# PICDEM™ Lab II
# Development Board
# User's Guide

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# PICDEM™ LAB II DEVELOPMENT BOARD USER'S GUIDE

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# Preface

## NOTICE TO CUSTOMERS

**All documentation becomes dated, and this manual is no exception. Microchip tools and documentation are constantly evolving to meet customer needs, so some actual dialogs and/or tool descriptions may differ from those in this document. Please refer to our web site (www.microchip.com) to obtain the latest documentation available.**

**Documents are identified with a "DS" number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is "DSXXXXXXXXA", where "XXXXXXXX" is the document number and "A" is the revision level of the document.**

**For the most up-to-date information on development tools, see the MPLAB® IDE online help. Select the Help menu, and then Topics to open a list of available online help files.**

## INTRODUCTION

This chapter contains general information that will be useful to know before using the PICDEM™ Lab II Development Board. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Recommended Reading
- The Microchip Web Site
- Development Systems Customer Change Notification Service
- Customer Support
- Revision History

## DOCUMENT LAYOUT

This document describes how to use the PICDEM Lab II Development Board as a development tool to emulate and debug firmware on a target board, as well as how to program devices. The document is organized as follows:

- **Chapter 1. "Introduction to PICDEM™ Lab II"** – This chapter contains general information regarding the PICDEM Lab II Development Board kit contents, layout and power source.
- **Chapter 2. "Getting Started"** – This chapter offers information on how to program microcontrollers loaded onto the PICDEM Lab II Development Board, general information on the prototyping area, and how to load the MCP2221 I$^2$C/SMBus Terminal program.
- **Chapter 3. "Where to Find the Lab Documentation"** – Consult this chapter for troubleshooting information.
- **Appendix A. "Schematics"** – This appendix lists the PICDEM Lab II Development Board schematic.

# PICDEM™ Lab II Development Board User's Guide

## CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

### DOCUMENTATION CONVENTIONS

| Description | Represents | Examples |
|---|---|---|
| **Arial font:** | | |
| Italic characters | Referenced books | *MPLAB® IDE User's Guide* |
| | Emphasized text | ...is the *only* compiler... |
| Initial caps | A window | the Output window |
| | A dialog | the Settings dialog |
| | A menu selection | select Enable Programmer |
| Quotes | A field name in a window or dialog | "Save project before build" |
| Underlined, italic text with right angle bracket | A menu path | *File>Save* |
| Bold characters | A dialog button | Click **OK** |
| | A tab | Click the **Power** tab |
| N'Rnnnn | A number in verilog format, where N is the total number of digits, R is the radix and n is a digit. | 4'b0010, 2'hF1 |
| Text in angle brackets < > | A key on the keyboard | Press <Enter>, <F1> |
| **Courier New font:** | | |
| Plain Courier New | Sample source code | `#define START` |
| | Filenames | `autoexec.bat` |
| | File paths | `c:\mcc18\h` |
| | Keywords | `_asm, _endasm, static` |
| | Command-line options | `-Opa+, -Opa-` |
| | Bit values | `0, 1` |
| | Constants | `0xFF, 'A'` |
| Italic Courier New | A variable argument | `file`.o, where `file` can be any valid filename |
| Square brackets [ ] | Optional arguments | `mcc18 [options] file [options]` |
| Curly brackets and pipe character: { \| } | Choice of mutually exclusive arguments; an OR selection | `errorlevel {0\|1}` |
| Ellipses... | Replaces repeated text | `var_name [, var_name...]` |
| | Represents code supplied by user | `void main (void) { ... }` |

## RECOMMENDED READING

This user's guide describes how to use the PICDEM Lab II Development Board. For the latest information on using other tools, refer to the MPLAB® X IDE home page: www.microchip.com/mplabx/. This resource page contains updated documentation, downloads and links to other MPLAB X compatible tools, plug-ins and much more.

## THE MICROCHIP WEB SITE

Microchip provides online support via our web site at www.microchip.com. This web site is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the web site contains the following information:

- **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. PICDEM Lab II Development Board specific product support can be accessed via the product web-page at www.microchip.com/PICDEMLABII.
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing.
- **Additional Labs** – Additional lab materials for the PICDEM Lab II Development Board are available via the PICDEM Lab II Development Board landing page. These lab materials cover additional hardware applications and labs relating to new and existing products.
- **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

## DEVELOPMENT SYSTEMS CUSTOMER CHANGE NOTIFICATION SERVICE

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

To register, access the Microchip web site at www.microchip.com, click on Customer Change Notification and follow the registration instructions.

The Development Systems product group categories are:

- **Compilers** – The latest information on Microchip C compilers, assemblers, linkers and other language tools. These include all MPLAB C compilers; all MPLAB assemblers (including MPASM™ assembler); all MPLAB linkers (including MPLINK™ object linker); and all MPLAB librarians (including MPLIB™ object librarian).
- **Emulators** – The latest information on Microchip in-circuit emulators.This includes the MPLAB REAL ICE™ and MPLAB ICE 2000 in-circuit emulators.
- **In-Circuit Debuggers** – The latest information on the Microchip in-circuit debuggers. This includes MPLAB ICD 3 in-circuit debuggers and PICkit™ 3 debug express.
- **MPLAB® IDE** – The latest information on Microchip MPLAB IDE, the Windows® Integrated Development Environment for development systems tools. This list is focused on the MPLAB IDE, MPLAB IDE Project Manager, MPLAB Editor and MPLAB SIM simulator, as well as general editing and debugging features.
- **Programmers** – The latest information on Microchip programmers. These include production programmers such as MPLAB REAL ICE in-circuit emulator, MPLAB ICD 3 in-circuit debugger and MPLAB PM3 device programmers. Also included are nonproduction development programmers such as PICSTART® Plus and PICkit 2 and 3.

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## CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

Customers should contact their distributor, representative or field application engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

Technical support is available through the web site at:

http://www.microchip.com/support.

## REVISION HISTORY

### Revision A (August 2015)

Initial release of this document.

# Chapter 1. Introduction to PICDEM™ Lab II

The PICDEM Lab II Development Board supports Microchip's 6-, 8-, 14-, 18-, 20-, 28-, and 40-pin 8-bit PIC® MCUs. Dual-row expansion headers on either side of each microcontroller sockets offer flexibility of connectivity to all pins on the PIC MCUs. This board provides flexibility for experimentation through a large solderless development block, a USB-Serial/I$^2$C interface and external board connectors. Additionally, it features a USB mini-B connector, two mikroBUS™ footprints to accommodate a variety of plug-in Click™ board sensors, and individual ICSP™/ICD connectors for each microcontroller.

## 1.1 PICDEM LAB II DEVELOPMENT BOARD KIT CONTENTS

The PICDEM Lab II Development Board kit contains the following (Figure 1-1):

- PICDEM Lab II Development Board
- Out-of-Box Lab Component Kit
- Quick Start Guide

**FIGURE 1-1:** PICDEM™ LAB II DEVELOPMENT BOARD KIT
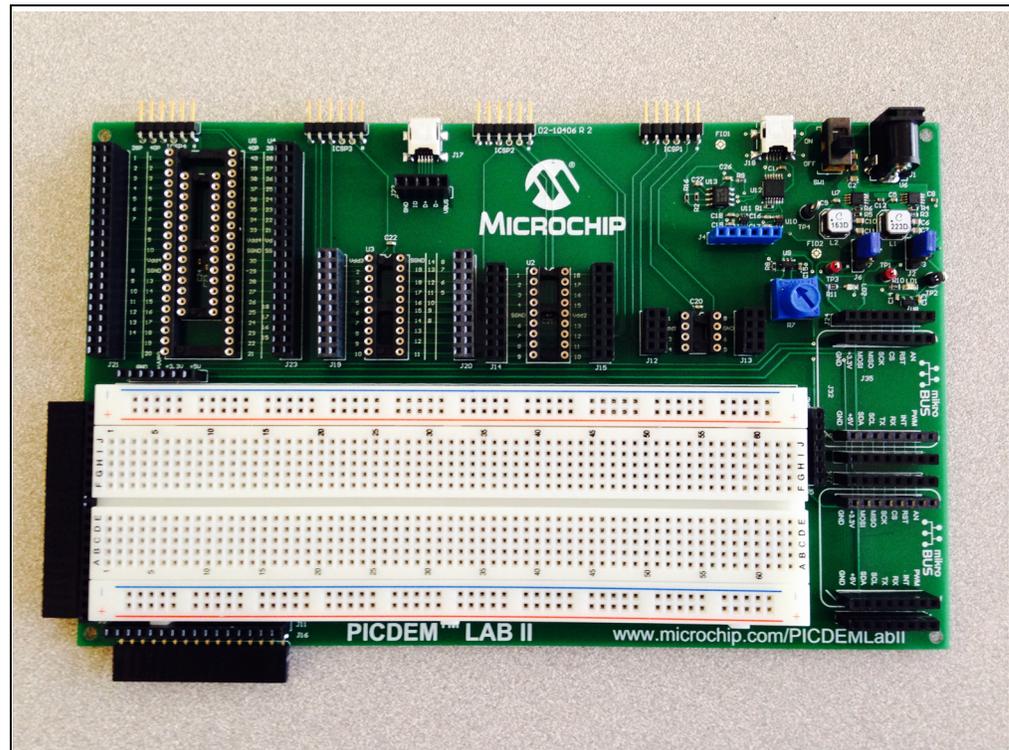
## 1.2 PICDEM LAB II DEVELOPMENT BOARD LAYOUT

Figure 1-2 identifies the major features of the PICDEM Lab II Development Board.

**FIGURE 1-2: PICDEM™ LAB II DEVELOPMENT BOARD LAYOUT**



1. Power connector (GND, GND, +V$_{VAR}$, +3.3V, +3.3V, +5V, +5V)
2. ICSP™/ICD 28/40-pin microcontroller socket
3. ICSP/ICD 8/14/20-pin microcontroller socket
4. USB™ mini-B socket for USB development
5. ICSP/ICD 18-pin microcontroller socket
6. ICSP/ICD 6-pin microcontroller socket (PIC10FXXX in 8-pin DIP)
7. Communications connector (RX, SCL, SDA, GND, V$_{DD}$, TX)
8. USB connector for USB-ASYNC/I$^2$C
9. Power switch
10. 9V power supply connector
11. Input voltage select jumpers
12. External supply connection points
13. V$_{VAR}$ adjustment potentiometer
14. mikroBUS™ Click board socket with breakout connectors
15. Power connector (GND, GND, +V$_{VAR}$, +3.3V, +3.3V, +5V, +5V)
16. Solderless bread board
17. mikroBUS™ Click board socket with breakout connectors
18. 20-pin expansion board connectors for external development boards
19. 16-pin expansion connectors for LCD modules
20. 28-/40-pin microcontroller sockets
21. 8-/14-/20-pin microcontroller socket
22. USB break-out connector
23. 18-pin microcontroller socket
24. 6-pin microcontroller socket (PIC10FXXX in 8-pin DIP)

## 1.3    POWER SOURCES

The PICDEM Lab II Development Board can be powered in one of three ways, depending on its usage.

### 1.3.1    USB Connector (J18)

The USB connector (J18) will power the entire PICDEM Lab II Development Board. Shunt jumpers must be placed onto jumpers J2 and J6 (Figure 1-2). Shunt jumpers connecting the center and right pins of J2 and J6 will connect the internal regulators to the USB supply on J18. With USB power connected to J18, power LEDs LD1 and LD2 will always be on to indicate that 5V, 3.3V, and $V_{VAR}$ are available on the board.

### 1.3.2    9V External Power Supply (J1)

The 9V external power supply (J1) will also power the entire PICDEM Lab II Development Board. Shunt jumpers must be placed onto jumpers J2 and J6 (Figure 1-2). Shunt jumpers connecting the center and top pins of J2 and J6 will connect the internal regulators to the 9V DC input J1. In this configuration, switch SW1 can be used to turn power to the board on and off. With 9V external power connected to J1, and switch SW1 in the on position, power LEDs LD1 and LD2 will always be on to indicate that 5V, 3.3V, and $V_{VAR}$ are available on the board.

### 1.3.3    External Supply Connection Points

The external supply connections points (TP1-4) will also power the entire PICDEM Lab II Development Board. Shunt jumpers must be placed onto jumpers J2 and J6 (Figure 1-2). The center and bottom pins of J2 and J6 will connect the 5V and 3.3V connections to the four external supply connection points (TP1-GND, TP2-5V, TP3-3.3V, TP4-GND). With 5V and 3.3V connected to the external supply connection points, power LEDs LD1 and LD2 will always be on to indicate that 5V, 3.3V and $V_{VAR}$ are available on the board.

## 1.4    CONNECTING THE PICkit™ PROGRAMMER/DEBUGGER

Connections for the PICkit programmer, REAL ICE™ in-circuit emulator or ICD modules are done through the 6-pin headers above the microcontroller sockets (Figure 1-2). Each socket group has a separate connector to allow individual programming of the devices. 28-/40-pin devices are programmed via ICSP4, 8-/14-/20-pin devices are programmed via ICSP3, 18-pin devices are programmed via ICSP2, and 6-pin PIC10FXXX devices are programmed via ICSP1. The pin to the furthest right of each ICSP connector has a small white dot that signifies the location of pin 1. The programmer should be connected to the appropriate ICSP connector with its pin 1 matching the ICSP connector pin 1. Start-up and programming of any programmer/in-circuit debugger should be performed as specified by the programmer/debugger documentation.

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## 1.5    CONNECTING THE USB I$^2$C/ASYNC COMMUNICATIONS

There are two connections to the on-board USB I$^2$C/ASYNC interface: the first is a USB mini-B connector J18, and the second is the on-board connector J4. A standard USB cable should be plugged into J18 and the PC/Apple computer to be used as an interface. If the driver for the MCP2221 has not been loaded, it should be loaded prior to connecting to the PICDEM Lab II Development Board. See **Section 2.2** for information concerning the installation of drivers and terminal programs.

To connect to the on-board connector J4, four connections must be made. Pins 2 and 3 of J4 should be connected to V$_{DD}$ (5V, 3.3V or V$_{VAR}$) and V$_{SS}$ of the target circuit. This will set the high and low voltage outputs for both the I$^2$C and ASYNC interfaces. Pins 1 and 6 of J4 should connect to the Rx and Tx connections, respectively, of the circuit being developed (pin 1 is Tx out of the interface and pin 6 is Rx into the interface). Alternately, pins 4 and 5 of J4 should connect to SDA and SCL, respectively, of the circuit being developed. The interface does not provide any pull-up resistors on either SDA or SCL, so the circuit being developed should include appropriate pull-up resistors for the I$^2$C interface.

## 1.6    INSTALLING MikroElektronika CLICK™ BOARDS

To install a Click board in the PICDEM Lab II Development Board, orient the Click board such that pin 1 faces away from the solderless prototyping block, align the Click board pins with the socket and press the board downward firmly until the pins fully seat in the sockets.

Connections between the power supply voltages (+5V, +3.3V and GND) and the Click board sockets are already present. It is left to the user to make connections between the Click board control interface and the appropriate pins of the microcontroller. The pinout of the Click boards is included below for reference.

Figure 1-3 lists the connections to the MikroElektronika Click boards.

**FIGURE 1-3:        PINOUT SPECIFICATIONS**
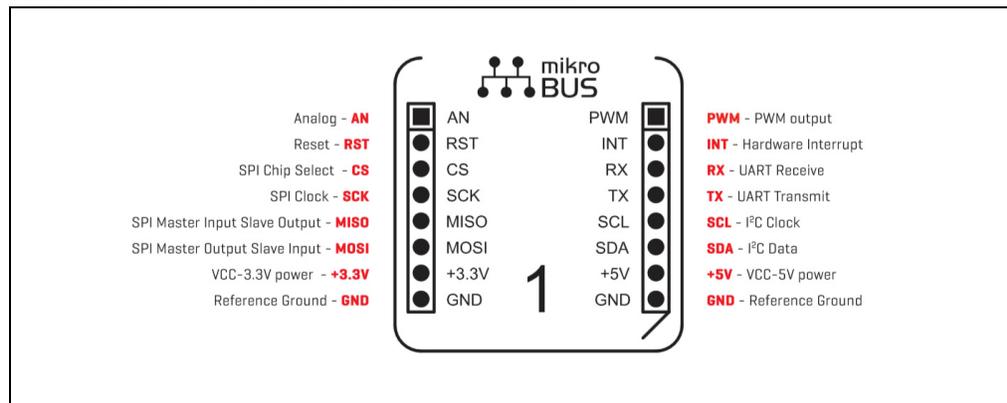
## 1.7    INSTALLING EXPANSION BOARDS AND AN LCD MODULE

Installing an expansion board on the PICDEM Lab II Development Board is very simple, provided the expansion board uses a single row 0.100" right angle, or vertical header. Simply push the pins of the header into the horizontal sockets of J8. Power, output and input pins from the expansion board can then be connected to the on-board circuitry using the vertical sockets of J8. The pins of the horizontal and vertical sockets of J8 are connected one-to-one, so any connection made in a horizontal socket will be connected to the adjacent vertical pin. This combination makes it very simple to connect to an expansion board without the need for a cumbersome wire connection off the PICDEM Lab II.

Installing an LCD module is equally easy, provided the LCD module uses a single-row 0.100" right angle, or vertical header. Note a horizontal header is more convenient in that it allows the LCD module to lay flat next to the PICDEM Lab II. Once installed, connections to the power, outputs and inputs of the LCD module are the same as for the expansion board mentioned above.

**NOTES:**

# Chapter 2.  Getting Started

The PICDEM Lab II Development Board must be used with the MPLAB X Integrated Development Environment (IDE) and either a PICkit™ 3 programmer/debugger, REAL-ICE in-circuit emulator or ICD3 programmer/debugger. The MPLAB X IDE is available free on Microchip's web site, www.microchip.com. Use version v3.05 or later. The PICDEM Lab II Development Board, through MPLAB X and a programmer/debugger, creates a low-voltage in-circuit debugger as well as a low-voltage programmer for all supported devices. In-circuit debugging allows the user to run, examine and modify programs for the supported device embedded in the PICDEM Lab II hardware. This facilitates the debugging of firmware and hardware concurrently. Use the PICDEM Lab II Development Board with MPLAB X IDE and a programmer/debugger to run, stop and single-step through programs – breakpoints can be set and the processor can be reset. When the processor stops, the contents of the register are available for examination and modification.

## 2.1    CONNECTING POWER TO THE PICDEM LAB II

The PICDEM Lab II Development Board can be powered in one of three ways:

• USB
• 9V DC input
• External power supplies.

### 2.1.1    USB Connector (J18)

To power the PICDEM Lab II via the USB port, connect a USB cable between the USB mini-B connector J18 and either a PC/Apple computer with a USB connector or a USB power supply. Shunt jumpers must be placed such that they connect the center and right pins of J2 and J6 (Figure 1-2). When the jumpers are placed properly and connected to a USB power source, power LEDs LD1 and LD2 should light, indicating that 5V, 3.3V and $V_{VAR}$ are available on the board.

### 2.1.2    9V External Power Supply (J1)

To power the PICDEM Lab II via the 9V external power supply, connect a 9V external power supply to connector J1. Shunt jumpers must be placed such that they connect the center and top pins of J2 and J6 (Figure 1-2). Next, move the switch SW1 to the on position. When the jumpers are placed properly, switch SW1 is in the on position and the board is connected to a powered 9V external power supply, power LEDs LD1 and LD2 should light, indicating that 5V, 3.3V and $V_{VAR}$ are available on the board.

### 2.1.3    External Supply Connection Points

To power the PICDEM Lab II via the external supply connection points, connect an external 5V power supply to TP1 and TP2 (TP1-GND, TP2-5V), then connect an external 3.3V power supply to TP3 and TP4 (TP3-3.3V, TP4-GND). Shunt jumpers must be placed such that they connect the center and bottom pins of J2 and J6 (Figure 1-2). When the jumpers are placed properly and the external power supplies are powered, power LEDs LD1 and LD2 should light, indicating that 5V, 3.3V and $V_{VAR}$ are available on the board.

> **Note:** $V_{VAR}$ is generated from the 5V input in all power supply modes of operation. Adjustment of $V_{VAR}$ is via potentiometer R7 (see item 13 in Figure 1-2). Full clockwise rotation of the potentiometer will result in approximately 1.5V, and full counterclockwise rotation will result in approximately 4.8V.

## 2.2    CONNECTING A PROGRAMMER/IN-CIRCUIT DEBUGGER

To connect either a programmer, REAL ICE in-circuit emulator or PICkit 3 programmer to the PICDEM Lab II, first, select the package size required for the microcontroller and load the device in the appropriate socket (see items 20, 21, 23, or 24 in Figure 1-2). Next, connect the 6-pin programming connector to the corresponding ICSP/ICD header on the PICDEM Lab II (see items 2, 3, 5, or 6). Note that pin 1 of the ICSP/ICD connectors is labeled by a small white dot on the silk screen of the board. Once the programmer/debugger is connected, connect power to the board (see **Section 2.1**), run MPLAB X, and follow the instructions listed in the MPLAB X IDE User's Guide (DS50002027) for loading, compiling and programming code into an 8-bit microcontroller.

## 2.3    LOADING DRIVERS AND TERMINAL PROGRAMS FOR THE USB-ASYNC/I$^2$C INTERFACE

Download the driver package from Microchip's MCP2221 web page (Figure 2-1).

**FIGURE 2-1:**    **MCP2221 DRIVER DOWNLOAD**
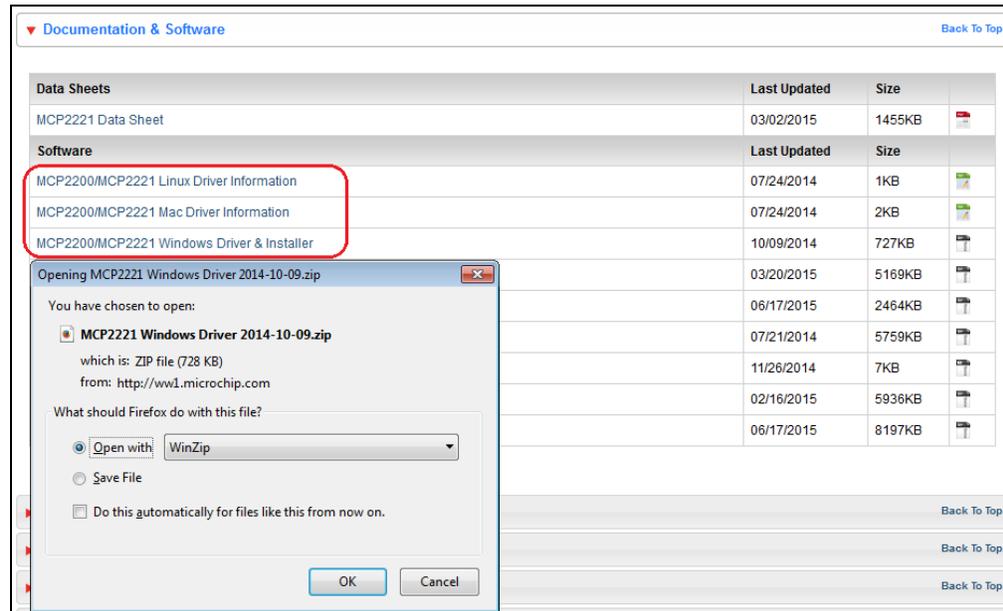


Unzip the file and double click on the `MchpCdcDriverInstallationTool.exe` icon (Figure 2-1).

**FIGURE 2-2:        MCP2221 DRIVER UNZIP**
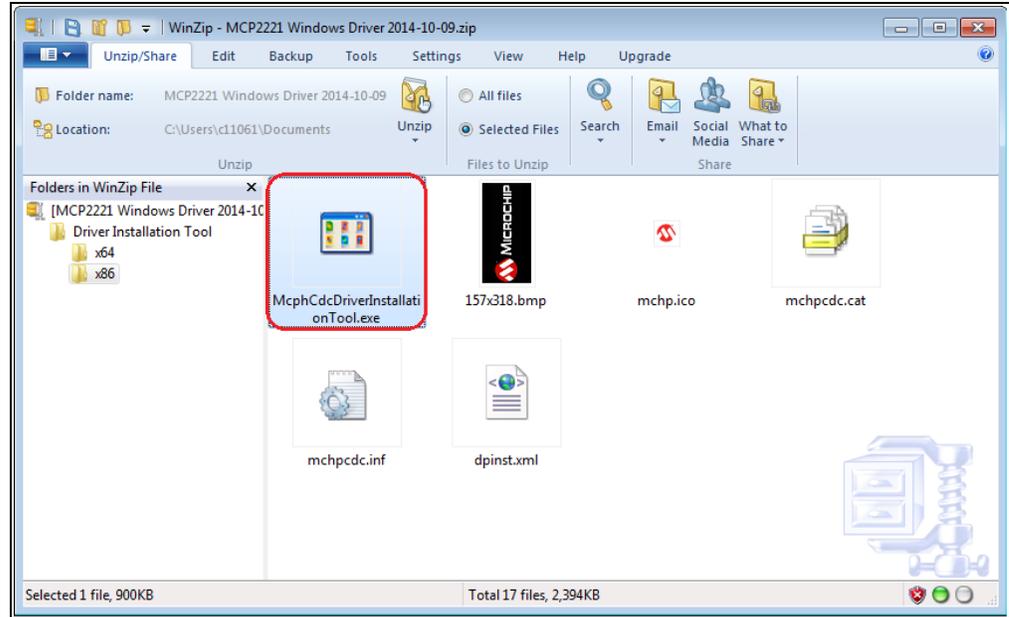


Finally, follow the direction of the installation tool until finished. At this point, the driver for the asynchronous serial port will be leaded and ready for use. Any asynchronous serial port terminal program can now be used. Select the Com port corresponding to the MCP2221 and configure the baud rate, Stop bits, and parity as necessary for the application.

To install the Microchip MCP2221 I$^2$C/SMBus terminal program installation package (Figure 2-3) from Microchip's MCP2221 web page, follow the steps below.

**FIGURE 2-3:        MCP2221 I$^2$C/SMBus TERMINAL DOWNLOAD**
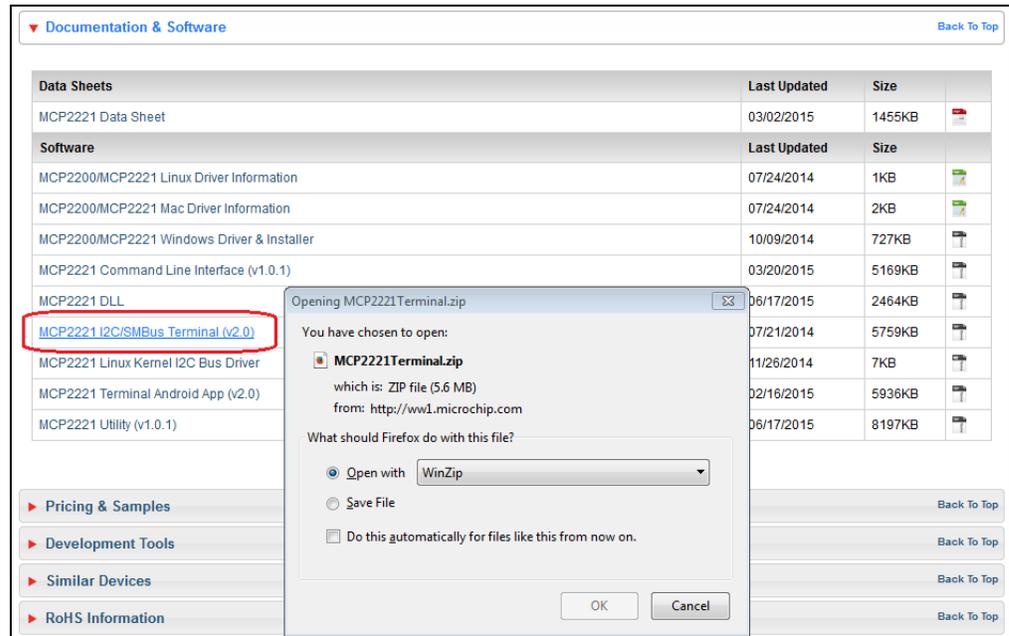
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Unzip and double click on the MCP2221 terminal installer program (Figure 2-4).

**FIGURE 2-4:** **MCP2221 I$^2$C/SMBus TERMINAL UNZIP**
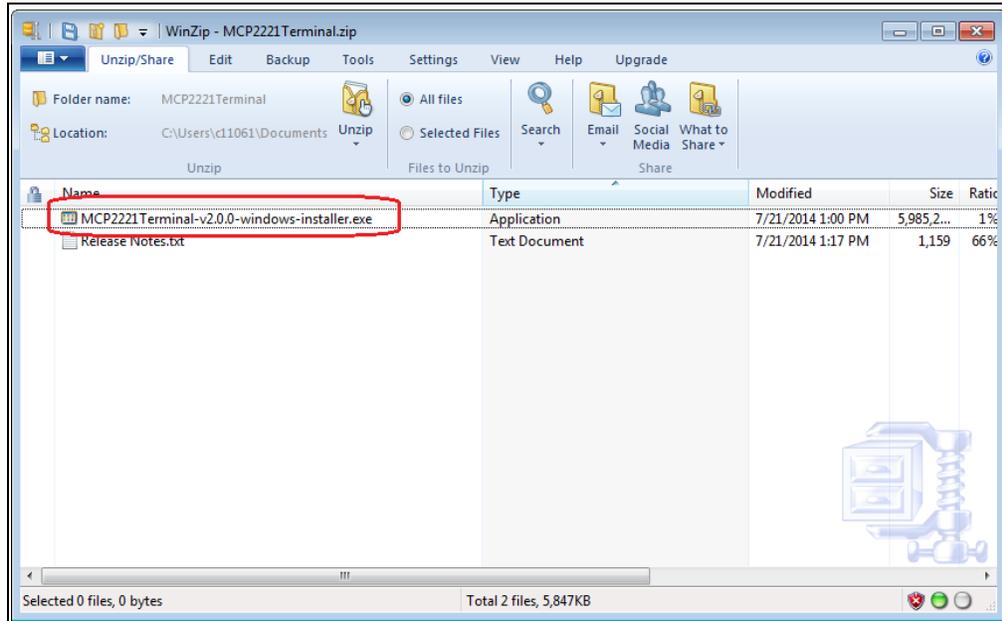
Finally, follow the direction of the installation tool until finished. At this point, the Terminal program is ready for use – just double click to open. The Terminal program should appear as in Figure 2-5.

**FIGURE 2-5:** **MCP2221 I$^2$C/SMBus TERMINAL WINDOW**



1. **SAVE**: This button will save the current set of commands to a `.cvs` file.
2. **PROTOCOL**: This pull-down box is used to select I$^2$C.
3. **ADDRESS LENGTH**: This box is used to select 7- or 10-bit addressing.
4. **ADDRESS**: This box is used to select the address to the device.
5. **OPERATION**: This box is used to select Read/Write/Set V$_{REF}$.
6. **IMPORT**: This button will allow the importation of a set of commands.
7. **DATA**: For writes, this is the data to be sent. For reads, this is the count.
8. **RECEIVED/SENT DATA**: This window shows the results of a command, all read and written data will appear here with a green **OK** if command was successful.
9. **SEND**: This button will execute the adjacent command.
10. **SPEED**: This window is used to select the bus speed 100/400 kb/s.
11. **SELECT DEVICE**: This window selects the MCP2221 required for communications. If only one device is on the system, then only one option will appear.

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## 2.4    LOADING MPLAB X IDE AND THE XC COMPILER

The MPLAB X IDE and XC8/16/32 compilers can be downloaded from the Microchip web page under the heading of Design Support. While the IDE is free to download, the XC8/16/32 compilers require a licensing fee for the professional version. A short term evaluation version is available, as well as a student version. To download the IDE and/or the compilers, go to the **Design Support** tab on the web site and click on the MPLAB X IDE option (Figure 2-6).

**FIGURE 2-6:**        **DESIGN SUPPORT**
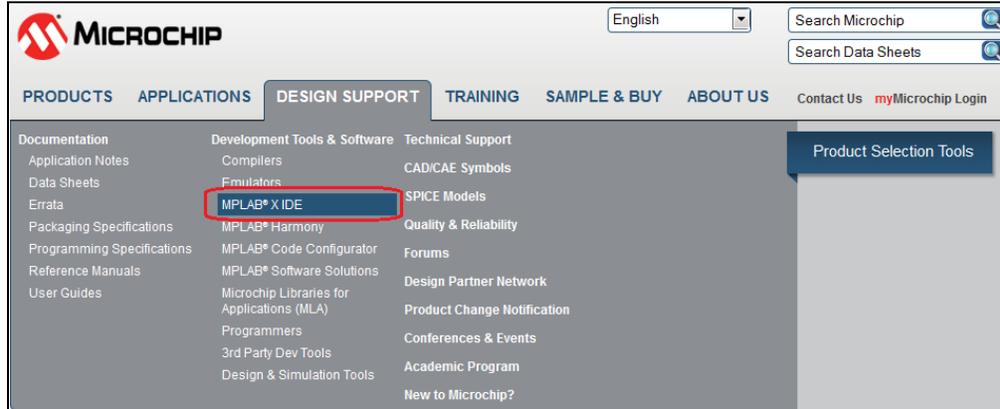


Then click on the **MPLAB X IDE Downloads** option on the left-hand side of the screen (Figure 2-7).

**FIGURE 2-7:**        **MPLAB® X IDE DOWNLOAD**

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Finally, select the appropriate operating system for the computer (Figure 2-8).

**FIGURE 2-8:** **MPLAB X IDE DOWNLOAD SELECTION**



Once the file is downloaded, double click on the file and follow the installation instructions provided with the install packages. If unfamiliar with MLAB X, there are several webinars available to help getting started (Figure 2-9).

**FIGURE 2-9:** **MPLAB® X IDE RELATED VIDEOS**



> **Note:** The MPLAB® X installation will prompt the user about installing the XC compilers as part of its install. Click **Yes** at the prompt, and copies of the XC compilers will be downloaded and installed.

## 2.5 LOADING MCC INTO MPLAB X

MCC can be downloaded within the MPLAB X IDE by selecting the **Tools** tab at the top of the window and then selecting Plugins from the resulting drop-down window (Figure 2-10).

**FIGURE 2-10:** LOADING MCC INTO MPLAB® X
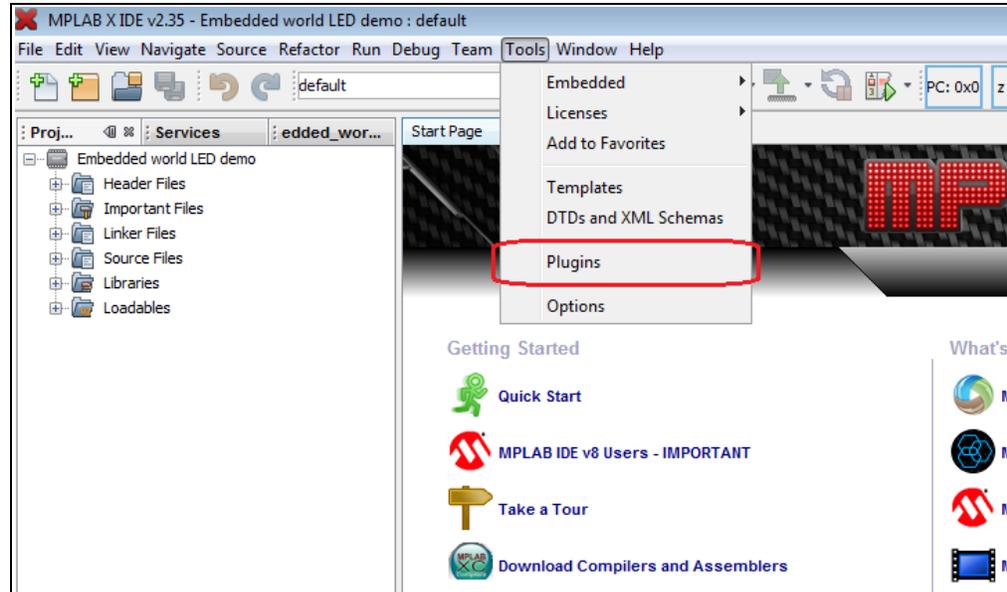


When the Plugins window appears, click on the table for Available Plugins and select MCC from the list of options and click on the **Install** button at the bottom left of the window. The IDE will then download and install the MCC within MPLAB X.

To open MCC within MPLAB X, select the Tools window, select the **Embedded** tab, and then click on the **MPLAB Code Configurator** option.

**FIGURE 2-11:** STARTING MCC IN MPLAB® X
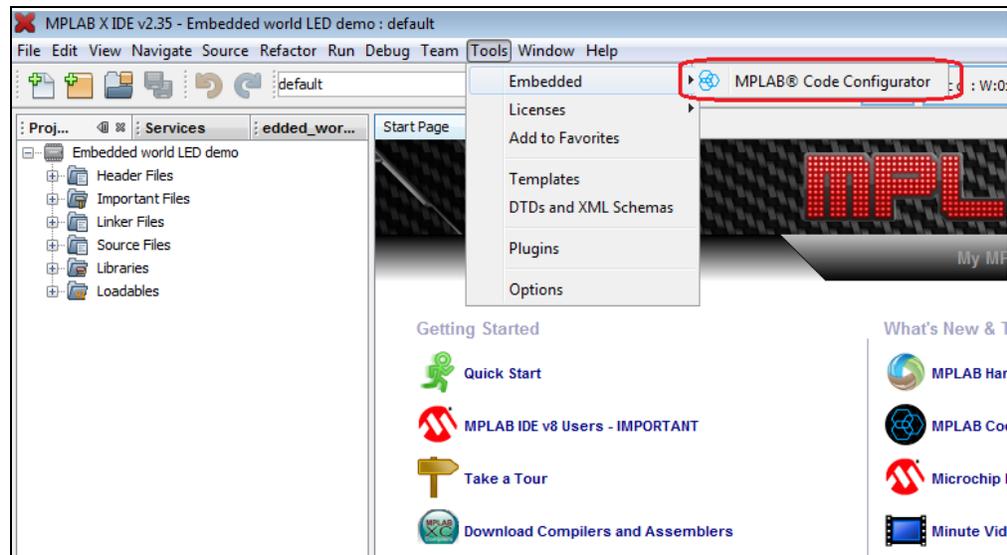


For additional information on the operation of the MCC refer to the training materials available on the Microchip website.

# Chapter 3. Where to Find the Lab Documentation

## 3.1 OUT-OF-THE-BOX LABS

The out-of-the-box labs can be downloaded from the Microchip web page under the PICDEM Lab II product page.

**FIGURE 3-1: OUT-OF-THE-BOX LABS**
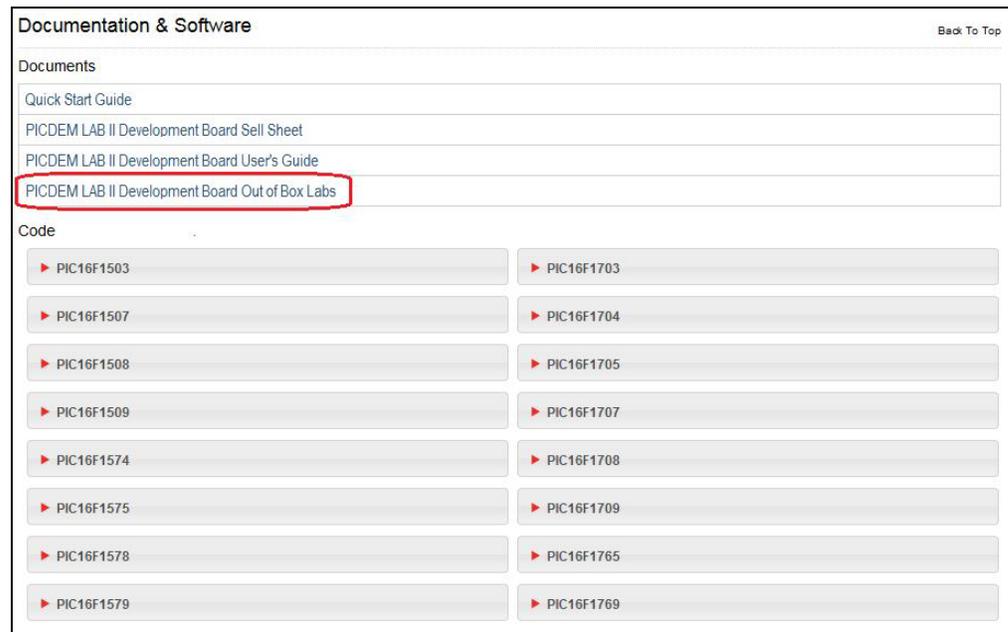


The four labs that use the included components are:

1. **Hello world embedded lab**: This lab is an introductory lab to make the user acquainted with operation of the PICDEM Lab II and the development tool suite. It uses a string of LEDs to produce a moving light. If the user presses a button while either end LED is lit, the direction of the moving light will change. This lab teaches basic tool operation such as editing, compiling and programming.

2. **Power conversion lab 1**: This lab introduces the use of microcontrollers to convert power from one voltage to another. The lab consists of two circuits: a Villard Multiplier which uses switched capacitors to produce a larger output voltage, and a Hysteretic Voltage mode inductive boost power supply. The inductive boost also uses voltage feedback to regulate its output. This lab teaches the basics of core independent peripherals and basic power conversion.

3. **IR remote control lab**: This lab uses two microcontrollers: one to create an IR remote control transmitter with four buttons, and the second to implement an IR remote control receiver with three LEDS. The transmitter generates an on/off keying coded signal that the receiver decodes. This lab teaches the use of the Data Signal Modulator and PWM peripherals in the transmitter and T1G of Timer1 in the receiver.

4.   **Class D audio amplifier lab**: This lab retrieves sound wave table information from a serial EEPROM and uses a Class D audio amplifier configuration to drive a small speaker. The retrieval of the wave table utilizes the $I^2C$ capability of the MSSP peripheral. The reconstruction of the audio signal uses the 10-bit DAC, and the class D amplifier uses the programmable ramp generator to create a triangle wave and a voltage comparator to turn the audio signal into a proportional PWM driver for the speaker.

## 3.2   ADDITIONAL LABS

As new labs are developed, additional labs will be added to the code list on the web page for the PICDEM Lab II.

**FIGURE 3-2:**          **ADDITIONAL LABS**
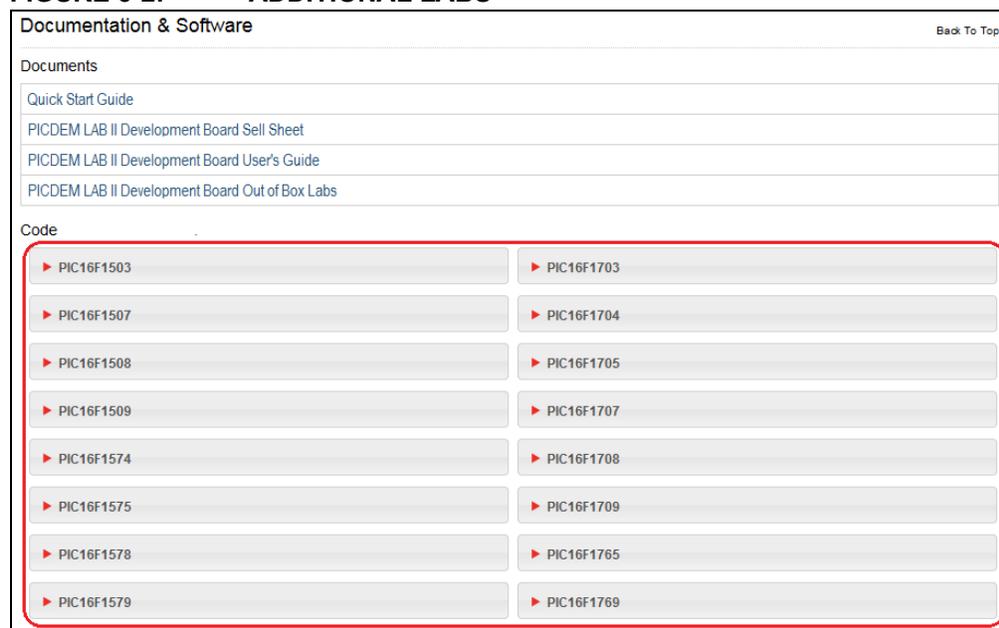


The labs will be organized by the processor used in the lab, and will be grouped with other labs using the same microcontroller. In the event that multiple microcontrollers can support a given lab, the lab will be modified for the additional microcontrollers and included in the zip file download for the microcontrollers.

## 3.3   OBTAINING LAB COMPONENTS

For each of the additional labs, a bill of materials is included which specifies the components used in the lab, the source for the components, and any specifications necessary for obtaining the components. Where possible, the vendor's part number is included to assist in the acquisition of the components.

# Chapter 4.  Troubleshooting

## 4.1    THE BOARD WILL NOT POWER-UP

- If the power indicator LEDs LD1 and LD2 do not light:
  - Verify power is connected to the board.
  - If the 9V input is used, verify the switch SW1 is in the on position.
  - Verify the jumpers on J2 and J6 are placed correctly.
  - Verify the 3.3V and 5.0V outputs are not shorted to GND.
- If only one of the power indicator LEDs does not light:
  - Verify the jumpers on J2 and J6 are placed correctly.
  - Verify that the missing voltage output is not shorted to GND.
- If both power indicator LEDs light but $V_{VAR}$ is missing:
  - Verify that the $V_{VAR}$ voltage output is not shorted to GND.
  - Verify the voltage adjustment potentiometer R7 is not broken.

For all other problems, consult Microchip's online help system.

## 4.2    THE MICROCONTROLLER WILL NOT PROGRAM/DEBUG

- If the programmer does not recognize the microcontroller:
  - Verify that the version of MPLAB X IDE loaded on the computer is yellow/green lighted for the microcontroller; if not, download the latest version.
  - Verify that the programmer/debugger is yellow/green lighted for the microcontroller; if not, download the latest version of the MPLAB X IDE.
  - Verify the programmer/debugger is plugged into the correct ICSP connector with the correct orientation.
  - Verify the programmer/debugger is connected to a working USB port on the computer.
  - Verify power is present on the PICDEM™ Lab II Development Board.
  - Verify voltage is supplied to all V$_{DD}$ pins of the microcontroller.
  - Verify the ICSP connections to the microcontroller are not loaded by external circuitry. See the documentation for the programmer/debugger.
  - Verify the MPLAB X IDE recognizes the programmer/debugger; if not, consult the MPLAB X IDE documentation for corrective actions.
- If the programmer recognizes the microcontroller but will not program the device:
  - Perform a bulk erase of the microcontroller.
  - Verify the low-voltage programming fuse in the Configuration Word is disabled in the code.
  - If the problem persists, contact Microchip concerning the replacement of the microcontroller.

For all other problems, or if the problem persists, contact Microchip's help line for further assistance.

## 4.3    SERIAL/I$^2$C COMMUNICATIONS DO NOT WORK

- If the PICDEM Lab II serial interface is not recognized by the ASYNC terminal program:
  - Verify that the serial driver for the MCP2221 is correctly loaded.
  - Verify the USB interface cable is firmly seated in the PICDEM Lab II board.
  - Verify the USB interface cable is firmly seated in the USB port of the computer.
  - Verify the USB port used is working.
  - Verify that power and GND are connected to pins 2 and 3 of J4 and that voltage is present at the connector.

If the problem persists, contact Microchip's help line for further assistance.

- If the PICDEM Lab II serial interface is not recognized by the I$^2$C/SMBus terminal program:
  - Verify that the I$^2$C/SMBus terminal program is correctly loaded.
  - Verify the USB interface cable is firmly seated in the PICDEM Lab II board.
  - Verify the USB interface cable is firmly seated in the USB port of the computer.
  - Verify the USB port used is working.
  - Verify that power and GND are connected to pins 2 and 3 of J4 and that voltage is present at the connector.
  - Verify pull-up resistors are present on the SDA and SCL (pins 4 and 5) lines of J4.

If the problem persists, contact Microchip's help line for further assistance.

# PICDEM™ LAB II DEVELOPMENT BOARD USER'S GUIDE

## Appendix A. Schematics

**FIGURE A-1:** PICDEM™ LAB II DEVELOPMENT BOARD SCHEMATIC 1
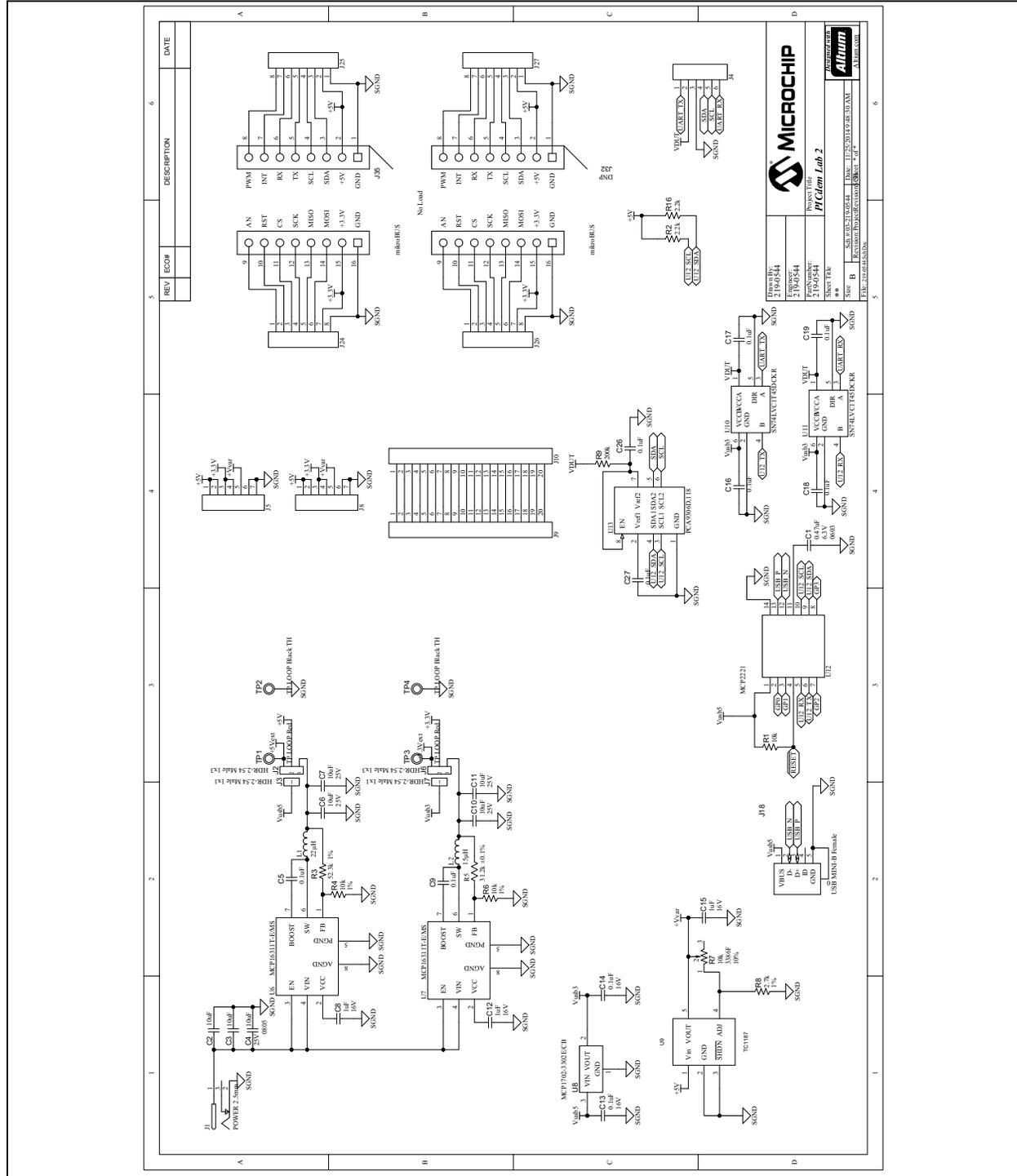
**FIGURE A-2:** PICDEM™ LAB II DEVELOPMENT BOARD SCHEMATIC 2
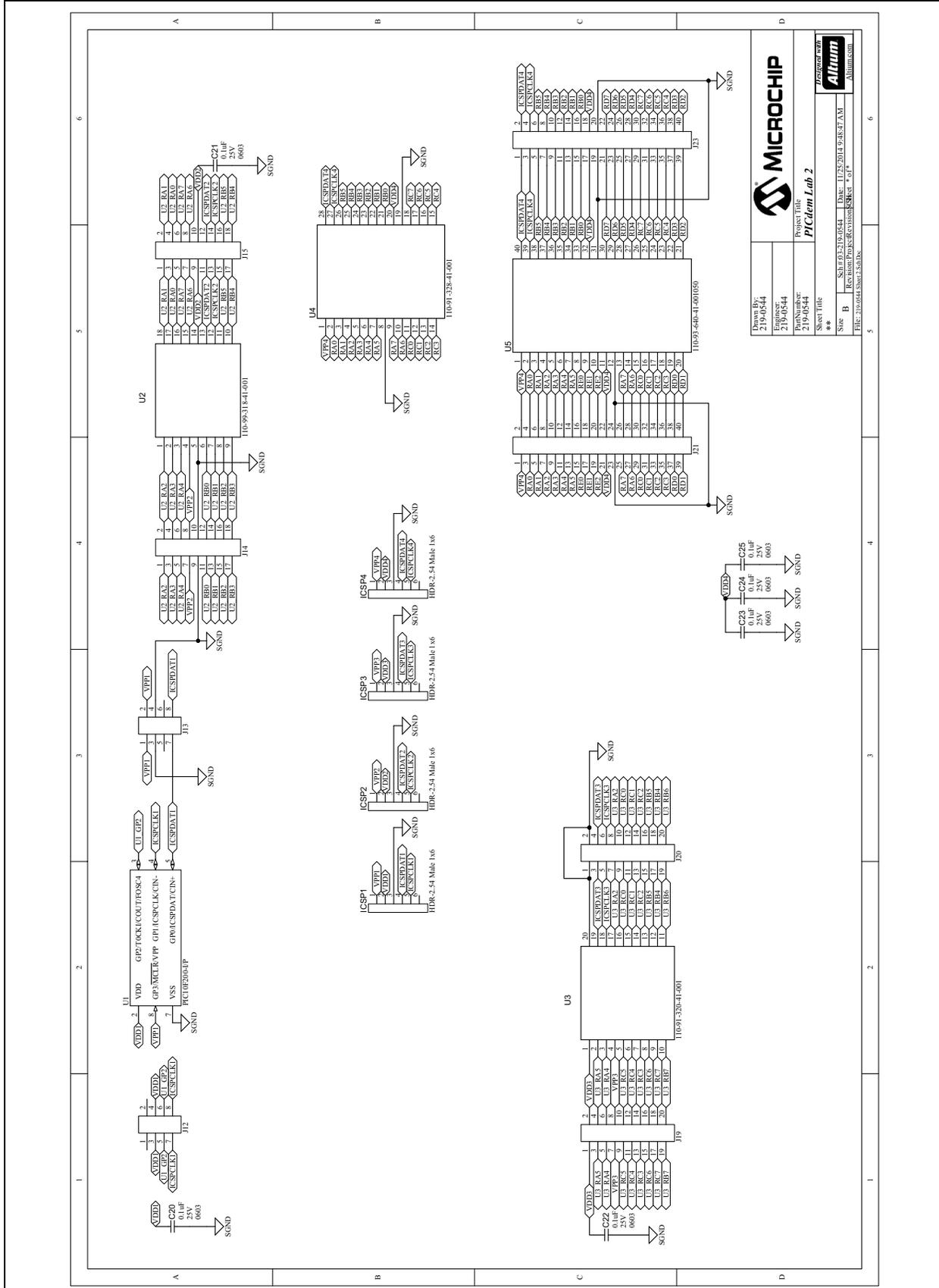
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