EVAL-AD2437B1NZ Manual

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Part Number
EVAL-AD2437B1NZ

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ANALOG DEVICES

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Regulatory Compliance

The *EVAL-AD2437B1NZ* evaluation board is designed to be used solely in a laboratory environment. The board is not intended for use as a consumer-end product or as a portion of a consumer-end product. The board is an open system design, which does not include a shielded enclosure and, therefore, may cause interference to other electrical devices in close proximity. This board should not be used in or near any medical equipment or RF devices.

The *EVAL-AD2437B1NZ* evaluation board contains ESD (electrostatic discharge) sensitive devices. Electrostatic charges readily accumulate on the human body and equipment and can discharge without detection. Permanent damage may occur on devices subjected to high-energy discharges. Proper ESD precautions are recommended to avoid performance degradation or loss of functionality. Store unused boards in the protective shipping package.	

Contents

1 Preface

Thank you for purchasing the Analog Devices, Inc. *EVAL-AD2437B1NZ* evaluation board.

The *EVAL-AD2437B1NZ* is an evaluation board to evaluate various peripherals of the AD2437 A^2B (Audio Bus) transceiver. Refer to the datasheet/manual to get more details about the AD2437.

The *EVAL-AD2437B1NZ* is configured to be a Bus-Powered Sub (BPS) node. The *EVAL-AD2437B1NZ* can be connected to a Main node, Local-Powered Sub (LPS) or a Bus-Powered Sub (BPS) node. These evaluation boards are intended to be used with the SigmaStudio+® graphical development tool.

Block Diagram of Evaluation Board:

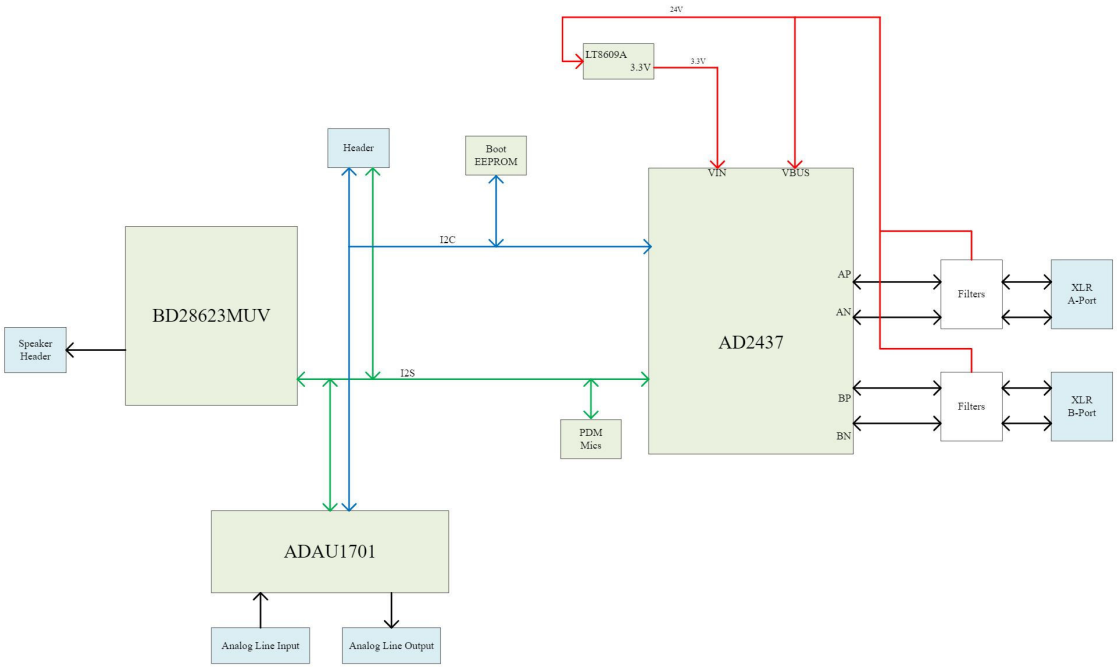

Figure 1-1: Block Diagram

A PC host controls the AD2437 A^2B main transceiver I2C/SPI signals over the USB-to- I2C/SPI bridge; USBi(EVAL-ADUSB2EB). This allows SigmaStudio+ to directly discover and control an A^2B network as well as to read back registers and monitor performance.

The SigmaStudio+® graphical development tool is the programming, development, and tuning software for the SigmaDSP, A^2B, and Sharc processors. Familiar audio processing blocks can be wired together as in a schematic, and the compiler generates DSP-ready code and a control surface for setting and tuning parameters. This tool allows engineers with no DSP code writing experience to easily implement a DSP into their design and yet is still powerful enough to satisfy the demands of experienced DSP designers. SigmaStudio+ links with both Analog Devices evaluation boards and production designs to provide full in-circuit real-time IC control.

SigmaStudio+ includes an extensive library of algorithms to perform audio processing such as filtering, mixing, and dynamics processing, as well as basic low-level DSP functions and control blocks. Advanced record-side processing algorithms such as Enhanced Stereo Capture and wind noise detection are included in the standard libraries. Plug-in algorithms from Analog Devices and 3rd party partners can be added to SigmaStudio+'s drag-and-drop library.

Along with its graphical DSP signal flow development, SigmaStudio+ also includes other features to speed up the design cycle from product concept to release. SigmaStudio+ includes tools for intuitively setting control registers, calculating tables of filter coefficients, visualizing filter magnitude and phase responses, generating C header files, and sequencing a series of controls to ease your transition from SigmaStudio+ to system implementation on your microcontroller.

Purpose of This Manual

This manual provides instructions for installing the product hardware (board). This manual describes the operation and configuration of board components and provides guidelines for running code on the board.

Manual Contents

The manual consists of:

- *Using the board*

  Provides basic board information.

- *Hardware Reference*

  Provides information about the hardware aspects of the board.

- *Bill of Materials*

  A companion file in PDF format that lists all of the components used on the board is available on the website at https://www.analog.com/en/design-center/evaluation-hardware-and-software/evaluation-boards-kits/EVAL-AD2437B1NZ.html.

- *Schematic*

A companion file in PDF format documenting all of the circuits used on the board is available on the website at https://www.analog.com/en/design-center/evaluation-hardware-and-software/evaluation-boards-kits/EVAL-AD2437B1NZ.html.

Technical Support

You can reach Analog Devices technical support in one of the following ways:

- Post your questions in the A^{2}B support community at EngineerZone®:

  http://ez.analog.com/a2b/

- Submit your questions to technical support directly at:

  http://www.analog.com/support

- E-mail your questions about A^{2}B transceiver applications and SigmaStudio+ to:

  A2B.support@analog.com

- Contact your Analog Devices sales office or authorized distributor. Locate one at:

  http://www.analog.com/adi-sales

Supported Integrated Circuit

This evaluation system supports the Analog Devices AD2437 IC.

Supported Tools

Information about SigmaStudio+ and the A^{2}B software plug-in for the *EVAL-AD2437B1NZ* evaluation board is available at: www.analog.com/SigmaStudio+.

Product Information

Information about the AD2437 product family is available at: www.analog.com/A2B

Analog Devices Website

The Analog Devices website, http://www.analog.com, provides information about a broad range of products - analog integrated circuits, amplifiers, converters, transceivers, and digital signal processors.

Also note, MyAnalog.com is a free feature of the Analog Devices website that allows customization of a web page to display only the latest information about products you are interested in. You can choose to receive weekly e-mail notifications containing updates to the web pages that meet your interests, including documentation errata against all manuals. MyAnalog.com provides access to books, application notes, data sheets, code examples, and more.

Visit MyAnalog.com to sign up. If you are a registered user, just log on. Your user name is your e-mail address.

EngineerZone

EngineerZone is a technical support forum from Analog Devices, Inc. It allows you direct access to ADI technical support engineers. You can search FAQs and technical information to get quick answers to your embedded processing and DSP design questions.

Use EngineerZone to connect with other DSP developers who face similar design challenges. You can also use this open forum to share knowledge and collaborate with the ADI support team and your peers. Visit http://ez.analog.com to sign up.

2 Using the Board

This chapter provides information on the major components and peripherals on the board, along with instructions for installing and setting up the emulation software.

Product Overview

The board features:

- Analog Devices AD2437 - Audio Bus A^{2}B Transceiver
- Audio
  - Analog Devices ADAU1701 SigmaDSP 28-/56-Bit Audio Processor with Two ADCs and Four DACs
  - Rohm Semiconductor BD28623MUV - Class D Speaker Amplifier
  - Four Stereo MMICT390200012 - Digital Output MEMS Microphone
  - EEPROM
  - Three 3.5mm audio jacks
- A^{2}B
  - Two XLR connectors
- LEDs
  - Nine LED's
- Switches
  - Three switches: Reset, SCL/SDA Select, and SIO2

Package Contents

Your *EVAL-AD2437B1NZ* package contains the following items.

- *EVAL-AD2437B1NZ* board
- A^{2}B Software - Online Request Documentation

- XLR Cable

Contact the vendor where you purchased your *EVAL-AD2437B1NZ* evaluation board or contact Analog Devices, Inc. if any item is missing.

Default Configuration

The ***Default Hardware Setup*** figure shows the default settings for jumpers and switches and the location of the jumpers, switches, connectors, and LEDs. Confirm that your board is in the default configuration before using the board.

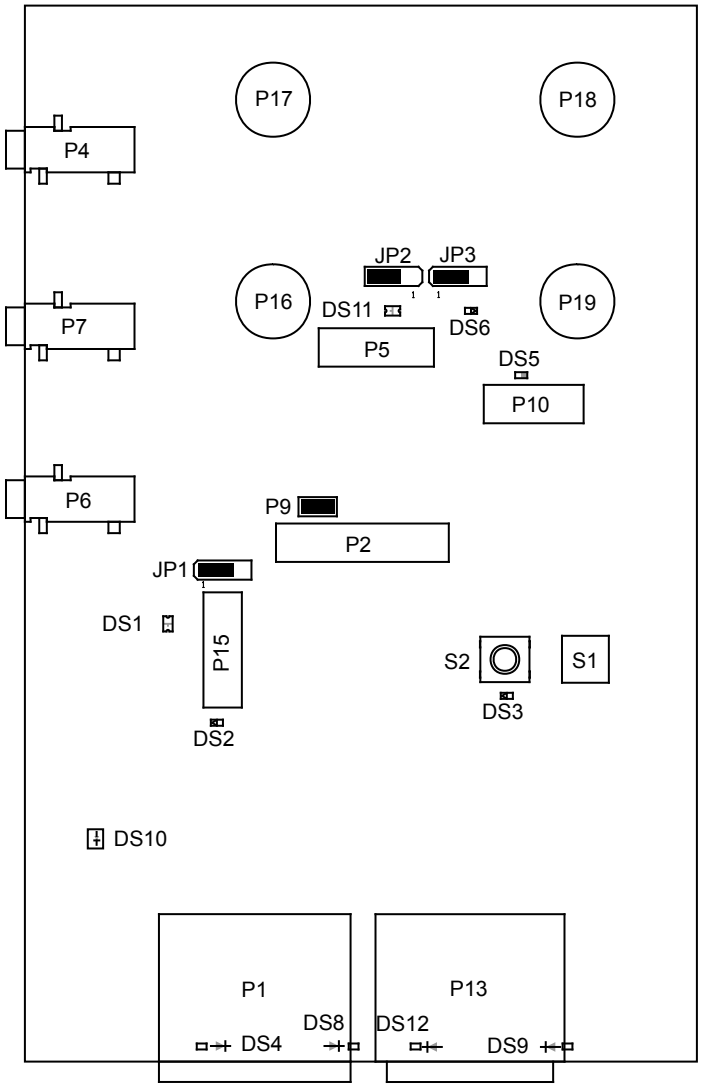

Figure 2-1: Default Hardware Setup

Reference Design Information

A reference design info package is available for download on the Analog Devices Web site. The package provides information on the schematic design, layout, fabrication, and assembly of the board.

The information can be found at:

https://www.analog.com/en/design-center/evaluation-hardware-and-software/evaluation-boards-kits/EVAL-AD2437B1NZ.html

AD2437 - Audio Bus A^{2}B Transceiver

The AD2437 provides a multi-channel, I2S/TDM link over distances of up to 30 m between nodes. It embeds bi-directional synchronous pulse-code modulation (PCM) data (for example, digital audio), clock, and synchronization signals onto a single differential wire pair. A^{2}B supports a direct point to point connection and allows multiple, daisy-chained nodes at different locations to contribute and/or consume time division multiplexed channel content.

A^{2}B is a single-main, multiple-sub system where the transceiver at the host controller is the main node and generates clock, synchronization, and framing for all sub nodes. The main A^{2}B device is programmable over a control bus (I^{2}C and SPI) for configuration and read back. An extension of this control bus is embedded in the A^{2}B data stream, which grants direct access of registers and status information on sub transceivers as well as I^{2}C and SPI communication over distance.

The transceiver can connect directly to general-purpose digital signal processors (DSPs), field-programmable gate arrays (FPGAs), application specific integrated circuits (ASICs), microphones, analog-to-digital converters (ADCs), digital-to-analog converters (DACs), and codecs through a multi-channel I^{2}S/TDM interface. It also provides a pulse density modulation (PDM) interface for direct connection of up to four PDM digital microphones.

Finally, the transceiver also supports an A^{2}B bus powering feature, where the main node supplies voltage and current to the sub nodes over the same daisy-chained, twisted pair cable as used for the communication link. Please refer to the datasheet for more details.

ADAU1701 SigmaDSP 28-/56-Bit Audio Processor with Two ADCs and Four DACs

The ADAU1701 is a complete single-chip audio system with a 28-/56-bit audio DSP, ADCs, DACs, and microcontroller-like control interfaces. Signal processing includes equalization, crossover, bass enhancement, multiband dynamics processing, delay compensation, speaker compensation, and stereo image widening. This processing can be used to compensate for real-world limitations of speakers, amplifiers, and listening environments, providing dramatic improvements in perceived audio quality.

Its signal processing is comparable to that found in high end studio equipment. Most processing is done in full 56-bit, double precision mode, resulting in very good low level signal performance. The ADAU1701 is a fully

programmable DSP. The easy to use SigmaStudio+™ software allows the user to graphically configure a custom signal processing flow using blocks such as biquad filters, dynamics processors, level controls, and GPIO interface controls.

ADAU1701 programs can be loaded on power-up either from a serial EEPROM through its own self-boot mechanism or from an external microcontroller. On power-down, the current state of the parameters can be written back to the EEPROM from the ADAU1701 to be recalled the next time the program is run.

Two Σ-Δ ADCs and four Σ-Δ DACs provide a 98.5 dB analog input to analog output dynamic range. Each ADC has a THD + N of –83 dB, and each DAC has a THD + N of –90 dB. Digital input and output ports allow a seamless connection to additional ADCs and DACs. The ADAU1701 communicates through an I2C bus or a 4-wire SPI port.

ADM6315 - Open-Drain Microprocessor Supervisory Circuit

The ADM6315 is a reliable voltage-monitoring device that is suitable for use in most voltage-monitoring applications.

The ADM6315 is designed to monitor as little as a 1.8% degradation of a power supply voltage. The ADM6315 can monitor all voltages (at 100 mV increments) from 2.5 V to 5 V.

Included in this circuit is a debounced manual reset input. RESET can be activated using an ordinary switch (pulling MR low), a low input from another digital device, or a degradation of the supply voltage.

The manual reset function is very useful, especially if the circuit in which the ADM6315 is operating enters into a state that can be detected only by the user. Allowing the user to reset a system manually can reduce the damage or danger that could otherwise be caused by an out-of-control or locked-up system.

BD28623MUV - Class D Speaker Amplifier

The BD28623MUV is a Class D Speaker Amplifier designed for Flat-panel TVs in particular for space-saving and low-power consumption. This IC delivers an output power of 20W+20W.

LT8609 - 2A/3A Peak Synchronous Step-Down Regulator with 2.5µA Quiescent Current

The LT8609 is a compact, high efficiency, high speed synchronous monolithic step-down switching regulator that consumes only 1.7µA of non switching quiescent current. The LT8609 can deliver 2A of continuous current with peak loads of 3A (<1sec). Burst Mode operation enables high efficiency down to very low output currents while keeping the output ripple below 10mVP-P. A SYNC pin allows synchronization to an external clock, or spread spectrum modulation for low EMI operation. Internal compensation with peak current mode topology allows the use of small inductors and results in fast transient response and good loop stability. The EN/UV pin has an accurate 1V threshold and can be used to program VIN UVLO or to shut down the part. A capacitor on the TR/SS pin

programs the output voltage ramp rate during start-up while the PG flag signals when VOUT is within ±8.5% of the programmed output voltage as well as fault conditions.

MMICT390200012 - Digital Output MEMS Microphone

The T3902 is a low-power, low-noise digital MEMS microphone in a small package. The T3902 consists of a MEMS microphone element and an impedance converter amplifier followed by a fourth-order Σ-Δ modulator. The pulse density modulated (PDM) interface allows two microphones to be time multiplexed on a data line using a single clock.

3 Hardware Reference

This chapter describes the hardware design of the *EVAL-AD2437B1NZ*.

Switches

This section describes operation of the switches. The switch locations are shown in the ***Switch Locations*** figure.

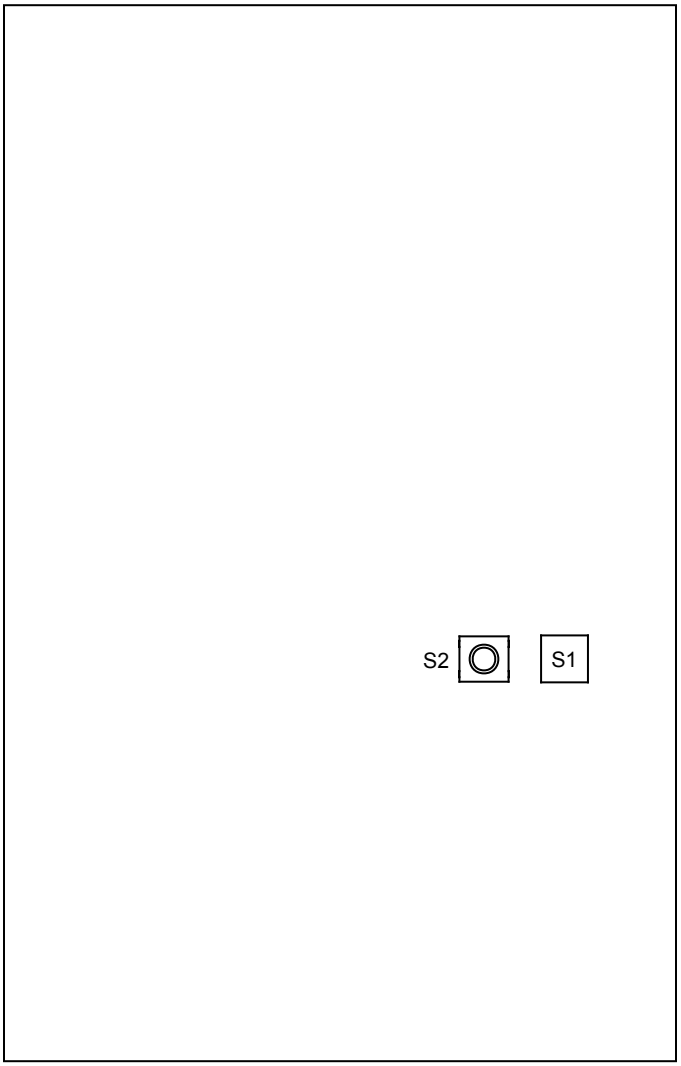

Figure 3-1: Switch Locations

I2C Bus Select (S1)

The I2C Bus Select switch isolates the 1701 I2C bus from the A2B I2C bus. The table below shows the default configuration, for more information about I2C clock routing, refer to schematic.

Switch	Position	I2C clock routing
1A/1B	ON	I2C from AD2437 (DEFAULT)
2A/2B	OFF	I2C from ADAU1701
3A/3B	ON	I2C from AD2437 (DEFAULT)
4A/4B	OFF	I2C from ADAU1701

User I/O Port (S2)

General purpose momentary push button connected to SIO2. There is also a corresponding LED that can be driven from SIO2. Please see PRM for SIO2 configuration.

Switch	Port
S2	SIO2

Connectors

This section describes connector functionality and provides information about mating connectors. The connector locations are shown in the ***Connector Locations*** figure.

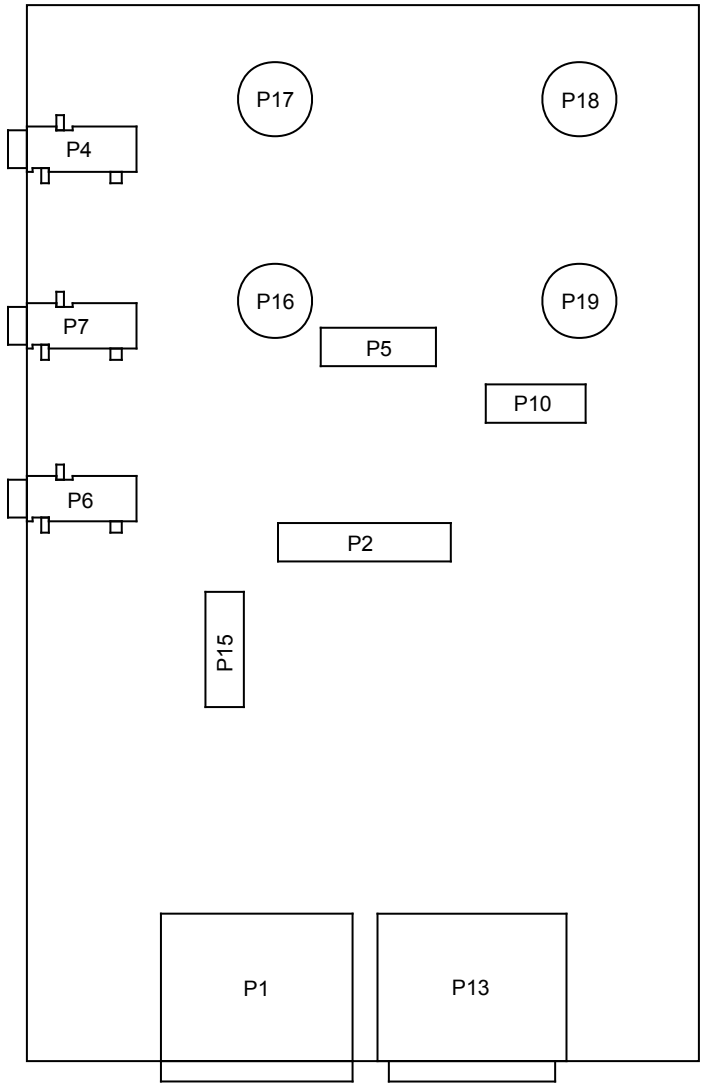

Figure 3-2: Connector Locations

A²B (P1 and P13)

P13 is used to connect towards the next sub board and P1is used to connect towards the main board. These connectors allow the AD2437 on the EVAL board to talk to other A²B devices on the bus.

Part Description	*Manufacturer*	*Part Number*	*RefDes*
3 pole XLR receptacle	Neutrik	NC3FAH2-LR-DAE NC3MAH-LR	P1 - female P13 - male
Mating Cable			
XLR cable assembly			

Audio I2S Connector (P2)

Multipurpose connector containing all a combination of SIO, clock, and GPIO signals.

Class D Speaker Connectors (P16–P18)

P16–P18 are the outputs of the Class - D amplifier and are used to connect stereo speakers to the board. Please ensure that the chosen speaker is no less than 8 ohms.

Connector	Speaker Side
P16	SPKR L-
P17	SPKR L+
P18	SPKR R-
P19	SPKR R+

ADC Input Connector (P4)

The ADAU1701 has two Σ-Δ ADCs. P4 will supply both signals through a 3.5mm Stereo TRS connector. The signal-to-noise ratio (SNR) of the ADCs is 100 dB, and the THD + N is –83 dB.

Part Description	*Manufacturer*	*Part Number*
3.5mm Stereo TRS connector	CUI Devices	SJ-3523-SMT

DAC Output Connector (P6 and P7)

The ADAU1701 includes four Σ-Δ DACs. The SNR of the DAC is 104 dB, and the THD + N is –90 dB. A full-scale output on the DACs is 0.9 V rms (2.5 V p-p). The DACs are in an inverting configuration. If a signal inversion from input to output is undesirable, it can be reversed either by using an inverting configuration for the output filter or by simply inverting the signal in the SigmaDSP program flow.

Part Description	*Manufacturer*	*Part Number*
3.5mm Stereo TRS Connector	CUI Devices	SJ-3523-SMT

Multipurpose pins (P5)

Bi-directional pins designed for multipurpose use. For further information please refer to the schematic.

ADAU1701 I2C Signals (P10)

P10 is an I2C header compatible with the USBi adapter for direct programming of the ADAU1701 through SigmaStudio+.

AD2437 SPI Connector (P15)

P15 provides access to the AD243x SPI port for interfacing with external peripherals. The connector has 0.1" headers. The pinouts can be found in the schematic.

Jumpers

This section describes functionality of the configuration jumpers. The ***Jumper Locations*** figure shows the jumper locations.

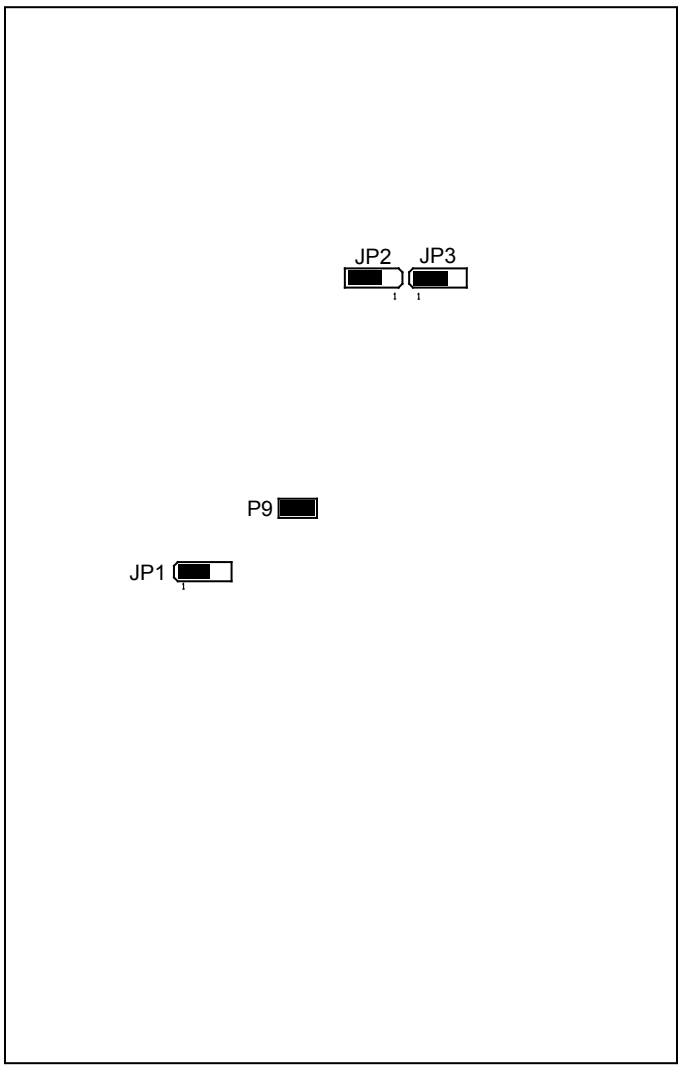

Figure 3-3: Jumper Configurations

Boot (P9)

The Boot jumper allows the ADAU1701 to perform a self boot, in which it loads its RAM and register settings from an external EEPROM. When the jumper is installed no self boot operation is initiated. When the jumper is removed a self boot operation is initiated the next time there is a rising edge on the RESET signal of the ADAU1701. This jumper is installed by default.

Gain (JP2)

Gain terminal sets the gain of the amplifier. Please set GAIN after setting MUTE low. A pop noise may occur if GAIN is set while MUTE is high.

GAIN	GAIN setting
OFF (DEFAULT)	17dB
ON	20dB

AD2437 SIO0 SELECT (JP1)

The SIO0 Select jumper is used to select SIO0 source for AD2437. For PDM microphone signal, jumper must be between 1 and 2. For SIO0 signal from ADAU1701, jumper should be on 2 and 3. The default position is 1 and 2.

Jumper	Routing
1 and 2 (DEFAULT)	PDM OUT
2 and 3	ADAU1701_MP6

Mute (JP3)

This jumper is used to mute the Class - D amplifier.

Jumper	MUTE setting
1 and 2 (DEFAULT)	OFF
2 and 3	ON - Controlled by ADR1

LEDs

This section describes the on-board LEDs. The ***LED Locations*** figure shows the LED locations.

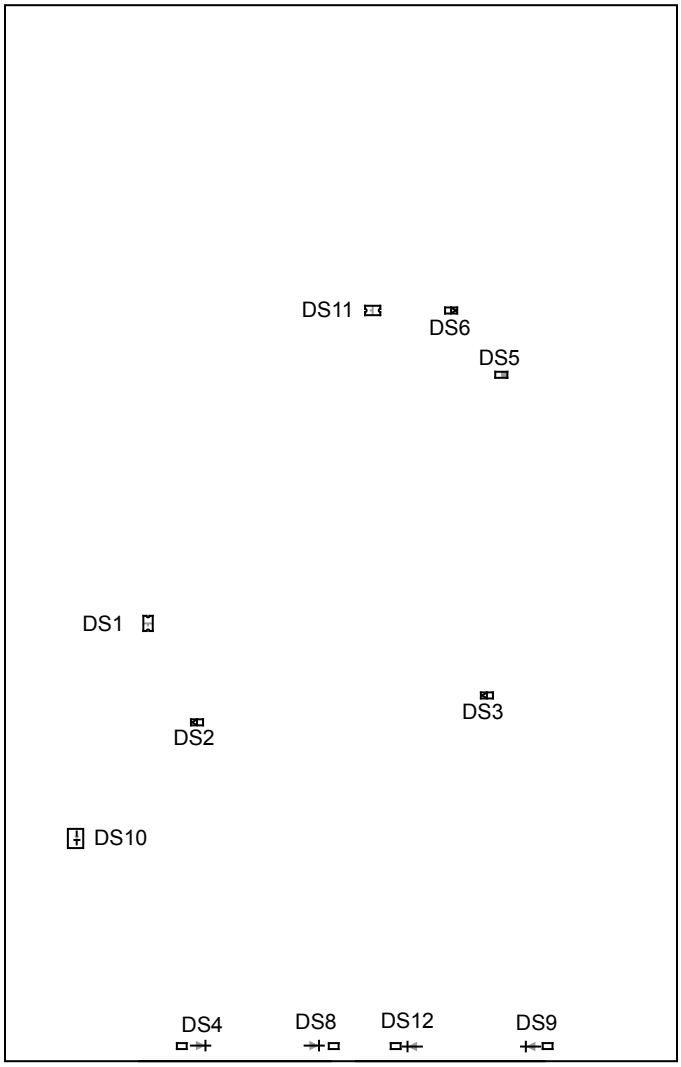

Figure 3-4: LED Locations

3.3V (DS1)

The 3.3V LED is driven by the voltage regulator. The LED is turned on to confirm 3.3V.

A^{2}B Interrupt (DS2)

The A^{2}B interrupt LED is driven by the AD2437. The LED is turned on when the IRQ pin drives it high. Refer to the HRM for further info on using interrupts.

User I/O Status (DS3)

LED will be on when SIO2 is configured as a GPIO output and driven low.

LED	PORT
DS3	SIO2

Port Connection Status (DS4, DS8, DS9 and DS12)

When XLR cable is plugged in, the rings will illuminate indicating a successfull connection.

Mute Status (DS6)

Mute status LED. when MUTE is driven high, the LED will be on, when driven low, the LED will be off.

Power Status LED Indicator

24V power indication. This LED will turn on when 24V is present on the board. DS10 : +24.0V @3.0A