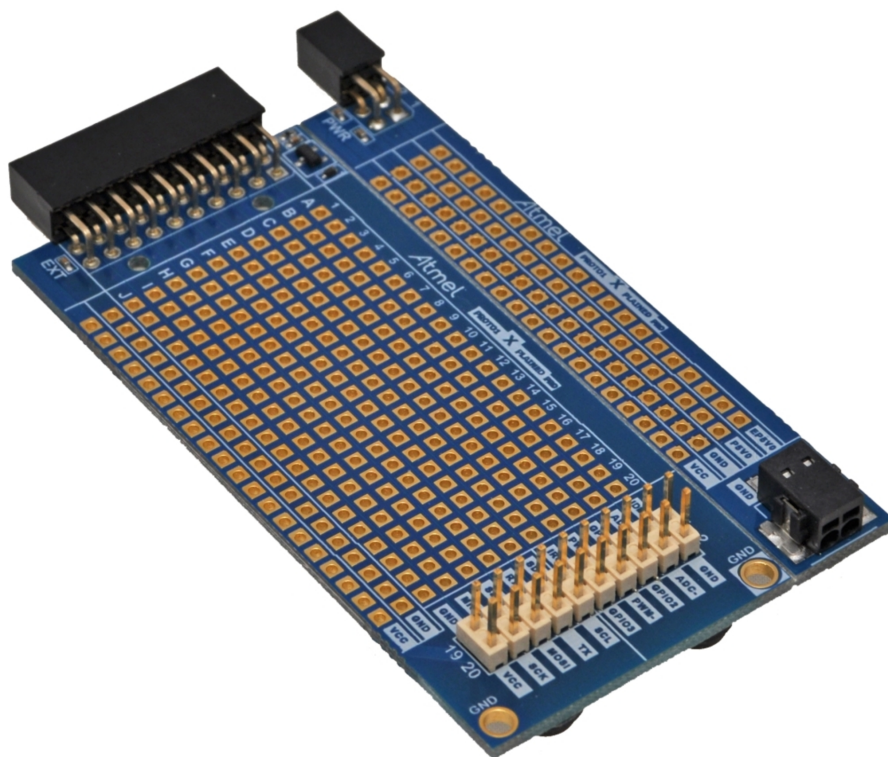


## Preface

The Atmel® PROTO1 Xplained Pro extension board is a development board that can be used to prototype small circuits and easy connect it to Xplained Pro MCU boards through one of the standard extension headers. It includes an ID chip and will be recognized by Atmel Studio. It can also be used to interface older Xplained top-modules like sensor boards. There is a separate connector available to connect external power to a Xplained Pro series evaluation kits. This section can be separated from the prototype section to be used standalone or not at all.



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# 1. Introduction

## 1.1. Features

- Prototyping area with 10 x 20 = 200 PADS
  - 100mil spacing to ease through-hole component prototyping
  - Square PADS to ease SMD passive component prototyping
  - Fits mini solderless breadboards for fast and simple prototyping
- Xplained Pro hardware identification system
- Can be used as an vertical extender for Xplained Pro standard extensions modules
- Support for Xplained series extension modules

## 1.2. Kit Overview

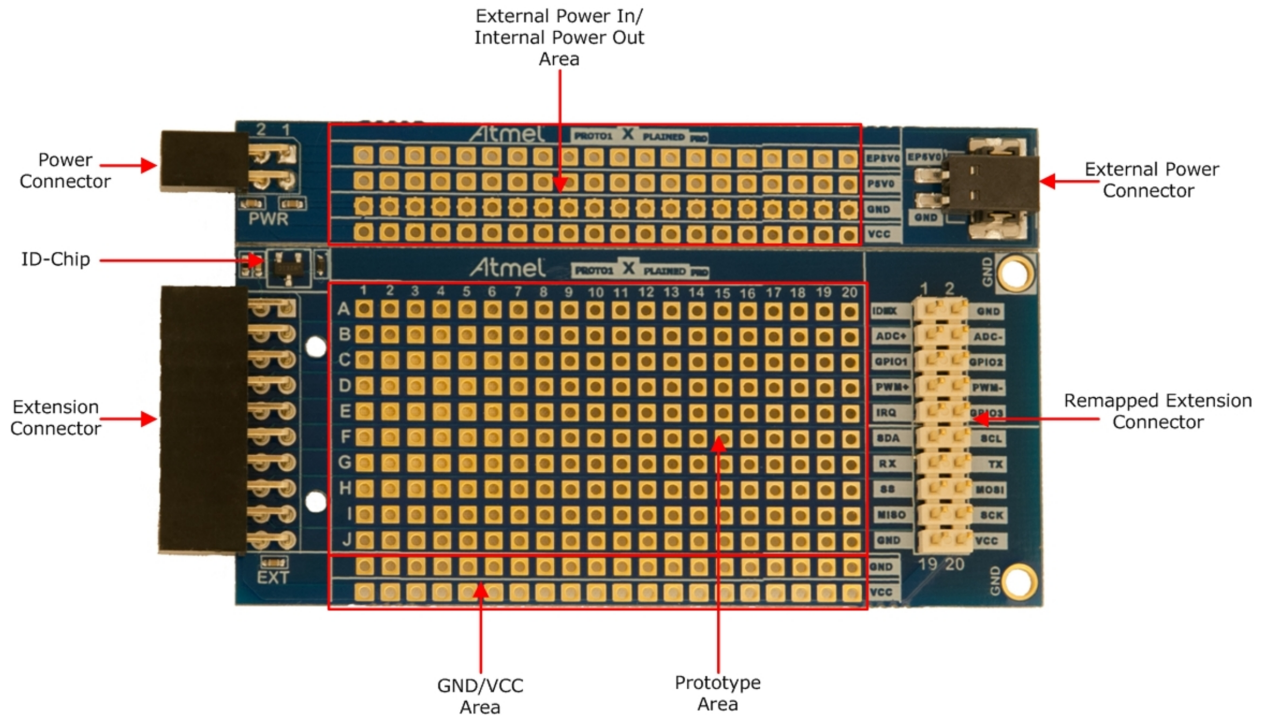
The Atmel PROTO1 Xplained Pro board is a generic prototyping extension board for the Xplained Pro platform. It connects to any standard extension header on any Xplained Pro MCU board and thus offers an easy way to do prototyping with the Xplained Pro platform. It can be used to prototype small designs that can be connected to the Xplained Pro MCU series of kits. The prototype area consists of 200 free square pads with 100mil (2.54mm) spacing that can be used to prototype both through-hole components as well as SMD components like resistors, capacitors, and inductors. The prototyping area is marked with letters and numbers on both sides of the board so it is easy to identify each pad with a coordinate to make precise connections. Power in the form of GND and VCC\_TARGET (is distributed horizontally along the lower side of the prototype for easy connection across the board. The prototyping area offers also space to fit a solderless breadboard on top. A popular size of these boards is 45mm x 35mm and provides 170 solderless points.

The top section of the board is a break-away section that can be used to connect external power to the Xplained Pro MCU board with a screw terminal block. It also distributes GND, VCC\_TARGET, and VCC\_USB (+5V) from the Xplained Pro MCU board that can easily be connected to the prototyping area.

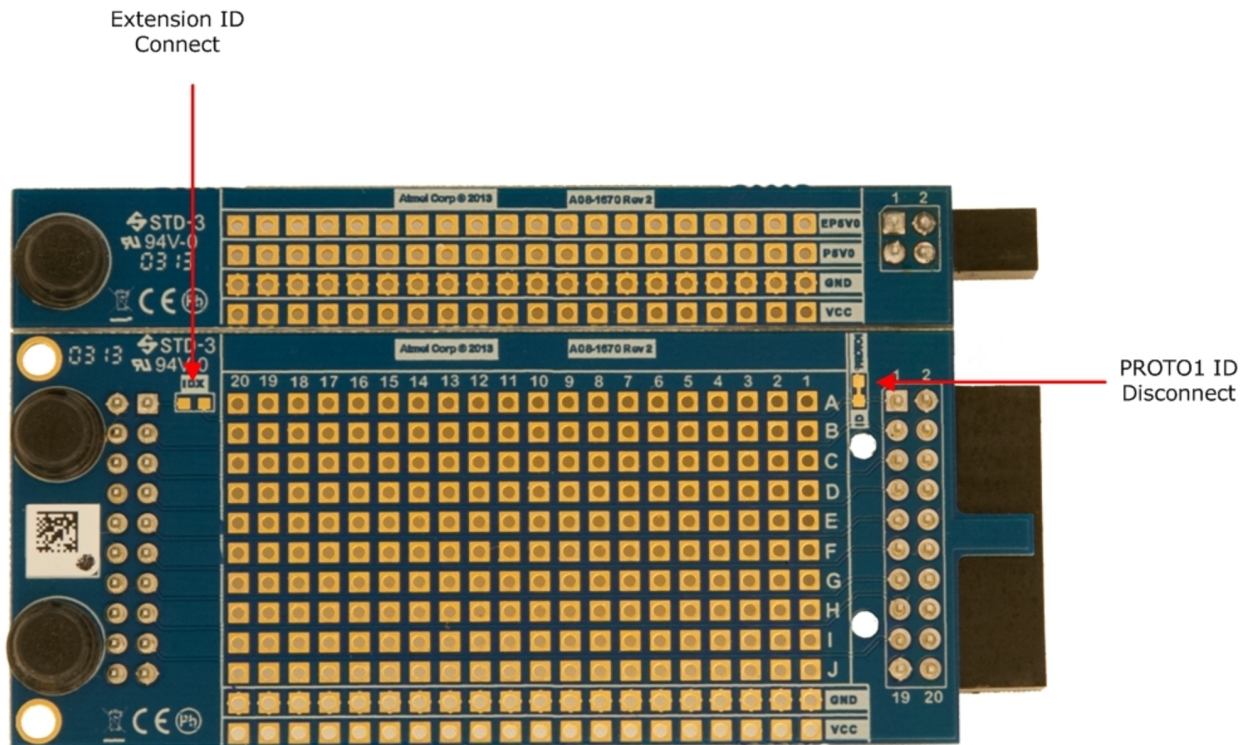
The lower section of the board has a right angled header on the left side that connects to Xplained Pro MCU boards, a prototyping area in the middle and another connector on the right side that provides easy access to the extension header signals. The vertical header on the right hand side can be used to connect the extension signals to the prototyping area or to connect extension modules of the Xplained platform e.g. sensor boards, or the RZ600 radio kit. More information on how to connect Xplained extensions is available in the hardware users guide section of this guide.

The Atmel PROTO1 Xplained Pro supports the Xplained Pro hardware identification system.

**Figure 1-1. PROTO1 Xplained Pro Extension Board, Top View**



**Figure 1-2. PROTO1 Xplained Pro Extension Board, Bottom View**



## 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 PROTO1 Xplained Pro to an Xplained Pro MCU board and connect a USB cable to the DEBUG USB port on the Xplained Pro MCU board.

When the Xplained Pro MCU kit is connected to your computer for the first time, the operating system will perform a driver software installation. The driver file supports both 32- and 64-bit versions of Microsoft® Windows® XP, Windows Vista®, Windows 7, Windows 8, Windows 10, and Windows Server 2012.

Once the Xplained Pro MCU board is powered the green power LED will be lit and Atmel Studio will auto detect which Xplained Pro MCU- and extension board(s) are connected. Atmel Studio will present relevant information like datasheets and kit documentation. The kit landing page in Atmel Studio also has the option to launch Atmel Software Framework (ASF) example applications for the kit. The target device is programmed and debugged by the on-board Embedded Debugger and therefore no external programmer or debugger tool is needed.

### 2.2. Design Documentation and Relevant Links

The following list contains links to the most relevant documents and software for PROTO1 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 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.
- [Hardware Users Guide in PDF format](#) - PDF version of this User Guide.
- [Design Documentation](#) - Package containing CAD source, schematics, BOM, assembly drawings, 3D plots, layer plots, etc.
- [PROTO1 Xplained Pro on Atmel web page](#) - Atmel website link.



### 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. 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 3-1. Xplained Pro ID Chip Content**

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

#### 3.2. Xplained Pro Headers and Connectors

##### 3.2.1. 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 3-2. Xplained Pro Standard Extension Header**

Pin number	Name	Description
1	ID	Communication line to the ID chip on an extension board
2	GND	Ground
3	ADC(+)	Analog to digital converter, alternatively positive part of differential ADC
4	ADC(-)	Analog to digital converter, alternatively negative part of differential ADC
5	GPIO1	General purpose I/O
6	GPIO2	General purpose I/O
7	PWM(+)	Pulse width modulation, alternatively positive part of differential PWM
8	PWM(-)	Pulse width modulation, alternatively negative part of differential PWM
9	IRQ/GPIO	Interrupt request line and/or general purpose I/O
10	SPI_SS_B/ GPIO	Slave select for SPI and/or general purpose I/O
11	I <sup>2</sup> C_SDA	Data line for I <sup>2</sup> C interface. Always implemented, bus type.
12	I <sup>2</sup> C_SCL	Clock line for I <sup>2</sup> C interface. Always implemented, bus type.
13	UART_RX	Receiver line of target device UART
14	UART_TX	Transmitter line of target device UART
15	SPI_SS_A	Slave select for SPI. Should preferably be unique.
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

### 3.2.2. Xplained Pro Power Header

The power header can be used to connect external power from an Xplained Pro extension to an Xplained Pro MCU board, or to use the Xplained Pro MCU boards 5V power source. Care must be taken not to exceed the total current limitation of the Xplained Pro MCU board regulator when using the VCC\_MCU\_BOARD pin.

**Table 3-3. Xplained Pro Power Header**

Pin number	Pin name	Description
1	VEXT_P5V0	5V input to Xplained Pro MCU board, highest priority power source
2	GND	Ground
3	VCC_P5V0	Unregulated 5V (output from Xplained Pro MCU board, derived from one of the input sources)
4	VCC_MCU_BOARD	Regulated target voltage (output, used as main power supply for Xplained Pro MCU board)



## 4. Hardware user guide

### 4.1. Electrical Characteristics

PROTO1 Xplained Pro can be connected to several Xplained Pro MCU boards and manually connected to other hardware. Xplained Pro MCU board(s) that does not have 3.3V as its primary target voltage will read all ID devices on connected extensions to check if they support the target voltage before enabling it to the extension headers. The table below shows the static content written in the ID chip.

**Table 4-1. PROTO1 Xplained Pro ID Chip Content**

Data field	Content
Product name	PROTO1 Xplained Pro
Minimum operation voltage	0.0V
Maximum operation voltage	5.0V
Maximum current	10mA

#### Related Links

[Hardware Identification System](#) on page 6

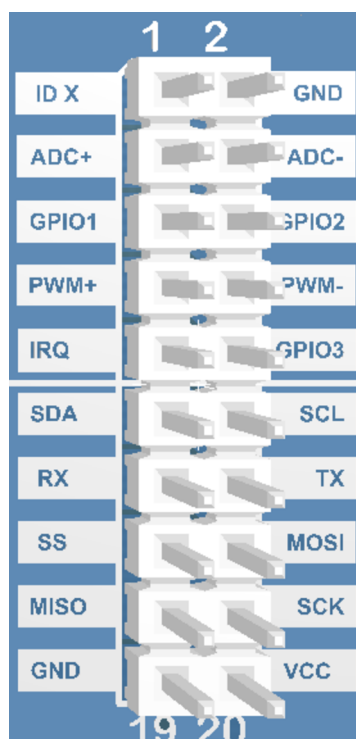
### 4.2. Headers and Connectors

This chapter describes the implementation of the relevant connectors and headers on PROTO1 Xplained Pro.

#### 4.2.1. PROTO1 Xplained Pro Extension Headers

The PROTO1 Xplained Pro has two 20-pin headers. One is angled (left side of the board) and is intended to be connected to a Xplained Pro MCU board, standard extension header. The other is a vertical header (right side of the board) that can be used to connect signals to the prototype area or to attach other extension modules to it. The signals are identical on both, except for the ID signal, which is slightly different. The rest of the signals follow the standard Xplained Pro extension header pin-out. The different ID signals are described in section [PROTO1 Xplained Pro ID System](#).

**Figure 4-1. Extension Header Connector**



#### Related Links

[Xplained Pro Standard Extension Header](#) on page 6

#### 4.2.2. Power Header

The four pin power header on the PROTO1 Xplained Pro extension board is used to probe the voltage on the board. The pins of the header are marked in silk screen with VCC for target voltage and GND for ground.



#### Caution:

The two pin power header should not be used to apply power to the PROTO1 Xplained Pro. The board will get power from the Xplained Pro MCU board through the 20-pin extension connector.

**Table 4-2. Power Header**

Silk screen marking	Description
VCC	Target voltage, main voltage of the PROTO1 Xplained Pro extension board
GND	Ground
EP5V0	External 5.0V supplied to the Xplained Pro MCU board
VP5V0	VCC_USB

#### 4.2.3. External Power Terminal Block Header

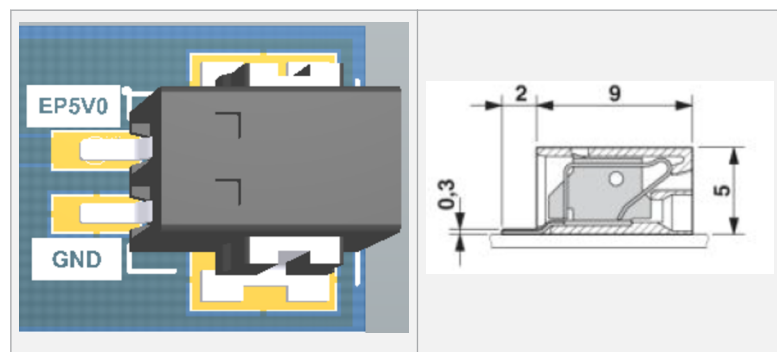
The PROTO1 Xplained Pro features a two pin terminal block header to connect external power to the board. To connect a cable to it, just insert it (remove the insulation from the end first) through the holes at the bottom entry of the connector. An internal spring blade will lock the wire in place. To release it again,

insert a small screwdriver or similar into the top hole to release the tension of the spring blade and pull the wire out. This is shown in the figure below.

**Table 4-3. Terminal Block Header**

Silk screen marking	Pin on terminal block connector
EP5V0	1
GND	2

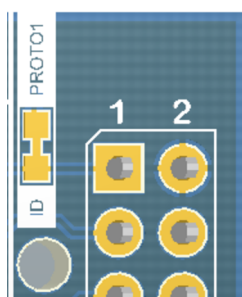
**Table 4-4. Terminal Block Header**



### 4.3. PROTO1 Xplained Pro ID System

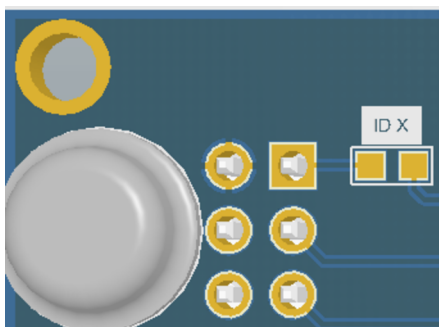
The PROTO1 Xplained Pro board has the Xplained Pro hardware identification system implemented. When the board is connected via an Atmel Xplained Pro MCU board to Atmel Studio it will be identified and relevant information like the user guide will be shown. By default the ID device on the board is connected to the right angled extension header and the ID X pin of the vertical extension header on the right side of the board is unconnected. It is however possible to connect the ID X signal to the right angled extension header with the hardware changes described below. This makes it possible to use the PROTO1 Xplained Pro as an right angle extender for extension boards and Atmel Studio will recognize their ID. In order to do so, the PROTO1 Xplained Pro ID needs to be disconnected and the ID X signal needs to be connected. To disconnect the PROTO1 Xplained Pro ID just cut the cut-strap marked as ID PROTO1 (see figure below) on the bottom side of the PCB.

**Figure 4-2. ID PROTO1**



To connect the ID X signal, solder a 0Ω resistor or a piece of wire to the open strap marked as ID X (see figure below) on the bottom side of the PCB.

Figure 4-3. ID X

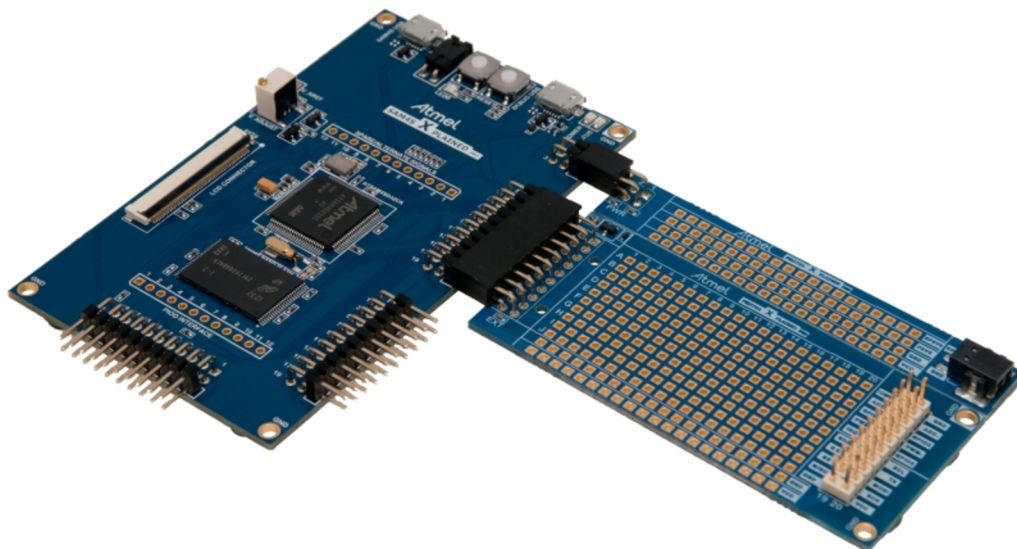


Now any connected Xplained Pro extension modules that are plugged into the vertical extension header on the right side of the board will be detected by Atmel Studio, the PROTO1 Xplained Pro extension board will not longer be detected.

#### 4.4. Connecting the PROTO1 Xplained Pro

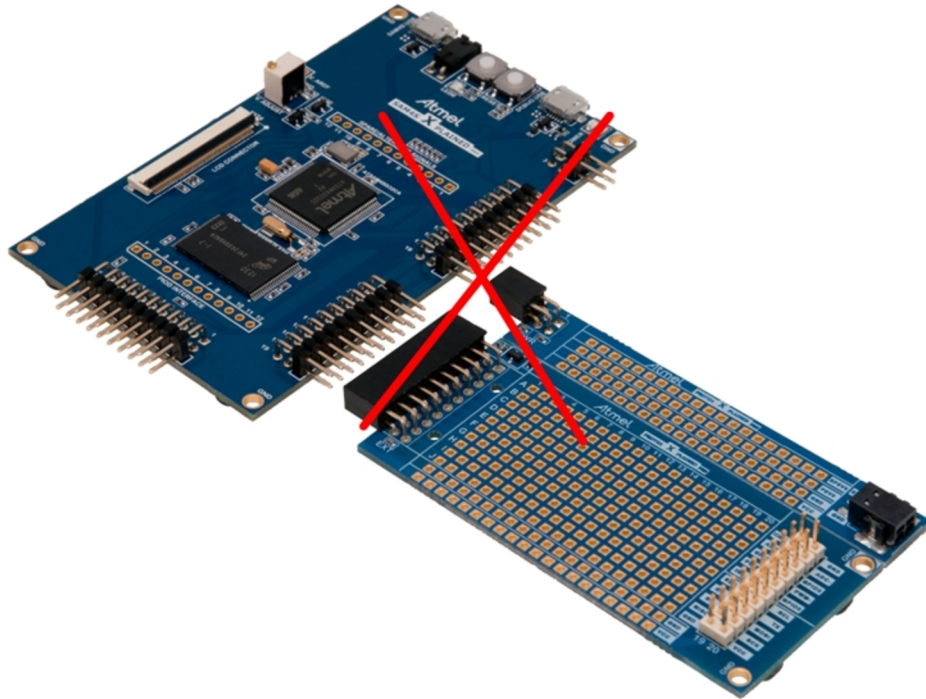
The lower part of the PROTO1 Xplained Pro board can be connected to all Xplained Pro MCU evaluation kits standard extension headers. If the upper break-off part, containing the additional power section, should be used, it is required to connect the board to the EXT1 header in order to connect to the Power header as well (see figure below). To break off the upper section of the board break it along the V-CUT score line across the PCB.

Figure 4-4. Example Connection



The connection indicated below may cause the power plug to short some of the EXT1 pins if it is connected externally. To avoid this, either move the PROTO1 Xplained Pro to another extension connector or break away the power section.

Figure 4-5. Not Recommended PROTO1 Xplained Pro Connection



**Info:** Note that any remaining mouse bite residues should be filed or cut away for optimum fit.

#### 4.4.1. Connecting Xplained Extension Boards

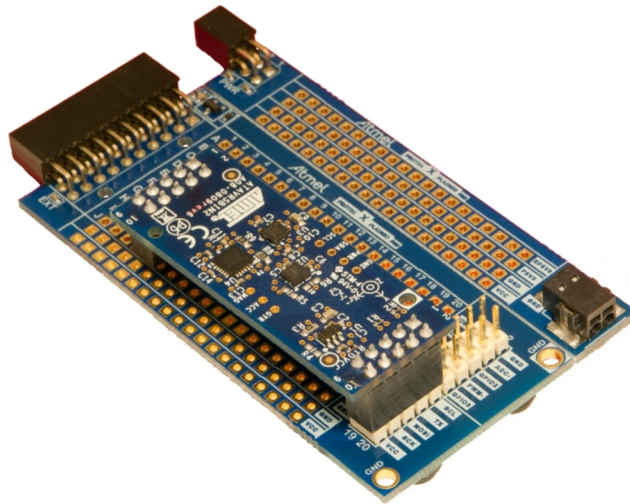
It is also possible to interface legacy Xplained top-modules via the PROTO1 Xplained Pro board. The signal layout on the extension connector below the white line, i.e. pins 11 - 20 is identical to the J1 connector (communication connector) on the legacy Xplained series MCU boards.

Figure 4-6. External Connector



So for legacy Xplained series top-modules that only uses this connector can be attached. Note that the extension connector on the Xplained Pro MCU board might not have all signals available due to lack of pin resources. This needs to be checked for each case. A mounting example is shown in the picture below with a sensor board.

Figure 4-7. Xplained Series Sensor Board Mounted on PROTO1 Xplained Pro

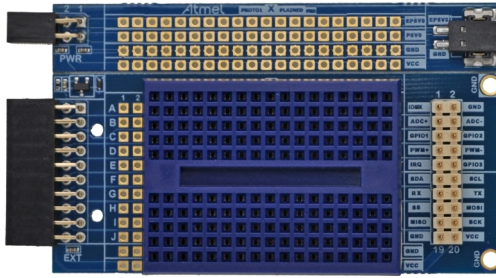


#### 4.4.2. Using PROTO1 Xplained Pro With a Solderless Breadboard

It is possible to mount a 170 Tie-points solderless breadboard (size 47mm x 35mm) on to the prototype section on the PROTO1 Xplained Pro board to ease prototyping as seen in the picture below. It lacks any GND/VCC rails so they need to be connected directly. These boards can be found at a low cost from several vendors on the internet.



Figure 4-8. Solderless Breadboard Mounted on PROTO1 Xplained Pro



## 5. Hardware Revision History and Known Issues

### 5.1. 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:

```
"nnnnrrssssssss"  
n = product identifier  
r = revision  
s = serial number
```

The product identifier for PROTO1 Xplained Pro is A09-1890.

### 5.2. Revision 2

Revision 2 of PROTO1 Xplained Pro is the initial released version.

PROTO1 Xplained Pro boards with a serial number that ends with a number lower than 19048 may have a wrong revision programmed into the Xplained Pro ID chip. This will only affect the information displayed by the Atmel Kits extension in Atmel Studio. It will not affect the operation of the board.

## 6. Document Revision History

Doc. rev.	Date	Comment
42080C	03/2016	Added <a href="#">Electrical Characteristics</a>
42080B	09/2013	Added errata about revision 2 of the board
42080A	02/2013	First release

## 7. 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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