Atmel QTouch

QT2 Xplained Pro

USER GUIDE

Preface

Atmel® QT2 Xplained Pro kit is an extension board that enables the evaluation of a mutual capacitance touch surface using the Peripheral Touch Controller (PTC) module. The kit shows how easy it is to design a capacitive touch surface solution for the PTC without the need for any external components. The kit includes one board with a 4 by 4 touch surface and a 7 by 7 blue LED matrix for a visual feedback of the touch.

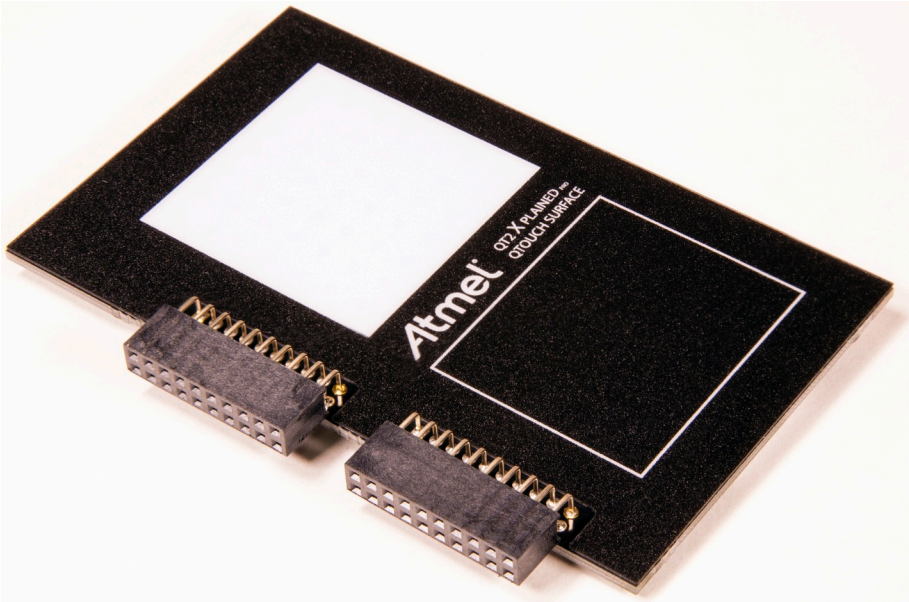


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1. Introduction

1.1. Features

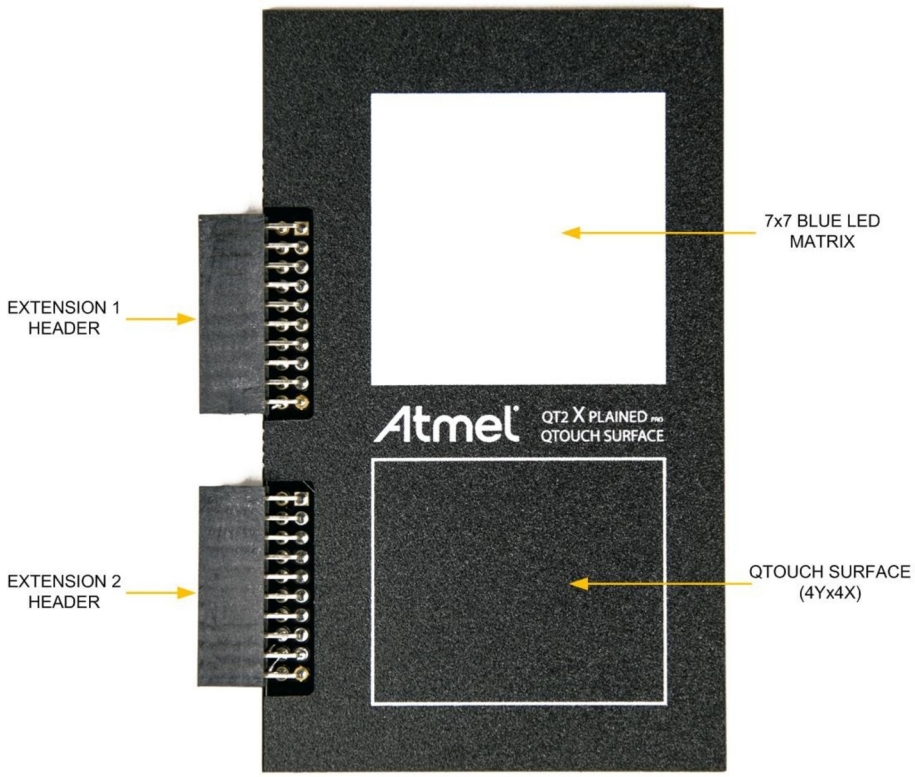
- QTouch®
  - 4x4 Mutual Capacitance matrix
- LEDs
  - 49 LED matrix
  - IS31FL3728 LED matrix controller from ISSI
- Xplained Pro hardware identification system

1.2. Kit Overview

Atmel QT2 Xplained Pro extension is designed specifically for Xplained Pro MCU boards featuring a MCU with a built-in peripheral touch controller.

The extension board can be used to explore the touch functions on the PTC module in mutual capacitance mode.

Figure 1-1. QT2 Xplained Pro Extension Board



1.3. Kit Compatibility

This kit is only supported by Xplained Pro MCU boards that have a MCU with a built-in PTC and a matching pin out that connects all sensors of the extension. There is no guarantee that every Xplained

Pro MCU board with a device that has PTC will manage to match the touch signal pin out to the extension headers.

Currently supported MCU boards are:

- SAM D20 Xplained Pro
- SAM D21 Xplained Pro
- SAM D11 Xplained Pro
- SAM C21 Xplained Pro
- SAM L21 Xplained Pro
- SAM L22 Xplained Pro
- SAM DA1 Xplained Pro

Other future Xplained MCU board designs may also support QT2 Xplained Pro.

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 QT2 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 QT2 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 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 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.
- **QT2 Xplained Pro on Atmel webpage** - Atmel website link.
- **Integrated Silicon Solution Inc.** - IS31FL3728 LED matrix controller manufacturer homepage.

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^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

4. Hardware Users Guide

4.1. Electrical Characteristics

QT2 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. QT2 Xplained Pro ID Chip Content

Data field	Content
Product name	QT2 Xplained Pro
Minimum operation voltage	2.7V
Maximum operation voltage	5.5V
Maximum current	45mA

Related Links

Hardware Identification System on page 6

4.2. Headers and Connectors

4.2.1. Xplained Pro Standard Extension Headers

QT2 Xplained Pro implements two Xplained Pro Standard Extension Header marked with EXT1 and EXT2 in silkscreen. These headers make it possible to connect the board to a Xplained Pro MCU board with a MCU featuring a PTC module. The pin-out definition for the extension headers can be seen in Table 4-2 QT2 Xplained Pro Extension Header 1 and Table 4-3 QT2 Xplained Pro Extension Header 2.

The X-sensors of the touch pad is available on both EXT1 and EXT2 header on the kit for supporting Xplained Pro MCU kits with and without the EXT2 header.

Table 4-2. QT2 Xplained Pro Extension Header 1

Pin on EXT	Function	Description
1	ID	Communication line to ID chip.
2	GND	Ground
3	Y1	Y-line 1
4	Y2	Y-line 2
5	Y3	Y-line 3
6	Y4	Y-line 4
7	X1	X-line 1 (For use with MCU kits without EXT2 header)
8	X2	X-line 2 (For use with MCU kits without EXT2 header)
9	X3	X-line 3 (For use with MCU kits without EXT2 header)

Pin on EXT	Function	Description
10	X4	X-line 4 (For use with MCU kits without EXT2 header)
11	I2C SDA	
12	I2C SCL	
13	Not Connected	
14	Not Connected	
15	Not Connected	
16	Not Connected	
17	Not Connected	
18	Not Connected	
19	GND	Ground
20	VCC	Target supply voltage

Table 4-3. QT2 Xplained Pro Extension Header 2

Pin on EXT	Function	Description
1	Not Connected	
2	GND	Ground
3	X1	X-line 1 (For use with MCU kits with EXT2 header)
4	X2	X-line 2 (For use with MCU kits with EXT2 header)
5	X3	X-line 3 (For use with MCU kits with EXT2 header)
6	X4	X-line 4 (For use with MCU kits with EXT2 header)
7	PWM	PWM for IS31FL3728
8	Not Connected	
9	Not Connected	
10	Not Connected	
11	Not Connected	
12	Not Connected	
13	Not Connected	
14	Not Connected	
15	Not Connected	
16	Not Connected	
17	Not Connected	
18	Not Connected	

Pin on EXT	Function	Description
19	GND	Ground
20	Not Connected	

4.3. Peripherals

4.3.1. LEDs

There are 49 blue LEDs arranged in a 7x7 matrix on the QT2 Xplained Pro extension board that can be used to visualize a touch in the QTouch sensor. All LED's on the boards driven by the LED matrix driver (IS31FL3728), which is controlled by I^2C. For detailed instruction how to interface the LED matrix driver, please refer to the devices datasheet at http://www.issi.com/.

4.3.2. Touch Sensors

QT2 Xplained Pro has one 4x4 mutual capacitance touch surface sensor that can be used as touch pad. Alternatively, the sensor can be configured as a 4 by 4 button array.

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:

"nnnnrrssssssssss"

n = product identifier

r = revision

s = serial number

The product identifier for QT2 Xplained Pro is A09-2289.

5.2. Revision 2

Revision 2 of QT2 Xplained Pro (2079) is the initial released version, there are no known issues.

6. Document Revision History

Doc. rev.	Date	Comment
42369B	03/2016	Added Electrical Characteristics.
42369A	01/2015	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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