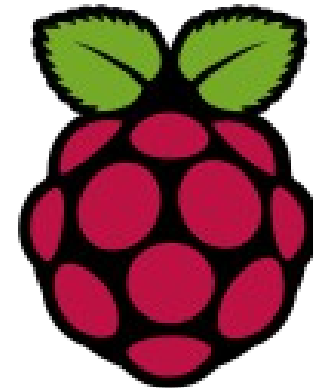


Introduction to Raspberry Pi

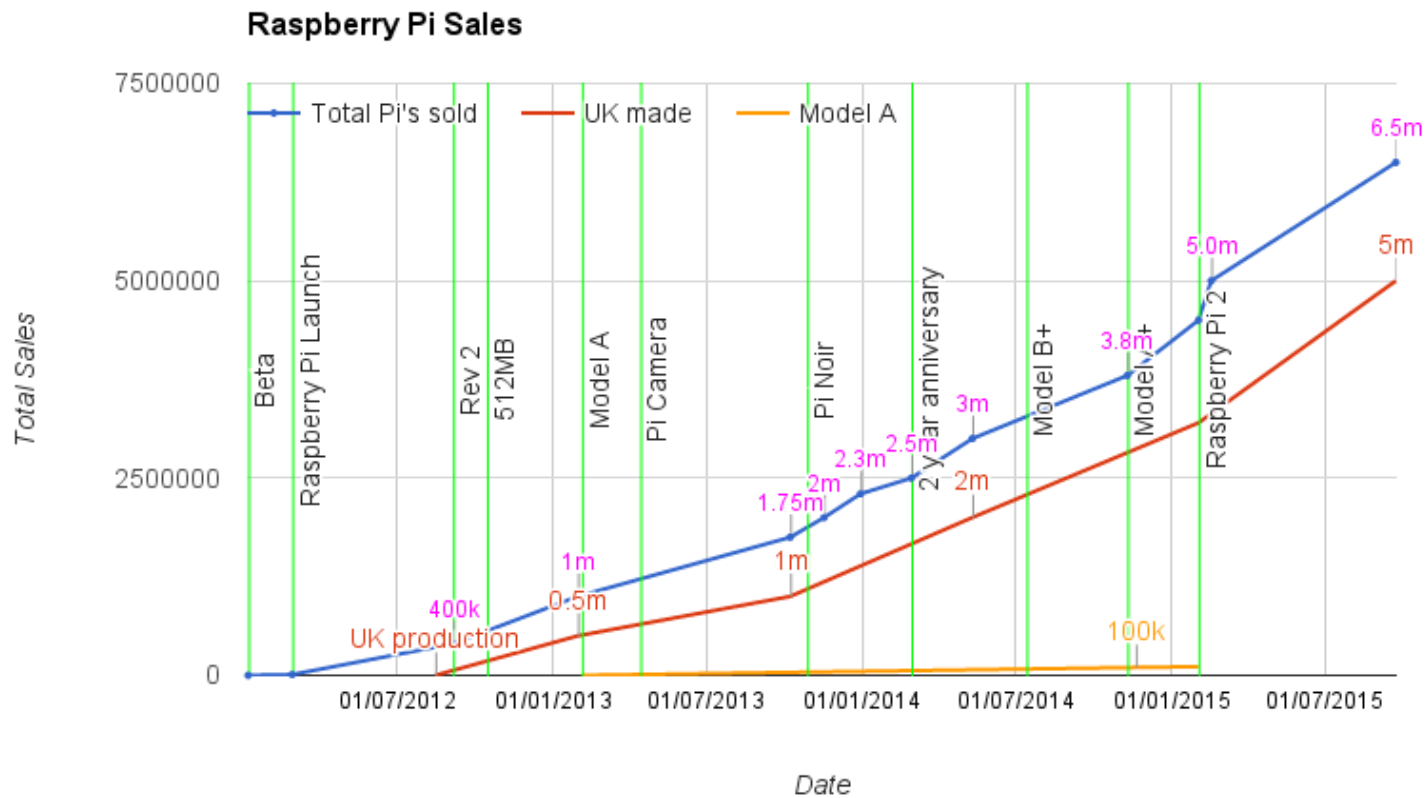
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<http://tusharkute.com>



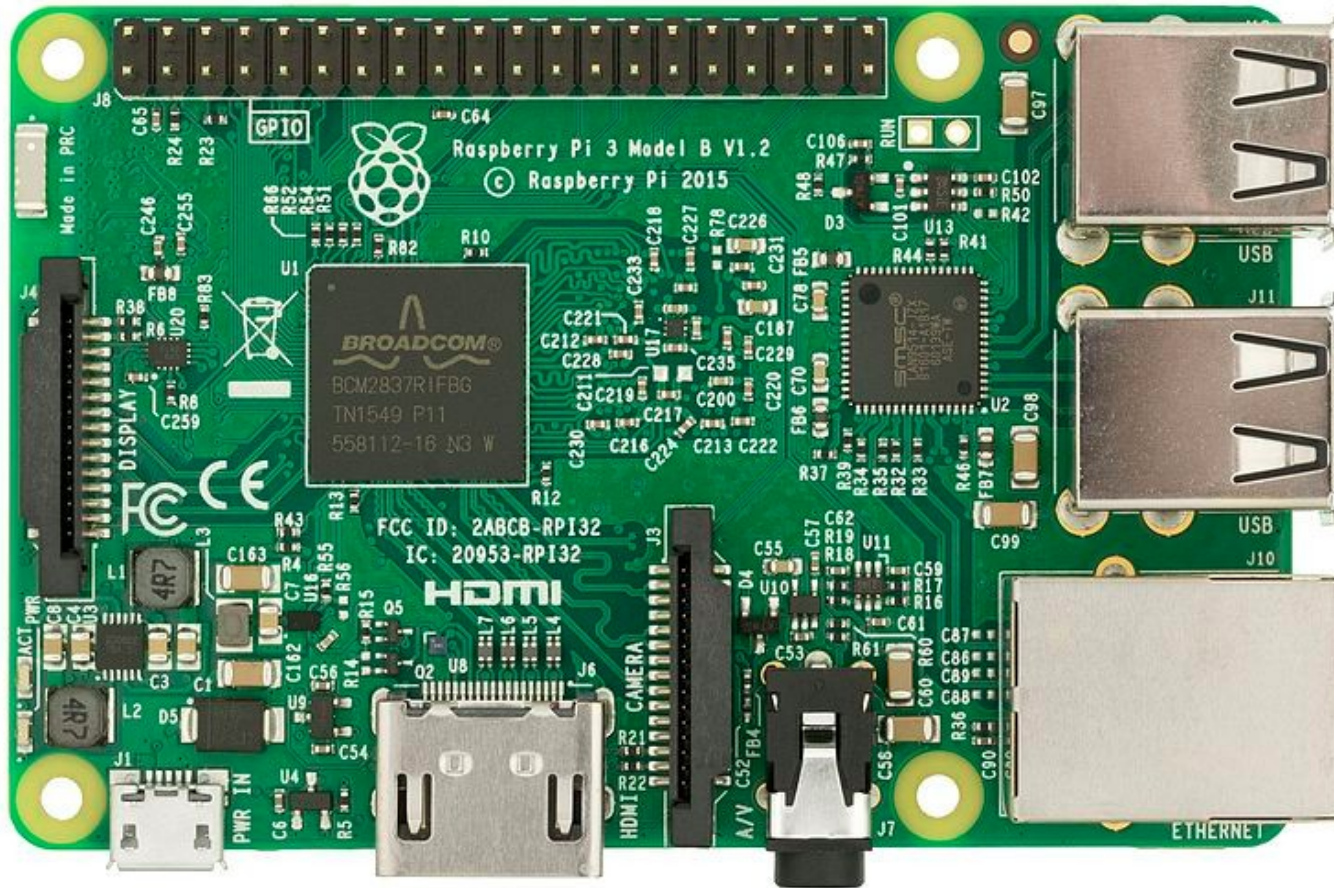
What is Raspberry Pi?

- The Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote the teaching of basic computer science in schools and in developing countries.
- The original model became far more popular than anticipated, selling outside of its target market for uses such as robotics.
- Over 5 million Raspberry Pis have been sold before February 2015, making it the best-selling British computer. By November 2016 they had sold 11 million units.

Raspberry Pi Sale



Raspberry Pi 3 Model B



The Timeline

- The first generation ([Raspberry Pi 1 Model B](#)) was released in February 2012. It was followed by a simpler and inexpensive model Model A.
- In 2014, the foundation released a board with an improved design in [Raspberry Pi 1 Model B+](#). These boards are approximately credit-card sized and represent the standard mainline form-factor.
- Improved A+ and B+ models were released a year later. A "compute module" was released in April 2014 for embedded applications, and a [Raspberry Pi Zero](#) with smaller size and reduced input/output (I/O) and general-purpose input/output (GPIO) capabilities was released in November 2015 for US\$5.

The Timeline

- The [Raspberry Pi 2](#) which added more RAM was released in February 2015.
- [Raspberry Pi 3 Model B](#) released in February 2016, is bundled with on-board WiFi, Bluetooth and USB boot capabilities.
- As of January 2017, [Raspberry Pi 3 Model B](#) is the newest mainline Raspberry Pi.
- Raspberry Pi boards are priced between US\$5–35.
- As of 28 February 2017, the [Raspberry Pi Zero W](#) was launched, which is identical to the Raspberry Pi Zero, but has the Wi-Fi and Bluetooth functionality of the Raspberry Pi 3 for US\$10.

Features

- All models feature a Broadcom system on a chip (SoC), which includes an ARM compatible central processing unit (CPU) and an on-chip graphics processing unit (GPU, a VideoCore IV).
- CPU speed ranges from 700 MHz to 1.2 GHz for the Pi 3 and on board memory range from 256 MB to 1 GB RAM.
- Secure Digital (SD) cards are used to store the operating system and program memory in either the SDHC or MicroSDHC sizes.

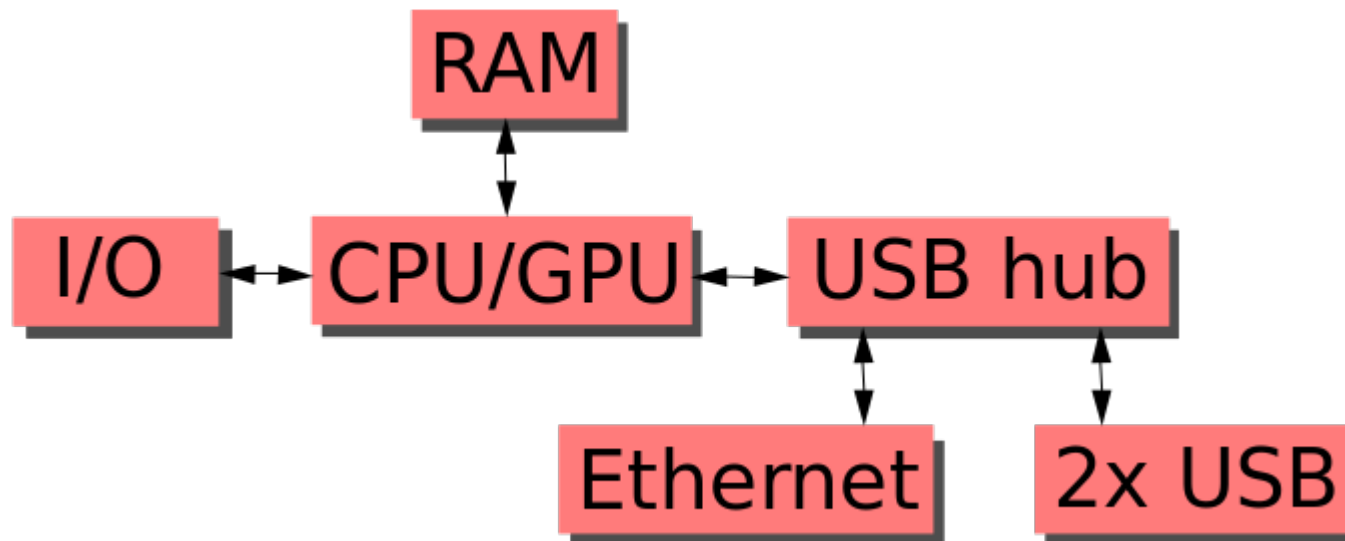
Features

- Most boards have between one and four USB slots, HDMI and composite video output, and a 3.5 mm phono jack for audio.
- Lower level output is provided by a number of GPIO pins which support common protocols like I²C.
- The B-models have an 8P8C Ethernet port and the Pi 3 and Pi Zero W have on board Wi-Fi 802.11n and Bluetooth.

Operating System

- The Foundation provides **Raspbian**, a Debian-based Linux distribution for download, as well as third party Ubuntu, Windows 10 IOT Core, RISC OS, and specialised media center distributions.
- It promotes Python and Scratch as the main programming language, with support for many other languages.
- The default firmware is closed source, while an unofficial open source is available.

Hardware



Hardware

- This block diagram depicts Models A, B, A+, and B+. Model A, A+, and the Pi Zero lack the Ethernet and USB hub components.
- The Ethernet adapter is internally connected to an additional USB port.
- In Model A, A+, and the Pi Zero, the USB port is connected directly to the system on a chip (SoC). On the Pi 1 Model B+ and later models the USB/Ethernet chip contains a five-point USB hub, of which four ports are available, while the Pi 1 Model B only provides two.
- On the Pi Zero, the USB port is also connected directly to the SoC, but it uses a micro USB (OTG) port.

Processor

- The [Broadcom BCM2835](#) SoC used in the first generation Raspberry Pi is somewhat equivalent to the chip used in first modern generation smartphones (its CPU is an older ARMv6 architecture), which includes a 700 MHz ARM1176JZF-S processor, VideoCore IV graphics processing unit (GPU), and RAM.
- It has a level 1 (L1) cache of 16 KB and a level 2 (L2) cache of 128 KB. The level 2 cache is used primarily by the GPU. The SoC is stacked underneath the RAM chip, so only its edge is visible.
- The Raspberry Pi 2 uses a [Broadcom BCM2836](#) SoC with a 900 MHz 32-bit quad-core ARM Cortex-A7 processor, with 256 KB shared L2 cache.
- The Raspberry Pi 3 uses a [Broadcom BCM2837](#) SoC with a 1.2 GHz 64-bit quad-core ARM Cortex-A53 processor, with 512 KB shared L2 cache

Performance

- The Raspberry Pi 3, with a quad-core Cortex-A53 processor, is described as **10 times** the performance of a Raspberry Pi 1. This was suggested to be highly dependent upon task threading and instruction set use. Benchmarks showed the Raspberry Pi 3 to be approximately **80%** faster than the Raspberry Pi 2 in parallelized tasks.
- Raspberry Pi 2 includes a quad-core Cortex-A7 CPU running at 900 MHz and 1 GB RAM. It is described as **4–6 times** more powerful than its predecessor. The GPU is identical to the original. In parallelized benchmarks, the Raspberry Pi 2 could be up to **14 times** faster than a Raspberry Pi 1 Model B+.

RAM

- The Raspberry Pi 2 and the Raspberry Pi 3 have 1 GB of RAM.
- The Raspberry Pi Zero and Zero W have 512 MB of RAM.

Networking

- The Model A, A+ and Pi Zero have **no Ethernet** circuitry and are commonly connected to a network using an external user-supplied USB Ethernet or Wi-Fi adapter.
- On the Model B and B+ the Ethernet port is provided by a built-in **USB Ethernet adapter** using the SMSC LAN9514 chip.
- The Raspberry Pi 3 and Pi Zero W (wireless) are equipped with 2.4 GHz **WiFi 802.11n** (150 Mbit/s) and **Bluetooth 4.1** (24 Mbit/s) based on Broadcom BCM43438 FullMAC chip with no official support for Monitor mode but implemented through unofficial firmware patching and the Pi 3 also has a 10/100 Ethernet port.

Peripherals

- The Raspberry Pi may be operated with any generic USB computer keyboard and mouse.
- It may also be used with USB storage, USB to MIDI converters, and virtually any other device/component with USB capabilities.
- Other peripherals can be attached through the various pins and connectors on the surface of the Raspberry Pi.

Video Capabilities

- The video controller can emit standard modern TV resolutions, such as HD and Full HD, and higher or lower monitor resolutions and older standard CRT TV resolutions.
- As shipped, it can emit these: 640×350 EGA; 640×480 VGA; 800×600 SVGA; 1024×768 XGA; 1280×720 720p HDTV; 1280×768 WXGA variant; 1280×800 WXGA variant; 1280×1024 SXGA; 1366×768 WXGA variant; 1400×1050 SXGA+; 1600×1200 UXGA; 1680×1050 WXGA+; 1920×1080 1080p HDTV; 1920×1200 WUXGA.

Summary

	Raspberry Pi 1 Model A	Raspberry Pi 1 Model A+	Raspberry Pi 1 Model B	Raspberry Pi 1 Model B+	Raspberry Pi 2 Model B	Raspberry Pi 3 Model B	Raspberry Pi Zero
USB 2.0 Ports	1	1	2	4	4	4	1 (Micro-USB)
Ethernet	None	None	10/100 Mbit/s	10/100 Mbit/s	10/100 Mbit/s	10/100 Mbit/s	None
Bluetooth	None	None	None	None	None	4.1	None
WiFi	None	None	None	None	None	802.11n	None
Audio In	I ² S	I ² S	I ² S	I ² S	I ² S	I ² S	I ² S
Audio Out	I ² S, analog (3.5mm jack), digital (HDMI)	I ² S, analog (3.5mm jack), digital (HDMI)	I ² S, analog (3.5mm jack), digital (HDMI)	I ² S, analog (3.5mm jack), digital (HDMI)	I ² S, analog (3.5mm jack), digital (HDMI)	I ² S, analog (3.5mm jack), digital (HDMI)	Digital (mini-HDMI), analog GPIO PWM
Video In	CSI Camera Connector	CSI Camera Connector	CSI Camera Connector	CSI Camera Connector	CSI Camera Connector	CSI Camera Connector	None
Video Out	HDMI, Composite (RCA)	HDMI, Composite (TRRS)	HDMI, Composite (RCA)	HDMI, Composite (TRRS)	HDMI, Composite (TRRS)	HDMI, Composite (TRRS)	Mini-HDMI, GPIO Composite
External Storage	SD	MicroSD	SD	MicroSD	MicroSD	MicroSD	MicroSD

Operating Systems



UBUNTU MATE



SNAPPY UBUNTU CORE



WINDOWS 10 IOT CORE



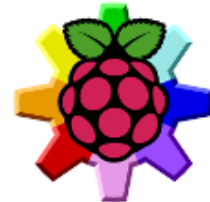
OSMC



LIBREELEC



PINET



RISC OS



WEATHER STATION

Operating Systems

- The Raspberry Pi Foundation recommends the use of **Raspbian**, a Debian-based Linux operating system.
- Other third party operating systems available via the official website include Ubuntu MATE, Snappy Ubuntu Core, Windows 10 IoT Core, RISC OS and specialised distributions for the Kodi media center and classroom management.

Linux Based Operating Systems

- Android Things
- Arch Linux
- OpenSuse
- Raspberry Pi Fedora Remix
- Pidora
- Gentoo Linux
- CentOS Raspberry Pi
- Kali Linux
- Slackware ARM
- Puppy Linux

Other Operating Systems

- RISC OS Pi
- FreeBSD
- NetBSD
- Windows 10 IOT Core
- Haiku
- HelenOS

Community

- The Raspberry Pi community was described by Jamie Ayre of FLOSS software company AdaCore as one of the most exciting parts of the project.
- Community blogger Russell Davis said that the community strength allows the Foundation to concentrate on documentation and teaching.
- The community developed a fanzine around the platform called The MagPi which in 2015, was handed over to the Raspberry Pi Foundation by its volunteers to be continued in-house.
- A series of community Raspberry Jam events have been held across the UK and around the world

The MagPi

- The MagPi is a free fanzine for users of the Raspberry Pi computer.
- It was created by the community as an unofficial volunteer produced Raspberry Pi publication and in 2015 was handed over to the Raspberry Pi Foundation to be run in-house as the official Raspberry Pi magazine.
- It was launched in May 2012 and contains news, projects and tutorials.

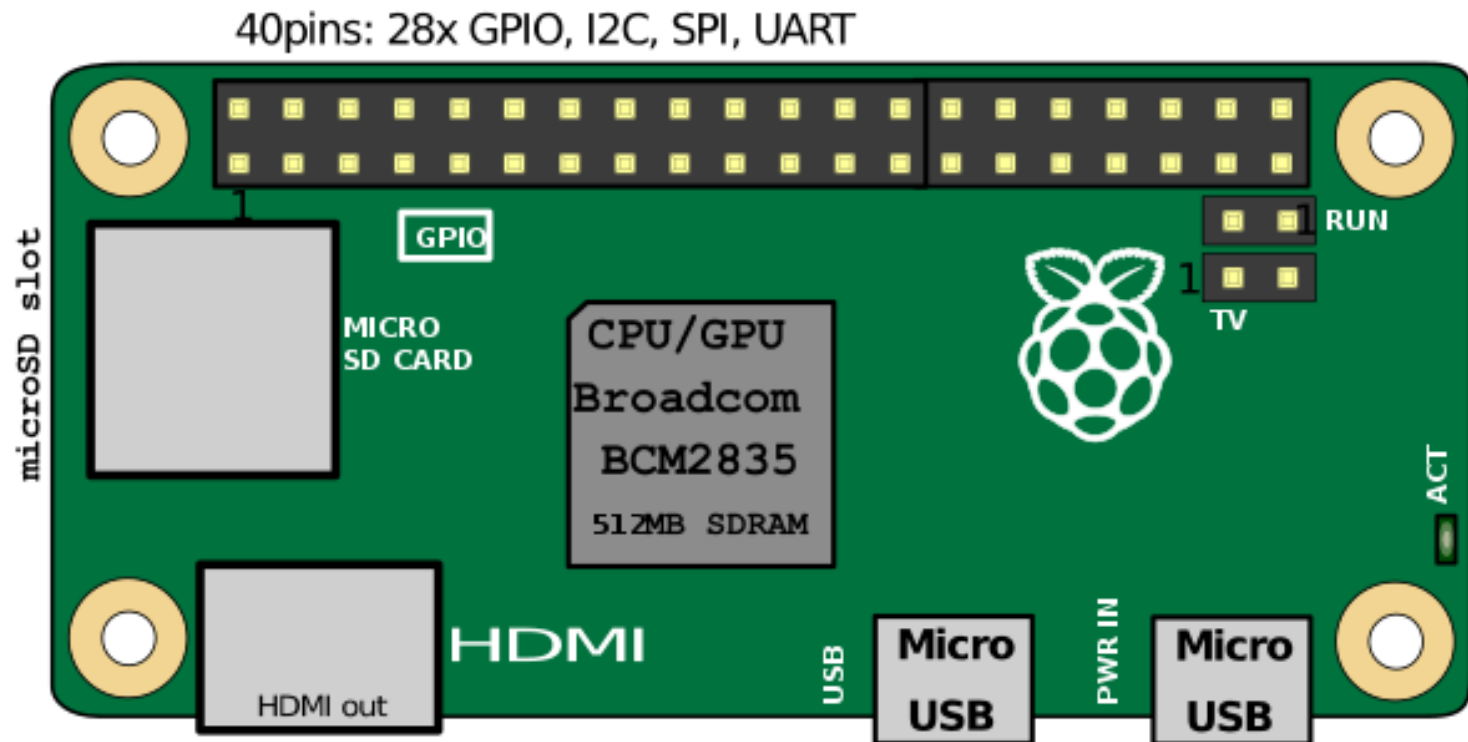
History

- In 2006, early concepts of the Raspberry Pi were based on the Atmel ATmega644 microcontroller. Its schematics and PCB layout are publicly available.
- Foundation trustee Eben Upton assembled a group of teachers, academics and computer enthusiasts to devise a computer to inspire children.
- The computer is inspired by Acorn's BBC Micro of 1981.
- The Model A, Model B and Model B+ names are references to the original models of the British educational BBC Micro computer, developed by Acorn Computers.
- The first ARM prototype version of the computer was mounted in a package the same size as a USB memory stick. It had a USB port on one end and an HDMI port on the other.

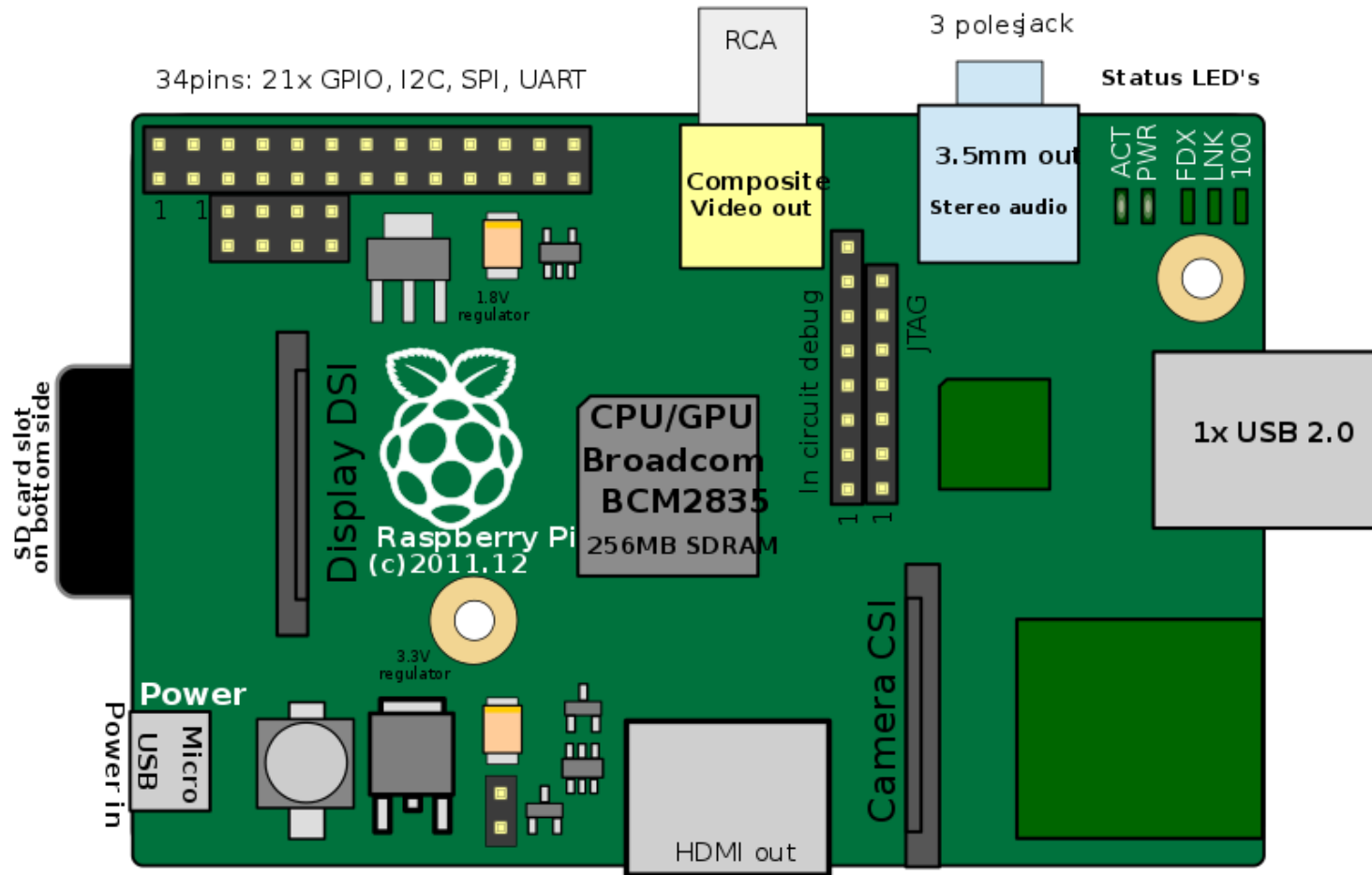
History

- The Foundation's goal was to offer two versions, priced at US\$25 and \$35.
- They started accepting orders for the higher priced Model B on 29 February 2012, the lower cost Model A on 4 February 2013. and the even lower cost (US\$20) A+ on 10 November 2014.
- On 26 November 2015, the cheapest Raspberry Pi yet, the Raspberry Pi Zero, was launched at US\$5 or £4.

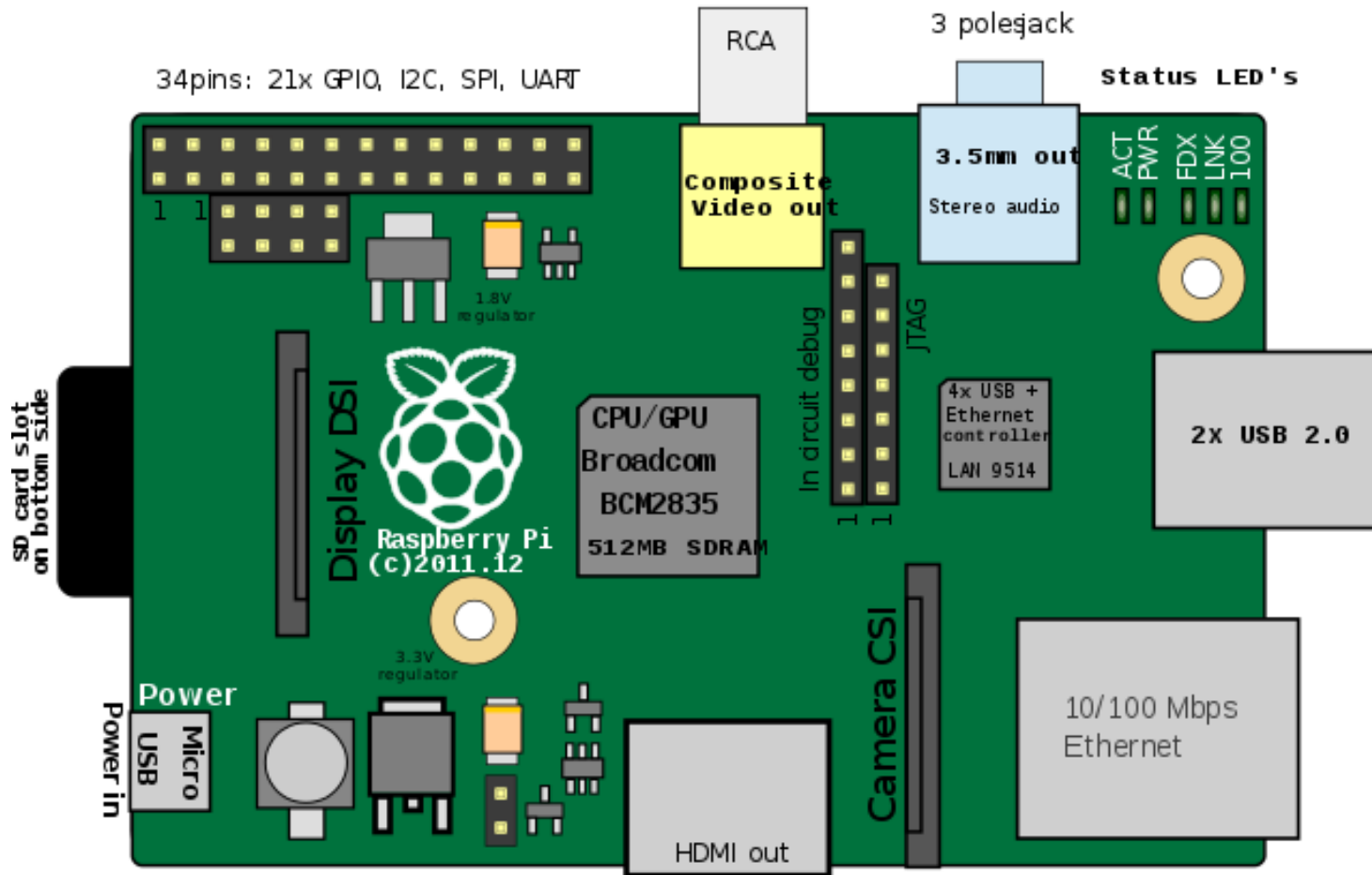
Raspberry Pi Zero



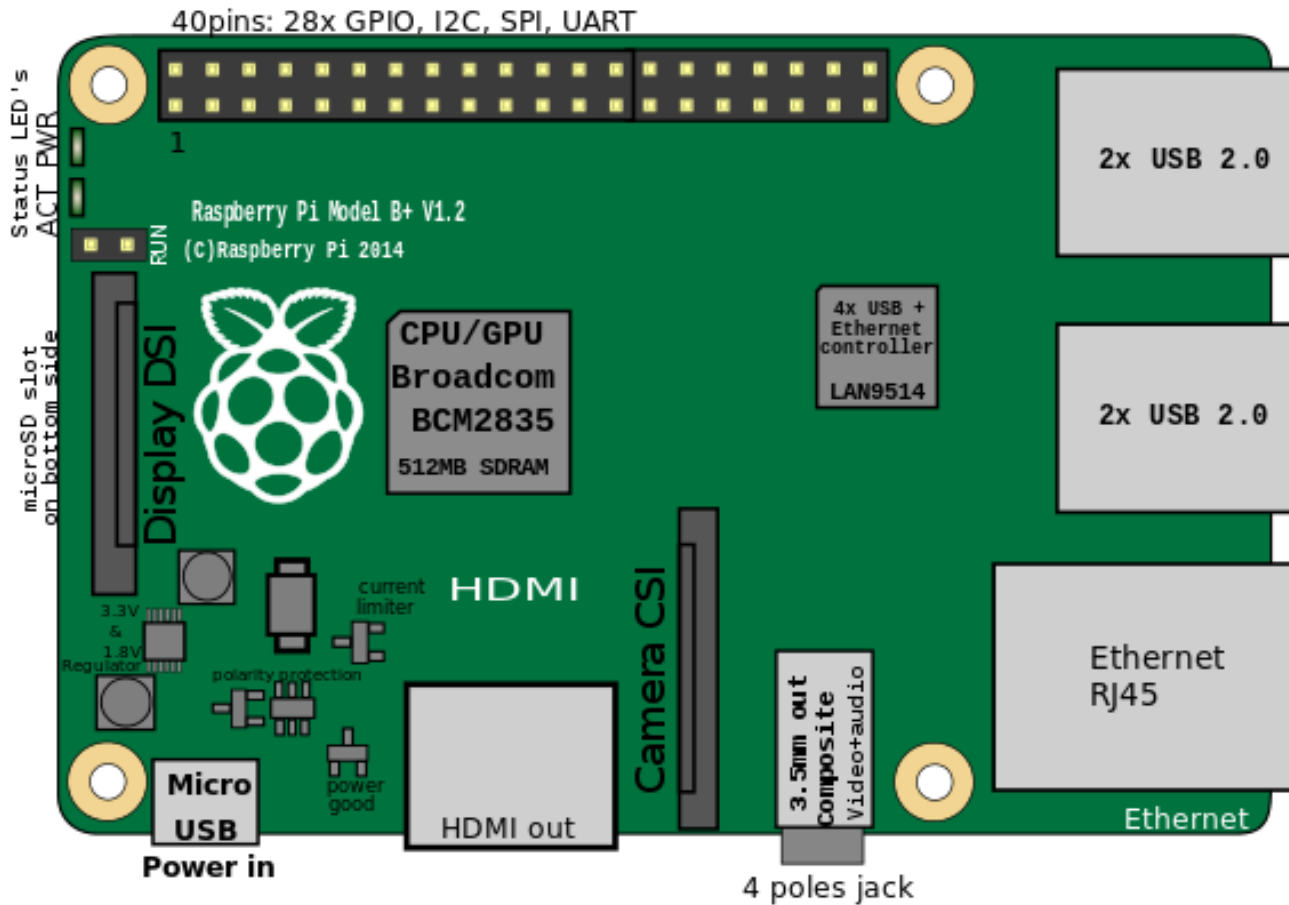
Raspberry Pi Model A



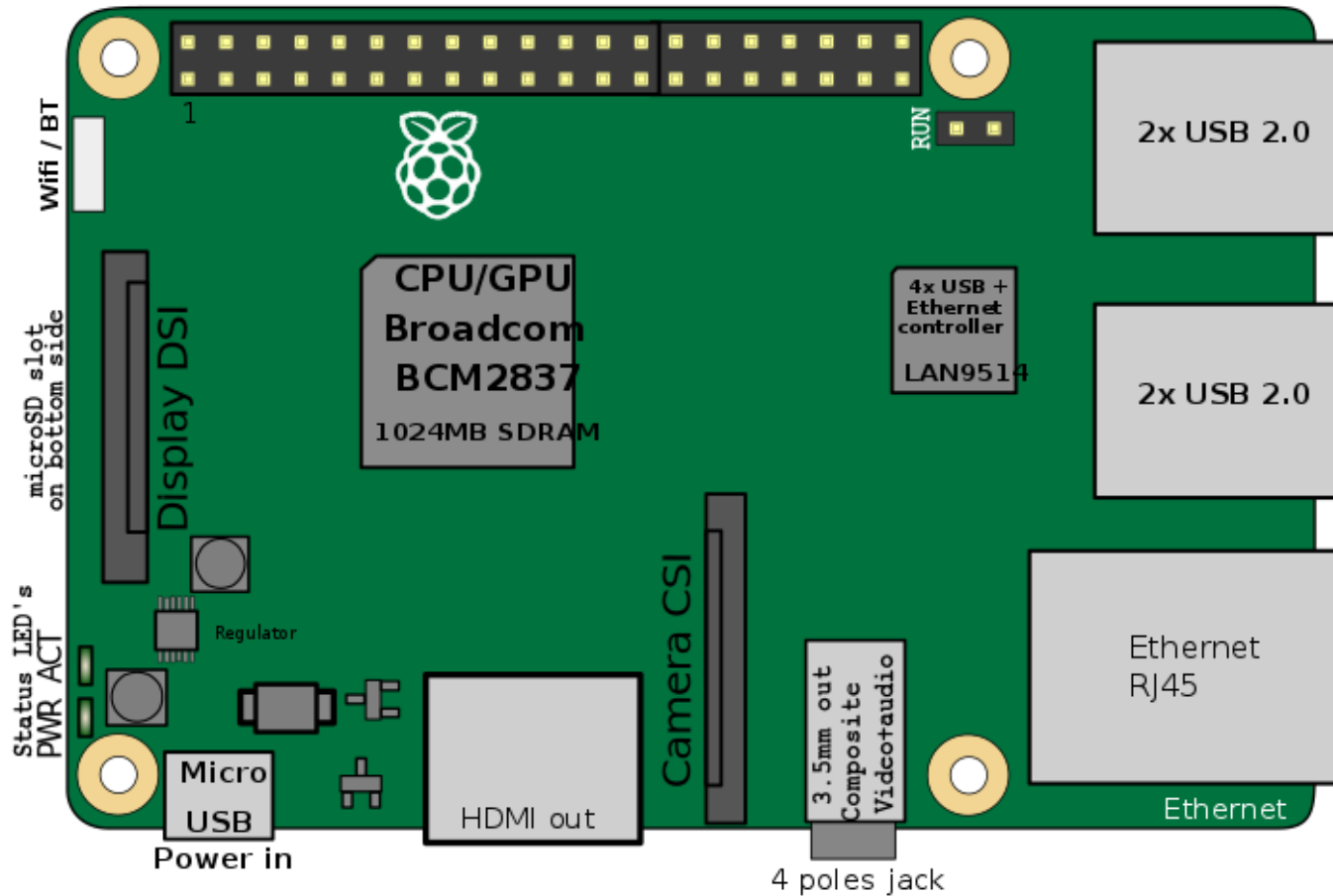
Raspberry Pi Model B



Raspberry Pi Model B+ and 2B



Raspberry Pi Model 3 B



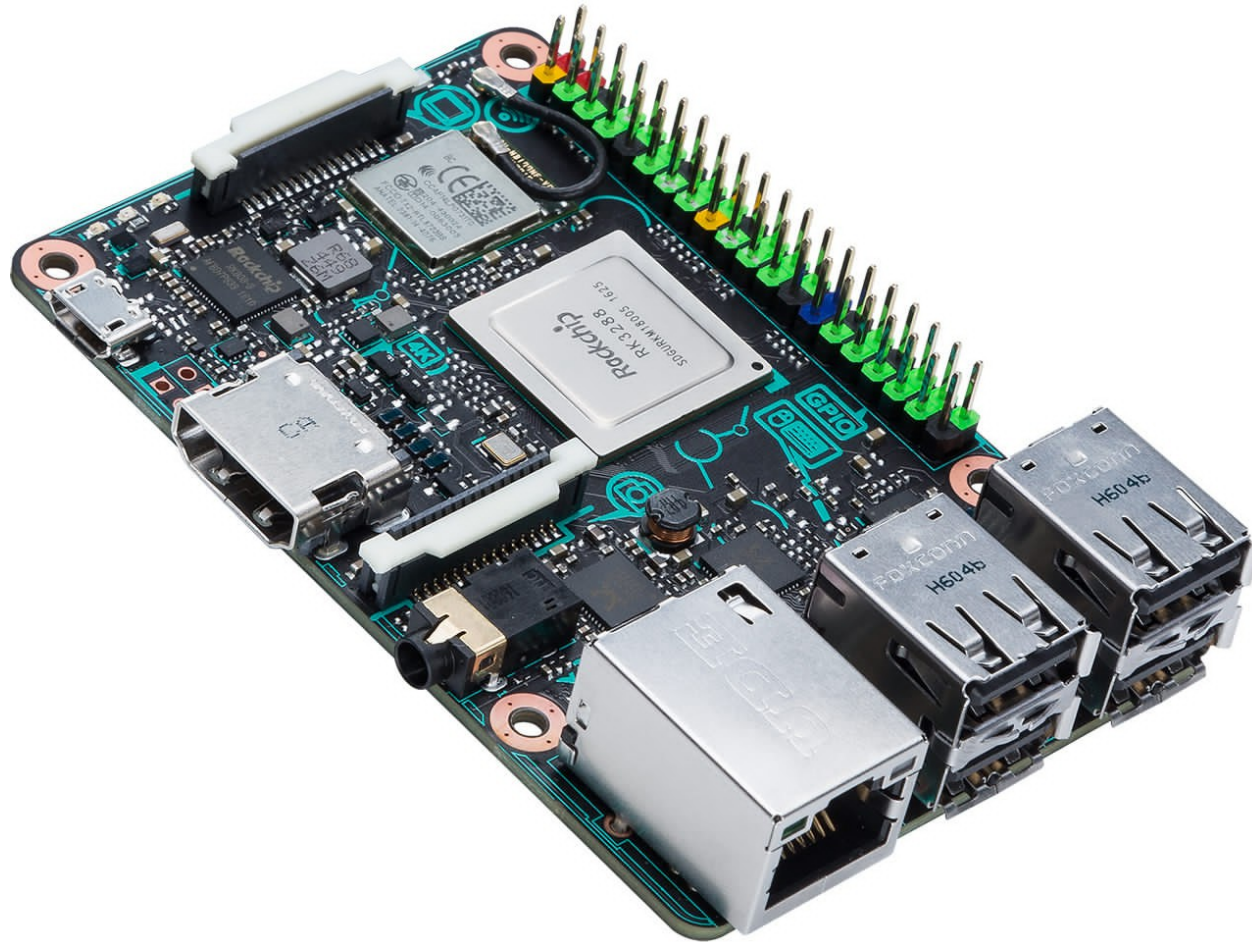
Accessories

- **Camera** – On 14 May 2013, the foundation and the distributors RS Components & Premier Farnell/Element 14 launched the Raspberry Pi camera board alongside a firmware update to accommodate it. The camera board is shipped with a flexible flat cable that plugs into the CSI connector which is located between the Ethernet and HDMI ports.
- **Gertboard** – A Raspberry Pi Foundation sanctioned device, designed for educational purposes, that expands the Raspberry Pi's GPIO pins to allow interface with and control of LEDs, switches, analog signals, sensors and other devices. It also includes an optional Arduino compatible controller to interface with the Pi.
- **Infrared Camera** – In October 2013, the foundation announced that they would begin producing a camera module without an infrared filter, called the Pi NoIR.
- **HAT (Hardware Attached on Top) expansion boards** – Together with the Model B+, inspired by the Arduino shield boards, the interface for HAT boards was devised by the Raspberry Pi Foundation.

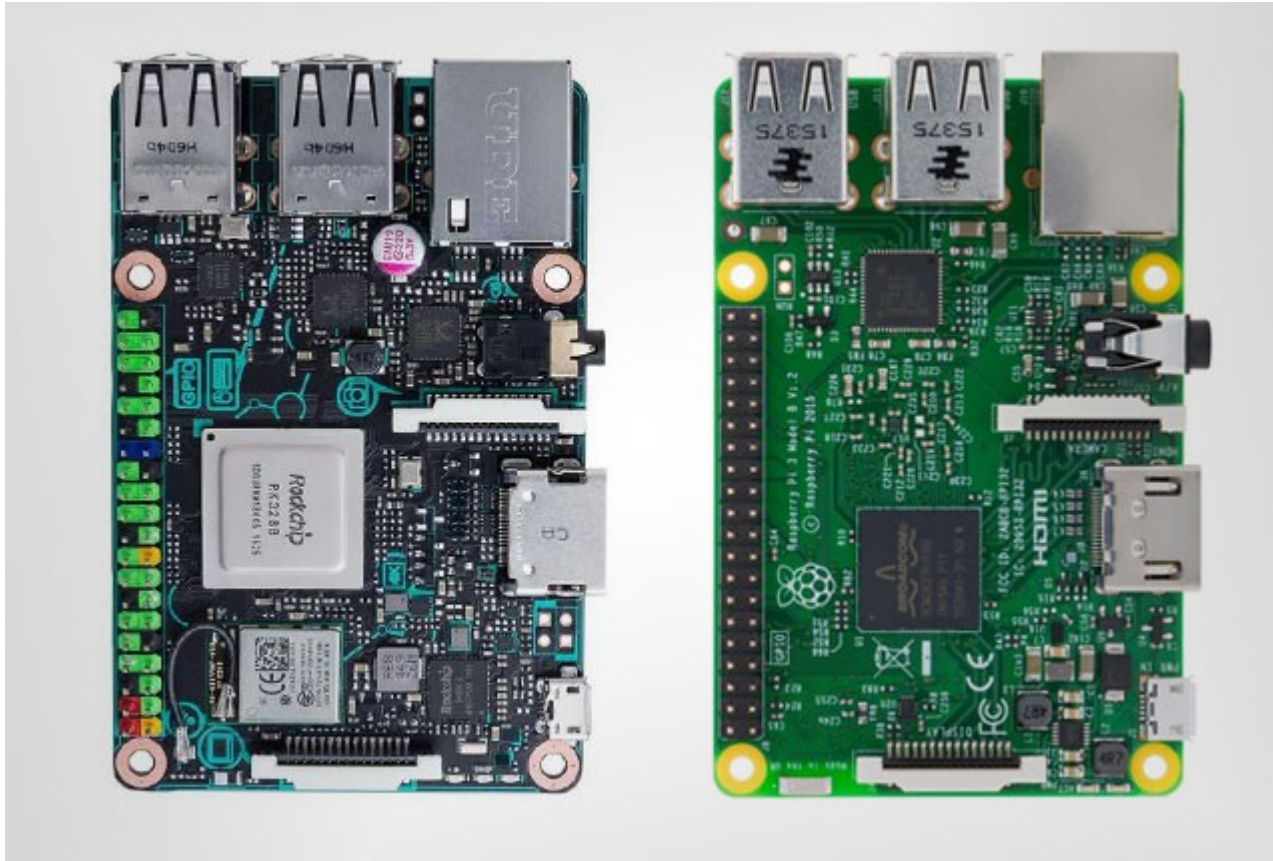
Other Development Boards

- Asus TinkerBoard
- BeagleBone
- Banana Pi
- Orange Pi
- Ordroid

Asus TinkerBoard



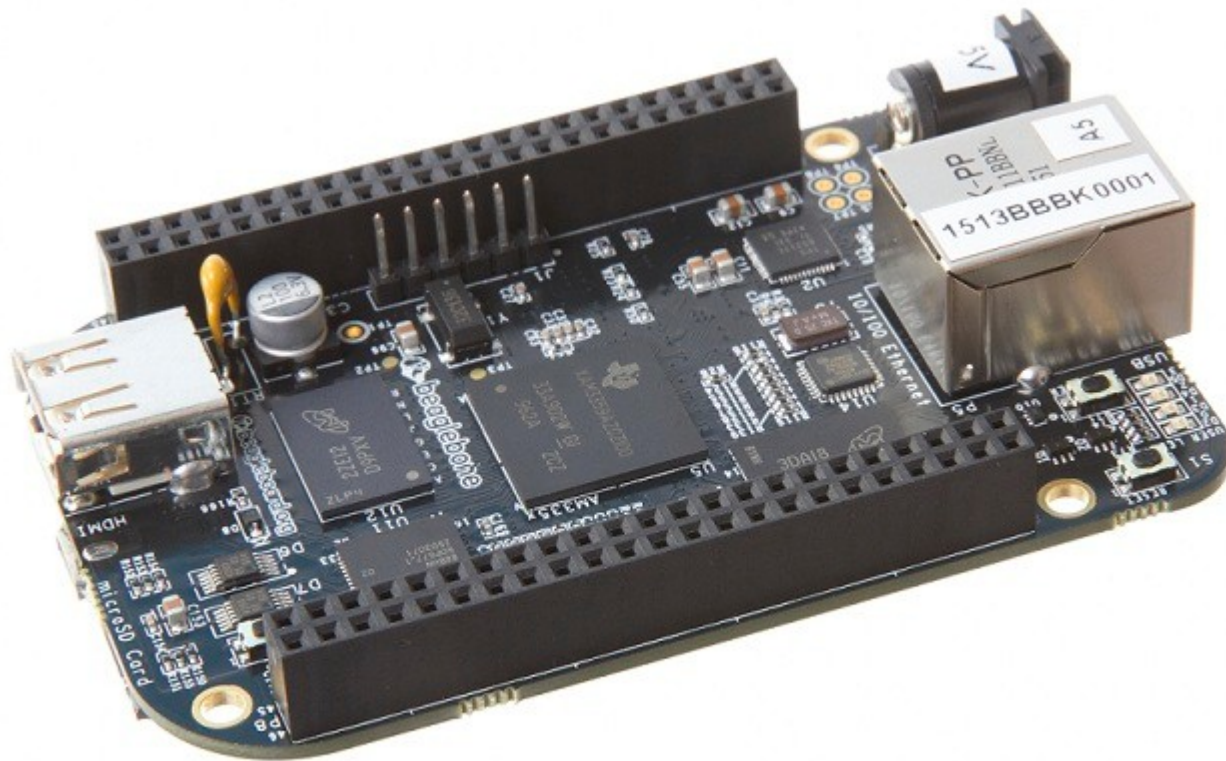
Raspberry Pi vs TinkerBoard



Raspberry Pi vs TinkerBoard

	WIN ASUS Tinker Board	Raspberry Pi 3 Model B
Core Processor (SoC)	Rockchip RK3288 Quad-Core 1.8Ghz	Broadcom BCM2837 Quad-Core 1.2Ghz
Benchmark Score (tested by GeekBench)	3925 Almost 2X faster!!	2092
RAM	2GB	1 GB RAM
Display	HDMI with H.264 4K decode capability	HDMI with HD resolution
NIC	Gb LAN	100M LAN
Audio	Supports up to 192K/24bit sample rate	48K/16bit
Wi-Fi	Yes, Wi-Fi 802.11 b/g/n + swappable antenna	Yes, Wi-Fi 802.11 b/g/n
Bluetooth	Yes, 4.0 + EDR	Yes, 4.1 + LE
SDIO	SDIO 3.0	SDIO 2.0
Official Supported OS	Linux – Debian / KODI	Linux – Debian

BeagleBone Black



BeagleBone Black vs. Raspberry Pi



Thank you

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Web Resources

<http://mitu.co.in>
<http://tusharkute.com>

Blogs

<http://digitallocha.blogspot.in>
<http://kyamputar.blogspot.in>

tushar@tusharkute.com