NL-NAU85L42

User Manual

Evaluation Board for NAU85L42

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1 OVERVIEW

The NL-NAU85L42 is the evaluation board for NAU85L42. This board is developed for users to quickly understand the characteristics of NAU85L42. For development flexibility, this board has a built-in microphone input, additional expansion connectors and digital interface. Nuvoton has also developed a USB control board, NU-NAUSB212C, which provides I2C control interface and digital audio interface signals. Along with the software NuvotonAudioGUI, users can quickly set up and use NL-NAU85L42 on their PCs.

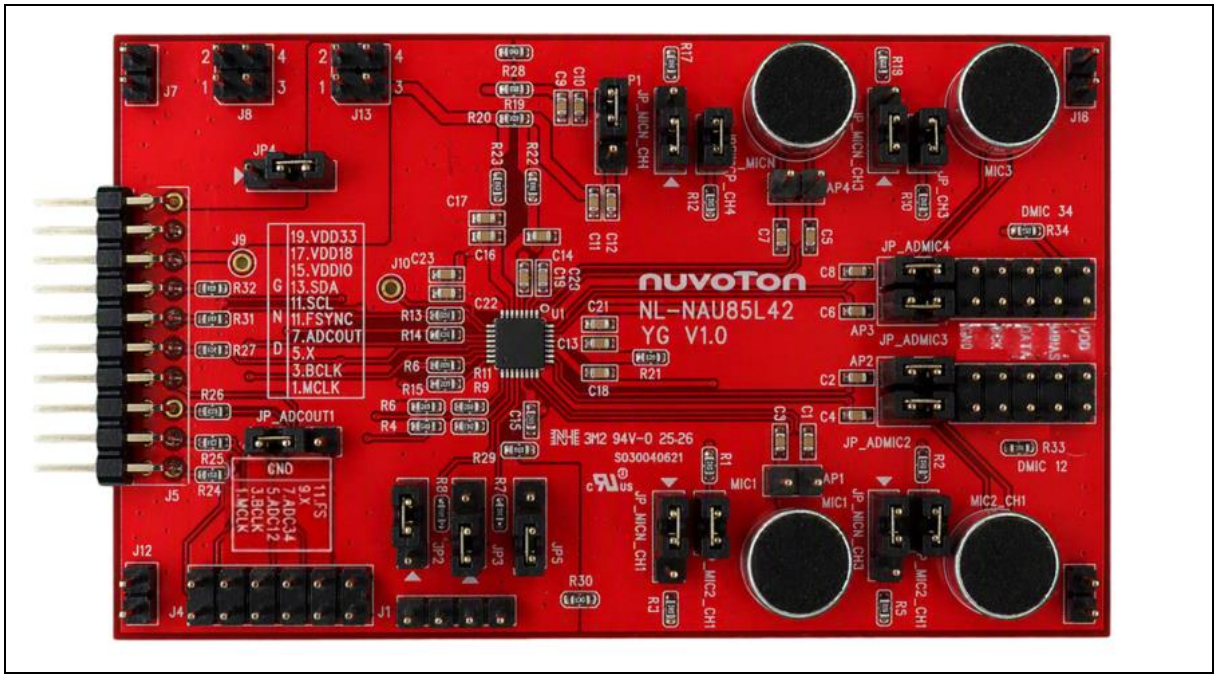


Figure 1-1 NL-NAU85L42 Evaluation Board

2 HARDWARE CONFIGURATION

2.1 NL-NAU85L42 Front View

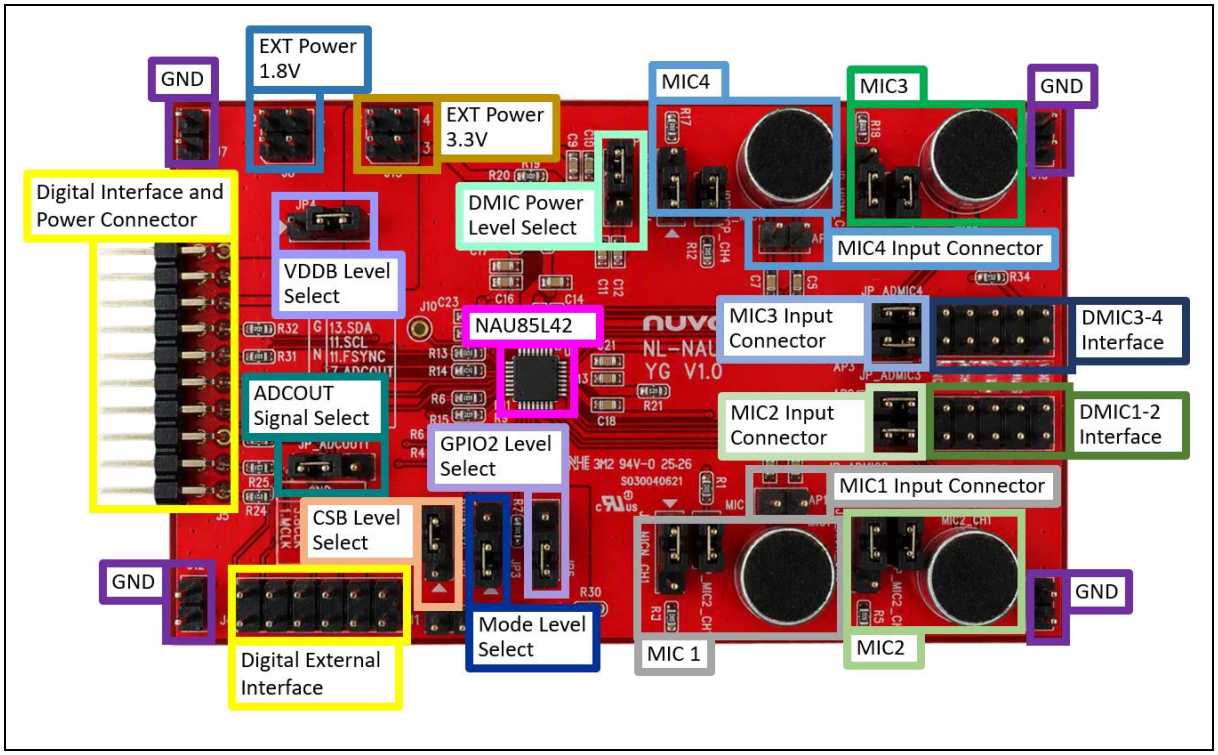


Figure 2-1 Front View of NL-NAU85L42

Figure 2-1 shows the main components and connectors from the front side of NL-NAU85L42 as the following list:

- Target Chip: NAU85L42 (U1)
- Analog Microphone (MIC1, MIC2, MIC3, MIC4)
- Microphone Input Connects
- DMIC Interface (J2, J3)
- Digital Interface and Power Extension Connector (P2)
- 3.3V EXT Power (J8)
- 1.8V EXT Power (J13)
- GND (J6, J7, J11, J12)
- VDDB Level Select (JP4)
- CSB Level Select (JP2)
- ADC Data OUT Select (JP_ADCOUT1)
- DMIC Power Level Select (JP1)

2.2 NL-NAU85L42 Connectors

Table 2-1 describes the connectors on NL-NAU85L42. Users can refer to Figure 2-1.

Header		NL-NAU85L42	
		Net Name in Schematic	Description
J5	J5.1	MCLKI	External Master Clock Source Input
	J5.2	GND	GND
	J5.3	BCLK	Serial Data Bit Clock Input / Output for I^{2}S / PCM Data
	J5.4	GND	GND
	J5.5		
	J5.6	GND	GND
	J5.7	ADCOUT	Serial Audio Data Output for I^{2}S / PCM Data
	J5.8	GND	GND
	J5.9	FS	Frame Sync Input / Output for I^{2}S / PCM Data
	J5.10	GND	GND
	J5.11	SCL	Serial Data Clock for I^{2}C
	J5.12	GND	GND
	J5.13	SDA	Serial Data for I^{2}C
	J5.14	GND	GND
	J5.15	VDDB	VDDB
	J5.16	GND	GND
	J5.17	VDD18	1.8V Power Supply
	J5.18	GND	GND
	J5.19	VDD33	3.3V Power Supply
	J5.20	GND	GND
JMIC1	JMIC1.1		MIC Positive Input 1
	JMIC1.2		MIC Negative Input 1

Header		NL-NAU85L42	
		Net Name in Schematic	Description
JP_ADMIC1	JP_ADMIC1.2		MIC2 Positive Input
JP_ADMIC2	JP_ADMIC2.2		MIC2 Negative Input
JP_ADMIC3	JP_ADMIC3.2		MIC3 Positive Input
JP_ADMIC4	JP_ADMIC4.2		MIC3 Negative Input
JMIC4	JMIC2.1		MIC4 Positive Input
	JMIC2.2		MIC4 Negative Input
J8	J8.1	VDD33	1.8V Power Supply
	J8.2		
	J8.3		
	J8.4		
J13	J13.1	VDD18	3.3V Power Supply
	J13.2		
	J13.3		
	J13.4		
J1	J1.1	SDA	3-Wire MPU Data Input / 2-Wire MPU Data I/O
	J1.2	SCL	3-Wire MPU Clock Input / 2-Wire MPU Clock Input
	J1.3	SDO	3-Wire MPU Data Input / 2-Wire MPU Data I/O
	J1.4	CSB	3-Wire MPU Chip Select/I2C address LSB
J6	J6.1	AGND	AGND
	J6.2		
J11	J11.1	AGND	AGND
	J11.2		
J7	J7.1	GND	GND
	J7.2		

Header		NL-NAU85L42	
		Net Name in Schematic	Description
J12	J12.1	GND	GND
	J12.2		
J2	J2.1	VDD_DMIC	Providing Power to DMIC
	J2.2		
	J2.3	MICBIAS1	Microphone Bias1
	J2.4		
	J2.5	MIC2P	DMIC 1 and 2 Data Input
	J2.6		
	J2.7	MIC2N	DMIC 1 and 2 Clock
	J2.8		
	J2.9	AGND	AGND
	J2.10		
J3	J3.1	VDD_DMIC	Providing Power to DMIC
	J3.2		
	J3.3	MICBIAS2	Microphone Bias2
	J3.4		
	J3.5	MIC2P	DMIC 3 and 4 Data Input
	J3.6		
	J3.7	MIC2N	DMIC 3 and 4 Clock
	J3.8		
	J3.9	AGND	AGND
	J3.10		

Header		NL-NAU85L42	
		Net Name in Schematic	Description
J4	J4.1	MCLKI	External Master Clock Source Input
	J4.2	GND	GND
	J4.3	BCLK	Serial Data Bit Clock Input / Output for I^2S / PCM Data
	J4.4	GND	GND
	J4.5	DO12	Serial Audio Data Output 1 and 2 for I^2S / PCM Data
	J4.6	GND	GND
	J4.7	DO34	Serial Audio Data Output 3 and 4 for I^2S / PCM Data
	J4.8	GND	GND
	J4.9		
	J4.10	GND	GND
	J4.11	FS	Frame Sync Input / Output for I^2S / PCM Data
	J4.12	GND	GND

Table 2-1 NL-NAU85L42 Extension Connectors

2.3 NL-NAU85L42 Jumpers

Table 2-2 describes the connectors on NL-NAU85L42. Users can refer to Figure 2-1 at the same time.

Jumper	NL-NAU85L42		
	Function Description	Options	Jumper Option Description
JP1	DMIC Power Level Select	1 – 2 (Default)	The DMIC Power Supply Pin on J2 and J3 is 3.3V
		2 – 3	The DMIC Power Supply Pin on J2 and J3 is 1.8V
JP2	CSB Level Select	1 – 2	CSB = VDDB, I²C Device Address: 0X1D
		2 – 3 (Default)	CSB = GND, I²C Device Address: 0X1C
JP3	MODE Level Select	1 – 2 (Default)	MODE = VDDB, 2-Wire Interface, Read/Write operation
		2 – 3	MODE = GND, 3-Wire and 4-Wire operation
JP4	VDDB Level Select	1 – 2 (Default)	VDDB = 3.3V
		2 – 3	VDDB = 1.8V
JP5	GPIO2 Level Select	1 – 2	GPIO2 = 3.3V
		2 – 3 (Default)	GPIO2 = 1.8V
JP_ADCOUT1	ADCOUT Signal Select	1 – 2 (Default)	J5.7 Outputs Audio ADC Data from ADC 1 and ADC 2
		2 – 3	J5.7 Outputs Audio ADC Data from ADC 3 and ADC 4
JP_MICP_CH1	Analog MIC1 Positive Input	1 – 2 (Default)	Analog MIC1 Positive Input Connected to MICBIAS1
		Floating	Analog MIC1 Positive Input Disconnect MICBIAS1
JP_MICN_CH1	Analog MIC1 Negative Input	1 – 2 (Default)	Analog MIC1 Negative Input: Signal-Ended Input
		2 – 3	Analog MIC1 Negative Input: Differential Input
JP_MICP_CH2	Analog MIC2 Positive Input	1 – 2 (Default)	Analog MIC2 Positive Input Connected to MICBIAS1
		Floating	Analog MIC2 Positive Input Disconnect MICBIAS1
JP_MICN_CH2	Analog MIC2 Negative Input	1 – 2 (Default)	Analog MIC2 Negative Input: Signal-Ended Input
		2 – 3	Analog MIC2 Negative Input: Differential Input
JP_MICP_CH3	Analog MIC3 Positive Input	1 – 2 (Default)	Analog MIC3 Positive Input Connected to MICBIAS2
		Floating	Analog MIC3 Positive Input Disconnect MICBIAS2

Jumper	NL-NAU85L42		
	Function Description	Options	Jumper Option Description
JP_MICN_CH3	Analog MIC3 Negative Input	1 – 2 (Default)	Analog MIC3 Negative Input: Signal-Ended Input
		2 – 3	Analog MIC3 Negative Input: Differential Input
JP_MICP_CH4	Analog MIC4 Positive Input	1 – 2 (Default)	Analog MIC4 Positive Input Connected to MICBIAS2
		Floating	Analog MIC4 Positive Input Disconnect MICBIAS2
JP_MICN_CH4	Analog MIC4 Negative Input	1 – 2 (Default)	Analog MIC4 Negative Input: Signal-Ended Input
		2 – 3	Analog MIC4 Negative Input: Differential Input
JP_ADMIC1	Digital or Analog MIC Mode Select	1 – 2 (Default)	Analog MiIC2 Positive Input
		Floating	For DMIC12 DATA Using
JP_ADMIC2	Digital or Analog MIC Mode Select	1 – 2 (Default)	Analog MiIC2 Negative Input
		Floating	For DMIC12 Clock Using
JP_ADMIC3	Digital or Analog MIC Mode Select	1 – 2 (Default)	Analog MiIC3 Positive Input
		Floating	For DMIC34 DATA Using
JP_ADMIC4	Digital or Analog MIC Mode Select	1 – 2 (Default)	Analog MiIC3 Negative Input
		Floating	For DMIC34 Clock Using

Table 2-2 NL-NAU85L42 Jumpers

2.4 NU-NAUSB2I2C USB Control Board View

The NU-NAUSB212C provides I²C control signals and common audio digital formats. With this board, users can quickly evaluate the functions and features of the NL-NAU85L42 and perform basic operations on the NL-NAU85L42 in conjunction with the content of this document. For more details of NU-NAUSB212C, please refer to ***NU-NAUSB212C User Manual***.

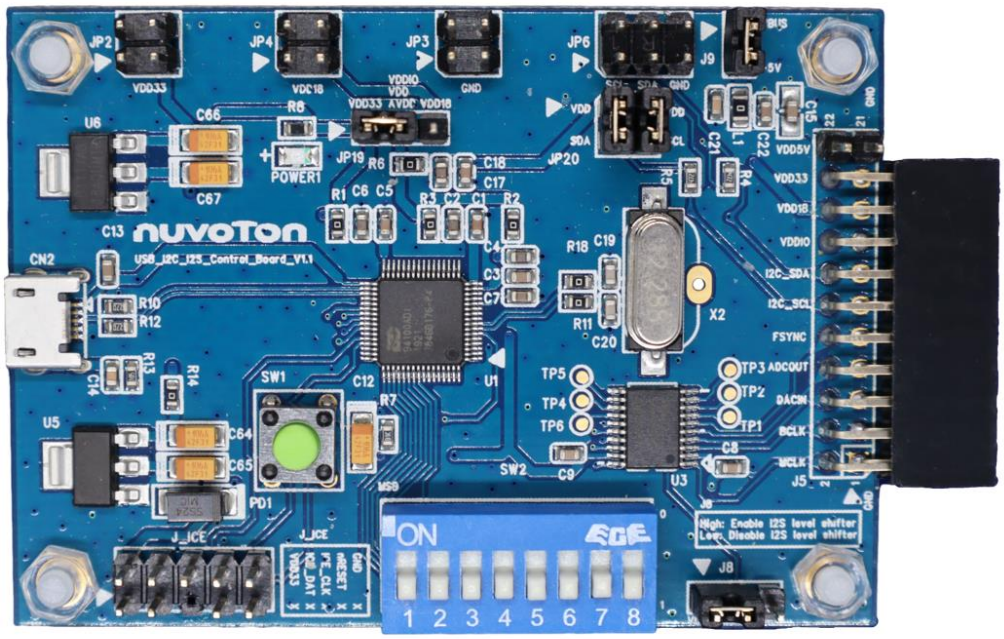


Figure 2-2 NU-NAUSB212C

2.5 Hardware Check and Connection by NuvotonAudioGUI

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-NAUSB212C is high and the rest are low level, as shown in Figure 2-3.

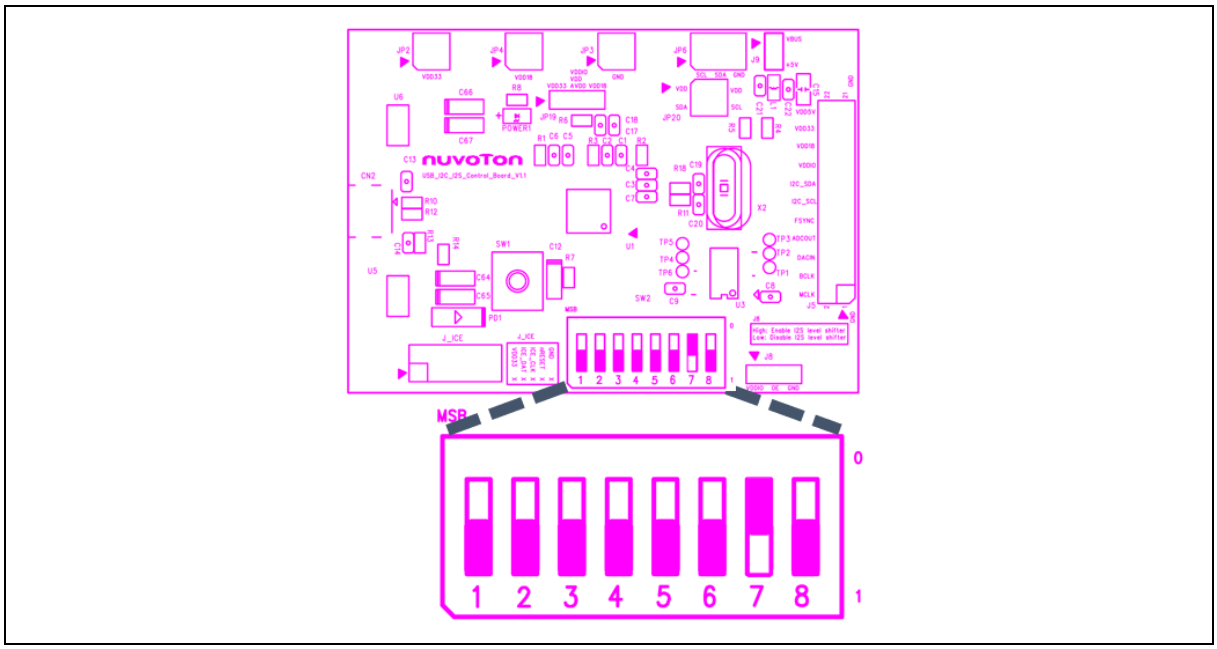


Figure 2-3 PIN Status of NU-NAUSB212C SW2

2. Connect J5 of NU-NAUSB212C to J5 of NL-NAU85L42. Figure 2-4 is the diagram after two boards are connected to each other.

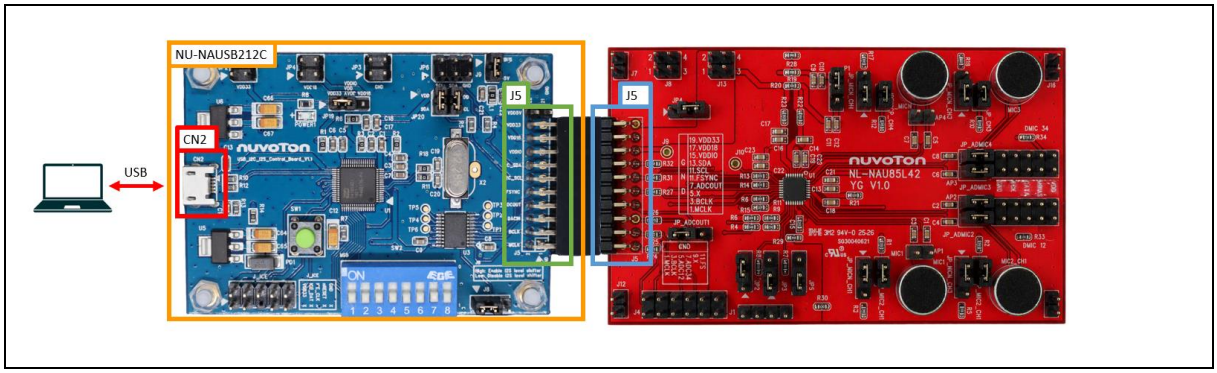


Figure 2-4 NU-NAUSB212C Connection

3. CN2 of NU-NAUSB212C 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.

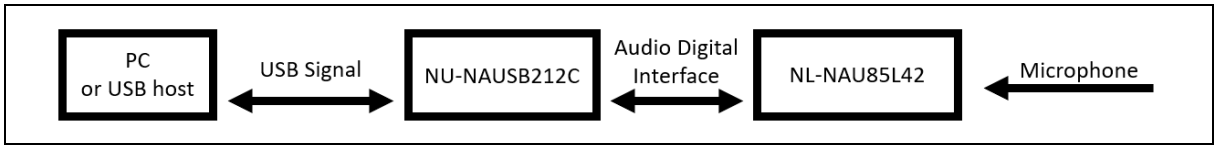


Figure 2-5 Signal Path of NU-NAUSB212C and NL-NAU85L42

4. Select the audio device on the PC as "Nuvoton UAC+HID Device". For example, under Win10 or Win11 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 or Figure 2-7. This will select "Nuvoton UAC+HID Device" as the current playback device.

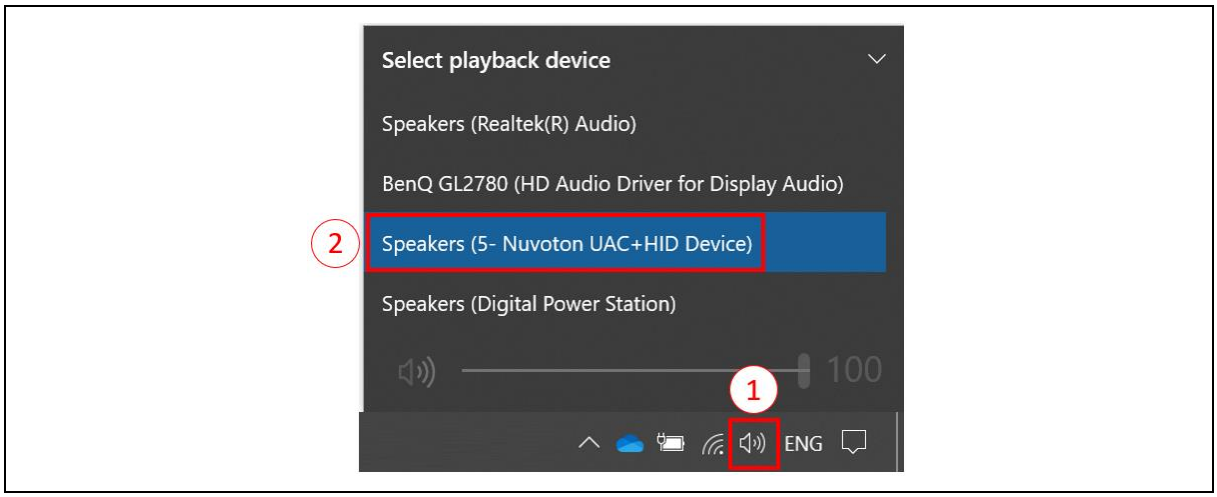


Figure 2-6 PC Audio Device Setting (Win10)

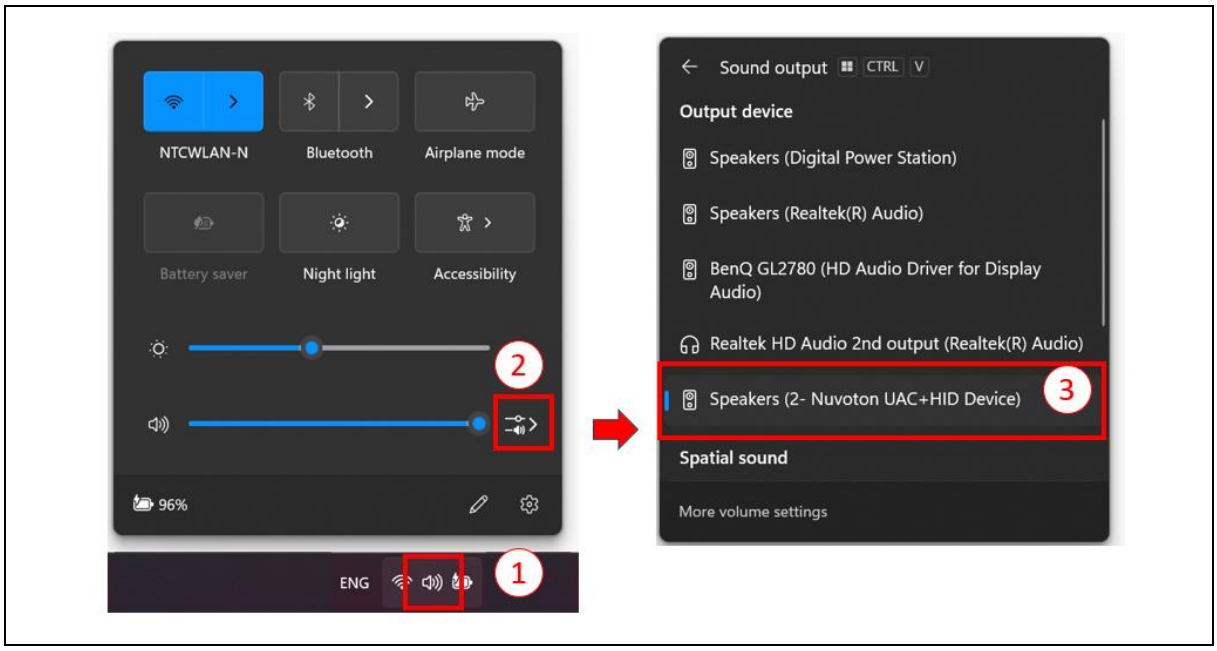


Figure 2-7 PC Audio Device Setting (Win11)

5. After the NU-NAUSB212C is connected to a PC, the Audio Interface is configured but remains inactive. The Audio Interface is enabled only when audio streaming is initiated by the host. Audio streaming can be triggered by playing an audio file or by navigating to **Settings > System > Sound** in Windows show in Figure 2-8. Once enabled, the NU-NAUSB212C outputs MCLK, BCLK, and FS signals to the audio device. It is recommended to perform this step before using the ADC function.

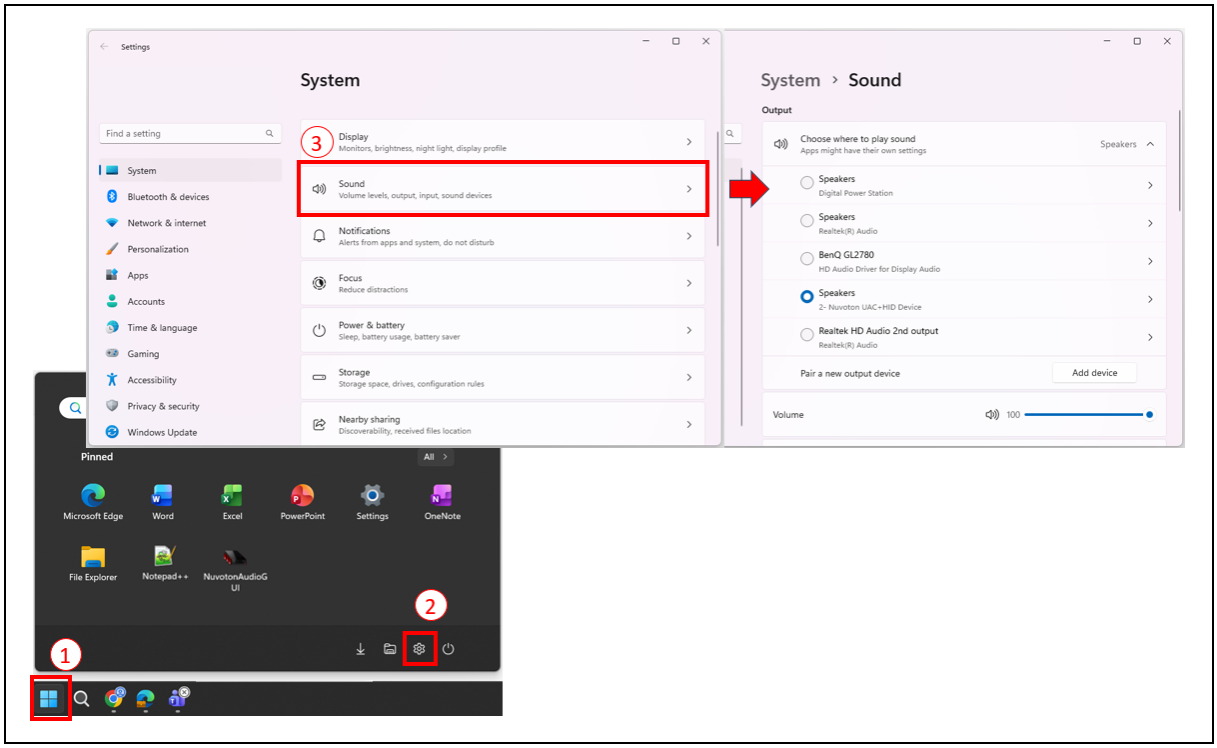


Figure 2-8 Navigate to Windows Settings > System > Sound

2.6 Hardware Check and Connection (Analog Microphone)

Figure 2-9 shows the configuration of the NL-NAU85L42 Analog Microphone. Users can select the microphone signal input through the jumper settings. Alternatively, the onboard analog microphone can be removed, and the desired signal source or microphone can be connected through the additional Signal Input connector.

When used with the NU-NAUSB212C, the board can be connected directly to the J5 connector on the NL-NAU85L42 (as shown in Figure 2-4). If a custom platform is used instead, the following signals and power supplies must be provided. The corresponding connector locations are listed below:

- I²C Control Interface
  - SCL: J5.11 or J1.2
  - SDA: J5.13 or J1.1
- Audio Interface
  - MCLK: J5.1 or J4.1
  - BCLK: J5.3 or J4.3
  - FS: J5.9 or J4.11
  - ADCOUT (ADC12 or ADC34): J5.7
  - ADC12: J4.5
  - ADC34: J4.7
- Power Supply
  - VDD18: J13 or J5.17
  - VDD33: J8 or J5.19

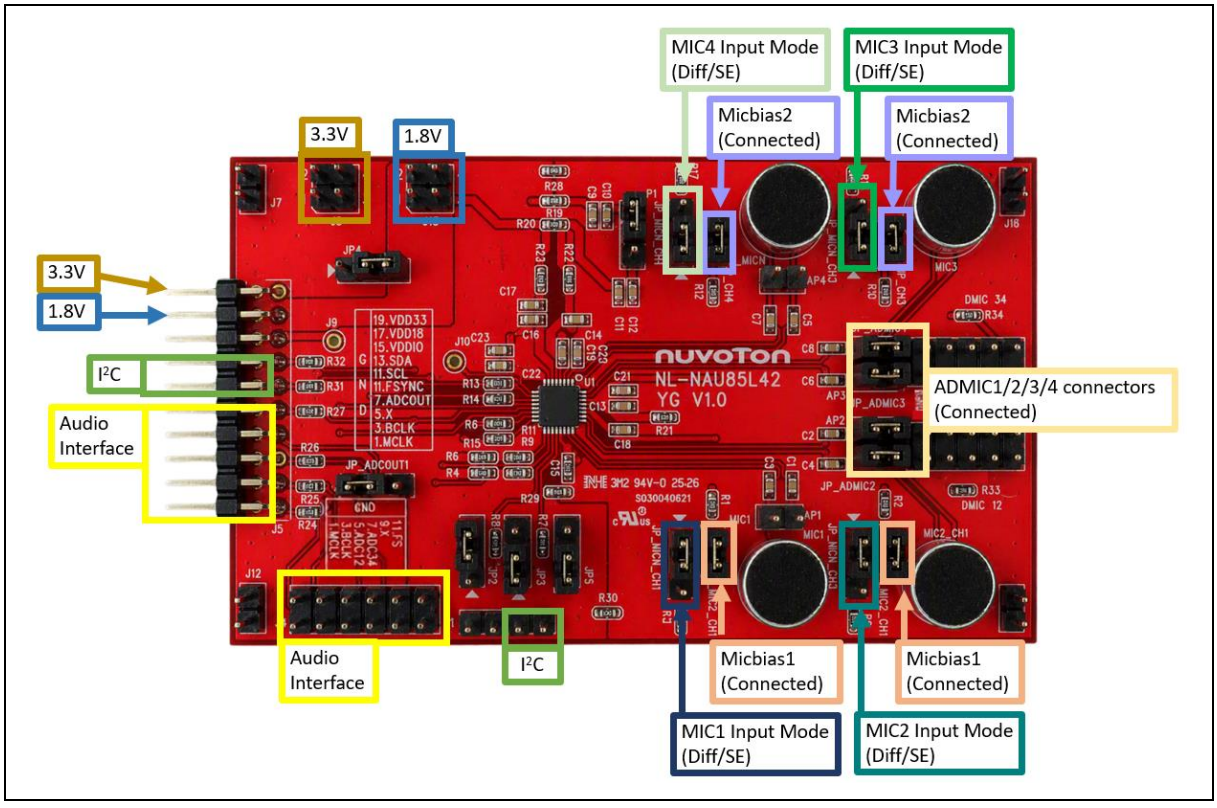


Figure 2-9 NL-NAU85L42 Analog Microphone Configuration

2.7 Hardware Check and Connection (Digital Microphone)

Figure 2-10 shows the configuration of the NL-NAU85L42 Digital Microphone. Users can connect the desired signal source or digital microphone through the additional DMIC Input connector.

When used with the NU-NAUSB212C, the board can be connected directly to the J5 connector on the NL-NAU85L42 (as shown in Figure 2-4). If a custom platform is used instead, the following signals and power supplies must be provided. The corresponding connector locations are listed below:

- I²C Control Interface
  - SCL: J5.11 or J1.2
  - SDA: J5.13 or J1.1
- Audio Interface
  - MCLK: J5.1 or J4.1
  - BCLK: J5.3 or J4.3
  - FS: J5.9 or J4.11
  - ADCOUT (ADC12 or ADC34): J5.7
  - ADC12: J4.5
  - ADC34: J4.7
- Power Supply
  - VDD18: J13 or J5.17
  - VDD33: J8 or J5.19

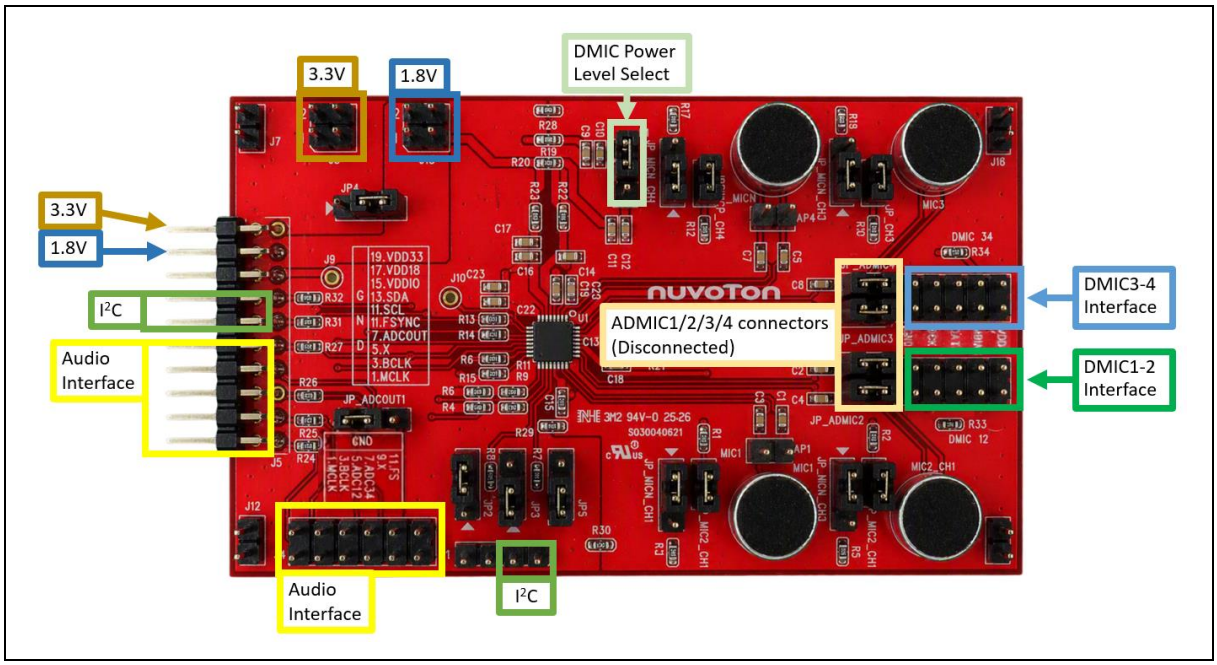


Figure 2-10 NL-NAU85L42 Digital Microphone Configuration

3 SOFTWARE CONFIGURATION

This document is compatible with NuvotonAudioGUI V2.07 or later.

Evaluation of NL-NAU85L42 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/

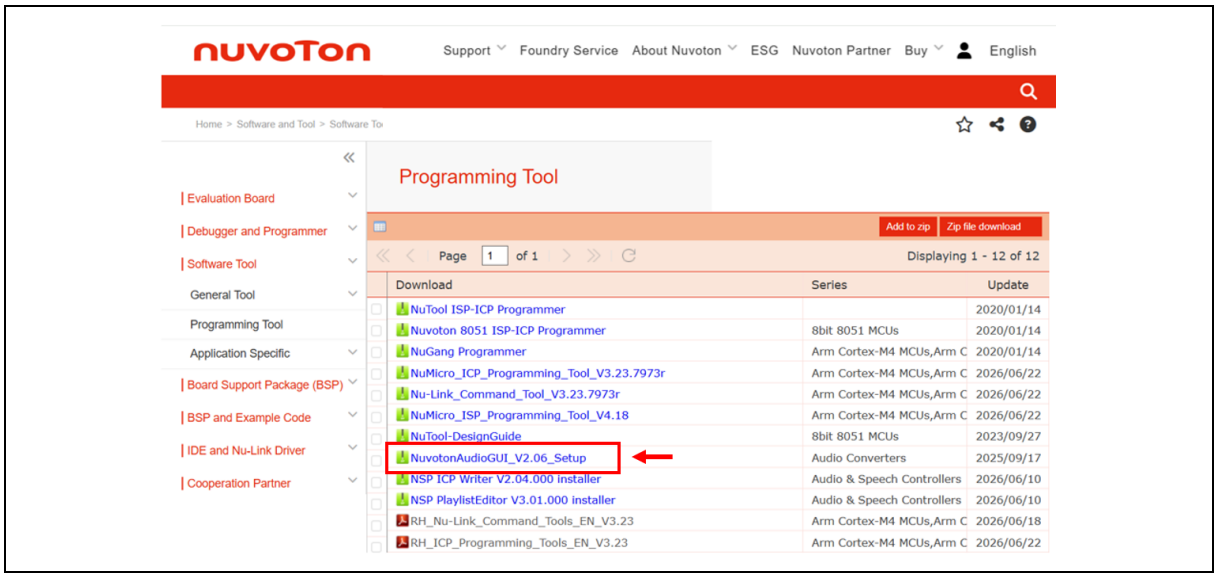


Figure 3-1 NuvotonAudioGUI Installation Step (1)

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



Figure 3-2 NuvotonAudioGUI Installation Step (2)

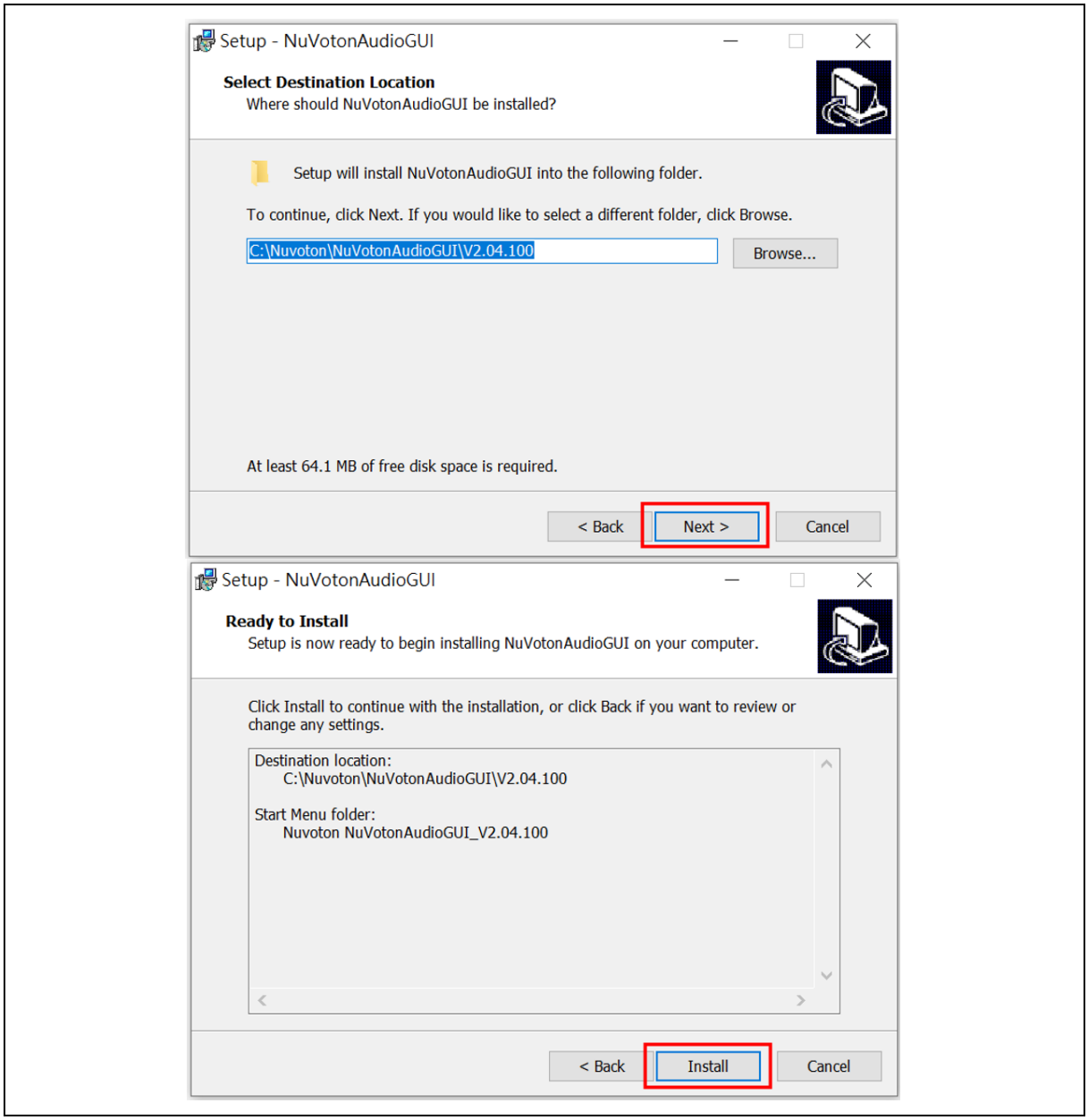


Figure 3-3 NuvotonAudioGUI Installation Step (3)

3.2 NuvotonAudioGUI Operating Instructions

1. Open NuvotonAudioGUI, choose the corresponding IC Part Number, then confirm the CSB setting (NL-NAU85L42 default is 0), and chick [OK], as shown in Figure 3-4.

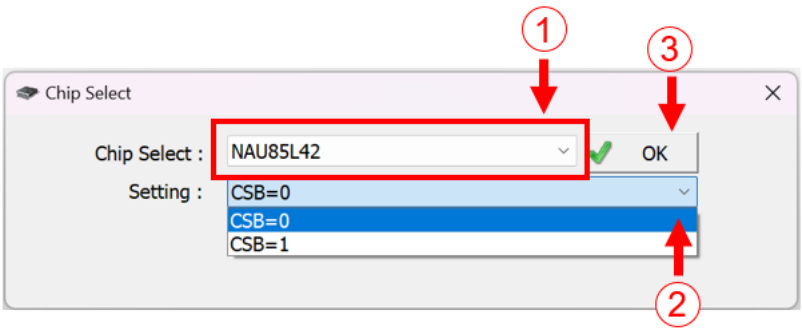


Figure 3-4 NuvotonAudioGUI Operating Step (1)

2. After clicking [OK], NuvotonAudioGUI will automatically read the connection status and verify the firmware version of the NU-NAUSB212C. 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-NAUSB212C User Manual*.

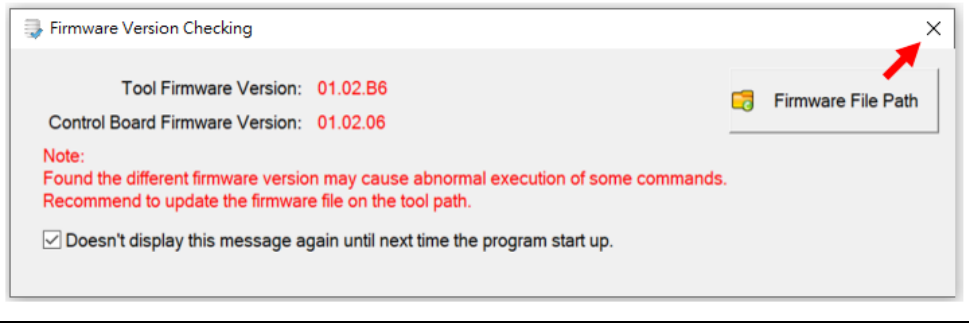


Figure 3-5 NuvotonAudioGUI Operating Step (2)

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-NAU85L42.

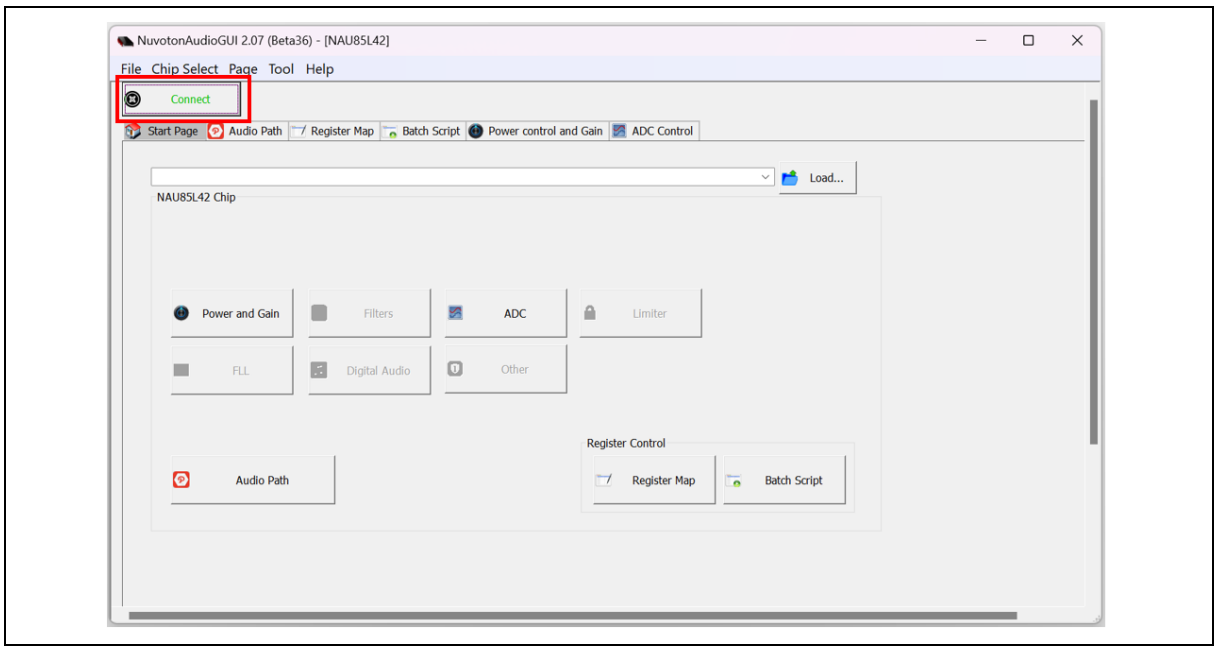


Figure 3-6 NuvotonAudioGUI Operating Step (3)

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

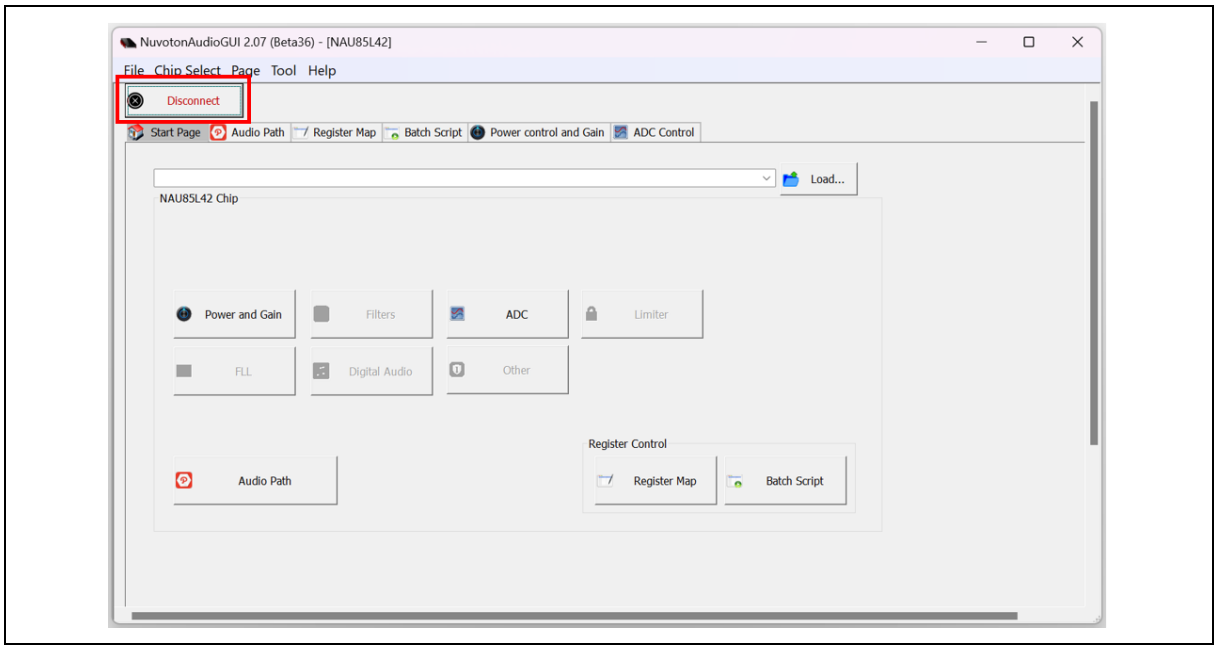


Figure 3-7 NuvotonAudioGUI Operating Step (4)

3.3 NuvotonAudioGUI Basic Page Introduction

NAU85L42 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-NAU85L42 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 a setting for users to choose from: DemoSequence_NAU85L42.

- DemoSequence_NAU85L42 AMIC:

  This setting enables the analog MIC IN (ADC function) of the NAU85L42. Users record their desired recording software on the PC and set the system recording device to "Nuvoton UAC+HID Device". For hardware configuration, please refer to Section 2.6.

- DemoSequence_NAU85L42 DMIC

  This setting enables the digital MIC IN (ADC function) of the NAU85L42. Users record their desired recording software on the PC and set the system recording device to "Nuvoton UAC+HID Device". For hardware configuration, please refer to Section 2.7.

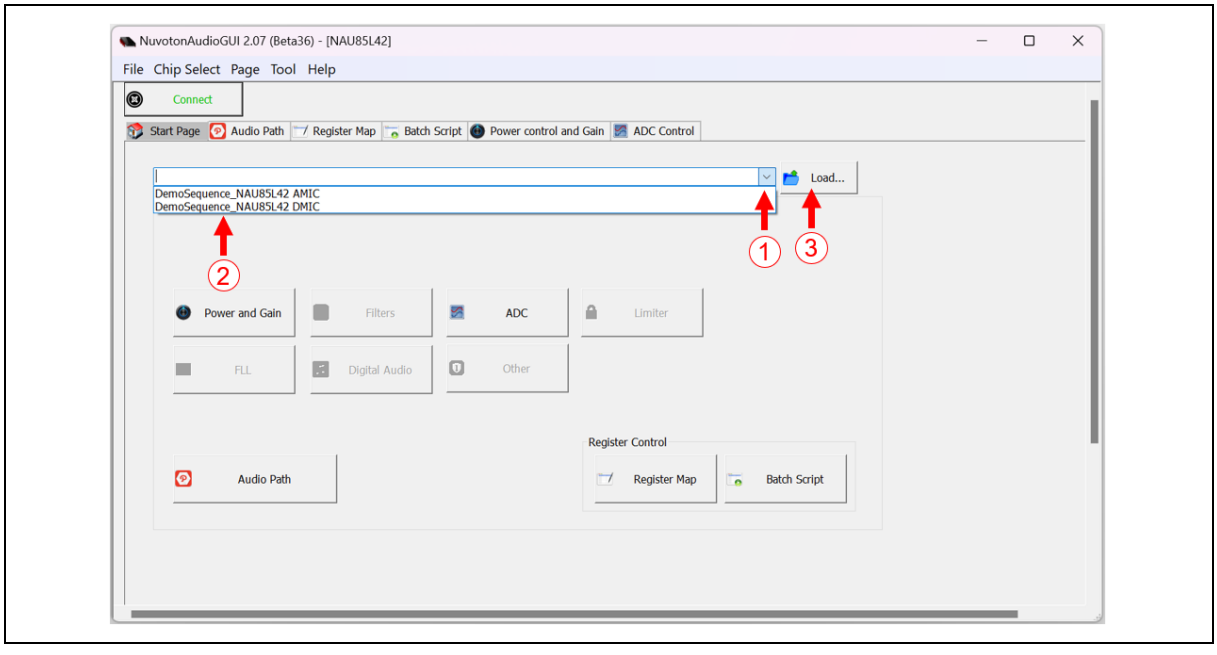


Figure 3-8 Start Page on NuvotonAudioGUI

3.3.2 Audio Path Page

The Audio Path Page graphically presents path switches, power controls, and Gain adjustments, allowing users to configure NAU85L42 as easy as possible. It is highly 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.

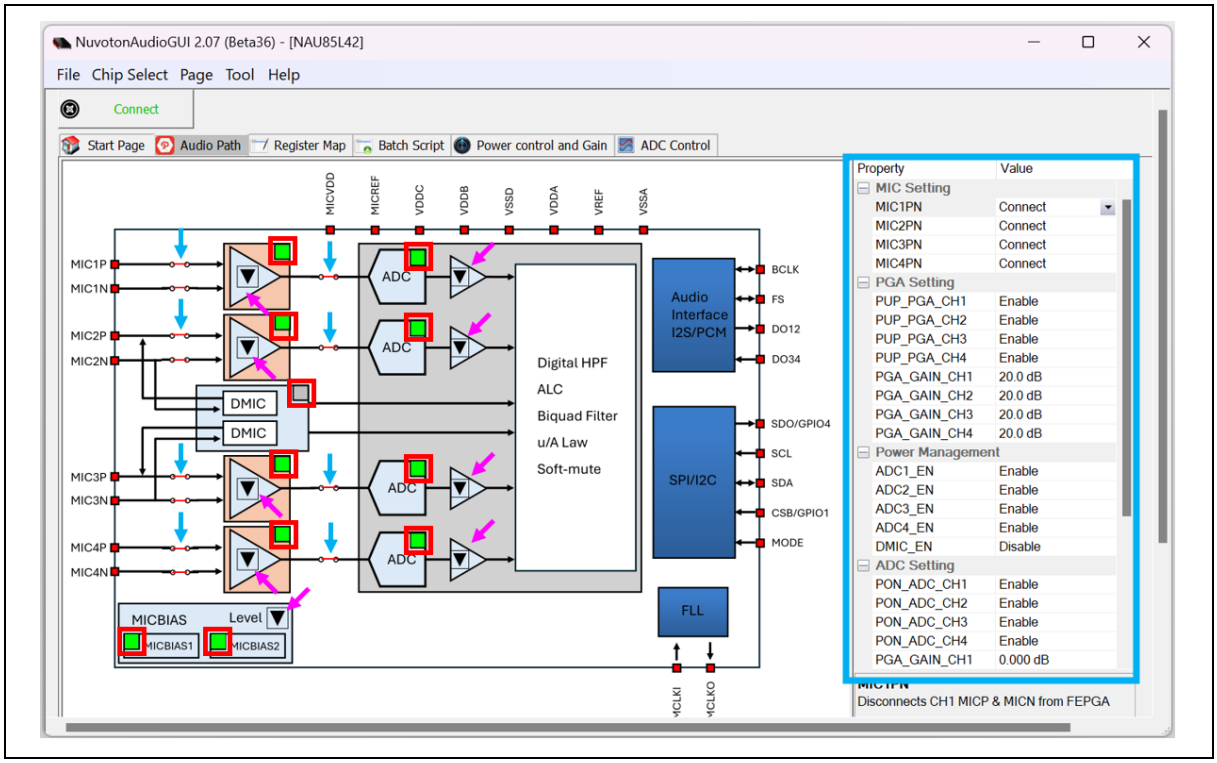


Figure 3-9 Audio Path Page on NuvotonAudioGUI

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 columns 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.

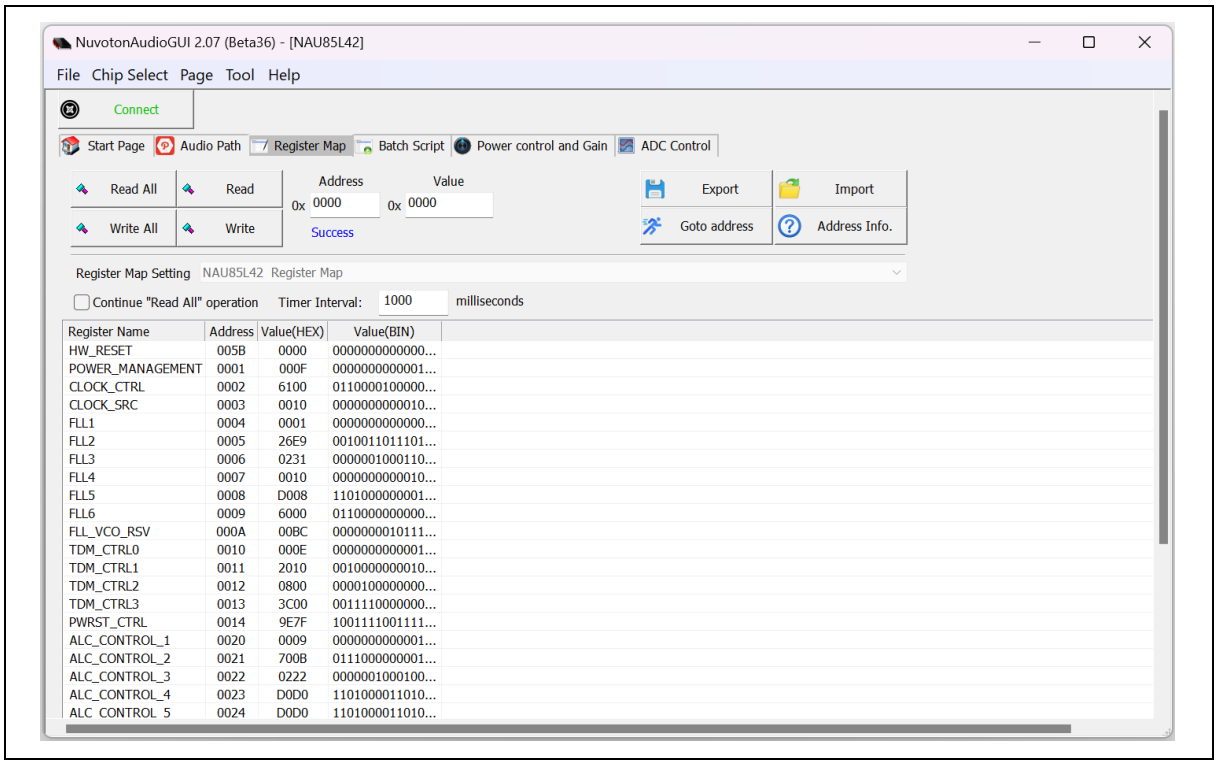


Figure 3-10 Register Map Page on NuvotonAudioGUI

3.4 Recording Software Verification

When using a microphone or other audio source to verify the ADC functionality of the NAU85L42, a simple way to confirm that the ADC is operating correctly is to record and play back the converted audio data on a PC.

When the NU-NAUSB212C is paired with the NL-NAU85L42, the ADC data can be streamed to a PC through USB, allowing users to verify ADC operation using Windows recording software or free applications such as Audacity.

Audacity is a free and user-friendly application for audio playback and recording. The following section briefly introduces how to record audio using Audacity. After opening Audacity, confirm that the recording device is set to "Nuvoton UAC+HID Device" by following Steps 1 through 3 in Figure 3-11. Click the button indicated in Step 4 to start recording, and click the button indicated in Step 5 to stop recording. Audio captured from the microphone or other audio source connected to the NL-NAU85L42 will be displayed as a waveform in the audio track.

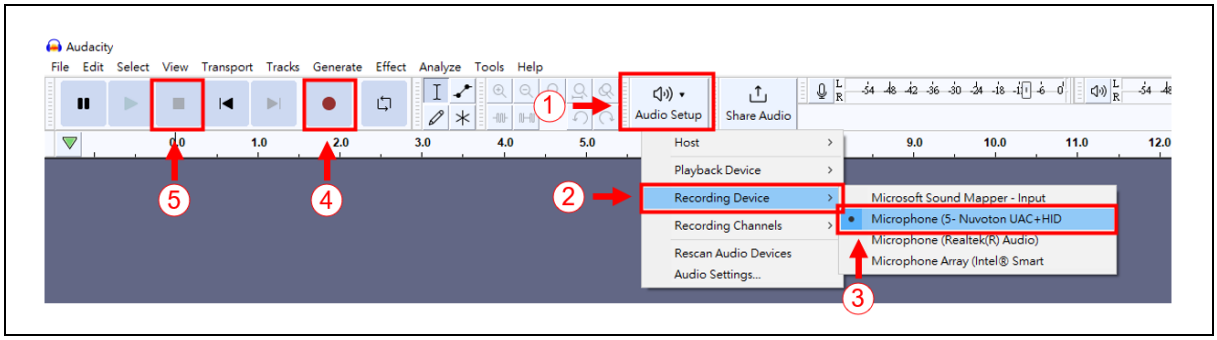


Figure 3-11 Audacity Recording Setting

4 SCHEMATICS

4.1 NL-NAU85L42 Schematic

Figure 4-1 shows the NL-NAU85L42 circuit.

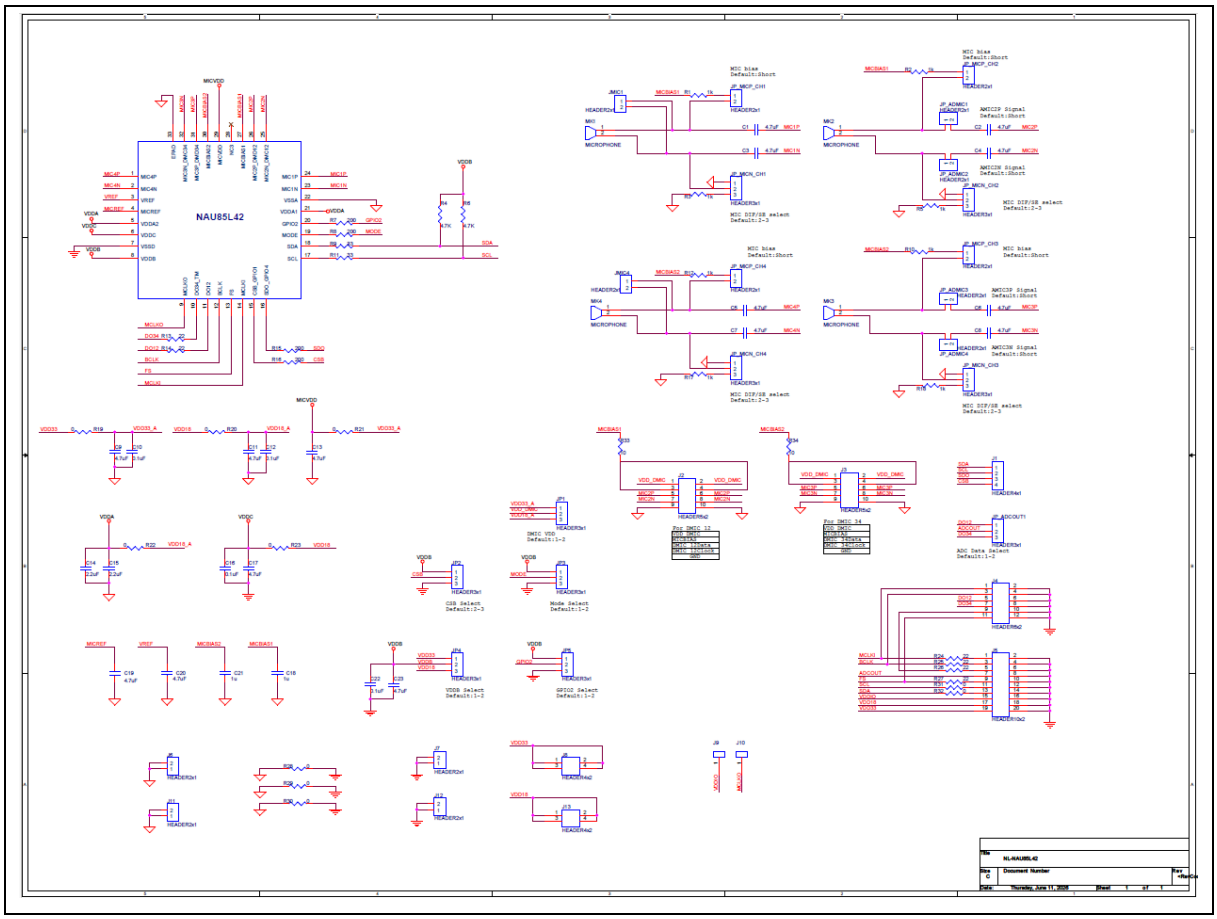


Figure 4-1 NL-NAU85L42 Circuit

4.2 NL-NAU85L42 PCB Layout

Figure 4-2 shows the components placement on the board NL-NAU85L42.

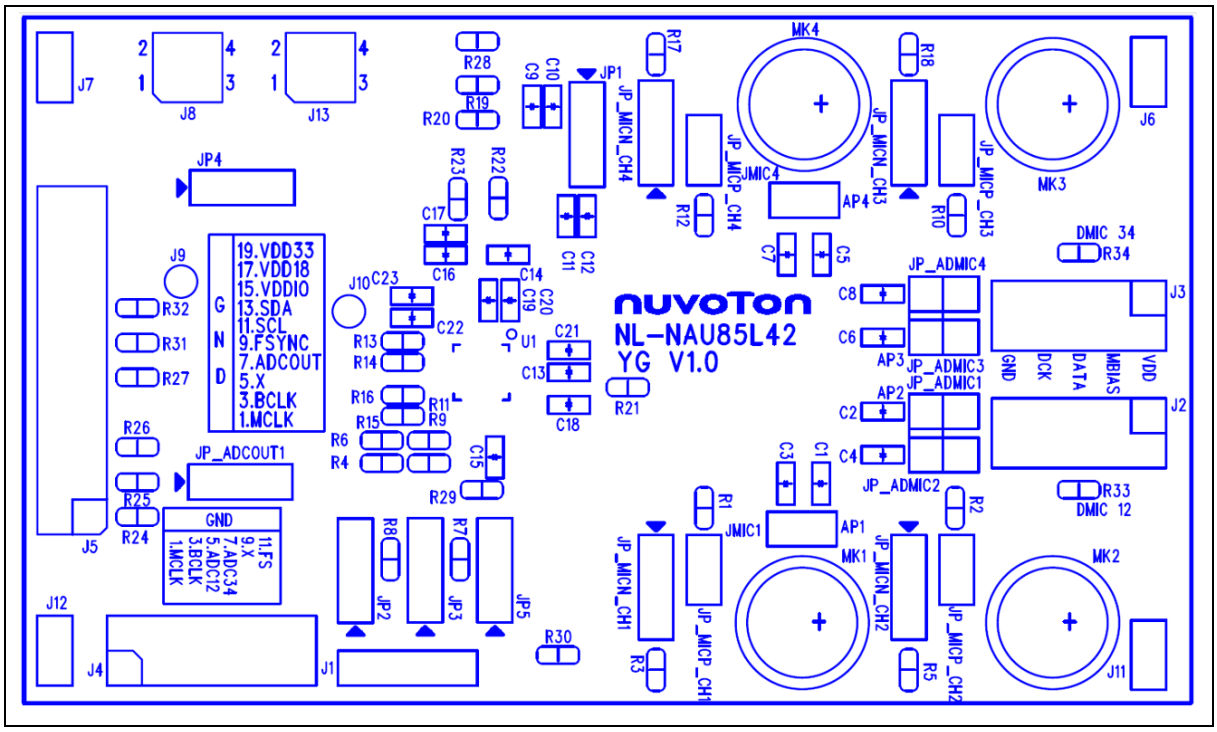


Figure 4-2 NL-NAU85L42 Layout

5 REVISION HISTORY

REVISION	DATE	DESCRIPTION
1.0	Jul 24, 2026	Initial Release

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