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Preface

The Atmel® | SMART SAM V71 Xplained Ultra evaluation kit is a hardware platform to evaluate the ATSAMV71Q21, and other Atmel ARM® Cortex® -M7-based microcontrollers in the SAM V70, SAM S70, and SAM E70 series.

Supported by the Atmel Studio integrated development platform, the kit provides easy access to the features of the Atmel ATSAMV71Q21 and explains how to integrate the device in a custom design.

The Xplained Ultra series evaluation kits include an on-board Embedded Debugger, and no external tools are necessary to program or debug the ATSAMV71Q21.

The Xplained Pro extension kits offers additional peripherals to extend the features of the board and ease the development of custom designs.

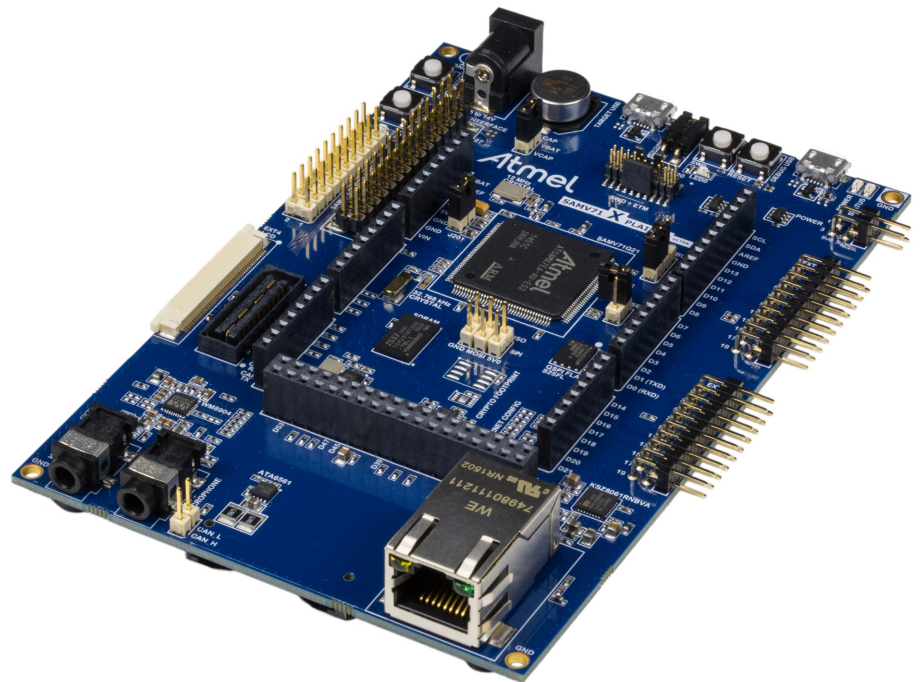


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1. Introduction

1.1. Features

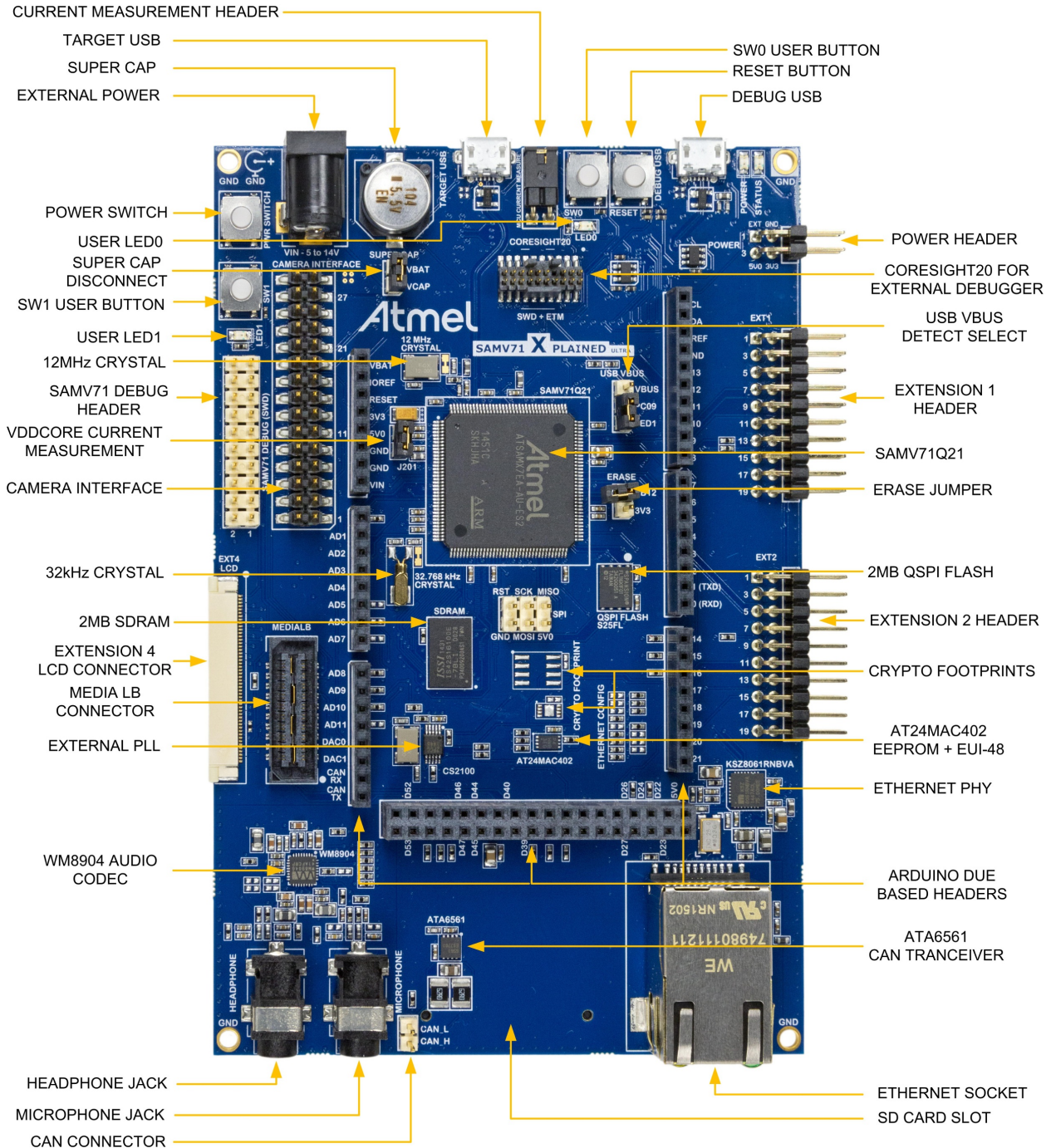
- ATSAMV71Q21 microcontroller
- One mechanical reset button
- One power switch button
- Two mechanical user pushbuttons
- Two yellow user LEDs
- Supercap backup
- 12.0MHz crystal
- 32.768kHz crystal
- 2MB SDRAM
- 2MB QSPI Flash
- Built in Ethernet MAC with external IEEE 802.3az 10Base-T/100Base-TX Ethernet RMII PHY
- AT24MAC402 256KB EEPROM with EUI-48 address
- WM8904 low power stereo audio codec
 - External PLL for precise clock generation
 - Microphone jack
 - Headphone jack
- ATA6561 CAN Transceiver
- SD Card connector with SDIO support
- Camera interface connector
- MediaLB connector
- Two Xplained Pro extension headers
- One Xplained Pro LCD header
- CoreSight 20 connector for 4-bit ETM
- Arduino Due based shield connectors
- External debugger connector
- USB interface, device and host mode
- Embedded Debugger
 - Auto-ID for board identification in Atmel Studio
 - One yellow status LED
 - One green board power LED
 - Symbolic debug of complex data types including scope information
 - Programming and debugging
 - Data Gateway Interface: SPI, I²C, four GPIOs
 - Virtual COM port (CDC)
- External power input (5-14V)
- USB powered

1.2. Kit Overview

The Atmel SAM V71 Xplained Ultra evaluation kit is a hardware platform to evaluate the Atmel ATSAMV71Q21.

The kit offers a set of features that enables the ATSAMV71Q21 user to get started with the SAM V70 and SAM V71 peripherals right away and to get an understanding of how to integrate the device in their own design.

Figure 1-1 SAM V71 Xplained Ultra Evaluation Kit Overview



2. Getting Started

2.1. SAM V71 Xplained Ultra Quick Start

Three steps to start exploring the Atmel SAM V71 Xplained Ultra:

1. Download [Atmel Studio](#).
2. Launch Atmel Studio.
3. Connect a USB cable (Standard-A to Micro-B or Micro-AB) between the PC and the DEBUG USB port on the kit.

When the Atmel SAM V71 Xplained Ultra is connected to your computer for the first time, the operating system will do a driver software installation. The driver file supports both 32-bit and 64-bit versions of Microsoft® Windows® XP, Windows Vista®, Windows 7, and Windows 8.

Once the kit is powered the green power LED will be lit and Atmel Studio will auto detect the kit and which Xplained Pro extension board(s) are connected. Atmel Studio will present relevant information like datasheets and kit documentation. The SAM V71 device is programmed and debugged by the on-board Embedded Debugger and therefore no external programmer or debugger tool is needed.

2.2. Design Documentation and Relevant Links

The following list contains links to the most relevant documents and software for the SAM V71 Xplained Ultra.

- [Xplained Pro products](#) - Atmel Xplained Pro is a series of small-sized and easy-to-use evaluation kits for Atmel microcontrollers and other Atmel products. It consists of a series of low cost MCU boards for evaluation and demonstration of features and capabilities of different MCU families.
- [Atmel Studio](#) - Free Atmel IDE for development of C/C++ and assembler code for Atmel microcontrollers.
- [Atmel sample store](#) - Atmel sample store where you can order samples of devices.
- [EDBG User Guide](#) - User guide containing more information about the on-board Embedded Debugger.
- [Atmel Data Visualizer](#) - Atmel Data Visualizer is a program used for processing and visualizing data. Data Visualizer can receive data from various sources such as the Embedded Debugger Data Gateway Interface found on Xplained Pro boards, and COM ports.
- [IAR Embedded Workbench® for ARM](#) - This is a commercial C/C++ compiler that is available for ARM. There is a 30 day evaluation version as well as a code size limited kick-start version available from their website. The code size limit is 16KB for devices with M0, M0+, and M1 cores and 32KB for devices with other cores.
- [Keil MDK-ARM Microcontroller Development Kit](#) - The MDK-ARM is a complete software development environment for Cortex-M, Cortex-R4, ARM7™, and ARM9™ processor-based devices. MDK-ARM is specifically designed for microcontroller applications, it is easy to learn and use, yet powerful enough for the most demanding embedded applications.
- [Design Documentation](#) - Package containing schematics, BOM, assembly drawings, 3D plots, layer plots etc.
- [Hardware Users Guide in PDF format](#) - PDF version of this User Guide.

3. Xplained Pro

SAM V71 Xplained Ultra implements several Xplained Pro standards like extension headers and connectors, this chapter documents these standards.

Xplained Pro is an evaluation platform that provides the full Atmel microcontroller experience. The platform consists of a series of Microcontroller (MCU) boards and extension boards that are integrated with Atmel Studio, support data streaming and more. Xplained Pro MCU boards support a wide range of Xplained Pro extension boards that are connected through a set of standardized headers and connectors. Each extension board has an identification (ID) chip to uniquely identify which boards are connected to a Xplained Pro MCU board. This information is used to present relevant user guides, application notes, datasheets, and example code through Atmel Studio.

3.1. Embedded Debugger

The SAM V71 Xplained Ultra contains the Atmel Embedded Debugger (EDBG) for on-board debugging. The EDBG is a composite USB device of three interfaces; a debugger, Virtual COM Port, and a Data Gateway Interface (DGI).

Together with Atmel Studio, the EDBG debugger interface can program and debug the ATSAMV71Q21. On SAM V71 Xplained Ultra, the SWD interface is connected between the EDBG and the ATSAMV71Q21.

The Virtual COM Port is connected to a UART on the ATSAMV71Q21 and provides an easy way to communicate with the target application through terminal software. It offers variable baud rate, parity, and stop bit settings. Note that the settings on the ATSAMV71Q21 must match the settings given in the terminal software.

Note: If not set automatically, data terminal ready (DTR) must be set in the terminal software.

The DGI consists of several physical interfaces for communication with the host computer. Communication over the interfaces is bidirectional. It can be used to send events and values from the ATSAMV71Q21 or as a generic printf-style data channel. Traffic over the interfaces can be timestamped on the EDBG for more accurate tracing of events. Note that timestamping imposes an overhead that reduces maximal throughput. [Atmel Data Visualizer](#) is used to send and receive data through DGI.

The EDBG controls two LEDs on SAM V71 Xplained Ultra; a power LED and a status LED. [Table 3-1 EDBG LED Control](#) on page 7 shows how the LEDs are controlled in different operation modes.

Table 3-1 EDBG LED Control

Operation Mode	Power LED	Status LED
Normal operation	Power LED is lit when power is applied to the board.	Activity indicator, LED flashes when any communication happens to the EDBG.
Bootloader mode (idle)	The power LED and the status LED blinks simultaneously.	
Bootloader mode (firmware upgrade)	The power LED and the status LED blinks in an alternating pattern.	

For further documentation on the EDBG, see the [EDBG User Guide](#).

3.2. Hardware Identification System

All Xplained Pro compatible extension boards have an Atmel ATSHA204 CryptoAuthentication™ chip mounted. This chip contains information that identifies the extension with its name and some extra data. When an Xplained Pro extension is connected to an Xplained Pro MCU board the information is read and sent to Atmel Studio. The Atmel Kits extension, installed with Atmel Studio, will give relevant information, code examples, and links to relevant documents. [Table 3-2 Xplained Pro ID Chip Content](#) on page 8 shows the data fields stored in the ID chip with example content.

Table 3-2 Xplained Pro ID Chip Content

Data field	Data type	Example content
Manufacturer	ASCII string	Atmel\0'
Product Name	ASCII string	Segment LCD1 Xplained Pro\0'
Product Revision	ASCII string	02\0'
Product Serial Number	ASCII string	1774020200000010\0'
Minimum Voltage [mV]	uint16_t	3000
Maximum Voltage [mV]	uint16_t	3600
Maximum Current [mA]	uint16_t	30

3.3. Power Sources

The SAM V71 Xplained Ultra kit can be powered by several power sources listed in [Table 3-3 Power Sources for SAM V71 Xplained Ultra](#) on page 8.

Table 3-3 Power Sources for SAM V71 Xplained Ultra

Power input	Voltage requirements	Current requirements	Connector marking
External power	5V ±2% (±100mV) for USB host operation. 4.3V to 5.5V if USB host operation is not required.	Recommended minimum is 1A to be able to provide enough current for connected USB devices and the board itself. Recommended maximum is 2A due to the input protection maximum current specification.	PWR
Embedded debugger USB	4.4V to 5.25V (according to USB spec.)	500mA (according to USB spec.)	DEBUG USB
Target USB	4.4V to 5.25V (according to USB spec.)	500mA (according to USB spec.)	TARGET USB
External jack input	Kit specific	Kit specific	VIN

The kit will automatically detect which power sources are available and choose which one to use according to the following priority:

1. External jack input.
2. External power.
3. Embedded Debugger USB.
4. Target USB.



Info: External power is required when 500mA from a USB connector is not enough to power the board with possible extension boards. A connected USB device in a USB host application might easily exceed this limit.

3.4. Xplained Pro Headers and Connectors

3.4.1. Xplained Pro Standard Extension Header

All Xplained Pro kits have one or more dual row, 20-pin, 100mil extension header. Xplained Pro MCU boards have male headers, while Xplained Pro extensions have their female counterparts. Note that all pins are not always connected. All connected pins follow the defined pin-out description in [Table 3-4 Xplained Pro Standard Extension Header](#) on page 9.

The extension headers can be used to connect a variety of Xplained Pro extensions to Xplained Pro MCU boards or to access the pins of the target MCU on Xplained Pro MCU boards directly.

Table 3-4 Xplained Pro Standard Extension Header

Pin number	Name	Description
1	ID	Communication line to the ID chip on an extension board
2	GND	Ground
3	ADC(+)	Analog to digital converter, alternatively positive part of differential ADC
4	ADC(-)	Analog to digital converter, alternatively negative part of differential ADC
5	GPIO1	General purpose I/O
6	GPIO2	General purpose I/O
7	PWM(+)	Pulse width modulation, alternatively positive part of differential PWM
8	PWM(-)	Pulse width modulation, alternatively negative part of differential PWM
9	IRQ/GPIO	Interrupt request line and/or general purpose I/O
10	SPI_SS_B/ GPIO	Slave select for SPI and/or general purpose I/O
11	I ² C_SDA	Data line for I ² C interface. Always implemented, bus type.

Pin number	Name	Description
12	I ² C_SCL	Clock line for I ² C interface. Always implemented, bus type.
13	UART_RX	Receiver line of target device UART
14	UART_TX	Transmitter line of target device UART
15	SPI_SS_A	Slave select for SPI. Should preferably be unique.
16	SPI_MOSI	Master out slave in line of serial peripheral interface. Always implemented, bus type.
17	SPI_MISO	Master in slave out line of serial peripheral interface. Always implemented, bus type.
18	SPI_SCK	Clock for serial peripheral interface. Always implemented, bus type.
19	GND	Ground
20	VCC	Power for extension board

3.4.2. Xplained Pro LCD Extension Connector

The LCD connector provides the ability to connect to display extensions that have a parallel interface. The connector implements signals for a MCU parallel bus interface and a LCD controller interface as well as signals for a touch controller. The connector pin-out definition is shown in [Table 3-5 Xplained Pro LCD Connector](#) on page 10. Note that usually only one display interface is implemented, either the LCD controller or the MCU bus interface.

A FPC/FFC connector with 50 pins and 0.5mm pitch is used for the LCD connector. The connector XF2M-5015-1A from Omron is used on several Xplained Pro designs and can be used as a reference.

Table 3-5 Xplained Pro LCD Connector

Pin number	Name	RGB interface description	MCU interface description
1	ID	Communication line to the ID chip on an extension board	
2	GND	Ground	
3	D0	Data line	
4	D1	Data line	
5	D2	Data line	
6	D3	Data line	
7	GND	Ground	
8	D4	Data line	
9	D5	Data line	
10	D6	Data line	
11	D7	Data line	
12	GND	Ground	
13	D8	Data line	
14	D9	Data line	

Pin number	Name	RGB interface description	MCU interface description
15	D10	Data line	
16	D11	Data line	
17	GND	Ground	
18	D12	Data line	
19	D13	Data line	
20	D14	Data line	
21	D15	Data line	
22	GND	Ground	
23	D16	Data line	
24	D17	Data line	
25	D18	Data line	
26	D19	Data line	
27	GND	Ground	
28	D20	Data line	
29	D21	Data line	
30	D22	Data line	
31	D23	Data line	
32	GND	Ground	
33	PCLK / CMD DATA SEL	Pixel clock	Display RAM select. One address line of the MCU for displays where it is possible to select either register or data interface.
34	VSYNC / CS	Vertical Synchronization	Chip select
35	HSYNC / WE	Horizontal Synchronization	Write enable signal
36	DATA ENABLE / RE	Data enable signal	Read enable signal
37	SPI SCK	Clock for serial peripheral interface	
38	SPI MOSI	Master out slave in of serial peripheral interface	
39	SPI MISO	Master in slave out of serial peripheral interface	
40	SPI SS	Slave select for serial peripheral interface. Preferably a dedicated pin.	
41	ENABLE	Display enable	
42	I ² C SDA	I ² C data	
43	I ² C SCL	I ² C clock	

Pin number	Name	RGB interface description	MCU interface description
44	IRQ1	Interrupt 1	
45	IRQ2	Interrupt 2	
46	PWM	Backlight control	
47	RESET	Extension reset	
48	VCC	3.3V power supply for extension board	
49	VCC	3.3V power supply for extension board	
50	GND	Ground	

3.4.3. Xplained Pro Power Header

The power header can be used to connect external power to the SAM V71 Xplained Ultra kit. The kit will automatically detect and switch to any external power if supplied. The power header can also be used as supply for external peripherals or extension boards. Care must be taken not to exceed the total current limitation of the on-board regulator when using the 3.3V pin.

Table 3-6 Xplained Pro Power Header

Pin number	Pin name	Description
1	VEXT_P5V0	External 5V input
2	GND	Ground
3	VCC_P5V0	Unregulated 5V (output, derived from one of the input sources)
4	VCC_P3V3	Regulated 3.3V (output, used as main power supply for the kit)

4. Hardware Users Guide

4.1. Power Distribution

SAM V71 Xplained Ultra has four power sources as described in [Power Sources](#) on page 8. [Figure 4-1 Power Supply Block Diagram](#) on page 13 shows a block diagram of the power supply circuitry, the related I/O pins are described in [Table 4-1 Power Distribution Signals](#) on page 14.

The kit can be powered from the EDBG USB, Target USB, external 5.0V, and/or a 5-14V DC jack input. The kit will automatically select a source to draw power from.

An on board supercap (100mF) is charged to 3.6V from the kits 5V net. When all external power is removed from the board or the 3.3V regulator is disabled by the application running on the ATSAMV71Q21 the power switch will supply the ATSAMV71Q21 from the supercap. It is intended that the supercap can supply the ATSAMV71Q21 in its low power backup mode.



Info: When the on-board regulator is turned off by the target application in the ATSAMV71Q21, all ICs on the kit are unpowered except the ATSAMV71Q21. Care must be taken to not supply and stray power these ICs through the ATSAMV71Q21s I/O pins.

Figure 4-1 Power Supply Block Diagram

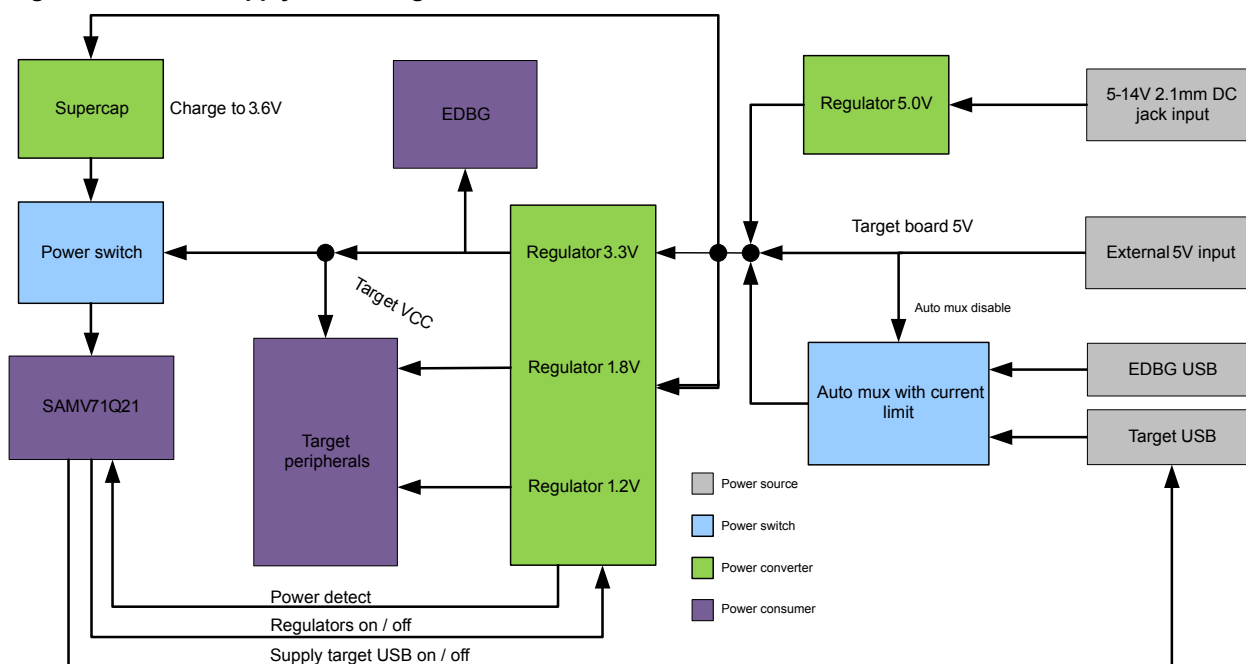


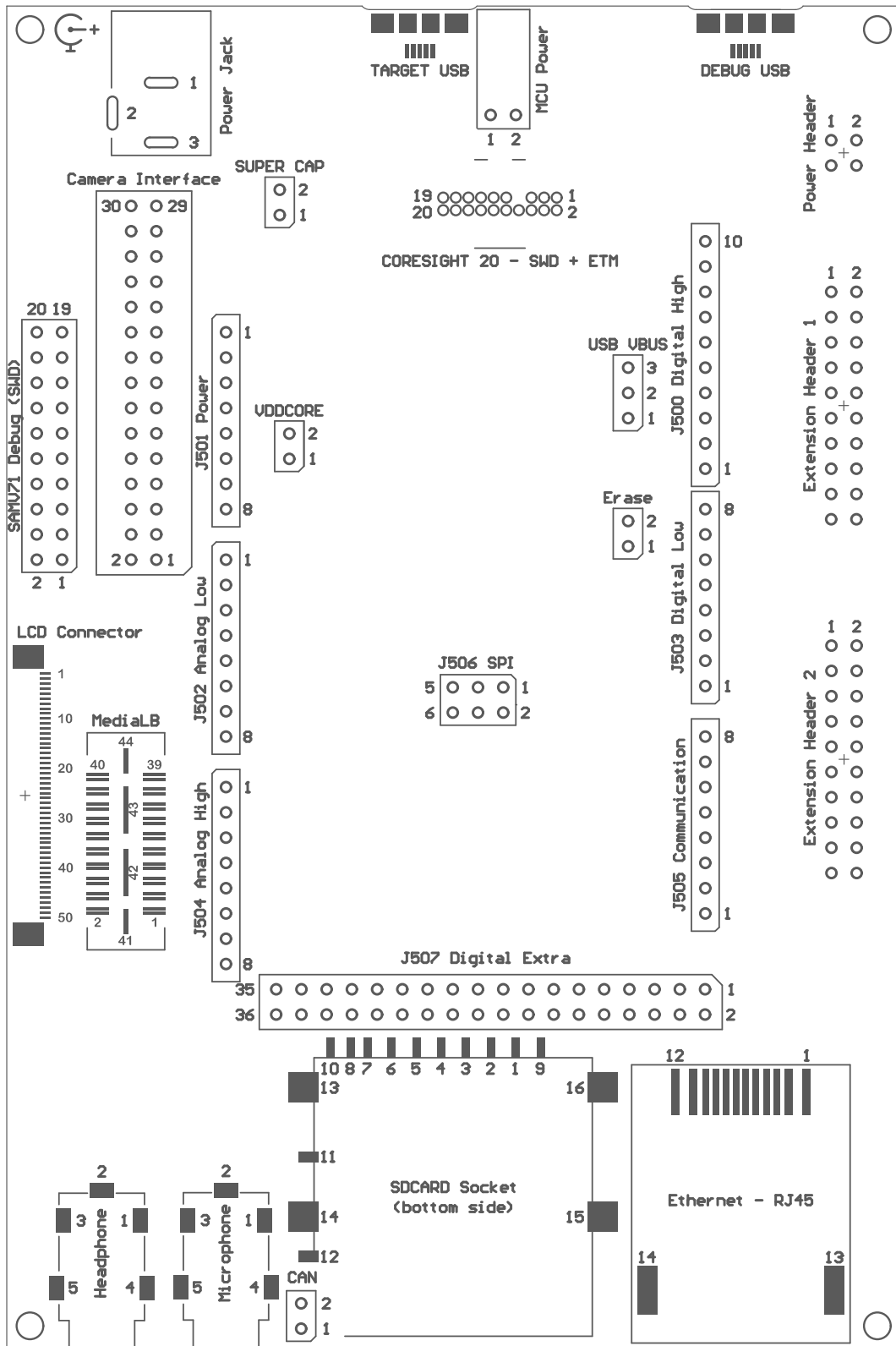
Table 4-1 Power Distribution Signals

SAM V71 pin	Function	Description
PC17	GPIO	Power Enable, drive low to disable the on-board voltage regulator
PA01	WKUP1	Regulator Power Detect, pulled high when the regulator output is good
PC16	GPIO	Drive low to enable the kit to supply the target USB

4.2. Connectors

These sections describes the implementation of the relevant connectors and headers on SAM V71 Xplained Ultra and their connection to the ATSAMV71Q21. The tables of connections in these sections also describes which signals are shared between the headers and on-board functionality. [Figure 4-2 SAM V71 Xplained Ultra Connector Overview](#) on page 15 shows all available connectors and jumpers on SAM V71 Xplained Ultra.

Figure 4-2 SAM V71 Xplained Ultra Connector Overview



4.2.1. Extension Headers

The Xplained Pro headers EXT1 and EXT2 on SAM V71 Xplained Ultra offers access to the I/O of the microcontroller in order to expand the board e.g. by connecting extensions to the board. The headers have a pitch of 2.54mm.

Table 4-2 Extension Header EXT1

EXT1 pin	SAM V71 pin	Function	Shared functionality
1 [ID]	-	-	Communication line to the ID chip on an extension board
2 [GND]	-	-	Ground
3 [ADC(+)]	PC31	AFE1_AD6	Shield
4 [ADC(-)]	PA19	AFE0_AD8	Ethernet and Shield
5 [GPIO1]	PB03	GPIO/RTS0	Camera, MediaLB, and Shield(2)
6 [GPIO2]	PB02	GPIO/CTS0	MediaLB and Shield(2)
7 [PWM(+)]	PA00	PWMH0	Shield
8 [PWM(-)]	PC30	TIOB5	LCD
9 [IRQ/GPIO]	PD28	WKUP5	EDBG GPIO, Camera, LCD, and Shield(2)
10 [SPI_SS_B/GPIO]	PA05	GPIO	Camera and Shield
11 [TWI_SDA]	PA03	TWID0	EXT2, EDDB I ² C, LCD, Camera, Audio, PLL, MediaLB, EEPROM, Crypto, and Shield
12 [TWI_SCL]	PA04	TWICK0	EXT2, EDDB I ² C, LCD, Camera, Audio, PLL, MediaLB, EEPROM, Crypto, and Shield
13 [USART_RX]	PB00	RXD0	Audio and Shield(2)
14 [USART_TX]	PB01	TXD0	Audio and Shield(2)
15 [SPI_SS_A]	PD25	SPI0_NPCS1	Camera and Shield
16 [SPI_MOSI]	PD21	SPI0_MOSI	EXT2, EDDB SPI, Audio, Camera, and Shield(2)
17 [SPI_MISO]	PD20	SPI0_MISO	EXT2, EDDB SPI, and Shield(2)
18 [SPI_SCK]	PD22	SPI0_SPCK	EXT2, EDDB SPI, Camera, and Shield(2)
19 [GND]	-	-	Ground
20 [VCC]	-	-	Power for extension board

Table 4-3 Extension Header EXT2

EXT2 pin	SAM V71 pin	Function	Shared functionality
1 [ID]	-	-	Communication line to the ID chip on an extension board
2 [GND]	-	-	Ground
3 [ADC(+)]	PD30	AFE0_AD0	Camera and Shield(2)
4 [ADC(-)]	PC13	AFE1_AD1	LCD and Shield
5 [GPIO1]	PA06	GPIO	Camera, MediaLB, and Shield
6 [GPIO2]	PD11	GPIO	Camera, Audio, and Shield
7 [PWM(+)]	PC19	PWMC0_PWMH2	Camera and Shield
8 [PWM(-)]	PD26	PWMC0_PWML2	Audio and Shield
9 [IRQ/GPIO]	PA02	WKUP2/GPIO	EDBG GPIO, LCD and Shield
10 [SPI_SS_B/GPIO]	PA24	GPIO	Camera and Shield
11 [TWI_SDA]	PA03	TWCK1	EXT1, EDDB I ² C, LCD, Camera, Audio, PLL, MediaLB, EEPROM, Crypto, and Shield
12 [TWI_SCL]	PA04	TWCK0	EXT1, EDDB I ² C, LCD, Camera, Audio, PLL, MediaLB, EEPROM, Crypto, and Shield
13 [USART_RX]	PA21	RXD1	EDBG CDC and Shield
14 [USART_TX]	PB04	TXD1	EDBG CDC, MediaLB and Shield
15 [SPI_SS_A]	PD27	SPI0_NPCS3	Camera and Shield(2)
16 [SPI_MOSI]	PD21	SPI0_MOSI	EXT1, EDDB SPI, Audio, Camera, and Shield(2)
17 [SPI_MISO]	PD20	SPI0_MISO	EXT1, EDDB SPI, and Shield(2)
18 [SPI_SCK]	PD22	SPI0_SPCK	EXT1, EDDB SPI, Camera, and Shield(2)

EXT2 pin	SAM V71 pin	Function	Shared functionality
19 [GND]	-	-	Ground
20 [VCC]	-	-	Power for extension board

4.2.2. LCD Extension Connector

Extension connector EXT4 is a special connector for LCD displays. The physical connector is a TE Connectivity 5-1734839-0 FPC connector.



Info:

Plugging a cable into the LCD connector creates routing stubs for the on-board SDRAM which creates ringing. The ringing will reduce the maximum SDRAM communication frequency. See [EBI Signal Integrity](#) on page 43 for more information.

Table 4-4 Xplained Pro LCD Connector EXT4

Pin on EXT4	SAM V71 pin	Function	Shared Functionality
1 [ID]	-	Communication line to ID chip on extension board	-
2 [GND]	-	GND	
3 [D0]	PC00	D0	SDRAM
4 [D1]	PC01	D1	SDRAM
5 [D2]	PC02	D2	SDRAM
6 [D3]	PC03	D3	SDRAM
7 [GND]	-	GND	
8 [D4]	PC04	D4	SDRAM
9 [D5]	PC05	D5	SDRAM
10 [D6]	PC06	D6	SDRAM
11 [D7]	PC07	D7	SDRAM
12 [GND]	-	GND	
13 [D8]	PE00	D8	SDRAM and Shield
14 [D9]	PE01	D9	SDRAM
15 [D10]	PE02	D10	SDRAM
16 [D11]	PE03	D11	SDRAM and Shield
17 [GND]	-	GND	
18 [D12]	PE04	D12	SDRAM and Shield
19 [D13]	PE05	D13	SDRAM and Shield
20 [D14]	PA15	D14	SDRAM
21 [D15]	PA16	D15	SDRAM
22 [GND]	-	GND	
23 [D16]	-	-	
24 [D17]	-	-	
25 [D18]	-	-	
26 [D19]	-	-	
27 [GND]	-	GND	
28 [D20]	-	-	
29 [D21]	-	-	
30 [D22]	-	-	
31 [D23]	-	-	
32 [GND]	-	GND	
33 [PCLK / CMD_DAT A_SEL]	PC30	GPIO	EXT1
34 [VSYNC / CS]	PD19	NCS3	Shield

Pin on EXT4	SAM V71 pin	Function	Shared Functionality
35 [HSYNC / WE]	PC08	NWE	
36 [DAT A ENABLE / RE]	PC11	NRD	
37 [SPI SCK]	-		
38 [SPI MOSI]	-		
39 [SPI MISO]	-		
40 [SPI SS]	-		
41 [DISP ENABLE]	-	100K resistor to VCC_TARGET_P3V3	
42 [TWI SDA]	PA03	TWD0	EXT1, EXT2, EDBG I2C, Camera, Audio, MediaLB, and Shield
43 [TWI SCL]	PA04	TWCK0	EXT1, EXT2, EDBG I2C, Camera, Audio, MediaLB, and Shield
44 [IRQ1]	PD28	WKUP5	EXT1, Camera, and Shield
45 [IRQ2]	PA02	WKUP2	EXT2, EDBG GPIO3, and Shield
46 [PWM]	PC09	TIOB7	LED1 and Shield
47 [RESET]	PC13	GPIO	EXT2 and Shield
48 [VCC]	-	VCC_TARGET_P3V3	
49 [VCC]	-	VCC_TARGET_P3V3	
50 [GND]	-	GND	

4.2.3. Arduino Connectors

SAM V71 Xplained Ultra implements extended Arduino shield connectors based on the [Arduino Due](#). All references to Arduino pin names and pin numbers are taken from the official [Arduino pin out list](#) of the Arduino Due.



Caution: Like the Arduino Due, SAM V71 Xplained Ultra runs at 3.3V and the maximum voltage that the I/O pins can tolerate is 3.3V, providing higher voltages like 5V to an I/O pin could damage the board.



Info: Note that all pins on the shield connectors aren't populated, each shield should be checked for compatibility before it is connected.

Table 4-5 J501 - Power

Pin on J501	SAM V71 pin	Arduino pin name	Arduino pin number	Function	Shared functionality
1	-	RFU	-	VBAT	
2	-	IOREF	-	VCC_TARGET_P3V3	
3	NRST	RESET	-	TARGET_RESET	
4	-	3.3V	-	VCC_TARGET_P3V3	
5	-	5V	-	VCC_P5V0	
6	-	GND	-	GND	
7	-	GND	-	GND	
8	-	VIN	-	VCC_EXT_P5V0_P14V0	

Table 4-6 J502 - Analog Low

Pin on J502	SAM V71 pin	Arduino pin name	Arduino pin number	Function	Shared functionality
1	PD26	A0	54	TD	Audio and EXT2
2	PC31	A1	55	AFE1_AD6	EXT1
3	PA19	A2	56	AFE0_AD8	Ethernet and EXT1
4	PD30	A3	57	AFE0_AD0	Camera, EXT2, and Shield
5	PC13	A4	58	AFE1_AD1	LCD and EXT2
6	PE00	A5	59	AFE1_AD11	SDRAM and LCD
7	PE03	A6	60	AFE1_AD10	SDRAM and LCD
8	PE04	A7	61	AFE0_AD4	SDRAM and LCD

Table 4-7 J504 - Analog High

Pin on J504	SAM V71 pin	Arduino pin name	Arduino pin number	Function	Shared functionality
1	PD24	A8	62	RF	Audio and Camera
2	PA10	A9	63	RD	Audio
3	PA22	A10	64	RK	Audio
4	PE05	A11	65	AFE0_AD3	SDRAM and LCD
5	PB13	DAC0	66	DAC0	Camera
6	PD00	DAC1	67	DAC1	Ethernet
7	PB03	CANRX	68	CANRX0 / AFE0_AD2	Camera, MediaLB, EXT1, and Shield
8	PB02	CANTX	69	CANTX0 / AFE0_AD5	MediaLB, EXT1, and Shield

Table 4-8 J503 - Digital Low

Pin on J503	SAM V71 pin	Arduino pin name	Arduino pin number	Function	Shared functionality
1	PD28	RX0	0	URXD3	Camera, LCD, EXT1, Shield, and EDBG GPIO
2	PD30	TX0	1	UTXD3	Camera, EXT2, and Shield
3	PA00	D2	2	PWMC0_PWMH0	EXT1
4	PA06	D3	3	GPIO	Camera, MediaLB, and EXT2
5	PD27	D4	4	PWMC0_PWML3	Camera, EXT2, and Shield
6	PD11	D5	5	PWMC0_PWMH0	Audio, Camera, and EXT2

Pin on J503	SAM V71 pin	Arduino pin name	Arduino pin number	Function	Shared functionality
7	PC19	D6	6	PWMC0_PWMH2	Camera and EXT2
8	PA02	D7	7	PWMC0_PWMH1	MediaLB, LCD, EXT2, and EDBG GPIO

Table 4-9 J500 - Digital High

Pin on J500	SAM V71 pin	Arduino pin name	Arduino pin number	Function	Shared functionality
1	PA05	D8	8	PWMC1_PWML3	Camera and EXT1
2	PC09	D9	9	TIOB7	LED1 and LCD
3	PD25	D10	10	PWMC0_PWML1 / SPI0_NPCS1	Camera and EXT1
4	PD21	D11	11	PWMC0_PWMH1 / SPI0_MOSI	PLL, Camera, EXT1, EXT2, Shield, and EDBG SPI
5	PD20	D12	12	PWMC0_PWMH0 / SPI0_MISO	EXT1, EXT2, Shield, and EDBG SPI
6	PD22	D13	13	PWMC0_PWMG2 / SPI0_SPCK	Camera, EXT1, EXT2, Shield, and EDBG SPI
7	-	GND	-	-	-
8	ADVREF	AREF	-	ADVREFP	-
9	PA03	SDA1	70	TWD0	PLL, Audio, Camera, LCD, EXT1, EXT2, Crypto, and EDBG I ² C
10	PA04	SCL1	71	TWCK0	PLL, Audio, Camera, LCD, EXT1, EXT2, Crypto, and EDBG I ² C

Table 4-10 J506 - SPI

Pin on J506	SAM V71 pin	Arduino pin name	Arduino pin number	Function	Shared functionality
1	PD20	MISO	74	SPI0_MISO	EXT1, EXT2, Shield, and EDBG SPI
2	-	5V	-	VCC_P5V0	-
3	PD22	SCLK	76	SPI0_SPCK	Camera, EXT1, EXT2, Shield, and EDBG SPI
4	PD21	MOSI	75	SPI0_MOSI	PLL, Camera, EXT1, EXT2, Shield, and EDBG SPI

Pin on J506	SAM V71 pin	Arduino pin name	Arduino pin number	Function	Shared functionality
5	NRST	RESET	-	RESET	Trace and EDBG Debug
6	-	GND	-	GND	-

Table 4-11 J505 - Communication

Pin on J505	SAM V71 pin	Arduino pin name	Arduino pin number	Function	Shared functionality
1	PD28	SCL	21	TWCK2	Camera , LCD , EXT1 , Shield , and EDBG GPIO
2	PD27	SDA	20	TWD2	Camera , EXT2 , and Shield
3	PD18	RX1	19	URXD4	SD Card and Shield
4	PD19	TX1	18	UTXD4	LCD and Shield
5	PD15	RX2	17	RXD2	SDRAM
6	PD16	TX2	16	TXD2	SDRAM
7	PB00	RX3	15	RXD0	Audio , EXT1 , and Shield
8	PB01	TX3	14	TXD0	Audio , EXT1 , and Shield

Table 4-12 J507 - Digital Extra

Pin on J507	SAM V71 pin	Arduino pin name	Arduino pin number	Function	Shared functionality
1	-	5V	-	VCC_P5V0	-
2	-	5V	-	VCC_P5V0	-
3	PA18	D22	22	PCK2	Audio
4	PB01	D23	23	TK	Audio , EXT1 , and Shield
5	PB00	D24	24	TF	Audio , EXT1 , and Shield
6	-	D25	25	-	-
7	PD19	D26	26	CTS2	LCD and Shield
8	PD18	D27	27	RTS2	SD Card and Shield
9	-	D28	28	-	-
10	-	D29	29	-	-
11	-	D30	30	-	-
12	-	D31	31	-	-
13	-	D32	32	-	-
14	-	D33	33	-	-
15	-	D34	34	-	-

Pin on J507	SAM V71 pin	Arduino pin name	Arduino pin number	Function	Shared functionality
16	-	D35	35	-	-
17	-	D36	36	-	-
18	-	D37	37	-	-
19	-	D38	38	-	-
20	PB02	D39	39	CTS0	MediaLB and EXT1
21	PB03	D40	40	RTS0	Camera, MediaLB, and EXT1
22	-	D41	41	-	-
23	-	D42	42	-	-
24	-	D43	43	-	-
25	PA25	D44	44	CTS1	SD Card
26	PA24	D45	45	RTS1	Camera and EXT2
27	PA21	D46	46	RXD1	EXT2 and EDBG CDC
28	PB04	D47	47	TXD1	MediaLB, EXT2, and EDBG CDC
29	-	D48	48	-	-
30	-	D49	49	-	-
31	-	D50	50	-	-
32	-	D51	51	-	-
33	PC12	D52	52	CANRX1	CAN
34	PC14	D53	53	CANTX1	CAN
35	-	GND	-	GND	-
36	-	GND	-	GND	-

4.2.4. MediaLB Connector

Media Local Bus (MediaLB) is an on-PCB or inter-chip communications bus, specifically designed to standardize a common hardware interface and software API library. This standardization allows an application or multiple applications to access the MOST[®] (Media Oriented Systems Transport) Network data, or to communicate with other applications, with minimum effort.

On SAM V71 Xplained Ultra the MLB module of the ATSAMV71Q21 is connected to a MediaLB connector implemented with a 40 pin [SAMTEC QSH-020-01-L-D-DP-A](#). This connector is intended to interface with a board that includes the MOST INIC and the MOST-50 physical layer connector (such as a Physical+ Interface Board OS81092 ePhy) or with other MOST tools. [Table 4-13 MediaLB Connector](#) on page 23 shows all connections between the ATSAMV71Q21 and the connector.



Info: To use the MediaLB connector with an external kit that requires 12V, a 12V supply must be connected to the power jack.

Table 4-13 MediaLB Connector

Pin number	SAM V71 Pin	Function	Shared functionality
1 [RESERVED]	-	-	
2 [MLB_CLK]	PB04	MLBCLK	EXT2, Shield, and EDBG CDC
3 [RESERVED]	-	-	
4 [MLB_ID0]	-	-	
5 [MLB_ID4]	-	-	
6 [MLBSIG]	PD10	MLBSIG	
7 [MLB_ID3]	-	-	
8 [MLB_ID1]	-	-	
9 [SCK]	-	-	
10 [MLBDAT]	PB05	MLBDAT	EDBG Debug
11 [FSY]	-	-	
12 [MLB_ID2]	-	-	
13 [RESERVED]	-	-	
14 [SX0]	-	-	
15 [RESERVED]	-	-	
16 [RMCK]	PA02	RMCK	LCD, EXT2, Shield, and EDBG GPIO3
17 [RESERVED]	-	-	
18 [SR0]	-	-	
19 [RESERVED]	-	-	
20 [RESERVED]	-	-	
21 [PS0]	-	-	
22 [PS1]	-	-	
23 [STATUS]	-	-	
24 [PWROFF]	-	-	
25 [RESET_N]	PA06	GPIO	Camera, EXT2, and Shield
26 [RSOUT]	-	-	

Pin number	SAM V71 Pin	Function	Shared functionality
27 [ERR/BOOT]	PB03	GPIO	Camera, EXT1, and Shield (2)
28 [MCK_IN]	-	-	
29 [TCK/D_SCL]	-	-	
30 [TMS]	-	-	
31 [TDO/DINT]	-	-	
32 [TDI/D_SDA]	-	-	
33 [I ² C_SCL]	PA04	TWCK0	EXT1, EXT2, EDBG I ² C, LCD, Audio, PLL, Camera, EEPROM, Crypto, and Shield
34 [MLB_INT]	PB02	GPIO	EXT1, Shield (2)
35 [I ² C_SDA]	PA03	TWD0	EXT1, EXT2, EDBG I ² C, LCD, Audio, PLL, Camera, EEPROM, Crypto, and Shield
36 [RESERVED]	-	-	
37 [3V3_SWITCHED]	-	-	
38 [3V3_CONTINUOUS]	-	-	
39 [3V3_SWITCHED]	-	-	
40 [12V0_CONTINUOUS]	-	-	

4.2.5. Camera Connector

A 2x15, 100mil pin-header camera connector is implemented to give access to the SAM V71's parallel Image Sensor Interface (ISI).

Table 4-14 Camera Connector

Pin number	SAM V71 pin	Function	Shared functionality
1 [VCC]	-	VCC_TARGET_P3V3	
2 [GND]	-	GND	
3 [VCC]	-	VCC_TARGET_P3V3	
4 [GND]	-	GND	
5 [RESET]	PB13	GPIO	Shield
6 [PWD]	PC19	ISI_PWD	EXT2 and Shield
7 [I ² C_SCK]	PA04	TWCK0	EXT1, EXT2, EDBG I ² C, LCD, Audio, PLL, MediaLB, EEPROM, Crypto, and Shield

Pin number	SAM V71 pin	Function	Shared functionality
8 [I2C_SDA]	PA03	TWD0	EXT1, EXT2, EDBG I ² C, LCD, Audio, PLL, MediaLB, EEPROM, Crypto, and Shield
9 [GND]	-	GND	
10 [MCK]	PA06	PCK0	EXT2, MediaLB, and Shield
11 [GND]	-	GND	
12 [VSYNC]	PD25	ISI_VSYNC	EXT1 and Shield
13 [GND]	-	GND	
14 [HSYNC]	PD24	ISI_HSYNC	Audio and Shield
15 [GND]	-	GND	
16 [PCK]	PA24	ISI_PCK	EXT2 and Shield
17 [GND]	-	GND	
18 [D0]	PD22	ISI_D0	EXT1, EXT2, EDBG SPI, and Shield (2)
19 [D1]	PD21	ISI_D1	EXT1, EXT2, EDBG SPI, Audio, and Shield (2)
20 [D2]	PB03	ISI_D2	EXT1, MediaLB, and Shield (2)
21 [D3]	PA09	ISI_D3	EDBG GPIO and SW0
22 [D4]	PA05	ISI_D4	EXT1 and Shield
23 [D5]	PD11	ISI_D5	EXT2, Audio, and Shield
24 [D6]	PD12	ISI_D6	EDBG SPI
25 [D7]	PA27	ISI_D7	SD Card
26 [D8]	PD27	ISI_D8	EXT2 and Shield (2)
27 [D9]	PD28	ISI_D9	EXT1, EDBG GPIO, LCD, and Shield (2)
28 [D10]	PD30	ISI_D10	EXT2 and Shield (2)
29 [D11]	PD31	ISI_D11	QSPI Flash
30 [GND]	-	GND	

4.2.6. USB

The SAM V71 Xplained Ultra has a Micro-USB connector for use with the SAM V71 USB module labeled as TARGET USB on the kit. In USB host mode VBUS voltage is provided by the kit and has to be enabled by setting the "VBUS Host Enable" pin low.