

PIC32-RETROBSD

a PIC32 board that runs BSD UNIX

USER'S MANUAL

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Designed by OLIMEX Ltd, 2015



All boards manufactured by OLIMEX LTD are RoHS compliant

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The software support was developed entirely by the RetroBSD community. The software is released under the terms of the RetroBSD project.

It is possible that the pictures in this manual differ from the latest hardware revision of the board.

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Table of Contents

<u>DISCLAIMER.....</u>	<u>2</u>
<u>CHAPTER 1: OVERVIEW.....</u>	<u>5</u>
<u>1. Introduction to the chapter.....</u>	<u>5</u>
<u>1.1 What is RetroBSD?.....</u>	<u>5</u>
<u>1.2 Features of PIC32-RETROBSD.....</u>	<u>6</u>
<u>1.3 Similar boards.....</u>	<u>6</u>
<u>1.4 Document organization.....</u>	<u>6</u>
<u>CHAPTER 2: BOARD DESCRIPTION.....</u>	<u>7</u>
<u>2. Introduction to the chapter.....</u>	<u>7</u>
<u>2.1 Layout (top side).....</u>	<u>7</u>
<u>2.2 Pinout (top view).....</u>	<u>8</u>
<u>2.3 Layout (bottom side).....</u>	<u>8</u>
<u>CHAPTER 3: SETTING UP THE PIC32-RETROBSD BOARD.....</u>	<u>9</u>
<u>3. Introduction to the chapter.....</u>	<u>9</u>
<u>3.1 Electrostatic and electrical polarity warnings.....</u>	<u>9</u>
<u>3.2 Requirements.....</u>	<u>9</u>
<u>3.3 General description of the RetroBSD first boot under Windows.....</u>	<u>10</u>
<u>3.4 Detailed description of first boot under Windows.....</u>	<u>10</u>
<u>3.4.1 MicroSD card preparation.....</u>	<u>10</u>
<u>3.4.2 Powering the setup with MicroSD card inserted.....</u>	<u>11</u>
<u>3.5 Updating the kernel.....</u>	<u>11</u>
<u>3.6 Restoring the bootloader.....</u>	<u>11</u>
<u>3.7 Software support.....</u>	<u>12</u>
<u>CHAPTER 4: THE PIC32MX795 PROCESSOR.....</u>	<u>13</u>
<u>4. Introduction to the chapter.....</u>	<u>13</u>
<u>4.1 The processor.....</u>	<u>13</u>
<u>CHAPTER 5: CONTROL CIRCUITY.....</u>	<u>15</u>
<u>5. Introduction to the chapter.....</u>	<u>15</u>
<u>5.1 Reset.....</u>	<u>15</u>
<u>5.2 Clocks.....</u>	<u>15</u>
<u>5.3 Power supply circuit.....</u>	<u>15</u>
<u>CHAPTER 6: CONNECTORS AND PINOUTS.....</u>	<u>16</u>
<u>6. Introduction to the chapter.....</u>	<u>16</u>
<u>6.1 Mini ICSP.....</u>	<u>16</u>
<u>6.2 UEXT.....</u>	<u>17</u>
<u>6.3 MicroSD card connector.....</u>	<u>18</u>
<u>6.4 USB mini connector.....</u>	<u>19</u>
<u>6.5 GPIO connectors.....</u>	<u>19</u>
<u>6.5.1 CON1 – 20pin connector.....</u>	<u>20</u>
<u>6.5.2 CON-2 – 20pin connector.....</u>	<u>21</u>

6.6 Jumper description.....	22
6.7 Additional hardware components.....	22
CHAPTER 7: SCHEMATICS.....	23
7. Introduction to the chapter.....	23
7.1 Eagle schematic.....	23
7.2 General physical dimensions.....	25
CHAPTER 8: REVISION HISTORY AND SUPPORT.....	26
8. Introduction to the chapter.....	26
8.1 Document revision.....	26
8.2 Board revision.....	26
8.3 Useful web links.....	27
8.4 How to purchase?.....	28
8.5 Order names.....	28
8.6 Frequently asked questions.....	29
8.7 Product support.....	30

CHAPTER 1: OVERVIEW

1. Introduction to the chapter

Thank you for choosing this development board designed and manufactured by Olimex! This document provides a user's guide for the PIC32-RETROBSD board. As an overview, this chapter gives the scope of this document and lists the board's features. The document's organization is then detailed.

PIC32-RETROBSD is an open-hardware board that runs RetroBSD. The design is based on our PIC32-PINGUINO-MICRO board but it comes with a bigger processor – PIC32MX795 (instead of the smaller PIC32MX440)!

The PIC32-RETROBSD development board comes programmed with a bootloader code that allows updating the firmware via the mini USB connector of the board. The memory of the board also contains the proper kernel binary of RetroBSD OS.

1.1 What is RetroBSD?

RetroBSD is a port of 2.11BSD Unix intended for embedded systems with fixed memory mapping. It runs fine on PIC32-RETROBSD's chip – Microchip's PIC32MX795 microcontroller with 128KB of RAM memory and 512KB of flash memory. This PIC32 processor has MIPS M4K architecture, executable data memory and flexible RAM partitioning between user and kernel modes.

The main features of RetroBSD are:

- Small resource requirements. RetroBSD needs only 128 kbytes of RAM to be up and running user applications.
- Memory protection. Kernel memory is fully protected from user application using hardware mechanisms.
- Open functionality. Usually, user application is fixed in Flash memory – but in case of RetroBSD, any number of applications could be placed into SD card, and run as required.
- Real multitasking. Standard POSIX API is implemented (fork, exec, wait4 etc).
- Development system on-board. It is possible to have C compiler in the system, and to recompile the user application (or the whole operating system) when needed.

Visit RetroBSD.org for more information about the project.

1.2 Features of PIC32-RETROBSD

The PIC32-RETROBSD board has the following set of features:

- Comes with RetroBSD kernel loaded
- Small footprint – only (55 × 33)mm ~ (2.2 × 1.3)”
- PIC32MX795F512H, 80 Mhz microcontroller, 512KB Flash, 128KB RAM
- You can use own microSD card for the file system
- UEXT connector which allows extending the hardware capabilities with additional modules (sensors, RF modules, GSM modules, GPS modules, etc)
- Two LEDs
- One BUTTON
- RESET button
- Mini USB connector that allows access to the RetroBSD via terminal program. The USB also powers the board. It can also be used to upgrade or re-program the board via the USB bootloader.
- All PIC pins available on 0.1" step headers, breadboard-friendly design
- mini ICSP connector with 0.05" step, can be used for general-purpose programming of the board or to restore the bootloader

1.3 Similar boards

PIC32-RETROBSD uses the same design and PCB as PIC32-PINGUINO-MICRO. The only hardware difference is that PIC32-RETROBSD comes with a bigger PIC32 processor. The processor in the design of PIC32-PINGUINO-MICRO is PIC32MX440 that is not powerful enough to run RetroBSD. That is why it was replaced by PIC32MX795. These processors are pin-to-pin compatible, drop-in replaceable so the board layouts of PIC32-PINGUINO-MICRO and PIC32-RETROBSD are identical.

There are also a number of Olimex designs that are also supported by the RetroBSD community. The DUINOMITE boards that also come with PIC32MX795 are well-supported.

1.4 Document organization

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 PIC32MX795 processor
- 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

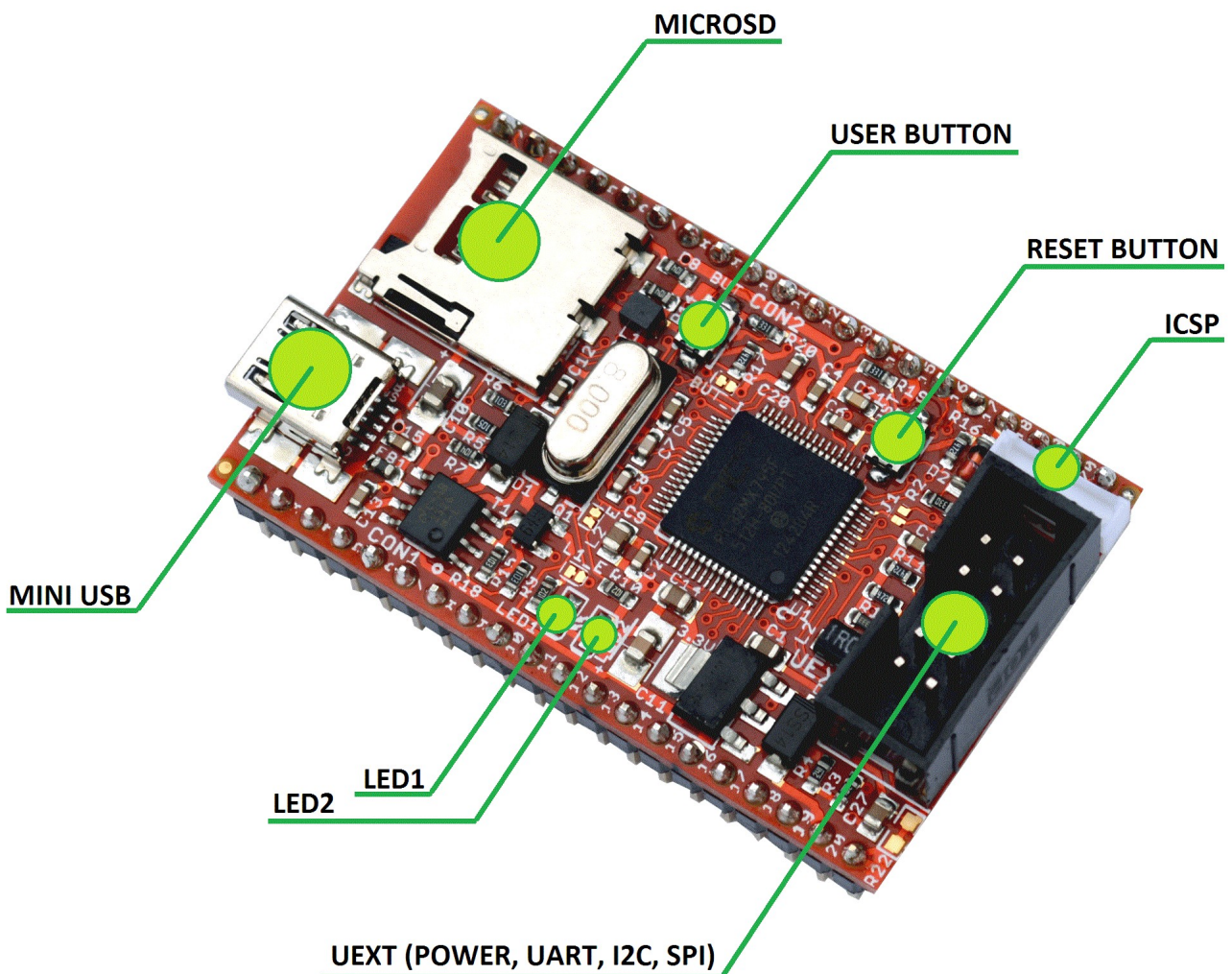
CHAPTER 2: BOARD DESCRIPTION

2. Introduction to the chapter

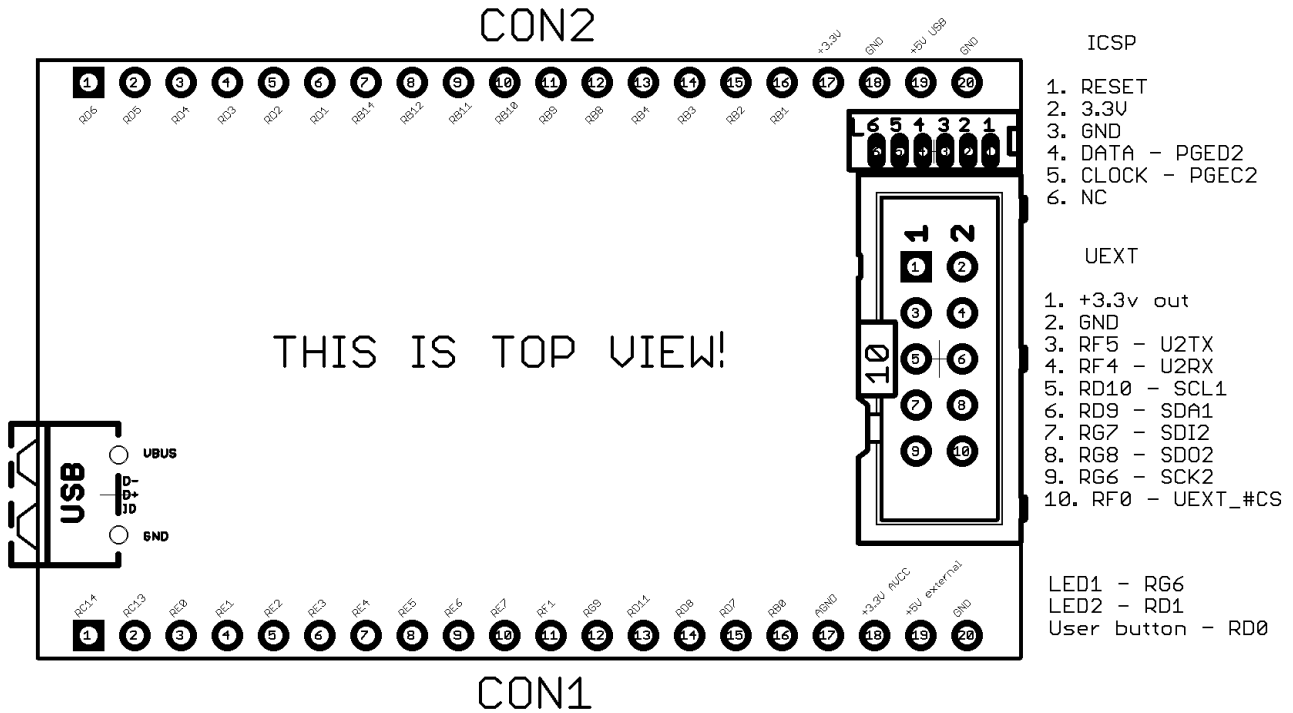
Here you get acquainted with the main parts of the board. Note the names used on the board might differ from the names used below to describe them. For the actual names check the PIC32-RETROBSD board itself.

2.1 Layout (top side)

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



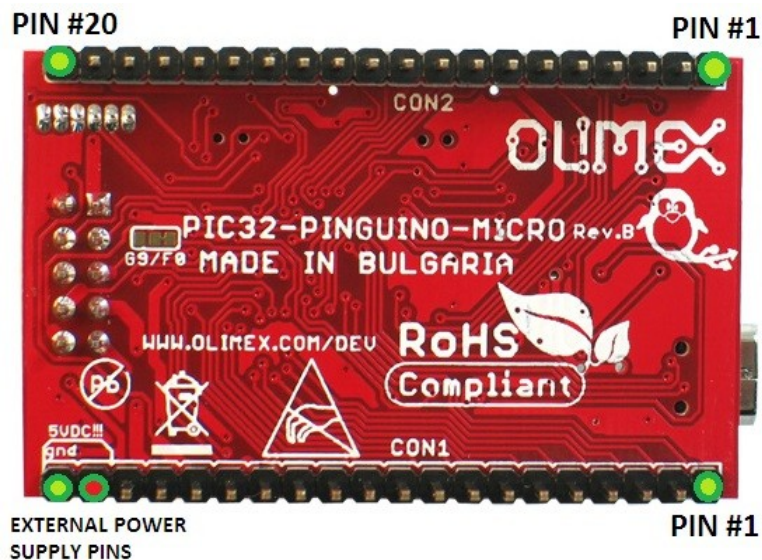
2.2 Pinout (top view)



2.3 Layout (bottom side)

Inspect the bottom side of the board. It is important to properly identify the first pins of CON1 and CON2 connectors.

Note that it is entirely fine if the white print at the bottom of the board says “PIC32-PINGUINO-MICRO”. The only hardware difference between PIC32-RETROBSD and PIC32-PINGUINO-MICRO is the chip at the top side! PIC32-RETROBSD comes with PIC32MX795, while PIC32-PINGUINO-MICRO comes with PIC32MX440. We use the same PCB for both boards. The picture below shows the bottom side of the board and highlights the most important parts:



CHAPTER 3: SETTING UP THE PIC32-RETROBSD BOARD

3. Introduction to the chapter

This section helps you set up the PIC32-RETROBSD development board for the first time. Please first consider 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

PIC32-RETROBSD boards are 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 when the board is powered.

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

3.2 Requirements

In order to set up the PIC32-RETROBSD 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;

The PIC32-RETROBSD board is typically used with a microSD card that contains the RetroBSD file system. The board comes without a microSD card included and you can use own card (we sell affordable compatible cards separately in case you don't have a card or if you don't want to bother with the preparation). The board gets connected to a personal computer via USB cable that has a mini USB connector. Through this cable PIC32-RETROBSD gets powered. Through the same cable the board communicates with the computer.

Required items:

- microSD card with compatible file system – the card contains the file system; the contents of the card might be downloaded from our GitHub and used on any card

- IO setup – USB cable with mini USB connector and a personal computer with terminal program

Consider that we also sell a card with the file system, the product is named PIC32-RETROBSD-SD. If you lack a cable with a mini connector also consider USB-MINI-CABLE.

Recommended items:

- SD writer – you would need one if you wish to prepare own microSD card with the file system
- Breadboard – PIC32-RETROBSD fits standard breadboards and that would allow accessing the free pins without additional soldering; consider our product BREADBOARD-1
- PIC32-compatible programmer tool – if you accidentally overwrite the bootloader the only way to re-write the RetroBSD kernel is via a programmer tool; if you use the board as a general-purpose development board you would also need such a tool; consider our PIC-KIT3
- adapter for the mini ICSP connector – only if you use a programmer tool to change the software of the board; consider our adapter PIC-ICSP

3.3 General description of the RetroBSD first boot under Windows

The general hardware setup is simple: insert a microSD card that contains the RetroBSD file system into the PIC32-RETROBSD board; plug a USB cable between the board and the personal computer.

The general software setup goes: PIC32-RETROBSD would create a virtual COM port (you might need to install the Microchip driver if Windows does not find it automatically). You have to access this COM port via a serial terminal software (like puTTY, TeraTerm, etc). The board would send information on the terminal.

3.4 Detailed description of first boot under Windows

3.4.1 MicroSD card preparation

In this part we would describe how we prepare a microSD card with the file system. Skip this step if you have purchased our ready-to-use card – PIC32-RETROBSD-SD.

First make sure that you have your microSD card reader plugged to your computer. Then insert a blank SD card into it. Start the software for download images to the card. You can use any piece of software that you are familiar with. In case of trouble use Win32 Disk Imager software (the software that we used for testing):

1. Download the torrent with the latest file system from the GitHub article of the board (in sub-folder Default binaries/Stable-release/): <https://github.com/OLIMEX/PIC32-RETROBSD>
2. Download Win32DiskImager from [this link](#). Under Linux you can use “dd” to prepare the card.
3. Insert card in your microSD card reader
4. Start the program
5. Select the image
6. Click "write"

Important! Instead of the files provided by Olimex it is always a better idea to use the latest binaries compiled by the RetroBSD community. These can be found here:

<http://retrobsd.org/wiki/autobuild.php>

3.4.2 Powering the setup with MicroSD card inserted

Insert the microSD with the file system into card connector of PIC32-RETROBSD and then connect the USB cable between the personal computer and the board.

At this point you might be prompted for drivers. If Windows does not automatically install the drivers, then use the following set of drivers:

<https://www.olimex.com/Products/Duino/PIC32/PIC32-RETROBSD/resources/MCP2221-Windows-Driver-2014-10-09.zip>

After the drivers are installed, a new virtual COM port should be created. Identify which is the number of the newly created COM port. In Windows this can be checked in “Windows Device Manager” in the COM & LPT section.

Once you know the number of the COM port start your favorite terminal program (we use TeraTerm and puTTY) and start a serial connection on the COM port that you identified. The baudrate we use is 115200, leave the rest of the settings as default.

Finally, press enter and when prompted for login type “root”. Leave the password blank (press “Enter”).

You should see a welcome message.

3.5 Updating the kernel

The RetroBSD community frequently releases updates to the kernel that contain fixes and new features. Under normal circumstances you can update the on-board kernel via the mini USB connector without a programmer tool.

In order to enter bootloader mode, press the BUT key first, hold it, then press and release the RST key. The LED will now flash and your board is ready to accept new code. The bootloader will appear as a HID device on your computer. Use pic32prog utility to program the Flash memory.

Early versions of PIC32-RETROBSD board were pre-programmed with outdated version of the bootloader, that did not properly initialize the BUT key. In this case, you can still enter bootloader mode if you connect together pin 14 (RD8) and pin 20 (GND) of CON1 and then press and release the RST key.

3.6 Restoring the bootloader

In case you managed to overwrite the bootloader you would need a PIC32-compatible programmer tool to restore it. The programmer has to be connected to the 6-pin ICSP connector.

The files require can be found again either in our repository or in the community pages.

3.7 Software support

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/>.

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 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.

CHAPTER 4: THE PIC32MX795 PROCESSOR

4. Introduction to the chapter

In this chapter is located the information about the heart of PIC32-RETROBSD – its main processor PIC32MX795F512H. This PIC32 chip is manufactured by Microchip from USA. The information is a modified version of the datasheet provided by its manufacturers.

4.1 The processor

A short list of features of PIC32MX795F512H might be found below.

MCU Core:

- 80MHz/105DMIPS, 32-bit MIPS M4K® Core
- USB 2.0 On-The-Go Peripheral with integrated PHY
- 10/100 Ethernet MAC with MII/RMII Interfaces
- 2 x CAN2.0b modules with 1024 buffers
- 8 Dedicated DMA Channels for USB OTG, Ethernet, and CAN
- 5 Stage pipeline, Harvard architecture
- MIPS16e mode for up to 40% smaller code size
- Single cycle multiply and hardware divide unit
- 32×32-bit Core Registers
- 32×32-bit Shadow Registers
- Fast context switch and interrupt response

MCU System Features:

- 512K Flash (plus 12K boot Flash)
- 128K RAM (can execute from RAM)
- 8 Channel General Hardware DMA Controller
- Flash prefetch module with 256 Byte cache
- Lock instructions or data in cache for fast access
- Programmable vector interrupt controller

Analog Features:

- Fast and Accurate 16 channel 10-bit ADC,
- Max 1 Mega sample per second at +/- 1LSB, conversion available during SLEEP & IDLE

Power Management Modes:

- RUN, IDLE, and SLEEP modes
- Multiple switchable clock modes for each power mode, enables optimum power settings

Debug Features:

- 8 hardware breakpoints (6 Instruction and 2 Data)
- 2 wire programming and debugging interface
- JTAG interface supporting Programming, Debugging and Boundary scan

Other MCU Features:

- Fail-Safe Clock Monitor – allows safe shutdown if clock fails
- 2 Internal oscillators (8MHz & 31KHz)
- Hardware RTCC (Real-Time Clock and Calendar with Alarms)
- Watchdog Timer with separate RC oscillator
- Pin compatible with 16-bit PIC® MCUs
- Serial Communication Modules allow flexible UART/SPI/I2C™ configuration

For more detailed and specific information about the processor, please refer to the original documentation released by Microchip:

<http://ww1.microchip.com/downloads/en/DeviceDoc/60001156J.pdf>

CHAPTER 5: CONTROL CIRCUITY

5. Introduction to the chapter

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

5.1 Reset

PIC32-RETROBSD's reset circuit includes D2 (1N4148), R16 (4.7k Ω), C21 (4.7nF), PIC32MX795's pin 7 (#MCLR) and a RESET button.

5.2 Clocks

Quartz crystal Q1 8.000 MHz is connected to PIC32MX795's pin 39 (OSC1/CLKI/RC12) and pin 40 (OSC2/CLKO/RC15).

5.3 Power supply circuit

The most common way to power PIC32-RETROBSD is via a USB cable. The board requires 5V of voltage on the power line.

When powered and functional the current consumption of the board is around 80 mA.

Additionally, the board can be powered using the pins of the CON1 connector. PIN20 is GND, PIN19 is +5V_EXT.

CHAPTER 6: CONNECTORS AND PINOUTS

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 Mini ICSP

The mini ICSP connector (6×1 layout, 0.05” step) provides the option to reprogram the board. For example, it can be used to restore the RetroBSD bootloader. This connector can be used for general-purpose programming. The mini ICSP connector should be accessed with PIC32-compatible programmers or debuggers.

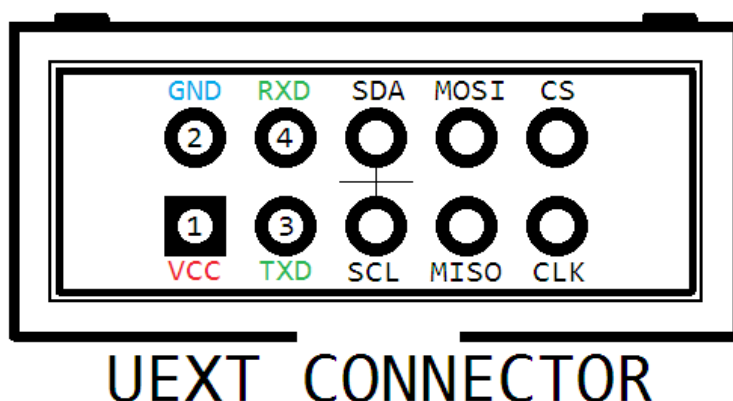


ICSP connector (0.05” step)		
Mini ICSP pin #	Connector	PIC32 processor
1	RESET	#7 (#MCLR)
2	+3.3V	-
3	GND	-
4	PGED2	#18 (RB7PGED2/AN7)
5	PGEC2	#17 (RB6/PGEC2/AN6/OCFA)
6	Not connected	Not connected

6.2 UEXT

UEXT is a 5×2 0.1” step connector that nests three serial communication interfaces – I2C, SPI and RS232. There are also a 3.3V output pin and a digital ground pin. The connector is usually used for attaching extension hardware to a board. You can find more information about UEXT here:

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



UEXT CONNECTOR

UEXT connector (0.1” step)			
UEXT pin #	Connector	PIC32 processor	Function
1	3.3V	-	Power out
2	GND	-	Digital ground
3	TXD	#32 (RF5/U2TX/SCL2)	UART send
4	RXD	#31 (RF4/U2RX/SDA2)	UART receive
5	SCL	#44 (RD10/SCL1/IC3)*	I2C
6	SDA	#43 (RD9/SDA1/IC2)*	I2C
7	MISO	#5 (RG7/SDI2)**	SPI
8	MOSI	#6 (RG8/SDO2)**	SPI
9	SCK/LED1	#4 (RG6/SCK2)**	SPI
10	UEXT_#CS	#58 (RF0)***	SPI

*SCL and SDA have 4.7K pull-up resistors by default.

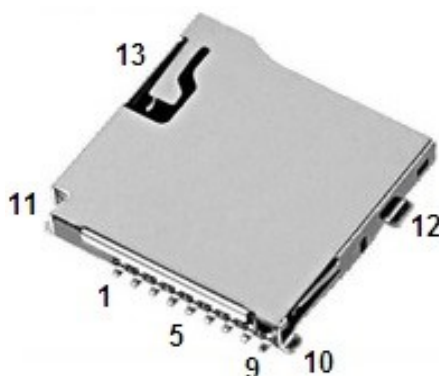
** MISO, MOSI, and SCK/LED1 are also routed to the microSD card. Additionally, SCL/LED1 is also routed to LED1.

***UEXT_#CS has 20K pull-up resistor by default. Note that the processor pin connected to UEXT_#CS can be changed via the SMT jumper G9/F0. By default the jumper is set to position F0 and the processor pin connected to UEXT_#CS is #58 (RF0). If you change the position to G9 the processor pin connected to UEXT_#CS would be #8 (RG9).

6.3 MicroSD card connector

The micro SD card slot is primarily used for the RetroBSD's file system.

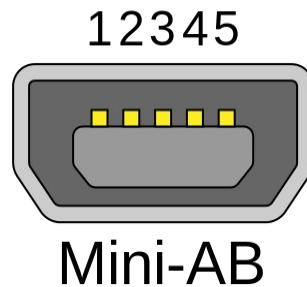
A micro SD card connector is available on PIC32-RETROBSD board, this connector is a push-push one – push to insert the card and push again to remove the card. The card connector is set to operate in SPI mode (MISO, MOSI, SS, SCK).



MicroSD card connector		
MicroSD pin #	Connector	PIC32 processor
1	DAT2/RES	-
2	CD/DAT3/CS – MMC_#SS	#28 (RB13)
3	CMD/DI – MOSI	#6 (RG8)
4	VDD	-
5	CLK/SCLK – SCK/LED1	#4 (RG6)
6	VSS	-
7	DAT0/DO – MISO	#5 (RG7)
8	DAT1/RES	-
9	VSS	-
10	SHIELD	-
11	SHIELD	-
12	SHIELD	-
13	SHIELD	-

6.4 USB mini connector

The board is equipped with USB mini connector. This connector is used to power the board and also to communicate with the board. The USB mini connector has USB on-the-go functionality – it can serve either as host or as device.



USB mini connector		
MicroSD pin #	Connector	PIC32 processor
1	+5V_BUS	-
2	D-	#36 (RG3/D-)
3	D+	#37 (RG2/D+)
4	USB_ID	#33 (RF3/USBID)
5	GND	-

6.5 GPIO connectors

There are two connectors with 0.1" at the bottom of the board that allows easier placement in own designs. These CON1 and CON2 headers can also be used to measure or access various signals. You can use the headers to attach additional hardware. For your convenience the pins are numbered individually on the top of the board. Please take extra care about the numbering.

6.5.1 CON1 – 20pin connector

CON1 @ 0.1" step		
MicroSD pin #	PIC32 processor	Function
1	#48 (RC14)	SOSCO
2	#47 (RC13)	SOSCI
3	#60 (RE0)	
4	#61 (RE1)	
5	#62 (RE2)	
6	#63 (RE3)	
7	#64 (RE4)	
8	#1 (RE5)	
9	#2 (RE6)	
10	#3 (RE7)	
11	#59 (RF1)	
12	#8 (RG9)	
13	#45 (RD11)	INT4
14	#42 (RD8)	INT1, RTCC
15	#55 (RD7)	
16	#16 (RB0)	VREF+, PGED1
17	-	AGND
18	-	+3.3V AVCC, see J1
19	-	+5V external
20	-	GND

6.5.2 CON-2 – 20pin connector

CON2 @ 0.1" step		
MicroSD pin #	PIC32 processor	Function
1	#54 (RD6)	
2	#53 (RD5)	
3	#52 (RD4)	
4	#51 (RD3)	U1TX
5	#50 (RD2)	U1RX
6	#49 (RD1)	LED2
7	#29 (RB14)	
8	#27 (RB12)	TDI
9	#24 (RB11)	TDO
10	#23 (RB10)	TMS
11	#22 (RB9)	
12	#21 (RB8)	
13	#12 (RB4)	
14	#13 (RB3)	
15	#14 (RB2)	PGEC1
16	#15 (RB1)	
17	-	+3.3V
18	-	GND
19	-	+5V from USB
20	-	GND

6.6 Jumper description

The board has a number of SMT jumper which can be manipulated to alter the hardware setup of the board. They can also be used as test pads or places to measure different electrical properties of the board. You don't need to modify the state of jumpers by default and if you feel insecure of your soldering experience it is better not to try to adjust these jumpers since it is possible to damage the board.

Board jumpers			
Jumper name	Type	Default position	Function
L1_E	SMT	Closed	When closed, enables LED1.
L2_E	SMT	Closed	When closed, enables LED2.
BUT_J	SMT	Closed	When closed, enables BUT.
J1	SMT	Open	When open, the analog voltage reference is 3.3V (high).
G9/F0	SMT	F0	When in position G9 – connects UEXT pin 10 (UEXT_#CS) to CON1-12 and processor pin #8 (RG9/#SS2/PMA2/CN11) When in position F0 – connects UEXT pin 10 (UEXT_#CS) to processor pin #58 (RF0).

6.7 Additional hardware components

RST button – reset – used to reset the board

BUT button – user button – can be programmed

LED1, LED2 – user-programmable LEDs

On-board button and LEDs		
Peripheral	PIC32 processor	Function
Button BUT	#46 (RD0)	Active low
LED1	#4 (RG6)	Green, UEXT pin #9, SD card
LED2	#49 (RD1)	Yellow, CON2 #6

CHAPTER 7: SCHEMATICS

7. Introduction to the chapter

In this chapter is located information about the schematics describing logically and physically PIC32-RETROBSD.

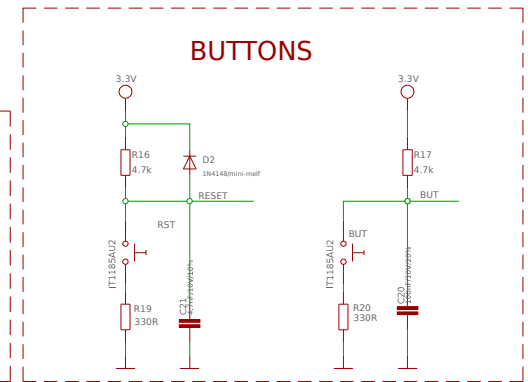
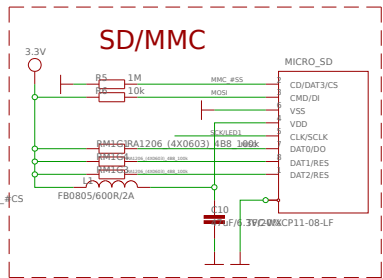
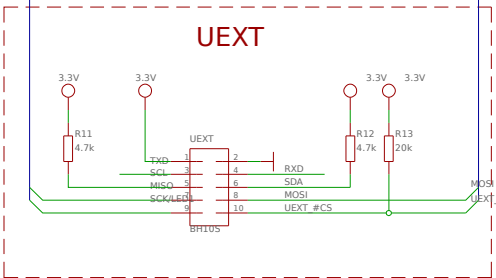
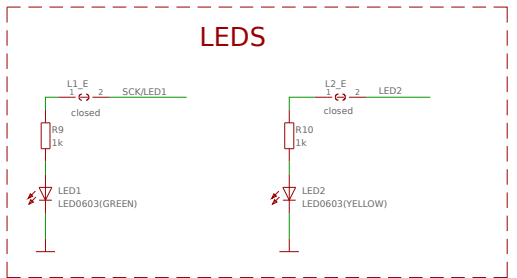
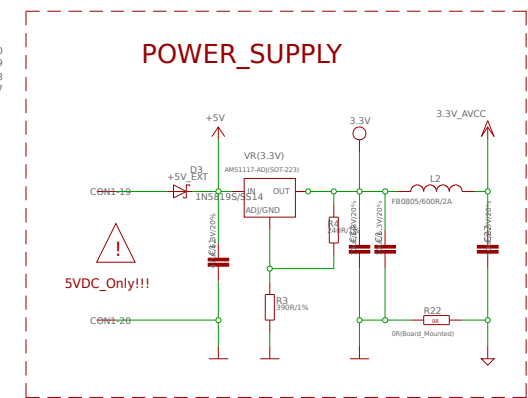
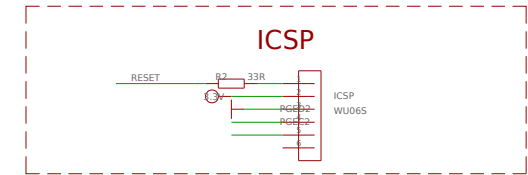
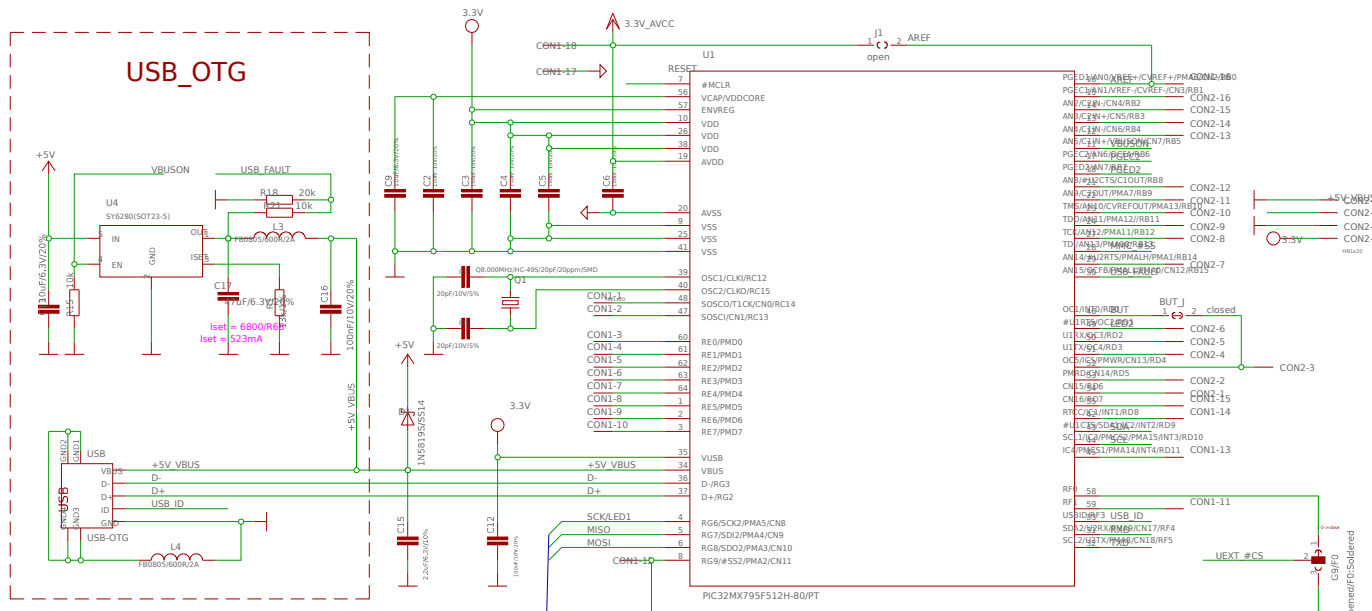
7.1 Eagle schematic

You can find the schematic of the board for quick reference.

A stand-alone export of the schematic of PIC32-RETROBSD may be found in the OLIMEX's GitHub repository: <https://github.com/OLIMEX/PIC32-RETROBSD>. The hardware source files are also available at in the same repository. You can download the whole repository as .zip without having a GitHub account.

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.

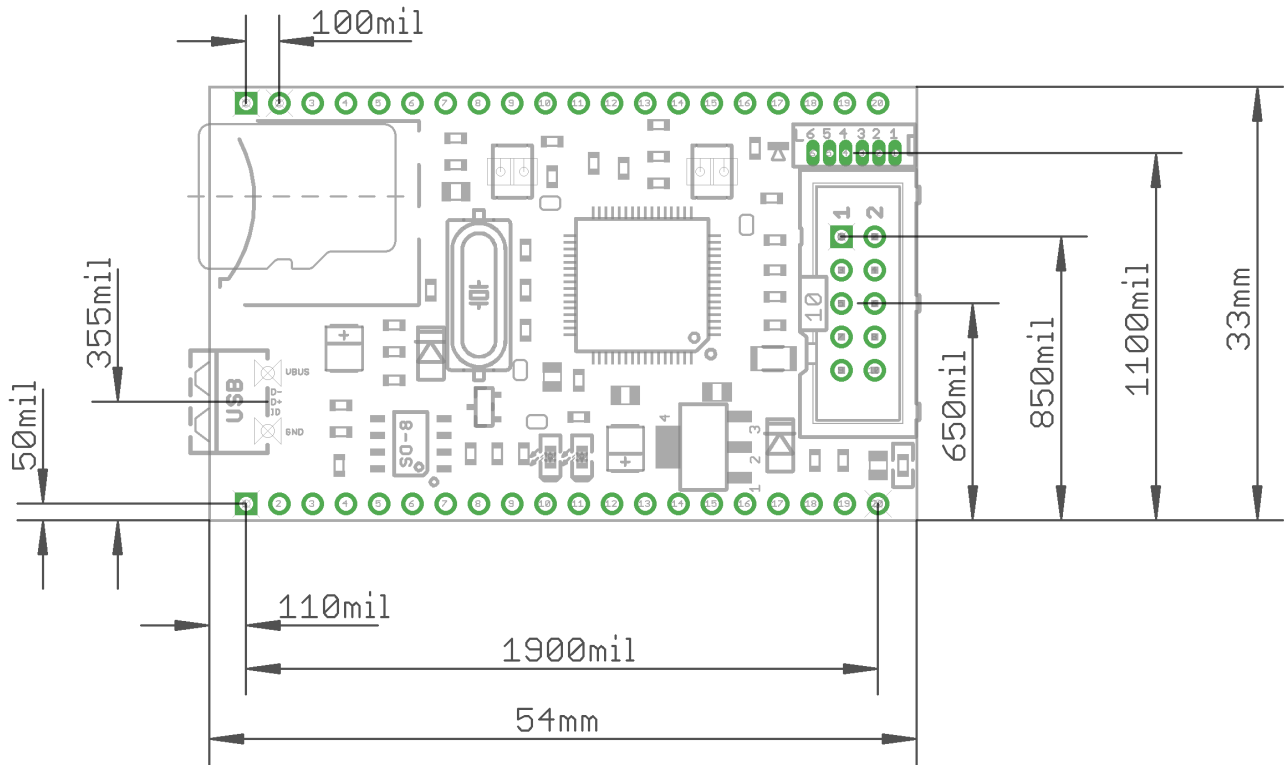
PIC32-RETROBSD, hardware revision C



Designed and manufactured by OLIMEX, Bulgaria

7.2 General physical dimensions

Note that the general board dimensions are in millimeter grid, while all the components are placed in mills grid.



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, 19.11.16	Initial manual release	All

8.2 Board revision

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

Board revision	Notable changes
B	Initial release of the board
C	Minor changes in the white print

8.3 Useful web links

The main hub for more information about PIC32-RETROBSD is:

- <https://www.olimex.com/Products/Duino/PIC32/PIC32-RETROBSD/open-source-hardware>

You can find hardware and software sources at our GitHub page:

- <https://github.com/OLIMEX/PIC32-RETROBSD>

RetroBSD's GitHub contains useful diagrams and pinout:

- <https://github.com/RetroBSD/retrobsd/wiki>

PIC32-RETROBSD's community page:

- <https://github.com/RetroBSD/retrobsd/wiki/Board-Olimex-PIC32-RetroBSD>

A place for general questions, FAQ or friendly talk:

- <https://www.olimex.com/forum/>

The RetroBSD's forum is full of helpful people:

- <http://retrobsd.org/index.php>

8.4 How to purchase?

You can purchase directly from our online shop or from any of 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 names

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

PIC32-RETROBSD – the target of this manual

PIC32-RETROBSD-SD – a tested class 4GB micro SD card that contains the RetroBSD's file system; this card is compatible with PIC32-RETROBSD

USB-MINI-CABLE – USB cable compatible with the board

8.6 Frequently asked questions

Q: Can I use the board without RetroBSD?

A: Yes, of course. Feel free to use PIC32-RETROBSD as a general-purpose development board.

8.7 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.