

iMX233-OLinuXino-NANO
Open-source single-board Linux computer
USER'S MANUAL

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Designed by OLIMEX Ltd, 2013



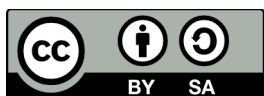
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CHAPTER 1 OVERVIEW

1. Introduction to the chapter

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

The OLinuXino development board enables code development of applications running on the iMX233 microcontroller, manufactured by Freescale Semiconductor.

OLinuXino is an open-source, open-hardware project and all documentation is available to the customer.

1.1 Features

- iMX233 ARM926J processor at 454Mhz
- 64 MB RAM
- SD-card connector for booting the Linux image
- 1 USB high speed host
- Three buttons
- Green LED
- [UEXT connector](#) for connection of different peripheral modules
- 2 row x 25 pinholes – can be used either to access processor features or as GPIOs
- U_DEBUG pin headers
- 3.7V Li-Po battery connector and built-in battery charger
- Breadboard compatible
- JTAG pads for bare-board programming
- **PCB dimensions: 3.00" x 0.8" (76.2mm x 20.3mm)**
- **Nominal dimensions: 3.40" x 0.8" (86.4mm x 20.3mm)**
- **Weight: 0.5 ounce (~14 grams)**

1.2 The OLinuXino family

The design of all the iMX233 boards follows the same pattern which makes the transition between different Olimex iMX233 boards easier.

However, there are significant differences in the dimensions, the peripherals available and the power options between the different boards.

Table of comparison				
	OLinuXino-NANO	OLinuXino-MICRO	OLinuXino-MINI	OLinuXino-MAXI
Processor	iMX233 @ 454Mhz	iMX233 @ 454Mhz	iMX233 @ 454Mhz	iMX233 @ 454Mhz
Ram [MB]	64	64	64	64
# USB hosts	1	1	3	2
100/150 Mbit Ethernet*	No/WIFI option**	No/WIFI option**	No/WIFI option***	Yes/WIFI option**
GPIO connector	40pins	60pins	40pins	40pins
# of buttons	3	3	2	2
Reset button	Yes	Yes	Yes	Yes
DC power supply	5V	5V	6V-16V	6V-16V
Dimensions	3.00'' x 0.80''	3.40'' x 1.70''	3.70'' x 2.65''	3.70'' x 2.65''
Breadboarding	Yes	Yes	No	No
Audio IN connector	No	No	Yes	Yes
Audio OUT connector	No	No	Yes	Yes
UEXT connector	Yes	No	Yes	Yes
Power jack	No****	Yes	Yes	Yes
VGA connector	No	Yes	Yes	Yes

* 100Mbit Ethernet for the wired network of OLinuXino-MAXI. 150Mbit for the WIFI following 811.02n standard.

** All three boards have the option to work with MOD-WIFI_RTL8188, which is USB WIFI modem with RTL8188CU chip and can be purchased separately. MOD-WIFI_RTL8188 can be connected to any of the OLinuXino boards via the USB.

*** OlinuXino-MINI has additional option of having RTL8188CU hardware mounted! If you wish RTL8188CU embedded in the device you should purchase OLinuXino-MINI-WIFI. Choosing the embedded WIFI option will leave your USB-HOSTs available for use.

**** There is an easy access to the power pin holes, however. Especially, if you use a breadboard.

1.2 Target market and purpose of the board

The boards from the OLinuXino family are ready-to-use, easy-to-setup and suitable for embedded programming enthusiasts, Linux hobbyists, gadget fans and also professionals (since its low cost makes it very good solution for application orientated embedded systems). The main usage of the board is software embedded development without the urge of understanding perfectly the hardware.

The dimensions, the light weight and the breadboard capabilities of iMX233-OLinuXino-NANO make it a perfect Linux board for embedding in custom devices. This of course comes at the cost of the lack of some peripherals included in the bigger iMX233 Olimex-made boards. It is generally advice to get one of the other iMX233 boards for research and development and use the NANO for the stage when you have to implement the product.

The board has a LiPo connector and battery charger – the microcontroller can work solely on battery power supply.

However, when powering the board with a LiPo battery, please note that the USB host will not be able to power your USB devices since neither the microcontroller is able to step-up the low input voltage (from the battery) to 5V, neither there is additional circuit for such a step-up.

Customers have full access to the technical documentation of the board. The software is released under General Purpose License and the board is considered open-hardware.

1.3 Organization

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

- Chapter 1 is an overview of the board usage and features
- Chapter 2 provides a guide for quickly setting up the board
- Chapter 3 contains the general board diagram and layout
- Chapter 4 describes the component that is the heart of the board: the iMX233 microcontroller
- Chapter 5 is an explanation of the control circuitry associated with the microcontroller to reset. Also shows the clocks on the board
- Chapter 6 covers the connector pinout, peripherals and jumper description
- Chapter 7 shows the memory map
- Chapter 8 provides the schematics
- Chapter 9 contains the revision history, useful links and support information

CHAPTER 2 SETTING UP THE OLINUXINO BOARD

2. Introduction to the chapter

This section helps you set up the OLinuXino 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.

2.1 Electrostatic warning

OLinuXino is shipped in a protective anti-static package. The board must not be exposed to high electrostatic potentials. A grounding strap or similar protective device should be worn when handling the board. Avoid touching the component pins or any other metallic element.

2.2 Requirements

In order to set up the iMX233-OLinuXino-NANO optimally one or more additional items may be used. They might be generally placed in three 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;

Additional – items that provide access to additional features or expand the features of the board.

Required items:

- 5V source of power with 1A maximum amperage OR suitable 3.7V Li-Pol battery
- Personal computer + **USB-SERIAL-CABLE-F** – needed for debugging (if you lack RS232/COM port or another RS232-USB cable).
- SD card with Linux image (the latest official image might be downloaded for free from the respective Olimex wiki article)

Note that the board arrives without SD card or Linux image. You can purchase a card with Linux separately. It is recommended that the user has basic Linux experience.

Recommended items:

- a breadboard – for easier access to the GPIO signals via jumper wires without the need of soldering

Additional items:

- JTAG parallel interface programmer – if you wish to bare program the board
- A number of extension modules that can add functionality or interface to the board on the UEXT connector; these can be explored here: <https://www.olimex.com/Products/Modules/>

Some of the suggested items may be purchased by Olimex, for instance:

SY0605E – power supply adapter 5V/1A for iMX233-OLinuXino-NANO (50Hz utility frequency - for EU residents only)

SY0605E-CHINA – cheaper power supply adapter 5/1A for iMX233-OLinuXino-NANO (50Hz utility frequency – for EU residents only)

iMX233-OLinuXino-SD – SD card with the Linux image

USB-SERIAL-CABLE-F – USB serial console cable female (check “6.1.1 UART Debug” for info how to connect it to the board)

BREADBOARD-1 – relatively small breadboard (82×52×10mm) that allows easy access to the GPIO pins via jumper wires (no soldering required)

2.3 Powering the board

The board may be powered via a 3.7V Li-Pol battery connected to the LIPO BAT connector or using a 5V external power supply on pins 1 and 2 of CON2 connector. When powering the board from CON2 it should be supplied with a 5V with a maximum current of 1A.

Note that there is a built-in battery charger the iMX233 processor.

When the board is powered only by a 3.7V battery the USB would NOT be able to power USB devices since there IS NO step-up convertor (to 5V).

It is a good idea to have a power supply providing minimum of 0.2 A.

If measuring the current consumption it should be around 0.06A before initializing all the peripherals. The consumption raises to 0.12A if performing a task without additional peripherals connected.

If Linux enters seep mode the consumption goes down to 0.01A.

2.4 Prebuilt software

Note that the boards arrive without Linux or SD card. The Linux image can be purchased separately on a SD card or you can built and write it yourself.

Currently the official iMX233 Linux image is based on Debian. It replaced the Archlinux distributions used before.

When we program the boards we change the default position of the following HW_OCOTP_ROM0 fuses of the processor:

SD_MBR_BOOT(3) - Blown

SD_POWER_GATE_GPIO(21:20) – 10-PWM3

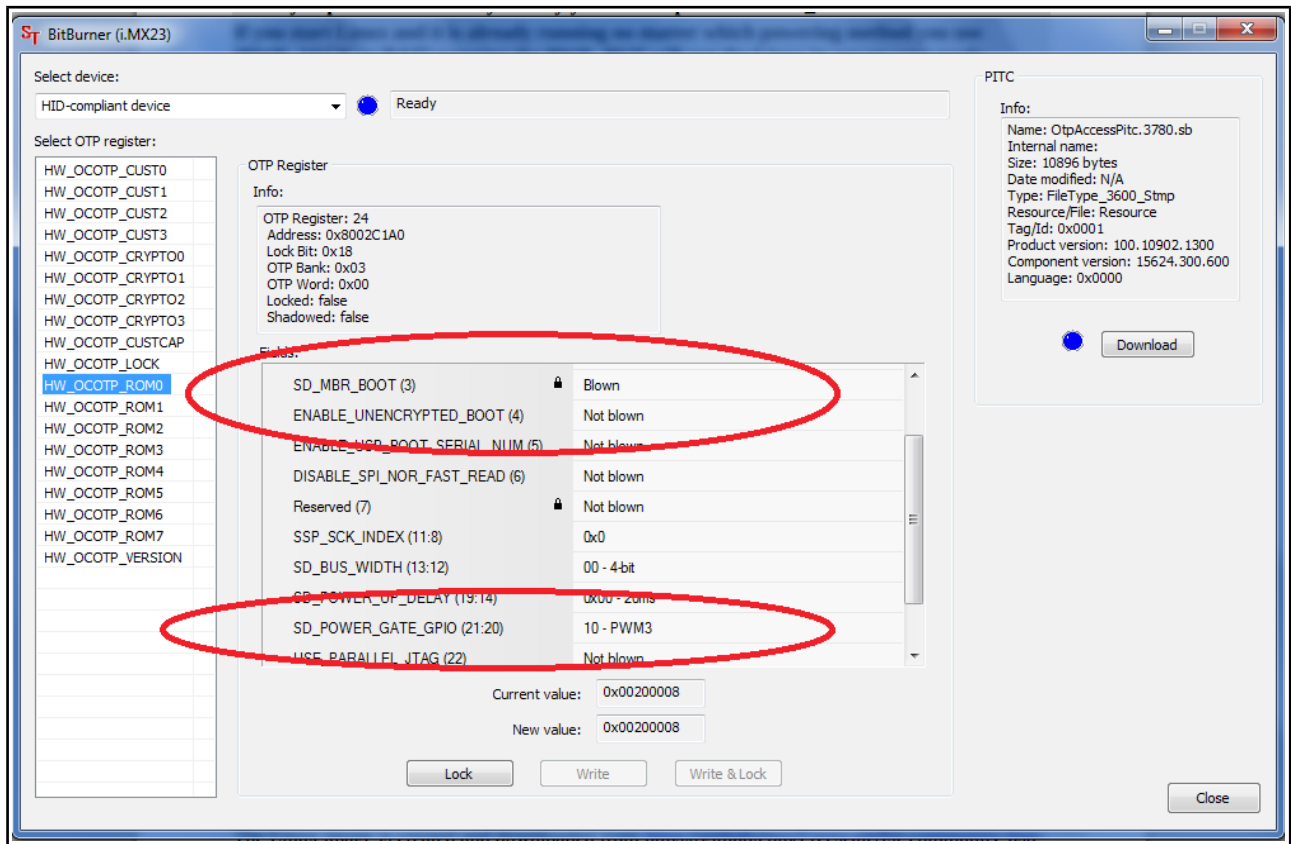
For burning the fuse position we use the BitBurner software. This operation is discussed in details before. Proceed with great caution when burning fuses since it is irreversible operation.

2.5 Using BitBurner

IMPORTANT! MODIFYING THE FUSES IS IRREVERSIBLE PROCESS! BURNING THE WRONG FUSES MIGHT DAMAGE OLINUXINO IRREVERSIBLY! BURNING WRONG FUSES MIGHT CAUSE BOOT PROBLEMS!

BURN FUSES AT OWN RISK!

The bit burning is done via the USB of the computer connected to the USB HOST connector OLINUXINO board and the BitBurner software. To be able to burn the fuses you will need to make a custom cable that connects a USB with the USB of your connector.



2.6 Building the Linux image

Notes on building the official Debian Linux image might be found at the following blog post:

<http://olimex.wordpress.com/2012/07/05/building-debian-linux-distribution-for-imx233-olinuxino/>

The board is also supported in the main Archlinux kernel. More info might be found at the Archlinux web here: <http://archlinuxarm.org/platforms/armv5/olinuxino>

The board has is supported in OpenWRT. More info might be found here: <http://wiki.openwrt.org/toh/olimex/imx233-olinuxino>

There are a number of unofficial images and guides avialable. Few of the good ones are linked

below. These guides are not created nor tested by Olimex, however, they are worth a look:

<https://github.com/koliqi/imx23-olinuxino>

<http://eewiki.net/display/linuxonarm/iMX233-OLinuXino>

http://www.jann.cc/2012/08/23/building_a_kernel_3_x_for_the_olinuxino_from_sources.html

2.7 How to use the I2C, SPI, UART

There are number of examples with our extension module boards to achieve the mentioned interfaces using the UEXT connector. The examples might be used as examples for I2C, SPI or UART communication. You can find them at our GitHub page:

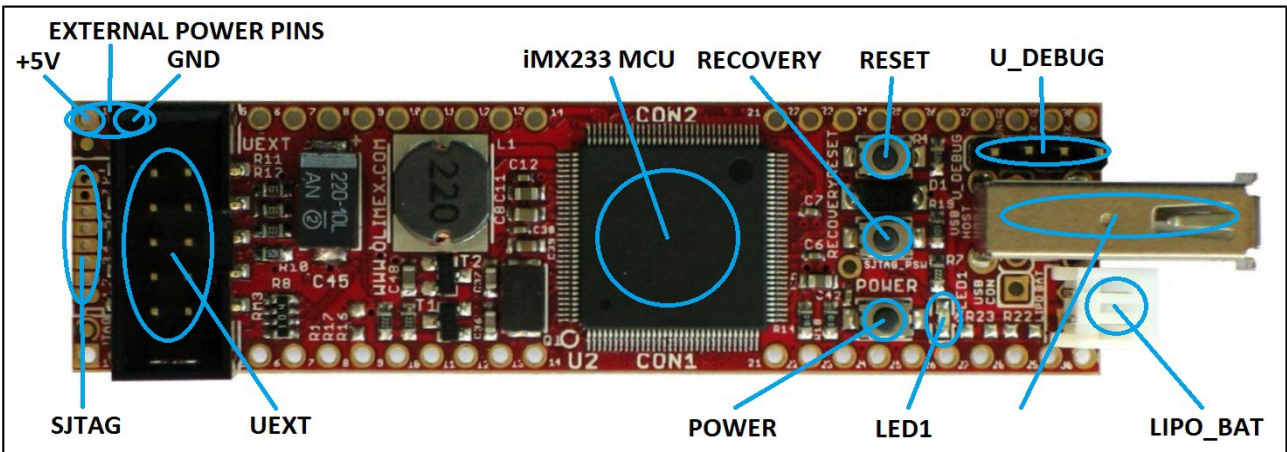
<https://github.com/OLIMEX/OLINUXINO/tree/master/SOFTWARE/iMX233>

CHAPTER 3 OLINUXINO BOARD DESCRIPTION

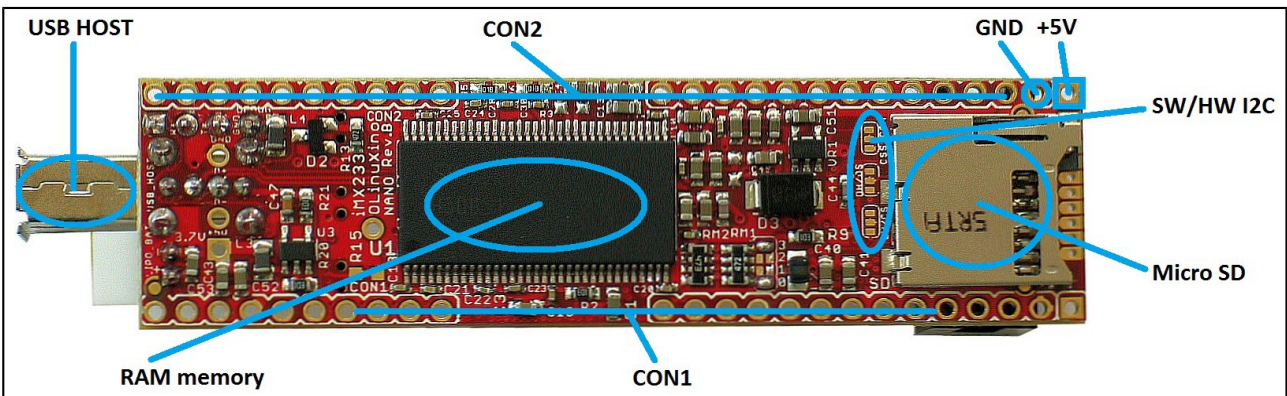
3. Introduction to the chapter

Here you get acquainted with the main parts of the board. Note the names used on the board differ from the names used to describe them. For the actual names check the OLinuXino board itself.

3.1 Layout (top view)



3.2 Layout (bottom view)



CHAPTER 4 THE iMX233 MICROCONTROLLER

4. Introduction to the chapter

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

4.1 The microcontroller

- ARM926 CPU Running at 454 MHz
- Integrated ARM926EJ-S CP
- 16-Kbyte data cache and 16-Kbyte instruction cache
 - One-wire JTAG interface
 - Resistor-less boot mode selection using integrated OTP values
- 32Kbytes of Integrated Low-Power On-Chip RAM
- 64 Kbytes of Integrated Mask-Programmable On-Chip ROM
- 1 Kbit of On-Chip One-Time-Programmable (OCOTP) ROM
- Universal Serial Bus (USB) High-Speed (Up to 480 Mb/s), Full-Speed (Up to 12 Mb/s)
 - Full-speed/high-speed USB device and host functions
 - Fully integrated full-speed/high-speed Physical Layer Protocol (PHY)
 - Mass storage host-capable (uncertified by USB-IF)
- Power Management Unit
 - Single inductor DC-DC switched converter with multi-channel output supporting Li-Ion batteries.
 - Features multi-channel outputs for VDDIO (3.3 V), VDDD (1.2 V), VDDA (1.8 V), VDDM (2.5V) and regulated 4.2V source.
 - Direct power from 5-V source (USB, wall power, or other source), with programmable current limits for load and battery charge circuits.
 - Silicon speed and temperature sensors enable adaptive power management over temperature and silicon process.
- Audio Codec
 - Stereo headphone DAC with 99 dB SNR
 - Stereo ADC with 85 dB SNR
 - Stereo headphone amplifier with short-circuit protection and direct drive to eliminate bulky capacitors
 - Amplifiers are designed for click/pop free operation.
 - Two stereo line inputs
 - Microphone input
 - SPDIF digital out
- 16-Channel Low-Resolution ADC
 - 6 independent channels and 10 dedicated channels
 - Resistive touchscreen controller
 - Temperature sensor controller
 - Absolute accuracy of 1.3%
- Security Features
 - Read-only unique ID for digital rights management algorithms
 - Secure boot using 128-bit AES hardware decryption

- SHA-1 hashing hardware
- Customer-programmed (OTP) 128 bit AES key is never visible to software.
- External Memory Interface (EMI)
 - Provides memory-mapped (load/store) access to external memories
 - Supports the following types DRAM:
 - 1.8V Mobile DDR
 - Standard 2.5V DDR1
- Wide Assortment of External Media Interfaces
 - High-speed MMC, secure digital (SD)
 - Hardware Reed-Solomon Error Correction Code (ECC) engine offers industry-leading protection and performance for NANDs.
 - Hardware BCH ECC engine allowing for up to 20-bit correction and programmable redundant area.
- Dual Peripheral Bus Bridges with 18 DMA Channels
 - Multiple peripheral clock domains save power while optimizing performance.
 - Direct Memory Access (DMA) with sophisticated linked DMA command architecture saves power and off-loads the CPU.
- Highly Flexible Display Controller
 - 8-bit data ITU-R BT.656 D1 digital video stream output mode (PAL/NTSC), with on-the-fly RGB to YCbCr color-space-conversion.
 - Flexible input formats
- Pixel Processing Pipeline (PXP)
 - Provides full path from color-space conversion, scaling, alpha-blending to rotation without intermediate memory access
 - Bi-linear scaling algorithm with cropping and letterboxing
 - Alpha-blend, BITBLT, color-keying
 - Memory efficient block-based rotation engine
- Integrated TV-Out Support
 - Integrated PAL/NTSC TV-encoder fully pipelined to display controller's D1 resolution output stream
 - Integrated low-power 10-bit Video DAC (VDAC) for composite analog video output.
- Data Co-Processor (DCP)
 - AES 128-bit encryption/decryption
 - SHA-1 hashing
 - High-speed memory copy
- Three Universal Asynchronous Receiver-Transmitters (UARTs)
 - Two high-speed application UARTs operating up to 3.25 Mb/s with hardware flow control and dual DMA.
 - Debug UART operates at up to 115Kb/s using programmed I/O.
- I2C Master/Slave
 - DMA control of an entire EEPROM or other device read/write transaction without CPU intervention
- Dual Synchronous Serial Ports (for SPI, MMC, SDIO, Triflash)
 - 1-bit, 4-bit and 8-bit MMC/SD/SDIO modes
 - Compliant with SDIO Rev. 2.0
 - SPI with single, dual and quad modes.
- Four-Channel 16-Bit Timer with Rotary Decoder
- Five-Channel Pulse Width Modulator (PWM)

- Real-Time Clock
 - Alarm clock can turn the system on.
 - Uses the existing 24-MHz XTAL for low cost or optional low power crystal (32.768 kHz or 32.0 kHz), customer-selectable via OTP.
- Customer-Programmable One-Time-Programmable (OTP) ROM via Integrated eFuse Block
 - Resistor-less boot mode selection
 - 128-bit boot mode crypto key
 - Boot mode specification of NAND characteristics for device that the customer is soldering to the board. This means no more costly delays waiting for new device support in the boot ROM.
 - Fully software-programmable and accessible
- Flexible I/O Pins
 - All digital pins have drive-strength controls
 - Most non-EMI digital pins have general-purpose input/output (GPIO) mode.

For comprehensive information on the microcontroller visit the Freescale's web page for a datasheet.

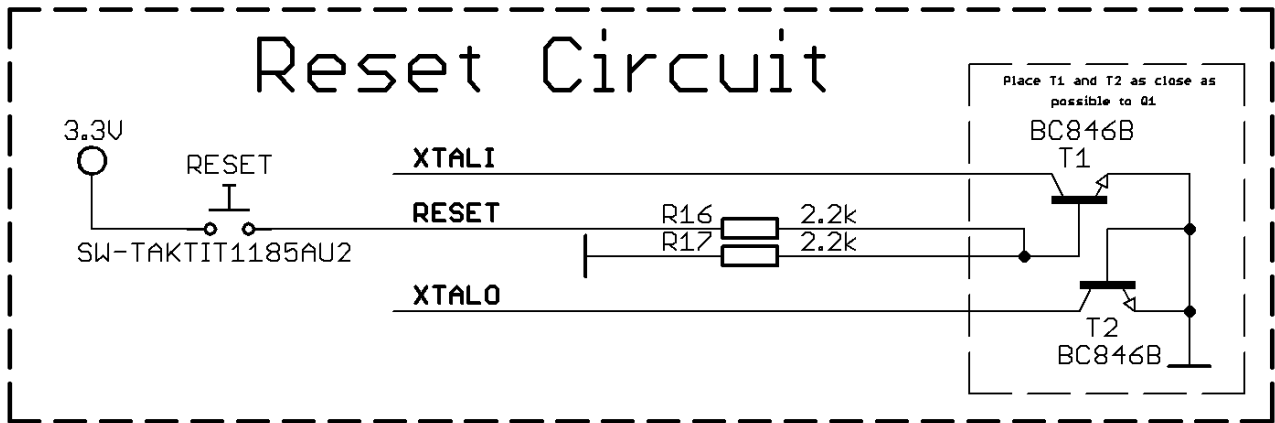
CHAPTER 5 CONTROL CIRCUITRY AND HARDWARE MODULES

5. Introduction to the chapter

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

5.1 Reset

OLinuXino's reset circuit includes R16 (2.2 kΩ), R17 (2.2 kΩ), T1, T2, quartz Q1 and a RESET button. The RESET is specific for the fact that it is accomplished when the quartz is disconnected using 3.3V and the transistors T1 and T2.



5.2 Clock

24 MHz quartz crystal Q1 is connected to pins 121 and 122 of the iMX233 processor.

CHAPTER 6 CONNECTORS AND PINOUT

6. Introduction to the chapter

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.

6.1 Debugging interfaces

There are two debugging options available on the OLinuXino – U_DEBUG and JTAG.

The U_DEBUG is the main way of interacting with the NANO and the operating system. The JTAG is suitable for bare board programming but there is multiplexing with the SD card.

If you use a JTAG to program the board, you won't be able to use the SD card.

6.1.1 U_DEBUG

The first one is a debug UART interface – U_DEBUG. You can use our USB-SERIAL-CABLE-F for debugging via the UART. Of course, if you already have a similar cable you can use it without problems.

If your computer has an RS232 (COM) port you might use it for debug connection also (as long as you bring its TTL levels down to CMOS). The important part is that you need a TTL ↔ CMOS converter (MAX232 IC) on the RS232 signals else you might damage the board. Cables like USB-SERIAL-CABLE-F have such a converter already.

How to use the U_DEBUG with USB-SERIAL-CABLE-F – which has RED GREEN BLUE wires GND=BLUE, RX(INPUT)=GREEN, TX(OUTPUT)=RED. You have to connect to OLinuXino-NANO U_DEBUG connector in this sequence:

BLUE wire to pin.3 (GND)
 GREEN wire to pin.2 (TX)
 RED wire to pin.1 (RX)

The settings for serial communication are: 115200, 8-N-1, no flow control.

U_DEBUG		
Pin #	Signal name	Processor pin #
1	PWM0/DUART_RXD	125
2	PWM1/DUART_TXD	126
3	GND	-
4	DEBUG	89

You can also check the pin names at the top and at the bottom of the board around the U_DEBUG pins.

6.1.2 JTAG debug

This option allows you to use the classic 6-pin parallel JTAG (not including GND and VCC). There are pads left for this option at the top of the board over the SD card holder.

The important thing is that these pins are multiplexed with the SD card signals. In order to use the 6-pin JTAG you will have to stop using the SD card. Note also that the classic JTAG interface comes without plastic header mounted so in order to use it you will need to use wires for connection.

Consider the software settings required to switch from SJTAG to 6-pin JTAG and vice versa referring to the iMX233 manual. For instance:

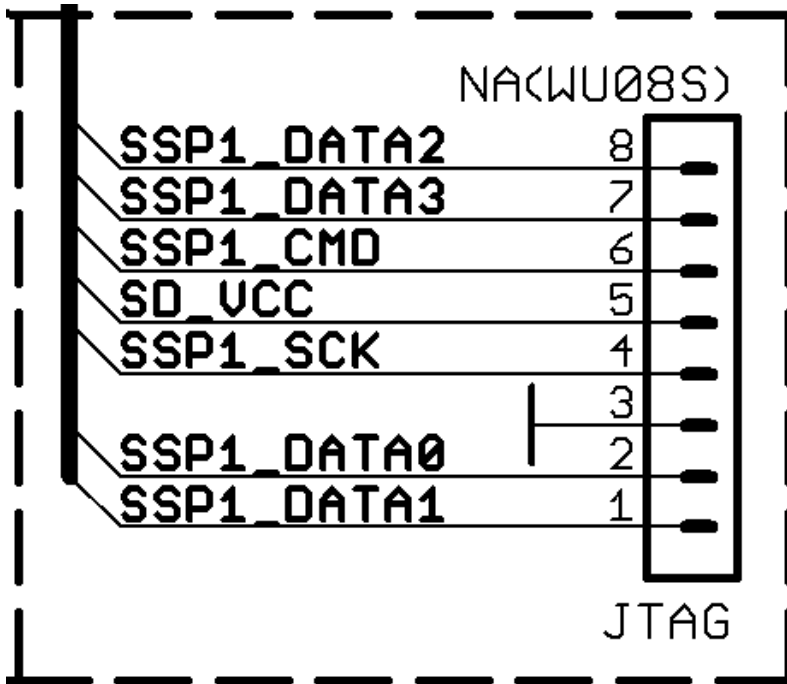
The HW_DIGCTL_CTRL_USE_SERIAL_JTAG bit in the digital control block selects whether the serial JTAG interface or the alternative six-wire parallel JTAG interface is used.

HW_DIGCTL_CTRL_USE_SERIAL_JTAG – 0x0 – selects whether the one-wire serial JTAG interface or the alternative six-wire parallel JTAG interface is used. 0 = Parallel six-wire JTAG is enabled and is mapped to a collection of module pins that must be enabled by programming their MUXSEL bits in the pin control block. 1 = Serial JTAG is enabled and uses the dedicated DEBUG pin. The ROM bootcode writes this field prior to enabling JTAG, selecting which type of JTAG pin signaling to use. OLD_JTAG = 0x0 Use six-wire parallel JTAG mode. SERIAL_JTAG = 0x1 Use one-wire serial JTAG mode.

It is good idea to check the datasheet of the iMX233 processor for all the options in the digital control block. The processor's datasheet should be always the first piece of paper you consult when dealing with electronics.

JTAG (multiplexed with SD card)		
Pin #	Signal name	Processor pin#
1	SSP1_DATA1	85
2	SSP1_DATA0	84
3	GND	-
4	SSP1_SCK	90
5	SD_VCC	-
6	SSP1_CMD	83
7	SSP1_DATA3	87
8	SSP1_DATA2	86

Notice that the pad numeration is written at the bottom of OLinuXino-NANO under the microSD card connector. Please check the manual part for microSD card for a schematic of the pins.

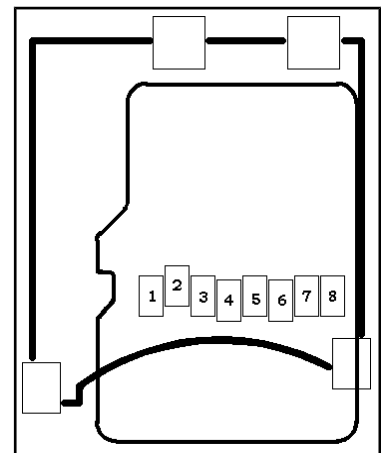


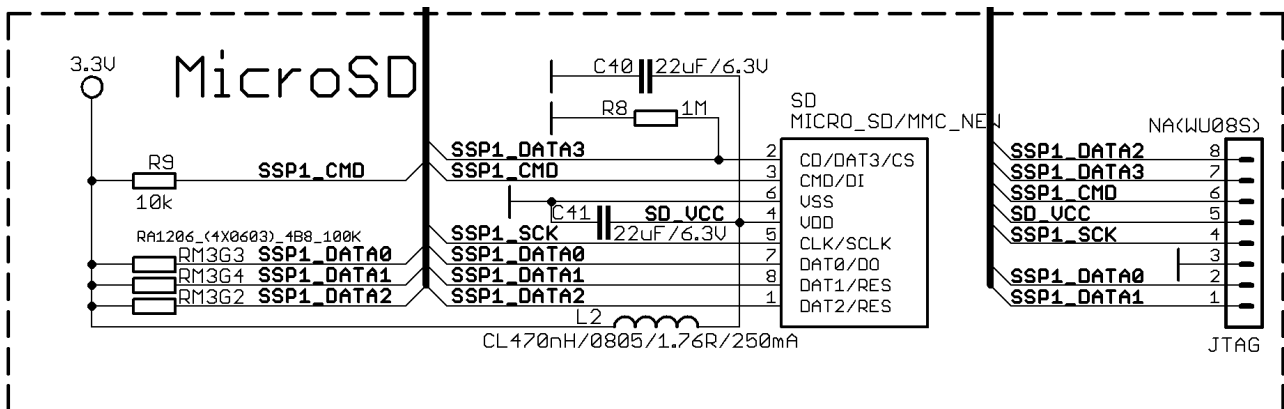
6.2 SD/MMC slot

The microSD card slot is a standard 8pin connector.

We have tested a number of microSD cards on the OLinuXino boards and all of them worked fine regardless manufacturer or capacity. However, keep in mind that some of the lower quality microSD cards might draw too much current from the slot which might cause power-state problems. If you suspect the microSD card is causing problems please try using another one of better quality for better results.

microSD card connector		
Pin #	Signal name	Processor pin #
1	SSP1_DATA2	86
2	SSP1_DATA3	87
3	SSP1_CMD	83
4	SD_VCC	-
5	SSP1_SCK	90
6	GND	-
7	SSP1_DATA0	84
8	SSP1_DATA1	85





Ensure the board is soft powered down before removing the SD card – unplugging the SD card during board operation OR removing the power supply during board operation might corrupt the SD card, rendering it useless.

When removing the card, please make sure that you release it from the connector by pushing and NOT by pulling the card directly (this can damage both the connector and the microSD card).

It is a good idea to be sure there are currently no read/write operations performed when ejecting the SD card, or you might corrupt your Linux OS. If you corrupt the SD card you can download a new image from the iMX233 wiki article at our web site.

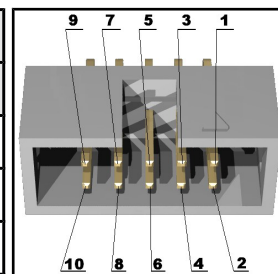
6.3 UEXT module

OLinuXino board has UEXT connector and can interface Olimex's UEXT modules. For more information on UEXT please visit: <https://www.olimex.com/Products/Modules/UEXT/>.

*Note the three jumpers PIN29/SOFT_CL – PIN22/LCD_EN/I2C_SCL; PIN28/SOFT_SDA3 – PIN21/LCD_HSYNC/I2C_SDA, and CS_SW:Open/CS_HW:Close which by default are set to a hardware I2C! They can be used to set the UEXT to a hardware SPI. Additionally the chip select might be left open.

Note that if you wish to use our UEXT modules the jumpers should be set to hardware I2C position.

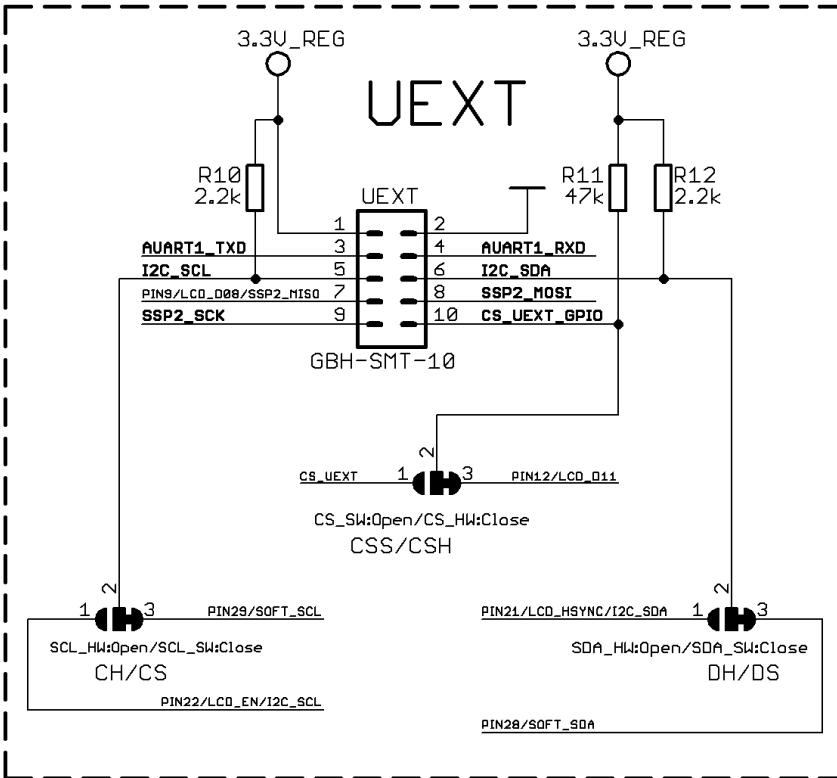
UEXT connector		
Pin #	Signal name	Processor pin #
1	+3.3V_REG	-
2	GND	-
3	AUART1_TXD	127
4	AUART1_RXD	128
5	I2C_SCL	34* OR 11(default)
6	I2C_SDA	31* OR 15(default)
7	PIN9/LCD_D08/SSP2_MISO	22



8	SSP2_MOSI	21
9	SSP2_SCK	33
10	CS_UEXT_GPIO	25(default) OR 32*

*Controlled by SMT jumper

The UEXT connections are visible below:



6.4 CON1 and CON2 – GPIO connectors

The pins that haven't been used by the peripherals mounted (or that are considered “important”) are lead out to the two rows of pins CON1 and CON2 near the edges of the board. They allow the user to attach additional hardware, check readings, perform hardware debug, etc. The “GPIO Pin#” column shows connector number and does NOT represent the naming on the bottom of the board.

Please note that pin holes 15-20 are not present. They are left to keep the 0.1" step free space for perfect breadboard fit.

CON1 and CON2 - GPIO pinhole rows					
CON1			CON2		
GPIO Pin#	Signal name	Processor pin#	GPIO Pin#	Signal name	Processor pin#
1	BAT	-	1	+5VEXT	-
2	GND	-	2	GND	-
3	3.3V	-	3	3.3V_REG	-
4	PIN1/LCD_D00	2	4	PWM0/DUART_RXD	125
5	PIN2/LCD_D01	3	5	PWM1/DUART_TXD	126
6	PIN3/LCD_D02	4	6	VDAC1	104
7	PIN4/LCD_D03	5	7	HPL	113
8	PIN5/LCD_D04	6	8	HPR	109
9	PIN6/LCD_D05	7	9	HP_VGND	111
10	PIN7/LCD_D06	8	10	LIN1_INL	115
11	PIN8/LCD_D07	9	11	LIN1_INR	114
12	PIN9/LCD_D08/SSP2_MISO	22	12	PIN34/MIC	116
13	PIN10/LCD_D09	23	13	PIN33/LRADC0	108
14	PIN11/LCD_D10	24	14	PIN32/LRADC1	107
21	PIN12/LCD_D11	25	21	PIN31	82
22	PIN13/LCD_D12	27	22	PIN30	81
23	PIN14/LCD_D13	26	23	PIN29/SOFT_SCL	34
24	PIN15/LCD_D14	29	24	PIN28/SOFT_SDA	31
25	PIN16/LCD_D15	28	25	PIN27/PWM2	91

CON1 and CON2 - GPIO pinhole rows					
GPIO Pin#	Name	Processor pin#	GPIO Pin#	Name	Processor pin#
26	PIN17/LCD_D16	19	26	PIN26/LCD_CS	10
27	PIN18/LCD_D17/USB_EN	20	27	PIN25/LCD_RS	14
28	PIN20/LCD_VSYNC	16	28	PIN24/LCD_WR	13
29	PIN21/LCD_HSYNC/I2C_SDA	15	29	PIN23/LCD_DISP	12
30	PIN22/LCD_EN/I2C_SCL	11	30	PIN19/LCD_DOTCLK	17

Signals in yellow color are the headphones out signals.

Signals in blue color are the line in signals.

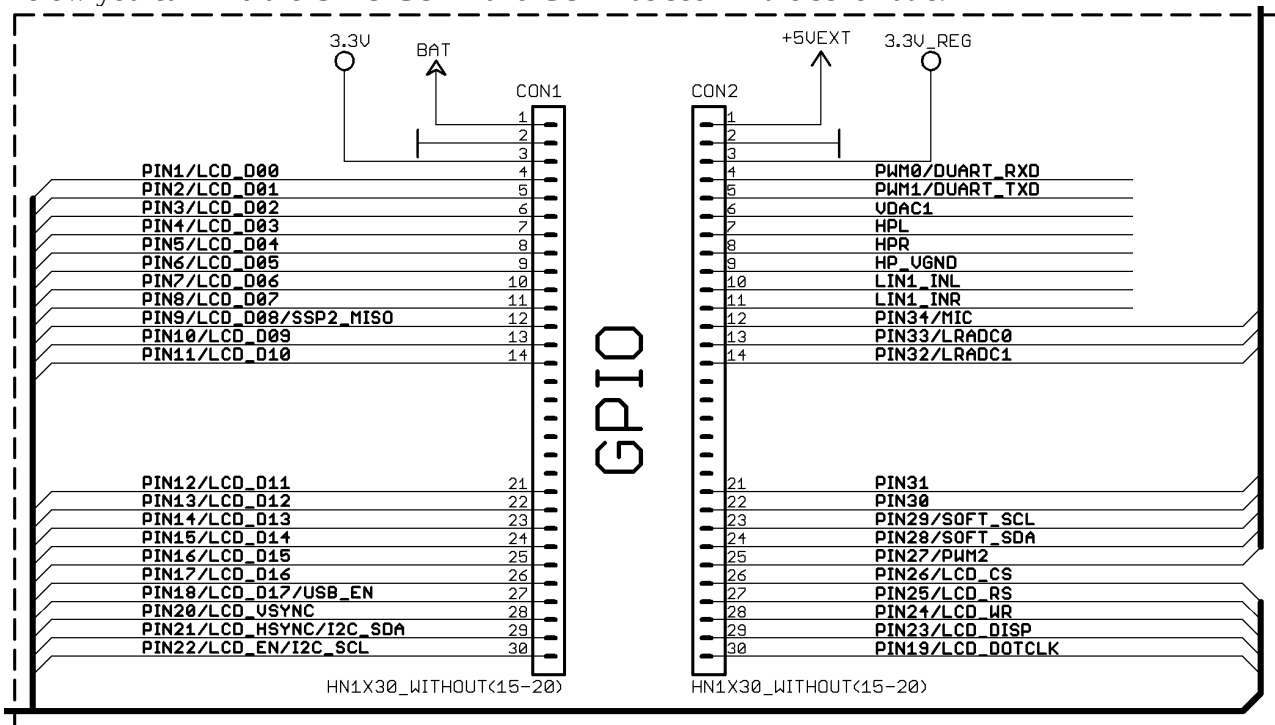
The hardware is associated differently in the Linux following the GPIO naming conventions suggested in the iMX233 datasheet. You can check the connection between Linux naming of the pin, Olimex naming of the pin and the consecutive connector pin number in the table below. The ones filled with “Not implemented” doesn't have Linux support by the time of writing and will be updated overtime. “Linux GPIO” is the one you should use in Linux (the one in the datasheet); “OLinuXino name” is the pin as written on the bottom of the board. ”OLinuXino GPIO Connector #” is the consecutive number of pins with BAT being Pin#1 and GND#40.

Note that if “OLinuXino Name” starts with P and then is followed by a number X, the PX is the name written on the bottom of the board (under the connector) with white ink. If “OLinuXino Name” is other text it is a signal used for the hardware of the board but still can be controller by the Linux (it can't be found at the GPIO connector though).

The Linux implementation of pins					
Linux GPIO/iMX 233 GPIO	OLinuXino Name	OLinuXino GPIO Connector #	Linux GPIO/iMX 233 GPIO	OLinuXino Name	OLinuXino GPIO Connector #
0	PIN9	19	32 to 39	Not implemented	Not implemented
1	PIN10	17	51	PIN23	18
2	PIN11	15	52	PIN25	16
3	PIN12	13	53	PIN24	20
4	PIN13	11	55	PIN19	12
5	PIN14	9	56	PIN22	10
6	PIN15	7	64	JTAG_TDO1 SSP1_CMD	Not implemented
7	PIN16	5	65	LED1	Not implemented

16	PIN17	3	91	PIN30	28
17	PIN18	4	92	PIN31	30
19	TEST_PAD	Not implemented			
20	UEXT_SPI2_MOSI	9			
23	PIN29	26			
24	UEXT_SPI2_SCK	Not implemented			
25	PIN28	24			
30	UEXT_TX1	Not implemented			
31	UEXT_RX1	Not implemented			

Below you can find the GPIO CON1 and CON2 as seen in the schematic:



There is numeration of the pinholes on the top of the board.

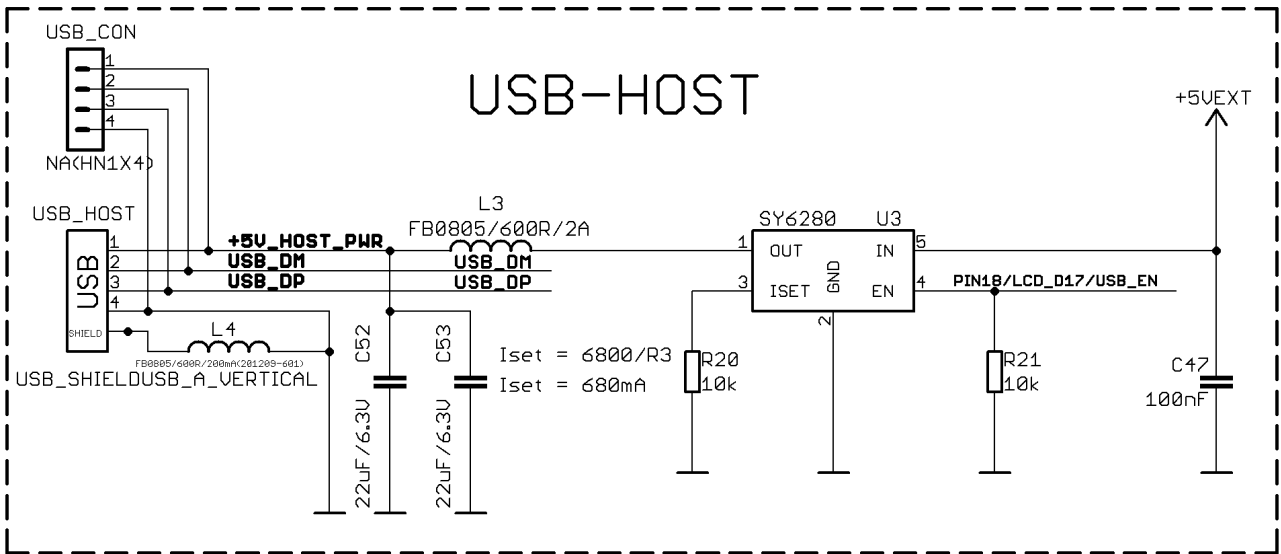
6.5 USB HOST connector

The USB host connector is a vertical one and it is side mounted. This is done to save space and to optimize the dimensions of the board.

It is a good idea to use an external USB hub (splitter) to connect more than one USB device to the board.

The signals follow the familiar and standard USB host pattern:

USB HOST	
Pin #	Signal name
1	+5V_HOST_PWR
2	USB_DM
3	USB_DP
4	GND



6.6 External power pins

The NANO board lacks power jack. If you wish to use regulated 5VDC you should provide it at pins 1 and 2 at the CON2 row of pins. Note that pin 1 is the VDC pins and pin 2 is the GND pin.

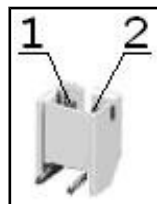
You would damage the board if you short-circuit the power supply to these pins!

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

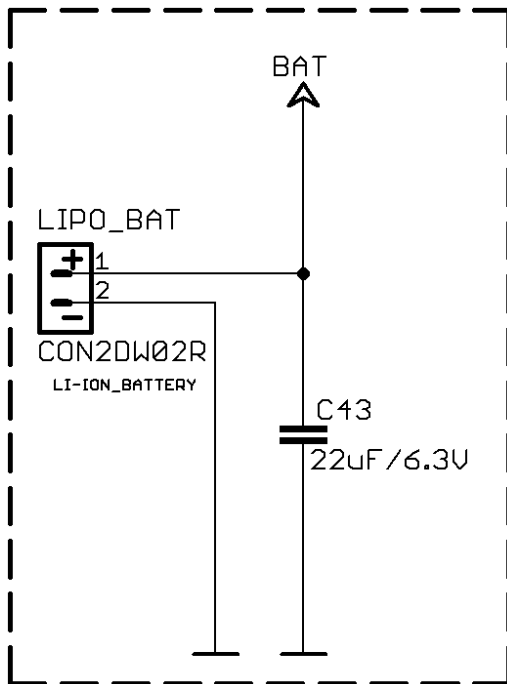
6.7 Battery connector

The voltage of a 3.7V LIPO battery would be enough to power the board. It uses the standard.

Pin #	Signal name
1	VBAT
2	GND



The pins are also written on the bottom of the board, under the connector.



The iMX233 has a built-in battery recharge circuit. This means that if you have a battery and external power supply connected simultaneously, if the battery is not fully charged it would start charging (drawing current from the external power supply).

6.8 Boot mode positions

The iMX233 can boot the operating system from different locations. The default location for the Linux files we used is the microSD card. There is a resistor matrix RM1 responsible for the boot mode. It is located on the back of the board. Note that the jumpers are SMD type and opening a jumper would require cutting, closing a jumper would require soldering. To be able to do the quoted operations you will need basic engineering skills and experience. You can check below the table or the schematic for the correct positions. Value of “1” means the jumper is closed.

BOOT MODE SELECT: BOOT MODE	LCD DATA			
	D03	D02	D01	D00
USB	0	0	0	0
3.3V I2C Master	0	0	0	1
3.3V SPI Flash 1 Master	0	0	1	0
3.3V SPI Flash 2 Master	0	0	1	1
3.3V NAND	0	1	0	0
Startup waits for JTAG debugger connection	0	1	1	0
3.3V SD/MMC 1 (Default !!!)	1	0	0	1
3.3V SD/MMC 2	1	0	1	0

BOOT MODE SELECT

You can find the boot mode options in the next table:

BOOT MODE	D03	d02	d01	d00
USB	0	0	0	0
3.3V I2C Master	0	0	0	1
3.3V SPI Flash 1 Master	0	0	1	0
3.3V SPI Flash 2 Master	0	0	1	1
3.3V NAND	0	1	0	0
Start up waits for JTAG debugger connection	0	1	1	0
3.3V SD/MMC 1 (Default!!!)	1	0	0	1
3.3V SD/MMC 2	1	0	1	0

6.9 Jumper description

Please note that all the jumpers on the board are SMD type. If you feel insecure in your soldering/cutting technique it is better not to try to adjust the jumpers. Additionally for the NANO board the jumpers are pretty tiny to keep the board factor as small as possible. If you are not good at soldering you might damage the board permanently.

6.9.1 CH/CS and DH/DS

Those two jumpers must be moved together – there are two available options – configuring software I2C interface (CS, DS) or hardware I2C interface (CH, DH).

The default positions of these jumpers of latest revisions of the board are CS/DS (hardware I2C).

Note that if you wish to use our UEXT modules the jumpers should be set to hardware I2C position.

6.9.2 CSS/CSH

This jumper controls whether the I2C CS (chip select) is software or hardware.

CS_SW:Open/CS_HW:Close

The default position is CS_HW closed (hardware CS).

6.9.3 Boot mode selecting jumpers

The boot mode is discussed in chapter 6.8 of this manual.

6.10 Additional hardware components

The components below are mounted on OLinuXino but are not discussed above. They are listed here for completeness:

Reset button – used to reset the board

Power button – when Linux is running pressing PWR_BUT will put the board in low power mode; when powered by battery PWR_BUT is used to initially power up the board – and pressing the board again after it is powered will put it low power mode

Recovery button – when powered by battery the recovery button is used to bring the processor to normal power mode

512 (32M x 16) MBit DDR SDRAM – the exact memory used at the moment of writing is Xylinx H5DU5xxxxyyy

Green LED1

6.11 Accessories

Here you will find additional information for Olimex products you can use with OLinuXino-NANO purchase

6.11.1 USB-SERIAL-CABLE-F

The cable for the U_DEBUG interface that can be purchased for additional cost has three cables. It is important to specify in your purchase order whether you want the USB-SERIAL-CABLE-F variant with male of female connectors.

You will need a drivers that can be downloaded from the page of USB-SERIAL-CABLE:
<https://www.olimex.com/Products/Components/Cables/USB-Serial-Cable/USB-Serial-Cable-F/>.

CHAPTER 7 BLOCK DIAGRAM AND MEMORY

7. Introduction to the chapter

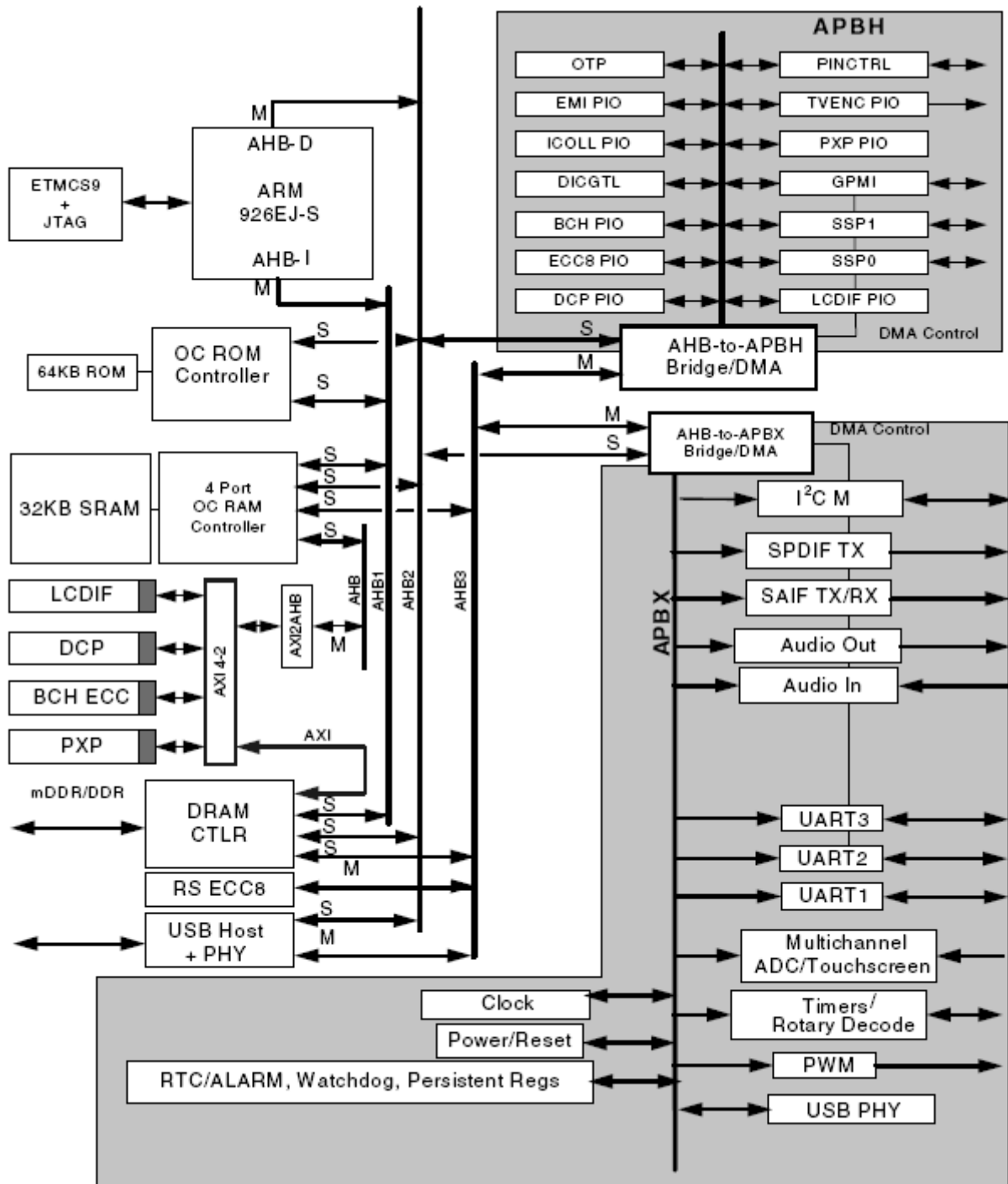
On the next page you can find a memory map for this family of processors. It is strongly recommended to refer to the original datasheet released by Freescale for one of higher quality.

7.1 Memory addresses

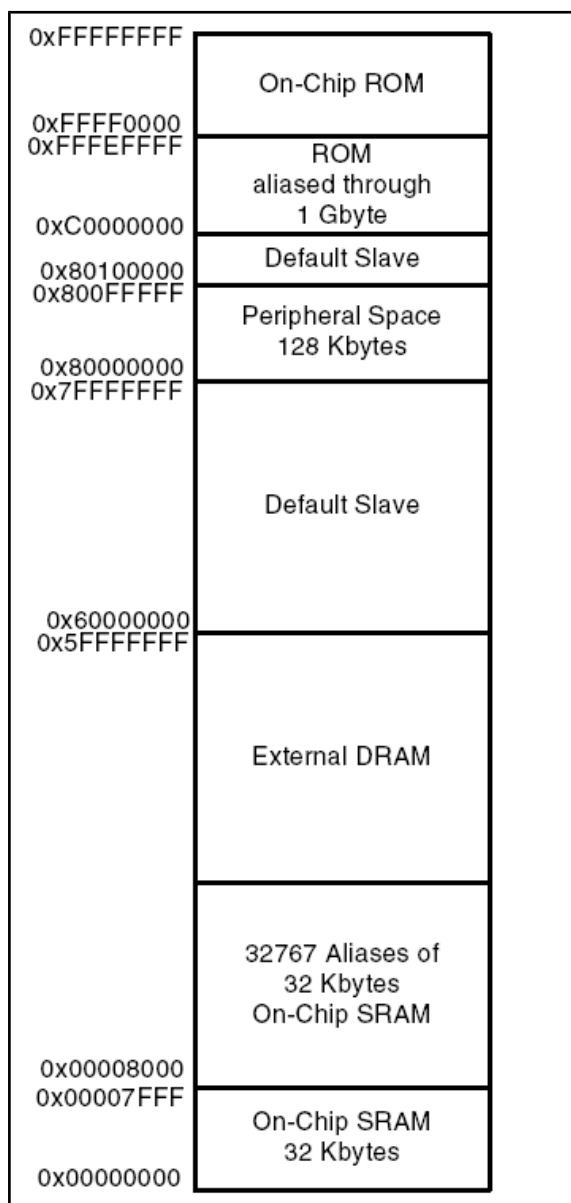
Below is the table with some of the most frequently used addresses. For full list of addresses check the manual released by Freescale (Chapter Memory Map).

Decode block	Device	Mnemonic	Start address	End address	Size
AHB	On-chip RAM	OCRAM	0x00000000	0x00007FFF	32KB
	On-chip RAM alias	OCRAM	0x00008000	0x3FFFFFFF	
	External memory		0x40000000	0x5FFFFFFF	512MB
	Default Slave		0x60000000	0x7FFFFFFF	512M

7.2 Processor block diagram



7.3 Physical memory map



CHAPTER 8 SCHEMATICS

8. Introduction to the chapter

In this chapter are located the schematics describing logically and physically OLinuXino.

8.1 Eagle schematic

OLinuXino schematics may be found it on the OLinuXino's GitHub repository:

<https://github.com/OLIMEX/OLINUXINO/tree/master/HARDWARE/iMX233-OLinuXino-NANO>.

You can download the whole repository as .zip without having a GitHub account.

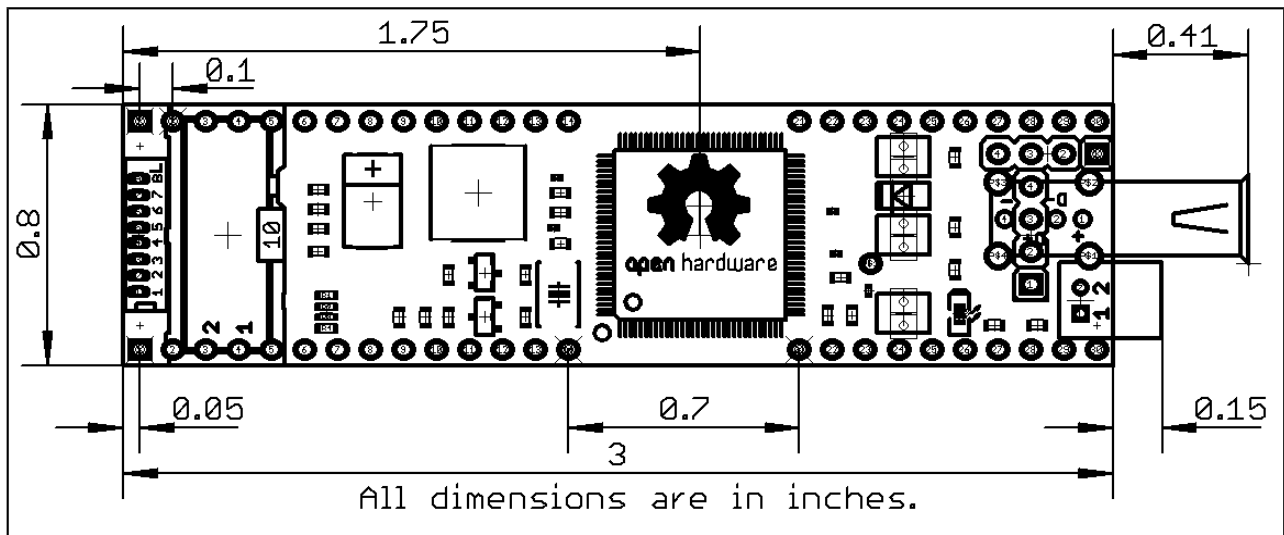
We use mostly Eagle by Cad Soft 4.16r2 for designing. However, the files should be compatible with the latest Eagle available. Cad Soft offers a trial version of their software that allows you to inspect schematics and board files (without being able to modify them).

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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.

8.2 Physical dimensions

Note that all dimensions are in inches.



Note that the iMX233-OLinuXino-NANO board has a 6-layer PCB. The three highest elements on the board in order from the tallest to the shortest are: vertical USB HOST – 16.2mm (0.640") over the pcb; UEXT connector – 13.6mm (0.525"); U_DEBUG pins – 12.0mm(0.464").

The heights listed above include the PCB height.

CHAPTER 9 REVISION HISTORY AND SUPPORT

9. 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.

9.1 Document revision

Revision	Changes	Modified page#
A, 27.09.13	Initial Creation	All
B, 30.09.13	Fixed error in the naming of the pins of the bottom view	11
	Fixed wrong mention of SPI instead of I2C	20
	Added more information about hardware I2C	27
C, 14.10.13	Wrong mention of iMX233-OLINUXINO-MICRO	2
	Various page formatting	8
	BREADBOARD-1 product added	9
	Battery charger information added	8, 9, 26
D, 06.12.13	Fixed wrongfully stated information about the presence of a step-up converter (3.7V to 5V).	7, 9, 26
E, 23.10.14	Expanded the information about serial connections	11
	Expanded the information about the building of Linux	19
	Few grammatical corrections	
F, 16.01.15	Fixed few errors about the GPIO count	6
	Updated the table of available iMX233 boards	6
	Updated headings of the document	

9.2 Board revision

Revision	Notable changes
B	Initial release of the board

9.3 Useful web links and purchase codes

The web page you can visit for more info on your device is

<https://www.olimex.com/Products/OLinuXino/iMX233/iMX233-OLinuXino-NANO/>.

It is highly recommended to visit the WIKI article which contains tons of useful information, sources and links: <https://www.olimex.com/wiki/IMX233>

You can get the latest updates on the software at: <https://github.com/OLIMEX/OLINUXINO>.

ORDER CODES:

iMX233-OLinuXino-NANO – the smallest version of the single-board computer

iMX233-OLinuXino-MAXI – the biggest version of OLinuXino featuring Ethernet controller

iMX233-OLinuXino-MICRO – tiny in size, tiny in price and perfect for breadboarding

iMX233-OLinuXino-MINI-WIFI – the MINI version of OLinuXino + embedded RTL8128CU WIFI module

USB-SERIAL-CABLE – USB serial console cable for U_DEBUG

SY0605E – power supply adapter 5V/1A for iMX233-OLinuXino-NANO (Will not work with iMX233-OLinuXino-MAXI and iMX233-OLinuXino-MINI)

SY0605E-CHINA – cheaper power supply adapter 5V/1A for iMX233-OLinuXino-NANO (Will not work with iMX233-OLinuXino-MAXI and iMX233-OLinuXino-MINI)

iMX233-OLinuXino-SD – SD card with the Linux image which can be used with every board from the OLinuXino family

MOD-WIFI_RTL8188 – external USB WIFI modem with RTL8188 chip

The latest price list can be found at <https://www.olimex.com/prices>.

How to order?

You can order directly from our web shop or from any of our distributors.

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

The full list of distributors can be found here: <https://www.olimex.com/Distributors/>