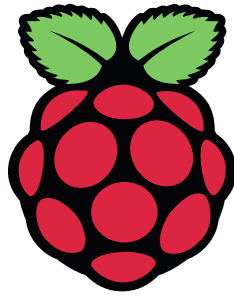


# **DATASHEET**



## **Raspberry Pi 4 Model B**

**Release 1**

**June 2019**

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Table 1: Release History

| Release | Date       | Description   |
|---------|------------|---------------|
| 1       | 21/06/2019 | First release |

The latest release of this document can be found at <https://www.raspberrypi.org>



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## 1 Introduction

The Raspberry Pi 4 Model B (Pi4B) is the first of a new generation of Raspberry Pi computers supporting more RAM and with significantly enhanced CPU, GPU and I/O performance; all within a similar form factor, power envelope and cost as the previous generation Raspberry Pi 3B+.

The Pi4B is available with either 1, 2 and 4 Gigabytes of LPDDR4 SDRAM.



## 2 Features

### 2.1 Hardware

- Quad core 64-bit ARM-Cortex A72 running at 1.5GHz
- 1, 2 and 4 Gigabyte LPDDR4 RAM options
- H.265 (HEVC) hardware decode (up to 4Kp60)
- H.264 hardware decode (up to 1080p60)
- VideoCore VI 3D Graphics
- Supports dual HDMI display output up to 4Kp60

### 2.2 Interfaces

- 802.11 b/g/n/ac Wireless LAN
- Bluetooth 5.0 with BLE
- 1x SD Card
- 2x micro-HDMI ports supporting dual displays up to 4Kp60 resolution
- 2x USB2 ports
- 2x USB3 ports
- 1x Gigabit Ethernet port (supports PoE with add-on PoE HAT)
- 1x Raspberry Pi camera port (2-lane MIPI CSI)
- 1x Raspberry Pi display port (2-lane MIPI DSI)
- 28x user GPIO supporting various interface options:
  - Up to 6x UART
  - Up to 6x I2C
  - Up to 5x SPI
  - 1x SDIO interface
  - 1x DPI (Parallel RGB Display)
  - 1x PCM
  - Up to 2x PWM channels
  - Up to 3x GPCLK outputs



## 2.3 Software

- ARMv8 Instruction Set
- Mature Linux software stack
- Actively developed and maintained
  - Recent Linux kernel support
  - Many drivers upstreamed
  - Stable and well supported userland
  - Availability of GPU functions using standard APIs

## 3 Mechanical Specification

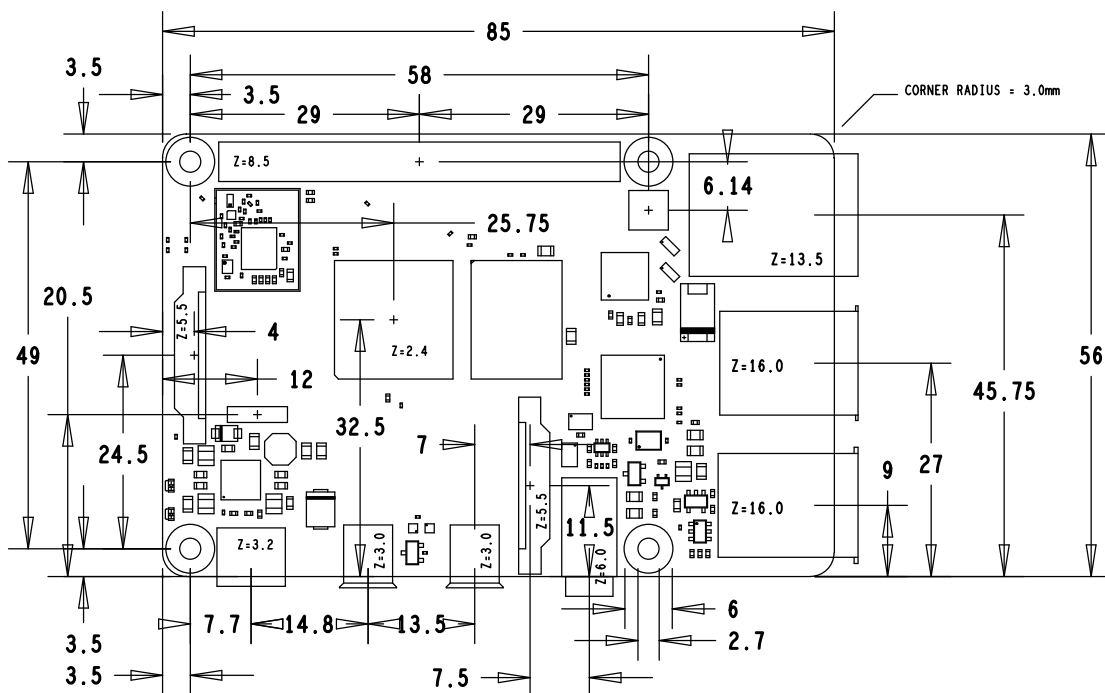


Figure 1: Mechanical Dimensions

## 4 Electrical Specification

**Caution!** Stresses above those listed in Table 2 may cause permanent damage to the device. This is a stress rating only; functional operation of the device under these or any other conditions above those listed in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.





| Symbol | Parameter        | Minimum | Maximum | Unit |
|--------|------------------|---------|---------|------|
| VIN    | 5V Input Voltage | -0.5    | 6.0     | V    |

Table 2: Absolute Maximum Ratings

Please note that VDD\_IO is the GPIO bank voltage which is tied to the on-board 3.3V supply rail.

| Symbol   | Parameter                        | Conditions                | Minimum | Typical | Maximum | Unit |
|----------|----------------------------------|---------------------------|---------|---------|---------|------|
| $V_{IL}$ | Input low voltage <sup>a</sup>   | VDD_IO = 3.3V             | -       | -       | TBD     | V    |
| $V_{IH}$ | Input high voltage <sup>a</sup>  | VDD_IO = 3.3V             | TBD     | -       | -       | V    |
| $I_{IL}$ | Input leakage current            | TA = +85°C                | -       | -       | TBD     | μA   |
| $C_{IN}$ | Input capacitance                | -                         | -       | TBD     | -       | pF   |
| $V_{OL}$ | Output low voltage <sup>b</sup>  | VDD_IO = 3.3V, IOL = -2mA | -       | -       | TBD     | V    |
| $V_{OH}$ | Output high voltage <sup>b</sup> | VDD_IO = 3.3V, IOH = 2mA  | TBD     | -       | -       | V    |
| $I_{OL}$ | Output low current <sup>c</sup>  | VDD_IO = 3.3V, VO = 0.4V  | TBD     | -       | -       | mA   |
| $I_{OH}$ | Output high current <sup>c</sup> | VDD_IO = 3.3V, VO = 2.3V  | TBD     | -       | -       | mA   |
| $R_{PU}$ | Pullup resistor                  | -                         | TBD     | -       | TBD     | kΩ   |
| $R_{PD}$ | Pulldown resistor                | -                         | TBD     | -       | TBD     | kΩ   |

<sup>a</sup> Hysteresis enabled

<sup>b</sup> Default drive strength (8mA)

<sup>c</sup> Maximum drive strength (16mA)

Table 3: DC Characteristics

| Pin Name        | Symbol     | Parameter                     | Minimum | Typical | Maximum | Unit |
|-----------------|------------|-------------------------------|---------|---------|---------|------|
| Digital outputs | $t_{rise}$ | 10-90% rise time <sup>a</sup> | -       | TBD     | -       | ns   |
| Digital outputs | $t_{fall}$ | 90-10% fall time <sup>a</sup> | -       | TBD     | -       | ns   |

<sup>a</sup> Default drive strength, CL = 5pF, VDD\_IO = 3.3V

Table 4: Digital I/O Pin AC Characteristics



Figure 2: Digital IO Characteristics



## 4.1 Power Requirements

The Pi4B requires a good quality USB-C power supply capable of delivering 5V at 3A. If attached downstream USB devices consume less than 500mA, a 5V, 2.5A supply may be used.

# 5 Peripherals

## 5.1 GPIO Interface

The Pi4B makes 28 BCM2711 GPIOs available via a standard Raspberry Pi 40-pin header. This header is backwards compatible with all previous Raspberry Pi boards with a 40-way header.

### 5.1.1 GPIO Pin Assignments

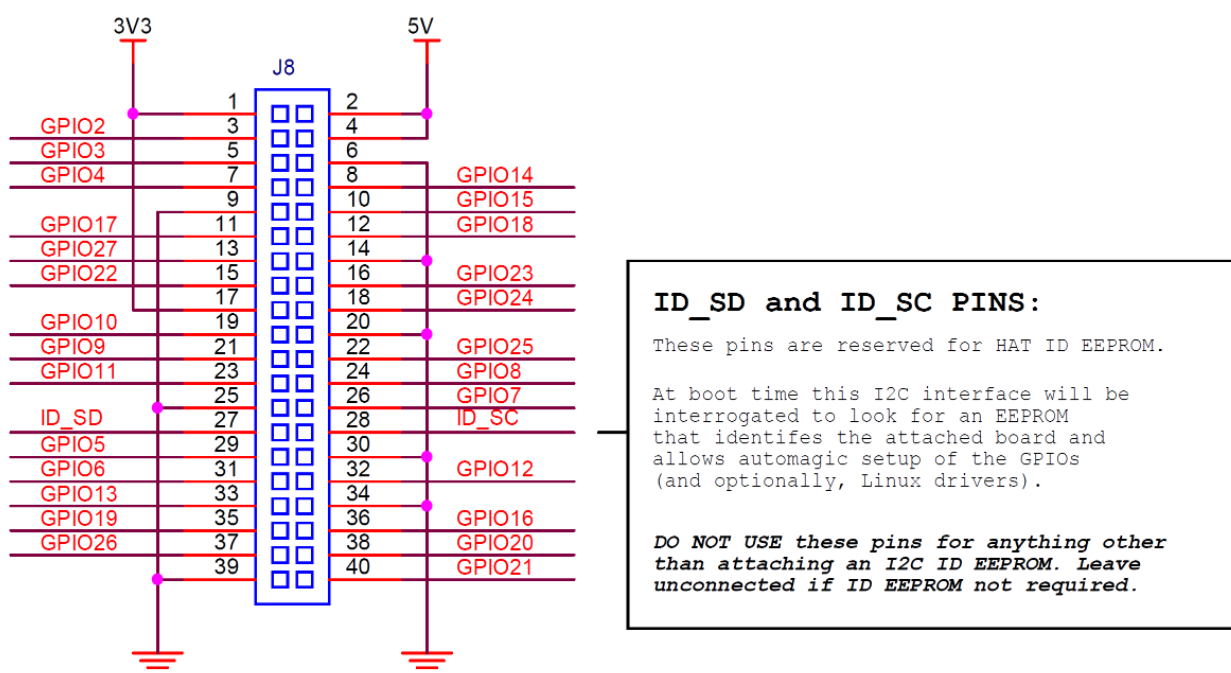


Figure 3: GPIO Connector Pinout

As well as being able to be used as straightforward software controlled input and output (with programmable pulls), GPIO pins can be switched (multiplexed) into various other modes backed by dedicated peripheral blocks such as I2C, UART and SPI.

In addition to the standard peripheral options found on legacy Pis, extra I2C, UART and SPI peripherals have been added to the BCM2711 chip and are available as further mux options on the Pi4. This gives users much more flexibility when attaching add-on hardware as compared to older models.



### 5.1.2 GPIO Alternate Functions

| GPIO | Default Pull | ALT0       | ALT1  | ALT2      | ALT3       | ALT4       | ALT5       |
|------|--------------|------------|-------|-----------|------------|------------|------------|
| 0    | High         | SDA0       | SA5   | PCLK      | SPI3_CE0_N | TXD2       | SDA6       |
| 1    | High         | SCL0       | SA4   | DE        | SPI3_MISO  | RXD2       | SCL6       |
| 2    | High         | SDA1       | SA3   | LCD_VSYNC | SPI3_MOSI  | CTS2       | SDA3       |
| 3    | High         | SCL1       | SA2   | LCD_HSYNC | SPI3_SCLK  | RTS2       | SCL3       |
| 4    | High         | GPCLK0     | SA1   | DPI_D0    | SPI4_CE0_N | TXD3       | SDA3       |
| 5    | High         | GPCLK1     | SA0   | DPI_D1    | SPI4_MISO  | RXD3       | SCL3       |
| 6    | High         | GPCLK2     | SOE_N | DPI_D2    | SPI4_MOSI  | CTS3       | SDA4       |
| 7    | High         | SPI0_CE1_N | SWE_N | DPI_D3    | SPI4_SCLK  | RTS3       | SCL4       |
| 8    | High         | SPI0_CE0_N | SD0   | DPI_D4    | -          | TXD4       | SDA4       |
| 9    | Low          | SPI0_MISO  | SD1   | DPI_D5    | -          | RXD4       | SCL4       |
| 10   | Low          | SPI0_MOSI  | SD2   | DPI_D6    | -          | CTS4       | SDA5       |
| 11   | Low          | SPI0_SCLK  | SD3   | DPI_D7    | -          | RTS4       | SCL5       |
| 12   | Low          | PWM0       | SD4   | DPI_D8    | SPI5_CE0_N | TXD5       | SDA5       |
| 13   | Low          | PWM1       | SD5   | DPI_D9    | SPI5_MISO  | RXD5       | SCL5       |
| 14   | Low          | TXD0       | SD6   | DPI_D10   | SPI5_MOSI  | CTS5       | TXD1       |
| 15   | Low          | RXD0       | SD7   | DPI_D11   | SPI5_SCLK  | RTS5       | RXD1       |
| 16   | Low          | FL0        | SD8   | DPI_D12   | CTS0       | SPI1_CE2_N | CTS1       |
| 17   | Low          | FL1        | SD9   | DPI_D13   | RTS0       | SPI1_CE1_N | RTS1       |
| 18   | Low          | PCM_CLK    | SD10  | DPI_D14   | SPI6_CE0_N | SPI1_CE0_N | PWM0       |
| 19   | Low          | PCM_FS     | SD11  | DPI_D15   | SPI6_MISO  | SPI1_MISO  | PWM1       |
| 20   | Low          | PCM_DIN    | SD12  | DPI_D16   | SPI6_MOSI  | SPI1_MOSI  | GPCLK0     |
| 21   | Low          | PCM_DOUT   | SD13  | DPI_D17   | SPI6_SCLK  | SPI1_SCLK  | GPCLK1     |
| 22   | Low          | SD0_CLK    | SD14  | DPI_D18   | SD1_CLK    | ARM_TRST   | SDA6       |
| 23   | Low          | SD0_CMD    | SD15  | DPI_D19   | SD1_CMD    | ARM_RTCK   | SCL6       |
| 24   | Low          | SD0_DAT0   | SD16  | DPI_D20   | SD1_DAT0   | ARM_TDO    | SPI3_CE1_N |
| 25   | Low          | SD0_DAT1   | SD17  | DPI_D21   | SD1_DAT1   | ARM_TCK    | SPI4_CE1_N |
| 26   | Low          | SD0_DAT2   | TE0   | DPI_D22   | SD1_DAT2   | ARM_TDI    | SPI5_CE1_N |
| 27   | Low          | SD0_DAT3   | TE1   | DPI_D23   | SD1_DAT3   | ARM_TMS    | SPI6_CE1_N |

Table 5: Raspberry Pi 4 GPIO Alternate Functions

Table 5 details the default pin pull state and available alternate GPIO functions. Most of these alternate peripheral functions are described in detail in the BCM2711 Peripherals Specification document which can be downloaded from the hardware documentation section of the website.



### 5.1.3 Display Parallel Interface (DPI)

A standard parallel RGB (DPI) interface is available the GPIOs. This up-to-24-bit parallel interface can support a secondary display.

### 5.1.4 SD/SDIO Interface

The Pi4B has a dedicated SD card socket which supports 1.8V, DDR50 mode (at a peak bandwidth of 50 Megabytes / sec). In addition, a legacy SDIO interface is available on the GPIO pins.

## 5.2 Camera and Display Interfaces

The Pi4B has 1x Raspberry Pi 2-lane MIPI CSI Camera and 1x Raspberry Pi 2-lane MIPI DSI Display connector. These connectors are backwards compatible with legacy Raspberry Pi boards, and support all of the available Raspberry Pi camera and display peripherals.

## 5.3 USB

The Pi4B has 2x USB2 and 2x USB3 type-A sockets. Downstream USB current is limited to approximately 1.1A in aggregate over the four sockets.

## 5.4 HDMI

The Pi4B has 2x micro-HDMI ports, both of which support CEC and HDMI 2.0 with resolutions up to 4Kp60.

## 5.5 Audio and Composite (TV Out)

The Pi4B supports near-CD-quality analogue audio output and composite TV-output via a 4-ring TRS 'A/V' jack.

The analog audio output can drive 32 Ohm headphones directly.

## 5.6 Temperature Range and Thermals

The recommended ambient operating temperature range is 0 to 50 degrees Celcius.

To reduce thermal output when idling or under light load, the Pi4B reduces the CPU clock speed and voltage. During heavier load the speed and voltage (and hence thermal output) are increased. The internal governor will throttle back both the CPU speed and voltage to make sure the CPU temperature never exceeds 85 degrees C.

The Pi4B will operate perfectly well without any extra cooling and is designed for sprint performance - expecting a light use case on average and ramping up the CPU speed when needed (e.g. when loading a webpage). If a user wishes to load the system continually or operate it at a high temperature at full performance, further cooling may be needed.



## **6 Availability**

Raspberry Pi guarantee availability Pi4B until at least January 2026.

## **7 Support**

For support please see the hardware documentation section of the Raspberry Pi website and post questions to the Raspberry Pi forum.