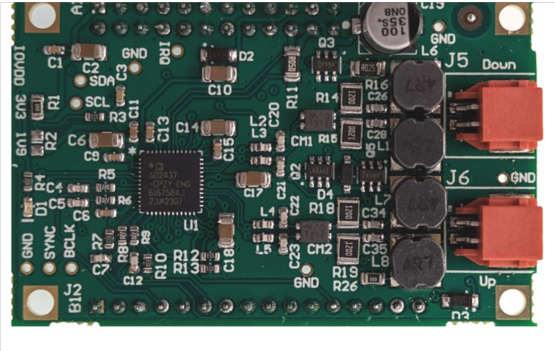
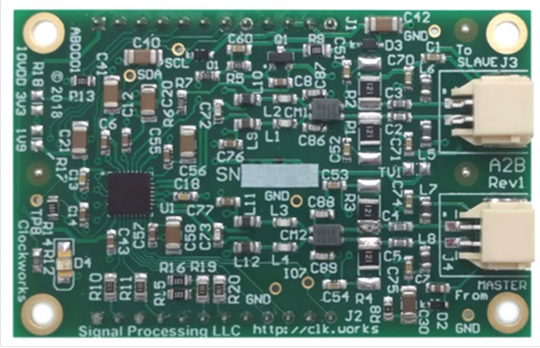


Signal Processing

A²B - I²S MODULES EVM SYSTEM



**SUPPORTS AD242X AND
AD243X A²B - I²S
MODULES**

**SUPPORTS
ANALOG DEVICES**



Summary

- Off the shelf modules for A²B interfacing to I²S, I²C, and SPI devices
- Evaluation (EVM) board kit with stereo audio in and out to jump start A²B system development
- Based on Analog Devices AD2428 or AD2437 A²B devices
- Fully supported by ADI's Sigma Studio/Plus tool's A²B extensions
- Quick turn custom versions for system developers needing near off-the-shelf solutions for A²B projects
- Modules provide full access to all AD2428 and AD2437 digital I/O pins to allow A²B root node or A²B client mode operation
- Provides CFG0 (9V) or CFG4 (24V) phantom power for downstream A²B clients with 2 wire (CFG0 & CFG4) bus power
- Fixed end to end latency regardless of number of nodes in system
- For more complex system design please see Clockworks AB0032 EVM supporting more audio I/O and a wider range of A²B modules.

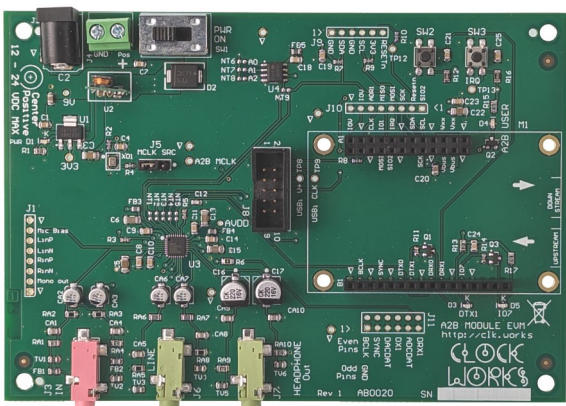
Introduction

Analog Devices' A²B system allows up to thirty two 24 bit 48 kHz data (audio) channels to be carried bidirectionally over twisted pair wire between multiple nodes. Supporting up to 30 meters of cable between nodes it provides a low cost way to create dispersed audio processing systems.

Clockwork's A²B modules provide an off the shelf solution to developers and OEMs needing a way to develop and ship products that include A²B but don't want to delay their projects working out their own A²B designs.

Clockworks offers 4 different modules, two based on the AD2428 and two based on the AD2437. They offer a common footprint and set of features consistent with the capabilities of the two different parts.

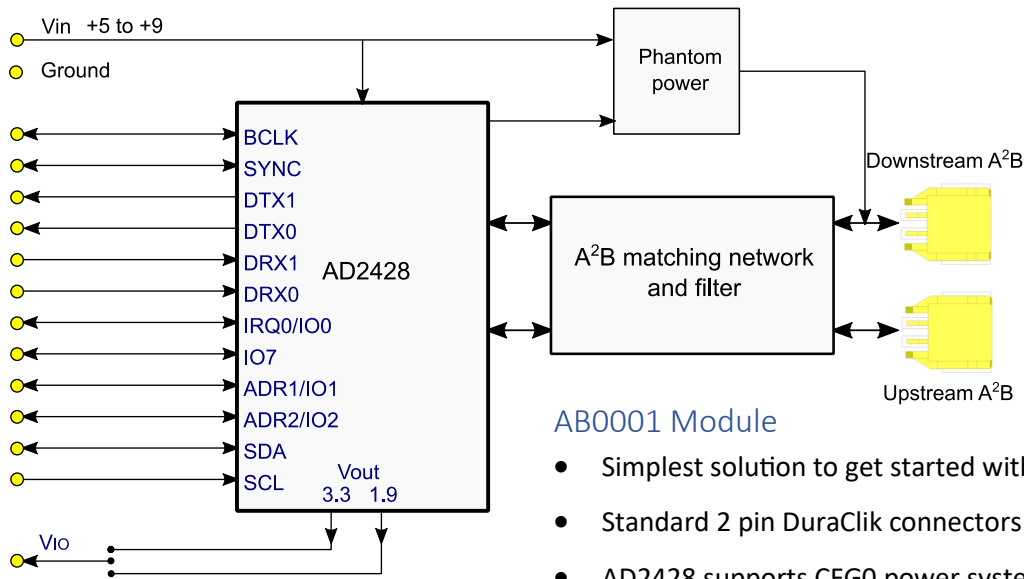
In addition to the EVM board Clockworks offers a range of breakout and microphone modules to provide fast, low risk A²B system development.



**EVM SYSTEM FOR A²B
AUDIO SYSTEM
DEVELOPMENT**

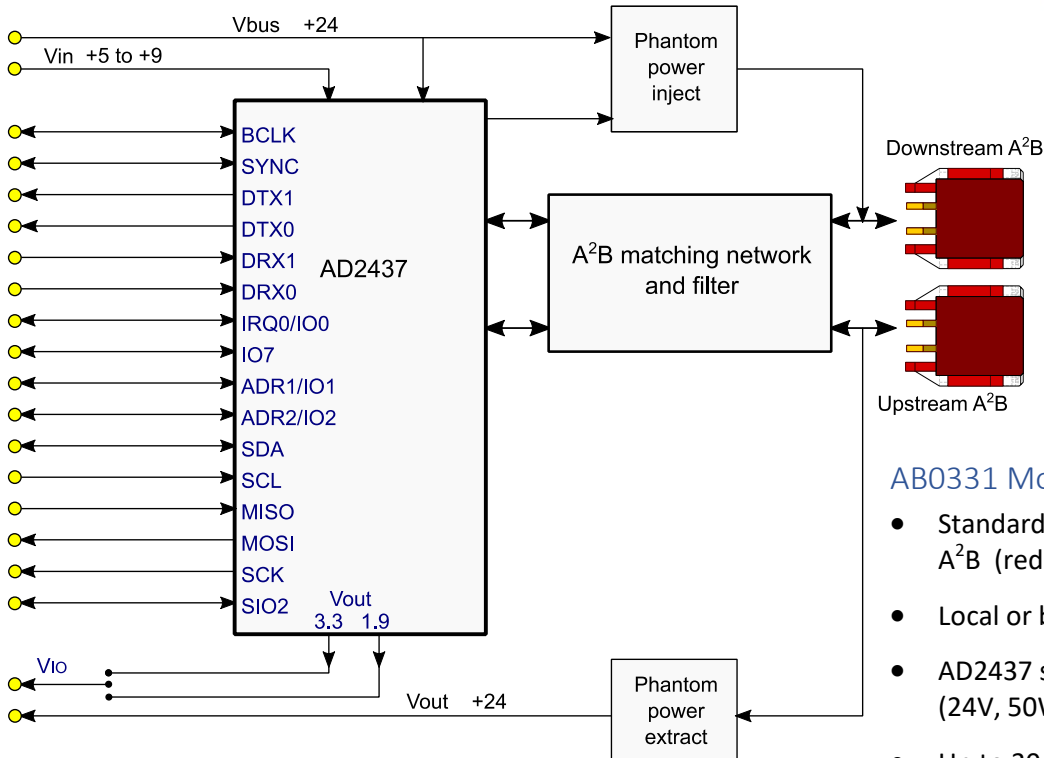
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SUPPORTED MODULES



AB0001 Module

- Simplest solution to get started with A²B
- Standard 2 pin DuraClik connectors for A²B
- AD2428 supports CFG0 power system (9V, 2.7W), local powered only
- Up to 15m node spacing, 40m overall, 10 nodes
- Can also be used with AB0032 EVM; see Clockworks website for a full list of boards this module can be used with



AB0331 Module

- Standard 2 pin DuraClik connectors for A²B (red indicates CFG4 power)
- Local or bus power
- AD2437 supports CFG4 power system (24V, 50W)
- Up to 30m node spacing, 300m overall, 16 nodes
- Can be also used with AB0032 EVM; see Clockworks website for a full list of boards this module can be used with

Module details

AB0001

For the AD2428 based AB0001 modules there are two 12 pin single row .1" (2.54 mm) connectors (male pins) on the bottom side of the module. They mate with standard single row header sockets such as Samtec's SSW-112-01-F-S.

The Clockworks AB0001 A²B modules uses a 2 layer PCB with all components mounted on one side. All components are 0603 or larger to allow those interested in modifying the filter/matching network an easy way to do this.

The AB0001 modules can be powered with a supply in the 5V to 9V range; the lower voltage will limit the number of phantom powered client nodes as each client drops about 0.5V and the AD2428 needs greater than 4V to operate.

Clockworks also offers the AB0003 module which instead of the Duraclik connectors has 4 pin headers that allow a custom carrier card to use any type of connector desired for A²B .

Pinout – A Connector

AB0001 (AD2428) modules

Pin	Name	Notes
1	IOVDD	1.8V or 3.3V. Jumper selects between AD2428 internal regulator voltages, defaults to 3.3V
2	GND	
3	ADR2	AD2428 ADR2/IO2 line with 10K pulldown, optional MCLK
4	ADR1	AD2428 ADR1/IO1 line with 10K pulldown
5	IRQ	AD2428 IRQ/IO0 line
6	GND	
7	SDA	I2C data
8	SCL	I2C clock
9	GND	
10,11	Vxx	Power 5-9V suggested range, 4V min, 9.2V max.
12	GND	

Pinout – B Connector

Pin	Name	Notes
1	GND	
2	BCLK	AD24xx bit clock (output as slave)
3	GND	
4	SYNC	AD24xx frame sync (output as slave)
5	GND	
6	DTX0	AD24xx DTX0 with 10K pulldown (output)
7	DTX1	AD24xx DTX1 with 10K pulldown (output)
8	GND	
9	DRX0	AD24xx DRX0
10	DRX1	AD24xx DRX1
11	GND	
12	IO7	AD24xx IO7
13	GND	AB0331 module only
14, 15	Vbout	AB0331 module only CFG4 phantom power out (24V typical)
16	GND	AB0331 module only

AB0331/71

AB0331/71 modules (AD2437 based) have one 12 pin single row .1" (2.54 mm) connector (male pins) and one 24 pin (2 row x 12) on the bottom side of the module. They mate with standard single and dual row header sockets such as Samtec's SSW-112-01-F-S and SSW-112-01-F-D. The AB0371 has one 4 pin header (upstream) and one 8 pin header (downstream) for the A²B bus and bus power connections.

The AB0331/71 modules are 4 layer dual sided boards, but like the AB0001/3 are built with 0603 and larger components to allow experimentation with optimizing the A²B interface for a specific application.

Both boards need 5-9V and 24V power to be supplied. This can either be from a local supply or with the appropriate external circuitry, A²B bus powered. For the AB0331 module with the 2 pin Dura-clik connectors all that is needed is a 9V regulator. For the AB0371 the design depends on how power will be carried between nodes. For an example see the AB0032 EVM; that board implements the RJ-45 scheme defined by ADI.

General

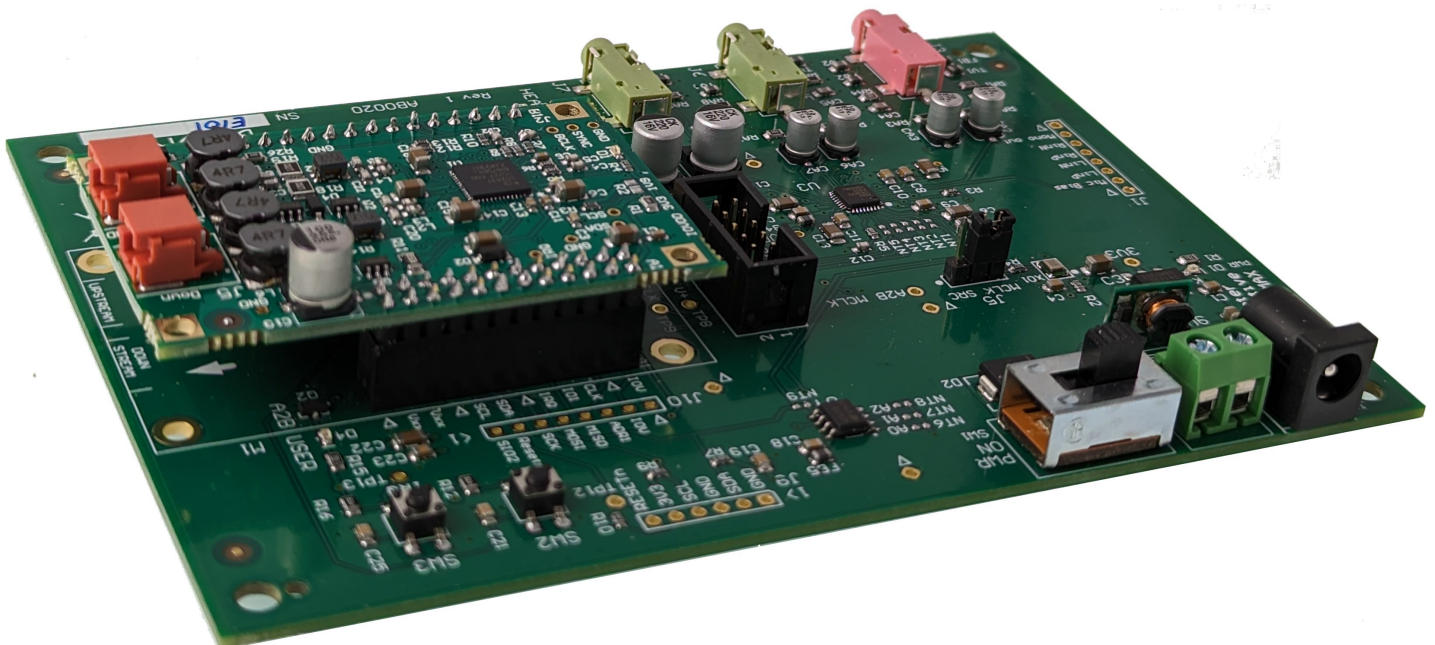
Four 3mm mounting holes are provided, please see the last page for detailed dimensions.

Module I²S output lines are series terminated on the module. A buffer should be added at the connector on the mating board if the trace length for the BLCK and SYNC lines will exceed around 2" (5 cm). Long I²S lines may also create EMI and proper high speed digital design techniques must be followed for all I²S lines.

When used as the root node the bit clock and frame clock must be supplied to the module. When used as a client node those two signals are outputs from the module.

For peripherals needing a higher speed clock—like 128x Fs and typically referred to as MCLK, one of the multiuse pins can be used. By convention that pin as the ADR2 line. For high performance audio applications please review the materials on the Clockworks website about A²B clock jitter.

Users of AD243x devices should also review the ADI chip errata for MCLK output enable conflicts when SPI is enabled in certain modes



Pinout – A Connector

AB0331 and AB0337 (AD2437) modules

J1 on PCB label. 2x12 pins, odd side is same as used in AB0001/3 modules

Notes	Name	Pin	Pin	Name	Notes
Connected to EVM reset line	/RESET	2	1	IOVDD	1.8V or 3.3V. Jumper selects between AD2437 internal regulator voltages, defaults to 3.3V
SPI Master in/Slave Out Data	MISO	4	3	GND	
	GND	6	5	ADR2	AD2437 ADR2/IO2 line with 10K pulldown
SPI Master out/Slave In Data	MOSI	8	7	ADR1	AD2428 ADR1/IO1 line with 10K pulldown (on EVM connects to LED)
AD2437 SIO2 pin. Use as SPI select.	SIO2	10	9	IRQ	AD2437 IRQ/IO0 line (on EVM can connect to pushbutton or GPIO9 of the RP2040 board)
	GND	12	11	GND	
Reserved	-	14	13	SDA	I2C data
	GND	16	15	SCL	I2C clock
SPI data clock	SCK	18	17	GND	
A2B bus power (24V 2 amp max)	VBus	20	19	Vxx	Power 5-9V suggested range, 4V min, 9.2V max.
	VBus	22	21	Vxx	Note: Vxx not used with all configurations
	GND	24	23	GND	

All of the Clockworks modules provide a method for supplying power to downstream nodes; the details are a function of the A²B power type (CFG0 or CFG4, see ADI documentation) and if CFG4: does the implementation use phantom power (2 or 3 wire schemes) or separate lines via RJ45 or other higher wire count solutions? The AD2437 provides fault detection and diagnostics for both CFG0 and CFG4 power schemes. The CFG4 system has several design considerations that are application dependent; the Clockworks AB0331/71 module designs reflects this fact that there's not a one size fits all solution across the entire application space.

Module schematics are available from the Clockworks website, along with a .STEP file for the A²B module to facilitate design of your own carrier board.

Software and documentation for the AD2428 or AD2437 A²B transceiver can be obtained directly from Analog Devices' website.

AB0032 EVM/carrier for A²B modules

The A²B module EVM provides an easy to use platform to test out the A²B bus operation without needing to connect your own hardware to the Clockworks' A²B module. The EVM provides 4 channels of line level analog input and output via standard 1/8" mini-phone jacks. Using an external 24 VDC supply, it provides power to the A²B module that can be used to power downstream A²B devices using A²B's phantom power feature.

Programming of the A²B device and the ADAU1761 SigmaDSP with Sigma Studio+ requires purchase of the USBi (part number EVAL-ADUSB2EBZ) Sigma DSP emulator from Analog Devices. Sigma Studio and the A²B software add on is available directly at no cost from Analog Devices. Please note SigmaStudio 4.7 must be used for ADAU1761 development, and SigmaStudio+ 2.0 (or later) for A²B.

A²B Module support

Due to the very flexible nature of A²B systems the options may seem all a bit confusing; please contact Clockworks with your requirements and we'll suggest a set of hardware options that will meet your needs. For those looking for a deeper dive, read on. For full details the schematic and User Manual are available from the Clockworks website.

The AB0020 EVM supports the Clockworks AB0001 (2 pin DuraClik A²B) AB0331 (2 pin DuraClik A²B) modules. The AB0003 (AD2428) and AB0371 (AD2437) modules are not supported as they use headers for the A²B connection and therefore the thing those modules plug in to need to prove the A²B connectivity as well as some CFG0 or CFG4 power management features. Please see the Clockworks website for other A²B boards. For general development the AB0032 EVM board can be used with the AB0003 (AD2428) and AB0371 (AD2437) modules.

Audio features

Even without an A²B module the EVM board can be used as a platform for audio development with the ADAU1761. The ADAU1761 SigmaDSP supports a basic range of signal processing applications, and the Sigma Studio environment makes it easy for non-experts to develop and tune applications.

When operated as the root node the ADAU1761 is responsible for creating the clock input needed by the A²B transceiver. When operated as a client node, the A²B transceiver is the clock master.

Power features

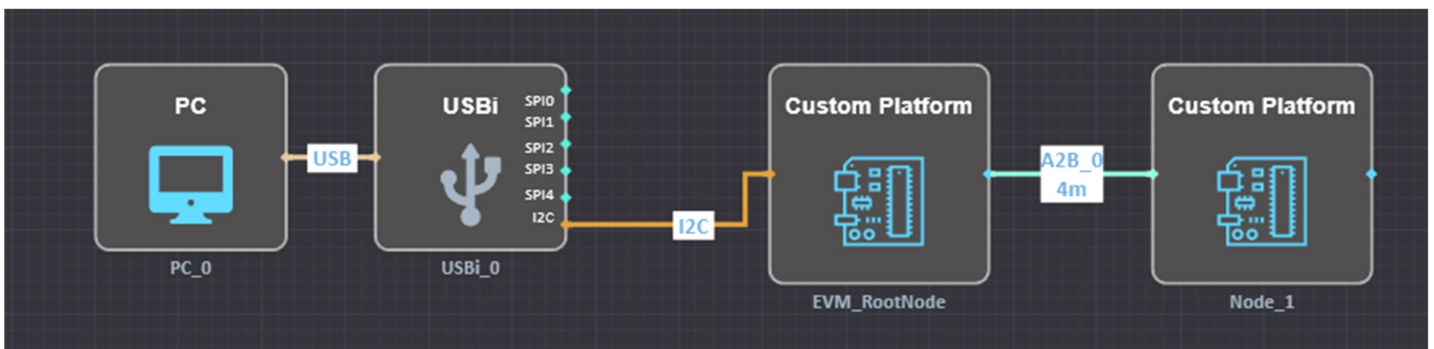
The EVM board is intended to be locally powered from an external supply. The EVM's regulators will supply the power needs for the board as well as the module's CFG0 or CFG4 downstream A²B power.

A²B can be galvanically isolated and for critical high performance systems should be considered for the actual node design.

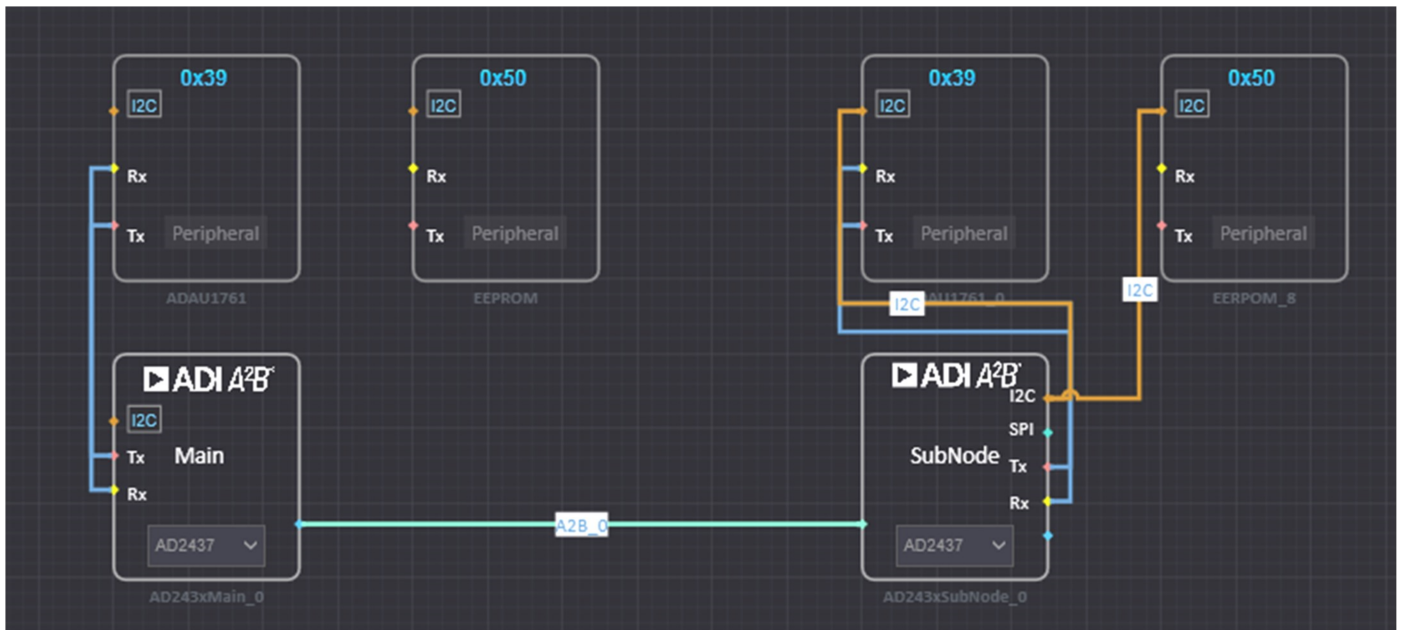
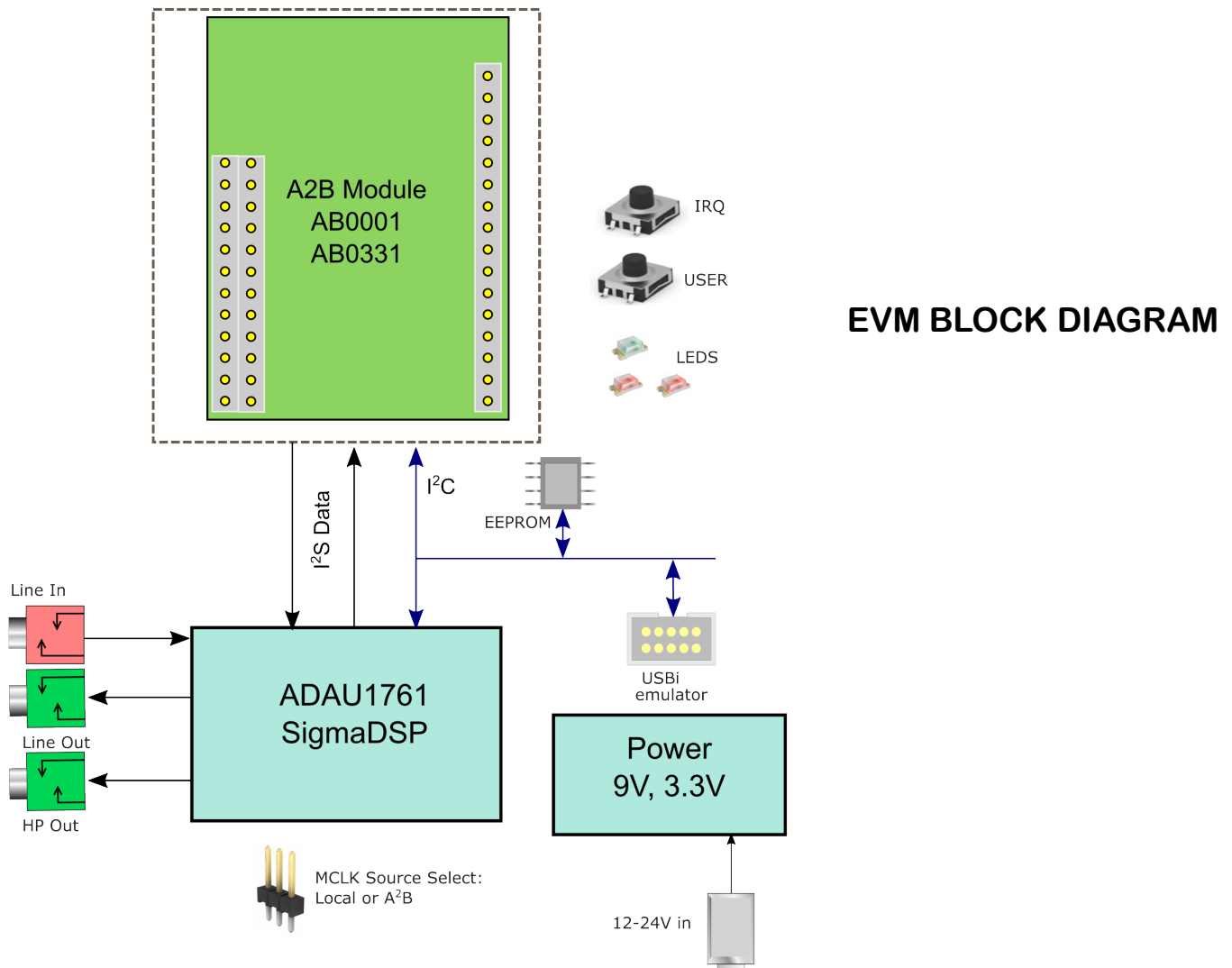
Developer features

A USBi connector is provided for A²B and DSP development using Sigma Studio/+. The primary control interface for these devices is I²C. A small I²C EEPROM is available for storing local parameters that can be accessed over A²B. Typically this is used to aid in node identification in non-fixed networks.

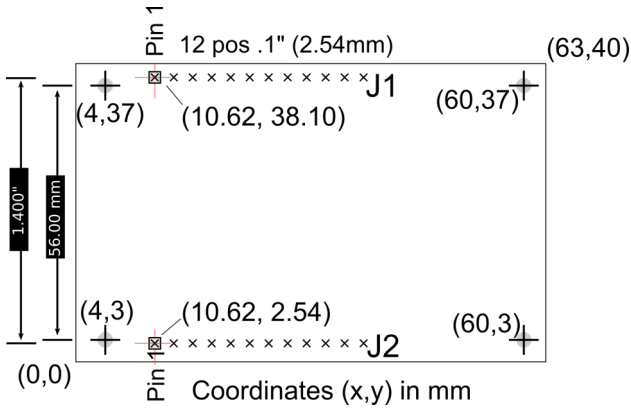
All of the A²B module signal I/O and I²S connections are available on test points or headers



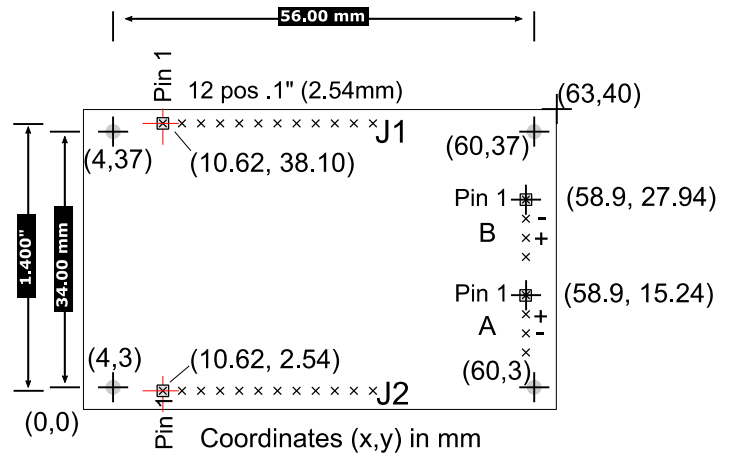
SIGMASTUDIO+ EXAMPLE WITH TWO CLOCKWORKS A²B EVMS



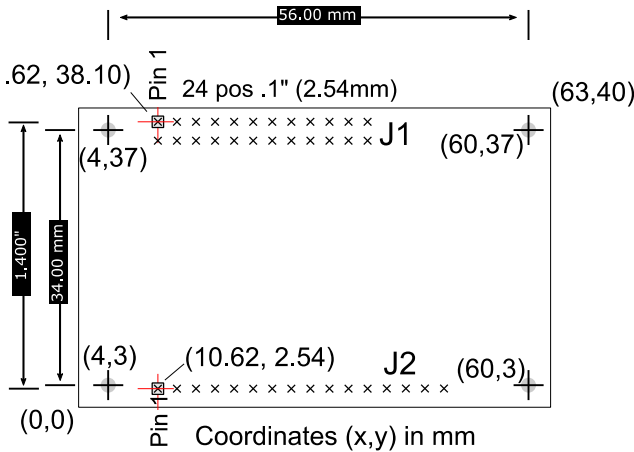
SIGMASTUDIO+ NETWORK VIEW



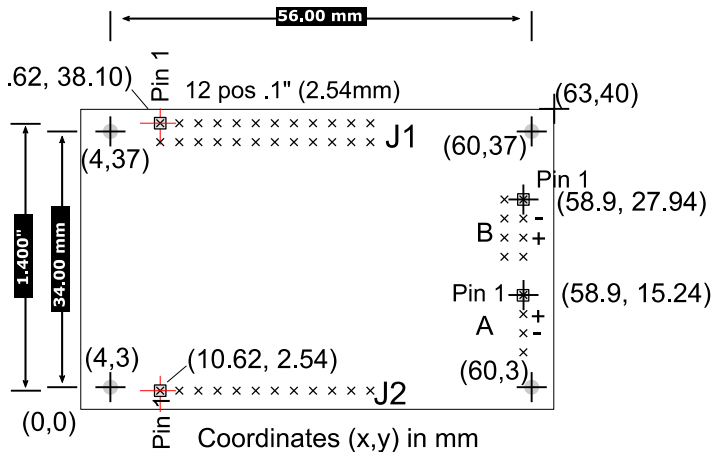
AB0001 A²B Module dimensions.
Mounting holes are 3mm.



AB0003 A²B Module dimensions.



AB0331 A²B Module dimensions.



AB0371 A²B Module dimensions.

A²B module dimensions and pin locations. Note this EVM just supports the AB0001 (AD2428) and AB0331 (AD2437) models of modules. STEP files of all modules are available for download from the Clockworks website.

For mounting to a carrier board 11mm standoffs can be used when using standard height mating (female) sockets.