Welcome

Thank you for choosing Freenove products!

Getting Started

When reading this, you should have downloaded the ZIP file for this product.
Unzip it and you will get a folder containing tutorials and related files. Please start with this PDF tutorial.

! Unzip the ZIP file instead of opening the file in the ZIP file directly.
! Do not move, delete or rename files in the folder just unzipped.

Get Support

Encounter problems? Don't worry! Refer to “TroubleShooting.pdf” or contact us.

When there are packaging damage, quality problems, questions encountering in use, etc., just send us an email. We will reply to you within one working day and provide a solution.

support@freenove.com

Safety and Precautions

Please follow the following safety precautions when using or storing this product:

- Keep this product out of the reach of children under 6 years old.
- This product should be used only when there is adult supervision present as young children lack necessary judgement regarding safety and the consequences of product misuse.
- This product contains small parts and parts, which are sharp. This product contains electrically conductive parts. Use caution with electrically conductive parts near or around power supplies, batteries and powered (live) circuits.
- When the product is turned ON, activated or tested, some parts will move or rotate. To avoid injuries to hands and fingers, keep them away from any moving parts!
- It is possible that an improperly connected or shorted circuit may cause overheating. Should this happen, immediately disconnect the power supply or remove the batteries and do not touch anything until it cools down! When everything is safe and cool, review the product tutorial to identify the cause.
- Only operate the product in accordance with the instructions and guidelines of this tutorial, otherwise parts may be damaged or you could be injured.
- Store the product in a cool dry place and avoid exposing the product to direct sunlight.
- After use, always turn the power OFF and remove or unplug the batteries before storing.

About Freenove

Freenove provides open source electronic products and services worldwide.

Freenove is committed to assist customers in their education of robotics, programming and electronic circuits so that they may transform their creative ideas into prototypes and new and innovative products. To this end, our services include but are not limited to:

- Educational and Entertaining Project Kits for Robots, Smart Cars and Drones
- Educational Kits to Learn Robotic Software Systems for Arduino, Raspberry Pi and micro: bit
- Electronic Component Assortments, Electronic Modules and Specialized Tools
- **Product Development and Customization Services**

You can find more about Freenove and get our latest news and updates through our website:

http://www.freenove.com

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Preface

Freenove Breakout Board is specially designed for various microcontrollers (MC), including but not limited to the Raspberry Pi Pico series, ESP32 WROOM, and ESP32 WROVER. It excels in both versatility and practicality, making it an ideal choice for developers and enthusiasts to carry out project development.

Here are main features of the Freenove Breakout Board:

- Wide Compatibility: It supports Raspberry Pi Pico series, ESP32 WROOM, ESP32 WROVER, ESP8266, and other development boards, meeting diversed project needs.
- Easy to Use: The simple design of the board allows you to quickly starter project development by simply plugging the development board to the breakout board.
- Abundant Interfaces: With headers leading out the signal pins of the development and wiring terminals inregrated, peripheral devices and sensors are easy to connect, thus greatly expanding the function of the projects.
- Each signal line is connected to an LED indicator light, which displays the signal status in real-time, allowing you to quickly understand the working condition of the circuit. This design not only helps with troubleshooting but also provides immediate feedback, enhancing the user experience.
- Adjustable Power Input: It is equipped with a DC power interface that supports 5~24V voltage input and includes a built-in voltage regulator module, making it convenient to provide a stable power supply for the development board and peripherals.

Whether you are an electronics enthusiast, a student, or a professional developer, this breakout board will provide strong support for your creativity. Let's explore more possibilities and embark on your maker journey together!

You can download the tutorial and related resources for various development boards with the links listed in the following table:

Development Boards	Download link
ESP32 WROOM	http://freenove.com/fnk0090
ESP32 WROVER	http://freenove.com/fnk0047
ESP32 S3 WROOM Lite	http://freenove.com/fnk0099
ESP32 S3 WROOM	http://freenove.com/fnk0082
ESP8266	http://freenove.com/fnk0073
Raspberry Pi Pico	http://freenove.com/fnk0058

After completing the projects in this tutorial, you can also combine the components in different projects to make your own smart homes, smart car, robot, etc., bringing your imagination and creativity to life with Freenove Breakout Board.

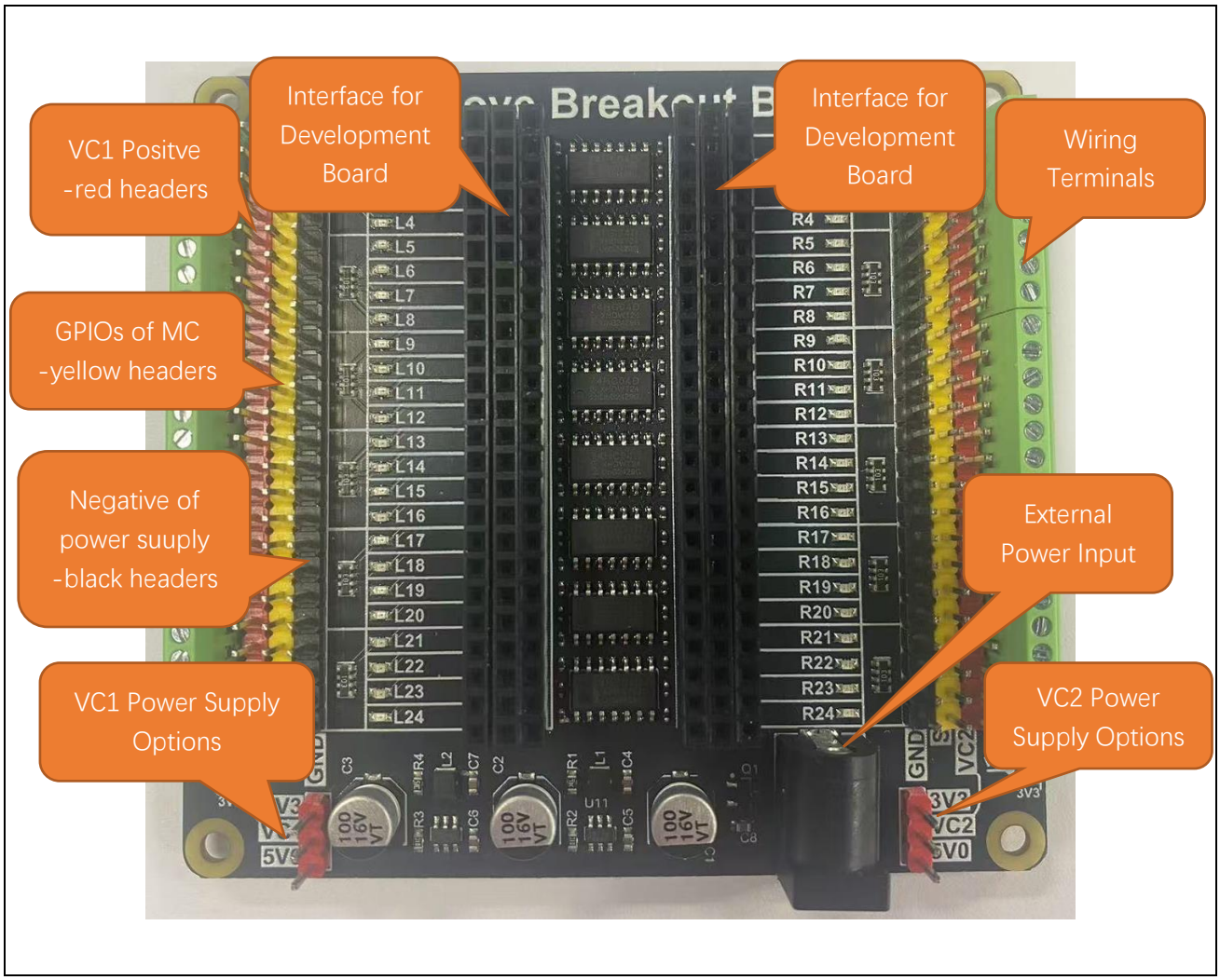
If you have any problems or difficulties using this product, please contact us for quick and free technical support: support@freenove.com

Any concerns? ✉ support@freenove.com

Chapter 1 Freenove Breakout Board

Introduction to Freenove Breakout Board

The hardware interfaces are distributed as follows:



Usage Notes:

1. The Freenove Breakout Board is compatible with various development boards, but the width of the development board should be between 600mil and 1000mil. If the development board does not meet the installation requirements, do not force it into place to avoid damaging the Freenove Breakout Board.

2. The Freenove Breakout Board includes two voltage regulator circuits. One circuit steps down the external input power to 5V at 3A, while the other steps it down to 3.3V at 3A. The external power input voltage range is 4-24V. We recommend using a power supply device with at least 12V at 3A to power the Freenove Breakout Board.

3. Please note that the red pins on the Freenove Breakout Board represent the positive power supply (VCC), and the black pins represent the negative power supply (GND). When connecting external circuits, do not short-circuit the red and black pins, as this may damage the Freenove Breakout Board or your development board.

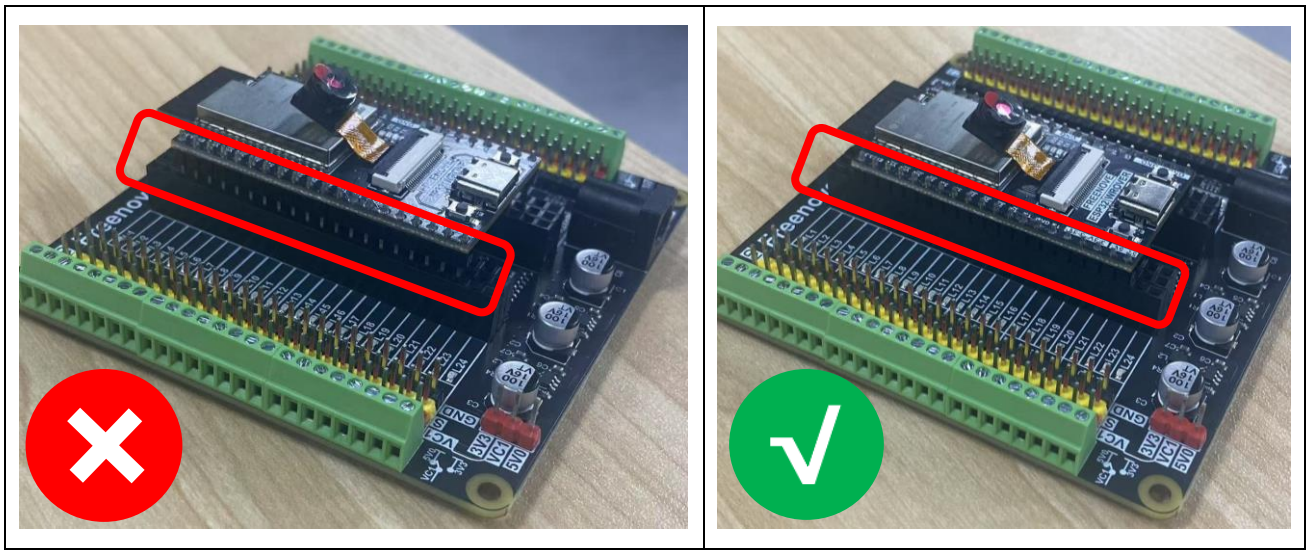
4. Connect VC1 to the red pins on the left side of the Freenove Breakout Board, and VC2 to the red pins on the right side. VC1 and VC2 can be freely chosen to be either 5V or 3.3V.

If you have any problems or difficulties using this product, please contact us for quick and free technical support: support@freenove.com

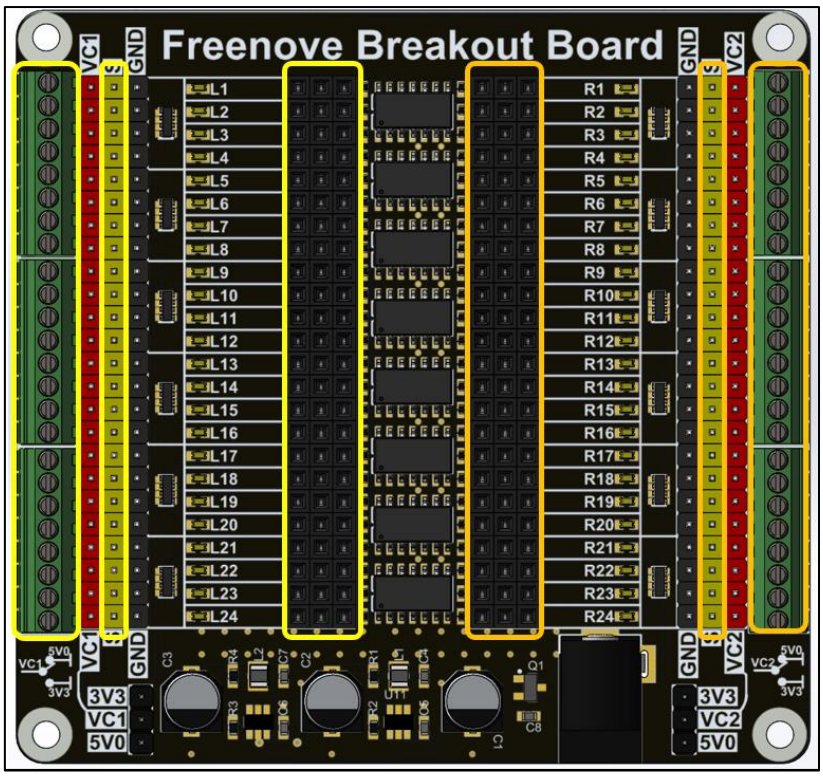
Installation of Freenove Breakout Board

Our Breakout Board is designed for great convenience and can accommodate a wide range of development boards. Regardless of the type of development board, the installation process remains consistent. For illustration purposes, we will use the Freenove ESP32 Wrover Board as an example.

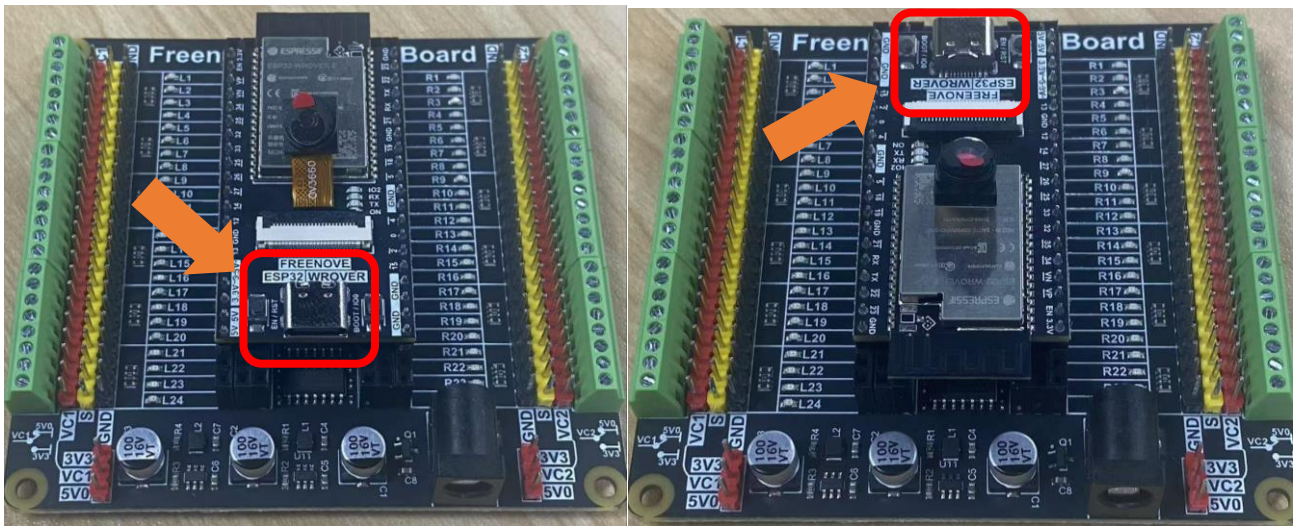
When installing the development board, ensure that the pin headers and sockets are securely aligned. Failure to do so may result in poor contact, potentially affecting the device's normal operation.



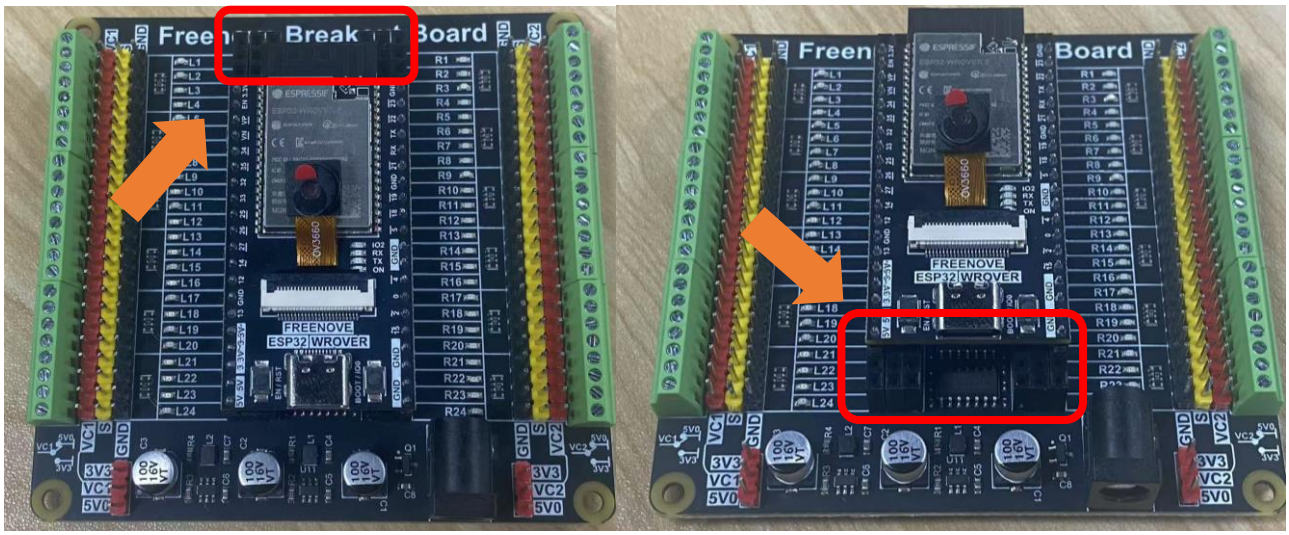
1. When installing the development board, please be patient. Forceful disassembly or installation may cause the board's pins to be bent or even damaged.
2. The wiring terminals, S pins, and sockets on the Freenove Breakout Board are interconnected, as shown in the figure below:



3. The Freenove Breakout Board does not restrict the installation direction of the development board, allowing you to choose different orientations for installation.

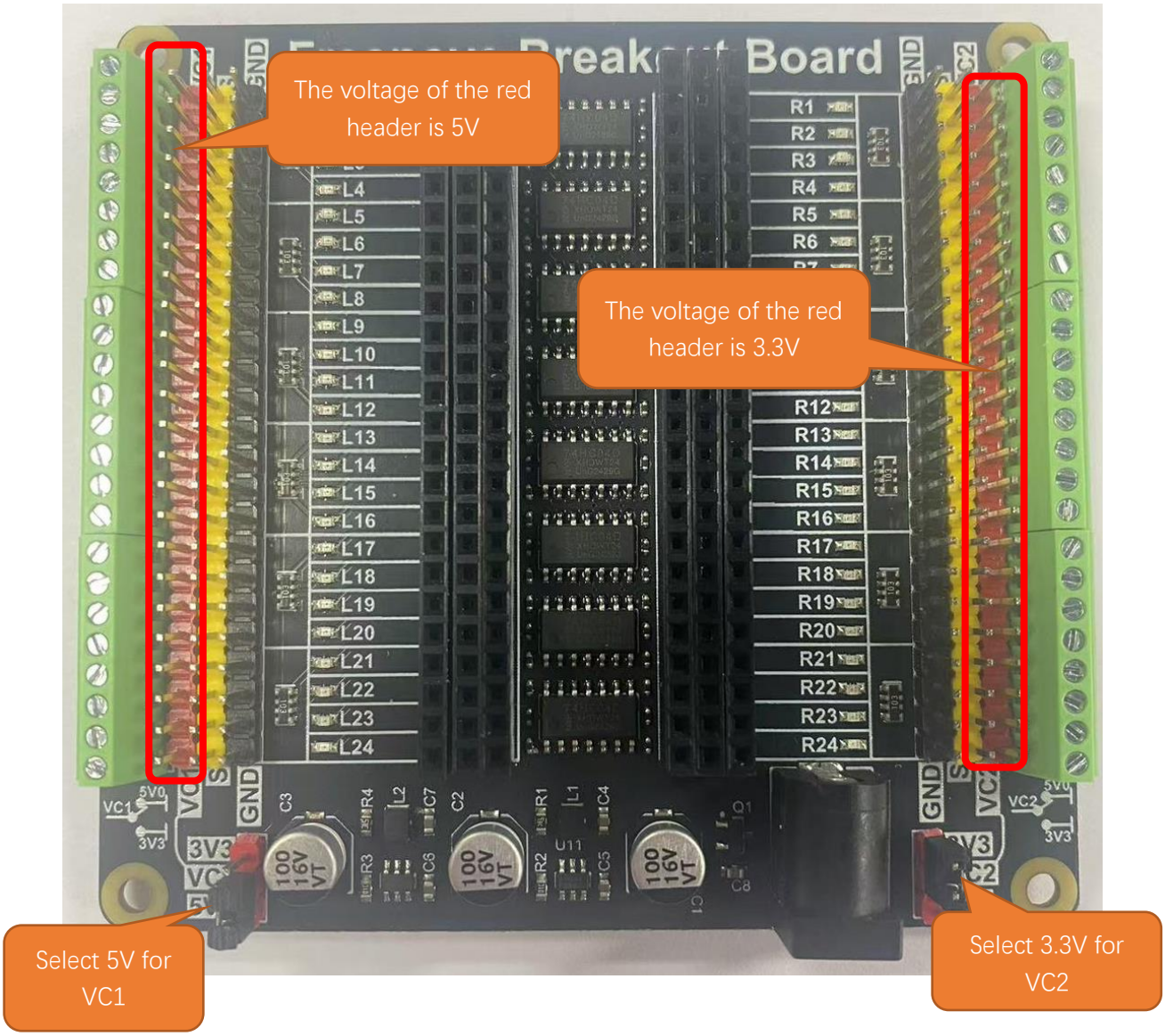


4. The Freenove Breakout Board does not restrict the installation position of the development board, enabling you to select an appropriate location for installation, as shown in the figure below:



Freenove Breakout Board Power Choice

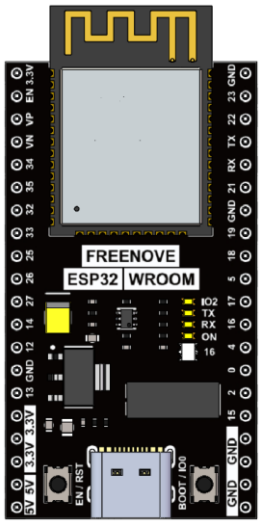
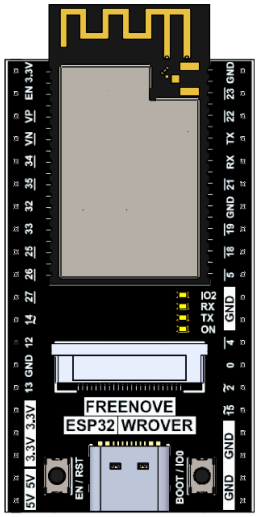
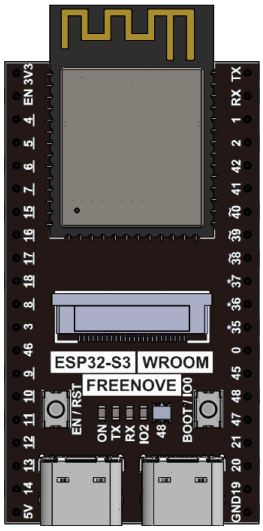
The Freenove Breakout Board allows you to select the appropriate power supply using jumper caps. As shown in the figure below, we use a jumper cap to connect VC1 to 5V0 and another jumper cap to connect VC2 to 3.3V.



Chapter 2 ESP32

The Freenove Breakout Board is compatible with a variety of development boards, including our Freenove ESP32 series boards as well as those from other manufacturers.
However, please note that the distance between the pin headers on the left and right sides of the development board should be between 600mil and 1000mil. If the development board does not meet the installation requirements, do not force it into place to avoid damaging the Freenove Breakout Board or your development board.

Introduction to Freenove ESP32 Series

ESP32 WROOM	ESP32 WROVER	ESP32 S3 WROOM Lite	ESP32 S3 WROOM
			

In this section, we take the Freenove ESP32 WROVER Board as an example. The usage of other development boards is the same.

We will not go into the programming process of ESP32 here. If you want to learn about ESP32 WROVER, ESP32 WROOM, ESP32 S3 WROOM, and ESP32 S3 WROOM Lite, you can refer to the following resources:

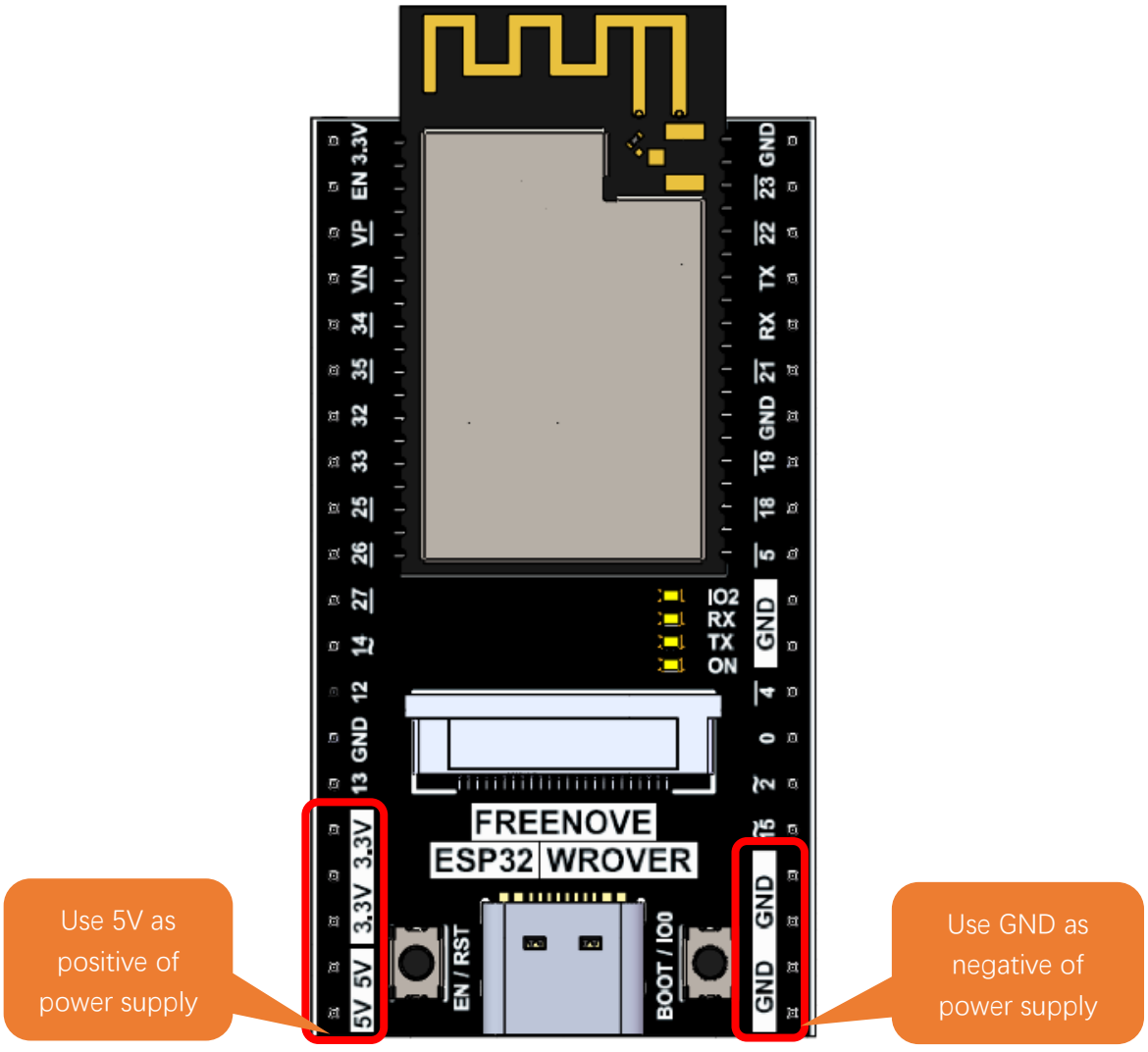
Development Board	Link to tutorial and code
ESP32 WROOM	https://github.com/Freenove/Freenove_ESP32_WROOM_Board
ESP32 WROVER	https://github.com/Freenove/Freenove_Ultimate_Starter_Kit_for_ESP32
ESP32 S3 WROOM Lite	https://github.com/Freenove/Freenove_ESP32_S3_WROOM_Board_Lite
ESP32 S3 WROOM	https://github.com/Freenove/Freenove_Ultimate_Starter_Kit_for_ESP32_S3

ESP32 Installation

Step1: Select the Power Input and GND Pins for the Microcontroller

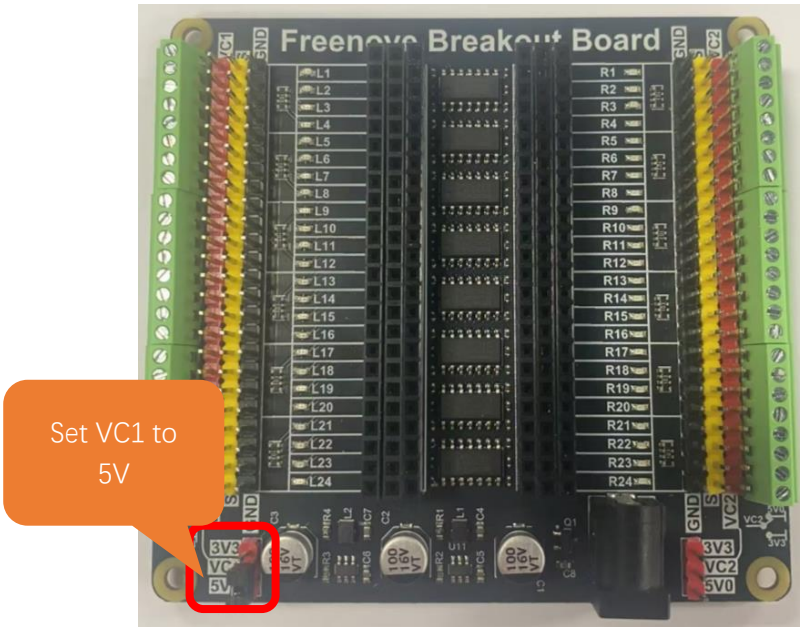
Regardless of the type of development board, it typically features external power input pins, which are commonly situated near the data line connection area on the board. It is important to note that when both VIN/VCC/5V and 3.3V power options are present on the development board, it is advisable to prioritize the use of VIN/VCC/5V for powering the board.

Taking the Freenove ESP32 WROVER Board as an example, this board is marked with both 5V and 3.3V silk screen labels. This indicates the presence of a voltage regulator circuit on the board that steps down the 5V input to a 3.3V output. Generally, the 3.3V is intended for use as an output power supply, while the 5V serves as the input power supply. Consequently, when powering the board, the 5V pin should be used as the positive terminal of the input power supply, and the GND pin should be used as the negative terminal. This is illustrated in the figure below.



Step2: Power the Development Board

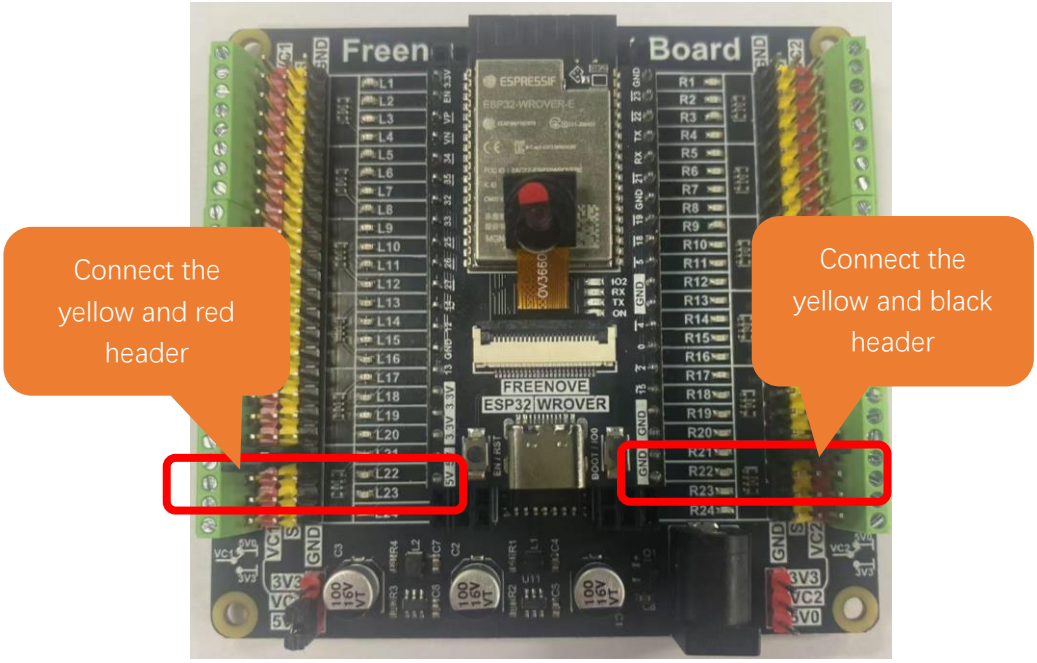
In the first step, the Freenove ESP32 WROVER Board utilizes 5V for the positive power supply terminal and GND for the negative power supply terminal. Consequently, it is necessary to set VC1 to 5V.



As illustrated below:

Conect the yellow header aligned with the 5V pin of the microcontroller to the red header on the left of the breakout board.

Connect the yellow header aligned with the GND pin of the microcontroller to the black header on the right of the breakout board.

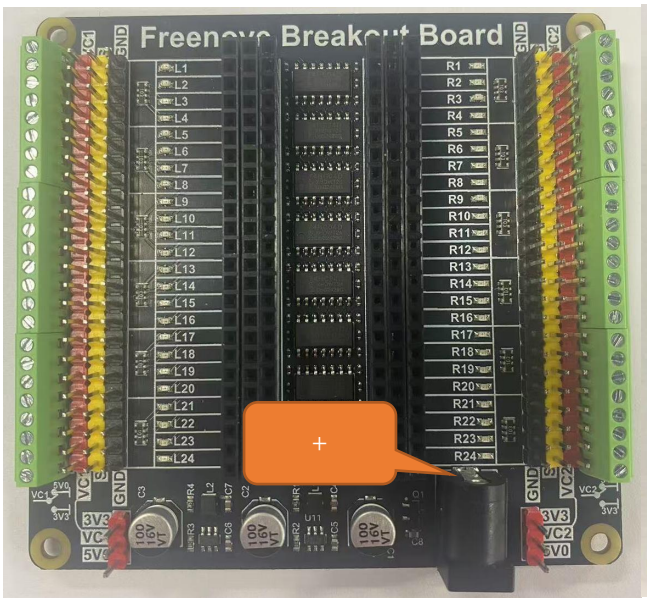


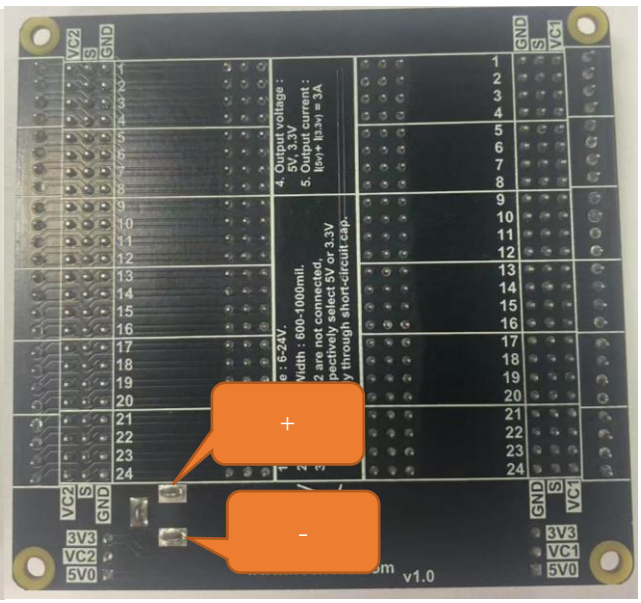
Please note: The red header pin represents the positive power terminal, and the black header pin represents the negative power terminal. During use, under no circumstances should the red and black header pins be short-circuited, as doing so will damage the Freenove Breakout Board.

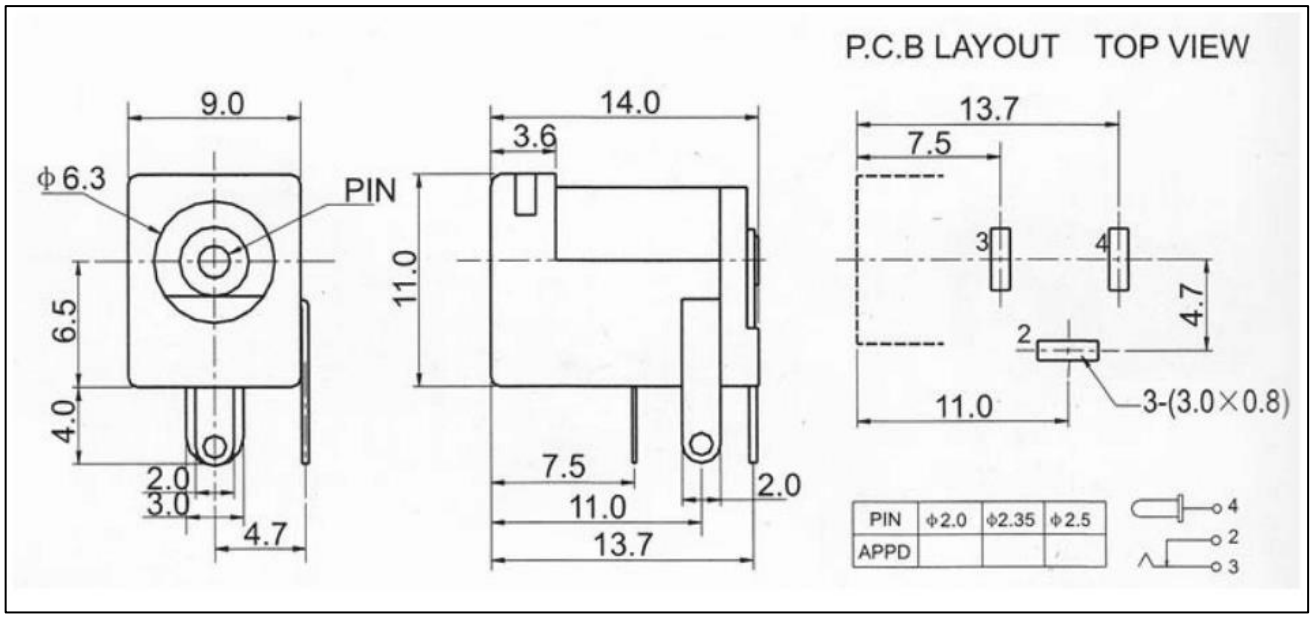
Step3: Power Supply Precautions

Freenove Breakout Board DC005 Jack

The interface for external power supply to Freenove Breakout board is a DC005 interface, whose size is 5.5x2.1mm. Please pay attention to its positive and negative terminals, as shown in the figures below.

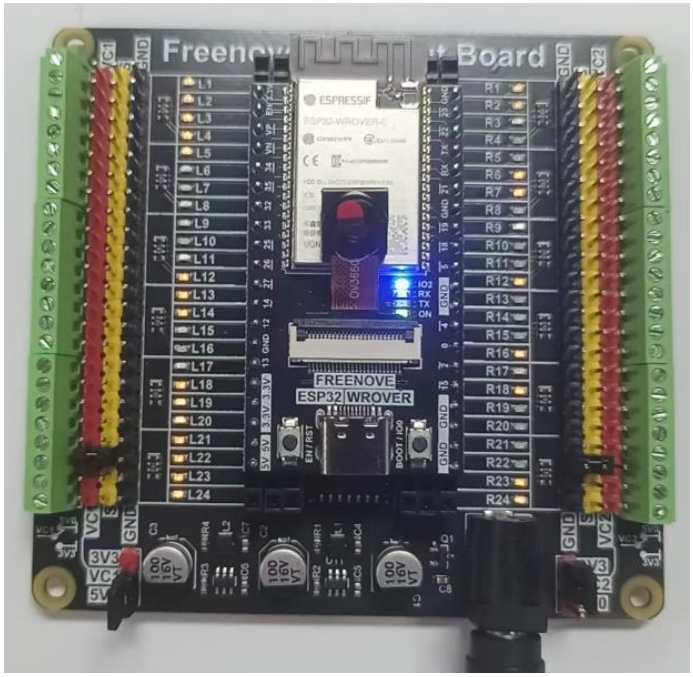






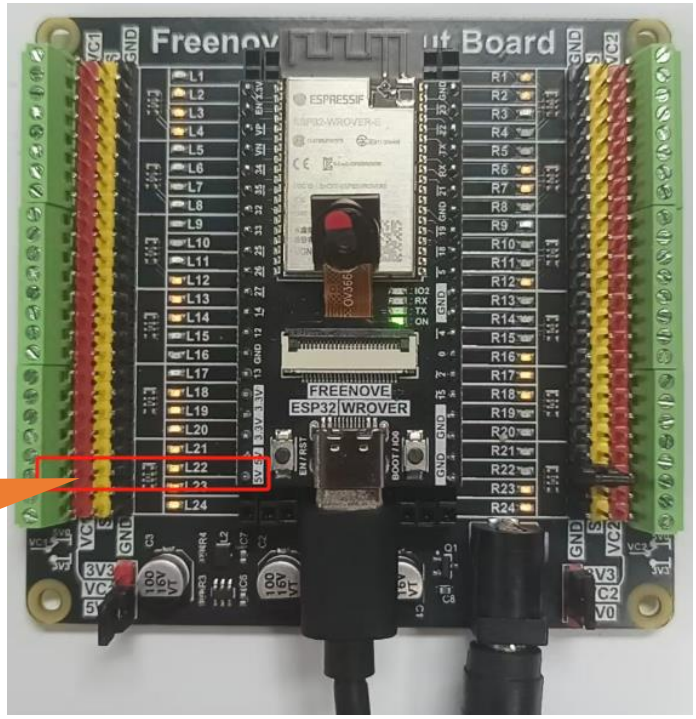
The Freenove Breakout Board features a reverse power protection circuit. This design ensures that the board is safeguarded from damage in the event of an improperly connected external power supply. If, after connecting the external power, the Freenove Breakout Board fails to power the development board, it is likely due to a polarity mismatch in the DC interface being used. The positive and negative terminals may be reversed. It is crucial to verify the specifications of the DC interface to confirm that it is correctly aligned with the board's requirements.

If the external power supply is connected correctly, the power indicator on the development board will light up.



Usage Recommendations:

1. During experiments, if the development board is connected to USB for power supply or code downloading, and the Freenove Breakout Board is powered by an external power source, we recommend that you disconnect the positive connection between the development board and the Freenove Breakout Board. This can better protect your development board. As shown in the figure below.



2. If you are powering the development board using only a data cable, be aware that the combined power consumption of the ESP32 and any external circuits should not be excessive. Generally, a computer's USB port can only supply 5V at 0.5A to 1A. If your total power consumption exceeds the USB port's capacity, it may cause the development board to operate abnormally or even damage your computer's USB port.

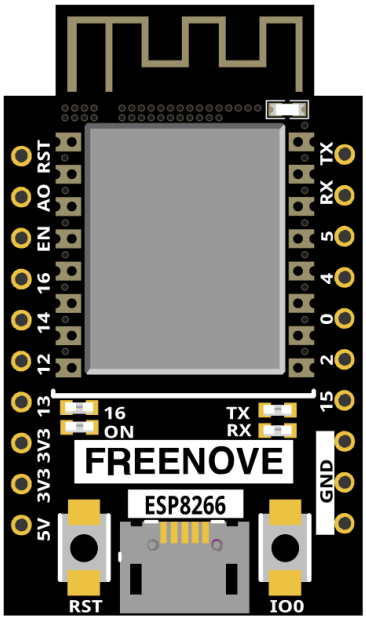
3. If you are using an external power source to power the development board, ensure that the positive and negative terminals of the development board are correctly connected to the Freenove Breakout Board.
4. Each pin on the Freenove Breakout Board is equipped with an indicator LED, which is used to indicate the voltage level state of the development board's pins. If you control a pin to output high or low voltage levels, the indicator LED will change accordingly. Similarly, if some pins on your development board are not in use, they will be in a floating state, which could be either high or low voltage. The corresponding indicator LED on the board will light up or turn off accordingly. If you do not want the indicator LED to light up or turn off, you can control it to output a high or low voltage level through programming.

If you need any support, please feel free to contact us via: support@freenove.com

Chapter 3 ESP8266

The Freenove Breakout Board is compatible with a variety of development boards. However, the width of the development board should be between 600mil and 1000mil. If the development board does not meet the installation requirements, do not force the installation, as this may cause damage to the Freenove Breakout Board.

This section will use the ESP8266 as an example.



Resources for ESP8266

Download link for Freenove ESP8266
https://freenove.com/fnk0073/
Or you can visit our github to download:
https://github.com/Freenove/Freenove_Ultimate_Starter_Kit_for_ESP8266
Regarding the programming instructions for the Freenove ESP8266, we won't delve into them here.

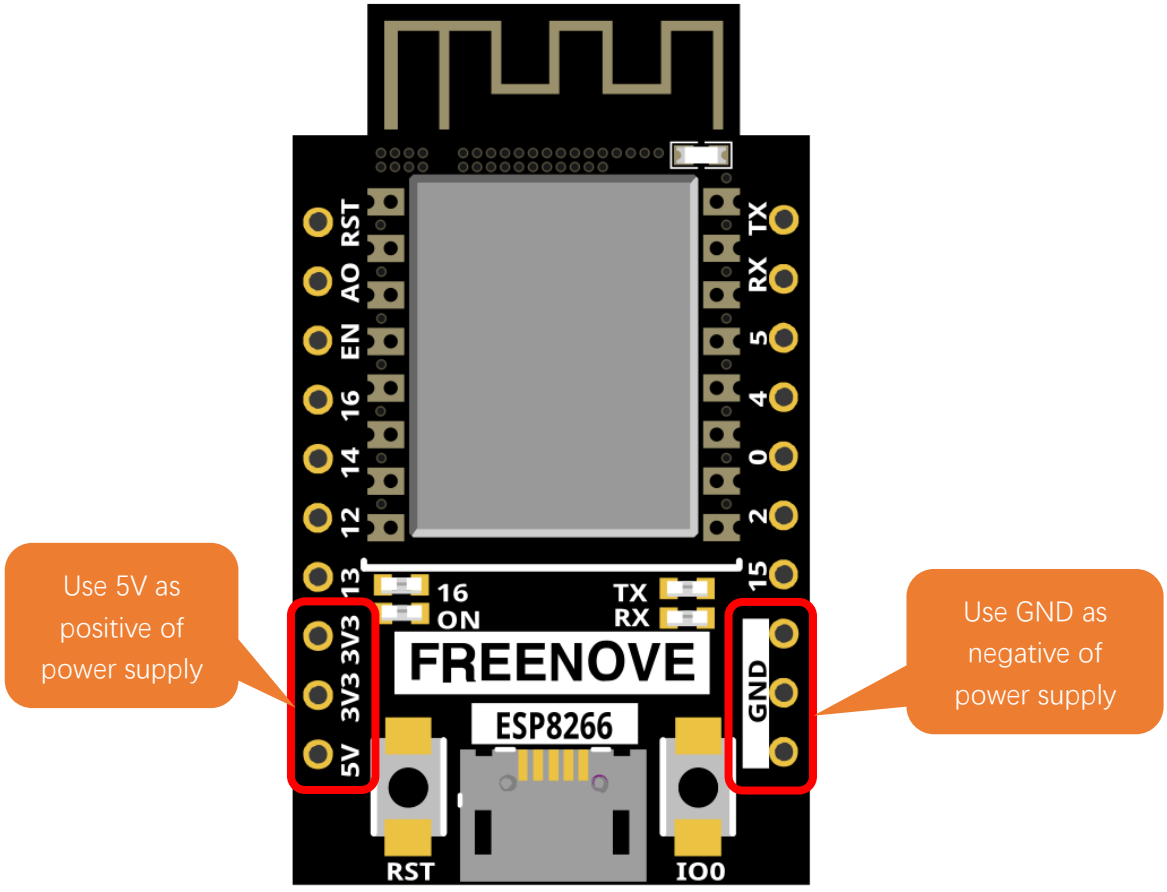
If you're interested, please refer to the following resources:
For For C Programming Tutorial, you can check
Freenove_Ultimate_Starter_Kit_for_ESP8266\C\C_Tutorial.pdf
For Python Programming Tutorial, you can refer to
Freenove_Ultimate_Starter_Kit_for_ESP8266\Python\Python_Tutorial.pdf
For Processing Programming Tutorial, you can refer to
Freenove_Ultimate_Starter_Kit_for_ESP8266\Processing\Processing_Tutorial.pdf

Installing ESP8266

Step1: Select the Power Input and GND Pins for the Microcontroller

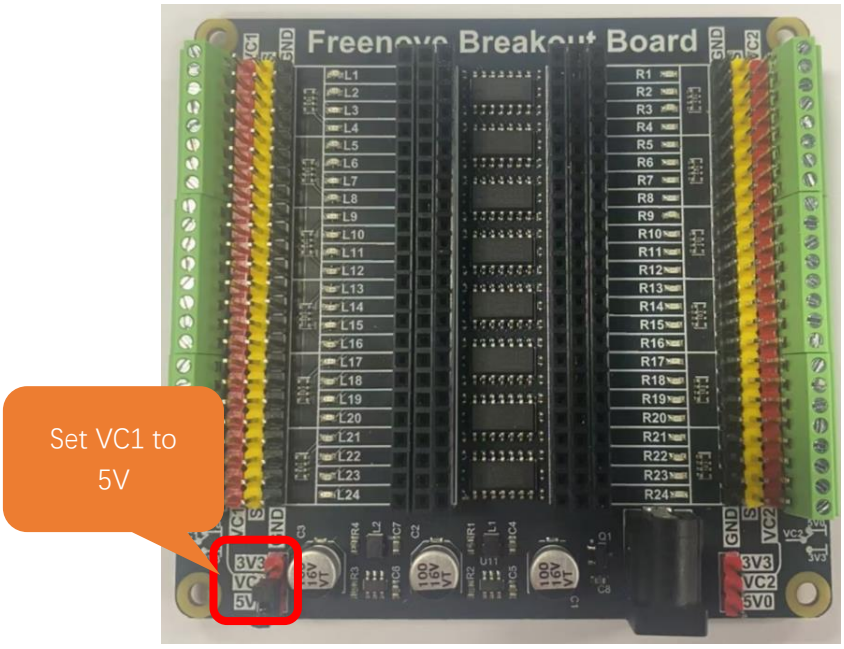
Regardless of the type of development board, it typically features external power input pins, which are commonly situated near the data line connection area on the board. It is important to note that when both VIN/VCC/5V and 3.3V power options are present on the development board, it is advisable to prioritize the use of VIN/VCC/5V for powering the board.

Taking the Freenove ESP8266 Board as an example, this board is marked with both 5V and 3.3V silk screen labels. This indicates the presence of a voltage regulator circuit on the board that steps down the 5V input to a 3.3V output. Generally, the 3.3V is intended for use as an output power supply, while the 5V serves as the input power supply. Consequently, when powering the board, the 5V pin should be used as the positive terminal of the input power supply, and the GND pin should be used as the negative terminal. This is illustrated in the figure below.



Step2: Power the Development Board

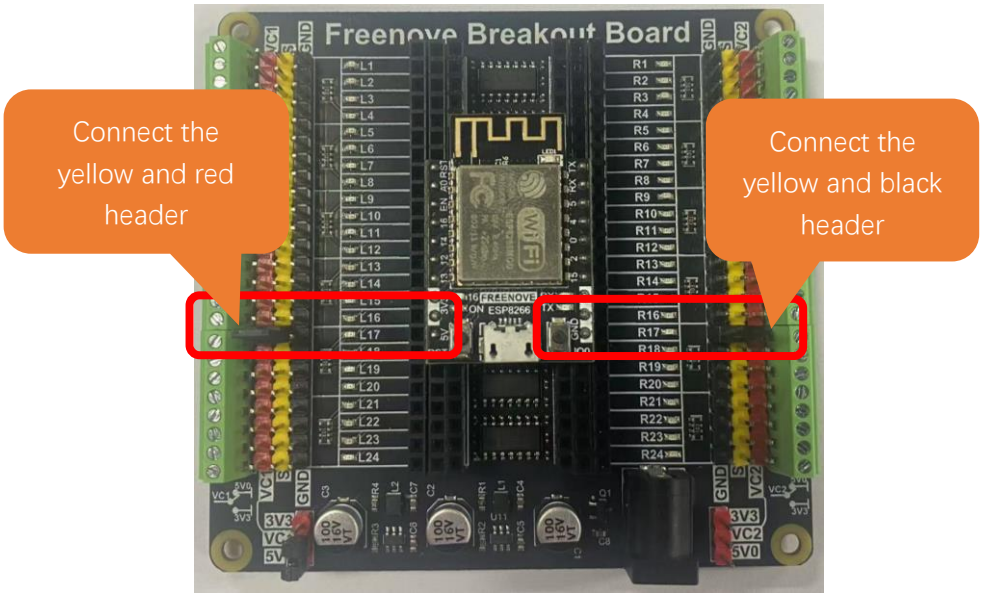
In the first step, the Freenove ESP32 WROVER Board utilizes 5V for the positive power supply terminal and GND for the negative power supply terminal. Consequently, it is necessary to set VC1 to 5V.



As illustrated below:

Conect the yellow header aligned with the 5V pin of the microcontroller to the red header on the left of the breakout board.

Connect the yellow header aligned with the GND pin of the microcontroller to the black header on the right of the breakout board.

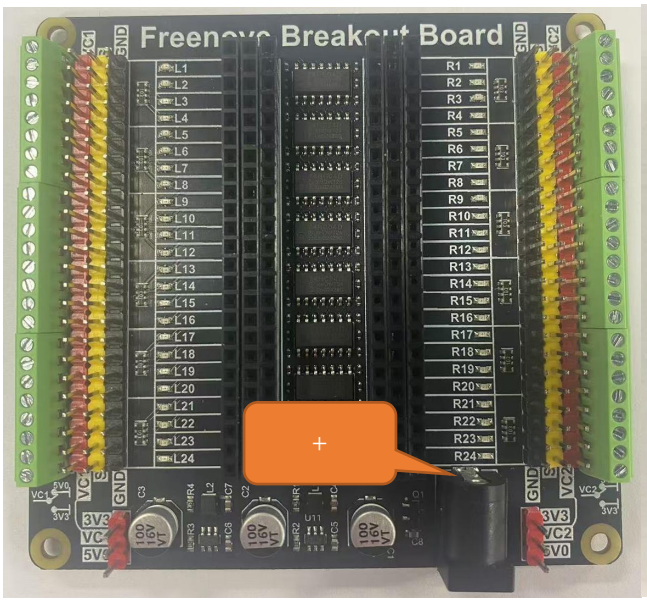


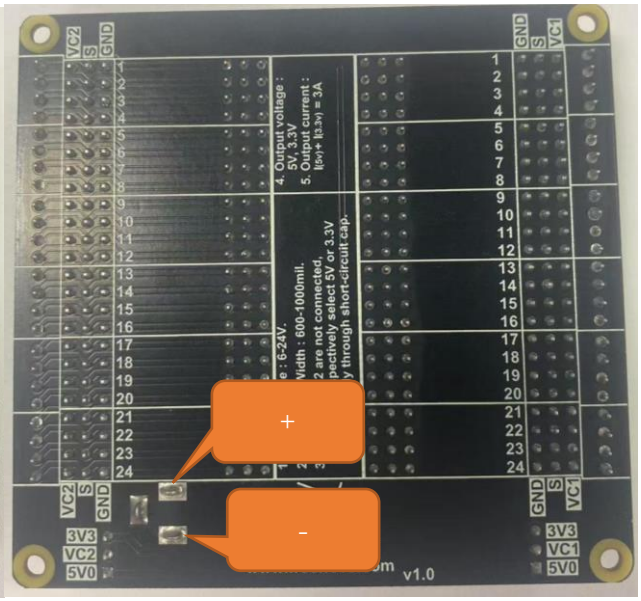
Please note: The red header pin represents the positive power terminal, and the black header pin represents the negative power terminal. During use, under no circumstances should the red and black header pins be short-circuited, as doing so will damage the Freenove Breakout Board.

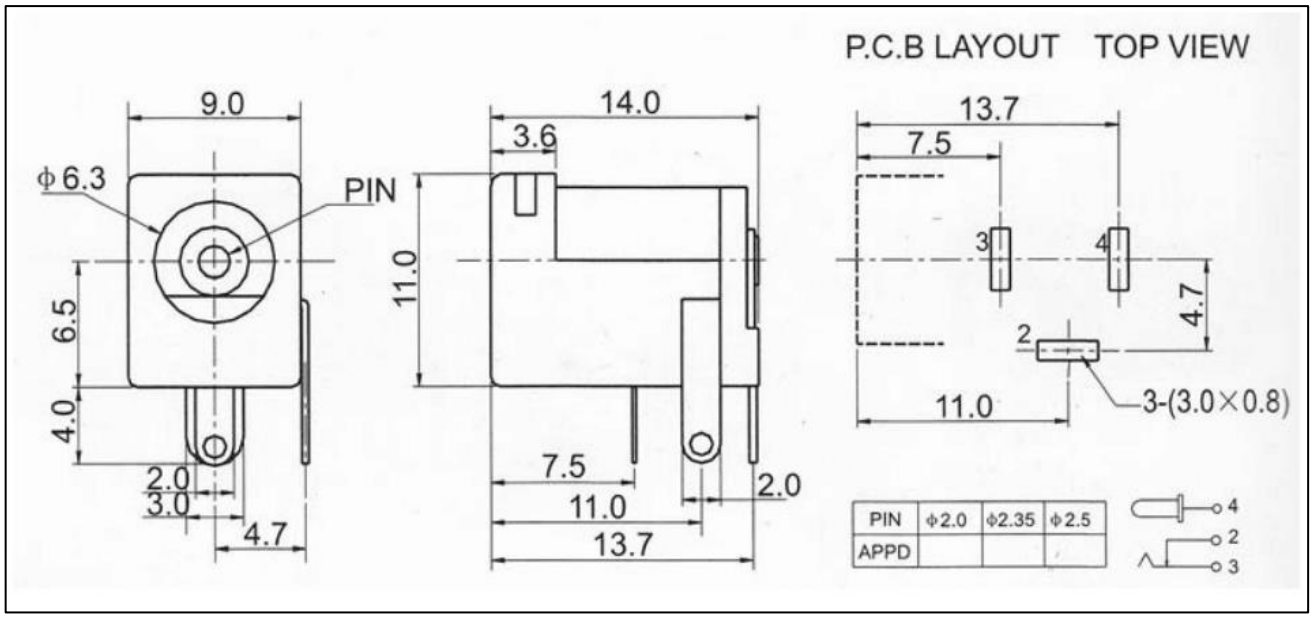
Step3: Power Supply Precautions

Freenove Breakout Board DC005 Jack

The interface for external power supply to Freenove Breakout board is a DC005 interface, whose size is 5.5x2.1mm. Please pay attention to its positive and negative terminals, as shown in the figures below.

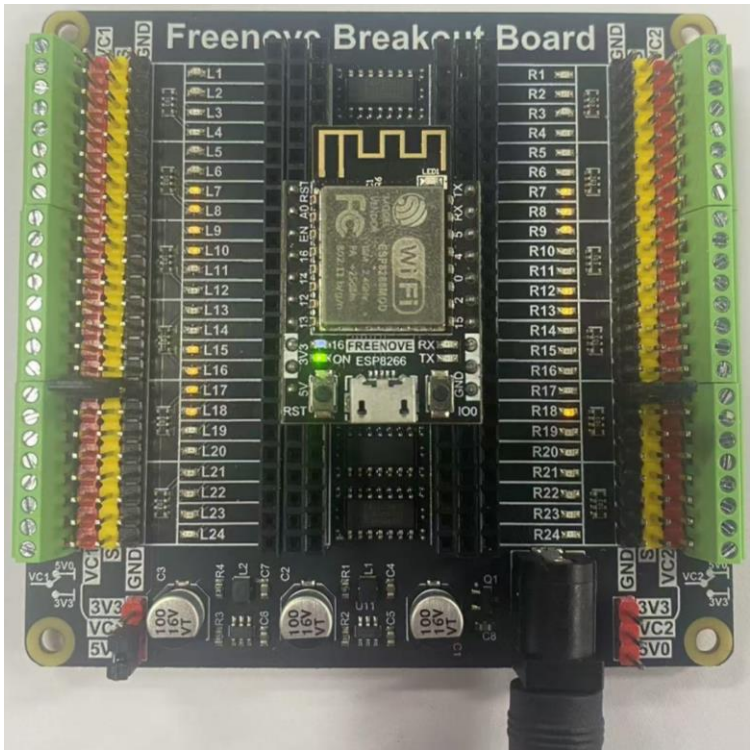






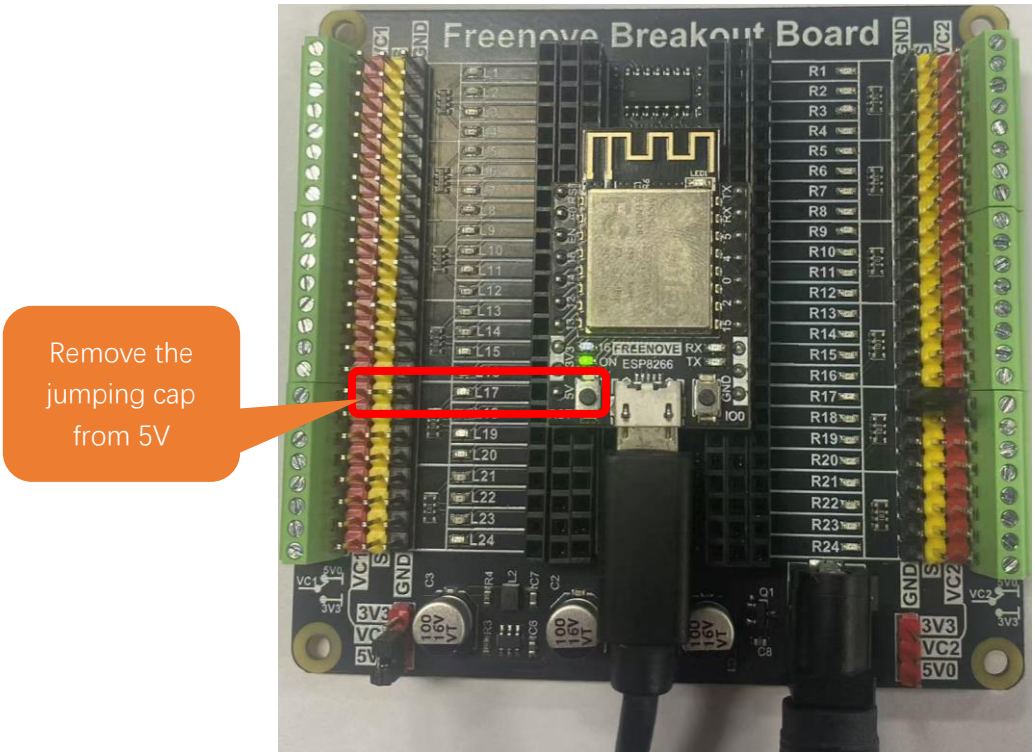
The Freenove Breakout Board features a reverse power protection circuit. This design ensures that the board is safeguarded from damage in the event of an improperly connected external power supply. If, after connecting the external power, the Freenove Breakout Board fails to power the development board, it is likely due to a polarity mismatch in the DC interface being used. The positive and negative terminals may be reversed. It is crucial to verify the specifications of the DC interface to confirm that it is correctly aligned with the board's requirements.

If the external power supply is connected correctly, the power indicator on the development board will light up.



Usage Recommendations:

1. During experiments, if the development board is connected to USB for power supply or code downloading, and the Freenove Breakout Board is powered by an external power source, we recommend that you disconnect the positive connection between the development board and the Freenove Breakout Board. This can better protect your development board. As shown in the figure below.



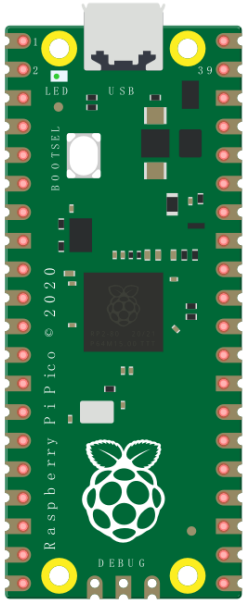
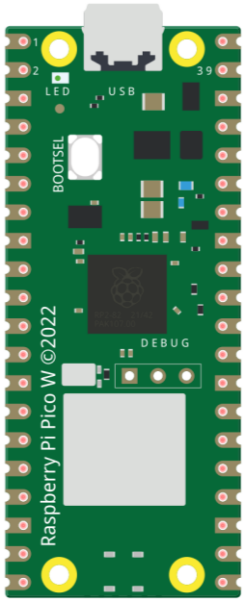
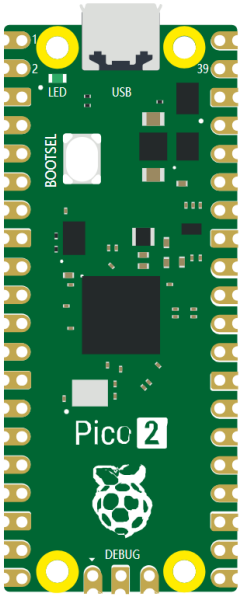
2. If you are powering the development board using only a data cable, be aware that the combined power consumption of the ESP8266 and any external circuits should not be excessive. Generally, a computer's USB port can only supply 5V at 0.5A to 1A. If your total power consumption exceeds the USB port's capacity, it may cause the development board to operate abnormally or even damage your computer's USB port.

3. If you are using an external power source to power the development board, ensure that the positive and negative terminals of the development board are correctly connected to the Freenove Breakout Board.
4. Each pin on the Freenove Breakout Board is equipped with an indicator LED, which is used to indicate the voltage level state of the development board's pins. If you control a pin to output high or low voltage levels, the indicator LED will change accordingly. Similarly, if some pins on your development board are not in use, they will be in a floating state, which could be either high or low voltage. The corresponding indicator LED on the board will light up or turn off accordingly. If you do not want the indicator LED to light up or turn off, you can control it to output a high or low voltage level through programming.

If you need any support, please feel free to contact us via: support@freenove.com

Chapter 4 Raspberry Pi Pico

The Freenove Breakout Board is compatible with a variety of development boards. However, please note that the distance width between the header pins on both sides of the development board should be between 600mil and 1000mil. If the development board does not meet the installation requirements, do not force the installation, as this may cause damage to the Freenove Breakout Board or your development board.

Raspberry Pi Pico	Raspberry Pi Pico W	Raspberry Pi Pico 2
		

Resources for Raspberry Pi Pico

This section will use the Raspberry Pi Pico W as an example; the usage method is the same for other development boards.

Regarding the programming process of the Raspberry Pi Pico, we will not delve into it here. If you are interested in learning about the Raspberry Pi Pico, Raspberry Pi Pico W, or Raspberry Pi Pico 2, the following resource links can assist you in your learning journey:
https://freenove.com/fnk0058/
Or you can visit our github to download:
https://github.com/Freenove/Freenove_Ultimate_Starter_Kit_for_Raspberry_Pi_Pico
Regarding the programming instructions for the Freenove Raspberry Pi Pico, we won't delve into them here. If you're interested, please refer to the following resources:
For For C Programming Tutorial, you can check
Freenove_Ultimate_Starter_Kit_for_Raspberry_Pi_Pico \C\C_Tutorial.pdf
For Python Programming Tutorial, you can refer to
Freenove_Ultimate_Starter_Kit_for_Raspberry_Pi_Pico \Python\Python_Tutorial.pdf
For Processing Programming Tutorial, you can refer to
Freenove_Ultimate_Starter_Kit_for_Raspberry_Pi_Pico \Processing\Processing_Tutorial.pdf

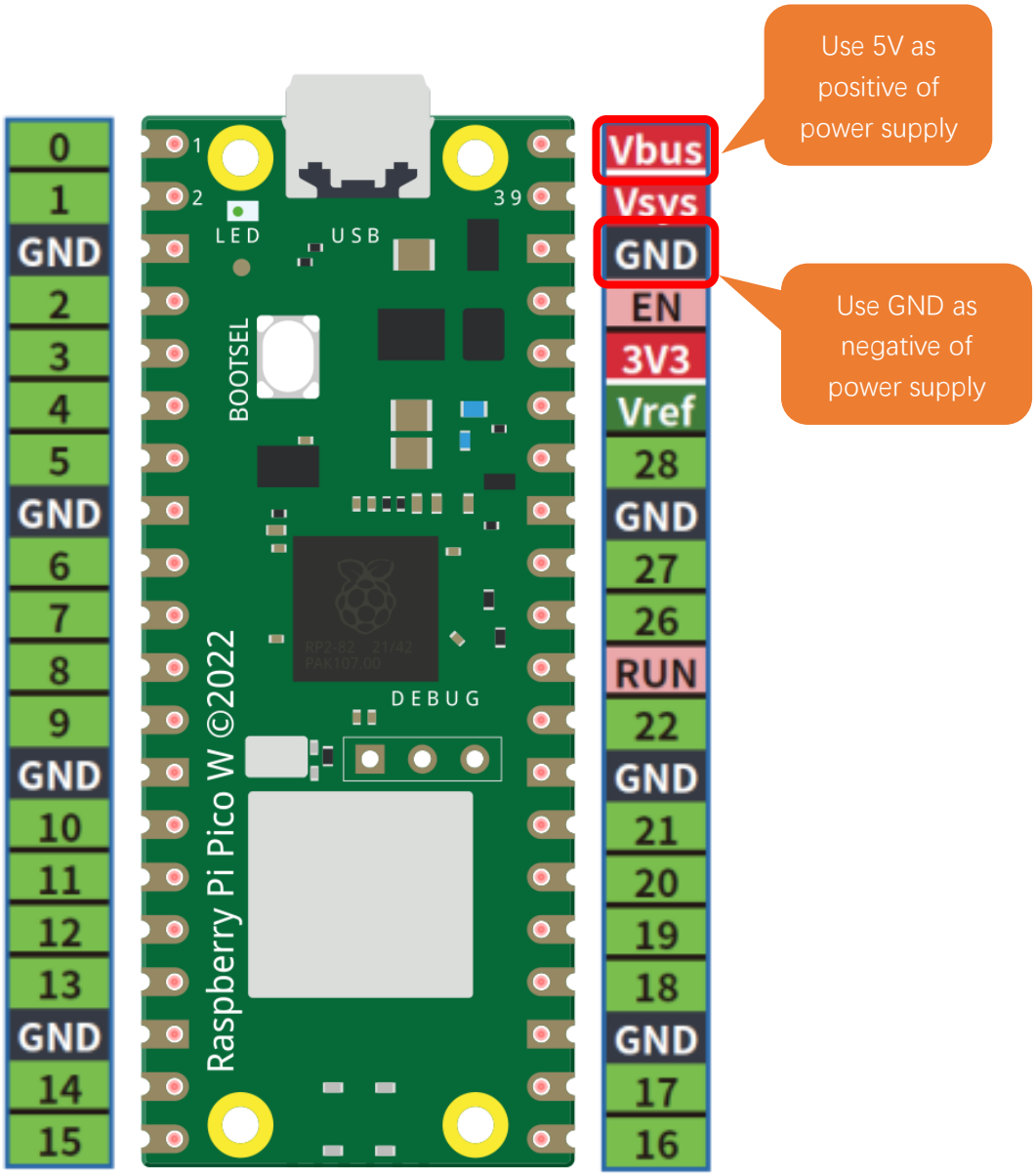
Any concerns? ✉ support@freenove.com

Installing Raspberry Pi Pico

Step1: Select the Power Input and GND Pins for the Microcontroller

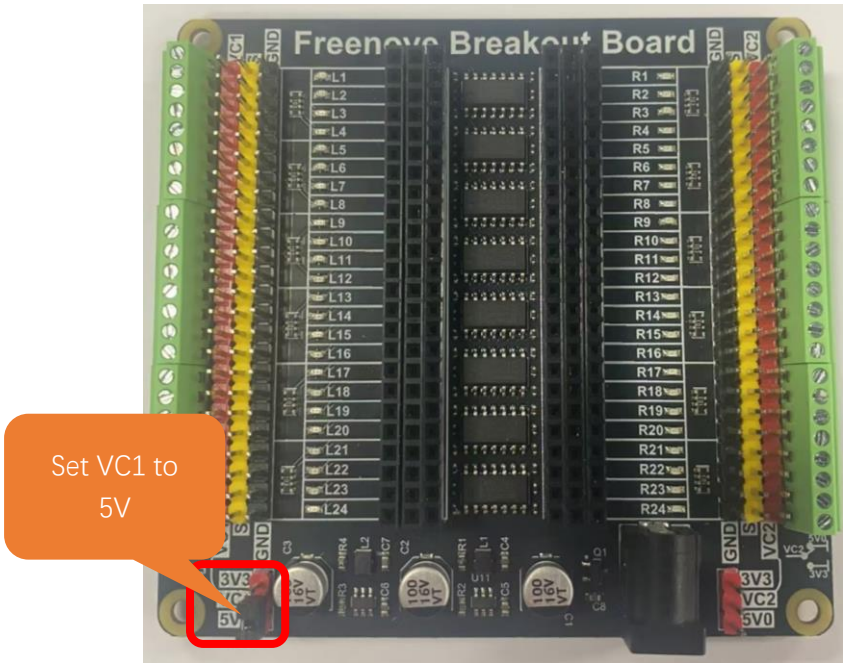
Regardless of the type of development board, it typically features external power input pins, which are commonly situated near the data line connection area on the board. It is important to note that when both VIN/VCC/5V and 3.3V power options are present on the development board, it is advisable to prioritize the use of VIN/VCC/5V for powering the board.

Taking the Raspberry Pi Pico W as an example, this board is marked with both 5V and 3.3V silk screen labels. This indicates the presence of a voltage regulator circuit on the board that steps down the 5V input to a 3.3V output. Generally, the 3.3V is intended for use as an output power supply, while the 5V serves as the input power supply. Consequently, when powering the board, the 5V pin should be used as the positive terminal of the input power supply, and the GND pin should be used as the negative terminal. This is illustrated in the figure below.

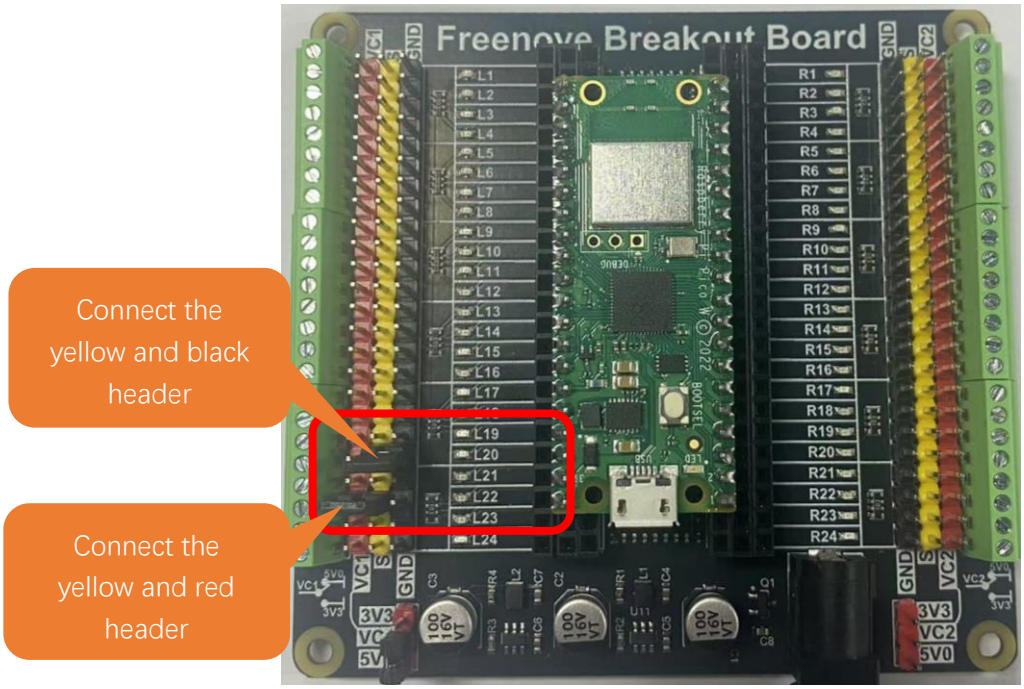


Step2: Power the Development Board

In the first step, the Freenove ESP32 WROVER Board utilizes 5V for the positive power supply terminal and GND for the negative power supply terminal. Consequently, it is necessary to set VC1 to 5V.



As illustrated below:
Conect the yellow header aligned with the 5V pin of the microcontroller to the red header.
Connect the yellow header aligned with the GND pin of the microcontroller to the black header.

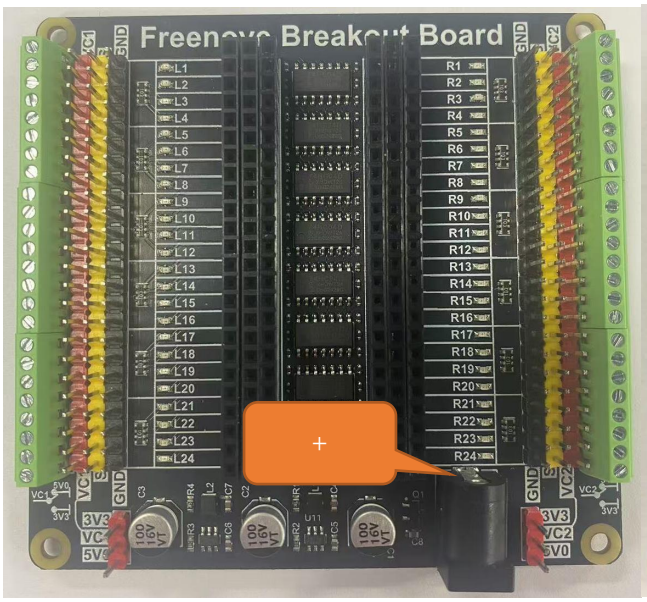


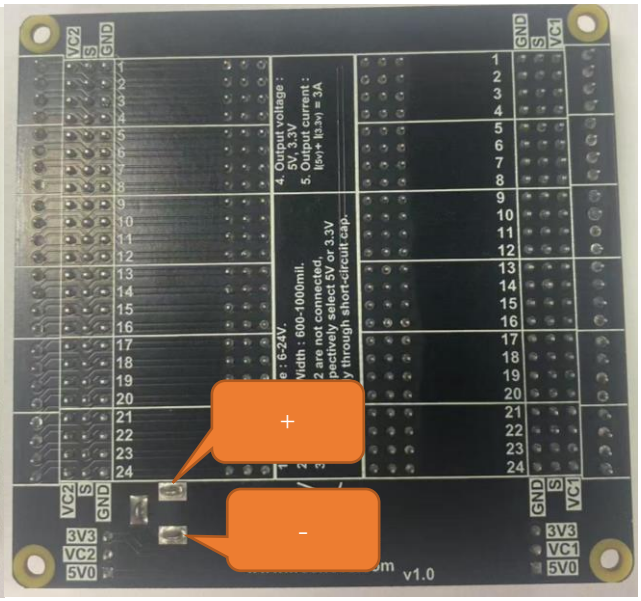
Please note: The red header pin represents the positive power terminal, and the black header pin represents the negative power terminal. During use, under no circumstances should the red and black header pins be short-circuited, as doing so will damage the Freenove Breakout Board.

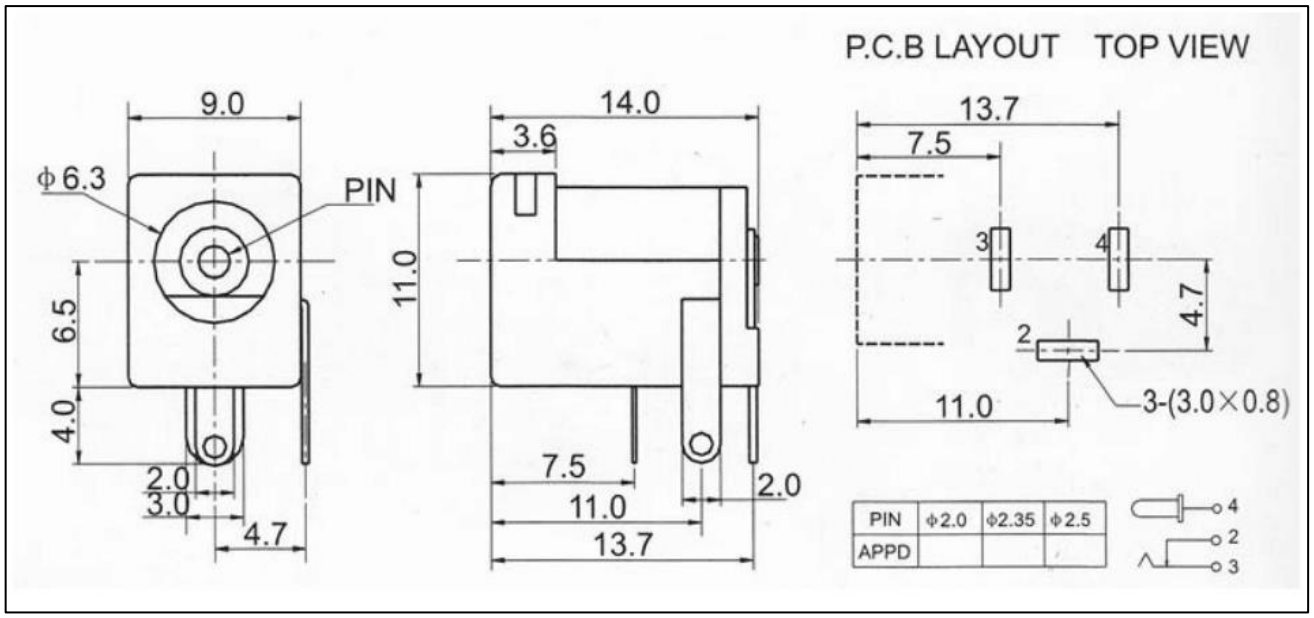
Step3: Power Supply Precautions

Freenove Breakout Board DC005 Jack

The interface for external power supply to Freenove Breakout board is a DC005 interface, whose size is 5.5x2.1mm. Please pay attention to its positive and negative terminals, as shown in the figures below.

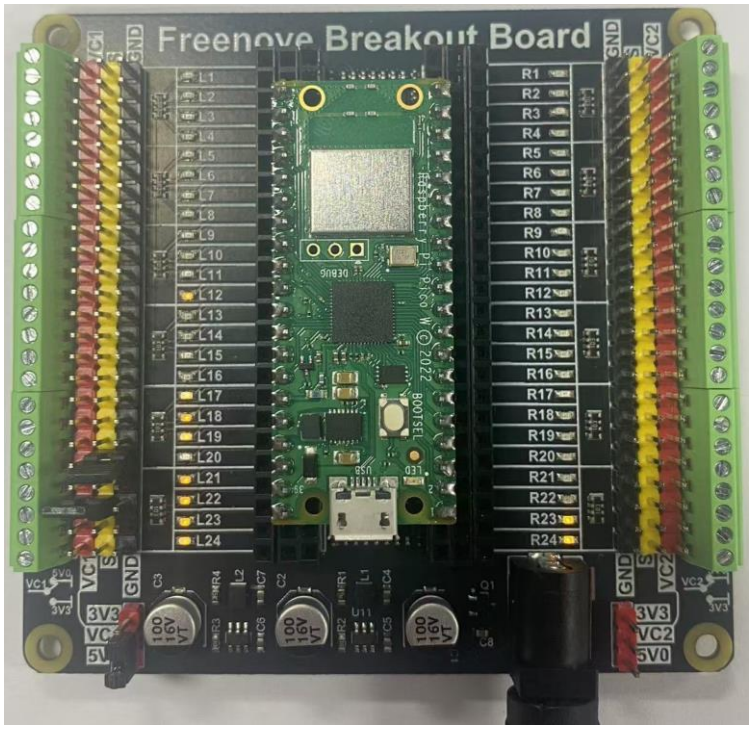






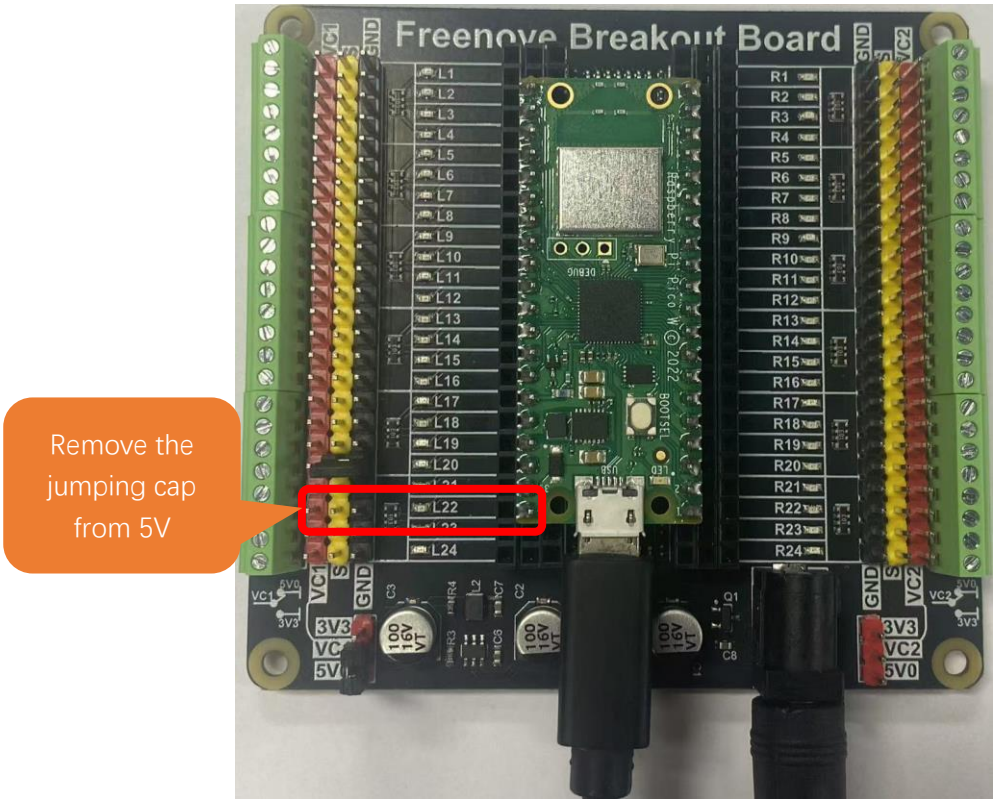
The Freenove Breakout Board features a reverse power protection circuit. This design ensures that the board is safeguarded from damage in the event of an improperly connected external power supply. If, after connecting the external power, the Freenove Breakout Board fails to power the development board, it is likely due to a polarity mismatch in the DC interface being used. The positive and negative terminals may be reversed. It is crucial to verify the specifications of the DC interface to confirm that it is correctly aligned with the board's requirements.

If the external power supply is connected correctly, the signal indicator on the breakout board will light up.



Usage Recommendations:

1. During experiments, if the development board is connected to USB for power supply or code downloading, and the Freenove Breakout Board is powered by an external power source, we recommend that you disconnect the positive connection between the development board and the Freenove Breakout Board. This can better protect your development board. As shown in the figure below.



2. If you are powering the development board using only a data cable, be aware that the combined power consumption of the Raspberry Pi Pico W and any external circuits should not be excessive. Generally, a computer's USB port can only supply 5V at 0.5A to 1A. If your total power consumption exceeds the USB port's capacity, it may cause the development board to operate abnormally or even damage your computer's USB port.

3. If you are using an external power source to power the development board, ensure that the positive and negative terminals of the development board are correctly connected to the Freenove Breakout Board.

4. Each pin on the Freenove Breakout Board is equipped with an indicator LED, which is used to indicate the voltage level state of the development board's pins. If you control a pin to output high or low voltage levels, the indicator LED will change accordingly. Similarly, if some pins on your development board are not in use, they will be in a floating state, which could be either high or low voltage. The corresponding indicator LED on the board will light up or turn off accordingly. If you do not want the indicator LED to light up or turn off, you can control it to output a high or low voltage level through programming.

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Chapter 5 Other Development Boards

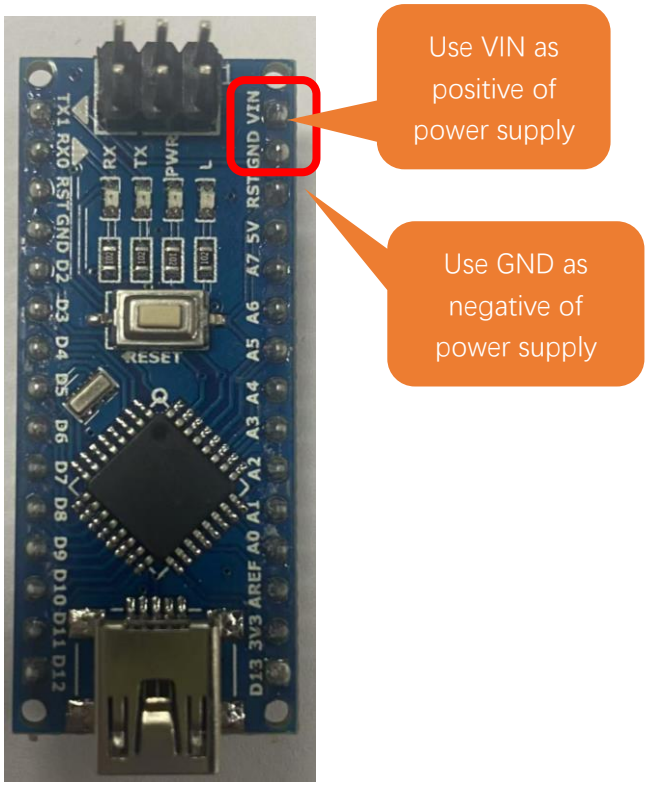
The Freenove Breakout Board is compatible with a variety of development boards, whether they are from our company or other manufacturers. However, please note that the distance between the header pins on both sides of the development board should be between 600mil and 1000mil. If the dimensions of the development board do not meet the installation requirements, do not force the installation, as this may cause damage to the Freenove Breakout Board or your development board.

Installing Development Board

Step1: Select the Power Input and GND Pins for the Microcontroller

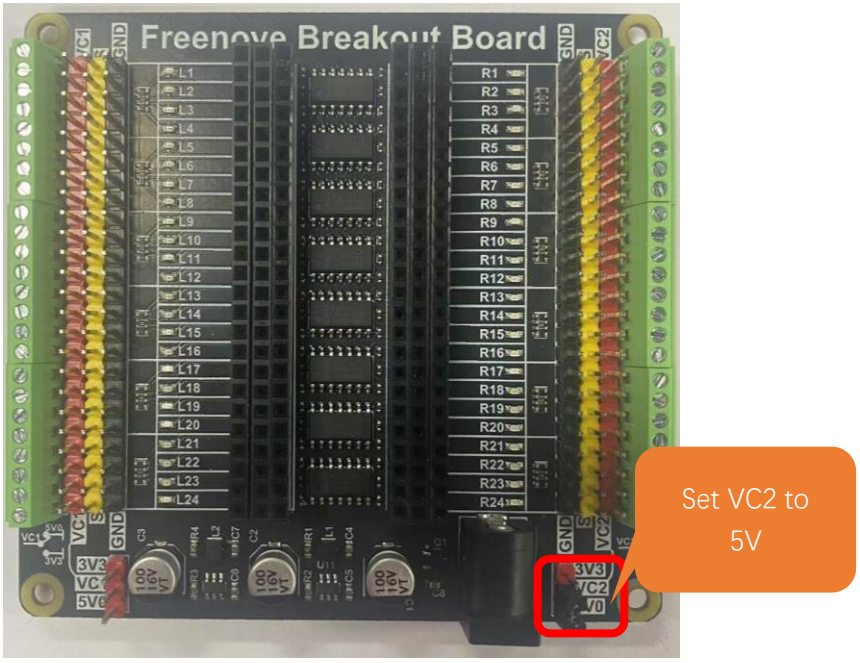
Regardless of the type of development board, it typically features external power input pins, which are commonly situated near the data line connection area on the board. It is important to note that when both VIN/VCC/5V and 3.3V power options are present on the development board, it is advisable to prioritize the use of VIN/VCC/5V for powering the board.

Taking the Freenove ESP8266 Board as an example, this board is marked with both 5V and 3.3V silk screen labels. This indicates the presence of a voltage regulator circuit on the board that steps down the 5V input to a 3.3V output. Generally, the 3.3V is intended for use as an output power supply, while the 5V serves as the input power supply. Consequently, when powering the board, the 5V pin should be used as the positive terminal of the input power supply, and the GND pin should be used as the negative terminal. This is illustrated in the figure below.



Step2: Power the Development Board

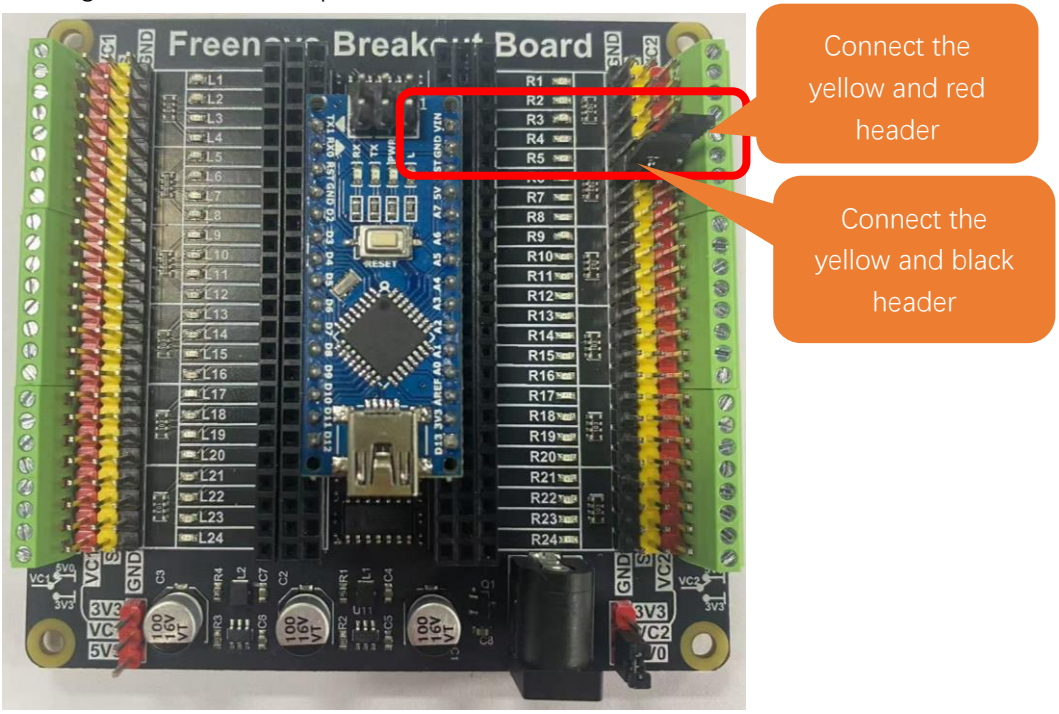
In the first step, the Freenove ESP32 WROVER Board utilizes 5V for the positive power supply terminal and GND for the negative power supply terminal. Consequently, it is necessary to set VC2 to 5V.



As illustrated below:

Conect the yellow header aligned with the 5V pin of the microcontroller to the red header

Connect the yellow header aligned with the GND pin of the microcontroller to the black header

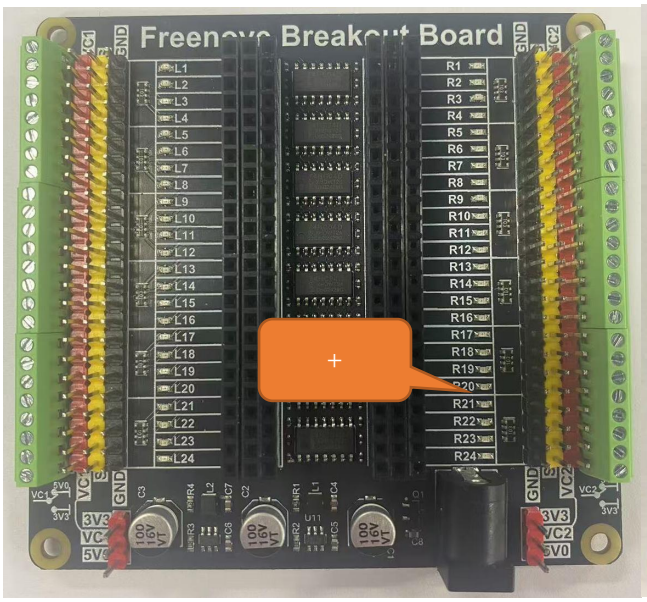


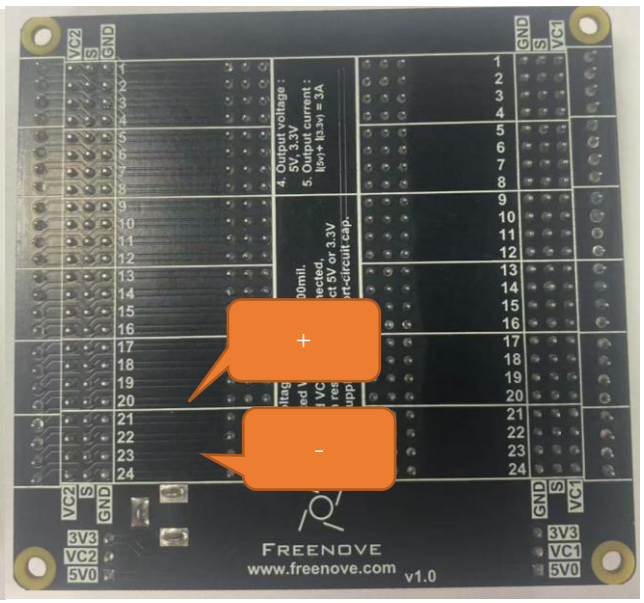
Please note: The red header pin represents the positive power terminal, and the black header pin represents the negative power terminal. During use, under no circumstances should the red and black header pins be short-circuited, as doing so will damage the Freenove Breakout Board.

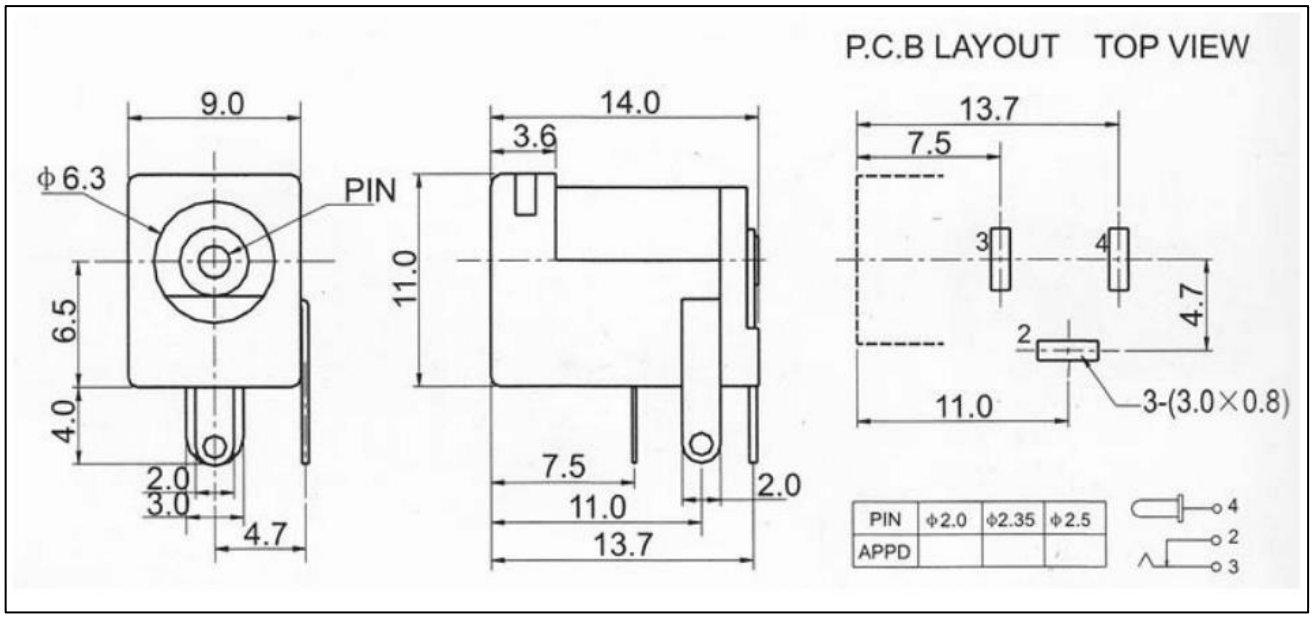
Step3: Power Supply Precautions

Freenove Breakout Board DC005 Jack

The interface for external power supply to Freenove Breakout board is a DC005 interface, whose size is 5.5x2.1mm. Please pay attention to its positive and negative terminals, as shown in the figures below.

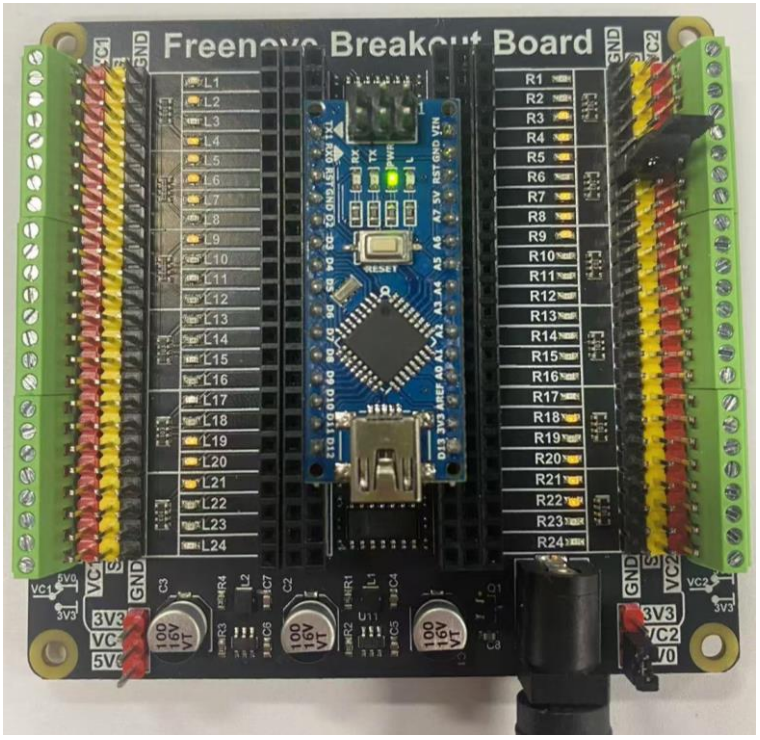






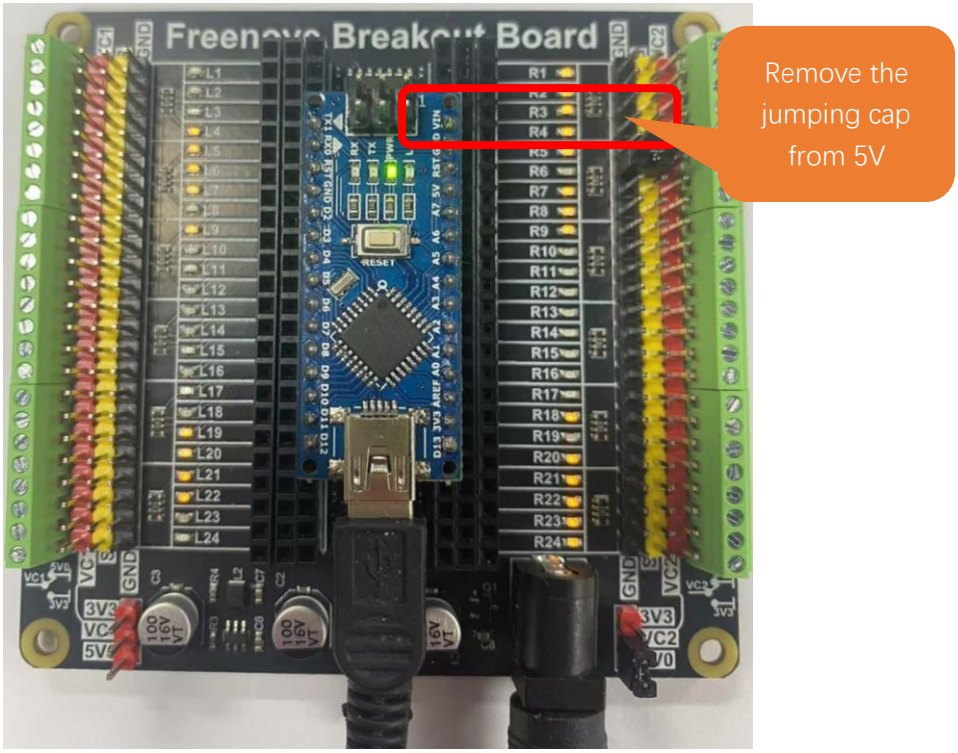
The Freenove Breakout Board features a reverse power protection circuit. This design ensures that the board is safeguarded from damage in the event of an improperly connected external power supply. If, after connecting the external power, the Freenove Breakout Board fails to power the development board, it is likely due to a polarity mismatch in the DC interface being used. The positive and negative terminals may be reversed. It is crucial to verify the specifications of the DC interface to confirm that it is correctly aligned with the board's requirements.

If the external power supply is connected correctly, the power indicator of the development board and the signal indicators on the breakout board will light up.



Usage Recommendations:

1. During experiments, if the development board is connected to USB for power supply or code downloading, and the Freenove Breakout Board is powered by an external power source, we recommend that you disconnect the positive connection between the development board and the Freenove Breakout Board. This can better protect your development board. As shown in the figure below.



2. If you are powering the development board using only a data cable, be aware that the combined power consumption of the development board and any external circuits should not be excessive. Generally, a computer's USB port can only supply 5V at 0.5A to 1A. If your total power consumption exceeds the USB port's capacity, it may cause the development board to operate abnormally or even damage your computer's USB port.

3. If you are using an external power source to power the development board, ensure that the positive and negative terminals of the development board are correctly connected to the Freenove Breakout Board.

4. Each pin on the Freenove Breakout Board is equipped with an indicator LED, which is used to indicate the voltage level state of the development board's pins. If you control a pin to output high or low voltage levels, the indicator LED will change accordingly. Similarly, if some pins on your development board are not in use, they will be in a floating state, which could be either high or low voltage. The corresponding indicator LED on the board will light up or turn off accordingly. If you do not want the indicator LED to light up or turn off, you can control it to output a high or low voltage level through programming.

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What's Next?

THANK YOU for participating in this learning experience!

We have reached the end of this Tutorial. If you find errors, omissions or you have suggestions and/or questions about the Tutorial or component contents of this kit, please feel free to contact us:
We will make every effort to make changes and correct errors as soon as feasibly possible and publish a revised version.

If you want to learn more about Arduino, Raspberry Pi, Smart Cars, Robotics and other interesting products in science and technology, please continue to visit our website. We will continue to launch fun, cost-effective, innovative and exciting products.

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