

## SAM7-LA2 development board

## Users Manual

Rev.A, July 2008

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## INTRODUCTION:

SAM7-LA2 is good platform for low power uC Linux applications. It uses the AT91SAM7A2 MCU which is targeting low power applications. The on board 4MB of RAM and 1 MB of Flash allow RTOS like uclinux, ucos, etc to be used. The CAN , RS232, 100Mbit Ethernet ports allow this board to be used in many applications.

## BOARD FEATURES:

- MCU: **AT91SAM7A2** 16/32-bit ARM7TDMI™ with 16K Bytes RAM, 4x CAN, RTT, 10 bit ADC 348 ksps, 2x UARTs, 2x SPI, 3x 32-bit TIMERS, 4x PWM, SSC, WDT, PDC (DMA) for all peripherals, up to 30MHz operation
- Standard JTAG connector with ARM 2x10 pin layout for programming/debugging with ARM-JTAG
- 4MB SRAM (2MB x 16-bit) PSRAM
- 1MB (512K x 16 bit) 55ns MX26LV800BTC FLASH
- Ethernet 10/100 with DM9000E + RJ45 connector with two status LEDs
- CAN driver and interface
- RS232 driver and interface
- SD/MMC card connector
- Button
- On-board voltage regulator 3.3V with up to 800mA current
- Single power supply: 6V AC or DC required, board can take power from CAN or external pin too
- Power supply LED
- Power supply filtering capacitor
- RESET circuit, RESET button
- 6 MHz crystal on socket
- 32768 Hz for RTC
- Extension headers for all uC ports
- PCB: FR-4, 1.5 mm(0.062"), soldermask, silkscreen component print
- Dimension: 11 x 80 mm (4.6 x .15")

## ELECTROSTATIC WARNING:

The SAM7-LA2 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:** You will need different cables depending on the used programming/debugging tool. If you use Olimex's ARM-JTAG, you will need a LPT cable. If you use ARM-USB-OCD or ARM-USB-TINY, you will need USB A-B cable. In the case of ARM-USB-OCD you could also use RS232 cable. You might need other cables in case of other programming/debugging hardware or software tools.

**Hardware:** Programmer/Debugger – **ARM-JTAG, ARM-USB-TINY** or **ARM-USB-OCD** or other compatible programming/debugging tool.

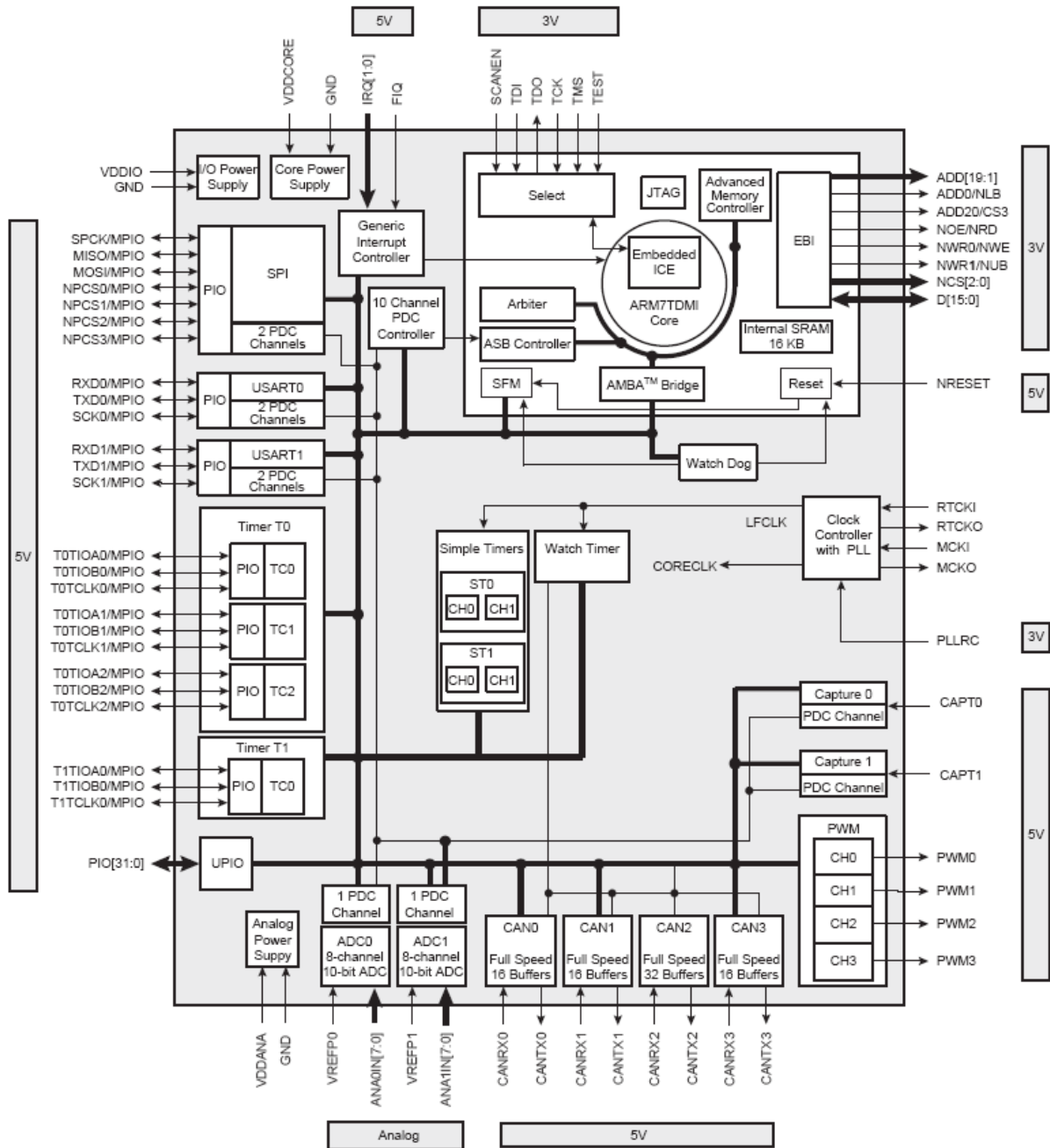
**Software:** **GCC, IAR EWARM** or other compatible software platforms.

## PROCESSOR FEATURES:

**SAM7-LA2** board uses MCU **AT91SAM7A2** from **Atmel** with these features:

- ARM7TDMI® ARM® Thumb® Processor Core
  - o High Performance 32-bit RISC
  - o High-density 16-bit Instruction set (Thumb)
  - o Leader in MIPS/Watt
  - o Embedded ICE (In Circuit Emulation)
- 16 Kbytes Internal SRAM
- Fully Programmable External Bus Interface (EBI)
  - o Maximum External Address Space of 6 Mbytes, Up to Four Chip Select Lines
- 8-level Priority, Vectored Interrupt Controller
  - o Three External Interrupts Including One Fast Interrupt Line
- Ten-channel Peripheral Data Controller (PDC)
- 57 Programmable I/O Lines
- Four 16-bit General Purpose Timers (GPT)
  - o Three Configurable Modes: Counter, PWM, Capture
  - o Four External Clock Inputs, Three Multi-purpose I/O Pins per Timer
- Four 16-bit Simple Timers (ST)
- Four Channel 16-bit Pulse Width Modulation (PWM)
- Four CAN Controllers 2.0A and 2.0B Full CAN
  - o One with 32 Buffers, Three with 16 Buffers
- Two USARTs
  - o Support for J1587 and LIN Protocols
- One Master/Slave SPI Interface
  - o 8 to 16-bit Programmable Data Length
  - o Four External Serial Peripheral Chip Selects
- Two 8-channel 10-bit Analog to Digital Converters (ADC)
- Two 16-bit Capture Modules (CAPT)
- Programmable Watch Timer (WT)
- Programmable Watchdog (WD)
- Power Management Controller (PMC)
  - o 32 kHz Oscillator, Main Oscillator and PLL
- IEEE 1149.1 JTAG Boundary-scan on all Digital Pins
- Fully Static Operation: 0 Hz to 30 MHz at VDDCORE = 3.3V, 85°C
- 3.0V to 5.5V Operating Voltage Range
- 3.0V to 3.6V Core, Memory and Analog Voltage Range
- -40° to +85°C Operating Temperature Range
- Available in a 176-lead LQFP Package

# BLOCK DIAGRAM:



## MEMORY MAP:

Memory Map in Reboot Mode

Memory Space	Application	Abort
0xFFFFFFFF – 0xFFE00000	Peripheral devices	No
0xFFDFFFFFFF – 0x00400000	Reserved	Yes
0x003FFFFFFF – 0x00300000	Internal RAM 16 kbytes repeated 64 times	No
0x002FFFFFFF – 0x00200000	Reserved (Read as '0')	No
0x001FFFFFFF – 0x00100000	Reserved	Yes
0x000FFFFFFF – 0x00000000	External memory on NCS0	No

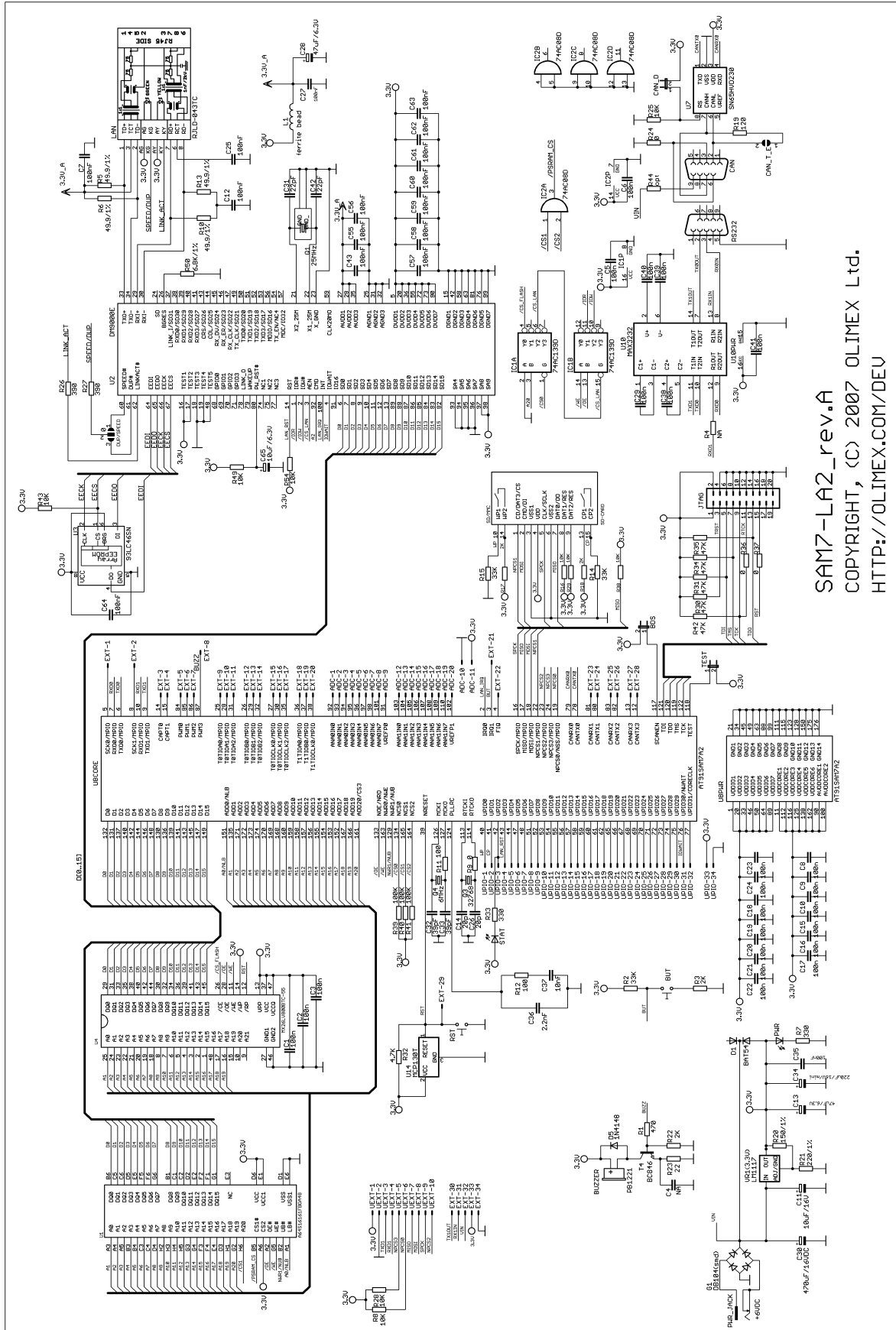
Memory Map in Remap Mode

Memory Space	Application	Abort
0xFFFFFFFF – 0xFFE00000	Peripheral devices	No
0xFFDFFFFFFF – 0x80000000	Reserved	Yes
0x7FFFFFFF – 0x40000000	External memories (up to 4) Memory values repeated within the page size programmed	Yes, outside of page defined in the AMC
0x3FFFFFFF – 0x00300000	Reserved	Yes
0x002FFFFFFF – 0x00100000	Reserved (Read as '0')	No
0x000FFFFFFF – 0x00000000	Internal RAM 16 kbytes repeated 64 times	No

### External Memory Map

<b>Memory Space</b>	<b>Size</b>	<b>Application</b>
0x(01XXb)XXFFFFFF – 0x(01XXb)XX00000	Up to 1 Mbytes	External memory on CS3
0x(01XXb)X1FFFFFF – 0x(01XXb)XX00000	Up to 2 Mbytes	External memory on NCS2
0x(01XXb)X1FFFFFF – 0x(01XXb)XX00000	Up to 2 Mbytes	External memory on NCS1
0x(01XXb)X1FFFFFF – 0x(01XXb)XX00000	Up to 2 Mbytes	External memory on NCS0

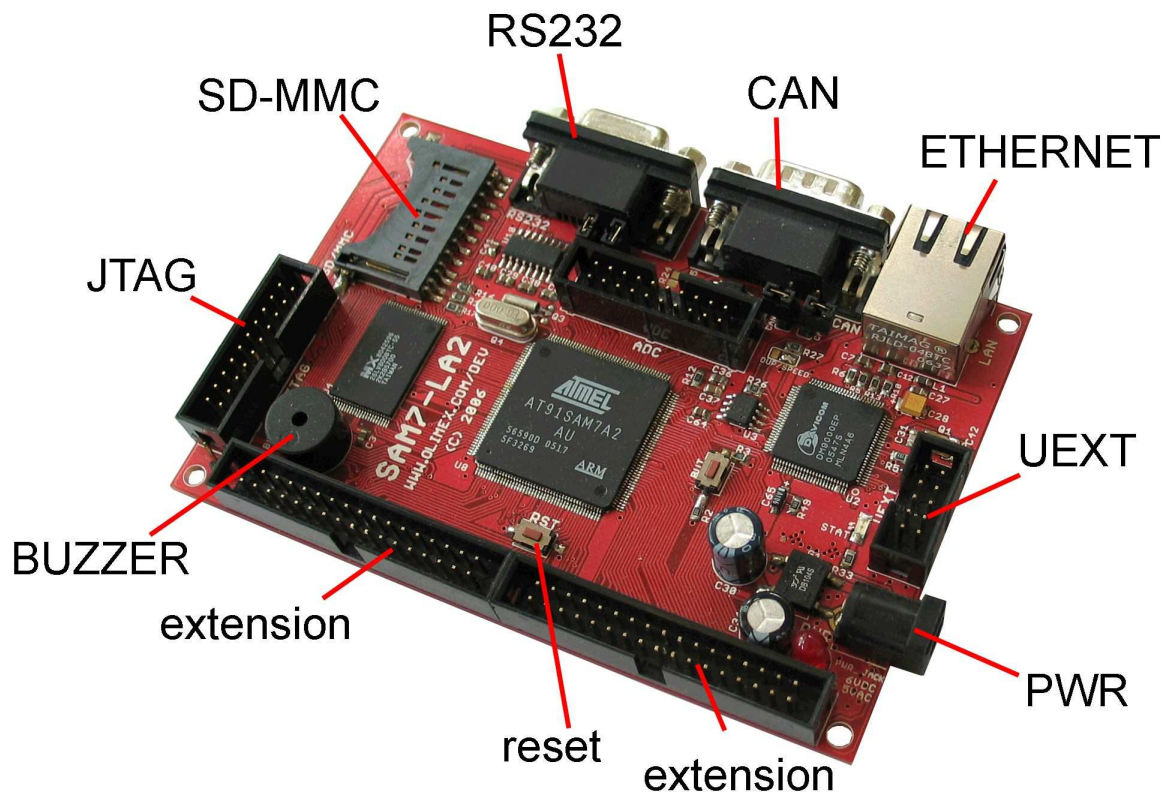
# SCHEMATIC:



SAM7-LA2\_rev.A  
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 HTTP://OLIMEX.COM/DEV



## BOARD LAYOUT:



## POWER SUPPLY CIRCUIT:

**SAM7-LA2** should be powered with 6VAC or 6VDC applied at the power jack. It could also take power over the CAN or from an extension pin.

The board power consumption is about 100mA.

## RESET CIRCUIT:


**SAM7-LA2** reset circuit is made with the circuit MCP130T which detects low voltage supply for the board. You could also reset the MCU by pushing the RST button.


## CLOCK CIRCUIT:


Quartz crystal 6 MHz is connected to AT91SAM7A2 pin 126 (MCKI) and pin 127 (MCKO).


Quartz crystal 32.768 kHz is connected to AT91SAM7A2 pin 113 (RTCKI) and pin 114 (RTCKO) and supplies the Real Time Clock.


## JUMPER DESCRIPTION:

**DUP/SPEED**  
connected to pin 61 (#DUP)  When 1-2 are shorted, DM9000E pin 60 (#SPEED) is KG pin of the LAN connector. When 2-3 are shorted, DM9000E is connected to KG pin of the LAN connector.  
Default position is 1-2 shorted.

**CAN\_T\_E**  
the bus it  This jumper assures correct work of the CAN. At each end of the bus it should be closed. This means that if you have only two devices with CAN, the jumpers of both devices should be closed. If you have more than two devices, only the two end-devices should be closed.  
Default state is closed.

**CAN\_D**  
 If you put this jumper, you disable the CAN interface.  
Default state is open.

**TEST**  
 If you put this jumper, you enable TEST mode for the MCU.  
Default state is open.

**BDS**  
boundary scan.  Boundary Scan. If you put this jumper, you enable the JTAG  
Default state is open.

## INPUT/OUTPUT:

**Button** with name **BUT**, connected to AT91SAM7A2 pin 3 (IRQ1).

**Reset button** with name **RST**, connected to AT91SAM7A2 pin 39 (NRESET).

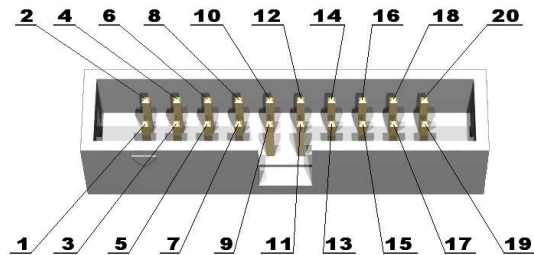
**User status LED** with name **STAT**, connected to AT91SAM7A2 pin 42 (UPIO2).

**Power-on LED** with name **PWR** showing that 3.3V voltage is available.

**Buzzer PB1221** connected to AT91SAM7A2 pin 87 (PWM3).

## EXTERNAL CONNECTORS DESCRIPTION:

### JTAG:



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

**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.

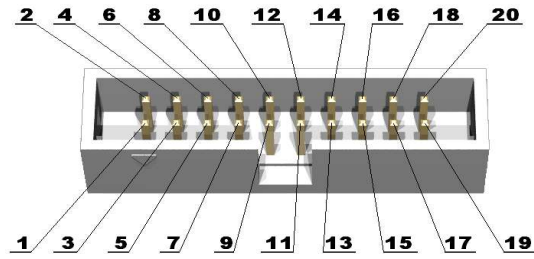
**TCK** Input **Test Clock**. This allows shifting of the data in, on the TMS and TDI pins. It is a positive edge triggered clock with the TMS and TCK signals that define the internal state of the device.

**TRST** Input **Target Reset**.

**RTCK** Output **Return Clock**. This is a synchronization signal which the JTAG connector uses to acknowledge it is ready to receive/transmit.

JTAG is used to to program and debug the MCU.

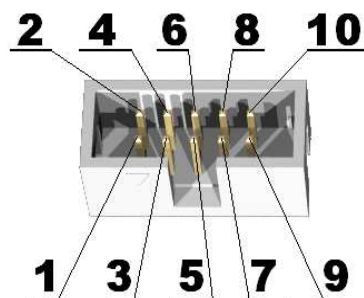
**ADC:**



Pin #	Signal Name	Pin #	Signal Name
1	ANA0IN0	2	ANA0IN1
3	ANA0IN2	4	ANA0IN3
5	ANA0IN4	6	ANA0IN5
7	ANA0IN6	8	ANA0IN7
9	VREFP0	10	GND
11	+3.3V	12	ANA1IN0
13	ANA1IN1	14	ANA1IN2
15	ANA1IN3	16	ANA1IN4
17	ANA1IN5	18	ANA1IN6
19	ANA1IN7	20	VREFP1

**UEXT:**

Pin #	Signal Name
1	+3.3V
2	GND
3	TXD1
4	RXD1
5	NPCS3



6	NPCS0
7	MISO
8	MOSI
9	SPCK
10	NPCS2

**TXD1** Output **Transmit Data 1**. This is the asynchronous serial data output 1 (RS232) for the UART controller.

**RXD1** Input **Receive Data 1**. This is the asynchronous serial data input 1 (RS232) for the UART controller.

**NPCS3** Output **SPI Chip Select 3**.

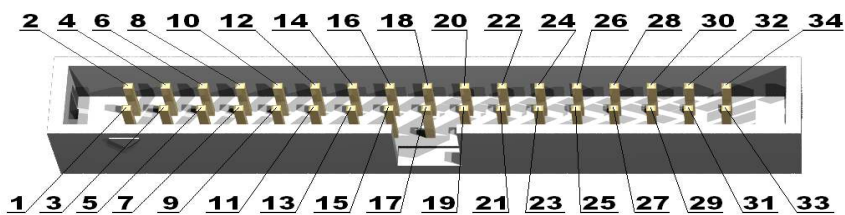
**NPCS0** Output **SPI Chip Select 0**.

**MISO** I/O **Master In Slave Out**. SPI data transfer signal. It is either input or output depending on whether the MCU is master or slave.

**MOSI** I/O **Master Out Slave In**. SPI data transfer signal. It is either input or output depending on whether the MCU is master or slave.

**NPCS2** Output **SPI Chip Select 2**.

**EXT:**

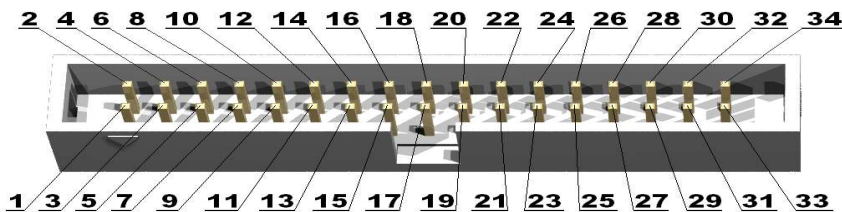


Pin #	Signal Name	Pin #	Signal Name
1	SCK0/MPIO	2	SCK1/MPIO
3	CAPT0	4	CAPT1
5	PWM0	6	PWM1
7	PWM2	8	PWM3/BUZZ
9	T0TIOA0/MPIO	10	T0TIOA1/MPIO
11	T0TIOA2/MPIO	12	T0TIOB0/MPIO
13	T0TIOB1/MPIO	14	T0TIOB2/MPIO
15	T0TIOCLK0/MPIO	16	T0TIOCLK1/MPIO
17	T0TIOCLK2/MPIO	18	T1TIOA0/MPIO
19	T1TIOB0/MPIO	20	T1TIOCLK0/MPIO

21	IRQ1/BUT	22	FIQ
23	CANRX1	24	CANTX1
25	CANRX2	26	CANTX2
27	CANRX3	28	CANTX3
29	RST	30	TX1OUT
31	RX1IN	32	VIN
33	+3.3V	34	GND

**CANRX1** Input      **CAN Receive Data 1.**  
**CANTX1** Output    **CAN Transmit Data 1.**  
**CANRX2** Input      **CAN Receive Data 2.**  
**CANTX2** Output    **CAN Transmit Data 2.**  
**CANRX3** Input      **CAN Receive Data 3.**  
**CANTX3** Output    **CAN Transmit Data 3.**  
**TX1OUT** Output    **Transmit Data 1.** This is the asynchronous serial data output 1 (RS232) after the UART controller.  
**RX1IN** Input        **Receive Data 1.** This is the asynchronous serial data input 1 (RS232) before the UART controller.

**UPIO:**

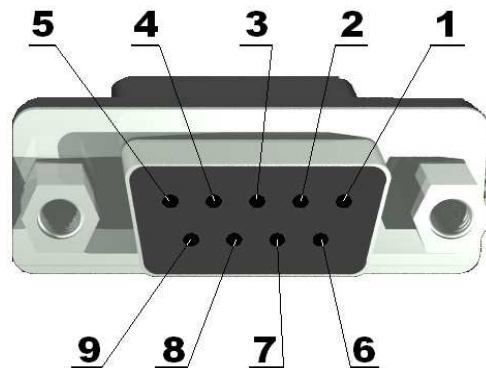


Pin #	Signal Name	Pin #	Signal Name
1	UPIO0/WP	2	UPIO1/CP
3	UPIO2	4	UPIO3/LAN_RST
5	UPIO4	6	UPIO5
7	UPIO6	8	UPIO7
9	UPIO8	10	UPIO9
11	UPIO10	12	UPIO11
13	UPIO12	14	UPIO13
15	UPIO14	16	UPIO15

17	UPIO16	18	UPIO17
19	UPIO18	20	UPIO19
21	UPIO20	22	UPIO21
23	UPIO22	24	UPIO23
25	UPIO24	26	UPIO25
27	UPIO26	28	UPIO27
29	UPIO28	30	UPIO29
31	UPIO30/IOWAIT	32	UPIO31
33	+3.3V	34	GND

### RS232:

Pin #	Signal Name
1	NC
2	TXD0
3	RXD0
4	NC
5	GND
6	NC
7	NC
8	NC
9	NC

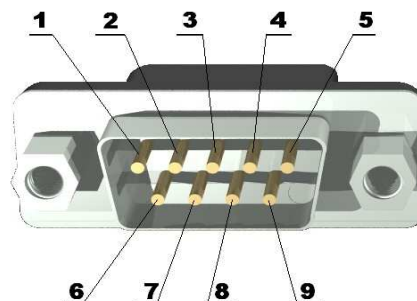


**TXD0** Output **Transmit Data**. This is the asynchronous serial data output (RS232) for the shift register on the UART controller.

**RXD0** Input **Receive Data**. This is the asynchronous serial data input (RS232) for the shift register on the UART controller.

### CAN:

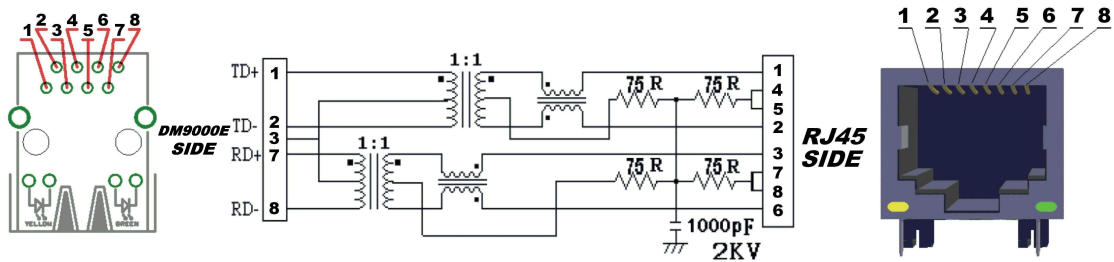
Pin #	Signal Name
1	NC



2	CANL
3	GND
4	NC
5	NC
6	GND
7	CANH
8	NC
9	VIN

CANL and CANH are either differential input, or differential output depending on the function of the SN65HVD230 CAN controller (receiving or transmitting data). VIN is voltage input and through this pin the board could be power-supplied.

**LAN:**



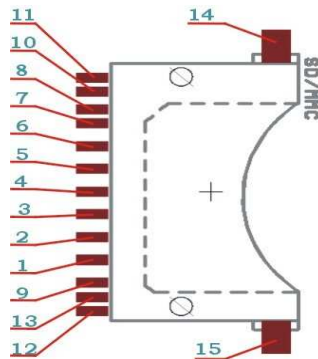
Pin #	Signal Name Chip Side	Pin #	Signal Name Chip Side
1	TD+	5	Not Connected (NC)
2	TD-	6	Not Connected (NC)
3	3.3V	7	RD+
4	Not Connected (NC)	8	RD-

LED	Color	Usage
Right	Yellow	Activity
Left	Green	100Mbits/s (Half/Full duplex)



- TD-** Output Differential signal output.
- TD+** Output Differential signal output.
- RD-** Input Differential signal input.
- RD+** Input Differential signal input.

**SD/MMC card slot:**



Pin #	Signal Name	Pin #	Signal Name
1	NPCS1	2	MOSI
3	GND	4	+3.3V
5	SPCK	6	GND
7	MISO	8	+3.3V
9	+3.3V	10	WP
11	-	12	-
13	+3.3V	14	+3.3V
15	CP		

**NPCS1** Output **SPI Chip Select 1**. The signal on this pin enables or disables the SD/MMC.

**MOSI** Output **Master Out Slave In**. As the access to the memory is via SPI interface, this is data output from the MCU (which is master) and input for the memory card (which is slave).

**SPCK** Output **Serial (Synchronization) Clock**. This is the synchronization clock for the data transfer.

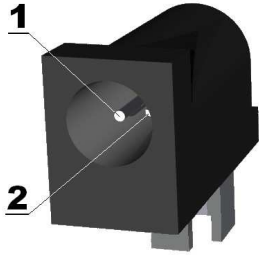
**MISO** Input **Master In Slave Out**. As the access to the memory card is via SPI interface, this is data input for the MCU (which is master) and data output from the memory card (which is slave).

**WP** Input **Write Protect**. This signal is input for the MCU.

**CP** Input **Card Present**. This signal is input for the MCU.

**PWR:**

Pin #	Signal Name
1	PWR
2	GND

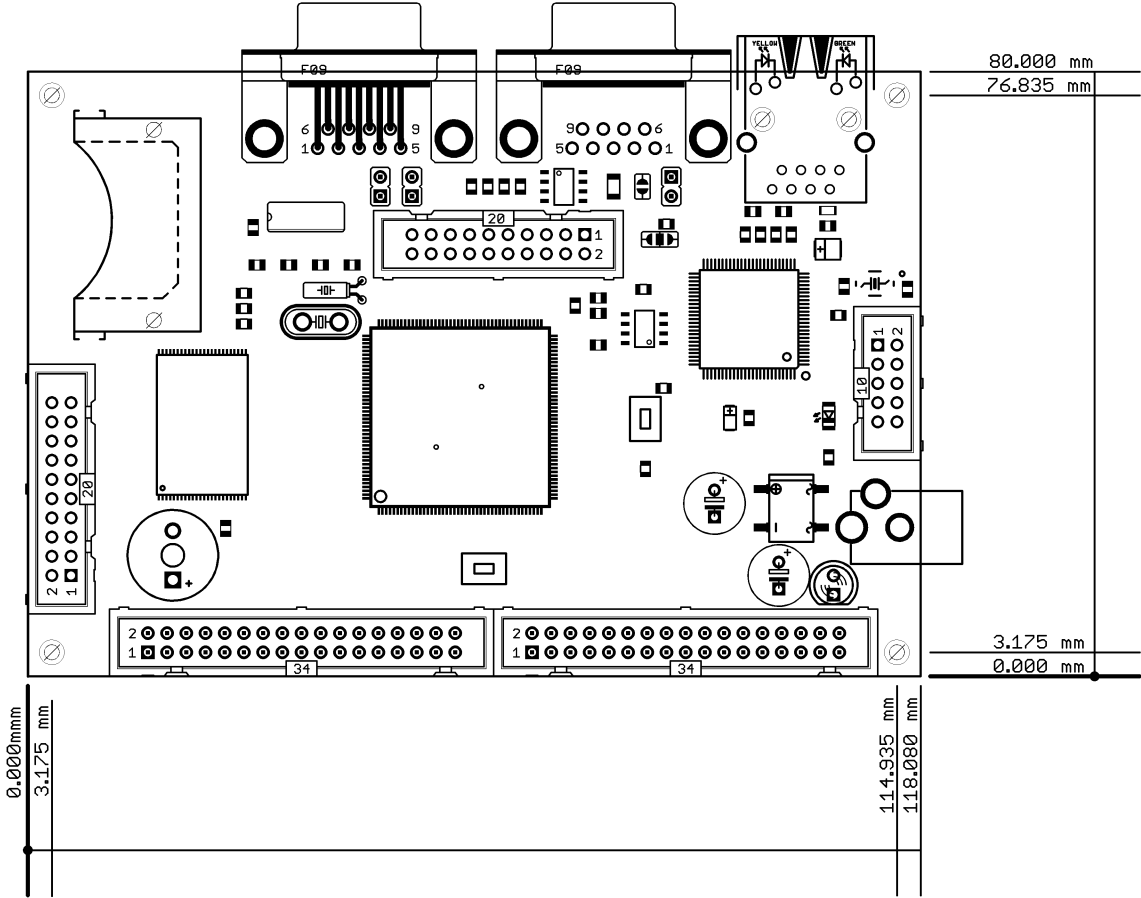


+6VDC.

At the PWR pin should be applied voltage

4.5VAC or

**MECHANICAL DIMENSIONS:**



All measures are in Inches.

**AVAILABLE DEMO SOFTWARE:**

You could find information about SAM7-LA2 demo software on [www.olimex.com/dev](http://www.olimex.com/dev).

## **ORDER CODE:**

**SAM7-LA2** – 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            July 2008

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