4 CHANNEL MICROPHONE BOARD

USER MANUAL

Rev 2

4-Nov-20

Signal Processing

http://clk.works/

Products covered:

AB0003 OEM A^2B to I^2S module (local or bus powered) or AB0001 (local powered only)

AB0105 Microphone module (A^2B client node, local or bus powered)

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1 INTRODUCTION

The 4 channel microphone module contains 4 PDM microphones in a configuration that makes then easy to use with Clockworks' AD2428 based A^{2}B modules.

Figure 1 AB0105 4 channel microphone board

The 4 mics are arranged in a symmetrical Y pattern with arm lengths of 12 mm. Clockworks also offers a larger round array microphone board with up to 8 microphones for use with A^{2}B, please see the Clockworks' website for available hardware.

Figure 2 shows the block diagram of the board. In addition to the two PDM outputs being buffered, the input clock signal is buffered. The AD2428's BLCK signal is used to clock the microphones.

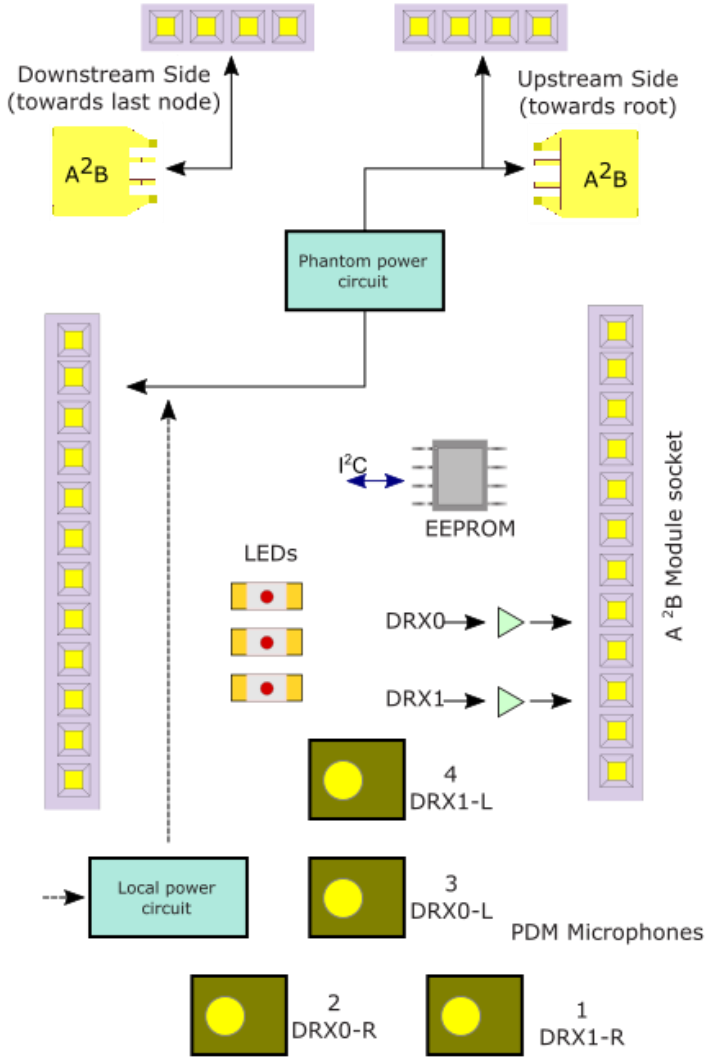


Figure 2 Board block diagram

The Clockworks OEM A^{2}B module AB0003 allows developers to quickly integrate Analog Device's A^{2}B capability in to both prototyping and production environments needing a different connector than the DurClik connector used on all A^{2}B development systems. The AB0001 has the DuraClik connectors on the board.

Figure 3 OEM A²B module – locally powered version (AB0003L)

Figure 4 OEM A²B module – phantom powered version (AB0003P)

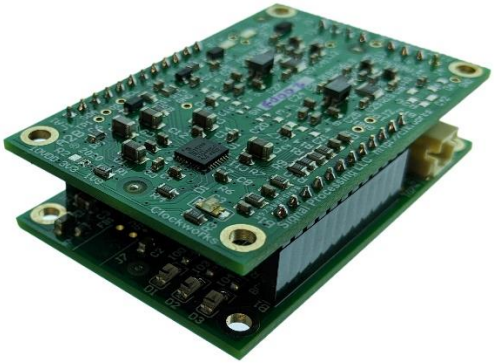
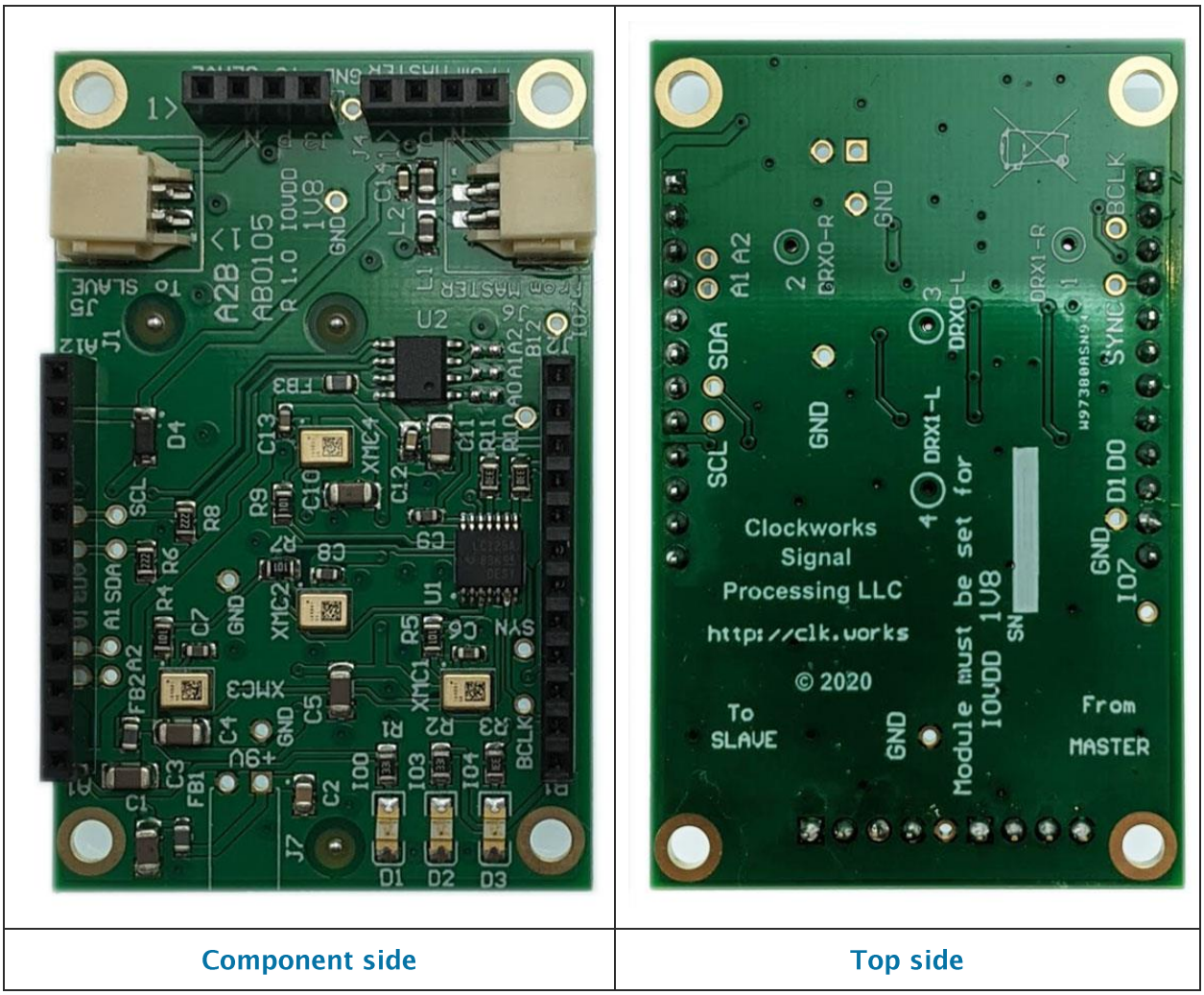
	
Bottom view	**Top view**

Figure 5 AB0105 & AB0003P module stack



Component side	Top side

Figure 6 AB0105

1.1 EVM KIT FOR DEVELOPMENT

Clockworks offers the AB0105 module as a standalone board, or bundled with the AB0003P A^{2}B module. The AB0003P (phantom powered) module is configured for Vio of 1.8V.

The board relies on the A^{2}B module to provide Vio of 1.8V, so if the board is used outside of an A^{2}B system power would need to be supplied as well.

1.2 SOFTWARE SUPPORT

A^{2}B software is supplied by ADI directly at no charge. This software includes both an add on for Sigma Studio that allows an A^{2}B network to be described graphically, and a library with a standard API that can be used by the (host) processor that is connected to the A^{2}B root node (first) node device.

The A^{2}B API information can be found in the ADI document *"AD2421/AD2422/AD2425 Automotive Audio Bus A^{2}B Transceiver Programming Reference"* document 82-100128-01, Rev 1.1 or as updated to the latest version. This guide, along with the AD2428 A^{2}B transceiver datasheet, is needed to understand the register settings that are exposed in the A^{2}B add-on for Sigma Studio.

When using ADI's tools for A^{2}B configuration and operation remember to set the A^{2}B device type for the module node to AD2428.

Please see section 6 for an example with the A^{2}B add-on for Sigma Studio.

1.3 1.8V = 1.9V?

There's some inconsistency on the way the lower of the two I/O voltages available from the AD2428 are labelled. While generally called the 1.8 volt supply, the actual voltage out of the AD2428 is 1.9V and is referenced that way in some places.

2 GETTING STARTED WITH THE BOARD

If ordered as a board set with the AB0003P board then everything is preconfigured and you just need to connect its upstream port (i.e. the side connecting towards the root or A^{2}B master node)

2.1 AD2428 CONTROLLED LEDS

Three red LEDs are connected to the AD2428's GPIO. They are controlled by IO0, IO3, and IO4.

2.2 USE

A^{2}B evaluation involves at least two nodes, the root (A^{2}B master) node and one or more client (A^{2}B slave) nodes. The examples presented here use the ADI's WDZ board for the root node, but substitution of other root node is easy enough.

Please see section 6 for an example with the A^{2}B add-on for Sigma Studio. Guidance for direct software development is included with the ADI API documentation.

3 BOARD DESIGN INFORMATION

The schematic is included at the end of this document, and 3D pdf is posted to the same place you go this document from on the Clockworks website.

The package includes the following information for AB0106, AB0108, or AB0110 boards:

- PDF of schematic. Part information is embedded in the PDF, click on a part symbol to see detailed information on the part.
- 3D PDF of the board. Note that Acrobat Reader security will ask if you trust the document. You must click yes. You then may need to click in the blank field to make it display. Some versions of Reader have a bug and will not display unless the document is saved locally. You can enable display of various board features and components using the standard 3D Acrobat features.

Available on request are:

- Zip with Gerbers.
- Altium project files
- BOM as an Excel spreadsheet

3.1 POWER INPUT

The board design includes a spot for mounting a 2 pin header for powering the A^{2}B module. Voltage should range from 5V to a maximum of 9V.

If connecting to test equipment the board must be locally powered as a phantom powered node's ground connection is not the same as system ground. Connecting the phantom powered node's ground to an instrument ground will cause an A^2B fault.

To locally power the board install a 2 pin connector at J7 or wire pigtails to connect to a 5-9V power source:

Figure 7 Locally powered node connector

L1 and L2 must be removed as otherwise the A^2B bus will be back powered and this is not a good thing to do.

Figure 8 Remove L1 & L2 if locally powering the node

Remember the microphone board requires 1.8V power, meaning that the A^2B module must be correctly jumpered to supply this.

3.2 EEPROM

The AB0105 (rev 2 and later) includes a SOIC-8 (150 mil) 8 pin EEPROM. The EEPROM is installed by default. A 32Kx8 part is used and typically resides at I^2C address 0x50. PCB traces/pads can be cut/jumpered to change this address.

Figure 9 EEPROM and address jumpers

Parts like Microchip's 24AA256T-I/SN or STMicro's M24256-BRMN6TP are typical of what's installed here.

4 A^2B MODULE INFORMATION

All module functions are determined by the AD2428 device, please refer to that device's datasheet and technical reference manual for detailed operating information.

4.1 CONNECTORS

There are four connectors on the bottom side of the AB0003 module that mate with this board.

4.1.1 PRIMARY SIGNALS

Pinout – A Connector, 12 pin .1" (2.54mm) single row, male pins.

Pin	Name	Notes
1	IOVDD	Jumper selects between AD2428 internal regulator voltages, default is 3.3V (vs. 1.8V required for the microphone board)
2	GND	
3	ADR2	AD2428 ADR2/IO2 line with 10K pulldown
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 5-8V suggested range, 4V min, 9V max.
12	GND	

Pinout – B Connector, 12 pin .1" (2.54mm) single row, male pins.

Pin	Name	Notes
1	GND	
2	BCLK	AD2428 bit clock (output from module as a client node)
3	GND	
4	SYNC	AD2428 frame sync (output from module as a client node)
5	GND	
6	DTX0	AD2428 DTX0 with 10K pulldown (output)
7	DTX1	AD2428 DTX1 with 10K pulldown (output)
8	GND	
9	DRX0	AD2428 DRX0
10	DRX1	AD2428 DRX1
11	GND	
12	IO7	AD2428 IO7/PDMCLK pin

4.1.2 A²B SIGNALS

Pinout – A Port (Upstream) Connector, 4 pin .1" (2.54mm) single row, male pins.

Pin	Name	Notes
1	GND	
2	P	A²B LVDS + side
3	N	A²B LVDS – side
4	GND	

Pinout – B Port (Downstream) Connector, 4 pin .1" (2.54mm) single row, male pins.

Pin	Name	Notes
1	GND	
2	N	A²B LVDS – side
3	P	A²B LVDS + side
4	GND	

The LVDS – signal is also the negative rail for phantom power. Phantom powered nodes can not connect their local ground (e.g. the low pass filtered – signal) to any external ground as that will be detected as a fault by the upstream node.

5 MECHANICAL INFORMATION

All components mount to one side to keep the pickup side as clear as possible of obstructions. There is the slight protrusion of the through hole headers that are used. If placing the board inside of an enclosure each microphone port hole must be acoustically isolated from the interior of the enclosure. Cross port leakage through cabinet ports will compromise most beam forming applications.

Avoid liquids, dust and high air pressure around the microphone ports, there is no additional barrier on these boards.

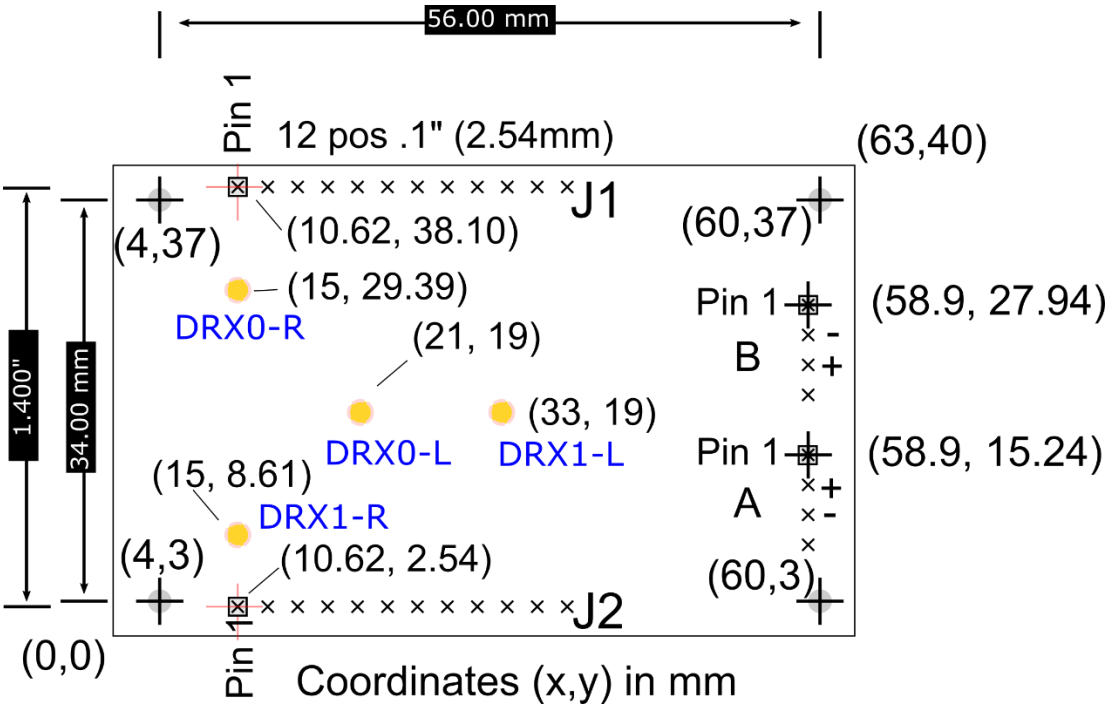


Figure 10 Mic, connector, and hole locations on the AB0105 board

6 CONFIGURATION EXAMPLE WITH SIGMA STUDIO

There are two provided examples for download. One uses the ADI WDZ board along with the microphone board. Since the WDZ board only has two outputs you'll need to open the ADAU1452 schematic for the WDZ node and change the routing to output the other pair of channels.

The second example, shown in Figure 11, sends two channels to the WDZ board and the other two mic channels with the Clockworks EVM board.

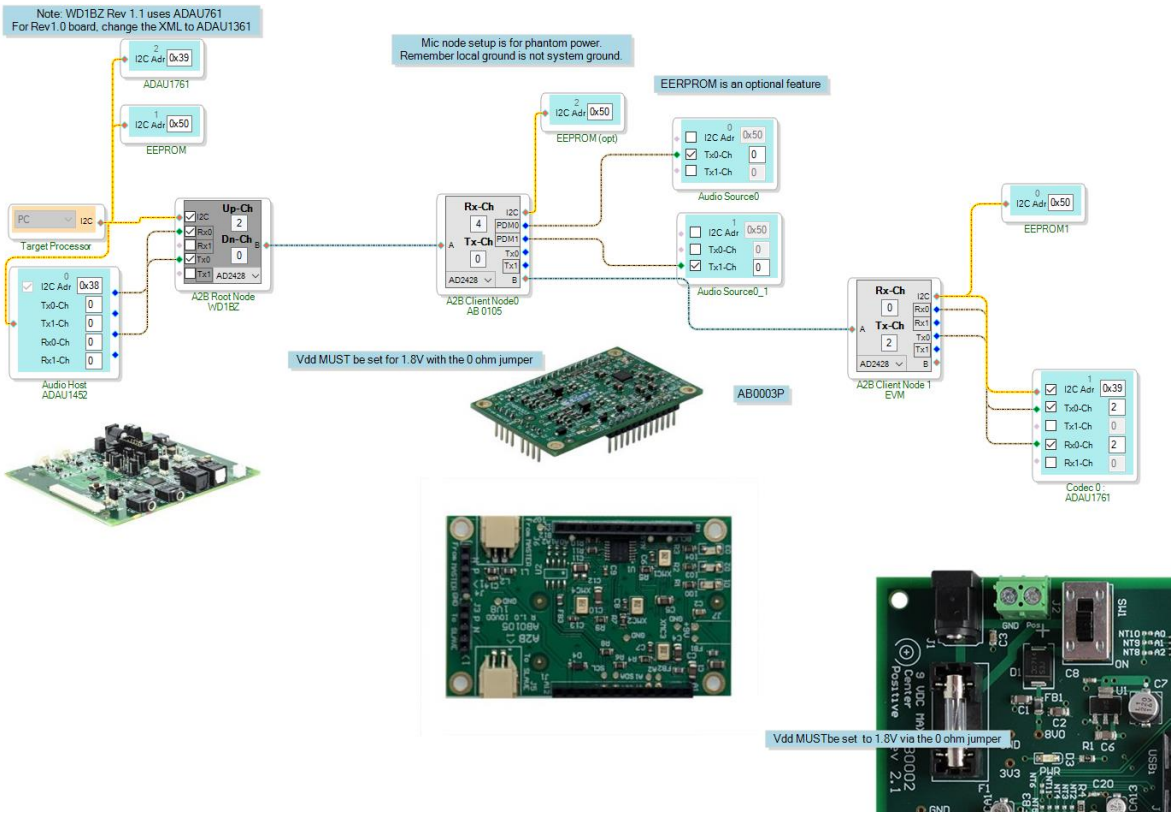


Figure 11 WDZ, Microphone board, and EVM example

If constructing a new diagram from scratch the important thing to remember is to change the AD2428's ports from I2S to PDM mode, which is done by clicking on the pin on the block. If starting from scratch the PDM clock and data formats must also be configured from the AD2428 properties block.

Figure 12 AD2428 properties for PDM microphones.