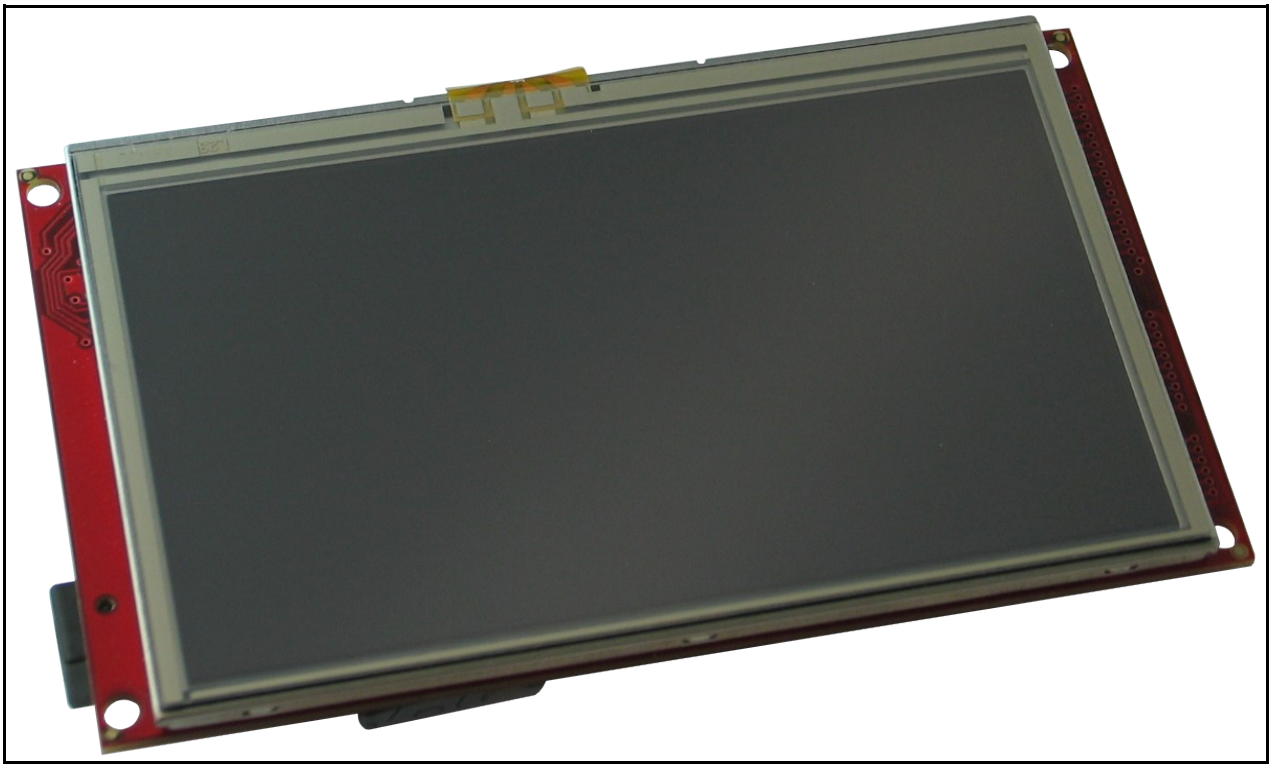

MOD-LCD4.3 development board
USER'S MANUAL

Revision E, September 2012
Designed by OLIMEX Ltd, 2011

All boards produced by Olimex LTD are ROHS compliant

Thank you for purchasing MOD-LCD4.3 development board assembled by OLIMEX LTD

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THERE IS NO WARRANTY FOR THE DESIGN MATERIALS AND THE COMPONENTS USED TO CREATE MOD-LCD4.3. THEY ARE CONSIDERED SUITABLE ONLY FOR MOD-LCD4.3.

Table of Contents

CHAPTER 1 OVERVIEW

1. Introduction to the chapter

Thank you for choosing the MOD-LCD4.3 development board from Olimex! This document provides a User's Guide for the Olimex MOD-LCD4.3 development 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.

The MOD-LCD4.3 development board enables code development of applications running on the LPC2478 microcontroller, manufactured by NXP.

The board is suitable as a touchscreen LCD extension to existing and future Olimex boards that have UEXT connector. Also due to the flexible flat cable connecting the display to the board, it is very easy for the LCD to be embedded in industrial panels.

1.1 Features

- MCU: LPC1788, frequencies of up to 120 MHz, 512 kB on-chip flash program memory, 96 kB on-chip SRAM, 4 kB on-chip EEPROM
- LCD 4.3" 480x272 pixels 24bit color TFT color with Backlight and Touchscreen
- micro SD card
- 32MB of SDRAM
- DC-DC for the LCD backlight
- UEXT connector to interface with any of our development boards with UEXT connector
- mini USB device connector
- optional 3-axis digital accelerometer with 11 bit accuracy
- USB device connector
- JTAG connector
- RESET button and circuit
- USER button
- power supply LED
- USB activity LED
- Touchscreen interface
- EXT1 and EXT2 2x20 pin 0.05" extension connectors on the board edge for all unused LPC1788 ports

- FR-4, 1.5 mm, red soldermask, component print
- Dimensions: 115mm x 67.5mm (4.5" x 2.7")

1.2 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 LPC1788 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

CHAPTER 2 SETTING UP THE MOD-LCD4.3 BOARD

2. Introduction to the chapter

This section helps you set up the MOD-LCD4.3 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

MOD-LCD4.3 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 MOD-LCD4.3, the following items are required:

- A source of power applied to at least one of the following:
  - mini USB – standard 5V
  - PWR JACK - 9-12Vdc or 6-9Vac
  - JTAG – 5V from the JTAG debugger
  - UEXT – 3.3V from external host device connected to the UEXT
  - EXT1/EXT2 – 5V applied directly
- A programmer that has 20 pin interface and supports programming of LPC2478

You may use any of Olimex's ARM-JTAG programmer/debugger (For example ARM-USB-TINY-H) for this task.

Also, a host-based software toolchain is required in order to program/debug the MOD-LCD4.3 board. There are also a number of ready IDEs available like IAR Embedded Workbench, Rowley CrossWorks, etc.

Olimex also maintains own distribution of GCC and Eclipse suitable for use with our programmers.

2.3 Powering the board

On powering the board the PWR LED, the SD LED and the display should turn on. After that the touchscreen should show a simple color palette and a mouse pointer that responses on dragging.

If measuring the current consumption it should be around 15 mA.

2.4 Prebuilt software

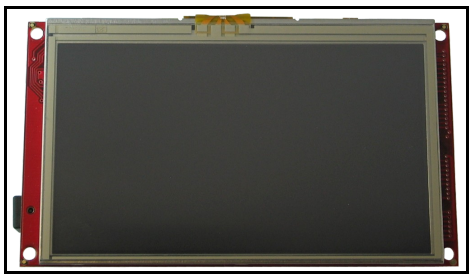
On arrival the board has a basic demo installed which features test of the LEDs, the color range and the touch response of the LCD, the SD card slot and the USB connectivity.

CHAPTER 3 MOD-LCD4.3 BOARD DESCRIPTION

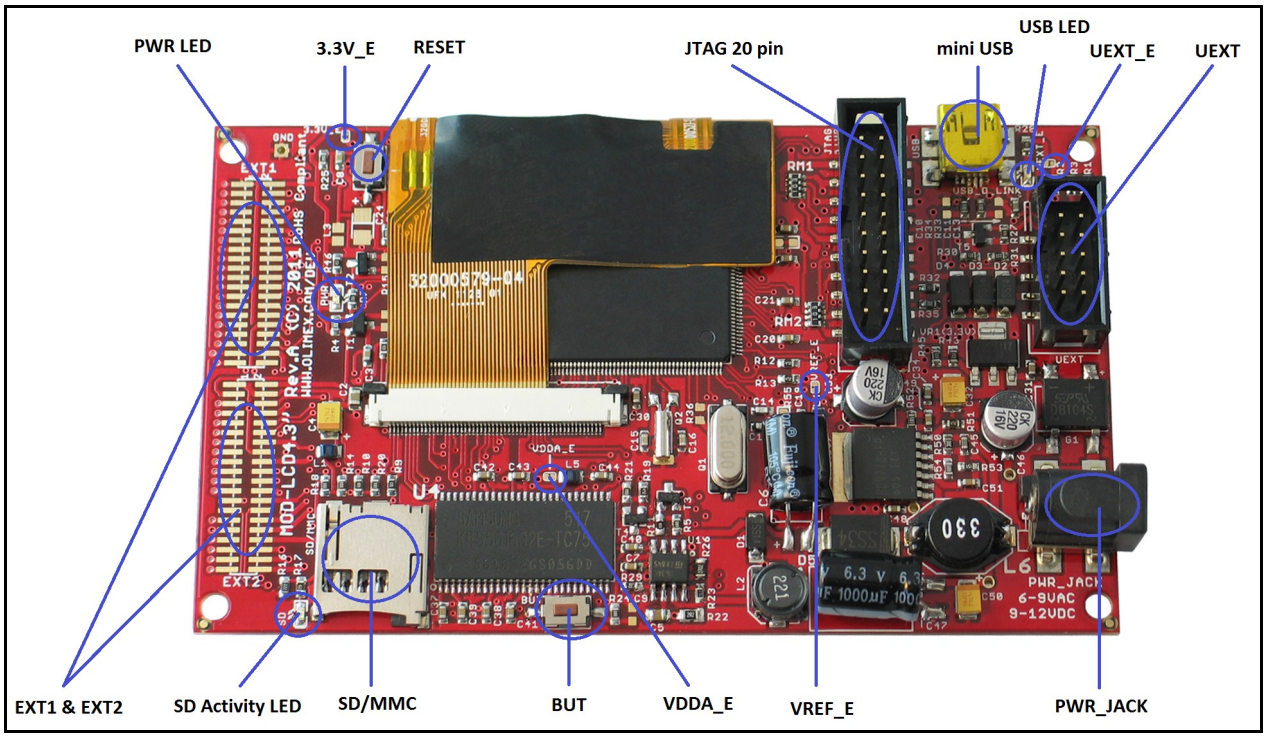
3. Introduction to the chapter

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 MOD-LCD4.3 board itself.

3.1 Layout (top view)



3.2 Layout (bottom view)



CHAPTER 4 THE LPC1788 MICROCONTROLLER

4. Introduction to the chapter

In this chapter is located the information about the heart of MOD-LCD4.3 – its microcontroller. The information is a modified version of the datasheet provided by its manufacturers.

4.1 The microcontroller

The LPC1788FBD208 microcontroller has the following features:

- Functional replacement for LPC23xx and 24xx family devices
- ARM Cortex-M3 processor, running at frequencies of up to 120 MHz
- ARM Cortex-M3 built-in Nested Vectored Interrupt Controller (NVIC)
- Multilayer AHB matrix interconnect provides a separate bus for each AHB master
- Split APB bus allows for higher throughput
- Cortex-M3 system tick timer, including an external clock input option
- Standard JTAG test/debug interface, Serial Wire Debug and Serial WireTrace Port
- Emulation trace module supports real-time trace
- Boundary scan for simplified board testing
- Non-maskable Interrupt (NMI) input
- 512 kB on-chip flash program memory
- 96 kB on-chip SRAM
- 4 kB on-chip EEPROM
- In-System Programming (ISP) and In-Application Programming (IAP) capabilities
- LCD controller, supporting both STN and TFT displays
- External Memory Controller (EMC)
- Eight channel General Purpose DMA controller (GPDMA)
- Ethernet MAC with MII/RMII interface and associated DMA controller
- USB 2.0 full-speed dual port device/host/OTG controller with on-chip PHY and DMA
- Five UARTs with fractional baud rate generation
- Three SSP controllers with FIFO and multi-protocol capabilities
- Three enhanced I2C-bus interfaces
- I2S (Inter-IC Sound) interface for digital audio input or output
- CAN controller with two channels

- SD/MMC memory card interface
- Up to 165 General Purpose I/O (GPIO) pins
- Two external interrupt inputs configurable as edge/level sensitive
- Four general purpose timers/counters
- Quadrature encoder interface that can monitor one external quadrature encoder
- Two standard PWM/timer blocks with external count input option
- Real-Time Clock (RTC) with a separate power domain
- Windowed Watchdog Timer (WWDT)
- 12-bit Analog-to-Digital Converter (ADC) with conversion rates up to 400 kHz
- 10-bit Digital-to-Analog Converter (DAC)
- Four reduced power modes: Sleep, Deep-sleep, Power-down, and Deep power-down
- Wake-up Interrupt Controller (WIC)
- Processor wake-up from Power-down mode via any interrupt
- Brownout detect with separate threshold for interrupt and forced reset
- On-chip Power-On Reset (POR)
- On-chip crystal oscillator with an operating range of 1 MHz to 25 MHz
- 12 MHz Internal RC oscillator (IRC) trimmed to 1% accuracy
- Unique device serial number for identification purposes
- Single 3.3 V power supply (2.4 V to 3.6 V)

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

At the moment of writing the microcontroller datasheet can be found at the following link:http://www.nxp.com/documents/data_sheet/LPC178X_7X.pdf

CHAPTER 5 CONTROL CIRCUITY

5. Introduction to the chapter

Here you can find information about reset circuit and quartz crystal locations.

5.1 Reset

MOD-LCD4.3 reset circuit includes R25 (33 KΩ), C8 (100 nF), LPC2478 pin 35 (NRST) and a RESET button. The RESET is also connected to the JTAG pin 15.

5.2 Clock

12 MHz quartz crystal Q1 is connected to pins 44 and 46 of the processor.

Real time clock (RTC) Q2 @ 32 768 Hz is found at pins 34 and 36 of the processor.

CHAPTER 6 HARDWARE

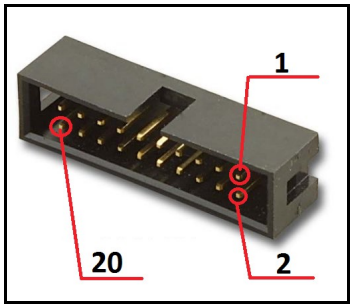
6. Introduction to the chapter

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

6.1 JTAG connector

The 20 pin JTAG connector provides the interface for JTAG programming/debugging.

JTAG interface			
Pin #	Signal Name	Pin #	Signal Name
1	+3.3V	11	+3.3 V
2	+3.3V	12	GND
3	TRST	13	TDO
4	GND	14	GND
5	TDI	15	RST
6	GND	16	GND
7	TMS	17	GND
8	GND	18	GND
9	TCK	19	+5V_JTAG
10	GND	20	GND



6.2 UEXT

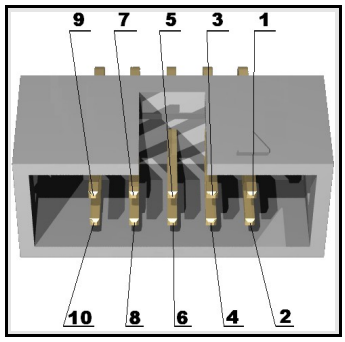
MOD-LCD4.3 board has UEXT connector and can interface Olimex's UEXT boards adding display and SD card functionality. Of course the board can be used standalone.

Note that the first batch of MOD-LCD4.3"+ (LPC1788) were send with an UEXT cable suitable for the board only to act as a HOST to other MOD boards. Later batches are shipped with cable pins 3 and 4 reversed so the board can be used as device. To make it is manually host or device swap 3 and 4 respectively. Without swapping by default the board is configured as a HOST to other MOD boards.

For more information on UEXT please visit:

http://www.olimex.com/dev/OTHER/UEXT.pdf

Pin #	Signal Name
1	+3.3V
2	GND
3	TXD0
4	RXD0
5	SCL2
6	SDA2
7	MISO
8	MOSI
9	SCK
10	SSL



6.3 EXT1 pads

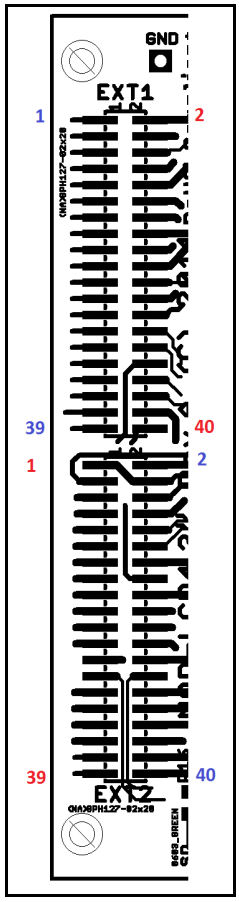
EXT1 and EXT2 lead the unused processor pins to neat pads positioned near the end of the bottom of the board. Note that there isn't connectors attached to them. Signals named Px[y] can be checked in the processor's datasheet for their corresponding functions.

EXT1			
Pin #	Pin signal	Pin #	Pin signal
1	GND	2	3.3V
3	+5V	4	Vin
5	GND	6	P2[3]
7	P2[5]	8	P2[11]
9	P2[14]	10	P2[15]
Pin #	Signal name	Pin #	Singal name
11	P2[19]	12	P2[21]
13	P2[22]	14	P2[23]
15	P2[25]	16	P2[26]
17	P2[27]	18	P2[30]
19	P2[31]	20	P3[16]
21	P3[17]	22	P3[18]
23	P3[19]	24	P3[20]
25	P3[21]	26	P3[22]
27	P3[23]	28	P3[24]
29	P3[25]	30	P3[26]
31	P3[27]	32	P3[28]
33	P3[29]	34	P3[30]
35	P3[31]	36	P4[15]
37	P4[16]	38	P4[17]
39	P4[18]	40	P4[19]

6.4 EXT2 pads

EXT2			
Pin #	Pin signal	Pin #	Pin signal
1	GND	2	3.3V

3	+5V	4	Vin
5	GND	6	P4[22]
7	P4[23]	8	P4[24]
9	P4[26]	10	P4[27]
11	P4[30]	12	P4[31]
13	ALARM	14	P1[31]
15	P1[30]	16	P1[17]
17	P1[16]	18	P1[15]
19	P1[14]	20	P1[13]
Pin #	Signal name	Pin #	Singal name
21	P1[10]	22	P1[9]
23	P1[8]	24	P1[4]
25	P1[1]	26	P1[0]
27	USB_D-2	28	P0[31]
29	P0[28]	30	P0[27]
31	P0[26]	32	P0[25]
33	P0[20]	34	P0[19]
35	P0[13]	36	P0[12]
37	P0[11]	38	P0[10]
39	P0[1]	40	P0[0]



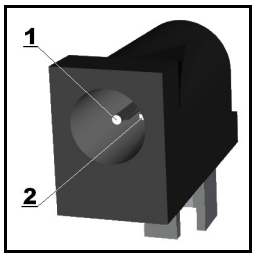
6.5 mini USB (device)

Pin #	Signal Name
1	+5V
2	D-
3	D+

4	Not connected
5	GND

6.6 PWR Jack

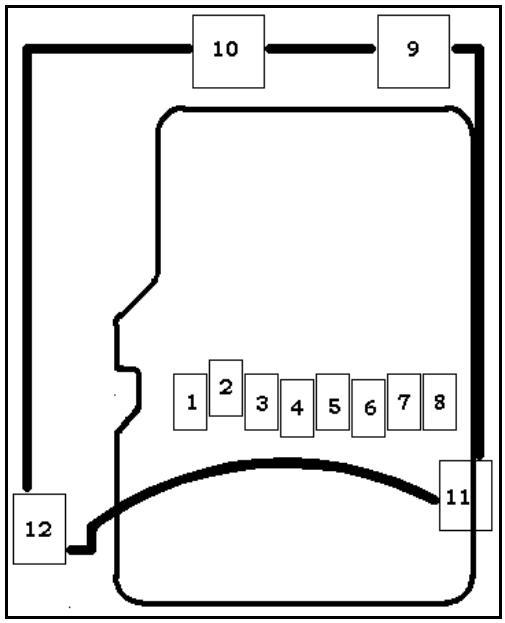
Pin #	Signal Name
1	Power Input
2	GND



6.7 microSD/MMC slot

Note that the micro SD cards supported are up to 2GB of size.

Pin #	Signal Name
1	MCIDAT2
2	MCIDAT3
3	MCICMD
4	VDD
5	MCICLK
6	VSS
7	MCIDAT0
8	MCIDAT1



6.8 Jumper description

Most of the jumper configurations are printed with white print on the PCB for your convenience. This board has only SMT jumpers which require soldering/unsoldering.

VDDA_E

When closed supplies power to the external memory.

Default state is closed.

3.3V_UEXT_E

When open enables UEXT connector.

Default state is open.

3.3V_E

When open disables the power supply to the processor.

Default state is closed.

VREF_E

When open disconnects VREF on the processor (PIN24)

Default state is closed.

6.9 Touchscreen display with backlight

Anti-glare surface treatment
Pixels: 480 × 3(RGB) × 272 Pixels,
Dot pitch: 0.066(W) × 0.198(H) mm

More info: http://www.datamate-j.com/201202/GFT043HA480272Y_Rev.A.pdf

6.10 Additional hardware components

The components below are mounted on MOD-LCD4.3 but are not discussed above. They are listed here for completeness:

Additional SDRAM

Buttons BUT + RST

2 status LEDs + PWR LED

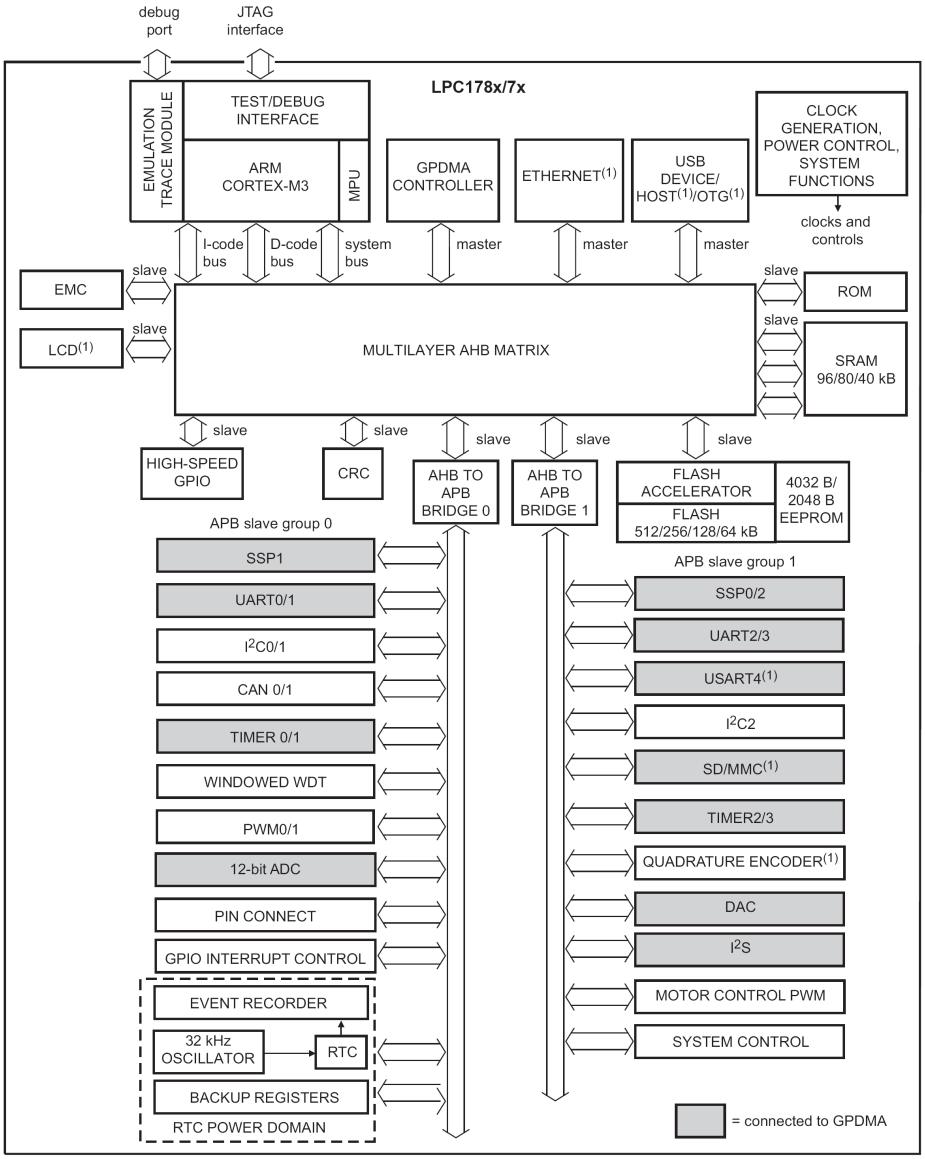
There is an option to have an accelerometer soldered (check the schematic) for additional price. This is useful, for example, for applications that can rotate the image when the display is rotated.

CHAPTER 7 MEMORY

7. Introduction to the chapter

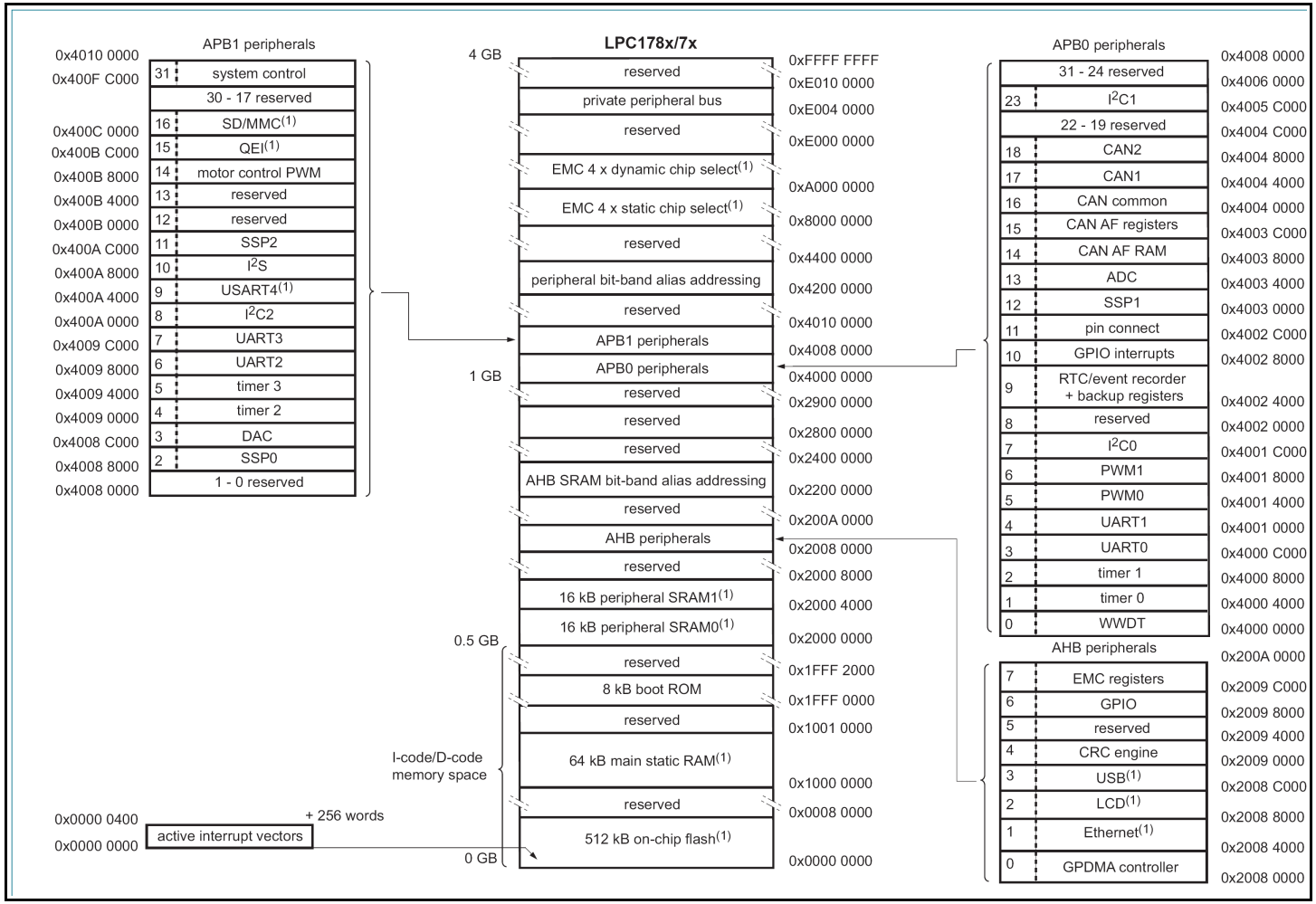
On the next page you can find a memory map for this family of processors. It is strongly recommended to refer to the original datasheet released by NXP for one of higher quality.

7.1 Block diagram



As shown in the processor's documentation

7.2 Memory map



CHAPTER 8 SCHEMATICS

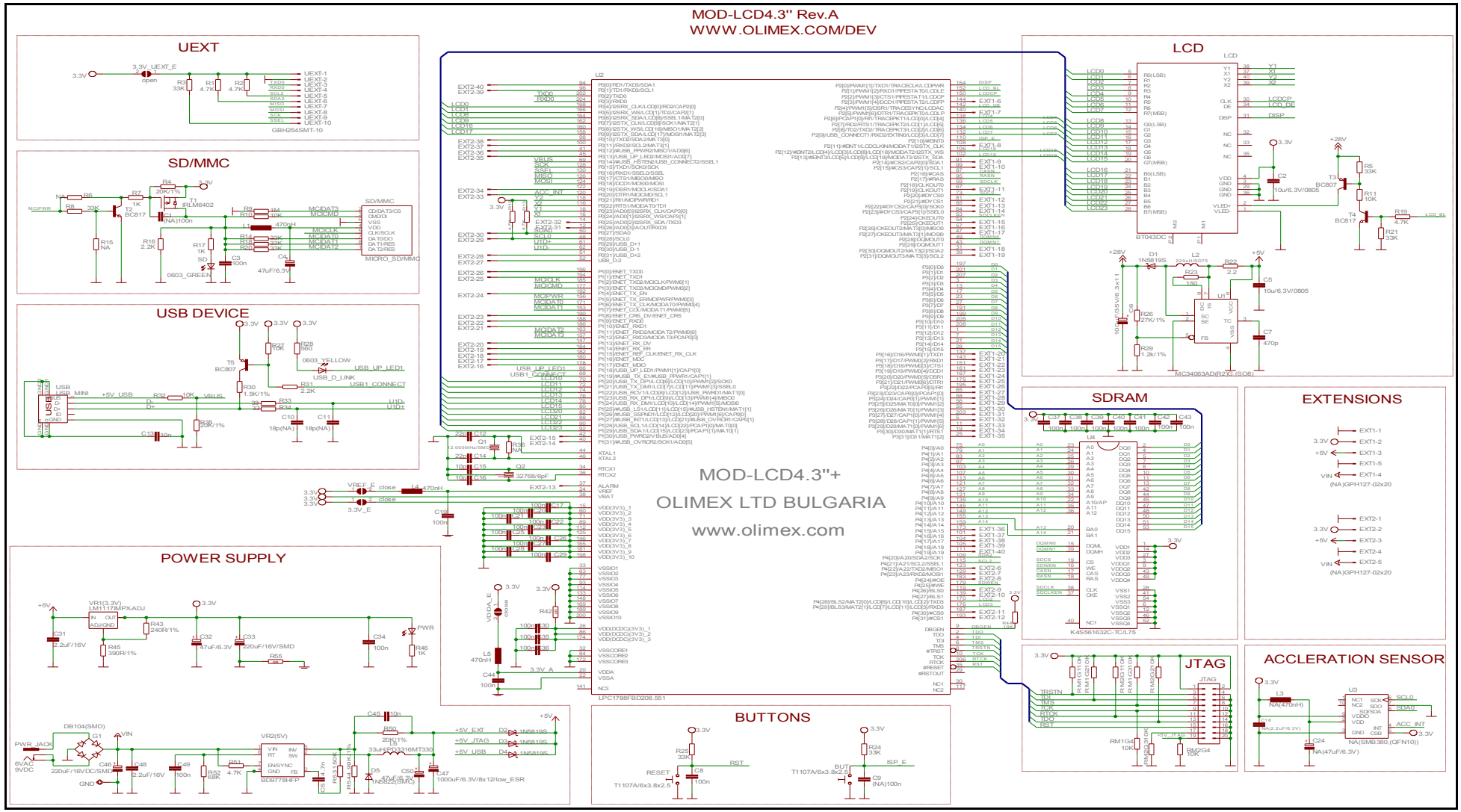
8. Introduction to the chapter

In this chapter are located the schematics describing logically and physically MOD-LCD4.3.

8.1 Eagle schematic

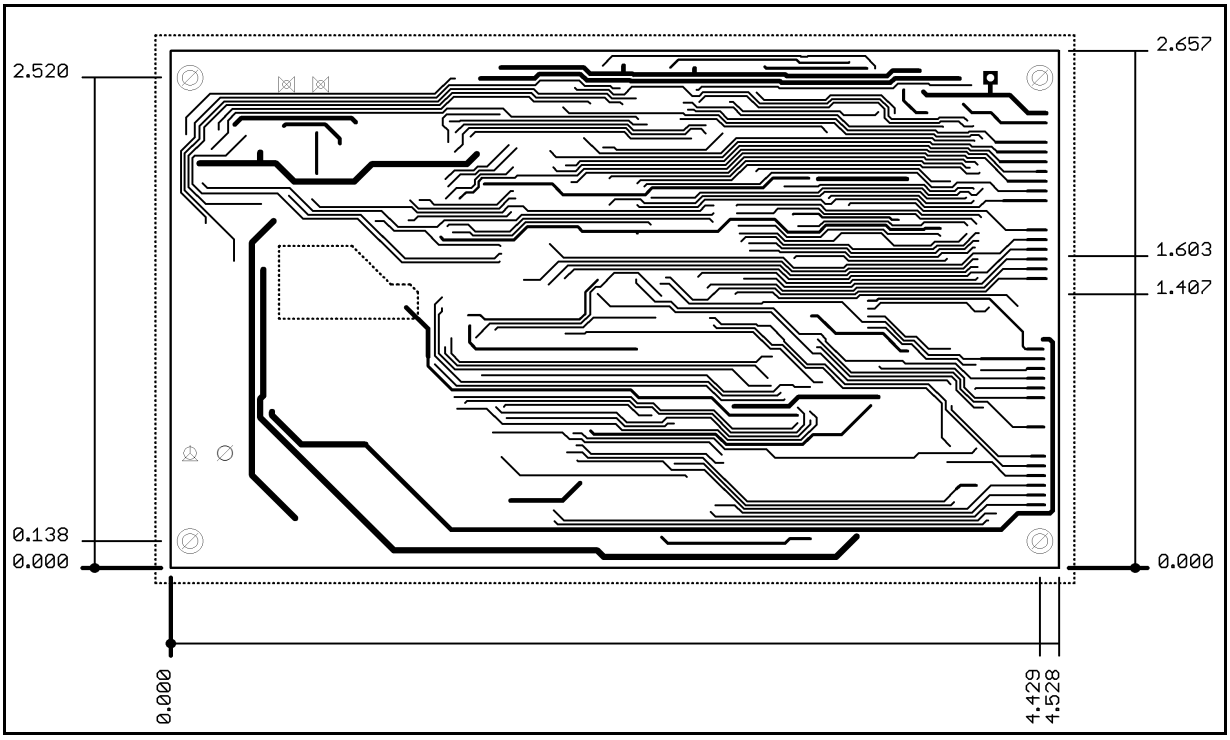
MOD-LCD4.3 schematic is visible for reference here. You can also find them on the web page for MOD-LCD4.3 at our site: http://olimex.com/dev/mod-lcd43.html. They are located in HARDWARE section.

The EAGLE schematic is situated on the next page for quicker reference.


MOD-LCD4.3" Rev.A
WWW.OLIMEX.COM/DEV
UEXT
SD/MMC
USB DEVICE
POWER SUPPLY
LCD
SDRAM
EXTENSIONS
JTAG
ACCLERATION SENSOR
BUTTONS
MOD-LCD4.3"+
OLIMEX LTD BULGARIA
www.olimex.com

8.2 Physical dimensions

Note that all dimensions are in inches.



CHAPTER 9 REVISION HISTORY

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 Board revision

Revision	Changes
MOD-LCD4.3	Initial board with LPC2478 microcontroller
MOD-LCD4.3+	Initial board with LPC1788 microcontroller Cortex M3 – functional replacement of LPC23xx and LPC24xx series

9.2 Document revision

Revision	Changes	Modified Pages
A	Initial Creation	All
B	Fixed error stating the board comes with an accelerometer	20
C	Added a note about MOD-LCD4.3+ (LPC1788), various formatting improvements	All
D	Changed schematics and specification to meet the improved LPC1788 microcontroller	All
E	Added information about the UEXT RX TX, device and host modes	14

9.2 Web page of your device

The web page you can visit for more info on your device is http://olimex.com/dev/mod-lcd43.html. There you can find more info and some examples.

ORDER CODES:

MOD-LCD4.3+ - featuring LPC1788FBD, completely assembled and tested

ARM-USB-TINY - for custom programming/debugging
ARM-USB-TINY-H - for custom programming/debugging
USB-MINI-CABLE - USBmini to USB-A cable

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