USB Power Delivery on Raspberry Pi 5

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Document version history

Release	Date	Description
1	5 Mar 2026	Initial release

Scope of document

This document applies to the following Raspberry Pi products:

Single Board Computers / SBCs

Pi Zero			Pi Zero 2		Pi 1				Pi 2	Pi 3			Pi 4	Pi 5
-	W	H	W	WH	A	B	A+	B+	B	A+	B	B+	B	-
														✓

Compute Modules

CM0	CM1	CM3	CM3+	CM4	CM4S	CM5
						✓

Keyboard Computers

Pi 400	Pi 500	Pi 500+
	✓	✓

Introduction

USB Power Delivery (USB PD) is a flexible power negotiation standard developed by the USB Implementers Forum (USB-IF). It enables higher power transfer, bidirectional energy flow, and intelligent negotiation between connected devices over USB Type-C.

As power requirements for Raspberry Pi single-board computers (SBCs) have increased with each new model, USB PD has become particularly useful for providing a stable and well-regulated 5V supply. Raspberry Pi SBCs benefit from the use of standards-compliant USB-C power sources.

This white paper describes the USB PD architecture and explains how it is used on Raspberry Pi SBCs.

The official USB PD specification can be found here.

An overview of USB Power Delivery

USB PD extends the USB Type-C specification to support:

- Power levels up to 240W (Extended Power Range, USB PD 3.1)
- Bidirectional power flow (source/sink role swapping)
- Programmable current and voltage profiles
- Power negotiation via structured messaging

On Raspberry Pi SBCs, only 5V power modes are supported.

USB Type-C electrical architecture

USB PD operates over the USB Type-C connector, which includes:

- VBUS: Power line
- GND: Ground return
- CC1 / CC2: Configuration channels
- SBU1 / SBU2: Sideband use pins
- High-speed differential pairs

Configuration channels (CCs)

The CC pins are fundamental to:

- Cable orientation detection
- Source/sink role detection
- Current advertisement (default, 1.5A, 3A)
- USB PD communication (BMC signalling)

Power profiles and negotiation

Power data objects (PDOs)

During connection:

1. Source advertises available PDOs
2. Sink evaluates options
3. Sink sends request data object (RDO)
4. Source accepts request and transitions voltage

Example source PDO set:

Voltage	Current	Power
5V	3A	15W
9V	3A	27W
15V	3A	45W
20V	5A	100W

The USB PD specification has a set of default PDOs that all supplies should implement, but it also allows other combinations from an optional list. One of these, 5V 5A, can be used by Raspberry Pi 5, if available.

Programmable power supply (PPS)

PPS enables dynamic voltage adjustments in 20mV steps; however, Raspberry Pi SBCs do **not** support PPS.

USB PD on Raspberry Pi SBCs

Raspberry Pi SBCs require a stable 5V rail. If you want to add HATs and USB devices to Raspberry Pi 5, the recommended power is 5V 5A, which makes 1.6A available to the USB ports.

On Raspberry Pi 5 systems:

- Only 5V PDOs are requested
- Higher-voltage PDOs are ignored

If available, the 5V 5A PDO will be used by Raspberry Pi 5, giving it a maximum power of 25W.

Tip

5V 5A is an officially recognised PDO. It is not part of the required set of PDOs, but rather the optional set. When choosing a power supply for a use case that requires higher power, check whether it implements this optional PDO.

If a 5V 5A supply is not detected, Raspberry Pi SBCs automatically limit the total power available to the USB ports to 600mA (instead of 1.6A). USB booting is also disabled unless the power switch is deliberately pressed, and the desktop will show a warning message saying power is limited.

A consequence of less power being made available to the USB ports is that high-current devices, including SSDs and hard drives, may fail to operate correctly. While Raspberry Pi recommends a 5V 5A supply for Raspberry Pi 5, it will function perfectly well with a 3A supply, provided that only lower-power peripherals are attached.

Note

A common question is why Raspberry Pi SBCs do not have circuitry on board to enable higher-voltage PDOs to be used, which would make them compatible with a greater variety of power supplies. This is for two main reasons:
- The PCBs are already very densely populated, leaving no space for this extra circuitry
- This would increase the temperature of the board, necessitating the use of a heatsink or other heat-dissipating techniques

Bypassing USB PD negotiation

In some circumstances, users may not wish to employ the USB-C power socket, preferring instead to supply power via the GPIO pins. Alternatively, they may wish to avoid PD negotiation altogether, such as if the power supply they are using provides 5V 5A but does not support PD. If USB PD is not present on the supply, the Raspberry Pi SBC will assume a 5V **3A** supply by default. There are two ways to bypass the USB PD system.

Firmware EEPROM configuration

There is an option to bypass the USB PD system in the EEPROM settings used by the bootloader.

PSU_MAX_CURRENT
: If set, this property instructs the firmware to skip USB Power Delivery negotiation and assume that it is connected to a power supply with the given current rating. Typically, this would be set to either 3000 or 5000, i.e. low- or high-current power supplies.

See our documentation for details on how to set EEPROM configuration options.

`config.txt` configuration

There is also an option in `config.txt` that instructs the system to allow full power to be made available to the USB ports.

usb_max_current_enable=1
: Informs the system to allow the USB ports to draw up to 1600mA (i.e. 1.6A) rather than 600mA.

`usb_max_current_enable` will be set automatically if the Raspberry Pi SBC has successfully negotiated 5V 5A with a PD power supply, or if `PSU_MAX_CURRENT` has been set to 5000.

Note

On Raspberry Pi 5, USB boot will be disabled if 5V 5A is not available. Setting either `PSU_MAX_CURRENT=5000` or `usb_max_current_enable=1` will re-enable USB boot.

Raspberry Pi USB PD power supplies

Raspberry Pi Ltd offers a range of high-quality power supplies that cover all of our SBC products. Two of these supplies incorporate USB Power Delivery, and these are shown below. Note that, alongside the 5V 5A mode, both of these power supplies also include other standard modes that are not used by Raspberry Pi SBCs, but which users may find useful for other tasks, such as charging phones or powering laptops.

All Raspberry Pi power supplies have thick, non-detachable power cables to minimise power loss and are available with different plugs for use worldwide. Raspberry Pi recommends using our official power supplies wherever possible. Many reports of problems with Raspberry Pi SBCs can be traced back to inadequate or inconsistent power supplies. Raspberry Pi power supplies are high quality, cost effective, and compliant with most global standards.

27W

The available profiles are 5V 3A, 5V 5A, 9V 3A, 12V 2.25A, and 15V 1.8A. These are all limited to a maximum of 27W.

Figure 1.
Raspberry Pi 27W USB-C Power Supply with USB PD

45W

The available profiles are 5V 3A, 5V 5A, 9V 5A, 12V 3.75A, 15V 3A, and 20V 2.25A. These are all limited to a maximum of 45W.

Figure 2.
Raspberry Pi 45W USB-C Power Supply with USB PD

Compliance and certification

Raspberry Pi's USB PD products (SBCs and power supplies) undergo USB-IF compliance testing and electrical and protocol validation. These certifications ensure safe operation, interoperability, and brand compliance.

For more information on the global compliance of Raspberry Pi power supplies, please see the accessories page on our Product Information Portal and choose the peripheral you are interested in.

Conclusion

USB PD provides a stable 5V supply from a simple USB-C connector. For Raspberry Pi SBCs, it offers:

- Simplified cabling
- Increased efficiency
- Improved user experience

Raspberry Pi 5 will request a 5V 5A supply via the USB PD system, but will revert to 3A if no 5A PDO is present. This can be overridden if required, although it should be noted that Raspberry Pi 5 will run smoothly on a 3A supply as long as the peripheral load is kept within the 3A envelope.

Contact Details for more information

Please contact applications@raspberrypi.com if you have any queries about this whitepaper.

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