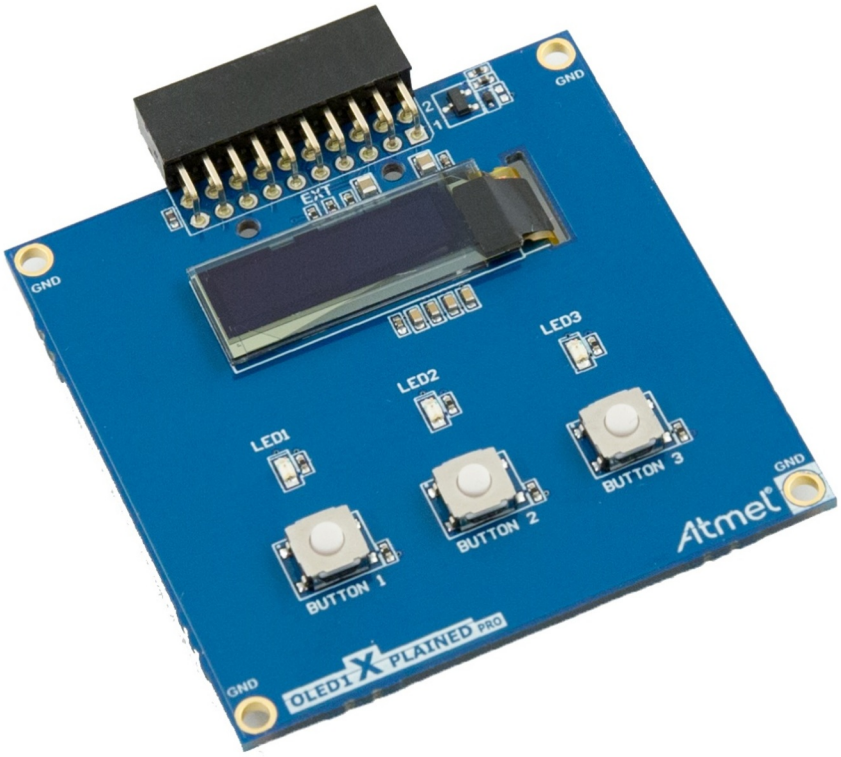
OLED1 Xplained Pro

OLED1 Xplained Pro User's Guide

Preface

Microchip OLED1 Xplained Pro is an extension board to the Microchip Xplained Pro evaluation platform. The board enables the user to experiment with user interface applications with buttons, LEDs, and a display.



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1. Introduction

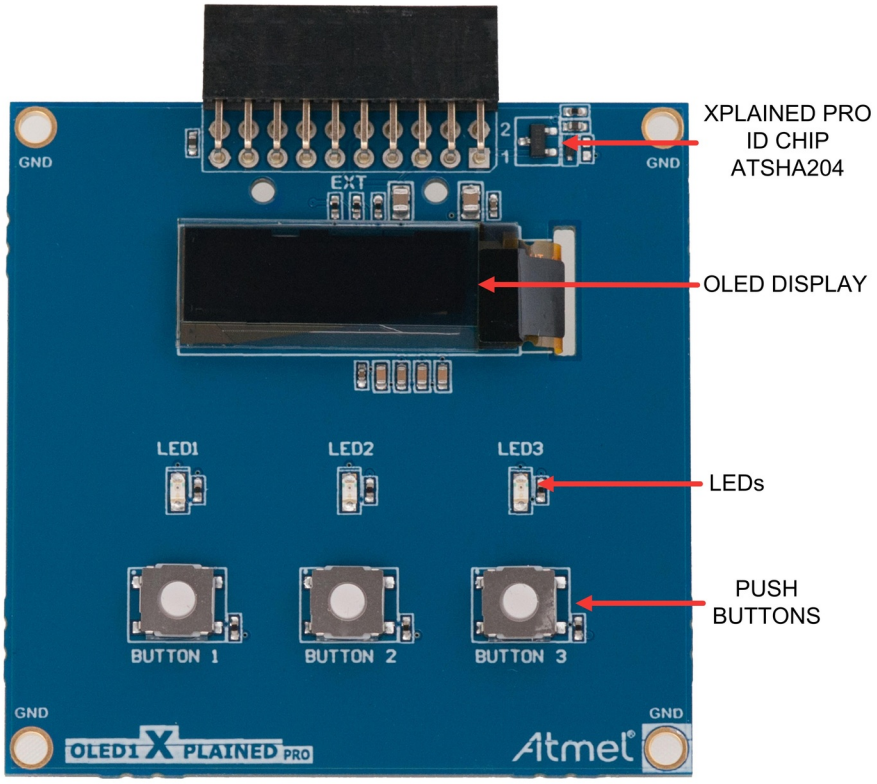
1.1 Features

- UG-2832HSWEG04 Monochrome OLED Display
  - 128 x 32 Pixels
  - Controlled By 4-wire SPI Interface, Up To 100 MHz
- Three LEDs
- Three Mechanical Push Buttons
- Xplained Pro Hardware Identification System

1.2 Kit Overview

OLED1 Xplained Pro is a basic extension board for the Xplained Pro platform with three LEDs, three push buttons, and an OLED display. The OLED display is controlled via a SPI interface up to 100 MHz. OLED1 Xplained Pro connects to any Xplained Pro standard extension header on any Xplained Pro MCU board.

Figure 1-1. OLED1 Xplained Pro Top Overview



2. Getting Started

2.1 Xplained Pro Quick Start

Steps to start exploring the Xplained Pro platform:

1. Download and install Atmel Studio/MPLAB® X.
2. Launch Atmel Studio/MPLAB® X.

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 Atmel Studio/MPLAB® X 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 target device is programmed and debugged by the on-board embedded debugger and, therefore, no external programmer or debugger tool is required.

2.2 Design Documentation and Relevant Links

The following list contains links to the most relevant documents and software for OLED1 Xplained Pro:

- **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 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 Studio** - Free IDE for the development of C/C++ and assembler code for microcontrollers.
- **Data Visualizer** - Data Visualizer is a program used for processing and visualizing data. The Data Visualizer can receive data from various sources such as serial ports and on-board debugger's Data Gateway Interface as found on Curiosity Nano and Xplained Pro boards.
- **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.
- **OLED1 Xplained Pro on Microchip web page** - Microchip website link.

3. Xplained Pro

Xplained Pro is an evaluation platform containing a series of microcontroller boards (evaluation kits) and extension boards. Atmel Studio/MPLAB® X 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 the Atmel Studio/MPLAB® X. 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 Headers and Connectors

3.2.1 Xplained Pro Standard Extension Header

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 to 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.

.....continued

Pin Number	Pin Name	Description
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^2C_SDA	Data pin for I^2C interface. Always connected, bus type.
12	I^2C_SCL	Clock pin for I^2C 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 User Guide

4.1 Electrical Characteristics

OLED1 Xplained Pro can be connected to several Xplained Pro MCU boards and manually connected to other hardware. Xplained Pro MCU board(s) that do 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. OLED1 Xplained Pro ID Chip Content

Data Field	Content
Product name	OLED1 Xplained Pro
Minimum operation voltage	3.0V
Maximum operation voltage	3.6V
Maximum current	10mA

See also Hardware Identification System.

4.2 Headers and Connectors

4.2.1 OLED1 Xplained Pro Extension Header

OLED1 Xplained Pro implements one Xplained Pro standard extension header marked with EXT in silkscreen. This header makes it possible to connect the board to any Xplained Pro MCU board. The pinout definition for the extension header can be seen in the table below.

Table 4-2. OLED1 Xplained Pro Extension Header

Pin Number	Function	Description
1	ID	Communication line to ID chip
2	GND	Ground
3	BUTTON2	Push button 2, active-low
4	BUTTON3	Push button 3, active-low
5	DATA_CMD_SEL	Data/command select for OLED display. High = data, low = command.
6	LED3	LED3, active-low
7	LED1	LED1, active-low
8	LED2	LED2, active-low
9	BUTTON1	Push button 1, active-low
10	DISPLAY_RESET	Reset line for OLED display, active-low
11	NC	
12	NC	
13	NC	
14	NC	

.....continued		
Pin Number	**Function**	**Description**
15	DISPLAY_SS	OLED display slave select, active-low
16	SPI MOSI	MOSI signal SPI connected to OLED display
17	NC	
18	SPI SCK	Clock signal for SPI connected to OLED display
19	GND	Ground
20	VCC	Target supply voltage

Related Links

3.2.1 Xplained Pro Standard Extension Header

4.3 Peripherals

4.3.1 LEDs

There are three yellow LEDs available on OLED1 Xplained Pro. The LEDs can be activated by driving the connected I/O line low.

Table 4-3. LED Connections

Pin On EXT Connector	Silk Screen Marking
7	LED1
8	LED2
6	LED3

4.3.2 Push Buttons

There are three push buttons available on OLED1 Xplained Pro. When a button is pushed, the corresponding I/O pin is connected to ground. There are no external pull-up resistors on OLED1 Xplained Pro, so internal pull-up resistors have to be enabled in the target microcontroller.

Info: Remember to enable internal pull-up resistors in the target device to get a defined electrical level on the I/O lines connected to the buttons.

Table 4-4. Push Buttons Connections

Pin On EXT Connector	Silk Screen Marking
9	BUTTON1
3	BUTTON2
4	BUTTON3

4.3.3 OLED Display

OLED1 Xplained Pro features a 128 x 32 pixel white monochrome OLED display, UG-2832HSWEG04, from WiseChip Semiconductor Inc. The display has a SSD1306 display controller by Solomon Systech built in and is controlled via a 4-wire SPI interface + reset with the signals described in the table below. The data sheets for the display module or the display controller is not publicly available and has to be acquired from the respective manufacturers.

Info:
Note that the OLED display does not have a SPI MISO signal. That means that data can only be written to the display, not read.

Table 4-5. OLED Display Connections

Pin On EXT Connector	Signal Name	Description
16	SPI_MOSI	SPI master out, slave in signal. Used to write data to the display.
18	SPI_SCK	SPI clock signal, generated by the master.
5	DATA_CMD_SEL	Data/command select. Used to choose whether the communication is data to the display memory or a command to the LCD controller.
15	DISPLAY_SS	SPI slave select signal, must be held low during SPI communication.
10	DISPLAY_RESET	Reset signal to the OLED display, active-low. Used during initialization of the display.

5. Hardware Revision History and Known Issues

5.1 Identifying Product ID and Revision

There are two ways to find the revision and product identifier of the Xplained Pro boards: either through Atmel Studio/ MPLAB® X 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/MPLAB® X 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 OLED1 Xplained Pro is A09-1769.

5.2 Revision 3

Revision 3 of OLED1 Xplained Pro is the initial released version.

OLED1 Xplained Pro boards with a serial number that ends with a number lower than 11148 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
A	02/2020	Converted to Microchip format and replaced the Atmel document number 42077C.
42077C	03/2016	Added electrical characteristics
42077B	09/2013	Added errata about revision 3 of the board
42077A	02/2013	First release

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