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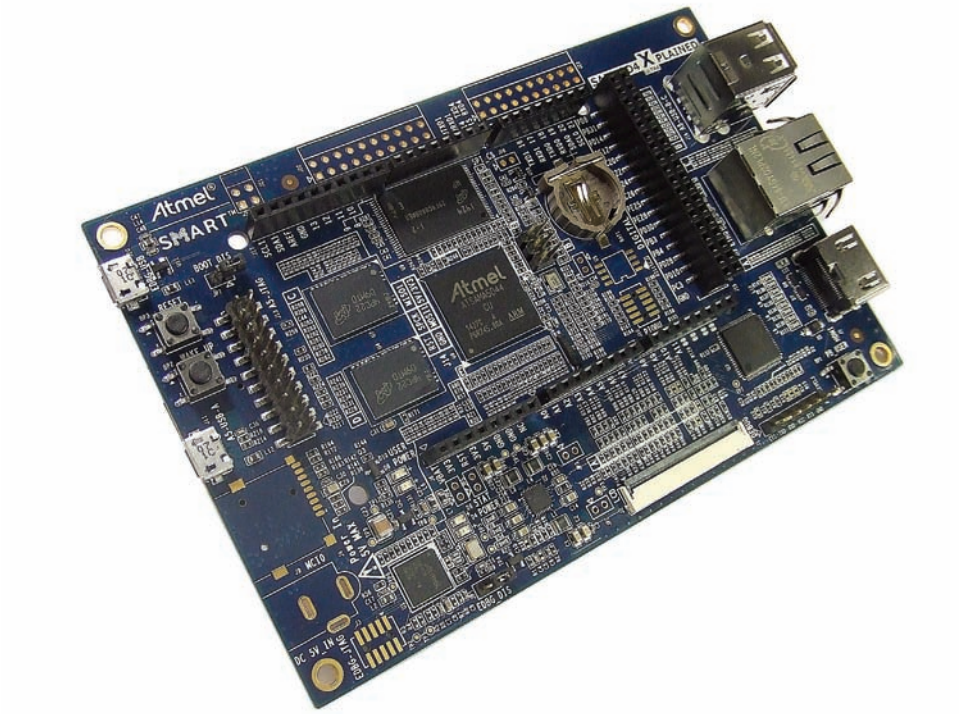
Atmel | SMART SAMA5D4 Series

SAMA5D4 Xplained Ultra Evaluation Kit

USER GUIDE



Introduction

This user guide introduces the Atmel® SAMA5D4 Xplained Ultra evaluation kit (SAMA5D4-XULT) and describes the development and debugging capabilities for applications running on the Atmel | SMART SAMA5D4 ARM® Cortex®-A5-based embedded microprocessor unit (eMPU).

Scope

This guide provides details on the SAMA5D4-XULT. 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 SAMA5D4-XULT board.
- Section 3. provides an overview of the SAMA5D4-XULT board.
- Section 4. describes the SAMA5D4-XULT board components.

Kit Contents

The SAMA5D4-XULT includes:

- Board
  - One SAMA5D4-XULT board
- Cables
  - One Micro-AB type USB cable
- Welcome letter

Table of Contents

1. Evaluation Kit Specifications

Table 1-1. Evaluation Kit Specifications

Characteristic		Specifications
Board		SAMA5D4-XULT
Board supply voltage		USB powered 5VDC from optional jack connector or from “Arduino shield”
Temperature	Operating	0°C to +70°C
	Storage	-40°C to +85°C
Relative Humidity		0 to 90% (non-condensing)
Dimensions: Main board		135 × 88 × 20 mm
RoHS status		Compliant
Board Identification		SAMA5D4-XULT

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 the J4 DC jack (can provide up to 1.2A on the 3.3V node).

2. Power Source

Several options are available to power up the SAMA5D4-XULT board.

The board can be:

- USB-powered through the USB Micro-AB connector (J11 - 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 (J4). The recommended output voltage range of the power adapter is 5V at 2A.
- Powered through the Arduino shield.
- Powered through the USB Micro-AB connector on the Atmel Embedded Debugger (EDBG) interface (J20).

Unlike Arduino Uno boards, the SAMA5D4-XULT 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. Connect the USB Micro-AB cable to the connector (J11). 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 (limits)	6 VCC
Max DC 3v3 current available	1.2A
I/O Voltage	3.3V only

2.2 Sample Code and Technical Support

After boot up, you can run some sample code or your own application on the development kit. 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 Overview

3.1 Introduction

The Atmel SAMA5D4-XULT is a fully-featured evaluation platform for the Atmel SAMA5D4 series ARM-based embedded microprocessor units (eMPU). It allows users to extensively evaluate, prototype and create application-specific designs.

3.2 Equipment List

The SAMA5D4-XULT board is based on the integration of an ARM Cortex-A5-based microprocessor with external memory, one Ethernet physical layer transceiver, two SD/MMC interfaces, two host USB ports and one device USB port, one 24-bit RGB LCD and HDMI interface and debug interfaces.

Seven headers, compatible with Arduino R3 (Uno, Due) and two Xplained headers are available for various shield connections.

3.3 Board Features

Table 3-1. Board Specifications

Characteristics	Specifications
Dimensions (L x W x H)	135 × 88 × 20 mm
Processor	SAMA5D44 (361-ball BGA package), 16x16 mm body, pitch 0.8 mm
Oscillators	MPU, EDBG: 12 MHz quartz RTC: 32.768 kHz PHY: 25 MHz
Main Memory	2 x DDR2 2 Gb 16 Meg x 16 x 8 banks (total 4 Gbit = 512 MB) 1 x SLC NAND Flash 4 Gb 8-bit data (total 4 Gbit = 512 MB)
Accessory memories	One optional Serial EEPROM SPI One EEPROM with Mac Address and Serial Number
SD/MMC	One 4-bit SD card connector One 4-bit Micro-SD card connector
USB	Two USB Hosts with power switch One Micro-AB USB device
Display	One LCD interface connector, LCD TFT Controller with overlay, alpha-blending, rotation, scaling and color space conversion
	One HDMI interface and connector
Ethernet	One Ethernet PHY (RMII 10/100MHz)
Debug port	One JTAG interface connector One EDBG interface One serial DBGU interface (3v3 level)
Expansion connector	Arduino R3 compatible set of connectors XPRO set of connectors
Board supply voltage	5V from USB, power jack, and Arduino shield On-board power regulation by PMIC
Battery	On-board battery socket
User interface	Reset, Wake-up and free user push button One red user/power LED One blue user LED

4. Board Components

4.1 Board Overview

The fully-featured SAMA5D4-XULT board integrates multiple peripherals and interface connectors, as shown in Figure 4-1.

Figure 4-1. SAMA5D4-XULT Board Overview

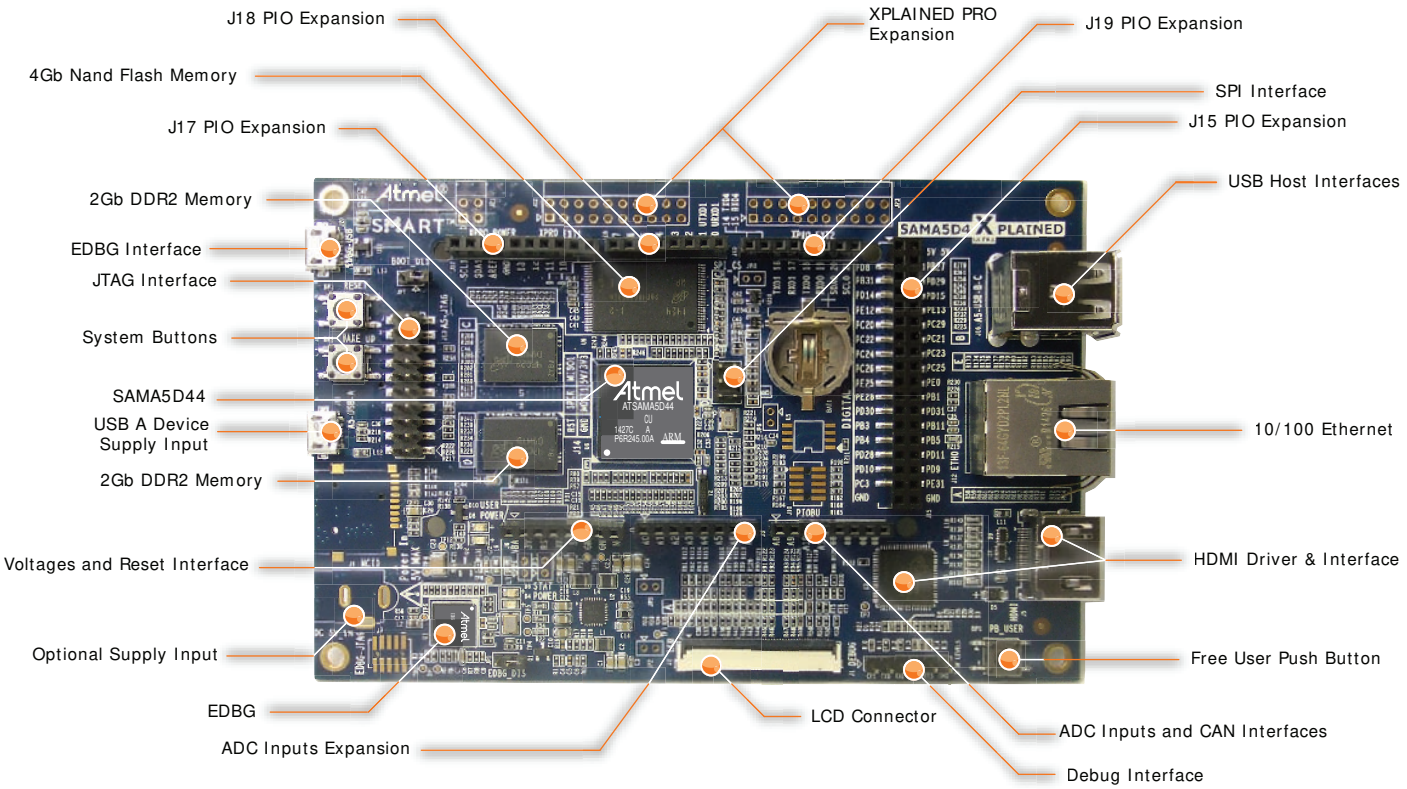


Table 4-1 describes the interface connectors on the SAMA5D4-XULT.

Table 4-1. SAMA5D4-XULT Board Interface Connectors

Connector	Interfaces to
J4	Main power supply
J11	USB A Device. Supports USB device using a type Micro-AB connector
J16	USB Host B and C. Supports USB host using a stacked type A connector
J1	Serial DBGU (3.3V level)
J13	JTAG, 20 pin IDC connector
J20	EDBG USB connector
J9	Micro-SD connector
J24	SD/MMC connector
J12	Ethernet ETH0
J2	Expansion connector with all LCD controller signals for display module connection (QTouch®, TFT LCD display with touchscreen and backlight)
J5	HDMI connector type A
BAT1	CR1225 Battery holder
J6, J7, J8, J14, J15, J17, J18, J19	Expansion connectors with Arduino R3 compatible PIO signals
J21, J22, J23	Expansion connectors Xplained
J3	JTAG EDBG (not populated)
J10	PIOBU extension (not populated)

4.2 Function Blocks

4.2.1 Processor

The Atmel® | SMART SAMA5D4 Series is a high-performance, power-efficient ARM® Cortex®-A5 processor MPU capable of running up to 600 MHz. It integrates the ARM NEON™ SIMD engine for accelerated signal processing, multimedia and graphics as well as a 128 KB L2-Cache for high system performance. The device features the ARM TrustZone® enabling a strong security perimeter for critical software, as well as several hardware security features. The device also features advanced user interface and connectivity peripherals.

The SAMA5D4 devices have three software-selectable low-power modes: Idle, Ultra Low-power, and Backup. In Idle mode, the processor is stopped while all other functions can be kept running at normal operating bus frequency. In Ultra Low-power mode, the processor is stopped while all other functions can be kept running at minimum operating bus frequency. In Backup mode, only the real-time clock, real-time timer, backup SRAM, backup registers, and wake-up logic are running.

The SAMA5D4 features an internal multi-layer bus architecture associated with 32 DMA channels to sustain the high bandwidth required by the processor and the high-speed peripherals. The device supports DDR2/LPDDR/LPDDR2 and SLC/MLC NAND Flash memory with 24-bit ECC.

The comprehensive peripheral set includes a 720p hardware video decoder, an LCD controller with overlays for hardware-accelerated image composition, a resistive touch screen function, and a CMOS sensor interface. Connectivity peripherals include a dual 10/100 Ethernet MAC with IEEE1588, three HS USB ports, UARTs, SPIs and I2Cs.

Security features includes an "on-the-fly" encryption-decryption process from the external DDR memory, tamper detection pins, secure storage of critical data, an integrity check monitor (ICM) to detect modification of the memory contents and a secure boot. The product also includes a dedicated coprocessor for public key cryptography such as RSA and elliptic curves algorithms (ECC), as well as AES, 3DES, SHA function and TRNG. These features permit to protect the system against counterfeiting, to safeguard sensitive data, authenticate safe program or secure external data transfers.

The SAMA5D4 series is optimized for control panel/HMI applications needing video playback and applications that require high levels of connectivity in the industrial and consumer market. Its security features make the SAMA5D4 well suited for secure gateways or for the IoT.

4.2.2 Power Supply Topology and Power Distribution

4.2.2.1 Power Lines

Refer to the Power Supplies and Power Supply Connections tables in the SAMA5D4 datasheet.

4.2.2.2 Power-up and Power-down Considerations

Power-up and power-down considerations are described in section “Power Considerations” of the SAMA5D4 Series datasheet.

4.2.2.3 SAMA5D44 Power Supplies Summary

Table 4-2. SAMA5D44 Power Supplies

Name	Voltage Range, Nominal	Associated Ground	Powers
VDDCORE	1.62–1.98V, 1.8V	GNDCORE	Regulator that generates core power supply on VCCCORE 10 µF decoupling capacitor is to be connected to VCCCORE MUST BE ESTABLISHED AFTER VDDIOP OR AT THE SAME TIME
VCCCORE	1.1–1.32V, 1.2V	GNDCORE	Core
VDDIODDR	1.70–1.90V, 1.8V	GNDIODDR	DDR2 Interface I/O lines
	1.14–1.30V, 1.2V		LP-DDR2 Interface I/O lines
VDDIOM	1.65–1.95V, 1.8V 3.0–3.6V, 3.3V	GNDIOM	NAND and HSMC Interface I/O lines
VDDIOP (1)	3.0–3.6V, 3.3V	GNDIOP	Peripherals I/O lines MUST BE ESTABLISHED PRIOR TO VDDCORE
VDDBU	1.88–2.12V, 2V	GNDBU	Slow Clock oscillator, the internal 64 kHz RC and a part of the System Controller MUST BE ESTABLISHED FIRST
VDDUTMIC	1.1–1.32V, 1.2V	GNDUTMI	USB device and host UTMI+ core and the UTMI PLL MUST be connected to VCCCORE
VDDUTMII	3.0–3.6V, 3.3V	GNDUTMI	USB device and host UTMI+ interface
VDDPLLA	1.1–1.32V, 1.2V	GNDPLL	PLLA cell MUST be connected to VCCCORE
VDDOSC	3.0–3.6V	GNDOSC	Main Oscillator cell
VDDANA(1)	3.0–3.6V, 3.3V	GNDANA	Analog parts MUST be connected to VDDIOP with filtering
VDDFUSE	2.25–2.75V, 2.5V	GNDFUSE	Fuse box for programming VDDFUSE must be 2.5V or 0V and must not be left floating

Notes: 1. Both VDDIOP and VDDANA must rise at the same time due to internal constraints.

4.2.2.4 ACT8865 Power Management IC

The ACT8865 is a complete, cost-effective and highly-efficient ActivePMU™ power management solution, optimized to provide a single-chip power solution and voltage sequencing for Atmel SAMA5D3/SAMA5D4 and SAM9 series MPUs. It also meets the control requirements of these devices.

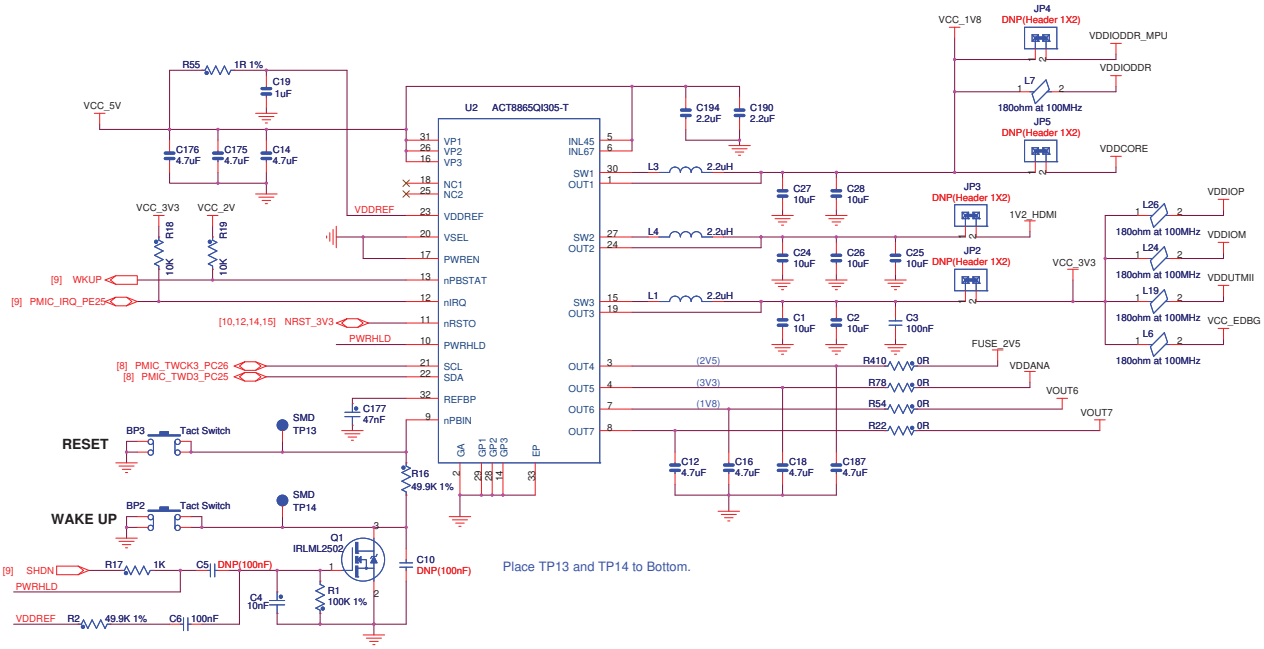
The ACT8865 features three step-down DC/DC converters and four low-noise, low-dropout linear regulators.

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 www.active-semi.com for more details.

Figure 4-2. Board Power Management



Supply Group Configuration

The ACT8865 provides:

- All power supplies required by the SAMA5D44 device:
  - 1.8V VDDCORE
  - 1.8V VDDIODDR
  - 2.0V VDDBU
  - 3.3V VDDIOP, VDDIOM, VDDANA, VDDUTMII
  - 2.5V VDDFUSE
- Power supplies to external chips on the main board:
  - 1.2V HDMI
  - 3.3V Ethernet PHY, HDMI, EDBG

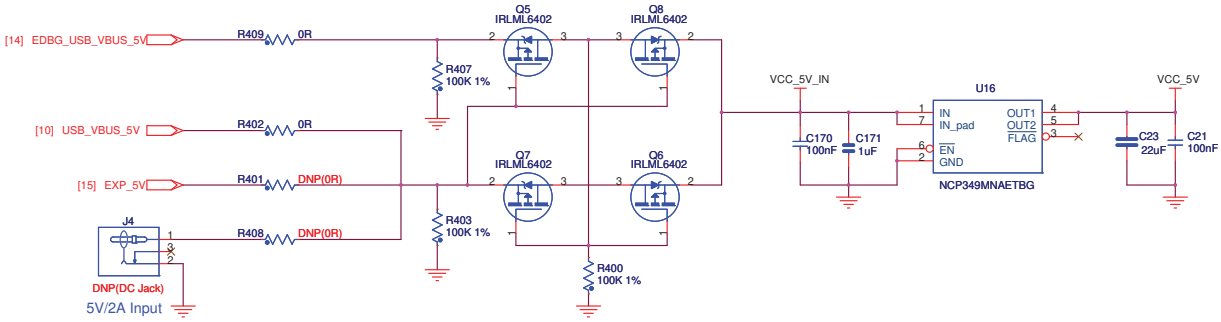
4.2.2.5 Power Options

There are several power options for the SAMA5D4-XULT board.

The power sources are selected by a set of 0R resistors. The USB-powered operation is the default configuration. It comes from the USB device port connected to a PC or a 5V DC supply. The USB supply is sufficient to power the board in most applications. It is important to note that when the USB supply is used, the USB Host ports do not function. If USB Host ports are required for the application, it is recommended that a DC supply be used.

Figure 4-3 provides the schematics of power options.

Figure 4-3. Input Powering Scheme Option



Note: USB-powered operation eliminates additional wires and batteries. It is the preferred mode of operation for any project that requires only a 5V source at up to 500 mA.

4.2.2.6 Wall Supply Source

A wall supply can be used to provide power to the board. A regulated 5V DC supply of at least 2A is required. If USB ports and expansion headers are used, a rating of 3A is preferred. A 2.1 mm plug with a center-hot configuration is required.

If the USB host ports or expansion board Arduino shields are used, additional current is necessary.

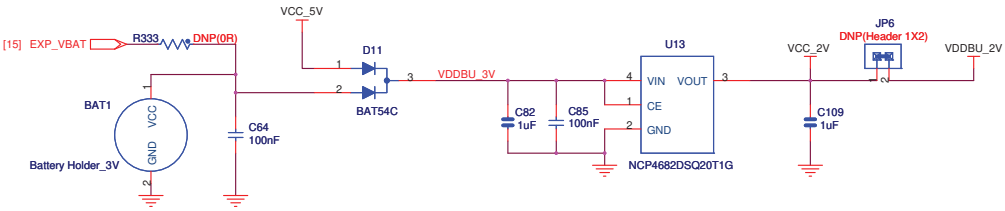
If the DC load required is greater than 500 mA per port, a higher current supply must be used.

4.2.2.7 Backup Power Supply

The SAMA5D4-XULT board requires a battery (3V lithium battery type CR1225 or equivalent) in order to permanently power the backup part of the SAMA5D4 device (refer to SAMA5D4 Series data sheet).

To avoid losing data and saved registers, the board must be powered on when replacing the battery.

Figure 4-4. VBAT Powering Scheme Option



4.2.2.8 Power Supply Control

In the ACT8865, three DCDCs (1.8V, 1.2V, 3.3V) and two LDO outputs are available.

All ACT8865 outputs can be controlled by the TWI interface through software.

The three DCDCs outputs can be enabled or disabled by the SAMA5D44 SHDN output:

- SHDN = 0: The DCDCs output is disabled.
- SHDN = 1: The DCDCs output is enabled.

Two push buttons are also available:

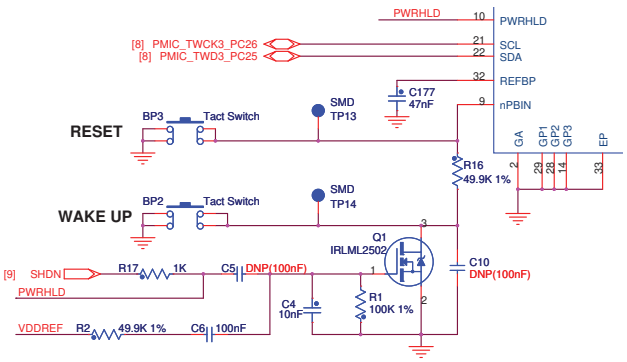
- Wakeup push button: When pressed, the ACT8865 power outputs are restarted if the ACT8865 is in shutdown mode.
- Reset push button: When pressed, the ACT8865 transfers the reset signal to NRST_3V3, and then to NRST_2V for the MPU by using a resistor divider.

4.2.3 Reset Circuitry

The reset sources for SAMA5D4-XULT board are:

- Power-on reset from the Power Management Unit (PMIC)
- Push button reset BP3
- External reset from Arduino connectors
- JTAG or EDBG reset from an in-circuit emulator

Figure 4-5. Reset/Wakeup and Shutdown Control

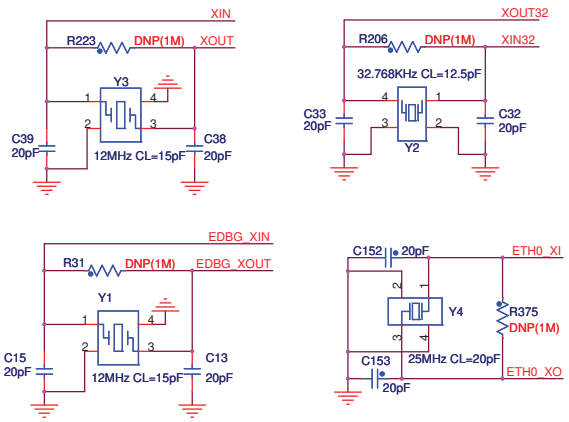


4.2.4 Clock Circuitry

The SAMA5D4-XULT board includes four clock sources:

- Two clocks are alternatives for the SAMA5D44 processor (12 MHz, 32 kHz)
- One crystal oscillator used for the Ethernet RMII chip (25 MHz)
- One crystal oscillator used for the EDBG (12 MHz)

Figure 4-6. Clock Circuitry



4.2.5 Memory

4.2.5.1 Memory Organization

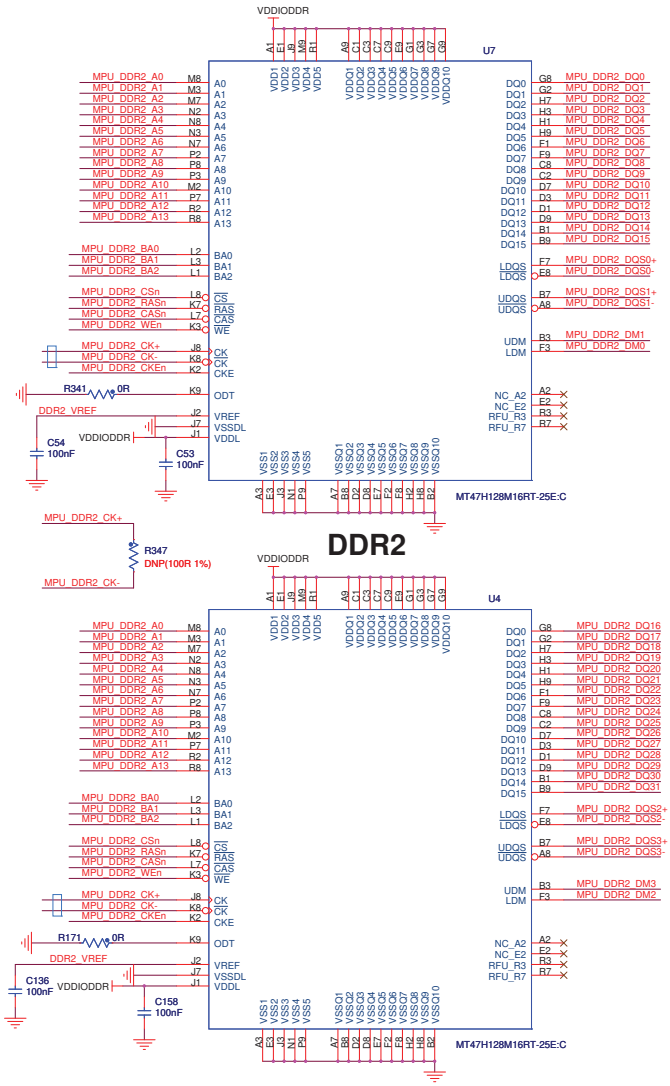
The SAMA5D4 features a DDR/SDR memory interface and an External Bus Interface (EBI) to permit interfacing to a wide range of external memories and to almost any kind of parallel peripheral.

This section describes the memory devices that equip the SAMA5D4-XULT board.

4.2.5.2 DDR2/SDRAM

- Two DDR2/SDRAM (MT47H128M16 - 2 Gb - 16 Meg x 16 x 8 banks) are used as main system memory. The board provides 4 Gb on-board, soldered DDR2 (double data rate) SDRAM. The memory bus is 32 bits wide and operates with a frequency of up to 176 MHz.

Figure 4-7. DDR2



4.2.5.3 DDR_CALP and DDR_CALN Analog Inputs

Two specific analog inputs, DDR_CALP and DDR_CALN, are used to calibrate all DDR I/Os.

Figure 4-8. DDR_CALP and DDR_CALN Analog Inputs

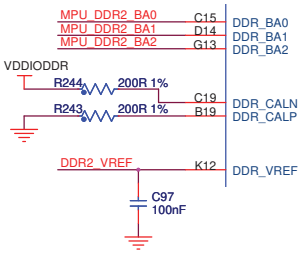


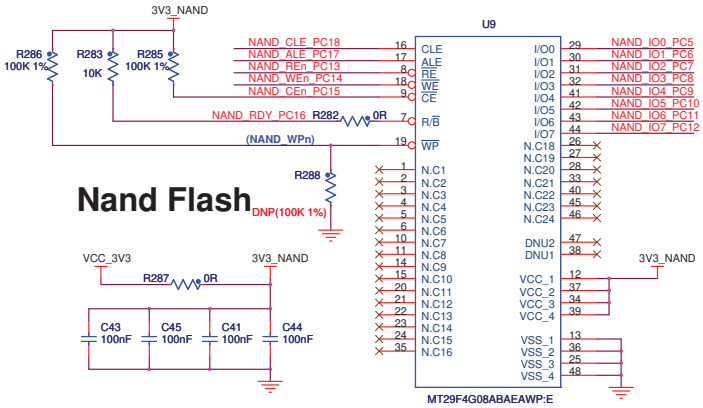
Table 4-3. DDR_CALN and DDR_CALP

Memory Type	CALP Pull-down	CALN Pull-up
DDR2	200 ohm	200 ohm
LPDDR2	240 ohm	240 ohm

4.2.5.4 NAND Flash

One 512 MB NAND Flash is connected to the processor.

Figure 4-9. NAND Flash



4.2.5.5 CS Disable

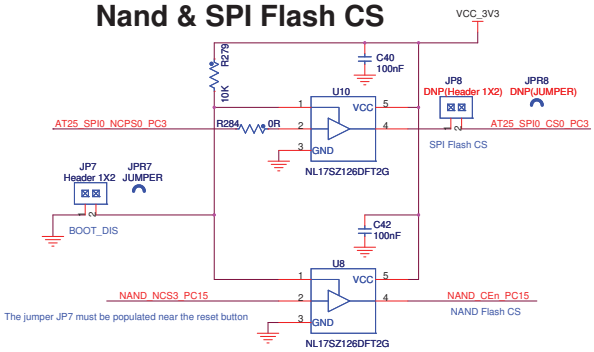
The SAMA5D44 device boots according to the following sequence:

1. D CARD connected on MCI1
2. Optional Dataflash connected on NPCS0 SPI0
3. 8-bit NAND Flash connected to D0–D7

In this sequence, the first device found with bootable contents is selected as the boot source. The others are disregarded.

On-board jumpers (JP7, JP8) control the selection (CS#) of the on-board bootable memory components (NAND Flash and Serial DataFlash) using a non-inverting 3-state buffer.

Figure 4-10. CS Disable



The rule of operation is:

- JP7 = OFF (default) → enable normal boot from NAND Flash (or serial DataFlash if mounted)
- JP7 = ON → booting from optional serial DataFlash or NAND Flash is disabled

JP8 (optional) also controls the serial DataFlash if mounted.

Refer to the SAMA5D4 Series datasheet for more information on standard boot strategies and sequencing.

4.2.6 Additional Memories

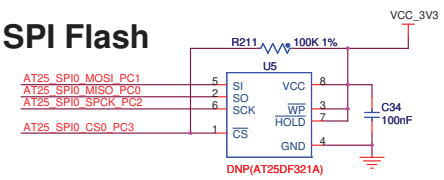
4.2.6.1 Serial Data Flash (optional)

The SAMA5D44 provides two high-speed Serial Peripheral Interface (SPI) controllers. One port is used to interface with the optional on-board serial DataFlash.

The four main signals used in the SPI are Clock, Data In, Data Out, and Chip Select. The SPI is a serial interface similar to the I^2C bus interface but with three main differences:

- It operates at a higher speed.
- Transmit and receive data lines are separate.
- Device access is chip select-based instead of address-based.

Figure 4-11. Optional Serial DataFlash



4.2.6.2 Serial EEPROM with Unique MAC Address

The SAMA5D4-XULT board embeds one Atmel AT24MAC402/602 EEPROM using a TWI0 interface.

The AT24MAC402/602 provides 2048 bits of Serial Electrically-Erasable Programmable Read-Only Memory (EEPROM) organized as 256 words of eight bits each and is accessed via an I^2C-compatible (2-wire) serial interface. In addition, the AT24MAC402/602 incorporates an easy and inexpensive method to obtain a globally unique MAC or EUI address (EUI-48 or EUI-64).

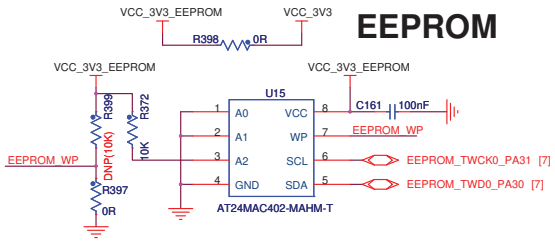
The EUI-48/64 addresses can be assigned as the actual physical address of a system hardware device or node, or it can be assigned to a software instance. These addresses are factory-programmed by Atmel and permanently write-protected in an extended memory block located outside of the standard 2-Kbit memory array.

In addition, the AT24MAC402/602 provides the value-added feature of a factory-programmed, guaranteed unique 128-bit serial number located in the extended memory block (same area as the EUI address values).

The EEPROM device is used as a “soft label” to store board information such as chip type, manufacture name and production date, using the last two 16-byte blocks in memory.

WARNING **The information contained in these blocks should not be modified.**

Figure 4-12. EEPROM



4.2.7 High-Speed Multimedia Card Interface (HSMCI)

4.2.7.1 Multimedia Card Interface (MCI)

The SAMA5D4-XULT board has two high-speed Multimedia Card interfaces (MCIs) that support the multimedia card (MMC) Specification V4.3, the SD Memory Card Specification V2.0 and the SDIO V1.1 specification:

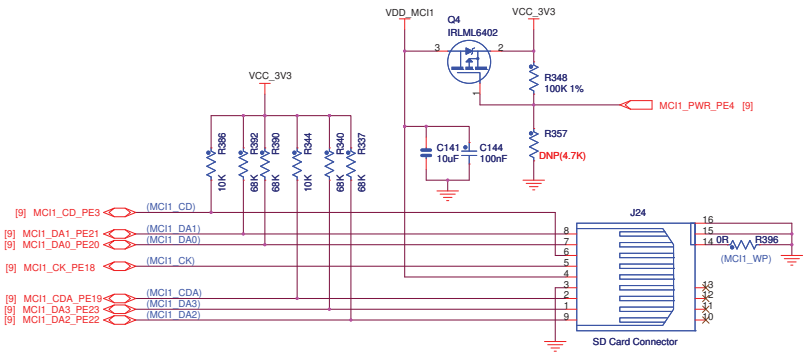
- **MCI0 interface** based on a 7-pin interface (clock, command, 4-bit data, power lines).
- **MCI1 Interface** based on a 7-pin interface (clock, command, 4-bit data, power lines).

4.2.7.2 HSMCI Card Connector

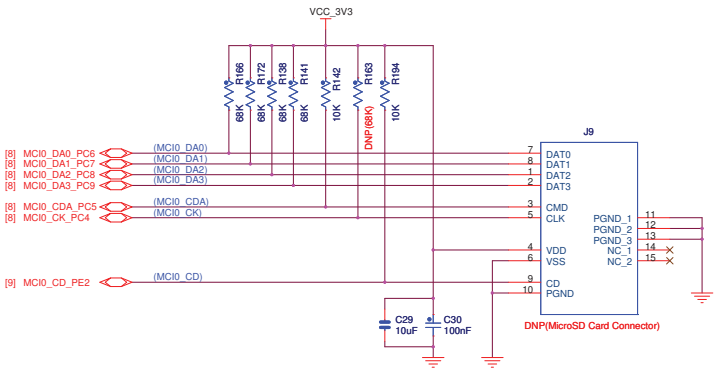
A standard MMC/SD card (push and click type) connector, connected to MCI1, is mounted on the top side of the board. It features a push-lock / push-eject mechanism and a card detection switch.

A micro SD card (push and click type) connector, connected to MCI0, is mountable as an option on the bottom side of the board.

Figure 4-13. HSMCI0 & HSMCI1



SD/MMCPlus CARD INTERFACE - MCI1



Micro SD CARD INTERFACE - MCI0

4.2.8 Communication Interfaces

The SAMA5D4-XULT board is equipped with EMAC and USB Host/Device communication interfaces.

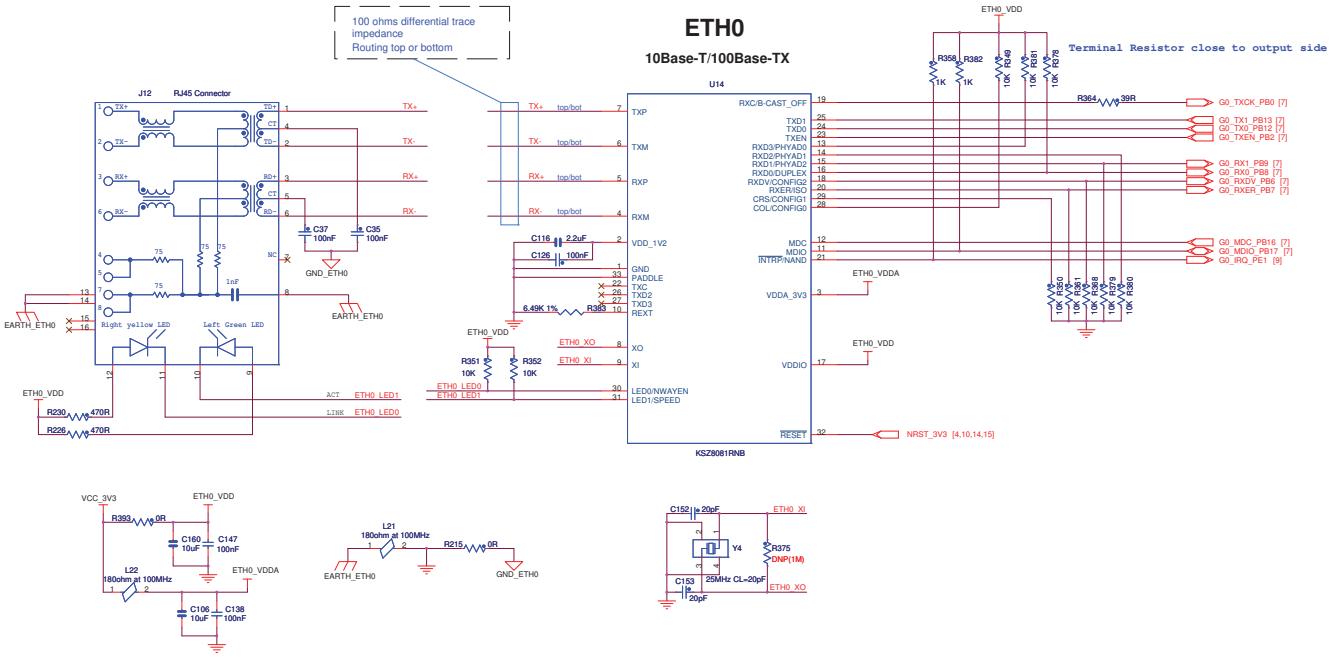
4.2.8.1 Ethernet 10/100 (EMAC) Port

The SAMA5D4-XULT board contains a MICREL PHY device (KSZ8081) 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 can be used to connect to a 10/100 Base-T RJ45 connector integrated on SAMA5D4-XULT board.

Additionally, for monitoring and control purposes, LED functionality is carried on the RJ45 connectors to indicate activity, link, and speed status information.

For more information about the Ethernet controller device, refer to the MICREL KSZ8081RN controller manufacturer's datasheet.

Figure 4-14. Ethernet

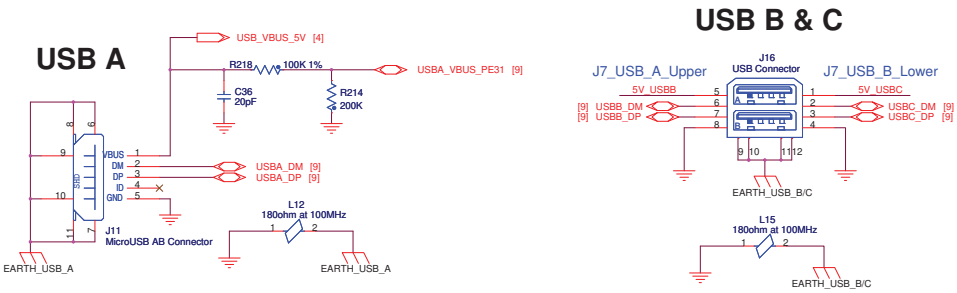


4.2.8.2 USB Host/Device A, B & C

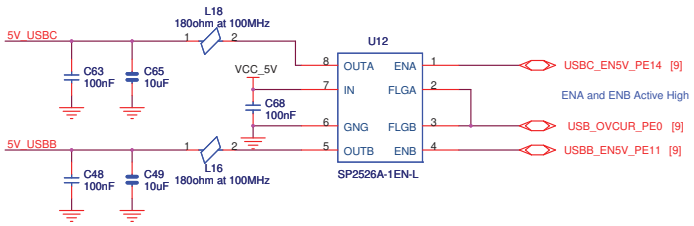
The SAMA5D4-XULT board features three USB communication ports:

- USB Host B/C High- and Full-speed Interface
  - Two USB host stacked type A connectors.
- USB Host/Device A Interface
  - One USB device standard micro-AB connector. This port has a VBUS detection function made through the resistor ladder R218 and R214.

Figure 4-15. USB Host & Device Interface



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



4.2.9 LCD TFT Interface

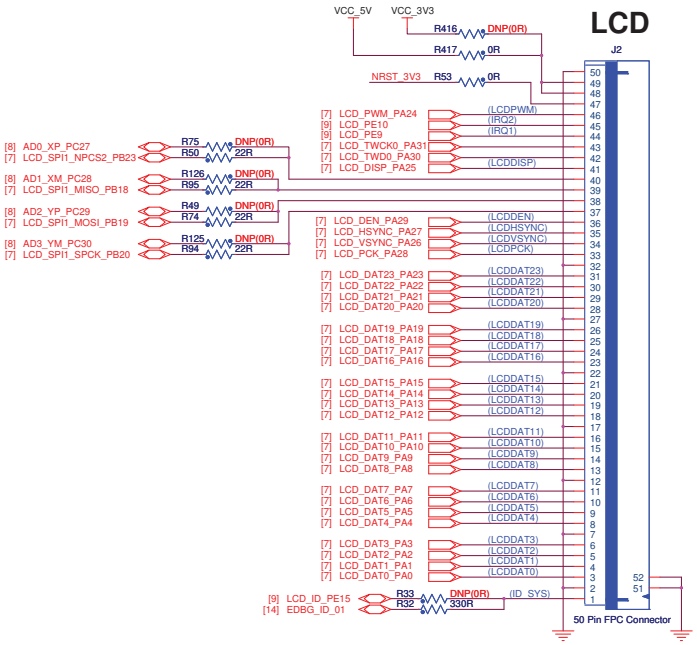
4.2.9.1 LCD

The SAMA5D4 provides 24 bits of data and control signals to the LCD interface. Other signals are used to control the LCD and are available on connector J2: TWI, SPI, 2 GPIOs for interrupt, 1-Wire and power supply lines.

4.2.9.2 LCD Expansion Header

J2 is a 1.27mm pitch 50-pin header; it gives access to the LCD signals.

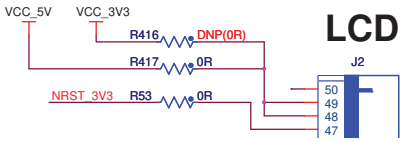
Figure 4-16. LCD Expansion Header Interface



4.2.9.3 LCD Power

In order to operate correctly out of the processor with various LCD modules, two voltage lines are available: 3.3V and 5 VCC (default), both selected by 0R resistors R416 and R417.

Figure 4-17. LCD Power



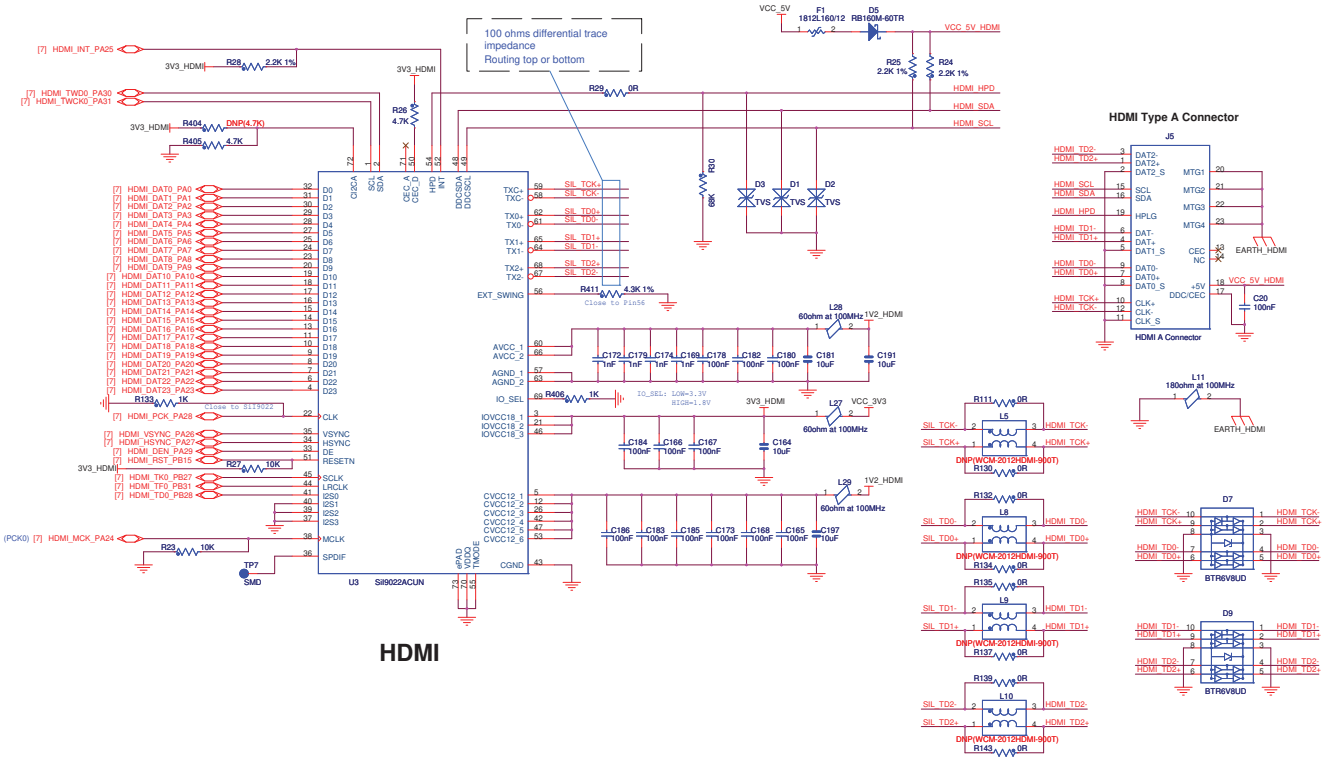
4.2.10 HDMI Transmitter Interface

The SAMA5D4-XULT board features the Silicon Image SiI9022ACUN device to convert video signals to the HDMI standard.

It features the following:

- Compliance
  - HDMI 1.2a, Simply HD, DVI 1.0
- Digital Video Output
  - Integrated TMDS core
  - DTV resolution support - 480i/576i/480p/576p/720p/1080i/1080p
  - PC resolution support - VGA/XGA/SXGA/WSXGA/UXGA
  - Flexible interface to HD MPEG decoders
  - Integrated YCbCr → RGB conversion
  - 4:2:2 → 4:4:4 up-converter
- Digital Audio Output
  - DVD-Audio support through 4 x I2S inputs
  - Supports 2-ch 192 kHz or 8-ch 96 kHz
  - Supports IEC60958 2-ch PCM or IEC61937 compressed audio (Dolby Digital, DTS, etc.)
  - Industry-standard S/PDIF input, Integrated MCLK generator
- Power Management
  - 1.2V and 1.8V cores provide low-power operation
  - Flexible power-down modes

Figure 4-18. HDMI Interface



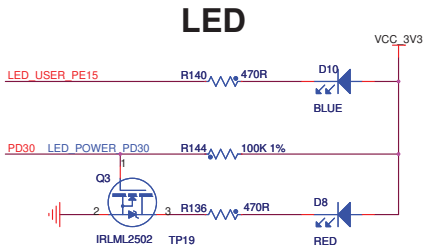
HDMI

4.2.11 Indicators

There are two LEDs on the SAMA5D4-XULT board that can be controlled by the user:

- The red LED provides an indication that power is supplied to the board and is controlled via software.
- The blue LED is controlled via GPIO pins.

Figure 4-19. LED Indicators

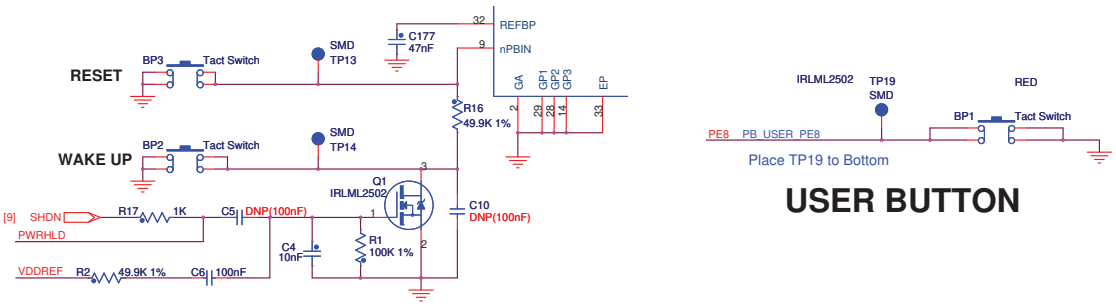


4.2.12 Push Button Switches

The SAMA5D4-XULT features three push buttons:

- One board Reset button (BP3). When pressed and released, it causes a power-on reset of the board.
- One Wakeup push button to exit the processor from low-power mode (BP2).
- One User momentary push button (BP1).

Figure 4-20. Push Buttons



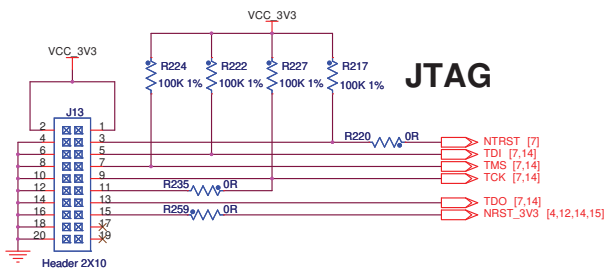
4.2.13 Debug Interfaces

The SAMA5D4-XULT board includes a JTAG, a Debug serial COM port and an EDBG interface port, to provide debug level access to the SAMA5D4.

4.2.13.1 Debug JTAG

A 2x10-pin JTAG header is provided on the SAMA5D4-XULT board to facilitate the software development and debugging by using various JTAG emulators. The interface signals have a voltage level of 3.3V.

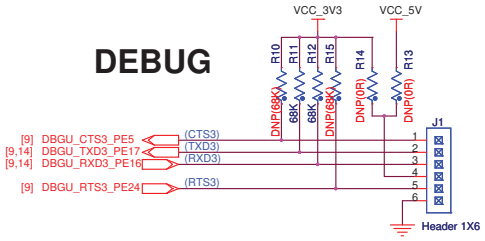
Figure 4-21. JTAG Interface



4.2.13.2 DBGU

The SAMA5D4-XULT board has a dedicated serial port for debugging, which is accessible through the 6-pin male header J1. Various interfaces can be used as USB/Serial DBGU port bridge, such as FTDI TTL-232R USB to TTL serial cable or basic breakout board for the RS232/USB converter.

Figure 4-22. DBGU Interface



R13 and R14 are optional (not implemented) resistors that can be used for power selection. Power can be delivered either by the SAMA5D4-XULT board or by the debug interface tool. To avoid malfunction between the debug interface (e.g., FTDI) and the on-board power system, ensure that the voltage level selected corresponds to application requirements.

4.2.14 Embedded Debugger (EDBG) Interface

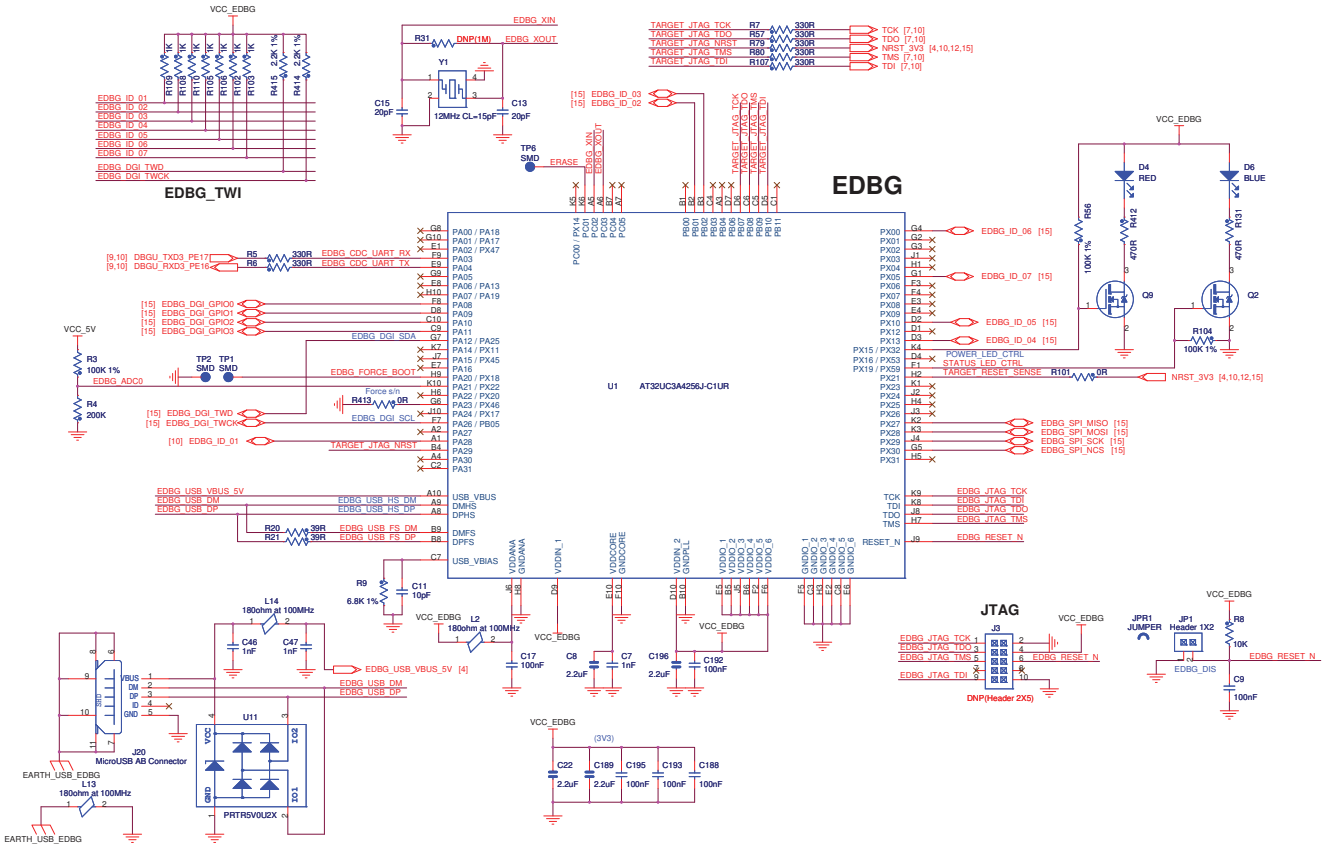
The Atmel Embedded Debugger (EDBG) [1] is an intuitive plug-and-play solution which adds full programming and debugging support to embedded hardware kits containing Atmel microcontrollers. It enables seamless integration between the target hardware and the Atmel Studio front end.

In addition to the Virtual COM port which provides a UART bridge to the target device, the EDBG provides a Data Gateway Interface, through which the target device and host PC can communicate, facilitating high-level application debugging, monitoring, graphing and logging of system information in real-time.

The EDBG is based on the Atmel UC3A4 high-performance low-power 32-bit AVR microcontroller running at up to 60 MHz. The device includes an on-chip USB 2.0 high-speed hardware module with dedicated DMA channels, making it ideal for data communications.

By default, the EDBG is in Reset state and not usable. To use the EDBG interface, remove the jumper JP1. To avoid any conflict with the debug signals, do not use the JTAG and EDBG at the same time.

Figure 4-23. EDBG Interface



1. Device and Ordering Information—The EDBG is a factory-programmed AT32UC3A4256J-C1UR standard microcontroller with ordering code AT32UC3A4256HHB-C1UR. For further information please contact edbg@atmel.com.