LinearPi

Ultra-low noise high current linear power supply

By Ian Jin Aug 23, 2020 Ver. 0.9b

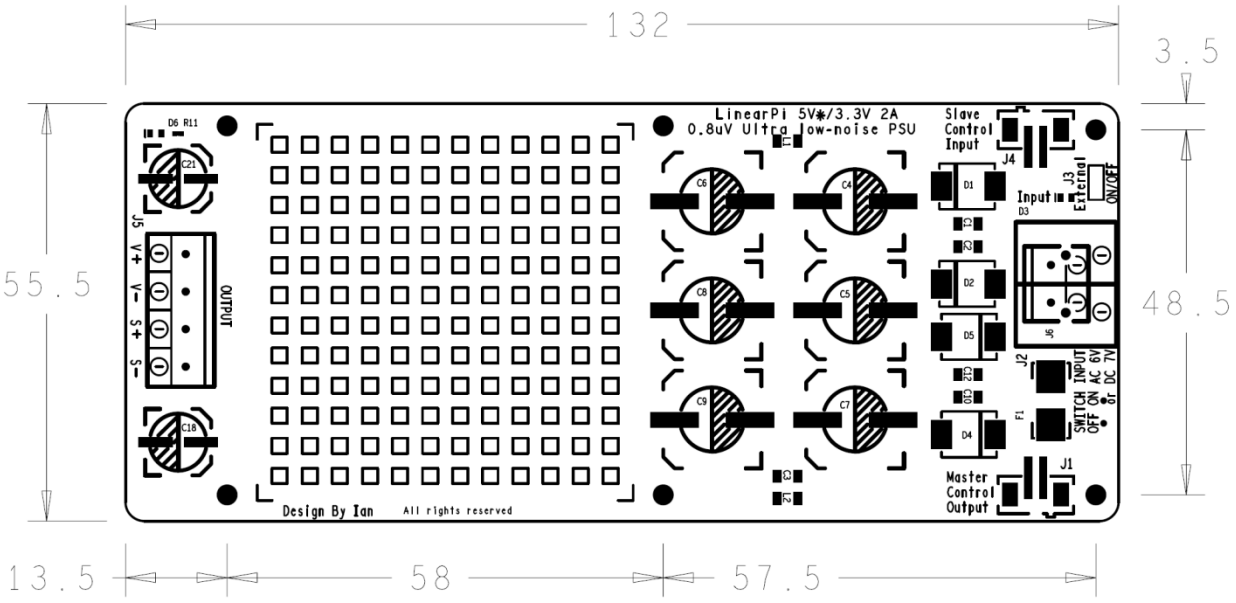
A. Introduction

LinearPi is a high quality audiophile grade manageable and expandable ultra-low noise high current linear power supply. It could be the one of the greatest Linear power supply solutions for RaspberryPi and other digital audio applications. Multiple LinearPis can be grouped into a whole power supply system. LinearPi can also be upgraded to ultra capacitor power supply by integrating with UcConditioner.

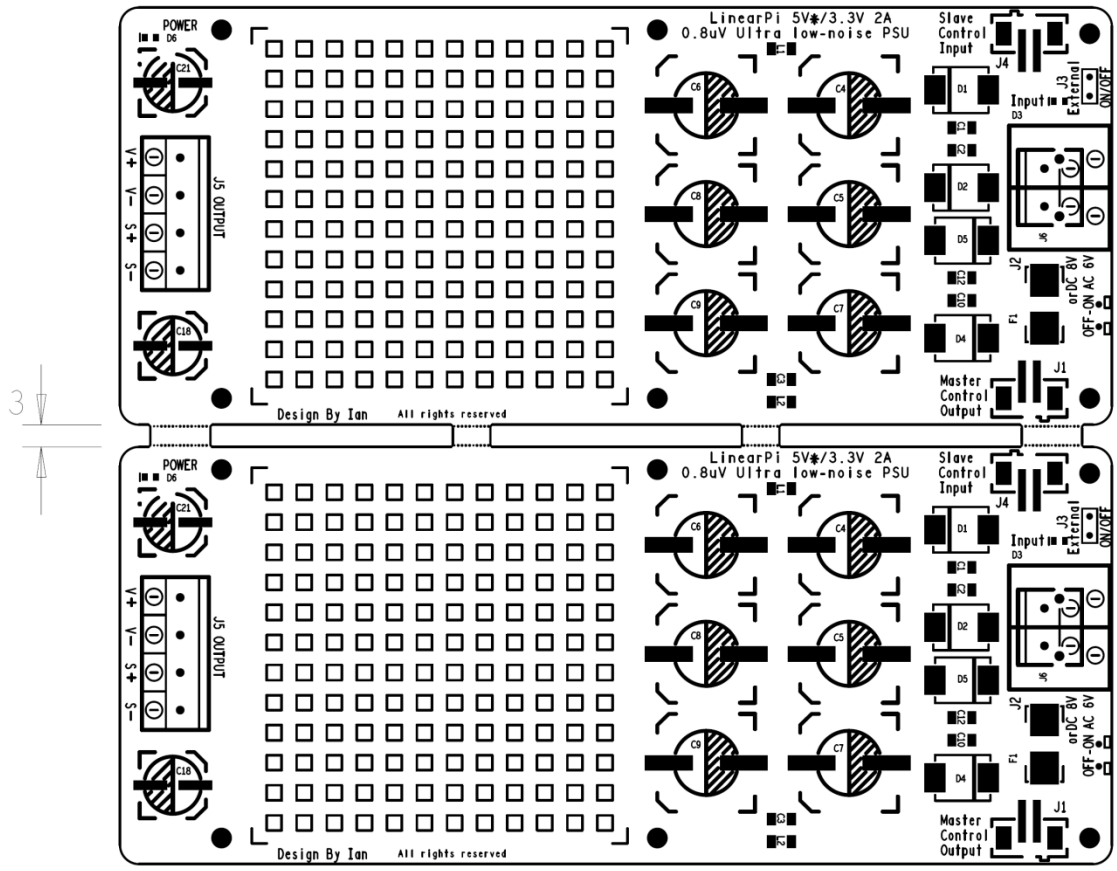
B. Specifications and Highlighted Features

- 5V or 3.3V pure linear DC power supply, 2.5A rated output current.
- 0.8uV Ultra-low noise level.
- Ultra-low output impedance.
- High speed high current low noise soft recovery Schottky rectifiers with optional shunt capacitors.
- Built-in on/off control logic with on-board or possible external on/off control switch.
- Multiple LinearPis can be grouped as a whole power supply system by making use of the built-in isolated master/slave control signal chain.
- Seamlessly integrates with UcConditioner to upgrade to an ultra capacitor power supply.
- Continuous AC input mode for best possible sound quality
- Optional Kelvin sense input for better possible performance.
- Deal with MLCC piezoelectric effect noise.
- Double thickness 2oz PCB copper layers for ultra-lower ESR performance.
- 6V AC or 7-9V DC power input.
- Heavy duty fully SMT design.

C. Layout and Dimensions (in mm)



LinearPi Solo



LinearPi Dual

D. Getting start

1. Make sure setting jumper S2 (at back side of the PCB) is open (factory default) for 5V output configuration.

   Or, please short S2 for 3.3V output.

2. Connect a 6V AC power input to J2 barrier terminal block. Turn on the AC power supply.

   Input LED D3 will be lit.

3. Turn the on-board on-off control switch S1 to on position. Power LED D6 will be lit. Make sure output voltage between V+ and V- at output terminal block J5 is correct (Please tighten the screws to ensure the connections)

4. Turn S1 to the off position. Connect the V+ and V- of J5 to the load through power cables (18 AWG or bigger).

   LinearPi in now ready to work.

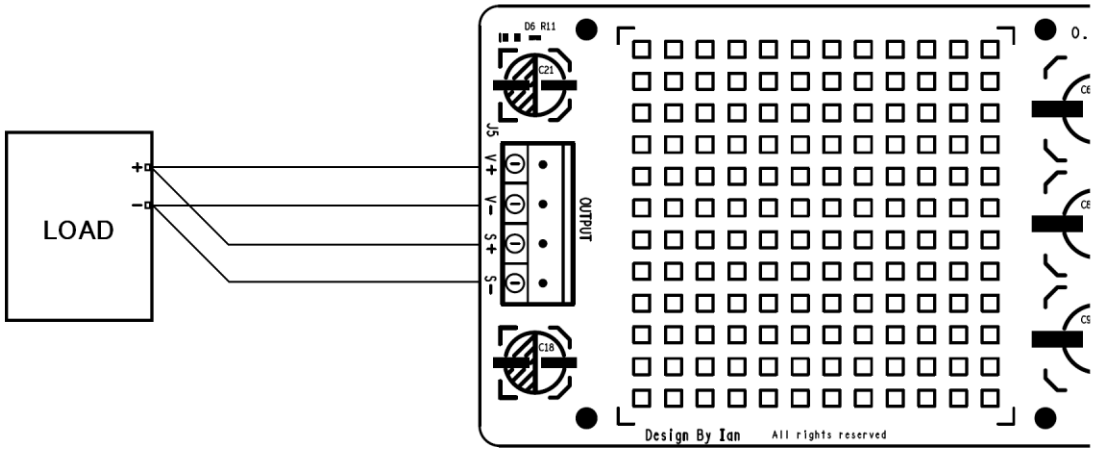
E. Connectors

J2: AC input in 2-pin barrier terminal block

A 6V AC power much be connected to J2 to operate. The maximum current has to be at least 200mA higher than the load averaged demand current. 2.5A or higher would be recommended. It is possible to use input AC voltage a bit higher than 6V. But have to make sure that the temperature at heat sink is not exceeding 70ºC.
AC power must be from an independent coil of a power transformer.
A 7V-9V DC power can also be used as input. The connection will be non-polarity. DC power must be totally isolated. Never share ground with other power supplies.

J5: Output in 4-pin 5.0mm terminal

V+ and V-: Output, 5V or 3.3V according to the jumper setting.
S+ and S-: Optional Kelvin sense input.
For normal applications, S+ and S- can be left unconnected.
However, if the power cable is longer than 5 inches, we can use this optional Kelvin sense input to keep the ultra-low output impedance and the good regulation performance.



J3: External on/off control switch connector, in 2-pin, 2.54mm

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 included in the package.

J4: Slave on/off control input in 2-pin PH2.0, isolated

LinearPi can be controlled remotely by this slave control input. LinearPi will be turned on when a 3V-12V control voltage is applied to this input. The control signal is non-polarity and optical isolated from LinearPi.

To use the remote on/off control, On-board switch S1 must be at off position.

J1: Master on/off control output in 2-pin PH2.0

1: Control signal –

2: Control signal +

To set up a control chain of a power supply group, please connecte J1 to the slave input J4 of the following LinearPi through the supplied control cable.

F. Switch and jumper

S1: ON-board on/off switch

On position: LinearPi will be enabled and output voltage will be applied to the output connector.

Off position: LinearPi will be disabled and no output.

S1 must be at off position if external on/off switch or slave control input is used.

S2: Output voltage setting jumper

Open (default) for 5V output

Short S2 for 3.3V output. Soldering iron can be used to join the two pins of S2 together

G. LED indicators

D3: Power input indicator. Indicating that the AC input voltage is applied when lit.

D6: Power on indicator. Indicating that the LinearPi is turned on and output voltage is applied to J5 when lit.

H. Application notes

1. Continuous AC input mode

Though we can use AC power to turn on and turn off the linearPi (on/off switch S1 has to be at on position). However for the best possible sound quality, it's highly recommended to use the continuous AC input mode by powering the AC input continuously while using the on/off control logic to turn on or turn off the LinearPi.

There will be no additional power consumption during the continuous AC input mode. Only the smoothing capacitors (capacitor array) will be kept in charged all the time.

2. **How to group LinearPis together**

   For LinearPi Dual, please connect the Master control output J1 of first LinearPi to the Slave control input J4 of second LinearPi by the supplied control cable.

   For a bigger group, please connect the Master control output to the Slave control input between LinearPis as a chain. Please use the on/off logic of the master LinearPi to control the whole power supply group.

3. **How to upgrade to ultra capacitor power supply**

   Mount a UcConditioner on top of the LinearPi by the LinearPi screw/standoff sets (sold separately).

   Connect V+ and V- of the LinearPi output J5 to the + and – of UcConditionerPi input J2 through power cables 18 AWG or bigger. And then, connect the UcConditioner output J6 to the device to be powered. Because UcConditioner is mainly a passive power supply, please use power cable as bigger and shorter as possible.

   Please make sure using the UcConditioner 5V for 5V LinearPi, and using the UcConditioner 3.3V for the 3.3V linearPi.

4. **About the optional rectifier shunt capacitors**

   LinearPi uses high speed high current low noise soft recovery Schottky diodes for rectifying. Under this configuration, we normally don't need the shunt capacitors to reduce the rectifier noise.

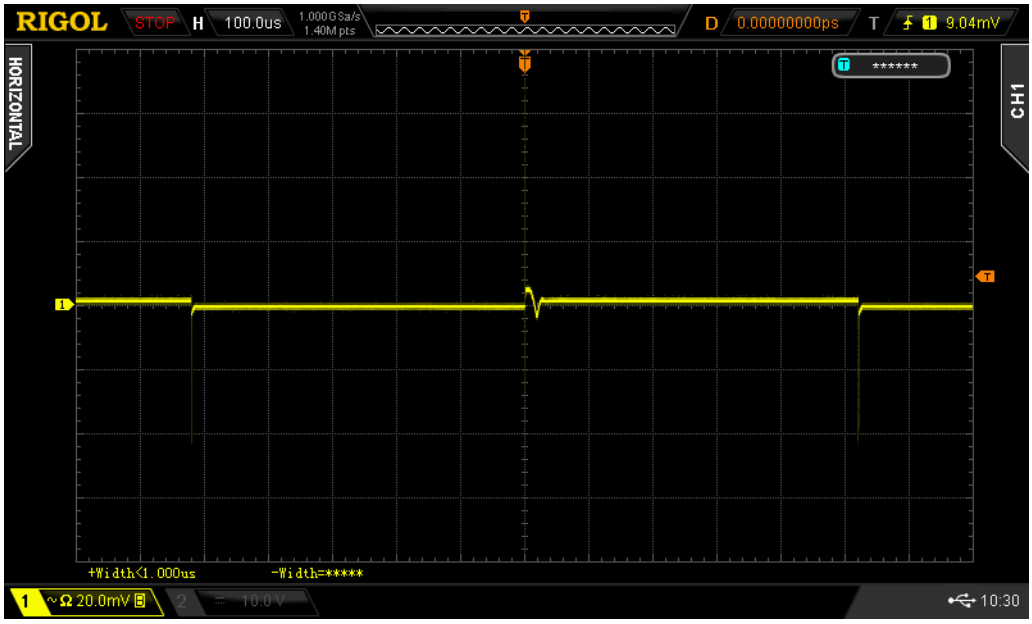
   However, if it is really necessary, we can assemble the 4 shunt capacitors to the reserved footprint C1, C2, C10 and C12. 10nF/50V NP0 chip capacitors in 1206 package are recommended.

   Possible part numbers are: CC1206JKNPO9BN103, or CGA5C2C0G1H103J060AA

5. **Fuse replacement**

   P/N: 0451008.MRL, Littelfuse

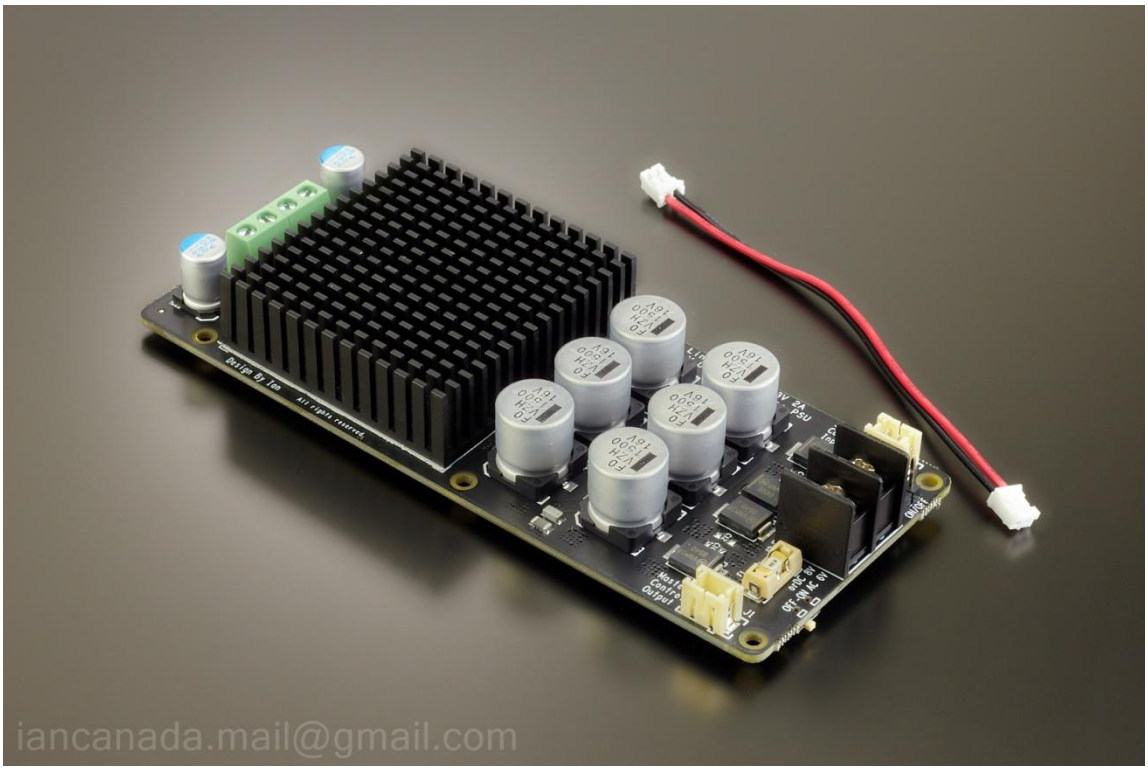
I. LinearPi load transient response



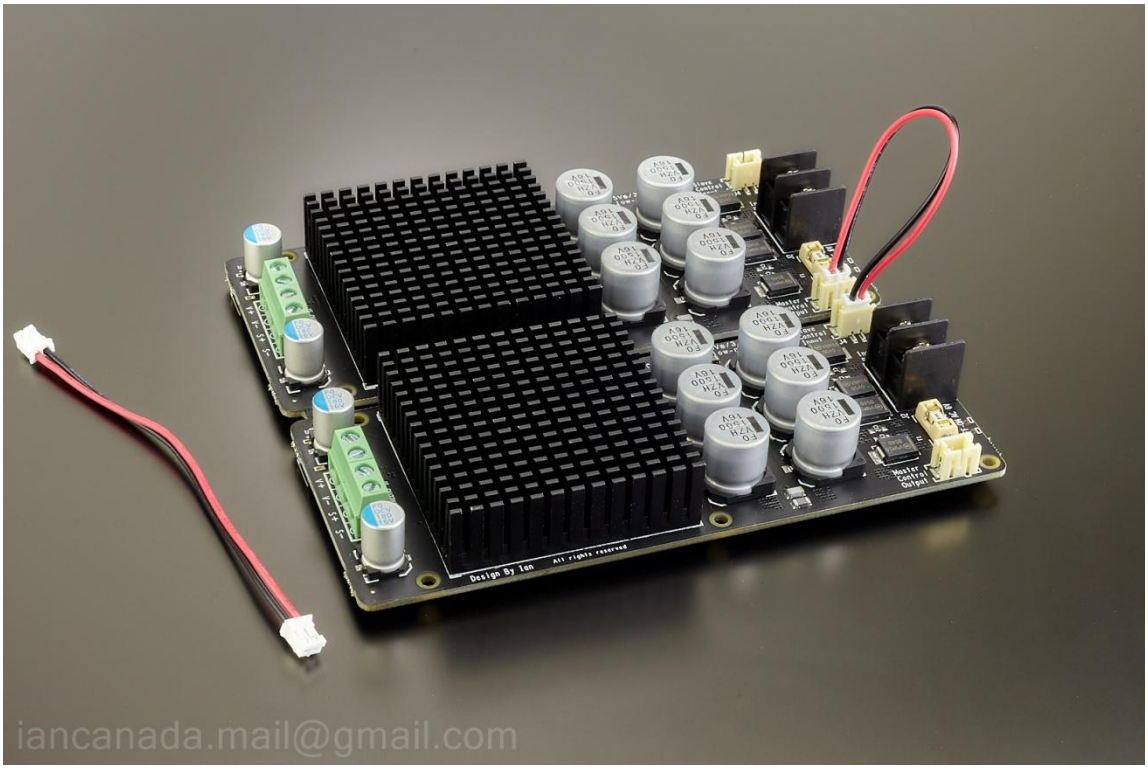
LOAD STEP = 100mA TO 1.5A, output voltage=5V, 20mV/DIV

J. Pictures of LinearPi

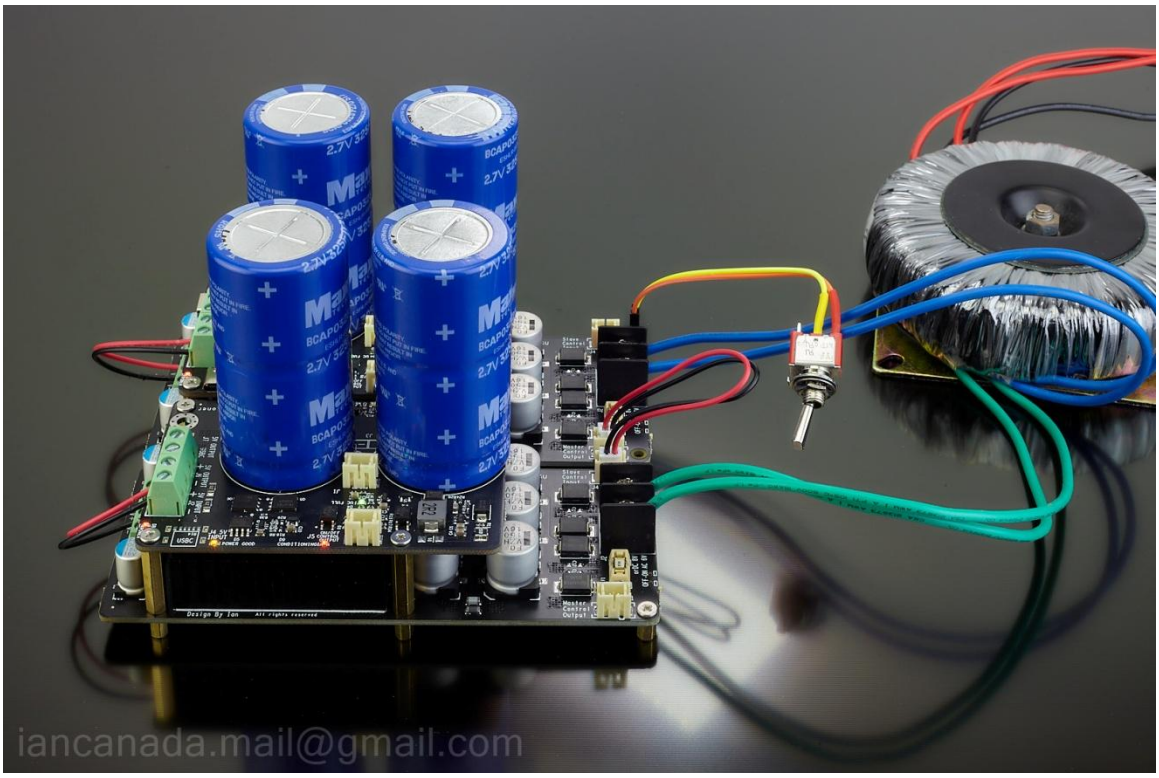
1. LinearPi Solo



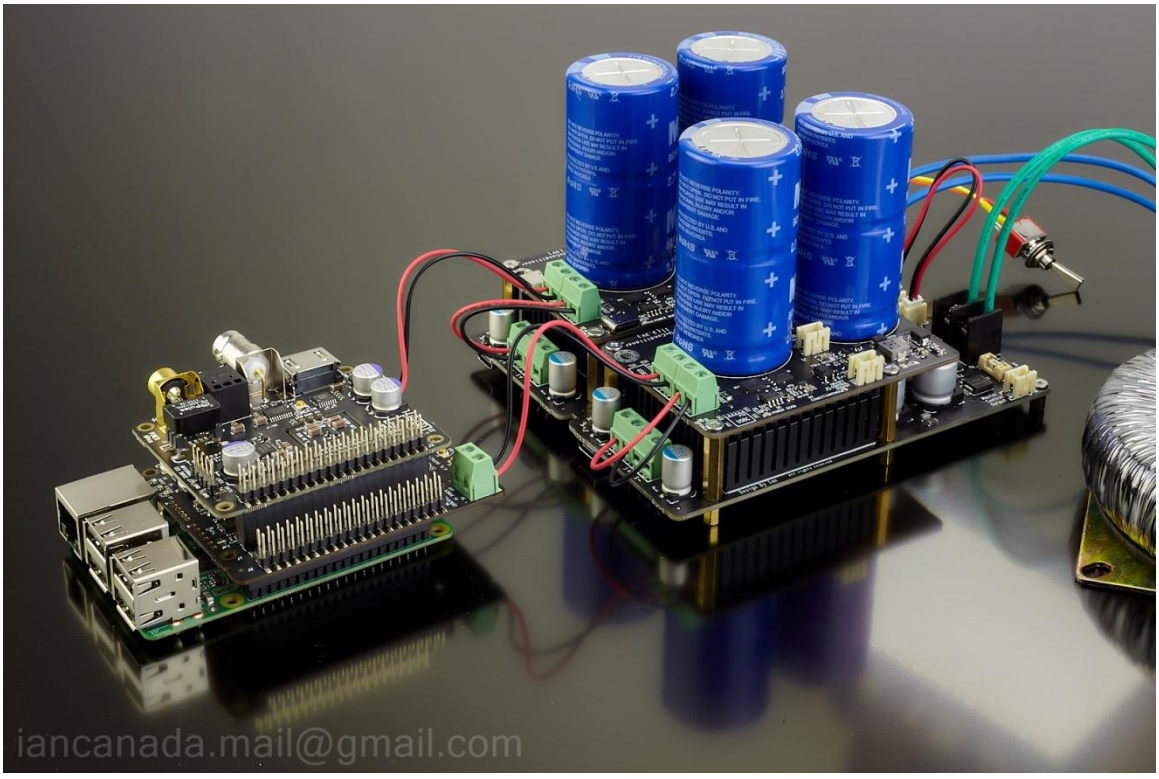
2. LinearPi Dual



3. Upgrade LinearPi to ultra capacitor power supply with UcConditioner



4. Power supply for high quality digital transport. (FifoPi + TransportPi)



K. History of revising

Aug 23, 2020 V0.9b released