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USER GUIDE**Introduction**

This User Guide introduces the Evaluation Kit and describes the development and debugging capabilities running on Atmel® | SMART SAM9 ARM®-based Embedded MPUs as listed below:

- SAM9G15
- SAM9G25
- SAM9X25
- SAM9G35
- SAM9X35

The User Guide pertains to the following Evaluation Kit references:

- SAM9G15-EK
- SAM9G25-EK
- SAM9X25-EK
- SAM9G35-EK
- SAM9X35-EK

Contents

- Board
 - One EK board
 - One of the five available CPU modules (CM)
 - SAM9G15-CM
 - SAM9G35-CM
 - SAM9X35-CM
 - SAM9G25-CM
 - SAM9X25-CM
 - One optional DM board featured in SAM9G15, SAM9G35, SAM9X35 kits only.
- Power supply
 - Universal input AC/DC power supply with US, Europe and UK plug adapters
 - One 3V Lithium Battery type CR1225
- Cables
 - One serial RS232 cable
 - One micro A/B-type USB cable
 - One RJ45 crossed cable
- A Welcome Letter

Board Photo (Display module is optional)



Related Documents

Title	Reference	Comment
SAM9G15 Datasheet	Atmel lit° 11052	These documents provide technical support for each of the Atmel ARM-based Embedded MPU products supported by these Evaluation Kits.
SAM9G25 Datasheet	Atmel lit° 11032	
SAM9X25 Datasheet	Atmel lit° 11054	
SAM9G35 Datasheet	Atmel lit° 11053	
SAM9X35 Datasheet	Atmel lit° 11055	

The datasheets can be found on www.atmel.com at the SAM9G MPU and SAM9X MPU product sections.

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1. Specifications

1.1 Kit Specifications

Unpack and inspect the kit carefully. Contact your local Atmel distributor, should there be issues concerning the contents of the kit.

Figure 1-1. Unpacked Evaluation Kit



1.2 Board Specifications

Table 1-1. Evaluation Kit Specifications

Characteristics	Specifications
Clock speed	400 MHz PCK, 133 MHz MCK
Ports	Ethernet, USB, RS232, DBGU, JTAG, CAN, Audio, SD Card
Board supply voltage	5 VDC from connector
Temperature	
- operating	-10° to +50° C
- storage	-40° to +85° C
Relative humidity	0 to 90% (non condensing)
Dimensions	
EK (Evaluation Kit)	165 mm x 135 mm
CM (Computer Module)	67.6 mm x 35 mm
DM (Display Module)	135 mm x 80 mm
RoHS status	Compliant

2. Power Up

2.1 Power Up the Board

Unpack the board taking care to avoid electrostatic discharge. Unpack the power supply, select the right power plug adapter corresponding to that of your country, and insert it in the power supply.

Connect the power supply DC connector to the board and plug the power supply to an AC power plug.

For SAM9G15, SAM9G35, SAM9X35 kits which contain LCD, the screen should light up and display the welcome page of a graphic demo. Click or touch icons displayed on the screen and enjoy the demo.

For SAM9G25 and SAM9X25 which do not contain LCD, before power up, connect DBGU port J11 on the EK board (refer to [Section 3.3.3.4](#) for details) to RS232 port on your computer through the RS232 cable provided with the kit. It is recommended to open a communication session under HyperTerminal. After power up, a command-line based demo runs that can be monitored on HyperTerminal window.

2.2 Sample Code and Technical Support

After boot up, designers can run sample code or their own application, on the development kit. Users can download sample code and get technical support from the Atmel web site:

http://www.atmel.com/products/at91/default.asp?category_id=163&family_id=605&source=global_nav

Figure 2-1. Atmel Web Site



Note: Different interfaces on the EK boards share the same connections to the CPU module. Therefore the actual usage depends on the CPU module featured in the evaluation kit.

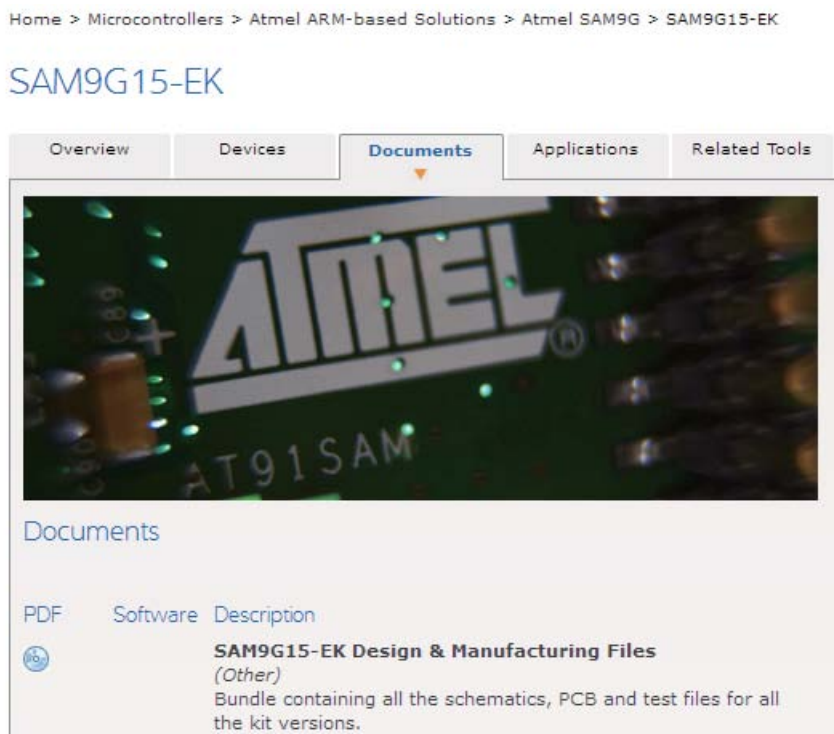
2.3 Recovery Procedure

All EK boards have passed strict test procedures before shipment. These test procedures are contained in the SPI serial Flash in case users need to examine the boards again at any time.

If the contents of the SPI serial Flash have been deleted, follow the instructions below to recover the state as it was when shipped by Atmel.

1. Go to the page on atmel.com for the EK being used.
2. Locate the EK Design & Manufacturing Files as shown in [Figure 2-2](#).
3. Find the *xxx-EK_test_12_public.zip*, which is the file for Flash content burning.
4. Follow the step-by-step instructions in the file *SAM9X5_EK_Test_Software* to recover the content and to test each section of the boards.

Figure 2-2. EK Design & Manufacturing Files



3. Hardware Overview

3.1 Introduction

The Evaluation Kit is a fully-featured evaluation platform for the Atmel MPU. The Evaluation Kit enables users to extensively evaluate, prototype and create application-specific designs.

The Evaluation Kit is a new platform architecture based on a Main Board (MB), a CPU Module (CM) equipped with one of the five processors and an optional Display Module (DM).

The Evaluation Kit consists of three boards:

1. The CPU Module (CM) board, is a single-board computer that integrates all the core components and is mounted onto an application-specific carrier board (EK board). The CPU Module has specified pinouts based on the SODIMM200 connector. It provides the functional requirements for an embedded application. These functions include, but are not limited to, graphics, audio, mass storage, network and multiple serial and USB ports. A single SODIMM200 connector provides an interface for the carrier board to carry all the I/O signals to and from the CPU Module.
2. The Evaluation Kit board (EK Main Board) provides all the interface connectors required to attach the system to the application specific peripherals. This versatility allows the designer to create a densely packed solution, which results in a more reliable product while simplifying system integration.
3. The optional Display Module (DM) board integrates LCD, TouchScreen and QTouch[®] technology.

[Table 3-1](#) lists the features provided on the Evaluation Kit:

Table 3-1. Evaluation Kit Features

Supported Modules			Product Name				
Expansion Slot	SO-DIMM200						
Processor Options			SAM9G15	SAM9G25	SAM9G35	SAM9X25	SAM9X35
LAN	MII/RMII Ethernet 10/100 w/PHY and three Led status	ETH0	–	X	X	X	X
	RMII Ethernet 10/100 w/PHY and three Led status	ETH1	–	–	–	X	–
USART/UART	RS232 four wires/RS485 Shared interface	COM0	X	X	X	X	X
	RS232 four wires	COM3	–	X	–	X	–
	RS232 two wires	DBGU	X	X	X	X	X
CAN	CAN interface Shared interface	CAN0	–	–	–	X	X
		CAN1	–	–	–	X	X
USB	2 * USB 2.0 Host	–	X	X	X	X	X
	1 * USB 2.0 Host/Device	–	X	X	X	X	X
SMD	Software Modem Device	–	X	X	X	X	X
Memory Card Support	µSD Card Slot Onboard	HSMCI0	X	X	X	X	X
	MMC/MMC+/SD/SDIO/CE-ATA	HSMCI1	X	X	X	X	X
ISI	–	–	–	X	–	–	–
LCD + Touch Screen	24-bit Output Mode	–	X	–	X	–	X
ZigBee®	–	–	X	X	X	X	X
SPI	–	–	X	X	X	X	X
TWI	–	–	X	X	X	X	X
DEBUG	JTAG Test Access Port	–	X	X	X	X	X

3.2 Computer Module (CM)

3.2.1 CM Board Overview

The CM board is the CPU module at the heart of the system. It connects to the EK board through a SO-DIMM200 interface. It carries the processor and external memories. The CM board serves as a minimal CPU sub-system. All five processors: SAM9G15, SAM9G25, SAM9X25, SAM9G35 and SAM9X35 share the same CM circuitry with minor configuration settings.

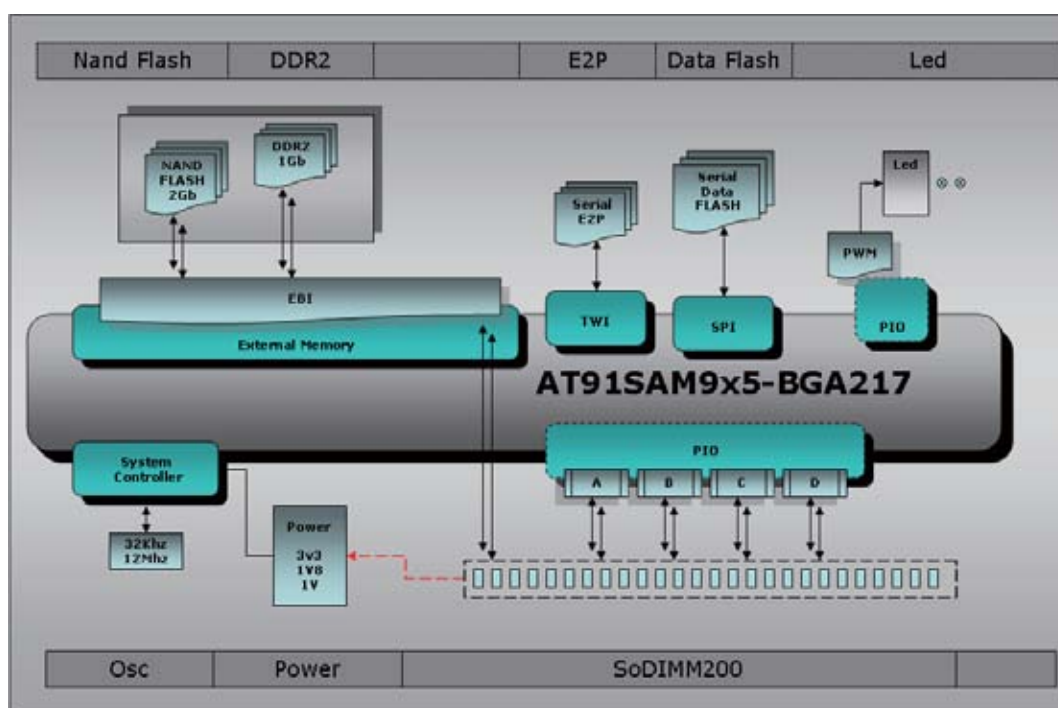
Note: There are three CM boards from three different manufacturers. The five processors are implemented as shown in [Table 3-2](#) below:

Table 3-2. CM Board Implementation

Manufacturer & Module kind	SAM9G15-CM	SAM9G25-CM	SAM9G35-CM	SAM9X25-CM	SAM9X35-CM
mfg 1	x	–	x	–	–
mfg 2	–	–	–	x	x
mfg 3	x	x	x	x	x

The three CM boards share the same circuitry design but with different designator information and PCB layouts. The circuitry reference in this guide, for common design parts, refers to schematics from SAM9G25-CM (mfg 3). All the other schematics are provided in [Section 3.2.6 "Schematics"](#).

Figure 3-1. Board Architecture



3.2.2 Equipment List

The CM board is built around the integration of an ARM926-based microcontroller (BGA217 package) with external memory and optional Ethernet PHYSical Layer Transceiver.

3.2.2.1 Devices

Following is the list of the CM board components:

- One SAM9 Embedded MPU from the list below
 - SAM9G15
 - SAM9G25
 - SAM9G35
 - SAM9X25
 - SAM9X35
- 12 MHz crystal
- 32.768 KHz crystal
- 1 Gbit DDR2 memory
- 2 Gits NAND Flash memory with Chip Selection control switch
- 32 Mbits SPI Serial Flash with Chip Selection control switch
- 512 Kbits EEPROM
- 1 Kbyte 1-Wire EEPROM
- On-board power regulation
- Two user LEDs
- Optional PHY

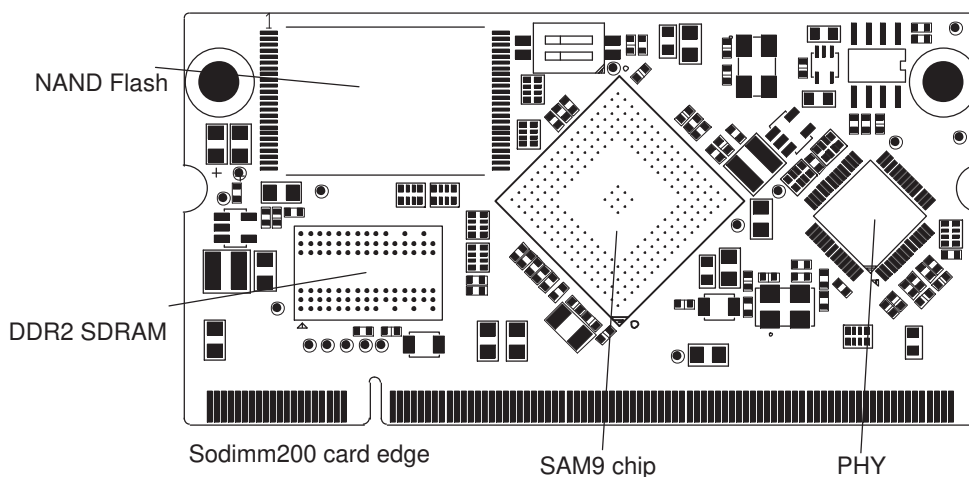
3.2.2.2 Interface Connection

- SODIMM200 card edge interface

3.2.2.3 Configuration Items

- Dual ON/OFF switch for NAND Flash and SPI serial Flash Chip Select connection

Figure 3-2. CM Board Layout Commented



3.2.3 Function Blocks

3.2.3.1 Processor

The CM Board is equipped with an Atmel ARM-based embedded MPU, as listed below, in a 217-ball BGA package. The five devices share an identical footprint. All five share the same CM Board PCB with minor configuration differences.

The five devices are:

- SAM9G15
- SAM9G25
- SAM9G35
- SAM9X25
- SAM9X35

As different interfaces can be defined using the same pins, it depends on the actual configuration of the CPU as to which functions are in fact available to the EK board.

Refer to [Section 3.2.4.1 "Chip Identification"](#) for details. The processor runs at a nominal frequency of 400 MHz for the core and 133 MHz for the system bus.

The peripheral configuration possibilities and implementation requirements of the CM are dependent on the module's chipset. Two configuration resistors are implemented on board in order to select the mode of configuration.

3.2.3.2 Clock Circuitry

The CM includes 3 clock sources:

- Two are alternatives for the processor main clock
- One crystal and one crystal oscillator are used for the Ethernet MII/RMII chip

Table 3-3. Main Components Associated with the Clock Systems

Quantity	Description	Component assignment
1	Crystal for Internal Clock, 12 MHz	Y1
1	Crystal for RTC Clock, 32.768 kHz	Y2
1	Oscillator for Ethernet Clock RMII, 50 MHz	Y3

3.2.3.3 Reset Circuitry

The reset sources for the CM board are:

- Power on reset
- Push button reset (Push button is equipped on EK board)
- JTAG reset from an in-circuit emulator (JTAG interface is equipped on EK board)

3.2.3.4 Power Supplies

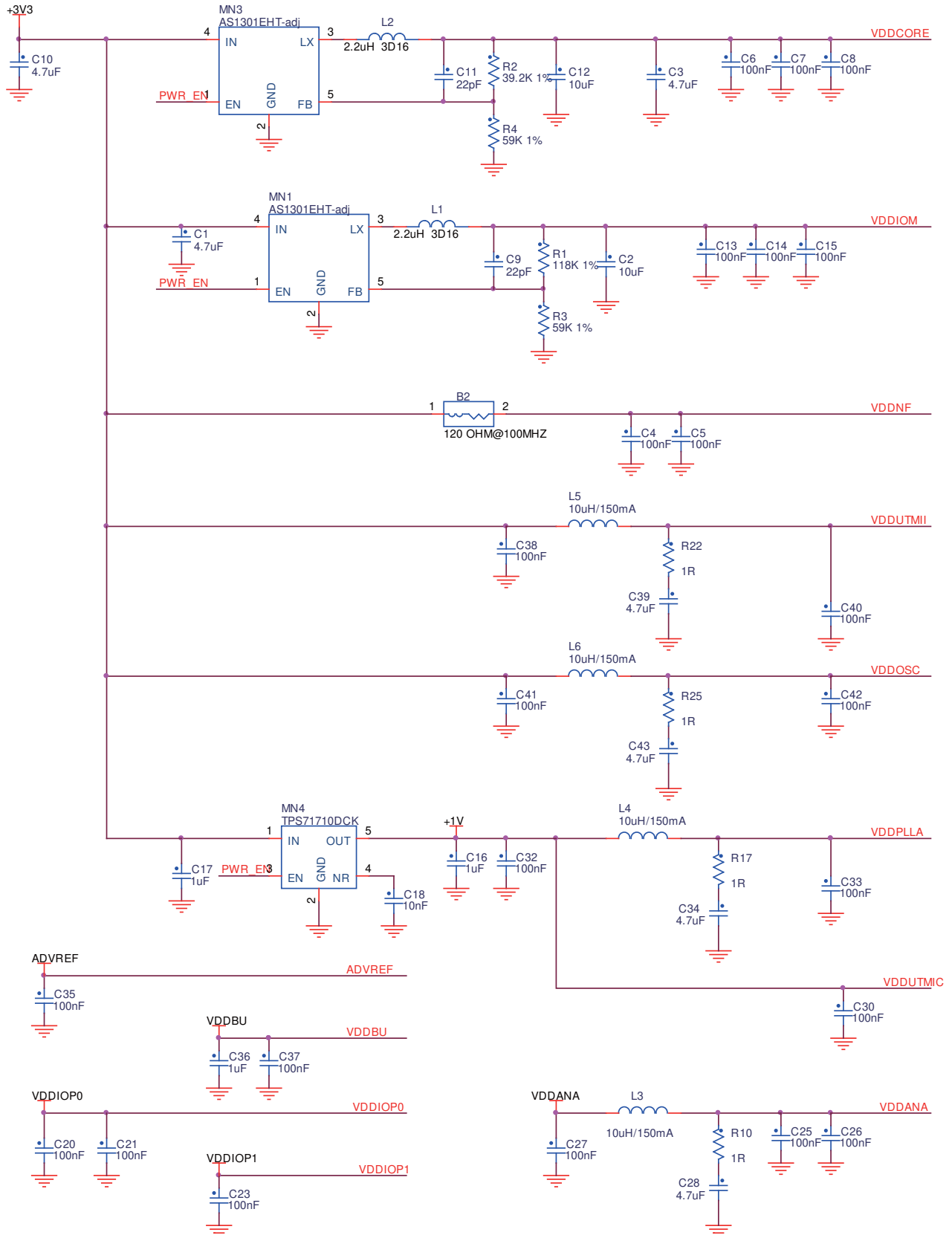
The CM Board is driven by +3V3 input power rail from the EK board through the SODIMM200 connector. The CM Board embeds all the necessary power rails required for the micro processor.

When additional voltages are required, for example VDDCORE, they are generated on board from the 3.3V supply. The detailed power supply requirements for any given module are specified within the corresponding product documentation. The following table summarizes the power specifications.

Table 3-4. Power Rails Associated with the Systems

Nominal	Name	Powers	Component
3.3v	VDDNF	the NAND Flash I/O and control, D16-D32 and multiplexed SMC lines	From SODIMM200 connector
3.3v	VDDIOP0	Partial Peripheral I/O lines	From SODIMM200 connector
3.3v	VDDIOP1	Partial Peripheral I/O lines	From SODIMM200 connector
3.0v	VDDBU	the Slow Clock oscillator, the internal 32 kHz RC, the internal 12 MHz RC and a part of the System Controller	From SODIMM200 connector
3.3v	VDDUTMII	the USB device and host UTMI+ interface	From SODIMM200 connector
3.3v	VDDOSC	the Main Oscillator cells	From SODIMM200 connector
3.3v	VDDANA	the Analog to Digital Converter	From SODIMM200 connector
1.8v	VDDIOM	the External Memory Interface I/O lines	on-board
1.0v	VDDUTMIC	DC Supply UDPHS and UPHPS UTMI+ Core	on-board
3.3v	VDDPLLUTMI	DC Supply UDPHS and UPHPS UTMI+ Interface	From SODIMM200 connector
1.0v	VDDPLLA	the PLLA cell	on-board
1.0v	VDDCORE	the core, including the processor, the embedded memories and the peripherals	on-board
3.0V or 3.3V configurable	ADVREF	ADC Reference voltage	From SODIMM200 connector

Figure 3-3. CM Power Supply



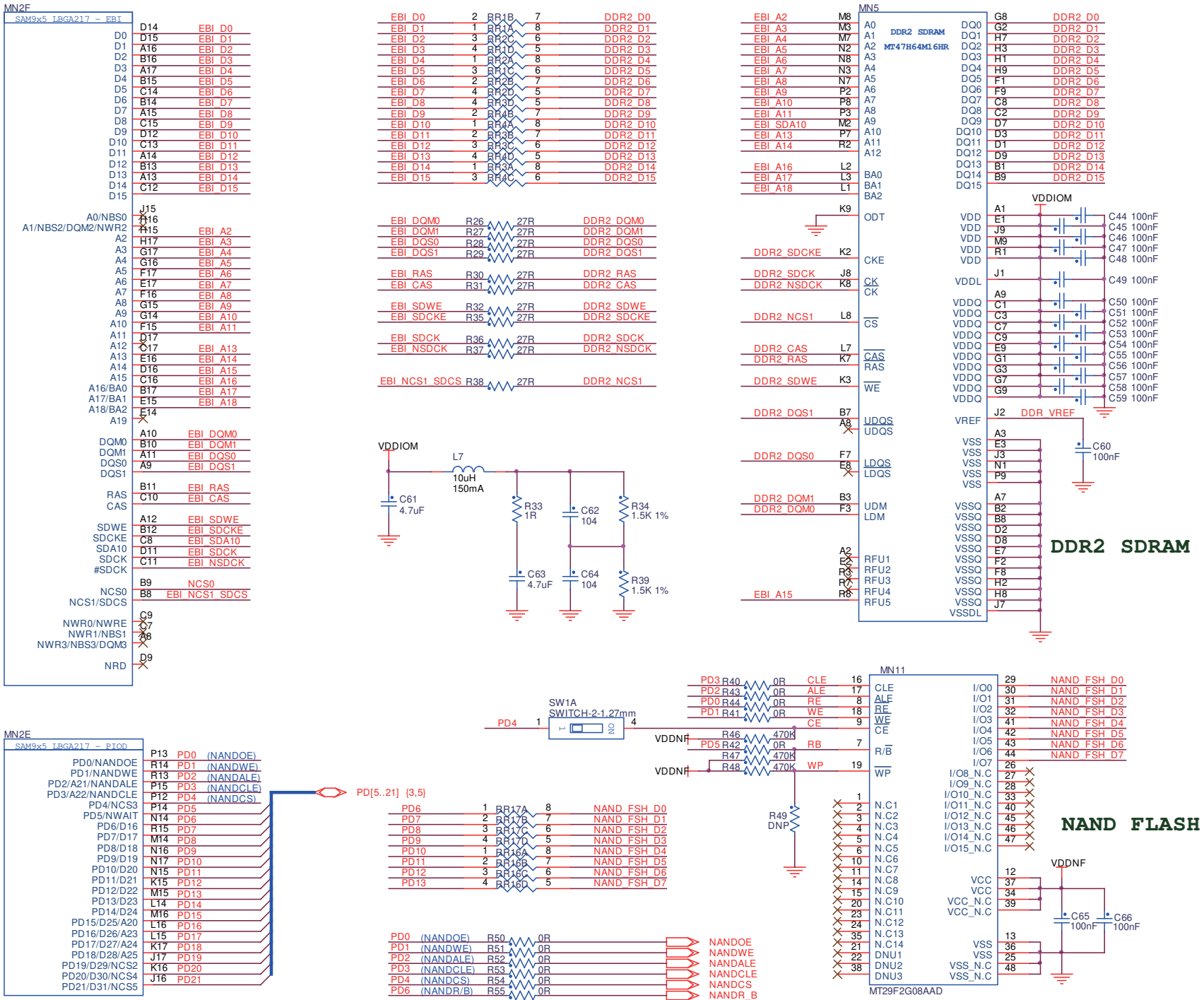
3.2.3.5 Memory

The Device serial processor features a DDR/SDR memory interface and an External Bus Interface (EBI) to enable interfacing to a wide range of external memories and to almost any kind of parallel peripheral.

The External Bus Interface (EBI) is connected to two kinds of memory devices:

- One 1 Gbyte DDR2 SDRAM
- One 2 Gbytes (or 4 Gbytes depending on supplier) NAND Flash

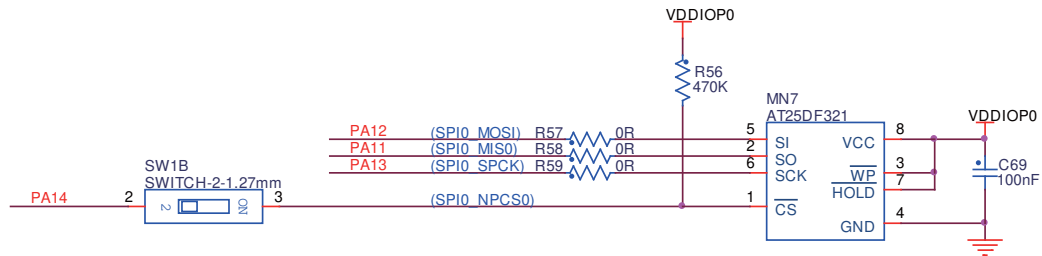
Figure 3-4. CM Board External Memory



3.2.3.6 Serial Peripheral Interface (SPI) Controller

The serial processor provides two high-speed Serial Peripheral Interface (SPI) controllers. One port is used to interface with the on-board serial Flash.

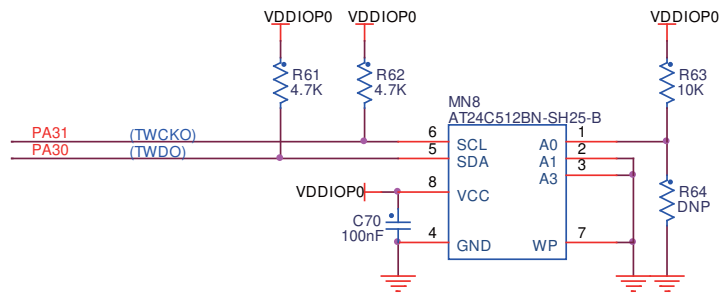
Figure 3-5. SPI



3.2.3.7 Two Wire Interface (TWI)

The serial processor has a full speed (400 kHz) master/slave TWI Serial Controller. The controller is mostly compatible with industry standard I2C and SMBus Interfaces. This port is used to interface with the on-board Serial EEPROM, I2S, QTouch device and audio codec interface.

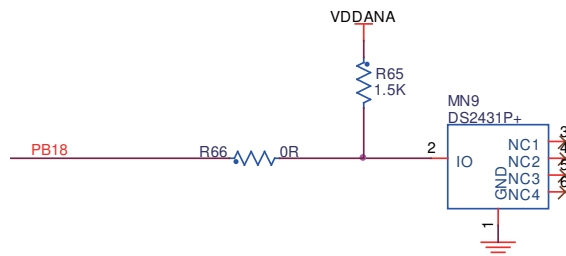
Figure 3-6. TWI



3.2.3.8 1-Wire EEPROM

The Evaluation Kit uses a 1-Wire device as “firmware label” to store the information such as chip type, manufacturer’s name, production date etc.

Figure 3-7. 1-Wire Device

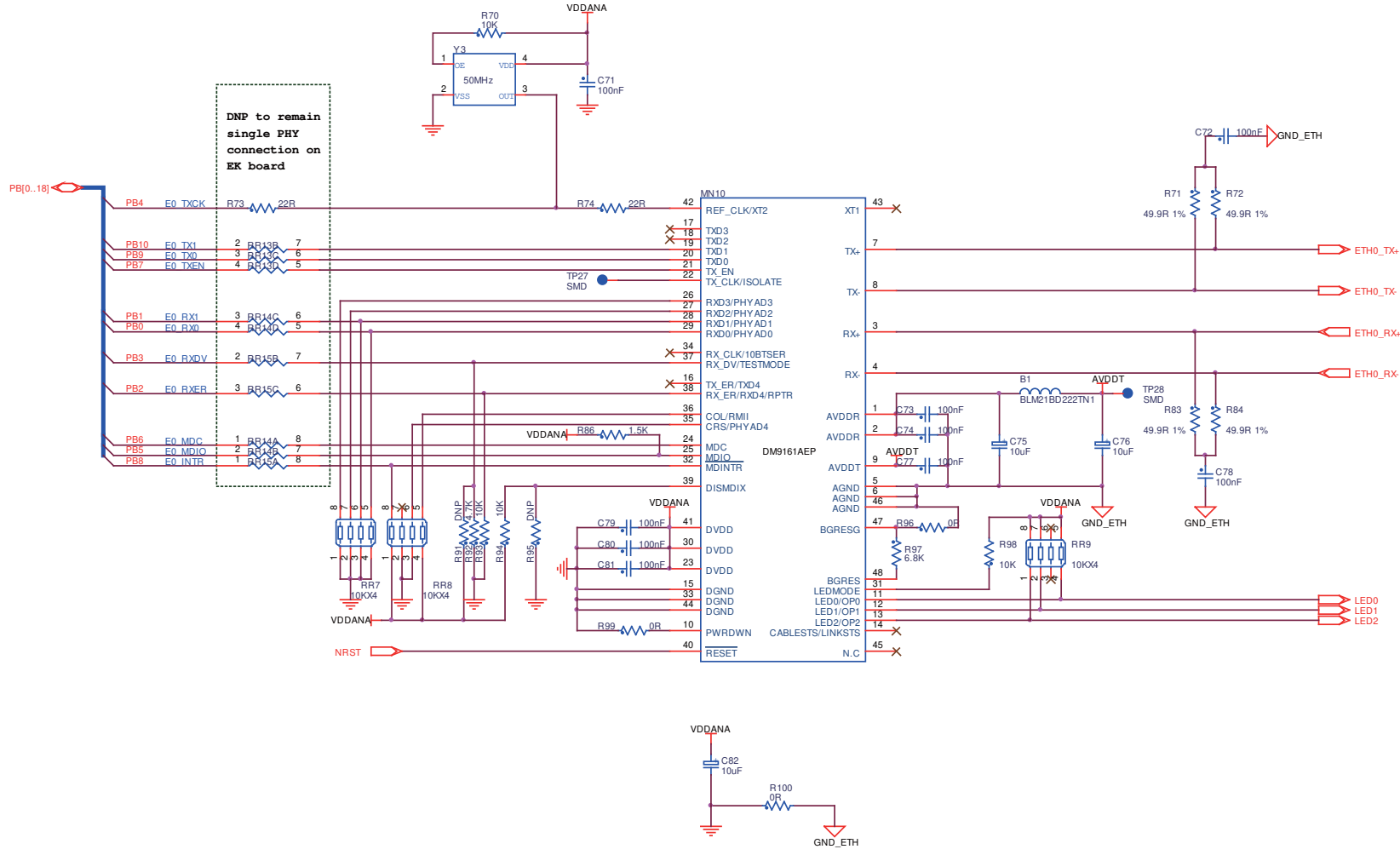


3.2.3.9 Optional PHY

Some of the device modules provide a location for a 10/100 Ethernet MAC/PHY interface.

For more information about the Ethernet controller device, refer to the Davicom DM9161 controller manufacturer's datasheet.

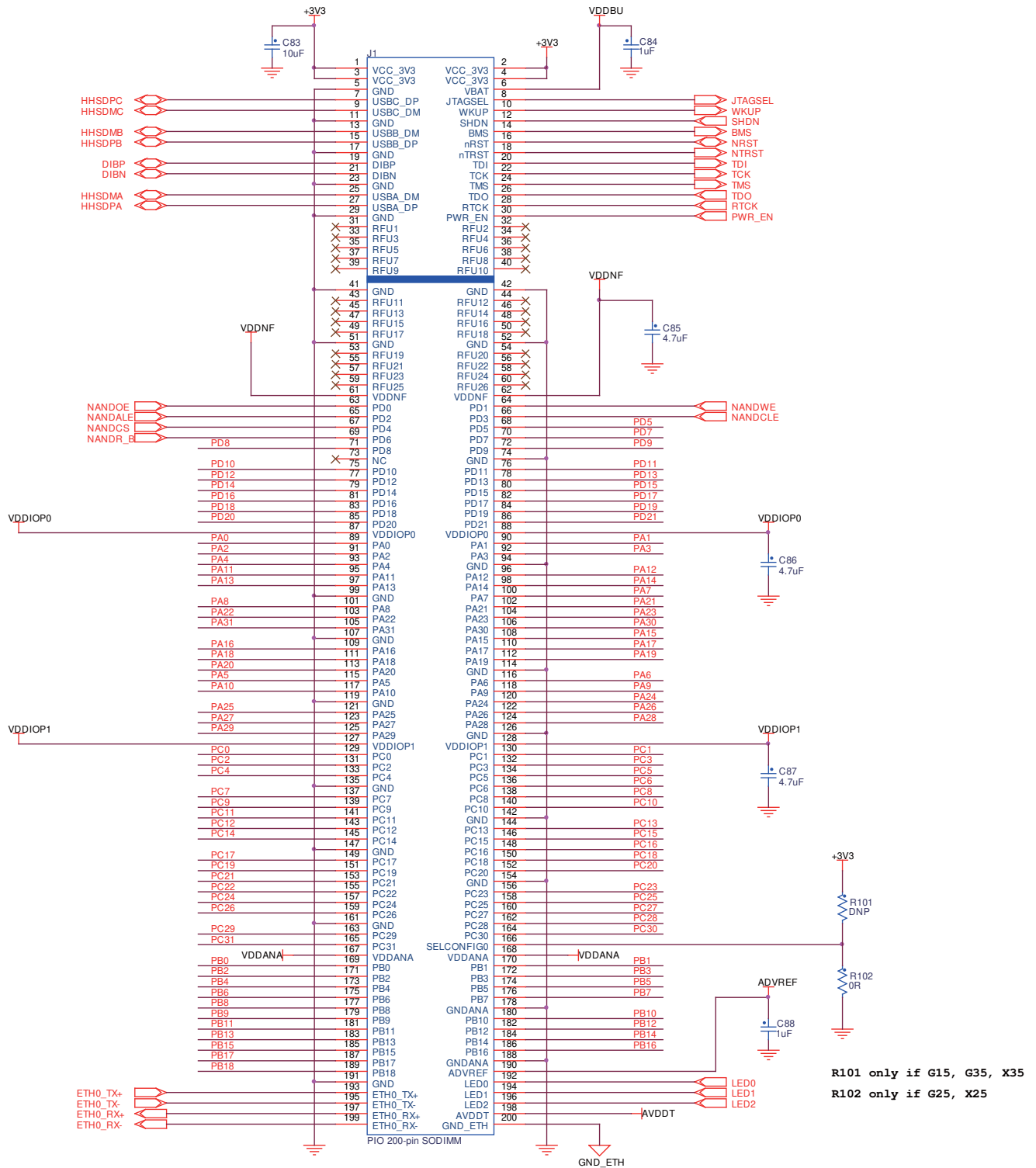
Figure 3-8. Ethernet



3.2.3.10 SODIMM200 Interface

The CM board uses SODIMM200 card edge connector to interface with the EK board.

Figure 3-9. SODIMM200 Interface on CM Board



R101 only if G15, G35, X35
R102 only if G25, X25

3.2.4 Configuration

3.2.4.1 Chip Identification

The CM board may be equipped with any of the five processors, all sharing an identical BGA217 footprint. There are two resistors on the CM board for the purpose of identifying which of the five is the one actually mounted.

The tables below show in detail how the CM board, relative to different processors, determines the dedicated “SELCONFIG” logic.

Table 3-5. Resistor Identification

Resistor	SAM9G15	SAM9G25	SAM9G35	SAM9X25	SAM9X35
R49	–	–	–	Populated	Not Populated
R50	–	–	–	Not Populated	Populated
R87	Populated	–	Populated	–	–
R88	Not Populated	–	Not Populated	–	–
R101	Populated	Not Populated	Populated	Not Populated	Populated
R102	Not Populated	Populated	Not Populated	Populated	Not Populated

Table 3-6. Module Configuration Identification

		SAM9G15 module	SAM9G35 module	SAM9X35 module	SAM9G25 module	SAM9X25 module
CM Setting	R101	Populated	Populated	Populated	Not Populated	Not Populated
	R102	Not Populated	Not Populated	Not Populated	Populated	Populated
	SELCONFIG (SODIMM200 pin 166)	High	High	High	Low	Low
EK Setting	USART3	Not Selected	Not Selected	Not Selected	Selected	Selected
	ETH1	Not Selected	Not Selected	Not Selected	Not Selected	Selected
DM Setting	LCD	Selected	Selected	Selected	Not Selected	Not Selected

3.2.4.2 Boot Configuration

In order to use the SAM-BA boot, users must ensure that JP9 (BMS configuration) on the board is open, so that the embedded ROM code runs and searches for a bootable device. For more details, refer to the product datasheet. To make the processor boot from SAM-BA, the external memory devices cannot be bootable.

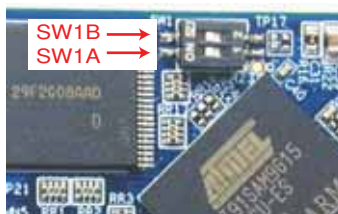
All three CM boards from different vendors feature a de-select function of the Chip Select signal on NAND and SPI serial Flash.

To boot from software, users may erase the bootable content within NAND and SPI serial Flash to launch a SAM-BA boot. A hardware disconnection of the Chip Select signal is not necessary.

Table 3-7. Boot Configuration

Board Vendor	Designation	Default Setting	Feature
Embest CM	SW1A (1,4)	ON	<ol style="list-style-type: none"> 1. Default ON to select NAND Flash 2. Set to OFF to deselect the NAND Flash
	SW1B (2,3)	ON	<ol style="list-style-type: none"> 1. Default ON to select SPI serial Flash 2. Set to OFF to deselect the SPI serial Flash
Ronetix CM	J1 R17	J1 DNP R17 populated	<ol style="list-style-type: none"> 1. Default select NAND Flash always 2. Users need to dismount R17, mount J1 as 2.54mm jumper to ease frequent changes 3. Close J1 to select NAND Flash Open J1 to deselect NAND Flash
	J2 R24	J2 DNP R24 populated	<ol style="list-style-type: none"> 1. Default select SPI serial Flash always 2. Users need to dismount R24, mount J2 as 2.54mm jumper to ease frequent changes 3. Close J2 to select SPI serial Flash Open J2 to deselect SPI serial Flash
Cogent CM	P2 R90	P2 normal close R90 DNP	<ol style="list-style-type: none"> 1. By default, P2 is closed to select NAND Flash 2. Open P2 to deselect NAND Flash 3. Mounting R90 as 0-ohm always selects NAND Flash
	R15	R15 populated	<ol style="list-style-type: none"> 1. Default select SPI serial Flash always 2. Dismount R15 to deselect SPI serial Flash

Figure 3-10. SW1A and SW1B Position on Embest Modules



3.2.5 Connectors

Figure 3-11. CM Board Dimensions

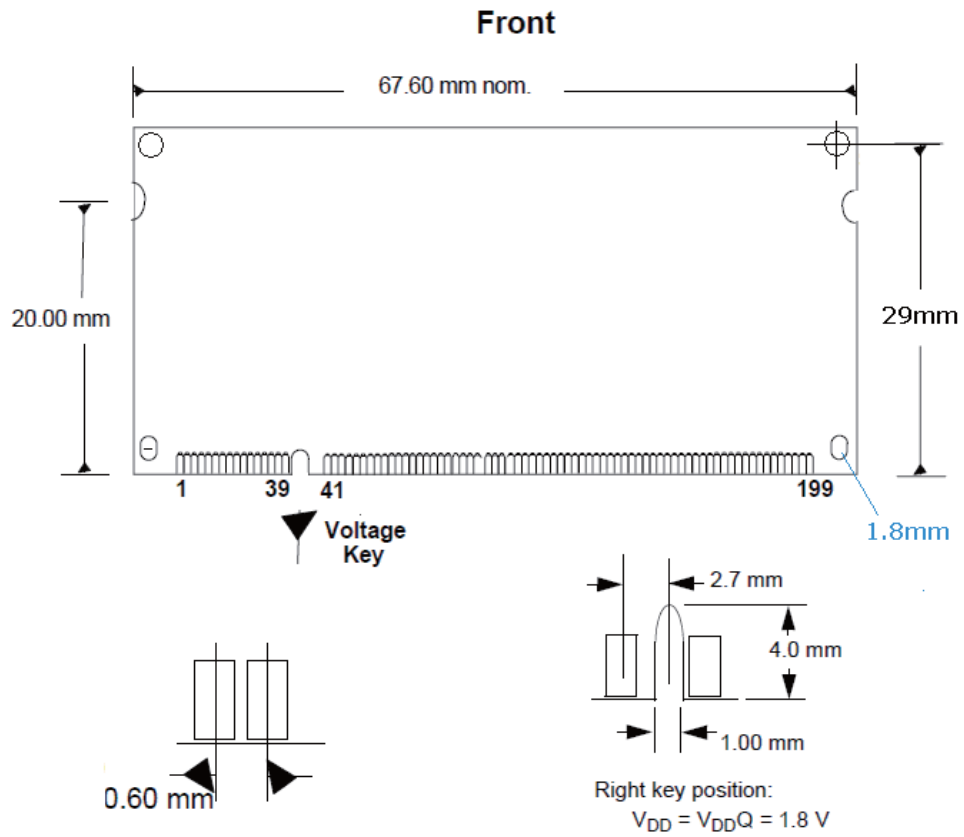
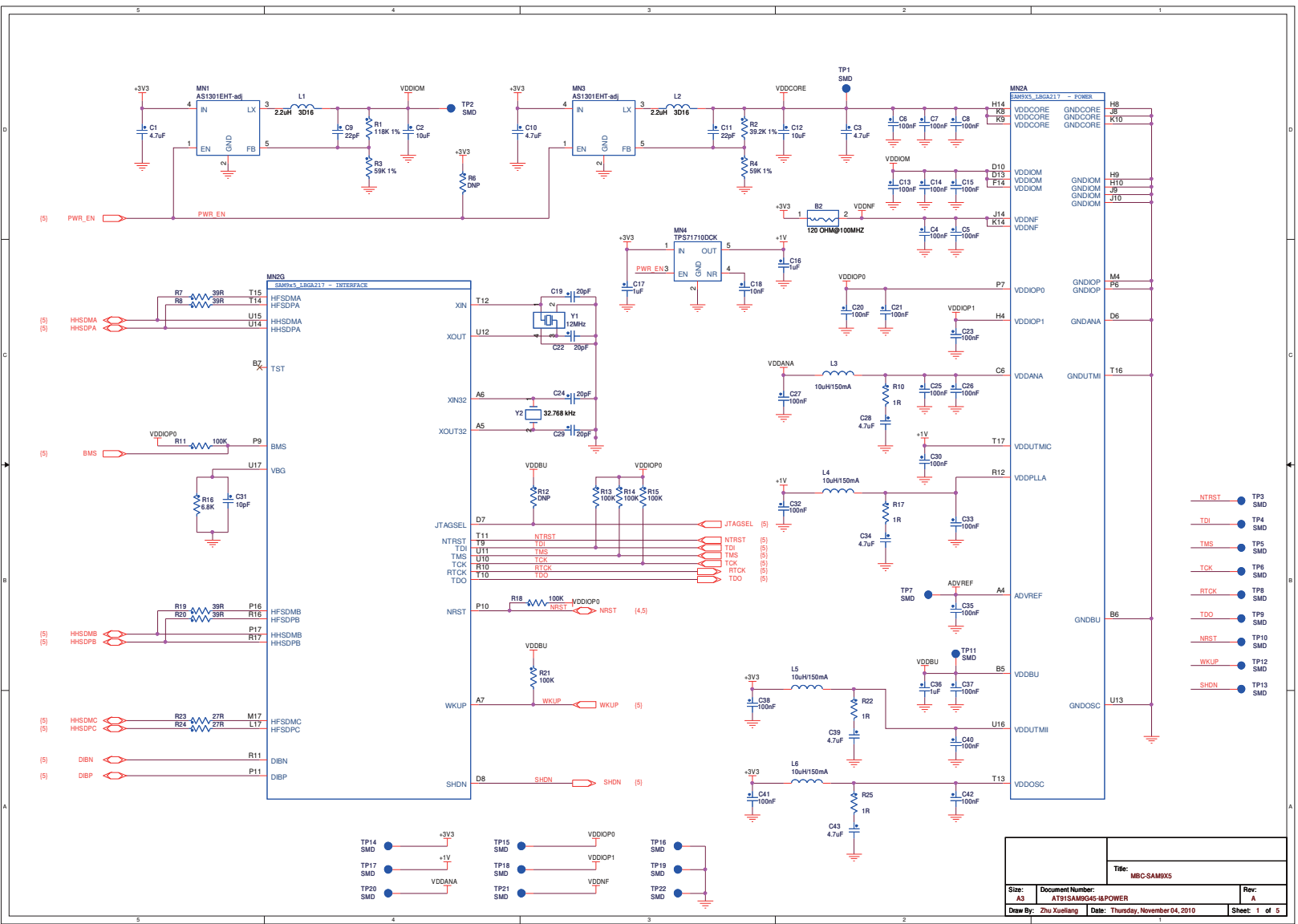
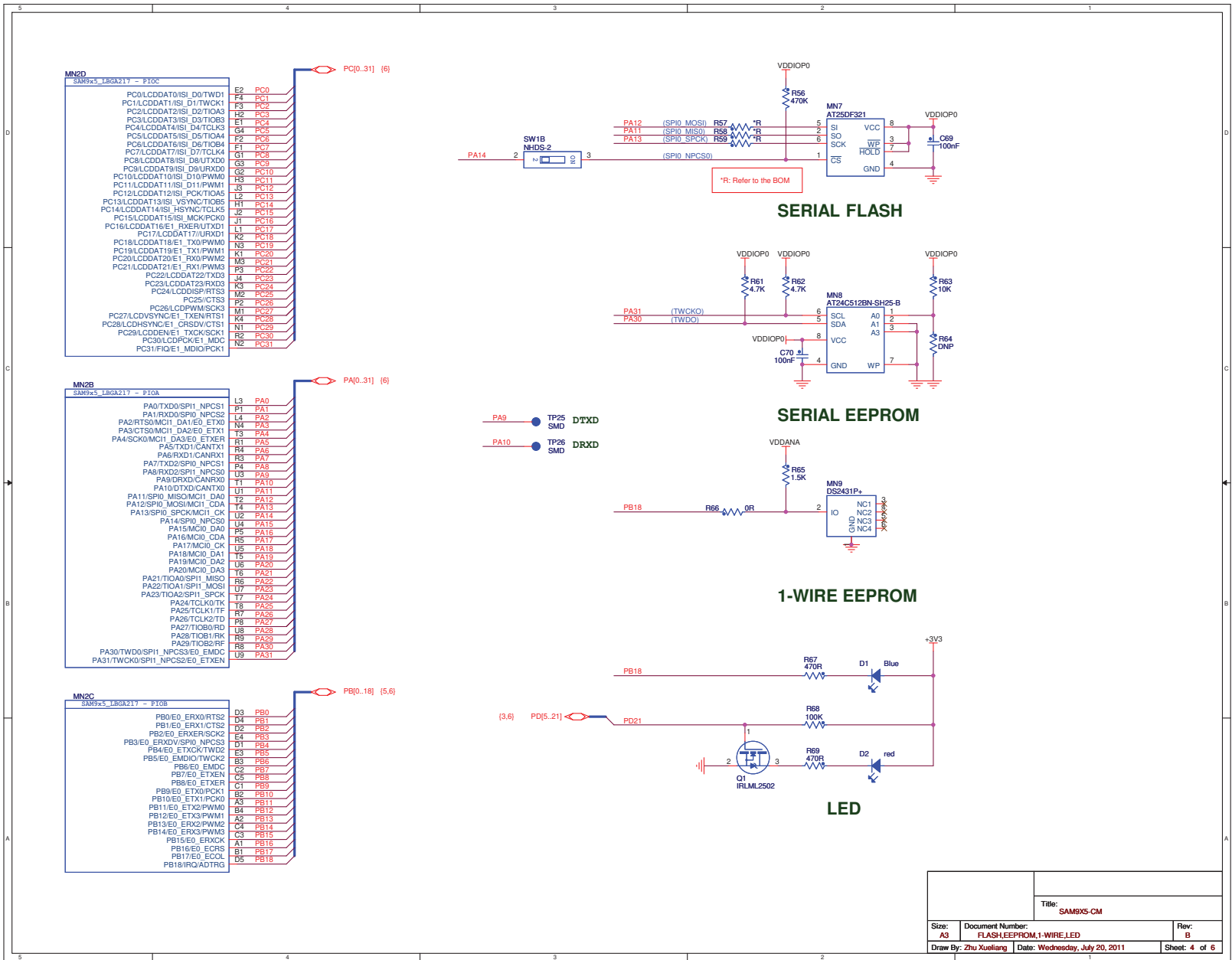


Figure 3-12. CM Board Schematics – 1 of 5



Title: MBC-SAM9XS	
Size: A3	Document Number: AT91SAM9G45-4&POWER
Drawn By: Zhu Xueliang	Date: Thursday, November 04, 2010
Rev: A	Sheet: 1 of 5



Title: SAM9XS-CM		
Size: A3	Document Number: FLASH_EEPROM_1-WIRE_LED	Rev: B
Draw By: Zhu Xuoliang	Date: Wednesday, July 20, 2011	Sheet: 4 of 6