QT7 Xplained Pro User's Guide

Preface

The Microchip QT7 Xplained Pro kit is an extension board that enables the evaluation of self-capacitance touch using the Peripheral Touch Controller (PTC) module. The kit shows the moisture performance of capacitive touch using the PTC Driven shield. The kit includes one board with a QTouch® technology self-capacitance slider, and two QTouch technology self-capacitance buttons. It also has 8 LEDs, one each for corresponding buttons and slider positions.
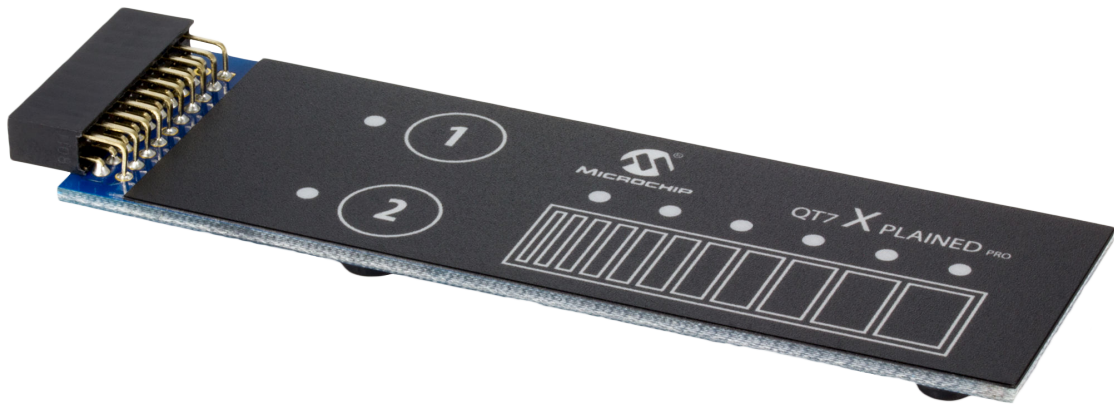
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1. Introduction

1.1 Features

- 2 Self-Capacitance QTouch Technology Keypads
- 1 Self-Capacitance QTouch Technology Slider
- 8 LEDs:
  - One LED for each key
  - Six LEDs for the sliders
- Xplained Pro Hardware Identification System

1.2 Kit Overview

The QT7 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 Self-Capacitance mode.

Figure 1-1. QT7 Xplained Pro Extension Board
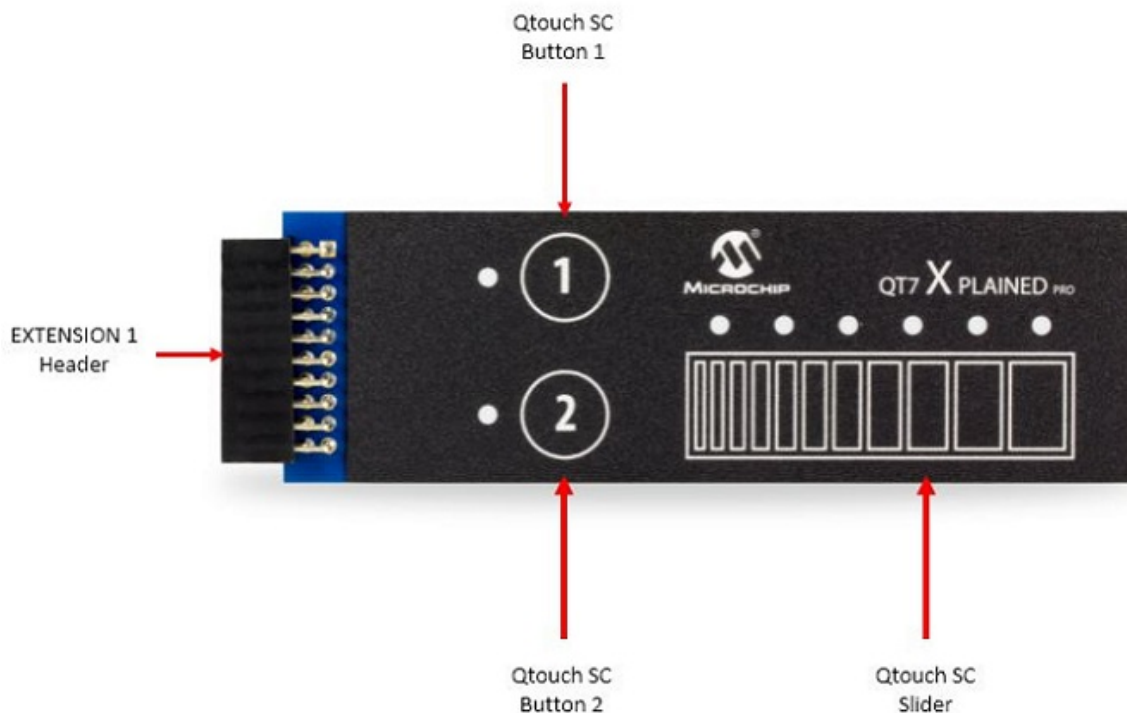
1.3 Kit Compatibility

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 D20 Xplained Pro
- SAM D21 Xplained Pro
- SAM DA1 Xplained Pro
- SAM C21 Xplained Pro
- SAM L21 Xplained Pro
- SAM L22 Xplained Pro
- SAM R21 Xplained Pro
- SAM E54 Xplained Pro
- ATmega324PB Xplained Pro
- ATtiny817 Xplained Pro

Other future Xplained Pro MCU board designs may also support the QT7 Xplained Pro.

2.   Getting Started

2.1   Xplained Pro Quick Start

Steps to start exploring the Xplained Pro platform:

1. Download and install Atmel Studio.
2. Launch Atmel Studio.

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 the Atmel Studio 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 QT7 Xplained Pro device is programmed and debugged by the on-board embedded debugger and therefore no external programmer or debugger tool is required.

2.2   Design Document and Relevant Links

-   **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 an 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 Start:** This tool will help you select and configure software components and tailor your embedded application in a usable and optimized manner.
-   **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 User's Guide:** PDF version of this user's guide.
-   **QT7 Xplained Pro on Microchip Page:** Microchip website link.

3. Xplained Pro

The Xplained Pro is an evaluation platform that contains a series of microcontroller boards (evaluation kits) and extension boards. Atmel Studio 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 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 Atmel Studio. The following table 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	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
Maximum voltage [mV]	uint16_t	3600
Maximum current [mA]	uint16_t	30

3.2 Xplained Pro Standard Connectors

3.2.1 Xplained Pro Standard Extension Headers

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 on 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 3-2. 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
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^{2}C_SDA	Data pin for I^{2}C interface. Always connected, bus type
12	I^{2}C_SCL	Clock pin for I^{2}C 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

4. Hardware Users Guide

4.1 Electrical Characteristics

QT7 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. QT7 Xplained Pro ID Chip Content

Data field	Content
Product name	QT7 Xplained Pro
Minimum operation voltage	2.7V
Maximum operation voltage	5.5V
Maximum current	45mA

See also Hardware Identification System.

4.2 Headers and Connectors

4.2.1 Extension Headers

The QT7 Xplained Pro implements one Xplained Pro Standard Extension Header (see also section Xplained Pro Standard Extension Header) 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. QT7 Xplained Pro Extension Header 1

Pin on EXT	Function	Description
1	ID	Communication Line to ID Chip
2	GND	Ground
3	Y-LINE-5	Y-line 5: Connected to Driven Shield
4	Y-LINE-1	Y-line 1: Connected to Button 1
5	LED0	Touch Status LED for Slider
6	LED6	Touch Status LED for Button 1
7	Y-LINE-2	Y-line 2: Connected to Slider
8	Y-LINE-3	Y-line 3: Connected to Slider
9	Y-LINE-4	Y-line 4: Connected to Slider
10	Y-LINE-0	Y-line 4: Connected to Button 2
11	LED7	Touch Status LED for Button 2

Pin on EXT	Function	Description
12	LED1	Touch Status LED for Slider
13	Not Connected	
14	Not Connected	
15	LED2	Touch Status LED for Slider
16	LED 3	Touch Status LED for Slider
17	LED 4	Touch Status LED for Slider
18	LED 5	Touch Status LED for Slider
19	GND	Ground
20	VCC	Target Supply Voltage

4.3   Peripherals

4.3.1   LEDs

There are 8 LEDs, one LED for each key and 6 LEDs for sliders. All 8 LEDs are used to visualize touch on the QTouch technology slider and QTouch technology buttons.

4.3.2   Touch Sensors

The QT7 Xplained Pro has one self-capacitance QTouch technology slider sensor and two self-capacitance QTouch technology buttons.

5. Hardware Revision History and Known Issues

5.1 Identifying Product ID and Revision

The revision and product identifier of the 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.

When an Xplained Pro MCU board is connected to a computer with Atmel Studio 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 QT7 Xplained Pro is A09-3091.

5.2 Revision 3

Revision 3 of QT7 Xplained Pro (A09-3091/03) is the initial released version. There are no known issues.

6.   Document Revision History

Doc. rev.	Date	Comment
A	01/2018	Initial document release

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