

# **AT91SAM9G10-EK Evaluation Board**

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## **User Guide**





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## Section 1

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# Overview

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### 1.1 Scope

The AT91SAM9G10-EK evaluation kit is an effective platform for evaluating chip performance and developing code for applications based on the AT91SAM9G10.

This guide is a description of the hardware included in the AT91SAM9G10-EK evaluation kit. Software files are available embedded into the board's memory upon delivery.

### 1.2 Deliverables

The AT91SAM9G10-EK package contains the following items:

- an AT91SAM9G10-EK board
- one A/B-type USB cable
- one serial RS232 cable
- one RJ45 crossed Ethernet cable
- universal input AC/DC power supply with US and EU plug adapter

### 1.3 The AT91SAM9G10-EK Evaluation Board

The board is equipped with an AT91SAM9G10 (217-ball LFBGA package) together with the following:

- 64 Mbytes of SDRAM memory
- 256 Mbytes of NAND Flash memory
- one Atmel<sup>®</sup> serial DataFlash<sup>®</sup>
- one USB device port interface
- two USB host port interfaces
- one DBGU serial communication port
- JTAG/ICE debug interface
- one Ethernet 100-base TX with three status LEDs
- one Atmel AT73C213 Audio DAC
- one 3.5" 1/4 VGA TFT LCD Module with TouchScreen and backlight
- one Power LED and two general-purpose LEDs
- four user input pushbuttons
- one wakeup input pushbutton
- one reset pushbutton
- one DataFlash SD/MMC card slot

- two expansion footprint connectors (solder side)
- one Lithium Coin Cell Battery Retainer for 12 mm cell size
- dual pitch prototyping area



## Section 2

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# Setting Up the AT91SAM9G10-EK Evaluation Board

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### 2.1 Electrostatic Warning

The AT91SAM9G10-EK evaluation board is shipped in a protective anti-static package. The board must not be subjected to high electrostatic potentials. In risky ESD environments (e.g. offices with carpet) a grounding strap or similar protective device should be worn when handling the board. Also, generally avoid touching the component pins or any other metallic element of the board.

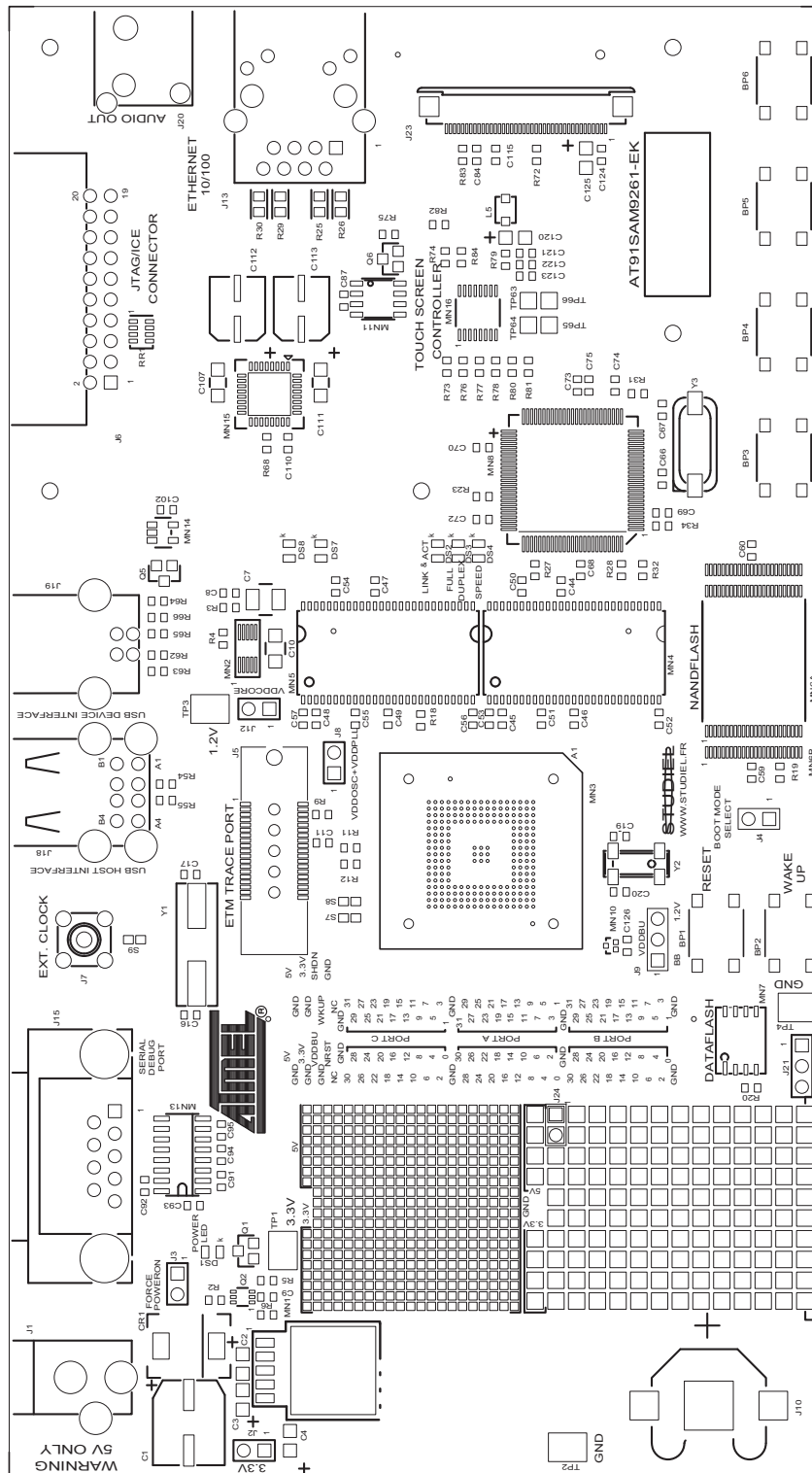
### 2.2 Requirements

In order to set up the AT91SAM9G10-EK evaluation board, the following items are required:

- the AT91SAM9G10-EK evaluation board itself
- AC/DC power adapter (5V at 2A), 2.1 mm by 5.5 mm

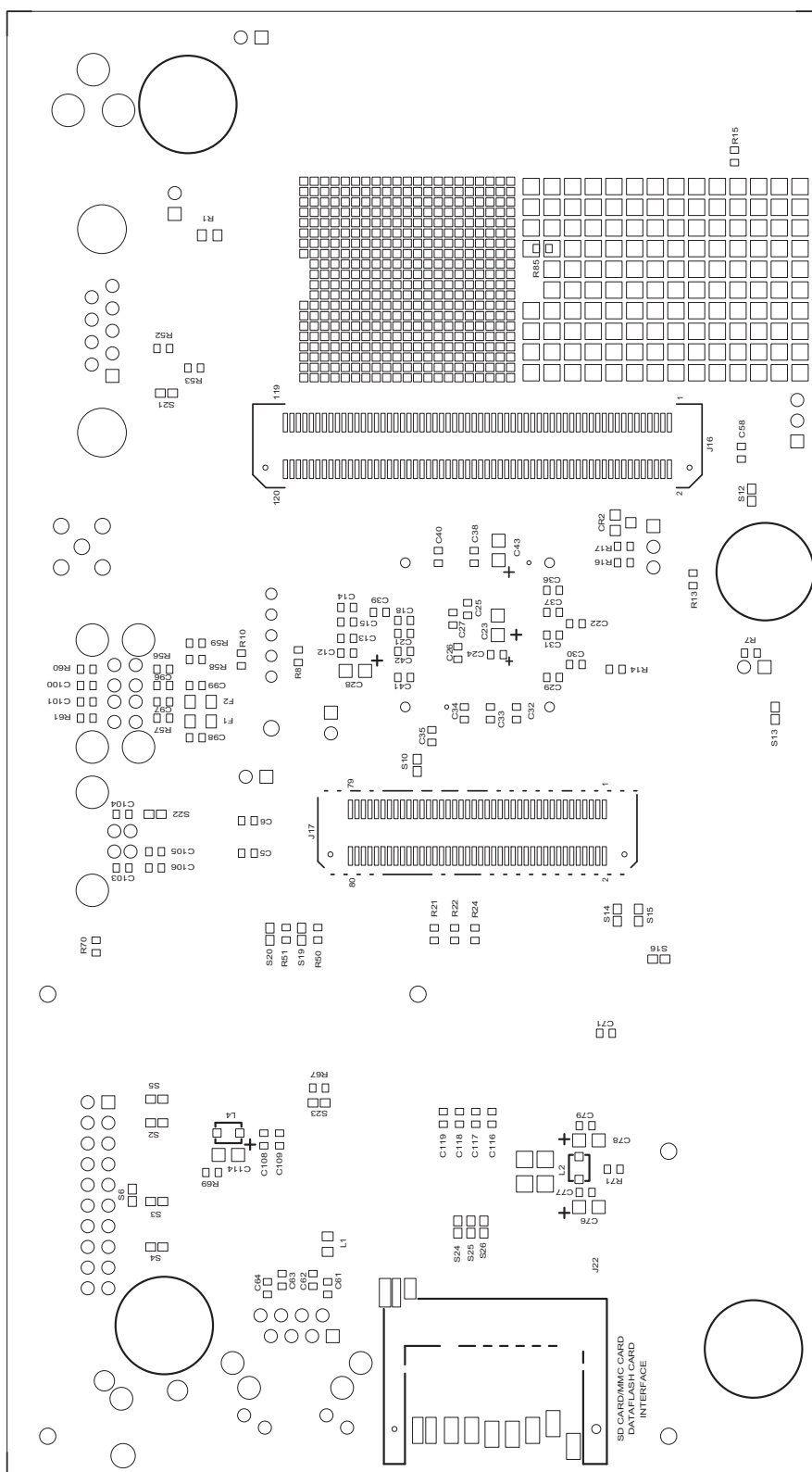
## 2.3 Layout

**Figure 2-1.** AT91SAM9G10-EK Layout - Top View





**Figure 2-2. AT91SAM9G10-EK Layout - Bottom View**



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## 2.4 Powering Up the Board

AT91SAM9G10-EK requires 5V DC ( $\pm 5\%$ ). DC power is supplied to the board via the 2.1 mm by 5.5 mm socket (J1). The coaxial power plug center pin is positive polarity.

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## 2.5 Backup Power Supply

The user has the possibility to add a battery (3V Lithium Battery CR1225 or equivalent) in order to permanently power the backup part of the device. In this case, J9 configuration must to be set in position 1, 2.

Refer to [Table 4-1](#), “Configuration Jumpers and Straps”.

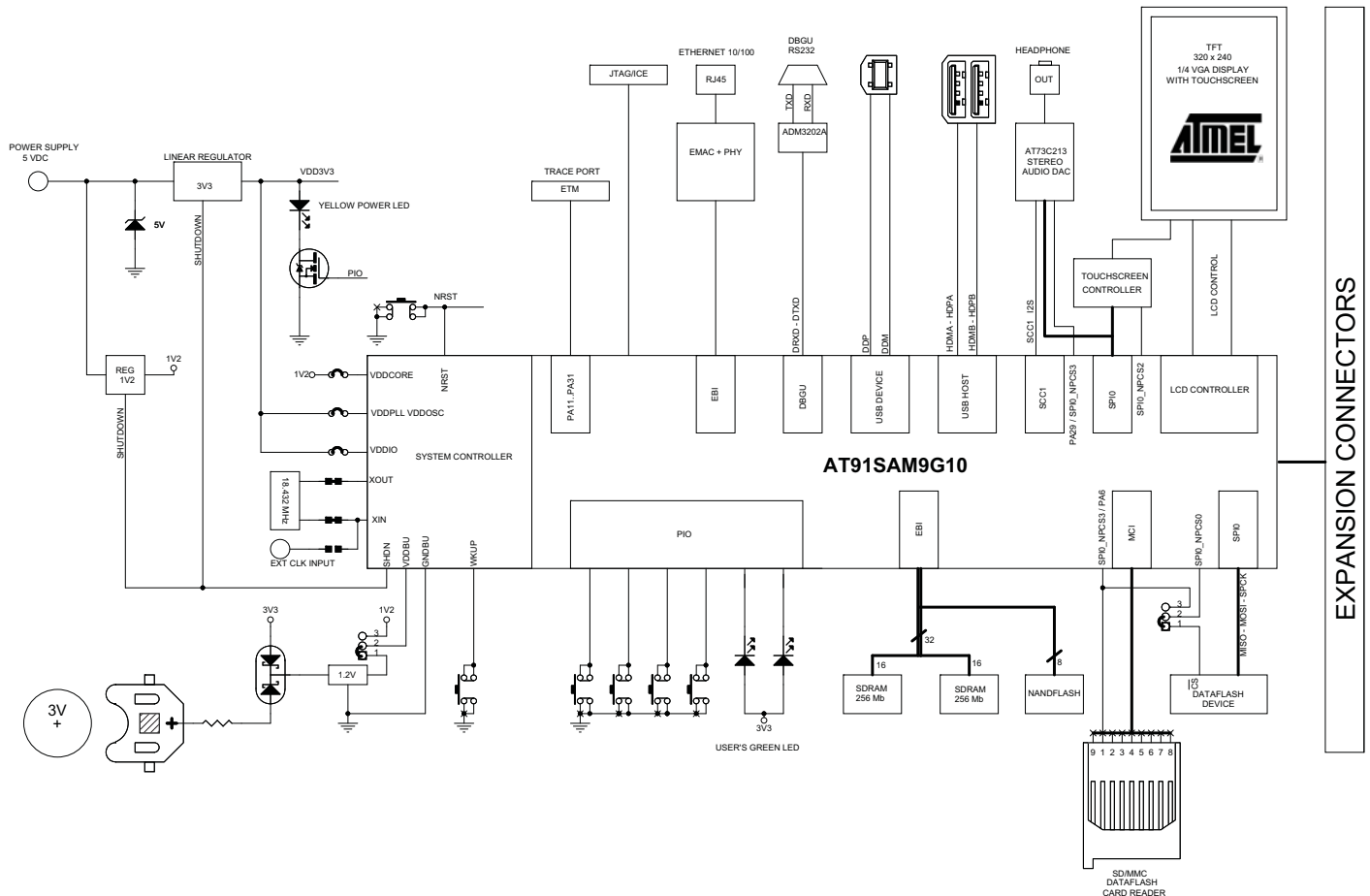
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## 2.6 Getting Started

The AT91SAM9G10-EK evaluation board is delivered with an embedded demo and documentation files allowing the user to begin evaluating the AT91 ARM Thumb 32-bit microcontroller quickly. Simply power the board and connect it to the USB port of your PC to open it. Also, please refer to the AT91 web site, [www.atmel.com/products/AT91/](http://www.atmel.com/products/AT91/), for the most up-to-date information on getting started with the AT91SAM9G10-EK.

## 2.7 AT91SAM9G10-EK Block Diagram

Figure 2-3. Block Diagram







### 3.1 AT91SAM9G10 Microcontroller

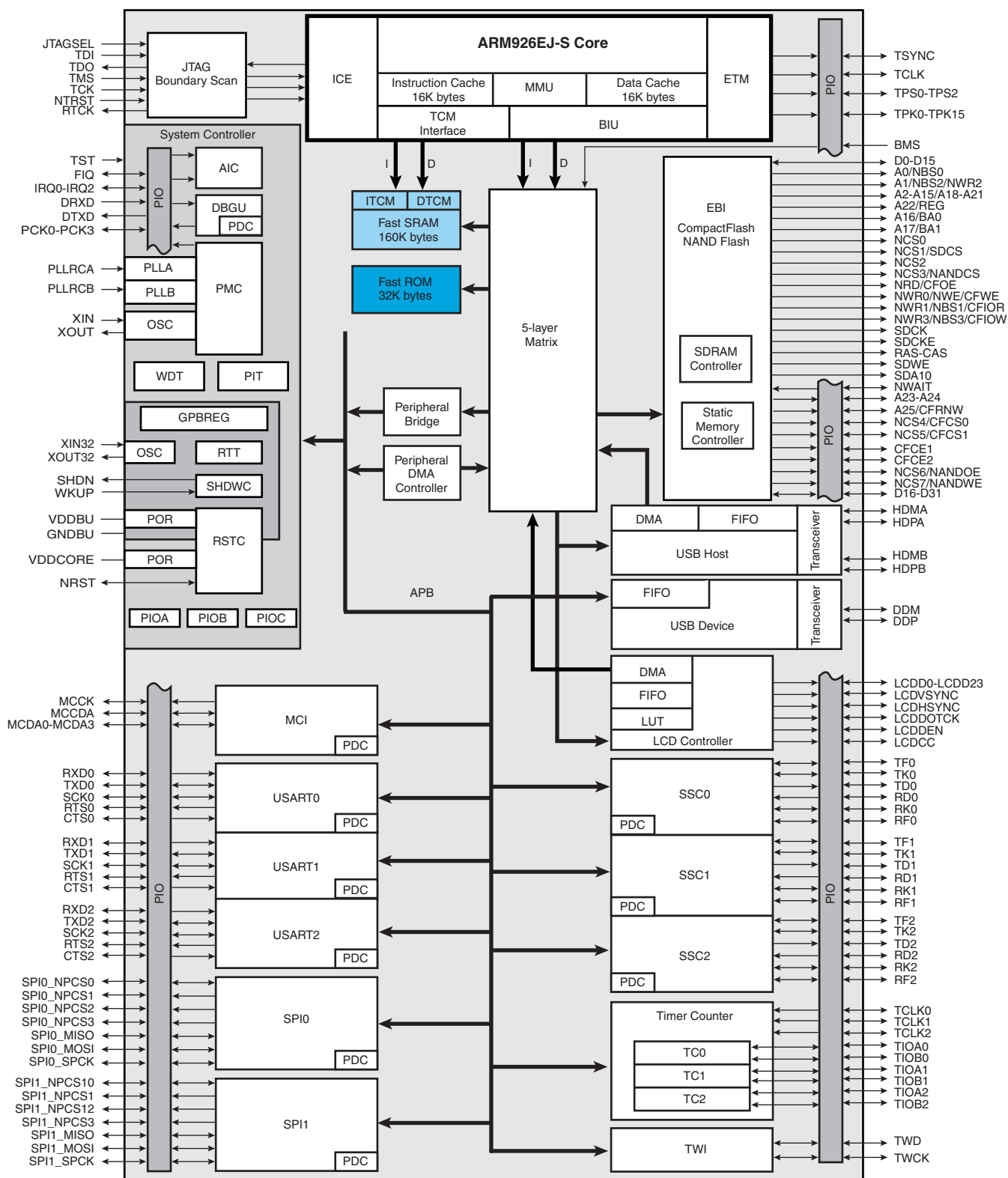
- Incorporates the ARM926EJ-S™ ARM Thumb Processor
  - DSP Instruction Extensions
  - ARM Jazelle® Technology for Java® Acceleration
  - 16-KByte Data Cache, 16-KByte Instruction Cache, Write Buffer
  - 266 MHz core frequency
  - Memory Management Unit
  - EmbeddedICE™ In-circuit Emulation, Debug Communication Channel Support
  - Mid-level implementation Embedded Trace Macrocell™
- Additional Embedded Memories
  - 32K Bytes of Internal ROM, Single-cycle Access at Maximum Bus Speed
  - 160K Bytes of Internal SRAM, Single-cycle Access at Maximum Processor or Bus Speed
- External Bus Interface (EBI)
  - Supports SDRAM, Static Memory, NAND Flash and CompactFlash®
- LCD Controller
  - RGB Addressing
  - Supports Passive or Active Displays
  - Up to 16-bits per Pixel in STN Color Mode
  - Up to 16M Colors in TFT Mode (24-bit per Pixel), Resolution up to 2048 x 2048
- USB
  - USB 2.0 Full Speed (12 Mbits per second) Host Double Port
    - Dual On-chip Transceivers
    - Integrated FIFOs and Dedicated DMA Channels
  - USB 2.0 Full Speed (12 Mbits per second) Device Port
    - On-chip Transceiver, 2-Kbyte Configurable Integrated FIFOs
- Bus Matrix
  - Handles Five Masters and Five Slaves
  - Boot Mode Select Option
  - Remap Command
- Fully Featured System Controller (SYSC) for Efficient System Management, including
  - Reset Controller, Shutdown Controller, 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
- Three 32-bit PIO Controllers
- **Reset Controller (RSTC)**
  - Based on Power-on Reset Cells, Reset Source Identification and Reset Output Control
- **Shutdown Controller (SHDWC)**
  - Programmable Shutdown Pin Control and Wake-up Circuitry
- **Clock Generator (CKGR)**
  - 32.768 kHz Low-power Oscillator on Battery Backup Power Supply, Providing a Permanent Slow Clock
  - 3 to 20 MHz On-chip Oscillator and two PLLs
- **Power Management Controller (PMC)**
  - Very Slow Clock Operating Mode, Software Programmable Power Optimization Capabilities
  - Four Programmable External Clock Signals
- **Advanced Interrupt Controller (AIC)**
  - Individually Maskable, Eight-level Priority, Vectored Interrupt Sources
  - Three External Interrupt Sources and One Fast Interrupt Source, Spurious Interrupt Protected
- **Debug Unit (DBGU)**
  - 2-wire USART and Support for Debug Communication Channel, Programmable ICE Access Prevention
- **Periodic Interval Timer (PIT)**
  - 20-bit Interval Timer plus 12-bit Interval Counter
- **Watchdog Timer (WDT)**
  - Key Protected, Programmable Only Once, Windowed 12-bit Counter, Running at Slow Clock
- **Real-Time Timer (RTT)**
  - 32-bit Free-running Backup Counter Running at Slow Clock
- **Three 32-bit Parallel Input/Output Controllers (PIO) PIOA, PIOB and PIOC**
  - 96 Programmable I/O Lines Multiplexed with up to Two Peripheral I/Os
  - Input Change Interrupt Capability on Each I/O Line
  - Individually Programmable Open-drain, Pull-up Resistor and Synchronous Output
- **Nineteen Peripheral DMA (PDC) Channels**
- **Multimedia Card Interface (MCI)**
  - Compliant with Multimedia Cards and SDCards
  - Automatic Protocol Control and Fast Automatic Data Transfers with PDC, MMC and SDCard Compliant
- **Three 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
- **Three Universal Synchronous/Asynchronous Receiver Transmitters (USART)**
  - Individual Baud Rate Generator, IrDA<sup>®</sup> Infrared Modulation/Demodulation

- Support for ISO7816 T0/T1 Smart Card, Hardware and Software Handshaking, RS485 Support
- Two Master/Slave Serial Peripheral Interface (SPI)
  - 8- to 16-bit Programmable Data Length, Four External Peripheral Chip Selects
- One Three-channel 16-bit Timer/Counters (TC)
  - Three External Clock Inputs, Two multi-purpose I/O Pins per Channel
  - Double PWM Generation, Capture/Waveform Mode, Up/Down Capability
- Two-wire Interface (TWI)
  - Master Mode Support, All Two-wire Atmel EEPROMs Supported
- IEEE® 1149.1 JTAG Boundary Scan on All Digital Pins
- Required Power Supplies:
  - 1.08V to 1.32V for VDDCORE and VDDBU
  - 3.0V to 3.6V for VDDOSC and for VDDPLL
  - 2.7V to 3.6V for VDDIOP (Peripheral I/Os)
  - 1.65V to 1.95V and 3.0V to 3.6V for VDDIOM (Memory I/Os)
- Available in a 217-ball LFBGA RoHS-compliant Package

## 3.2 AT91SAM9G10 Block Diagram

Figure 3-1. Block Diagram





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### 3.3 Memory

- 32 Kbytes of Internal ROM
- 160 Kbytes of Internal High-speed SRAM
- Atmel serial DataFlash
- 64 Mbytes of SDRAM memory
- 256 Mbytes of NAND Flash memory

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### 3.4 Clock Circuitry

- 18.432 MHz standard crystal for the embedded oscillator
- 32.768 kHz standard crystal for the slow clock oscillator

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### 3.5 Reset Circuitry

- Internal reset controller with a bi-directional reset pin
- External reset push button

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### 3.6 Shutdown Controller

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

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### 3.7 Power Supply Circuitry

- For dynamic power consumption, the AT91SAM9G10 consumes a maximum of 50 mA on VDDCORE at maximum speed in typical conditions (1.2V, 25°C), processor running full-performance algorithm
- On-board 1.2V high efficiency step-down charge pump regulator with shutdown control
- On-board 3.3V linear regulator with shutdown control

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### 3.8 Remote Communication

- One Serial interface (DBGU COM Port) via RS-232 DB9 male socket
- USB V2.0 Full-speed Compliant, 12 Mbits per second (UDP)
- Two USB Host port V2.0 Full-speed Compliant, 12 Mbits per second (UHP)
- One Ethernet 100-base TX with three status LEDs

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### 3.9 Audio Stereo Interface

- One Atmel stereo audio DAC AT73C213
- One 32 Ohm/20 mW Stereo Headset output (J20) with Master Volume and Mute Controls

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### 3.10 User Interface

- Four user input pushbuttons
- Two user green LEDs
- One yellow power LED (can be also software controlled)
- One ¼ VGA display LCD with Touchscreen and white LED backlight

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### 3.11 Debug Interface

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

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### 3.12 Expansion Slot

- One DataFlash, SD/MMC card slot
- All I/Os of the AT91SAM9G10 are routed to peripheral extension footprint connectors (J16 and J17). 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.

### 3.13 PIO Usage

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

| I/O Line | Peripheral A | Peripheral B | Comments                                                                              |                       |
|----------|--------------|--------------|---------------------------------------------------------------------------------------|-----------------------|
| PA0      | SPI0_MISO    | MCDA0        | SD/MMC/DATAFLASH SOCKET (J9) & DATAFLASH DEVICE & TOUCH SCREEN CONTROLLER & AUDIO DAC | SPI0_MISO or MCI0_DA0 |
| PA1      | SPI0_MOSI    | MCCDA        | SD/MMC/DATAFLASH SOCKET (J9) & DATAFLASH DEVICE & TOUCH SCREEN CONTROLLER & AUDIO DAC | SPI0_MOSI or MCI0_CDA |
| PA2      | SPI0_SPCK    | MCCK         | SD/MMC/DATAFLASH SOCKET (J9) & DATAFLASH DEVICE & TOUCH SCREEN CONTROLLER & AUDIO DAC | SPI0_SPCK or MCCK     |
| PA3      | SPI0_NPCS0   |              | DATAFLASH DEVICE or DATAFLASH SOCKET (J9)                                             | SPI0_NPCS0            |
| PA4      | SPI0_NPCS1   | MCDA1        | SD/MMC/DATAFLASH SOCKET (J9)                                                          | MCDA1                 |
| PA5      | SPI0_NPCS2   | MCDA2        | SD/MMC/DATAFLASH SOCKET (J9)                                                          | MCDA2                 |
| PA6      | SPI0_NPCS3   | MCDA3        | SD/MMC/DATAFLASH SOCKET (J9)                                                          | SPI0_NPCS3 or MCDA3   |
| PA7      | TWD          | PCK0         |                                                                                       |                       |
| PA8      | TWCK         | PCK1         |                                                                                       |                       |
| PA9      | DRXD         | PCK2         | SERIAL DEBUG PORT (J15)                                                               | DRXD                  |
| PA10     | DTXD         | PCK3         | SERIAL DEBUG PORT (J15)                                                               | DTXD                  |
| PA11     | TSYNC        | SCK1         | TOUCH SCREEN CONTROLLER (MN16) BUSY                                                   | PA11                  |
| PA12     | TCLK         | RTS1         | TFT PANEL CONTROL (J23) POWER CONTROL IN                                              | PA12                  |
| PA13     | TPS0         | CTS1         | GREEN USER'S LED 1 (DS8)                                                              | PA13                  |
| PA14     | TPS1         | SCK2         | GREEN USER'S LED 2 (DS7)                                                              | PA14                  |
| PA15     | TPS2         | RTS2         |                                                                                       |                       |
| PA16     | TPK0         | CTS2         |                                                                                       |                       |
| PA17     | TPK1         | TF1          | I2S AUDIO DAC AT73C213 (MN15) LRFS                                                    | TF1                   |
| PA18     | TPK2         | TK1          | I2S AUDIO DAC AT73C213 (MN15) BCLK                                                    | TK1                   |
| PA19     | TPK3         | TD1          | I2S AUDIO DAC AT73C213 (MN15) SDIN                                                    | TD1                   |
| PA20     | TPK4         | RD1          |                                                                                       |                       |
| PA21     | TPK5         | RK1          |                                                                                       |                       |
| PA22     | TPK6         | RF1          |                                                                                       |                       |
| PA23     | TPK7         | RTS0         | YELLOW POWER LED CONTROL (DS1)                                                        | PA23                  |
| PA24     | TPK8         | SPI1_NPCS1   | USER'S PUSH BUTTON INPUT (BP6)                                                        | PA24                  |
| PA25     | TPK9         | SPI1_NPCS2   | USER'S PUSH BUTTON INPUT (BP5)                                                        | PA25                  |
| PA26     | TPK10        | SPI1_NPCS3   | USER'S PUSH BUTTON INPUT (BP4)                                                        | PA26                  |
| PA27     | TPK11        | SPI0_NPCS1   | USER'S PUSH BUTTON INPUT (BP3)                                                        | PA27                  |
| PA28     | TPK12        | SPI0_NPCS2   | TOUCH SCREEN CONTROLLER (MN16)                                                        | SPI0_NPCS2            |
| PA29     | TPK13        | SPI0_NPCS3   | I2S AUDIO DAC AT73C213 (MN15)                                                         | SPI0_NPCS3            |
| PA30     | TPK14        | A23          |                                                                                       |                       |
| PA31     | TPK15        | A24          |                                                                                       |                       |

**Table 3-2.** PIO Controller B

| I/O Line | Peripheral A | Peripheral B | Comments                           |          |       |
|----------|--------------|--------------|------------------------------------|----------|-------|
| PB0      | LCDVSYNC     |              |                                    |          |       |
| PB1      | LCDHSYNC     |              | TFT PANEL CONTROL (J23)            | LCDHSYNC |       |
| PB2      | LCDDOTCK     | PCK0         | TFT PANEL CONTROL (J23)            | LCDDOTCK |       |
| PB3      | LCDDEN       |              | TFT PANEL CONTROL (J23)            | LCDDEN   |       |
| PB4      | LCDDCC       | LCDD2        | TFT PANEL CONTROL (J23) BACKLIGHT  | LCDDCC   |       |
| PB5      | LCDD0        | LCDD3        |                                    |          |       |
| PB6      | LCDD1        | LCDD4        |                                    |          |       |
| PB7      | LCDD2        | LCDD5        | TFT PANEL CONTROL (J23)            | LCDD2    | RED   |
| PB8      | LCDD3        | LCDD6        | TFT PANEL CONTROL (J23)            | LCDD3    | RED   |
| PB9      | LCDD4        | LCDD7        | TFT PANEL CONTROL (J23)            | LCDD4    | RED   |
| PB10     | LCDD5        | LCDD10       | TFT PANEL CONTROL (J23)            | LCDD5    | RED   |
| PB11     | LCDD6        | LCDD11       | TFT PANEL CONTROL (J23)            | LCDD6    | RED   |
| PB12     | LCDD7        | LCDD12       | TFT PANEL CONTROL (J23)            | LCDD7    | RED   |
| PB13     | LCDD8        | LCDD13       |                                    |          |       |
| PB14     | LCDD9        | LCDD14       |                                    |          |       |
| PB15     | LCDD10       | LCDD15       | TFT PANEL CONTROL (J23)            | LCDD10   | GREEN |
| PB16     | LCDD11       | LCDD19       | TFT PANEL CONTROL (J23)            | LCDD11   | GREEN |
| PB17     | LCDD12       | LCDD20       | TFT PANEL CONTROL (J23)            | LCDD12   | GREEN |
| PB18     | LCDD13       | LCDD21       | TFT PANEL CONTROL (J23)            | LCDD13   | GREEN |
| PB19     | LCDD14       | LCDD22       | TFT PANEL CONTROL (J23)            | LCDD14   | GREEN |
| PB20     | LCDD15       | LCDD23       | TFT PANEL CONTROL (J23)            | LCDD15   | GREEN |
| PB21     | TF0          | LCDD16       |                                    |          |       |
| PB22     | TK0          | LCDD17       |                                    |          |       |
| PB23     | TD0          | LCDD18       | TFT PANEL CONTROL (J23)            | LCDD18   | BLUE  |
| PB24     | RD0          | LCDD19       | TFT PANEL CONTROL (J23)            | LCDD19   | BLUE  |
| PB25     | RK0          | LCDD20       | TFT PANEL CONTROL (J23)            | LCDD20   | BLUE  |
| PB26     | RF0          | LCDD21       | TFT PANEL CONTROL (J23)            | LCDD21   | BLUE  |
| PB27     | SPI1_NPCS1   | LCDD22       | TFT PANEL CONTROL (J23)            | LCDD22   | BLUE  |
| PB28     | SPI1_NPCS0   | LCDD23       | TFT PANEL CONTROL (J23)            | LCDD23   | BLUE  |
| PB29     | SPI1_SPCK    | IRQ2         | USB DEVICE INTERFACE (J19) USB_CNX | PB29     |       |
| PB30     | SPI1_MISO    | IRQ1         |                                    |          |       |
| PB31     | SPI1_MOSI    | PCK2         | I2S AUDIO DAC AT73C213 (MN15) MCLK | PCK2     |       |

**Table 3-3.** PIO Controller C

| I/O Line | Peripheral A | Peripheral B | Comments                                  |        |
|----------|--------------|--------------|-------------------------------------------|--------|
| PC0      | NANDOE       | NCS6         | NAND FLASH DEVICE (MN6x)                  | NANDOE |
| PC1      | NANDWE       | NCS7         | NAND FLASH DEVICE (MN6x)                  | NANDWE |
| PC2      | NWAIT        | IRQ0         | TOUCH SCREEN CONTROLLER (MN16) PENIRQ     | IRQ0   |
| PC3      | A25/CFRNW    |              |                                           |        |
| PC4      | NCS4/CFCS0   |              |                                           |        |
| PC5      | NCS5/CFCS1   |              |                                           |        |
| PC6      | CFCE1        |              |                                           |        |
| PC7      | CFCE2        |              |                                           |        |
| PC8      | TXD0         | PCK2         |                                           |        |
| PC9      | RXD0         | PCK3         |                                           |        |
| PC10     | RTS0         | SCK0         | ETHERNET CONTROLLER (MN8) RST             | PC10   |
| PC11     | CTS0         | FIQ          | ETHERNET CONTROLLER (MN8) IRQ             | PC11   |
| PC12     | TXD1         | NCS6         |                                           |        |
| PC13     | RXD1         | NCS7         |                                           |        |
| PC14     | TXD2         | SPI1_NPCS2   | NAND FLASH DEVICE (MN6x) CHIP ENABLE (CE) | PC14   |
| PC15     | RXD2         | SPI1_NPCS3   | NAND FLASH DEVICE (MN6x) READY/BUSY (R/B) | PC15   |
| PC16     | D16          | TCLK0        | EBI DATA BUS D16                          | D16    |
| PC17     | D17          | TCLK1        | EBI DATA BUS D17                          | D17    |
| PC18     | D18          | TCLK2        | EBI DATA BUS D18                          | D18    |
| PC19     | D19          | TIOA0        | EBI DATA BUS D19                          | D19    |
| PC20     | D20          | TIOB0        | EBI DATA BUS D20                          | D20    |
| PC21     | D21          | TIOA1        | EBI DATA BUS D21                          | D21    |
| PC22     | D22          | TIOB1        | EBI DATA BUS D22                          | D22    |
| PC23     | D23          | TIOA2        | EBI DATA BUS D23                          | D23    |
| PC24     | D24          | TIOB2        | EBI DATA BUS D24                          | D24    |
| PC25     | D25          | TF2          | EBI DATA BUS D25                          | D25    |
| PC26     | D26          | TK2          | EBI DATA BUS D26                          | D26    |
| PC27     | D27          | TD2          | EBI DATA BUS D27                          | D27    |
| PC28     | D28          | RD2          | EBI DATA BUS D28                          | D28    |
| PC29     | D29          | RK2          | EBI DATA BUS D29                          | D29    |
| PC30     | D30          | RF2          | EBI DATA BUS D30                          | D30    |
| PC31     | D31          | PCK1         | EBI DATA BUS D31                          | D31    |



# Configuration Straps

## 4.1 Configuration Straps

Table 4-1 gives details on configuration straps on the AT91SAM9G10-EK evaluation board and their default settings.

**Table 4-1.** Configuration Jumpers and Straps

| Designation | Default Setting | Feature                                                                                                                                                                                                                            |
|-------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| J2          | Closed          | 3.3V Jumper <sup>(1)</sup><br>This jumper footprint is provided for 3.3V power consumption measurement use. By default, it is closed. To use this feature, the user has to open the strap by cutting it before soldering a jumper. |
| J3          | Closed          | Forces power on. To use the software shutdown control, J3 must be opened.                                                                                                                                                          |
| J4          | Open            | Enables Boot on the internal ROM                                                                                                                                                                                                   |
|             | Closed          | Enables Boot on the NCS0                                                                                                                                                                                                           |
| J8          | Closed          | VDDPLL Jumper <sup>(1)</sup>                                                                                                                                                                                                       |
| J9          | 2-3             | VDDBU Jumper select <sup>(1)</sup><br>1-2: Lithium 3V Battery<br>2-3: 1.2V from VDDCORE                                                                                                                                            |
| J12         | Closed          | VDDCORE Jumper <sup>(1)</sup>                                                                                                                                                                                                      |
| J21         | 1-2             | NPCS0 select<br>1-2: DataFlash device (MN7)<br>2-3: DataFlash card interface (J22)<br><b>Warning: In this case NPCS03 must be configured as input.</b>                                                                             |
| J24         | Closed          | Enables the selection of the on-board Nand-Flash device. Remove this jumper to prevent the system boot from that device and to be able to reprogram it.                                                                            |
| S2          | Open            | Disables the ICE NTRST input                                                                                                                                                                                                       |
| S3          | Closed          | Enables the ICE RTCK return. S6 must be opened                                                                                                                                                                                     |
| S4          | Closed          | Enables the ICE NRST input                                                                                                                                                                                                         |
| S5          | Open            | Selects ICE mode or JTAG mode (See Section 6, Errata)                                                                                                                                                                              |
| S6          | Open            | Disables TCK <-> RTCK local loop. If S6 is closed, S3 must be opened.                                                                                                                                                              |
| S7-S8<br>S9 | Closed<br>Open  | Enables the use of 18.432 MHz crystal. If external clock used, S7-S8 must be opened and S9 closed.                                                                                                                                 |

**Table 4-1.** Configuration Jumpers and Straps

| Designation | Default Setting | Feature                                                       |
|-------------|-----------------|---------------------------------------------------------------|
| S10         | Closed          | Enables the use of SDRAM (NCS1_SDCS)                          |
| S12         | Open            | Disables Serial DataFlash write protect.                      |
| S13         | Closed          | Disables NAND FLASH write protect.                            |
| S14         | Closed          | Enables the use of interrupt ETHERNET MAC (PC11_FIQ).         |
| S15         | Closed          | Enables the use of ETHERNET MAC (NCS2).                       |
| S16         | Open            | Disables the use of NWAIT ETHERNET MAC signal (PC2_NWAIT)     |
| S19         | Closed          | Enables the use of the User LED DS7 (PA14)                    |
| S20         | Closed          | Enables the use of the User LED DS8 (PA13)                    |
| S21         | Closed          | Enables the use of the DBGU RXD signal (PA9)                  |
| S22         | Closed          | Enables the use of the USB CNX detection (PB29)               |
| S23         | Closed          | Enables the use of AUDIO DAC INTERFACE (NPCS03)               |
| S24         | Closed          | Enables the use of TOUCH SCREEN CONTROLLER (NPCS02)           |
| S25         | Closed          | Enables the use of TOUCH SCREEN CONTROLLER BUSY signal (PA11) |
| S26         | Closed          | Enables the use of TOUCH SCREEN CONTROLLER PENIRQ (PC2_IRQ0)  |
| TP1         | N.A             | 3.3V Test point.                                              |
| TP2         | N.A             | GND Test point.                                               |
| TP3         | N.A             | 1.2V Test point.                                              |
| TP4         | N.A             | GND Test point.                                               |
| TP63        | N.A             | 0 to 3.3V analog user's input                                 |
| TP64        | N.A             | 0 to 3.3V analog user's input                                 |
| TP65        | N.A             | AGND of TP63                                                  |
| TP66        | N.A             | AGND of TP64                                                  |

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





## Section 5

---

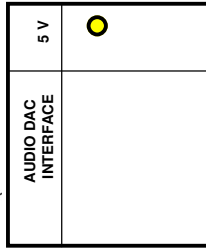
# Schematics

### 5.1 Schematics

---

This section contains the following schematics:

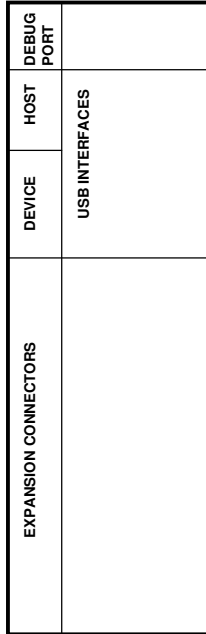
- Power Supply and Audio
- AT91SAM9G10 Device
- SDRAM and NAND Flash
- Ethernet
- LCD and User Interface
- Serial and I/O Expansion



POWER

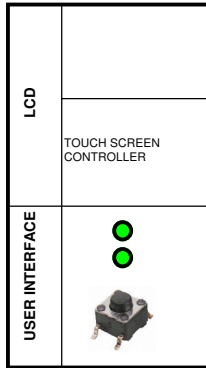
PIO A,B,C

SHEET 2



PIO A,B,C

SHEET 7



SHEET 6

PIO A,B,C

ATMEL  
ARM9 Processor  
SAM9G10 (LFBGA217)

ICE INTERFACE

SHEET 3

EBI SDRAM INTERFACE

DATA BUS

ADRESSE BUS

PIO A,B,C

DATA BUS

EBI SDRAM

SDRAM

NAND FLASH

SERIAL DATA FLASH

CARD READER

MMC/SD DATAFLASH CARD

SHEET 4

ETHERNET

SHEET 5



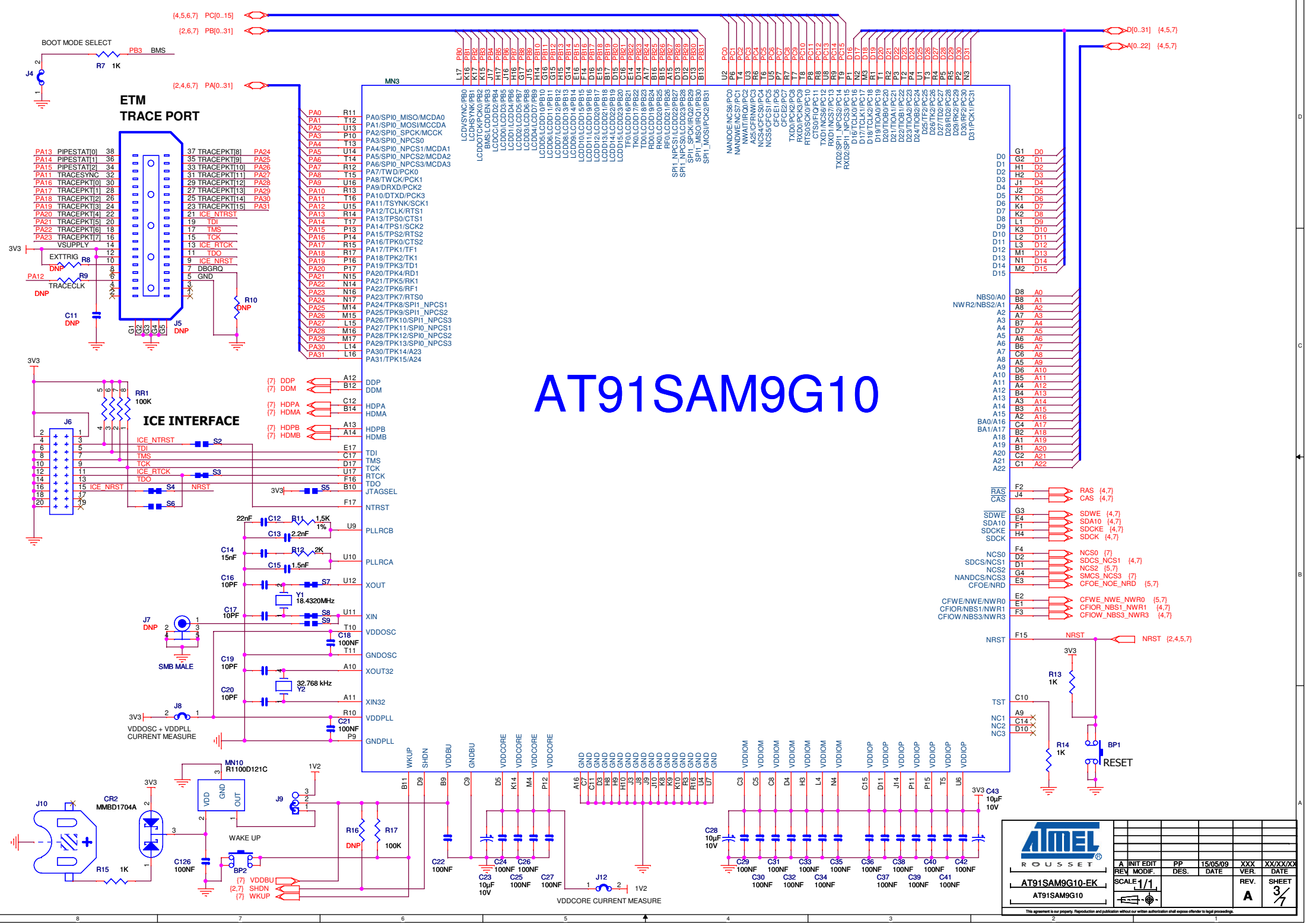
NOTE

"DNP" means the component is not populated by default

| PIO MUXING |                  |      |            |      |            |
|------------|------------------|------|------------|------|------------|
| PIOA       | USAGE            | PIOA | USAGE      | PIOB | USAGE      |
| PA0        | SPI0 MISO/MCDA0  | PA16 | --         | PB0  | --         |
| PA1        | SPI0 MOSI/MCDA1  | PA17 | TF1        | PB1  | LCDHSYNC   |
| PA2        | SPI0 SPCK        | PA18 | TK1        | PB2  | LCDDDOTCK  |
| PA3        | SPI0 NPCS0       | PA19 | TD1        | PB3  | LCDDEN     |
| PA4        | MCDA1            | PA20 | --         | PB4  | LCDDCC     |
| PA5        | MCDA2            | PA21 | --         | PB5  | --         |
| PA6        | SPI0 NPCS3 MCDA3 | PA22 | --         | PB6  | --         |
| PA7        | --               | PA23 | POWER LED  | PB7  | R0         |
| PA8        | --               | PA24 | BP5        | PB8  | R1         |
| PA9        | DBGU_RXD         | PA25 | BP5        | PB9  | R2         |
| PA10       | DBGU_TXD         | PA26 | BP4        | PB10 | R3         |
| PA11       | BUSY             | PA27 | BP3        | PB11 | R4         |
| PA12       | POWER CONTROL IN | PA28 | SPI0 NPCS2 | PB12 | R5         |
| PA13       | USER LED         | PA29 | SPI0 NPCS3 | PB13 | --         |
| PA14       | USER LED         | PA30 | --         | PB14 | --         |
| PA15       | --               | PA31 | --         | PB15 | G0         |
|            |                  |      |            | PB16 | G1         |
|            |                  |      |            | PB17 | G2         |
|            |                  |      |            | PB18 | G3         |
|            |                  |      |            | PB19 | G4         |
|            |                  |      |            | PB20 | G5         |
|            |                  |      |            | PB21 | --         |
|            |                  |      |            | PB22 | --         |
|            |                  |      |            | PB23 | B0         |
|            |                  |      |            | PB24 | B1         |
|            |                  |      |            | PB25 | B2         |
|            |                  |      |            | PB26 | B3         |
|            |                  |      |            | PB27 | B4         |
|            |                  |      |            | PB28 | B5         |
|            |                  |      |            | PB29 | USB CNX    |
|            |                  |      |            | PB30 | USB DP PUP |
|            |                  |      |            | PB31 | PCK2       |
|            |                  |      |            | PC0  | NANDOE     |
|            |                  |      |            | PC1  | NANDWE     |
|            |                  |      |            | PC2  | IRQ0/NWAIT |
|            |                  |      |            | PC3  | --         |
|            |                  |      |            | PC4  | --         |
|            |                  |      |            | PC5  | --         |
|            |                  |      |            | PC6  | --         |
|            |                  |      |            | PC7  | --         |
|            |                  |      |            | PC8  | --         |
|            |                  |      |            | PC9  | --         |
|            |                  |      |            | PC10 | RST        |
|            |                  |      |            | PC11 | FIQ        |
|            |                  |      |            | PC12 | --         |
|            |                  |      |            | PC13 | --         |
|            |                  |      |            | PC14 | #CE        |
|            |                  |      |            | PC15 | R/#B       |

|                                                                                                                                            |  |           |  |      |  |          |  |       |  |     |  |
|--------------------------------------------------------------------------------------------------------------------------------------------|--|-----------|--|------|--|----------|--|-------|--|-----|--|
| <b>ATMEL</b><br>ROUSSET                                                                                                                    |  |           |  |      |  |          |  |       |  |     |  |
| AT91SAM9G10-EK                                                                                                                             |  | TOP LEVEL |  |      |  |          |  |       |  |     |  |
| SCALE 1/1                                                                                                                                  |  |           |  |      |  |          |  |       |  |     |  |
| REV. MODIF.                                                                                                                                |  | DES.      |  | DATE |  | REV.     |  | SHEET |  |     |  |
| A                                                                                                                                          |  | 15MAY09   |  | XXX  |  | XX/XX/XX |  | A     |  | 1/1 |  |
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# AT91SAM9G10



ROUSSET

AT91SAM9G10-EK

AT91SAM9G10

| REV | MODIF | DES. | DATE     | XXX | XX/XX/XX |
|-----|-------|------|----------|-----|----------|
| 1   |       |      | 15/05/09 |     |          |

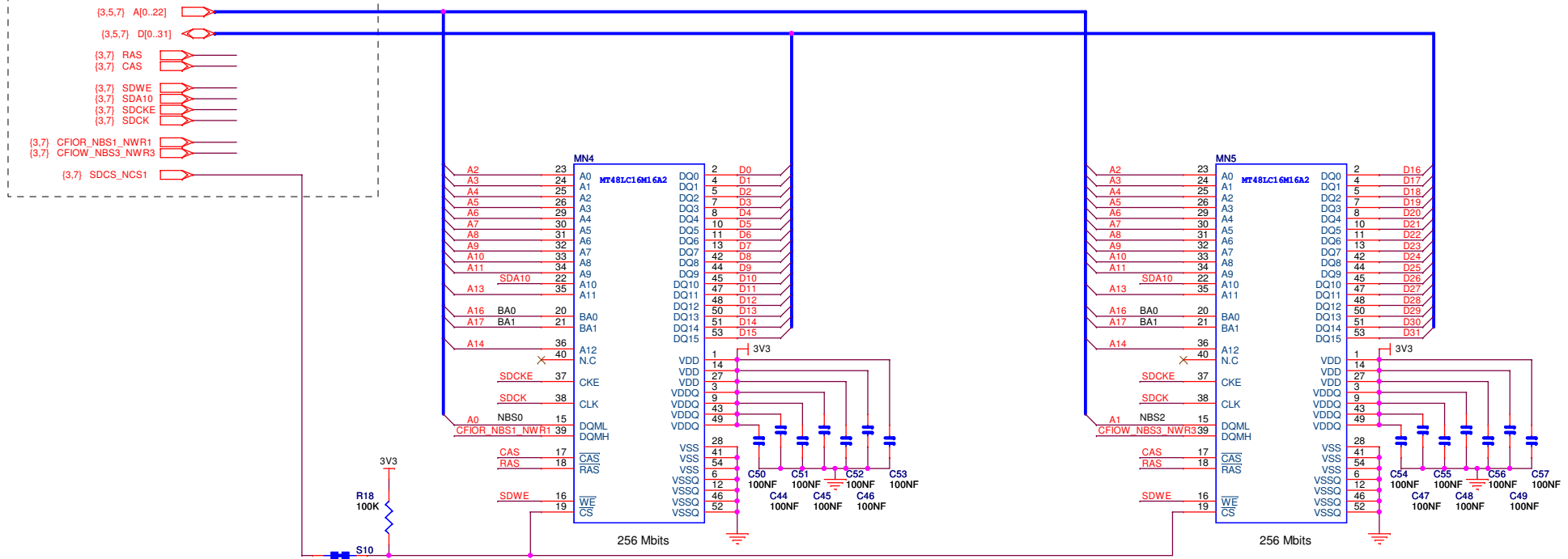
SCALE 1/1

REV. A

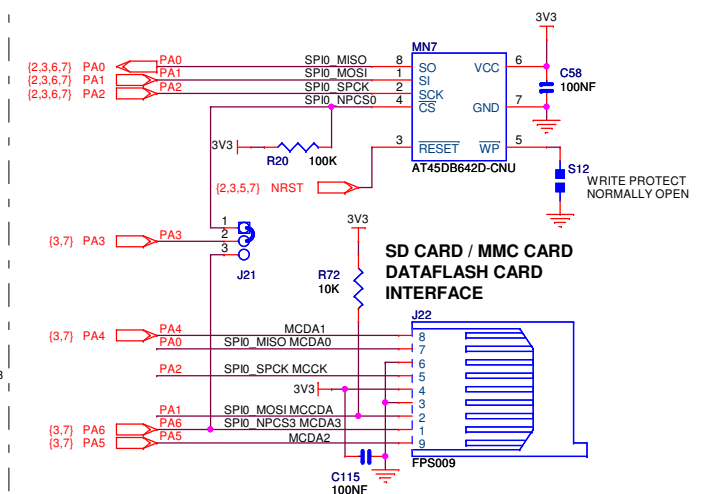
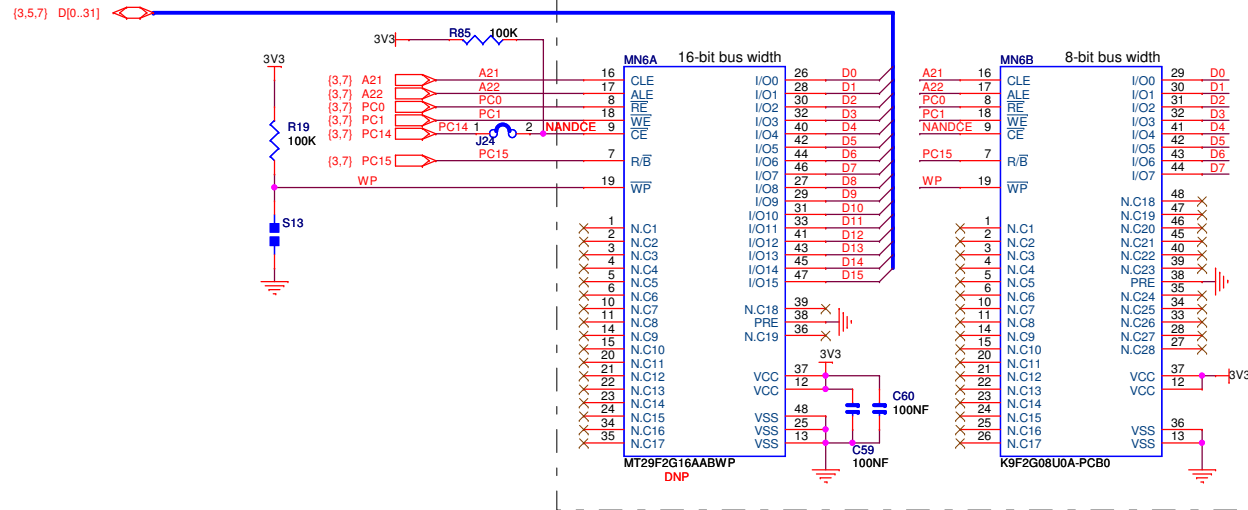
SHEET 3/7

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# EBI SDRAM INTERFACE



## DUAL FOOTPRINT



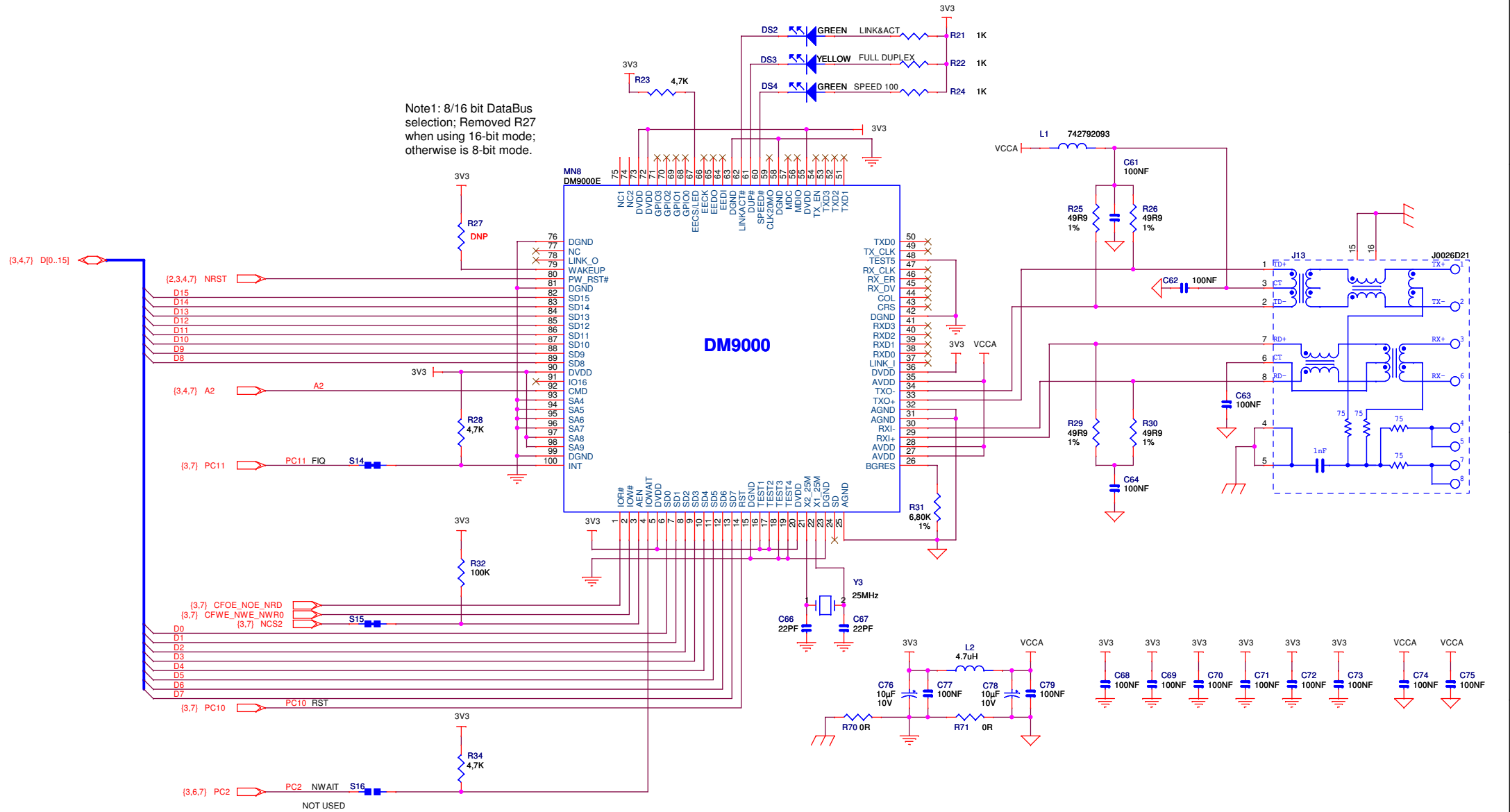
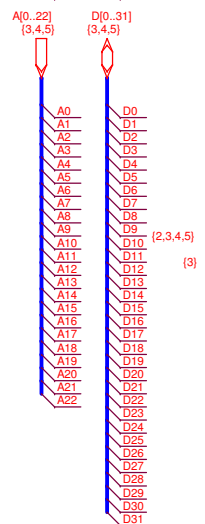


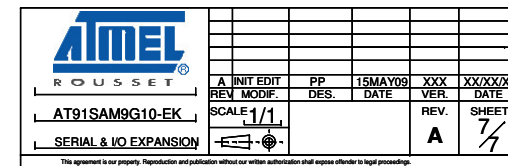
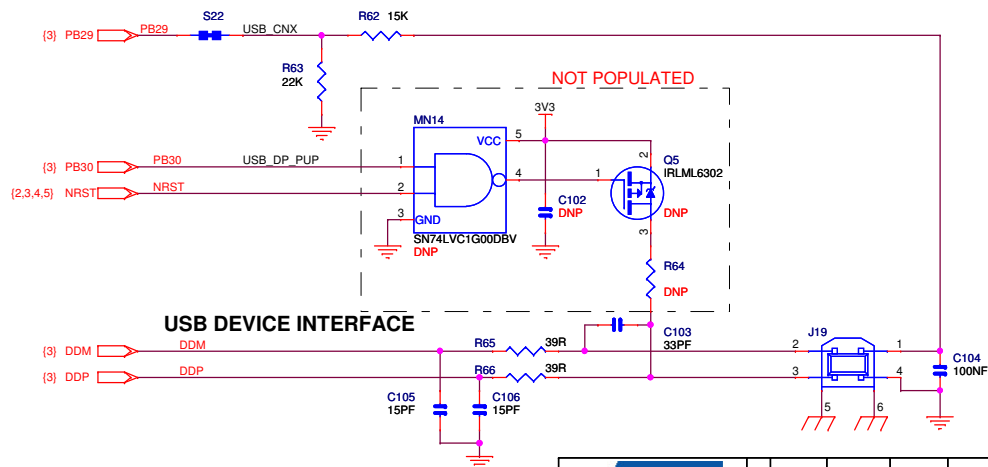
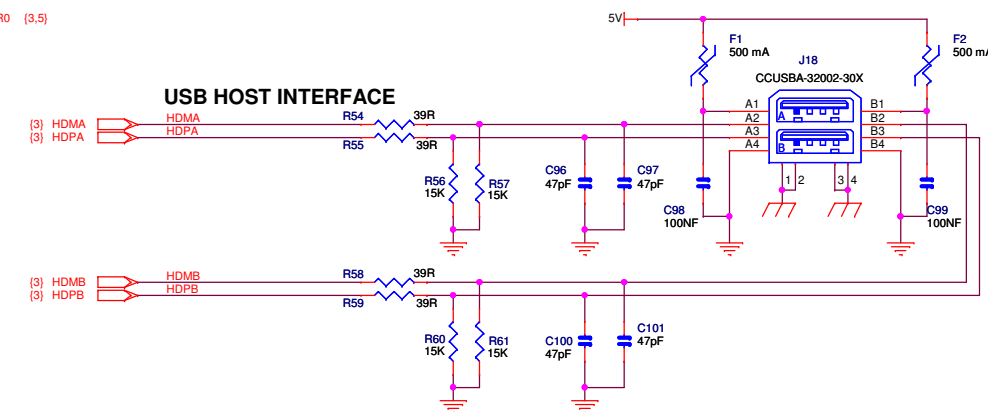
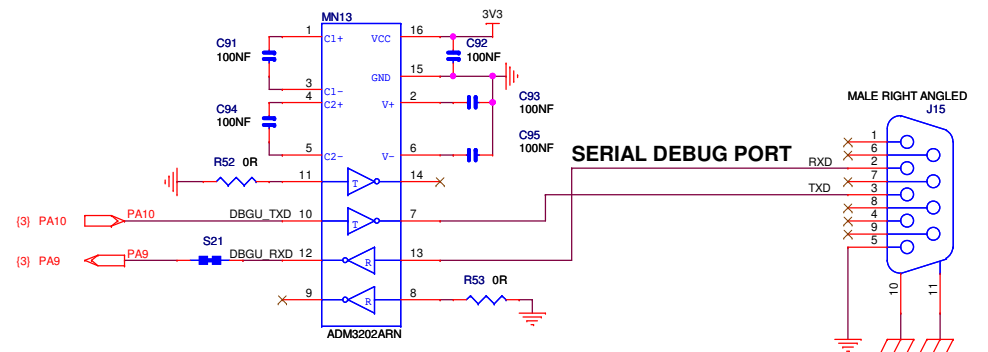


Figure 1 shows three vertical columns of red circles representing particles. The left column is labeled PA0...PA31 with coordinates [2, 3, 4, 6]. The middle column is labeled PB0...PB31 with coordinates [2, 3, 6]. The right column is labeled PC0...PC31 with coordinates [3, 4, 5, 6]. Each column has a blue vertical line passing through its center, and the circles are arranged in a staggered pattern across the columns.



| J16     |         |
|---------|---------|
| 1       | 2       |
| PB0 3   | 4 PB1   |
| PB2 5   | 6 PB3   |
| PB4 7   | 8 PB5   |
| PB6 9   | 10 PB7  |
| PB8 11  | 12 PB9  |
| PB10 13 | 14 PB11 |
| PB12 15 | 16 PB13 |
| PB14 17 | 18 PB15 |
| PB16 19 | 20 PB17 |
| PB18 21 | 22 PB19 |
| PB20 23 | 24 PB21 |
| PB22 25 | 26 PB23 |
| PB24 27 | 28 PB25 |
| PB26 29 | 30 PB27 |
| PB28 31 | 32 PB29 |
| PB30 33 | 34 PB31 |
| 35      | 36      |
| PA0 37  | 38 PA1  |
| PA2 39  | 40 PA3  |
| PA4 41  | 42 PA5  |
| PA6 43  | 44 PA7  |
| PA8 45  | 46 PA9  |
| PA10 47 | 48 PA11 |
| PA12 49 | 50 PA13 |
| PA14 51 | 52 PA15 |
| PA16 53 | 54 PA17 |
| PA18 55 | 56 PA19 |
| PA20 57 | 58 PA21 |
| PA22 59 | 60 PA23 |
| PA24 61 | 62 PA25 |
| PA26 63 | 64 PA27 |
| PA28 65 | 66 PA29 |
| PA30 67 | 68 PA31 |
| 69      | 70      |
| PC0 71  | 72 PC1  |
| PC2 73  | 74 PC3  |
| PC4 75  | 76 PC5  |
| PC6 77  | 78 PC7  |
| PC8 79  | 80 PC9  |
| PC10 81 | 82 PC11 |
| PC12 83 | 84 PC13 |
| PC14 85 | 86 PC15 |
| D16 87  | 88 D17  |
| D18 89  | 90 D19  |
| D20 91  | 92 D21  |
| D22 93  | 94 D23  |
| D24 95  | 96 D25  |
| D26 97  | 98 D27  |
| D28 99  | 100 D29 |
| D30 101 | 102 D31 |
| 103     | 104     |
| 105     | 106     |
| 107     | 108     |
| 109     | 110     |
| 111     | 112     |
| 113     | 114     |
| 3V3 115 | 116 3V3 |
| 5V 117  | 118     |
| 119     | 120 5V  |

Pinout diagram for the J17 connector. The diagram shows a central blue connector with 80 pins. Pins 1-19 are on the left, 20-39 on the right, and 40-80 at the bottom. Pin 1 is labeled '1', pin 2 '2', pin 3 '3', pin 4 '4', pin 5 '5', pin 6 '6', pin 7 '7', pin 8 '8', pin 9 '9', pin 10 '10', pin 11 '11', pin 12 '12', pin 13 '13', pin 14 '14', pin 15 '15', pin 16 '16', pin 17 '17', pin 18 '18', pin 19 '19', pin 20 '20', pin 21 '21', pin 22 '22', pin 23 '23', pin 24 '24', pin 25 '25', pin 26 '26', pin 27 '27', pin 28 '28', pin 29 '29', pin 30 '30', pin 31 '31', pin 32 '32', pin 33 '33', pin 34 '34', pin 35 '35', pin 36 '36', pin 37 '37', pin 38 '38', pin 39 '39', pin 40 '40', pin 41 '41', pin 42 '42', pin 43 '43', pin 44 '44', pin 45 '45', pin 46 '46', pin 47 '47', pin 48 '48', pin 49 '49', pin 50 '50', pin 51 '51', pin 52 '52', pin 53 '53', pin 54 '54', pin 55 '55', pin 56 '56', pin 57 '57', pin 58 '58', pin 59 '59', pin 60 '60', pin 61 '61', pin 62 '62', pin 63 '63', pin 64 '64', pin 65 '65', pin 66 '66', pin 67 '67', pin 68 '68', pin 69 '69', pin 70 '70', pin 71 '71', pin 72 '72', pin 73 '73', pin 74 '74', pin 75 '75', pin 76 '76', pin 77 '77', pin 78 '78', pin 79 '79', pin 80 '80'. The diagram also shows the following labels: A1, A4, A7, A11, A13, A15, A18, A0, A10, A17, A21, A22, D2, D3, D10, D8, D12, D11, D6, D9, 3V3, 3V3, 5V, A2, A3, A6, A9, A12, A14, A16, A19, A5, A8, A20, D1, D5, D7, D4, D15, D13, D14, D1, D5, D7, D4, D15, D13, D14, 3V3, 3V3, 5V.









## Section 6

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### Errata

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#### 6.1 JTAGSEL S5 Footprint Selector

For JTAG selection, the S5 footprint must never be soldered, otherwise the chip can be damaged.

By default, the JTAGSEL input pin integrates a pull-down resistor (ICE mode).

To select JTAG mode, the designer should connect the JTAGSEL input pin to VDDBU power.

---

#### 6.2 External Capacitor Values on XIN and XOUT

The external capacitor values on XIN and XOUT are not correct.

The 10 pF capacitors must be replaced by 22 pF capacitors.

Please refer to the electrical parameters section of the datasheet.





## Section 7

# Revision History

### 7.1 Revision History

*Table 7-1.*

| Document | Comments     | Change Request Ref. |
|----------|--------------|---------------------|
| 6479A    | First issue. |                     |





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