode control	GPIO connection to smart blocking diode control at Channel A.	Not connected Open
	P47 (Blue)	GPIO_B smart diode control	GPIO connection to smart blocking diode control at Channel B.	Not connected Open
	P49 (Blue)	GPIO_C smart diode control	GPIO connection to smart blocking diode control at Channel C.	Not connected Open
	P51 (Blue)	GPIO_D smart diode control	GPIO connection to smart blocking diode control at Channel D.	Not connected Open
EXTERNAL REFERENCE	P44 (Black)	External reference	Connect 2.5V external reference output to AD74414H REFIO pin.	External reference Closed
LOW VOLTAGE ADC INPUT (LVIN PIN)	P12 (Black)	LVIN configuration	Connector for LVIN pin: allows to connect thermistor to LVIN pin or to connect LVIN input pin externally.	Thermistor Pin 1 to Pin 2
SPI	P11 (Red)	SPI address	Configuration of SPI address of AD74414H.	Address 00 Pin 1 to Pin 2 Pin 3 to Pin 4
	P36 (Red)	SDO enable	Enable SDO signal generated by AD74414H.	SDO enabled Closed
	P38 (Red)	$\overline{\text{SYNC}}$, SDI, SCLK enable	Enable $\overline{\text{SYNC}}$, SDI and SCLK SPI signals to AD74414H.	Signals enabled Closed
	P62 (Red)	SPI interconnection	Connects SPI signals to P9 board-to-board connector.	Not connected (5 signal jumpers) Open
	P8 (Red)	$\overline{\text{SYNC}}$ configuration	Alternative $\overline{\text{SYNC}}$ lines options.	uc_SYNCB Pin 1 to Pin 3
SPI/DIGITAL	P7 (Black)	Isolators power	Power for isolators at Arduino side of the board.	+3V3_IO Pin 1 to Pin 2
DIGITAL	P34 (Black)	$\overline{\text{ALERT}}$ open collector bypass	Bypass open collector driver at $\overline{\text{ALERT}}$ signal. Once $\overline{\text{ALERT}}$ is active, red LED DS8 indicates it.	Open collector Active Open
	P35 (Black)	$\overline{\text{ADC\_RDY}}$ open collector bypass	Bypass open collector driver at $\overline{\text{ADC\_RDY}}$ signal. Once $\overline{\text{ADC\_RDY}}$ is active, orange LED DS9 indicates it.	Open collector Active Open
	P37 (Black)	$\overline{\text{ALERT}}$ and $\overline{\text{ADC\_RDY}}$ enable	Enable $\overline{\text{ALERT}}$ and $\overline{\text{ADC\_RDY}}$ signal generated by AD74414H.	Signals enabled Closed
	P39 (Black)	$\overline{\text{RESET}}$ and GPIO_x enable	Enabled $\overline{\text{RESET}}$ and GPIO_x signal generated at Arduino side.	Signals enabled Closed
	P40 (Black)	$\overline{\text{RESET}}$ signal	Activates $\overline{\text{RESET}}$ signal generated at Arduino side.	$\overline{\text{RESET}}$ not connected

EVALUATION BOARD HARDWARE

Table 1. Header Configurations and Jumper Functionality (Continued)

Header Group	Header (Jumper)	Function	Description	Default Position
				Open
	P41 (Black)	GPIO_F signal	Activates GPIO_F signal generated at Arduino side.	Not connected Open[2]
	P42 (Black)	$\overline{\text{ALERT}}$ signal	Connects $\overline{\text{ALERT}}$ signal generated by AD74414H.	$\overline{\text{ALERT}}$ connected Closed
	P43 (Black)	$\overline{\text{ADC\_RDY}}$ signal	Connects $\overline{\text{ADC\_RDY}}$ signal generated by AD74414H.	$\overline{\text{ADC\_RDY}}$ connected Closed

[1] AVDD_HI domain is significantly current limited. For more details, see the Power Supplies section.

[2] When header P41 is closed, GPIO_F must be configured as input. Not doing so creates conflict with enabled and connected GPIO_x signal.

POWER SUPPLIES

The EV-AD74414H-ARDZ comes with a power supply connector VIN (P54) that provides power directly to the flyback. Set this supply to 24V (range between 19.2V and 28.8V). Green LED diode DS7 indicates the presence of input voltage.

The flyback solution utilizing the MAX17691B generates the following isolated supply voltages to the AD74414H:

- +AVDD_HI provides the AD74414H AVDD_HI voltage supply of 21V.
- +AVDD_LO provides the AD74414H AVDD_LO voltage supply of 13V.
- +AVCC_DVCC provides the AD74414H AVCC and DVCC voltage supplies of 5V.
- −AVSS provides the AD74414H AVSS voltage supply of −16V.

The 2.5V external reference (ADR4525) is powered by AVCC domain. Use the ADR4525 as an alternative to the AD74414H on-chip reference. On-board isolators ADuM341E and ADuM342E are powered by DVCC domain of the AD74414H.

Optionally, supply each power supply rail externally by a connector, AVDD_HI by P29, AVDD_LO by P30, AVCC_DVCC by P58, and AVSS by P55. This gives user a flexibility of the AD74414H evaluation under various power supply conditions.

To use an external connector, change configuration of the corresponding header (P60 for AVDD_HI, P61 for AVDD_LO, P56 for AVCC, P59 for DVCC, and P53 for AVSS). Headers are placed below the power connectors, and the setting for using an external connector is labeled as EXT. By default, the board is configured to use the flyback solution labeled at jumpers as FLYBACK.

The digital output DO_SUPPLY connector (P32) provides a power supply to the digital output circuitry and features. For demonstration purposes, configure the header P33 in such a way that the DO_VDD voltage of the AD74414H is provided by the AVDD_HI voltage rail. If the AVDD_HI is supplied from the flyback +AVDD_HI voltage rail, the output current is significantly limited to <100mA as the total sum of all channel's output currents, and this value cannot be exceeded.

Figure 4 shows the placement of power connector and power configuration headers on the EV-AD74414H-ARDZ board.

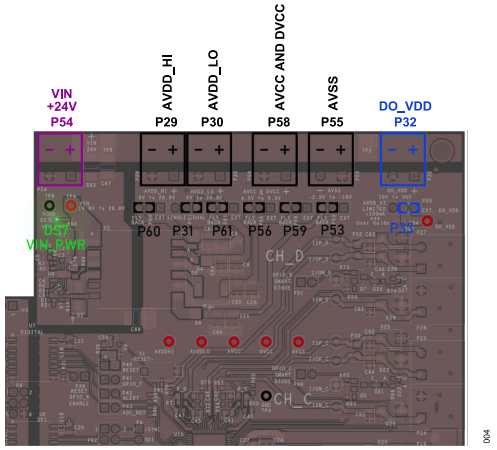

Figure 4. Power Supplies Connectors and Headers

SPI COMMUNICATION

The EVAL-SDP-CK1Z (SDP-K1) board handles the communication to the EV-AD74414H-ARDZ by the PC. The EVAL-SDP-CK1Z (SDP-K1) is connected to the EV-AD74414H-ARDZ using the Arduino header connections.

The EVAL-SDP-CK1Z (SDP-K1) board controls the SPI communication using ADuM341E isolator. The ADuM341E isolator must have enabled output drivers to operate correctly. Header P36 and P38 enable the ADuM341E isolator, and these jumpers must be in-place as per default configuration.

The address pins header P11 is available to configure the SPI address of the AD74414H. For default configuration of SPI address header, place one jumper between Pin 1 and Pin 2 and place another jumper between Pin 3 and Pin 4. The default address is 00 and must be configured during evaluation of the AD74414H when using ACE Software. The SPI address header (P11) configuration is shown in Table 2.

EVALUATION BOARD HARDWARE

Table 2. P11 – SPI Address Header Configuration

Binary Address	Pin 1 to Pin 2 (AD0)	Pin 3 to Pin 4 (AD1)
00	Closed	Closed
01	Open	Closed
10	Closed	Open
11	Open	Open

$\overline{SYNC}$ (also called chip select) signal is configured by P8 jumper setting. P8 jumper allows to use alternative pins to drive this signal. For evaluation using ACE Software, jumper must be placed between Pin 1 and Pin 3 of P8 header. $\overline{SYNC}$ signal configuration by header P8 is shown in Table 3.

Table 3. P8 – $\overline{SYNC}$ Signal Configuration

$\overline{SYNC}$ Source	$\overline{SYNC}$ Name	P8 Jumper Placement
P6 (Pin 3)	uc_SYNCB	Pin 1 to Pin 3
P2 (Pin 1)	uc_SYNCB2	Pin 2 to Pin 4
P2 (Pin 2)	uc_SYNCB3	Pin 3 to Pin 5
P2 (Pin 3)	uc_SYNCB4	Pin 4 to Pin 6

The SPI jumpers for header configurations are red, which allow for easy discernment from other settings.

The isolators on the Arduino connector side are powered by the EVAL-SDP-CK1Z (SDP-K1) board. Place the jumper at header P7 between Pin 1 and Pin 2 as per default configuration to ensure that sufficient power for the isolators during operation.

A reset button (S1) is also available on the EV-AD74414H-ARDZ to manually reset the AD74414H.

REFERENCE OPTIONS

By default, the EV-AD74414H-ARDZ is configured to use an external reference, the ADR4525. The external reference is connected to a REFIO signal by placing the jumper at header P44. Alternatively, use the AD74414H on-chip reference by disconnecting header P44 and enabling an internal reference. The internal reference of the AD74414H is enabled by SPI write to the relevant register. For more details, refer to the AD74414H data sheet. Figure 5 shows a schematic snippet.

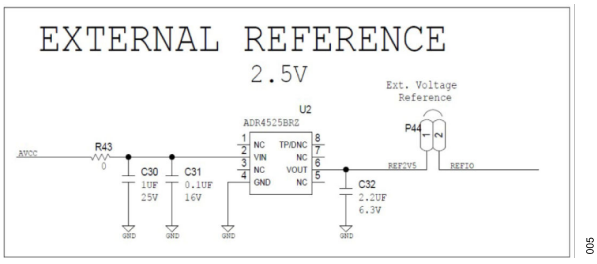

Figure 5. External Reference Connection

LVIN PIN – LOW VOLTAGE ADC INPUT

The LVIN pin is the low voltage input to the ADC. The LVIN pin is useful for measurements depending on application needs, the LVIN pin can have numerous uses. For more details on LVIN pin, refer to the AD74414H data sheet.

The header P12 is dedicated to the LVIN pin. Placing a jumper from Pin 1 to Pin 2 on the P12 header allows connection of on board thermistor. If external connection of low voltage input is required, disconnect the jumper from Pin 1 to Pin 2 and use Pin 2 (AD74414H LVIN Pin) and Pin 3 (GND) to connect external voltage source (see the schematic snippet, as shown in Figure 6).

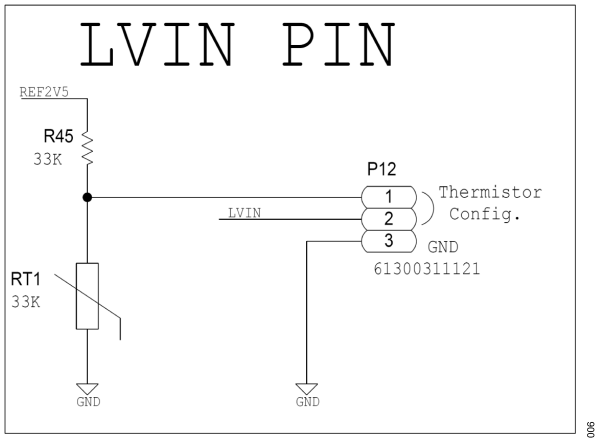

Figure 6. LVIN PIN Connection

OUTPUT CHANNELS

The AD74414H channels are configured, as shown in the AD74414H data sheet. The EV-AD74414H-ARDZ features the following four channels: Channel A, Channel B, Channel C, and Channel D. There are two input/output and two sensing screw terminal blocks for each channel.

Use the input/output positive (I/OP_x) and the input/output negative (I/ON_x) screw terminals to connect the required load to the AD74414H channel.

In addition, the input sensing negative (ISN_x) terminal is available. ISN_x terminal has test point available. By default, the 0Ω jumper is placed between ISP_x and I/OP_x terminals to ensure direct connection, as for this particular generic (AD74414H), it is the most common configuration.

Figure 7 shows the output channels, connectors, configuration headers, and test points placement. The blue jumpers are related to channel configuration of digital output. For more details on digital output, see the Digital Output section.

EVALUATION BOARD HARDWARE

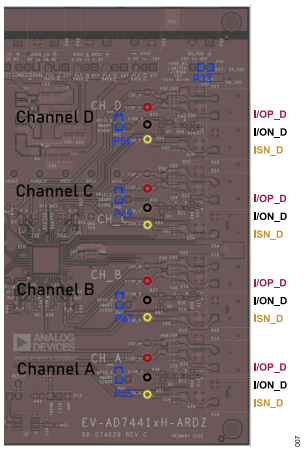

Figure 7. Output Channels

DIGITAL OUTPUT

For digital output, an additional power supply is required to provide current to the external field-effect transistors (FETs).

When using the digital output function, connect the DO_VDD power supply supplied from external connector (P32) by connecting Pin 1 to Pin 2 of P33 header. For demonstration purposes, use the AVDD_HI power domain. However, if AVDD_HI domain is supplied from on-board flyback, there are significant current limitations and the digital output load must be a high resistance value. For more details, see the Power Supplies section.

The EV-AD74414H-ARDZ headers related to digital output are blue.

Use caution with the external FETs that are thermally damaged if the short-circuit times are set too long. Choose the following FETs for the external digital output function: SI7113ADN-T1-GE3: P-channel metal-oxide semiconductor (PMOS) FET.

A smart blocking diode is available at each channel. The smart blocking diode allows reduction of power being dissipated at the blocking diode. The smart blocking diode circuit is controlled by corresponding GPIO_x.

The following is an example of how to configure the smart blocking diode for Channel A:

1. Set the AD74414H Channel A to high impedance.
2. Configure GPIO_A as output.
3. Place a jumper at header P45 to connect the GPIO_A signal to the smart diode circuitry.
4. Drive the GPIO_A pin output to high to activate the smart diode.
5. Enable the digital output function, and control Channel A output FET.

Example for Channel A, if the smart blocking diode feature is not required, then disconnect the jumper P45. In this scenario, the body diode of the PMOS transistor (Q2), which is typically used as the smart blocking diode, functions as a simple blocking diode.

TEST POINTS

Multiple test points are available on the EV-AD74414H-ARDZ for all critical pins and on the connector screw terminals. Each board section has relevant ground test points, such as GND TP9, MGND TP1, and PGND TP8. The test point's locations are shown in Figure 8. Along with dedicated test points, use each header to probe a corresponding signal.

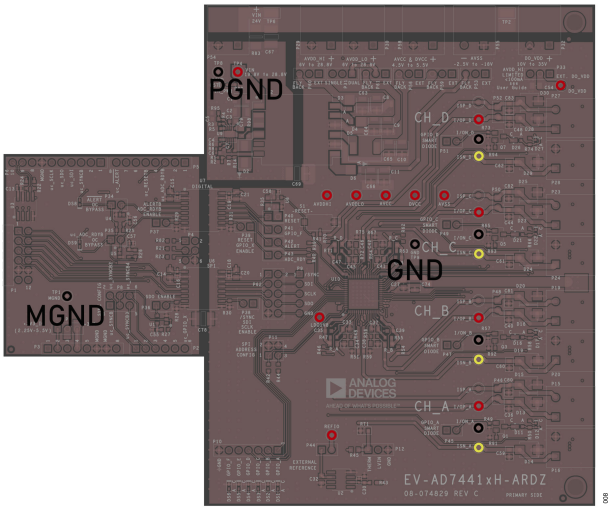

Figure 8. EV-AD74414H-ARDZ Test Points

GENERIC ID

Each evaluation board have a sticker placed on the top to identify the generic part assembled on the board. Evaluation board with AD74414H generic carries EV-AD74414H-ARDZ label.

In addition to physical label on the boards, it is possible to read GENERIC_ID register. The GENERIC_ID register contains generic identifier in the 3 bits GENERIC_ID bit field. Table 4 shows the identifiers for each part.

Table 4. GENERIC_ID Identification

Part	GENERIC_ID
AD74414H	4 (100 binary)

SOFTWARE QUICK START PROCEDURES

ACCESSING ACE SOFTWARE FOR AD74414H EVALUATION

To evaluate the AD74414H, do the following steps:

1. Download and install the ACE Software.
2. Run the ACE Software.
3. The AD74414H plug-in must be automatically listed in Plug-in Manager. If a user does not find it, refresh the plug-ins and install the new plug-ins listed.

CONFIGURING THE EV-AD74414H-ARDZ

To set up the EV-AD74414H-ARDZ, do the following steps:

1. Set VIO_ADJUST to 3.3V using the P14 header (close to USB C) on the EVAL-SDP-CK1Z (SDP-K1) board.
2. Connect a USB cable to the PC, and then to the EVAL-SDP-CK1Z (SDP-K1) board.
3. Connect the EVAL-SDP-CK1Z (SDP-K1) board to the EV-AD74414H-ARDZ. Board are design to be mounted into each other via Arduino shield connector. Insert EV-AD74414H-ARDZ pins directly into EVAL-SDP-CK1Z (SDP-K1) sockets in the way that connectors at both boards correctly align 1:1.
4. Power up the EV-AD74414H-ARDZ with the relevant power supplies.
5. Open the ACE Software.
6. The EVAL-SDP-CK1Z (SDP-K1) board program automatically updates the ACE drivers. The DS1 diode (next to USB C connector) at EVAL-SDP-CK1Z (SDP-K1) flashes. Do this step when EVAL-SDP-CK1Z (SDP-K1) board is connected with the running ACE GUI.
7. The board appears as **Attached Hardware** (see Figure 9). To continue, double-click the **AD74414H Board** window.

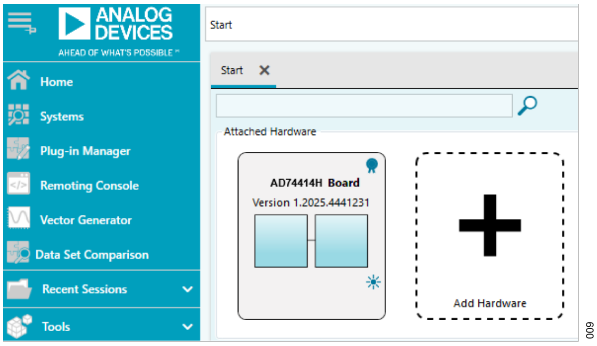

Figure 9. ACE Evaluation Software − Attached Hardware

USING THE SOFTWARE FOR EVALUATION

Main AD74414H Tab

The main AD74414H tab view is shown in Figure 11, which shows the interactive blocks of the AD74414H. To configure the AD74414H, click the interactive blocks. The interactive blocks have darker blue color compared to static figures.

The main AD74414H tab view allows configuration of **Main ADC**, **Diagnostic Channel**, **Temperature Sensor**, **Watchdog Timer**, the GPIOs, the channel functions, and other sub-blocks.

Configure each channel independently using the drop-down menu next to the corresponding channel label: **CHA**, **CHB**, **CHC**, and **CHD**. When switching channel functions, always configure the corresponding channel back to high impedance prior to making the channel function change. For more details, refer to the AD74414H data sheet.

To access the alerts of the AD74414H, click one of the corresponding alert pages, such as **ALERTS**, **CHANNEL ALERTS**, or **HART ALERTS**. For more details on alert tabs, see the Alerts Tabs section.

The AD74414H diagnostics measurements are accessible through **Diagnostics Results**. For more details on how to set up the diagnostics, see the Diagnostic Measurement section.

To access the register map, click the **Proceed to Memory Map** button at the bottom right corner of the window.

To plot the ADC results, click the **Proceed to Analysis** button at the bottom right corner of the window.

The value of the ADC channel measurements appears next to the relevant channel function if ADC is enabled.

To calculate and optimize chip power dissipation, click the **APS Calculator** button above **Adaptive Power Switching** block.

Each AD74414H ACE sub-windows have evaluation control panel, see Figure 10. Control panel is placed at top of the sub-window. Control panel buttons have the following functions:

- **Apply Changes**: Writes configured values and bit fields of the ACE GUI into the AD74414H register map by SPI.
- **Read All**: Reads all registers of the AD74414H.
- **Reset Chip**: Initiates software reset of the AD74414H by SPI.
- **Diff**: Highlights the register value differences at Memory Map view, and allows to write register values configured at ACE. To do this change, click **Apply Changes**.
- **Software Defaults**: Configures the register to its default values. To do this change, click **Apply Changes**.
- **Memory Map Side-By-Side**: Allows to turn on register map of the AD74414H.

SOFTWARE QUICK START PROCEDURES

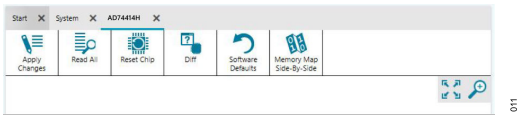

Figure 10. Evaluation Control Panel

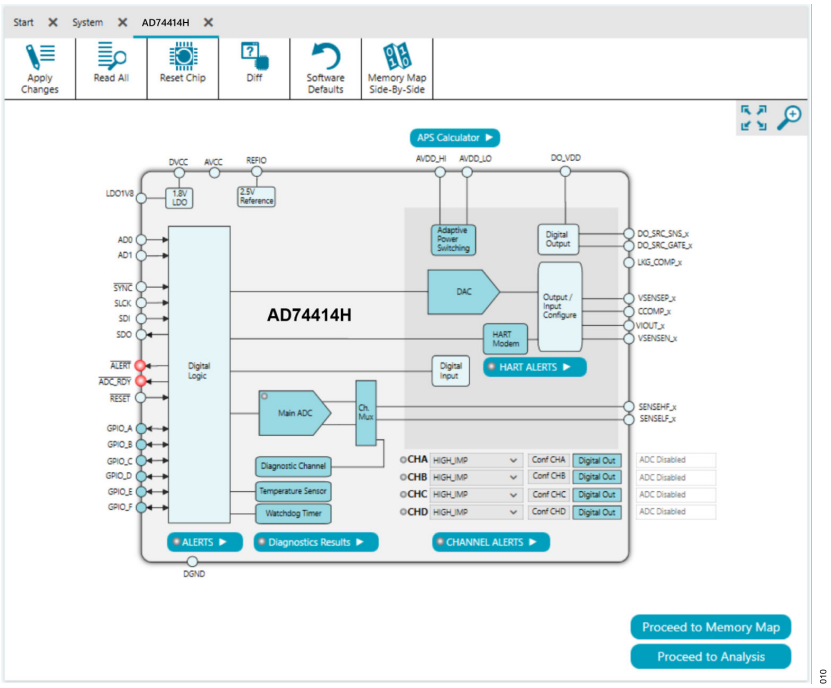

Figure 11. Main AD74414H Tab View

SOFTWARE QUICK START PROCEDURES

Alerts Tabs

The AD74414H alerts are logically divided into corresponding tabs **ALERTS**, **CHANNEL ALERTS**, or **HART ALERTS**.

ALERTS tab shows the alerts of the AD74414H. **ALERT STATUS** section shows the general alerts, which reflects the alert status register. The **LIVE STATUS** register shows the currently ongoing alerts (the cause of those alerts is not removed yet), and the **SUPPLY ALERT STATUS** section shows the alerts related to power supplies (see Figure 12).

The **RESET_OCURRED** bit is active once the reset is complete. This alert informs the user that a reset of AD74414H has occurred.

To clear all active alerts, click **Clear All Status Flags** button. Also, to clear the individual alerts one by one, click the corresponding **STATUS** bit. Clear the greyed out **STATUS** bit in the corresponding sub-registers, for example, clear CHANNEL_ALERT_A at the **CHANNEL ALERT STATUS** tab. Clear all alerts after reset of the part. **ALERTS** tab is shown in Figure 12. Mask the individual bits if required by using the corresponding **MASK** bit. The same functionality is also available on the other alert tabs.

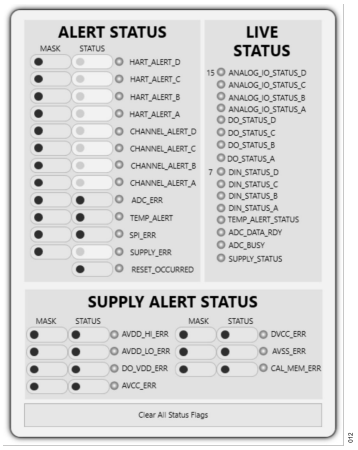

Figure 12. ALERTS Tab View

CHANNEL ALERT STATUS tab is shown in Figure 13. **CHANNEL ALERT STATUS** tab shows the summary of the alerts presented at individual channels. Each channel consists of the breakdown of the alert indicators based on the channel function.

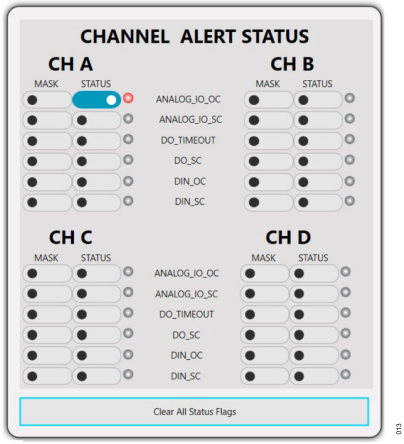

Figure 13. CHANNEL ALERT STATUS Tab View

HART ALERT STATUS tab is shown in Figure 14. **HART ALERT STATUS** tab shows the summary of the alerts related to the HART modem per each channel.

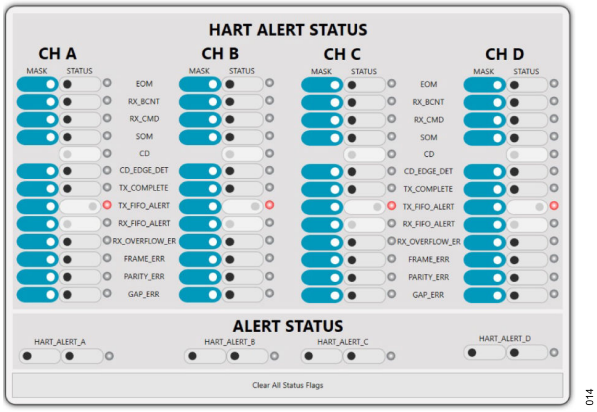

Figure 14. HART ALERT STATUS Tab View

Diagnostic Measurement

The AD74414H features four diagnostic channels that a user can enable simultaneously. The diagnostics gives additional insights into state of the AD74414H or its channel loads. For more details on diagnostics, refer to the AD74414H data sheet.

To enable diagnostic measurement, do the following steps:

1. Click the **Diagnostic Channel** button to choose the diagnostic to measure. A Diagnostic Assignment Cfg window appears, as shown in Figure 15. In the **ADC_CONV_CTRL** > **CONV_SEQ** area, select ADC in **IDLE** mode, once changes to ADC configuration complete.

SOFTWARE QUICK START PROCEDURES

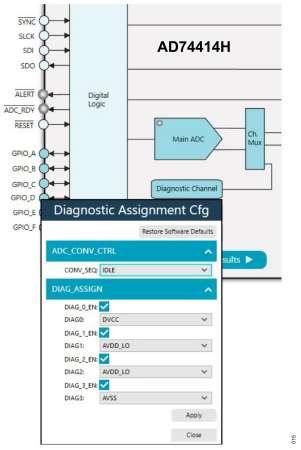

Figure 15. Assigning Diagnostic

2. To start ADC measurements, in the **CONV_SEQ** area, select **CONTINUOUS**, as shown in Figure 16. This results in continuous measurement of the ADC.

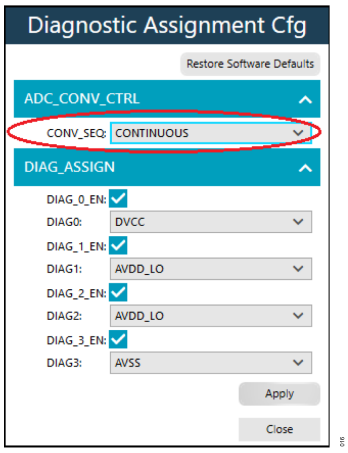

Figure 16. Start ADC Measurements

3. A user can view the results at **Diagnostic Result** view, as shown in Figure 17. Green indicator lights up at **Diagnostics Results** tab, which indicates active diagnostics measurement. Alternatively, to plot the results in the **Analysis** tab, click **Proceed to Analysis** button at the bottom right corner. For more details on Analysis tab, see the Analysis Tab section.

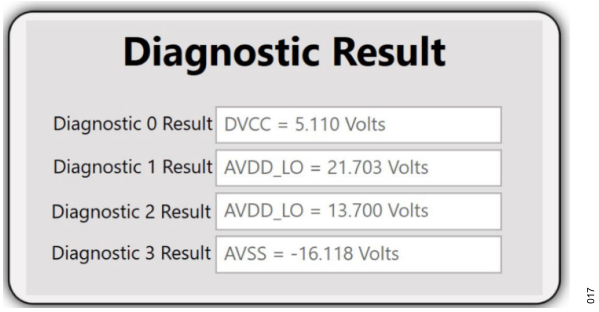

Figure 17. Diagnostics Measurements

SOFTWARE QUICK START PROCEDURES

Analysis Tab

The Analysis tab allows for further evaluation of input and output variables or diagnostic measurements. Click the **Proceed to Analysis** button at the bottom right corner of the main window (as shown in Figure 11).

Analysis allows the ADC output to be plotted in real time and gives additional insights into the measured signal. As shown in Figure 18, in the **CAPTURE** tab > **Channel Settings** > **Select Channel to Plot** drop-down menu, choose the signal source that is plotted.

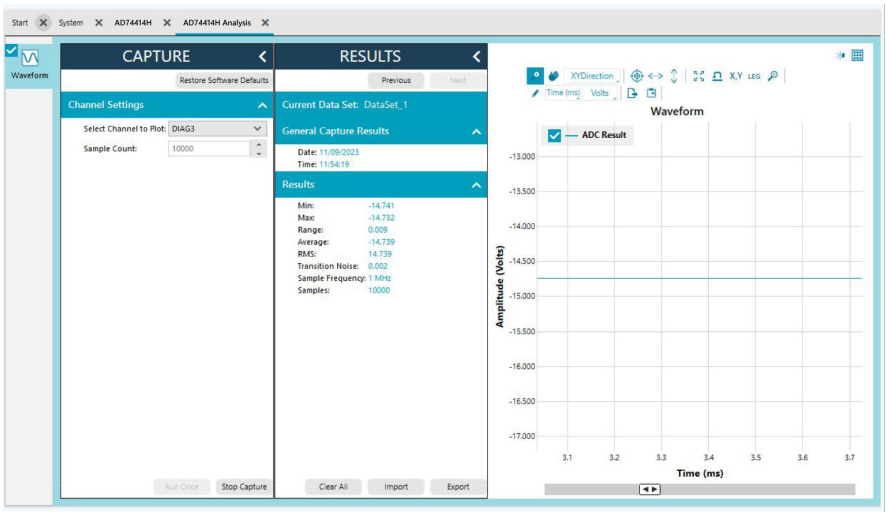

Figure 18. Analysis Window

SOFTWARE QUICK START PROCEDURES

Register Map

To access the register map, click the **Proceed to Memory Map** button at the bottom right corner of the main window, as shown in Figure 11. Use the register map to interface directly to the AD74414H. To write each register change by SPI to AD74414H, click **Apply Changes**.

To open more details in another window, click an individual register. Configure the individual bit fields in the register in the detailed register window.

Figure 19 shows the register map and detailed register window.

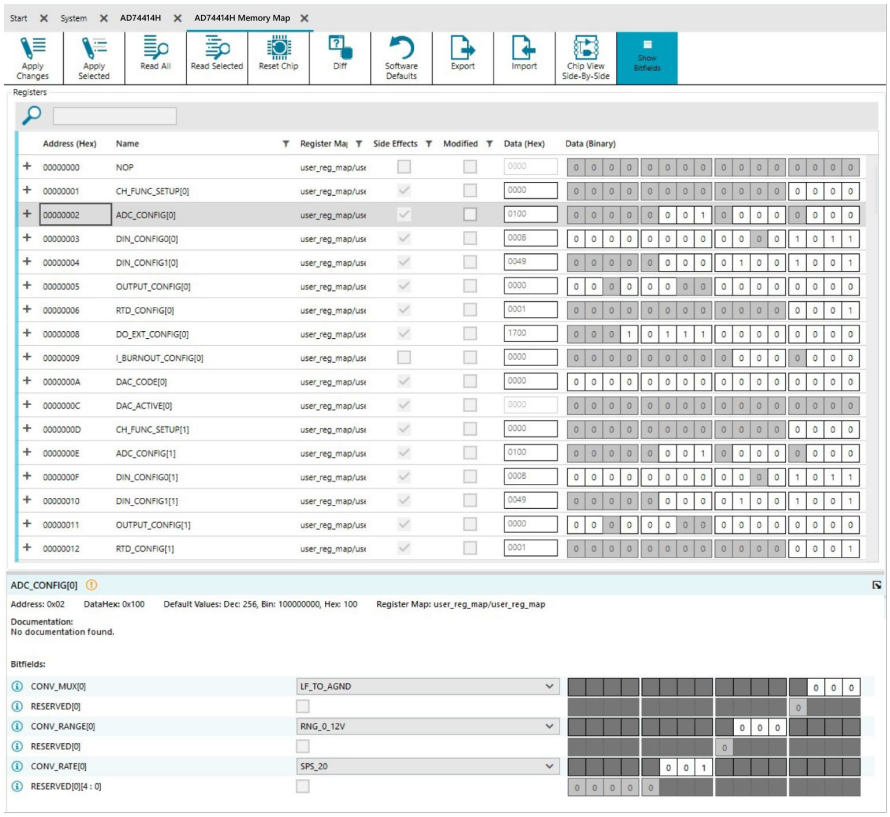

Figure 19. Register Map Window

SOFTWARE QUICK START PROCEDURES

Adaptive Power Switching (APS) Calculator

The APS Calculator allows user to seamlessly estimate and optimize the AD74414H power dissipation. Although the APS Calculator is part of the ACE plug-in, it does not require a physical board or hardware. The APS Calculator operates independently of the EV-AD74414H-ARDZ connected to the system and allows access via the released AD74414H ACE plug-in.

The **ADAPTIVE POWER SWITCHING CALCULATOR** menu controls the APS Calculator. To provide a comfortable interface on low-resolution displays, the system can hide the **ADAPTIVE POWER SWITCHING CALCULATOR** menu. Click the white arrow **<** pointing inward next to the **ADAPTIVE POWER SWITCHING CALCULATOR** menu label to hide the main control menu (see Figure 20).

The optimization process begins with user input, and once the user adjusts the **Input Parameters**, the system immediately displays an optimization plot of dissipated power based on the loading condition.

The system refreshes the optimization plots with each configuration change, which enables a quick optimization. **INFORMATION** section logs previous configurations to allow easy comparison between results.

Click **HELP** to turn on additional information about individual settings, then position the pointer over the **i** icon to view the additional information.

Change the **Optimization** settings to optimize power dissipation in two basic ways:

- **Chip Power**: The APS Calculator optimizes power while focusing on reducing heat dissipation inside the AD74414H chip. Choose this option when reducing the AD74414H junction temperature is the priority.
- **System Power**: The system optimizes the resulting power dissipation to minimize the power dissipation inside the module, which considers both the **DC/DC Efficiency** and the AD74414H chip. This option optimizes the sum of overall power dissipation inside the DC/DC converter and the AD74414H. Choose this option when reducing system power consumption is a priority, and the AD74414H temperature is less critical.

AD74414H Data sheet Parameters allows user to modify different parameters considered during power optimization. Click **Quiescent Pow** to exclude the chip's quiescent power from the optimization process.

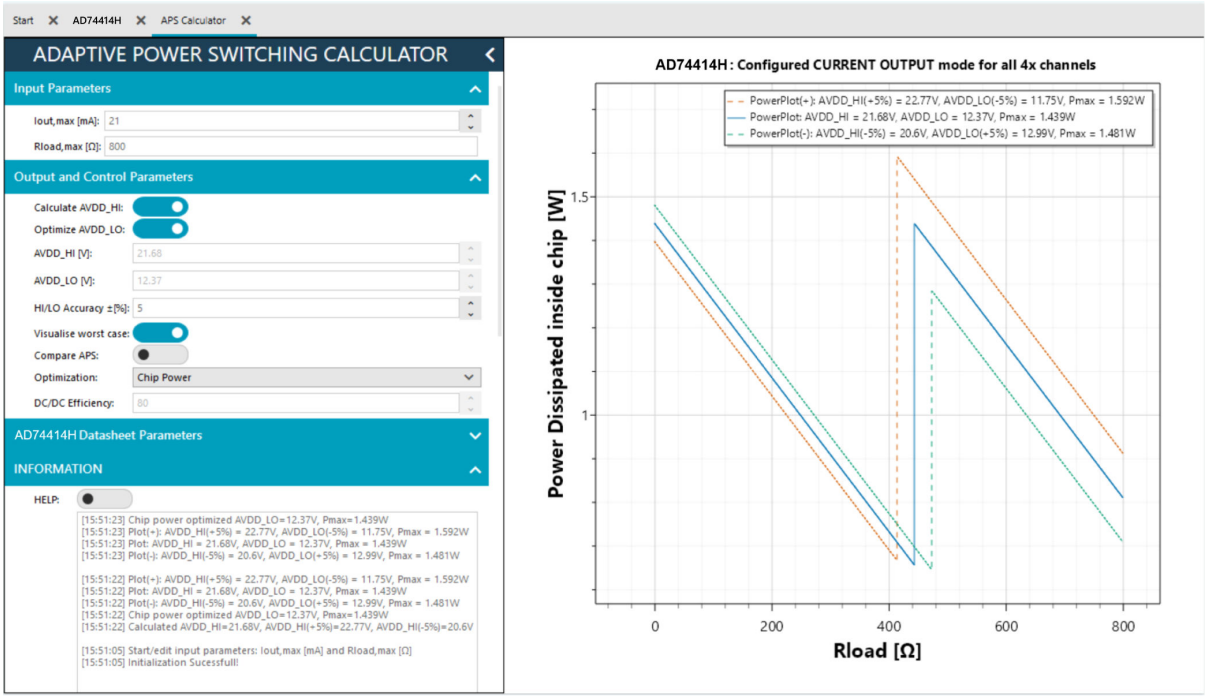

Figure 20. APS Calculator

EVALUATION BOARD SCHEMATICS AND ARTWORK

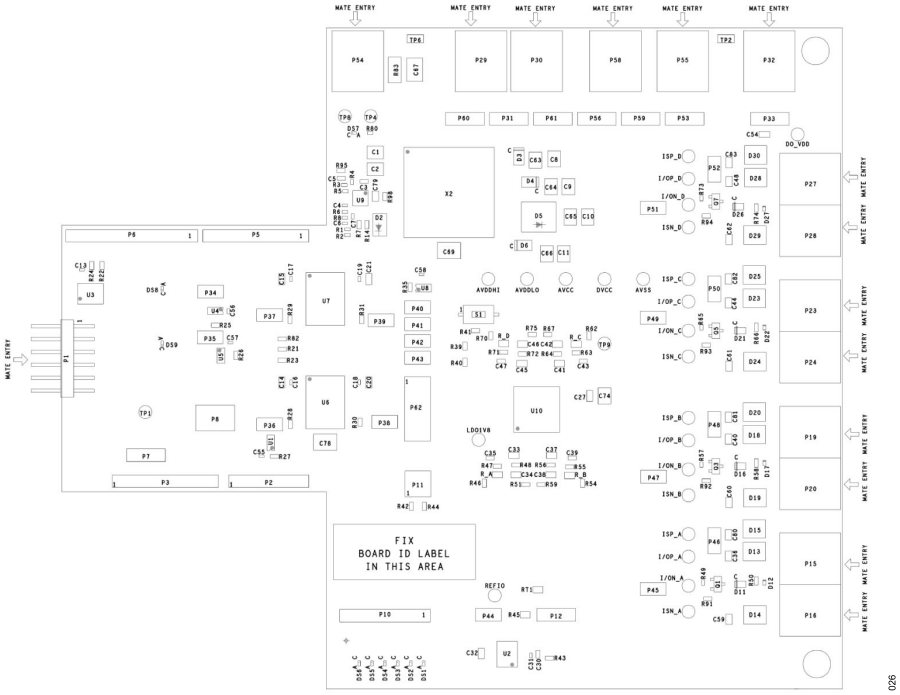

Figure 21. EV-AD74414H-ARDZ Assembly Diagram, Top View

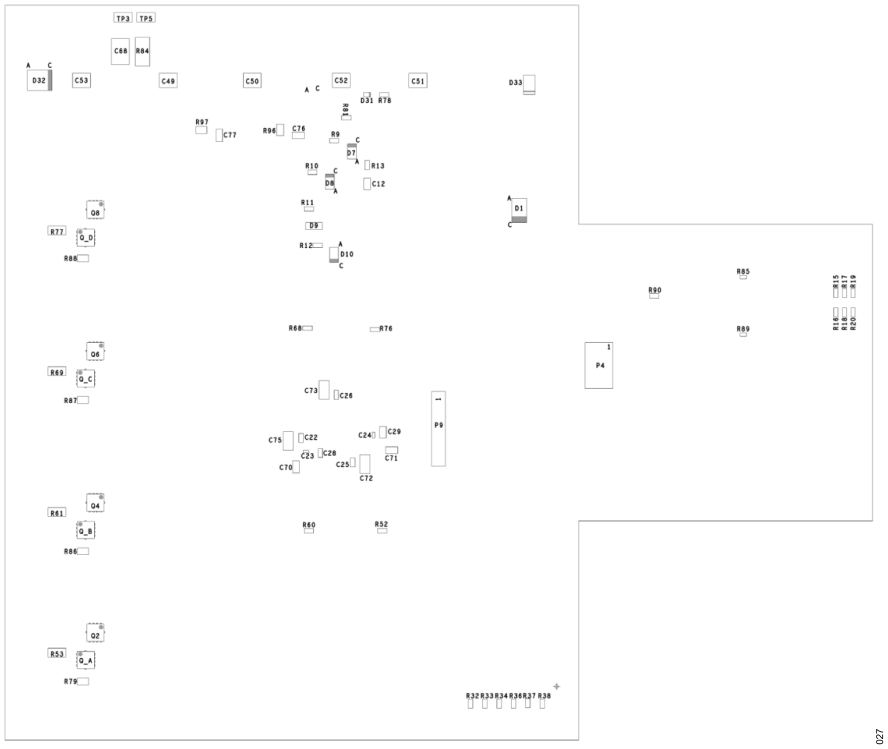

Figure 22. EV-AD74414H-ARDZ Assembly Diagram, Bottom View

EVALUATION BOARD SCHEMATICS AND ARTWORK

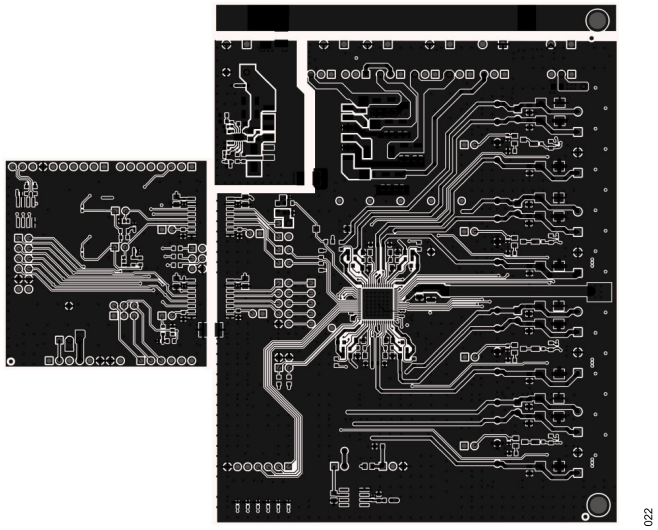

Figure 23. EV-AD74414H-ARDZ Layer 1, Top Layer

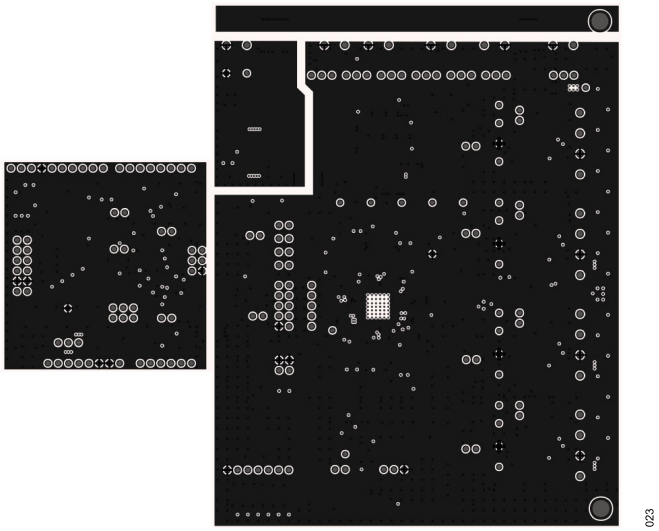

Figure 24. EV-AD74414H-ARDZ Layer 2, Ground Layer

EVALUATION BOARD SCHEMATICS AND ARTWORK

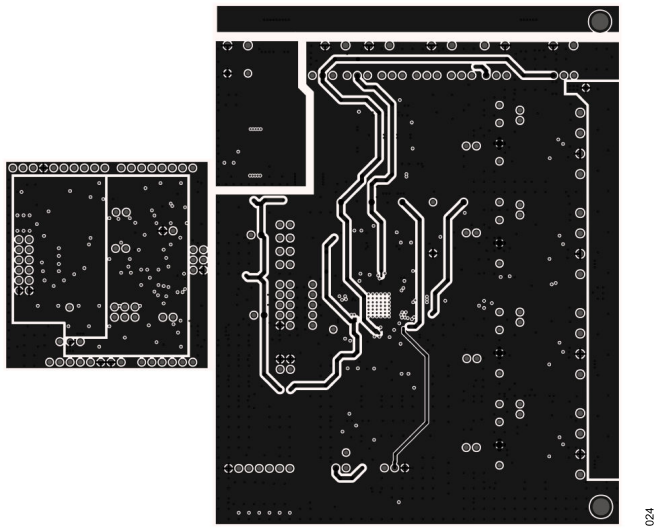

Figure 25. EV-AD74414H-ARDZ Layer 3, Power Layer

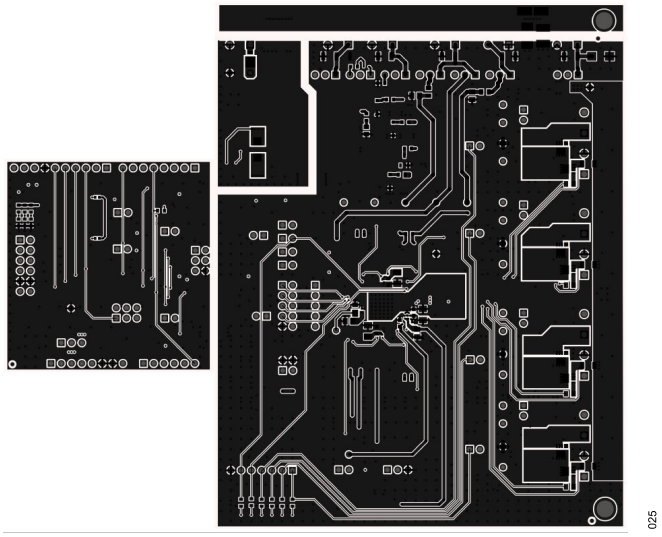

Figure 26. EV-AD74414H-ARDZ Layer 4, Bottom Layer

ORDERING INFORMATION

BILL OF MATERIALS

Table 5. Bill of Materials for EV-AD74414H-ARDZ

Quantity	Reference Designator	Description	Manufacturer	Part Number
13	AVCC, AVDDHI, AVDDLO, AVSS, DO_VDD, DVCC, I/OP_A, I/OP_B, I/OP_C, I/OP_D, LDO1V8, REFIO, TP4	Connectors, PCB test points, red	Vero Technologies	20-313137
14	C1, C2, C8, C9, C11, C49, C50, C51, C52, C53, C63, C64, C66, C74	Ceramic capacitors, 10µF, 100V, 10%, X7S, 1210	Murata	GRM32EC72A106KE05L
2	C10, C65	Ceramic capacitors, low ESR, 22µF, 16V, 20%, X7R, 1210	TDK	C3225X7R1C226M250AC
12	C13, C16, C17, C18, C19, C23, C24, C31, C55, C56, C57, C58	Ceramic capacitors, 0.1µF, 16V, 10%, X7R, 0402	Wurth Elektronik	885012205037
7	C14, C15, C20, C21, C70, C71, C76	Ceramic capacitors, 10µF, 10V, 10%, X7R, 0805	Wurth Elektronik	885012207026
3	C22, C25, C26	Ceramic capacitors, 0.1µF, 50V, 10%, X7R, 0603	AVX	06035C104KAT2A
2	C27, C54	Ceramic capacitors, 0.1µF, 100V, 10%, X7R, 0805	TDK	C2012X7R2A104K125AA
1	C28	Ceramic capacitor, 0.039µF, 16V, 10%, X7R, 0603	Yageo	CC0603KRX7R7BB393
2	C29, C32	Ceramic capacitors, 2.2µF, 6.3V, 10%, X7R, 0805	Kemet	C0805C225K9RACTU
1	C3	Ceramic capacitor, low ESR, 2.2µF, 16V, 10%, X7S, 0603, AEC-Q200	TDK	CGA3E1X7S1C225K080AC
1	C30	Ceramic capacitor, 1µF, 25V, 10%, X7R, 0603	Wurth Elektronik	885012206076
12	C33, C34, C36, C37, C38, C40, C41, C42, C44, C45, C46, C48	Ceramic capacitors, 4.7nF, 100V, 10%, X7R, 0805	Wurth Elektronik	885012207120
4	C35, C39, C43, C47	Ceramic capacitors, 220pF, 50V, 5%, C0G, 0603	Yageo	CC0603JRNPO9BN221
1	C4	Ceramic capacitor, low ESR, 1000pF, 50V, 10%, X7R, 0402, AEC-Q200	TDK	CGA2B2X7R1H102K050BA
1	C6	Ceramic capacitor, 0.012µF, 16V, 10%, X7R, 0402	AVX	0402YC123KAT2A
4	C67, C68, C69, C78	Ceramic capacitors, 3300pF, 3000V, 10%, X7R, 1812	Vishay	HV1812Y332KXHATHV
1	C7	Ceramic capacitor, 100pF, 16V, 10%, X7R, 0402	AVX	0402YC101KAT2A
3	C72, C73, C75	Ceramic capacitors, 10µF, 50V, 10%, X7R, 1206	Samsung	CL31B106KBHNNNE
1	D1	Single Zener diode, 36V, 5%, DO214-AC, AEC-Q101	Onsemi	SZ1SMA5938BT3G
1	D10	Zener diode, 17V, 2%, 19Ω, 1/2W, SOD-123	Vishay	MMSZ5247C-E3-08
4	D11, D16, D21, D26	Diodes, ESD capability rectifiers, 1A	Vishay	MSE1PB-M3/89A
4	D12, D17, D22, D27	TVS diodes, unidirectional	Onsemi	ESD9M5.0ST5G
8	D13, D14, D18, D19, D23, D24, D28, D29	TVS diodes, bidirectional, 36V, 600W	Taiwan Semiconductor	SMBJ36CA
1	D2	Diode switching, 100V, 1A, DO-214AC	Diodes Inc.	S1B-13-F
3	D3, D4, D6, D33	Schottky diodes (TMBS), rectifiers, 100V, 3A, D0-220AA, AEC-Q101	Vishay	V3PM10-M3/H
1	D31	Small signal Schottky diode, 100V, 0.2A, SOD-523	ST Microelectronics	BAT41KFILM
1	D32	TVS diode, single, unidirectional, 36V, 600W	Vishay	SMBJ36A-E3/52
1	D5	Schottky diode barrier rectifier, 50V, 3A, DO-214AB	Vishay	SS35-E3/57T
1	D7	Zener diode, 22V, 2%, 29Ω, 1/2W, SOD-123	Vishay	MMSZ5251C-E3-08
1	D8	Zener diode, 14V, 2%, 15Ω, 1/2W, SOD-123	Vishay	MMSZ5244C-E3-08
1	D9	Zener diode, 5.3V, 0.25W, 4%, SOT-23-3, AEC-Q101	Nexperia	PLVA653A,215
7	DS1, DS2, DS3, DS4, DS5, DS6, DS7	Green LEDs, SMD	Kingbright	APHHS1005ZGC
1	DS8	Hyper red LED, SMD	Kingbright	APHHS1005SURCK
1	DS9	Orange LED, unicolor, 610nm	Kingbright	APHHS1005SECK
7	I/ON_A, I/ON_B, I/ON_C, I/ON_D, TP1, TP8, TP9	Connectors, PCB test points, black	Vero Technologies	20-2137
8	ISN_A, ISN_B, ISN_C, ISN_D, ISP_A, ISP_B, ISP_C, ISP_D	Connectors, PCB test points, yellow	Vero Technologies	20-313140

ORDERING INFORMATION

Table 5. Bill of Materials for EV-AD74414H-ARDZ (Continued)

Quantity	Reference Designator	Description	Manufacturer	Part Number
1	P1	PCB connector, unshrouded, header, right angle, 2.54mm pitch	Samtec	TSW-106-08-L-D-RA
1	P10	PCB connector, 7 positions, male pin, unshrouded, header, 2.54mm pitch, 5.84mm post height, 2.54mm solder tail	Samtec	TSW-107-07-L-S
1	P11	PCB connector, 4 positions, male pin, unshrouded, header, double row, straight, 2.54mm pitch, 5.84mm post height, 2.54mm solder tail	Samtec	TSW-102-07-T-D
9	P7, P12, P31, P33, P53, P56, P59, P60, P61	PCB connectors, unshrouded, header, 2.54mm pitch, 6mm post height	Wurth Elektronik	61300311121
14	P15, P16, P19, P20, P23, P24, P27, P28, P29, P30, P32, P54, P55, P58	PCB connectors, header, 2 positions	Phoenix Contact	1759017
1	P2	PCB connector, receptacle, 25mil, square post, 2.54mm pitch	Samtec	SSQ-106-03-G-S
2	P3, P5	PCB connectors, receptacles, 25mil, square post, 2.54mm pitch	Samtec	SSQ-108-03-G-S
19	P34, P35, P36, P37, P38, P39, P40, P41, P42, P43, P44, P45, P46, P47, P48, P49, P50, P51, P52	PCB connectors, 2 positions, header, vertical, 2.54mm pitch	Wurth Elektronik	61300211121
1	P4	PCB connector, receptacle, 25mil, square post, dual row, 2.54mm pitch	Samtec	SSQ-103-03-G-D
1	P6	PCB connector, receptacle, 25mil, square post, 2.54mm pitch	Samtec	SSQ-110-03-G-S
1	P62	PCB connector, unshrouded, header, 10 positions, 2.54mm pitch, gold, 12.7mm × 8.54mm × 5.08mm, straight, through-hole technology	Wurth Elektronik	61301021121
1	P8	PCB connector, 6 positions, male pin, unshrouded, header, 0.64mm square post, 2.54mm pitch, 6mm post height, 3mm solder tail, for CN6P_JMPRSHRT add 3X M000385	Wurth Elektronik	61300621121
1	P9	PCB connector, 5 positions, female header/socket, single row, straight, 2.54mm pitch, 10mm solder tail	Samtec	SSQ-105-03-G-S
4	Q1, Q3, Q5, Q7	N-channel MOSFETs, transistors, 50V, 0.2A, SOT-23-3	Diodes Inc.	BSS138-7-F
8	Q2, Q4, Q6, Q8, Q_A, Q_B, Q_C, Q_D	P-channel MOSFETs, transistors, 100V, 10.8A	Vishay	SI7113ADN-T1-GE3
1	R1	Resistor, SMD, 3.3MΩ, 1%, 1/16W, 0402	Yageo	RC0402FR-073M3L
2	R10, R12	Resistors, SMD, 22.1Ω, 1%, 1/8W, 0603, AEC-Q200	KOA Speer Electronics, Inc.	RK73H1JTTD22R1F
1	R11	Resistor, SMD, 10Ω, 1%, 1/10W, 0603, AEC-Q200	Vishay	CRCW060310R0FKEA
1	R14	Resistor, SMD, 1Ω, 1%, 1/8W, 0603, AEC-Q200	KOA Speer Electronics, Inc.	RK73H1JTTD1R00F
7	R16, R17, R20, R51, R59, R67, R75	Resistors, SMD, 100kΩ, 1%, 1/16W, 0603	Multicomp (SPC)	MC0063W06031100K
1	R2	Resistor, SMD, 249kΩ, 1%, 1/16W, 0402	Yageo	RC0402FR-07249KL
27	R22, R24, R28, R29, R30, R31, R32, R33, R34, R35, R36, R37, R38, R39, R40, R41, R42, R44, R50, R52, R58, R60, R66, R68, R74, R76, R90	Resistors, SMD, 10kΩ, 1%, 1/10W, 0603, AEC-Q200	Panasonic	ERJ-3EKF1002V
2	R25, R26	Resistors, SMD, 4.7kΩ, 5%, 1/10W, 0603	Yageo	RC0603JR-074K7L
1	R3	Resistor, SMD, 100kΩ, 1%, 1/10W, 0402, AEC-Q200	Panasonic	ERJ-2RKF1003X
2	R43, R95	Resistors, SMD, 0Ω, jumper, 1/10W, 0603, AEC-Q200	Panasonic	ERJ-3GEY0R00V
1	R45	Resistor, SMD, 33kΩ, 0.1%, 1/8W, 0805, AEC-Q200, high reliability type	Panasonic	ERA-6AEB333V

ORDERING INFORMATION

Table 5. Bill of Materials for EV-AD74414H-ARDZ (Continued)

Quantity	Reference Designator	Description	Manufacturer	Part Number
9	R46, R48, R54, R56, R62, R64, R70, R72, R78	Resistors, SMD, 2kΩ, 1%, 1/10W, 0603, AEC-Q200	Panasonic	ERJ-3EKF2001V
4	R47, R55, R63, R71	Resistors, SMD, 2kΩ, 0.01%, 1/10W, 0603, AEC-Q200	Stackpole Electronics, Inc.	RNCF0603TKY2K00
4	R49, R57, R65, R73	Resistors, SMD, 100kΩ, 5%, 1/16W, 0402	Yageo	RC0402JR-07100KL
1	R5	Resistor, SMD, 200kΩ, 1%, 1/10W, 0402, AEC-Q200	Panasonic	ERJ-2RKF2003X
4	R53, R61, R69, R77	Resistors, SMD, 0.15Ω, 1%, 1/2W, 1206	Bourns Inc.	CRL1206-FW-R150ELF
1	R6	Resistor, SMD, 10kΩ, 1%, 1/10W, 0402, AEC-Q200	Panasonic	ERJ-2RKF1002X
1	R7	Resistor, SMD, 226kΩ, 1%, 1/10W, 0603, AEC-Q200	Panasonic	ERJ-3EKF2263V
4	R79, R86, R87, R88	Resistors, SMD, 0Ω, 1/10W, 0805	Multicomp (SPC)	MC01W08050R
1	R8	Resistor, SMD, 23.7kΩ, 1%, 1/10W, 0402, AEC-Q200	Panasonic	ERJ-2RKF2372X
1	R80	Resistor, SMD, 56kΩ, 1%, 1/10W, 0402, AEC-Q200	Panasonic	ERJ-2RKF5602X
2	R83, R84	Resistors, SMD, high voltage, 4.7MΩ, 5%, 1/2W, 2010	Bourns Inc.	CHV2010-JW-475ELF
2	R85, R89	Resistors, SMD, 1kΩ, 5%, 1/16W, 0402	Yageo	RC0402JR-071KL
1	R9	Resistor, SMD, 33.2Ω, 1%, 1/8W, 0603, AEC-Q200	KOA Speer Electronics, Inc.	RK73H1JTTDD33R2F
4	R91, R92, R93, R94	Resistors, SMD, 3.9kΩ, 1%, 1/10W, 0603	Yageo	RC0603FR-073K9L
1	R96	Resistor, SMD, 10Ω, 1%, 1/8W, 0805, AEC-Q200	Panasonic	ERJ-6ENF10R0V
1	R97	Resistor, SMD, 0Ω, 1/8W, 0805, AEC-Q200	Panasonic	ERJ-6GEY0R00V
1	RT1	NTC thermistor, 33kΩ, 5%, 0805, AEC-Q200	Vishay	NTCS0805E3333JHT
4	R_A, R_B, R_C, R_D	Resistors, SMD, 12Ω, 0.1%, 1/10W, 0805	TE Connectivity	CPF0805B12RE1
1	S1	Tactile switch, SPST-NO, 0.05A, 12V	C&K	RS-282G05A3-SM RT
1	U1	IC-TTL, CMOS, high-speed single unbuffered inverter	Onsemi	MC74VHC1GU04DBVT1G
1	U10	IC, quad-channel, software configurable input and output with HART modem, prelim	Analog Devices, Inc.	AD74414HBCPZ-RL7
1	U2	IC, ultra-low noise, high accuracy voltage references	Analog Devices, Inc.	ADR4525BRZ
1	U3	IC, 32Kbit, serial EEPROM	Microchip Technology	24AA32A-I/SN
3	U4, U5, U8	IC-TTL, obsolete, 2 inputs, AND gate with open drain output	Onsemi	MC74VHC1G09DTT1G
1	U6	IC, 5.7kV rms quad digital isolators	Analog Devices, Inc.	ADuM341E1BRWZ
1	U7	IC, 5.7kV rms quad digital isolators	Analog Devices, Inc.	ADuM342E1BRWZ
1	U9	IC, 4.2V to 60V no-opto isolated flyback converter with integrated FET	Analog Devices, Inc.	MAX17691BATC+
1	X2	Custom transformer, 75µH, 20%, 10kHz, prelim	Wurth Elektronik	750320519
2	C12, C79	Ceramic capacitors, 47pF, 100V, 5%, C0G, 0805	AVX	08051A470JAT2A
1	C5	Ceramic capacitor, 6800pF, 16V, 10%, X7R, 0603	AVX	0603YC682KAT2A
8	C59, C60, C61, C62, C80, C81, C82, C83	Ceramic capacitors, 4.7nF, 100V, 10%, X7R, 0805	Wurth Elektronik	885012207120
1	C77	Ceramic capacitor, 10µF, 10V, 10%, X7R, 0805	Wurth Elektronik	885012207026
2	R13, R98	Resistors, SMD, 820Ω, 1%, 1/16W, 0603	Multicomp (SPC)	MC0063W06031820R
6	R15, R18, R19, R21, R23, R82	Resistors, SMD, 0Ω, jumper, 1/10W, 0603, AEC-Q200	Panasonic	ERJ-3GEY0R00V
2	R27, R81	Resistors, SMD, 100kΩ, 1%, 1/16W, 0603	Multicomp (SPC)	MC0063W06031100K
1	R4	Resistor, SMD, 422kΩ, 1%, 1/16W, 0402	Yageo	RC0402FR-07422KL
4	TP2, TP3, TP5, TP6	Connectors, PCB test point	Harwin Inc.	S1751-46
4	D15, D20, D25, D30	TVS diodes, bidirectional, 36V, 600W	Taiwan Semiconductor	SMBJ36CA

ORDERING INFORMATION

ORDERING GUIDE

Model[1]	Description
EV-AD74414H-ARDZ	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.