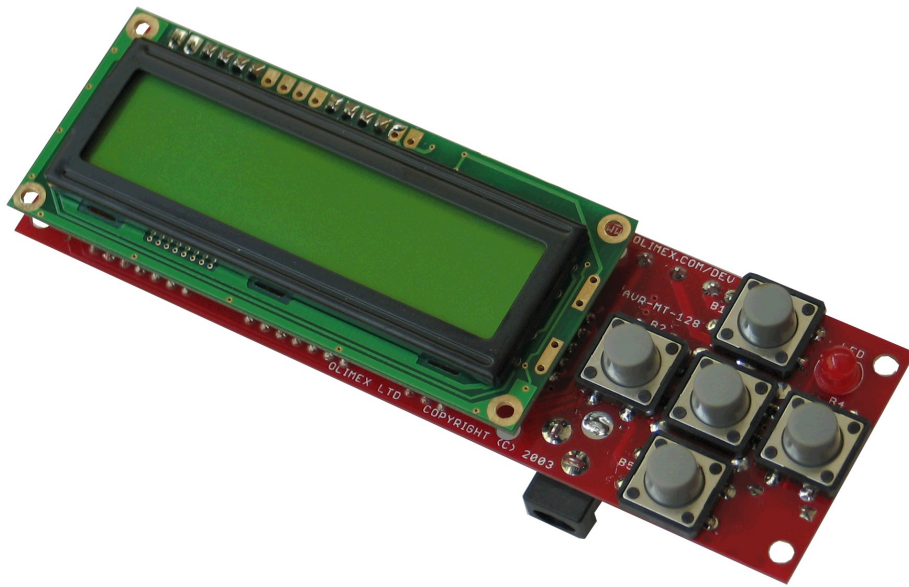




# THE DATASHEET OF AVR-MT128





# AVR-MT128 development board

## Users Manual

Rev.A, July 2008

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## INTRODUCTION:

**AVR-MT128** is simple but powerful board which uses the MCU ATmega128 from Atmel. With its LCD, buttons, relay and variety of interfaces such as RS232 (in two variants – 4 pins and DB9), JTAG, ISCP, Dallas, etc. this board is suitable for different embedded systems applications.

## BOARD FEATURES:

- MCU: **ATmega128-16AI** with 128K Bytes Program Flash, 4K Bytes data EEPROM, 4K Bytes RAM
- JTAG connector for in-circuit programming and debugging with AVR-JTAG
- ICSP 5x2 (10) pin STKxxx compatible connector for in-circuit programming with AVR-PG1B or AVR-PG2B
- RS232 connector with TTL levels
- RS232 interface circuit with Tx, Rx signals
- RS232 DB9 female connector
- Dallas touch button port
- Frequency input
- LCD 16x2 display
- Status LED
- Five buttons
- Buzzer
- Power supply circuit +5V, 78L05 with plug-in power jack and diode bridge
- 32 768 Hz oscillator crystal
- 16 MHz crystal oscillator
- Power supply filtering capacitor
- RESET supervisor IC ZM33064
- RELAY with 10A/250VAC NO and NC contacts with screw terminals
- Extension headers for unused in the schematic ports available for external connection
- PCB: FR-4, 1.5 mm (0,062"), green soldermask, white silkscreen component print
- Four mounting holes 3.3 mm (0.13")
- Dimensions: 120x38 mm (4.7x1.5")

## ELECTROSTATIC WARNING:

The AVR-MT128 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:** RS232 straight male-to-female DB9 cable (Note: this is not a null modem cable)
- Hardware:** Programmer: AVR-PG1, AVR-PG2, AVR-ISP500, AVR-ISP500-TINY, AVR-ISP500-ISO or other compatible tool;  
Debugger: AVR-JTAG, AVR-JTAG-USB or other compatible tool;

**Software:** AVR Studio + WinAVR – free C compiler and debugger can be downloaded at [avrfreaks.org](http://avrfreaks.org) web site. IAR IW for AVR is a commercial software for development of embedded systems software.

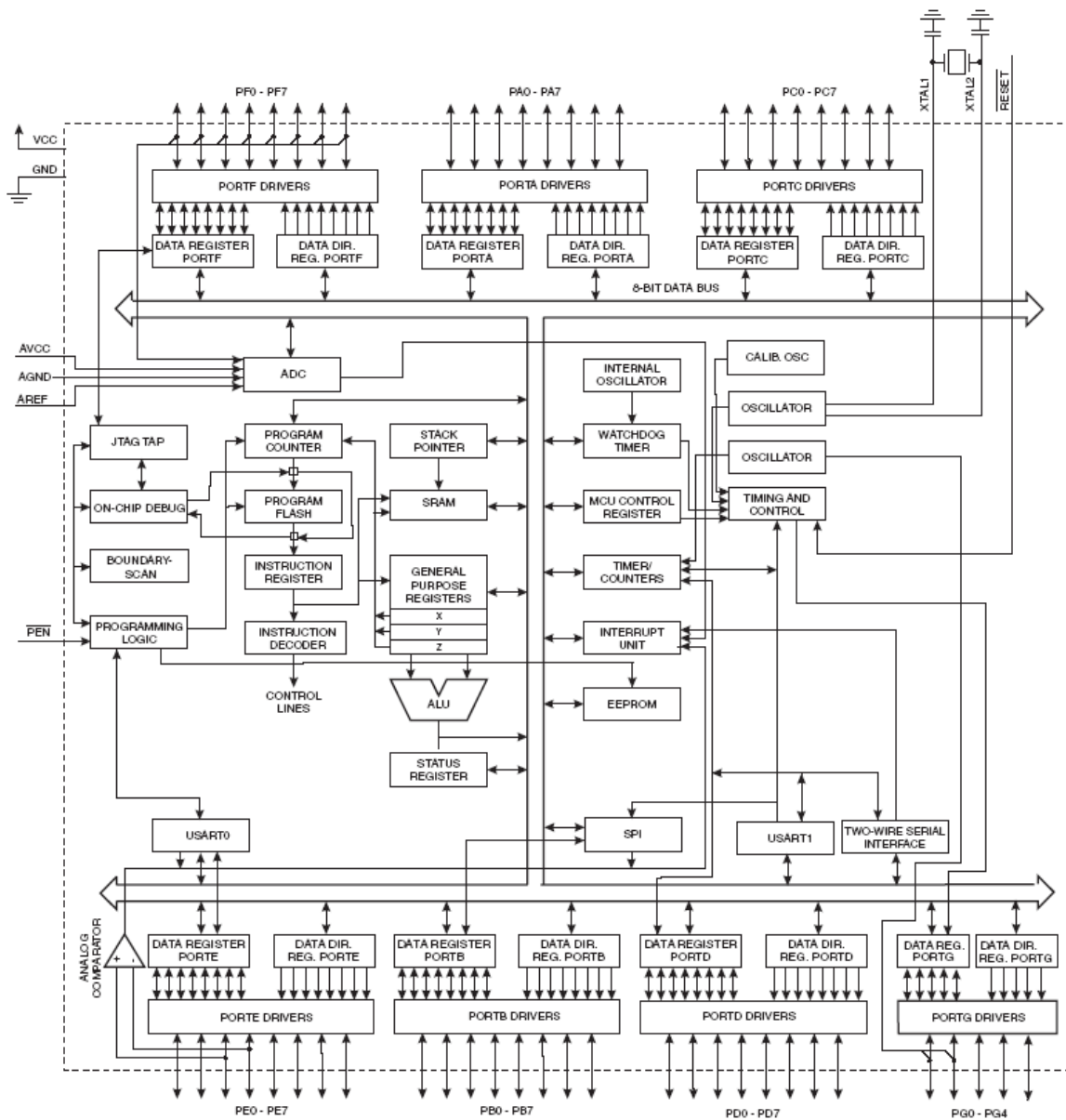
## PROCESSOR FEATURES:

**AVR-MT128** uses ATmega128 MCU from Atmel with the following features:

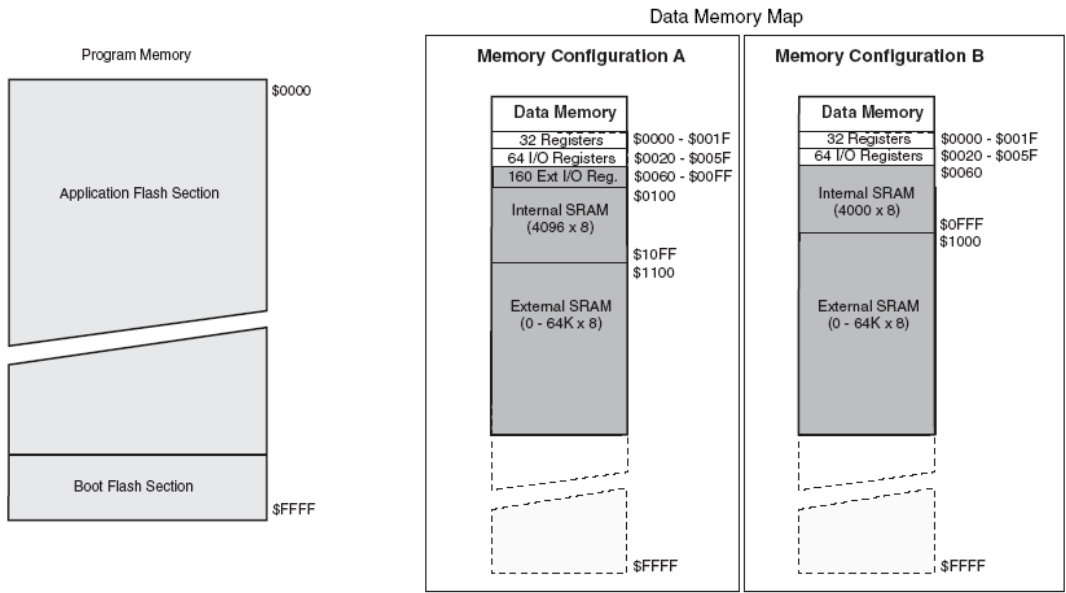
- High-performance, Low-power AVR® 8-bit Microcontroller
- Advanced RISC Architecture
  - o 133 Powerful Instructions – Most Single Clock Cycle Execution
  - o 32 x 8 General Purpose Working Registers + Peripheral Control Registers
  - o Fully Static Operation
  - o Up to 16 MIPS Throughput at 16 MHz
  - o On-chip 2-cycle Multiplier
  - o Nonvolatile Program and Data Memories
  - o 128K Bytes of In-System Reprogrammable Flash  
Endurance: 10,000 Write/Erase Cycles
  - o Optional Boot Code Section with Independent Lock Bits  
In-System Programming by On-chip Boot Program  
True Read-While-Write Operation
  - o 4K Bytes EEPROM  
Endurance: 100,000 Write/Erase Cycles
  - o 4K Bytes Internal SRAM
  - o Up to 64K Bytes Optional External Memory Space
  - o Programming Lock for Software Security
  - o SPI Interface for In-System Programming
- JTAG (IEEE std. 1149.1 Compliant) Interface
  - o Boundary-scan Capabilities According to the JTAG Standard
  - o Extensive On-chip Debug Support
  - o Programming of Flash, EEPROM, Fuses and Lock Bits through the JTAG Interface
- Peripheral Features
  - o Two 8-bit Timer/Counters with Separate Prescalers and Compare Modes
  - o Two Expanded 16-bit Timer/Counters with Separate Prescaler, Compare Mode and Capture Mode
  - o Real Time Counter with Separate Oscillator
  - o Two 8-bit PWM Channels
  - o 6 PWM Channels with Programmable Resolution from 2 to 16 Bits
  - o Output Compare Modulator
  - o 8-channel, 10-bit ADC  
8 Single-ended Channels  
7 Differential Channels  
2 Differential Channels with Programmable Gain at 1x, 10x, or 200x
  - o Byte-oriented Two-wire Serial Interface
  - o Dual Programmable Serial USARTs
  - o Master/Slave SPI Serial Interface
  - o Programmable Watchdog Timer with On-chip Oscillator
  - o On-chip Analog Comparator
- Special Microcontroller Features
  - o Power-on Reset and Programmable Brown-out Detection
  - o Internal Calibrated RC Oscillator
  - o External and Internal Interrupt Sources

- Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby, and Extended Standby
- Software Selectable Clock Frequency
- ATmega103 Compatibility Mode Selected by a Fuse
- Global Pull-up Disable
- I/O and Packages
  - 53 Programmable I/O Lines
  - 64-lead TQFP and 64-pad MLF
- Operating Voltages
  - 4.5 - 5.5V for ATmega128
- Speed Grades
  - 0 - 16 MHz for ATmega128

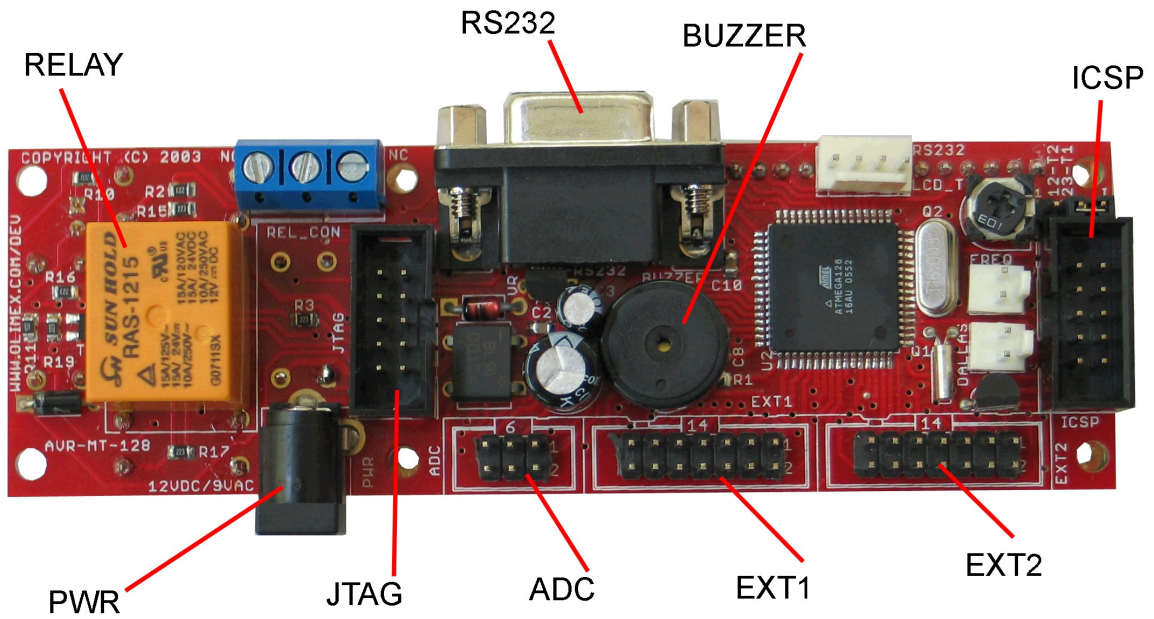
## **BLOCK DIAGRAM:**



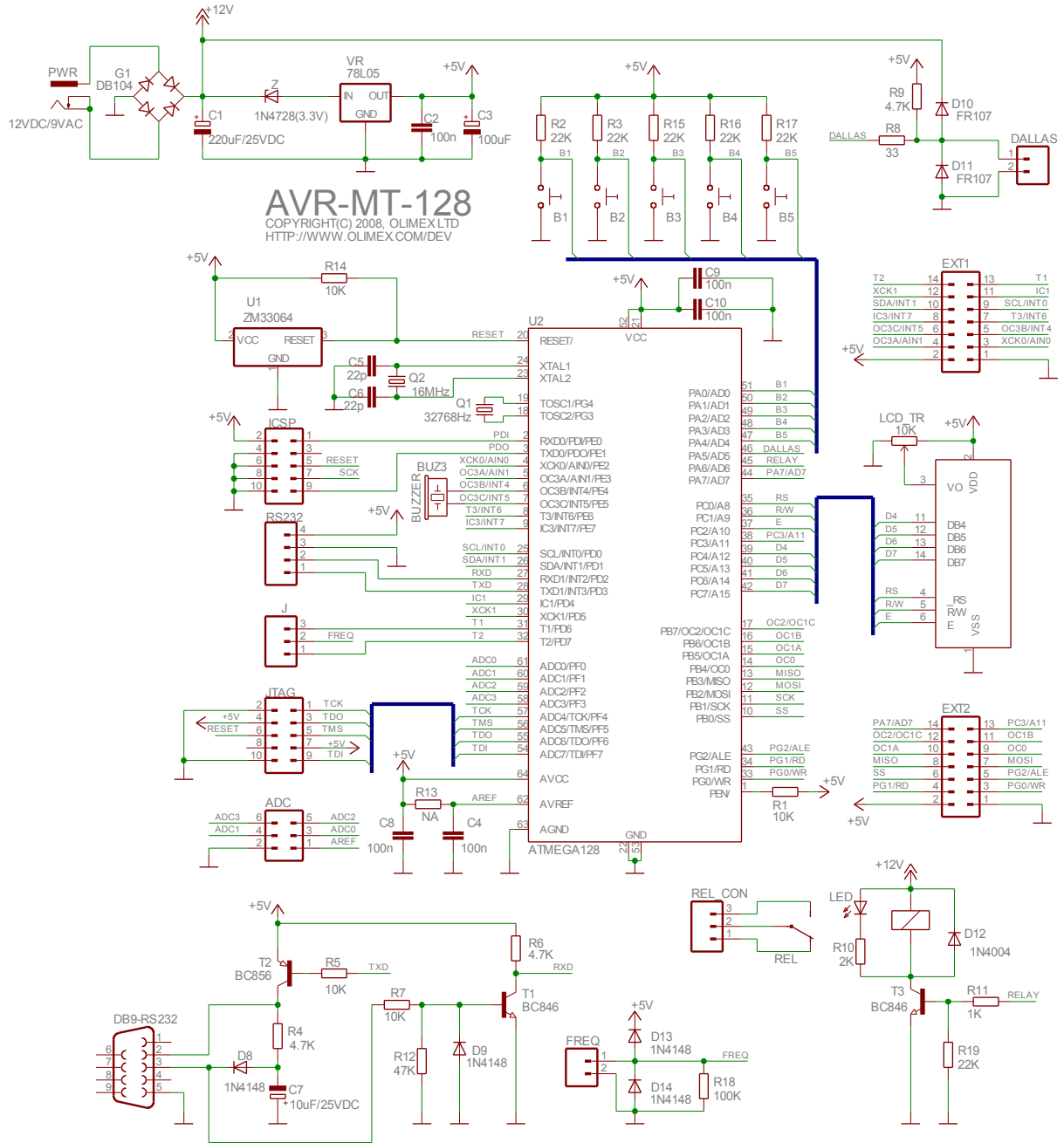
# MEMORY MAP:



# BOARD LAYOUT:



# SCHEMATIC:



## POWER SUPPLY CIRCUIT:

The power supply of AVR-MT128 is taken from Power jack connector. You should apply 9 VAC or +12 VDC at the positive central pin. The consumption of the board is about 30 mA.

## RESET CIRCUIT:

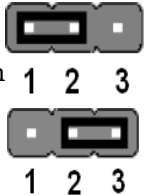
AVR-MT128 reset circuit is made with ZM33064 with typical threshold 4.5V. When the voltage falls below that minimum, the MSU resets.

## CLOCK CIRCUIT:

Quartz crystal 16MHz for maximum performance is connected to ATmega128 pin 23 (XTAL2) and pin 24 (XTAL1). Additional 32 768 Hz tact generator is connected to ATmega128 pin 18 (TOSC2/PG3) and pin 19 (TOSC1/PG4) and supplies the Real Time Clock.

## JUMPER DESCRIPTION:

J



pin 31  
frequency pin  
connected to

1 2 3

1 2 3

This jumper supplies the input user frequency **FREQ** to either (T1/PD6) or pin 32 (T2/PD7). When 1-2 is shorted the input frequency pin is connected to T2. When 2-3 is shorted the input frequency pin is T1.

Default state is 1-2 shorted.

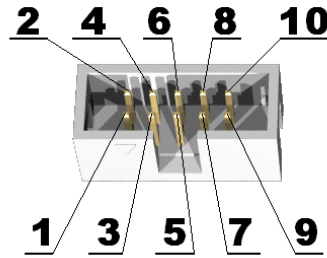
## INPUT/OUTPUT:

**Status LED** (red) connected to the relay.  
**Relay** with name **REL** connected to ATmega128 pin 45 (PA6/AD6).  
**Trimmer LED TR** connected to the LCD.  
**Liquid crystal display.**  
**Buzzer** with name **BUZZ** connected to ATmega128 pin 6 (OC3B/INT4/PE4) and pin 7 (OC3C/INT5/PE5).  
**User button B1** connected to ATmega128 pin 51 (PA0/AD0).  
**User button B2** connected to ATmega128 pin 50 (PA1/AD1).  
**User button B3** connected to ATmega128 pin 49 (PA2/AD2).  
**User button B4** connected to ATmega128 pin 48 (PA3/AD3).  
**User button B5** connected to ATmega128 pin 47 (PA4/AD4).

## CONNECTOR DESCRIPTIONS:

### JTAG:

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



This connector allows programming and debugging via AVR-JTAG or other compatible tools.

**TDI** Input **Test Data In**. This is the serial data input for the shift register.

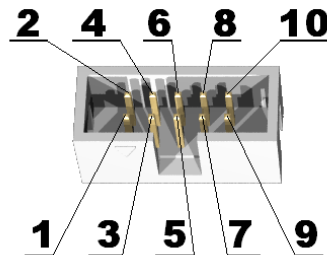
**TDO** Output **Test Data Out**. This is the serial data output for the shift register. Data is shifted out of the device on the negative edge of the TCK signal.

**TMS** Input **Test Mode Select**. The TMS pin selects the next state in the TAP state machine.

**TCK** Input **Test Clock**. This allows shifting of the data in, on the TMS and TDI pins. It is a positive edge triggered clock with the TMS and TCK signals that define the internal state of the device.

### ICSP:

Pin #	Signal Name
1	PDI
2	+5V
3	NC
4	GND
5	RST
6	GND



7	SCK
8	GND
9	PDO
10	GND

This connector allows programming via AVR-PG1, AVR-PG2 or other compatible tool.

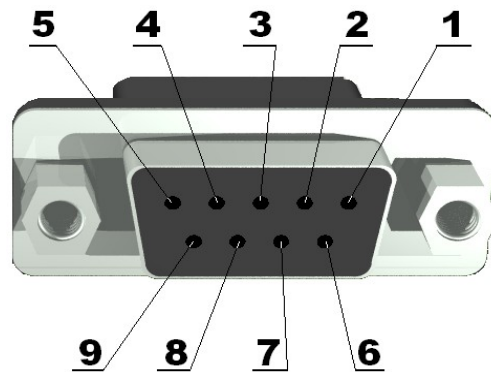
**PDI** Input **Program Data In.** This pin is serial data input for the MCU.

**PDO** Output **Program Data Out.** This pin is serial data output from the MCU.

**SCK** I/O **Serial (Synchronization) Clock.** This is the synchronization signal.

### DB9-RS232:

Pin #	Signal Name
1	NC
2	TXD
3	RXD
4	NC
5	GND
6	NC
7	NC
8	NC
9	NC

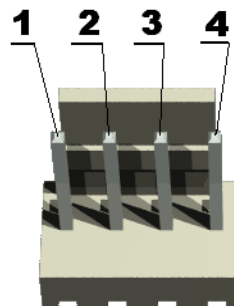


**TXD** Output **Transmit Data.** This is the asynchronous serial data output for the RS232 interface.

**RXD** Input **Receive Data.** This is the asynchronous serial data input for the RS232 interface.

### RS232:

Pin #	Signal Name
1	TXD
2	RXD
3	GND



4	+5V

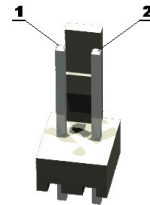
### RELAY CONNECTOR:



This connector provides the user with access to the contact plates of the relay.

### FREQ:

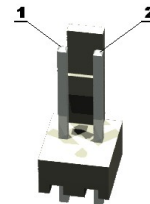
Pin #	Signal Name
1	FREQ
2	GND



External input frequency is applied at pin 1.

### DALLAS:

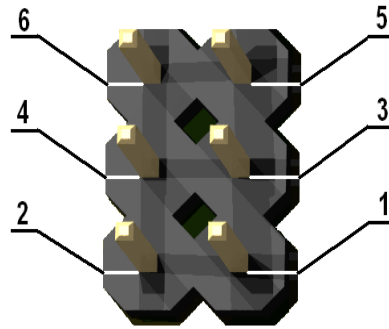
Pin #	Signal Name
1	DALLAS
2	GND



Signal from Dallas chips is applied at pin 1 of the Dallas interface.

## ADC:

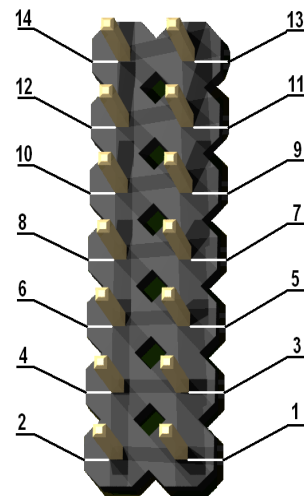
Pin #	Signal Name
1	AREF
2	GND
3	ADC0
4	ADC1
5	ADC2
6	ADC3



Some of the Analog to Digital Converter signals are grouped into an extension.

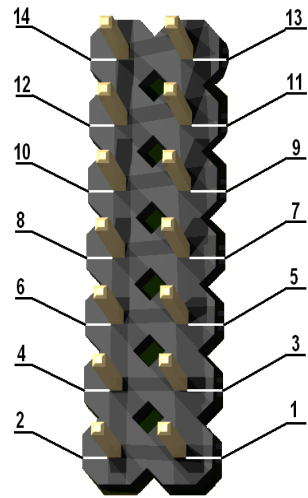
## EXT1:

Pin #	Signal Name
1	GND
2	+5V
3	XCK0/AIN0
4	OC3A/AIN1
5	OC3B/INT4
6	OC3C/INT5
7	T3/INT6
8	IC3/INT7
9	SCL/INT0
10	SDA/INT1
11	IC1
12	XCK1
13	T1
14	T2



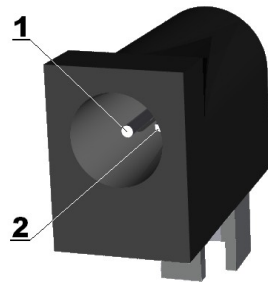
**EXT2:**

Pin #	Signal Name
1	GND
2	+5V
3	PG0/WR
4	PG1/RD
5	PG2/ALE
6	SS
7	MOSI
8	MISO
9	OC0
10	OC1A
11	OC1B
12	OC2/OC1C
13	PC3/A11
14	PA7/AD7



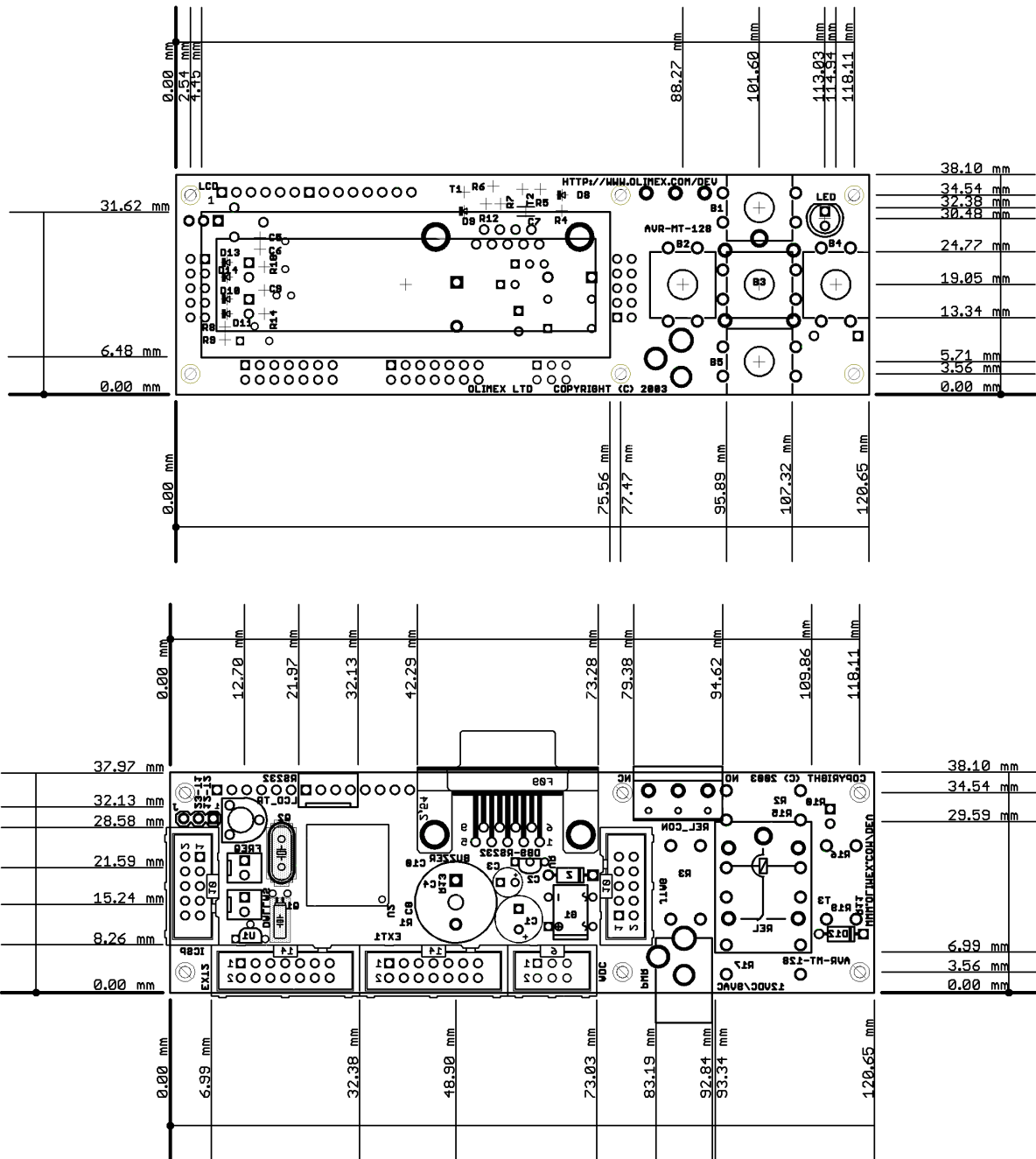
**PWR:**

Pin #	Signal Name
1	PWR
2	GND



You should apply 9 VAC or +12VDC on pin 1.

## MECHANICAL DIMENSIONS:



All measures are in mm.

## AVAILABLE DEMO SOFTWARE:

Check for available demo software for **AVR-MT128** on our website:  
[www.olimex.com/dev](http://www.olimex.com/dev).

## ORDER CODE:

**AVR-MT128 - assembled and tested (no kit, no soldering required)**

**How to order?**

**You can order to us directly or by any of our distributors.**

**Check our web [www.olimex.com/dev](http://www.olimex.com/dev) for more info.**



All boards produced by Olimex are ROHS compliant

### **Revision history:**

REV.A - created September 2008

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