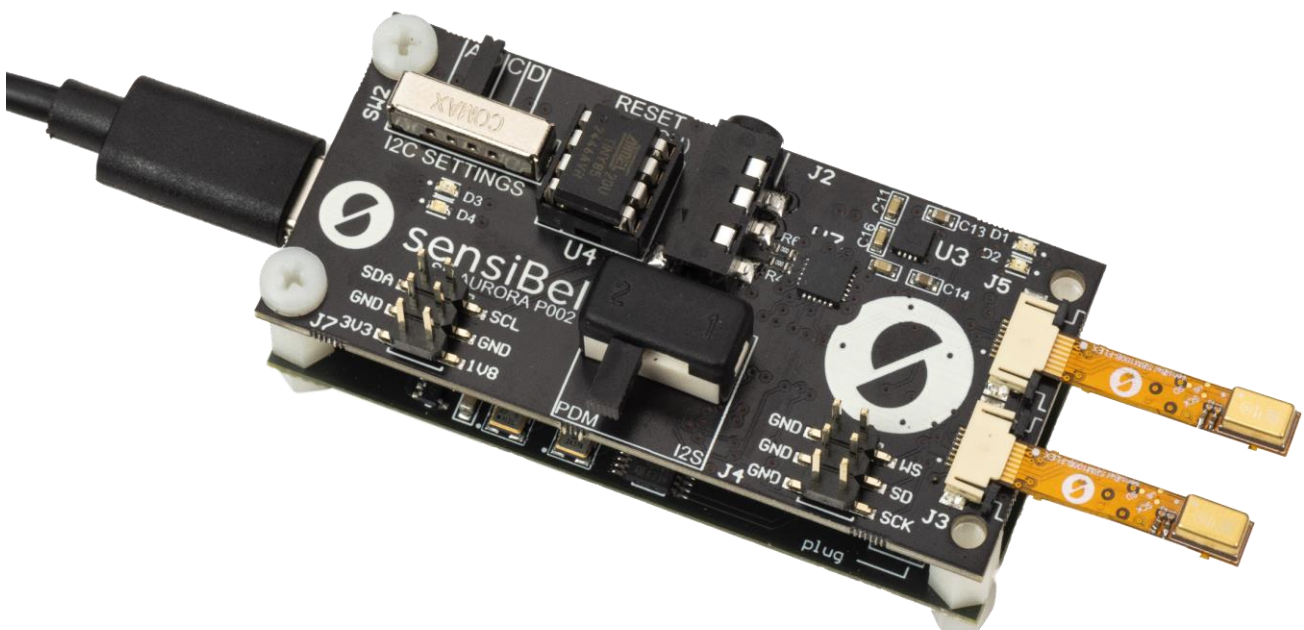




UG-104

User Guide for AURORA™ Evaluation Kit





1 Overview

This user guide describes the design, setup and operation of the sensiBel Aurora Evaluation Kit. The kit provides a high-performance USB audio streaming solution for sensiBel MEMS microphones allowing the user to record with their software of choice.

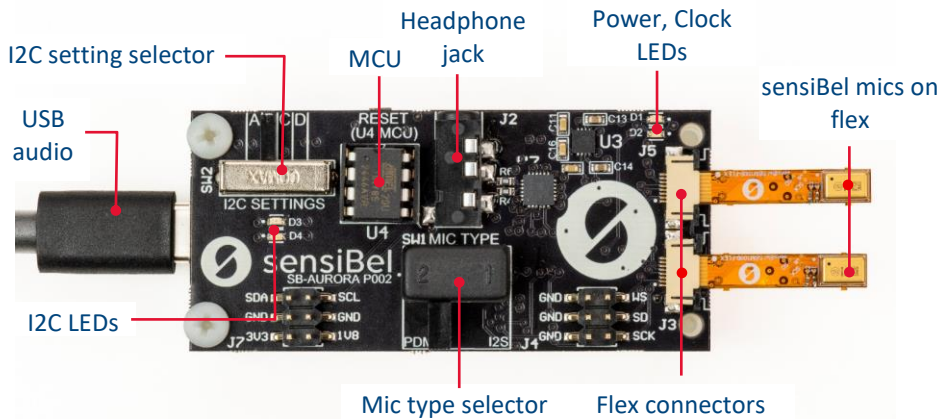


Figure 1. SB-AURORA PCB features and layout

Kit features:

- Complete evaluation and streaming solution for sensiBel MEMS microphones
- Compatible with Windows, MacOS, Android and iOS devices
- Plug and play USB interface for simple setup
- Microphone type selection, I2S or PDM
- User gain adjustment via I2C setting selector
- LED indicators for power, clock and I2C write status
- High performance headphone DAC for real time listening
- Powered through USB interface – no power adapter required

Specifications:

- USB Audio Class 2.0 device
- 24-bit audio
- 44.1kHz, 48kHz, 88.2kHz and 96kHz sample rates

2 Kit Contents

The kit includes everything you need to get started evaluating sensiBel PDM or I2S MEMS microphones. The kit includes:

- Aurora Eval kit stackup: SB-Aurora mic interface PCB (top) and I2S to USB PCB (bottom)
- USB-A to USB-C cable
- USB-C to USB-C cable
- Quick start guide card

Supplied with the kit in a separate box:

- sensiBel I2S or PDM microphones on Flex

3 Aurora Quick Start Guide

1. Connect the microphones on flex (2 x PDM or 2x I2S, but not one of each) to the Aurora flex connectors J3 and J5. The flexes should be oriented such that lid of the mic should be facing up and acoustic port facing down as shown in the image below. Ensure the flexes are fully inserted into the connector and the side tabs are fully closed to lock the connector. Select the appropriate PDM or I2S on SW1 Mic Type for the mics on flex connected.

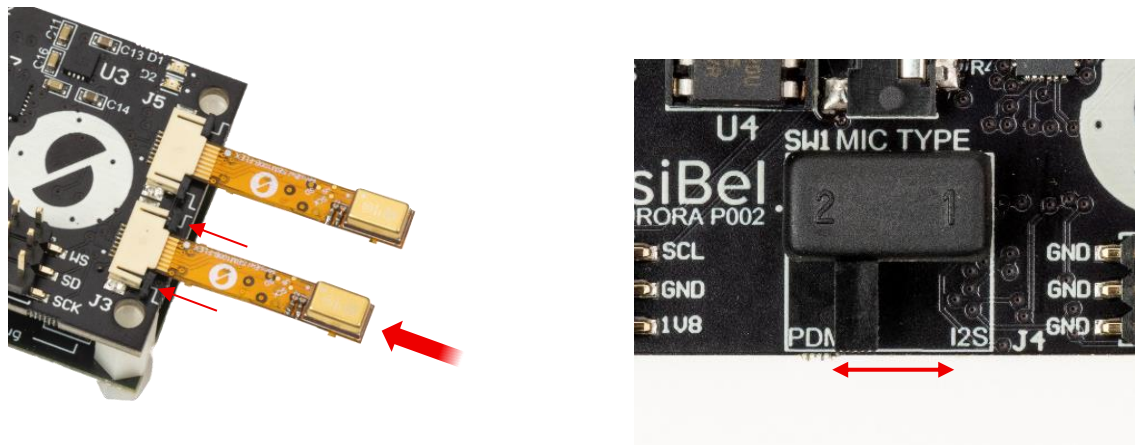


Figure 2. (a) Insertion of mics on flex, left (b) Selection of Mic Type, right

2. Connect to a computer using either of the USB-C cables provided. Tablets and phones are also supported, contact the sensiBel team for details.
3. Windows 10/11 setup
Confirm the board is present by going to Settings-> Home -> Sound -> More sound settings, which will open this window:

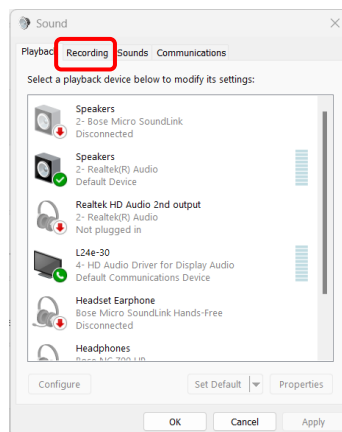


Figure 3. Windows Sound Settings window

Select the Recording tab, where “SB-AURORA” board should be visible as a microphone input device. Then click on SB-AURORA->Properties->Advanced and make sure the following options are visible and enabled, take note of the sample rate that it matches your desired recording sample rate (here at 96kHz):

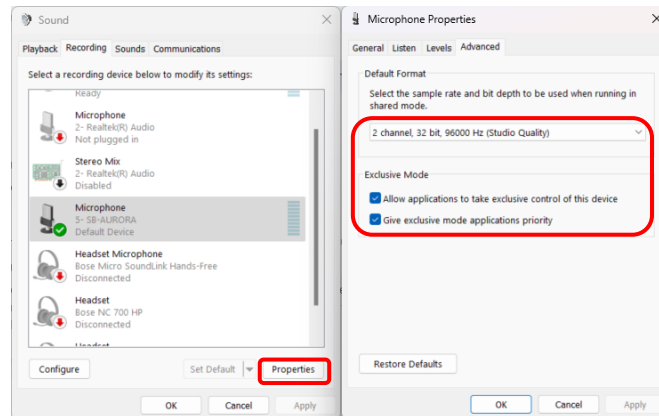


Figure 4. Windows Sound Settings with Microphone Properties selected

4. Windows - Start Recording Software

Audacity:

- i. Select Host -> Windows WASAPI

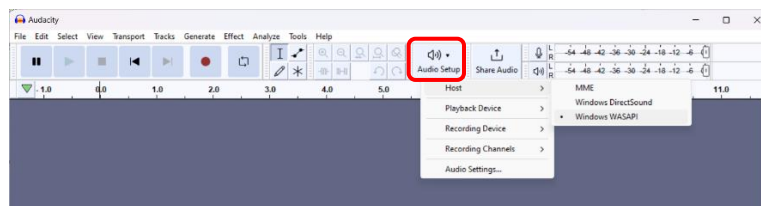


Figure 5. Audio Host selection in Audacity

- ii. Select Recording Device -> Microphone ("SB-AURORA"):

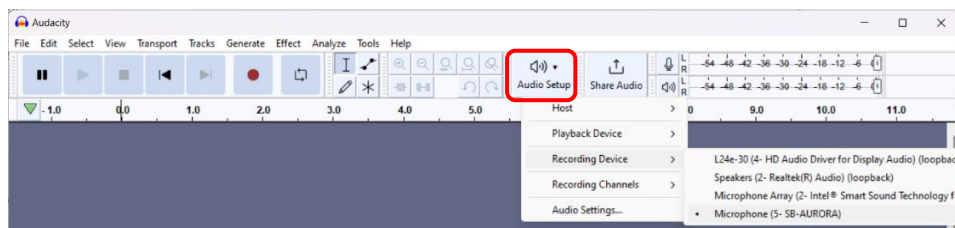


Figure 6. Recording Device selection in Audacity

- iii. Check that the sample rate (in the bottom left of the window) matches your desired recording sample rate:

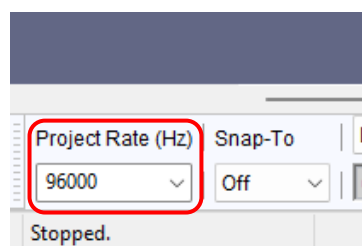


Figure 7. Sample rate selection

and then hit Record:

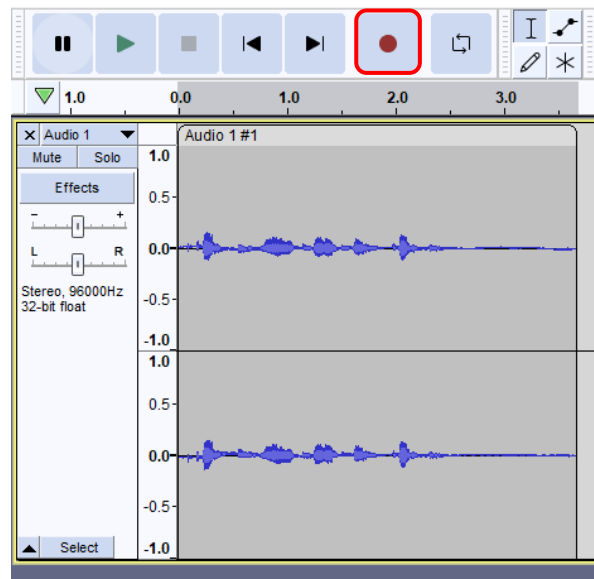


Figure 8. Sample recording in Audacity for Windows

Note the recording levels captured here were taken with position C selected on SW2 I2C settings (user gain). If you are experiencing significantly lower signal levels to normal speech tests, SW2 is likely set to A or B. For ease of listening the levels can be increased by selecting C or D on SW2 as outlined in User Gain Settings and Custom Configuration, or alternatively in post processing using Audacity feature Effect > Amplify with +20 to +30dB of gain.

5. MacBook Setup

Confirm “SB-AURORA” is visible and selected in Settings-> Sound:

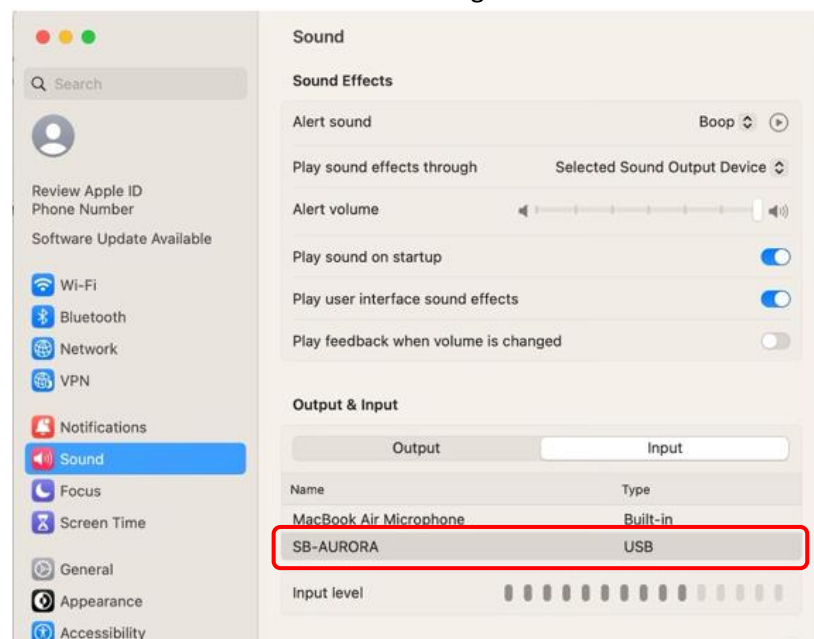


Figure 9. Confirmation of SB-AURORA in MacOS Sound Settings



To check sample rate and confirm settings it is recommended to use spotlight to search for “Audio MIDI Setup” or go to Applications > Utilities > Audio MIDI Setup which will open this window:

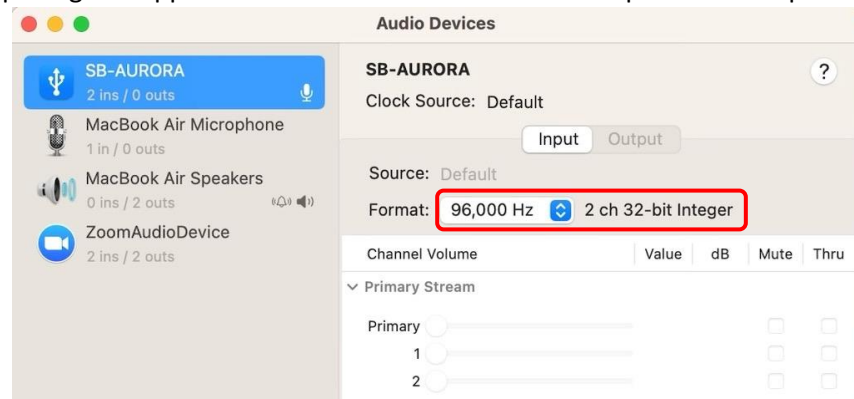


Figure 10. Confirmation of sample rate in Audio MIDI Setup

Setting the same sample rate here and in recording software ensures that the audio is not down sampled.

6. MacBook – Start Recording Software

Audacity:

- i. Select Audio Setup -> Recording Device -> SB-AURORA

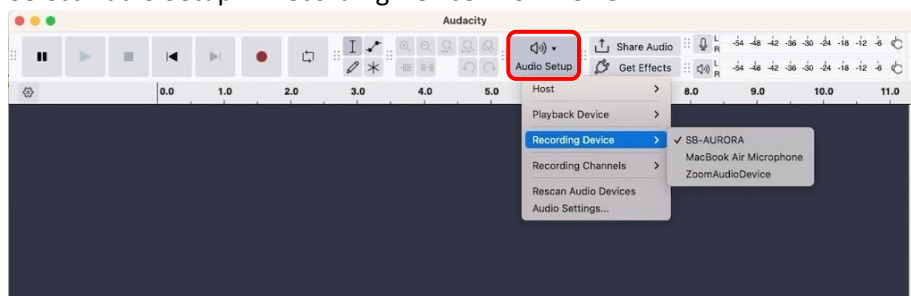


Figure 11. Recording Device selection in Audacity

- ii. Click on Audio Setup -> Audio settings and check that the sample rate in the Audio Settings Window matches your desired recording sample rate (here 96kHz):

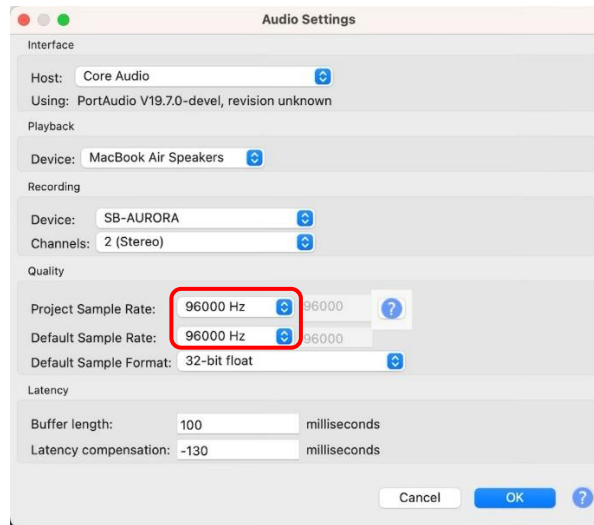


Figure 12. Confirmation of sample rate

And then hit record:

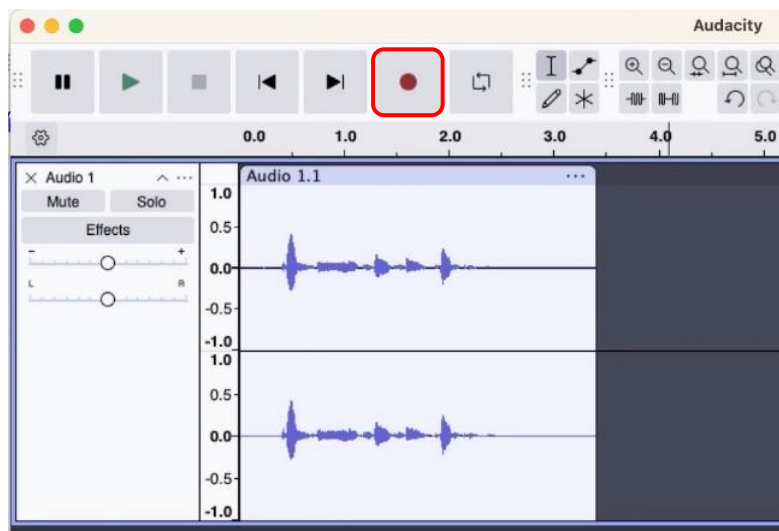


Figure 13. Sample recording in Audacity for MacOS

Note the recording levels captured here were taken with position C selected on SW2 I2C settings (user gain). If you are experiencing significantly lower signal levels to normal speech tests, SW2 is likely set to A or B. For ease of listening the levels can be increased by selecting C or D on SW2 as outlined in User Gain Settings and Custom Configuration, or alternatively in post processing using Audacity feature Effect > Amplify with +20 to +30dB of gain.

7. User Gain Settings and Custom Configuration

The on board MCU carries out custom configuration to sensiBel microphones using the I2C interface. The MCU default function User Gain, where 4 settings are available corresponding to the 4 positions of SW2. Other parameter adjustments are possible via MCU update, please contact sensiBel support team if required. The following steps describe the operation of a successful User Gain adjustment:



- a. Check for correct powerup before write:

Before applying the settings, the microphones should have power (green LED D2 lighting) and should be receiving a clock (orange LED D1 lighting).

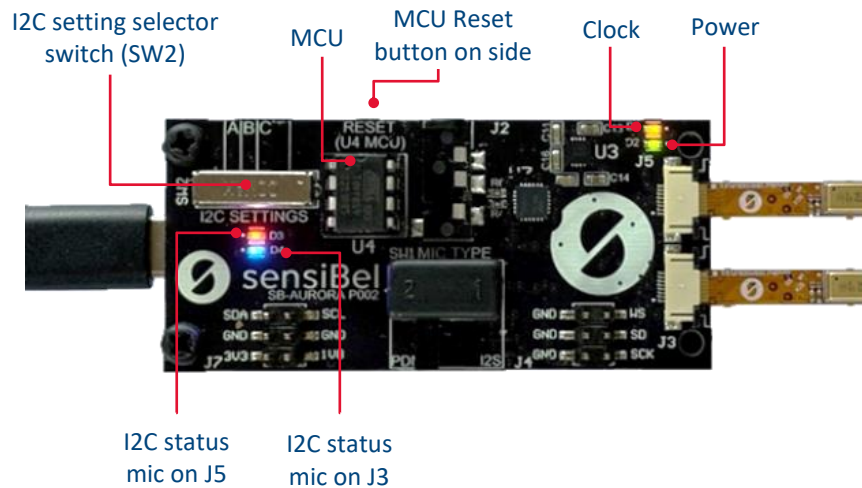


Figure 14. Relevant SB-AURORA selections and indicators for custom configurations

- b. Available User Gain settings:

The MCU is programmed to apply 4 different user gain settings depending on the selection of A, B, C or D of I2C setting selector switch (SW2).

Table 1. User gain settings for SW2

Setting	User Gain	Mic Sensitivity	Performance at setting		Comment/recommended use
			SNR	AOP	
A	-6dB	-52 dB FS	80 dBA	146 dB SPL	Measure/evaluate maximum AOP
B	0 dB	-46 dB FS	80 dBA	140 dB SPL	Default microphone condition
C	+18 dB	-28 dB FS	80 dBA	122 dB SPL	Higher sensitivity to overcome bit depth reduction by host software.
D	+30 dB	-16 dB FS	80 dBA	110 dB SPL	Higher sensitivity to overcome bit depth reduction by host software. User listening through DAC.

- c. Applying settings, confirmation of successful write:

LEDs D3 and D4 indicate I2C activity on each mic J5 and J3 respectively. See Table 2 and Figure 15, Figure 16 below for details.

Table 2. LED indicators D3, D4 details

LED name	LED colour	Corresponding Microphone	LED activity to indicate successful I2C write	LED activity to indicate unsuccessful I2C write
D3	Red	J5	3 blinks then stays ON	1 blink then turns OFF



D4	Blue	J3		
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Successful write D4 example (blinks 3x then stays on):



Figure 15. LED sequence for successful I2C write

Unsuccessful write D4 example (blinks 1x then turns OFF):



Figure 16. LED sequence for unsuccessful I2C write

d. Troubleshooting unsuccessful writes:

- Check the flex EV in question is properly inserted and is straight. The outer pins of the flex EV edge connector are used for I2C and if either of the two pins have a poor connection, I2C will fail.
- Check that clock and power are present i.e. D1 and D2 are lighting
- After checking i and ii above, repeat step c. to attempt another I2C write. A repeat setting can be applied by toggling SW2 to an adjacent setting and back, or by resetting the MCU via the button accessed from the side of the pcb.

8. DAC Listening

Aurora includes a high-quality DAC connected to a 3.5mm headphone jack. The DAC has a stereo output where both microphones are output on either stereo channel.

Recommended setup:

- Plug in headphones before powering/connecting the USB of the board, this ensures stereo output



- Set I2C configuration to C or D, which adds gain for easiest listening.

When only a single microphone is connected to the kit then it is expected to have a dual-mono output for the PDM variant and a single mono output for I2S.



Figure 17. Aurora kit with headphone jack connected

4 Block Schematic

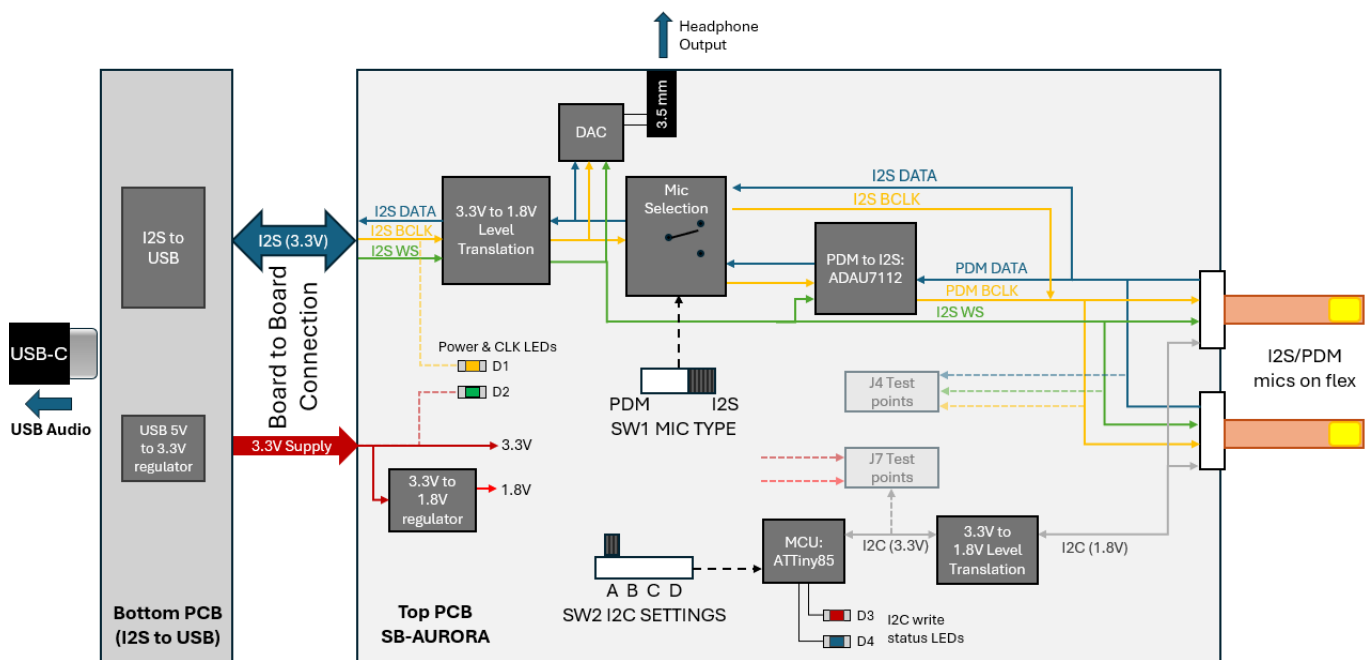


Figure 18. Block schematic of SB-AURORA

Note:

- Illustration for block schematic purposes – not to scale or accurate to entire pcb layout
- I2S and PDM I/O share the same 8 pin flex connectors. BCLK and DATA lines split to separate signal paths for I2S or PDM, connection of either path to downstream audio processing depends on SW1 Mic Type selection. The specific net naming of I2S and PDM for DATA and BCLK after the split is in anticipation of this selection and connection of corresponding mics to flex connectors.

5 Reference Information

The functions of SB-AURORA connectors, switches and indicators are summarized here.

Table 3. Summary of SB-AURORA connectors, switches and indicators

Connector/ Indicator Name	Description	Details
J1	20 pin Board to Board connector	For details contact sensiBel team
J2	Headphone Jack	Stereo output
J3	Microphone on Flex connector	For mic with Config0 (Select) = GND
J4	6 pin header	See table for details
J5	Microphone on Flex connector	For mic with Config0 (Select) = 1.8V
J6	MCU socket	Supplied with ATTiny MCU installed
J7	6 pin header	See table for details
SW1	Mic type selection	PDM or I2S as indicated
SW2	I2C setting selection	A, B, C, D as indicated
RESET 1	MCU reset switch	Single press to reset MCU
D1	CLOCK LED indicator	BCLK active in 3.3V domain
D2	POWER LED indicator	3.3V power supply active
D3	I2C write LED indicator	I2C activity with mic on J5, see section 7 for details
D4	I2C write LED indicator	I2C activity with mic on J3, see section 7 for details

Test pin connectors:

Table 4. Test pin connectors J4, J7 details

Pin Header	Pin Number	Pin Description	Details
J4	1	BCLK 1.8V	Bit Clock at mics for PDM or I2S mics
	2	GND	Ground
	3	DATA 1.8V	Data at mics for PDM or I2S mics
	4	GND	Ground
	5	WS 1.8V	Word Select at mics for I2S mics, no connect for PDM mics
	6	GND	Ground
J7	1	1.8V	1.8V power supply
	2	3.3V	3.3V power supply
	3	GND	Ground
	4	GND	Ground
	5	SCL	I2C SCL in 3.3V domain – connect external I2C device here
	6	SDA	I2C SDA in 3.3V domain – connect external I2C device here



6 Revision History

Table 5. Revision History

Document version	Date	Comment
0.1	16-05-2025	First revision
0.2	04-06-2025	Updated details on functional blocks of SB-AURORA PCB, formatting, description
0.3	16-07-2025	Updated formatting, front page, revision history.
0.4	25-08-2025	Updated user gain setting description.

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