

SAM9N12/CN11-EK

User Guide



Section 1

Introduction	1-1
1.1 SAM9N12/CN11 Evaluation Kit.....	1-1
1.2 User Guide Content	1-1
1.3 References and Applicable Documents	1-1

Section 2

Kit Contents	2-1
2.1 Deliverables	2-1
2.2 Evaluation Board Specifications.....	2-2
2.3 Electrostatic Warning	2-2

Section 3

Power Up	3-1
3.1 Power up the Board	3-1
3.2 Battery.....	3-1
3.3 Sample Code and Technical Support	3-1
3.4 Recovery Procedure	3-1

Section 4

Evaluation Kit Hardware	4-1
4.1 Board Overview.....	4-1
4.2 Equipment List	4-2
4.2.1 Features List	4-2
4.2.2 Interface Connection.....	4-3
4.2.3 Configuration Items.....	4-3
4.3 Function Blocks.....	4-5
4.3.1 Processor.....	4-5
4.3.2 Clock Distribution.....	4-5
4.3.3 Reset and Wake-up Circuitry	4-6
4.3.4 Power Supplies.....	4-6
4.3.5 Power Rails.....	4-7
4.3.6 Battery Backup	4-8
4.3.7 Memory	4-9
4.3.8 UART DBGU.....	4-10
4.3.9 JTAG Interface.....	4-10
4.3.10 Serial Peripheral Interface (SPI) Controller	4-11
4.3.11 Two Wire Interface (TWI).....	4-11
4.3.12 USB Ports	4-12
4.3.13 1-Wire EEPROM.....	4-13
4.3.14 ETH on EBI.....	4-13

4.3.15	Audio.....	4-14
4.3.16	SD Card	4-15
4.3.17	ZigBee Interface	4-15
4.3.18	Analog Interface	4-16
4.3.19	LED Indicators	4-16
4.3.20	Push Buttons	4-17
4.3.21	Expansion Ports.....	4-18
4.3.22	PIO Usage	4-19
4.4	Connectors.....	4-23
4.4.1	Power Supply.....	4-23
4.4.2	JTAG/ICE Connector	4-23
4.4.3	DBGU	4-24
4.4.4	USB MicroB	4-25
4.4.5	USB Type A port.....	4-25
4.4.6	SD Card MCI	4-26
4.4.7	Ethernet RJ45 Socket.....	4-27
4.4.8	Zigbee Socket J12	4-27
4.4.9	LCD Socket.....	4-28
4.4.10	IO Expansion Port	4-30

Section 5

EK Schematics	5-1
5.1 SAM9N12-EK Schematics	5-1
5.2 SAM9CN11-EK Schematics.....	5-2

Section 6

Display Module Hardware.....	6-1
6.1 Board Overview.....	6-1
6.2 Equipment List	6-1
6.3 Function Blocks.....	6-2
6.3.1 3.3V Regulator	6-2
6.3.2 TFT LCD with Touch Panel	6-2
6.3.3 Back Light	6-3
6.3.4 QTouch	6-4
6.3.5 1-Wire	6-4

Section 7

DM Schematics.....	7-1
7.1 DM Board Schematics	7-1

Section 8

Revision History.....	8-1
-----------------------	-----



8.1	Revision History	8-1
-----	------------------------	-----



Section 1

Introduction

1.1 SAM9N12/CN11 Evaluation Kit

This User Guide introduces the SAM9N12 and SAM9CN11 Evaluation Kits and describes their development and debugging capabilities running on SAM9N12 and SAM9CN11 devices.

The Atmel® SAM9N12/CN11 Evaluation Kit is a fully-featured evaluation platform for the Atmel SAM9N12 and SAM9CN11 microcontrollers. The evaluation kit allows users to extensively evaluate, prototype and create application-specific designs.

SAM9N12/CN11 Evaluation Kit consists of two boards:

- The Evaluation Kit (EK) board
- The Display Module (DM) board

1.2 User Guide Content

This guide gives details on how the SAM9N12/CN11-EK has been designed. It is made up of 8 sections:

- Section 1 Introduction (including references, applicable documents)
- Section 2 Kit Contents
- Section 3 Power Up
- Section 4 Evaluation Kit Hardware
- Section 5 EK Schematics
- Section 6 Display Module Hardware
- Section 7 DM Schematics
- Section 8 Revision History

1.3 References and Applicable Documents

The documents listed below should be referred for more information on the SAM9CN11-EK.

Table 1-1. References and Applicable Documents

Title	Comment
SAM9N12/CN11 Datasheet	www.atmel.com

2.1 Deliverables

The Atmel SAM9N12/CN11 Evaluation Kit contains the following items:

- Board
 - One SAM9N12/CN11-EK board
 - One SAM9N12/CN11-DM board
- 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 SAM9N12/CN11-EK



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

2.2 Evaluation Board Specifications

Table 2-1. SAM9N12/CN11 Evaluation Kit Specifications

Characteristics	Specifications
Clock speed	400 MHz PCK, 133 MHz MCK
Ports	Ethernet, USB, RS232, JTAG, Audio, SD card
Board supply voltage	5V DC from connector, or 5V DC from Micro USB receptacle
Temperature - operating - storage	-10°C to + 50°C -40°C to + 85°C
Relative humidity	0 to 90% (non condensing)
Dimensions - SAM9N12/CN11-EK - SAM9N12/CN11-DM	135 mm x 100 mm 135 mm x 70 mm
RoHS status	Compliant

2.3 Electrostatic Warning

The SAM9N12/CN11 Evaluation Kit is shipped in a protective anti-static package. The board system must not be subjected to high electrostatic potentials. We strongly recommend using a grounding strap or similar ESD protective device 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

Power Up

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 graphic demo program. Then, click or touch icons displayed on the screen and enjoy the demo.

3.2 Battery

The SAM9N12/CN11-EK ships with a 3V coin battery.

This battery is not required for the board to start up.

The coin battery is provided for user convenience in case the user would like to exercise the date and time backup function of the SAM9N12/CN11 devices when the board is switched off.

3.3 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/>.

3.4 Recovery Procedure

All boards of Evaluation Kit have passed strict test procedures before shipment. The demo software boots from SPI DataFlash® and stores the binary image in the NAND Flash. If the contents of either of the Flash have been deleted, follow the instructions below to recover it to the state as it was when shipped by Atmel.

Under the web page of SAM9N12/CN11-EK, find the test package of AT91SAM9N12/CN11-EK_test_xx_public.zip (xx is the version number), which is the file for Flash content burning. A step-by-step instruction is available in name of SAM9N12/CN11_EK_Test_Software on how to recover the contents and how to make test for each section of the boards.

4.1 Board Overview

This section introduces the Atmel SAM9N12/CN11 Evaluation Kit design. It introduces system-level concepts, such as power distribution, memory, and interface assignments.

The SAM9N12/CN11-EK board is built around on the integration of an ARM®926-based microcontroller (BGA 217 package) with on-board SDRAM, NAND-Flash and a set of popular peripherals. It is designed to provide a high performance processor evaluation solution with high flexibility for various kinds of applications.

Figure 4-1. SAM9N12 Board Architecture

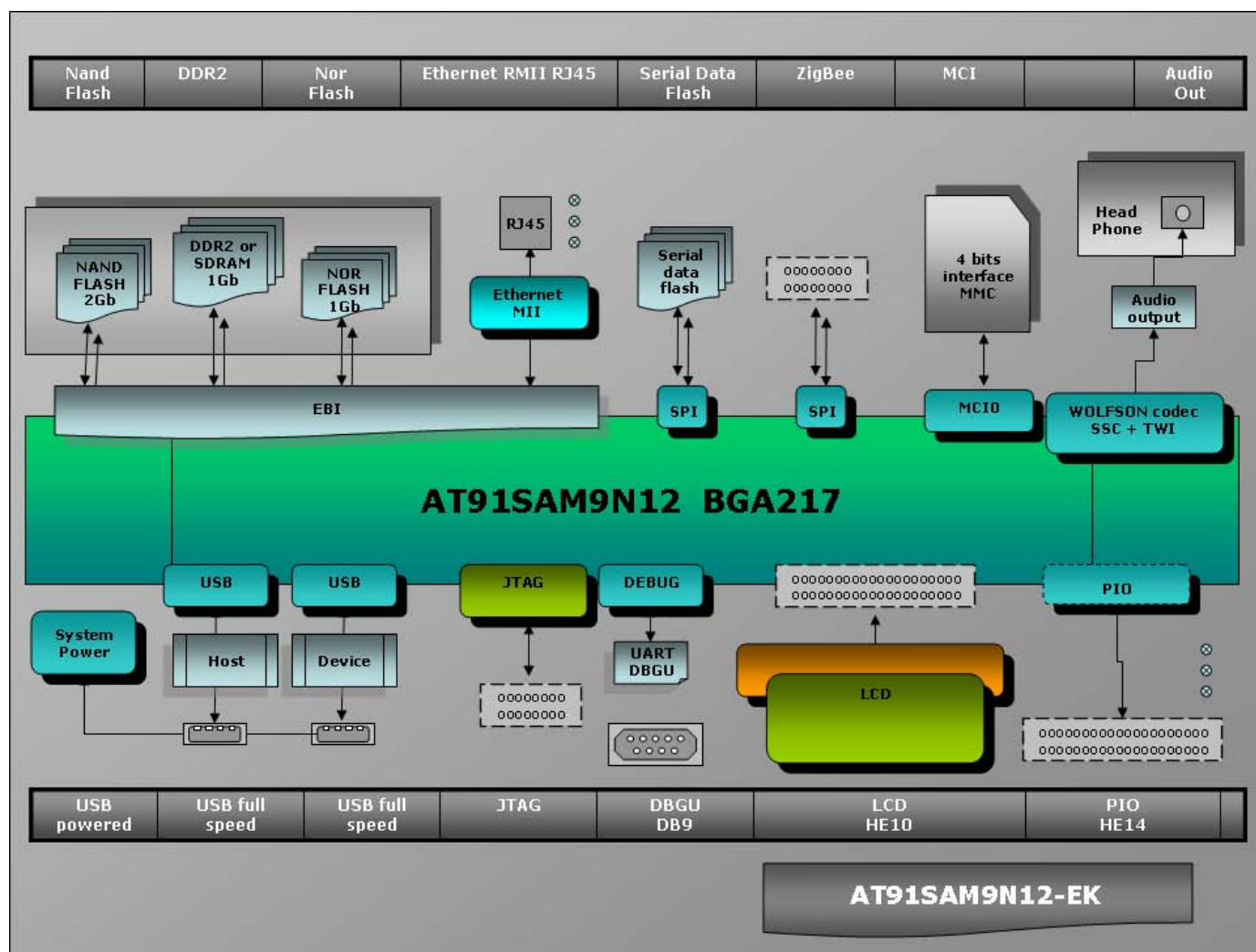
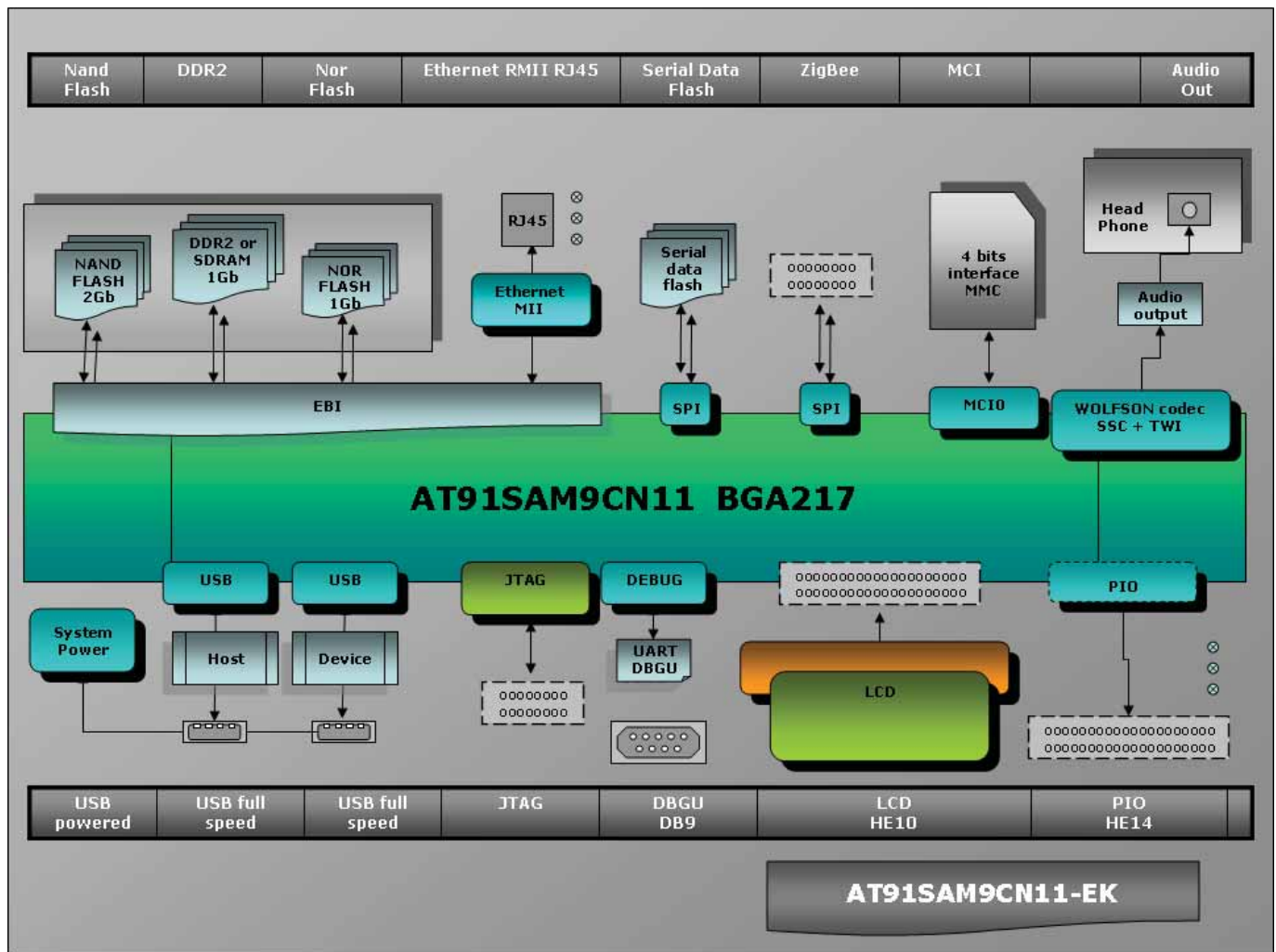


Figure 4-2. SAM9CN11 Board Architecture



4.2 Equipment List

4.2.1 Features List

Here is the list of the EK board components:

- SAM9N12/CN11 microcontroller BGA
 - 16 MHz crystal
 - 32.768 kHz crystal
- Memory
 - 1 Gbit DDR2 memory
 - 2 Gbits NAND Flash memory with chip selection control switch
 - Optional NOR Flash
 - 32 Mbits SPI serial DataFlash with chip selection control switch
 - 512 Kbits serial EEPROM
 - 1 Kbit 1-Wire EEPROM



- SD/MMC interface
- Communication
 - One Ethernet Physical Transceiver Layer with RJ45 connector
 - UART DBGU port with level shifter IC
 - JTAG/ICE port
 - USB Host and Device
 - ZigBee®
- Add-on Display Module
 - TFT LCD module with touch screen
 - QTouch® elements for user QTouch: K1 to K4
- Audio CODEC with input stereo headphone and microphone
- On-board power regulation and backup battery
- Two user LEDs and one power LED
- System buttons: NRST, WKUP, OE_CS
- One user button

4.2.2 Interface Connection

The SAM9N12/CN11-EK board includes hardware interfaces such as:

- DC power supply (J1)
- Backup battery (Bt1)
- USB host, type A connector (J2)
- USB device, micro B connector (J3)
- One Ethernet 10/100 interface through an ETH controller (J16)
- DBGU (RX and TX only) connected to a 9-way male RS232 connector (J11)
- JTAG, 20 pin IDC connector (J4)
- SD connector (J8)
- Headphone (J13), line-in (J15), on board mic-phone (mic1)
- DM board connection for QTouch and TFT LCD display with touch screen and backlight (J9, J10)
- ZigBee connector (J12)
- Three IO expansion ports (J5, J6, J7)
- Test points (various test points are located throughout the board)

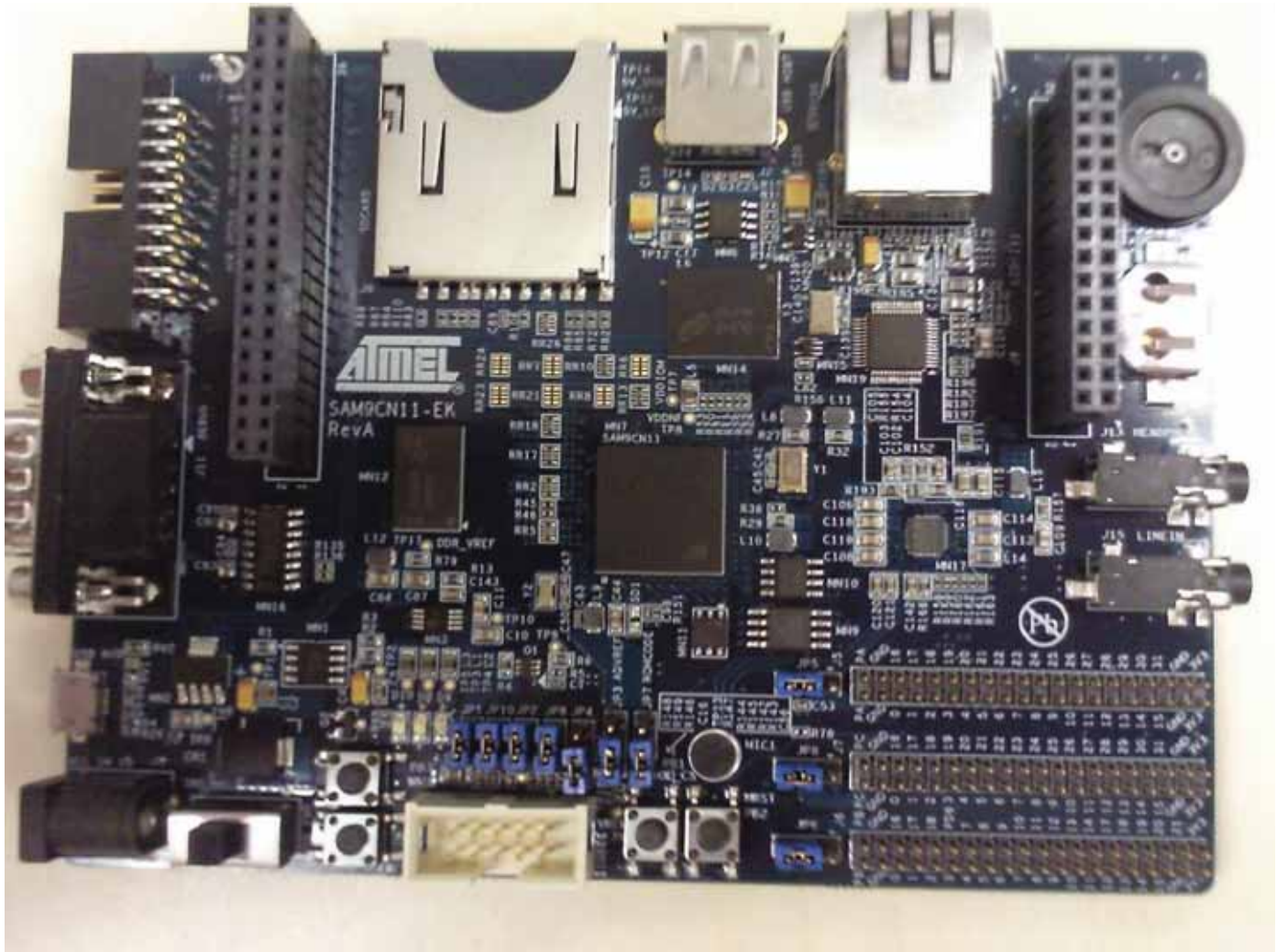
4.2.3 Configuration Items

- Power selection switch (SW1)
- Push button - NAND/DataFlash OS_CS (PB1)
- Push button - NRST, board reset (PB2)
- Push button - Wake-up (PB3)
- Push button - PB_USER (PB4)

Figure 4-3. SAM9N12-EK Board Layout



Figure 4-4. SAM9CN11-EK Board Layout



4.3 Function Blocks

4.3.1 Processor

The EK board is equipped with a SAM9N12/CN11 device in BGA217 package. The processor runs at a nominal frequency of 400 MHz for the core and 133 MHz for the system bus.

4.3.2 Clock Distribution

The SAM9N12/CN11-EK board includes three clock systems. Two of the clock systems are alternatives for the SAM9N12/CN11 main clock and one clock system is an oscillator used for the Ethernet controller chip.

Table 4-1 lists the main components associated with these clock systems.

Table 4-1. Main Components Associated with the Clock Systems

QTY	Description	Component assignment
1	Crystal for Internal Clock, 16 MHz	Y1
1	Crystal for RTC Clock, 32.768 kHz	Y2
1	Crystal for Ethernet Clock, 25 MHz	Y3

4.3.3 Reset and Wake-up Circuitry

The reset sources for the EK board are:

- Power-on reset
- Push-button reset (PB2)
- JTAG reset from an in-circuit emulator (JTAG interface is equipped on EK board)

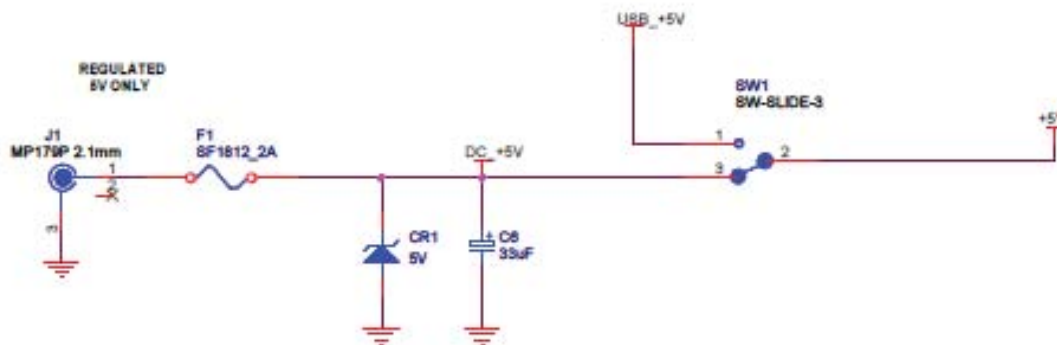
To disable any bootable content in NAND Flash or DataFlash, please refer to [“Push Buttons”](#).

4.3.4 Power Supplies

The SAM9N12/CN11-EK board evaluation and development platform embeds all the necessary power rails required for the SAM9N12/CN11 processor and peripherals. The SAM9N12/CN11-EK board can be supplied by either a USB connection via J3 or a 5V DC block through input J1 (refer to usb schematic).

A manual power supply selection (SW1) between the USB supply and the 5V power supply is provided to select the main power line.

Figure 4-5. Power Input



Connector J1 is provided for use with a DC adapter. It is a 2.5 mm male power jack. [Table 4-2](#) below lists the DC adapter connector pinouts.

Table 4-2. Power Input Configuration

PIN	INPUT
1 (Center)	Positive
2	No connection
3 (Outside)	Ground

4.3.5 Power Rails

The SAM9N12/CN11-EK Board contains three regulated power supplies:

- 3.3V DC supply
- 1.8V DC supply
- 1.0V DC core supply

The outputs of these regulated power supplies are distributed as necessary to the circuits on boards.

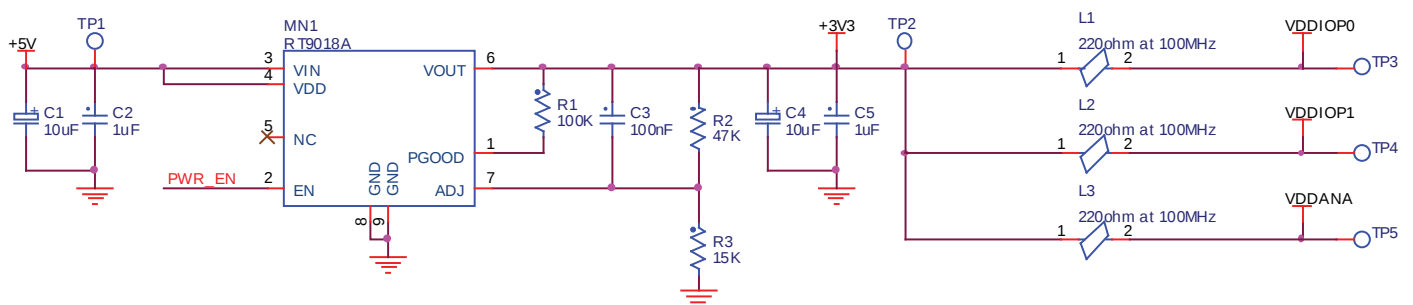
The USB supplies and the 5V input DC block are further regulated to 3.3V. The main 3.3V regulator is based on a RICHTEK RT9018A low dropout regulator providing a fixed output of 3.3V. Its output is used for:

- VDDIOP0
- VDDIOP1
- VDDANA
- VDDOSC
- VDDUSB
- VDDFUSE

When the 3.3V supply is present, power LED D10 is lit.

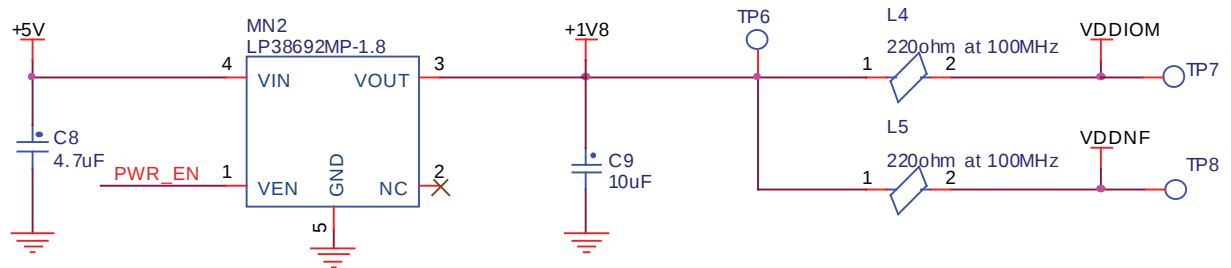
Test points TP2 to TP5 are used to perform testing.

Figure 4-6. 3.3V Supply



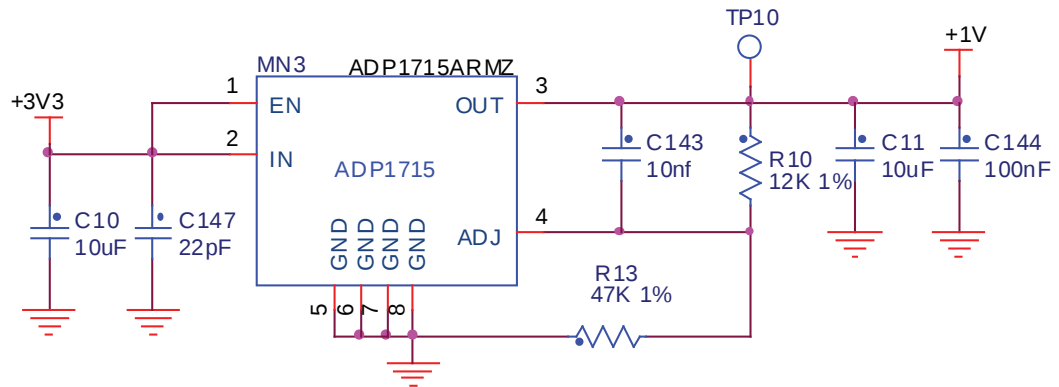
The 1.8V DC core supply is based on an LDO LP38692MP IC. It is powered by the 5V DC supply. Its output is used for VDDIOM and VDDNF. Test point TP6 is used to perform testing.

Figure 4-7. 1.8V Supply



The 1.0V DC core supply is based on an LDO ADP1715AR. It is powered by the output of the 3.3V CC supply. Its output is used for VDDCORE and VDDPLL. Test point TP10 is used to perform testing.

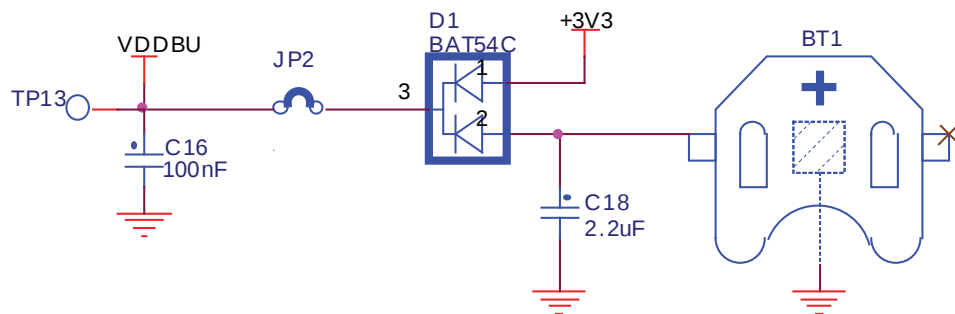
Figure 4-8. 1V Supply



4.3.6 Battery Backup

VDDBU pin is powered from the 3.3V rail and a backup battery BT1 via a dual Schottky diode D1. Test point TP13 and jumper JP2 are used to perform testing.

Figure 4-9. Backup Battery



Note: Test points (TPn) are provided for easy access to each of the regulated power lines.

4.3.7 Memory

4.3.7.1 DDR2 SDRAM

The SAM9N12/CN11 processor uses DDR2 SDRAM as the system memory. The DDR2 interface uses 1.8V power. The DDR2 chips and SAM9N12/CN11 processor are connected directly. The interface is 1.8V provided by an on-board voltage regulator.

VREF, which is half the interface voltage, or 0.9V, is provided by a simple voltage divider of 1.8V.

- One 1 Gbit DDR2-SDRAM memory (Micron MT47H64M16HR 8Meg*16*8), 16 bits data interface connected to D[0-15].

4.3.7.2 NAND FLASH

The SAM9N12/CN11-EK has native support for NAND Flash memory and implements an 8-bit NAND Flash with 2 Gbits in size.

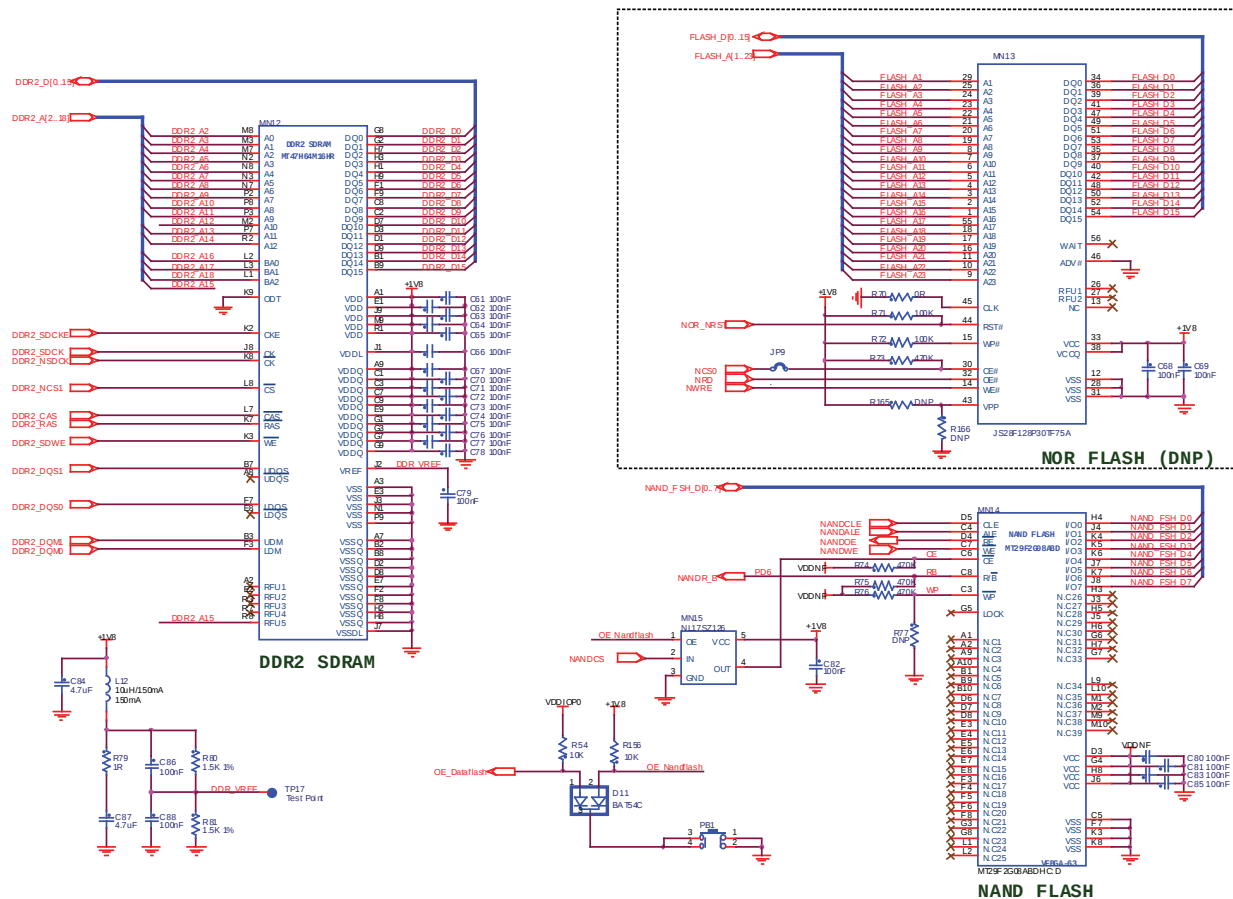
- One 2 Gbits NAND Flash (Micro MT29F2G08ABDHC), 16 bits data interface connected to D[0-15].

4.3.7.3 NOR FLASH

The SAM9N12/CN11-EK provides an optional 128 Mbits of Flash memory using a chip-select signal. The Flash memory is used with the 16-bit port size.

- One reserved position for 128 Mbits NOR Flash (Numonyx JS28F128P30TF75A).

Figure 4-10. External memory



DBGU

The Universal Asynchronous Receiver Transmitter features a two-pin UART that can be used for communication and trace purposes and offers an ideal medium for in-situ programming solutions.

Figure 4-11. UART



Figure 4-12. JTAG

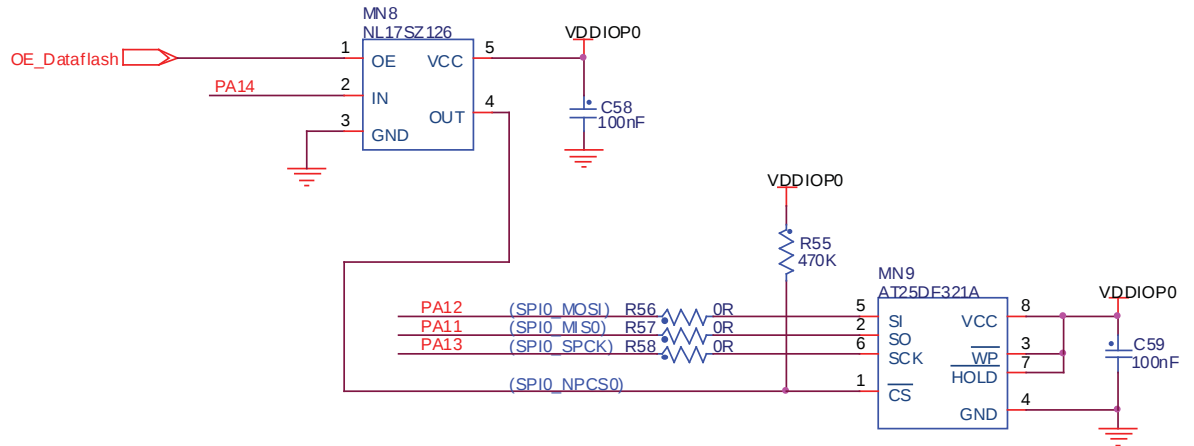


4.3.10 Serial Peripheral Interface (SPI) Controller

The SAM9N12/CN11 serial processor provides two high-speed Serial Peripheral Interface (SPI) controllers. One port is used to interface with the on-board serial DataFlash.

A 3-state buffer is in serial with DataFlash CS signal, with PB1 to give a manually disable manner for DataFlash boot.

Figure 4-13. SPI DataFlash

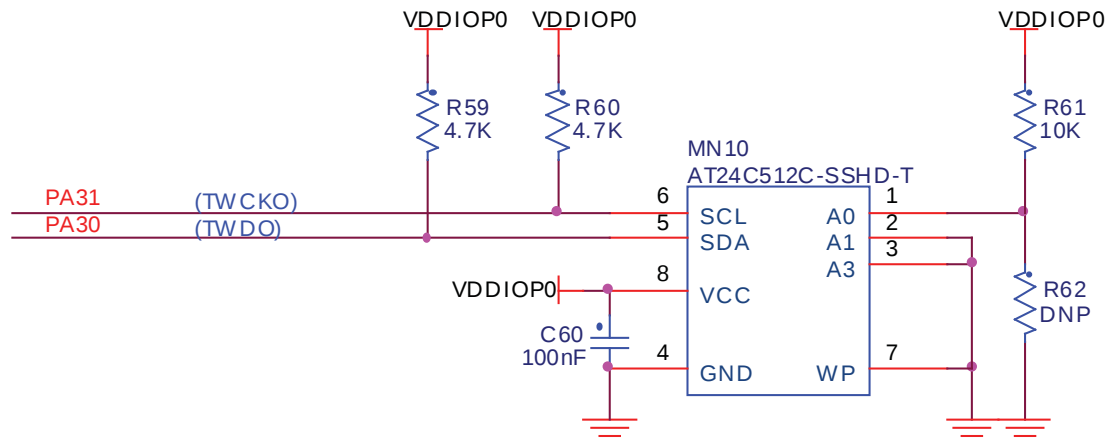


4.3.11 Two Wire Interface (TWI)

The SAM9N12/CN11 processor has two full speed (400 kHz) master/slave I2C serial controllers. The controllers are fully compatible with the industry standard I2C interfaces. On the EK board, TWI0 port is used to interface with serial EEPROM, QTouch device and audio CODEC interface.

SAM9N12/CN11 processor supports TWI EEPROM boot at the device address of 0x50. On board, the EEPROM device address is 0x51. Customer needs to dismount R61 and mount R62 as 10 kohms, if EEPROM boot is needed.

Figure 4-14. EEPROM



4.3.12 USB Ports

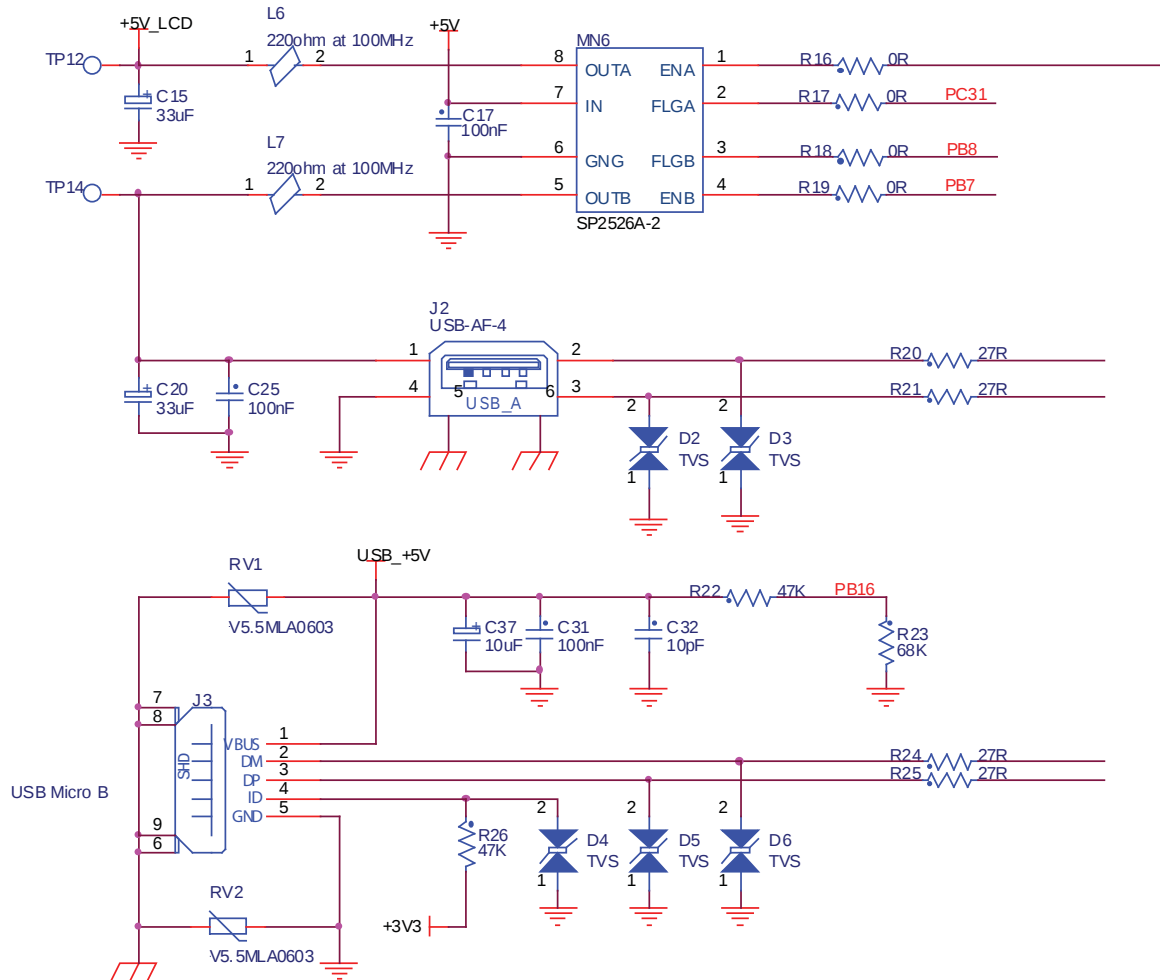
The SAM9N12/CN11-EK features two full speed (OHCI) USB ports:

- Host full speed, type A USB receptacle, J2
- Device full speed, micro B USB receptacle, J3

SAM9N12/CN11-EK features USB power function from device port J3. SW1 functions as switch between USB supply and DC input jack J1.

The USB host ports are equipped with 500 mA power switch for bus-powered applications.

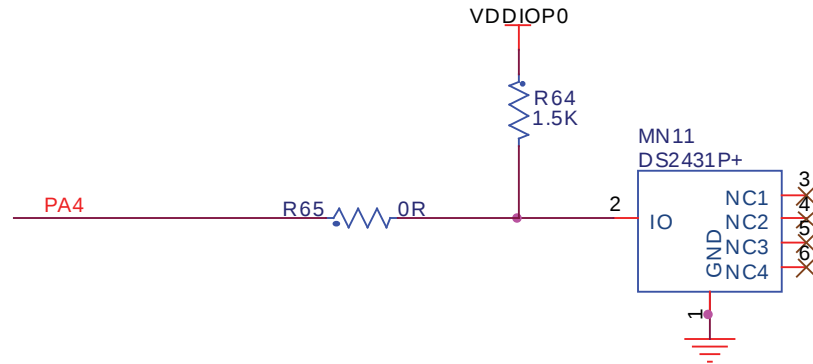
Figure 4-15. USB Port



4.3.13 1-Wire EEPROM

The SAM9N12/CN11 Evaluation Kit uses 1-Wire device as “soft label” to store the information such as chip type, manufacture's name, production date, etc.

Figure 4-16. 1-Wire

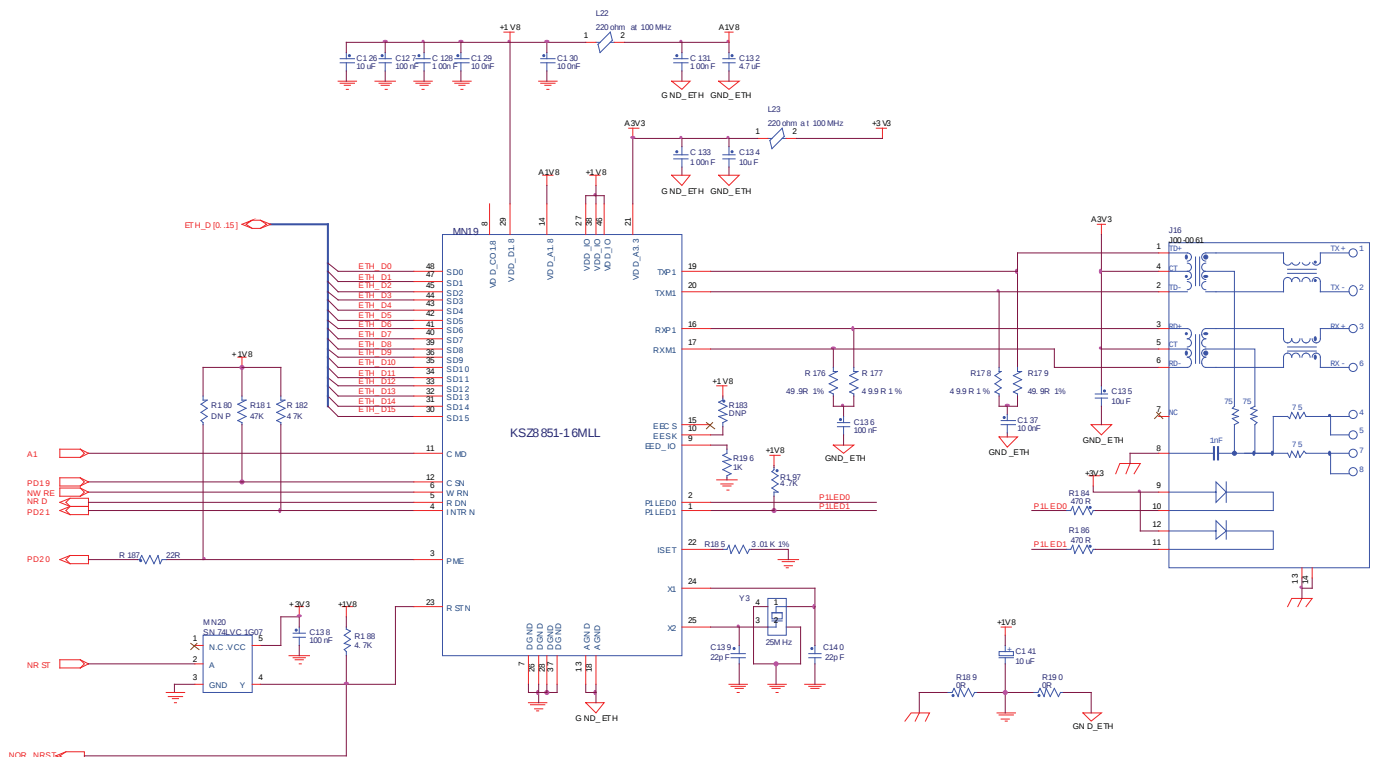


4.3.14 ETH on EBI

The SAM9N12/CN11 Evaluation Kit uses EBI-based 8-bit EMAC controller KSZ8851 to implement a 10/100 Ethernet access. The board integrates an RJ45 connector with embedded transformer, and two status LEDs.

For more information about the Ethernet controller device, refer to the Micrel KSZ8851 manufacturer's datasheet.

Figure 4-17. Ethernet



4.3.15 Audio

The SAM9N12/CN11-EK includes a WM8904 audio CODEC for digital sound input and output. This interface includes features and audio jacks for:

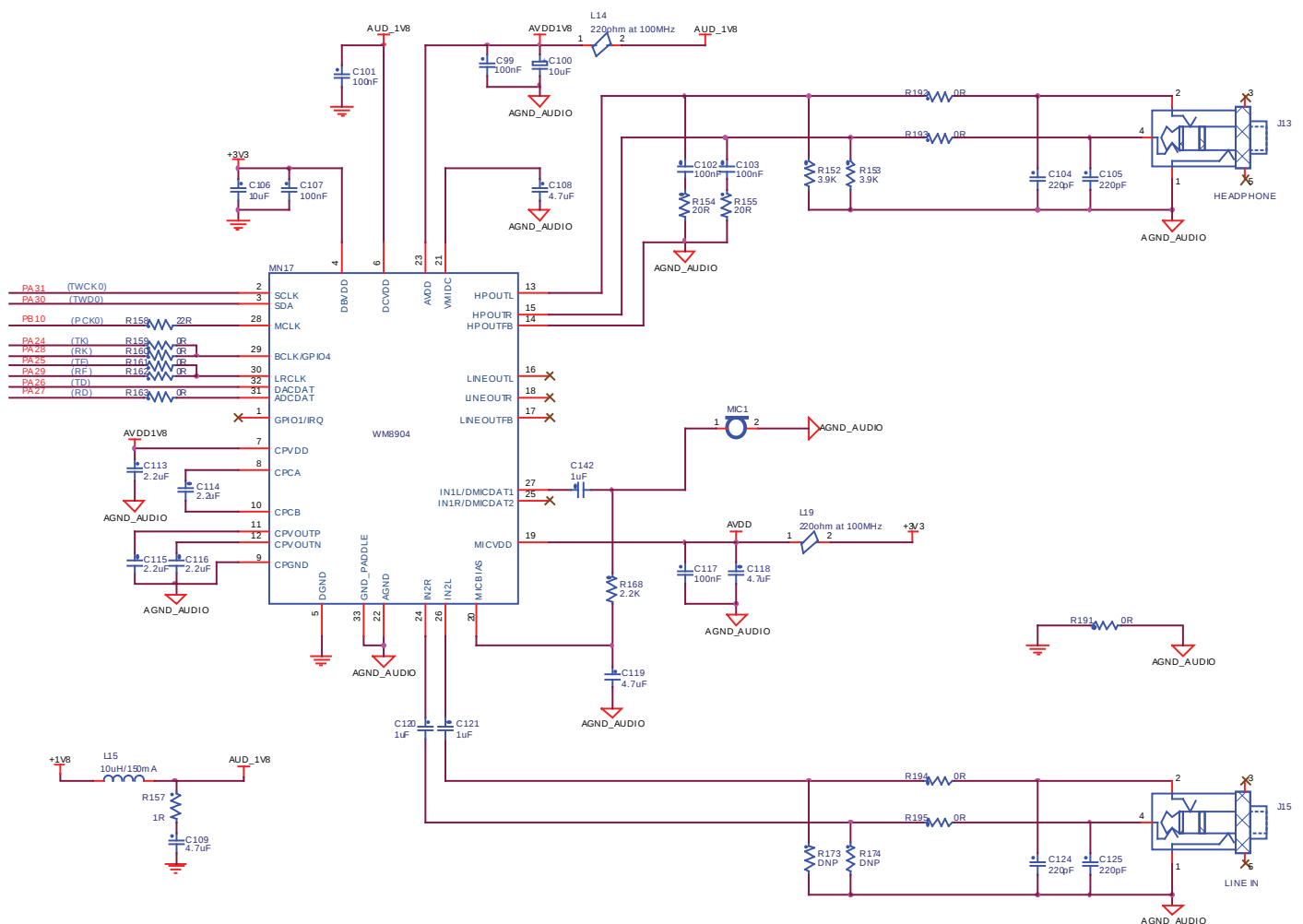
- Line In (J13)
- Headphone output (J15)
- Microphone on board

The SAM9N12/CN11 programmable clock output PCK0 is used to generate the WM8904 master clock (MCLK).

The bit clock is shared; it can be the SSC Transmitter Clock (TK) or the Receiver Clock (RK). The default setting on SAM9N12/CN11-EK is TK and RK shorted together through R159/R160. Please note that trying different ADC/DAC rates would mean different RK/TK rates; this default setting can be modified.

The 0-ohm resistors R159 to R163 have been implemented to offer a disconnection possibility (freeing these dedicated PIO lines for other custom usages).

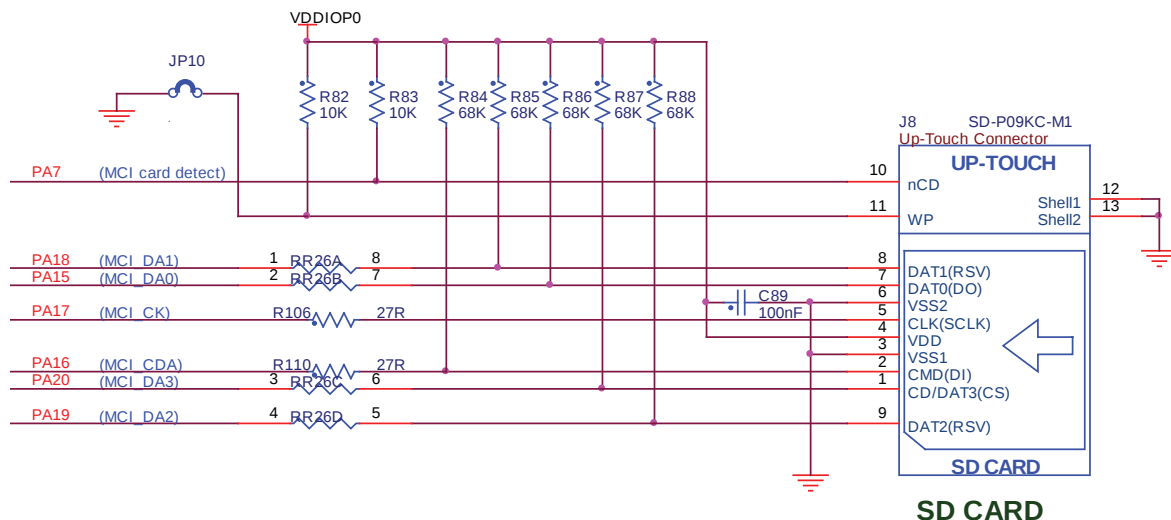
Figure 4-18. Audio CODEC



4.3.16 SD Card

The SAM9N12/CN11 has a high-speed Multimedia Card Interface (MCI). It is used as a 4-bit interface connected to an SD card slot.

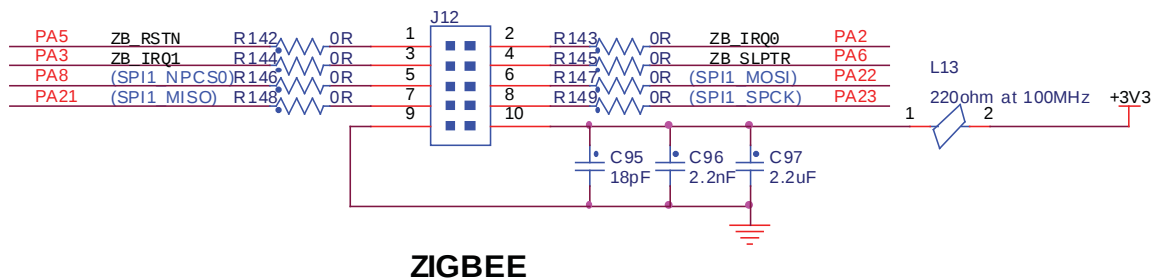
Figure 4-19. SD Card



4.3.17 ZigBee Interface

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, it enables their individual disconnection, should a conflict occur in user application.

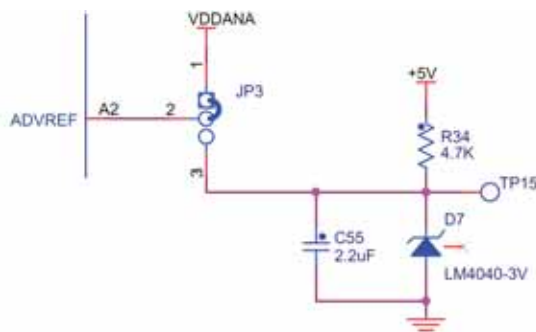
Figure 4-20. ZigBee



4.3.18 Analog Interface

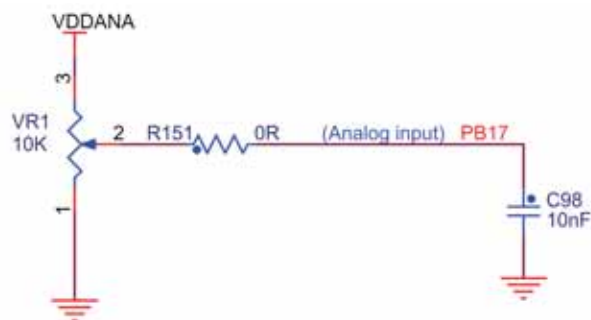
The 3.0V voltage reference is based on an LM4040 (Precision Micropower Shunt Voltage Reference). This ADVREF level can be set as 3.0V or 3.3V via the jumper JP3.

Figure 4-21. Analog Reference



A 10 kohm potentiometer (VR1) is connected to AD6 port PB17 to implement an easy access to ADC programming and debugging (or to implement an analog user control such as display brightness, volume, etc).

Figure 4-22. Potentiometer

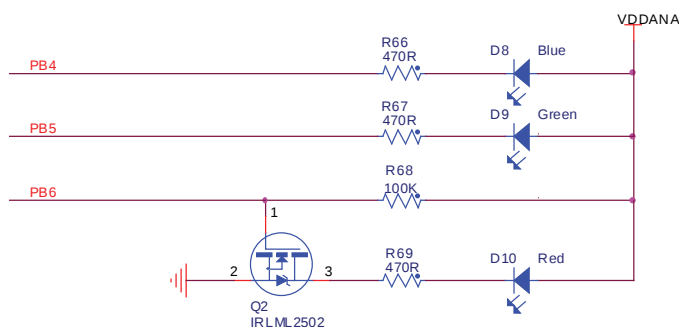


4.3.19 LED Indicators

There are three LEDs for general purpose on the SAM9N12/CN11-EK board:

- D8 blue and D9 green LEDs are user defined and controlled by the GPIO.
- D10 red LED is a power LED indicating that the 3.3V rail is enabled. It can also be controlled by the GPIO (by default, the GPIO is disabled and an on-board pull-up to 3.3V lights the LED).

Figure 4-23. LED



4.3.20 Push Buttons

SAM9N12/CN11-EK has three mechanical push buttons for system application (PB1 to PB3) and one for free use (PB4).

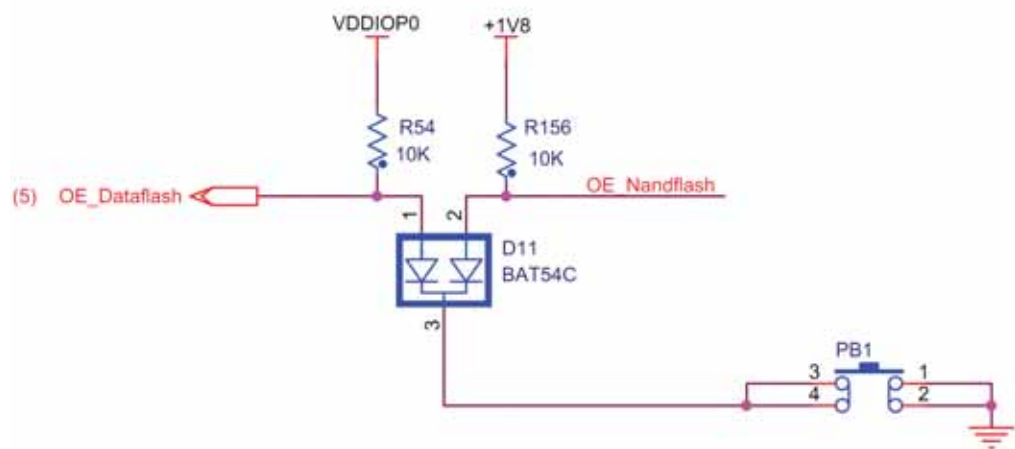
4.3.20.1 PB1 Output Enable Chip Select

Access to the RomBoot:

1. Press simultaneously the PBs OE-CS and NRST
2. Release the PB NRST
3. Then release PB OE-CS

The program boots to the ROM code whatever the contents of the NAND Flash or serial DataFlash. Please refer to SAM9N12/CN11 datasheet boot strategy for details.

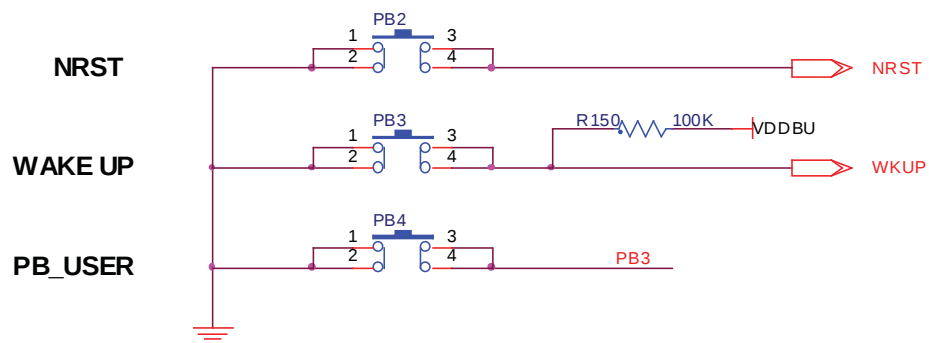
Figure 4-24. PB1



4.3.20.2 PB2 NRST

The NRST pin is bidirectional. It is handled by the on-chip reset controller and can be driven low to provide a reset signal to the external components, or be asserted low externally to reset the microcontroller. It will reset the core and the peripherals except for the backup region.

Figure 4-25. Push Button



4.3.21 Expansion Ports

Most of GPIOs are led to expansion ports J5, J6, J7.

LCD and touch screen connector include J9 and J10 to interface DM board.

Figure 4-26. PIO Expansion Ports

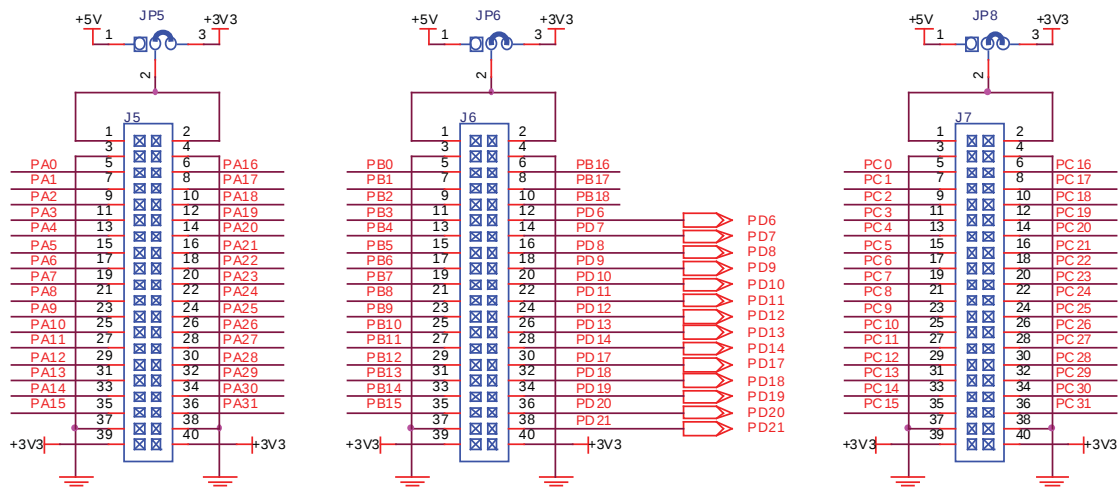
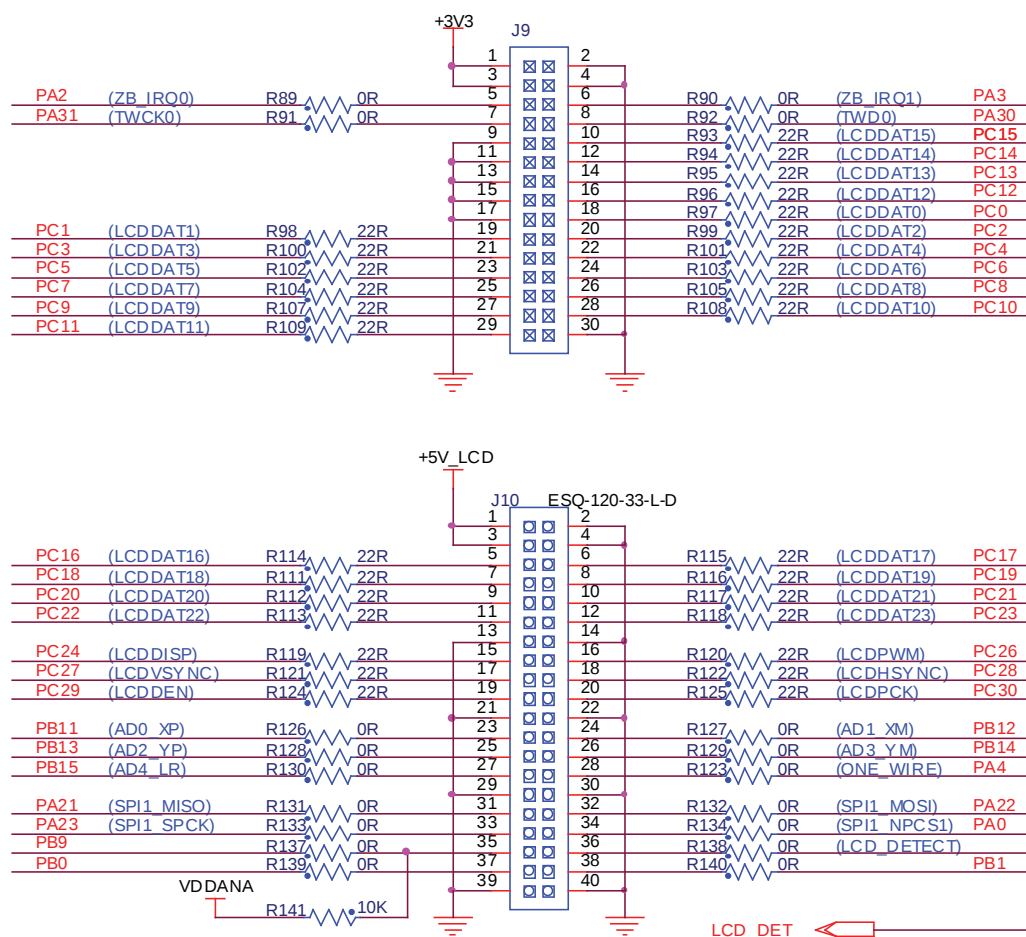


Figure 4-27. LCD Expansion Ports



4.3.22 PIO Usage

■ PIO A Pin Assignment

Table 4-3. PIO A Pin Assignment and Signal Descriptions

Signal	Alternate	Periph A	Periph B	Periph C	
PA0		TXD0	SPI1_NPCS1		(LCD connector)
PA1		RXD0	SPI0_NPCS2		
PA2		RTS0			ZB_IRQ0
PA3		CTS0			ZB_IRQ1
PA4		SCK0			One Wire
PA5		TXD1			ZB_RSTN
PA6		RXD1			ZB_SLPTR
PA7		TXD2	SPI0_NPCS1		MCI card detect
PA8		RXD2	SPI1_NPCS0		ZigBee
PA9		DRXD			DBGU
PA10		DTXD			DBGU
PA11		SPI0_MISO	MCI_DA4		Serial DataFlash
PA12		SPI0_MOSI	MCI_DA5		Serial DataFlash
PA13		SPI0_SPCK	MCI_DA6		Serial DataFlash
PA14		SPI0_NPCS0	MCI_DA7		Serial DataFlash
PA15		MCI_DA0			MCI
PA16		MCI_CDA			MCI
PA17		MCI_CK			MCI
PA18		MCI_DA1			MCI
PA19		MCI_DA2			MCI
PA20		MCI_DA3			MCI
PA21		TIOA0	SPI1_MISO		ZigBee
PA22		TIOA1	SPI1_MOSI		ZigBee
PA23		TIOA2	SPI1_SPCK		ZigBee
PA24		TCLK0	TK		Audio
PA25		TCLK1	TF		Audio
PA26		TCLK2	TD		Audio
PA27		TIOB0	RD		Audio
PA28		TIOB1	RK		Audio
PA29		TIOB2	RF		Audio
PA30		TWD0	SPI1_NPCS3		Audio & LCD connector
PA31		TWCK0	SPI1_NPCS2		Audio & LCD connector



■ PIO B Pin Assignment

Table 4-4. PIO B Pin Assignment and Signal Descriptions

Signal	Alternate	Periph A	Periph B	Periph C	
PB0			RTS2		(LCD connector)
PB1			CTS2		(LCD connector)
PB2			SCK2		JUMPER to GND
PB3			SPI0_NPCS3		PB_USER1
PB4					USER_LED1
PB5					USER_LED2
PB6	AD7				PWR_LED
PB7	AD8				EN5V_HOST
PB8	AD9				OVCUR_USB
PB9	AD10		PCK1		(LCD connector)
PB10	AD11		PCK0		Audio
PB11	AD0		PWM0		TSC
PB12	AD1		PWM1		TSC
PB13	AD2		PWM2		TSC
PB14	AD3		PWM3		TSC
PB15	AD4				(TSC)
PB16	AD5				VBUS_SENSE
PB17	AD6				Analog input
PB18		IRQ	ADTRG		LCDHSYNC (+0R)

■ PIO C Pin Assignment

Table 4-5. PIO C Pin Assignment and Signal Descriptions

Signal	Alternate	Periph A	Periph B	Periph C	
PC0		LCDDAT0		TWD1	LCD
PC1		LCDDAT1		TWCK1	LCD
PC2		LCDDAT2		TIOA3	LCD
PC3		LCDDAT3		TIOB3	LCD
PC4		LCDDAT4		TCLK3	LCD
PC5		LCDDAT5		TIOA4	LCD
PC6		LCDDAT6		TIOB4	LCD
PC7		LCDDAT7		TCLK4	LCD
PC8		LCDDAT8		UTXD0	LCD
PC9		LCDDAT9		URXD0	LCD
PC10		LCDDAT10		PWM0	LCD
PC11		LCDDAT11		PWM1	LCD
PC12		LCDDAT12		TIOA5	LCD
PC13		LCDDAT13		TIOB5	LCD
PC14		LCDDAT14		TCLK5	LCD
PC15		LCDDAT15		PCK0	LCD
PC16		LCDDAT16		UTXD1	LCD
PC17		LCDDAT17		URXD1	LCD
PC18		LCDDAT18		PWM0	LCD
PC19		LCDDAT19		PWM1	LCD
PC20		LCDDAT20		PWM2	LCD
PC21		LCDDAT21		PWM3	LCD
PC22		LCDDAT22	TXD3		LCD
PC23		LCDDAT23	RXD3		LCD
PC24		LCDDISP	RTS3		LCD
PC25			CTS3		EN5V_LCD
PC26		LCDPWM	SCK3		LCD
PC27		LCDVSYNC		RTS1	LCD
PC28		LCDHSYNC		CTS1	LCD
PC29		LCDDEN		SCK1	LCD
PC30		LCDPCK			LCD
PC31		FIQ		PCK1	OVCUR_LCD

■ PIO D Pin Assignment

Table 4-6. PIO D Pin Assignment and Signal Descriptions

Signal	Alternate	Periph A	Periph B	Periph C	
PD0		NANDOE			NAND Flash
PD1		NANDWE			NAND Flash
PD2		A21/NANDALE			NAND Flash
PD3		A22/NANDCLE			NAND Flash
PD4		NCS3			NAND Flash
PD5		NWAIT			
PD6		D16			NAND Flash
PD7		D17			NAND Flash
PD8		D18			NAND Flash
PD9		D19			NAND Flash
PD10		D20			NAND Flash
PD11		D21			NAND Flash
PD12		D22			NAND Flash
PD13		D23			NAND Flash
PD14		D24			
PD15		D25	A20		
PD16		D26	A23		
PD17		D27	A24		
PD18		D28	A25		
PD19		D29	NCS2		
PD20		D30	NCS4		
PD21		D31	NCS5		ETH INT

4.4 Connectors

4.4.1 Power Supply

Figure 4-28. Power Supply Connector J1

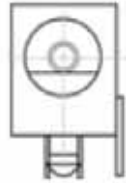


Table 4-7. Power Supply Connector J1 Signal Descriptions

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

4.4.2 JTAG/ICE Connector

Figure 4-29. JTAG J4

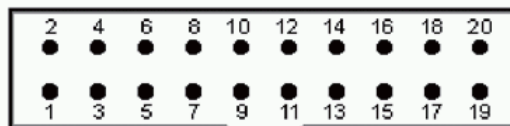


Table 4-8. JTAG/ICE Connector J4 Signal Descriptions

Pin	Mnemonic	Signal 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.

Table 4-8. JTAG/ICE Connector J4 Signal Descriptions

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

4.4.3 DBGU

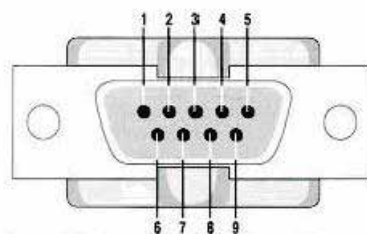
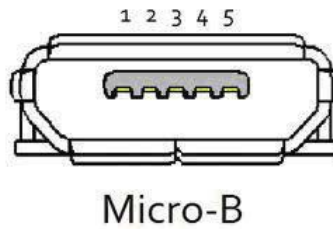
Figure 4-30. DBGU Connector J11

Table 4-9. DBGU Connector J11 Signal Descriptions

Pin	Mnemonic	PIO (Via translator)	Description
1, 4, 6, 9			No connection
2	RXD (Received Data)	PA9	RS232 serial data output signal
3	TXD (Transmitted Data)	PA10	RS232 serial data input signal
5	GND		Common ground
7	RTS (Request To Send)		Not used
8	CTS (Clear To Send)		Not used
Mechanical pins			Shield

4.4.4 USB MicroB

Figure 4-31. USB Device Micro B Connector J3



Micro-B

Table 4-10. USB Device Micro B Connector J3 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
6, 7, 8, 9	Shield	Mechanical pins

4.4.5 USB Type A port

Figure 4-32. USB Type A Port J2

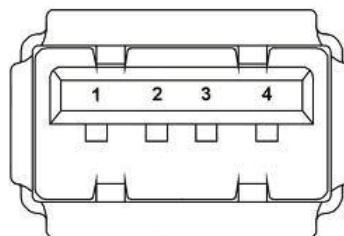


Table 4-11. USB Type A Port J2 Signal Descriptions

Pin	Mnemonic	Description
1	Vbus	5V power
2	DM	Data minus
3	DP	Data plus
4	GND	Common ground
5, 6	Shield	Mechanical pins

4.4.6 SD Card MCI

Figure 4-33. SD/MMC Socket J8

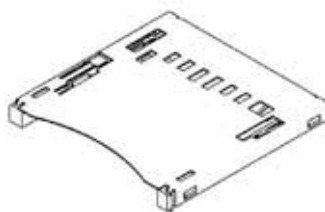


Table 4-12. SD Socket J8 Signal Descriptions

Pin	Function	PIO
1	MCI_DA3	PA20
2	MCI_CMD	PA16
3	GND	
4	VDDIOP0	
5	MCI_CLK	PA17
6	GND	
7	MCI_DA0	PA15
8	MCI_DA1	PA18
9	MCI_DA2	PA19
10	MCI_CD	PA7
11	WP	
12	GND	
13	GND	

4.4.7 Ethernet RJ45 Socket

Figure 4-34. Ethernet RJ45 Socket J16

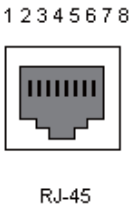


Table 4-13. RJ45 Socket J16 Signal Descriptions

Pin	Mnemonic	Description
1	TX+	Differential output plus
2	TX-	Differential output minus
3	RX+	Differential input plus
4	Reserved	
5	Reserved	
6	RX-	Differential input minus
7	Reserved	
8	Reserved	

4.4.8 Zigbee Socket J12

Figure 4-35. Zigbee Socket J12

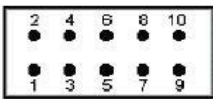


Table 4-14. Zigbee Socket J12 Signal Descriptions

Function	Signal Name	Port	Pin	Pin	Port	Signal Name	Function
Reset	/RST		1	2		IRQ0	Interrupt Request
Interrupt Request	IRQ1		3	4		SLP_TR	SLP_TR
SPI chip select	/CS		5	6		MOSI	SPI MOSI
SPI MISO	MISO		7	8		SCLK	SPI CLK
Power Supply	GND	GND	9	10	VCC	VCC	VCC

4.4.9 LCD Socket

Figure 4-36. LCD Socket J9

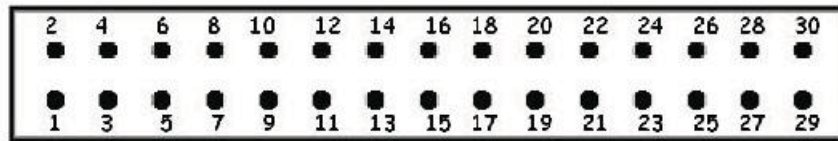


Table 4-15. LCD Socket J9 Signal Descriptions

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
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

Figure 4-37. LCD Socket J10

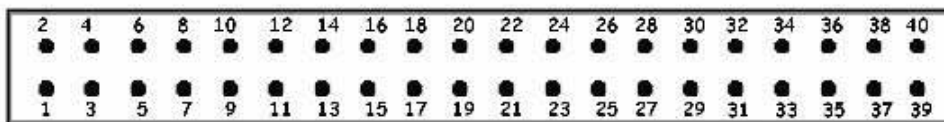


Table 4-16. LCD Socket J10 Signal Descriptions

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

4.4.10 IO Expansion Port

Figure 4-38. IO Expansion Socket J5

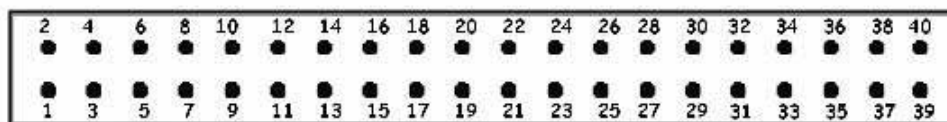


Table 4-17. IO Expansion Socket J5 Signal Descriptions

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	

Figure 4-39. IO Expansion Socket J6

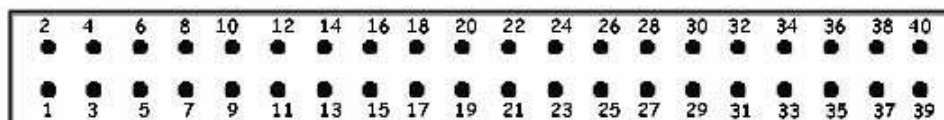


Table 4-18. IO Expansion Socket J6 Signal Descriptions

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		PD6
PB4		13	14		PD7
PB5		15	16		PD8
PB6		17	18		PD9
PB7		19	20		PD10
PB8		21	22		PD11
PB9		23	24		PD12
PB10		25	26		PD13
PB11		27	28		PD14
PB12		29	30		PD17
PB13		31	32		PD18
PB14		33	34		PD19
PB15		35	36		PD20
	GND	37	38		PD21
	3V3	39	40	3V3	

Figure 4-40. IO Expansion Socket J7

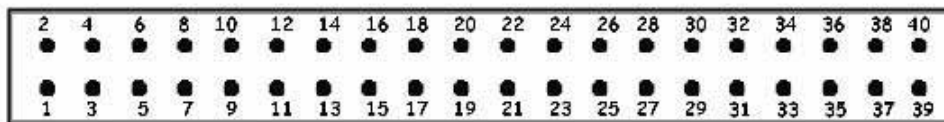


Table 4-19. IO Expansion Socket J7 Signal Descriptions

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	



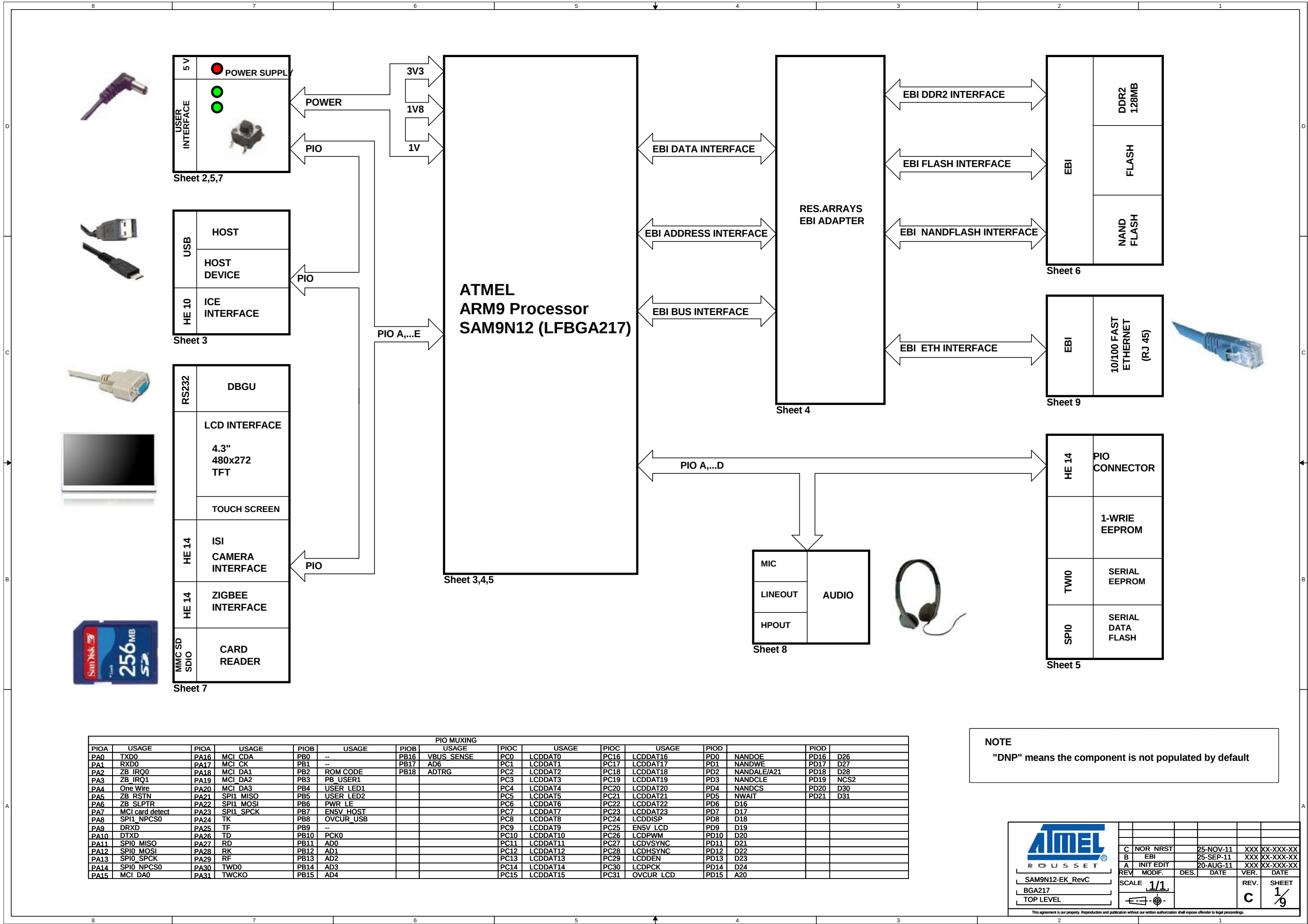
Section 5

EK Schematics

5.1 SAM9N12-EK Schematics

This section contains the following schematics:

- Top Level
- Power Supply
- AT91SAM9N12
- EBI Interface
- PIO Interfaces
- DDR2 NAND Flash
- Serial Interfaces
- Audio
- ETH





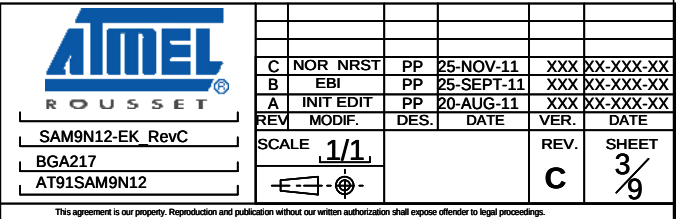
J1
Jack 2.1mm

SF1812 2A

DC +5V

5

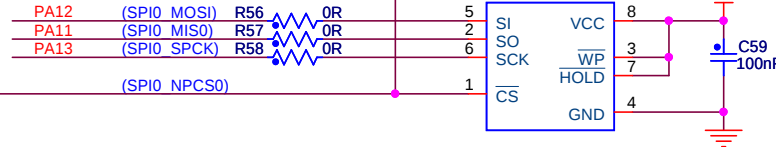
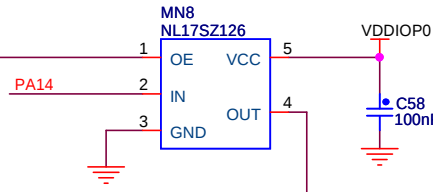
								
	C	NOR NRST	PP	25-NOV-11	XXX	XX-XXX-XX		
	B	EBI	PP	25-SEPT-11	XXX	XX-XXX-XX		
	A	INIT EDIT	PP	20-AUG-11	XXX	XX-XXX-XX		
	REV	MODIF.	DES.	DATE	VER.	DATE		
SAM9N12-EK RevC	SCALE <u>1/1</u>					REV. C	SHEET 2/9	
BGA217								
POWER SUPPLY								
This agreement is our property. Reproduction and publication without our written authorization shall expose offender to legal proceedings.								



MN7B SAM9N12_LBGA217 - PIOA	
PA0/TXD0/SPI1_NPCS1	T3 PA0
PA1/RXD0/SPI0_NPCS2	U2 PA1
PA2/RTS0	U3 PA2
PA3/CTS0	P4 PA3
PA4/SCK0	T4 PA4
PA5/TXD1	U4 PA5
PA6/RXD1	P5 PA6
PA7/TXD2/SPI0_NPCS1	R4 PA7
PA8/RXD2/SPI1_NPCS0	U6 PA8
PA9/DRXD	R5 PA9
PA10/DTXD	R6 PA10
PA11/SPI0_MISO/MCI_DA4	T5 PA11
PA12/SPI0_MOSI/MCI_DA5	T6 PA12
PA13/SPI0_SPCK/MCI_DA6	U5 PA13
PA14/SPI0_NPCS0/MCI_DA7	U7 PA14
PA15/MCI_DA0	T7 PA15
PA16/MCI_CDA	R7 PA16
PA17/MCI_CK	U8 PA17
PA18/MCI_DA1	P8 PA18
PA19/MCI_DA2	T8 PA19
PA20/MCI_DA3	U9 PA21
PA21/TIOA0/SPI1_MISO	U10 PA22
PA22/TIOA1/SPI1_MOSI	T9 PA23
PA23/TIOA2/SPI1_SPCK	U11 PA24
PA24/TCLK0/TK	T10 PA25
PA25/TCLK1/TF	R9 PA26
PA26/TCLK2/TD	U12 PA27
PA27/TIOB0/RD	T11 PA28
PA28/TIOB1/RK	U13 PA29
PA29/TIOB2/RF	R10 PA30
PA30/TWD0/SPI1_NPCS3	T12 PA31
PA31/TWCK0/SPI1_NPCS2	

PA[0..31] (7,8)

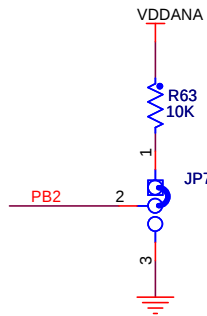
(6) OE_Dataflash



SERIAL DATAFLASH

MN7C SAM9N12_LBGA217 - PIOB	
PB0/RTS2	F3 PB0
PB1/CTS2	F4 PB1
PB2/SCK2	F2 PB2
PB3/SPI0_NPCS3	G4 PB3
PB4	G3 PB4
PB5	D2 PB5
PB6/AD7	E2 PB6
PB7/AD8	D1 PB7
PB8/AD9	F1 PB8
PB9/AD10/PCK1	E1 PB9
PB10/AD11/PCK0	A1 PB10
PB11/AD0/PWM0	C3 PB11
PB12/AD1/PWM1	B1 PB12
PB13/AD2/PWM2	C2 PB13
PB14/AD3/PWM3	D3 PB14
PB15/AD4	C1 PB15
PB16/AD5	E3 PB16
PB17/AD6	D4 PB17
PB18/IRQ/ADTRG	D4 PB18

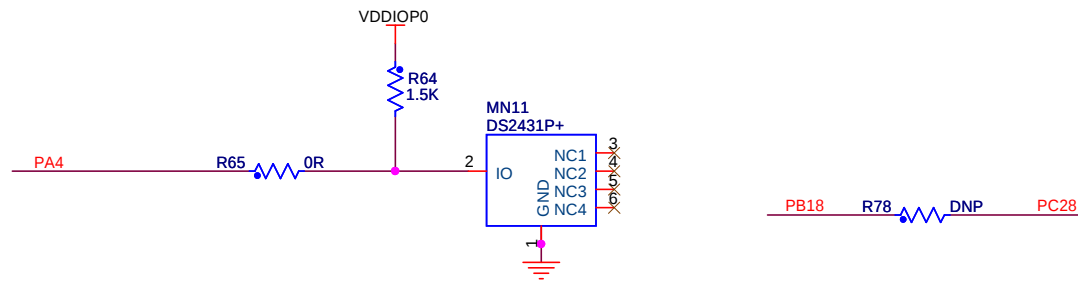
PB[0..18] (3,7,8)



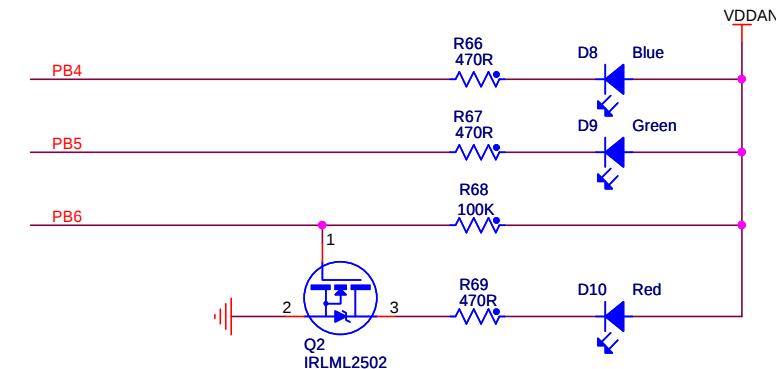
SERIAL EEPROM

MN7D SAM9N12_LBGA217 - PIOC	
PC0/LCDDAT0/TWD1	G2 PC0
PC1/LCDDAT1/TWCK1	G1 PC1
PC2/LCDDAT2/TIOA3	H4 PC2
PC3/LCDDAT3/TIOB3	J1 PC3
PC4/LCDDAT4/TCLK3	H3 PC4
PC5/LCDDAT5/TIOA4	J3 PC5
PC6/LCDDAT6/TIOB4	H2 PC6
PC7/LCDDAT7/TCLK4	H1 PC7
PC8/LCDDAT8/UTXD0	K2 PC8
PC9/LCDDAT9/URXD0	J2 PC9
PC10/LCDDAT10/PWM0	L1 PC10
PC11/LCDDAT11/PWM1	K1 PC11
PC12/LCDDAT12/TIOA5	L2 PC12
PC13/LCDDAT13/TIOB5	K3 PC13
PC14/LCDDAT14/TCLK5	M1 PC14
PC15/LCDDAT15/PCK0	M2 PC15
PC16/LCDDAT16/UTXD1	K4 PC16
PC17/LCDDAT17/URXD1	M3 PC17
PC18/LCDDAT18/PWM0	N1 PC18
PC19/LCDDAT19/PWM1	N2 PC19
PC20/LCDDAT20/PWM2	N3 PC20
PC21/LCDDAT21/PWM3	P1 PC21
PC22/LCDDAT22/TXD3	P2 PC22
PC23/LCDDAT23/RXD3	P3 PC23
PC24/LCDDISP/RTS3	R1 PC24
PC25//CTS3	R3 PC25
PC26/LCDPWM/SCK3	R2 PC26
PC27/LCDVSYNC//RTS1	T1 PC27
PC28/LCDHSYNC//CTS1	M4 PC28
PC29/LCDDEN//SCK1	N4 PC29
PC30/LCDPCK	T2 PC30
PC31/FIQ//PCK1	U1 PC31

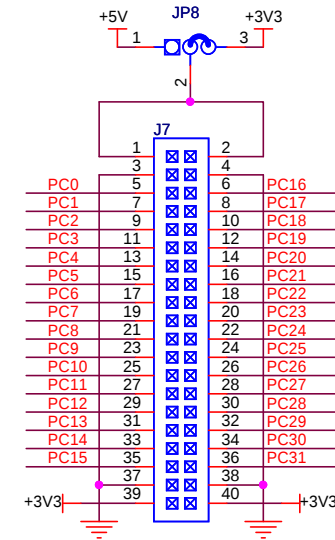
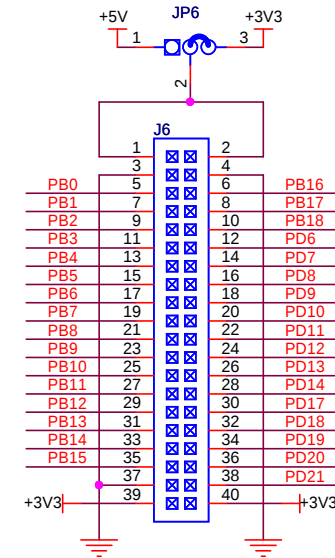
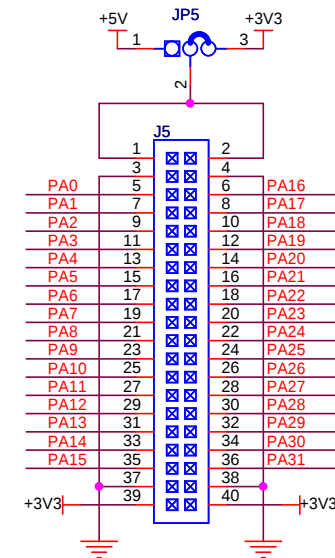
PC[0..31] (3,7)



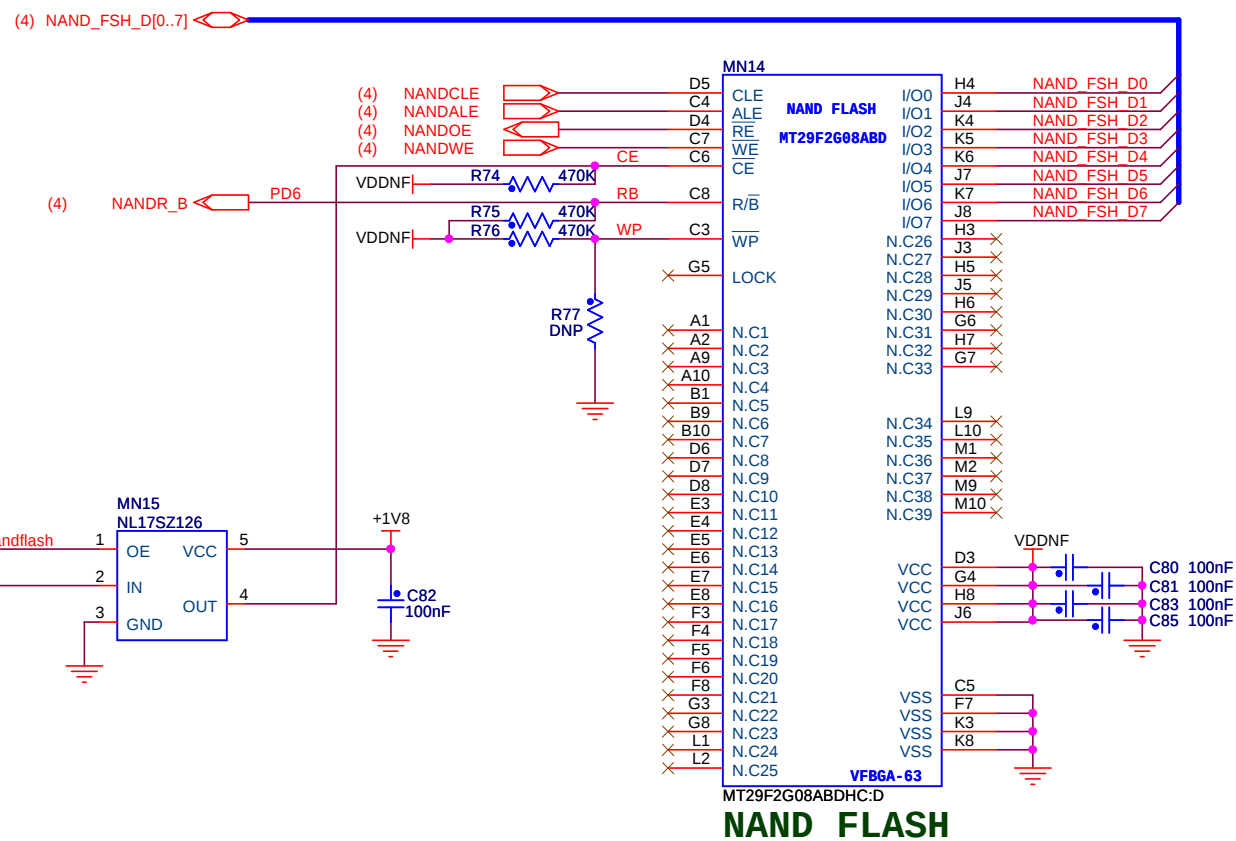
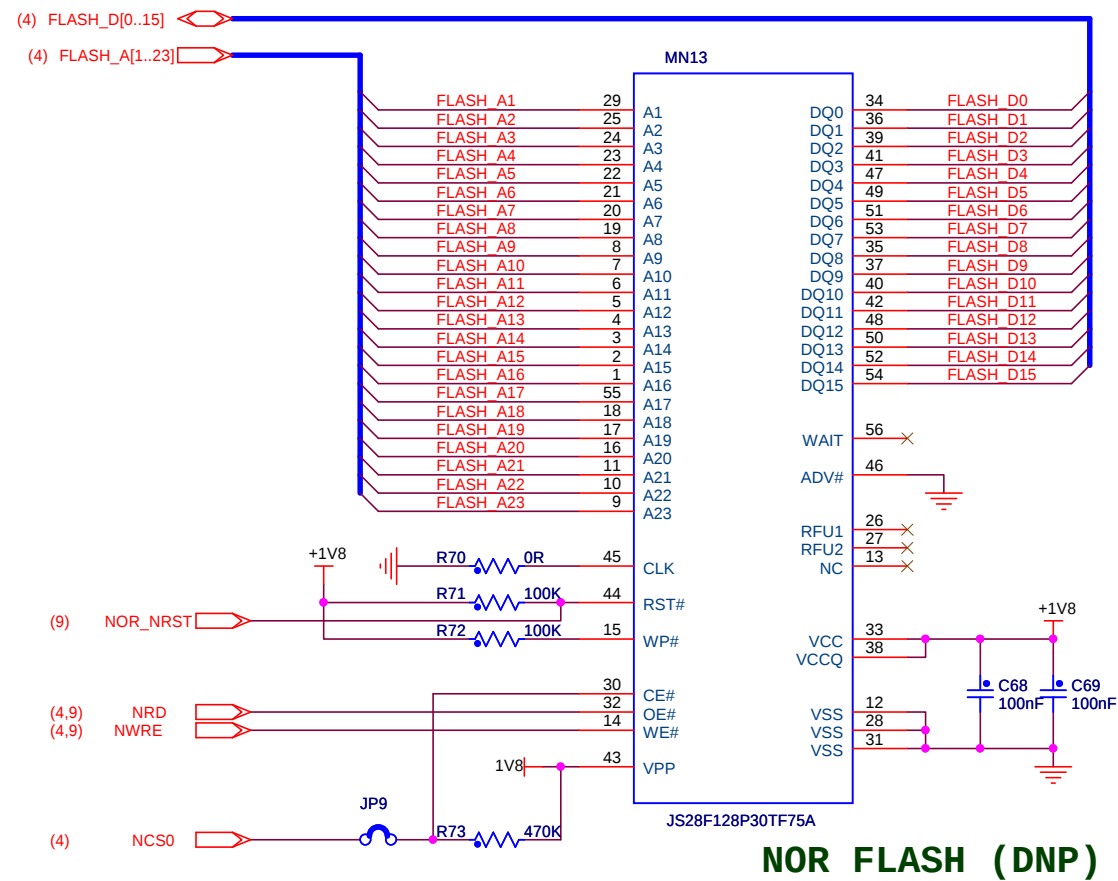
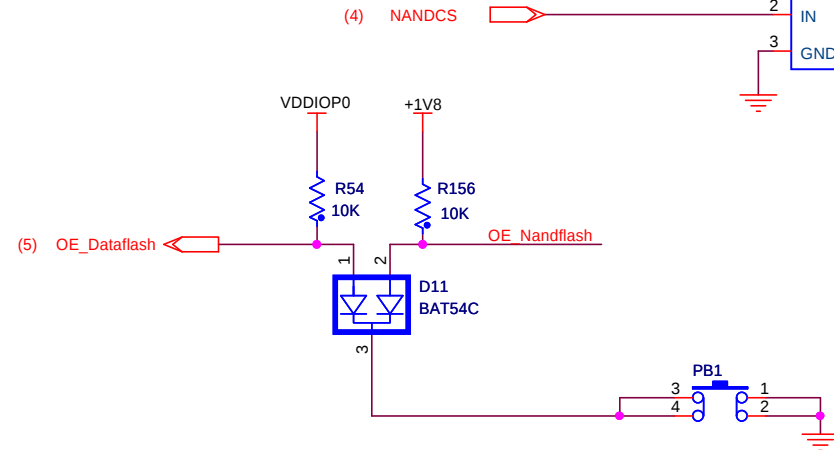
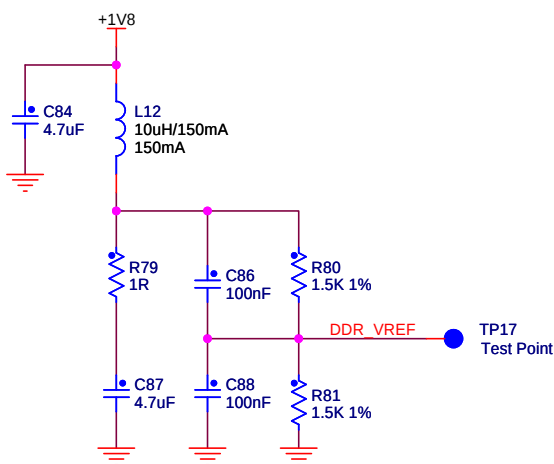
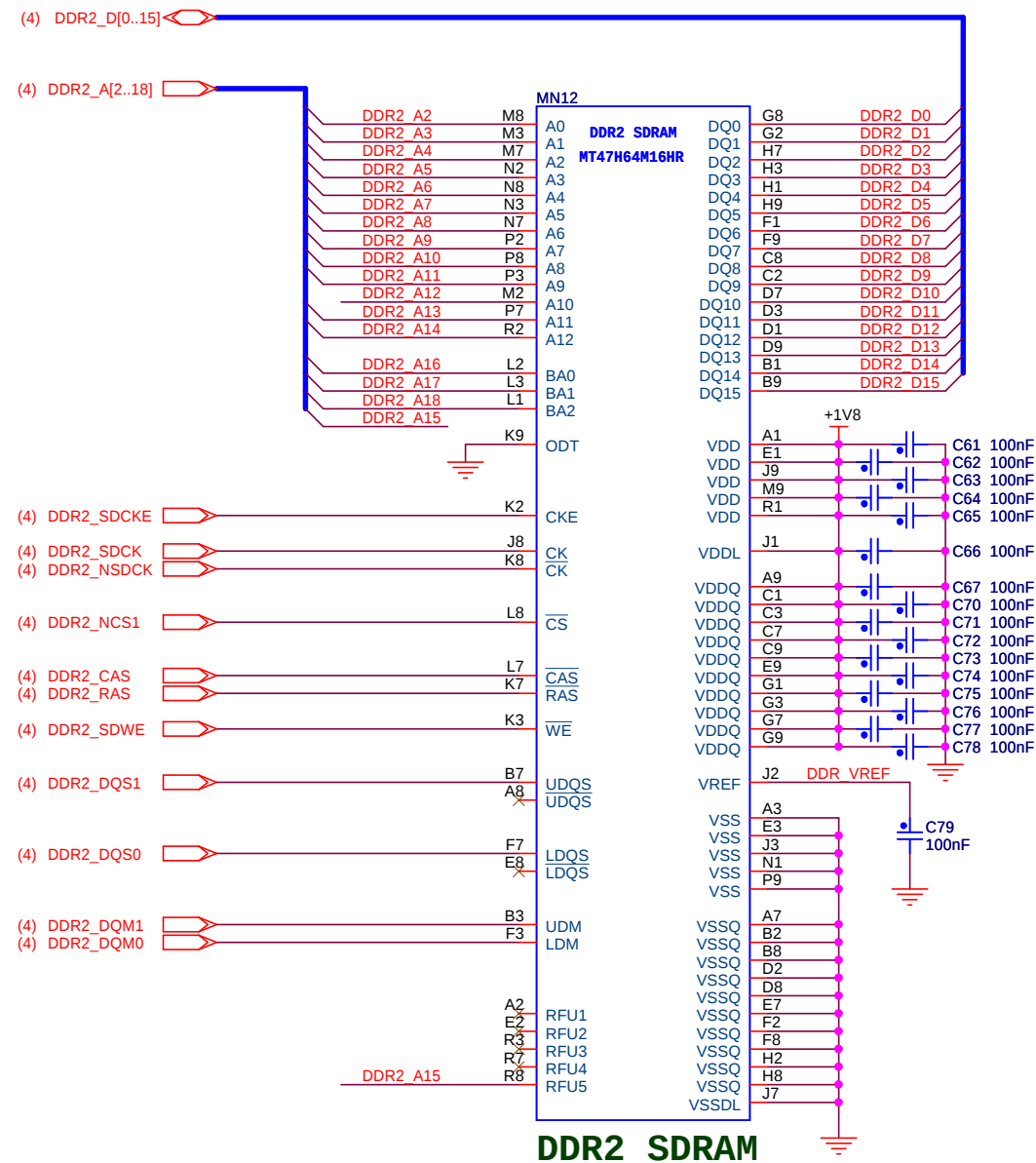
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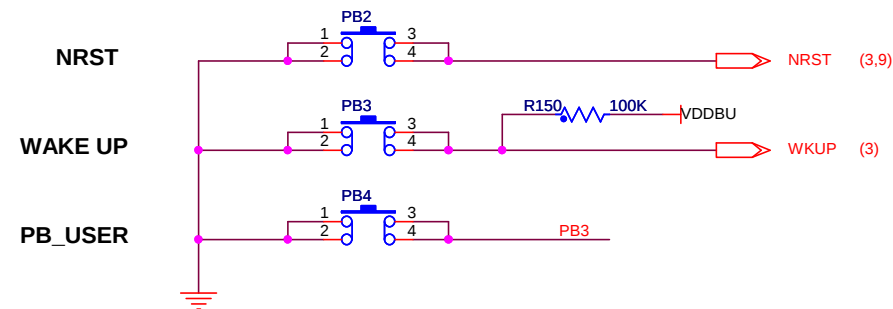
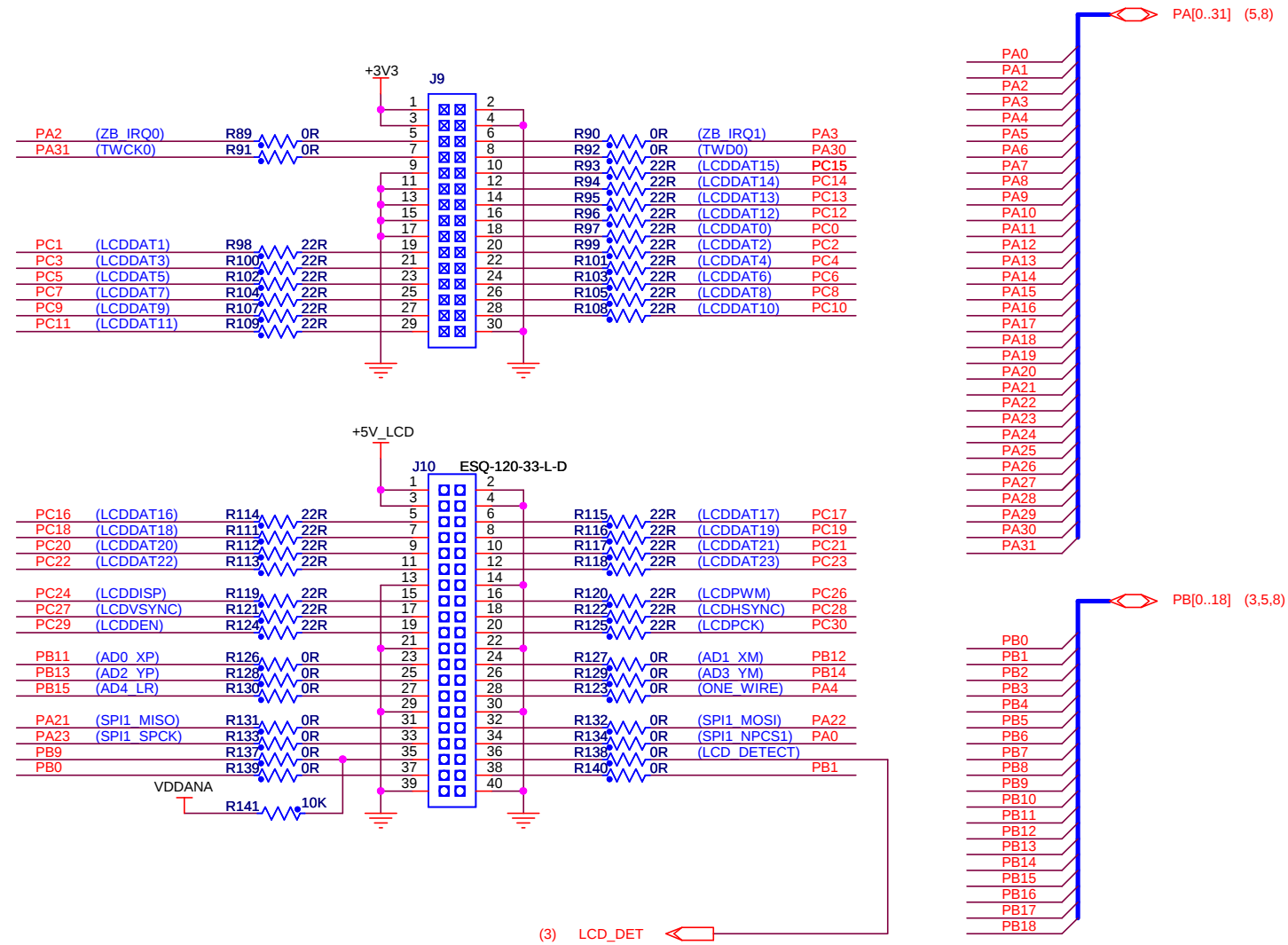
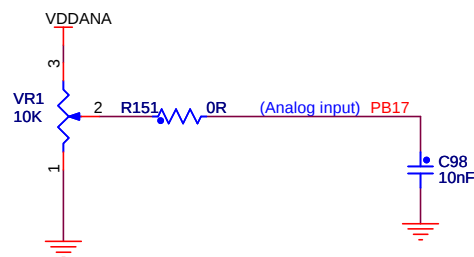
LED



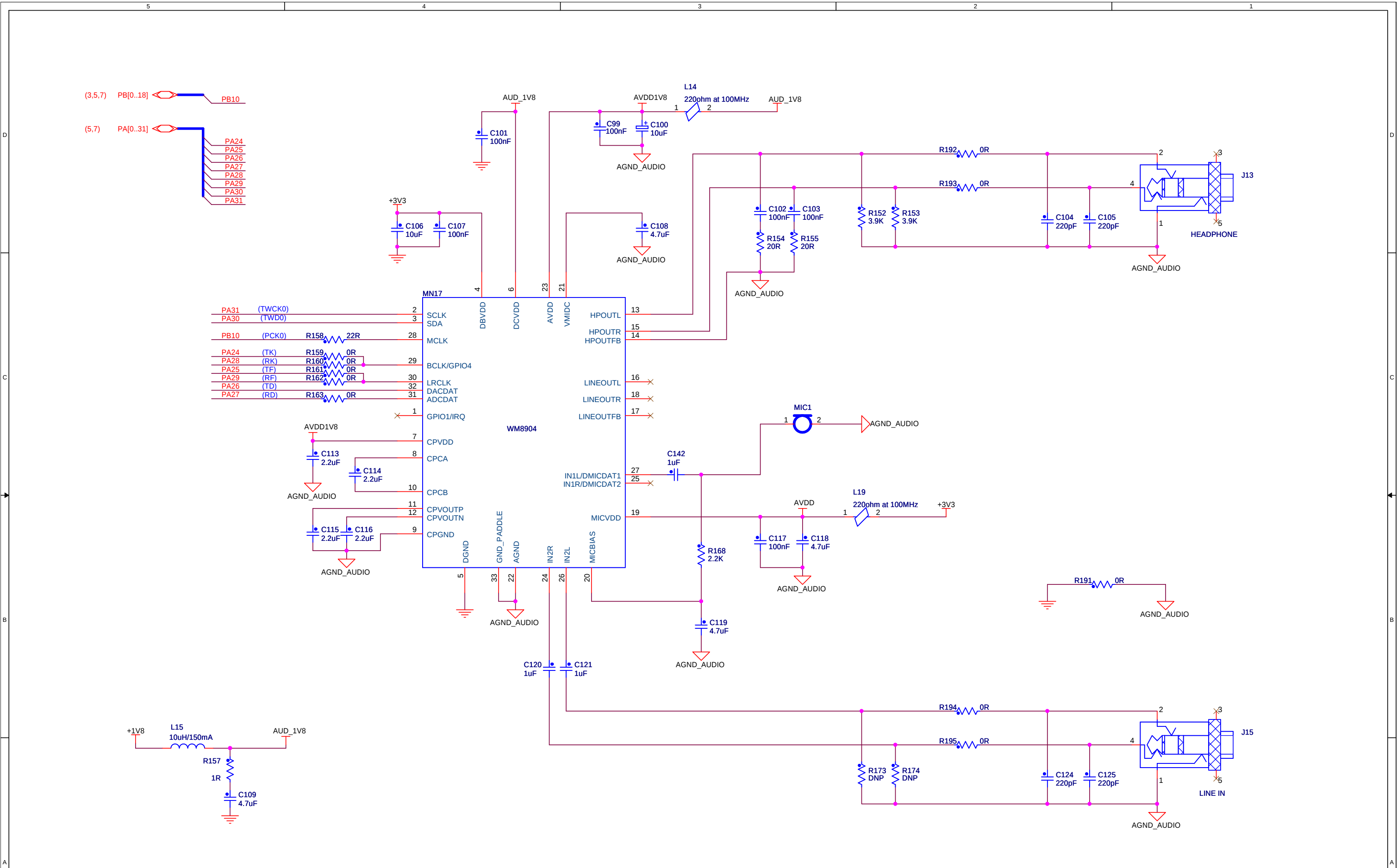
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B EBI		PP 25-SEPT-11		XXX KX-XXX-XX		XXX KX-XXX-XX	
A INIT EDIT		PP 20-AUG-11		XXX KX-XXX-XX		XXX KX-XXX-XX	
REV	MODIF.	DES.	DATE	VER.	DATE	REV.	SHEET
BGA217	SCALE 1/1					C	5/9
PIO_INTERFACES							

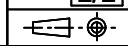


ATMEL							
ROUSSET							
SAM9N12-EK RevC		C	NOR NRST	PP	25-NOV-11	XXX	XX-XXX-XX
BGA217		B	EBI	PP	25-SEPT-11	XXX	XX-XXX-XX
DDR2 NAND FLASH		A	INIT EDIT	PP	20-AUG-11	XXX	XX-XXX-XX
		REV	MODIF.	DES.	DATE	VER.	DATE
		SCALE	1/1				
						REV.	SHEET
						C	6/9



							
	C	NOR NRST	PP	25-NOV-11	XXX	XX-XXX-XX	
	B	EBI	PP	25-SEPT-11	XXX	XX-XXX-XX	
	A	INIT EDIT	PP	20-AUG-11	XXX	XX-XXX-XX	
	REV	MODIF.	DES.	DATE	VER.	DATE	
SAM9N12-EK RevC	SCALE	<u>1/1</u>			REV.	SHEET	
BGA217					C	7/9	
SERIAL INTERFACES							
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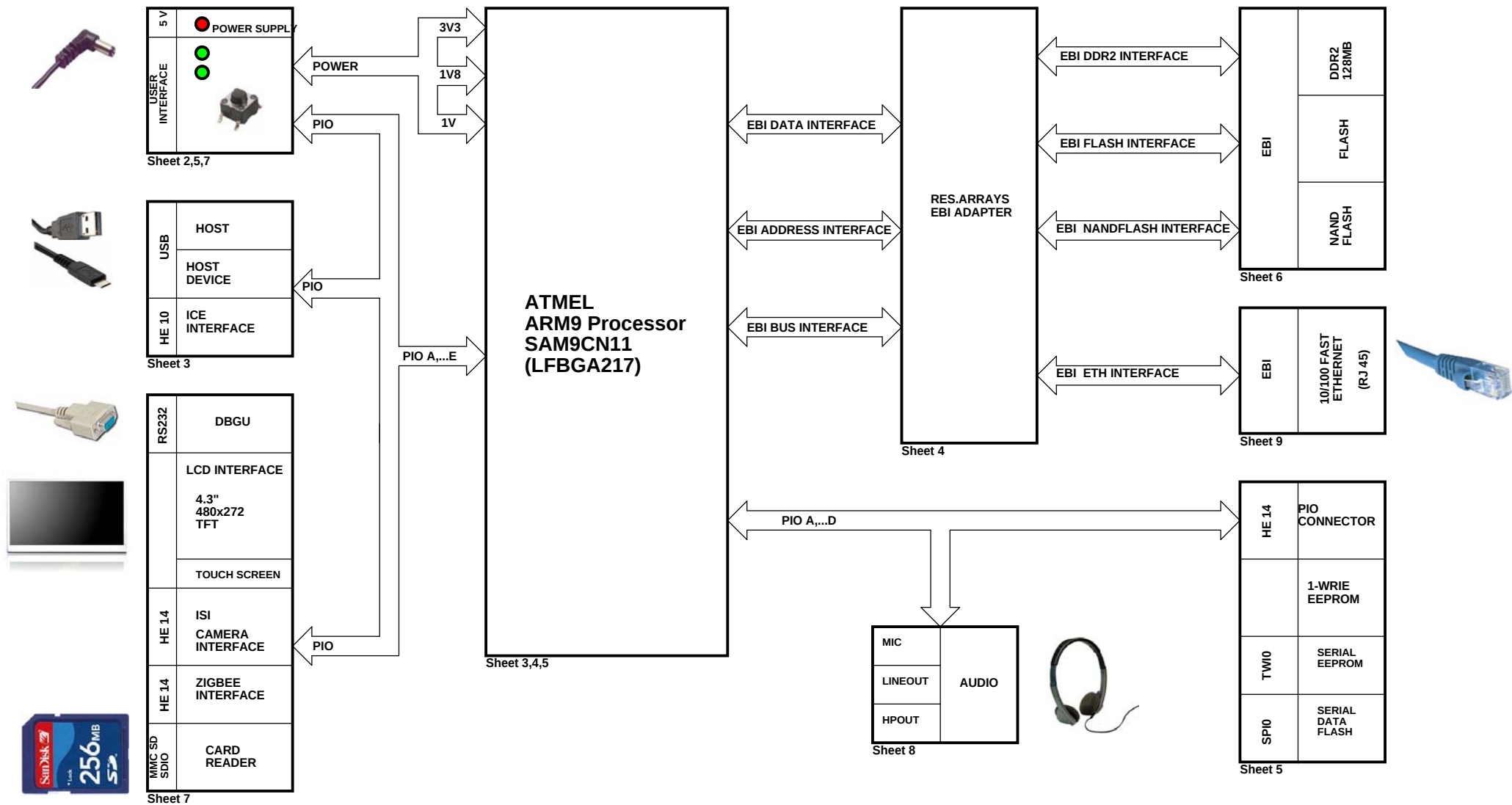


 SAM9N12-EK_RevC BGA217 AUDIO	C NOR NRST PP 25-NOV-11 XXX XX-XXX-XX				
	B EBI PP 25-SEPT-11 XXX XX-XXX-XX				
	A INIT EDIT PP 20-AUG-11 XXX XX-XXX-XX				
	REV	MODIF.	DES.	DATE	
SCALE 1/1				REV.	SHEET
				C	8/9
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5.2 SAM9CN11-EK Schematics

This section contains the following schematics:

- Block Diagram
- Power Supply
- AT91SAM9CN11
- EBI Interface
- PIO Interfaces
- DDR2 NAND Flash
- Serial Interfaces
- Audio
- ETH

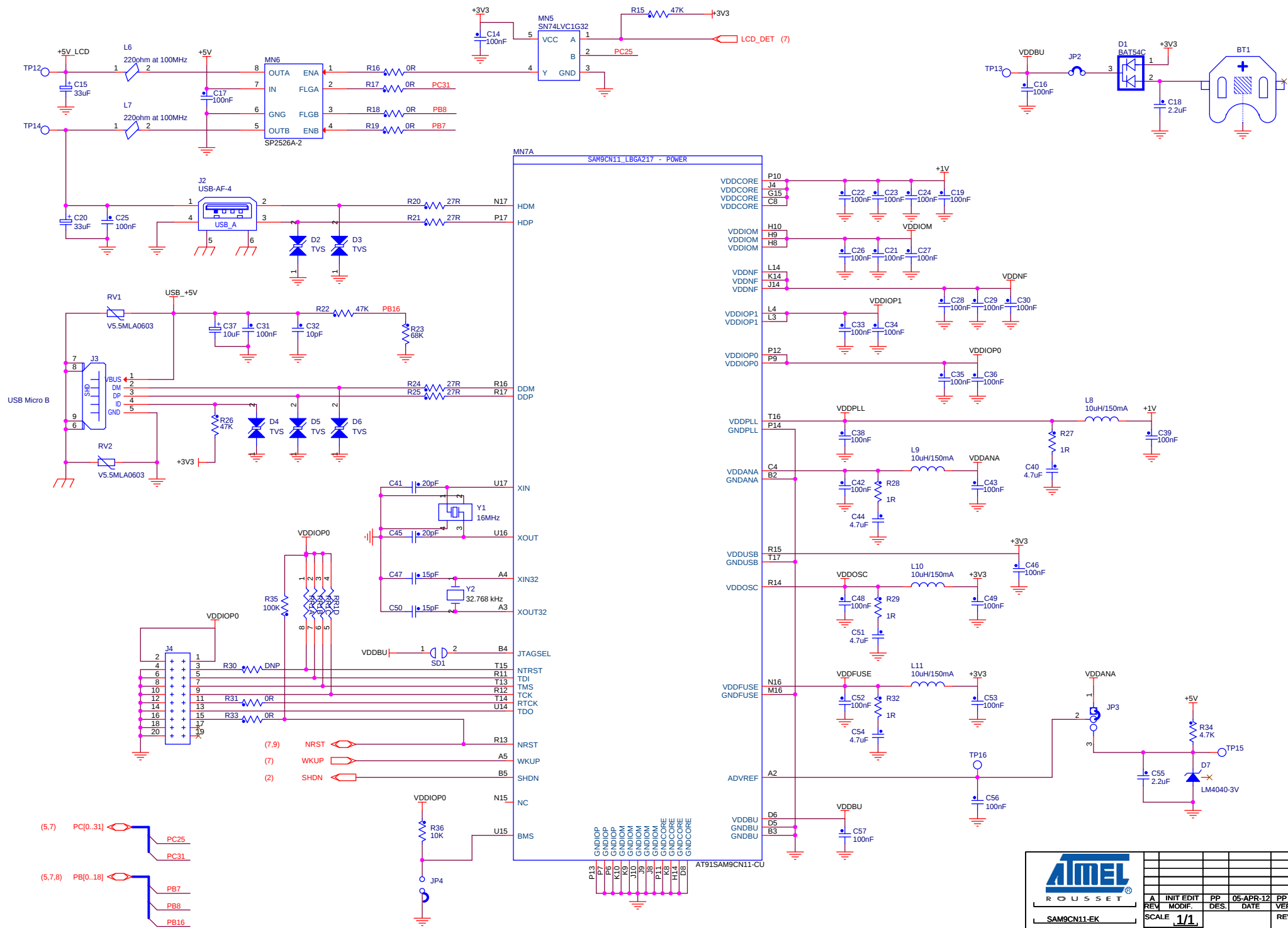


PIO MUXING											
PIOA	USAGE	PIOA	USAGE	PIOB	USAGE	PIOB	USAGE	PIOC	USAGE	PIOD	USAGE
PA0	TXD0	PA16	MCI CDA	PB0	--	PB16	VBUS_SENSE	PC0	LCDDAT0	PD0	NANDOE
PA1	RXD0	PA17	MCI CK	PB1	--	PB17	AD6	PC1	LCDDAT1	PD1	NANDWE
PA2	ZB IRQ0	PA18	MCI DA1	PB2	ROM CODE	PB18	ADTRG	PC2	LCDDAT2	PD2	NANDAE/A21
PA3	ZB IRQ1	PA19	MCI DA2	PB3	PB_USER1			PC3	LCDDAT3	PD3	NANDCLE
PA4	One Wire	PA20	MCI DA3	PB4	USER_LED1			PC4	LCDDAT4	PD4	NANDCS
PA5	ZB_RSTN	PA21	SPI1_MISO	PB5	USER_LED2			PC5	LCDDAT5	PD5	NWAIT
PA6	ZB_SL_PTR	PA22	SPI1_MOSI	PB6	PWR_LE			PC6	LCDDAT6	PD6	D16
PA7	MCI card detect	PA23	SPI1_SPCK	PB7	ENSV_HOST			PC7	LCDDAT7	PD7	D17
PA8	SPI1_NPCS0	PA24	TK	PB8	OVCUR_USB			PC8	LCDDAT8	PD8	D18
PA9	DRXD	PA25	TF	PB9	--			PC9	LCDDAT9	PD9	D19
PA10	DTXD	PA26	TD	PB10	PCK0			PC10	LCDDAT10	PD10	D20
PA11	SPI0_MISO	PA27	RD	PB11	AD0			PC11	LCDDAT11	PD11	D21
PA12	SPI0_MOSI	PA28	RK	PB12	AD1			PC12	LCDDAT12	PD12	D22
PA13	SPI0_SPCK	PA29	RF	PB13	AD2			PC13	LCDDAT13	PD13	D23
PA14	SPI0_NPCS0	PA30	TWD0	PB14	AD3			PC14	LCDDAT14	PD14	D24
PA15	MCI DA0	PA31	TWCKO	PB15	AD4			PC15	LCDDAT15	PD15	A20

NOTE

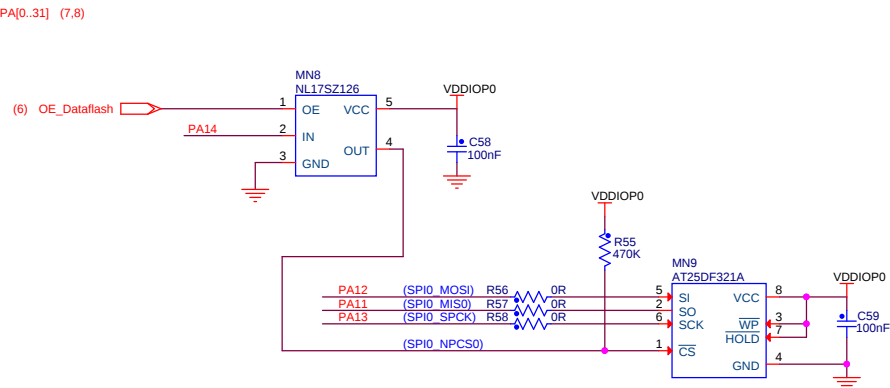
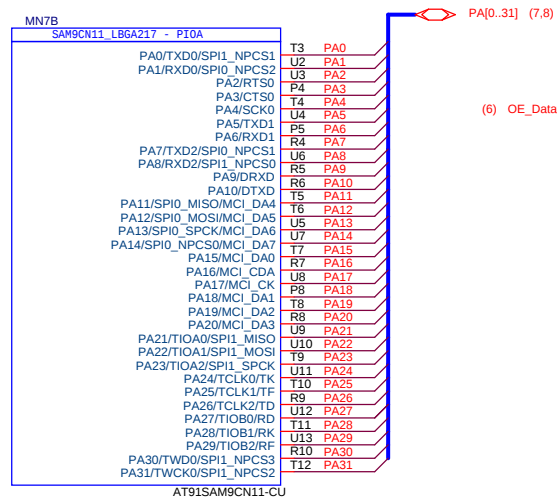
"DNP" means the component is not populated by default

ATMEL		ROUSSET		SCALE		REV.		SHEET	
SAM9CN11-EK		Block Diagram		1/1		A		1/9	
INIT	EDIT	PP	DES.	DATE	PP	VER.	DATE		
05-APR-12	05-APR-12	05-APR-12	05-APR-12	05-APR-12	05-APR-12	05-APR-12	05-APR-12		

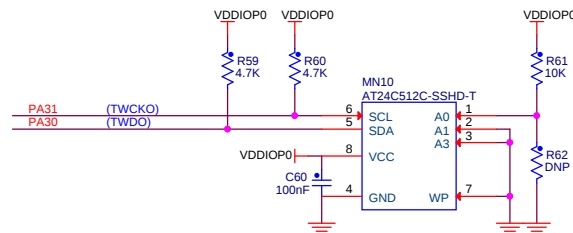
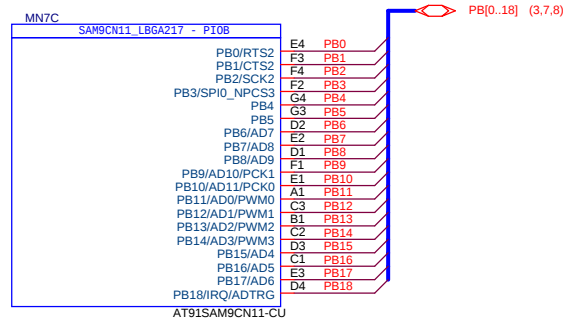
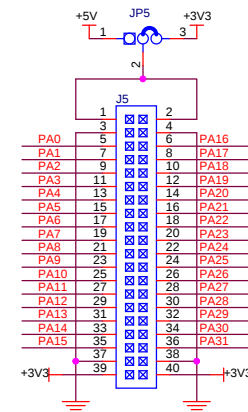


		REV	INIT	EDIT	PP	05-APR-12	PP	05-APR-12
		SCALE	1/1			DATE	REV.	SHEET
SAM9CN11-EK							A	3/9
AT91SAM9CN11								

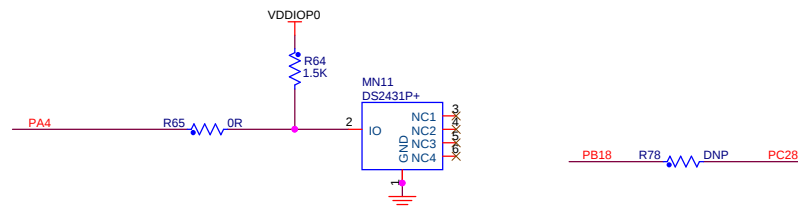
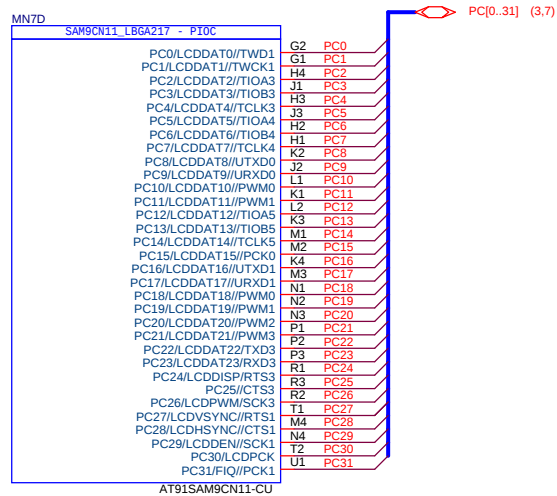
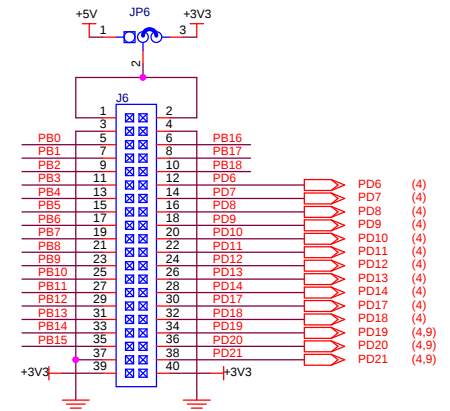
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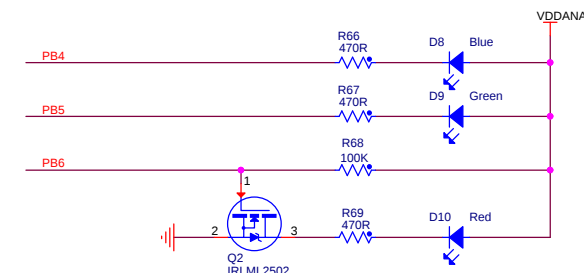
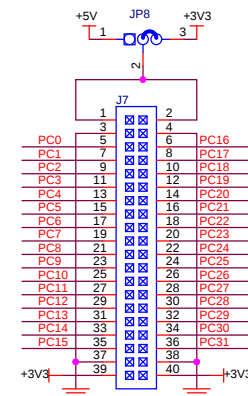
SERIAL DATAFLASH



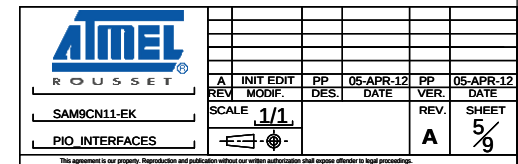
SERIAL EEPROM

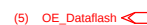


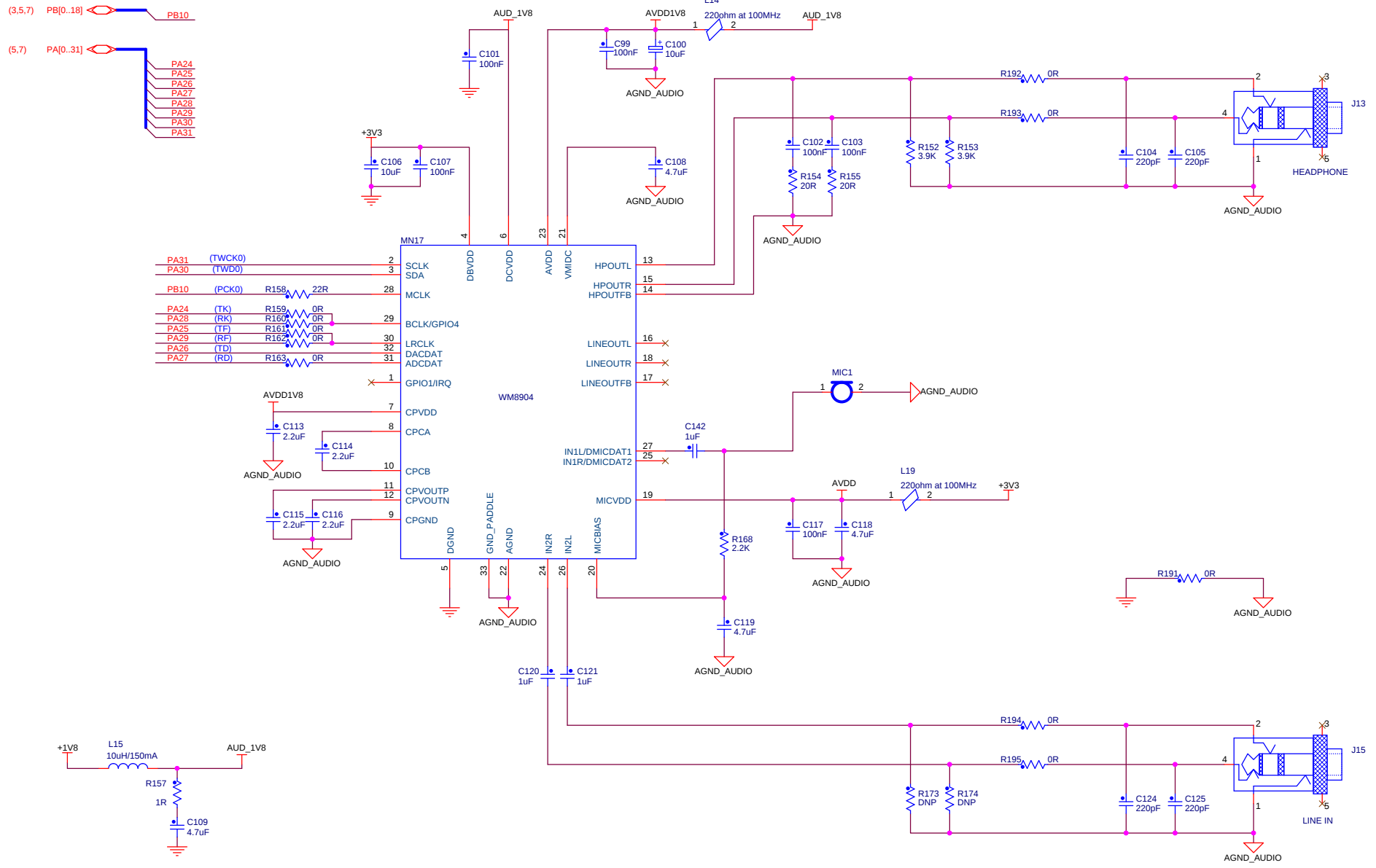
1-WIRE EEPROM

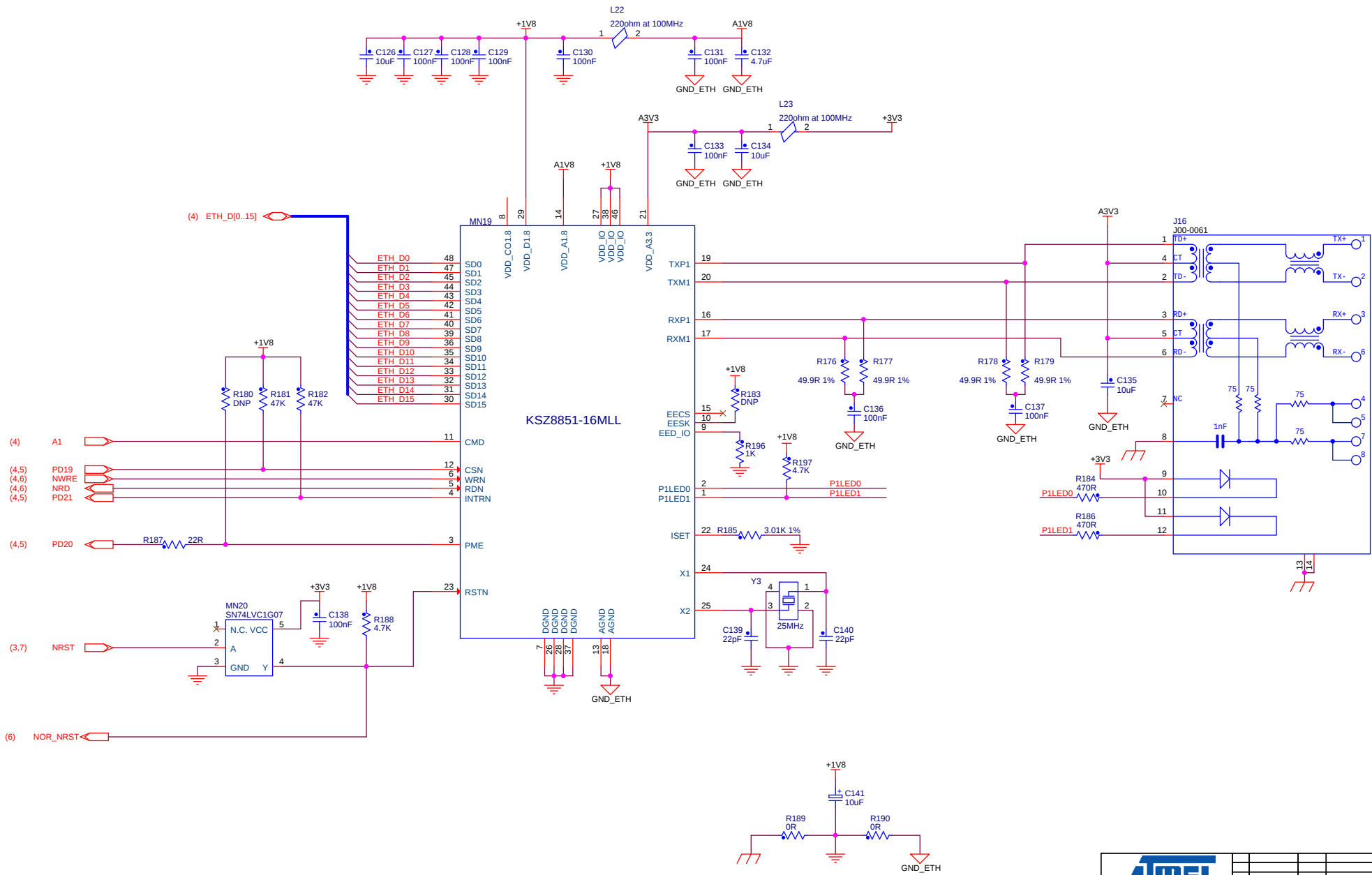


LED









Display Module Hardware

6.1 Board Overview

SAM9N12/CN11-DM board carries a 4.3" TFT LCD module with touch screen.

The DM board also carries four QTouch pads.

Figure 6-1. DM Board



6.2 Equipment List

Here is the list of the DM board components:

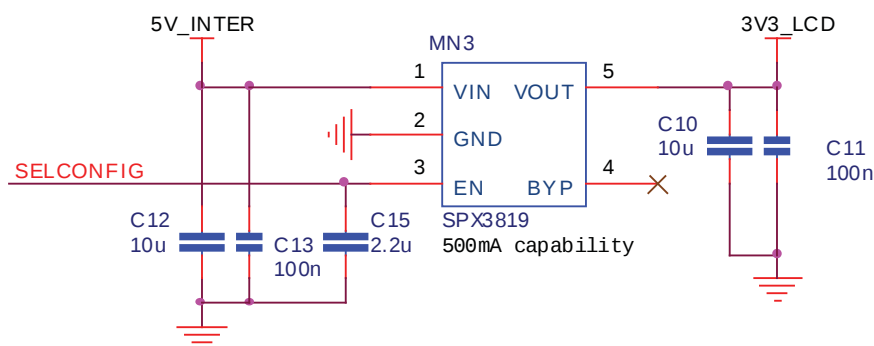
- One 4.3" TFT LCD module
- LCD Back light driver
- 3.3V regulator
- QTouch device
- 1-Wire device

6.3 Function Blocks

6.3.1 3.3V Regulator

The SAM9N12/CN11-DM board features its own LDO for local power regulation. It accepts DC 5V power from a 500 mA power switch on the EK and outputs a regulated +3.3V to most other circuits on the board.

Figure 6-2. DM Board Power Supply



6.3.2 TFT LCD with Touch Panel

The SAM9N12/CN11-DM board features an LCD controller. The 4.3" 480x272 LCD provides the DM with a low power LCD 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 (8 bit x RGB by default). 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.

[illegible]

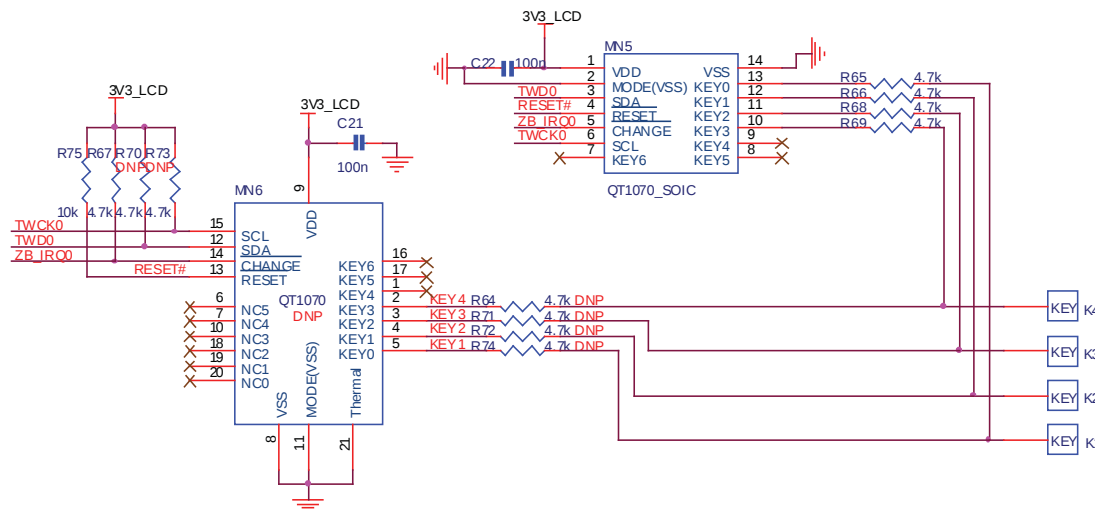
The back light voltage is generated from a CP2122ST boost converter. It is powered directly by the DC 5 V from the EK board. The back light level is controlled by a PWM signal generated from the SAM9N12/CN11 processor.

6.3.4 QTouch

The SAM9N12/CN11-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.

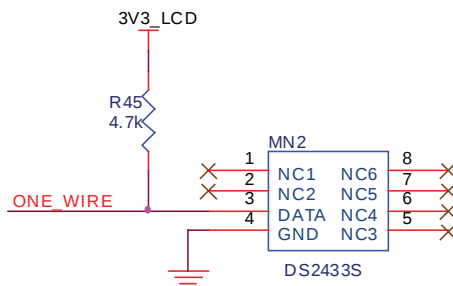
Figure 6-5. QTouch



6.3.5 1-Wire

The DM board also uses 1-Wire device as “soft label” to store the information such as chip type, manufacture name, production date, etc.

Figure 6-6. 1-Wire on DM





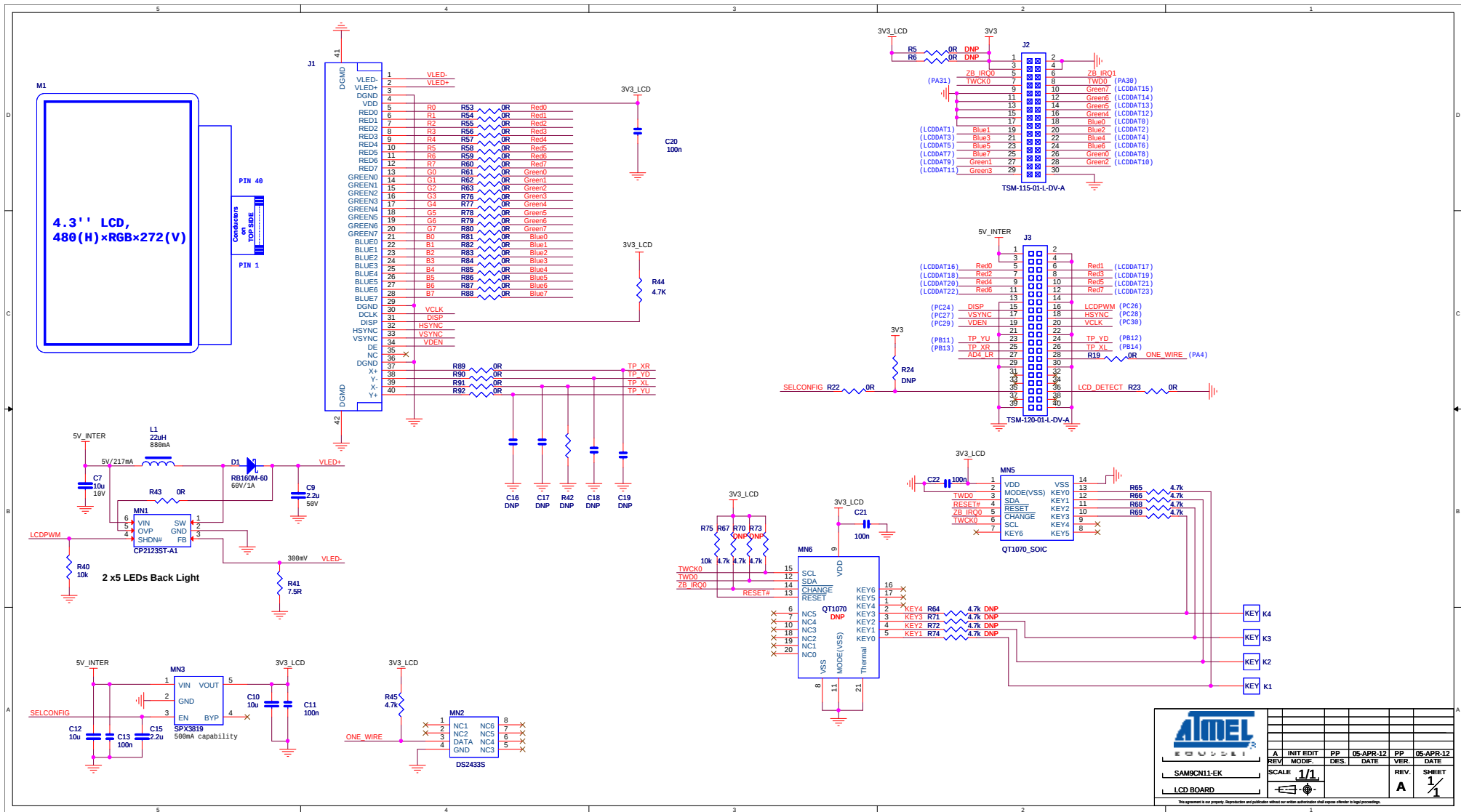
Section 7

DM Schematics

7.1 DM Board Schematics

This section contains the following schematic:

- LCD Board





Section 8

Revision History

8.1 Revision History

Table 8-1.

Document	Comments	Change Request Ref.
11186A	First issue.	



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