

# **AT91SAM9RL-EK Evaluation Board**

---

## **User Guide**







## Table of Contents

---

### Section 1

Overview .....	1-1
1.1 Scope.....	1-1
1.2 Deliverables .....	1-1
1.3 AT91SAM9RL-EK Evaluation Board.....	1-1

---

### Section 2

Setting Up the AT91SAM9RL-EK Board .....	2-1
2.1 Electrostatic Warning .....	2-1
2.2 Requirements.....	2-1
2.3 Layout .....	2-2
2.4 Powering Up the Board.....	2-4
2.5 Backup Power Supply .....	2-4
2.6 Getting Started.....	2-4
2.7 AT91SAM9RL-EK Block Diagram.....	2-5

---

### Section 3

Board Description .....	3-1
3.1 AT91SAM9RL64 Microcontroller .....	3-1
3.2 AT91SAM9RL Block Diagram.....	3-4
3.3 Microcontroller .....	3-4
3.4 Memory .....	3-4
3.5 Clock Circuitry .....	3-4
3.6 Reset Circuitry .....	3-5
3.7 Shutdown Controller .....	3-5
3.8 Power Supply Circuitry.....	3-5
3.9 Remote Communication .....	3-5
3.10 Audio Stereo Interface .....	3-5
3.11 User Interface .....	3-5
3.12 Debug Interface .....	3-5
3.13 Expansion Slot.....	3-6
3.14 PIO Usage .....	3-7

---

### Section 4

Jumpers.....	4-1
4.1 Jumpers .....	4-1
4.2 JTAG/ICE.....	4-1

**Table of Contents (Continued)**

4.3	Microcontroller Clock .....	4-2
4.4	Memory .....	4-2
4.5	Miscellaneous .....	4-2

---

**Section 5**

Schematics .....	5-1
5.1 Board Schematics .....	5-1

---

**Section 6**

Revision History .....	6-1
6.1 Revision History .....	6-1





# Section 1

---

## Overview

---

### 1.1 Scope

The AT91SAM9RL-EK evaluation kit enables the evaluation of and code development for applications running on an AT91SAM9RL device. It significantly reduces design cycle time, increasing confidence in a right-first-time system solution.

This guide focuses on the AT91SAM9RL-EK board as an evaluation platform.

The board supports the AT91SAM9RL in an LFBGA217 package.

---

### 1.2 Deliverables

The AT91SAM9RL-EK package contains the following items:

- an AT91SAM9RL-EK board
- universal input AC/DC power supply with US, UK and Europe plug adapter
- one 3V battery backup (CR1225 or equivalent)
- one A/B-type USB cable
- one serial RS232 cable
- one CD-ROM that allows the user to begin evaluating the AT91 ARM<sup>®</sup> Thumb<sup>®</sup> 32-bit microcontroller quickly.

---

### 1.3 AT91SAM9RL-EK Evaluation Board

- The board is equipped with an AT91SAM9RL64 (217-ball LFBGA package) together with the following:
  - 64 Mbytes of SDRAM memory
  - 256 Mbytes of NAND Flash memory
  - one Atmel serial DataFlash<sup>®</sup>
  - one Atmel TWI serial EEPROM (footprint only)
  - one USB High Speed device port interface
  - one DBGU serial communication port
  - one additional serial communication port with RTS/CTS handshake control
  - JTAG/ICE debug interface
  - one AC97 Audio Codec
  - one 3.5" 1/4 VGA TFT LCD Module with TouchScreen and backlight
  - one Power LED and two general-purpose LED

## **Overview**

- two user input push buttons
- one Wakeup input push button
- one reset push button
- one MCI SD/MMC card slot
- four expansion connectors (PIOA, PIOB, PIOC, PIOD)
- one BGA-like EBI expansion footprint connector
- one Lithium Coin Cell Battery Retainer for 12 mm cell size



# Setting Up the AT91SAM9RL-EK Board

---

## 2.1 Electrostatic Warning

Upon delivery, the AT91SAM9RL-EK evaluation board is wrapped in a protective anti-static bag. The board must not be exposed to electrostatic discharges. A grounding strap or similar protective device should be worn when handling the board. Avoid touching the component pins or any other on-board metallic element.

---

## 2.2 Requirements

In order to set up the AT91SAM9RL-EK evaluation board, the following items are needed:

- The AT91SAM9RL-EK evaluation board itself
- AC/DC power adapter (5V at 2A), 2.1 mm by 5.5 mm

## 2.3 Layout

Figure 2-1. AT91SAM9RL-EK Layout - Top View

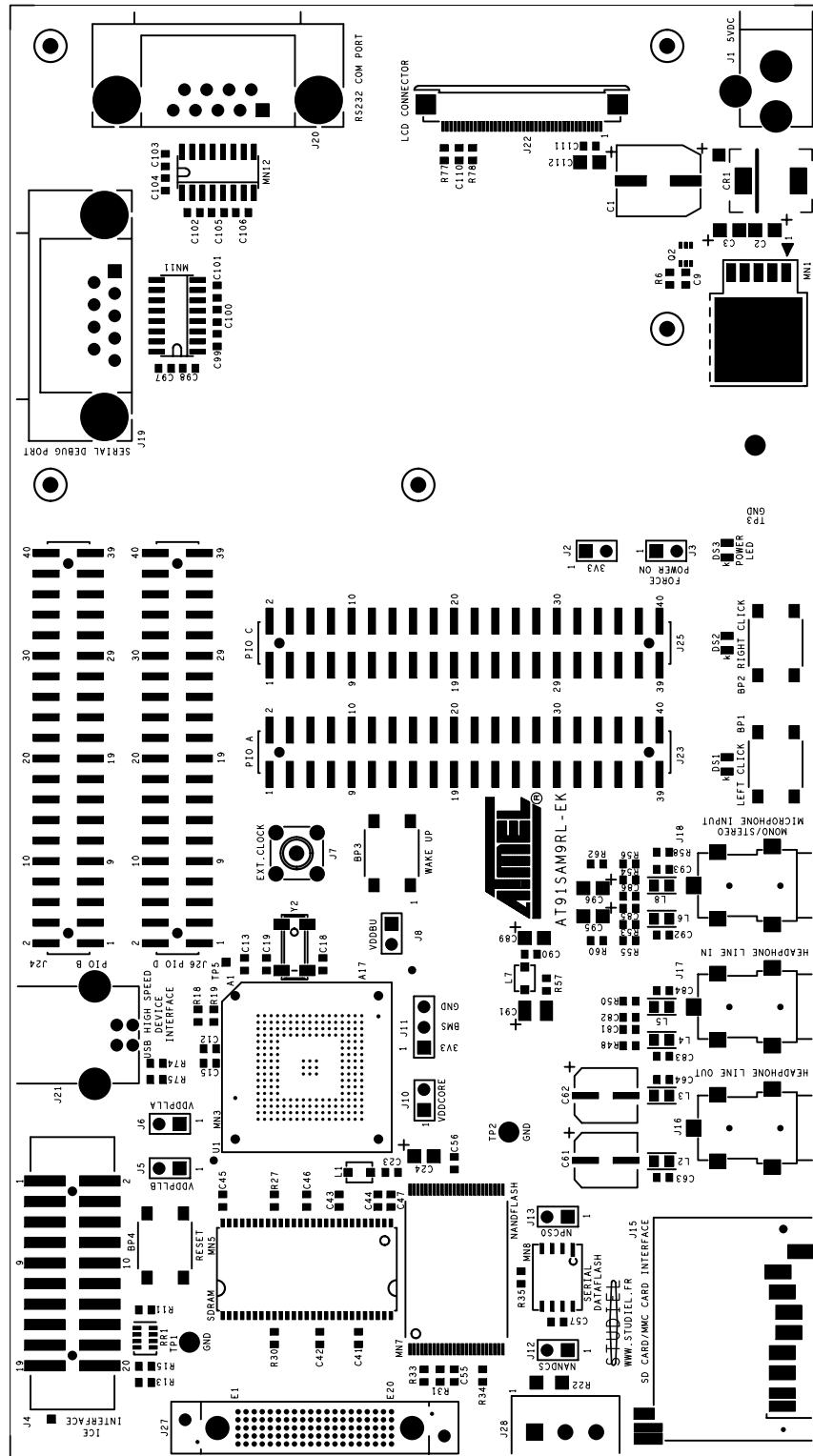
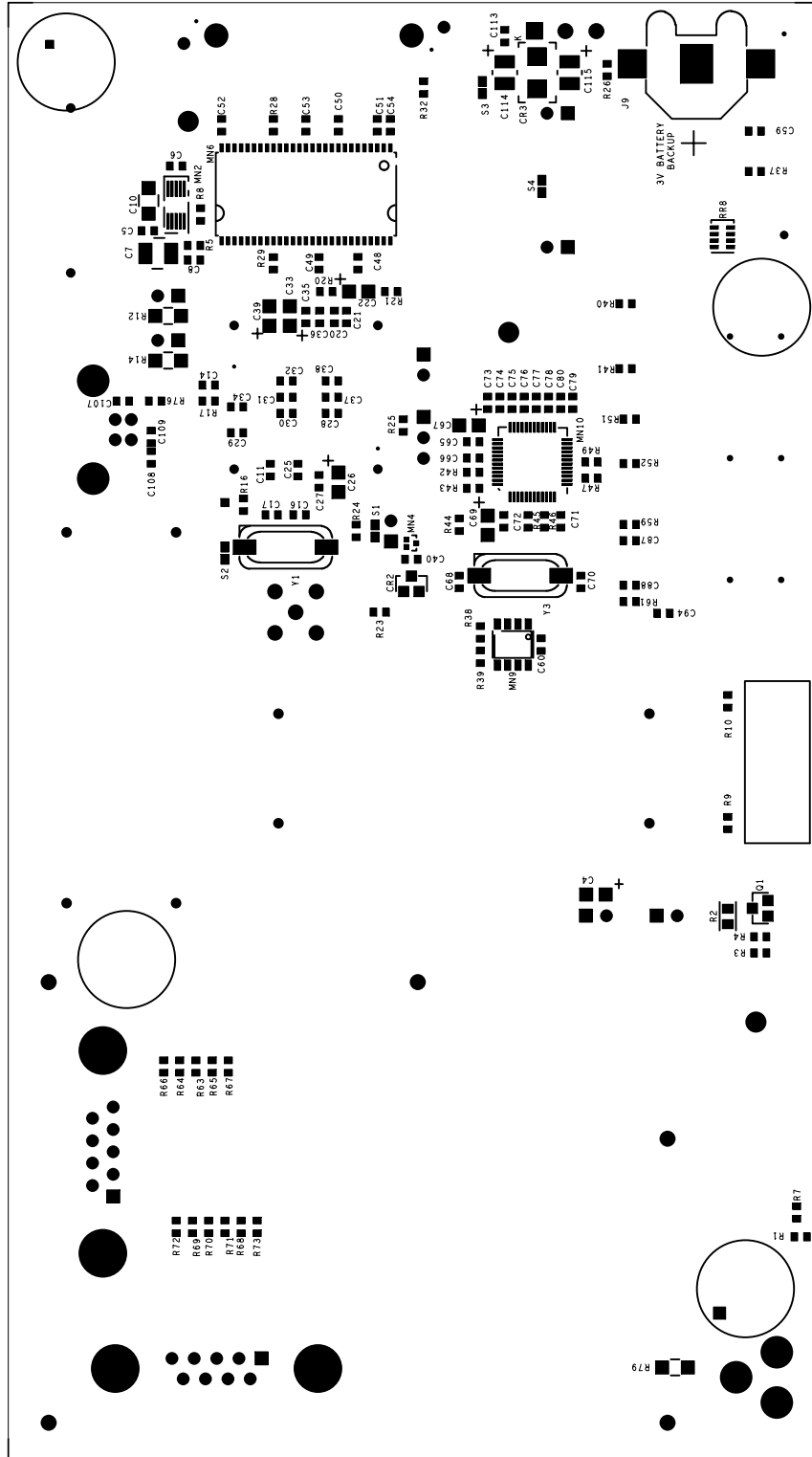




Figure 2-2. AT91SAM9RL-EK Layout - Bottom View



## **2.4 Powering Up the Board**

The AT91SAM9RL-EK requires 5V DC ( $\pm 5\%$ ). DC power is supplied to the board via the 2.1 mm by 5.5 mm socket J1. Coaxial plug center positive standard.

---

## **2.5 Backup Power Supply**

The user has the possibility to plug a battery (3V Lithium Battery CR1225 or equivalent) in order to permanently power the backup part of the device.

Refer to [Section 4](#).

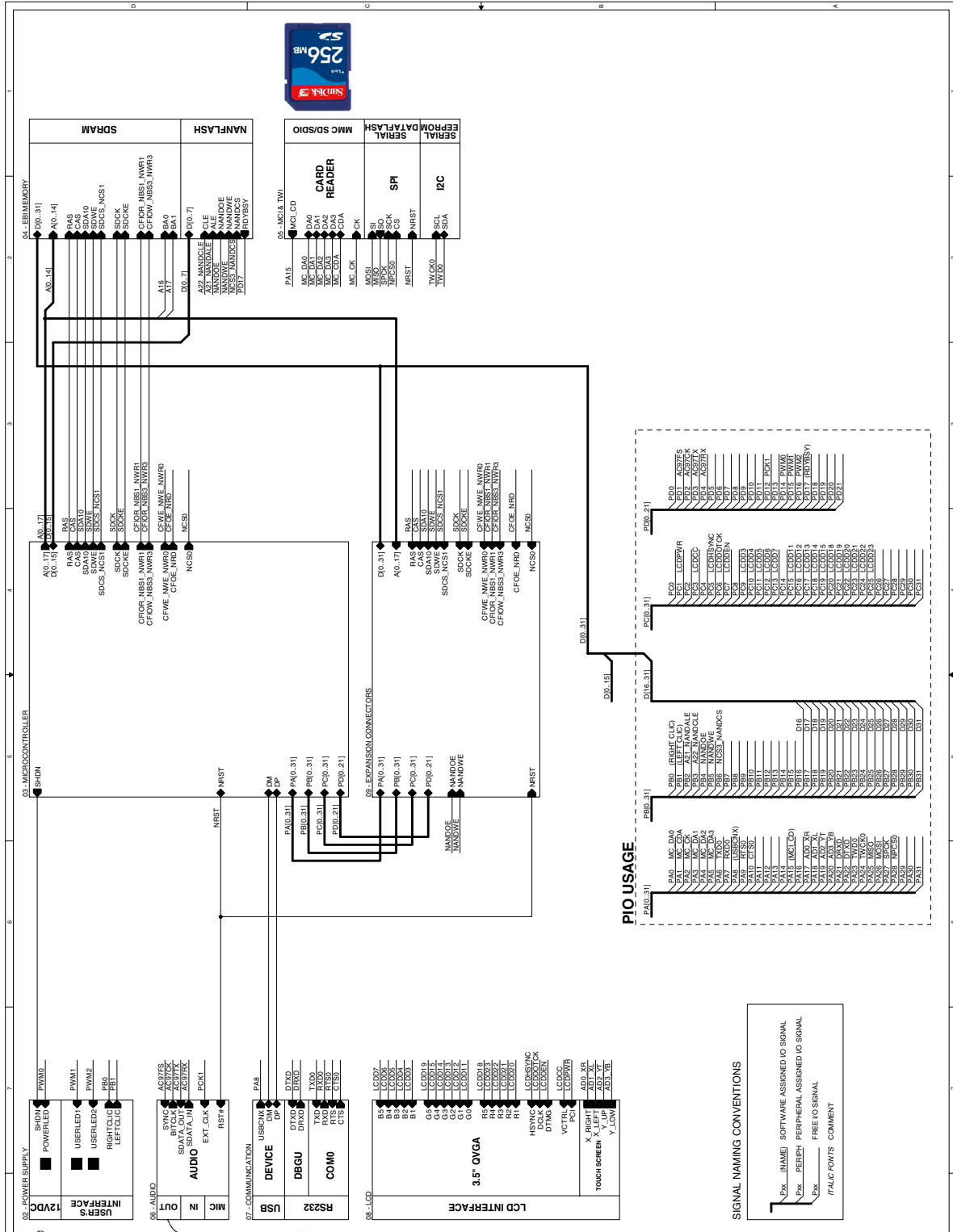
---

## **2.6 Getting Started**

The AT91SAM9RL-EK evaluation board is delivered with a CD-ROM containing all necessary information and step-by-step procedures for working with the most common development toolchains. Please refer to this CD-ROM, or to the AT91 web site, <http://www.atmel.com/products/AT91/>, for the most up-to-date information on getting started with the AT91SAM9RL-EK.

## 2.7 AT91SAM9RL-EK Block Diagram

Figure 2-3. AT91SAM9RL-EK Block Diagram



**SIGNAL NAMING CONVENTIONS**

- Ex. (NAME) SOFTWARE ASSIGNED IO SIGNAL
- Ex. PERIPHERAL ASSIGNED IO SIGNAL
- Ex. FREE IO SIGNAL
- ITALIC FONTS COMMENT





### 3.1 AT91SAM9RL64 Microcontroller

- Incorporates the ARM926EJ-S™ ARM® Thumb® Processor
  - DSP Instruction Extensions
  - ARM Jazelle® Technology for Java® Acceleration
  - 4 Kbyte Data Cache, 4 Kbyte Instruction Cache, Write Buffer
  - 210 MIPS at 190 MHz
  - Memory Management Unit
  - EmbeddedICE™ In-circuit Emulation, Debug Communication Channel Support
  - Mid-level implementation Embedded Trace Macrocell™
- Multi-layer AHB Bus Matrix for Large Bandwidth Transfers
  - Six 32-bit-layer Matrix
  - Boot Mode Select Option, Remap Command
- One 32-KByte internal ROM, Single-cycle Access at Maximum Speed
- One 64-KByte internal SRAM, Single-cycle Access at Maximum Speed
  - 4 Blocks of 16 Kbytes Configurable in TCM or General-purpose SRAM on the AHB Bus Matrix
- Single-cycle Accessible on AHB Bus at Bus Speed
- Single-cycle Accessible on TCM Interface at Processor Speed
- 2-channel DMA
  - Memory to Memory Transfer
  - 16 Bytes FIFO
  - Linked List
- External Bus Interface (EBI)
  - EBI Supports SDRAM, Static Memory, ECC-enabled NAND Flash and CompactFlash®
- LCD Controller
  - Supports Passive or Active Displays
  - Up to 24 Bits per Pixel in TFT Mode, Up to 16 bits per Pixel in STN Color Mode
  - Up to 16M Colors in TFT Mode, Resolution Up to 2048x2048, Virtual Screen Support
- High Speed (480 Mbit/s) USB 2.0 Device Controller
  - On-Chip High Speed Transceiver, UTMI+ Physical Interface
  - Integrated FIFOs and Dedicated DMA
  - 4 Kbyte Configurable Integrated DPRAM
- Fully-featured System Controller, including
  - Reset Controller, Shutdown Controller

## Board Description

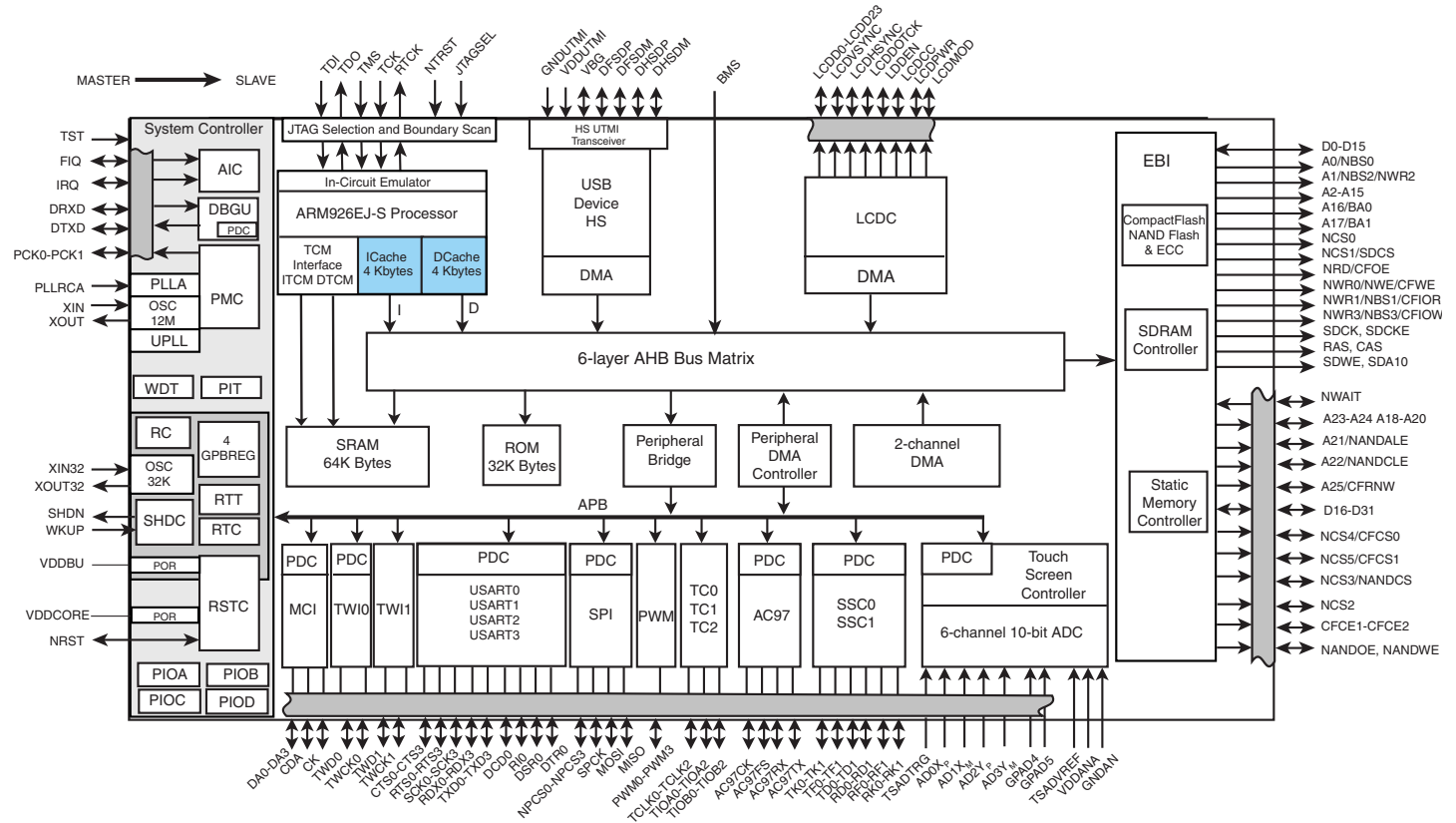
- Four 32-bit Battery Backup Registers for a Total of 16 Bytes
- Clock Generator and Power Management Controller
- Advanced Interrupt Controller and Debug Unit
- Periodic Interval Timer, Watchdog Timer and Real-time Timer and Real-time Clock
- Reset Controller (RSTC)
  - Based on Two Power-on Reset Cells
  - Reset Source Identification and Reset Output Control
- Shutdown Controller (SHDC)
  - Programmable Shutdown Pin Control and Wake-up Circuitry
- Clock Generator (CKGR)
  - Selectable 32768 Hz Low-power oscillator or Internal Low-power RC Oscillator on Battery Backup Power Supply, Providing a Permanent Slow Clock
  - 12 MHz On-chip Oscillator for Main System Clock and USB Clock
  - One PLL up to 240 MHz
  - One PLL 480 MHz Optimized for USB HS
- Power Management Controller (PMC)
  - Very Slow Clock Operating Mode, Software Programmable Power Optimization Capabilities
  - Two Programmable External Clock Signals
- Advanced Interrupt Controller (AIC)
  - Individually Maskable, Eight-level Priority, Vectored Interrupt Sources
  - One External Interrupt Sources and One Fast Interrupt Source, Spurious Interrupt Protected
- Debug Unit (DBGU)
  - 2-wire UART and support for Debug Communication Channel
- Periodic Interval Timer (PIT)
  - 20-bit interval timer plus 12-bit interval counter
- Watchdog Timer (WDT)
  - Key-protected, Programmable Only Once, Windowed 16-bit Counter Running at Slow Clock
- Real-time Timer (RTT)
  - 32-bit Free-running Backup Counter Running at Slow Clock with 16-bit Prescaler
- Real-time Clock (RTC)
  - Time, Date and Alarm 32-bit Parallel Load
  - Low Power Consumption
  - Programmable Periodic Interrupt
- One 6-channel 10-Bit Analog-to-Digital Converter
  - Touch Screen Interface Compatible with Industry Standard 4-wire Sensitive Touch Panels
- Four 32-bit Parallel Input/Output Controllers (PIOA, PIOB, PIOC and PIOD)
  - 118 Programmable I/O Lines Multiplexed with up to Two Peripheral I/Os for 217-ball BGA package
  - Input Change Interrupt Capability on Each I/O Line
  - Individually Programmable Open-drain, Pull-up resistor and Synchronous Output
- 24-channel Peripheral DMA Controller (PDC)
- One Multimedia Card Interface (MCI)
  - SDCard/SDIO 1.0 and MultiMedia Card 3.1 Compliant



- Automatic Protocol Control and Fast Automatic Data Transfers with PDC
- Two Synchronous Serial Controllers (SSC)
  - Independent Clock and Frame Sync Signals for Each Receiver and Transmitter
  - I<sup>2</sup>S Analog Interface Support, Time Division Multiplex Support
  - High-speed Continuous Data Stream Capabilities with 32-bit Data Transfer
- One AC97 Controller (AC97C)
  - 6-channel Single AC97 Analog Front End Interface, Slot Assigner
- Four Universal Synchronous/Asynchronous Receiver Transmitters (USART)
  - Individual Baud Rate Generator, IrDA Infrared Modulation/Demodulation, Manchester Encoding/Decoding
  - Support for ISO7816 T0/T1 Smart Card, Hardware Handshaking, RS485 Support
- One Master/Slave Serial Peripheral Interface (SPI)
  - 8- to 16-bit Programmable Data Length, Four External Peripheral Chip Selects
  - High-speed Synchronous Communications
- One Three-channel 16-bit Timer/Counter (TC)
  - Three External Clock Inputs, Two Multi-purpose I/O Pins per Channel
  - Double PWM Generation, Capture/Waveform Mode, Up/Down Capability
- One Four-channel 16-bit PWM Controller (PWMC)
- Two Two-wire Interfaces (TWI)
  - Compatible with Standard Two-wire Serial Memories
  - One, Two or Three Bytes for Slave Address
  - Sequential Read/Write Operations
  - Master, Multi-master and Slave Mode Operation
  - Bit Rate: Up to 400 Kbits
  - General Call Supported in Slave mode
  - Connection to Peripheral DMA Controller (PDC) Channel Capabilities Optimizes Data Transfers in Master Mode Only (TWI0 only)
- SAM-BA Boot Assistant
  - Default Boot Program
  - Interface with SAM-BA Graphic User Interface
- IEEE 1149.1 JTAG Boundary Scan on All Digital Pins
- Required Power Supplies:
  - 1.08 to 1.32V for VDDCORE, VDDPLL and VDDBU
  - 3.0V to 3.6V for VDDPLLA, VDDANA, VDDUTMI and VDDIOP
  - Programmable 1.65V to 1.95V or 3.0V to 3.6V for VDDIOM
- Available in a 144-ball BGA (AT91SAM9R64) and a 217-ball LFBGA (AT91SAM9RL64) Package

### 3.2 AT91SAM9RL Block Diagram

Figure 3-1. AT91SAM9RL Block Diagram



### 3.3 Microcontroller

- One AT91SAM9RL64 217-ball LFBGA fitted on board

### 3.4 Memory

- 32 Kbytes of Internal ROM
- 64 Kbyte of Internal SRAM
- Atmel serial DataFlash
- 64 Mbytes of SDRAM memory (32-bit bus width)
- 256 Mbytes of NAND Flash memory (8-bit bus width)
- TWI serial EEPROM (footprint only)

### 3.5 Clock Circuitry

- 12 MHz standard crystal for the embedded oscillator

- Software selectable, 32768Hz Low-power external standard crystal Oscillator or Internal Low Power RC Oscillator

---

### 3.6 Reset Circuitry

- Internal reset controller with bi-directional reset pin
- External reset pushbutton

---

### 3.7 Shutdown Controller

- Programmable shutdown and Wake-Up
- Wake-up push button

---

### 3.8 Power Supply Circuitry

- On-board 1.2V High Efficiency step-down charge pump regulator with shutdown control
- On-board 3.3V linear regulator with shutdown control

---

### 3.9 Remote Communication

- One serial interface (DBGU COM Port) via RS-232 DB9 male socket
- One additional serial interface (COM Port 1) with RTS/CTS handshake control via RS-232 DB9 male socket
- One High Speed USB 2.0 port 480 Mbits per second (UDP)

---

### 3.10 Audio Stereo Interface

- One AC97 audio CODEC with:
- One 32 Ohm Stereo Headset output (J16) with master volume and mute controls
- One line-in
- One Mono/Stereo Microphone input.

---

### 3.11 User Interface

- Two user input pushbuttons
- Two user green LED
- One yellow power LED (can be also software controlled)

---

### 3.12 Debug Interface

- 20-pin JTAG/ICE interface connector
- DBGU COM port



### **3.13 Expansion Slot**

- One DataFlash, SD/MMC card slot
- All I/Os of the AT91SAM9RL are routed to peripheral extension connectors (J23, J24, J25, J26).
- All EBI Signals of the AT91SAM9RL are routed to extension footprint connectors (J27). Refer to the Atmel application note [Connecting EBI Memory Daughter Boards to AT91SAM Evaluation Boards, lit. no. 6309](#).
- This allows the developer to check the integrity of the components and to extend the features of the board by adding external hardware components or boards.

### 3.14 PIO Usage

**Table 3-1.** PIO Controller A

I/O Line	Peripheral A	Peripheral B	Application Usage		Powered by
PA0	MC_DA0		SD/MMC CARD READER	MC_DA0	VDDIOP
PA1	MC_CDA		SD/MMC CARD READER	MC_CDA	VDDIOP
PA2	MC_CK		SD/MMC CARD READER	MC_CK	VDDIOP
PA3	MC_DA1	TCLK0	SD/MMC CARD READER	MC_DA1	VDDIOP
PA4	MC_DA2	TIOA0	SD/MMC CARD READER	MC_DA2	VDDIOP
PA5	MC_DA3	TIOB0	SD/MMC CARD READER	MC_DA3	VDDIOP
PA6	TXD0		RS232 COM PORT	TXD0	VDDIOP
PA7	RXD0		RS232 COM PORT	RXD0	VDDIOP
PA8	SCK0	RF1	USB DEVICE	PA8 as USB_CNX	VDDIOP
PA9	RTS0	RK1	RS232 COM PORT	RTS0	VDDIOP
PA10	CTS0	RK0	RS232 COM PORT	CTS0	VDDIOP
PA11	TXD1				VDDIOP
PA12	RXD1				VDDIOP
PA13	TXD2	TD1			VDDIOP
PA14	RXD2	RD1			VDDIOP
PA15	TD0		SD/MMC CARD READER	PA15 as MCI_CD	VDDIOP
PA16	RD0				VDDIOP
PA17	AD0		TOUCH SCREEN PANEL	AD0_XR	VDDIOP
PA18	AD1	RTS1	TOUCH SCREEN PANEL	AD1_XL	VDDIOP
PA19	AD2	CTS1	TOUCH SCREEN PANEL	AD2_YT	VDDIOP
PA20	AD3	SCK3	TOUCH SCREEN PANEL	AD3_YB	VDDIOP
PA21	DRXD		SERIAL DEBUG PORT	DRXD	VDDIOP
PA22	DTXD	RF0	SERIAL DEBUG PORT	DTXD	VDDIOP
PA23	TWD0		I2C MEMORY	TWD0	VDDIOP
PA24	TWCK0		I2C MEMORY	TWCK0	VDDIOP
PA25	MISO		DATAFLASH DEVICE	MISO	VDDIOP
PA26	MOSI		DATAFLASH DEVICE	MOSI	VDDIOP
PA27	SPCK		DATAFLASH DEVICE	SPCK	VDDIOP
PA28	NPCS0		DATAFLASH DEVICE	NPCS0	VDDIOP
PA29	RTS2	TF1			VDDIOP
PA30	CTS2	TK1			VDDIOP
PA31	NWAIT	IRQ			VDDIOP

Table 3-2. PIO Controller B

I/O Line	Peripheral A	Peripheral B	Application Usage		Powered by
PB0	TXD3		USER'S PUSH BUTTON 1	PB0 as LEFT CLICK	VDDIOP
PB1	RXD3		USER'S PUSH BUTTON 2	PB1 as RIGHT CLICK	VDDIOP
PB2	A21/NANDALE		NAND FLASH MEMORY	NANDALE	VDDIOM
PB3	A22/NANDCLE		NAND FLASH MEMORY	NANDCLE	VDDIOM
PB4	NANDOE		NAND FLASH MEMORY	NANDOE	VDDIOM
PB5	NANDWE		NAND FLASH MEMORY	NANDWE	VDDIOM
PB6	NCS3/NANDCS		NAND FLASH MEMORY	NCS3/NANDCS	VDDIOM
PB7	NCS4/CFCS0	NPCS1			VDDIOM
PB8	CFE1	PWM0			VDDIOM
PB9	CFE2	PWM1			VDDIOM
PB10	A25/CFRNW	FIQ			VDDIOM
PB11	A18				VDDIOM
PB12	A19				VDDIOM
PB13	A20				VDDIOM
PB14	A23	PCK0			VDDIOM
PB15	A24	ADTRG			VDDIOM
PB16	D16		SDRAM MEMORY	D16	VDDIOM
PB17	D17		SDRAM MEMORY	D17	VDDIOM
PB18	D18		SDRAM MEMORY	D18	VDDIOM
PB19	D19		SDRAM MEMORY	D19	VDDIOM
PB20	D20		SDRAM MEMORY	D20	VDDIOM
PB21	D21		SDRAM MEMORY	D21	VDDIOM
PB22	D22		SDRAM MEMORY	D22	VDDIOM
PB23	D23		SDRAM MEMORY	D23	VDDIOM
PB24	D24		SDRAM MEMORY	D24	VDDIOM
PB25	D25		SDRAM MEMORY	D25	VDDIOM
PB26	D26		SDRAM MEMORY	D26	VDDIOM
PB27	D27		SDRAM MEMORY	D27	VDDIOM
PB28	D28		SDRAM MEMORY	D28	VDDIOM
PB29	D29		SDRAM MEMORY	D29	VDDIOM
PB30	D30		SDRAM MEMORY	D30	VDDIOM
PB31	D31		SDRAM MEMORY	D31	VDDIOM

Table 3-3. PIO Controller C

I/O Line	Peripheral A	Peripheral B	Application Usage		Powered by
PC0	TF0				VDDIOP
PC1	TK0	LCDPWR	LCD PANEL	LCDPWR	VDDIOP
PC2	LCDMOD	PWM0			VDDIOP
PC3	LCDC	PWM1	LCD PANEL	LCDC	VDDIOP
PC4	LCVSYNC				VDDIOP
PC5	LCVHSYNC		LCD PANEL	LCVHSYNC	VDDIOP
PC6	LCDDOTCK		LCD PANEL	LCDDOTCK	VDDIOP
PC7	LCDDEN		LCD PANEL	LCDDEN	VDDIOP
PC8	LCDD0	LCDD2	LCD PANEL	LCDD2	VDDIOP
PC9	LCDD1	LCDD3	LCD PANEL	LCDD3	VDDIOP
PC10	LCDD2	LCDD4	LCD PANEL	LCDD4	VDDIOP
PC11	LCDD3	LCDD5	LCD PANEL	LCDD5	VDDIOP
PC12	LCDD4	LCDD6	LCD PANEL	LCDD6	VDDIOP
PC13	LCDD5	LCDD7	LCD PANEL	LCDD7	VDDIOP
PC14	LCDD6	LCDD10	LCD PANEL	LCDD10	VDDIOP
PC15	LCDD7	LCDD11	LCD PANEL	LCDD11	VDDIOP
PC16	LCDD8	LCDD12	LCD PANEL	LCDD12	VDDIOP
PC17	LCDD9	LCDD13	LCD PANEL	LCDD13	VDDIOP
PC18	LCDD10	LCDD14	LCD PANEL	LCDD14	VDDIOP
PC19	LCDD11	LCDD15	LCD PANEL	LCDD15	VDDIOP
PC20	LCDD12	LCDD18	LCD PANEL	LCDD18	VDDIOP
PC21	LCDD13	LCDD19	LCD PANEL	LCDD19	VDDIOP
PC22	LCDD14	LCDD20	LCD PANEL	LCDD20	VDDIOP
PC23	LCDD15	LCDD21	LCD PANEL	LCDD21	VDDIOP
PC24	LCDD16	LCDD22	LCD PANEL	LCDD22	VDDIOP
PC25	LCDD17	LCDD23	LCD PANEL	LCDD23	VDDIOP
PC26	LCDD18				VDDIOP
PC27	LCDD19				VDDIOP
PC28	LCDD20				VDDIOP
PC29	LCDD21	TIOA1			VDDIOP
PC30	LCDD22	TIOB1			VDDIOP
PC31	LCDD23	TCLK1			VDDIOP

**Table 3-4.** PIO Controller D

<b>I/O Line</b>	<b>Peripheral A</b>	<b>Peripheral B</b>	<b>Application Usage</b>		<b>Powered by</b>
PD0	NCS2				VDDIOP
PD1	AC97_FS		AC97 CODEC	AC97_FS	VDDIOP
PD2	AC97_CK	SCK1	AC97 CODEC	AC97_CK	VDDIOP
PD3	AC97_TX	CTS3	AC97 CODEC	AC97_TX	VDDIOP
PD4	AC97_RX	RTS3	AC97 CODEC	AC97_RX	VDDIOP
PD5	DTXD	PWM2			VDDIOP
PD6	AD4				VDDIOP
PD7	AD5				VDDIOP
PD8	NPCS2	PWM3			VDDIOP
PD9	SCK2	NPCS3			VDDIOP
PD10	TWD1	TIOA2			VDDIOP
PD11	TWCK1	TIOB2			VDDIOP
PD12	PWM2	PCK1			VDDIOP
PD13	NCS5/GFCS1	NPCS3			VDDIOP
PD14	DSR0	PWM0	POWER LED	PD14 or PWM0	VDDIOP
PD15	DTR0	PWM1	USER LED 1	PD15 or PWM1	VDDIOP
PD16	DCD0	PWM2	USER LED 2	PD16 or PWM2	VDDIOP
PD17	RI0		NAND FLASH MEMORY	PD17 as RDYBSY	VDDIOP
PD18	PWM3				VDDIOP
PD19	PCK0				VDDIOP
PD20	PCK1				VDDIOP
PD21	TCLK2				VDDIOP



## Section 4

# Jumpers

### 4.1 Jumpers

**Table 4-1.** Jumpers Configuration

Designation	Default Setting	Feature
J2	Closed	3.3V Jumper <sup>(1)</sup>
J3	Closed	Forces power on. To use the software shutdown control, J3 must be opened. 3V battery backup must be present.
J5	Closed	VDDPLL B Jumper <sup>(1)</sup>
J6	Closed	VDDPLLA Jumper <sup>(1)</sup>
J8	Closed	VDDBU Jumper <sup>(1)</sup>
J10	Closed	VDDCORE Jumper <sup>(1)</sup>
J11	1-2	BMS (Boot Mode Select) 1-2: Internal ROM 2-3: NCS0
J12	Closed	Enables the use of the embedded NAND FLASH device (MN7)
J13	Closed	Enables the use of the embedded SERIAL DATAFLASH device (MN8)

Note: 1. These jumpers are provided for power consumption measurement use. By default, they are closed. To use this feature, the user has to open the strap and insert an anmeter.

### 4.2 JTAG/ICE

**Table 4-2.** JTAG/ICE Configuration

Designation	Default Setting	Feature
S1	Opened	Selects ICE mode or JTAG mode
R11	Soldered	Enables the ICE NTRST input
R13	Soldered	Enables the ICE NRST input

## 4.3 Microcontroller Clock

**Table 4-3.** Microcontroller Clock Configuration

Designation	Default Setting	Feature
S2	Opened	To use an external source clock, the user has to close S2 and populate J7. In this case, C16, C17 and J7 have to be unsoldered.

## 4.4 Memory

**Table 4-4.** Memory Configuration

Designation	Default Setting	Feature
<b>SDRAM (MN5 &amp; MN6)</b>		
R29	Soldered	Enables MN5 Chip select access
R30	Soldered	Enables MN6 Chip select access
<b>NANDFLASH (MN7)</b>		
J12	Closed	Enables the use of the NANDFLASH device
R32	Soldered	Enables the use of the Ready/Busy signal
S3	Opened	Disables the write protect
<b>SERIAL DATAFLASH (MN8)</b>		
J13	Closed	Enables the use of the DATAFLASH device
S4	Opened	Disables the write protect.
<b>TWI SERIAL EEPROM NOT POPULATED (MN9)</b>		

## 4.5 Miscellaneous

Refer to the TOP level schematic for the PIO usage.

**Table 4-5.** Miscellaneous

Designation	Default Setting	Feature
<b>USB HIGH SPEED DEVICE INTERFACE</b>		
R75	Soldered	USB DEVICE: Enables the use of the USBCNX signal
<b>DBGU COM PORT</b>		
R64	Soldered	Enables the use of DTXD output signal
R66	Soldered	Enables the use of DRXD input
<b>RS232 COM PORT:</b> Enable the use of Input/output signals		

**Table 4-5.** Miscellaneous

<b>Designation</b>	<b>Default Setting</b>	<b>Feature</b>
R70	Soldered	TXD
R71	Soldered	RTS
R72	Soldered	RXD
R73	Soldered	CTS
TP1	N.A	GND Test point
TP2	N.A	GND Test point
TP3	N.A	GND Test point





## Section 5

---

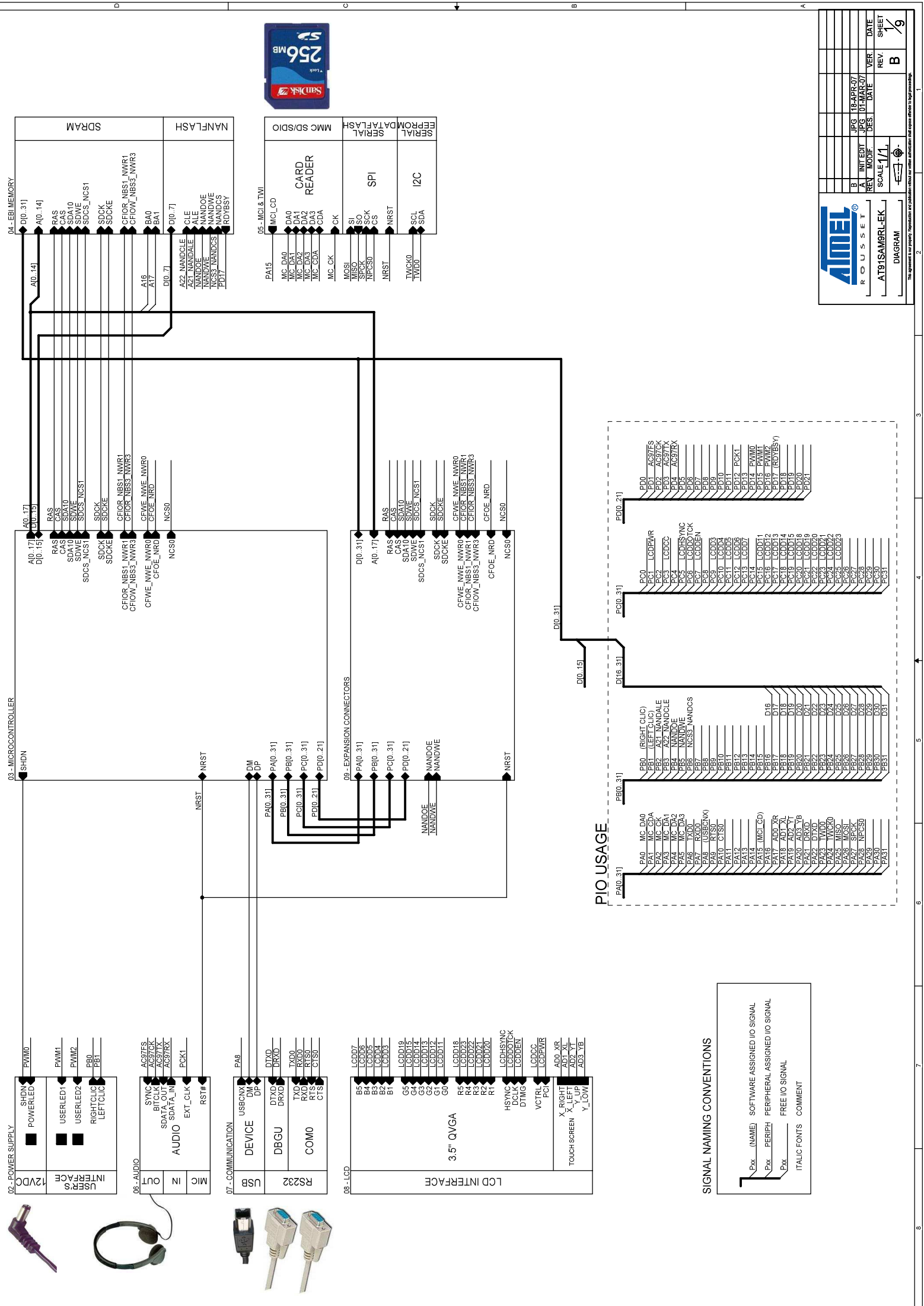
# Schematics

---

### 5.1 Board Schematics

This section contains the following schematics:

- Board Diagram - Schematic Top Level
- Power supply
- AT91SAM9RL Microcontroller
- EBI Memory
- Serial Memory
- Audio AC97
- Serial Interface
- TFT LCD display
- Expansion connectors



AMEL  
ROUSSET

AT91SAM9RL-LEK

DIAGRAM

REV.	DATE	DES.	DATE	VER.	DATE
B	18-APR-07	JPG	01-MAR-07		
A		INIT EDIT			
		MODIF.			

SCALE 1/1

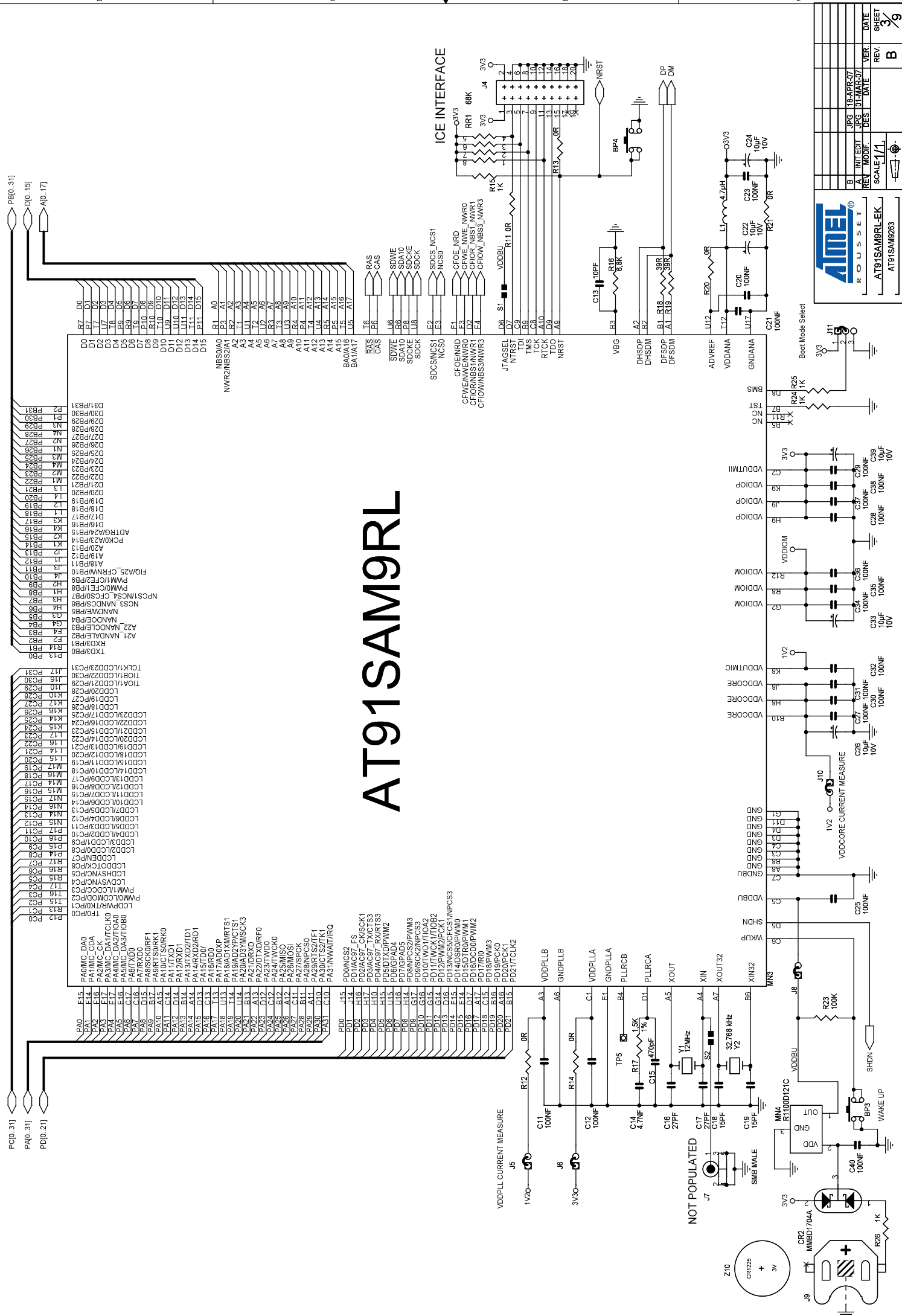
SHEET 1/9

### PIO USAGE

PA0	MC DA0	PB0	RIGHT CLIC
PA1	MC DA1	PB1	MC DA0
PA2	MC DA2	PB2	MC DA1
PA3	MC DA3	PB3	A21 NANDCLE
PA4	TXD	PB4	NANDOE
PA5	RXD	PB5	NANDWE
PA6	CTS	PB6	NCS3_NANDCS
PA7	DM	PB7	NCS0
PA8	DP	PB8	NCS1
PA9	TXD0	PB9	NCS2
PA10	RXD0	PB10	NCS3
PA11	CTS0	PB11	NANDOE
PA12	CTS1	PB12	NANDWE
PA13	CTS2	PB13	NANDOE
PA14	CTS3	PB14	NANDWE
PA15 (MCI CD)		PB15	NANDOE
PA16		PB16	NANDWE
PA17 ADD_XR		PB17	D16
PA18 ADD_YR		PB18	D17
PA19 ADD_XL		PB19	D18
PA20 ADD_YL		PB20	D19
PA21 DRXD		PB21	D20
PA22 DRXD		PB22	D21
PA23 TXD0		PB23	D22
PA24 RXD0		PB24	D23
PA25 MOS		PB25	D24
PA26 MOS		PB26	D25
PA27 SPOK		PB27	D26
PA28 NFCSS0		PB28	D27
PA29 NFCSS1		PB29	D28
PA30 NFCSS2		PB30	D29
PA31		PB31	D30
		PB32	D31
		PB33	D32
		PB34	D33
		PB35	D34
		PB36	D35
		PB37	D36
		PB38	D37
		PB39	D38
		PB40	D39
		PB41	D40
		PB42	D41
		PB43	D42
		PB44	D43
		PB45	D44
		PB46	D45
		PB47	D46
		PB48	D47
		PB49	D48
		PB50	D49
		PB51	D50
		PB52	D51
		PB53	D52
		PB54	D53
		PB55	D54
		PB56	D55
		PB57	D56
		PB58	D57
		PB59	D58
		PB60	D59
		PB61	D60
		PB62	D61
		PB63	D62
		PB64	D63
		PB65	D64
		PB66	D65
		PB67	D66
		PB68	D67
		PB69	D68
		PB70	D69
		PB71	D70
		PB72	D71
		PB73	D72
		PB74	D73
		PB75	D74
		PB76	D75
		PB77	D76
		PB78	D77
		PB79	D78
		PB80	D79
		PB81	D80
		PB82	D81
		PB83	D82
		PB84	D83
		PB85	D84
		PB86	D85
		PB87	D86
		PB88	D87
		PB89	D88
		PB90	D89
		PB91	D90
		PB92	D91
		PB93	D92
		PB94	D93
		PB95	D94
		PB96	D95
		PB97	D96
		PB98	D97
		PB99	D98
		PB100	D99
		PB101	D100
		PB102	D101
		PB103	D102
		PB104	D103
		PB105	D104
		PB106	D105
		PB107	D106
		PB108	D107
		PB109	D108
		PB110	D109
		PB111	D110
		PB112	D111
		PB113	D112
		PB114	D113
		PB115	D114
		PB116	D115
		PB117	D116
		PB118	D117
		PB119	D118
		PB120	D119
		PB121	D120
		PB122	D121
		PB123	D122
		PB124	D123
		PB125	D124
		PB126	D125
		PB127	D126
		PB128	D127
		PB129	D128
		PB130	D129
		PB131	D130
		PB132	D131
		PB133	D132
		PB134	D133
		PB135	D134
		PB136	D135
		PB137	D136
		PB138	D137
		PB139	D138
		PB140	D139
		PB141	D140
		PB142	D141
		PB143	D142
		PB144	D143
		PB145	D144
		PB146	D145
		PB147	D146
		PB148	D147
		PB149	D148
		PB150	D149
		PB151	D150
		PB152	D151
		PB153	D152
		PB154	D153
		PB155	D154
		PB156	D155
		PB157	D156
		PB158	D157
		PB159	D158
		PB160	D159
		PB161	D160
		PB162	D161
		PB163	D162
		PB164	D163
		PB165	D164
		PB166	D165
		PB167	D166
		PB168	D167
		PB169	D168
		PB170	D169
		PB171	D170
		PB172	D171
		PB173	D172
		PB174	D173
		PB175	D174
		PB176	D175
		PB177	D176
		PB178	D177
		PB179	D178
		PB180	D179
		PB181	D180
		PB182	D181
		PB183	D182
		PB184	D183
		PB185	D184
		PB186	D185
		PB187	D186
		PB188	D187
		PB189	D188
		PB190	D189
		PB191	D190
		PB192	D191
		PB193	D192
		PB194	D193
		PB195	D194
		PB196	D195
		PB197	D196
		PB198	D197
		PB199	D198
		PB200	D199
		PB201	D200
		PB202	D201
		PB203	D202
		PB204	D203
		PB205	D204
		PB206	D205
		PB207	D206
		PB208	D207
		PB209	D208
		PB210	D209
		PB211	D210
		PB212	D211
		PB213	D212
		PB214	D213
		PB215	D214
		PB216	D215
		PB217	D216
		PB218	D217
		PB219	D218
		PB220	D219
		PB221	D220
		PB222	D221
		PB223	D222
		PB224	D223
		PB225	D224
		PB226	D225
		PB227	D226
		PB228	D227
		PB229	D228
		PB230	D229
		PB231	D230
		PB232	D231
		PB233	D232
		PB234	D233
		PB235	D234
		PB236	D235
		PB237	D236
		PB238	D237
		PB239	D238
		PB240	D239
		PB241	D240
		PB242	D241
		PB243	D242
		PB244	D243
		PB245	D244
		PB246	D245
		PB247	D246
		PB248	D247
		PB249	D248
		PB250	D249
		PB251	D250
		PB252	D251
		PB253	D252
		PB254	D253
		PB255	D254
		PB256	D255
		PB257	D256
		PB258	D257
		PB259	D258
		PB260	D259
		PB261	D260
		PB262	D261
		PB263	D262
		PB264	D263
		PB265	D264
		PB266	D265
		PB267	D266
		PB268	D267
		PB269	D268
		PB270	D269
		PB271	D270
		PB272	D271
		PB273	D272
		PB274	D273
		PB275	D274
		PB276	D275
		PB277	D276
		PB278	D277
		PB279	D278
		PB280	D279
		PB281	D280
		PB282	D281
		PB283	D282
		PB284	D283
		PB285	D284
		PB286	D285
		PB287	D286
		PB288	D287
		PB289	D288
		PB290	D289
		PB291	D290
		PB292	D291
		PB293	D292
		PB294	D293
		PB295	D294
		PB296	D295
		PB297	D296
		PB298	D297
		PB299	D298
		PB300	D299
		PB301	D300
		PB302	D301
		PB303	D302
		PB304	D303
		PB305	D304
		PB306	D305
		PB307	D306
		PB308	D307
		PB309	D308
		PB310	D309
		PB311	D310
		PB312	D311
		PB313	D312
		PB314	D313
		PB315	D314
		PB316	D315
		PB317	D316
		PB318	D317
		PB319	D318
		PB320	D319
		PB321	D320
		PB322	D321
		PB323	D322
		PB324	D323
		PB325	D324
		PB326	D325
		PB327	D326
		PB328	D327
		PB329	



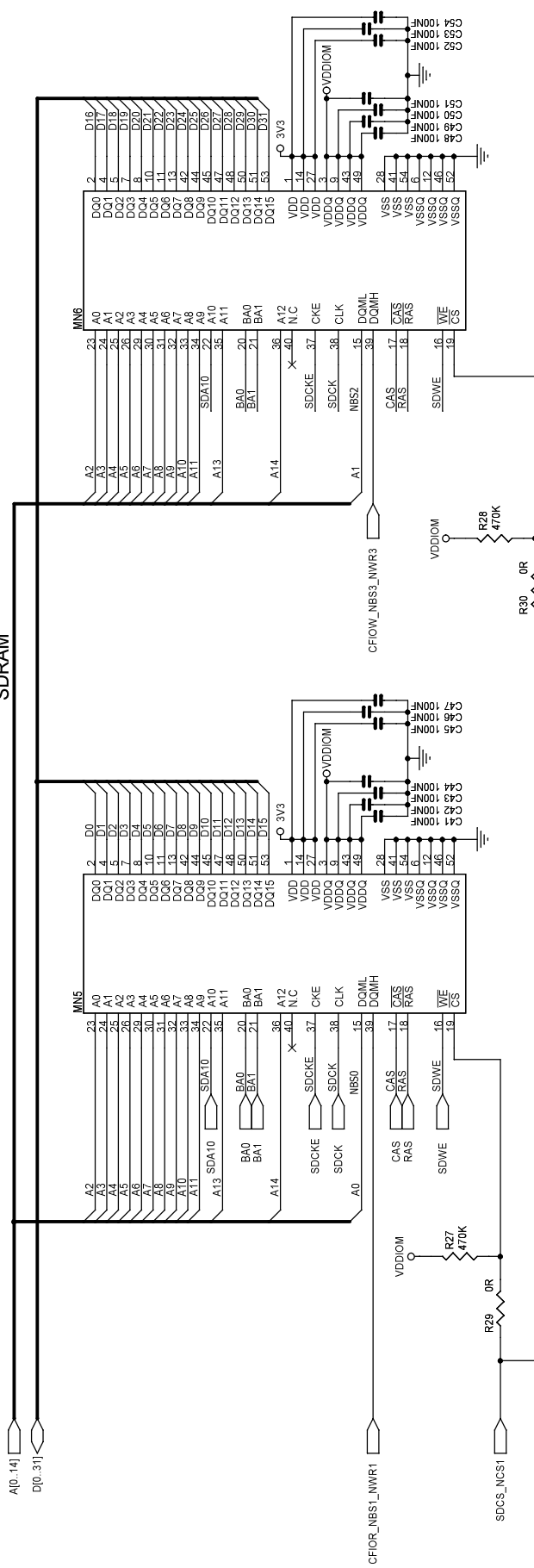
# AT91SAM9RL



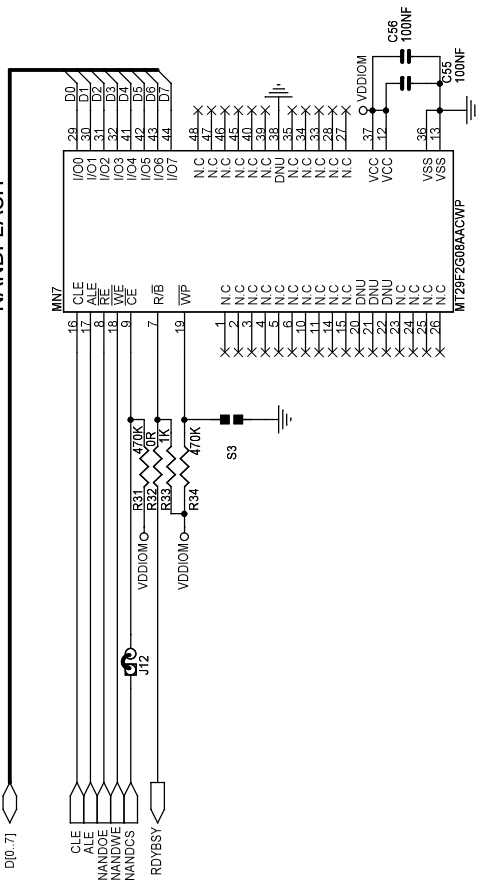
<b>AMEL</b>		DATE: 18-APR-07	REV: B
ROUSSET		DESIGN: 11	SCALE: 1/1
AT91SAM9RL-EK		SHEET 3/9	
AT91SAM9263		REV. DATE	

The agreement is for project: *Atmel.com* and publication: *Atmel.com*. All rights reserved. No part of this document may be reproduced without the prior written permission of Atmel Corporation.

SDRAM



NANDFLASH



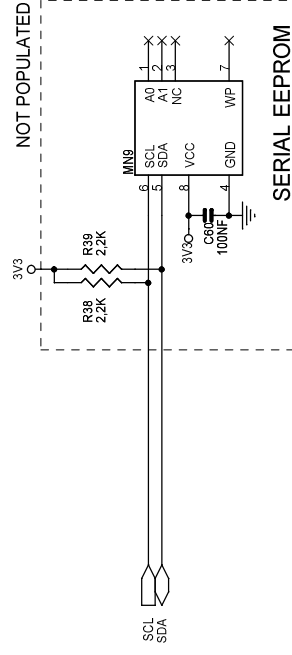
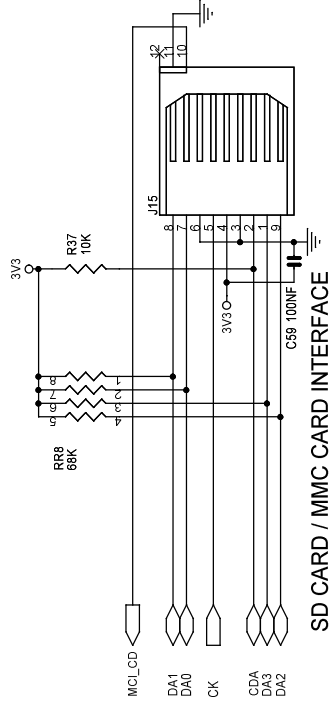
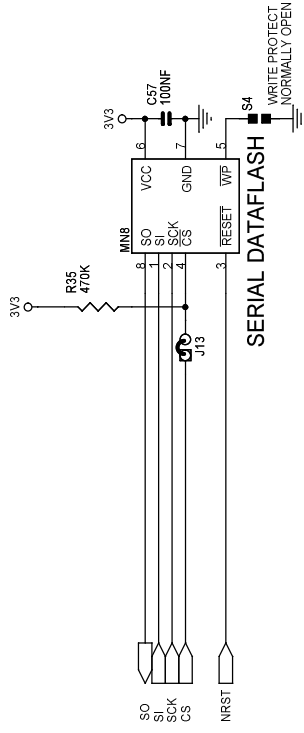
ROUSSET  
AT91SAM9RL-EK  
EBI MEMORY

REV.	DATE	VER.	DATE
B	18-APR-07		
A	01-MAR-07		
INIT EDIT	JPG	DES	DATE
MODIF.			
SCALE	1/1		

SHEET 4/9

REV. B

The agreement is our property. Reproduction and distribution without our written authorization has severe effects on legal proceedings.



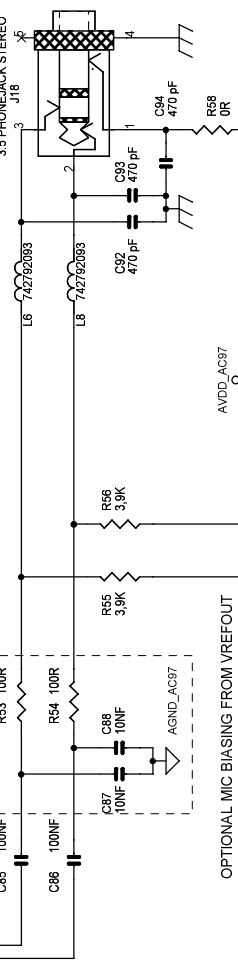
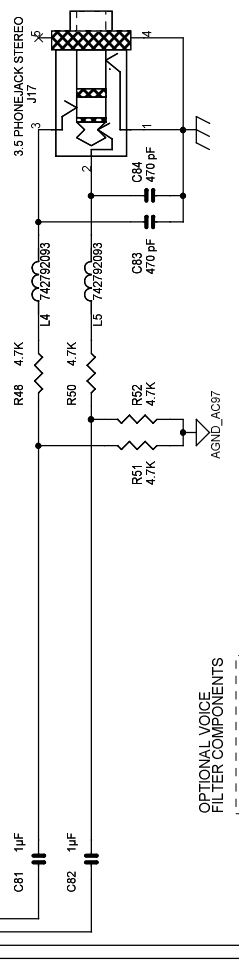
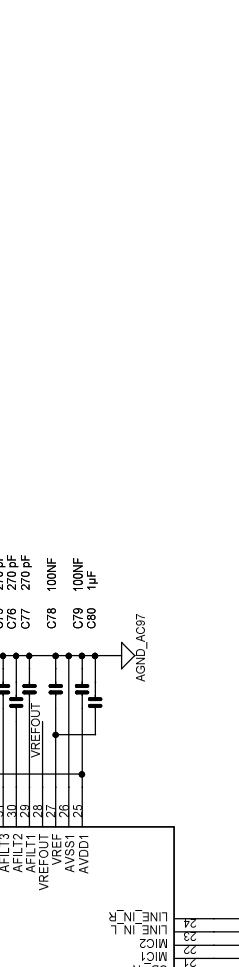
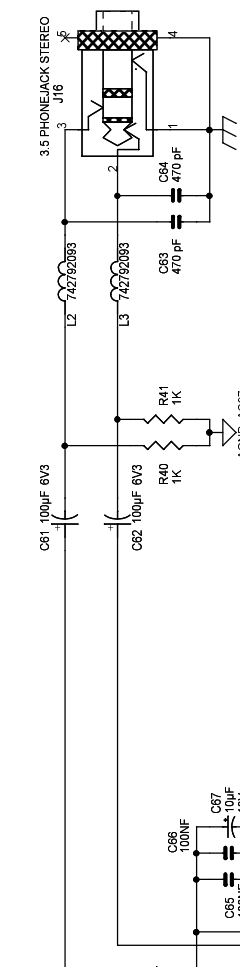
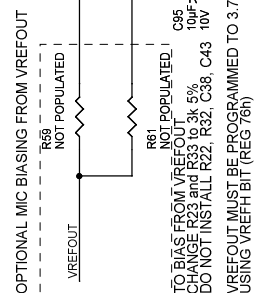
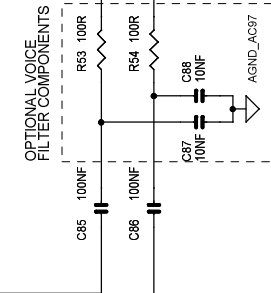
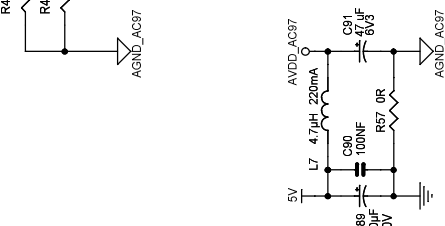
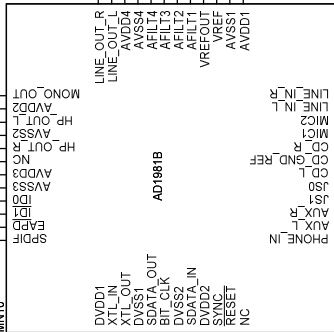
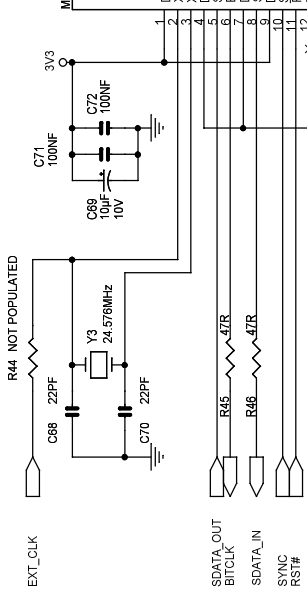
ROUSSET  
AT91SAM9RL-EK  
SERIAL MEMORY

The agreement is our property. Reproduction and distribution without our written authorization has severe effects on legal proceedings.

REV.	DATE	VER.	DATE	REV.	DATE
B	18-APR-07			B	
A	01-MAR-07				
INIT EDIT	JPG	DES	DATE	REV.	DATE
MODIF.	JPG	DES	DATE	REV.	DATE
SCALE: 1/1			SHEET 5/9		

CLOCK SELECTION - PIN STRAPING TABLE

RA	RB	CODEC ID	CLK FREQ
OUT	OUT	PRIMARY	24.576 MHz
OUT	OUT	PRIMARY	48.000 MHz
IN	IN	PRIMARY	14.318 MHz
IN	IN	EXT. BITCLK	Ext. BITCLK (into XTAL-IN)
IN	IN	EXT. BITCLK	Ext. BITCLK (into XTAL-IN)



ROUSSET

AT91SAM9RL-LEK

AUDIO AC97

SCALE 1/1

REV. B

SHEET 6/9

DATE 18-APR-07

DES. DATE 01-MAR-07

INIT EDIT

JPG

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

18-APR-07

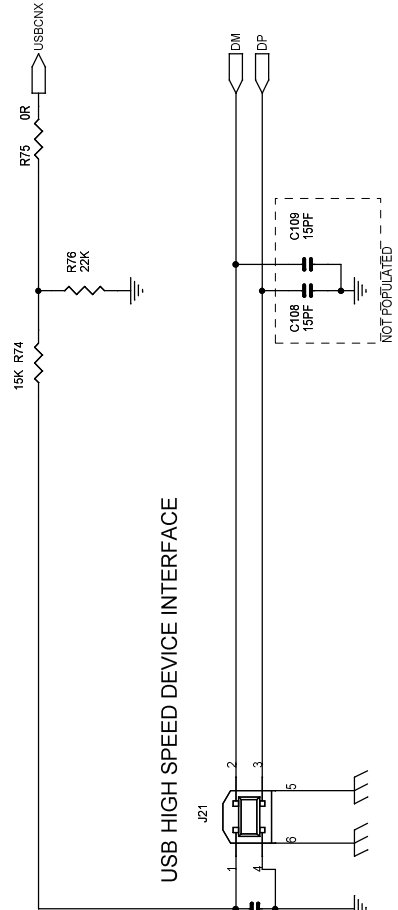
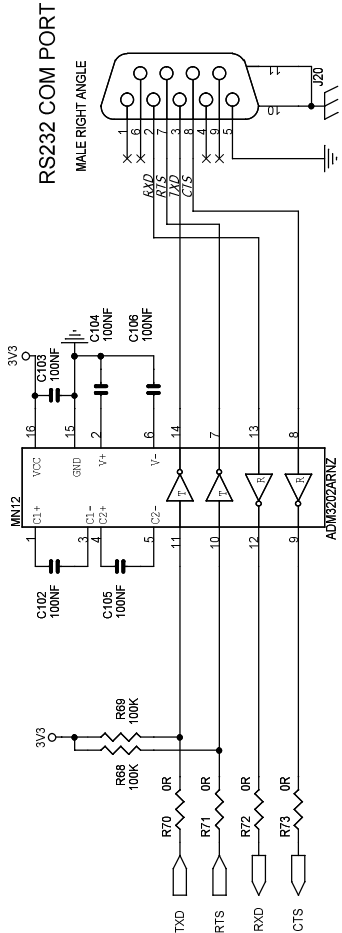
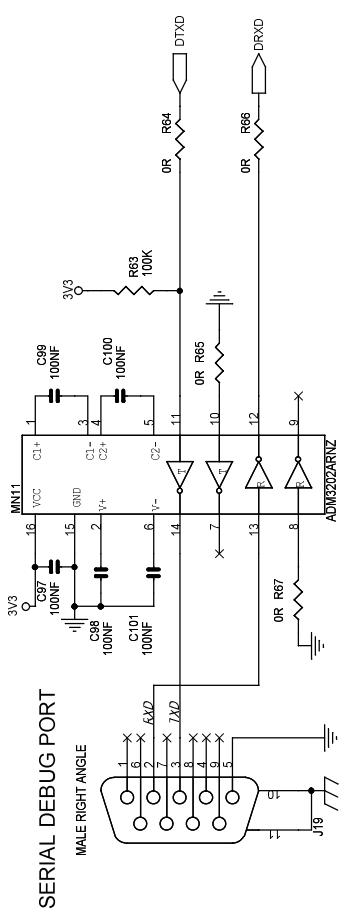
18-APR-07

18-APR-07

18-APR-07

18-APR-07

This agreement is for personal, non-commercial use only. Redistribution or publication without the express written consent of the copyright owner is prohibited.



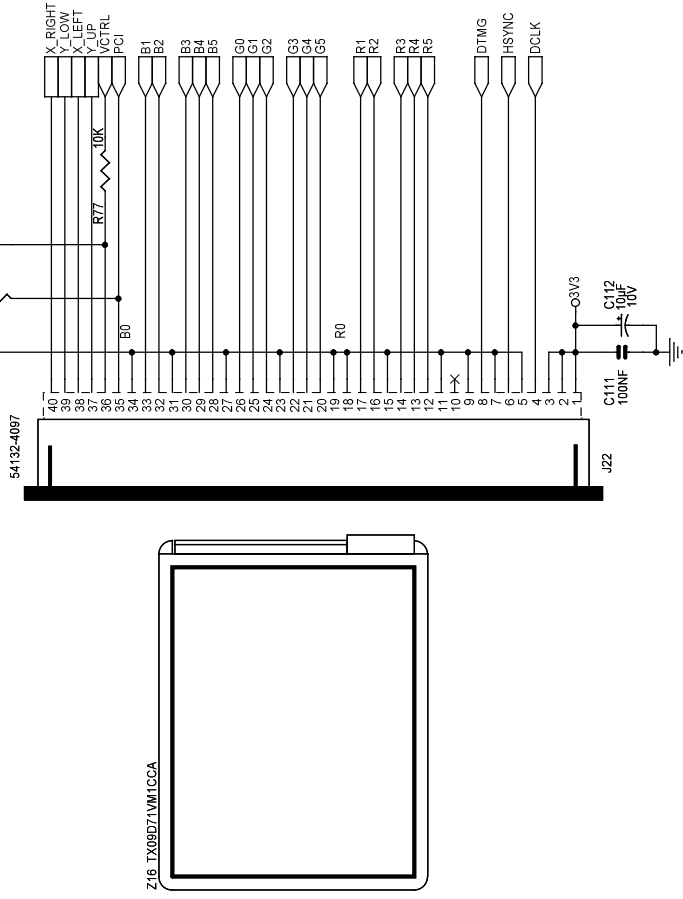
ROUSSET		SCALE 1/1	
AT91SAM9RL-LEK			
SERIAL INTERFACES			

REV.	DATE	DES.	DATE	VER.	DATE	SHEET
B	18-APR-07	JPG	18-APR-07	B		7/9
A	01-MAR-07	JPG	01-MAR-07			
REV.	DATE	DES.	DATE	VER.	DATE	SHEET
B				B		7/9

This agreement is for project: [Project Name] and is not valid for other projects without the express written consent of the project manager.

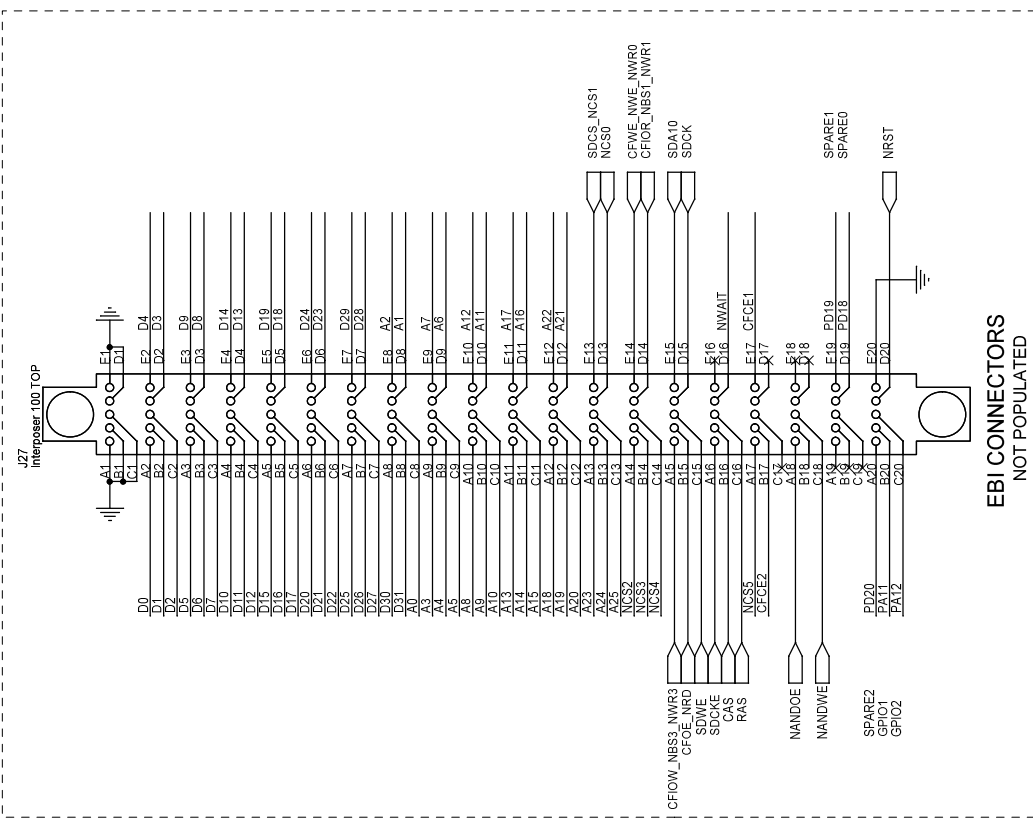


# 1/4 VGA TFT LCD DISPLAY

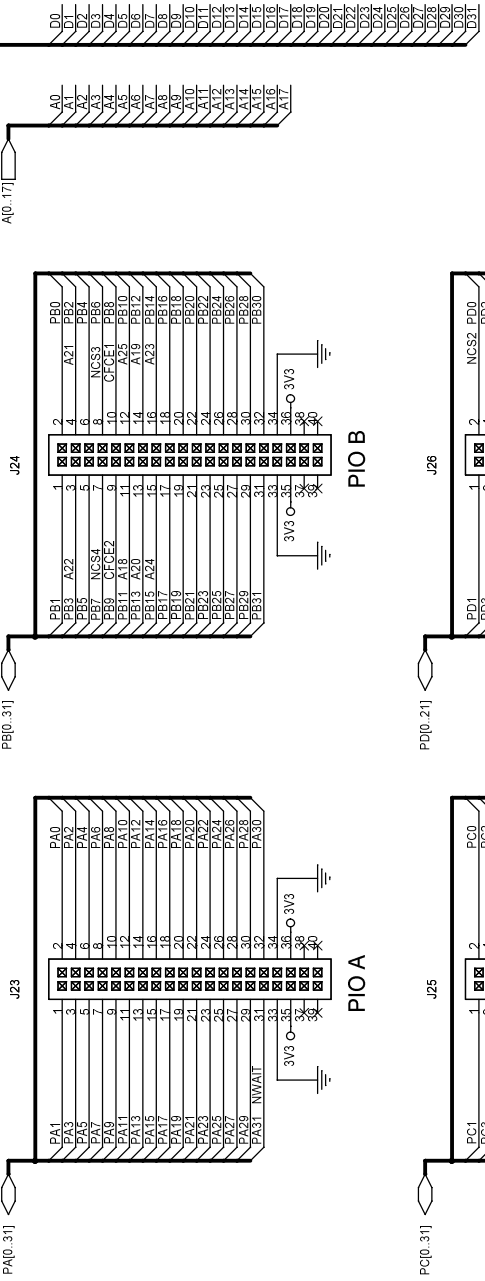
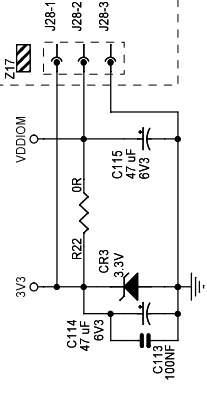


ROUSSET  
AT91SAM9RL-EK  
LCD

REV.	DATE	VER.	DATE
B	18-APR-07		
A	01-MAR-07		
JPG	JPG	DES	DATE
INIT EDIT	DES	DATE	VER.
SCALE 1/1			
REV.	DATE	VER.	DATE
B		B	
SHEET		SHEET	
8		8	
9		9	



**EBI CONNECTORS  
NOT POPULATED**



		EXPANSION	
ROUSSET		AT91SAM9RL-EK	
REV.	DATE	REV.	DATE
B	18-APR-07	B	18-APR-07
A	01-MAR-07	A	01-MAR-07
INIT EDIT	JPG	DES	JPG
SCALE 1/1		SHEET 9/9	

This agreement is our property. Reproduction and/or distribution without our written authorization has severe effects on legal proceedings.



## Section 6

# Revision History

### 6.1 Revision History

**Table 6-1.** Revision History

Document Ref.	Comments	Change Request Ref.
6325A	First issue.	



## Headquarters

---

**Atmel Corporation**  
2325 Orchard Parkway  
San Jose, CA 95131  
USA  
Tel: 1(408) 441-0311  
Fax: 1(408) 487-2600

## International

---

**Atmel Asia**  
Room 1219  
Chinachem Golden Plaza  
77 Mody Road Tsimshatsui  
East Kowloon  
Hong Kong  
Tel: (852) 2721-9778  
Fax: (852) 2722-1369

**Atmel Europe**  
Le Krebs  
8, Rue Jean-Pierre Timbaud  
BP 309  
78054 Saint-Quentin-en-  
Yvelines Cedex  
France  
Tel: (33) 1-30-60-70-00  
Fax: (33) 1-30-60-71-11

**Atmel Japan**  
9F, Tonetsu Shinkawa Bldg.  
1-24-8 Shinkawa  
Chuo-ku, Tokyo 104-0033  
Japan  
Tel: (81) 3-3523-3551  
Fax: (81) 3-3523-7581

## Product Contact

---

**Web Site**  
[www.atmel.com](http://www.atmel.com)  
[www.atmel.com/AT91SAM](http://www.atmel.com/AT91SAM)

**Technical Support**  
[AT91SAM Support](http://www.atmel.com/AT91SAM_Support)

**Sales Contacts**  
[www.atmel.com/contacts/](http://www.atmel.com/contacts/)

**Literature Requests**  
[www.atmel.com/literature](http://www.atmel.com/literature)

---

**Disclaimer:** The information in this document is provided in connection with Atmel products. No license, express or implied, by estoppel or otherwise, to any intellectual property right is granted by this document or in connection with the sale of Atmel products. **EXCEPT AS SET FORTH IN ATMEL'S TERMS AND CONDITIONS OF SALE LOCATED ON ATMEL'S WEB SITE, ATMEL ASSUMES NO LIABILITY WHATSOEVER AND DISCLAIMS ANY EXPRESS, IMPLIED OR STATUTORY WARRANTY RELATING TO ITS PRODUCTS INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT. IN NO EVENT SHALL ATMEL BE LIABLE FOR ANY DIRECT, INDIRECT, CONSEQUENTIAL, PUNITIVE, SPECIAL OR INCIDENTAL DAMAGES (INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS OF PROFITS, BUSINESS INTERRUPTION, OR LOSS OF INFORMATION) ARISING OUT OF THE USE OR INABILITY TO USE THIS DOCUMENT, EVEN IF ATMEL HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.** Atmel makes no representations or warranties with respect to the accuracy or completeness of the contents of this document and reserves the right to make changes to specifications and product descriptions at any time without notice. Atmel does not make any commitment to update the information contained herein. Unless specifically provided otherwise, Atmel products are not suitable for, and shall not be used in, automotive applications. Atmel's products are not intended, authorized, or warranted for use as components in applications intended to support or sustain life.



© 2008 Atmel Corporation. All rights reserved. Atmel®, logo and combinations thereof, DataFlash® and others are registered trademarks or trademarks of Atmel Corporation or its subsidiaries. ARM®, the ARMPowered® logo, Thumb® and others are the registered trademarks or trademarks of ARM Ltd. Other terms and product names may be trademarks of others.