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User Guide | EVAL-AD74416H

Evaluating the AD74416H Quad-Channel, Software Configurable Input and Output with HART Modem

FEATURES

- Fully-featured evaluation board for the AD74416H
- 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
- No-OS MBED drivers providing example code in C

EVALUATION KIT CONTENTS

- EVAL-AD74416H-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

- AD74416H data sheet
- MAX17691B data sheet
- ADuM341E and ADuM342E data sheets
- ADR4525 data sheet

SOFTWARE NEEDED

- ACE software

- AD74416H ACE plug-in for control

GENERAL DESCRIPTION

The EVAL-AD74416H-ARDZ is a fully-featured evaluation board that a user can use to evaluate the features of the AD74416H as a full system solution. Power is provided by the MAX17691B isolated flyback solution. Digital channels isolation utilizes the ADuM341E and ADuM342E isolators.

The AD74416H is a quad-channel, software configurable, and input and output device. The device has functionality for analog input/output, digital input/output, thermocouple, and 2-wire, 3-wire resistance temperature detector (RTD) measurements integrated into a single-chip solution with a compatible serial-peripheral interface (SPI).

A user can control the EVAL-AD74416H-ARDZ by a system demonstration platform (SDP) board. The EVAL-SDP-CK1Z (SDP-K1) board allows the EVAL-AD74416H-ARDZ to be controlled by the USB port of a PC using the AD74416H ACE software. The EVAL-AD74416H-ARDZ requires an operating supply of 24V. The PC provides power to the EVAL-SDP-CK1Z (SDP-K1) board.

Full specifications on the AD74416H, 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 EVAL-AD74416H-ARDZ board.

PLEASE SEE THE LAST PAGE FOR AN IMPORTANT WARNING AND LEGAL TERMS AND CONDITIONS.

REVISION HISTORY

3/2025—Revision 0: Initial Version

EVALUATION BOARD PHOTOGRAPH

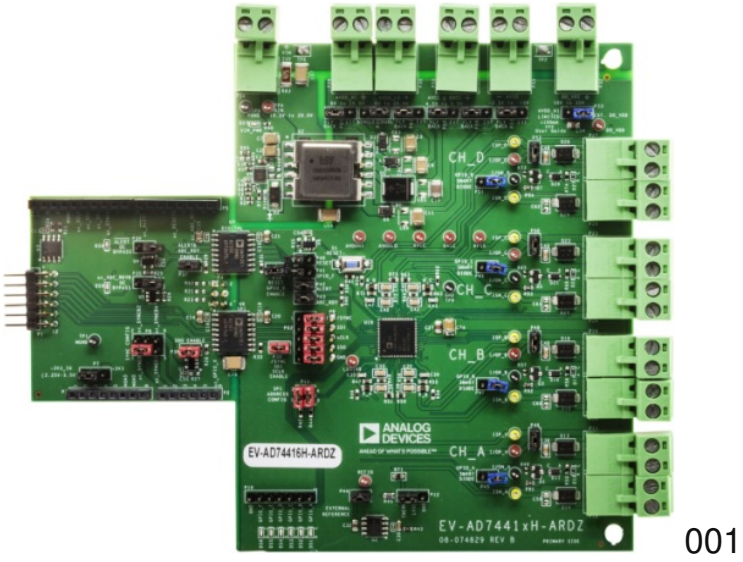

Figure 1. EVAL-AD74416H-ARDZ Evaluation Board Photograph

EVALUATION BOARD HARDWARE

BOARD LAYOUT

The EVAL-AD74416H-ARDZ is laid out with the following three isolated zones:

- PGND: The input power supply is applied to the power side of the EVAL-AD74416H-ARDZ.
- MGND: Communications to the EVAL-AD74416H-ARDZ are received on the micro side by the SDP Arduino header connection.
- GND: The AD74416H and all related circuitry are on the AD74416H (or field) side of the EVAL-AD74416H-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 EVAL-AD74416H-ARDZ.

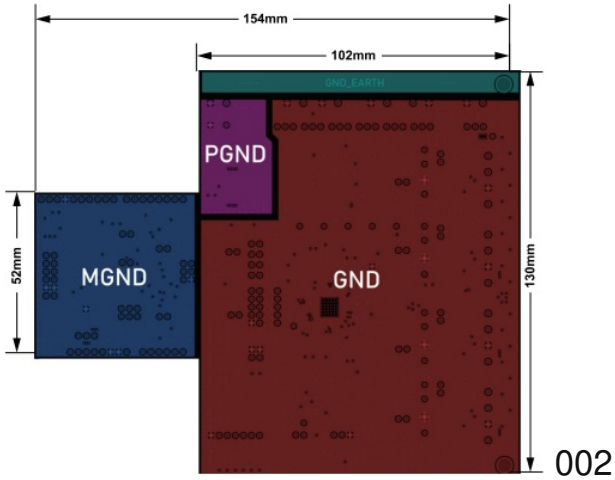

Figure 2. Isolation Zones on the EVAL-AD74416H-ARDZ

HEADER CONFIGURATION OPTIONS

Configuration headers must be set by the jumpers properly for operation of the EVAL-AD74416H-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 EVAL-AD74416H-ARDZ, ensure that all links are set to the default positions, as defined in Table 1.

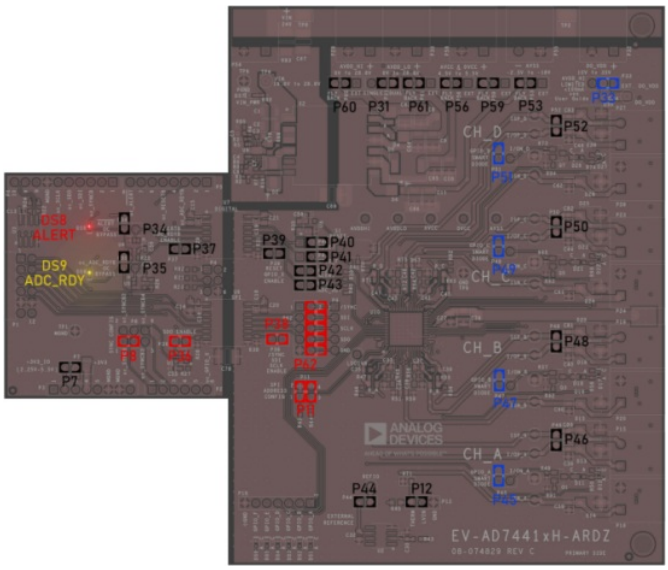

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Figure 3. Default Header Configurations

Table 1. Header Configurations and Jumper Functionality

Header Group	Header (Jumper)	Function	Description	Default Position

POWER SUPPLIES	P31 (Black)	AD74416H 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
	P45 (Blue)	GPIO_A smart diode control	GPIO connection to smart blocking diode control at Channel A.	Not connected Open

DIGITAL OUTPUT	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 AD74416H 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 AD74416H.	Address 00 Pin 1 to Pin 2 Pin 3 to Pin 4
	P36 (Red)	SDO enable	Enable SDO signal generated by AD74416H.	SDO enabled Closed
	P38 (Red)	SYNC, SDI, SCLK enable	Enable SYNC, SDI and SCLK SPI signals to AD74416H.	Signals enabled Closed

	P62 (Red)	SPI interconnection	Connects SPI signals to P9 board-to-board connector.	Not connected (5 signal jumpers) Open
	P8 (Red)	SYNC configuration	Alternative 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)	ALERT open collector bypass	Bypass open collector driver at ALERT signal. Once ALERT is active, red LED DS8 indicates it.	Open collector Active Open
	P35 (Black)	ADC_RDY open collector bypass	Bypass open collector driver at ADC_RDY signal. Once ADC_RDY is active, orange LED DS9 indicates it.	Open collector Active Open
	P37 (Black)	ALERT and ADC_RDY enable	Enable ALERT and ADC_RDY signal generated by AD74416H.	Signals enabled Closed
	P39 (Black)	RESET and GPIO_x enable	Enabled RESET and GPIO_x signal generated at Arduino side.	Signals enabled Closed
	P40 (Black)	RESET signal	Activates RESET signal generated at Arduino side.	RESET not connected Open

	P41 (Black)	GPIO_F signal	Activates GPIO_F signal generated at Arduino side.	Not connected Open[2]
	P42 (Black)	ALERT signal	Connects ALERT signal generated by AD74416H.	ALERT connected Closed
	P43 (Black)	ADC_RDY signal	Connects ADC_RDY signal generated by AD74416H.	ADC_RDY connected Closed
CHANNEL INPUT AND OUTPUT TERMINALS	P46 (Black)	ISP_A to I/OP_A connection	Channel A direct connection of the ISP_A to I/OP_A terminals. Header is open only in 4-wire voltage output mode.	ISP_A and I/OP_A connected Closed
	P48 (Black)	ISP_B to I/OP_B connection	Channel B direct connection of the ISP_B to I/OP_B terminals. Header is open only in 4-wire voltage output mode.	ISP_B and I/OP_B connected Closed
	P50 (Black)	ISP_C to I/OP_C connection	Channel A direct connection of the ISP_C to I/OP_C terminals. Header is open only in 4-wire voltage output mode.	ISP_C and I/OP_C connected Closed
	P52 (Black)	ISP_D to I/OP_D connection	Channel A direct connection of the ISP_D to I/OP_D terminals. Header is open only in 4-wire voltage output mode.	ISP_D and I/OP_D 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 EVAL-AD74416H-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 AD74416H:

- +AVDD_HI provides the AD74416H AVDD_HI voltage supply of 21V.
- +AVDD_LO provides the AD74416H AVDD_LO voltage supply of 13V.
- +AVCC_DVCC provides the AD74416H AVCC and DVCC voltage supplies of 5V.
- -AVSS provides the AD74416H AVSS voltage supply of -16V.

The 2.5V external reference (ADR4525) is powered by AVCC domain. Use the ADR4525 as an alternative to the AD74416H on-chip reference. On-board isolators ADuM341E and ADuM342E are powered by DVCC domain of the AD74416H.

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 AD74416H 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 AD74416H 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 EVAL-AD74416H-ARDZ board.

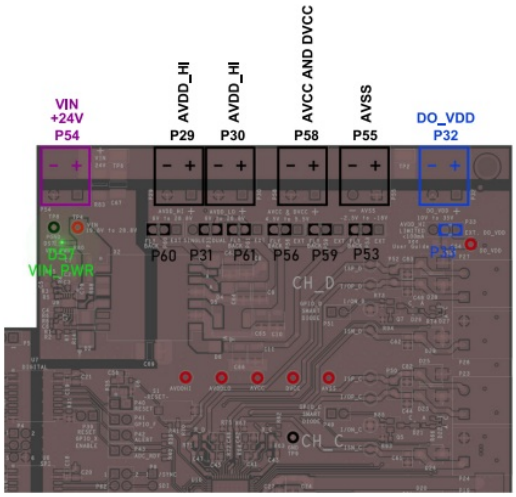

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Figure 4. Power Supplies Connectors and Headers

SPI COMMUNICATION

The EVAL-SDP-CK1Z (SDP-K1) board handles the communication to the EVAL-AD74416H-ARDZ by the PC. The EVAL-SDP-CK1Z (SDP-K1) is connected to the EVAL-AD74416H-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 AD74416H. 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 AD74416H when using ACE software. The SPI address header (P11) configuration is shown in Table 2.

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

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. SYNC signal configuration by header P8 is shown in Table 3.

Table 3. P8 – SYNC Signal Configuration

SYNC Source	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 EVAL-AD74416H-ARDZ to manually reset the AD74416H.

REFERENCE OPTIONS

By default, the EVAL-AD74416H-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 AD74416H on-chip reference by disconnecting header P44 and enabling an internal reference. The internal reference of the AD74416H is enabled by SPI write to the relevant register. For more details, refer to the AD74416H data sheet. Figure 5 shows a schematic snippet.

EXTERNAL REFERENCE

2.5V

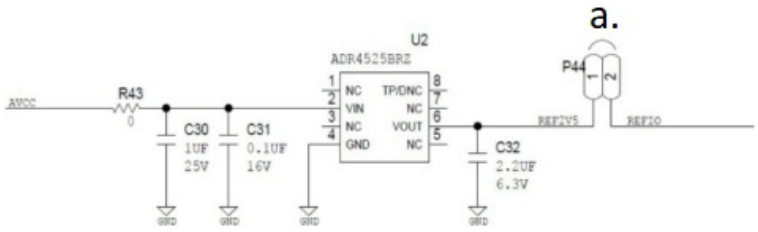

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Figure 5. External Reference Connection

a. Ext. Voltage Reference

LVIN PIN – LOW VOLTAGE ADC INPUT

The LVIN pin is the low voltage input to the ADC. The LVIN pin is particularly useful for thermocouple measurement and connecting the thermistor for cold junction compensation. Depending on application needs, the LVIN pin can have other uses. For more details on LVIN pin, refer to the AD74416H 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 (AD74416H LVIN Pin) and Pin 3 (GND) to connect external voltage source (see the schematic snippet, as shown in Figure 6).

LVIN PIN

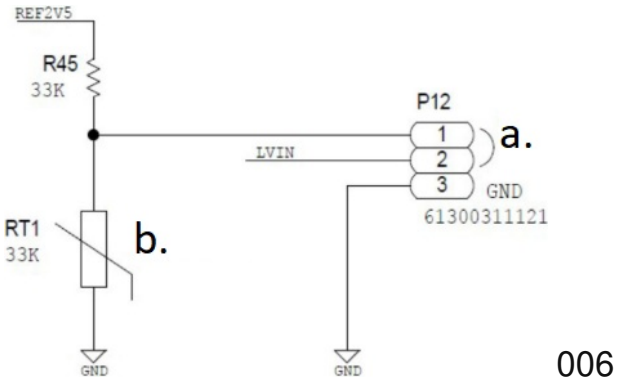

Figure 6. LVIN PIN Connection

a. Thermistor Config.
b. Cold Junction compensation

OUTPUT CHANNELS

The AD74416H channels are configured, as shown in the AD74416H data sheet. The EVAL-AD74416H-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 AD74416H channel.

In some channel functions, more than two screw terminals are required for operation. In such a case, the input sensing positive (ISP_x) and the input sensing negative (ISN_x) terminals are available.

Each terminal also has corresponding test points available. Each channel has the configuration headers (P46, P48, P50, and P52). By default, the jumper is placed to this configuration header. Create direct connection of ISP_x and I/OP_x terminals. Disconnect the jumper if a 4-wire voltage output channel function is required.

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.

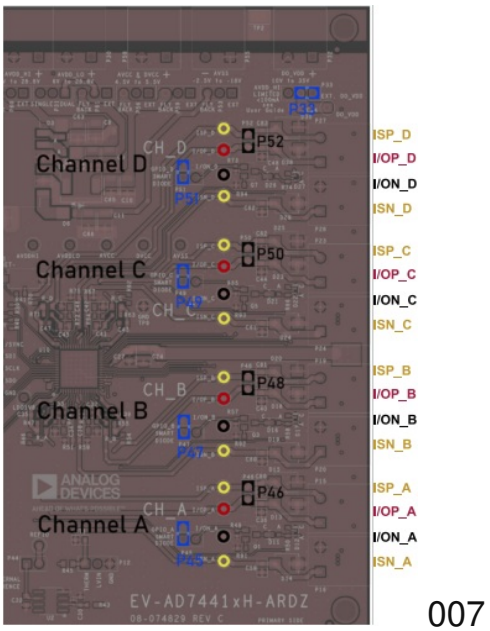

Figure 7. Output Channels

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 EVAL-AD74416H-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 AD74416H 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 EVAL-AD74416H-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.

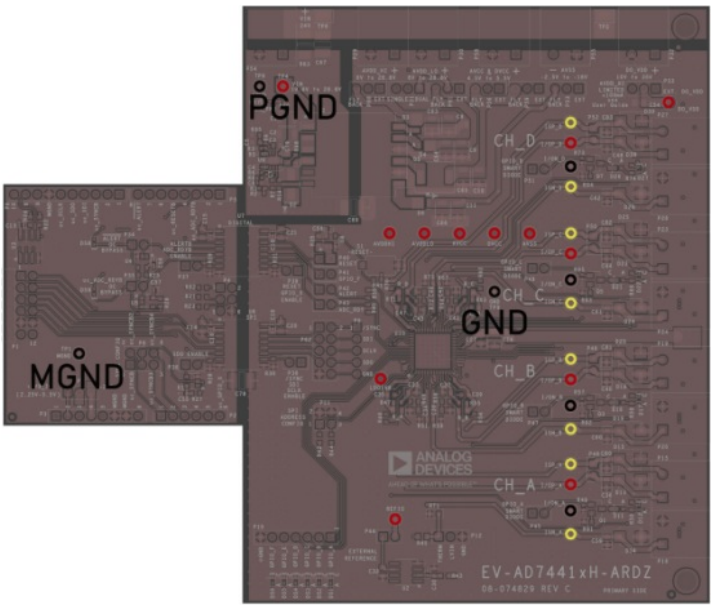

Figure 8. EVAL-AD74416H-ARDZ Test Points

GENERIC ID

Each evaluation board have a sticker placed on the top to identify the generic part assembled on the board. Evaluation board with AD74416H generic carries EVAL-AD74416H-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
AD74416H	6 (110 binary)

SOFTWARE QUICK START PROCEDURES

ACCESSING ACE SOFTWARE FOR AD74416H EVALUATION

To evaluate the AD74416H, do the following steps:

1. Download and install the ACE software.
2. Run the ACE software.
3. The AD74416H 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 EVAL-AD74416H-ARDZ

To set up the EVAL-AD74416H-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 EVAL-AD74416H-ARDZ. Board are design to be mounted into each other via Arduino shield connector. Insert EVAL-AD74416H-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 EVAL-AD74416H-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 **AD74416H Board** window.

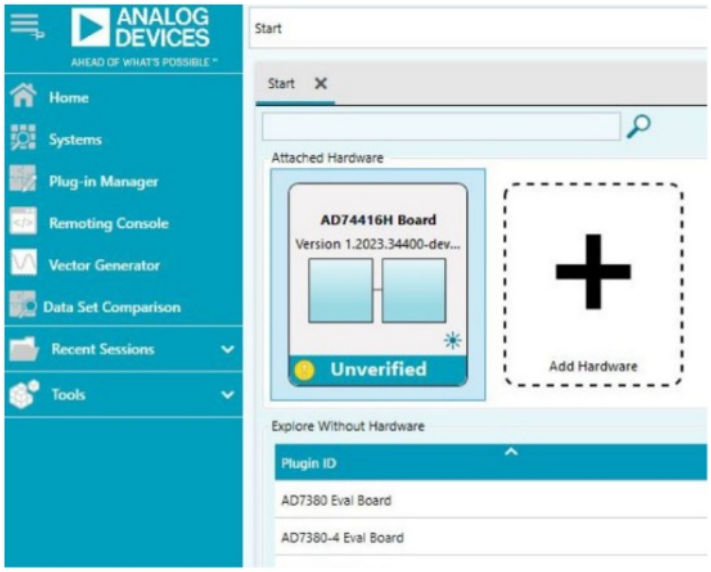

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Figure 9. ACE Evaluation Software – Attached Hardware

USING THE SOFTWARE FOR EVALUATION

Main AD74416H Tab

The main AD74416H tab view is shown in Figure 11, which shows the interactive blocks of the AD74416H. To configure the AD74416H, click the interactive blocks. The interactive blocks have darker blue color compared to static figures.

The main AD74416H 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 AD74416H data sheet.

To access the alerts of the AD74416H, 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 AD74416H 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.

Each AD74416H 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 AD74416H register map by SPI.
- **Read All:** Reads all registers of the AD74416H.
- **Reset Chip:** Initiates software reset of the AD74416H 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:** Configure the registers to its default values. To do this change, click **Apply Changes**.
- **Memory Map Side-By-Side:** Allows to turn on register map of the AD74416H.

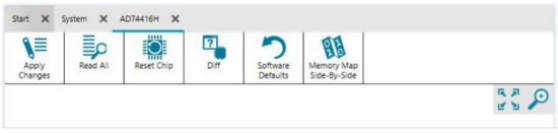

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Figure 10. Evaluation Control Panel

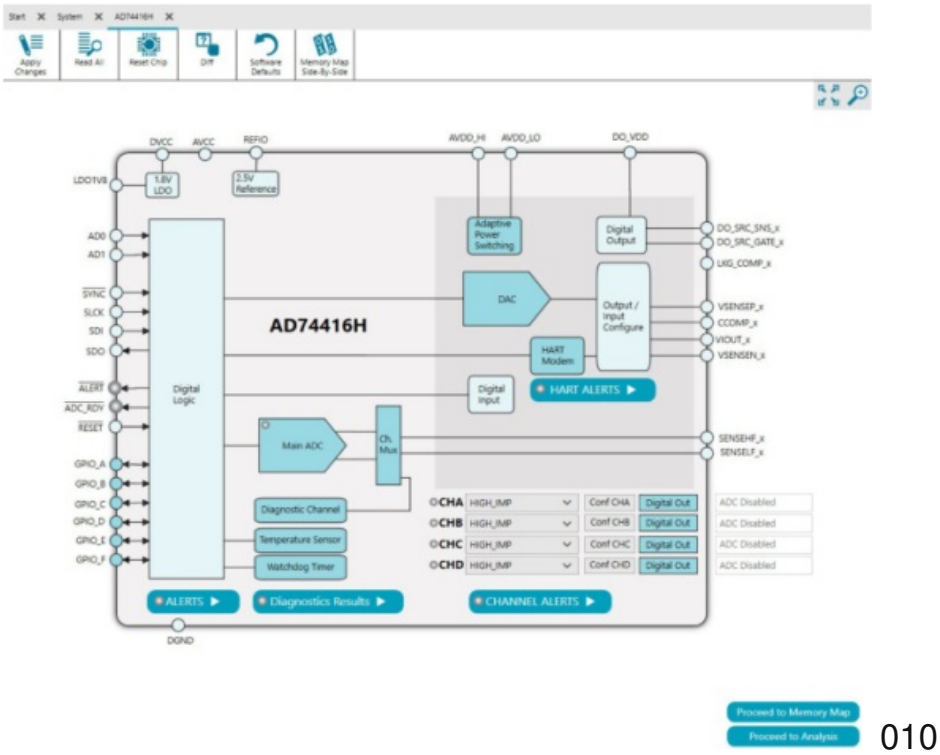

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Figure 11. Main AD74416H Tab View

Alerts Tabs

The AD74416H alerts are logically divided into corresponding tabs **ALERTS**, **CHANNEL ALERTS**, or **HART ALERTS**.

ALERTS tab shows the alerts of the AD74416H. **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 AD74416H 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 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.

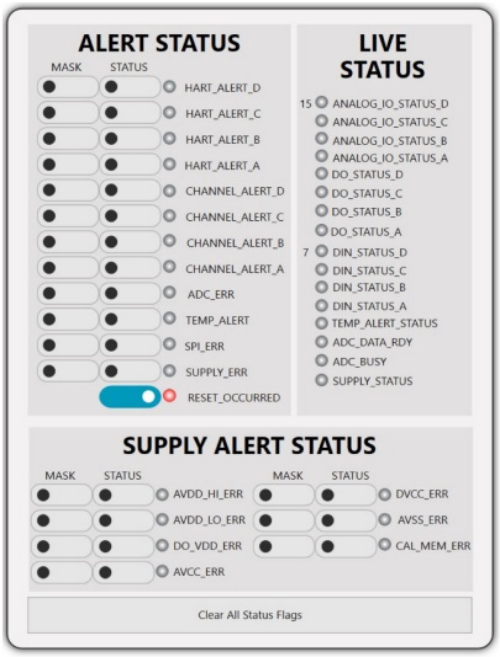

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Figure 12. ALERTS Tab View

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.

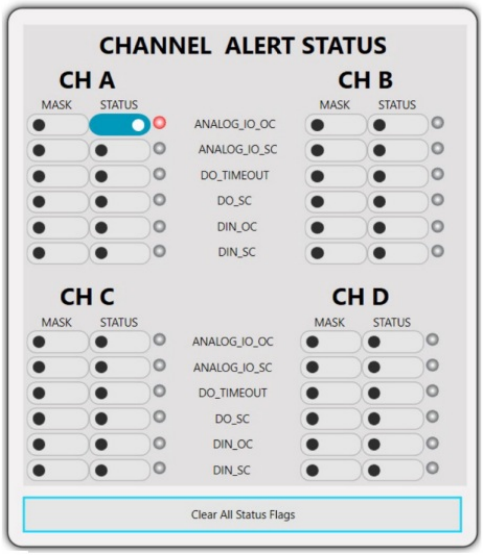

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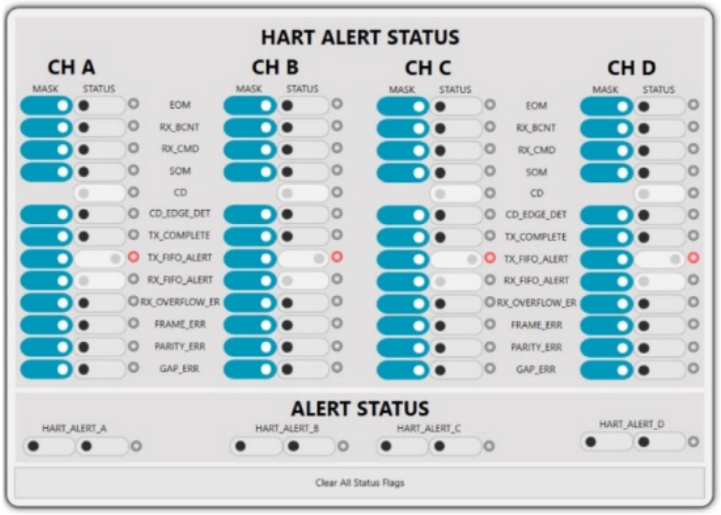
Figure 13. CHANNEL ALERT STATUS Tab View

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.



014

Figure 14. HART ALERT STATUS Tab View

Diagnostic Measurement

The AD74416H features four diagnostic channels that a user can enable simultaneously. The diagnostics gives additional insights into state of the AD74416H or its channel loads. For more details on diagnostics, refer to the AD74416H 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.

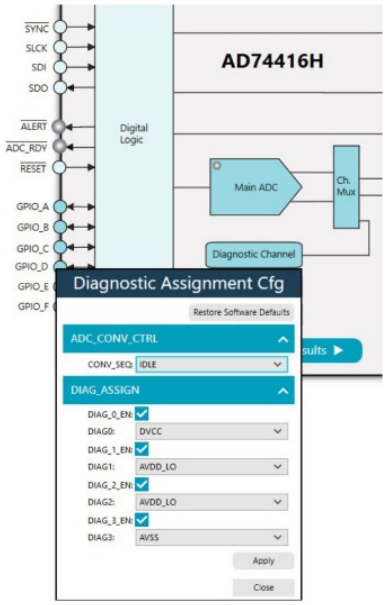


Figure 15. Assigning Diagnostic

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.

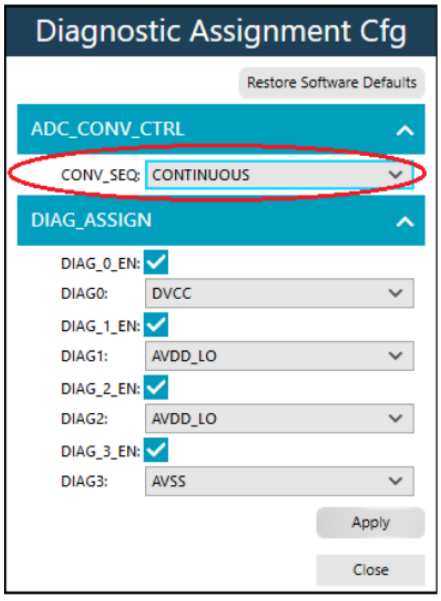
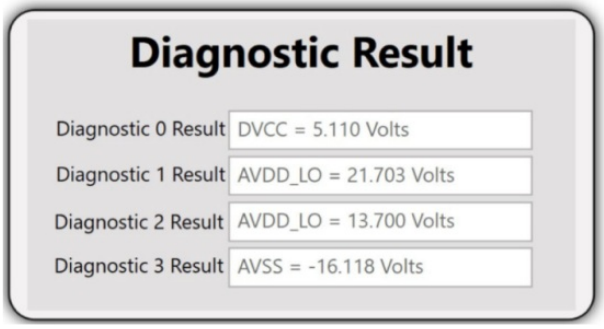


Figure 16. Start ADC Measurements

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.



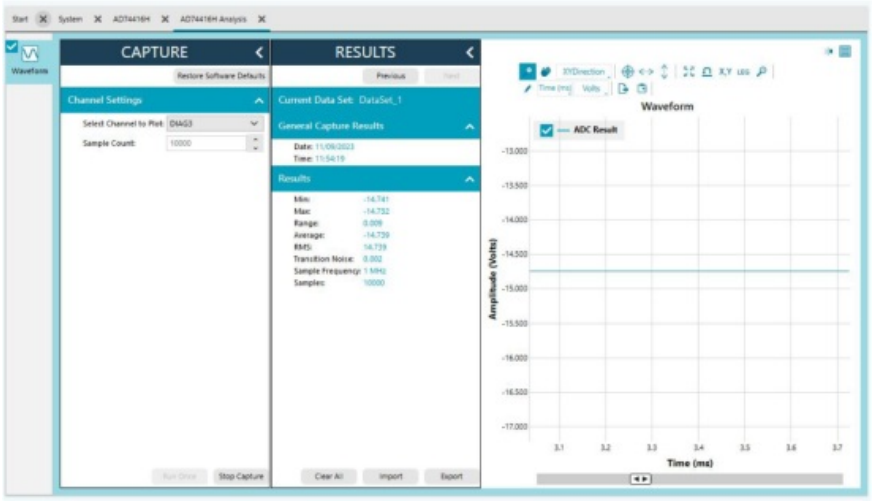
017

Figure 17. Diagnostics Measurements

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 seen on figure 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.



018

Figure 18. Analysis Window

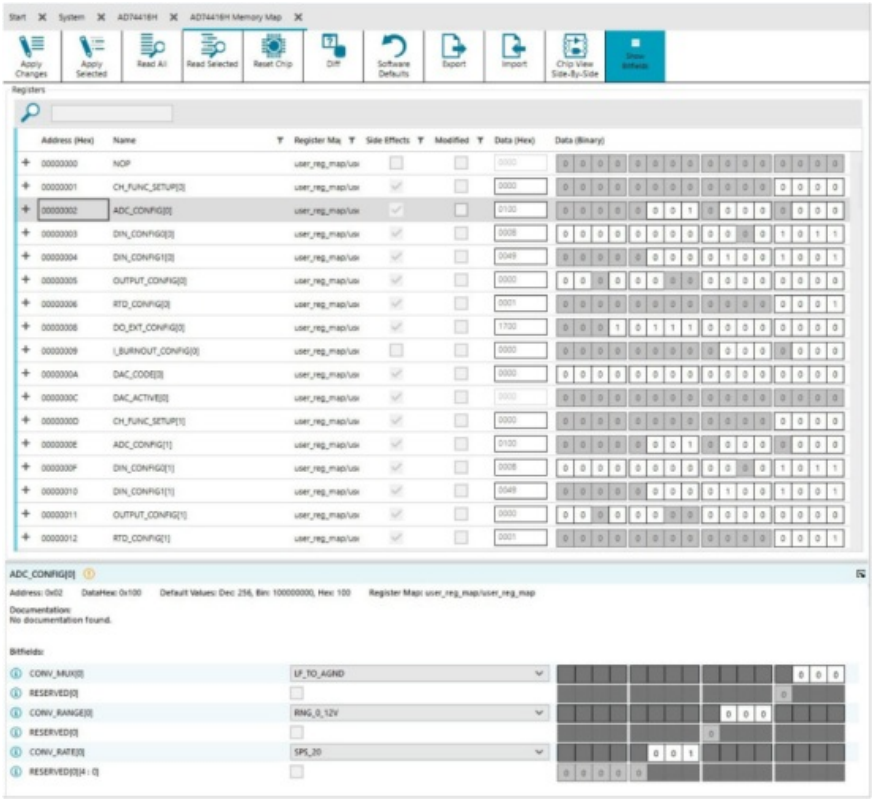
Register Map

To access the register map, click the **Proceed to Memory Map** button at the bottom right corner of the main window, as shown in the Figure 11. Use the register map to

interface directly to the AD74416H. To write each register change by SPI to AD74416H, 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.



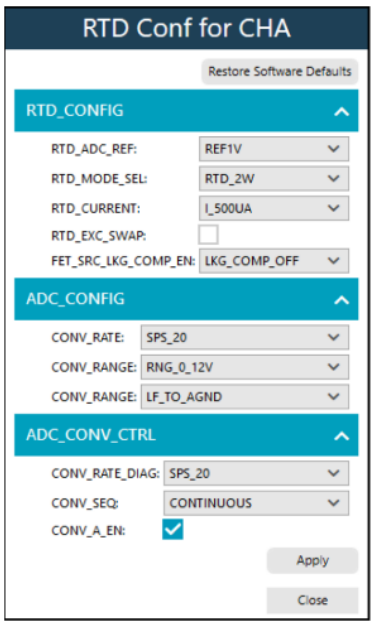
019

Figure 19. Register Map Window

RTD Configuration Example

This section shows the examples of channel configurations for RTD measurements. Configure each channel independently using the drop-down menu next to the corresponding channel label: **CHA**, **CHB**, **CHC**, and **CHD**, as shown in the main window Figure 11. For detailed functionality and configuration of the RTD, refer to the AD74416H data sheet.

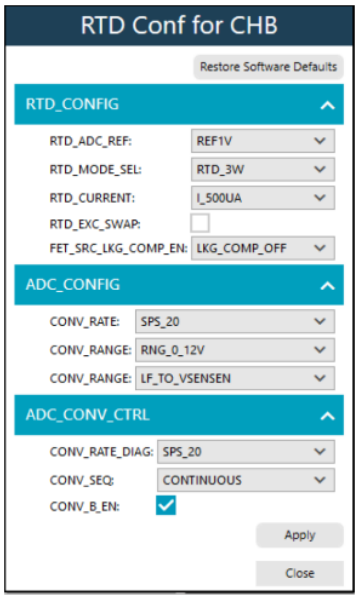
To configure the 2-wire RTD to measure Pt1000, follow the configuration example, as shown in Figure 20.



020

Figure 20. 2-Wire RTD Configuration to Measure Pt1000 at Channel A

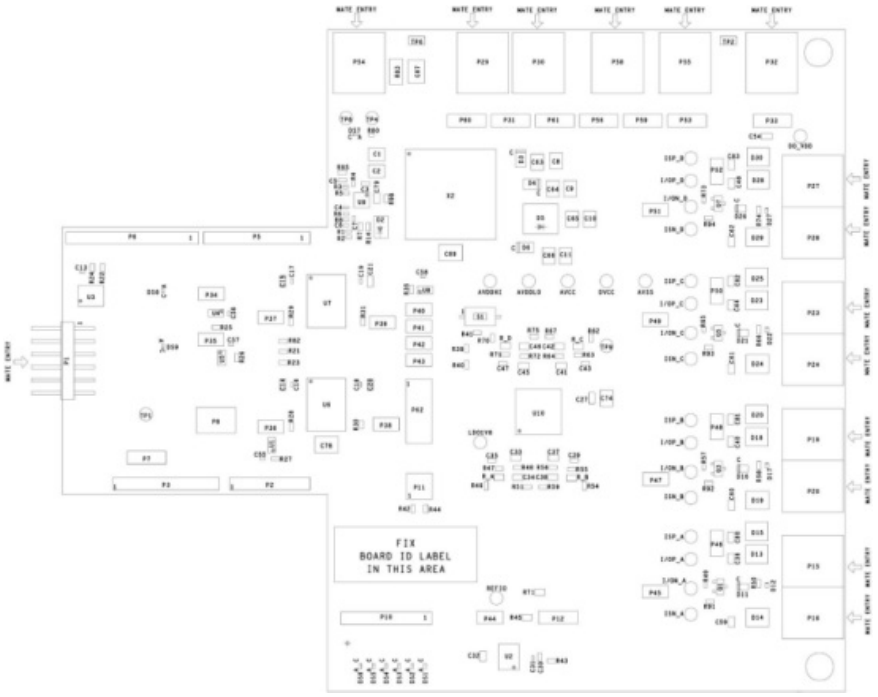
To configure the 3-wire RTD to measure Pt1000, follow the configuration example, as shown in Figure 21.



021

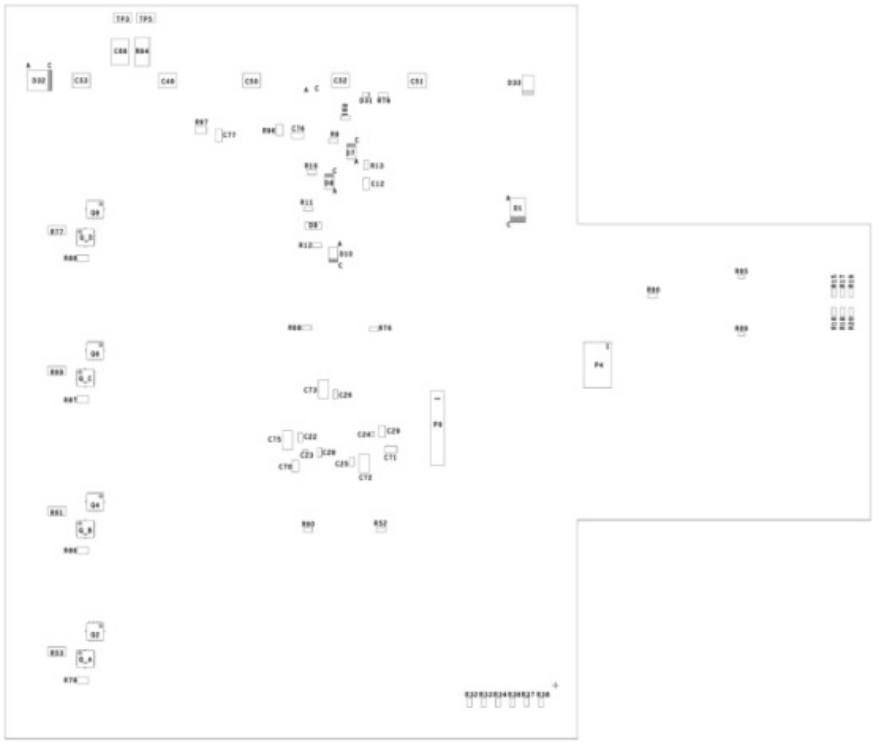
Figure 21. 3-Wire RTD Configuration to Measure Pt1000 at Channel B

EVALUATION BOARD SCHEMATICS AND ARTWORK



026

Figure 22. EVAL-AD74416H-ARDZ Assembly Diagram, Top View



027

Figure 23. EVAL-AD74416H-ARDZ Assembly Diagram, Bottom View

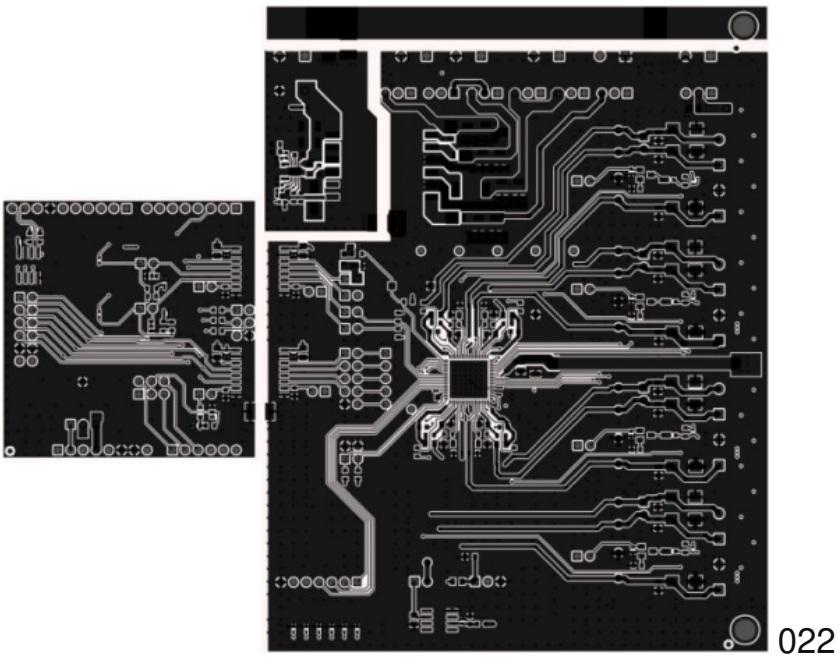


Figure 24. EVAL-AD74416H-ARDZ Layer 1, Top Layer

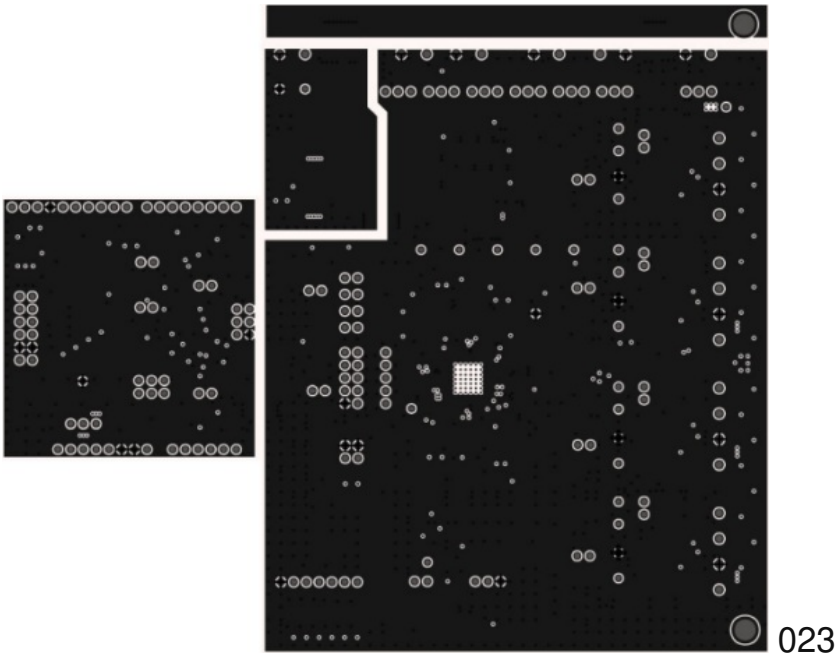


Figure 25. EVAL-AD74416H-ARDZ Layer 2, Ground Layer

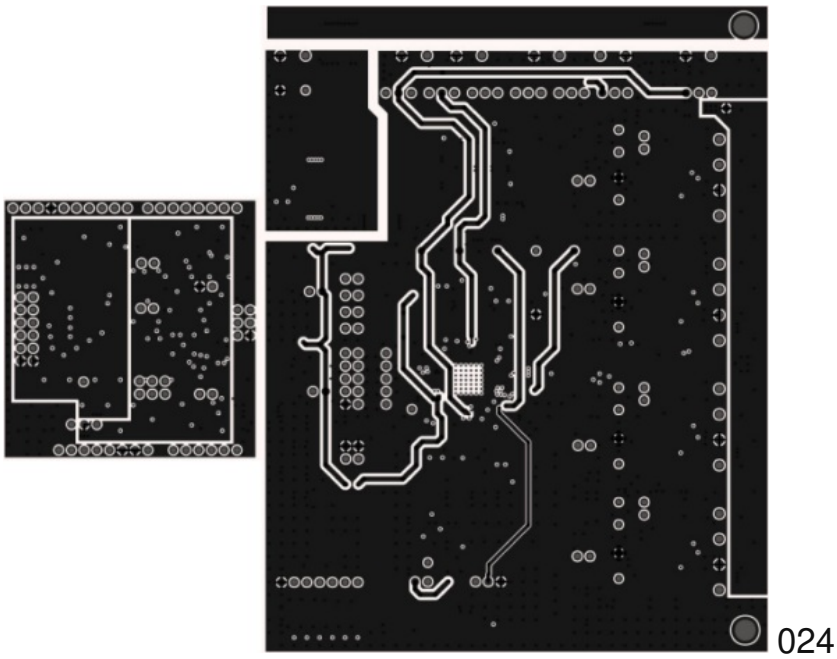


Figure 26. EVAL-AD74416H-ARDZ Layer 3, Power Layer

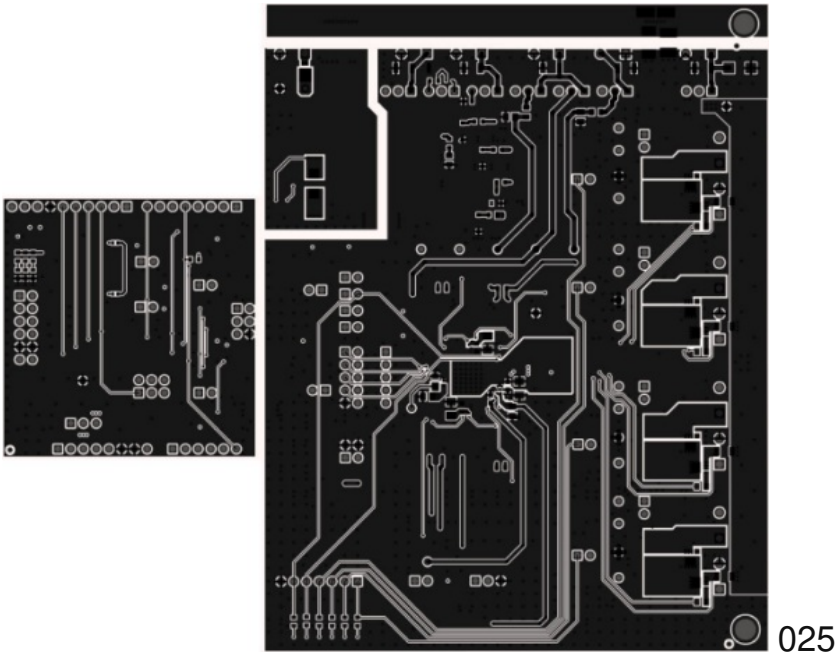


Figure 27. EVAL-AD74416H-ARDZ Layer 4, Bottom Layer

ORDERING INFORMATION

BILL OF MATERIALS

Table 5. Bill of Materials for EVAL-AD74416H-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	040 2YC 123 KAT 2A
4	C67, C68, C69, C78	Ceramic capacitors, 3300pF, 3000V , 10%, X7R, 1812	Vis hay	HV1 812 Y33 2KX HAT HV
1	C7	Ceramic capacitor, 100pF, 16V, 10 %, X7R, 0402	AVX	040 2YC 101 KAT 2A
3	C72, C73, C75	Ceramic capacitors, 10µF, 50V, 10 %, X7R, 1206	Sa msu ng	CL3 1B1 06K BH NN NE
1	D1	Single Zener diode, 36V, 5%, DO21 4-AC, AECQ101	Ons emi	SZ1 SM A59 38B T3G

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, 36 V, 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, AECQ101	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

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	613002111121
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	613010211121
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	613006211121

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	CRCW0603 10R0FKEA
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)	MC0063W0603110 0K
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, AECQ200	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, AECQ200	Panasonic	ERJ-2RKF1003X
2	R43, R95	Resistors, SMD, 0Ω, jumper, 1/10W, 0603, AECQ200	Panasonic	ERJ-3GEY0R00V
1	R45	Resistor, SMD, 33kΩ, 0.1%, 1/8W, 0805, AECQ200, high reliability type	Panasonic	ERA-6AEB333V
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%, 1/10 W, 0603, AECQ200	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, AECQ200	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, AECQ200	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, AECQ200	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, 12 V	C&K	RS-282G05A3-SMRT
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.	AD74416HBCPZ-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%, 10 kHz, 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, AECQ200	Panasonic	ERJ-3GEY0R00V
2	R27, R81	Resistors, SMD, 100kΩ, 1%, 1/16W, 0603	Multicomp (SPC)	MC0063W0603110 0K
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, 600 W	Taiwan Semiconductor	SMBJ36CA

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.

Legal Terms and Conditions

By using the evaluation board discussed herein (together with any tools, components documentation or support materials, the “Evaluation Board”), you are agreeing to be bound by the terms and conditions set forth below (“Agreement”) unless you have purchased the Evaluation Board, in which case the Analog Devices Standard Terms and Conditions of Sale shall govern. Do not use the Evaluation Board until you have read and agreed to the Agreement. Your use of the Evaluation Board shall signify your

acceptance of the Agreement. This Agreement is made by and between you (“Customer”) and Analog Devices, Inc. (“ADI”), with its principal place of business at Subject to the terms and conditions of the Agreement, ADI hereby grants to Customer a free, limited, personal, temporary, non-exclusive, non-sublicensable, non-transferable license to use the Evaluation Board FOR EVALUATION PURPOSES ONLY. Customer understands and agrees that the Evaluation Board is provided for the sole and exclusive purpose referenced above, and agrees not to use the Evaluation Board for any other purpose. Furthermore, the license granted is expressly made subject to the following additional limitations: Customer shall not (i) rent, lease, display, sell, transfer, assign, sublicense, or distribute the Evaluation Board; and (ii) permit any Third Party to access the Evaluation Board. As used herein, the term “Third Party” includes any entity other than ADI, Customer, their employees, affiliates and in-house consultants. The Evaluation Board is NOT sold to Customer; all rights not expressly granted herein, including ownership of the Evaluation Board, are reserved by ADI. CONFIDENTIALITY. This Agreement and the Evaluation Board shall all be considered the confidential and proprietary information of ADI. Customer may not disclose or transfer any portion of the Evaluation Board to any other party for any reason. Upon discontinuation of use of the Evaluation Board or termination of this Agreement, Customer agrees to promptly return the Evaluation Board to ADI. ADDITIONAL RESTRICTIONS. Customer may not disassemble, decompile or reverse engineer chips on the Evaluation Board. Customer shall inform ADI of any occurred damages or any modifications or alterations it makes to the Evaluation Board, including but not limited to soldering or any other activity that affects the material content of the Evaluation Board. Modifications to the Evaluation Board must comply with applicable law, including but not limited to the RoHS Directive. TERMINATION. ADI may terminate this Agreement at any time upon giving written notice to Customer. Customer agrees to return to ADI the Evaluation Board at that time. LIMITATION OF LIABILITY. THE EVALUATION BOARD PROVIDED HEREUNDER IS PROVIDED “AS IS” AND ADI MAKES NO WARRANTIES OR REPRESENTATIONS OF ANY KIND WITH RESPECT TO IT. ADI SPECIFICALLY DISCLAIMS ANY REPRESENTATIONS, ENDORSEMENTS, GUARANTEES, OR WARRANTIES, EXPRESS OR IMPLIED, RELATED TO THE EVALUATION BOARD INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, TITLE, FITNESS FOR A PARTICULAR PURPOSE OR NONINFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. IN NO EVENT WILL ADI AND ITS LICENSORS

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One Analog Way, Wilmington, MA 01887-2356, U.S.A.

Rev. 0

Documents / Resources

	ANALOG DEVICES AD74416H Evaluation Board [pdf] User Guide AD74416H Evaluation Board, AD74416H, Evaluation Board, Board

References

- User Manual

AD74416H, AD74416H Evaluation Board, Analog Devices, Board, Evaluation Board

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