

RP2040-Tiny

From Waveshare Wiki

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Overview

RP2040-Tiny micro development board, using the RP2040 developed by Raspberry Pi as the core.

With a separate adapter board design, USB and keypad circuits can be separated, reducing the overall thickness and size of the PCB and making it easier for users to integrate into their projects.

The separate adapter board design, compact size, and very thin thickness make this board ideal for projects requiring a small size.

Whether you are a beginner or an experienced developer, it is a great choice for your next project.

Features

- RP2040 microcontroller chip designed by Raspberry Pi in the United Kingdom.
- Dual-core Arm Cortex M0+ processor, flexible clock running up to 133 MHz.
- 264KB of SRAM, and 2MB of onboard Flash memory.
- Onboard FPC 8PIN connector, adapting USB Type-C port via an adapter board.
- Castellated module allows soldering directly to carrier boards.
- USB 1.1 with device and host support.
- Low-power sleep and dormant modes.
- Drag-and-drop programming using mass storage over USB.
- 20 × multi-function GPIO pins.
- 2 × SPI, 2 × I2C, 2 × UART, 4 × 12-bit ADC, 16 × controllable PWM channels.
- Accurate clock and timer on-chip.
- Temperature sensor.
- Accelerated floating-point libraries on-chip.

RP2040-Tiny

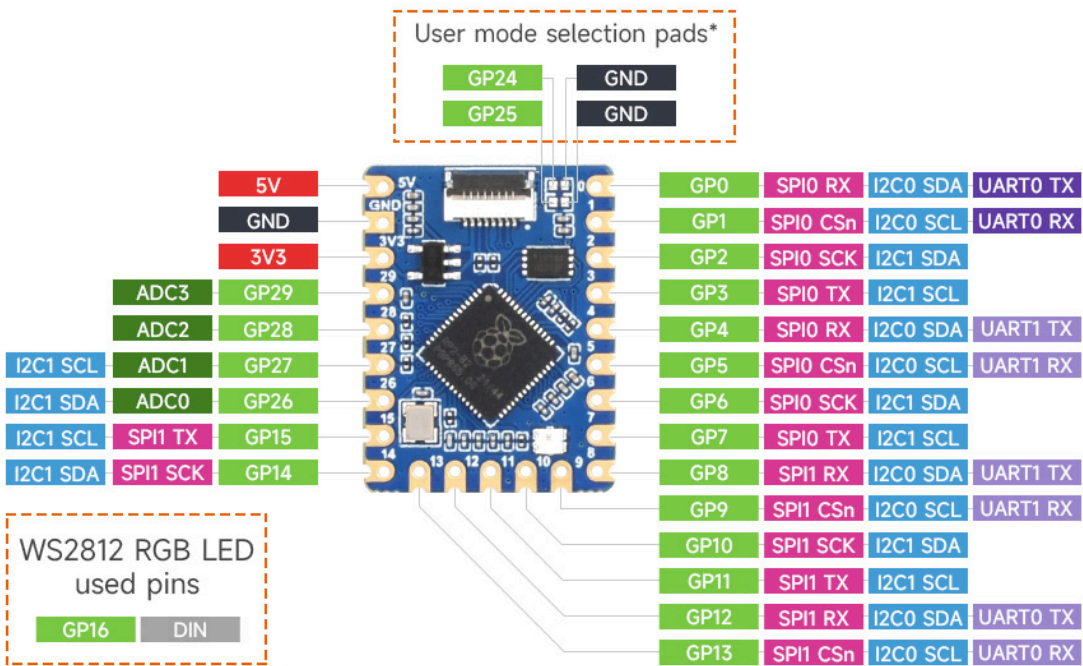


(<https://www.waveshare.com/rp2040-tiny.htm>)

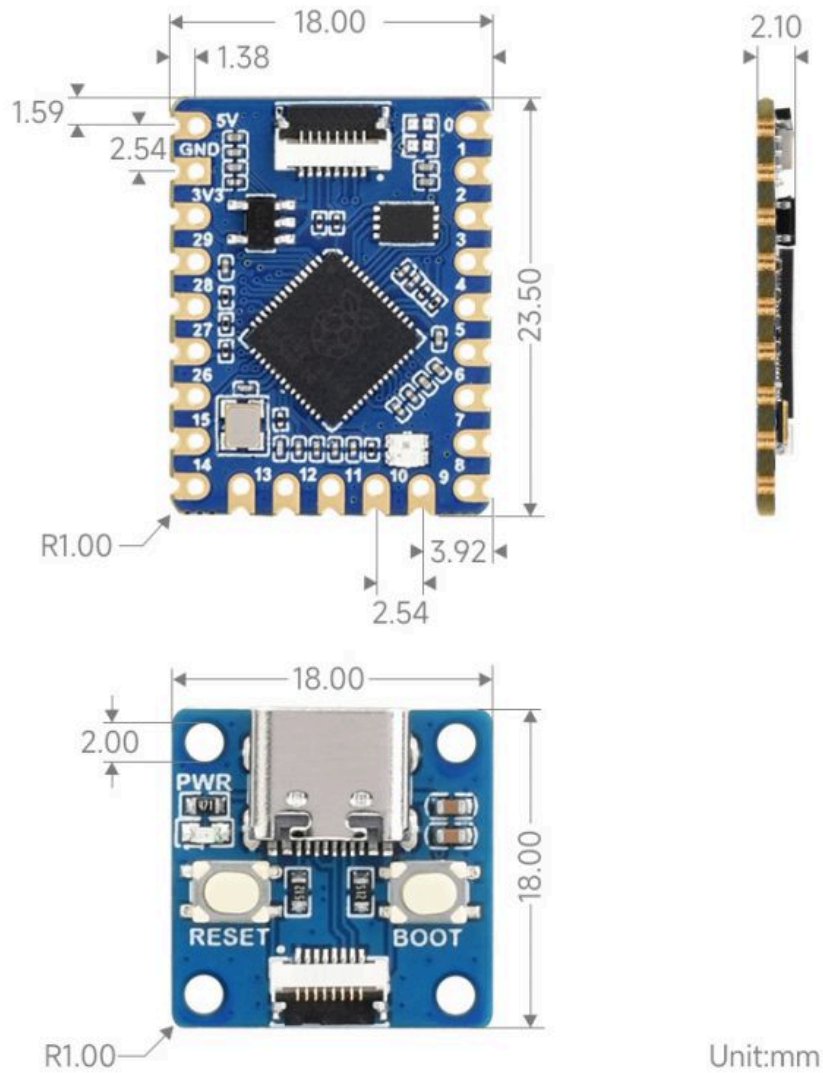
RP2040, FPC

- 8 × Programmable I/O (PIO) state machines for custom peripheral support.

Pinout



Dimensions



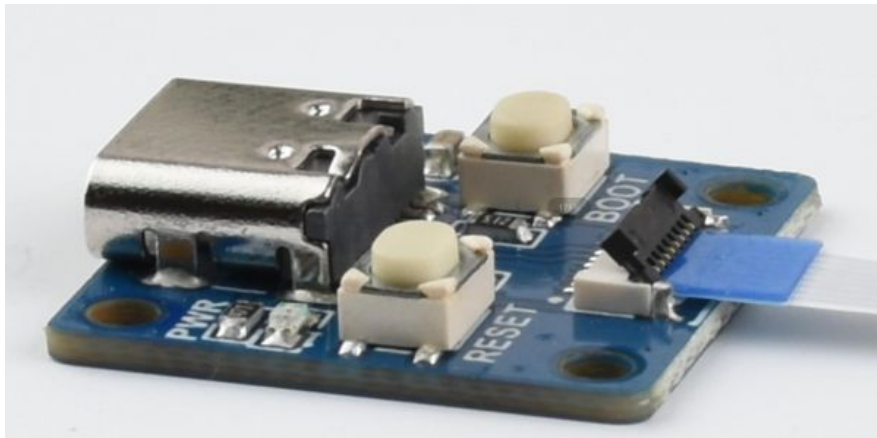
Cable Connection

- **Please read this section and the precautions before connection, otherwise the device may be damaged or short-circuited!**
- FPC connector update in V1.1 version and above can bring you a better experience, which can be identified by the back of the Rev*. * for version differentiation.

1. Open the flip cover of the cable connector.

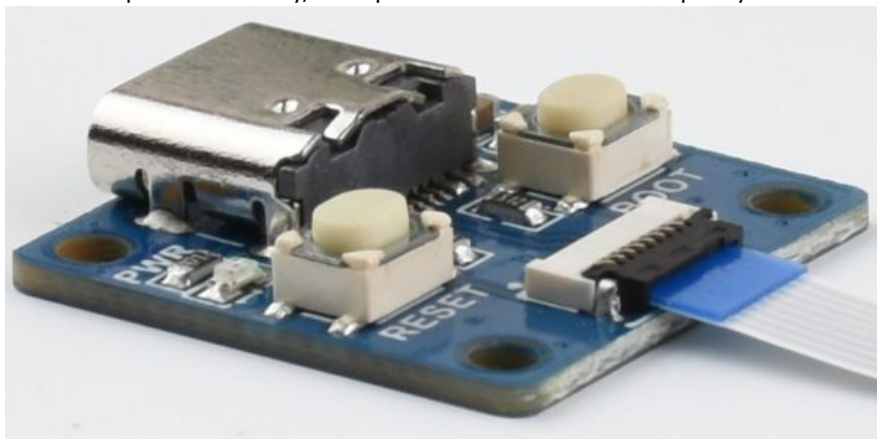


2. Please make sure to install the cable in the center.



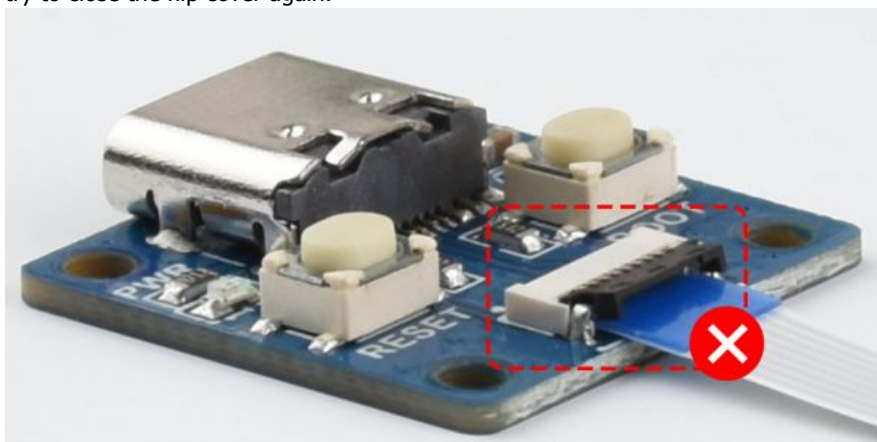
(/wiki/File:Ting-connect-01.jpg)

3. Close the flip cover. Normally, the flip cover should be closed completely.



(/wiki/File:Ting-connect-02.jpg)

4. If the cable is not properly installed, it may prevent the flip cover from closing correctly. Please adjust the position of the cable and try to close the flip cover again.



(/wiki/File:Ting-connect-WR.jpg)

Note

- Please do not unplug the cable with electricity, otherwise it may lead to a short circuit.
- When installing the cable, it is important to pay attention to its proper connection in the center and ensure that it is inserted fully into the socket. Incorrect installation may result in connection issues or even short circuits.

Pico Getting Started

Firmware Download

- [MicroPython Firmware Download](#)

[\[Expand\]](#)

Introduction

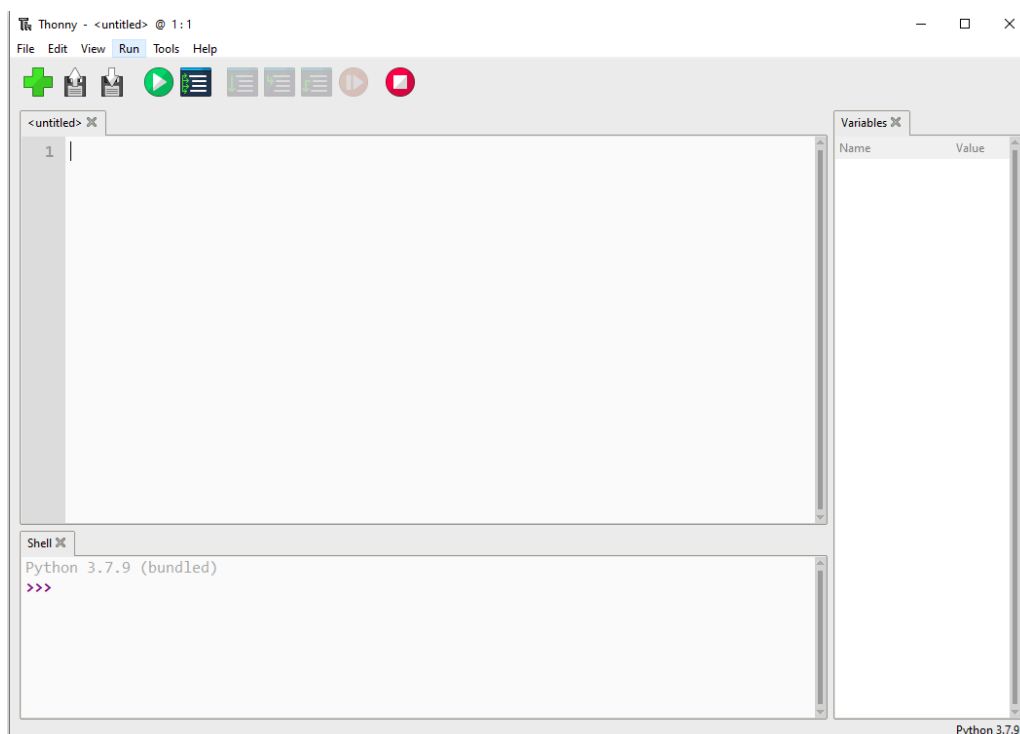
Raspberry Pi Pico Basics (https://www.waveshare.com/wiki/Raspberry_Pi_Pico)

MicroPython Series

Install Thonny IDE

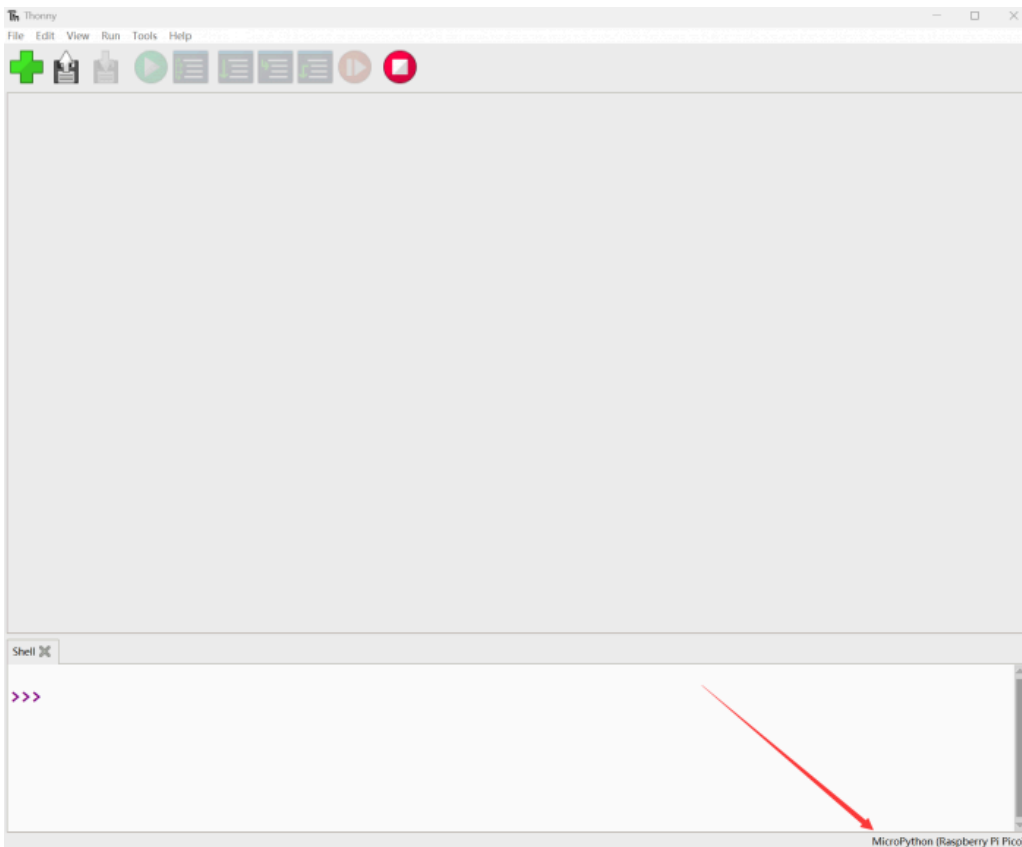
In order to facilitate the development of Pico/Pico2 boards using MicroPython on a computer, it is recommended to download the Thonny IDE

- Download Thonny IDE and follow the steps to install, the installation packages are all Windows versions, please refer to Thonny's official website for other versions
 - Thonny IDE official download link (<https://github.com/thonny/thonny/releases/download/v3.3.3/thonny-3.3.3.exe>)
 - Thonny IDE download link (<https://files.waveshare.com/wiki/common/Thonny-3.3.3.zip>)
 - Thonny official website (<https://thonny.org/>)
- After installation, the language and motherboard environment need to be configured for the first use. Since we are using Pico/Pico2, pay attention to selecting the Raspberry Pi option for the motherboard environment



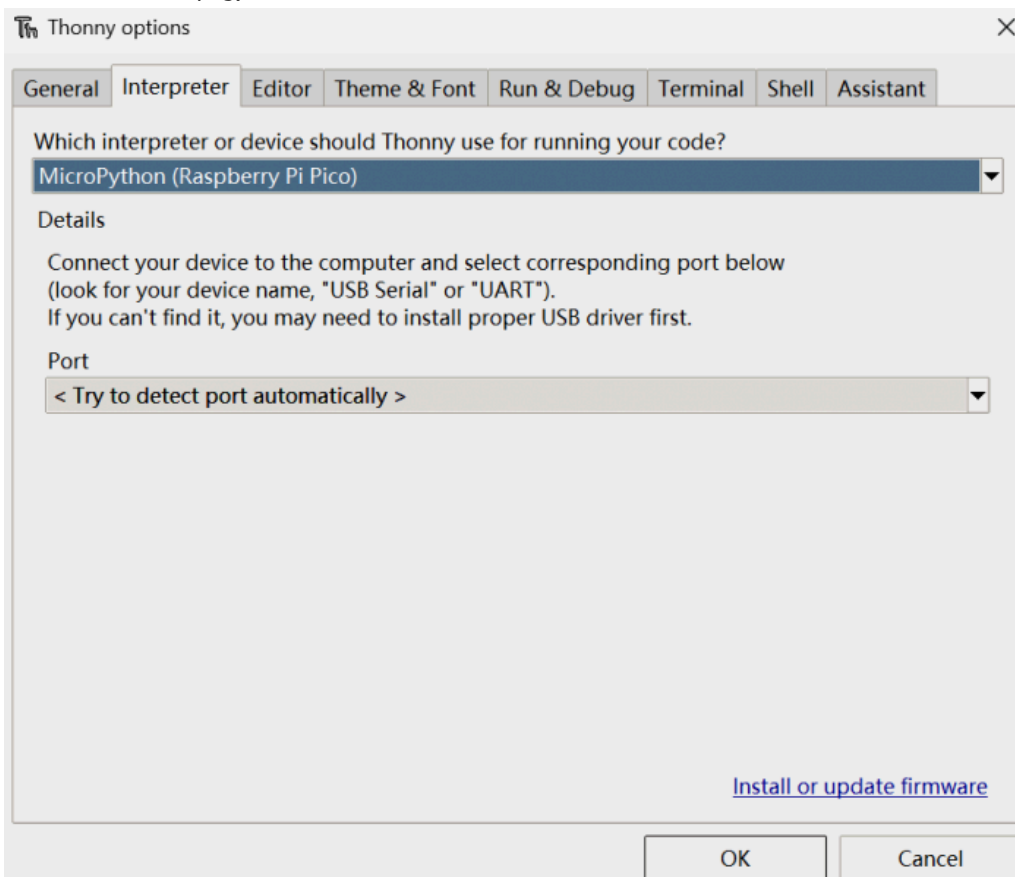
(/wiki/File:Pico-R3-Tonny1.png)

- Configure MicroPython environment and choose Pico/Pico2 port
 - Connect Pico/Pico2 to your computer first, and in the lower right corner of Thonny left-click on the configuration environment option --> select Configure interpreter
 - In the pop-up window, select MicroPython (Raspberry Pi Pico), and choose the corresponding port



(/wiki/File:700px-Raspberry-Pi-

Pico-Basic-Kit-M-2.png)



(/wiki/File:700px-Raspberry-Pi-

Pico-Basic-Kit-M-3.png)

Flash Firmware

- Click OK to return to the Thonny main interface, download the corresponding firmware library and burn it to the device, and then click the Stop button to display the current environment in the Shell window
- Note: Flashing the Pico2 firmware provided by Micropython may cause the device to be unrecognized, please use the firmware below or in the package**
 - Pico firmware library (<https://files.waveshare.com/wiki/common/Rp2-pico-20210418-v1.15.7z>)
 - Pico2 firmware library (https://files.waveshare.com/wiki/common/RPI_PICO2-20240809-v1.24.0.zip)

- How to download the firmware library for Pico/Pico2 in windows: After holding down the BOOT button and connecting to the computer, release the BOOT button, a removable disk will appear on the computer, copy the firmware library into it
- How to download the firmware library for RP2040/RP2350 in windows: After connecting to the computer, press the BOOT key and the RESET key at the same time, release the RESET key first and then release the BOOT key, a removable disk will appear on the computer, copy the firmware library into it (you can also use the Pico/Pico2 method)



(/wiki/File:Raspberry-Pi-Pico2-

Python.png)

MicroPython Series

【MicroPython】 machine.Pin class function details (https://www.waveshare.com/wiki/%E3%80%90MicroPython%E3%80%91Machine.Pin_Functions)

【MicroPython】 machine.PWM class function details (https://www.waveshare.com/wiki/%E3%80%90MicroPython%E3%80%91Machine.PWM_Function)

【MicroPython】 machine.ADC class function details (https://www.waveshare.com/wiki/%E3%80%90MicroPython%E3%80%91Machine.ADC_Function)

【MicroPython】 machine.UART class function details (https://www.waveshare.com/wiki/%E3%80%90MicroPython%E3%80%91Machine.UART_Function)

【MicroPython】 machine.I2C class function details (https://www.waveshare.com/wiki/%E3%80%90MicroPython%E3%80%91Machine.I2C_Function)

【MicroPython】 machine.SPI class function details (https://www.waveshare.com/wiki/%E3%80%90MicroPython%E3%80%91Machine.SPI_Function)

【MicroPython】 rp2.StateMachine class function details (https://www.waveshare.com/wiki/%E3%80%90MicroPython%E3%80%91RP2.StateMachine_Function)

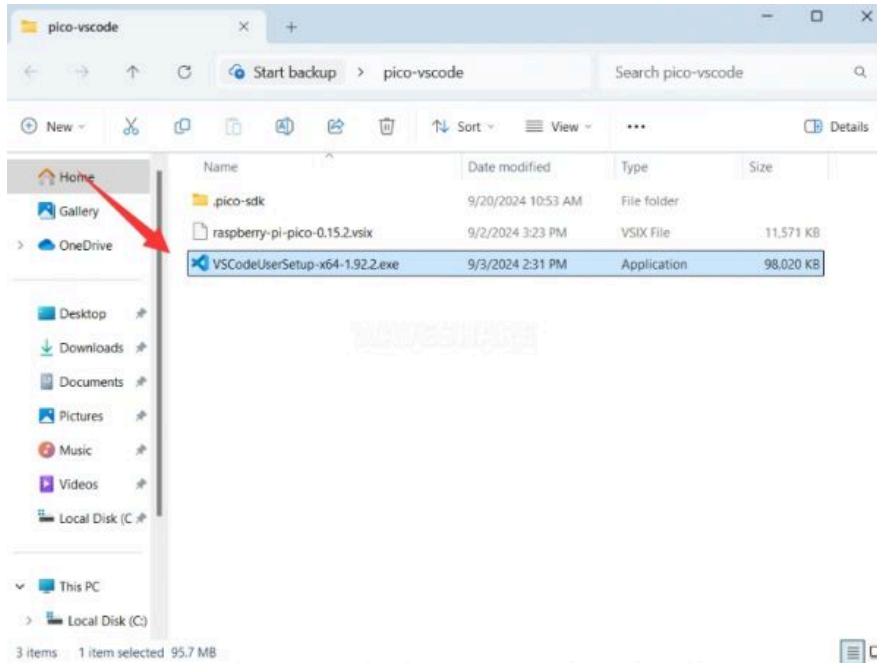
C/C++ Series

For C/C++, it is recommended to use Pico VS Code for development. This is a Microsoft Visual Studio Code extension designed to make it easier for you to create, develop, and debug projects for the Raspberry Pi Pico series development boards. No matter if you are a beginner or an experienced professional, this tool can assist you in developing Pico with confidence and ease. Here's how to install and use the extension.

- Official website tutorial: <https://www.raspberrypi.com/news/pico-vscode-extension/> (<https://www.raspberrypi.com/news/pico-vscode-extension/>)
- This tutorial is suitable for Raspberry Pi Pico, Pico2 and the RP2040 and RP2350 series development boards developed by WaveShare
- The development environment defaults to Windows11. For other environments, please refer to the official tutorial for installation

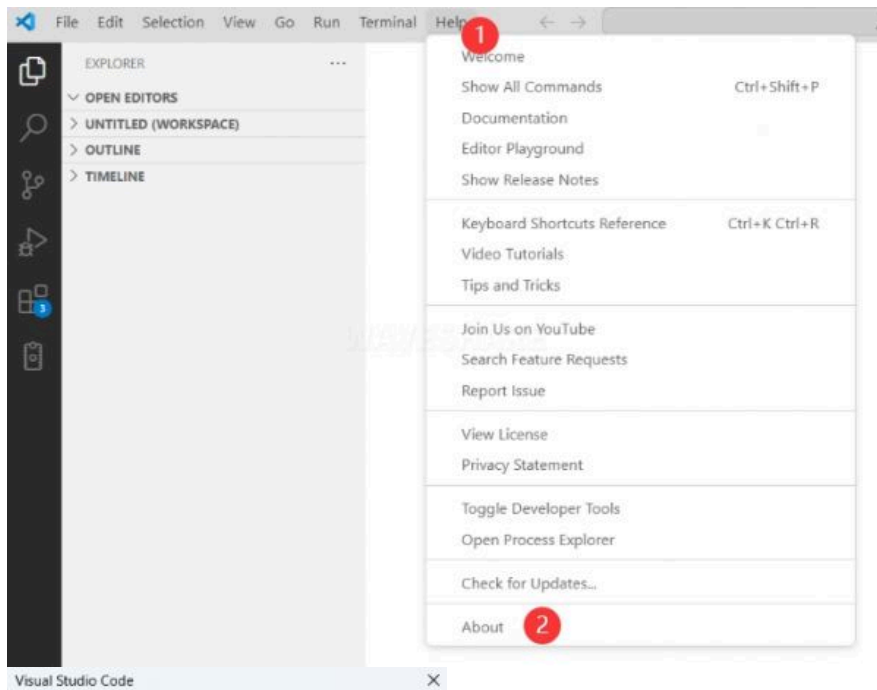
Install VSCode

1. First, click to download pico-vscode package (<https://drive.google.com/file/d/18-KDNrQII0KuTMdS6W5iblUGaGm3FbVJ/view?usp=s> haring), unzip and open the package, double-click to install VSCode

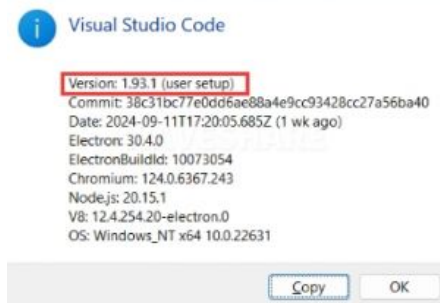


(/wiki/File:Pico-vscode-1.JPG)

Note: If vscode is installed, check if the version is v1.87.0 or later



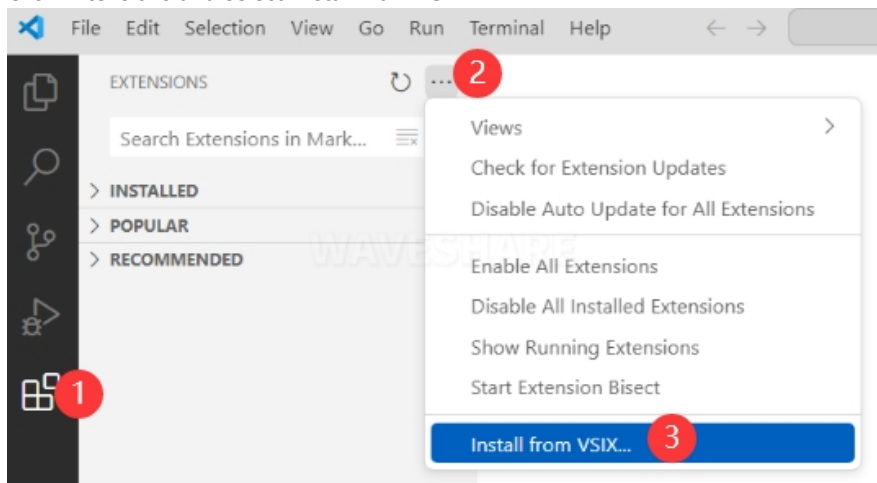
(/wiki/File:Pico-vscode-2.JPG)



(/wiki/File:Pico-vscode-3.JPG)

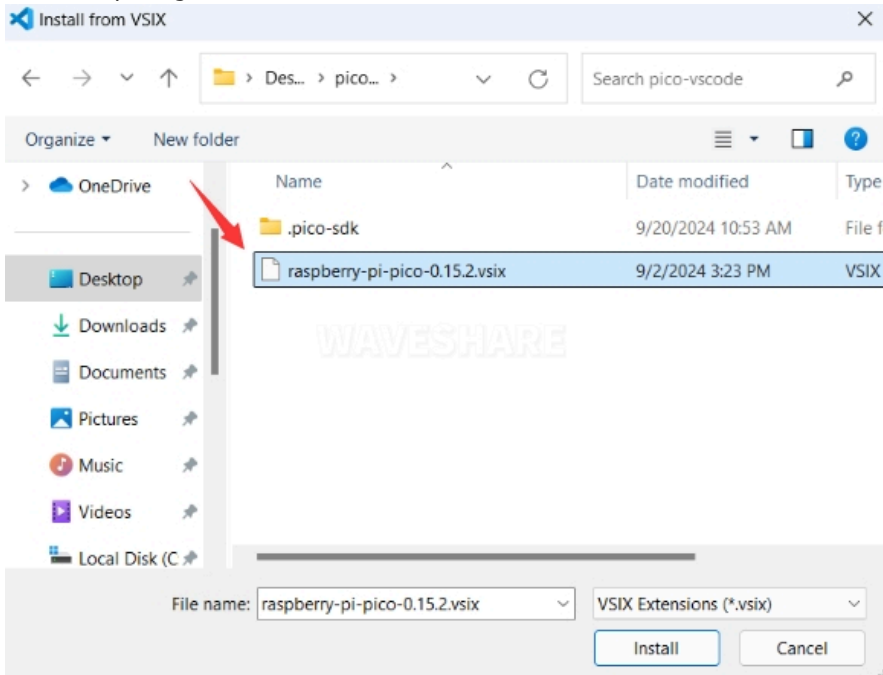
Install Extension

1. Click Extensions and select Install from VSIX

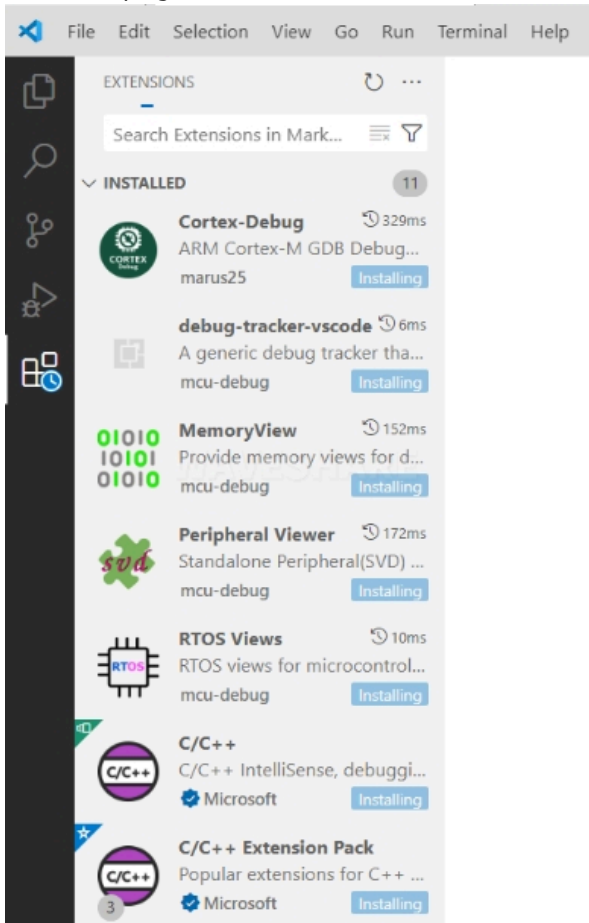


(/wiki/File:Pico-vscode-4.JPG)

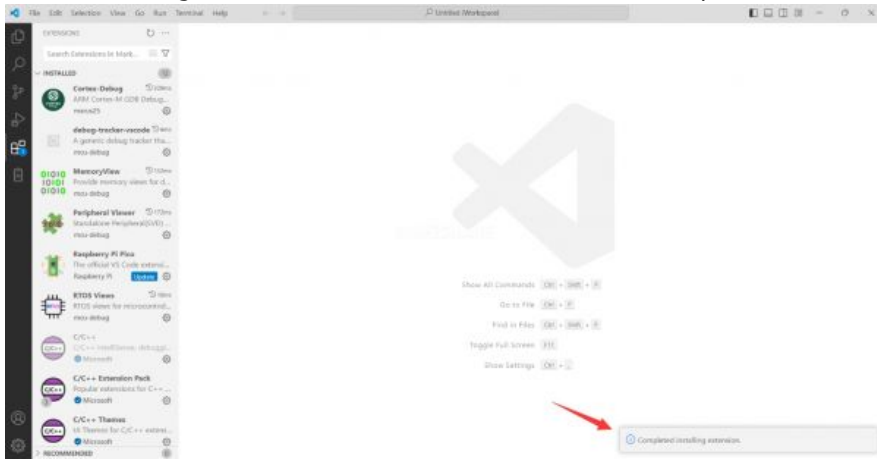
2. Select the package with the vsix suffix and click Install



3. Then vscode will automatically install raspberry-pi-pico and its dependency extensions, you can click Refresh to check the installation progress



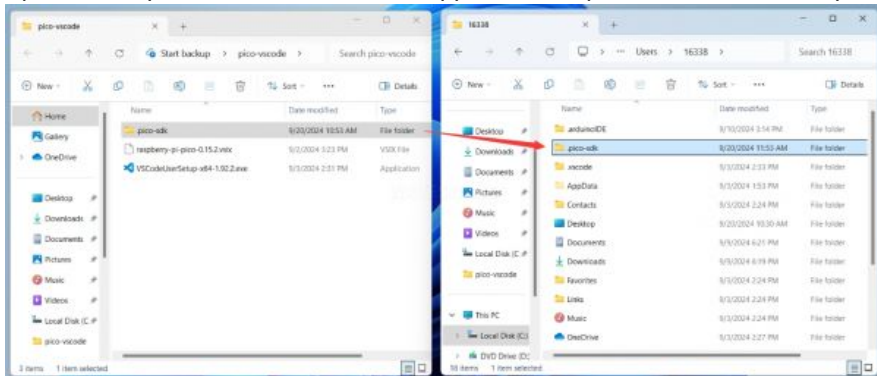
4. The text in the right lower corner shows that the installation is complete. Close VSCode



(/wiki/File:Pico-vscode-7.JPG)

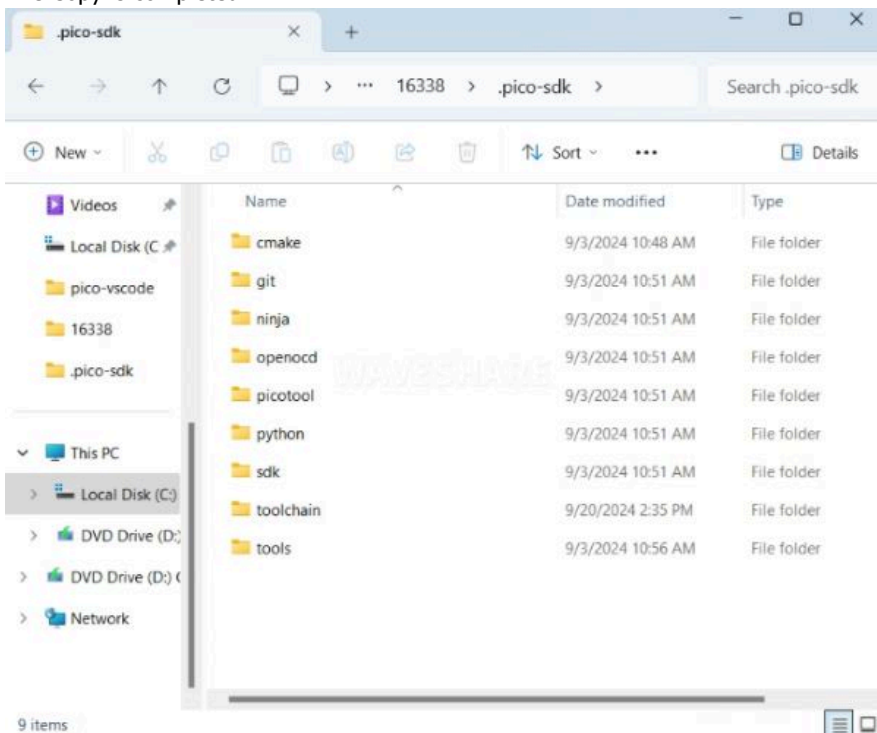
Configure Extension

1. Open directory C:\Users\username and copy the entire .pico-sdk to that directory



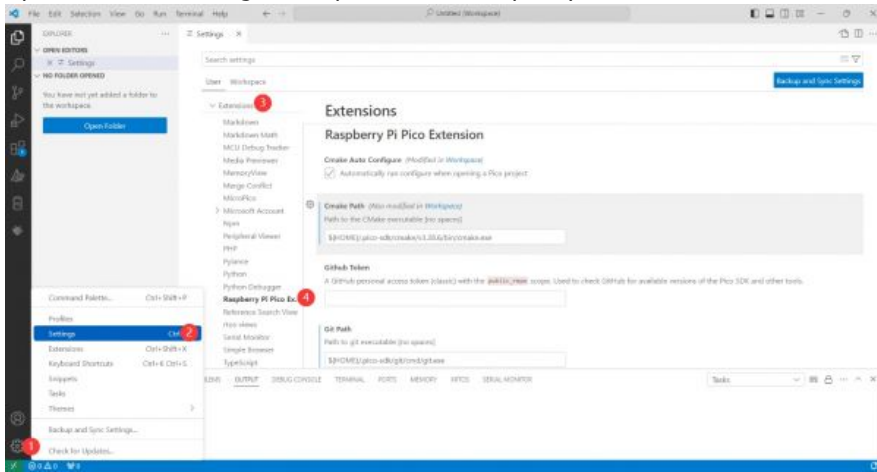
(/wiki/File:Pico-vscode-8.JPG)

2. The Copy is completed



(/wiki/File:Pico-vscode-9.JPG)

3. Open vscode and configure the paths for the Raspberry Pi Pico extensions



(/wiki/File:Pico-vscode-10.JPG)

The configuration is as follows:

```
Cmake Path:
${HOME}/.pico-sdk/cmake/v3.28.6/bin/cmake.exe

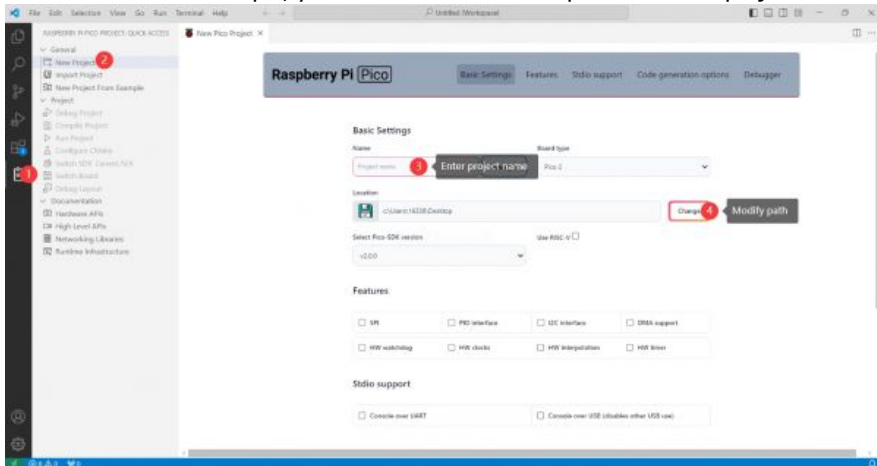
Git Path:
${HOME}/.pico-sdk/git/cmd/git.exe

Ninja Path:
${HOME}/.pico-sdk/ninja/v1.12.1/ninja.exe

Python3 Path:
${HOME}/.pico-sdk/python/3.12.1/python.exe
```

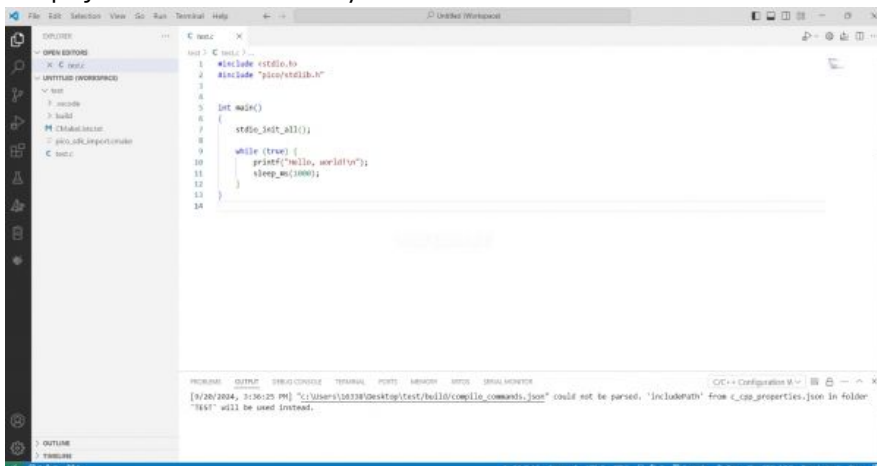
New Project

1. The configuration is complete, create a new project, enter the project name, select the path, and click Create to create the project
To test the official example, you can click on the Example next to the project name to select



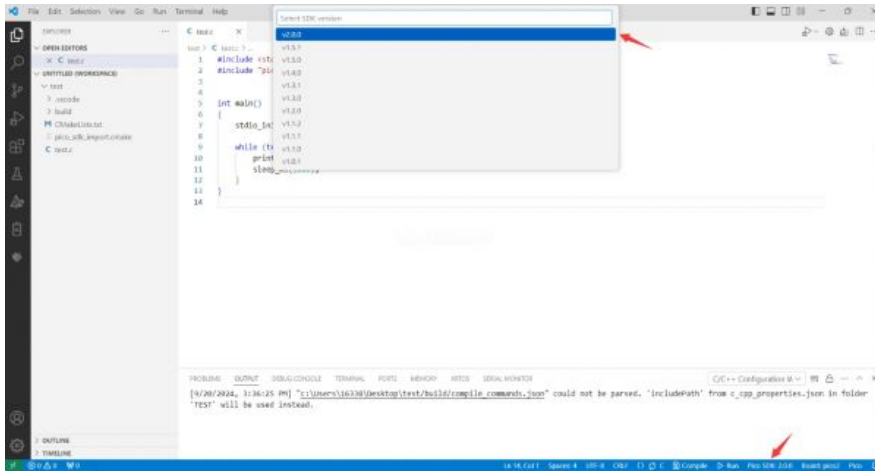
(/wiki/File:Pico-vscode-11.JPG)

2. The project is created successfully



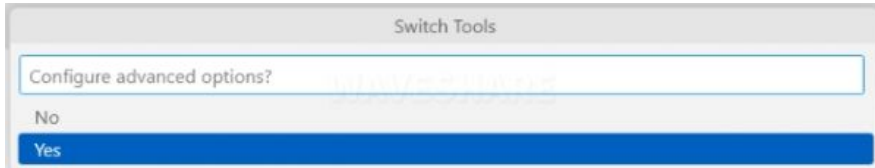
(/wiki/File:Pico-vscode-12.JPG)

3. Select the SDK version



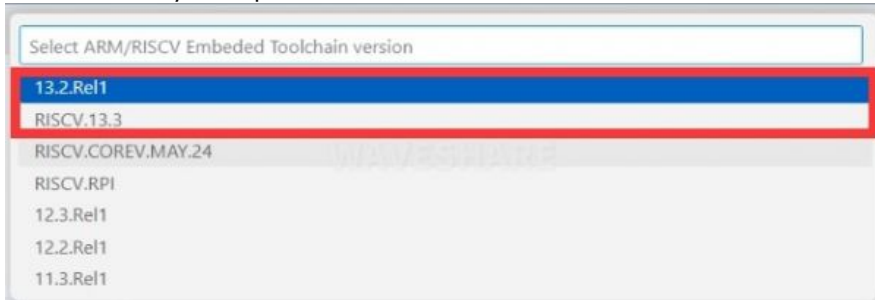
(/wiki/File:Pico-vscode-13.JPG)

4. Select Yes for advanced configuration



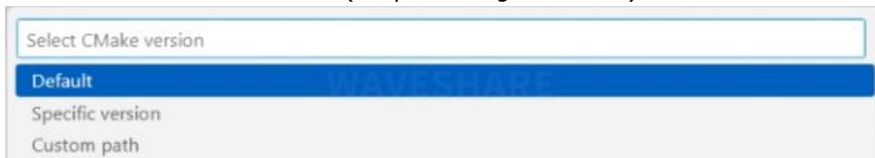
(/wiki/File:Pico-vscode-14.JPG)

5. Choose the cross-compilation chain, 13.2.Rel1 is applicable for ARM cores, RISC.V13.3 is applicable for RISC.V cores. You can select either based on your requirements



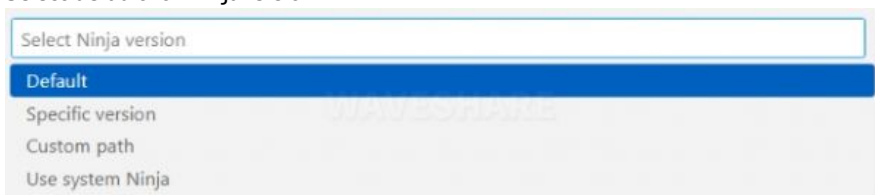
(/wiki/File:Pico-vscode-15.JPG)

6. Select default for CMake version (the path configured earlier)



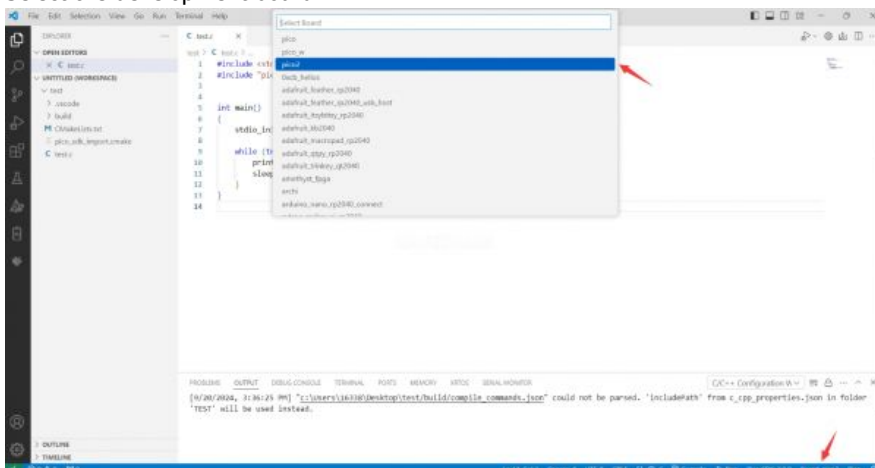
(/wiki/File:Pico-vscode-16.JPG)

7. Select default for Ninja version



(/wiki/File:Pico-vscode-17.JPG)

8. Select the development board



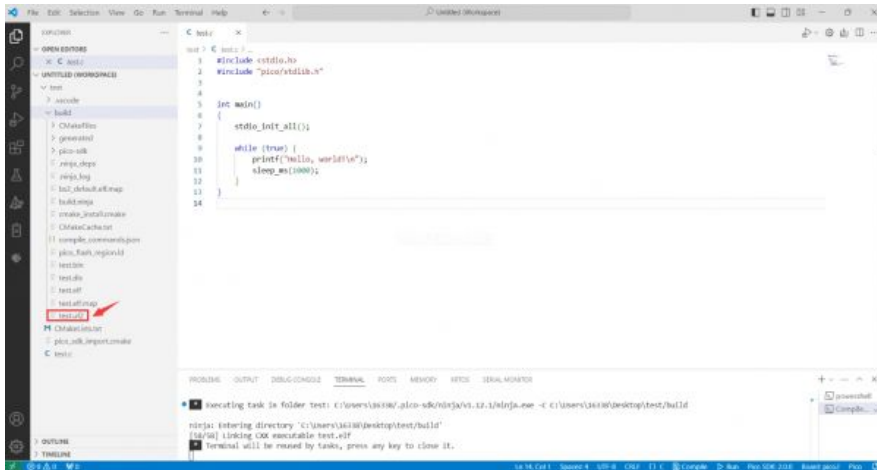
(/wiki/File:Pico-vscode-18.JPG)

9. Click Compile to compile



(/wiki/File:Pico-vscode-19.JPG)

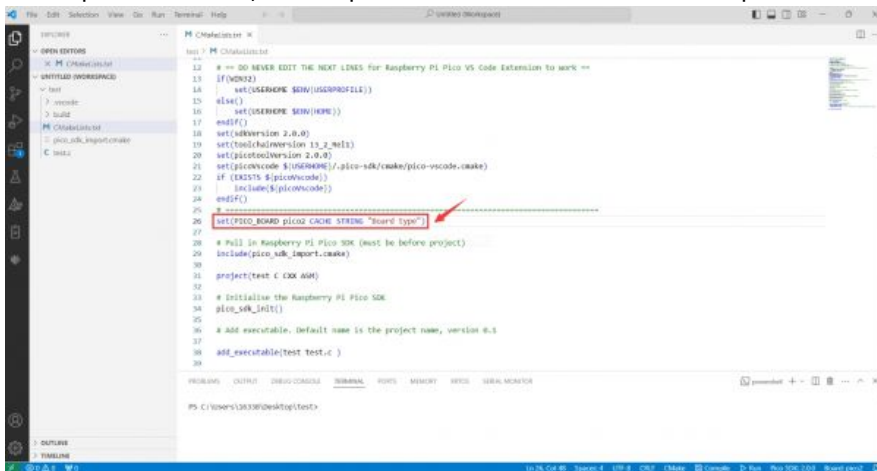
10. The uf2 format file is successfully compiled



(/wiki/File:Pico-vscode-20.JPG)

Import Project

1. The Cmake file of the imported project cannot have Chinese (including comments), otherwise the import may fail
2. To import your own project, you need to add a line of code to the Cmake file to switch between pico and pico2 normally, otherwise even if pico2 is selected, the compiled firmware will still be suitable for pico

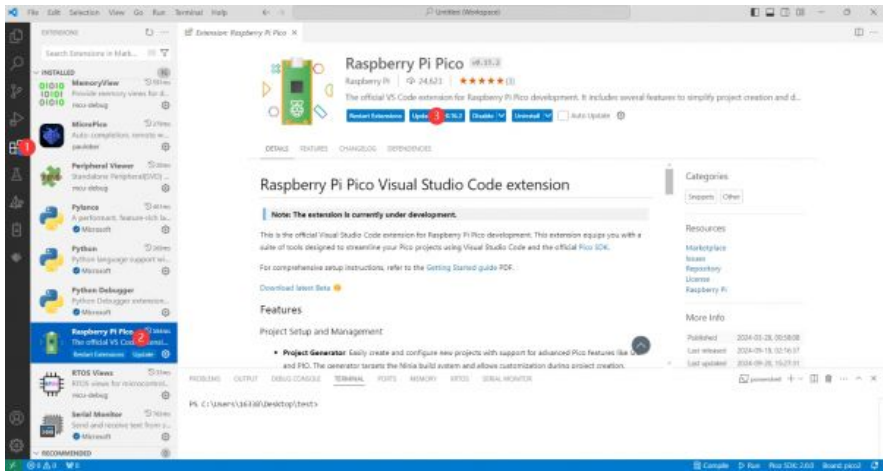


(/wiki/File:Pico-vscode-21.JPG)

set(PICO_BOARD pico CACHE STRING "Board type")

Update Extension

1. The extension version in the offline package is 0.15.2, and you can also choose to update to the latest version after the installation is complete

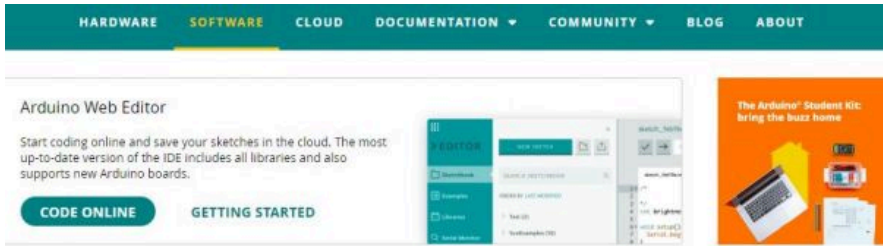


(/wiki/File:Pico-vscode-22.JPG)

Arduino IDE Series

Install Arduino IDE

1. First, go to Arduino official website (<https://www.arduino.cc/>) to download the installation package of the Arduino IDE.



Downloads



(/wiki/File:600px-

Arduino%E4%B8%8B%E8%BD%BD2.0%E7%89%88%E6%9C%AC.jpg)

2. Here, you can select Just Download.

Support the Arduino IDE

Since the release 1.x release in March 2015, the Arduino IDE has been downloaded **69,954,557** times — impressive! Help its development with a donation.

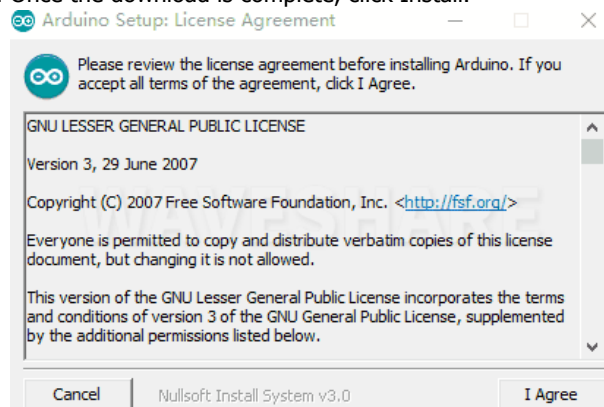
\$3	\$5	\$10	\$25	\$50	Other
-----	-----	------	------	------	-------



Learn more about [donating to Arduino](#).

(/wiki/File:%E4%BB%85%E4%B8%8B%E8%BD%BD%E4%B8%8D%E6%8D%90%E8%B5%A0.png)

3. Once the download is complete, click Install.



(/wiki/File:IDE%E5%AE%89%E8%A3%85%E6%B0%B4%E5%8D%B0-1.gif)

Notice: During the installation process, it will prompt you to install the driver, just click Install

600px (/w/index.php?

title=Special:Upload&wpDestFile=Arduino%E9%A9%B1%E5%8A%A8%E5%AE%89%E8%A3%85%E6%B0%B4%E5%8D%B0.jpg)

Arduino IDE Interface

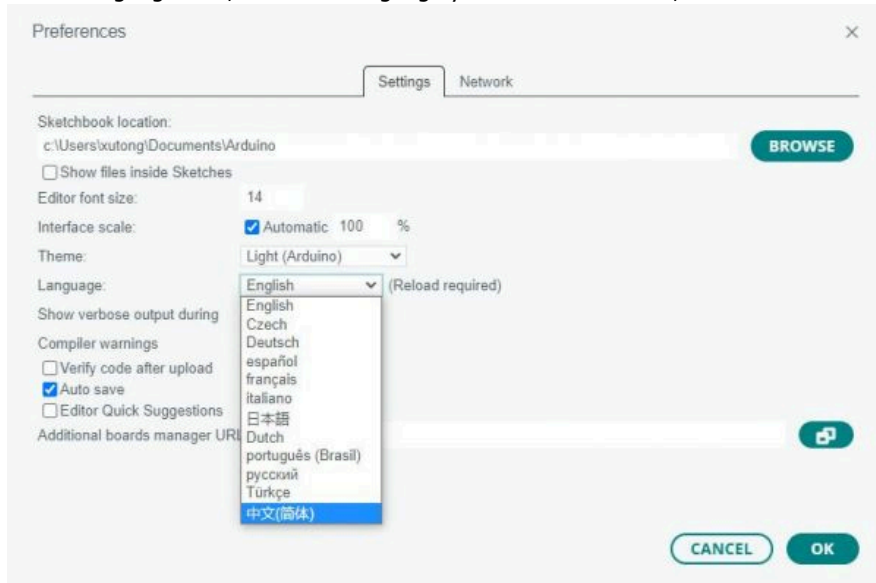
1. After the first installation, when you open the Arduino IDE, it will be in English. You can switch to other languages in File --> Preferences, or continue using the English interface.



(/wiki/File:%E9%A6%96%E9%80%89%E9%A1%B9-

%E7%AE%80%E4%BD%93%E4%B8%AD%E6%96%87.jpg)

2. In the Language field, select the language you want to switch to, and click OK.



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%E9%A6%96%E9%80%89%E9%A1%B9-%E7%AE%80%E4%BD%93%E4%B8%AD%E6%96%87ok.jpg)

Install Arduino-Pico Core in the Arduino IDE

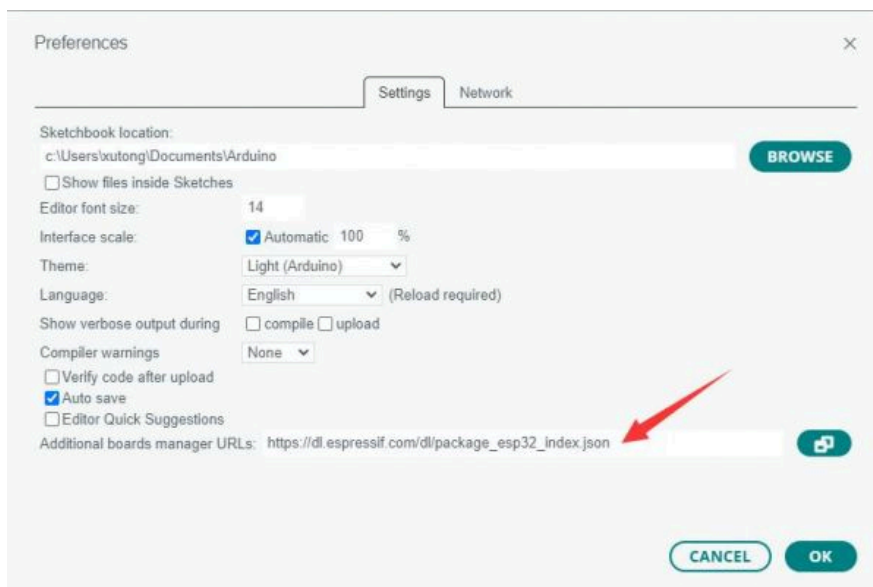
1. Open the Arduino IDE, click on the file in the top left corner, and select Preferences



(/wiki/File:RoArm-M1_Tutorial04.jpg)

2. Add the following link to the attached board manager URL, and then click OK

https://github.com/earlephilhower/arduino-pico/releases/download/4.0.2/package_rp2040_index.json

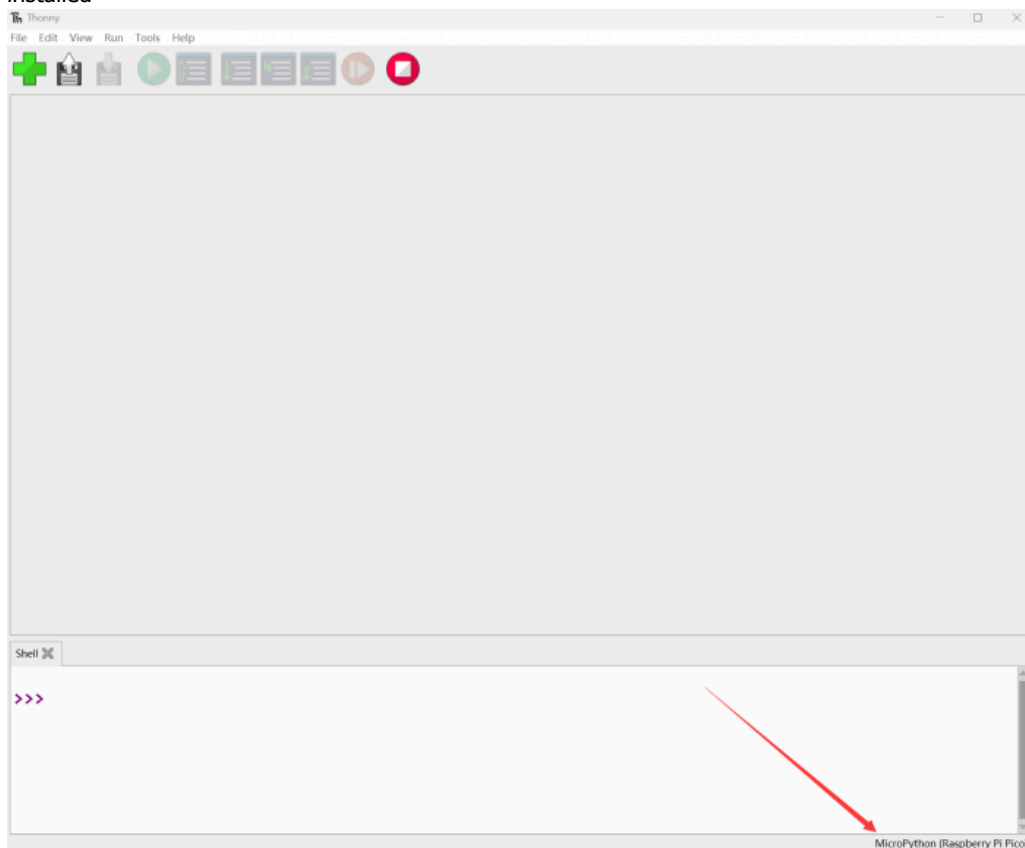


(/wiki/File:RoArm-M1_Tutorial_II05.jpg)

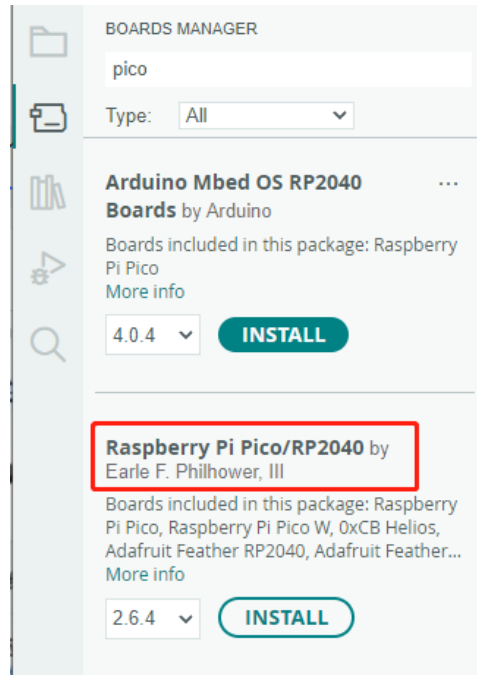
Note: If you already have an ESP32 board URL, you can use a comma to separate the URLs as follows:

`https://dl.espressif.com/dl/package_esp32_index.json,https://github.com/earlephilhower/arduino-pico/releases/download/4.0.2/package_rp2040_index.json`

3. Click Tools > Development Board > Board Manager > Search pico, as my computer has already been installed, it shows that it is installed



(/wiki/File:Pico_Get_Start_05.png)



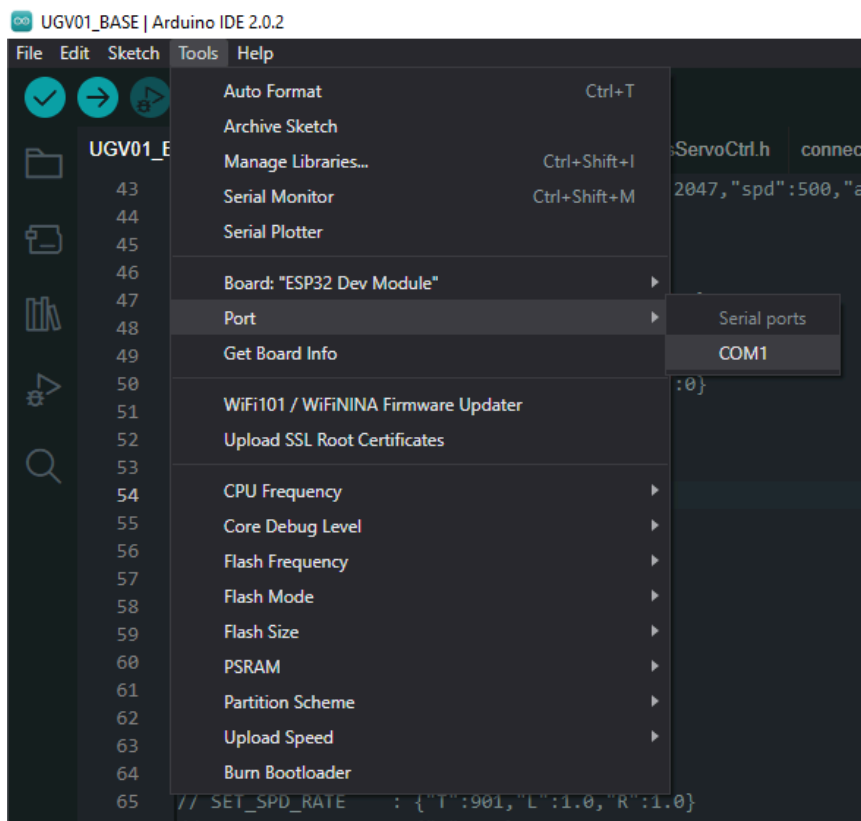
(/wiki/File:Pico_Get_Start_06.png)

Upload Demo at the First Time

1. Press and hold the BOOTSET button on the Pico board, connect the pico to the USB port of the computer via the Micro USB cable, and release the button after the computer recognizes a removable hard disk (RPI-RP2).

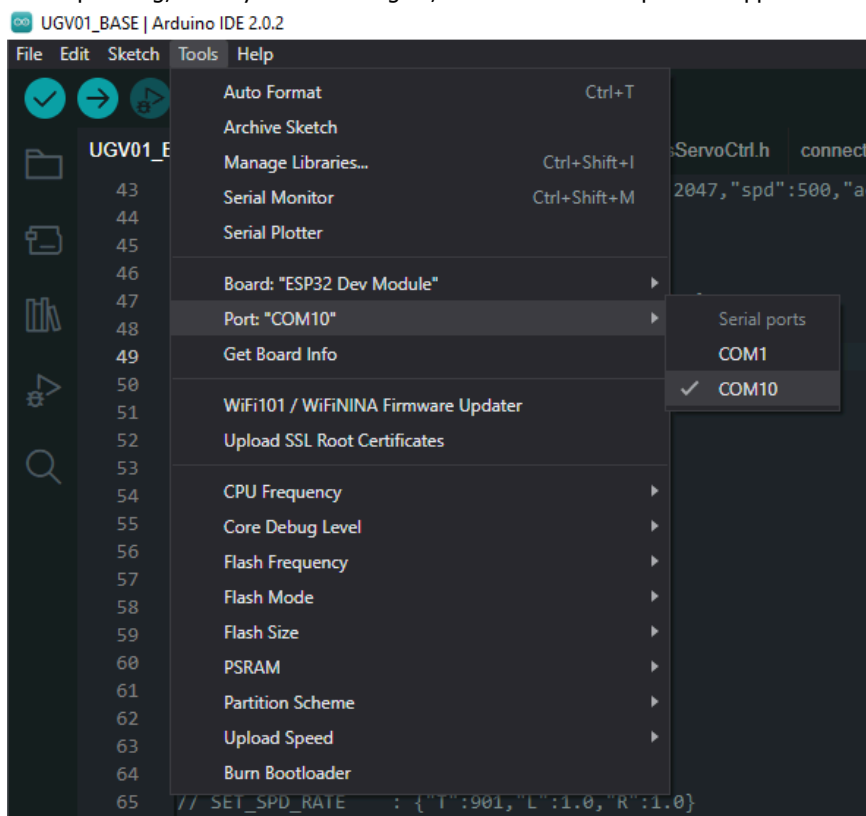
(/wiki/File:Pico_Get_Start.gif)

2. Download the program and open D1-LED.ino under the arduino\PWM\D1-LED path
3. Click Tools --> Port, remember the existing COM, do not click this COM (the COM displayed is different on different computers, remember the COM on your own computer)



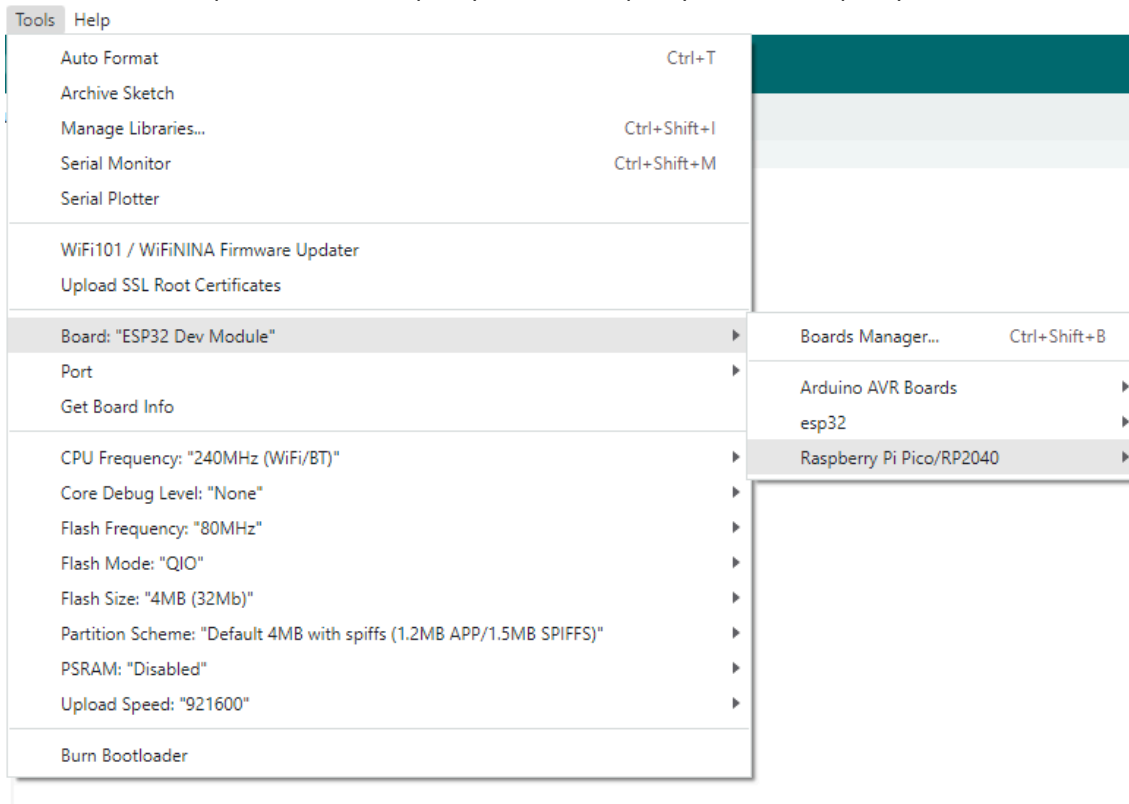
(/wiki/File:UGV1_doenload02EN.png)

4. Connect the driver board to the computer using a USB cable. Then, go to Tools > Port. For the first connection, select uf2 Board. After uploading, when you connect again, an additional COM port will appear



(/wiki/File:UGV1_doenload03EN.png)

5. Click Tools > Development Board > Raspberry Pi Pico > Raspberry Pi Pico or Raspberry Pi Pico 2



(/wiki/File:Pico_Get_Start02.png)

6. After setting it up, click the right arrow to upload the program



(/wiki/File:Pico_Get_Start03.png)

- **If issues arise during this period, and if you need to reinstall or update the Arduino IDE version, it is necessary to uninstall the Arduino IDE completely. After uninstalling the software, you need to manually delete all contents within the C:\Users\[name]\AppData\Local\Arduino15 folder (you need to show hidden files to see this folder). Then, proceed with a fresh installation.**

Open Source Demos

MircoPython video demo (github) (https://github.com/waveshareteam/Pico_MircoPython_Examples)

MicroPython firmware/Blink demos (C) (https://files.waveshare.com/wiki/common/Raspberry_Pi_Pico_Demo.zip)

Raspberry Pi official C/C++ demo (github) (<https://github.com/raspberrypi/pico-examples/>)

Raspberry Pi official micropython demo (github) (<https://github.com/raspberrypi/pico-micropython-examples>)

Arduino official C/C++ demo (github) (<https://github.com/earlephilhower/arduino-pico>)

Resource

Document

- RP2040-Tiny Schematic (https://files.waveshare.com/upload/7/7a/RP2040-Tiny_Schematic.pdf)
- V1.1 Schematic (https://files.waveshare.com/upload/7/7f/RP2040-Tiny_V1.1_SCH.pdf)
- RP2040-Tiny Adapter V1.1 Schematic (https://files.waveshare.com/upload/3/35/RP2040-Tiny-Adapter_V1.1-SCH.pdf)
- Note that there is a logo "Rev*. *" on the back of the V1.1 and above. Please select the corresponding schematic according to your version.

3D Model

- RP2040-Tiny 3D Model (https://files.waveshare.com/upload/9/94/RP2040-Tiny-Step_V1.1.zip)

- RP2040-Tiny Adapter 3D Model (https://files.waveshare.com/upload/1/1e/RP2040-Tiny-Adapter-Step_V1.1.zip)

Demo

- WS2812B Test Demo (<https://files.waveshare.com/upload/5/58/RP2040-Zero.zip>)

Application Demo

- JustUSB (shared by Waveshare users) (<https://github.com/Alwinator/JustUSB>)

Official Resource

Raspberry Pi

- Raspberry Pi Pico Get Started with MicroPython on Raspberry Pi Pico (<https://hackspace.raspberrypi.org/books/micropython-pico>)
- Official website of Pico (<https://www.raspberrypi.org/documentation/pico/getting-started/>)
- Getting started with Pico (https://files.waveshare.com/upload/3/30/Getting_started_with_pico.pdf)
- Pico C SDK (https://files.waveshare.com/upload/5/5f/Pico_c_sdk.pdf)
- Pico Python SDK (https://files.waveshare.com/upload/b/b0/Pico_python_sdk.pdf)
- Pico Pinout (<https://files.waveshare.com/upload/5/52/Pico-R3-A4-Pinout.pdf>)
- Pico Datasheet (https://files.waveshare.com/upload/1/11/Pico_datasheet.pdf)
- RP2040 Datasheet (https://files.waveshare.com/upload/f/fd/Rp2040_datasheet.pdf)
- RP2040 Hardware design (https://files.waveshare.com/upload/9/9d/Hardware_design_with_rp2040.pdf)

Examples

- Raspberry Pi C/C++ demo (github) (<https://github.com/raspberrypi/pico-examples/>)
- Raspberry Pi micropython demo (github) (<https://github.com/raspberrypi/pico-micropython-examples>)

Development Software

- Zimo221.7z (<https://files.waveshare.com/upload/c/c6/Zimo221.7z>)
- Image2Lcd.7z (<https://files.waveshare.com/upload/3/36/Image2Lcd.7z>)
- Font Library Tutorial (https://www.waveshare.com/wiki/Ink_Screen_Font_Library_Tutorial)
- Image Extraction Tutorial (https://www.waveshare.com/wiki/Image_Extraction)
- Thonny Python IDE (Windows V3.3.3) (<https://files.waveshare.com/upload/7/73/Thonny-3.3.3.zip>)

FAQ

Question: What is the temperature sensor address or is there some other way to read the temperature sensor?

Answer:

You can refer to Pico C SDK (https://files.waveshare.com/upload/5/5f/Pico_c_sdk.pdf) and Pico Python SDK (https://files.waveshare.com/upload/b/b0/Pico_python_sdk.pdf).

Question: Whether a USB PID: VID was allocated for this board?

Answer:

Please check the attached GitHub page for USB PID support: <https://github.com/raspberrypi/usb-pid> (<https://github.com/raspberrypi/usb-pid>)

Support

Technical Support

If you need technical support or have any feedback/review, please click the **Submit Now** button to submit a ticket, Our support team will check and reply to you within 1 to 2 working days. Please be patient as we make every effort to help you to resolve the issue.

Working Time: 9 AM - 6 PM GMT+8 (Monday to Friday)

Submit Now (<https://service.waveshare.com/>)

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