Linux For Embedded Systems

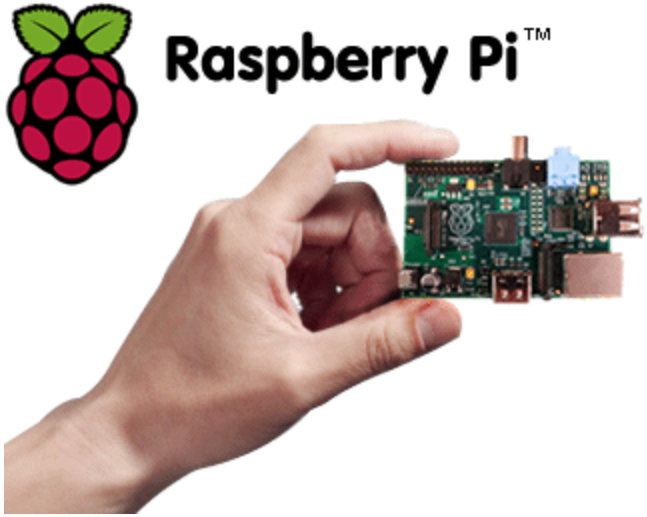
For Arabs

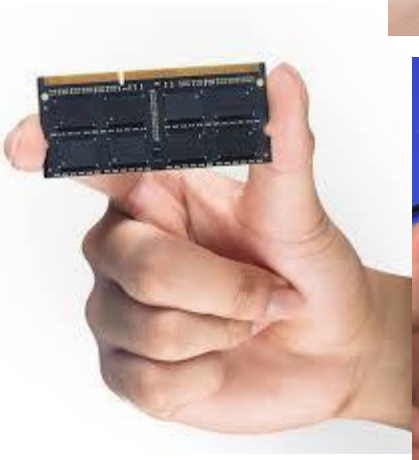
Cairo University
Computer Eng. Dept.
CMP445-Embedded Systems

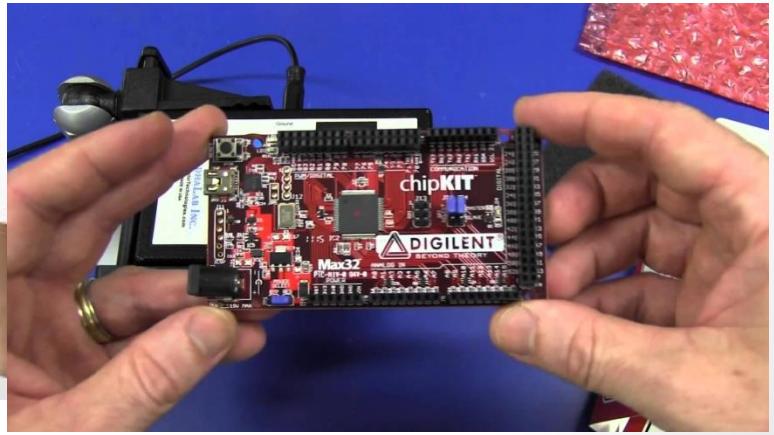
Ahmed ElArabawy

Lecture 7: Unwrapping the Pi

Handling The board







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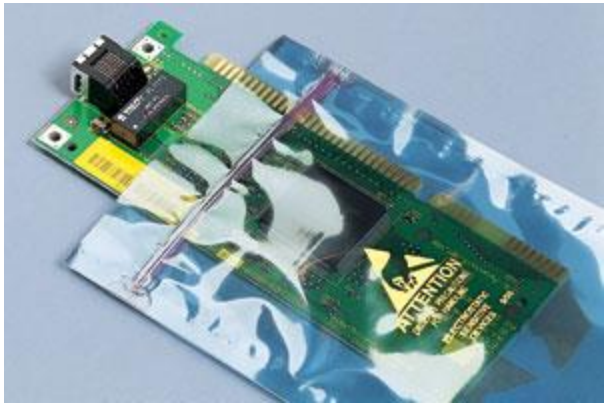
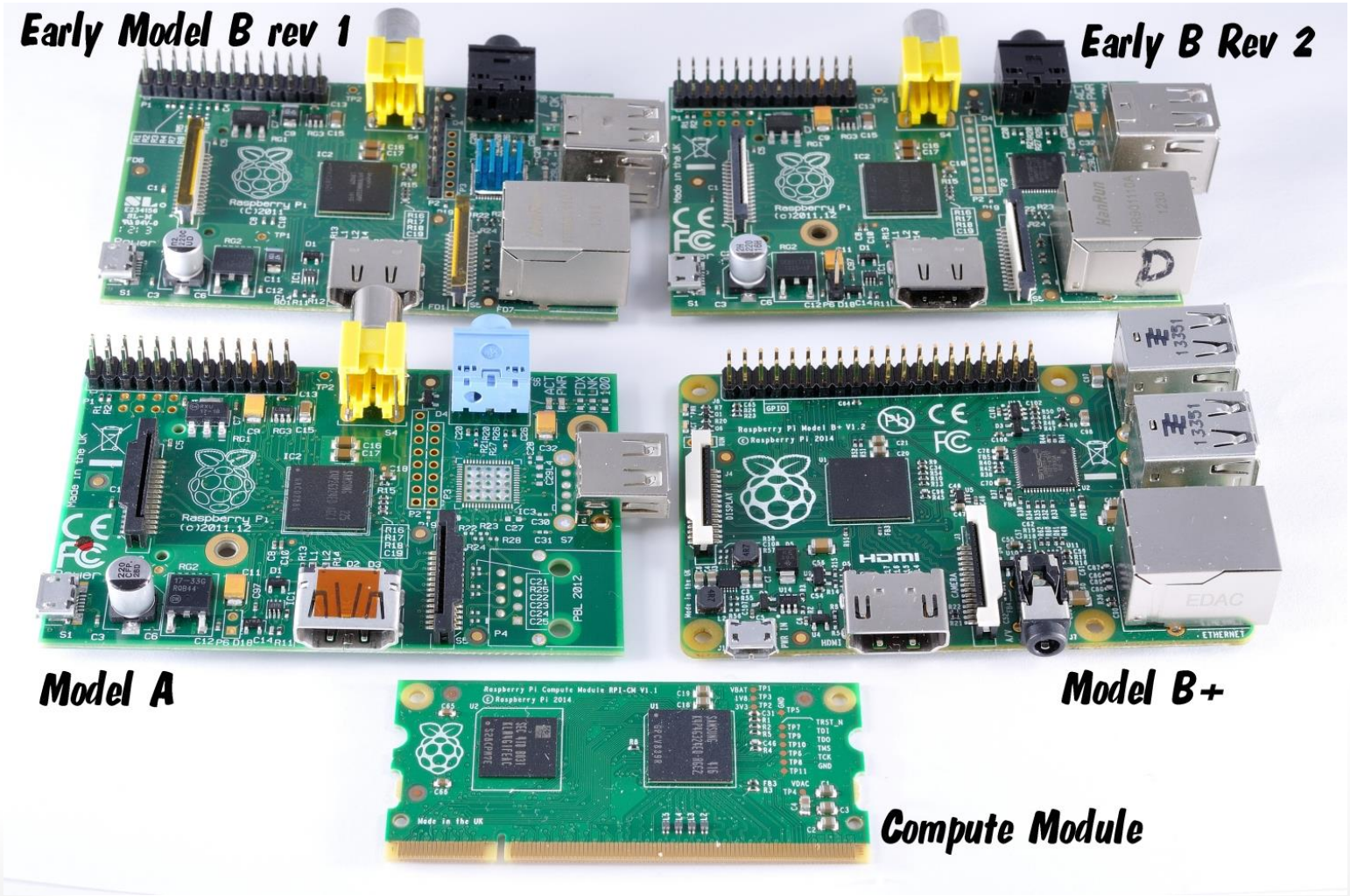


Hello Raspberry Pi ...

What is the Raspberry Pi

- The Raspberry Pi is a credit card sized Single Board Computer
- It is developed by the **Raspberry Pi Foundation** (a UK charity Organization) as a way to help improve computer education in schools
- Then it caught attention by both students and adult embedded hobbyists
- Now the Raspberry Pi is being considered as a popular platform for embedded systems
- The Raspberry Pi is an open hardware platform, which means the schematics for the board is publicly published
- The Raspberry Pi comes in different models and configurations

Raspberry Pi Board Configurations



Raspberry Pi Roadmap

Model B rev 1

Model B rev 2

Model A

Compute Module

Model B+

Model A+

Raspberry Pi 2

Feb 2012 | Sept 2012 | Feb 2013 | April 2014 | July 2014 | Nov 2014 | Feb 2015

Raspberry Pi Board Configurations

- Initially it was decided to have two main models,
  - **Model A:** A low cost model (around $25) with less capabilities
  - **Model B:** A higher cost model (around $35)
- Model B was first released in Feb 2012, while Model A was first released in Feb 2013
- Model A did not get much attention
- The Model B went through two revisions, with minor changes
  - **Model B rev 1**
  - **Model B rev 2** (Released in Sept 2012)
- Aiming for using the Raspberry Pi in commercial and industrial products, the **Raspberry Pi Compute module** was announced in April 2014, this is a new form factor (200 Pin SO-DIMM Form factor), and much more signals available for developer than the other form
- In July 2014, a new model (**Model B+**) was released, with few upgrades in the power supply, USB ports, GPIOs and other changes
- In Nov. 2014, a new model (**Model A+**) was released with several upgrades from the original Model A

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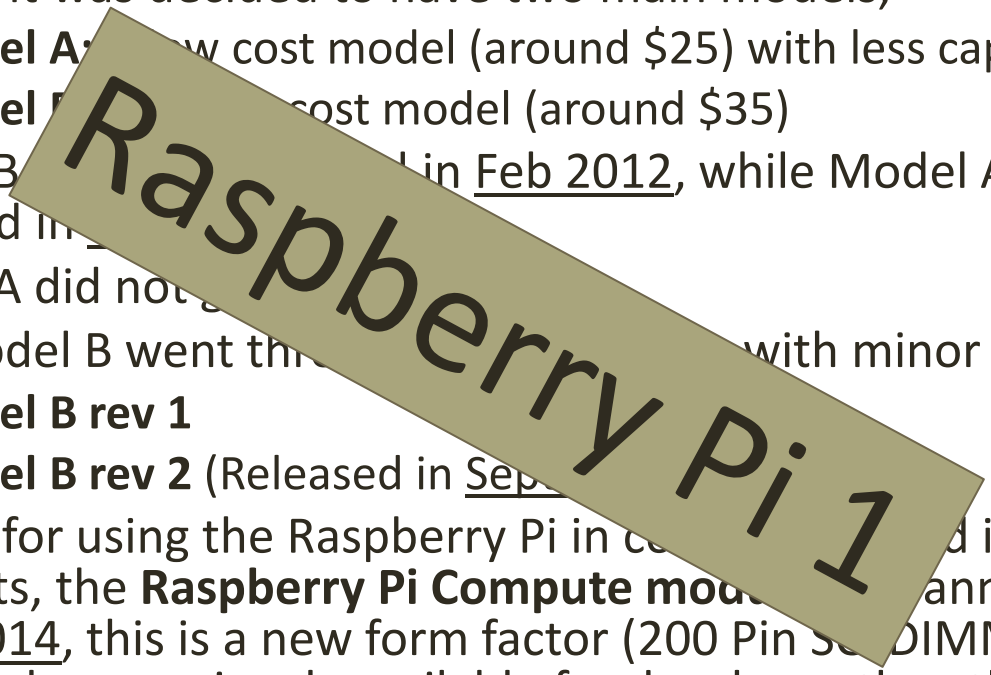
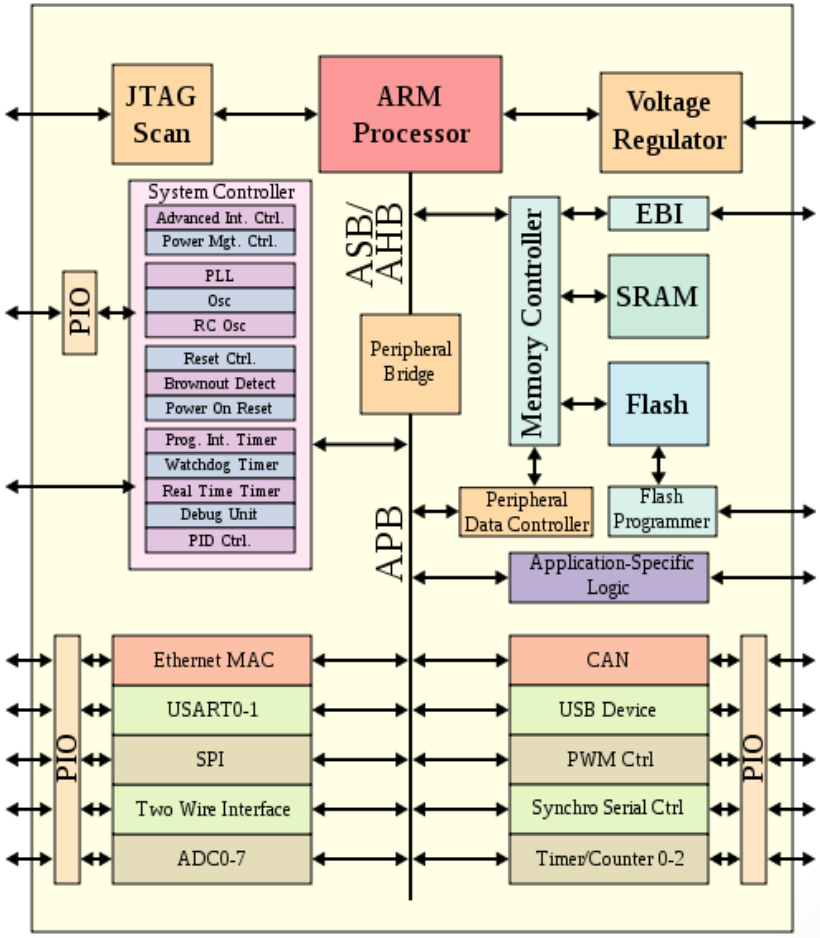


Raspberry Pi 2

- Released in Feb 2015
- Looks the same as the Raspberry Pi 1, Model B+
- However, internally, it is a major upgrade from previous boards

SoC (System on a Chip)

- SoC is a single chip that contains a whole system
  - Processor (one or more)
  - Memory
  - I/O Devices



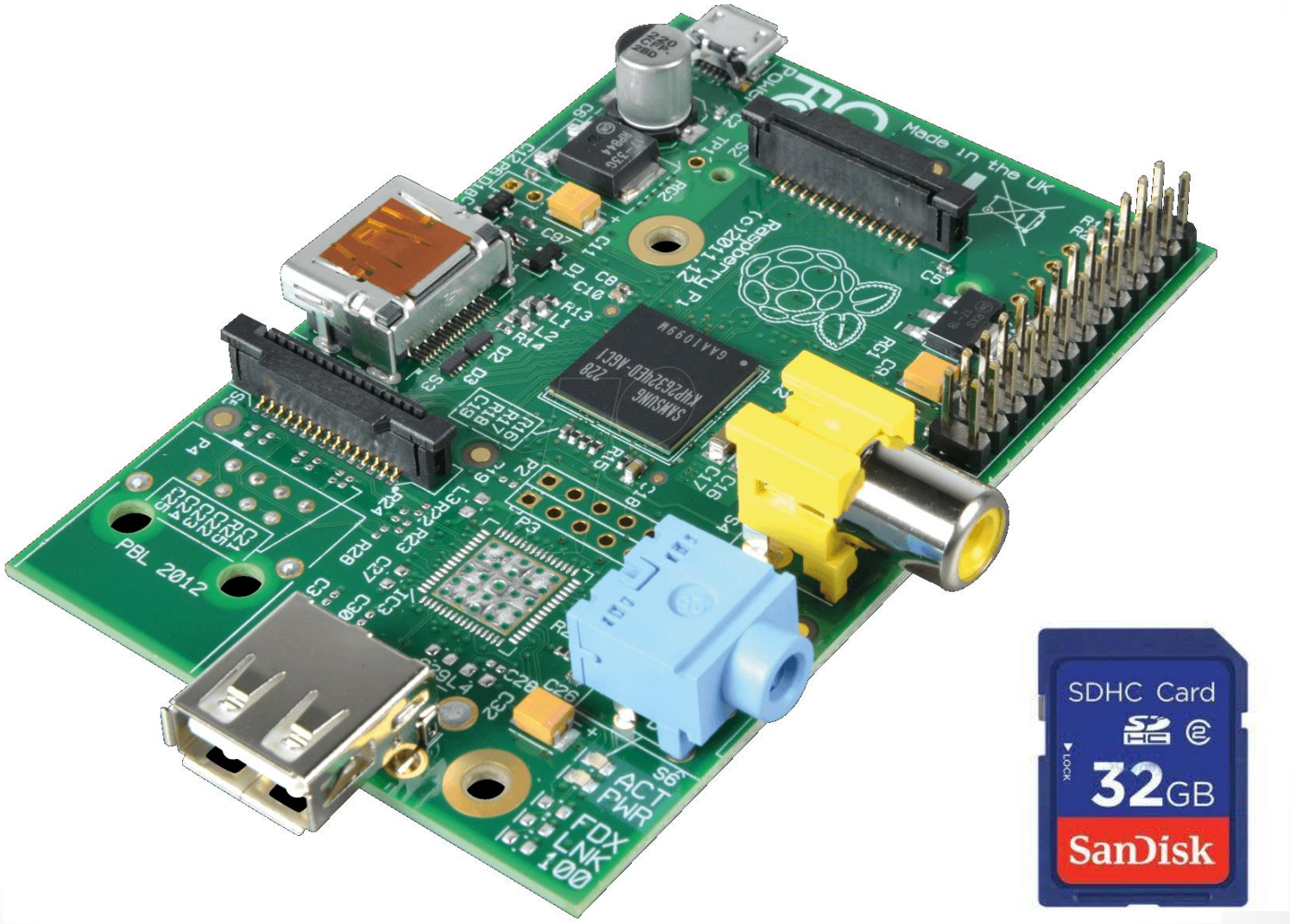
Hardware Highlights (Raspberry Pi 1)

- The Raspberry Pi main chip is the Broadcom ***BCM2835*** System on a Chip (SoC)
- This chip contains,
  - A single ARM core **CPU** (***ARM11***) running at 700 MHz
  - This core supports ARMv6 Instruction Set
  - A dual core **GPU** (***VideoCore IV***) for Video Processing
  - RAM (to be split between the CPU and the GPU)
    - 256 MB : For Model A & A+
    - 512 MB : For Model B & B+
- Models A, A+, B, and B+ do not come with a flash memory for storage, hence the OS is put on an SD Card (Micro SD Card in A+ & B+)
- The Compute Module uses a 4GB eMMC Flash memory, and hence no need for the SD Card for the basic system startup

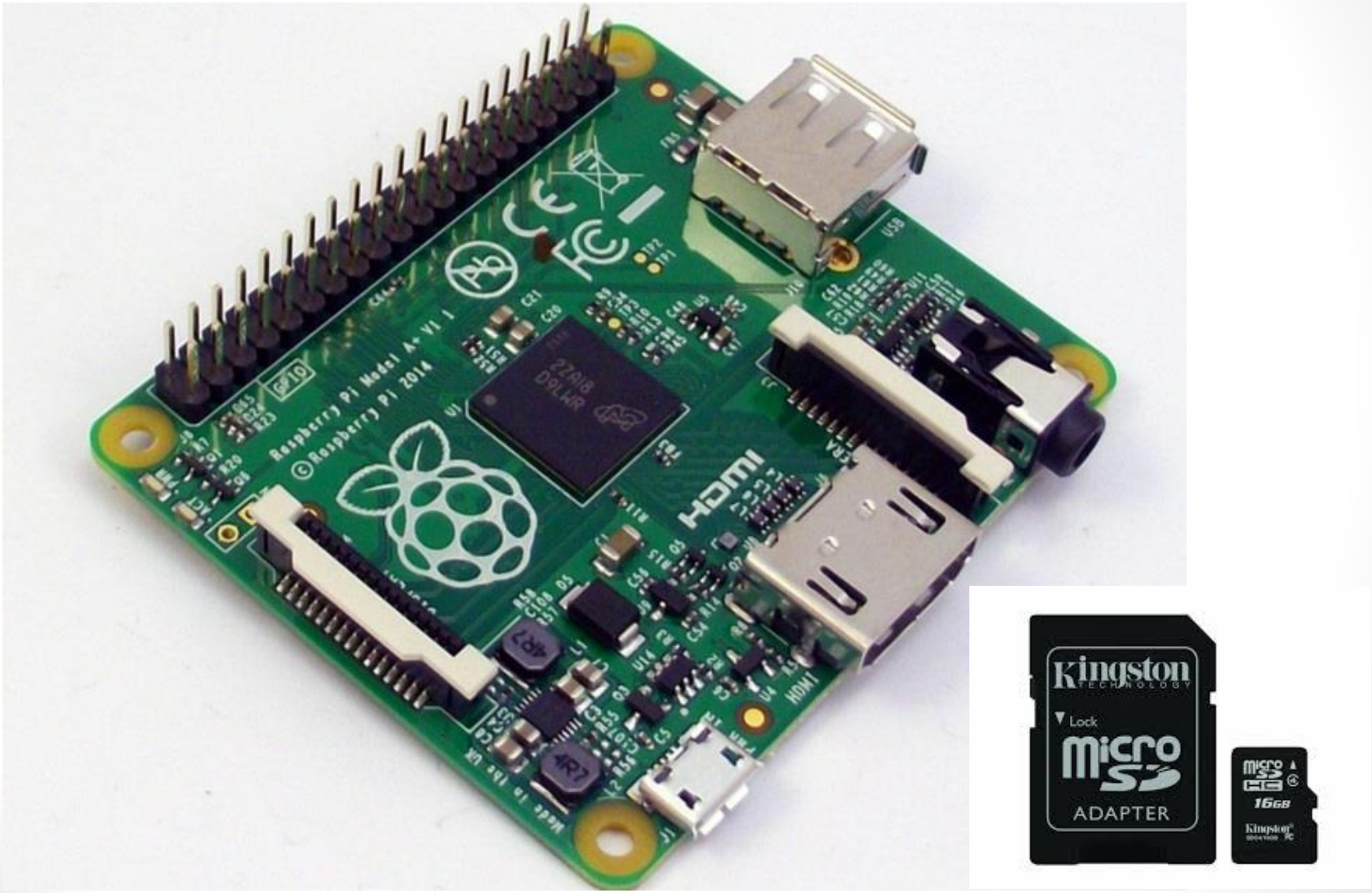
Raspberry Pi Model 2

- Uses a different Broadcom chip (***BCM2836***)
- A big upgrade from the older platforms
  - Quad core ***ARM Cortex A7*** (900 MHz)
  - 1 GB SDRAM
- The new ARM Core supports the ***ARMv7*** Instruction set
  - This enables it to run ***Ubuntu*** and ***Windows 10*** OSs
- Fully backward compatible with the older models

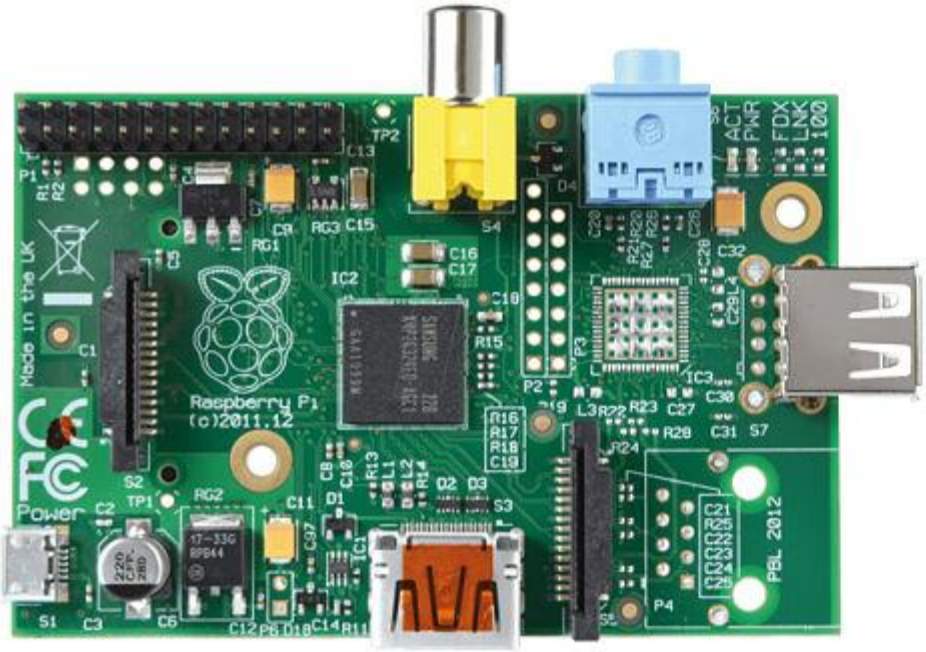
Raspberry Pi Model A



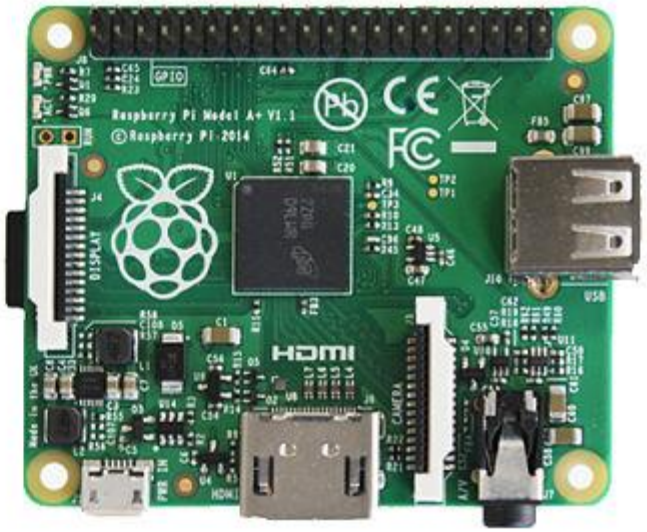
Raspberry Pi Model A+



Raspberry Pi A versus A+

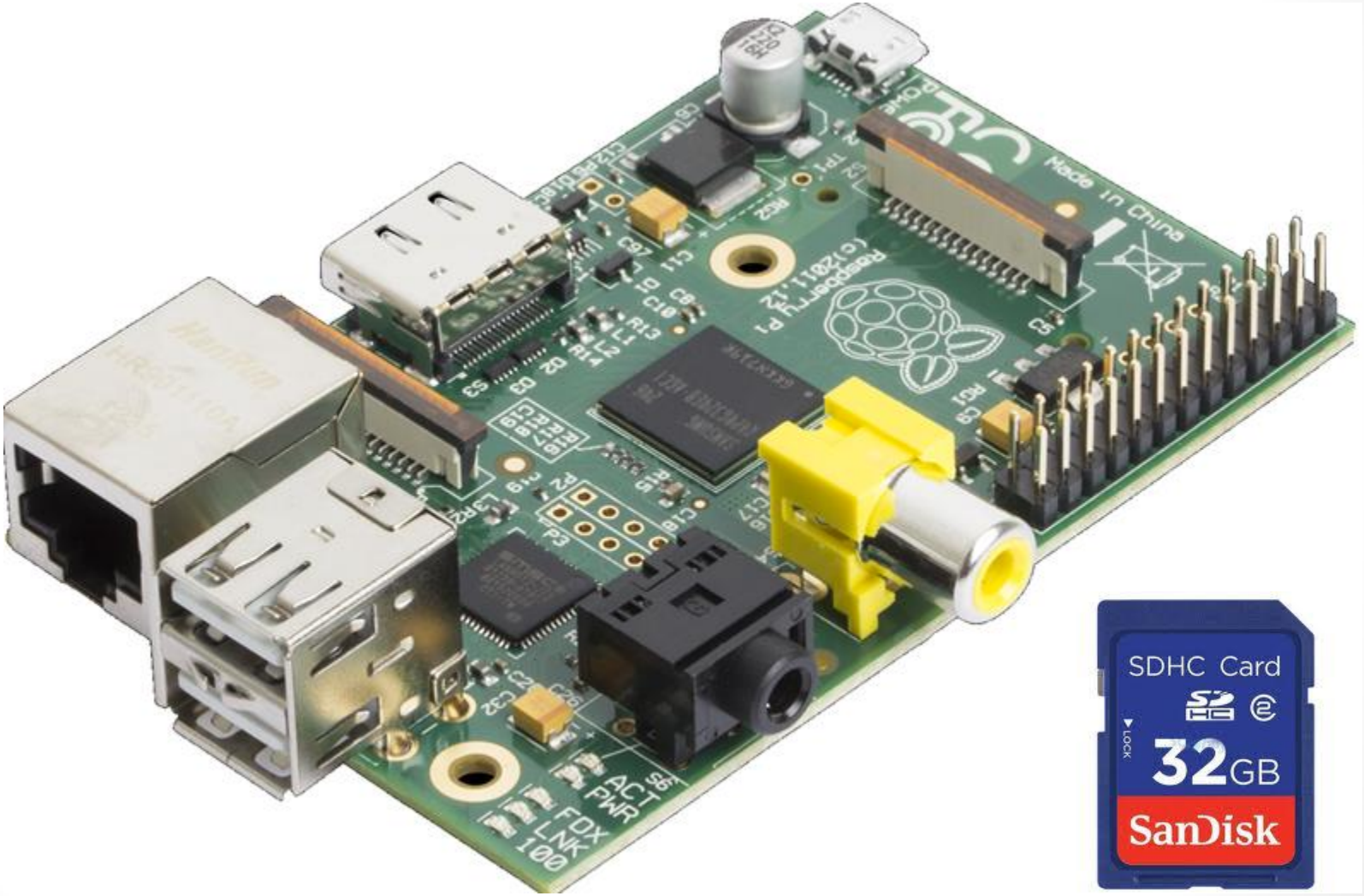


Raspberry Pi Model A



Raspberry Pi Model A+

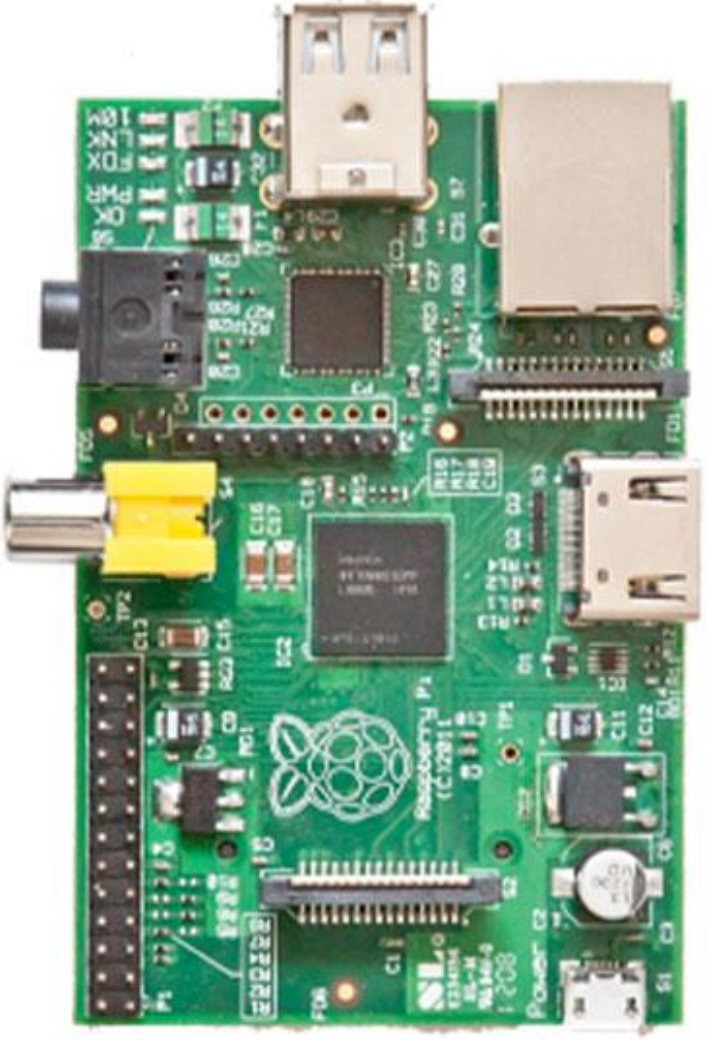
Raspberry Pi Model B



Raspberry Pi Model B+

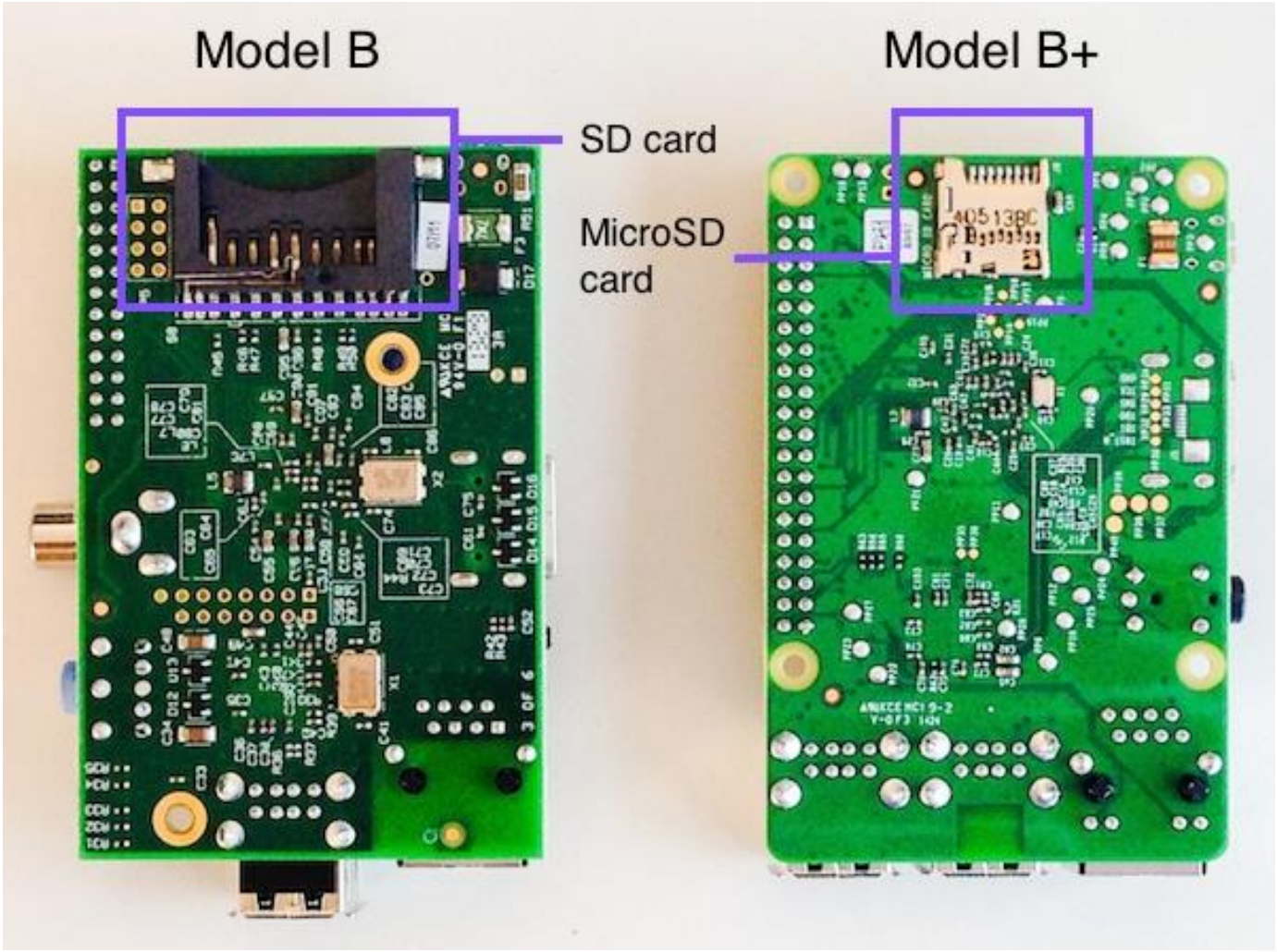
Raspberry Pi B versus B+

model b

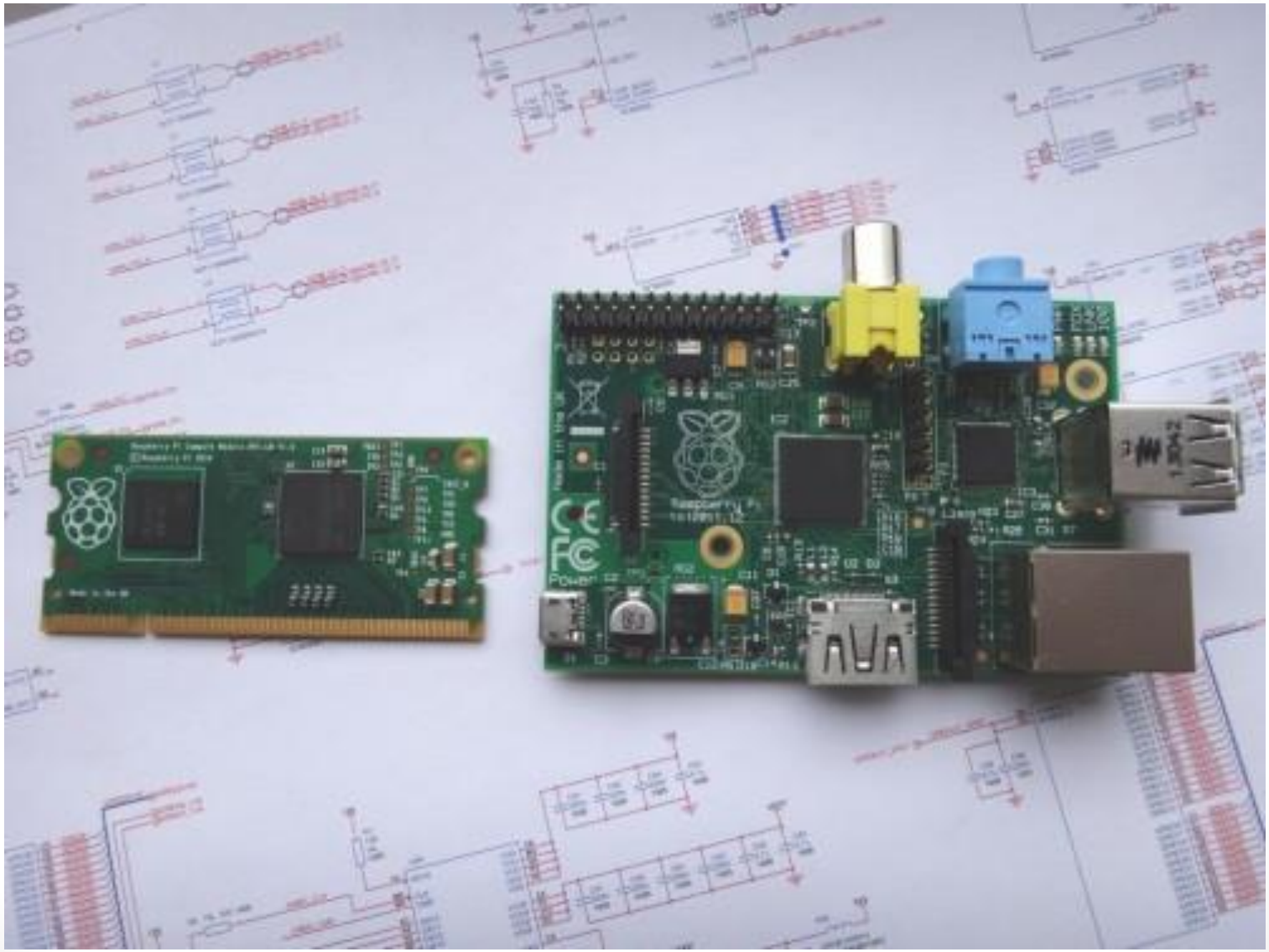


model b+

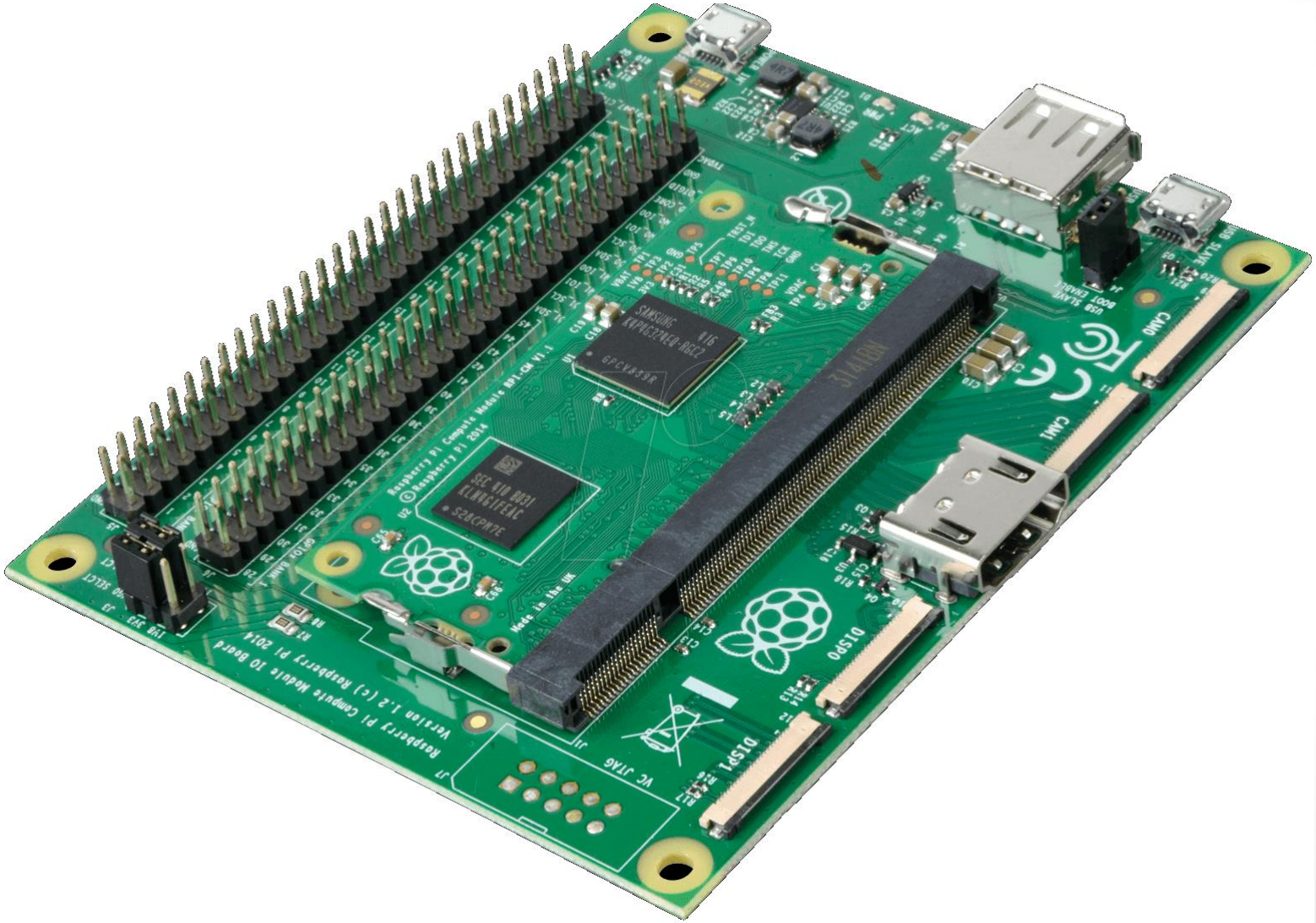
Raspberry Pi B versus B+



Raspberry Pi Compute Module
The Module

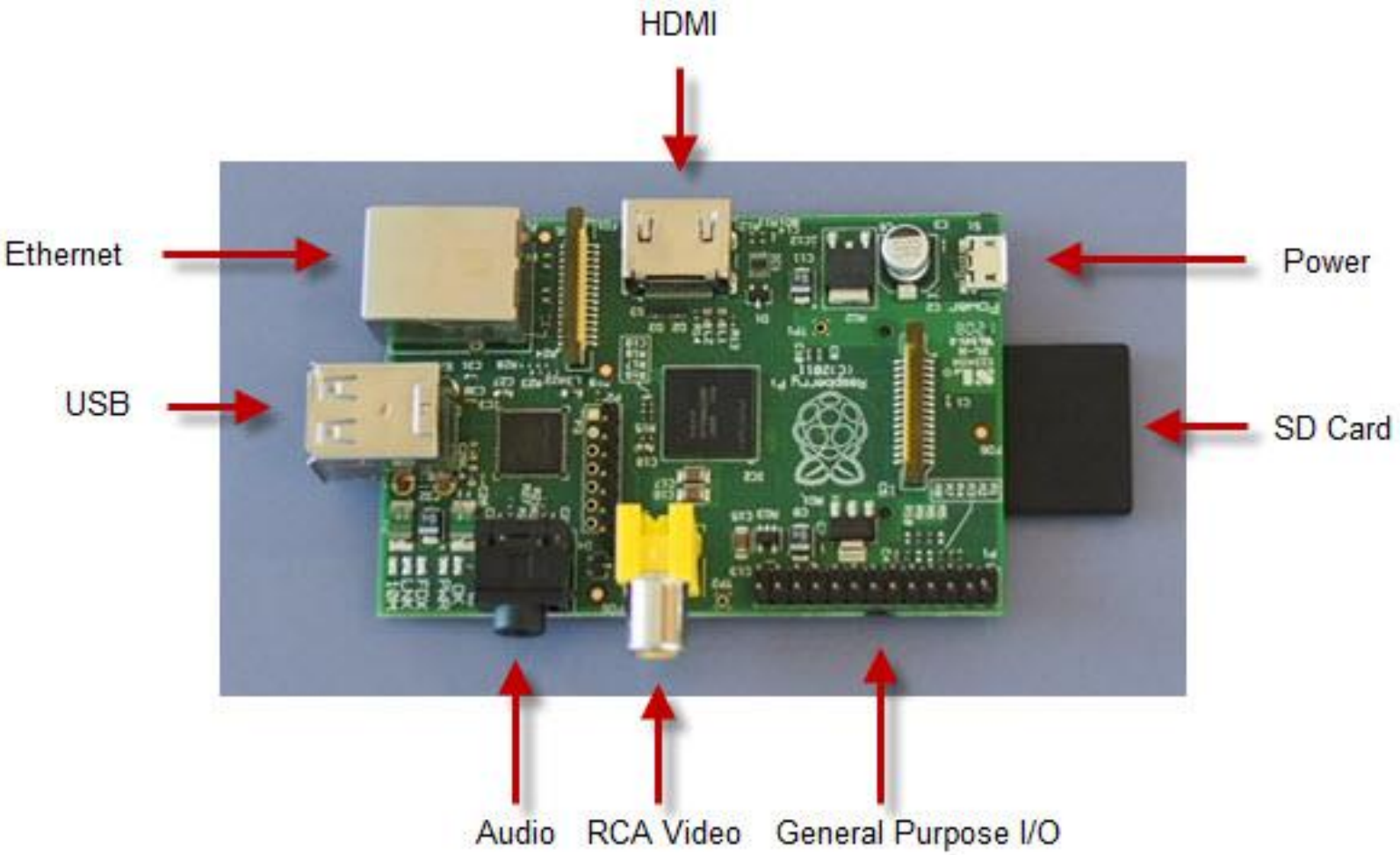


Raspberry Pi Compute Module
The IO Board

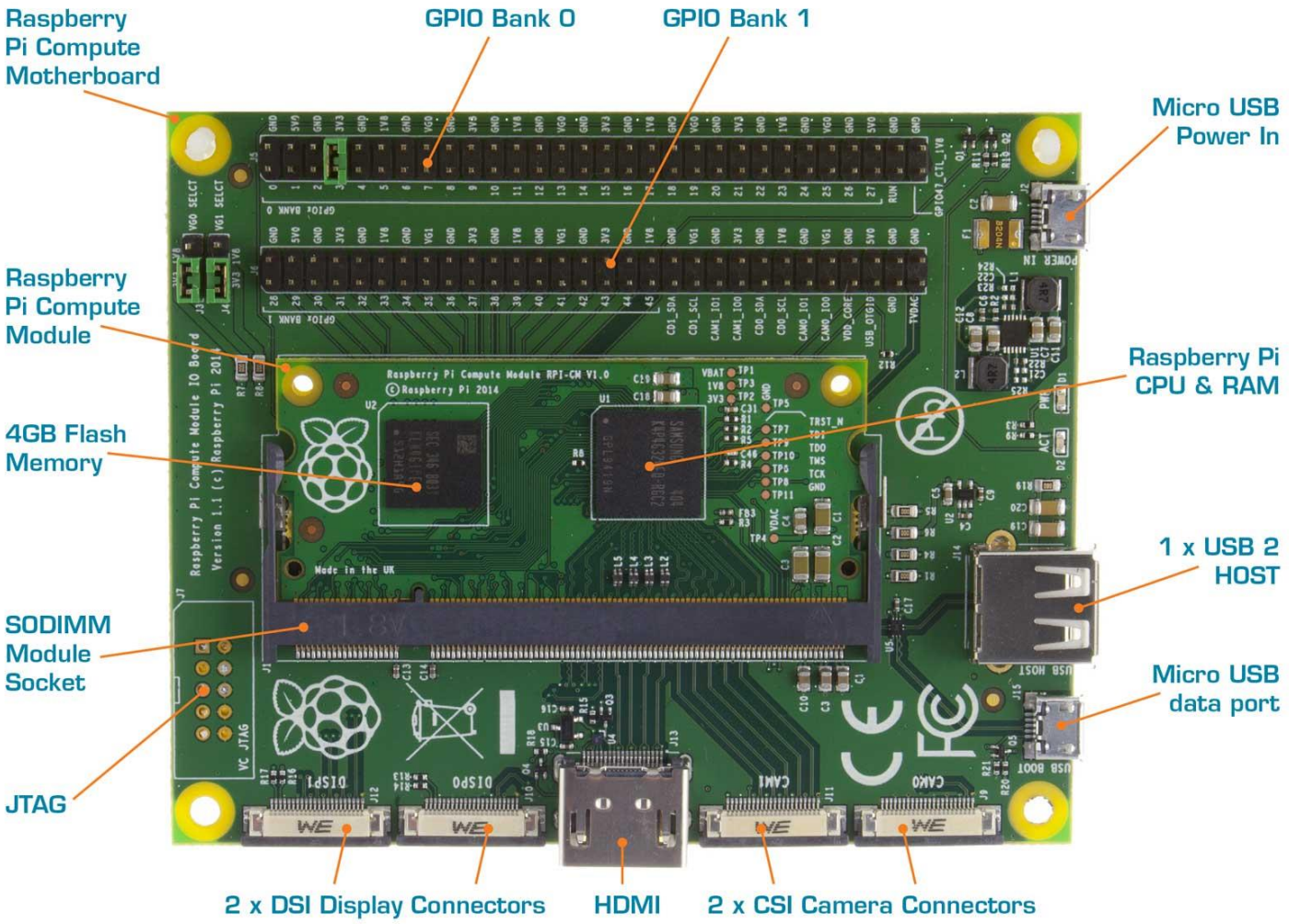


Raspberry Pi Model 2

Raspberry Pi Interfaces
B Model



Raspberry Pi Interfaces


Raspberry Pi Compute Motherboard
GPIO Bank 0
GPIO Bank 1
Micro USB Power In
Raspberry Pi Compute Module
Raspberry Pi CPU & RAM
4GB Flash Memory
1 x USB 2 HOST
SODIMM Module Socket
Micro USB data port
JTAG
2 x DSI Display Connectors
HDMI
2 x CSI Camera Connectors

Raspberry Pi Useful Web Sites

- The following Websites are very useful:
  - The Official Raspberry Pi Site
    http://www.raspberrypi.org/
  - The Pi Store
    http://store.raspberrypi.com/projects
  - Adafruit Raspberry Pi Tutorials
    https://learn.adafruit.com/category/raspberry-pi
  - The MagPi Online Magazine
    http://www.themagpi.com/

And a Lot More….

Linux 4 Embedded Systems

http://Linux4EmbeddedSystems.com