4 CHANNEL MICROPHONE BOARD

AB0204 LINEAR ARRAY

USER MANUAL

Rev 1

17-Feb-22

Signal Processing

http://clk.works/

1. TABLE OF CONTENTS

1 INTRODUCTION

The 4 channel microphone module contains 4 PDM microphones in a configuration that makes them easy to use for A^{2}B based audio application development.

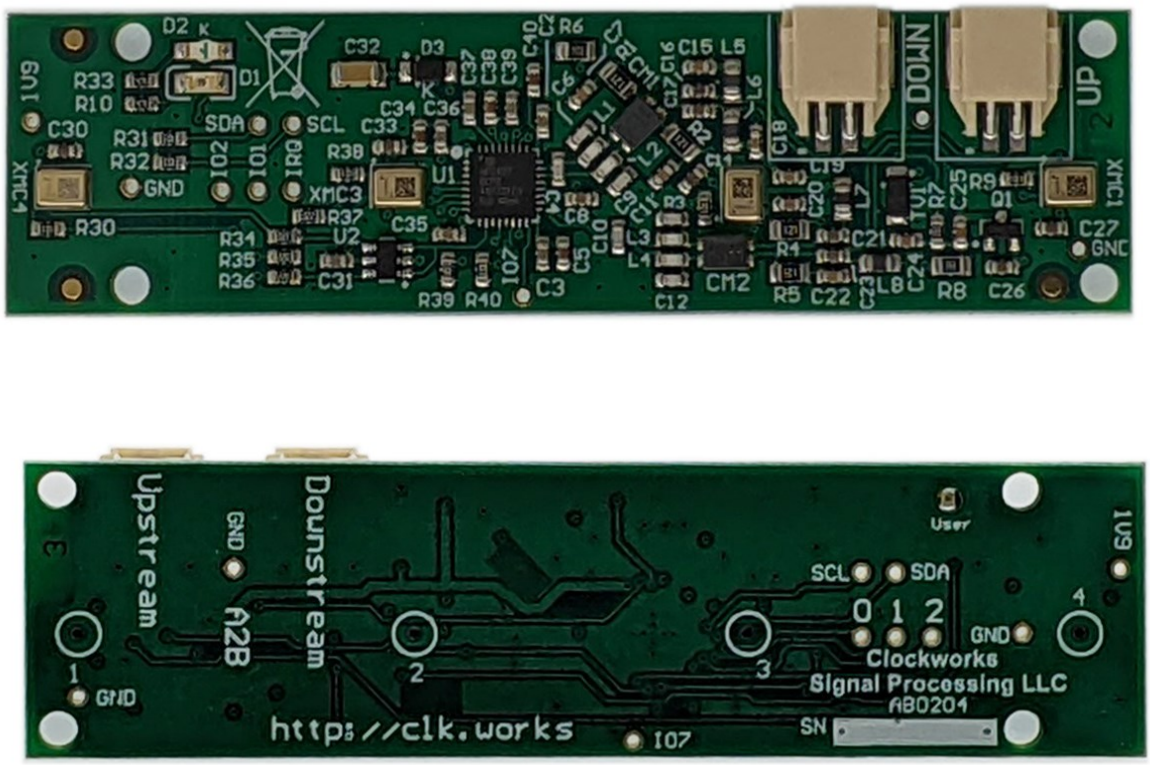

Figure 1 AB0204 4 channel microphone board

The 4 Infineon IM69D120 MEMS microphones are arranged in a linear pattern with spacing of 25 mm. Clockworks also offers a Y configuration and 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.

Unlike some of the Clockwork's A^{2}B products that combine a standard A^{2}B breakout module with a function specific module, the AB0204 is a fully self-contained single PCB. This minimizes size to make microphone placement easier, though at the loss of some flexibility offered by the stacked modules solutions.

1.1 OPTIONS FOR DEVELOPMENT

The AB0204 quad mic module is an A^{2}B client (slave) node that works with an A^{2}B root (master) node in an A^{2}B system. A^{2}B supports 32 uplink channels, which would be eight of the AB0204 with all four of the microphones being used.

Clockworks offers several different options for the root node. One option is for a 3rd part USB interface that can connect to a PC host.

For more details please see Clockworks AppNote002, available at the Clockworks website.

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 AD242x 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 AD2427.

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 AD242l are labeled. While generally called the 1.8 volt supply, the actual voltage out of the AD2427 is 1.9V and is referenced that way in some places.

1.4 PHANTOM POWER

The AB0204 are phantom powered. 7 nodes would use the power budget of the A^{2}B bus. Voltage drops across each node are actually more of a limitation than the current, and the limit is 5 or 6 nodes for reliable operation.

Systems with more than that number of AB0204 will need to have a locally A^{2}B powered node midspan to provide additional phantom A^{2}B power.

2 GETTING STARTED WITH THE BOARD

The connector labeled UP (Upstream) should be connected with an A^{2}B cable to the downstream port of the next higher (closer to root) node, or to the root node. The connector label DOWN (Downstream) should be connected to the next device (electrically) downstream.

The default routing in SigmaStudio will assign upstream A^{2}B slots starting with the farthest away node.

2.1 AD2427 CONTROLLED LEDS

Two red LEDs are connected to the AD2427's GPIO IO3. One faces the component side, the other is a reverse mount LED that shines though a hole in the PCB. This allows the indicator to be visible regardless of board placement.

The LED is typically used to help identify nodes in a large network, or as a host controlled activity indicator.

There are 4 additional GPIO that can be used for additional LEDs. Power consumption of additional indicators must be considered in the phantom power distribution limits.

The two onboard LEDs use about 2mA each.

2.2 USE

A^2B evaluation involves at least two nodes, the root (A^2B master) node and one or more client (A^2B 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 5 for an example with the A^2B 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 and a .STEP file are posted to the same place you go this document from on the Clockworks website.

Available on request are:

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

4 MECHANICAL INFORMATION

All components are mounted to one side to keep the pickup side clear of obstructions. 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. For use other than on the bench an acoustically transparent dust and moisture shield should be added.

Board dimensions and mounting hole locations are shown in Figure 2.

Figure 2 AB0204 dimensions and hole locations

5 CONFIGURATION EXAMPLE WITH SIGMA STUDIO

A basic examples for download. It 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.

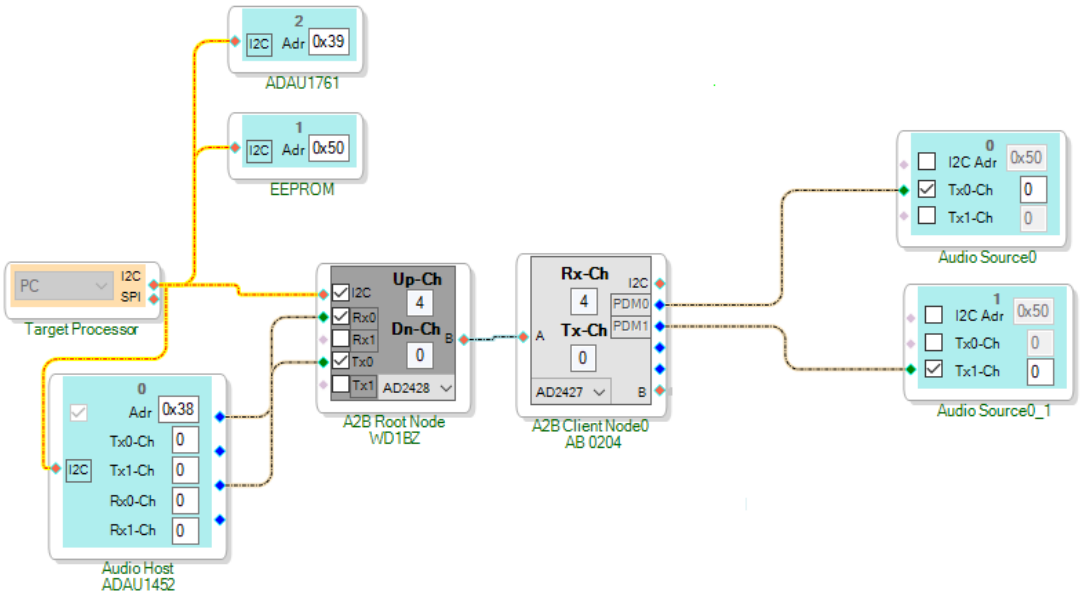

Figure 3 WDZ, Microphone board example

If constructing a new diagram from scratch the important thing to remember is to change the AD2427'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 AD2427 properties block, see Figure 4.

Figure 4 AD24287 properties for PDM microphones.

Per ADI recomendation, ground plane removed under CMs

In Rev 2 corrected trace impedances on the diff pair as after review what CS came up with (or pilot error) was not correct.

100 ohm diff pair w=0.65mm with s=0.155 mm (6.1 mil) (105 ohm calculated)

Two layer board single traces have 'high' impedance. For 0.3mm width used for I2S these are 120 ohm, which if you employ wishful thinking nominally matches the 0.1" connector.

B (slave facing) side drawn with *P on top but on PCB it is on 'bottom' so leads to some oddness perhaps in the way this schematic was drawn. Note CM1 and CM2 orientation and pin numbering does not match parts from other vendors.

CM1 and CM2 are TDK ACT1210L1012PTL00. Non L version is simlilar but degrades EMI performance.
Similar issue on the 3.3 uH inductors, the listed MLZ2012M3R3ATD69 is a special version that is simlar to MLZ2012M3R3HT000 but would degrade EMI

Cables are crossover cables, i.e. 1 -> 2 and 2 -> 1 . The A2B part's pin placement handles this to avoid crossing over PCB traces, etc.

The differential pair aren't swappable as phantom power is carried on the *P side.

Mics to be spaced 25mm apart

ADI calls out 1/2W Rterm to meet 200 mA injection test. (it's across 3- 200 Mhz so it' a crazy test designed to produce smoke).

We don't have the spec here and this board is does not need that type of immunity.

I don't know how the AD2428 survives the BCI test since it sees half the power too.

Title	Quad linear A2B mic array
Size: Tabloid	Number: AB0204 Revision: 1
Date: 2/17/2022	Time: 12:34:43 AM Sheet 1 of 1
File:	AB0204_quad_mic.SchDoc

Clockworks Signal Processing http://clk.works