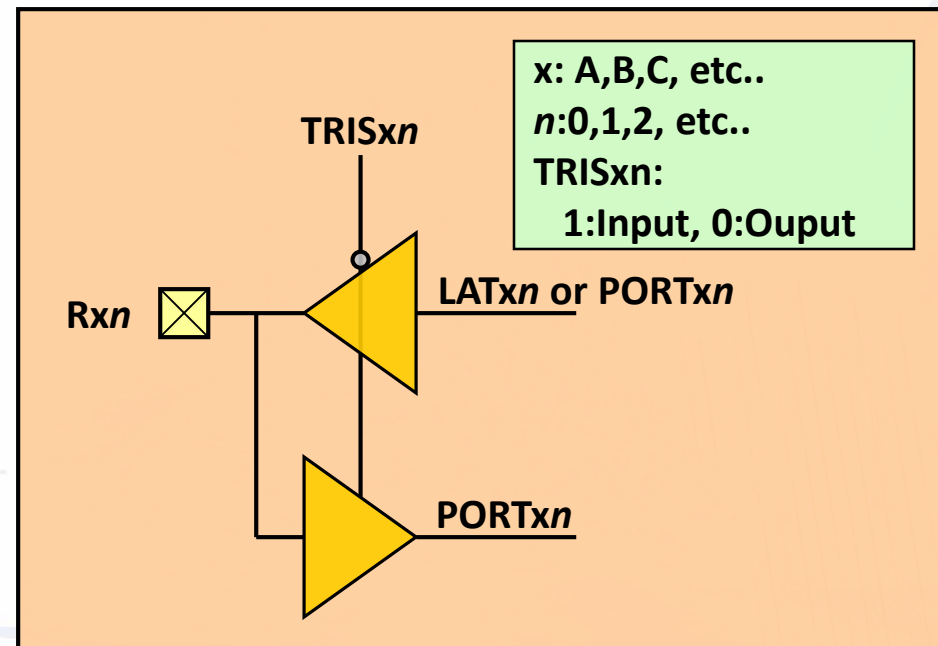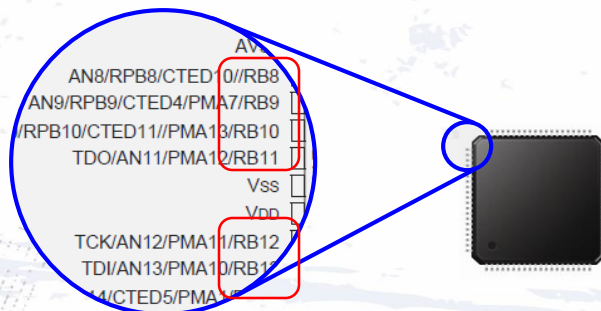# MICROCHIP

Regional Training Centers
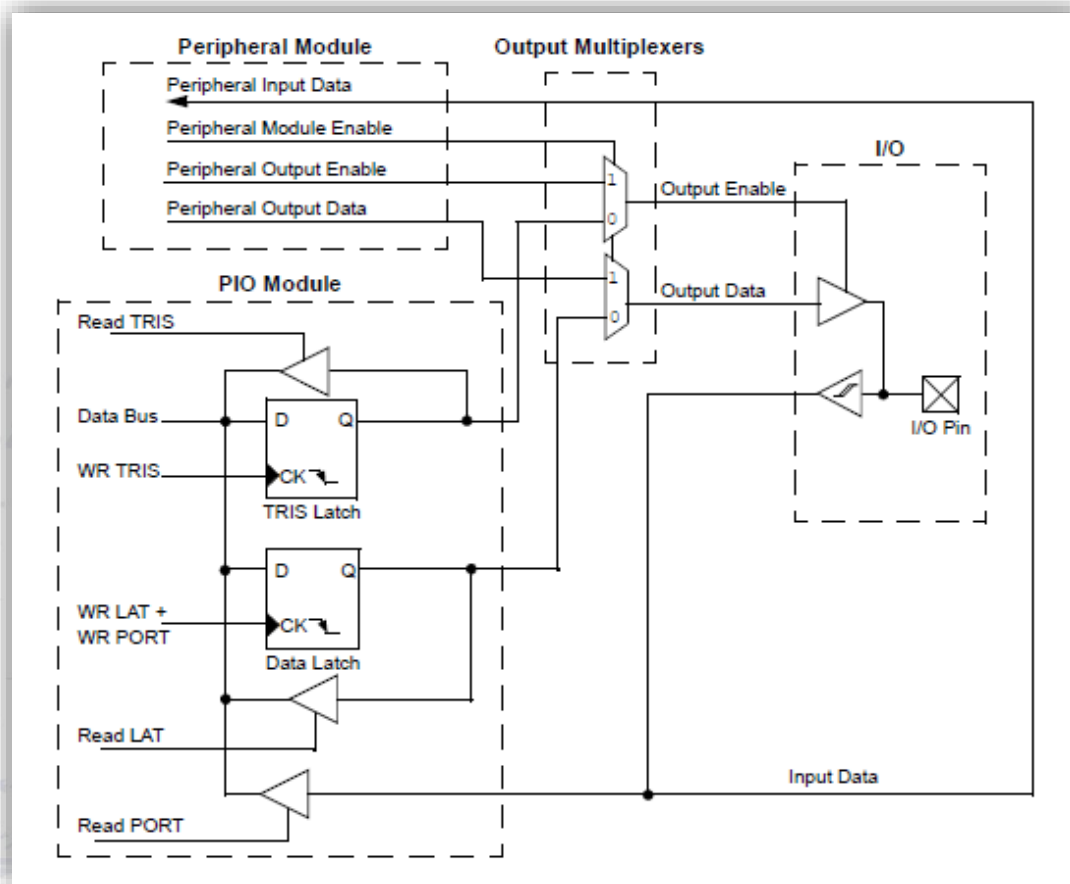
Section 5
GPIO Architecture

GPIO Block Diagram

- **Please refer to the block diagram, this is the concept for programming model. The real and detail block diagram please refer to the following slide.**

- **TRIS: use to determine in or out. 1 for input, 0 for output.**

- **LAT: set output drive value for Output pins.**

- **PORT: reaction logical level from Input pins.**

x: A,B,C, etc..
n:0,1,2, etc..
TRISxn:
   1:Input, 0:Ouput

TRISxn

Rxn

LATxn or PORTxn

PORTxn

AN8/RPB8/CTED10//RB8
AN9/RPB9/CTED4/PMA7/RB9
/RPB10/CTED11//PMA13/RB10
TDO/AN11/PMA12/RB11
Vss
Vpp
TCK/AN12/PMA11/RB12
TDI/AN13/PMA10/RB1
4/CTED5/PMA

GPIO Block Diagram

- **PIC24FJGB Family GPIO Block Diagram**

Lab1 GPIO Output

Lab1 GPIO Output

- **Try to use MCC to generate your first MCC style code and control GPIO base on MCC style.**

- **Try to set RB7 to digital output mode and output high, low level and toggle level (period around 500ms ~ 1S), individually.**

- **Please connect RB7 to LED(D1) to observe pin status.**

How to start ?

Lab1 GPIO Output
Step 1

🔹 **Create New Project again**
Project Name : Lab1_GPIOOutput
Project Location : C:\PIC24_Exercises\Exams

Lab1 GPIO Output

Step 2

- **Execute MCC**

  Select **Tools ▸ Embedded ▸ MPLAB Code Configurator**
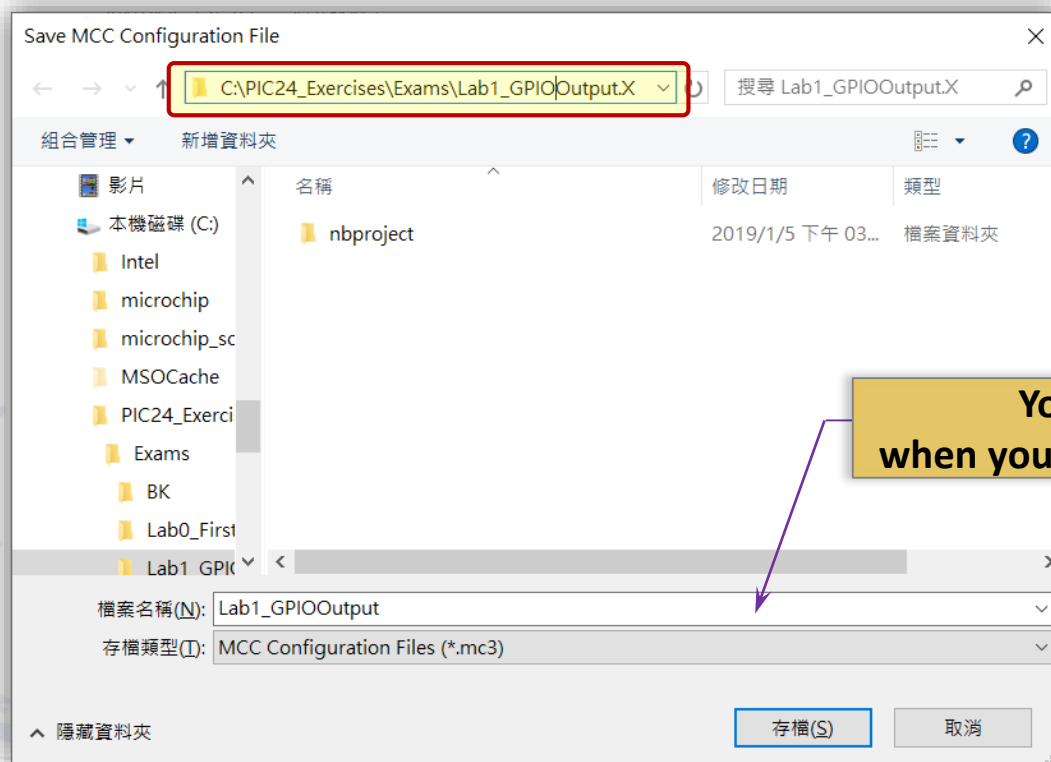 or Click **icon**
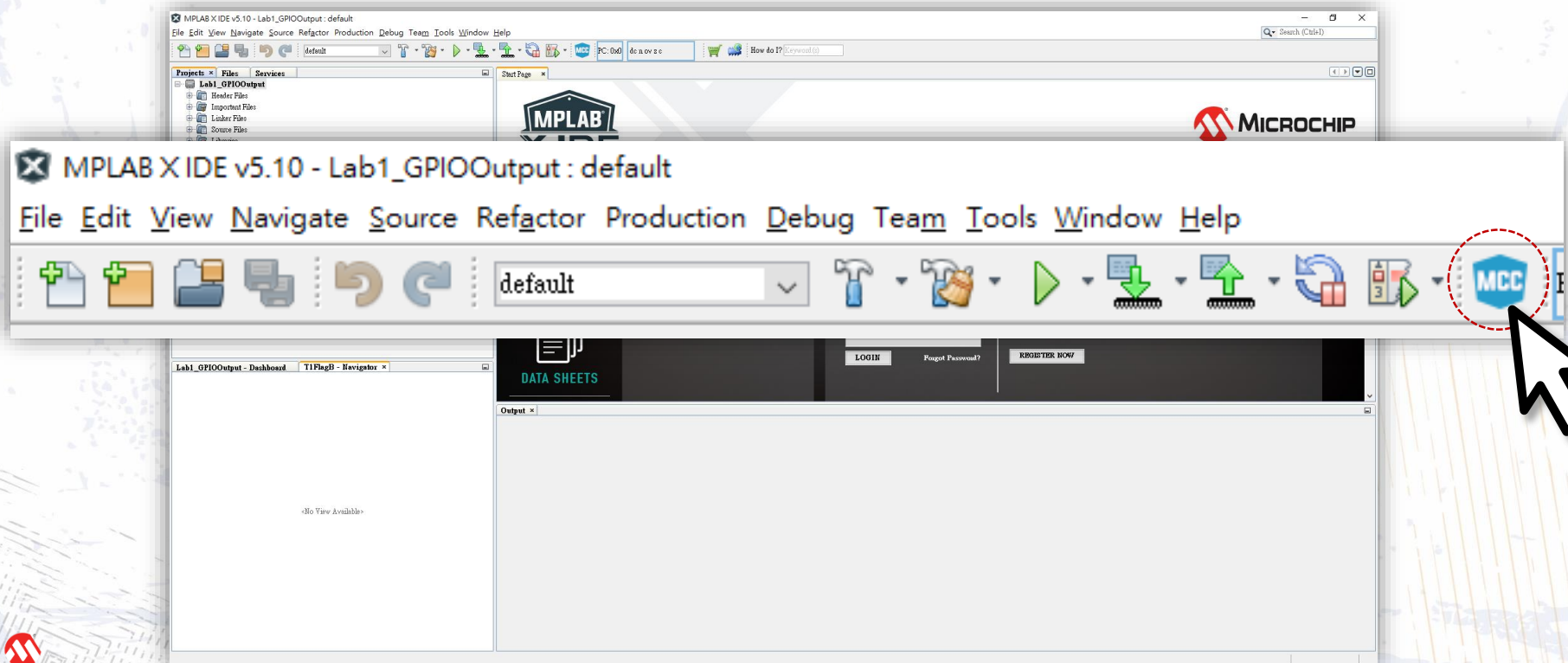
Lab1 GPIO Output

Step 3

- **Save MCC Configuration File**
  Select save directory at your project folder.
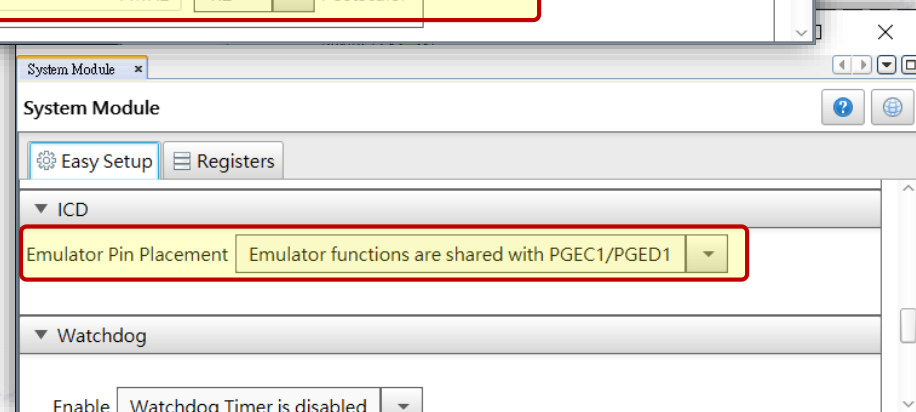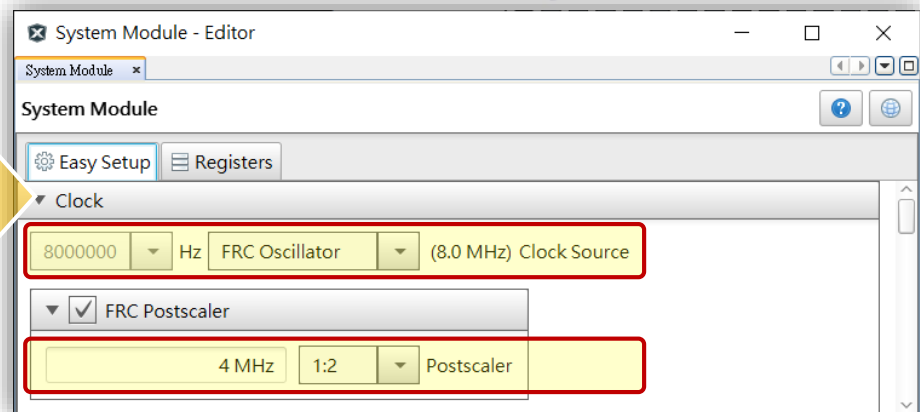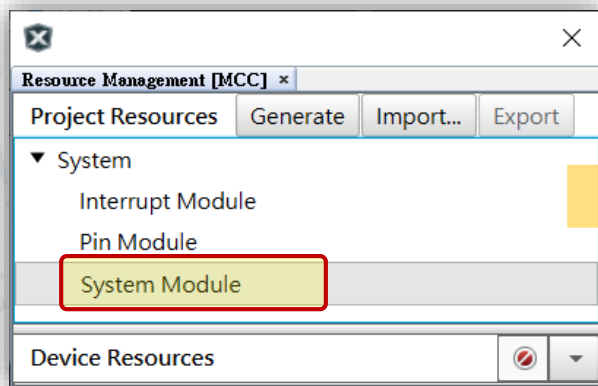 **E.g. C:\PIC24_Exercises\Exams\Lab1_GPIOOutput.X**

You muse save when you open MCC first time

Lab1 GPIO Output
Step 4

◆ **Set System Clock & Debug Interface.**
   System Module ▸ Clock ▸ FRC Oscillator, Postscaler:1:2
   System Module ▸ ICD ▸ PGEC1/PGED1

Lab1 GPIO Output

Step 5

● **Set RB7 to digital output mode**

Pin Manager :

Gird View ▶ Click RB7 to lock to GPIO output
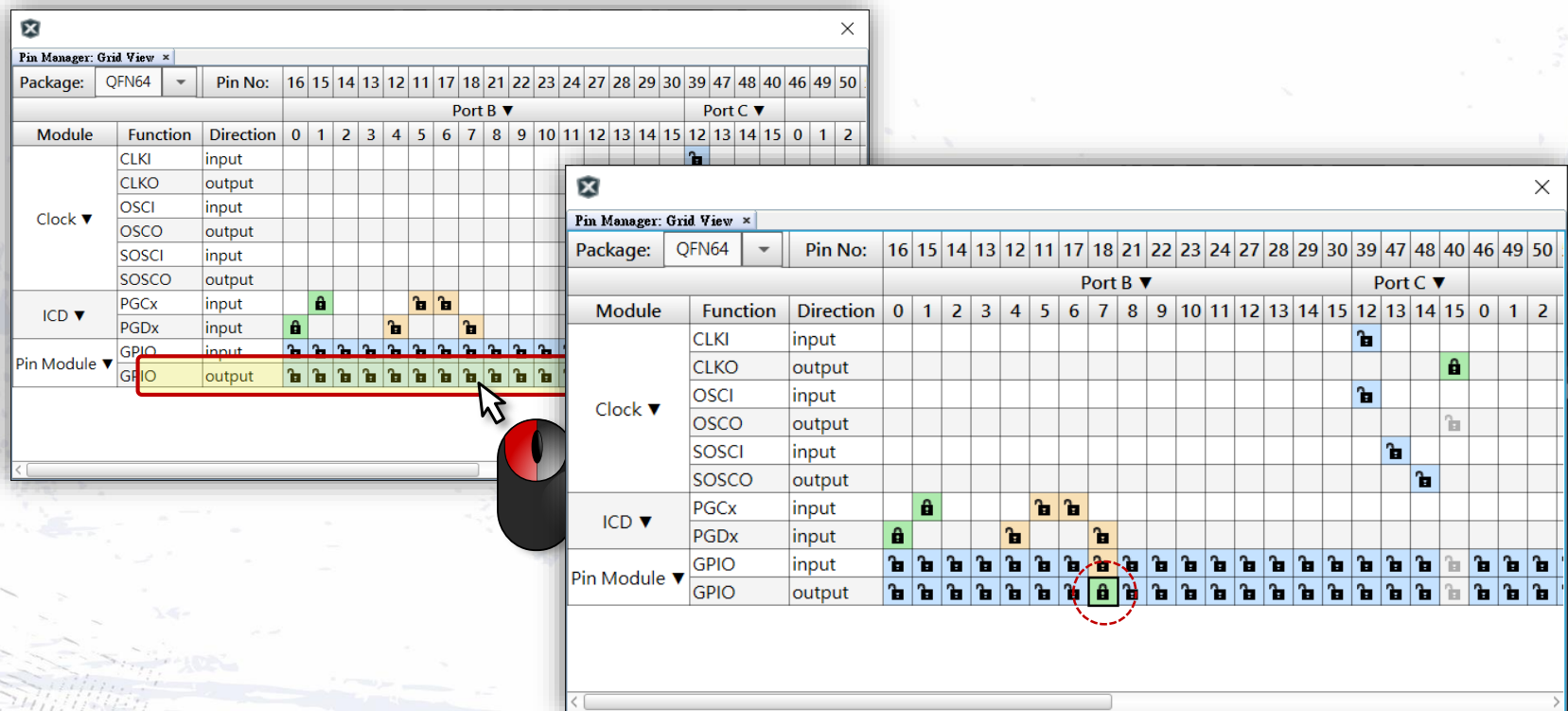
Lab1 GPIO Output
Step 6

⬙ **Set Alias for RB7**

uncheck Analog, check Output & Start high
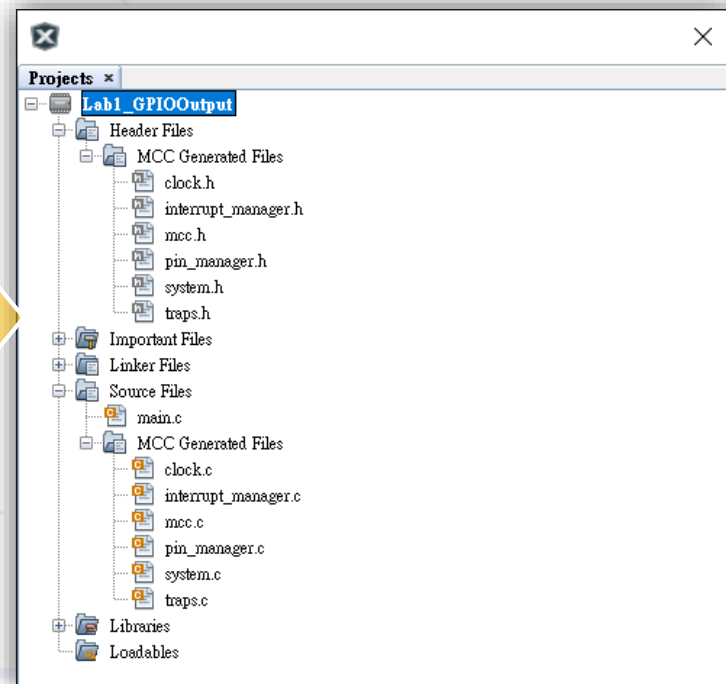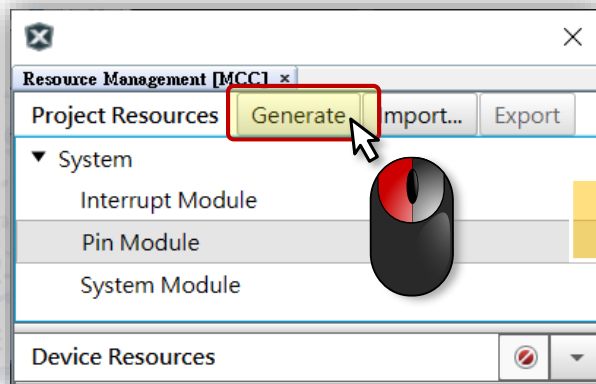
Alias (Custom Name) : D1
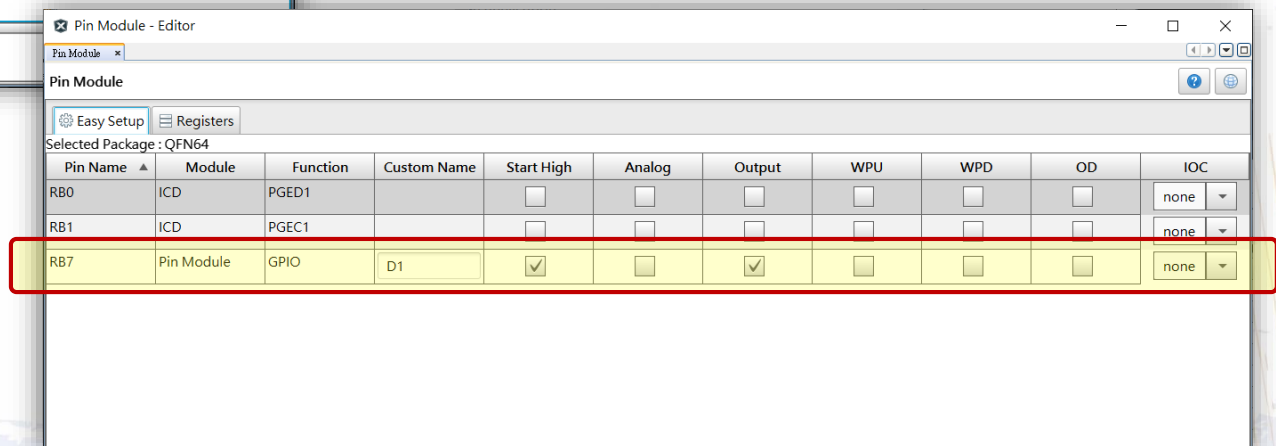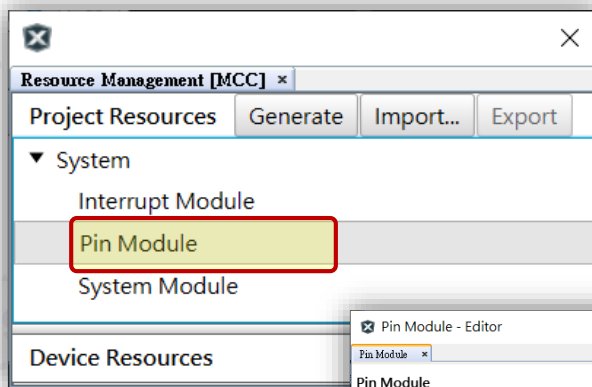
Lab1 GPIO Output

Step 7

- **Generate Code**

  Click Generate Code Button to generate your first MCC's style Project.

  All files generate by MCC include main.c automatically.

Lab1 GPIO Output

Step 8

🔳 **Try to add code to main function**

Double Click main.c to view & add below code to main().
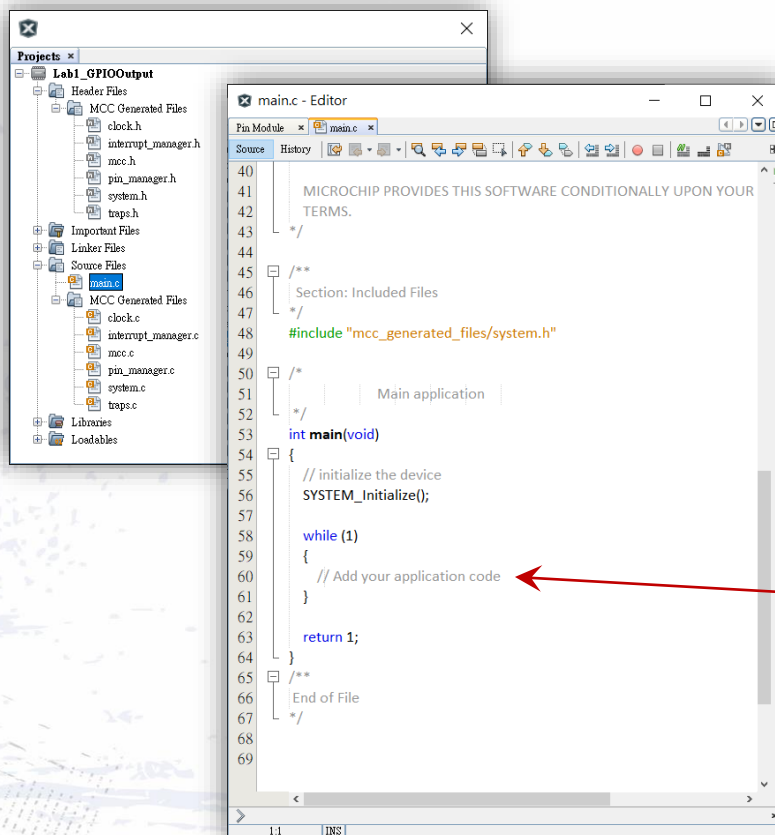
Add below code to main()
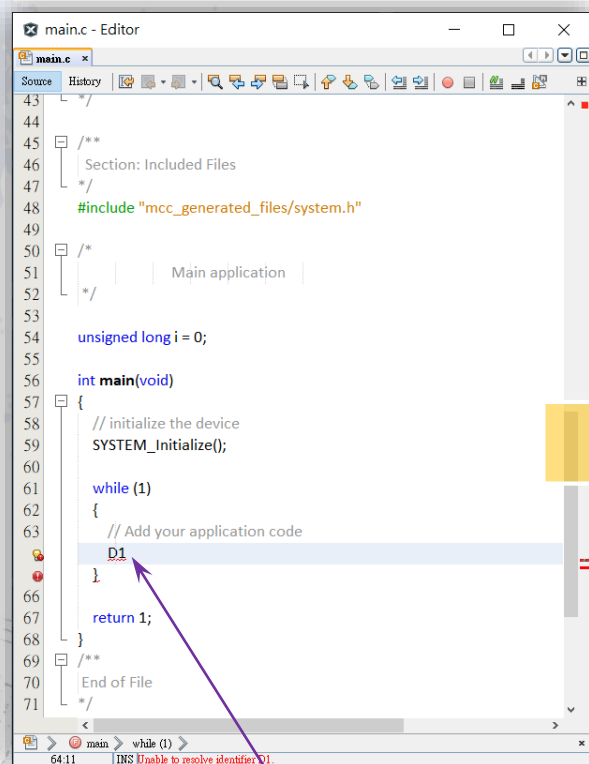
```
#include "mcc_generated_files/system.h"
#include "mcc_generated_files/pin_manager.h"

unsigned long i = 0;

int main(void)
{
    // initialize the device
    SYSTEM_Initialize();

    while (1)
    {
        // Add your application code
        D1_Toggle();
        for (i = 0; i < 80000; i++);
    }
    return -1;
}
```
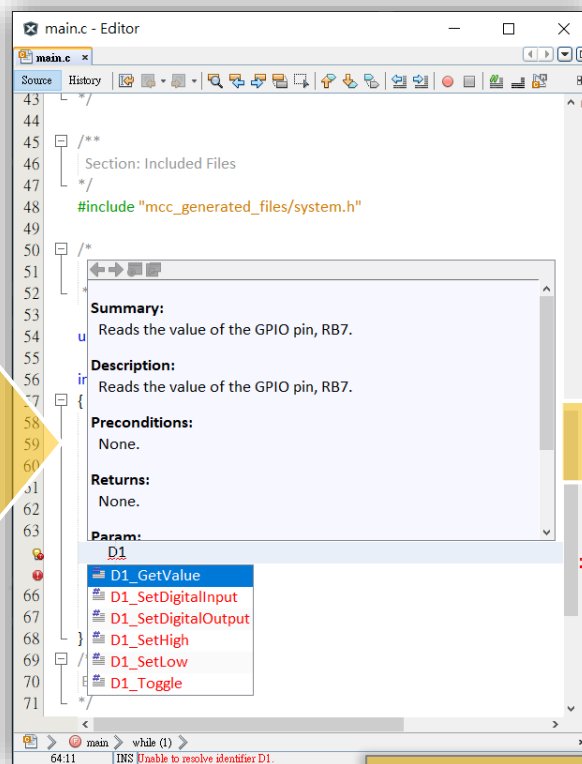
MPLAB X IDE Hints
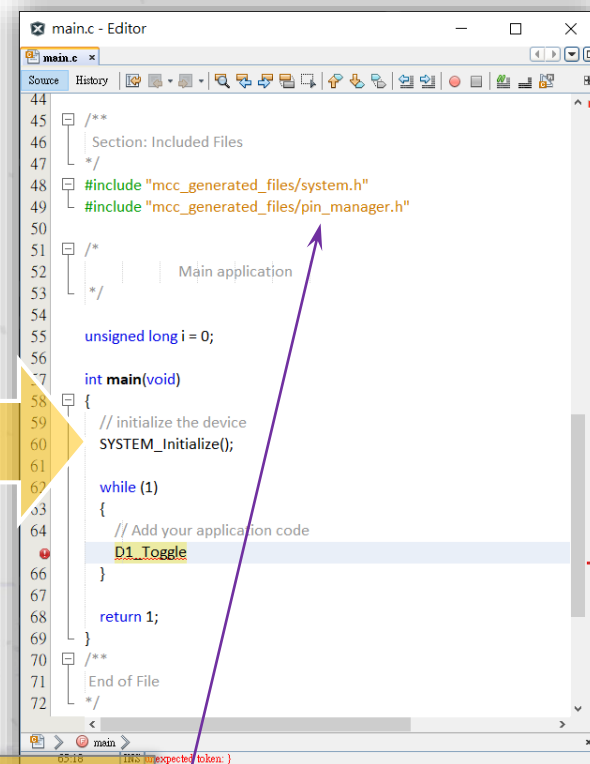
- **Hot key "Ctrl+Alt+\\"**
  - Type D1 first than use "Ctrl+Alt+\\" to find you want.

Ctrl+Alt+

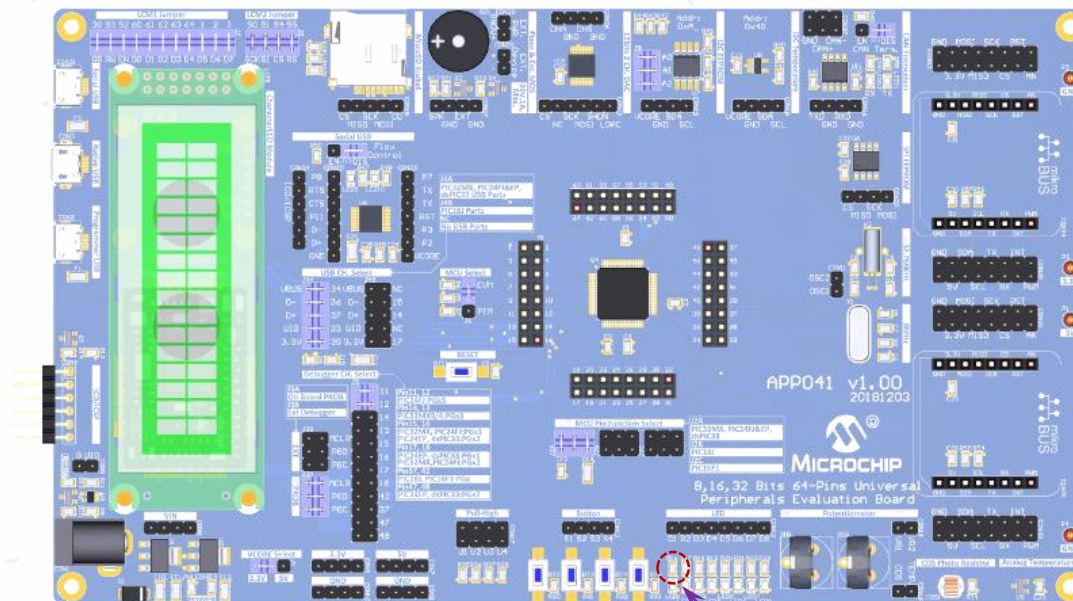**Add header file automatically.**
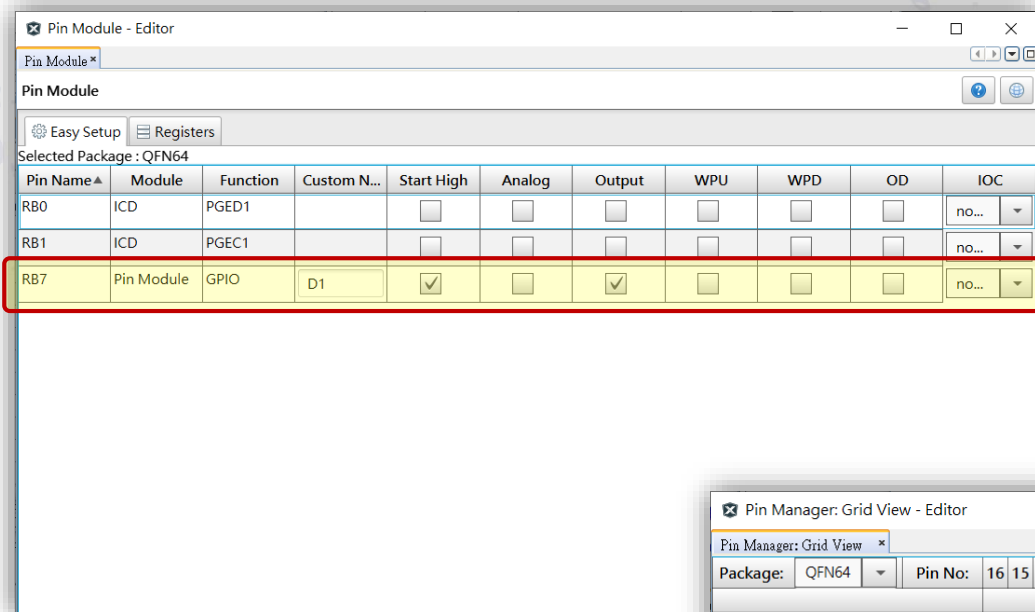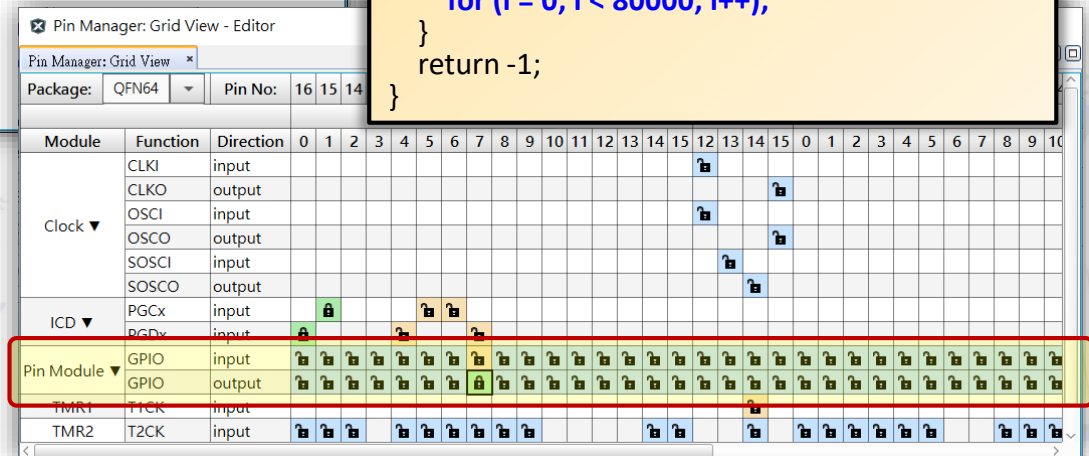
Lab1 GPIO Output

Step 9 & Result

- Try to program your code to your target board.
  Select **Make and Program Device Main Project** icon
  Make sure **Programming/Verify complete**

- **Please connect RB7 to LED(D1) to observe LED status.**

LED1 Toggle !

Lab1 – GPIO Output
MCC's Setting & Code Example


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

unsigned long i = 0;

int main(void)
{
    // initialize the device
    SYSTEM_Initialize();

    while (1)
    {
        // Add your application code
        D1_Toggle();
        for (i = 0; i < 80000; i++);
    }
    return -1;
}
```

Lab1 GPIO Output

Review

- **Open pin_manager.h & pin_manager.c**
- **Try to find D1xxxx relate function & definition at pin_manager.h**
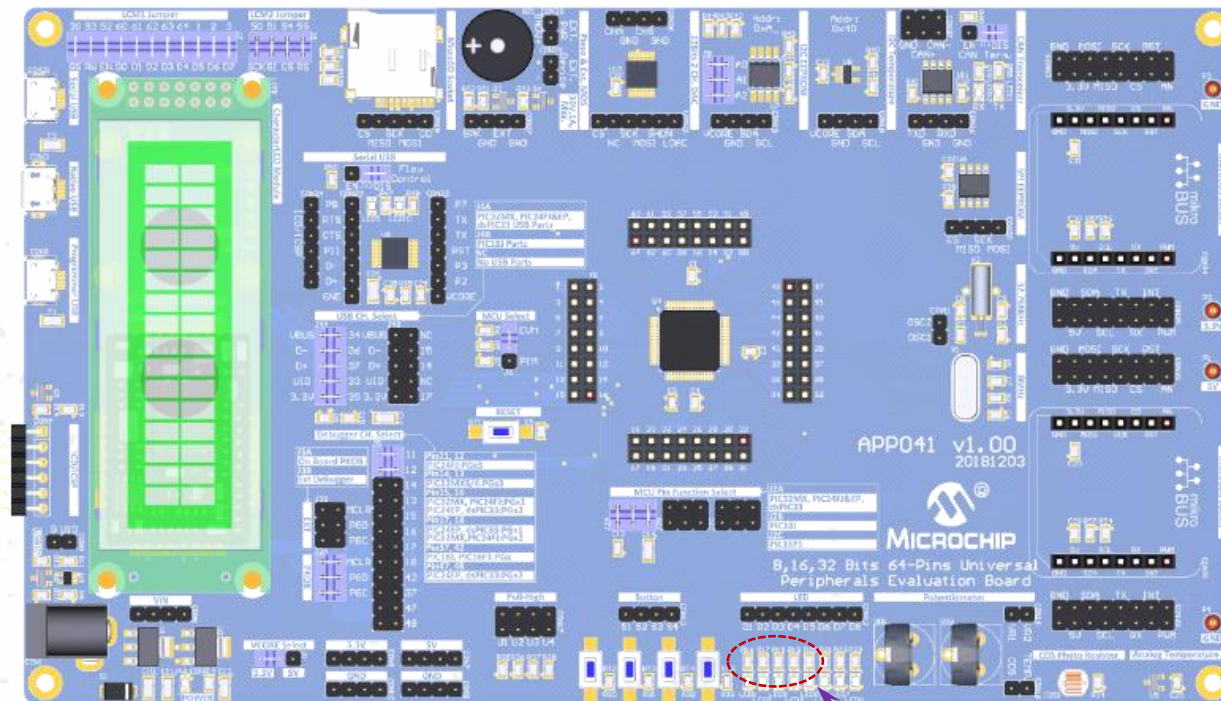
Lab2 Multi-GPIO Output

Lab2 Multi-GPIO Output

- Try to set more GPIO pins to digital output mode and toggle levels (period around 500ms ~ 1S), individually.

- RB7 -> LED1(D1)
  RB8 -> LED2(D2)
  RB9 -> LED3(D3)
  RB10 -> LED4(D4)

- # Let's go!

2019 Winter Elite

MICROCHIP

Lab2 Multi-GPIO Output

Result

LEDs Control by Software Delay.

Lab2 Multi-GPIO Output
MCC's Setting & Code Example


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

int main(void)
{
    // initialize the device
    SYSTEM_Initialize();

    while (1)
    {
        // Add your application code
        D1_Toggle();
        D2_Toggle();
        D3_Toggle();
        D4_Toggle();
        for (i = 0; i < 80000; i++);
    }
    return -1;
}
```
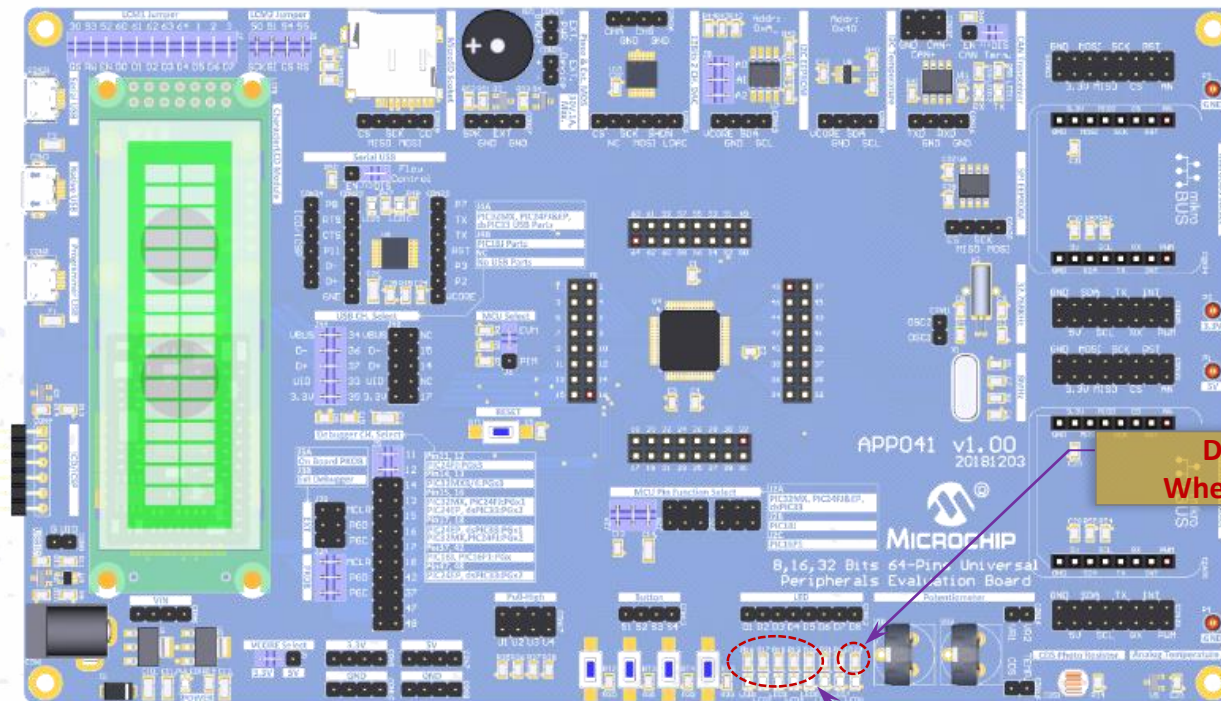
Lab3 GPIO Input

Lab3 GPIO Input

- **Try to set RC13 to digital input to get button status.**

- **Try to do that to get button status then control another led status.**
  S1 Pressed -> D8 Light
  S1 Released -> D8 Dark

- **Please connect RC13 to Button(S1), RB14 to LED(D8).**

Let's go!

Lab3 GPIO Input
Result

D8 Turn On,
When S1 Pressed.

LEDs Control by Software Delay.

Lab3 GPIO Input
MCC's Setting & Code Example


```c
int main(void)
{
    // initialize the device
    SYSTEM_Initialize();

    while (1)
    {
        // Add your application code
        if(i++>80000)
        {
            D1_Toggle();

            ...
            i = 0;
        }

        if(S1_GetValue())
            D8_SetLow();
        else
            D8_SetHigh();
    }
    return -1;
}
```