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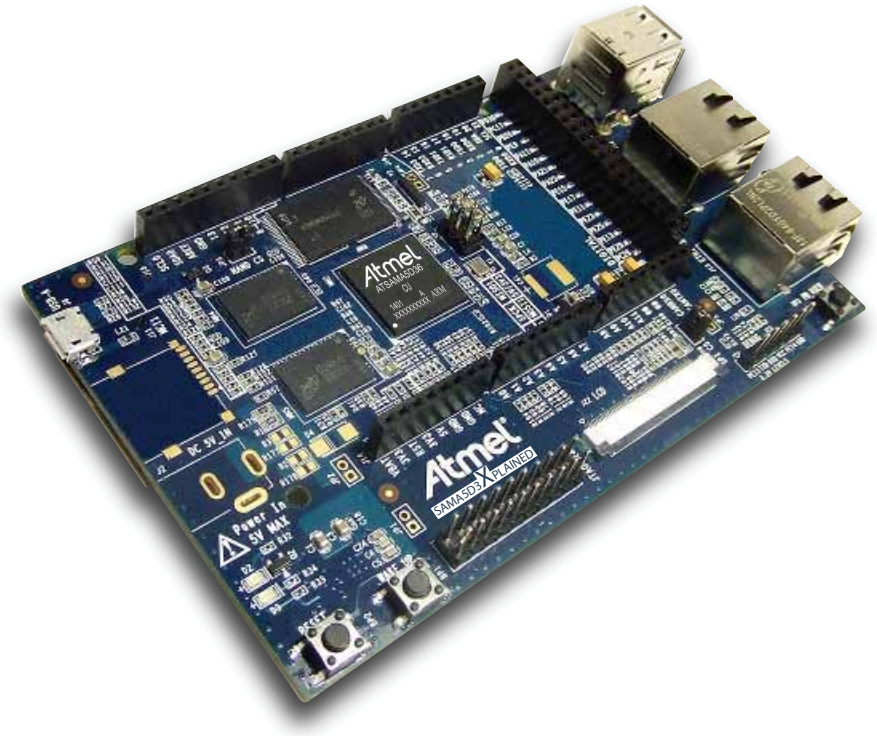
Atmel | SMART SAMA5D3 Series

SAMA5D3 Xplained

USER GUIDE



Introduction

This user guide introduces the Atmel® SAMA5D3 Xplained evaluation kit and describes the development and debugging capabilities for applications running on a SAMA5D36 ARM®-based embedded microprocessor unit (eMPU).

Scope

This guide provides details on the SAMA5D3 Xplained evaluation kit. It is made up of four main sections:

- Section 1. describes the evaluation kit content and its main features.
- Section 2. provides instructions to power up the SAMA5D3 Xplained board.
- Section 3. provides an overview of the SAMA5D3 Xplained board.
- Section 4. describes the SAMA5D3 Xplained board components.

Contents

- Boards
  - One SAMA5D3 Xplained board
- Cables
  - One micro-AB type USB cable
- A welcome letter

Related Items

- Atmel SAMA5D3 Series Datasheet
- SAMA5D3 Xplained Getting Started

Table of Contents

1. Evaluation Kit Specifications

Table 1-1. Evaluation Kit Specifications

Characteristic		Specifications
Temperature	Operating	0°C to +70°C
	Storage	-40°C to +85°C
Relative Humidity		0 to 90% (non-condensing)
RoHS status		Compliant
Ordering code		ATSAMA5D3-XPLD

1.1 Electrostatic Warning

ESD-Sensitive Electronic Equipment!

The evaluation kit is shipped in a protective anti-static package. The board system must not be subject 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.

1.2 Power Supply Warning

Hardware Power Supply Limitation

Using a power adapter greater than 5Vcc (e.g. the 12Vcc power adapters from other kits such as Arduino kits) may damage the board.

Hardware Power Budget

Using the USB as the main power source (max. 500 mA) is acceptable only with the use of the on-board peripherals and low-power LCD extension.

When external peripheral or add-on boards need to be powered, we recommend the use of an external power adapter connected to a J2 DC Jack (can provide up to 1.2A on the 3.3V node).

2. Power Up

Several power source options are available to power up the SAMA5D3 Xplained board.

The board can be:

- USB-powered through the USB Micro-AB connector (J6 connector - default configuration)
- Powered through an external AC-to-DC adapter connected via a 2.1 mm center-positive plug into the optional power jack of the board. The recommended output voltage range of the power adapter is 5V at 2A.
- Powered through the Arduino shield.

Unlike Arduino Uno boards, the SAMA5D3 Xplained board runs at 3.3V. The maximum voltage that the I/O pins can tolerate is 3.3V. Providing higher voltages (e.g. 5V) to an I/O pin could damage the board.

2.1 Power up the Board

Unpack the board, taking care to avoid electrostatic discharge. Simply connect the USB Micro-AB cable to the connector (J6).Then, connect the other end of the cable to a free USB port of your PC.

Table 2-1. Electrical Characteristics

Electrical Parameter	Values
Input voltage	5 VCC
Maximum input voltage	6 VCC
Max DC 3.3V current available	1.2A
I/O Voltage	3.3V only

2.2 Sample Code and Technical Support

After booting up the board, you can run sample code or your own application on the board. You can download sample code and get technical support from the Atmel website.

Linux software and demos can be found on the website Linux4SAM.

3. Hardware Introduction

3.1 Introduction

The Atmel SAMA5D3 Xplained board is a fully-featured evaluation platform for Atmel SAMA5D3 series microcontrollers. It allows users to extensively evaluate, prototype and create application-specific designs.

3.2 Equipment List

The SAMA5D3 Xplained board is built around the integration of a Cortex®-A5-based microcontroller (BGA 324 package) with external memory, dual Ethernet physical layer transceiver, two SD/MMC interfaces, two host USB ports and one device USB port, one 24-bit RGB LCD interface and one debug interface.

Seven headers, compatible with Arduino R3, are available for various shield connections.

3.3 Board features

Table 3-1. Board Specifications

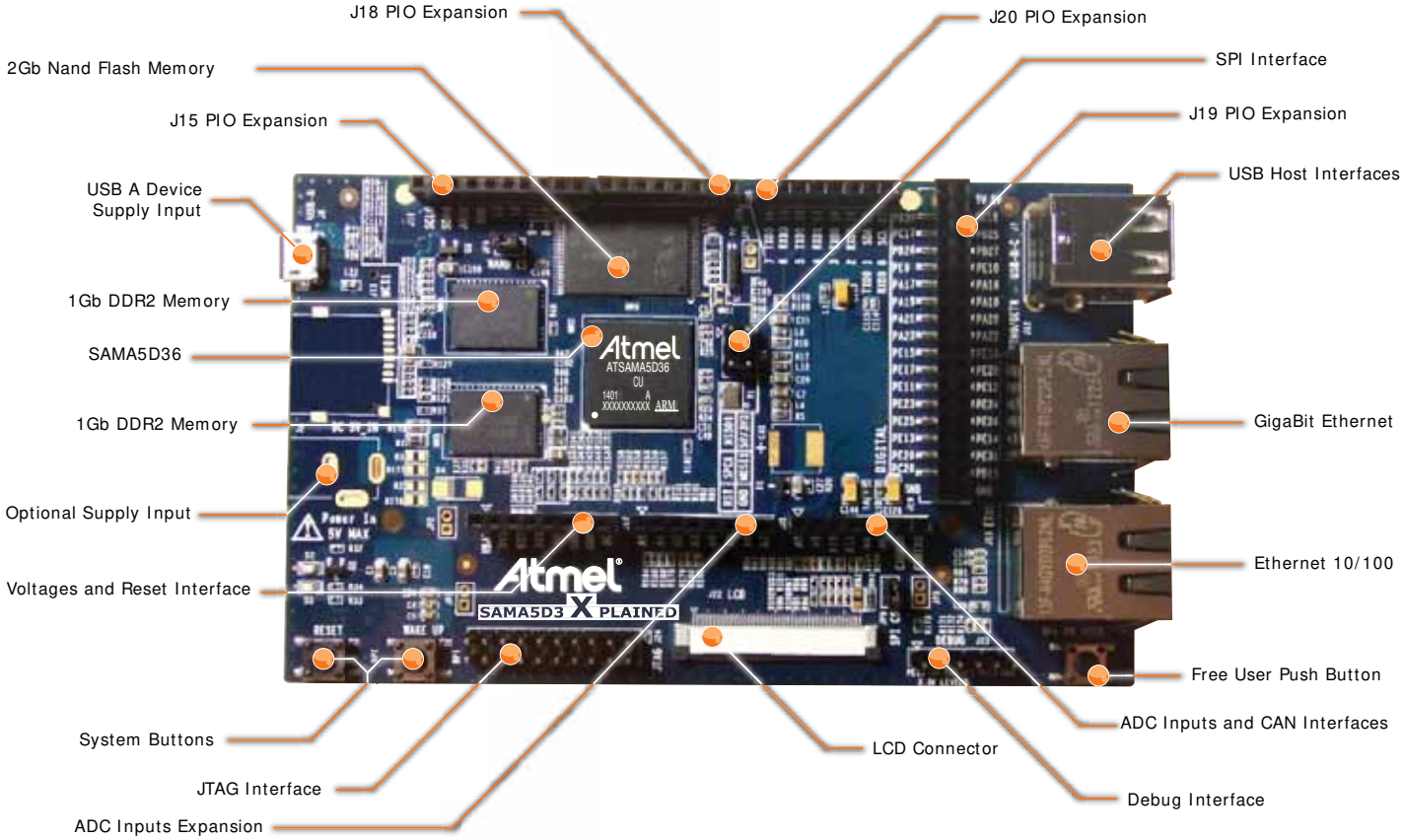
Characteristics	Specifications
PCB characteristics	125 x 75 x 20mm (10-layers)
Processor	SAMA5D36 (324-ball BGA package) ARM Cortex-A5 Processor with ARM v7-A Thumb2® instruction set, core frequency up to 536 MHz.
Processor clock sources	12-MHz crystal oscillator 32.768-kHz crystal oscillator
Memory	2 x 1Gb DDR2 (16M x 16 bits x 8 banks) 1 x 2Gb SLC NAND Flash (256M x 8 bits)
Optional on-board memory	One Serial EEPROM SPI One 1-Wire EEPROM
SD/MMC	One 8-bit SD card connector One optional 4-bit Micro-SD card connector
USB	Two USB Hosts with power switch One Micro-AB USB device
Display interface	One LCD interface connector, LCD TFT Controller with overlay, alpha-blending, rotation, scaling and color space conversion
Ethernet	One Gigabit Ethernet PHY (GRMII 10/100/1000) One Ethernet PHY (RMII 10/100)
Debug port	One JTAG interface connector One serial DBGU interface (3.3V level)
Expansion connectors	Arduino R3 compatible set of headers The SAMA5D36 GPIO,TWI, SPI, USART, UART, Audio and ISI interfaces are accessible through these headers.
Board supply voltage	5V from USB or power jack or Arduino shield On-board power regulation is performed by a Power Management Unit (PMU)
Battery	On-board optional power Cap for CMOS backup
User interface	Reset, wakeup and free user pushbutton One red user/power LED and one blue user LED

4. Board Components

4.1 Board Overview

The full-featured SAMA5D3 Xplained board integrates several peripherals and interface connectors, as shown in Figure 4-1.

Figure 4-1. SAMA5D3 Xplained Board Overview



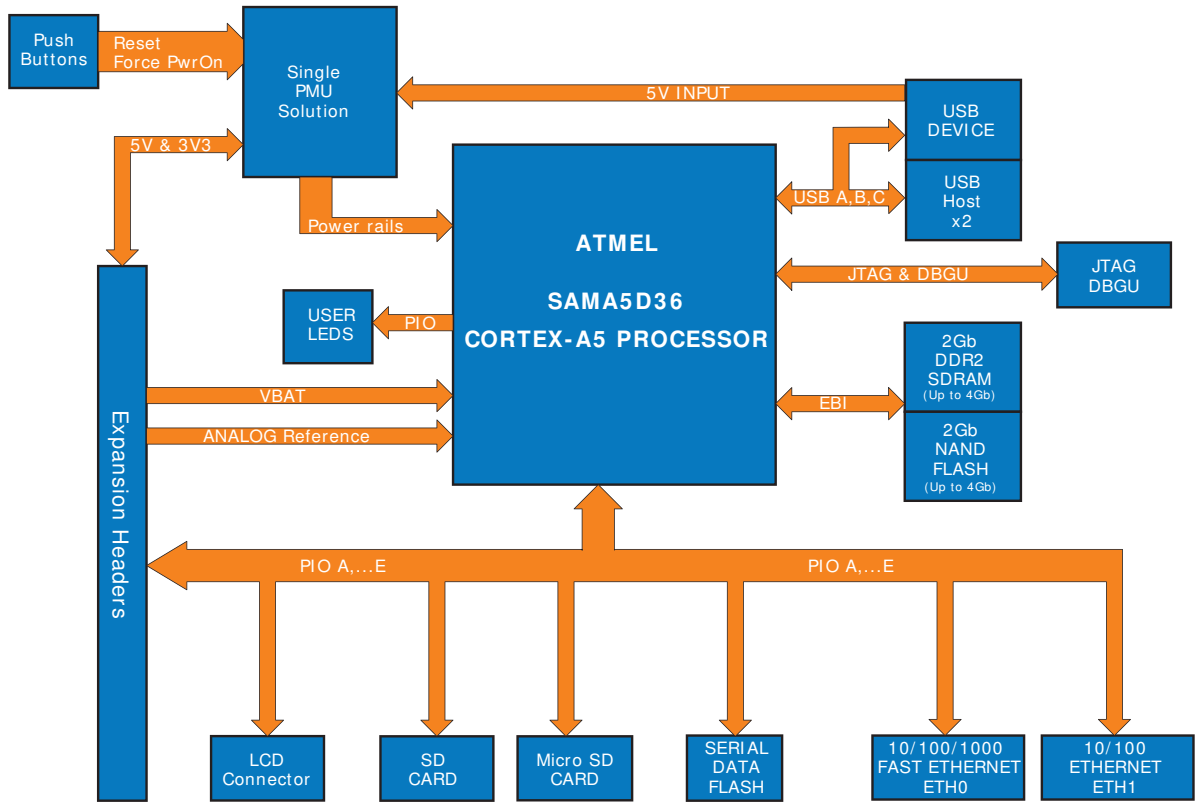
The SAMA5D3 Xplained board is equipped with the interface connectors described in Table 4-1.

Table 4-1. SAMA5D3 Xplained Board Interface Connectors

Header	Interfaces to
J2	Main power supply
J6	USB A device. Supports USB device using a Micro-AB connector
J7 (upper)	USB B Host. Supports USB host using a type A connector
J7 (lower)	USB C Host. Supports USB host using a type A connector
J23	Serial DBGU 3.3V level
J24	JTAG, 20-pin IDC connector
J10	SD/MMC connector
J11	Micro-SD connector
J12	Gigabit Ethernet ETH0
J13	Ethernet ETH1
J22	Expansion connector with all LCD controller signals for display module connection (QTouch®, TFT LCD display with Touch Screen and backlight
C41	Optional SuperCap
J14–J21	Expansion connectors with Arduino R3 compatible PIO signals
–	Various test points located on the board

4.2 Function Blocks

Figure 4-2. Evaluation Kit Architecture



4.2.1 Processor

The SAMA5D3 Xplained board is built around the SAMA5D36, a Cortex-A5 application processor which combines high-performance computing device with low-power consumption and a wide range of communication peripherals. It features a combination of user interface functionalities and high data rate IOs, including LCD controller, touchscreen, camera interface, Gigabit and 10/100 Ethernet ports, high-speed USB and SDIO.

The ARM Cortex-A5 supports the latest generation of DDR2 and NAND Flash memory interfaces for program and data storage. An internal 166-MHz multi-layer bus architecture associated with 24 DMA channels and two 64-Kbyte SRAM blocks, sustains the high bandwidth required by the processor and the high-speed peripherals.

4.2.2 Clock Circuitry

The SAMA5D3 Xplained evaluation board features four clock sources:

- Two clocks are alternatives for the SAMA5D3 series processor main clock
- Two crystal oscillators are used for the GETH and Ethernet MII/RMII chip

Table 4-2. 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 RGMII, 25 MHz	Y3
1	Oscillator for ethernet clock RMII, 25 MHz	Y4

4.2.3 Power Supplies

The on-board power supply generation is based on the Active-Semi® Power Management Unit (PMU) featuring a 3-channel (3.3V / 1.8V /1.2V or 1.0V) topology. For maximum efficiency, these supply channels are generated by three integrated step-down converters.

In addition to these 3 DCDC channels, 4 LDO channels with low noise and high PSRR performance are available for the application. These channels are disabled at startup by default and can be turned on and adjusted under software control through an I²C link. They are also used to supply the 2.5V VDDFUSE and the 3.3V VDDANA power inputs of the processor.

The power supply sequencing of the three primary channels is controlled by the PMU itself in full compliance with the SAMAD3 requirements. The turn-on sequence is: 3.3V first, then 1.8V and finally 1.2V.

WARNING

There is a known error on the ACT8865 I²C implementation. The port must be shut off after configuration or problems may occur with devices using the same I²C channel, e.g., TM43xx LCD display.

Refer to the ACT8865 datasheet at http://www.active-semi.com/ for more details.

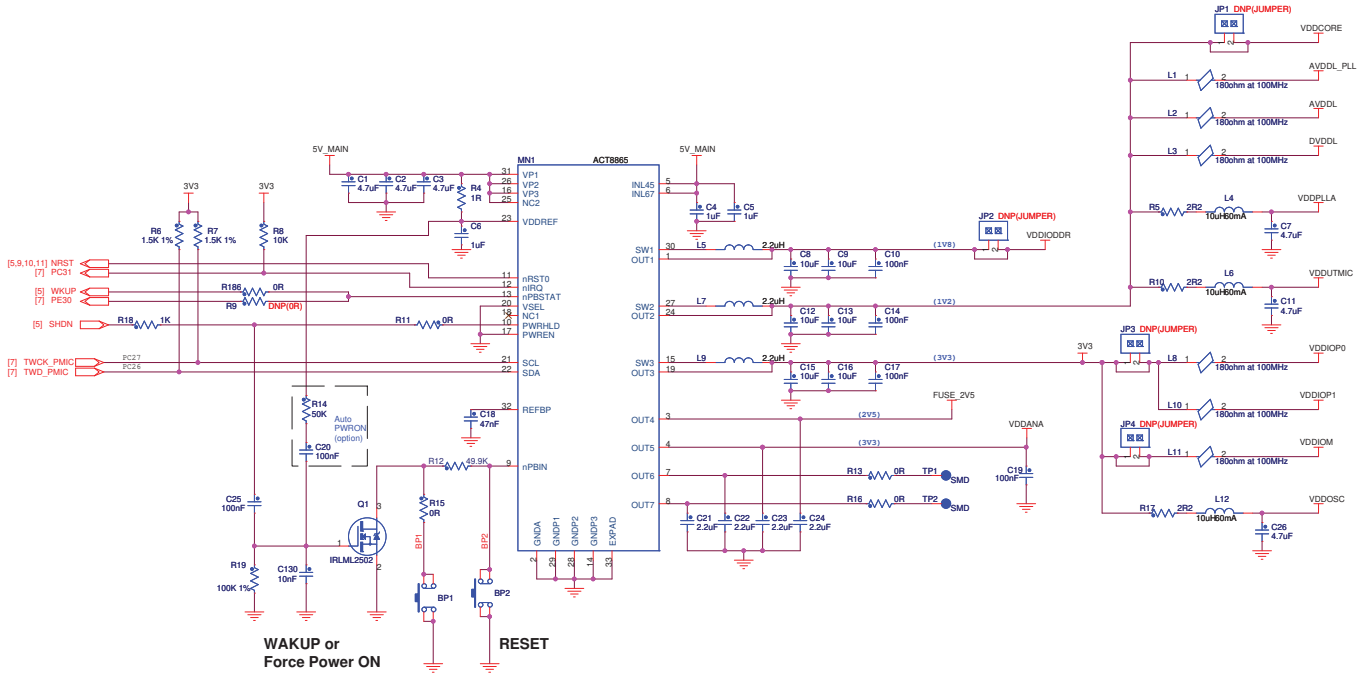
Table 4-3 summarizes the power specifications.

Table 4-3. Supply Group Configuration

Nominal	Name	Power domains	Power source
3.0V	VDDBU	The slow clock oscillator, the internal 32K RC, the internal 12M RC and a part of the system controller	Optional on-board battery
3.3V	VDDIOP0	A part of peripheral I/O lines	PMU
3.3V	VDDIOP1	A part of peripheral I/O lines	
3.3V	VDDUTMII	The three USB interfaces	
3.3V	VDDOSC	The main oscillator cells	
3.3V	VDDANA	The analog-to-digital converter	
1.2V	VDDCORE	The core, including the processor, the embedded memories and the peripherals	
1.2V	VDDUTMIC	The USB UTMI + core	PMU
1.2V	VDDPLLA	The PLLA cell	
1.8V	VDDIODDR	DDR2 interface I/O lines	
1.8V	VDDIOM	NAND, NOR Flash and SMC interface I/O lines	
3.0V to 3.3V	ADVREF	ADC reference voltage	J15 header
2.5V	VDDFUSE	Fuse box for programming	PMU

Note: Jumper footprints are available on board to measure power consumption on main power lines. By default, the jumpers are not implemented. They are short-circuited by a thin PCB wire. To use this functionality, open the short circuit and mount a 2-pin jumper.

Figure 4-3. Board Power Management Schematic



4.2.3.1 Power Options

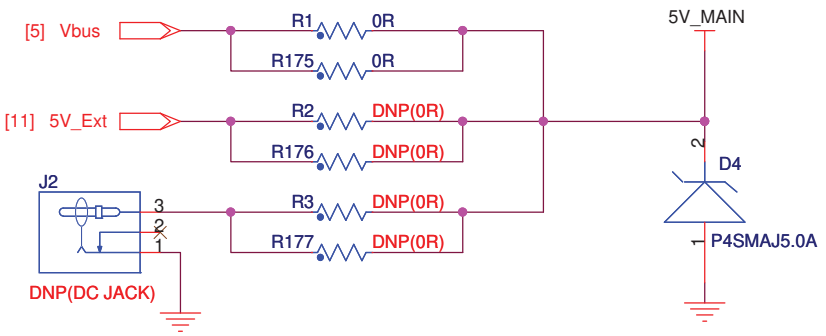
Several power options are available to configure the SAMA5D3 Xplained board powering scheme.

The power sources are selected by a set of 0R resistors.

The USB-powered operation is the default configuration. The power source is the USB device port (J6) connected to a PC or a mini-AB 5V DC supply. The USB supply is sufficient to power the board in most applications if USB host ports are not used. If USB host ports are used, it is recommended to use a DC supply source.

Schematic diagrams of various power options are illustrated in Figure 4-4.

Figure 4-4. Input Powering Scheme Option Schematic



Note: USB-powered operation is a good “single cable” solution because it combines powering and board control through a unique cable. Consequently, it eliminates the need for other wires and batteries. This power option is suitable for most projects that only require 5 volts at up to 500 mA.

4.2.3.2 Mains Power Adapter

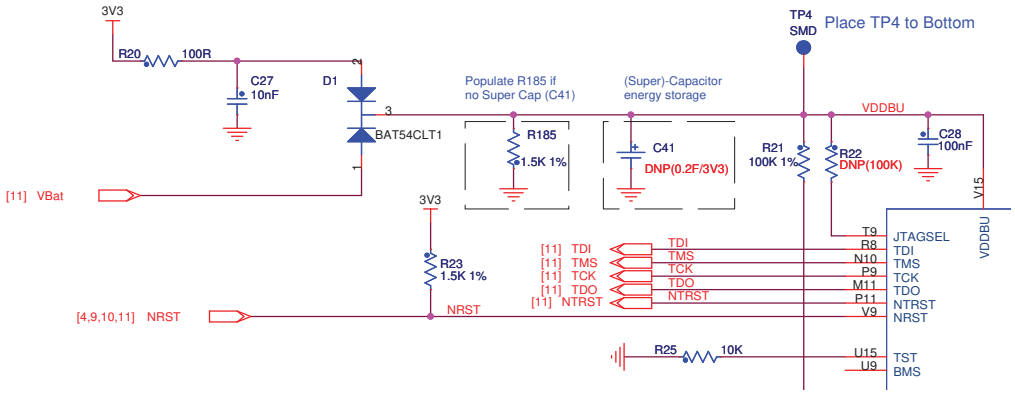
A mains power supply adapter can be used to provide power to the board. A regulated 5V DC supply of typically 2A is required but a current range of 3A is recommended if the USB ports and expansion headers are likely to be used. It needs a 2.1 mm plug with a center-hot configuration.

If you are using the USB host ports or expansion board Arduino shields, a higher current is required. To supply the full 500 mA per port, a mains power adapter must be used.

4.2.3.3 VBAT

By default, VDDBU is delivered through the 3.3V node. An optional SuperCap (C41), used for real-time clock backup, is provided. The board does not come equipped with the SuperCap. When the SuperCap is not installed, an R185 must be installed. You must make sure that the R185 is removed prior to installing the SuperCap.

Figure 4-5. VBAT Powering Scheme Option Schematic



4.2.4 Reset Circuitry

The reset sources for the SAMA5D3 Xplained board are:

- Power-on reset from the Power Management Unit (PMU),
- Reset Pushbutton BP2,
- JTAG reset from an in-circuit emulator (through JTAG interface)

4.2.5 Memory Organization

The SAMA5D3x-series processor features a DDR2/SDRAM memory interface and an External Bus Interface (EBI) to interface with a wide range of external memories and to almost any kind of parallel peripherals.

The memory devices that equip the SAMA5D3 Xplained evaluation kit are as follows:

- Two DDR2/SDRAM (MT47H64M16HR) used as main system memory (256 MByte). The board includes 2 Gbits of on-board soldered DDR2 (double data rate) SDRAM. The footprints can also host two DDR2 (MT47H128M16RT) from Micron® for a total of 512 MBytes of DDR2 memory. The memory bus is 32 bits wide and operates with a frequency of up to 166 MHz (See Figure 4-6).
- One NAND Flash (MT29F2G08ABAEAWP) connected to the processor. The default size is 256 MBytes. The footprint can also host a 4-Gbit Micron chip for a total of 512 MBytes of NAND Flash memory (See Figure 4-7).

Figure 4-6. DDR2 Schematic

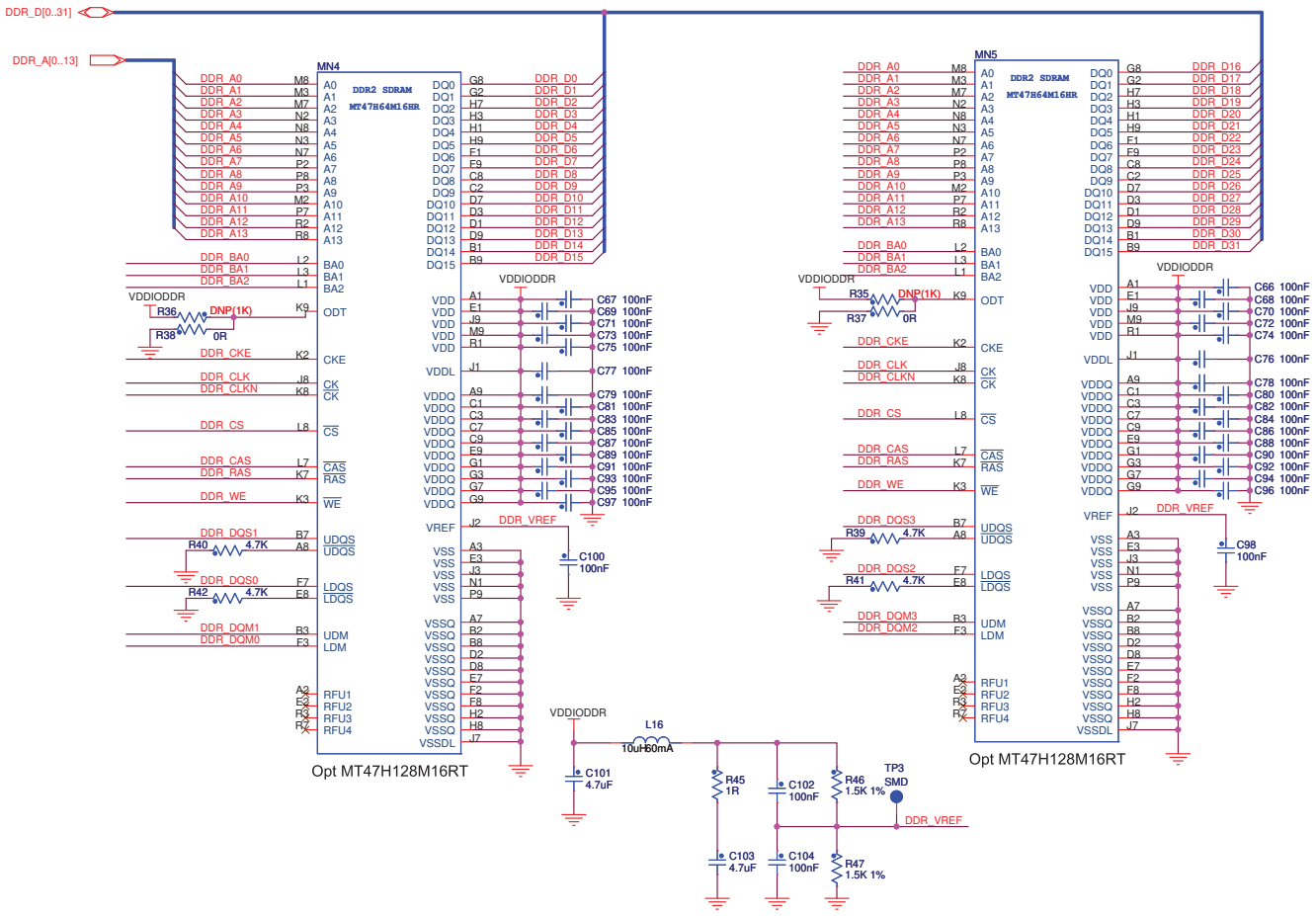
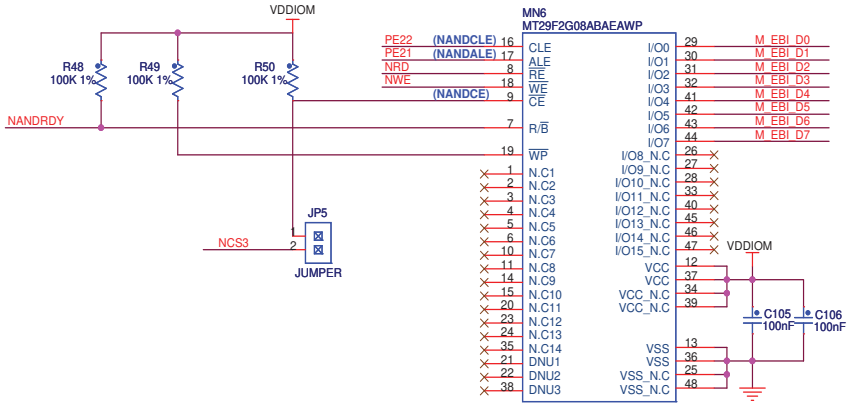


Figure 4-7. NAND Flash Schematic



The following memory part numbers are recommended:

Table 4-4. Recommended Memories

Part Number	Supplier	Size	Type
MT47H128M16	Micron	2 Gb (16 M x 16 x 8 banks)	DDR2 - BGA
MT47H128M32	Micron	4 Gb (32 M x 16 x 8 banks)	DDR2 - BGA
MT29F2G08	Micron	2 Gb	NAND Flash - TSOP
MT29F4G08	Micron	4 Gb	NAND Flash - TSOP

4.2.6 SD/MMC Interface

The SAMA5D3 Xplained board features two high-speed Multimedia Card Interfaces (MCI).

- The first interface is used as an 8-bit interface (MCI0), connected to a SD/MMC card slot (J10) located on the bottom side of the PCB.
- The second interface is used as a 4-bit interface (MCI1), connected to an optional Micro-SD card connector (J11) located on the top side of the PCB.

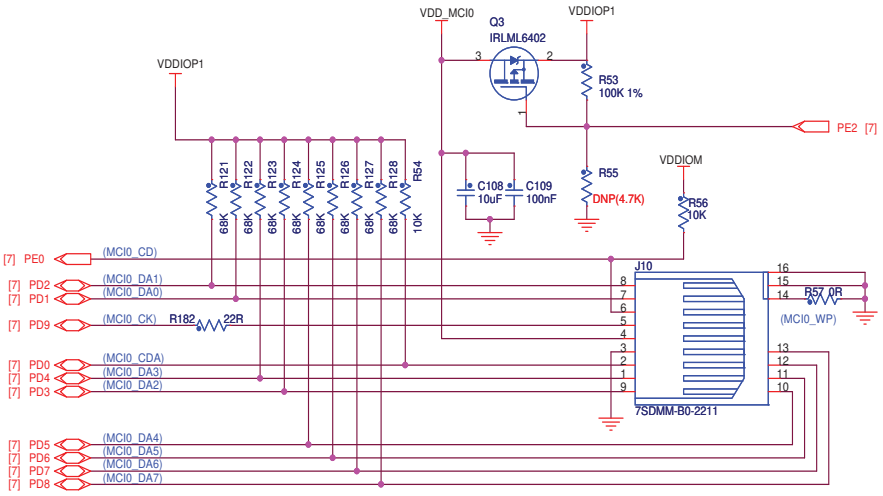
The MCI0 SD card power line is enabled by default. It is PIO-controlled through a MOSFET transistor.

Note: The power source is VCC (3.3 volts).

4.2.6.1 J10 SD Card Slot

When a card is inserted into the SD/MMC connector, the Card Detect pin (PE0) is tied to ground.

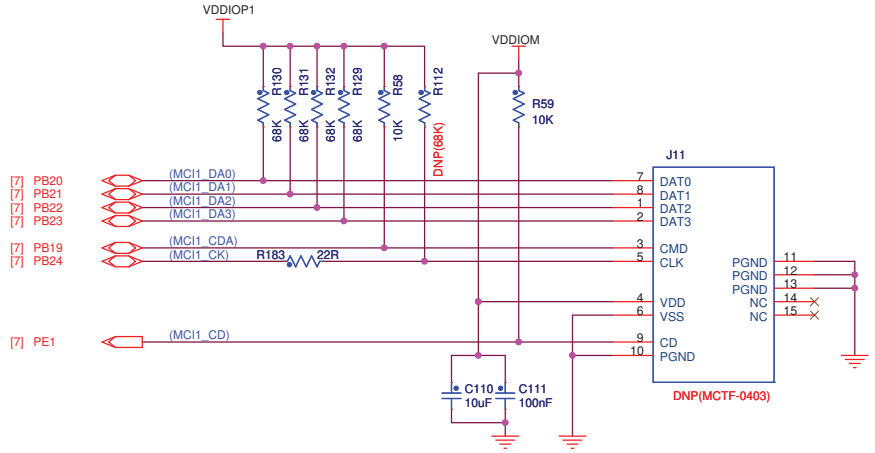
Figure 4-8. J10 SD Card Schematic



4.2.6.2 J11 SD Card Slot (optional)

When a card is inserted into the Micro SD connector, the Card Detect pin is tied to ground. This is detected on pin PE1 of the main processor.

Figure 4-9. J11 Micro SD Card Schematic



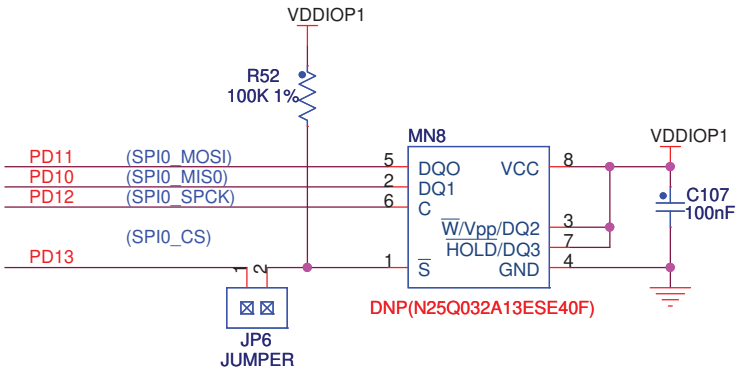
Micro SD CARD INTERFACE - MCI1

4.2.7 Serial Peripheral Interface (SPI)

The SAMA5D3X-series processor features two high-speed Serial Peripheral Interfaces. One port is used to interface with the optional on-board serial DataFlash®.

There are four main signals used in the SPI interface; Clock, Data In, Data Out, and Chip Select.

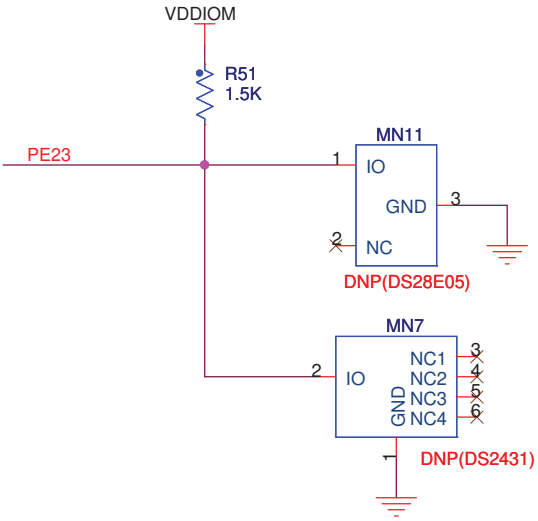
Figure 4-10. Optional Serial DataFlash Schematic



4.2.8 Optional 1-Wire EEPROM

The SAMA5D3 Xplained board can use a 1-Wire device as “soft label” to store data such as chip type, manufacturer’s name, production date, etc.

Figure 4-11. Optional One-Wire EEPROM Schematic



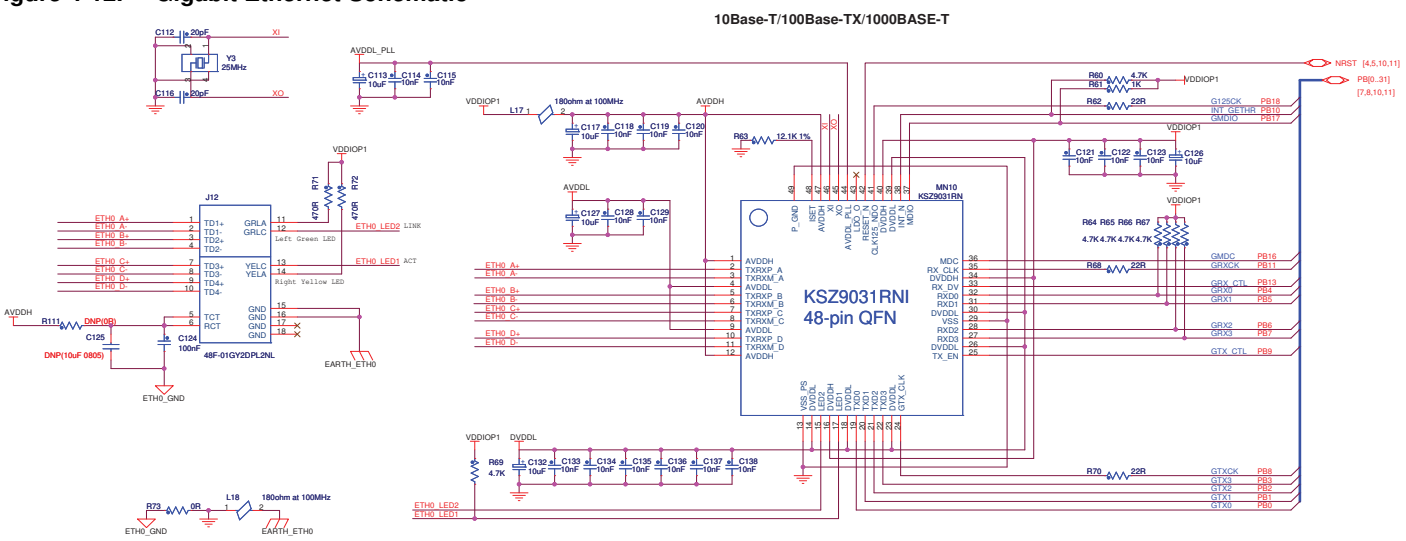
4.2.9 10/100/100 Ethernet Port

The SAMA5D3 Xplained board features a MICREL PHY device (KSZ9031RN) operating at 10/100/1000 Mb/s. The board supports the RGMII interface mode. The Ethernet interface consists of four pairs of low-voltage differential pair signals designated from GRX± and GTX± plus control signals for link activity indicators. These signals are routed to the 10/100/1000 BaseT RJ45 connector (J12).

For monitoring and control purposes, LEDs are integrated in the RJ45 connectors to indicate activity, link, and speed status information for the corresponding ports.

For more information about the Ethernet controller device, refer to the MICREL KSZ9031RN datasheet.

Figure 4-12. Gigabit Ethernet Schematic



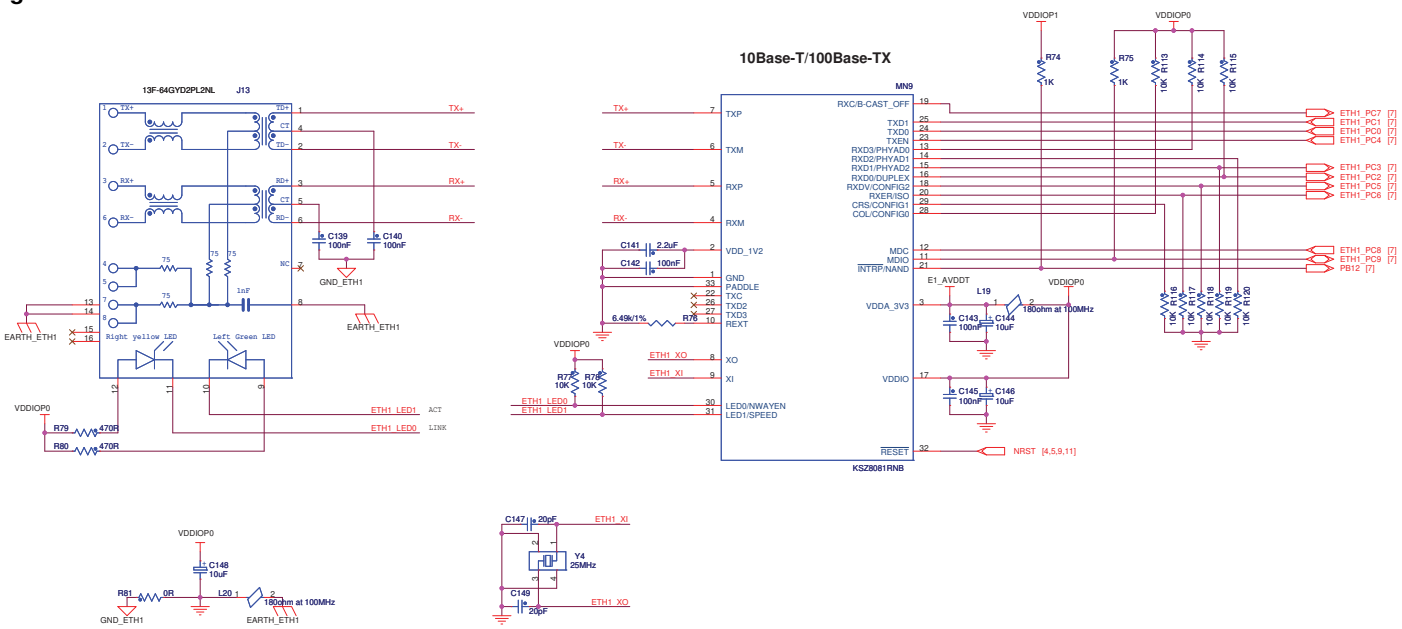
4.2.10 Ethernet 10/100 Port

The SAMA5D3 Xplained board features a MICREL PHY device (KSZ8081RNB) operating at 10/100 Mb/s. The board supports RMII interface modes. The Ethernet interface consists of two pairs of low-voltage differential pair signals designated from GRX± and GTX± plus control signals for link activity indicators. These signals are routed to the 10/100 BaseT RJ45 connector (J13).

For monitoring and control purposes, a LED functionality is added on the RJ45 connectors to indicate activity, link, and speed status information for the corresponding ports.

For more information about the Ethernet controller device, refer to the MICREL KSZ8081RNB controller manufacturer's datasheet.

Figure 4-13. RMII Ethernet Schematic

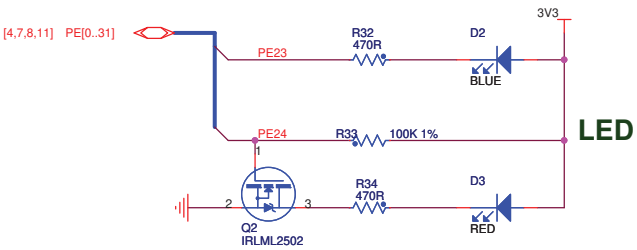


4.2.11 Indicators

Two LEDs are available on the SAMA5D3 Xplained board. Both can be software-controlled by the user.

- The red LED indicates that power is applied to the board (by default). It can be controlled via software.
- The blue LED is mainly controlled by one GPIO line.

Figure 4-14. LED Indicators Schematic



4.2.12 USB

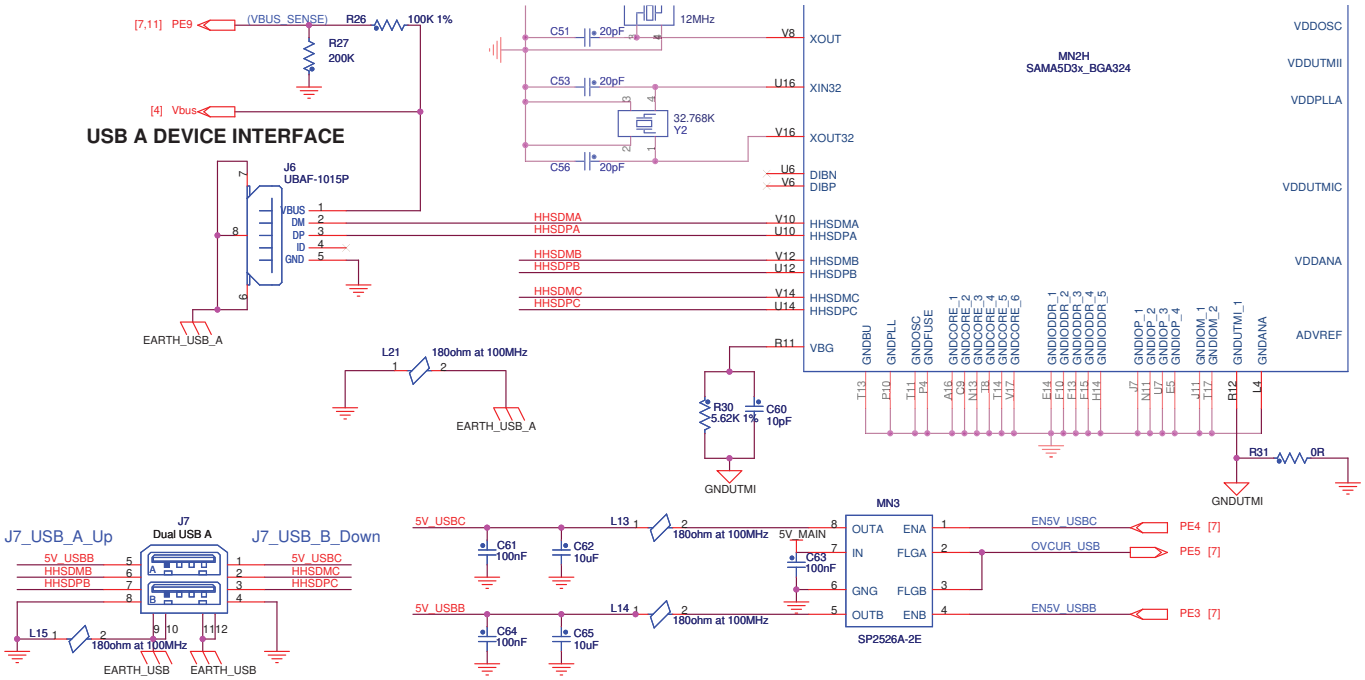
The SAMA5D3 Xplained board features three USB communication ports:

- Port A: High-speed (EHCI) and full-speed (OHCI) host multiplexed with high-speed USB device Micro-AB connector (J6)
- Port B: High-speed (EHCI) and full-speed (OHCI) host, standard type A connector (J7 upper port)
- Port C: Full-speed OHCI host, standard type A connector (J7 lower port)

The two USB host ports are equipped with 500-mA high-side power switch for self-powered and bus-powered applications.

The USB device port A (J6) features a VBUS insert detection function through the ladder-type resistors R26 and R27.

Figure 4-15. USB Interface Schematic

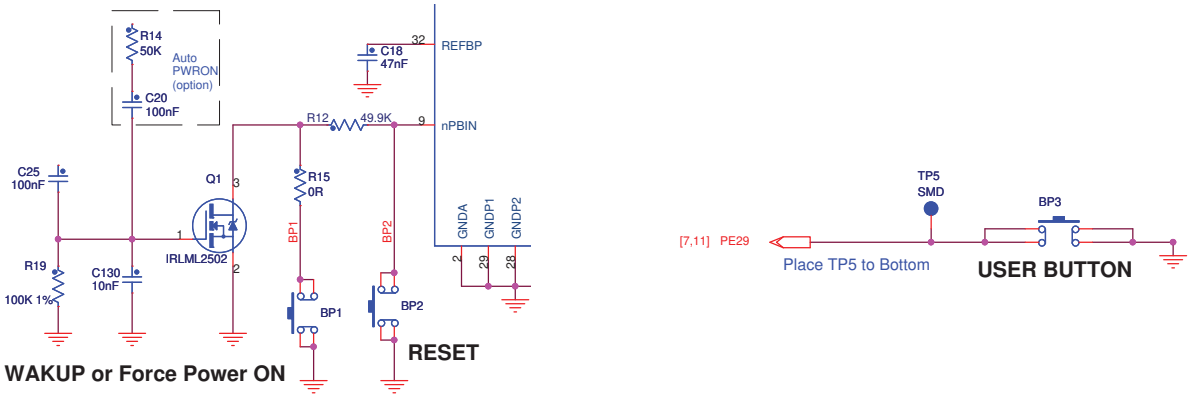


4.2.13 Pushbutton Switches

The following pushbuttons switches are available:

- One board reset button (BP2). When pressed and released, this pushbutton causes a power-on reset of the whole board.
- One wakeup pushbutton that brings the processor out of Low-power mode (BP1)
- One user pushbutton (BP3)

Figure 4-16. Pushbutton Schematic



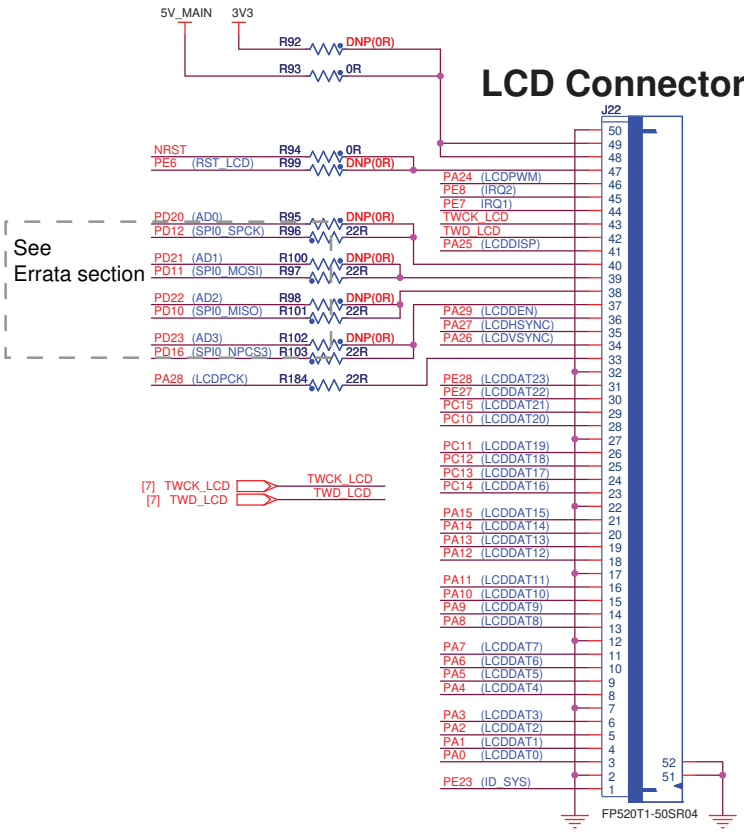
4.2.14 LCD

The SAMA5D36 processor drives 24 bits of data and control signals to the LCD interface. Other signals are used to control the LCD and are also routed to the J22 connector: TWI, SPI, 2 GPIOs for interrupt, ID for 1-Wire EEPROM (ID_SYS) and power supply lines.

4.2.14.1 LCD Connector

One 1.27 mm pitch 50-pin header is provided to gain access to the LCD signals.

Figure 4-17. LCD Expansion Header Interface Schematic



4.2.14.2 LCD Power

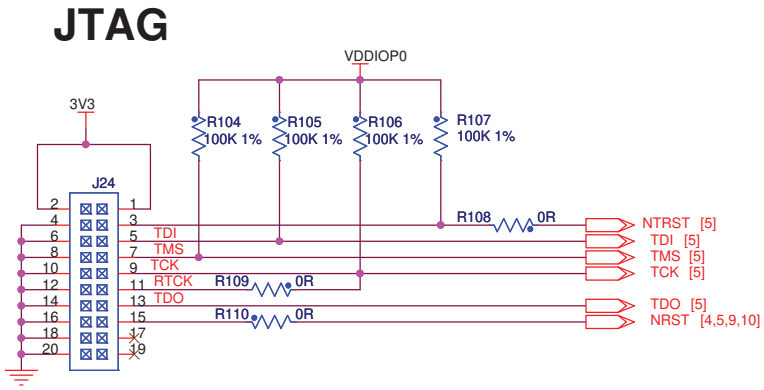
To operate correctly with various LCD modules, regardless of the processor, two voltage lines are available: 3V3 by default and 5V_MAIN, both selected by 0R resistors R92 and R93.

4.2.15 Debug JTAG/ICE and DBGU

4.2.15.1 Debug JTAG/ICE

A 2x10-pin JTAG header is implemented on the SAMA5D3 Xplained board to enable the software development and debugging of the board by using various JTAG emulators. The interface signals have a voltage level of 3.3V.

Figure 4-18. JTAG/ICE Interface Schematic



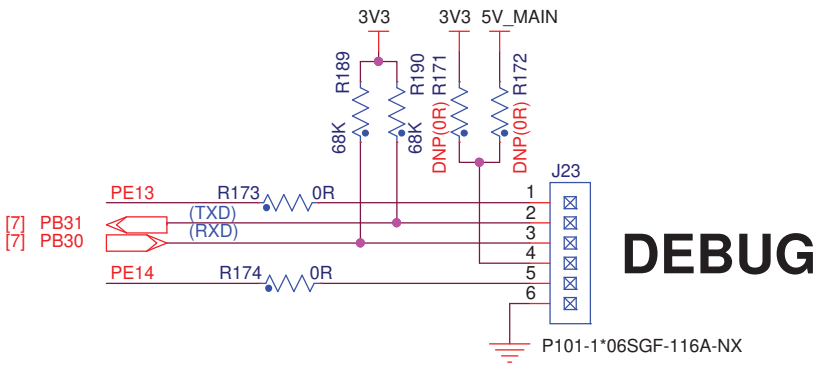
4.2.15.2 DBGU

The SAMA5D3 Xplained board has a dedicated serial port for debugging, which is accessible through the 6-pin male header J23. Various interfaces can be used as USB/Serial DBGU port bridge, such as FTDI TTL-232R-3V3 USB to TTL serial cable or basic breakout board for the 232/USB converter.

These interfaces are available on the following websites:

- Adafruit: http://www.adafruit.com/products/284
- Sparkfun: https://www.sparkfun.com/products/9873

Figure 4-19. DBGU Interface Schematic



R171 and R172 are optional (not implemented) resistors that can be used for power selection. Power can be delivered either by the SAMA5D3 Xplained board or by the debug interface tool. To avoid a contention between your debug interface (e.g. FTDI) and the on-board power system, be careful during the installation of one of this resistor.

4.2.16 Expansion Ports

Five 8-pin, one 10-pin, one 6-pin and one 2x18-pin headers (J14 to J21) are implemented on the board to enable the PIO connection of various expansion cards that could be developed by users or by other sources. Due to

multiplexing, different signals can be provided on each pin. These connectors are mechanically- and footprint-compatible with the Arduino R3 shields. As the SAMA5D3 signals have a voltage level of 3.3V, 5-V level shields must not be used on the SAMA5D3 Xplained.

In addition to its standard IO functionality, the SAMA5D3 processor can provide alternate functions to external IO lines available on the J14 to J21 headers.

These alternate functions are:

- UARTs: UART0, UART1
- USARTs: USART0, USART1, USART2, USART3
- SPI: SPI1
- I²C: TWI0, TWI1
- Timer capture and compare: TIOA, TIOB
- Clock out: PCK0, PCK1, PCK2
- PWMs: PWML0, PWMH0, PWML1, PWMH1
- DIGITAL AUDIO: TD0, TK0, TF0, RD0, RK0, RF0
- ISI: ISI[D0:D11], ISI_HSYNC, ISI_VSYNC, ISI_PCK
- CAN: CAN-RX0, CANTX0, CANRX1, CAN_TX1
- Analog: AD[0:11], ADTRG, ADREF
- GPIO: MISC
- RESET
- VBAT

Refer to the SAMA5D3 series datasheet for further details on the PIO multiplexing and alternate function selection.

4.2.16.1 Functions Available Through the Arduino Headers

The following tables illustrate the functionalities provided by the SAMA5D3 Xplained board. They show the pins used to implement each functionality.

Note: Some pins are multiplexed for different functionalities, which means that only one at a time can be active for each pin.

Table 4-5. Function by PIO (Part 1)

PIO NAME	PCK	ISI	SSC	CAN	SPI
PC16	--	--	TK0	--	--
PC17	--	--	TF0	--	--
PC18	--	--	TD0	--	--
PC20/PD28	--	--	RF0	--	--
PC21/PD29	--	--	RD0	--	--
PC19/PD30	PCK0	--	RK0	--	--
PD30/PC15	PCK0/PCK2	--	--	--	--
PD31	PCK1	--	--	--	--
PB14	--	--	--	CANRX1	--
PD14	--	--	--	CANRX0	--
PB15	--	--	--	CANTX1	--
PD15	--	--	--	CANTX0	--
PC22/PC1	--	--	--	--	SPI1_MISO
PC24/PC0	--	--	--	--	SPI1_SPCK
PC23/PC2	--	--	--	--	SPI1_MOSI
PC25	--	--	--	--	SPI1_NPCS0
PC26/PA30	--	ISI_D11/VSYNC	--	--	SPI1_NPCS1
PC27/PA31	--	ISI_D10/HSYNC	--	--	SPI1_NPCS2
PC28	--	ISI_D9	--	--	SPI1_NPCS3
PC29	--	ISI_D8	--	--	--
PA23	--	ISI_D7	--	--	--
PA22	--	ISI_D6	--	--	--
PA21	--	ISI_D5	--	--	--
PA20	--	ISI_D4	--	--	--
PA19	--	ISI_D3	--	--	--
PA18	--	ISI_D2	--	--	--
PA17	--	ISI_D1	--	--	--
PA16	--	ISI_D0	--	--	--
PC30	--	ISI_PCK	--	--	--
PA30	--	ISI_VSYNC	--	--	--
PA31	--	ISI_HSYNC	--	--	--

Table 4-6. Function by PIO (Part 2)

PIO NAME	TWI	UART/USART	ANALOG	MISC
3V3/5V	--	--	--	3V3/5V
nRTS	--	--	--	nRTS
GND	--	--	--	GND
AREF	--	--	AREF	--
5V	--	--	--	5V
PC18	--	--	AD0	--
PD21	--	--	AD1	--
PD22	--	--	AD2	--
PD23	--	--	AD3	--
PD24	--	--	AD4	--
PD25	--	--	AD5	--
PD26	--	--	AD6	--
PD27	--	--	AD7	--
PC20/PD28	--	--	AD8	--
PC21/PD29	--	--	AD9	--
PC19/PD30	--	--	AD10	--
PD31	--	--	AD11	--
PD19/PB15	--	--	ADTRG	--
PA19	TWCK2	--	--	--
PA18	TWD2	--	--	--
PC26	TWD1	--	--	--
PA30	TWD0	URXD1	--	--
PA31	TWCK0	UTXD1	--	--
PC26/PA30	TWD0/TWD1	URXD1	--	--
PC27/PA31	TWCK0/TWCK1	URTD1	--	--
PC30	--	UTXD0	--	--
PC29	--	URXD0	--	PWMFI2
PD14	--	SCK0	--	--
PD15	--	CTS0	--	--
PD18	--	TXD0	--	--
PD17	--	RXD0	--	--
PB25	--	SCK1	--	--
PB26	--	CTS1	--	--
PB29	--	TXD1	--	--
PB28	--	RXD1	--	--
PB27	--	RTS1	--	PWMH1