NL-NAU8421

User Manual

Evaluation Board for NAU8421

For additional information or questions, please contact: Nuvoton Technology Corporation.

www.nuvoton.com

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1 OVERVIEW

The NL-NAU8421 is the evaluation board for NAU8421. This board is developed for users to quickly understand the characteristics of NAU8421. For development flexibility, this board has a built-in microphone and additional expansion connectors that provide speaker output and digital interface. For development convenience, NL-NAU8421 can be connected with speakers or directly to customized system.

Nuvoton has also developed a USB control board, NU-NAUSB2I2C, which provides I²C control interface and digital audio interface signals. Along with the software NuvotonAudioGUI, users can quickly set up and use NL-NAU8421 on their PCs.

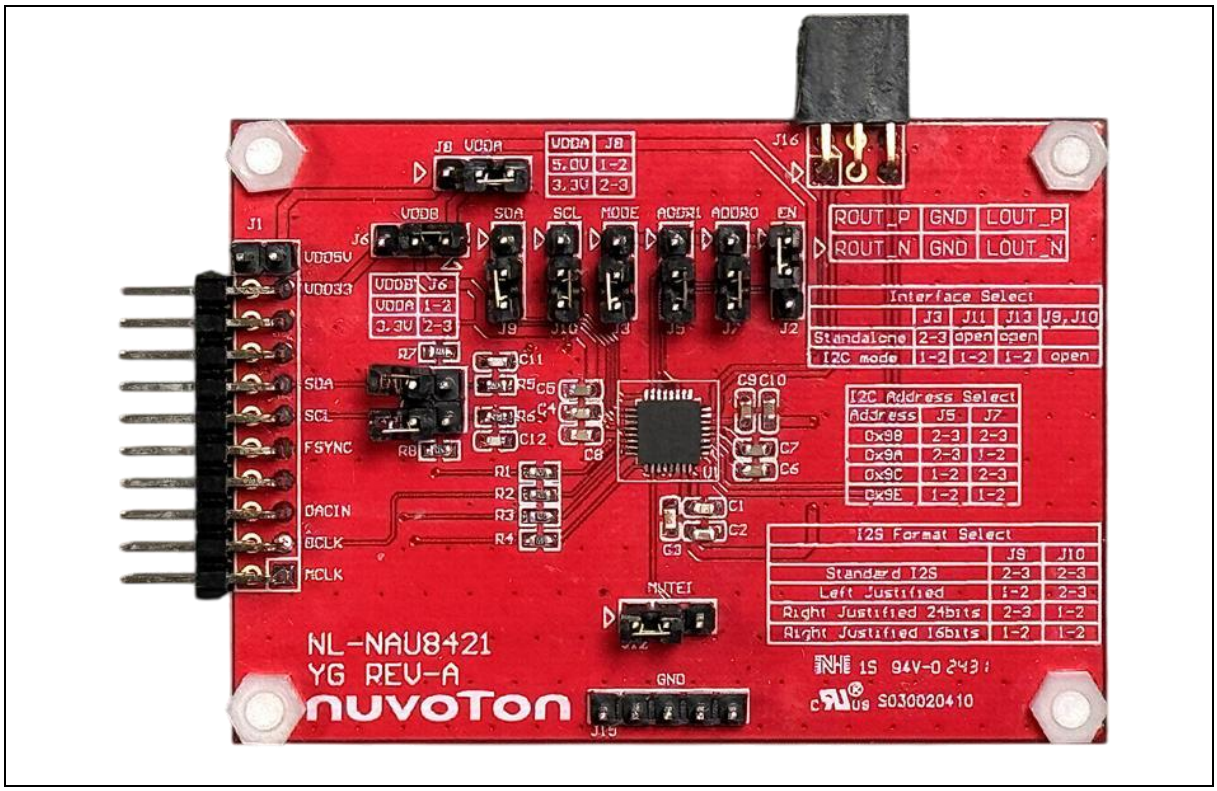

Figure 1-1 NL-NAU8421 Evaluation Board

2 HARDWARE CONFIGURATION

2.1 NL-NAU8421 Front View

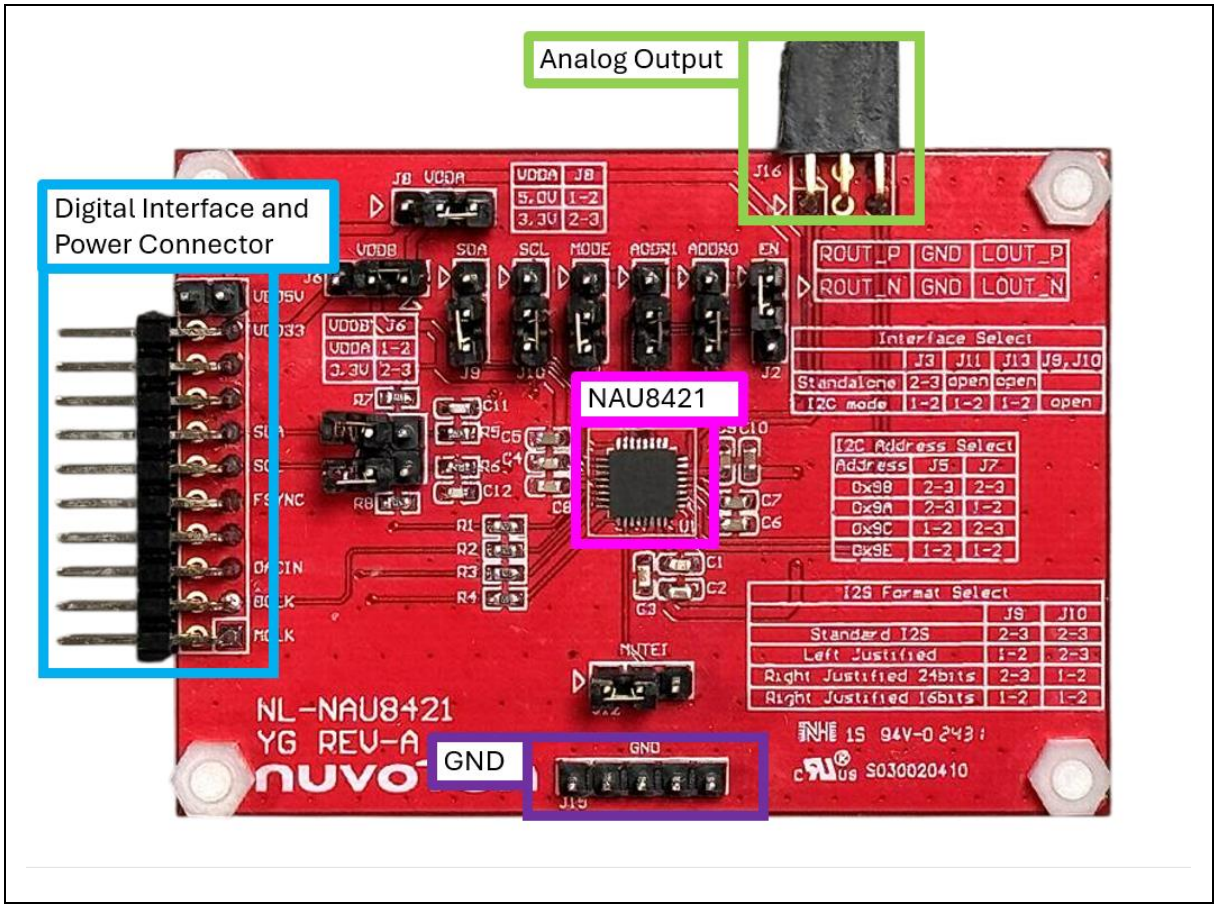

Figure 2-1 Front View of NL-NAU8421

Figure 2-1 shows the main components and connectors from the front side of NL-NAU8421. The following lists components and connectors from the front view:

- Target Chip: NAU8421 (U1)
- Analog Output (J16)
- Digital Interface and Power Extension Connecter(J1)
- GND (J15)

2.2 NL-NAU8421 Connectors

Table 2-1 describes the connectors on NL-NAU8421. Users can also refer to Figure 2-1.

Header		NL-NAU8421	
		Net Name in Schematic	Description
J1	J1.1	MCLK	External Master Clock Source Input
	J1.2	GND	GND
	J1.3	BCLK	Serial Data Bit Clock Input / Output for I^2S / PCM Data
	J1.4	GND	GND
	J1.5	DACIN	Serial Audio Data Input for I^2S / PCM Data
	J1.6	GND	GND
	J1.7	NC	None Connected
	J1.8	GND	GND
	J1.9	FS	Frame Sync Input / Output for I^2S / PCM Data
	J1.10	GND	GND
	J1.11	SCL	Serial Data Clock for I^2C
	J1.12	GND	GND
	J1.13	SDA	Serial Data for I^2C
	J1.14	GND	GND
	J1.15	NC	None Connected
	J1.16	GND	GND
	J1.17	NC	None Connected
	J1.18	GND	GND
	J1.19	+3V3	3.3V Power Supply
	J1.20	GND	GND
	J1.21	+5V	5V Power Supply
	J1.22	GND	GND

Header		NL-NAU8421	
		Net Name in Schematic	Description
J15	J15.1	GND	GND
	J15.2		
	J15.3		
	J15.4		
	J15.5		
J16	J16.1	ROUT_N	Right Channel Negative Output
	J16.2	ROUT_P	Right Channel Positive Output
	J16.3	GND	GND
	J16.4		
	J16.5	LOUT_N	Left Channel Negative Output
	J16.6	LOUT_P	Left Channel Positive Output

Table 2-1 NL-NAU8421 Extension Connectors

2.3 NL-NAU8421 Jumpers

Table 2-2 describes the connectors on NL-NAU8421. Users can also refer to Figure 2-1.

Jumper	NL-NAU84211		
	Function Description	Options	Jumper option description
J2	Enable Control	J6.1 – J6.2 (Default)	Chip Enable
		J6.2 – J6.3	Chip Disable
J5, J7	Device Address Selection (I^2C Mode Only)	J5.2 – J5.3 J7.2 – J7.3	Address:0x98
		J5.2 – J5.3 J7.1 – J7.2	Address:0x9A
		J5.1 – J5.2 J7.2 – J7.3	Address:0x9B
		J5.1 – J5.2 J7.1 – J7.2	Address:0x9C
J6	VDDB Selection	J6.1 – J6.2	VDDB = 5V
		J6.2 – J6.3	VDDB = 3.3V
J8	VDDA Selection	J8.1 – J8.2	VDDA = 5V
		J8.2 – J8.3	VDDA = 3.3V
J9, J10	Digital Interface Selection (Standalone Mode Only)	J9.2 – J9.3 J10.2 – J10.3	Standard I^2S
		J9.1 – J9.2 J10.2 – J10.3	Left Justified
		J9.2 – J9.3 J10.1 – J10.2	Right Justified 24 bits
		J9.1 – J9.2 J10.1 – J10.2	Right Justified 16 bits
J3, J11, J13	Mode selection	J3.2 – J3.3 J11 Open J13 Open	Operation in Standalone Mode
		J3.1 – J3.2 J11.1 – J11.2 J13.1 – J13.2	Operation in I^2C Mode
J12	Mute Control	J12.1 – J12.2	Chip Mute Disable
		J12.2 – J12.3	Chip Mute Enable

Table 2-2 NL-NAU8421 Jumper

2.4 NL-NAU8421 Mode Selection

NL-NAU8421 has two modes, "Standalone mode" and "I²C mode" for users to choose. Users can adjust the jumpers according to Table 2-3 and Table 2-4 based on their needs.

Jumper	Description
J5, J7	J5 = 2 - 3 J7 = 2 - 3
J9, J10	Standard I²S: J9.2 – J9.3 J10.2 – J10.3 Left Justified: J9.1 – J9.2 J10.2 – J10.3 Right Justified 24 bits: J9.2 – J9.3 J10.1 – J10.2 Right Justified 16 bits: J9.1 – J9.2 J10.1 – J10.2
J27	Open
J28	Open
Gain Selection	Gain Selection in Standalone Mode: Gain = 36dB, 1 - 5 Gain = 32dB, 2 - 5 Gain = 24dB, Open Gain = 19dB, 3 - 5 Gain = 0dB, 4 - 5

Table 2-3 NL-NAU8421 Standalone Mode

Jumper	Description
J5, J7	Address Selection Address = 0x12: J5 = 2 - 3 J7 = 1 - 2 Address = 0x14: J5 = 1 - 2 J7 = 2 - 3 Address = 0x16: J5 = 1 - 2 J7 = 1 - 2
J9, J10	Open
J27	Short
J28	Short
Gain Selection	Open

Table 2-4 NL-NAU8421 I²C Mode

2.5 NU-NAUSB2I2C 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-NAU8421 and perform basic operations on the NL-NAU8421 in conjunction with the content of this document. For more details of NU-NAUSB2I2C, please refer to *NU-NAUSB2I2C User Manual*.

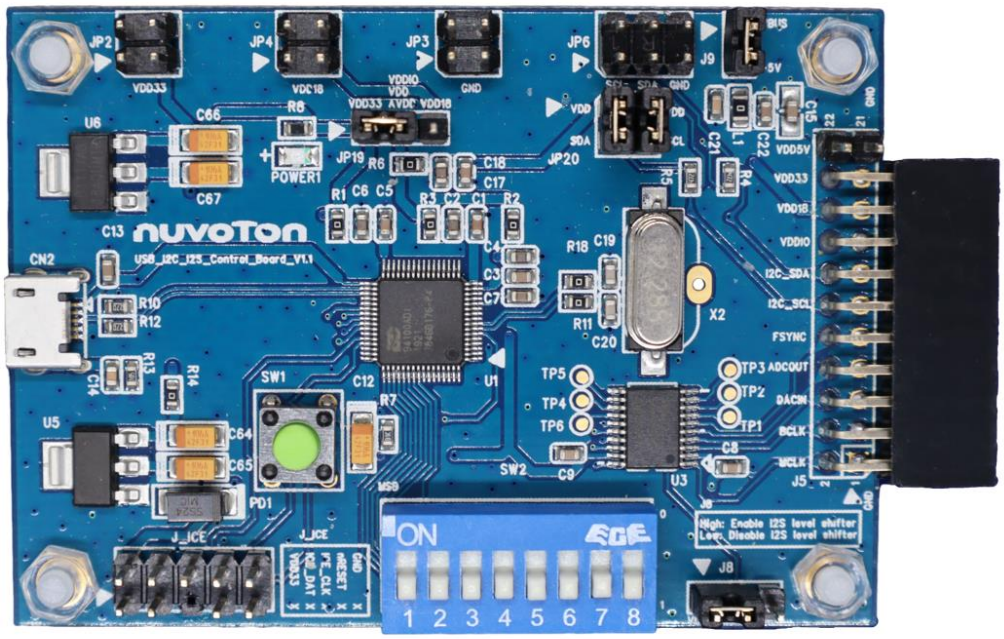

Figure 2-2 NU-NAUSB2I2C

2.6 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.

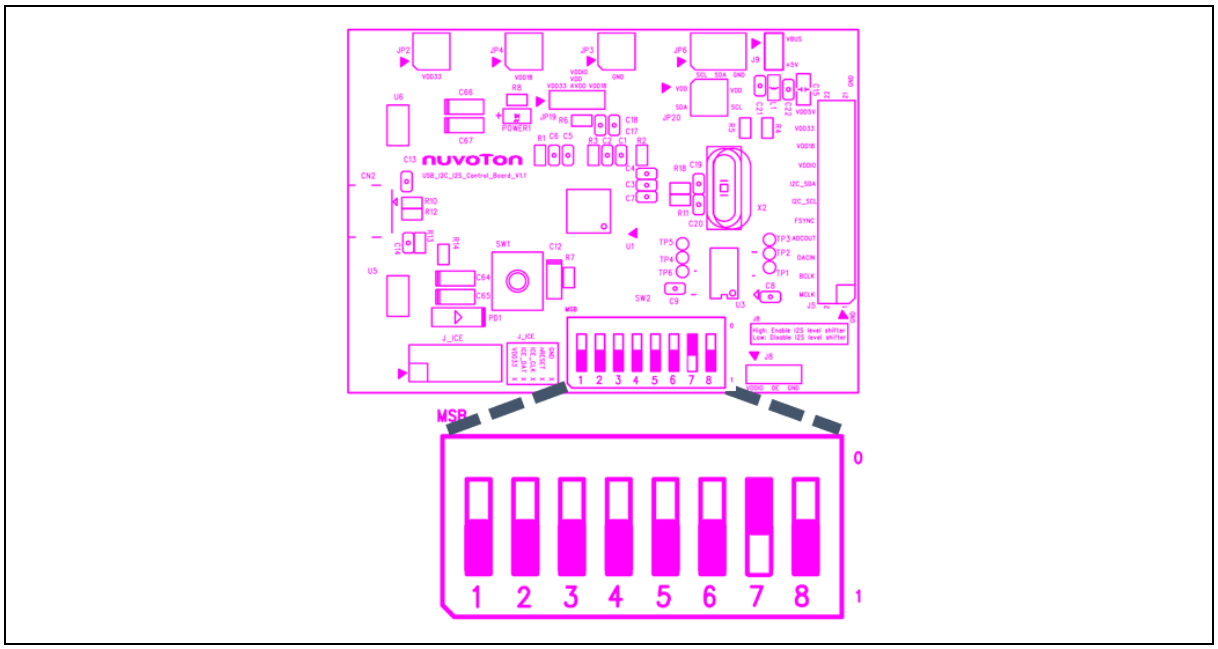

Figure 2-3 PIN Status of NU-NAUSB2I2C SW2

2. Connect J5 of NU-NAUSB2I2C to JP2 of NL-NAU8421. Figure 2-4 is the diagram after two boards are connected to each other.

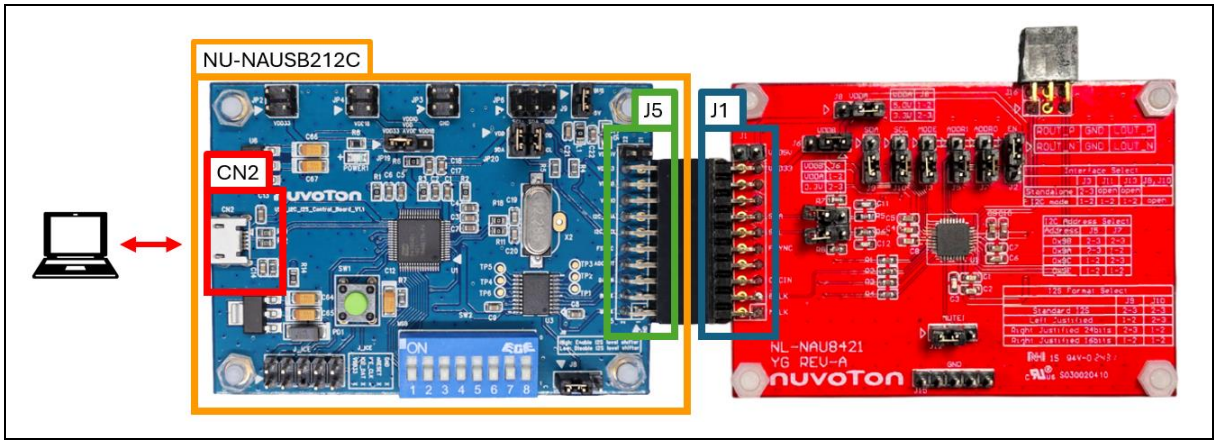

Figure 2-4 NU-NAUSB2I2C Connection

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-NAU8421

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.

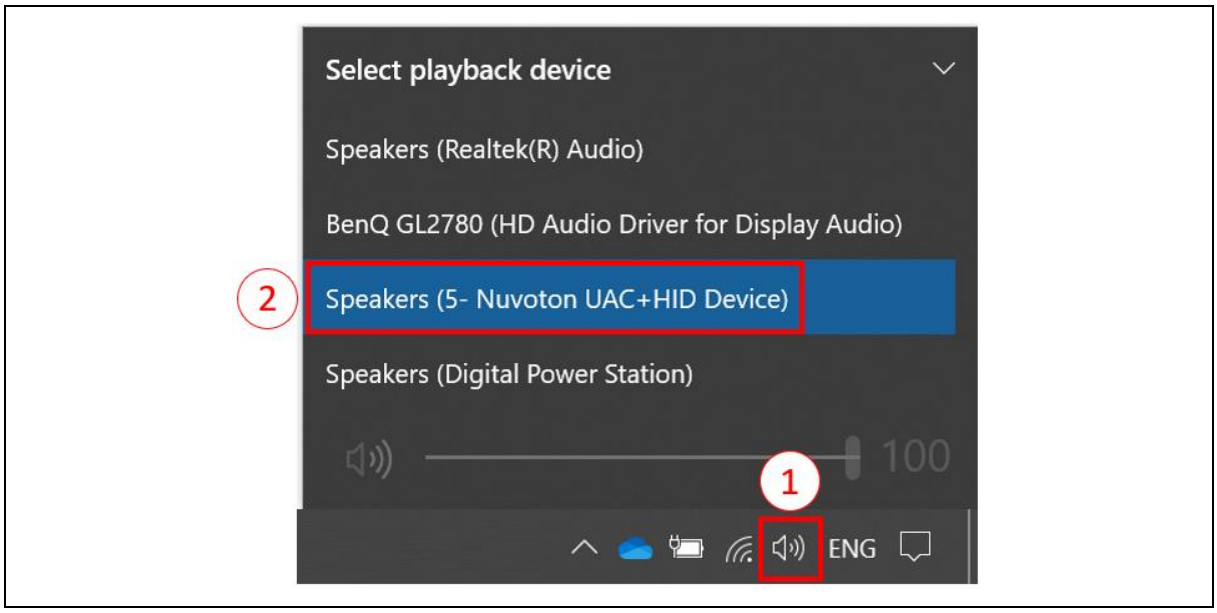

Figure 2-6 PC Audio Device Setting

2.7 Standalone Mode for Demonstration

With Standalone mode, users don't need to install NuvotonAudioGUI on PC. By changing gain selection jumper, users can quickly start evaluation by the steps below. Figure 2-8 is Standalone Mode Signal Path of NU-NAUSB2I2C and NL-NAU8421.

Target of NL-NAU8421 settings:

- Standalone Mode
- Digital Interface: I²S

Configuration of jumpers:

1. Set J3 jumper pin to J3.2 – J3.3.
2. Leave J11 and J13 as open.
3. Set J5 jumper pin to J5.2 – J5.3.

   Set J7 jumper pin to J7.2 – J7.3.
4. Set J9 jumper pin to J9.2 – J9.3.

   Set J10 jumper pin to J10.2 – J10.3.
5. Connect NL-NAU82421 to NU-NAUSB2I2C, then PC to NU-NAUSB2I2C. (for power and I²S output)

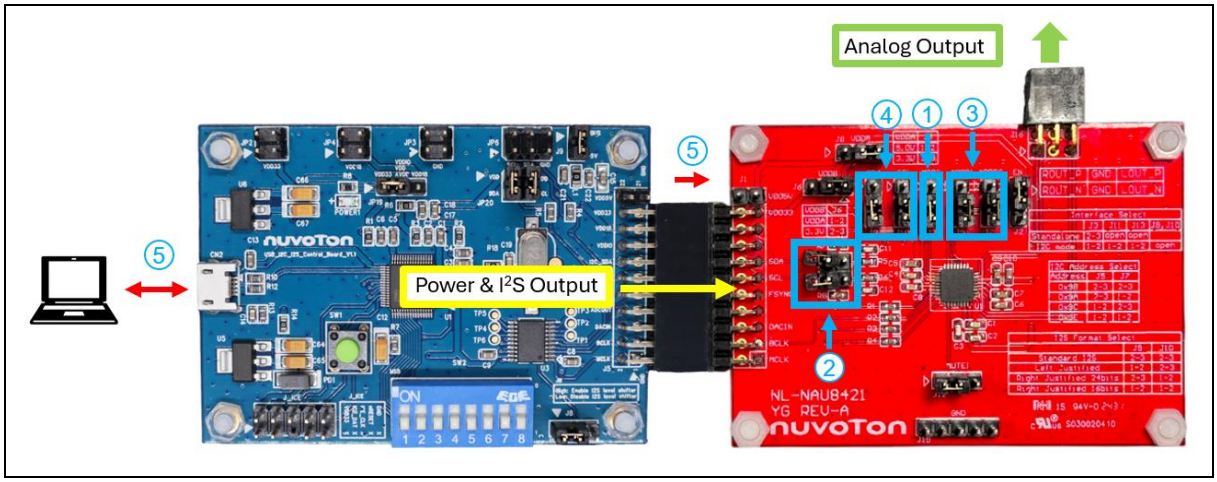

Figure 2-7 NL-NAU8421 Jumpers Setting in Standalone Mode

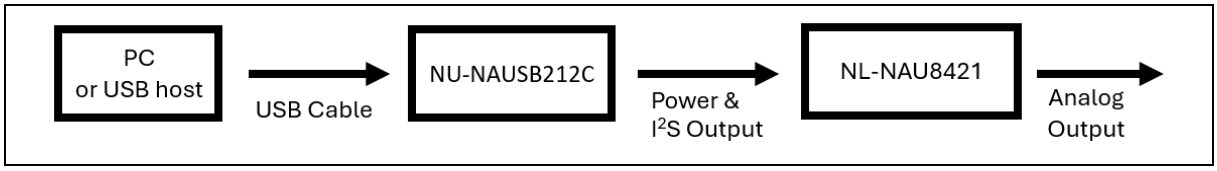

Figure 2-8 Standalone Mode Signal Path of NU-NAUSB2I2C and NL-NAU8421

3 SOFTWARE CONFIGURATION

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

Evaluation of NL-NAU8421 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/

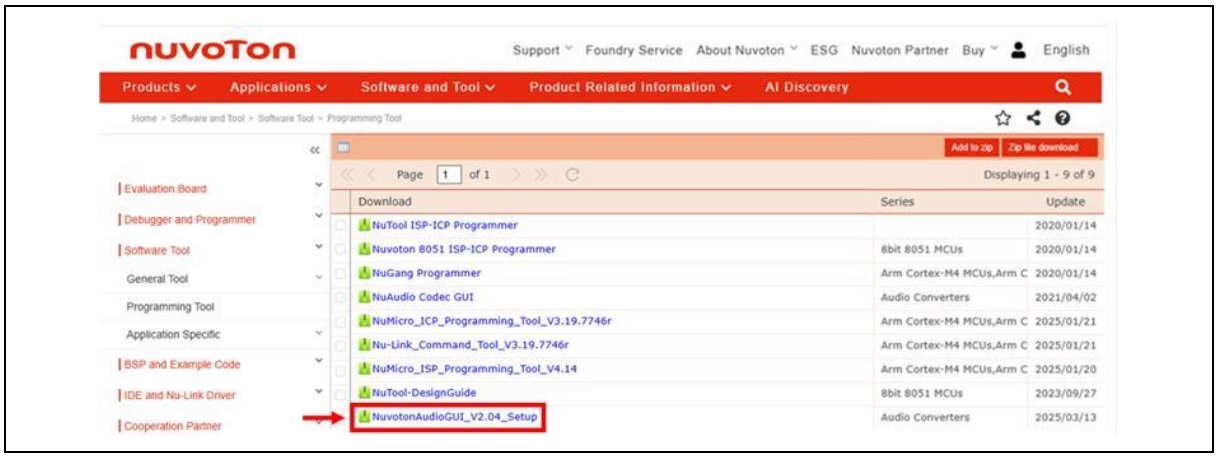

Figure 3-1 NuvotonAudioGUI Installation Step (1)

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

Figure 3-2 NuvotonAudioGUI Installation Step (2)

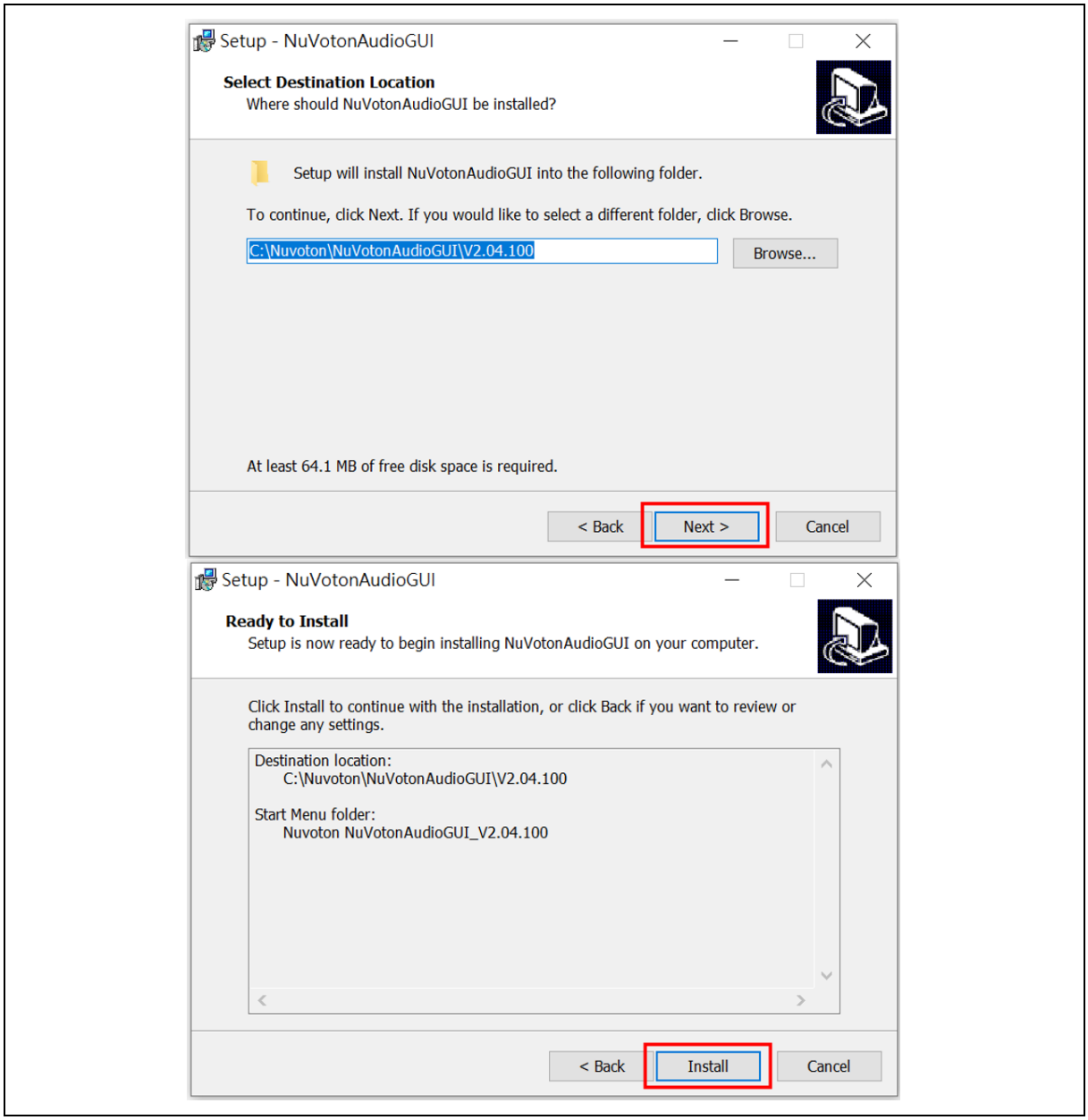

Figure 3-3 NuvotonAudioGUI Installation Step (3)

3.2 NuvotonAudioGUI Operating Instructions

1. Open NuvotonAudioGUI, choose the corresponding IC Part Number, address setting of I²C(check by J5, J7), and click [OK], as shown in Figure 3-4.

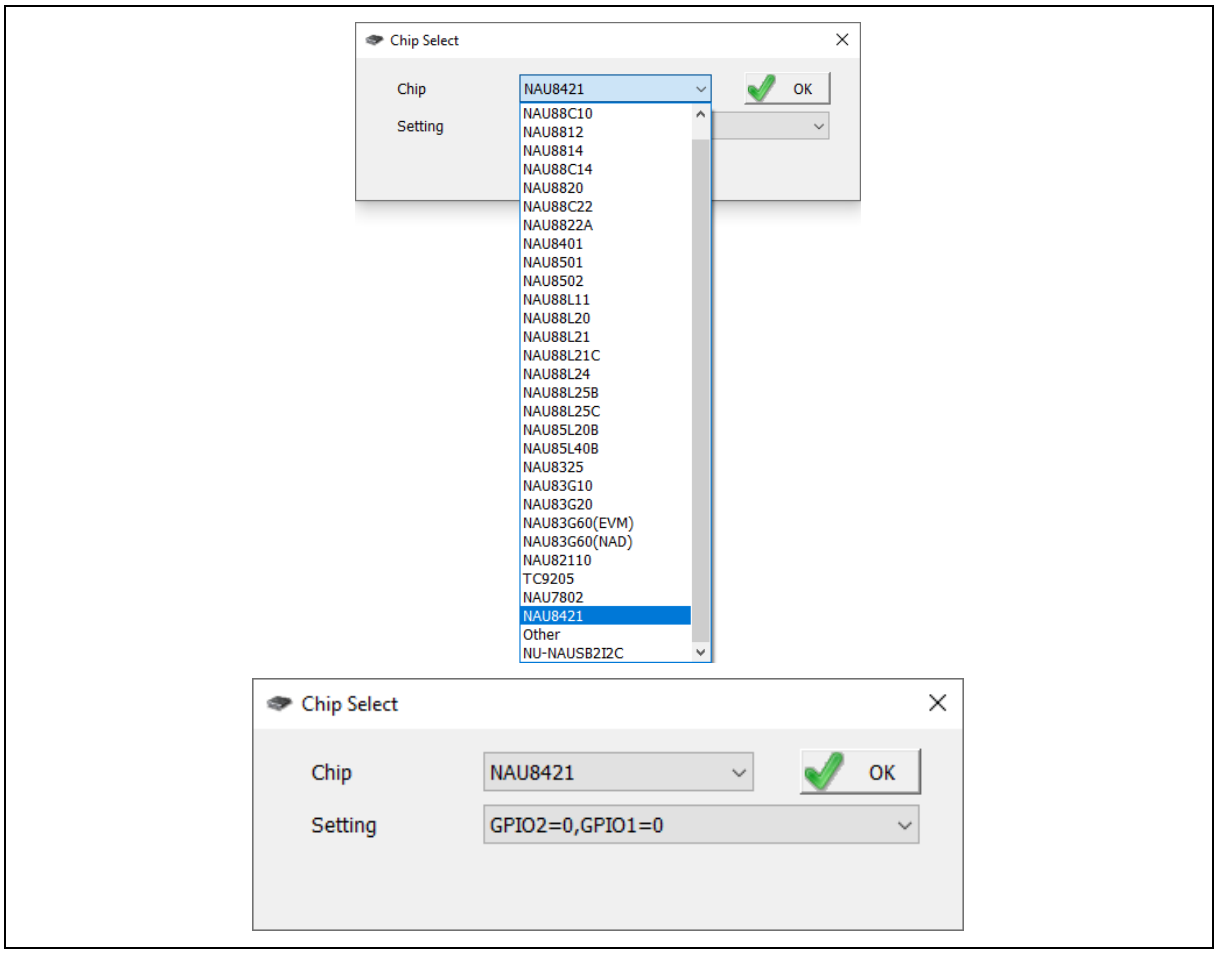

Figure 3-4 NuvotonAudioGUI Operating Step (1)

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*.

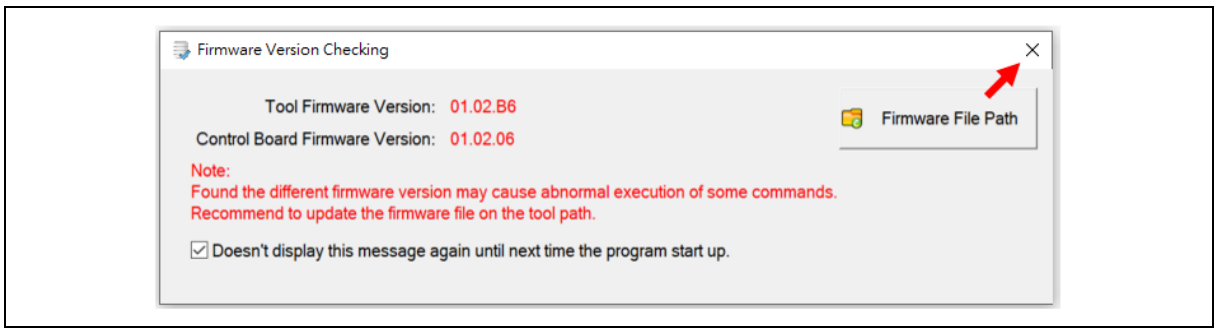

Figure 3-5 NuvotonAudioGUI Operating Step (2)

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-NAU8421.

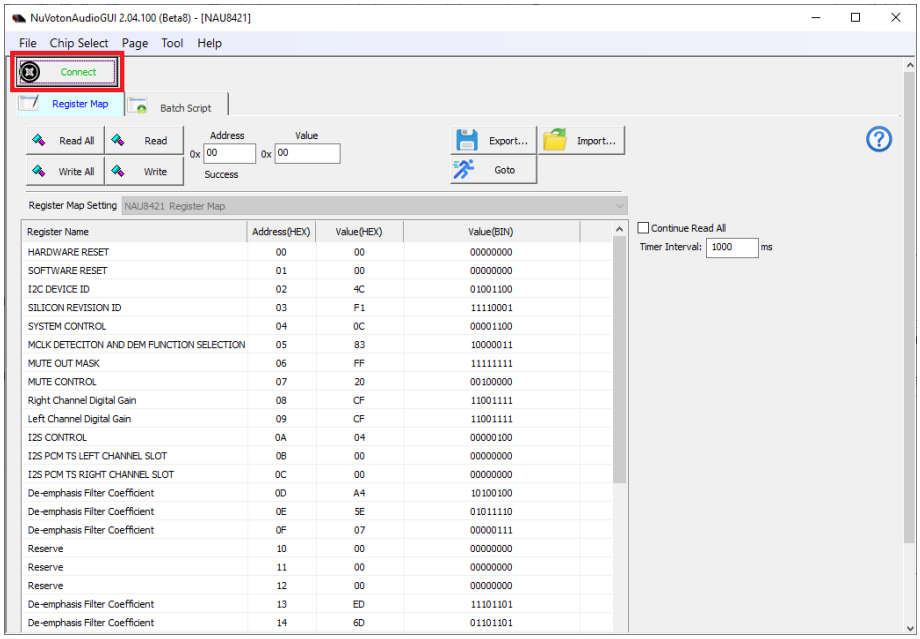

Figure 3-6 NuvotonAudioGUI Operating Step (3)

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 2.6 is executed correctly. If the problem still exists, please contact Nuvoton.

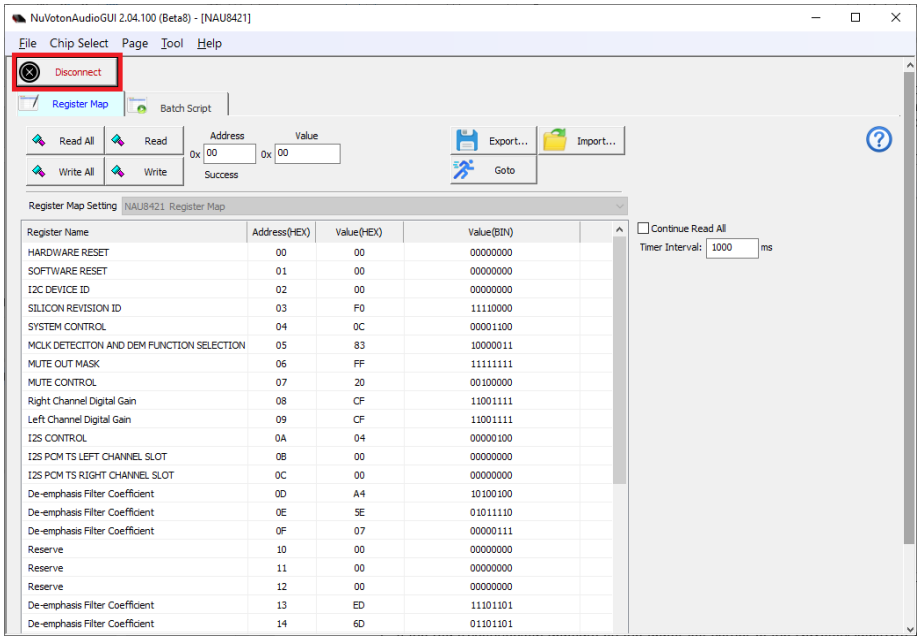

Figure 3-7 NuvotonAudioGUI Operating Step (4)

3.3 NuvotonAudioGUI Basic Page Introduction

NAU8421 function settings are divided into multiple pages in NuvotonAudioGUI. This document will take a few frequently used pages as brief introduction.

3.3.1 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 3-8. ("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 3-8. 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.

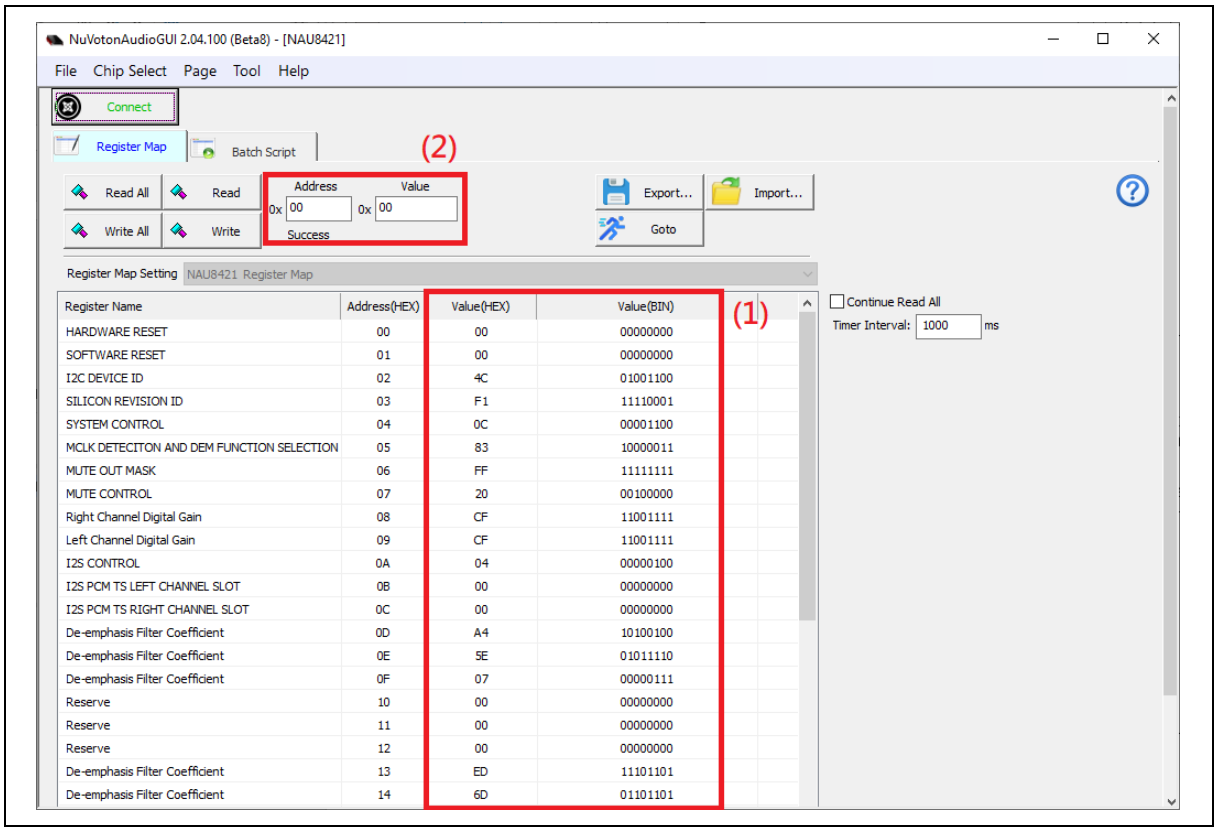

Figure 3-8 Register Map Page on NuvotonAudioGUI

3.4 I²C Mode for Demonstration

With I²C mode, users need to install NuvotonAudioGUI on PC. By leaving gain selection jumper as open, users can quickly start evaluation by the steps below. Figure 3-9 is I²C Mode Signal Path of NU-NAUSB2I2C and NL-NAU8421.

Target of NL-NAU8421 settings:

- I²C Mode
- Device Address is 0x98
- Left Channel Gain is 3dB, Right Channel Gain is 5dB,

Configuration of jumpers:

1. Set J3 jumper pin to J3.1 – J3.2
2. Short jumpers J11 and J13.
3. Set J5 jumper pin to J5.2 – J5.3
4. Set J7 jumper pin to J7.2 – J7.3.

   Leave jumpers J9 and J10 as open.
5. Connect NL-NAU8421 to NU-NAUSB2I2C, then PC to NU-NAUSB2I2C.

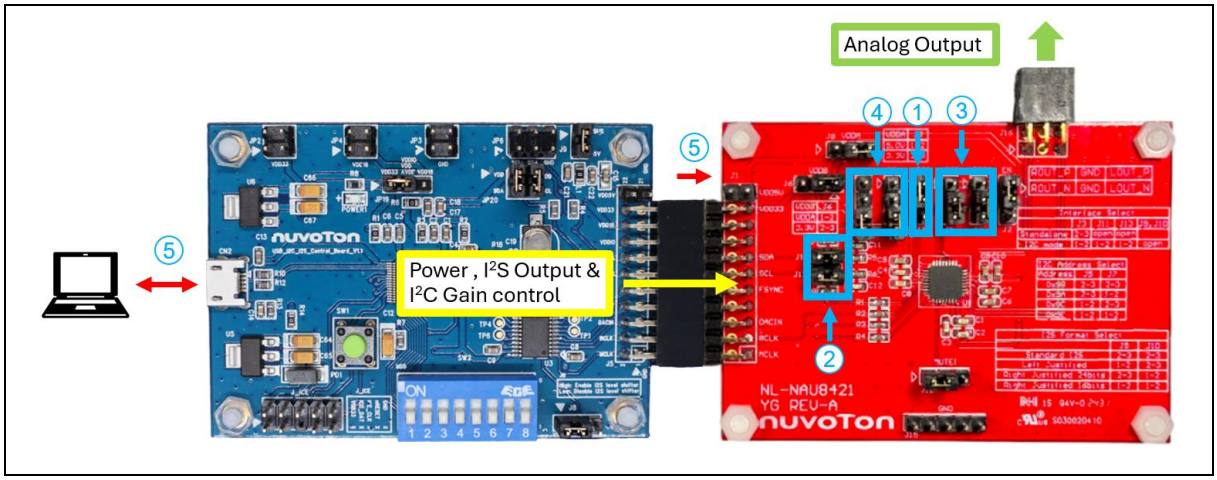

Figure 3-9 NL-NAU8421 Jumpers Setting in I²C Mode

NuvotonAudioGUI operation:

6. After confirming that NuvotonAudioGUI is correctly connected to the PC, perform settings and click [OK].
7. Adjust REG0x0008 (Right Channel Gain setting) to 0x00D9 (as 5dB) and REG0x0009 (Left Channel Gain setting) to 0x00D5 (as 3dB) in NuvotonAudioGUI.

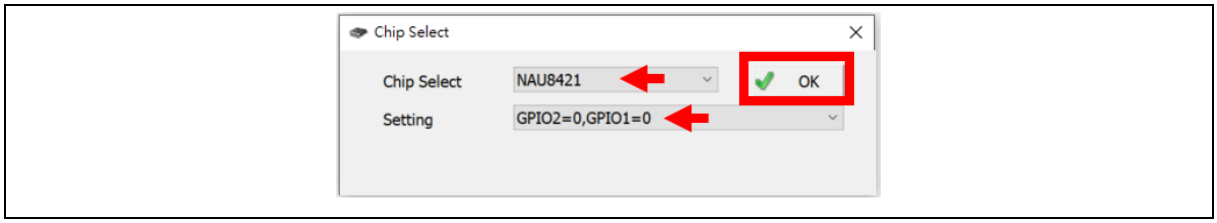

Figure 3-10 NL-NAU8421 NuvotonAudioGUI Setting in I²C Mode (1)

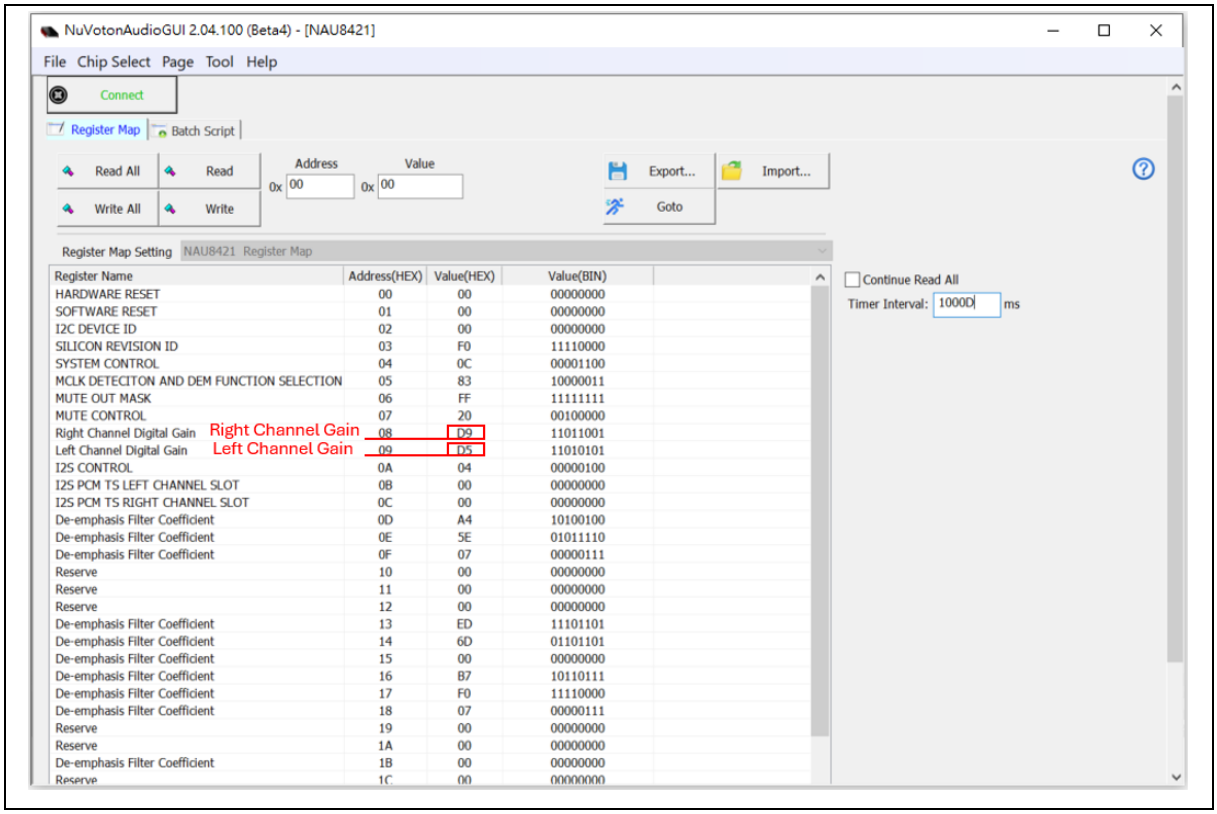

Figure 3-11 NL-NAU8421 NuvotonAudioGUI Setting in I²C Mode (2)

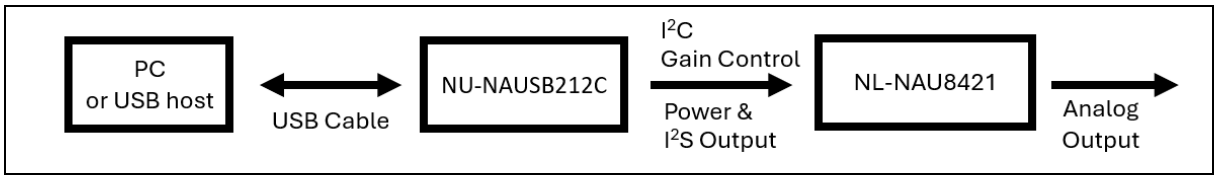

Figure 3-12 I²C Mode Signal Path of NU-NAUSB2I2C and NL-NAU8421

4 SCHEMATICS

4.1 NL-NAU8421 Schematic

Figure 4-1 shows the NL-NAU8421 circuit.

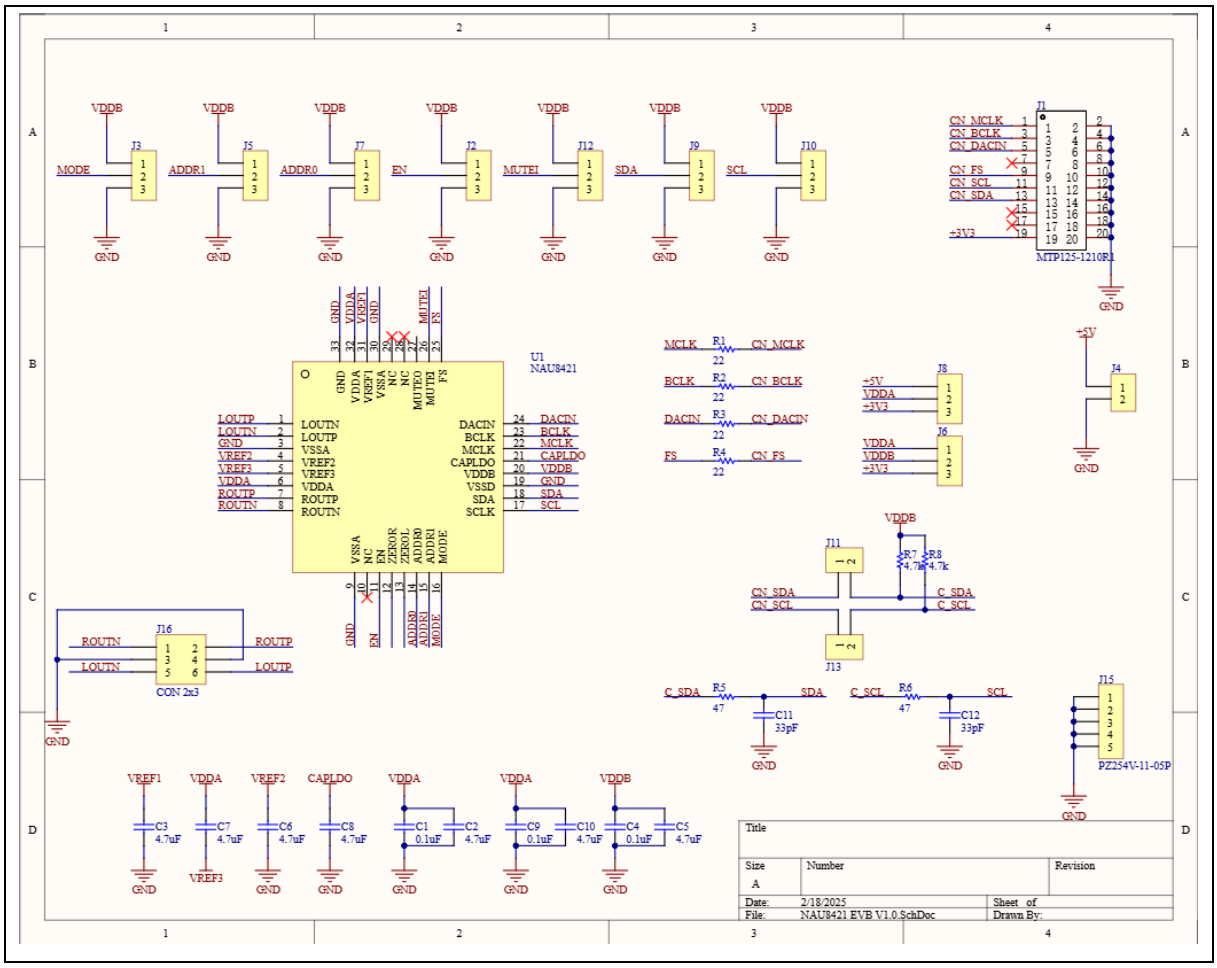

Figure 4-1 NL-NAU8421 Circuit

4.2 NL-NAU8421 PCB Layout

Figure 4-2 shows the placement of NL-NAU8421.

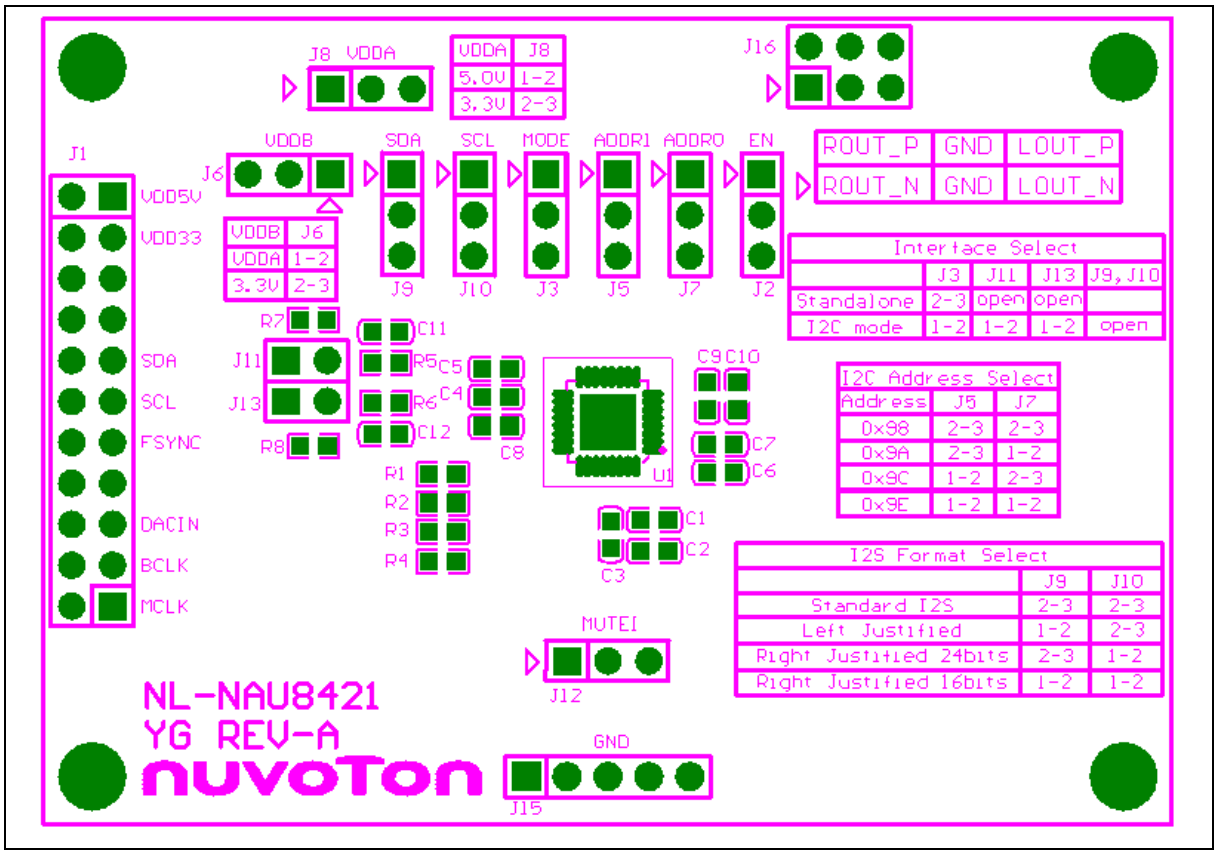

Figure 4-2 NL-NAU8421 Layout

5 REVISION HISTORY

REVISION	DATE	DESCRIPTION
1.0	Mar 3, 2025	Initial Release
1.1	Mar 17, 2025	Updated 3.1 NuvotonAudioGUI Installation

IMPORTANT NOTICE

Nuvoton Products are neither intended nor warranted for usage in systems or equipment, any malfunction or failure of which may cause loss of human life, bodily injury or severe property damage. Such applications are deemed, "Insecure Usage".

Insecure usage includes, but is not limited to: equipment for surgical implementation, atomic energy control instruments, airplane or spaceship instruments, the control or operation of dynamic, brake or safety systems designed for vehicular use, traffic signal instruments, all types of safety devices, and other applications intended to support or sustain life.

All Insecure Usage shall be made at customer's risk, and in the event that third parties lay claims to Nuvoton as a result of customer's Insecure Usage, customer shall indemnify the damages and liabilities thus incurred by Nuvoton.