



First Look at Raspberry Pi-5



Ray Hitt, N8VMX

Jan 18, 2024



Topics

- General history and description of Raspberry Pi
- What's new with Raspberry Pi-5
- What's better / what's worse
- Ramifications for amateur radio

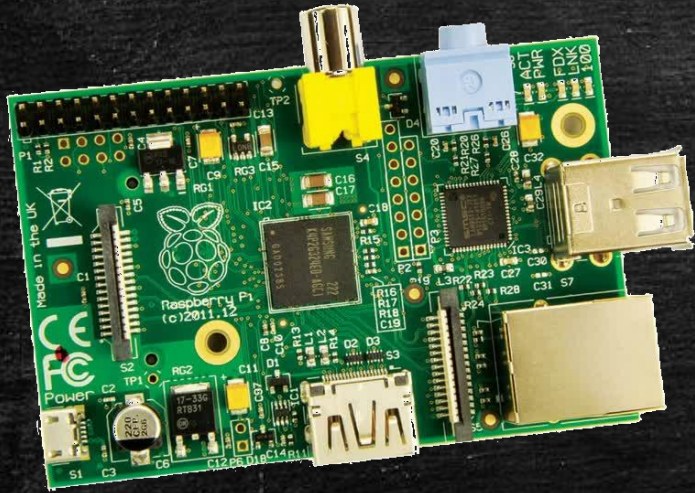


Background of the Raspberry Pi

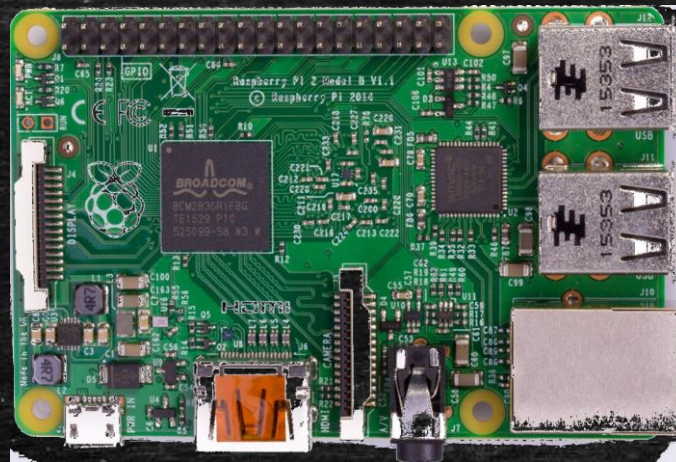
- Single board computer containing a wide variety of inputs, outputs
- Invented at Cambridge, UK, in a 2006 project led by Eben Upton
- Invented to provide inexpensive computer for students (first college, then school-age children) interested in learning about computer science
- First board released for sale in Feb 2012
- Interesting name?
 - Computer projects often named after fruit (Apple, Blackberry, Raspberry)
 - Pi? – Could be because of the Python language, or scientists' love of π ? Or pie?



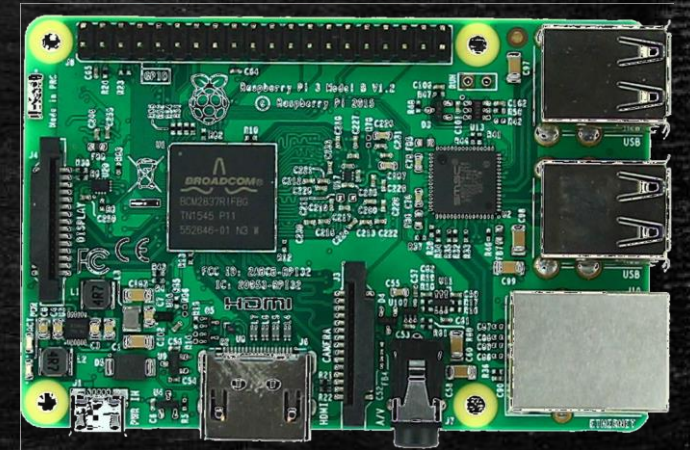
Models of Raspberry Pi SBCs



Model B (2012)



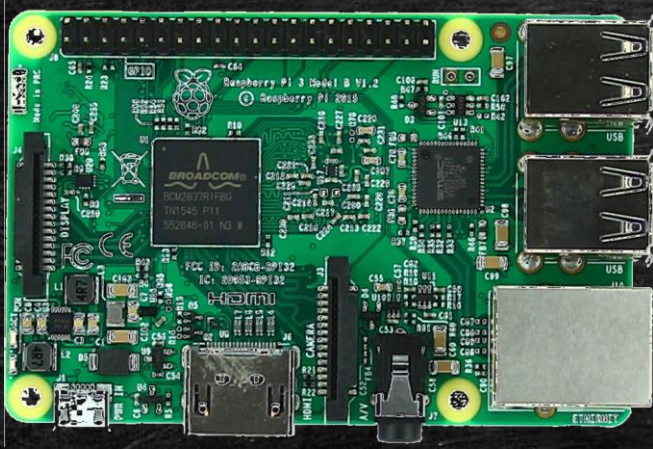
Pi-2 (2015)



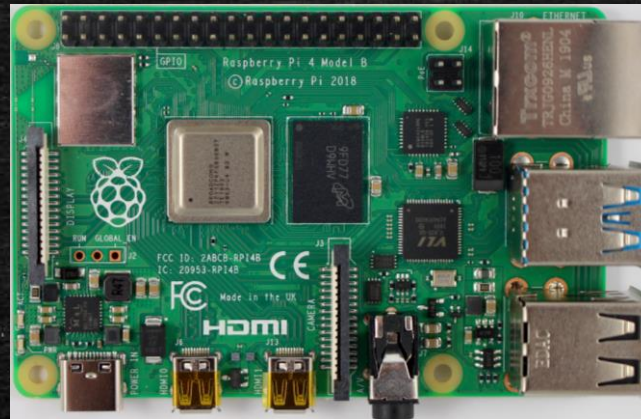
Pi-3 (2016)



Models of Raspberry Pi SBCs



Pi-3 Model B+ (2018)



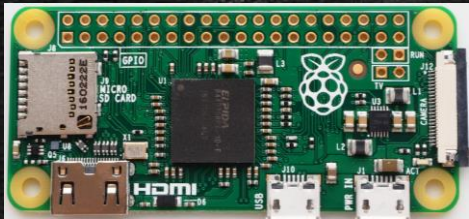
Pi-4 Model B (2019)



Pi-5 (2023)



Other Styles of Raspberry SBCs



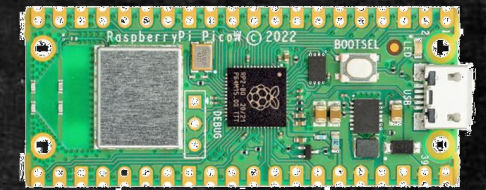
Pi-Zero (2015)



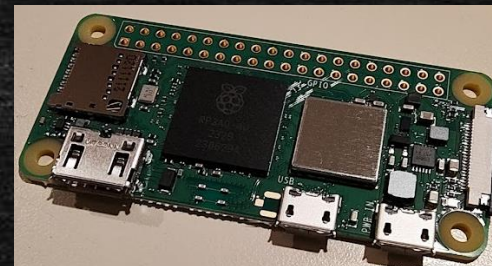
Pi-Pico (2021)



Pi-Zero W (2017)



Pi-Pico W (2023)



Pi-Zero 2W (2022)



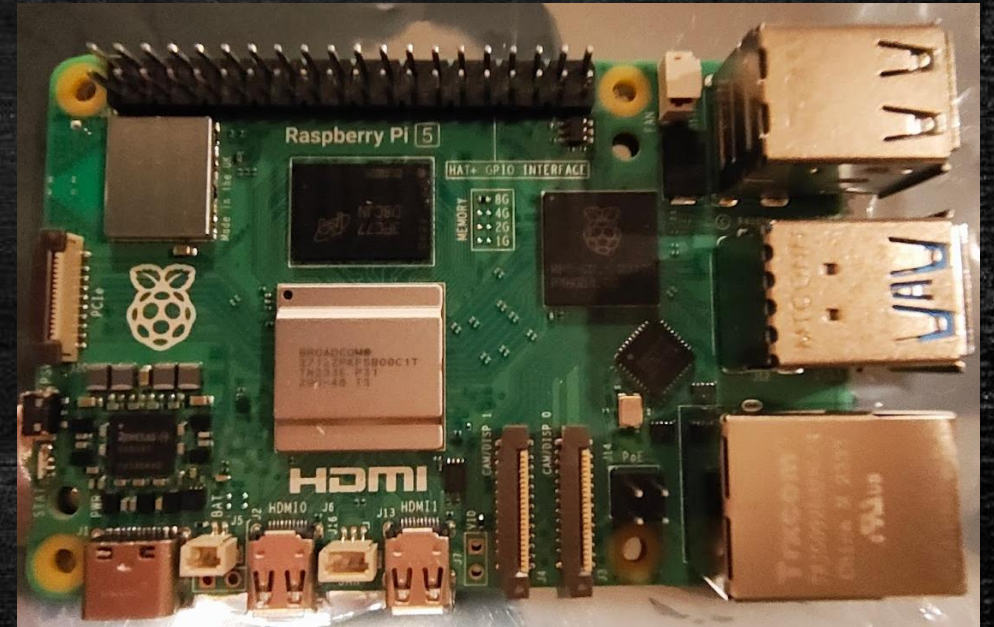
Technical Evolution of Raspberry Pi

Model	CPU	CPU Clock Speed	Number of CPU Cores	RAM megabytes (MB) or gigabytes (GB)	Release Date
Raspberry Pi Model B	ARM1176JZF-S	700 MHz	1	256 MB 512 MB	15 Feb 2012 15 Apr 2014
Raspberry Pi-2	Cortex-A7	900 MHz	4	1 GB	1 Feb 2015
Raspberry Pi-3 Model B Raspberry Pi-3 Model B+	Cortex-A53 64-bit	1.2 GHz 1.4 GHz	4	1 GB	29 Feb 2016 14 Mar 2018
Raspberry Pi-4 Model B	Cortex-A72 (ARM v8) 64-bit	1.5 GHz	4	1, 2, 4, or 8 GB	24 Jun 2019
Raspberry Pi-5	Cortex-A76 64-bit	2.4GHz	4	1, 2, 4, or 8 GB	15 Oct 2023



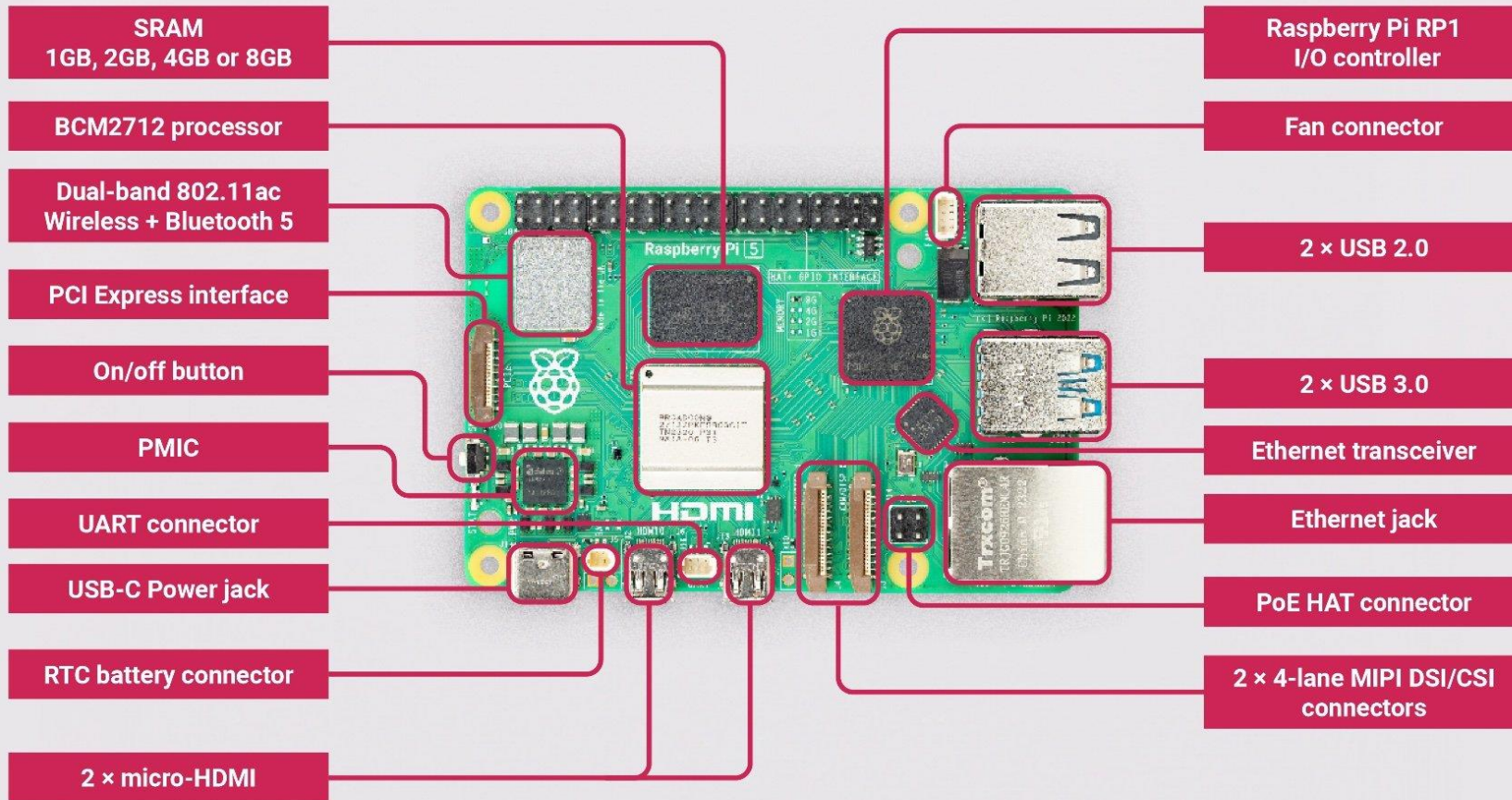
What's New in Raspberry Pi-5

- Speed: 2-3 times faster than the Pi-4 (which is no slouch itself)
- Custom I/O (USB 2, USB 3, GPIO, etc.) reduces bottlenecks off card
- On-board fan connector makes use of thermal management for cooling
- Power button on board to allow startup, shutdown (can be extended off board)
- Real-Time Clock on board (requires rechargeable battery)
- PCI Express connector for M.2 SSD hat (hat still under final development)
- Dual 4Kp60 HDMI monitor support (wow!)





What's New in Raspberry Pi-5





What's Better and What's Worse?

- Better

- Speed

- Can run multiple applications at the same time without sluggish performance
 - Smooth video without loading processor (better GPU)

- Worse

- Power consumption pushing the limits of USB-C

- Specially-designed power supply required for full-speed operation (5V, 5A USB-C PD)
 - Can operate in degraded mode with 5V, 3A USB-C PD supplies
 - Workarounds exist – I'll talk about them later

- New Debian 12 (Bookworm) Linux required


- Great software, but many nuisance changes and some apps not yet available

- No more analog audio jack, need to use Bluetooth or add-on USB audio adapter



Power Specifications

- Raspberry Pi-5 uses more power than its predecessors
 - Processor consumes more power
 - If adequate power supply is attached and detected, each USB port will be activated in high power mode (from 600 mA max per port to 1600 mA max per port)
 - Pi-5 uses power management to optimize clock speed and power draw with processor workload
- Pi-5: 5.1 V, 5A max (26 Watts max)
- Pi-4: 5.1V, 3A max (6 Watts max)
- Pi-3: 5.1V, 700 mA (3.6 W max)
- Pi-2: 5.1V, 400mA (2 Watts max)



Raspberry Pi


27W USB-C Power Supply

Get started
raspberrypi.com/products/power-supply

Features

- AC 100–240V 50/60Hz input
- USB power delivery, providing 5.1V, 5.0A DC; 9.0V, 3.0A DC; 12.0V, 2.25A DC; 15.0V, 1.8A DC
- 27W maximum output power
- 1.2m 17AWG captive cable
- USB-C output connector

US White



Raspberry Pi

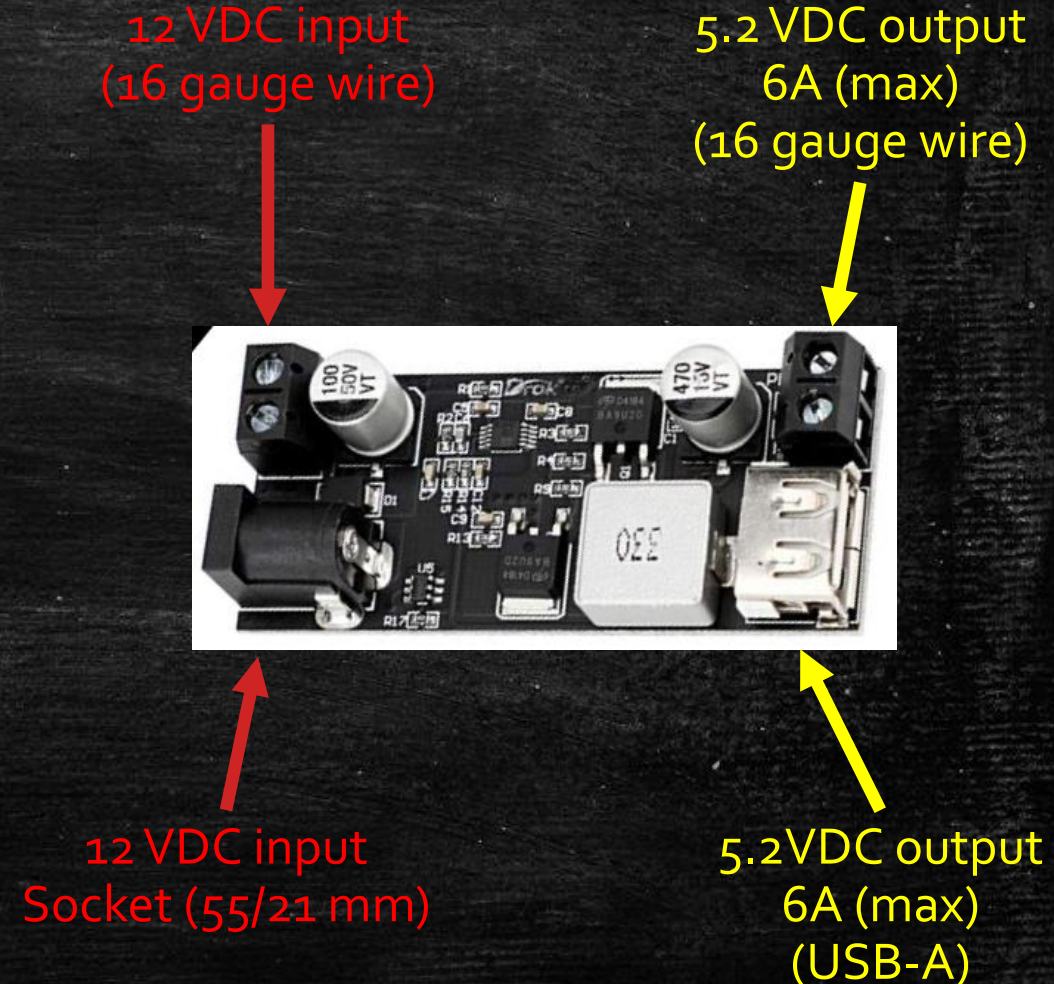
Raspberry Pi is a trademark of Raspberry Pi Ltd



Buck Converter

Alternative to Official Raspberry Pi Power Supply?

- Converts 12 Volts DC to regulated 5.1 VDC
- Use a USB-A to USB-C cable for Pi-5 making sure it's of sufficient quality and as short as possible
- 12V input can vary from 9-36 Volts
- This device will reliably power the Raspberry Pi-5 from LiFePO₄, car, solar , etc.
- No case for this circuit board, can be 3D printed
- Have not had time to assess radio interference
- Prudent to test the output voltage before using to make sure you're getting 5.1 – 5.2 VDC





Impacts on Ham Radio Software

- I now use the following software packages on the Raspberry Pi (refer to my presentation from Sep 2020)
 - FLRig (Transceiver control)
 - FLDigi (PSK-31, CW, RTTY, etc.)
 - WSJTX (FT-4, FT-8 etc.)
 - GPSD (GPS daemon for location and timing with USB GPS receiver)
 - NTP (precision timekeeping)
 - GridTracker (graphical world map of FT-8 with many other useful features)
- I've set up a Raspberry Pi-5 with my favorite software packages, here's how it did...



Software Results so far

(32-bit Debian 12 Bookworm)

- FLRig: Works great, no issues
- FLDigi: Works great, no issues
- WSJTX: Required special startup command for proper display on Wayland (Debian 12 replacement of X-11 used for decades)
- GPSD: Works great, no issues
- NTP: Debian 12 changed file locations, need to migrate Debian 11 files to new location. DHCP inappropriately overrides server selections
- GridTracker: Doesn't work yet. Development team needs a Raspberry Pi-5 to implement changes. Incompatible with Wayland (Debian 12 shift from X-11)
- GQRX: Can display larger fft sizes with higher frame rates (up to 60 fps), SDRs run at higher sample rates



Initial Findings

- As of now, ham radio software requires Debian 12 (Bookworm) 32-bit, not 64-bit
- Recommend Raspberry Pi power adapter for Home QTH operation – allows for full speed (or higher) operation with no impairments
- If you need to operate off battery, use 12V to 5V buck converter – allows Home and POTA operation
- Config settings in Pi-5 bootup can override defaults to allow other power supplies to be used without current limiting
- Possible to “underclock” Pi-5 to run slower and use less battery power and improve stability under POTA conditions
- My current approach is to use Raspberry Pi-5 at home QTH and Raspberry Pi-4 as POTA CPU, but still experimenting



Wrap-up

- Raspberry Pi-5 represents a huge increase in performance
- Read up on what others are experiencing getting your favorite software to run
- Not all amateur radio applications need this much performance, but it represents a useful addition to the ham shack
- Don't throw away your Pi-2, Pi-3, or Pi-4; they still have their unique applications (DMR hot spots for example)
- Prepare to wait awhile if you're ordering one
- The Feb 2024 *Full Quieting* newsletter will have more details to go with this presentation



Questions?
