Atmel QTouch

QT5 Xplained Pro User Guide

USER GUIDE

Preface

Atmel® QT5 Xplained Pro kit is an extension board that enables the evaluation of mutual-capacitance touch using the Peripheral Touch Controller (PTC) module. The kit shows how easy it is to design a nice looking capacitive touch user interface for the PTC. The kit includes one board with a curved QTouch® mutual-capacitance slider and two QTouch mutual-capacitance buttons. In addition it has 16 LEDs arranged as two 7-segment digits separated with a colon.

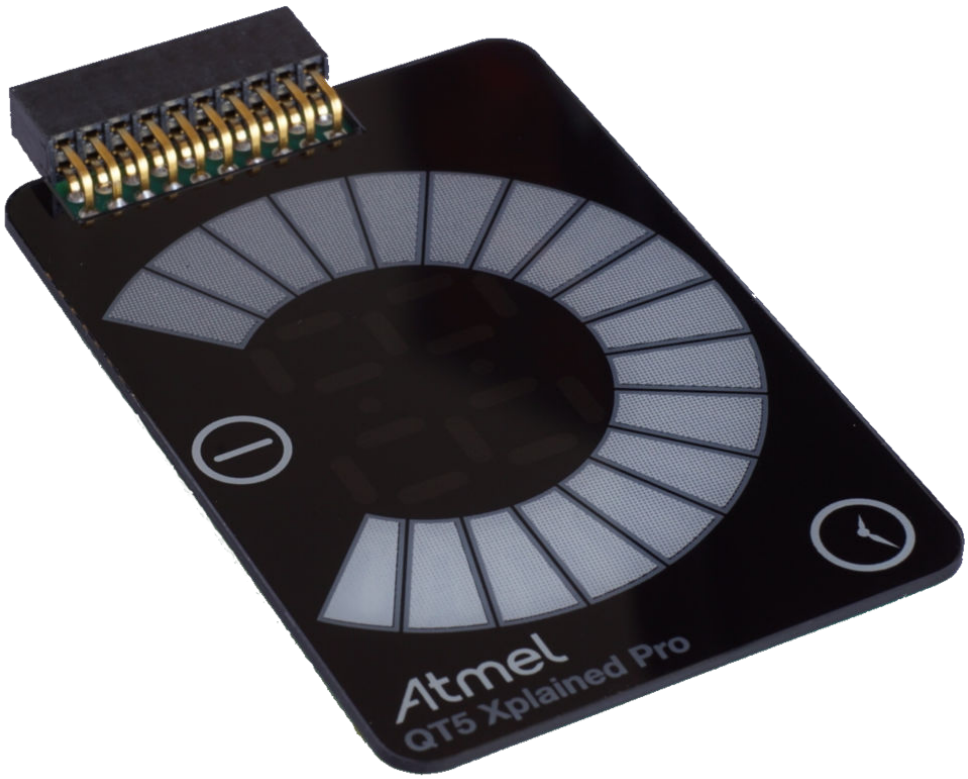


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1. Introduction

1.1. Features

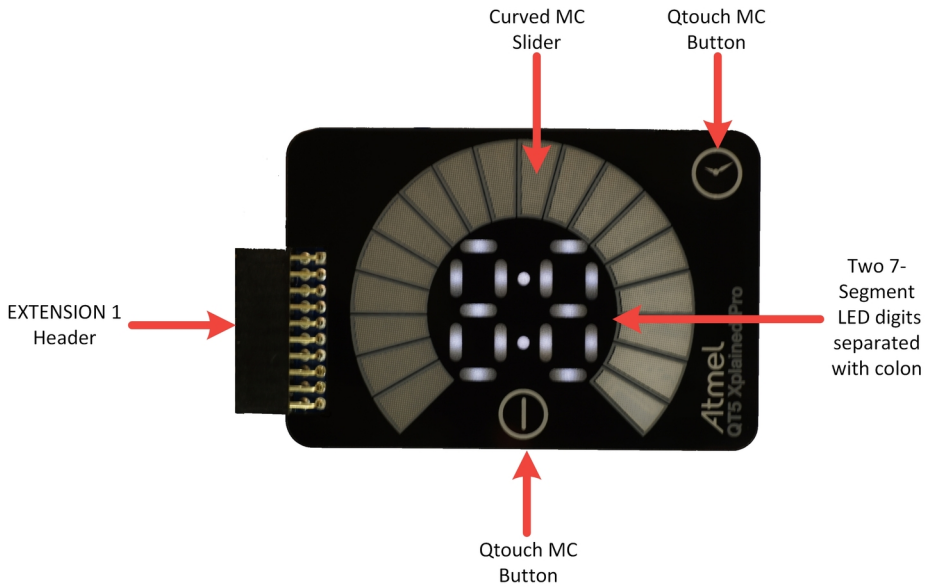
- QTouch
  - One 4-channel (4X x 1Y) mutual-capacitance curved slider
  - Two mutual-capacitance buttons
- LEDs
  - 16 LEDs arranged as two 7-segment digits separated with a colon
  - IS31FL3728 I^2C LED matrix controller from ISSI
- Xplained Pro hardware identification system

1.2. Kit Overview

Atmel QT5 Xplained Pro extension is designed specifically for Xplained Pro MCU boards featuring an 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 QT5 Xplained Pro Extension Board



1.3. Kit Compatibility

This kit is only supported by Xplained Pro MCU boards that have an MCU with a built-in PTC and a matching pinout 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 pinout to the extension headers.

Currently supported MCU boards are:

- SAM D11 Xplained Pro

- SAM C21 Xplained Pro
- SAM L21 Xplained Pro
- SAM L22 Xplained Pro
- SAM R21 Xplained Pro
- ATmega324PB Xplained Pro

Other future Xplained Pro MCU board designs may also support QT5 Xplained Pro.

2. Getting Started

2.1. Xplained Pro Quick Start

Three steps to start exploring the Atmel Xplained Pro platform:

1. Download Atmel Studio.
2. Launch Atmel Studio.
3. Connect QT5 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, and Windows 8.

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 QT5 Xplained Pro:

- **Xplained Pro products** - Atmel Xplained Pro is a series of small-sized and easy-to-use evaluation kits for Atmel microcontrollers and other Atmel products. It consists of a series of low-cost MCU boards for evaluation and demonstration of features and capabilities of different MCU families.
- **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.
- **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.
- **QT5 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

QT5 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 it's 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 QT5 Xplained Pro ID Chip Content

Data field	Content
Product name	QT5 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

QT5 Xplained Pro implements one Xplained Pro Standard Extension Header (see also section Xplained Pro Standard Extension Header on page 6) marked with EXT1 in silkscreen. This header make it possible to connect the board to an Xplained Pro MCU board with an MCU featuring a PTC module. The pinout definition for the extension header can be seen in the table below.

Table 4-2 QT5 Xplained Pro Extension Header 1

Pin on EXT	Function	Description
1	ID	Communication line to ID chip
2	GND	Ground
3	Y0	Y-line 0: Connected to Slider
4	Y1	Y-line 1: Connected to Buttons
5	Not Connected	
6	Not Connected	
7	X0	X-line 0: Connected to Slider and Buttons
8	X1	X-line 1: Connected to Slider
9	X2	X-line 2: Connected to Slider and Buttons
10	X3	X-line 3: Connected to Slider
11	I^2C SDA	Connected to LED driver IC

Pin on EXT	Function	Description
12	I^2C SCL	Connected to LED driver IC
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

4.3. Peripherals

4.3.1. LEDs

There are 16 white LEDs arranged as two 7-segment digits, separated with a colon on the QT5 Xplained Pro extension board that can be used to visualize touch on the QTouch slider sensor. All LEDs on the board are driven by the LED matrix driver (IS31FL3728), which is controlled by I^2C. For detailed instructions on how to interface the LED matrix driver, refer to the devices datasheet at http://www.issi.com/.

4.3.2. Touch Sensors

QT5 Xplained Pro has one 4-channel (4X x 1Y) mutual-capacitance curved slider sensor and two mutual-capacitance buttons.

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 QT5 Xplained Pro is A09-2494.

5.2. Revision 4

Revision 4 of QT5 Xplained Pro (A09-2494/04) is the initial released version. There are no known issues.

6. Document Revision History

Doc. rev.	Date	Comment
42637A	12/2015	Initial document 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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