

## RT5350F-OLinuXino RT5350F-OLinuXino-EVB

System-on-Module system capable of running OpenWrt Linux

# USER'S MANUAL

Document revision A, June 2017  
Designed by OLIMEX Ltd, 2015



All boards produced by Olimex LTD are ROHS compliant

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## CHAPTER 1: OVERVIEW

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### 1. Introduction to the chapter

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Thank you for choosing this single-board computer from Olimex! This document provides a user's guide for the RT5350F-OLinuXino and RT5350F-OLinuXino-EVB boards. As an overview, this chapter gives the scope of this document and lists the board's features. The document's organization is then detailed.

The RT5350F-OLinuXino development board enables code development of applications running on the RT5350F SoC microcontroller, manufactured by Ralink (a MediaTek's subsidiary company) from Taiwan.

The RT5350F-OLinuXino is typically used together with RT5350F-OLinuXino-EVB which features most of the peripherals and connectors needed for evaluation and utilization of the RT5350 SoC.

The hardware designs of RT5350F-OLinuXino and RT5350F-OLinuXino-EVB board are open-source, open-hardware and all documentation used for the hardware design and manufacturing is available to the customer.

The software written by Olimex for both boards is also open-source and released under GPL license.

#### 1.1 Introduction to system-on-a-module design

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The design of both RT5350F-OLinuXino and RT5350F-OLinuXino-EVB follows the system-on-a-module approach. A low-cost modular design which allows rapid product development and integration in own products. It is a two part system – a main part (smaller, multilayer, very densely populated) that nests the processor, the memory, the power control unit and a peripheral part (bigger and less densely populated) which contains the USB ports, the Ethernet connectors, most of the other connectors and interfaces. SOM designs are targeted at customers who want to apply custom modifications for own projects without having to deal with multilayer PCBs with controlled impedance and BGA assembly. This modular approach makes it possible to create simple 2-layer boards (that can be manufactured by your local PCB manufacturer) containing only the peripherals you need with the dimensions and shape suitable for your specific case.

Both the main part and the peripheral part of the SOM system have support in the official OpenWRT images distributed by Olimex and maintained by Olimex. These recommended images are typically available at the wiki articles of the board. Furthermore, the OpenWRT community recognizes the board and also provides official builds.

The hardware designs of both RT5350F-OLinuXino and RT5350F-OLinuXino-F are open source, unlike other Olimex SOM designs (where the design layout of the densely populated part is propriety).

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## 1.2 Target market of the board

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The RT5350F-OLinuXino board is meant for people interested in single-board Linux computers with extended networking capabilities. The board is easily setup as web server. Basic electronics understanding and experience are recommended. Previous Linux experience and knowledge of OpenWRT are highly recommended.

Using the RT5350F-OLinuXino as a stand-alone development board would be more suitable for users with hardware experience or people already familiar with other single-board Linux boards and designs. As mentioned in the previous chapter the stand-alone board can be implemented in own hardware designs.

It is highly recommended to use RT5350F-OLinuXino with RT5350F-OLinuXino-EVB initially, unless you have previous experience with the same chip or similar boards manufactured by OLIMEX.

Some previous experience with OpenWRT is highly recommended.

Note that in the OLIMEX web-shop the product named “RT5350F-OLinuXino-EVB” includes the main board named “RT5350F-OLinuXino”.

RT5350F-OLinuXino is typically evaluated together with RT5350F-OLinuXino-EVB. In that case, the board's target market widens drastically – the combination is suitable for people familiar with OpenWRT, embedded systems enthusiasts, Linux gadget fans and also networking professionals (since its low cost and OpenWRT compatibility makes it a very good solution for application-orientated embedded systems with networking). The reason for this alteration is the additional hardware provided by RT5350F-OLinuXino-EVB. Generally, the processor's features become easier to access.

In which cases a RT5350F-OLinuXino is suitable for you:

1. The need to implement low-cost wireless and/or wired server or networking option to your end product using Linux-capable module
2. General-purpose performance and video output are not important for your task
3. Interest in OpenWRT Linux or routers in general

In case you are looking for a board suitable for more of a general usage – it might be a good idea to take a look at other OLinuXino boards that provide more desktop-like experience (like A64-OLinuXino-eMMC, A20-OLinuXino-MICRO, or A20-OLiuXino-LIME2).

### 1.3 Features of R5350F-OLinuXino

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The RT5350F-OLinuXino board has the following set of features:

- RT5350F SoC – Ralink’s IEEE 802.11n draft compliant 1T1R MAC/BBP/PA/RF; 360 MHz MIPS24KEc CPU core; a 5-port integrated 10/100 Ethernet switch/PHY and a USB
- 32MB SDRAM
- 8MB SPI NAND Flash
- On-board antenna
- WLAN activity LED
- Power LED
- x3 external connectors at convenient 0.1" step with all RT5350F signals
- x3 external DCDC power converters releasing internal RT5350F vreg and preventing common problem with overheating with this chip.
- Two mounting holes
- Suitable for embedding
- Operating temperature: -10+55C
- Size: (1600×1900)mils ~ (41×48)mm

### 1.4 Features of R5350F-OLinuXino-EVB

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The RT5350F-OLinuXino-EVB board extends the hardware provided by RT5350F-OLinuXino in order to make it easier for initial evaluation with the following set of features:

- Barrel power jack for easier powering (5V only!)
- USB 2.0 type A connector
- 2×10/100 Mbps Ethernet ports with connectors
- UART connector pins at 0.1" step for easier serial debugging
- 2×15A/240VAC relays with connectors and status LEDs
- User-programmable button
- UEXT connector
- JTAG pinholes exposed for chain programming
- EXT connector at 0.1" step with the unused RT5350 signals
- 27 GPIOs on a connector (24 free GPIOs)
- 4 grounded mounting holes
- Operating temperature: -10+55C
- Dimensions: (4000×2500)mils ~ (102×64)mm

Note that the product named “RT5350F-OLinuXino-EVB” in our web-shop includes the main board named “RT5350F-OLinuXino”.

### 1.5 Board revisions used in the manual

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The documents follows the hardware layout of RT5350F-OLinuXino board revision D. RT5350F-OLinuXino-EVB revision B board of peripherals was used while writing this document. Different board revisions might have different features or settings. It is possible that parts of this document do not apply to all board revisions.

## 1.6 Document organization

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Each section in this document covers a separate topic, organized as follows:

- Chapter 1 is an overview of the board usage and features
- Chapter 2 contains the general board diagram and layout
- Chapter 3 provides a guide for quickly setting up the board and software notes
- Chapter 4 describes the component that is the heart of the board: the RT5350F SoC
- Chapter 5 is an explanation of the control circuitry associated with the microcontroller
- Chapter 6 covers the connector pinout, peripherals and jumper description
- Chapter 7 provides the schematics and the dimensions of the board
- Chapter 8 contains the revision history, useful links and support information

## CHAPTER 2: BOARD DESCRIPTION

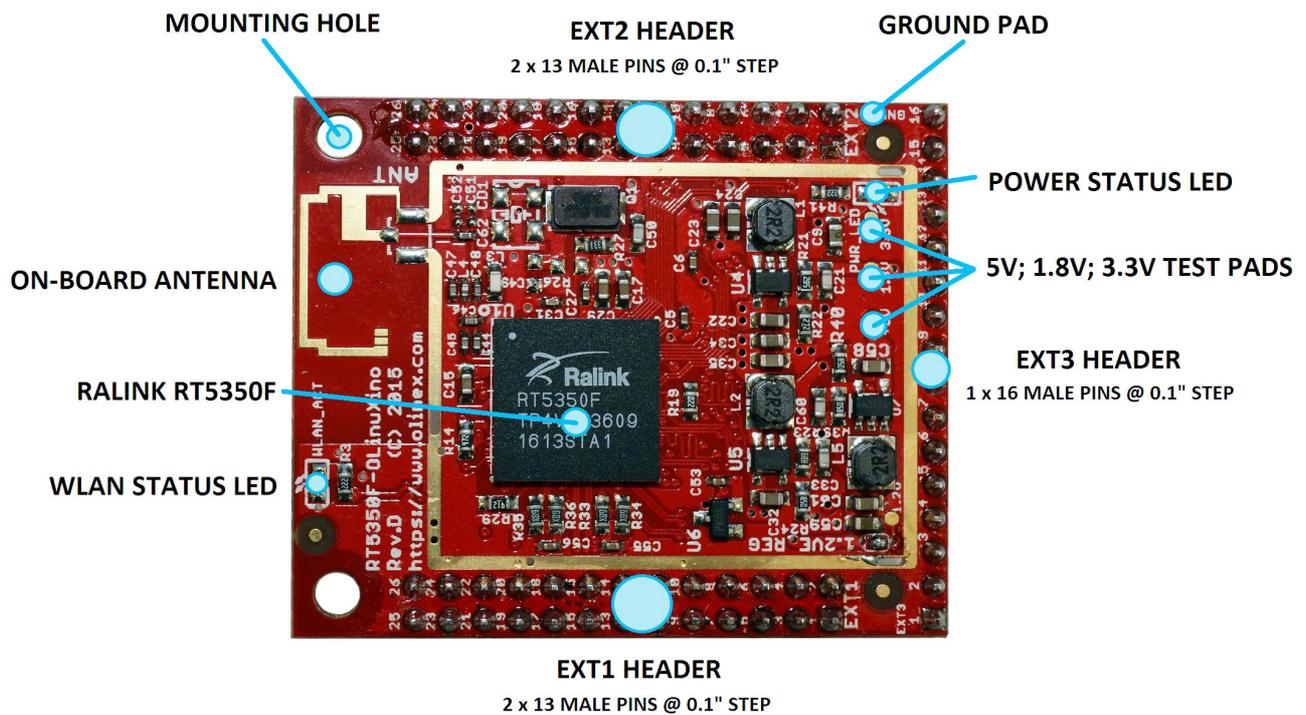
### 2. Introduction to the chapter

Here you get acquainted with the main parts of the board. Note the names used on the boards might differ from the names used below to describe them. For the actual names either refer to the hardware design files or inspect the white print on the boards.

### 2.1 Layouts

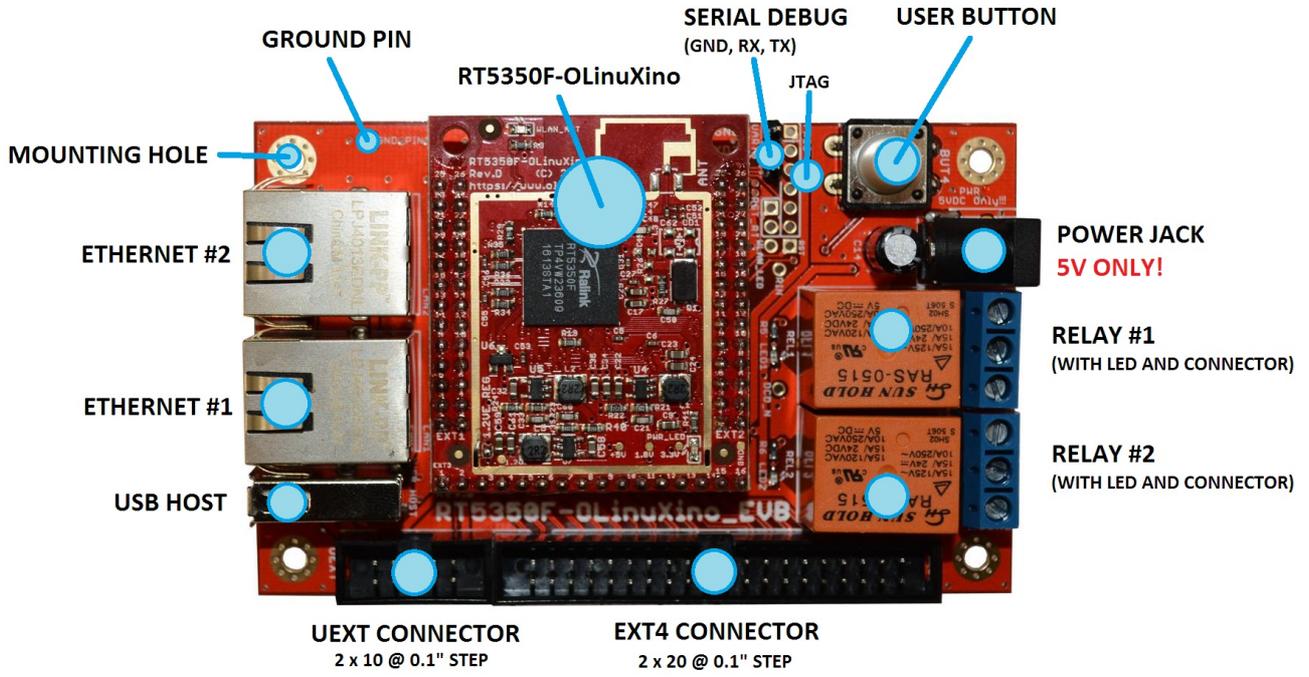
#### 2.1.1 RT5350F-OLinuXino top view

The picture below shows the top side of the RT5350F-OLinuXino board and highlights the most important parts:



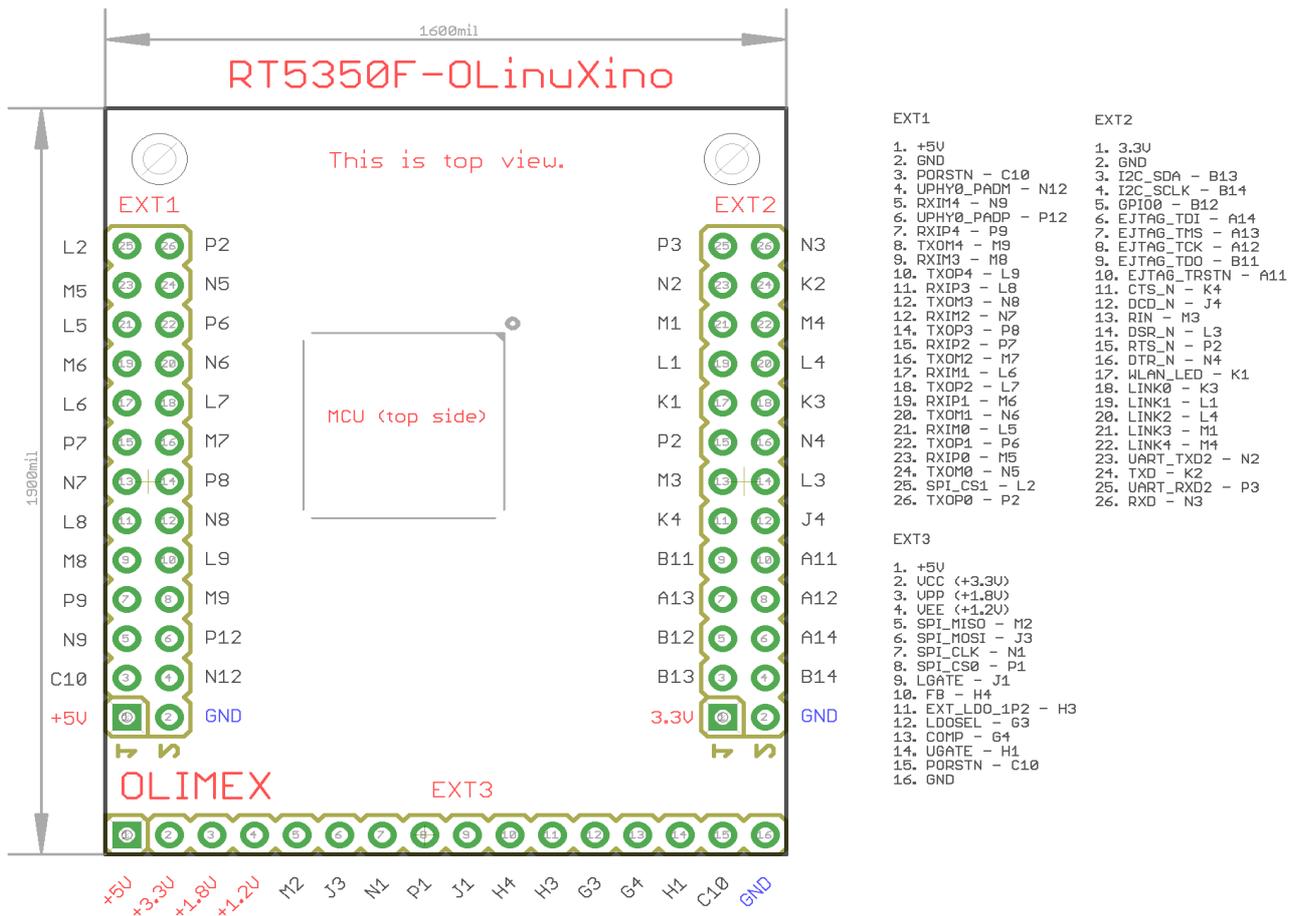
### 2.1.2 RT5350F-OLinuCino-EVB top view

You may find similar picture of RT5350F-OLinuCino-EVB on the next page.



## 2.2 Pinout RT5350F-OLinuXino (top view)

The picture below shows the pinout of the EXT1, EXT2, and EXT3 connectors at the top side of the board. EXT1, EXT2 and EXT3 come with male connectors with 0.1" step placed at the bottom of the board. These are used to attach RT5350F-OLinuXino to RT5350F-OLinuXino-EVB (or to your custom shield of peripherals).



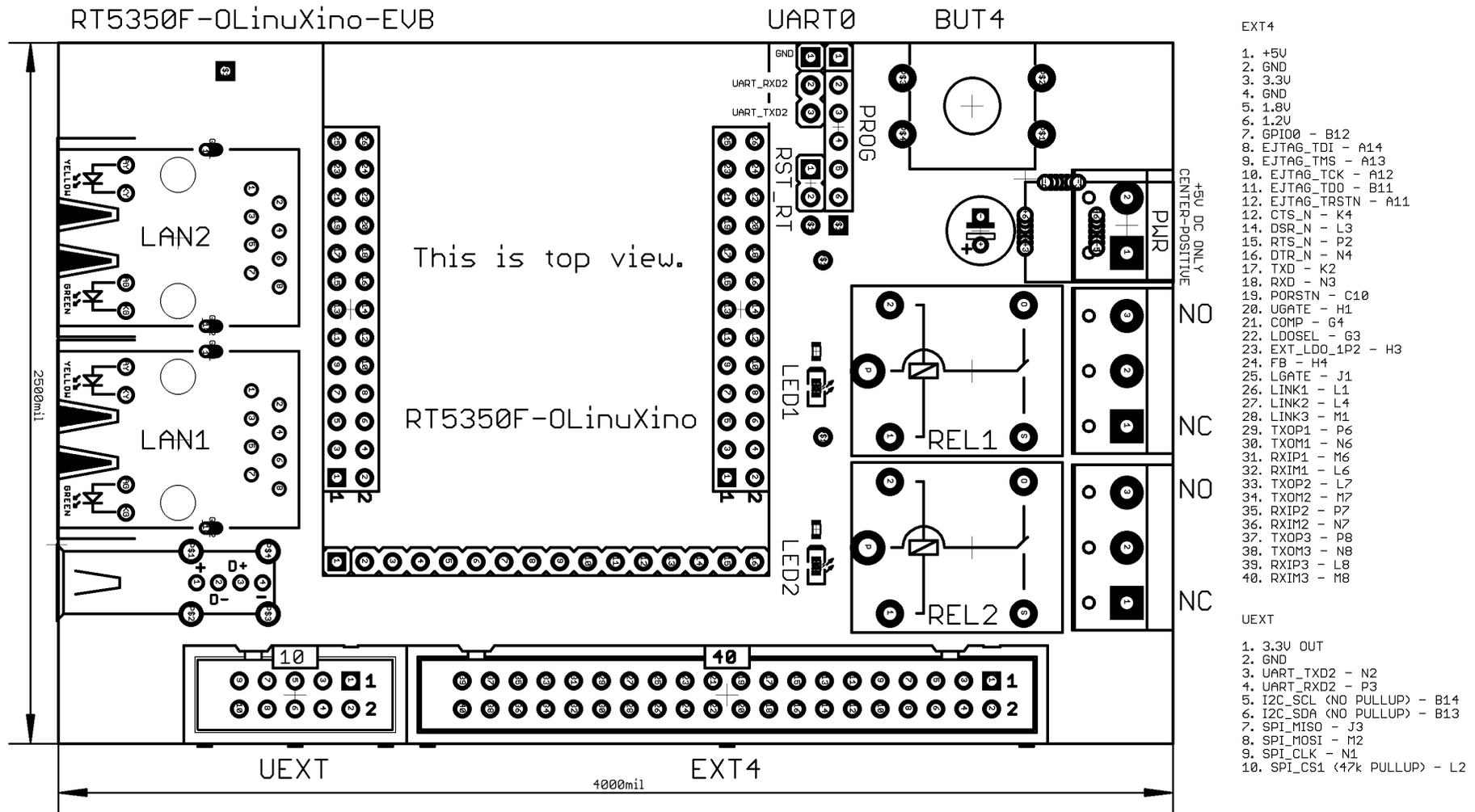
You can find the board's schematics at our GitHub pages.

[www.OLIMEX.com](http://www.OLIMEX.com)

You can find a stand alone picture of the pinout at the following link:

<https://www.olimex.com/Products/OLinuXino/RT5350F/RT5350F-OLinuXino/resources/rt5350f-olinuxino-pinout.png>

### 2.3 Pinout RT5350F-OLinuXino-EVB (top view)



You can find a stand alone picture of the pinout at the following link: [RT5350F-OLinuXino-EVB's pinout](#)

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## CHAPTER 3: SETTING UP THE RT5350F BOARD

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### 3. Introduction to the chapter

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This section helps you set up the development board for the first time. Please consider first the electrostatic warning to avoid damaging the board, then discover the hardware and software required to operate the board.

The procedure to power up the board is given, and a description of the default board behavior is detailed.

#### 3.1 Electrostatic and electrical polarity warnings

---

The RT5350F-OLinuXino and RT5350F-OLinuXino-EVB boards are shipped in protective anti-static cases. The boards must not be exposed to high electrostatic potentials. A grounding strap or similar protective device should be worn when handling the boards in an environment where there is a chance of electrostatic influence. Avoid touching the component pins or any other metallic element with bare hands.

Ensure that your development board gets attached to properly working hardware. If this is not possible please use isolators (like USB-ISO) to save your development board from potential over voltage.

If you connect other electrical devices to the board make sure that they have equal electrical polarity. For example, when you connect a serial cable between a PC and the board's UART pin it is a good idea to have them both connected to the same electrical source (to the same utility power socket). In rare cases different polarity might cause hardware damage to the board.

#### 3.2 Requirements

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In order to set up the RT5350F-OLinuXino-EVB board optimally one or more additional items may be needed. They might be generally placed in two categories:

**Required** – items that are needed in order to achieve minimum functionality;

**Recommended** – items that is good to have in order to be able to interact with the most important of the features of the board;

Note that if RT5350F-OLinuXino is used without RT5350F-OLinuXino-EVB – the requirements would be different! The requirements below are for the typical use of RT5350-OLinuXino-EVB.

**Required items:**

- 5V external power supply with proper connector – RT5350F-OLinuXino-EVB has a power jack – a DC barrel jack with a 2.0mm thick inner pin and the diameter of the hole is 6.3mm. The inner pin is the positive electrode.

- Output device – USB ↔ SERIAL cable + personal computer with serial terminal program – RT5350-OLinuXino-EVB also has other options for debugging (SSH via the network interfaces, for example), but these might require extra software configuration, so initially you would need a serial cable that would always work; the cable needs to have a converter in order to be compatible with the CMOS levels of the board's signals.

Some of the above-suggested items can be purchased by Olimex, for instance:

**USB-SERIAL-CABLE-F** – female USB serial adapter cable – provides the easiest way of debugging

**BB-CH340T** – USB serial adapter, open source hardware design, comes without wires

**SY0605E** – 5V power adapter suitable for 220V/50Hz power socket; with compatible power jack

**SY0605E-CHINA** – cheaper version of a 5V power adapter suitable for 220V/50Hz power socket; with compatible power jack

### **3.3 Preparing the OS to boot**

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Olimex provides an official image for RT5350F-OLinuXino-EVB board – each board comes pre-programmed with this OpenWRT image on-board. Typically, you only need to attach serial cable and power the board.

Step-by-step instructions on how the images were prepared (and links to the resources used) are available at the bottom of the wiki article e: <https://www.olimex.com/wiki/RT5350F-OLinuXino>

The board is also recognized by the OpenWRT community. There are images and builds available at the official OpenWRT repositories, compatible with Olimex RT5350F-OLinuXino and RT5350F-OLinuXino-EVB.

#### **3.3.1 Repairing the default image**

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In case you have modified the memory with other image or you want to update the image you can always revert to the official image. There are two methods that we have described in detail at the wiki article – either by using the on-board u-boot menu or by using third party programmer. Refer to the wiki article for detailed instructions on how to proceed (<https://www.olimex.com/wiki/RT5350F-OLinuXino>).

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## 3.4 Powering the board

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The powering requirements of the RT5350F-OLinuXino are different depending on whether you use it in stand-alone mode or mounted atop RT5350F-OLinuXino-EVB. The sub-chapters below deal with both scenarios.

### 3.4.1 Mounted powering

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Typically, RT5350-OLinuXino gets evaluated when mounted atop RT5350-OLinuXino-EVB. In this case the former is powered via the latter. The power line, altogether with a number of other important processor lines, is transferred via the three headers EXT1, EXT2, and EXT3.

You need to provide 5V DC voltage to the power jack (named PWR) of RT5350F-OLinuXino-EVB board. The DC barrel jack has 2.0mm inner pin and 6.3mm hole. More information about the exact component might be found here: <https://www.olimex.com/wiki/PWRJACK>

The typical consumption of RT5350F-OLinuXino + RT5350F-OLinuXino-EVB is around 0.15A @ 5V but might reach peaks up to 0.20A @ 5V during initial boot. These values were measured without anything else connected to the board (e.g. no keyboard, no mouse, etc).

Do not provide AC voltage to the RT5350F-OLinuXino board! Do not provide more than 5V of voltage directly to neither the RT5350F-OLinuXino nor RT5350F-OLinuXino-EVB boards! Providing 12V would instantly cause permanent hardware damage!

For the European customers, we also stock and sell basic power supply adapters compatible with the power jack.

It is always recommended to perform a soft “turn off” of the board.

If you disconnect the power supply before turning off the board you may corrupt the Linux file system.

Note that it is normal that when the board is powered some integrated circuits might appear hotter than others. This is perfectly normal for some electronic components – for instance – the voltage regulators and the main processor.

### 3.4.2 Stand-alone powering of RT5350F-OLinuXino

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If you use only RT5350F-OLinuXino board (e.g. it is neither attached to RT5350F-OLinuXino-EVB nor to any other board of peripherals) the is only one options for powering it – using the male pins of EXT1. Provide +5V to pin #1 of EXT1 header; connect ground to pin #2 of the same EXT1 header. Double check the white print of the names of the header and the pins before applying any voltage! Make sure that you have properly identified EXT1 and EXT2 headers and pins #1 and #2!

The minimum power that your supply should be able to provide is 2W (equivalent of 0.4A of

current at 5V of voltage). Note that there is no standard jack for the powering circuit but you might add own DC power jack.

Do not provide AC voltage to the RT5350F-OLinuXino board! Do not provide more than 5V of voltage directly to the RT5350F-OLinuXino board! Providing 12V would instantly cause permanent hardware damage!

### 3.5 Button functions

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The RT5350F-OLinuXino has no buttons. The RT5350-OLinuXino-EVB board has only one – the user programmable button BUT4.

### 3.6 Interacting with the board

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The typical and recommended way of interacting with RT5350F-OLinuXino and RT5350F-OLinuXino-EVB board is via a serial cable and a personal computer. The computer needs to be able to recognize your cable and you need a serial terminal program. You would probably need a cable suitable for such a connection due to the fact that most personal computers lack a serial port nowadays. Even if you have serial port you should respect the CMOS levels of the board which are incompatible with the TTL levels of your computer.

*We distribute ready-to-use plug-and-play cables that fit the criteria – one of them is called BB-CH430T and the other one is called USB-SERIAL-CABLE-F. Even if you already have such a cable or you decide to purchase it elsewhere it is advisable to visit the product pages for a reference.*

There are other ways to connect to the board, once you are comfortable with it. For example, via the Ethernet or WIFI using SSH protocol. Yet, this connection requires setting properly the software configuration, and it is possible to corrupt the output settings when connected over those interfaces and, thus, lose the output. In such cases, you can always use the serial cable as a reliable way to establish connection to the board.

#### 3.6.1 Basic setup of RT5350F-OLinuXino

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During typical evaluation of RT5350F-OLinuXino-EVB you need to connect the USB ↔ serial cable to the board's UART0 pins as follows: RX line to UART\_TXD2 pin; TX line to UART\_RXD2 pin; GND to GND (if using only RT5350F-OLinuXino you can find these signals on EXT2 header). Make sure that the serial cable is connected to your personal computer and recognized properly after driver installation. After the hardware connection is established, open a serial terminal program on the serial (COM) port which the cable is associated with. Famous serial terminal programs are “PuTTY”, “TeraTerm”, “Console”, “minicom”, etc. The typical baud rate is 57600, the rest of the settings should be left as per default.

After the serial connection, cable, and computer are set, you would need to power the board as explained in “3.4 Powering the board”. After applying the power supply, you should receive boot information on the serial terminal. In the command line interface of the official OpenWRT image you are automatically logged as root. You can test a few commands now and configure the WIFI.

Type:

```
cat /etc/config/wireless
```

Enable the wireless server with:

```
uci set wireless.@wifi-device[0].disabled=0; uci commit wireless; wifi
```

This would create a WIFI network with SSID “OpenWRT”. Connect to the network and the board via a WIFI-capable device (for example, a laptop or a smartphone). Then start a web-browser and open 192.168.1.1 which would start the LuCI webUI – the graphical user control panel of the server, hosted on the RT5350F-OLinuXino board. Set up a password and explore the different options of the router.

More information for the initial software setup can be found here:

<https://wiki.openwrt.org/doc/howto/firstlogin>

and here:

<https://wiki.openwrt.org/doc/howto/basic.config>

### 3.7 Software support

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At the moment, we provide ready-to-use OpenWRT Linux images suitable for the flash memory of the board. We also provide instructions and sources of these releases. These images might be downloaded for free and modified as the user wishes. The latest images and updates are featured at the wiki article of the device: <https://www.olimex.com/wiki/RT5350F-OLinuXino>

We usually try to provide extra details and best experiences with our products at our wordpress page: <http://olimex.wordpress.com/>. Another useful place is the Olimex forums where a lot of people share their experience and advice: <https://www.olimex.com/forum/>.

The official images are a constant work-in-progress – newer releases are packed with better hardware support, newer kernels and extra features.

You are more than welcome to send or share your suggestions and ideas at our e-mail, the public forums or irc channel. We would attempt to help in almost every case. We listen to the feedback and if the majority of users suggest a software change or update we try to implement such. Customer feedback is very important for the overall state of the software support. However, do not expect full Linux software support.

We can share our experience. We can give you full details for things we have tried. We can point you to a resource or a guide. We can give you general directions to solving a specific problem or places to look for more information. However, we won't install a piece of software for you or write custom program for you. We won't provide a specific software solution to a specific software problem.

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## CHAPTER 4: THE RT5350F PROCESSOR

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### 4. Introduction to the chapter

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In this chapter is located the information about the heart of RT5350F-OLinuXino – its main processor. The information is a modified version of the datasheet provided by its manufacturers.

#### 4.1 The processor

---

RT5350 is a system-on-a-chip processor – it packs a lot of features and requires only a few external components to create a wireless product. The embedded, high performance CPU can easily manage advanced applications such as Wi-Fi data processing without overloading the host processor. The chip also features a fast Ethernet switch, should you need wired networking. In addition, the RT5350 offers a variety of hardware interfaces (SPI/I2S/I2C/PCM/UART/USB) to support a range of possible applications. The software support for the features in the processor is at pretty good state thanks to the efforts of the community.

A short list of the features of the chip might be found below:

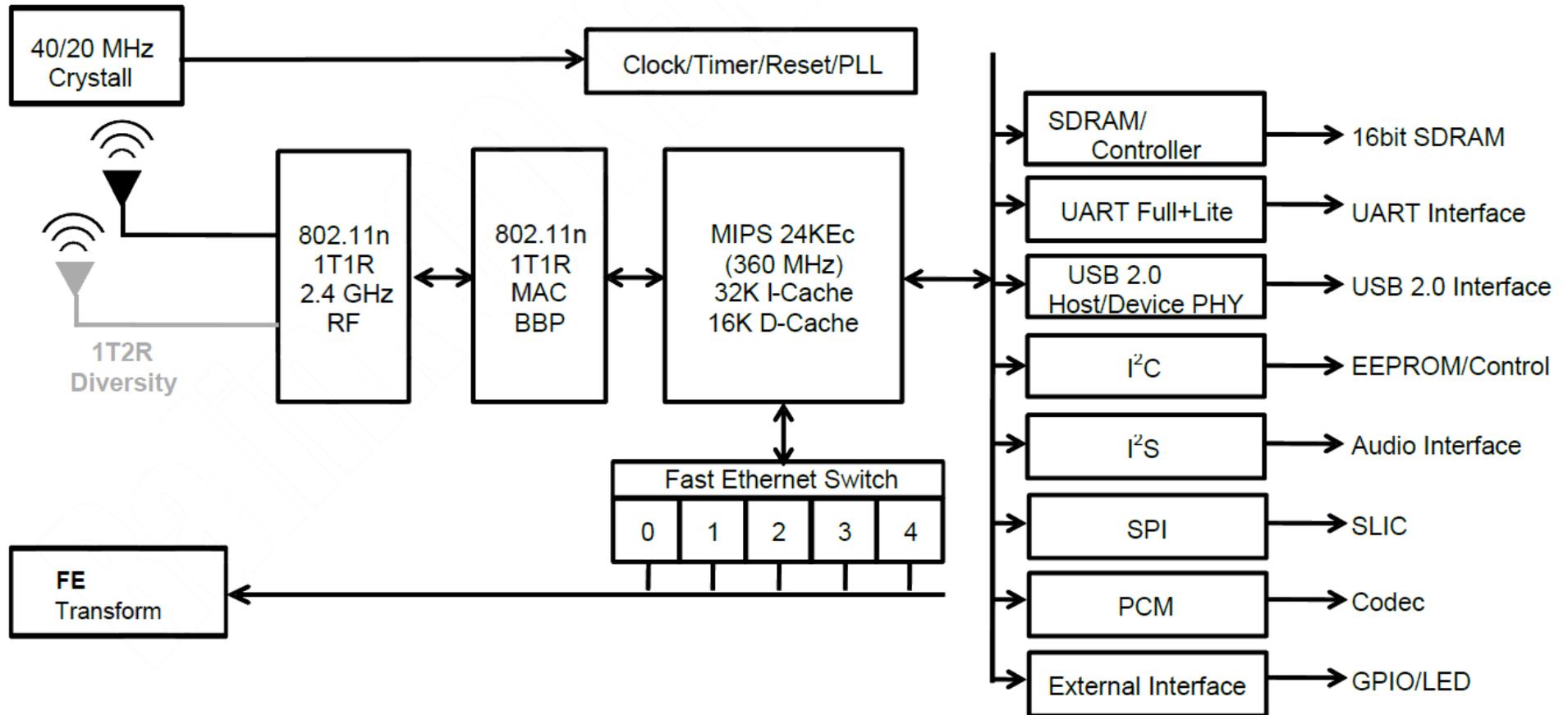
- CPU: MIPS 24KEc 360 Mhz with 32 KB I cache/16KB D cache
- Embedded 1T1R 2.4G CMOS RF
- Embedded 802.11n 1T1R MAC/BBP with MLD enhancement
- Embedded 5-port 10/100 Mbps Ethernet switch and 5-port UTP PHY
- Embedded PA/LNA
- 150 Mbps PHY data rate
- 20 MHz/40 MHz channel width
- Bluetooth Co-existence
- Multiple BSSID (up to 16)
- WEP64/128, WPA, WPA2, WAPI engines
- QoS – WMM, WMM Power Save
- Supports 802.11h TPC
- Supports 16-bit SDR SDRAM (up to 64 MB)
- USB 2.0 host/device dual mode x1
- Slow speed I/O: GPIO, SPI, I2C, I2S, PCM, UART, and JTAG
- Rich on peripheral support and connectivity options

More information about the features of the processor can be found in its datasheet (also available at the Olimex GitHub repository):

<https://github.com/OLIMEX/OLINUXINO/blob/master/HARDWARE/RT5350F/RT5350.pdf>

## 4.2 Block diagram

The block diagram is based on the RT5350's documentation.



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## CHAPTER 5: CONTROL CIRCUITY

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### 5. Introduction to the chapter

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Here you can find information about hardware reset circuit and quartz crystals locations, the power supply circuit is also briefly discussed.

#### 5.1 Reset

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Neither RT5350F-OLinuXino, nor RT5350F-OLinuXino-EVB have hardware reset circuit implemented. Should you need hardware reset, you can use the two pinholes named “RST\_RT” on the RT5350F-OLinuXino-EVB board (on the top side, near UART0 debug pins). “RST\_RT” has two pinholes – the first one is routed to PORSTN (pin #15 of EXT3 connector; processor pin C10). Nearby you can also find a standalone RST pinhole exposed (only PORSTN).

It is a good practice to perform software reset of the board. Performing a hardware reset or power-cycling the board (reset by disconnecting and re-applying the main power supply) might lead to software corruption of the operating system.

#### 5.2 Clocks

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The board uses 20Mhz resonator Q2 (20MHz/9pF/10ppm). It is connected to pins A7 and B7 of the main chip.

The frequency is quite important for a fluent WIFI operation. If you face connectivity problems make sure to check this article:

<https://github.com/OLIMEX/OLINUXINO/tree/master/SOFTWARE/RT5350F/Prebuilt%20images/mtd2%20recovery>

#### 5.3 Power supply circuit

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The board requires 5V power supply. The different voltages required by the chip are derived from the 5V source via three step down regulators (SY8009AAAC). The RT5350-OLinuXino-EVB just adds a power jack to the design, in order to connect and disconnect the power supply easily. The power jack has 2.0mm thick inner pin. The outer hole diameter is 6.3mm. Refer to this wiki article for more information about the component used: <https://www.olimex.com/wiki/PWRJACK>

Make sure your power supply is capable of providing at least 0.5A of current at 5V of voltage (2.5W).

For more info on how to power the board refer to chapter “3.4 Powering the board”.

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## CHAPTER 6: CONNECTORS AND PINOUT

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### 6. Introduction to the chapter

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In this chapter are presented the connectors that can be found on the board all together with their pinout and notes about them. Jumpers functions are described. Notes and info on specific peripherals are presented. Notes regarding the interfaces are given.

Overview images with the pinout can be found in “2.2 Pinout RT5350F-OLinuXino (top view)” and “2.3 Pinout RT5350F-OLinuXino-EVB (top view)”.

Stand-alone images with the pinout can also be found at the following locations: [RT5350F-OLinuXino pinout](#) and [RT5350F-OLinuXino-EVB](#)

### 6.1 Accessing RT5350F-OLinuXino and RT5350F-OLinuXino-EVB

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The direct access method to the Linux command interface is via the serial debug interface. In the case of RT5350F-OLinuXino-EVB you would need to use the three pins of the UART0 header and then use your favorite terminal program (puTTY, minicom, picocom, teraterm, etc) to access the command line interface of the Linux. The board's connectors have the convenient 0.1” step which allows you to use a number of compatible cables (and breadboards).

Note that UART0 header and UEXT connector share same UART signals (UART\_RXD2 and UART\_TXD2). The logical voltage level of the UART is 3.3V.

If you want to access the RT5350F-OLinuXino only, then you can connect the serial cable to the EXT2 connector – pin #2 is GND; pin #23 is UART\_TXD2; pin #25 is UART\_RXD2. Remember that you would also need to power the board via the 5V power supply attached to EXT1 (EXT1's pin #1 is +5V; EXT1's pin #2 is GND).

In both scenarios you can use USB-SERIAL-CABLE-F with the serial interface that allows you to connect to a personal computer with a free USB port.

If you decide to make your own cable you would need to consider the 3.3V level of each signal available at the board's connector UART0 and you would need a convertor to reach the voltage level of your computer or cable! That is true for the RX and TX also!

*It is highly recommended to have an USB-SERIAL-CABLE-F (or similar product) at hand when debugging – the other methods of accessing the board are not always reliable and might require additional configuration. You might be unable to access the board without a proper UART0 connection.*

For more information please refer to chapter “3.5 Interacting with the board”.

## 6.2 UART0 header of RT5350F-OLinuXino-EVB

The pins of the UART0 header, located on RT5350F-OLinuXino-EVB, might be used for serial communication between the board and a personal computer. In the case of an output problem a cable might provide the needed feedback and greatly reduce the efforts needed to repair the board or to adjust the software setting.

Note that by default only UART0 is defined as a port suitable for serial debug. You can use our USB-SERIAL-CABLE-F for debugging.

Even when RT5350F-OLinuXino is mounted on RT5350F-OLinuXino-EVB, the default debug port remains UART0.

Consider the table on the next page when connecting the USB-SERIAL-CABLE-F to the board. Remember to refer to the wire color code of the cable. The RX line of the cable (GREEN wire) should go to TX line of the target board; the TX line of the cable (RED wire) should go to the RX line of the target board. The BLUE wire should go to a target's GND line.

The signal names are printed near the pins, make sure to inspect the names before connecting the supply.

More info about the power supply can be found in chapter 5 of this manual.

UART0 connector (RT5350F-OLinuXino-EVB)			
Pin #	Printed name	Signal name	Processor pin
1	GND	GND	-POWER CIRCUIT-
2	UART_RXD2 <sup>1</sup>	UART_RXD2	P3
3	UART_TXD2 <sup>13</sup>	UART_TXD2 (PULLED DOWN VIA 4.7K)	N2

<sup>1</sup> UART0's RXD2 and TXD2 are available also at, respectively, pins #25 and #23 of connector EXT2

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## 6.3 Connectors of RT5350F-OLinuXino

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There are three connectors located on the bottom side of RT5350F-OLinuXino. They ease the access to processors pins. These connectors also provide a way to attach the board to a board of peripherals (like RT5350F-OLinuXino-EVB). The RT5350F-OLinuXino board has male connectors, while the bottom board has female connectors.

The power line at the EXT connectors that might be used as power input is the one named '+5V' available at the first pin of EXT1 and also the first pin of EXT3 connector. The rest of the power signals are outputs and it would be incorrect to try to power the board from there.

To keep the form factor as small as possible the GPIO and LCD\_CON connectors have 0.05" step.

**IMPORTANT:** The connectors are fragile – if you attempt to disconnect the board in one single pull or by pulling only one side out it might break! Furthermore – you might bend the board's pins! Use pliers or other suitable object as lever to disconnect the connectors carefully.

Below you would find tables with the signal at each pin. To understand better what each processor pin does it might be a good idea to refer to the schematics.

**IMPORTANT:** Some of the pins described below are used for the boot up sequence. Setting those pins improperly during power up might lead to start up problems.

Refer to the bottom-right corner of the schematic of the board for the boot up sequence configuration and options.

You can also find the pinout of the EXT connectors in a stand-alone document at the following link:

<https://www.olimex.com/Products/OLinuXino/RT5350F/RT5350F-OLinuXino/resources/rt5350f-olinuxino-pinout.png>

### 6.3.1 EXT1 connector

The connector has 2 rows with 13 pins each. The step between the pins is 0.1”.

EXT1 connector (RT5350F-OLinuXino)					
Pin#	Signal name	Processor pin	Pin#	Signal name	Processor pin
1	+5V	-POWER CIRCUIT-	2	GND	-POWER CIRCUIT-
3	PORSTN <sup>2</sup>	C10 (SUPERVISED BY MCP130T-300I/TT)	4	UPHY0_PADM	N12
5	RXIM4	N9	6	UPHY0_PADP	P12
7	RXIP4	P9	8	TXOM4	M9
9	RXIM3	M8	10	TXOP4	L9
11	RXIP3	L8	12	TXOM3	N8
13	RXIM2	N7	14	TXOP3	P8
15	RXIP2	P7	16	TXOM2	M7
17	RXIM1	L6	18	TXOP2	L7
19	RXIP1	M6	20	TXOM1	N6
21	RXIM0	L5	22	TXOP1	P6
23	RXIP0	M5	24	TXOM0	N5
25	SPI_CS1	L2	26	TXOP0	P5

### 6.3.2 EXT2 connector

The connector has 2 rows with 13 pins each. The step between the pins is 0.1”.

EXT2 connector (RT5350F-OLinuXino)					
Pin#	Signal name	Processor pin#	Pin#	Signal name	Processor pin#
1	3.3V	-POWER CIRCUIT-	2	GND	-POWER CIRCUIT-
3	I2C_SD	B13 (PULLED UP TO 3.3V VIA 2.2K)	4	I2C_SCLK	B14 (PULLED UP TO 3.3V VIA 2.2K)
5	GPIO0	B12	6	EJTAG_TDI	A13
7	EJTAG_TMS	A13	8	EJTAG_TCK	A12
9	EJTAG_TDO	B11	10	EJTAG_TRSTN	A11
11	CTS_N	K4	12	DCD_N	J4
13	RIN	M3	14	DSR_N	L3
15	RTS_N	P2	16	DTR_N	N4
17	WLAN_LED <sup>3</sup>	K1 (PULLED DOWN VIA 4.7K; WLAN_ACT LED)	18	LINK0 <sup>3</sup>	K3 (PULLED DOWN VIA 4.7K)
19	LINK1 <sup>3</sup>	L1 (PULLED DOWN VIA 4.7K)	20	LINK2 <sup>3</sup>	L4 (PULLED DOWN VIA 4.7K)
21	LINK3 <sup>3</sup>	M1 (PULLED UP TO 3.3V VIA 4.7K)	22	LINK4 <sup>3</sup>	M4 (PULLED DOWN VIA 4.7K)
23	UART_TXD2 <sup>13</sup>	N2	24	TXD <sup>3</sup>	K2 (PULLED DOWN VIA 4.7K)
25	UART_RXD2 <sup>1</sup>	P3	26	RXD	N3

<sup>2</sup> Also available at pin #15 of connector EXT3

<sup>3</sup> Boot up sequence configuration

### 6.3.3 EXT3 connector

The connector has a single row of 16 pins. The step between the pins is 0.1”.

EXT3 connector (RT5350F-OLinuXino)		
Pin#	Signal name	Processor pin#
1	+5V	-POWER CIRCUIT-
2	3.3V	-POWER CIRCUIT-
3	1.8V	-POWER CIRCUIT-
4	1.2V	-POWER CIRCUIT-
5	SPI_MISO	M2
6	SPI_MOSI <sup>3</sup>	J3 (PULLED DOWN VIA 4.7K; CONNECTED TO EN25Q64)
7	SPI_CLK <sup>3</sup>	N1 (PULLED DOWN VIA 4.7K; CONNECTED TO EN25Q64)
8	SPI_CS0	P1
9	LGATE	J1
10	FB	H4
11	EXT_LDO_1P2	H3
12	LDOSEL	G3 (PULLED UP TO 3.3V VIA 4.7K)
13	COMP	G4
14	UGATE	H1
15	PORSTN <sup>4</sup>	C10 (RESET IS SUPERVISED BY MCP130T-300I/TT)
16	GND	-POWER CIRCUIT-

4 Also available at pin #3 of connector EXT1

## 6.4 Connectors of RT5350F-OLinuXino-EVB

RT5350F-OLinuXino-EVB has three female connectors that are used to interface with the main board RT5350F-OLinuXino. The pinaout is similar to that of the male connectors of the main board, so these would be listed below.

### 6.4.1 EXT4 connector

The bottom board has own 40-pin connector at 0.1” step for the ease of accessing a number of pins. This connector allow the user to attach additional hardware, check readings or perform hardware debug.

Full list of recommended displays for the board might be found in chapter “3.7 Connecting and calibrating a display”.

EXT4 connector (RT5350F-OLinuXino-EVB)					
Pin #	Signal name	Processor pin	Pin #	Signal name	Processor pin
1	+5V	-POWER CIRCUIT-	2	GND	-POWER CIRCUIT-
3	3.3V	-POWER CIRCUIT-	4	GND	-POWER CIRCUIT-
5	1.8V	-POWER CIRCUIT-	6	1.2V	-POWER CIRCUIT-
7	GPI00	B12	8	EJTAG_TDI	A13
9	EJTAG_TMS	A13	10	EJTAG_TCK	A12
11	EJTAG_TDO	B11	12	EJTAG_TRSTN	A11
13	CTS_N	K4	14	DSR_N	L3
15	RTS_N	P2	16	DTR_N	N4
17	TXD <sup>3</sup>	K2 (PULLED DOWN VIA 4.7K)	18	RXD	N3
19	PORSTN	C10 (SUPERVISED BY MCP130T-300I/TT)	20	UGATE	H1
21	COMP	G4	22	LDOSEL	G3 (PULLED UP TO 3.3V VIA 4.7K)
23	EXT_LDO_1P2	H3	24	FB	H4
25	LGATE	J1	26	LINK1 <sup>3</sup>	L1 (PULLED DOWN VIA 4.7K)
27	LINK2 <sup>3</sup>	L4 (PULLED DOWN VIA 4.7K)	28	LINK3 <sup>3</sup>	M1 (PULL UP 3.3V VIA 4.7K)
29	TXOP1	P6	30	TXOM1	N6
31	RXIP1	M6	32	RXIM1	L6
33	TXOP2	L7	34	TXOM2	M7
35	RXIP2	P7	36	RXIM2	N7
37	TXOP3	P8	38	TXOM3	N8
39	RXIP3	L8	40	RXIM3	M8

## 6.4.2 UEXT connector

Located on RT5350F-OLinuXino-EVB. The connector has two rows of 5 pins. The step between the pins is 0.1". This connector is typically used for attaching additional modules – it nests power out pins, and several frequently used interfaces – UART, I2C, and SPI.

UEXT connector (RT5350F-OLinuXino-EVB)		
Pin#	Signal name	Processor pin#
1	3.3V	-POWER CIRCUIT-
2	GND	-POWER CIRCUIT-
3	UART_TXD2	N2
4	UART_RXD2(PULLED UP VIA 10K)	P3
5	I2C_SCL (PADS FOR PULLUPS)	B14
6	I2C_SDA (PADS FOR PULLUPS)	B13
7	SPI_MISO	M2
8	SPI_MOSI	J3
9	SPI_CLK	N1
10	SPI_CS1	L2

## 6.4.3 Relays of RT5350F-OLinuXino-EVB

The EVB part of the board has two electromechanical relays RAS-0515 (5V/72mA). Each of them has a status LED. Relay REL1 uses signal RIN to drive the relay (RIN goes to EXT2 connector and it is routed to processor pin M3). Relay REL2 uses signal DCD\_N (DCD\_N also goes to EXT2 connector and it is routed to processor pin J4).

There are pads provided behind the relays for measuring the levels of RIN and DCD\_N lines.

## 6.4.4 Ethernet connectors of RT5350F-OLinuXino-EVB

The board has two standard RJ45 Ethernet connectors on the EVB part. They use two of the five ports of the chip (available after the embedded fast Ethernet switch). LAN1 uses the following data signals: LINK4, TXOP4, TXOM4, RXIP4, RXIM4. LAN2 uses LINK0, TXOP0, TXOM0, RXIP0, RXIM0. These signals are located on EXT1 and EXT2 connectors.

## 6.4.5 USB\_HOST connector on RT5350F-OLinuXino-EVB

There is a side-placed USB type A connector available on board. It acts as USB host interface, as the name suggests. It uses two data signals – UPHY0\_PADM and UPHY0\_PADP (both signals can be found on EXT1).

## 6.5 Additional hardware components

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The components below are mounted on the RT5350F-OLinuXino or RT5350F-OLinuXino-EVB but are not discussed above. They are listed here for completeness:

- **PWR\_LED** (RT5350F-OLinuXino) – power identification LED – turns on upon powering the RT5350F-OLinuXino board;
- **WLAN\_ACT** (RT5350F-OLinuXino) - indicates WLAN activity;

The components below are placed on RT5350F-OLinuXino-EVB:

- **BUT4** button – user programmable – used to reset the board – drives signal GPIO0 (processor pin B12)
- **PROG** pinholes – can be used for programming the board over the SPI (#1 – 3.3V; #2 – SPI\_MISO; #3 – SPI\_MOSI; #4 - SPI\_CLK; #5 – SPI\_CS0; #6 – GND; all of these signals can be found at EXT3 header); refer to the wiki entry on how to use a programmer like ARM-USB-OCD-H with the board: [https://www.olimex.com/wiki/RT5350F-OLinuXino#Upload\\_prebuilt\\_images\\_using\\_programmer\\_tool](https://www.olimex.com/wiki/RT5350F-OLinuXino#Upload_prebuilt_images_using_programmer_tool)
- **RST** pinhole – located next to PROG row of pinholes – connected to PORSTN signal and RST\_RT pin #1
- **RST\_RT** pinholes – consists of RST and GND pinholes – allows the addition of reset button
- **GND\_PIN** pinhole – allows easier access to a GND signal

## CHAPTER 7: SCHEMATICS

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### 7. Introduction to the chapter

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In this chapter is located information about the schematics describing logically RT5350F-OLinuXino and RT5350F-OLinuXino-EVB.

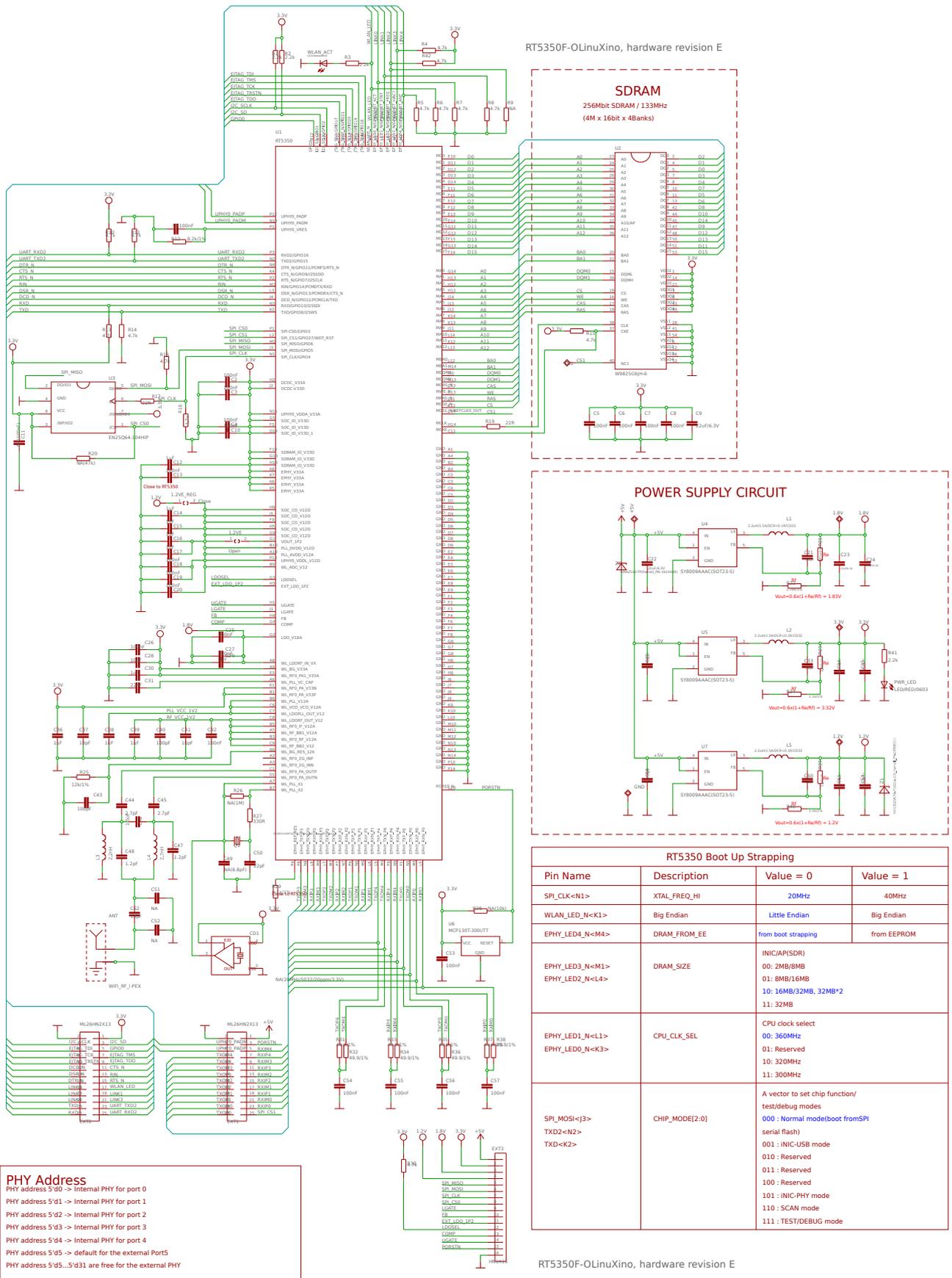
#### 7.1 Eagle schematic

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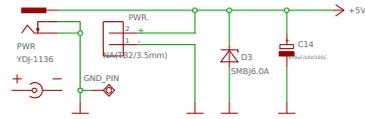
RT5350F schematics may be found in the OLIMEX's GitHub repository:

<https://github.com/OLIMEX/OLINUXINO/tree/master/HARDWARE/RT5350F> (each part of the modular design has own folder). You can download the whole repository as .zip without having a GitHub account.

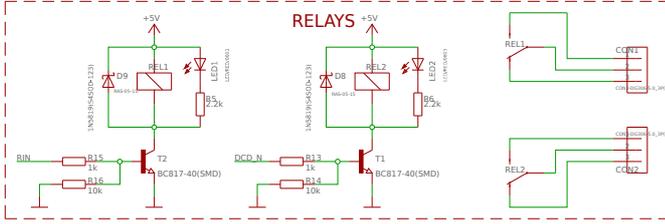
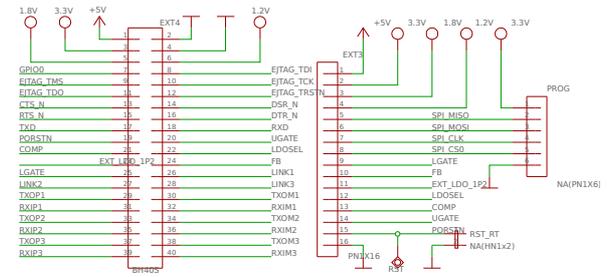
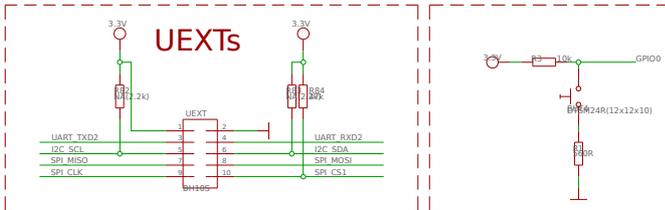
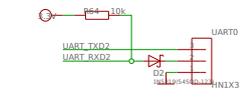
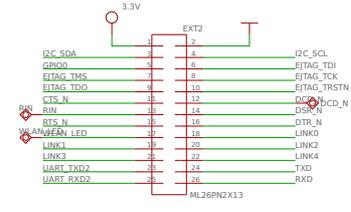
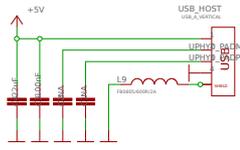
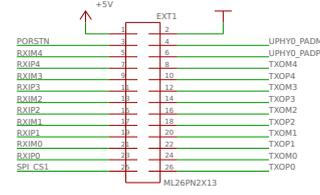
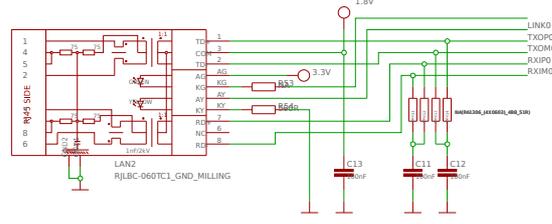
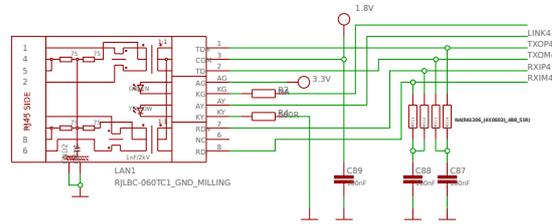
You can find lower resolution exports of the schematics on the next two pages. The hardware revision of the exports might not be the latest. For an older or a newer hardware revision design files make sure to check the Git location linked above. If you are looking for a schematic of an older revision of the board and it isn't available at our web site you may request it by the support e-mail.



5VDC Only!!!



RT5350F-OLinuXino-EVB, hardware revision B



RT5350F-OLinuXino-EVB, hardware revision B

## CHAPTER 8: REVISION HISTORY AND SUPPORT

### 8. Introduction to the chapter

In this chapter you will find the current and the previous version of the document you are reading. Also the web-page for your device is listed. Be sure to check it after a purchase for the latest available updates and examples.

#### 8.1 Document revision

Document revision	Changes	Modified page
A, 07.06.17	Initial manual release	All

#### 8.2 Board revisions

Remember to check the schematics and the board design files to compare the differences.

##### 8.2.1 RT5350F-OLinuXino hardware revisions

Board revision	Notable changes
B	Initial hardware revision of the board
C	<ol style="list-style-type: none"> <li>Added power LED to the 3.3V line</li> <li>Added Zener diode Z1 -&gt; DDZ9678-7(SOD-123)_Farnell_PN-1858631</li> <li>Added 5.6V Zener diode to +5V</li> <li>Changed the value of the quartz from 20ppm to 10 ppm E4SB20.000F20E15(20MHz/10pF/10ppm/5x3.2mm)</li> <li>Changed C49 from NA to 6.8pF and C50 from 27pF to 22pF.</li> </ol>
D	<ol style="list-style-type: none"> <li>Added CD1 oscillator for testing purposes</li> <li>Added R42 (4.7k) pull-up on EPHY_LED2_N and changed R7 to NA</li> </ol>
E	<ol style="list-style-type: none"> <li>Changed value of R42 to NA (down from 4.7K)</li> <li>R9 value changed to NA (down from 4.7K)</li> <li>C49 value changed to NA (down from 6.8pF)</li> </ol>

##### 8.2.2 RT5350F-OLinuXino-EVB hardware revisions

Board revision	Notable changes
B	Initial hardware revision of the board

## 8.3 Useful web links

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The web pages you can visit for more information about RT5350F-OLinuXino are:

<https://www.olimex.com/Products/OLinuXino/RT5350F/RT5350F-OLinuXino/> and  
<https://www.olimex.com/Products/OLinuXino/RT5350F/RT5350F-OLinuXino-EVB/>

Wiki article of the boards: <https://www.olimex.com/wiki/RT5350F-OLinuXino>

Wiki article at the OpenWRT site: <https://wiki.openwrt.org/toh/olimex/rt5350f-olinuxino-evb>

You can get the latest hardware updates at the GitHub page:

<https://github.com/OLIMEX/OLINUXINO/tree/master/HARDWARE/RT5350F>

A place for general questions, FAQ or friendly talk: <https://www.olimex.com/forum/>

You may may join our IRC channel #olimex @ freenode.net (<http://webchat.freenode.net/?channels=olimex>).

## 8.4 How to purchase?

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You can purchase directly from our online shop or from any of our distributors. Note that usually it might be faster and cheaper to purchase Olimex products from our distributors. List of confirmed Olimex LTD distributors and resellers: <https://www.olimex.com/Distributors>.

Please visit <https://www.olimex.com/> for more info.

## 8.5 Order codes

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Short summary of the formal product names of the devices mentioned in this document:

**RT5350F-OLinuXino** – the target of this manual

**RT5350F-OLInuXino-EVB** – RT5350F-OLinuXino + RT5350F-OLinuXino-EVB – the main board with board with all important peripherals that makes it easier access chip's resources (two Ethernet connectors; USB HOST connector; two relays with status LEDs; a power jack; UEXT; 0.1" step GPIO connectors; etc)

**USB-SERIAL-CABLE-F** – USB serial console cable with female leads

## 8.6 Frequently asked questions

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### **Q: I just received the product. How to establish basic connection with the board?**

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Connect USB<->serial cable between the UART0 pins of the board and your personal computer. Open your favorite serial terminal software on the COM port, created by your USB<->serial cable. The baud rate for the connection is 57600. Power RT5350F-OLinuXino-EVB using the PWR barrel jack (5V DC only!).

### **Q: I see only 16MB RAM listed in OpenWRT! The board is supposed to have 32MB RAM! Did I get a defective board? What should I do in order to see 32MB RAM?**

---

The board should be fine – during the production tests the amount of RAM listed in OpenWRT gets verified by a technician. Usually there are three ways to fix this issue:

- 1) Unpower the board. Disconnect your serial cable from the board. Power the board and wait 30 seconds then connect the serial cable. The whole 32MB of RAM memory should be available now. Some noisy serial cables might alter the levels of the board, which affects the bootstrap configuration.
- 2) Purchase a better USB <-> serial cable. Our serial cables (USB-SERIAL-CABLE-F) should work fine.
- 3) Disconnect the power supply from the board. Connect pin #27 from EXT4 connector to pin #3 of the same connector via a 1K resistor. After the connection is established apply power to the board. This forces a 32MB-only bootstrap configuration – this alteration just pulls up LINK2 (since LINK3 is already pulled-up). Refer to the datasheet of RT5350 for more information.

## 8.7 Quality control

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Each board designed and manufactured by Olimex passes a number of tests to ensure it is working properly. There are tests performed before and after assembly.

Before assembly:

- the PCB of each the boards passes electrical test for obvious short circuits
- the bigger components get tested for obvious manufacturing problems

If there is a problem with a board PCB components before assembly the faulty PCB or the faulty component typically go directly to the trash.

The largest part of the assembly is usually performed by automatic SMT placing machines. Yet, some components can be placed only by hand (plastic connectors, for example).

Tests performed after assembly:

- the board passes automatized optical inspection for component misplacement and soldering issues.
- the board gets inspected visually by a technician
- the assembled board passes electrical tests performed by a technician
- the board passes software tests performed by a technician; the software checks every peripheral, and every free pin of the board (via additional hardware headers, specifically designed for testing)

If there is a problem after the assembly usually we attempt to fix the problem (only if it is possible; if it is not – we salvage what we can and throw the rest). Fixing the problem often requires manual soldering, which sometimes leads to not-so-pretty looking but perfectly functional board. After the problem is fixed the board is cleaned and has to pass all tests again.

## 8.8 Product support

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For product support, hardware information and error reports mail to: [support@olimex.com](mailto:support@olimex.com). All document or hardware feedback is welcome. Note that we are primarily a hardware company and our software support is limited. Please consider reading the paragraph below about the warranty of Olimex products.

All goods are checked before they are sent out. In the unlikely event that goods are faulty, they must be returned, to OLIMEX at the address listed on your order invoice.

OLIMEX will not accept goods that have clearly been used more than the amount needed to evaluate their functionality.

If the goods are found to be in working condition, and the lack of functionality is a result of lack of knowledge on the customers part, no refund will be made, but the goods will be returned to the user at their expense.

All returns must be authorized by an RMA Number. Email [support@olimex.com](mailto:support@olimex.com) for authorization number before shipping back any merchandise. Please include your name, phone number and order number in your email request.

Returns for any unaffected development board, programmer, tools, and cables permitted within 7 days from the date of receipt of merchandise. After such time, all sales are considered final.

Returns of incorrect ordered items are allowed subject to a 10% restocking fee. What is unaffected? If you hooked it to power, you affected it. To be clear, this includes items that have been soldered to, or have had their firmware changed. Because of the nature of the products we deal with (prototyping electronic tools) we cannot allow returns of items that have been programmed, powered up, or otherwise changed post shipment from our warehouse.

All returned merchandise must be in its original mint and clean condition. Returns on damaged, scratched, programmed, burnt, or otherwise 'played with' merchandise will not be accepted.

All returns must include all the factory accessories which come with the item. This includes any In-Circuit-Serial-Programming cables, anti-static packing, boxes, etc.

With your return, enclose your PO#. Also include a brief letter of explanation of why the merchandise is being returned and state your request for either a refund or an exchange. Include the authorization number on this letter, and on the outside of the shipping box.

Please note: It is your responsibility to ensure that returned goods reach us. Please use a reliable form of shipping. If we do not receive your package we will not be held liable.

Shipping and handling charges are not refundable. We are not responsible for any shipping charges of merchandise being returned to us or returning working items to you.

The full text might be found at <https://www.olimex.com/wiki/GTC#Warranty> for future reference.