

## Introduction

Author: Phillip Olk, Microchip Technology Inc.

This application note outlines how to get started with the AVR® EA Family of microcontrollers. Refer to the data sheet for further information on the differences between the AVR® EA Family devices.

## Features Presented in this Document

- Getting Started with AVR® EA Family Microcontrollers and Tools
- Getting Started with AVR64EA48 Curiosity Nano and Microchip Studio 7.0
- Getting Started with AVR64EA48 Curiosity Nano and MPLAB® X
- Code Examples on MPLAB Discover and GitHub

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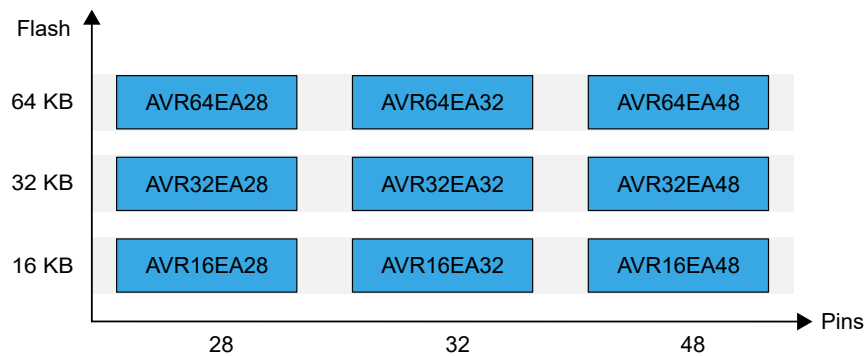
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## 1. Relevant Devices

This section lists the relevant devices for this document. The following figures show the different family devices, laying out pin count variants and memory sizes:

- Vertical migration upwards is possible without code modification, as these devices are pin-compatible and provide the same or more features
- Horizontal migration to the left reduces the pin count and, therefore, the available features
- Devices with different Flash memory sizes typically also have different SRAM and EEPROM

**Figure 1-1.** AVR® EA Family Overview



## 2. Get the Device Data Sheet

### Product pages

- AVR16EA28: [www.microchip.com/wwwproducts/en/AVR16EA28](http://www.microchip.com/wwwproducts/en/AVR16EA28)
- AVR16EA32: [www.microchip.com/wwwproducts/en/AVR16EA32](http://www.microchip.com/wwwproducts/en/AVR16EA32)
- AVR16EA48: [www.microchip.com/wwwproducts/en/AVR16EA48](http://www.microchip.com/wwwproducts/en/AVR16EA48)
- AVR32EA28: [www.microchip.com/wwwproducts/en/AVR32EA28](http://www.microchip.com/wwwproducts/en/AVR32EA28)
- AVR32EA32: [www.microchip.com/wwwproducts/en/AVR32EA32](http://www.microchip.com/wwwproducts/en/AVR32EA32)
- AVR32EA48: [www.microchip.com/wwwproducts/en/AVR32EA48](http://www.microchip.com/wwwproducts/en/AVR32EA48)
- AVR64EA28: [www.microchip.com/wwwproducts/en/AVR64EA28](http://www.microchip.com/wwwproducts/en/AVR64EA28)
- AVR64EA32: [www.microchip.com/wwwproducts/en/AVR64EA32](http://www.microchip.com/wwwproducts/en/AVR64EA32)
- AVR64EA48: [www.microchip.com/wwwproducts/en/AVR64EA48](http://www.microchip.com/wwwproducts/en/AVR64EA48)

### Documents

- AVR EA Product Brief (.pdf)
- AVR64EA Data Sheet (.pdf)
- AVR64EA Silicon Errata and Data Sheet Clarifications (.pdf)

The documentation for the AVR® EA Family is split into two document types:

- Data sheet<sup>(1)</sup> (includes device description, number of peripherals, pinout and electrical characteristics)
- Errata (includes known errata for the device)

### Note:

1. For devices that are future products, the product brief is available instead of the data sheet.

### 3. Relevant Documents

All relevant documents can be found under the documentation tab on the product page.

Below is a list of documents relevant to the AVR® EA Family Microcontrollers.

**Table 3-1.** Application Notes and Example Code

Publication	MPLAB Discover
<a href="#">AN4886 - Acquiring Analog Sensor Data in Low-Power Applications</a>	<a href="#">MPLAB X, Microchip Studio</a>
<a href="#">AN4515 - Processing Analog Sensor Data with Digital Filtering</a>	<a href="#">MPLAB X, Microchip Studio</a>



The MPLAB Discover webpage: [MPLAB Discover](#)



### Code Examples

Finding code examples for devices in the AVR EA Family can be done by searching for the device name, e.g., AVR64EA48, in the search bar.

You can download code examples as a .zip file directly from MPLAB Discover. Repositories ending with "studio" can be opened in Microchip Studio. Repositories ending with "mplab-mcc" can be opened in MPLAB X.

When the code example is hosted on [GitHub](#), MPLAB Discover provides a link "Open with Github". There you can download the example code or use the git tool on your PC to create a local repository clone.

## 4.3 Get Microchip Studio 7.0

Webpage: [Microchip Studio](#)

### Document/file:

- Microchip Studio for AVR and SAM Devices 7.0 Installer (.exe)

Microchip Studio 7.0 1.0.18 or later is the preferred IDE for developing and debugging firmware for the AVR® EA Family.

For device support, refer to [4.4. Get Device Support for Microchip Studio](#).

## 4.4 Get Device Support for Microchip Studio

**Microchip Studio:** Use the Device Pack Manager, found under Tools → Device Pack Manager, to add support for new devices in Microchip Studio.

For the AVR® EA Family, update to the latest version by performing the following steps:

1. Click **Check for Updates**.
2. For AVR® EA Family, select the latest version of *AVR-Ex\_DFP*.
3. Click **Install**.

For offline installers, go to [packs.download.atmel.com/](https://packs.download.atmel.com/). Double click on the installer file and follow the instructions to install a package. Any open Microchip Studio window must be closed for the installation to take effect.

**IAR™:** Install the latest service pack to add support for new devices in IAR Embedded Workbench. The service pack is available at *My Pages* on <https://iar.com> (*MyPages* is available for users with registered IAR™ licenses using the same email address used to register the license).

## 4.5 Get MPLAB® X

**Webpage:** [MPLAB® X IDE](#)

**Document/file:**

- MPLAB X

MPLAB X can be utilized as an IDE for developing and debugging the firmware for the AVR® EA Family.

For device support, refer to [4.6. Get Device Support for MPLAB X](#).

## 4.6 Get Device Support for MPLAB® X

**MPLAB X:** Use the MPLAB Pack Manager, found under Tools → Packs, to add support for new devices in MPLAB X.

For the AVR® EA Family, update to the latest version by performing the following steps:

1. Click **Check for Updates**.
2. For the AVR® EA Family, select the latest available version of *AVR-Ex\_DFP*.
3. Click **Install**.

For offline installers, go to [packs.download.microchip.com/](https://packs.download.microchip.com/). Double click on the installer file and follow the instructions to install a package. Any open MPLAB X window must be closed for the installation to take effect.

## 4.7 Get MPLAB® Code Configurator

**Webpage:** [MPLAB® Code Configurator](#)

**Document/file:**

- MCC Melody

MPLAB® Code Configurator (MCC) Melody can be utilized within MPLAB® X IDE as a graphical programming interface that generates peripherals and library code for the AVR® EA Family.

## 5. Microchip Studio Users Getting Started

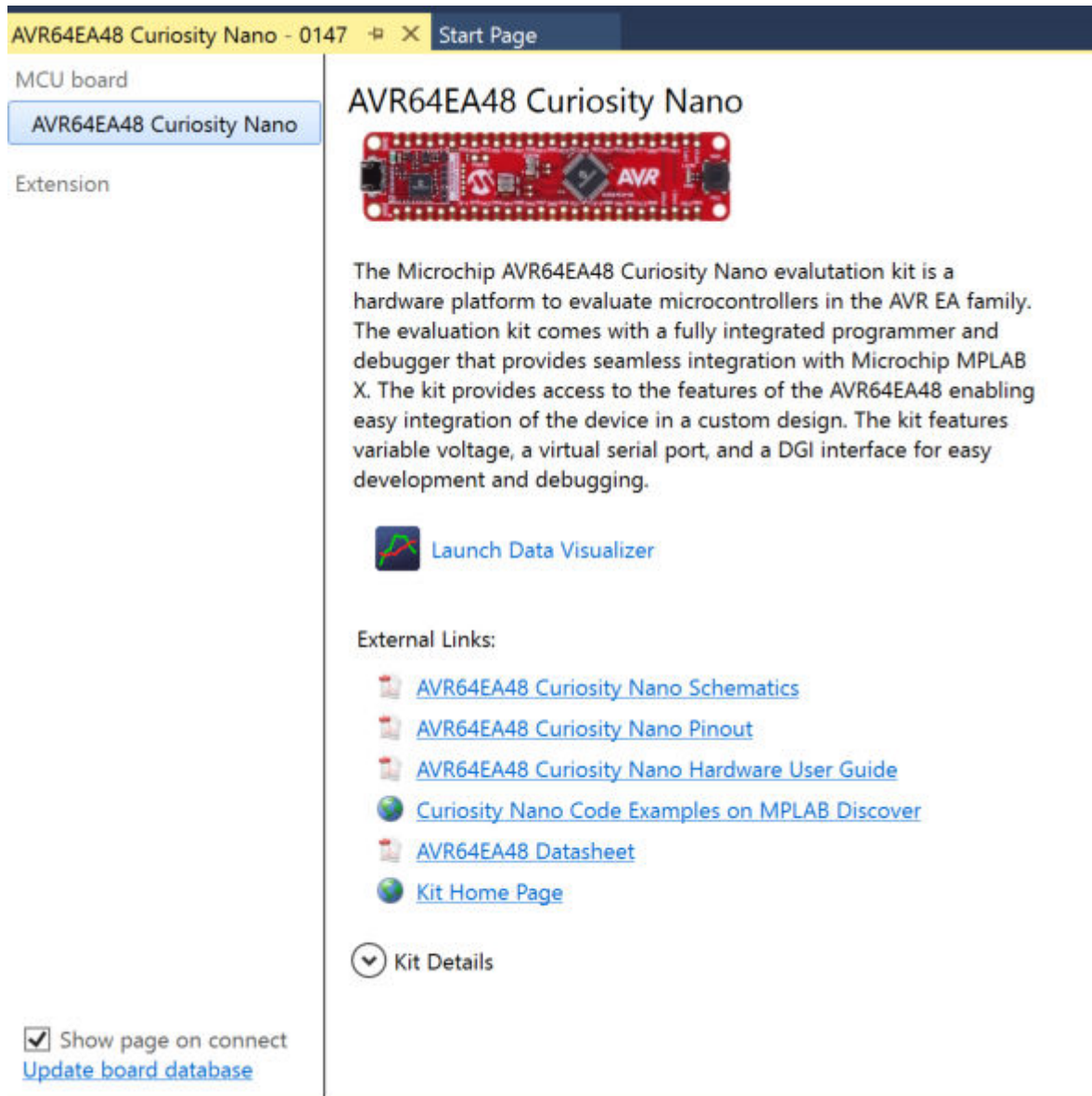
### 5.1 Microchip Studio with AVR64EA48 Curiosity Nano

#### Prerequisites

- Microchip Studio 7.0.2594 or later installed
- The AVR64EA48 Curiosity Nano Board is connected to Atmel Studio 7.0 via the on-board USB connector, which is connected to the embedded debugger. The kit will be powered by the USB, and the embedded debugger will enable debugging and programming via the USB.

#### Workflow

1. Launch Microchip Studio 7.0.
2. The page shown below will appear when AVR64EA48 Curiosity Nano is connected to Atmel Studio 7.0.

**Figure 5-1.** AVR64EA48 Curiosity Nano Page in Microchip Studio


AVR64EA48 Curiosity Nano - 0147 Start Page

MCU board


AVR64EA48 Curiosity Nano

Extension







## AVR64EA48 Curiosity Nano




The Microchip AVR64EA48 Curiosity Nano evaluation kit is a hardware platform to evaluate microcontrollers in the AVR EA family. The evaluation kit comes with a fully integrated programmer and debugger that provides seamless integration with Microchip MPLAB X. The kit provides access to the features of the AVR64EA48 enabling easy integration of the device in a custom design. The kit features variable voltage, a virtual serial port, and a DGI interface for easy development and debugging.

 [Launch Data Visualizer](#)

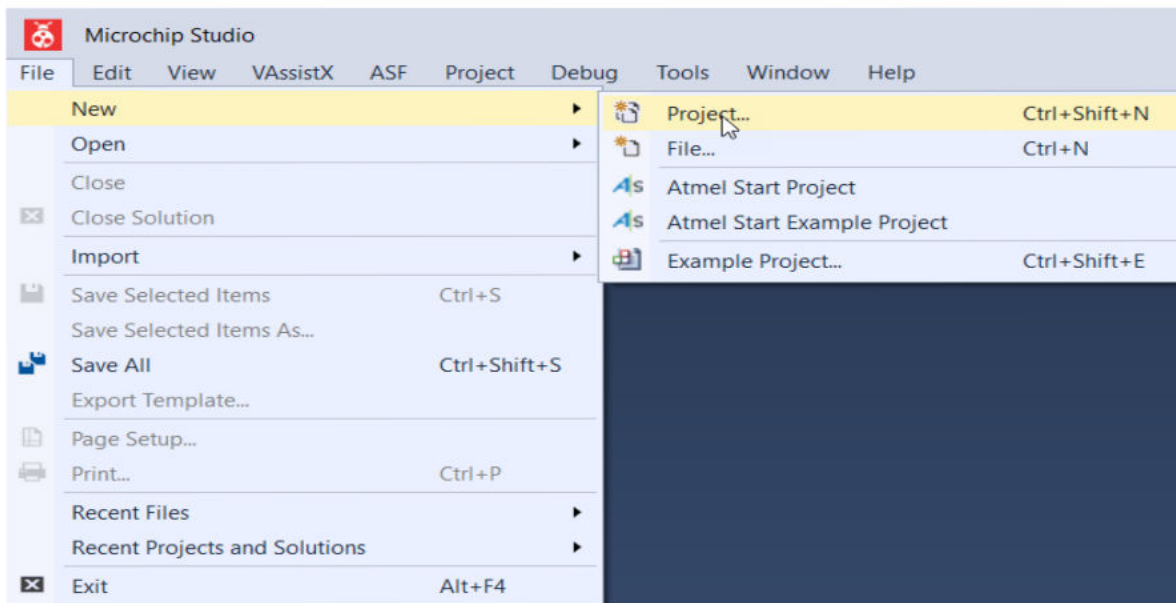
External Links:

-  [AVR64EA48 Curiosity Nano Schematics](#)
-  [AVR64EA48 Curiosity Nano Pinout](#)
-  [AVR64EA48 Curiosity Nano Hardware User Guide](#)
-  [Curiosity Nano Code Examples on MPLAB Discover](#)
-  [AVR64EA48 Datasheet](#)
-  [Kit Home Page](#)

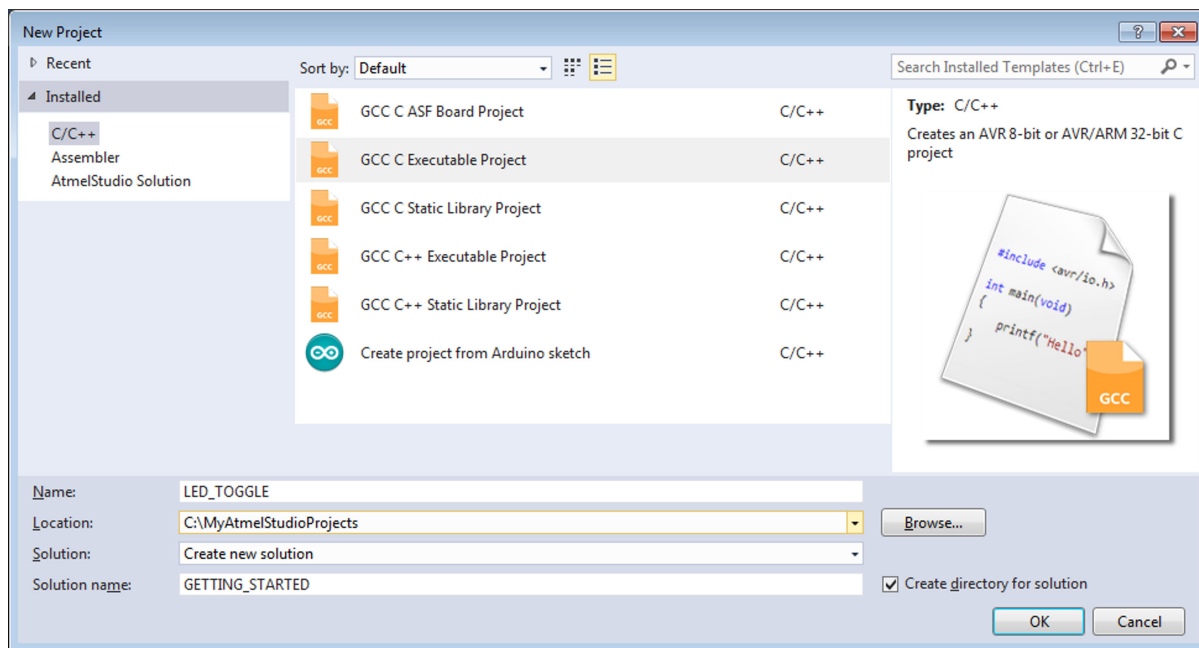
 Kit Details

Show page on connect  
[Update board database](#)

3. Start creating a new project by clicking **New → Project...** or by using the **Ctrl+Shift+N** shortcut, as shown in [Figure 5-2](#).

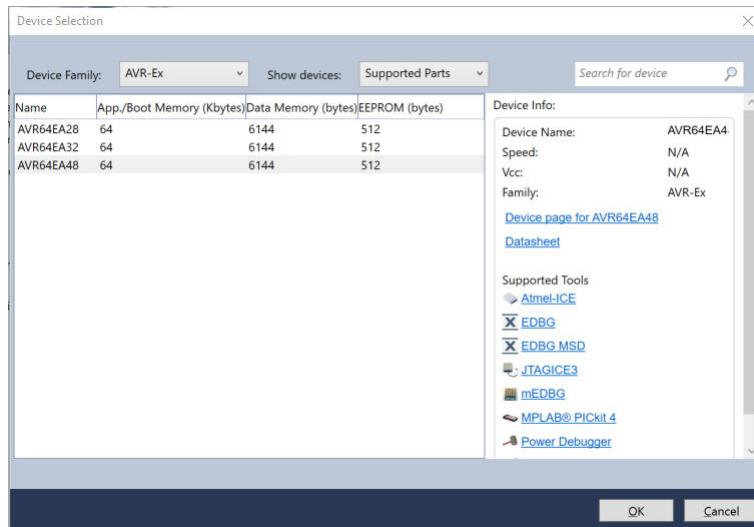
**Figure 5-2.** Create New Project in Microchip Studio

4. Select the **GCC C Executable Project** template, as shown in [Figure 5-3](#), type in the name of the solution and project (e.g., *GETTING\_STARTED* and *LED\_TOGGLE*), and click **OK**.

**Figure 5-3.** New Project Wizard

5. Select AVR64EA48 as shown in [Figure 5-4](#), and click **OK**.

Figure 5-4. Device Selection Wizard



A new project with a `main.c` file associated will be generated in Microchip Studio.

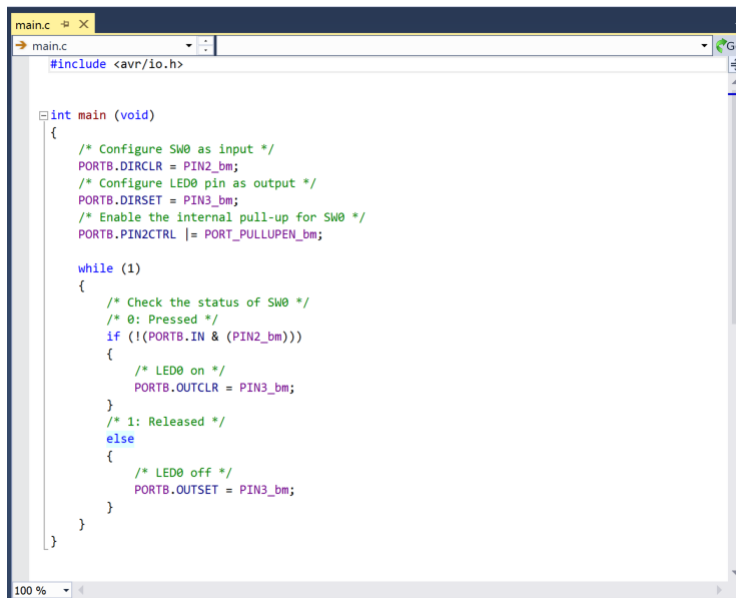
- Replace the `main.c` file with the following code snippet:

```
int main (void)
{
    /* Configure SW0 as input */
    PORTB.DIRCLR = PIN2_bm;
    /* Configure LED0 pin as output */
    PORTB.DIRSET = PIN3_bm;
    /* Enable the internal pull-up for SW0 */
    PORTB.PIN2CTRL |= PORT_PULLUPEN_bm;

    while (1)
    {
        /* Check the status of SW0 */
        /* 0: Pressed */
        if (!(PORTB.IN & (PIN2_bm)))
        {
            /* LED0 on */
            PORTB.OUTCLR = PIN3_bm;
        }
        /* 1: Released */
        else
        {
            /* LED0 off */
            PORTB.OUTSET = PIN3_bm;
        }
    }
}
```

In the code editor, the code will appear, as shown in Figure 5-5.

Figure 5-5. Code Editor Window



```

main.c
main.c
#include <avr/io.h>

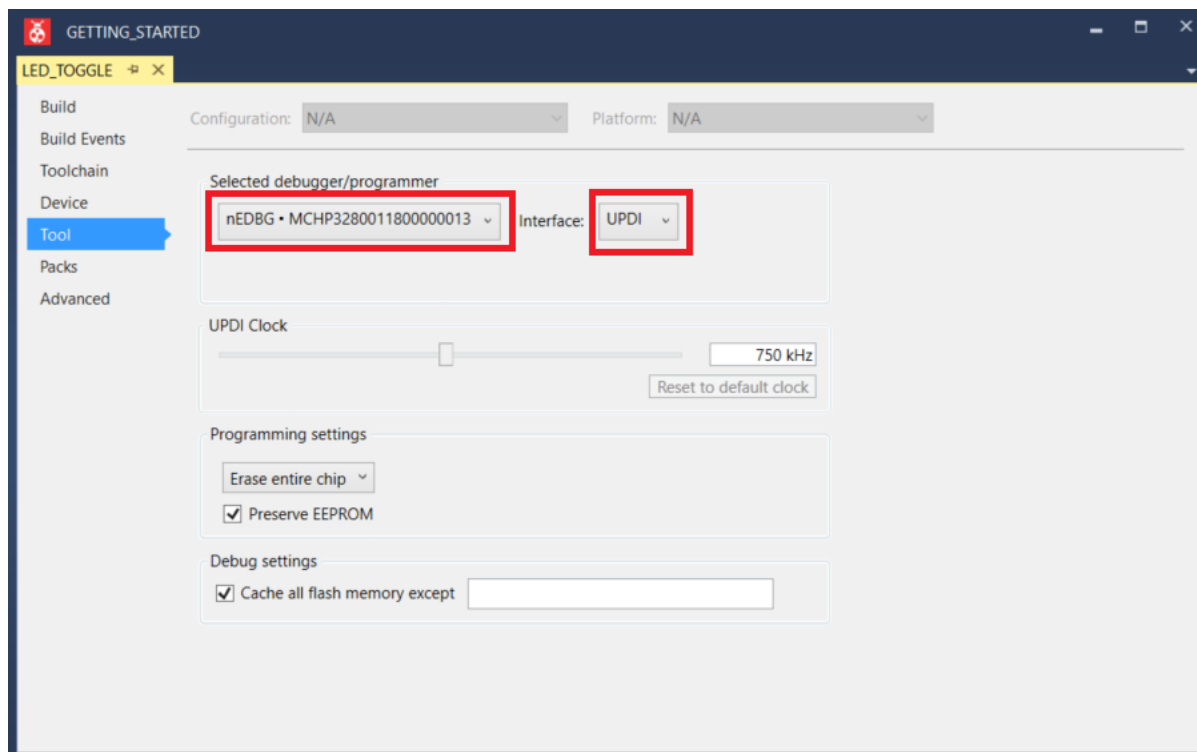
int main (void)
{
    /* Configure SW0 as input */
    PORTB.DIRCLR = PIN2_bm;
    /* Configure LED0 pin as output */
    PORTB.DIRSET = PIN3_bm;
    /* Enable the internal pull-up for SW0 */
    PORTB.PIN2CTRL |= PORT_PULLUPEN_bm;

    while (1)
    {
        /* Check the status of SW0 */
        /* 0: Pressed */
        if (!(PORTB.IN & (PIN2_bm)))
        {
            /* LED0 on */
            PORTB.OUTCLR = PIN3_bm;
        }
        /* 1: Released */
        else
        {
            /* LED0 off */
            PORTB.OUTSET = PIN3_bm;
        }
    }
}
100%

```

7. Open project properties by clicking **Project** → **Properties** or by using the **ALT+F7** shortcut.
8. In the **Tool** view (see Figure 5-6), set *Selected debugger/programmer* to nEDBG and *Interface* to UPDI.

Figure 5-6. Debugger and Interface for AVR64EA48



9. Build the project by clicking **Build** → **Build Solution** or by using the **F7** shortcut.
10. Program AVR64EA48 with the project code and start debugging by clicking **Debug** → **Start debugging and break** or by using the **ALT+F5** shortcut. The application is programmed onto the device, and program execution will break in the `main()` function.

11. Run the code by clicking **Debug → Continue** or by using the **F5** shortcut.
12. Verify that LED0 is lit when SW0 is pushed on the AVR64EA48 Curiosity Nano.

## 6. MPLAB® X Users Getting Started

### 6.1 MPLAB® X with AVR64EA48 Curiosity Nano

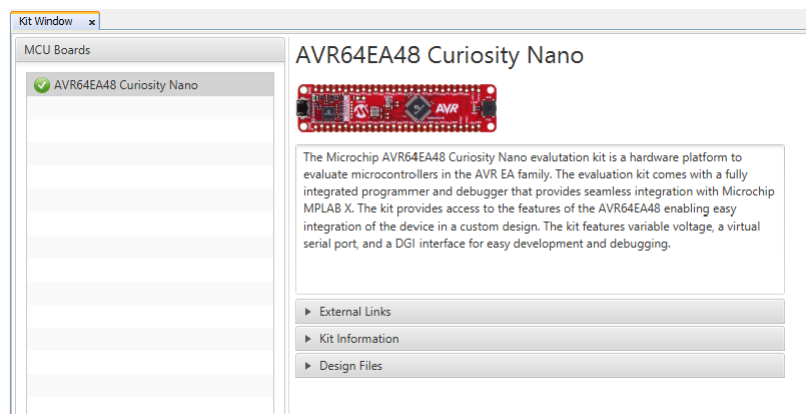
#### Prerequisites

- MPLAB X installed
- The AVR64EA48 Curiosity Nano Board is connected to MPLAB X via the on-board USB connector connected to the embedded debugger. The USB powers the kit, and the embedded debugger will enable debugging and programming via the USB.

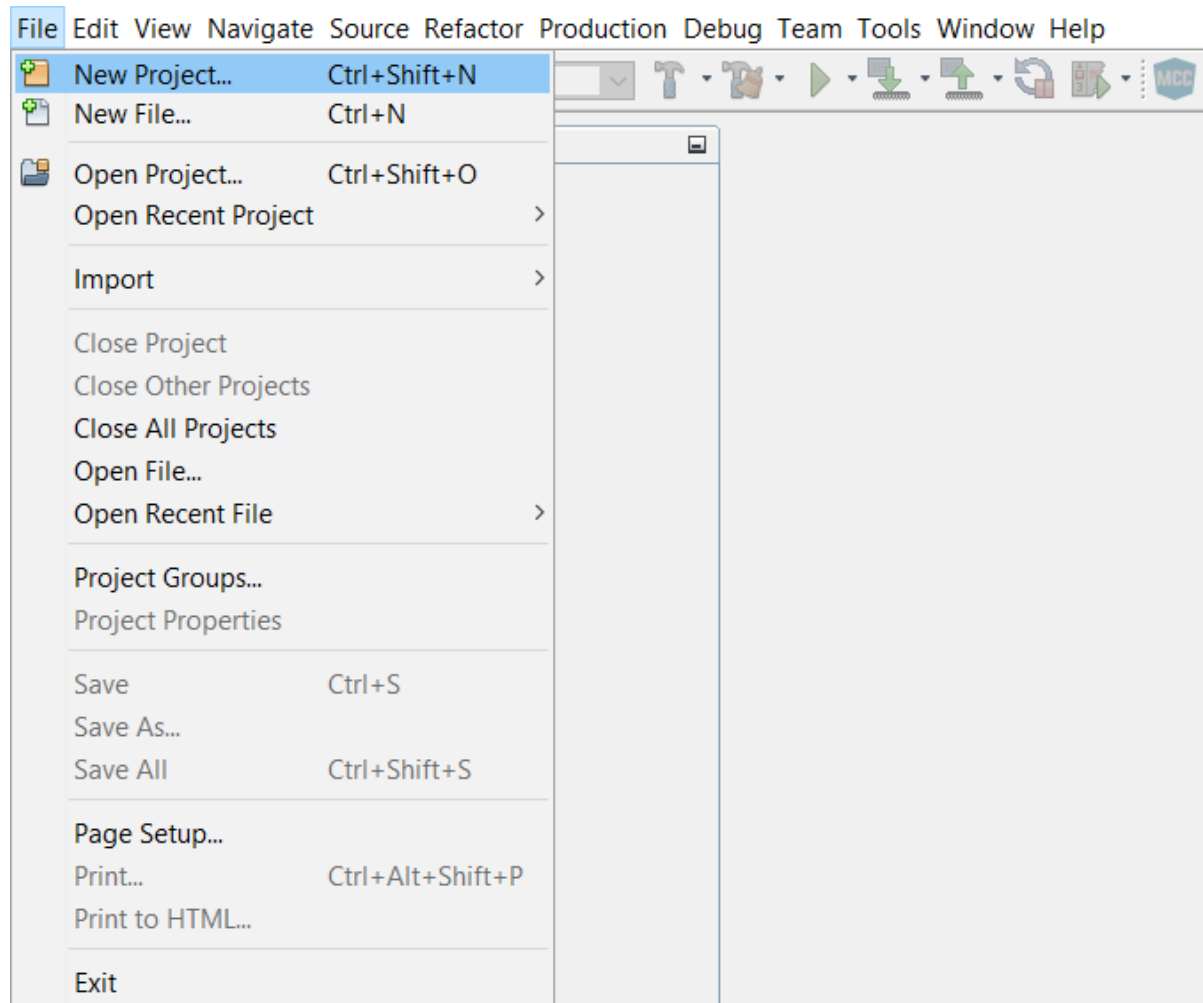
#### Workflow

1. Launch MPLAB X.
2. The page shown in [Figure 6-1](#) will appear when AVR64EA48 Curiosity Nano is connected to MPLAB X.

**Figure 6-1.** AVR64EA48 Curiosity Nano Page in MPLAB® X

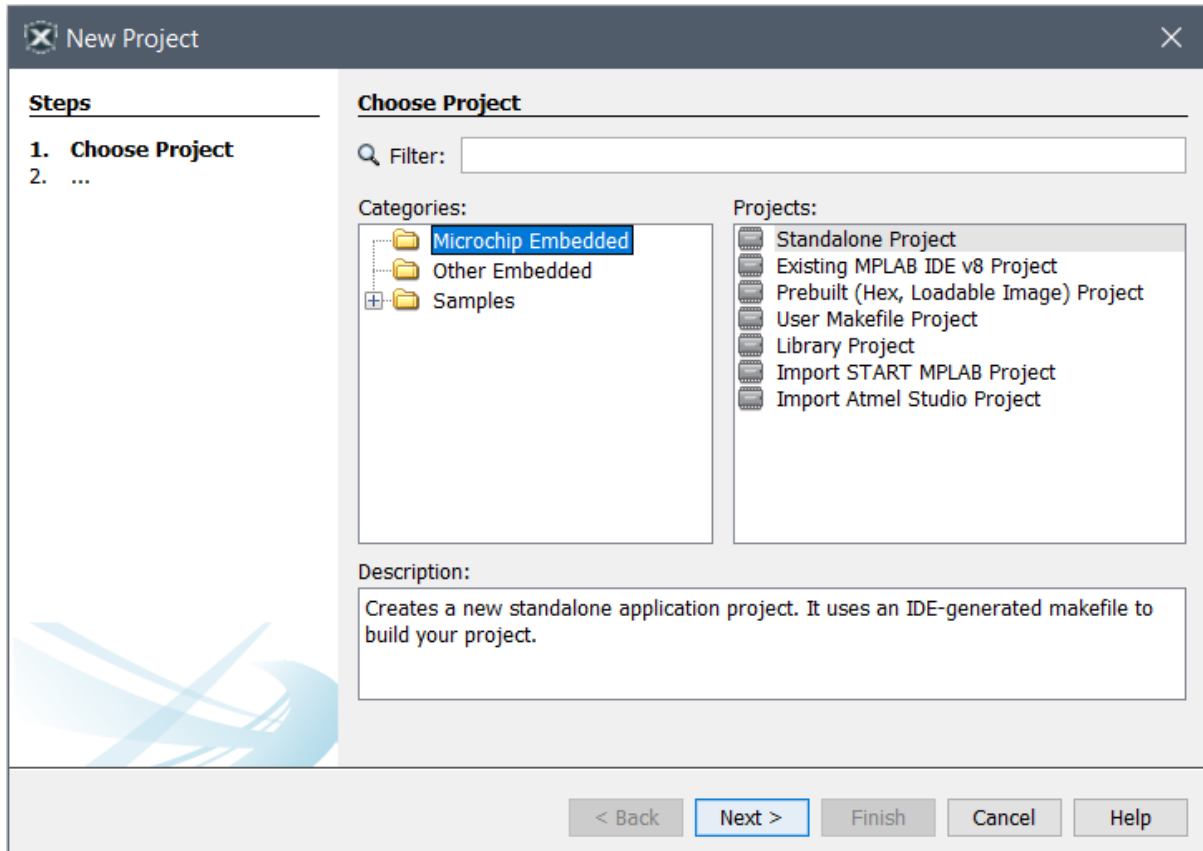


3. Start creating a new project by clicking **File → New Project...** or using the **Ctrl+Shift+N** shortcut, as shown in [Figure 6-2](#).

**Figure 6-2.** Create New Project in MPLAB® X

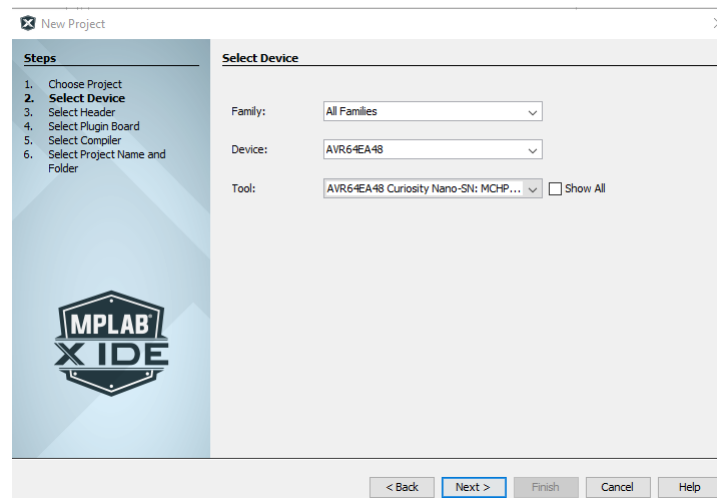
4. Select the **Categories** → **Microchip Embedded** and **Projects** → **Standalone Project** template from [Figure 6-7](#), and click **Next**.

Figure 6-3. New Project Window



5. Select AVR64EA48 (see [Figure 6-4](#)) and click **Next**.

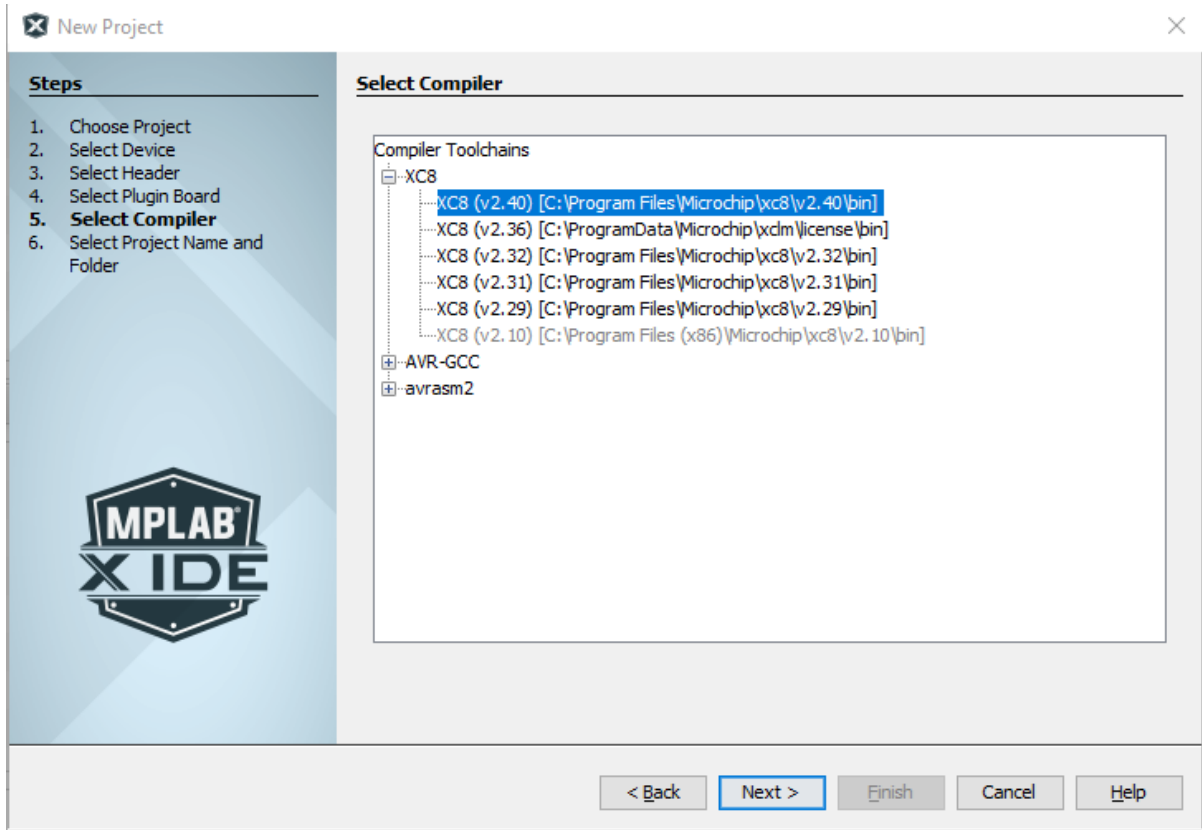
Figure 6-4. Device Selection Window



Then select the board and the desired compiler, if there are any.

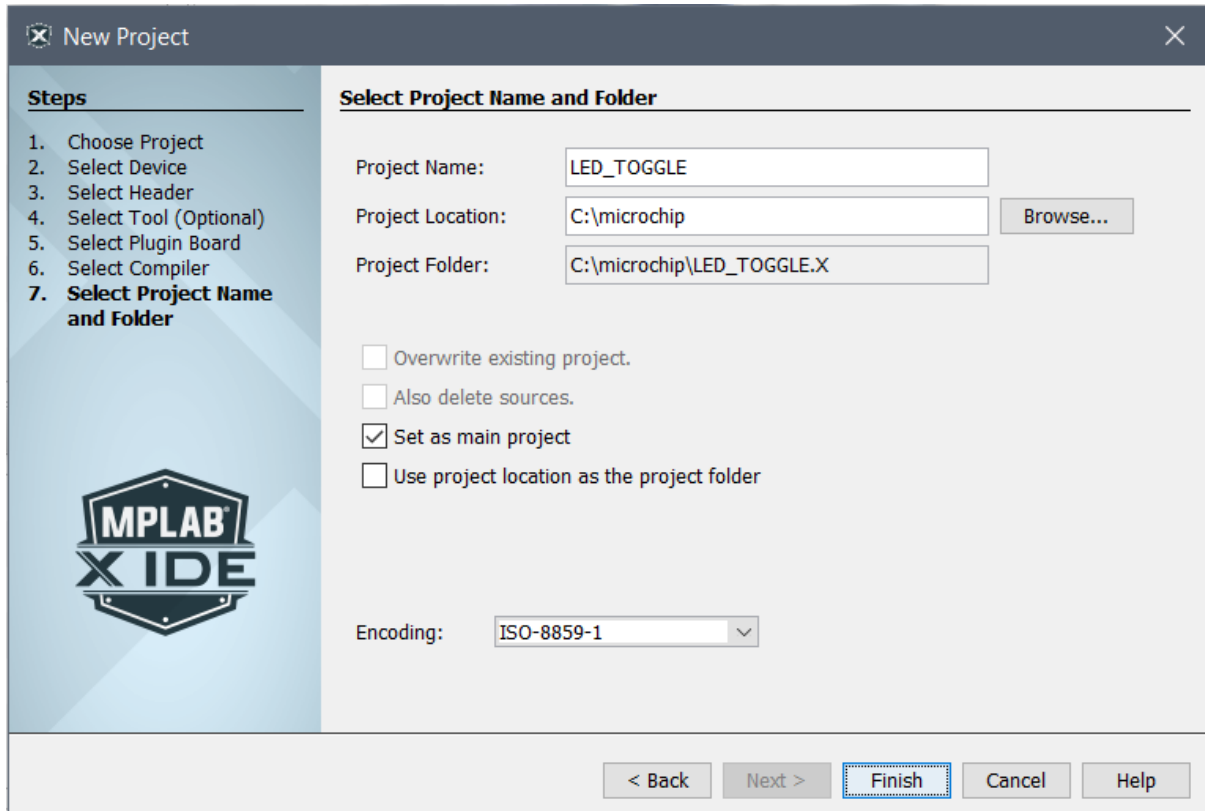
6. Select an available compiler (e.g., XC8 (v.2.40)), and click **Finish**.

Figure 6-5. Compiler Selection Window

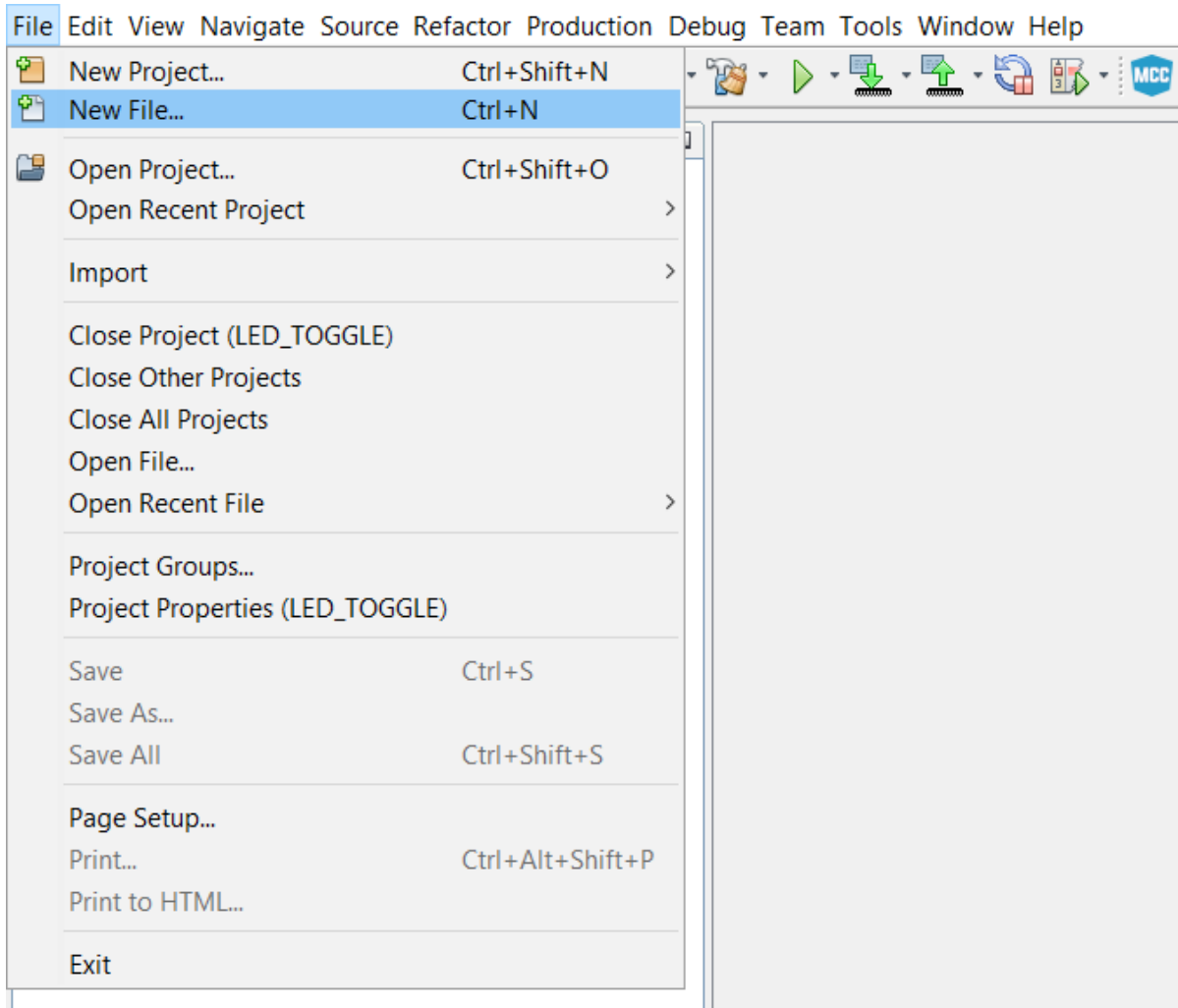


7. Type in the name of the project (e.g., *LED\_TOGGLE*) and the project location (e.g., *C:\microchip*), and click **Finish**.

Figure 6-6. Project Name and Location Selection Window

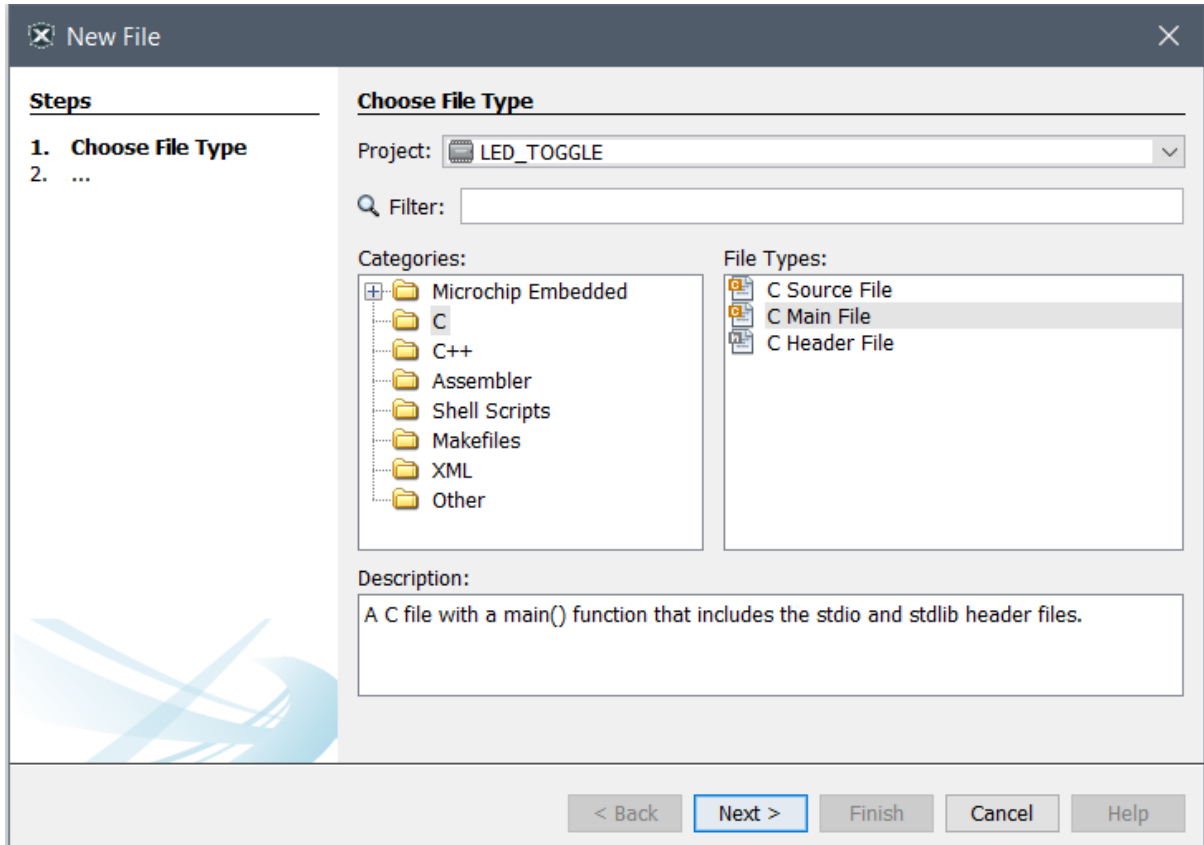


8. Create a new `main.c` file by clicking **File** → **New File...** or using the **Ctrl+N** shortcut, as shown in Figure 6-7.

**Figure 6-7.** Create a New File in MPLAB® X

9. Select the **Categories → C** and **File Types → C Main File** template from [Figure 6-8](#), and click **Next**.

Figure 6-8. New File Window



10. Type in the file name (e.g., *main*) and click **Finish**.

Figure 6-9. File Name Window

11. Replace the `main.c` file with the following code snippet:

```
int main (void)
{
    /* Configure SW0 as input */
    PORTB.DIRCLR = PIN2_bm;
    /* Configure LED0 pin as output */
    PORTB.DIRSET = PIN3_bm;
    /* Enable the internal pull-up for SW0 */
    PORTB.PIN2CTRL |= PORT_PULLUPEN_bm;

    while (1)
    {
        /* Check the status of SW0 */
        /* 0: Pressed */
        if (!(PORTB.IN & (PIN2_bm)))
        {
            /* LED0 on */
            PORTB.OUTCLR = PIN3_bm;
        }
        /* 1: Released */
        else
        {
            /* LED0 off */
            PORTB.OUTSET = PIN3_bm;
        }
    }
}
```

Add `#include<avr/io.h>` in `main.c`. In the code editor, the code will appear as shown in [Figure 6-10](#).

Figure 6-10. Code Editor Window

```

1
2  #include <avr/io.h>
3
4  int main (void)
5  {
6      /* Configure SW0 as input */
7      PORTB.DIRCLR = PIN2_bm;
8      /* Configure LED0 pin as output */
9      PORTB.DIRSET = PIN3_bm;
10     /* Enable the internal pull-up for SW0 */
11     PORTB.PIN2CTRL |= PORT_PULLUPEN_bm;
12
13     while (1)
14     {
15         /* Check the status of SW0 */
16         /* 0: Pressed */
17         if (!(PORTB.IN & (PIN2_bm)))
18         {
19             /* LED0 on */
20             PORTB.OUTCLR = PIN3_bm;
21         }
22         /* 1: Released */
23         else
24         {
25             /* LED0 off */
26             PORTB.OUTSET = PIN3_bm;
27         }
28     }
29 }
30

```

12. Build the code by clicking on **Production** → **Clean and Build Main Project** or using the **Shift + F11** shortcut.
13. Program AVR64EA48 with the project code and start debugging by clicking **Debug** → **Debugging Main Project**.
14. Verify that LED0 is lit when SW0 is pushed on the AVR64EA48 Curiosity Nano.

## 7. What's Next

For further information on related AVR products and IDE, refer to the links below:

### Software:

- [MPLAB X](#)
- [Microchip Studio](#)
- Microchip Studio help: **Help** → **View Help** (shortcut **CTRL+F1**)
- [Microchip Gallery](#)
- IAR Embedded Workbench for AVR: Go to [www.iar.com](http://www.iar.com), and search for "AVR."

### Firmware:

- [MPLAB Discover examples](#)
- [GitHub examples](#)

### Hardware:

- [AN2519: AVR Microcontroller Hardware Design Considerations](#)
- [AVR IBIS files](#)
- [AVR BSDL files](#)

### Recommended Programming/Debugging Tools:

- Atmel-ICE:
  - [User Guide](#)
  - [Buy](#)
- Power Debugger:
  - [User Guide](#)
  - [Buy](#)
- MPLAB Snap:
  - [Buy](#)
- MPLAB PICKit® 5:
  - [Buy](#)

### Other:

- AVR Freaks®: [www.avrfreaks.net/](http://www.avrfreaks.net/)
- Product Selector and Application Notes: [www.microchip.com/en-us/products/microcontrollers-and-microprocessors/8-bit-mcus/avr-mcus/avr-ea](http://www.microchip.com/en-us/products/microcontrollers-and-microprocessors/8-bit-mcus/avr-mcus/avr-ea)  
Find the preferred device in the Family Offerings or Products list and go to the product page. All relevant application notes can be found under the documentation tab.
- Overview of the tool ecosystem for AVR microcontrollers: [www.microchip.com/en-us/products/microcontrollers-and-microprocessors/8-bit-mcus/avr-mcus/get-started-now](http://www.microchip.com/en-us/products/microcontrollers-and-microprocessors/8-bit-mcus/avr-mcus/get-started-now)
- More online technical documentation concerning various products: [onlinedocs.microchip.com/](http://onlinedocs.microchip.com/)
- Microchip Technical Support: [microchipsupport.force.com/s/](http://microchipsupport.force.com/s/)

## 8. Revision History

Doc. Rev.	Date	Comments
A	09/2023	Initial document release

## Microchip Information

### The Microchip Website

Microchip provides online support via our website at [www.microchip.com/](http://www.microchip.com/). This website is used to make files and information easily available to customers. Some of the content available includes:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user’s guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip design partner program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

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### Customer Support

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Embedded Solutions Engineer (ESE)
- Technical Support

Customers should contact their distributor, representative or ESE for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in this document.

Technical support is available through the website at: [www.microchip.com/support](http://www.microchip.com/support)

### Microchip Devices Code Protection Feature

Note the following details of the code protection feature on Microchip products:

- Microchip products meet the specifications contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is secure when used in the intended manner, within operating specifications, and under normal conditions.
- Microchip values and aggressively protects its intellectual property rights. Attempts to breach the code protection features of Microchip product is strictly prohibited and may violate the Digital Millennium Copyright Act.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of its code. Code protection does not mean that we are guaranteeing the product is “unbreakable”. Code protection is constantly evolving. Microchip is committed to continuously improving the code protection features of our products.

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