TransportPi Digi

High performance master mode all-in-one RaspberryPi digi transport

user's guide

By Ian Jin, Jul 18, 2022 Ver. 0.9b

A. Introduction

TransportPi Digi is an audiophile grade high-performance low-cost master mode all-in-one Raspberry Pi interface transport. It successfully achieves an ultra-low jitter low noise signal quality by using IanCanada's well reputed 1-bit three stages discrete re-clock technology for the S/PDIF signals and two-stages multi-bits re-clockers for the I2S over HDMI signals. TransportPi Digi also has dual XOs sockets for local audio clocks to make it possible to be upgraded to even higher sound quality level by installing OCXOs or other kinds of ultra-low phase noise clocks.

As an all-in-one digi transport, it provides almost all kinds of high quality re-clocked output: RCA, OPT, HDMI and GPIO. Because of the most advanced low-jitter and low-low noise technologies it employs, TransportPiDigi could be the best sound quality compact size RPi streamer transport when working with UcPi, PurePi or other high quality power supplies.

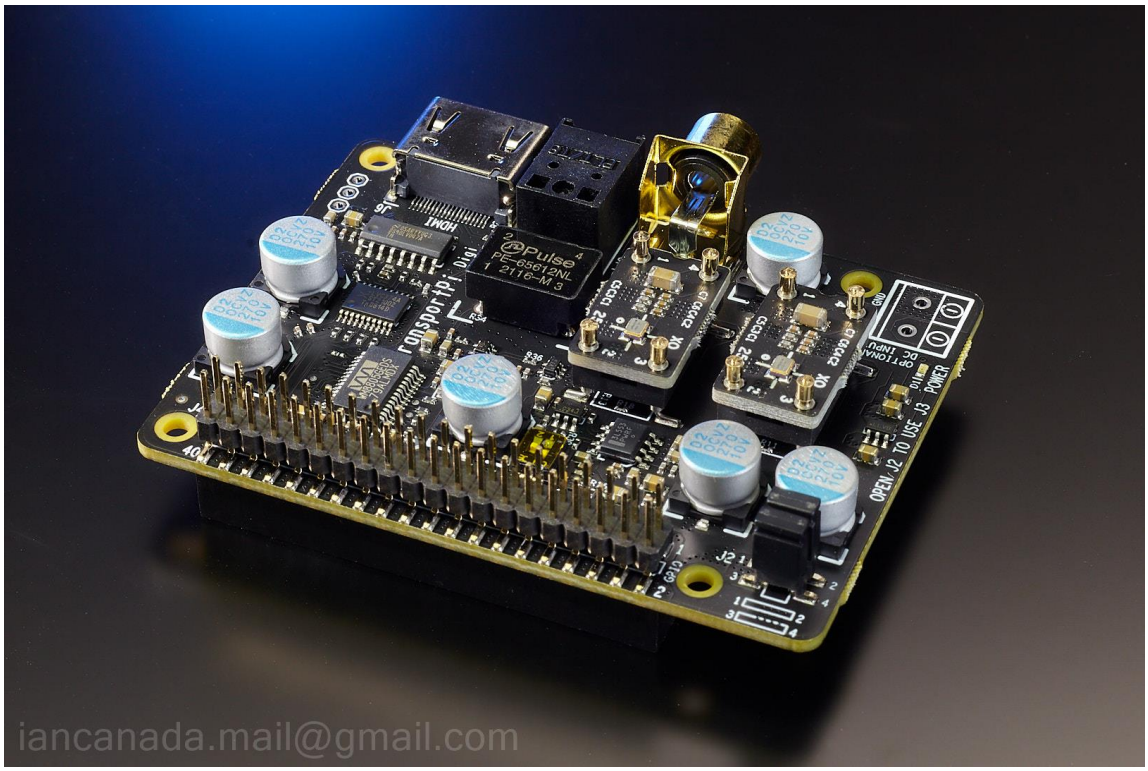
TransportPi Digi is functionally equivalent to a I2S FIFO re-clocker plus a TransportPi

B. Features and Specifications

- Four high quality outputs: re-clocked S/PDIF output in RCA (Isolated) and OPT, re-clocked I2S output over HDMI, re-clocked I2S output over GPIO
- Low noise 1-bit discrete re-clocker for S/PDIF signals (three stages in total)
- Two-stages multi-bits re-clocker for I2S over HDMI signals
- 45.1584/49.1520 MHz dual low phase noise local clocks were pre-installed in the upgradeable/swappable XO sockets which are compatible with FifoPi. 22.5792 /24.5760 MHz clocks can also be used
- Has high quality local MCLK output in U.FL coaxial cable connector
- Can also work as an I2S FIFO re-clocker.
- Has low noise clean 3.3V/5V power supply input which is great for directly work with the LifePO4 battery or ultracapacitor power supply. On-board LDO can also be bypassed.
- Can also share Raspberry Pi 's power supply
- Works with SinePi to take external high quality sine clocks
- Great for compact size audiophile integrated Raspberry Pi streamer transport solution
- Up to 192KHz
- Four layers PCB design with two inner PCB layers as dedicated shield plates to lower the noise more
- Enhanced power supply filtering network with more than 130 ultra-low ESR decoupling capacitors

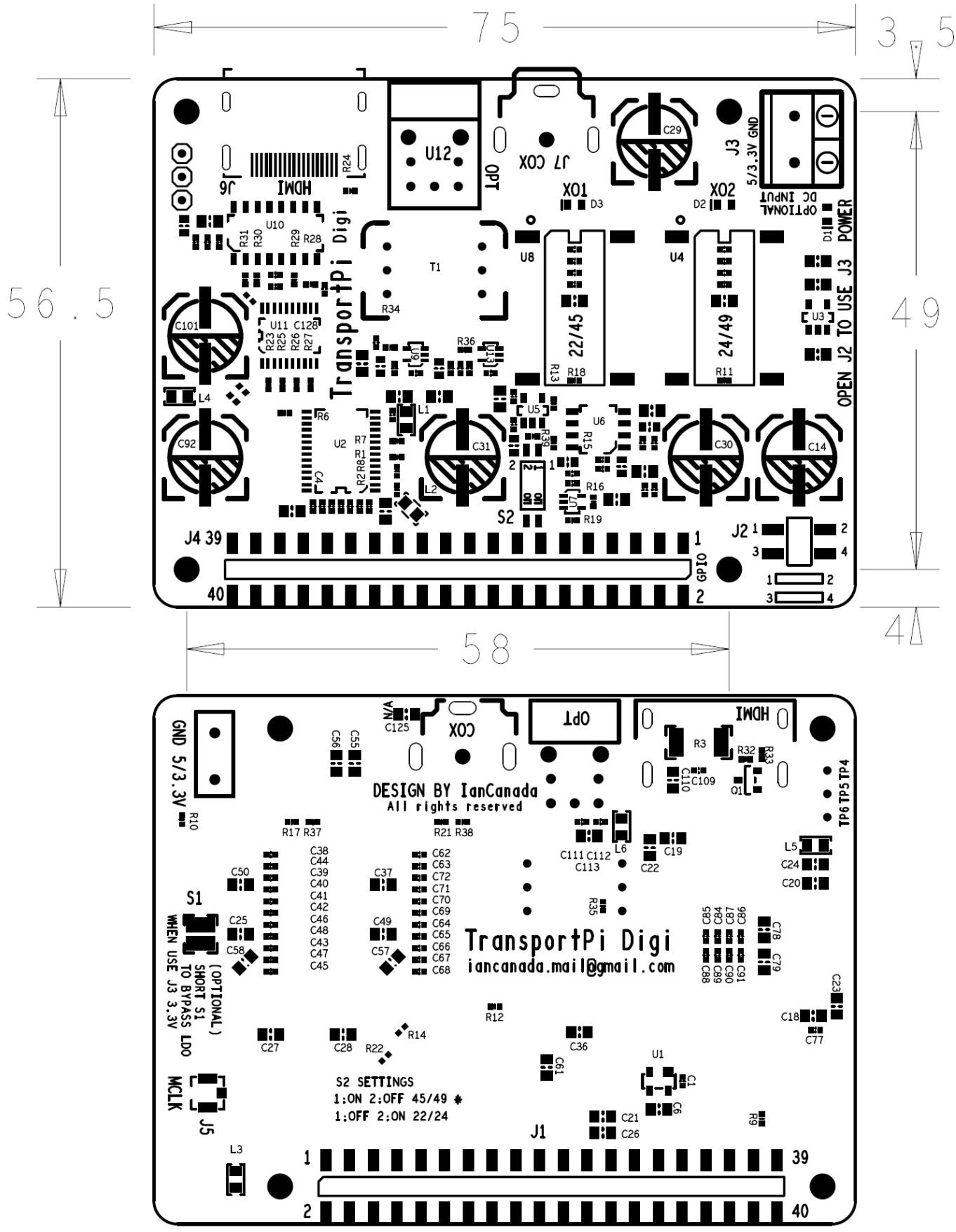
- No need a FifoPi to work with
- uses standard WM8805 Linux driver
- Low cost but no compromise on performance
- bit-perfect and lossless
- Diy friendly plug-and-play

C. TransportPi Digi picture



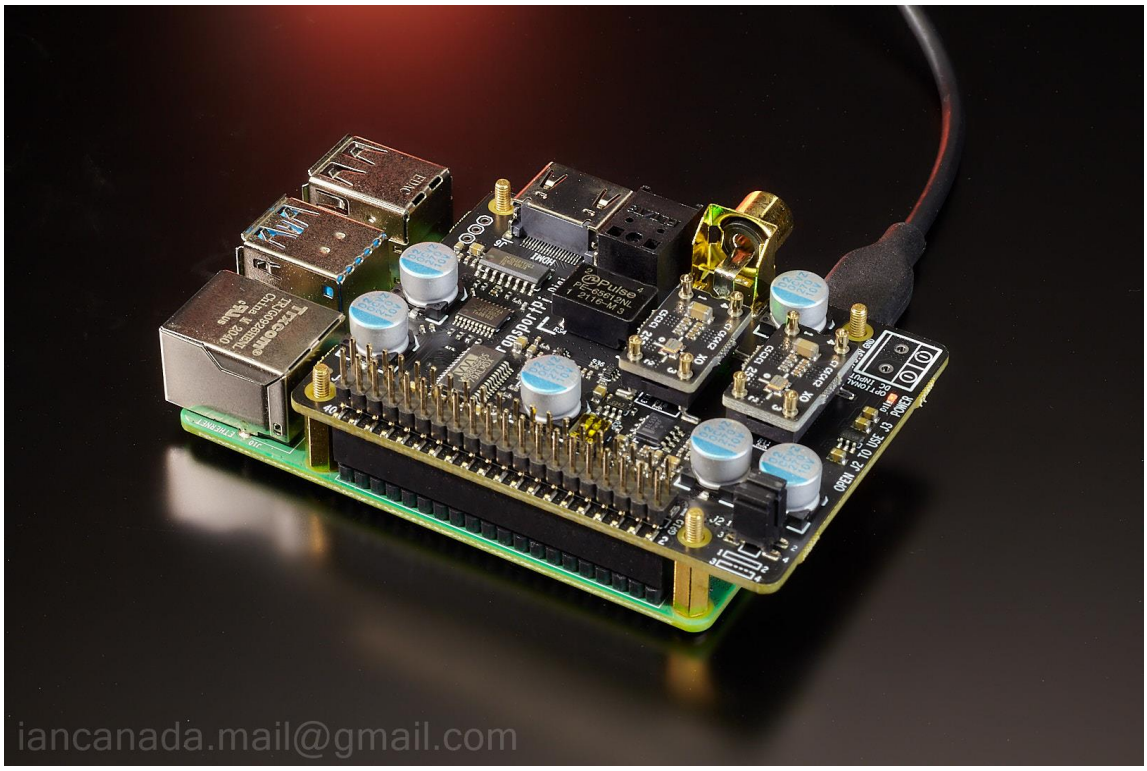
TransportPi Digi as shipped

D. Layout and Dimensions (in mm)


75
3.5
56.5
49
4
58
TransportPi Digi
OPEN J2 TO USE J3 POWER
5/3.3V GND
OPTIONAL DC INPUT
HDMI
COX
OPT
GPIO
DESIGN BY IanCanada
All rights reserved
TransportPi Digi
iancanada.mail@gmail.com
GND 5/3.3V
S1
WHEN USE J3 3.3V SHORT S1 TO BYPASS LDO (OPTIONAL)
MCLK
S2 SETTINGS
1:ON 2:OFF 45/49 *
1:OFF 2:ON 22/24
22/45
24/49

E. Quick-Start Guide

1. Install the TransportPi Digi on top of a Raspberry Pi using four 11mm standoffs.
2. Install a micro-SD card loaded with your player image into your Raspberry Pi.
3. Power the Raspberry Pi by a standard USB-C power adapter (5V/2.5A). The power LED D1 will be lit.
4. In the player software settings, select the standard WM8805 I2S device, such as Hifiberry Digi+ Pro, as the Linux driver. Make other configurations as needed to enable your Raspberry Pi player to operate.
5. Connect to your DAC through a RAC coaxial cable, a HDMI cable or a TOSLINK optical cable
6. Start to play. Either XO1 or XO2 LED will be lit corresponding to the music Fs frequency
7. Enjoy the music



Tips: Using better power supply can improve sound quality. UcPi or PurePi would be highly recommended to build a compact size RPi digi transport.

F. Connectors

J7: RCA S/PDIF output

Isolated standard 75-ohm S/PDIF output in RCA connector.

U12: OPT S/PDIF output

Standard S/PDIF output in TOSLINK optical connector.

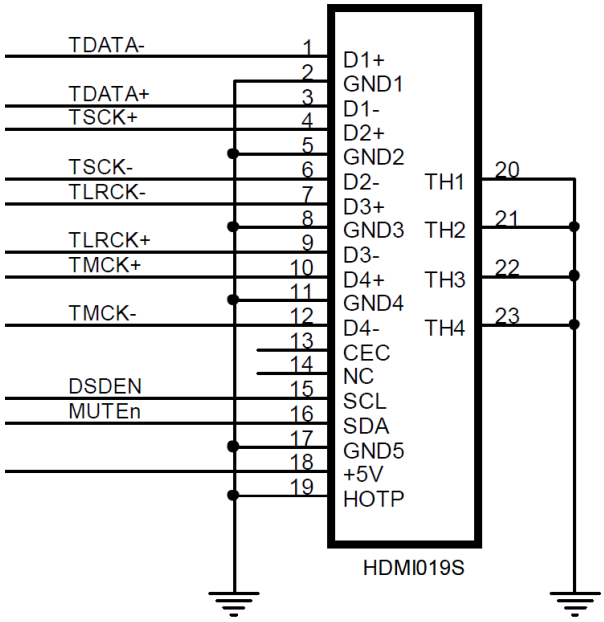
J6: HDMI output connector

Standard HDMI connector. To output I2S signals to receiver through HDMI LVDS cable.

For higher signal quality, high speed HDMI cables version 2.0 or higher are recommended.

Please refer the following schematic for signal configurations.

Note: There are two kinds of I2S to HDMI configuration, mode A and mode B. TransportPi Digi uses mode B to optimize to high-speed PCB layout for best possible signal quality. Please make sure your DAC is set up in the same configuration.



J5: MCLK output (U.FL coaxial cable socket)

MCLK (master clock) output for audio HAT or external DAC. As the same as the MCLK signal from a FifoPi.

40PIN GPIO connectors

	J1	J4
PIN#	GPIO connecting Raspberry Pi to TransportPi Digi	Prime GPIO for a DAC HAT or other audio devices
1	Raspberry Pi 3.3V output	TransportPi Digi clean 3.3V
2,4	Raspberry Pi 5V input/output	Raspberry Pi 5V
6,9,14,20, 25,30,34, 39	GND	GND
3	I2C DA	I2C DA
5	I2C CL	I2C CL
12	SCK Input	Re-clocked SCK output
35	LRCK Input	Re-clocked LRCK output
40	SD/D2 Input	Re-clocked DATA output
All other pins	Connected to the GPIO pins of the Raspberry Pi	Not connected

XO1, XO2: XO sockets for local audio clocks

The TransportPi Digi has two sockets for local clocks, XO1 (U8) and XO2 (U4). Low-jitter 45.1584/49.1520 MHz clocks were installed in to the sockets as default. Standard DIP14 3.3V clock oscillators **with OE pin** are good for XO1 and XO2. Surface mount (SMT) oscillators can also be used by mounting them on the SMT XO adapters.

J3: Optional DC power input

By default, TransportPi Digi shares the RPi power supply through the GPIO. For upgrade, it's still available to connect a 3.3V or 5V 100mA (minimum) DC power supply to this optional 2-pin 5.0mm terminal. MAINTAINING CORRECT POLARITY!!! Direct-connected 3.3V ultra capacitor / LifePO4 battery power supply would be highly recommended for the best possible performance.

J3 Is not assembled by default. You can use any 2 Position 5mm or 5.08mm Wire to Board Terminal Block for it, such as a Phoenix 1935161 (Digikey P/N: 277-1667-ND) or Würth Elektronik 691137710002 (digikey P/N:732-10955-ND). To assemble, please use solder iron higher than 80W to ensure it is soldered well to the TransportPiDigi's 4-layers PCB.

J2 1-2, 3-4 must be open when TransportPi Digi takes power form J3.

G. Jumper settings

S2: Clock frequency group selection

1. 1-ON, 2-OFF: Install 45.1584 MHz in XO1 socket (U13) and 49.1520MHz in XO2 socket (U7) (default).
2. 1-OFF, 2-ON: Install 22.5792 MHz in XO1 socket (U13) and 24.5760MHz in XO2 socket (U7)

J2: Power supply sharing jumpers

1. Short 1-2 and 3-4 to share Raspberry Pi power supply (default)
2. Open 1-2 and 3-4 to power TransportPi Digi by independent clean 3.3V or 5V power supply from J3

S1: LDO enable/bypass (located at top side of the PCB)

1. Open: Enable the on-board low noise 3.3V LDO (default)

2. Short by a soldering spot: Bypass the on-board LDO to reduce the power supply ESR more. **But have to be only under this condition:**

   a. J3 powered by a 3.3V power supply

   b. **1-2 and 3-4 of J2 are open.**

H. LED indicators

Group	LED	Description	On Indicates...
Power indication	D1	POWER LED	TransportPi Digi is powered
Clock Selection	D6	XO1	XO1 is selected for MCLK
	D5	XO2	XO2 is selected for MCLK

I. Application examples

1. Low-cost high-performance compact size Raspberry Pi Digi transport using UcPi ultracapacitor power supply

Components:

(1). Raspberry Pi

(2). TransportPi Digi

(3). MonitorPi as OLED real-time display (optional)

Power supply:

UcPi ultracapacitor power supply with USB-C power input

Configurations:

Keep everything as default

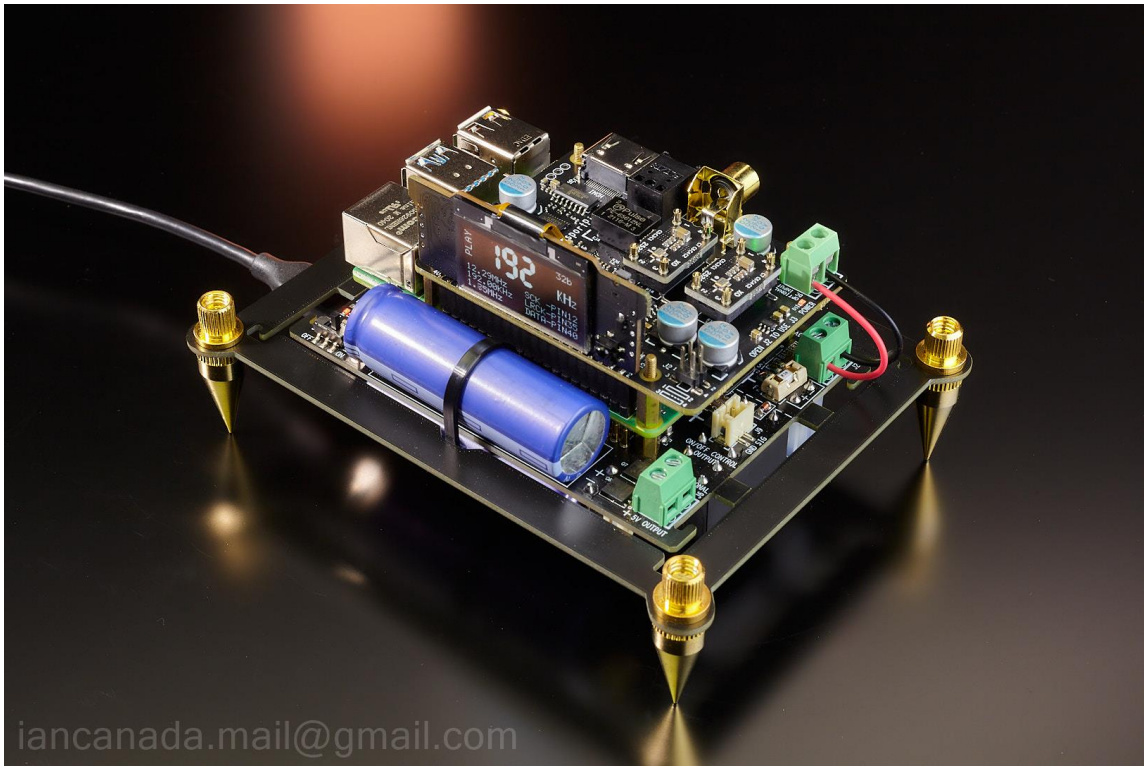
Connections:

No need any additional connections in between

Note:

The spike feet kit can be found at Amazon.

2. **Audiophile compact size RaspberryPi Digi Transport using PurePi ultracapacitor/LifePO4 pure battery power supply**



Components:

(1). Raspberry Pi

(2). TransportPi Digi

(3). MonitorPi as OLED real-time display (optional)

Power supply:

PurePi (5V ultracapacitor, 3.3V LifePO4 battery power supply combo) with USBC power input

Configurations:

Remove the two jumpers from J2 of the TransportPi Digi to keep it open. Anything else no change as default

Connections:

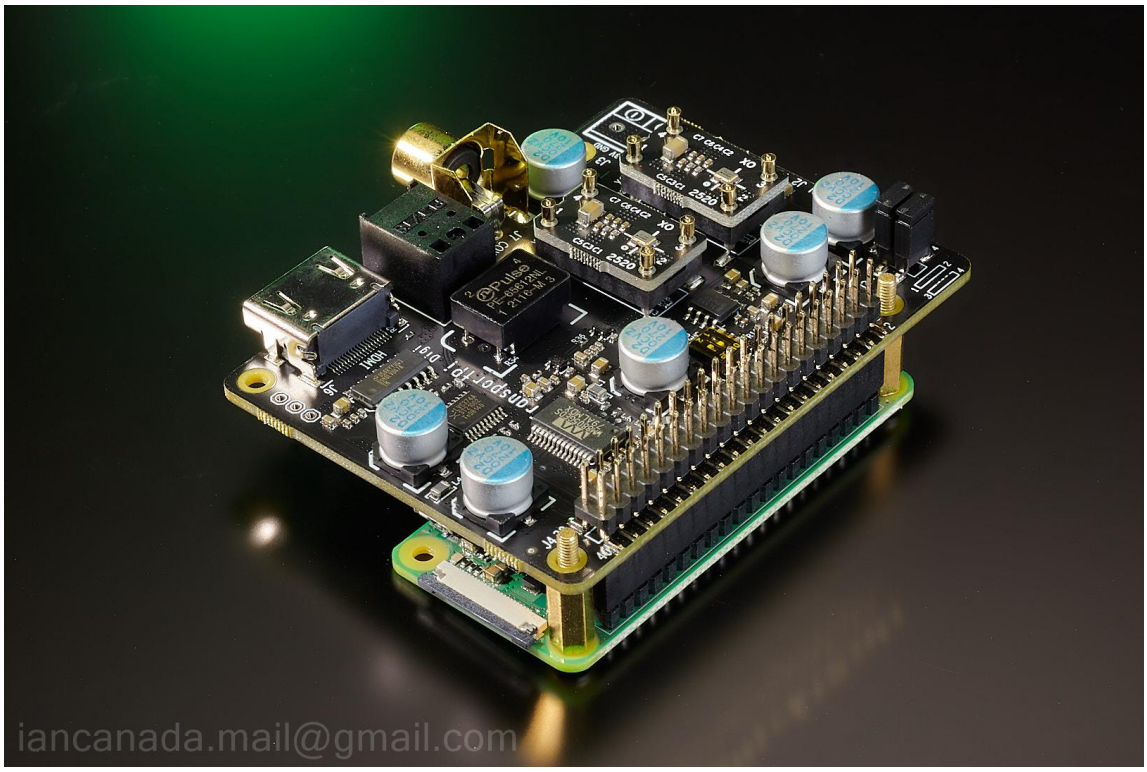
Connect the 3.3V battery power supply from J2 of PurePi to J3 of TransportPi Digi with two high quality wires.

Note:

The spike feet kit can be found at Amazon.

For safety reason, battery can not be shipped. Have to source two 18650 LifePO4 battery cells locally.

3. **Lowest-cost low-jitter Mini Digi Transport**



Components:
(1). Raspberry Pi Zero 2
(2). TransportPi Digi

Power supply:
USB-C power adapter

Configurations:
Keep everything default no change

Connections:
None

J. How to produce the best sound quality

1. Install great clocks

The primary mechanism the TransportPi Digi uses to lower jitter and improve the sound is by generating the audio stream referenced to low-jitter clocks. The better clock you use, the more improvement you can get from your TransportPi Digi.

The two XO oscillators supplied with the board are carefully selected low phase noise XOs and batter then the most low-cost generic clocks. They are great for you to get started to experience the improvement of low jitter clocks. We have tested the CCHD-957 series XO oscillators from Crystek and found to be a good choice at a reasonable price.

You may also use OCXOs with better phase noise performance for even better results as long as you factor in the higher current requirements of these devices. Ultra-low phase noise sine wave clocks can also be used for TransportPi Digi through the SinePi adapter.

Trying different clocks for better sound is an interesting experience similar to capacitor, tube or opamp rolling.

2. Power your TransportPi Digi from a directly-connected 3.3V ultra capacitor or LiFePO4 battery supply

The quality of your TransportPi Digi power supply directly impacts both TransportPi Digi and clock performance. As an alternative to very good quality linear power supplies, we have used a directly-connected 3.3V LiFePO4 battery or UcConditioner 3.3V ultracapacitor power supplies. Our experience is that these types of supplies do a very good job of improving the resulting sound quality AND are very hard to better with a traditional active power supply. You can connect this type of supply directly to the DC input terminal J3.

If you are building a compact system, UcPi or PurePi power supply will be highly recommended to get the most out of the TransportPi Digi's performance at a more reasonable cost.

Otherwise, A LinearPi 5V and a LinearPi 3.3V, with a ConditionerPi 5V and a ConditionerPi 3.3V combination would be a greater option.

K. Some application notes

1. The size of standoffs

11mm M2.5 standoffs are suggested to be installed between RaspberryPi and the TransportPi Digi.

2. How to install a MonitorPi

MonitorPi can be a good OLED real time display for TransportPi Digi. To install it, you just need to plug it on to the GPIO connector J4. Please make sure all the pins are properly installed. MonitorPi is plug-and-play. No need any software support.

3. How to use TransportPi Digi's FIFO function

TransportPi Digi has basic I2S FIFO function. The re-clocked I2S FIFO outputs are at:

MCLK: J5

SCK: GPIO J4 PIN12

LRCK: GPIO J4 PIN35

DATA: GPIUO J4 PIN40

To use the FIFO function, you can

a. Install a SYNC mode DAC or other audio HAT on top of the GPIO J4. Connect the MCLK through a U.FL cable as required.

b. Or, connect the above FIFO output signals to an external SYNC mode DAC or other digital audio devices.

4. How to remove/replace SMT XO sockets

XO sockets may get loose if being used for many times. In this case, we need to replace the sockets.

Cut the four pins by a side cutter at bottom of a SMT XO socket.

Clean the pads by de-soldering wick

Solder a new SMT XO socket at the same position.

5. XO warm-up time

All XO and OCXO oscillators take time to warm-up and stabilize before producing their lowest jitter, best sounding clock signal. This will take anywhere from a couple of minutes to a half hour or even longer. Please allow for your clocks to warm up and stabilize before performing any critical evaluations.