NL-NAU88L21C

User Manual

Evaluation Board for NAU88L21C

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Table of Contents

List of Figures

List of Tables

1 OVERVIEW

The NL-NAU88L21C is the evaluation board for NAU88L21C. This board is developed for users to quickly understand the characteristics of NAU88L21C. For development flexibility, this board has a built-in headset jack and additional expansion connectors that provide microphone input, headphone output and digital interface.

Nuvoton has also developed a USB control board, NU-NAUSB2I2C, which provides I^2C control interface and digital audio interface signals. Along with the software NuvotonAudioGUI, users can quickly set up and use NL-NAU88L21C on their PCs.

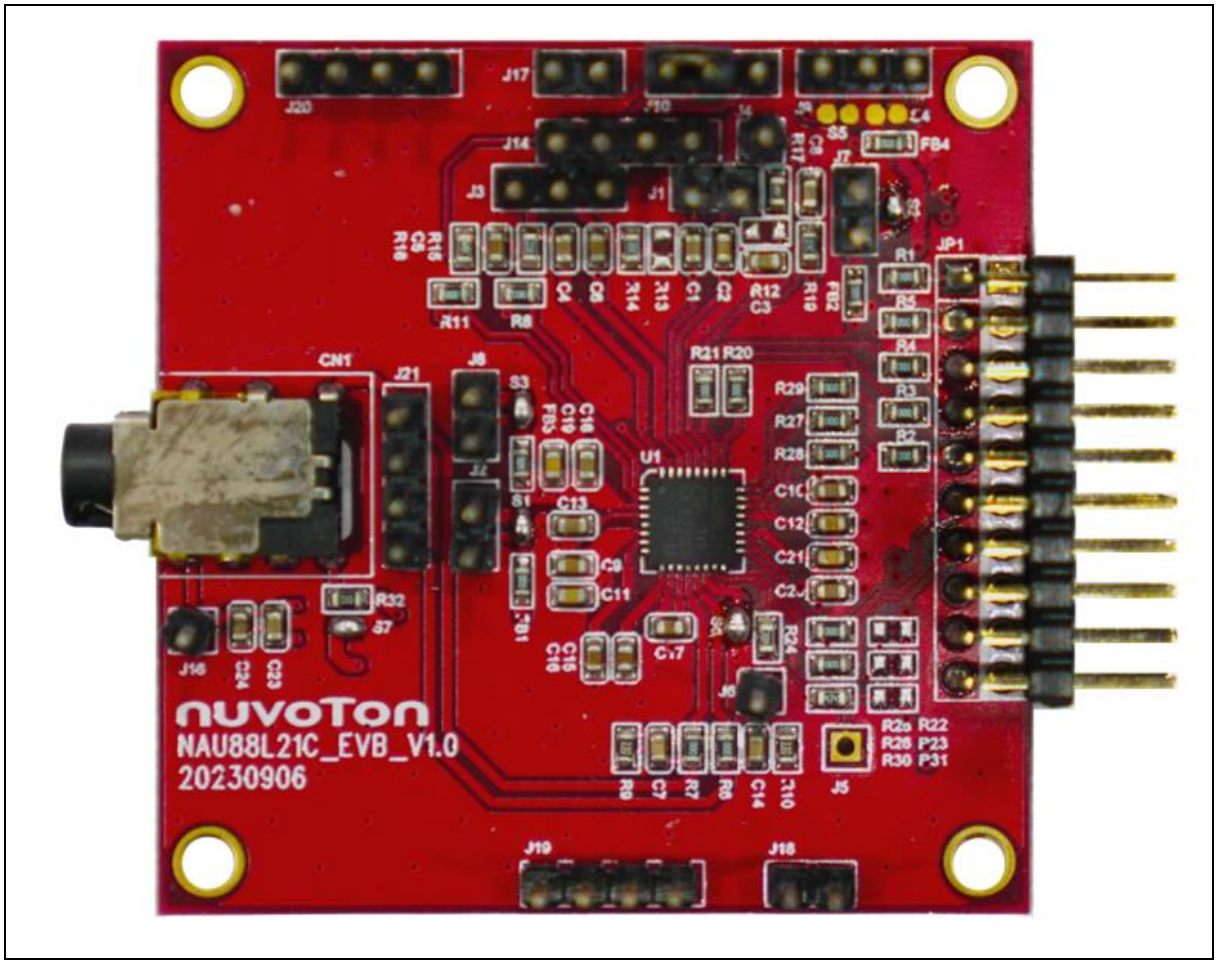

Figure 1-1 NL-NAU88L21C Evaluation Board

2 HARDWARE CONFIGURATION

2.1 NL-NAU88L21C Front View

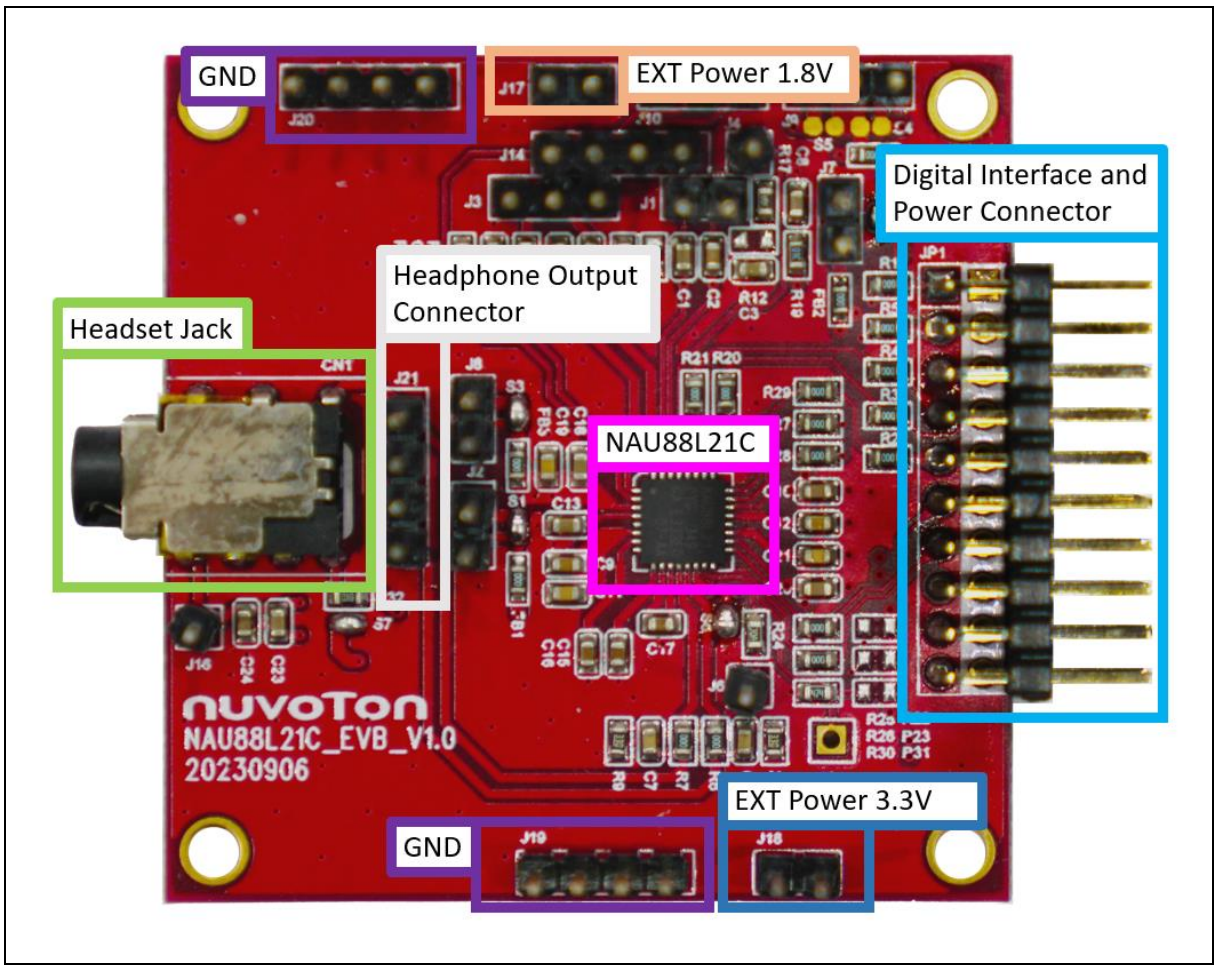

Figure 2-1 Front View of NL-NAU88L21C

Figure 2-1 shows the main components and connectors from the front side of NL-NAU88L21C as the following list:

- Target Chip: NAU88L21C (U1)
- 3.5mm Headset Jack Input (CN1)
- Headphone(HP) Output Extension Connector (J21)
- Digital Interface and Power Extension Connector (JP1)
- 3.3V EXT Power (J18)
- 1.8V EXT Power (J17)
- GND (J19, J20)

2.2 NL-NAU88L21C Connectors

Table 2-1 describes the connectors on NL-NAU88L21C. Users can refer to Figure 2-1.

Header		NL-NAU88L21C	
		Net Name in Schematic	Description
JP1	JP1.1	MCLK	CODEC External Master Clock Source Input
	JP1.2	GND	GND
	JP1.3	BCLK	Serial Data Bit Clock Input / Output for I^2S / PCM Data
	JP1.4	GND	GND
	JP1.5	DACIN	Serial Audio Data Input for I^2S / PCM Data
	JP1.6	GND	GND
	JP1.7	ADCOUT	Serial Audio Data Output for I^2S / PCM Data
	JP1.8	GND	GND
	JP1.9	FSYNC	Frame Sync Input / Output for I^2S / PCM Data
	JP1.10	GND	GND
	JP1.11	SCL	Serial Data Clock for I^2C
	JP1.12	GND	GND
	JP1.13	SDA	Serial Data for I^2C
	JP1.14	GND	GND
	JP1.15	VDDIO	VDDIO
	JP1.16	GND	GND
	JP1.17	1V8	1.8V Power Supply
	JP1.18	GND	GND
	JP1.19	3V3	3.3V Power Supply
	JP1.20	GND	GND
J17	J17.1	1V8	1.8V External Power Supply
	J17.2		

Header		NL-NAU88L21C	
		Net Name in Schematic	Description
J18	J18.1	3V3	3.3V External Power Supply
	J18.2		
J19	J19.1	GND	GND
	J19.2		
	J19.3		
	J19.4		
J20	J20.1	GND	GND
	J20.2		
	J20.3		
	J20.4		
J21	J21.1	HPL	Headphone Left Channel Output
	J21.2	GND	GND
	J21.3		
	J21.4	HPL	Headphone Right Channel Output

Table 2-1 NL-NAU88L21C Extension Connectors

2.3 NU-NAUSB2I2C USB Control Board View

The NU-NAUSB2I2C provides I²C control signals and common audio digital formats. With this board, users can quickly evaluate the functions and features of the NL-NAU88L21C and perform basic operations on the NL-NAU88L21C in conjunction with the content of this document. For more details of NU-NAUSB2I2C, please refer to *NU-NAUSB2I2C User Manual*.

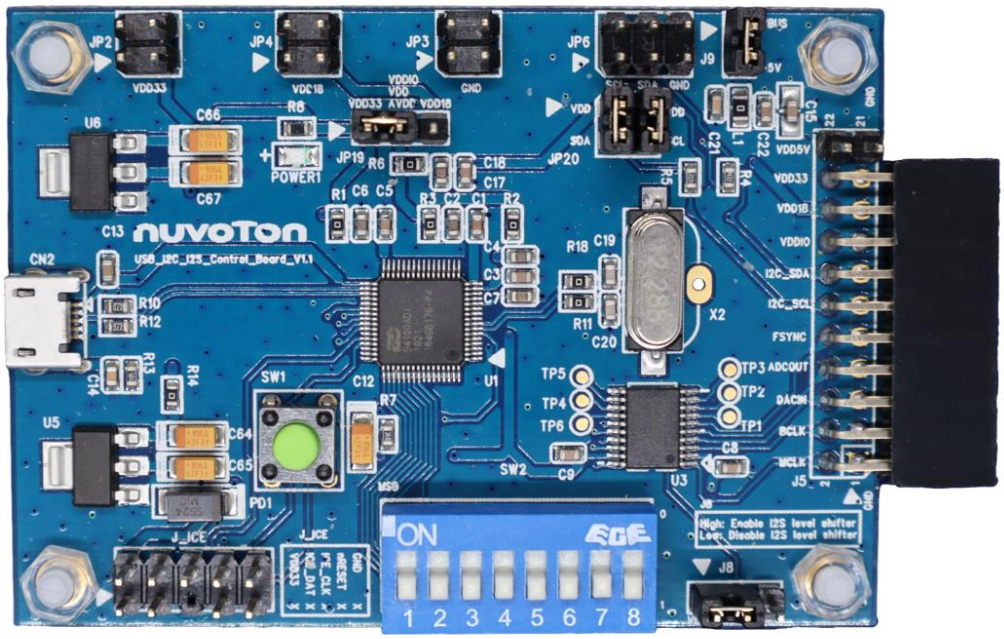

Figure 2-2 NU-NAUSB2I2C

2.4 Hardware Check and Connection

Before using NuvotonAudioGUI, please confirm the hardware configured as follows before connecting to a Windows based PC.

1. Confirm that pin 7 of SW2 of NU-NAUSB2I2C is high and the rest are low level, as shown in Figure 2-3.

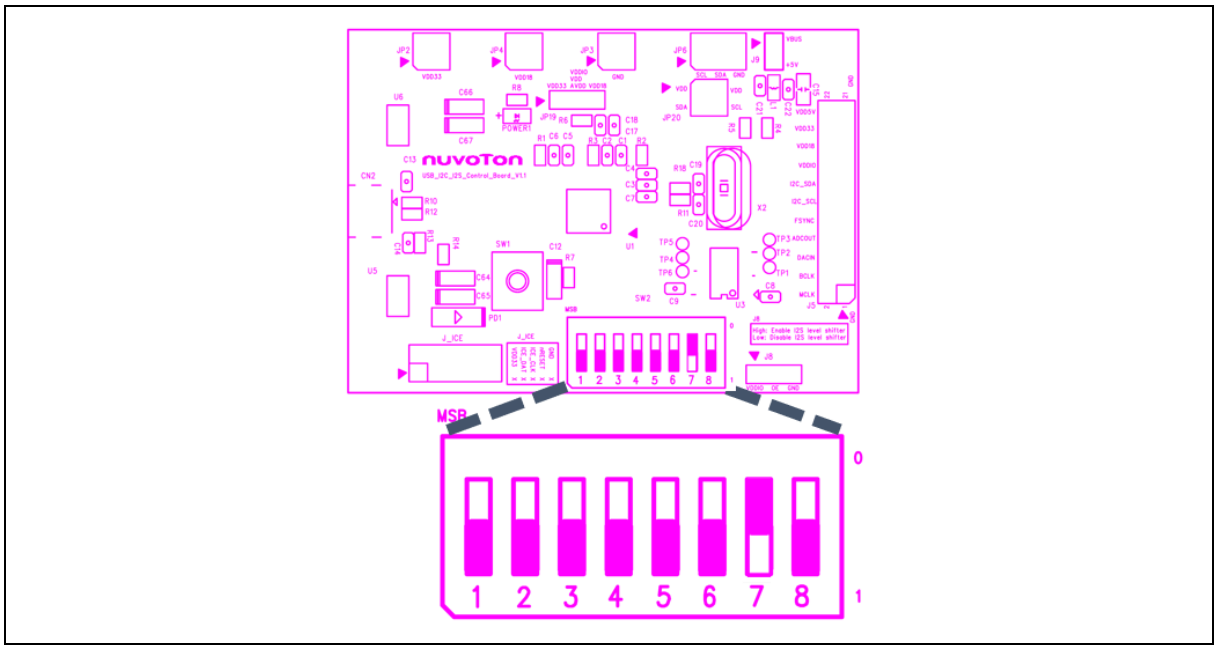

Figure 2-3 PIN Status of NU-NAUSB2I2C SW2

2. Connect J5 of NU-NAUSB2I2C to JP1 of NL-NAU88L21C. Figure 2-4 is the diagram after two boards are connected to each other.

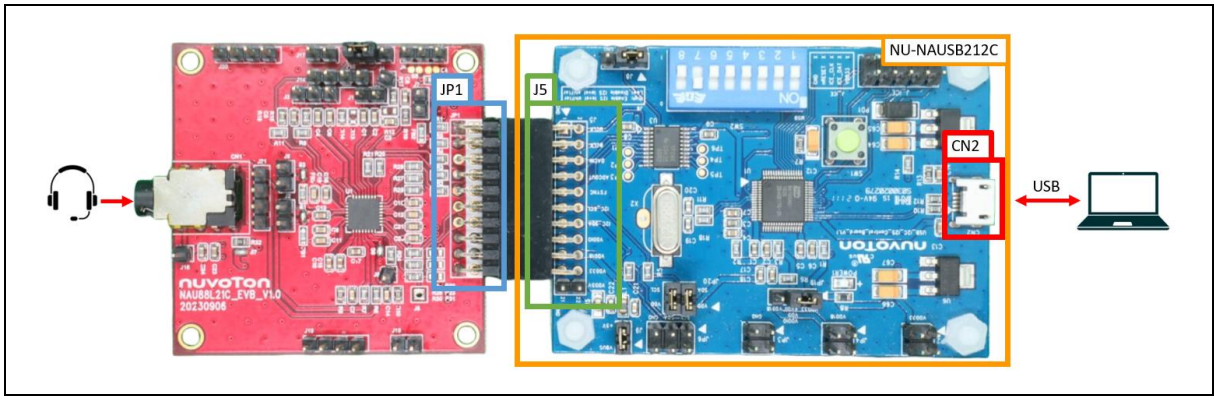

Figure 2-4 NU-NAUSB2I2C Connection

3. CN2 of NU-NAUSB2I2C uses USB Cable to connect to a PC under Windows system. (If possible, please do not connect to the PC through USB HUB). Figure 2-5 shows the audio signal path after the two boards are connected to each other.

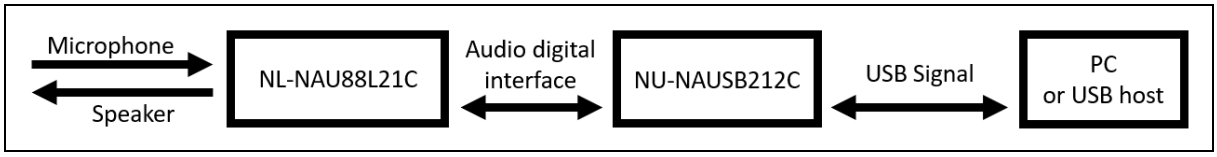

Figure 2-5 Signal Path of NU-NAUSB2I2C and NL-NAU88L21C

4. Select the audio device on the PC as "Nuvoton UAC+HID Device". For example, under Win10 system, users can click the speaker icon on the bottom-right corner of the desktop and choose the device "Nuvoton UAC+HID Device," as shown in Figure 2-6. This will select "Nuvoton UAC+HID Device" as the current playback device.

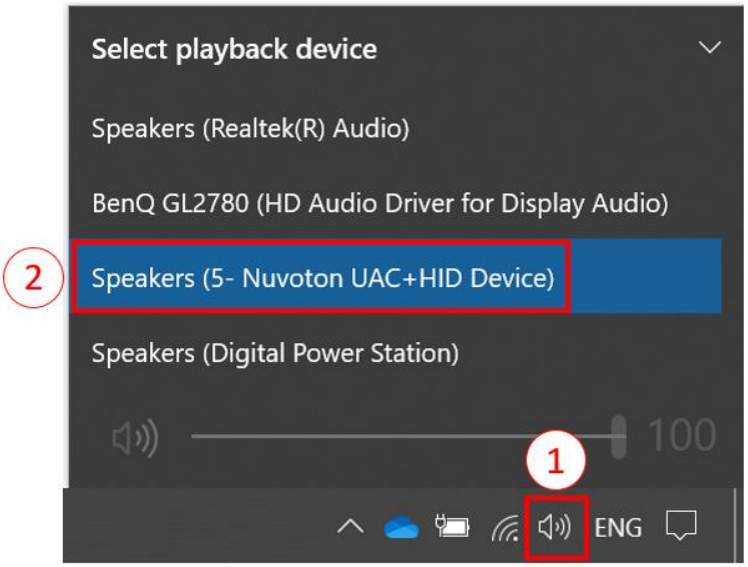

Figure 2-6 PC Audio Device Setting

3 SOFTWARE CONFIGURATION

This document is compatible with NuvotonAudioGUI V2.04 or later.

Evaluation of NL-NAU88L21C feature needs to install NuvotonAudioGUI.

3.1 NuvotonAudioGUI Installation

1. Visit Nuvoton Website.

   Download NuvotonAudioGUI software.

   https://www.nuvoton.com/tool-and-software/software-tool/programmer-tool/

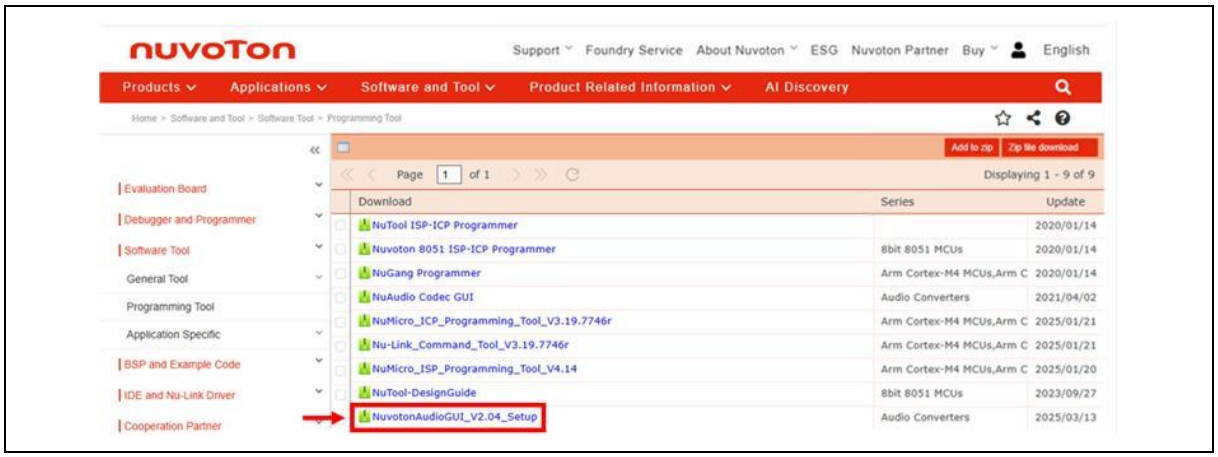

Figure 3-1 NuvotonAudioGUI Installation Step (1)

2. Install the NuvotonAudioGUI. The installation steps are shown in Figure 3-2 and Figure 3-3.

Figure 3-2 NuvotonAudioGUI Installation Step (2)

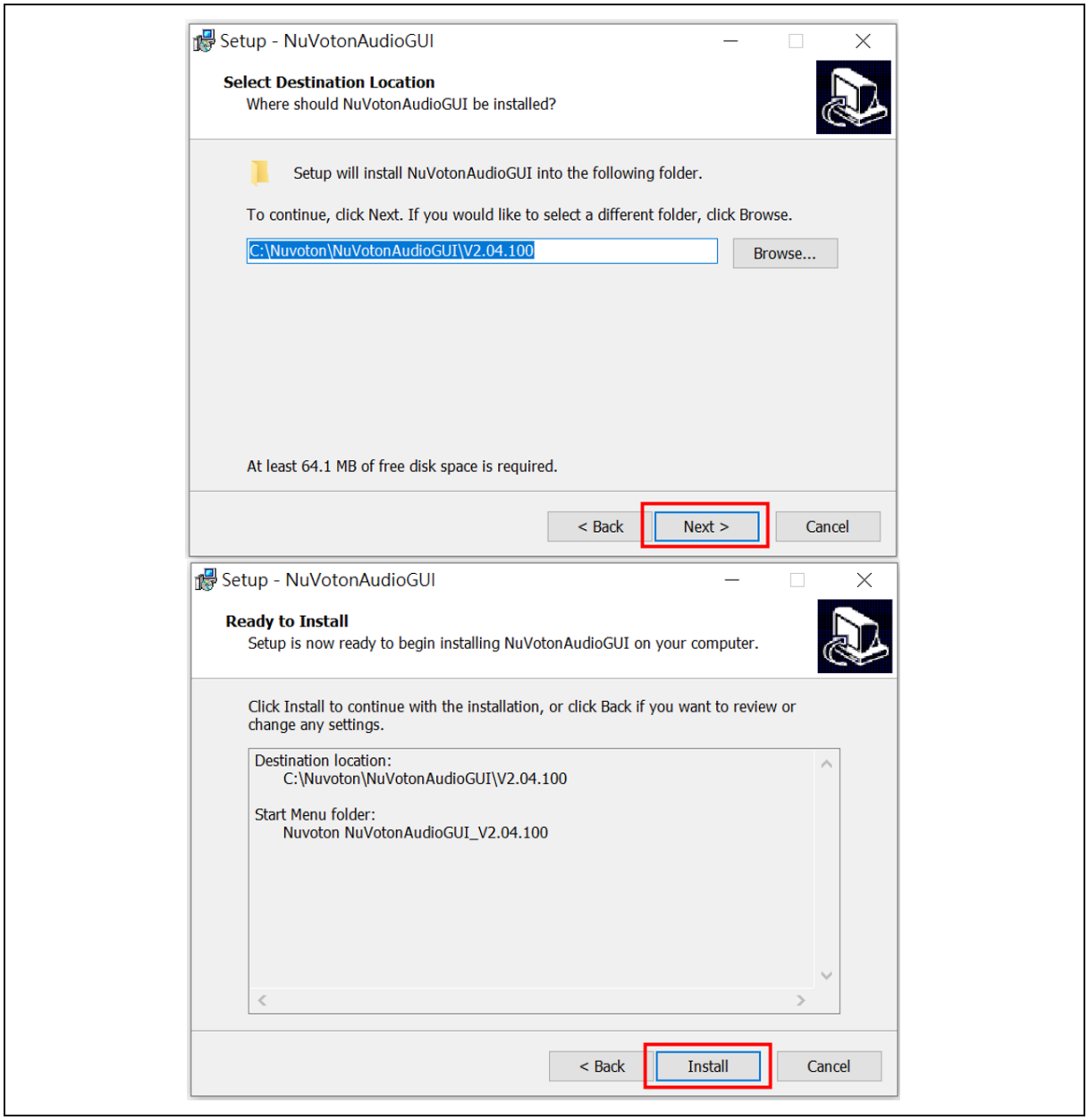

Figure 3-3 NuvotonAudioGUI Installation Step (3)

3.2 NuvotonAudioGUI Operating Instructions

1. Open NuvotonAudioGUI, choose the corresponding IC Part Number, then confirm the CSB setting (NL-NAU88L21C default is 0), and chick [OK], as shown in Figure 3-4.

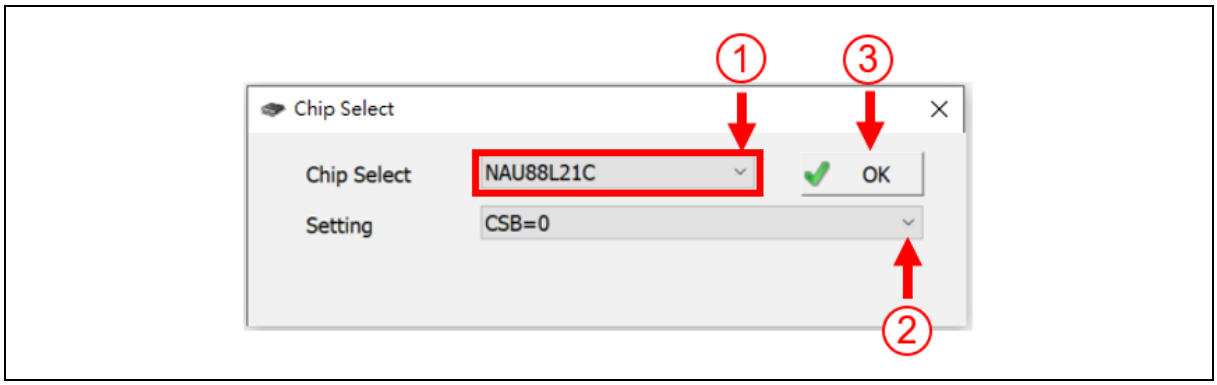

Figure 3-4 NuvotonAudioGUI Operating Step (1)

2. After clicking [OK], NuvotonAudioGUI will automatically read the connection status and verify the firmware version of the NU-NAUSB2I2C. If the firmware version is outdated, the version reminder window shown in Figure 3-5 will pop up. Users can ignore this message and continue operating NuvotonAudioGUI by clicking the [X] on the top-right corner.

   For more firmware update process information, please refer to *NU-NAUSB2I2C User Manual*.

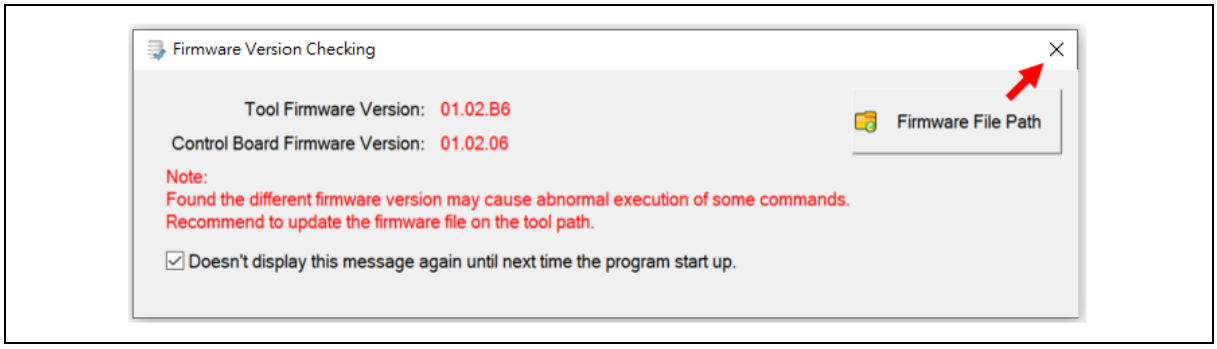

Figure 3-5 NuvotonAudioGUI Operating Step (2)

3. NuvotonAudioGUI will automatically read connection status. If the hardware and software are properly configured, a green [Connect] will appear on the upper left corner of the NuvotonAudioGUI window, as shown in Figure 3-6. Then users can issue I²C commands through NuvotonAudioGUI to control NL-NAU88L21C.

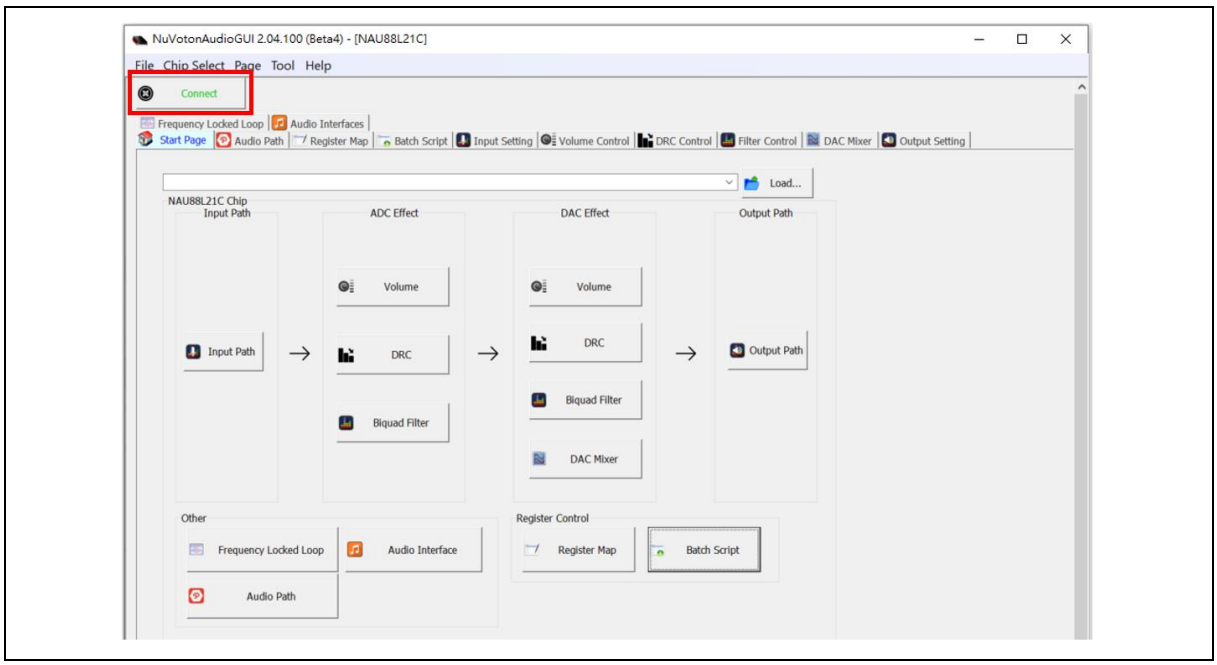

Figure 3-6 NuvotonAudioGUI Operating Step (3)

4. If the red [Disonnected] appears on the upper left corner of the NuvotonAudioGUI window, as shown in Figure 3-7, check if the hardware configuration is correct.

   For example: USB cable, whether your PC USB has read and write permissions, and whether Section 2.4 is executed correctly. If the problem still exists, please contact Nuvoton.

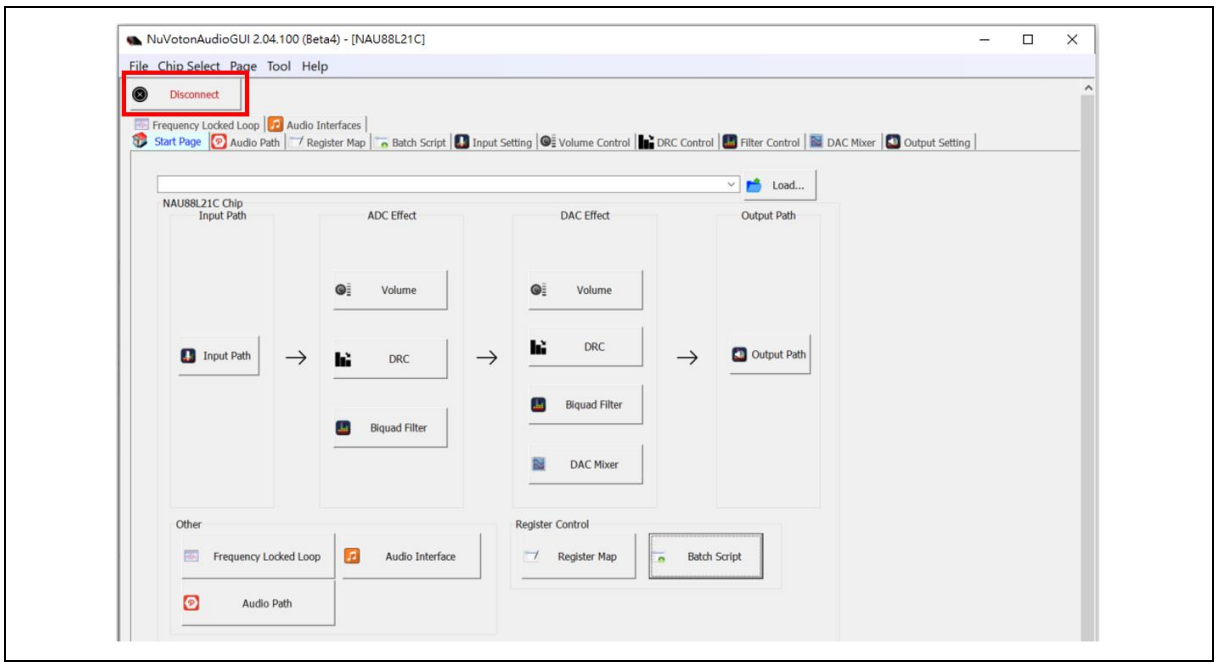

Figure 3-7 NuvotonAudioGUI Operating Step (4)

3.3 NuvotonAudioGUI Basic Page Introduction

NAU88L21C function settings are divided into multiple pages in NuvotonAudioGUI. This document will take a few frequently used pages as brief introduction.

3.3.1 Start Page and Demo Sequence

Start Page is the default view of NuvotonAudioGUI with links to all pages. Users can immediately enable the NL-NAU88L21C function by this page and the NuvotonAudioGUI built-in demo sequences. Refer to Figure 3-8 and the following description to operate.

1. Click the drop-down menu on the start page.
2. Select the option for the corresponding evaluation board.
3. Click the [Load] button.

NuvotonAudioGUI provides two sets of settings for users to choose from: DemoSequence_NAU88L21C and DemoSequence_NAU88L21C+Sidetone.

- DemoSequence_NAU88L21C:

  This setting enables the MIC IN (ADC function) and HP OUT (DAC function) functions of the NAU88L21C. Users can play their desired audio files using the playback device on the PC with the system playback device set to "Nuvoton UAC+HID Device". The audio will then be heard through the headphone or headset connected on the NL-NAU88L21C.

- DemoSequence_NAU88L21C+Sidetone:

  This setting is almost identical to DemoSequence_NAU88L21C, with the difference being that the headphones can directly play the sound captured by the microphone of headset.

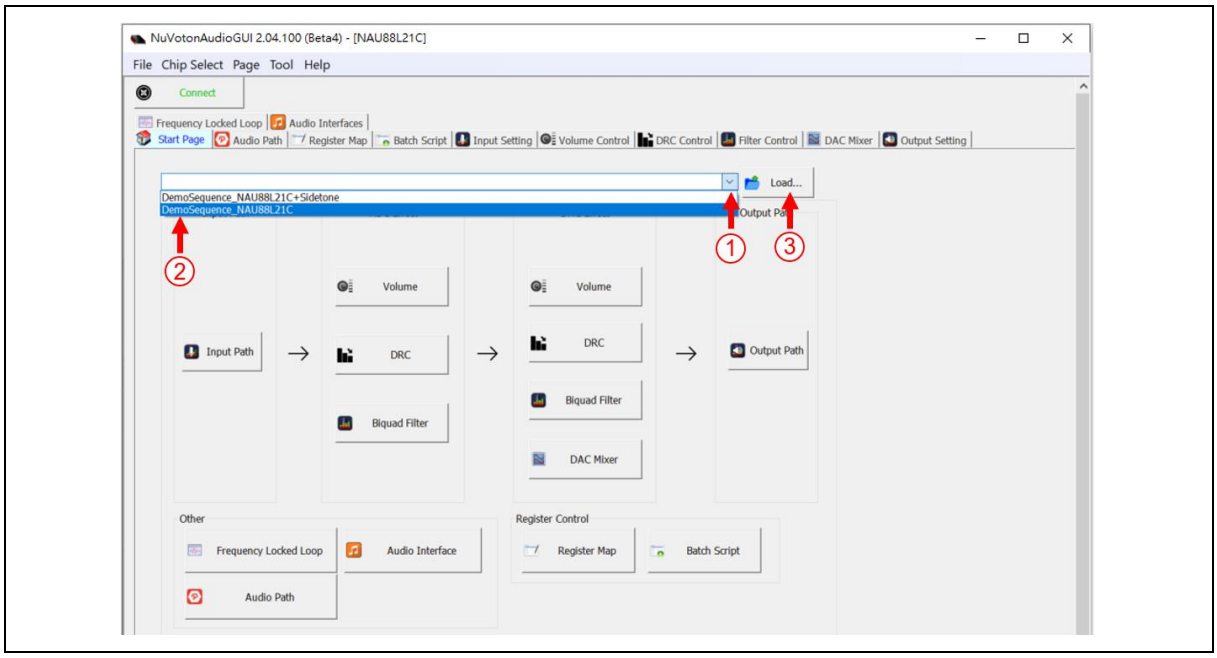

Figure 3-8 Start Page on NuvotonAudioGUI

3.3.2 Audio Path Page

The Audio Path page graphically presents path switches, power controls, and Gain adjustments, allowing users to configure NAU88L21C as easy as possible. It is high recommended to use the DemoSequence setting first, and then use the Audio Path page to do more customized control.

- Click on the red boxes in Figure 3-9 to adjust the power of this function. When power is on, the box will be green. When Power is off, the box will be gray.
- Click on the blue arrows in Figure 3-9 to adjust the enabling status of the path.
- Click on the pink arrows in Figure 3-9 and a drop-down menu will appear, where the user can adjust the Gain there.
- The blue box in Figure 3-9 lists the current graphical status here in text form. The user can also modify the status of the function from here.

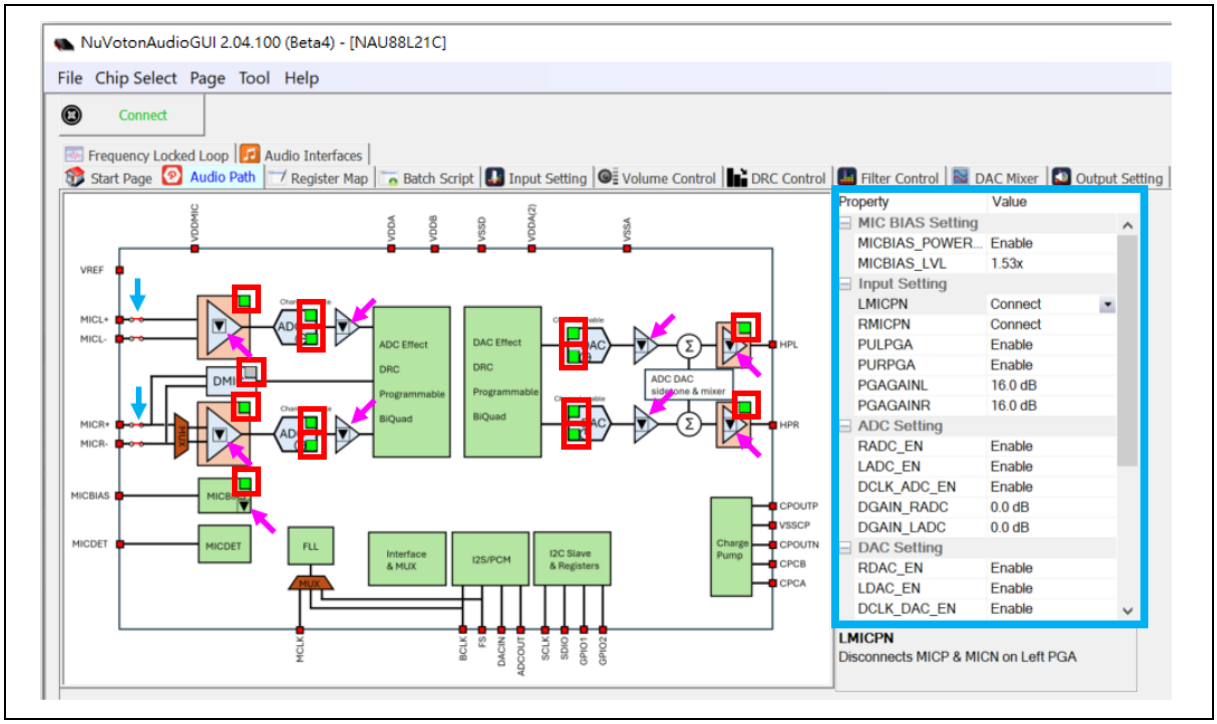

Figure 3-9 Audio Path Page on NuvotonAudioGUI

3.3.3 Register Map

The Register map page can modify the target register value through NuvotonAudioGUI. The following explains two main modification methods.

- Users can directly key in desired register values into the "Value" field next to the corresponding address, as shown in Figure 3-10. ("Value" has hexadecimal and binary column respectively, just select one to modify.)
- If users want to read the specified address value, enter the address value in the "Address" field, as shown in Figure 3-10. After clicking the [Read] button on the left, the address value will be displayed in the "Value" field. If users want to modify the specified address value, enter the desired address and corresponding value in the "Address" and "Value" fields respectively, and click the [Write] button on the left to complete the modification.

There are two functions [Import] and [Export] on the Register page:

- [Export]: Export the currently set values into a text file.
- [Import]: Import external text files and set them to the target evaluation board.

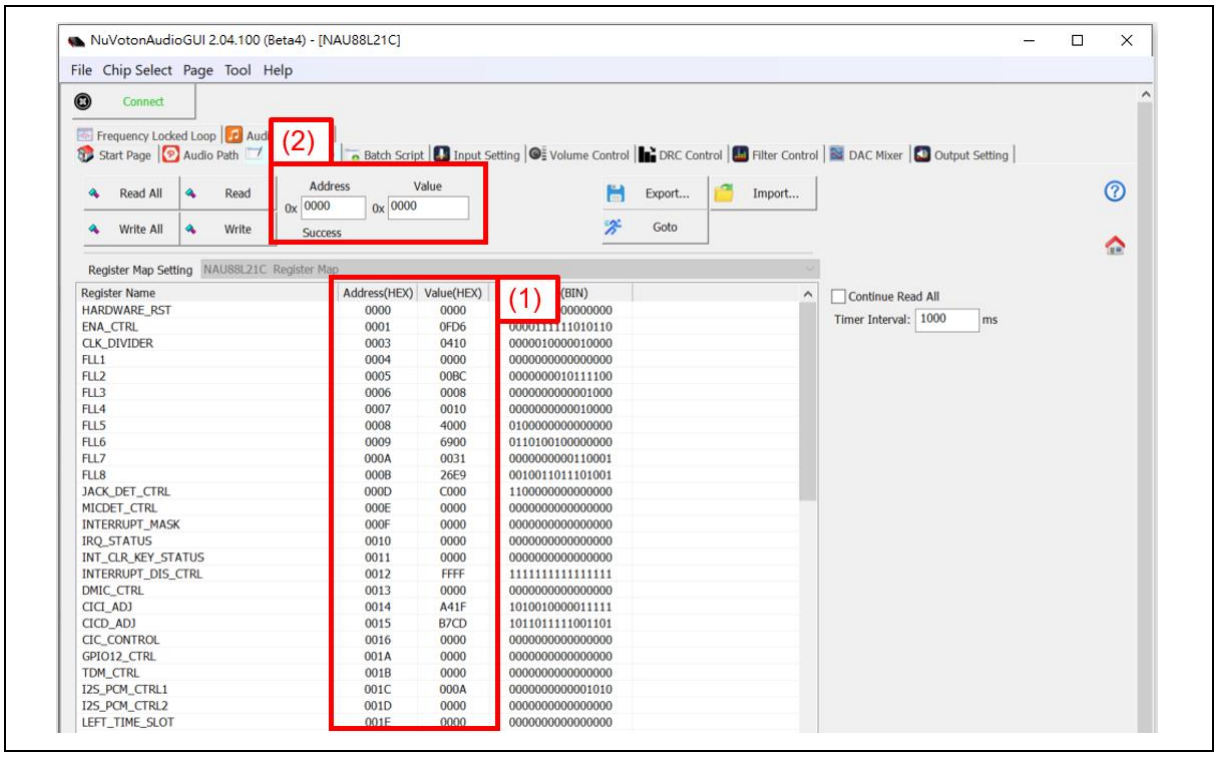

Figure 3-10 Register Map Page on NuvotonAudioGUI

3.4 Recording Software Verification

When user uses a microphone or other audio source devices to verify the ADC functionality of the NAU88L21C, the digital signal from the converted ADC data is not easy to quickly verify or test using common instruments. However, when the NU-NAUSB2I2C is paired with the NL-NAU88L21C, NU-NAUSB2I2C can convert the ADC data signal and deliver it to the PC, allowing the user to verify the ADC functionality of the NAU88L21C using Windows' built-in recording software or other recording applications.

Audacity is a free and user-friendly software that allows users to perform playback and recording tests. The following briefly introduces how to record with Audacity. After opening Audacity, confirm or set the recording device to "Nuvoton UAC+HID Device" by following the Step 1 to 3 in Figure 3-11. Click the icon shown in Step 4 of the figure to start recording and the icon in Step 5 of the figure to stop recording. The sound captured by the microphone or other audio source devices on the NL-NAU88L21C will be shown on the audio track.

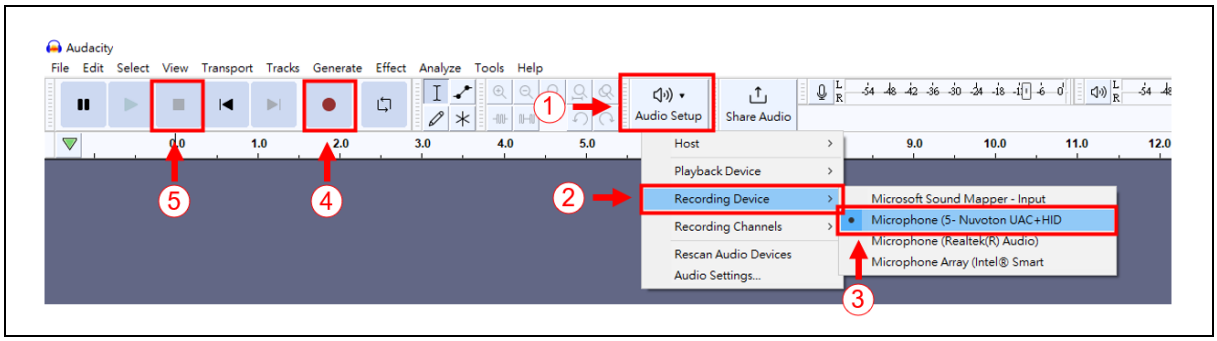

Figure 3-11 Audacity Recording Setting

4 SCHEMATICS

4.1 NL-NAU88L21C Schematic

Figure 4-1 shows the NL-NAU88L21C circuit.

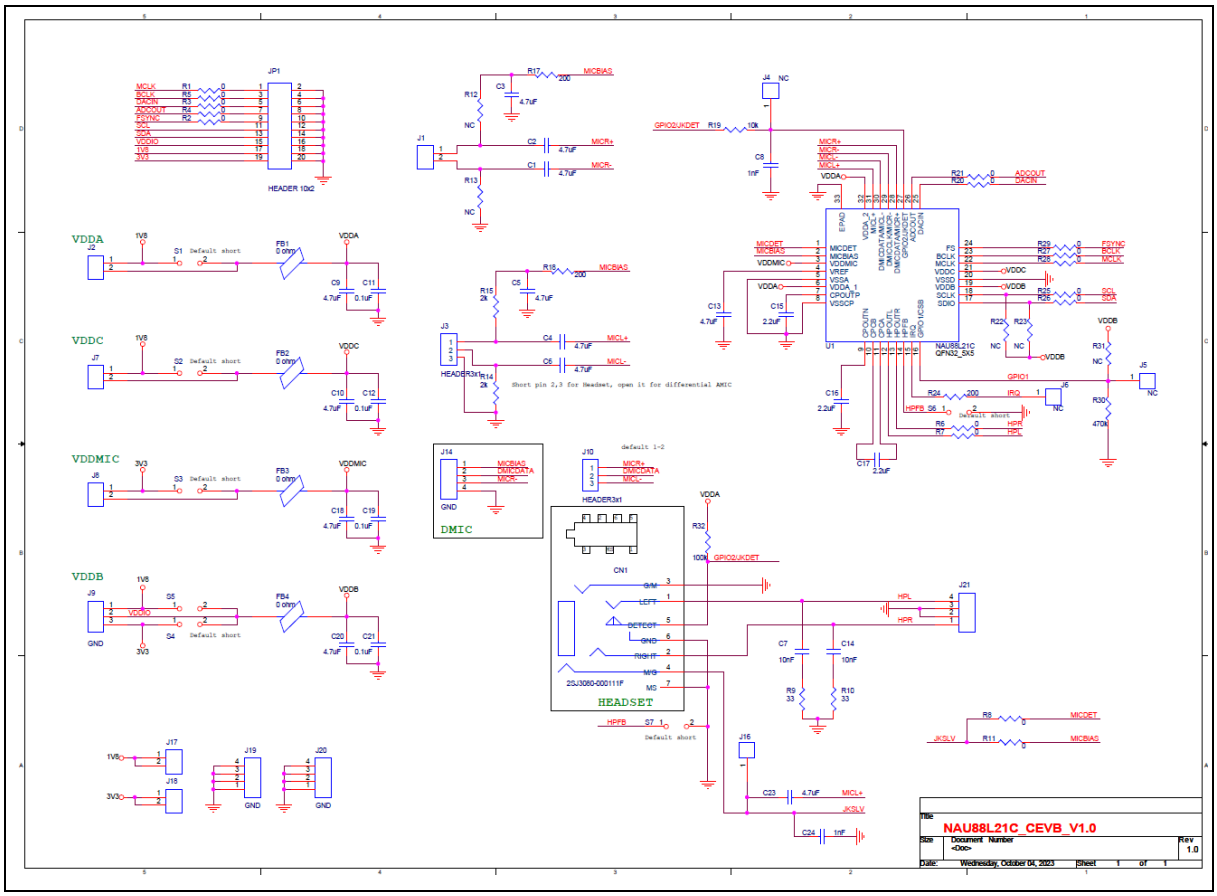

Figure 4-1 NL-NAU88L21C Circuit

4.2 NL-NAU88L21C PCB Layout

Figure 4-2 shows the placement of NL-NAU88L21C.

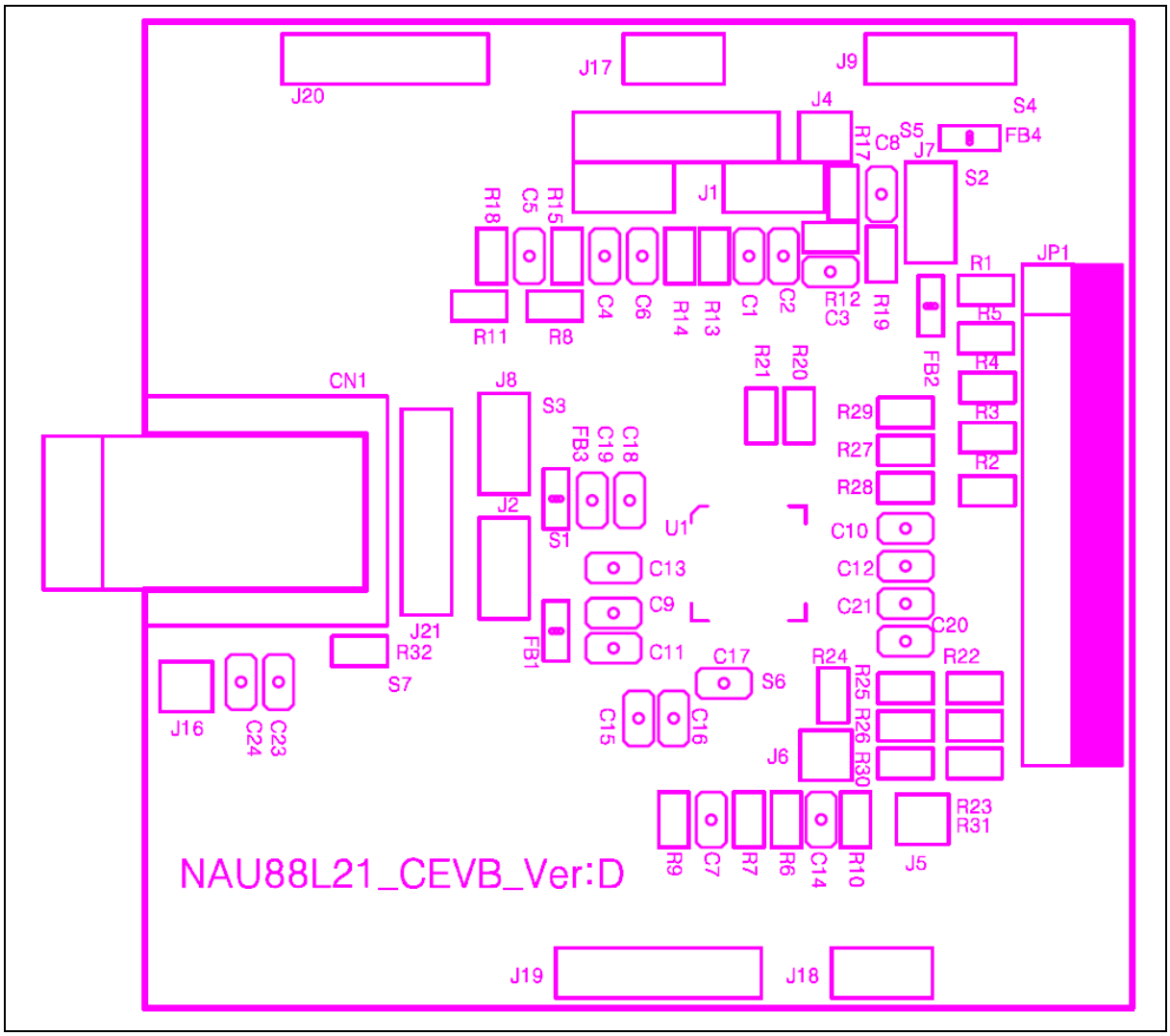

Figure 4-2 NL-NAU88L21C Layout

5 REVISION HISTORY

REVISION	DATE	DESCRIPTION
1.0	Mar 17, 2025	Initial Release

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