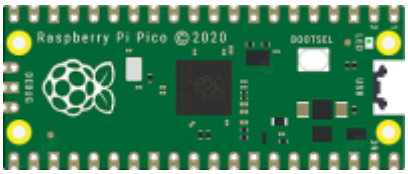
Raspberry Pi Pico Hardware

Jun 2026



Introduction

Pico microcontroller boards

Raspberry Pi Pico is a development board that uses Raspberry Pi microcontrollers (RP2040 or RP2350). A Raspberry Pi Pico is programmed using MicroPython, C, or C++ and, unlike other Raspberry Pi devices, doesn't run Linux or support removable storage. Instead, Raspberry Pi Pico is programmed by flashing binaries to the on-board flash memory.

There are two generations of the Raspberry Pi Pico series:

- Raspberry Pi Pico (Pico 1)
- Raspberry Pi Pico 2

Each generation is available in four variants, which differ based on:

- Wireless connectivity. Variants that include the W suffix in the name include Wi-Fi and Bluetooth.
- Presoldered headers. Variants are available either as castellated modules (for direct soldering) or with presoldered pin headers

Raspberry Pi Pico

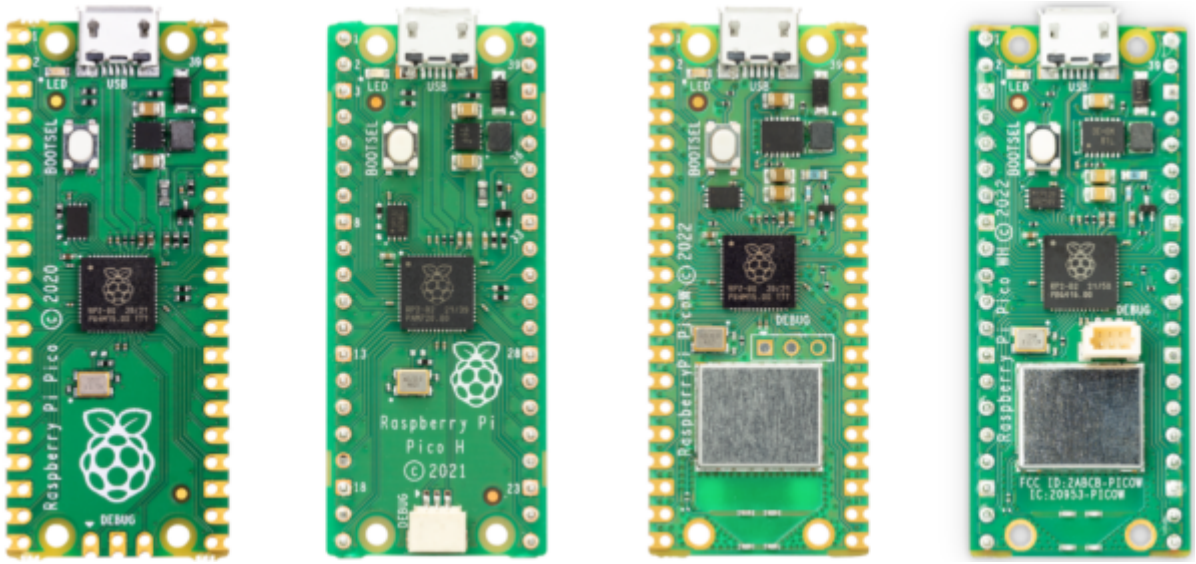
The first generation of Raspberry Pi Pico is based on the RP2040 microcontroller chip. It comes in four variants, listed below. For more detail about the variants, see Non-wireless Raspberry Pi Pico boards (Raspberry Pi Pico and Pico H) and Wireless Raspberry Pi Pico boards (Raspberry Pi Pico W and Pico WH).

	Wireless	Headers
Raspberry Pi **Pico**	No	No
Raspberry Pi **Pico H**	No	Yes (presoldered)
Raspberry Pi **Pico W**	Yes (Wi-Fi and Bluetooth)	No
Raspberry Pi **Pico WH**	Yes (Wi-Fi and Bluetooth)	Yes (presoldered)

Figure 1 provides a visual reference for the four Raspberry Pi Pico variants as seen from the top. Visually, these variants differ most obviously based on:

- The presence or absence of a wireless component.
- The presence or absence of presoldered header pins.
- The location and type of Serial Wire Debug (SWD) interface.

For more information about these differences, see Non-wireless Raspberry Pi Pico boards and Wireless Raspberry Pi Pico boards.



Non-wireless Raspberry Pi Pico boards

Raspberry Pi Pico and Pico H are first-generation, non-wireless microcontroller boards based on the RP2040 chip. Both boards offer identical hardware capabilities, with the only physical differences being the presence of presoldered header pins on Raspberry Pi Pico H, and the style of the debug connector at the bottom of the boards. For more information, see Debug connector (SWD).

The pinout and board layout for Raspberry Pi Pico and Pico H is the same as for Raspberry Pi Pico 2 and Pico 2 with headers. For more information, see Non-wireless board layout.

Key Features

Raspberry Pi Pico and Pico H offer the following key features:

1. RP2040 microcontroller chip, including:

- Dual-core M0+ processor.
- Flexible clock running up to 133 MHz.
- 264 kB of SRAM.
- USB 1.1 controller and PHY with device and host support.
- Low-power sleep and dormant modes.
- Accurate clock and timer.
- Accelerated floating-point libraries.
- Temperature sensor.
- Eight Programmable I/O (PIO) state machines for custom peripheral support.
- Flexible, user-programmable high-speed I/O.
- Can emulate interfaces such as SD card and VGA.

1. Board features:

- rag-and-drop programming using mass storage over USB.
- 2 MB of on-board flash memory.
- 26 multi-function GPIO pins. For more information, see Non-wireless board layout.
- Debug connector. For more information, see Debug connector (SWD).

1. Peripheral interfaces:

- Two SPI

- Two I2C
- Two UART
- Three 12-bit ADC
- 16 PWM channels

Wireless Raspberry Pi Pico boards

Raspberry Pi Pico W and Pico WH are first-generation, wireless microcontroller boards based on the RP2040 chip. Both boards offer identical hardware capabilities, with the only physical differences being the presence of presoldered header pins on Raspberry Pi Pico WH, and the style of the debug connector below the microcontroller.

The pinout and board layout for Raspberry Pi Pico W and Pico WH is the same as for Raspberry Pi Pico 2 W and Pico 2 W with headers.

Key Features

Raspberry Pi Pico W and Pico WH offer the same key features as Raspberry Pi Pico and Pico H, but with added wireless functionality. Specifically, Raspberry Pi Pico W and Pico WH offer the following key features:

RP2040 microcontroller chip

Including:

- Dual-core M0+ processor.
- Flexible clock running up to 133 MHz.
- 264 kB of SRAM.
- USB 1.1 controller and PHY with device and host support.
- Low-power sleep and dormant modes.
- Accurate clock and timer.
- Accelerated floating-point libraries.
- Temperature sensor.
- Eight Programmable I/O (PIO) state machines for custom peripheral support.
- Flexible, user-programmable high-speed I/O.
- Can emulate interfaces such as SD card and VGA.

Board features

- Drag-and-drop programming using mass storage over USB.
- 2 MB of on-board flash memory.
- 26 multi-function GPIO pins. For more information.
- Debug connector. For more information.

Peripheral interfaces:

- Two SPI
- Two I2C
- Two UART
- Three 12-bit ADC
- 16 PWM channels

Wireless connectivity

- Wi-Fi (802.11n):
- Single-band (2.4 GHz).
- WPA3, a modern security protocol for wireless connectivity.
- Soft access point for broadcasting a Wi-Fi network, supporting up to four clients.

- Bluetooth 5.2:
- Support for Bluetooth Low Energy (BLE) Central and Peripheral roles.
- Support for Bluetooth Classic.

Raspberry Pi Pico 2

Raspberry Pi Pico 2 is based on the RP2350 microcontroller chip. It comes in four variants, listed in Table 2. Unlike Raspberry Pi Pico H and Pico WH, 'headers' isn't shortened to 'H'.

	Wireless	Headers
Raspberry Pi **Pico 2**	No	No
Raspberry Pi **Pico 2 with headers**	No	Yes (presoldered)
Raspberry Pi **Pico 2 W**	Yes (Wi-Fi and Bluetooth)	No
Raspberry Pi **Pico 2 W with headers**	Yes (Wi-Fi and Bluetooth)	Yes (presoldered)

Wireless Raspberry Pi Pico 2 boards

Raspberry Pi Pico 2 W and Pico 2 W with headers are wireless microcontroller boards based on the RP2350 chip. Both boards offer identical hardware capabilities, with the only physical differences being the presence of presoldered header pins on Raspberry Pi Pico 2 with headers, and the style of the debug connector below the microcontroller.

The pinout and board layout for Raspberry Pi Pico 2 W and Pico 2 W with headers is the same as for Raspberry Pi Pico W and Pico WH

Key Features

Raspberry Pi Pico 2 W and Pico 2 W with headers offer the same key features as Raspberry Pi Pico 2 and Pico 2 with headers, but with added wireless functionality. Specifically, Raspberry Pi Pico 2 W and Pico 2 W with headers offer the following key features:

RP2350 microcontroller chip

Including:

- A choice of CPU architectures that can run tasks in parallel. For more information, see Architecture switching:
- Dual-core Arm Cortex-M33.
- Dual-core Hazard3 RISC-V processor.
- Flexible clock running up to 150 MHz.
- 520 kB of SRAM.
- USB 1.1 controller and PHY with device and host support.
- Low-power sleep and dormant modes.
- Accurate clock and timer.
- Temperature sensor.

- Twelve Programmable I/O (PIO) state machines for custom peripheral support.
- Flexible, user-programmable high-speed I/O.
- Can emulate interfaces such as SD card and VGA.

Board Features

- rag-and-drop programming using mass storage over USB.
- 4 MB of on-board flash memory.
- 26 multi-function GPIO pins. For more information, see Non-wireless board layout.
- Hardware and software compatibility with Raspberry Pi Pico 1.
- Two timers with 4 alarms, and an AON timer.
- Debug connector

Peripheral interfaces

- Two SPI
- Two I2C
- Two UART
- Three 12-bit ADC
- 16 PWM channels

Wireless connectivity

- Wi-Fi (802.11n):
- Single-band (2.4 GHz).
- WPA3, a modern security protocol for wireless connectivity.
- Soft access point for broadcasting a Wi-Fi network, supporting up to four clients.
- Bluetooth 5.2:
- Support for Bluetooth Low Energy (BLE) Central and Peripheral roles.
- Support for Bluetooth Classic.

Wireless Details

Wireless Raspberry Pi Pico models (Raspberry Pi Pico W, Pico WH, Pico 2 W, and Pico 2 W with headers) integrate Wi-Fi and Bluetooth connectivity directly into the board, making them suitable for connected and IoT applications, without requiring external radio modules.

Wireless hardware and antenna

Wireless Raspberry Pi Pico models use the Infineon CYW43439 wireless chip, connected to the on-board microcontroller through an SPI interface operating at up to 33 MHz. Wireless Raspberry Pi Pico models also feature an on-board antenna licensed from ABRACON (formerly ProAnt).

Because this wireless subsystem shares some of the pins, some interface signals are multiplexed with other board functions.

- The SPI clock line (CLK) is shared with the VSYS voltage monitor, and so the ADC can only read VSYS when no SPI transaction is in progress.
- The Infineon CYW43439 DIN/OUT and IRQ signals share a pin, so you can only check for interrupt requests (IRQ) when no SPI transaction is in progress.

For optimal wireless performance, keep the antenna space free. Placing metal near or under the antenna can significantly reduce signal gain and bandwidth; grounded metal placed along the sides of the antenna can improve the antenna's bandwidth.

Wireless software licensing

The software libraries, libcyw43 and BTstack, are free to use for non-commercial projects. However, Raspberry Pi has negotiated special commercial rights for Raspberry Pi Pico and microcontroller users. This means that users are granted a free licence for commercial use for projects built with:

- Wireless Raspberry Pi Pico boards (Raspberry Pi Pico W, Pico WH, Pico 2 W, and Pico 2 W with headers).
- A combination of RP2040 and CYW43439, or RP2350 and CYW43439.

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