Low-Power Projected Capacitive Touch Pad Development Kit User's Guide

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Derek Carlson
VP Development Tools

16-July-2013
Date

LOW-POWER PROJECTED CAPACITIVE TOUCH PAD DEVELOPMENT KIT 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 Low-Power Projected Capacitive Touch Pad Development Kit. 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
- Document Revision History

DOCUMENT LAYOUT

This document describes the Low-Power Projected Capacitive Touch Pad Development Kit and is organized as follows:

- **Chapter 1. Introduction**
- **Chapter 2. Getting Started**
- **Chapter 3. Evaluating MTCH6102**
- **Chapter 4. Programming**
- **Chapter 5. Restoring Factory Defaults**
- **Appendix A. Board Schematic and Bill of Materials**

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 Low-Power Projected Capacitive Touch Pad Development Kit. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

- *"MTCH6102 Low-Power Projected Capacitive Touch Controller Data Sheet"* (DS40001750) – It contains information about the turnkey MTCH6102 low-power projected capacitive touch controller.
- Please refer to this and other sensor layout documentation on the MTCH6102 device page.

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. Information about the Low-Power Projected Capacitive Touch Pad Development Kit can be directly accessed via http://www.microchip.com/dm160219.

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.

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:

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

DOCUMENT REVISION HISTORY

Revision A (June 2014)

- Initial release of the document.

Chapter 1. Overview

1.1 INTRODUCTION

Microchip's Low-Power Projected Capacitive Touch Pad Development Kit (part number DM160219) showcases the high-performance, flexible design of Microchip's MTCH6102 turnkey projected capacitive (PCAP) touch controller. This development kit includes everything needed to create a feature-rich, low-power, PCAP-based user interface with full XY coordinate output and gesture recognition.

The MTCH6102 controller board includes a separate PIC16LF1454 preprogrammed as an I^2C™ to USB bridge for PC connection to the MTCH6102 Utility. This software utility provides a GUI interface to monitor the performance of the touch solution and allows the user to optimize the sensor response.

The MTCH6102 Utility program and documentation files are available on the Microchip Low-Power Projected Capacitive Touch Pad Development Kit web page (part number DM160219).

1.2 DEVELOPMENT KIT FEATURES

- MTCH6102 Development Board
  - MTCH6102 controller driving 9x6 touch pad sensor (electronics schematic and sensor layout files are available on the Low-Power Projected Capacitive Touch Pad Development Kit web page)
  - 0.7 mm Lexan™ cover layer
  - LED indicators for power and USB communication
  - Mini USB connector
  - Switchable between 3.3V onboard LDO/External 1.8-3.6V supply
  - Two options for communication:
    a) Onboard I^2C to USB conversion via PIC16LF1454 (preprogrammed) for use with GUI or PC development
    b) Stand-alone MTCH6102 I^2C connection to host application circuit through breakout connection
- Single-Touch Detection and Gesture Decoding
- MTCH6102 Utility software allows observation of signals and tuning of firmware parameters

1.3 BASIC REQUIREMENTS

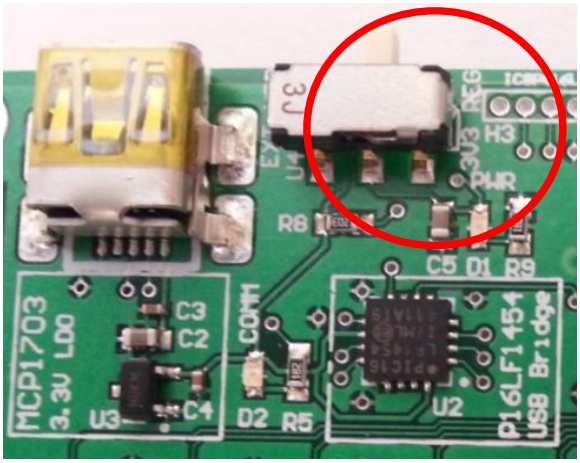
- 32-Bit or 64-Bit Windows® XP or Windows 7 Development Environment
- USB Mini Cable (included)
  - MTCH6102 Utility V1.03 or later, available from the Low-Power Projected Capacitive Touch Pad Development Kit web page (part number DM160219)

Chapter 2. Getting Started

2.1 GETTING STARTED

One switch is mounted on the board (U4) to toggle the power options. 3.3V regulated power through the onboard MCP1703 LDO is the default setting and intended for use with the included USB cable. The user may alternatively select an external 1.8V-3.6V power supply. The onboard PIC16LF1454 has been preprogrammed to function as a USB-to-I^{2}C communication bridge. This source code is available on the Low-Power Projected Capacitive Touch Pad Development Kit web page (part number DM160219) for reference. To quickly get started, ensure the switch is set in the 3.3V REG position (see Figure 2-1) and connect the development board to a USB port on a PC with the USB cable.

FIGURE 2-1: DEFAULT SWITCH SETTING AT 3.3V REG



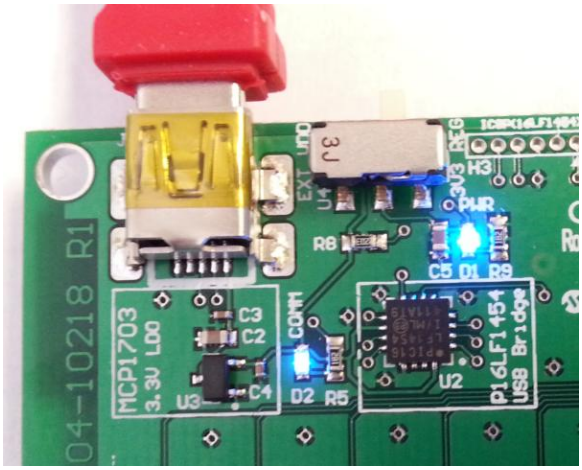
Note: The full electronics schematic and sensor layout files are available on the Low-Power Projected Capacitive Touch Pad Development Kit web page (part number DM160219).

Chapter 3. Evaluating MTCH6102

3.1 INTRODUCTION

The MTCH6102 development board may be used to demonstrate the gestures and single-touch capabilities of Microchip's MTCH6102 projected capacitive controller. Once connected to a PC through the USB cable, the Power LED (D1) will turn ON. When communication is established with the MTCH6102 Utility or other application, the Communication LED (D2) will also turn ON (see Figure 3-1).

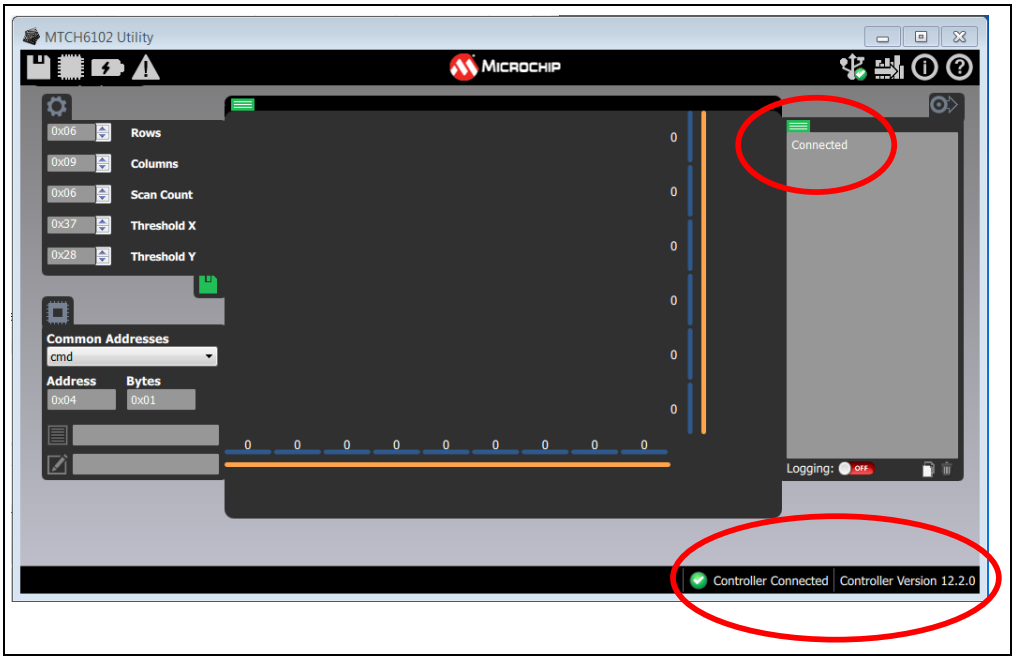
FIGURE 3-1: POWER AND COMMUNICATION LEDS



3.2 LAUNCHING THE MTCH6102 UTILITY

When launched, the MTCH6102 Utility auto-detect feature will attempt to connect to the development board (see Figure 3-2). Alternatively, the user may manually connect/disconnect using the USB icon in the upper right-hand corner of the utility.

FIGURE 3-2: CONNECTION STATUS



Once connected, all features of the utility are accessible. Reference the documentation on the MTCH6102 device page for more details on the full features and functions of the utility.

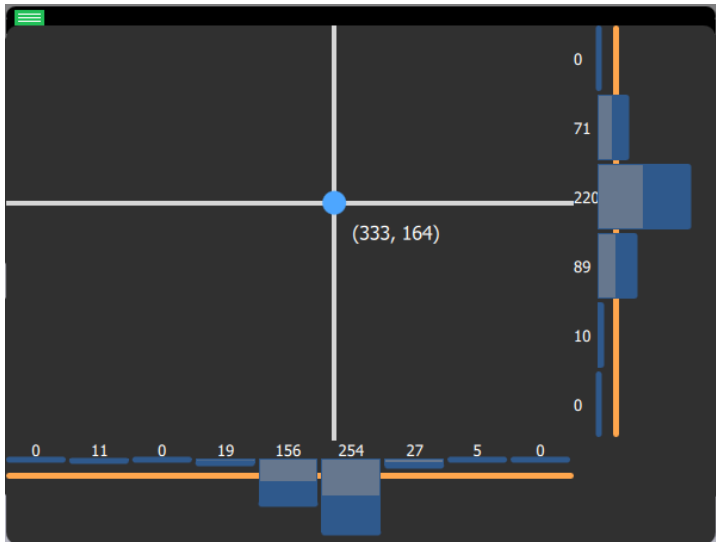
Note: Changing the rows and columns requires custom hardware and is intended for development purposes when integrating the MTCH6102 into a new design. The MTCH6102 development board has a built-in 6x9 channel PCB diamond-pattern touch pad. Do not alter the rows and columns settings in the utility when evaluating the MTCH6102 development board. Any setting other than six rows and nine columns will result in loss of normal functionality. Instructions to return the device to factory defaults are included in **Chapter 5. "Restoring Factory Defaults"**.

3.3 COMMON EVALUATION STEPS

3.3.1 Single-Finger Draw

Draw on the touch pad and see MTCH6102 fully-processed touch coordinates in the Visualization area of the utility (see Figure 3-3). The signal levels on each channel are shown as blue bars and the threshold for a touch detection is represented as an orange bar along each axis.

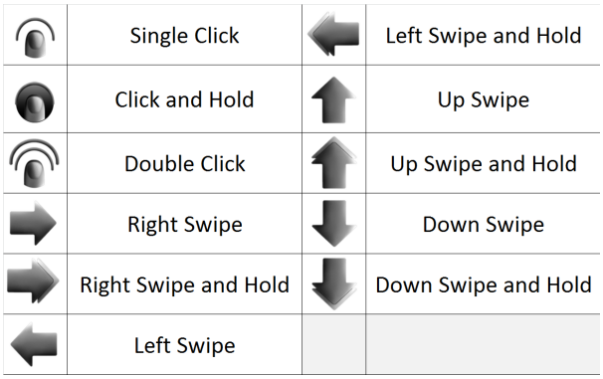
FIGURE 3-3: VISUALIZATION AREA OF THE UTILITY



3.3.2 Single-Touch Gestures

Perform one of the single-touch gestures shown in Figure 3-4 and see it displayed underneath the Visualization area. These gestures are fully processed and decoded by the MTCH6102 controller.

FIGURE 3-4: MTCH6102 GESTURES



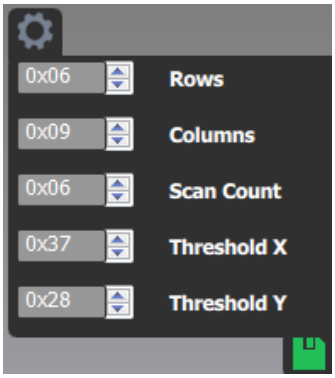
3.3.3 Configuration Options

The Configuration area of the utility allows easy modification to the scan count and threshold parameters of the MTCH6102. These commonly-adjusted parameters provide instant functional feedback to tune a desired level of sensitivity, speed and power.

3.3.3.1 EXAMPLE 1

Raise the threshold values and apply them with the green icon to see the orange bars move further away. A change in how much signal is required to generate a touch event will be noticed. The sensor may need to be pressed harder (producing more contact area and more signal) to register a touch as the threshold is raised (see Figure 3-5).

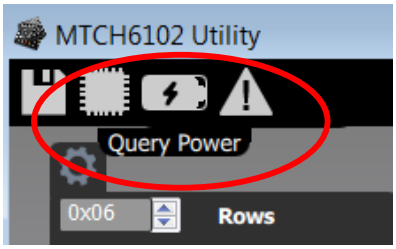
FIGURE 3-5: EXAMPLE 1



3.3.3.2 EXAMPLE 2

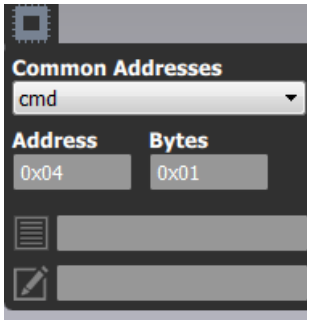
Raise the scan count, apply the changes with the green icon and click the Power icon with and without a touch. More scans require more power. This may be a necessary trade-off to achieve desired performance in noisy environments or applications for which increased accuracy is required.

FIGURE 3-6: EXAMPLE 2



Reference the *MTCH6102 Low-Power Projected Capacitive Touch Controller Data Sheet* (DS40001750) for a complete list and description of user parameters that may be modified. The MTCH6102 Utility allows easy reading and writing to these locations (see Figure 3-7).

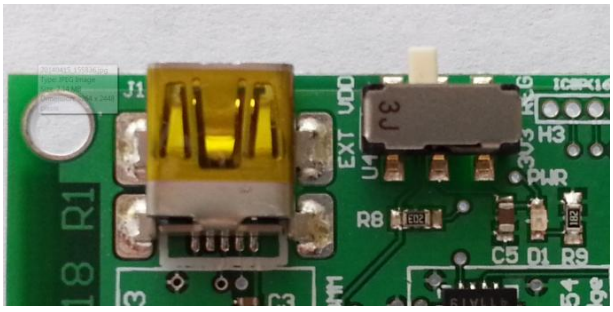
FIGURE 3-7: READ/WRITE OPTIONS



3.4 EVALUATING THE DEVELOPMENT BOARD WITH THE USER'S HOST DEVICE

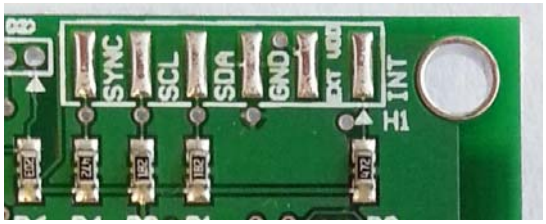
To test the MTCH6102 with the user's host device, a breakout connection for direct access to the MTCH6102 I^2C lines has been provided. To configure the development board for this purpose, remove the USB cable and toggle the Power switch (U4) to EXT V_{DD} (see Figure 3-8).

FIGURE 3-8: POWER SWITCH TOGGLED FOR EXT V_{DD}



Next, connect the host device to the H1 surface mount pads. External power (1.8V-3.6V) and ground must also be connected (see Figure 3-9).

FIGURE 3-9: H1 SURFACE MOUNT HEADER PADS



This alternative breakout connection is intended to allow the user's host to directly interact with the MTCH6102 in this reference environment of a 6x9 channel PCB-based sensor. Reference the *MTCH6102 Low-Power Projected Capacitive Touch Controller Data Sheet* (DS40001750) for the device communication protocol and available configuration registers.

Chapter 4. Programming

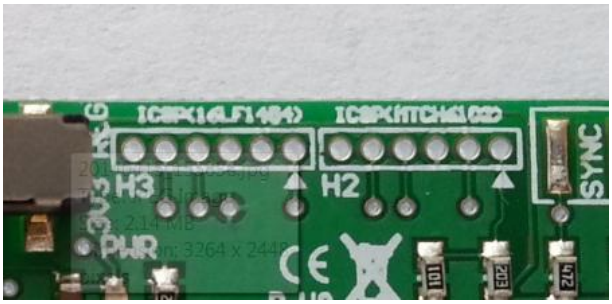
4.1 PROGRAMMING

Two sets of through-holes for programming headers are included on the board. H2 is used to reprogram the MTCH6102 and H3 is used to reprogram the PIC16LF1454 (USB bridge). The source code and released hex for the USB bridge is available on the Low-Power Projected Capacitive Touch Pad Development Kit web page (part number DM160219).

Supported Microchip programming devices include:

- PICKit 3
- ICD 3

FIGURE 4-1: H2 AND H3 PROGRAMMING THROUGH-HOLES



Chapter 5. Restoring Factory Defaults

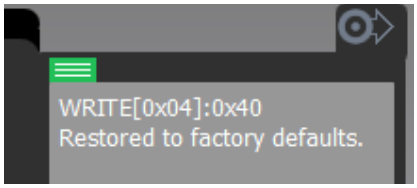
5.1 RESTORING FACTORY DEFAULTS

While using the MTCH6102 Utility, it is possible to adjust particular settings outside of expected operating ranges. It may be necessary to force the board to factory default settings to restore functionality.

Click the Restore to Defaults icon in the MTCH6102 Utility (see Figure 5-1) to restore the MTCH6102 controller to factory defaults. Wait for the "Restored to factory defaults" message to appear in the output window of the utility (see Figure 5-2). Normal operation should then be restored.

FIGURE 5-1: ICON TO RESTORE FACTORY DEFAULTS

FIGURE 5-2: OUTPUT WINDOW



Appendix A. Board Schematic and Bill of Materials

FIGURE A-1: MTCH6102 DEVELOPMENT BOARD SCHEMATIC

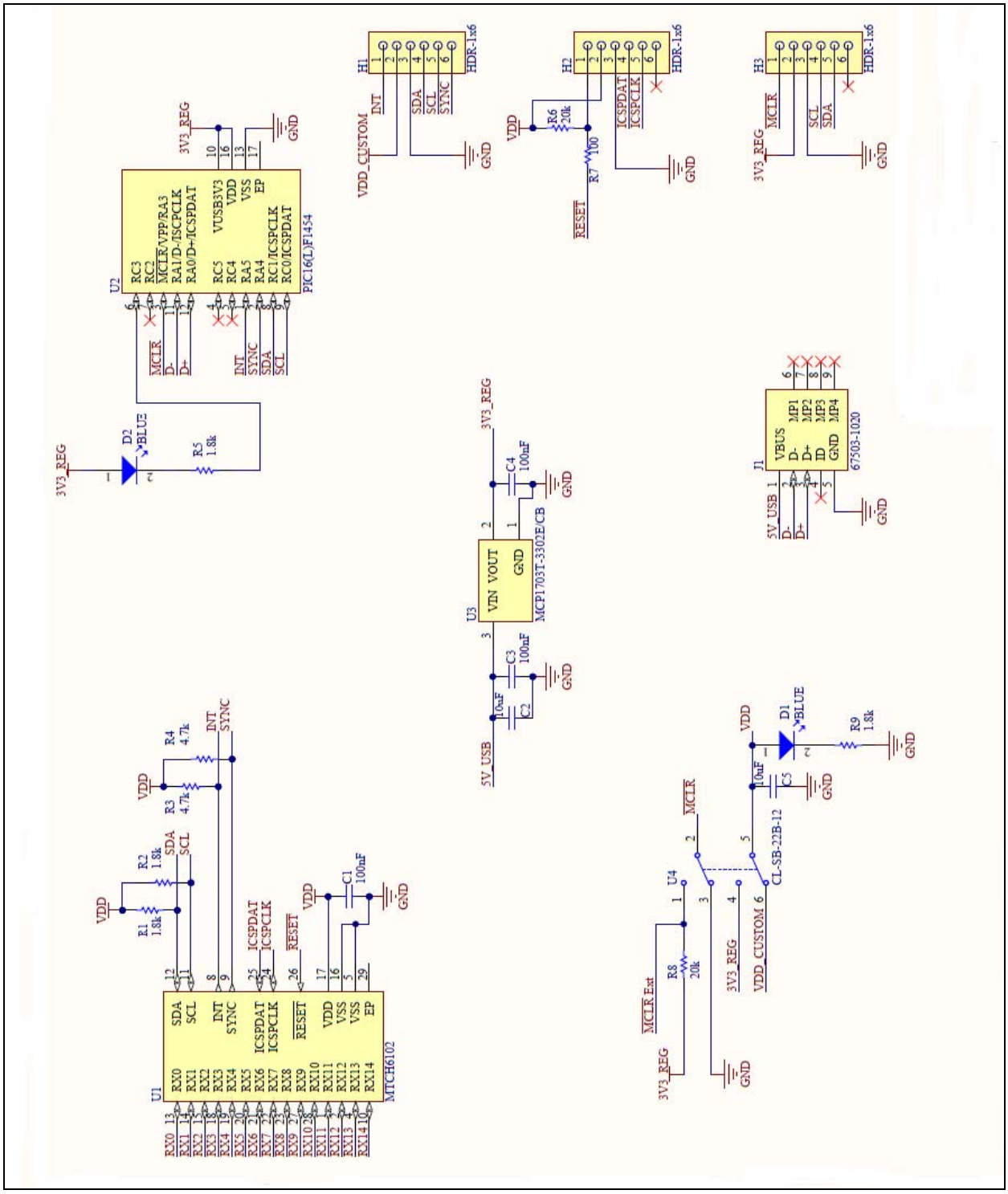


TABLE A-1: MTCH6102 DEVELOPMENT BOARD BILL OF MATERIALS(1)

No.	Designator	Quantity	Description	OEM		$ ea.	$ Total	Equiv. Allowed	RoH
				Manufacturer	Part Number				
1	C1, C3, C4	3	CAP CER 0.1 UF 50V 20% X7R 0402	TDK Corporation	C1005X7R1H104M050BB	0.000		√	√
2	C2, C5	2	CAP CER 10 UF 6.3V 20% X5R 0603	TDK Corporation	C1608X5R0J106M080AB	0.000		√	√
3	D1, D2	2	Blue LED, 0603	Lite-on	LTST-C191TBKT	0.000		√	√
4	J1	1	Conn. Recept. Mini USB R/A 5POS SMD	Molex	675031020	0.000		√	√
5	R1, R2, R5, R9	4	1K8 0.1W 5% 0603 (1608 Metric) SMD	Panasonic – ECG	ERJ-3GEYJ182V	0.000		√	√
6	R3, R4	2	4K7 0.1W 5% 0603 (1608 Metric) SMD	Panasonic – ECG	ERJ-3GEYJ472V	0.000		√	√
7	R6, R8	2	20K 0.1W 5% 0603 (1608 Metric) SMD	Panasonic – ECG	ERJ-3GEYJ203V	0.000		√	√
8	R7	1	100 0.1W 5% 0603 (1608 Metric) SMD	Panasonic – ECG	ERJ-3GEYJ101V	0.000		√	√
9	U1	1	MTCH6102 Single Touch Controller	Microchip	MTCH6102-I/ML	0.000		—	√
10	U2	1	PIC16LF1454	Microchip	PIC16LF1454-I/ML	0.000		—	√
11	U3	1	250 mA, 16V, LDO Regulator, 3-pin SOT-23A	Microchip	MCP1703T-3302E/CB	0.000		—	√
12	U4	1	Copal DPDT Slide Switch	Copal Electronics	CL-SB-22B-12T	0.000		√	√
13	LENS	1	0.020" Black Lexan™ FR700 with 3M 467 MP adhesive back, 54 mmx36 mm	—	FR700-54 mm x 36 mm	0.000		—	√
14	FEET	4	Rubber pad, square taper, 0.50x0.50x0.23 – black	3M	SJ5518 (Black)	0.000	0.00	—	—

Note 1: All parts must be RoHS compliant.

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Malaysia - Penang
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Philippines - Manila
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