



KAmoD RPi5 DAC



Rev. 20251017112817

Źródło: https://wiki.kamamilabs.com/index.php?title=KAmoD_RPi5_DAC

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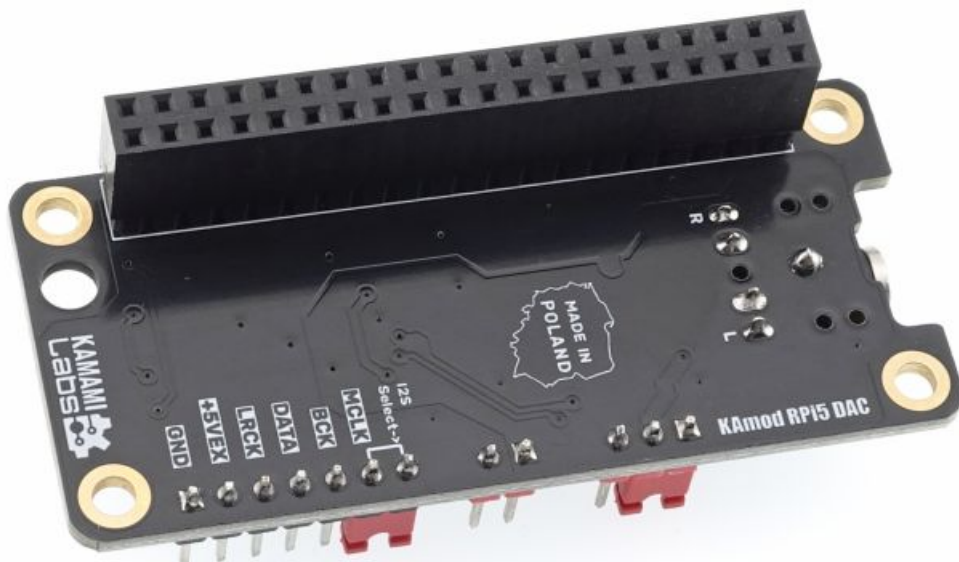
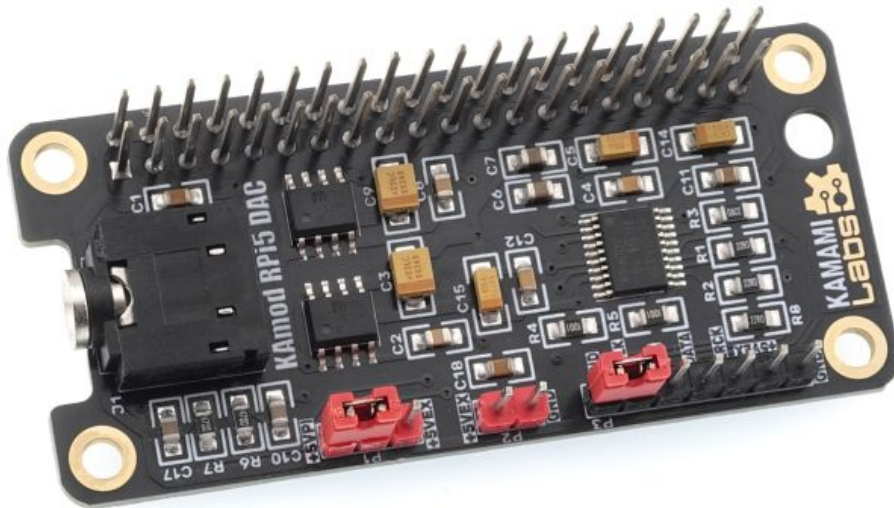
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Description

KAmoD RPi5 DAC - I2S Audio DAC for Raspberry Pi with PCM5102 Chip

A digital-to-analog converter module with a linear audio output to a standard 3.5mm stereo jack. It is designed for use with Raspberry Pi-5, Raspberry Pi-4, and Raspberry Pi-3 single-board computers and is connected to them via a 40-pin GPIO connector. This connection provides +5V power to the module and I2S signals generated by the Raspberry Pi.

The converter module can also be configured as a standalone external digital-to-analog converter connected to any I2S digital audio signal source, for example, an S/PDIF receiver.



Basic Specifications

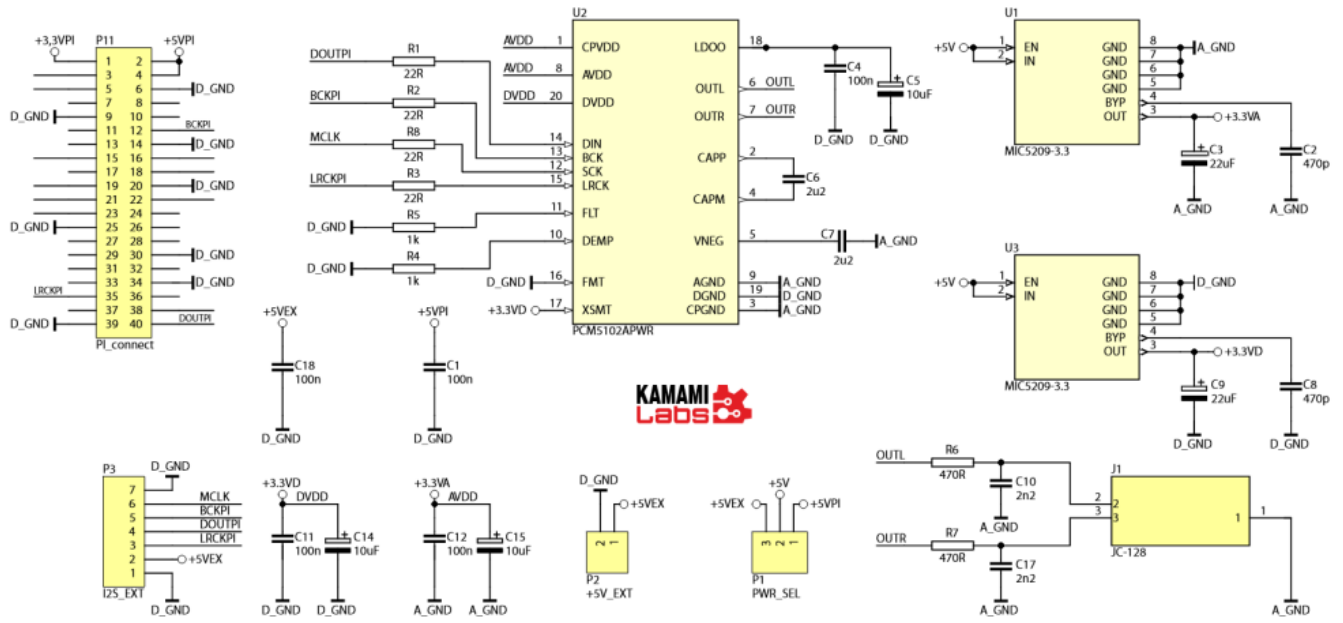
- Compatible with Raspberry Pi computers. Connects as a HAT via the 40-pin GPIO connector.
- Can be powered by +5V from the Raspberry Pi computer or an external +5V power supply
- Can be configured to operate as a standalone external DAC with its own power supply
- Digital audio data format: I2S or Left-Justified
- Accepts PCM data with lengths of 16, 20, 24, or 32 bits
- Sampling rate from 8 kHz to 384 kHz
- Built-in audio PLL that generates a SCK signal from the BCK signal
- Asymmetric audio output 2.1 V RMS
- No DC coupling capacitor
- Supply voltage: +3.3 V analog section, +1.8 V to 3.3 V digital section
- Separate supply voltage and ground for the digital and analog sections. Each section is powered by a separate low-noise MIC5209 3.3 ohm regulator.

Standard Equipment

Code	Description
KAmoD RPi5 DAC	- Assembled and powered-up module - Set of screws and spacers for attaching the shield to the Raspberry Pi board



Schematic

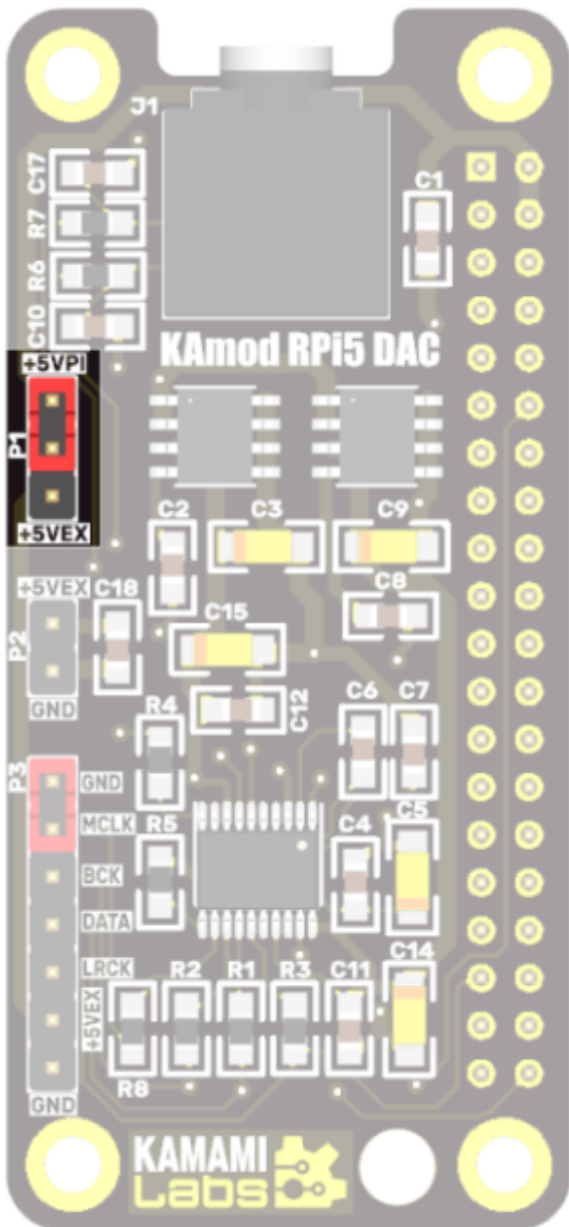


Power Configuration

By default, the module can be powered by +5V from the Raspberry Pi computer, taken from pins 2 and 4 of connector P11 (40-PIN GPIO). Alternatively, it can be powered by +5V from an external power supply.

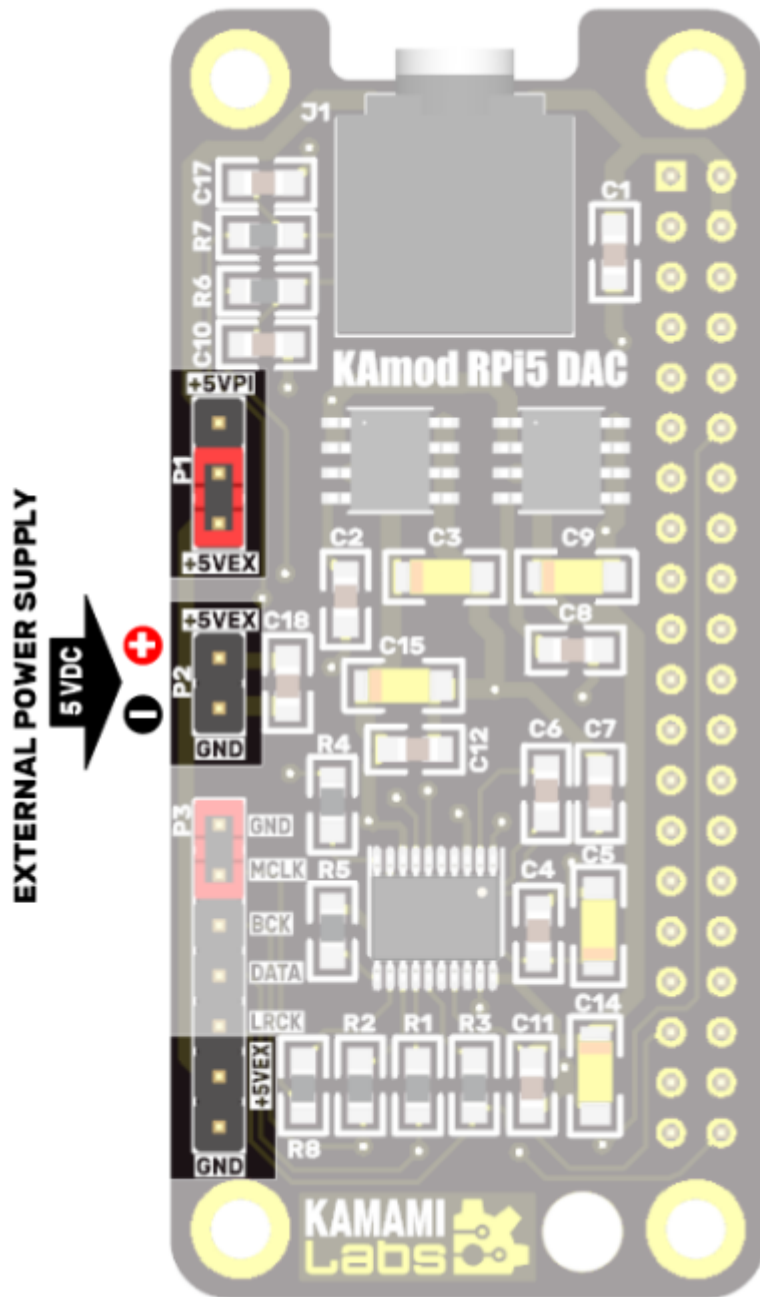
The 3-pin jumper P1 (PWR_SEL) is used to select the power source.

- Shorting pins 1-2 selects +5V power from the Raspberry Pi computer.



Selecting the converter module's power supply from the Raspberry Pi computer

- Shorting pins 2-3 selects +5V power from the external power supply. This option can be selected when the DAC module is connected to a computer via the 40-pin GPIO or when operating as an external DAC. External power from a good linear power supply can improve the audio signal quality at the DAC output when working with a Raspberry Pi. The external voltage is applied to pins 1 and 2 of connector P2 (+5V_EXT), or alternatively, to pins 1 and 2 of connector P3 (I2S_EXT).



Selecting DAC module power from an external power supply

Configuring the I2S Interface Operating Mode

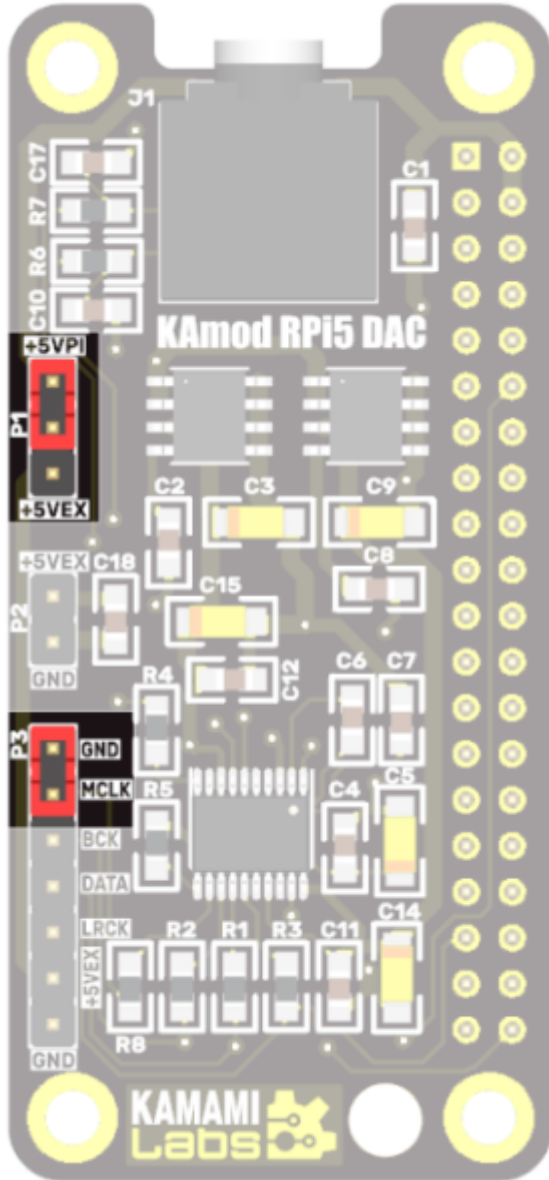
Audio data for DAC conversion is transmitted via the I2S interface, which consists of the following signals:

- DOUT data
- LRCK clock, which specifies which channel is being transmitted
- BCK clock, which clocks the transmission of audio data bits

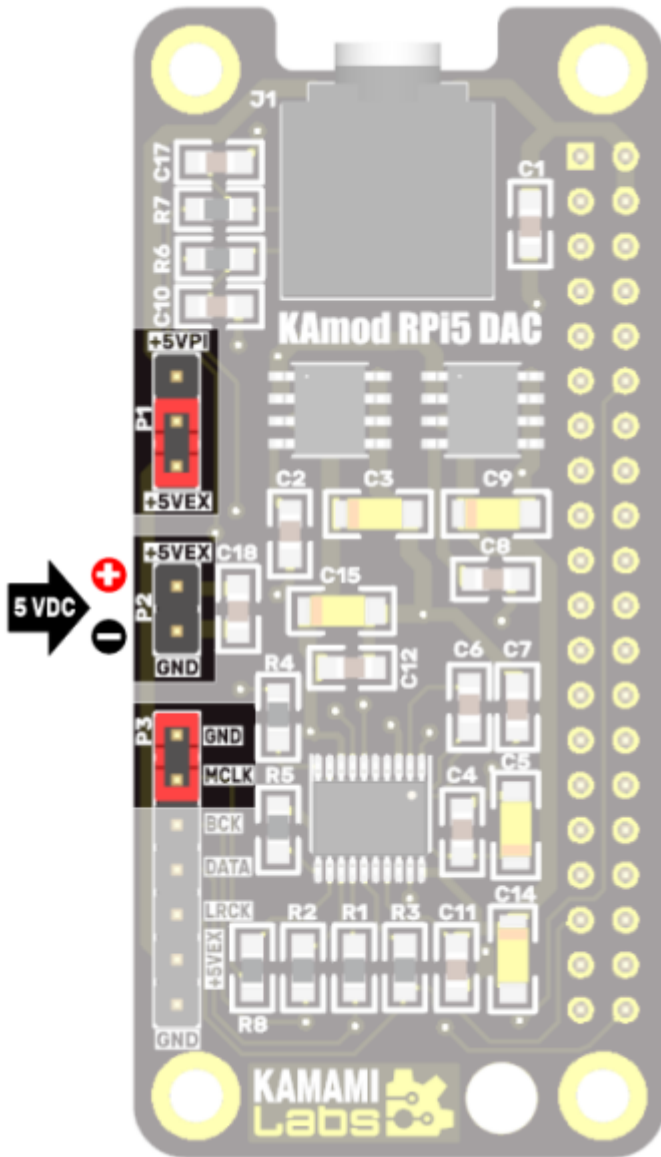
The standard does not define a Master Clock MCLK (typically $256 \times \text{LRCK}$) for internal synchronization of the DAC.

Configuring the module for use with the Raspberry Pi

The Raspberry Pi's I2S interface does not provide an MCLK signal. The converter used here can generate the MCLK internally from the SCK signal using its own internal PLL. To enable the MCLK-generating PLL, which is necessary for operation with the Raspberry Pi's I2S interface, the MCLK signal input must be low when the PCM5102 converter is powered on. This is achieved by shorting pins 6-7 of connector P3 (I2S_EXT). The module is connected to the Raspberry Pi via connector P11. Pins 3, 4, and 5 of the P3 connector are not connected.



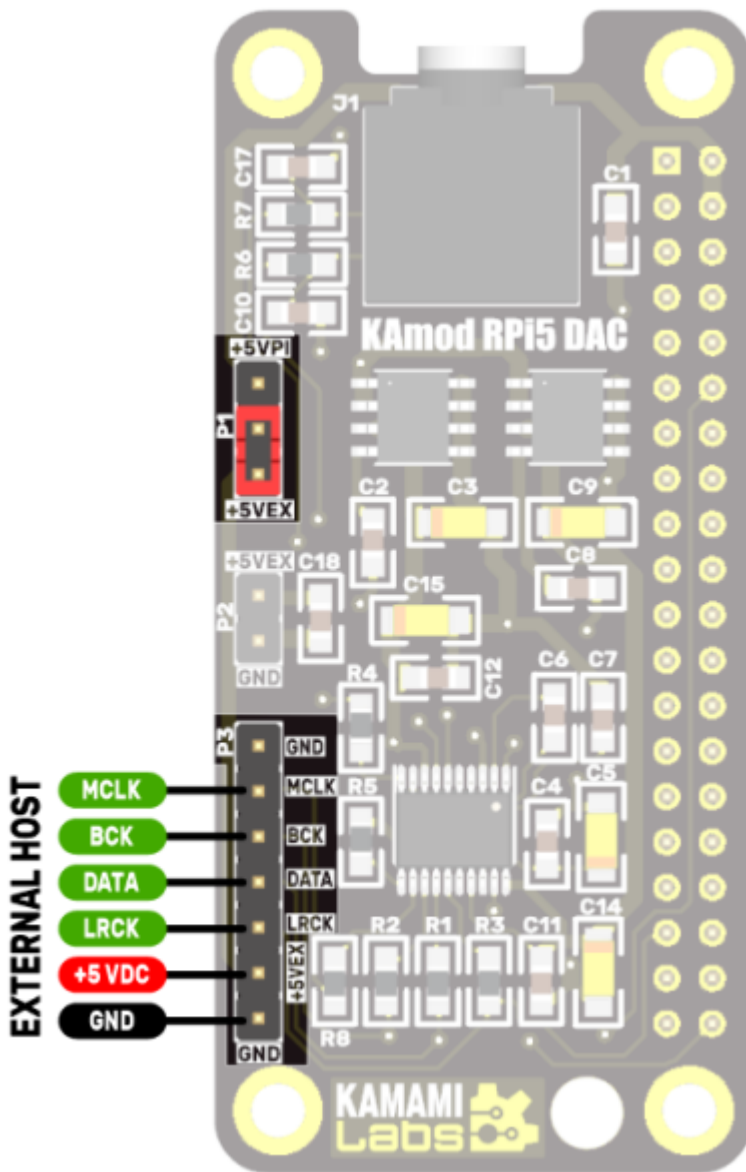
Configuration for operation with a Raspberry Pi and with power from a Raspberry Pi



Configuration for operation with a Raspberry Pi and with external power

Configuring the Module as an External DAC

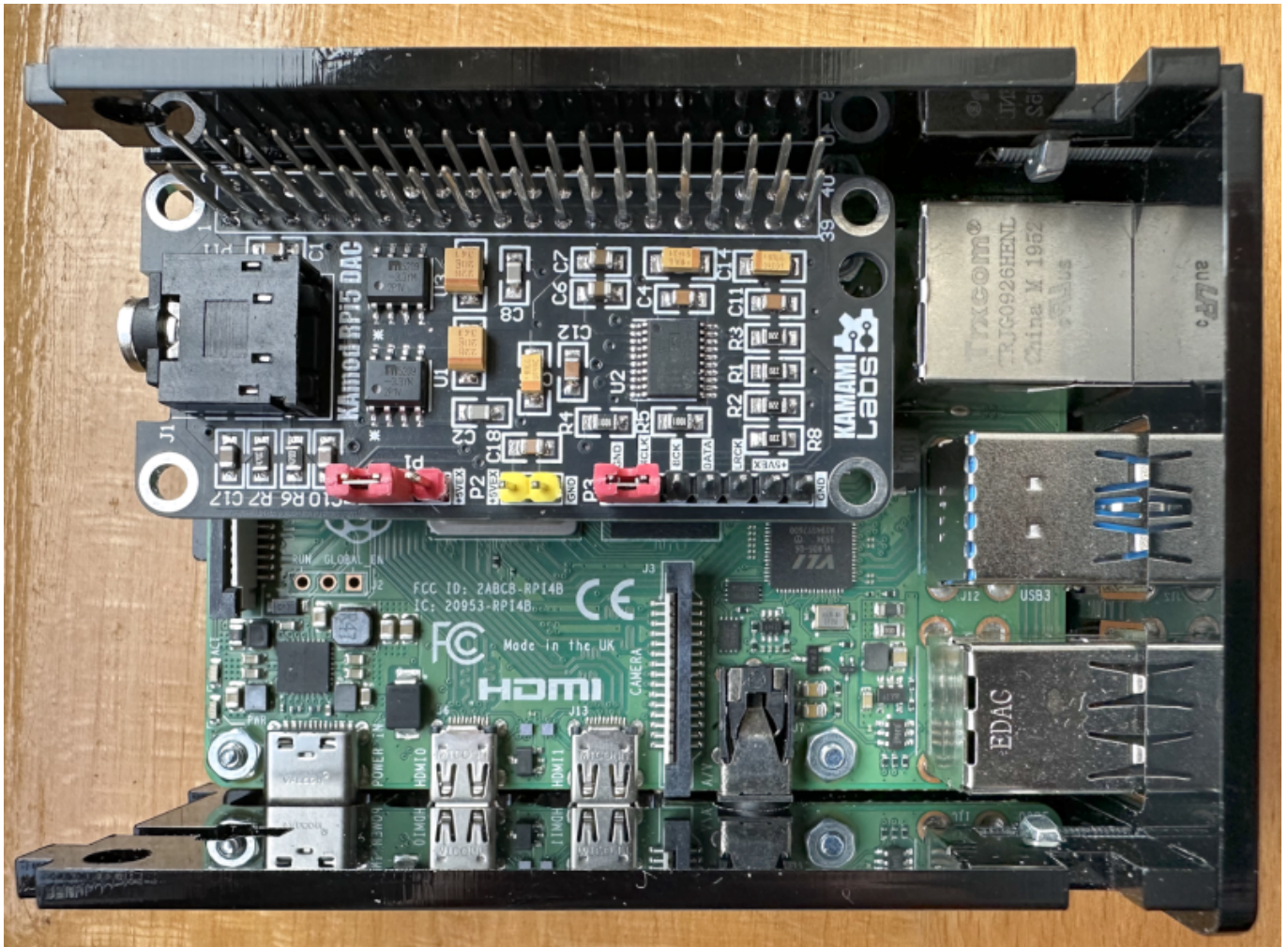
When operating as an external DAC, configure the module to be powered by an external power supply and apply I2S interface signals to connector P3. The module cannot be connected to the Raspberry Pi via connector P11. If the external audio source generates an MCLK signal, short-circuit pins 6-7 of connector P3 and connect the MCLK signal to pin 6.



Configuring the Module as an External DAC (without Raspberry Pi)

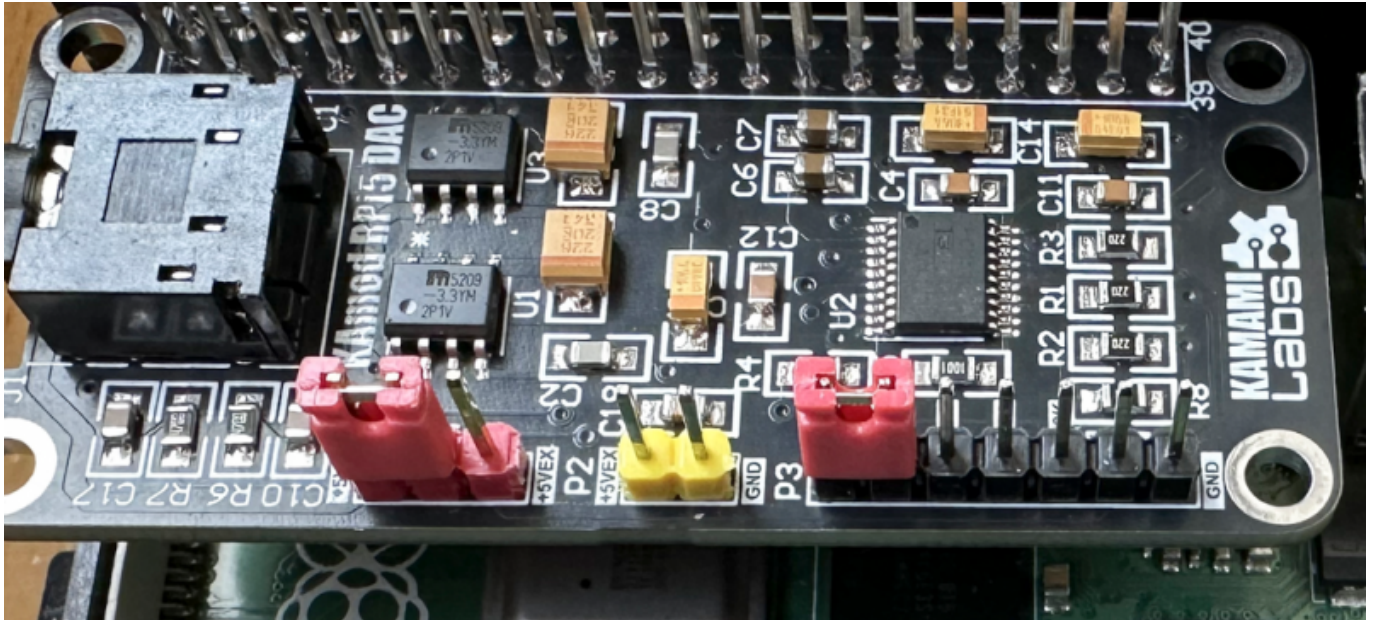
Connecting the Converter Module to the Raspberry Pi

The converter module should be connected to the Raspberry Pi computer using the 40-pin GPIO-40 connector. Remember to properly seat the female 40-pin connector of the Kamod RPi5_DAC module in the pins of the GPIO-40 connector of the Raspberry Pi (without misalignment).



Connecting the Kamod RPi5_DAC module to the Raspberry Pi

The power jumper should be set to +5VPI. The second jumper, specifying the I2S interface operating mode, must short the GND and MCLK pins of connector P3 (pins 6-7).

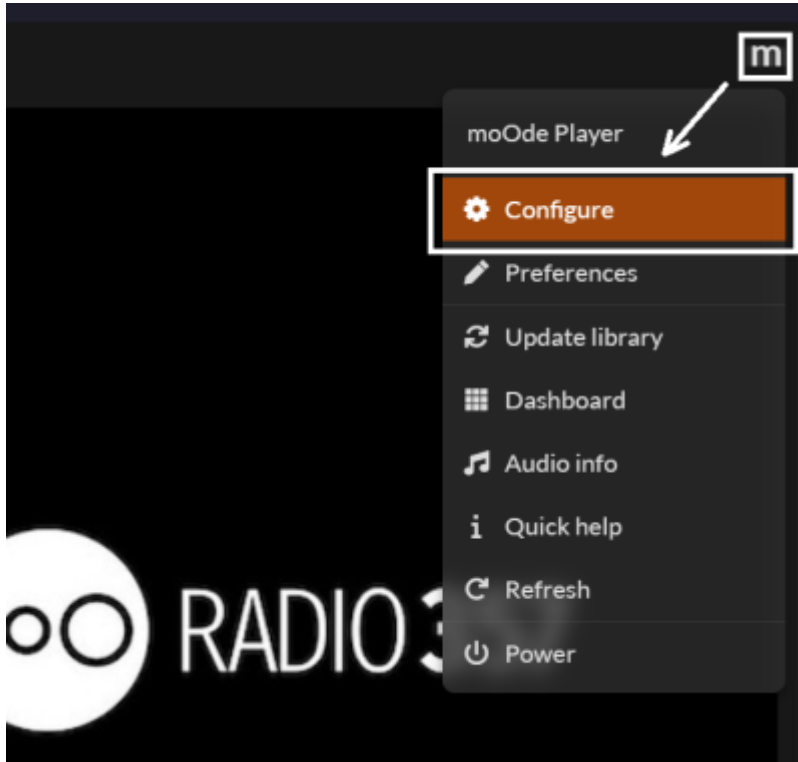


Jumper locations in the module configuration for use with Raspberry Pi

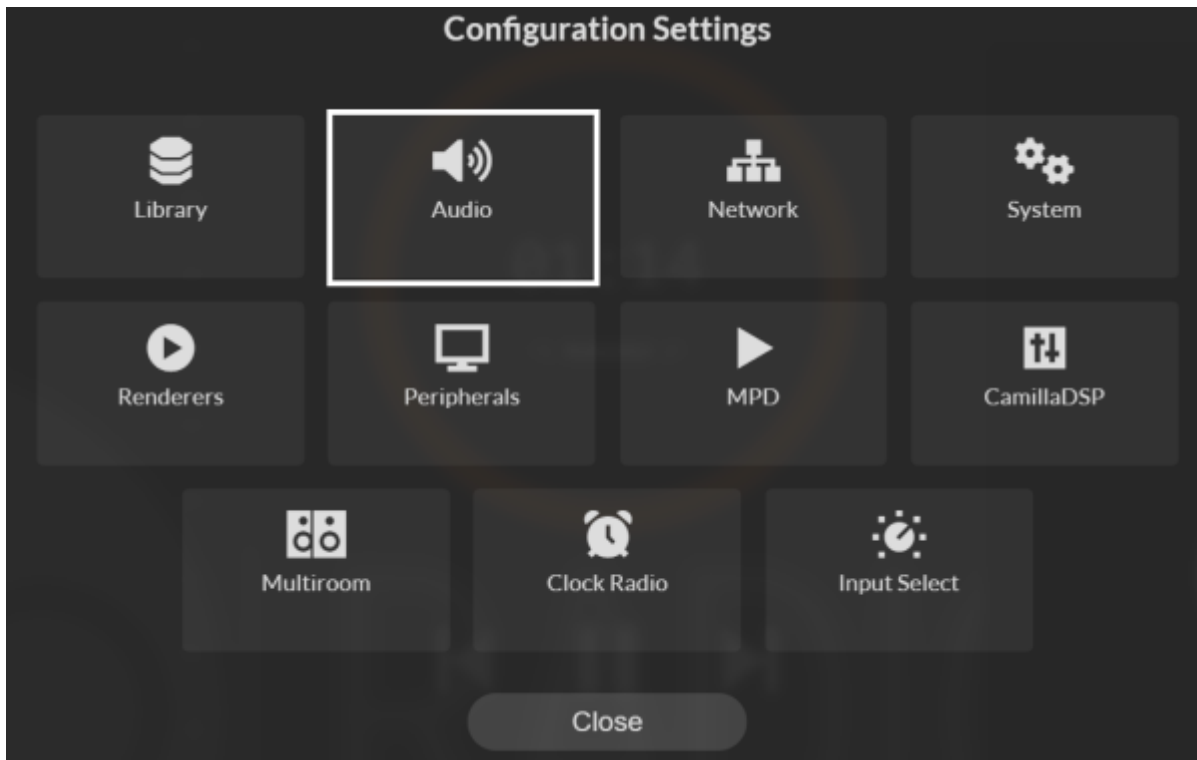
Example integration with the Moode player running on a Raspberry Pi

After turning on the networked Raspberry Pi with the Moode application, open the `//moode.local` window in your browser.

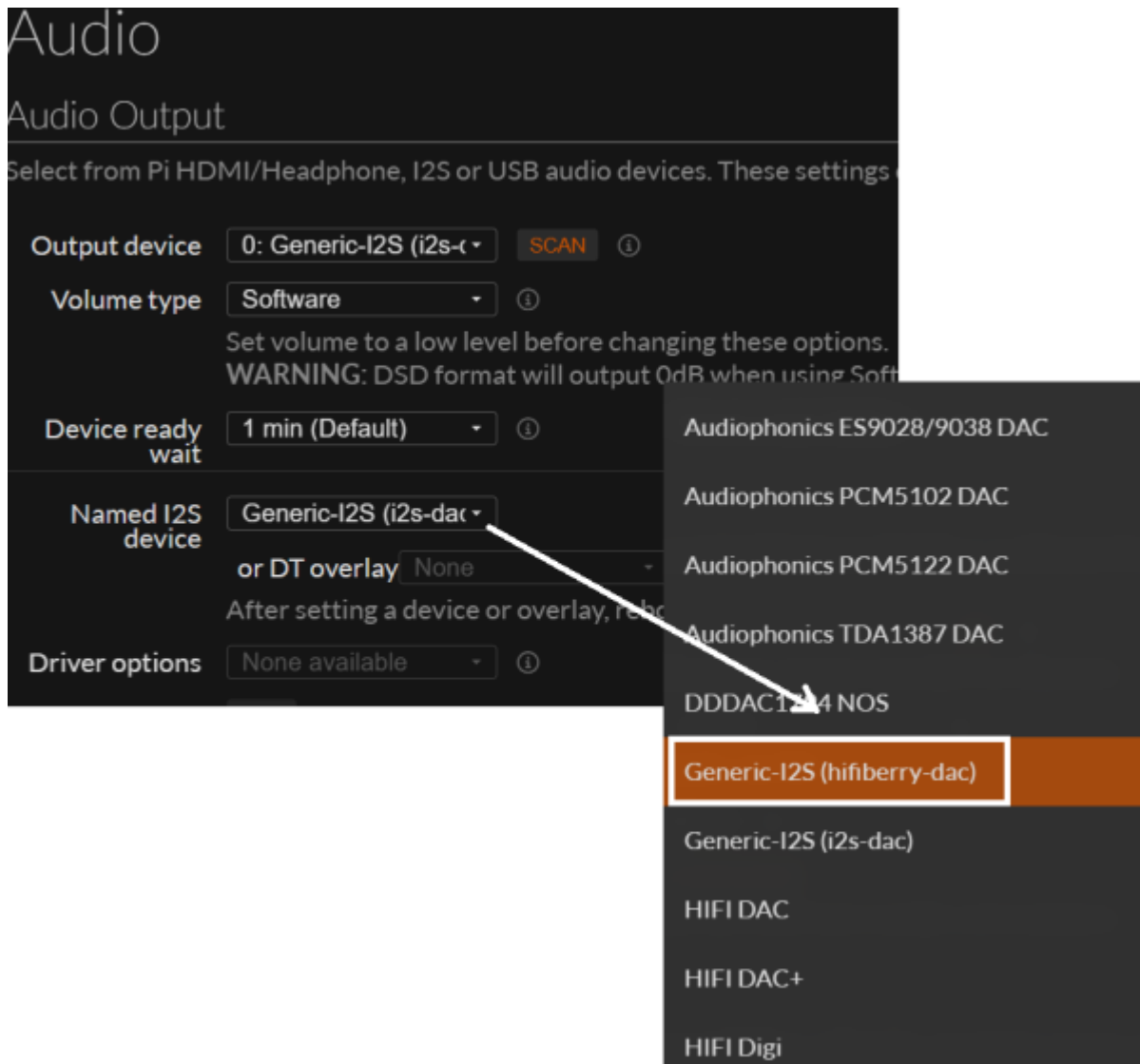
Click the m icon in the upper right corner and select Configure from the drop-down menu.



The Configuration Settings window will open. Click Audio.

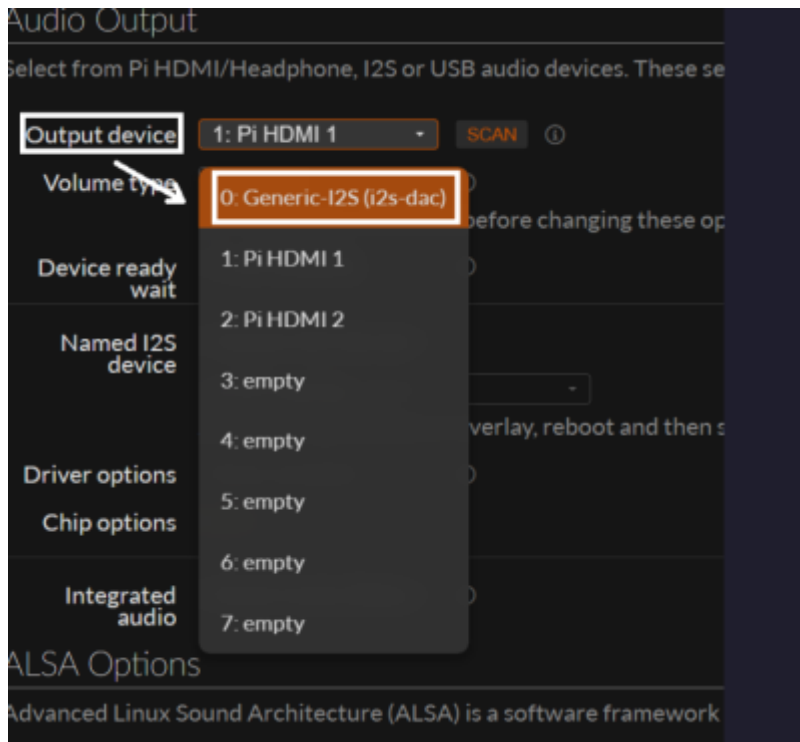


The Audio window will now open. In the Audio Output section, configure the audio stream to be routed to the I2S interface. In the first step, select one of the Generic-I2S options from the Named I2S device drop-down list, so that it can later appear in the Output Device window.



After confirming, restart the Moode application, open the Audio window, and select the Generic device selected in the previous step from the Output Device drop-down list.

After these steps, Moode will route the audio data stream through the I2S interface available on the 40-pin GPIO connector.



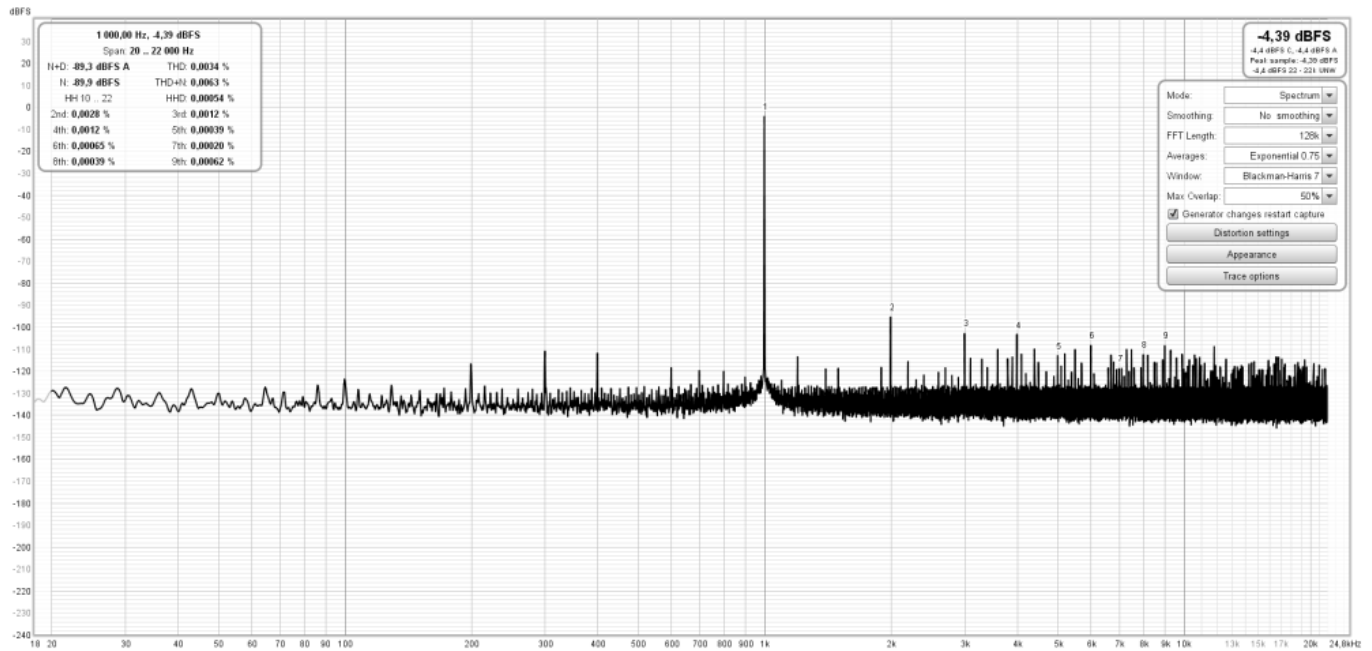
The player is ready to work with the KAmoD RPi5 DAC module.

DAC Measurements

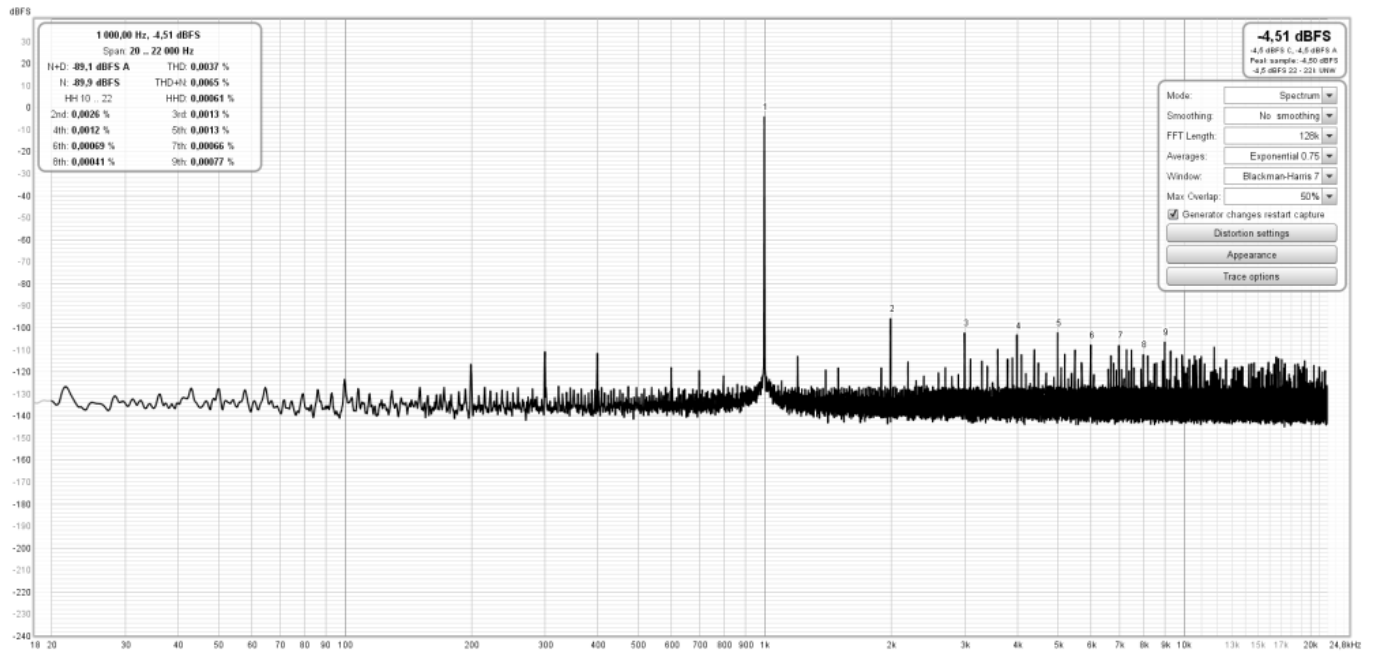
Measurements were made using a Focusrite Scarlet 2i2 sound card and REW software. THD and THD+N (plus noise) were measured in both channels at 1kHz.

The THD data for the PCM5102A DAC is -93dB (0.0022%). The THD measured for the left channel is THD = 0.0034%, and expressed in decibels is -89.3dB. The THD+N measurement result is 0.0063%, which is -84dB. For the right channel, the measurement results are very similar.

These are very good parameters, allowing for high-quality audio playback.

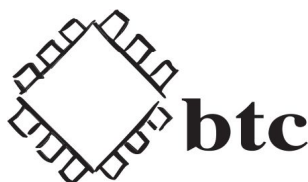


Measurements for the left channel



Links

- [PCM5102A documentation](#)
- [MIC5209 documentation](#)
- [Raspberry Pi](#)
- [Moode Audio player](#)
- [Volumio player](#)
- [CAD Model \(STEP\)](#)



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