

# 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

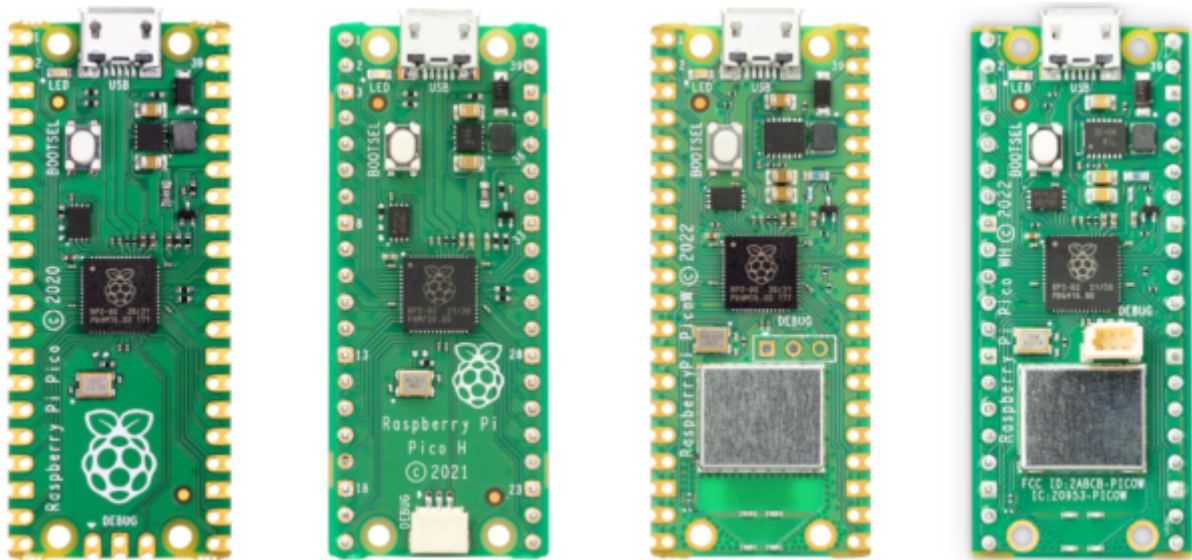
The first generation of Raspberry Pi Pico is based on the RP2040 microcontroller chip. It comes in four variants, listed below. For more detail about the variants, see [Non-wireless Raspberry Pi Pico boards \(Raspberry Pi Pico and Pico H\)](#) and [Wireless Raspberry Pi Pico boards \(Raspberry Pi Pico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

|                      | 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
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## 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.

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Last update: **2026/06/14 20:29**

