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**Curiosity Low Pin Count (LPC)  
Development Board  
User's Guide**

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# CURIOSITY LOW PIN COUNT DEVELOPMENT BOARD USER'S GUIDE

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# CURIOSITY LOW PIN COUNT DEVELOPMENT BOARD USER'S GUIDE

## 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 website ([www.microchip.com](http://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 “DSXXXXA”, where “XXXX” 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 Curiosity LPC Development Board. Items discussed in this chapter include:

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

## DOCUMENT LAYOUT

This document describes how to use the Curiosity LPC Development Board as a development tool to emulate and debug firmware on a target board. The document is organized as follows:

- **Chapter 1. “Introduction to Curiosity Low Pin Count (LPC)”** – This chapter contains general information regarding the Curiosity LPC Development Board kit contents, layout and power source.
- **Chapter 2. “Getting Started”** – This chapter offers information on how to program the Curiosity LPC Development Board.
- **Chapter 3. “Troubleshooting”** – Consult this chapter for troubleshooting information.
- **Appendix A. “Schematic”** – This appendix lists the Curiosity LPC Development Board schematic.
- **Appendix B. “General Notes”** – Refer to this appendix for general notes on using the Click module sockets and the solder blob jumpers.

# Curiosity Low Pin Count Development Board User's Guide

## CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

### DOCUMENT CONVENTIONS

Description	Represents	Examples
<b>Arial font:</b>		
Italic characters	Referenced books	<i>MPLAB IDE User's Guide</i>
	Emphasized text	...is the <i>only</i> 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	<u><i>File&gt;Save</i></u>
Bold characters	A dialog button	Click <b>OK</b>
	A tab	Click the <b>Power</b> 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>
<b>Courier New font:</b>		
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	<i>file.o</i> , where <i>file</i> can be any valid filename
Square brackets [ ]	Optional arguments	mcc18 [options] <i>file</i> [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 Curiosity LPC Development Board. For the latest information on using other tools, refer to the MPLAB® X IDE home page: [www.microchip.com/mplab/mplab-x-ide](http://www.microchip.com/mplab/mplab-x-ide). This resource page contains updated documentation, downloads and links to other MPLAB X compatible tools, plug-ins and much more.

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- **Product Support** – Data sheets and errata, application notes, sample programs and labs, design resources, user's guides and hardware support documents, latest software releases and archived software  
Curiosity Development Board-specific product support can be accessed via our website at [www.microchip.com/promo/curiosity-development-boards](http://www.microchip.com/promo/curiosity-development-boards).
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

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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.

## 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.

Technical support is available through the website at:

[www.microchip.com/support](http://www.microchip.com/support).

## REVISION HISTORY

### **Revision D (March 2020)**

Added new layout revision and content updates.

### **Revision C (September 2019)**

Updated Figures 2-1 through 2-4 and A-1.

Remove EU Declaration of Conformity.

### **Revision B (April 2016)**

Added the EU Declaration of Conformity.

### **Revision A (July 2015)**

Initial release of this document.

## Chapter 1. Introduction to Curiosity Low Pin Count (LPC)

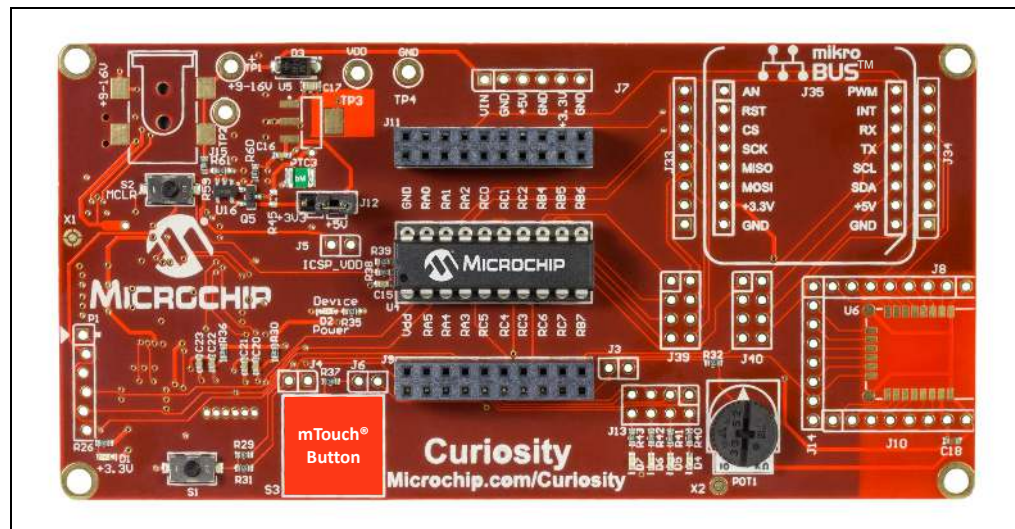
The Curiosity Low Pin Count (LPC) Development Board supports Microchip's 8-, 14- and 20-pin 8-bit PIC<sup>®</sup> MCUs. Dual-row expansion headers on either side of the socket offer flexibility of connectivity to all pins on the PIC MCUs. Programming/debugging is accomplished through the PICkit<sup>™</sup> On-Board (PKOB), eliminating the need for an external programming/debugging tool. This board provides flexibility for experimentation through an application header with a ground (GND) and supply voltage (V<sub>SS</sub>) connections. It is also a set of indication LEDs, mTouch<sup>®</sup> button and push button switches, and a variable potentiometer. Additionally, the Curiosity LPC Board integrates a MikroElektronika mikroBUS<sup>™</sup> socket, which can accommodate a variety of plug-in Click<sup>™</sup> Board modules that can be used for application development.

### 1.1 CURIOSITY LOW PIN COUNT (LPC) DEVELOPMENT BOARD KIT CONTENTS

The Curiosity Low Pin Count (LPC) Development Board kit contains the following:

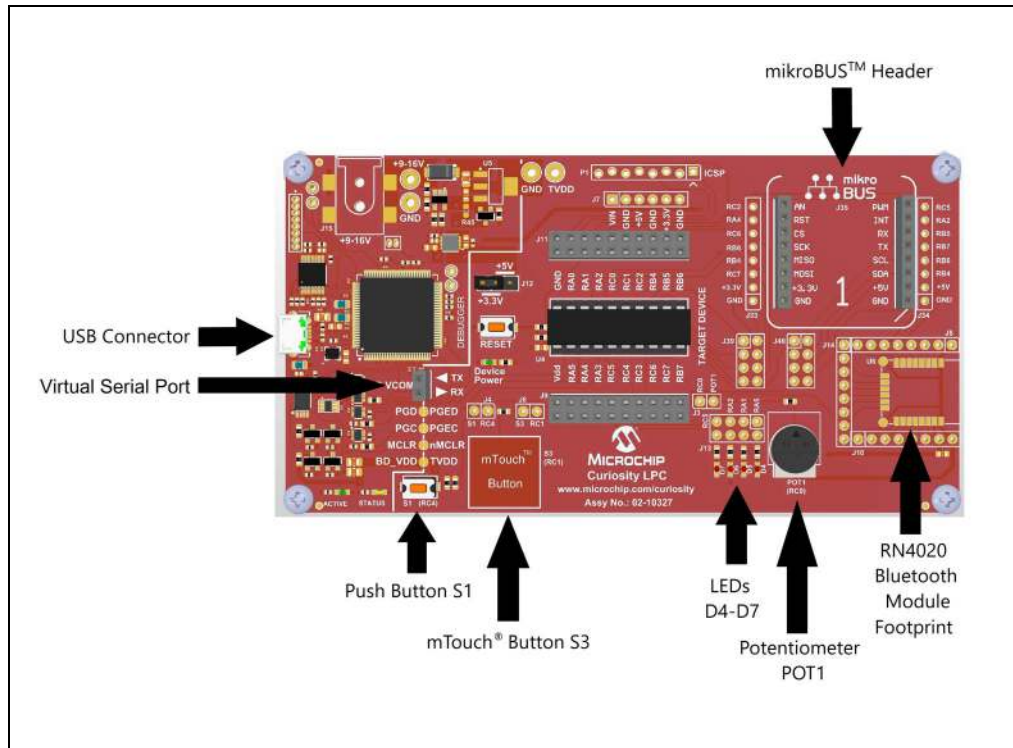
- Curiosity Low Pin Count (LPC) Development Board
- Quick Start Guide
- PIC16F18446 MCU

**FIGURE 1-1: CURIOSITY LOW PIN COUNT (LPC) DEVELOPMENT BOARD REV 2**





**FIGURE 1-2: CURIOSITY LOW PIN COUNT (LPC) DEVELOPMENT BOARD REV 4**



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## Chapter 2. Getting Started

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The Curiosity Low Pin Count (LPC) Development Board contains a PICkit On-Board (PKOB) which allows for both low-voltage programming and low-voltage in-circuit debugging for all supported devices. When used with the MPLAB IDE, in-circuit debugging allows the user to run, modify, and troubleshoot their custom software and hardware quickly, without the need for additional debugging tools.

### 2.1 PROGRAMMING THE CURIOSITY LOW PIN COUNT (LPC) DEVELOPMENT BOARD

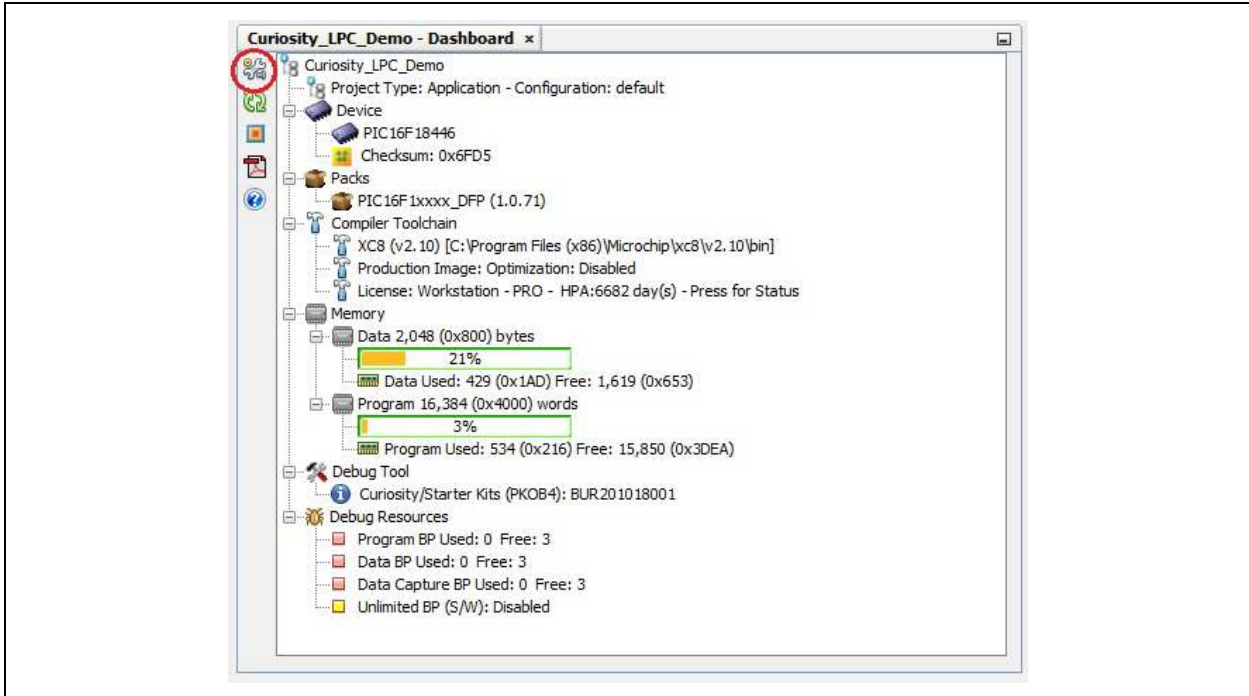
Programming the Curiosity LPC Development Board can be accomplished through MPLAB X IDE (version 3.30 or higher for Rev 2 and version 5.20 or higher for Rev 4).

<p><b>Note:</b> The Curiosity LPC Board must be programmed using Low-Voltage Programming (LVP). The LVP bit of the Configuration Word(s) must be set (LVP = ON or '1').</p>
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#### 2.1.1 Programming Using MPLAB® X IDE

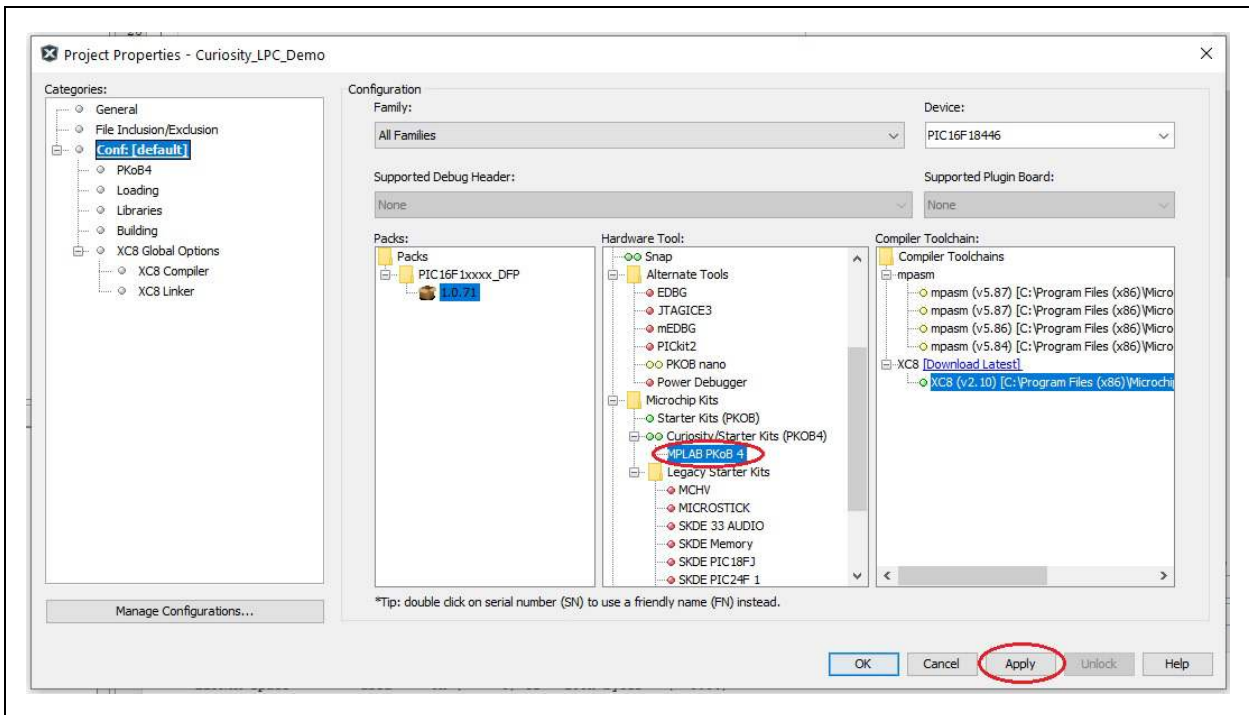
1. Connect the Curiosity LPC Board to the computer using the on-board micro-USB connector.
2. Open MPLAB X IDE and either create a new project or open an existing one.
3. Click on the **Project Properties** icon located in the project's Dashboard window (as seen in [Figure 2-1](#)). Alternatively, the Project Properties window can be opened by clicking on *File > Project Properties*, or by right clicking on the project name in the Projects window and clicking **Properties**.

**FIGURE 2-1: PROJECT PROPERTIES BUTTON**



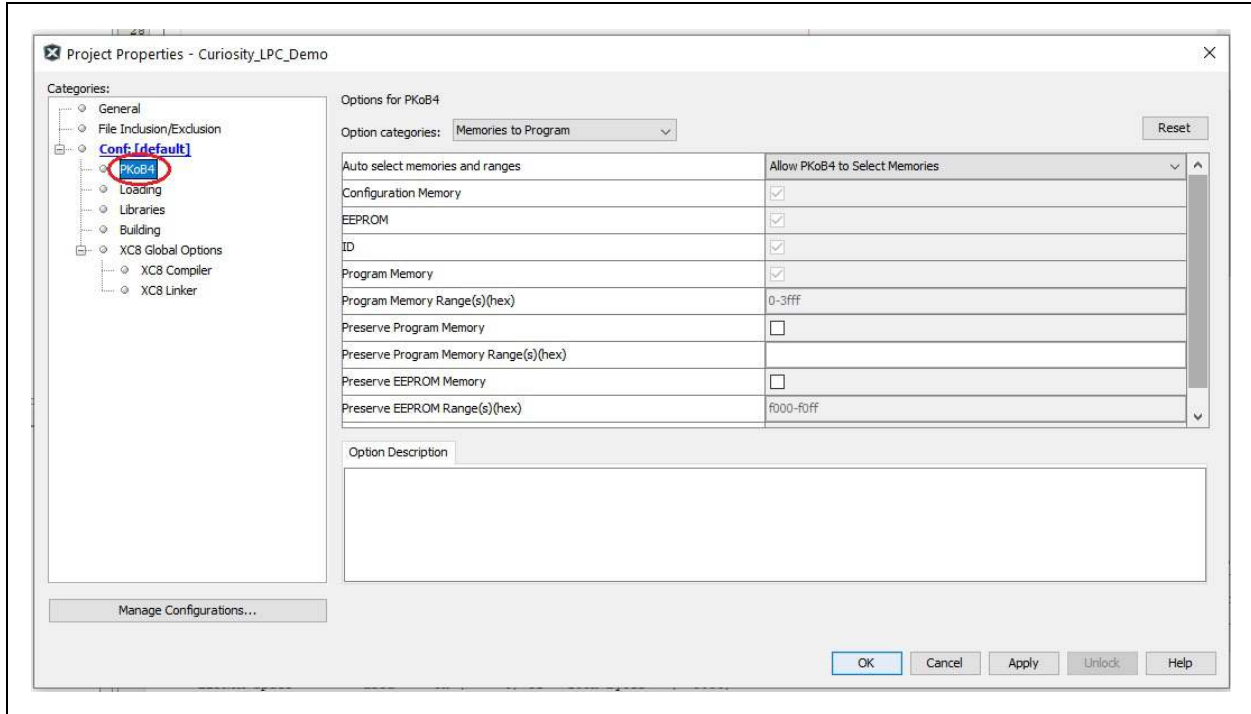
4. The Project Properties window will open. This window allows for the selection of the programming tool, compiler and PIC MCU. MPLAB X IDE refers to the Curiosity LPC Board as “Starter Kits” in the Hardware Tool selection window, as seen in [Figure 2-2](#).

**FIGURE 2-2: SELECTING THE CURIOSITY LPC DEVELOPMENT BOARD**



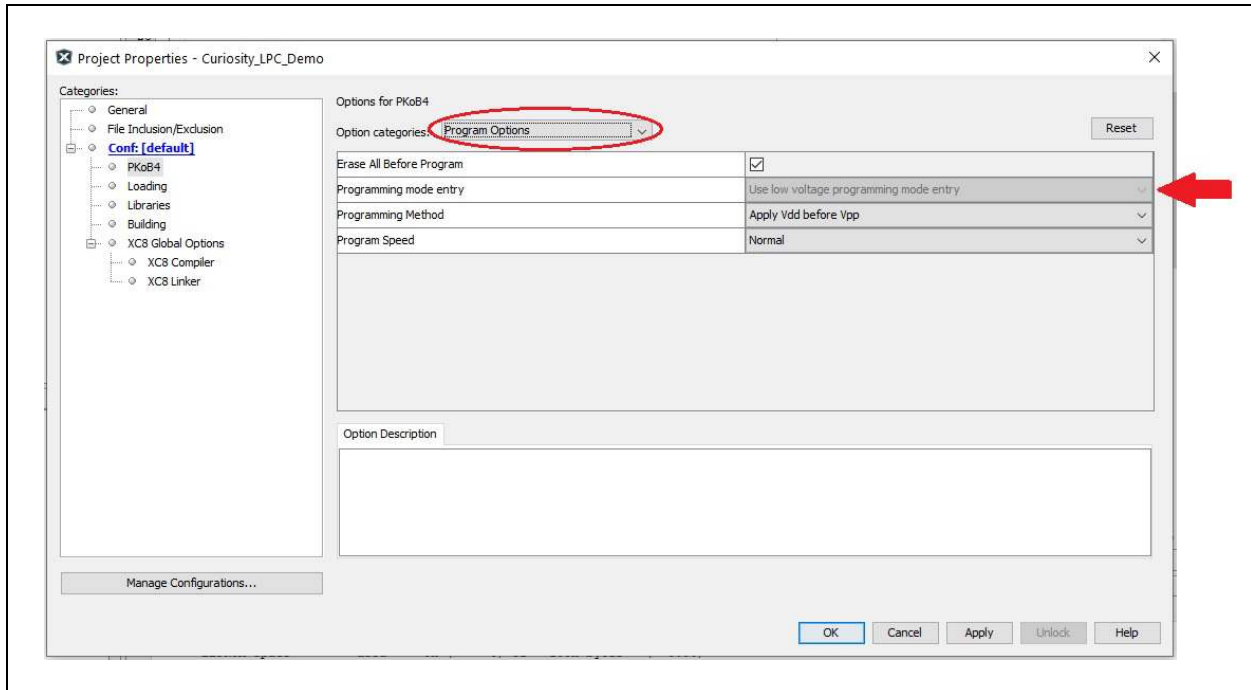
5. In the upper left-hand corner of the Project Properties window, click on **Starter Kits (PKOB)**. The window will now show the configuration options for the PKOB programmer, as shown in [Figure 2-3](#).

**FIGURE 2-3: PROGRAM OPTIONS FOR THE PICKIT™ ON-BOARD (PKOB)**



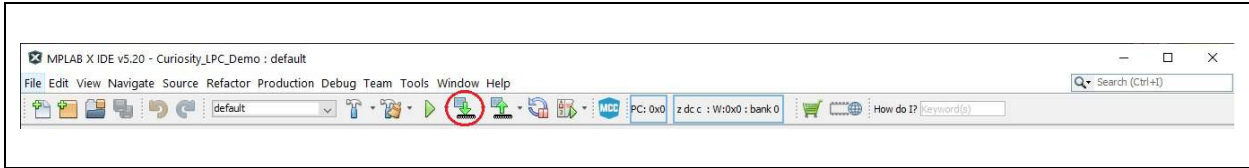
6. In the Option categories drop-down menu, select **Program Options**; ensure that the Low Voltage Programming mode is selected for Programming mode entry (Figure 2-4). The Curiosity LPC Board is now ready to be programmed.

**FIGURE 2-4: ENSURE LOW-VOLTAGE PROGRAMMING IS ENABLED**



- 
7. Once the project is ready to be programmed, simply click on the **Make and Program Device** button, and MPLAB X IDE will build and compile the code and program the PIC device, as displayed in [Figure 2-5](#).

**FIGURE 2-5: DEVICE PROGRAMMING**



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## Chapter 3. Troubleshooting

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This chapter discusses common operational issues and methods to resolve them.

### 3.1 THE MCU WILL NOT PROGRAM USING THE PKOB

The Curiosity LPC Development Board's PICkit On-Board (PKOB) uses low-voltage programming. Both MPLAB X IDE and MPLAB Xpress set the Low-Voltage Programming (LVP) bit to a '1', allowing low-voltage programming.

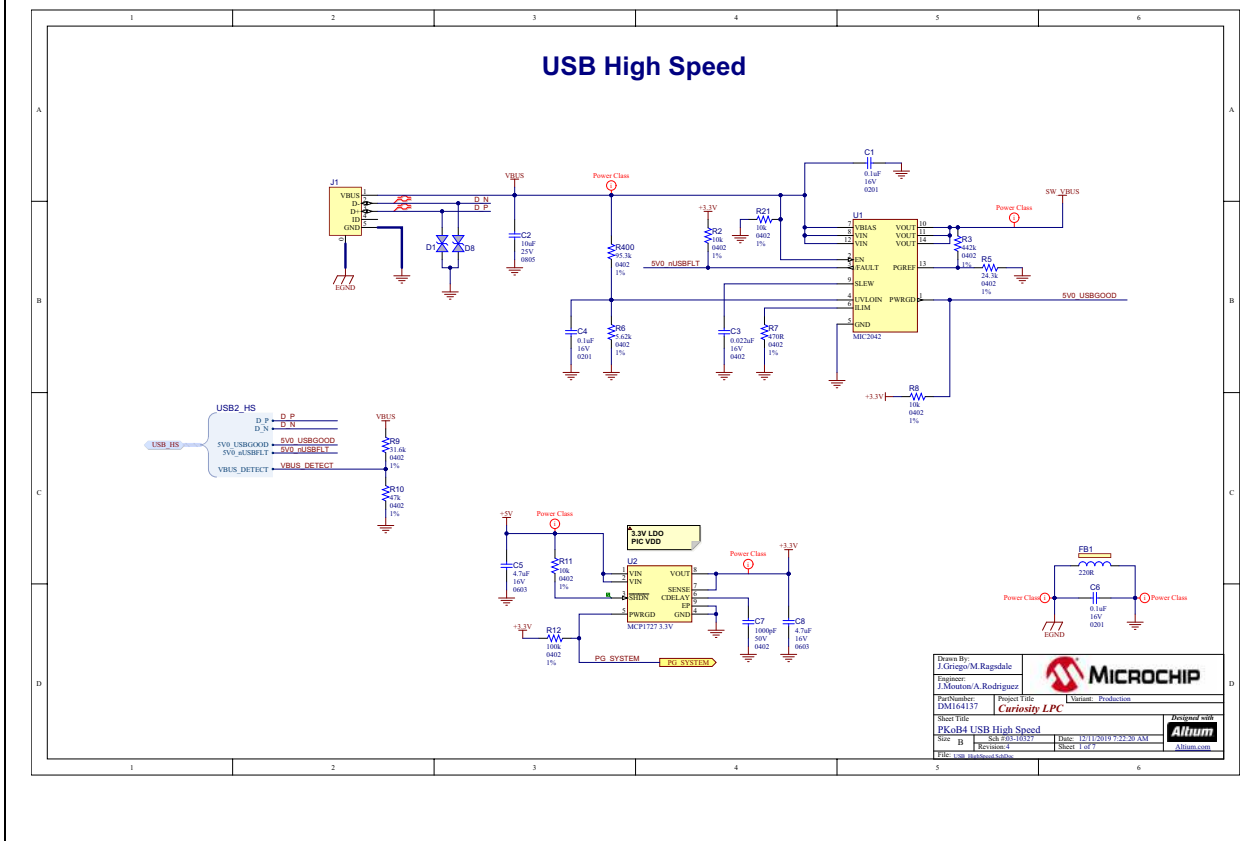
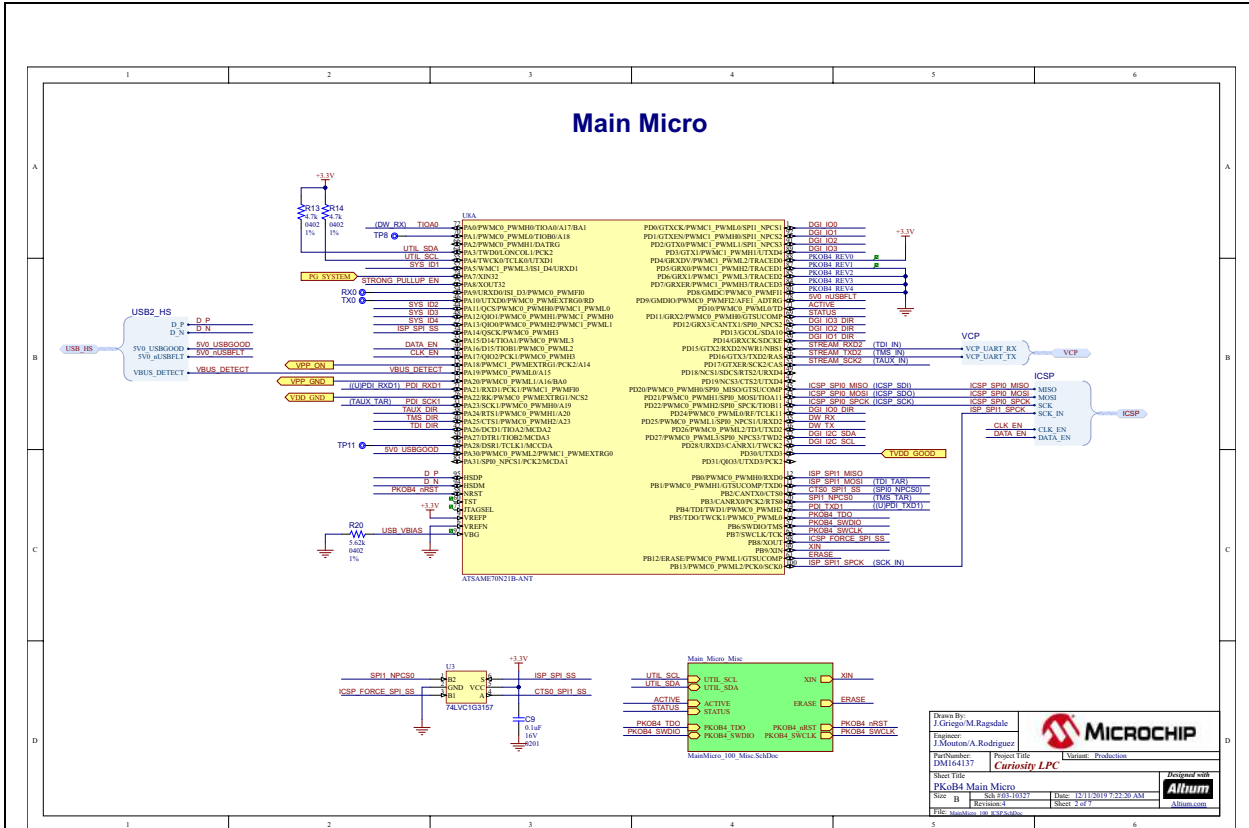
1. When using custom firmware, the LVP bit must be set to '1' in the Configuration Word. MPLAB X IDE will not allow programming using the PKOB unless the bit is properly configured.
2. When using a PIC microcontroller (one not included with the Curiosity Development Board) that has already been programmed using high-voltage programming and the LVP bit is cleared (LVP = OFF or '0'), the device will not be recognized and cannot be programmed using the PKOB. Reprogramming the device can be achieved by one of the following two methods:
  - a) Connect a PICkit™ 3 Programmer to the PIC device dual-row expansion headers, ensuring the appropriate ICSP™, GND, and VDD connections are made. Configure MPLAB IDE to use the PICkit 3 as the programmer, and ensure the LVP bit is set to '1' in the Configuration Word. Reprogram the device.
  - b) Use an unprogrammed (blank) device and ensure the LVP bit is set to '1' in the Configuration Word.

### 3.2 THE MPLAB PICKIT™ 4 ON-BOARD (PKOB4) DOES NOT PERFORM

Use the **Hardware Tool Emergency Boot Firmware Recovery Utility** to restore hardware tool boot firmware to its factory state. The recovery utility window can be opened by clicking on *Debug > Hardware Tool Emergency Boot Firmware Recovery Utility* in MPLAB X IDE. The Curiosity LPC Development Board's PICkit On-Board (PKOB) uses low-voltage programming. Both MPLAB X IDE and MPLAB Xpress sets the Low-Voltage Programming (LVP) bit to a '1', allowing low-voltage programming.

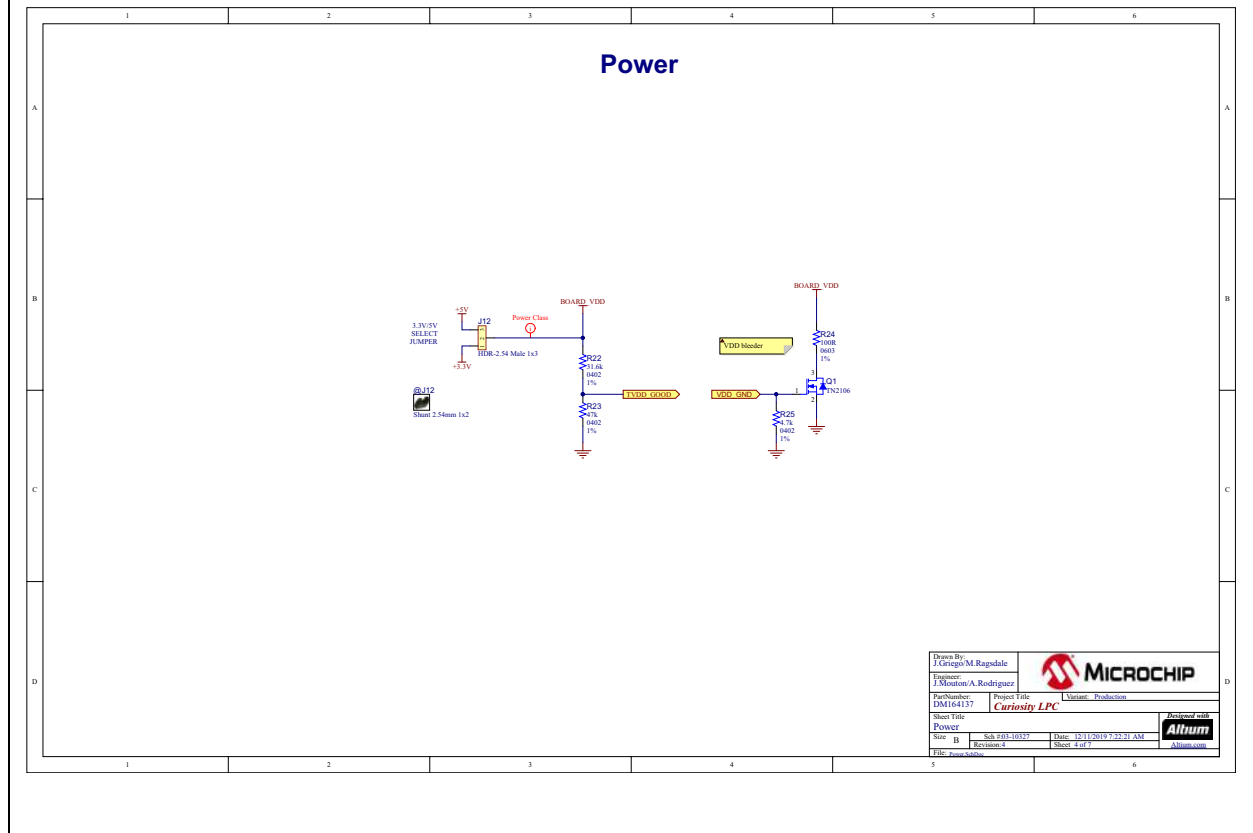
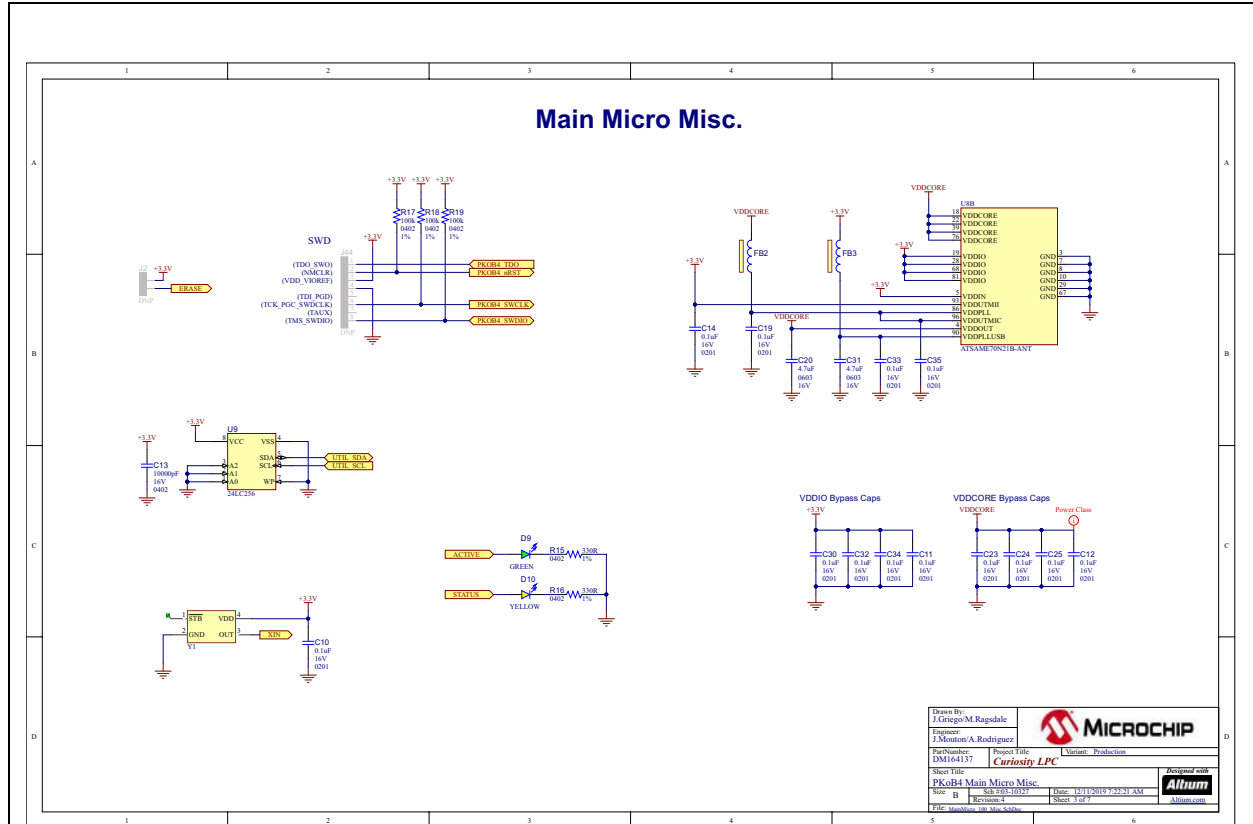


**FIGURE A-2: CURIOSITY LPC DEVELOPMENT BOARD SCHEMATIC REV 4 (1 OF 4)**

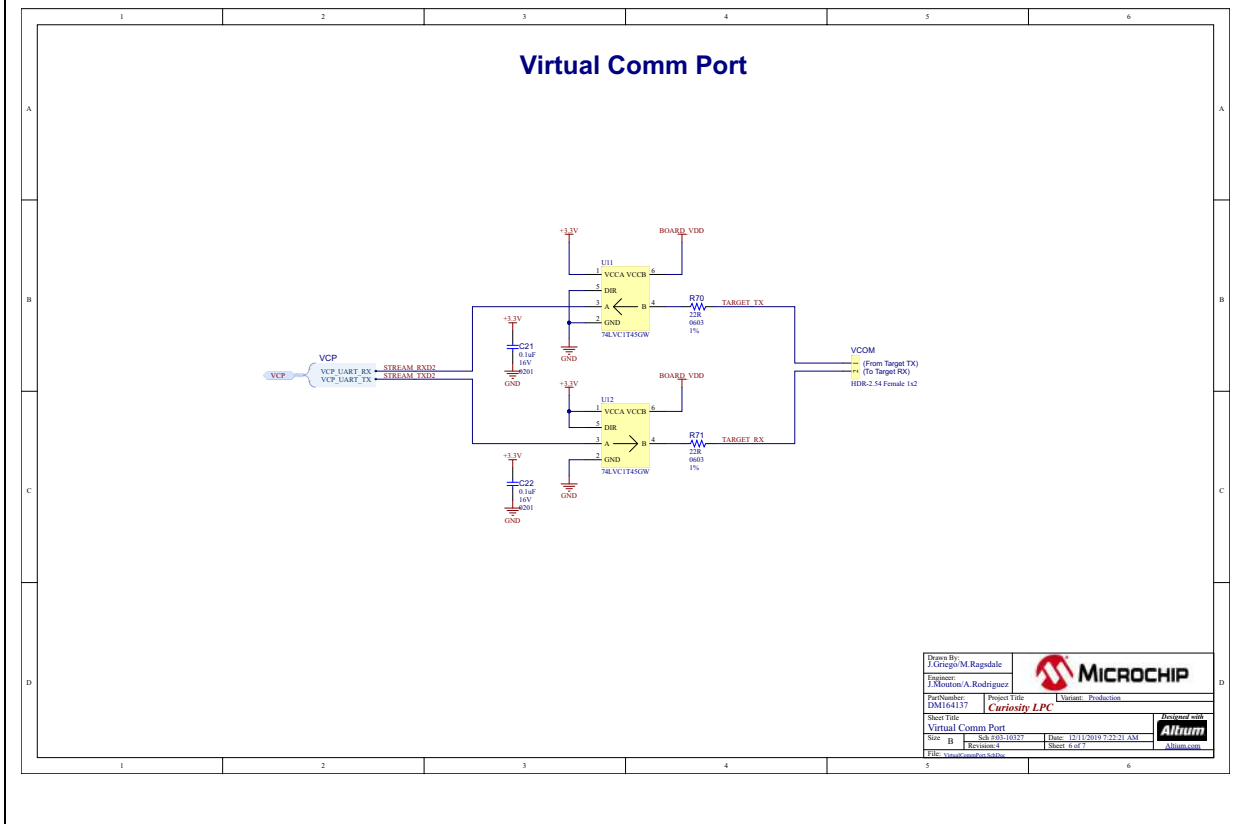
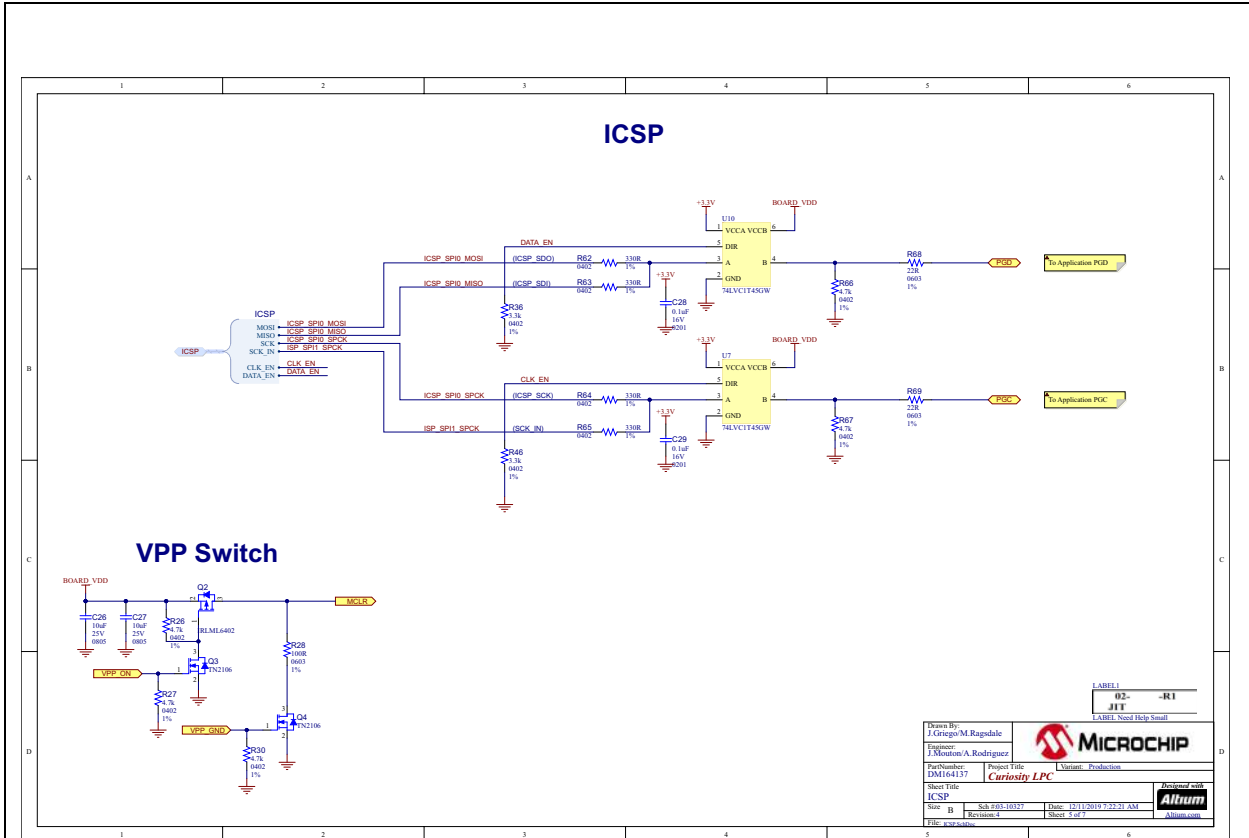




**FIGURE A-3: CURIOSITY LPC DEVELOPMENT BOARD SCHEMATIC REV 4 (2 OF 4)**



**FIGURE A-4: CURIOSITY LPC DEVELOPMENT BOARD SCHEMATIC REV 4 (3 OF 4)**





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## Appendix B. General Notes

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### B.1 mikroBUS™ CLICKS

Module 1 is the main click socket, and Module 2 is the secondary socket. Both sockets are fully compatible with a 40-pin PIC device; however, when using 28-pin devices, not all pins are available.

All pins in Module 1 are available for use with the exception of the mikroBUS's Reset (RST) signal, which is tied to pin RD0. PORT D is not available on 28-pin devices. If the RST signal is needed, remove the solder blob jumper associated with the mikroBUS RST connection, and place a jumper wire between the via next to the solder blob jumper and the desired pin connection found in the J8 or J11 dual-row expansion headers (see [Figure 1-1](#)).

All pins in Module 2 are available for use with the exception of the mikroBUS's Reset (RST) signal (RD2), SPI Chip Select ( $\overline{CS}$ ) signal (RD3), and the PWM (RD1) signal. These signals are routed to the PORT D pins, which are not available on 28-pin PIC devices. If these signals are needed, remove the solder blob jumpers associated with the mikroBUS connection pins, and place jumper wires from the vias located next to the associated solder blob jumpers to the desired pin connections found in the J8 or J11 dual-row expansion headers (see [Figure 1-1](#)).

### B.2 SOLDER BLOB JUMPER

Solder blob jumpers can be found on each Click module, push-button switch, LED, or potentiometer connection. This allows the user to utilize those pin connections for other applications.



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