



## A<sup>2</sup>B<sup>®</sup> - I<sup>2</sup>S MODULE

### SUPPORTS ANALOG DEVICES



### EVM WITH MODULE



## Signal Processing

### A<sup>2</sup>B - I<sup>2</sup>S MODULE

### MODULE EVM SYSTEM

## Summary

- Off the shelf module for A<sup>2</sup>B<sup>®</sup> interfacing to I<sup>2</sup>S and I<sup>2</sup>C devices
- Based on Analog Devices newest AD2428W A<sup>2</sup>B device
- Evaluation (EVM) board kit with stereo audio in and out to jump start A<sup>2</sup>B system development (A<sup>2</sup>B Master or Slave capable)
- Fully supported by ADI's SigmaStudio™ tools A<sup>2</sup>B extensions
- Use ADI's SHARC™ Audio Module as A<sup>2</sup>B host or other ADI EVMs
- Available in OEM quantities for system developers needing off-the-shelf solution for A<sup>2</sup>B interface
- 0.1" (2.54 mm) connector pitch for easy mating to development hardware
- Full access to all AD2428W digital I/O pins to allow A<sup>2</sup>B master or A<sup>2</sup>B slave mode operation
- Provides phantom power for downstream A<sup>2</sup>B slaves
- Selectable I/O voltage
- Compact 63 x 40 mm (2.5" x 1.6") module

## Introduction

Analog Devices' A<sup>2</sup>B 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 15 meters of cable between nodes it provides a low cost way to expand audio processing systems.

Clockwork's A<sup>2</sup>B module provides an off the shelf solution to developers and OEMs needing a way to develop and ship products that include A<sup>2</sup>B but don't want to delay their projects working out their own A<sup>2</sup>B designs.

The module has two 12 pin .1" (2.54 mm) spaced headers to allow for easy mating with standard development PCBs.

The EVM board includes an Analog Devices ADAU1761 SigmaDSP<sup>®</sup> device which allows for local signal processing of the stereo audio input and outputs.

A<sup>2</sup>B, SigmaDSP, SigmaStudio, and SHARC are trademarks of Analog Devices Inc.

## Module details

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 A<sup>2</sup>B module 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 versus implementations using 0402 components on both sides of the PCB.

The module can be powered with a supply in the 5V to 9V range; the lower voltage will limit the number of phantom powered slaves as each slave drops about 0.5V and the AD2428W needs greater than 4V to operate (9V max).

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

### Pinout – A Connector

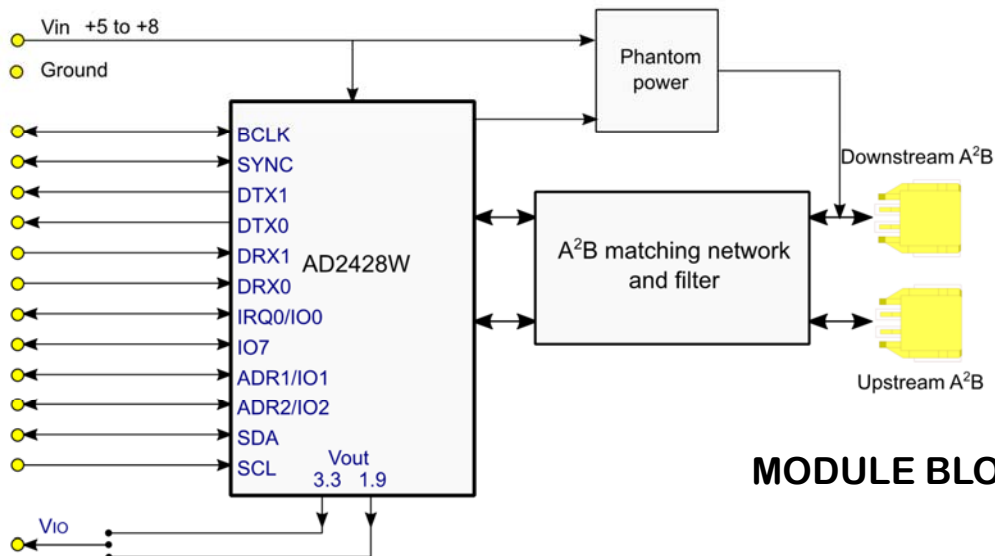
J1 on PCB label.

Pin	Name	Notes
1	IOVDD	Jumper selects between AD2428 internal regulator voltages, defaults to 3.3V
2	GND	
3	ADR2	AD2428W ADR2/IO2, 10K pulldown
4	ADR1	AD2428W ADR1/IO1, 10K pulldown
5	IRQ	AD2428W IRQ/IO0
6	GND	
7	SDA	I2C data
8	SCL	I2C clock
9	GND	
10,11	Vxx	Power 5-8V suggested range, 4V min, 9V max.
12	GND	

### Pinout – B Connector

J2 on PCB label.

Pin	Name	Notes
1	GND	
2	BCLK	AD2428W bit clock (output as slave)
3	GND	
4	SYNC	AD2428W frame sync (output as slave)
5	GND	
6	DTX0	AD2428W DTX0/IO3, 10K pulldown (output)
7	DTX1	AD2428W DTX1/IO4, 10K pulldown (output)
8	GND	
9	DRX0	AD2428W DRX0/IO5
10	DRX1	AD2428W DRX1/IO6
11	GND	
12	IO7	AD2428W IO7



**MODULE BLOCK DIAGRAM**

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

## A<sup>2</sup>B module EVM

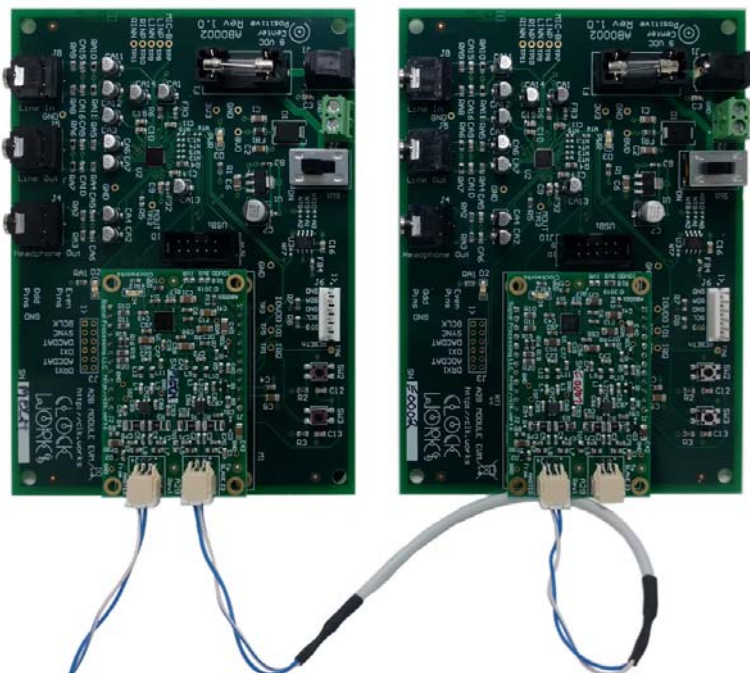
The A<sup>2</sup>B module EVM provides an easy to use platform to test out the A<sup>2</sup>B bus operation without needing to connect your own hardware to the Clockworks' A<sup>2</sup>B module. The EVM provides stereo analog input and output via standard 1/8" mini-phone jacks. Using an external 9VDC supply, it provides power to the A<sup>2</sup>B module that can be used to power downstream A<sup>2</sup>B slave devices using A<sup>2</sup>B's phantom power feature.

The module's hardware design, when mated to the Clockworks' A<sup>2</sup>B module, emulates Analog Devices AD2410WBZ evaluation board (similar to the newer EVAL-AD2428WB1BZ) and can therefore be used with all of the standard A<sup>2</sup>B examples included with the Sigma Studio add on for A<sup>2</sup>B. The Analog Devices board uses the automotive qualified ADAU1461 SigmaDSP whereas the Clockworks board uses the functionally identical ADAU1761.

As with the Analog Devices EVM, there are two push button switches that can be used for emulating user input in an actual system.

### Developer features

A USBi connector to attach an Analog Devices USBi emulator (or equivalent) is provided for operation of the EVM as an A<sup>2</sup>B master, as well as development of ADAU1761 software if the EVM is used without the A<sup>2</sup>B module (for a slave mode EVM). The EVM slave mode board relies on the A<sup>2</sup>B module to provide the ADAU1761's master clock input, which is normally 12.288 MHz (256 fs where fs is 48 kHz). The EVM master mode board (or a slave board without a module for 1761 development) includes an oscillator. If not using USBi then an external controller is required to load the AD2428W for master mode operation and/or loading the ADAU1761's program memory over I<sup>2</sup>C.



Analog Devices' A<sup>2</sup>B system operates as a daisy chain. One connector is the upstream side that ultimately connects to the first (master) device. The second connector connects downstream towards the last (slave) device in the daisy chain. Up to 9 modules may be daisy chained with up to 15m between nodes and total wire length of 40m.

Clockworks' A<sup>2</sup>B modules can operate as master (first) or a slave node device. The Clockworks EVM can be ordered as a slave device for use with A<sup>2</sup>B masters such as the Analog Devices SHARC<sup>®</sup> Audio Module or EVAL-AD2428WD1BZ A2B master evaluation kit, or ordered configured for operation as an A<sup>2</sup>B master for use with any A<sup>2</sup>B slave.

A two EVM package of one master and one slave is also available.

The EVM board provides a (unpopulated) 12 pin .1" pitch dual row header for monitoring the I<sup>2</sup>S lines. There is a 6 pin .1" MTA style connector that conforms to the Clockworks standard AUX CTRL connector pinout and provides access to the I<sup>2</sup>C bus. Neither the ADAU1761 nor the AD2428W devices have a RESET pin; a device hang during development may require a power cycle to resolve.

A small EEPROM is available for storing local parameters that can be accessed over A<sup>2</sup>B. Analog Devices defines the use of the EEPROM for their eval kits and users may need to program the contents on the Clockworks EVM board to emulate specific Analog Devices capabilities.

The EVM (with module) as an A<sup>2</sup>B slave and can be used with any ADI A<sup>2</sup>B Master, including the SHARC Audio Module and the EVAL-AD2428WB1BZ evaluation board.

### Software support

ADI provides both the SigmaStudio A<sup>2</sup>B add-ons and an A<sup>2</sup>B software stack for the AD2428W. The AD2428W supports routing of audio directly between nodes, which allows the EVM to be used to monitor audio traffic in a A<sup>2</sup>B system without affecting the host (master) node. If using SigmaStudio this type of operation can be configured in a matter of seconds.

### Ordering information

For OEM quantities of modules please contact Clockworks for price and lead time. EVM kits and small quantities of modules are normally available from stock.

The EVM kit documentation package includes the A<sup>2</sup>B module and EVM User Guide, and the EVM schematic (pdf, Altium), EVM layout (Altium), EVM BOM and EVM gerbers. A .STEP file for the A<sup>2</sup>B module is included to facilitate design of your own carrier board.

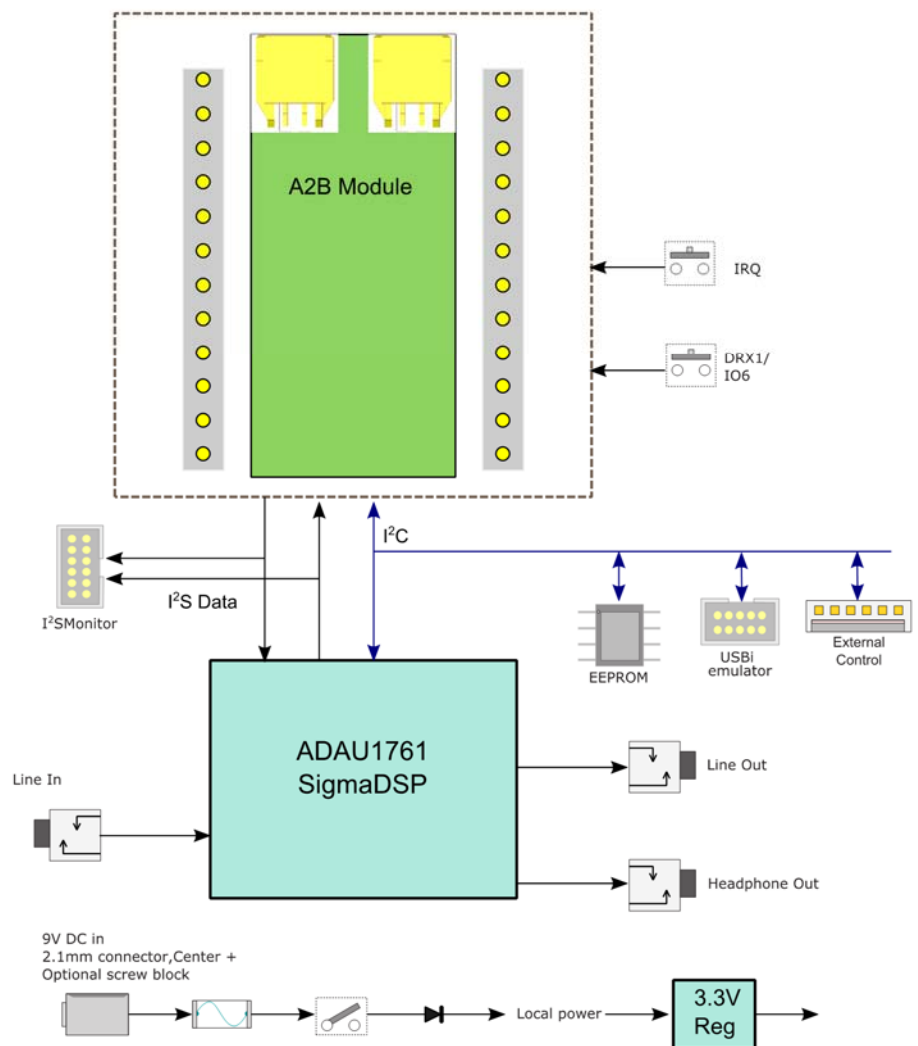
SigmaStudio examples are included for demonstrating EVM operation.

The EVM in a master configuration requires the Analog Devices USBi to operate the AD2428W.

Standalone programming of the ADAU1761 requires purchase of the USBi (part number EVAL-ADUSB2EBZ) Sigma DSP emulator from Analog Devices.

SigmaStudio is available directly from Analog Devices at no charge, along with the A2B add-ons.

### EVM BLOCK DIAGRAM



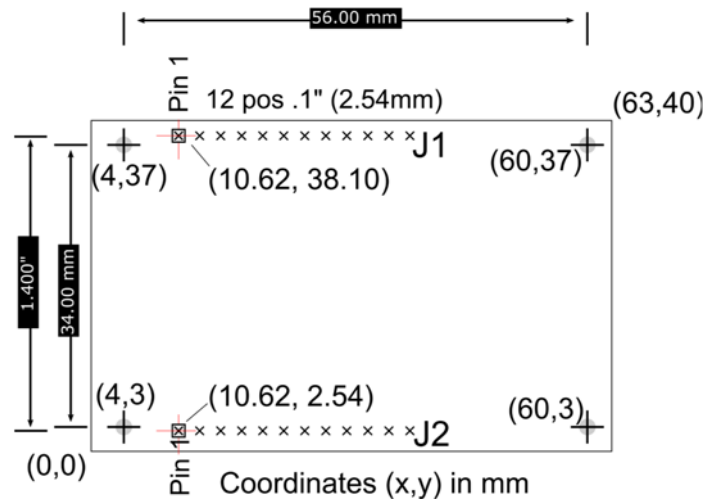


## Order codes

A2B01-S	A <sup>2</sup> B to I <sup>2</sup> S module, single.
A2B01-V	5 pack A <sup>2</sup> B to I <sup>2</sup> S modules.
A2B01-XX	20 pack A <sup>2</sup> B to I <sup>2</sup> S modules.
EVMA2B01-NA	Slave mode EVM kit with ADAU1761 main board, A <sup>2</sup> B module, 1m A <sup>2</sup> B cable, 9V supply with universal AC input supply (NEMA 1-15 blade), documentation package.
EVMA2B01-INT	As above but with universal AC input supply with multi-blade kit (NA, EU,UK,AUS,CN)
EVMA2B51	Slave mode EVM board only.
EVMA2B02-NA	Master mode EVM kit , see EVMA2B01-NA for contents
EVMA2B02-INT	Master mode EVM kit , see EVMA2B01-INT for contents
EVMA2B03-NA	Master + slave EVMs: EVMA2B01-NA and EVMA2B02-NA
EVMA2B03-INT	Master + slave EVMs: EVMA2B01-INT and EVMA2B02-INT

EVM and Module are RoHS compliant.

Development tools are not tested for FCC/CE emissions. Modules may need to be installed in an appropriately shielded user supplied enclosure.



**A<sup>2</sup>B Module dimensions. Mounting holes are 3mm.**

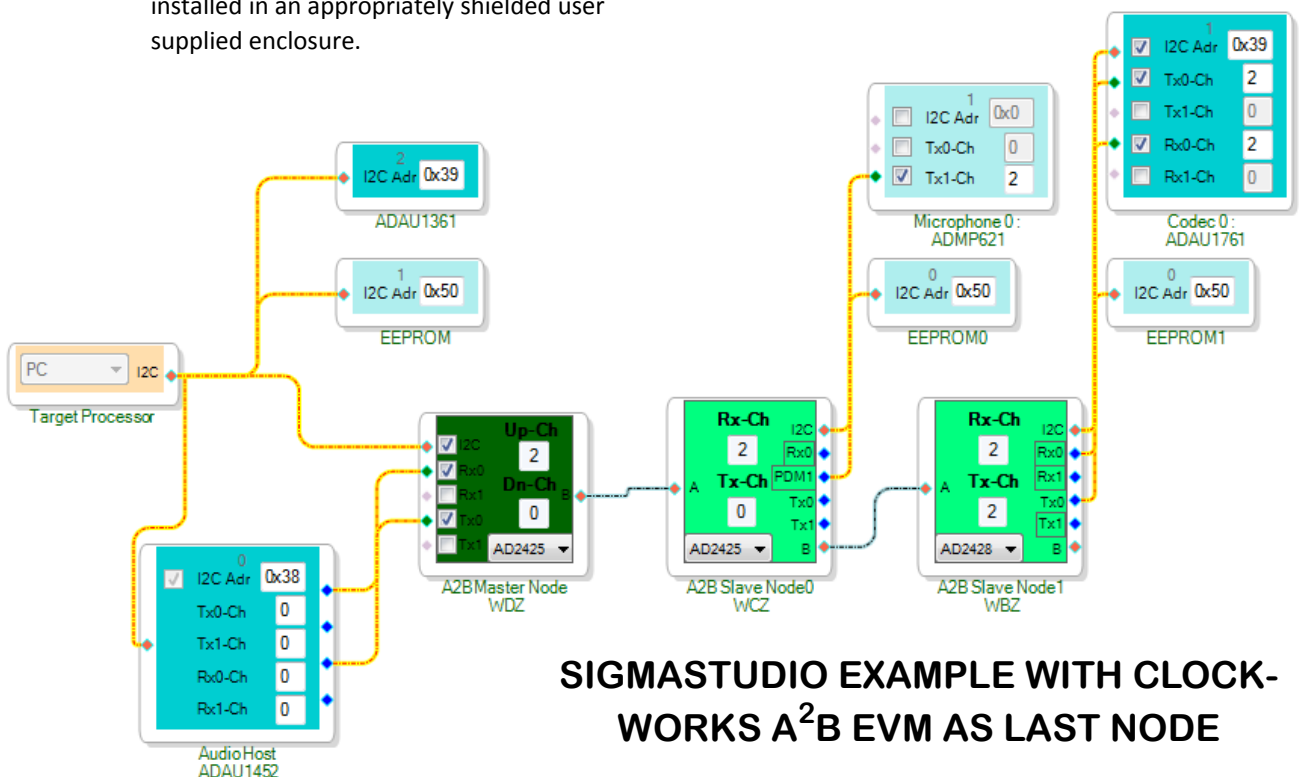
## Module summary specification

The module data pins for inputs are directly connected to the AD2428W and for outputs (BCLK, SYNC, DTX0, DTX1) through a 33 ohm series resistor.

DTX0, DTX1, ADR1, and ADR2 have a 10 k pull-down.

The AD2428W has a maximum input of 9V. There is a Schottky diode in series with the V<sub>xx</sub> connector pin.

Module power consumption should be calculated using the AD2428W datasheet procedure plus 1.6mA for the LED.



## SIGMASTUDIO EXAMPLE WITH CLOCKWORKS A<sup>2</sup>B EVM AS LAST NODE