Curiosity Development Board User's Guide

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Object of Declaration: Curiosity Development Board

EU Declaration of Conformity

Manufacturer: Microchip Technology Inc.
2355 W. Chandler Blvd.
Chandler, Arizona, 85224-6199
USA

This declaration of conformity is issued by the manufacturer.

The development/evaluation tool is designed to be used for research and development in a laboratory environment. This development/evaluation tool is not a Finished Appliance, nor is it intended for incorporation into Finished Appliances that are made commercially available as single functional units to end users under EU EMC Directive 2004/108/EC and as supported by the European Commission's Guide for the EMC Directive 2004/108/EC (8th February 2010).

This development/evaluation tool complies with EU RoHS2 Directive 2011/65/EU.

This development/evaluation tool, when incorporating wireless and radio-telecom functionality, is in compliance with the essential requirement and other relevant provisions of the R&TTE Directive 1999/5/EC and the FCC rules as stated in the declaration of conformity provided in the module datasheet and the module product page available at www.microchip.com.

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Signed for and on behalf of Microchip Technology Inc. at Chandler, Arizona, USA

Derek Carlson
VP Development Tools

12-Sep-14
Date

NOTES:

CURIOSITY 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 "DSXXXXXA", where "XXXXX" 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 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 Curiosity 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"** – This chapter contains general information regarding the Curiosity Development Board kit contents, layout and power source.
- **Chapter 2. "Getting Started"** – This chapter offers information on how to program the Curiosity Development Board.
- **Chapter 3. "Troubleshooting"** – Consult this chapter for troubleshooting information.
- **Appendix A. "Schematic"** – This appendix lists the Curiosity Development Board schematic.
- **Appendix B. "General Notes"** – Refer to this appendix for general notes on power options, configuration of the RN4020 Bluetooth® low-energy module and the Click module, debugging, routing and flexibility of the board.

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENT 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 Curiosity 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, 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/curiosity.
  •**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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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.

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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 web site at:

www.microchip.com/support.

REVISION HISTORY

Revision A (July 2015)

Initial release of this document.

Revision B (April 2016)

Added the EU Declaration of Conformity.

Chapter 1. Introduction to Curiosity

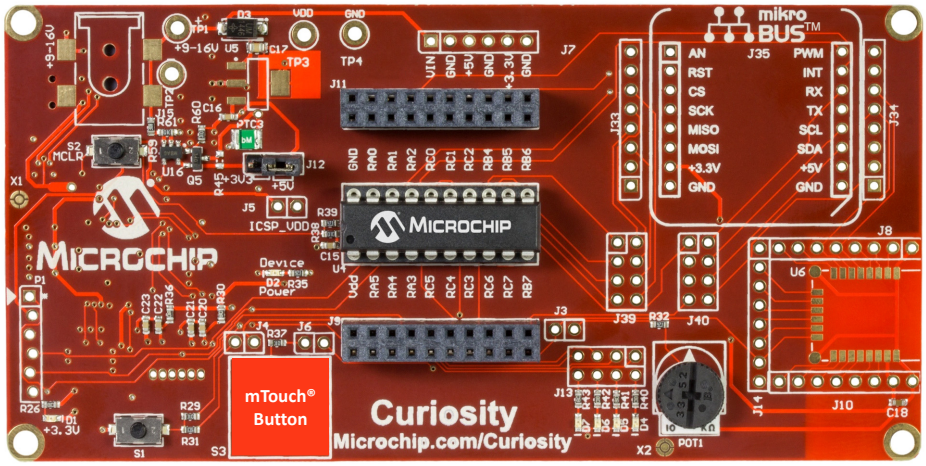
The Curiosity Development Board supports Microchip's 8-, 14- and 20-pin 8-bit PIC® MCUs. Dual-row expansion headers on either side of the socket offer flexibility of connectivity to all pins on the PIC MCUs. This board provides flexibility for experimentation through an application header with ground (GND) and supply voltage (V_{DD}) connections. It also includes a set of indication LEDs, mTouch® button and push-button switches, and a variable potentiometer. Additionally, it features a Bluetooth® low-energy footprint and a mikroBUS™ footprint to accommodate a variety of plug-in Click™ Board sensors that can be used in application development.

1.1 CURIOSITY DEVELOPMENT BOARD KIT CONTENTS

The Curiosity Development Board kit contains the following:

- Curiosity Development Board
- Quick Start Guide

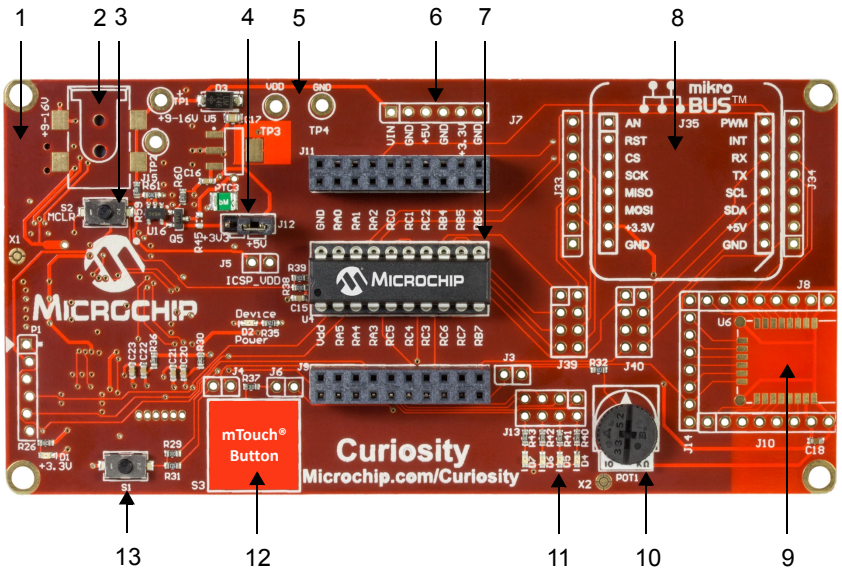
FIGURE 1-1: CURIOSITY DEVELOPMENT BOARD KIT



1.2 CURIOSITY DEVELOPMENT BOARD LAYOUT

Figure 1-2 identifies the major features of the Curiosity Development Board.

FIGURE 1-2: CURIOSITY DEVELOPMENT BOARD LAYOUT



1. USB mini-B connector (on back)
2. Footprint for 9V connector
3. Master Clear Reset button
4. 3.3/5V power jumper (J12)
5. Posts for external variable power supply
6. Expansion board connector
7. PIC® MCU socket for 8, 14, and 20-pin microcontrollers
8. mikroBUS™ Click Board footprint for application development
9. RN4020 Bluetooth® Module Footprint
10. Potentiometer
11. LEDs
12. mTouch® button
13. Push button

1.3 POWER SOURCES

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

1.3.1 USB Connector (J2)

The USB connector (J2) will power the entire Curiosity Development Board. A shunt jumper must be placed onto jumper J12 (Figure 1-2). The right two pins of J12 will connect +5V from the USB connector J2. The left two pins of J12 will connect +3.3V from the USB voltage regulator on the back side of the development board. With USB power connected to J2, power LED D1 will always be ON to indicate that +3.3V is available on the board.

1.3.2 9V External Power Supply (J15)

The 9V external power supply (J15) will also power the entire Curiosity Development Board. A shunt jumper must be placed onto jumper J12 (Figure 1-2). The right two pins of J12 will connect +5V from the on-board voltage regulator circuitry connected to connector J15. The left two pins of J12 will connect +3.3V from the on-board voltage regulator circuitry. With 9V external power connected to J15, power LED D1 will always be ON to indicate that +3.3V is available on the board. Power LED D2 will only be ON when power (+3.3V or +5V) is applied to V_{DD} via a shunt jumper placed on J12.

1.3.3 Variable External Power Supply (TP3, TP4)

A variable external power supply connected to TP3 and TP4 will power the entire Curiosity Development Board. A shunt jumper is not needed on J12, thus either +3.3V or +5V can be directly applied via a variable external power supply to V_{DD}.

NOTES:

Chapter 2. Getting Started

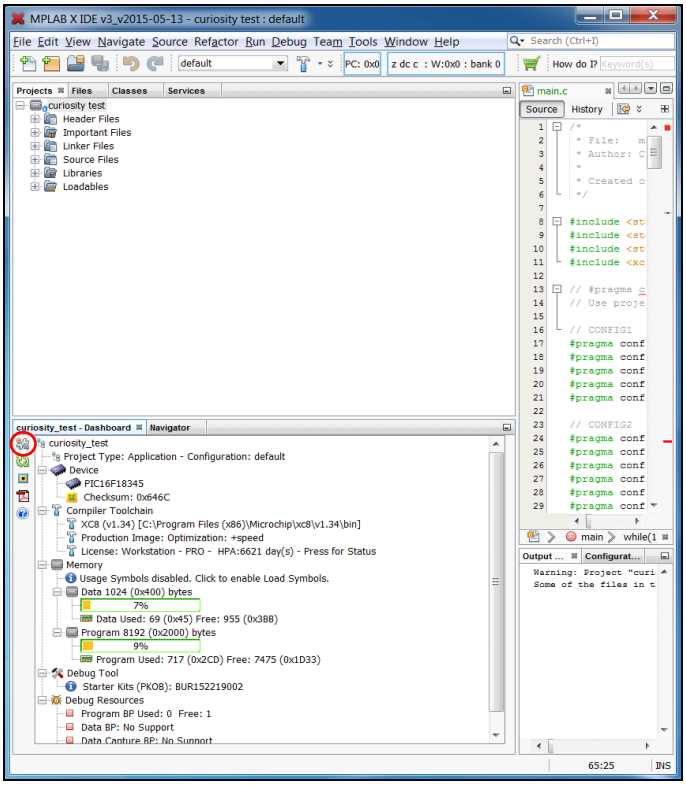
The Curiosity Development Board must be used with MPLAB X Integrated Development Environment (IDE), available free on Microchip's web site, www.microchip.com. Use version v3.05 or later.

The Curiosity Development Board, through MPLAB X, is 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 Curiosity hardware. This facilitates the debugging of firmware and hardware concurrently. Use the Curiosity Development Board with MPLAB X IDE 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 PROGRAMMING THE CURIOSITY DEVELOPMENT BOARD

After connecting the Curiosity Development Board to the computer using the on-board USB connector (J2 on the back of the board), open the MPLAB X IDE. Then create a new project or open an existing project. Click on the Project Properties icon located in the project's Dashboard window (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).

FIGURE 2-1: SELECTING THE CURIOSITY DEVELOPMENT BOARD IN THE MPLAB® X IDE



MPLAB X refers to the Curiosity Development Board as "Starter Kits (PKOB)", with "Curiosity" listed below. Click on **Curiosity**, the correct device and XC8 compiler version being used, then click **Apply** (Figure 2-2). On the upper left hand corner of the Properties window, click on **Starter Kit (PKOB)** (Figure 2-3). The window will change to the Options for Starter Kit (PKOB) window (Figure 2-3).

FIGURE 2-2: CURIOSITY DEVELOPMENT BOARD CONFIGURATION

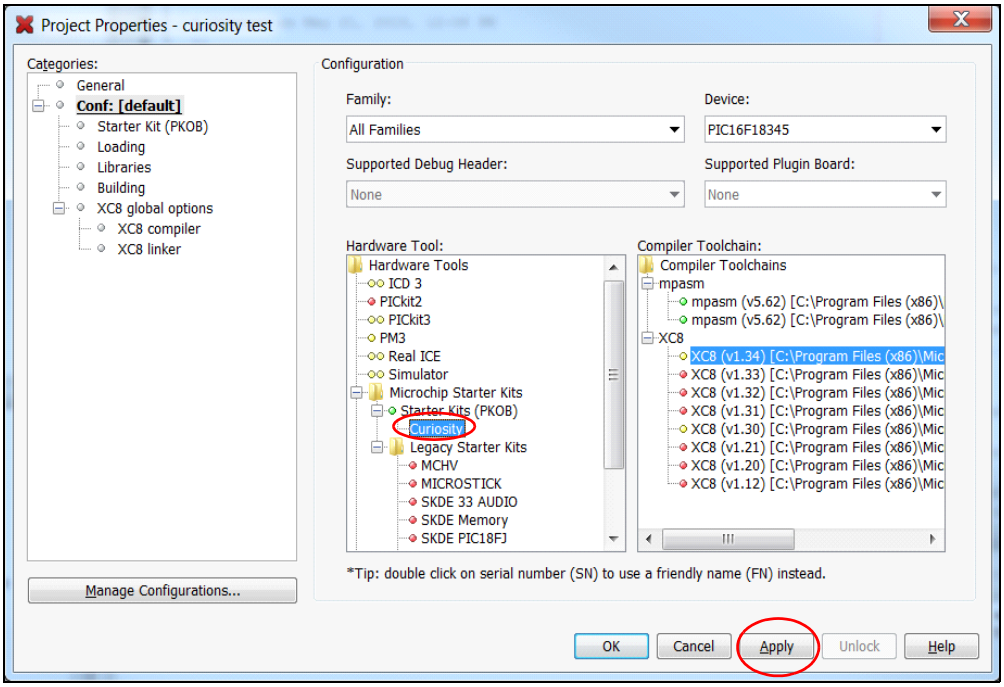
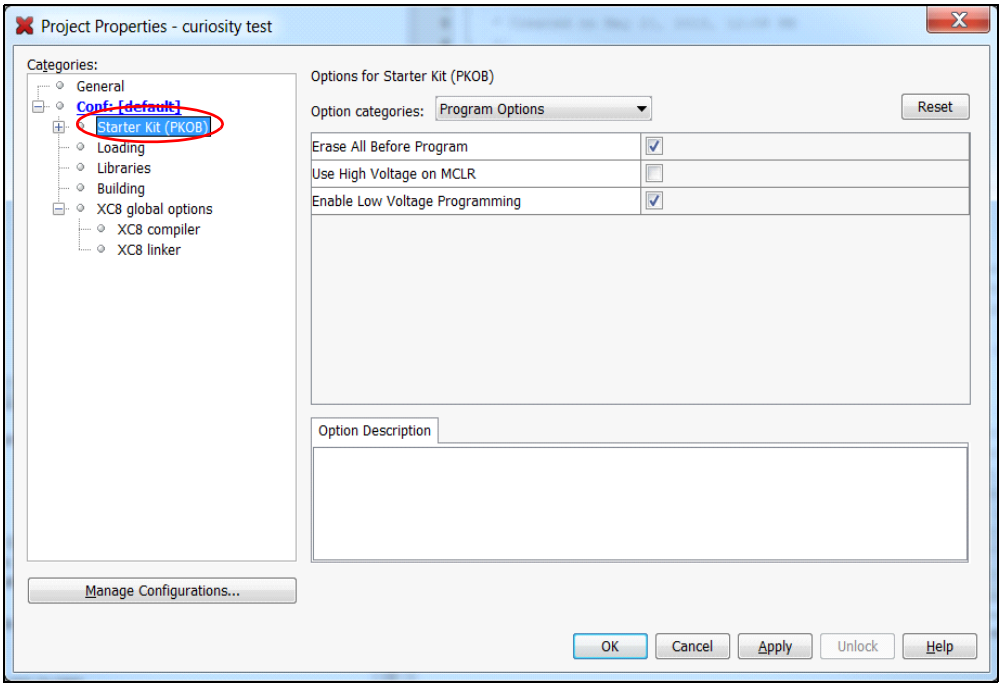


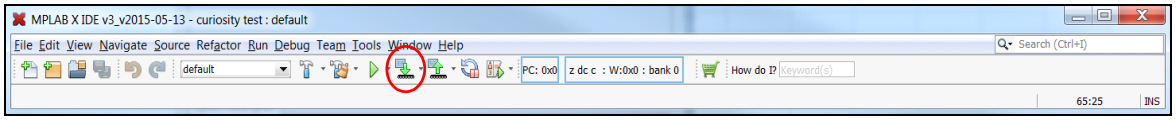
FIGURE 2-3: PROGRAM OPTIONS FOR STARTER KIT (PKOB)



Note: When using the PKOB for programming, the Low Voltage Programming (LVP) bit of the Configuration Word(s) must be set (LVP = ON or '1').

Select options category “Program Options” and then “Enable Low Voltage Programming,” if it is not already selected. Click **Apply**, then **OK** (Figure 2-3). Once the project is finished, the microcontroller is ready to be programmed. Simply click on the **Make and Program Device Main Project** button and the device will be programmed (Figure 2-4).

FIGURE 2-4: PROGRAMMING THE DEVICE ON THE CURIOSITY DEVELOPMENT BOARD



NOTES:

Chapter 3. Troubleshooting

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

3.1 THE DEMO APPLICATION DOES NOT RUN

Curiosity Development Board must be plugged into a powered USB hub, computer, or other USB host device. To run the application, ensure the conditions listed below are met:

1. Start by plugging it into the USB device port, J2. LEDs D1 and D2 should light when V_{BUS} is detected.
2. If D1 is not lit, verify that the USB host side port is functional.
3. If D2 is not lit, verify that jumper J12 is connected to the proper device voltage.

3.2 THE MCU WILL NOT PROGRAM USING THE PKOB

The Curiosity Development Board's PICkit on board (PKOB) uses low-voltage programming. The demo application code sets 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 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 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 Curiosity board, configuring MPLAB to use the PICkit 3 as the programmer, and ensuring 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.

3.3 THE MCU WILL NOT PROGRAM USING THE PICkit 3

If the PIC device will not program using the PICkit 3, ensure that the 3.3/5V jumper (J12) is removed.

NOTES:

Appendix A. Schematic

A.1 CURIOSITY DEVELOPMENT BOARD SCHEMATIC

FIGURE A-1: CURIOSITY DEVELOPMENT BOARD SCHEMATIC

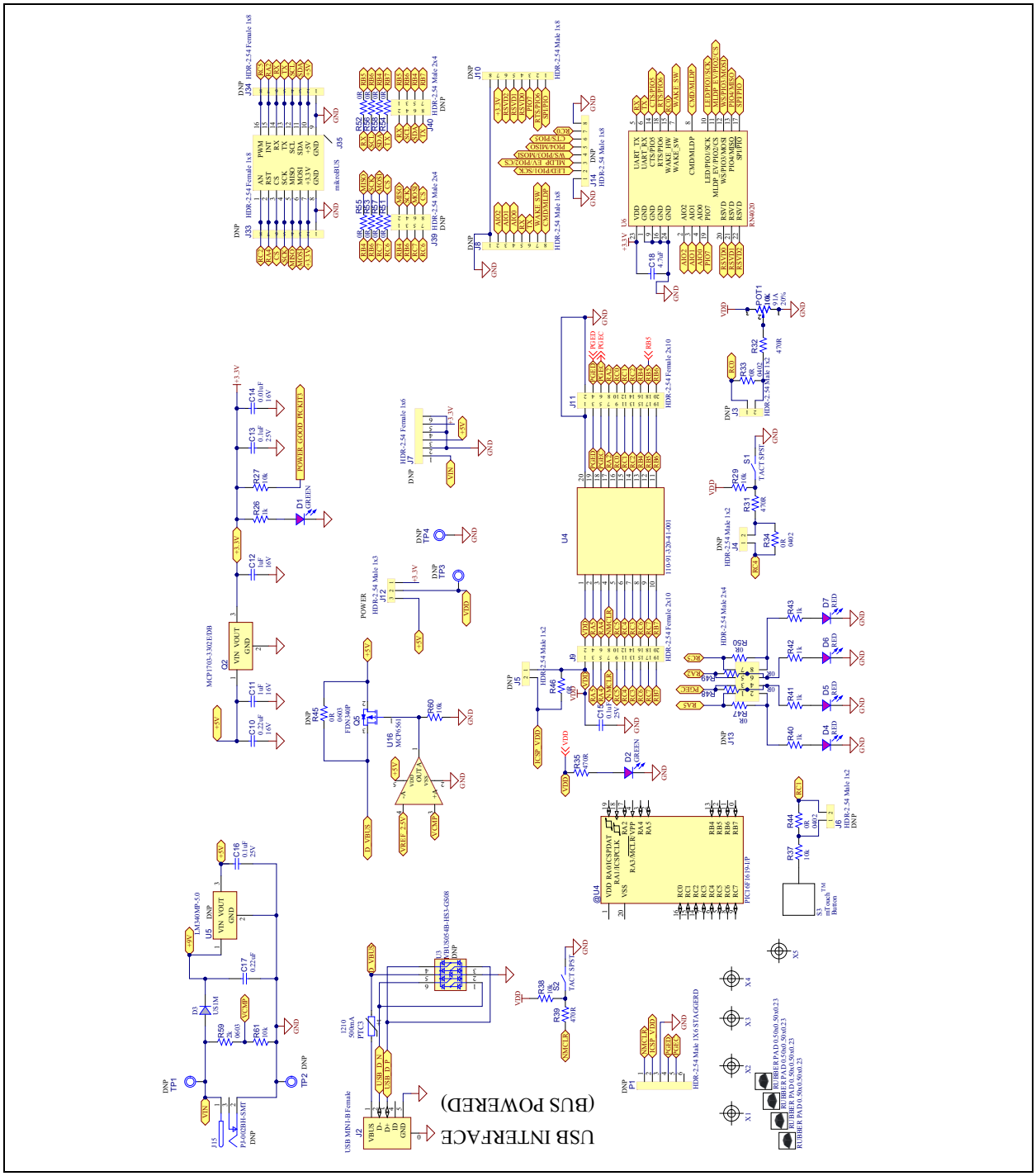


Table A-1 lists the parts that are not included with the Curiosity Development Board.

TABLE A-1: PARTS NOT INCLUDED WITH THE CURIOSITY DEVELOPMENT BOARD

Item	Manufacturing Part Number	Manufacturer	Digi-Key Part Number	Description
J15	PJ-002BH-SMT	CUI Inc.	CP-002BHPJDTR-ND	CONN POWER JACK 2.5X5.5 mm HI CUR
U5	LM340MP-5.0/NOPB	TI	LM340MP-5.0/NOPBTR-ND	IC REG LDO 5V 1A SOT223
J33, J34	PPTC081LFBN-RC	Sullins Connector Solutions	S7006-ND	CONN HEADER FEMALE 8POS .1" TIN
J7	PPTC061LFBN-RC	Sullins Connector Solutions	S7004-ND	CONN HEADER FEMALE 6POS .1" TIN
J8, J10, J14	PRPC008SAAN-RC	Sullins Connector Solutions	S1011EC-08-ND	CONN HEADER .100" SNGL STR 8POS
J13, J39, J40	PRPC004DAAN-RC	Sullins Connector Solutions	S2011EC-04-ND	CONN HEADER .100" DUAL STR 8POS
J3, J4, J5, J6	PREC002SAAN-RC	Sullins Connector Solutions	S1012EC-02-ND	CONN HEADER .100" SNGL STR 2POS

Appendix B. General Notes

B.1 POWER

When the Curiosity board is USB-powered though a 5V supply rather than a USB port on a computer, MCLR is held in Reset for approximately five seconds.

B.2 RN4020 BLUETOOTH® LOW ENERGY (BLE) MODULE

1. The RN4020 Bluetooth Low Energy (BLE) module must be configured before use. This can be achieved by either of the following methods:
   a) Connecting the UART TX and RX lines to an external UART-to-USB bridge, such as the MCP2200, and using a terminal program to communicate with and program the BLE module
   b) Writing custom firmware and programming the BLE module through the PIC MCU.
2. The `Wake_HW` line (pin 15 of the RN4020) was not connected, but is now recommended. This line must be connected for proper BLE functionality. See the *RN4020 Bluetooth® Low Energy Module Command Reference User's Guide* (DS70005191) for more information.

B.3 CLICK OR RN4020 MODULES

Shared UART TX and RX lines supply connection to either the RN4020 BLE module or a Click module (which uses UART for communication with the PIC MCU), but not both.

B.4 DEBUGGING MODE

During Debug mode, LED D5 is not available to the user. This was done to provide out-of-the-box LED access to Microchip's 8-pin MCUs. There are zero-ohm-resistors in series that can be removed to allow connection to another pin, if desired.

B.5 ROUTING AND FLEXIBILITY

Pinouts to the various connections provide connectivity to many devices. With zero-ohm-resistors in series to all connections, i.e., the mikroBUS™, TouchPad, and LEDs, the board can be modified for many situations without cutting the printed circuit board (PCB) traces.

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