AVR 8-bit Microcontrollers

# ATtiny817 Xplained Pro

**USER GUIDE**

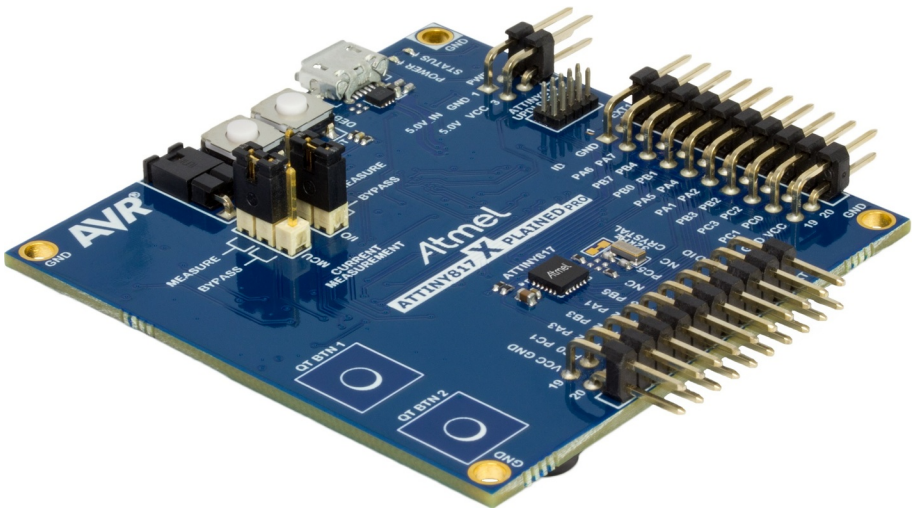
## Preface

The Atmel® ATtiny817 Xplained Pro evaluation kit is a hardware platform to evaluate the ATtiny817 microcontroller.

Supported by the Atmel Studio integrated development platform, the kit provides easy access to the features of the Atmel ATtiny817 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 ATtiny817.

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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  - One yellow status LED
  - One green board power LED
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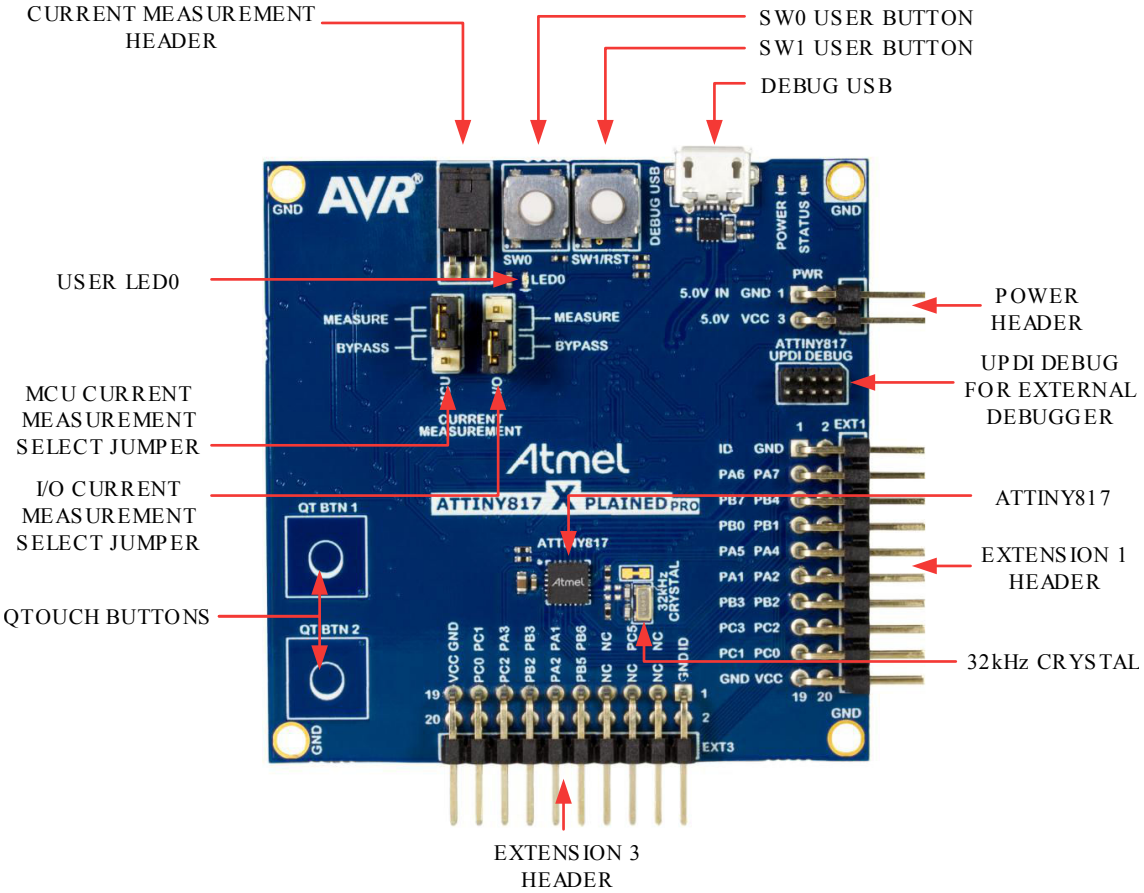
  - Programming and debugging, including power measurements
  - Data Gateway Interface: SPI, $I^2C$, two GPIOs
  - Virtual COM Port (CDC)
- Embedded current measurement circuitry, with Atmel Data Visualizer support for data visualization
- USB powered
- Supported with application examples in Atmel Start

## 1.2. Kit Overview

The Atmel ATtiny817 Xplained Pro evaluation kit is a hardware platform to evaluate the Atmel ATtiny817.

The kit offers a set of features that enables the ATtiny817 user to get started with the ATtiny817 peripherals right away and to get an understanding of how to integrate the device in their own design.

**Figure 1-1. ATtiny817 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 the DEBUG USB port on the kit to the PC 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 will install the software driver. The driver file supports both 32- 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 green power LED will glow and Atmel Studio will auto-detect the specific Xplained Pro MCU- and extension board(s) that are connected. Atmel Studio will present relevant information such as datasheets and kit documentation. The kit landing page in Atmel Studio also has an option to launch the Atmel Software Framework (ASF) example applications for the kit. The ATtiny817 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 ATtiny817 Xplained Pro.

- **Xplained products** - Atmel Xplained evaluation kits are a series of easy-to-use evaluation kits for Atmel microcontrollers and other Atmel products. For low pin-count devices the Xplained Nano series provides a minimalistic solution with access to all I/O pins of the target microcontroller. Xplained Mini kits are for medium pin-count devices and adds Arduino UNO compatible header footprint and a prototyping area. Xplained Pro kits are for medium to high pin-count devices, they features advanced debugging and standardized extensions for peripheral functions. All these kits have on board programmers/debuggers which creates a set of low-cost boards for evaluation and demonstration of features and capabilities of different Atmel products.
- **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 Atmel 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 4KB code size limited kick-start version available from their website.
- **Atmel QTouch® Library PTC** - QTouch Library for Atmel AVR® and ARM®-based microcontrollers.
- **Atmel QTouch® Composer** - Tool for developing capacitive buttons, sliders, and wheels applications.
- **Atmel QTouch® Design Guide** - PTC Robustness design guide document for touch sensor development.

- **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.
- **Design Documentation** - Package containing CAD source, schematics, BOM, assembly drawings, 3D plots, layer plots, etc.
- **Hardware Users Guide in PDF format** - PDF version of this User Guide.

# 3. 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.

## 3.1. Embedded Debugger

The ATtiny817 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 ATtiny817. On ATtiny817 Xplained Pro, the UPDI interface is connected between the EDBG and the ATtiny817.

The Virtual COM Port is connected to a UART on the ATtiny817 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 ATtiny817 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 ATtiny817. 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 ATtiny817 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 ATtiny817 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**

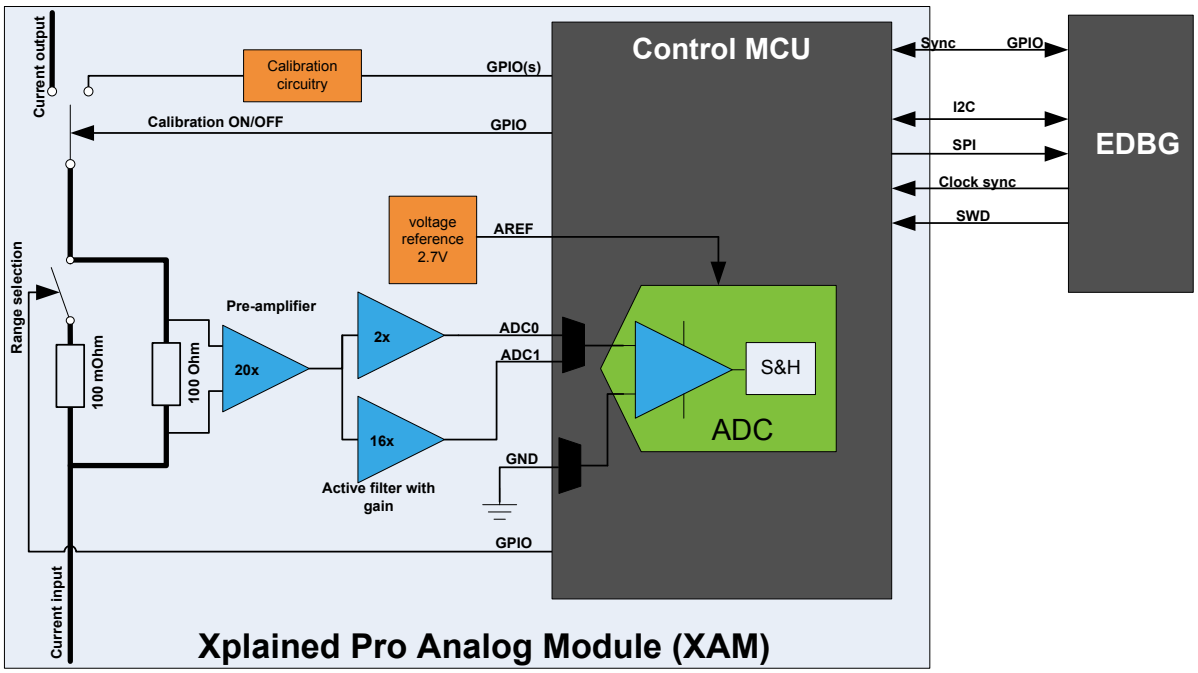
| Operation Mode | Power LED | Status LED |
|---|---|---|
| Normal operation | Power LED is lit when power is applied to the board. | Activity indicator, LED flashes when any communication happens to the EDBG. |
| Bootloader mode (idle) | The power LED and the status LED blinks simultaneously. | |
|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

## 3.2. Xplained Pro Analog Module (XAM)

### 3.2.1. 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.

### 3.2.2. EDBG Interface

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

- **I²C**: 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.
- **Clock sync**: Synchronization signal to synchronize ADC measurements with EDBG.
- **Reference clock**: Reference clock for the XAM.

### 3.2.3. 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).

### 3.2.4. 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.

## 3.3. 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' |

| Data Field | Data Type | Example Content |
|---|---|---|
| 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 |

## 3.4. Power Sources

The ATtiny817 Xplained Pro kit can be powered by several power sources as listed in the table below.

**Table 3-3. Power Sources for ATtiny817 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.

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

## 3.5. Xplained Pro Headers and Connectors

### 3.5.1. 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 | $I^2C$_SDA | Data line for $I^2C$ interface. Always implemented, bus type. |
| 12 | $I^2C$_SCL | Clock line for $I^2C$ 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 |

### 3.5.2. Xplained Pro Power Header

The power header can be used to connect external power to the ATtiny817 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**

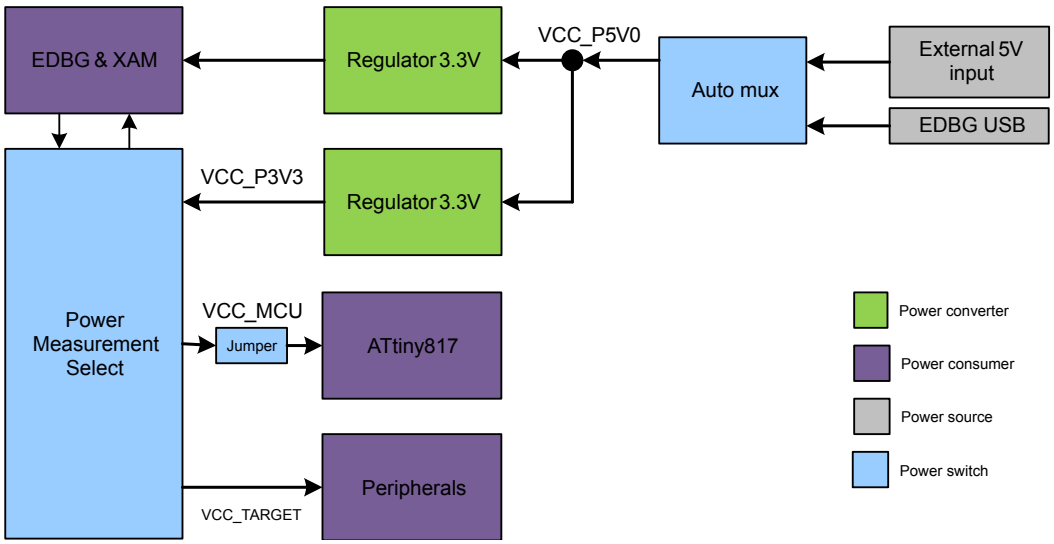
| Pin Number | Pin Name | Description |
|---|---|---|
| 1 | VEXT_P5V0 | External 5V input |
| 2 | GND | Ground |
| 3 | VCC_P5V0 | Unregulated 5V (output, derived from one of the input sources) |
| 4 | VCC_P3V3 | Regulated 3.3V (output, used as main power supply for the kit) |

# 4. Hardware User Guide

## 4.1. Power Distribution

ATtiny817 Xplained Pro has two power sources; EDBG USB and external 5.0V. The kit will automatically select the source to draw power from. The kit has two on-board 3.3V voltage regulators, one for the EDBG and XAM, and one for the ATtiny817 and other peripherals.

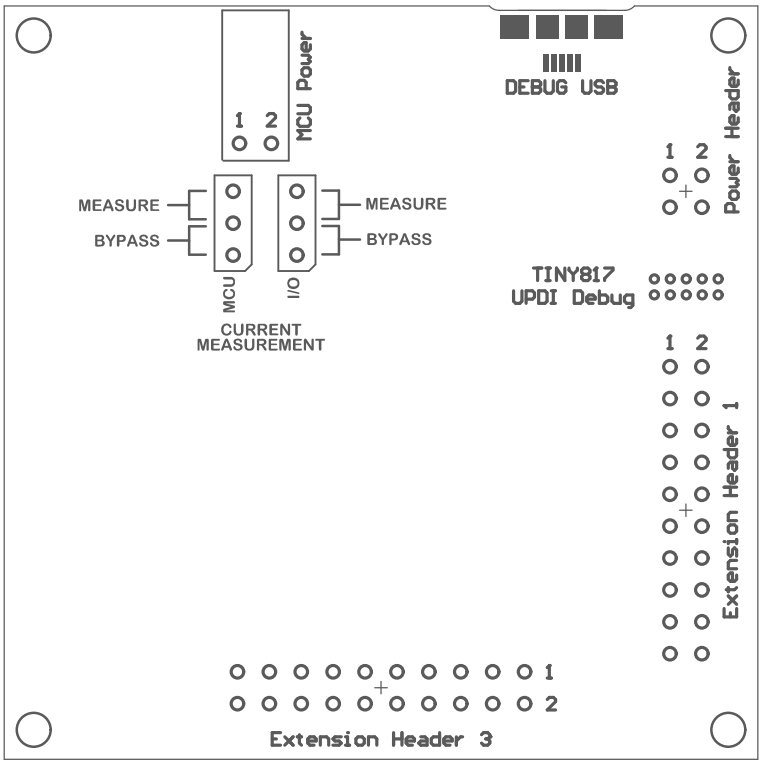
**Figure 4-1. Power Supply Block Diagram**




## 4.2. Connectors

The following sections describes the implementation of the relevant connectors and headers on ATtiny817 Xplained Pro and their connection to the ATtiny817. The tables of connections in the sections also describes which signals are shared between the headers and on-board functionality. The figure below shows all available connectors and jumpers on ATtiny817 Xplained Pro.

**Figure 4-2. ATtiny817 Xplained Pro Connector Overview**




### 4.2.1. Xplained Pro Standard Extension Headers

The ATtiny817 Xplained Pro headers EXT1 and EXT3 offer 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 the table below. The headers have a pitch of 2.54mm.

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

| EXT1 pin | ATtiny817 pin | Function | Shared functionality |
|---|---|---|---|
| 1 [ID] | - | - | Communication line to the ID chip on an extension board |
| 2 [GND] | - | - | Ground |
| 3 [ADC(+)] | PA6 | AIN6 | QTouch Button 1 |
| 4 [ADC(-)] | PA7 | AIN7 | QTouch Button 2 |
| 5 [GPIO1] | PB7 | GPIO | - |
| 6 [GPIO2] | PB4 | GPIO | LED0 |
| 7 [PWM(+)] | PB0 | TC/W0 | - |
| 8 [PWM(-)] | PB1 | TC/W1 | - |
| 9 [IRQ/GPIO] | PA5 | IRQ/GPIO | - |
| 10 [SPI_SS_B/GPIO] | PA4 | GPIO | - |
| 11 [I²C_SDA] | PA1 | *I²C SDA* | EXT3 and EDBG I²C |

| EXT1 pin | ATtiny817 pin | Function | Shared functionality |
|---|---|---|---|
| 12 [I²C_SCL] | PA2 | *I²C SCL* | EXT3 and EDBG I²C |
| 13 [USART_RX] | PB3 | UART RX | EXT3, EDBG CDC, and Crystal (1) |
| 14 [USART_TX] | PB2 | UART TX | EXT3, EDBG CDC, and Crystal (1) |
| 15 [SPI_SS_A] | PC3 | *SPI SS* | - |
| 16 [SPI_MOSI] | PC2 | *SPI MOSI* | EXT3 and EDBG SPI |
| 17 [SPI_MISO] | PC1 | *SPI MISO* | EXT3 and EDBG SPI |
| 18 [SPI_SCK] | PC0 | *SPI SCK* | EXT3 and EDBG SPI |
| 19 [GND] | - | - | Ground |
| 20 [VCC] | - | - | Power for extension board |

1) Not connected by default, see Connecting the 32kHz Crystal for more information.

**Note:** Signal functions in *italic* use alternative pin location. This has to be configured in the PORTMUX register of the device.

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

| EXT3 pin | ATtiny817 pin | Function | Shared functionality |
|---|---|---|---|
| 1 [ID] | - | - | Communication line to the ID chip on an extension board |
| 2 [GND] | - | - | Ground |
| 3 [ADC(+)] | - | - | |
| 4 [ADC(-)] | - | - | |
| 5 [GPIO1] | PC5 | GPIO | SW1 and UPDI debug connector |
| 6 [GPIO2] | - | - | |
| 7 [PWM(+)] | - | - | |
| 8 [PWM(-)] | - | - | |
| 9 [IRQ/GPIO] | PB6 | IRQ/GPIO | EDBG DGI |
| 10 [SPI_SS_B/GPIO] | PB5 | GPIO | SW0 and EDBG DGI |
| 11 [I²C_SDA] | PA1 | *I²C SDA* | EXT1 and EDBG I²C |
| 12 [I²C_SCL] | PA2 | *I²C SCL* | EXT1 and EDBG I²C |
| 13 [USART_RX] | PB3 | UART RX | EXT1, EDBG CDC, and Crystal (1) |
| 14 [USART_TX] | PB2 | UART TX | EXT1, EDBG CDC, and Crystal (1) |

| EXT3 pin | ATtiny817 pin | Function | Shared functionality |
|---|---|---|---|
| 15 [SPI_SS_A] | PA3 | GPIO / SPI_SS | - |
| 16 [SPI_MOSI] | PC2 | *SPI MOSI* | EXT1 and EDBG SPI |
| 17 [SPI_MISO] | PC1 | *SPI MISO* | EXT1 and EDBG SPI |
| 18 [SPI_SCK] | PC0 | *SPI SCK* | EXT1 and EDBG SPI |
| 19 [GND] | - | - | Ground |
| 20 [VCC] | - | - | Power for extension board |

1) Not connected by default, see Connecting the 32kHz Crystal for more information.

**Note:** Signal functions in *italic* use alternative pin location. This has to be configured in the PORTMUX register of the device.

### 4.2.2. UPDI Debug Connector

ATtiny817 Xplained Pro has a 10-pin 50-mil UPDI Debug Connector that can be used to attach external debuggers to the ATtiny817.

**Table 4-3. UPDI Debug Connector**

| UPDI Debug Connector pin | Pin/Net | Function | Shared functionality |
|---|---|---|---|
| 1 | - | - | |
| 2 | GND | Ground | |
| 3 | PA0 | UPDI/RESET | EDBG |
| 4 | VCC_TARGET_P3V3 | ATtiny817 voltage | |
| 5 | - | - | |
| 6 | PC5 | - | SW1 and EXT3 |
| 7 | - | - | |
| 8 | - | - | |
| 9 | - | - | |
| 10 | - | - | |

**Note:**

1. PA0 is configured as UPDI by default. PA0 can be fused to be RESET or GPIO, but this is prevented by the EDBG as this will disable all further programming and debugging by the EDBG.
2. Even though PC5 is connected to the UPDI debug connector this pin is not used for programming or debugging.

## 4.3. Peripherals

### 4.3.1. Mechanical Buttons

ATtiny817 Xplained Pro contains two generic user configurable mechanical buttons. When a button is pressed it will drive the I/O line to GND.

**Info:** There is no pull-up resistor connected to the generic user button SW0. Remember to enable the internal pull-up in the ATtiny817 to use the button. There is an on-board pull-up resistor connected to the generic user button SW1. There is no need to enable the internal pull-up in the ATtiny817 to use the button.

**Table 4-4. Mechanical Buttons**

| ATtiny817 pin | Silkscreen text | Shared functionality |
|---|---|---|
| PB5 | SW0 | EXT3 and EDBG DGI |
| PC5 | SW1 / RST | EXT3 and UPDI debug connector |

**Info:** PC5 is connected to a button that states "SW1 / RST" because PC5 had reset capabilities in an early version of the ATtiny817. Today the ATtiny817 does not have any reset capabilities on PC5.

### 4.3.2. Crystal

The ATtiny817 Xplained Pro kit contains a 32.768kHz crystal that can be used as clock source for the ATtiny817 device. The crystal has a cut-strap next to it 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 can be found in the AVR4100 application note from Atmel.

The 32.768kHz crystal on ATtiny817 Xplained Pro is a Kyocera Crystal Device Corporation ST3215SB32768E0HPWBB. The crystal has been formally tested and matched to the ATtiny817 by Kyocera. The test report is available in the Design Documentation for ATtiny817 Xplained Pro.

**Info:** The crystal is not connected to the device by default as the crystal pins on the device is shared with the UART module. If the crystal is needed by the application, the UART interface is lost. See Kit Modifications for instructions on how to modify the kit for crystal operation.

**Info:** Kyocera Crystal Device Corporation crystals that are matched with Atmel products can be found on their web site: http://prdct-search.kyocera.co.jp/crystal-ic/?p=en_search/

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

| ATtiny817 pin | Function |
|---|---|
| PB2 | XOUT32 |
| PB3 | XIN32 |

**Related Links**

Design Documentation and Relevant Links on page 6

### 4.3.3. LED

There is one yellow LED available on the ATtiny817 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 4-6. LED Connection**

| ATtiny817 pin | Silkscreen text | Shared functionality |
|---|---|---|
| PB4 | LED0 | EXT1 |

### 4.3.4. QTouch Button

There are two self capacitance buttons available on the ATtiny817 Xplained Pro board that can be used as input buttons for an application. These QTouch buttons are intended to be driven by the built-in Peripheral Touch Controller (PTC) of the device.

**Info:** To get started with QTouch, refer to Atmel QTouch® Library and Atmel QTouch® Composer.

**Tip:** The touch buttons on the kit are placed in the inner layers of the PCB, and has a very small overlay. Due to the short distance from the sensor to the touch area, it might be oversensitive. Different overlays can be used to avoid saturation of the sensor.

**Table 4-7. QTouch Connection**

| ATtiny817 pin | Silkscreen text | Shared functionality |
|---|---|---|
| PA7 | QT BTN1 | EXT1 |
| PA6 | QT BTN2 | EXT1 |

## 4.4. Embedded Debugger Implementation

The ATtiny817 Xplained Pro contains an Embedded Debugger (EDBG) that can be used to program and debug the ATtiny817 using Unified Program Debug Interface (UPDI). The Embedded Debugger also include a Virtual COM Port interface over UART, an Atmel Data Gateway Interface over SPI, $I^2C$, and two ATtiny817 GPIOs. The kit also includes an 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.

### 4.4.1. Unified Program Debug Interface

The Unified Program Debug Interface (UPDI) use one pin to communicate with the target. For further information on how to use the programming and debugging capabilities of the EDBG, see section Embedded Debugger.

**Table 4-8. UPDI Connections**

| ATtiny817 pin | Function | Shared functionality |
|---|---|---|
| PA0 | UPDI interface | UPDI debug connector |

### 4.4.2. Virtual COM Port

The Embedded Debugger acts as a Virtual COM Port gateway by using one of the ATtiny817 UARTs. For further information on how to use the Virtual COM Port, see section Embedded Debugger.

**Table 4-9. Virtual COM Port Connections**

| ATtiny817 pin | Function | Shared functionality |
|---|---|---|
| PB2 | UART TXD (ATtiny817 TX line) | EXT1 and EXT3 |
| PB3 | UART RXD (ATtiny817 RX line) | EXT1 and EXT3 |

### 4.4.3. Atmel Data Gateway Interface

The Embedded Debugger features an Atmel Data Gateway Interface (DGI) by using either an SPI or I²C. The DGI can be used to send a variety of data from the ATtiny817 to the host PC. For further information on how to use the DGI interface, see the Atmel Data Visualizer and the EDBG User Guide.

**Table 4-10. DGI Interface Connections when using SPI**

| ATtiny817 pin | Function | Shared functionality |
|---|---|---|
| PC4 | SPI SS (Slave select) (ATtiny817 is Master) | - |
| PC2 | *SPI MOSI* (Master Out, Slave in) | EXT1 and EXT3 |
| PC1 | *SPI MISO* (Master In, Slave Out) | EXT1 and EXT3 |
| PC0 | *SPI SCK* (Clock Out) | EXT1 and EXT3 |

**Table 4-11. DGI Interface Connections when using I²C**

| ATtiny817 pin | Function | Shared functionality |
|---|---|---|
| PA1 | *$I^2C$ SDA* (Data line) | EXT1 and EXT3 |
| PA2 | *$I^2C$ SCL* (Clock line) | EXT1 and EXT3 |

**Note:** Signal functions in *italic* use alternative pin location. This has to be configured in the PORTMUX register of the device.

Two 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 ATtiny817 application code. For further information on how to configure and use the GPIO monitoring features, see the Atmel Data Visualizer and the EDBG User Guide.

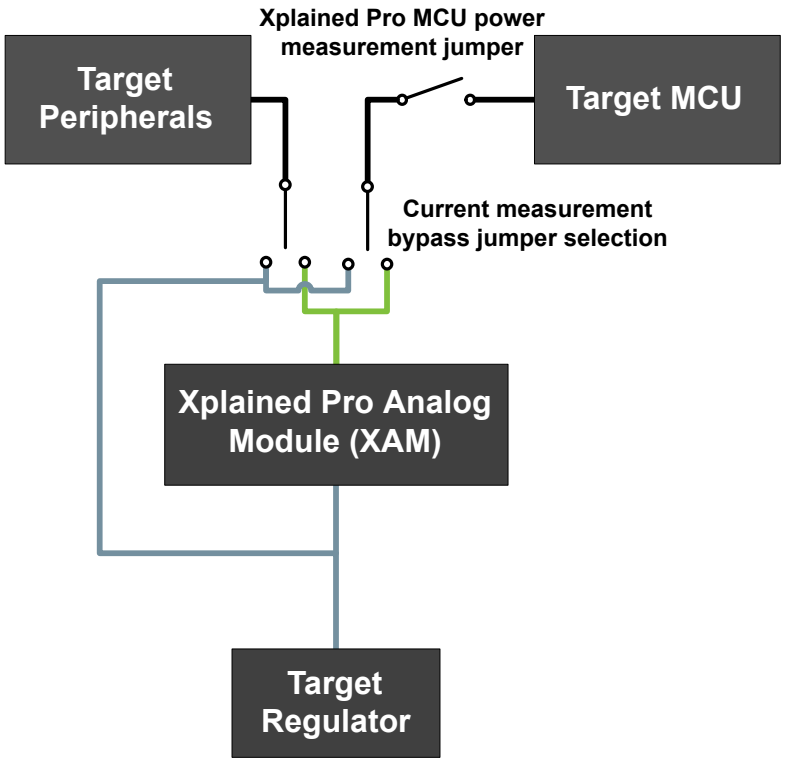
**Table 4-12. GPIO Lines Connected to the EDBG**

| ATtiny817 pin | Function | Shared functionality |
|---|---|---|
| PB5 | GPIO0 | EXT3 and SW0 |
| PB6 | GPIO1 | EXT3 |

### 4.4.4. XAM Configuration

On the ATtiny817 Xplained Pro the MCU and the MCU peripherals (e.g. extensions) are powered by its own regulator as shown in the figure below. All other parts of the board, mainly the embedded debugger and the 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 4-3. ATtiny817 Xplained Pro XAM Implementation Block Diagram**




On the ATtiny817 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 the 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 configuration place the jumper for "I/O" (peripherals) into the "BYPASS" position and the "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 the MCU and the peripherals are measured by the XAM. Place both jumpers on "I/O" and "MCU" headers in the "MEASURE" position.

## 4.5. Kit Modifications

ATtiny817 Xplained Pro has several resistors that can be used to disconnect I/O pins of the ATtiny817 from connectors and on-board ICs and to disconnect power signals.

**Info:** Note that there are some resistors that aren't mounted by default on the kit listed in the table below.

**Table 4-13. Kit Modifications**

| Designator | Value | Mounted | From | To | Comment |
|---|---|---|---|---|---|
| J100 | cut-strap | N/A | VCC_P3V3 | VCC_P3V3_CM_IN | ATtiny817, peripherals, and connectors power supply |
| R107 | 0R | Yes | U100 OUT | VCC_CM_P3V3 | XAM power supply |
| R108 | 0R | Yes | U100 OUT | VCC_EDBG_P3V3 | EDBG power supply |
| R302 | 10k | Yes | QT BTN1 | PA6 AIN6 | Onboard QTouch buttons to the ATtiny817 |
| R305 | 10k | Yes | QT BTN2 | PA7 AIN7 | |
| R307 | 0R | Yes | PB2 UART TXD | PB2 | EDBG CDC and UART on extension headers to the ATtiny817 |
| R308 | 0R | Yes | PB3 UART RXD | PB3 | |
| R309 | 0R | Yes | SW1 | PC5 | Mechanical button SW1 |
| R312 | 0R | **No** | PB2 TOSC2 | PB2 | 32kHz crystal to the ATtiny817 |
| R313 | 0R | **No** | PB3 TOSC1 | PB3 | |
| R404 | 0R | Yes | EDBG UPDI | PA0 UDPI RST | Debug interface from the EDBG to the ATtiny817 |

| Designator | Value | Mounted | From | To | Comment |
|---|---|---|---|---|---|
| R406 | 0R | Yes | EDBG CDC RX | PB2 UART TX | EDBG CDC and DGI interfaces to the ATtiny817 |
| R407 | 0R | Yes | EDBG I²C SDA | PA1 I²C SDA | |
| R408 | 0R | Yes | EDBG I²C SCL | PA2 I²C SCL | |
| R414 | 330R | Yes | EDBG CDC TX | PB3 UART RX | |
| R415 | 0R | Yes | EDBG SPI MOSI | PC2 SPI MOSI | |
| R416 | 330R | Yes | EDBG DGI_GPIO0 | PB5 GPIO | |
| R417 | 330R | Yes | EDBG DGI_GPIO1 | PB6 IRQ GPIO | |
| R420 | 330R | Yes | EDBG SPI MISO | PC1 SPI MISO | |
| R425 | 0R | Yes | EDBG SPI SCK | PC0 SPI SCK | |
| R426 | 0R | Yes | EDBG SS | PC4 SPI SS | |

**Figure 4-4. Assembly Drawing Top**

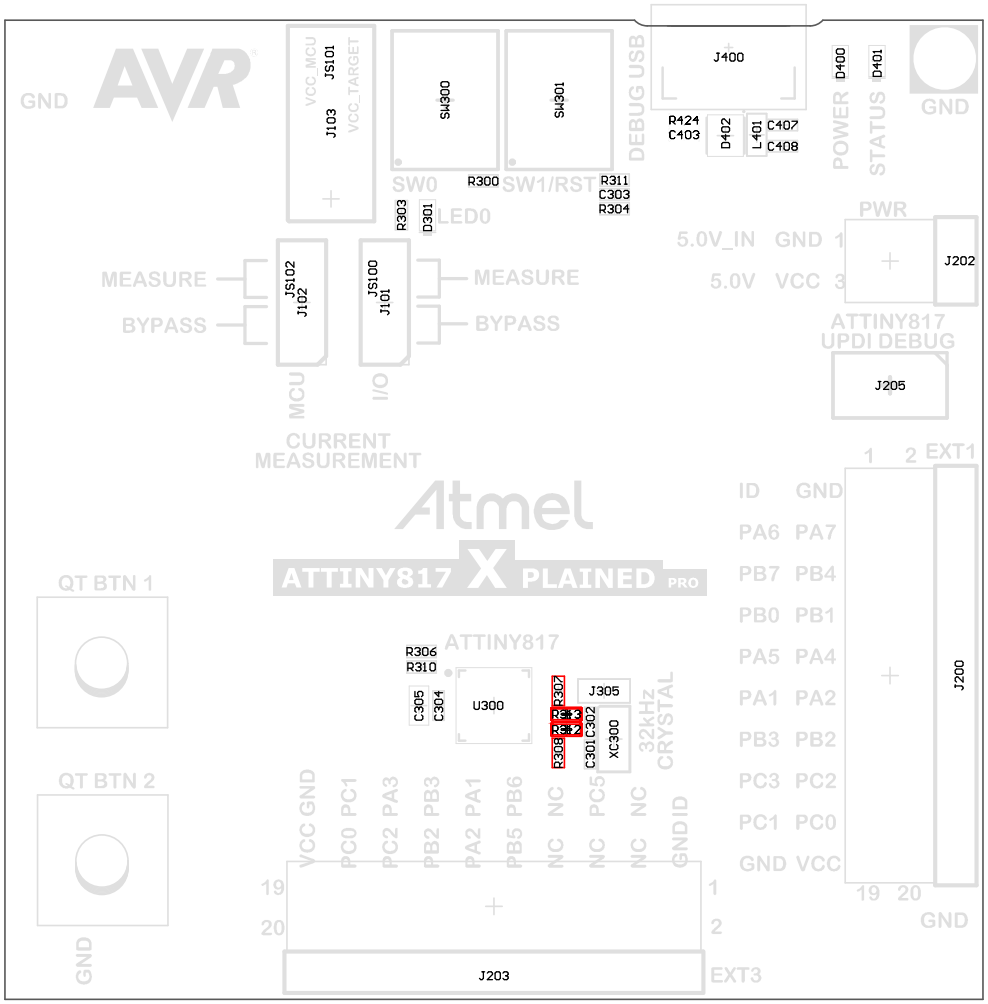
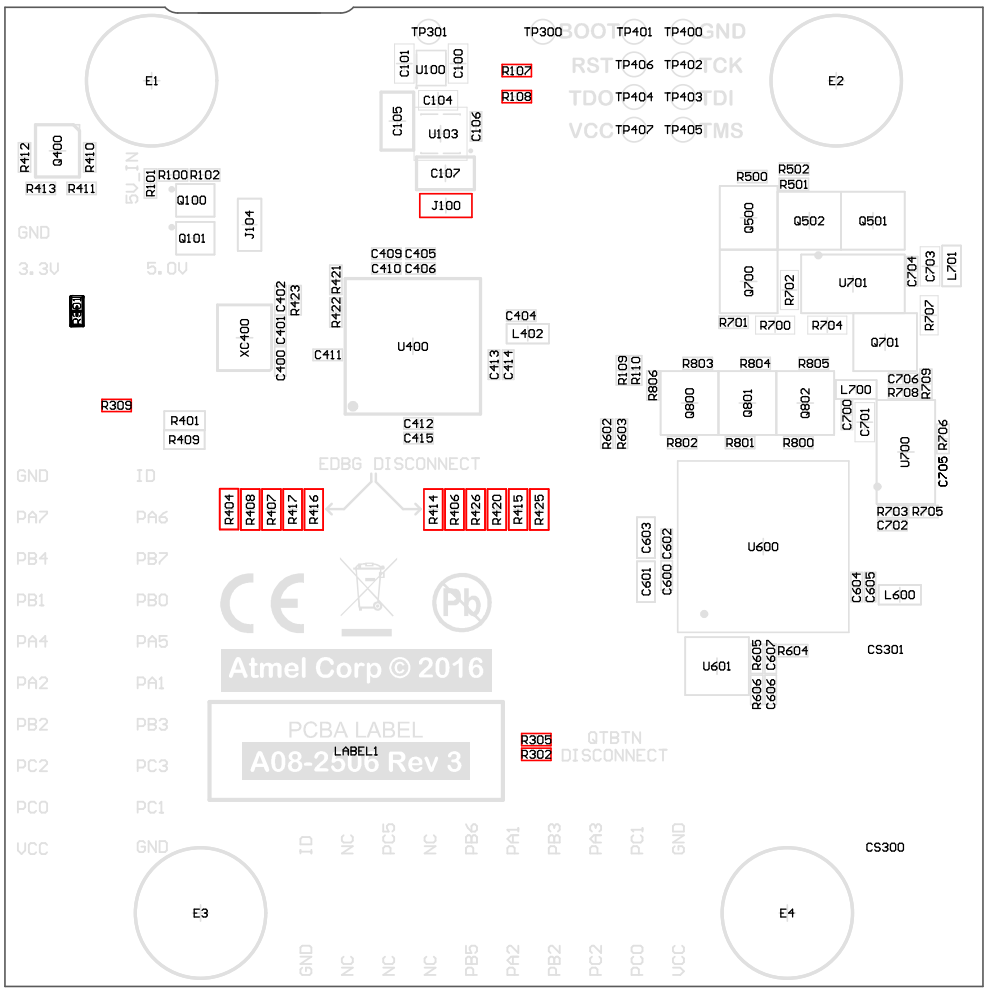


**Figure 4-5. Assembly Drawing Bottom**



### 4.5.1. Connecting the 32kHz Crystal

The ATtiny817 Xplained Pro board has a 32.768Hz crystal mounted on the kit. By default the crystal is not connected, as the TOSC pins on the device is used for UART communication to the extension headers and the EDBG CDC. To use the crystal, this connection has to be broken in order to get a functional crystal operation.

To connect the crystal, remove resistors R307 and R308, and place them on the footprints for R312 and R313. To locate the components, see the assembly drawing in the section above (*Kit Modifications*).

**Info:** Operating the ATtiny817 with the crystal requires physical modifications on the kit using a soldering iron.

### 4.5.2. Operation at Other Voltages

The ATtiny817 Xplained Pro board is operated at 3.3V by default, but it also has the possibility of running at other voltages from an external supply. The EDBG is designed to run from a 3.3V supply and won't work on other voltages, therefore all connections from the EDBG and the on-board 3.3V regulator to the ATtiny817 should be removed.

To completely disconnect the EDBG and the on-board power supply from the ATtiny817, do the following:

- Remove the two jumpers from the on-board 3-pin current measurement headers (J101 and J102), and connect the two center pins (pin 2) together with a wire or an ammeter, as shown in Figure 4-7
- Remove R404, R406, R407, R408, R414, R415, R416, R417, R420, R425, R426
- Optionally, cut J100 to remove power to the on-board current measurement headers (J101 and J102) from the on-board regulator

Figure 4-6 shows all components that have to be removed from the bottom side of the PCB for operation at other voltages. To locate the other components, see the assembly drawing in the section above. When the components are removed, the kit can be supplied with a desired voltage through the pins marked 3.3V (pin four) and GND (pin two) on the Xplained Pro power header. To program and debug the ATtiny817 the 2x5 50mil UPDI debug connector has to be used with an external debugger.

**Info:** Operating the ATtiny817 on other voltages than 3.3V requires physical modifications on the kit using a soldering iron and an external debugger for programming the ATtiny817. The on-board current measurement only works at 3.3V. The on-board LED is selected for 3.3V operation. The light level at 1.8V operation is very low. To increase the emitted light level the value of the series resistor can be lowered. The EDBG functionality can be restored by re-soldering the removed components. If J100 was cut a 0Ω resistor can be soldered across the cut.

**Caution:** The voltage supplied through the power header is applied directly to the ATtiny817 and the extension headers. Applying a voltage higher than 5.5V may damage the board permanently.

**Figure 4-6. ATtiny817 Xplained Pro EDBG Disconnect**

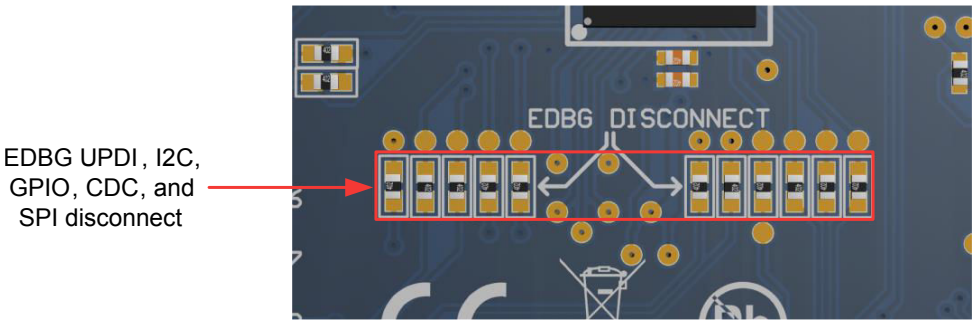
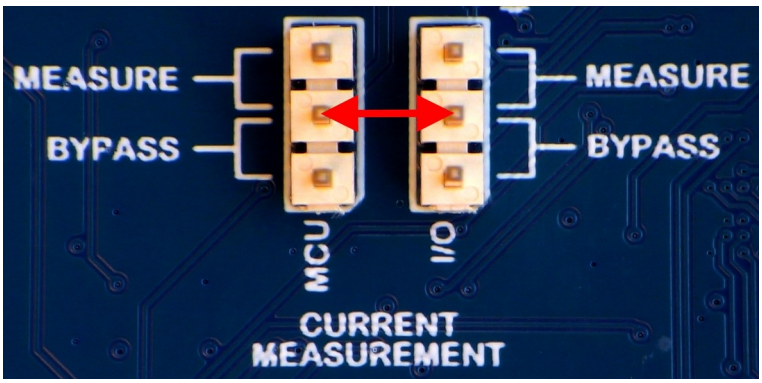



**Figure 4-7. ATtiny817 Xplained Pro Current Measurement Headers**




**Related Links**

Xplained Pro Power Header on page 12
UPDI Debug Connector on page 17
Connectors on page 14

# 5. Appendix

## 5.1. Getting Started with IAR

IAR Embedded Workbench® for AVR® is a proprietary high efficiency compiler 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 have to 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.

**Figure 5-1. Select Target Device**

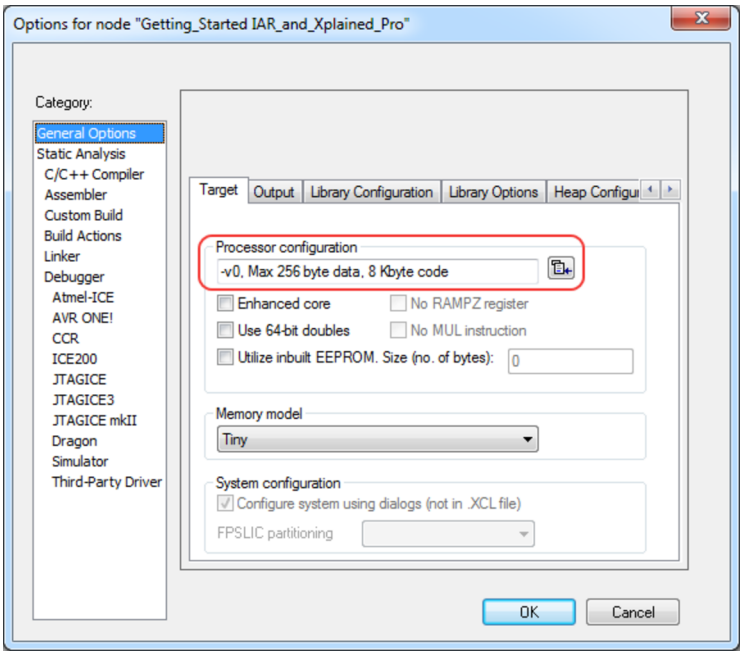


**Figure 5-2. Select Debugger**

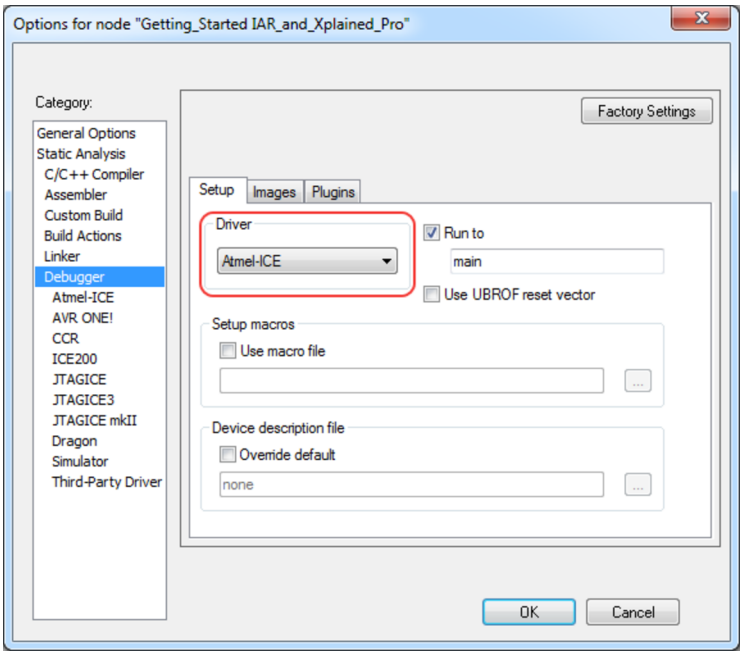
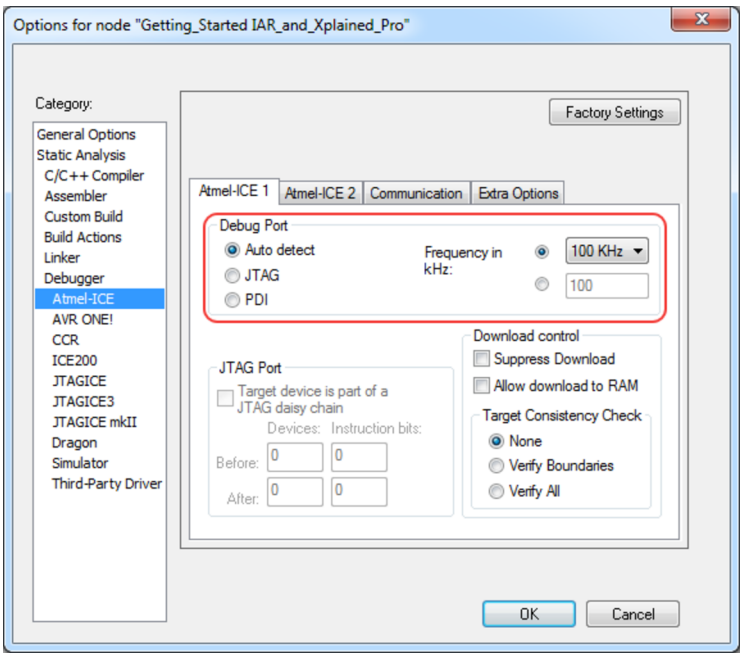



**Figure 5-3. Configure Interface**



# 6. Hardware Revision History and Known Issues

This user guide is written to reflect 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

The revision and product identifier of Xplained Pro boards can be found in two ways; either through Atmel Studio or by looking at the sticker on the bottom side of the PCB.

By connecting an Xplained Pro MCU board to a computer with Atmel Studio running, an information window will pop up. The first six digits of the serial number, which is listed under kit details, contain the product identifier and revision. Information about connected Xplained Pro extension boards will also appear in the Atmel Kit's window.

The same information can be found on the sticker on the bottom side of the PCB. Most kits will print the identifier and revision 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 QR-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 ATtiny817 Xplained Pro is A09-2654.

## 6.2. Revision 4

Revision 4 is the initially released revision.

# 7. Document Revision History

| Doc. rev. | Date | Comment |
|---|---|---|
| 42745A | 11/2016 | Initial document release |

# 8. Evaluation Board/Kit Important Notice

This evaluation board/kit is intended for use for **FURTHER ENGINEERING, DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY.** It is not a finished product and may not (yet) comply with some or any technical or legal requirements that are applicable to finished products, including, without limitation, directives regarding electromagnetic compatibility, recycling (WEEE), FCC, CE or UL (except as may be otherwise noted on the board/kit). Atmel supplied this board/kit "AS IS", without any warranties, with all faults, at the buyer's and further users' sole risk. The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies Atmel from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge and any other technical or legal concerns.

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