# ATtiny3217 Xplained Pro

## ATtiny3217 Xplained Pro

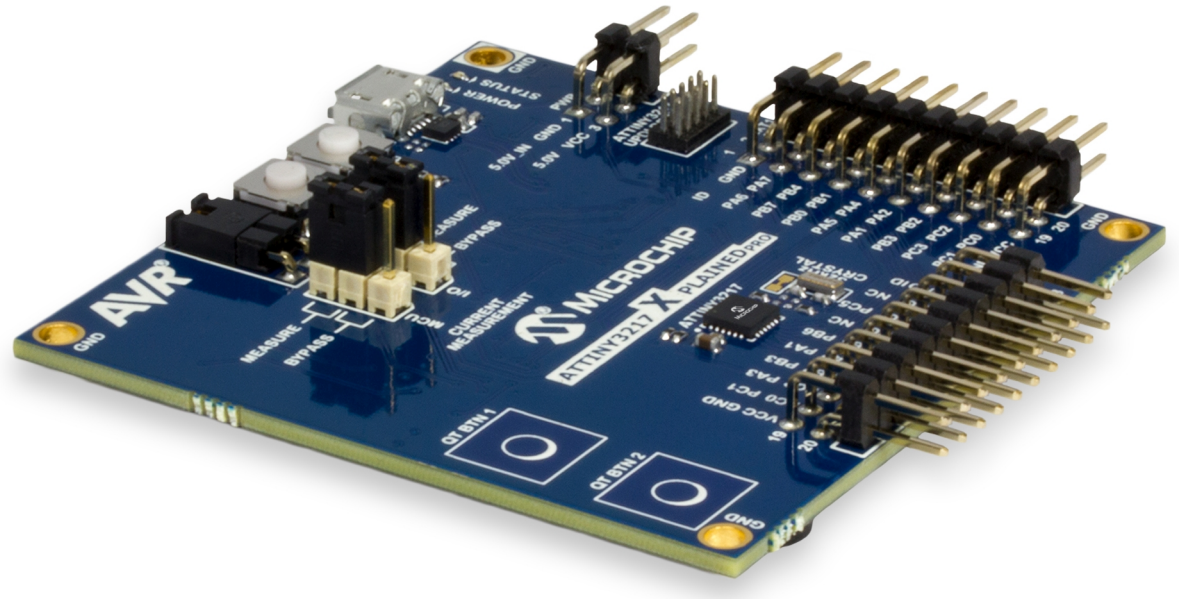
## Preface

The ATtiny3217 Xplained Pro evaluation kit is a hardware platform to evaluate the ATtiny3217 microcontroller.

Supported by the Atmel Studio and MPLAB® X integrated development platform, the kit provides easy access to the features of the ATtiny3217 and explains how to integrate the device into a custom design.

The Xplained Pro MCU series evaluation kits include on-board Embedded Debuggers. No external tools are necessary to program or debug the ATtiny3217.

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

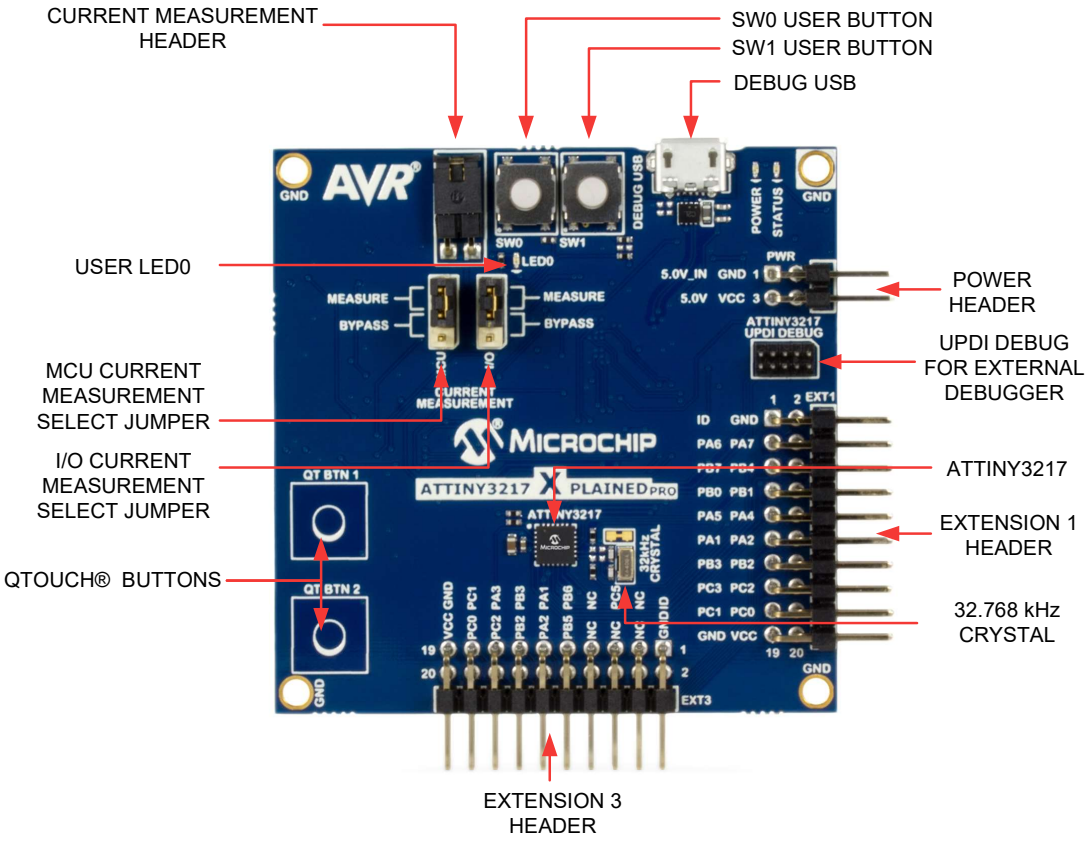
- ATtiny3217 Microcontroller
- Two Mechanical User Buttons
- Two QTouch® Buttons
- One Yellow User LED
- 32.768 kHz Crystal
- Two Xplained Pro Extension Headers
- Embedded Debugger
  - Auto-ID for board identification in Atmel Studio/MPLAB® X
  - One yellow status LED
  - One green board power LED
  - Symbolic debug of complex data types including scope information
  - Programming and debugging, including power measurements
  - Data Gateway Interface: SPI, $I^2C$, two GPIOs
  - Virtual COM Port (CDC)
- Embedded Current Measurement Circuitry (XAM)
  - Measures power consumption of the ATtiny3217 and/or peripherals
  - Measures current between 100 nA and 400 mA
  - Current measurement data are shown in Microchip Data Visualizer
- USB Powered
- Supported With Application Examples In Atmel START

## 1.2 Kit Overview

The ATtiny3217 Xplained Pro evaluation kit is a hardware platform to evaluate the ATtiny3217.

The kit offers a set of features that enables the ATtiny3217 user to get started with the ATtiny3217 peripherals right away and to get an understanding of how to integrate the device into their design.

**Figure 1-1. ATtiny3217 Xplained Pro Evaluation Kit Overview**



# 2. Getting Started

## 2.1 Xplained Pro Quick Start

Steps to start exploring the Xplained Pro platform:

1. Download and install Atmel Studio/MPLAB® X.
2. Launch Atmel Studio/MPLAB® X.
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/MPLAB® X 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 ATtiny3217 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 ATtiny3217 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 feature advanced debugging and standardized extensions for peripheral functions.

  **Note:** All the above kits have on-board programmers/debuggers, which creates 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.
- **MPLAB® X IDE** - MPLAB® X IDE is a software program that runs on a PC (Windows®, Mac OS®, Linux®) to develop applications for Microchip microcontrollers and digital signal controllers. It is called an Integrated Development Environment (IDE) because it provides a single integrated “environment” to develop code for embedded microcontrollers.
- **Atmel 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.
- **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.
- **QTouch® Tools** - A collection of tools to design capacitive touch applications.
- **QTouch® Design Guide** - PTC Robustness design guide document for touch sensor development.
- **Data Visualizer** - Data Visualizer is a program used for processing and visualizing data. The Data Visualizer can receive data from various sources such as serial ports and on-board debugger’s Data Gateway Interface as found on Curiosity Nano and Xplained Pro boards.
- **ATtiny3217 Xplained Pro website** - Kit information, latest user guide and design documentation.
- **ATtiny3217 Xplained Pro on Microchip Direct** - Purchase this kit on Microchip Direct.

# 3. Xplained Pro

Xplained Pro is an evaluation platform containing a series of microcontroller boards (evaluation kits) and extension boards. Atmel Studio/MPLAB® X 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 ATtiny3217 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 ATtiny3217 with the help of Atmel Studio/MPLAB® X. The UPDI interface is connected between the EDBG and the ATtiny3217 on the ATtiny3217 Xplained Pro.

The Virtual COM Port is connected to a UART on the ATtiny3217 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 ATtiny3217 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 ATtiny3217. 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 ATtiny3217. 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 ATtiny3217 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. | |

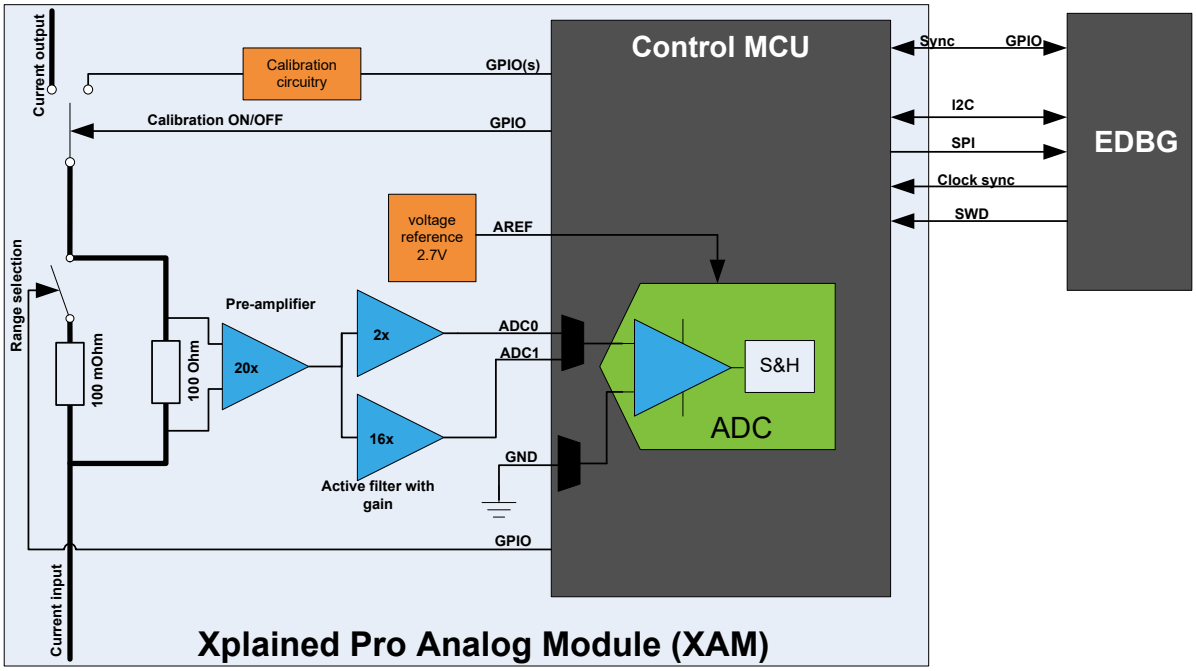
For additional information on the EDBG, see the EDBG User Guide.

## 3.2 Xplained Pro Analog Module (XAM)

### 3.2.1 Overview

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

**Figure 3-1. XAM Block Diagram**




The XAM consists of:

- Calibration Circuitry
- Voltage Reference Circuitry
- Analog Front-End:
  - 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 front-end is a high side shunt measurement with a pre-amplifier and a second active filter stage with gain, as shown in Figure 3-1. The wide dynamic range is achieved by four measurement ranges, which are defined by two shunt resistors and the two parallel second stage active filters with gain.

### 3.2.2 EDBG Interface

The XAM is connected to the EDBG with the following interfaces:

- **I²C**: This is used to control and configure the XAM.
- **SPI**: Current measurement data are streamed to the EDBG via this interface. This is a unidirectional channel from the XAM to the EDBG.
- **SWD**: The MCU in the XAM is programmed via SWD from the EDBG.
- **Clock sync**: Signal used to synchronize ADC measurements with the EDBG.

- **Reference clock**: Reference clock for the XAM.

### 3.2.3 Sample Rate

The raw sampling rate of the XAM is up to 250 kHz, and with the default averaging configuration (average of 16 samples), the actual output of the XAM is 16.67 ksps.

**Info:** The XAM output sample rate is not an integer fraction of the raw sampling.

### 3.2.4 Measurement Ranges and Accuracy

The XAM has four measurement ranges. These are defined by two shunt resistors and two gain stages.

**Table 3-2. XAM Measurement Ranges and Accuracy**

| Measurement Range | Hardware | Resolution | Accuracy | Comments |
|---|---|---|---|---|
| Range 1 | Low current shunt and high gain stage | 20 nA | 1 LSB ±1% | Accuracy will decrease below 1 µA. The typical accuracy for 300 nA is 1 LSB ±10%. |
| Range 2 | Low current shunt and low gain stage | 150 nA | 1 LSB ±1% | |
| Range 3 | High current shunt and high gain stage | 10 µA | 1 LSB ±1% | |
| Range 4 | High current shunt and low gain stage | 100 µA | 1 LSB ±1% | Accuracy will decrease above 100 mA. Typical accuracy is 1 LSB ±5% at 400 mA. The maximum current is 400 mA. |

The ranges are automatically switched by the XAM to achieve the best measurement results, and the currently active range is visualized in the Data Visualizer front-end tool. The maximum voltage drop over the shunt resistor is 100 mV, and the XAM switches the range automatically before reaching this limit.

## 3.3 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/MPLAB® X. The following table shows the data fields stored in the ID chip with example content.

**Table 3-3. 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 |

| .....continued | | |
|---|---|---|
| **Data Field** | **Data Type** | **Example Content** |
| Maximum voltage [mV] | uint16_t | 3600 |
| Maximum current [mA] | uint16_t | 30 |

## 3.4 Power Sources

The ATtiny3217 Xplained Pro kit can be powered by several power sources, as listed in the following table.

**Table 3-4. Power Sources for ATtiny3217 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 host operation is not required. | The recommended value for the maximum current is 2A | PWR |
| 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.

## 3.5 Xplained Pro Headers and Connectors

### 3.5.1 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 to 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 3-5. 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. |

.....continued

| Pin Number | Pin Name | Description |
|---|---|---|
| 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. |
| 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. |

### 3.5.2 Xplained Pro Power Header

The power header can be used to connect external power to the ATtiny3217 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 3-6. Xplained Pro Power Header**

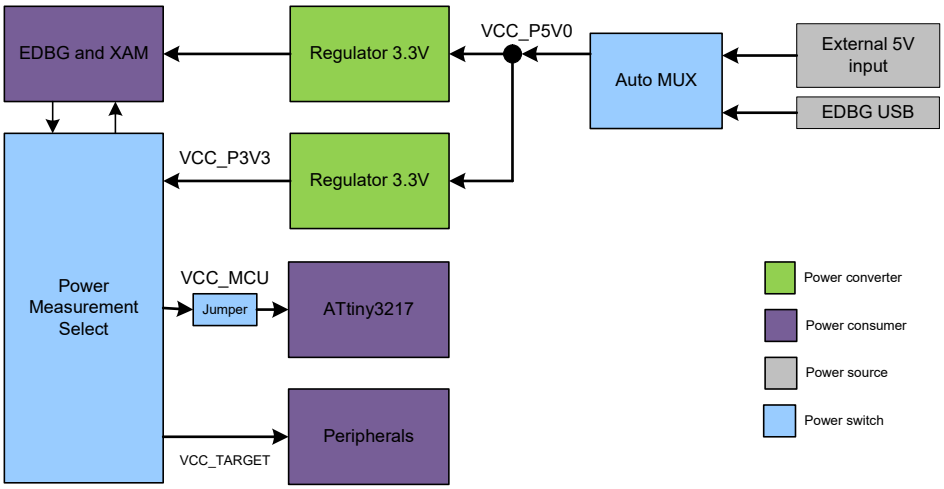
| Pin Number | Pin Name | Description |
|---|---|---|
| 1 | VEXT_P5V0 | External 5V input pin |
| 2 | GND | Ground pin |
| 3 | VCC_P5V0 | Unregulated 5V pin (an output, derived from one of the input sources) |
| 4 | VCC_P3V3 | Regulated 3.3V pin (an output, used as the main power supply for the kit)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

# 4. Hardware User Guide

## 4.1 Power Distribution

ATtiny3217 Xplained Pro has two power sources; EDBG USB and external 5.0V. The kit will automatically select the power source. The kit has two on-board 3.3V voltage regulators; one for the EDBG and XAM, and one for the ATtiny3217 and other peripherals.

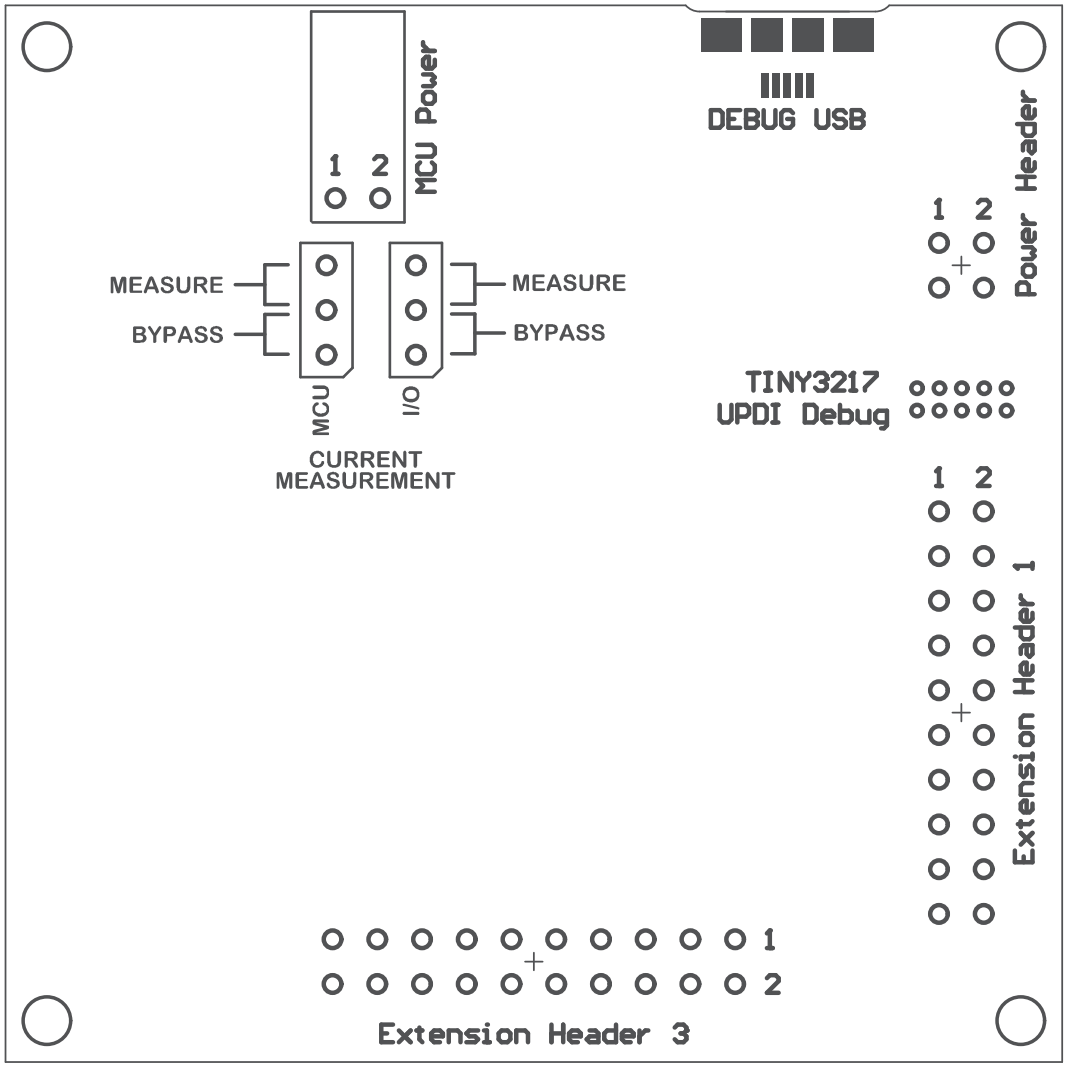
**Figure 4-1. Power Supply Block Diagram**




## 4.2 Connectors

The following sections describe the implementation of the relevant connectors and headers on the ATtiny3217 Xplained Pro and their connection to the ATtiny3217. The tables of connections in the sections also describe which signals are shared between the headers and on-board functionality. The figure below shows all available connectors and jumpers on ATtiny3217 Xplained Pro.

**Figure 4-2. ATtiny3217 Xplained Pro Connector Overview**




### 4.2.1 Xplained Pro Standard Extension Headers

The ATtiny3217 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 2.54 mm.

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

| EXT1 Pin | ATtiny3217 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 | - |

.....continued

| EXT1 Pin | ATtiny3217 Pin | Function | Shared Functionality |
|---|---|---|---|
| 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 |
| 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 4.5.1 Connecting the 32.768 kHz Crystal for more information.

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

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

| EXT3 Pin | ATtiny3217 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) |
| 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 |

| .....continued | | | |
|---|---|---|---|
| **EXT3 Pin** | **ATtiny3217 Pin** | **Function** | **Shared Functionality** |
| 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 4.5.1 Connecting the 32.768 kHz Crystal for more information.

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

### 4.2.2 UPDI Debug Connector

ATtiny3217 Xplained Pro has a 10-pin 50-mil UPDI Debug Connector that can be used to attach external debuggers to the ATtiny3217.

**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 | ATtiny3217 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

ATtiny3217 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 ATtiny3217 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 ATtiny3217 to use the button.

**Table 4-4. Mechanical Buttons**

| ATtiny3217 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 ATtiny3217. Today the ATtiny3217 does not have any reset capabilities on PC5.

### 4.3.2 Crystal

The ATtiny3217 Xplained Pro kit contains a 32.768 kHz crystal, which can be used as the clock source for the ATtiny3217 device. The crystal has a cut-strap next to it, which 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 AN2648 application note from Microchip.

There is a 9 pF, 32.768 kHz crystal in a 3.2 mm by 1.5 mm package mounted on ATtiny3217 Xplained Pro.

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

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

| ATtiny3217 Pin | Function |
|---|---|
| PB2 | XOUT32 |
| PB3 | XIN32 |

**Related Links**

2.2 Design Documentation and Relevant Links

### 4.3.3 LED

There is one yellow LED available on the ATtiny3217 Xplained Pro board that can be turned ON and OFF. The LED can be activated by connecting the I/O line to GND.

**Table 4-6. LED Connection**

| ATtiny3217 Pin | Silkscreen Text | Shared Functionality |
|---|---|---|
| PB4 | LED0 | EXT1 |

### 4.3.4 QTouch® Button

There are two self-capacitance buttons available on the ATtiny3217 Xplained Pro board, which 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.

To get started using the QTouch buttons and the PTC, there is a similar example project that can be opened here: QTouch Tiny817 Xplained Pro Selfcap Example in Atmel Start (http://start.atmel.com/#examples). The two kits are identical except for the device.

**Tip:** The touch buttons in the kit are placed on the inner layers of the PCB and have 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**

| ATtiny3217 Pin | Silkscreen Text | Shared Functionality |
|---|---|---|
| PA7 | QT BTN1 | EXT1 |
| PA6 | QT BTN2 | EXT1 |

## 4.4 Embedded Debugger Implementation

The ATtiny3217 Xplained Pro contains an Embedded Debugger (EDBG), which can be used to program and debug the ATtiny3217 using Unified Program Debug Interface (UPDI). The Embedded Debugger also includes a Virtual COM Port interface over UART, a Data Gateway Interface over SPI, I²C, and two ATtiny3217 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) uses one pin to communicate with the target. For further information on how to use the programming and debugging capabilities of the EDBG, see section 3.1 Embedded Debugger.

**Table 4-8. UPDI Connections**

| ATtiny3217 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 ATtiny3217 UARTs. For further information on how to use the Virtual COM Port, see section 3.1 Embedded Debugger.

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

| ATtiny3217 Pin | Function | Shared Functionality |
|---|---|---|
| PB2 | UART TXD (ATtiny3217 TX line) | EXT1 and EXT3 |
| PB3 | UART RXD (ATtiny3217 RX line) | EXT1 and EXT3 |

### 4.4.3 Data Gateway Interface

The Embedded Debugger features a Data Gateway Interface (DGI) by using either an SPI or I²C. The DGI can be used to send a variety of data from the ATtiny3217 to the host PC. For further information on how to use the DGI interface, see the Data Visualizer and the EDBG User Guide.

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

| ATtiny3217 Pin | Function | Shared Functionality |
|---|---|---|
| PC4 | SPI SS (Slave select) (ATtiny3217 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**

| ATtiny3217 Pin | Function | Shared Functionality |
|---|---|---|
| PA1 | *I²C SDA* (Data line) | EXT1 and EXT3 |
| PA2 | *I²C SCL* (Clock line) | EXT1 and EXT3 |

**Note:** Signal functions in *italic* use alternative pin location. These have 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 timestamp pin value changes. This makes it possible to accurately timestamp events in the ATtiny3217 application code. For further information on how to configure and use the GPIO monitoring features, see the Data Visualizer and the EDBG User Guide.

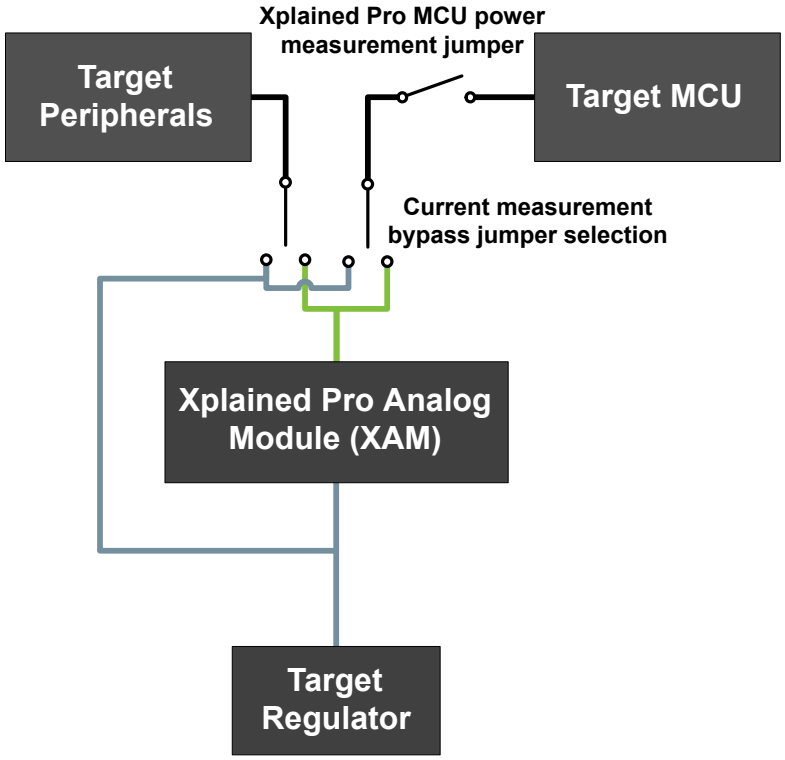
**Table 4-12. GPIO Lines Connected to the EDBG**

| ATtiny3217 Pin | Function | Shared Functionality |
|---|---|---|
| PB5 | GPIO0 | EXT3 and SW0 |
| PB6 | GPIO1 | EXT3 |

### 4.4.4 XAM Configuration

On the ATtiny3217 Xplained Pro, the MCU and the MCU peripherals (e.g., extensions) are powered by their own regulator, as shown in the figure below. All the 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 the peripherals can be measured by connecting them to the XAM output through jumper settings.

**Figure 4-3. ATtiny3217 Xplained Pro XAM Implementation Block Diagram**




On the ATtiny3217 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 the “I/O” and “MCU” headers in the “MEASURE” position.

## 4.5 Kit Modifications

ATtiny3217 Xplained Pro has several resistors that can be used to disconnect I/O pins of the ATtiny3217 from connectors and on-board ICs and to disconnect power signals.

**Info:** Note that some resistors 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 | ATtiny3217, 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 ATtiny3217 |
| R305 | 10k | Yes | QT BTN2 | PA7 AIN7 | |
| R307 | 0R | Yes | PB2 UART TXD | PB2 | EDBG CDC and UART on extension headers to the ATtiny3217 |
| R308 | 0R | Yes | PB3 UART RXD | PB3 | |
| R309 | 0R | Yes | SW1 | PC5 | Mechanical button SW1 |
| R312 | 0R | **No** | PB3 TOSC1 | PB3 | 32.768 kHz crystal to the ATtiny3217 |
| R313 | 0R | **No** | PB2 TOSC2 | PB2 | |
| R404 | 0R | Yes | EDBG UPDI | PA0 UDPI RST | Debug interface from the EDBG to the ATtiny3217 |

| .....continued | | | | | |
|---|---|---|---|---|---|
| **Designator** | **Value** | **Mounted** | **From** | **To** | **Comment** |
| R406 | 0R | Yes | EDBG CDC RX | PB2 UART TX | EDBG CDC and DGI interfaces to the ATtiny3217 |
| 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**

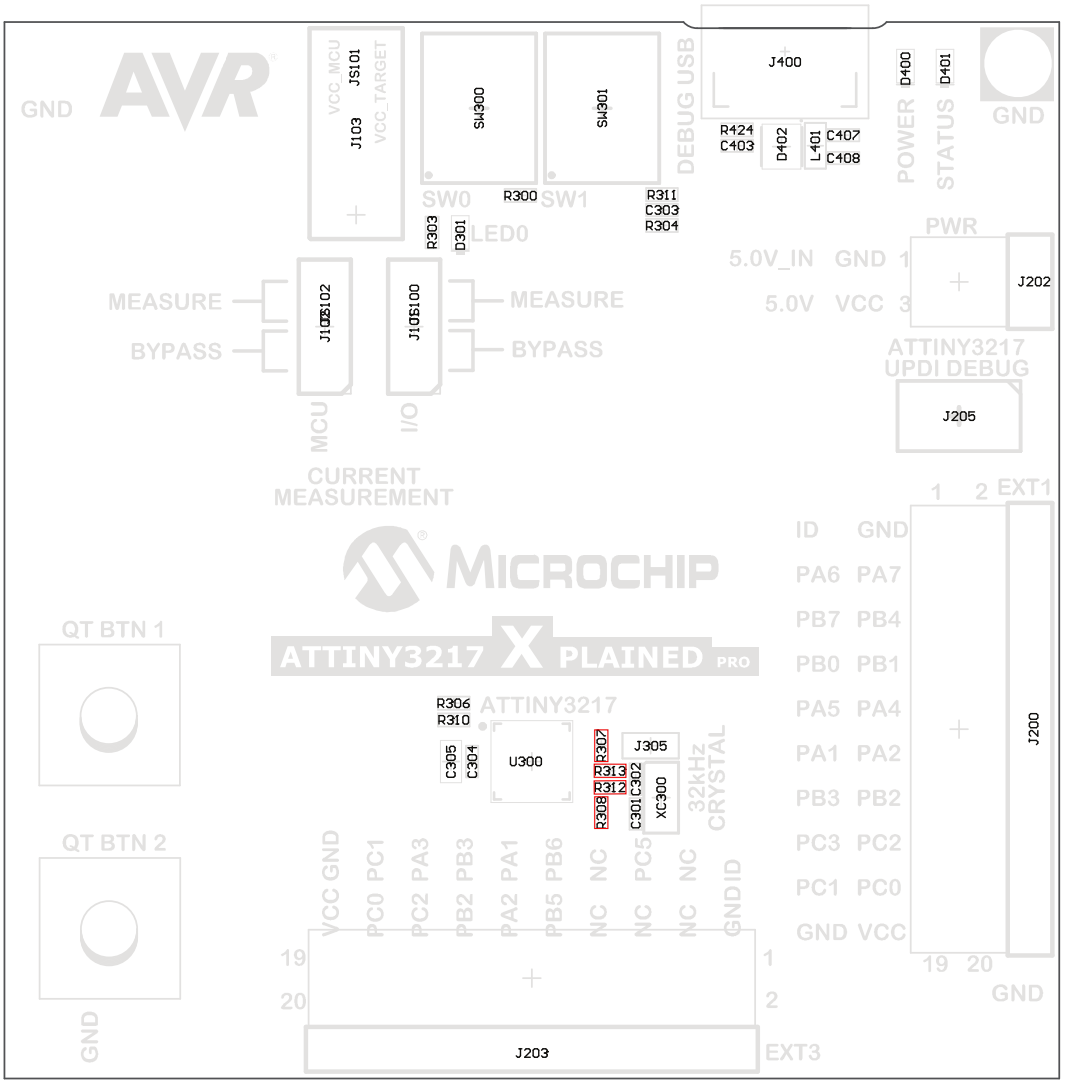
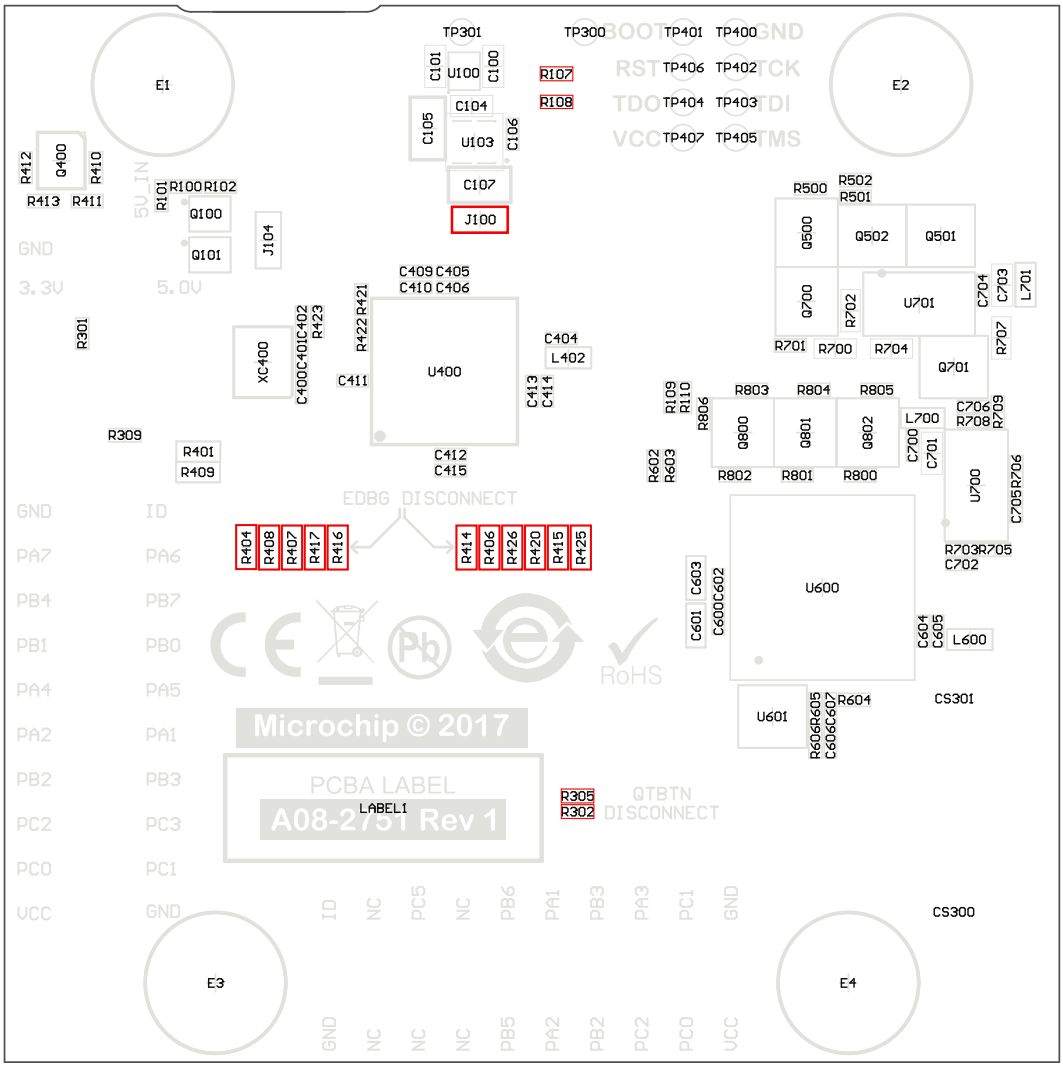


**Figure 4-5. Assembly Drawing Bottom**




## 4.5.1 Connecting the 32.768 kHz Crystal

The ATtiny3217 Xplained Pro board has a 32.768 kHz crystal mounted on the kit. The crystal is not connected by default as the TOSC pins on the device are used for UART communication to the extension headers and the EDBG CDC. To use the crystal, this connection has to be broken 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 ATtiny3217 with the crystal requires physical modifications on the kit using a soldering iron.

## 4.5.2 Operation at Other Voltages

The ATtiny3217 Xplained Pro board is operated at 3.3V by default, but it can also operate from 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 ATtiny3217 should be removed.

To completely disconnect the EDBG and the on-board power supply from the ATtiny3217, 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) 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. The kit can be supplied with the desired voltage through the pins marked 3.3V (pin four) and GND (pin two) on the Xplained Pro power header when the components are removed. To program and debug the ATtiny3217, the 2x5 50mil UPDI debug connector has to be used with an external debugger.

**Info:** Operating the ATtiny3217 on other voltages than 3.3V requires physical modifications on the kit using a soldering iron and an external debugger for programming the ATtiny3217. 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 ATtiny3217 and the extension headers. Applying a voltage higher than 5.5V may damage the board permanently.

**Figure 4-6. ATtiny3217 Xplained Pro EDBG Disconnect**

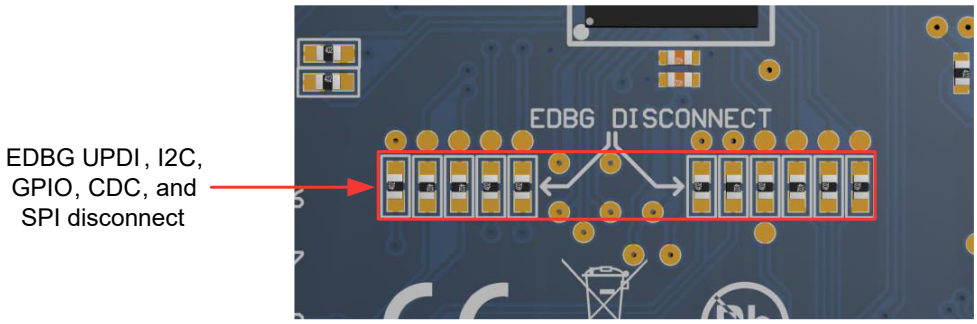
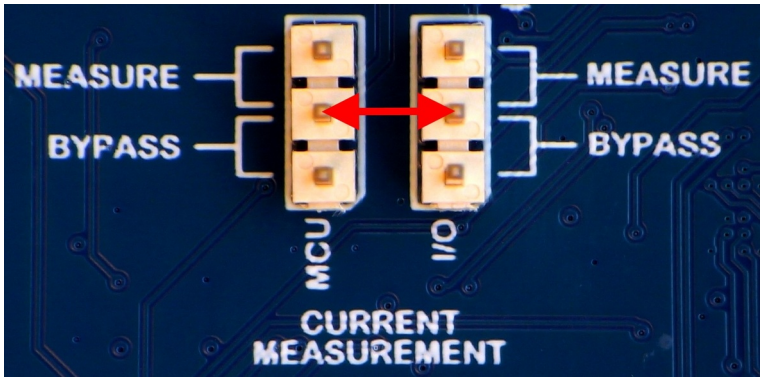



**Figure 4-7. ATtiny3217 Xplained Pro Current Measurement Headers**




**Related Links**

3.5.2 Xplained Pro Power Header
4.2 Connectors
4.2.2 UPDI Debug Connector

# 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 ATtiny3217 Xplained Pro is 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, as shown in Figure 7-7.
3. In the category **Debugger**, select the **Setup** tab. Select **Atmel-ICE** as the driver, as shown in Figure 7-8.
4. In the category *Debugger > Atmel-ICE*, select the **Atmel-ICE 1** tab. Select **UPDI** as the interface and, optionally, select the **UPDI** frequency, as shown in Figure 7-9.

**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**

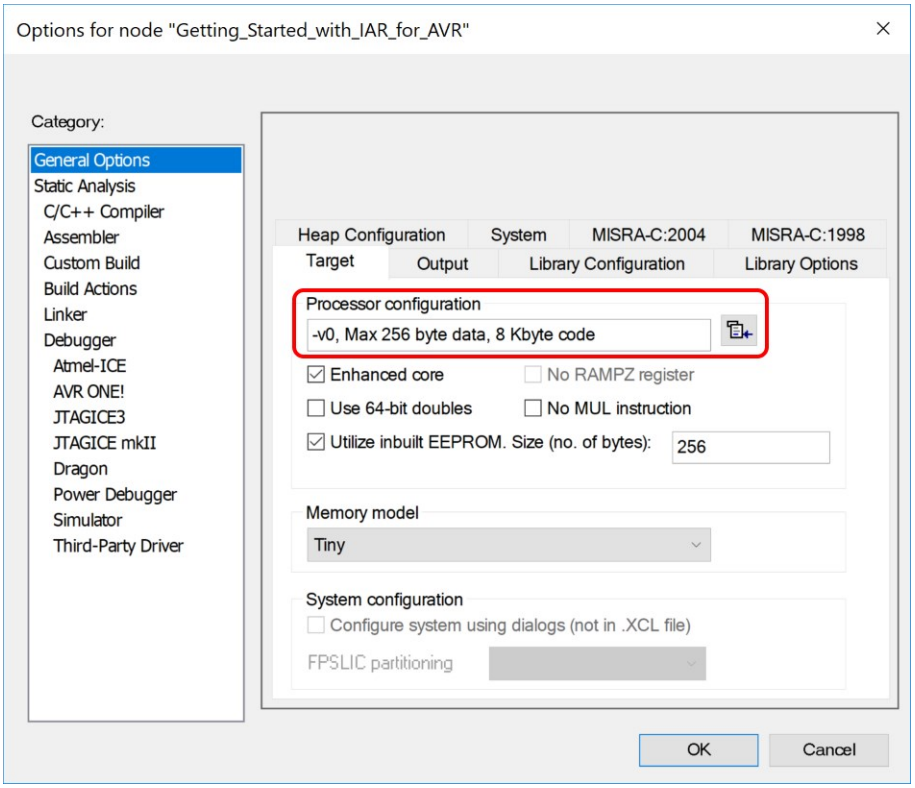


**Figure 5-2. Select Debugger**

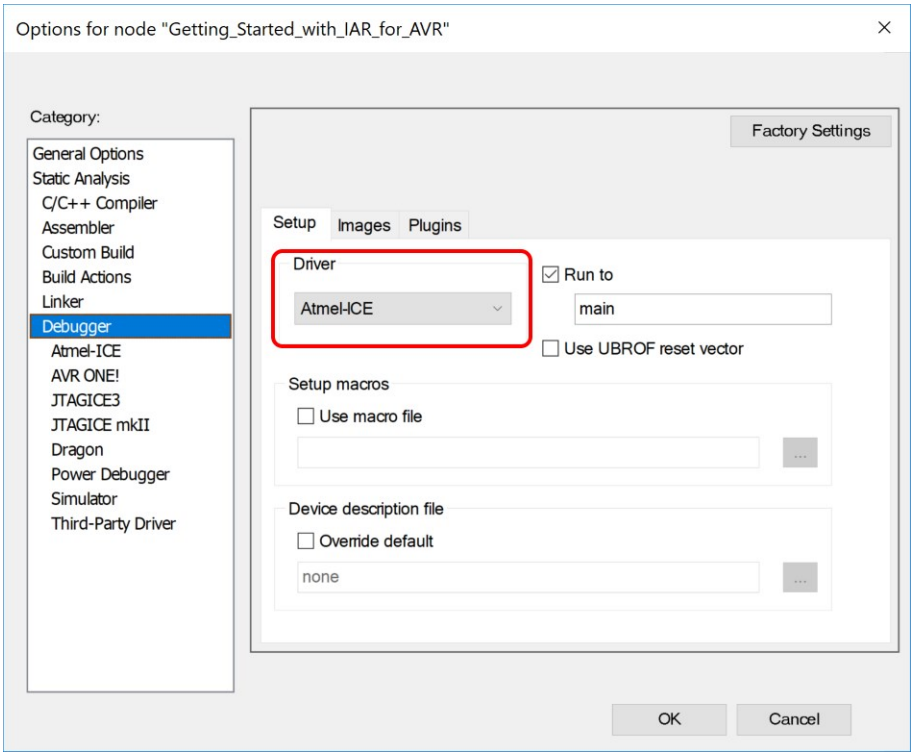
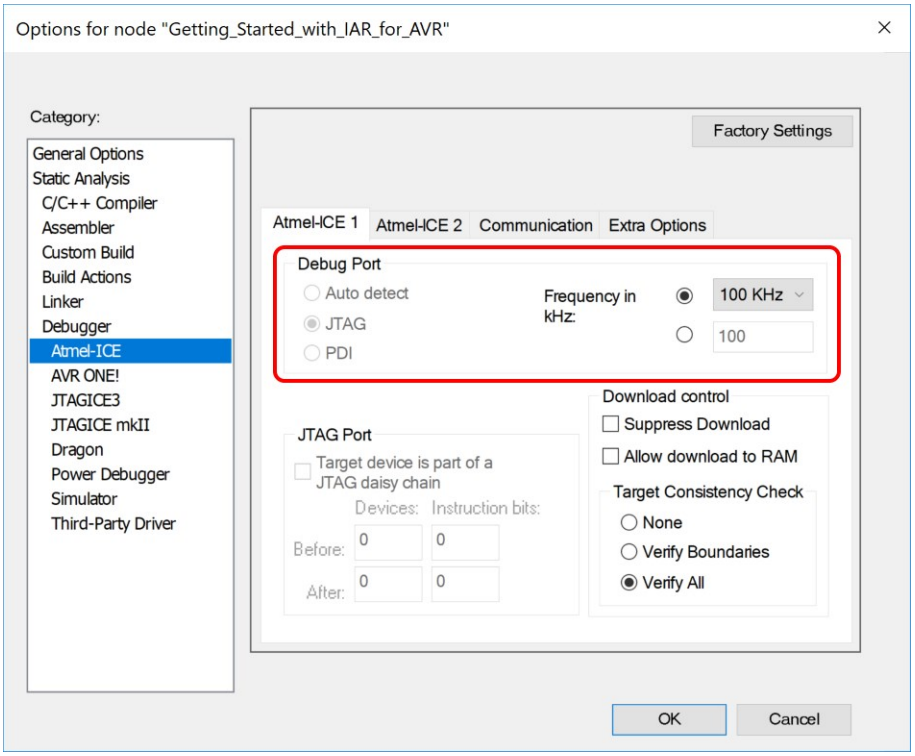



**Figure 5-3. Configure Interface**



# 6. Hardware Revision History and Known Issues

This user guide is written to provide information about the latest available revision of the board. The following sections contain 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/ MPLAB® X 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/MPLAB® X 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 ATtiny3217 Xplained Pro is A09-2835.

## 6.2 Revision 4

32.768 kHz crystal manufacturer changed.

## 6.3 Revision 3

Revision 3 is identical to revision 2, but with ATtiny3217 production samples.

## 6.4 Revision 2

Revision 2 is the initially released revision using ATtiny3217 engineering samples.

# 7. Document Revision History

| Doc. rev. | Date | Comment |
|---|---|---|
| B | 02/2020 | HW revision 3 and 4 added. 32.768 kHz crystal information updated. |
| A | 06/2018 | Initial document release |

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