ATmega4809 Xplained Pro

ATmega4809 Xplained Pro

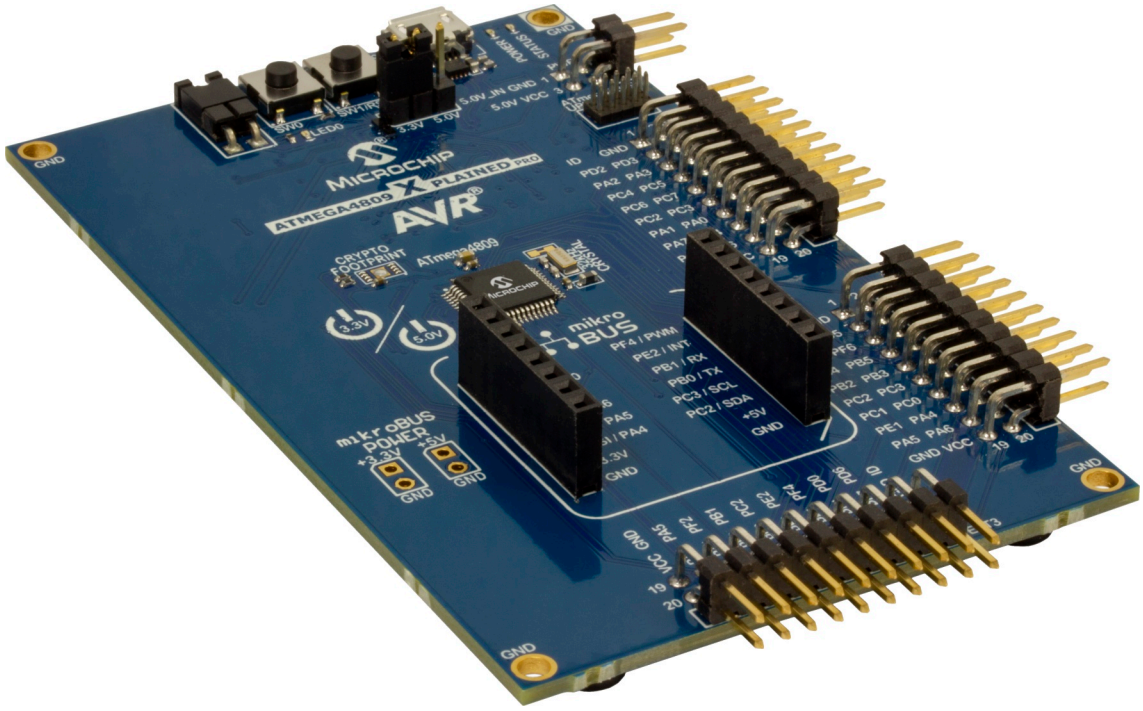
Preface

The ATmega4809 Xplained Pro evaluation kit is a hardware platform to evaluate the ATmega4809 microcontroller.

Supported by the integrated development platform Atmel Studio, the kit provides easy access to the features of the ATmega4809 and explains how to integrate the device into a custom design.

The Xplained Pro MCU series evaluation kits include an on-board Embedded Debugger. No external tools are necessary to program or debug the ATmega4809.

The Xplained Pro extension kits offer 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

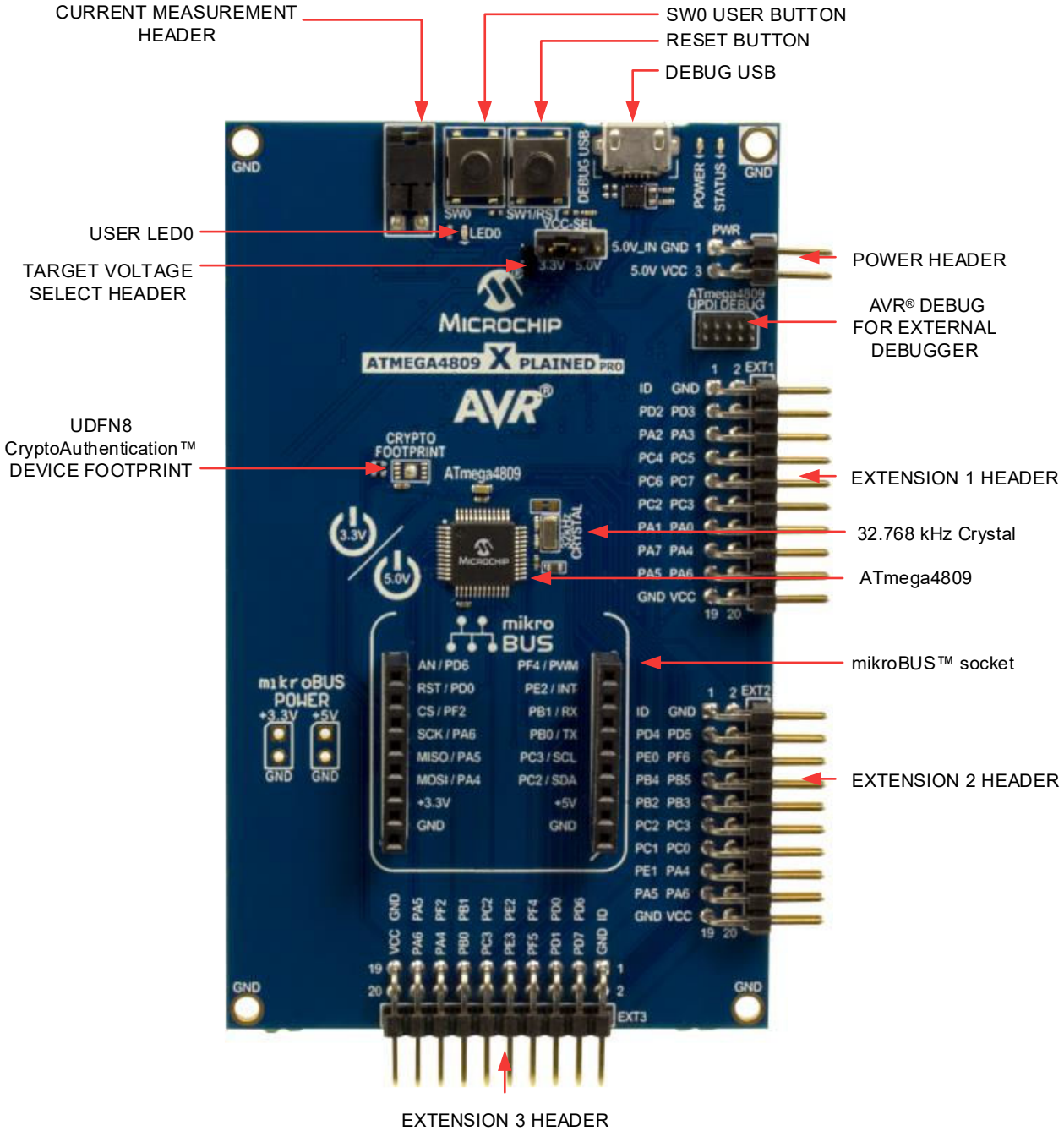
- ATmega4809 microcontroller
- Selectable target voltage
  - 3.3V
  - 5.0V (USB/external power)
- One mechanical reset/user programmable button
- One mechanical user programmable button
- One yellow user programmable LED
- UDFN8 footprint for Microchip CryptoAuthentication™ devices
- 32.768 kHz crystal
- Three Xplained Pro extension headers
- One mikroBUS™ socket
- 10-pin, 50-mil AVR® Debug Connector with UPDI
- 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^2C, four GPIOs
  - Virtual COM port (CDC)
- USB powered

1.2 Kit Overview

The ATmega4809 Xplained Pro evaluation kit is a hardware platform to evaluate the ATmega4809.

The kit offers a set of features that enables the ATmega4809 user to get started with the ATmega4809 peripherals right away and to get an understanding of how to integrate the device into their own design.

Figure 1-1. ATmega4809 Xplained Pro Evaluation Kit Overview



Info: There is no IC mounted on the UDFN8 CryptoAuthentication footprint.

2. Getting Started

2.1 Xplained Pro Quick Start

Steps to start exploring the Xplained Pro platform:

1. Download and install Atmel Studio.
2. Launch Atmel Studio.
3. Connect the Debug USB port on the evaluation kit to the computer using a USB cable (Standard-A to Micro-B or Micro-AB).

When the Xplained Pro MCU kit is connected to the computer for the first time, the operating system installs the driver software automatically. This driver supports 32-bit and 64-bit versions of Microsoft® Windows® XP, Windows Vista®, Windows 7, Windows 8, Windows 10, and Windows Server 2012.

When the Xplained Pro MCU board is powered, the power LED (green) glows, and Atmel Studio automatically detects the specific Xplained Pro MCU and extension board(s) that are connected. The landing page of the kit in the Atmel Studio has an option to launch the Atmel Software Framework (ASF) and the Atmel START example application codes for the kit. The ATmega4809 device is programmed and debugged by the on-board embedded debugger and therefore no external programmer or debugger tool is required.

2.2 Design Documentation and Relevant Links

The following list contains links to the most relevant documents and software for the ATmega4809 Xplained Pro.

- **Xplained products** - Xplained evaluation kits are a series of easy-to-use evaluation kits for Microchip microcontrollers and other Microchip products.
  - Xplained Nano - used for low pin count devices and provides a minimalistic solution with access to all I/O pins of the target microcontroller.
  - Xplained Mini - used for medium pin count devices and adds Arduino Uno compatible header footprint and a prototyping area.
  - Xplained Pro - used for medium to high pin count devices that features advanced debugging and standardized extensions for peripheral functions.

  Note: All the above kits have on-board programmers/debuggers, which create a set of low-cost boards for evaluation and demonstration of features and capabilities of different Microchip products.
- **Atmel Studio** - Free IDE for the development of C/C++ and assembler code for microcontrollers.
- **EDBG User Guide** - User guide containing more information about the on-board Embedded Debugger.
- **IAR Embedded Workbench® for AVR®** - This is a commercial C/C++ compiler that is available for 8-bit AVR. There is a 30-day evaluation version as well as a 4 KB code-size-limited kick-start version available from their website.
- **http://microchip.com/start** - Atmel START is an online tool that helps the user to select and configure software components and tailor your embedded application in a usable and optimized manner.
- **ATmega4809 Xplained Pro website** - Kit information, latest user guide and design documentation.
- **ATmega4809 Xplained Pro on Microchip Direct** - Purchase this kit on Microchip Direct.

- **CryptoAuthentication Devices** - Microchip CryptoAuthentication devices offer hardware-based ultra secure key storage to ensure that a product with the consumables it uses, firmware it runs, accessories that supports it, and the network nodes it connects to are not cloned, counterfeited, or tampered with.

3. Xplained Pro

Xplained Pro is an evaluation platform which contains a series of microcontroller boards (evaluation kits) and extension boards. Atmel Studio is used to program and debug the microcontrollers on these boards. Atmel Studio includes Advanced Software Framework (ASF) and Atmel START, which has drivers and demo code, and Data Visualizer, which supports data streaming and advanced debugging. Xplained Pro evaluation kits can be connected to a wide range of Xplained Pro extension boards through standardized headers and connectors. Xplained Pro extension boards have identification (ID) chips to uniquely identify which boards are connected to the Xplained Pro evaluation kits.

3.1 Embedded Debugger

The ATmega4809 Xplained Pro contains an Embedded Debugger (EDBG) for on-board debugging. The EDBG is a USB composite device with the following interfaces:

- Debugger
- Virtual COM Port
- Data Gateway Interface (DGI)

The EDBG can program and debug the ATmega4809 with the help of Atmel Studio. The UPDI interface is connected between the EDBG and the ATmega4809 on the ATmega4809 Xplained Pro.

The Virtual COM Port is connected to a UART on the ATmega4809 and provides an easy way to communicate with the target application through terminal software. It offers variable baud rate, parity, and stop bit settings. The settings on the ATmega4809 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 ATmega4809. If the DTR signal is not enabled, the UART pins on the EDBG are kept in tri-state (high-Z) to render the COM Port not usable. The DTR signal is automatically set by terminal software, but it may have to be manually enabled in your terminal.

The DGI consists of several physical interfaces for bidirectional communication with the host computer. Communication over the interfaces is bidirectional. It can be used to send event values and data from the ATmega4809. Traffic over the interfaces can be timestamped by the EDBG for more accurate tracking of events, but timestamping reduces the maximal data throughput. The Data Visualizer is used to send and receive data through DGI.

The EDBG controls two LEDs on the ATmega4809 Xplained Pro; a power LED and a status LED. The following table provides details on how the LEDs are controlled in different operation modes.

Table 3-1. EDBG LED Control

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

For additional information on the EDBG, see the EDBG User Guide.

3.2 Hardware Identification System

All Xplained Pro extension boards come with an identification chip (ATSHA204A CryptoAuthentication™ chip) to uniquely identify the boards that are connected to the Xplained Pro evaluation kit. 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 evaluation kit, the information is read and sent to the Atmel Studio. The following table 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	Microchip'\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 ATmega4809 Xplained Pro kit can be powered by several power sources, as listed in the following table.

Table 3-3. Power Sources for ATmega4809 Xplained Pro

Power Source	Voltage Requirements	Current Requirements	Connector Marking
External power	5V ±2% (±100 mV) for USB host operation. 4.3V to 5.5V if a USB	The recommended value for maximum current is 2A.	PWR

Power Source	Voltage Requirements	Current Requirements	Connector Marking
	host operation is not required.		
Embedded debugger USB	4.4V to 5.25V (according to USB specification)	500 mA (according to USB specification)	DEBUG USB

The kit automatically detects the available power sources and chooses which to use according to the following priority:

1. External power.
2. Embedded debugger USB.

Info: External power is required when 500 mA from a USB connector is not enough to power the board with possible extension boards.

3.4 Xplained Pro Headers and Connectors

3.4.1 Xplained Pro Standard Extension Header

All Xplained Pro kits have many dual-row, 20-pin, 100-mil extension headers. The Xplained Pro MCU boards have male headers, while the Xplained Pro extensions have their female counterparts. The following table provides the pin description of all the connected pins.

Info: Not all pins are always connected on all extension headers.

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 microcontroller on the Xplained Pro boards.

Table 3-4. Xplained Pro Standard Extension Header

Pin Number	Pin Name	Description
1	ID	Pin to communicate with the ID chip on an extension board.
2	GND	Ground
3	ADC(+)	Analog-to-Digital Converter; alternatively, a pin for the positive terminal of a differential ADC.
4	ADC(-)	Analog-to-Digital Converter; alternatively, a pin for the negative terminal of a differential ADC.
5	GPIO1	General purpose I/O pin.
6	GPIO2	General purpose I/O pin.

Pin Number	Pin Name	Description
7	PWM(+)	Pulse-Width Modulation; alternatively, a pin for the positive part of a differential PWM.
8	PWM(-)	Pulse-Width Modulation; alternatively, a pin for the negative part of a differential PWM.
9	IRQ/GPIO	Interrupt request pin and/or general purpose I/O pin.
10	SPI_SS_B/ GPIO	Slave select pin for Serial Peripheral Interface (SPI) and/or general purpose I/O pin.
11	I^2C_SDA	Data pin for I^2C interface. Always connected, bus type.
12	I^2C_SCL	Clock pin for I^2C interface. Always connected, bus type.
13	UART_RX	Receiver pin of target device UART.
14	UART_TX	Transmitter pin of target device UART.
15	SPI_SS_A	Slave select for SPI. This pin should preferably not be connected to anything else.
16	SPI_MOSI	SPI master out slave in pin. Always connected, bus type.
17	SPI_MISO	SPI master in slave out pin. Always connected, bus type.
18	SPI_SCK	SPI clock pin. Always connected, bus type.
19	GND	Ground pin for extension boards.
20	VCC	Power pin for extension boards.

3.4.2 Xplained Pro Power Header

The power header can be used to connect external power to the ATmega4809 Xplained Pro kit. The kit automatically detects and switches to an external power source, if supplied. The power header can also be used to supply power to external peripherals or extension boards. Ensure that the total current does not exceed the recommended current limit of the on-board regulator when using the 3.3V pin.

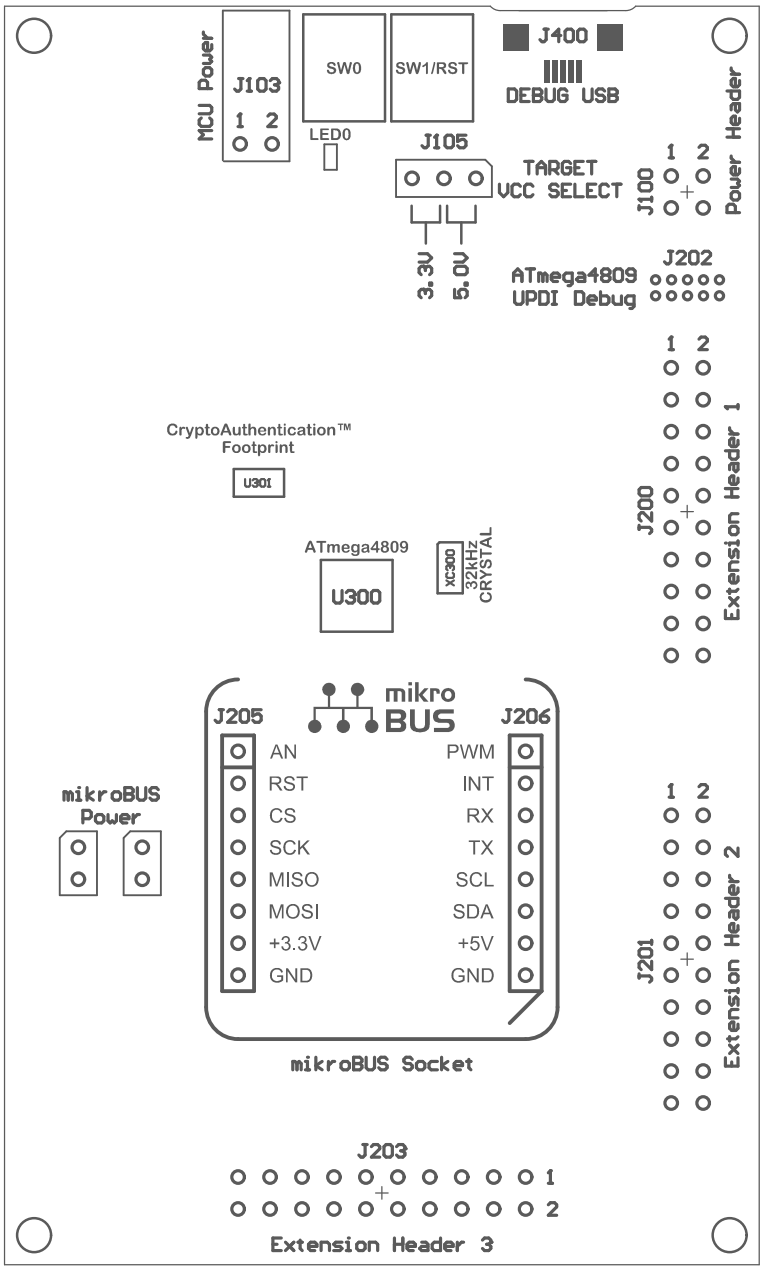
Table 3-5. Xplained Pro Power Header

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

4. Hardware User Guide

The following sections describe the implementation of the relevant connectors, headers, and peripherals on ATmega4809 Xplained Pro, and their connection to ATmega4809. The tables of connections in the sections also describe which signals are shared between the connectors, headers, and peripherals. The figure below shows all available headers, connectors, jumpers, and peripherals on ATmega4809 Xplained Pro.

Figure 4-1. ATmega4809 Xplained Pro Connector Overview



4.1 Power Distribution

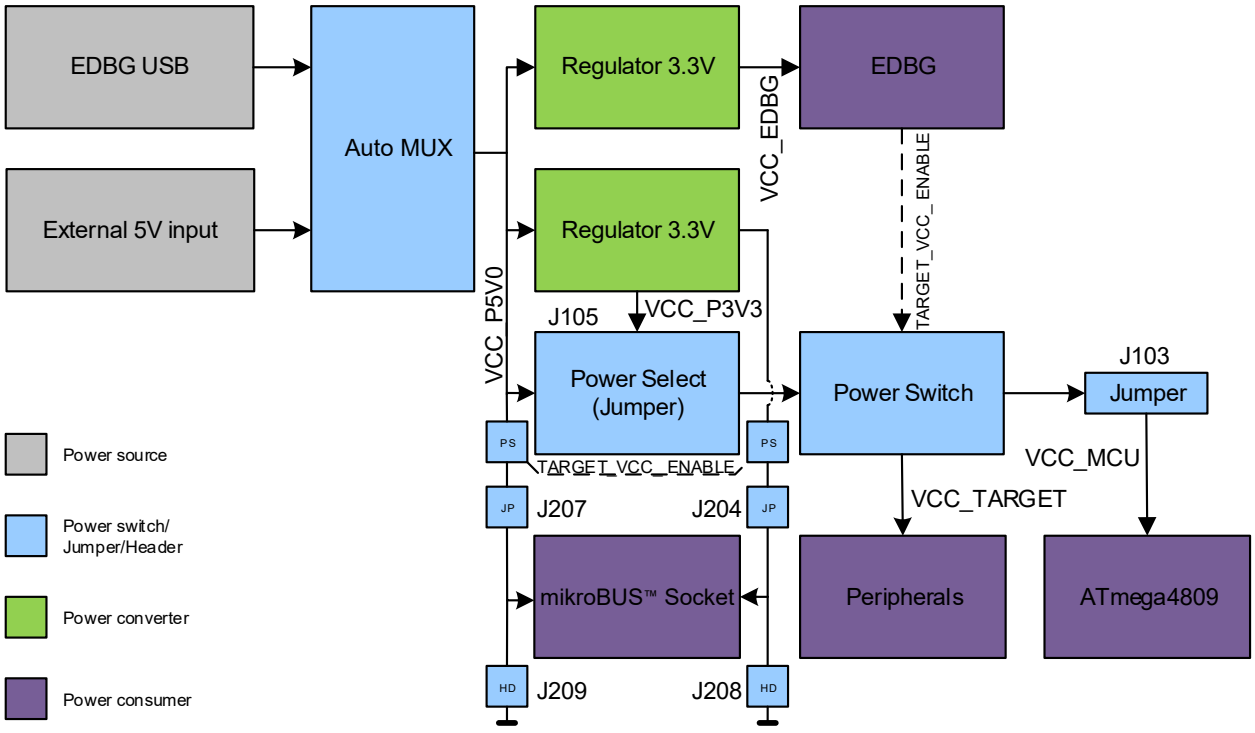
ATmega4809 Xplained Pro has two power sources as described in 3.3 Power Sources. The block diagram below shows the power supply circuitry on the board. The kit can be powered by the EDBG USB and an external 5.0V source. The kit will automatically select which source to draw power from. ATmega4809 can be powered by 3.3V (regulated) or 5.0V (USB/external voltage). The voltage is selectable using a jumper on the power selection header *J105*.

An on-board power switch is used to turn power to the ATmega4809 ON and OFF. This power switch is controlled by the EDBG. When the kit is powered up, the EDBG reads the ID chip information from all connected Xplained Pro extension boards and checks that they are compatible with the voltage selected by the power selection header *J105*. If the selected voltage is within the connected extensions ranges the switch will open. If not, the EDBG power LED will blink rapidly and the switch will stay closed resulting in no power provided to ATmega4809, the on-board peripherals, and the connectors.

⚠ CAUTION As ATmega4809 Xplained Pro can be powered by 5.0V care must be taken not to connect any Xplained Pro extensions that do not support this voltage, doing so may result in permanent damage. Check the respective extension kit's user guide to see which voltages are acceptable.

Info: The EDBG reads the ID information from Xplained Pro extensions and controls the power switch when the kit is powered up. This mechanism does not check hot-plugging of extension boards.

Figure 4-2. Power Supply Block Diagram



4.2 Connectors

4.2.1 Xplained Pro Standard Extension Headers

The Xplained Pro extension headers EXT1, EXT2, and EXT3 offer access to the I/O of the microcontroller to expand the board, for example, by connecting extensions to the board. These headers are based on the standard Xplained Pro extension header specification. The connections are shown in the table below. The headers have a pitch of 2.54 mm.

Table 4-1. Extension Header EXT1

EXT1 Pin	ATmega4809 Pin	Function	Shared Functionality
1 [ID]	-	-	Communication line to the ID chip on an extension board
2 [GND]	-	-	Ground
3 [ADC(+)]	PD2	ADC0 AIN2	-
4 [ADC(-)]	PD3	ADC0 AIN3	-
5 [GPIO1]	PA2	GPIO (USART0 XCK)	-
6 [GPIO2]	PA3	GPIO (USART0 XDIR)	-
7 [PWM(+)]	PC4	*TCA0 WO4*	-
8 [PWM(-)]	PC5	*TCA0 WO5*	-
9 [IRQ/GPIO]	PC6	GPIO	-
10 [SPI_SS_B/ GPIO]	PC7	GPIO	-
11 [TWI_SDA]	PC2	*TWI0 SDA*	EXT2, EXT3, mikroBUS™, CryptoAuthentication™ footprint, EDBG DGI
12 [TWI_SCL]	PC3	*TWI0 SCL*	EXT2, EXT3, mikroBUS™, CryptoAuthentication™ footprint, EDBG DGI
13 [USART_RX]	PA1	USART0 RxD	-
14 [USART_TX]	PA0	USART0 TxD	-
15 [SPI_SS_A]	PA7	SPI0 SS	-
16 [SPI_MOSI]	PA4	SPI0 MOSI	EXT2, EXT3, mikroBUS™, EDBG DGI
17 [SPI_MISO]	PA5	SPI0 MISO	EXT2, EXT3, mikroBUS™, EDBG DGI
18 [SPI_SCK]	PA6	SPI0 SCK	EXT2, EXT3, mikroBUS™, EDBG DGI

EXT1 Pin	ATmega4809 Pin	Function	Shared Functionality
19 [GND]	-	-	Ground
20 [VCC]	-	-	Power for extension board

Table 4-2. Extension Header EXT2

EXT2 Pin	ATmega4809 Pin	Function	Shared Functionality
1 [ID]	-	-	Communication line to the ID chip on an extension board
2 [GND]	-	-	Ground
3 [ADC(+)]	PD4	ADC0 AIN4	-
4 [ADC(-)]	PD5	ADC0 AIN5	-
5 [GPIO1]	PE0	GPIO	-
6 [GPIO2]	PF6	GPIO/RESET	SW1, DEBUG, EDBG
7 [PWM(+)]	PB4	*TCA0 WO4*	DGI GPIO2
8 [PWM(-)]	PB5	*TCA0 WO5*	DGI GPIO3, LED0
9 [IRQ/GPIO]	PB2	GPIO	DGI GPIO0, SW0
10 [SPI_SS_B/ GPIO]	PB3	GPIO	DGI GPIO1
11 [TWI_SDA]	PC2	*TWI0 SDA*	EXT1, EXT3, mikroBUS™, CryptoAuthentication™ footprint, EDBG DGI
12 [TWI_SCL]	PC3	*TWI0 SCL*	EXT1, EXT3, mikroBUS™, CryptoAuthentication™ footprint, EDBG DGI
13 [USART_RX]	PC1	USART1 RxD	EDBG CDC
14 [USART_TX]	PC0	USART1 TxD	EDBG CDC
15 [SPI_SS_A]	PE1	GPIO	-
16 [SPI_MOSI]	PA4	SPI0 MOSI	EXT1, EXT3, mikroBUS™, EDBG DGI
17 [SPI_MISO]	PA5	SPI0 MISO	EXT1, EXT3, mikroBUS™, EDBG DGI
18 [SPI_SCK]	PA6	SPI0 SCK	EXT1, EXT3, mikroBUS™, EDBG DGI
19 [GND]	-	-	Ground
20 [VCC]	-	-	Power for extension board

Table 4-3. Extension Header EXT3

EXT3 Pin	ATmega4809 Pin	Function	Shared Functionality
1 [ID]	-	-	Communication line to the ID chip on an extension board
2 [GND]	-	-	Ground
3 [ADC(+)]	PD6	ADC0 AIN6	mikroBUS™
4 [ADC(-)]	PD7	ADC0 AIN7	-
5 [GPIO1]	PD0	GPIO	mikroBUS™
6 [GPIO2]	PD1	GPIO	mikroBUS™
7 [PWM(+)]	PF4	TCB0 WO (*TCA0 WO4*)	mikroBUS™
8 [PWM(-)]	PF5	TCB1 WO (*TCA0 WO5*)	mikroBUS™
9 [IRQ/GPIO]	PE2	GPIO	mikroBUS™
10 [SPI_SS_B/ GPIO]	PE3	GPIO	-
11 [TWI_SDA]	PC2	*TWI0 SDA*	EXT1, EXT2, mikroBUS™, CryptoAuthentication™ footprint, EDBG DGI
12 [TWI_SCL]	PC3	*TWI0 SCL*	EXT1, EXT2, mikroBUS™, CryptoAuthentication™ footprint, EDBG DGI
13 [USART_RX]	PB1	USART3 RxD	mikroBUS™
14 [USART_TX]	PB0	USART3 TxD	mikroBUS™
15 [SPI_SS_A]	PF2	GPIO	mikroBUS™
16 [SPI_MOSI]	PA4	SPI0 MOSI	EXT1, EXT2, mikroBUS™, EDBG DGI
17 [SPI_MISO]	PA5	SPI0 MISO	EXT1, EXT2, mikroBUS™, EDBG DGI
18 [SPI_SCK]	PA6	SPI0 SCK	EXT1, EXT2, mikroBUS™, EDBG DGI
19 [GND]	-	-	Ground
20 [VCC]	-	-	Power for extension board

4.2.2 mikroBUS™ Socket

ATmega4809 Xplained Pro has one mikroBUS socket that can be used with MikroElektronika click modules. The table below shows the signals connected to the mikroBUS socket.

Table 4-4. mikroBUS™ Socket

Function	ATmega4809 Pin	mikroBUS™		ATmega4809 Pin	Function
ADC0 AIN7	PD6	AN	PWM	PF4	TCB0 WO (*TCA0 WO4*)
GPIO	PD0	RST	INT	PE2	GPIO
GPIO	PF2	CS	RX	PB1	USART3 RxD
SPI0 SCK	PA6	SCK	TX	PB0	USART3 TxD
SPI0 MISO	PA5	MISO	SCL	PC3	*TWI0 SCL*
SPI0 MOSI	PA4	MOSI	SDA	PC2	*TWI0 SDA*
	-	3.3V	5.0V	-	
	-	GND	GND	-	

Info: All signals on the mikroBUS socket are shared with Xplained Pro extension header EXT3. Make sure that the connected mikroBUS add-on board and Xplained Pro extension does not use the same signals if both connectors are used at the same time.

Attention: 3.3V and 5.0V are connected directly to the mikroBUS socket. It is important to make sure the ATmega4809 operates at the same voltage as the connected mikroBUS socket. The operating voltage for the ATmega4809 is selected with the power selection header *J105*.

Related Links

4.1 Power Distribution

4.2.3 AVR® Debugger Connector

ATmega4809 Xplained Pro has a 10-pin 50-mil AVR Debug Connector (*J202*) with UPDI that can be used to attach external debuggers to the ATmega4809. Microchip debugging tools like the Atmel-ICE and Power Debugger can connect directly to this connector.

Table 4-5. AVR® 10-Pin Debugger Connector

AVR® 10-Pin Debugger Connector Pin	Pin/Net	Function	Shared Functionality
1 [TCK]	-	-	
2 [GND]	GND	Ground	
3 [TDO/UPDI]	UPDI	UPDI programming/ debug	EDBG
4 [VTG]	VCC_TARGET	ATmega4809 voltage	
5 [TMS]	-	-	
6 [nSRST]	PF6	ATmega4809 reset signal	SW1, EXT1, EDBG

AVR® 10-Pin Debugger Connector Pin	Pin/Net	Function	Shared Functionality
7 [NC]	-	-	
8 [nTRST]	-	-	
9 [TDI]	-	-	
10 [GND]	GND	Ground	

Info: PF6 (RESET) is usually not used by external debuggers as the ATmega4809 can be reset through the UPDI interface. If your debugger requires the use of the RESET, pin PF6 has to be configured as RESET with a fuse in the ATmega4809.

4.3 Peripherals

4.3.1 Crystals

ATmega4809 Xplained Pro has a 32.768 kHz crystal that can be used as clock source for the ATmega4809 device. There are cut-straps located close to the crystals that can be used to measure the oscillator safety factor. This is done by cutting the strap and adding a resistor across the strap. More information about oscillator allowance and safety factor is available in the AVR4100 application note.

The 32.768 kHz crystal on ATmega4809 Xplained Pro is a Kyocera Corporation ST3215SB32768C0HPWBB 7 pF crystal.

The crystal has been formally tested and matched to the ATmega4809 by Kyocera. The test report is available in the design documentation distributed with this document for ATmega4809 Xplained Pro.

Info: Kyocera Crystal Device Corporation crystals matched with specific products can be found on their website: http://prdct-search.kyocera.co.jp/crystal-ic/?p=en_search/.

Table 4-6. External 32.768 kHz Crystal

ATmega4809 Pin	Function
PF0	XIN32
PF1	XOUT32

Related Links

2.2 Design Documentation and Relevant Links

4.3.2 Mechanical Buttons

ATmega4809 Xplained Pro has two mechanical buttons. Both buttons are connected to I/O-pins on the ATmega4809 and can be used as general purpose buttons in your application. When a button is pressed it will drive the I/O line to GND.

Button SW1 can also be used as a reset button if PF6 is configured as the RESET pin in the ATmega4809. PF6 is configured as a RESET pin by writing fuses, for more information see the ATmega4809 data sheet.

Info: There is no pull-up resistor connected to the generic user button SW0. Remember to enable the internal pull-up in the ATmega4809 to use the button. There is an external pull-up resistor connected to SW1 connected to PF6.

Table 4-7. Mechanical Buttons

ATmega4809 Pin	Silkscreen Text	Shared Functionality
PB2	SW0	EXT2, DGI GPIO0
PF6	SW1/RESET	EXT2, DEBUG, EDBG

4.3.3 LED

One yellow LED available on the ATmega4809 Xplained Pro board can be turned ON and OFF. Drive the connected I/O line to GND to activate the LED.

Table 4-8. LED Connection

ATmega4809 Pin	Function	Shared Functionality
PB5	Yellow LED0	EXT2, DGI GPIO3

4.3.4 Footprint for CryptoAuthentication™ Devices

ATmega4809 Xplained Pro has one UDFN8 footprint for Microchip I²C CryptoAuthentication devices where several models can be soldered on. The table below shows all the connections between the UDFN8 footprint and the ATmega4809.

Info: ATSHA204A, ATAES132A, ATECC608A, and ATECC508A are examples of devices that can be soldered onto the UDFN8 footprint.

Info: The footprint is connected to I²C pins on the ATmega4809.

Table 4-9. UDFN8 Footprint Connections

UDFN8 Footprint Pin	ATmega4809 Pin	Function	Shared Functionality
1 [NC]	-	-	-
2 [NC]	-	-	-
3 [NC]	-	-	-
4 [GND]	-	GND	-
5 [SDA]	PC2	*TWI0 SDA*	EXT1, EXT2, EXT3, mikroBUS™, EDBG DGI

UDFN8 Footprint Pin	ATmega4809 Pin	Function	Shared Functionality
6 [SCL]	PC3	*TWI0 SCL*	EXT1, EXT2, EXT3, mikroBUS™, EDBG DGI
7 [NC]	-		-
8 [VCC]	-	VCC_TARGET	-
9 [PAD]	-	GND	-

4.4 Embedded Debugger Implementation

ATmega4809 Xplained Pro contains an Embedded Debugger (EDBG) that can be used to program and debug the ATmega4809 using the UPDI interface. The Embedded Debugger also includes a Virtual Com port interface over UART, a Data Gateway Interface over SPI, and I^2C, and it includes four of the ATmega4809 GPIOs. Atmel Studio can be used as a front-end for the Embedded Debugger.

4.4.1 UPDI

The UPDI interface uses one pin to communicate with the target. For further information on how to use the programming and debugging capabilities of the EDBG, see 3.1 Embedded Debugger.

Table 4-10. UPDI Connections

ATmega4809 Pin	Function	Shared Functionality
UPDI	UPDI programming/debugging	DEBUG
PF6	RESET	SW1, EXT1, DEBUG

Info: PF6 (RESET) is usually not used by the EDBG as the ATmega4809 can be reset through the UPDI interface.

4.4.2 Virtual COM Port

The Embedded Debugger acts as a Virtual Com Port gateway by using one of the ATmega4809 UARTs. For further information on how to use the Virtual COM port, see 3.1 Embedded Debugger.

Table 4-11. Virtual COM Port Connections

ATmega4809 Pin	Function	Shared Functionality
PC0	USART1 TxD (ATmega4809 TX line)	EXT2
PC1	USART1 RxD (ATmega4809 RX line)	EXT2

4.4.3 Data Gateway Interface

The Embedded Debugger features a Data Gateway Interface (DGI) by using either an SPI or I^2C. The DGI can be used to send a variety of data from the ATmega4809 to the host PC. For further information on how to use the DGI interface, see Data Visualizer and the EDBG User Guide.

Table 4-12. DGI Interface Connections when using SPI

ATmega4809 Pin	Function	Shared Functionality
PF3	GPIO SPI SS (Slave select) (ATmega4809 is Master)	-
PA4	SPI0 MOSI (Master Out, Slave In)	EXT1, EXT2, EXT3, mikroBUS™
PA5	SPI0 MISO (Master In, Slave Out)	EXT1, EXT2, EXT3, mikroBUS™
PA6	SPI0 SCK (Clock Out)	EXT1, EXT2, EXT3, mikroBUS™

Table 4-13. DGI Interface Connections when using I^2C

ATmega4809 Pin	Function	Shared Functionality
PC2	*TWI0 SDA*	EXT1, EXT2, EXT3, mikroBUS™, CryptoAuthentication™ footprint
PC3	*TWI0 SCL*	EXT1, EXT2, EXT3, mikroBUS™, CryptoAuthentication™ footprint

Four GPIO lines are connected to the Embedded Debugger. The EDBG can monitor these lines and time stamp pin value changes, which make it possible to accurately time-stamp events in the ATmega4809 application code. For further information on how to configure and use the GPIO monitoring features, see Data Visualizer and the EDBG User Guide.

Table 4-14. GPIO Lines Connected to the EDBG

ATmega4809 Pin	Function	Shared Functionality
PB2	GPIO0	EXT2, SW0
PB3	GPIO1	EXT2
PB4	GPIO2	EXT2
PB5	GPIO3	EXT2, LED0

4.5 Kit Modifications

ATmega4809 Xplained Pro has several components that can be used to disconnect I/O pins of the ATmega4809 from connectors and on-board ICs, and to disconnect power signals.

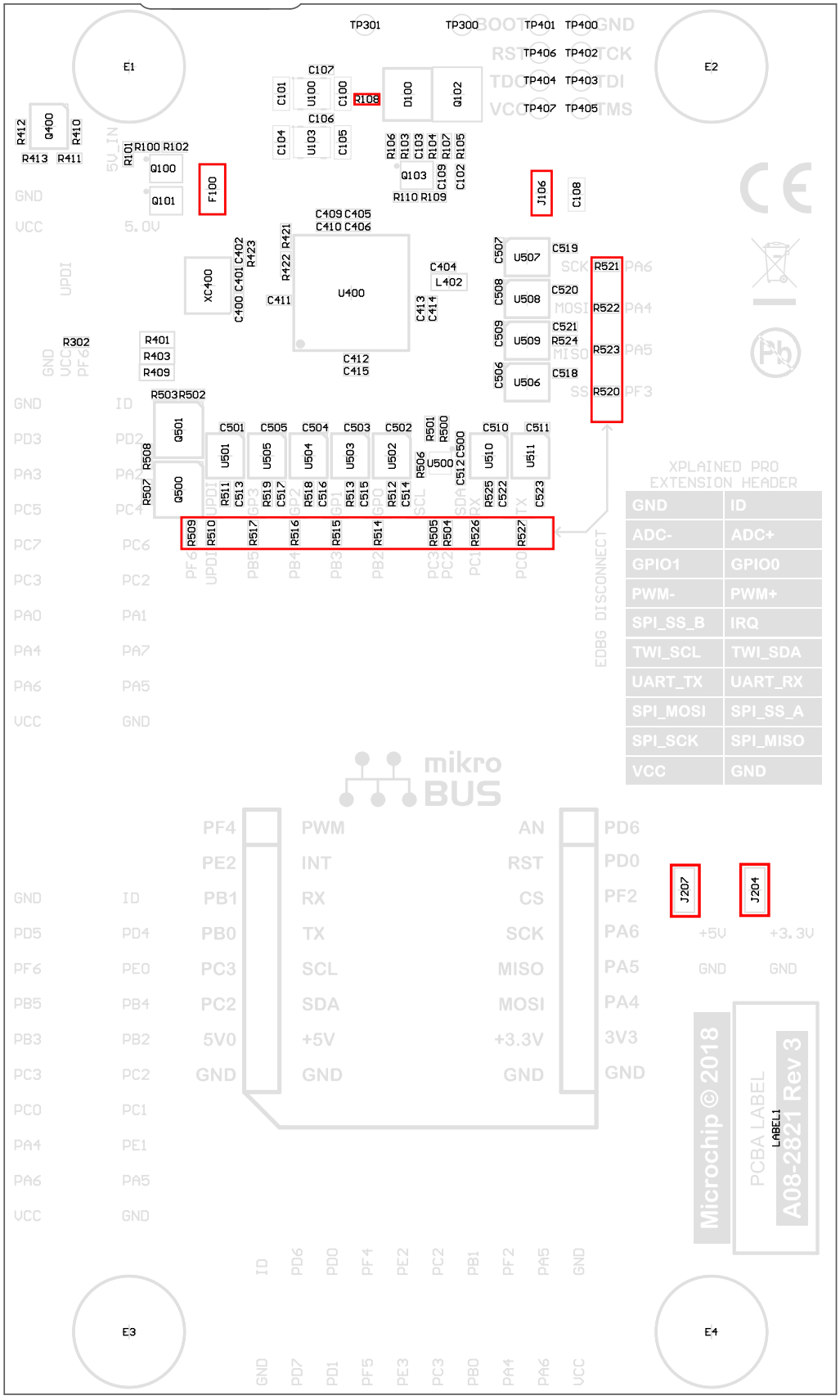
The table and figure below show components to modify connections to the EDBG and power supplies.

Table 4-15. Resistors

Designator	Value	From	To	Comment
J106	Cut-strap	J100 pin 4	VCC_TARGET	Power header VCC target disconnect
J204	Cut-strap	Power supply	mikroBUS™ 5V0	Cut to remove power from the mikroBUS™ header

Designator	Value	From	To	Comment
J207	Cut-strap	Power supply	mikroBUS™ 3V3	Cut to remove power from the mikroBUS™ header
F100	PTC fuse	5V input (USB and External)	VCC_P5V0	All external 5V power, EDBG USB and external 5V on J100 pin 1
R108	0Ω	U100 OUT	VCC_EDBG_P3V3	EDBG power supply
R504	0Ω	EDBG DGI I^2C SDA	PC2 *TWI0 SDA*	EDBG DGI I^2C interface
R505	0Ω	EDBG DGI I^2C SCL	PC3 *TWI0 SCL*	
R509	0Ω	EDBG TARGET RESET	PF6	ATmega4809 RESET
R510	0Ω	EDBG UPDI	UPDI	UPDI Programming/Debugging signal
R514	330Ω	EDBG DGI GPIO0	PB2	EDBG DGI GPIO interface
R515	330Ω	EDBG DGI GPIO1	PB3	
R516	330Ω	EDBG DGI GPIO2	PB4	
R517	330Ω	EDBG DGI GPIO3	PB5	
R520	0Ω	EDBG DGI SPI SS	PF3 GPIO	EDBG DGI SPI interface
R521	0Ω	EDBG DGI SPI SCK	PA6 SPI0 SCK	
R522	0Ω	EDBG DGI SPI MOSI	PA4 SPI0 MOSI	
R523	330Ω	EDBG DGI SPI MISO	PA5 SPI0 MISO	
R526	330Ω	EDBG CDC UART TX	PC1 USART1 RxD	EDBG CDC interface
R527	0Ω	EDBG CDC UART RX	PC0 USART1 TxD	

Figure 4-3. Assembly Drawing Bottom



4.5.1 Operation at Other Voltages

The ATmega4809 Xplained Pro board is operated at 3.3V or 5.0V by default but it also has the possibility of running at other voltages from an external supply.

All signals between the EDBG and the ATmega4809 are level-shifted through level shifters compatible with supply voltages from 1.65V to 5.5V.

To supply an external voltage:

1. Remove the voltage selection jumper from the power select header *J105*.
2. Check that your external voltage is within the specification of on-board and connected peripherals.
3. Supply the external voltage to the center pin (pin 2) of *J105* (do not forget ground).
4. Plug in the EDBG USB cable.

Info: The ATmega4809 can be powered from 1.8V to 5.5V, remember to check the voltage range of any parts soldered on the CryptoAuthentication footprint.

Info: The EDBG checks the voltage at *J105* pin 2 when USB power is applied. If the voltage is between 1.6V to 5.5V, and not higher than the maximum supported voltage of any connected Xplained Pro extension power is applied to the ATmega4809, Xplained Pro extension headers, and the CryptoAuthentication footprint. To bypass this voltage check connect the external voltage to *J100* pin 4, instead of *J105* pin 2.

⚠ CAUTION Applying power directly to *J100* pin 4, which is outside the limits of the board may cause permanent damage.

⚠ CAUTION 3.3V and 5.0V is connected directly to the mikroBUS socket on the board. These voltages will not follow the externally supplied voltage.

Related Links

4. Hardware User Guide

5. Appendix

5.1 Getting Started with IAR

IAR Embedded Workbench® for AVR® is a proprietary high-efficiency compiler which is not based on GCC. Programming and debugging of Xplained Pro kits are supported in IAR™ Embedded Workbench for AVR using the Atmel-ICE interface. Some initial settings must be set up in the project to get the programming and debugging to work.

The following steps will explain how to get your project ready for programming and debugging:

1. Make sure you have opened the project you want to configure. Open the **OPTIONS** dialog for the project.
2. In the category **General Options**, select the **Target** tab. Select the device for the project, or, if not listed, the core of the device.
3. In the category **Debugger**, select the **Setup** tab. Select **Atmel-ICE** as the driver.
4. In the category **Debugger** > **Atmel-ICE**, select the **Atmel-ICE 1** tab. Select **UPDI** as the interface and optionally select the **UPDI** frequency.

Info: If the selection of Debug Port, mentioned in step 4, is grayed out, the interface is preselected, and the user can skip this configuration step.

Figure 5-1. Select Target Device

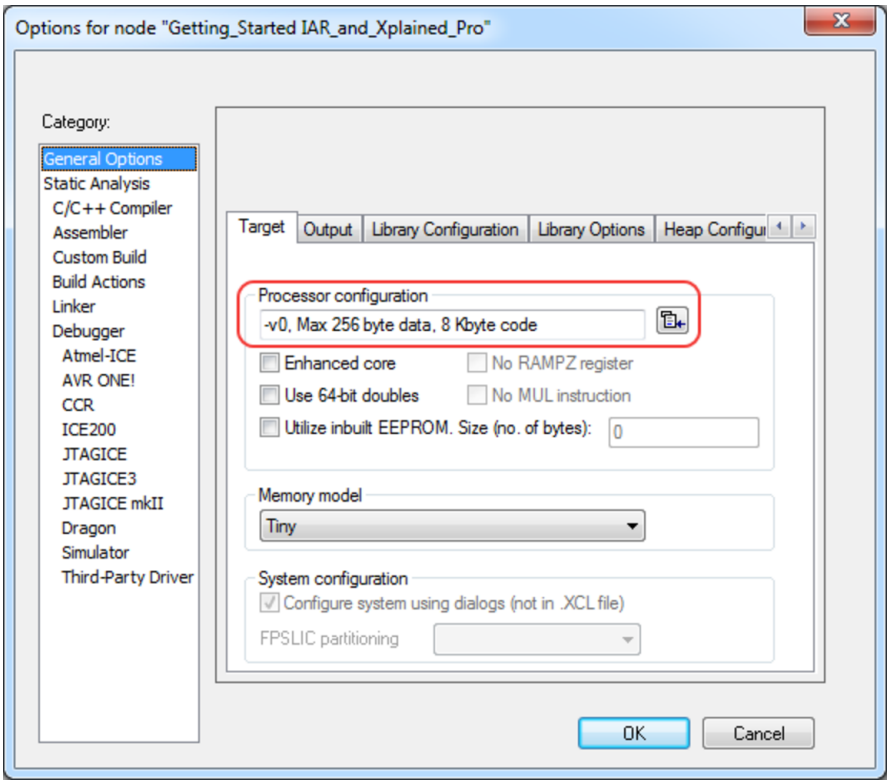


Figure 5-2. Select Debugger

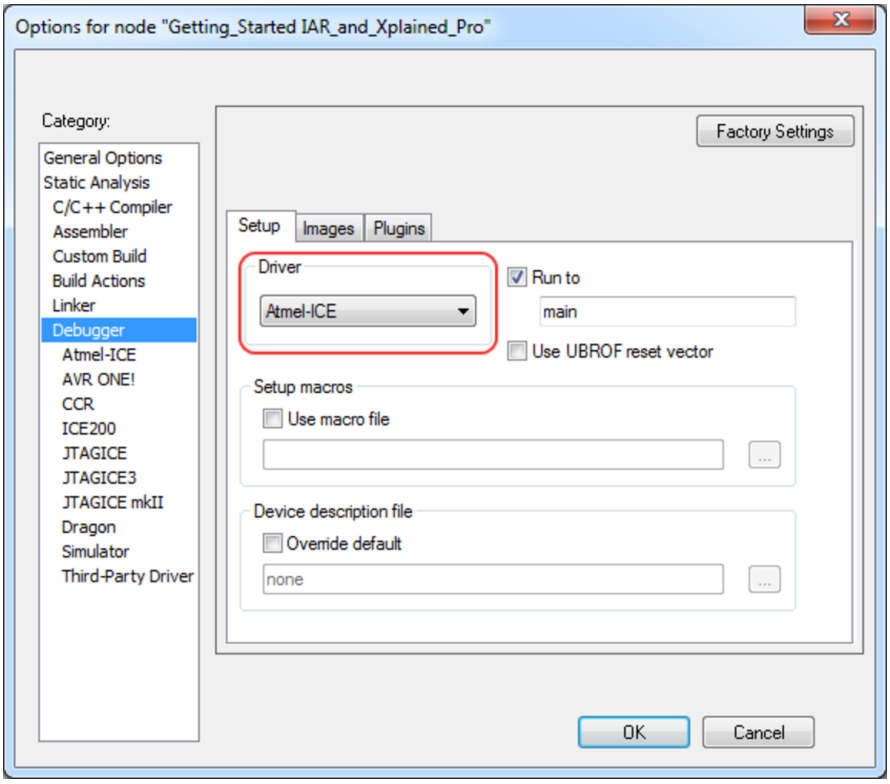
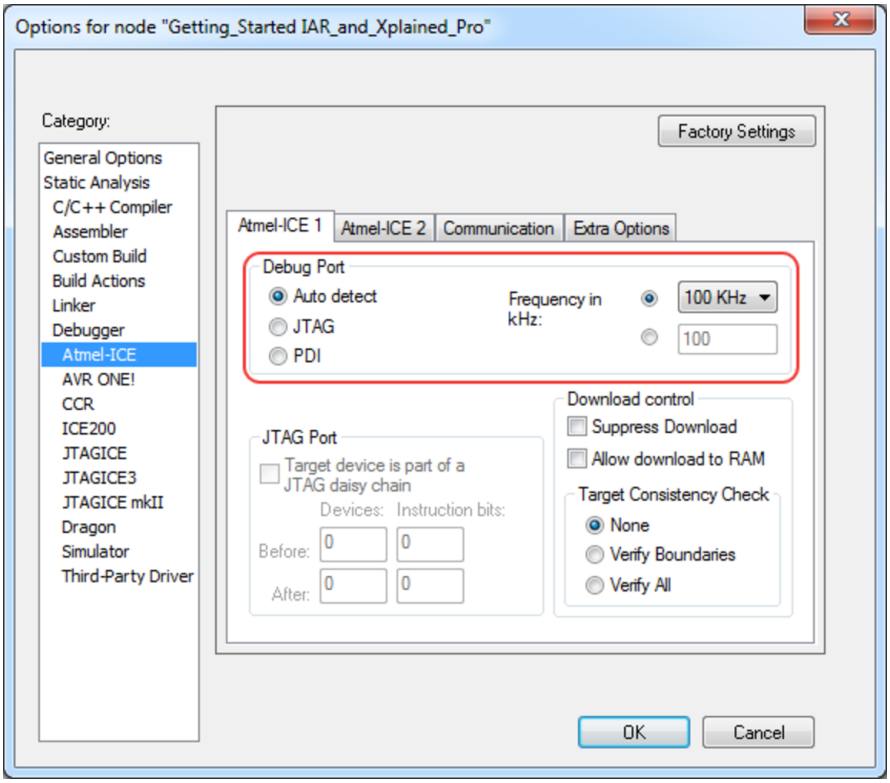


Figure 5-3. Configure Interface



6. Hardware Revision History

This user guide provides the latest available revision of the kit. This chapter contains information about known issues, a revision history of older revisions, and how older revisions differ from the latest revision.

6.1 Identifying Product ID and Revision

There are two ways to find the revision and product identifier of the Xplained Pro boards: either through Atmel Studio or by looking at the sticker on the bottom side of the PCB.

When an Xplained Pro MCU board is connected to a computer with Atmel Studio running, an information window with the serial number is shown. The first six digits of the serial number contain the product identifier and revision. Information about connected Xplained Pro extension boards is also shown in the window.

The same information can be found on the sticker on the bottom side of the PCB. Most kits have stickers that have the identifier and revision printed in plain text as A09-nnnn/rr, where nnnn is the identifier and rr is the revision. Boards with limited space have a sticker with only a data matrix code, which contains a serial number string.

The serial number string has the following format:

"nnnnrrssssssssss"

n = product identifier

r = revision

s = serial number

The product identifier for the ATmega4809 Xplained Pro is A09-3074.

6.2 Revision 6

Target MCU with part number ATMEGA4809-AFR is mounted on revision 6 of ATmega4809 Xplained Pro.

Revision 6 fixes the power ramp up issue where voltage is applied to the mikroBUS socket before target power is present. This issue is present on all earlier revisions of the kit.

Related Links

6.3 mikroBUS Socket and Kit Power Supply

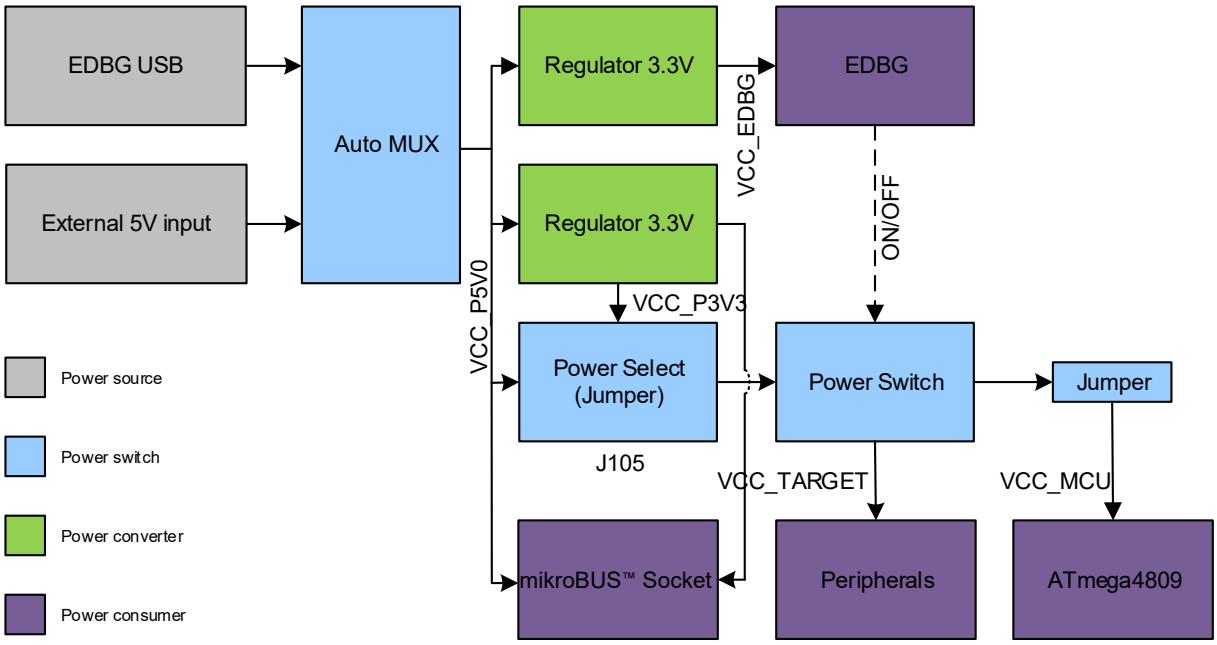
6.3 mikroBUS™ Socket and Kit Power Supply

When the ATmega4809 Xplained Pro board is powered from an off state, the on-board EDBG tries to read ID chips from all the Xplained Pro extension connectors to determine the maximum allowed voltage that can be applied. The EDBG uses this information to decide if it can safely open the power switch shown in the block diagram below.

The mikroBUS connector is powered directly from the 3.3V and 5.0V power rails shown in the block diagram. If a mikroBUS add-on board is connected when the board is powered up, the voltage can leak through the mikroBUS connector to the ATmega4809 through its I/O pins while the power switch is closed.

In a worst-case scenario powering the ATmega4809 through its I/O pins can damage the device and/or cause a power-on-latch-up where the firmware in the ATmega4809 does not start and the only possible recovery method is a power cycle. The failures and severity of this problem are determined by how the mikroBUS add-on board is designed and how the power nets are related to the I/O pins on the board.

Figure 6-1. Power Supply - Kit Revision 5, 4, and 3

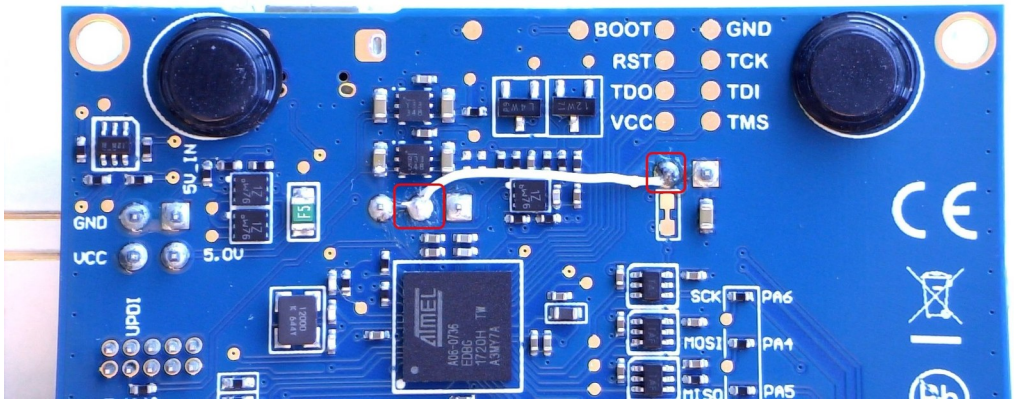


Work Around

Bypassing the power switch shown in the block diagram above will prevent the power up problems. The work around is to short-circuit J105 pin 2 and J103 pin 2, as shown in the image below.

⚠WARNING This work around removes the Xplained Pro extension overvoltage protection feature. Make sure that the electrical specifications of the connected Xplained Pro extensions match the voltage configuration of the ATmega4809 Xplained Pro. E.g., do not connect an Xplained Pro extension that does not support 5V to an ATmega4809 Xplained Pro in a 5V configuration.

Figure 6-2. Power Supply Work Around



Revision 5 of ATmega4809 Xplained Pro already implements this hot-fix.

Affected Kit Revisions
This design flaw affects revision 3, 4, and 5 of ATmega4809 Xplained Pro.

6.4 Revision 5

Engineering samples with part number ATMEGA4809-MFRES are mounted on revision 5 of ATmega4809 Xplained Pro.

Revision 5 does not have the header footprints for external 3.3V and 5.0V supply to the mikroBUS socket.

6.5 Revision 4

Engineering samples with part number ATMEGA4809-MFRES are mounted on revision 4 of ATmega4809 Xplained Pro.

Revision 4 has a new PCB that fixes the SPI MISO/MOSI issue in revision 3.

Revision 4 does not have the header footprints for external 3.3V and 5.0V supply to the mikroBUS socket.

Instead of the crystal documented in 4.3.1 Crystals, the 32.768 kHz crystal on ATmega4809 Xplained Pro revision 4 is a Kyocera Corporation ST3215SB32768E0HPWBB 9 pF crystal. This crystal configuration is not optimally matched and has a capacitance mismatch that causes the oscillation frequency to be off by ~30 ppm.

This revision of the kit has an ATECC508A mounted on the CryptoAuthentication footprint.

Related Links
4.3.1 Crystals
4.3.4 Footprint for CryptoAuthentication Devices

6.6 Revision 3

Revision 3 is the initially released revision.

Engineering samples with part number ATMEGA4809-MFRES are mounted on revision 3 of ATmega4809 Xplained Pro.

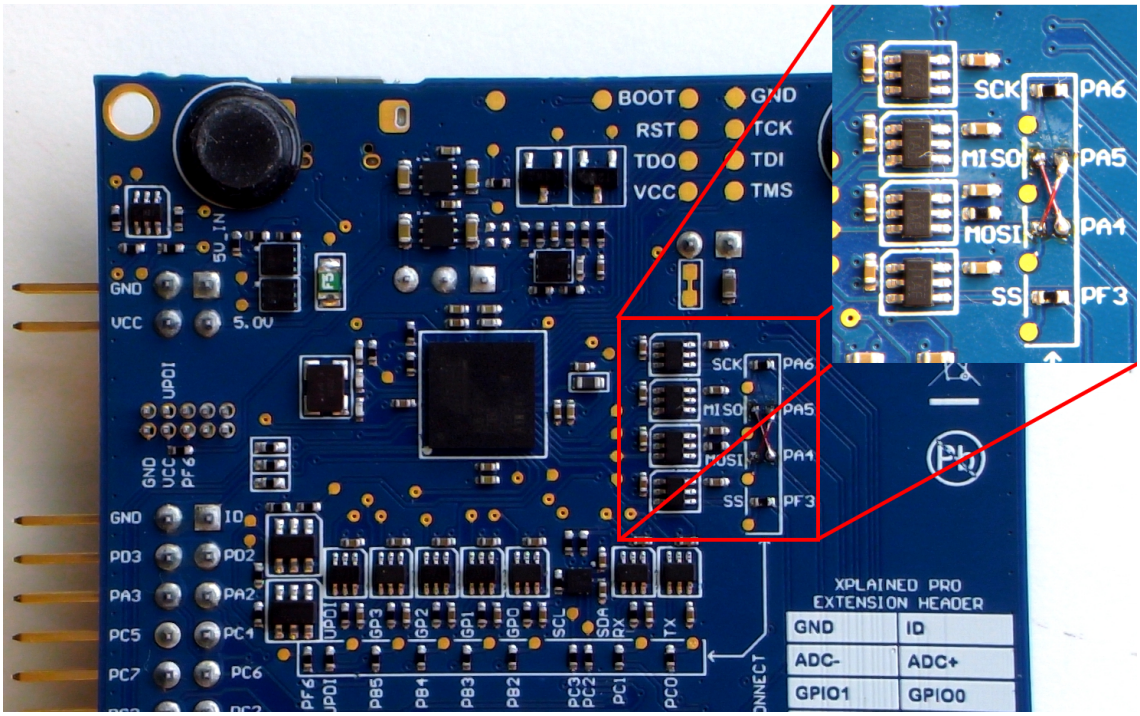
Pin 10 on the AVR UPDI debug connector (*J202*) is not connected to GND on revision 3 of ATmega4809 Xplained Pro.

Revision 3 does not have the header footprints for external 3.3V and 5.0V supply to the mikroBUS socket.

Instead of the crystal documented in 4.3.1 Crystals, the 32.768 kHz crystal on ATmega4809 Xplained Pro revision 4 is a Kyocera Corporation ST3215SB32768E0HPWBB 9 pF crystal. This crystal configuration is not optimally matched and has a capacitance mismatch that causes the oscillation frequency to be off by ~30 ppm.

This revision of the kit has an ATECC508A mounted on the CryptoAuthentication footprint.

The SPI MISO and SPI MOSI signals between the EDBG and the ATmega4809 are crossed in this version of the kit. The image shows the implemented fly-wire fix.



Related Links

4.2.3 AVR Debugger Connector

Table 4-12

4.3.1 Crystals

7. Document Revision History

Doc. Rev.	Date	Comment
B	06/2018	Updated for kit revision 6.
A	02/2018	Initial document release.

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