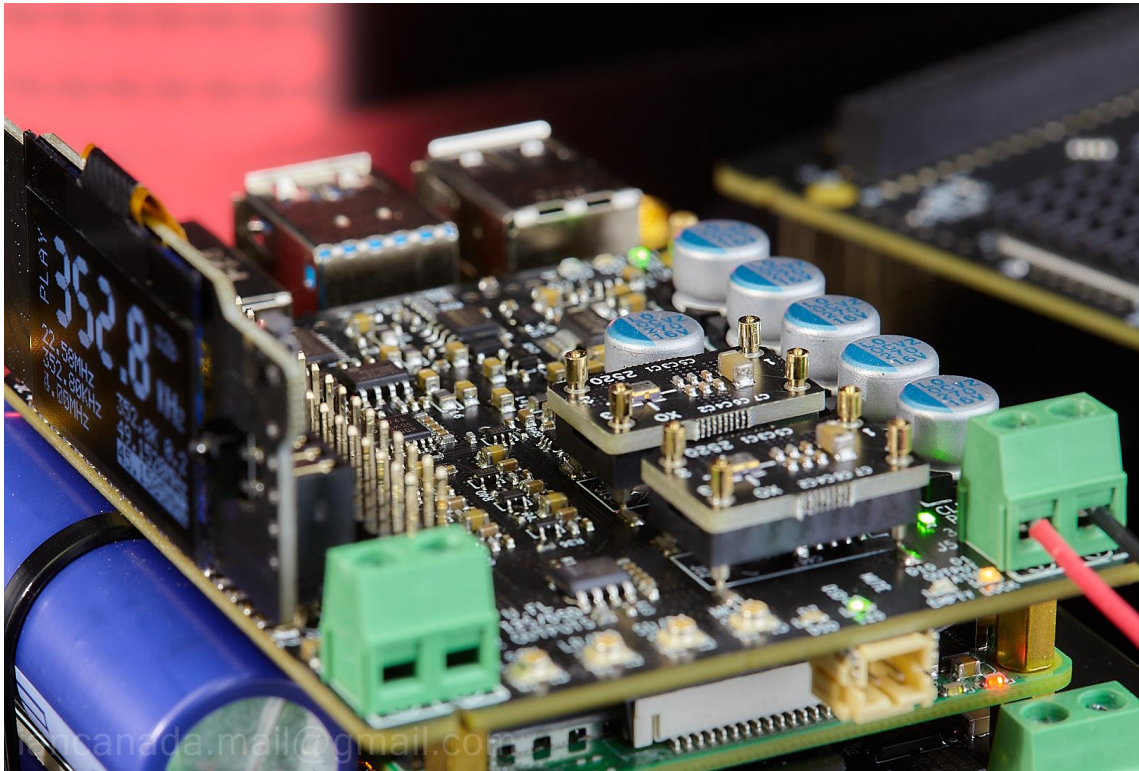# FifoPi Q7

Flagship Synchronous Mode I2S/DSD/DoP FIFO Re-clocker

IanCanada

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A. Introduction

FifoPi Q7 is the new flagship of the FifoPi re-clocker family. It successfully achieves so far the best ultra-low jitter and ultra-low noise performance by using many next generation technologies. Such as the well-reputed 1-bit multi-stages discrete re-clockers, low EMI leakage discrete isolators, programmable constant FIFO delay time and automatic adaptive depth control, Continuous clock mode, 32bit high performance FIFO engine architecture, enhanced wide bandwidth power supply filtering networks and so on.

FifoPi Q7 would be a great device for audiophile DIYers to improve the sound quality of high-end DACs and streamer transports.

B. Features and Specifications

- Synchronous clock mode for the best possible sound quality

- New generation 32bit FIFO engine architecture with 64Mb large FIFO memory

- Equipped with well-reputed 1- bit discrete 3 stages low noise re-clockers to ensure so far the best I2S/DSD signal quality. The output I2S/DSD signals are almost perfect in terms of signal integrity

- Built-in discrete/optical digital isolators to ensure best isolation performance and lowest EMI leakage

- Support I2S input/output up to 768KHz

- Support native DSD input/output up to DSD 1024

- On board DoP decoder is capable of Raspberry Pi's native DSD playback over GPIO up to DSD256

- Programmable delay time from 0.1 seconds to 1 second

- The Advanced variable depth FPGA algorithm adjusts the FIFO memory automatically according to the music frequencies to hold same delay time constant across different audio formats and frequencies.

- New continuous clock mode makes it possible to keep the current output clocks no change until a new music frequency is locked. This feature can eliminate the pop sound of a DAC to a lowest possible degree at the moment of music start/stop/change even it doesn't have a MUTE control

- Can use a MonitroPi as the FifoPiQ7 controller

- Works with the touch screen of StationPi Pro

- Two upgradable/swapable XO sockets mounted low phase noise local clocks (XOs or OCXOs, with/without OE pin) support frequencies from 5.6448MHz to 89.304MHz and for both 44.1 and 48 sampling frequency families

- Works with SinePi to make use of external high quality sine clocks

- Two separate DC inputs to provide both clean power to the FiFoPi Q7 and the optional Raspberry Pi power via GPIO

- 3.3V ultracapacitor or LifePO4 battery power supplies can be fed directly to the clean side of FifoPiQ7

- Optimized wide bandwidth decoupling networks improve more to the power supply performance

- Non-isolated GPIO connector is designed to install DAC controllers, MonitorPi or other RPi accessories in isolating mode without affecting the signal quality of the isolated outputs

- FIFO memory works as clock isolator across two clock domains to make I2S/DSD signals synchronized to MCLK of XO oscillators.

- Has three output groups: U.FL coaxial connectors, GPIO and the AUX GPIO . They are all independent from each other

- No need for a Linux driver. Can also be used for Raspberry Pi free applications

- Can work with all kind of digital audio sources such as USB, S/PDIF, StationPi, StationPi Pro and so on

- Internal hardware 16 to 32bit lossless convertor

- Bit-perfect and audiophile friendly

- Size and dimensions are compatible with FifoPiQ3 and FifoPi Q7

C. Layout and Dimensions (in mm)

75

58

3.5

65.5

49

POWER

D2

C25 C24 C50 C49 C48 C47

CLEAN POWER

3.3V GND

D3 INPUTS
D4 STATUS
D9

I2S
DSD
DoP

R51 R55

FifoPi
Q7

C176

U13 XO1

U7 XO2

J5

D10 D1 OUTPUT
STATUS

EMPTY LOCK

L1 U11
U2
R57
U20 L5
R48 U25
R46
R50
R1 L8
L10

R54 R39
R52

R30
R27
L4
R49 U19

C67

C66

J13

J12

D7 OUTPUT
FORMAT

D8

DSD I2S

L6

R56 U22

R8
U5

U3
R29 R28
R31 R25
R35 R24

R40

R43 U18

R36

U6

R13
R14

MCLK J6

SD/D1 J10

LR/D0 J9

U21

R26

R9

R32

R23

U.FL I2S/DSD
OUTPUTS

SCK J8

L2

39 GPIO
J7
40

1

2
1
J3 GND

pi POWER

R34 R33 R45 L7

ISO
NONE 39 GPIO
J2
40

2

5V

GND 3.3V

FifoPi Q7
FIFO/Reclocker
I2S/DSD

U24
R65 R64 U23
U16
R62 Q1 R63

J4

F1

R42
R38
R37

L3

R41 R58
R53

J14

R17

R18

C54
C55
C56
C57
C60
C62
C63
C61
C59

MUTE DSD

C75
C76
C85
C84
C83
C82
C77
C78

R59 R61

88 45

89 44

U1

R47

R60

132

133 176

R19

C32 C33
C43 C38
C46 C39

C28 C68

iancanada.mail@gmail.com

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R9 R11
R7

R3

S1

2 1

MCLK J11

U4

R16

C41 C40
C42 C37

R12

R21
R22

R20

R4
R15

2
S1
GND

R6
R67

1 39

J1
2 40

GND 5V

U17

D. Getting started

1. Install the FifoPi Q7 on top of a Raspberry Pi. Please use **11mm standoffs**.

2. Connect a TransportPi, a HdmiPi, or a SYNC mode DAC, or other audio HAT on top of the FifoPi Q7 (or connect to an external DAC through the U.FL connectors). Please use **13mm standoffs** to avoid possible short circuit in between. Connect a MCLK coaxial cable in between through the U.FL connectors if it is required.

3. Install a micro-SD card loaded with the software image of your player into your Raspberry Pi.

4. Connect a good low noise 3.3V DC power supply (LifePO4 battery or Ultracapacitor supply are preferred) to J5. PurePi power supply combo is also recommended for compact size applications.

5. (Optional) If it is required, install a MonitorPi (as FifoPi Q7 controller) or an ESS controller into the non-isolated GPIO J2.

6. Power the Raspberry Pi with 5V DC power supply either at J3 of FifoPi Q7 (via GPIO) or by a PurePi from bottom side of Raspberry Pi GPIO, or directly by a USBC power adapter.

7. Turn on the power supplies. The Input and output status LEDs will be quickly flashed and then the POWER LED D2 and EMPTY LED D10 will change to solid red.

8. Choose the "**Audiophonics I-Sabre ES9028Q2M**" or the "**Generic I2S DAC**" are recommended. The first one is capable of up to 384KHz. (FifoPi Q7 itself doesn't need a Linux driver. But you have to choose a driver for you play software to output digital music signals over GPIO.)

9. Enjoy the music.

VOLUMIO

General Playback Options

🔊 Audio Output

I2S DAC   [On]   ⓘ

DAC Model   Audiophonics I-Sabre ES9028Q2M▾

[Save]

⇶ General Playback Options

DSD Playback Mode   DSD over PCM (DoP) ▾   ⓘ

DSD Auto Volume Level   Off   ⓘ

Volume Normalization   Off   ⓘ

Audio Buffer Size   2 MB ▾   ⓘ

Persistent Queue   [On]   ⓘ

Playback Mode   Continuous ▾   ⓘ

[Save]

🔊 Volume Options

Mixer Type   None ▾   ⓘ

[Save]

🎛 Audio Resampling

Audio Resampling   Off   ⓘ

E. FifoPi Q7 pictures
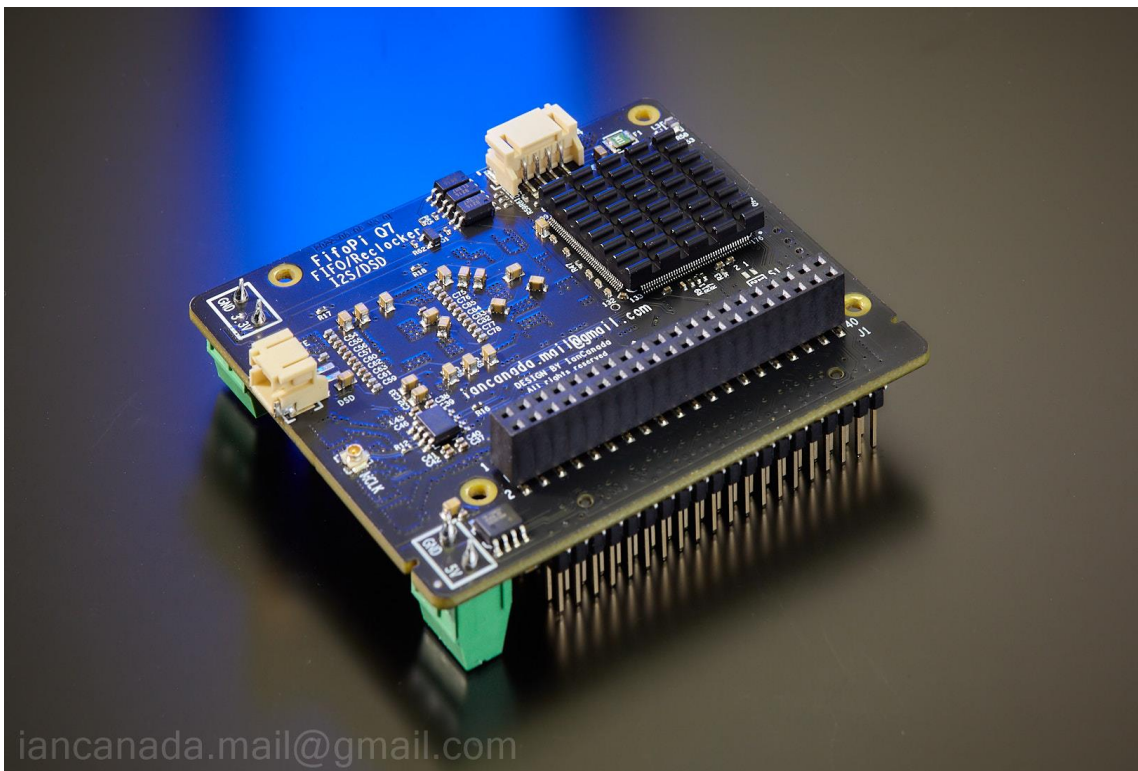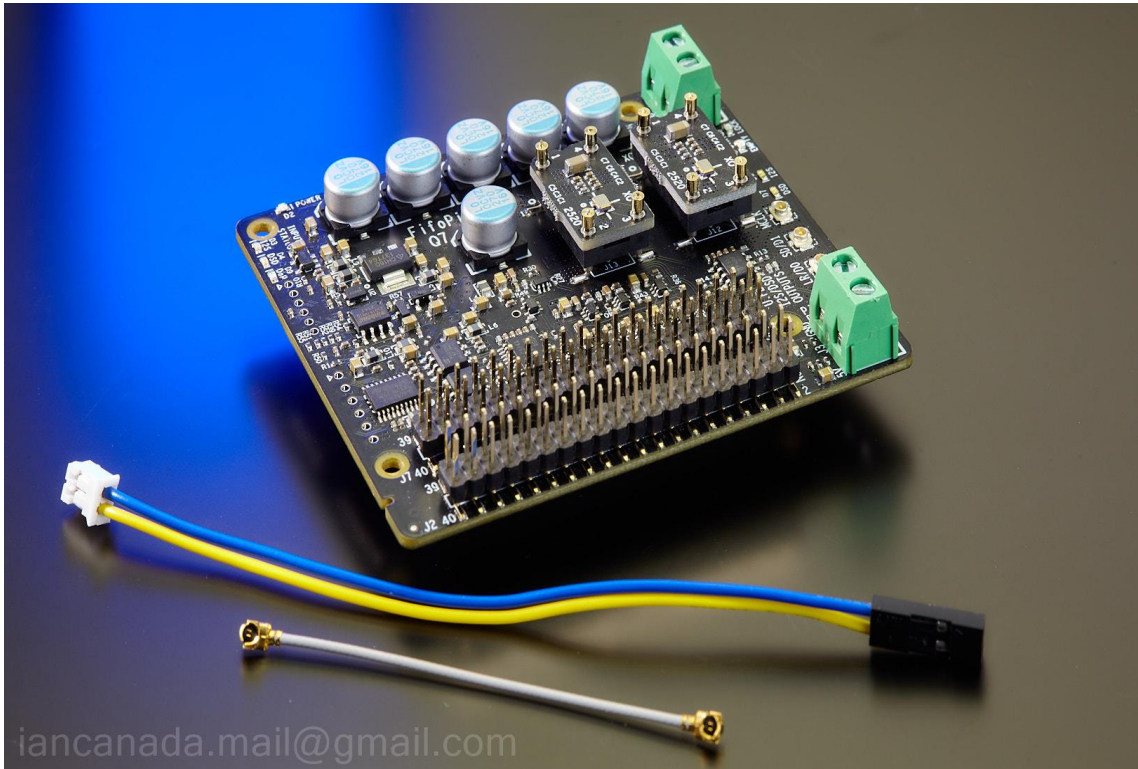
F. Connectors

J5: 3.3V FifoPi Q7 clean side DC power input

Connect a 3.3V DC / 200mA (minimum) power supply to J5 to power the FiFoPi Q7, MAINTAINING CORRECT POLARITY!!! The FifoPi Q7 consumes about 100mA average current with typical 45.1584/49.1520 MHz XO clocks, a little higher with higher frequency clocks. If you use OCXOs or other high current-consuming clocks, you MUST account for the additional current required in your clocks in your choice of a power supply. We prefer to use a 3.3V ultracapacitor / LifePO4 battery direct power supply to achieve best possible sound quality. PurePi is recommend as a decent power supply solution to start. LifePO4Mini 3.3V with a UcConditioner 3.3V would be an even better option to get more improvement. To use this direct 3.3V DC input, a fast start-up power will be required. Be very careful with some linear power supply, they may not meet the timing of FifoPi Q7's initialization timing if they have a soft start performance.

J3: (Optional) 5V RaspberryPi DC power input

You can power your RaspberryPi via GPIO through J3 to the RPi USB power connection. To do so, connect a 5V 2A DC power supply to J3, MAINTAINING CORRECT POLARITY!!! DO NOT connect power to J3 if you already power your Raspberry Pi by a PurePi to the GPIO at the bottom side, or via another method, such as the Micro-USB port. FifoPi Q7 has much powerful FIFO engine, so it's need 5V power supply for J3. FifoPi Q7 will not work if you feed 3.3V to J3.

J6, J11: MCLK outputs (U.FL coaxial cable socket)

MCLK (master clock) output for DAC HAT or external DAC. To operate a DAC (HAT or external) in synchronized clock mode you must connect this to your DAC. J11, a second MCLK output socket, is located at the bottom side of PCB.

J8: SCK outputs (U.FL coaxial cable socket)

SCK (bit clock) output for external DAC. This output is the same for both PCM and DSD format.

J9: LRCK/D1 output (U.FL coaxial cable socket)

LRCK/D1 (PCM left/right clock or DSD data 1) output for external DAC. This Serial Audio Data line is formatted as LRCK when the signal is PCM I2S or D1 when the signal is DSD.

J10: SD/D2 output (U.FL coaxial cable socket)

SD/D2 (PCM data or DSD data 2) output for external DAC. This Serial Audio Data line is formatted as SD when the signal is PCM I2S or D2 when the signal is DSD

J14: MUTE/DSD control signals

Pin 1: MUTE signal. A logic high output indicates DAC should be muted. This signal is optional. Most DACs or DAC HATs do not need this signal.
Pin 2: DSD_EN signal. A logic high output indicates native DSD format is playing. This signal is optional. Can be used for external or internal DAC that need this signal to switch between PCM and DSD.

The MUTE/DSD can be connected to TransportPi, HdmiPi Pro or HdmiPi if your DAC takes those control signals.

40PIN GPIO connectors

PIN#	J1	J2	J7
	GPIO connecting Raspberry Pi to FifoPi Q7	AUX GPIO for a controller or other digital devices	Prime GPIO for a DAC HAT or other audio devices
1,17	Raspberry Pi 3.3V output	Raspberry Pi 3.3V output	Only 1 for FifoPi Q7 clean 3.3V
2,4	Raspberry Pi 5V input/output	RaspberryPi 5V input/output	FifoPi Q7 clean 3.3V internally connected to J5+
6,9,14,20, 25,30,34, 39	GND	GND	GND
3	I2C DA of RPi	I2C DA of FifoPi Q7	I2C DA of FifoPi Q7
5	I2C CL of RPi	I2C CL of FifoPi Q7	I2C CL of FifoPi Q7
12	SCK Input	AUX SCK output	Prime SCK output
35	LRCK Input	AUX LRCK/D1 output	Prime LRCK/D1 output
40	SD/D2 Input	AUX SD/D2 output	Prime SD/D2 output
All other pins	Connected to the GPIO pins of the Raspberry Pi	Duplicating the same # GPIO pins of the Raspberry Pi	Not connected

J12/J13: Optional External oscillator inputs in U.FL

J12/J13 can be used to connect to external oscillators via U.FL coaxial cables. Uninstalled by default.

XO sockets U7 and U13 have to be removed before soldering U.FL sockets to J12 and J13 position.

No XO selection logic is required for external oscillators.

J4: External Display/Control Panel connector (for future external display/controller)
4pin PH2.0mm connector

1	2	3	4
GND	RXd	5V	TXd

Note1: Can be used to connect to the StationPi Pro. StationPi Pro touch screen can be used together with MonitorPi.
Note2: All input/output signals are at LVTTL (3.3V) logic level.

G. Use MonitorPi as FifoPi Q7 controller

The MonitorPi's FifoPi Q7 controller function will be enabled when the MonitorPi is installed into the non-isolated GPIO of the FifoPiQ7. FifoPi Q7 controller function doesn't affect MonitorPi's other functions.

(1). FifoPi Q7 information display areas

Once the FifoPi Q7 controller function is enabled, the bottom-right area of the MonitorPi OLED screen will display FifoPi Q7 information. Such as music format and signal status, delay time, XO1 and XO2 frequency.

(2). FifoPi Q7 settings

Press the control button at the top right corner of the MonitorPi, the countdown page will appear. You can now go to the setting page by pressing the control button again within the three seconds when the countdown page is showing. And then at the setting page, continuously press the control button to go through all setting items.

Press and hold the button when FifoPi is highlighted. FifoPi setting page will show. Press and hold the button at the highlighted settings you want to change to enable editing mode. And then press the button for more times to get the setting options. Stop at the option that you want to change to, MonitorPi will automatically confirm and apply that setting option in three seconds. Once done, it will return to the main display page.

FifoPi Q7 will have the following settings:

Delay time: 0.1 seconds to 1 second

> Default delay time is 0.2s. If it is possible, select a loner delay time, such as 0.5second, to make it buffering music with bigger FIFO memory. FifoPi Q7 has the advanced variable depth FPGA algorithm which can adjust the FIFO memory automatically according to the music frequencies to make the same delay time apply to all different sample rates and formats.

DoP hardware decoder: Enable/Disable

> By default, the DoP decoder function is enabled.

> Some DAC chips (such as ES9038Q2M) have a built-in DoP decoder. If you want to use those built-in DoP decoders, you need to disable FifoPi's DoP decoding function to pass through the DoP. Otherwise, any DoP stream will be converted into native DSD format by FifoPi's hardware DoP decoder. When DoP decoder is disabled, DoP stream will be treated as PCM format and passed through un-converted.

16bit to 32bit hardware lossless convertor: Enable/Disable

> By default, the 16bit to 32bit converting function is disabled. FifoPi Q7 will output 16bit music in its original data depth.

> Some DAC doesn't support 16bit music, for example the popular 44.1KHz 16bit CD format. In this case, you have to enable the software up-sampling to convert it into 32bit, otherwise it will be no sound or play noise. However, the software up-sampling process may not be in a way of lossless. With a FifoPi Q7 in system, you can simply fix this problem by just enabling the 16bit to 32bit hardware lossless convertor function.

Continuous clock output mode: Enable/Disable

This is a great feature to eliminate the pop sound when music is start/stop or changed.

By default, this function is disabled. In this case, the FifoPi Q7's SCK/BCK, LRCK output will be stopped if the RaspberryPi or input music is stopped.

When this function is enabled, both SCK/BCK and LRCK, as well as music format will be continuously output without change even the Raspberry Pi or input music is stopped or to be changed. Silence pattern will be played for both I2S and DSD music meanwhile. Once the music is started again, the new music will be seamlessly played upon locked.

This feature applies to both PCM and DSD music.

You can enable this function if your DAC doesn't have an auto mute function or has pos sound at the moment of music start/stop or change between PCM and DSD. I suggest set delay time longer than 0.5s when this function is enables for a smoother playback.

Please note that this feature can eliminate the pop sound of a DAC to a lowest possible degree. However, it may still up to the particular DAC. You can also try to use the MUTE control signal from J14 as an alternative option.

(3). Save FifoPi Q7 settings

The settings will be automatically saved into the Flash memory of the FifiPi Q7 once applied. So, the settings will be kept and carried over at next time power up, even if the MonitorPi is removed from the system.

(4). Note:

To use MonitorPi for the FifoPi Q7 settings, both pins of the setting jumper S1 have to be kept in "OFF" positions.

Can move MonitorPi externally to front panel by install it into a universal GPIO extension KIT.

H. Jumper settings (not recommended)

Jumper switch S1 is located at bottom side of PCB. It can be an alternative to the MonitorPi for the FifoPi Q7 settings.

To use this hardware jumper settings, all the MonitorPi settings have to be kept as default. MonitorPi would be a better solution for FifoPi Q7 settings. Jumper switch S1 is not recommended to use.

Jumper Switch S1	OFF (default)	ON
1	DoP decoding enabled	DoP decoding disabled
2	Output format bit depth keeps the same as original input format	Force lossless conversion of16bit PCM I2S into 32bit

I. LED indicators

Group	LED	Description	On Indicates...
Input status	D3	I2S	PCM I2S format input
	D4	DSD	Native DSD format input
	D9	DoP	DoP format input and converted into DSD format
Output status	D8	I2S	PCM I2S format output
	D7	DSD	Native DSD format output
FIFO status	D1	LOCK	FiFoPi locked with input
	D10	EMPTY	FiFoPi is empty
Clock Selection	D6	XO1	XO1 is selected for MCLK
	D5	XO2	XO2 is selected for MCLK
Power	D2	Power	FifoPi Q7 Pi side power is on and FPGA is in working order

J. Clocks

The FiFoPi Q7 has two sockets for clocks, XO1 (U13) and XO2 (U7). A clock appropriate to your serial audio data stream's sampling frequency must be installed in at least one of them. Standard DIP 3.3V clock oscillators with DIP 14 pin configurations are good for XO1 and XO2. Surface mount (SMT) oscillators can also be used by mounting them on SMT adapters.

IF your incoming PCM I2S or DSD stream will always have the same or same Fs family, you can install a clock for that Fs family and leave the other socket empty. The clock or clocks you use can be installed in either socket, the FiFoPi will recognize the clock frequencies and use them as appropriate.

Clock frequencies must be selected from the following two frequency groups.

Clock frequency group 1		Fs supported				
		44.1KHz DSD64	88.2KHz DSD128	176.4KHz DSD256	352.8KHz DSD512	705.6KHz DSD1024
XO/OCXO Frequencies can be used *	5.6448MHz	√				
	11.2896 MHz	√	√			
	22.5792 MHz	√	√	√		
	45.1584 MHz	√	√	√	√	
	90.3168 MHz	√	√	√	√	√

Clock frequency group 2		Fs supported				
		48KHz	96KHz	192KHz	384KHz	768KHz
XO/OCXO Frequencies can be used *	6.144MHz	√				
	12.2880 MHz	√	√			
	24.5760 MHz	√	√	√		
	49.1520 MHz	√	√	√	√	
	98.3040 MHz	√	√	√	√	√

Clock Note 1: When using 2 clocks, they have to be selected from two different frequency groups, but don't have to be a frequency pair nor do they have to both be XOs or OCXOs. For example, a 22.5792 MHz XO can work together with a 49.1520 MHz XO. AND one of them can be an XO and the other an OCXO.

Clock Note 2: OE (output enable/disable function) pin is no longer required for XOs.

K. Application examples

1. Compact size high performance Raspberry Pi streamer transport
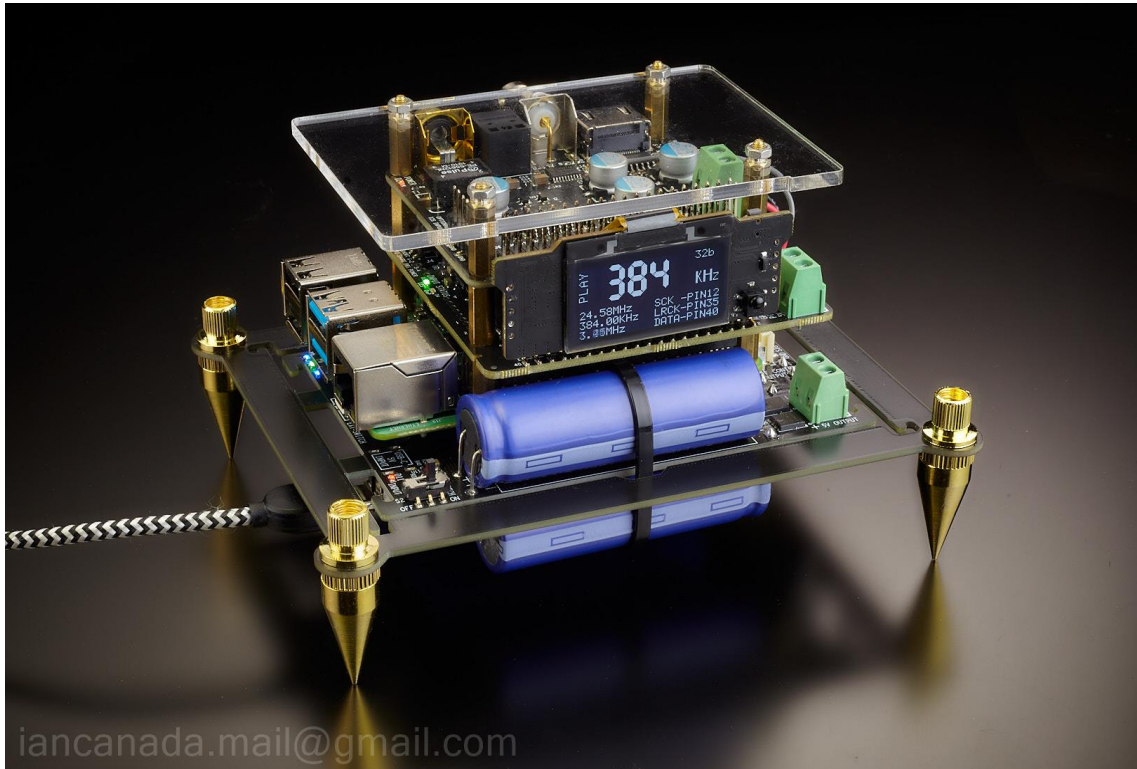
Components:

(1). Raspberry Pi

(2). FifoPi Q7

(3). TransportPi MKII (or HdmiPi, or the coming TransportAES and the HdmiPiPro)

(4). MonitorPi as OLED display (optional)

Power supply:

PurePi (5V ultracapacitor, 3.3V LifePO4 battery power supply combo) with USBC input (2.5A)

Configurations:

Keep everything no change as default

Connections:

(1). Connect the MCLK signal from J6 of FifoPi Q7 J6 to J4 of TransportPi MKII.

(2). Connect the 3.3V battery power supply from J2 of PurePi to J5 of FifoPi Q7 with two high quality wires.

(3). Install the MonitorPi onto the AUX GPIO of the FifoPi Q7 (optional)

Note:

The spike feet kit can be found at Amazon.

2. **Flagship I2S/DSD over HDMI transport**
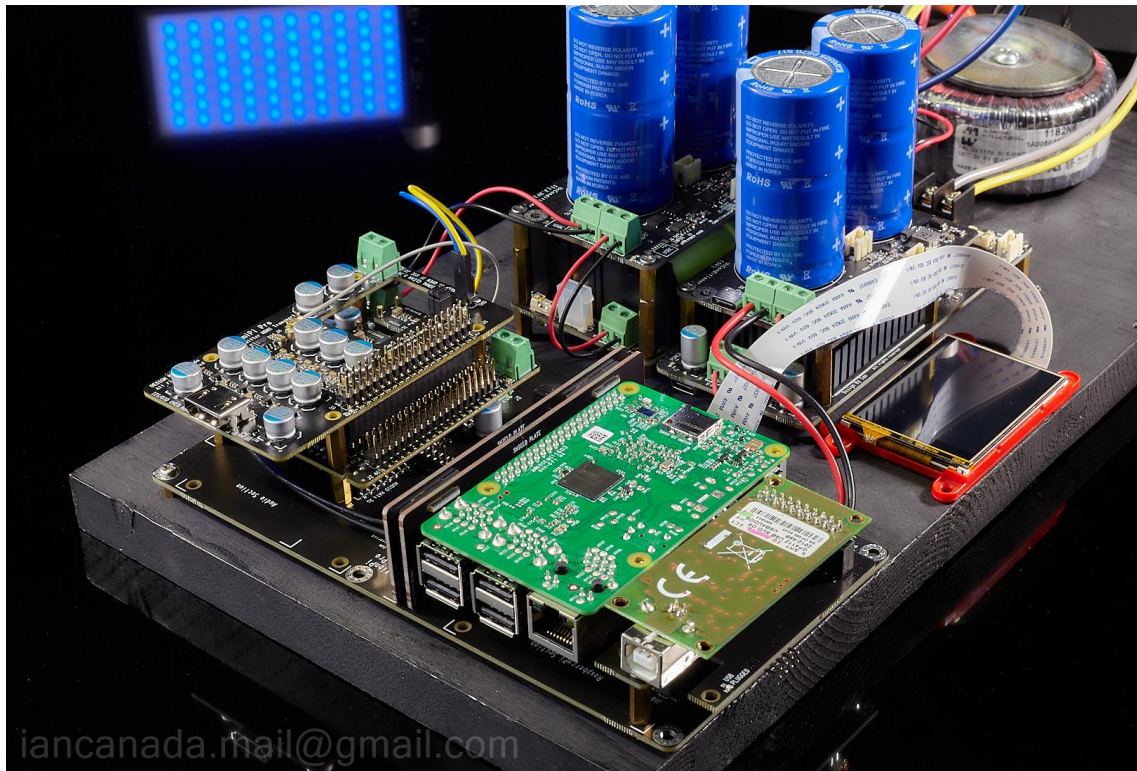
Components

(1). HdmiPi Pro

(2). FifiPi Q7

(3). StationPi Pro

(4). GEN4-ULCD-24PT Touch screen as StationPi Pro and FifoPiQ7 controller

(5). Raspberry Pi

(6). Amanero Combo384 or compatible size USB streamer (optional).

Power supply

(1). LinearPi 5V + UcConditioner 5V

(2). LifePO4 Mini + UcConditioner 3.3V

(3). Hammond 1182N6 transformer

Connections

(1). Connect the MCLK from FifoPi to J4 of HdmiPi Pro

(3). Connect DSD/MUTE control signals from FifoPi to J6 of HdmiPi Pro

(3). Connect the 3.3V output from UcConditioner 3.3V to 3.3V clean side DC input of FifoPi

(4). Connect the 5V output from UcConditioner 5V to the 5V input of StationPi pro.

(5). Keep both jumpers at J9 on StationPi Pro short to share 5V with FifoPi Pi side

(6). Connect the control cable from FifoPi to StationPi Pro

L. How to produce the best sound quality using your FifoPi Q7

1. Install great clocks

The primary mechanism the FifoPi Q7 uses to lower jitter and improve the sound is by recreating the audio stream referenced to low-jitter clocks. The better clock you use, the more improvement you can get from your FifoPi Q7.

The two XO oscillators supplied with the board are carefully selected low jitter 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. Another good choice are the SDA series from NDK, but you will need SMT XO adapter to install.

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 FifoPi Q7 through the SinePi adapter.

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

2. XO frequency and the sound

When connecting the MCLK line to a DAC to run it in synchronous mode, for a given sampling rate frequency ratio (Fs), using different frequency clock may produce slightly different results. This is caused by the differences in the internal processing in the DAC chips as they perform the digital-to-analog conversion. For example, we listened to a 44.1 KHz audio stream reproduced by some DAC chips (not all), first with a 22.5792 MHz (512Fs) and then with a 11.2896 MHz (256Fs) clock installed. We found the sound stage changed slightly based on the clock. And with some DAC chips, we preferred the results using 90.3168/98.3040 MHz clocks than the more commonly used 45.1584/49.1520 MHz. Feel free to not only try clock types, but also different clock frequencies according to your personal preference.

3. Power your FifoPi Q7 from a directly-connected 3.3V ultra capacitor or LiFePO4 battery supply

The quality of your FiFoPi power supply directly impacts both FiFoPi 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 isolated DC input terminal J5.

If you are building a compact system, PurePi power supply will be highly recommended to provide both ultracapacitor 5V and pure isolated LifePO4 3.3V for both RaspberryPi and the FifoPi Q7 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 great option.

If your system needs more voltage rails, the LifePO4 power supply could be a good option to provide up to six 3.3V battery outputs and one 5V linear output. UcMateConditioer and UcHybrid and UcAdapter are also available to upgrade this solution with ultracapacitors.

M. Some application notes

1. Can FifoPi Q7 work with TransportPi or HdmiPi?

Yes, FifoPi Q7 works with all SYNC mode audio HATs such as a TransportPi or HdmiPi to improve sound quality.

2. What kinds of DACs can a FifoPi Q7 work with?

Any kinds of SYNC mode DACs, such as the dual mono ESS9038Q2M DAC, the ES9028Q2M DAC, external DACs and so on, should work greatly with FifoPi Q7. However, by principle, any master clock mode DACs, such as a Hifiberry DAC+, have no way work with any re-clockers including the FifoPi Q7, FifoPiQ3 and FifoPi Q7.

3. Can FifoPi Q7 work with ReceiverPi or a RaspberryPi free application?

Yes, FifoPi Q7 is an independent FIFO re-clocker working in SYNC mode. It will work great for any Raspberry free application.

4. 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.

5. 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.

6. The size of standoffs

11mm M2.5 standoffs are suggested to be installed between RaspberryPi and the FifoPi Q7.

13mm M2.5 standoffs can be used between FifoPi Q7 and other HATs on top to avoid short circuit.

7. Power supply selection guide for FifoPi Q7

Power supply is very significant to FifoPi Q7 to achieve its low noise and low jitter performance at the highest possible level. Here are some power supply options:

(a) 3.3V linear regulator or LDO

Linear regulator has much less noise than a SMPS. It will be one of the good options to power a FifoPi Q7. However, some linear regulators have very slow start-up time which may not meet the FifoPi Q7's initialization timing. So have to carefully select a fast start-up linear power supply for the FifoPi Q7. On the other hand, the active components in the linear regulators can result in higher 1/f noise and flicker noise level, so they may not perform as good as an ultracapacitor power supply or battery power supply for the FifoPi Q7.

(b). PurePi

I highly recommend the PurePi for compact size FifoPi Q7 applications because it integrates both 5V ultracapacitor power supply and 3.3V isolated pure LifePO4 battery power supply together for RaspberryPi and FifoPi Q7. Furthermore, there are still rooms to improve if you install an UcConditioner 3.3V to work with the PurePi battery voltage rail down the road. PurePi is also not expensive compared with the performance.

(c). LifePO4 Mini 3.3V

LifePO4 Mini 3.3V would be highly recommended for larger scale FifoPi Q7 applications (with StationPi for example).   It has bigger battery cells than the PurePi, so the ESR will be lower and the pure time will be longer. LifePO4Mini 3.3V can also be upgraded by an UcConditioner 3.3V to achieve a higher performance level.

(d). UcPure pure ultracapacitor power supply in 3.3V configuration

UcPure could be the best performance ultra-low noise high dynamic power supply so far in the world. Performance wise, it's the best of the best. However, the 3000F ultracapacitors could be too big and too expensive. That is the only drawback I can see.

N. FifoPi Q7, FifoPiQ3 and FifoPiMa cross reference

Comparison	FifoPi Ma	FifoPi Q3	FifoPi Q7
Key features	High performance competitive price	Advanced	Flagship
Mode	Master	SYNC	SYNC
Low jiter MCLK output	Yes	Yes	Yes
Engine Architecture	N/A	16 bit	32 bit
FIFO Memory	None	64Mbit	64Mbit
I2S/DSD Re-clocker	2 stages low noise discrete one-bit re-clockers	1 stage multi-bits re-clocker	3 stages low noise discrete one-bit re-clockers
Built-in Isolator	None	Yes, with integrated isolator	Yes, with low noise discrete isolators for the best possible isolation performance
Ouput signal quality	ultra low noise, almost perfect signal quality	Signal quality is great but still has chance to improve by installing a ReClockPi	ultra low noise with isolation, almost perfect signal quality
PCM input/output	384KHz	768KHz	768KHz
DSD	DSD 128 output only	DSD1024	DSD1024

input/output			
DoP input/output	DoP Decode/pass through	DoP Decode/pass through	DoP Decode/pass through
Linux driver	Need	No Need	No Need
XO sockets	Yes, upgradable	Yes, upgradable/swappable	Yes, upgradable/swappable
Work with RPi	Yes	Yes	Yes
Work USB	No	Yes	Yes
S/PDIF or I2S over HDMI as input	No	Yes	Yes
StationPi Pro External Controller	No support	Yes	Yes
Support MonitorPi as Controller	No support	NO	Yes
GPIO OLED controller	Works with MonitorPi but no control function	External controller of Works with MonitorPi but no control function	Yes, Works with MonitorPi for both control and monitoring functions, Also works with StationPi Pro Touch screen as controller
Continuous clock mode	Yes	No	Yes, Advanced continuous clock mode for both PCM and DSD
Clean Side power supply	3.3V /Ultracapacitor/battery	Isolated 3.3V /Ultracapacitor/battery	Isolated 3.3V /Ultracapacitor/battery
XO frequencies support (MHz)	22/24, 45/49	5.6/6.1,11/12,22/24,45/49,90/98	5.6/6.x,11/12,22/24,45/49,90/99
Delay Time	No delay	fixed 0.2s delay time for all Fs	Programmable delay time between 0.1s - 1s
Work with SinePi	Yes	Yes	Yes
16bit to 32bit lossless convertor	Yes (V1.5 or higher)	Yes	Yes
Bit-perfect	Bit-perfect	Bit-perfect	Bit-perfect
Size and dimension	Same and compatible	Same and compatible	Same and compatible
Price	Lower	Higher	Even higher

O. Troubleshooting

1. I upgraded my FifoPiMa with a FifpiQ7. But when I start to play music, the warning window popped up on the screen saying the Linux driver doesn't work. How to fix it?
   Solution:
   FifoPiMa needs a Linux driver to function. However, with that driver it will not play music correctly if FifoPiMa is removed from system.
   When selecting the "Audiophonics I-Sabre ES9028Q2M" or the "Generic I2S DAC" as the output device driver for FifoPi Q7, the issue is fixed.

2. After upgrading with the Accusilicon AS318B XOs, FifoPiQ7 doesn't lock to the music. Both input LED and EMPTY LED light up when playing music. But there is no output. How to solve this problem?
   Solution:
   A few kinds of XO clocks have very strong internal pull-up resistors on the OE pin which could result in a wrong logic level to the XO selection signal. However, FifoPiQ7 doesn't need that OE pin. If that's the case, please just bend or simply remove the pin1 of those XOs so that the pin1 doesn't be plugged in the XO socket, the problem will be solved. Please see the pictures for below for details.
   Actually, without OE pin could be a better option, because both XO can keep running in even for the one that is not currently selected. However, if you still prefer keeping the OE function in this case, you can also take another solution to fix the issue by reducing the pull-up strength, which is just simply connect a 1K resistor between the pin1(OE) and pin2(GND) of both XOs.

3. When install the FifoPi Q7 at horizontal position into the J7 on StationPi Pro, the heatsink will touch the pins of StationPi Pro GPIO connector J2 at bottom side of FifoPi Q7 PCB. How to address this issue.

   Solution:

   You can just simply bend the first six pins of GPIO connector J2 on StationPi Pro to the both sides. Please make sure the bended pins are no long touch the FifoPi Q7 heatsink and also with safe space.

   Down the road, if you want to install the FifoPi Q7 at vertical position to StationPi J2, you can just bend those pins back to the original positions.

4. I installed 11mm standoffs between FifoPiQ7 and the TransportPi MkII (or other audio HAT), but my FifoPiQ7 PCB was blown out when I turn on the power supply. Why?

   Solution:

   11mm standoffs are too short to leave enough space in between. It can result in a short circuit between FifoPiQ7 and other audio HATs on top. Especially when you use metal case XOs.

   Please use 13mm standoffs to avoid this kind of damage.