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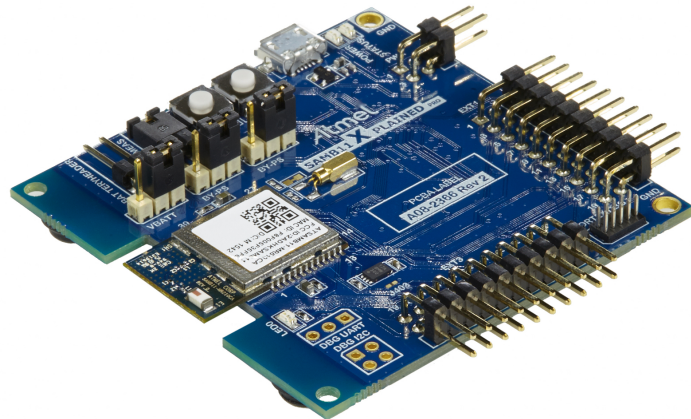
## Preface

The Atmel® SAM B11 Xplained Pro evaluation kit is a hardware platform to evaluate the ATSAMB11G18A microcontroller.

Supported by the Atmel Studio integrated development platform, the kit provides easy access to the features of the Atmel ATSAMB11G18A and explains how to integrate the device in a custom design.

The Xplained Pro MCU series evaluation kits include an on-board Embedded Debugger, and no external tools are necessary to program or debug the ATSAMB11G18A.

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

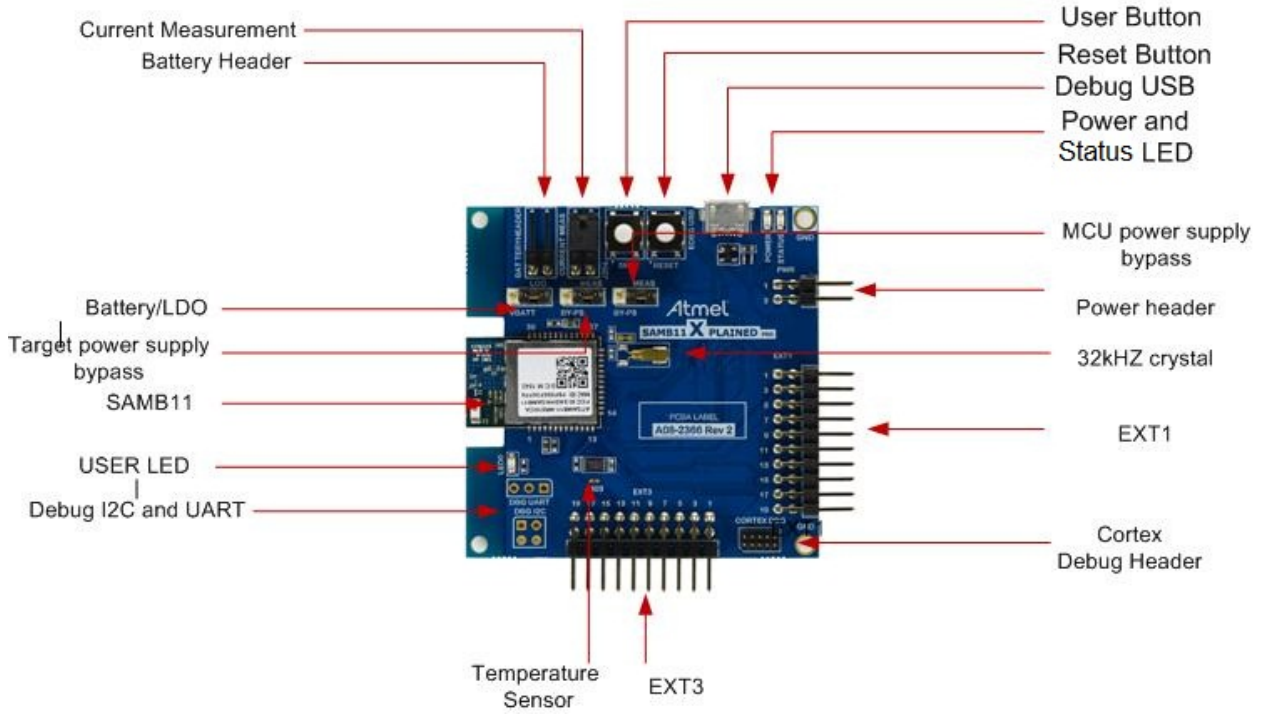
- ATSAMB11G18A microcontroller
- Bluetooth Host and Device mode
- One mechanical reset button
- One mechanical programmable button
- One yellow user LED
- Battery header (1x2 100mil header)
- 32.768kHz crystal
- Two Xplained Pro extension headers
- Embedded Debugger
  - Auto-ID for board identification in Atmel Studio
  - One yellow status LED
  - One green board power LED
  - Symbolic debug of complex data types including scope information
  - Programming and debugging, including power measurements
  - Data Gateway Interface: SPI, I<sup>2</sup>C, four GPIOs
  - Virtual COM port (CDC)
- Embedded current measurement circuitry, with [Atmel Data Visualizer](#) support for data visualization
- USB powered
- Supported with application examples in Atmel Software Framework

## 1.2. Kit Overview

The Atmel SAM B11 Xplained Pro evaluation kit is a hardware platform to evaluate the Atmel ATSAMB11G18A.

The kit offers a set of features that enables the ATSAMB11G18A user to get started with the SAM B peripherals right away and to get an understanding of how to integrate the device in their own design.

Figure 1-1. SAM B11 Xplained Pro Evaluation Kit Overview



## 2. Getting Started

### 2.1. Xplained Pro Quick Start

Steps to start exploring the Atmel Xplained Pro platform:

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 Xplained Pro MCU kit is connected to your computer for the first time, the operating system will perform a driver software installation. The driver file supports both 32- and 64-bit versions of Microsoft® Windows® XP, Windows Vista®, Windows 7, and Windows 8.

Once the Xplained Pro MCU board is powered the green power LED will be lit and Atmel Studio will auto detect which Xplained Pro MCU- and extension board(s) are connected. Atmel Studio will present relevant information like datasheets and kit documentation. The kit landing page in Atmel Studio also has the option to launch Atmel Software Framework (ASF) example applications for the kit. The SAM B11 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 B11 Xplained Pro.

- [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.
- [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.
- [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.

## 3. Xplained Pro

### 3.1. Xplained Pro

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, which are integrated with Atmel Studio, have Atmel Software Framework (ASF) drivers and demo code, support data streaming, and more. Xplained Pro MCU boards support a wide range of Xplained Pro extension boards, which 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 an Xplained Pro MCU board. This information is used to present relevant user guides, application notes, datasheets, and example code through Atmel Studio.

### 3.2. Embedded Debugger

The SAM B11 Xplained Pro 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 ATSAMB11G18A. On SAM B11 Xplained Pro, the SWD interface is connected between the EDBG and the ATSAMB11G18A.

The Virtual COM Port is connected to a UART on the ATSAMB11G18A 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 ATSAMB11G18A must match the settings given in the terminal software.



**Info:** The virtual COM port in the EDBG requires the terminal software to set the data terminal ready (DTR) signal to enable the UART pins connected to the ATSAMB11G18A. If the DTR signal is not enabled the UART pins on the EDBG is kept in high-z (tristate) rendering the COM port unusable. The DTR signal is set automatically by some terminal software, but it may have to be manually enabled in your terminal.

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 ATSAMB11G18A 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 B11 Xplained Pro; a power LED and a status LED. The table below shows how the LEDs are controlled in different operation modes.

**Table 3-1. EDBG LED Control**

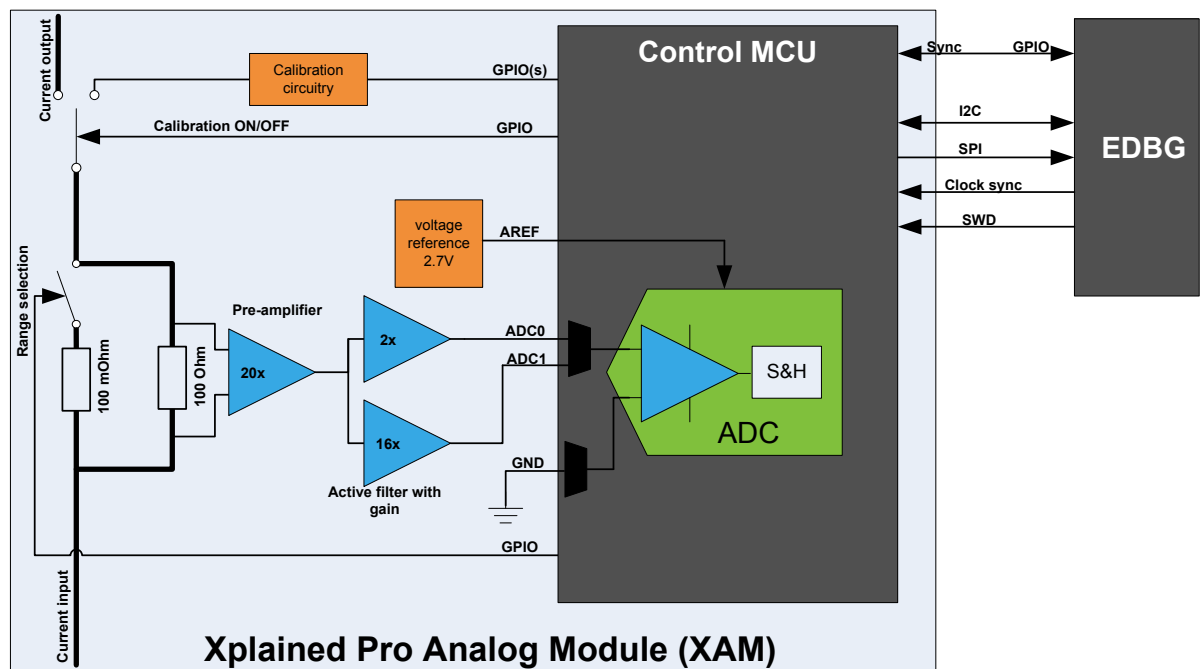
Operation mode	Power LED	Status LED
Normal operation	Power LED is lit when power is applied to the board.	Activity indicator, LED flashes when any communication happens to the EDBG.
Bootloader mode (idle)	The power LED and the status LED blinks simultaneously.	
Bootloader mode (firmware upgrade)	The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

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

### 3.3. Xplained Pro Analog Module

#### 3.3.1. Overview

The Xplained Pro Analog Module (XAM) extends the embedded debugger with high dynamic range current measurement. This enables power profiling of the target system.



The XAM consists of:

- Calibration circuitry
- Voltage reference
- Analog frontend
  - Shunt resistors with a range selection switch
  - Pre-amplifier
  - Two active filters with gain
- Control MCU



- Analog to digital converter
- Signal processing
- Control/communication interface to the EDBG

The current measurement frontend is a high side shunt measurement with a pre-amplifier and a second active filter stage with gain. The wide dynamic range is achieved by four measurement ranges which are defined by two shunts and the two parallel second stage active filters with gain.

### 3.3.2. EDBG Interface

The Xplained Pro Analog Module (XAM) is connected to the EDBG with the following interfaces:

- I<sup>2</sup>C: This is used to control and configure the XAM
- SPI: Current measurement data is streamed to the EDBG via this interface. This is a one-way data transfer channel from the XAM to the EDBG
- SWD: The MCU in the XAM is programmed via SWD from the EDBG
- GPIO: At least one GPIO that is connected to the EDBG from the target MCU is also connected to the current measurement unit to enable the user to sync current measurements with his application
- Clock sync: Synchronization signal to synchronize ADC measurements with EDBG
- Reference clock: Reference clock for the XAM

### 3.3.3. Sample Rate

The raw sampling rate of the Xplained Pro analog module (XAM) is up to 250kHz and with the default averaging configuration (average of 16 samples) the actual output of the XAM is 16.67kSPS (note that the XAM output sample rate is not an integer fraction of the raw sampling).

### 3.3.4. Measurement Ranges and Accuracy

The Xplained Pro analog module has four measurement ranges. These are defined by two shunt resistors and two gain stages.

Measurement range	Hardware	Resolution	Accuracy	Comments
Range 1	Low current shunt and high gain stage	20nA	1 LSB ±1%	Below 1µA the error will increase. Typical error for 300nA is 1 LSB ± 10%
Range 2	Low current shunt and low gain stage	150nA	1 LSB ±1%	
Range 3	High current shunt and high gain stage	10µA	1 LSB ±1%	
Range 4	High current shunt and low gain stage	100µA	1 LSB ±1%	Above 100mA the error will increase to 1 LSB ±5% at 400mA. Maximum current is 400mA

The ranges are switched automatically by the XAM to achieve best measurement results and the currently active range is visualized in the [Atmel Data Visualizer](#) frontend tool. The maximum voltage drop over the shunt resistor is 100mV and the XAM will switch the range automatically before this limit is reached.

### 3.4. 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. The table below 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

### 3.5. Power Sources

The SAM B11 Xplained Pro kit can be powered by several power sources as listed in the table below.

**Table 3-3. Power Sources for SAM B11 Xplained Pro**

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

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

1. External power.
2. Embedded Debugger USB.

**Note:** The selection for the supply of the Target MCU has a separate connector. The above priority selects which supply is used to power the EDBG and the VCC\_P3V3\_CON.



**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.

## 3.6. Xplained Pro Headers and Connectors

### 3.6.1. 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 the table below.

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 <sup>2</sup> C_SDA	Data line for I <sup>2</sup> C interface. Always implemented, bus type.
12	I <sup>2</sup> C_SCL	Clock line for I <sup>2</sup> 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.

Pin number	Name	Description
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

### 3.6.2. Xplained Pro Power Header

The power header can be used to connect external power to the SAM B11 Xplained Pro 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 3-5. 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 User Guide

### 4.1. Connectors

The following sections describes the implementation of the relevant connectors and headers on SAM B11 Xplained Pro and their connection to the ATSAMB11G18A. The tables of connections in the sections also describes which signals are shared between the headers and on-board functionality.

#### 4.1.1. Xplained Pro Extension Headers

The SAM B11 Xplained Pro headers EXT1 and EXT3 offers access to the I/O of the microcontroller in order to expand the board e.g., by connecting extensions to the board. These headers are based on the standard extension header specified in [Table 3-4 Xplained Pro Standard Extension Header](#) on page 10 . The headers have a pitch of 2.54mm

**Table 4-1. Extension Header EXT1**

EXT1 pin	SAM B11 pin	Function	Shared functionality
1 [ID]	-	-	Communication line to the ID chip on an extension board
2 [GND]	-	-	Ground
3 [ADC(+)]	GPIO_M S1	ADC	
4 [ADC(-)]	GPIO_M S2	ADC	
5 [GPIO1]	GPIO4	GPIO	<a href="#">EDBG SPI</a>
6 [GPIO2]	AO_GPIO _2	GPIO/IRQ	
7 [PWM(+)]	-	-	
8 [PWM(-)]	-	-	
9 [IRQ/GPIO]	AO_GPIO _0	IRQ/GPIO	
10 [SPI_SS_B/GPIO]	GPIO_5	GPIO	<a href="#">Temperature Sensor</a> on page 17
11 [TWI_SDA]	LP_GPIO _8	I <sup>2</sup> C SDA	<a href="#">EDBG I<sup>2</sup>C</a> , <a href="#">Temperature Sensor</a>
12 [TWI_SCL]	LP_GPIO _9	I <sup>2</sup> C SCL	<a href="#">EDBG I<sup>2</sup>C</a> , <a href="#">Temperature Sensor</a>
13 [USART_RX]	LP_GPIO _2	UART1 RXD	
14 [USART_TX]	LP_GPIO _3	UART TXD	

EXT1 pin	SAM B11 pin	Function	Shared functionality
15 [SPI_SS_A]	LP_GPIO_12	SPI_SSN	
16 [SPI_MOSI]	LP_GPIO_11	SPI MOSI	EDBG SPI
17 [SPI_MISO]	LP_GPIO_13	SPI MISO	EDBG SPI
18 [SPI_SCK]	LP_GPIO_10	SPI SCK	EDBG SPI
19 [GND]	-	-	Ground
20 [VCC]	-	-	Power for extension board

**Table 4-2. Extension Header EXT3**

EXT3 pin	SAM B11 pin	Function	Shared functionality
1 [ID]	-	-	Communication line to the ID chip on an extension board
2 [GND]	-	-	Ground
3 [ADC(+)]	GPIO_MS3	ADC	
4 [ADC(-)]	GPIO_MS4	ADC	
5 [GPIO1]	LP_GPIO_20	GPIO	EDBG GPIO3
6 [GPIO2]	-	-	
7 [PWM(+)]	-	-	
8 [PWM(-)]	-	-	
9 [IRQ/GPIO]	AO_GPIO_1	IRQ/GPIO	
10 [SPI_SS_B/GPIO]	-	-	
11 [TWI_SDA]	LP_GPIO_14	I <sup>2</sup> C SDA	DEBUG I <sup>2</sup> C
12 [TWI_SCL]	LP_GPIO_15	I <sup>2</sup> C SCL	DEBUG I <sup>2</sup> C
13 [USART_RX]	LP_GPIO_6	UART2 RX	DEBUG UART
14 [USART_TX]	LP_GPIO_7	UART2 TX	DEBUG UART

EXT3 pin	SAM B11 pin	Function	Shared functionality
15 [SPI_SS_A]	LP_GPIO_16	SPI1 SSN	
16 [SPI_MOSI]	LP_GPIO_19	SPI1 MOSI	
17 [SPI_MISO]	LP_GPIO_18	SPI1 MISO	
18 [SPI_SCK]	LP_GPIO_17	SPI1 SCK	
19 [GND]	-	-	Ground
20 [VCC]	-	-	Power for extension board

#### 4.1.2. VDDIO Header

The SAM B11 Xplained Pro has a 2-pin header connecting the power supply from the VCC\_MCU net to VCC\_IO net through a jumper. This header can be used to measure the current to the I/O block of the SAM B11 device by removing the jumper and connect an ammeter. SAM B11 has the possibility to run the I/O block at a lower voltage level than the MCU is running and thus support interfacing devices that require lower operating voltages. The header can then be used to power the VCC\_IO pin at a different voltage level by removing the jumper and connecting a power supply with the desired voltage. Refer to the datasheet of the device for valid operating voltages.

**Table 4-3. VDDIO Header**

VDDIO header pin	Function
1	VCC_MCU power supply
2	VCC_IO power input

#### 4.1.3. Current Measurement Header

An angled 1x2, 100mil pin-header marked with MCU current measurement is located at the upper edge of the SAM B11 Xplained Pro. All power to the ATSAMB11G18A is routed through this header. To measure the power consumption of the device remove the jumper and replace it with an ammeter.



**Caution:** Removing the jumper from the pin-header while the kit is powered may cause the ATSAMB11G18A to be powered through its I/O pins. This may cause permanent damage to the device.

#### 4.1.4. Cortex Debug Connector

SAM B11 Xplained Pro has a 10-pin 50-mil Cortex<sup>®</sup> Debug Connector that can be used to attach external debuggers to the ATSAMB11G18A.

**Table 4-4. Cortex Debug Connector**

Cortex Debug Connector pin	Pin / Net	Function	Shared functionality
1	VCC_TARGET_P3V3	ATSAMB11G18A voltage	
2	GPIO_1	SWD data signal	EDBG SWD
3	GND	Ground	
4	GPIO_2	SWD clock signal	EDBG SWD
5	GND	Ground	
6	-	-	
7	-	-	
8	-	-	
9	GND	Ground	
10	RESETN	Target reset signal	

The Target reset is isolated from the Cortex Debug Connector by R300 (0 Ohm link) which is not mounted by default in the PCBA

## 4.2. Peripherals

### 4.2.1. Crystals

The SAM B11 Xplained Pro kit contains one mounted 32.768kHz crystal that can be used as clock sources for the SAM B11. The crystal has cut-straps next to them that can be used to measure the oscillator safety factor. This is done by cutting the strap and adding a resistor across the strap. Information about oscillator allowance and safety factor can be found in application note [AVR41001](#), information about clock calibration and compensation can be found in application note [AT03155](#).

The footprint for the external crystal is based on the Fox FQ5032B series

**Table 4-5. External 32.768kHz Crystal**

SAM B11 pin	Function	Shared functionality
RTC_CLKP	XIN32	-
RTC_CLKN	XOUT32	-

### 4.2.2. Mechanical Buttons

SAM B11 Xplained Pro contains two mechanical buttons. One button is the RESET button connected to the SAM B11 reset line and the other is a generic user configurable button. When a button is pressed it will drive the I/O line to GND.

**Note:** There is no pull-up resistor connected to the generic user button. Remember to enable the internal pull-up in the SAM B11 to use the button.



**Table 4-6. Mechanical Buttons**

SAM B11 pin	Silkscreen text	Shared functionality
RESET	RESET	-
GPIO_23	SW0	<a href="#">EDBG GPIO</a>

**4.2.3. LED**

There is one yellow LED available on the SAM B11 Xplained Pro board that can be turned on and off. The LED can be activated by driving the connected I/O line to GND.

**Table 4-7. LED Connection**

SAM B11 pin	Function	Shared functionality
GPIO_22	Yellow LED0	<a href="#">EDBG GPIO</a>

**4.2.4. Debug I<sup>2</sup>C and UART**

Debug I<sup>2</sup>C and UART are used for debugging the BLE stack in the SAM B11 boards. Both these headers are not mounted on the production variant.

Pinout for the Debug I<sup>2</sup>C:

**Table 4-8. Debug I<sup>2</sup>C Pinout Specification**

SAM B11 pin	Function	Shared functionality
I <sup>2</sup> C SCL	Clock line for I <sup>2</sup> C	<a href="#">EXT3</a>
GND	Ground	
I <sup>2</sup> C SDA	Data line for I <sup>2</sup> C	<a href="#">EXT3</a>
NC		

Pinout for Debug UART:

**Table 4-9. Debug UART Pinout Specification**

SAM B11 pin	Function	Shared functionality
UART TXD	UART TX pin	<a href="#">EXT3</a>
UART RXD	UART RX pin	<a href="#">EXT3</a>
GND		

**4.2.5. Battery header**

The SAM B11 Xplained Pro has a BATTERY HEADER for connecting the battery for use with the SAM B11 module. The battery header has a VCC and GND pin and disconnects the LDO for the MCU. It is polarity protected. The batter power supply can be given to the device by placing a jumper over pin 1-2 on the 3-pin VBAT SELECT header.

By default the jumper is placed over pin 2-3 to select the board power supply. This configuration is selected to avoid draining the battery and can be used during development.

**Table 4-10. VBAT SELECT Header**

VBAT SELECT pin	Function
1	Power from battery
2	VCC pin of SAM B11 board, powers both MCU and Extensions
3	Power from board supply

#### 4.2.6. Temperature Sensor

The SAM B11 Xplained Pro has an on board temperature sensor AT30TSE758A, powered by the VCC\_TARGET\_P3V3 of the board. The temperature sensor is I<sup>2</sup>C controlled and is available on the address 0x48 (7bit MSB address)

AT30TSE758A also has a serial EEPROM accessible through I<sup>2</sup>C

SAMB11 pin	Function	Shared functionality
LP_GPIO_8	SDA (Data line)	EXT1, EDBG I <sup>2</sup> C
LP_GPIO_9	SCL (Clock line)	EXT1, EDBG I <sup>2</sup> C
LP_GPIO_5	ALERT	EXT1

### 4.3. Embedded Debugger Implementation

SAM B11 Xplained Pro contain an Embedded Debugger (EDBG) that can be used to program and debug the ATSAM11G18A using Serial Wire Debug (SWD). The Embedded Debugger also include a Virtual Com port interface over UART, an Atmel Data Gateway Interface over SPI, and I<sup>2</sup>C and it includes four of the SAM B11 GPIOs. The kit also includes a XAM extension processor to the Embedded Debugger for on-board current measurement. Atmel Studio can be used as a front end for the Embedded Debugger.

#### 4.3.1. Serial Wire Debug

The Serial Wire Debug (SWD) use two pins to communicate with the target. For further information on how to use the programming and debugging capabilities of the EDBG, see [Embedded Debugger](#) on page 6.

**Table 4-11. SWD Connections**

SAM B11 pin	Function	Shared functionality
LP_GPIO_0	SWD clock	<a href="#">Table 4-4 Cortex Debug Connector</a> on page 15
LP_GPIO_1	SWD data	<a href="#">Table 4-4 Cortex Debug Connector</a> on page 15

#### 4.3.2. Virtual COM Port

The Embedded Debugger acts as a Virtual Com Port gateway by using one of the ATSAM11G18A UARTs. For further information on how to use the Virtual COM port, see [Embedded Debugger](#) on page 6.

**Table 4-12. Virtual COM Port Connections**

SAM B11 pin	Function	Shared functionality
LP_GPIO_2	UART TXD(SAM B11 TX line)	EXT1
LP_GPIO_3	UART RXD (SAM B11 RX line)	EXT1

### 4.3.3. Atmel Data Gateway Interface

The Embedded Debugger features an Atmel Data Gateway Interface (DGI) by using either a SPI or I<sup>2</sup>C. The DGI can be used to send a variety of data from the ATSAMB11G18A to the host PC. For further information on how to use the DGI interface, see [Atmel Data Visualizer](#) and the [EDBG User Guide](#).

**Table 4-13. DGI Interface Connections When Using SPI**

SAM B11 pin	Function	Shared functionality
LP_GPIO_7	GPIO/SPI SS (Slave select) ((SAM B11 is Master))	-
LP_GPIO_13	SPI MISO (Master In, Slave Out)	EXT1
LP_GPIO_11	SERCOM5 PAD[2] SPI MOSI (Master Out, Slave in)	EXT1
LP_GPIO_10	SERCOM5 PAD[3] SPI SCK (Clock Out)	EXT1

**Table 4-14. DGI Interface Connections When Using I<sup>2</sup>C**

SAM B11 pin	Function	Shared functionality
LP_GPIO_8	SDA (Data line)	EXT1
LP_GPIO_9	SCL (Clock line)	EXT1

Four GPIO lines are connected to the Embedded Debugger. The EDBG can monitor these lines and time stamp pin value changes. This makes it possible to accurately time stamp events in the SAM B11 application code. For further information on how to configure and use the GPIO monitoring features, see [Atmel Data Visualizer](#) and the [EDBG User Guide](#).

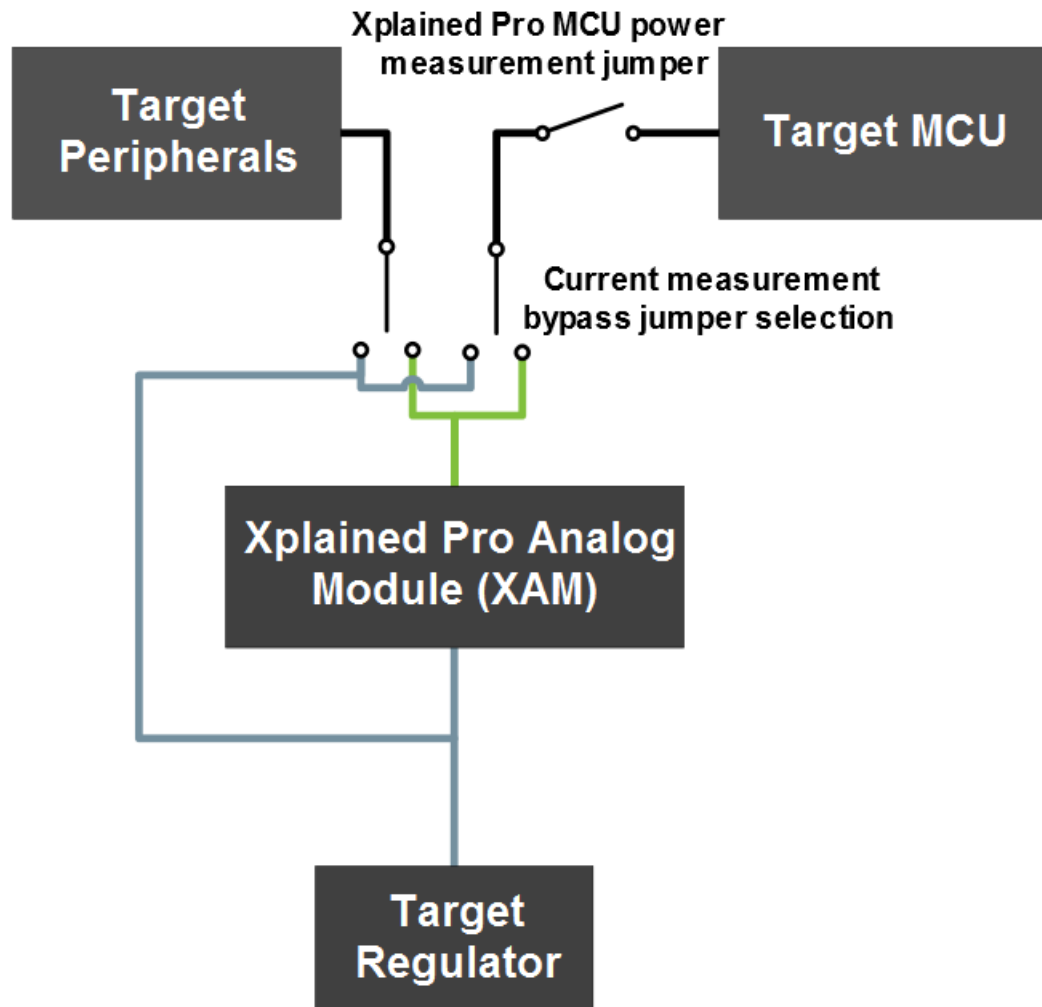
**Table 4-15. GPIO Lines Connected to the EDBG**

SAM B11 pin	Function	Shared functionality
LP_GPIO_22	GPIO0	USER LED
LP_GPIO_23	GPIO1	USER BUTTON
LP_GPIO_18	GPIO2	EXT3
LP_GPIO_20	GPIO3	

### 4.3.4. SAM B11 Xplained Pro XAM Configuration

On the SAM B11 Xplained Pro the MCU and the MCU peripherals (e.g. extensions) are powered by its own regulator as show in the following figure. All other parts of the board, mainly embedded debugger and accompanying Xplained Pro Analog Module (XAM), are powered from a separate regulator. The current to the MCU and peripherals can be measured by connecting them to the XAM output through jumper settings.

Figure 4-1. SAMB11 XAM Implementation Block Diagram



On the SAM B11 Xplained Pro the XAM can be used in four configurations:

1. **No current measurement or external MCU current measurement:** The XAM is bypassed and thus the MCU and peripherals are supplied directly by the regulator. Set both jumpers in the "BYPASS" position. In this configuration it is also possible to connect external measurement tools on the Xplained Pro MCU power measurement header to measure MCU current directly instead of using the XAM.
2. **MCU current measurement:** The XAM measures only the MCU current while the peripherals are supplied directly by the regulator. For this configurations place the jumper for "I/O" (peripherals) into the "BYPASS" position and the for "MCU" into the "MEASURE" position.
3. **Peripherals measurement:** The XAM measures only the peripherals current while the MCU is directly supplied by the regulator. For this configuration place the jumper for "MCU" into the "BYPASS" position and the "I/O" jumper into the "MEASURE" position.
4. **MCU and peripherals measurement:** In this configuration both MCU and peripherals are measured by the XAM. Place both jumpers on "I/O" and "MCU" headers in the "MEASURE" position.

## 5. Document Revision History

Doc. rev.	Date	Comment
42664A	02/2016	Initial document release.



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