

## ARM<sup>®</sup> Cortex<sup>®</sup>-M0 32-bit Microcontroller

# NuMicro<sup>®</sup> Family NuMaker UNO User Manual

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#### **1 OVERVIEW**

Arduino is an open-source electronics platform based on easy-to-use hardware and software. The NuMicro<sup>®</sup> NuMaker UNO Evaluation Board is an Arduino compatible hardware using NuMicro<sup>®</sup> microcontroller (MCU) as the MCU. Its function can be extended with Arduino add-ons. With the Arduino IDE, users can develop their applications and leverage large number of open source samples.



Figure 1-1 NuMaker UNO Board

The NuMaker UNO is a specific development tool for NuMicro<sup>®</sup> NUC131 series by which users can develop and verify the application program easily. Its purpose is to provide a platform for development and learning. With ADC, PWM, I<sup>2</sup>C, SPI, UART and other peripheral functions, user can set different functions on the NuMaker UNO development kit, or increase the peripheral functions according to the user needs on the development kit. The NuMaker UNO includes two portions: NuMaker UNO (an evaluation board) and Nu-Link-Me (Debug Adaptor). With the NuMaker UNO, users do not need additional ICE or debug equipment.



Figure 1-2 NuMaker UNO Board with Different Add-ons

The NuMaker UNO is pin to pin compatible with Arduino UNO board.

Digital pins provide UART, I2C, LED, INT, and 10-channels PWM. In addition, the extended pins of MCU NUC131SD2AE provide 24-channels PWM and 6-channels UART. Clock Output (CLKO) is also available on extra pin.

### 2 FEATURES

The NuMaker UNO development board provides the following features:

- Wide range of development tools for Learning/applications/debug
- Portable package development and debugging tools
- Rich MCU peripheral functions, such as ADC, PWM, I<sup>2</sup>C, SPI, and UART
- Able to connect to different application modules due to high scalability
- Supports pin to pin compatible with Arduino UNO revision 3
- Supports USB virtual serial port (VCOM)
- Supported by a wide choice of Integrated Development Environments (IDEs) including Arduino IDE, IAR EWARM and Keil RVMDK IDE
- Extension resources:
  - NuMicro<sup>®</sup> Morpho extension pin headers for full access to all MCU NUC131 I/O
  - On-board Nu-Link debugger/programmer with SWD connector
- Flexible board power supply:
  - USB VBUS (jumper JPR1 can be used to select 5V or 3.3V)
  - External VIN (7V ~ 12V) supply voltage from transformer converted into 5V
  - External 2.5 ~ 5.5V supply voltage from other power source input to V<sub>DD</sub> pin
- LEDs Status
  - Power, TX, RX, ICE and user status
- One push button: RESET

#### 3 INTRODUCTION TO NUMAKER UNO DEVELOPMENT BOARD

Figure 3-1 and Figure 3-2 show the NuMaker UNO development board, in which the left portion is called NuMaker UNO target board and the right portion is Debug Adaptor called Nu-Link-Me.

The NuMaker UNO is similar to other development boards. Users can use it to develop and verify applications to emulate the real behavior. NuMaker UNO can be a real system controller to design user's target system. NuMaker UNO is pin to pin compatible with Arduino UNO revision 3. The left portion is NuMaker UNO target board where the NUC131 series MCU is mounted on. The NUC131 series provides 24-ch PWM as well as 6-ch UART, and commonly used peripherals such as Timer, WDT, SPI, I<sup>2</sup>C and ADC. The NUC131 series also provides CAN communication interface.

The right portion is the debug adaptor called Nu-Link-Me which connects the USB port from PC to user's target system (via the Serial Wired Debug port) and allows users to program and debug embedded programs on the target hardware. In addition to loading external application, it also provides a virtual serial port (VCOM) functions. The debug messages through user-friendly Nu-Link-Me is displayed on the computer screen. For detailed description, please refer to section 3.1.2. The NuMaker UNO supports Arduino IDE, Keil, and IAR. For detailed installation and setup, please refer to section 4.1.

The NuMaker UNO development board provides the Arduino pin-out definition and extended connectors for each pin from the NUC131SD2AE MCU. It can be used to connect the application circuit board. The target board also supports a wide range of power supplies, such as from ICE,  $V_{DD}$  & GND (JP1 & JP2) or from 7V ~ 12V transformer. LED status is for power, I/O, TX, RX and ICE, as shown in Figure 3-1.



Figure 3-1 NuMaker UNO Development Board – Upper Side



Figure 3-2 NuMaker UNO Development Board – Bottom Side

#### 3.1 NuMaker UNO Jumper Description

#### 3.1.1 Power Settings

There are three methods to use the NuMaker UNO board to provide power to V<sub>DD</sub>. The first method is through the Nu-Link-Me USB interface. This power will go through LDO voltage regulator to 3.3V, JPR1 can be used to adjust V<sub>DD</sub> power to 5V or 3.3V. The second method is through the JP1 on development board to V<sub>DD</sub> by DC 2.5V ~ 5.5V power supply. The third method is through transformer (7V ~ 12V) and then the voltage is converted into 5V through the step-down circuit. Please refer to the table below.

Model	JPR1 (Selection Voltage)	JP1 (V <sub>DD</sub> Provided Voltage)	MCU Voltage
USB	Select 5V or 3.3V (Default is 5V)	USB, target board will be able to get the supply voltage. (SW2 pin1 need on)	DC 5V or 3.3V
Other power for $V_{DD}$ pin	х	External power supply DC 2.5 V ~ 5.5 V.	Voltage by JP1 input
Transformer	х	Transformer DC 7 V ~ 12 V, after pass the step-down circuit, it provides 5V supply to target chip (J2 need short)	DC 5V



#### 3.1.2 USB Virtual COM Function Setting

• SW2: Open the Virtual COM mode for the debug message and supply power to NuMaker UNO.

The Virtual COM function can be used for Arduino IDE, Keil and IAR. To enable VCOM function on Nu-Link Me, turn on all SW2 pins. To enable the UART0 function, turn off pin 2  $\sim$  pin 4 on SW2. Please refer to the table below.

Switch Pin Number	Function Name	UART0 Mode	VCOM Mode
1	ICE_VCC	On	On
2	VCOM_En	Off	On
3	VCOM_TX	Off	On
4	VCOM_RX	Off	On

Table 3-2 USB VCOM Setting (Default as VCOM Mode)

#### 3.1.3 Header Description

JP1	$V_{\text{DD}}$ connector on NuMaker UNO, can be accessed by an external power supply DC 2.5V $\sim$ 5.5V, in order to provide NuMaker UNO power supply
JP2	GND connector on NuMaker UNO, can be accessed by external power supply GND
J1	Mini USB connector on Nu-Link-Me connected to the PC USB port
SW2	Pin 1 is ICE $V_{DD}$ connected to target chip $V_{DD}$
CON1	7 V ~ 12 V transformer
J2	Power JACK is connected to $V_{\text{DD}}$ transformer, after the step-down circuit then to provide $V_{\text{DD}}$ power supply to target Chip
SW1	Reset button on NuMaker UNO
JP10	Connector on target board (NuMaker UNO) for connecting to Nuvoton ICE adaptor (Nu-Link-Me)
JP9	Connector on ICE adaptor (Nu-Link-Me) for connecting to the target board (NuMaker UNO)
JP3 ~ JP6	Show all NUC131SD2AE MCU pin-out on NuMaker UNO
x	Unused

#### Table 3-3 Header Description

Note: When using the transformer power supply, please turn off all the SW2 pins.

#### 3.2 Pin Assignment for NUC131SD2AE Extended Connectors

The NuMaker UNO provides the NUC131SD2AE target chip on board and the NUC131SD2AE extended connectors (**JP3**, **JP4**, **JP5** and **JP6**) for LQFP64-pin. Table 3-4 shows the pin assignment for NUC131SD2AE.

Pin No	Pin Name	Pin No	Pin Name
01	PB.14,INT0	33	PC.11,PWM1_BRAKE1
02	PB.13	34	PC.10,PWM1_BRAKE0
03	PB.12,CLKO,BPWM1_CH3	35	PC.9,PWM0_BRAKE1
04	PF.5,I2C0_SCL,PWM1_CH5	36	PC.8,PWM0_BRAKE0
05	PF.4,I2C0_SDA,PWM1_CH4	37	PA.15,PWM0_CH3
06	PA.11,I2C1_SCL,PWM1_CH3	38	PA.14,PWM0_CH2
07	PA.10,I2C1_SDA,PWM1_CH2	39	PA.13,PWM0_CH1,UART5_TXD
08	PA.9,I2C0_SCL,UART1_nCTS	40	PA.12,PWM0_CH0,UART5_RXD
09	PA.8,I2C0_SDA,UART1_nRTS	41	PF.7,ICE_DAT
10	PB.4,UART1_RXD	42	PF.6,ICE_CLK
11	PB.5,UART1_TXD	43	AVSS
12	PB.6,UART1_nRTS	44	PA.0,PWM0_CH4,ADC0,I2C1_SCL,UART5_TXD
13	PB.7,UART1_nCTS	45	PA.1,PWM0_CH5,ADC1,I2C1_SDA,UART5_RXD
14	LDO_CAP	46	PA.2,PWM1_CH0,ADC2,UART3_TXD
15	V <sub>DD</sub>	47	PA.3,PWM1_CH1,ADC3,UART3_RXD
16	V <sub>SS</sub>	48	PA.4,ADC4
17	PB.0,UART0_RXD	49	PA.5,UART3_RXD,ADC5
18	PB.1,UART0_TXD	50	PA.6,UART3_TXD,ADC6

19	PB.2,UART0_nRTS,TM2_EXT,TM2,PWM1_BRAK	51	PA.7,Vref,ADC7
20	PB.3,UART0_nCTS,TM3_EXT,TM3,PWM1_BRAK	52	AV <sub>DD</sub>
21	PD.6,BPWM1_CH1,CAN0_RXD	53	PC.7,PWM0_BRAKE1,I2C0_SCL,UART4_RXD
22	PD.7,BPWM1_CH0,CAN0_TXD	54	PC.6,PWM0_BRAKE0,I2C0_SDA,UART4_TXD
23	PD.14,BPWM0_CH5,UART2_RXD	55	PC.15
24	PD.15,BPWM0_CH4,UART2_TXD	56	PC.14
25	PC.3,BPWM0_CH3,SPI0_MOSI0	57	PB.15, ,BPWM1_CH5TM0,TM0_EXT,INT1
26	PC.2,BPWM0_CH2,SPI0_MISO0	58	PF.0,XT1_OUT
27	PC.1,BPWM0_CH1,SPI0_CLK	59	PF.1,XT1_IN
28	PC.0,BPWM0_CH0,SPI0_SS0	60	nRESET
29	PE.5,PWM0_CH5,TM1_EXT,TM1	61	V <sub>SS</sub>
30	PB.11,TM3,PWM0_CH4	62	V <sub>DD</sub>
31	PB.10,TM2	63	PF.8, PWM1_CH4,CLKO
32	PB.9,TM1	64	PB.8,BPWM1_CH2,CLKO,TM0,STADC

Table 3-4 Pin A	Assignment for	NUC131SD2AE
	looignin ont ion	

#### 3.3 NuMaker UNO NUC131SD2AE Extended Connectors Layout



Figure 3-3 NuMaker UNO NUC131SD2AE Extended Connectors Layout

#### 3.4 Arduino UNO Pin Assignment for NuMaker UNO

The NuMaker UNO provides the NUC131SD2AE target chip on board and the Arduino UNO extended connectors (**NU1**, **NU2**, **NU3**, **NU4** and **NU5**) for LQFP64-pin. Table 3-5 shows the pin assignment for NuMaker UNO.

	Pin No	Pin Name	Pin No	Pin Name
Clock Output	1	CLKO	5	5V
	2	VCC	6	GND
Power	3	RESET	7	GND
	4	3.3V	8	Vin
	1	A0	4	A3
Analog	2	A1	5	A4
	3	A2	6	A5
	0	PB.0/UART_RX0	9	PA.14/PWM0_CH2
	1	PB.1/UART_TX0	10	PA.13/PWM0_CH1
	2	PF.4/PWM1_CH4	11	PA.12/PWM0_CH0
	3	PF.5/PWM1_CH5	12	PB.15/TM0/INT1
Digital	4	PA.10/PWM1_CH2	13	PB.13(LED)
	5	PA.11/PWM1_CH3	VSS	VSS
	6	PA.15/PWM0_CH3	VREF	VREF
	7	PE.5/PWM0_CH5	I2C	PA.8/SDA
	8	PB.11/PWM0_CH4	I2C	PA.9/SCL
	1	PC.2/SPI0_MISO	5	RESET
SPI	2	V <sub>DD</sub>	6	GND
Interface	3	PC.1/SPI0_CLK	7	PC.0/SPI0_SS
	4	PC.3/SPI0_MOSI	8	PB.9/TM1

Table 3-5 Pin Assignment for NuMaker UNO

#### 3.5 NuMaker UNO Arduino Layout



Figure 3-4 NuMaker UNO Pin Design for Arduino

#### 3.6 NuMaker UNO PCB Placement



Figure 3-5 NuMaker UNO PCB Placement

## 4 DOWNLOADING AND INSTALLING ARDUINO IDE 1.8.5 AND NUMAKER UNO SOFTWARE

#### 4.1 Downloading and Installing Arduino IDE 1.8.5 Software

Please visit the Arduino official website (<u>http://www.arduino.cc/en/Main/software</u>) to download and install the Arduino IDE 1.8.5. Currently it is recommended to install Arduino IDE 1.8.5 for Windows version, since the other operating system has not been verified.

The Arduino IDE 1.8.5 installation steps are as follows:

#### 4.1.1 Step 1: Download Arduino IDE 1.8.5 software

Visit https://www.arduino.cc/en/Main/Software, and download the latest Arduino.



Figure 4-1 Find and Click "previous version of the current release"

#### 4.1.2 Step 2: Check if download file is version 1.8.5

Click on download.

nuvoton



Figure 4-2 Find and Download Arduino 1.8.5

#### 4.1.3 Step 4: Install the "Arduino-1.8.5-windows.exe" file

Double click on the "arduino-1.8.5-windows.exe" and click "Run".



Figure 4-5 Install arduino-1.8.5-windows.exe Installation File

#### 4.1.4 Step 5: Select the installation folder

Select the installation folder and click "Install".

folder, installa	will install Arduino in the following fold click Browse and select another folde ation.	der. To install in er. Click Install t	a different o start the
-Destination	Folder		
C:\Program	1 Files (x86)\Arduino		Browse
Space required Space available	l: 403.6MB e: 251.4GB		

Figure 4-6 Install arduino-1.8.5-windows.exe to Installation Folder

#### 4.1.5 Step 6: Wait for the installation is complete

Wait the installation process until it is finished. It will take about 2 minutes to install arduino-1.8.5-windows file to the installation folder.

Arduino Setup: Installing	
Show details	
Cancel Nullsoft Install System v2,46 < Back Close	

Figure 4-7 Install arduino-1.8.5-windows to Installation Folder

After installation is finished, two executable files can be found in the Arduino 1.8.5 installation directory, including arduino.exe and arduino\_debug.exe. Both files are able to start the Arduino

IDE program. As for the arduino\_debug.exe, you can open the debug window. When the program is executed or compiled, the debug window will open for users to check which part of the problem occurs.

	drivers 2018/7/3下午 03:24 File folder			
examples 2018/7/		2018/7/3 下午 03:24	File folder	
	hardware	2018/7/16 下午 02:	File folder	
	java	2018/7/3 下午 03:25	File folder	
	lib	2018/7/3 下午 03:25	File folder	
	libraries	2018/8/1 下午 06:16	File folder	
	reference	2018/7/3 下午 03:25	File folder	
	tools	2018/7/3 下午 03:25	File folder	
	tools-builder	2018/6/29 下午 01:	File folder	
	arduino.exe	2017/10/2 下午 09:	Application	395 KB
a a	arduino.l4j.ini	2017/10/2 下午 09:	Configuration sett.	1 KB
0	arduino_debug.exe	2017/10/2 下午 09:	Application	393 KB
ů.	arduino_debug.l4j.ini	2017/10/2 下午 09:	Configuration sett.	1 KB
	arduino-builder.exe	2017/10/2 下午 09:	Application	3,214 KB
٩	libusb0.dll	2017/10/2 下午 09:	Application extens.	43 KB
4	msvcp100.dll	2017/10/2 下午 09:	Application extens.	412 KB
0	msvcr100.dll	2017/10/2 下午 09:	Application extens.	753 KB
[	revisions.txt	2017/10/2 下午 09:	Text Document	84 KB
10	uninstall.exe	2018/7/3 下午 03:25	Application	404 KB
-	wrapper-manifest.xml	2017/10/2 下午 09:	XML Document	1 KB

Figure 4-8 Arduino 1.8.5 Installation Directory

#### 4.2 Installing Nu-Link USB Driver for Arduino IDE 1.8.5

Please visit the Nuvoton NuMaker UNO official website (<u>www.nuvoton.com/NuMaker\_UNO</u>) to download "<u>Nu-Link USB Driver</u>".

Note: It is recommended to use Arduino IDE version 1.8.5.

The Nu-Link USB Driver installation steps are as follows:

#### 4.2.1 Step 1: Download Nu-Link USB Driver

Visit www.nuvoton.com/NuMaker UNO and find Resources. Click on "Nu-Link USB Driver".

Resou	rces :		
ŧ	NuMicro® NUC131 Series Selection Guide	÷	Technical Reference Manual
F	Nu-Link USB Driver	-	NuMaker Uno User Manual
-	Datasheet	-	Schematics

Figure 4-9 Find and Click Nu-Link USB Driver

#### 4.2.2 Step 2: Select the installation folder

Select the installation folder and click "Next" to install.

Select Destination Locati	on	
Where should Nu-Link USE	Driver be installed?	Č 🍐
Setup will install !	Nu-Link USB Driver into the following f	older.
To continue, dick Next. If	you would like to select a different fo	lder, click Browse.
C:\Program Files\Nuvotor	n Tools\Wu-Link_USB_Driver	Browse
At least 25.4 MB of free d	isk space is required.	

Figure 4-10 Installing Nu-Link USB Driver

#### 4.2.3 Step 3: Run Arduino IDE 1.8.5

Go to File  $\rightarrow$  Preferences, enter the following URL to textbox of 'Additional Board Manager URLs'

https://raw.githubuserc	content.co	m/OpenNuv	oton/NuMaker-
UNO/master/package	nuvoton	index.json	

New	Ctrl+N		
Open	Ctrl+0		101
Open Reci	ent >		
Sketchhor	k k		*
Examples			
Close	Ctrl+W	up code here, to run or	ice .
Save	Ctrl+S		
Save As	Ctrl+Shift+S		
Page Setu	Ctrl+Shift+P		
Print	Ctrl+P		
Preference	s Ctrl+Comma		
Quit	Ctrl+Q	1 code here, to run rep	pea
}			
,			

Figure 4-11 Arduino IDE 1.8.5 Select File and Click Preferences

Non-Andrian als for an Alama			
sketchpook location:			
C:\Program Files (x86)\Arduir	no\examples		Browse
Editor language:	System Default	<ul> <li>(requires restart of Arduino)</li> </ul>	
Editor font size:	12		
interface scale:	Automatic 120 🔶 % (requires restart	of Arduino)	
Show verbose output during:	compilation upload		
Compiler warnings:	None 👻		
V Display line numbers			
Enable Code Folding			
Verify code after upload			
Use external editor			
Check for updates on sta	rtup		
Update sketch files to new	w extension on save (.pde -> .ino)		
Save when verifying or u	bloading		
Additional Boards Manager UR	Ls: https://raw.githubusercontent.com/OpenN	uvoton/NuMaker-UNO/master/package_nuvoto	n index.isor
vore preterences can be edit	ad directly in the tile	, , , , , , , , , , , , , , , , , , , ,	
C:\Users\PPERMATA\AppData	a/Local/Arduino 15/preferences.txt		
(edit only when Arduino is not	running)		

Figure 4-12 Enter the NuMaker UNO Board's URL to 'Additional Board Manager URLs'

### 4.2.4 Step 4: Install NuMaker UNO on Arduino IDE 1.8.5 Boards Manager

Go to **Tools**  $\rightarrow$  **Board**  $\rightarrow$  **Boards Manager** on Arduino IDE 1.8.5.



Figure 4-13 Click Boards Manager on Arduino IDE 1.8.5



Search "MuMaker" and the NuMaker UNO will show up on the list. Select NuMaker UNO and click install.

Boards Manager	
Pe All V NuMaker	
uMaker UNO (32-bits NUC131 Cortex-M0) by Nuvoton	
Jards Included in this package: Jyoton NuMaker Uno.	
nline help ore info	
	Install
	110001
	Close

Figure 4-14 Select NuMaker UNO and Click Install

#### 4.2.5 Step 5: Select NuMaker UNO on Arduino IDE 1.8.5 Board Selection

After the package download is finished, go to **Tools**  $\rightarrow$  **Board** and select NuMaker UNO to use it.



Figure 4-15 Select NuMaker UNO on Board Selection to Use It

#### 4.3 Hardware Setup

Hardware connections are shown in the figure below. Use a mini USB to connect to a computer.



Figure 4-16 NuMaker UNO Connected to Computer

#### 4.4 Testing USB and VCOM Device in the Device Manager

Before connecting the NuMaker UNO development board to the computer, please enable SW2 of VCOM Function. All the SW2 pins shall be turned on. Please refer to section 3.1.2. Open the device manager and check if the USB is detected. If it is not detected, please reinstall the Nu-Link USB Driver.



Figure 4-17 USB Device Detected by Device Manager

#### 5 STARTING TO USE NUMAKER UNO ON ARDUINO IDE 1.8.5

#### 5.1 Compiling and Executing Example Program

This example demonstrates how to download an application and debug using virtual serial port on a NuMaker UNO board. When users install the Nu-Link USB Driver, the "NuMaker UNO" can be found in Arduino IDE on **Tools**  $\rightarrow$  **Board**  $\rightarrow$  **NuMaker UNO** as shown in the figure below.

**Note:** Execute the "arduino\_debug.exe" file in the installation path.

#### 5.1.1 Step 1: Select the NuMaker UNO Board



Figure 5-1 NuMaker UNO Board Selection on Arduino IDE

#### 5.1.2 Step 2: Open virtual serial modes and select Debug Serial Port

**SW2**: Supply power to NuMaker UNO. Before NuMaker UNO is connected to PC, all the SW2 pins shall be turned on. To activate UART0 function, SW2 pin2 ~ pin4 shall be turned off.

Switch Pin Number	Function Name	UART0 Mode	VCOM Mode	SW2
1	ICE_VCC	On	On	
2	VCOM_En	Off	On	
3	VCOM_TX	Off	On	- A
4	VCOM_RX	Off	On	

Table 5-1 SW2 Mode Setting (Default as VCOM Mode)

Alter SW2 setting is con	npieted, you will be abi	e lo see lhe s	senal COM port number.
Тос	ols Help		
	Auto Format Archive Sketch Fix Encoding & Reload	Ctrl+T	
	Serial Monitor Serial Plotter	Ctrl+Shift+M Ctrl+Shift+L	run once
	WiFi101 Firmware Updater Board: "NuMaker UNO"	•	
	Port: "COM3"	1	Serial ports
	Get Board Info		✓ СОМЗ
	Programmer: "AVRISP mkII"	•	
	Burn Bootloader		

....

Figure 5-2 Select NuMaker-UNO Serial COM Port

**Note 1:** If the SW2 pin 2 of VCOM function is not enabled, **Tools**  $\rightarrow$  **Port** will become gray (disabled), unless the board is re-connected to the computer. However, before re-connecting to PC, you must open the VCOM function.

Note 2: If the serial port number is not selected, you will not be able to use the serial monitor.

Board at COM38 is not available	Board at COM38 is not available	Copy error messages
	Board at COM38 is not available	

Figure 5-3 COM port Not Detected and Unable to Use Serial Monitor

#### 5.1.3 Step 3: Open the sample code

Open the sample code through File  $\rightarrow$  Examples  $\rightarrow$  03.Analog  $\rightarrow$  AnalogInOutSerial.

File	Edit Sketch	Tools Help				
	New	Ctrl+N		Δ		
	Open	Ctrl+O		Built-in Examples	u	n once:
	Open Recent			01.Basics	•	
	Sketchbook			02.Digital	•	
	Examples		$\rightarrow$	03.Analog		AnalogInOutSerial
	Close	Ctrl+W		04.Communication		AnalogInput
	Save	Ctrl+S		05.Control		AnalogWriteMega
	Save As	Ctrl+Shift+S		06.Sensors		Calibration
	Dama Catura	Chill, Childh, D		07.Display		Fading
	Page Setup	Ctrl+ D		08.Strings		Smoothing
	Plint	Cuite				
	Preferences	Ctrl+Comma				
	Ouit	Ctrl+O				
	Quit	Cui+Q				

Figure 5-4 Open the Sample Code

#### 5.1.4 Step 4: Download the sample code

Use the Upload button to compile and load code to target board or use the Verify button to compile code.

Upload: This button can compile and load code to a target board. 1. 2. Verify: This button can compile code. ø 3. Serial Monitor: This button can open the serial monitor. File Edit Sketch Tools Help 2<sup>AnalquinOutSerial</sup> Analog input, analog output, serial output Reads an analog input pin, maps the result to a range from 0 to 255 and uses the result to set the pulsewidth modulation (PWM) of an output pin. Also prints the results to the serial monitor. The circuit: \* potentiometer connected to analog pin 0. Center pin of the potentioneter goes to the analog pin. wide pins of the potentiometer go to +5V and ground \* LED connected from digital pin 9 to ground created 29 Dec. 2008 modified 9 Apr 2012 by Ton 1goe Compiling sketch

Figure 5-5 Sample Program Compiled and Loaded

#### 5.1.5 Step 5: Check the Correctness of the VCOM Baud Rate

User needs to check if the virtual serial port baud rate setting is the same as the program setting. When the program is set to 9600, the virtual serial port monitor will be set as 9600.

### NuMaker UNO

### nuvoton

1			Send
seusor = o	borpar = o		
sensor = 0	output = 0		
sensor - O	putput - O		
sensor = O	output = 0		
sensor = 0	output = 0		
senaor - O	putput - O		
sensor = O	output - O		
sensor = 0	output = 0		
sensor = 0	output = 0		
sensor = O	output - O		
sensor = 0	output = 0		
sensor = 0	output = 0		-
W Autoscrol		No inc ondina	9600 baud

Figure 5-6 Serial Monitor

This example uses ADC0 to perform ADC conversion into a digital value which is then displayed by the virtual serial port out. To set a COM port baud rate and then display the virtual serial conversion results, use the ADC0 pin connected to  $V_{\text{DD}}$  or  $V_{\text{SS}}$ . Then, whether the ADC conversion result is correct can be displayed.



Figure 5-7 Sample Program Baud Rate Setting

### NuMaker UNO

## nuvoTon

1		
sensor = 1023	output = 255	
sensor = 1023	output = 255	
sensor = 1023	output = 255	
sensor = 1023	output = 255	
sensor = 1023	output = 255	
sensor = 1023	output = 255	
sensor = 1023	output = 255	
sensor = 1023	output = 255	
sensor = 1023	output = 255	
sensor = 1023	output = 255	
sensor = 1023	output = 255	
sensor = 1023	output = 255	
sensor = 1023	output = 255	
sensor = 1023	output = 255	
sensor = 1023	output = 255	
sensor = 1023	output = 255	
sensor = 1023	output = 255	
sensor = 1023	output = 255	
sensor = 1023	output = 255	
sensor = 1023	output = 255	
sensor = 1023	output = 255	
sensor = 1023	output = 255	
sensor = 1023	output = 255	
sensor = 1023	output = 255	
sensor = $1023$	output = 255	

Figure 5-8 Serial Monitor Shows ADC0 Conversion Result

### 6 STARTING TO USE NUMAKER UNO ON KEIL μVISION<sup>®</sup> IDE

#### 6.1 Downloading and Installing Keil µVision<sup>®</sup> IDE Software

Please visit the Keil official website (http://www.keil.com) to download the Keil  $\mu$ Vision<sup>®</sup> IDE and install the RVMDK.

#### 6.2 Downloading and Installing Nu-Link Keil Driver

Please visit Nuvoton NuMicro<sup>®</sup> official website (http://www.nuvoton.com/NuMicro) to download the "*NuMicro Nu-Link Keil Driver*" file. Please refer to section 8.1 for the detailed download flow. After the Nu-Link driver is downloaded, please unzip the file and execute the "Nu-Link Keil Driver.exe" to install the driver.

#### 6.3 Hardware Setup

The hardware setup is shown in the figure 6-1. If users want to use the VCOM function, turn on all the SW2 pins (refer to section 3.1.2).



Figure 6-1 NuMaker UNO Connected to the Computer

#### 6.4 Procedure for Downloading and Debugging Example Program

This example demonstrates how to download and debug a program on the NuMaker UNO board. The example file can be found in the directory list as shown in the following figure.

#### 6.4.1 Step 1: Open the Project

Please open the following path.

"C:\Nuvoton\BSPLibrary\NUC131BSP\_CMSIS\_v3.00.001\SampleCode\StdDriver\ADC\_Result Monitor\KEIL"

### NuMaker UNO

## nuvoTon



Figure 6-2 ADC Sample Program

#### 6.4.2 Step 2: Check Device Chip and Debug Chip

Please open the "target options" to check the device chip and if the debug chip selection is correct. Figure 6-3 shows the correct device chip selection. Figure 6-4 shows the correct debug chip selection. Figure 6-5 shows the debugging tool to confirm the selection is correct.

### NuMaker UNO

### nuvoton



Figure 6-3 Select Device Chip



Figure 6-4 Select Debug Chip

Ì	Nuvoton Nu-Link Debugger 💌 Settings 🔽 Update Target before Debugging
Init File:	Edit
C Use Extern	al Tool for Flash Programming
Command:	
Arguments:	
	Run Independent

Figure 6-5 Select Nuvoton Debugger Tool (Nu-Link)

#### 6.4.3 Step 3: Build and Download Sample Code

Click the Build button to see the completed compilation for error if any, and finally load the code to the development board.

Build

Download

#### 6.4.4 Step 4: Open the Serial Monitor and Set Baud Rate

User can open the serial monitor to print debug message. The present example uses the "PuTTY tool".

### NuMaker UNO

### nuvoTon

<ul> <li>Session</li> <li>Logging</li> <li>Terminal</li> <li>Keyboard</li> <li>Bell</li> <li>Features</li> <li>Window</li> <li>Appearance</li> <li>Behaviour</li> <li>Translation</li> <li>Selection</li> <li>Colours</li> <li>Connection</li> <li>Data</li> <li>Proxy</li> <li>Telnet</li> <li>Rlogin</li> <li>SSH</li> <li>Serial</li> </ul>	Basic options for your PuTTY session	
	Specify the destination you want to connect to	
	Serial line	Speed
	COM38	115200
	Connection type.	Rlogin 🔘 SSH 💿 Serial ed session
	Saved Sessions	
	Default Settings	Load Save Delete
	Close window on exit:	Only on clean exit

Figure 6-6 Set the Baud Rate on PuTTY Tool

#### 6.4.5 Step 5: Click the Reset Button to Run Your Code.

After clicking the Reset button, chip will re-execute the program. The debug messages are displayed as shown below

EP COM38 - Pully	_
System clock rate: 50000000 Hz	^
ADC compare function (result monitor) sample code   ++	
<pre>In this test, software will compare the conversion result of channel 2. Set the compare condition of comparator 0: channel 2 is less than 0x800; matc h count is 5. Set the compare condition of comparator 1: channel 2 is greater than or equal to 0x800; match count is 5. Comparator 0 interrupt occurs. The conversion result of channel 2 is less than 0x800</pre>	-
Exit ADC sample code	

Figure 6-7 Serial Monitor Window

Function Button Description:

1. **Open µVision<sup>®</sup>** Development Tool 4 Open Debug Mode (Step 4 in Figure Project – Open 6-9) Open the SYS.uvproj project file (Step 1 When using the debugger commands, it in Figure 6-8) has the following features: a. Window View to detect changes in Project – Build 2. the value of variables and registers • Compile and link the SYS application (Step 4a in Figure 6-10) (Step 2 in Figure 6-9) LOAD b. 🚹 Single-Step through code (Step 4b 👯 Flash – Download 3. in Figure 6-10) • Program the application code into on-chip Flash ROM (Step 3 in Figure 6-9) c. Reset the device (Step 4c in Figure 6-10) d. 🗐 Run the application (Step 4d in Figure 6-10)



Figure 6-8 ADC Sample Code Path

File Edit View Project	Flash Debug Peripherals Tools SVCS Window Help
🗋 🎯 🖬 🕼 🔺 🛓	2 跑   今 (2)   今 (4)   陀 (2) (2) (2)   字 譯 //: //::   過 (20) semihost 💿 🗟 (4) 🔍 🧕 (1) 🔗 (4)   回 🖓
🕸 🗄 🛅 🖉 🔛 🙀	ADC_ResultMonitor 💽 🔊 🛔 🗟 🧇 🚳
roject 🛛 🕈 🖻	
AD 2 Result Monit	3 1 1/**********************************
	2 * @file main.c
	3 * @version V2.0
	4 * \$Revision: 6 \$
E Change	5 * \$Date: 15/01/15 1:32p \$
	6 * @brief Monitor the conversion result of channel 2 by the digital compare function.
	7 * @note
	8 * Copyright (C) 2014 Nuvoton Technology Corp. All rights reserved.
	9 *
	10 L ***********************************
	11 #include <stdio.h></stdio.h>
	12 #include "NUC131.h"
	13
	14
	15 #define PLL_CLOCK 5000000
	16
	17
	18
	19 /*
	20 /* Define Function Prototypes
	22 void Sis Int (void);
	23 VOID OARIO INIC(VOID);





Figure 6-10 ADC Enter Debug Mode Interface

#### 7 STARTING TO USE NUMAKER UNO ON IAR EMBEDDED WORKBENCH

#### 7.1 Downloading and Installing IAR Embedded Workbench Software

Please visit IAR official website (http://www.iar.com) to download the IAR Embedded Workbench and install the EWARM.

#### 7.2 Downloading and Installing Nu-Link IAR Driver

Please visit Nuvoton NuMicro<sup>®</sup> official website (http://www.nuvoton.com/NuMicro) to download "NuMicro Nu-Link IAR Driver" file. Please refer to section 8.2 for the detailed download flow. After the Nu-Link driver is downloaded, please unzip the file and execute the "Nu-Link IAR Driver.exe" to install the driver.

#### 7.3 Hardware Setup

The hardware setup is shown in the figure 7-1. If users want to use the VCOM function, please turn on all the SW2 pins. Please refer to section 3.1.2.



Figure 7-1 NuMaker UNO Connected to the Computer

#### 7.4 Procedure for Downloading and Debugging Example Program

This example demonstrates how to download and debug an application on a NuMaker UNO board. The example file can be found in the directory list as shown in the following figure.

#### 7.4.1 Step 1: Open the Project

Please open the following path example program. "C:\Nuvoton\BSPLibrary\NUC131BSP\_CMSIS\_v3.00.001\SampleCode\StdDriver\ADC\_Result Monitor\IAR".

Figure 7-2 ADC Sample Program in IAR

#### 7.4.2 Step 2: Download the Sample Code.

Click the button on the top right corner to download the program.

ADC_ResultMonitor - IAR Embedde	ed Workbench IDE
File Edit View Project Nu-Link	CTools Window Help
D 🚅 🛛 🖉 🍊 👗 🖻 🖻	v a 🔹 🗸 🔸 🦕 💆 🔊 🖉 🗣 🖓 🖓 🔛 😓 🕭
Workspace ×	nain.c
Release       Files     Can Base       Image: Comparison of the state of the s	<pre>{     if (ADC_GET_INT_FLAG(ADC, ADC_CMP0_INT) != 0)     {         g_u32AdcCmp0IntFlag = 1;         ADC_CLR_INT_FLAG(ADC, ADC_CMP0_INT); /* clear the A/D compare flag 0 */     } </pre>
Comparison	<pre>if(ADC_GET_INT_FLAG(ADC, ADC_CMP1_INT) != 0) {     g_u32AdcCmp1IntFlag = 1;     ADC_CLR_INT_FLAG(ADC, ADC_CMP1_INT); /* clear the A/D compare flag 1 */ }</pre>

Figure 7-3 Compile and Load Program in IAR

#### 7.4.3 Step 3: Click the Reset Button to Run Your Code

After clicking the Reset button, chip will re-execute the application and debug messages are displayed.



Figure 7-4 Serial Monitor Window

Function Button Description:

- Open IAR Embedded Workbench File – Open – Workspace Open the SYS.eww workspace file
- Project Make Compile and link the SYS application
- Project Download and Debug Program the application code into on-chip Flash ROM. It has the following features:



Reset the device



### 8 DOWNLOADING NU-LINK DRIVER FROM NUVOTON WEBSITE

### 8.1 Downloading and Installing Nu-Link Keil Driver

Step 1	Visit Nuvoton NuMicro <sup>®</sup> Website: http://www.nuvoton.com/NuMicro				
Step 2	2.1. Move to "Support"				
Step 3	Image: Products       Image: Products       Image: Products       Image: Product > Tool & Software > Software         Home > Support > Tool & Software > Software       Software       Image: Product Related Information         Brochures and Flyers       Tool & Software       Image: Product Related Information         Brochures and Flyers       Image: Product Related Information       Image: Product Related Information         Brochures and Flyers       Tool & Software       Image: Product Related Information         Brochures and Flyers       Tool & Software       Image: Product Related Information         Brochures and Flyers       Tool & Software       Image: Product Related Information         Brochures and Flyers       Tool & Software       Image: Product Related Information         Brochures and Flyers       Tool & Software       Image: Product Related Information         Brochures and Flyers       Tool & Software       Image: Product Related Information         Brochures and Flyers       Tool & Software       Image: Product Related Information         Image: Development Tool Hardware       Image: Product Related Information       Image: Product Related Information         Image: Development Tool Hardware       Image: Product Related Rel				



#### 8.2 Downloading and Installing Nu-Link IAR Driver



### nuvoton



### NuMaker UNO

## nuvoTon

#### 9 NUMAKER UNO SCHEMATICS

#### 9.1 NuMaker UNO I/O Schematic



### NuMaker UNO

#### 9.2 NuMaker UNO NUC131SD2AE Schematic



#### 9.3 Nu-Link-Me Schematic



#### **10 REVISION HISTORY**

Date	Revision	Description	
2015.07.20	1.00	1.	Initially issued.
2016.11.02	1.01	1.	Changed the board name from NuEdu-UNO to NuMaker UNO.
		2.	Updated NuMicro <sup>®</sup> Patch for Arduino 1.5.8 to Nu-Link_USB_Driver_V1.2 in section 4.2.
		3.	Added section 3.3 NuMaker UNO NUC131SD2AE Extended Connectors Layout.
2018.08.20	1.02	1.	Update installing instruction in section 4.1, 4.2.
		2.	Update NuMaker-UNO package for Arduino 1.8.5

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