# ShieldPi Pro

# ShieldPi Pro MkII

# Multi-functional Raspberry Pi EMI shield / power filter HAT

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## 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 RespberryPi applications to reduce both EMI noise and power supply noise. Improvement can be made right away by just installing it into the system.
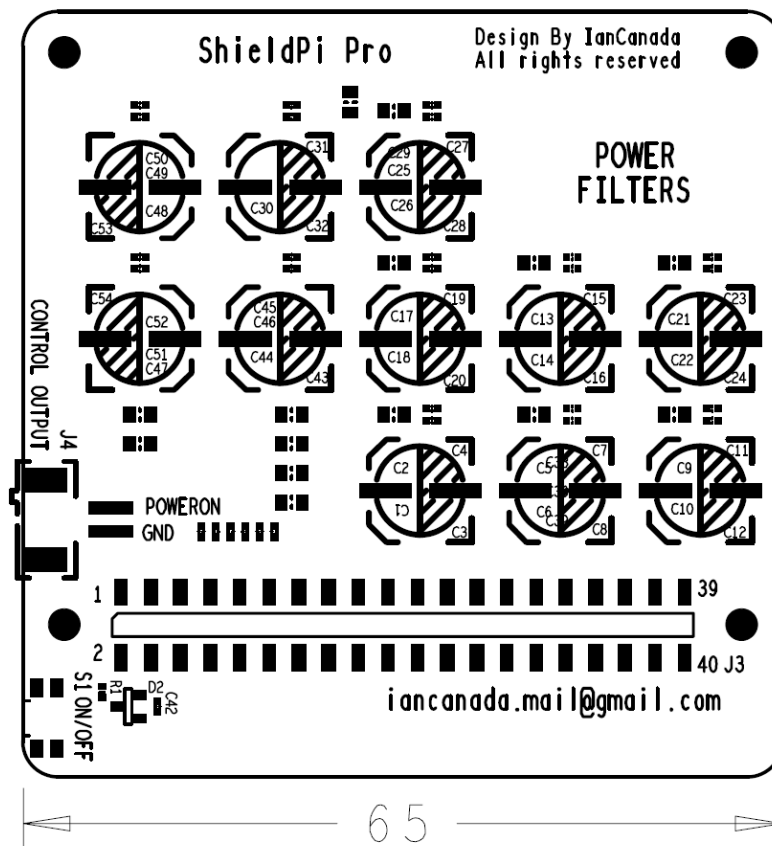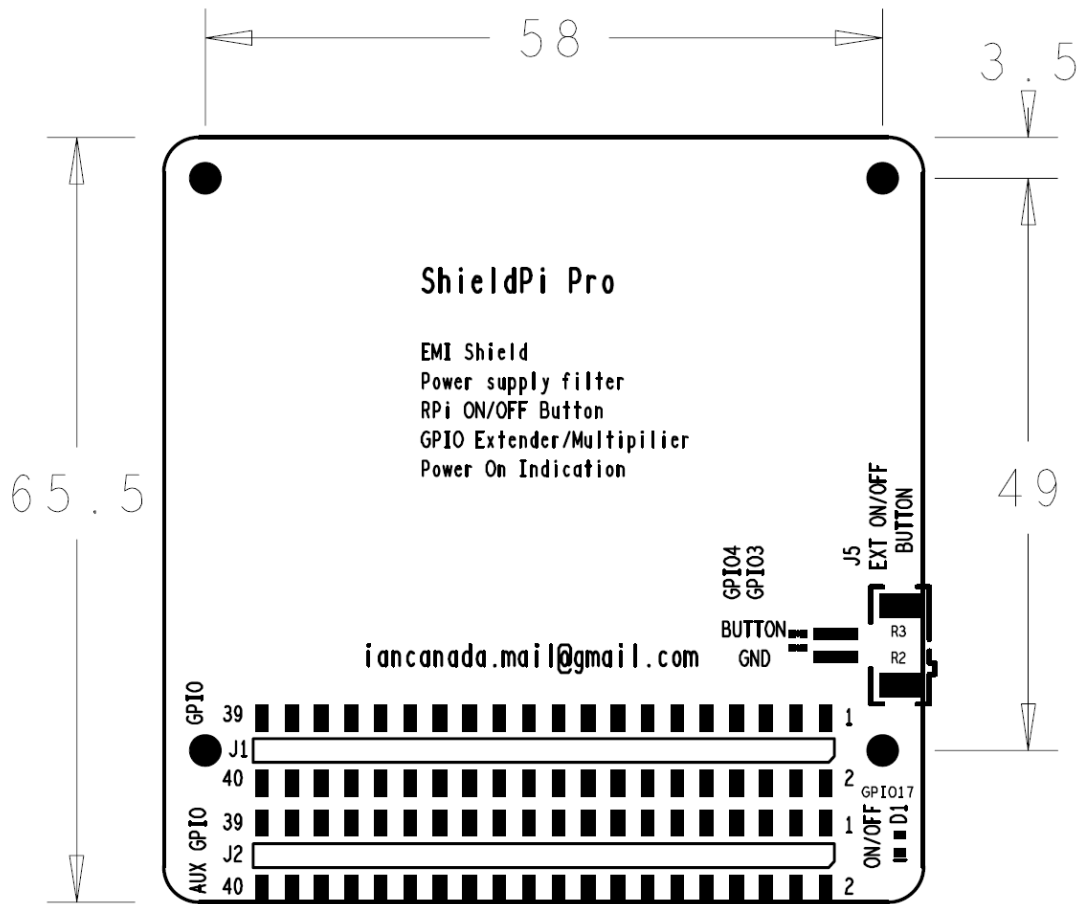
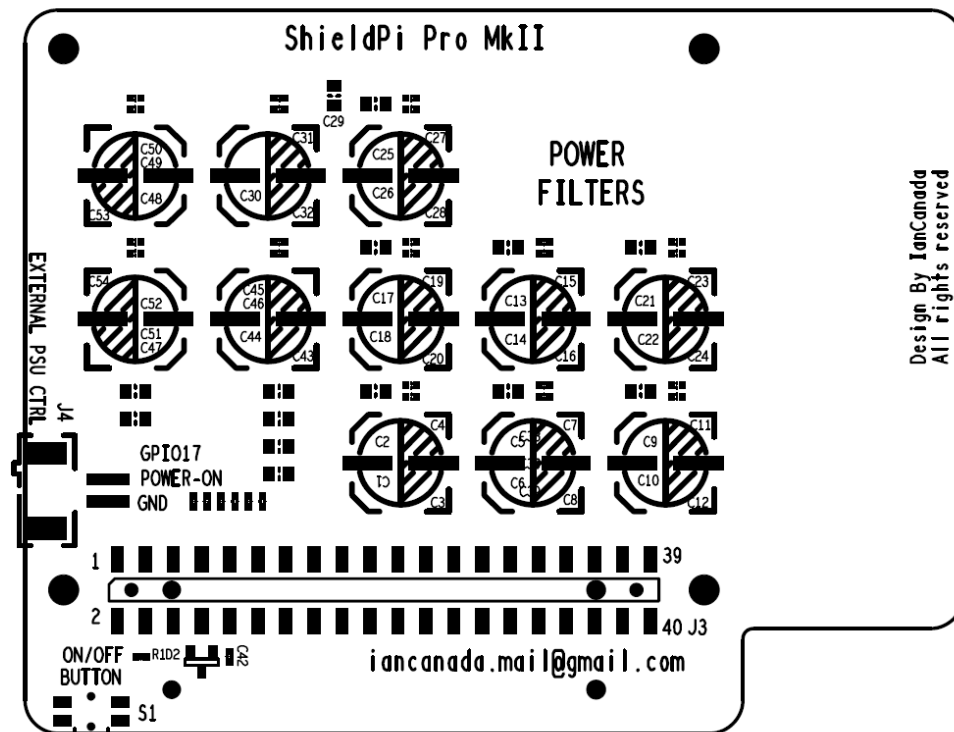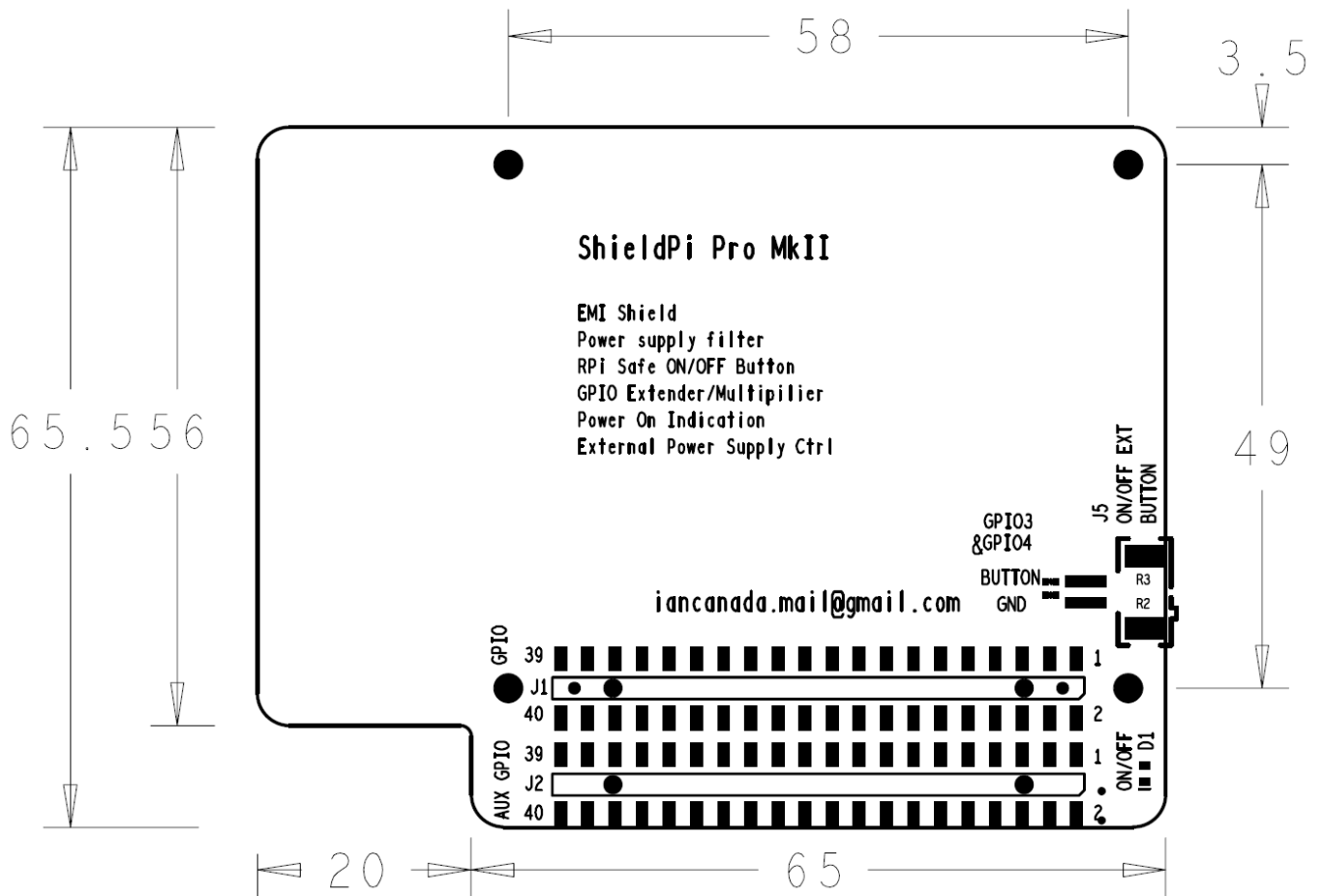## B. Highlighted Features and Specifications

- 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: 2mΩ@200KHz, 0.3mΩ/@2Mhz, 1mΩ@20MHz, 4mΩ/@200MHz

- 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. ShieldPi Pro MkII new features

- Full size shield HAT that can cover the whole Raspberry Pi PCB area

- Better EMI suspension performance will be expected

- High profile GPIO connector makes it possible to work with RPi that is equipped with a heatsink

- ON/OFF button moved to the front edge of PCB to make it easier to operate

## D. Layout and Dimensions (in mm)

**58**

**3.5**

**65.5**

**49**

## ShieldPi Pro

EMI Shield
Power supply filter
RPi ON/OFF Button
GPIO Extender/Multipilier
Power On Indication

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GPIO4 GPIO3

BUTTON
GND

J5 EXT ON/OFF BUTTON

R3
R2

GPIO
39  J1  1
40  2  GPIO17
AUX GPIO
39  J2  1  ON/OFF  D1
40  2

## ShieldPi Pro

POWER FILTERS

C50 C49 C48 C53
C31 C30 C32
C29 C27 C25 C26 C28

CONTROL OUTPUT J4

C54 C52 C51 C47
C45 C46 C44 C43
C17 C19 C18 C20
C13 C15 C14 C16
C21 C23 C22 C24

POWERON
GND

C2 C1 C3
C5 C4 C6 C8
C9 C11 C10 C12

S1 ON/OFF
R1  D2 C42

1  39
2  40  J3

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**65**

**58**     **3.5**

**65.556**

## ShieldPi Pro MkII

EMI Shield
Power supply filter
RPi Safe ON/OFF Button
GPIO Extender/Multipilier
Power On Indication
External Power Supply Ctrl

**49**

J5 ON/OFF EXT BUTTON

GPIO3
&GPIO4

BUTTON
GND

R3
R2

GPIO

39
J1
40

1
2

AUX GPIO

39
J2
40

1
2

ON/OFF D1

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**20**     **65**

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## ShieldPi Pro MkII

POWER
FILTERS

C29
C31
C50 C49 C48
C53
C30 C32
C25 C27
C26 C28

C54
C52
C51 C47
C45 C46
C44 C43
C17 C19
C18 C20
C13 C15
C14 C16
C21 C23
C22 C24

EXTERNAL PSU CTRL

J4

GPIO17
POWER-ON
GND

C2
C1 C3
C5 C7
C6 C8
C9 C11
C10 C12

1
2

39
40 J3

ON/OFF
BUTTON

R1 D2
C42

S1

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## E. Pictures



ShieldPi Pro



ShieldPi Pro MkII

## F. 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.



## G. 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 Raspberry Pi GPIO port. DAC or other HATs need to be installed into this GPIO connector.

**J2: AUX GPIO connector**

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

**S1: Power ON/OFF button**

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

**J4: External ON/OFF button connector**

J4 is functionally equivalent to S1. An external button can be connected to this connector to perform the same ON/OFF control function. J4 is a 2pin PH2.0mm connector.
*Note: PCB silk screen could be wrong.

**D1: Power status LED**

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

**J5: External power supply ON/OFF control signal output**

J5 is the designed to control the on/off of an external power supply, such as a DAC power supply. J5 is logically equivalent to power status LED D1. It should keep logic high when power is on. J5 is a 2pin PH2.0mm connector.
*Note: PCB silk screen was wrong to "ON/OFF EXT button"

## H.  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).

### I. How to enable the RaspberryPi safe shutdown/ power on button?

The GPIO power on function is enabled by default. The Raspberry Pi can be turned on at any time when press the button S1 after it was shutdown.

However, the S1 safe shutdown button function has to be enabled in the software. To implement, you will need to edit the file /boot/config.txt on the SD image, adding a new line to the end, then save the config.txt file.

**dtoverlay=gpio-shutdown,gpio_pin=4**

There are many ways to edit the config.txt, but the simplest way is directly open the config.txt file on a PC using a SD card reader.

Note: Please use the latest version Raspberry Pi with the most updated bootloader to ensure this function.

### J. How to enable the power status LED and external power supply on/off control signal?

To enable this function, you just need to edit the /boot/config.txt again, adding a new line to the end, then save the config.txt file.

**gpio=17=op,dh**

Once enabled, we can use J4 to control the external power supply, such as LifePO4 power supply, LifePO4 Mini, LinearPi, UcPure and so on.
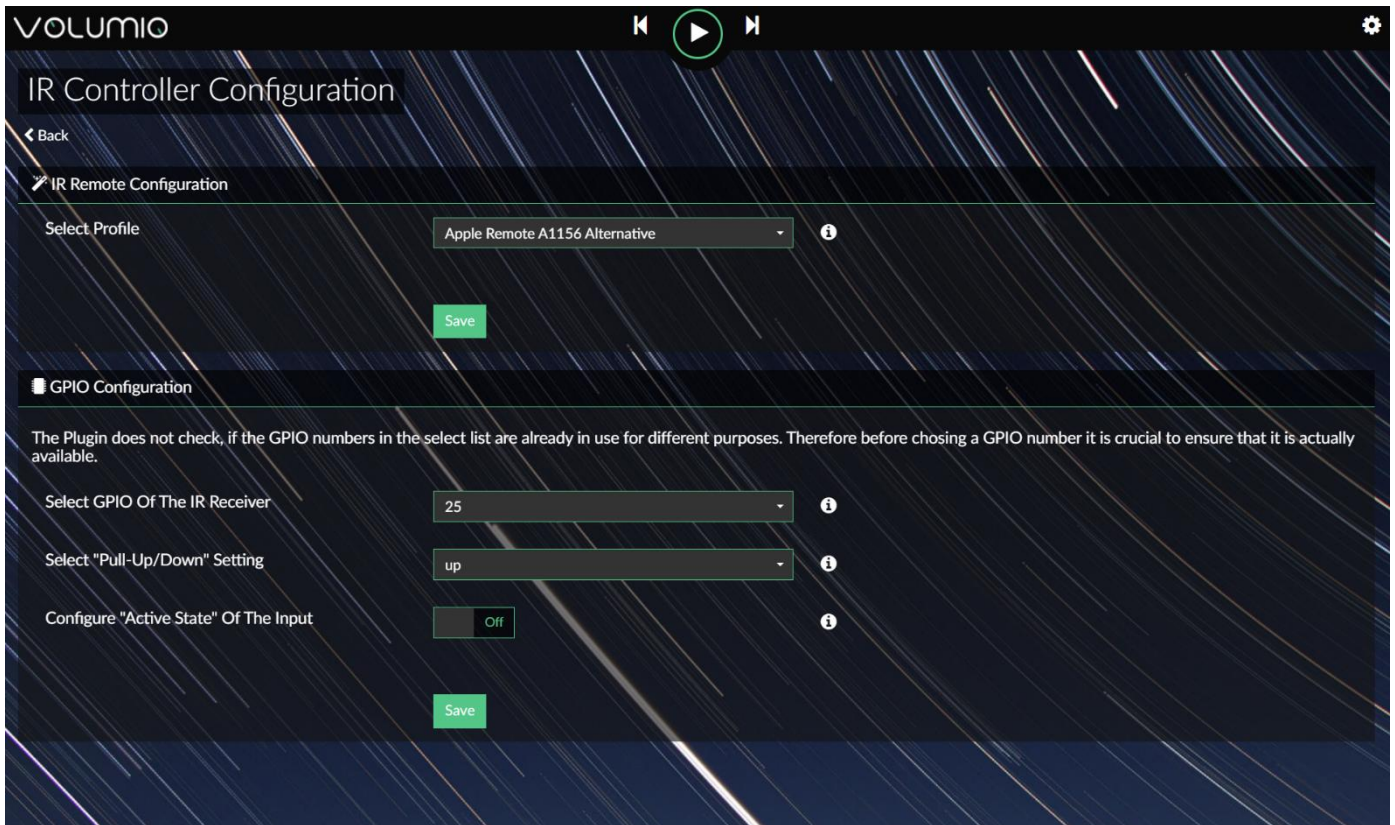
### K. Standoffs

ShieldPi Pro needs 4 of 11mm standoffs to install

ShieldPi Pro MkII needs 4 of 16mm standoffs to install

### L. 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.

1. Config this plugin settings as below.



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.

## M. 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

5. **ShieldPi Pro MkII works with Raspberry Pi that is equipped with a heatsink**
   Note: special size standoffs that come with the heatsink could be required to install