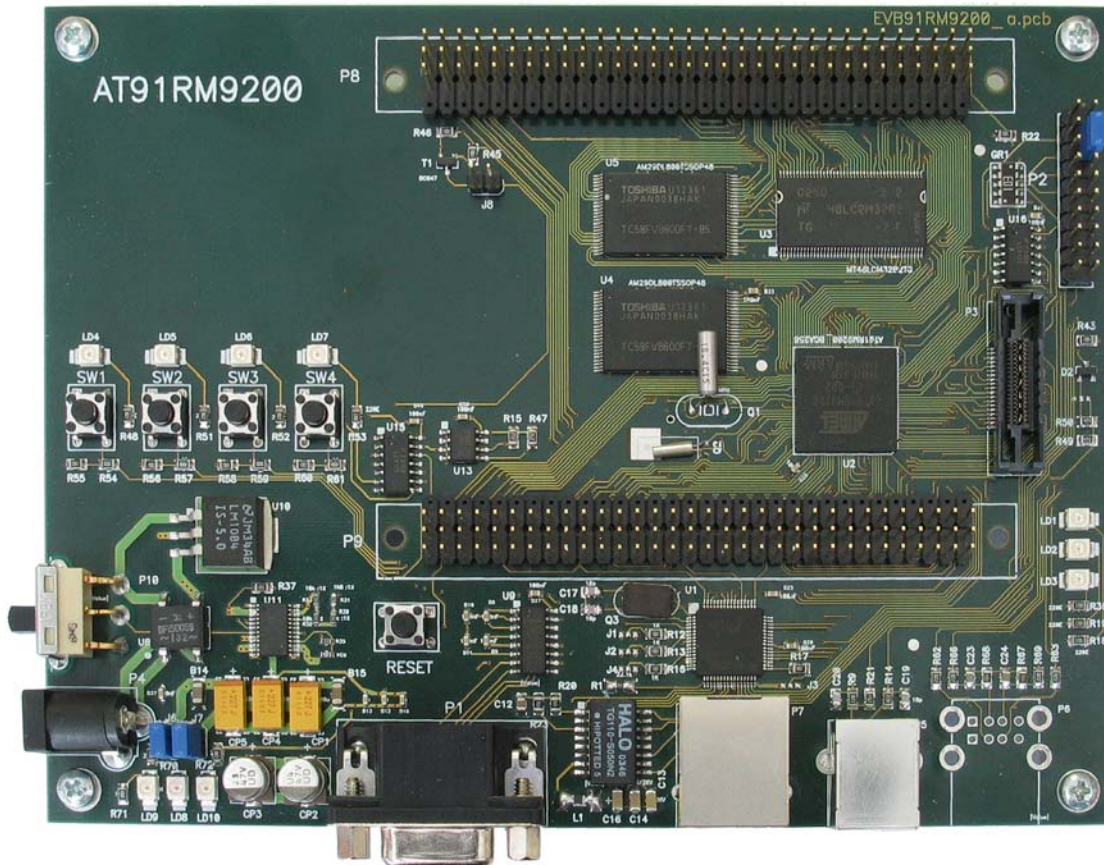


## User's Guide

# Atmel AT91RM9200 Evaluation Board

|               |              |
|---------------|--------------|
| Ordering code | ITAT91RM9200 |
|---------------|--------------|



*ITAT91RM9200 Evaluation Board*

# **Contents**

|                                      |          |
|--------------------------------------|----------|
| <b>Contents</b>                      | <b>2</b> |
| <b>About the ITAT91RM9200 board</b>  | <b>3</b> |
| Features                             | 3        |
| <b>Quick start</b>                   | <b>3</b> |
| Board Installation                   | 3        |
| <b>Functional Description</b>        | <b>4</b> |
| Power supply                         | 4        |
| Expansion Ports                      | 4        |
| On-Board LED's and push buttons      | 6        |
| Ethernet Port                        | 6        |
| Serial port                          | 7        |
| USB Host and Device ports            | 7        |
| JTAG and ETM Debug Ports             | 8        |
| Reset and Boot                       | 8        |
| <b>On-Board Software</b>             | <b>9</b> |
| Testing the ITAT91RM9200 board       | 9        |
| Running the uCOS-II Operating System | 9        |
| <b>Schematic</b>                     | <b>9</b> |

## About the ITAT91RM9200 board

ITAT91RM9200 is a medium size (160x120 mm) board based on Atmel's AT91RM9200 32-bit ARM920T RISC microcontroller. The board is well suited for a wide range of application development and prototyping purposes. The evaluation board is capable of running different kinds of operating systems and debugging systems like the iSYSTEM iC3000 debugger using JTAG and ETM debugging resources.

## Features

The ITAT91RM9200 board provides the following features:

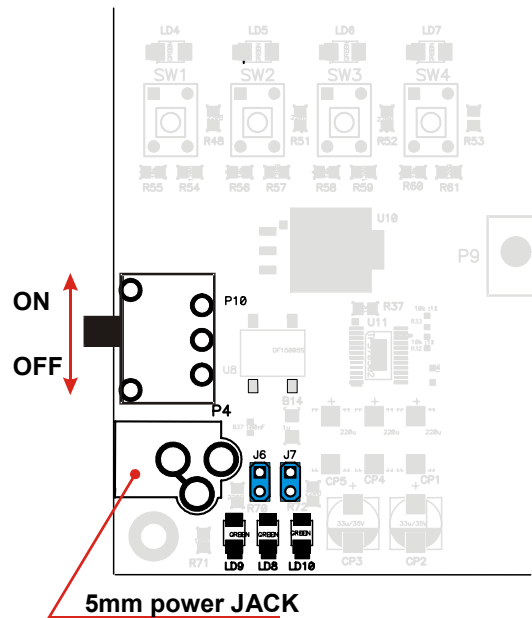
- AT91RM9200 microcontroller with 32-bit ARM920T core capable running at 180Mhz and up to 200 MIPS throughput,
- 8MB of 32-bit external SDRAM (143MHz)
- 2MB FLASH memory (2x TC58FVB800) with 16-bit wide bus
- two-wire in-system programmable serial EEPROM
- 10/100 BaseT fast Ethernet port, based on LXT972A Ethernet PHY Transceiver
- USB 2.0 device and host port (not assembled)
- General purpose RS-232 serial port
- LED indicators for power supply and Ethernet activity
- 4 programmable LEDs and 4 push buttons
- 8-24 Vdc power supply

## Quick start

### Board Installation

The board is designed to work with any regulated or unregulated DC power supply, which is capable of delivering 8-24 Vdc, 400mA on a standard 5mm power JACK connector. The polarity of the power supply is not critical. When the power is switched ON by the P10 switch, the LD8 and LD9 light up. When the power switch is in the OFF state and the power cable is connected to the P4, the LD10 should light up. If it does not, check the power supply connection. If the jumpers marked as J6 and J7 are not populated, switch the board OFF, disconnect the power cable, set them like they are shown on the picture and then switch the board ON.

***Do not remove or install J6 and J7 while the power supply connection is plugged in to P4!***



## Functional Description

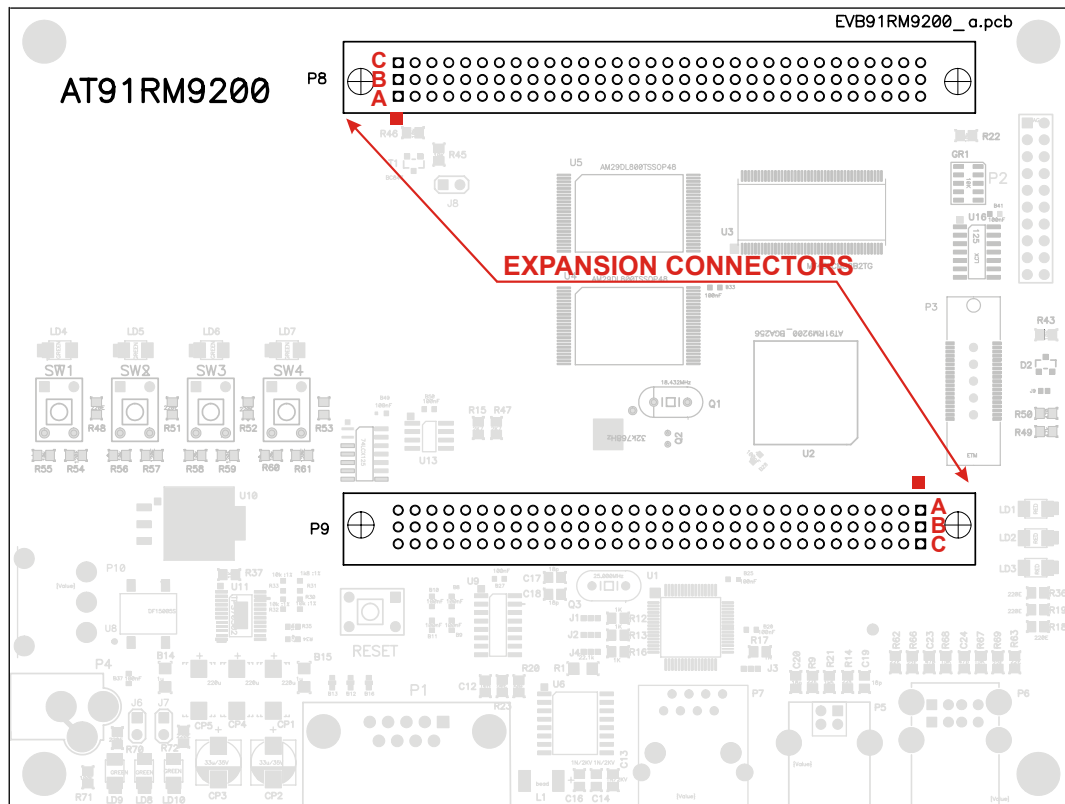
Using this board, the user can evaluate ARM ARM920T core and the Atmel AT91RM9200 CPU with belonging peripherals. It can also be used as a development platform. The user can exploit available debug capabilities by connecting the development tool to a standard 20-pin ARM debug connector or to the 38-pin Mictor connector, which connects to the on-chip debug (ARM EmbeddedICE) and trace (ETM) module.

## Power supply

The board can be powered from any regulated or unregulated power supply. The board has low-drop voltage regulators providing low voltage such as +5V for USB, +3.3V for local peripherals, CPU and custom made hardware and +1.8V for CPU core supply. The +3.3V power supply is also accessible through the expansion connectors P8 and P9.

## Expansion Ports

The I/O expansion connectors P8 and P9 provide easy access to general-purpose I/O lines from the CPU, +3.3V and GND. The board can be assembled either with DIN 41 612 or any 3x32 connector on a 0.1" (2.54mm) pitch.



| PIN | P8       |       |       |
|-----|----------|-------|-------|
|     | PIN NAME |       |       |
|     | ROWS     |       |       |
|     | A        | B     | C     |
| 1   | +3.3V    | +3.3V | +3.3V |
| 2   | GND      | GND   | GND   |
| 3   | PD2      | PD1   | PD0   |
| 4   | PD5      | PD4   | PD3   |
| 5   | A1       | A0    | PD6   |
| 6   | A4       | A3    | A2    |
| 7   | A7       | A6    | A5    |
| 8   | GND      | GND   | GND   |
| 9   | A10      | A9    | A8    |
| 10  | A13      | A12   | A11   |
| 11  | A16      | A15   | A14   |
| 12  | A19      | A18   | A17   |
| 13  | A22      | A19   | A20   |
| 14  | GND      | GND   | GND   |
| 15  | D0       | D1    | D2    |
| 16  | D3       | D4    | D5    |
| 17  | D6       | D7    | D8    |
| 18  | D9       | D10   | D11   |
| 19  | GND      | GND   | GND   |
| 20  | D12      | D13   | D14   |
| 21  | D15      | D16   | D17   |
| 22  | D18      | D19   | D20   |
| 23  | D21      | D22   | D23   |
| 24  | D24      | D25   | D26   |
| 25  | GND      | GND   | GND   |
| 26  | D27      | D28   | D29   |
| 27  | D30      | D31   | DQM1  |
| 28  | DQM3     | SDCKE | SDCK  |
| 29  | nOE      | SDWE  | CAS   |
| 30  | RAS      | SDCS  | SDA10 |
| 31  | nCS0     | WE    | nCS1  |
| 32  | GND      | GND   | nCS3  |

| PIN | P9       |          |        |
|-----|----------|----------|--------|
|     | PIN NAME |          |        |
|     | ROWS     |          |        |
|     | A        | B        | C      |
| 1   | GND      | GND      | GND    |
| 2   | PB2      | PB1      | PB0    |
| 3   | PB5      | PB4      | PB3    |
| 4   | PB8      | PB7      | PB6    |
| 5   | PB11     | PB10     | PB9    |
| 6   | E_TXER   | E_TX3    | E_TX2  |
| 7   | E_RXDV   | E_RX3    | E_RX2  |
| 8   | GND      | GND      | GND    |
| 9   | PB20     | E_RXCLK  | E_COL  |
| 10  | PB23     | PB22     | PB21   |
| 11  | PB26     | PB25     | PB24   |
| 12  | PB29     | PB28     | PB27   |
| 13  | PA2      | PA1      | PA0    |
| 14  | GND      | GND      | GND    |
| 15  | PA5      | PA4      | PA3    |
| 16  | E_TX_EN  | E_TXCLK  | PA6    |
| 17  | E_CRS    | E_TX1    | E_TX0  |
| 18  | E_RXER   | E_RX1    | E_RX0  |
| 19  | GND      | GND      | GND    |
| 20  | TXD0     | E_MDIO   | E_MDC  |
| 21  | CTS0     | PA19     | RXD0   |
| 22  | PA23     | PA22     | RTS0   |
| 23  | PA26_SCL | PA25_SDA | PA24   |
| 24  | PA29     | PA28     | Pa27   |
| 25  | GND      | GND      | GND    |
| 26  | PC0      | BOOT     | PA30   |
| 27  | PC3      | PC2      | PC1    |
| 28  | PC6      | PC5      | nE_INT |
| 29  | PC9      | PC8      | PC7    |
| 30  | PC12     | PC11     | PC10   |
| 31  | PC15     | PC14     | PC13   |
| 32  | GND      | GND      | GND    |

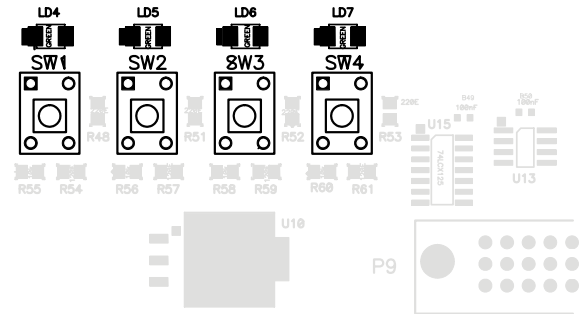
*Not all CPU signals are present on the expansion connector, since some critical signals are only routed to the peripheral device. Signal names used in the tables above are not the exact names used in Atmel's data sheet; they are based on a board netlist, therefore the user should check the board schematics to find out the right link between signal names used and Atmel's names presented in AT91RM9200 data sheet.*

## On-Board LED's and push buttons

The ITAT91RM9200 board is equipped with 4 general-purpose LED indicators and 4 switches. Below two tables depict how they are connected to the CPU ports.

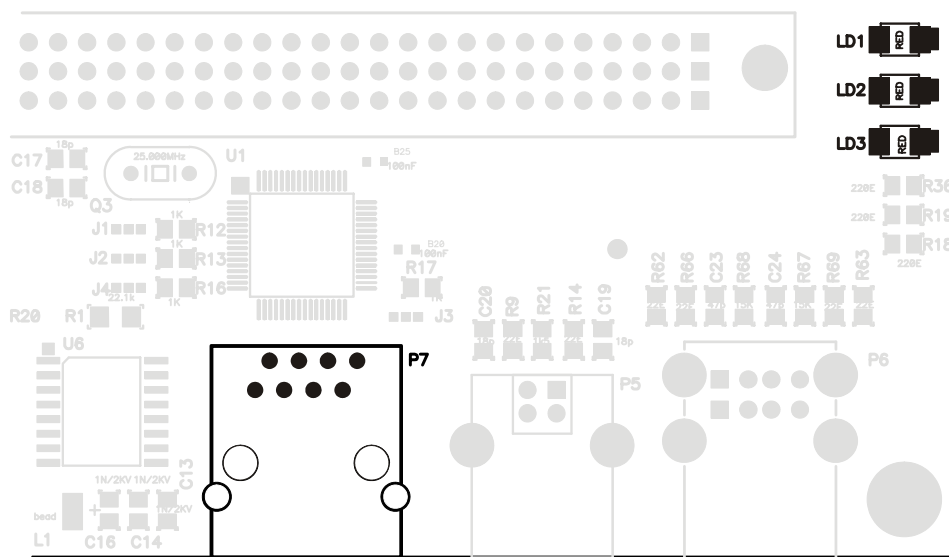
| Led | CPU |
|-----|-----|
| LD4 | PB0 |
| LD5 | PB1 |
| LD6 | PB2 |
| LD7 | PB3 |

| Button | CPU |
|--------|-----|
| SW1    | PB4 |
| SW2    | PB5 |
| SW3    | PB6 |
| SW4    | PB7 |



## Ethernet Port

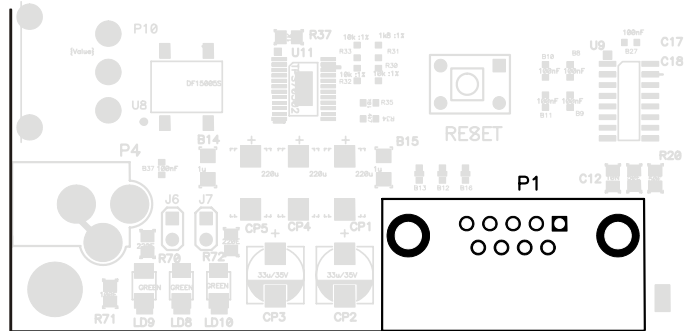
The ITAT91RM9200 provides an on-board RJ-45 connector (P7) for the Ethernet port. This port is connected to the external fast Ethernet PHY transceiver LXT972A, and directly supports both 100BaseTX and 10BaseT application. LD1, LD2 and LD2 are Ethernet LEDs and its function can be programmed. For more details please refer to the schematics.



## Serial port

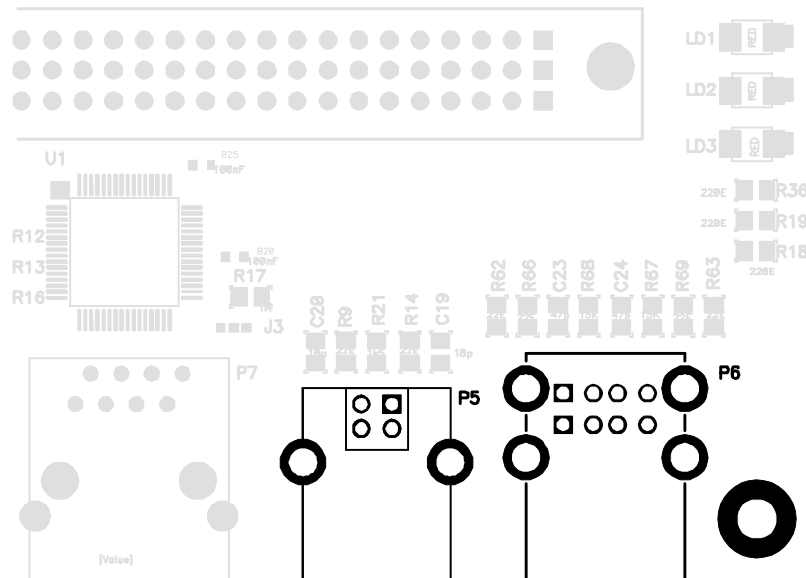
The ITAT91RM9200 provides an on-board standard DB-9 female connector (P1) for RS-232 serial communication. The On-board P1 connector connects to the UART0 of the AT91RM9200 controller and it incorporates all features provided by the CPU. The table below shows the connection between the CPU and the P1 connector.

| PIN | Signal | CPU  |
|-----|--------|------|
| 1   | -      | -    |
| 2   | TX     | PA17 |
| 3   | RX     | PA18 |
| 4   | -      | -    |
| 5   | GND    | -    |
| 6   | -      | -    |
| 7   | CTS    | PA20 |
| 8   | RTS    | PA21 |
| 9   | -      | -    |



## USB Host and Device ports

The ITAT91RM9200 Board is ready to use both the host P6 (2 ports) and device P5 USB connection. The host connectors are not assembled; therefore the user should assemble them when needed.



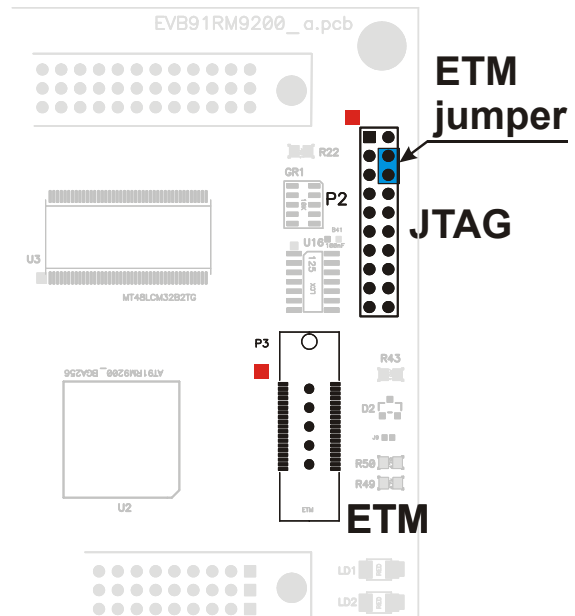
## JTAG and ETM Debug Ports

Two debug connectors are available on the board for debugging. The first connector (P2) is a standard 20-pin JTAG connector, where the debugger connects (iSYSTEM iC3000 with debug ARM9 iCARD). Additionally, the CPU features on-chip trace (ETM), which should be used when real-time debugging is required. In that case, 38-pin Mictor (P3) is used to connect the development tool to the target. iSYSTEM offers iTRACE and iTRACE PRO development tools supporting ARM ETM.

For security reasons the CPU JTAG pins are buffered and tri-stated. For that reason, the P2 (JTAG) connector is hot pluggable, which means that when the JTAG probe is plugged in, JTAG will be enabled and the debugger can control the CPU. When debugging through the Mictor connector (P3), a jumper must be set on 20-pin debug connector (P2) as the picture below depicts. In all other cases, the jumper must be removed.

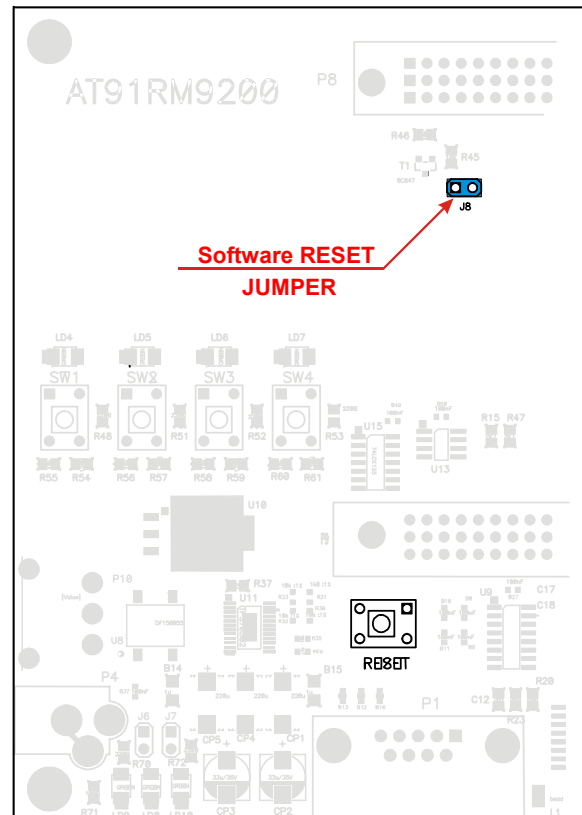
Pin 1 on both connectors is marked with a red square.

**When the application is not debugged, the ETM jumper must be removed from the P2 connector, otherwise the board doesn't function properly!**



## Reset and Boot

The on-board voltage regulator has a built-in supervisory circuit to detect and consequently reset the board when the 3.3V supply voltage drops below 3.1V. The same supervisory circuit also provides a manual reset signal, which is tied to the push button marked as RESET SW. Beside mentioned reset sources, the ITAT91RM9200 also incorporates software reset through the PD6 CPU pin. To enable this feature, the J8 jumper should be installed. The board normally boots from the external 16-bit FLASH memory connected to the nCS0. The user can write down its own boot manager to copy code from the FLASH to the RAM memory area for faster execution.



## **On-Board Software**

The ITAT91RM9200 comes with a sample test project running on the embedded uCOS-II operating system. The test software is built with the GNU GCC 3.3.1 compiler. The on-board software initializes the board and provides several routines which handle the basic CPU initialization, i.e. clocks, memory, ports, interrupts...

## **Testing the ITAT91RM9200 board**

The sample application initializes the CPU, the memory, the system timer for periodic interrupts and the local serial port. The LD4 LED is flashing based on system timer interrupts and push buttons SW1 through SW4 are initialized to act as inputs. For better understanding and more help, explore the test program in more details. In the source files you will find basic help information on how to use and call written functions.

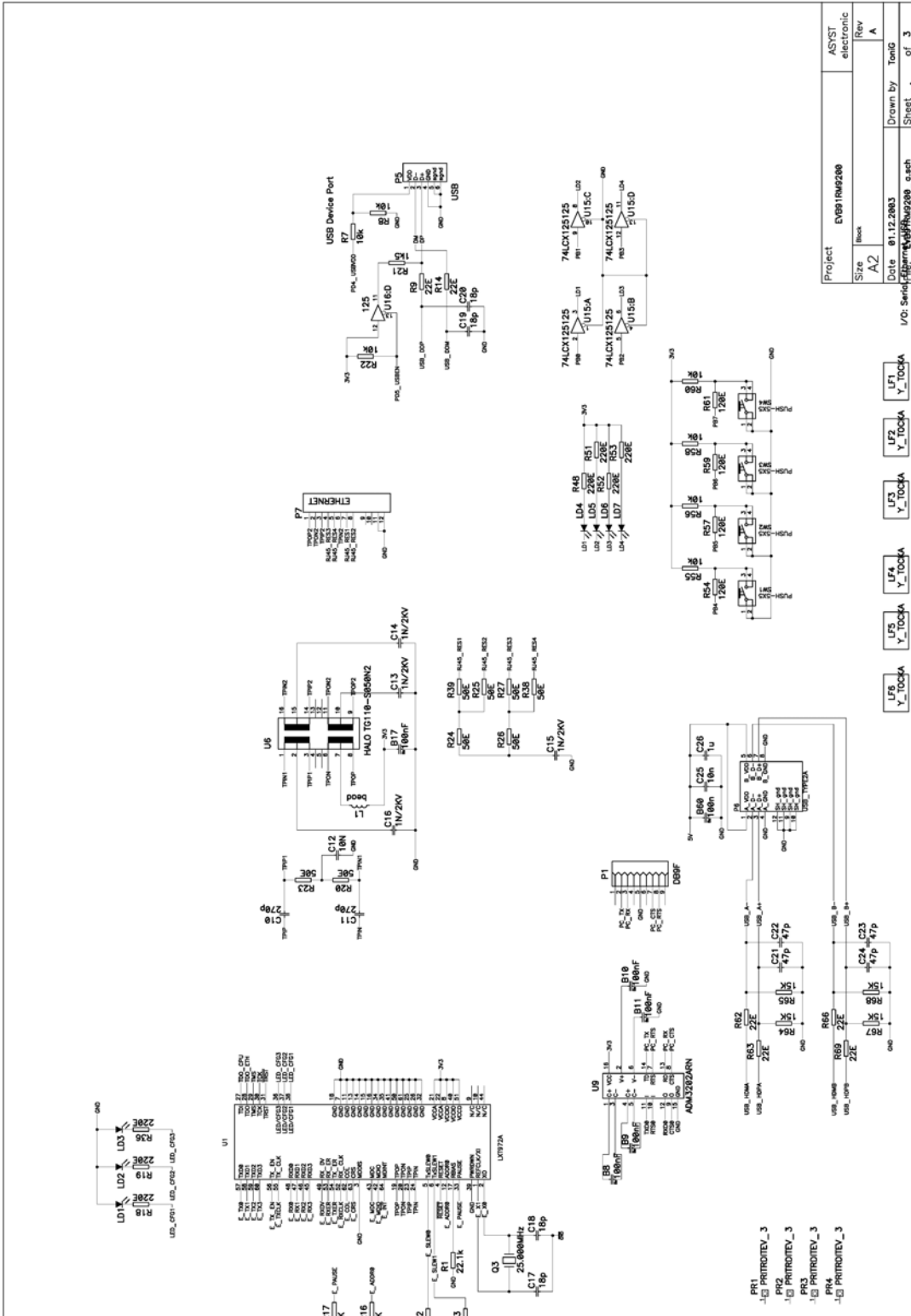
## **Running the uCOS-II Operating System**

The board is tested with the real time operating system uCOS-II, which can be obtained from <http://www.ucos-ii.com>. A sample project shipped with the board, shows the ability to run the code on AT91RM9200 CPU with integrated uCOS-II operating system. The board was fully tested with the uCOS-II v2.52 and v2.75 versions. When running the operating system with an application, the LD4 is reserved and flashes based on the system timer. For further details and more explanation please explore the sample project and demo applications supplied with the board.

## **Schematic**

Please see the next pages for the schematic of the board.





|          |            |            |
|----------|------------|------------|
| Project  | EV91166288 | ASYST      |
| Size     | A2         | electronic |
| Rev      | A          | Rev        |
| Date     | 01.12.2003 | Drawn By   |
| I/O: Smd | U15C       | TenG       |
| I/O: Smd | U15D       | Sheet      |
| I/O: Smd | U15A       | of         |
| I/O: Smd | U15B       | 3          |

- U15C Y\_TOCKA
- U15D Y\_TOCKA
- U15A Y\_TOCKA
- U15B Y\_TOCKA
- U15E Y\_TOCKA
- U15F Y\_TOCKA
- U15G Y\_TOCKA
- U15H Y\_TOCKA
- U15I Y\_TOCKA
- U15J Y\_TOCKA
- U15K Y\_TOCKA
- U15L Y\_TOCKA
- U15M Y\_TOCKA
- U15N Y\_TOCKA
- U15O Y\_TOCKA
- U15P Y\_TOCKA
- U15Q Y\_TOCKA
- U15R Y\_TOCKA
- U15S Y\_TOCKA
- U15T Y\_TOCKA
- U15U Y\_TOCKA
- U15V Y\_TOCKA
- U15W Y\_TOCKA
- U15X Y\_TOCKA
- U15Y Y\_TOCKA
- U15Z Y\_TOCKA

