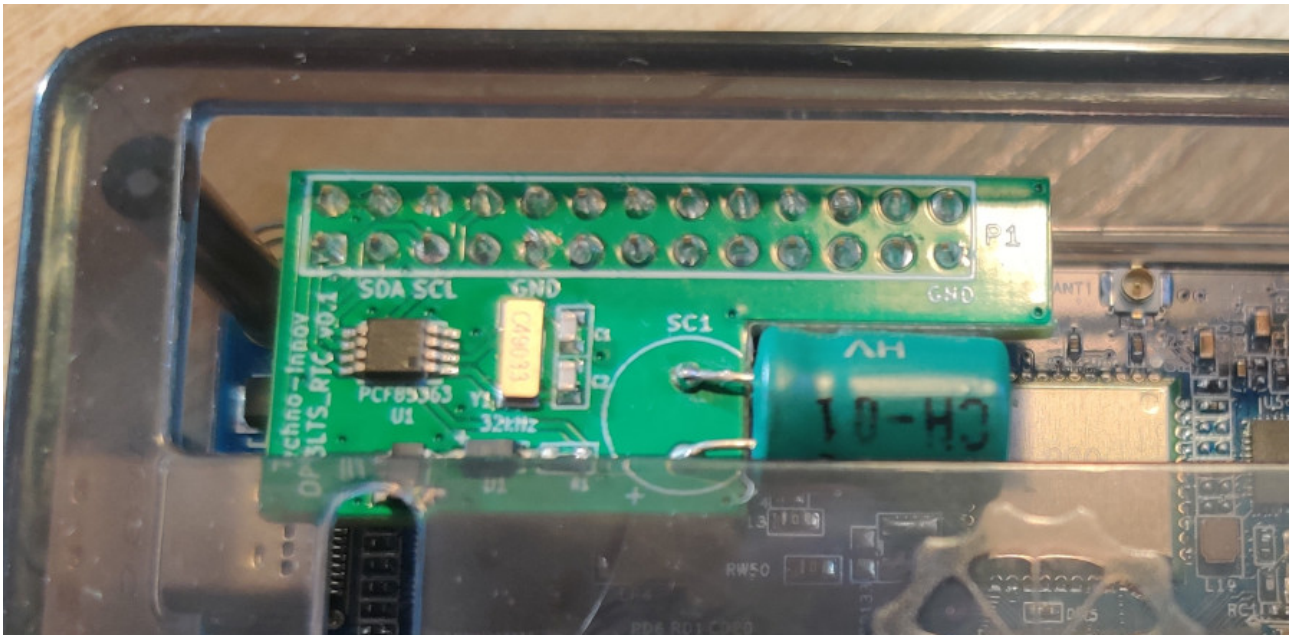
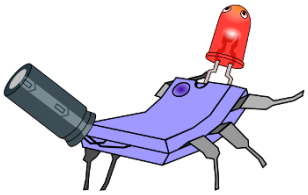


Pi RTC and NVMEM Extention
System Reference Manual

PiRTC_SRM for Board v0.2
January, 24 2025 - Doc rev 0.1
Author: Nathaël Pajani



Contents

1 Introduction

You are reading the **System Reference Manual** for the Pi RTC.

The Pi RTC is an electronics development and prototyping adapter board for Single Board Computers (SBC) like OrangePi or Raspberry PI SBC's.
The Pi RTC provides an RTC with Super-Capa power backup and 64 bytes of non-volatile RAM.

The Board uses the 26 pins version of the common extention connector found on many SBC with a form factor close to the original Raspberry Pi, often compatible with the pinout of the 40 pin connector.

The Pi RTC is designed for users interested in embedded ARM development using free, libre and open source softwares only.
Every information about the design is available and all components documentations are freely accessible. You can download the source files for the Pi RTC and modify them using KiCad [1] EDA (GPL) according to the license terms found in the license section.
You can create and produce your own Pi RTC or a modified version (but not sell them).

2 Licenses

2.1 Documentation license

The present document is under Creative Commons CC BY-SA-NC 4.0 [2] License.
It is written in LaTeX and the PDF version is generated using pdflatex.

2.2 Hardware license

The Pi RTC hardware and schematics are under Creative Commons CC BY-SA-NC 4.0 [3] License.
You can produce your own original or modified version of the Pi RTC, and use it however you like, but not sell them, even without profit.

2.3 Software license

All the software examples created for the Pi RTC are under GPLv3 License.

1. http://www.kicad-pcb.org/display/KICAD/
2. https://creativecommons.org/licenses/by-nc-sa/4.0/legalcode
3. https://creativecommons.org/licenses/by-nc-sa/4.0/legalcode

3 Hardware

3.1 Dimensions

Figure 1 gives the different dimensions and the positions of the main elements of the Pi RTC.

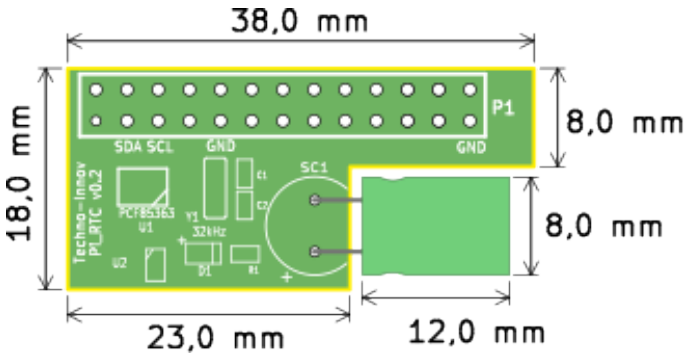


Fig 1 – Board dimensions

3.2 Connectors

3.2.1 P1 Connector

P1 connector is a standard 2.54mm (0.1 inch) pitch header, with 2 row of 13 pins.
P1 connector provides access to the common PI expansion header.

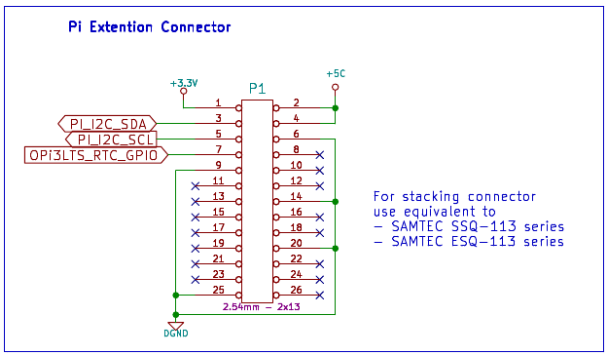


Fig 2 – P1 Connector

Pin #	Description	RPi signal
1	+3.3V from Pi	+3.3V
2	+5V from Pi (RTC charge)	+5V
3	SDA : Serial Data for I²C bus	I2C1 SDA
4	+5V from Pi (RTC charge)	+5V
5	SCL : Clock for I²C bus	I2C1 SCL
6	GND : Ground	GND
7	RTC GPIO	GPIO 4
8	Unused - Not Connected	-
9	GND : Ground	GND
10 to 13	Unused - Not Connected	-
14	GND : Ground	GND
15 to 19	Unused - Not Connected	-
20	GND : Ground	GND
21 to 24	Unused - Not Connected	-
25	GND : Ground	GND
26	Unused - Not Connected	-

Table 1 – P1 Connector Pinout

4 Electronics

The Pi RTC has been created using KiCad [4] EDA software suite for the creation of the schematics and printed circuit boards.

See page 9 in the annexes for the full schematics. The sources for the schematics are available for download from the tindie product page and the Pi RTC directory [5] on techdata.techno-innov.fr.

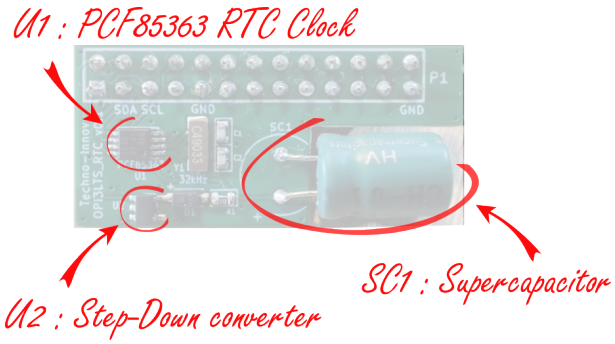


Fig 3 – PiRTC Main Components

Name	Description
U1	NXP PCF85363 RTC Clock.
U2	TI LP2985 DC-DC step-down converter.
SC1	Bussmann 1 Farad supercapacitor.

Table 2 – PiRTC Main Components Description

4.1 I²C

The Pi RTC uses the only I²C bus from the 26 pins Pi connector.
Bus 1 holds the PCF85363 RTC clock at address 0x51.

4.1.1 I²C Addresses

I²C Component	7 bits I²C address	I²C Address + R / W bit
PCF85363 RTC Clock	0x51	0xA2 / 0xA3

Table 3 – I²C Addresses

Table 3 shows all the possible I²C Addresses for the components used on the PiRTC.

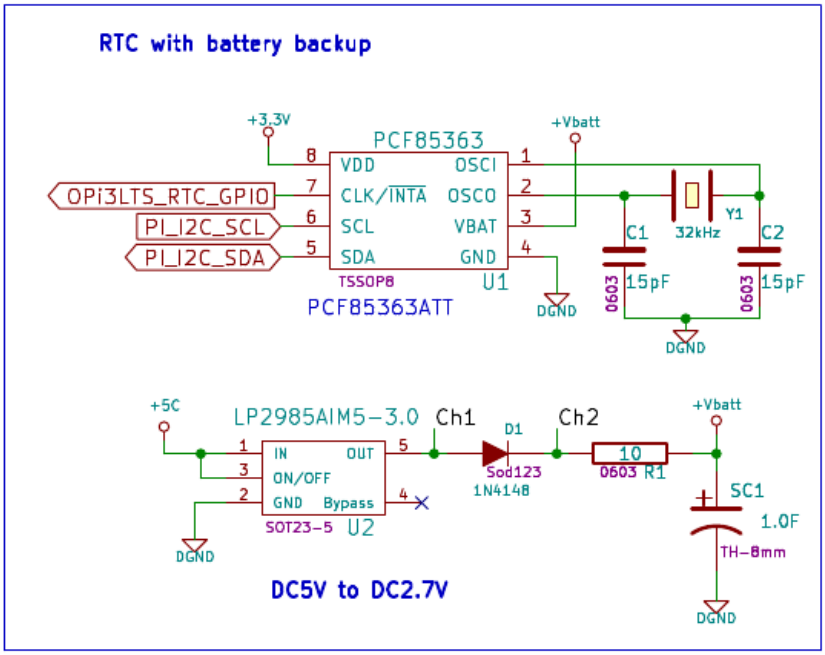


Fig 4 – RTC Clock

4.1.2 RTC Clock

The Pi RTC includes a PCF85363 RTC with super-capacitor power backup.
The use of a Super-capacitor for power backup lowers the environmental footprint and remove the need to replace (and dispose of) the battery at the expense of a shorter time retention, which is between one and two months, but should be enough for most applications.

The Linux kernel has support for the PCF85363 RTC in the rtc-pcf85363 module (`CONFIG_RTC_DRV_PCF85363`).
After loading the rtc-pcf85363 module in the kernel, you must add the RTC to the list of devices on the I²C bus 1 :
`echo pcf85363 0x51 > /sys/bus/i2c/devices/i2c-1/new_device`
This is not necessary if the device tree already contains the corresponding information.
You can the access the RTC with the `hwclock` command (from the `util-linux` package on Debian based GNU/Linux distributions) as one of the `/dev/rtcN` (replace 'N' with the appropriate RTC number).

4.1.3 NVMEM

The PCF85363 RTC includes 64 bytes of non-volatile RAM (so long as the supercapacitor power runs).
In order to be able to access this memory you must have the following config set in your Linux Kernel.

- CONFIG_RTC_NVMEM=y
- CONFIG_NVMEM=y
- CONFIG_NVMEM_SYSFS=y

Refer to our Wiki for further information about how to use the NVMEM.

4. http://www.kicad-pcb.org/display/KICAD/
5. https://techdata.techno-innov.fr/Adapters/PiSerialPower/

5 Software

We noticed that software information evolves way too quickly to be included in such a documentation.

You will find all relevant information on our public wiki : http://wiki.techno-innov.fr/index.php/Products/PiRTC [6]

6 Board revisions history

6.1 v0.1

This board revision has not been sold to public.
First prototype version, produced on customer request.

6.2 v0.2

Actual version sold as of writting of this documentation.
Move RTC GPIO Pin to P1 pin7 instead of P1 pin 8 (UART Tx).

7 Annexes

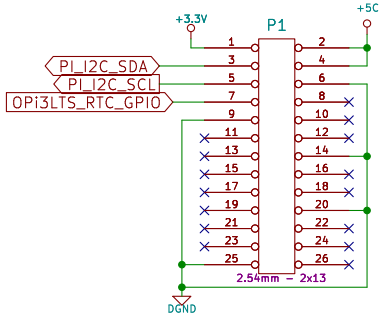
7.1 Schematics

The board schematics and PCB layout have been created using KiCad [7] EDA software suite. You can download the sources on the PiRTC page [8] on wiki.techno-innov.fr.

(See on next pages)

6. http://wiki.techno-innov.fr/index.php/Products/PiRTC
7. http://www.kicad-pcb.org/display/KICAD/
8. http://wiki.techno-innov.fr/index.php/Products/PiRTC

Pi Extention Connector

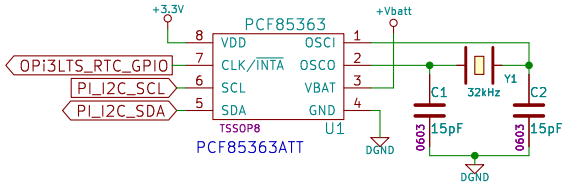


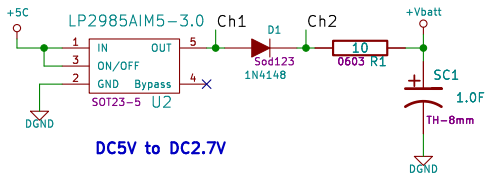
For stacking connector
use equivalent to
- SAMTEC SSQ-113 series
- SAMTEC ESQ-113 series

```
                3.3V - 1  2 - 5V
I2C3 SDA - PD26 - 3  4 - 5V
I2C3 SCL - PD25 - 5  6 - GND
    PWM0 - PD22 - 7  8 - PL2
             GND - 9  10 - PL3
Uart3 Tx - PD24 - 11  12 - PD18
Uart3 Tx - PD23 - 13  14 - GND
           PL10 - 15  16 - PD15
            3.3V - 17  18 - PD16
SPI1 MOSI - PH5 - 19  20 - GND
SPI1 MISO - PH6 - 21  22 - PD21
SPI1 SCLK - PH4 - 23  24 - SPI1 CS - PH3
             GND - 25  26 - PL8
```

OPi3LTS Pinout

RTC with battery backup



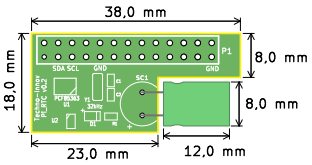


DC5V to DC2.7V

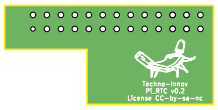
Author : Nathael Pajani - nathael.pajani@techno-innov.fr

Title: OPi3LTS_RTC Adapter	**Rev: 0.2**
Sheet: /	Id: 1/1
Techno-Innov	Date: 2024-03-27

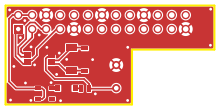
Top silkscreen



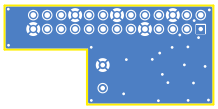
Bottom silkscreen



Top copper layer



Bottom copper layer



Author : Nathael Pajani – nathael.pajani@techno-innov.fr
Licence : Creative Commons – CC – By – SA – NC
Techno-Innov

Sheet:
File: OPi3LTS_RTC.kicad_pcb

Title: OPi3LTS_RTC Adapter

Size: A4	Date: 2024-03-27	**Rev: 0.2**
KiCad E.D.A. 8.0.8		Id: 1/1

7.2 BOM

Part Description	Ref	Module	Nb	Vendor	Vendor ref	Farnell
xRpi connector						
2x13 Extended Tail Socket	-	TH	1	-	SAMTEC	-
RTC						
PCF85363 RTC I²C 64Bytes SRAM	U1	TSSOP-8	1	NXP	PCF85363ATT/AJ	2775939
Xtal CMS ABS10 32,768KHz	Y1	ABS10	1	ABRACON	ABS10-32.768KHZ-7-T	2101351
Capacitor 15pF 0603 NPO 50V 5%	C1, C2	0603	2	MULTICOM	MC0603N150J500CT	1759055
LDO 3,0V	U2	SOT23-5	1	Texas Instruments	LP2985AIM5-3.0/NOPB	1469133
Diode 1N4148	D1	SOD-123	1	DIODES Inc	1N4148W-7-F,	1776392
Super capacitor 1F, 2,7V	SC1	TH-8mm	1	BUSSMANN	HV0810-2R7105-R	2148482
Resistor 33 Ohms – curent limit	R1	0603	1	MULTICOM	MCWR06X33R0FTL	2447344

TABLE 4 – BOM by functional block

Note : Components used on Board may change for functionnally equivalent references without prior notice

7.3 Document revision History

Version	Date	Author	Information
0.1	January, 24 2025	Nathaël Pajani	Initial revision

7.4 Disclaimer

The Pi RTC is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. The entire risk as to the quality and performance of the Pi RTC is with you. Should the Pi RTC prove defective, you assume the cost of all necessary servicing, repair or correction.