UcPi

UcPi 2025

Universal Ultracapacitor Power Supply for Raspberry Pi

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A. Introduction

UcPi is a high performance low cost 5V universal Raspberry Pi ultracapacitor power supply. It was specially designed for all Raspberry Pi audio applications to achieve better sound quality by improving the power supply quality. UcPi uniquely uses spring contacts to power to the RPi GPIO directly from the bottom side of the PCB, so the installation becomes very easy. UcPi can also be used as a seat base of an audio project with anti-vibration spike feet and the possible rubber ring suspensions. Any existing RPi audio projects can be upgraded by the UcPi right away by just simply installing the HAT stack on top of it. UcPi will be in fully finished with ultracapacitors pre-installed as shipped.

B. Features and Specifications

- 5V ultracapacitor power supply with two ultracapacitors pre-installed.

- Specially designed gold-plated spring contacts to power a Raspberry Pi directly to GPIO from the bottom side of PCB without any additional connections

- Works as a seat base of the whole project. Anti-vibration spike feet can be installed. And the rubber ring suspensions are also possible to be installed.

- Uses a standard 5V, 2.5A or higher current USB-C power supply as input.

- On-board power ON/OFF control switch. This switch can also be extended as an external ON/OFF switch.

- Optical isolator controlled ultra-low ESR MOSFETs are used to eliminate any possible leakage current and ripple voltage

- Built-in active balancers for ultracapacitor protection.

- Low cost but no compromise on performance

- Upgrade any existing Raspberry Pi audio projects right away by just simply installing them on top of the UcPi

C. UcPi 2025 New Features

- Optimized for the new RaspberryPi 5 and all other RaspberryPi generations.

- Hybrid Ultracapacitor and Polymer capacitor power supply cleaning/filtering technology.

- Upgraded to higher performance 120F/3V ultracapacitors for 20% greater capacity than the previous version.

- 20% lower ESR for higher current applications.

- Higher current output terminal connector.

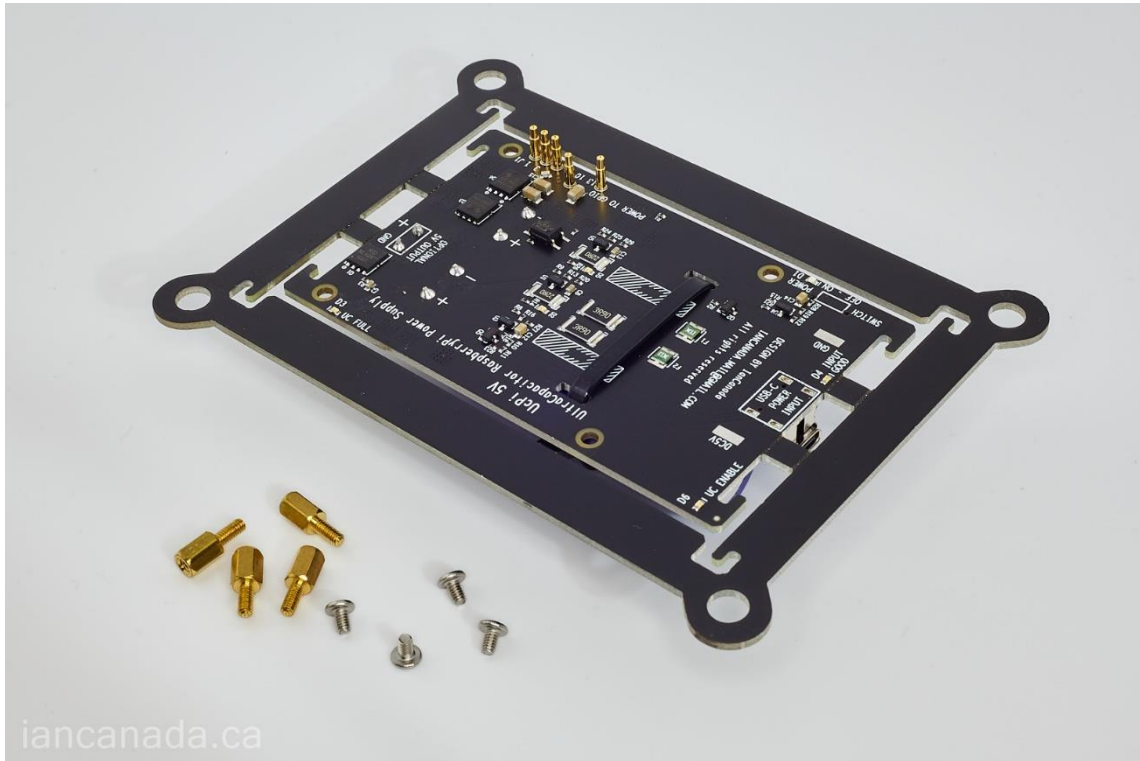- Input power supply wires other than USB-C can be soldered directly to the PCB.

D. Layout and Diminsions (in mm)
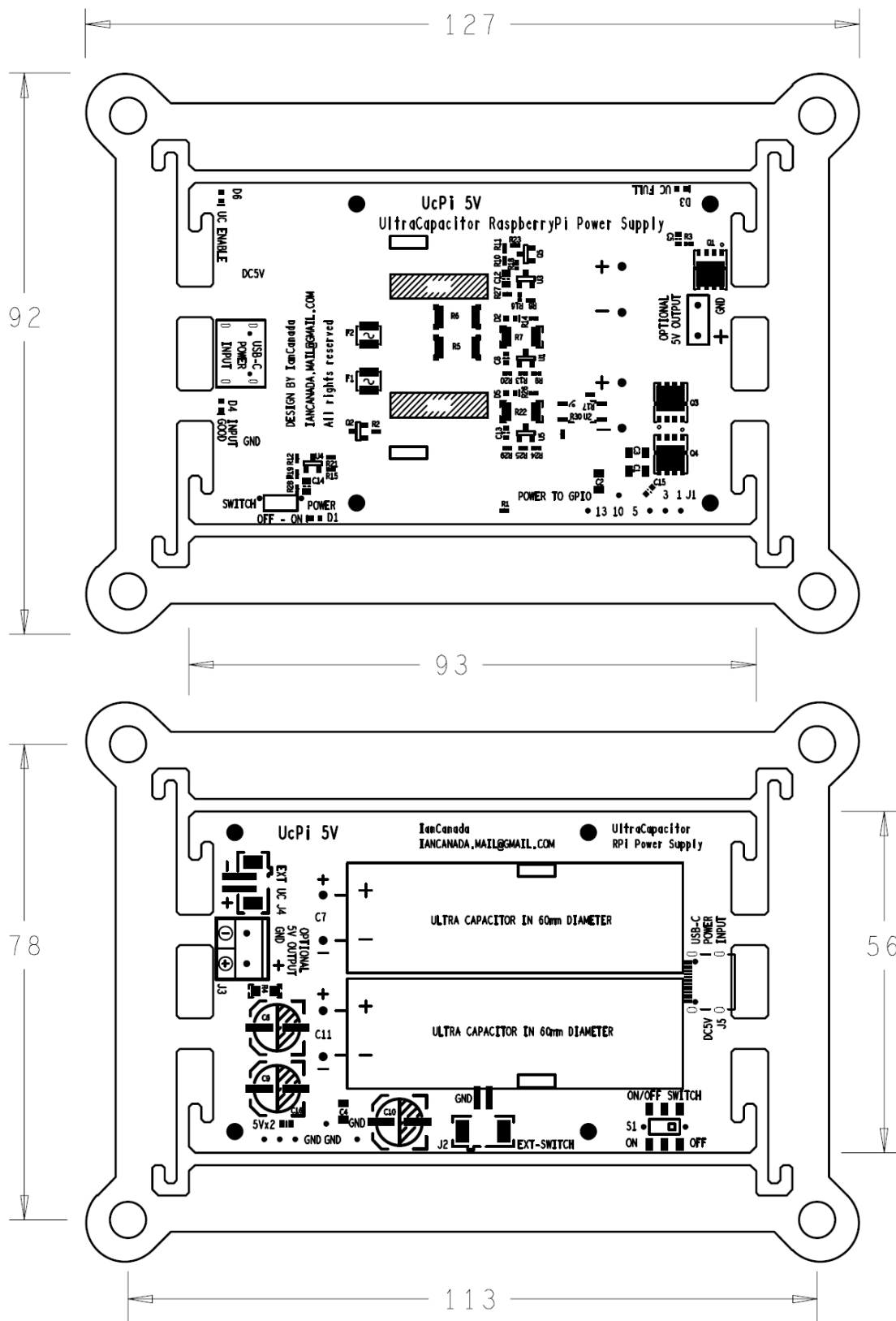
E. UcPi KIT

#47A UcPi 2025

#47A0 UcPi

UcPi/2025 as shipped (bottom side)
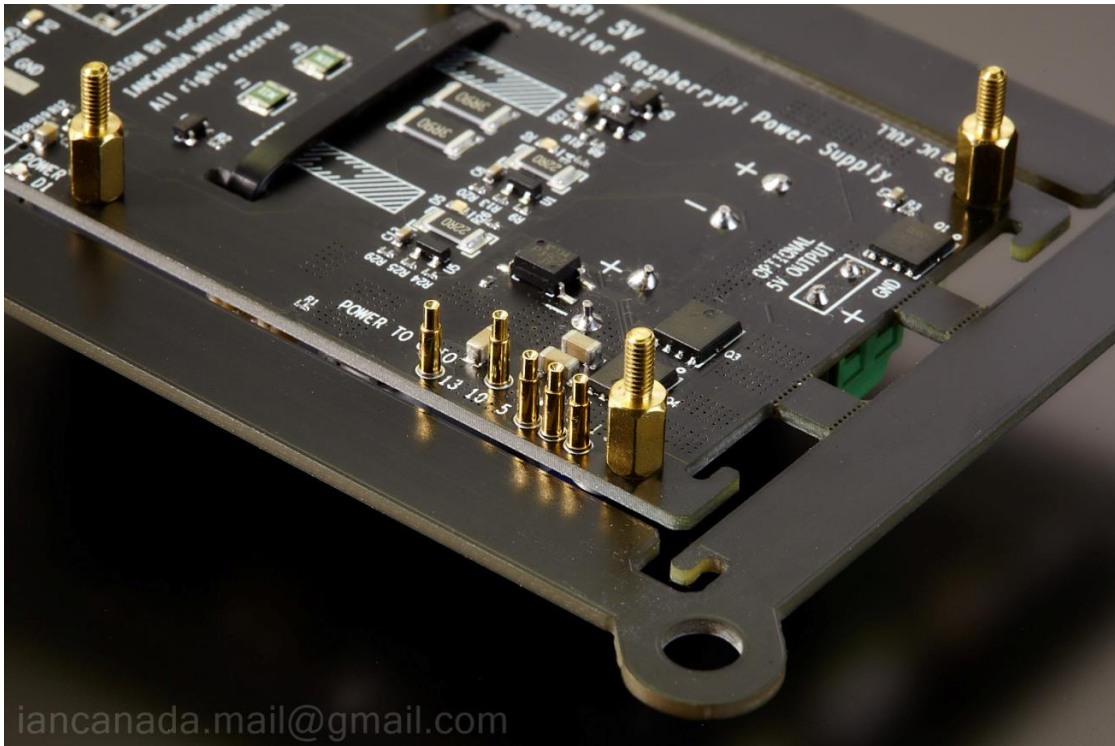
Kit includes:

UcPi or UcPi 2025 (fully finished with ultracapacitors pre-installed)

4 of 7 mm M2.5 standoffs

4 of M2.5 screws

F. Getting started

1. Install 4 M2.5 standoffs to the UcPi. You will need the 6mm standoffs (sold separately,#12D) if have a Raspberry Pi5. Otherwise, please use the supplied 7mm standoffs.

2. Install your Raspberry Pi on top of the UcPi through the standoffs. And then, install another 4 standoffs (11mm/M2.5, come with other KIT or user prepare) to fix the RPi at the stack. Make sure the five spring contacts are touched properly to the GPIO pins at the bottom side of the Raspberry Pi PCB.
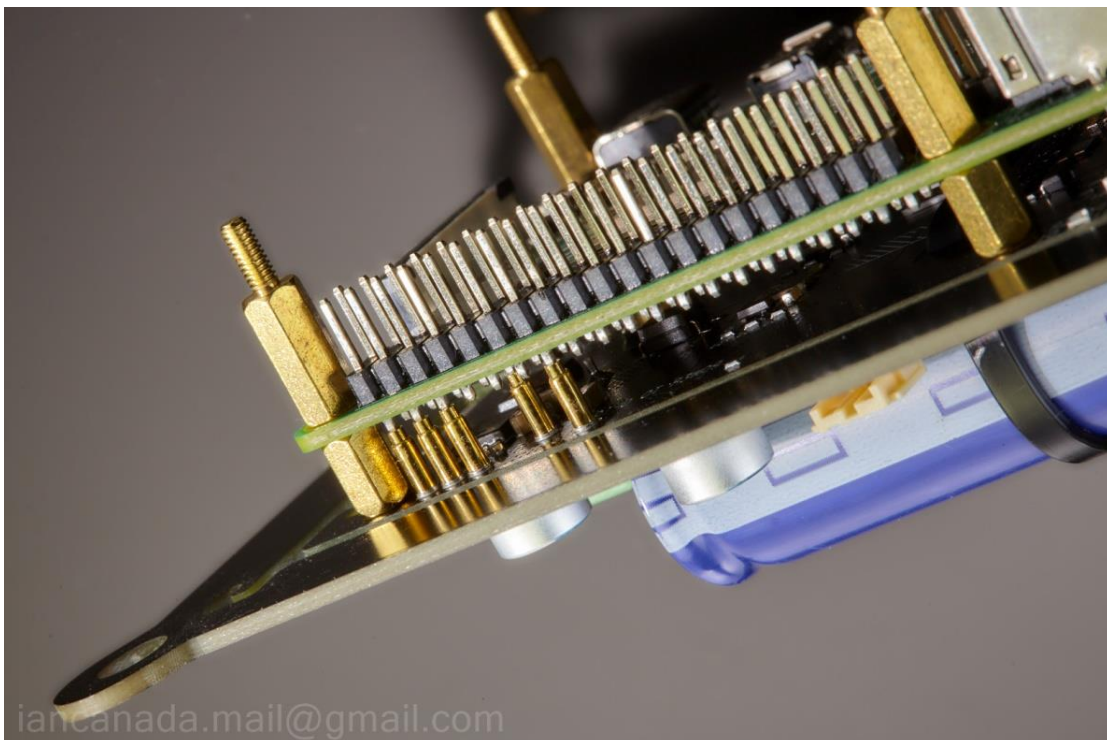
3. Install the other audio HATs of your project on top of the Raspberry Pi.

    (May need 11mm to 13mm standoffs according to the height of their GPIO connectors)
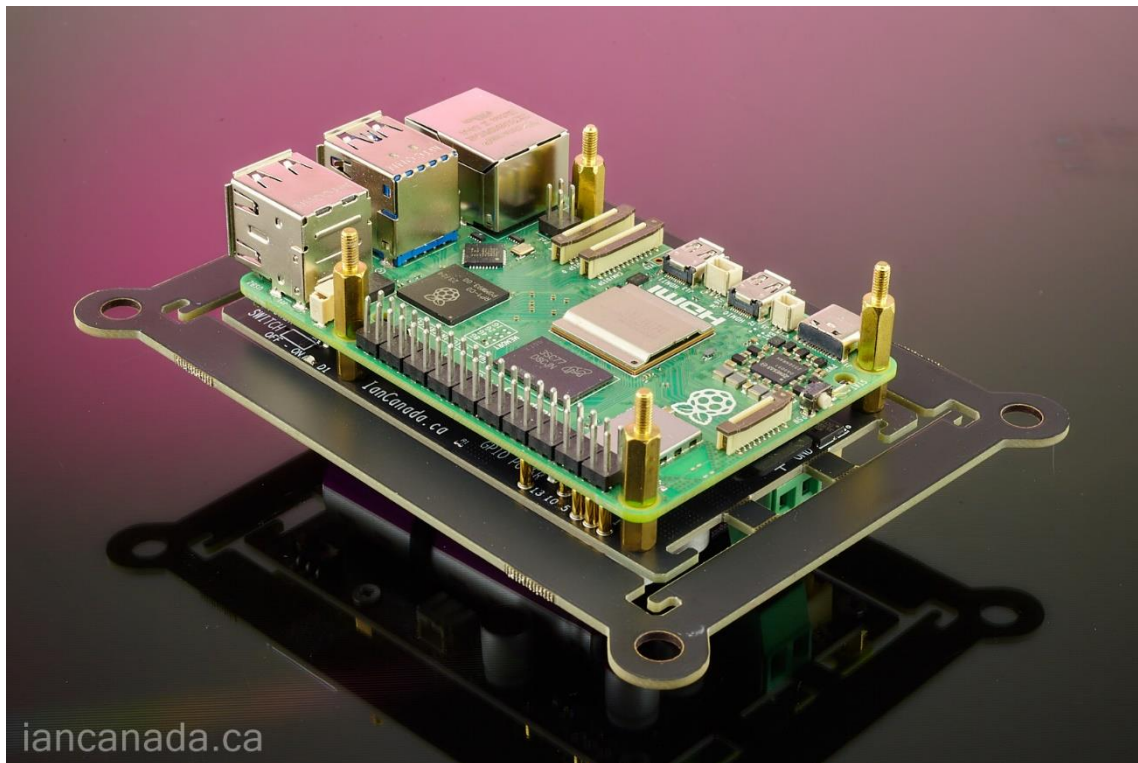
4. Connect a standard 5V USB-C power adapter with 2.5A or higher rated current to DC input J5 of the UcPi. The DC input indication LED D4 will light up shortly, or flash for a while before lit up.

5. If it is the first time using the UcPi, or without powering it for a long time, please wait for 10 to 20 minutes until Uc Full LED D3 lights up. Then turn the power switch S1 to the ON position. Both power on LED D1 and Uc Enable LED D6 will be lit up.

6. Make sure your PRi is running properly.

7. Enjoy the music.

8. Turn S1 to the OFF position when finish.

Tips:

1. It's strongly advised to leave the DC input always connected to J5, so that the ultracapacitors can keep fully charged at any time when it turned on.

2. If D4 doesn't light up when USB power input is plugged, it means either the USB power cable is too long or the USB power adapter doesn't have enough output current. If that's the case, please replace with a good USB power cable or the power adapter to fix the issue. Or, just wait to see if it is light up after ultracapacitors are fully charged.

G. Connectors

J5: DC power input connector in USB-C

A standard 5V USB-C power adapter with higher than rated 2.5A current must be connected to this connector to function. Recommend use a 5A USB-C adapter when works with a RPi5.

J1: 5V ultracapacitor power output in spring contacts

1, 3: 5V
5, 10, 13: GND

This is the main output of UcPi. This output will be turned on and off when ON/OFF switch is turned on or off. It designed to connect to the GPIO of a RaspberryPi directly from the bottom side.

J3: Additional 5V ultracapacitor output in 5mm terminal block

J3 internally connected to the same 5V output of J1. This output can be used as additional 5V output if application requires.

J2: External on/off control switch connector, in 2-pin PH2.0 connector

External on/off control switch is functionally equivalent to the on-board switch S1.
To use the external on/off control switch, On-board switch S1 must be at off position.
External on/off switch is not supplied in the package.

J4: External ultracapacitor connector in 2-pin PH2.0

1: Ultracapacitor –
2: Ultracapacitor +

Though it is not recommended but if you really want to increase the ultracapacitor capacity of a UcPi, you can install an external ultracapacitor pack to this connected. But it has to be very very careful:

1. The external ultracapacitor pack must in 5.4V or higher rated voltage
2. **Both internal and the external capacitors have to be discharged (by a 3-20 ohm power dump resistor) completely before connect to J4.**
3. The pre-charge time of UcPi can be longer than before.

Power input pads

1: DC5V
2: GND

Power wires can be soldered directly to the two pads if you want to use 5V power input other than the USB-C.

H.   LED indicators

D4: Power INPUT GOOD indicator. it Indicates that the power input is connected and the voltage is higher than 4.8V.

D1: Power ON indicator. Indicates that the UcPi is turned on and output voltage is applied to J1 and J3.

D6: Ultracapacitor enabled indicator. When lit, it indicates that the ultracapacitors are fully charge and applied to the output in conditioning mode. If this LED is off when power on, it means that the voltages over ultracapacitors are not enough to be enabled for output. They still need to be charged more.

D3: UC FULL indicator. Indicating that the ultracapacitors are fully charged.

D2, D5: Ultracapacitor over voltage indicators. It means that the voltage of corresponding ultracapacitor is higher than 2.7V. Normally the on-board balancers can fix this issue automatically, but it may take overnight.
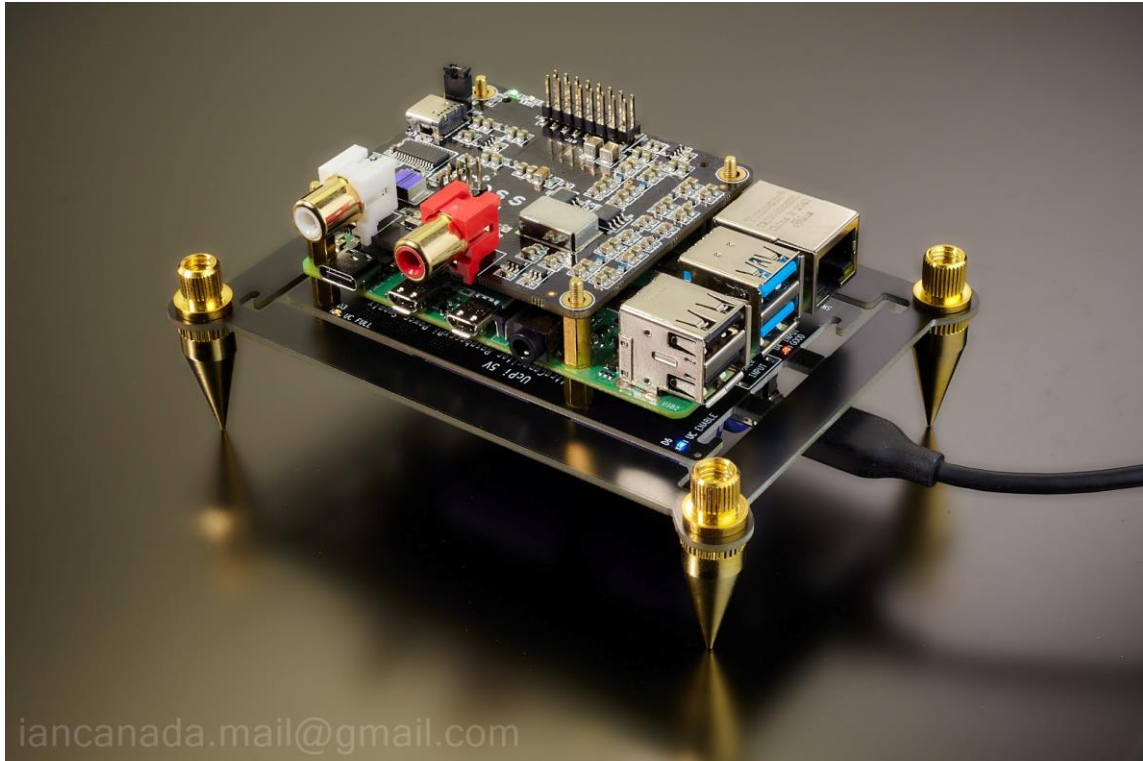
I.   UcPi example projects

1. Low cost audiophile grade ultra-low jitter Raspberry Pi streamer transport
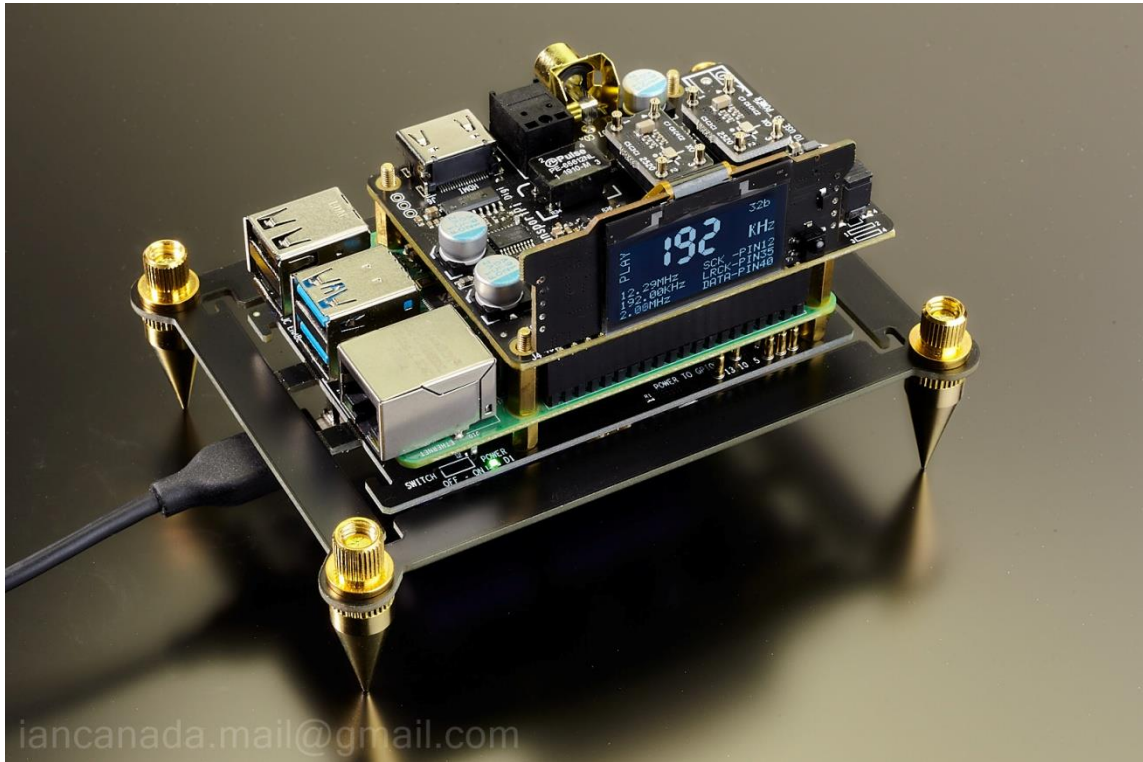
Project includes:

(1). UcPi/2025

(2). Raspberry Pi

(3). TransportPi Digi (In master mode, with XO sockets, has RCA, OPT and I2S over HDMI outputs)

(4). MonitorPi/Pro (optional)

2. Upgrade a standard Raspberry Pi DAC with an UcPi/2025

UcPi/2025 **+** Raspberry Pi **+** Boss DAC

3. Upgrade Audiophonics I-Sabre ESS DAC with an UcPi/2025

4. Upgrade a standard Raspberry digital interface streamer with an UcPi/2025

UcPi/2025 + Raspberry Pi + Hifiberry Digi Pro digital interface

J. Application notes

1. Safety notes

Once charged, the ultracapacitors will store energy even UcPi is switched at the OFF position. Please be very careful during installation to prevent from short the circuit, especially when using the metal tools.

2. Can I use linear 5V power supply as the DC input?

Yes, you can. A linear power supplies with 2.5A or higher rated output current are always preferred for much lower noise levels. LinearPi Pro 5V or LinearPi 5V are highly recommended. You can use a USB-C cable to connect them directly. Other qualified high current linear power can also be used.

3. Where can I buy the spike feet?

Spike feet kit can be found at IanCanada.ca or Amazon.

https://iancanada.ca/products/22b-high-quality-spike-feet-kit-lot-of-4

https://www.amazon.com/Tihebeyan-Isolation-Shockproof-Amplifier-Turntable/dp/B07TVP547J/ref=sr_1_7?crid=2LTB2SSHUQBI5&keywords=spike+feet+kit&qid=1657989109&sprefix=%2Caps%2C76&sr=8-7

4. How to install the anti-vibration rubber ring suspensions?

Rubber ring suspensions help the XO oscillators to improve phase noise performance by reducing mechanical vibration. It is possible to implement this solution on an UcPi. To do so, you will need:

a. Break the UcPi PCB form the frame.

b. Hook up 4 rubber o-rings (5x2 or similar) between the frame and the UcPi. (O-rings can also be found at Amazon)

Note: Please don't break the UcPi PCB unless you really decide to.