MCP1502
Evaluation Board
User's Guide

Note the following details of the code protection feature on Microchip products:

- Microchip products meet the specifications contained in their particular Microchip Data Sheet.

- Microchip believes that its family of products is secure when used in the intended manner, within operating specifications, and under normal conditions.

- Microchip values and aggressively protects its intellectual property rights. Attempts to breach the code protection features of Microchip product is strictly prohibited and may violate the Digital Millennium Copyright Act.

- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of its code. Code protection does not mean that we are guaranteeing the product is "unbreakable" Code protection is constantly evolving. Microchip is committed to continuously improving the code protection features of our products.

This publication and the information herein may be used only with Microchip products, including to design, test, and integrate Microchip products with your application. Use of this information in any other manner violates these terms. Information regarding device applications is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. Contact your local Microchip sales office for additional support or, obtain additional support at https://www.microchip.com/en-us/support/design-help/client-support-services.

THIS INFORMATION IS PROVIDED BY MICROCHIP "AS IS". MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE, OR WARRANTIES RELATED TO ITS CONDITION, QUALITY, OR PERFORMANCE.

IN NO EVENT WILL MICROCHIP BE LIABLE FOR ANY INDIRECT, SPECIAL, PUNITIVE, INCIDENTAL, OR CONSEQUENTIAL LOSS, DAMAGE, COST, OR EXPENSE OF ANY KIND WHATSOEVER RELATED TO THE INFORMATION OR ITS USE, HOWEVER CAUSED, EVEN IF MICROCHIP HAS BEEN ADVISED OF THE POSSIBILITY OR THE DAMAGES ARE FORESEEABLE. TO THE FULLEST EXTENT ALLOWED BY LAW, MICROCHIP'S TOTAL LIABILITY ON ALL CLAIMS IN ANY WAY RELATED TO THE INFORMATION OR ITS USE WILL NOT EXCEED THE AMOUNT OF FEES, IF ANY, THAT YOU HAVE PAID DIRECTLY TO MICROCHIP FOR THE INFORMATION.

Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

For information regarding Microchip's Quality Management Systems, please visit www.microchip.com/quality.

Table of Contents

NOTES:

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) 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 MCP1502 Evaluation Board User's Guide. Items discussed in this chapter include:

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

DOCUMENT LAYOUT

This document describes how to use the MCP1502 Evaluation Board to demonstrate the performance of the MCP1502 device family. The manual layout is as follows:

- **Chapter 1. "Product Overview"** – Important information about the MCP1502 Evaluation Board.
- **Chapter 2. "Installation and Operation"** – Includes instructions on how to get started with the MCP1502 Evaluation Board.
- **Appendix A. "Schematic and Layouts"** – Shows the schematic and layout diagrams for the MCP1502 Evaluation Board.
- **Appendix B. "Bill of Materials (BOM)"** – Lists the parts used to build the MCP1502 Evaluation Board.

MCP1502 Evaluation 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 MCP1502 Evaluation Board. Other useful documents are listed below.

- **MCP1502 Data Sheet –** *"High-Precision Buffered Voltage Reference"* **(DS20006593)**

THE MICROCHIP WEBSITE

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

PRODUCT CHANGE NOTIFICATION SERVICE

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

To register, access the Microchip website at www.microchip.com, click on **Product Change Notification** and follow the registration instructions.

CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Embedded System Engineer (ESE)
- 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 website at:
https://www.microchip.com/support.

DOCUMENT REVISION HISTORY

Revision A (July 2022)

- Initial release of this document.

NOTES:

Chapter 1. Product Overview

1.1 INTRODUCTION

This chapter provides an overview of the MCP1502 Evaluation Board and covers the following topics:

- A quick overview of the MCP1502 device
- An overview of the MCP1502 Evaluation Board
- MCP1502 Evaluation Board Kit Contents

1.2 MCP1502 DEVICE OVERVIEW

The MCP1502 is a high-precision buffered voltage reference capable of sinking and sourcing 20 mA of current. The voltage reference is a low-drift band gap-based reference. The band gap uses chopper-based amplifiers, effectively reducing the drift to zero. The MCP1502 band gap is based on a second-order temperature compensated circuit. This allows the MCP1502 to achieve high initial accuracy and low-temperature coefficient operation across voltage and temperature. The band gap curvature compensation is determined during device characterization and is trimmed for optimal accuracy. The MCP1502 includes a chopper-based amplifier architecture that ensures excellent low-noise operation, further reduces temperature-dependent offsets that otherwise increase the temperature coefficient of the MCP1502 and significantly improves long-term drift performance.

The MCP1502 is available in 6-lead SOT-23 (AEC-Q100 automotive qualified) package and is specified over an extended temperature range of -40°C to +125°C.

The MCP1502 voltage reference is available in ten voltage options:

- 1.024V
- 1.250V
- 1.800V
- 2.048V
- 2.500V
- 3.000V
- 3.300V
- 4.096V
- 4.500V
- 5.000V

MCP1502 Evaluation Board User's Guide

1.3   MCP1502 EVALUATION BOARD OVERVIEW

The MCP1502 Evaluation Board provides the possibility to evaluate the performance of all ten voltage options of the MCP1502. It also provides the external filter circuit with an option to connect each voltage option exclusively and evaluate the output.
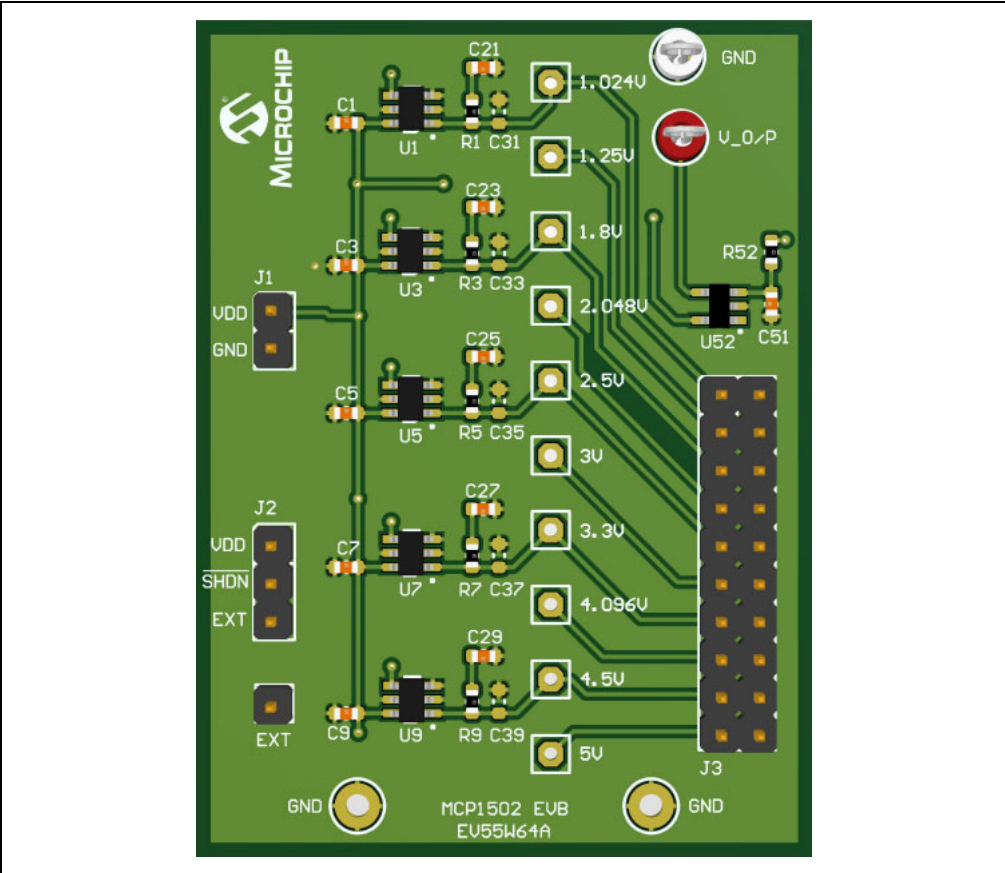

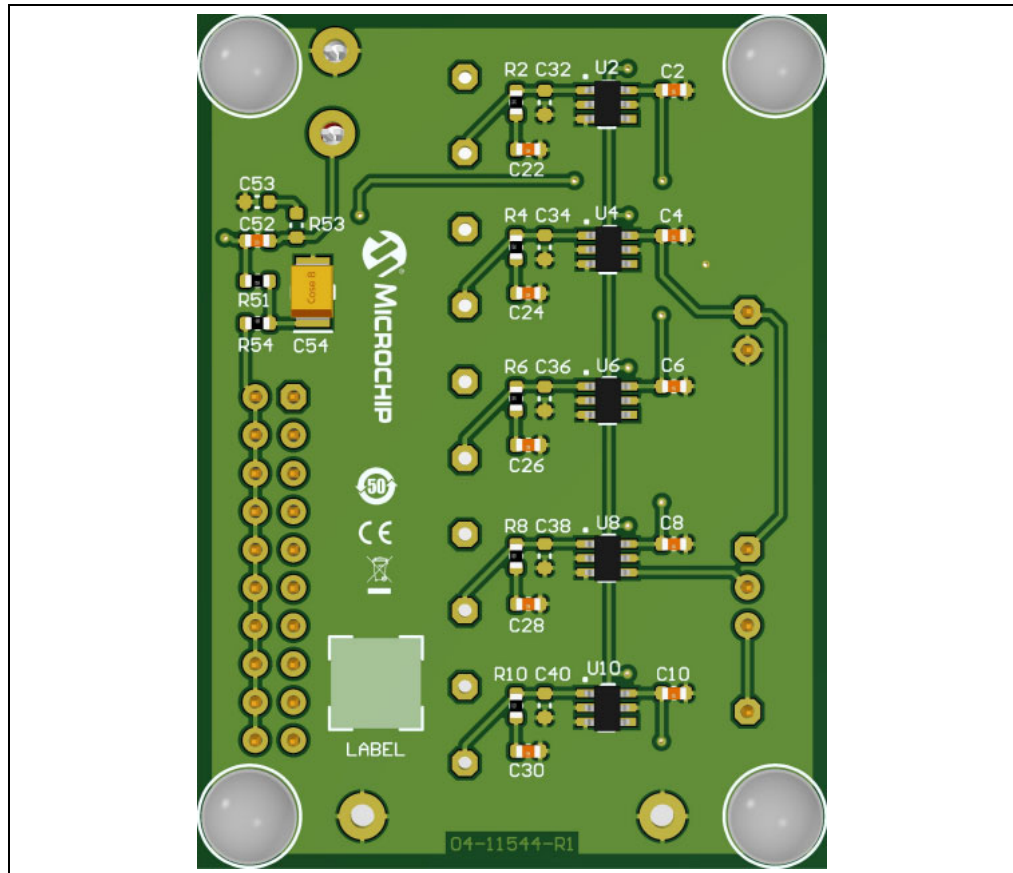**FIGURE 1-1:**   *MCP1502 Evaluation Board Top View.*

FIGURE 1-2:   *MCP1502 Evaluation Board Bottom View.*

1.4   MCP1502 EVALUATION BOARD KIT CONTENTS

The MCP1502 Evaluation Board kit includes:

• MCP1502 Evaluation Board (EV55W64A)
• Jumper
• Important Information Sheet

NOTES:

Chapter 2. Installation and Operation

2.1   CONFIGURATION REQUIREMENTS

To power-up and run the evaluation board, the following are required:

- MCP1502 Evaluation Board (EV55W64A)
- External DC power supply
- Jumper

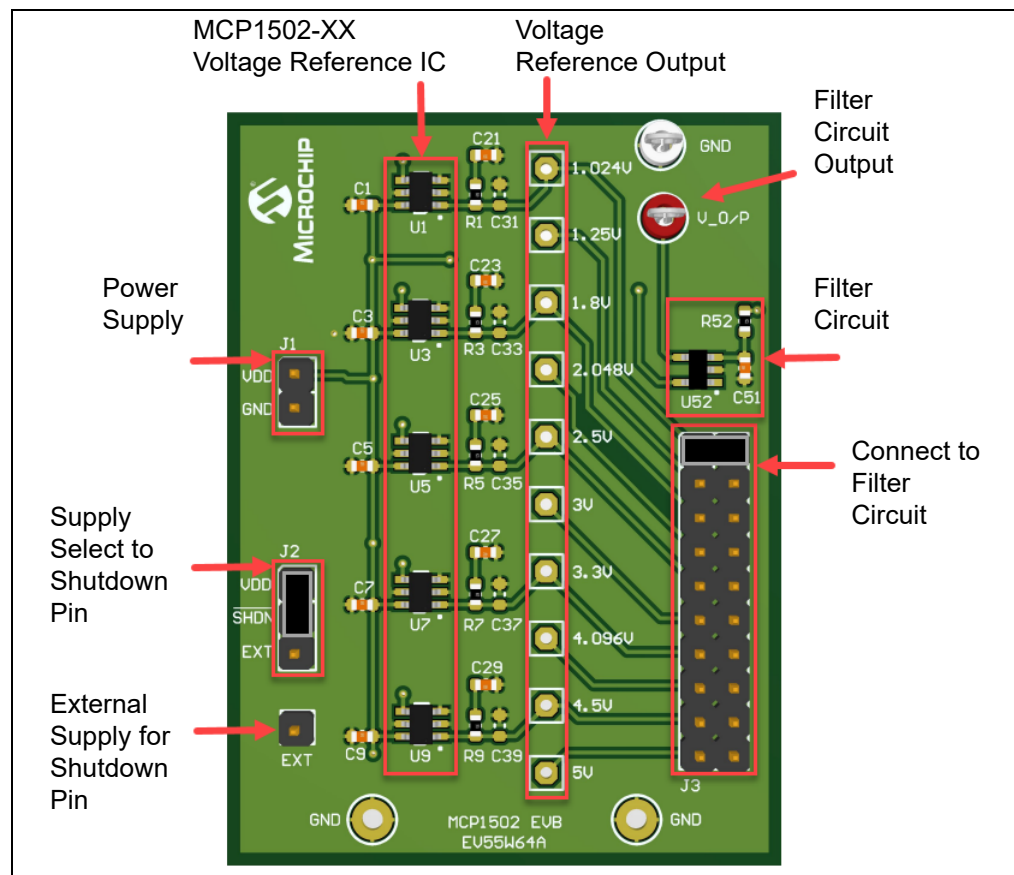| **WARNING** |
|---|
| **Avoid connecting a power supply with a voltage greater than what is recommended in this user's guide. Doing so can damage the voltage reference IC, requiring them to be replaced.** |

2.2   GETTING STARTED

FIGURE 2-1:   *MCP1502 Evaluation Board Connections.*

MCP1502 Evaluation Board User's Guide

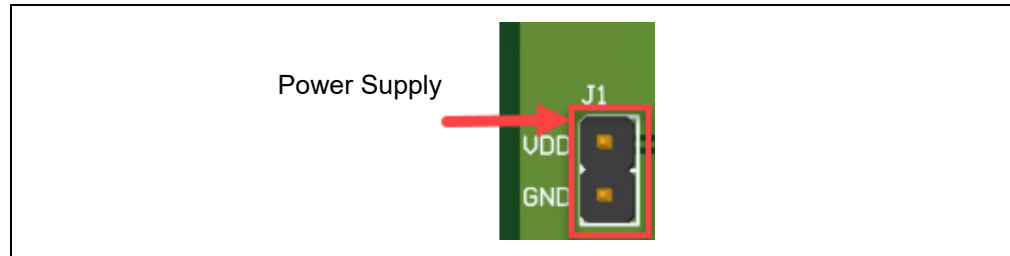1. Connect the +5.5V DC power supply at VDD (J1 connector) on the MCP1502 Evaluation Board as shown in Figure 2-2.

FIGURE 2-2:   *Power Supply Connection.*

2. Connect the jumper between VDD and $\overline{\text{SHDN}}$ (J2 connector) to provide supply at the MCP1502-XX Shutdown pin, as shown in Figure 2-3. The J2 connector provides the opportunity to select between VDD and EXT supply for the Shutdown pin of the MCP1502-XX. Figure 2-4 shows a connection to the EXT supply.

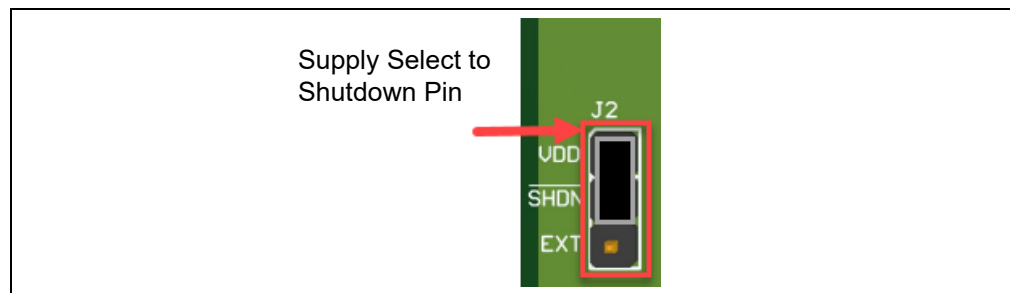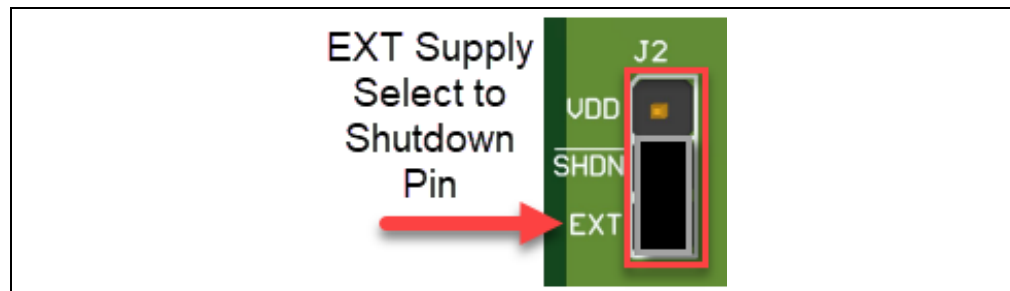**FIGURE 2-3:**   *VDD to Shutdown Pin Connection.*

FIGURE 2-4:   *EXT to Shutdown Pin Connection.*

> **Note:** The external supply for the Shutdown pin can be applied through the EXT header provided on board.

3. Test points with voltage values, as shown in Figure 2-5, are provided to check the respective output voltage of the MCP1502-XX using a digital multimeter.
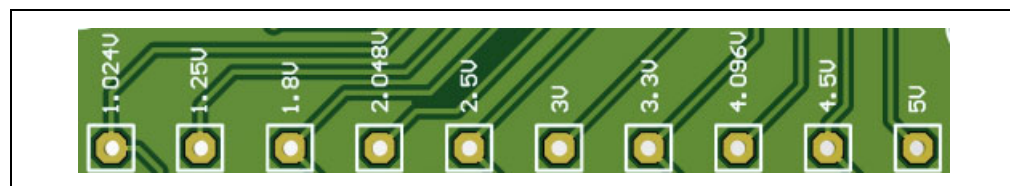
FIGURE 2-5:   *Test Points.*

4. The J3 connector can be used to connect the MCP1502-XX outputs to the on-board filter circuit (see Figure 2-6). For example, in Figure 2-6, the 1.024V output is connected to the Filter circuit. It is possible to connect any of the 10 Vref output to the filter circuit one at a time.
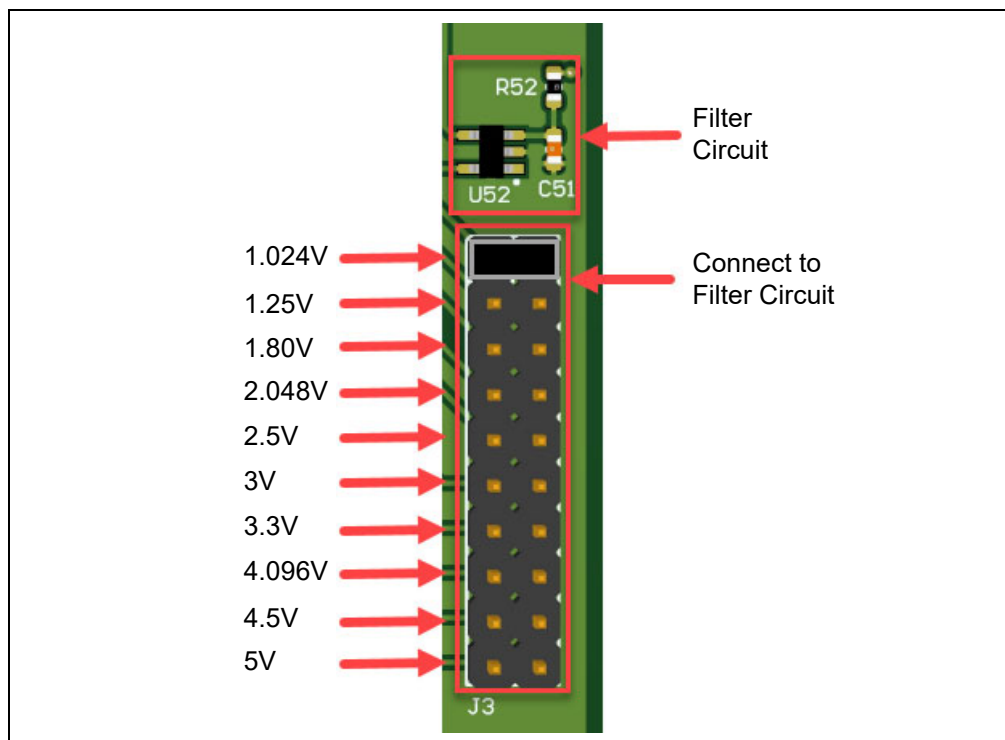
FIGURE 2-6:   *Connection to the Filter Circuit.*

5. The filter output can be observed by using a digital multimeter/oscilloscope at V_O/P, as shown in Figure 2-7.
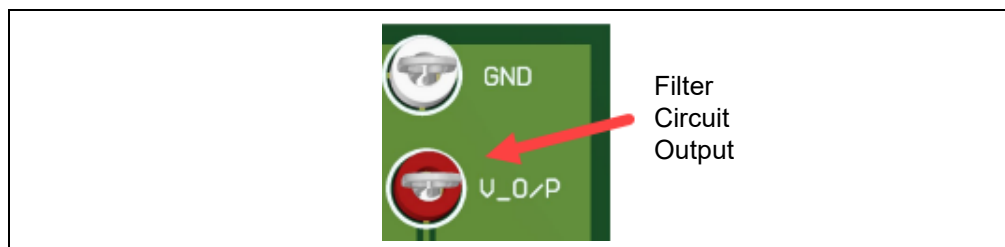
FIGURE 2-7:   *Filter Output.*

NOTES:

Appendix A. Schematic and Layouts

A.1 INTRODUCTION

This appendix contains the following schematic and layouts for the MCP1502 Evaluation Board:

- Board – Schematic
- Board – Top Silk
- Board – Top Copper and Silk
- Board – Top Copper
- Board – Bottom Copper
- Board – Bottom Copper and Silk
- Board – Bottom Silk

MCP1502 Evaluation Board User's Guide

A.2   BOARD – SCHEMATIC

MCP1502 VREF Options
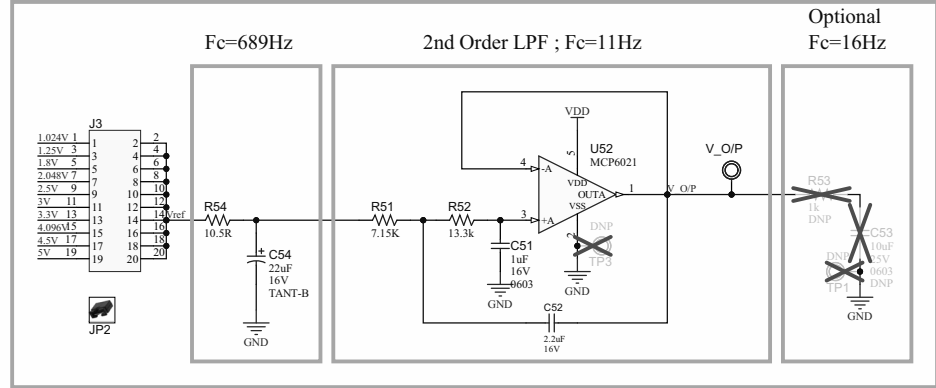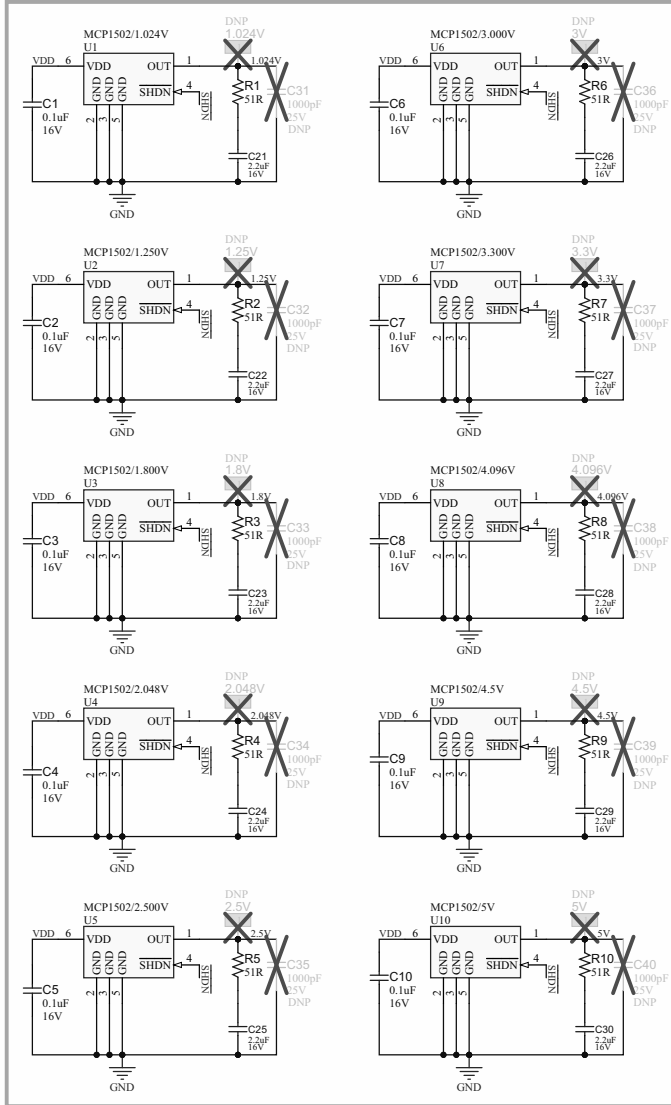
SHDN Connector
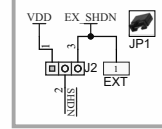
Power Supply
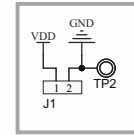
Fc=689Hz

2nd Order LPF ; Fc=11Hz

Optional Fc=16Hz

A.3   BOARD – TOP SILK
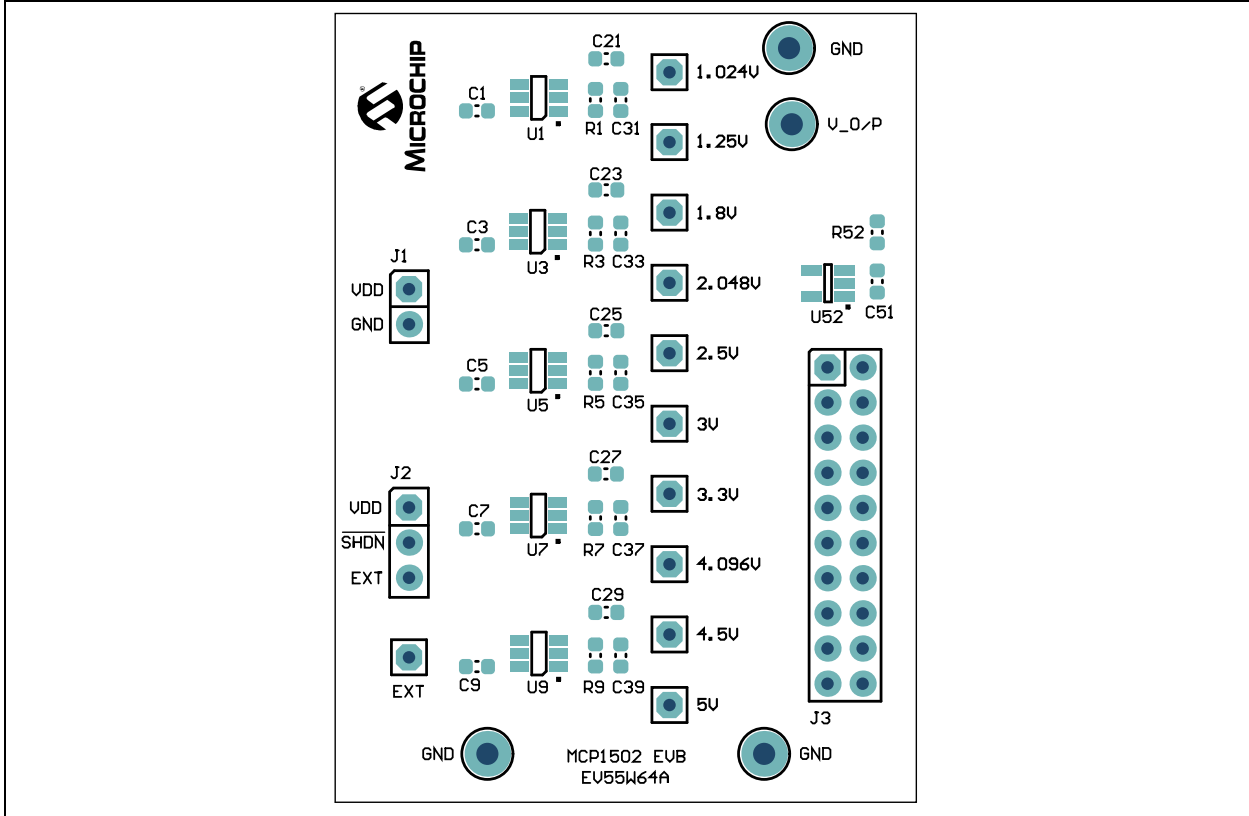
A.4   BOARD – TOP COPPER AND SILK

MCP1502 Evaluation Board User's Guide

A.5   BOARD – TOP COPPER

A.6   BOARD – BOTTOM COPPER

04-11544-R1
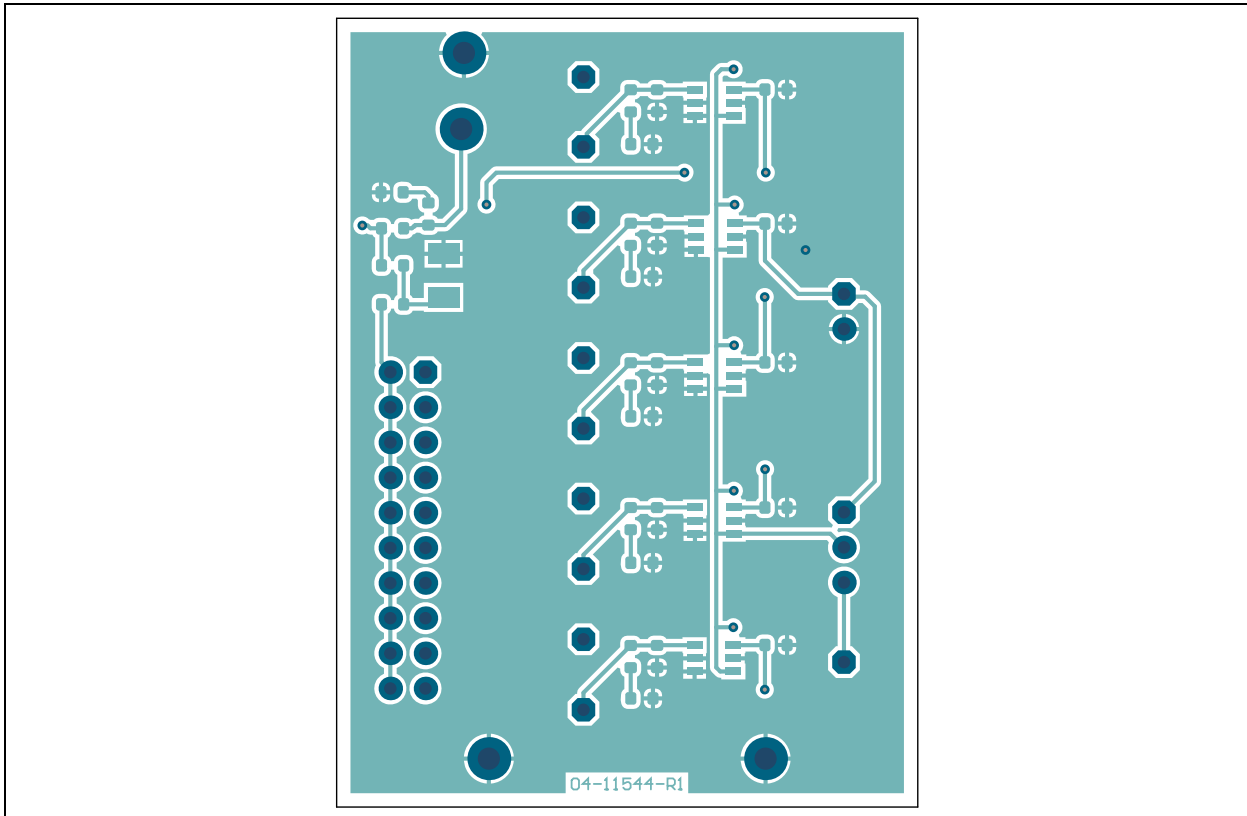
A.7   BOARD – BOTTOM COPPER AND SILK

A.8   BOARD – BOTTOM SILK
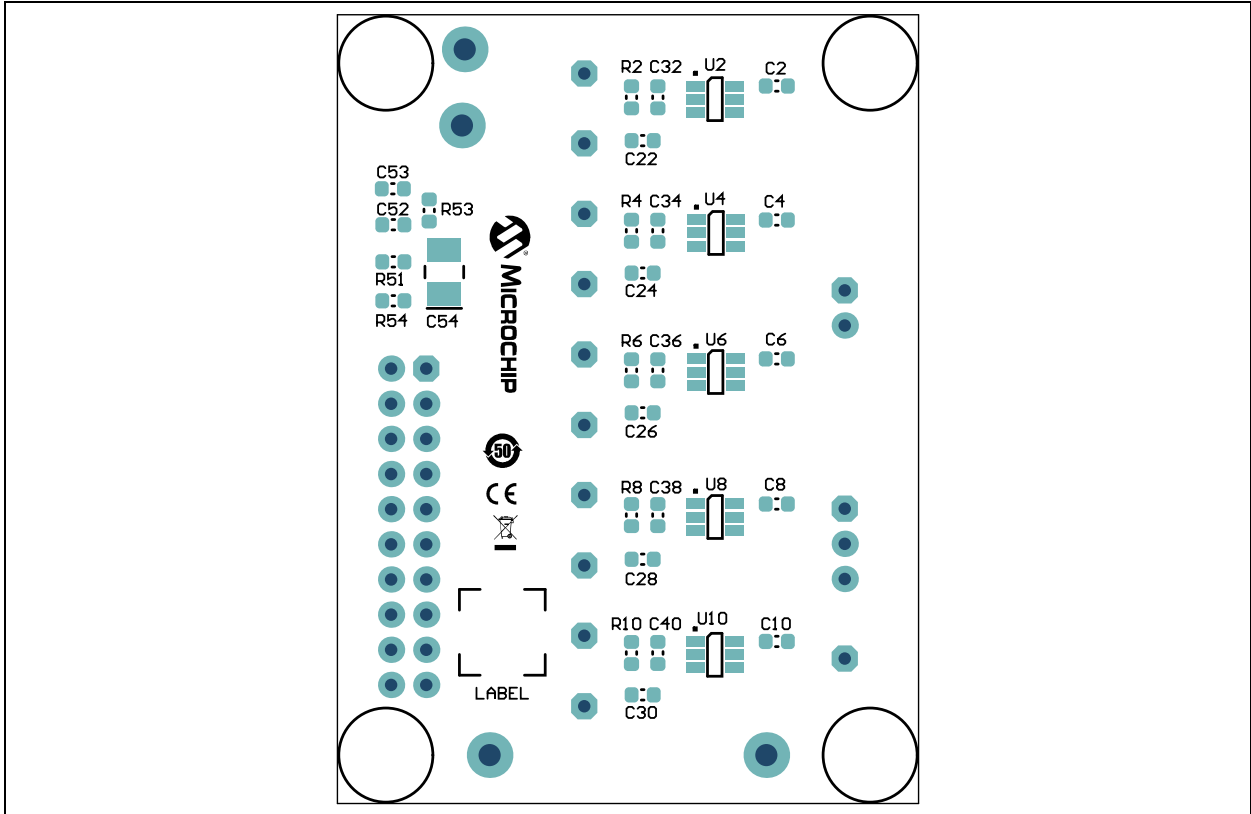
NOTES:

Appendix B. Bill of Materials (BOM)

TABLE B-1: BILL OF MATERIALS (BOM)

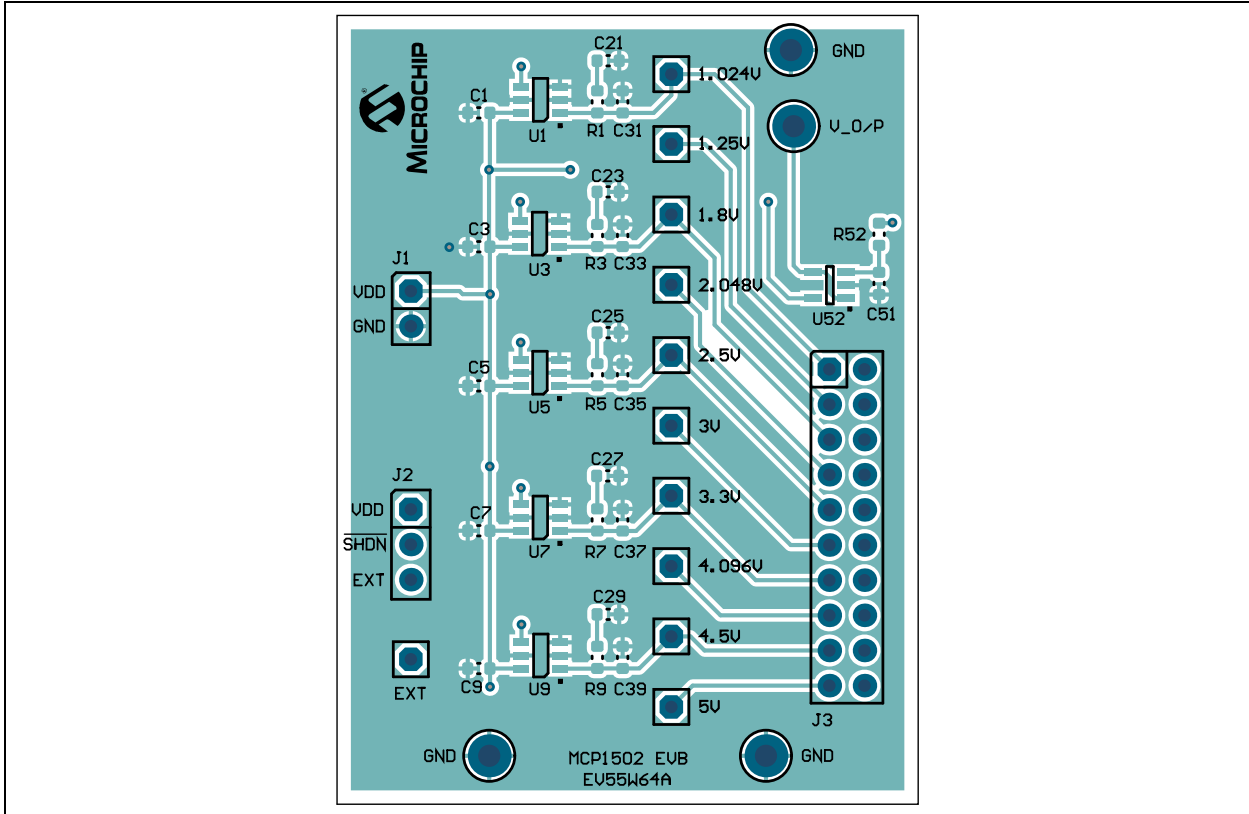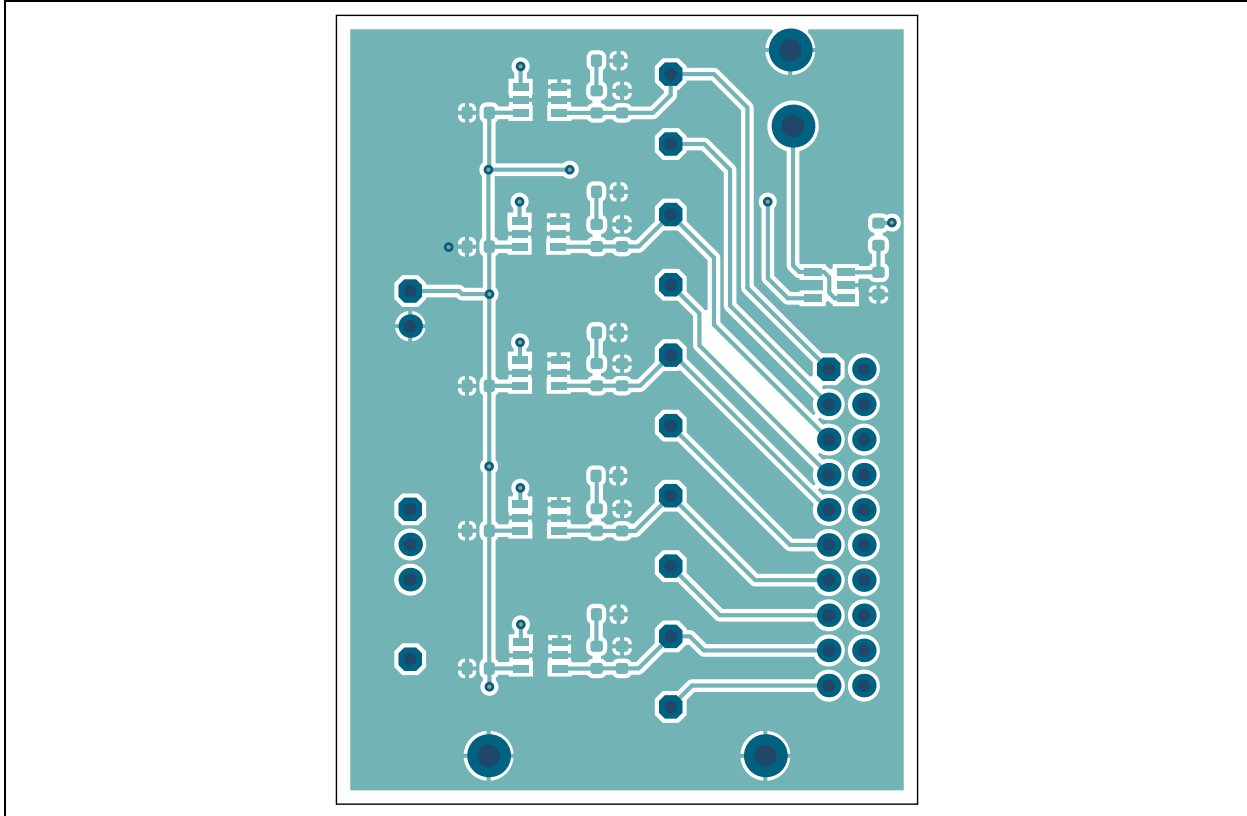| Qty.	Reference	Description	Manufacturer	Manufacturer Part Number
0	1.024V, 1.25V, 1.8V, 2.048V, 2.5V, 3V, 3.3V, 4.096V, 4.5V, 5V	**DO NOT POPULATE**, Connector, Header-2.54, Male, 1x1, Gold, 5.84 MH, Through-Hole, Vertical	Samtec, Inc.	TSW-101-07-G-S
10	C1, C2, C3, C4, C5, C6, C7, C8, C9, C10	Ceramic, capacitor, 0.1 µF, 16V, 10%, X7R, SMD, 0603	Samsung Electro-Mechanics America, Inc.	CL10B104KO8NNNC
11	C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C52	Ceramic, capacitor, 2.2 µF, 16V, 10%, X5R, SMD, 0603	TDK Corporation	C1608X5R1C225K080AB
0	C31, C32, C33, C34, C35, C36, C37, C38, C39, C40	**DO NOT POPULATE**, Ceramic, capacitor, 1000 pF, 25V, 5%, C0G/NP0, SMD, 0603	KEMET	C0603C102J3GACTU
1	C51	Ceramic, capacitor, 1 µF, 16V, 10%, X7R, SMD, 0603	Samsung Electro-Mechanics America, Inc.	CL10B105KO8VPNC
0	C53	**DO NOT POPULATE**, Ceramic capacitor,10 µF, 25V, 20%, X5R, SMD, 0603	TDK Corporation	C1608X5R1E106M080AC
1	C54	Tantalum, capacitor, 22 µF, 16V, 10%, 2.3R, SMD B	Kyocera AVX	TAJB226K016RNJ
1	EXT	Connector, Header-2.54, Male, 1x1, Gold, 5.84 MH, Through-Hole, Vertical	Samtec, Inc.	TSW-101-07-L-S
1	J1	Connector, Header-2.54, Male, 1x2, Gold, 5.84 MH, Through-Hole, Vertical	Multicomp Inc.	SPC20481
1	J2	Connector, Header-2.54, Male, 1x3, Tin, 5.84 MH, Through-Hole, Vertical	Samtec, Inc.	TSW-103-07-T-S
1	J3	Connector, Header-2.54, Male, 2x10, 3u inches, Gold in Contact Area Matte Tin on Tail, 5.84 MH, Through-Hole, Vertical	Samtec, Inc.	TSW-110-07-F-D
2	JP1, JP2	Mechanical, hardware, jumper, 2.54 mm, 1x2, handle, Gold	TE Connectivity AMP	881545-2

Note 1: The components listed in this Bill of Materials are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant components.

MCP1502 Evaluation Board User's Guide

TABLE B-1:   BILL OF MATERIALS (BOM) (CONTINUED)

Qty.	Reference	Description	Manufacturer	Manufacturer Part Number
1	LABEL	Label, PCBA, 6x6 mm, Datamatrix	ACT Logimark AS	505462
4	PAD1, PAD2, PAD3, PAD4	Mechanical, hardware, rubber pPad, Hemisphere, D6.4, H1.9, Clear	3M	70070662963
1	PCB1	MCP1502 Evaluation Board – Printed Circuit Board	Microchip Technology Inc.	**04-11544-R1**
10	R1, R2, R3, R4, R5, R6, R7, R8, R9, R10	Resistor, TKF, 51R, 5%, 1/10W, SMD 0603	Panasonic®	ERJ-3GEYJ510V
1	R51	Resistor, TKF, 7.15 kΩ, 1%, 1/10W, SMD, 0603	Panasonic	ERJ-3EKF7151V
1	R52	Resistor, TKF, 13.3 kΩ, 1%, 1/10W, SMD, 0603	Stackpole Electronics, Inc.	RMCF0603FT13K3
0	R53	**DO NOT POPULATE**, Resistor, TKF, 1 kΩ, 5%, 1/10W, SMD, 0603	Panasonic	ERJ-3GEYJ102V
1	R54	Resistor, TKF, 10.5R, 1%, 1/10W, SMD, 0603	Vishay Intertechnology, Inc.	CRCW060310R5FKEA
0	TP1, TP3	**DO NOT POPULATE**, Connector, TP, Loop White TH	Keystone® Electronics Corp.	5012
1	TP2	Connector, TP, Loop White TH	Keystone Electronics Corp.	5012
1	U1	Microchip, Analog, VREF, 1.024V, MCP1502T-10E/CHY, SOT-23-6	Microchip Technology Inc.	**MCP1502T-10E/CHY**
1	U2	Microchip, Analog, VREF, 1.250V, MCP1502T-12E/CHY, SOT-23-6	Microchip Technology Inc.	**MCP1502T-12E/CHY**
1	U3	Microchip, Analog, VREF, 1.800V, MCP1502T-12E/CHY, SOT-23-6	Microchip Technology Inc.	**MCP1502T-18E/CHY**
1	U4	Microchip, Analog, VREF, 2.048V, MCP1502T-12E/CHY, SOT-23-6	Microchip Technology Inc.	**MCP1502T-20E/CHY**
1	U5	Microchip, Analog, VREF, 2.500V, MCP1502T-12E/CHY, SOT-23-6	Microchip Technology Inc.	**MCP1502T-25E/CHY**
1	U6	Microchip, Analog, VREF, 3.000V, MCP1502T-12E/CHY, SOT-23-6	Microchip Technology Inc.	**MCP1502T-30E/CHY**
1	U7	Microchip, Analog, VREF, 3.300V, MCP1502T-12E/CHY, SOT-23-6	Microchip Technology Inc.	**MCP1502T-33E/CHY**
1	U8	Microchip, Analog, VREF, 4.096V, MCP1502T-12E/CHY, SOT-23-6	Microchip Technology Inc.	**MCP1502T-40E/CHY**
1	U9	Microchip, Analog, VREF, 4.5V, MCP1502T-45E/CHY, SOT-23-6	Microchip Technology Inc.	**MCP1502T-45E/CHY**
1	U10	Microchip, Analog, VREF, 5.0V, MCP1502T-50E/CHY, SOT-23-6	Microchip Technology Inc.	**MCP1502T-50E/CHY**
1	U52	Microchip, Analog, op amp, 1-Ch, 10 MHz, MCP6021T-E/OT, SOT-23-5	Microchip Technology Inc.	**MCP6021T-E/OT**
1	V_O/P	Connector, TP, Loop, Red, TH	Keystone Electronics Corp.	5010

Note 1:   The components listed in this Bill of Materials are representative of the PCB assembly. The released BOM used in manufacturing uses all RoHS-compliant components.

Worldwide Sales and Service

AMERICAS

Corporate Office
2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7200
Fax: 480-792-7277
Technical Support:
http://www.microchip.com/
support
Web Address:
www.microchip.com

Atlanta
Duluth, GA
Tel: 678-957-9614
Fax: 678-957-1455

Austin, TX
Tel: 512-257-3370

Boston
Westborough, MA
Tel: 774-760-0087
Fax: 774-760-0088

Chicago
Itasca, IL
Tel: 630-285-0071
Fax: 630-285-0075

Dallas
Addison, TX
Tel: 972-818-7423
Fax: 972-818-2924

Detroit
Novi, MI
Tel: 248-848-4000

Houston, TX
Tel: 281-894-5983

Indianapolis
Noblesville, IN
Tel: 317-773-8323
Fax: 317-773-5453
Tel: 317-536-2380

Los Angeles
Mission Viejo, CA
Tel: 949-462-9523
Fax: 949-462-9608
Tel: 951-273-7800

Raleigh, NC
Tel: 919-844-7510

New York, NY
Tel: 631-435-6000

San Jose, CA
Tel: 408-735-9110
Tel: 408-436-4270

Canada - Toronto
Tel: 905-695-1980
Fax: 905-695-2078

ASIA/PACIFIC

Australia - Sydney
Tel: 61-2-9868-6733

China - Beijing
Tel: 86-10-8569-7000

China - Chengdu
Tel: 86-28-8665-5511

China - Chongqing
Tel: 86-23-8980-9588

China - Dongguan
Tel: 86-769-8702-9880

China - Guangzhou
Tel: 86-20-8755-8029

China - Hangzhou
Tel: 86-571-8792-8115

China - Hong Kong SAR
Tel: 852-2943-5100

China - Nanjing
Tel: 86-25-8473-2460

China - Qingdao
Tel: 86-532-8502-7355

China - Shanghai
Tel: 86-21-3326-8000

China - Shenyang
Tel: 86-24-2334-2829

China - Shenzhen
Tel: 86-755-8864-2200

China - Suzhou
Tel: 86-186-6233-1526

China - Wuhan
Tel: 86-27-5980-5300

China - Xian
Tel: 86-29-8833-7252

China - Xiamen
Tel: 86-592-2388138

China - Zhuhai
Tel: 86-756-3210040

ASIA/PACIFIC

India - Bangalore
Tel: 91-80-3090-4444

India - New Delhi
Tel: 91-11-4160-8631

India - Pune
Tel: 91-20-4121-0141

Japan - Osaka
Tel: 81-6-6152-7160

Japan - Tokyo
Tel: 81-3-6880- 3770

Korea - Daegu
Tel: 82-53-744-4301

Korea - Seoul
Tel: 82-2-554-7200

Malaysia - Kuala Lumpur
Tel: 60-3-7651-7906

Malaysia - Penang
Tel: 60-4-227-8870

Philippines - Manila
Tel: 63-2-634-9065

Singapore
Tel: 65-6334-8870

Taiwan - Hsin Chu
Tel: 886-3-577-8366

Taiwan - Kaohsiung
Tel: 886-7-213-7830

Taiwan - Taipei
Tel: 886-2-2508-8600

Thailand - Bangkok
Tel: 66-2-694-1351

Vietnam - Ho Chi Minh
Tel: 84-28-5448-2100

EUROPE

Austria - Wels
Tel: 43-7242-2244-39
Fax: 43-7242-2244-393

Denmark - Copenhagen
Tel: 45-4485-5910
Fax: 45-4485-2829

Finland - Espoo
Tel: 358-9-4520-820

France - Paris
Tel: 33-1-69-53-63-20
Fax: 33-1-69-30-90-79

Germany - Garching
Tel: 49-8931-9700

Germany - Haan
Tel: 49-2129-3766400

Germany - Heilbronn
Tel: 49-7131-72400

Germany - Karlsruhe
Tel: 49-721-625370

Germany - Munich
Tel: 49-89-627-144-0
Fax: 49-89-627-144-44

Germany - Rosenheim
Tel: 49-8031-354-560

Israel - Ra'anana
Tel: 972-9-744-7705

Italy - Milan
Tel: 39-0331-742611
Fax: 39-0331-466781

Italy - Padova
Tel: 39-049-7625286

Netherlands - Drunen
Tel: 31-416-690399
Fax: 31-416-690340

Norway - Trondheim
Tel: 47-7288-4388

Poland - Warsaw
Tel: 48-22-3325737

Romania - Bucharest
Tel: 40-21-407-87-50

Spain - Madrid
Tel: 34-91-708-08-90
Fax: 34-91-708-08-91

Sweden - Gothenberg
Tel: 46-31-704-60-40

Sweden - Stockholm
Tel: 46-8-5090-4654

UK - Wokingham
Tel: 44-118-921-5800
Fax: 44-118-921-5820

09/14/21