# Raspberry Pi
# Compute Module 4 IO Board
An application board for the
Compute Module 4

# Colophon

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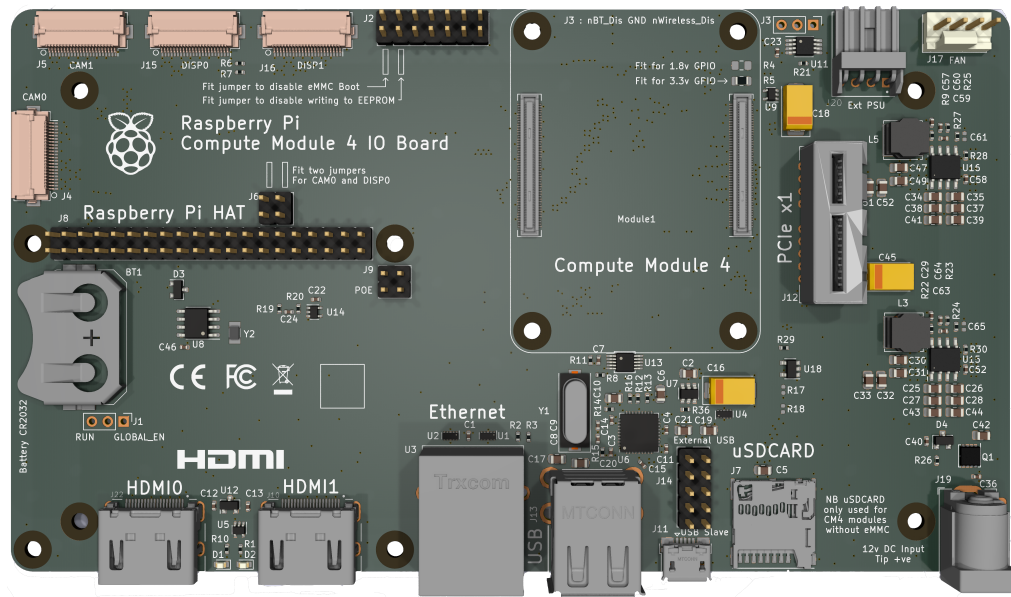
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# Chapter 1. Introduction

The Raspberry Pi Compute Module 4 IO Board (CM4IO) is designed to assist in the development of products that make use of Raspberry Pi Compute Module 4. The Raspberry Pi Compute Module 4 IO Board contains many of the interfaces that Raspberry Pi 4 Model B has, and for general usage you should refer to the Raspberry Pi 4 Model B documentation. The significant difference between CM4IO and Raspberry Pi 4 Model B is the addition of a single PCIe socket. The CM4IO has been designed as both a reference design for CM4 or to be used directly as a product with the possible addition of PCIe Cards and Raspberry Pi HATs.

# Chapter 2. Features

- Accepts the complete range of CM4 modules

- External +12V PSU

- 2 × full-size HDMI 2.0 connectors

- Gigabit Ethernet RJ45 with PoE support

- 2 × USB 2 sockets, with header for two more sockets

- Micro USB socket for updating CM4

- microSD card socket for CM4Lite modules

- PCIe Gen 2 socket

- Standard fan connector

- External power connector (+5V, +12V)

- 2 × MIPI DSI display FPC connectors (22-pin 0.5mm pitch cable)

- 2 × MIPI CSI-2 camera FPC connectors (22-pin 0.5mm pitch cable)

- Raspberry Pi HAT connector

- RTC with battery socket and ability to wake up CM4

- Jumpers to disable features, e.g. wireless, EEPROM writing

## 2.1. CM4 module connectors

The two CM4 module connectors are positioned so the on-board wireless antenna is at the edge of the board for best wireless performance.

## 2.2. PSU input

The main PSU input (J19) is a 2.1mm DC tip positive +12V input. There is an on-board +12V to +5V DC-DC converter to power the CM4. There is also an on-board +12V to +3.3V DC-DC converter PSU which is only used for the PCIe slot. The +12V input feeds the +12V PCIe slot, the external PSU connector and the fan connector directly. If these aren't being used then a wider input supply is possible (+7.5V to +28V).

With a +12V supply via the DC barrel jack, the external PSU connector (J20 with +5V and +12V) is ideal to connect to PCIe cards that require an external PSU. You should ensure that the PSUs aren't overloaded. The J20 mating connector is known as "Berg" connector, part number AMP/TE Connectivity 171822-4 or similar.

The exact current required from the +12V PSU is dependent on the application and on what is connected to the Raspberry Pi Compute Module 4 IO Board. We recommend budgeting 9W for CM4.

If you want to supply an external +5V supply to the board, e.g. via J20 or via PoE J9, then we recommend that L5 be removed. Removing L5 will prevent the on-board +5V and +3.3V supplies from starting up and +5V coming out of the DC jack socket (J19).

## 2.3. Dual full-size HDMI 2.0 connectors

CM4 does most of the interfacing required for the HDMI interface so that most signals are directly connected to the

CM4 board. HDMI connectors require a +5V supply, which is provided on the Raspberry Pi Compute Module 4 IO Board via a current-limited switch.

## 2.4. Gigabit Ethernet RJ45

The Raspberry Pi Compute Module 4 IO Board uses a standard 1:1 Ethernet magjack, which supports PoE as well. Additional ESD protection is provided on the Raspberry Pi Compute Module 4 IO Board as it is typically needed in PoE applications. The PoE signals from the RJ45 connector are connected to J5. Typically a PoE HAT will supply +5V to the Raspberry Pi Compute Module 4 IO Board. As a typical PoE HAT doesn't generate a +12V power rail, PCIe expansion cards and the fan will not function.

## 2.5. USB 2.0 hub

The Raspberry Pi Compute Module 4 IO Board has an on-board USB 2.0 hub. This connects to the CM4 USB 2.0 port. Two ports from the hub are connected to a connector. The other two ports are connected to a header; this header can be used to provide two extra internal ports.

There is an internal current limit switch to provide VBUS to the USB connectors. The current limit is set to approximately 1.2A.

The USB interface is disabled to save power by default on the CM4. To enable it you need to add the following to the config.txt file:

```
dtoverlay=dwc2,dr_mode=host
```

## 2.6. Micro USB connector

The micro USB connector is designed to enable CM4 to be updated via rpiboot. When a micro USB cable is plugged in the USB hub is automatically disabled, so the CM4 USB 2.0 port becomes a USB device.

## 2.7. microSD card socket

⛔ **WARNING**

For use only with CM4Lite modules

The microSD card socket is a push-push socket. To release the microSD card, a gentle push on the card will enable it to be removed.

## 2.8. PCIe Gen 2 x1 socket

The PCIe socket is designed to take standard PC PCIe cards. You should ensure that there is a suitable OS driver for your card.

The PCIe link on the Raspberry Pi 4 Model B is used for the USB 3.0 interface via the VLI805 XHCI controller. If the application requires USB 3.0 interface then an external XHCI controller is required like the VLI805.

The PCIe link has been successfully used with an NVMe drive via a passive PCIe adaptor.

> ℹ️ **NOTE**

> Booting isn't supported via a PCIe switch.

If the application uses a standard PCIe card then it might be useful to have a small PCIe adapter to rotate the PCIe card 90degress to enable a more compact case.

> ℹ️ **NOTE**

> The PCIe interface doesn't support MSI-X. Typically PCIe devices will fall back to MSI.

## 2.9. Fan connector

This connector supports standard +12V fans with PWM drive and tacho output. An EMC2301 controls the fan via I2C. The mating connector part number is Molex 47054-1000 or similar. The +12V power for the fan comes from the +12V input and isn't regulated.

> 💡 **TIP**

> To enable the I2C bus to the fan controller, you will need `dtparam=i2c_vc=on` set in config.txt. The fan controller will then be on i2c-10 address 0x2f (7-bit address).

## 2.10. Dual DSI display connectors (22-pin 0.5mm pitch cable)

Both DSI interfaces (2-channel and 4-channel) are brought out to separate 22-way 0.5mm pitch connectors. These connectors are the same as on the existing CMIO board; note that they are different from Raspberry Pi 4 Model B. If the DSI0 interface (2-channel) is used, then the two jumpers on J6 must be fitted to route the I2C bus to the connector.

## 2.11. Dual CSI-2 camera connectors (22-pin 0.5mm pitch cable)

Both CSI-2 interfaces (2-channel and 4-channel) are brought out to separate 22-way 0.5mm pitch connectors. These connectors are the same as on the existing CMIO board; note that they are different from Raspberry Pi 4 Model B. If the CSI0 interface (2-channel) is used, then the two jumpers on J6 must be fitted to route the I2C bus to the connector.

## 2.12. Raspberry Pi HAT connector

The Raspberry Pi Compute Module 4 IO Board has a standard Raspberry Pi 40-way HAT connector. Mounting holes are also provided so that standard HATs may be used.

## 2.13. Real time clock (RTC)

A PCF85063AT RTC is provided on the Raspberry Pi Compute Module 4 IO Board. A battery socket is provided for a CR2032 battery. On initial setup, the CLKOUT of the RTC should be disabled to save power.

The alarm output of the RTC is used to wake CM4 from a previous shutdown. If an alarm goes off during normal

operation, the CM4 will be reset; this can be used as a watchdog timer if required.

> 💡 **TIP**
>
> To enable the I2C bus to the RTC you will need `dtparam=i2c_vc=on` set in config.txt. The RTC then will be on i2c-10 address 0x51 (7-bit address).

## 2.14. Jumpers

*R4/R5 Vref voltage selection*

By default the Raspberry Pi Compute Module 4 IO Board sets the CM4 IO voltage to +3.3V via R5. Moving R5 to R4 sets the IO voltage on CM4 to +1.8V. Moving the resistor requires the use of a soldering iron.

> ℹ️ **NOTE**
>
> Only one of R4 or R5 may be fitted at any one time.

> ℹ️ **NOTE**
>
> *J6 CSI0 DSI0 I2C enable*
>
> For the J6 jumpers, if either CSI0 or DSI0 is used then both jumpers must be fitted to route the I2C bus to the connectors.

*Table 1. J2 jumpers*

| Pin | Function |
|-----|----------|
| 1-2 | nRPIBOOT - if fitted, forces USB booting; it is useful if the eMMC becomes corrupted |
| 3-4 | EEPROM_nWP - if fitted, write-protects the EEPROM on CM4 |
| 5 | AIN0 MXL7704 - analog input; consult MXL7704 datasheet for details |
| 6 | AIN1 MXL7704 - analog input; consult MXL7704 datasheet for details |
| 7 | GND for AIN signals |
| 8 | SYNC_IN |
| 9 | SYNC_OUT |
| 10 | GND |
| 11 | TV_OUT |
| 12 | GND |
| 13-14 | Connect a push button to wake CM4 from low-power mode. It can't be used to shut down CM4. |

*Table 2. J3 (not fitted by default)*

| Pin | Function |
|-----|----------|
| 1 | WL_nDIS - when connected to ground the wireless interface will be disabled |
| 2 | GND - ground |
| 3 | BT_nDIS - when connected to ground the Bluetooth interface will be disabled |

*Table 3. J1 (not fitted by default)*

| Pin | Function |
|-----|----------|
| 1 | GLOBAL_EN |
| 2 | GND |

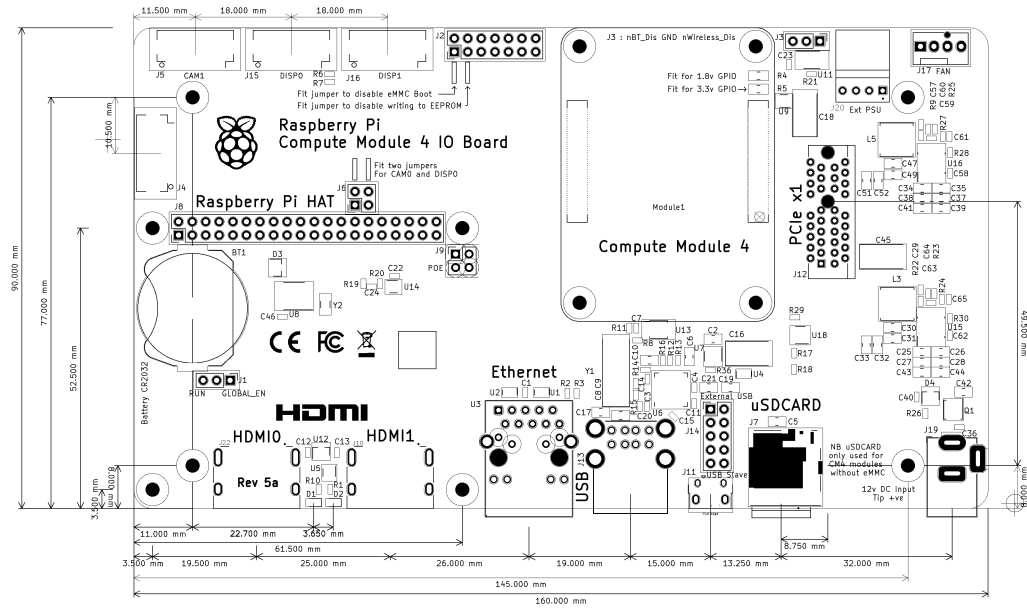| 3 | RUN_PG |
|---|--------|

## 2.15. LEDs

**Red LED**

This LED duplicates the function of the red LED on Raspberry Pi 4 Model B

**Green LED**

This LED duplicates the function of the green LED on Raspberry Pi 4 Model B

# Chapter 3. Mechanical diagram

*Figure 2. Mechanical diagram of the Raspberry Pi Compute Module 4 IO Board.*
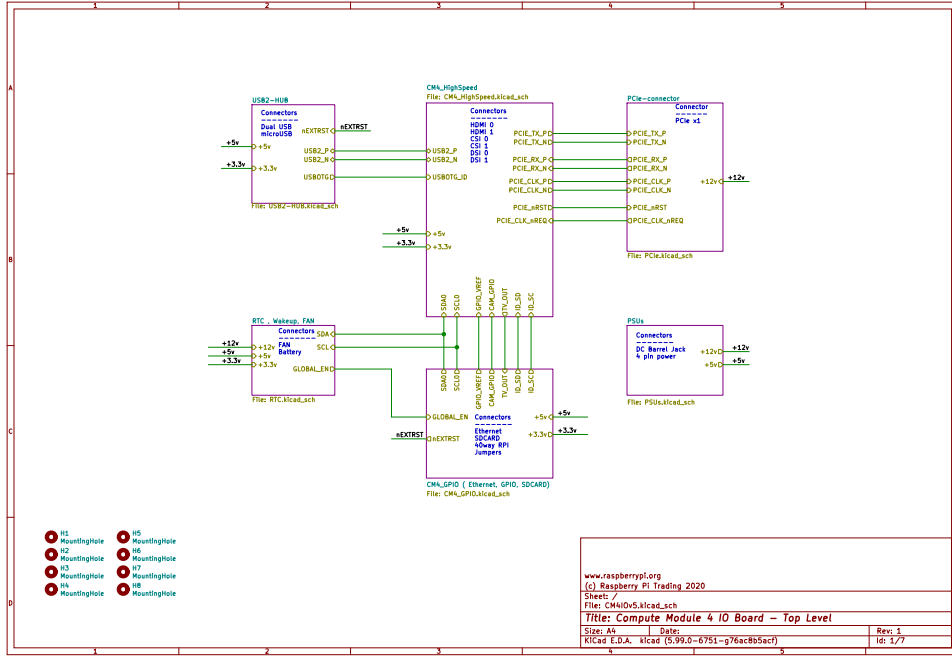
# Chapter 4. Circuit diagram
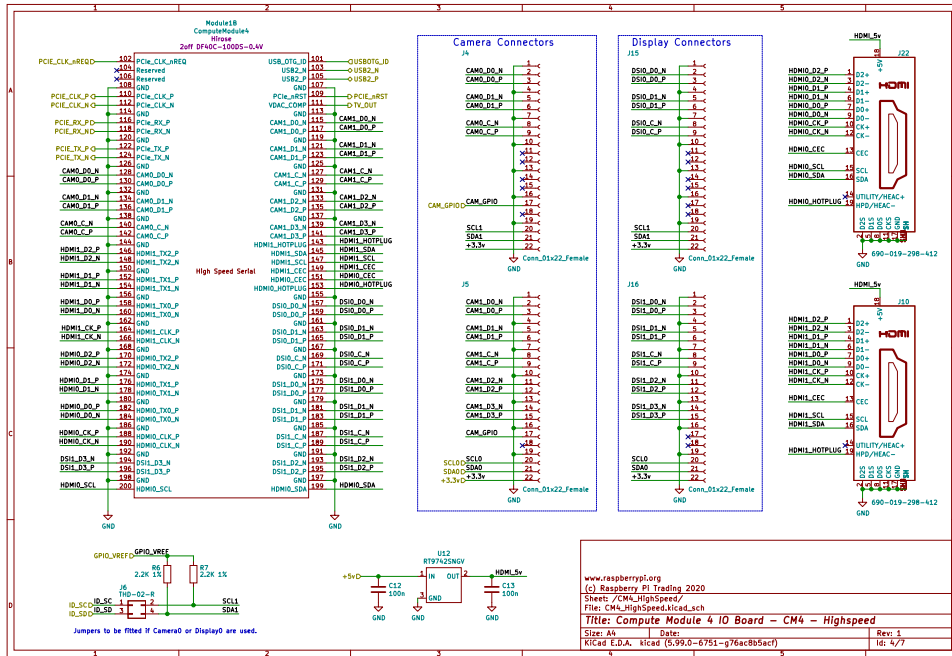
Figure 3. Top level
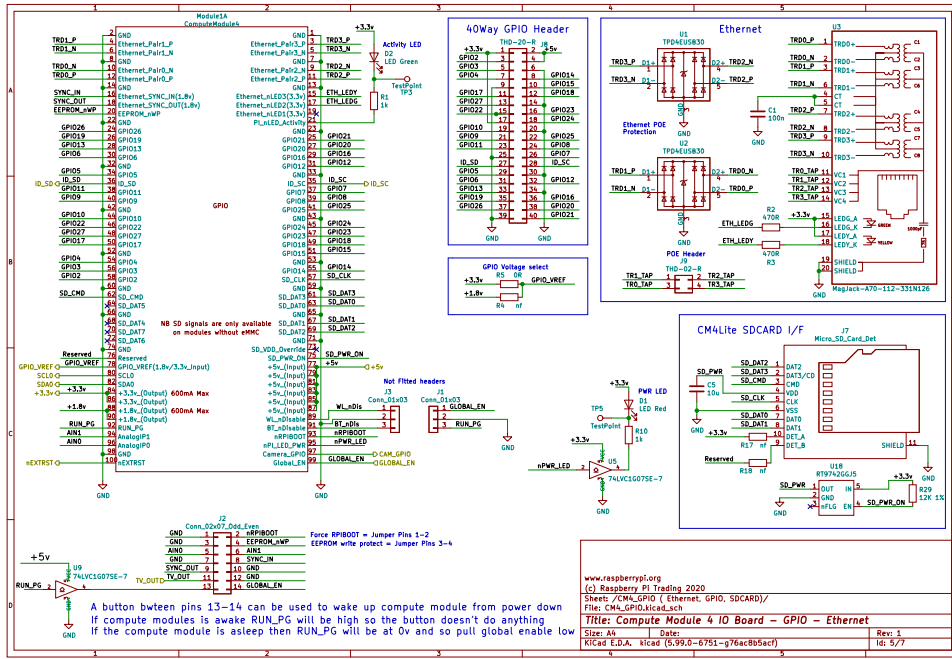


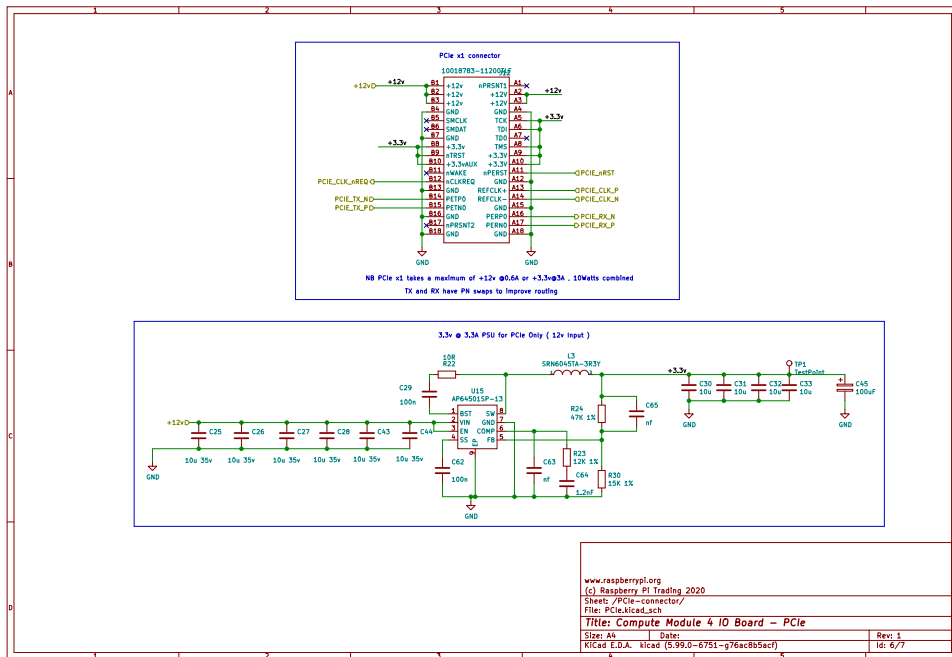Figure 4. CM4 high speed
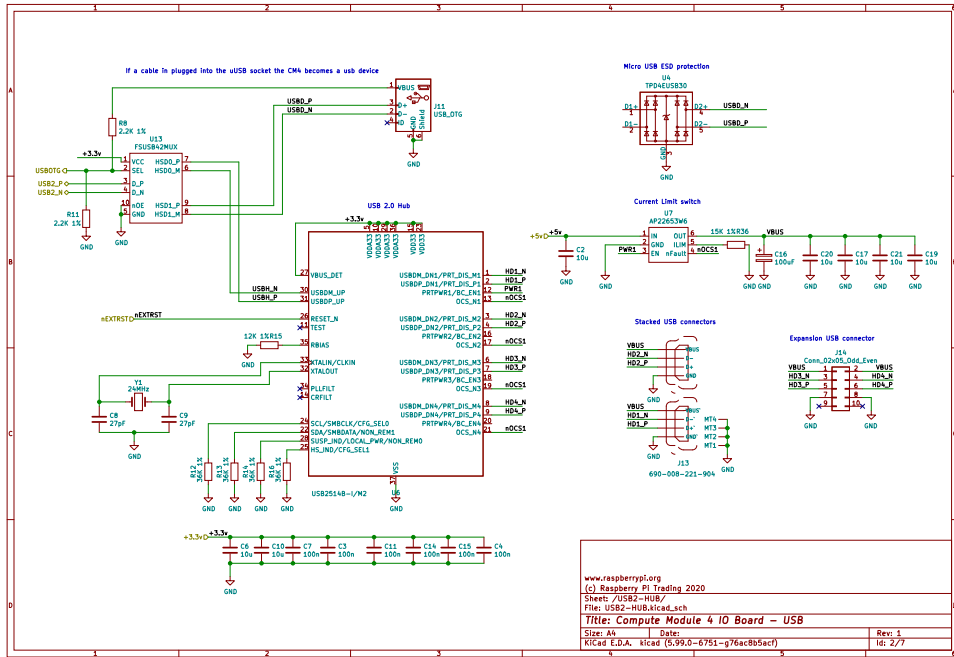
*Figure 5. CM4 GPIO*



*Figure 6. PCIe connector*

*Figure 7. USB2 hub*
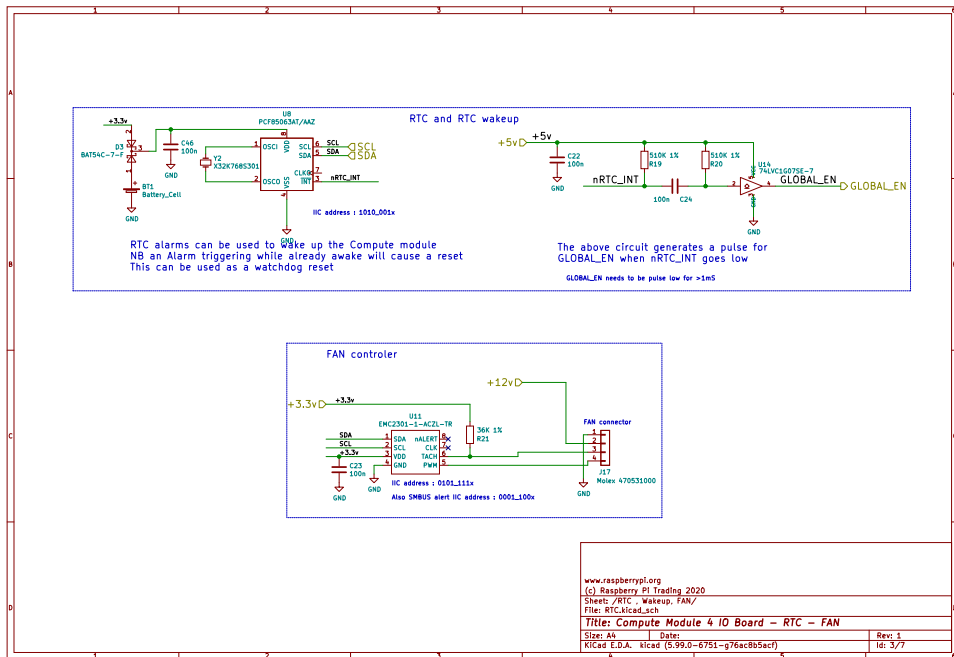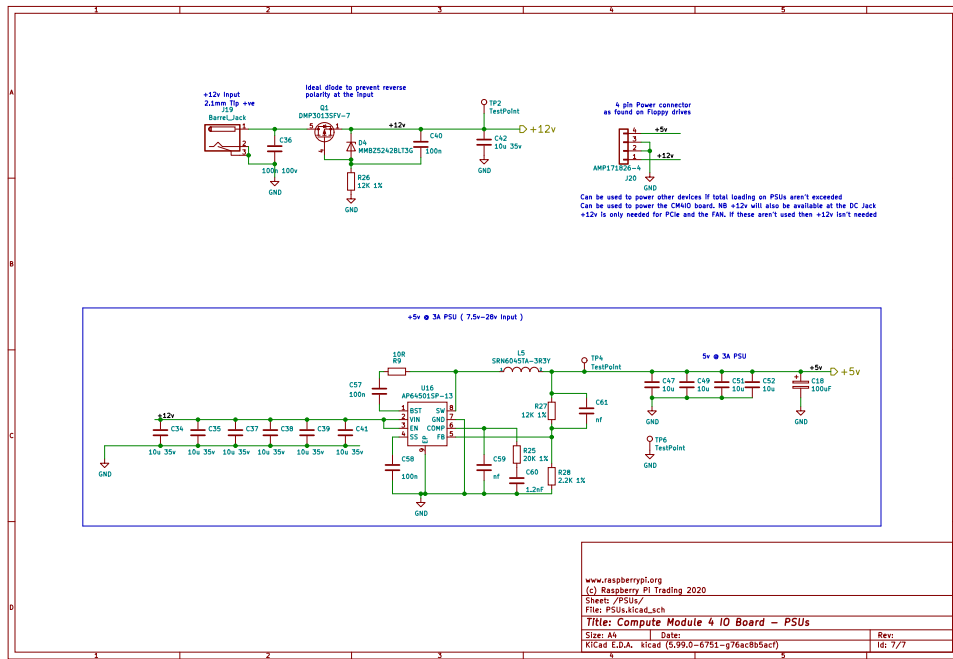


*Figure 8. RTC wakeup and fan*

*Figure 9. PSU*