LinearPi Pro

Ultra-low noise high current linear power supply

IanCanada Ver. 1.0

A. Introduction

LinearPi Pro is a top-quality high current ultra-low noise audiophile grade linear power supply. It can deliver up to **5A** continuous output current at extremely low-noise level which is much suitable for Raspberry Pi 5 and other high current noise sensitive applications. It could be the one of the best linear power supply solutions for both digital and analog audio applications. Multiple LinearPi Pros can be grouped into a big power supply system. LinearPi Pro can also be upgraded to an 5V/3.3V ultra capacitor power supply by integrating with UcConditioner/Pro.

B. Specifications and Highlighted Features

- 0.8uV Ultra-low noise level.

- Built-in ON/OFF control logic with on-board or possible external ON/OFF control switch.

- Multiple LinearPi Pros can be grouped into a big power supply system by making use of the built-in isolated master/slave on-off control signal chain.

- Seamlessly integrates with UcConditioner/Pro to be upgraded to an ultracapacitor power supply.

- Optimized for continuous AC input mode to get best possible sound quality.

- Deal with MLCC piezoelectric effect noise.

- 5V, 3.3V and 12V configurations.

- Two stages ultra-low noise soft start up feature great for both digital and analog application.

- Fully SMT high-quality heavy-duty design.

C. LinearPi Pro New Features

- 5A high continuous output current.

- 2.5 mOhm ultra-low output impedance.

- New parallel power output stages architecture.

- 4 layers double copper thickness PCB for higher current density and additional shield layers.

- 29080 uF total filtering capacitance.

- Enhanced optional Kelvin sense input to lower the output impedance and improve performance.

- Actual noise level superior to LinearPi because of the parallel architecture and the new shield layers.

- New low drop high speed high current soft recovery Schottky rectifiers.

- Bigger size heat sink

D. PCB Layout (Please download DXF files for the Dimensions)
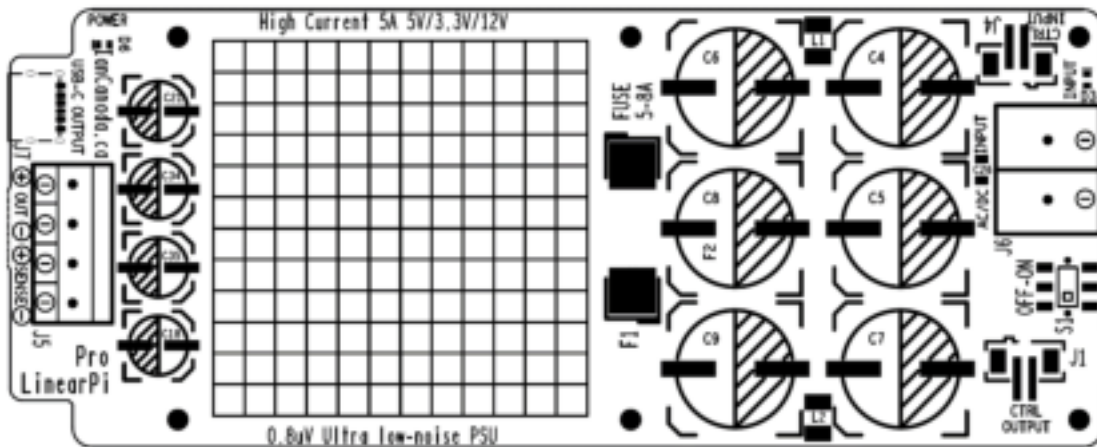
LinearPi Pro Solo
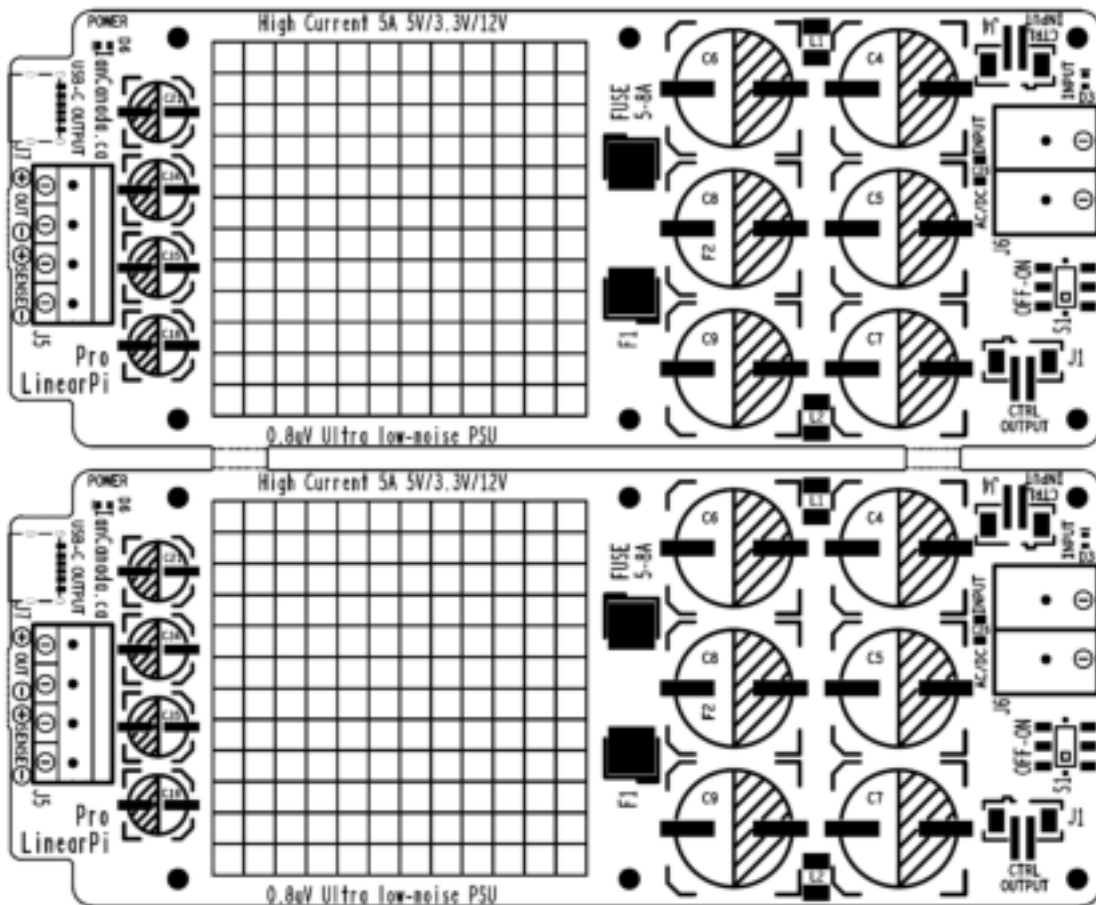
LinearPi Pro Dual or +/- 5V or 5V+3.3V

E. Order information

1. **#38A** LinearPi Pro Dual (default 5V, settable for 3.3V or 12V)

2. **#38B** LinearPi Pro Solo (default 5V, settable for 3.3V or 12V)

3. **#38C** LinearPi Pro Dual 5V + 3.3V

4. **#38D** LinearPi Pro Dual +/- 12V

F. Getting start

1. Make sure setting jumpers S2 and S3 (at back side of the PCB) are configured correctly to the desired output voltage 3.3V, 5V(default) or 12V.

2. Connect an AC power supply to J6 according to the below transformer recommendation chart. Power up 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 your device by high quality power wires (18 AWG or bigger).

    LinearPi Pro is now ready to work.

G. Connectors

J6: AC/DC input in 2-pin barrier terminal block

An AC or DC power input must be connected to J6 to operate. 5A or higher current is recommended.

Transformer recommendation chart

Voltage configuration	Working current	Transformer P/N (or equivalent)
3.3V	0 - 5A	1182Q6
	0 – 2.5A	1182N6 or 1182L6
5V	0 – 5A	1182Q6
	0 – 2.5A	1182N6 or 1182M9
12V	0 – 3A	1182M12 or 1182P12
	0 – 2A	1182L12 or 1182M12

For lower current applications, the input voltage can be a litter bit higher than the above numbers to get more headroom, but have to make sure that the temperature at heat sink is not exceeding 80ºC.

AC input must be from an independent coil of a power transformer. Never share the coil with other power supply or module.

DC power input will also be OK, non-polarity but must be totally isolated from all other circuits. Never share DC input ground with other power supplies. Here are DC input voltages suggestions:

3.3V configuration: DC5V
5V configuration: DC9V
12V configuration: DC15V

J5: Output in 4-pin 5.0mm terminal
V+ and V-: Output, 5V or 3.3V or 12V according to the jumper settings.
S+ and S-: Optional Kelvin sensing inputs.

For normal applications, S+ and S- can be left unconnected.

LinearPiPro equipped with enhanced Kelvin sensing circuit. If the power cable is longer than 5 inches, or you want to improve the power supply performance more, you can use this optional Kelvin sense input to keep the ultra-low output impedance and the good regulation performance.
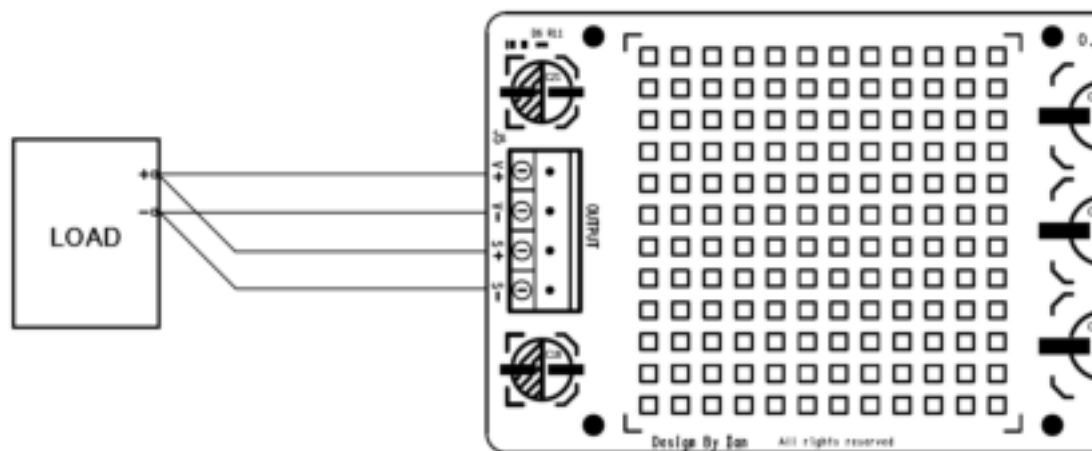
J7: Output in USB-C connector
Internally connected the V+ and V- of J5.
Please note that the output voltage will follow the settings and not always be 5V.

J3: External ON/OFF control switch connector, in 2-pin PH2.0 (at bottom side of the PCB)
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 Pro can be controlled remotely by this slave control input. LinearPi Pro 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 Pro.
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 connect J1 to the slave input J4 of the following LinearPi Pro through the supplied control cable. As well as other power supplies with the slave control input.

H. Switch and jumper

S1: ON-board ON/OFF switch

ON position: LinearPi Pro will be enabled and output voltage will be applied to the output connectors.
OFF position: LinearPi Pro will be disabled and there will be no output at J5 or J7.

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

S2, S3: Output voltage setting jumper

S2	S3	Output voltage
short	short	3.3V
short	open	5V (default)
open	open	12V
open	short	5.3V

I. LED indicators

D3: Power input indicator. Indicating that the power input is applied when lit.
D6: Power on indicator. Indicating that the LinearPi Pro is turned on and output voltage is applied to J5 when lit.

J. Fuse

The fuse is a standard 5*20mm fast-action glass fuse. The default fuse is Littelfuse **0235005.MXP**

The fuse can be sourced here (**#60B**):
https://iancanada.ca/products/fuses?variant=47645175447852

K. Load transient response measurement of a LinearPi Pro

LinearPi Pro has a really great load transient response performance. The output voltage drop is only 10mV at ultra-low noise level when output current changes over very **big steps between 1A to 5A**. The measured dynamic output impedance is only **2.5mOhm** (@1kHz), which could be the best performance among all the low-noise linear power supplies in the market.
With Kelvin sensing input connected, this performance can be even better.

Here is the measured load transient response waveform.
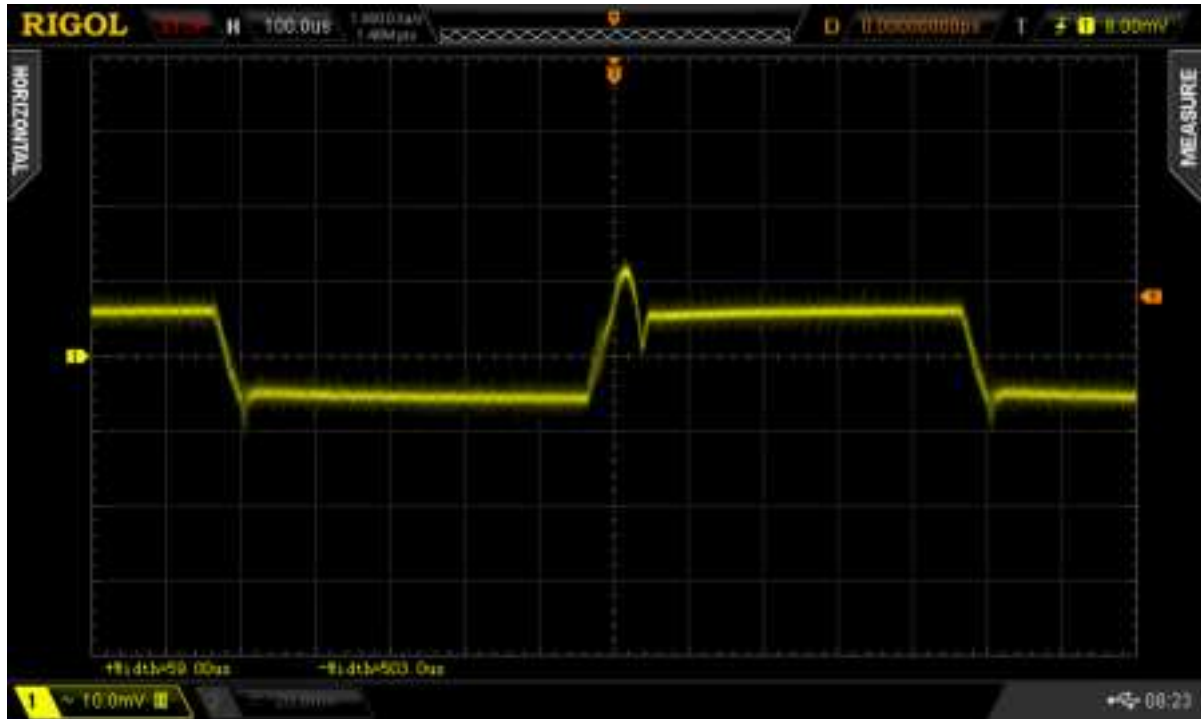
Testing conditions:

          Load current steps: between **1A to 5A**
          Output voltage: 5V
          Frequency: 1kHz
          Duty cycle: 50%
          Probe: 1:1, 1 mOhm, 10mV/DIV

L. Application notes

1. About the two stages soft start up feature

0V-3.0V: Fast startup stage to meet the reset timing requirements of some digital circuit, such as FifoPi Ma and so on.
After 3.0V: Slow startup stage to keep the ultra-low noise performance for both analog and digital circuit.

2. **How to upgrade to ultra capacitor power supply by a UcConditioner Pro**

Upgrading a LinearPi Pro by a UcConditioner Pro can make an even more improvement to the low-noise performance.

Here are the steps to perform the upgrade:

a. Mount a UcConditioner Pro (same voltage) on top of the LinearPi Pro by the 35mm LinearPi Pro screw/standoff sets (sold separately).
b. Connect V+ and V- of the LinearPi Pro output J5 to the + and – of input J2 of the UcConditioner Pro through big power wires, 18 AWG or bigger.
c. (Optional) Connect S+ and S- of the LinearPi Pro Kelvin sensing input J5 to the + and – of the **output J6** of the UcConditioner Pro (Please use high quality wires but don't have to be very big).
d. Finally, connect the UcConditioner Pro output J6 to the device that needs to be powered.

Note:
1. Please make sure use the UcConditioner Pro 5V for default 5V LinearPi Pro, and use the UcConditioner Pro 3.3V for the LinearPi Pro at 3.3V configuration.
2. It's highly recommended to use this enhanced Kelvin sensing function when working with a UcConditioner Pro to reduce the output impedance even more. But without the sensing connections, there will be fewer active components involved in the final output (more passive). So, I suggest make the decision according to your own preference based on a real listening test.

3. Recommend the continuous AC input mode

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

In this continuous AC input mode, filtering capacitors (capacitor array) will be continuously charged to keep them break-in. There will be no additional power consumption when LinearPi Pro is off.

4. How to group LinearPi Pro power supplies using control chains

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

To setup a bigger group, please connect the Master control output J1 to the Slave control input J4 of the following LinearPi Pro, and so on, one by one as a chain. Please use the ON/OFF switch/logic of the master LinearPi Pro to control the whole power supply group.

M. Pictures

1. LinearPi Pro Solo

2. LinearPi Pro Dual, or LinearPi Pro 5V +3.3V, or LinearPi +/- 15V

3. As a great linear low-noise power supply for RaspberryPi 5

N. History of revising