
Atmel maXTouch Xplained Pro



Preface

Atmel® maXTouch Xplained Pro is an extension board to the Atmel Xplained Pro evaluation platform. The board enables the user to experiment with user interface applications with maXTouch® and LCD.

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1. Introduction

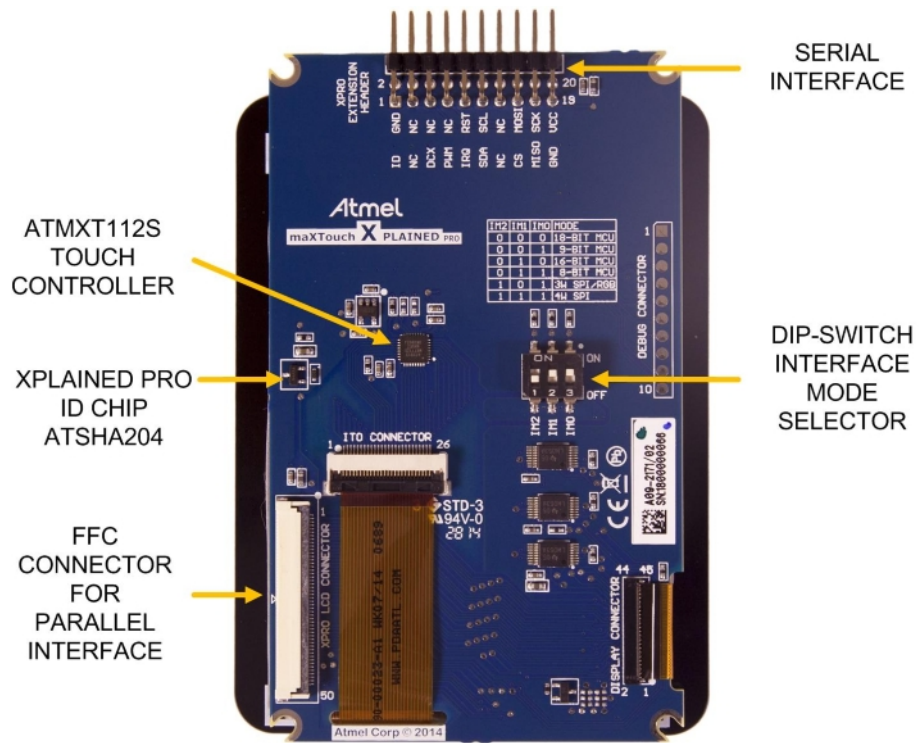
1.1 Features

- 4.3" Display module
 - ILI9488 LCD Driver
 - 320x480 Resolution
 - Parallel interface (up to 18-bit)
 - Parallel RGB interface
 - 3- and 4-wire SPI interface
 - maXTouch capacitive touch screen controller
- Xplained Pro hardware identification system
- Kit Contents
 - One 4.3" display module
 - One 50-way Flexible Flat Cable (FFC)
 - One 20-way Ribbon Cable
 - Four mounting screws and eight threaded spacers

1.2 Kit Overview

Atmel maXTouch Xplained Pro is an extension board for the Xplained Pro platform with a 320x480 RGB LCD and a capacitive touch sensor with a maXTouch controller. The LCD can be controlled via different interfaces, including 3- and 4-wire SPI, Parallel and RGB Parallel interface mode using the DIP-switch to select the interface. The maXTouch Xplained Pro kit connects to any Xplained Pro standard extension header on any Xplained Pro MCU board using the 20-pin header, but is limited to 3- and 4-wire SPI mode. maXTouch Xplained Pro also features a standard Xplained Pro LCD connector (FFC), which enables use of the parallel interfaces. Both connections features SPI interface for the LCD and I²C for the maXTouch device.

Figure 1-1. maXTouch Xplained Pro Extension Board



2. Getting Started

2.1 Three Steps to Start Exploring the Atmel Xplained Pro Platform

1. Download and install [Atmel Studio](#).
2. Launch Atmel Studio.
3. Connect maXTouch Xplained Pro to an Xplained Pro MCU board and connect a USB cable to DEBUG USB port on the Xplained Pro MCU board.

2.2 Connecting maXTouch Xplained Pro to the Xplained Pro MCU Board

Atmel maXTouch Xplained Pro has been designed to be connected to the Xplained Pro header marked EXT3. However it is compatible with all Xplained Pro EXT headers. Refer to the pin-out of your Xplained Pro evaluation kit to find out which Xplained Pro EXT headers that can be used. The Flexible Flat Cable (FFC) connector can be used if parallel interface from the MCU to the display is used on kits featuring the Xplained Pro LCD connector. (Only one cables should be connected at the same time.)

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) that is connected. Atmel Studio will present relevant information like datasheets and kit documentation. The kit landing page in Atmel Studio also have 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. No external programmer or debugger tool is needed.

2.3 Design Documentation and Related Links

The following list contains links to the most relevant documents and software for maXTouch Xplained Pro.

1. [Xplained Pro products](#)¹ - Atmel Xplained Pro is a series of small-sized and easy-to-use evaluation kits for Atmel AVR[®] 8- and 32-bit microcontrollers. It consists of a series of low cost MCU boards for evaluation and demonstration of features and capabilities of different MCU families.
2. [maXTouch Xplained Pro User Guide](#)² - PDF version of this User Guide.
3. [maXTouch Xplained Pro Design Documentation](#)³ - Package containing schematics, BOM, assembly drawings, 3D plots, layer plots etc.
4. [Atmel Studio](#)⁴ - Free Atmel IDE for development of C/C++ and assembler code for Atmel microcontrollers.

¹ <http://www.atmel.com/XplainedPro>

² http://www.atmel.com/Images/Atmel-42350-maXTouch-Xplained-Pro_User-Guide.pdf

³ http://www.atmel.com/Images/Atmel-42350-maXTouch-Xplained-Pro_User-Guide.zip

⁴ <http://www.atmel.com/atmelstudio>

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 that 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 that are connected through a set of standardized headers and connectors. Each extension board has an identification (ID) chip to uniquely identify which boards are mounted on a Xplained Pro MCU board. This information is used to present relevant user guides, application notes, datasheets, and example code through Atmel Studio. Available Xplained Pro MCU and extension boards can be purchased in the [Atmel Web Store](#)¹.

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 board 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. [Table 3-1, “Xplained Pro ID Chip Content” on page 6](#) 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 Standard 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 headers. Xplained Pro MCU boards have male headers while Xplained Pro extensions have their female counterparts. Note that all pins are not always connected. However, all the connected pins follow the defined pin-out described in [Table 3-2, “Xplained Pro Extension Header” on page 6](#). The extension headers can be used to connect a wide variety of Xplained Pro extensions to Xplained Pro MCU boards and to access the pins of the target MCU on Xplained Pro MCU board directly.

Table 3-2. Xplained Pro Extension Header

| Pin number | Name | Description |
|------------|--------|---|
| 1 | ID | Communication line to the ID chip on 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 positive part of differential PWM. |

¹ <http://store.atmel.com/CBC.aspx?q=c:100113>

| Pin number | Name | Description |
|------------|---------------|---|
| 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 | TWI_SDA | Data line for two-wire interface. Always implemented, bus type. |
| 12 | TWI_SCL | Clock line for two-wire interface. Always implemented, bus type. |
| 13 | USART_RX | Receiver line of Universal Synchronous and Asynchronous serial Receiver and Transmitter. |
| 14 | USART_TX | Transmitter line of Universal Synchronous and Asynchronous serial Receiver and Transmitter. |
| 15 | SPI_SS_A | Slave select for SPI. Should be unique if possible. |
| 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 LCD Connector

The LCD connector provides the ability to connect to display extensions that have a parallel interface. The connector implements signals for a MCU parallel bus interface and a RGB interface as well as signals for a touchcontroller. The connector pin-out definition is shown in [Table 3-3, “Xplained Pro LCD Connector” on page 7](#). Note that usually only one display interface is implemented, either RGB interface or MCU parallel bus interface.

A FPC/FFC connector with 50 pins and 0.5mm pitch is used for the LCD connector. The connector (XF2M-5015-1A) from Omron is used on several designs and can be used as a reference.

Table 3-3. Xplained Pro LCD Connector

| Pin number | Name | RGB interface description | MCU interface description |
|------------|------|---|---------------------------|
| 1 | ID | Communication line to ID chip on extension board. | |
| 2 | GND | | Ground |
| 3 | D0 | | Data line |
| 4 | D1 | | Data line |
| 5 | D2 | | Data line |
| 6 | D3 | | Data line |
| 7 | GND | | Ground |
| 8 | D4 | | Data line |
| 9 | D5 | | Data line |
| 10 | D6 | | Data line |
| 11 | D7 | | Data line |
| 12 | GND | | Ground |
| 13 | D8 | | Data line |
| 14 | D9 | | Data line |
| 15 | D10 | | Data line |
| 16 | D11 | | Data line |
| 17 | GND | | Ground |

| Pin number | Name | RGB interface description | MCU interface description |
|------------|------------------------|---|---|
| 18 | D12 | | Data line |
| 19 | D12 | | Data line |
| 20 | D14 | | Data line |
| 21 | D15 | | Data line |
| 22 | GND | | Ground |
| 23 | D16 | | Data line |
| 24 | D17 | | Data line |
| 25 | D18 | | Data line |
| 26 | D19 | | Data line |
| 27 | GND | | Ground |
| 28 | D20 | | Data line |
| 29 | D21 | | Data line |
| 30 | D22 | | Data line |
| 31 | D23 | | Data line |
| 32 | GND | | Ground |
| 33 | PCLK / CMD_DATA_SEL | Pixel clock | Display RAM select. One address line of the MCU for displays where it is possible to select either the register or the data interface. |
| 34 | VSYNC / CS | Vertical synchronization | Chip select |
| 35 | HSYNC / WE | Horizontal synchronization | Write enable signal |
| 36 | DATA ENABLE / RE | Data enable signal | Read enable signal |
| 37 | SPI SCK | Clock for Serial peripheral interface | |
| 38 | SPI MOSI | Master out slave in line of Serial peripheral interface | |
| 39 | SPI MISO | Master in slave out line of Serial peripheral interface | |
| 40 | SPI SS | Slave select for SPI. Should be unique if possible | |
| 41 | ENABLE | Display enable signal | |
| 42 | TWI SDA | I ² C data line (maXTouch [®]) | |
| 43 | TWI SCL | I ² C clock line (maXTouch) | |
| 44 | IRQ1 | maXTouch interrupt line | |
| 45 | IRQ2 | Interrupt line for other I ² C devices | |
| 46 | PWM | Backlight control | |
| 47 | RESET | Reset for both display and maXTouch | |
| 48 | VCC | 3.3V power supply for extension board | |
| 49 | VCC | 3.3V power supply for extension board | |
| 50 | GND | Ground | |

4. Hardware User Guide

4.1 Headers and Connectors

4.1.1 maXTouch Xplained Pro Extension Headers

maXTouch Xplained Pro implements one [Xplained Pro Standard Extension Header on page 6](#) marked with XPRO EXTENSION HEADER in silkscreen. This header makes it possible to connect the board to any Xplained Pro MCU board using a 20-pin ribbon cable (included in kit). maXTouch Xplained Pro also implements one [Xplained PRO standard LCD connector on page 7](#) marked with XPRO LCD CONNECTOR in silkscreen. The pin-out definition for the extension header can be seen in [Table 4-1, “maXTouch Xplained Pro Standard Extension Header” on page 9](#) and the pin-out for the LCD connector in [Table 4-2, “maXTouch Xplained Pro Xplained Pro LCD Connector” on page 9](#).

Table 4-1. maXTouch Xplained Pro Standard Extension Header

| Pin on EXT | Function | Description |
|------------|---------------|--|
| 1 | ID | Communication line to ID chip |
| 2 | GND | Ground |
| 3 | Not Connected | |
| 4 | Not Connected | |
| 5 | GPIO | Command/Data Select |
| 6 | Not Connected | |
| 7 | PWM | Backlight control |
| 8 | Not Connected | |
| 9 | GPIO/IRQ | IRQ from maXTouch controller |
| 10 | GPIO | RESET signal for maXTouch and LCD controller |
| 11 | I2C SDA | I2C Data line for maXTouch controller |
| 12 | I2C SCL | I2C Clock line for maXTouch controller |
| 13 | Not Connected | |
| 14 | Not Connected | |
| 15 | CS | CS line for LCD controller |
| 16 | SPI MOSI | SPI Data to LCD controller |
| 17 | SPI MISO | SPI Data from LCD controller |
| 18 | SPI SCK | SPI Clock line |
| 19 | GND | Ground |
| 20 | VCC | Target supply voltage |

Table 4-2. maXTouch Xplained Pro Xplained Pro LCD Connector

| Pin number | Name | RGB interface description | MCU interface description |
|------------|------|--|---------------------------|
| 1 | ID | Communication line to ID chip on extension board | |
| 2 | GND | | Ground |
| 3 | D0 | | Data line |
| 4 | D1 | | Data line |
| 5 | D2 | | Data line |
| 6 | D3 | | Data line |
| 7 | GND | | Ground |
| 8 | D4 | | Data line |
| 9 | D5 | | Data line |
| 10 | D6 | | Data line |

| Pin number | Name | RGB interface description | MCU interface description |
|------------|------------------------|---|--|
| 11 | D7 | | Data line |
| 12 | GND | | Ground |
| 13 | D8 | | Data line |
| 14 | D9 | | Data line |
| 15 | D10 | | Data line |
| 16 | D11 | | Data line |
| 17 | GND | | Ground |
| 18 | D12 | | Data line |
| 19 | D12 | | Data line |
| 20 | D14 | | Data line |
| 21 | D15 | | Data line |
| 22 | GND | | Ground |
| 23 | D16 | | Data line |
| 24 | D17 | | Data line |
| 25 | Not Connected | | |
| 26 | Not Connected | | |
| 27 | GND | | Ground |
| 28 | Not Connected | | |
| 29 | Not Connected | | |
| 30 | Not Connected | | |
| 31 | Not Connected | | |
| 32 | GND | | Ground |
| 33 | PCLK / CMD_DATA_SEL | Pixel clock | Display RAM select. One address line of the MCU for displays where it is possible to select either the register or the data interface |
| 34 | VSYNC / CS | Vertical synchronization | Chip select |
| 35 | HSYNC / WE | Horizontal synchronization | Write enable signal |
| 36 | DATA ENABLE / RE | Data enable signal | Read enable signal |
| 37 | SPI SCK | Clock for Serial peripheral interface | |
| 38 | SPI MOSI | Master out slave in line of Serial peripheral interface | |
| 39 | SPI MISO | Master in slave out line of Serial peripheral interface | |
| 40 | SPI SS | Slave select for SPI. Should be unique if possible | |
| 41 | Not Connected | | |
| 42 | TWI SDA | I ² C data line (maXTouch [®]) | |
| 43 | TWI SCL | I ² C clock line (maXTouch) | |
| 44 | IRQ1 | maXTouch interrupt line | |
| 45 | Not Connected | | |
| 46 | PWM | Backlight control | |
| 47 | RESET | Reset for both display and maxTouch | |
| 48 | VCC | 3.3V power supply for extension board | |

| Pin number | Name | RGB interface description | MCU interface description |
|------------|------|---------------------------------------|---------------------------|
| 49 | VCC | 3.3V power supply for extension board | |
| 50 | GND | Ground | |

4.1.2 Peripherals

4.1.2.1 maXTouch Capacitive Touch Controller

maXTouch Xplained Pro has a ATMXT112S capacitive touch controller that's accessible over I²C. See code examples in ASF for how to set up and use the touch controller.

4.1.2.2 Interface Selector

maXTouch Xplained Pro features a 3-way DIP-switch that is used for configuring the display interface mode. Setting the switch positions to ON, will result in a high level (1) for the IMx line. See [Table 4-3, "maXTouch Xplained Pro DIP-Switch Settings" on page 11](#)

Table 4-3. maXTouch Xplained Pro DIP-Switch Settings

| IM2 | IM1 | IM0 | Interface | Pins in use |
|-----|-----|-----|---------------------------------------|--|
| 0 | 0 | 0 | 18-bit parallel bus | DB[17:0], CS, D/C, WE, RE |
| 0 | 0 | 1 | 9-bit parallel bus | DB[8:0], CS, D/C, WE, RE |
| 0 | 1 | 0 | 16-bit parallel bus | DB[15:0], CS, D/C, WE, RE |
| 0 | 1 | 1 | 8-bit parallel bus | DB[7:0], CS, D/C, WE, RE |
| 1 | 0 | 1 | 18-bit RGB parallel mode ¹ | DB[17:0], HSYNC, VSYNC, PCLK, DE, MOSI, MISO, SCLK, CS |
| 1 | 0 | 1 | 3-wire/9-bit SPI mode ¹ | MOSI, MISO, SCLK, CS |
| 1 | 1 | 1 | 4-wire/8-bit SPI mode | MOSI, MISO, SCLK, CS, D/C |

Notes: ¹The setting for RGB parallel mode and 3-wire SPI is the same. To be able to use the RGB mode, the internal configuration registers needs to be set correctly using 3-wire SPI.

4.1.3 Mounting

The kit includes accessories for mounting the display module to a MCU board.

- Mounting accessories:
 - Four M2.5 x 5 mm screws
 - Four M2.5 x 20 mm hex spacers (male to female)
 - Four M2.5 x 10 mm hex spacers (female to female)

4.1.3.1 Board Stacking Options

maXTouch Xplained Pro display module is intended to be mountable on top, on the bottom or placed sideways to an Xplained Pro MCU board as shown in the following illustrations.

Figure 4-1. Side by Side Connection Option

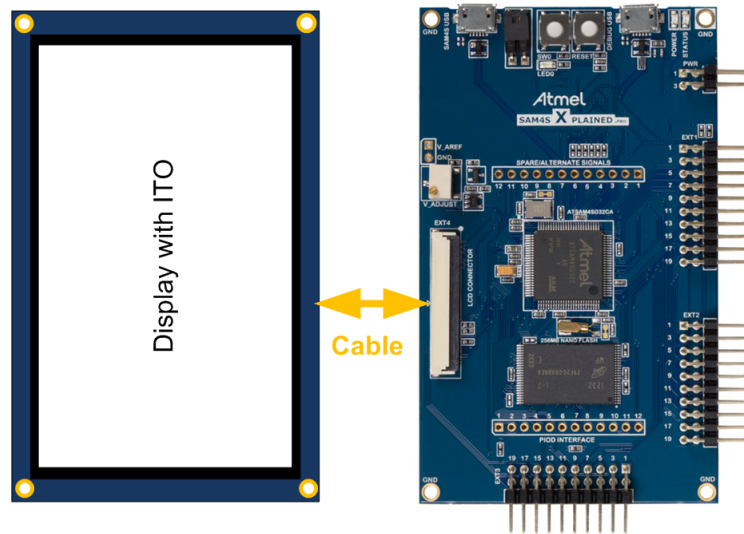


Figure 4-2. Top Side Mounting

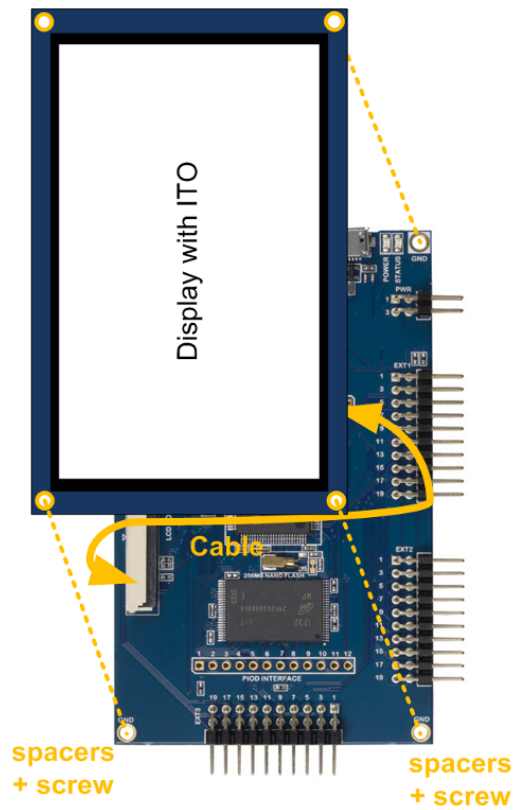
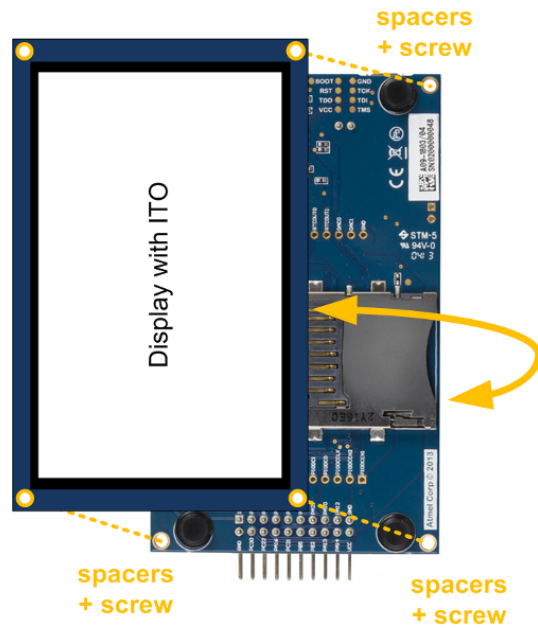


Figure 4-3. Bottom Side Mounting



The stacking is supported by spacers and screws. [Figure 4-4, “Display Module Top-Stacked” on page 13](#) shows an display module stacked on top of a MCU board. [Figure 4-5, “Display Module Bottom-Stacked” on page 14](#) shows an LCD board stacked on the bottom side of a MCU board, note that the MCU board has been flipped up-side down in this drawing. Both of these mounting configurations requires four long spacers (M2.5 x 20 mm, female/male), four short spacers (M2.5 x 10 mm, female/female) and four screws (M2.5 x 5 mm).

Figure 4-4. Display Module Top-Stacked

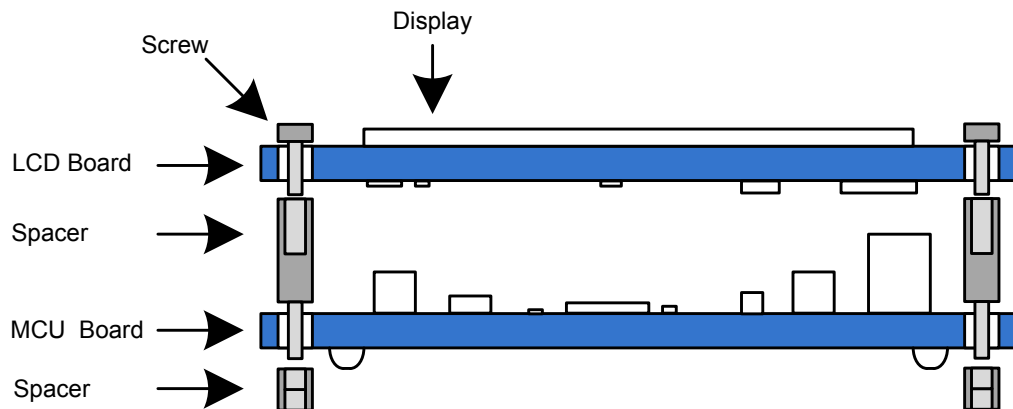
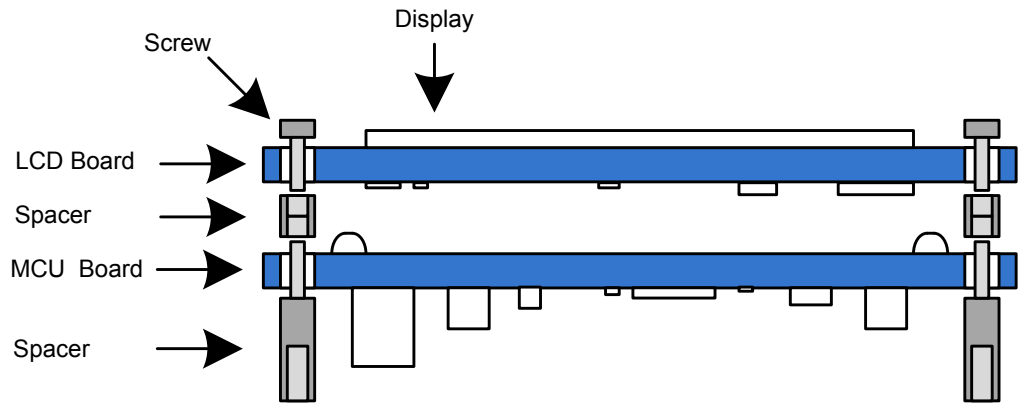


Figure 4-5. Display Module Bottom-Stacked



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, through Atmel Studio or by looking at the sticker on the bottom side of the PCB.

By connecting a 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 Kits 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 kit identifier for maXTouch Xplained Pro is 2171.

5.2 Revision 2

Revision 2 of maXTouch Xplained Pro (2171) is the initial released version.

6. Document Revision History

| Document revision | Date | Comment |
|-------------------|---------|---------------------------|
| 42350A | 11/2014 | 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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