OLIMEX

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PIC32-MX460 development board
Users Manual

Pb-free, Green

All boards produced by Olimex are ROHS compliant

INTRODUCTION

PIC32-MX460 is low cost development board with the new high-performance 80MHz MIPS-Based 32-bit Flash microcontroller PIC32MX460F512L – 100 pin general purpose and USB. This powerful microcontroller supports various serial interfaces such as USB Device/Host/OTG, UART. In addition you will find also audio input and output, debug interface, LCD, UEXT, mini SD/MMC, User Joystick, User Leds, RF Module area. All this allows you to build a diversity of powerful applications to be used in a wide range of situations.

BOARD FEATURES

- PIC32MX460F512L microcontroller

- Audio input

- Audio output

- USB host

- USB device

- USB OTG

- provisions for MRF24J40MA module

- SD card

- Reset Circuit

- Power supply

- UEXT connector for other Olimex modules like MOD-MP3, MOD-NRF24Lx, MOD-SMB380, MOD-RFID125 etc.

- ICSP/ICD connector for programming with PIC-ICD2-POCKET

- JTAG connector

- RD232 interface with driver

- LCD Nokia 3310 BW 84 x48 pixels

- Quartz crystalls 8 Mhz and 32768 Hz

- two status LED

- Joystick

- Reset button

- Power plug-in jack with diode bridge can be powered with AC or DC power supply

- 3.3V voltage regulator

- Extension slot on every uC pin

- Gird 100 mils

- GND bus

- Vcc bus

- Four mounting holes 3,3 mm (0,13")

- PCB: FR-4, 1.5 mm (0,062"), solder mask, silkscreen component print

- Dimensions 135.9x101.6 mm (5.35x4.00")

ELECTROSTATIC WARNING

The PIC32-MX460 board is shipped in protective anti-static packaging. The board must not be subject to high electrostatic potentials. General practice for working with static sensitive devices should be applied when working with this board.

BOARD USE REQUIREMENTS

Cables: Depends on the used programming/debugging tool. It could be 1.8 meter USB A-B cable to connect PIC-ICD2 or PIC-ICD2-POCKET to USB host on PC or RS232 cable in case of PIC-ICD2-TINY or other programming/debugging tools. You will need a serial cable if not for programming, than for configuring the board. You will also need a USB OTG cable.

Hardware: Programmer/Debugger – most of Olimex programmers are applicable, for example **PIC-ICD2**, **PIC-ICD2-POCKET, PIC-ICD2-TINY** or other compatible programming/debugging tool.

!!!Warning!!! When you want to program this microcontroller with PIC-ICD2, PIC-ICD2-POCKET or PIC-ICD2-TINY, before connecting the programmer to your target board, you should first connect the programmer to your computer and open MPLAB. There, first from menu Configure – Select Device – choose the microcontroller you are about to program, then from menu Programmer – Select Programmer – choose MPLAB ICD 2, wait while MPLAB is downloading operation system, and after ICD2 is connected – check in menu Programmer – Settings – Power – there is option – Power target circuit from MPLAB ICD 2 – this option should be forbidden, you could not select it. Now it is safe to connect the programmer to your target board.

PROCESSOR FEATURES

PIC32-MX460 board use High-Performance 32-bit RISC microcontroller PIC32MX460F512L from Microchip Technology Inc with these features:

– Operating Voltage Range of 2.3V to 3.6V

– 512K Flash Memory (plus an additional 12KB of Boot Flash)

– 32K SRAM Memory

– Pin-Compatible with Most PIC24/dsPIC® Devices

– Multiple Power Management Modes

– Multiple Interrupt Vectors with Individually Programmable Priority

– Fail-Safe Clock Monitor Mode

– Configurable Watchdog Timer with On-Chip Low-Power RC Oscillator for Reliable Operation

Peripheral Features:

– Atomic SET, CLEAR and INVERT Operation on Select Peripheral Registers

– Up to 4-Channel Hardware DMA with Automatic Data Size Detection

- USB 2.0 Compliant Full Speed Device and On-The-Go (OTG) Controller
- USB has a Dedicated DMA Channel
- 40 MHz Crystal Oscillator
- Internal 8 MHz and 32 kHz Oscillators
- Separate PLLs for CPU and USB Clocks
- Two I2C™ Modules
- Two UART Modules with:
    - RS-232, RS-485 and LIN 1.2 support
    - IrDA® with On-Chip Hardware Encoder and Decoder
- Parallel Master and Slave Port (PMP/PSP) with 8-bit and 16-bit Data and Up to 16 Address Lines
- Hardware Real-Time Clock/Calendar (RTCC)
- Five 16-bit Timers/Counters (two 16-bit pairs combine to create two 32-bit timers)
- Five Capture Inputs
- Five Compare/PWM Outputs
- Five External Interrupt Pins
- High-Speed I/O Pins Capable of Toggling at 80 MHz
- High-Current Sink/Source (18 mA/18 mA) on All I/O Pins
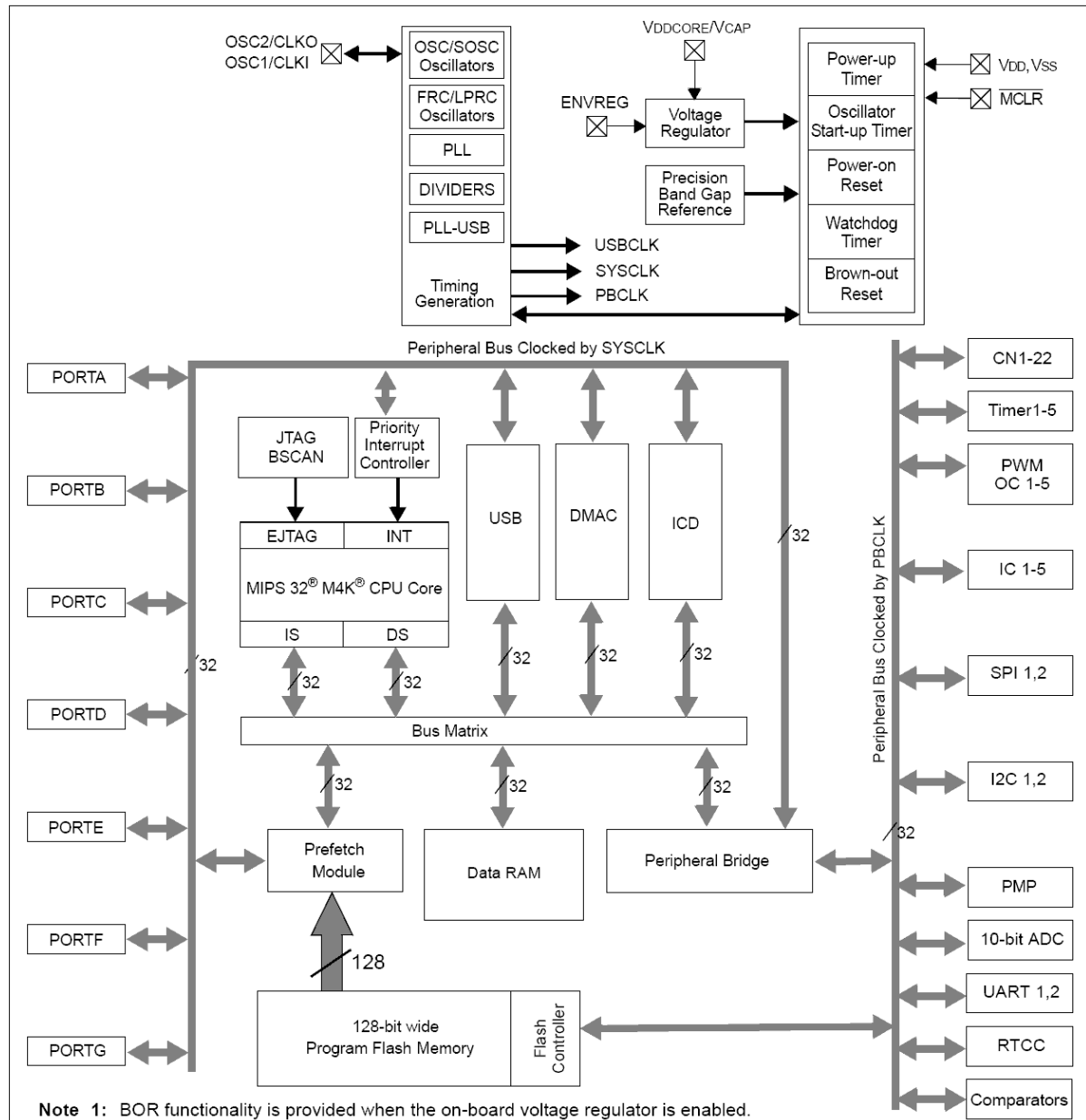- Configurable Open-Drain Output on Digital I/O Pins

Debug Features:

- Two Programming and Debugging Interfaces:
    - 2-Wire Interface with Unintrusive Access and Real-time Data Exchange with Application
    - 4-wire MIPS® Standard Enhanced JTAG interface
- Unintrusive Hardware-Based Instruction Trace
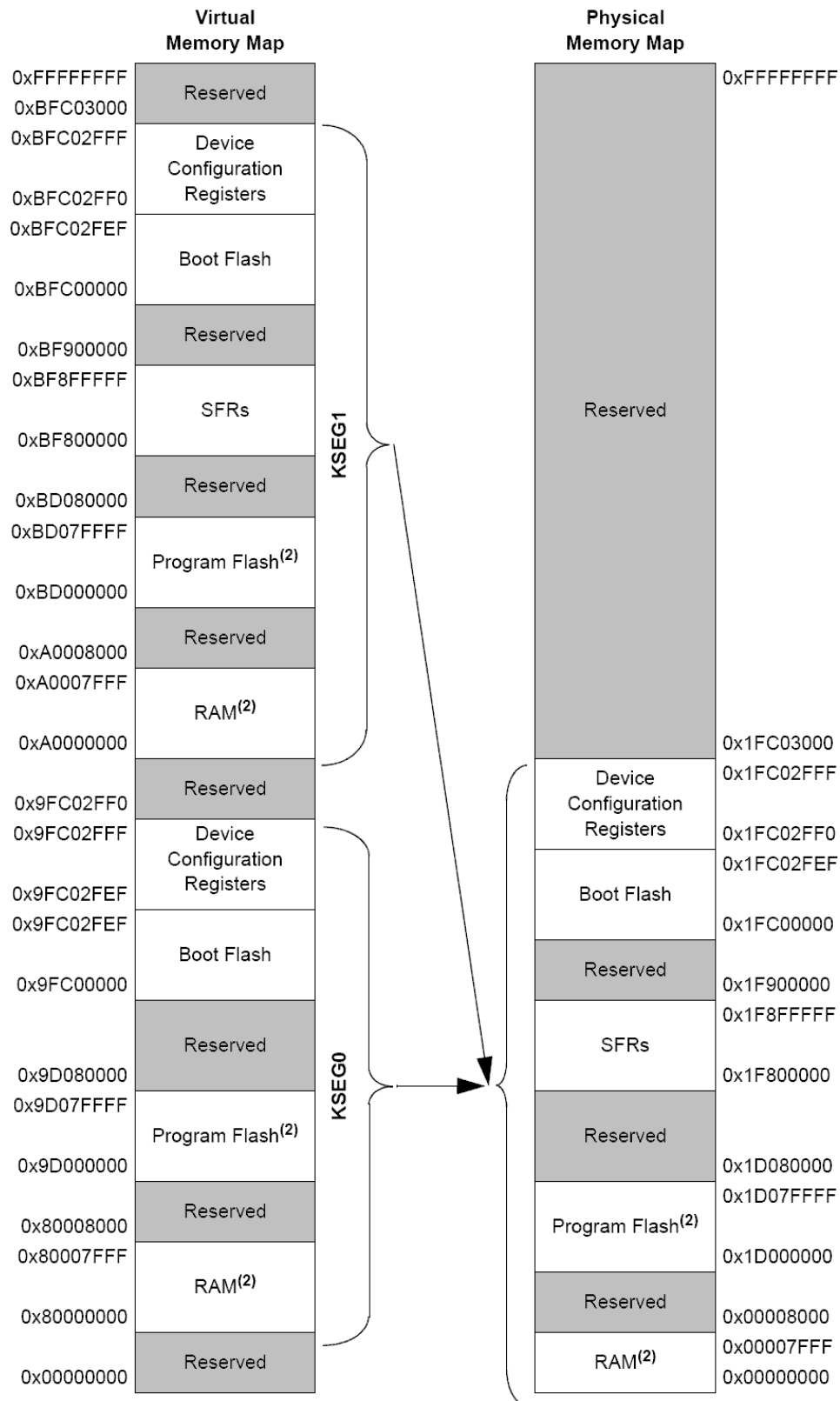- IEEE Std 1149.2 Compatible (JTAG) Boundary Scan

Analog Features:

- 16-Channel 10-bit Analog-to-Digital Converter:
    - 1000 ksps Conversion Rate
    - Conversion Available During Sleep, Idle
- Two Analog Comparators
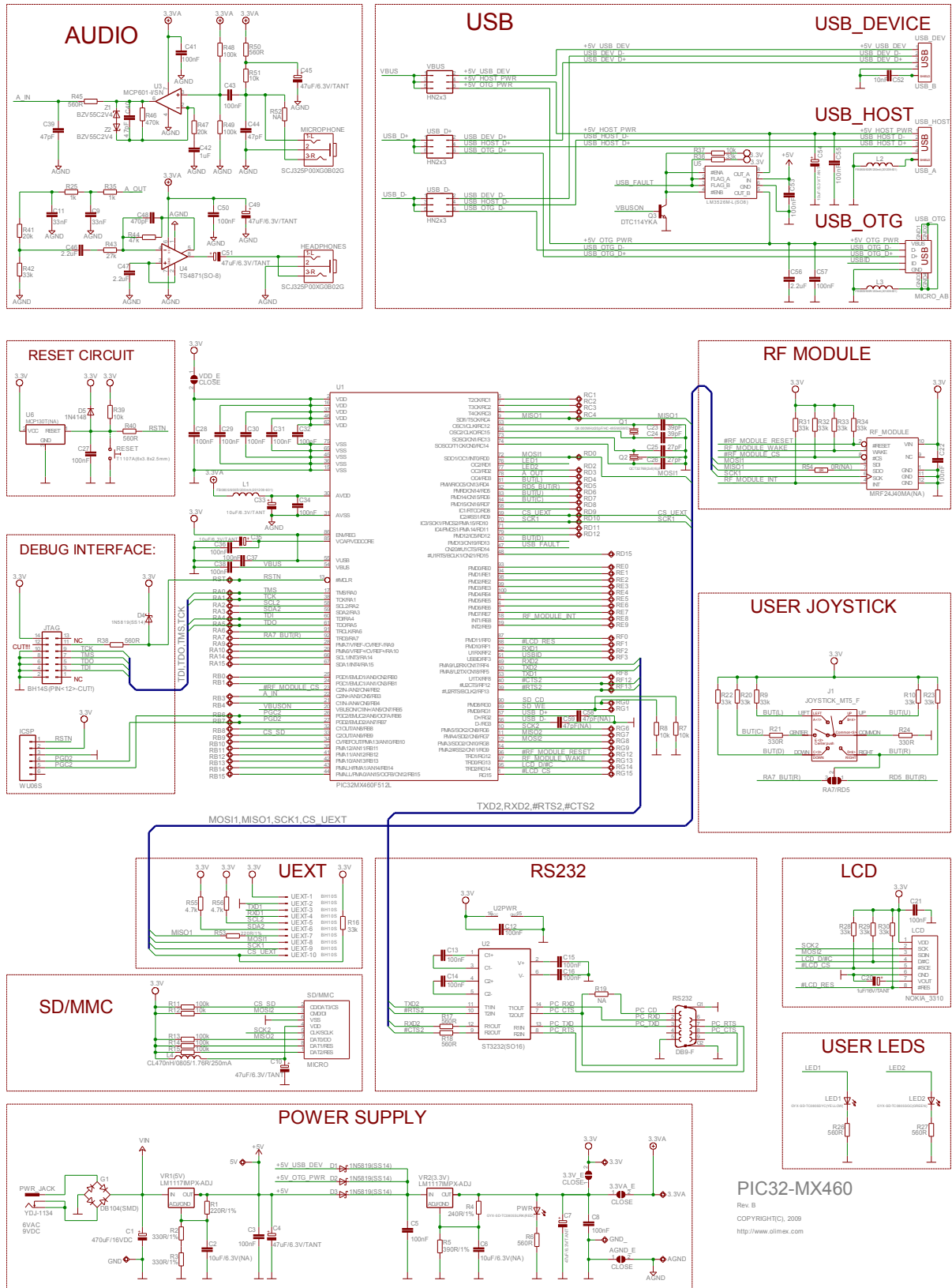- 5V Tolerant Input Pins (digital pins only)

BLOCK DIAGRAM

Note 1: BOR functionality is provided when the on-board voltage regulator is enabled.

MEMORY MAP

Virtual Memory Map		Physical Memory Map
0xFFFFFFFF		0xFFFFFFFF
Reserved		
0xBFC03000		
0xBFC02FFF	Device Configuration Registers	
0xBFC02FF0		
0xBFC02FEF	Boot Flash	
0xBFC00000		
Reserved		
0xBF900000		
0xBF8FFFFF	SFRs	
0xBF800000		
Reserved		
0xBD080000		
0xBD07FFFF	Program Flash(2)	
0xBD000000		
Reserved		
0xA0008000		
0xA0007FFF	RAM(2)	
0xA0000000		

KSEG1

Reserved (Physical: 0xFFFFFFFF)

Virtual	Physical
Reserved	
0x9FC02FF0	0x1FC03000
0x9FC02FFF — Device Configuration Registers	0x1FC02FFF — Device Configuration Registers
0x9FC02FEF	0x1FC02FF0
	0x1FC02FEF
0x9FC02FEF — Boot Flash	Boot Flash
0x9FC00000	0x1FC00000
Reserved	Reserved
0x9D080000	0x1F900000
0x9D07FFFF	0x1F8FFFFF
Program Flash(2)	SFRs
0x9D000000	0x1F800000
Reserved	Reserved
0x80008000	0x1D080000
0x80007FFF	0x1D07FFFF
RAM(2)	Program Flash(2)
0x80000000	0x1D000000
Reserved	Reserved
0x00000000	0x00008000
	0x00007FFF — RAM(2)
	0x00000000

KSEG0

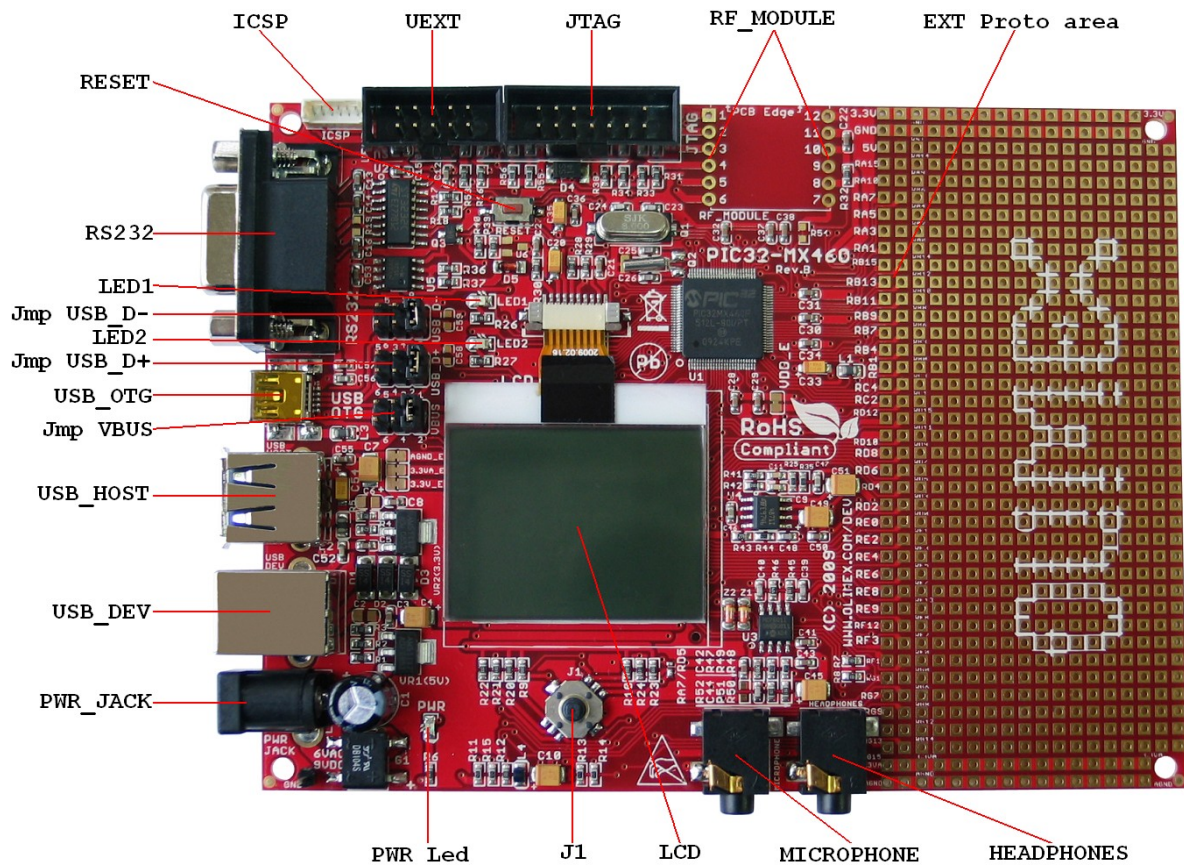**Note 1:** Memory areas are not shown to scale.

2: The size of this memory region is programmable and can be changed by initialization code provided by end-user development tools (refer to the specific development tool documentation for information).

SCHEMATIC

AUDIO

USB

USB_DEVICE

USB_HOST

USB_OTG

RESET CIRCUIT

RF MODULE

DEBUG INTERFACE:

USER JOYSTICK

UEXT

RS232

LCD

SD/MMC

USER LEDS

POWER SUPPLY

PIC32-MX460
Rev. B
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BOARD LAYOUT

ICSP UEXT JTAG RF_MODULE EXT Proto area

RESET

RS232

LED1
Jmp USB_D-
LED2
Jmp USB_D+
USB_OTG
Jmp VBUS

USB_HOST

USB_DEV

PWR_JACK

PWR Led   J1   LCD   MICROPHONE   HEADPHONES

PIC32-MX460

Rev.B

OLIMEX

USB_D+	USB_D-	VBUS	DESCRIPTION:
1-2	1-2	1-2	USB_DEVICE is active!
3-4	3-4	3-4	USB_HOST is active!
5-6	5-6	5-6	USB_OTG is active!

SD/MMC

POWER SUPPLY CIRCUIT

PIC32-MX460 can take power from three sources:

- PWR_JACK where 9V DC, or 6V AC is applied by external power source.
- +5V from USB DEV
- +5V from USB OTG

The board power consumption is: about 110 mA with all peripherals and microcontroller running at full speed.

RESET CIRCUIT

PIC32-MX460 reset circuit is made with R39 (10k) pull-up, R40 (560R) serial resistor and RST button.

CLOCK CIRCUIT

Quartz crystal 8MHz is connected to **PIC32MX460F512L** pin 63 (OSC1/CLKI/RC12) and pin 64 (OSC2/CLKO/RC15).

Quartz crystal 32.768 KHz is connected to **PIC32MX460F512L** pin 73 (SOSCI/CN1/RC13) and pin 74 (SOSCO/T1CK/CN0/RC14).

JUMPER DESCRIPTION

3.3V_E

Enable 3.3V board digital power supply.
Default state is closed.

3.3VA_E

Enable 3.3V board analog power supply.
Default state is closed.

VDD_E

Enable PIC32MX460F512L power supply.
Default state is closed.

AGND_E

Enable board analog ground.
Default state is closed.

RA7/RD5

Gives user opportunity to select between RD5 and RA7 BUT(R) connection.
Default state is RA7.

USB_D+, USB-, VBUS
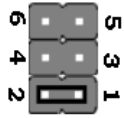
USB_D+	USB_D-	VBUS	DESCRIPTION:
1-2	1-2	1-2	USB_DEVICE is active!
3-4	3-4	3-4	USB_HOST is active!
5-6	5-6	5-6	USB_OTG is active!

Default state is 1-2.

INPUT/OUTPUT

User joystick with name **J1** – this is 4 directions plus center button, in the schematic the joystick four directions switches are connected: UP, DOWN, LEFT, RIGHT and CENTER - through 33k resistors to 3.3V also RIGHT is connected to PIC32MX460F512L pins – 92 (TRD3/RA7), when JMP RA7/RD5 is in position RA7 and 82 (PMRD/CN14/RD5), when JMP RA7/RD5 is in position RD5.

Status LED (yellow) with name **LED1** connected to PIC32MX460F512L pin 76 (OC2/RD1).

Status LED (green) with name **LED2** connected to PIC32MX460F512L pin 77 (OC3/RD2)

Power supply LED (red) with name **PWR** – indicates that external power source is applied and board power supply is applied.

Reset button with name **RESET**, connected to PIC32MX460F512L pin 13 (#MCLR), ICSP pin 1 and through R38 (560) to JTAG pin 11.

LCD black/white 84x48 pixels

EXTERNAL CONNECTORS DESCRIPTION

JTAG
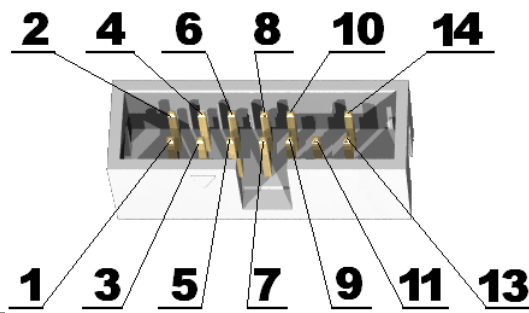
#Pin	Signal Name	#Pin	Signal Name
1	NC	2	GND
3	TDI	4	GND
5	TDO	6	GND
7	TMS	8	GND
9	TCK	10	GND
11	Through R38 to RSTN	12	Removed
13	NC	14	3.3V

ICSP

#Pin	Signal Name
1	RSTN
2	3.3V
3	GND
4	PGD2
5	PGC2
6	NC
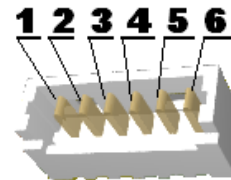
PWR JACK

Pin #	Signal Name
1	Power Input
2	GND
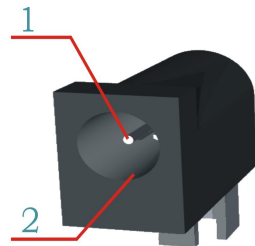
RS232

Pin #	Signal Name
1	PC_CD
2	PC_RXD
3	PC_TXD
4	NC
5	GND
6	NC
7	PC_RTS
8	PC_CTS
9	NC
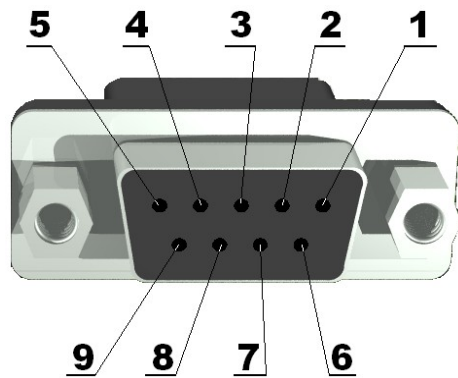
UEXT

Pin #	Signal Name
1	3.3V
2	GND
3	TXD1
4	RXD1
5	SCL2
6	SDA2
7	MISO1
8	MOSI1
9	SCK1
10	CS_UEXT
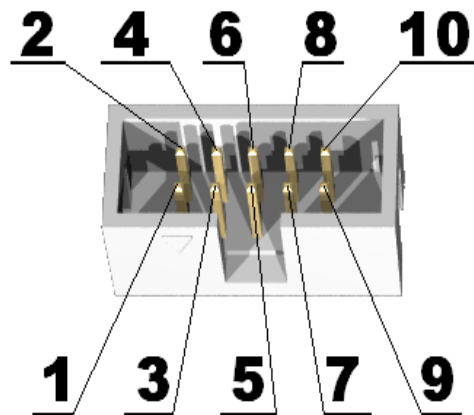
USB_DEVICE

Pin #	Signal Name
1	+5V_USB_DEV
2	USB_DEV_D-
3	USB_DEV_D+
4	GND
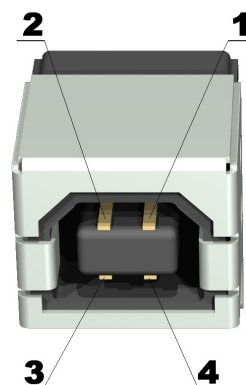
USB_HOST

Pin #	Signal Name
1	+5V_HOST_PWR
2	USB_HOST_D-
3	USB_HOST_D+
4	GND
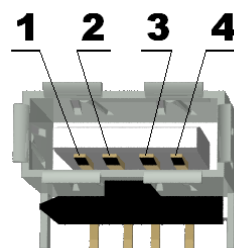
USB_OTG

Pin #	Signal Name
1	+5V_OTG_PWR
2	USB_OTG_D-
3	USB_OTG_D+
4	USBID
5	GND
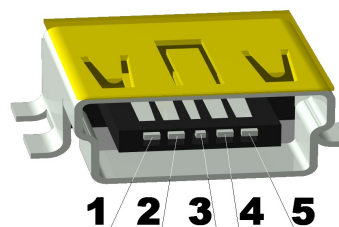
MIC

Pin #	Signal Name
1	AGND
2	NC
3	MIC
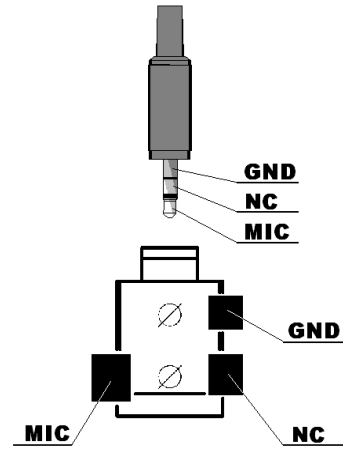
HEADPHONE

Pin #	Signal Name
1	AGND
2	IN1=IN2
3	IN2=IN1
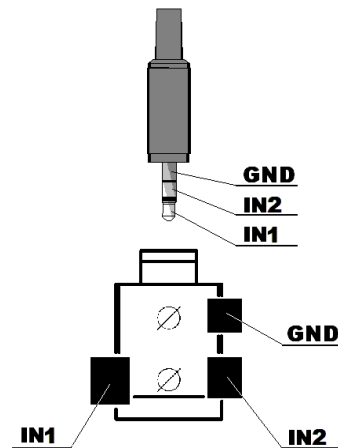
SD/MMC

Pin #	Signal Name
1	Pull-up
2	CS_SD
3	MOSI2
4	VDD (power supply)
5	SCK2
6	GND
7	MISO2
8	Pull-up
9	Not connected
10	Not connected
11	Not connected
12	Not connected
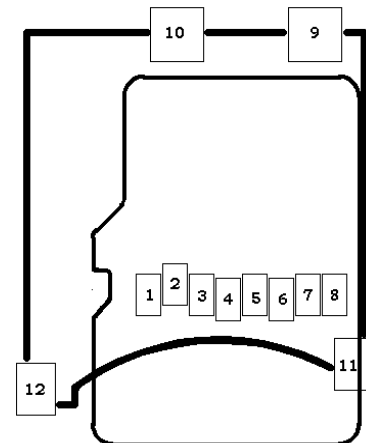
EXT (Proto area)

Pin #	Signal Name	Pin #	Signal Name
1	3.3V	2	3.3V
3	GND	4	GND
5	5V	6	RST
7	RA15	8	RA14
9	RA10	10	RA9
11	RA7	12	RA6
13	RA5	14	RA4
15	RA3	16	RA2
17	RA1	18	RA0
19	RB15	20	RB14
21	RB13	22	RB12
23	RB11	24	RB10
25	RB9	26	RB8
27	RB7	28	RB6
29	RB4	30	RB3
31	RB1	32	RB0
33	RC4	34	RC3
35	RC2	36	RC1
37	RD12	38	RD15
39	RD10	40	RD11
41	RD8	42	RD9
43	RD6	44	RD7
45	RD4	46	RD5
47	RD2	48	RD3
49	RE0	50	RD0
51	RE2	52	RE1
53	RE4	54	RE3
55	RE6	56	RE5
57	RE8	58	RE7
59	RE9	60	RF13
61	RF12	62	RF8
63	RF3	64	RF2
65	RF1	66	RF0
67	RG1	68	RG0
69	RG7	70	RG6
71	RG9	72	RG8
73	RG13	74	RG12
75	RG15	76	RG14
77	3.3VA	78	3.3VA
79	AGND	80	AGND

RF_MODULE

Pin #	Signal Name	Pin #	Signal Name
1	GND	2	#RF_MODULE_RESET
3	RF_MODULE_WAKE	4	RF_MODULE_INT
5	MOSI1	6	SCK1
7	MISO1	8	#RF_MODULE_CS
9	NC	10	3.3V
11	GND	12	GND


```
PCB Antenna
Out of PCB!!!

1  PCB Edge  12
2            11
3            10
4             9
5             8
6             7
RF_MODULE
```
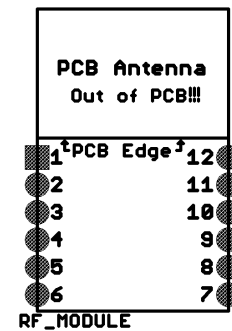
SPI

- Master and Slave Modes Support
- Four Different Clock Formats
- Framed SPI Protocol Support
- User Configurable 8-bit, 16-bit and 32-bit Data Width
- Separate SPI Data Registers for Receive and Transmit
- Programmable Interrupt Event on every 8-bit, 16-bit and 32-bit Data Transfer
- Operation during CPU Sleep and Idle Mode
- Fast Bit Manipulation using CLR, SET and INV Registers

I²C

The PIC32MX460F512L microcontroller has two I²C interface modules, denoted as I2C1 and I2C2. Each I²C module has a 2-pin interface: the SCLx pin is clock and the SDAx pin is data.

Each I²C module 'I²Cx' (x = 1 or 2) offers the following key features:

- I²C Interface Supporting both Master and Slave Operation.
- I²C Slave Mode Supports 7 and 10-bit Address.
- I²C Master Mode Supports 7 and 10-bit Address.
- I²C Port allows Bidirectional Transfers between Master and Slaves.
- Serial Clock Synchronization for I²C Port can be used as a Handshake Mechanism to Suspend and Resume Serial Transfer (SCLREL control).
- I²C Supports Multi-master Operation; Detects Bus Collision and Arbitrates Accordingly.
- Provides Support for Address Bit Masking.

MECHANICAL DIMENSIONS
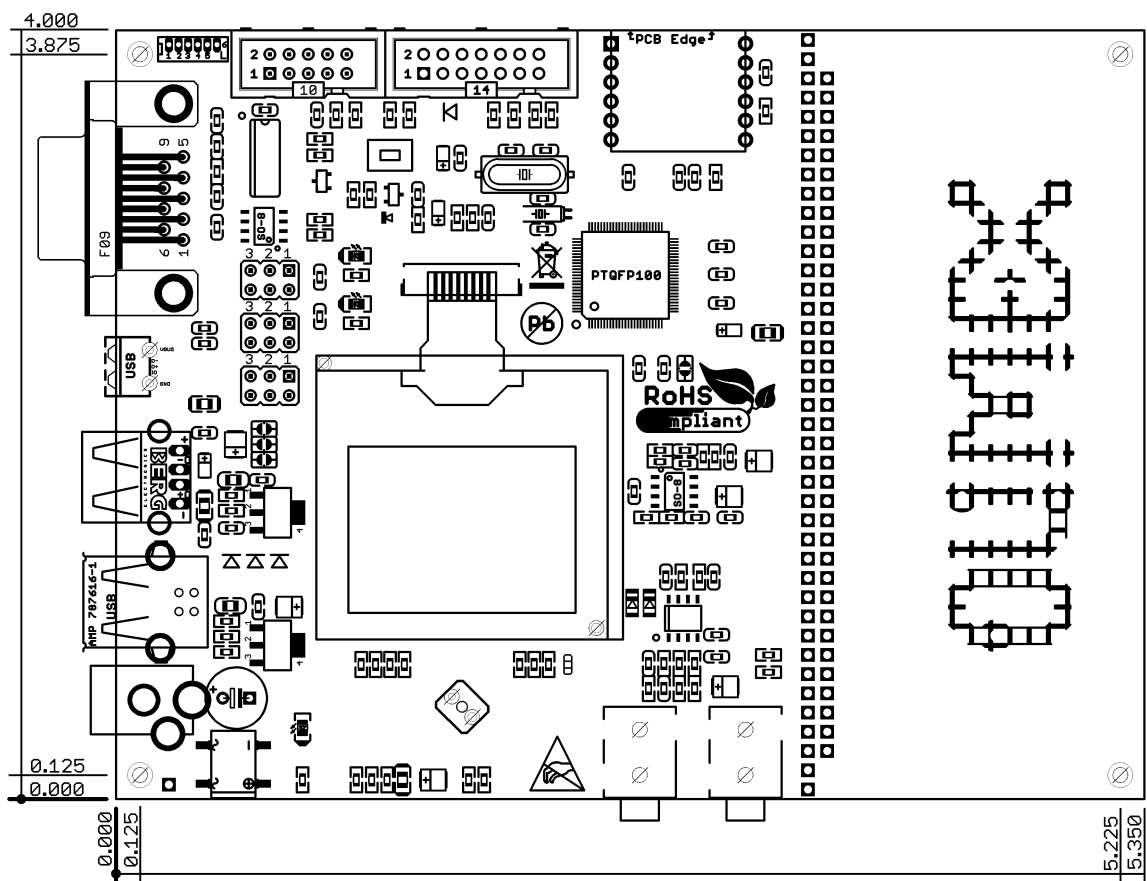
All measures are in Inches.

AVAILABLE DEMO SOFTWARE

- PIC32-MX460 Demo software - includes Audio demo, USB device demo. LCD/joystick demo

ORDER CODE

PIC32-MX460 - completely assembled and tested.

How to order?
You can order to us directly or by any of our distributors.
Check our web www.olimex.com/dev for more info.

Revision history:

REV. B   - create   May 2009

REV.C   February 2011 – change picture

Mouser Electronics

Authorized Distributor

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