

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

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**User Guide**





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### 1.1 Scope

This User Guide introduces the Evaluation Kit and describes the development and debugging capabilities running on an AT91SAM9 ARM<sup>®</sup>-based Embedded MPUs as listed below:

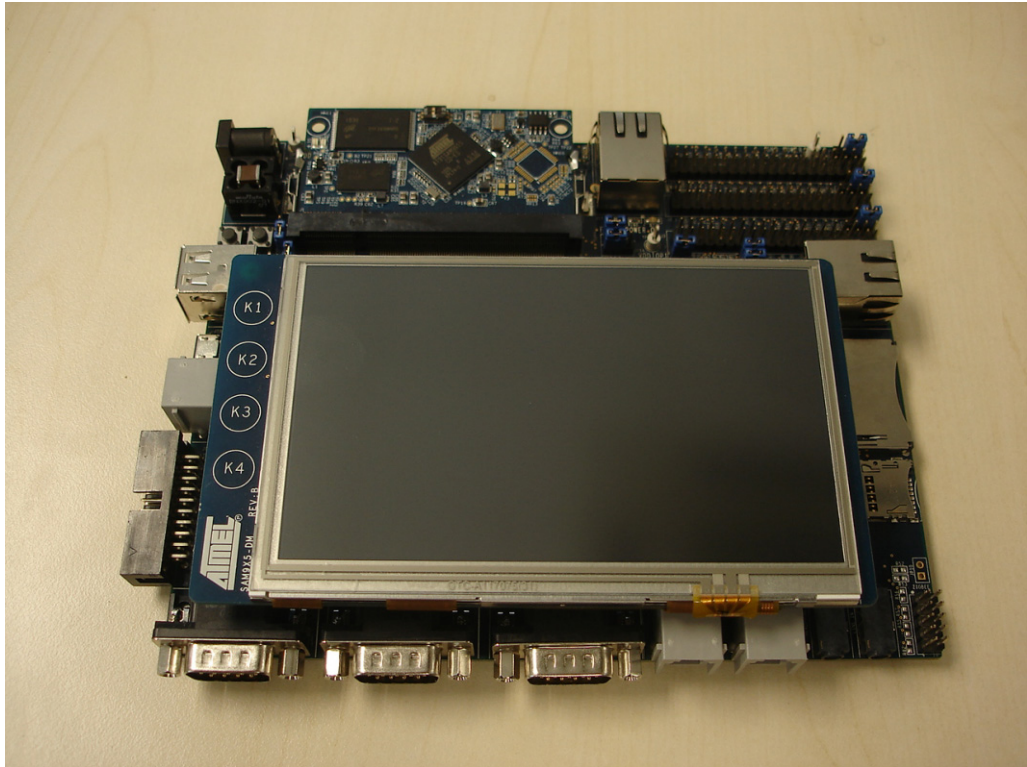
- SAM9G15
- SAM9G25
- SAM9X25
- SAM9G35
- SAM9X35

The User Guide pertains to the following Evaluation Kit references:

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

This User Guide gives design details on the Evaluation Kit and is made up of 5 sections:

- Section 1 includes a photo of the board, device and kit references and applicable documents.
- Section 2 describes the kit contents, its main features.
- Section 3 provides instructions to power up the Evaluation Kit and describes how to use it.
- Section 4 describes the CPU Module (CM), the Main Board (MB) and optional Display Module (DM).

**Figure 1-1.** Board Photo (Display module is optional)

## 1.2 Applicable Documents

**Table 1-1.** Applicable Documents

Reference	Title	Comment
Atmel lit° 11052	SAM9G15 datasheet	These documents provide technical support for each one of the Atmel ARM-based Embedded MPU products supported by these Evaluation Kits.  The datasheets can be found on <a href="http://www.atmel.com">www.atmel.com</a> in the SAM9G/SAM9X product families by means of the link below:
Atmel lit° 11032	SAM9G25 datasheet	
Atmel lit° 11054	SAM9X25 datasheet	
Atmel lit° 11053	SAM9G35 datasheet	
Atmel lit° 11055	SAM9X35 datasheet	

[http://www.atmel.com/products/at91/default.asp?category\\_id=163&family\\_id=605&source=global\\_nav](http://www.atmel.com/products/at91/default.asp?category_id=163&family_id=605&source=global_nav)



## Section 2

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# Kit Contents

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### 2.1 Deliverables

The Evaluation Kits include:

- 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

**Figure 2-1.** Unpacked Evaluation Kit



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

## 2.2 Evaluation Board Specifications

**Table 2-1.** 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



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## 2.3 Electrostatic Warning

The Evaluation Kit is shipped in a protective anti-static package. The board system must not be subjected to high electrostatic potentials. A grounding strap or similar ESD protective device should be worn when handling the board in hostile ESD environments (offices with synthetic carpet, for example). Avoid touching the component pins or any other metallic element on the board.



## Section 3

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# Power Up

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### 3.1 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.

The board LCD should light up and display a welcome page. Then, click or touch icons displayed on the screen and enjoy the demo.

### 3.2 DevStart

The on-board NAND Flash contains an installation guide named: “SAM9x5-EK DevStart”.

It is stored in the “SAM9x5-EK DevStart” folder on the USB Flash disk available when the Evaluation Kit is connected to a host computer.

Click the file “welcome.html” in this folder to launch the SAM9x5-EK DevStart.

DevStart guides the user through the installation processes of IAR™ EWARM, Keil™ MDK and GNU toolkits. Then, it gives step-by-step instructions on how to rebuild a single example project and how to program it into the Evaluation Kit. Optionally, if the user has a SAM-ICE™ interface, instructions are also given about how to debug the code.

**It is strongly recommended that users backup the “SAM9x5-EK DevStart” folder on their computer before launching it.**

### 3.3 Recovery Procedure

The DevStart ends by giving step-by-step instructions on how to recover the Evaluation Kit to the state as it was when shipped by Atmel.

Follow the instructions if contents of the NAND Flash or the SPI DataFlash<sup>®</sup> have been deleted, in order to recover from this situation.

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

**Figure 3-1.** 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.



### 4.1 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 4-1](#), on the page that follows, lists the features provided on the Evaluation Kit:

**Table 4-1.** Evaluation Kit Features

Supported modules		SAM9 products					
Expansion Slot	SO-DIMM200						
Processor options		SAM9 G15	SAM9 G25	SAM9 G35	SAM9 X25	SAM9 X35	
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	HSMCI 0	X	X	X	X	X
	MMC/MMC+/SD/SDIO/CE-ATA	HSMCI 1	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

## 4.2 Computer Module (CM)

### 4.2.1 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.

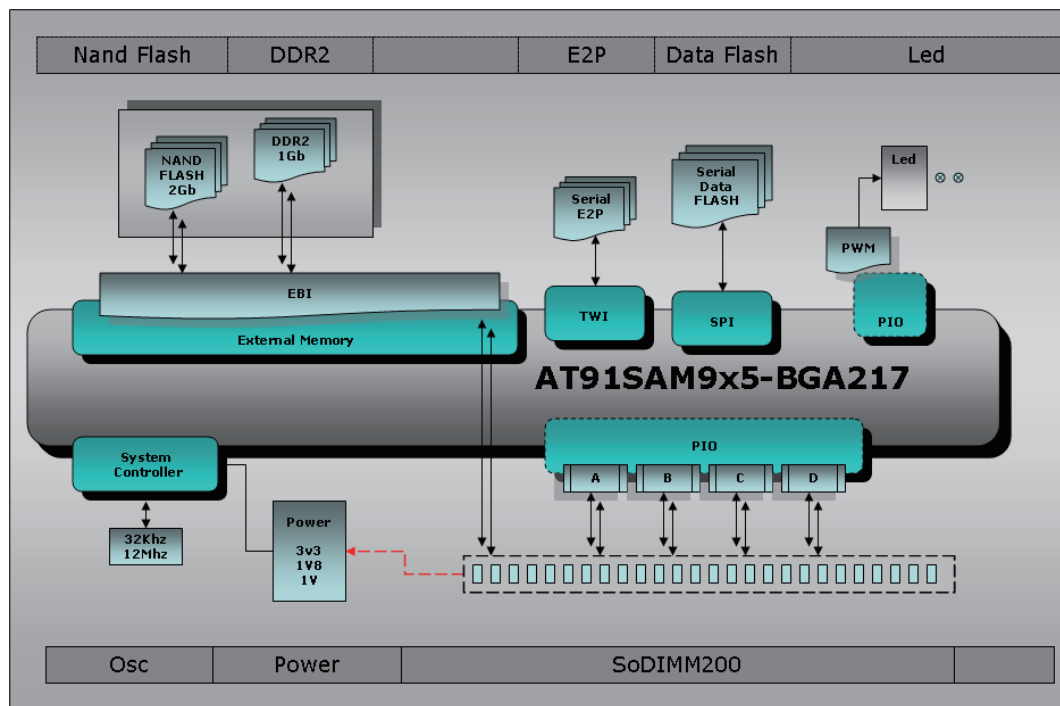
**Note:** There are three CM boards from three different manufacturers. The five processors are implemented as shown in Table 4-2 below:

**Table 4-2.** 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 4.2.6 "Schematics".

**Figure 4-1.** Board Architecture



### 4.2.2 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.



### 4.2.2.1 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 DataFlash with Chip Selection control switch
- 512 Kbits EEPROM
- 1 Kbyte 1-Wire EEPROM
- On-board power regulation
- Two user LEDs
- Optional PHY

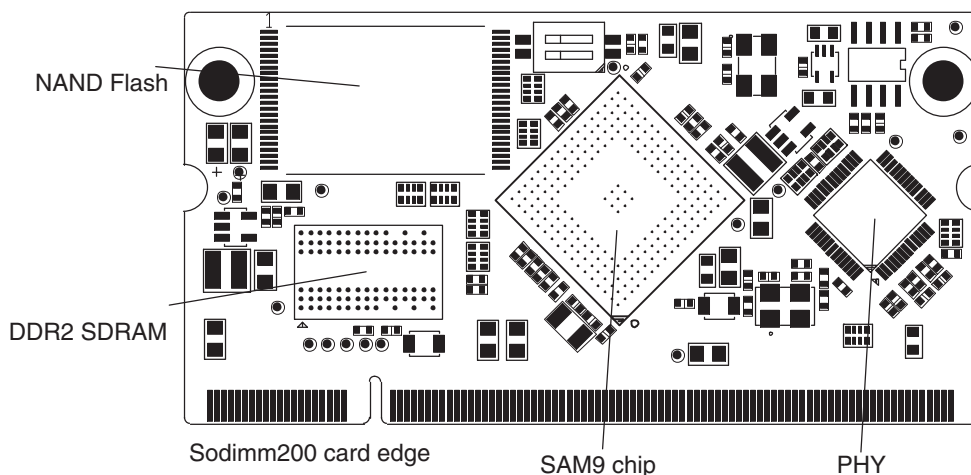
### 4.2.2.2 Interface Connection

- SODIMM200 card edge interface

### 4.2.2.3 Configuration Items

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

**Figure 4-2.** CM Board Layout Commented



## 4.2.3 Function Blocks

### 4.2.3.1 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 4.2.4.1 "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.

### 4.2.3.2 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 4-3.** 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

### 4.2.3.3 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)





**4.2.3.4 Power Supplies**

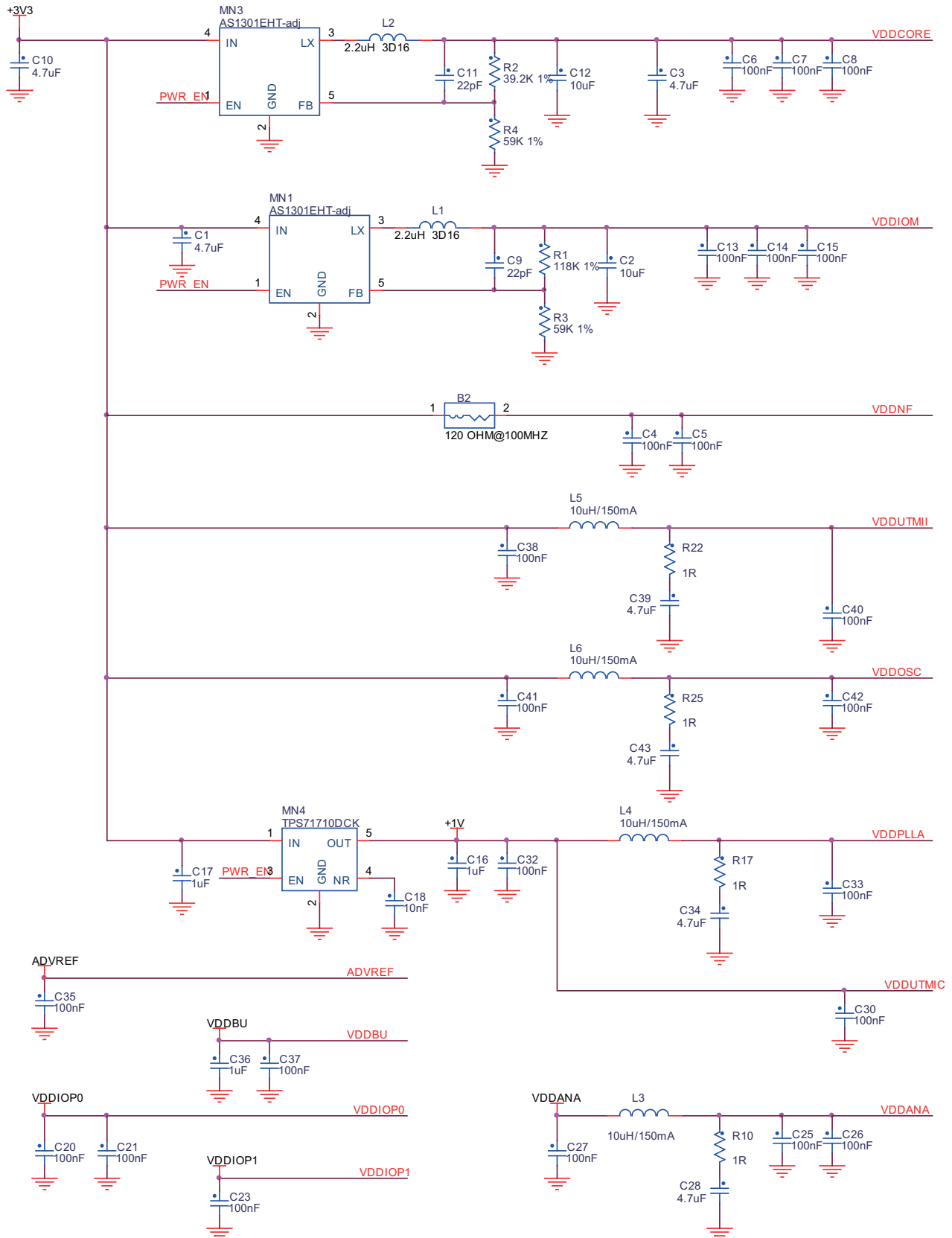
The CM Board is driven by +3V3 input power rail from the EK board through the SODIMM200 connector. The CM Board embeds all the necessary power rails required for the micro processor.

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 4-4.** 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 4-3. CM Power Supply



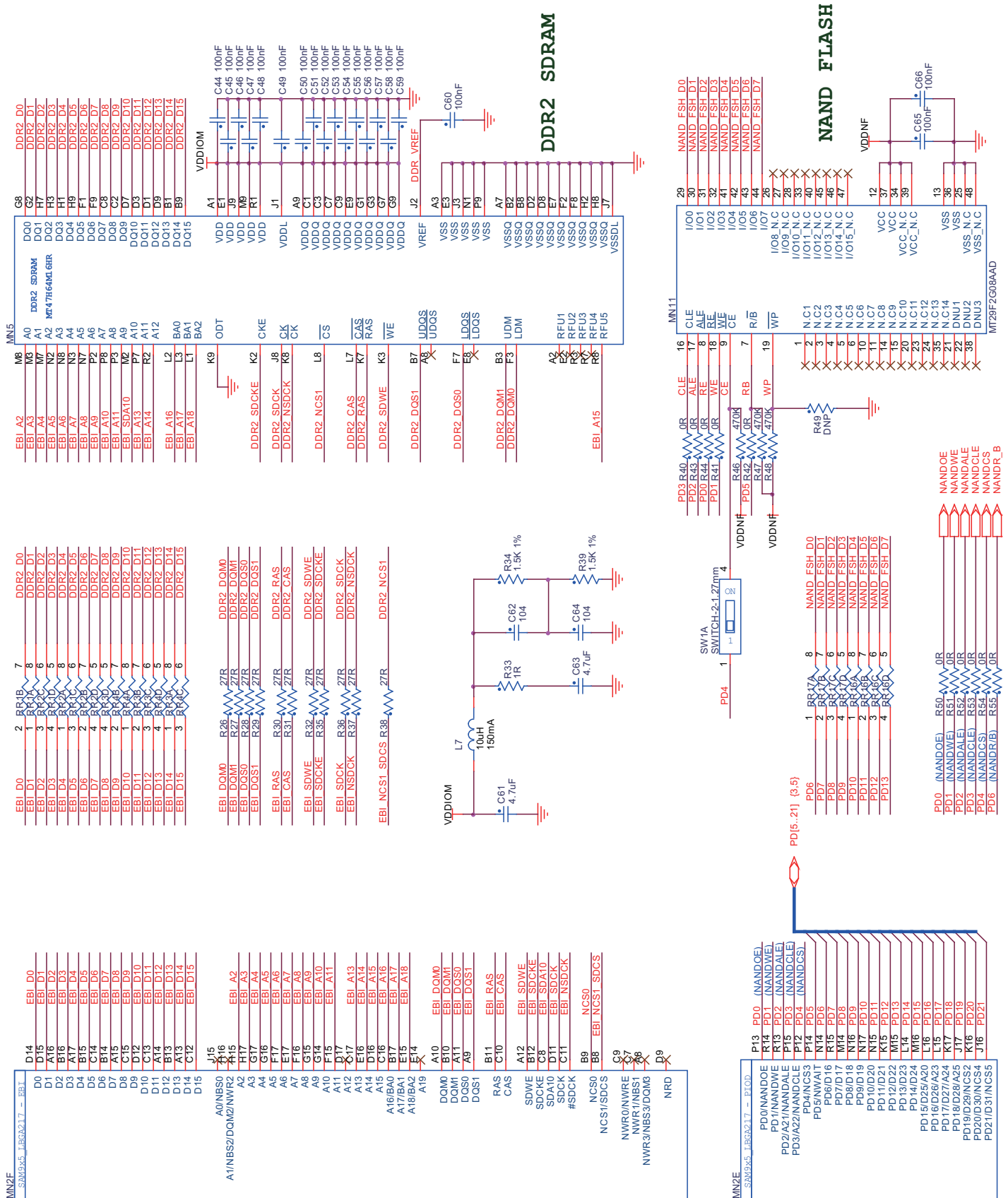
### **4.2.3.5 Memory**

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

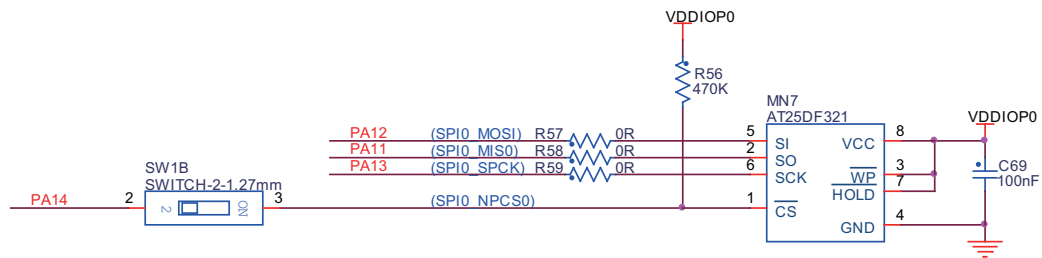
Figure 4-4. CM Board External Memory



### 4.2.3.6 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 DataFlash®.

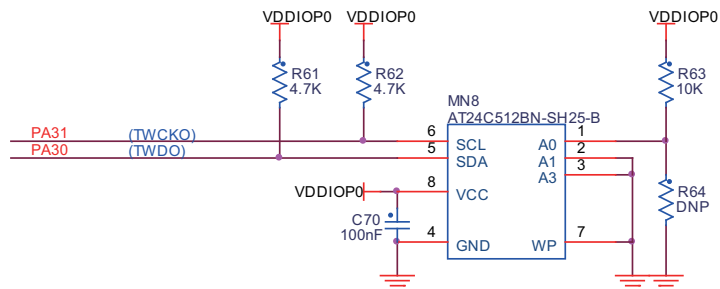
Figure 4-5. SPI



### 4.2.3.7 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, ISI, QTouch device and audio codec interface.

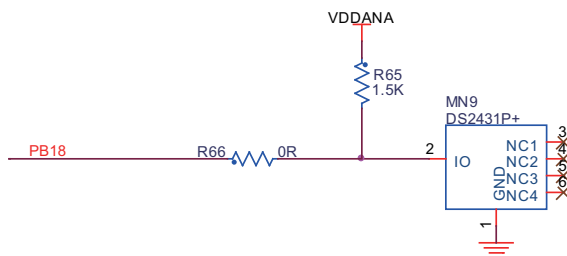
Figure 4-6. TWI



### 4.2.3.8 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 4-7. 1-Wire Device



#### **4.2.3.9 Optional PHY**

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

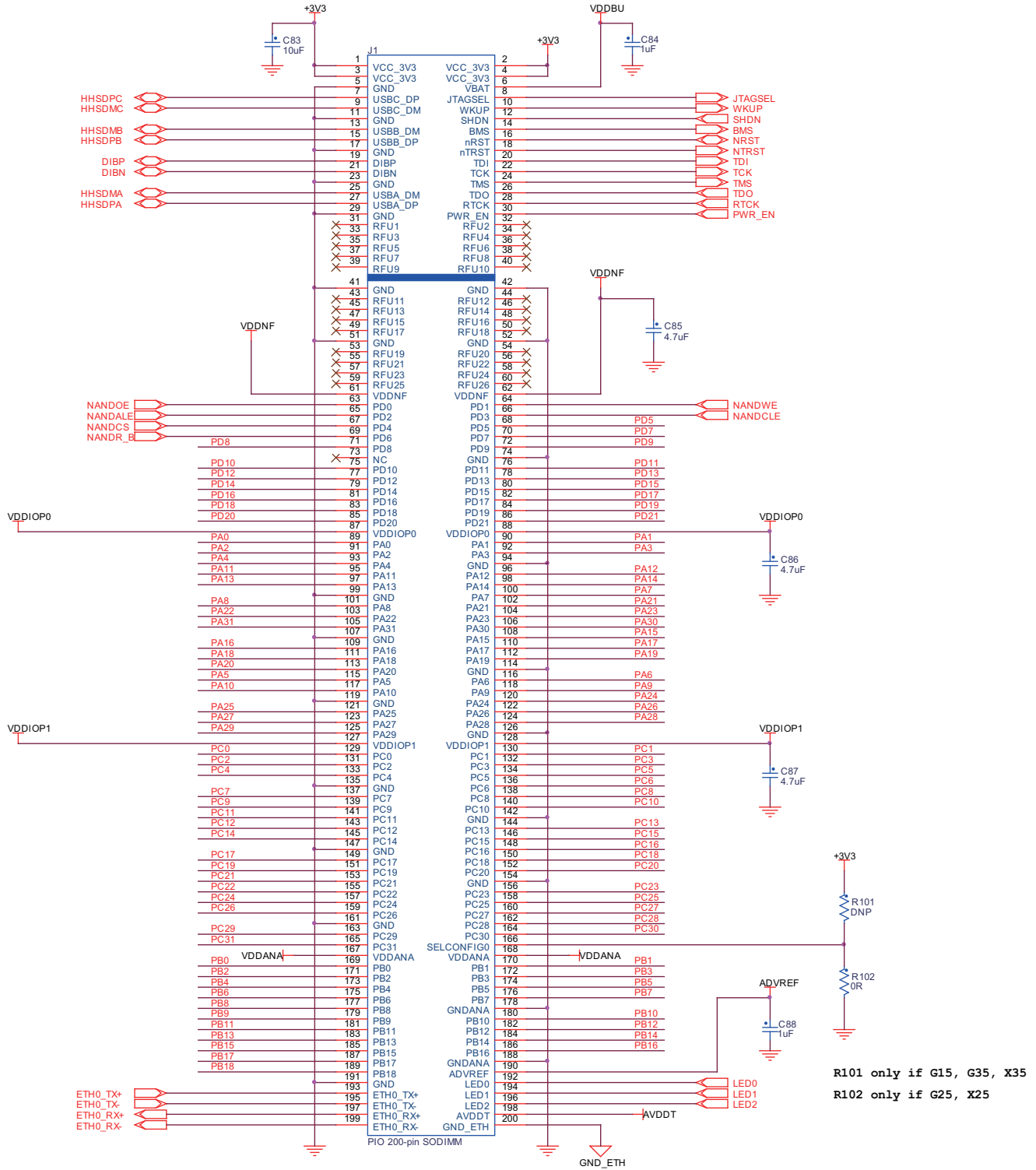
For more information about the Ethernet controller device, refer to the Davicom DM9161 controller manufacturer's datasheet.



### 4.2.3.10 SODIMM200 Interface

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

Figure 4-9. SODIMM200 Interface on CM Board



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





## 4.2.4 Configuration

### 4.2.4.1 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 4-5.** 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 4-6.** 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

#### 4.2.4.2 Boot Configuration

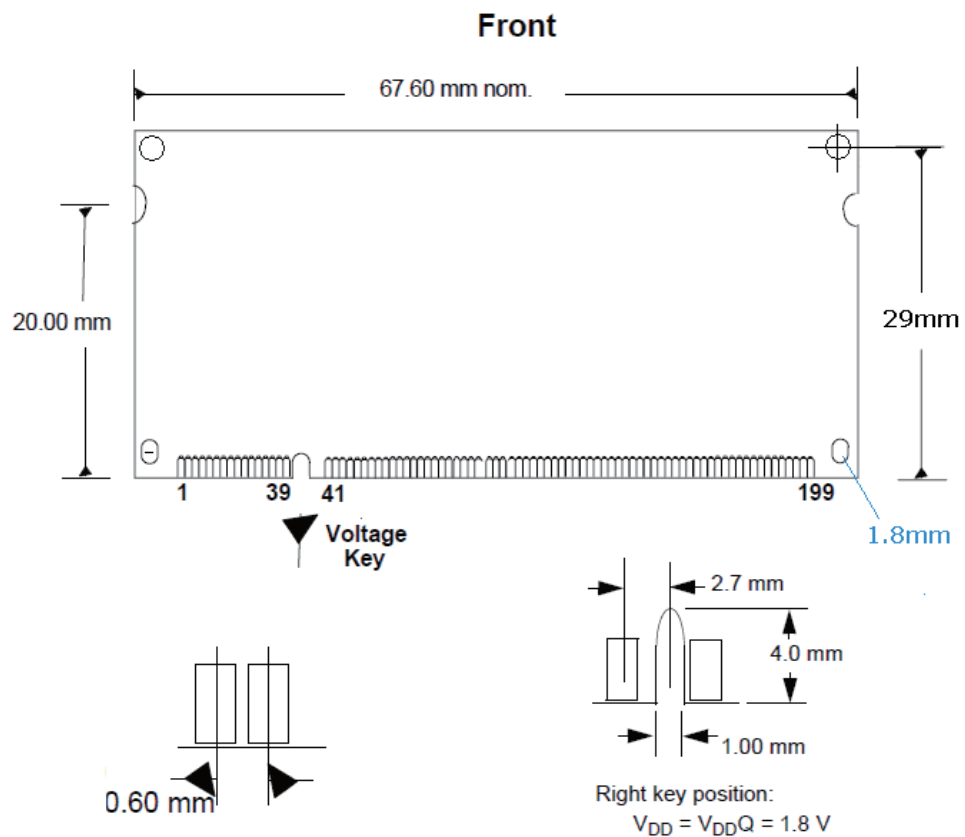
In order to use SAM-BA boot, the NAND Flash and SPI DataFlash must be deselected. SW1 is dedicated to this purpose.

**Table 4-7.** Boot Configuration

Designation	Default Setting	Feature
SW1 (1, 4)	ON	Set to OFF disables the NAND flash
SW1 (2, 3)	ON	Set to OFF disables the SPI DataFlash

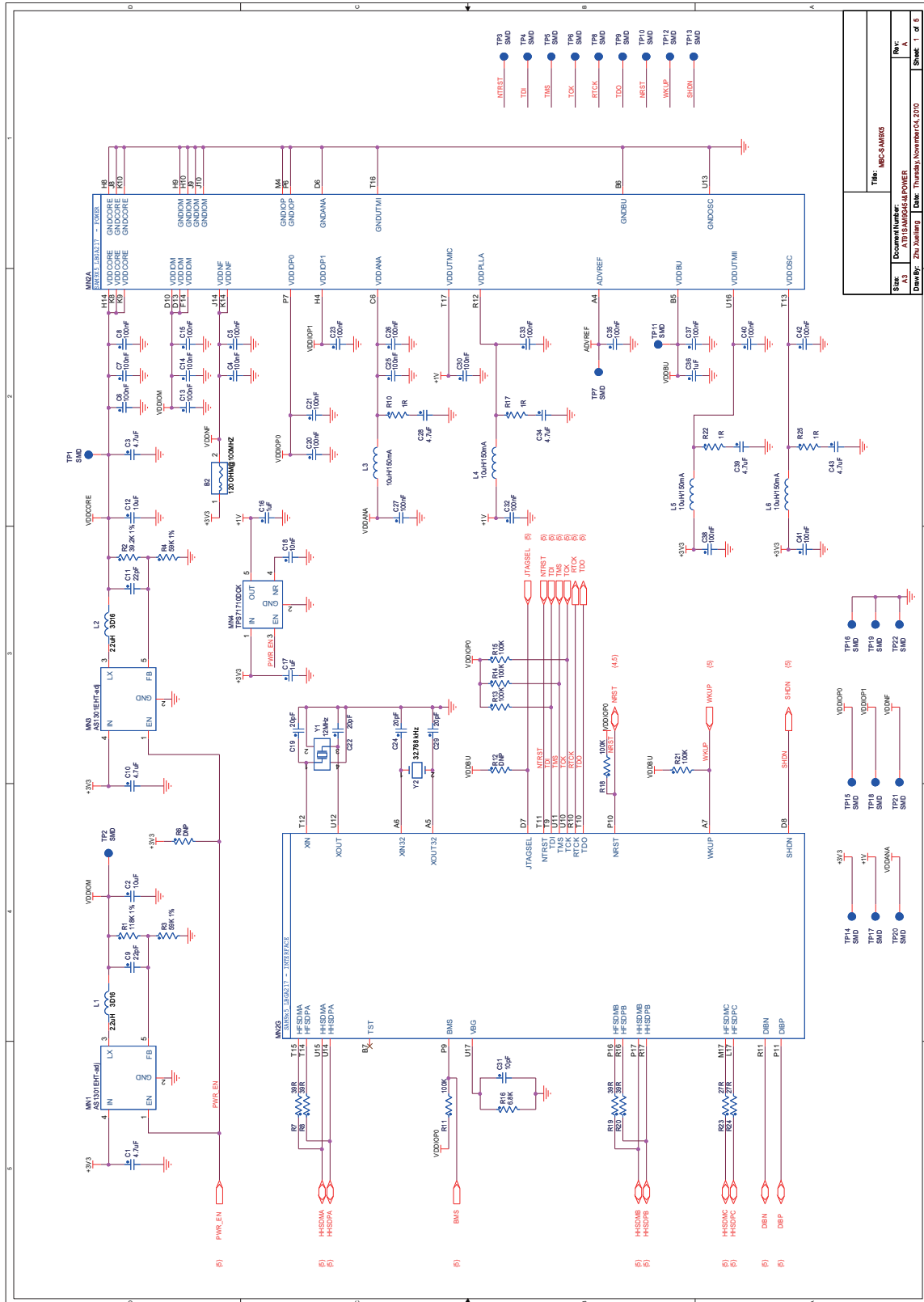
#### 4.2.5 Connectors

**Figure 4-10.** CM Board Dimensions



4.2.6 Schematics

Figure 4-11. CM Board Schematics – 1of 5



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Date:	Thursday, November 04, 2010
Sheet:	1 of 5



Figure 4-12. CM Board Schematics – 2 of 5

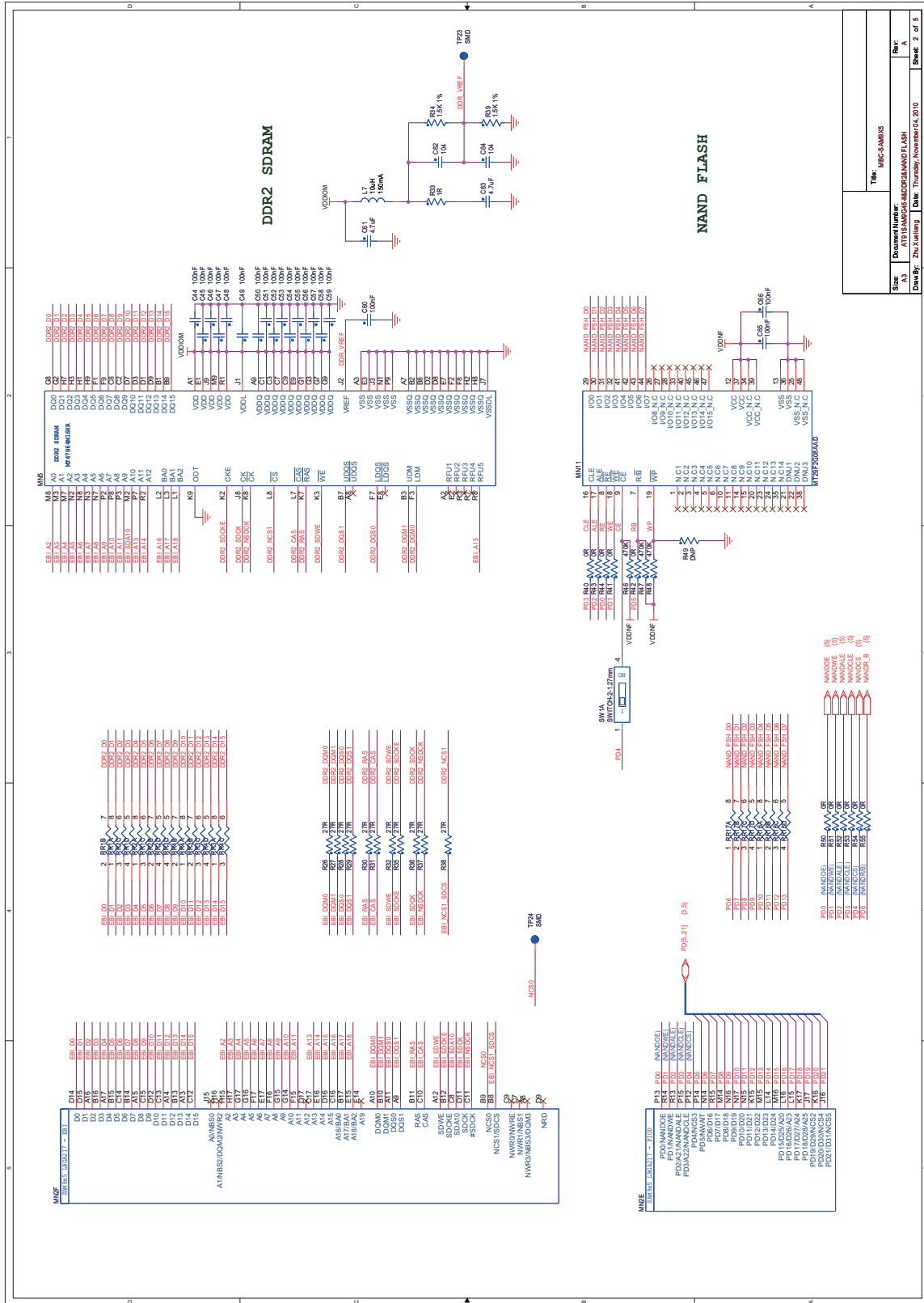
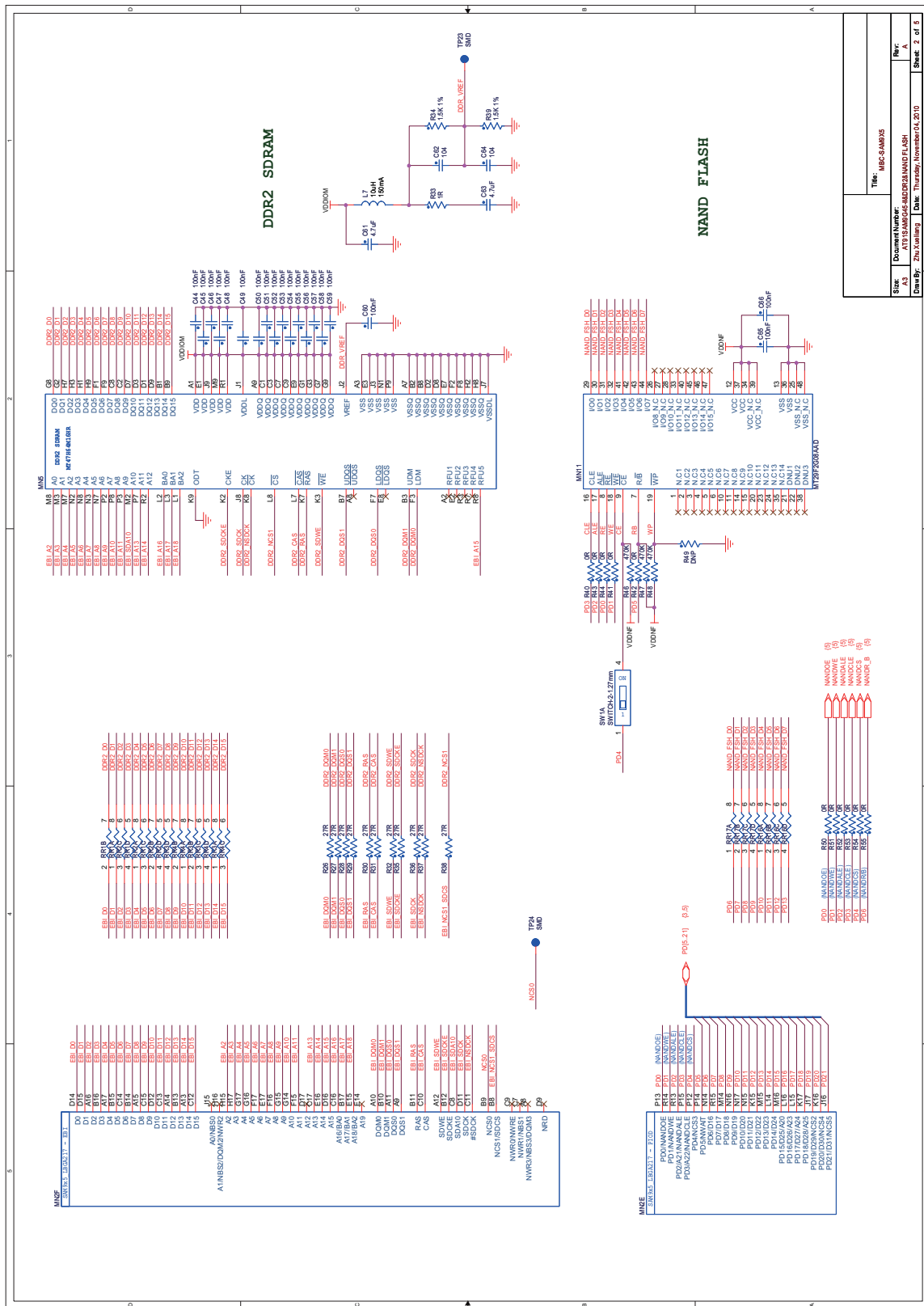


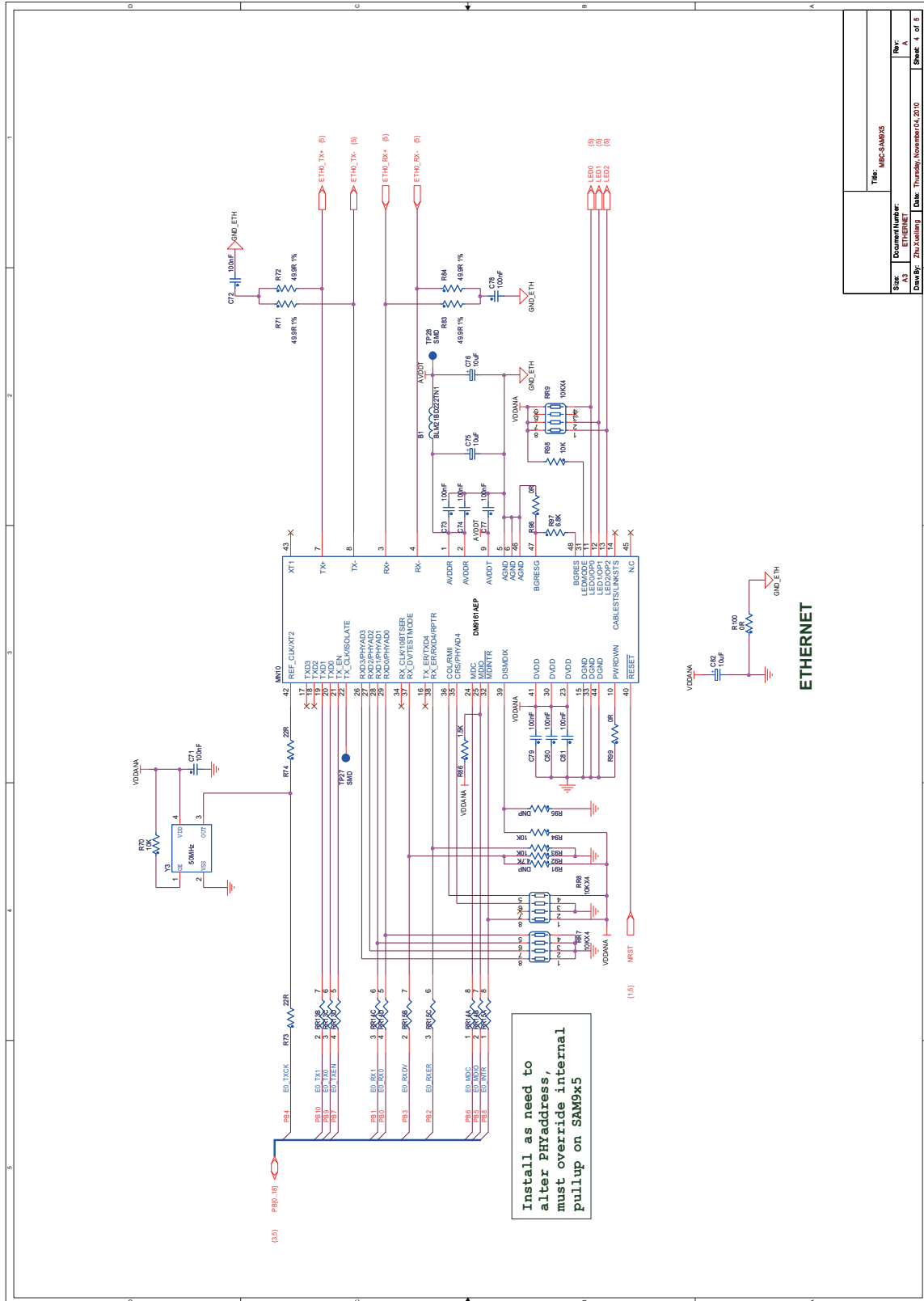
Figure 4-13. CM Board Schematics – 3 of 5



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Zhi-Canling	Thursday, November 14, 2010	2 of 5



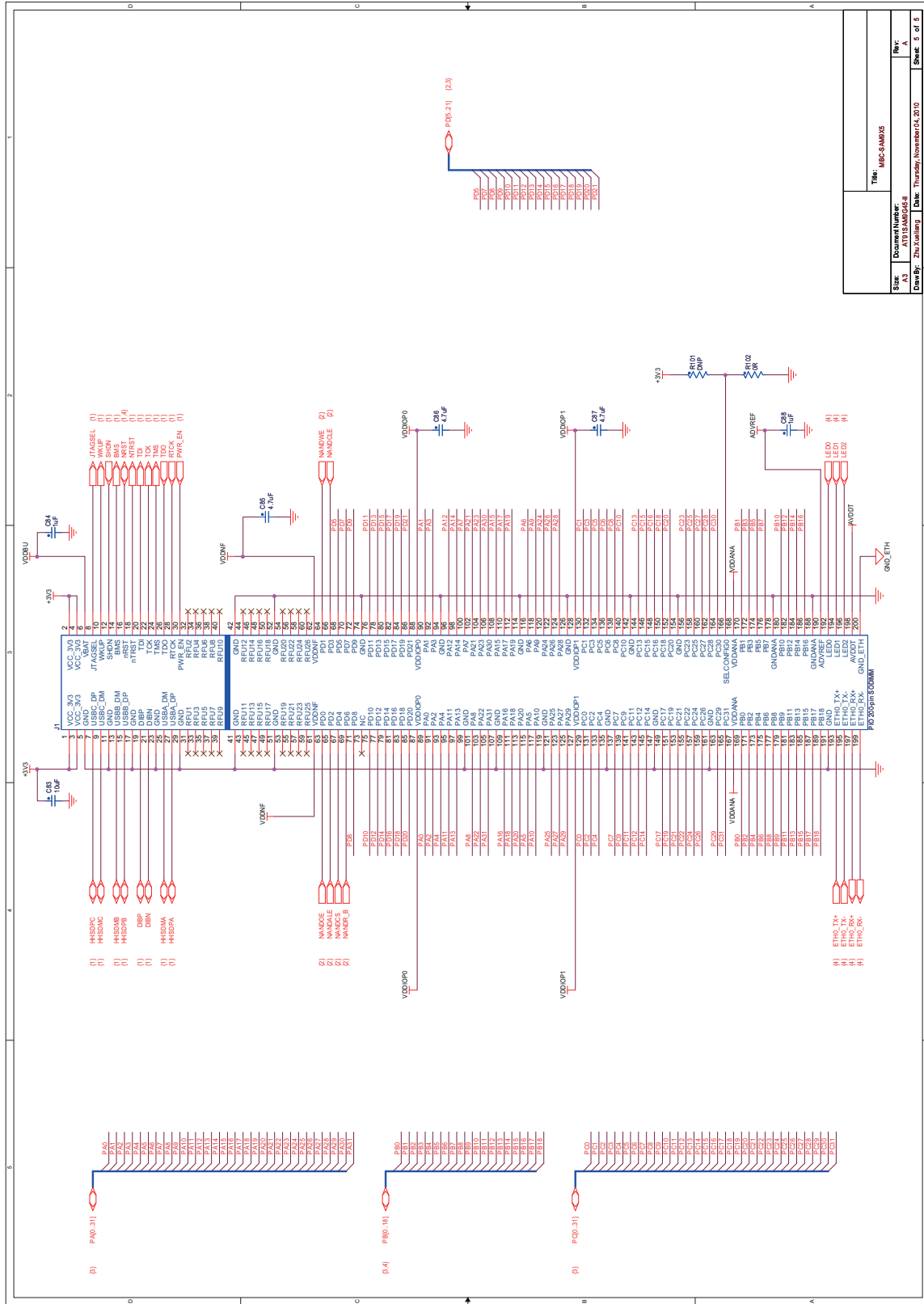
Figure 4-14. CM Board Schematics – 4 of 5



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Drawn By:	Zhu,Weiwei
Date:	Thursday, November 04, 2010
Rev:	A
Sheet:	4 of 5



Figure 4-15. CM Board Schematics – 5 of 5

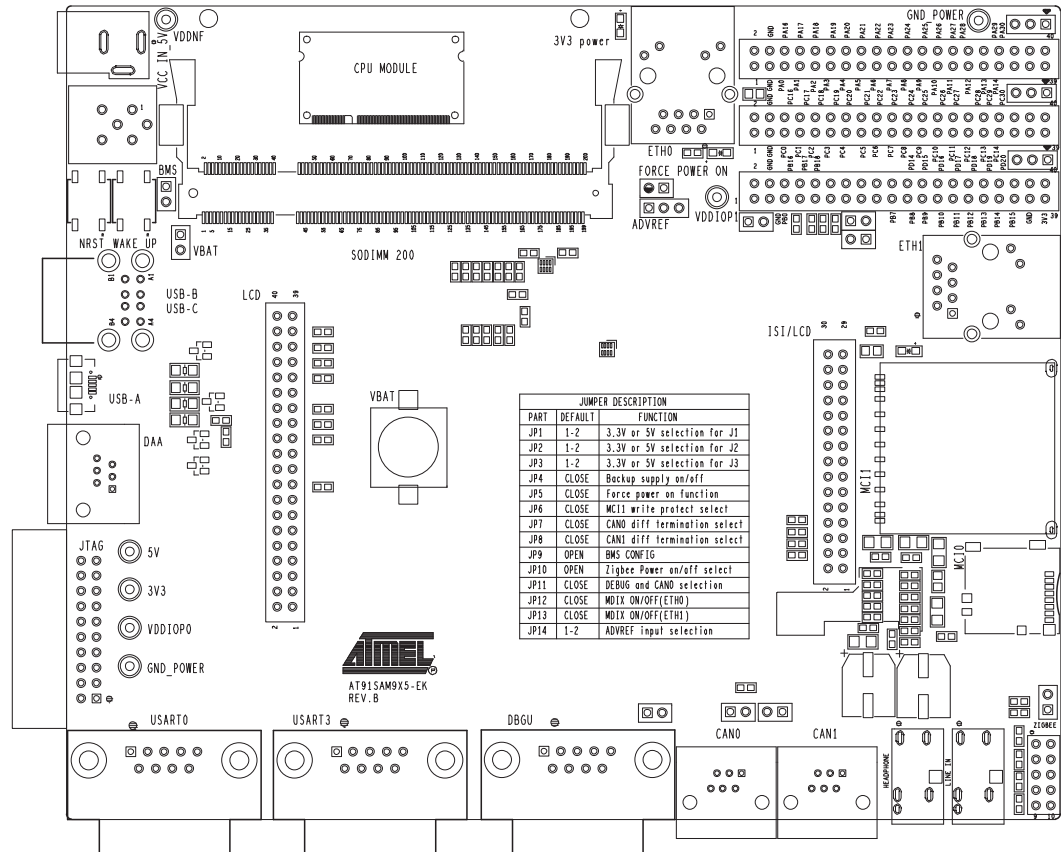


## 4.3 EK Board Description

### 4.3.1 EK Board Overview

The EK board serves as the main board that carries the CPU module. It features all necessary peripherals and interfaces for processor evaluation.

Figure 4-16. Commented EK Board Layout





### 4.3.2 Equipment List

Based on the processor installed on the CM board, the EK board is equipped with the following interfaces or peripherals:

#### 4.3.2.1 Devices

List of the EK board peripherals:

- Two EMAC PHY
- One Audio codec
- Two high speed MCI Card interfaces
- Two CAN transceivers
- Three RS232 ports with level translator features: DBGU, USART0 and USART3
- One Smart DAA port
- Two USB host ports
- One USB host/device port
- On-board power regulation
- LCD/ISI extension interface
- ZigBee® interface
- One-wire device

#### 4.3.2.2 Board Interface Connection

- Main power supply (J4)
- One SODIMM200 socket (CON1)
- USB A Host/Device, support USB host/device using a type micro AB connector (J20)
- USB B Host, support USB host using a type A connector (J19, upper)
- USB C Host, support USB host using a type A connector (J19, lower)
- DBGU (RX and TX only) connected to a 9-way male RS232 connector (J11)
- USART1 (RX, TX, RTS, CTS) connected to a 9-way male RS232 connector (J8)
- USART3 (RX, TX, RTS, CTS) connected to a 9-way male RS232 connector (J12)
- JTAG, 20 pin IDC connector (J9)
- MicroSD connector (J6)
- SD/MMC connector (J7)
- Headphone (J15), line-in (J13)
- Image sensor connector (J21)
- DM board connection for QTouch and TFT LCD display with Touch Screen and backlight (J21, J22)
- DAA connector RJ11 6P4C type (J16)
- CAN bus connectors RJ12 6P6C type (CON2, CON3)
- ZigBee connector (J10)
- Three IO expansion ports (J1, J2, J3)
- Test points, various test points are located throughout the board

#### 4.3.2.3 Push Button Switches

- Reset, board reset (BP1)
- Wake up, push button to bring the processor out of low power mode (BP2)



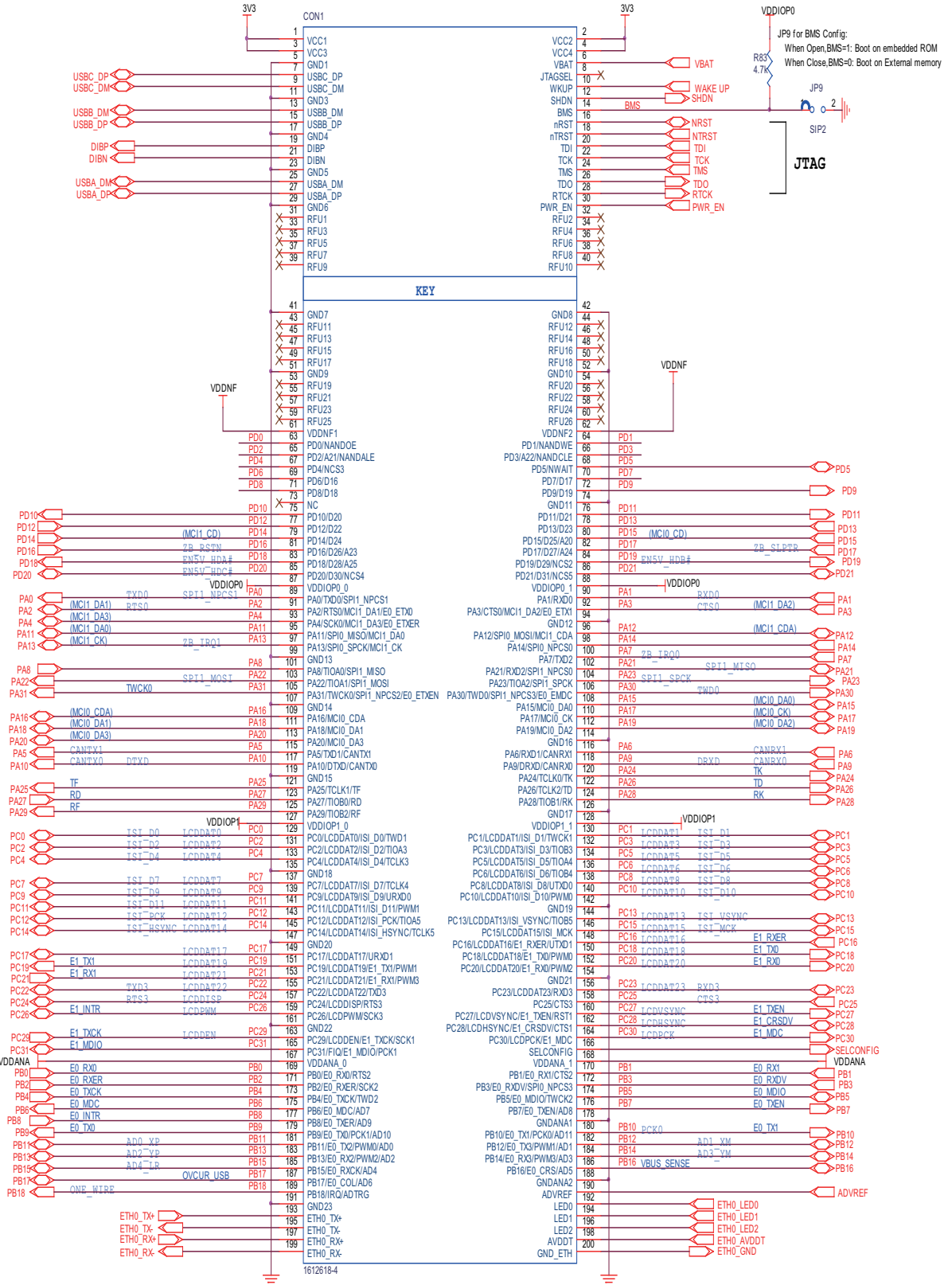
### 4.3.3 Function Blocks

#### 4.3.3.1 Processor

The Evaluation Kit board may be used with any of the Core Modules:

- SAM9G15
- SAM9G25
- SAM9G35
- SAM9X25
- SAM9X35

Figure 4-17. SODIMM Interface on EK Board



### 4.3.3.2 Power Supplies

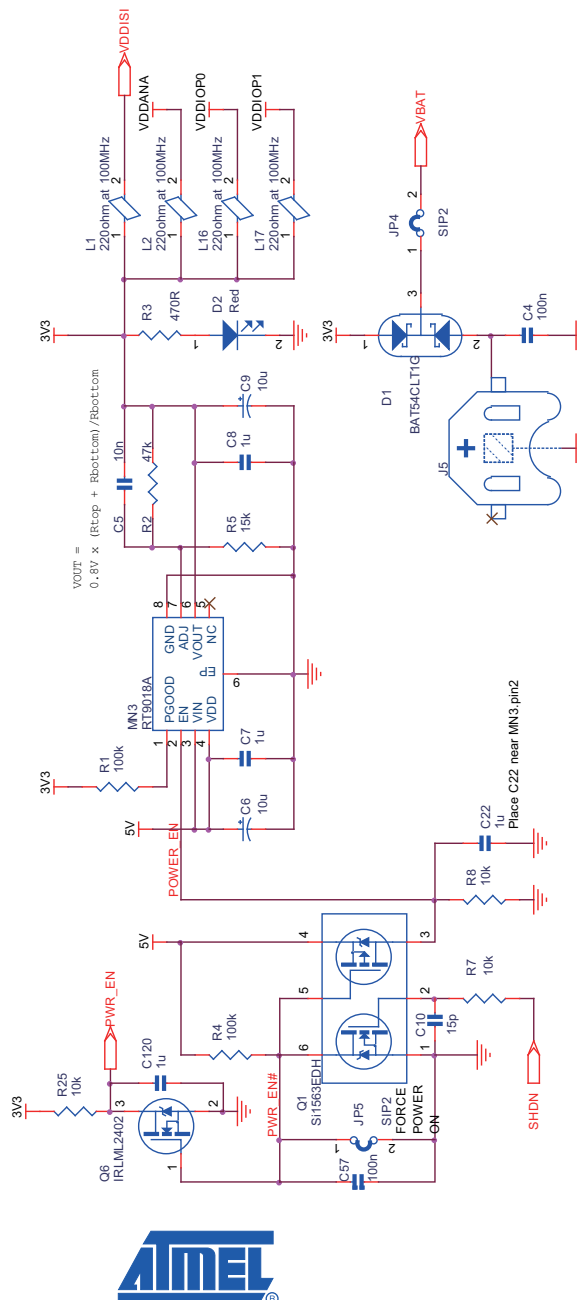
The EK Board features one adjustable LDO. It accepts DC 5V power input and outputs a regulated +3.3V to most other circuits on the board through four 3.3V rails.

- VDDPIO0
- VDDPIO1
- VDDANA
- VDDISI

This LDO is enabled through a dual FET scheme. The processor can assert SHDN (which is a VDDDBU-powered I/O) to shut down the LDO to enter the so-called backup mode. The regulator on CM board is also shut down by the action of the SHDN signal.

If the 3V battery is mounted on J5, both CM and EK boards can be woken up by action on the BP2 button, which drives the WKUP signal (also a VDDDBU-powered I/O).

**Figure 4-18.** EK Board Power Management

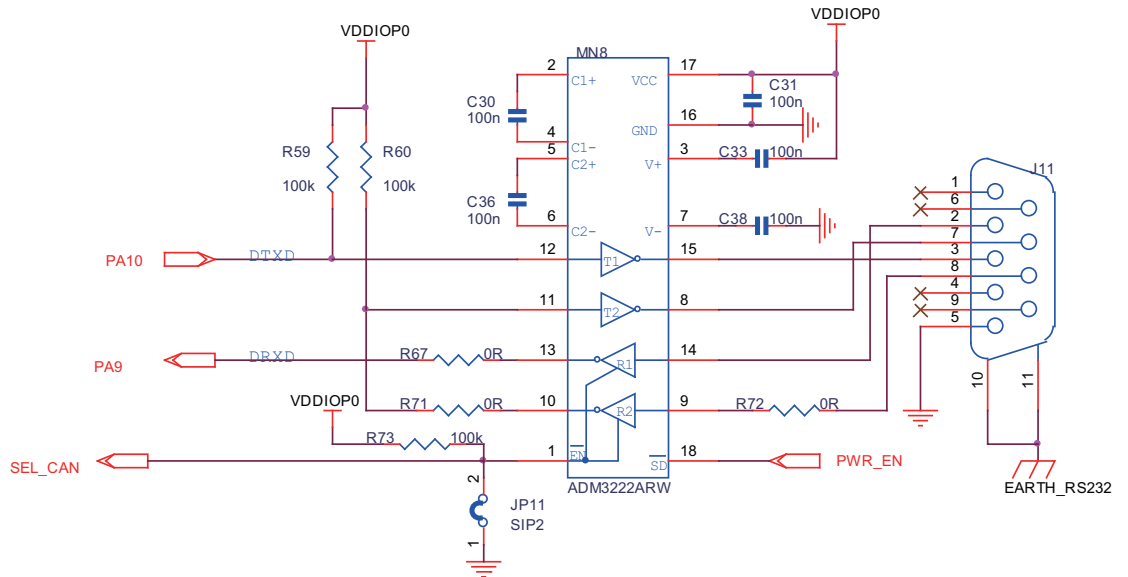




### 4.3.3.4 DBGU

The UART is connected to the DB-9 male socket through an RS-232 Transceiver (TXD and RXD only). A jumper, JP11, is used to select DBGU or CAN0 between IO (PA9, PA10) sharing scheme. Close JP11 to select DBGU.

**Figure 4-21.** DBGU Com Port

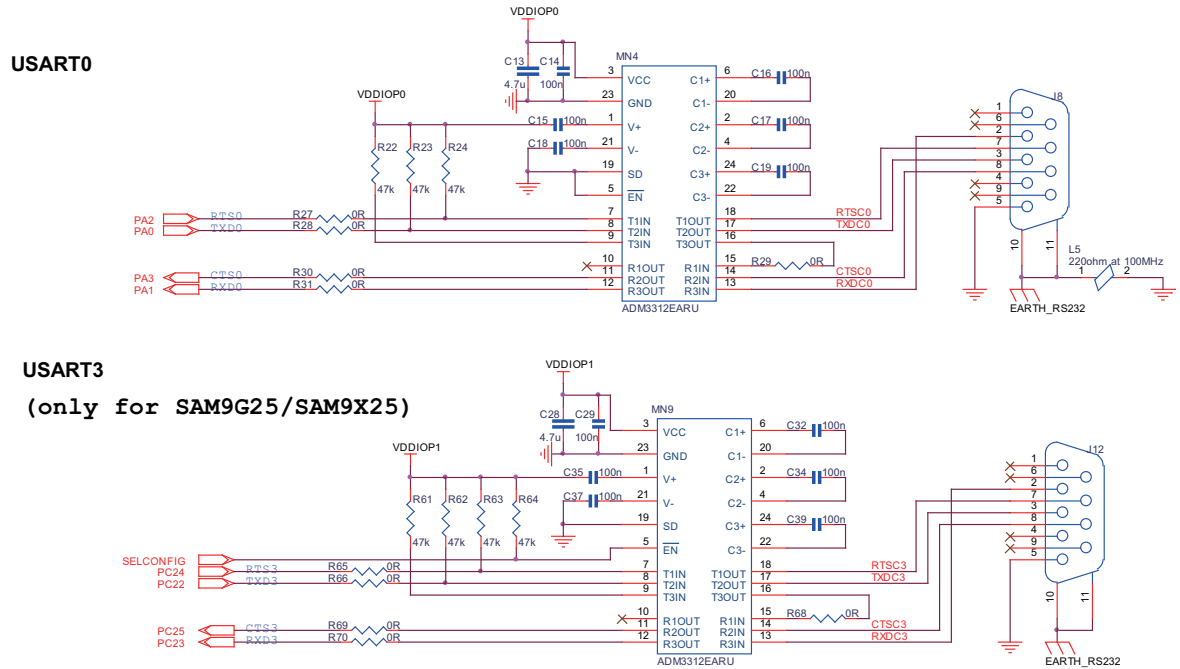


4.3.3.5 USART

The USART0 and USART3 are used as serial communication ports. Both USARTs are buffered with an RS-232 Transceiver (TXD, RXD and handshake CTS/RTS control) and connected to the DB-9 male socket. The software must assign the appropriate PIO pins to enable the USART function.

The USART3 is only supported by SAM9G25 and SAM9X25 processors. The RS-232 Transceiver for USART3 is enabled by the signal SELCONFIG comprised of a pull down resistor on CM board. Ref to Section 4.4.1 "DM Board Overview" for details.

Figure 4-22. USART Com Port



### 4.3.3.6 USB Ports

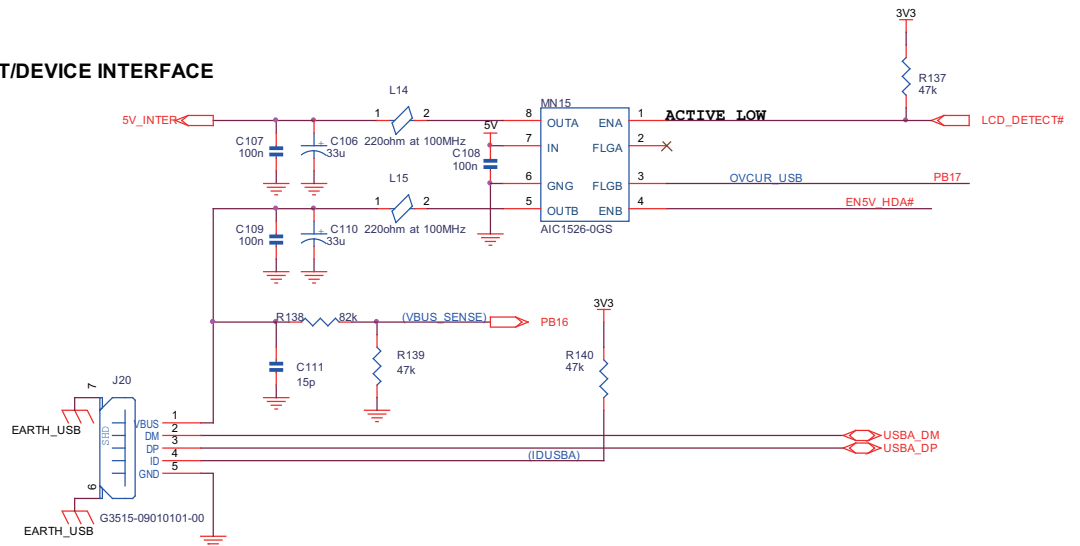
The Evaluation Kit features three USB communication ports:

- Port A Host High Speed (EHCI) and Full Speed (OHCI) multiplexed with USB Device High speed Micro AB connector, J20
- Port B Host High Speed (EHCI) and Full Speed (OHCI) standard type A connector, J19 upper port
- Port C Host Full speed OHCI only standard type A connector, J19 lower port

All three USB Host ports are equipped with 500 mA high-side power switch for self-powered and bus-powered applications. The USB device port features VBUS insert detection function through the resistor ladder R138 and R139.

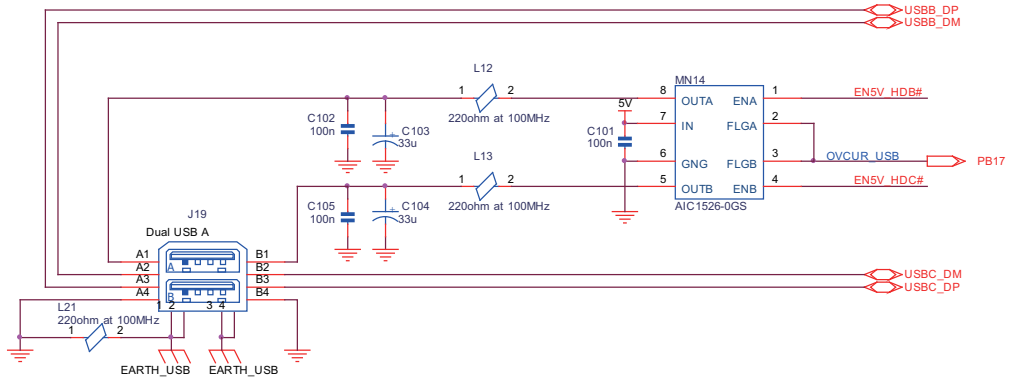
Refer to the embedded MPU product datasheet for detailed programming information. For datasheet reference numbers and titles, see [Section 1.2 "Applicable Documents"](#).

**Figure 4-23.** USB Port (A)



**Figure 4-24.** USB Port (B & C)

#### USB HOST B&C INTERFACE





**4.3.3.7 Ethernet 10/100 (EMAC) Port**

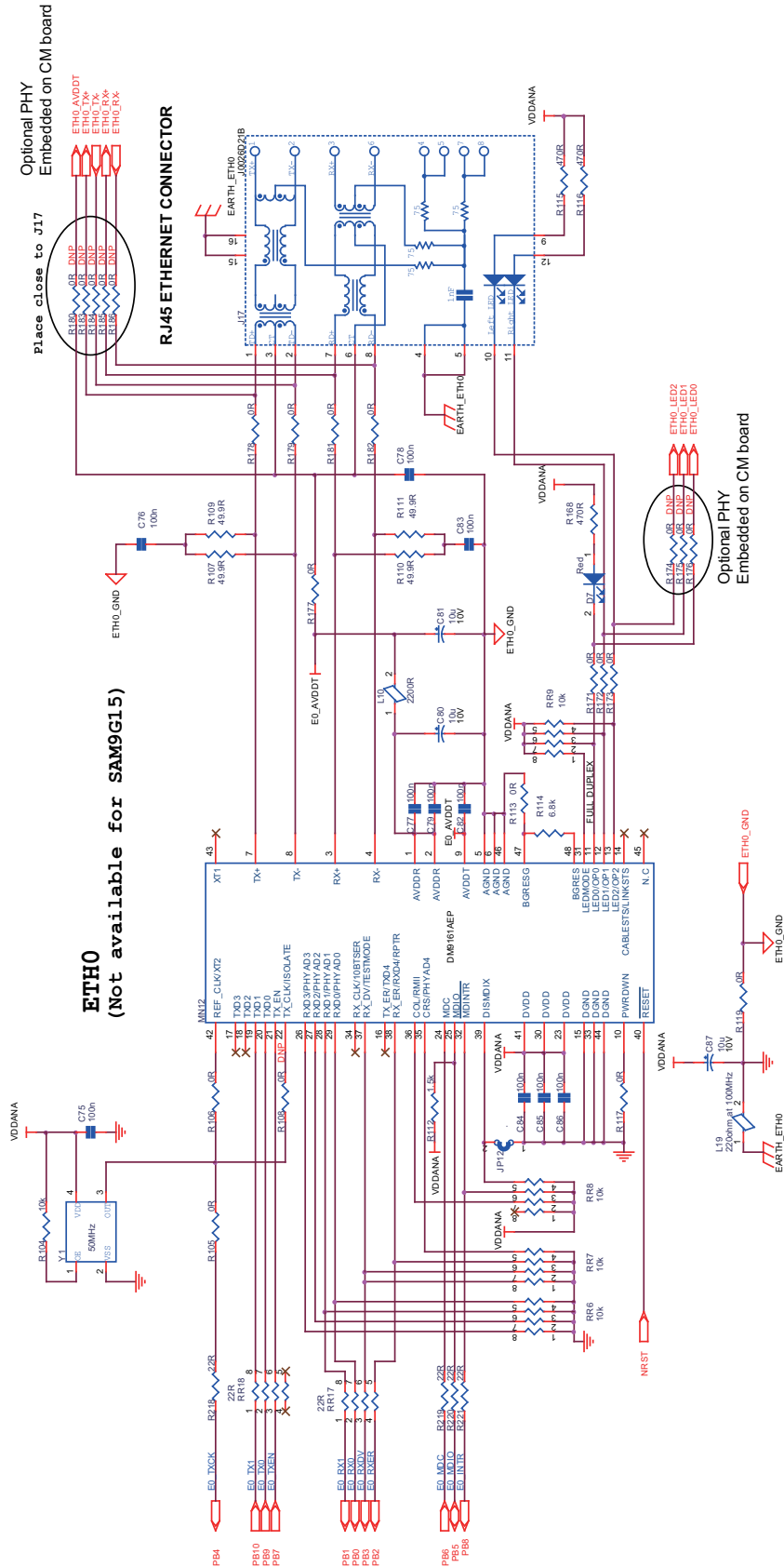
Except for SAM9G15, the processor has two 10/100 Mbps Ethernet Mac Controllers.

	SAM9G15	SAM9G35	SAM9X35	SAM9G25	SAM9X25
EMAC	–	RMII	RMII	MII	MII + RMII

The EK board is equipped with two Davicom DM9161AEP PHYs for each Ethernet port. Both PHY Transceivers are configured as RMII mode. Both PHY transceivers have an RJ45 port with embedded transformer and three-status LEDs.

By default, the ETH0 interface is implemented on the EK board. Additionally, for monitoring and control purposes, an LED functionality is carried on the RJ45 connectors to indicate activity, link, and speed status information for the respective ports.

Figure 4-25. ETH0 Port

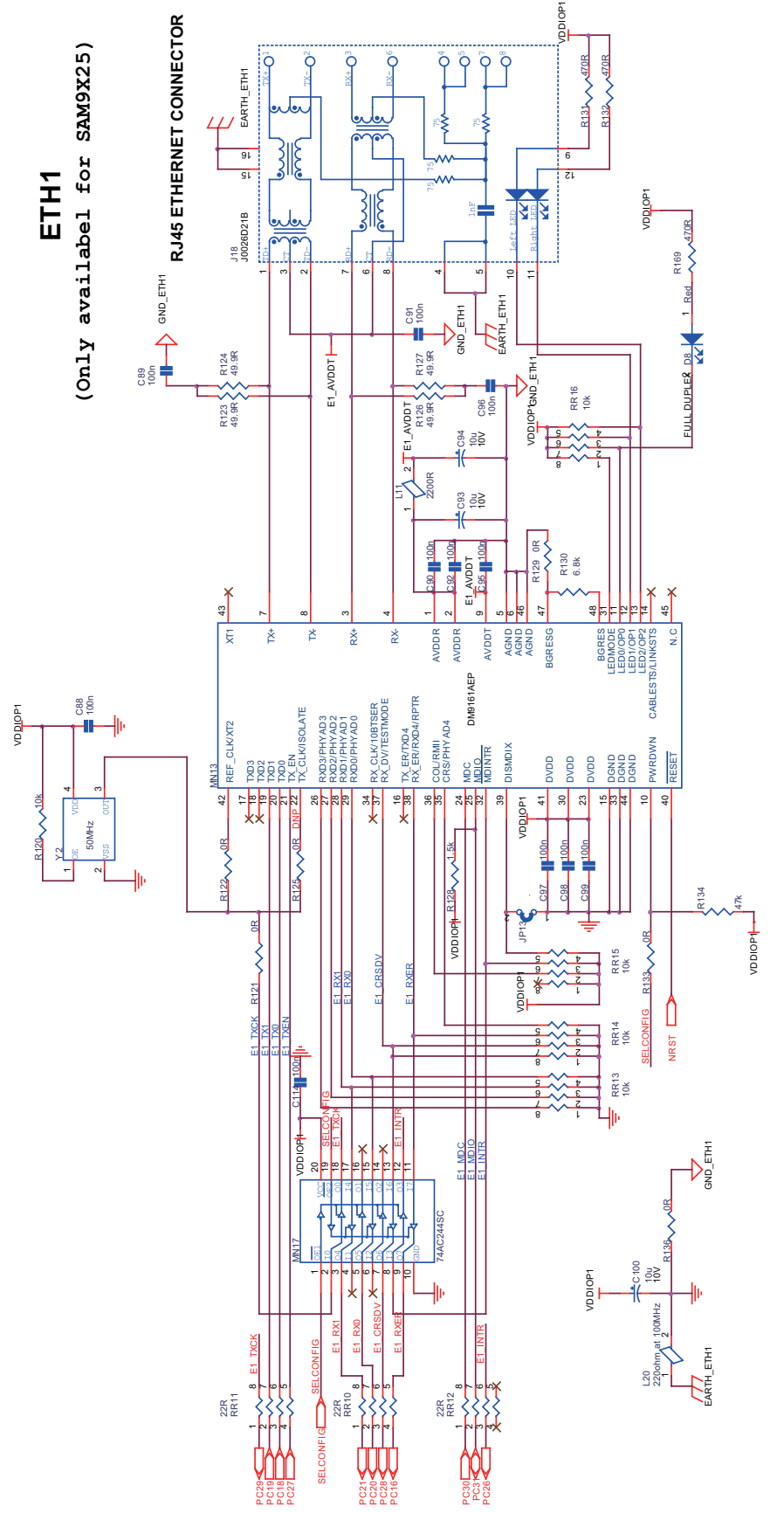


## **Evaluation Kit Hardware**

Ethernet 1 is only available for SAM9X25. The PHY on Ethernet 1 is enabled by the SELCONFIG signal from a pull-down resistor on the CM board. Refer to [Section 4.4.1 "DM Board Overview"](#) for detail.

Some pins (PC16, PC20, PC21, PC28, PC26 and PC29) are configured as Ethernet 1 input from PHY for SAM9X25, whereas they are configured as LCD data pins on other processors. An IO buffer MN17 is inserted in series with these signals to prevent the LCD from being disturbed by unknown status of the PHY device.

Figure 4-26. ETH1 Port

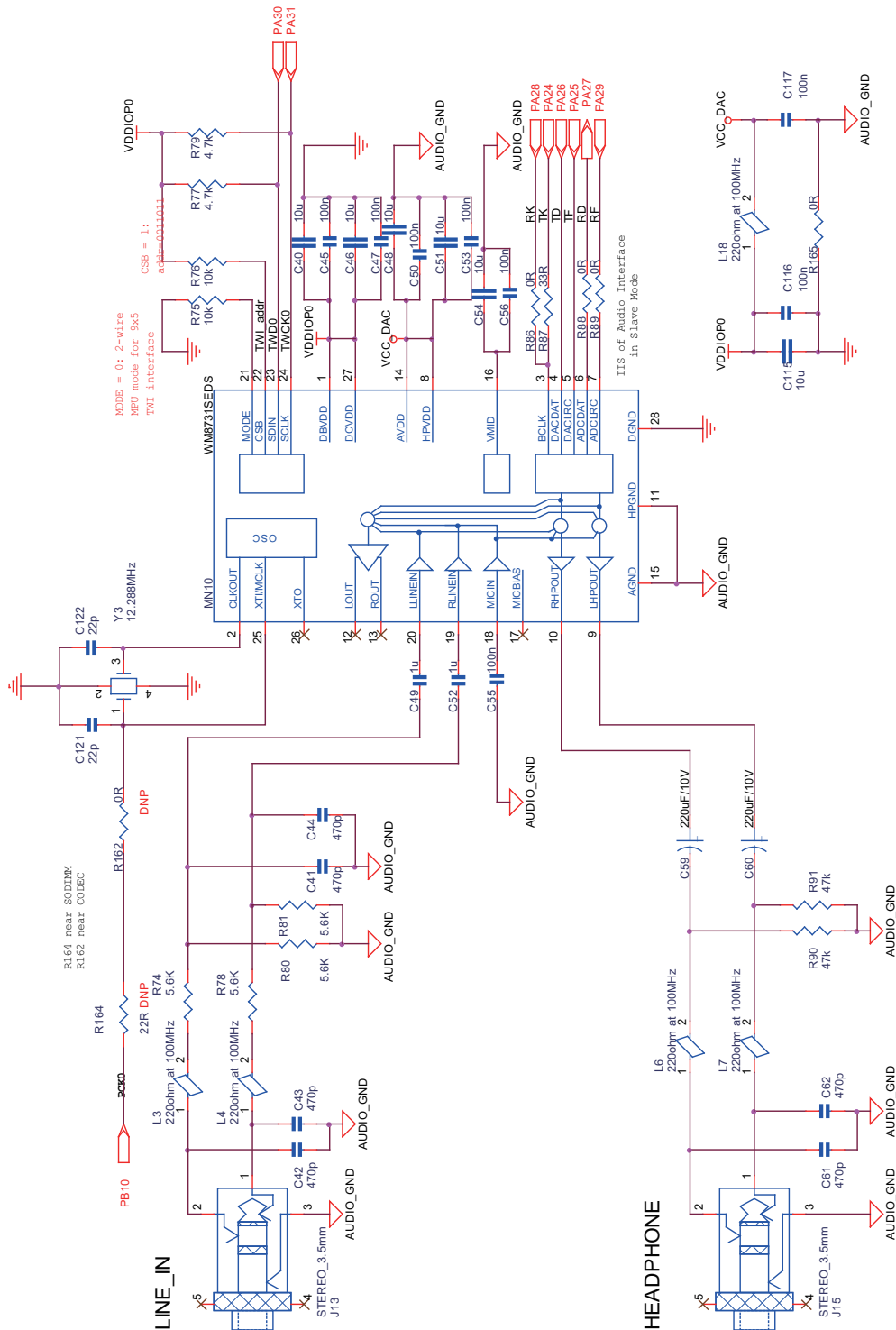


4.3.3.8 Audio

The Evaluation Kit includes a WM8731 CODEC for digital sound input and output. This interface includes audio jacks for line audio input (J13) and headphone line output (J15).

The SAM9 processor is configured in IIS slave mode to interface with the WM8731 Codec. The IIS master mode is also possible for evaluation by populating R162/R164 and removing the crystal Y3.

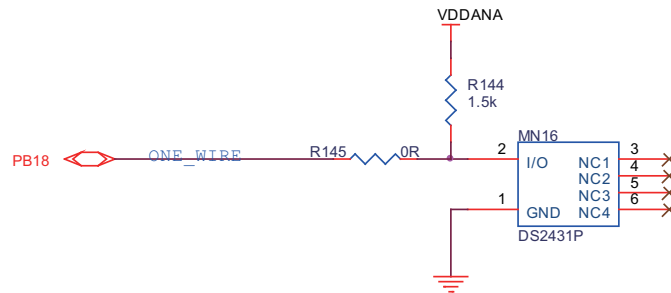
Figure 4-27. Audio Interface



### 4.3.3.9 1-Wire EEPROM

The EK board also features a 1-Wire device acting as a “firmware label” to store information like chip type, manufacturer’s name, production date etc.

**Figure 4-28.** 1-Wire on EK



### 4.3.3.10 CAN Bus

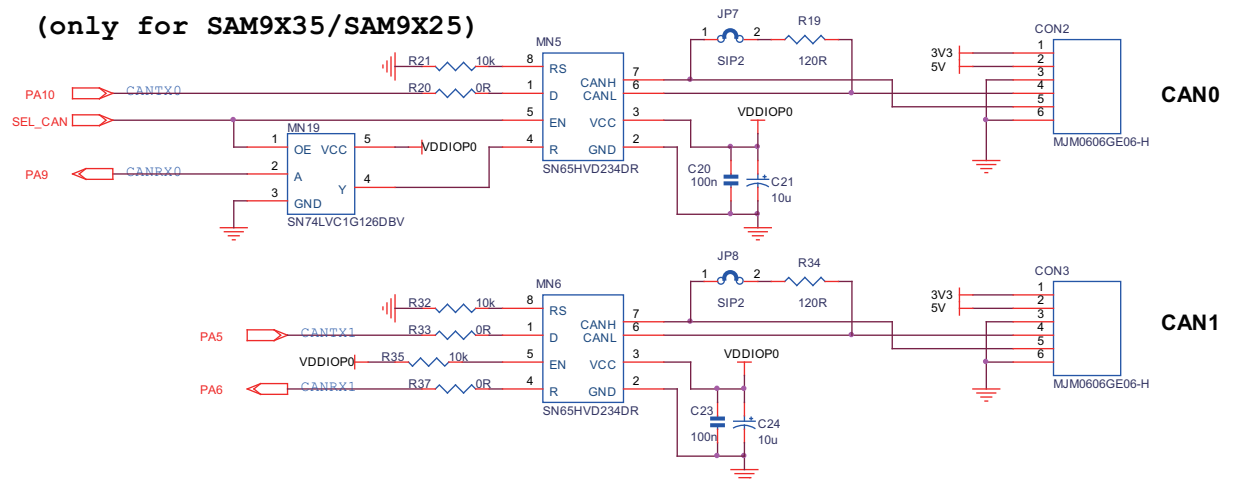
Two boards, the SAM9X35-EK and SAM9X25-EK, feature two Controller Area Network (CAN) ports with transceiver.

CAN0 uses the same IOs (PA9, PA10) as the DBGU. A jumper, JP11, is used to select either of the interfaces.

- Open JP11 to select the CAN function.
- Close JP11 to select the DBGU function.

A 3-state output buffer, MN19 is inserted in series with the output channels of the CAN transceiver, which share IOs with the DBGU. This is necessary because the CAN transceiver does not feature 3-state outputs.

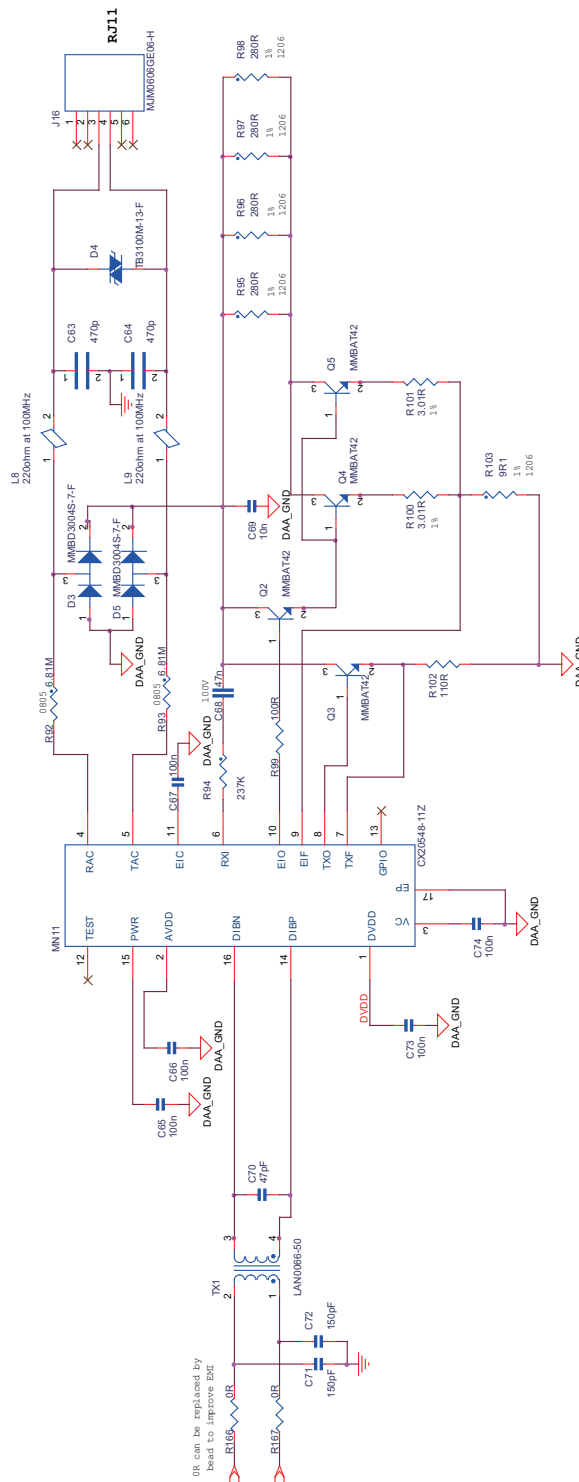
**Figure 4-29.** CAN on EK



4.3.3.11 Telephone Interface

The Evaluation Kit features a smart DAA (Data Access Arrangement) chip to drive an analog telephone line on RJ11 6P4C port (J16).

Figure 4-30. Telephone Interface



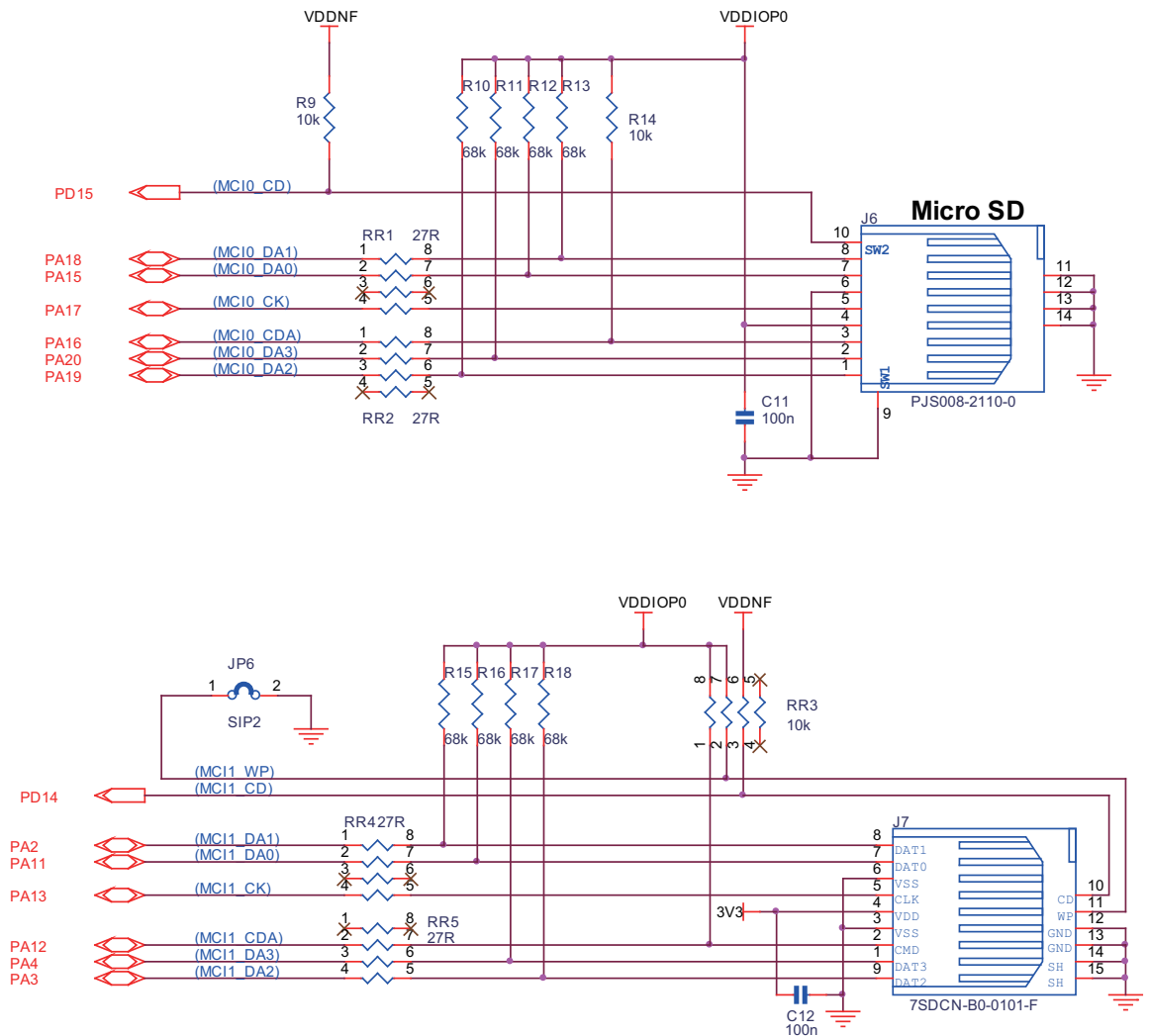
### 4.3.3.12 SD/MMC Interface

The Evaluation Kit has two high-speed MultiMedia Card Interfaces (MCI). The first interface is used as a 4-bit interface (MCI0), connected to a MicroSD card slot. The second interface is used as a 4-bit interface (MCI1), connected to an SD/MMC card slot.

The memory card is not included in the Evaluation Kit.

Please note that the power is connected to VCC, which is 3.3 volts.

**Figure 4-31.** SD/MMC Interface



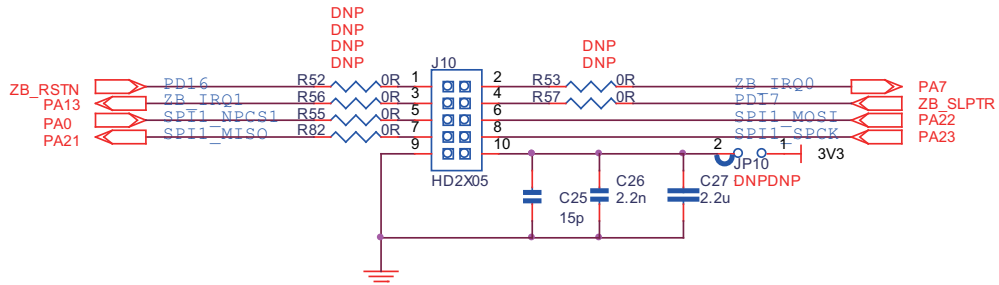


### 4.3.3.13 ZigBee

The EK board has a 10-pin male connector for the Atmel RZ600 ZigBee module.

DNP 0 Ohm resistors have been implemented in series with the PIO lines that are used elsewhere in the design. Thereby, enable their individual disconnections, should a conflict occur in user application.

Figure 4-32. ZigBee Interface



### 4.3.3.14 LED Indicators

The EK board has three LED indicators for purposes shown below:

Table 4-8. LED Indicators

Reference	Color	Function
D2	Red	3v3 Power indicator
D7	Red	ETH0 Full Duplex
D8	Red	ETH1 Full Duplex

Refer to Section 4.3.3.2 "Power Supplies" and Section 4.3.3.7 "Ethernet 10/100 (EMAC) Port" for details.

### 4.3.3.15 Expansion Ports

Most GPIOs are routed to expansion ports J1, J2, J3.

All I/Os of the MPU Image Sensor Interface (ISI) are routed to connectors J21.

The LCD and touch screen interfaces are routed to connectors J21, J22.

Figure 4-33. I/O Expansion

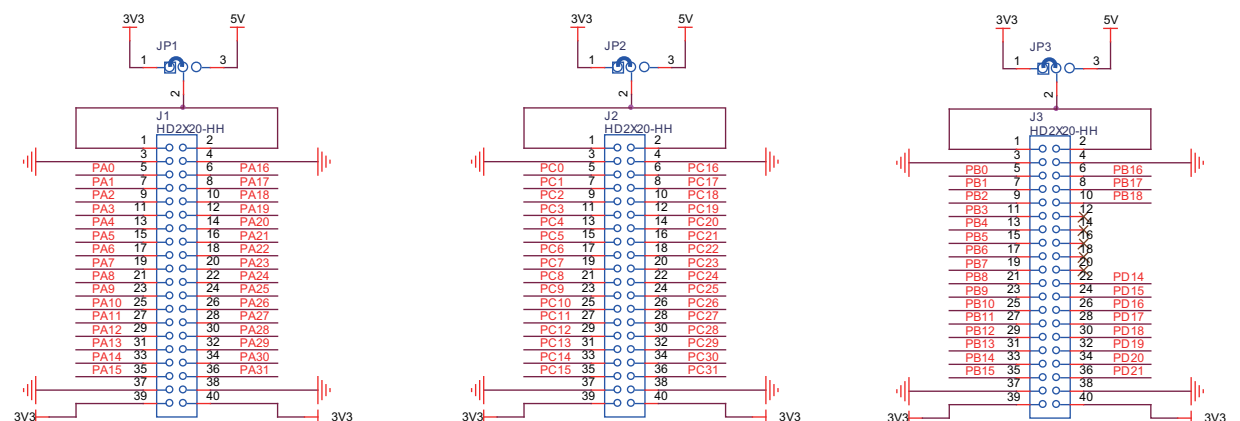
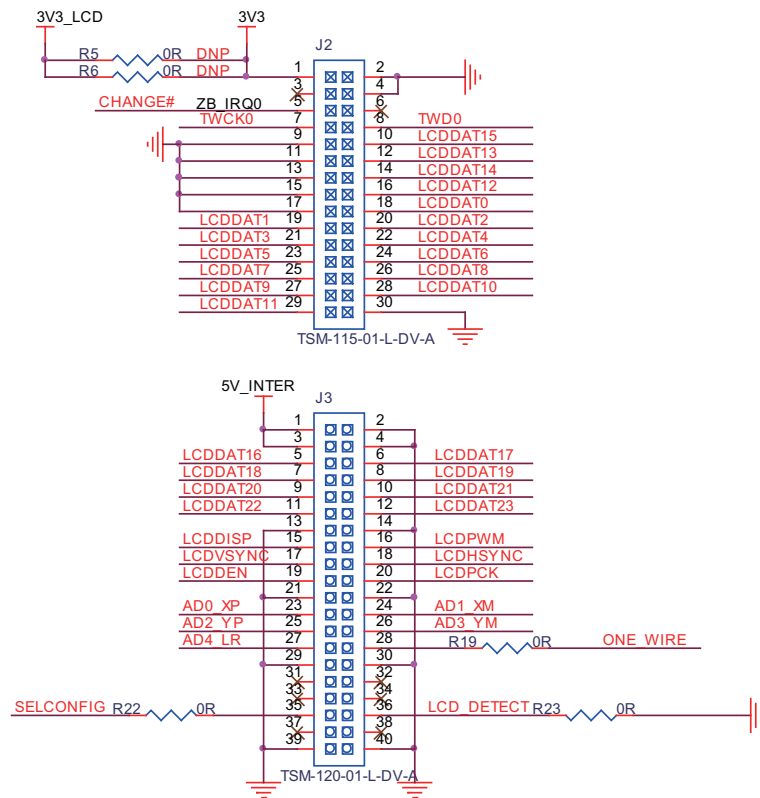


Figure 4-34. LCD and ISI Expansion



### 4.3.4 Configuration

This section describes the PIO usage, the jumpers, the test points and the solder drops of the EK board.

#### 4.3.4.1 JTAG/ICE Configuration

Table 4-9. JTAG/ICE

Designation	Default Setting	Feature
R50	Not Populated	Disables the ICE NTRST input
R51	Populated	Enables the ICE RTCK return. R94 must be opened
R54	Populated	Enables the ICE NRST input
R58	Not Populated	Disables TCK <-> RTCK local loop

#### 4.3.4.2 Boot Mode Select Configuration

Table 4-10. BMS

Designation	Default Setting	Feature
JP9	Open	Default to boot on embedded ROM Close to boot on external memory



#### 4.3.4.3 Force Power ON Configuration

**Table 4-11.** Force Power ON

Designation	Default Setting	Feature
JP5	Close	Keep on-board regulator always on Open to feature SHDN function

#### 4.3.4.4 White Protection Configuration on MCI1

**Table 4-12.** Write Protection on MCI1

Designation	Default Setting	Feature
JP6	Close	MCI1 write protect selected Open to disable protection

#### 4.3.4.5 Selection between DBGU and CAN

**Table 4-13.** Select DBGU or CAN

Designation	Default Setting	Feature
JP11	Close	Default to select DBGU Open to select CAN0

#### 4.3.4.6 Codec IIS Configuration

**Table 4-14.** Codec IIS

Designation	Default Setting	Feature
R162, R164	Not Populated	IIS master mode, clock the codec by PCK0
C121, C122, Y3	Populated	IIS slaver mode, clock the codec by external crystal

#### 4.3.4.7 ETH0 Configuration

**Table 4-15.** ETH0

Designation	Default Setting	Feature
R180, R183, R184, R185, R185, R186, R174, R175, R176	Not Populated	Populated to select the PHY channel on CM. Channel on EK must be cut if select the PHY on CM.
R177, R178, R179, R181, R182, R218, R171, R172, R173	Populated	Selection of PHY channel on EK

## 4.3.4.8 PIO Usage

Table 4-16. PIO A Pin Assignment and Signal Description

Signal	Alternate	Periph A	Periph B	Periph C		
PA0		TXD0	SPI1_NPCS1		TXD0/ ZigBee	USART0 shared with ZigBee
PA1		RXD0	SPI0_NPCS2		RXD0	USART0
PA2		RTS0	MCI1_DA1	E0_ETX0	RTS0/ MCI1	USART0 shared with MCI1
PA3		CTS0	MCI1_DA2	E0_ETX1	CTS0/ MCI1	USART0 shared with MCI1
PA4		SCK0	MCI1_DA3	E0_ETXER	MCI1	
PA5		TXD1	CANTX1		CAN1	
PA6		RXD1	CANRX1		CAN1	
PA7		TXD2	SPI0_NPCS1			ZB_IRQ0
PA8		RXD2	SPI1_NPCS0			DataFlash
PA9			CANRX0		DBGU+CAN0	DBGU shared with CAN0
PA10			CANTX0		DBGU+CAN0	DBGU shared with CAN0
PA11		SPI0_MISO	MCI1_DA0		MCI1	
PA12		SPI0_MOSI	MCI1_CDA		MCI1	
PA13		SPI0_SPCK	MCI1_CK		MCI1	ZB_IRQ1
PA14		SPI0_NPCS0				MCI0
PA15		MCI0_DA0				MCI0
PA16		MCI0_CDA				MCI0
PA17		MCI0_CK				MCI0
PA18		MCI0_DA1				MCI0
PA19		MCI0_DA2				MCI0
PA20		MCI0_DA3				DataFlash
PA21		TIOA0	SPI1_MISO		ZigBee	DataFlash
PA22		TIOA1	SPI1_MOSI		ZigBee	DataFlash
PA23		TIOA2	SPI1_SPCK		ZigBee	SSC
PA24		TCLK0	TK			SSC
PA25		TCLK1	TF			SSC
PA26		TCLK2	TD			SSC
PA27		TIOB0	RD			SSC
PA28		TIOB1	RK			SSC
PA29		TIOB2	RF			SSC
PA30		TWD0	SPI1_NPCS3	E0_EMDC		TWD0
PA31		TWCK0	SPI1_NPCS2	E0_ETXEN		TWCK0



**Table 4-17.** PIO B Pin Assignment and Signal Description

Signal	Alternate	Periph A	Periph B	Periph C	Module CM	EK
PB0		E0_RX0	RTS2		ETH0	
PB1		E0_RX1	CTS2		ETH0	
PB2		E0_RXER	SCK2		ETH0	
PB3		E0_RXDV	SPI0_NPCS3		ETH0	
PB4		E0_TXCK	TWD2		ETH0	
PB5		E0_MDIO	TWCK2		ETH0	
PB6	AD7	E0_MDC			ETH0	
PB7	AD8	E0_TXEN			ETH0	
PB8	AD9	E0_TXER			ETH0_INTR	
PB9	AD10	E0_TX0	PCK1		ETH0	
PB10	AD11	E0_TX1	PCK0		ETH0	
PB11	AD0xp	E0_TX2	PWM0			TSC
PB12	AD1xm	E0_TX3	PWM1			TSC
PB13	AD2yp	E0_RX2	PWM2			TSC
PB14	AD3ym	E0_RX3	PWM3			TSC
PB15	AD4lr	E0_RXCK				TSC
PB16	AD5	E0_CRCS				VBUS_SENSE (USB)
PB17	AD6	E0_COL				OVCUR_USB (Open drain)
PB18		IRQ	ADTRG		USER_LED1#	ONE_WIRE

**Table 4-18.** PIO C Pin Assignment and Signal Description

Signal	Alternate	Periph A	Periph B	Periph C		EK f (LCD)	EK f (ISI+IO)
PC0		LCDDAT0	ISI_D0	TWD1		LCDDAT0	ISI_D0
PC1		LCDDAT1	ISI_D1	TWCK1		LCDDAT1	ISI_D1
PC2		LCDDAT2	ISI_D2	TIOA3		LCDDAT2	ISI_D2
PC3		LCDDAT3	ISI_D3	TIOB3		LCDDAT3	ISI_D3
PC4		LCDDAT4	ISI_D4	TCLK3		LCDDAT4	ISI_D4
PC5		LCDDAT5	ISI_D5	TIOA4		LCDDAT5	ISI_D5
PC6		LCDDAT6	ISI_D6	TIOB4		LCDDAT6	ISI_D6
PC7		LCDDAT7	ISI_D7	TCLK4		LCDDAT7	ISI_D7
PC8		LCDDAT8	ISI_D8	UTXD0		LCDDAT8	ISI_D8
PC9		LCDDAT9	ISI_D9	URXD0		LCDDAT9	ISI_D9
PC10		LCDDAT10	ISI_D10	PWM0		LCDDAT10	ISI_D10
PC11		LCDDAT11	ISI_D11	PWM1		LCDDAT11	ISI_D11
PC12		LCDDAT12	ISI_PCK	TIOA5		LCDDAT12	ISI_PCK
PC13		LCDDAT13	ISI_VSYNC	TIOB5		LCDDAT13	ISI_VSYNC
PC14		LCDDAT14	ISI_HSYNC	TCLK5		LCDDAT14	ISI_HSYNC
PC15		LCDDAT15	ISI_MCK	PCK0	SSC	LCDDAT15	ISI_MCK/PCK0
PC16		LCDDAT16	E1_RXER	UTXD1		LCDDAT16	E1_RXER
PC17		LCDDAT17		URXD1		LCDDAT17	
PC18		LCDDAT18	E1_TX0	PWM0		LCDDAT18	E1_TX0
PC19		LCDDAT19	E1_TX1	PWM1		LCDDAT19	E1_TX1
PC20		LCDDAT20	E1_RX0	PWM2		LCDDAT20	E1_RX0
PC21		LCDDAT21	E1_RX1	PWM3		LCDDAT21	E1_RX1
PC22		LCDDAT22	TXD3			LCDDAT22	TXD3
PC23		LCDDAT23	RXD3			LCDDAT23	RXD3
PC24		LCDDISP	RTS3			LCDDISP	RTS3
PC25			CTS3				CTS3
PC26		LCDPWM	SCK3		Eth1_Intr1	LCDPWM	
PC27		LCDVSYNC	E1_TXEN	RTS1		LCDVSYNC	E1_TXEN
PC28		LCDHSYNC	E1_CRSDV	CTS1		LCDHSYNC	E1_CRSDV
PC29		LCDDEN	E1_TXCK	SCK1		LCDDEN	E1_TXCK
PC30		LCDPCK	E1_MDC			LCDPCK	E1_MDC
PC31		FIQ	E1_MDIO	PCK1			E1_MDIO

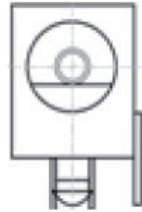
**Table 4-19.** PIO D Pin Assignment and Signal Description

Signal	Alternate	Periph A	Periph B	Periph C	Module CM	EK
PD0		NANDOE			Nand Flash	
PD1		NANDWE			Nand Flash	
PD2		A21/NANDALE			Nand Flash	
PD3		A22/NANDCLE			Nand Flash	
PD4		NCS3			CS NAND Flash	
PD5		NWAIT			NAND_RD/BY	
PD6		D16			Nand Flash	
PD7		D17			Nand Flash	
PD8		D18			Nand Flash	
PD9		D19			Nand Flash	
PD10		D20			Nand Flash	MCI0_CD (switch)
PD11		D21			Nand Flash	MCI1_CD (switch)
PD12		D22			Nand Flash	ZB_RSTN
PD13		D23			Nand Flash	ZB_SLPTR
PD14		D24				EN5V_HDA#
PD15		D25	A20			EN5V_HDB#
PD16		D26	A23			EN5V_HDC#
PD17		D27	A24			
PD18		D28	A25			
PD19		D29	NCS2			
PD20		D30	NCS4			
PD21		D31	NCS5		POWR_LED	

### 4.3.5 Connectors

#### 4.3.5.1 Power Supply

**Figure 4-35.** Power Supply Connector J4



**Table 4-20.** Power Supply Connector J2 Signal Description

Pin	Mnemonic	Signal description
1	Center	+5V
2		GND
3		Floating

#### 4.3.5.2 SODIMM Card Edge Socket

The Evaluation Kit uses a SODIMM200 standard connector for CM board interfacing.

Please note that this is not an industry standard pin-out and that it is unlikely to be compatible with off-the-shelf SODIMM cards.

**Figure 4-36.** SODIMM200 Socket CON1



**Table 4-21.** SODIMM200 CON1 Signal Descriptions

Function	Type	x5 pad name	SODIMM 200			x5 pad name	Type	Function
		Front Side	A		B	Back Side		
VCC 3V3		POWER OUTPUT	1		2	POWER OUTPUT		VCC 3V3
VCC 3V3		POWER OUTPUT	3		4	POWER OUTPUT		VCC 3V3
GND			5		6	POWER OUTPUT	VBAT	
USBC_DP	I/O	USB Data Positive	7		8		SYSC	JTAGSEL
USBC_DM	I/O	USB Data Negative	9		10		SYSC	WKUP
GND			11		12		SYSC	SHDN





Table 4-21. SODIMM200 CON1 Signal Descriptions (Continued)

Function	Type	x5 pad name	SODIMM 200			x5 pad name	Type	Function
USBB_DM	I/O	USB Data Negative	13		14		SYSC	BMS
USBB_DP	I/O	USB Data Positive	15		16		SYSC	nRST
GND			17		18		SYSC	nTRST
DIBP	I/O		19		20		RSTJTAG	TDI
DIBN	I/O		21		22		RSTJTAG	TCK
GND			23		24		RSTJTAG	TMS
USBA_DM	I/O	USB Data Negative	25		26		RSTJTAG	TDO
USBA_DP	I/O	USB Data Positive	27		28		RSTJTAG	RTCK
GND			29		30			PWR_EN
RFU		RFU	31		32	RFU		RFU
RFU		RFU	33		34	RFU		RFU
RFU		RFU	35		36	RFU		RFU
RFU		RFU	37		38	RFU		RFU
RFU		RFU	39		40	RFU		RFU
KEY								
GND			41		42			GND
RFU		RFU	43		44	RFU		RFU
RFU		RFU	45		46	RFU		RFU
RFU		RFU	47		48	RFU		RFU
RFU		RFU	49		50	RFU		RFU
GND			51		52			GND
RFU		RFU	53		54	RFU		RFU
RFU		RFU	55		56	RFU		RFU
RFU		RFU	57		58	RFU		RFU
RFU		RFU	59		60	RFU		RFU
VDDNF		POWER DOMAIN FROM CM	61		62	POWER DOMAIN FROM CM		VDDNF
PD0	GPIO D	NANDOE	63		64	NANDWE	GPIO D	PD1
PD2	GPIO D	A21/NANDALE	65		66	A22/NANDCLE	GPIO D	PD3
PD4	GPIO D	NCS3	67		68	NWAIT	GPIO D	PD5
PD6	GPIO D	D16	69		70	D17	GPIO D	PD7
PD8	GPIO D	D18	71		72	D19	GPIO D	PD9
GND			73		74			GND
PD10	GPIO D	D20	75		76	D21	GPIO D	PD11
PD12	GPIO D	D22	77		78	D23	GPIO D	PD13
PD14	GPIO D	D24	79		80	D25/A20	GPIO D	PD15
PD16	GPIO D	D26/A23	81		82	D27/A24	GPIO D	PD17
PD18	GPIO D	D28/A25	83		84	D29/NCS2	GPIO D	PD19



Table 4-21. SODIMM200 CON1 Signal Descriptions (Continued)

Function	Type	x5 pad name	SODIMM 200			x5 pad name	Type	Function
USBB_DM	I/O	USB Data Negative	13		14		SYSC	BMS
USBB_DP	I/O	USB Data Positive	15		16		SYSC	nRST
GND			17		18		SYSC	nTRST
DIBP	I/O		19		20		RSTJTAG	TDI
DIBN	I/O		21		22		RSTJTAG	TCK
GND			23		24		RSTJTAG	TMS
USBA_DM	I/O	USB Data Negative	25		26		RSTJTAG	TDO
USBA_DP	I/O	USB Data Positive	27		28		RSTJTAG	RTCK
GND			29		30			PWR_EN
RFU		RFU	31		32	RFU		RFU
RFU		RFU	33		34	RFU		RFU
RFU		RFU	35		36	RFU		RFU
RFU		RFU	37		38	RFU		RFU
RFU		RFU	39		40	RFU		RFU
KEY								
GND			41		42			GND
RFU		RFU	43		44	RFU		RFU
RFU		RFU	45		46	RFU		RFU
RFU		RFU	47		48	RFU		RFU
RFU		RFU	49		50	RFU		RFU
GND			51		52			GND
RFU		RFU	53		54	RFU		RFU
RFU		RFU	55		56	RFU		RFU
RFU		RFU	57		58	RFU		RFU
RFU		RFU	59		60	RFU		RFU
VDDNF		POWER DOMAIN FROM CM	61		62	POWER DOMAIN FROM CM		VDDNF
PD0	GPIO D	NANDOE	63		64	NANDWE	GPIO D	PD1
PD2	GPIO D	A21/NANDALE	65		66	A22/NANDCLE	GPIO D	PD3
PD4	GPIO D	NCS3	67		68	NWAIT	GPIO D	PD5
PD6	GPIO D	D16	69		70	D17	GPIO D	PD7
PD8	GPIO D	D18	71		72	D19	GPIO D	PD9
GND			73		74			GND
PD10	GPIO D	D20	75		76	D21	GPIO D	PD11
PD12	GPIO D	D22	77		78	D23	GPIO D	PD13
PD14	GPIO D	D24	79		80	D25/A20	GPIO D	PD15
PD16	GPIO D	D26/A23	81		82	D27/A24	GPIO D	PD17
PD18	GPIO D	D28/A25	83		84	D29/NCS2	GPIO D	PD19



Table 4-21. SODIMM200 CON1 Signal Descriptions (Continued)

Function	Type	x5 pad name	SODIMM 200			x5 pad name	Type	Function
USBB_DM	I/O	USB Data Negative	13		14		SYSC	BMS
USBB_DP	I/O	USB Data Positive	15		16		SYSC	nRST
GND			17		18		SYSC	nTRST
DIBP	I/O		19		20		RSTJTAG	TDI
DIBN	I/O		21		22		RSTJTAG	TCK
GND			23		24		RSTJTAG	TMS
USBA_DM	I/O	USB Data Negative	25		26		RSTJTAG	TDO
USBA_DP	I/O	USB Data Positive	27		28		RSTJTAG	RTCK
GND			29		30			PWR_EN
RFU		RFU	31		32	RFU		RFU
RFU		RFU	33		34	RFU		RFU
RFU		RFU	35		36	RFU		RFU
RFU		RFU	37		38	RFU		RFU
RFU		RFU	39		40	RFU		RFU
KEY								
GND			41		42			GND
RFU		RFU	43		44	RFU		RFU
RFU		RFU	45		46	RFU		RFU
RFU		RFU	47		48	RFU		RFU
RFU		RFU	49		50	RFU		RFU
GND			51		52			GND
RFU		RFU	53		54	RFU		RFU
RFU		RFU	55		56	RFU		RFU
RFU		RFU	57		58	RFU		RFU
RFU		RFU	59		60	RFU		RFU
VDDNF		POWER DOMAIN FROM CM	61		62	POWER DOMAIN FROM CM		VDDNF
PD0	GPIO D	NANDOE	63		64	NANDWE	GPIO D	PD1
PD2	GPIO D	A21/NANDALE	65		66	A22/NANDCLE	GPIO D	PD3
PD4	GPIO D	NCS3	67		68	NWAIT	GPIO D	PD5
PD6	GPIO D	D16	69		70	D17	GPIO D	PD7
PD8	GPIO D	D18	71		72	D19	GPIO D	PD9
GND			73		74			GND
PD10	GPIO D	D20	75		76	D21	GPIO D	PD11
PD12	GPIO D	D22	77		78	D23	GPIO D	PD13
PD14	GPIO D	D24	79		80	D25/A20	GPIO D	PD15
PD16	GPIO D	D26/A23	81		82	D27/A24	GPIO D	PD17
PD18	GPIO D	D28/A25	83		84	D29/NCS2	GPIO D	PD19



Table 4-21. SODIMM200 CON1 Signal Descriptions (Continued)

Function	Type	x5 pad name	SODIMM 200		x5 pad name	Type	Function
PD20	GPIO D	D30/NCS4	85	86	D31/NCS5	GPIO D	PD21
VDDIOP0	POWER OUTPUT		87	88	POWER OUTPUT		VDDIOP0
PA0	GPIO A	TXD0/SPI1-NPCS1	89	90	RXD0/SPI0-NPCS2	GPIO A	PA1
PA2	GPIO A	MCI1_DA1/E0_ETX0	91	92	CTS0/ MCI1_DA2/ E0_ETX1	GPIO A	PA3
PA4	GPIO A	SCK0/MCI1_DA3/ E0_ETXER	93	94			GND
PA11	GPIO A	SPI0_MISO/ MCI1_DA0	95	96	SPI0_MOSI/ MCI1_CDA	GPIO A	PA12
PA13	GPIO A	SPI0_SPCK/ MCI1_CK	97	98	SPI0_NPCS0	GPIO A	PA14
GND			99	100	TXD2/ SPI0_NPCS1	GPIO A	PA7
PA8	GPIO A	RXD2/SPI1_NPCS0	101	102	TIOA0 /SPI1_MISO	GPIO A	PA21
PA22	GPIO A	TIOA1/SPI1_MOS1	103	104	TIOA2/ SPI1_SPCK	GPIO A	PA23
PA31	GPIO A	TWCK0/SPI1_NPCS2/ E0_ETXEN	105	106	TWD0/ SPI1_NPCS3/ E0_EMDC	GPIO A	PA30
GND			107	108	MCI0_DA0	GPIO A	PA15
PA16	GPIO A	MCI0_CDA	109	110	MCI0_CK	GPIO A	PA17
PA18	GPIO A	MCI0_DA1	111	112	MCI0_DA2	GPIO A	PA19
PA20	GPIO A	MCI0_DA3	113	114			GND
PA5	GPIO A	TXD1/CANTX1	115	116	RXD1/CANRX1	GPIO A	PA6
PA10	GPIO A	DTXD/CANTX0	117	118	DRXD/CANRX0	GPIO A	PA9
GND			119	120	TCLK0/TK	GPIO A	PA24
PA25	GPIO A	TCLK1/TF	121	122	TCLK2/TD	GPIO A	PA26
PA27	GPIO A	TIOB0/RD	123	124	TIOB1/RK	GPIO A	PA28
PA29	GPIO A	TIOB2/RF	125	126			GND
VDDIOP1	POWER OUTPUT		127	128	POWER OUTPUT		VDDIOP1
PC0	GPIO C	LCDDAT0/ISI_D0	129	130	LCDDAT1	GPIO C	PC1
PC2	GPIO C	LCDDAT2/ISI_D2	131	132	LCDDAT3	GPIO C	PC3
PC4	GPIO C	LCDDAT4	133	134	LCDDAT5	GPIO C	PC5
GND			135	136	LCDDAT6	GPIO C	PC6
PC7	GPIO C	LCDDAT7	137	138	LCDDAT8	GPIO C	PC8
PC9	GPIO C	LCDDAT9	139	140	LCDDAT10	GPIO C	PC10
PC11	GPIO C	LCDDAT11	141	142			GND
PC12	GPIO C	LCDDAT12	143	144	LCDDAT13	GPIO C	PC13
PC14	GPIO C	LCDDAT14	145	146	LCDDAT15	GPIO C	PC15
GND			147	148	LCDDAT16	GPIO C	PC16

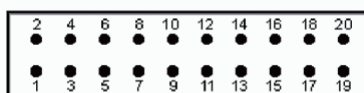


Table 4-21. SODIMM200 CON1 Signal Descriptions (Continued)

Function	Type	x5 pad name	SODIMM 200			x5 pad name	Type	Function
PC17	GPIO C	LCDDAT17	149		150	LCDDAT18	GPIO C	PC18
PC19	GPIO C	LCDDAT19	151		152	LCDDAT20	GPIO C	PC20
PC21	GPIO C	LCDDAT21	153		154			GND
PC22	GPIO C	LCDDAT22	155		156	LCDDAT23	GPIO C	PC23
PC24	GPIO C	LCDDISP	157		158		GPIO C	PC25
PC26	GPIO C	LCDPWM	159		160	LCDVSYNC	GPIO C	PC27
GND			161		162	LCDHSYNC	GPIO C	PC28
PC29	GPIO C	LCDDEN	163		164	E1_MDC	GPIO C	PC30
PC31	GPIO C	E1_MDIO	165		166			SELCONFIG
VDDANA	POWER OUTPUT		167		168	POWER OUTPUT		VDDANA
PB0	GPIO B	E0_RX0	169		170	E0_RX1	GPIO B	PB1
PB2	GPIO B	E0_RXER	171		172	E0_RXDV	GPIO B	PB3
PB4	GPIO B	E0_TXCK	173		174	E0_MDIO	GPIO B	PB5
PB6	GPIO B	E0_MDC	175		176	E0_TXEN	GPIO B	PB7
PB8	GPIO B	E0_TXER	177		178	GNDANA		
PB9	GPIO B	E0_TX0	179		180	E0_TX1	GPIO B	PB10
PB11	GPIO B	E0_TX2	181		182	E0_TX3	GPIO B	PB12
PB13	GPIO B	E0_RX2	183		184	E0_RX3	GPIO B	PB14
PB15	GPIO B	E0_RXCK	185		186	E0_CRS	GPIO B	PB16
PB17	GPIO B	E0_COL	187		188	GNDANA		
PB18	GPIO B	IRQ	189		190	POWER OUTPUT		POWR_REF
GND			191		192		ETH	LED0
ETH0_TX+	ETH		193		194		ETH	LED1
ETH0_TX-	ETH		195		196		ETH	LED2
ETH0_RX+	ETH		197		198		ETH	AVDDT
ETH0_RX-	ETH		199		200			GND_ETH

4.3.5.3 JTAG/ICE Connector

Figure 4-37. JTAG J9



**Table 4-22.** JTAG/ICE Connector J13 Signal Descriptions

Pin	Mnemonic	Description
1	VTref. 3.3V power	This is the target reference voltage. It is used to check if the target has power, to create the logic-level reference for the input comparators, and to control the output logic levels to the target. It is normally fed from VDD on the target board and must not have a series resistor.
2	Vsupply. 3.3V power	This pin is not connected in SAM-ICE. It is reserved for compatibility with other equipment. Connect to VDD or leave open in target system.
3	nTRST TARGET RESET - Active-low output signal that resets the target	JTAG Reset. Output from SAM-ICE to the Reset signal on the target JTAG port. Typically connected to nTRST on the target CPU. This pin is normally pulled HIGH on the target to avoid unintentional resets when there is no connection.
4	GND	Common ground
5	TDI TEST DATA INPUT - Serial data output line, sampled on the rising edge of the TCK signal.	JTAG data input of target CPU. It is recommended that this pin is pulled to a defined state on the target board. Typically connected to TDI on target CPU.
6	GND	Common ground
7	TMS TEST MODE SELECT	JTAG mode set input of target CPU. This pin should be pulled up on the target. Typically connected to TMS on target CPU. Output signal that sequences the target's JTAG state machine, sampled on the rising edge of the TCK signal.
8	GND	Common ground
9	TCK TEST CLOCK - Output timing signal, for synchronizing test logic and control register access.	JTAG clock signal to target CPU. It is recommended that this pin is pulled to a defined state on the target board. Typically connected to TCK on target CPU.
10	GND	Common ground
11	RTCK - Input Return test clock signal from the target.	Some targets must synchronize the JTAG inputs to internal clocks. To assist in meeting this requirement, a returned and retimed TCK can be used to dynamically control the TCK rate. SAM-ICE supports adaptive clocking which waits for TCK changes to be echoed correctly before making further changes. Connect to RTCK if available, otherwise to GND.
12	GND	Common ground
13	TDO JTAG TEST DATA OUTPUT - Serial data input from the target.	JTAG data output from target CPU. Typically connected to TDO on target CPU.
14	GND	Common ground
15	nSRST RESET	Active-low reset signal. Target CPU reset signal.
16	GND	Common ground
17	RFU	This pin is not connected in SAM-ICE.
18	GND	Common ground
19	RFU	This pin is not connected in SAM-ICE.
20	GND	Common ground

4.3.5.4 USB Type A Dual Port

Figure 4-38. USB Type A Dual Port J19

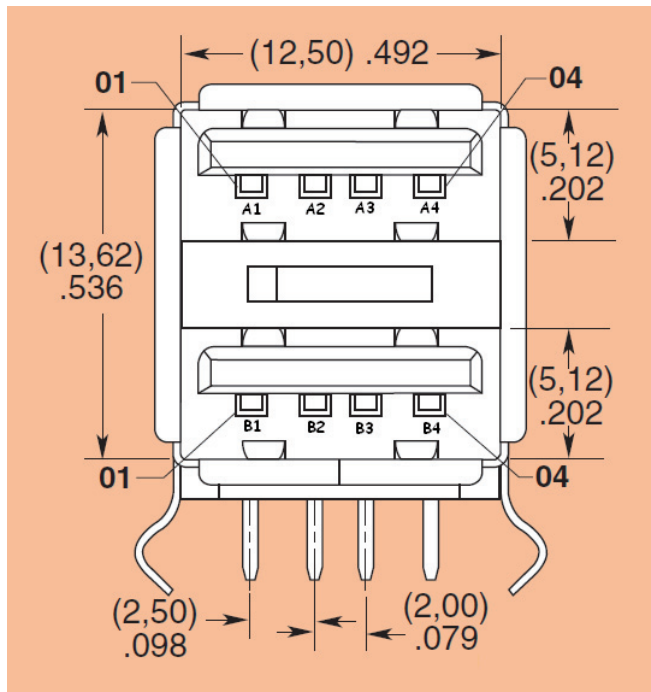


Table 4-23. USB Type A Dual Port J19 Signal Descriptions

Pin	Mnemonic	Description
A1	Vbus – USB_A	5V power
A2	DM – USB_A	Data minus
A3	DP – USB_A	Data plus
A4	GND	Common ground
B1	Vbus – USB_A	5V power
B2	DM – USB_A	Data minus
B3	DP – USB_A	Data plus
B4	GND	Common ground
Mechanical pins		Shield

### 4.3.5.5 USB Micro AB

**Figure 4-39.** USB Host/Device Micro AB Connector J20

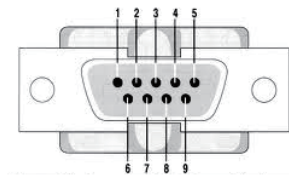


**Table 4-24.** USB Host/Device Micro AB Connector J20 Signal Descriptions

Pin	Mnemonic	Description
1	Vbus	5v power
2	DM	Data minus
3	DP	Data plus
4	ID	On the Go Identification
5	GND	Common ground

### 4.3.5.6 DBGU

**Figure 4-40.** DBGU Connector J11



**Table 4-25.** DBGU Connector J11 Signal Descriptions

Pin	Mnemonic	Description
1, 4, 6, 9		NO CONNECTION
2	RXD (RECEIVED DATA)	RS232 serial data output signal
3	TXD (TRANSMITTED Data)	RS232 serial data input signal
5	GND	Common ground
7	RTS (REQUEST TO SEND)	NO USED
8	CTS (CLEAR TO SEND)	NO USED
Mechanical pins		Shield



4.3.5.7 RS232 Connector with RTS/CTS Handshake Support

Figure 4-41. USART Connector J12, J13

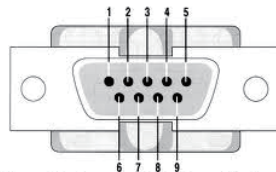


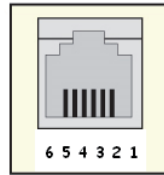
Table 4-26. USART Connector J12 Signal Descriptions

Pin	Mnemonic		Description
1, 4, 6, 9			NO CONNECTION
2	RXD (RECEIVED DATA)	PA1	RS232 serial data output signal
3	TXD (TRANSMITTED Data)	PA0	RS232 serial data input signal
5	GND		Common ground
7	RTS (REQUEST TO SEND)	PA2	Active-positive RS232 input signal
8	CTS (CLEAR TO SEND)	PA3	Active-positive RS232 output signal
Mechanical pins			Shield

Table 4-27. USART Connector J13 Signal Descriptions

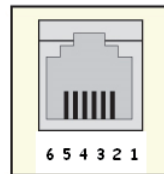
Pin	Mnemonic		Description
1, 4, 6, 9			NO CONNECTION
2	RXD (RECEIVED DATA)	PC23	RS232 serial data output signal
3	TXD (TRANSMITTED Data)	PC22	RS232 serial data input signal
5	GND		Common ground
7	RTS (REQUEST TO SEND)	PC24	Active-positive RS232 input signal
8	CTS (CLEAR TO SEND)	PC25	Active-positive RS232 output signal
Mechanical pins			Shield

## 4.3.5.8 DAA RJ11 Socket (6P4C)

**Figure 4-42.** DAA RJ11 Socket J16**Table 4-28.** DAA RJ11 Socket J16 Signal Descriptions

Pin	Mnemonic	Description
1, 2, 5, 6		NO CONNECTION
3	RAC	RING side of ordinary telephone line
4	TAC	TIP side of ordinary telephone line

## 4.3.5.9 CAN RJ12 Socket (6P6C)

**Figure 4-43.** CAN RJ12 Socket CON2, CON3**Table 4-29.** DAA RJ11 Socket J16 Signal Descriptions

Pin	Mnemonic	Description
1	3V3	POWER PIN
2	5V	POWER PIN
4	CANL	CAN bus differential pair
5	CANH	CAN bus differential pair
4, 6	GND	Common ground

4.3.5.10 MicroSD MCI0

Figure 4-44. MicroSD Socket J6

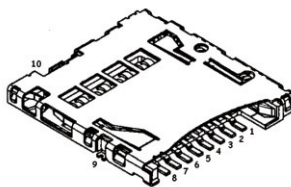


Table 4-30. MicroSD Socket J6 Signal Descriptions

Pin	Mnemonic	Description
1	DAT2	Data Bit 2
2	CD/DAT3	Card Detect/Data Bit 3
3	CMD	Command Line
4	VCC	Supply Voltage 3.3V
5	CLK	Command Line
6	VSS	Common ground
7	DAT0	Data Bit 0
8	DAT1	Data Bit 1
9	SW1	No use, grounded
10	CARD DETECT	CARD DETECT

4.3.5.11 SD/MMC MCI1

Figure 4-45. SD/MMC Socket J7

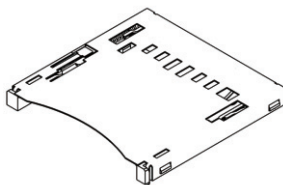


Table 4-31. SD Socket J7 Signal Descriptions

Pin	Mnemonic	PIO	Signal		
			MMC Card	SD Card	
				1-Bit Mode	4-Bit Mode
1	MCI1_DA2	PA3	Not Used	Read Wait (RW)	Data Line DAT2 or Read Wait (RW)
2	MCI1_DA3	PA4	Reserved	Not Used	Data Line DAT3
3	MCI1_CDA	PA12	Command/Response		
4	VDDIOP0		Supply Voltage (3.3-volts) VDDIOP0		

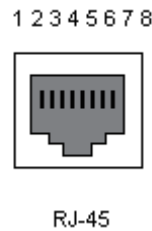


**Table 4-31.** SD Socket J7 Signal Descriptions (Continued)

Pin	Mnemonic	PIO	Signal		
			MMC Card	SD Card	
				1-Bit Mode	4-Bit Mode
5	MCI1_CK	PA13	Clock		
6	GND		Ground		
7	MCI1_DA0	PA11	Data Line DAT0		
8	MC1_DA1	PA2	Not Used	Interrupt (IRQ)	Data Line DAT1 or Interrupt (IRQ)
9	GND		Ground		
10	MCI1_CD	PD14	Card Detect, configured as GPIO, Power domain VDDNF		
11	WP		Write Protect Detect, connects to jumper JP6		
12	GND		Ground		
13	GND		Ground		
14	GND		Ground		
15	GND		Ground		

**4.3.5.12 Ethernet RJ45 Socket J17, J18**

**Figure 4-46.** Ethernet RJ45 Socket J17, J18



**Table 4-32.** DAA RJ11 Socket J16 Signal Descriptions

Pin	Mnemonic	Description
1	TX+	DIFFERENTIAL OUTPUT PLUS
2	TX-	DIFFERENTIAL OUTPUT MINUS
3	RX+	DIFFERENTIAL INPUT PLUS
4	Reserved	
5	Reserved	DIFFERENTIAL INPUT MINUS
6	RX-	
7	Reserved	
8	Reserved	

4.3.5.13 ZigBee Socket J10

Figure 4-47. ZigBee Socket J10

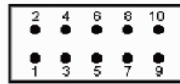


Table 4-33. ZigBee Socket J10 Signal Descriptions

Function	Signal Name	Port	Pin	Pin	Port	Signal Name	Function	Option on misc. port set by OR or solder shunts
Reset	/RST		1	2		Misc.		<ul style="list-style-type: none"> <li>■ EEprom for MAC address, cap array settings and serial number</li> <li>■ TST: test mode activation</li> <li>■ CLKM: RF chip clock output</li> </ul>
Interrupt Request	IRQ		3	4		SLP_TR	SLP_TR	
SPI chip select	/SEL		5	6		MOSI	SPI MOSI	
SPI MISO	MISO		7	8		SCLK	SPI CLK	
Power Supply	GND	GND	9	10	VCC	VCC	VCC	Voltage range: 1.8v to 5.5v, regulated to 3.3v

4.3.5.14 LCD/ISI Socket J21

Figure 4-48. LCD/ISI Socket J21

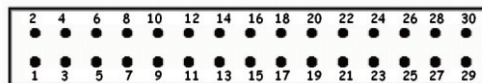


Table 4-34. LCD/ISI Socket J21 Signal Descriptions

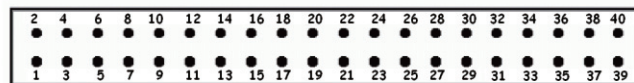
LCD	ISI	Pin Num	Pin Num	ISI	LCD
3V3	3V3	1	2	GND	GND
VDDISI	VDDISI	3	4	GND	GND
ZB_IRQ0	ZB_IRQ0	5	6		ZB_IRQ1
TWCK0	TWCK0	7	8		TWD0
GND	GND	9	10	ISI_MCK	LCDDAT15
GND	GND	11	12	ISI_VSYNC	LCDDAT13
GND	GND	13	14	ISI_HSYNC	LCDDAT14



**Table 4-34.** LCD/ISI Socket J21 Signal Descriptions (Continued)

LCD	ISI	Pin Num	Pin Num	ISI	LCD
GND	GND	15	16	ISI_PCK	LCDDAT12
GND	GND	17	18	ISI_D0	LCDDAT0
LCDDAT1	ISI_D1	19	20	ISI_D2	LCDDAT2
LCDDAT3	ISI_D3	21	22	ISI_D4	LCDDAT4
LCDDAT5	ISI_D5	23	24	ISI_D6	LCDDAT6
LCDDAT7	ISI_D7	25	26	ISI_D8	LCDDAT8
LCDDAT9	ISI_D9	27	28	ISI_D10	LCDDAT10
LCDDAT11	ISI_D11	29	30	GND	GND

#### 4.3.5.15 LCD/TSC Socket J22

**Figure 4-49.** LCD/TSC Socket J22**Table 4-35.** LCD/TSC Socket J22 Signal Descriptions

LCD		Pin Num	Pin Num		LCD
5V	5V_INTER	1	2	GND	GND
5V	5V_INTER	3	4	GND	GND
LCDDAT16		5	6		LCDDAT17
LCDDAT18		7	8		LCDDAT19
LCDDAT20		9	10		LCDDAT21
LCDDAT22		11	12		LCDDAT23
GND	GND	13	14	GND	GND
LCDDISP		15	16		LCDPWM
LCDCSYNC		17	18		LCDHSYNC
LCDDEN		19	20		LCDPCK
GND	GND	21	22	GND	GND
AD0_XP	TSC	23	24	TSC	AD1_XM
AD2_YP	TSC	25	26	TSC	AD3_YM
AD4_LR	TSC	27	28		ONE_WIRE
GND	GND	29	30	GND	GND
SPI1_MISO		31	32		SPI1_MOSI
SPI1_SPCK		33	34		SPI1_NPCS1
EN_PWRLCD	SELCONFIG	35	36	LCD_DETECT	LCD_DETECT#
PD16		37	38		PD17
GND	GND	39	40	GND	GND



4.3.5.16 IO Expansion Port J1

Figure 4-50. IO Expansion Socket J1

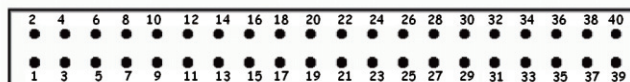


Table 4-36. Expansion Socket J1 Signal Descriptions

PIO	Power	Pin Num	Pin Num	Power	PIO
	3V3, or 5V	1	2	3V3, or 5V	
	GND	3	4	GND	
PA0		5	6		PA16
PA1		7	8		PA17
PA2		9	10		PA18
PA3		11	12		PA19
PA4		13	14		PA20
PA5		15	16		PA21
PA6		17	18		PA22
PA7		19	20		PA23
PA8		21	22		PA24
PA9		23	24		PA25
PA10		25	26		PA26
PA11		27	28		PA27
PA12		29	30		PA28
PA13		31	32		PA29
PA14		33	34		PA30
PA15		35	36		PA31
	GND	37	38	GND	
	3V3	39	40	3V3	

4.3.5.17 IO Expansion Port J2

Figure 4-51. IO Expansion Socket J2

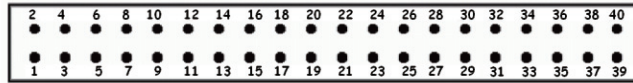


Table 4-37. Expansion Socket J1 Signal Descriptions

PIO	Power	Pin Num	Pin Num	Power	PIO
	3V3, or 5V	1	2	3V3, or 5V	
	GND	3	4	GND	
PC0		5	6		PC16
PC1		7	8		PC17
PC2		9	10		PC18
PC3		11	12		PC19
PC4		13	14		PC20
PC5		15	16		PC21
PC6		17	18		PC22
PC7		19	20		PC23
PC8		21	22		PC24
PC9		23	24		PC25
PC10		25	26		PC26
PC11		27	28		PC27
PC12		29	30		PC28
PC13		31	32		PC29
PC14		33	34		PC30
PC15		35	36		PC31
	GND	37	38	GND	
	3V3	39	40	3V3	



4.3.5.18 IO Expansion Port J3

Figure 4-52. IO Expansion Socket J3

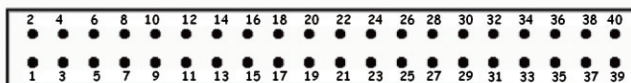
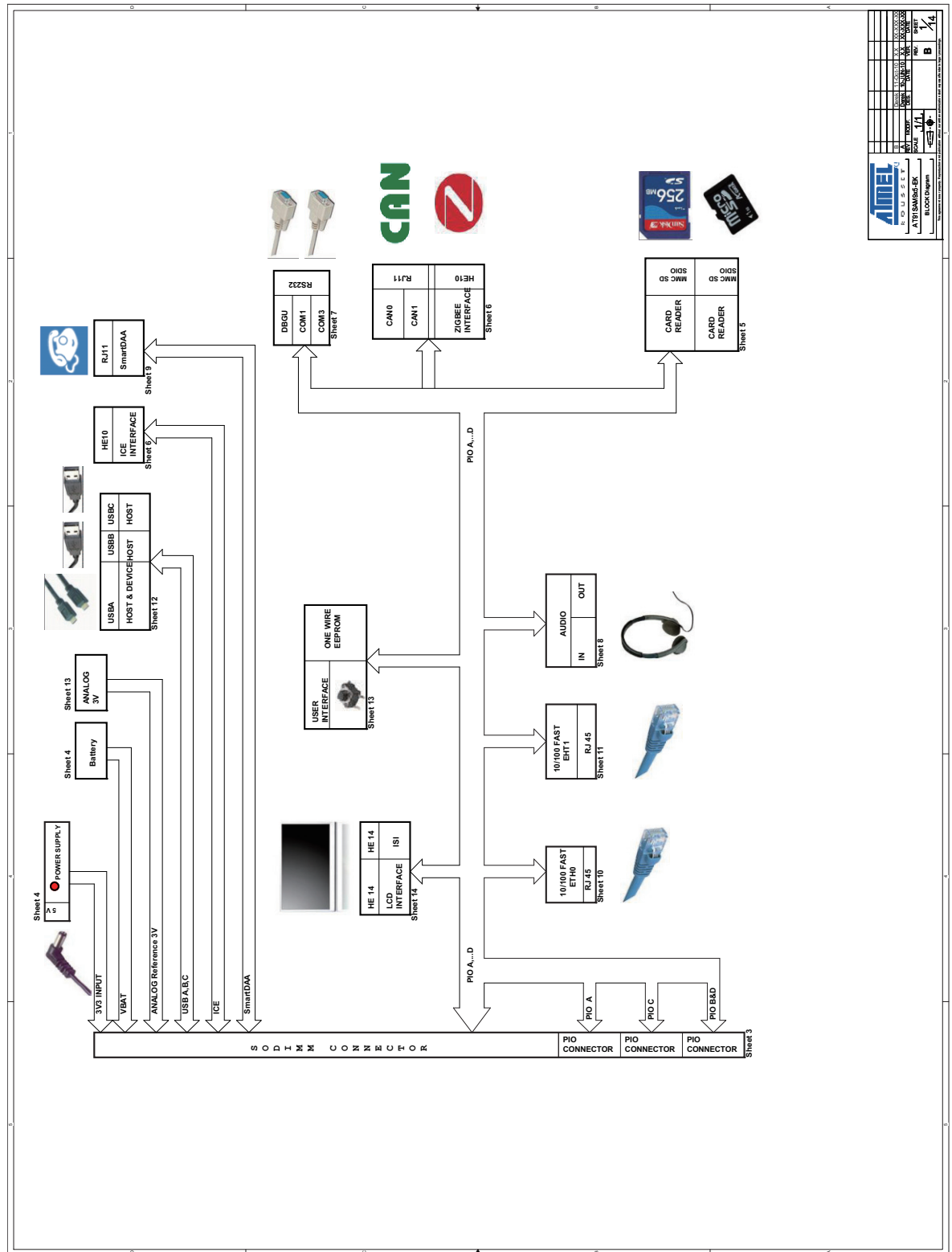


Table 4-38. Expansion Socket J1 Signal Descriptions

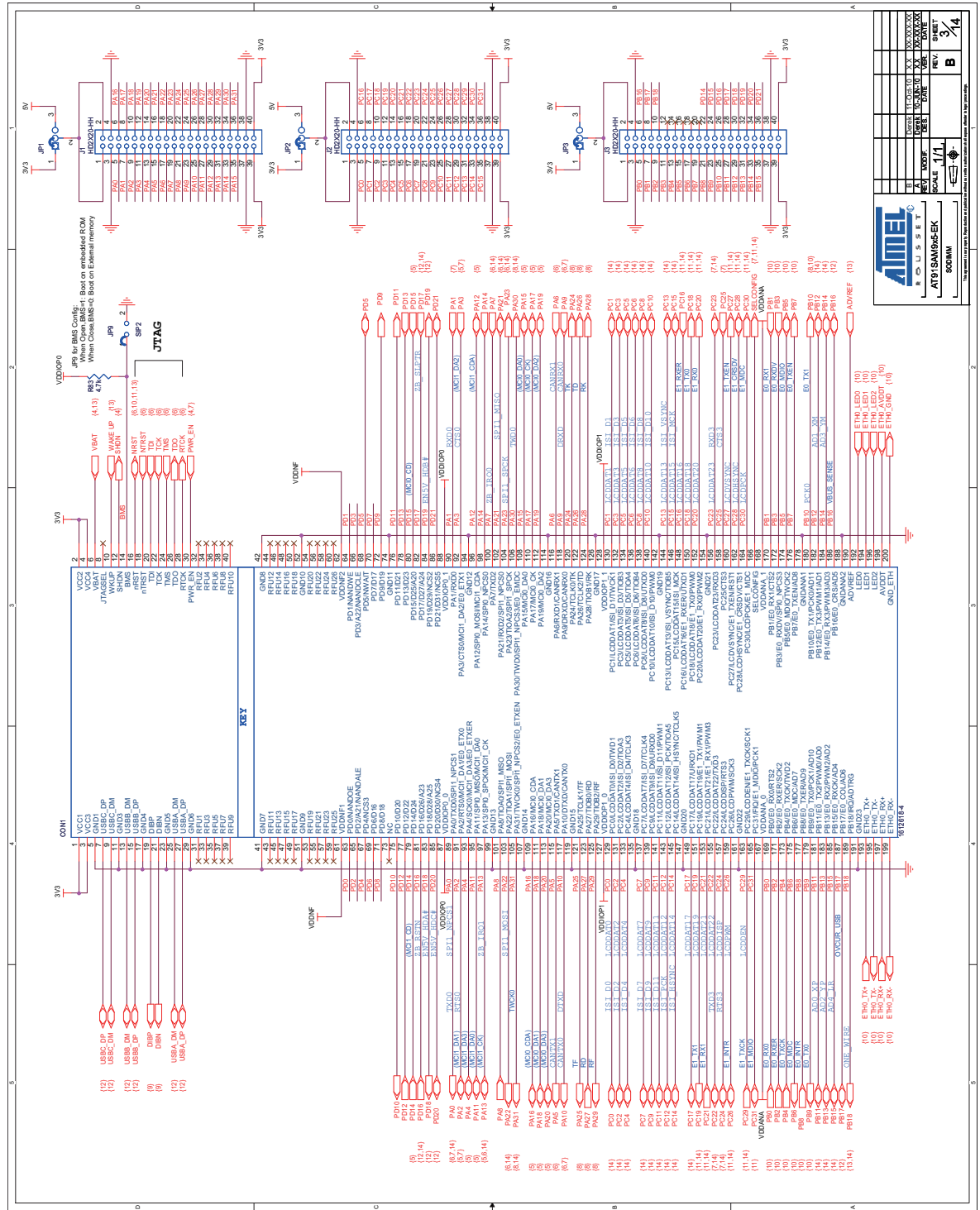
PIO	Power	Pin Num	Pin Num	Power	PIO
	3V3, or 5V	1	2	3V3, or 5V	
	GND	3	4	GND	
PB0		5	6		PB16
PB1		7	8		PB17
PB2		9	10		PB18
PB3		11	12		-
PB4		13	14		-
PB5		15	16		-
PB6		17	18		-
PB7		19	20		-
PB8		21	22		PD14
PB9		23	24		PD15
PB10		25	26		PD16
PB11		27	28		PD17
PB12		29	30		PD18
PB13		31	32		PD19
PB14		33	34		PD20
PB15		35	36		PD21
	GND	37	38	GND	
	3V3	39	40	3V3	

4.3.6 Schematics

Figure 4-53. EK Board Schematics

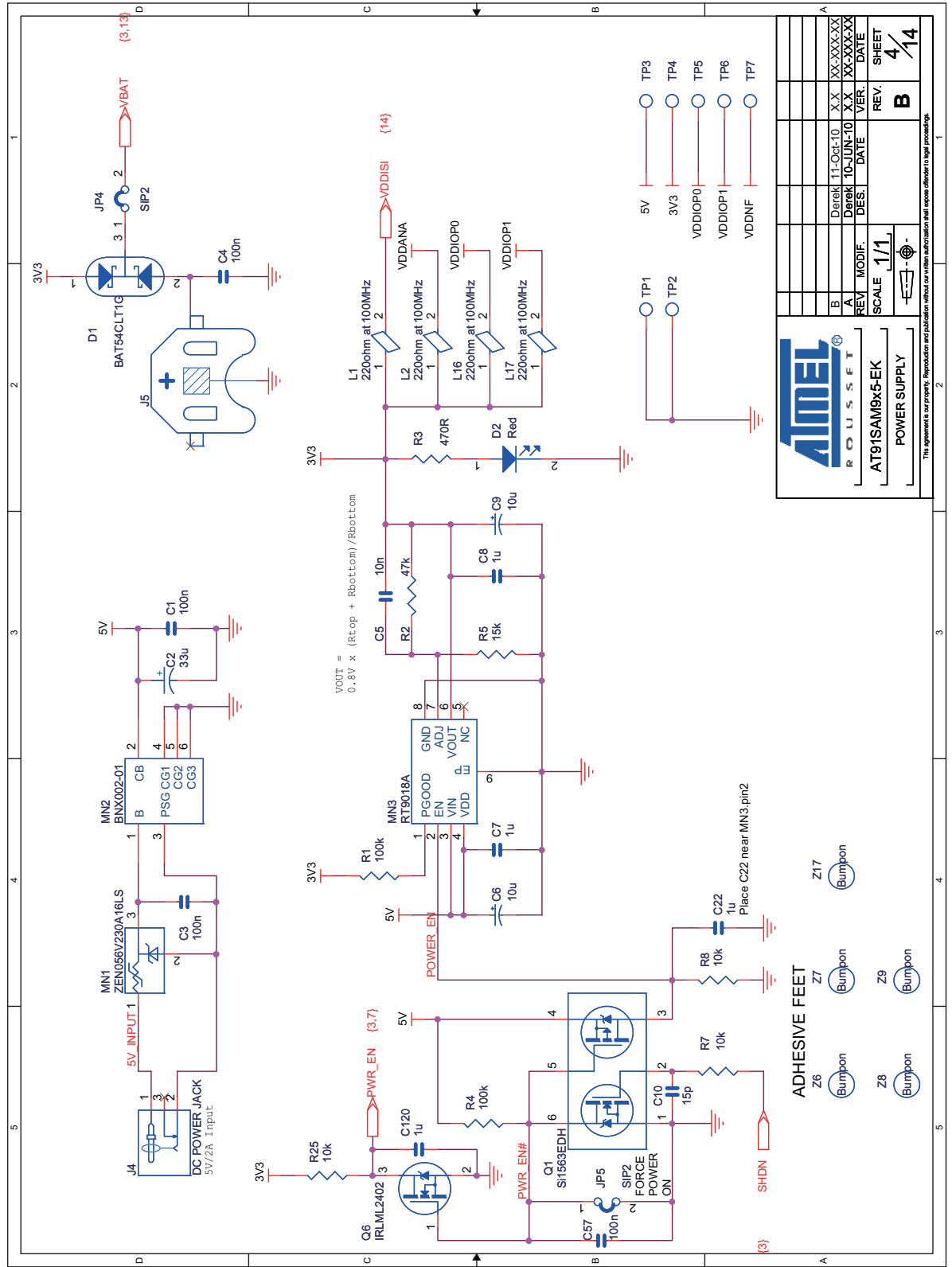


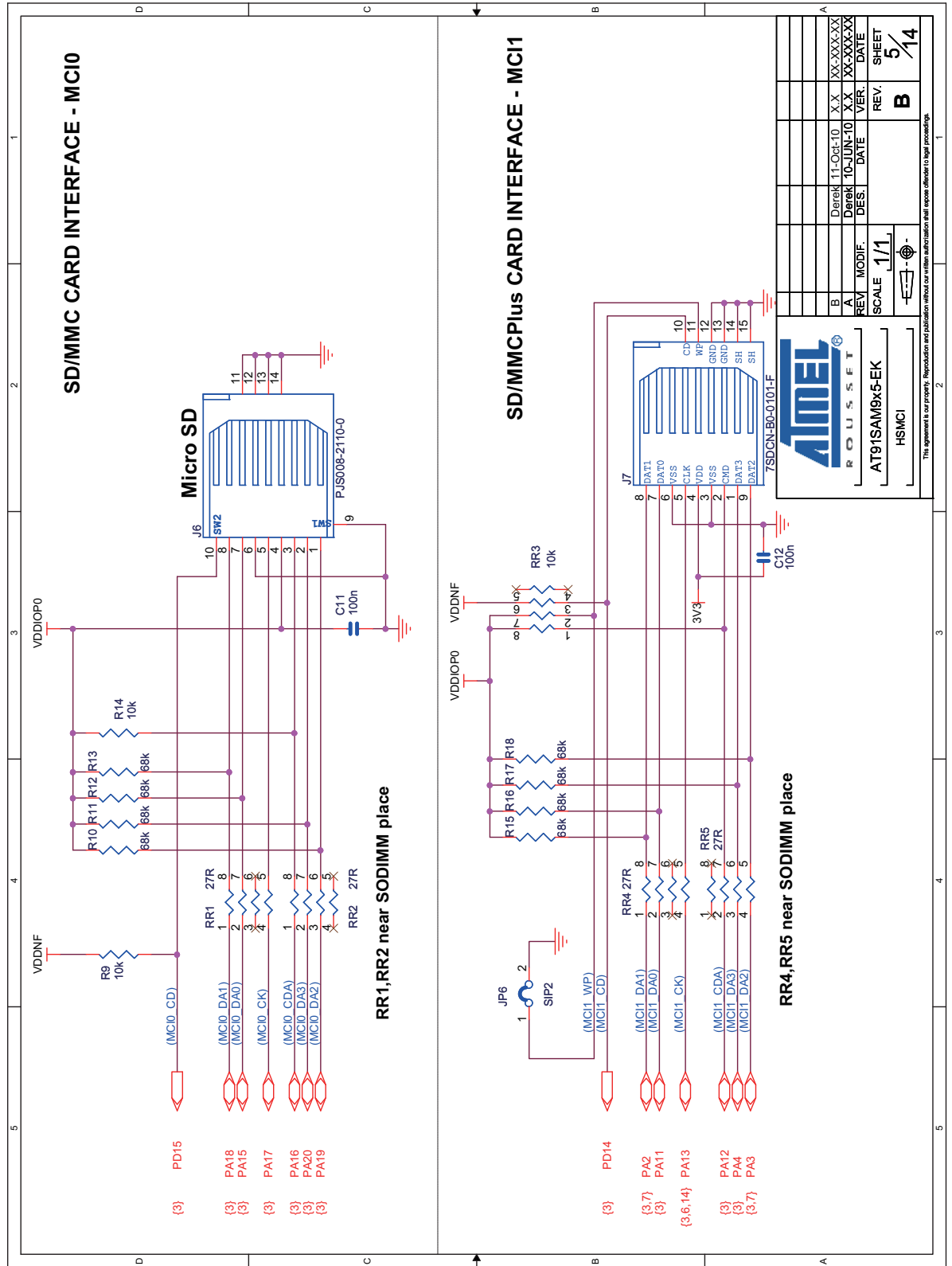


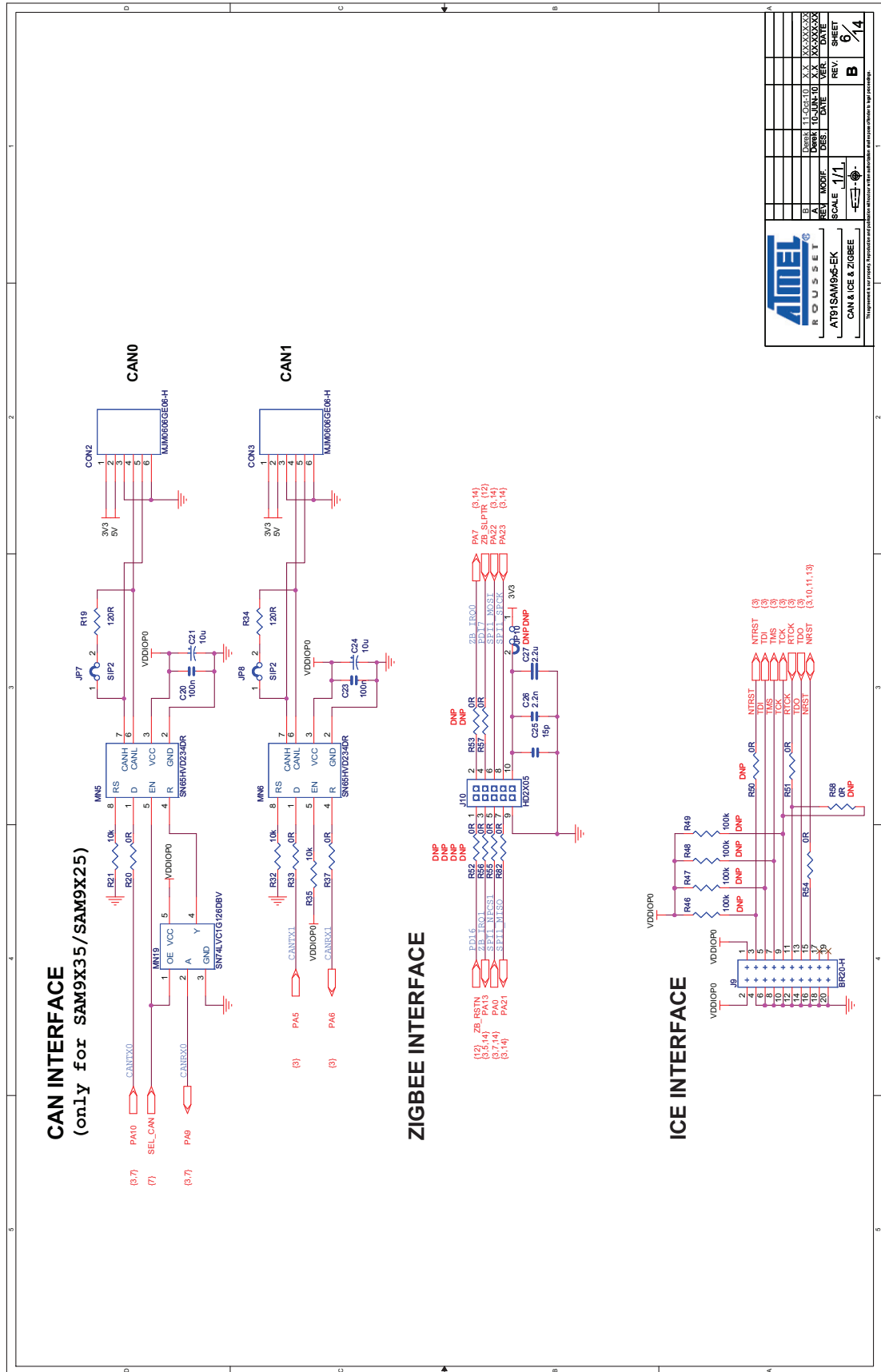


AMEL  
 L 0191SAM9G-EK  
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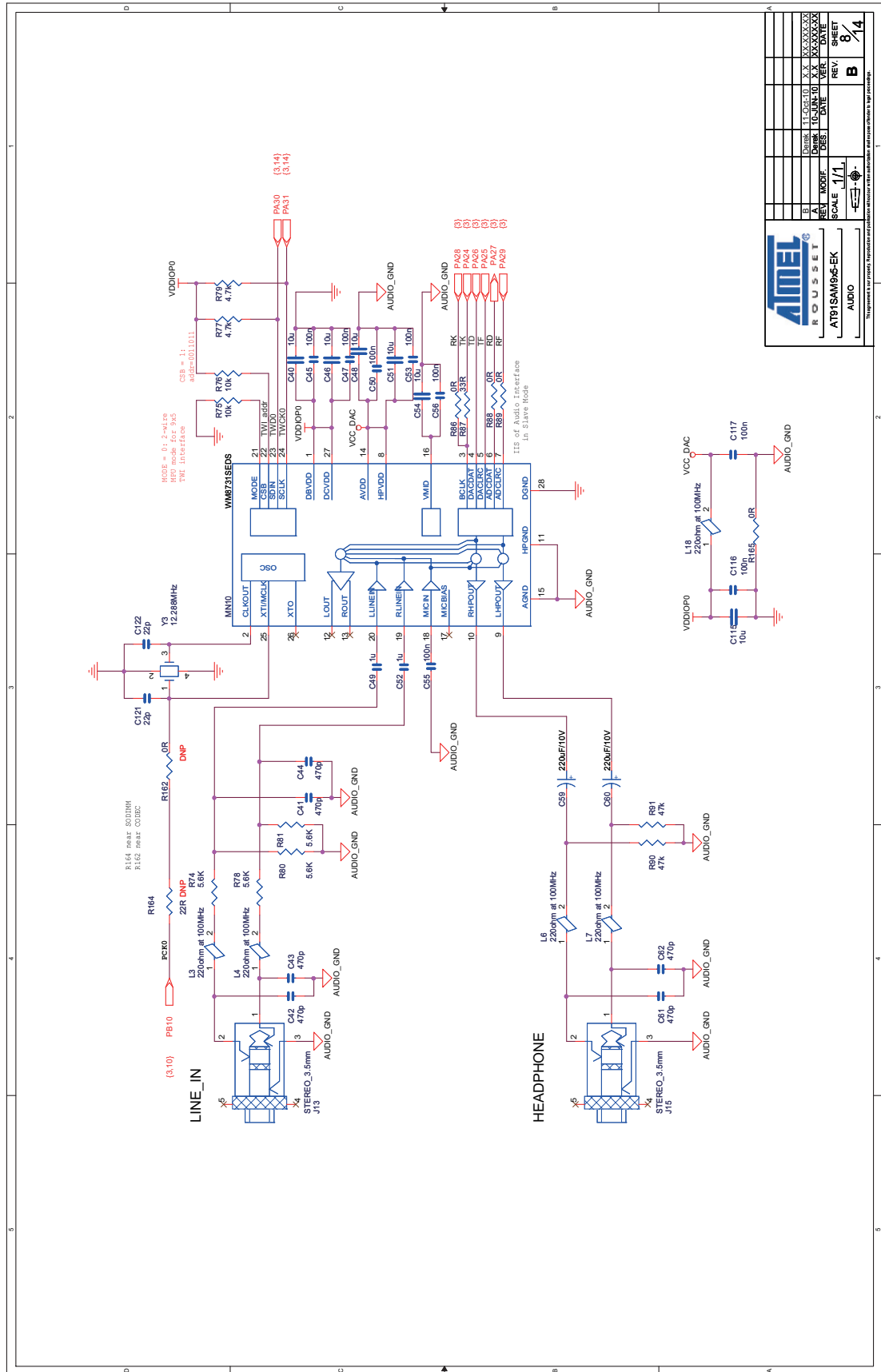
REV	MODIF.	DATE	VER	SHEET
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SCALE 1/1				B
CAN & ICE & ZIGBEE				

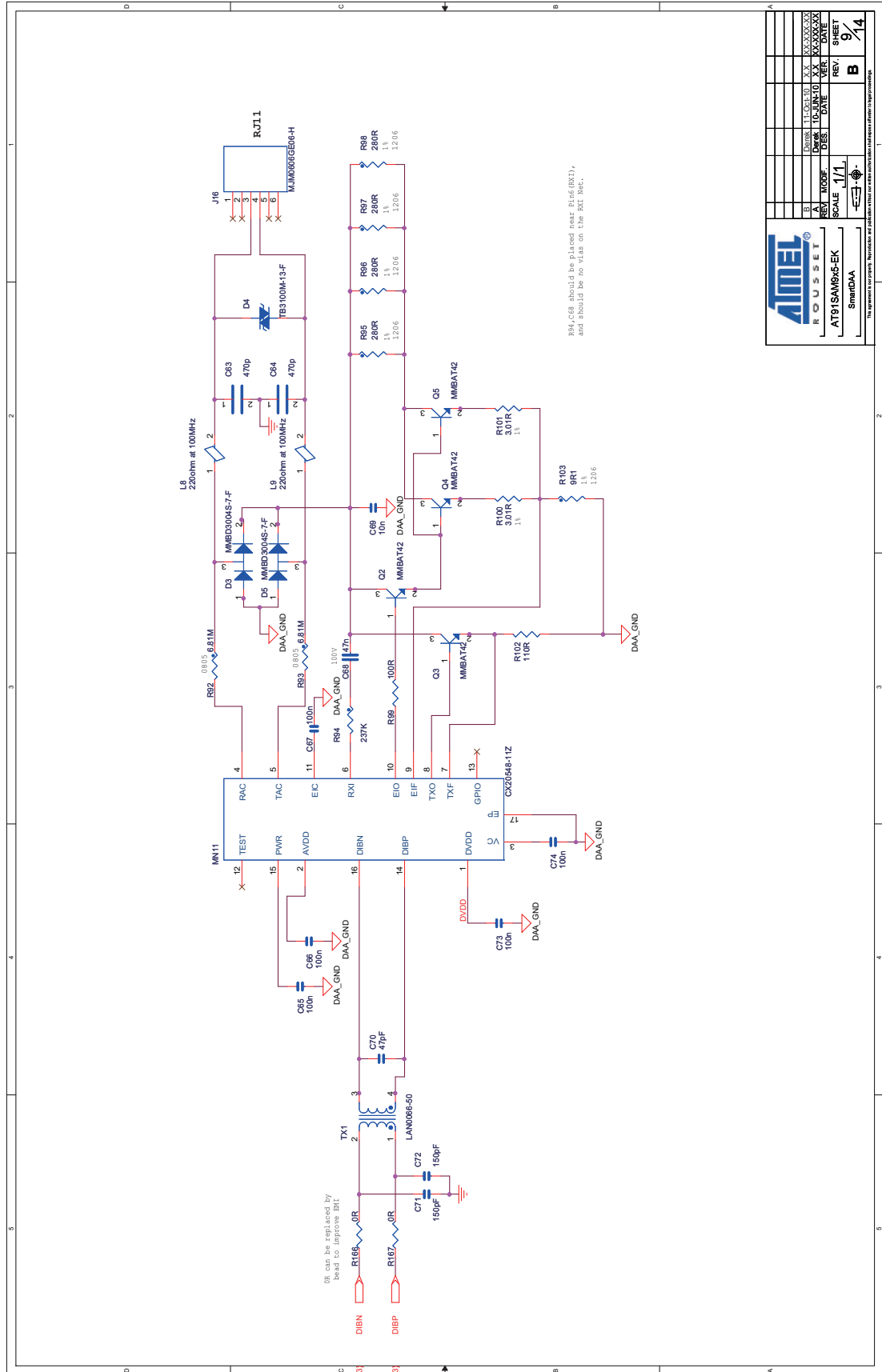
AT91SAM935-EK  
CAN & ICE & ZIGBEE





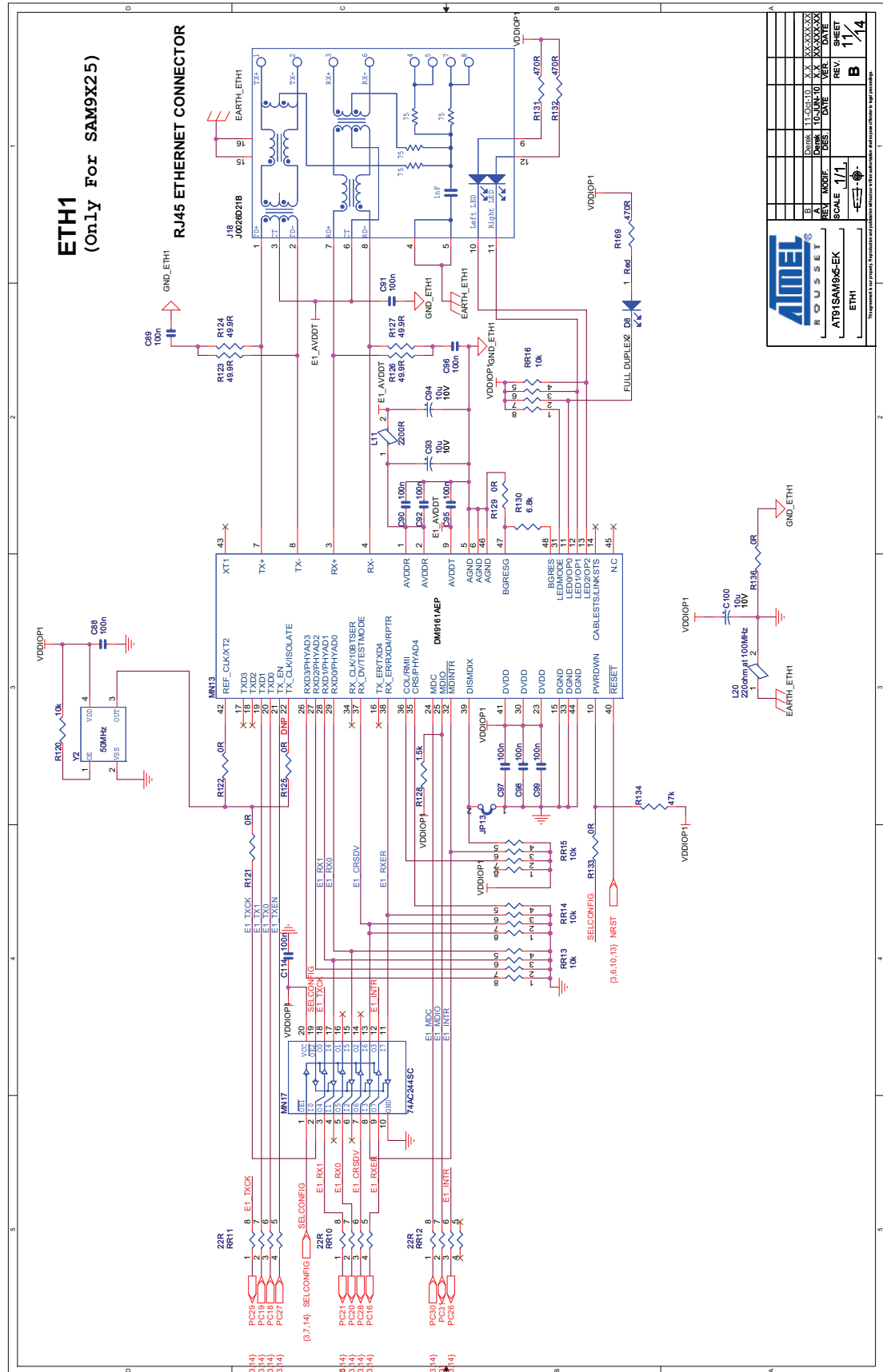


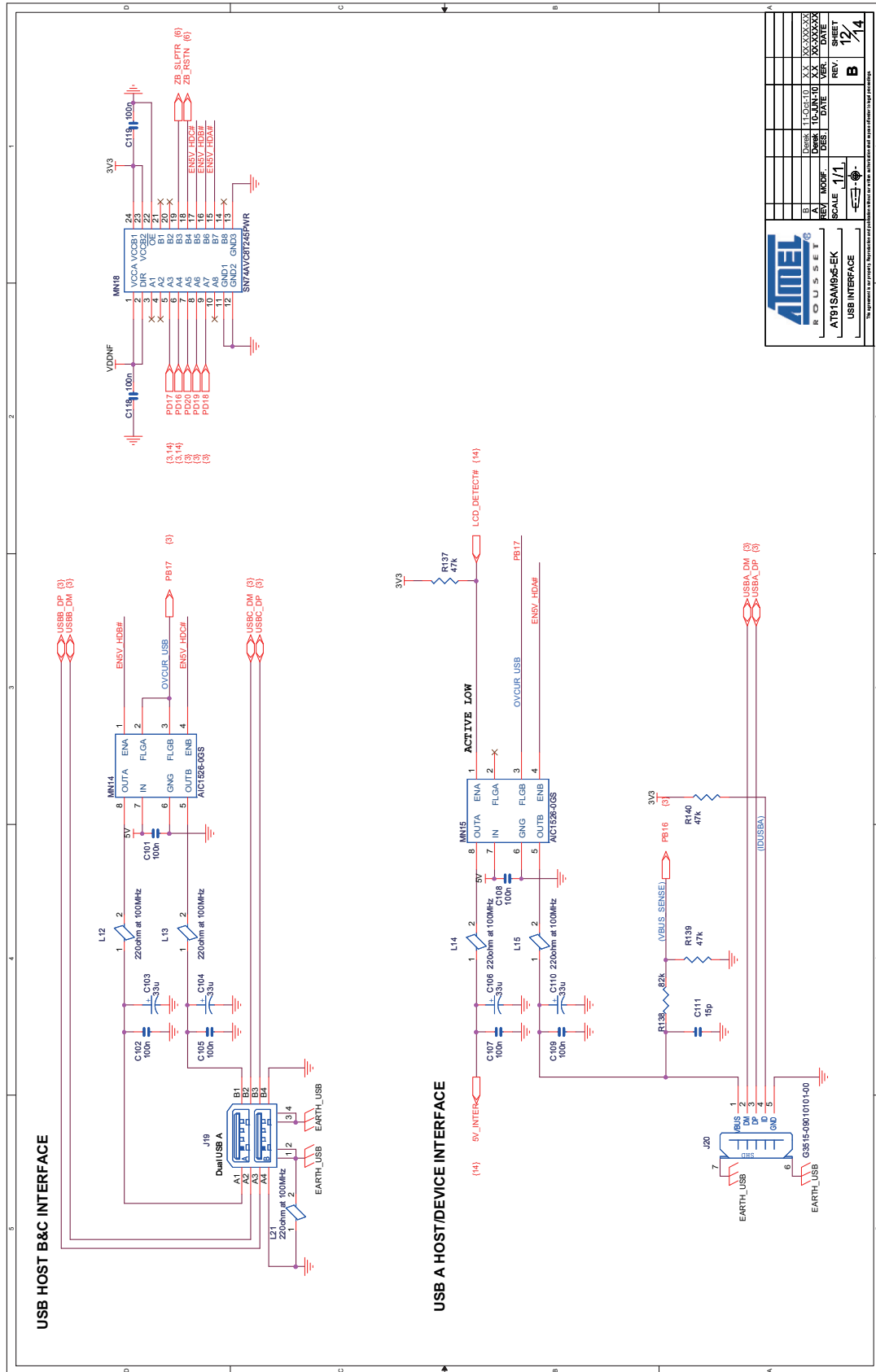


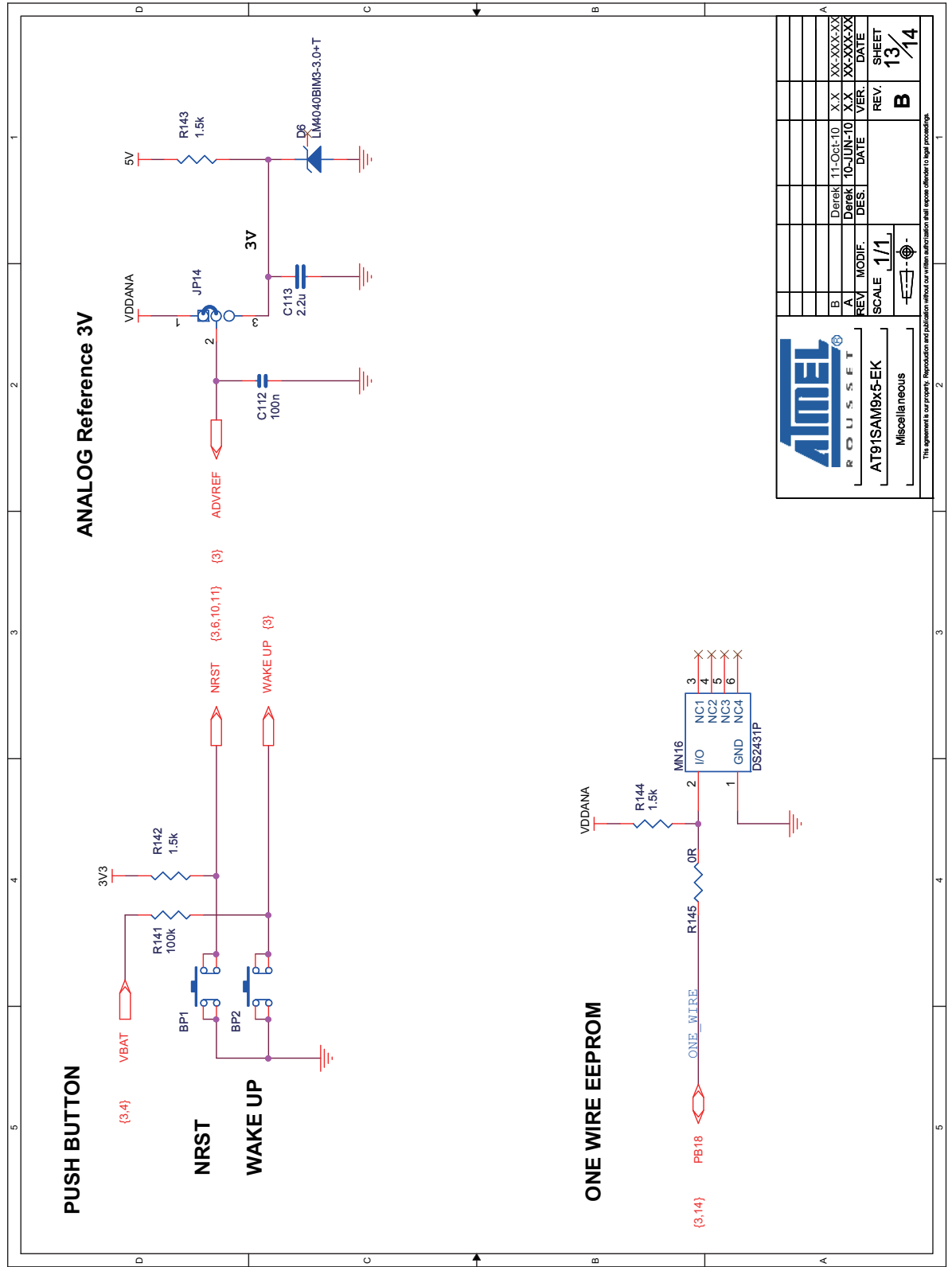












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		SCALE 1/1						13/14
AT91SAM9X5-EK Miscellaneous		This agreement is our property. Reproduction and publication without our written authorization shall expose offender to legal proceedings.						





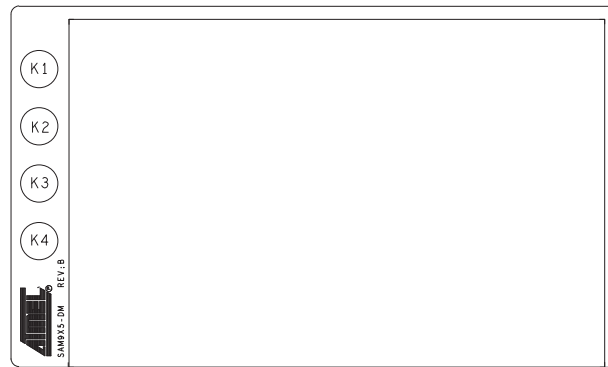


## 4.4 Optional Display Module (DM) Board Hardware

### 4.4.1 DM Board Overview

The optional DM board carries a 5.0" TFT LCD module with touch screen. The DM board also carries four QTouch pads.

**Figure 4-54.** DM Board Layout



### 4.4.2 Equipment List

The list of the DM board components follows:

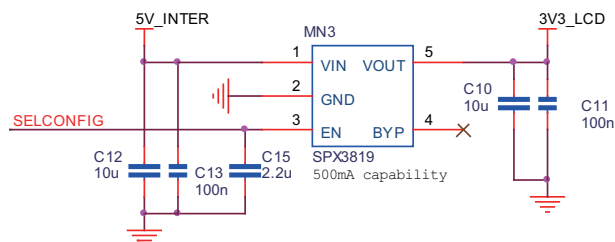
- One 5.0" TFT LCD module
- LCD Back light driver
- 3.3V regulator
- QTouch device
- 1-Wire device

### 4.4.3 Function Blocks

#### 4.4.3.1 3.3V Regulator

The DM Board features its own LDO for local power regulation. It accepts DC 5V power from a 500 mA high-side power switch on the EK and outputs a regulated +3.3 V to most other circuits on the board.

**Figure 4-55.** DM Board Power Supply



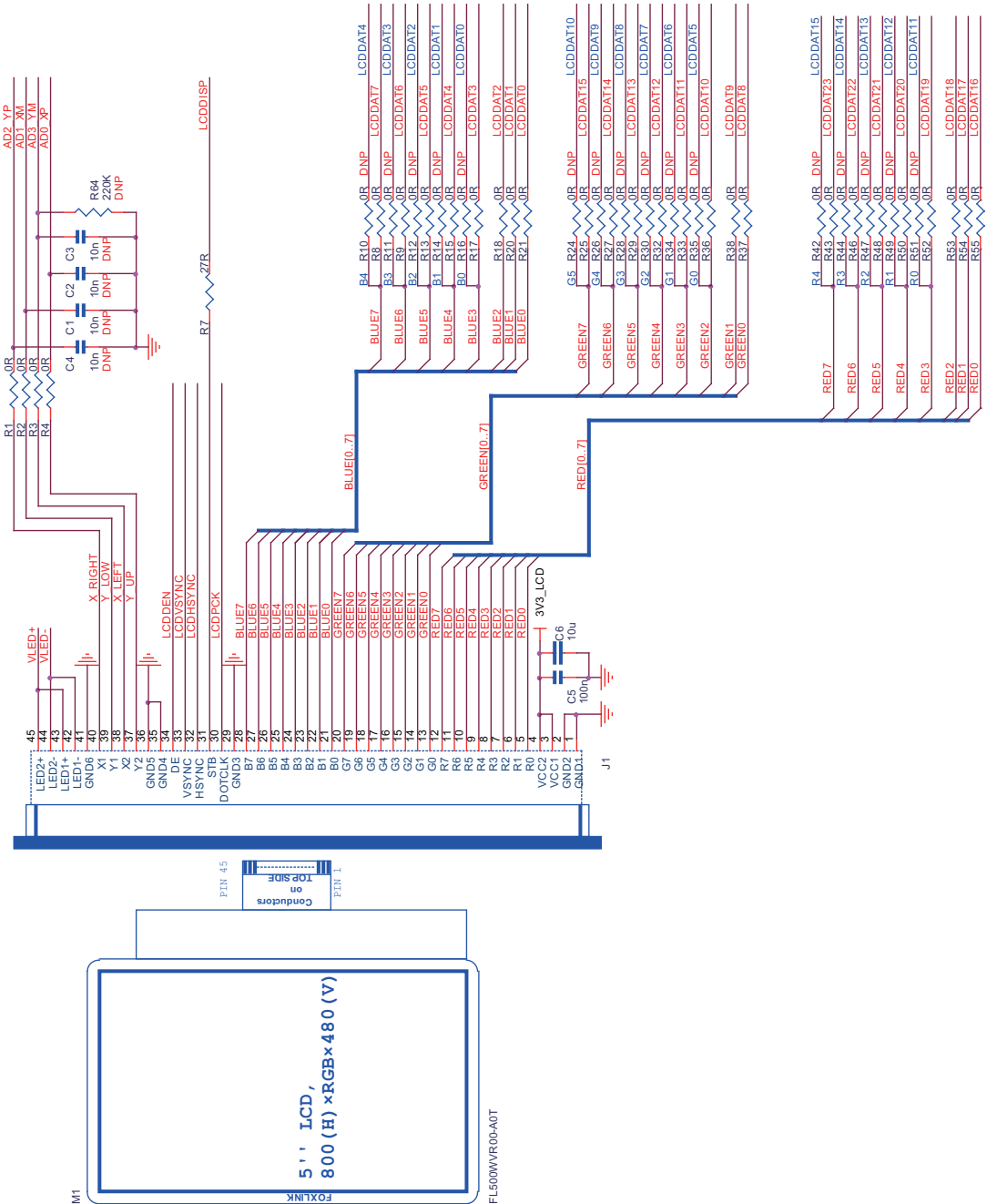
### 4.4.3.2 TFT LCD with Touch Panel

A 5" 800x480 LCD provides the DM with a low power display feature, back light unit and a touch panel, similar to that used on commercial PDAs.

Graphics and text can be displayed on the dot matrix panel with up to 16 million colors by supplying 24-bit data signals (8bit x RGB by default) or 16-bit data signals (5+6+5bit x RGB in option). This allows the user to develop graphical user interfaces for a wide variety of end applications.

**Warning:** Never connect/disconnect the LCD display from the board while the power supply is on. Doing so may damage both units.

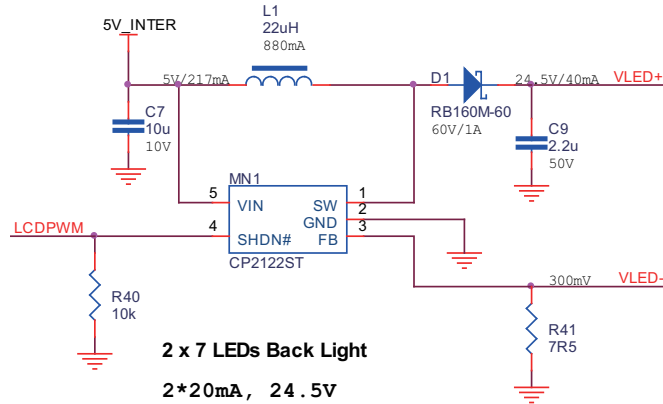
Figure 4-56. LCD with Touch Panel



### 4.4.3.3 Back Light

The back light voltage is generated from a CP2122ST boost converter. It is powered directly by the DC 5V from the EK board. The back light level is controlled by a PWM signal generated from the MPU Device processor.

Figure 4-57. Back Light Control

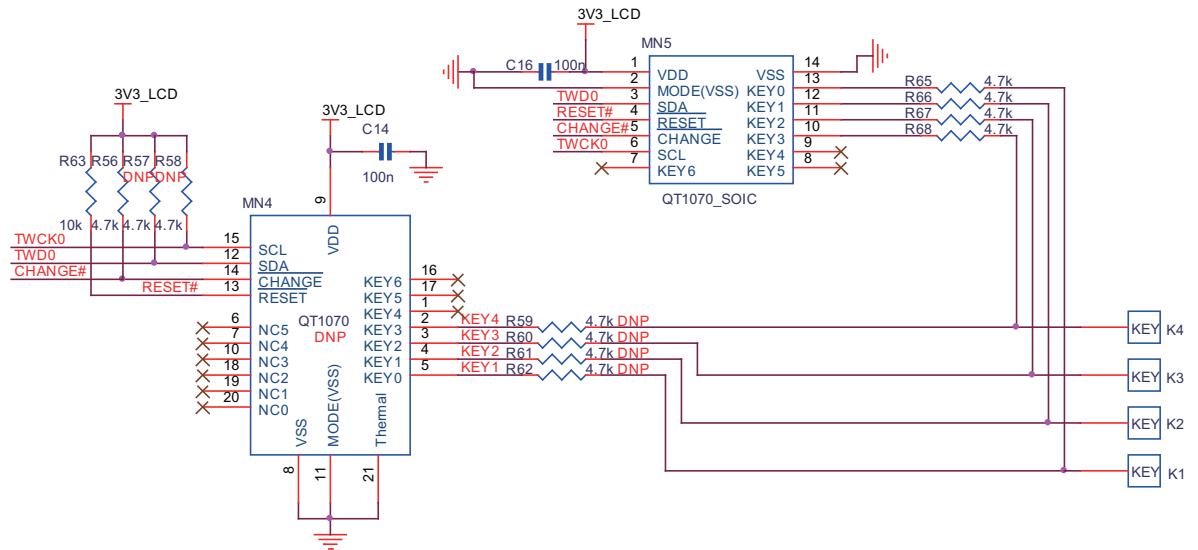


### 4.4.3.4 QTouch

The DM board carries a QTouch device piloted through a TWI interface. It manages four capacitive touch buttons directly printed on the PCB.

There are dual footprints for the QTouch device, and SOIC is the default mounted one.

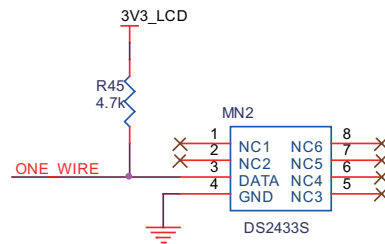
Figure 4-58. QTouch



#### 4.4.3.5 1-Wire

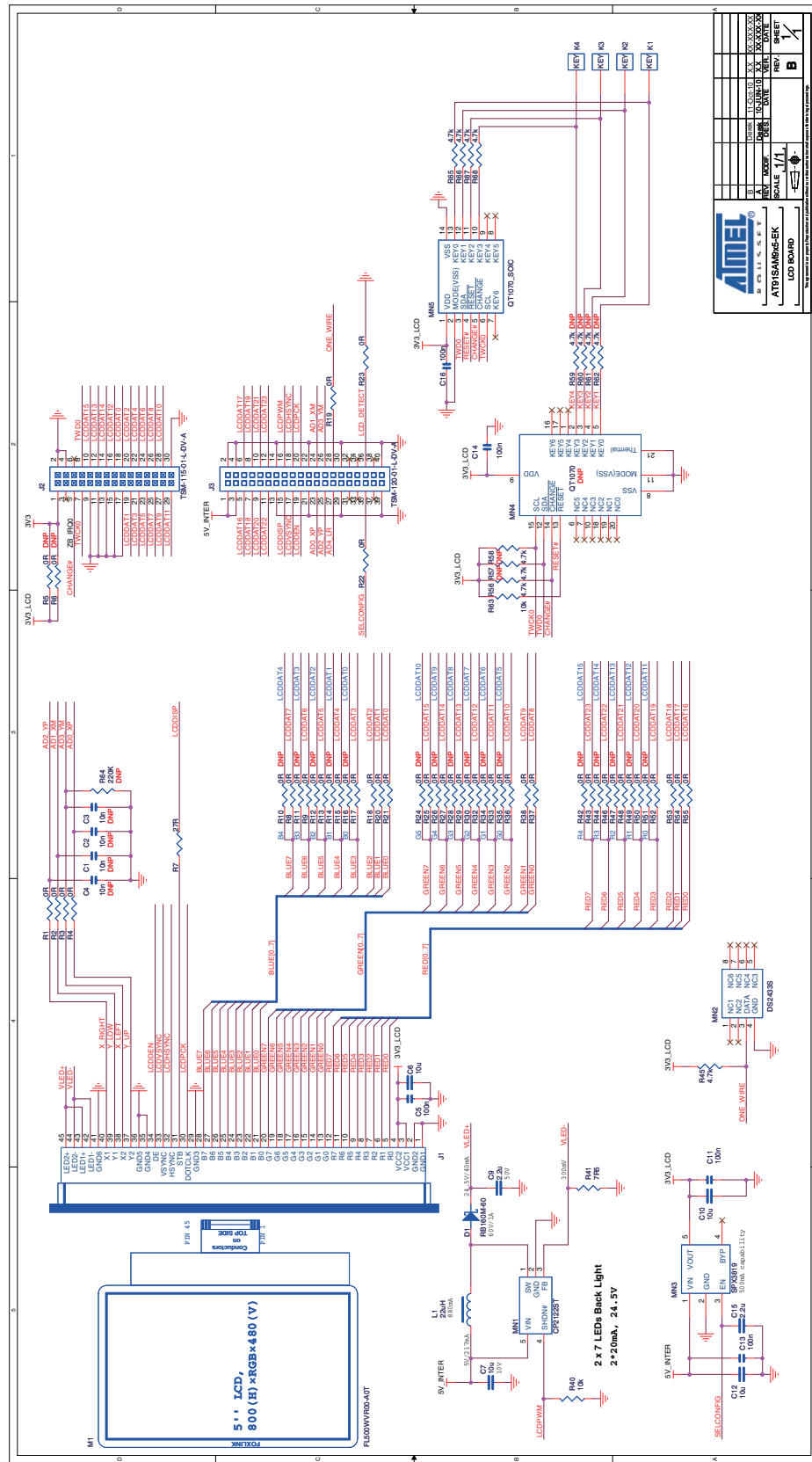
The DM board also uses a 1-Wire device as “firmware label” to store the information such as chip type, manufacturer’s name, production date etc.

**Figure 4-59.** 1-Wire on DM



4.4.4 Schematics

Figure 4-60. DM Board Schematics





## Section 5

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# Revision History

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### 5.1 Revision History

*Table 5-1.*

Document	Comments	Change Request Ref.
11115A	First issue.	



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