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**Getting Started Using
8-bit MCUs in the
MPLAB[®] Xpress Ecosystem**

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Chapter 1. Overview of the MPLAB® Xpress Ecosystem

1.1 INTRODUCTION

MPLAB® Xpress is an ecosystem is comprised of:

- [MPLAB Xpress IDE](#)
- [MPLAB Code Configurator](#)
- [MPLAB Xpress Evaluation Boards](#)
- [Other Compatible Hardware](#)

1.2 MPLAB XPRESS IDE

MPLAB Xpress cloud-based IDE is an online development environment that contains the most popular features of our award-winning MPLAB® X IDE. This simplified and distilled application is a faithful reproduction of our desktop-based program, which allows users to easily transition between the two environments.

MPLAB Xpress is a perfect starting point for new users of PIC® microcontrollers (MCUs) – no downloads, no machine configuration, and no waiting to get started on your system development.

MPLAB Xpress incorporates the latest version of MPLAB Code Configurator, which enables users to automatically generate initialization and application C code for 8-bit and 16-bit PIC MCUs and dsPIC® DSCs using a graphical interface and pin map.

With massive amounts of storage available to users, you can store your current projects in the cloud. The Community feature allows you to share your ideas with others, or gain inspiration from the shared code repository.

Best of all, MPLAB Xpress IDE is free, and can be accessed from any Internet-connected PC or Mac, anywhere in the world.

1.3 MPLAB CODE CONFIGURATOR

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

MPLAB Code Configurator supports 8-bit, 16-bit and 32-bit PIC microcontrollers. MCC is incorporated into both the downloadable MPLAB X IDE, and the cloud based MPLAB Xpress IDE.

1.4 MPLAB XPRESS EVALUATION BOARDS

MPLAB Xpress evaluation boards are the easiest way to get started. They feature an easy-to-use USB programmer, and offer full access to the features of the target MCU.

1.5 OTHER COMPATIBLE HARDWARE

Additional hardware that may be used with MPLAB Xpress IDE are listed below.

Curiosity Development Boards

Curiosity Development Boards are cost-effective, fully integrated MCU development platforms targeted at first-time users, makers, and those seeking a feature-rich rapid prototyping board. The family offers a full on-board programmer/debugger, and several add-on board options.

Explorer 16/32 Development Board

The Explorer 16/32 Development Kit is a flexible, convenient and ready to start development, demonstration and testing platform for 16-bit PIC24 MCUs, dsPIC DSCs and 32-bit PIC32 MCUs. It features all the necessary hardware to begin developing and debugging a complete embedded application.

PICKit™ 3 Programmer/Debugger

PICKit 3 is a standalone programmer/debugger for use with any PIC MCU or dsPIC DSC DSC. PICKit 3 is the perfect option for those with their own custom prototype hardware.

Chapter 2. Equipment Used

2.1 INTRODUCTION

This content of this document was developed using the tools listed in the following sections:

- [Hardware](#)
- [Software](#)
- [Additional Resources](#)

2.2 HARDWARE

- MPLAB Xpress Evaluation Boards: <http://www.microchip.com/xpress>
- USB cable type A to type micro-B

2.3 SOFTWARE

- MPLAB Xpress IDE: <http://www.microchip.com/xpress>
- Free Terminal Emulation Software:
 - Tera Term (Windows only): <http://www.teraterm.org>
 - CoolTerm (Windows, Linux, MAC OS): <http://freeware.the-meiers.org/>

2.4 ADDITIONAL RESOURCES

- MPLAB XC8 C Compiler Homepage: <http://www.microchip.com/xc8>
- MPLAB Code Configurator Homepage: <http://www.microchip.com/mcc>
- MPLAB Xpress Wiki Homepage: <http://microchip.wikidot.com/xpress:start>

Using 8-bit MCUs in MPLAB® Xpress

NOTES:

Chapter 3. Programming the Evaluation Board

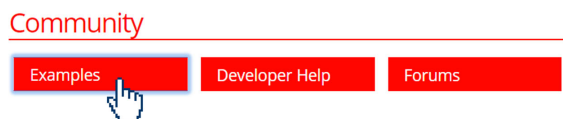
3.1 INTRODUCTION

The purpose of this section is to introduce basic concepts of the MPLAB Xpress IDE with one of the available example projects.

- [Opening an Example Project in MPLAB Xpress IDE](#)
- [Download an Example Project to the Evaluation Board](#)
- [Setup Serial Communication with the Evaluation Board](#)
- [Programming Result](#)

3.2 OPENING AN EXAMPLE PROJECT IN MPLAB XPRESS IDE

1. Navigate to the MPLAB Xpress IDE homepage and click on the **Examples** link at the bottom of the page under the “Community” heading:
<https://www.microchip.com/xpress>

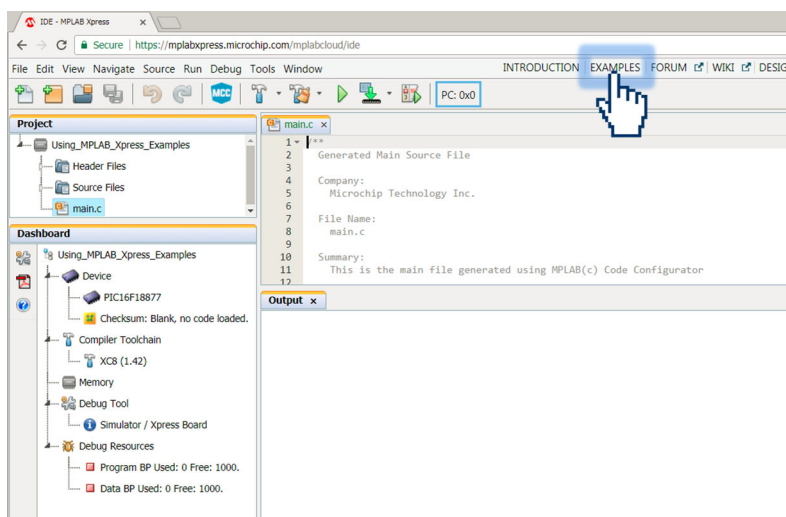


OR

You can navigate directly to the examples page via:
<https://www.microchip.com/xpress/examples>

OR

Navigate to the examples page from within the MPLAB Xpress IDE by clicking on the **Examples** link at the top of the IDE window.



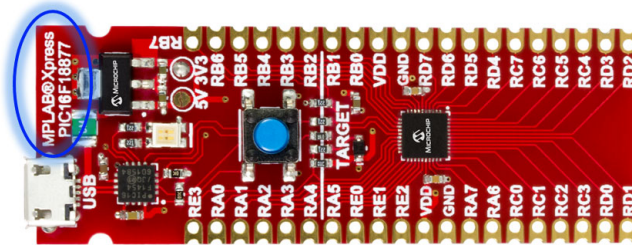
Using 8-bit MCUs in MPLAB® Xpress

2. On the **MPLAB Xpress Examples** homepage, filter through the examples as follows:

- a) **Author:** Microchip Technology
- b) **Tags:** #GettingStarted
- c) **Board:** Xpress Board
- d) **Device:** <the device you are using>

In this example the PIC16F18877 is used.

The name of the device populating a given MPLAB Xpress Evaluation Board can be found next to the board's USB connector.



Scroll through the available examples and locate “Using MPLAB Xpress Examples.” A description of the example, along with any additional resources which could include videos links to step-by-step tutorials and more, can be accessed by clicking on the title of the example.

Open the example inside the online MPLAB Xpress IDE by clicking on the **IDE** button in the Open column.

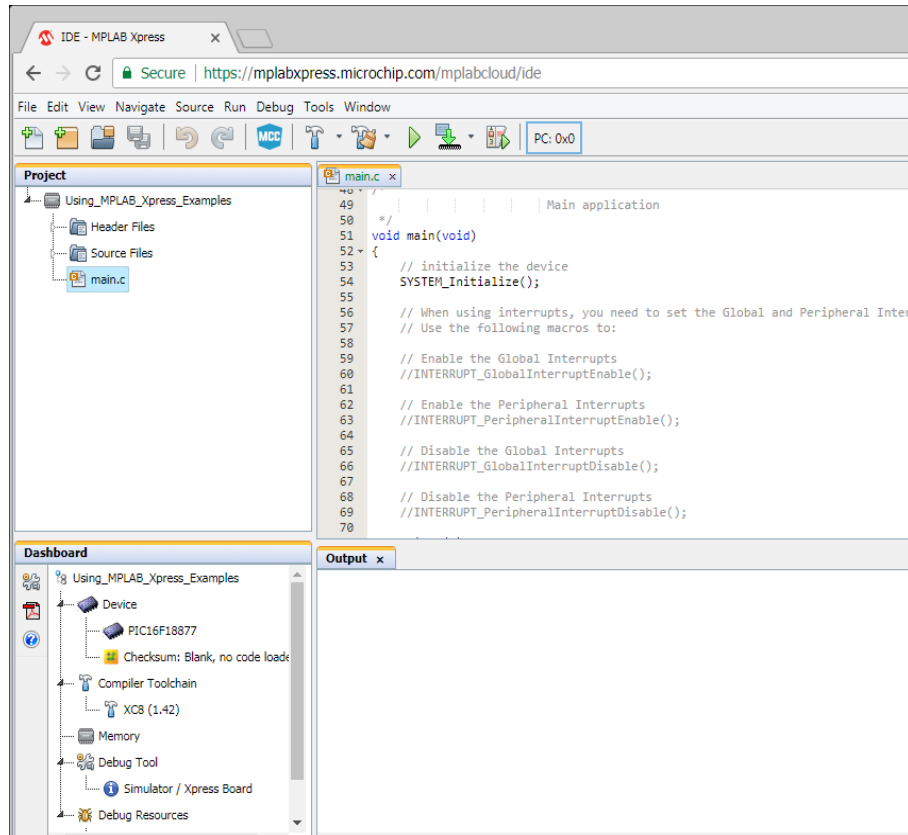
MPLAB Xpress Code Examples

Manage My Examples Manage All Examples

Title	Author	Like	Watch	Import	Tags	Board	Device	Updated	Open
Search	<input type="text"/>	From <input type="text"/> To <input type="text"/>	From <input type="text"/> To <input type="text"/>	From <input type="text"/> To <input type="text"/>	<input checked="" type="checkbox"/> #Getting Started <input type="checkbox"/> ADC <input type="checkbox"/> ADCC	<input type="checkbox"/> PIC24FJ256GA7 Curic... <input type="checkbox"/> PIC32MM Curiosity <input checked="" type="checkbox"/> Xpress Board	<input type="text" value="PIC16F18877"/>	From <input type="text"/> To <input type="text"/>	<input type="text"/>
Creating a Serial Communication Link ...		0	0	23	#Getting Started, UART, ...	Xpress Board	PIC16F18877	10/03/2017	IDE
Blink		0	1	20	#Getting Started, Config...	Xpress Board	PIC16F18877	10/03/2017	IDE
Reading Analog Signals using the MPL...		0	1	11	#Getting Started, ADC, ...	Xpress Board	PIC16F18877	10/03/2017	IDE
Hello World		0	1	10	#Getting Started	Xpress Board	PIC16F18877	10/03/2017	IDE
Using MPLAB Xpress Examples		0	1	2	#Getting Started	Xpress Board	PIC16F18877	09/29/2017	IDE
Create a Project in MPLAB Xpress IDE		0	1	0	#Getting Started	Xpress Board	PIC16LF18877	10/02/2017	IDE
Open the MPLAB Code Configurator G...		0	1	0	#Getting Started	Xpress Board	PIC16F18877	10/02/2017	IDE
MPLAB Code Configurator (MCC) Wal...		0	1	0	#Getting Started	Xpress Board	PIC16F18877	10/03/2017	IDE
Locating Serial Comms Pins on MPLA...		0	1	0	#Getting Started, UART	Xpress Board	PIC16F18877	10/04/2017	IDE

Showing 1 to 9 of 9

Programming the Evaluation Board

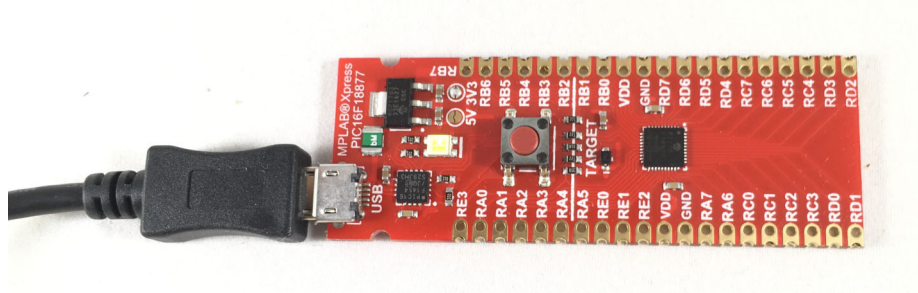


All source code is available along with information related to the development tools and device that the project was configured to use.

Using 8-bit MCUs in MPLAB® Xpress


3.3 DOWNLOAD AN EXAMPLE PROJECT TO THE EVALUATION BOARD

1. Connect the MPLAB Xpress Evaluation board to an available USB Port on the computer.

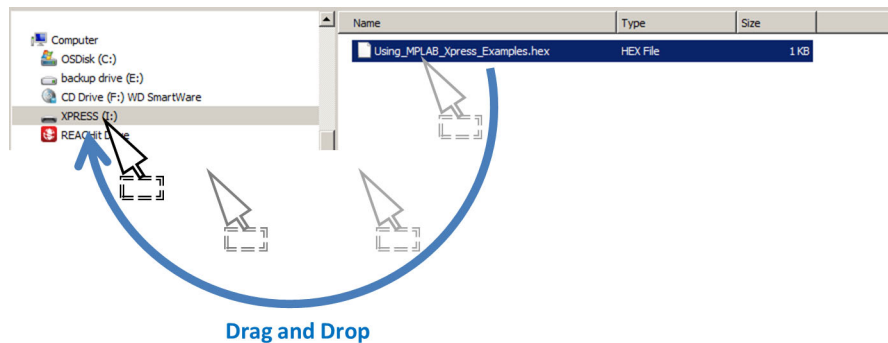


2. Once connected and the device drivers have completed installation, the MPLAB Xpress Board should be recognized as a Mass Storage Device on the Host Computer and listed as an available drive (Windows® Explorer shown here).



3. Click on the **Make and Program Device**  button at the top of the MPLAB Xpress IDE to generate and download a .hex file that will be used to program the PIC16F18877 microcontroller populating this particular MPLAB Xpress Evaluation Board.

In some browsers the generated .hex file may be available within the browser window or may need to be accessed from a "Downloads" folder associated with the browser. Navigate to the downloaded .hex file and drag it into the XPRESS directory shown in Step 2.



Once the `Using_MPLAB_Xpress_Examples.hex` file has been dragged and dropped into the XPRESS directory, the LED on the MPLAB Xpress Board will briefly flash red, indicating that the PIC16F18877 is programmed.

Programming the Evaluation Board

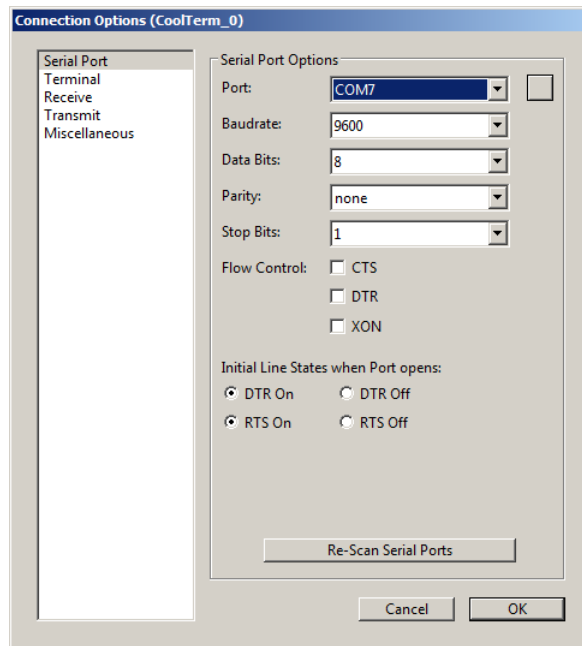
3.4 SETUP SERIAL COMMUNICATION WITH THE EVALUATION BOARD


1. Open a terminal emulator program on the host computer and select the COM port associated with the MPLAB Xpress board.

In this example a free program called CoolTerm is used. If using CoolTerm, open the Connection>Options dialog and configure the serial port at the 9600 baud rate.

Note: The COM port number will vary from that shown below.

Click **OK** to continue.

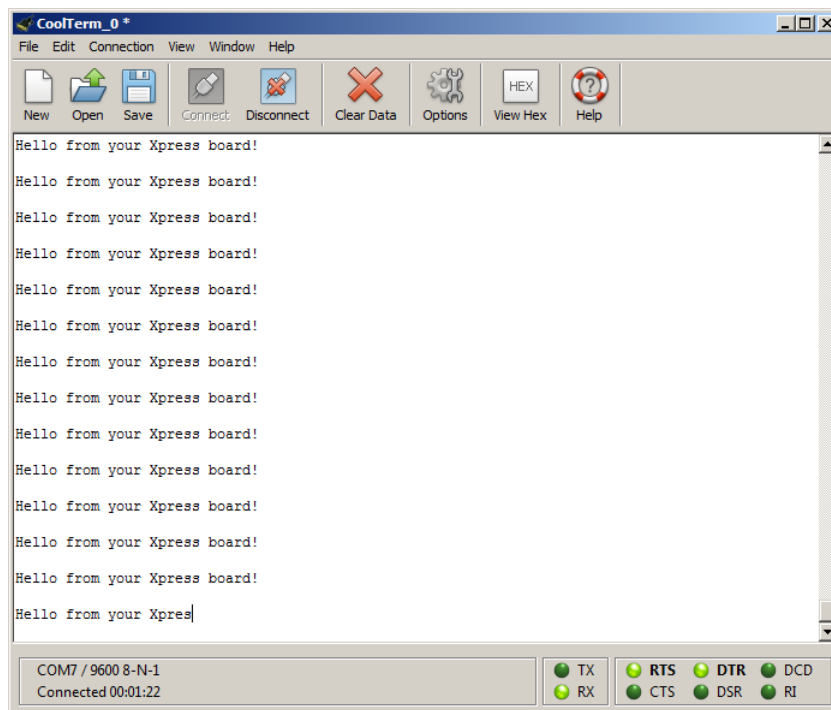


2. Inside the terminal window, click on the  **Connect** button to establish connection with the MPLAB Xpress board.

Using 8-bit MCUs in MPLAB® Xpress

3.5 PROGRAMMING RESULT

Once communication is established, the terminal window should display the message “Hello from your Xpress board!”



Chapter 4. Launching MPLAB® Xpress MCC Plugin


4.1 INTRODUCTION

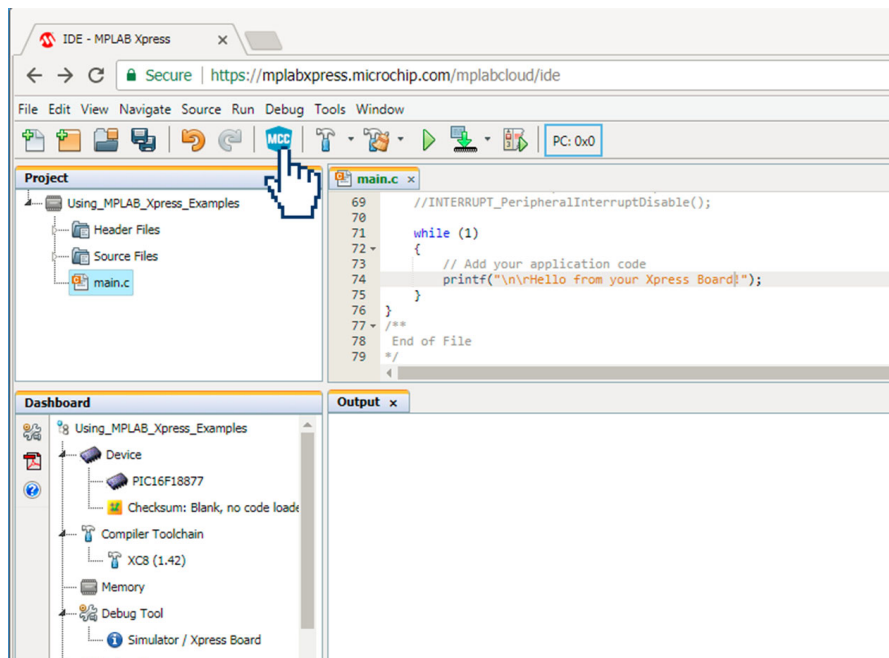
This chapter demonstrates how to launch the MPLAB Code Configurator (MCC) plugin from within MPLAB Xpress IDE. MCC is a free graphical programming environment that generates seamless, easy-to-understand C code that is inserted into your project. Using an intuitive interface, MCC enables and configures a rich set of peripherals and functions.

The example project from the previous chapter will be used.

- [Opening the MCC Plugin for the First Time](#)
- [MCC in MPLAB Xpress](#)

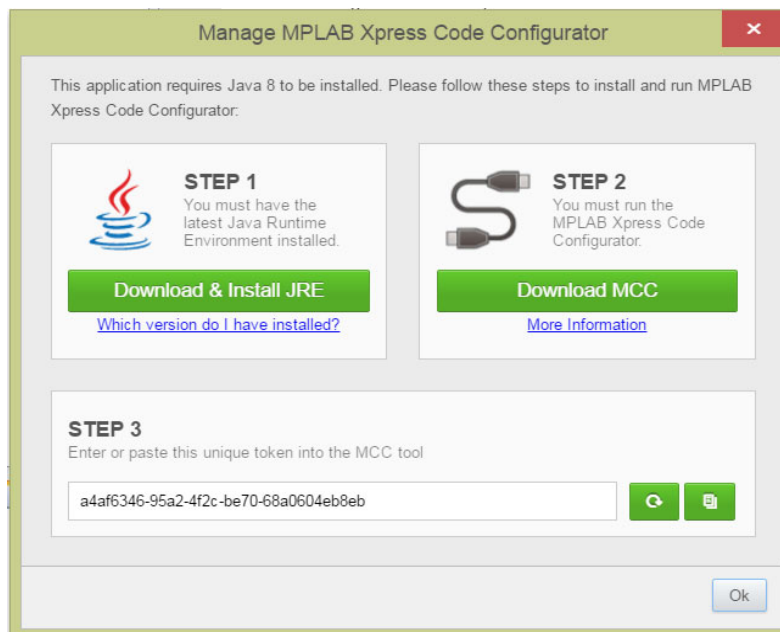
4.2 OPENING THE MCC PLUGIN FOR THE FIRST TIME

1. Launch the **Manage MPLAB Xpress Code Configurator** dialog by clicking on the  button at the top of the IDE or through *Tools>Embedded>MPLAB Xpress Code Configurator*.

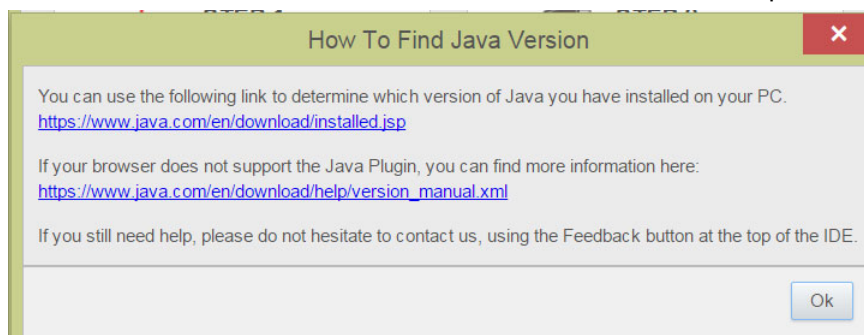


Using 8-bit MCUs in MPLAB® Xpress

The **Manage MPLAB Xpress Code Configurator** dialog should now be open.



2. **STEP 1** ensures that the latest Java Runtime Environment (JRE) is installed on your computer. If unsure of the current version of the JRE on your computer, click on the 'Which version do I have installed?' link and follow the steps.

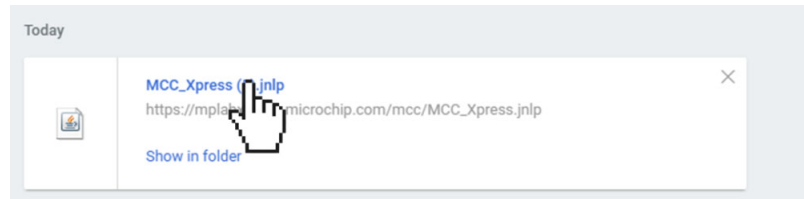


Clicking on the green **Download & Install JRE** button will redirect you to the Java Runtime Environment homepage. To install JRE, simply follow the instructions.

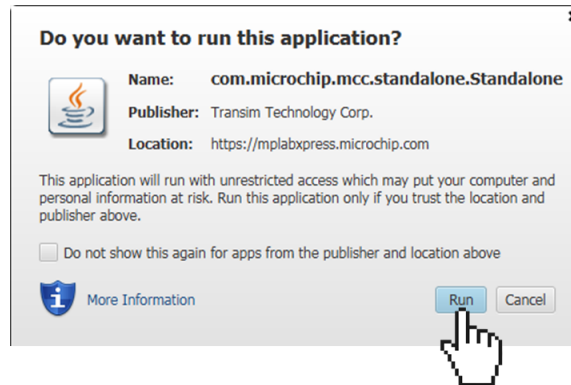


Launching MPLAB® Xpress MCC Plugin

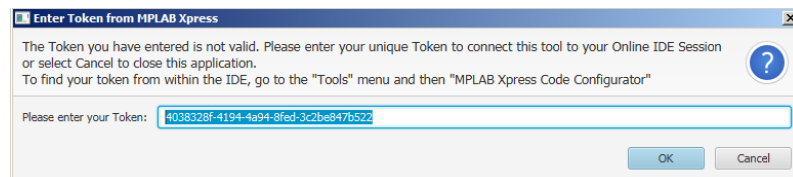
3. **STEP 2** is used to download the necessary .jnlp file to launch MCC.
MCC is a Java application that runs directly from the internet using a web browser (Chrome is used here). This requires the use of the Java Web Start application software which follows the Java Network Launching Protocol (JNLP) to download and launch the application.
 - a) Click the green **Download MCC** button to download the JNLP file. Then click on the MCC_Xpress.jnlp file to launch the Code Configurator.



- b) Click **Run** when prompted to run the application.

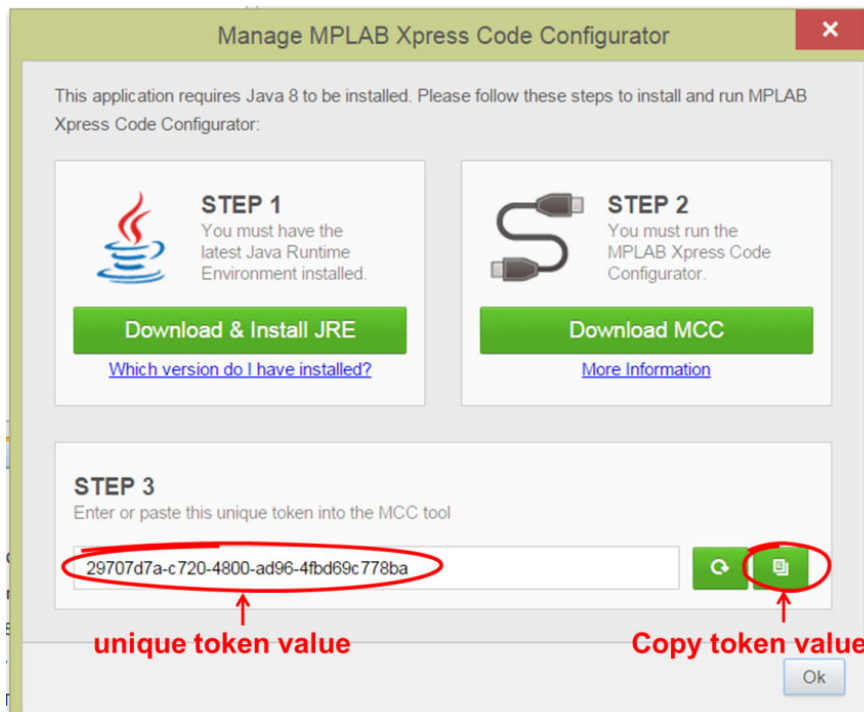


- c) The **Enter Token from MPLAB Xpress** window will now open.

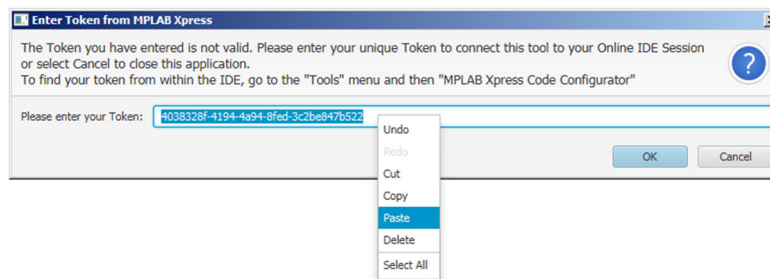



Using 8-bit MCUs in MPLAB® Xpress

4. **STEP 3** provides a unique token value that will be used in the **Enter Token from MPLAB Xpress** window. To locate the token, return to the **Manage MPLAB Xpress Code Configurator** window. Then click on the **Copy** button next to the unique token value..



5. Return to the **Enter Token from MPLAB Xpress** window. Past the copied token value into the “Please enter your Token” field.

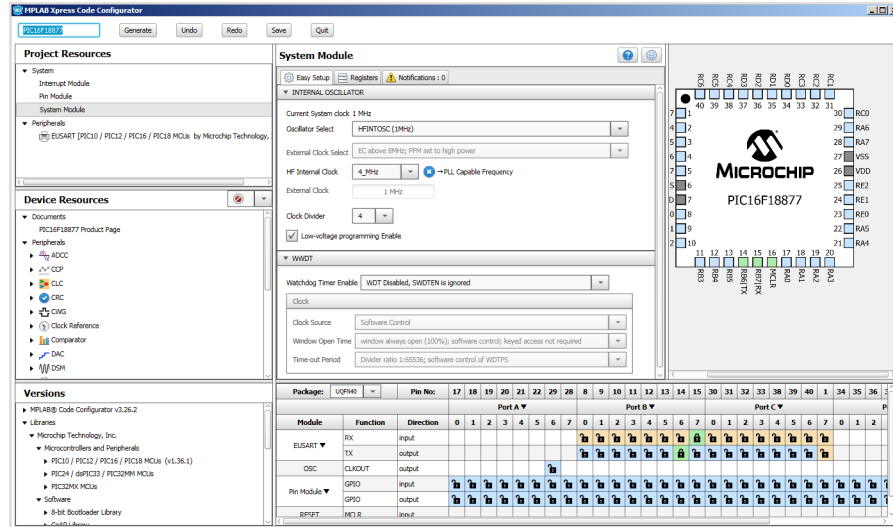


6. Click **OK** to initialize the device-specific libraries for the microcontroller selected and open the MCC.
If the token is not valid, refresh the token value in **STEP 3** by clicking on the **Refresh Token Value** button  in the **Manage MPLAB Xpress Code Configurator** window.
7. Recopy the new Unique Token Value and paste into the “Please enter your Token” field of the **Enter Token from MPLAB Xpress** window.

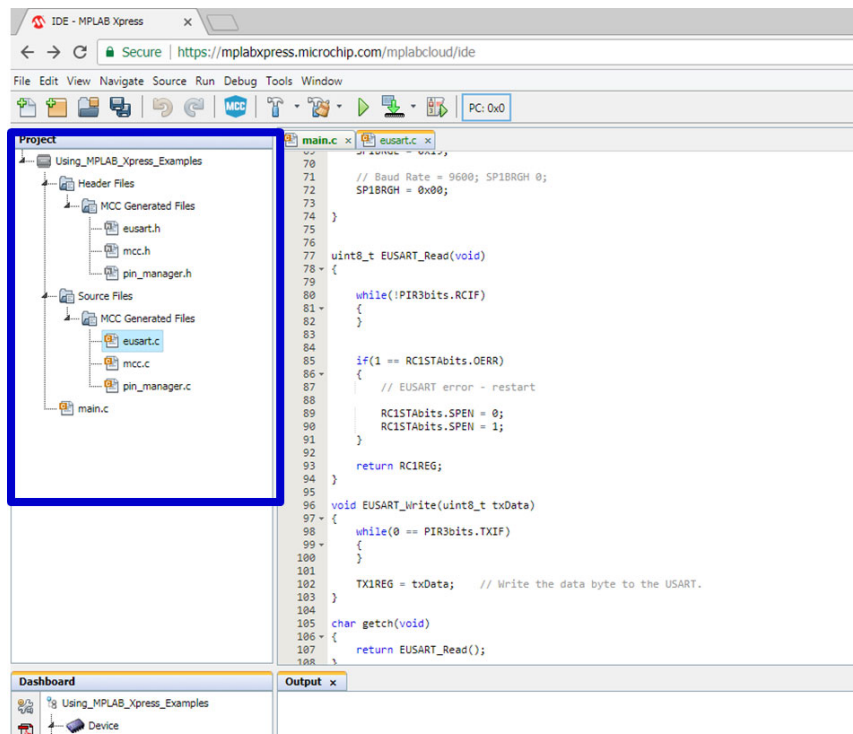
Launching MPLAB® Xpress MCC Plugin

4.3 MCC IN MPLAB XPRESS

The MCC is a graphical programming environment used to configure device features including oscillator setup, peripheral configuration and assign signals within the microcontroller to pins on the device package. You are encouraged to take some time and explore the configurator to see how the MCU was configured to implement the “Using MPLAB Xpress Examples” example project.



Source and header files generated for the original project can be viewed in the Project pane of the MPLAB Xpress IDE under the Header Files and Source Files folders.



Using 8-bit MCUs in MPLAB® Xpress

NOTES:

Chapter 5. Using the MPLAB® Code Configurator (MCC)

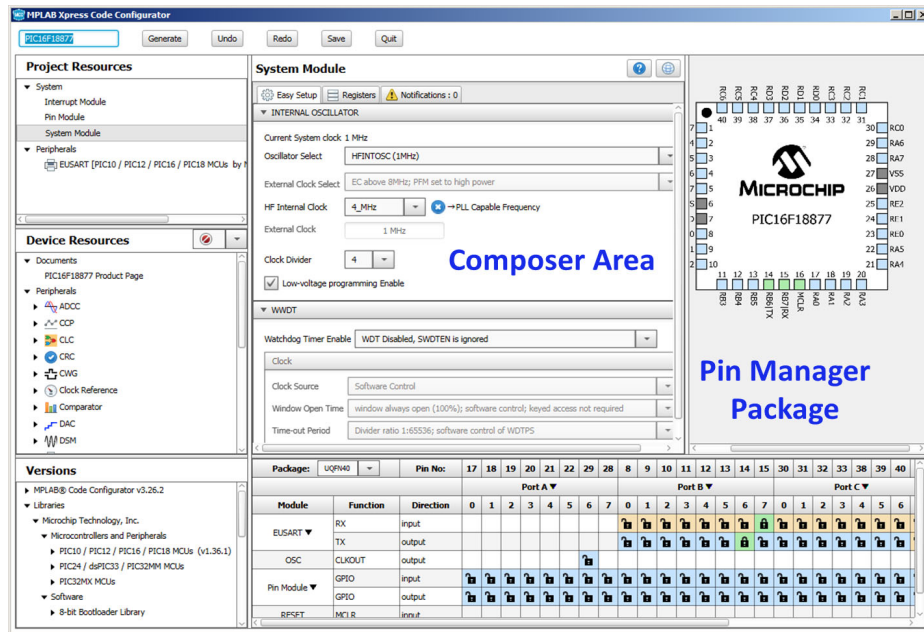
5.1 INTRODUCTION

The MPLAB Code Configurator (MCC) is a Graphical User Interface (GUI) that gives the developer a high level view of a given microcontroller, making it much easier to configure:

- Core device capabilities
- Peripherals and configuration
- MCU signal pin assignment
- Related libraries

These features can all be configured through the use of intuitive drop-down menus, check boxes, and fields. In this way the developer can quickly configure the target device, minimizing the amount of time spent reviewing registers in a data sheet.

Key MCC tool areas are shown in the screen capture below.



Pin Manager Table

Key tool areas are discussed further in these topics:

- [Project Resources](#)
- [Device Resources](#)
- [Composer Area](#)
- [Pin Manager](#)

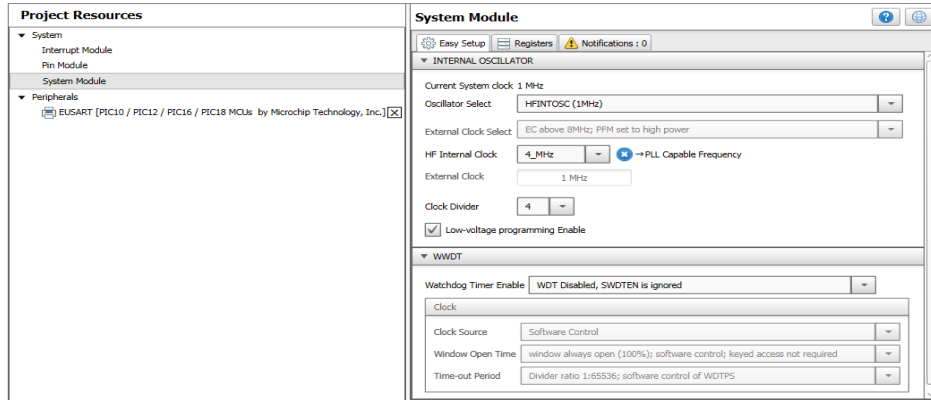
Using 8-bit MCUs in MPLAB® Xpress

5.2 PROJECT RESOURCES

Displays device features currently being used in this project.

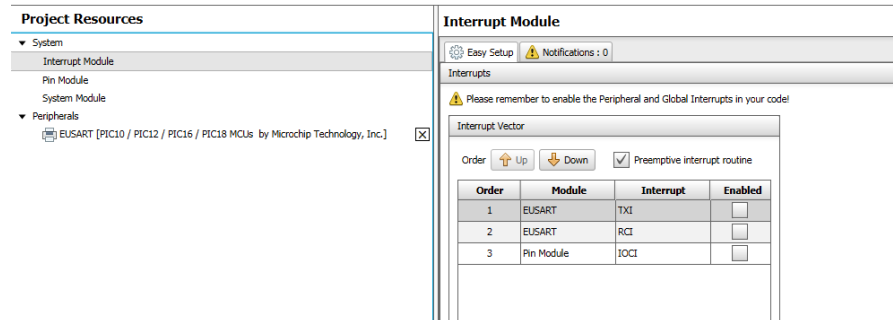
5.2.1 System Module

Configure core parameters such as the system clock, configuration bits and other device-level functions.



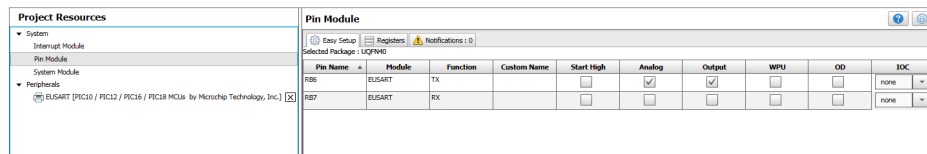
5.2.2 Interrupt Module

Enable or configure interrupt priority for interrupt sources available in the project.



5.2.3 Pin Module

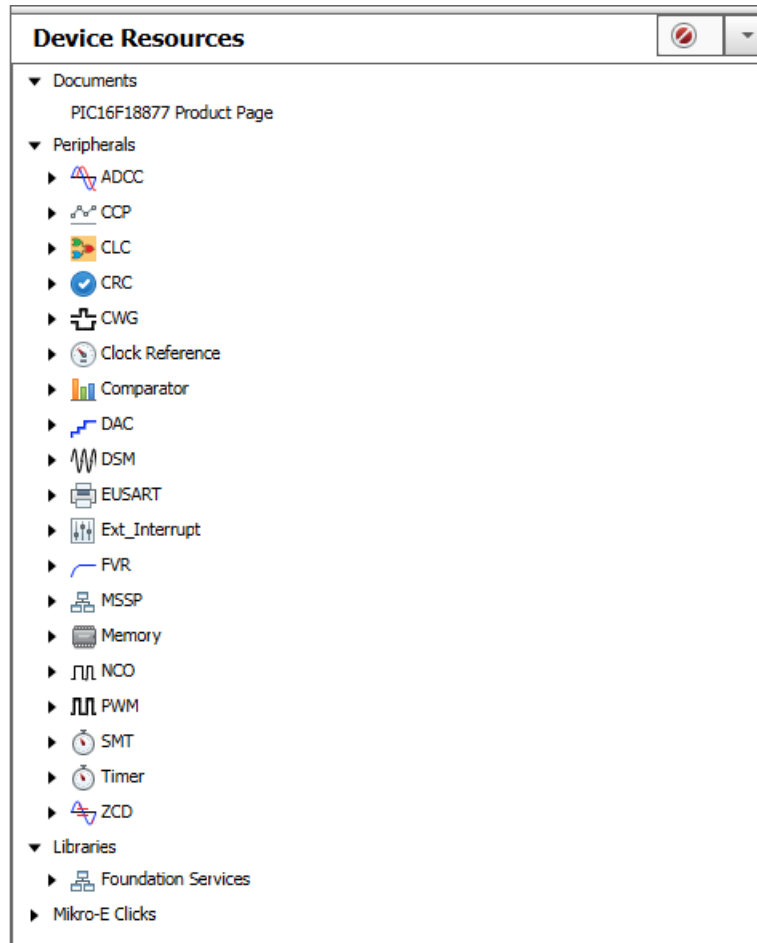
Configuration of individual pins selected from the Pin Manager such as pin direction (input or output), analog functionality and weak pull-up resistors, if available. In some instances a custom name can be given for a pin that will be referenced throughout generated code.



Using the MPLAB® Code Configurator (MCC)

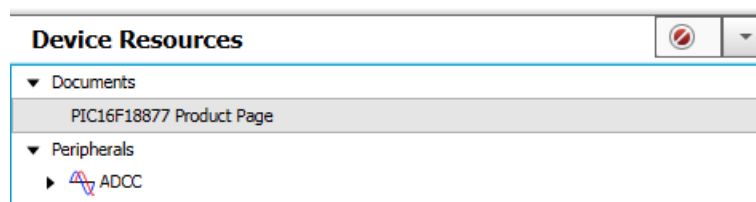
5.3 DEVICE RESOURCES

This area displays features that are available for use for the selected target device. Features are added by double clicking on the listing in the Device Resources section.



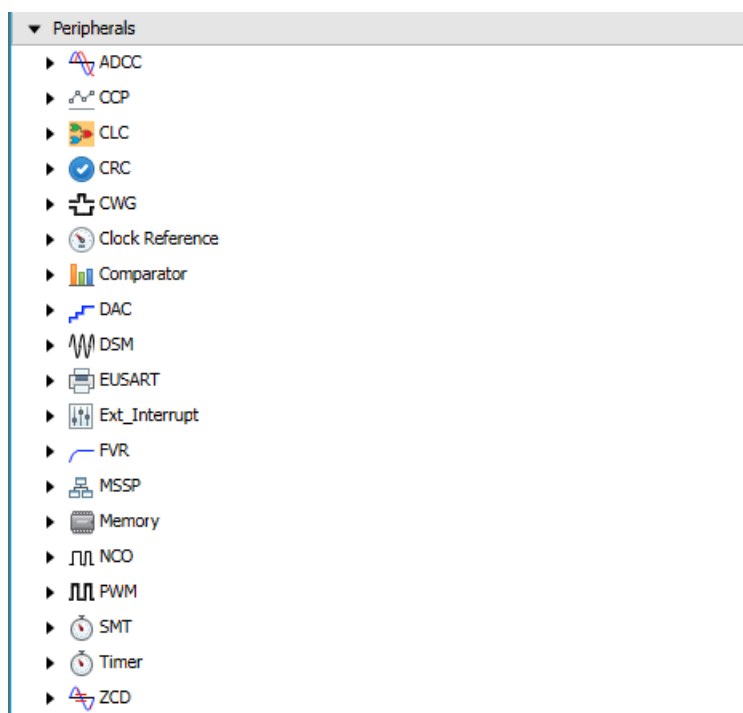
5.3.1 Product Page

Links to the selected device's product homepage where the data sheet and other documentation, such as relevant application notes, can be found.



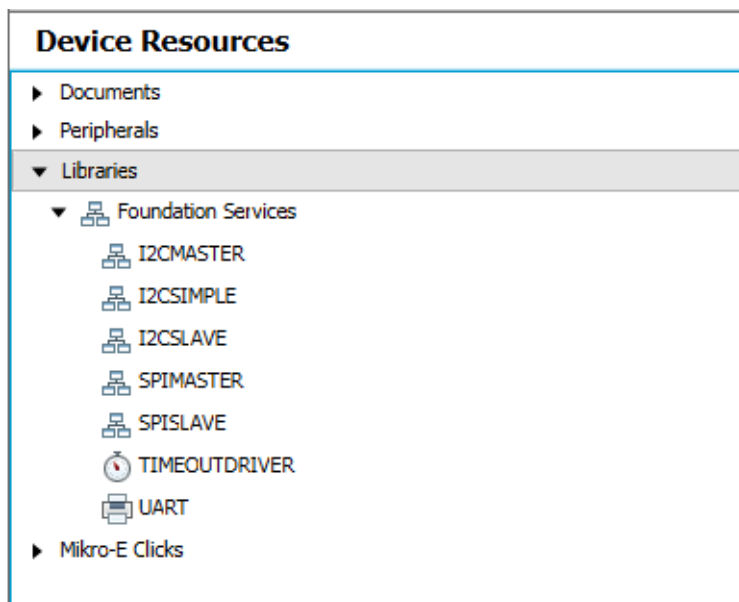
5.3.2 Peripherals

Displays all peripherals that are available on the selected target device. Different devices will have different peripherals. Peripherals are added to the project by double clicking on the listing.



5.3.3 Libraries

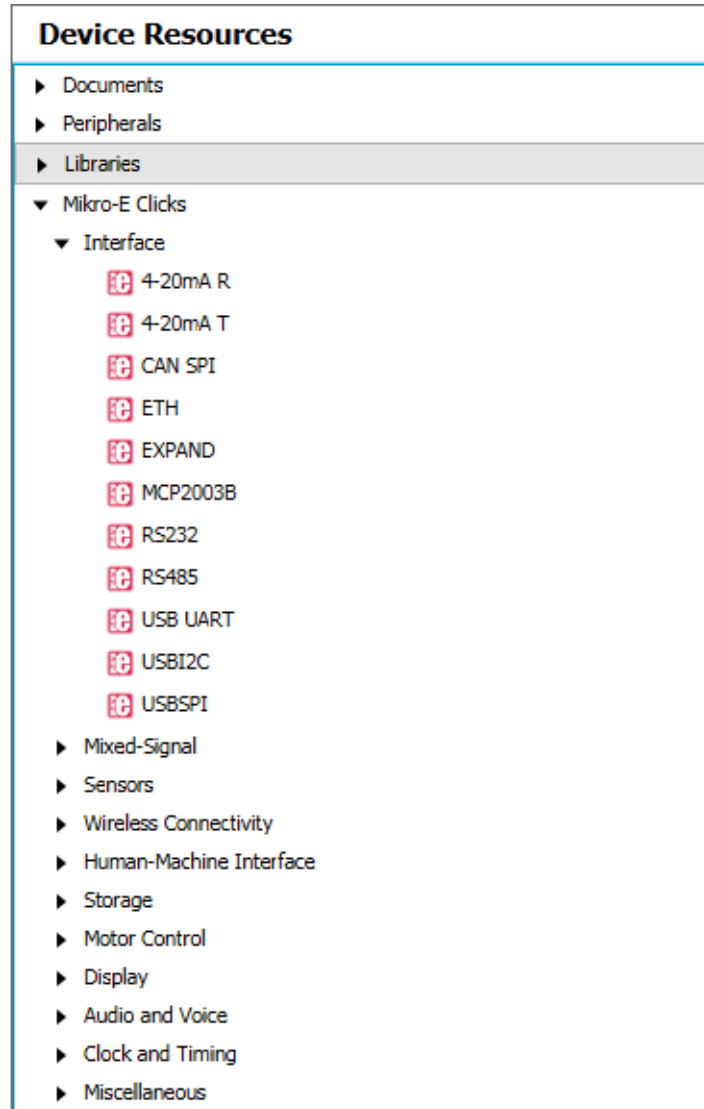
Lists available libraries that have been created to simplify certain functionality such as using serial communication protocols. These libraries are presented to the user as any other module in the MCC using an easy-to-use graphical interface to configure various library parameters. Libraries are added to the project by double clicking on the listing.



Using the MPLAB® Code Configurator (MCC)

5.3.4 MIKRO-E Clicks

MikroElektronika Click boards™ are expansion daughter cards featuring various types of sensors, communication modules and other interface components that can be used with the target device to quickly add additional functionality to an application. Click boards are added to the project by double clicking on the listing in the Device Resources, which adds required peripherals as needed that interface with the selected module.

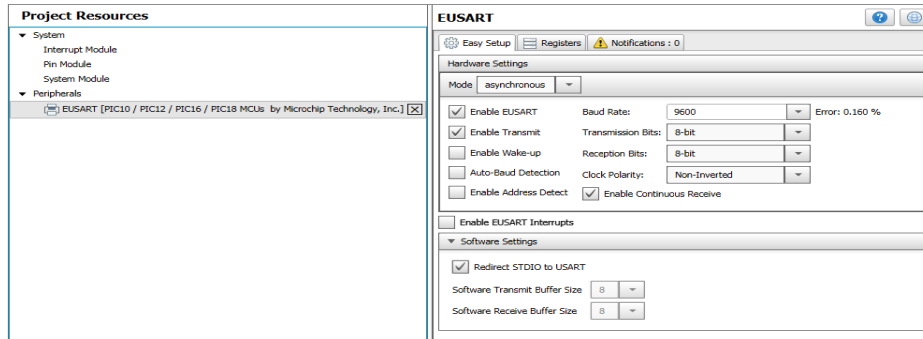


5.4 COMPOSER AREA

Main interface area in which a peripheral, library or driver is configured.

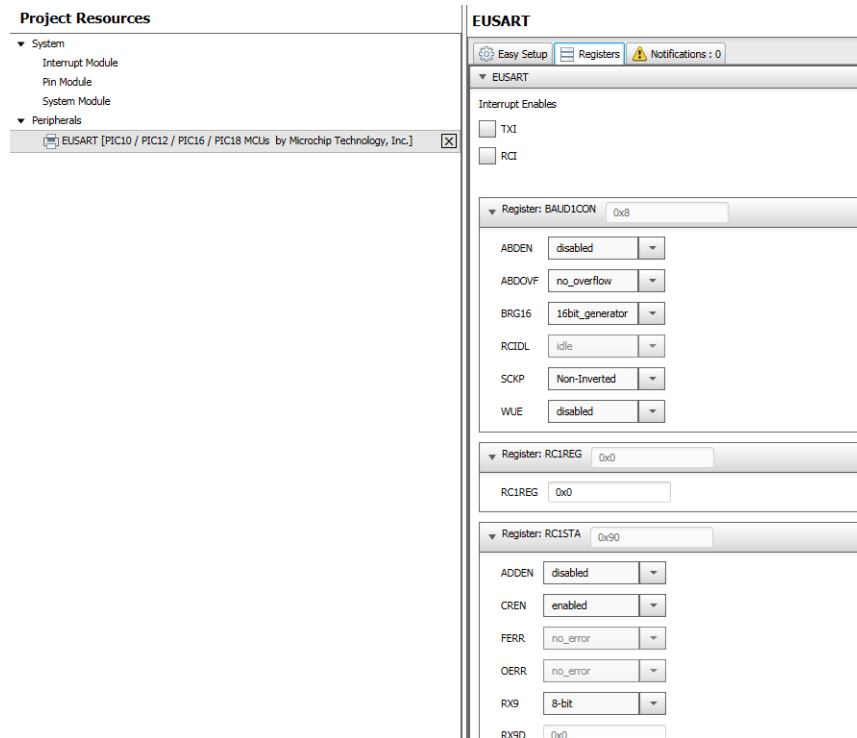
5.4.1 Easy Setup Tab

This tab presents the peripheral, library or driver at a high level so that it can be configured using intuitive check boxes, value fields and drop-down selections (EUSART peripheral Easy Setup shown).



5.4.2 Registers Tab

Presents the registers associated with device peripherals and features. Registers can be configured using either drop-down menus or by entering a hexadecimal value next to the register name representing individual bit settings (EUSART peripheral Registers shown).



Using the MPLAB® Code Configurator (MCC)

5.4.3 Notifications Tab

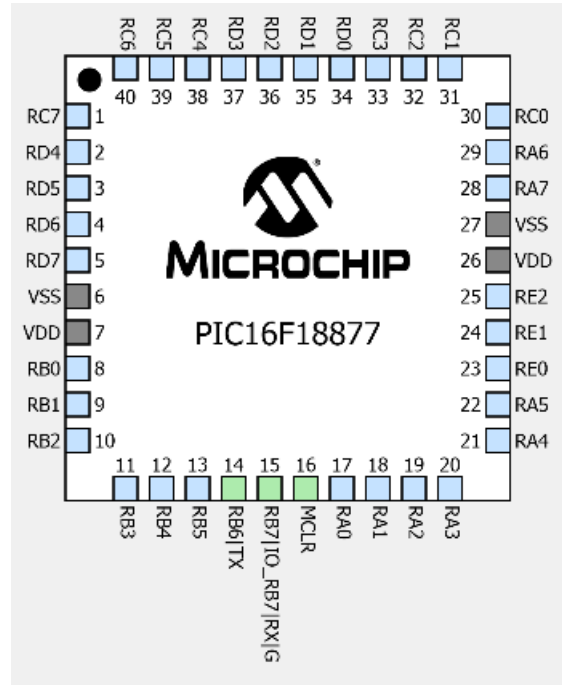
This tab displays important information concerning various modules that have been configured including warnings, hints and general information (EUSART Notifications shown where the System Clock was set to a lower frequency that is insufficient to obtain the desired Baud rate).

Category	Module Name	Type	Description
	EUSART	HINT	Baud rate error exceeds 2%

Using the MPLAB® Code Configurator (MCC)

5.5.2 Pin Manager Package View

Displays pins on the selected device package. Color codes follow above adding Gray colored pins indicating that the pin is not usable in the selected configuration. Microcontroller signals can also be assigned to pins in this view by right clicking on the pin and selecting the available signal.



5.5.3 Versions

This section of the MCC provides information about the versions of the component groups that make up MCC. These component groups are called libraries. Intermediate users can configure the MCC to use a specific version of a library for a given MCC project. More information is available in the MCC User's Guide available in the MCC homepage in the documents section at the bottom of the page:

<http://www.microchip.com/mcc>

The screenshot shows the 'Versions' configuration page in MPLAB Xpress. The page is titled 'Versions' and has a light blue header. Below the header, there is a tree view of the configuration. The root node is 'MPLAB® Code Configurator v3.26.2', which is expanded. Underneath, 'Core v4.15' is selected and marked with a green checkmark. Below that is the 'Libraries' section, which is also expanded. Under 'Libraries', there are two main categories: 'Microchip Technology, Inc.' and another 'Microchip Technology, Inc.' category. The first 'Microchip Technology, Inc.' category is expanded to show 'Microcontrollers and Peripherals' and 'Software'. 'Microcontrollers and Peripherals' has three sub-items: 'PIC10 / PIC12 / PIC16 / PIC18 MCUs (v1.36.1)', 'PIC24 / dsPIC33 / PIC32MM MCUs', and 'PIC32MX MCUs'. 'Software' has 14 sub-items: '8-bit Bootloader Library', 'CoAP Library', 'Dac Library', 'Foundation Services Library (v0.1.21)', 'LIN Library', 'LoRaWAN Library', 'MCP794XX I2C RTCC', 'MikroElektronika Click Library (v1.0.25)', 'mTouch Capacitive Sensing Library', 'TCP/IP Lite Stack', 'Temperature Sensor Library', 'UCS211x', and 'USB Framework Lite'. The second 'Microchip Technology, Inc.' category is expanded to show 'Software', which has one sub-item: '47XXX I2C EERAM'.

```
graph TD
    Root[MPLAB® Code Configurator v3.26.2] --> Core[Core v4.15]
    Root --> Libraries[Libraries]
    Libraries --> Microchip1[Microchip Technology, Inc.]
    Libraries --> Microchip2[Microchip Technology, Inc.]
    Microchip1 --> Microcontrollers[Microcontrollers and Peripherals]
    Microchip1 --> Software1[Software]
    Microcontrollers --> PIC10[PIC10 / PIC12 / PIC16 / PIC18 MCUs (v1.36.1)]
    Microcontrollers --> PIC24[PIC24 / dsPIC33 / PIC32MM MCUs]
    Microcontrollers --> PIC32MX[PIC32MX MCUs]
    Software1 --> Bootloader[8-bit Bootloader Library]
    Software1 --> CoAP[CoAP Library]
    Software1 --> Dac[Dac Library]
    Software1 --> Foundation[Foundation Services Library (v0.1.21)]
    Software1 --> LIN[LIN Library]
    Software1 --> LoRaWAN[LoRaWAN Library]
    Software1 --> MCP794XX[MCP794XX I2C RTCC]
    Software1 --> MikroElektronika[MikroElektronika Click Library (v1.0.25)]
    Software1 --> mTouch[mTouch Capacitive Sensing Library]
    Software1 --> TCP_IP[TCP/IP Lite Stack]
    Software1 --> Temperature[Temperature Sensor Library]
    Software1 --> UCS211x[UCS211x]
    Software1 --> USB[USB Framework Lite]
    Microchip2 --> Software2[Software]
    Software2 --> 47XXX[47XXX I2C EERAM]
```

Chapter 6. Building a Serial Communications Link

6.1 INTRODUCTION

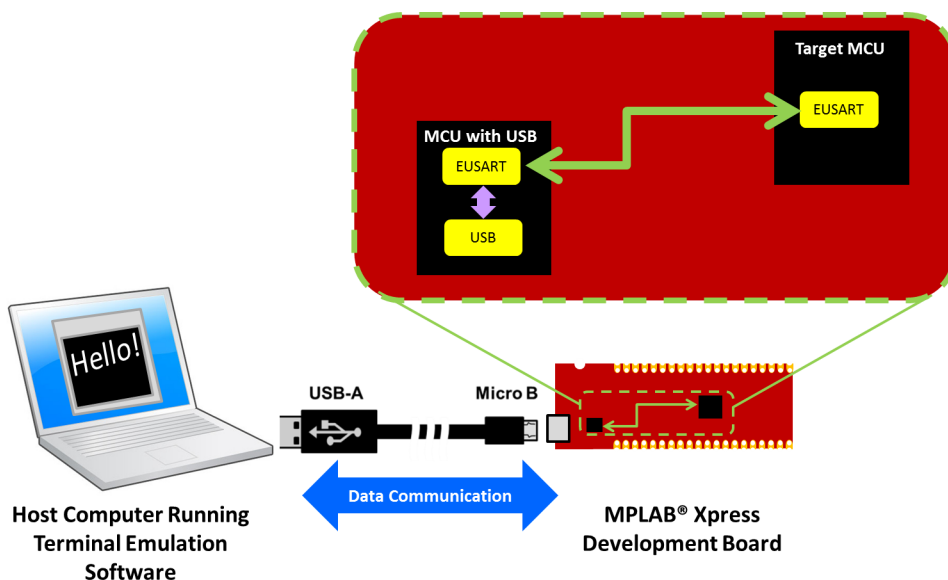
The purpose of this chapter is to demonstrate how to build the serial communications link that has been used throughout this document between an MPLAB Xpress Evaluation Board and a host computer. This communication is enabled by a second MCU with USB capabilities that populates the board along with the target MCU. This second MCU with USB performs the following USB tasks:

- USB Mass Storage Device (MSD) Class: Receives .hex files from the host PC and then programs the target device using Microchip's In-Circuit Serial Programming™ (ICSP™) technology.

Note: Hardware debugging is not available.

- USB Communications Device Class (USB CDC): Translates EUSART data transmissions from the target MCU and transmits over the USB connection to the host PC


Using the latter CDC configuration enables the target MCU to send and receive information through the second MCU with USB capabilities to an available USB port on a host computer. Terminal emulation software (see links in [Chapter 2. "Equipment Used"](#)) running on the host computer connected to the associated COM Port can then be used to display information from the target MCU or allow the user to send commands back to the microcontroller.

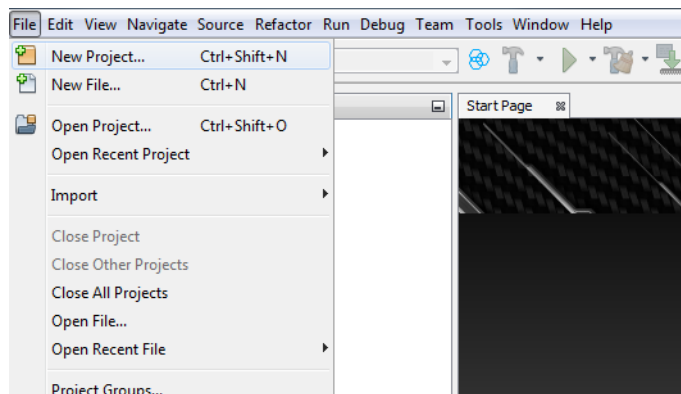


Using 8-bit MCUs in MPLAB® Xpress

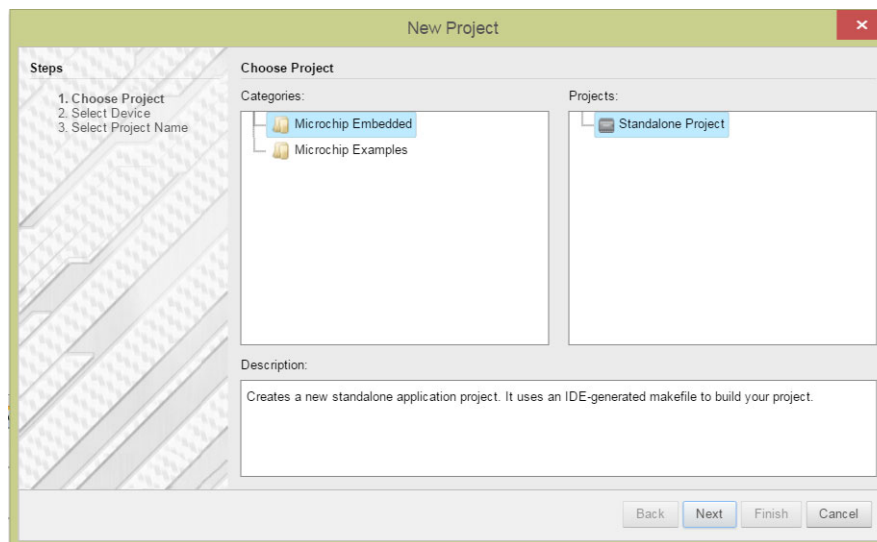
6.2 HOW TO CREATE A NEW PROJECT IN MPLAB XPRESS IDE

At this point only existing projects have been covered. In this section, you will create a new original project in MPLAB Xpress IDE.

1. Navigate to MPLAB Xpress IDE.
<https://mplabxpress.microchip.com/mplabcloud/ide>
2. Create a new project by clicking the New Project icon  or by selecting *File>New Project*.

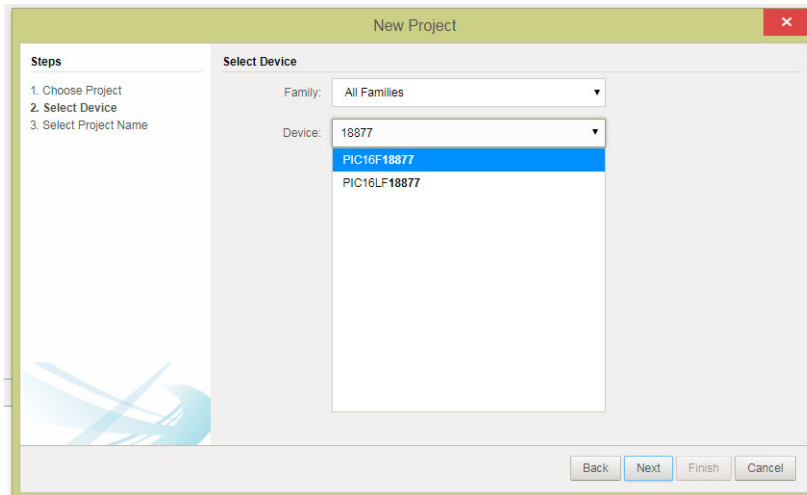


3. In the New Project window, select “Microchip Embedded” in the “Categories” frame and “Standalone Project” in the “Projects” frame. Click **Next**.

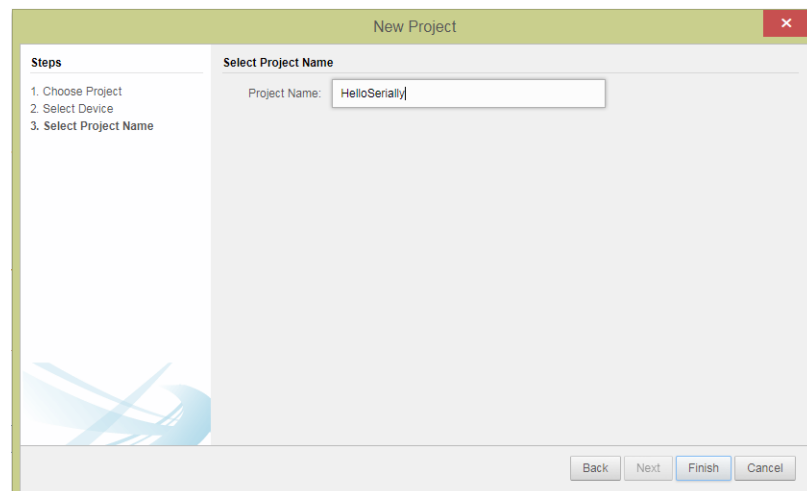


Building a Serial Communications Link

4. Select or type in the MCU being used (PIC16F18877 shown) in the “Device” drop-down in the Select Device window. Click **Next**.

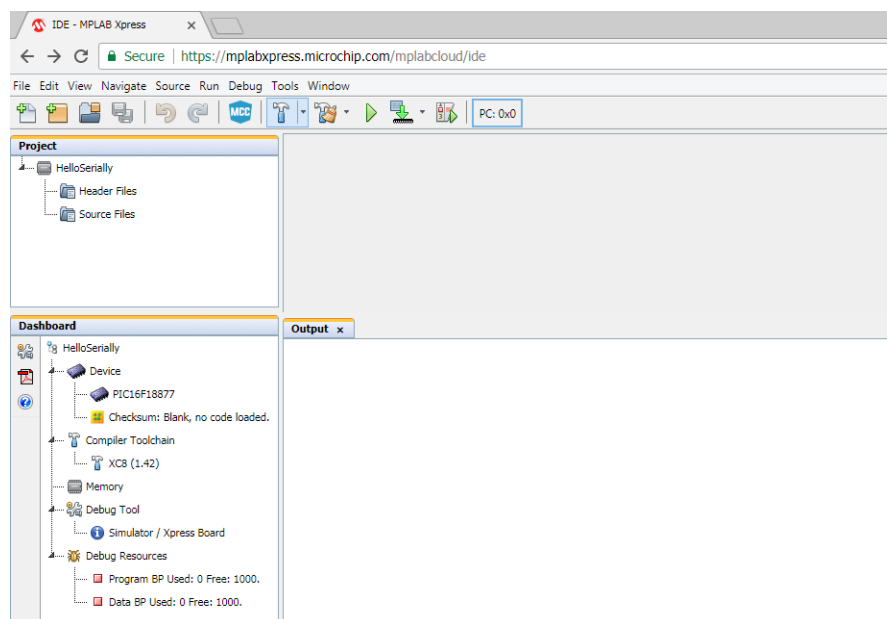


5. Name the project something relevant, like HelloSerially, in the “Project Name” field of the Select Project Name window. Click **Finish**.




Using 8-bit MCUs in MPLAB® Xpress

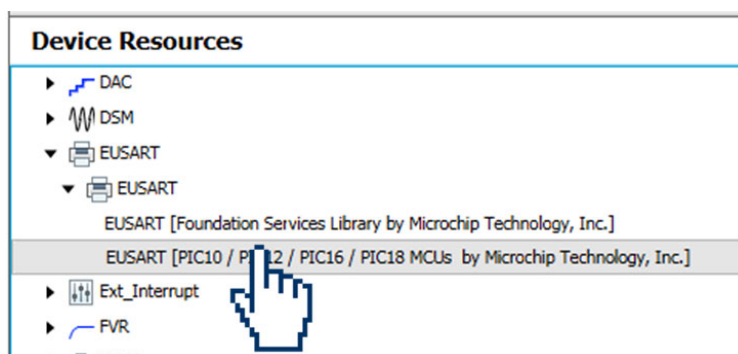
The MPLAB Xpress IDE workspace should look similar to below.



6.3 HOW TO SET UP MCC TO GENERATE PROJECT CODE

Once your MPLAB Xpress project is created, you will set up MPLAB Code Configurator (MCC) options for generating code.

1. Open the MCC plugin by clicking on the  button at the top of the IDE or through *Tools>Embedded>MPLAB Xpress Code Configurator*. For details on the MCC GUI, see [Chapter 5. “Using the MPLAB® Code Configurator \(MCC\)”](#).
2. In the open MCC window, the default parameters for the “Project Resources>System” can be used.
3. In the “Device Resources” area, scroll down to locate the EUSART peripheral and expand. Double click on the EUSART to add the peripheral to “Project Resources.”



Building a Serial Communications Link

4. Select the EUSART peripheral under the “Peripheral” heading in the “Project Resources” pane to open the peripheral configuration and configure as follows:
 - a) Enable Transmit
 - b) Baud Rate: 9600 (default)

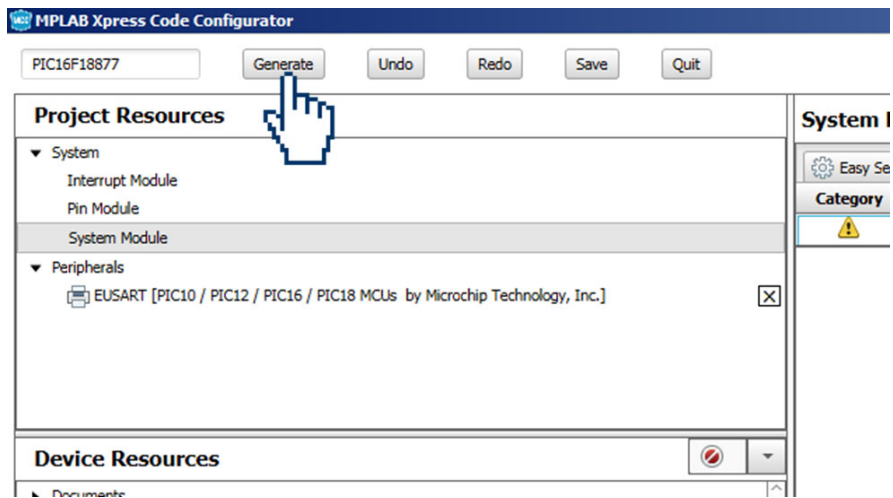
5. In the “Pin Manager” section, connect the EUSART TX signal to pin RB6 and the RX signal to pin RB7 by clicking on the blue unlock button, turning it to a green locked symbol, for the associated signal row and pin columns as shown below.

Module	Function	Direction	-	0	1	2	3	4	5	6	7	-
EUSART ▼	RX	input										
	TX	output										

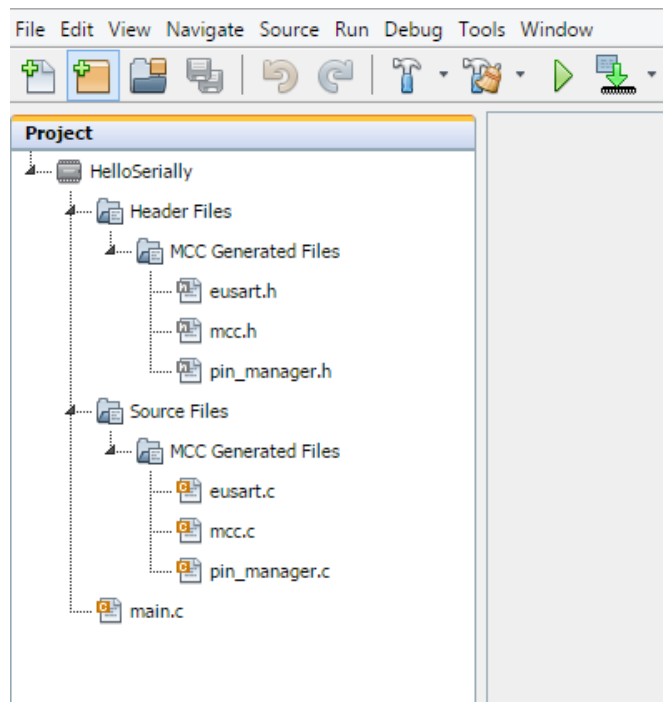
When communicating with the second microcontroller using USB, the RB6 pin is for the EUSART transmit (TX) signal and the RB7 pin is for the EUSART receive (RX) signal on most MPLAB Xpress Evaluation Boards, including the green “General Purpose MPLAB Xpress Evaluation Board” and 40-pin variants of the red “Device-Specific MPLAB Xpress Evaluation Boards.” The 20-pin red “Device-Specific MPLAB Xpress Evaluation Board” will use the RA1 pin for EUSART TX and the RA0 pin for the EUSART RX signal.

Using 8-bit MCUs in MPLAB® Xpress

- Click the **Generate** button in MCC to create the appropriate header and source files for this configuration.



- The new MCC Generated header and source files should now be present in the Project window of the MPLAB Xpress IDE including a new `main.c` source file.

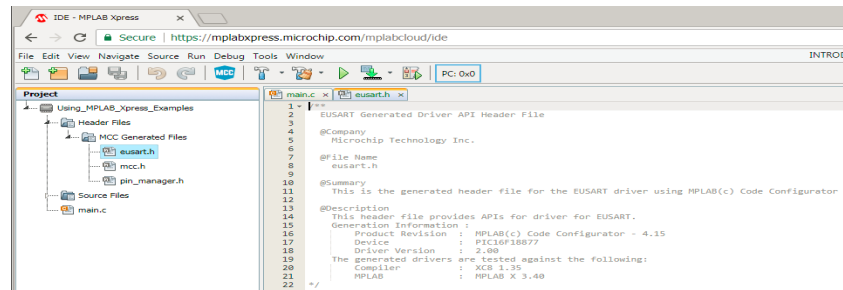


Building a Serial Communications Link

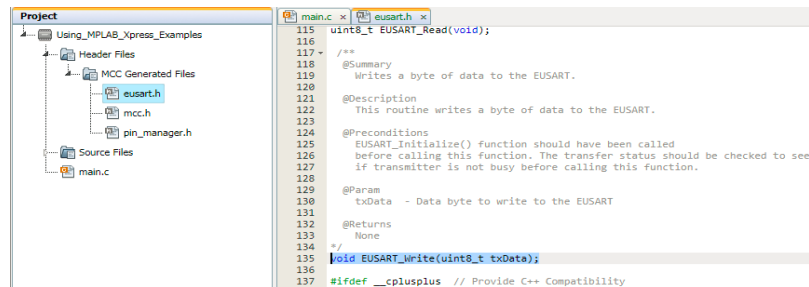
6.4 HOW TO USE THE MCC-GENERATED SERIAL FUNCTION

The MPLAB Code Configurator generates code used to configure the device and selected peripherals. Additionally, a series of functions are generated for a number of the selected resources that enable you to write your own code which can facilitate dynamic system changes to occur at runtime. Function descriptions along with example code can be referenced in the associated peripheral's header file.

1. Highlight the `eusart.h` file under the “Header Files>MCC Generated Files” folder inside the Project pane of the MPLAB Xpress IDE to open the file.



2. Scroll through the `eusart.h` file to locate the `EUSART_Write()` function.

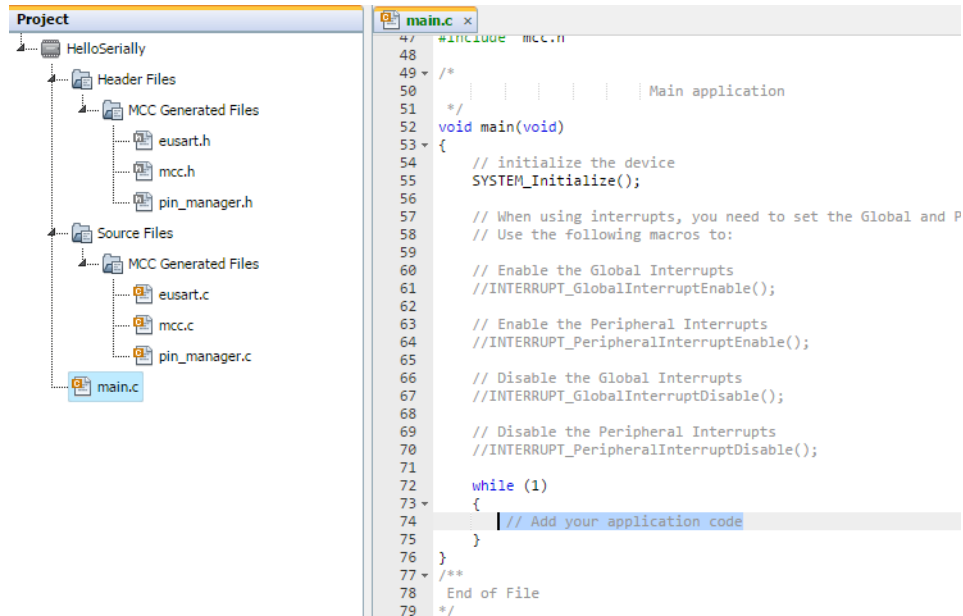


Highlight the function and copy using Ctrl+X (Windows keyboard shortcut).

Note: Copy and paste within the MPLAB Xpress IDE must be done using keyboard shortcuts. Using these functions from the toolbar or from the right click Context Menu is not supported.

Using 8-bit MCUs in MPLAB® Xpress

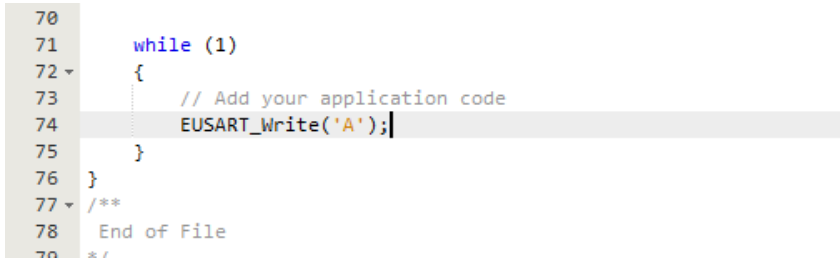
- Click on the `main.c` source file in the Project pane to open the file and scroll through the code to locate the `// Add your application code` comment inside of the `while(1)` loop inside `main()`.



The screenshot shows the MPLAB Xpress IDE interface. On the left, the Project pane displays a project named 'HelloSerially' with a tree structure including 'Header Files' (euserart.h, mcc.h, pin_manager.h) and 'Source Files' (euserart.c, mcc.c, pin_manager.c, main.c). The 'main.c' file is selected. On the right, the main.c source file is open in an editor, showing the following code:

```
47 #include "mcc.h"
48
49 /*
50 |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
51 */
52 void main(void)
53 {
54     // initialize the device
55     SYSTEM_Initialize();
56
57     // When using interrupts, you need to set the Global and P
58     // Use the following macros to:
59
60     // Enable the Global Interrupts
61     //INTERRUPT_GlobalInterruptEnable();
62
63     // Enable the Peripheral Interrupts
64     //INTERRUPT_PeripheralInterruptEnable();
65
66     // Disable the Global Interrupts
67     //INTERRUPT_GlobalInterruptDisable();
68
69     // Disable the Peripheral Interrupts
70     //INTERRUPT_PeripheralInterruptDisable();
71
72     while (1)
73     {
74         // Add your application code
75     }
76 }
77 /**
78 End of File
79 */
```

Paste the copied `EUSART_Write()` function at this location and replace the arguments within the brackets to a character such as 'A'.




This close-up screenshot highlights the application code insertion point within the `while(1)` loop of `main.c`. The code is as follows:

```
70
71     while (1)
72     {
73         // Add your application code
74         EUSART_Write('A');
75     }
76 }
77 /**
78 End of File
79 */
```

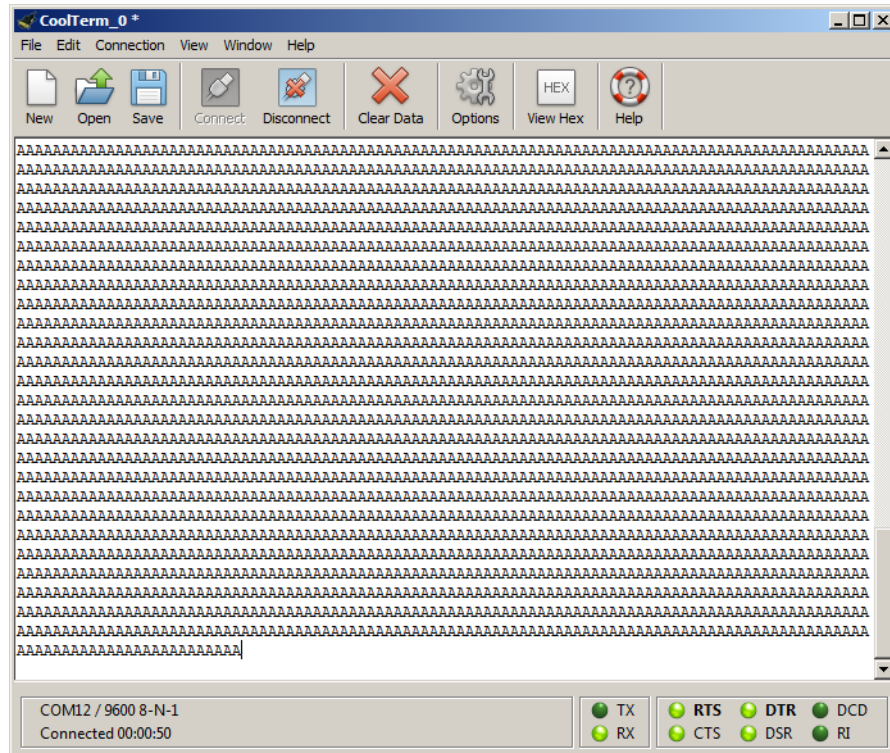
- Compile and download the project `.hex` file by clicking on the **Make and Program Device** button at the top of the MPLAB Xpress IDE.
- Program the MPLAB Xpress board by dragging the project `.hex` file from the downloads section of the browser and dropping the file into the XPRESS drive as shown in [Chapter 3. "Programming the Evaluation Board"](#).

Building a Serial Communications Link

6.5 HOW TO DISPLAY THE SERIAL MESSAGE ON A HOST COMPUTER

1. Open a terminal emulator program (see [Section 2.3 “Software”](#)) on the host computer and select the COM port associated with the MPLAB Xpress board.
2. Open the *Connection>Options* dialog and configure the serial port at the 9600 baud rate that was configured earlier in the project when configuring the EUSART in MCC.
3. Inside the terminal window, click on the  button to establish connection with the Xpress board.

Once communication is established, the terminal window should display the character added to the `EUSART_Write()` earlier in the project.



Using 8-bit MCUs in MPLAB® Xpress

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Appendix A. MPLAB® Xpress Evaluation Boards

A.1 INTRODUCTION

MPLAB Xpress Evaluation Boards have been designed to work in conjunction with the cloud-based MPLAB Xpress Integrated Development Environment (IDE). The combination of the IDE and the MPLAB Xpress Evaluation Board provide a platform for rapid development of applications without having to download or update the IDE or compilers.

All MPLAB Xpress boards contain two sections:

1. The **programmer section**, which contains the circuitry necessary to serve as a dedicated drag-and-drop programmer for the target device using Microchip Technology's proprietary In-Circuit Serial Programming (ICSP) protocol. In this way, no additional hardware is needed to program the target device other than a simple USB connection to a host computer.
2. The **application section**, which contains the circuitry that is used by the microcontroller application.

Additionally, MPLAB Xpress Evaluation Boards feature a Communications Device Class (CDC) interface to facilitate serial communication between the target device and a host computer.

There are three variants of MPLAB Xpress Evaluation Boards:

1. General Purpose MPLAB Xpress Evaluation Board
2. Device Specific MPLAB Xpress Evaluation Board (20-pin variant)
3. Device Specific MPLAB Xpress Evaluation Board (40-pin variant)

A.2 POWERING THE BOARDS

The MPLAB Xpress Evaluation Boards can be powered in one of two ways, depending on its usage. It should be noted that only one power source should be connected at a time.

A.2.1 USB Connector

The USB connector will power the entire MPLAB Xpress Evaluation Board. With USB power connected, the power LED will always be on (green) to indicate that +3.3V is available on the board.

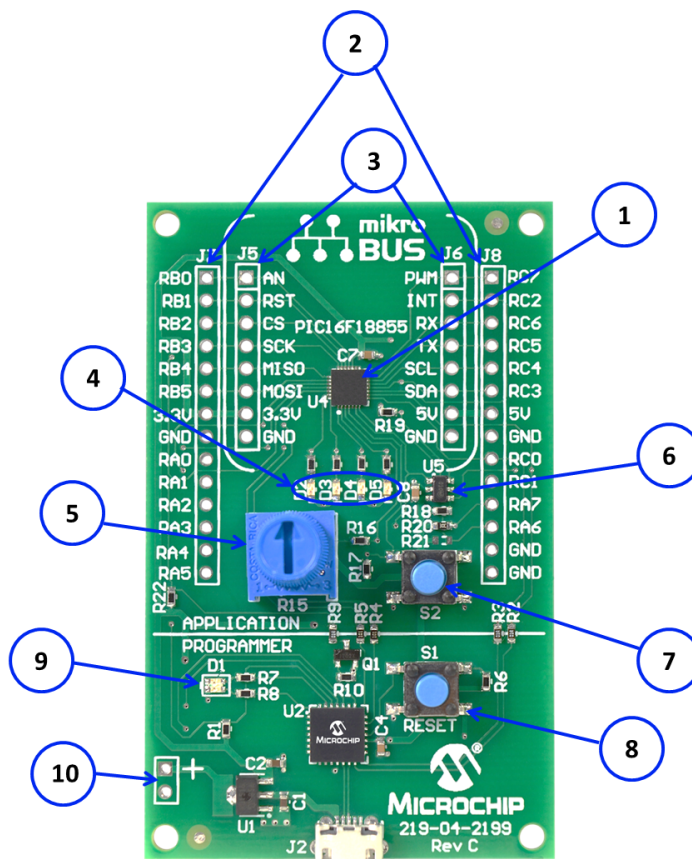
A.2.2 2.7V-16V External Power Supply (General Purpose MPLAB Xpress Board Only)

The external power supply option is available on the General Purpose MPLAB Xpress Board only. It will also power the entire MPLAB Xpress Evaluation Board. The external power supply is connected to a Low Dropout (LDO) voltage regulator, configured to deliver 3.3V to the board. The external power supply range is from 2.7V to 16V, allowing use with two to six primary cells, 9V alkaline batteries, or one or two-cell Li-Ion batteries. LED D1 will illuminate green when the external power supply is active and supplying sufficient voltage.

Using 8-bit MCUs in MPLAB® Xpress

A.3 GENERAL PURPOSE EVALUATION BOARD

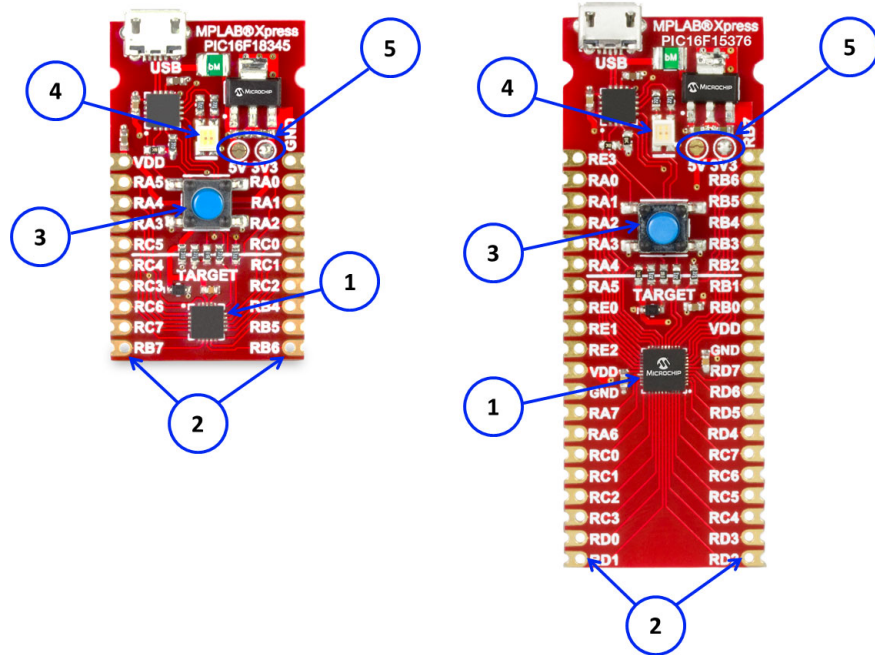
The MPLAB Xpress General Purpose Evaluation Board features an 8-bit PIC16F18855 microcontroller. This board differs from other variants in that it also features basic interface components to the target device such as LEDs, potentiometer, switch and more.



1. PIC16F18855 target microcontroller
2. Connection header corresponding to target microcontroller pins
3. mikroBUS™ socket to accommodate a variety of plug-in MikroElektronika Click boards™ that can be used in application development
4. Four user LEDs
5. Potentiometer
6. EMC1001 temperature sensor
7. Push button switch
8. Master RESET switch
9. LED:
 - a) Green: power to target
 - b) Flashing Red: target being programmed
10. 2.7V-16V Battery/External power connection

A.4 DEVICE-SPECIFIC EVALUATION BOARDS

The MPLAB Xpress Device Specific Evaluation Boards contain a specific PIC16 or PIC18 device the board is targeted towards in addition to the built-in programmer. They are available in 20-pin and 40-pin variants based on the device.



1. Target microcontroller
2. Connection header corresponding to target microcontroller pins
3. Master RESET switch
4. LED:
 - a) Green: power to target
 - b) Flashing Red: target being programmed
5. Selects 5V from USB supply or 3.3V from LDO regulator output to power target device (default is 3.3V)

Using 8-bit MCUs in MPLAB® Xpress

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Appendix B. MPLAB® Xpress Evaluation Board Schematics

FIGURE B-1: GENERAL PURPOSE EVALUATION BOARD SCHEMATIC (APPLICATION SECTION)

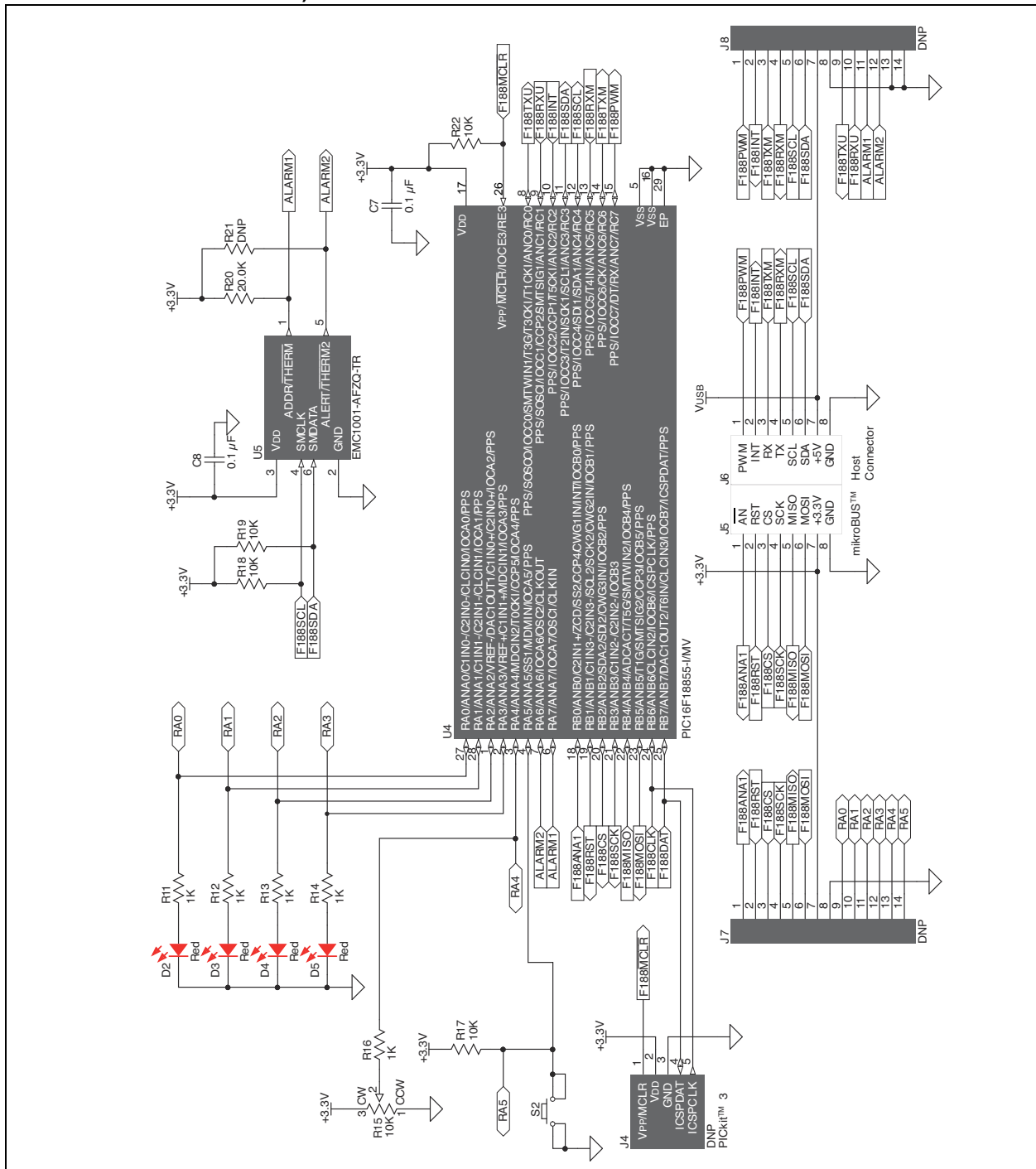
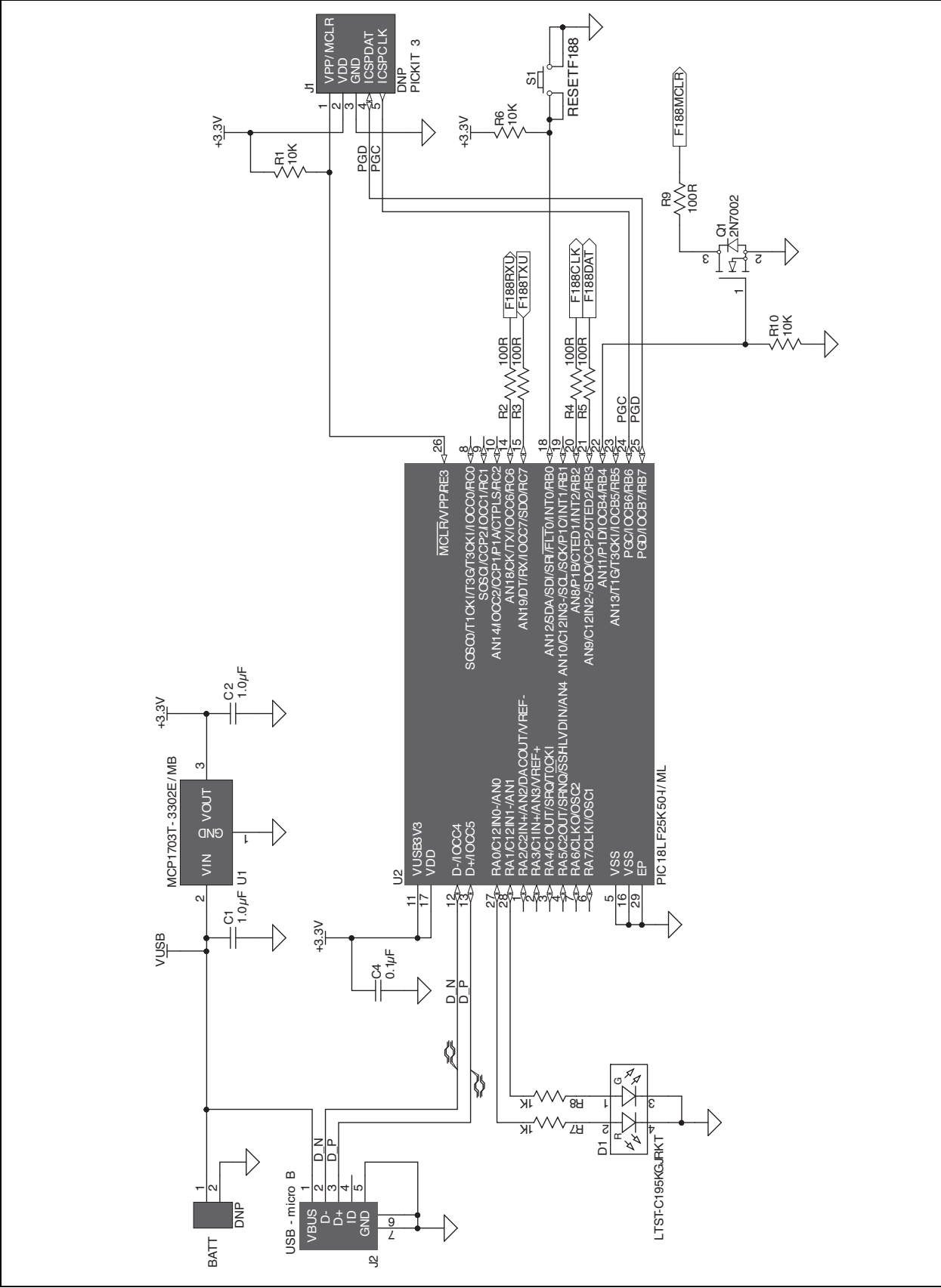
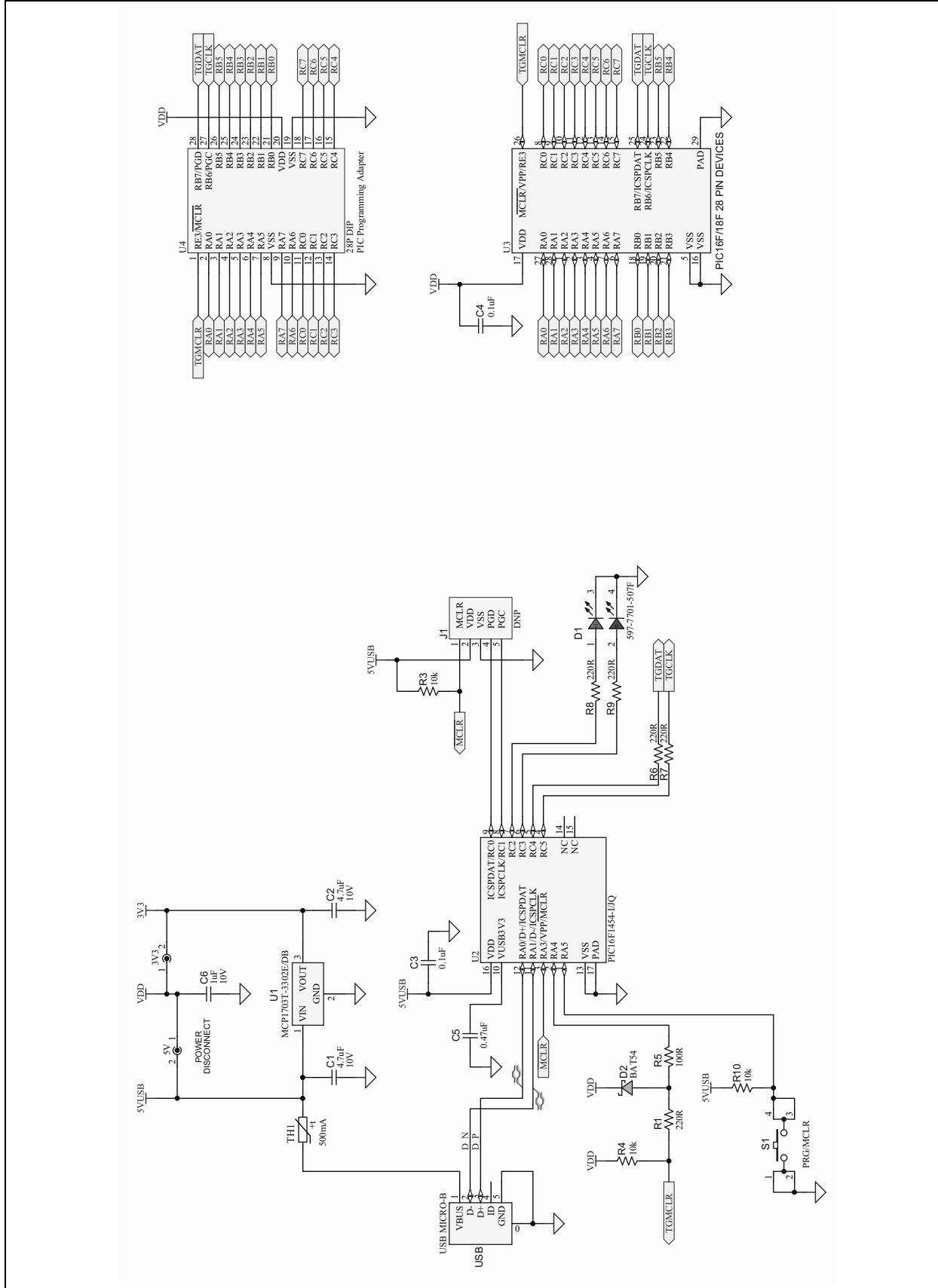


FIGURE B-2: GENERAL PURPOSE EVALUATION BOARD SCHEMATIC (PROGRAMMER SECTION)



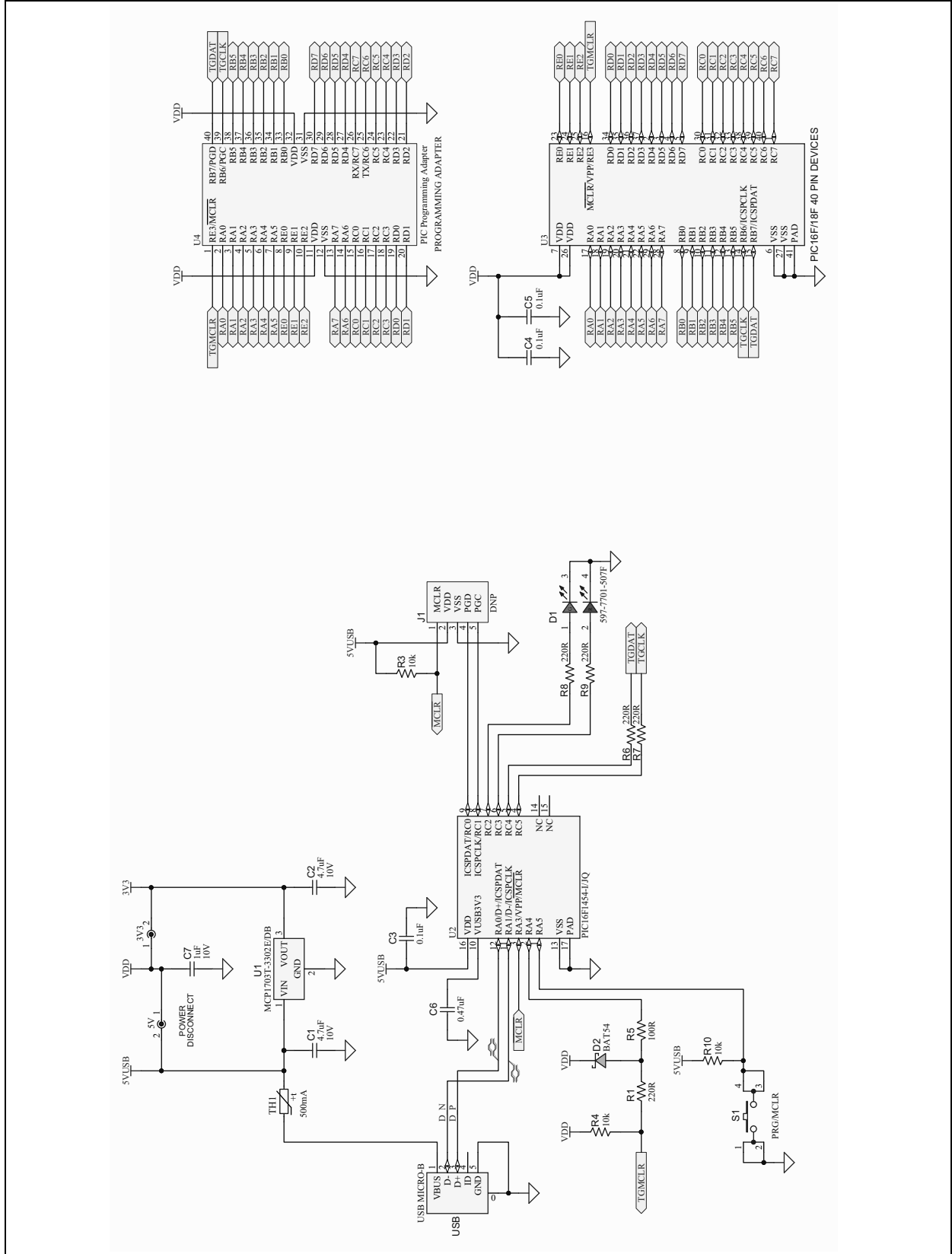
Using 8-bit MCUs in MPLAB[®] Xpress

FIGURE B-4: 28-PIN DEVICE-SPECIFIC EVALUATION BOARD SCHEMATIC



MPLAB® Xpress Evaluation Board Schematics

FIGURE B-5: 40-PIN DEVICE-SPECIFIC EVALUATION BOARD SCHEMATIC



Using 8-bit MCUs in MPLAB® Xpress

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GETTING STARTED USING 8-BIT MCUs IN THE MPLAB® Xpress ECOSYSTEM

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