

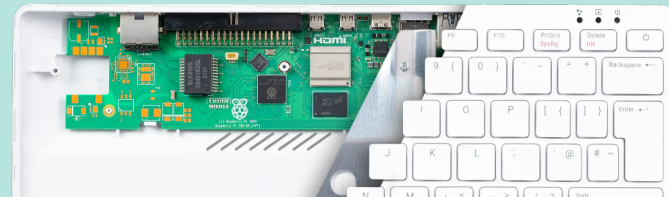
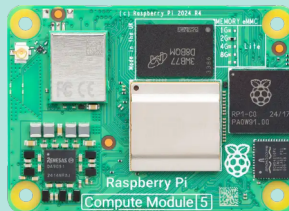
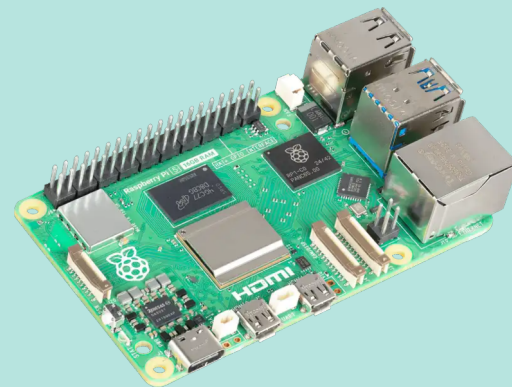
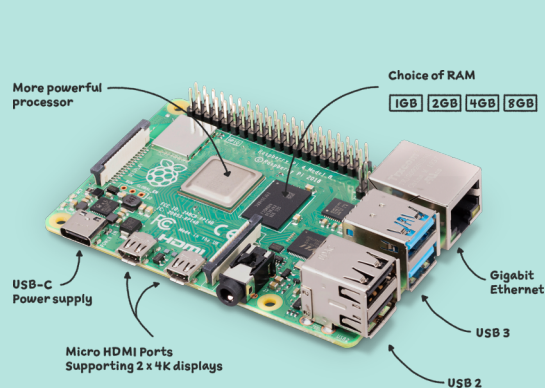


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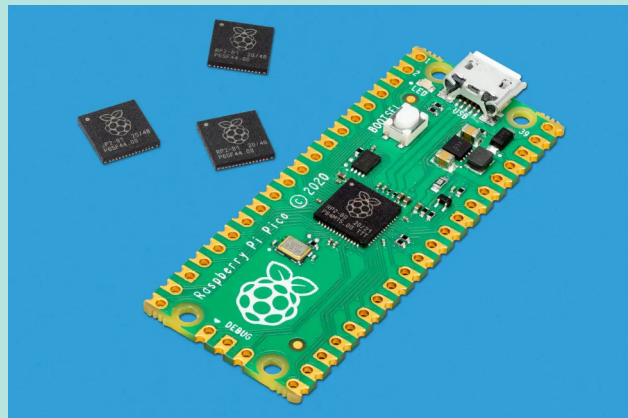
A Slice of Zephyr Pi

William Vinnicombe, Raspberry Pi
Tim Guite, Magpie Embedded

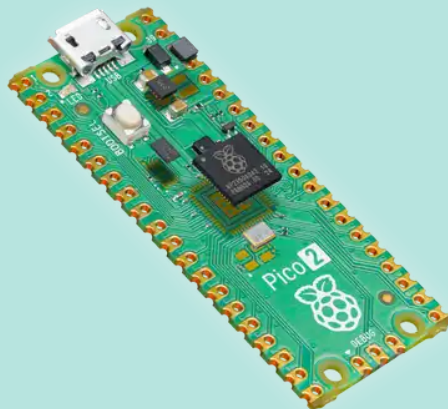
Since 2012



Meet the family!

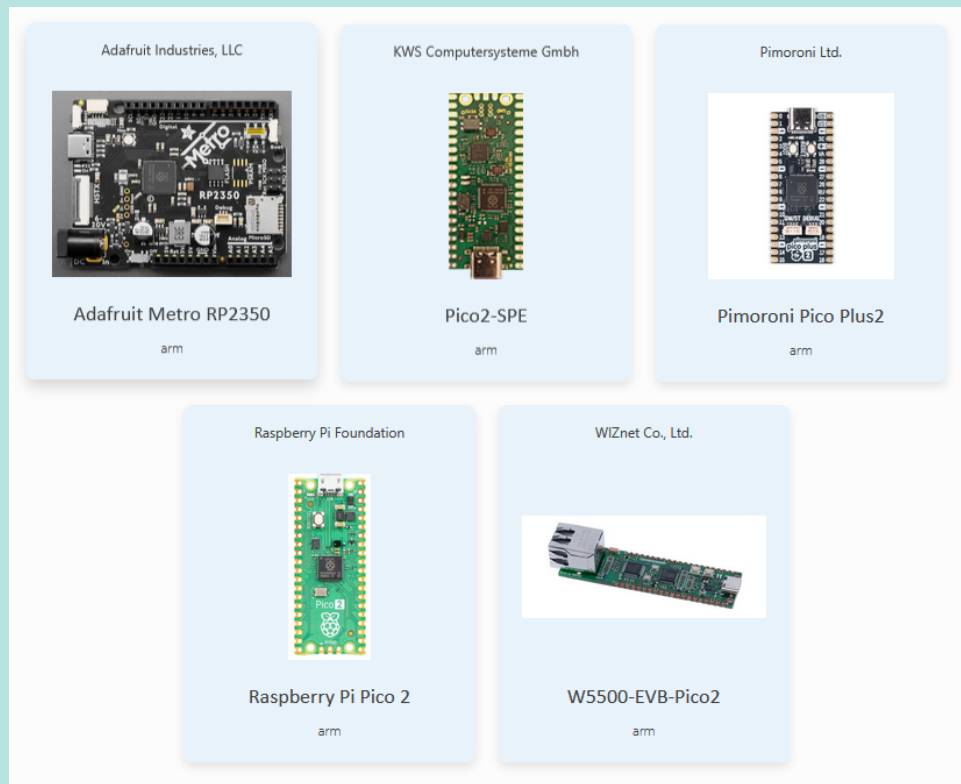


RP2040
Pico & Pico W



RP2350
Pico 2 & Pico 2W

Over 15
million sold!





“ The Raspberry Pi silicon products bring our signature values of high performance, low cost, and ease of use to the microcontroller space. We have watched Zephyr grow over the last few years and we think it matches these values. We want to provide a great experience for users working with Zephyr on Pi microcontrollers. ”

Gordon Hollingworth
Raspberry Pi CTO



Zephyr Timeline



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Meet Raspberry Silicon: Raspberry Pi Pico now on sale at \$4



21st Jan 2021 James Adams 251 comments



yonsch commented on May 4, 2021 • edited by carlescufi

Contributor

This PR provides very basic support for the Raspberry Pi Pico board. It continues [#33172](#) by [@loannisg](#). It currently supports the boot process and UART, and is able to run the `hello_world` sample.

As this is still very premature, it still lacks a few important features, such as spawning the second core or supporting `west flash`, but it's probably enough so that other people can start using this board with Zephyr and improve this port.

This PR assumes there is a `hal_raspberrypi` module under `zephyrproject-rtos`. Since I don't have permissions to create this repository, I will need someone to do so, so that I can push my local changes.

If anyone wants to run this, I used raspberrypi's fork of openocd together with a JLink adapter to flash. If you're using JLink, make sure to checkout to the `rp2040_jlink` branch of their fork before installing openocd. Flash using this command:

```
openocd -f interface/jlink.cfg -c 'transport select swd' -f target/rp2040.cfg -c "adapter_khz 2000" -c 'targets rp2040' -c 'reset
```

Closes [#33012](#)



carlescufi merged commit `efa170f` into `zephyrproject-rtos:main` on Feb 2, 2022

Conversation 285



Yonatan Schachter
yonsch



Ioannis Giaropoulos
loannisg

Raspberry Pi Pico W: your \$6 IoT platform



30th Jun 2022 Eben Upton 112 comments



beechwoods-software commented on May 1, 2023 • edited ▾

...

This is a barebones implementation of the board definition for the Raspberry Pi Pico W. Effort has been made to abstract the features that are common to both the Pico and Pico W into a shared file when possible. This commit does not include the addition of bluetooth or wifi drivers for the W's Infineon module.



carlescufi merged commit `b116f0a` into `zephyrproject-rtos:main` on May 12, 2023



Conversation 105



Dave Rensberger
drensber



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Raspberry Pi Pico 2, our new \$5 microcontroller board, on sale now



8th Aug 2024 Eben Upton 69 comments



ajf58 commented on Aug 21, 2024 • edited by kartben

Contributor

<https://builds.zephyrproject.io/zephyr/pr/77368/docs/boards/index.html#name=pico+2>

This is a PR to add support for the Raspberry Pi Pico 2 board, and the RP2350 SoC. See also the discussion at [#77329](#)

~~This should not be merged currently, as it includes changes that will break the clock control driver for the RP2040.~~

Dependencies

1. [west: hal_rpi_pico: Update Pico-SDK to 2.0.0](#) #76986
2. Updating hal_rpi_pico incorporate the change for [raspberrypi/pico-sdk@ 0e5ef0f](#)

cc: [@yonsch](#) [@soburi](#)



2

9



kartben merged commit 6a47f72 into [zephyrproject-rtos:main](#) on Dec 23, 2024
39 checks passed



Conversation 402



Andrew Featherstone
ajf58



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Raspberry Pi Pico 2 W on sale now at \$7



25th Nov 2024 Eben Upton 47 comments



MagpieEmbedded commented on May 29

Contributor ...

The Pico 2W board is similar to the Pico 2 apart from the addition of an Infineon Wifi chip. This commit is based on the Pico and Pico W setup. There is a small change to the pin definition to allow communication with the Wifi chip using the Pio SPI device.

Currently dependent on this PR to fix the AIROC configuration: [#90789](#)



hal: infineon: Add option to disable SDIO pullups during SPI sleep #28

Merged npal-cy merged 1 commit into [zephyrproject-rtos:master](#) from [MagpieEmbedded:disable_sdio_pullup_during_spi_sleep](#) on Jun 17

modules: hal: infineon: Add Kconfig option for pullups in Wifi Host Driver #91227

Merged cfridrt merged 1 commit into [zephyrproject-rtos:main](#) from [MagpieEmbedded:airoc_disable_sdio_pullups_during_spi_sleep](#) 3 weeks ago

drivers: spi: spi_pico_pio: Prevent dma_config check if DMA is not enabled #94910

Merged [kartben](#) merged 1 commit into [zephyrproject-rtos:main](#) from [TerryGeng:fix-dma-check](#) 8 hours ago



MaureenHelm merged commit 3d2f8b1 into [zephyrproject-rtos:main](#) 2 weeks ago

23 checks passed



Conversation 58



Magpie Embedded
MagpieEmbedded



David Żytka
dzytko



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zephyr / MAINTAINERS.yml

Code

Blame

6101 lines (5745 loc) · 121 KB

```
5416 "West project: hal_rpi_pico":
5417     status: maintained
5418     maintainers:
5419         - soburi
5420     collaborators:
5421         - yonsch
5422         - threeeights
5423         - ajf58
5424     files:
5425         - modules/hal_rpi_pico/
5426     labels:
5427         - "platform: Raspberry Pi Pico"
```

zephyr / MAINTAINERS.yml

Code

Blame

6101 lines (5745 loc) · 121 KB

```
5290 "West project: hal_infineon":
5291     status: maintained
5292     maintainers:
5293         - sreeramIfx
5294     collaborators:
5295         - parthitce
5296         - taliho
5297         - mcattee-infineon
5298     files:
5299         - modules/Kconfig.infineon
5300         - modules/hal_infineon/
5301     labels:
5302         - "platform: Infineon"
```



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Zephyr Features for Pi



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Networking Comparison with Pico SDK

Iperf server example

VS

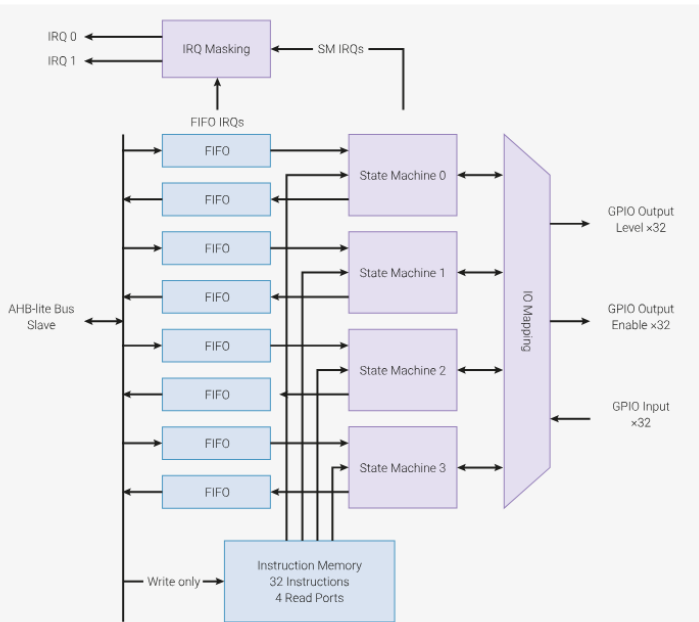
Zperf server sample ([zperf](#))

Possible speed up **today:** [#94888](#)

	Pico SDK (Mbps)	Zephyr (Mbps)
Pico W	16.9	2.7
Pico 2W	16.8	3.3

PIO – Programmable I/O

Figure 38. PIO block-level diagram. There are two PIO blocks with four state machines each. The four state machines simultaneously execute programs from a shared instruction memory. FIFO data queues buffer data transferred between PIO and the system. GPIO mapping logic allows each state machine to observe and manipulate up to 30 GPIOs.



- Additional hardware interfaces without extra silicon
- Drivers available for SPI, UART and WS2812 LED Strip in Zephyr

PIO – Programmable I/O

```
&pio1 {
    status = "okay";

    pio_uart0: uart0 {
        pinctrl-0 = <&pio1_uart0_default>;
        pinctrl-names = "default";

        compatible = "raspberrypi,pico-uart-pio";
        current-speed = <115200>;
        status = "okay";
    };

    pio_uart1: uart1 {
        pinctrl-0 = <&pio1_uart1_default>;
        pinctrl-names = "default";

        compatible = "raspberrypi,pico-uart-pio";
        current-speed = <115200>;
        status = "okay";
    };
};
```

```
samples > boards > raspberrypi > rpi_pico > uart_pio > src > C main.c > ...
1  /*
2   * Copyright (c) 2023 Yonatan Schachter
3   *
4   * SPDX-License-Identifier: Apache-2.0
5   */
6
7  #include <zephyr/kernel.h>
8  #include <zephyr/device.h>
9  #include <zephyr/drivers/uart.h>
10
11  int main(void)
12  {
13      char data;
14      const struct device *uart0 = DEVICE_DT_GET(DT_MODELABEL(pio1_uart0));
15      const struct device *uart1 = DEVICE_DT_GET(DT_MODELABEL(pio1_uart1));
16
17      if (!device_is_ready(uart0)) {
18          return 0;
19      }
20
21      if (!device_is_ready(uart1)) {
22          return 0;
23      }
24
25      while (1) {
26          if (!uart_poll_in(uart0, &data)) {
27              uart_poll_out(uart0, data);
28          }
29
30          if (!uart_poll_in(uart1, &data)) {
31              uart_poll_out(uart1, data);
32          }
33      }
34
35      return 0;
36  }
```

PIO Example: `west build -p -b rpi_pico2/rp2350a/m33 samples/boards/raspberrypi/rpi_pico/uart_pio/`

RISC-V and Rust

RISC-V on Raspberry Pi Pico 2



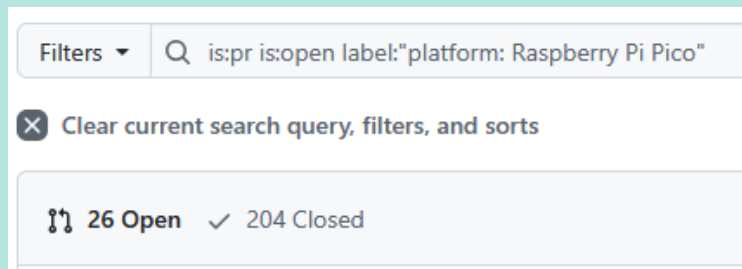
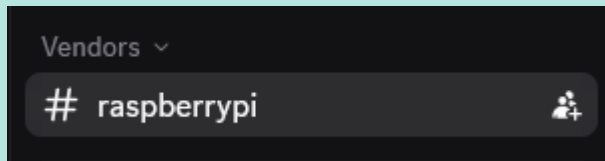
25th Sep 2024 Luke Wren 3 comments

Hazard3 RISC-V Support: [#89758](#)

```
1 // Copyright (c) 2024 Linaro LTD
2 // SPDX-License-Identifier: Apache-2.0
3
4 #![no_std]
5
6 use log::info;
7
8 #![no_mangle]
9 extern "C" fn rust_main() {
10     unsafe {
11         zephyr::set_logger().unwrap();
12     }
13
14     info!("Hello world from Rust on {}", zephyr::kconfig::CONFIG_BOARD);
15 }
```

Get Involved!

- Multicore AMP: [#93379](#)
- Wi-Fi Blinky: [#92861](#)
- Hazard3 RISC-V Support: [#89758](#)
- Secure Boot: [#94583](#)
- <https://chat.zephyrproject.org/>



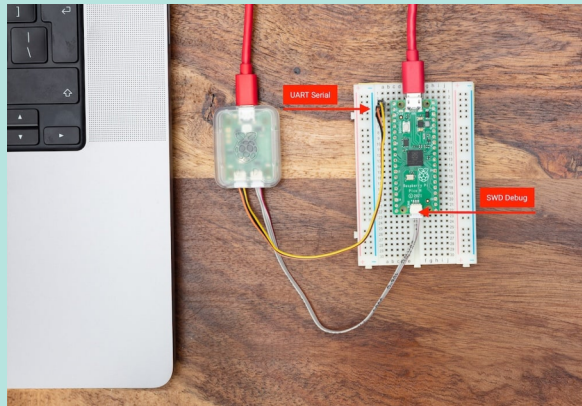


Demo Time!

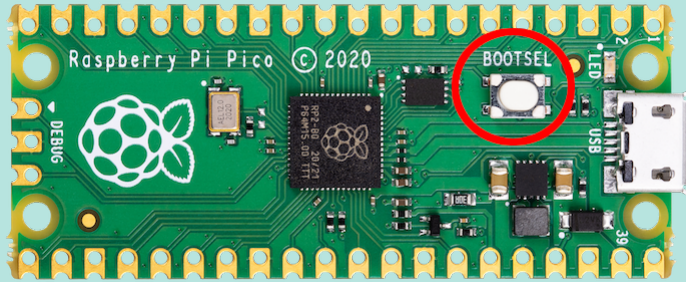
Debugging your Pico

- Debug requires OpenOCD fork ([here](#)) (for now)
- Can use Pico as debugger with DebugProbe
- Or use the Debug Probe
- Add to build:

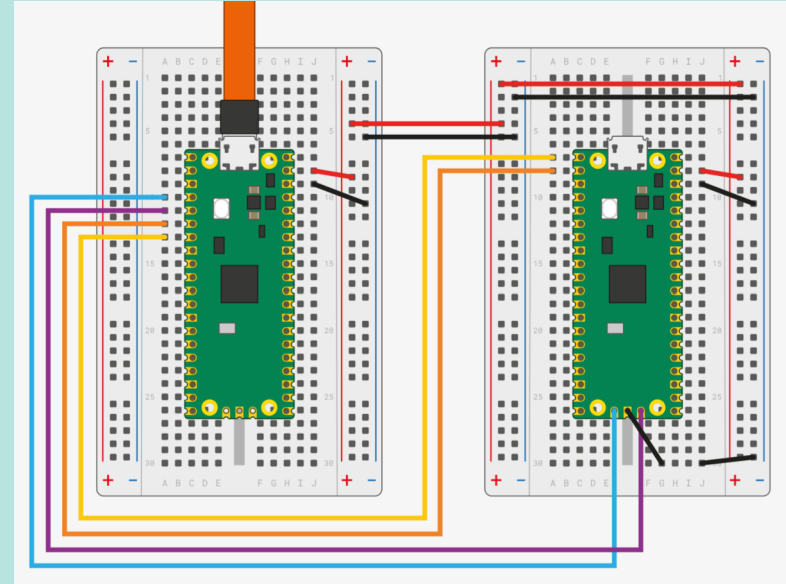
```
west build -p -b rpi_pico2/rp2350a/m33/w samples/net/wifi/shell --  
-DOPENOCD=/home/.pico-sdk/openocd/0.12.0+dev/openocd.exe  
-DOPENOCD_DEFAULT_PATH=/home/.pico-sdk/openocd/0.12.0+dev/scripts/
```



Debugging your Pico



Picotool (USB Only)
Program with a button and copy paste!



Debugprobe on Pico

Pico Extension for VSCode

New Zephyr Pico Project X

Raspberry Pi **Pico** Basic Settings Modules

Basic Settings

Name:

Board type:

Project template:

Location: Change

Modules

Kconfig options to enable the below modules

☐ SPI	☐ I2C interface	☐ GPIO
☐ Wifi	☐ Sensor interface	☐ Shell

Stdio support:

☒ Console over UART ☐ Console over USB

CMake Version: Latest: v4.2.0-rc1

Ninja Version: Latest: v1.13.1

Cancel Create

Download from VSCode Marketplace



Thank You!