PIC16F15244 Quick Start Guide

PIC16F15244 Family Quick Start Guide

Introduction

The PIC16F15244 family of microcontrollers incorporates simplified analog core features, digital communication peripherals, timers, and waveform generators. This microcontroller family also provides flexible memory features, such as the Memory Access Partition (MAP) and Device Information Area (DIA).

This document is intended to enable the new PIC16F15244 family users to get a basic hardware and software understanding of the PIC16F15244 family and get started with software development for the PIC16F15244 family of microcontrollers.

This document provides an overview of the PIC16F15244 family and associated technical collateral provided by Microchip.

To understand more about the PIC16F15244 family core features, memory, operating characteristics, power saving functionalities, digital peripherals, analog peripherals, clock structures and features overview, refer to the PIC16F15244 Family device data sheet.

Features

This quick start guide features the following content:

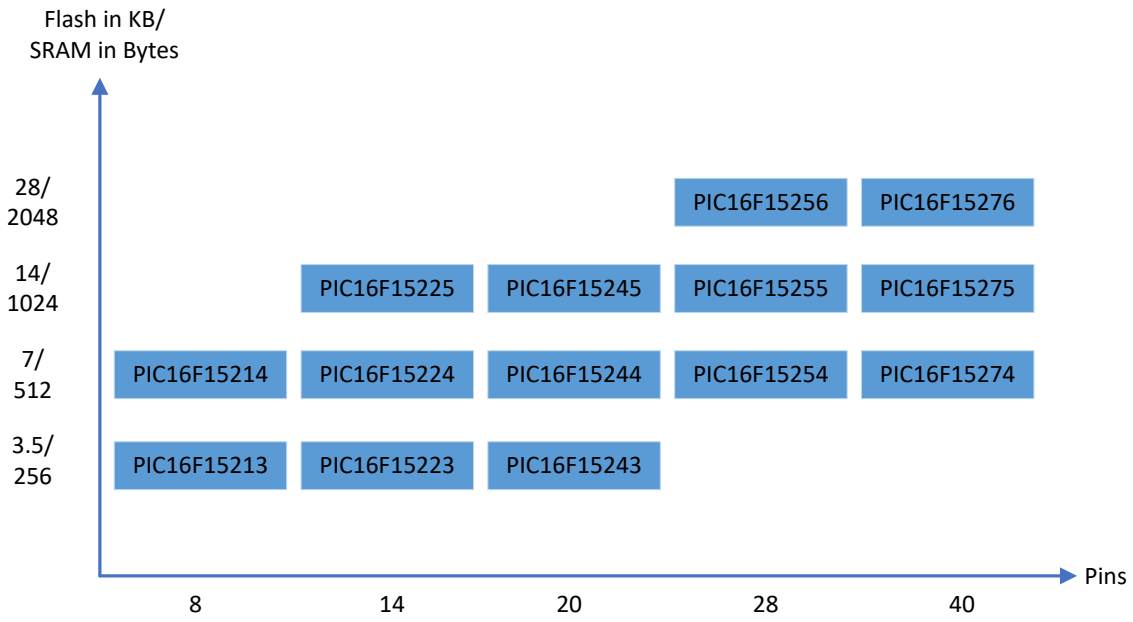
- Product Family Introduction
- Relevant Devices
- Code Examples on GitHub
- Tools Ecosystem

Table of Contents

1. Relevant Devices

The PIC16F15244 family products are available in 8/14/16/20/28/40/44-pin packages for cost-sensitive sensor and real-time control applications. The PIC16F15244 family of microcontrollers offers up to 28 KB of Flash memory, up to 2 KB of SRAM, and it also provides memory features. The PIC16F15244 family of microcontrollers offers a rich set of core features, memory functionalities, power-saving abilities, digital and analog peripherals.

Figure 1-1. Overview of PIC16F15244 Family of Microcontrollers



2. Device References

2.1 Product Pages

- PIC16F15213: https://www.microchip.com/wwwproducts/en/PIC16F15213
- PIC16F15214: https://www.microchip.com/wwwproducts/en/PIC16F15214
- PIC16F15223: https://www.microchip.com/wwwproducts/en/PIC16F15223
- PIC16F15224: https://www.microchip.com/wwwproducts/en/PIC16F15224
- PIC16F15225: https://www.microchip.com/wwwproducts/en/PIC16F15225
- PIC16F15243: https://www.microchip.com/wwwproducts/en/PIC16F15243
- PIC16F15244: https://www.microchip.com/wwwproducts/en/PIC16F15244
- PIC16F15245: https://www.microchip.com/wwwproducts/en/PIC16F15245
- PIC16F15254: https://www.microchip.com/wwwproducts/en/PIC16F15254
- PIC16F15255: https://www.microchip.com/wwwproducts/en/PIC16F15255
- PIC16F15256: https://www.microchip.com/wwwproducts/en/PIC16F15256
- PIC16F15274: https://www.microchip.com/wwwproducts/en/PIC16F15274
- PIC16F15275: https://www.microchip.com/wwwproducts/en/PIC16F15275
- PIC16F15276: https://www.microchip.com/wwwproducts/en/PIC16F15276

2.2 Documents

- Migration Document:
  - Migration from PIC12F to PIC16F15244 Microcontroller Family
- Data Sheets:
  - PIC16F15213/14/23/24/43/44 Full-Featured 8/14/20-Pin Microcontrollers
  - PIC16F15225/45 Full-Featured 14/20-Pin Microcontrollers
  - PIC16F15256/74/75/76 28/40-Pin Microcontrollers
  - PIC16F15254/55 28-Pin Microcontrollers
- Product Brief:
  - PIC16F15244 Family Product Brief
- Errata:
  - PIC16F15213/14/23/24/43/44 Silicon Errata and Data Sheet Clarifications
  - PIC16F15225/45 Silicon Errata and Data Sheet Clarifications
  - PIC16F15256/74/75/76 Silicon Errata and Datasheet Clarifications
  - PIC16F15254/55 Silicon Errata and Data Sheet Clarifications
- Programming Specification:
  - PIC16F15244 Family Programming Specification

3. Code Examples

The code examples for the PIC16F15244 family and examples associated with different peripherals such as MSSP, PWM, WDT, EUSART, and Timers are available through GitHub.

Find code examples for the PIC16F15244 family of microcontrollers by searching the device name (e.g., PIC16F15244) in the GitHub microchip-pic-avr-examples repository. Microchip also enables users to find the desired code examples using the Microchip Discover Portal.

The code can be downloaded as a .zip file or can be cloned as a Git repository.

4. Development Tools

The PIC16F15244 family of microcontrollers supports multiple hardware and software platforms for programming and debugging. Developers can choose the appropriate evaluation kits, programmers, and debuggers for their application development.

This quick start guide covers the available supporting development tools ecosystem to help developers get started with application development using the PIC16F15244 family of microcontrollers.

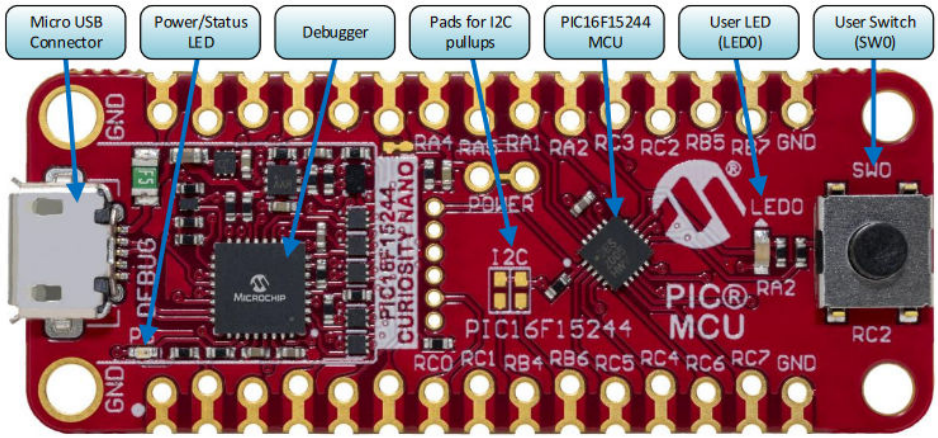
5. Hardware Tools

5.1 Evaluation Kits

PIC16F15244/76 Curiosity Nano Evaluation Kit

The PIC16F15244/76 Curiosity Nano Evaluation Kit is a hardware platform to evaluate PIC16F15244/76 microcontrollers which provides easy access to the features of the microcontrollers. The Curiosity Nano Evaluation Kits include an on-board debugger (EDBG), which means that there is no need for external tools for programming and debugging the PIC16F15244/76 microcontroller.

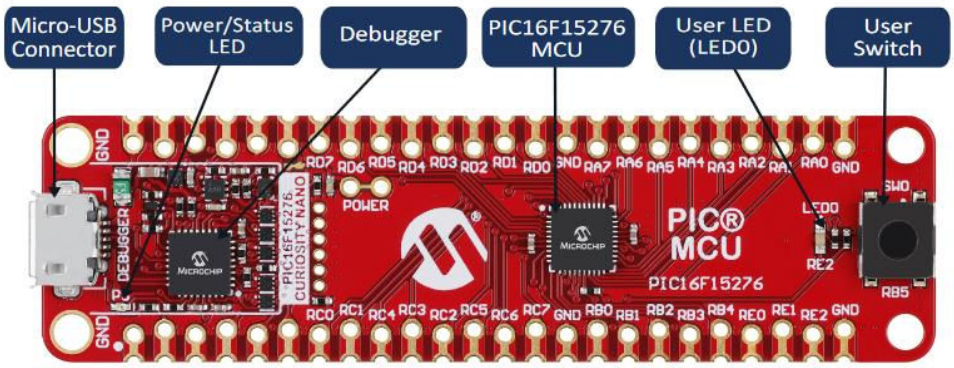
Figure 5-1. Overview of PIC16F15244 Curiosity Nano Kit



Web Page:https://www.microchip.com/developmenttools/productdetails/partno/EV09Z19A

Get the Kit: https://www.microchipdirect.com/dev-tools/EV09Z19A?productLoaded=true&allDevTools=true

Figure 5-2. Overview of PIC16F15276 Curiosity Nano Kit



Web Page: https://www.microchip.com/DevelopmentTools/ProductDetails/PartNO/EV35F40A

Get the Kit: https://www.microchipdirect.com/dev-tools/EV35F40A?productLoaded=true&allDevTools=true

Features:

- PIC16F15244/76 Microcontroller
- One Yellow User LED
- One Mechanical User Switch
- On-Board Debugger:
  - Board identification in MPLAB® X Integrated Development Environment (IDE)
  - One green power and status LED

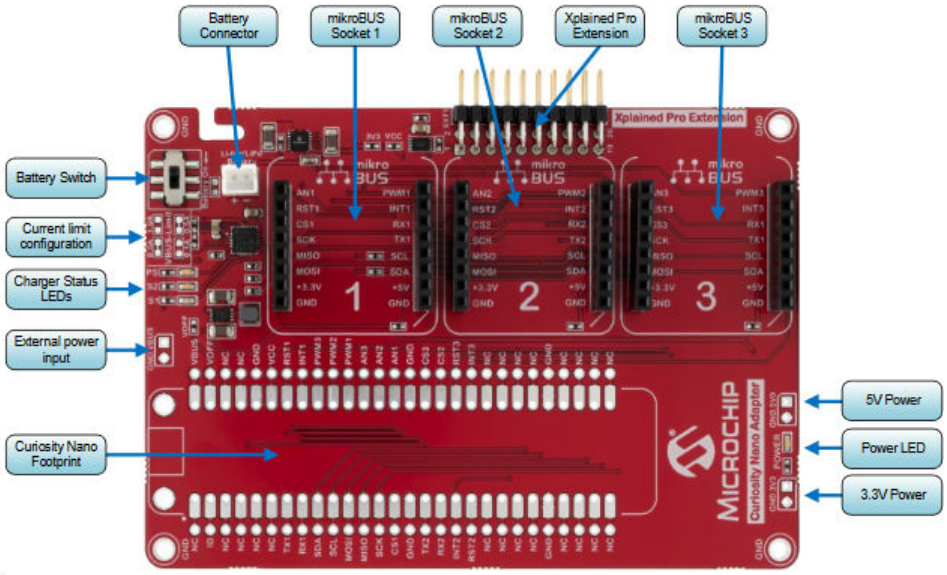
- Programming and debugging
- Virtual COM port (CDC) for microcontroller to PC communication
- Data Gateway Interface (DGI): one GPIO
- USB Powered

For more details, refer to the PIC16F15244 Curiosity Nano Hardware User Guide or the PIC16F15276 Curiosity Nano Hardware User Guide.

Curiosity Nano Base for Click Boards™ Evaluation Kit

The Curiosity Nano Base for Click Boards evaluation kit is a hardware extension platform intended to ease the connection between the Curiosity Nano evaluation kit, the mikroBUS Click boards, and the Xplained Pro extension kits.

Figure 5-3. Overview of Curiosity Nano Base for Click Boards



Web Page: https://www.microchip.com/DevelopmentTools/ProductDetails/PartNO/AC164162

Get the Kit: https://www.microchipdirect.com/dev-tools/AC164162?productLoaded=true&allDevTools=true

Features:

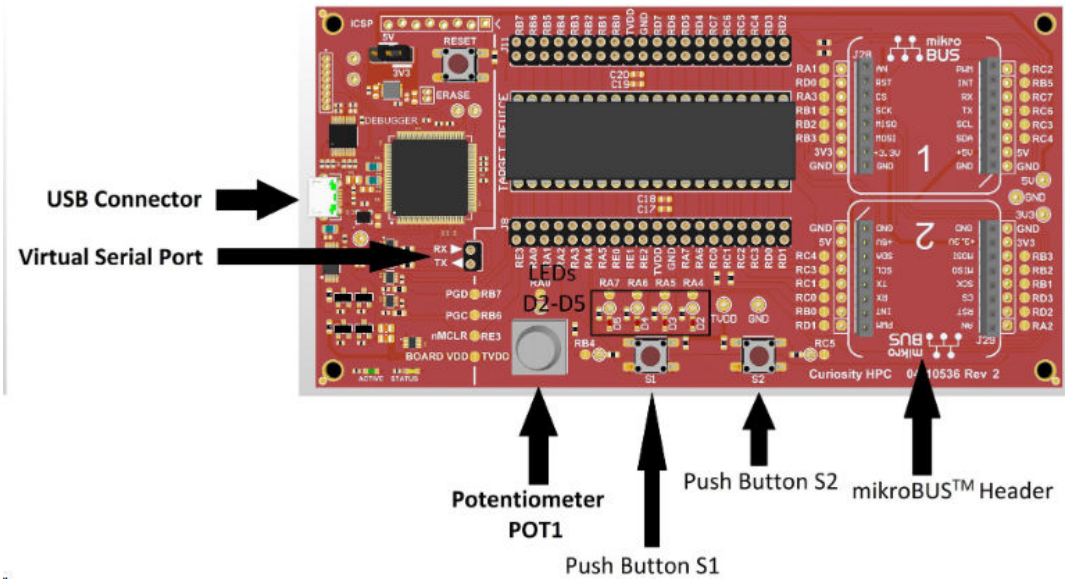
- Curiosity Nano Footprint
- One Power LED
- Three mikroBUS™ Sockets
- One Xplained Pro Extension Header
- Power:
  - USB powered from the Curiosity Nano kit
  - Alternative external power input
  - Option to power from, and charge, 4.20V Li-Ion/LiPo batteries
  - Fixed 3.3V PSU for target and mikroBUS sockets
  - Fixed 5.0V Boost converter for 5V mikroBUS sockets

For more details, refer to the Curiosity Nano Base for Click boards User Guide: ww1.microchip.com/downloads/en/DeviceDoc/Curiosity-Nano-Base-for-Click-boards-User-Guide-50002839B.pdf

Microchip Curiosity High Pin Count Development Evaluation Kit

The Microchip Curiosity High Pin Count (HPC) Development kit supports Microchip's 8-Pin, 14-Pin, 20-Pin, and 40-Pin 8-bit PIC microcontrollers. The expansion headers on either side of the microcontroller socket provide access to all pins on the PIC microcontroller.

Figure 5-4. Overview of Curiosity High Pin Count Kit



Web Page: https://www.microchip.com/DevelopmentTools/ProductDetails/PartNO/DM164136

Get the Kit: https://www.microchipdirect.com/dev-tools/DM164136?allDevTools=true

Features:

- MPLAB® X Integrated Development Environment (IDE) compatibility
- Programming and debugging support
- Powered from USB, with option jumper for 3.3/5V
- Master Clear (MCLR) Reset
- Dual-row expansion headers
- PIC® MCU PDIP sockets for 28-pin and 40-pin microcontrollers
- Two mikroBUS sockets
- Four indication LEDs
- Two push buttons
- One potentiometer

For more details, refer to the Curiosity High Pin Count Development Board User Guide: ww1.microchip.com/downloads/en/DeviceDoc/Curiosity-High-Pin-Count-Development-Board-User-Guide-40001856C.pdf

5.2 Programmers and Debuggers

Microchip offers a range of programmers, debuggers, and extensions to support all device architectures. All solutions/in-circuit debuggers and programmers are USB-powered and fully integrated into their respective environments. MPLAB ICD 4 In-Circuit Debugger offers debug and hardware features sufficient for most users. MPLAB Snap In-Circuit and MPLAB PICkit 4 In-Circuit Debuggers are economical choices for fundamental debugging functionalities.

- MPLAB PICkit 4 In-Circuit Debugger
  - Product Page
  - Buy Here
  - User Guide
  - Microchip Developer Help
- MPLAB ICD 4 In-Circuit Debugger
  - Product Page
  - Buy Here

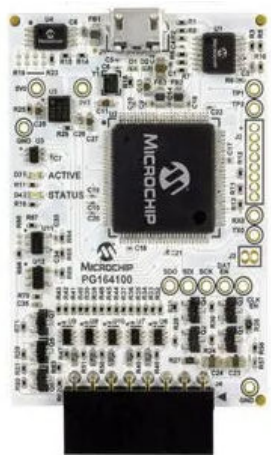
  - User Guide
  - Microchip Developer Help
- MPLAB Snap In-Circuit Debugger
  - Product Page
  - Buy Here
  - User Guide
  - Microchip Developer Help

The figure below shows the various types of programmers and debuggers offered by Microchip.

Figure 5-5. Microchip Programmers and Debuggers

MPLAB PICkit 4

MPLAB ICD 4



MPLAB SNAP

6. Software Tools

MPLAB X Integrated Development Environment (IDE)

MPLAB X IDE is a software program that runs on a PC (Windows®, Mac OS®, Linux®) for the development of applications for Microchip microcontrollers. It is called an Integrated Development Environment because it provides a single integrated environment to develop code for embedded microcontrollers.

MPLAB Code Configurator (MCC)

MPLAB MCC is a free, graphical programming environment that generates seamless, easy-to understand C code to be included into the project. Using an intuitive interface, it enables and configures a rich set of peripherals and functions specific to application development.

There are three ways to get the **MCC software** to development environment:

- Use MPLAB® Xpress Cloud-Based IDE
- Install the MPLAB X IDE Plug-In
- Install the MPLAB Code Configurator (MCC)

MCC Features:

- An easy-to-install MPLAB X IDE plug-in
- A list of available peripherals
- Easy selection of the peripheral configuration
- Integration of the MCC Code into an existing project or start a new project from scratch
- Simple removal of peripherals
- Retention of changes to generated code
- Generation and usage of specialized and standardized drivers

MPLAB® XC8 C Compiler

The optimizations found on the MPLAB XC8 provide code size reductions and speed enhancements that benefit design projects. A PRO license is available for designs that require maximum code reductions and best performance. The MPLAB XC8 C Compiler contains a free, 60-day trial of a PRO license for evaluation when activated. Also, the MPLAB XC8 is TÜV SÜD certified.

Figure 6-1. Microchip Software Tools

MPLAB X IDE | MPLAB CODE CONFIGURATOR (MCC) | MPLAB XC8 COMPLIER

7. Recommended Programming and Debugging Tools

- MPLAB PICkit 4 In-Circuit Debugger
  - User Guide: ww1.microchip.com/downloads/en/DeviceDoc/50002751F.pdf
  - How to Buy: www.microchipdirect.com/dev-tools/PG164140?productLoaded=true&allDevTools=true
- MPLAB ICD 4 In-Circuit Debugger
  - User Guide: ww1.microchip.com/downloads/en/DeviceDoc/50002596E.pdf
  - How to Buy: www.microchipdirect.com/dev-tools/DV164045?productLoaded=true&allDevTools=true

8. What's Next

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

- Migration guide:
  - Migration from PIC12F to PIC16F15244 Microcontroller Family
- Application Notes:
  - PID Fan Speed Control for 4-Wire Fans
  - Simple LiPo Battery Management
  - A Simple Water Monitoring System with I^2C Communication
- Technical Briefs:
  - Using the I^2C in Host Mode
  - Using the I^2C in Client Mode
  - Using PWM to Generate an Analog Output
- For more information about project creation and debugging, refer to the MPLAB X Quick Start Guide.
- For generating the device drivers using MPLAB MCC, refer to the MPLAB MCC guide.
- PIC16F Functional Safety Guide

9. Appendix

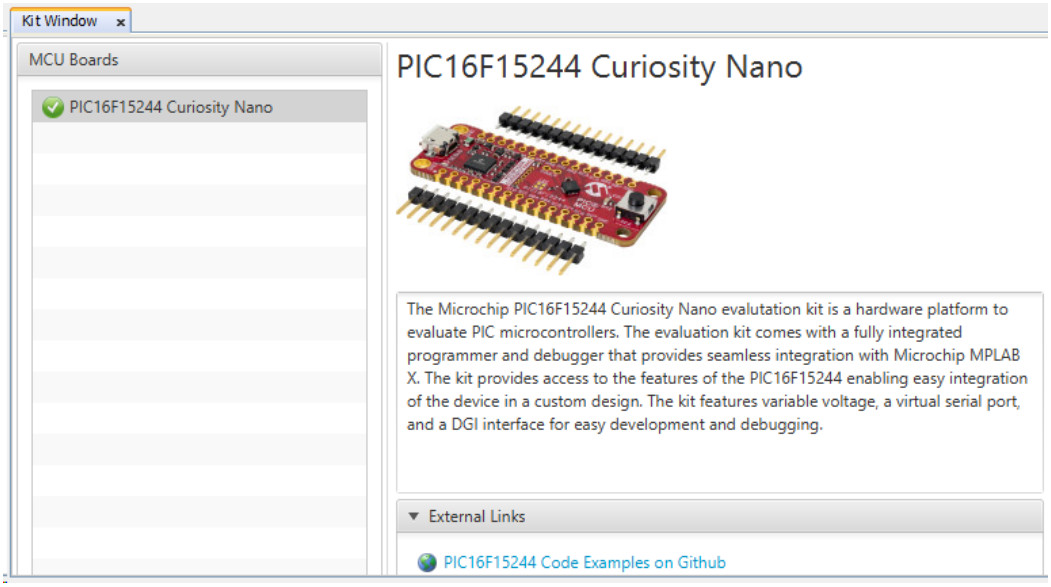
9.1 Project Creation with MPLAB® X Integrated Development Environment (IDE) and MPLAB® Code Configurator (MCC)

Prerequisites

- Install MPLAB X IDE v5.50 or the latest version.
- Install MPLAB MCC v4.2.1 or the latest version available as plug-in.
- Install DFP package from the Packs, which provides device support in the IDE.

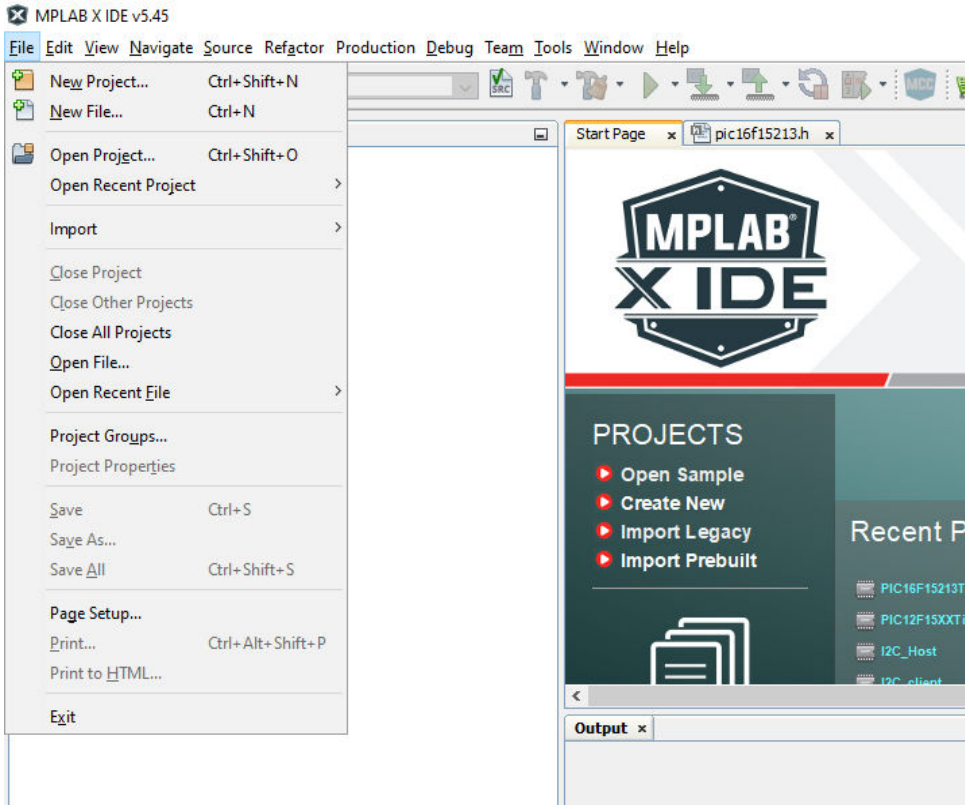
The following page will appear when PIC16F15244 Curiosity Nano is connected to MPLAB X IDE through USB.

Figure 9-1. MPLAB® Kit Window



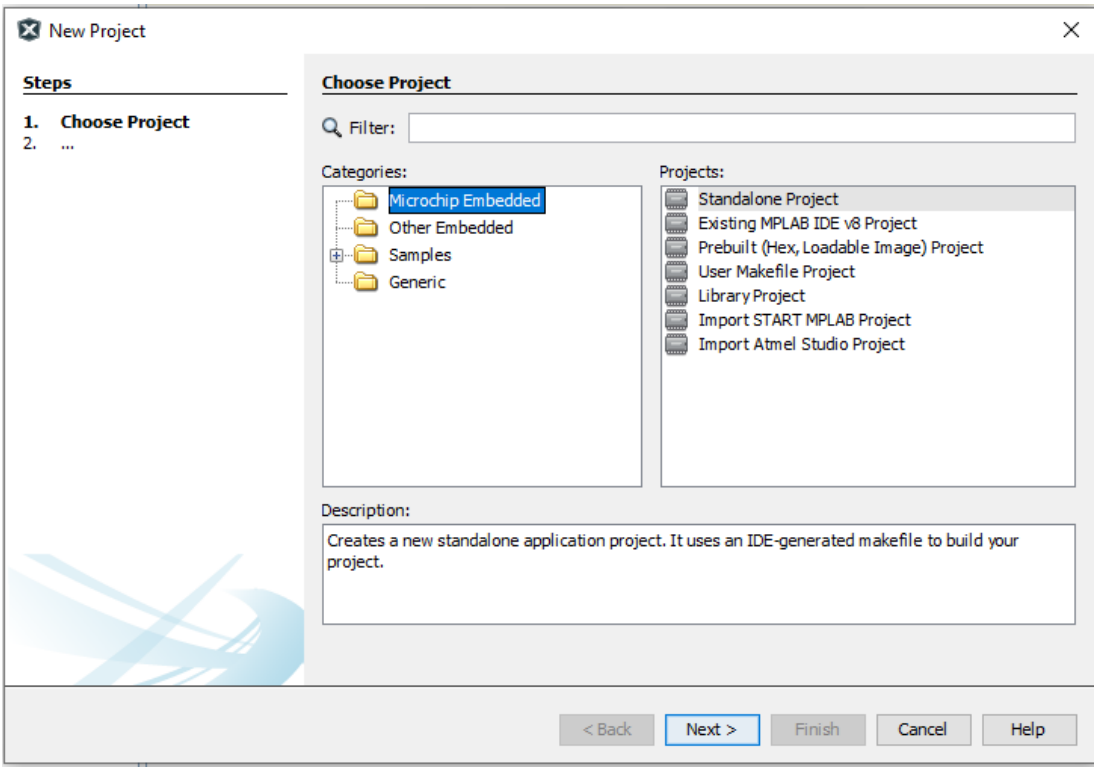
1. Create a new project by going to *File >New Project* or by clicking the shortcut **Ctrl+Shift+N**.

Figure 9-2. MPLAB® X IDE Project Creation Window



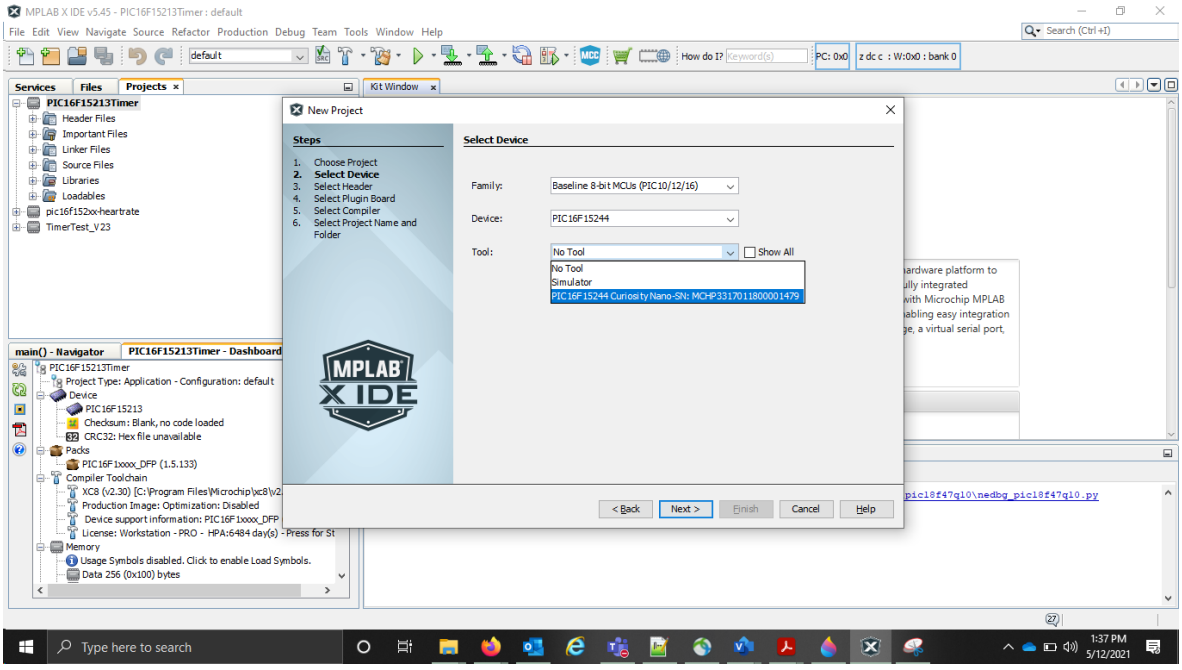
2. Select Microchip Embedded in the Categories window and Standalone Project in Projects window and click **Next**.

Figure 9-3. Project Categories and Project Type Selection Window



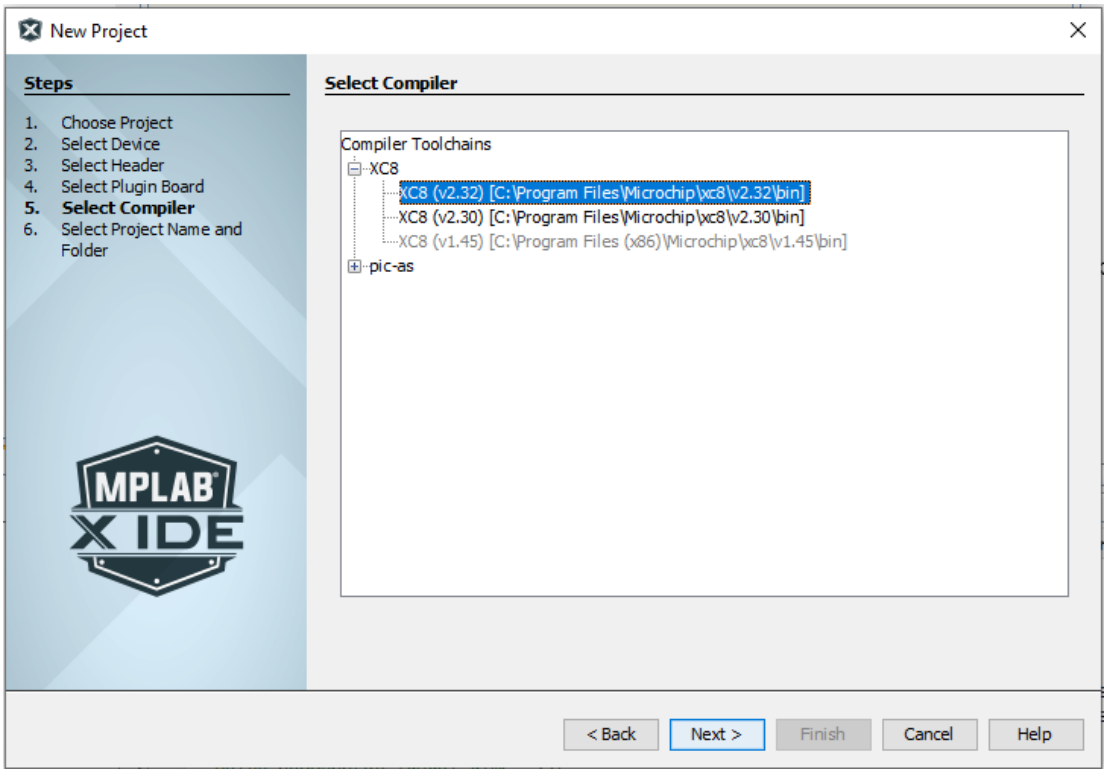
3. Enter the device (PIC16F15244), select PIC16F15244 Curiosity Nano from the Tool drop-down list, then click **Next** .

Figure 9-4. Device Selection Window



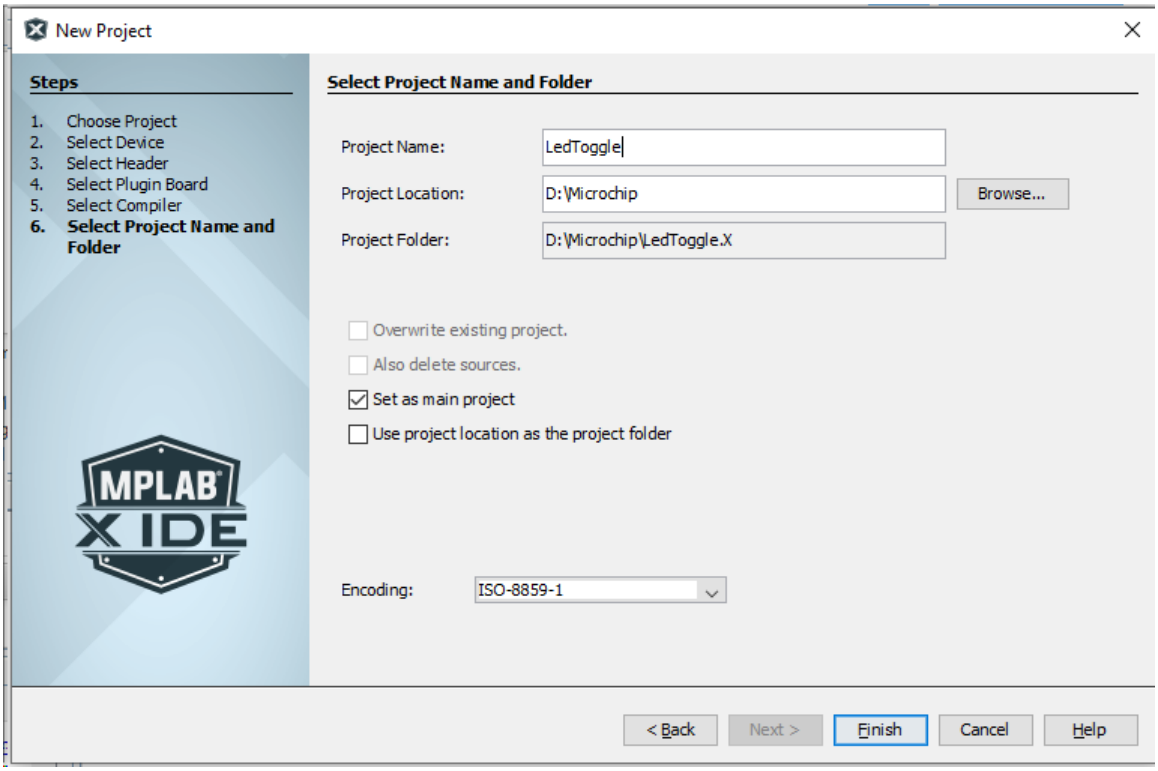
4. After the microcontroller is selected, select the XC8 Compiler and click **Next**.

Figure 9-5. Compiler Selection Window



5. Type the name of the project in the “Project Name” field, e.g., LedToggle, (blank space, brackets, semicolons, and special characters are not allowed). Then, navigate to the desired project location (e.g., D:/Microchip) and click on **Finish**.

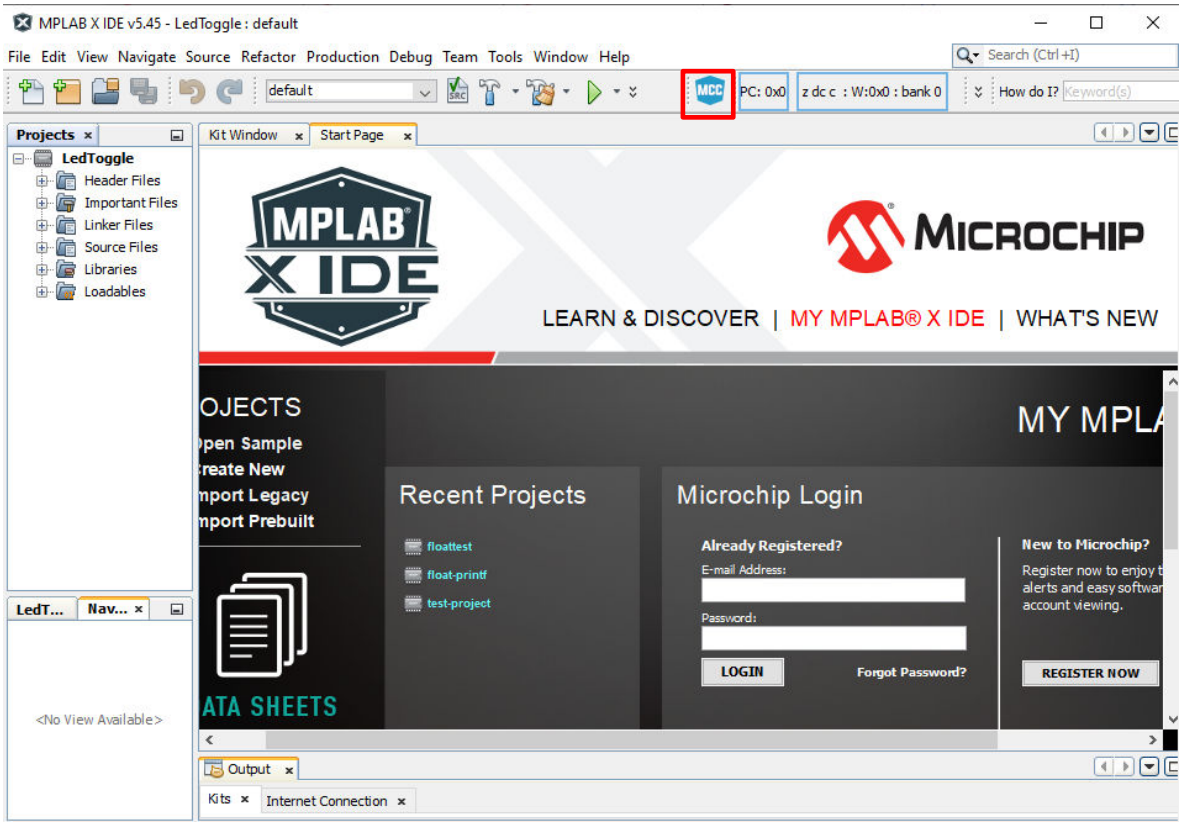
Figure 9-6. Project Name and Folder Window



6. To initialize and configure the project, click on the **MCC icon**.

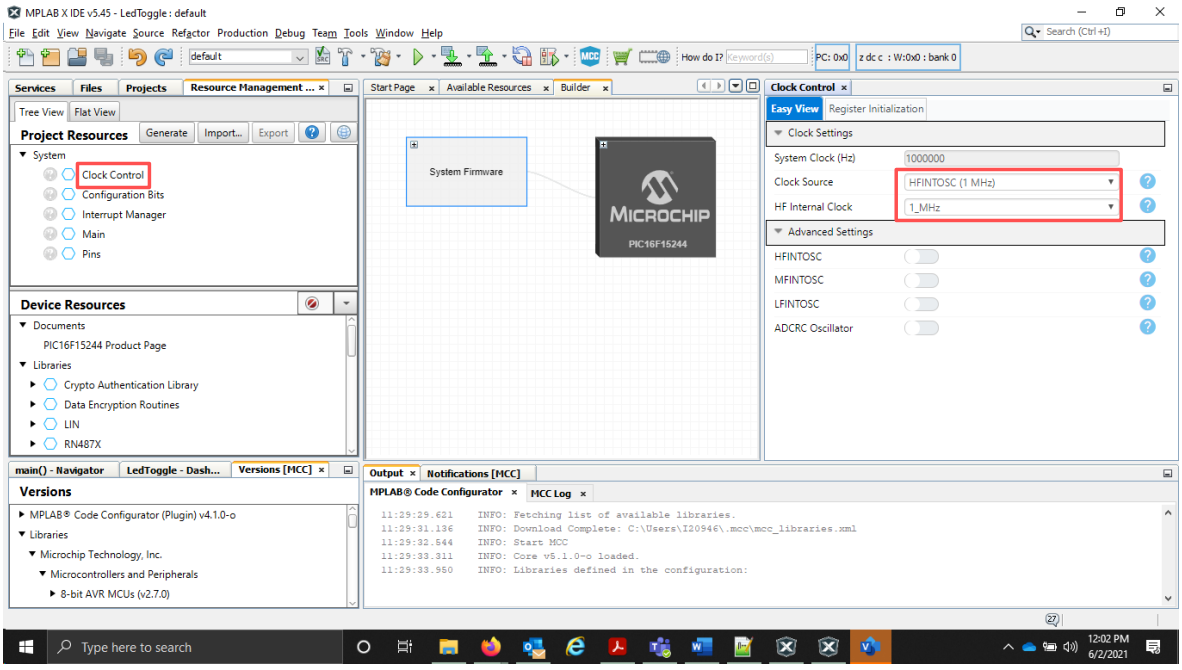
Important: To install MCC in MPLAB X IDE, select *Tools>Plugins>Available Plugins* and click **MPLAB Code Configurator option** and then click **Install**.

Figure 9-7. Icon to Open MCC



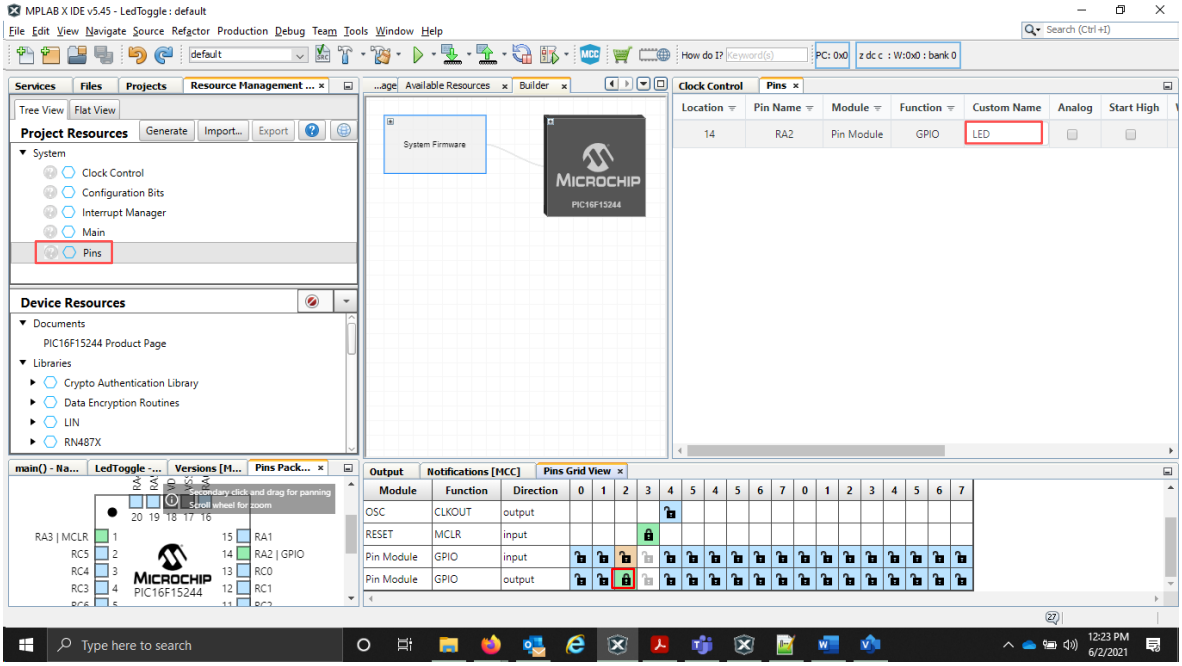
7. The Resource Management MCC window will open. Configure the system clock by clicking on the **Clock Control** option under the **System** module of the **Project Resource** section. Select the clock as HFINTOSC (1 MHz) from the Clock Source drop-down list.

Figure 9-8. MCC System Configuration Window



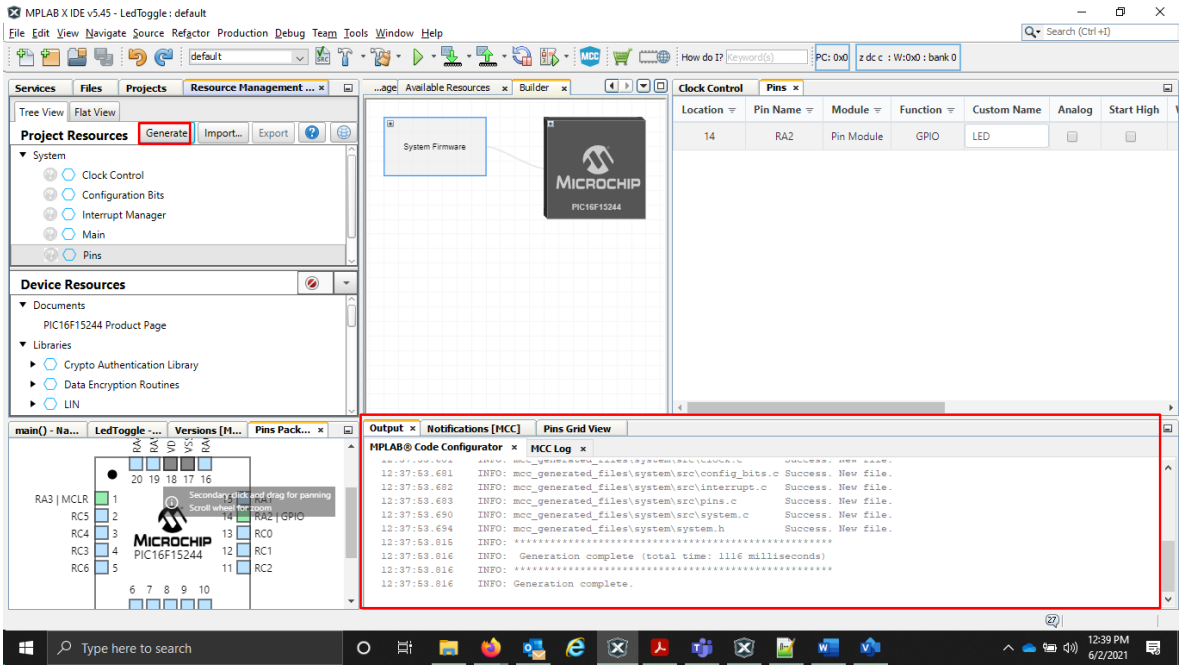
8. The GPIO configuration of the LED with MCC is selected in the Pin Manager: Grid View window, as shown below. Set the name for GPIO pin RA2 to 'LED', as it is easier to remember when developing source code later.

Figure 9-9. MPLAB® MCC Pin Configuration Window



9. To generate the configured MCC project, click on the **Generate** button under the **Resource Management** tab. The output of the generator is viewable in the MPLAB Code Configurator window.

Figure 9-10. MCC Firmware Generation Output



10. Add the code to toggle the LED in the main.c file, located in the Projects window, under the Source Files folder. Copy and paste the following code inside the while (1) loop.

```
#include "mcc_generated_files/system/system.h"

#define _XTAL_FREQ 1000000
```

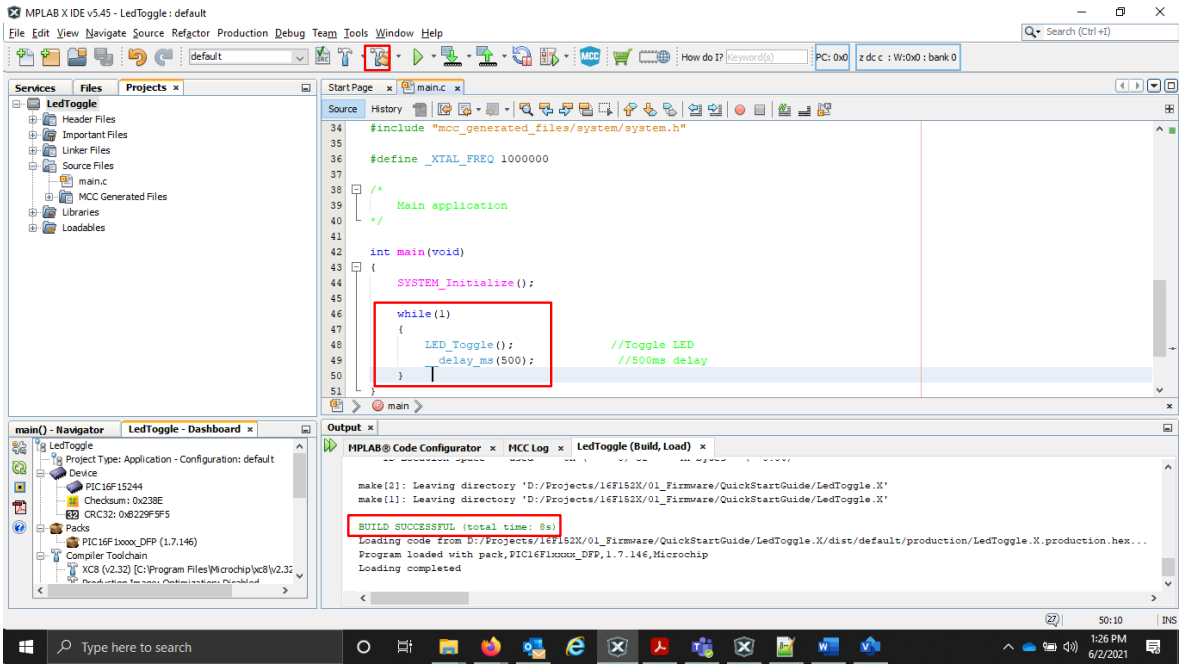
```
/*
    Main application
*/

int main(void)
{
    SYSTEM_Initialize();

    while(1)
    {
        LED_Toggle();               //Toggle LED
        __delay_ms(500);             //500ms delay
    }
}
```

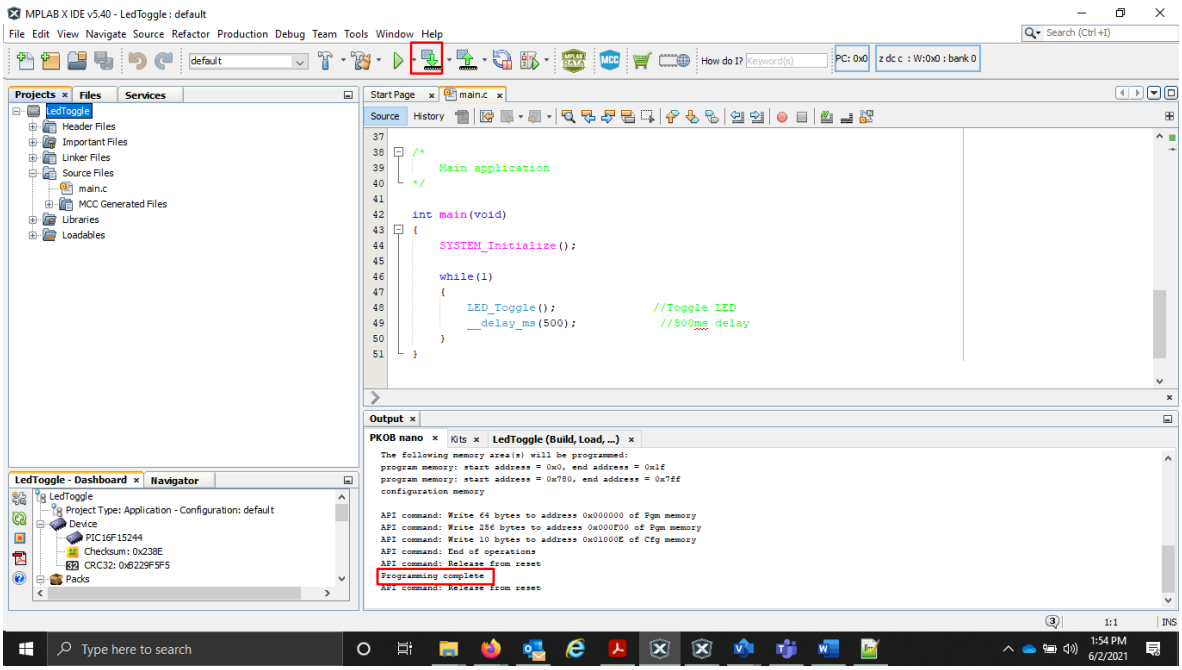
11. Build the project by clicking on **Clean and Build Main Project** icon, to check that there are not any build errors in the project.

Figure 9-11. Building and Cleaning the Project



12. Program the project to the PIC16F15244 Curiosity Nano board by clicking on the **Make and Program Device** icon.

Figure 9-12. Make and Device Programming

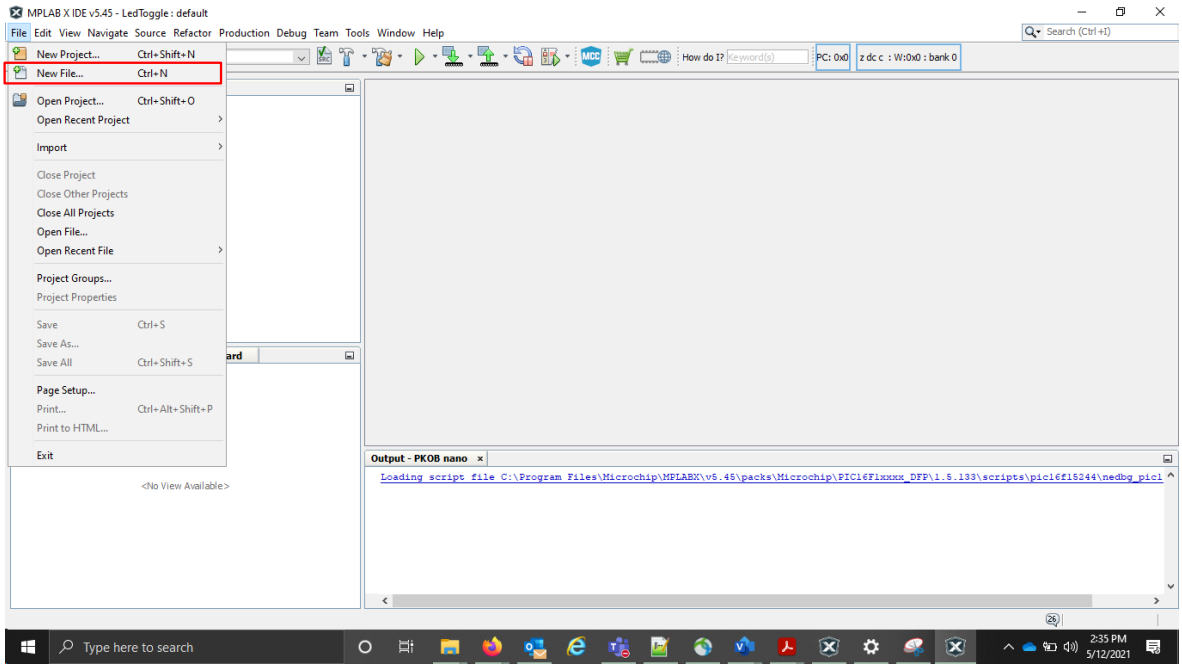


13. Verify that the LED is toggling on the PIC16F15244 Curiosity Nano board.

9.2 Optional Steps

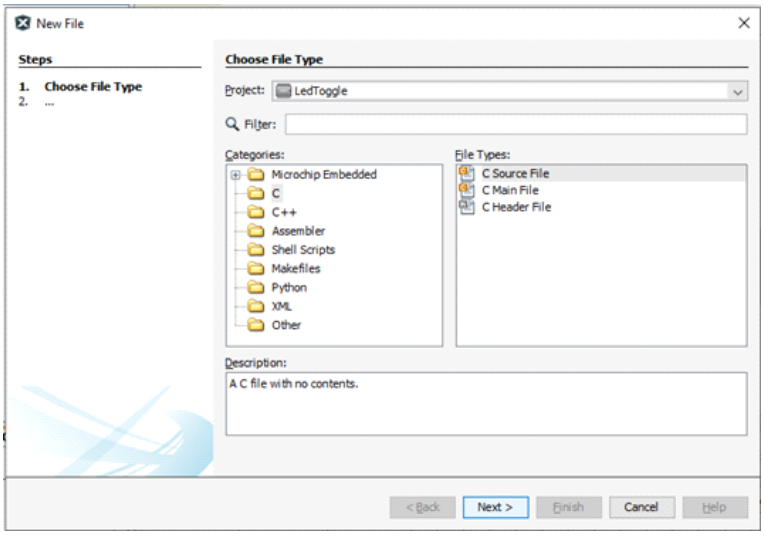
1. To create an additional source .c/.h file, go to *File>New File* or by using the shortcut **Ctrl+N**.

Figure 9-13. New File Creation Window



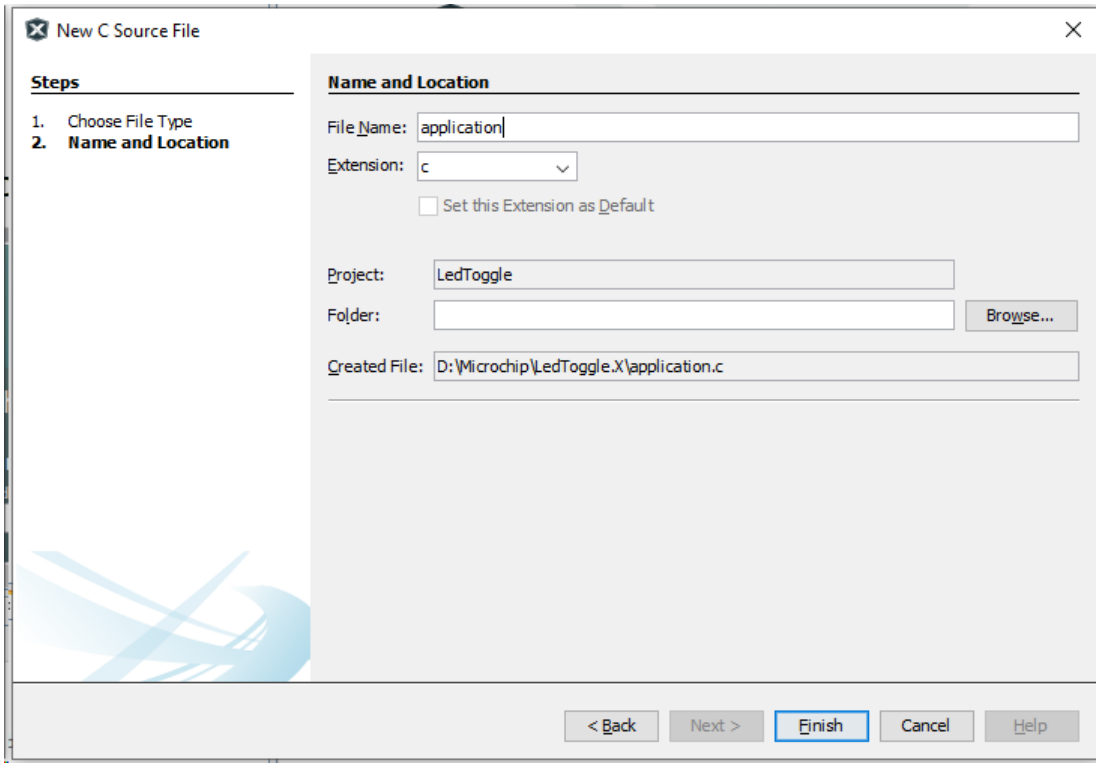
2. Select the *Categories>C* and *File Types>C>Source File>Main File/Header File*, then click **Next**.

Figure 9-14. File Type Selection Window



3. Type the file name in the 'File Name' field and click **Finish**.

Figure 9-15. File Name Field Window



The Microchip Website

Microchip provides online support via our website at 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

Product Change Notification Service

Microchip's product change notification service helps keep customers current on Microchip products. Subscribers will receive email notification whenever there are changes, updates, revisions or errata related to a specified product family or development tool of interest.

To register, go to www.microchip.com/pcn and follow the registration instructions.

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

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.

Legal Notice

This publication and the information herein may be used only with Microchip products, including to design, test, and integrate Microchip products with your application. Use of this information in any other manner violates these terms. Information regarding device applications is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. Contact your local Microchip sales office for additional support or, obtain additional support at www.microchip.com/en-us/support/design-help/client-support-services.

Trademarks

ISBN: 978-1-5224-8562-9

Quality Management System

For information regarding Microchip’s Quality Management Systems, please visit www.microchip.com/quality.

Worldwide Sales and Service

AMERICAS	ASIA/PACIFIC	ASIA/PACIFIC	EUROPE
Corporate Office 2355 West Chandler Blvd. Chandler, AZ 85224-6199 Tel: 480-792-7200 Fax: 480-792-7277 Technical Support: www.microchip.com/support Web Address: www.microchip.com **Atlanta** Duluth, GA Tel: 678-957-9614 Fax: 678-957-1455 **Austin, TX** Tel: 512-257-3370 **Boston** Westborough, MA Tel: 774-760-0087 Fax: 774-760-0088 **Chicago** Itasca, IL Tel: 630-285-0071 Fax: 630-285-0075 **Dallas** Addison, TX Tel: 972-818-7423 Fax: 972-818-2924 **Detroit** Novi, MI Tel: 248-848-4000 **Houston, TX** Tel: 281-894-5983 **Indianapolis** Noblesville, IN Tel: 317-773-8323 Fax: 317-773-5453 Tel: 317-536-2380 **Los Angeles** Mission Viejo, CA Tel: 949-462-9523 Fax: 949-462-9608 Tel: 951-273-7800 **Raleigh, NC** Tel: 919-844-7510 **New York, NY** Tel: 631-435-6000 **San Jose, CA** Tel: 408-735-9110 Tel: 408-436-4270 **Canada - Toronto** Tel: 905-695-1980 Fax: 905-695-2078	**Australia - Sydney** Tel: 61-2-9868-6733 **China - Beijing** Tel: 86-10-8569-7000 **China - Chengdu** Tel: 86-28-8665-5511 **China - Chongqing** Tel: 86-23-8980-9588 **China - Dongguan** Tel: 86-769-8702-9880 **China - Guangzhou** Tel: 86-20-8755-8029 **China - Hangzhou** Tel: 86-571-8792-8115 **China - Hong Kong SAR** Tel: 852-2943-5100 **China - Nanjing** Tel: 86-25-8473-2460 **China - Qingdao** Tel: 86-532-8502-7355 **China - Shanghai** Tel: 86-21-3326-8000 **China - Shenyang** Tel: 86-24-2334-2829 **China - Shenzhen** Tel: 86-755-8864-2200 **China - Suzhou** Tel: 86-186-6233-1526 **China - Wuhan** Tel: 86-27-5980-5300 **China - Xian** Tel: 86-29-8833-7252 **China - Xiamen** Tel: 86-592-2388138 **China - Zhuhai** Tel: 86-756-3210040	**India - Bangalore** Tel: 91-80-3090-4444 **India - New Delhi** Tel: 91-11-4160-8631 **India - Pune** Tel: 91-20-4121-0141 **Japan - Osaka** Tel: 81-6-6152-7160 **Japan - Tokyo** Tel: 81-3-6880- 3770 **Korea - Daegu** Tel: 82-53-744-4301 **Korea - Seoul** Tel: 82-2-554-7200 **Malaysia - Kuala Lumpur** Tel: 60-3-7651-7906 **Malaysia - Penang** Tel: 60-4-227-8870 **Philippines - Manila** Tel: 63-2-634-9065 **Singapore** Tel: 65-6334-8870 **Taiwan - Hsin Chu** Tel: 886-3-577-8366 **Taiwan - Kaohsiung** Tel: 886-7-213-7830 **Taiwan - Taipei** Tel: 886-2-2508-8600 **Thailand - Bangkok** Tel: 66-2-694-1351 **Vietnam - Ho Chi Minh** Tel: 84-28-5448-2100	**Austria - Wels** Tel: 43-7242-2244-39 Fax: 43-7242-2244-393 **Denmark - Copenhagen** Tel: 45-4485-5910 Fax: 45-4485-2829 **Finland - Espoo** Tel: 358-9-4520-820 **France - Paris** Tel: 33-1-69-53-63-20 Fax: 33-1-69-30-90-79 **Germany - Garching** Tel: 49-8931-9700 **Germany - Haan** Tel: 49-2129-3766400 **Germany - Heilbronn** Tel: 49-7131-72400 **Germany - Karlsruhe** Tel: 49-721-625370 **Germany - Munich** Tel: 49-89-627-144-0 Fax: 49-89-627-144-44 **Germany - Rosenheim** Tel: 49-8031-354-560 **Israel - Ra'anana** Tel: 972-9-744-7705 **Italy - Milan** Tel: 39-0331-742611 Fax: 39-0331-466781 **Italy - Padova** Tel: 39-049-7625286 **Netherlands - Drunen** Tel: 31-416-690399 Fax: 31-416-690340 **Norway - Trondheim** Tel: 47-72884388 **Poland - Warsaw** Tel: 48-22-3325737 **Romania - Bucharest** Tel: 40-21-407-87-50 **Spain - Madrid** Tel: 34-91-708-08-90 Fax: 34-91-708-08-91 **Sweden - Gothenberg** Tel: 46-31-704-60-40 **Sweden - Stockholm** Tel: 46-8-5090-4654 **UK - Wokingham** Tel: 44-118-921-5800 Fax: 44-118-921-5820