ANALOG DEVICES

EVAL-ADAU1372Z User Guide
UG-807

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Evaluating the ADAU1372 Quad ADC, Dual DAC, Low Latency, Low Power Codec

EVAL-ADAU1372Z PACKAGE CONTENTS

EVAL-ADAU1372Z evaluation board
EVAL-ADUSB2EBZ (USBi) communications adapter
USB cable with Mini-B plug
Evaluation board/software quick start guide

DOCUMENTS NEEDED

ADAU1372 data sheet
AN-1006 Application Note, *Using the EVAL-ADUSB2EBZ*

GENERAL DESCRIPTION

This user guide explains the design and setup of the EVAL-ADAU1372Z evaluation board.

This evaluation board provides full access to all analog and digital inputs/outputs on the ADAU1372. The ADAU1372 register can be controlled by Analog Devices, Inc., SigmaStudio™ software, which interfaces to the board via a USB connection. The EVAL-ADAU1372Z can be powered by a single AAA battery, by the USB bus, or by a single 3.8 V to 6 V supply; any of these are regulated to the voltages required on the board. The printed circuit board (PCB) is a 4-layer design, with a single ground plane and a single power plane on the inner layers. The board contains connectors for external microphones and speakers. The master clock can be provided externally or by the on-board 12.288 MHz passive crystal.

Note that throughout this application note, multifunction pins, such as SCL/SCLK, are referred to either by the entire pin name or by a single function of the pin, for example, SCLK, when only that function is relevant.

Complete specifications for the ADAU1372 are available in the ADAU1372 data sheet available from Analog Devices, and should be consulted in conjunction with this user guide when using the evaluation board.

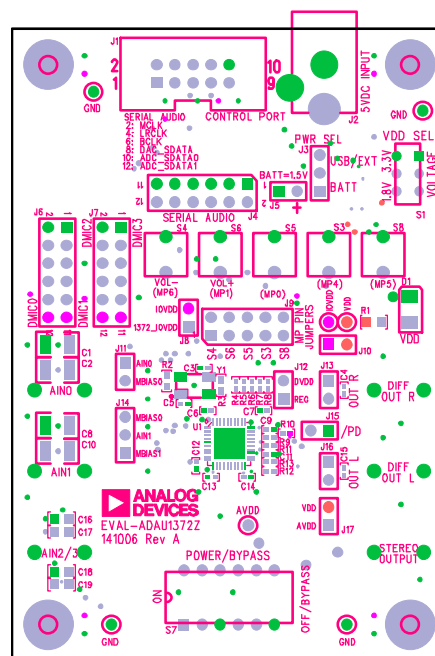## EVAL-ADAU1372Z EVALUATION BOARD, TOP SIDE AND BOTTOM SIDE

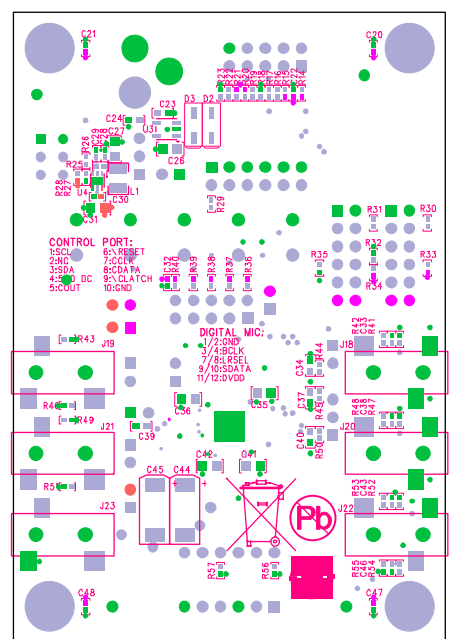*Figure 1. EVAL-ADAU1372Z Evaluation Board, Top Side*

Figure 2. EVAL-ADAU1372Z Evaluation Board, Bottom Side

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REVISION HISTORY

2/15—Revision 0: Initial Version

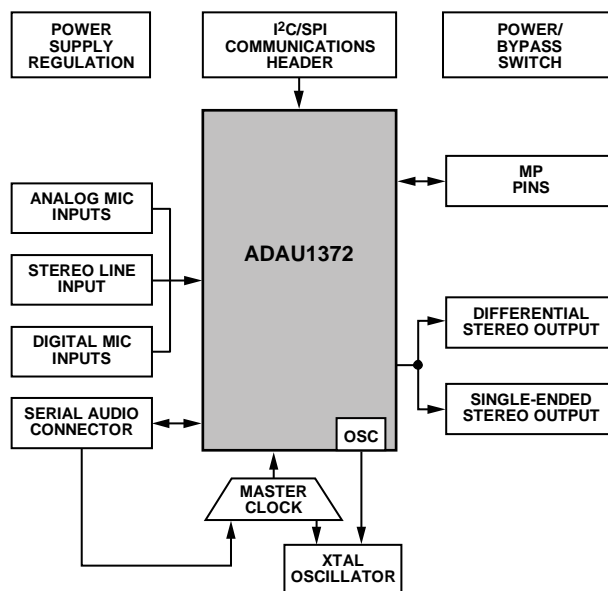# EVALUATION BOARD BLOCK DIAGRAMS
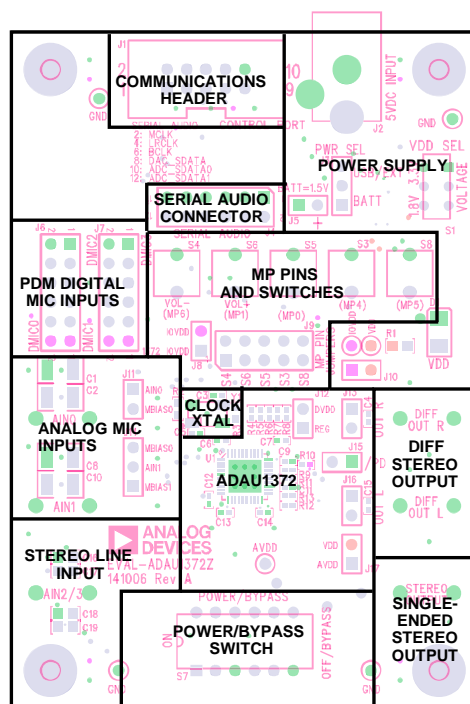

Figure 3. Functional Block Diagram

Figure 4. Board Layout Block Diagram

Figure 5. Default Jumper and Switch Settings (Solid Black Rectangles Indicate Switch or Jumper Positions)

SETTING UP THE EVALUATION BOARD

INSTALLING THE SigmaStudio SOFTWARE

SigmaStudio must be installed to use the EVAL-ADAU1372Z.

Download the latest version of SigmaStudio by completing the following steps:

1. Create or log into your myAnalog account at analog.com.
2. Download the SigmaStudio software from analog.com/SigmaStudioDownload.
3. Install SigmaStudio by double clicking **ADI_SigmaStudioRel-<version>.exe** and following the prompts. A computer restart is not required.
4. Consult ez.analog.com/community/dsp/SigmaDSP for answers to any questions.

INSTALLING THE USBi DRIVERS

For Windows XP

SigmaStudio must be installed to use the USBi. When SigmaStudio has been properly installed, connect the USBi to an available USB port with the included USB cable. At this point, Windows® XP recognizes the device (see Figure 6) and prompts the user to install drivers.

Figure 6. Found New Hardware Notification

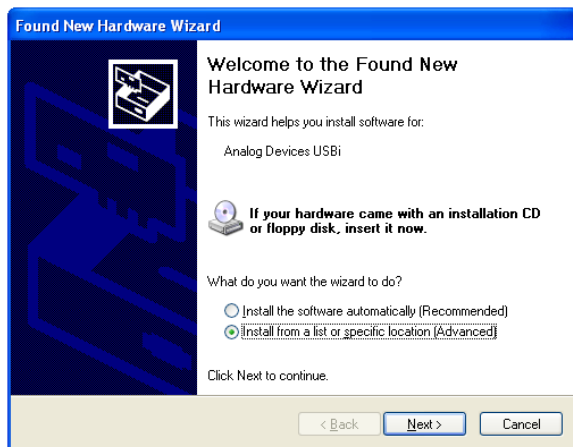Click **Install from a list or specific location (Advanced)** and then click **Next** (see Figure 7).

Figure 7. Found New Hardware Wizard—Installation

Click **Search for the best driver in these locations**, select **Include this location in the search**, and click **Browse** to find the **SigmaStudio 3.x\USB drivers** directory (see Figure 8).
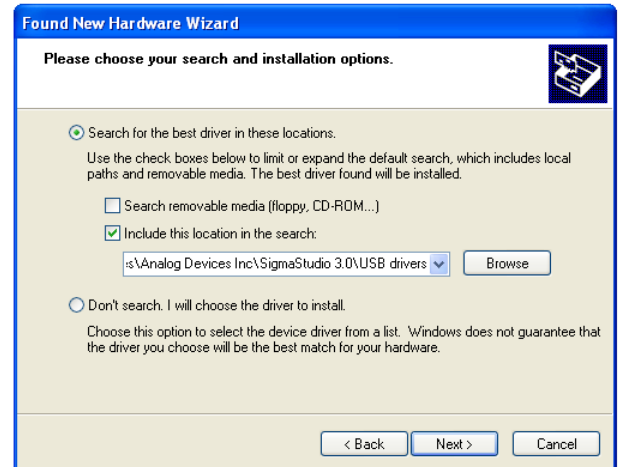
Figure 8. Found New Hardware Wizard—Search and Installation Options

When the message about Windows logo testing appears, click **Continue Anyway** (see Figure 9).

Figure 9. Hardware Installation—Windows Logo Testing Warning

The USBi drivers are now installed. Leave the USBi connected to the PC.

For Windows 7 and Windows Vista

Connect the USBi to an available USB port with the included USB cable. At this point, Windows 7 recognizes the device and installs the drivers (see Figure 10).
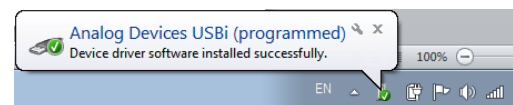
Figure 10. USBi Driver Installed Correctly

DEFAULT SWITCH AND JUMPER SETTINGS

The J8, J10, J12, and J17 jumpers must be connected, and the J3 jumper must be set to the USB/EXT power setting. The MPx pin jumpers (J9) can be connected as desired to use the MPx push-buttons or switches. The microphone bias jumpers, J11 and J14, can be inserted if microphone bias is needed on Input 0 and Input 1.

Switch S7 selects whether the board is to be powered up or if audio is to be bypassed from input to output with the board powered down. For normal operation, slide the switch to the left. S1 selects whether the ADAU1372 is powered from 3.3 V or 1.8 V; the default is 3.3 V. When powering the board via the USBi, ensure that the switch on the bottom of the USBi board is set to the correct voltage (1.8 V or 3.3 V).

POWERING UP THE BOARD

To power up the evaluation board, connect the ribbon cable of the USBi to J1 (CONTROL PORT) of the EVAL-ADAU1372Z.

CONNECTING THE AUDIO CABLES

Connect a stereo audio source to J22 (AIN2/3). Connect head-phones or powered speakers to J23 (STEREO OUT). The labels for J22 and J23 are only visible on the bottom of the board (see Figure 11).
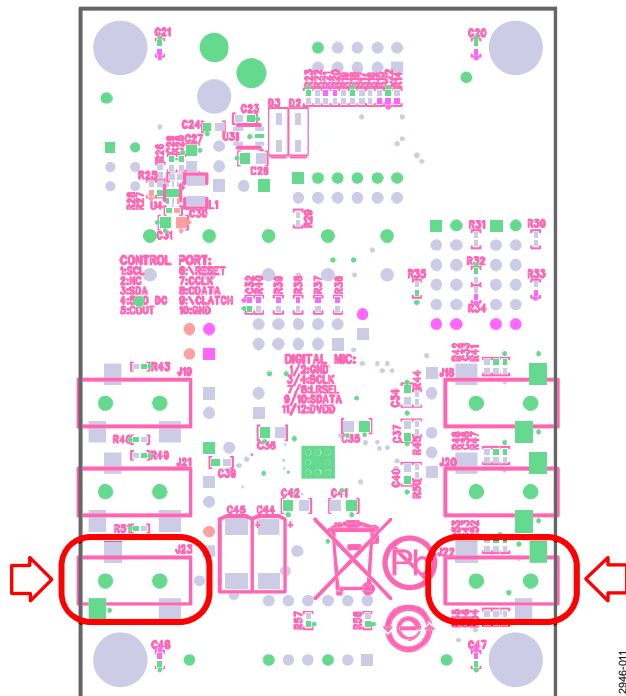

Figure 11. Stereo Out (J23), Left, and Stereo Input, AIN2/3 (J22), Right

SETTING UP COMMUNICATIONS IN SigmaStudio

Start SigmaStudio by double-clicking the shortcut on the desktop. To create a new project, click **New Project** in the **File** menu or press **CTRL + N**. The default view of the new project is called the Hardware Configuration tab.

To use the USBi in conjunction with SigmaStudio, select it in the Communication Channels subsection of the toolbox on the left side of the Hardware Configuration tab, and add it to the project space by clicking and dragging it to the right (see Figure 12).
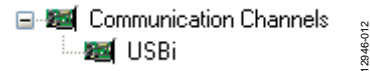

Figure 12. Adding the USBi Communication Channel

If SigmaStudio cannot detect the USBi on the USB port of the PC, the background of the USB label is red (see Figure 13). This lack of communication can happen when the USBi is not connected or when the drivers are incorrectly installed.
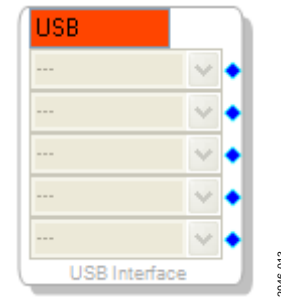

Figure 13. USBi Not Detected by SigmaStudio

If SigmaStudio detects the USBi on the USB port of the PC, the background of the USB label changes to green (see Figure 14).
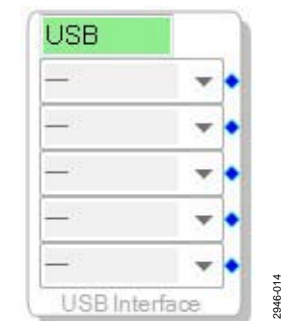

Figure 14. USBi Detected by SigmaStudio

To add an ADAU1372 to the project, select it from the **Processors (ICs/DSPs)** list and drag it to the project space (see Figure 15).
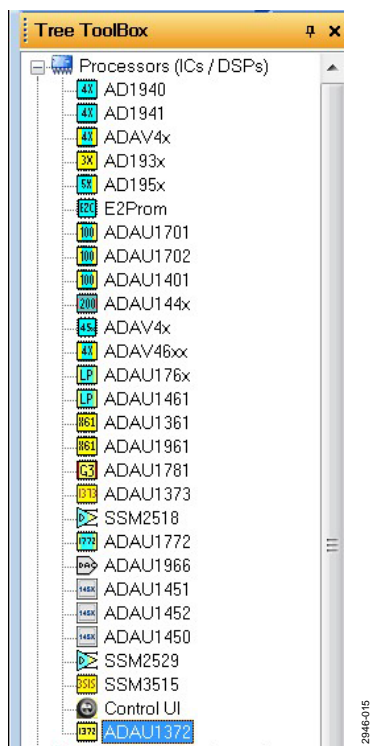

Figure 15. Adding an ADAU1372

To use the USB interface to communicate with the target integrated circuit (IC), connect it by clicking and dragging a wire between the blue pin of the USBi and the green pin of the IC (see Figure 16). The corresponding list of the USBi automatically fills with the default mode and channel for that IC.
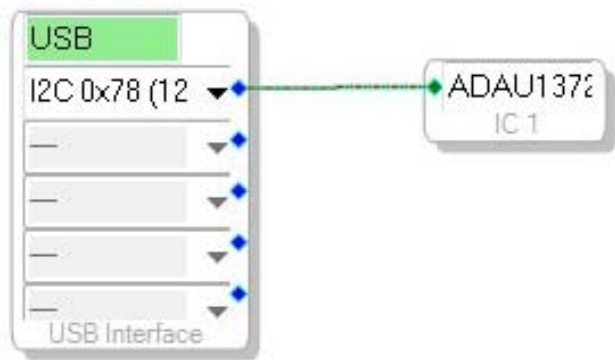

Figure 16. Connecting the USB Interface to an ADAU1372 IC

DOWNLOADING THE DEFAULT SETTINGS

The SigmaStudio default settings for the ADAU1372 set up the device to send the analog-to-digital converter (ADC) outputs to the serial ports in two I²S serial streams. The serial input port is routed to the two digital-to-analog converter (DAC) outputs. To update all of the registers with the default settings, click the **Link-Compile-Download** button once in the main toolbar of SigmaStudio (see Figure 17). Alternately, press **F7**.

*Figure 17. **Link-Compile-Download** Button*

After the download is complete, the registers for the ADAU1372 can be viewed and changed using SigmaStudio.

CONTROLLING REGISTERS USING SigmaStudio

With SigmaStudio, users can view and change the register settings in real time. Click the **IC 1—ADAU1372 Register Control** tab on the bottom of the Hardware Configuration window to view and change the registers and to reveal the tabs on the top of the window used to view different groupings of registers (see Figure 18).
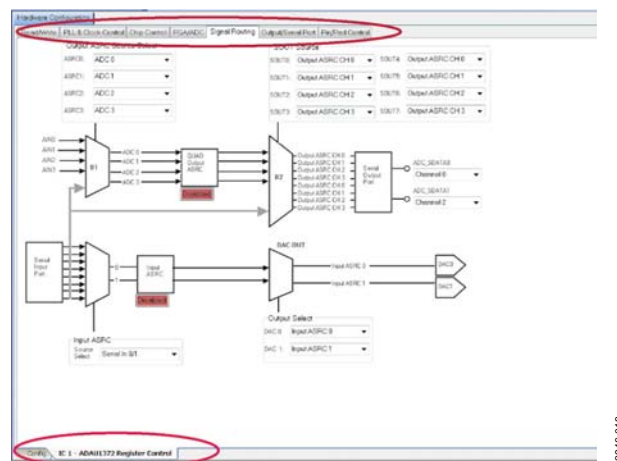

Figure 18. Hardware Configuration—Register Control in SigmaStudio

Clicking any of these register setting buttons or changing a drop-down box immediately changes the register setting. There is no need to click the **Link-Compile-Download** button again. The **Link-Compile-Download** button is useful for transferring all of the settings shown on every tab to the ADAU1372 with one click. Transferring the settings is a good thing to do when the device is first powered up. Until the **Link-Compile-Download** button is clicked, the settings of the device do not necessarily reflect the settings shown in SigmaStudio.

Alternatively, use the **Read All Registers** button to read the state of the device and update all of the objects in SigmaStudio. This button is often hidden from view and requires the user to scroll down to the bottom of the window. The **Link-Compile-Download** button is useful when working on hardware changes to quickly return the device to a known state after cycling the power.

The Capture window at the very bottom of the SigmaStudio window shows the registers that are being written when a control is activated.

One other detail about the link-compile-download function is that it properly sets the phase-locked loop (PLL) and main clock controls in the proper order to allow the PLL to lock and start up the internal clocks. The user is not required to select the proper sequence of controls to start up the ADAU1372.

USING THE EVALUATION BOARD

POWER

Power can be supplied to the EVAL-ADAU1372Z in one of three ways. When Jumper J3 is in the USB/EXT position, power can be supplied by connecting the EVAL-ADUSB2EBZ (USBi) board to J1 (see Figure 19) or by connecting a tip positive 3.8 V dc to 6 V dc power supply on J2.
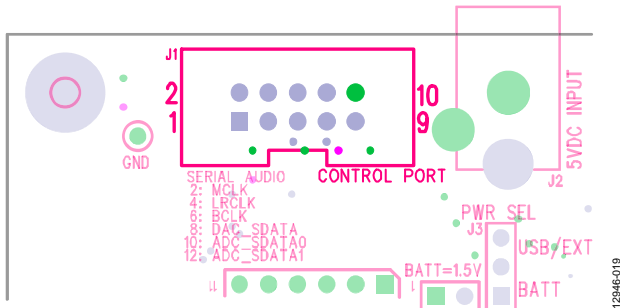

Figure 19. Header J1, Control Port

To supply power via a 1.5 V battery, J3 must be set to the BATT position, and the battery must be connected to J5. The on-board regulator generates the 3.3 V dc or 1.8 V dc supply, determined by S1, for the on-board circuitry. LED D1 lights up when power is supplied to the board. To connect power to the ADAU1372, connect the J8, J10, J12, and J17 jumpers (see Figure 20).
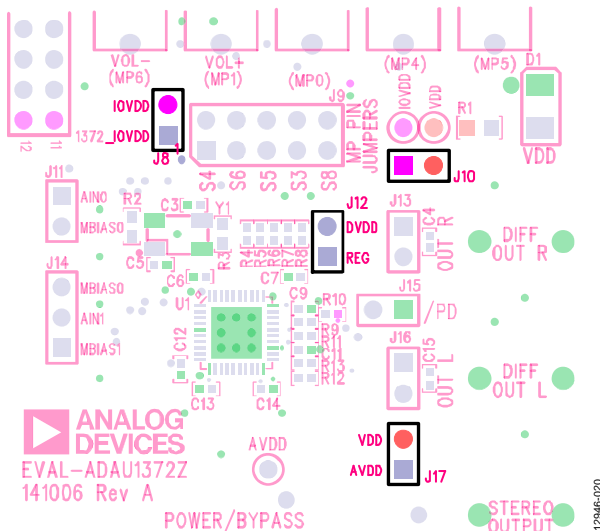
Figure 20. Power Jumpers

INPUTS AND OUTPUTS

The EVAL-ADAU1372Z has multiple audio input and output options, including digital and analog. There are four single-ended analog inputs that are configurable as microphone or line inputs, dual stereo digital microphone inputs, and two differential outputs that can also be used in a single-ended configuration.

Analog Microphone Inputs

For microphone signals, the ADAU1372 analog inputs can be configured as single-ended inputs with an optional programmable gain amplifier (PGA) mode.

Microphone Bias

To add MBIAS0 to AIN0, connect a jumper to the J11 header. Similarly, MBIAS1 or MBIAS0 can be added to AIN1 by connecting a jumper to the J14 header (see Figure 21).
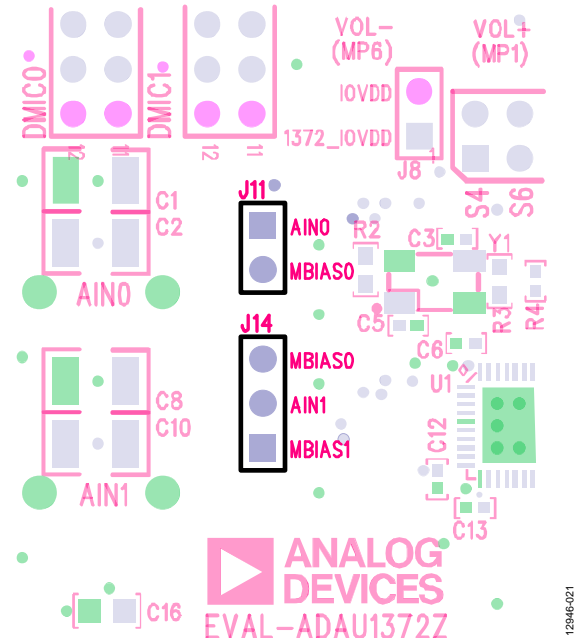
Figure 21. Microphone Bias Headers

Enable the microphone bias circuitry in the PGA/ADC tab of SigmaStudio to use it. The appropriate gain settings can also be chosen in this tab (see Figure 22).

Stereo Line Input

The stereo input jack, J22, accepts a standard stereo TRS 1/8 inch mini-plug (tip is left, ring is right) with two channels of audio.

Digital Microphones

Pulse density modulated (PDM) digital microphones can be connected to standard 0.100 inch headers (J6 and J7). For example, the ADMP521 digital microphone from InvenSense plugs directly into the header.

To use the digital microphone headers on the EVAL-ADAU1372Z, ensure that the proper settings are selected in SigmaStudio. Click the **Pin/Pad Control** tab. Change the value of the **CLKOUT/ ADC_SDATA1/MP6** menu to **Clock Output** (see Figure 23).
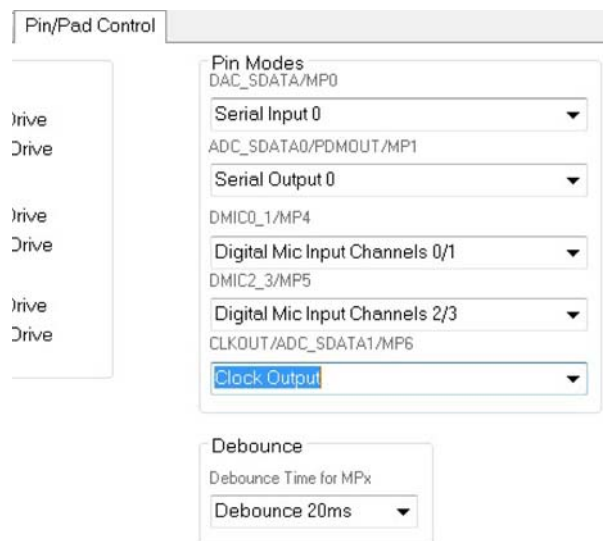

Figure 23. Pin/Pad Control—MP6, Clock Output

To set the value of BCLK, click the **PLL & Clock Control** tab and change the value of the **Output Clock Frequency** menu to the desired division on the internal master clock (MCLK) (see Figure 24).
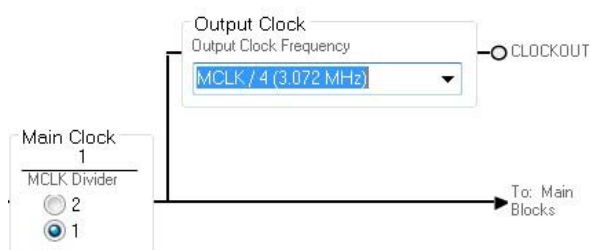
Figure 24. Clock Output Enabled/Divided

Next, set the input of the ADAU1372 to be the digital microphones instead of the ADCs by selecting the appropriate decimator source settings. Click the **PGA/ADC** tab to find and set the decimator source as shown in Figure 25.
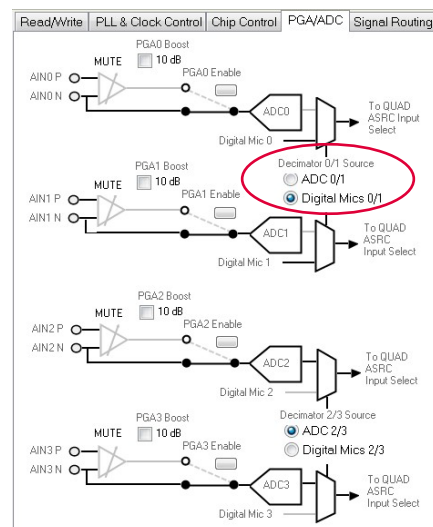
Figure 25. Decimator Source

The digital microphones can then be routed via the appropriate inputs on the audio input cell.

Headphone Output

The headphone output, J23, connects to any standard 1/8 inch mini-plug stereo headphones. By setting the HP_EN_L and HP_EN_R bits in the headphone line output select register (Address 0x43), the output pins can be driven either by a line output driver or by a headphone driver. Headphones can be driven either as single-ended or differential outputs, and there are bits to disable the LN and RN pins if single-ended.

Line Outputs

The analog output pins, J19 and J21, can be used to drive differential loads. In their default settings, these pins can drive line loads of 10 Ω or greater.

To use an external speaker, wires can be soldered to the unpopulated header pads, J13 and J16 (see Figure 26).

Figure 26. Unpopulated J13 and J16 Headers

MPx PINS

The MPx pin jumpers, Header J9, provide access to the MPx pins (MP0, MP1, MP4, MP5, and MP6) of the ADAU1372, as well as facilitate the use of the push-buttons on the EVAL-ADAU1372Z evaluation board. See Figure 37 for the pinout of the header. These jumpers are used to enable the use of the volume control, mute, and other capabilities of the ADAU1372.

To use the full functionality of the MPx pins on the ADAU1372, change the selections in the menus under the Pin/Pad Control tab in the Hardware Configuration/ADAU1372 Register Control section of SigmaStudio. An example is shown in Figure 27.

Figure 27. Pin/Pad Control—Menus for MPx Pins

The MP4 and MP5 pins are connected to the digital microphone headers, J6 and J7, respectively. The MP6 pin also connects to both J6 and J7.

SERIAL AUDIO INTERFACE

Serial audio signals in I²S, left justified, right justified, or time-division multiplexing (TDM) format are available via the serial audio interface header, J4. This header also includes master clock input and output connection pins. To use MCLK on the J4 header, first install a resistor across the R2 pads. The R2 resistor is not populated from the factory. To use an external MCLK, remove the R3 resistor from the board to eliminate contention from the crystal oscillator on the MCLK line (see Figure 28).

Figure 28. R2 and R3

TDM/I²S Stream

To use the serial audio outputs, connect the LRCLK, BCLK, and SDATA lines to the appropriate MPx pins on the evaluation board. The connections are located on the J4 header. The silk screen above the header helps identify where to connect the clocks and data (see Figure 29).
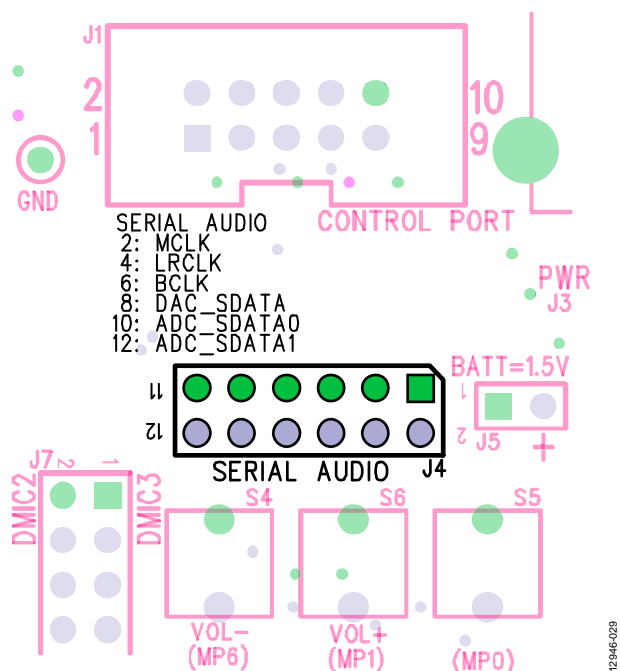

Figure 29. Serial Audio Port

After connecting, use SigmaStudio to set the registers for the desired operation. In the Output/Serial Port tab, under the Serial Port Control section, the settings can be manipulated to create the specific data stream desired. These settings include serial port FS (sample rate), serial port mode, serial port format, LRCLK/BCLK mode (slave or master), BCLK data change edge, bit width in TDM mode, BCLK cycles per channel, data input/output on LSB/MSB, unused TDM outputs, LRCLK mode (as pulse or 50% duty cycle), and LRCLK polarity (see Figure 30).
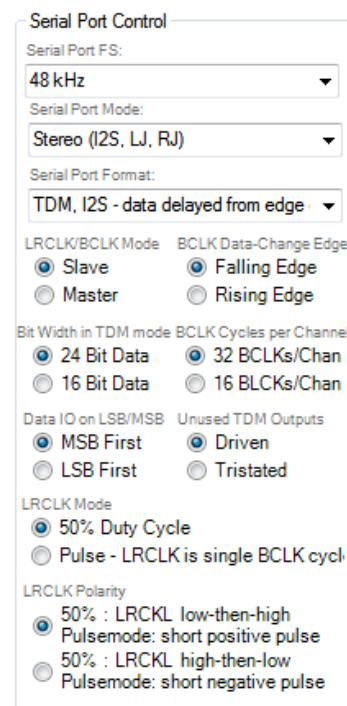

Figure 30. Serial Port Control

When using TDM mode, ensure that the appropriate TDM output channels are enabled in the TDM Output Channel section (see Figure 31).
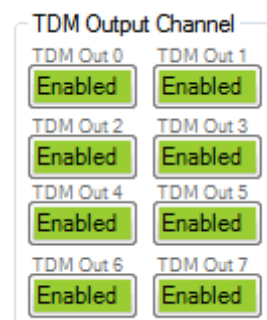

Figure 31. TDM Output Channel

Use the Signal Routing tab to route the ADCs or serial inputs to either of the two available serial output lines. Ensure that quad output asynchronous sample rate converter (ASRC) is enabled (see Figure 32).

When using the serial input port, ensure that the input ASRC is enabled and select which TDM slots or I²S slots are output to the appropriate DAC outputs. The serial input stream can also be routed to the serial output stream, which allows the daisy-chaining of other ADC data into a TDM, 8-channel stream.
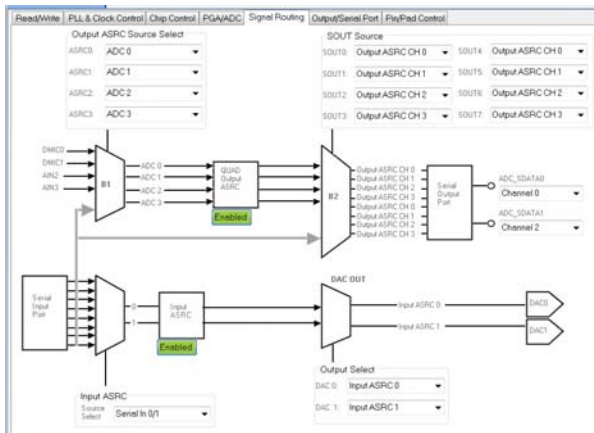
Figure 32. Signal Routing

COMMUNICATIONS HEADER (J1)

J1 connects to the EVAL-ADUSB2EBZ USBi. More information about the USBi can be found in the AN-1006 Application Note.

The IC defaults to I²C mode; however, it can be put into serial peripheral interface (SPI) control mode by pulling the $\overline{SS}$ pin low three times.

POWER-DOWN

The power-down header, J15 (/PD), on the silkscreen of the board provides access to the power-down pin, $\overline{PD}$, on the ADAU1372. Put a jumper on the header to power down all analog and digital circuits. Before enabling the $\overline{PD}$ pin, mute the outputs to avoid any pops or clicks when the IC is powered down (see Figure 33).
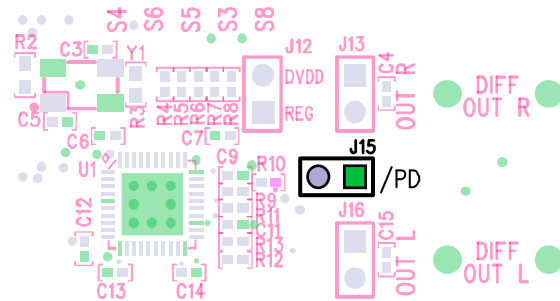

Figure 33. Power-Down Header J15

HARDWARE DESCRIPTION
JUMPERS

Table 1. Connector and Jack Descriptions

Reference	Functional Name	Description
J1	Control port	The header facilitates communication between the evaluation board and USBi board.
J2	5 V dc input	The connector provides external power to the board and accepts 3.8 V dc to 6 V dc input.
J3	Power select	The jumper is used to select power source for the evaluation board, selectable between USB/external and battery.
J4	Serial audio	The header accepts serial audio signals in I²S, left justified, right justified, or TDM format.
J5	Battery 1.5 V	The jumper used to power the board via a 1.5 V battery.
J6, J7	Digital microphone inputs	Headers that allow digital microphones to be connected to the evaluation board.
J8	IOVDD 1372_IOVDD	The jumper supplies power to the IOVDD supply of the ADAU1372 from the power supply section.
J9	MPx pin jumpers	The jumpers used to connect push-buttons on the board to MPx pins on the ADAU1372.
J10	IOVDD VDD	The jumper connects IOVDD on the ADAU1372 to VDD (3.3 V board supply) on the evaluation board.
J11, J14	Microphone bias	The jumpers used to add a microphone bias to the analog microphone inputs, AIN0 and AIN1.
J12	DVDD regulator (REG)	The jumper connects DVDD on the ADAU1372 to its internal regulator.
J13	Out R	The jumper provides access to the mono differential right channel output.
J15	Power down	The jumper used to power down the ADAU1372 analog and digital circuits.
J16	Out L	The jumper provides access to the mono differential left channel output.
J17	VDD AVDD	The jumper connects AVDD on the ADAU1372 to VDD (3.3 V board supply) on the evaluation board.

INTEGRATED CIRCUITS (IC)

Table 2. IC Descriptions

Reference	Functional Name	Description
U1	ADAU1372 codec	The codec being evaluated
U3	ADP1713AUJZ low dropout (LDO) regulator	Linear regulator that generates 1.5 V from an off board power supply
U4	ADP1607 boost regulator	Boost regulator that generates 1.8 V or 3.3 V for the board supply from a 1.5 V input

LED

Table 3. LED Description

Reference	Functional Name	Description
D1	VDD power LED	The LED illuminates when the evaluation board is powered up.

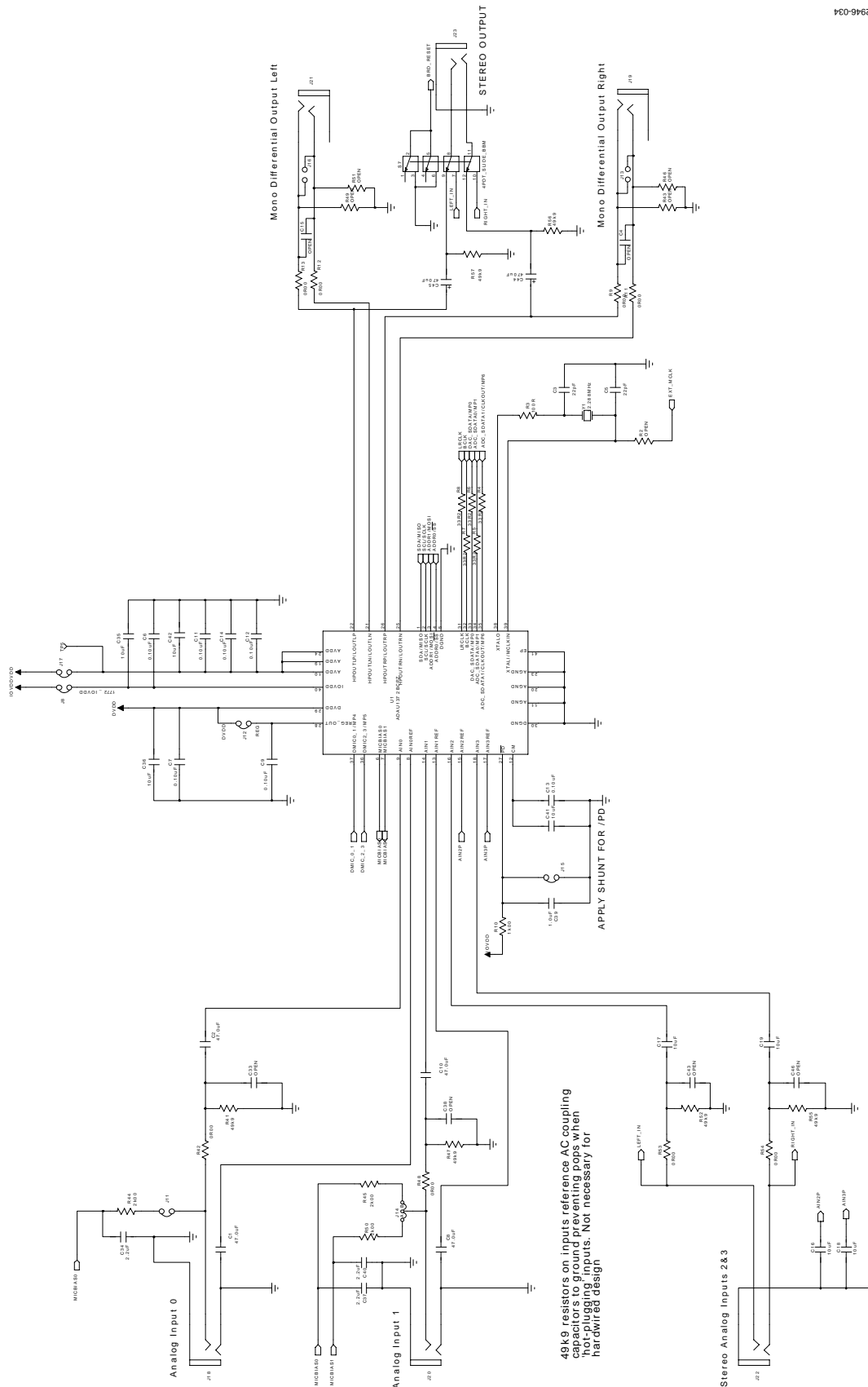# EVALUATION BOARD SCHEMATICS AND ARTWORK

Figure 34. EVAL-ADAU1372Z Evaluation Board Schematic—Digital and Analog Input/Output, Master Clock Generation
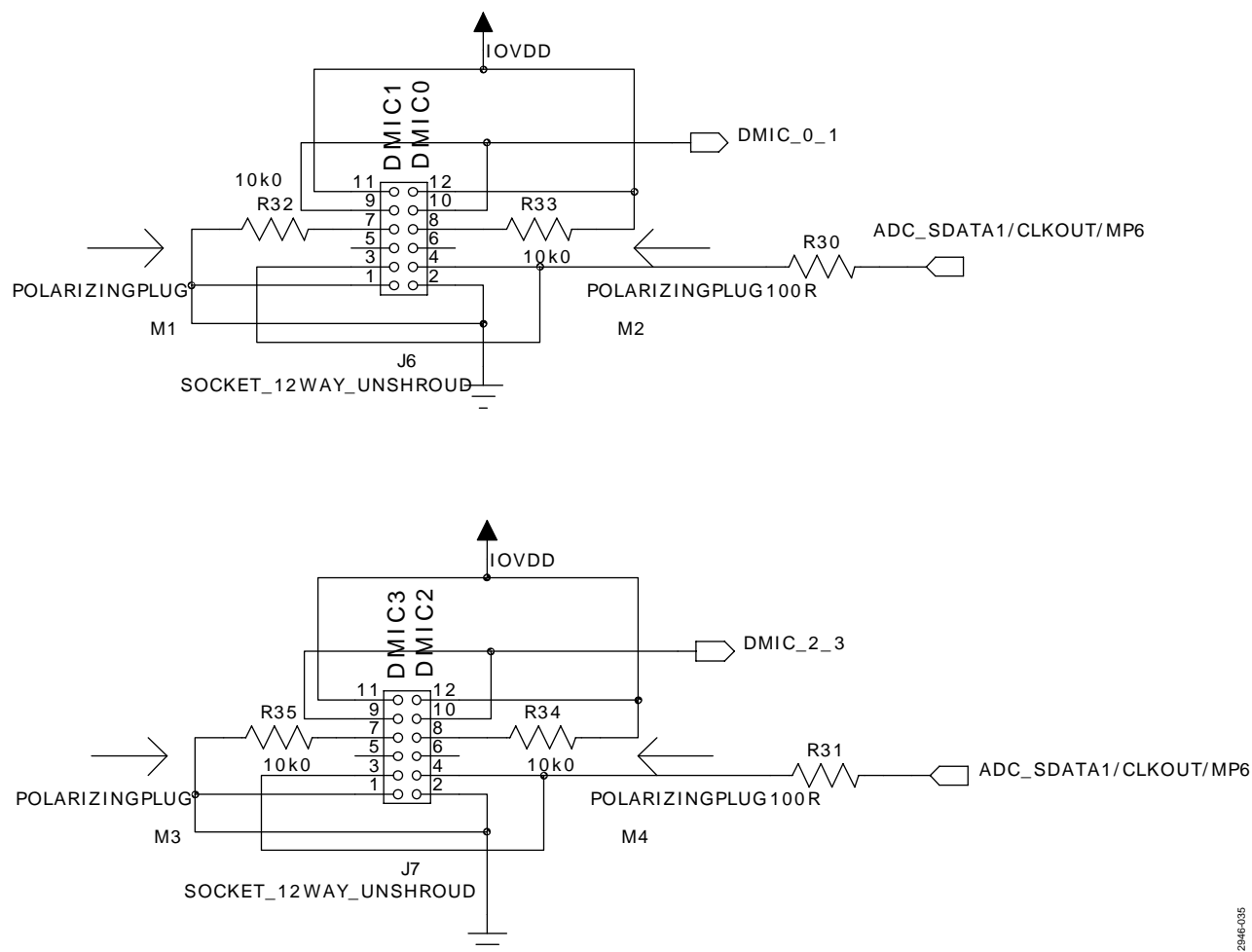
PDM Digital Microphone Inputs

Figure 35. *EVAL-ADAU1372Z* Evaluation Board Schematic—PDM Digital Microphone Interface
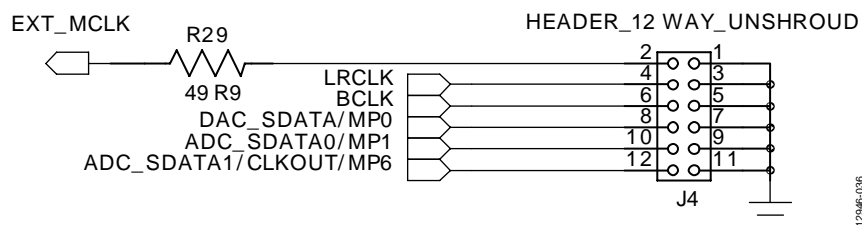
Serial Audio Interface

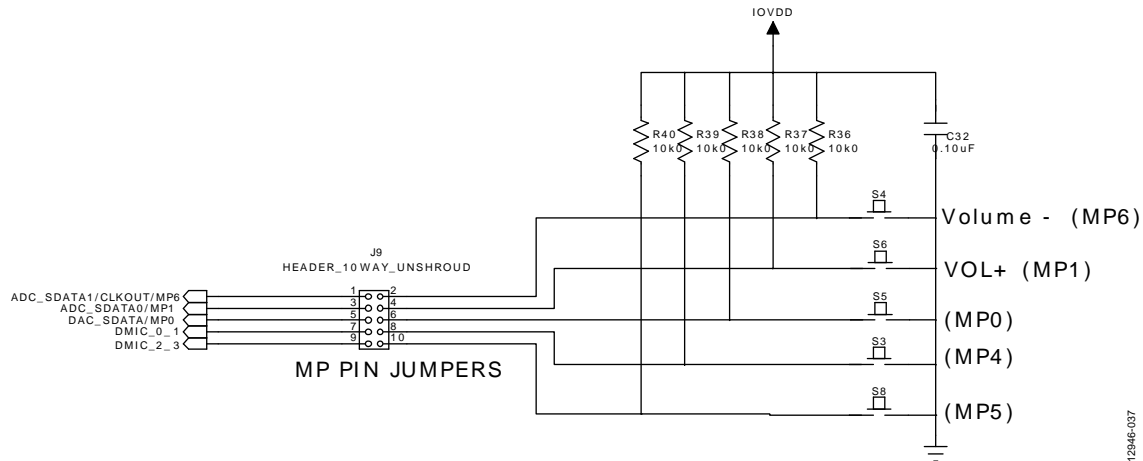Figure 36. *EVAL-ADAU1372Z* Evaluation Board Schematic—Serial Audio Interface

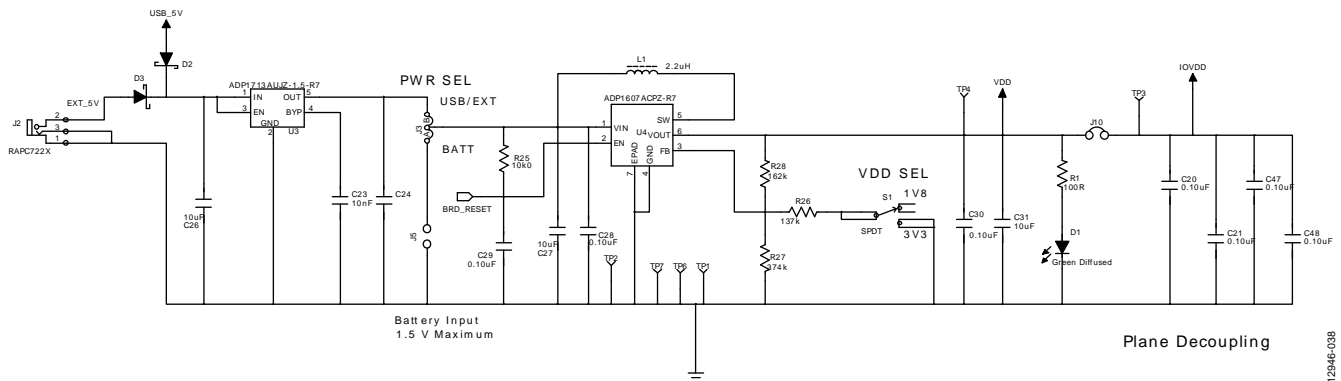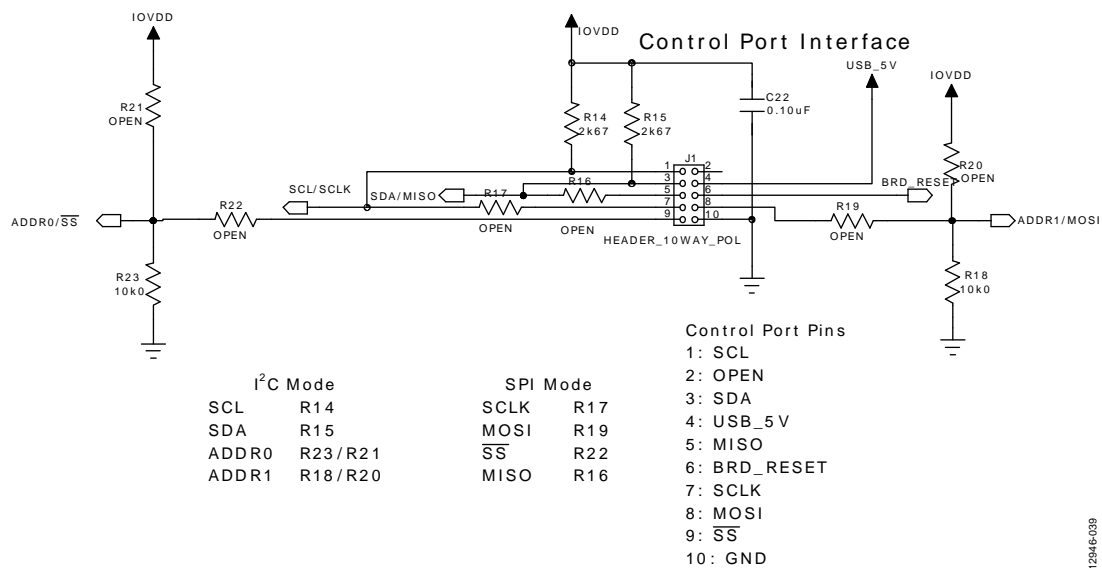*Figure 37. EVAL-ADAU1372Z Evaluation Board Schematic—MPx Pin Jumpers*

Figure 38. EVAL-ADAU1372Z Evaluation Board Schematic—Power Supply

Figure 39. EVAL-ADAU1372Z Evaluation Board Schematic—Control Port Interface
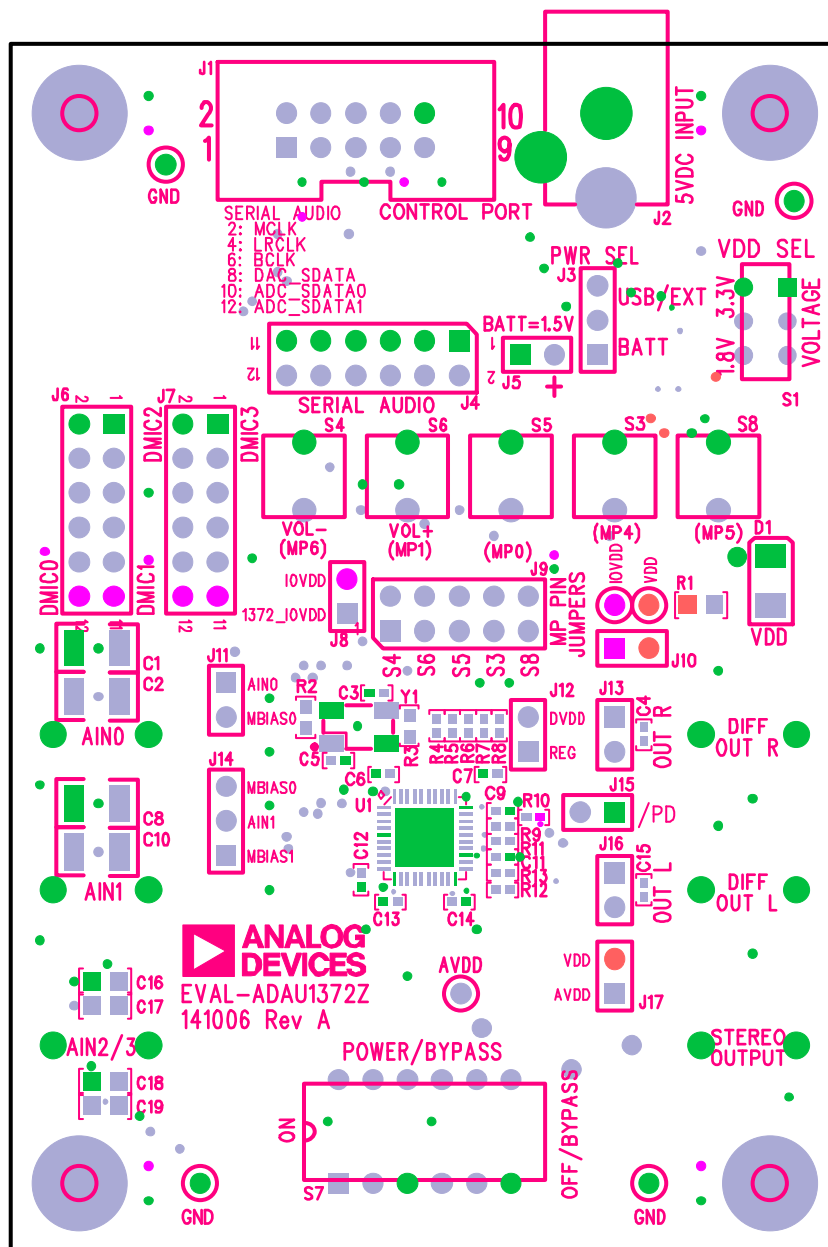
Figure 40. *EVAL-ADAU1372Z* Evaluation Board Layout—Top Assembly
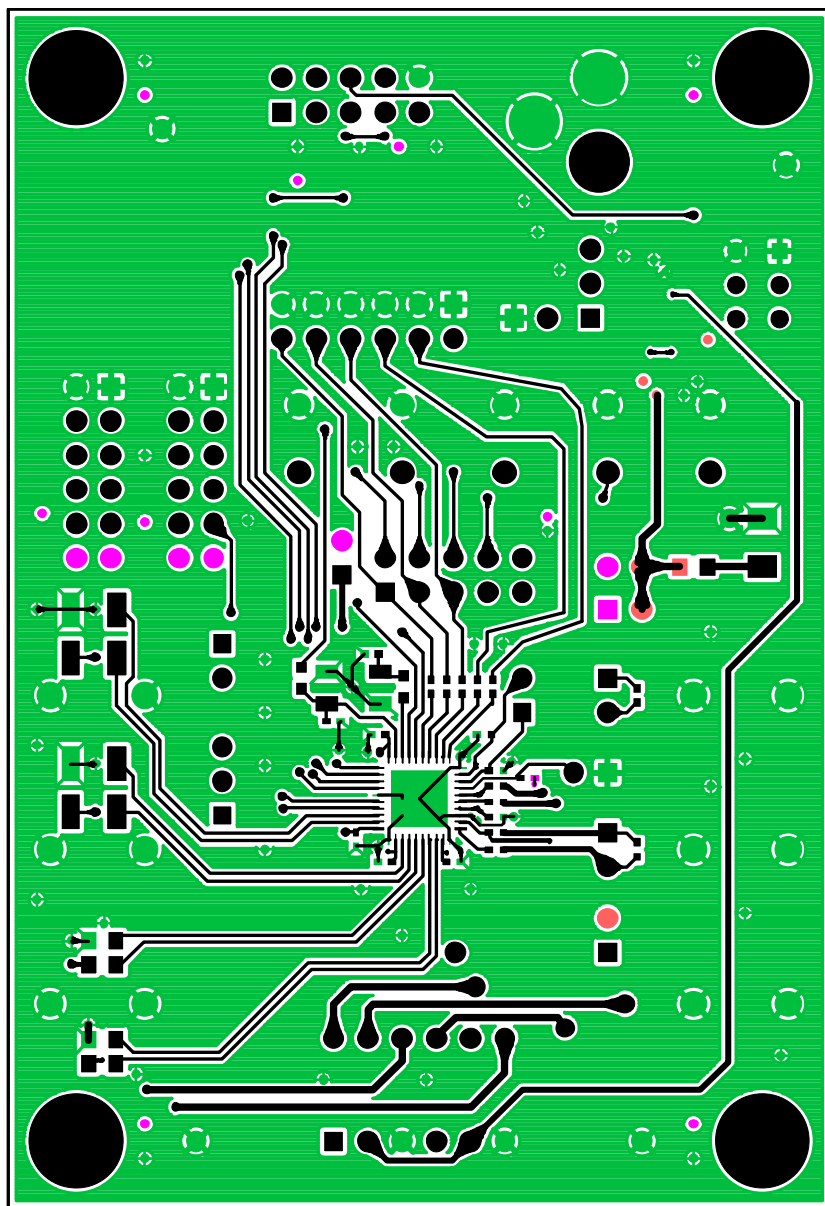
Figure 41. EVAL-ADAU1372Z Evaluation Board Layout—Top Copper
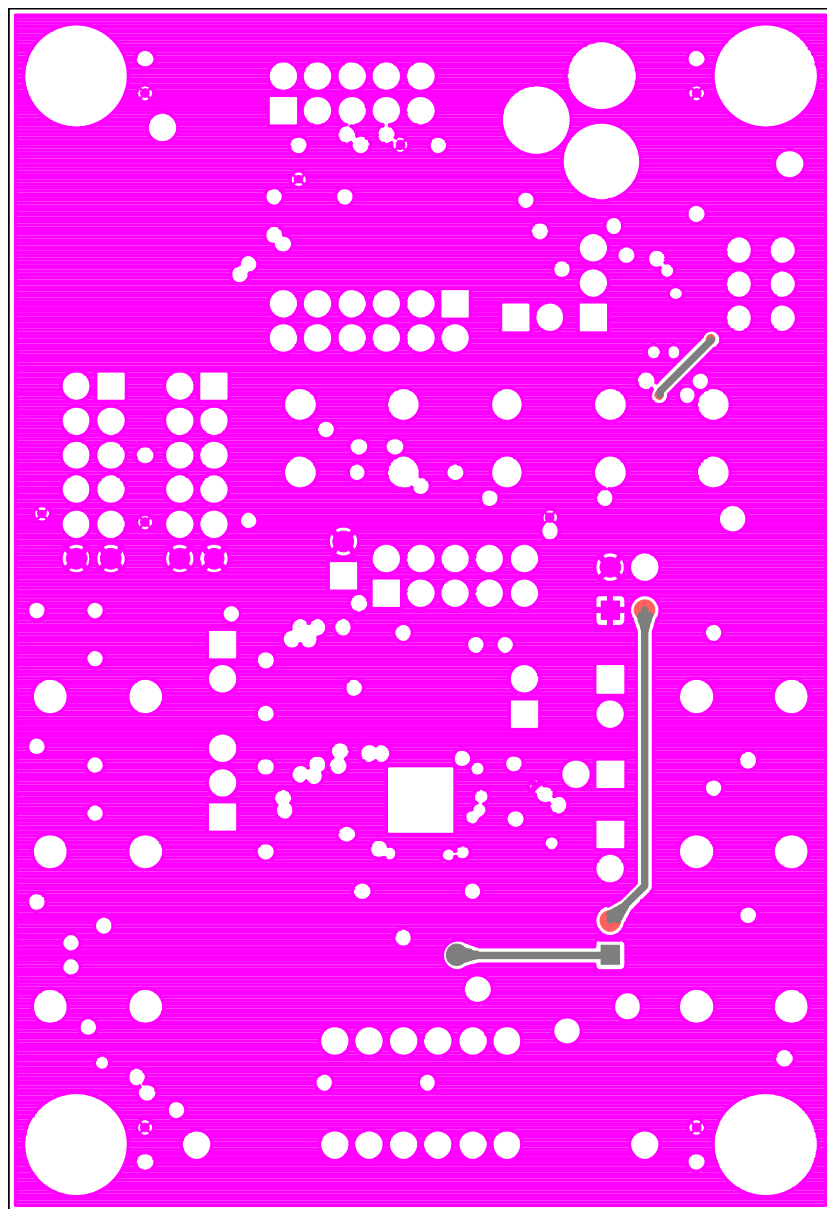
Figure 42. EVAL-ADAU1372Z Evaluation Board Layout—Power Plan, Layer 3
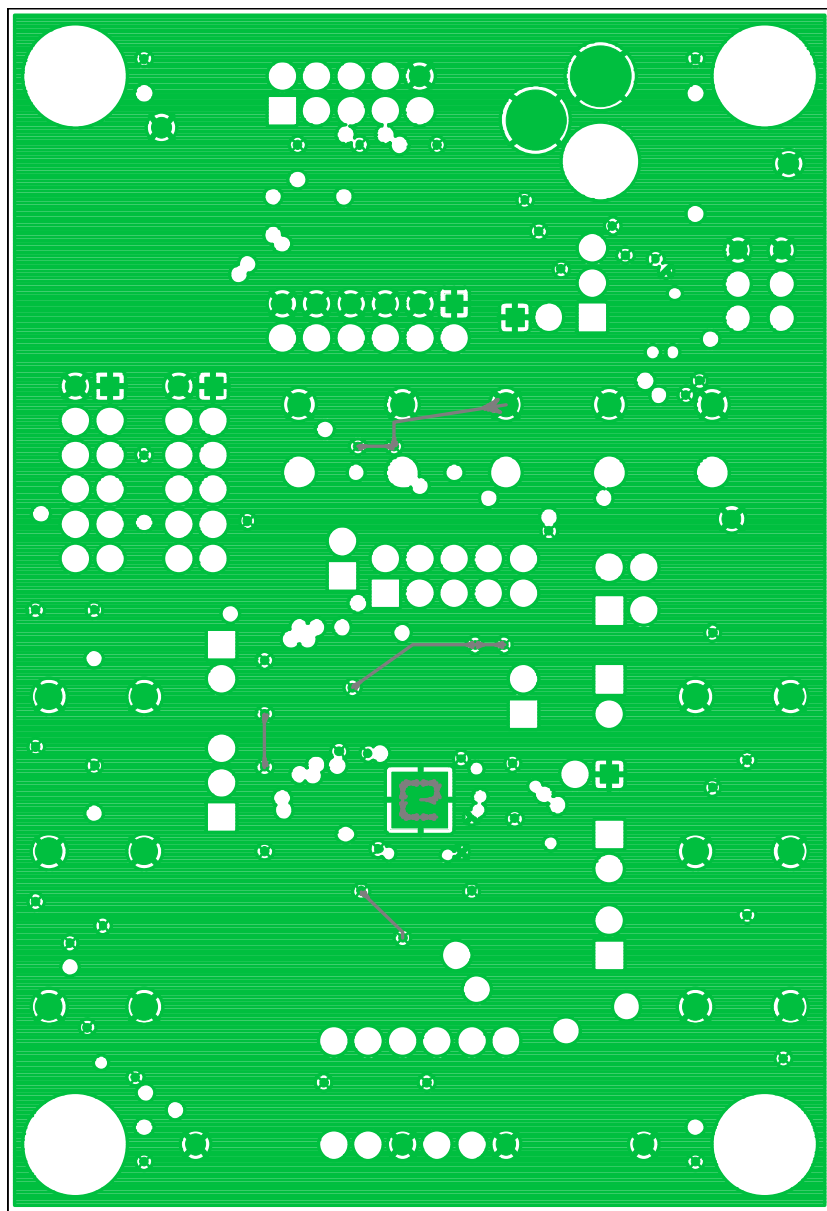
Figure 43. EVAL-ADAU1372Z Evaluation Board Layout—Ground Plane, Layer 2
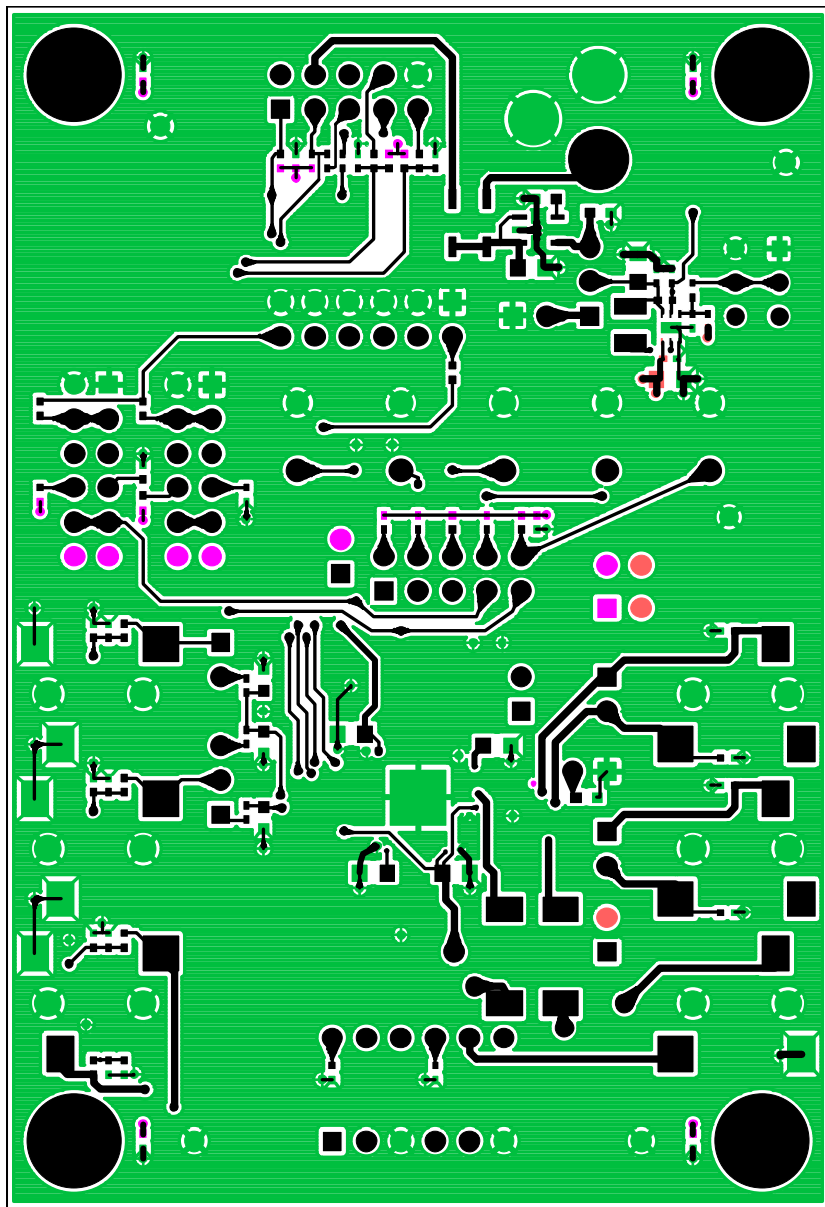
Figure 44. EVAL-ADAU1372Z Evaluation Board Layout—Bottom Copper
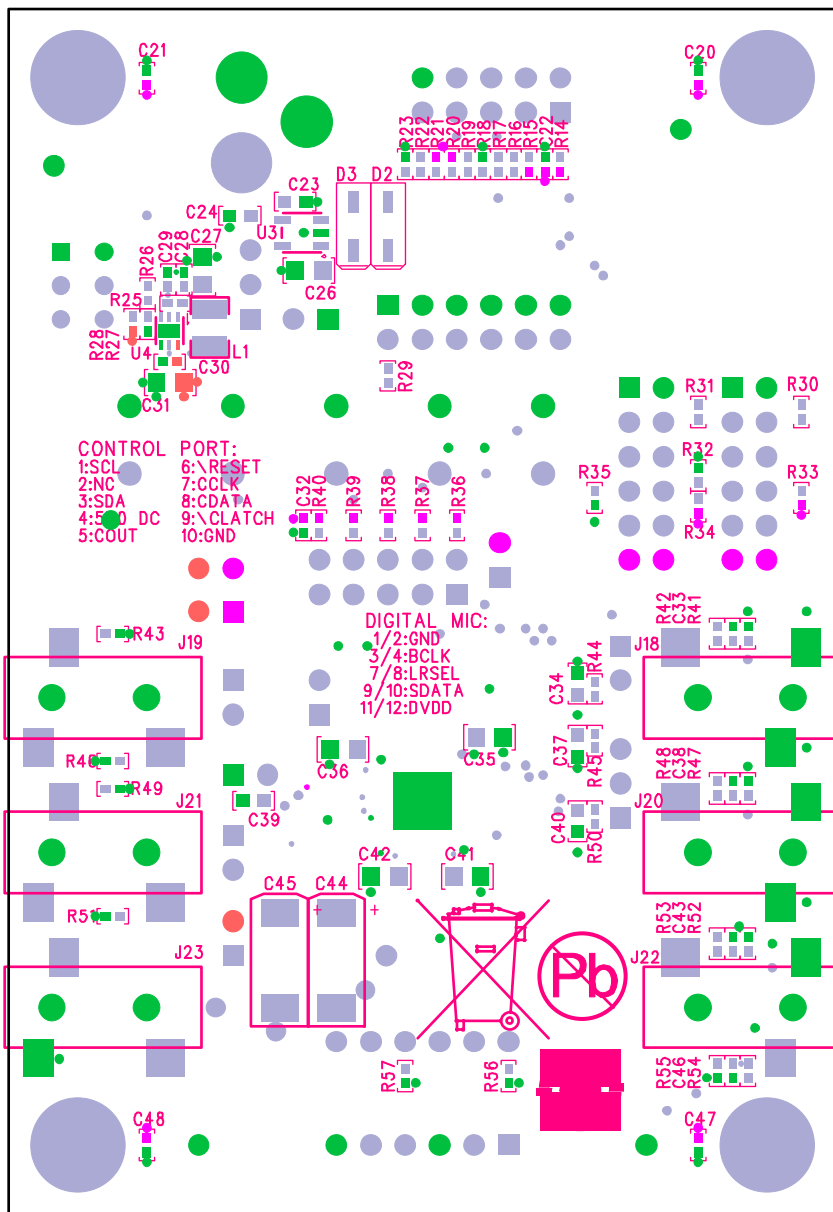
Figure 45. EVAL-ADAU1372Z Evaluation Board Layout—Bottom Assembly

ORDERING INFORMATION

BILL OF MATERIALS

Table 4.

Qty.	Designator	Description	Part Number	Manufacturer
16	C6 to C7, C9, C11 to C14, C20 to C22, C28 to C30, C32, C47 to C48	0.10 µF multilayer ceramic, 16 V, X7R (0402)	ECJ-0EX1C104K	Panasonic EC
8	R9, R11 to R13, R42, R48, R53 to R54	0 Ω chip resistor, 5%, 63 mW, thick film, 0402	ERJ-2GE0R00X	Panasonic EC
1	C24	1.0 µF multilayer ceramic, 16 V, X7R, 0603	GRM188R71C105KA12D	Murata ENA
1	C39	1.0 µF multilayer ceramic, 16 V, X7R, 0603	EMK107BJ105KA-TR	Taiyo Yuden
2	R30, R31	100 Ω chip resistor, 1%, 63 mW, thick film, 0402	MCR01MZPF1000	Rohm
1	R3	100 Ω chip resistor, 1%, 100 mW, thick film, 0603	ERJ-3EKF1000V	Panasonic EC
1	R1	100 Ω chip resistor, 1%, 125 mW, thick film, 0805	ERJ-6ENF1000V	Panasonic EC
12	R18, R23, R25, R32 to R40	10 kΩ chip resistor, 1%, 63 mW, thick film, 0402	MCR01MZPF1002	Rohm
1	C23	10 nF multilayer ceramic, 25 V, NP0, 0603	C1608C0G1E103J	TDK Corporation
11	C16 to C19, C26 to C27, C31, C35 to C36, C41 to C42	10 µF multilayer ceramic, 10 V, X7R, 0805	GRM21BR71A106KE51L	Murata ENA
1	R26	137 kΩ chip resistor, 1%, 63 mW, thick film, 0402	ERJ-2RKF1373X	Panasonic ECG
1	R28	162 kΩ chip resistor, 1%, 63 mW, thick film, 0402	ERJ-2RKF1623X	Panasonic ECG
1	R10	1.00 kΩ chip resistor, 1%, 63 mW, thick film, 0402	ERJ-2RKF1001X	Panasonic EC
3	C34, C37, C40	2.2 µF multilayer ceramic, 10 V, X7R, 0603	GRM188R71A225KE15D	Murata ENA
1	L1	2.2 µH inductor	LQH32PN2R2NN0L	Murata Electronics
2	C3, C5	22 pF multilayer ceramic, 50 V, NP0, 0402	GRM1555C1H220JZ01D	Murata ENC
3	R44 to R45, R50	2.00 kΩ chip resistor, 1%, 63 mW, thick film, 0402	ERJ-2RKF2001X	Panasonic EC
2	R14 to R15	2.67 kΩ chip resistor, 1%, 63 mW, thick film, 0402	CRCW04022K67FKED	Vishay/Dale
5	R4 to R8	33.2 Ω chip resistor, 1%, 63 mW, thick film, 0402	RMCF0402FT33R2	Stackpole
1	R27	374 kΩ chip resistor, 1%, 63 mW, thick film, 0402	ERJ-2RKF3743X	Panasonic ECG
2	C44 to C45	470 µF SMD tantalum capacitor, SMD D, 6.3 V	TR3D477M6R3C0200	Vishay/Sprague
4	C1 to C2, C8, C10	47.0 µF ceramic capacitor, 6.3 V, X7R, 1210	GCM32ER70J476KE19L	Murata
6	R41, R47, R52, R55 to R57	49.9 kΩ chip resistor, 1%, 63 mW, thick film, 0402	CRCW040249K9FKED	Vishay/Dale
1	R29	49.9 kΩ chip resistor, 1%, 63 mW, thick film, 0402	MCR01MZPF49R9	Rohm
1	S7	Four-pole, double-throw slide switch vertical break-before-make	ASE4204	Tyco Electronics
1	Y1	12.288 MHz crystal, SMT, 18 pF	ABM3B-12.288MHZ-10-1-U-T	Abracon Corporation
1	U1	Quad ADC, dual DAC codec	ADAU1372BCPZ	Analog Devices
1	U4	Synchronous boost dc-to-dc converter	ADP1607ACPZ-R7	Analog Devices
1	U3	Fixed low dropout voltage regulator	ADP1713AUJZ-1.5-R7	Analog Devices
1	J1	10-way shroud polarized header, 2 × 5	N2510-6002RB	3M
1	J9	10-way unshrouded jumper, 2 × 6	PBC05DAAN or cut PBC36DAAN	Sullins Connector Solutions
1	J4	12-way unshrouded jumper	PBC06DAAN or cut PBC36DAAN	Sullins Connector Solutions
7	J5, J8, J10 to J12, J15, J17	2-pin header, unshrouded jumper, 0.10 inch; use shunt Tyco 881545-2	PBC02SAAN; or cut PBC36SAAN	Sullins Connector Solutions
2	J3, J14	Three-position SIP header	PBC03SAAN; or cut PBC36SAAN	Sullins Connector Solutions
1	D1	Green diffused, 10 millicandela, 565 nm, 1206	SML-LX1206GW-TR	Lumex Opto
2	D2 to D3	Schottky, 30 V, 0.5 A, SOD123 diode	MBR0530T1G	On Semiconductor
6	J18 to J23	Stereo mini jack	SJ-3523-SMT	CUI, Inc.
10	R16 to R17, R19 to R22, R43, R46, R49, R51	Do not stuff	Open	Do not stuff
1	R2	Do not stuff	Open	Do not stuff
6	C4, C15, C33, C38, C43, C46	Do not stuff	Open	Do not stuff
1	J2	Mini power jack, 0.08 inch, R/A, TH	RAPC722X	Switchcraft

Qty.	Designator	Description	Part Number	Manufacturer
2	J6 to J7	12-way socket unshrouded, 2 × 6	PPPC062LFBN-RC	3M
1	S1	Single-pole, double-throw slide switch PC mount	EG1271	E-Switch
5	S3 to S6. S8	Tact switch long stroke (normally open)	B3M-6009	Omron Electronics
7	TP1 to TP7	Mini test point, white, 0.1 inch, OD	5002	Keystone Electronics
2	J13, J16	Do not stuff	Open	Do not stuff

I^2C refers to a communications protocol originally developed by Philips Semiconductors (now NXP Semiconductors).

ESD Caution

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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