

OLIMEXINO-328 an Arduino-like development board

USER'S MANUAL

Document revision C, April 2017
Designed by OLIMEX Ltd, 2011



All boards produced by Olimex LTD are ROHS compliant

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CHAPTER 1 – OVERVIEW

1. Introduction to the chapter

Thank you for choosing the OLIMEXINO-328 board from Olimex! This document provides a user's guide for the Olimex Arduino-like OLIMEXINO-328. As an overview, this chapter gives the introduction to Arduino, the scope of this document and lists the features of the board. The document's organization is then detailed.

1.1 Introduction to Arduino

Arduino is an open-source electronics prototyping platform, designed to make the process of using electronics in multidisciplinary projects more accessible. The hardware consists of a simple open design for the Arduino board with an Atmel AVR processor and on-board I/O support. The software consists of a standard programming language and the boot loader that runs on the board.

Arduino hardware is programmed using a Wiring-based language (syntax + libraries), similar to C++ with some simplifications and modifications, and a processing-based IDE.

The project began in Ivrea, Italy in 2005 to make a device for controlling student-built interaction design projects less expensively than other prototyping systems available at the time. As of February 2010 more than 120,000 Arduino boards had been shipped. Founders Massimo Banzi and David Cuartielles named the project after Arduino, a local bar. The name is an Italian masculine first name, meaning "strong friend". The English pronunciation is "Hardwin", a namesake of Arduino of Ivrea.

More information can be found at the creators web page <http://arduino.cc/> and in the Arduino Wiki <http://en.wikipedia.org/wiki/Arduino>. To make the story short – Arduino is easy for the beginners with minimal Electronics knowledge, while not restricting the professionals, as they can program it in C++ or a mix of Arduino/C++ language.

There are thousands of projects which make the startup easy as there is almost no field Arduino enthusiasts have not explored already.

1.2 Improvements over the original Arduino design

We entered the Arduino field 5 years after the design was introduced, allowing us to see and skip most of the errors the Arduino inventors made. We were able to read feedback from current customers and to implement what they wanted to see in the original Arduino.

There are a number of improvements over the original Arduino design that we have implemented in OLIMEXINO-328:

1. We allowed the board to work at different frequencies with easy exchange of the quartz crystal.
2. The original Arduino used a linear power supply. This limited the input voltage range. We designed a switching power supply to accept input voltages from 9 to 30V DC, making it possible

to use virtually any power supply adapter on the market, including applications with the standard 24VDC industrial power supply.

3. We carefully selected all components to work reliably over the industrial temperature range -25+85C so the board can be used in industrial applications (the original design was suitable for the commercial 0-70C operating temperature).

4. The original Arduino design was not good for portable applications as it dissipated too much power in the linear voltage regulators. We chose ULTRA LOW POWER voltage regulators with consumption of only few microamps to enable handheld and battery powered applications.

5. We added a Li-Ion rechargeable battery power supply option with a BUILT-IN onboard charger, so when a battery is attached it is automatically kept charged . When the other power source (USB or external adapter) is removed it will AUTOMATICALLY power the board - no jumpers, no switches!

6. Our design can work both on 3.3V and on 5V, switch-selectable.

7. Our boards included the UEXT connector, allowing many existing modules like RF, ZIGBEE, GSM, and GPS to be connected. It also saves soldering to interface I2C, UART and/or SPI.

8. Our design allows a Real Time Clock (RTC).

9. We made our design noise immune in the RESET circuit. There are a number of threads on the Arduino forum for problems with the RESET when the board works with motors, since Atmel recommendations were omitted in the original design. We fixed this.

10. We used a separate voltage regulator for the Analog part, allowing the ADC to be read correctly without digital noise pickup.

11. We made provision for the optional ARef precision voltage source, for users who need higher precision and temperature stability in Analog readings.

12. We placed the LEDs and the BUTTONs on the edge of the board for easy access even if the boards have shields on them.

13. All components were placed LOWER than the connectors, so the shields do not interfere with them.

14. We used a mini USB connector which is common and used in most cell phones, so you do not have to buy other cables.

15. The original design did not space the connectors at 0.1", making perfboard use impossible. For compatibility, we used the same spacing but we added footprints next to the connectors on 0.1" which customers can use with perforated boards.

16. All signals on the connectors are printed on top and on bottom of the board, so when you check with a probe you know exactly which point you are measuring.

17. We added 4 mounting holes making board attachment easier.

1.3 Target market and purpose of the board

The board is aimed at beginners due to the fact it might be programmed without the need of third-party tools and the big Arduino community. It is also suitable for professionals due to the industrial range of operation, small form factor and wide power supply choice. The board is suitable for hand-held applications.

1.4 Hardware revision of the board used in the manual

Revision B and revision C boards and resources were used while writing this document. It is possible that all revisions used to create the document are outdated so it is recommended to download the latest sources from the web-page of OLIMEXINO-328 at the official www.olimex.com web-site.

1.4 Document 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 setting the board

Chapter 3 contains the general board diagram and layout

Chapter 4 mentions the control circuitry used in OLIMEXINO-328

Chapter 5 is an explanation of the connectors, the LEDs and the jumpers position

Chapter 6 contains the general board diagram and layout

Chapter 7 contains the revision history, useful links and support information

CHAPTER 2 – SETTING UP THE OLIMEXINO-328

2. Introduction to the chapter

This section helps you set up the OLIMEXINO-328 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

The OLIMEXINO-328 board is shipped in protective anti-static packaging. The board must not be subjected to high electrostatic potentials. General practice for working with static sensitive devices should be applied when working with this board.

2.2 Requirements

In order to set up the OLIMEXINO-328 optimally, you might need to update your set of hardware and/or software tools. The major needed components are listed below.

Hardware tools:

- USB type A to USB mini cable
- Personal computer with USB type A port

Software tools:

- any official Arduino IDE

You would need additional hardware and software if you want to use OLIMEXINO-328 as a general-purpose Atmel AVR board (or you want to reprogram the bootloader, required for Arduino IDE communication).

You would need to have a working combination of a programmer tool and a software development environment. You would also need a 6-pin header or jumper wires to establish proper hardware connection between the programmer tool and the board.

Currently OLIMEX sells a couple of ATmega328-compatible programmers that would also work with the most common software environments (AVR Studio 4 and 5; Atmel Studio 6; AVRdude – the built-in Arduino programmer). These programmers are: [AVR-ISP500](#) and [AVR-ISP-MK2](#).

2.3 Connecting to Arduino IDE

The latest Arduino IDE might be downloaded from the official Arduino web-site: <http://arduino.cc>.

After you have downloaded and installed (or extracted) the environment you should connect the OLIMEXINO-328 to the computer via an USB type A to USB mini cable.

The first time you connect the board you would be asked for drivers. You can find the drivers needed for OLIMEXINO-328 in the install folders of the Arduino IDE (usually in folder “drivers”).

After the drivers are successfully installed you should run the Arduino IDE.

In “Tools->Board” you should select “Arduino Duemilanove w/ ATmega328”.

That is all. Now you can load any built-in example or you can refer to the number of demo examples in the “SOFTWARE” section of the OLIMEXINO-328's web-page:
<https://www.olimex.com/Products/Duino/AVR/OLIMEXINO-328/>

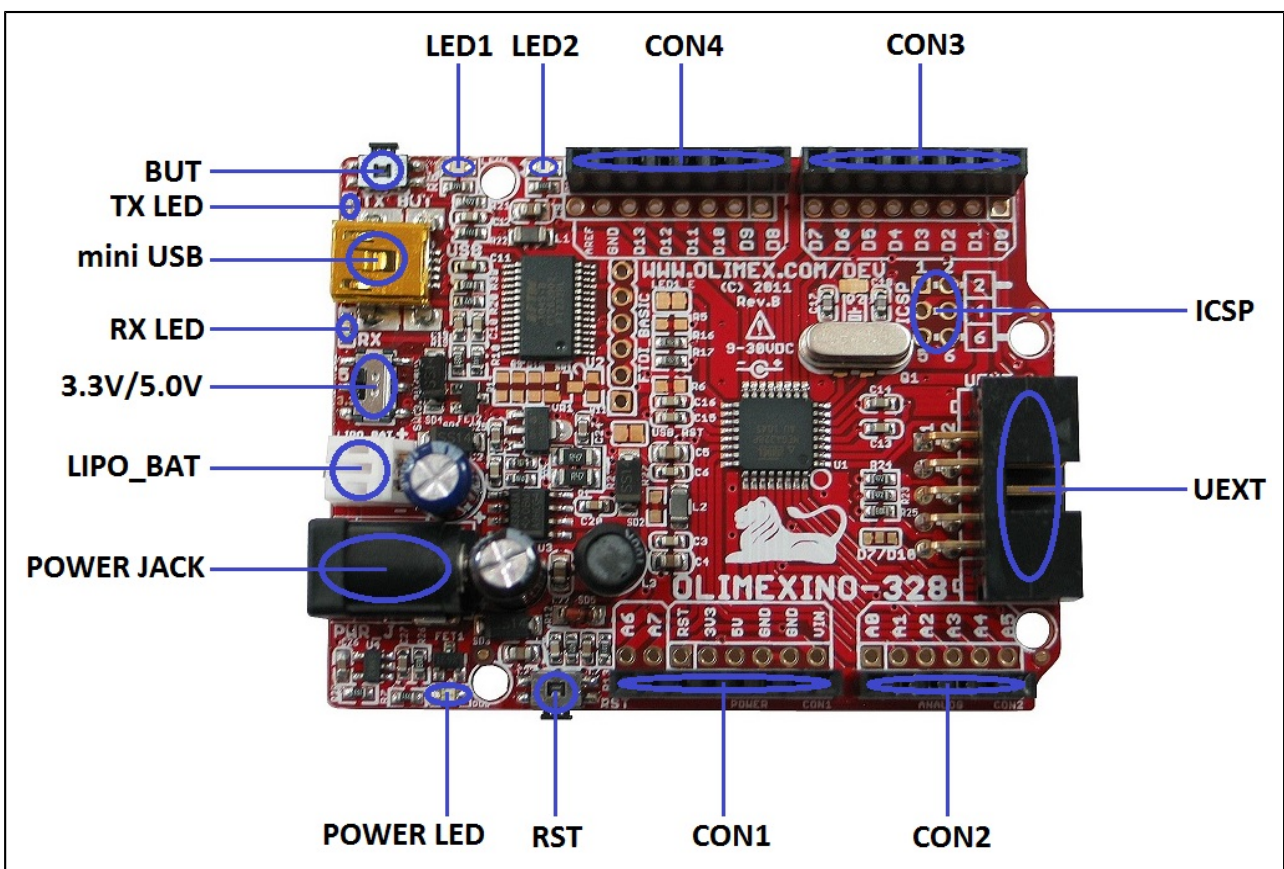
For more detailed instructions and Linux installation please check the following document:
https://www.olimex.com/Products/Duino/AVR/OLIMEXINO-328/resources/Install_OLIMEXINO-328.pdf

CHAPTER 3 – OLIMEXINO-328 BOARD DESCRIPTION

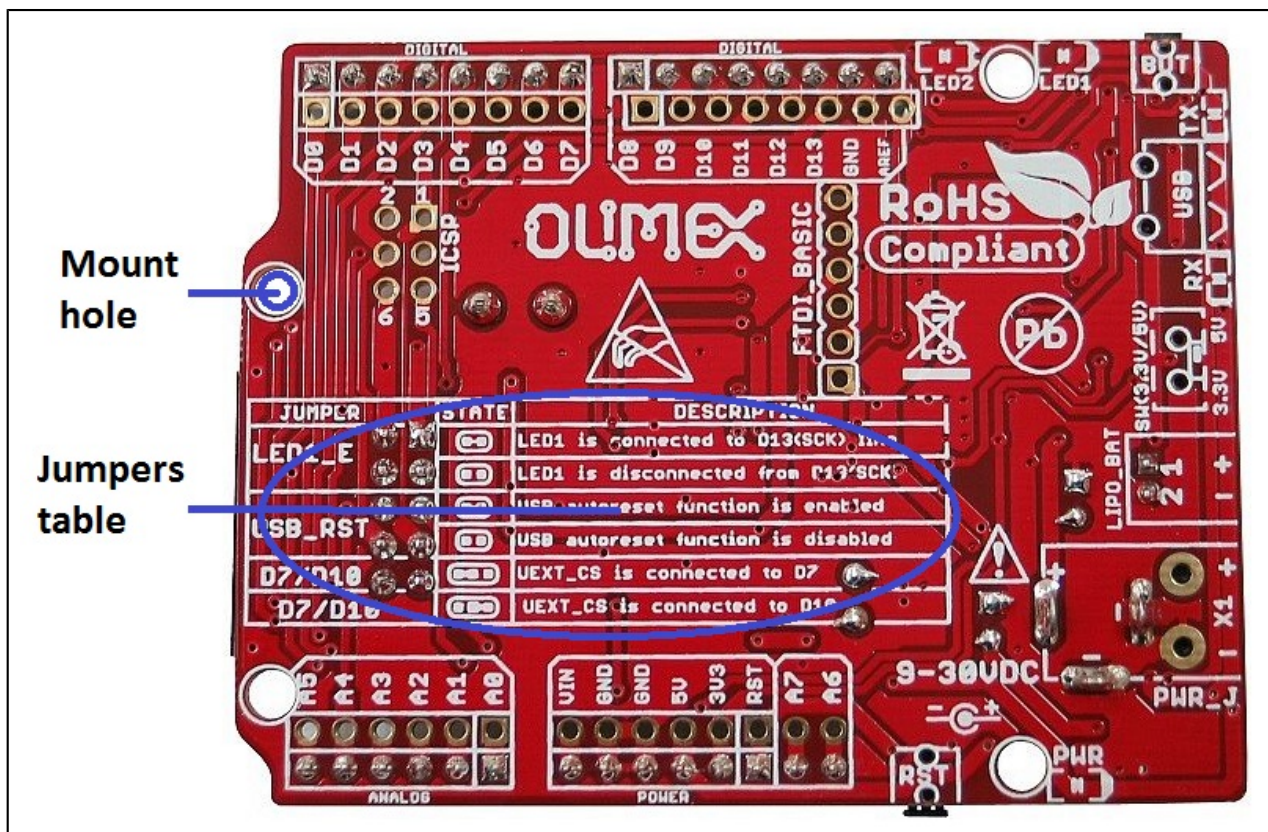
3. Introduction to the chapter

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, please, check the OLIMEXINO-328 itself.

3.1 Layout (top view)



3.2 Layout (bottom view)



CHAPTER 4 – CONTROL CIRCUITY

4. Introduction to the chapter

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

4.1 Reset

OLIMEXINO-328 reset circuit includes R12 (4.7k Ω), R13 (330 Ω), SD5 (1N4148), C7 (4.7nF), C8(100nF), jumper USB_RST, ATmega328P pin29 (PC6/3RESET/PCINT14) and RST button.

4.2 Clocks

Quartz crystal Q1 16 MHz is connected to ATmega328P pin 7 (XTAL1) and pin 8 (XTAL2). Note that the crystal is on socket and can be changed to any value.

4.3 Power supply circuit

OLIMEXINO-328 can take power supply from:

- external power supply (9-30) VDC.
- +5V from USB
- 3.7V Li-ion battery

The programmed board power consumption is about 20mA with all peripherals enabled.

The board can operate at either 3.3V or 5V, selected via a switch. When operating at 5V ensure that the boards connected to OLIMEXINO-328 can also operate at 5V. If you are not sure, set the switch to 3.3V operation.

CHAPTER 5 – INTERFACES AND HARDWARE

5. Introduction to the chapter

In this chapter are presented the interfaces found on the programmed that can be found on the board. Jumpers functions are described.

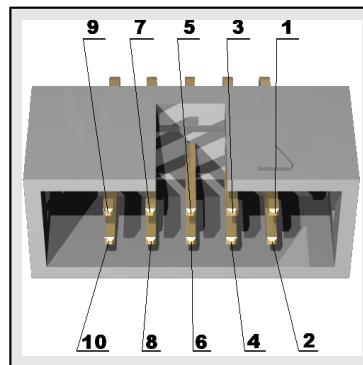
5.1 UEXT connector

The UEXT is used to connect additional extension modules to the OLIMEXINO-328. Most Olimex extensions (named MOD-XXXX) can be plugged directly to this connector. If you wish to add additional extras to your board this is the right interface. Of course, using jumper wires you might connect any other board that uses I2C, SPI or UART interface without the need of soldering.

More information about the UEXT might be found here:

<https://www.olimex.com/Products/Modules/UEXT/>

Pin #	Signal name
1	VCC (3.3 or 5V)
2	GND
3	D1(TXD)
4	D0(RXD)
5	A5(SCL)
6	A4(SDA)
7	D12(MISO)
8	D11(MOSI)
9	D13(SCK/LED1)
10	UEXT_#CS



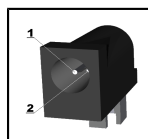
IMPORTANT: Be careful with the voltage levels of the signals of the UEXT and specifically the output available at pin #1. The on-board 3.3V/5V switch also controls the voltage output of the UEXT! Do not connect Olimex modules when the switch is set to 5V position, unless you are 100% sure that these UEXT modules work fine at 5V (most Olimex modules can not work properly at 5V, only at 3.3V)

5.2 PWR_J connector

The power jack used is the typical 2.5mm one used by Olimex in most of our products. You should provide between 6 and 16 volts @ 1.5A maximum to the board.

Note that we also sell a couple of compatible 12V capable power supplies suitable for European customers. These might be found here: <https://www.olimex.com/Products/Power/>.

Pin #	Signal name
1	Power Input
2	GND



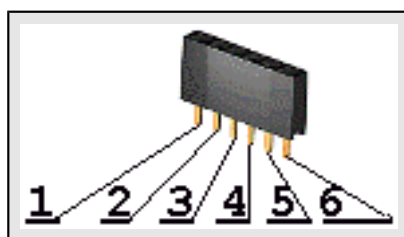
5.3 Arduino shield platform

These four connectors are usually used when you want to mount extension shield on the OLIMEXINO-328. The shield connector layout follows the original Arduino layout and spacing BUT we have also provided set of metalized holes that improve the layout by keeping 0.1" step between connectors. The extra holes might be used when the original connector get clunky of wires. They can be used for placing measuring tools.

Olimex has a number of shields available. They might be found here:
<https://www.olimex.com/Products/Duino/Shields/>

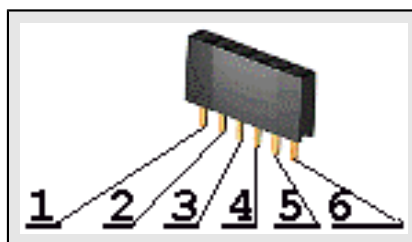
5.3.1 CON1 – POWER

Pin #	Signal name
1	RESET
2	+3.3V
3	+5V
4	GND
5	GND
6	VIN



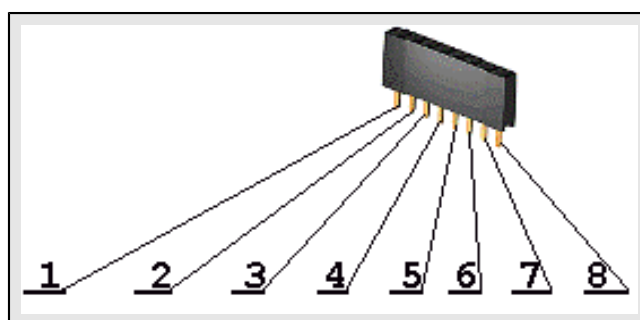
5.3.2 CON2 – ANALOG

Pin #	Signal name
1	A0
2	A1
3	A2
4	A3
5	A4(SDA)
6	A5(SCL)



5.3.3 CON3 – DIGITAL

Pin #	Signal name
1	D0(RXD)
2	D1(TXD)
3	D2(BUT)
4	D3
5	D4
6	D5
7	D6
8	D7

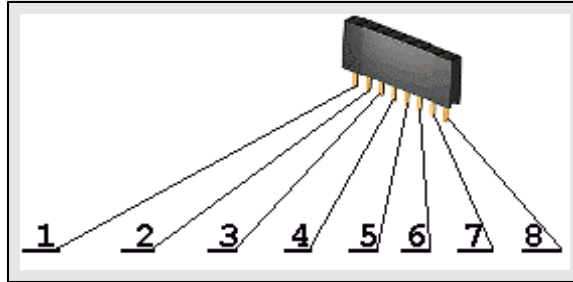


Note: There is a capacitor C12 connected to D2 and in parallel to BUT (for filtering bounces of the BUT) but it can cause interference (and unwanted filtering of signals) if you want to connect for instance RF module to D2, remove C12.

5.3.4 CON4 – DIGITAL:

Note that the additional pads near the CON4 seems slightly off due to the improvement of the shield design we have made. Consider this alignment when referring to the white print on the board.

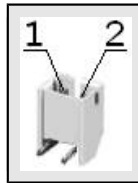
Pin #	Signal name
1	D8
2	D9
3	D10(#SS)
4	D11(MOSI)
5	D12(MISO)
6	D13(SCK/LED1)
7	GND
8	AREF



5.4 LIPO_BAT connector

The LIPO_BAT connector comes handy when you want to use the OLIMEXINO-328 as a stand-alone device.

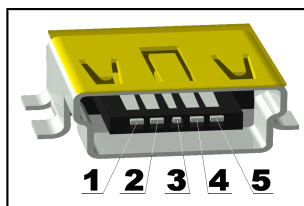
Pin #	Signal name
1	VBAT
2	GND



Olimex LTD has a number of batteries with the proper connector. They might be found here: <https://www.olimex.com/Products/Power/>

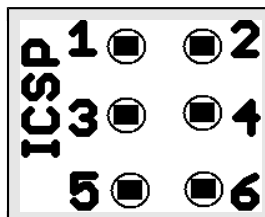
5.4 mini USB connector

Pin #	Signal name
1	+5V_VBUS (VCCINT)
2	USBDM
3	USBDP
4	Not connected
5	GND



5.5 ICSP pads

Pin #	Signal name
1	D12(MISO)
2	VCC
3	D13(SCK/LED1)
4	D11(MOSI)
5	RESET
6	GND



Note, that there is no plastic component mounted for this connector. You would either need own

connector or jumper wires to be able to connect your AVR programmer tool.

Please make sure you are not trying to use TPI or PDI interface with the ICSP pads.

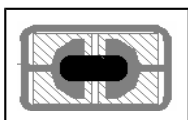
If your programmer has only 10 pin ICSP cable you would need to use jumper wires or adapter to be able to connect to the 6 pin interface.

5.6 Jumper description

The pictures below show the default jumper position. Note that the board has only SMT jumpers which require soldering to close the jumper; and melting the solder plus cutting between the pads to disconnect the jumper.

5.6.1 USB_RST jumper

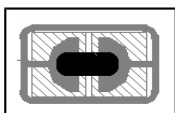
When closed USB_RST jumper enables USB auto-reset function. After reset the bootloader is started and loads the program into the Flash.



Default state is closed.

5.6.2 LED1_E jumper

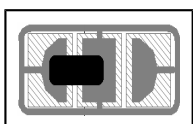
When closed LED1_E, connects LED1 to D13(SCK) line.



Default state is closed.

5.6.3 D7-D10 jumper

When D7/D10 jumper is closed in position D7 – UEXT pin 10 (UEXT_CS) is connected to Atmega328P pin 11 (PD7) – signal D7, when this jumper is closed in position D10 – UEXT pin 10 (UEXT_CS) is connected to Atmega328P pin 14 (PB2/#SS) – signal D10(3SS).



Default state is closed in position D7.

5.7 LEDs and buttons

Status LED with name LED1 (green) connected via jumper LED1_E to ATmega328P pin 17 (SCK/PCINT5/PB5) – signal D13(SCK/LED1).

Status LED with name LED2 (yellow) connected to ATmega328P pin 13 (PCINT1/OC1A/PB1) – signal D9(LED2).

Status LED with name TX (red) indicates that there is transfer in the FTDI.

Status LED with name RX (green) indicates that there is transfer in the FTDI.

Power-on LED (red) with name PWR – this LED shows that the board is power supplied.

User button with name BUT connected to ATmega328P pin 32 (INT0/PCINT18/PD2) – signal D2(BUT).

User button with name RST connected to ATmega328P pin 29 (PC6/#RESET).

Switch with name SW(3.3V/5V) – selects between 3.3V and 5V power supply of the board. This switch controls whether the board is powered by 3.3Vdc source or 5Vdc. It is provided to ensure compatibility with both original 5V shields and 3.3V modules.

Important! Changing this jumper also changes the voltage available at pin #1 of UEXT and also the voltage levels of all data signals available there (UART, SPI, I2C). Most Olimex-manufactured UEXT modules work at 3.3V – they would get damaged if the jumper is set to 5V. When using Olimex MOD- board on this UEXT ensure the jumper is set to 3.3V, else you might damage the module.

CHAPTER 6 – SCHEMATICS

6. Introduction to the chapter

In this chapter is located information about the schematics describing logically and physically OLIMEXINO-328.

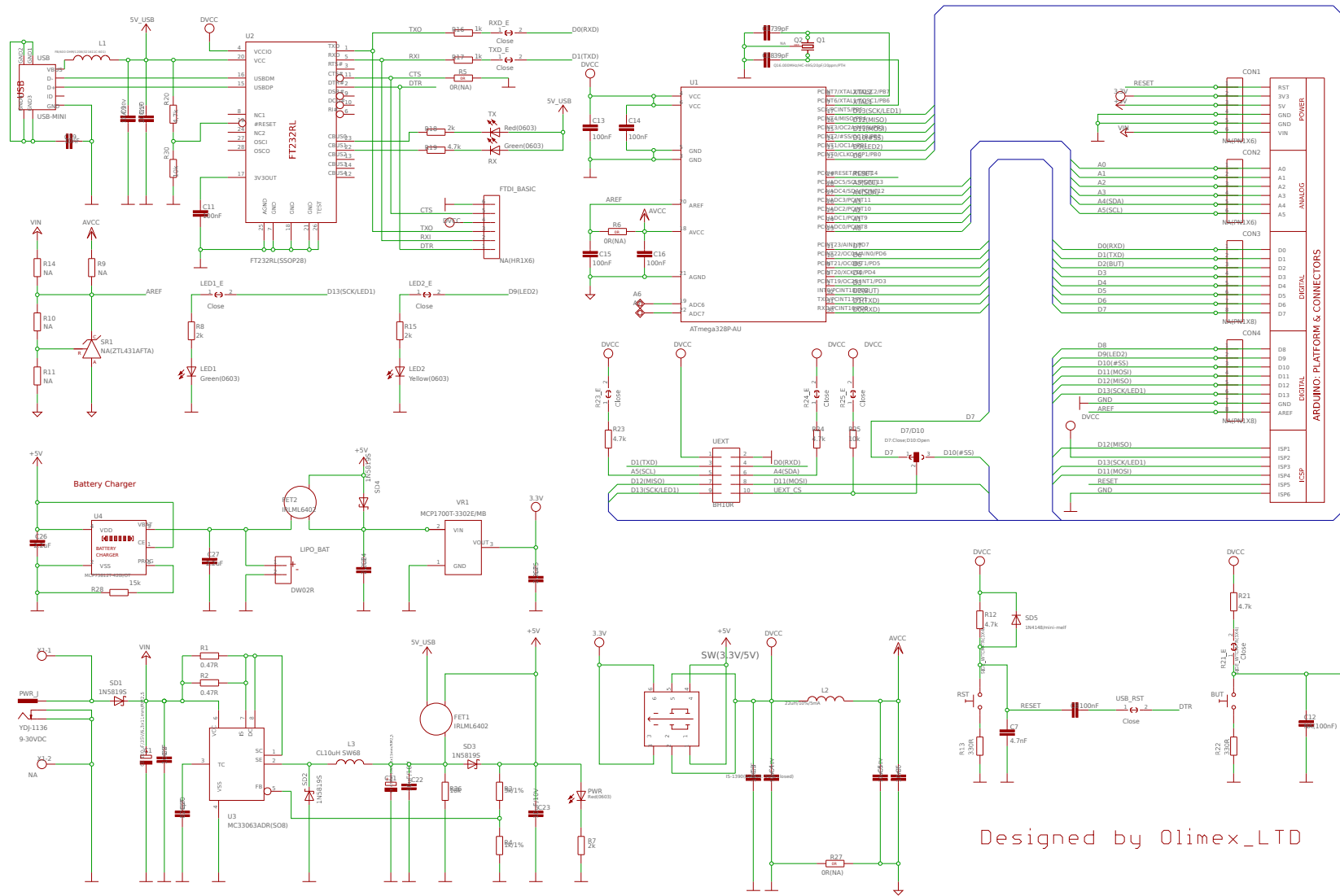
6.1 Eagle schematics

Stand-alone search-able schematic in PDF format might be found at the web page of OLIMEXINO-328.

The schematic is also shown on the next page for quicker reference.

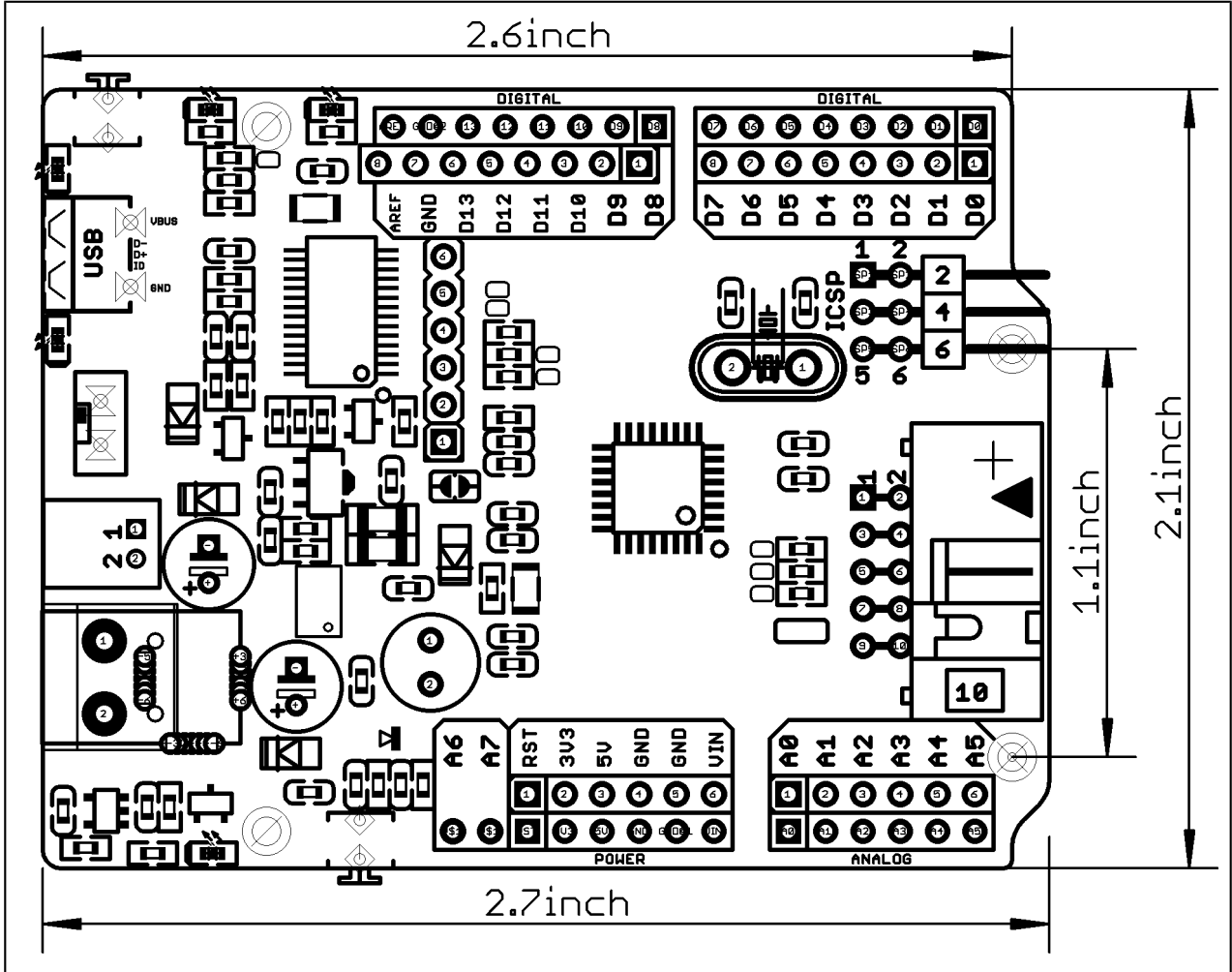
We mostly use Eagle by Cad Soft 4.16r2 for designing. However, the files should be compatible with the latest Eagle available. Cad Soft offers a trial version of their software that allows you to inspect schematics and board files (without being able to modify them).

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6.2 Physical dimensions

Note that all dimensions are in inches.



CHAPTER 7 – REVISION HISTORY AND SUPPORT

7. 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.

7.1 Document revision

Revision, date	Changes	Modified page
A, 20.08.11	Initial manual release	All
B, 14.11.13	Major document changes	All
C, 04.07.17	Added information about UEXT voltage levels depending on the position of 3.3V/5V switch position; updated schematic and board revision notes	All

7.2 Board revision

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

Revision	Notable changes
B	Initial release of the board
C	<ol style="list-style-type: none"> 1. Changed 0805 LEDs to 0603 LEDs and resistors to 2K to reduce overall current consumption 2. Added new label "Made in Bulgaria" in the board file 3. Added jumpers that help disconnecting pull-up resistors of signals of the Arduino shield platform 4. Added new label "Designed by Olimex_LTD" in the schematic 5. Adjusted resistors 10uF/6.3V(0805) to 10uF/10V(0603)

7.3 Useful web links and purchase codes

The web page you can visit for more info on your device is <https://www.olimex.com/Products/Duino/AVR/OLIMEXINO-328/>.

For more info on the original Arduino design please visit: <http://arduino.cc/en/Main/arduinoBoardDuemilanove>.

ORDER CODES:

OLIMEXINO-328 – assembled and tested Arduino-like board

AVR-ISP500 – assembled and tested AVR-ISP compatible programmer

AVR-ISP-MK2 – assembled and tested AVR-ISP compatible programmer

How to purchase Olimex products?

You can order from our web-shop or from any of our distributors. The list of official Olimex distributors might be found at: <https://www.olimex.com/Distributors/>.

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

7.4 FAQ

Q1: I installed the OLIMEXINO-328 drivers. The board shows in “Windows Device Manager” correctly. Yet, the board cannot be programmed in Arduino IDE?

A1. Try installing older FTDI drivers. FTDI drivers 2.08.14 or earlier should fix the issue. The problem with the FTDI drivers is described in this forum post: <https://www.olimex.com/forum/index.php?topic=2031.0>.

Q2: I have OLIMEXINO-328 and Olimex AVR-ISP-MK2. The drivers seem correct, yet I'm unable to program the board. What might be causing the problem?

A2: Very often people try to use the PDI or TPI interface of AVR-ISP-MK2 for the ICSP slot of OLIMEXINO-328. Please, use jumper wires to transform the 10-pin ICSP of the AVR-ISP-MK2 to 6-pin ICSP connector of the OLIMEXINO-328.

7.5 Product support

For product support, hardware information and error reports mail to: 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 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.