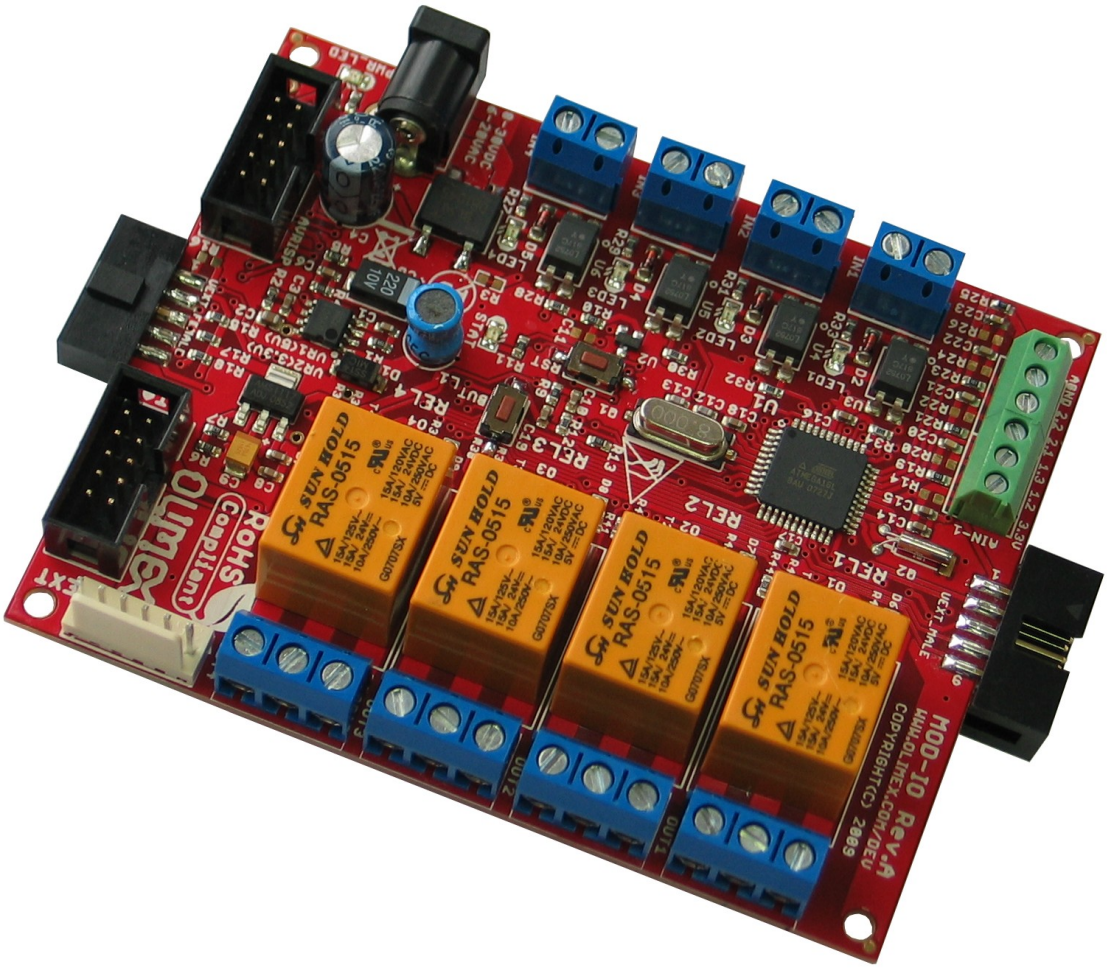


MOD-IO development board

Users Manual

Pb-free, Green All boards produced by Olimex are ROHS compliant

Rev. B, September 2011

INTRODUCTION

MOD-IO is a small but powerful development board who let you control 4 optoisolated input and 4 relay outputs - with this features is possible to turn on and off almost any electronic device at home. The board has UEXT_FEMALE connector which allows you to communicate with a PC and UEXT_MALE connector where you can connect other Olimex board with UEXT.
The main idea of MOD-IO chain connection is to extend:
- isolated relay outputs
- isolated digit inputs
- non isolated analog inputs
- non isolated digit inputs/outputs

using UEXT male/female connector. So the MCU interfaces (I2C, SPI, UART) from all chain boards are connected in parallel.
Note that if you want to connect more than 1 MOD-IO board then on the interface bus (I2C or UART or SPI) has to have only one Master device. The other devices have to be Slaves.
For example: if UART interface is used - the master will send a string with Slave address and command. All Slaves will listen UART bus through RXD line while all Slave TXD lines are inputs. So when the address is recognized from the Slave device, the one will answer as it will force TXD pin like output but immediately after command answer is finished the Slave TXD pin must be initialized like input.
The same principle can be used for other interfaces (SPI or I2C).

BOARD FEATURES

- Microcontroller: Atmega16L
- AVRISP connector
- JTAG connector
- EXT connector
- UEXT_MALE
- UEXT_FEMALE
- Clock circuit
- User button
- Reset circuit and button
- Power Jack
- Power-on led
- Nine status leds
- Four optocoupler isolated inputs
- Four Relays
- PCB: FR-4, 1.5 mm (0,062"), solder mask, silkscreen component print
- Dimensions: 100x80 mm (3.94x3.15")

ELECTROSTATIC WARNING

The MOD-IO 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: The cable you will need depends on the programmer/debugger you use. If you use AVR-PG1, or AVR-JTAG, you will need RS232 cable, if you use AVR-PG2, you will need LPT cable, if you use AVR-USB-JTAG, AVR-ISP500, AVR-ISP500-TINY, or AVR-ISP500-ISO, you will need 1.8 meter A-B USB cable.

Hardware: One of Olimex programmers/debuggers – AVR-PG1, AVR-PG2, AVR-ISP500, AVR-ISP500-TINY, AVR-ISP500-ISO, AVR-JTAG, AVR-USB-JTAG, or other compatible programming/debugging tool.

Software: AVR C Compiler

PROCESSOR FEATURES

MOD-IO use 8-bit AVR Microcontroller with 16K Bytes In-System Programmable Flash, with these features:

- High-performance, Low-power AVR® 8-bit Microcontroller
- Advanced RISC Architecture
  - 131 Powerful Instructions – Most Single-clock Cycle Execution
  - 32 x 8 General Purpose Working Registers
  - Fully Static Operation
  - Up to 16 MIPS Throughput at 16 MHz
  - On-chip 2-cycle Multiplier
- High Endurance Non-volatile Memory segments
  - 16K Bytes of In-System Self-programmable Flash program memory
  - 512 Bytes EEPROM
  - 1K Byte Internal SRAM
  - Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
  - Data retention: 20 years at 85°C/100 years at 25°C
  - Optional Boot Code Section with Independent Lock Bits

    In-System Programming by On-chip Boot Program

    True Read-While-Write Operation
  - Programming Lock for Software Security
- JTAG (IEEE std. 1149.1 Compliant) Interface
  - Boundary-scan Capabilities According to the JTAG Standard
  - Extensive On-chip Debug Support

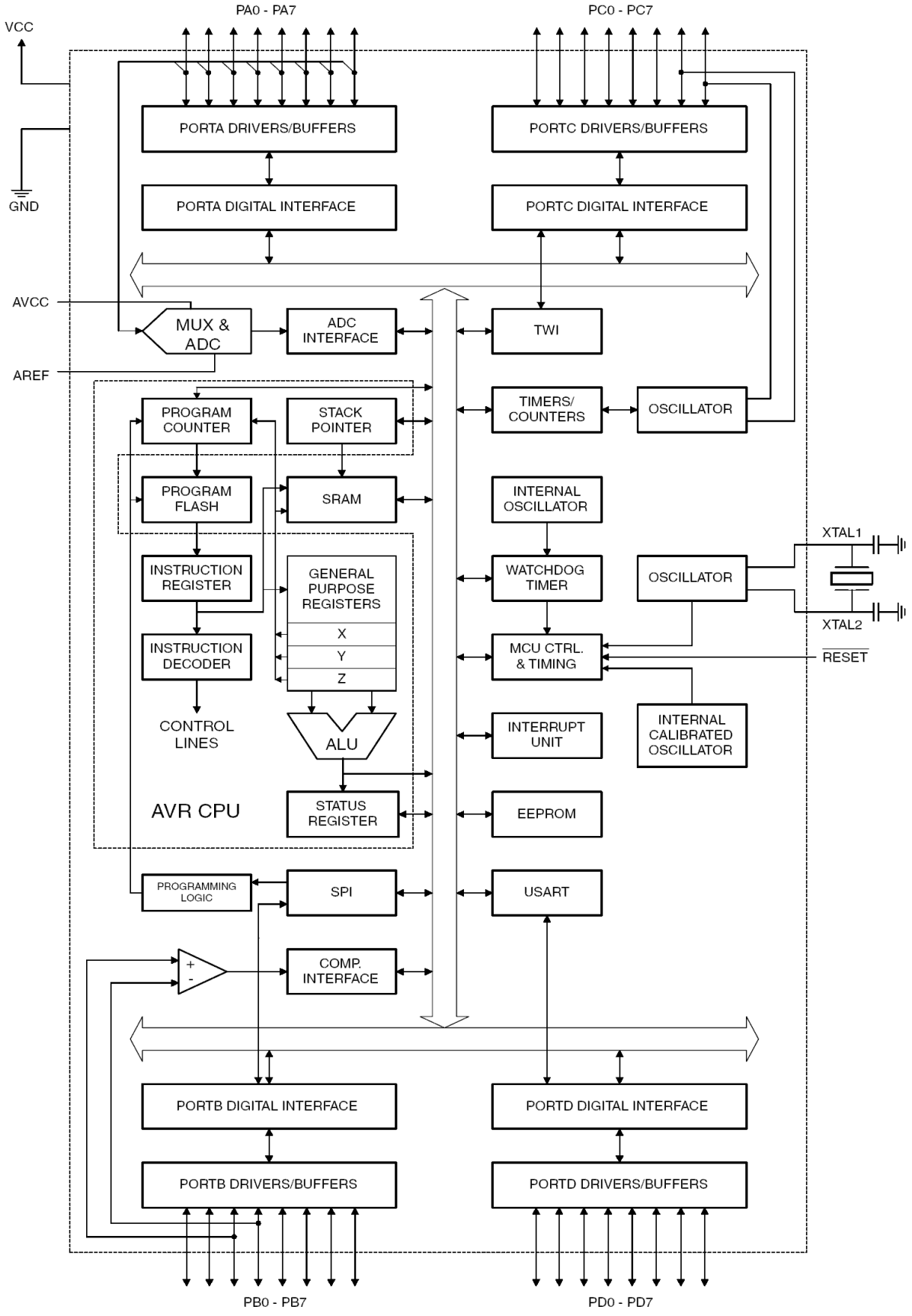
  - Programming of Flash, EEPROM, Fuses, and Lock Bits through the JTAG Interface
- Peripheral Features
  - Two 8-bit Timer/Counters with Separate Prescalers and Compare Modes
  - One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode
  - Real Time Counter with Separate Oscillator
  - Four PWM Channels
  - 8-channel, 10-bit ADC

    8 Single-ended Channels

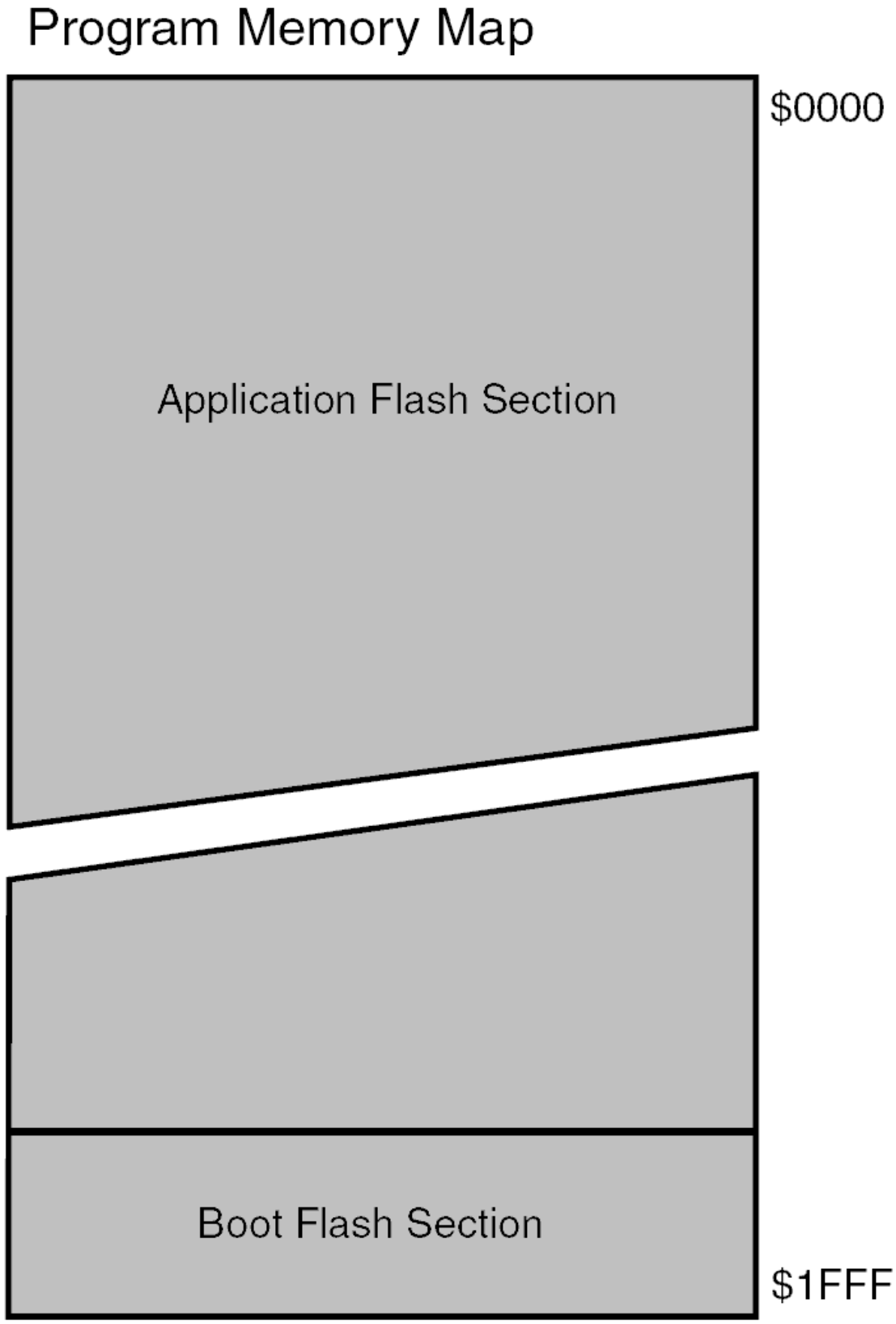
    7 Differential Channels in TQFP Package Only

    2 Differential Channels with Programmable Gain at 1x, 10x, or 200x
  - Byte-oriented Two-wire Serial Interface
  - Programmable Serial USART
  - Master/Slave SPI Serial Interface
  - Programmable Watchdog Timer with Separate On-chip Oscillator
  - On-chip Analog Comparator
- Special Microcontroller Features
  - Power-on Reset and Programmable Brown-out Detection
  - Internal Calibrated RC Oscillator
  - External and Internal Interrupt Sources
  - Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby and Extended Standby
- I/O and Packages
  - 32 Programmable I/O Lines
- Operating Voltages
  - 2.7 - 5.5V
- Speed Grades
  - 0 - 8 MHz
- Power Consumption @ 1 MHz, 3V, and 25·C
  - Active: 1.1 mA
  - Idle Mode: 0.35 mA
  - Power-down Mode: < 1 µA

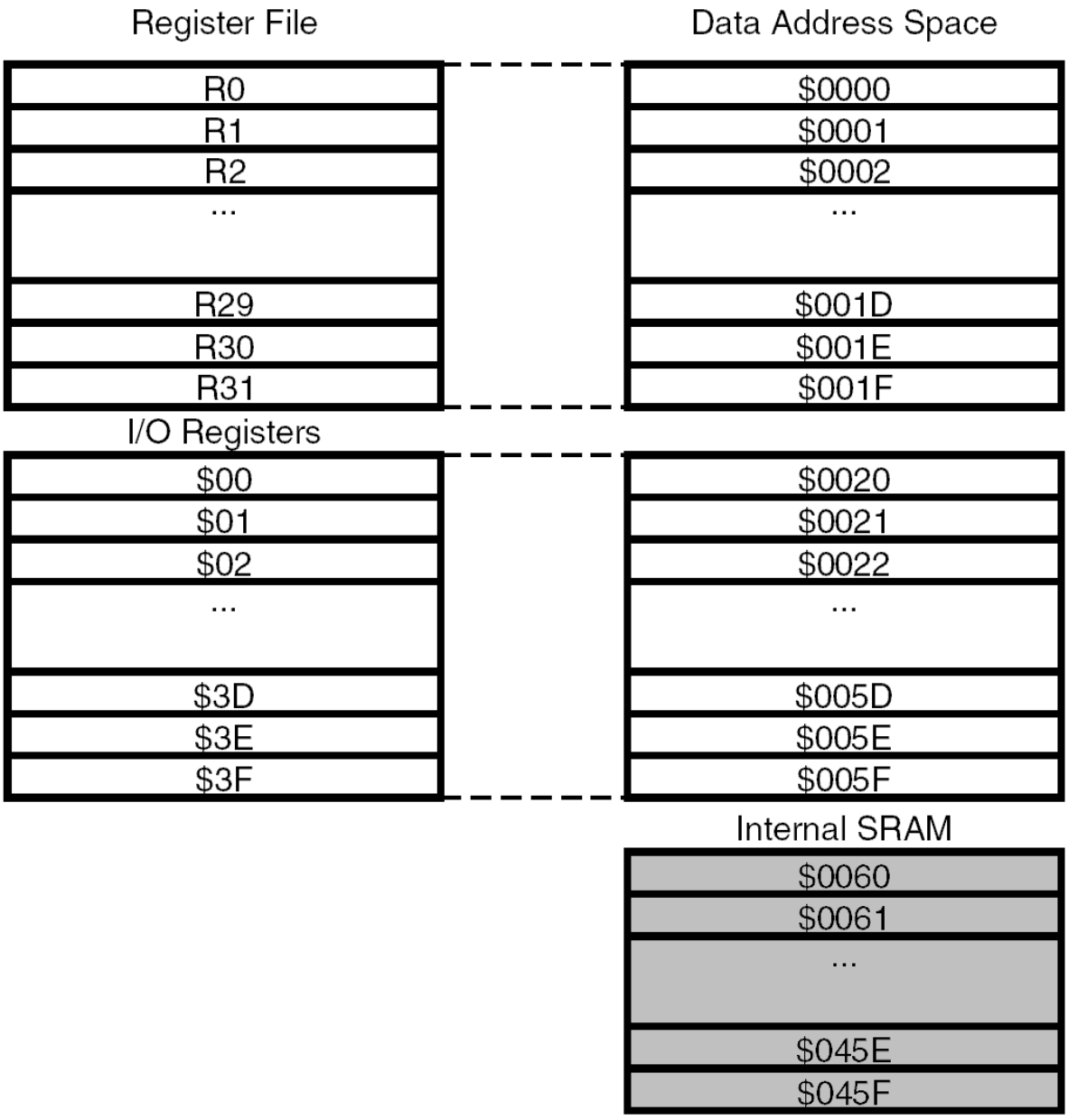
BLOCK DIAGRAM



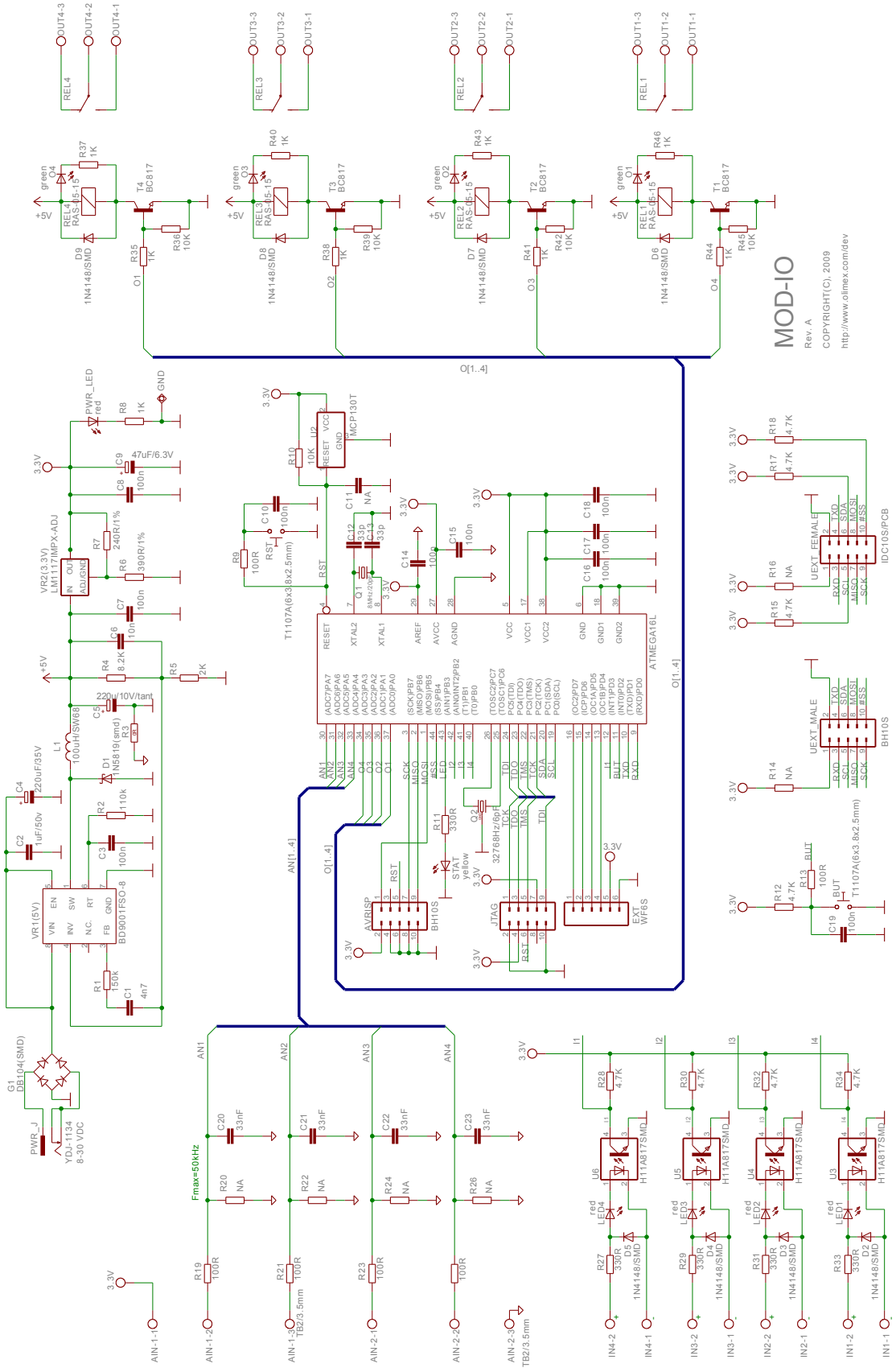
MEMORY MAP


Program Memory Map
$0000
Application Flash Section
Boot Flash Section
$1FFF

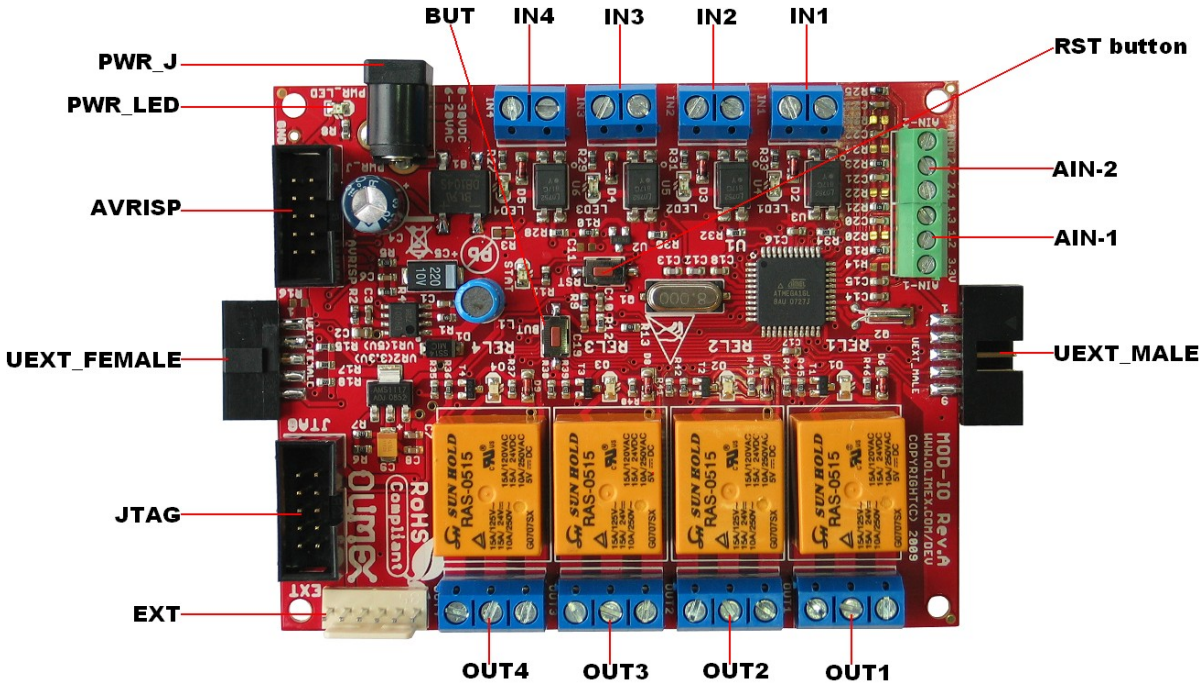
Data Memory Map



SCHEMATIC


MOD-IO
Rev. A
COPYRIGHT(C), 2009
http://www.olimex.com/dev
ATMEGA16L
T1107A(6x3.8x2.5mm)
BD9001FSO-8
VR1(5V)
LM1117MPX-ADJ
VR2(3.3V)
BH10S
IDC10S/PCB
UEXT_FEMALE
UEXT_MALE
JTAG
EXT W/F6S
H11A817SMD
1N4148/SMD
RAS-05-15
BC817
DB104(SMD)
YDJ-1134
8-30 VDC
32768Hz/6pF
8MHz/20pF
Fmax=50kHz
TB2/3.5mm
O[1..4]
AN[1..4]
I[1..4]

BOARD LAYOUT



POWER SUPPLY CIRCUIT

MOD-IO is typically power supplied with 8-30V DC.

Power consumption when all relays are working is about 310 mA.

CLOCK CIRCUIT

Crystal Quartz 8 MHz connected to Atmega16l pin 7 (XTAL2) and pin 8 (XTAL1). Crystal Quartz 32.768kHz connected to Atmega16L pin 25 ((TOSC1)PC6) and pin 26 ((TOSC2)PC7).

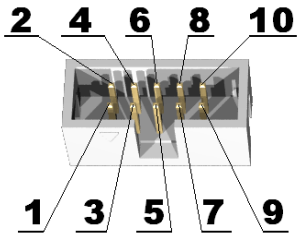
RESET CIRCUIT

MOD-IO reset circuit includes Reset scheme MCP130T (U2), AVRISP connector pin 5, JTAG connector pin 6, Atmega16L pin 4 (RESET), R9 (100Ohm), R10 (10k), C10 (100nF) and RST button.

CONNECTOR DESCRIPTIONS

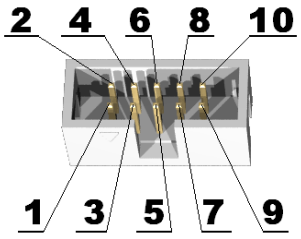
AVRISP

Pin #	Signal Name
1	MOSI
2	3.3V
3	NC
4	GND
5	RST
6	GND
7	SCK
8	GND
9	MISO
10	GND



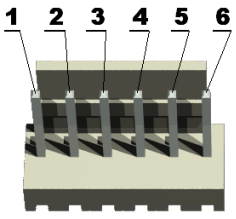
JTAG

Pin #	Signal Name
1	TCK
2	GND
3	TDO
4	3.3V
5	TMS
6	RST
7	3.3V
8	NC
9	TDI
10	GND



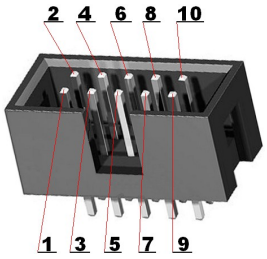
EXT

Pin #	Signal Name
1	PD7
2	PD6
3	PD5
4	PD4
5	3.3V
6	GND



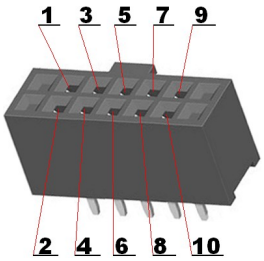
UEXT_MALE

Pin #	Signal Name
1	NC
2	GND
3	RXD
4	TXD
5	SCL
6	SDA
7	MISO
8	MOSI
9	SCK
10	#SS



UEXT_FEMALE

Pin #	Signal Name
1	NC
2	GND
3	RXD
4	TXD
5	SCL
6	SDA
7	MISO
8	MOSI
9	SCK
10	#SS



IN1, IN2 IN3, IN4

Pin #	Signal
1	-
2	+

IN1 connected to (T0)PB0 – signal I4

IN2 connected to (T1)PB1 – signal I3

IN2 connected to (AIN0/INT2)PB2 – signal I2

IN4 connected to (INT1)PD3 – signal I1

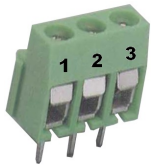
OUT1, OUT2, OUT3, OUT4

OUT1 connected to (ADC3)PA3 – signal name O4

OUT2 connected to (ADC2)PA2 – signal name O3

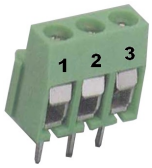
OUT3 connected to (ADC1)PA1 – signal name O2

OUT4 connected to (ADC0)PA0 – signal name O1



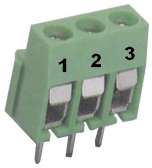
AIN-1

Pin #	Signal Name	Connected to
1	3.3V	VCC
2	AN1	(ADC7)PA7
3	AN2	(ADC6)PA6



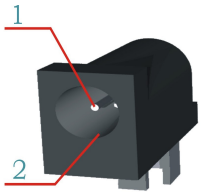
AIN-2

Pin #	Signal Name	Connected to
1	AN3	(ADC5)PA5
2	AN4	(ADC4)PA4
3	AGND	Analog GND



PWR_J

Pin #	Signal Name
1	Power Input
2	GND



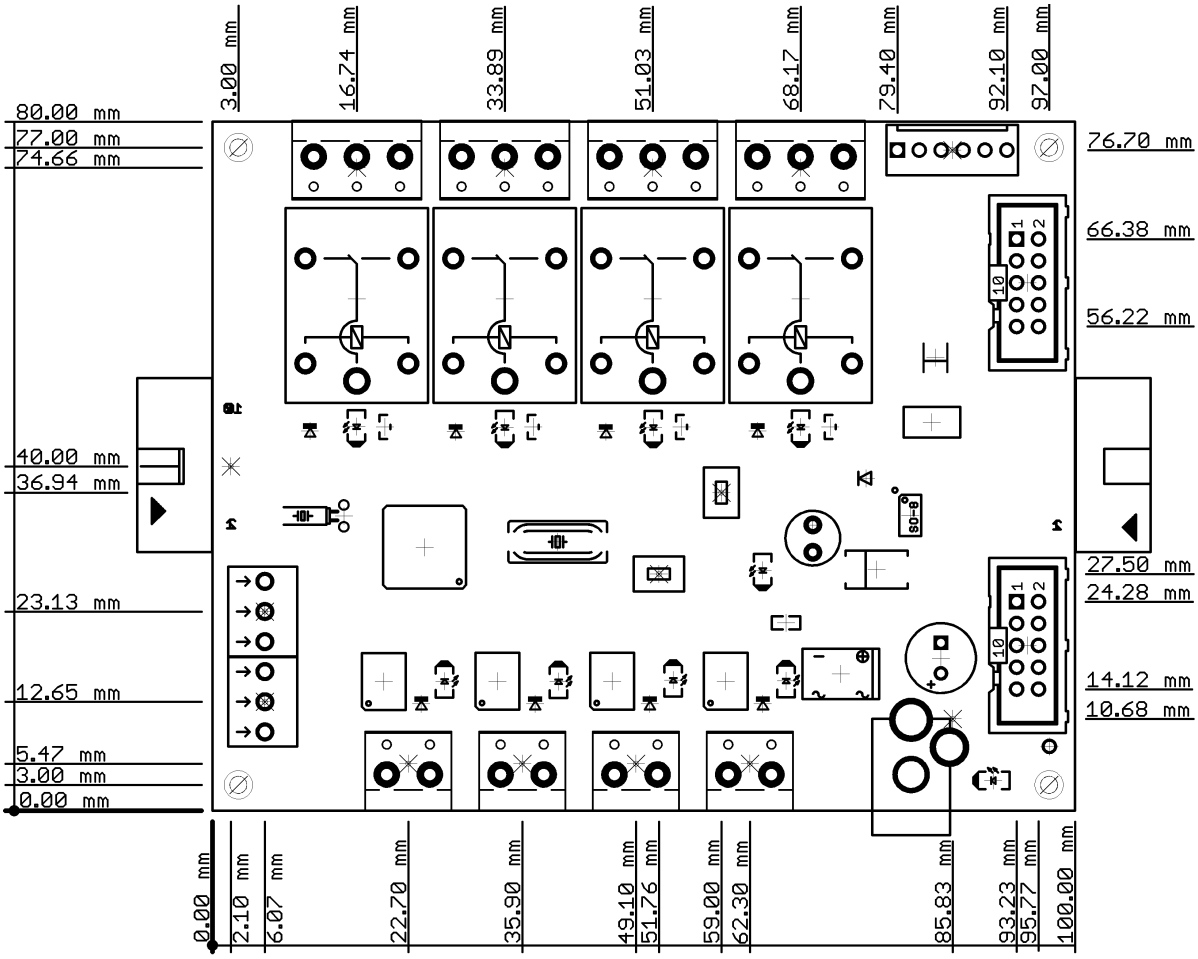
JUMPER DESCRIPTION

There are no jumpers on this board.

INPUT/OUTPUT

User button with name **BUT –** connected to Atmega16L pin 11 ((INT0)PD2).
Reset button with name **RST** – connected to Atmega16L pin 4 (RESET).
Status LED (yellow) with name **STAT** – connected via R11 (330 Ohm) to Atmega16l pin 43 ((AIN1)PB3).
Status LED (red) with name **LED1** – visualize input (IN1) state.
Status LED (red) with name **LED2** – visualize input (IN2) state.
Status LED (red) with name **LED3** – visualize input (IN3) state.
Status LED (red) with name **LED4** – visualize input (IN4) state.
Status LED (green) with name **O1** – visualize relay (REL1) state.
Status LED (green) with name **O2** – visualize relay (REL2) state.
Status LED (green) with name **O3** – visualize relay (REL3) state.
Status LED (green) with name **O4** – visualize relay (REL4) state.
Power-on LED (red) with name **PWR_LED –** shows that +3.3V voltage is applied to the board.

MECHANICAL DIMENSIONS



AVAILABLE DEMO SOFTWARE

- MOD-IO firmware C source and HEX

ORDER CODE

MOD-IO 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:

Board's revision:	Rev. A - create November 2009
Manual's revision:	Rev. B – edited September 2011 added more detailed INTRODUCTION and MECHANICAL DIMENSIONS

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