NL-NAU82110

User Manual

Evaluation Board for NAU82110

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

www.nuvoton.com

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1 OVERVIEW

The NL-NAU82110 is the evaluation board for NAU82110. This board is developed for users to quickly understand the characteristics of NAU82110. For development flexibility, this board has an analog input and class-D speaker output and can setting by I²C mode or standalone mode. For development convenience, NL-NAU82110 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-NAU8211 on their PCs.

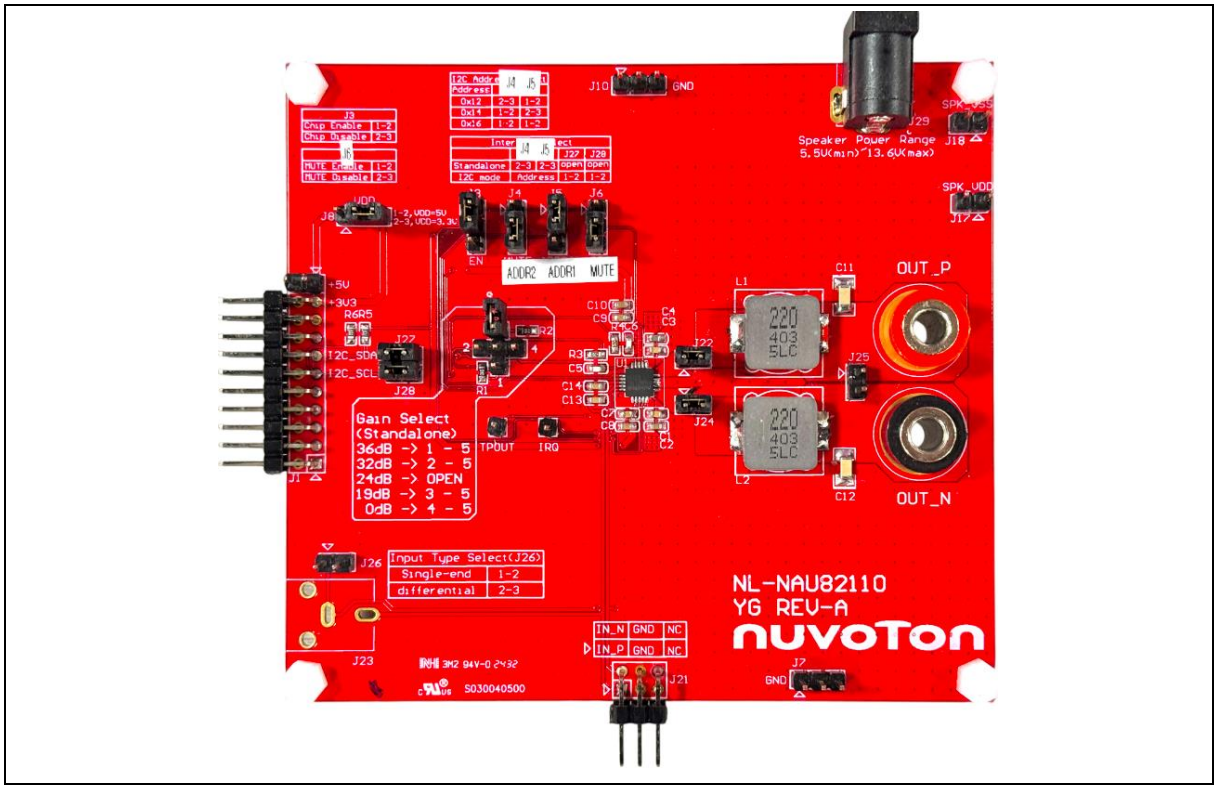


Figure 1-1 NL-NAU82110 Evaluation Board

2 HARDWARE CONFIGURATION

2.1 NL-NAU82110 Front View

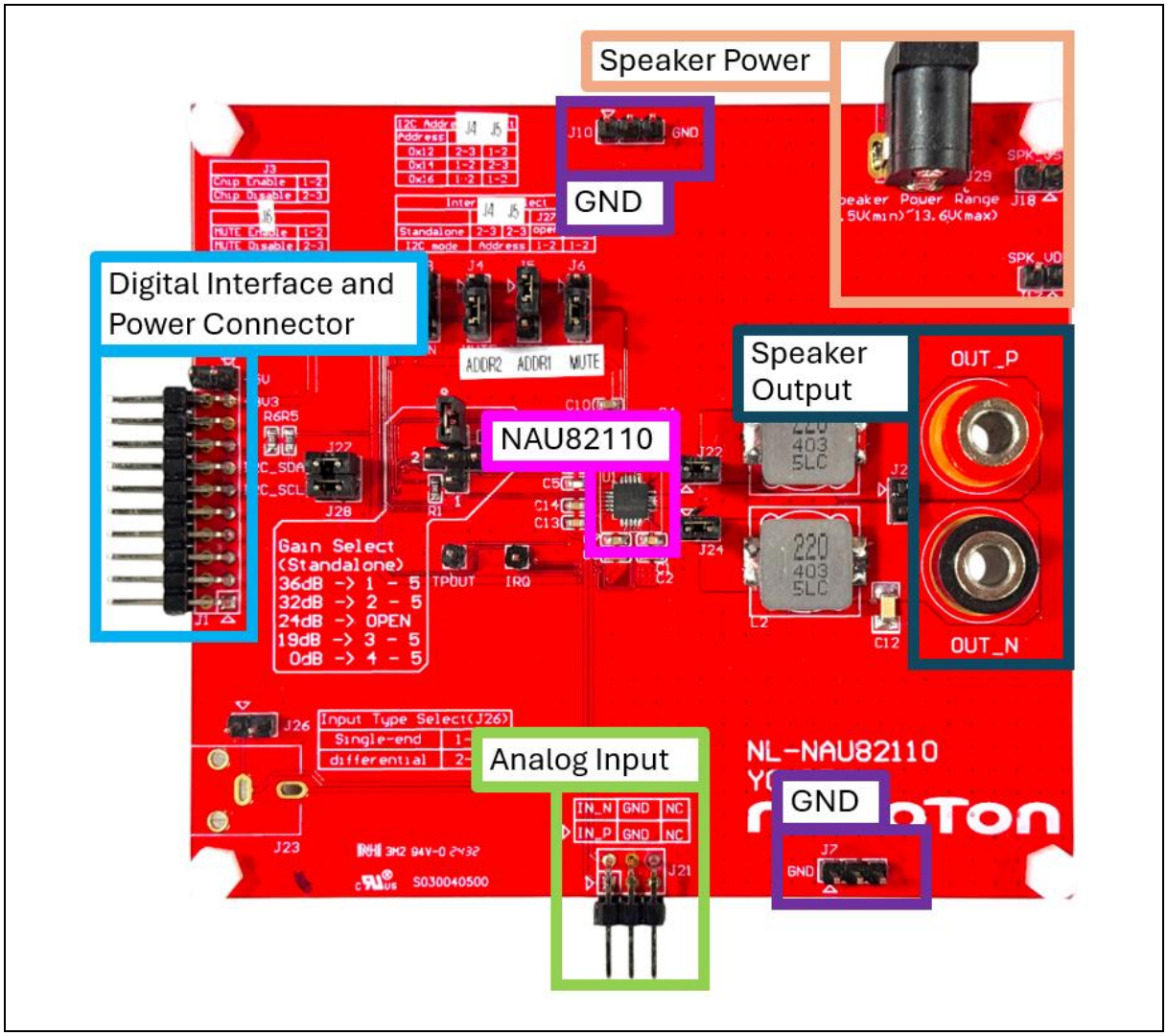


Figure 2-1 Front View of NL-NAU82110

Figure 2-1 shows the main components and connectors from the front side of NL-NAU82110 as the following list:

- Target Chip: NAU82110 (U1)
- Digital Interface and Power Extension Connector (J1)
- Analog Input (J21)
- EXT Speaker Power(J17, J18, J29)
- SPK Output Extension Connector (OUTP, OUTN)
- GND (J7, J10)

2.2 NL-NAU82110 Connectors

Table 2-1 describes the connectors on NL-NAU82110. Users can refer to Figure 2-1 at the same time.

Header		NL-NAU82110	
		Net Name in Schematic	Description
J1	J1.1	NC	None Connected
	J1.2	GND	GND
	J1.3	NC	None Connected
	J1.4	GND	GND
	J1.5	NC	None Connected
	J1.6	GND	GND
	J1.7	NC	None Connected
	J1.8	GND	GND
	J1.9	NC	None Connected
	J1.10	GND	GND
	J1.11	CN_SCL	Serial Data Clock for I^2C
	J1.12	GND	GND
	J1.13	CN_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
J2	J2.1	+5V	5V Power Supply
	J2.2	GND	GND
J29			VDDSPK Input (Jack Terminal)

Header		NL-NAU82110	
		Net Name in Schematic	Description
J7	J7.1	GND	GND
	J7.2		
	J7.3		
J10	J10.1	GND	GND
	J10.2		
	J10.3		
J17	J17.1	VDDSPK	VDDSPK Input
	J17.2		
J18	J18.1	GND	GND
	J18.2		
J20	J20.1	AMP_IRQ	Interrupt Output
J21	J21.1	IN+	Signal Positive Input
	J21.2	IN-	Signal Negative Input
	J21.3	GND	GND
	J21.4		
	J21.5	NC	None Connected
	J21.6		
J25	J25.1	OUTP	Positive speaker Output after RC Filter
	J25.2	OUTN	Negative Speaker Output after RC Filter
OUT_P		OUT_P	Positive Speaker Output after RC Filter (Banana Terminal)
OUT_N		OUT_N	Negative Speaker Output after RC Filter (Banana Terminal)
J26	J26.1	IN+	Signal Positive Input
	J26.2	GND	GND

Table 2-1 NL-NAU82110 Extension Connectors

2.3 NL-NAU82110 Jumpers

Table 2-2 describes the jumpers on NL-NAU82110. Users can refer to Figure 2-1.

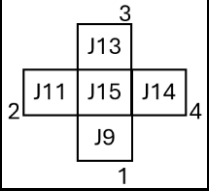
Jumper	NL-NAU82110		
	Function Description	Options	Jumper option description
J3	Enable Control	J3.1 – J3.2 (Default)	Chip Enable
		J3.2 – J3.3	Chip Disable
J4, J5	Mode and I²C Device Address Selection	J4.2 – J4.3 J5.2 – J5.3 (Default)	Operation in Standalone Mode
		J4.2 – J4.3 J5.1 – J5.2	Operation in I²C Mode, Device Address = 0x12
		J4.1 – J4.2 J5.2 – J5.3	Operation in I²C Mode, Device Address = 0x14
		J4.2 – J4.3 J5.2 – J5.3	Operation in I²C Mode, Device Address = 0x16
J6	Mute Control	J6.1 – J6.2	Chip Mute Enable
		J6.2 – J6.3 (Default)	Chip Mute Disable
J8	VDDA Selection	J8.1 – J8.2	VDDA = 5.5V
		J8.2 – J8.3 (Default)	VDDA = 3.3V
J22	Positive Speaker Output Connected to LC Filter	J22.1 – J22.2 (Default)	Connect LC Filter. OUT_P and J25.1 are Positive Speaker Output after RC Filter
		Open	Disconnect LC Filter. J22.1 is Positive Speaker Output Signal of the Chip
J24	Negative Speaker Output Connected to LC Filter	J24.1 – J24.2 (Default)	Connect LC Filter. OUT_P and J25.2 are Negative Speaker Output after RC Filter
		OPEN	Disconnect LC Filter. J24.1 is Negative Speaker Output Signal of the Chip
J27	I²C Dada Control	J27.1 – J27.2 (Default)	The I²C Data Signal can be Provided by J1.11
		Open	The I²C Data Signal can't be Provided by J1.11
J28	I²C Clock Control	J28.1 – J28.2 (Default)	The I²C Clock Signal can be Provided by J1.11
		Open	The I²C Clock Signal can't be Provided by J1.11
J9, J11, J13, J14, J15	Gain Selection in Standalone Mode	J9 – J15	Gain 36 dB
		J11 – J15	Gain 32 dB
		Open	Gain 24 dB
		J13 – J15 (Default)	Gain 19 dB
		J14 – J15	Gain 0 dB

Table 2-2 NL-NAU82110 Jumpers

2.4 NL-NAU82110 Mode Selection

NL-NAU82110 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
J4, J5	J4 = 2 - 3 J5 = 2 - 3
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-NAU82110 Standalone Mode

Jumper	Description
J4, J5	Device Address Selection Address = 0x12: J4 = 2 - 3 J5 = 1 - 2 Address = 0x14: J4 = 1 - 2 J5 = 2 - 3 Address = 0x16: J4 = 1 - 2 J5 = 1 - 2
J27	Short
J28	Short
Gain Selection	Open

Table 2-4 NL-NAU82110 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-NAU82110 and perform basic operations on the I²C mode of NL-NAU82110 in conjunction with the content of this document. For more details of NU-NAUSB2I2C, please refer to *NU-NAUSB2I2C User Manual*.

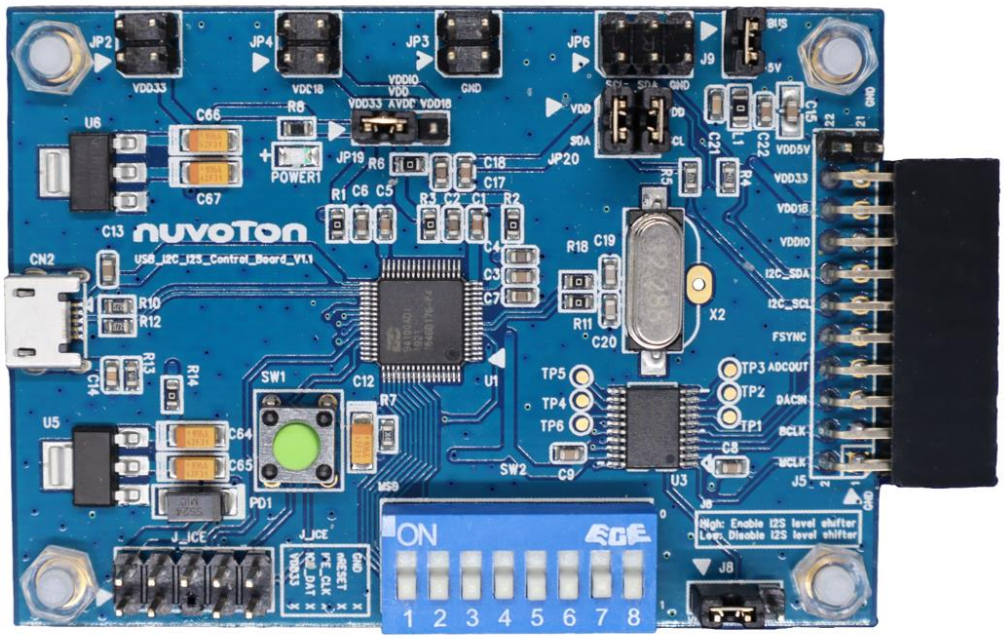


Figure 2-2 NU-NAUSB2I2C

2.6 Hardware Check and Connection

Before using NuvotonAudioGUI and operating I²C mode, 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.

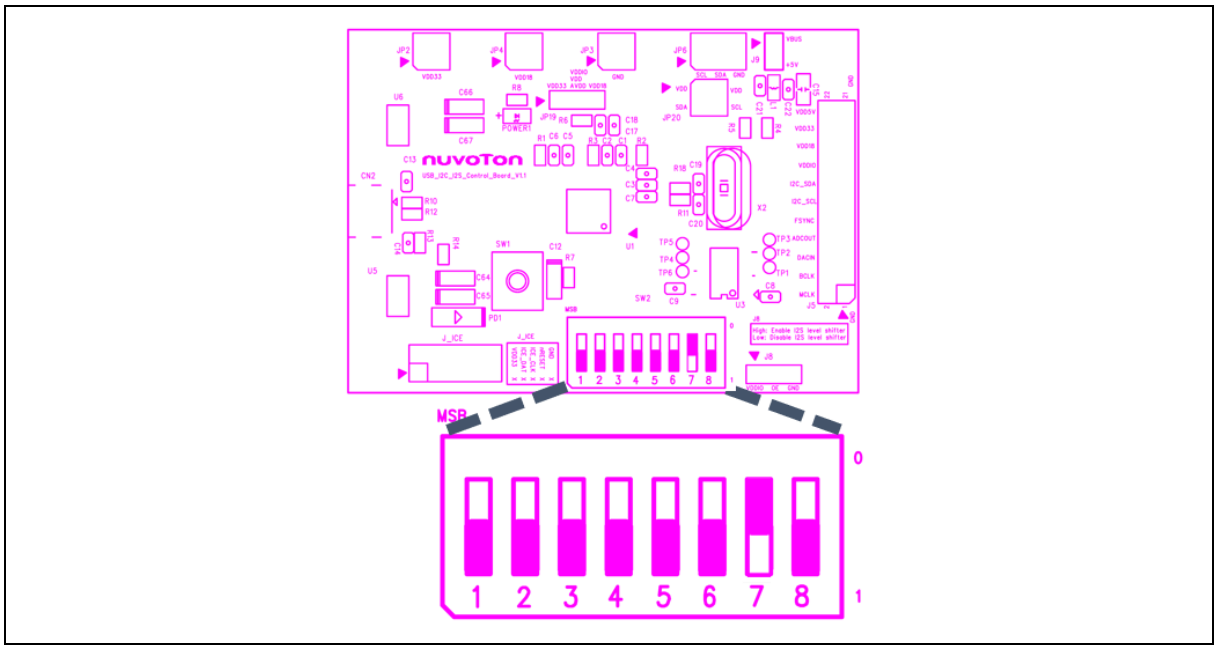


Figure 2-3 PIN Status of NU-NAUSB2I2C SW2

2. Connect J5 of NU-NAUSB2I2C to J1 of NL-NAU82110. Figure 2-4 is the diagram after two boards are connected to each other.

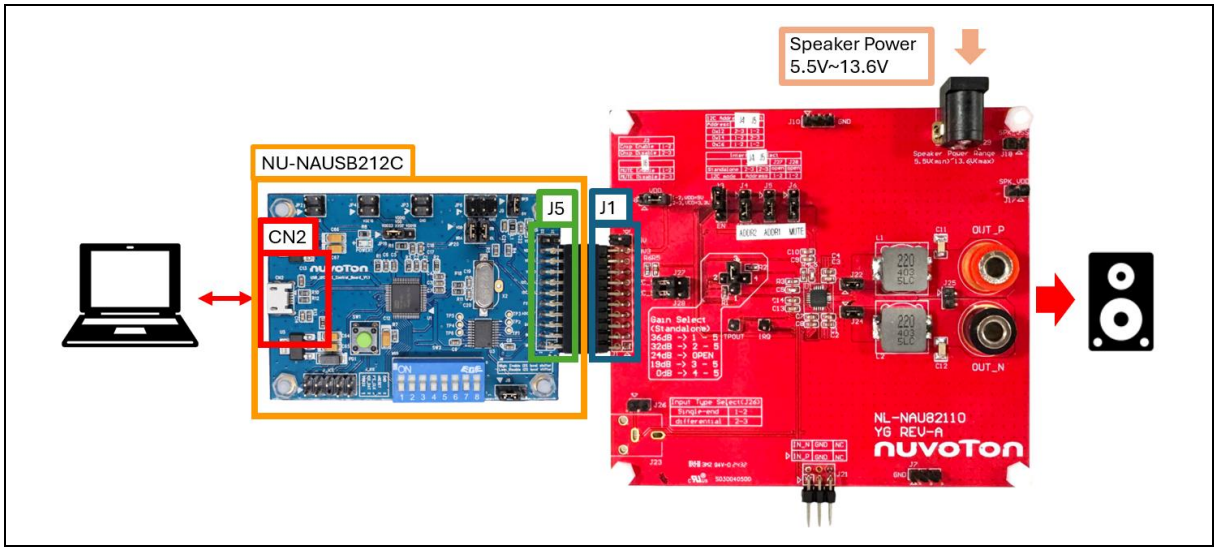


Figure 2-4 NU-NAUSB2I2C Connection

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-NAU82110

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 current playback device.

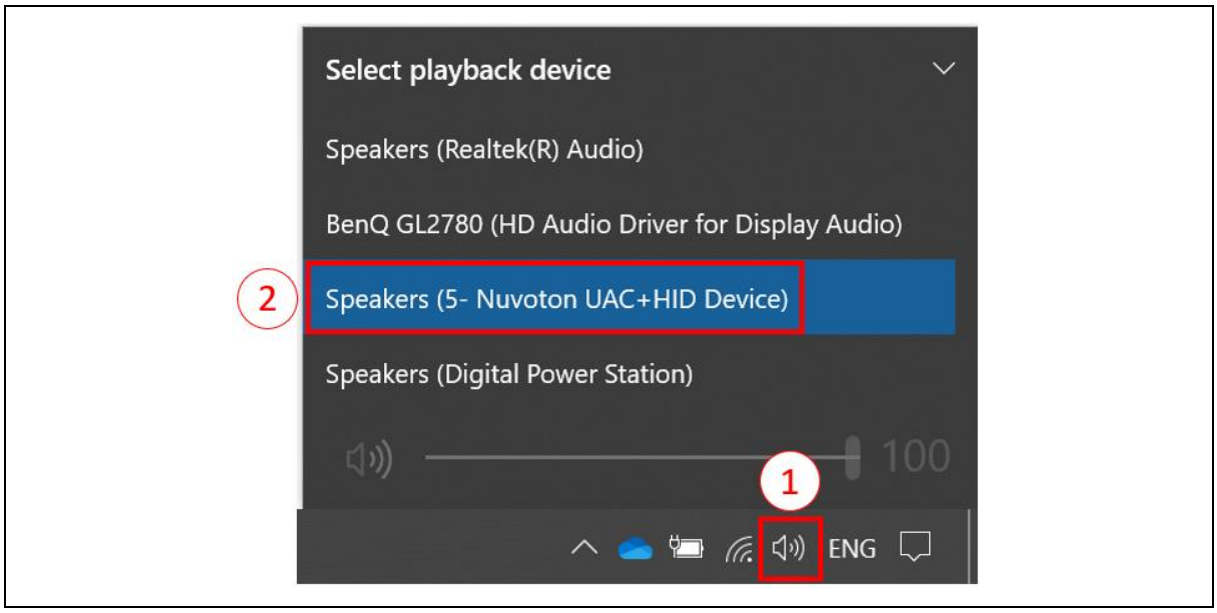


Figure 2-6 PC Audio Device Setting

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-NAU82110.

Target of NL-NAU82110 settings:

- Standalone Mode
- Gain 19dB

Configuration of jumpers:

1. Leave the jumpers J27 and J28 as open.
2. Set gain selection pin to 3 – 5.
3. Set J4 jumper pin to J4.2 – J4.3.
   Set J5 jumper pin to J5.2 – J5.3.
4. Connect NL-NAU82110 to NU-NAUSB2I2C, then PC to NU-NAUSB2I2C. (only for power)
5. Connect analog input to NL-NAU82110.
6. Connect NL-NAU82110 to speaker.
7. Connect speaker power (5.5V~13.6V) to DC jack.

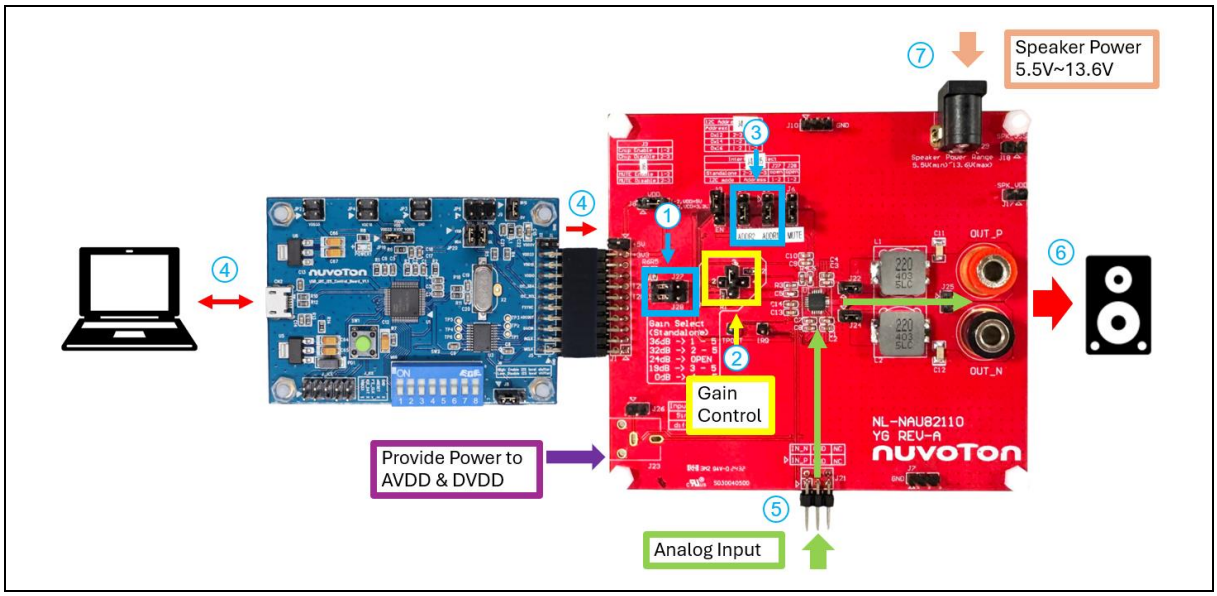


Figure 2-7 NL-NAU82110 Jumpers Setting in Standalone Mode

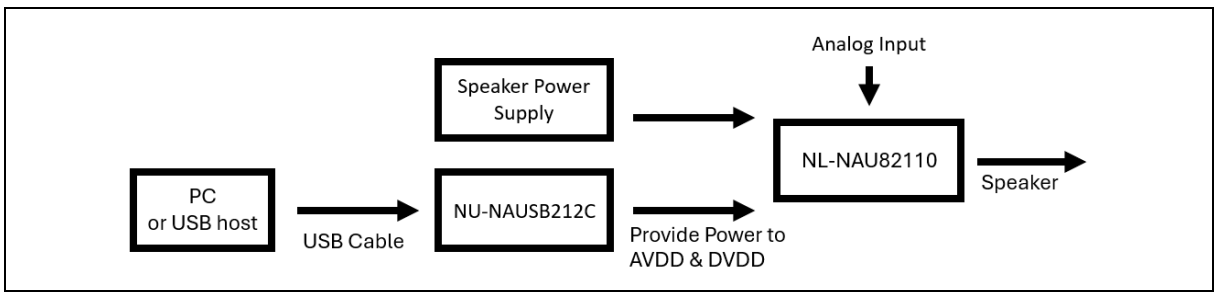


Figure 2-8 Standalone Mode Signal Path of NU-NAUSB2I2C and NL-NAU82110

3 SOFTWARE CONFIGURATION

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

Evaluation of NL-NAU82110 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/

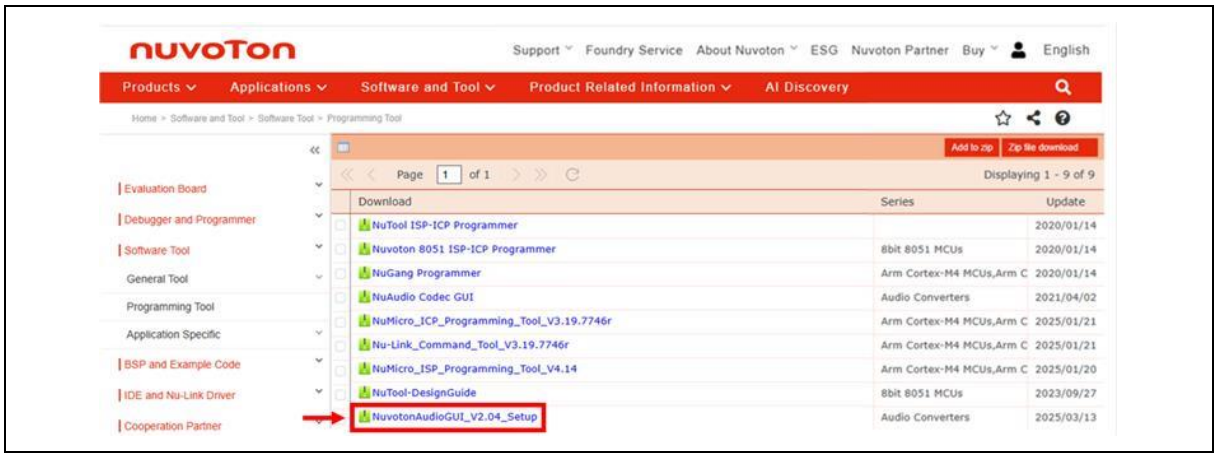


Figure 3-1 NuvotonAudioGUI Installation Step (1)

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

Figure 3-2 NuvotonAudioGUI Installation Step (2)

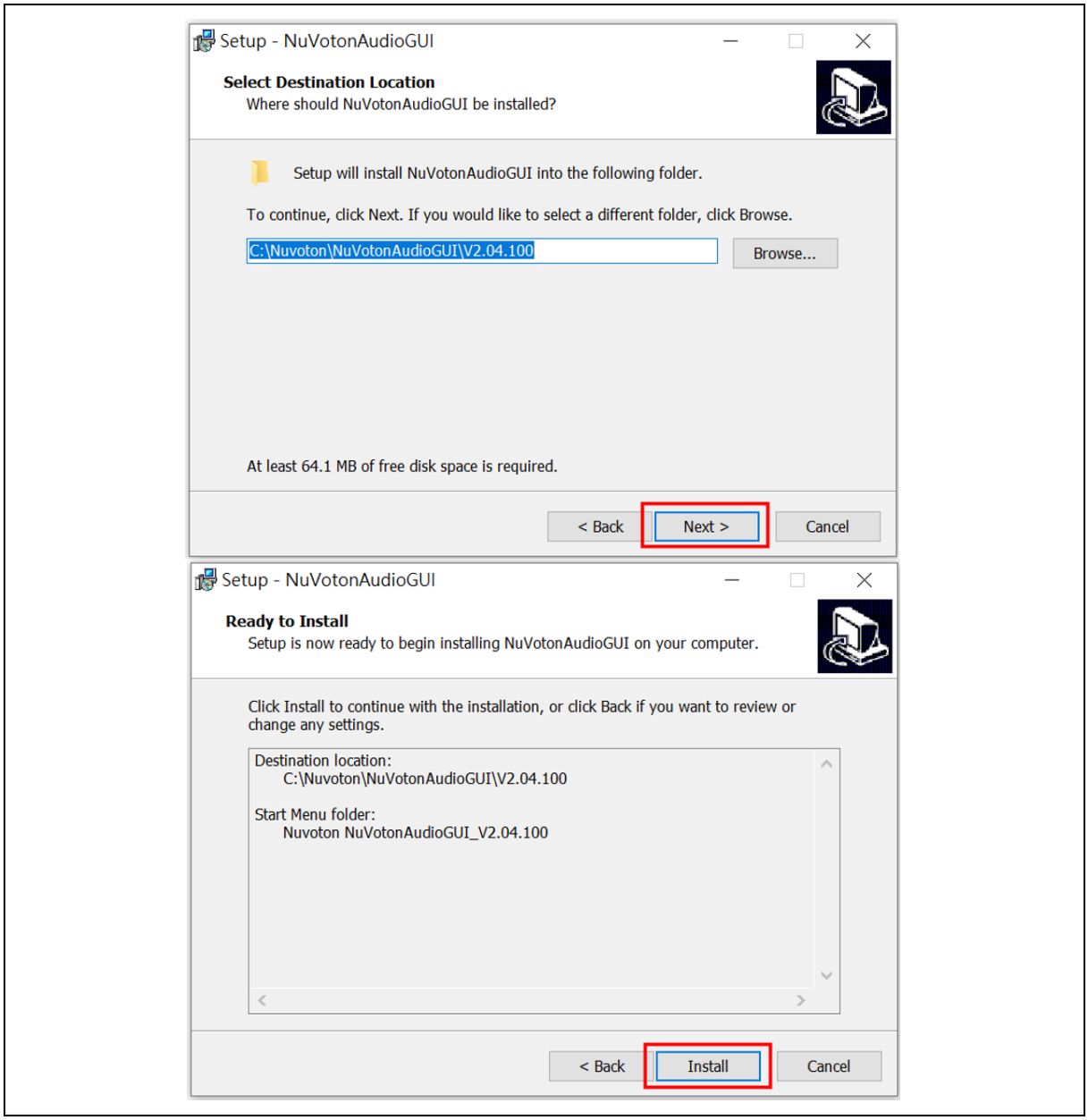


Figure 3-3 NuvotonAudioGUI Installation Step (3)

3.2 NuvotonAudioGUI Operating Instructions

1. Open NuvotonAudioGUI, choose the corresponding IC Part Number, address setting of I²C(check by J5, J6), and click [OK], as shown in Figure 3-4.

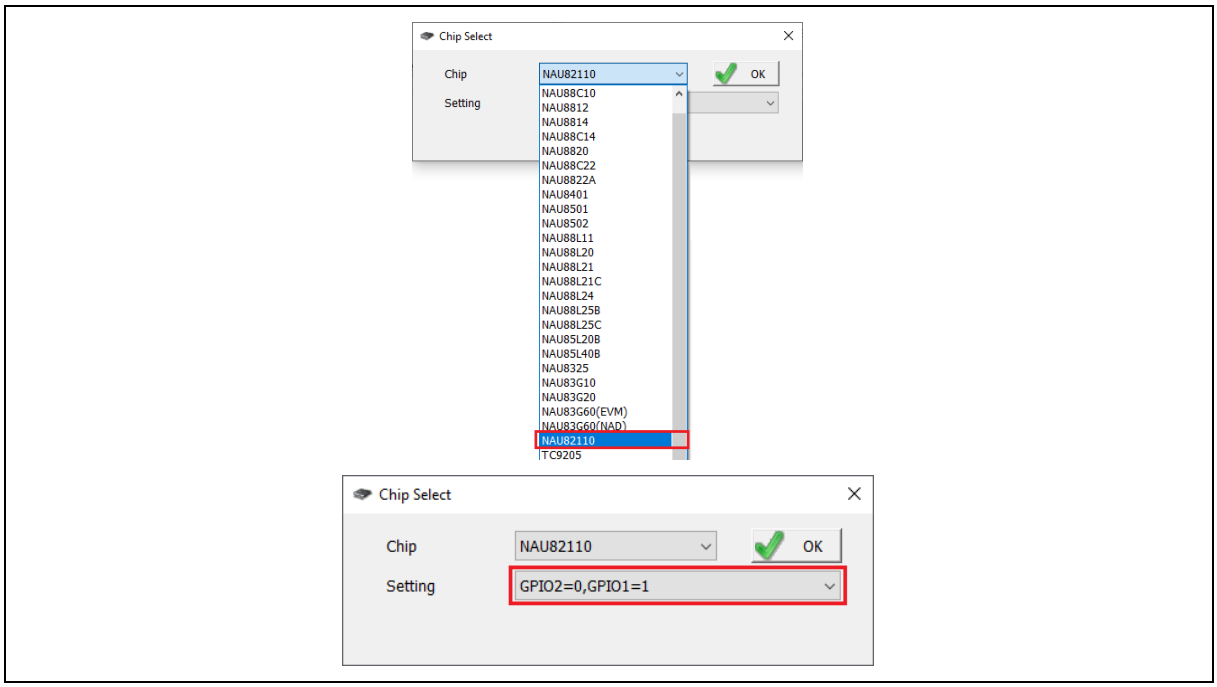


Figure 3-4 NuvotonAudioGUI Operating Step (1)

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*.

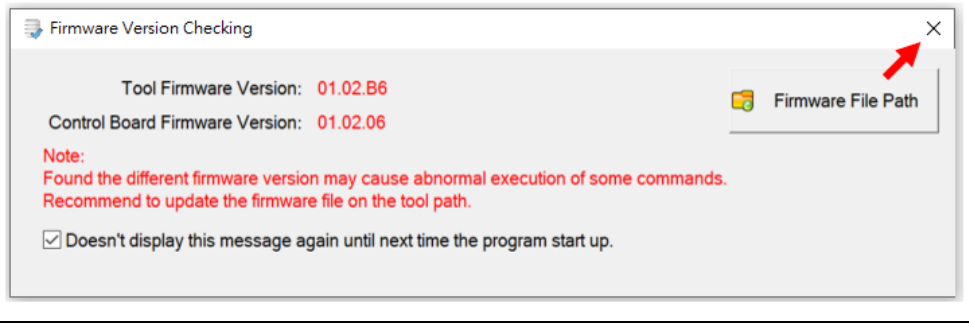


Figure 3-5 NuvotonAudioGUI Operating Step (2)

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-NAU82110.

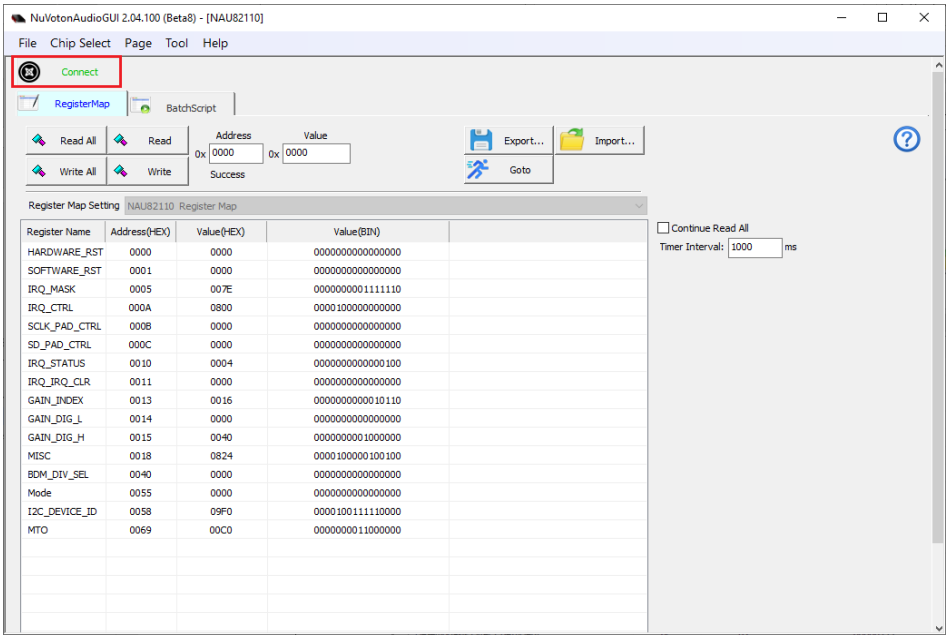


Figure 3-6 NuvotonAudioGUI Operating Step (3)

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.

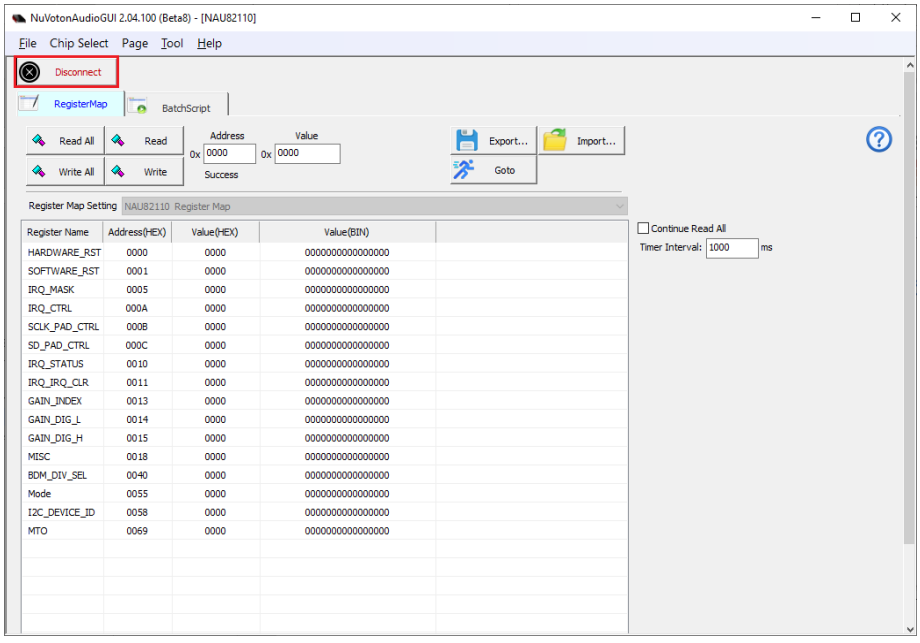


Figure 3-7 NuvotonAudioGUI Operating Step (4)

3.3 NuvotonAudioGUI Basic Page Introduction

NAU82110 function settings are divided into multiple pages in NuvotonAudioGUI. This document will take a few frequent-use pages as brief introduction.

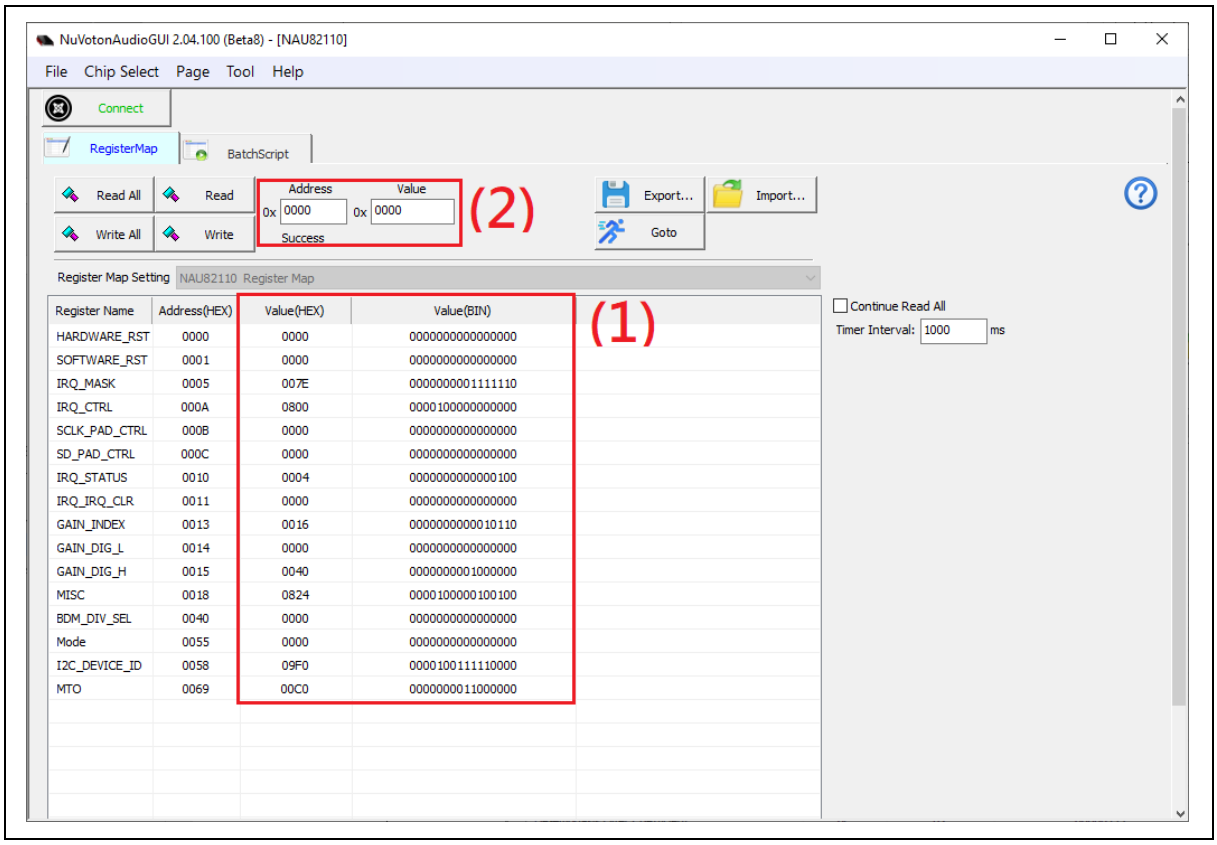
3.3.1 Register Map

The Register map page of NAU82110 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.



Register Name	Address(HEX)	Value(HEX)	Value(BIN)
HARDWARE_RST	0000	0000	0000000000000000
SOFTWARE_RST	0001	0000	0000000000000000
IRQ_MASK	0005	007E	0000000001111110
IRQ_CTRL	000A	0800	0000100000000000
SCLK_PAD_CTRL	000B	0000	0000000000000000
SD_PAD_CTRL	000C	0000	0000000000000000
IRQ_STATUS	0010	0004	0000000000000100
IRQ_IRQ_CLR	0011	0000	0000000000000000
GAIN_INDEX	0013	0016	0000000000010110
GAIN_DIG_L	0014	0000	0000000000000000
GAIN_DIG_H	0015	0040	0000000001000000
MISC	0018	0824	0000100000100100
BDM_DIV_SEL	0040	0000	0000000000000000
Mode	0055	0000	0000000000000000
I2C_DEVICE_ID	0058	09F0	0000100111110000
MTO	0069	00C0	0000000011000000

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-NAU82110.

Target of NL-NAU82110 settings:

- I²C Mode
- Device Address 0x14
- Gain 12dB

Configuration of jumpers:

1. Short the jumpers J27 and J28.
2. Leave gain selection pin as open.
3. Set J4 jumper pin to J4.1 – J4.2.

   Set J5 jumper pin to J5.2 – J5.3.
4. Connect NL-NAU82110 to NU-NAUSB2I2C, then PC to NU-NAUSB2I2C.
5. Connect analog input to NL-NAU82110.
6. Connect NL-NAU82110 to speaker.
7. Connect speaker power (5.5V~13.6V) to DC jack.

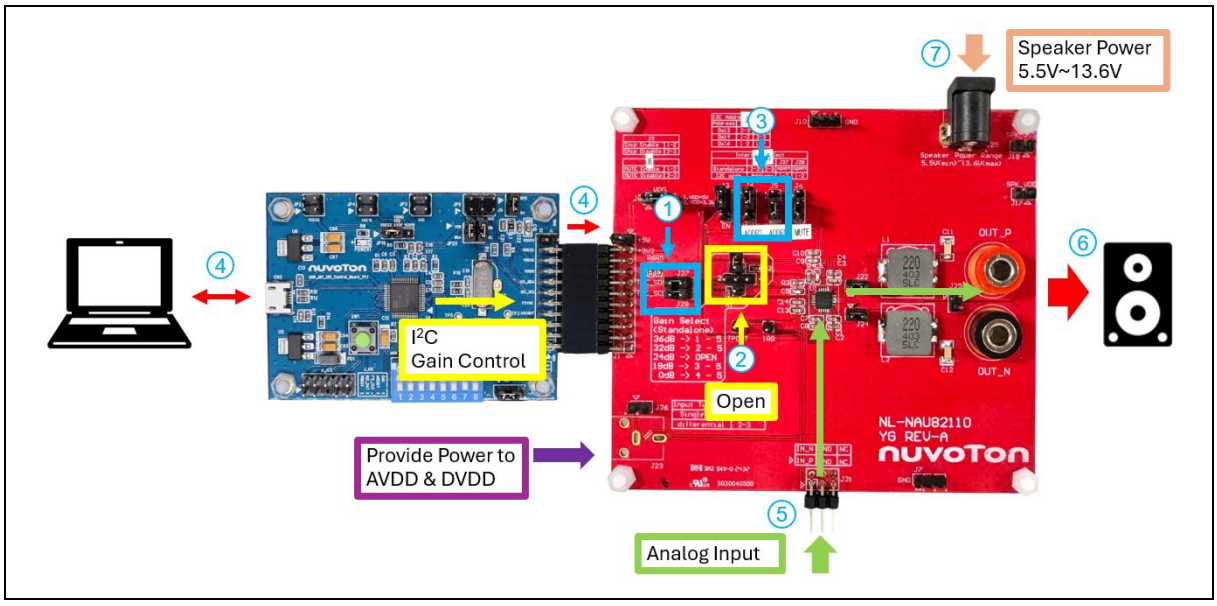


Figure 3-9 NL-NAU82110 Jumpers Setting in I²C Mode

NuvotonAudioGUI operation:

8. After confirming that NuvotonAudioGUI is correctly connected to the PC, perform settings and click [OK].
9. Adjust REG0x0013 (Gain setting) to value 0x0019 (as 12dB) in NuvotonAudioGUI.

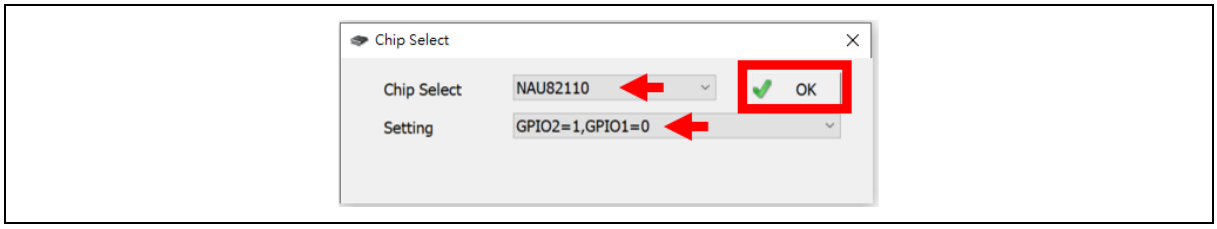


Figure 3-10 NL-NAU82110 NuvotonAudioGUI Setting in I²C Mode (1)

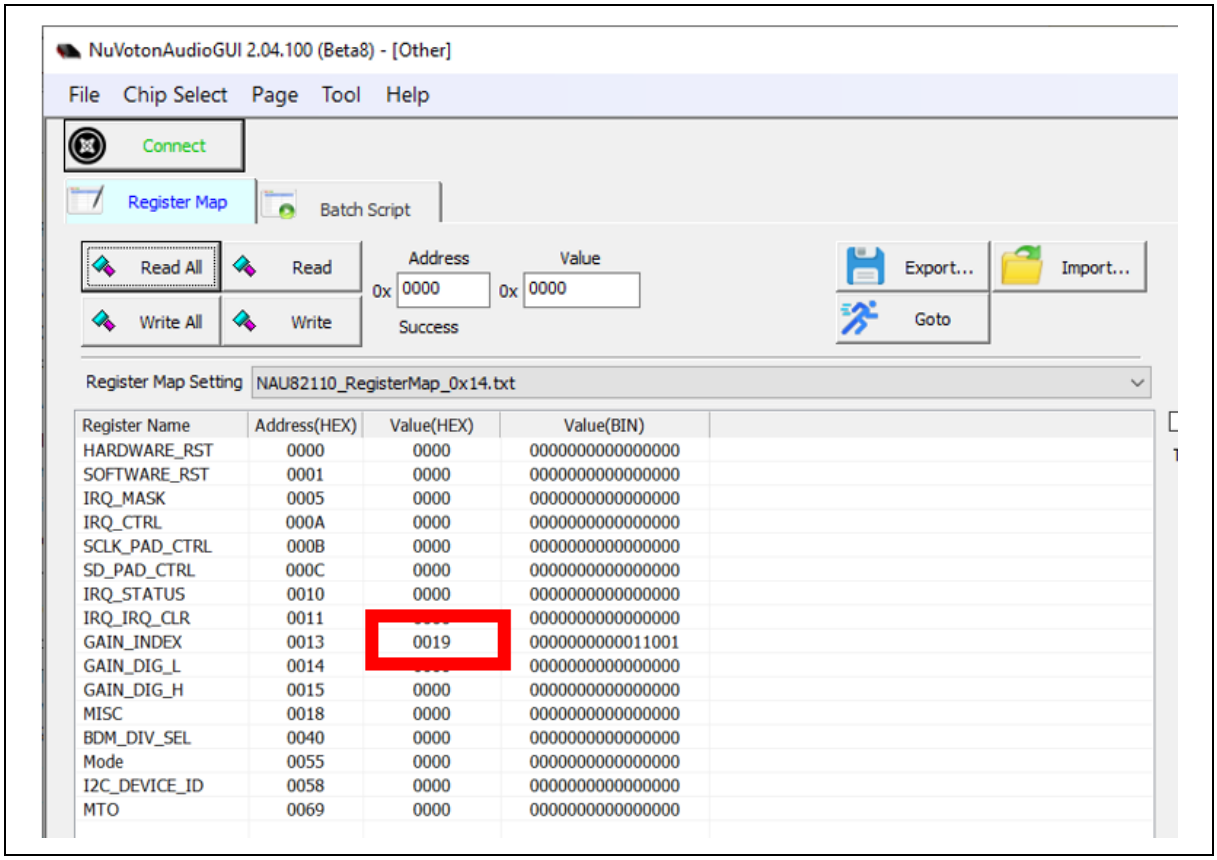


Figure 3-11 NL-NAU82110 NuvotonAudioGUI Setting in I²C Mode (2)

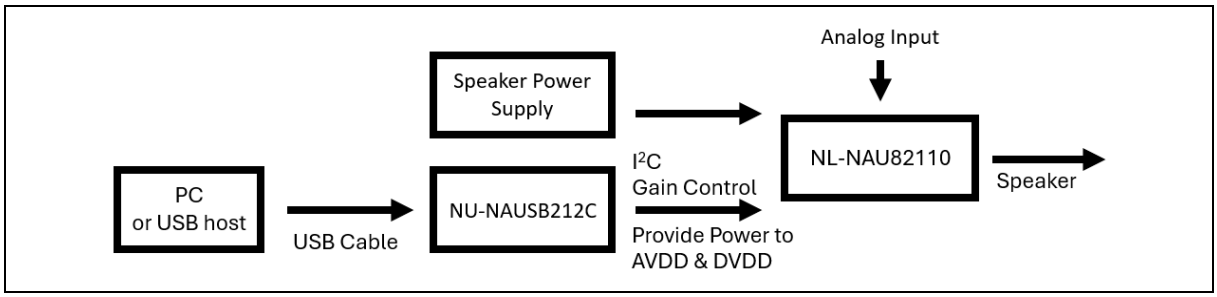


Figure 3-12 I²C Mode Signal Path of NU-NAUSB2I2C and NL-NAU82110

4 SCHEMATICS

4.1 NL-NAU82110 Schematic

Figure 4-1 shows the NL-NAU82110 circuit.

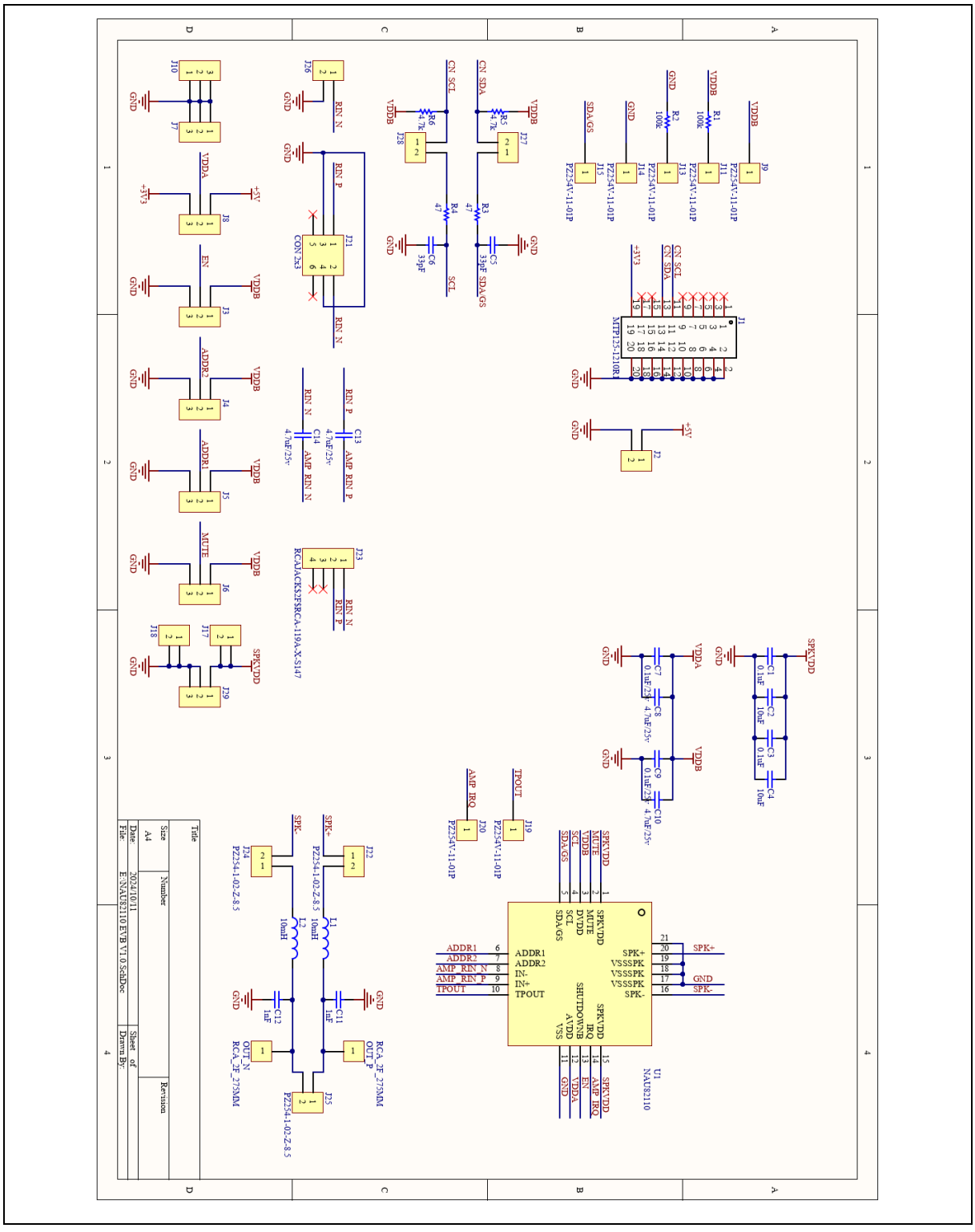


Figure 4-1 NL-NAU82110 Circuit

4.2 NL-NAU82110 PCB Layout

Figure 4-2 shows the placement of NL-NAU82110.

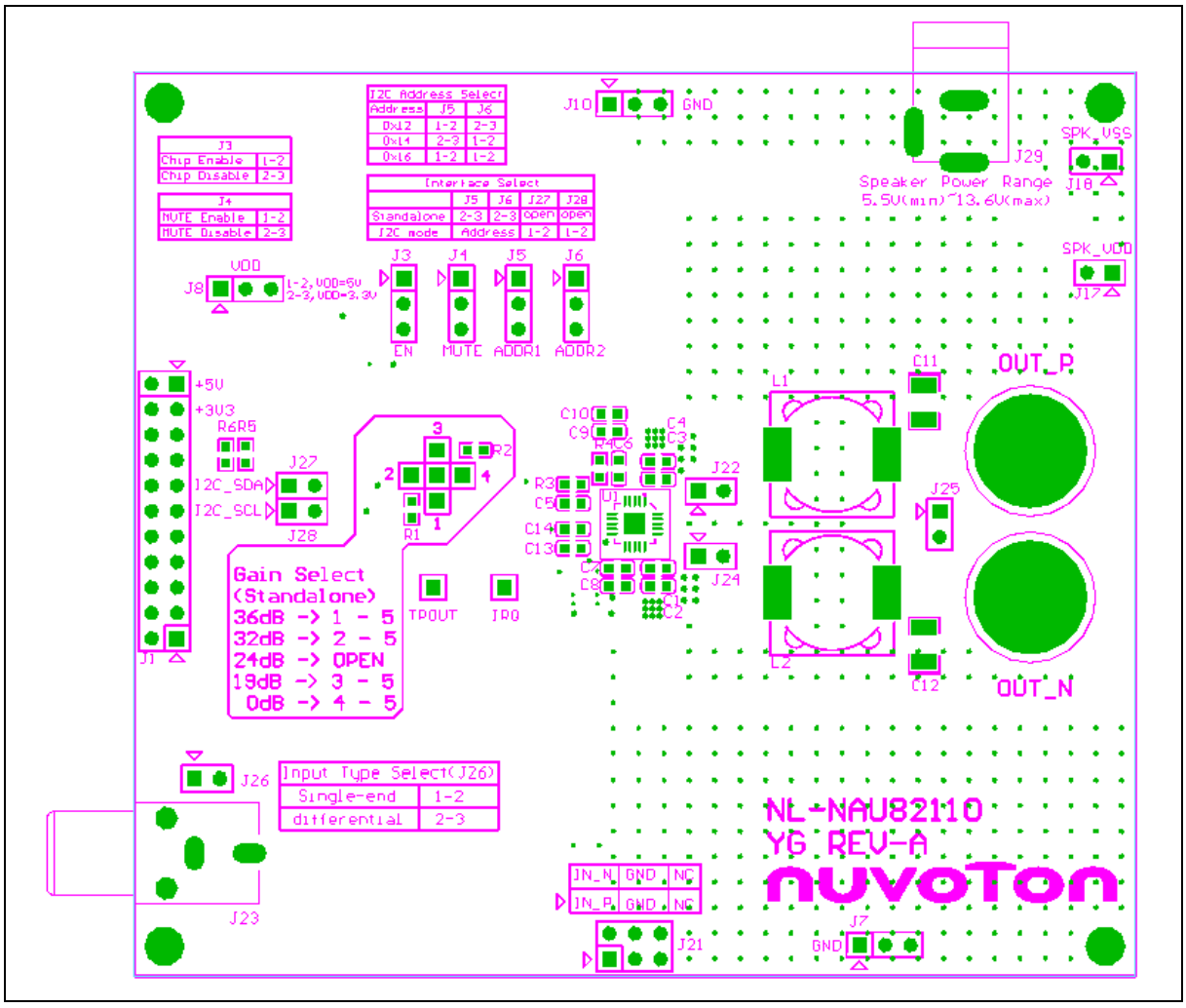


Figure 4-2 NL-NAU82110 Layout

5 REVISION HISTORY

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

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