



BB89X25A
MCP1501 Voltage Reference
BBS Kit User 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 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 BB89X25A MCP1501 Voltage Reference BBS Kit. Items discussed in this chapter include:

- [Document Layout](#)
- [Conventions Used in this Guide](#)
- [Recommended Reading](#)
- [The Microchip Website](#)
- [Customer Support](#)
- [Document Revision History](#)

DOCUMENT LAYOUT

This document describes how to use the BB89X25A MCP1501 Voltage Reference BBS Kit to emulate and debug firmware on a target board. The manual layout is as follows:

- **Chapter 1. “Product Overview”** – This chapter describes the most important features of the BB89X25A MCP1501 Voltage Reference BBS Kit as well as the contents of the kit and a step-by-step Quick Start Guide.
- **Chapter 2. “Installation and Operation”** – This chapter provides technical details important for the operation of the BB89X25A MCP1501 Voltage Reference BBS Kit.
- **Appendix A. “Schematic and Layouts”** – Shows the schematic and layout diagrams for the BB89X25A MCP1501 Voltage Reference BBS Kit.
- **Appendix B. “Bill of Materials (BOM)”** – Lists the parts used to build the BB89X25A MCP1501 Voltage Reference BBS Kit.

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CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	<i>MPLAB® IDE User 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>Save</i></u>
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	<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 guide describes how to use the BB89X25A MCP1501 Voltage Reference BBS Kit. The following Microchip documents are available and recommended as supplemental reference resources.

- **DAC-Based 4-20 mA Current Loop Reference Design (DS50003623)**
- **Low Voltage 32V Battery Management System Demonstration Application**

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 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

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- 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 (March 2026)

- Initial release of this document.

Chapter 1. Product Overview

1.1 INTRODUCTION

This chapter provides an overview of the BB89X25A MCP1501 Voltage Reference BBS Kit and covers the following topics:

- Voltage Reference Building Block Solution (BBS) Kit Overview
- Voltage Reference Building Block Solution (BBS) Kit Features
- What does the Voltage Reference Building Block Solution (BBS) Kit include?

1.2 WHAT IS THE SMALL SIGNAL SENSOR BUILDING BLOCK SOLUTION (BBS) KIT?

The BB89X25A MCP1501 Voltage Reference BBS Kit contains several analog and mixed signal devices configured in separate BBS boards for easy evaluation and implementation in system level applications.

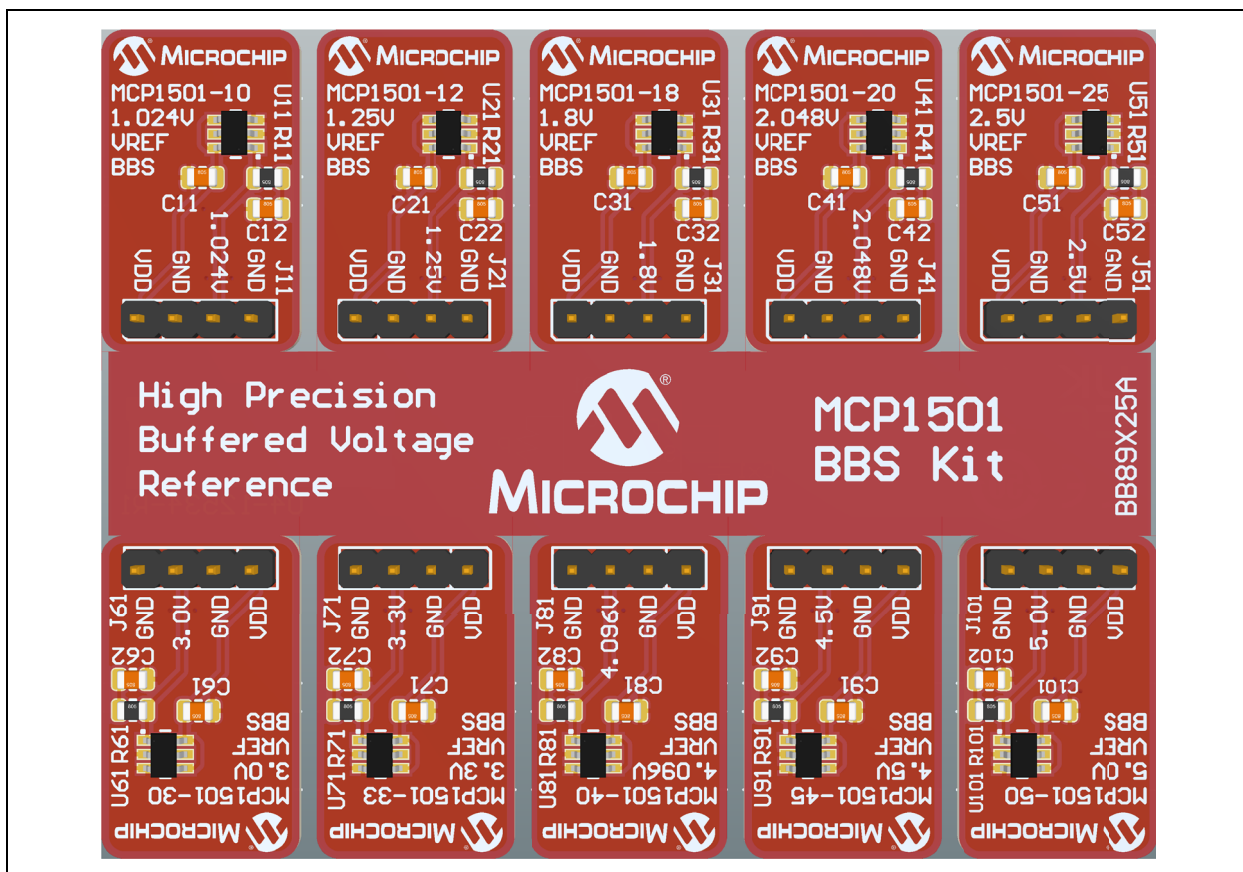


FIGURE 1-1: MCP1501 BBS Kit Board.

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1.3 WHAT DOES THE VOLTAGE REFERENCE BBS KIT CONTAIN?

The BB89X25A MCP1501 Voltage Reference BBS Kit contains several analog devices configured in separate BBS boards for easy evaluation and implementation in system level applications. This kit features 10 Voltage Variants Available BBS boards with the following MCP1501 High Precision Voltage Reference devices:

Product Description	Output Voltage
MCP1501-10	1.024V
MCP1501-12	1.25V
MCP1501-18	1.8V
MCP1501-20	2.048V
MCP1501-25	2.5V
MCP1501-30	3.0V
MCP1501-33	3.3V
MCP1501-40	4.096V
MCP1501-45	4.5V
MCP1501-50	5.0V

Chapter 2. Installation and Operation

2.1 INTRODUCTION

The BB89X25A MCP1501 Voltage Reference BBS Kit provides 10 different voltage reference devices. This BBS kit configuration allows users to seamlessly integrate individual boards into existing systems or configure multiple boards for diverse application requirements. This flexibility enables rapid prototyping, system expansion, and customized solutions for various applications.

Items discussed in this chapter include:

- Getting started
- Each board functional description
- Possible configurations

2.2 GETTING STARTED

This section describes how to power up and interface the BB89X25A MCP1501 Voltage Reference BBS Kit.

2.2.1 Hardware Setup

The BB89X25A MCP1501 Voltage Reference BBS Kit requires additional components and instrumentation for proper operation and testing.

- Header pins (not included) are necessary for connectivity.
- Power supply, oscilloscopes are recommended to provide power and data acquisition capabilities.

Depending on the specific application, some or all of these components and tools may be required in combination.

2.3 FUNCTIONAL DESCRIPTION

2.3.1 MCP1501 – Voltage Reference

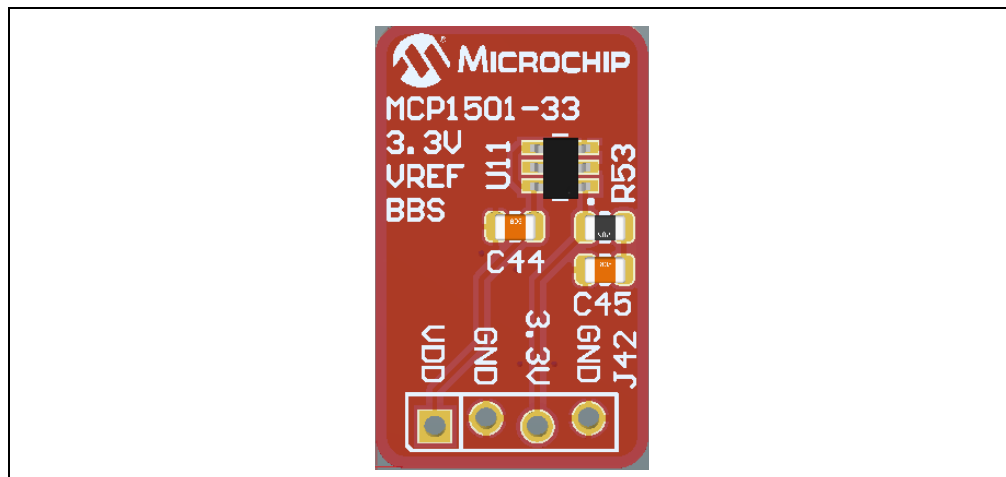


FIGURE 2-1: MCP1501 V_{REF} BBS Board.

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This board outputs a high-precision, buffered reference voltage capable of sinking and sourcing 20 mA of current. The MCP1501-18 1.8V reference voltage BBS board is useful for supplying a stable, high precision reference voltage for the 1.8V AV_{DD} pin on the MCP33131-10 SAR ADC BBS Board. On the MCP1501 Voltage Reference BBS Kit Board product webpage is provided a Mindi circuit simulation of this BBS board called “MCP1501-33.sxsch”.

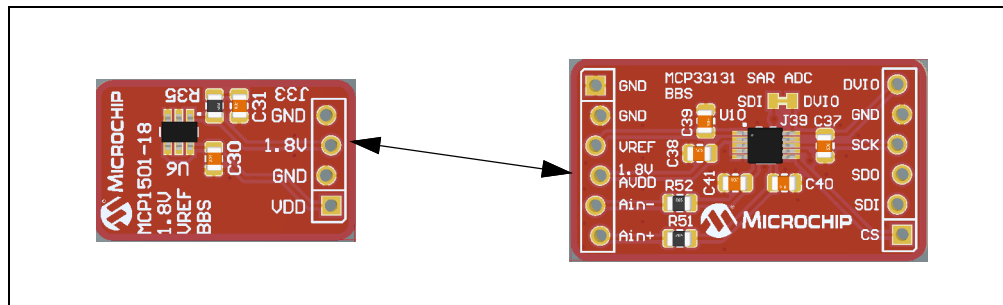


FIGURE 2-2: MCP1501 1.8V V_{REF} + MCP33131 SAR ADC.

- MCP1501 Product Webpage: <https://www.microchip.com/en-us/product/mcp1501>
- MCP1501 Collateral: <https://www.microchip.com/en-us/product/mcp1501#Documentation>

2.4 POSSIBLE CONFIGURATIONS

2.4.1 Battery Management System

Microchip's family of automotive-qualified (Q100) Analog-to-Digital Converters (ADCs), Voltage References and Thermistor ICs can deliver high reliability and high precision and are great choices for any automotive or industrial Battery Management/Monitoring Systems.

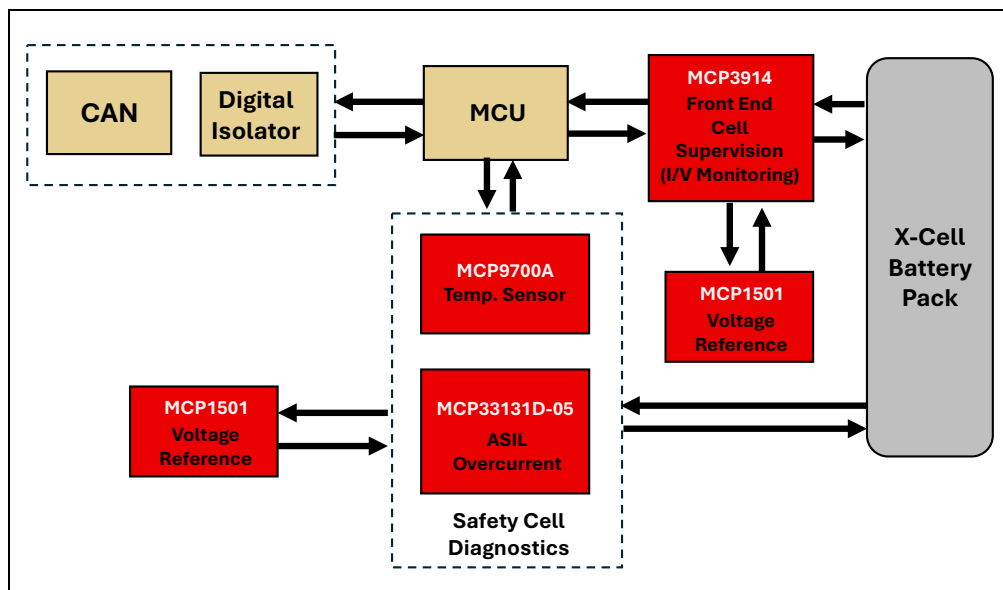


FIGURE 2-3: Battery Management System.

- To learn more about analog offerings, visit: <https://www.microchip.com/en-us/about/media-center/videos/DDniHYIcwIY>.

2.4.2 Basic Circuit Configuration

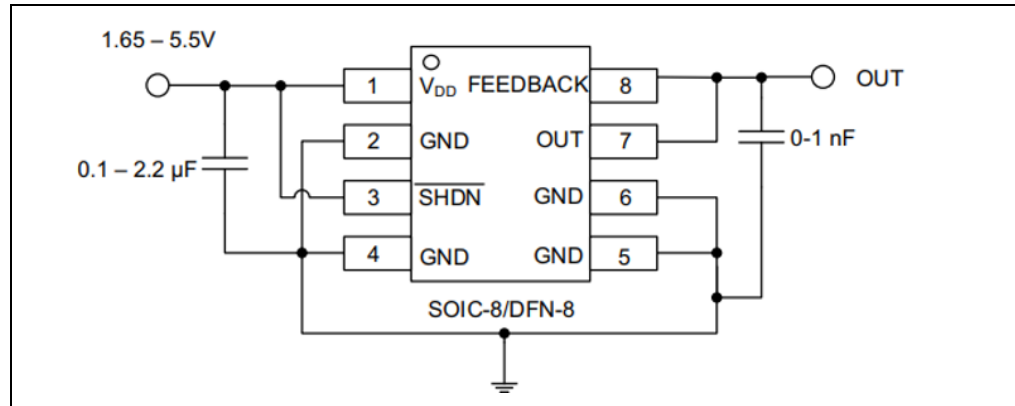


FIGURE 2-4: Basic Circuit Configuration.

2.4.3 Negative Voltage Reference

A negative voltage reference can be generated using any of the devices in the MCP1501 family. A typical application is shown in [Figure 2-5](#). In this circuit, the voltage inversion is implemented using the MCP6061 and two equal resistors. The voltage at the output of the MCP1501 voltage reference drives R1, which is connected to the inverting input of the MCP6061 amplifier.

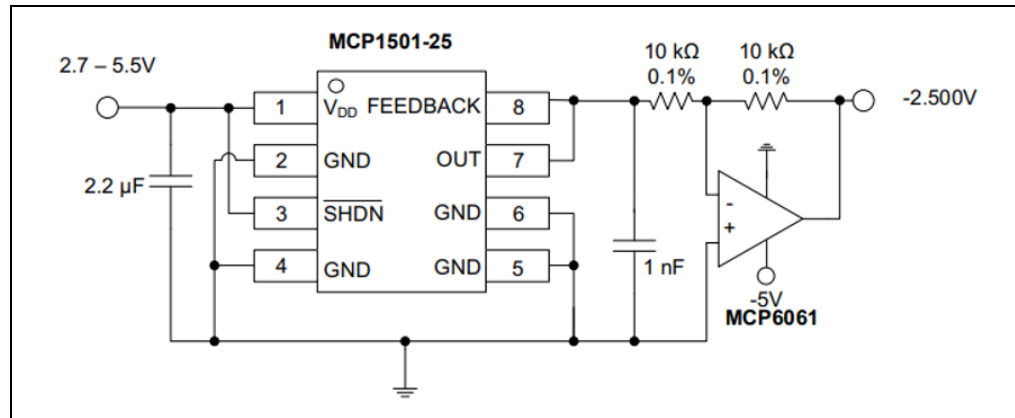


FIGURE 2-5: Negative Voltage Reference.

2.4.4 A/D Converter Reference

The MCP1501 product family was carefully designed to provide a precise, low noise voltage reference for the Microchip families of ADCs. The circuit shown in [Figure 2-6](#) shows a MCP1501-25 configured to provide the reference to the MCP3201, a 12-bit ADC.

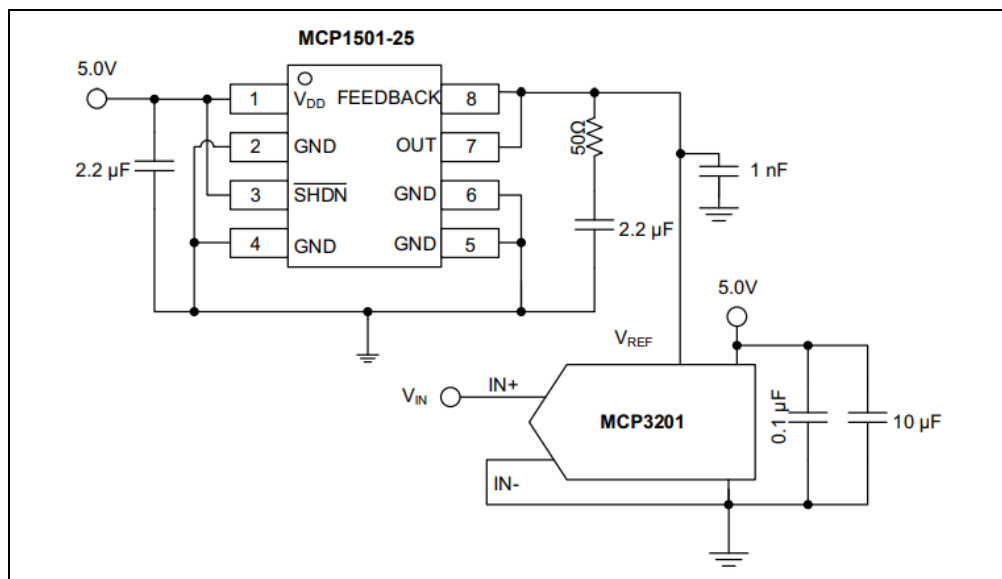


FIGURE 2-6: ADC Example Circuit.

Appendix A. Schematic and Layouts

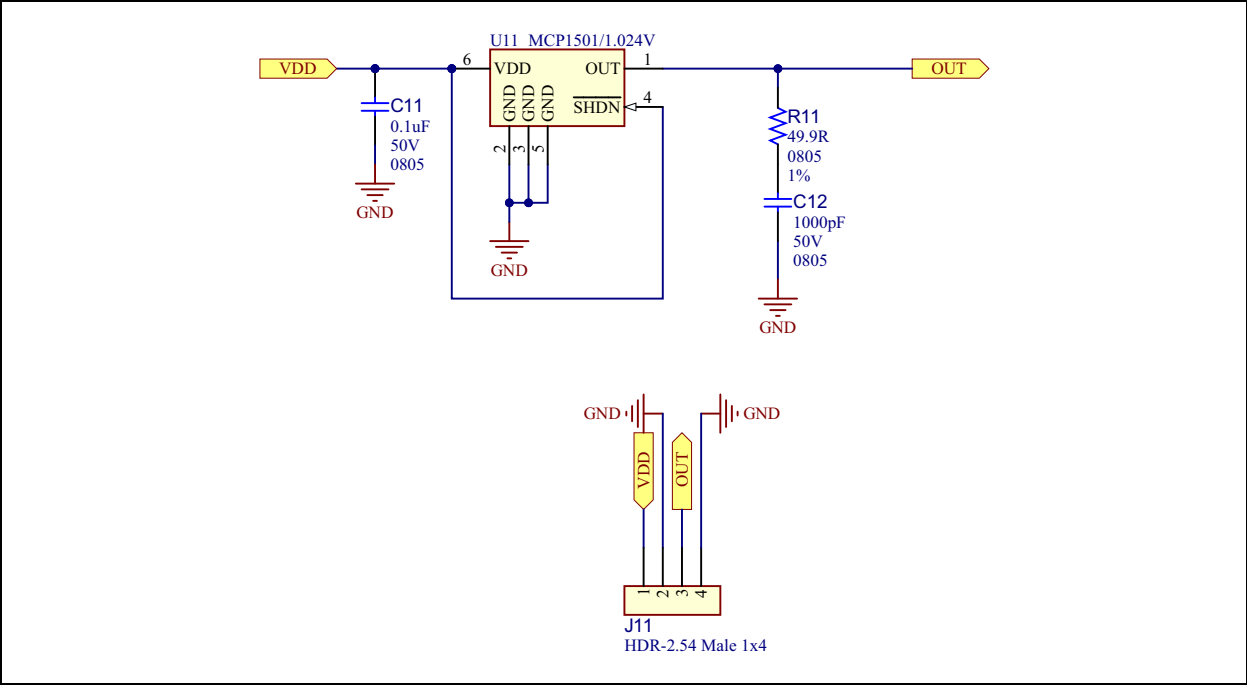
A.1 INTRODUCTION

This appendix contains the following schematics and layouts for the BB89X25A MCP1501 Voltage Reference BBS Kit:

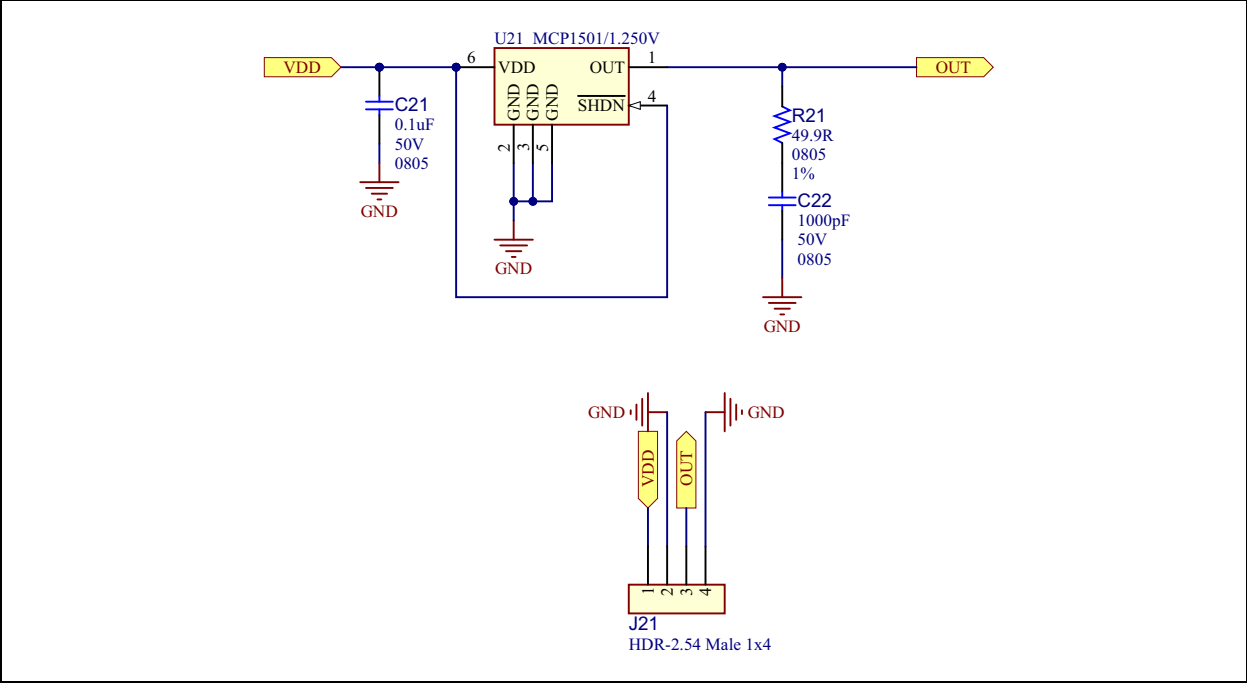
- [Board – Schematic 1](#)
- [Board – Schematic 2](#)
- [Board – Schematic 3](#)
- [Board – Schematic 4](#)
- [Board – Schematic 5](#)
- [Board – Schematic 6](#)
- [Board – Schematic 7](#)
- [Board – Schematic 8](#)
- [Board – Schematic 9](#)
- [Board – Schematic 10](#)
- [Board – Top Silk](#)
- [Board – Top Copper and Silk](#)
- [Board – Top Copper](#)
- [Board – Bottom Copper](#)
- [Board – Bottom Copper and Silk](#)
- [Board – Bottom Silk](#)

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A.2 BOARD – SCHEMATIC 1

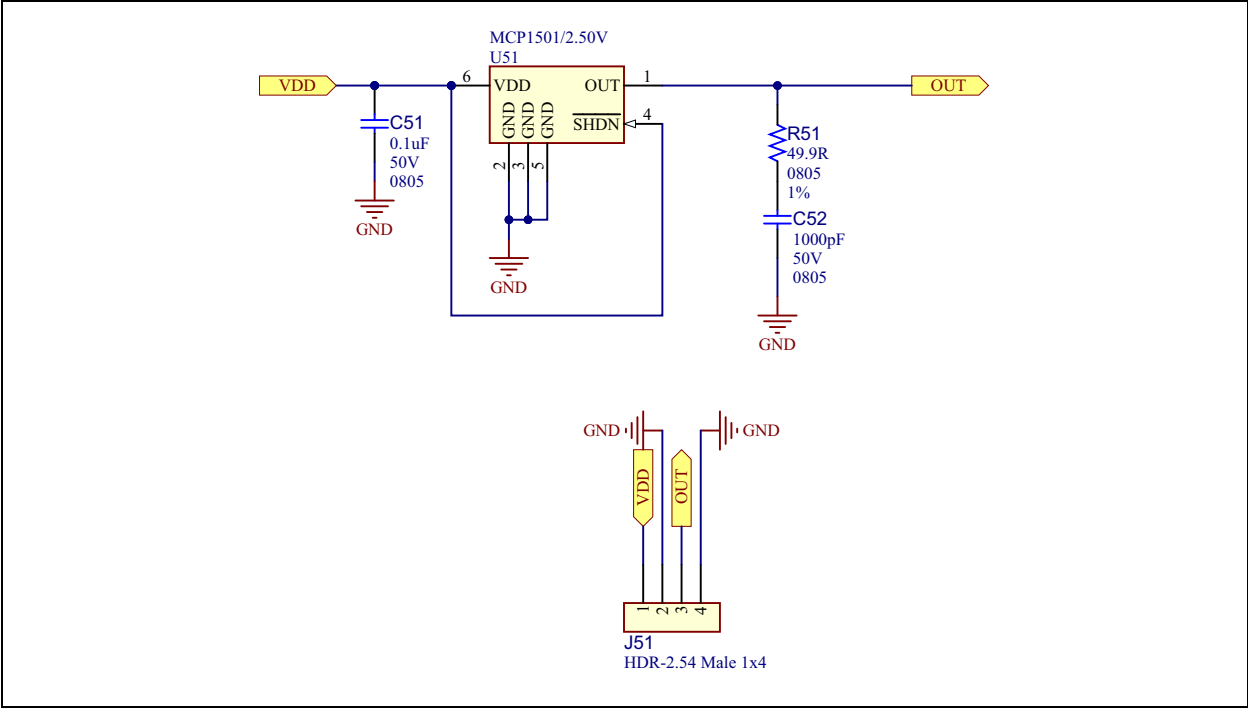


A.3 BOARD – SCHEMATIC 2

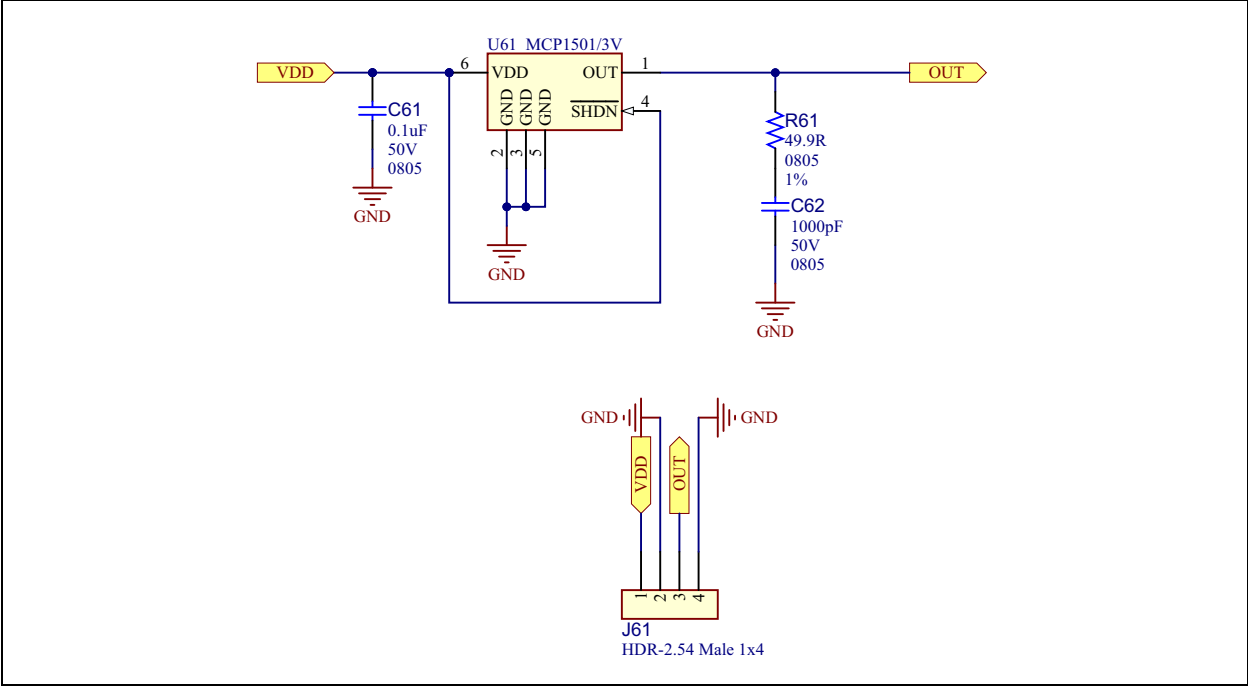


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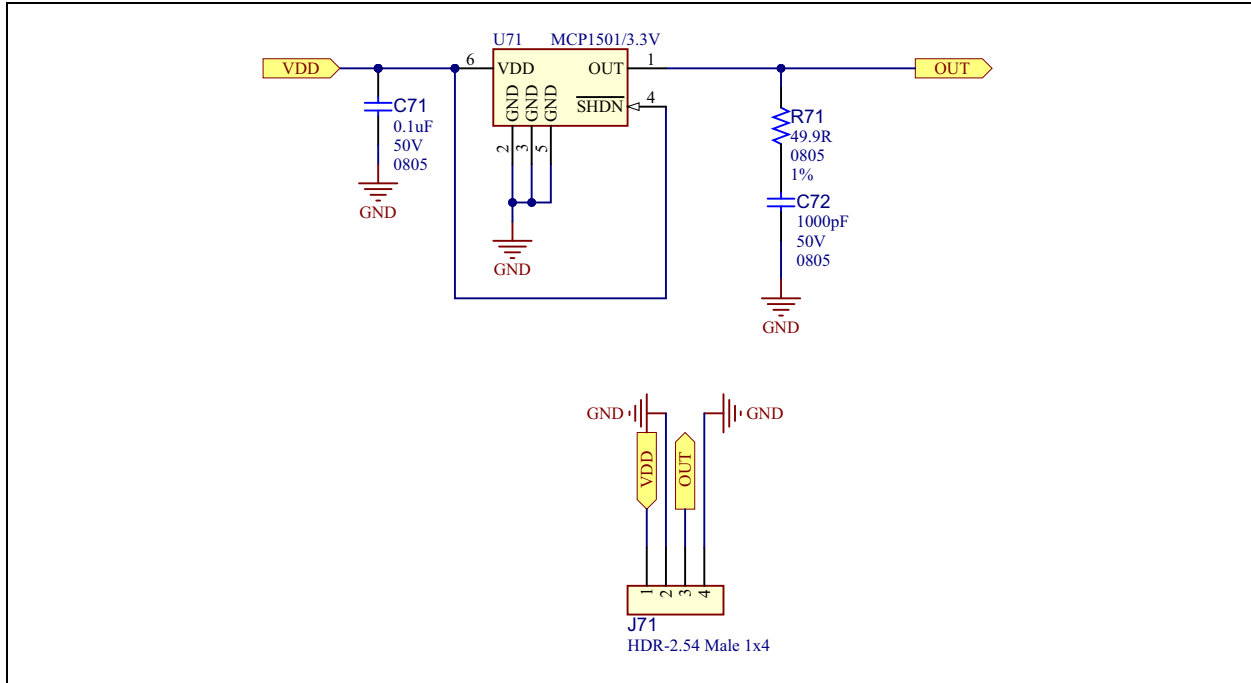
A.6 BOARD – SCHEMATIC 5



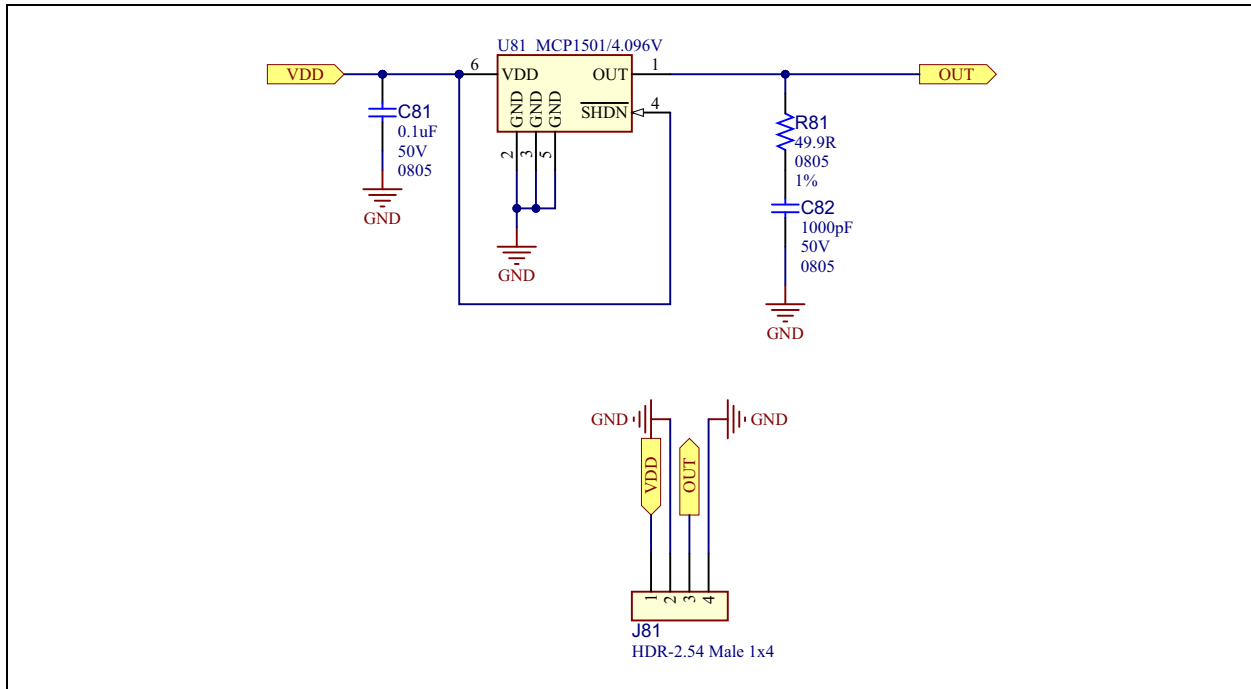
A.7 BOARD – SCHEMATIC 6



A.8 BOARD – SCHEMATIC 7

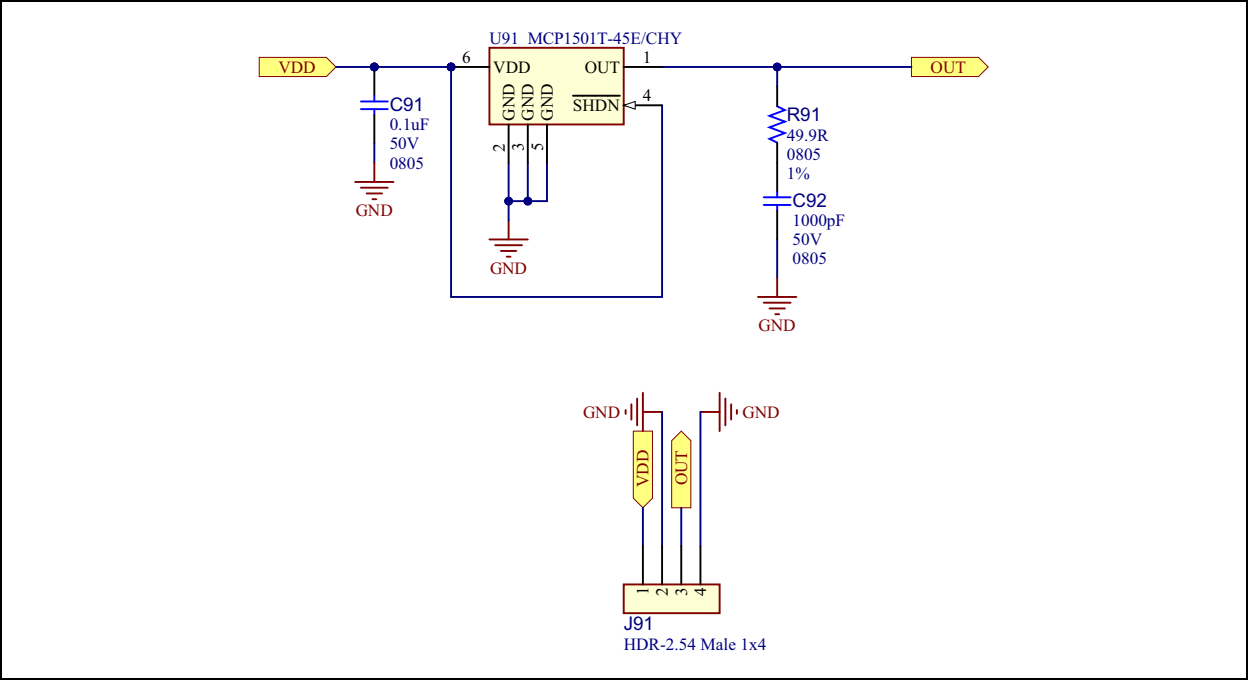


A.9 BOARD – SCHEMATIC 8

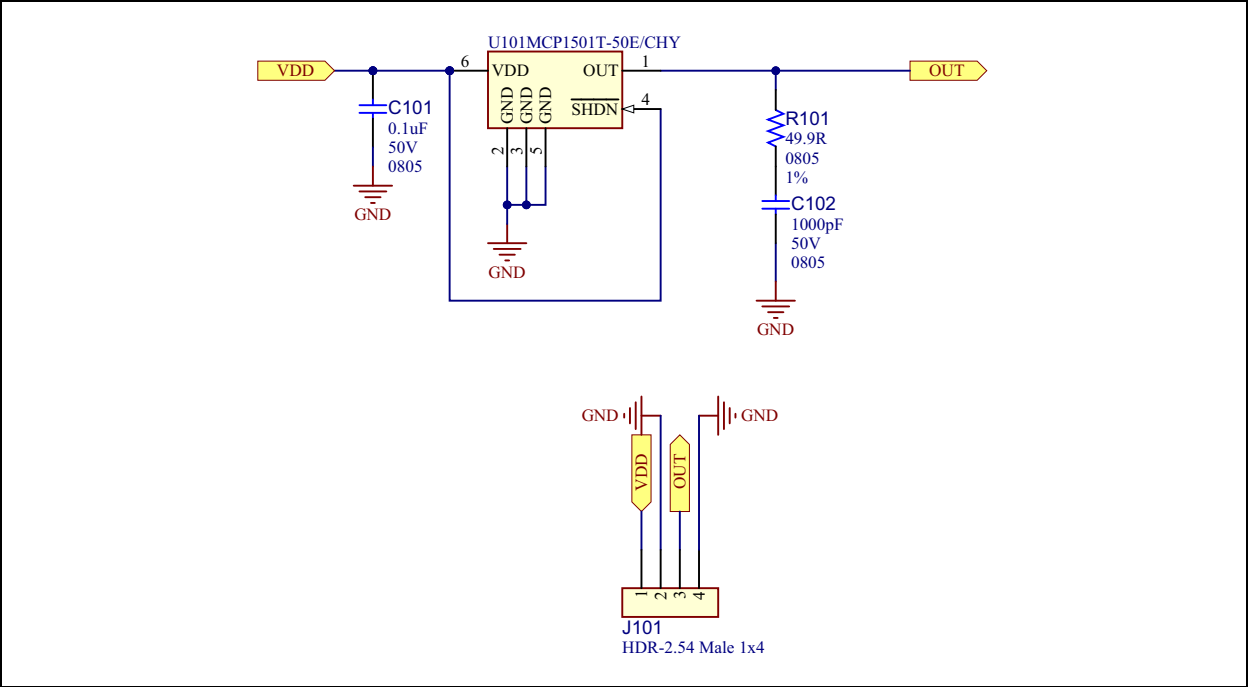


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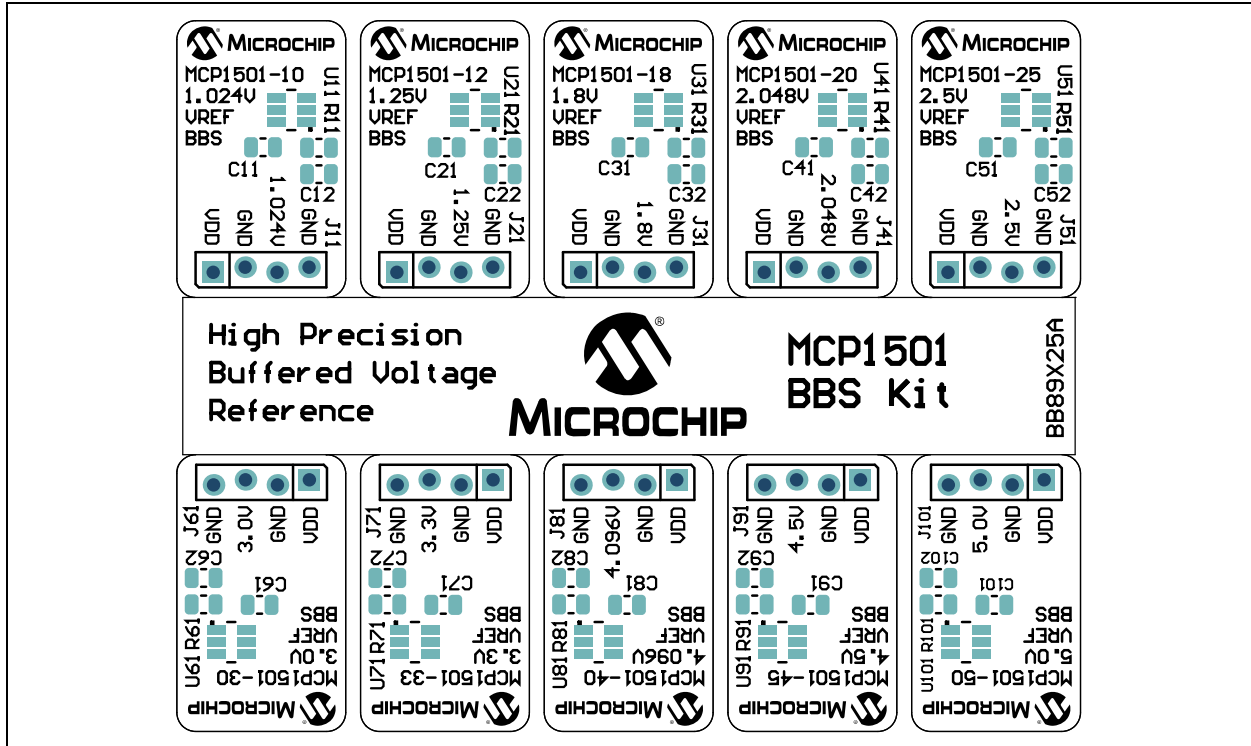
A.10 BOARD – SCHEMATIC 9



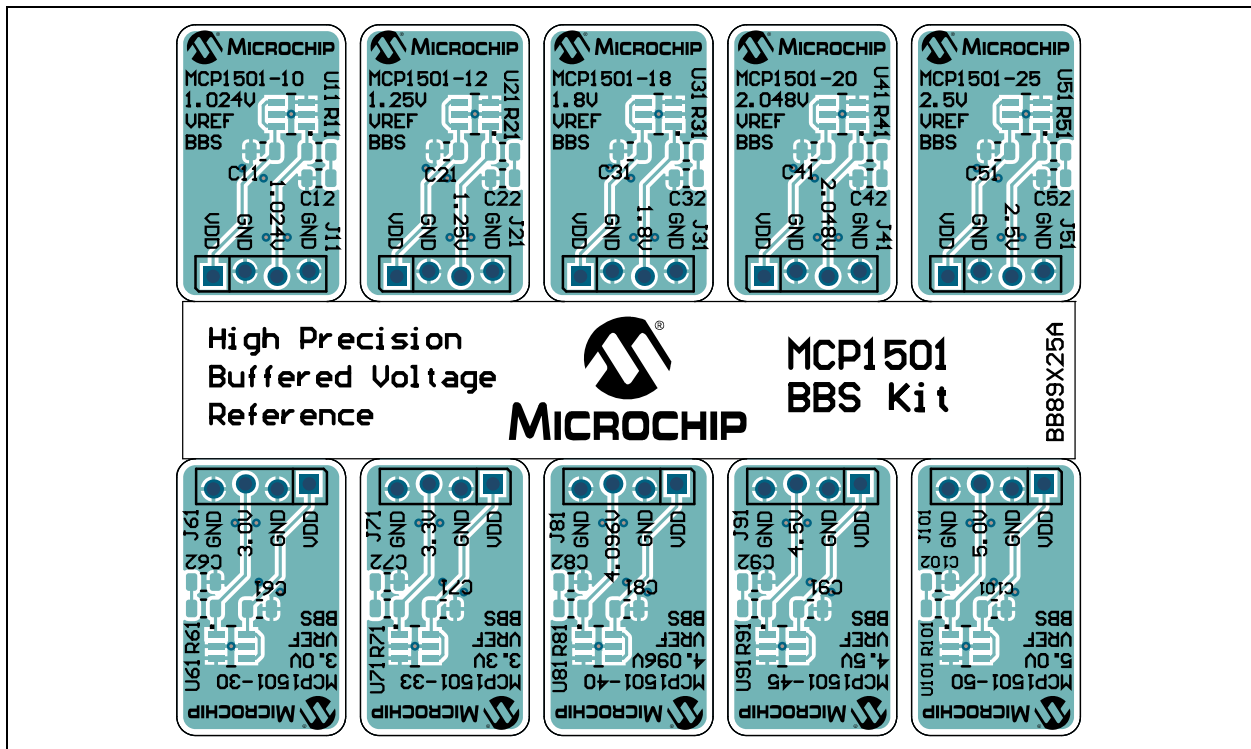
A.11 BOARD – SCHEMATIC 10



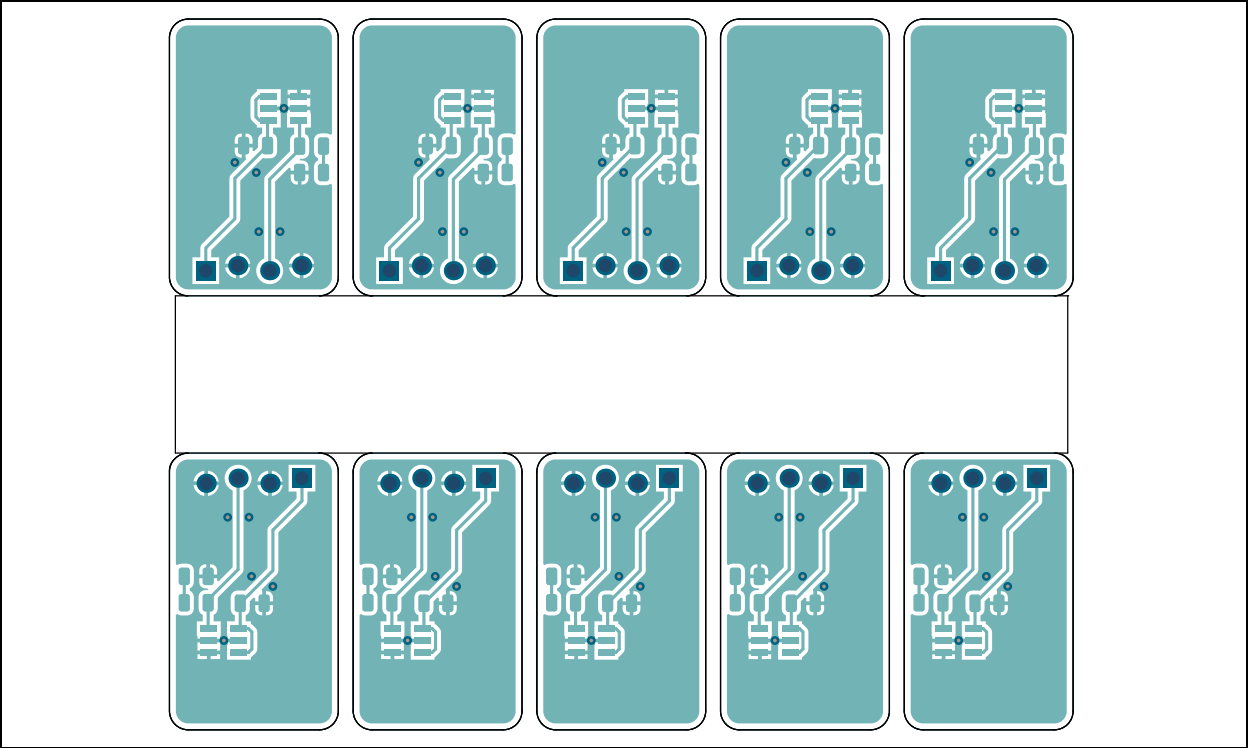
A.12 BOARD – TOP SILK



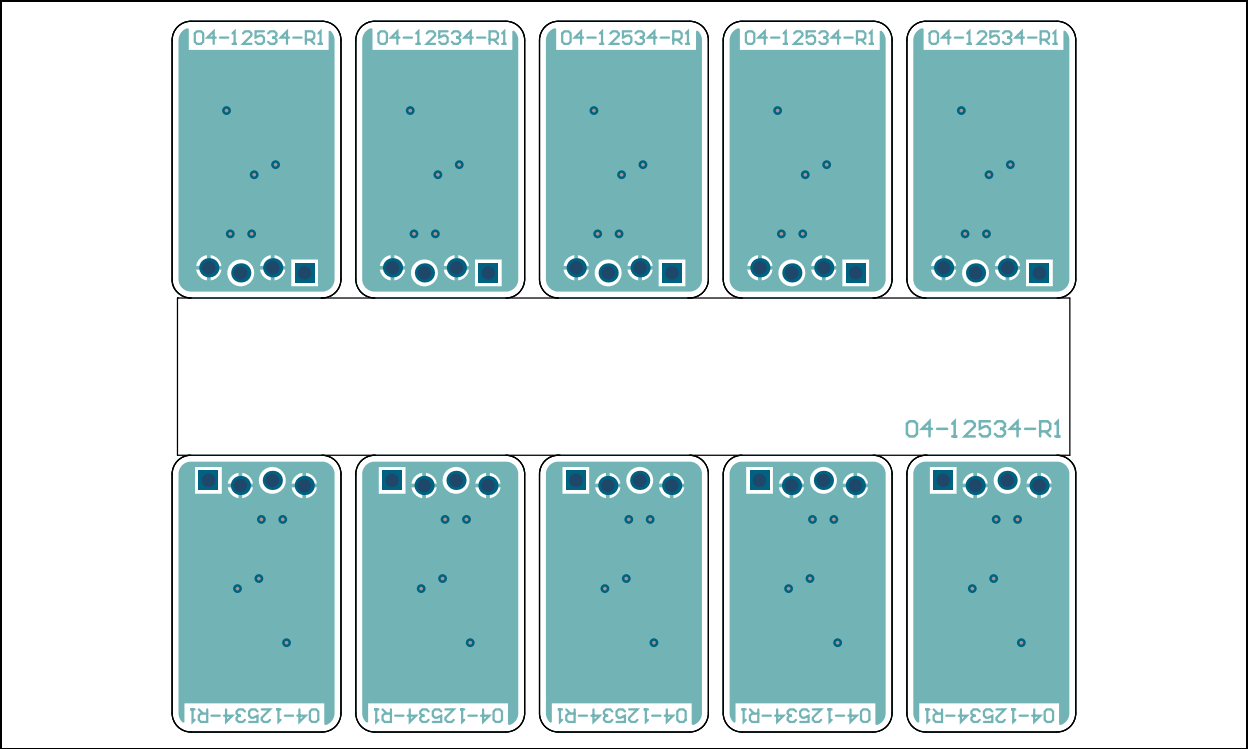
A.13 BOARD – TOP COPPER AND SILK



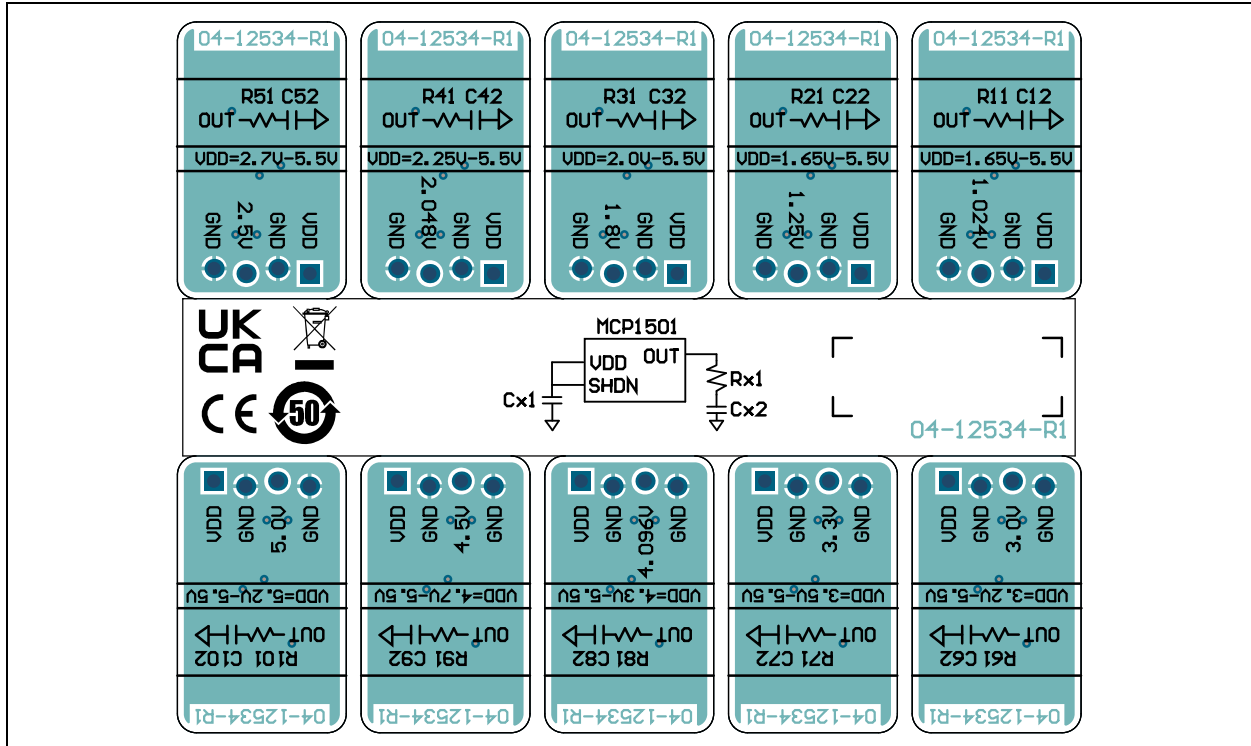
A.14 BOARD – TOP COPPER



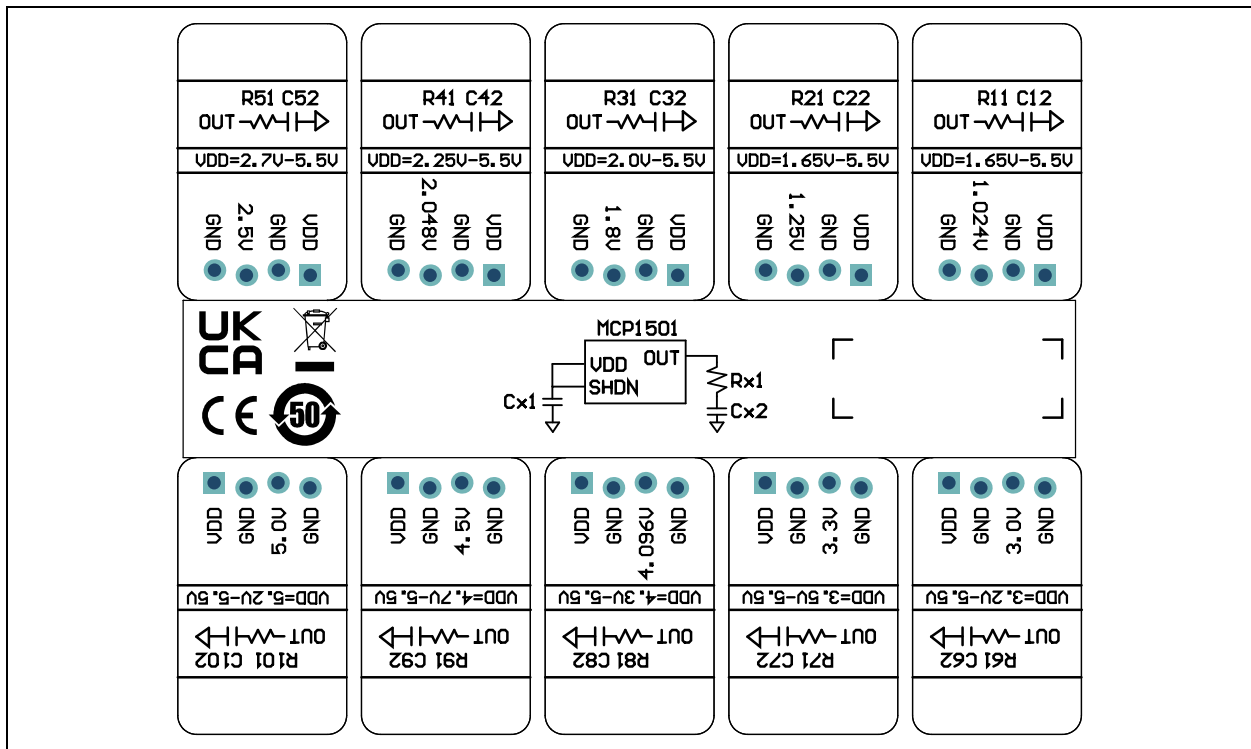
A.15 BOARD – BOTTOM COPPER



A.16 BOARD – BOTTOM COPPER AND SILK



A.17 BOARD – BOTTOM SILK



Appendix B. Bill of Materials (BOM)

TABLE B-1: BILL OF MATERIALS (BOM)

Qty.	Reference	Description	Manufacturer	Part Number
10	C11, C21, C31, C41, C51, C61, C71, C81, C91, C101	Capacitor, ceramic, 0.1 μ F, 50V, 10%, X7R, SMD, 0805	KEMET	C0805C104K5RACTU
10	C12, C22, C32, C42, C52, C62, C72, C82, C92, C102	Capacitor, ceramic, 1000 pF, 50V, 10%, X7R, SMD, 0805	YAGEO Corporation	CC0805KRX7R9BB102
10	J11, J21, J31, J41, J51, J61, J71, J81, J91, J101	Connector, header-2.54, male, 1x4, gold, 5.84MH, TH, vertical	Samtec, Inc.	TSW-104-07-G-S
1	LABEL1	Label, PCBA, 18x6 mm, Datamatrix, Assy# / Rev / Serial / Date	ACT Logimark AS	505462
1	PCB1	Printed Circuit Board	Microchip Technology Inc.	04-12534-R1
1	PCBA1	PCB Assembly	Microchip Technology Inc.	02-01479-R1
10	R11, R21, R31, R41, R51, R61, R71, R81, R91, R101	Resistor, TKF, 49.9R, 1%, 1/8W, SMD, 0805	Panasonic® – ECG	ERJ-6ENF49R9V
1	U11	Microchip, Analog, VREF, 1.024V, MCP1501T-10E/CHY SOT-23-6	Microchip Technology Inc.	MCP1501T-10E/CHY
1	U21	Microchip, Analog, VREF, 1.25V, MCP1501T-12E/CHY SOT-23-6	Microchip Technology Inc.	MCP1501T-12E/CHY
1	U31	Microchip, Analog, VREF, 1.80V, MCP1501T-18E/CHY SOT-23-6	Microchip Technology Inc.	MCP1501T-18E/CHY
1	U41	Microchip, Analog, VREF, 2.048V, MCP1501T-20E/CHY	Microchip Technology Inc.	MCP1501T-20E/CHY
1	U51	Microchip, Analog, VREF, 2.50V, MCP1501T-25E/CHY SOT-23-6	Microchip Technology Inc.	MCP1501T-25E/CHY
1	U61	Microchip, Analog, VREF, 3V, MCP1501T-30E/CHY SOT-23-6	Microchip Technology Inc.	MCP1501T-30E/CHY
1	U71	Microchip, Analog, VREF, 3.3V, MCP1501T-33E/CHY SOT-23-6	Microchip Technology Inc.	MCP1501T-33E/CHY
1	U81	Microchip, Analog, VREF, 4.096V, MCP1501T-40E/CHY SOT-23-6	Microchip Technology Inc.	MCP1501T-40E/CHY

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.

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

Qty.	Reference	Description	Manufacturer	Part Number
1	U91	Microchip, Analog, VREF, 4.5V, MCP1501T-45E/CHY SOT-23-6	Microchip Technology Inc.	MCP1501T-45E/CHY
1	U101	Microchip, Analog, VREF, 5.0V, MCP1501T-50E/CHY SOT-23-6	Microchip Technology Inc.	MCP1501T-50E/CHY

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.