

ShieldPi Pro

Multi-functional Raspberry Pi EMI shield / power filter HAT

IanCanada

Oct. 25, 2022 Ver 1.0b



A. Introduction

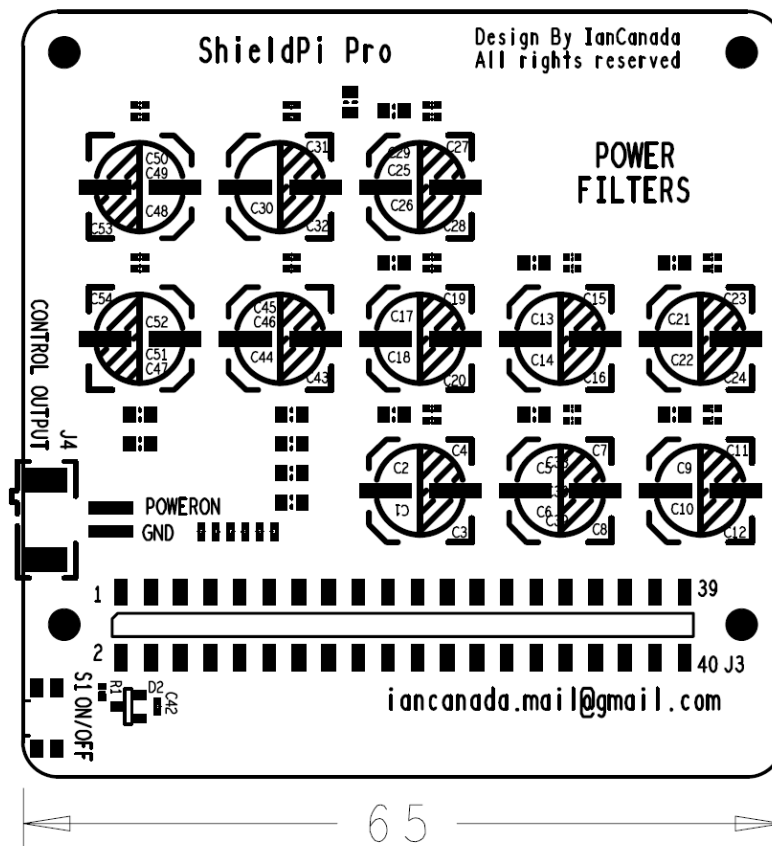
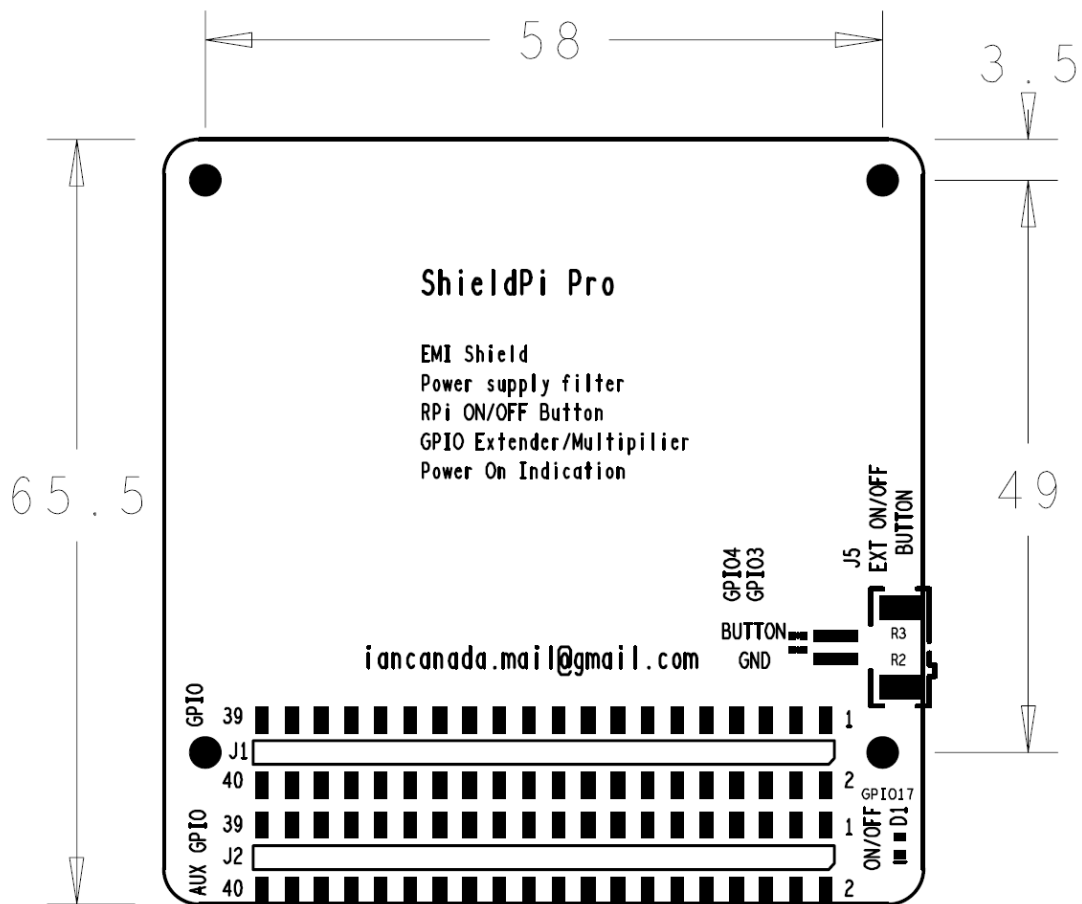
ShieldPi Pro is not only a universal Raspberry Pi EMI shield HAT, but also a high-performance power supply filter, an ON/OFF control button and a GPIO extender/multiplier. IR-remote control function can also be implemented when working together with a MonitorPi.

ShieldPi Pro is suitable to all RaspberryPi applications to reduce both EMI noise and power supply noise. Improvement can be made right away by just installing it into the system.

B. Highlighted Features and Specifications

- Zero current single-point grounding shield plate to eliminate EMI noise of the Raspberry Pi
- Ultra-low ESR wide bandwidth 5V power supply filtering networks cover the frequency range up to GHz
ESR: $2\text{m}\Omega@200\text{KHz}$, $0.3\text{m}\Omega/@2\text{Mhz}$, $1\text{m}\Omega@20\text{MHz}$, $4\text{m}\Omega/@200\text{MHz}$
- Full 40 pins GPIO extender
- Full 40 pins GPIO multiplier (AUX GPIO)
- Has a Raspberry Pi GPIO power ON/OFF button and a connector to external power button
- Has an optional power on indication LED and a power on/off control signal output
- Can implement Raspberry Pi's IR-remote control function when working with a MonitorPi
- Reduce both EMI noise and power supply noise
- Improve Raspberry Pi application's performance to a higher level
- DIY friendly and plug and play

C. Layout and Dimensions (in mm)



D. Getting start

1. Make sure your RaspberryPi system hardware and software are configured well and working properly.
2. Install the ShieldPi Pro J3 into the GPIO connector of the RaspberryPi. Please use the 11mm standoffs.
3. Install the rest of HATs into the GPIO port J1 on top of the ShieldPi Pro.
4. Install the MonitorPi into the AUX GPIO J2 of the ShieldPi Pro (optional).
5. Power the system as usual.
6. Enjoy the music.



E. Connectors and other resources

J3: GPIO socket

J1 need to be installed into the Raspberry Pi GPIO connector.

J1: GPIO connector

J2 is the extension of the RaspberryPi GPIO port. DAC or other HATs need to be installed into this GPIO connector.

J2: AUX GPIO connector

J2 is a duplicated RaspberryPi GPIO port. A MonitorPi or other required HAT can be installed into this connector.

S1: Power ON/OFF button

RaspberryPi can be turned on or safe shutdown by just pressing this button (may need software support).

J5: External ON/OFF button connector

J5 is functionally equivalent to S1. An external button can be connected to this connector to perform the same ON/OFF control function. J5 is a 2pin PH2.0mm connector.

D1: Power status LED

D1 is designed to indicate the power on/off status. This function needs to be enabled by the software.

J4: Connector of the power ON/OFF control output

J4 is the designed as a control signal for the DAC power supply or other audio power supply. J4 is logically equivalent to power status LED D1. It should keep logic high when power is on. J4 is a 2pin PH2.0mm connector.

F. Operating principle

ShieldPi Pro is designed in two side surface mounted PCB.

The top side, or we call it the audio side is a pure shield layer. This layer is a whole piece of single-point grounded copper plate. Because of there is no any current going through this shield layer, the EMI noise from Raspberry Pi will be blocked without introducing into the audio HATs through the space in between.

The bottom side, or we call it the Pi side is the wide bandwidth power supply filtering network to improve Raspberry Pi power supply dynamic response and lower the noise. This filtering network uses the combination of polymer, and NP0 capacitor groups to achieve an ultra-low ESR performance over a wide frequency range extended GHz.

With a ShiledPi Pro installed in the system, both EMI noise and power supply noise will be reduced. Therefore, improvements can be expected.

To perform a safe power on and shut down function, ShiledPi Pro is integrated with a Raspberry Pi GPIO power on/off button and power status LED. The power on control wire is connected to GPIO3 (or PIN5, the Raspberry Pi default power on GPIO pin), while the power off control wire is connected to GPIO4 (PIN7). The power indication LED D1 is connected to GPIO17 (PIN11)

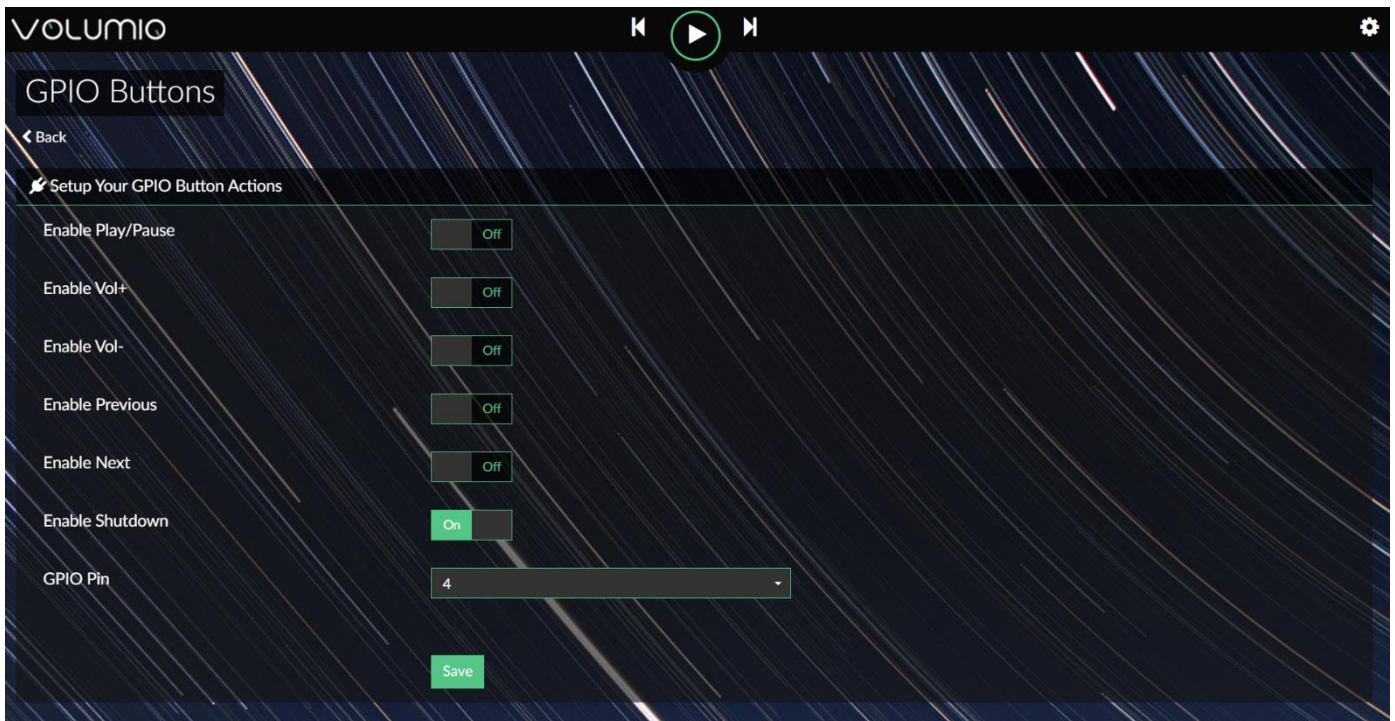
The RaspberryPi IR-remote control function can also be implemented if a MonitorPi is installed into the AUX GPIO connector J2. The IR receiving signal will be connected to GPIO25 (PIN22).

G. How to enable the GPIO power on/off button

The GPIO power on function is enabled by default. The RaspberryPi can be turned on when press the button S1 after it was shut down in the software.

However, the S1 safe shut down button function has to be enabled in the software. Take an example, if we use Volumio, we can do it in this way:

1. Install the GPIO buttons plugin.
2. Config this plugin settings as below.



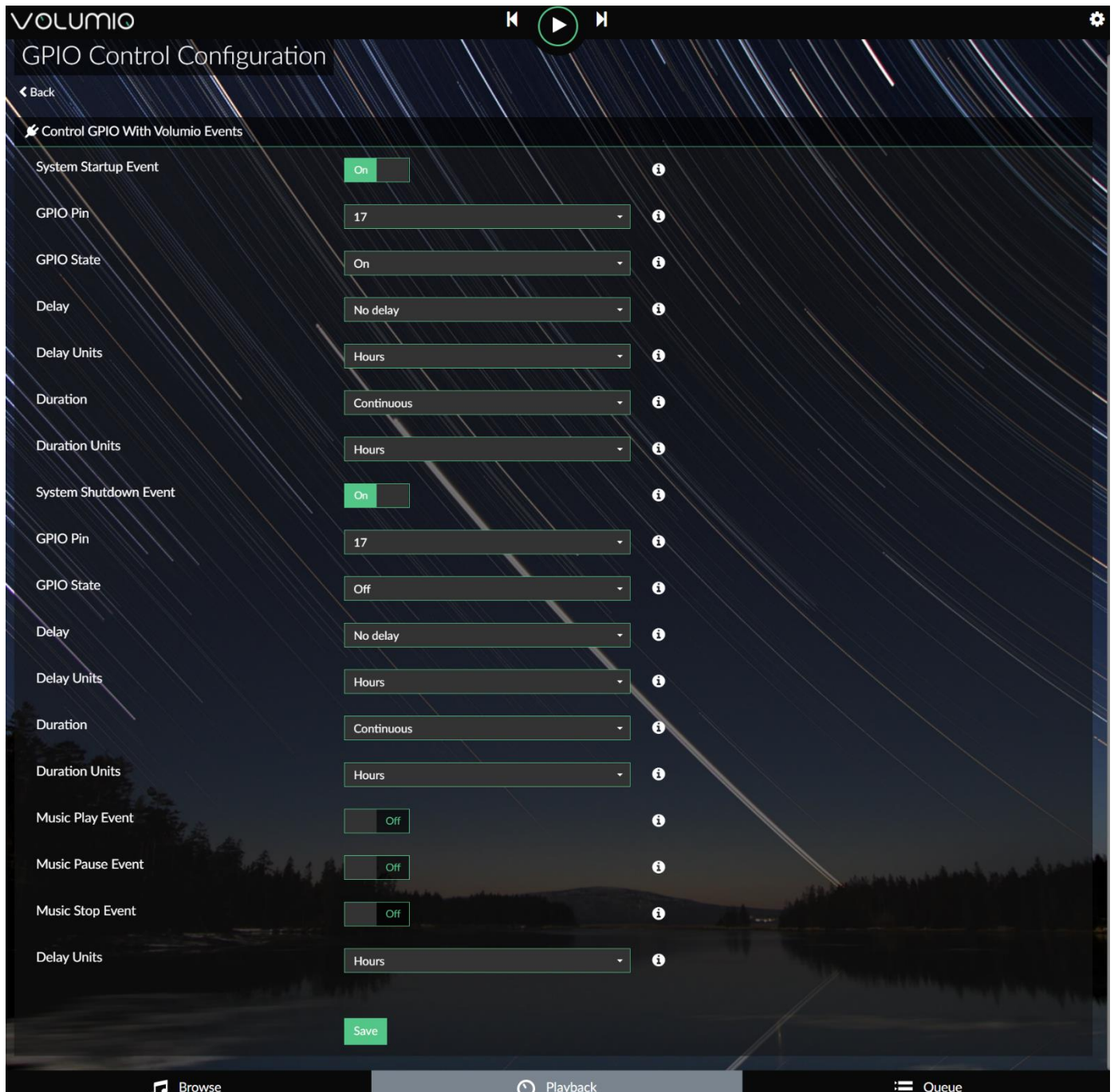
Please note:

1. Please use the latest version RaspberryPi with the most updated bootloader to ensure this function.
2. The settings of other player software could be differently. Please inquire the software supplier if need help.
3. The green LED on the RaspberryPi will start to flash when press the button to turn on, and it will stay off after a safe shut down.

H. How to enable the power status LED

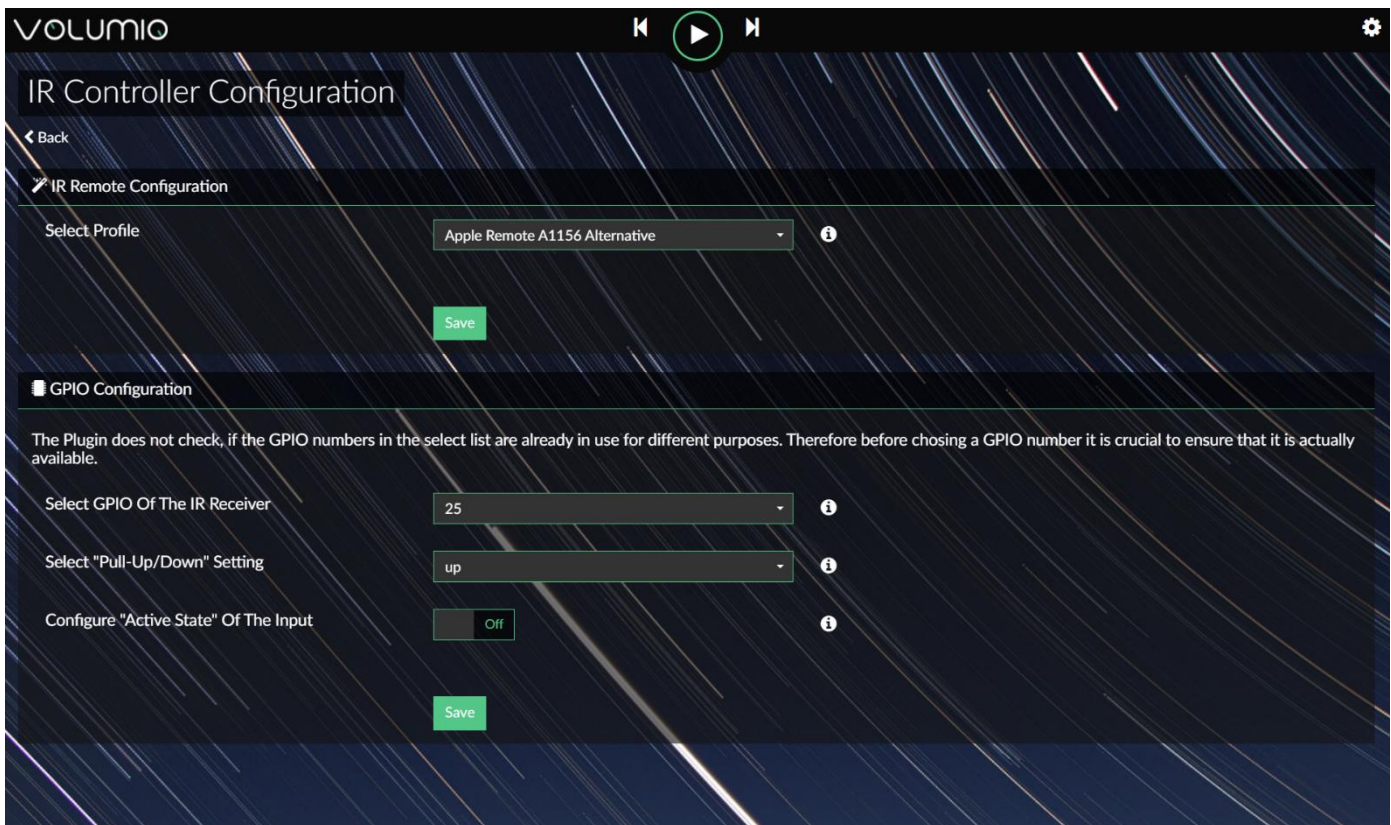
The power status LED D1 has to be enabled in the software. Take an example, if we use Volumio, we can do it in this way:

1. Install the GPIO control plugin.
2. Config this plugin settings as below.



I. How to enable the IR-remote controller function

1. Install a MonitorPi into the AUX GPIO connector J2
2. If use Volumio software, we need to install the IR Remote Controller plugin.
3. Config this plugin settings as below.



The screenshot shows the Volumio web interface with the 'IR Controller Configuration' screen. At the top, there's a 'VOLUMIO' header and navigation icons. The main title is 'IR Controller Configuration'. Below it, there's a 'Back' button and a 'Pencil' icon for editing. The 'IR Remote Configuration' section has a 'Select Profile' dropdown menu set to 'Apple Remote A1156 Alternative' with an information icon. A green 'Save' button is below it. The 'GPIO Configuration' section has a warning message: 'The Plugin does not check, if the GPIO numbers in the select list are already in use for different purposes. Therefore before choosing a GPIO number it is crucial to ensure that it is actually available.' It contains three settings: 'Select GPIO Of The IR Receiver' set to '25', 'Select "Pull-Up/Down" Setting' set to 'up', and 'Configure "Active State" Of The Input' set to 'Off' (via a toggle switch). Each setting has an information icon. A green 'Save' button is at the bottom.

Please note, the IR-remote controller will not work if wrong profile is selected. For the Apple aluminum remote controller, we need to select the **A1156 Alternative**. For other remote controller, we need to select the profile accordingly. You can also try different profiles until the remote controller works.

J. Application examples

1. Upgrade the high performance Audiophonics I-Sabre ES9038Q2M DAC

Components

- (1). Audiophonics I-Sabre ES9038Q2M DAC
- (2). ShieldPi Pro
- (3). MonitorPi (optional)
- (4). Raspberry Pi

Power supply

UcPi 5V ultracapacitor power supply (optional)



2. Improve the ultra-low jitter TransportPi Digi network streamer transport

Components

- (1). TransportPi Digi
- (2). ShieldPi Pro
- (3). MonitorPi (optional)
- (4). Raspberry Pi

Power supply

UcPi 5V ultracapacitor power supply (optional)



3. Upgrade a standard RaspberryPi DAC

Components

- (1). BOSS PCM5122 DAC or other Pi DACs
- (2). ShieldPi Pro
- (3). MonitorPi (optional)
- (4). Raspberry Pi



4. Upgrade a simple RaspberryPi DAC or digi interface

- (1). Hifiberry DAC+ Pro (or Hifiberry Digi+)
- (2). ShieldPi Pro
- (3). Raspberry Pi



© 2022 IanCanada. The firmware code embedded in the ShieldPi Pro is the property of Ian Jin. You are granted a non-exclusive, non-transferable, non-sublicenseable, royalty-free right to use the ShieldPi Pro board solely for your own, non-commercial purposes. You may not distribute, sell, lease, transfer, modify, adapt, translate, reverse engineer, prepare derivative works of, decompile, or disassemble the software provided. All rights reserved.