



**MCP6XXX Amplifier  
Evaluation Board 2  
User's Guide**

---

**Note the following details of the code protection feature on Microchip devices:**

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

---

Information contained in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates.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. 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 ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. Microchip disclaims all liability arising from this information and its use. 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.

**Trademarks**

The Microchip name and logo, the Microchip logo, Accuron, dsPIC, KEELOQ, KEELOQ logo, microID, MPLAB, PIC, PICmicro, PICSTART, PRO MATE, rfPIC and SmartShunt are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.


AmpLab, FilterLab, Linear Active Thermistor, Migratable Memory, MXDEV, MXLAB, SEEVAL, SmartSensor and The Embedded Control Solutions Company are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Analog-for-the-Digital Age, Application Maestro, CodeGuard, dsPICDEM, dsPICDEM.net, dsPICworks, ECAN, ECONOMONITOR, FanSense, FlexROM, fuzzyLAB, In-Circuit Serial Programming, ICSP, ICEPIC, Mindi, MiWi, MPASM, MPLAB Certified logo, MPLIB, MPLINK, PICkit, PICDEM, PICDEM.net, PICLAB, PICtail, PowerCal, PowerInfo, PowerMate, PowerTool, REAL ICE, rFLAB, Select Mode, Smart Serial, SmartTel, Total Endurance, UNI/O, WiperLock and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

All other trademarks mentioned herein are property of their respective companies.

© 2007, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

 Printed on recycled paper.

**QUALITY MANAGEMENT SYSTEM**  
**CERTIFIED BY DNV**  
**== ISO/TS 16949:2002 ==**

*Microchip received ISO/TS-16949:2002 certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona; Gresham, Oregon and design centers in California and India. The Company's quality system processes and procedures are for its PIC® MCUs and dsPIC® DSCs, KEELOQ® code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.*



# MCP6XXX AMPLIFIER EVALUATION BOARD 2 USER'S GUIDE

---

---

## Table of Contents

---

---

<b>Preface</b> .....	<b>1</b>
Introduction.....	1
Document Layout .....	1
Conventions Used in this Guide .....	2
Recommended Reading.....	3
The Microchip Web Site .....	3
Customer Support .....	3
Document Revision History .....	3
<b>Chapter 1. Product Overview</b> .....	<b>5</b>
1.1 Introduction .....	5
1.2 MCP6XXX Amplifier Evaluation Board 2 Kit Contents .....	5
1.3 Microchip's Web-Based Mindi™ Analog Simulator Tool .....	6
1.4 MCP6XXX Amplifier Evaluation Board 2 Description .....	6
<b>Chapter 2. Installation and Operation</b> .....	<b>7</b>
2.1 Introduction .....	7
2.2 Required Tools .....	7
2.3 MCP6XXX Amplifier Evaluation Board 2 Set-up .....	7
2.4 MCP6XXX Amplifier Evaluation Board 2 Operation .....	13
<b>Appendix A. Schematic and Layouts</b> .....	<b>23</b>
A.1 Introduction .....	23
A.2 Board - Schematic .....	24
A.3 Board - Top Silk Layer .....	25
A.4 Board - Top Metal Layer .....	26
A.5 Board - Bottom Metal Layer .....	27
<b>Appendix B. Bill of Materials (BOM)</b> .....	<b>29</b>
B.1 MCP6XXX Amplifier Evaluation Board 2 BOM .....	29
<b>Worldwide Sales and Service</b> .....	<b>32</b>

# MCP6XXX Amplifier Evaluation Board 2 User's Guide

---

NOTES:



# MCP6XXX AMPLIFIER EVALUATION BOARD 2 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 web site ([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 on-line help. Select the Help menu, and then Topics to open a list of available on-line help files.

## INTRODUCTION

This chapter contains general information that will be useful to know before using the MCP6XXX Amplifier Evaluation Board 2. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Recommended Reading
- The Microchip Web Site
- Customer Support
- Document Revision History

## DOCUMENT LAYOUT

This document describes how to use the MCP6XXX Amplifier Evaluation Board 2. The manual layout is as follows:

- **Chapter 1. "Product Overview"** - Provides the important information about the MCP6XXX Amplifier Evaluation Board 2.
- **Chapter 2. "Installation and Operation"** – Covers the installation and operation of the MCP6XXX Amplifier Evaluation Board 2. It lists the required tools, shows how to set up the board, and demonstrates how to verify the amplifier operation.
- **Appendix A. "Schematic and Layouts"** – Shows the schematic and board layouts for the MCP6XXX Amplifier Evaluation Board 2.
- **Appendix B. "Bill of Materials (BOM)"** – Lists the parts used to build the MCP6XXX Amplifier Evaluation Board 2.

# MCP6XXX Amplifier Evaluation Board 2 User's Guide

---

## CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

### DOCUMENTATION CONVENTIONS

Description	Represents	Examples
<b>Arial font:</b>		
Italic characters	Referenced books	<i>MPLAB<sup>®</sup> 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 MCP6XXX Amplifier Evaluation Board 2. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

**MCP6021/2/3/4 Data Sheet, “Rail-to-Rail Input/Output, 10 MHz Op Amps” (DS21685)**

This data sheet provides detailed information regarding the MCP602X product family.

## THE MICROCHIP WEB SITE

Microchip provides online support via our web site at [www.microchip.com](http://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 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

## CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support
- Development Systems Information Line

Customers should contact their distributor, representative or field application engineer 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 web site at: <http://support.microchip.com>

## DOCUMENT REVISION HISTORY

**Revision A (July 2007)**

- Initial Release of this Document.

# MCP6XXX Amplifier Evaluation Board 2 User's Guide

---

NOTES:



## Chapter 1. Product Overview

### 1.1 INTRODUCTION

The MCP6XXX Amplifier Evaluation Board 2 is described by the following:

- Assembly # : 114-00148
- Order # : MCP6XXXEV-AMP2
- Name: MCP6XXX Amplifier Evaluation Board 2

Items discussed in this chapter include:

- **Section 1.2 “MCP6XXX Amplifier Evaluation Board 2 Kit Contents”**
- **Section 1.3 “Microchip’s Web-Based Mindi™ Analog Simulator Tool”**
- **Section 1.4 “MCP6XXX Amplifier Evaluation Board 2 Description”**

### 1.2 MCP6XXX AMPLIFIER EVALUATION BOARD 2 KIT CONTENTS

- MCP6XXX Amplifier Evaluation Board 2 - One partially assembled board
- Important Information “Read First”
- Accessory Bag - Contains loose parts for populating sockets on board
- Analog and Interface Products Demonstration Boards CD-ROM (DS21912)
  - MCP6XXX Amplifier Evaluation Board 2 User’s Guide (DS51668)



**FIGURE 1-1:** MCP6XXX Amplifier Evaluation Board 2 Kit.

# MCP6XXX Amplifier Evaluation Board 2 User's Guide

## 1.3 MICROCHIP'S WEB-BASED MINDI™ ANALOG SIMULATOR TOOL

The Mindi™ Analog Simulator tool is an innovative software tool that simplifies analog circuit design. The Mindi™ Analog Simulator tool supports the following application circuits: 1) Active Filters, 2) Amplifiers, 3) Battery Chargers, and 4) DC-to-DC Converters. The Mindi™ Amplifier Designer provides full schematic diagrams of the amplifier application circuit with recommended component values and displays the responses in frequency and time domains.

The Mindi™ Analog Simulator tool is a free web-based design tool available on the Microchip web site at <http://www.microchip.com> under “**Online Simulation Tools**” or by going directly to the Mindi™ web site at <http://www.microchip.com/mindi>.

The circuit simulator within the Mindi™ Analog Simulator tool can be downloaded and installed on a personal computer (PC) for more convenient simulations. Modified circuit files can also be downloaded to the PC.

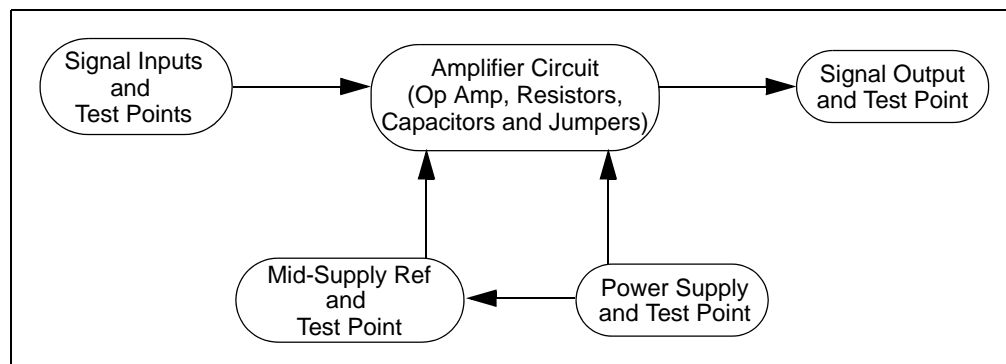
## 1.4 MCP6XXX AMPLIFIER EVALUATION BOARD 2 DESCRIPTION

MCP6XXX Amplifier Evaluation Board 2 is designed to support inverting/non-inverting summing amplifier circuits, however, at this time, the Mindi™ Amplifier Designer only supports the inverting summing amplifier circuits.

The MCP6XXX Amplifier Evaluation Board 2 has the following features:

- All amplifier resistors and capacitors are socketed
- All of the component labels on board keep consistent with those on schematic generated in the Mindi™ Amplifier Designer
- Supports all Microchip single op amps
  - PDIP-8 package (e.g., MCP6021) are socketed
  - SOIC-8 package can be accommodated; see **Section 2.4.3 “Amplifier Modifications Using 8-Pin SOIC Op Amps”**
- Test points for connecting lab equipment
- Single supply configuration

Figure 1-2 shows the block diagram of the MCP6XXX Amplifier Evaluation Board 2. Lab equipment can be attached (via test points) to measure the amplifier response.



**FIGURE 1-2:** MCP6XXX Amplifier Evaluation Board 2 Block Diagram.

## Chapter 2. Installation and Operation

### 2.1 INTRODUCTION

This chapter shows how to set up the MCP6XXX Amplifier Evaluation Board 2.

Items discussed in this chapter include:

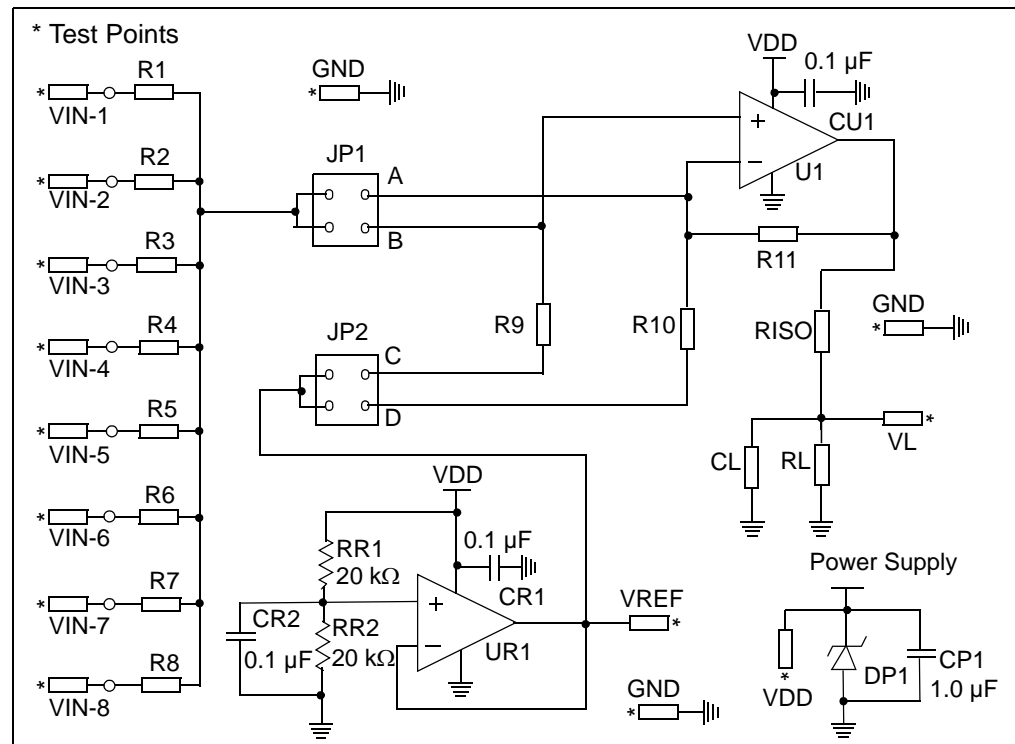
- Required Tools
- MCP6XXX Amplifier Evaluation Board 2 Set-Up
- MCP6XXX Amplifier Evaluation Board 2 Operation

### 2.2 REQUIRED TOOLS

- Lab power supply
- Lab signal source (e.g., function generator)
- Lab measurement equipment (e.g., oscilloscope)

### 2.3 MCP6XXX AMPLIFIER EVALUATION BOARD 2 SET-UP

The MCP6XXX Amplifier Evaluation Board 2 supports inverting summing amplifier and non-inverting summing amplifier. This section details the conversion of these topologies to the MCP6XXX Amplifier Evaluation Board 2. Figure 2-1 shows the circuit diagram for the board.



**FIGURE 2-1:** MCP6XXX Amplifier Evaluation Board 2 Circuit Diagram.

# MCP6XXX Amplifier Evaluation Board 2 User's Guide

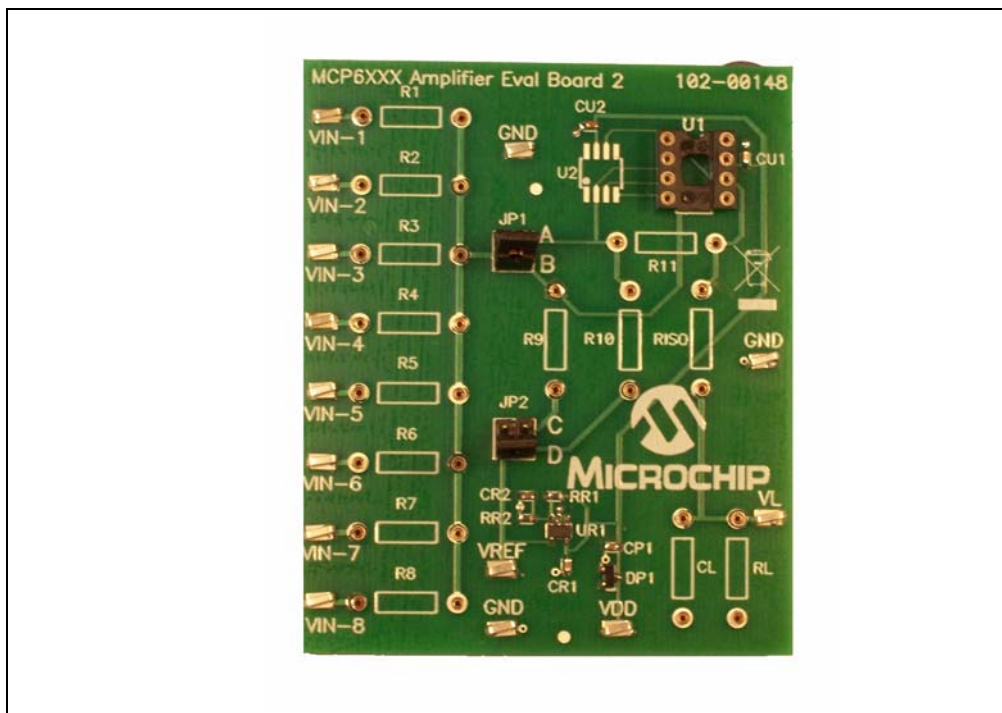
The power supply voltage needs to be in the allowed range for the installed op amps. Any of Microchip's op amps that operate below 5.5V can be used. Moreover, the power supply is protected by a zener diode with nominal voltage 6.2V and bypassed by a 1.0  $\mu$ F capacitor. (See **Figure 2-3: "Power Supply Block."**)

The mid-supply reference consists of a voltage divider and a buffer amplifier. (See **Figure 2-4: "Mid-supply Reference Block."**)

The resistors that are part of an amplifier are placed in pin sockets which are labeled. All of the component labels on board keep consistent with those on schematic generated in the Minda™ Amplifier Designer. The op amps are bypassed by 0.1  $\mu$ F capacitors and the single op amp U1 can have either a PDIP-8 or SOIC-8 package.

- PDIP-8 packages are inserted into the DIP-8 socket to the right of the U1 label.
- SOIC-8 packages can be accommodated; see **Section 2.4.3 "Amplifier Modifications Using 8-Pin SOIC Op Amps"**.

The (surface mount) test points for power supply, ground, input signal and output signal allow lab equipment to be connected to the board. The MCP6XXX Amplifier Evaluation Board 2 top view is shown in Figure 2-2.

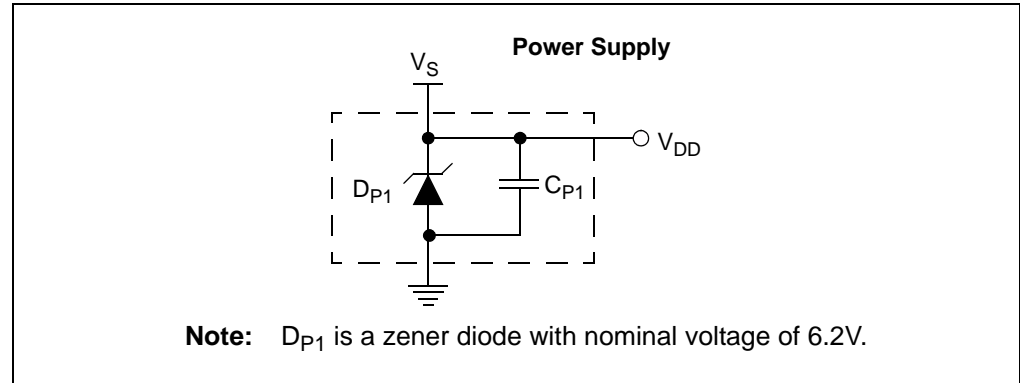


**FIGURE 2-2:** MCP6XXX Amplifier Evaluation Board 2 Top View.

## 2.3.1 Top Level Amplifier Circuit Diagrams

### 2.3.1.1 POWER SUPPLY BLOCK

The power supply is protected by a zener diode and bypassed by a capacitor. Figure 2-3 shows the circuit diagram for the power supply.  $C_{P1} = 1.0 \mu\text{F}$ .

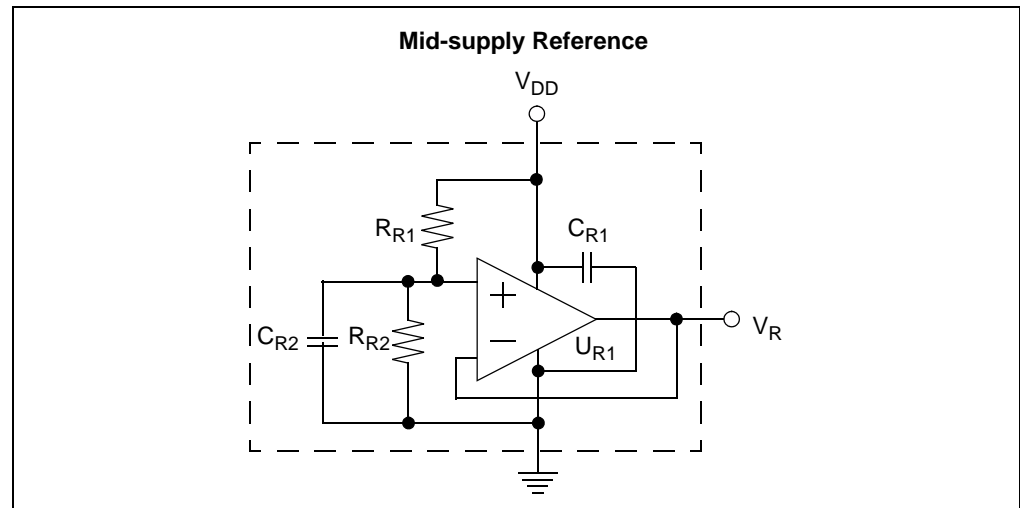


**FIGURE 2-3:** Power Supply Block.

### 2.3.1.2 MID-SUPPLY REFERENCE BLOCK

The mid-supply reference consists of a voltage divider and a buffer amplifier. Figure 2-4 shows the circuit diagram for the mid-supply reference.

$C_{R1} = C_{R2} = 0.1 \mu\text{F}$ ,  $R_{R1} = R_{R2} = 20.0 \text{ k}\Omega$ .



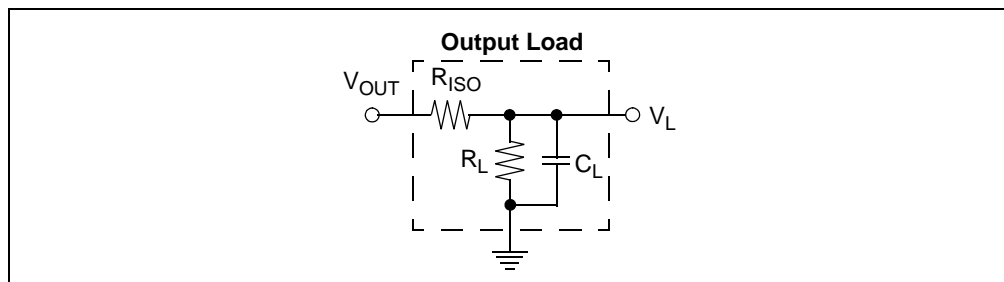
**FIGURE 2-4:** Mid-supply Reference Block.

# MCP6XXX Amplifier Evaluation Board 2 User's Guide

---

## 2.3.1.3 OUTPUT LOAD BLOCK

The output load consists of a capacitor and two resistors. Figure 2-5 shows the circuit diagram for the output load.  $R_{ISO}$  is used to stabilize the amplifier when it drives a large capacitive load ( $C_L$ ).  $R_{ISO}$  is a short circuit ( $0\Omega$ ) when  $C_L$  is small.

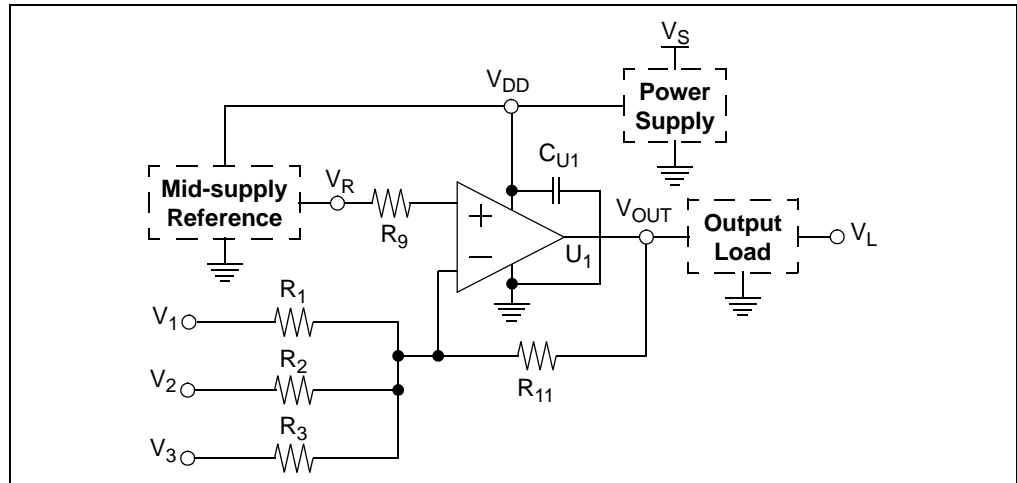


**FIGURE 2-5:** Output Load Block.

# Installation and Operation

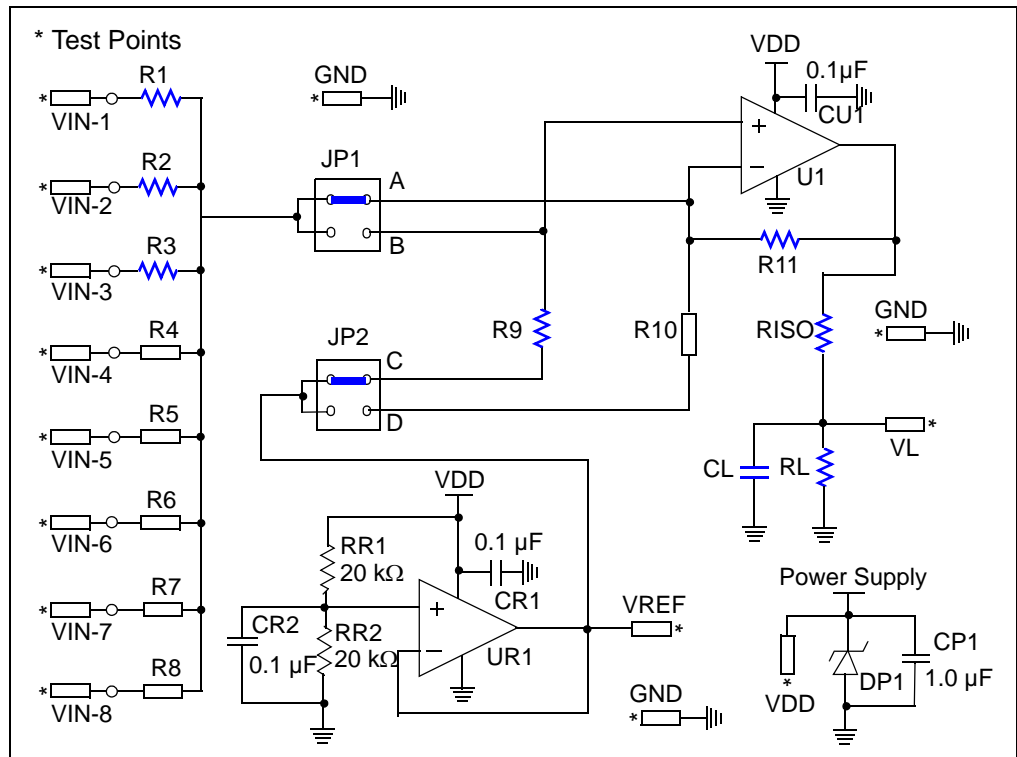
## 2.3.1.4 INVERTING SUMMING AMPLIFIER

- Amplifies two or more input voltages with an inverting gain. Input and output voltages are shifted by a reference voltage for single supply
- The Mindi™ Amplifier Designer gives design recommendations for circuits with up to 8 inputs; see the circuit diagram shown in Figure 2-6.
  - Fill the sockets with the recommended resistors and capacitors
  - Set JP1 and JP2 in the correct positions (for the given example, JP1: Position A, JP2: Position C)



**FIGURE 2-6:** Inverting Summing Amplifier Circuit Diagram.

Figure 2-7 shows an example of the inverting summing amplifier circuit diagram supported by MCP6XXX Amplifier Evaluation Board 2.

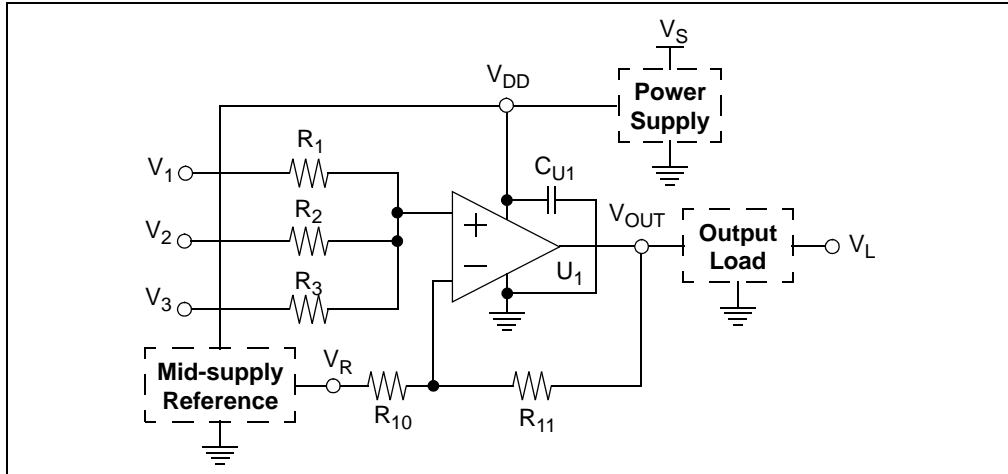


**FIGURE 2-7:** Inverting Summing Amplifier Example Supported by the MCP6XXX Amplifier Evaluation Board 2.

# MCP6XXX Amplifier Evaluation Board 2 User's Guide

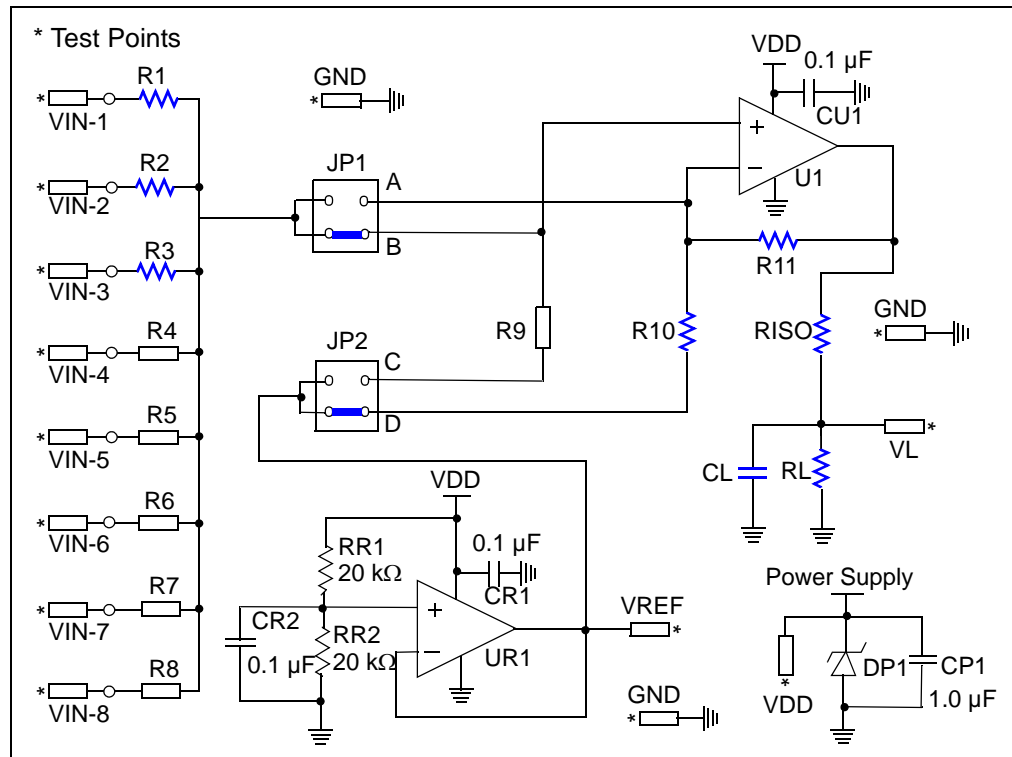
## 2.3.1.5 NON-INVERTING SUMMING AMPLIFIER (NOT SUPPORTED)

- Amplifies two or more voltages with a non-inverting gain. Input and output voltages are shifted by a reference voltage for single supply
- It is up to the user to design this circuit to produce the target gains for up to eight inputs
  - Select the correct resistor and capacitor values
  - Set JP1 and JP2 as needed  
(for the given example, JP1: Position B, JP2: Position D)



**FIGURE 2-8:** Non-Inverting Summing Amplifier Circuit Diagram.

Figure 2-9 shows an example of the non-inverting summing amplifier circuit diagram supported by MCP6XXX Amplifier Evaluation Board 2.



**FIGURE 2-9:** Non-Inverting Summing Amplifier Example Supported by the MCP6XXX Amplifier Evaluation Board 2.



## 2.4 MCP6XXX AMPLIFIER EVALUATION BOARD 2 OPERATION

Items discussed in this section include:

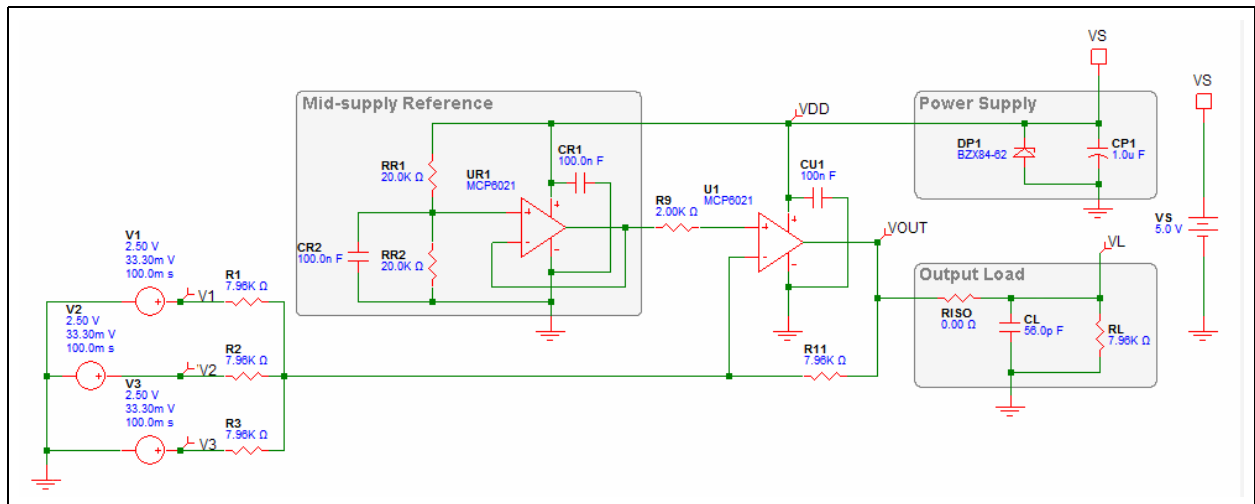
- Building the Amplifier
- Testing the Amplifier
- Amplifier Modification: Using 8-Pin SOIC Op Amps

### 2.4.1 Building the Amplifier

The accessory bag that comes with this kit makes it quick and easy to evaluate the amplifier described below, which was designed in the Mindi™ Amplifier Designer.

This amplifier is described as follows:

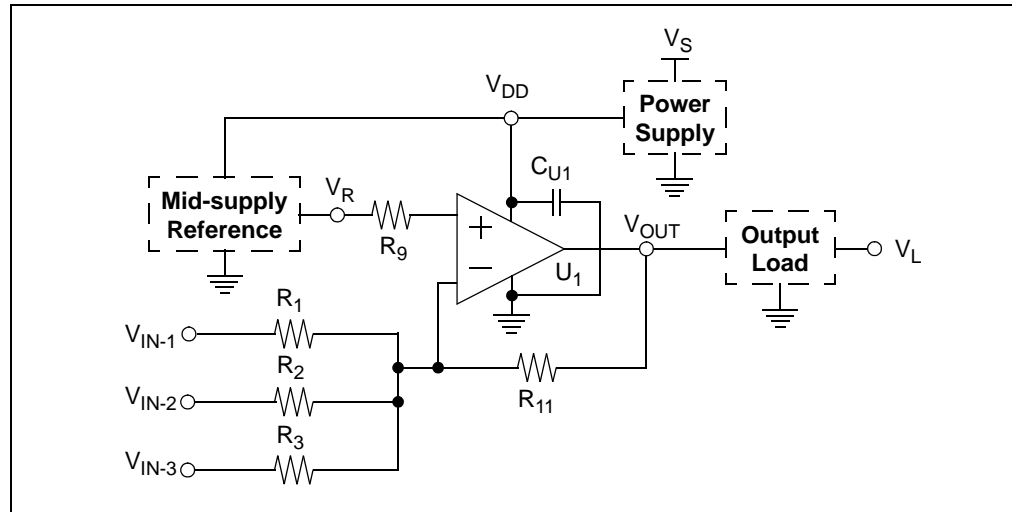
- Inverting Summing Amplifier (Single Supply Configuration)
- Power Supply Voltage is 5.0V
- Desired Gain for  $V_{IN-1}$  is 1 V/V
- Desired Gain for  $V_{IN-2}$  is 1 V/V
- Desired Gain for  $V_{IN-3}$  is 1 V/V
- Load Capacitance is 56 pF



**FIGURE 2-10:** Inverting Summing Amplifier Designed In the Mindi™ Amplifier Designer.

# MCP6XXX Amplifier Evaluation Board 2 User's Guide

Figure 2-11 shows the same circuit redrawn to emphasize the inverting summing amplifier.



**FIGURE 2-11:** Inverting Summing Amplifier Supported by the MCP6XXX Amplifier Evaluation Board 2 Kit.

Each of the components in Figure 2-11 that needs to be inserted in a socket on the MCP6XXX Amplifier Evaluation Board 2 is listed in Table 2-1 and Table 2-2.

**TABLE 2-1: AMPLIFIER COMPONENTS LIST**

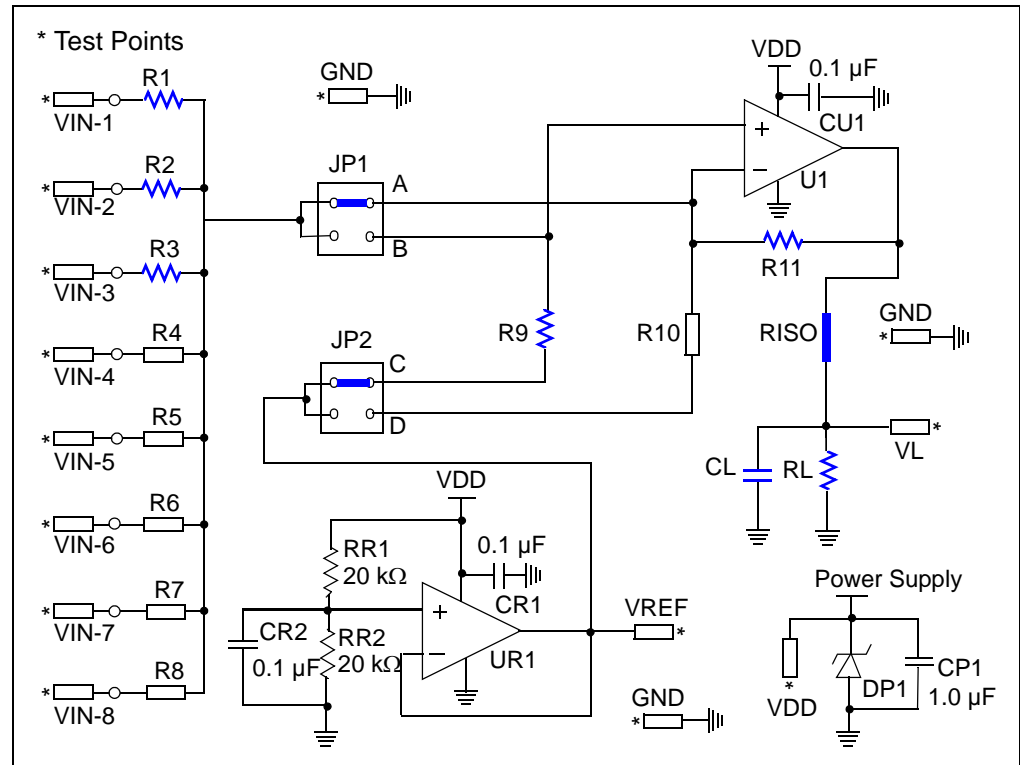
PCB Labels	Component Values
R1	7.96 k $\Omega$
R2	7.96 k $\Omega$
R3	7.96 k $\Omega$
R9	2.00 k $\Omega$
R11	7.96 k $\Omega$
RISO	0 $\Omega$
RL	7.96 k $\Omega$
CL	56 nF
U1	MCP6021, PDIP-8, 10 MHz

**TABLE 2-2: JUMPER POSITIONS**

Jumper	Position
JP1	A
JP2	C

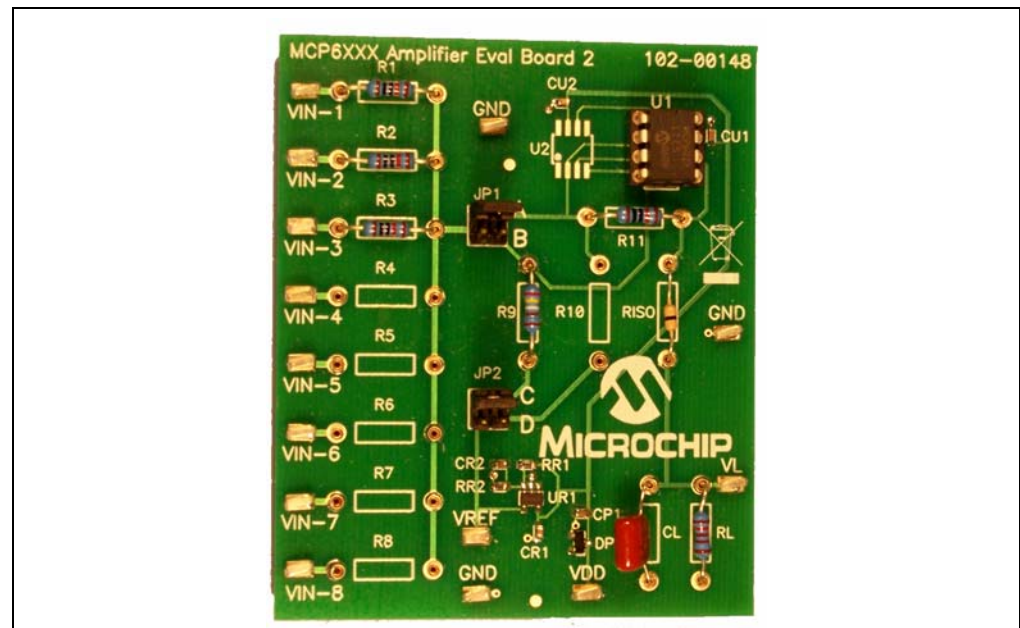
# Installation and Operation

Figure 2-12 is the fully assembled inverting summing amplifier's circuit diagram.



**FIGURE 2-12:** Fully Assembled Inverting Summing Amplifier Supported by the MCP6XXX Amplifier Evaluation Board 2.

The fully assembled MCP6XXX Amplifier Evaluation Board 2 top view is shown in Figure 2-13.



**FIGURE 2-13:** Picture of the Inverting Summing Amplifier Supported by the MCP6XXX Amplifier Evaluation Board 2.

# MCP6XXX Amplifier Evaluation Board 2 User's Guide

## 2.4.2 Testing the Amplifier

### 2.4.2.1 CHECKING THE TEST POINTS

The (surface mount) test points for power supply, ground, input signal and output signal allow lab equipment to be connected to the board. Figure 2-14 shows the test points to check.

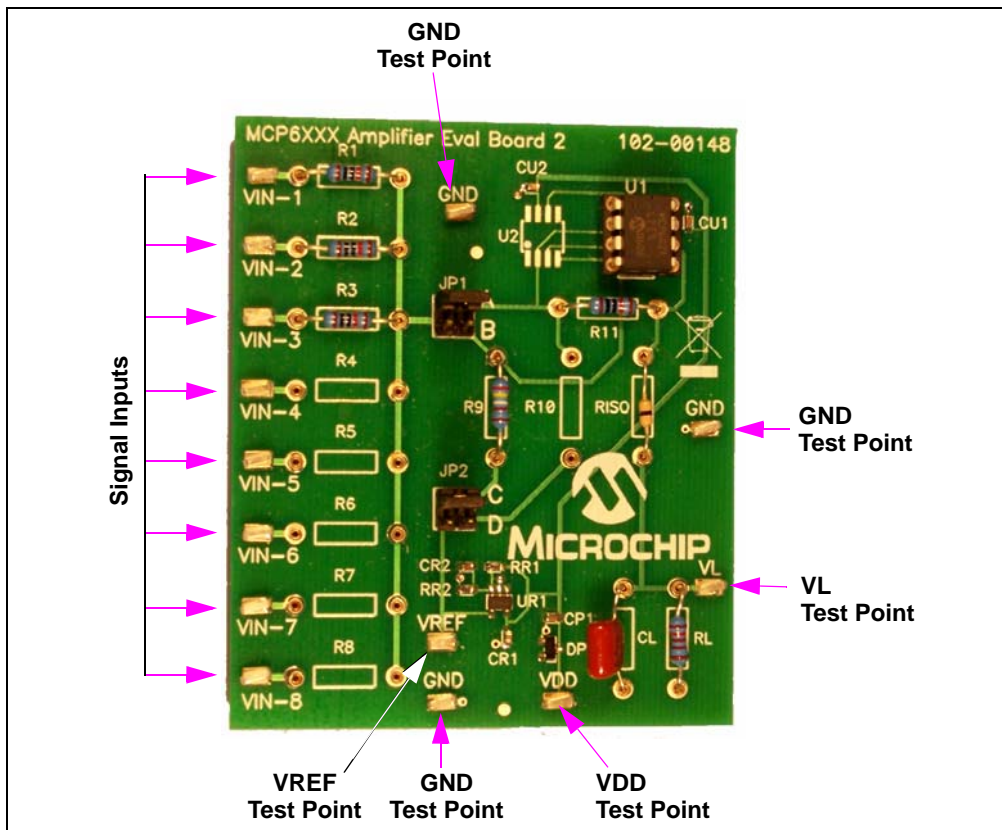


FIGURE 2-14: Checking the Test Points.

## 2.4.2.2 TRANSIENT RESPONSES

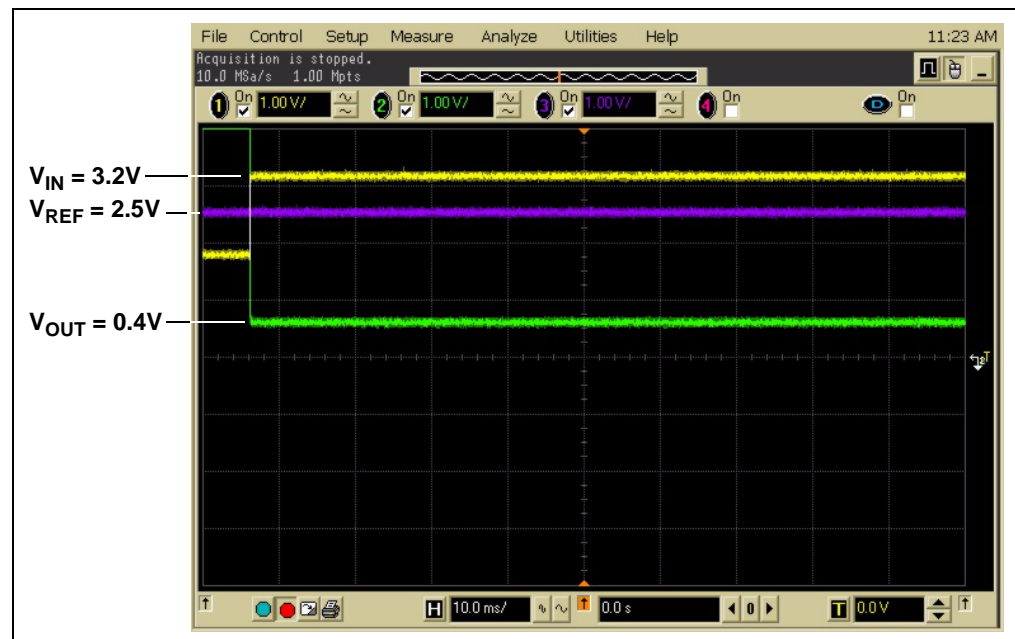
This inverting summing amplifier was built, and its responses were measured. A MCP6021 op amp, 1% resistors, and 5% capacitors were used. Notice how close the measured and simulated data are.

### 2.4.2.2.1 Transient Step Response

In Bench Measurement:

- Set  $V_{IN}$  with a step amplitude of 1.4V and a center voltage of 2.5V. (i.e.  $V_{IN}$  starts 0.7V below center and ends 0.7V above center)
- The measured step response is shown in Figure 2-15. It is a signal with a step amplitude of 4.2V and a center voltage of 2.5V. (i.e.  $V_{OUT}$  starts 2.1V above center and ends 2.1V below center)

**Note:** The center voltage of  $V_{IN}$  is set at  $V_{REF} = V_{DD}/2$  (For  $V_{DD} = 5.0V$ ,  $V_{REF} = 2.5V$ )



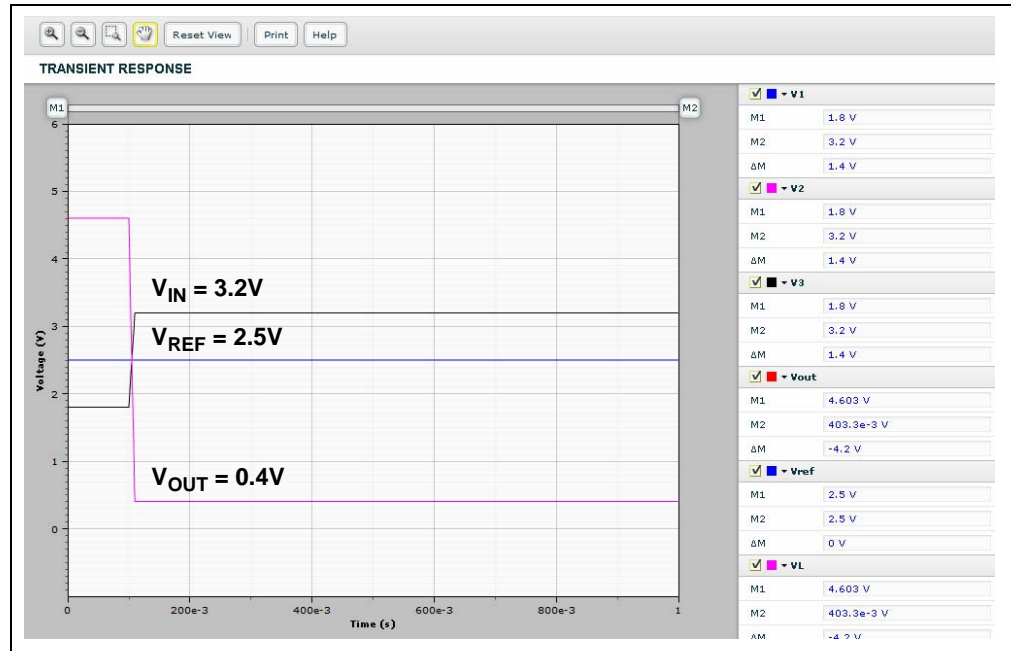
**FIGURE 2-15:** Measured Step Response.

# MCP6XXX Amplifier Evaluation Board 2 User's Guide

In the Mindi™ Amplifier Designer:

- Set  $V_{IN}$  with a step amplitude of 1.4V and a center voltage of 2.5V. (i.e.  $V_{IN}$  starts 0.7V below center and ends 0.7V above center)
- The output step response is shown in Figure 2-16. It is a signal with a step amplitude of 4.2V and a center voltage of 2.5V. (i.e.  $V_{OUT}$  starts 2.1V above center and ends 2.1V below center)

**Note:** The center voltage of  $V_{IN}$  is set at  $V_{REF} = V_{DD}/2$  (For  $V_{DD} = 5.0V$ ,  $V_{REF} = 2.5V$ )



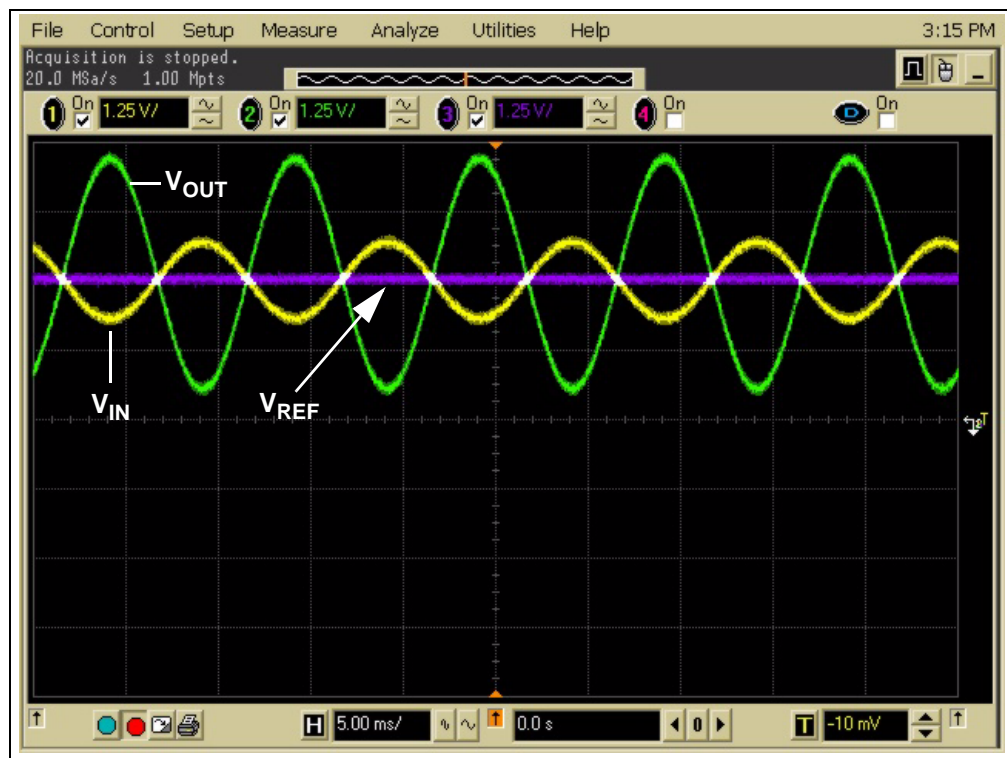
**FIGURE 2-16:** Simulated Step Response.

## 2.4.2.2.2 Transient Sine Wave Response

In Bench Measurement:

- Set  $V_{IN}$  as a sine wave with a frequency of 100.0 Hz, a peak-to-peak voltage of 1.4V and a center voltage of 2.5V
- The measured sine wave response is shown in Figure 2-17. It is a sine wave signal with a frequency of 100.0 Hz, a peak-to-peak voltage of 4.2V and a center voltage of 2.5V

**Note:** The center voltage of  $V_{IN}$  is set at  $V_{REF} = V_{DD}/2$  (For  $V_{DD} = 5.0V$ ,  $V_{REF} = 2.5V$ )



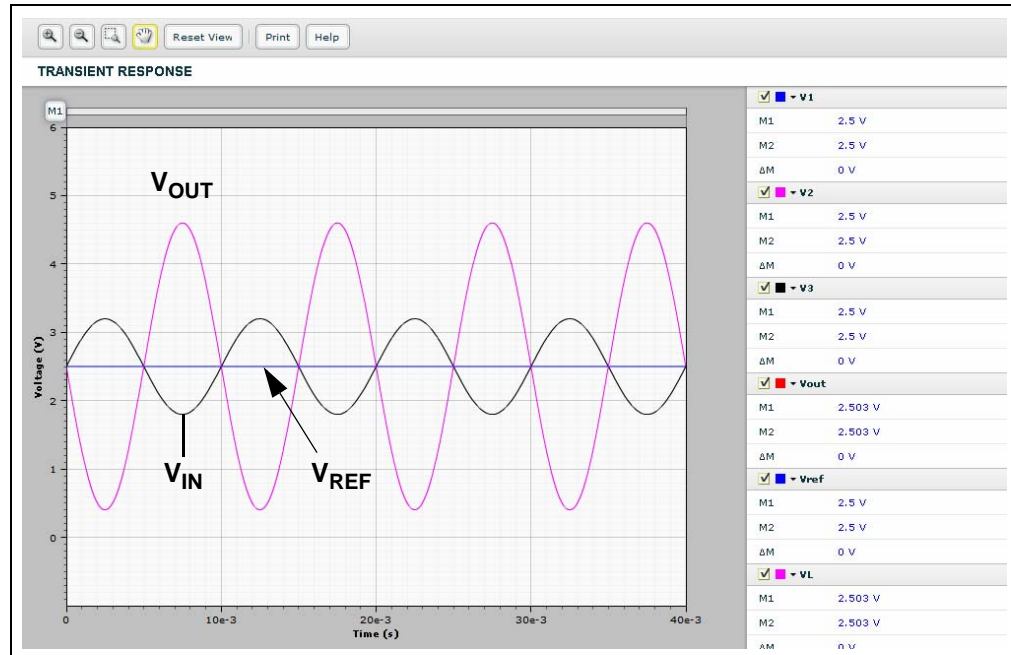
**FIGURE 2-17:** Measured Sine Wave Response.

# MCP6XXX Amplifier Evaluation Board 2 User's Guide

In the Mindi™ Amplifier Designer:

- Set  $V_{IN}$  as a sine wave with a frequency of 100.0 Hz, a peak-to-peak voltage of 1.4V and a center voltage of 2.5V
- The simulated sine wave response is shown in Figure 2-18. It is a sine wave signal with a frequency of 100.0 Hz, a peak-to-peak voltage of 4.2V and a center voltage of 2.5V

**Note:** The center voltage of  $V_{IN}$  is set at  $V_{REF} = V_{DD}/2$  (For  $V_{DD} = 5.0V$ ,  $V_{REF} = 2.5V$ )



**FIGURE 2-18:** Simulated Sine Wave Response.



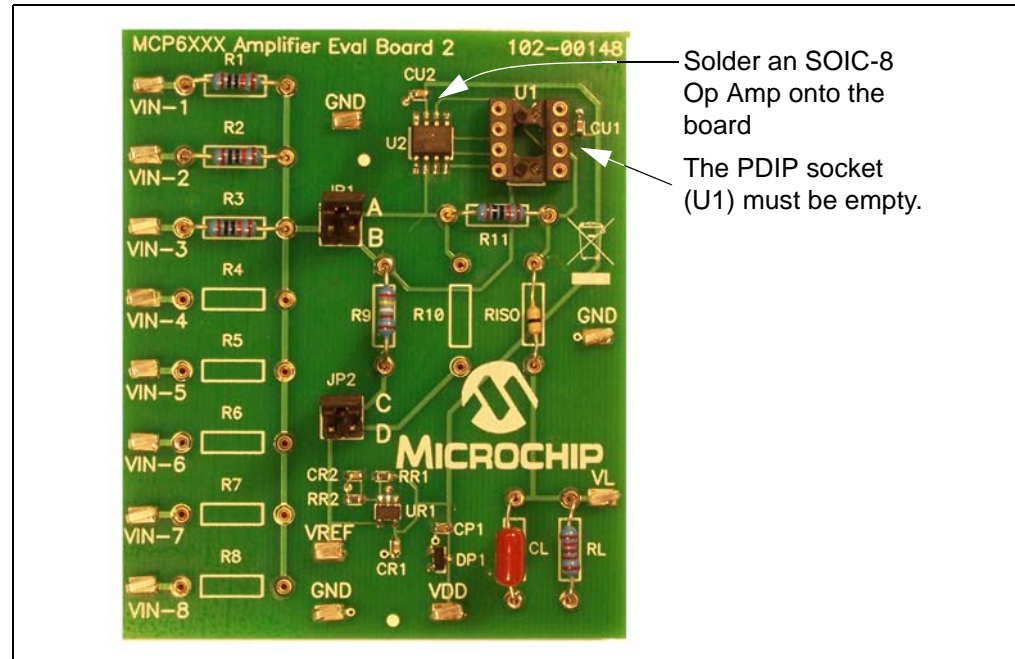
## 2.4.3 Amplifier Modifications Using 8-Pin SOIC Op Amps

There are two options available to use single op amps in SOIC-8 packages (150 mil wide):

- Soldering onto the MCP6XXX Amplifier Evaluation Board 2, or
- Soldering it onto a separate board which is connected to the DIP-8 socket

**Note:** The DIP-8 socket must be empty; only one op amp can be used at a time.

Figure 2-19 shows a SOIC-8 op amp soldered onto the MCP6XXX Amplifier Evaluation Board 2.

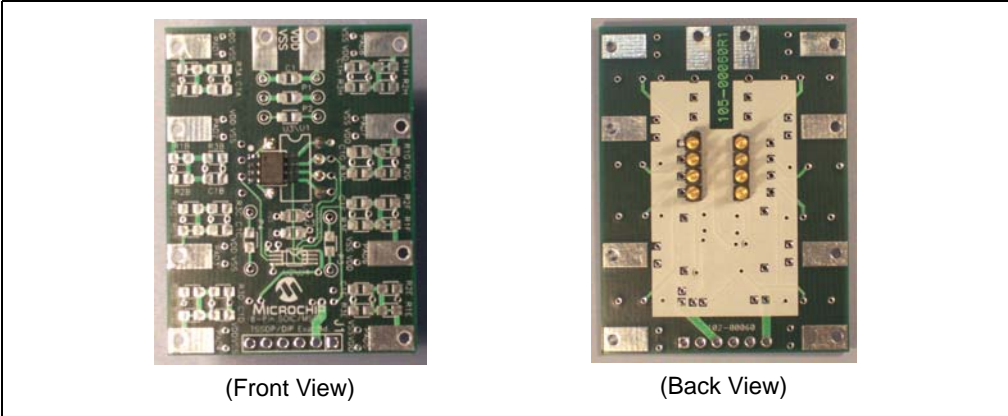


**FIGURE 2-19:** Op Amp in SOIC-8 package soldered onto MCP6XXX Amplifier Evaluation Board 2.

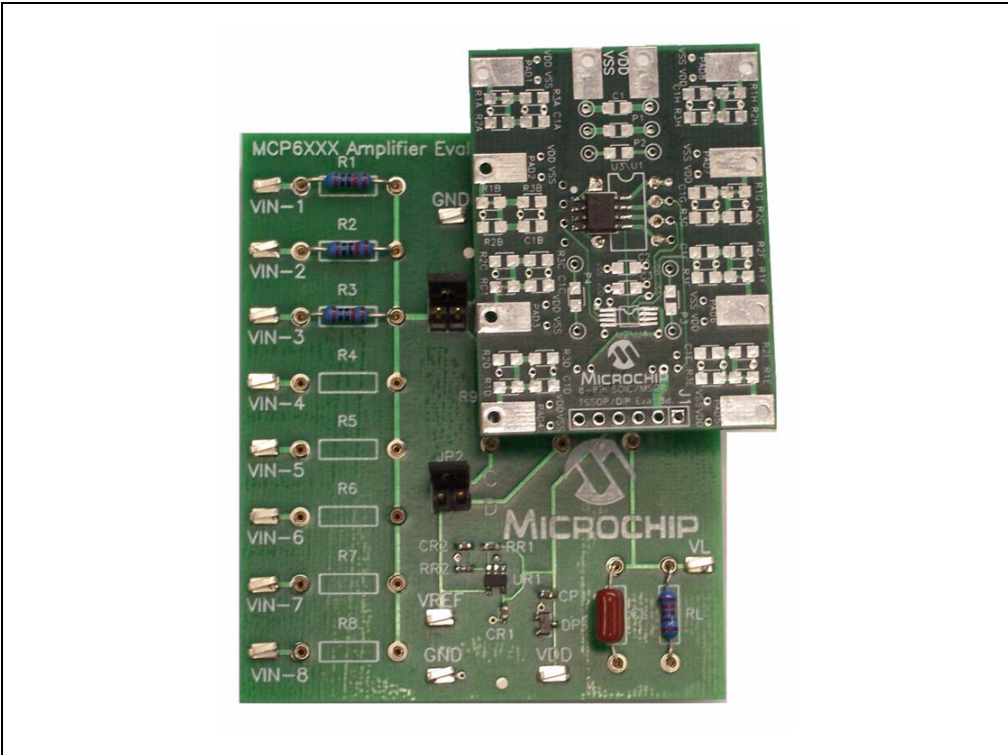
Figure 2-20 shows a SOIC-8 op amp and a DIP-8 socket, soldered onto the 8-Pin SOIC/MSOP/TSSOP/DIP Evaluation Board available from Microchip Technology Inc. (order # SOIC8EV). The two interconnect strips on the bottom are Samtec part # BBS-14-T-B or equivalent and are soldered into the through holes for the DIP-8 socket. Figure 2-21 shows this board plugged into the MCP6XXX Amplifier Evaluation Board 2.

**Note:** Insert the interconnect strips into the DIP-8 socket on the MCP6XXX Amplifier Evaluation Board 2. Place the SOIC8EV board on the top of the interconnect strips with the same pin orientation. Now solder the strips to the top board; this procedure ensures correct alignment of the strips. Clip the pins flush with the top surface of the SOIC8EV board, then solder the SOIC-8 op amp on the top.

# MCP6XXX Amplifier Evaluation Board 2 User's Guide



**FIGURE 2-20:** Op Amp in SOIC-8 package soldered to a separate board.



**FIGURE 2-21:** Connecting Adaptor Board onto MCP6XXX Amplifier Evaluation Board 2.



# MCP6XXX AMPLIFIER EVALUATION BOARD 2 USER'S GUIDE

---

---

## Appendix A. Schematic and Layouts

---

---

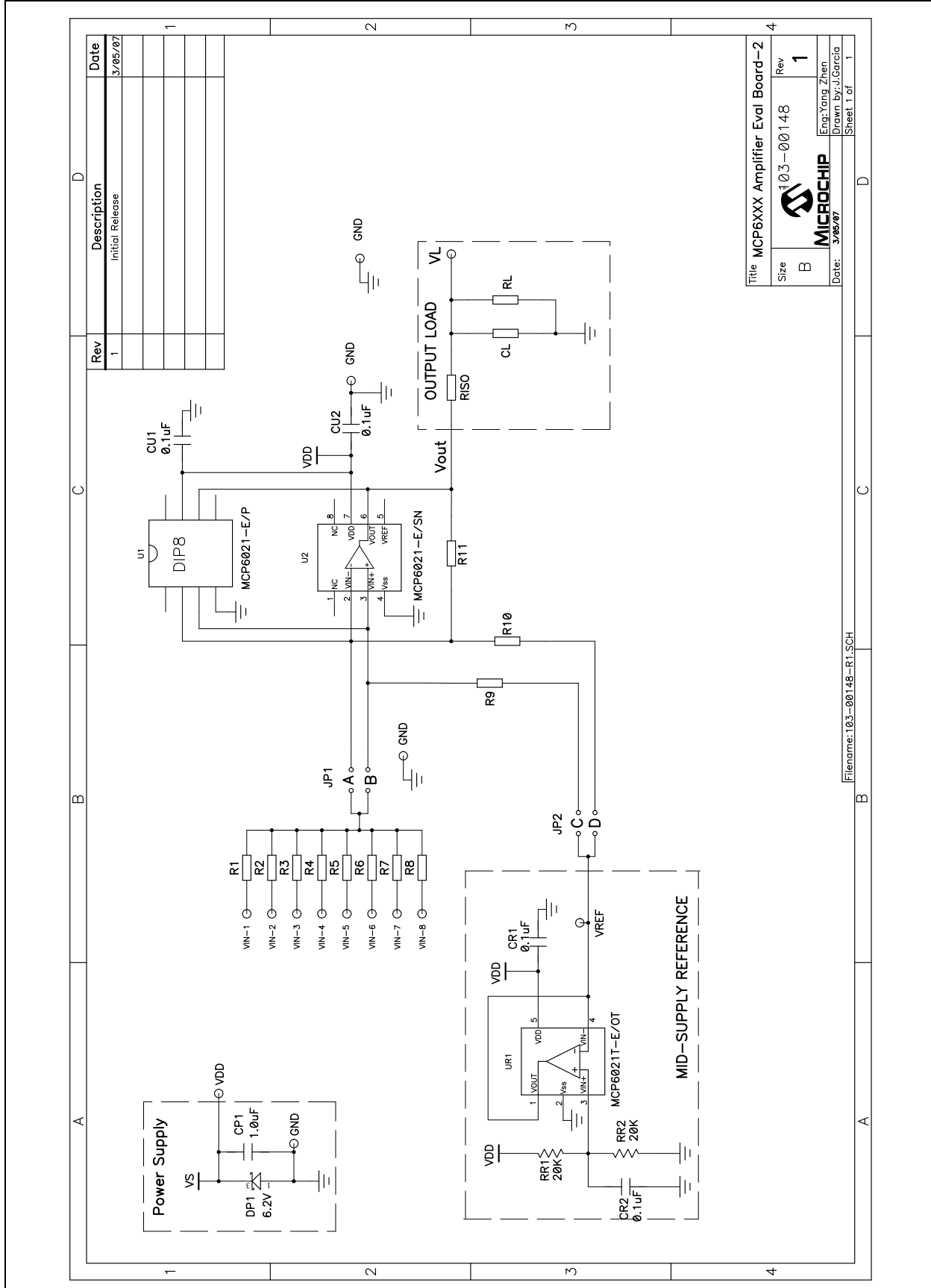
### A.1 INTRODUCTION

This appendix contains the following schematics and layouts for the MCP6XXX Amplifier Evaluation Board 2:

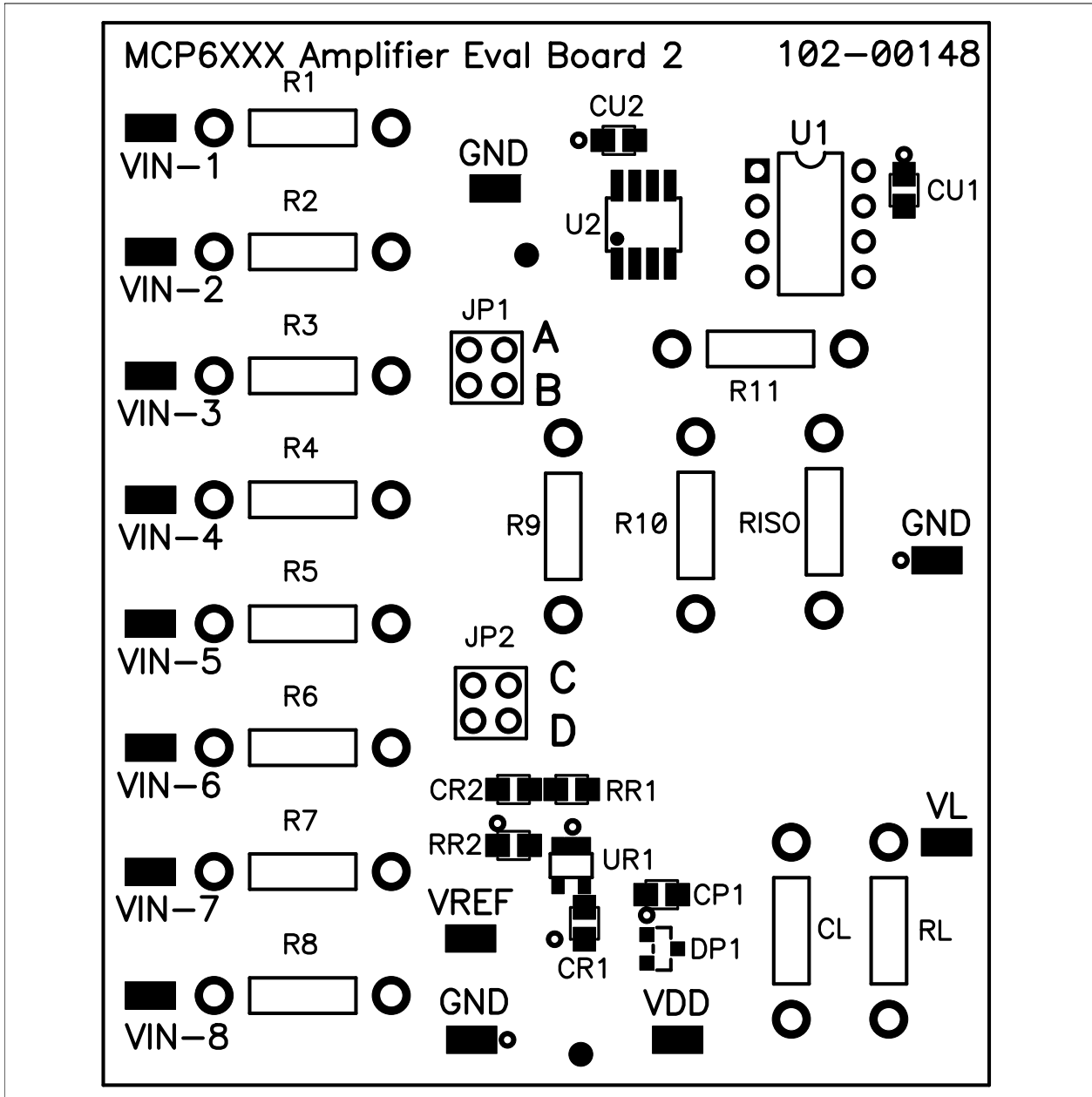
- Board – Schematic
- Board – Top Silk Layer
- Board – Top Metal Layer
- Board – Bottom Metal Layer

# MCP6XXX Amplifier Evaluation Board 2 User's Guide

## A.2 BOARD - SCHEMATIC



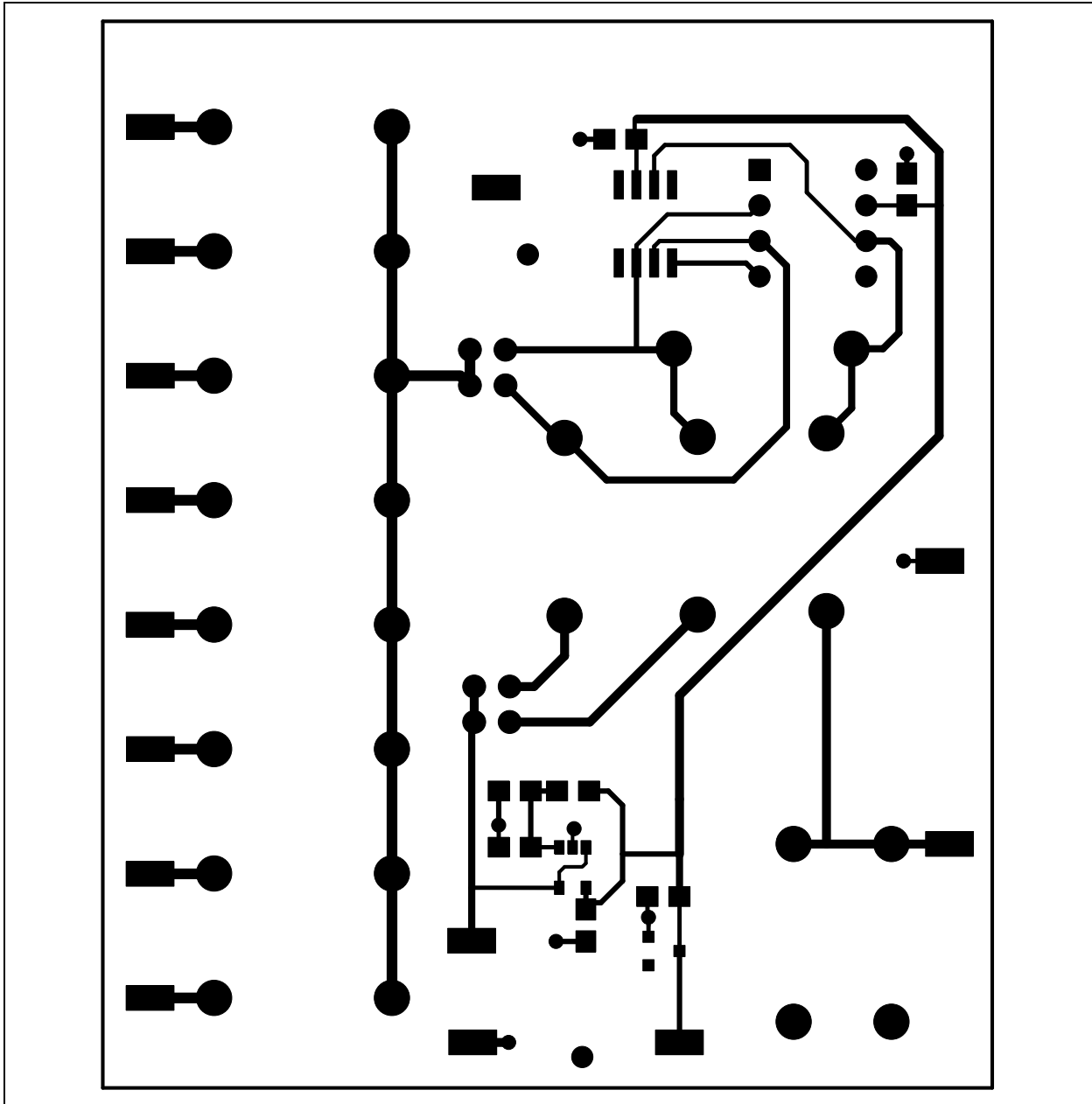
## A.3 BOARD - TOP SILK LAYER



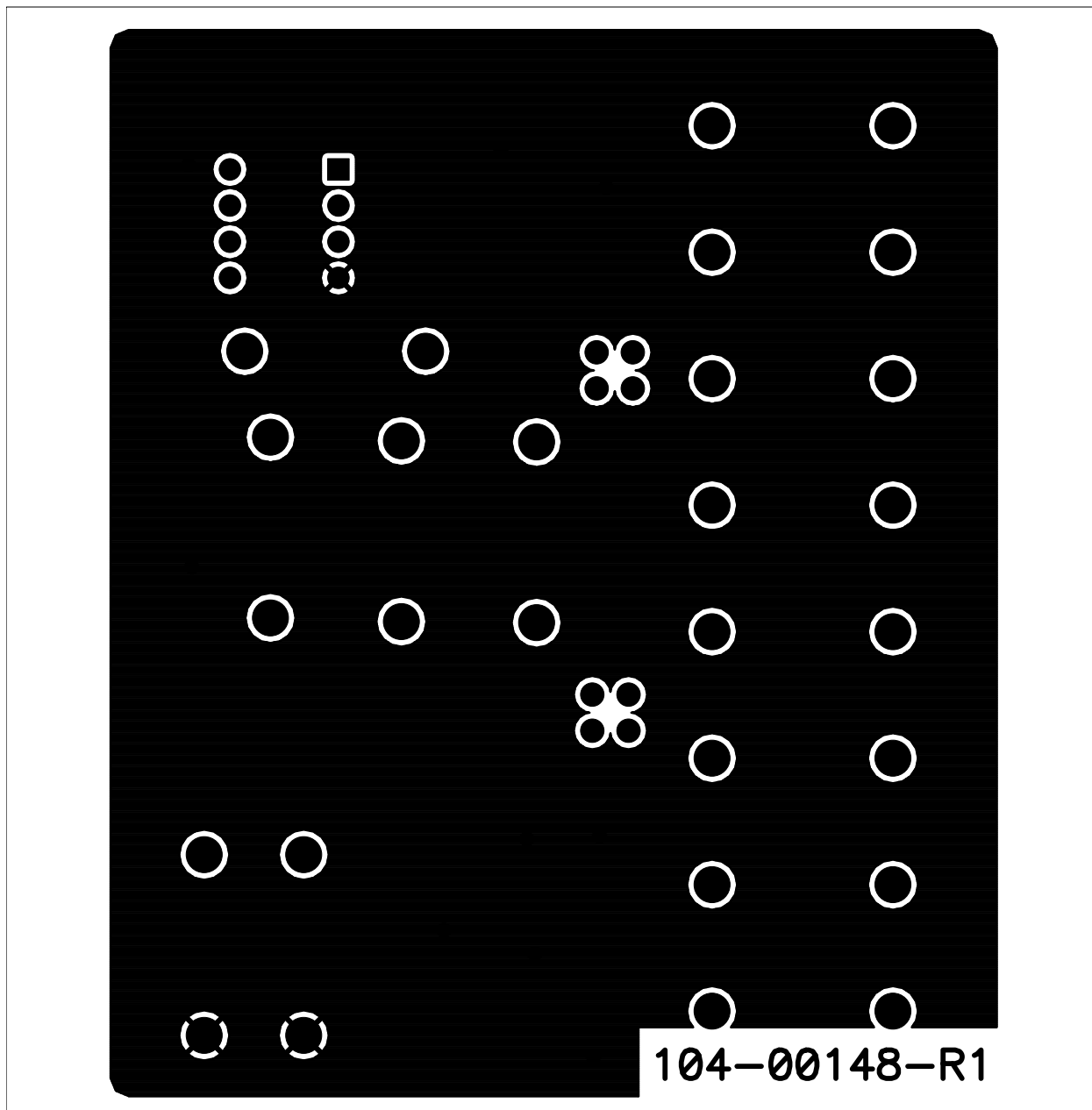
# MCP6XXX Amplifier Evaluation Board 2 User's Guide

---

## A.4 BOARD - TOP METAL LAYER



## A.5 BOARD - BOTTOM METAL LAYER



# MCP6XXX Amplifier Evaluation Board 2 User's Guide

---

---

NOTES:



**Appendix B. Bill of Materials (BOM)**

**B.1 MCP6XXX AMPLIFIER EVALUATION BOARD 2 BOM**

The Bill of Materials (BOM) in Table B-1 corresponds to Figure 2-1 and Figure 2-2. Unpopulated parts are in Table B-2.

**TABLE B-1: BILL OF MATERIALS (102-00148R1) (NOTE 1)**

Qty	Reference	Description	Manufacturer	Part Number
1	CP1	Capacitor Ceramic 1 $\mu$ F 10% 25V X5R 0805	Panasonic <sup>®</sup> - ECG	ECJ-2FB1E105K
4	CR1, CR2, CU1, CU2	Capacitor Ceramic 0.1 $\mu$ F 10% 25V X7R 0805	Panasonic- ECG	ECJ-2VB1E104K
1	DP1	Zener Diode, 6.2V 350mW SOT-23	Fairchild Semiconductor <sup>®</sup>	BZX84C6V2
4	Ea Corner	Bumper clear 0.375X 15" Dome	Richco Plastic Co	RBS-12
2	J1, J2	Connector Header Breakaway 0.100 04POS STR	AMP <sup>®</sup> /Tyco <sup>®</sup> Electronics	9-146258-0-02
1	PCB	RoHS Compliant Bare PCB, MCP6XXX Amplifier Evaluation Board 2	—	104-00148
28	Pin Sockets	Pin Recpt, 0.015/.025 dia., 0667 SER	Mill-Max <sup>®</sup>	0667-0-15-01-30-27-10-0
2	RR1, RR2	Resistor 20.0 k $\Omega$ , 1/8W, 1%, 0805 SMD	Panasonic- ECG	ERJ-6ENF2002V
2	Shunts for J1, J2	Socket, Short Blks w/Tab Blk	Jameco, Valuepro	2012JH-R
14	Test Points	PC Test Point, Compact, Surface Mount	Keystone Electronics <sup>®</sup>	5016
1	UR1	MCP6021 SOT-23-5, Single Op Amp	Microchip Technology Inc	MCP6021T-E/OT
1	U1	IC Socket, 8-position DIP, Tin	AMP/Tyco Electronics	2-641260-1

**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.

# MCP6XXX Amplifier Evaluation Board 2 User's Guide

**TABLE B-2: BILL OF MATERIALS – UNPOPULATED PARTS (102-00148R1)**

Qty	Reference	Description	Manufacturer	Part Number
1	U1	MCP6021, PDIP-8, Single Op Amp	Microchip Technology Inc	MCP6021-E/P
1	U2	MCP6021, SOIC-8, Single Op Amp	Microchip Technology Inc	MCP6021-E/SN
15	R1-R7, RISO, RL C1-C5, CL	Not populated when shipped to customer	—	—

**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.

The BOM in Table B-3 corresponds to the collection of resistors, capacitors, jumpers and MCP6021 op amps that come in the Accessory Bag which is shipped in the MCP6XXX Amplifier Evaluation Board 2 Kit. These components are placed in an separate ESD bag. They support the circuit in **Section 2.4.1 “Building the Amplifier”**. Customers need to provide the resistors and capacitors for more amplifier circuits.

**TABLE B-3: BILL OF MATERIALS – ACCESSORY BAG PARTS (102-00148R1)**

Qty	Reference	Description	Manufacturer	Part Number
1	Accessory Bag	CAP CER 56PF 50V C0G RADIAL	Murata Electronics	RPE5C1H560J2P1Z03B
1	Accessory Bag	JUMPER ZERO OHM 1/8W	Yageo Corporation	ZOR-12-B-52
1	Accessory Bag	RES 2.00K OHM 1/4W 1% METAL FILM	Yageo Corporation	MFR-25FBB-2K00
5	Accessory Bag	RES 7.87K OHM 1/4W 1% METAL FILM	Yageo Corporation	MFR-25FBB-7K87
1	ESD Sample Box	MCP6021, Single Op Amp, PDIP-8	Microchip Technology Inc.	MCP6021-E/P

**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.

NOTES:



---

---

## 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://support.microchip.com>  
Web Address:  
[www.microchip.com](http://www.microchip.com)

#### Atlanta

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

#### 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

Farmington Hills, MI  
Tel: 248-538-2250  
Fax: 248-538-2260

#### Kokomo

Kokomo, IN  
Tel: 765-864-8360  
Fax: 765-864-8387

#### Los Angeles

Mission Viejo, CA  
Tel: 949-462-9523  
Fax: 949-462-9608

#### Santa Clara

Santa Clara, CA  
Tel: 408-961-6444  
Fax: 408-961-6445

#### Toronto

Mississauga, Ontario,  
Canada  
Tel: 905-673-0699  
Fax: 905-673-6509

### ASIA/PACIFIC

#### Asia Pacific Office

Suites 3707-14, 37th Floor  
Tower 6, The Gateway  
Harbour City, Kowloon  
Hong Kong  
Tel: 852-2401-1200  
Fax: 852-2401-3431

#### Australia - Sydney

Tel: 61-2-9868-6733  
Fax: 61-2-9868-6755

#### China - Beijing

Tel: 86-10-8528-2100  
Fax: 86-10-8528-2104

#### China - Chengdu

Tel: 86-28-8665-5511  
Fax: 86-28-8665-7889

#### China - Fuzhou

Tel: 86-591-8750-3506  
Fax: 86-591-8750-3521

#### China - Hong Kong SAR

Tel: 852-2401-1200  
Fax: 852-2401-3431

#### China - Qingdao

Tel: 86-532-8502-7355  
Fax: 86-532-8502-7205

#### China - Shanghai

Tel: 86-21-5407-5533  
Fax: 86-21-5407-5066

#### China - Shenyang

Tel: 86-24-2334-2829  
Fax: 86-24-2334-2393

#### China - Shenzhen

Tel: 86-755-8203-2660  
Fax: 86-755-8203-1760

#### China - Shunde

Tel: 86-757-2839-5507  
Fax: 86-757-2839-5571

#### China - Wuhan

Tel: 86-27-5980-5300  
Fax: 86-27-5980-5118

#### China - Xian

Tel: 86-29-8833-7252  
Fax: 86-29-8833-7256

### ASIA/PACIFIC

#### India - Bangalore

Tel: 91-80-4182-8400  
Fax: 91-80-4182-8422

#### India - New Delhi

Tel: 91-11-4160-8631  
Fax: 91-11-4160-8632

#### India - Pune

Tel: 91-20-2566-1512  
Fax: 91-20-2566-1513

#### Japan - Yokohama

Tel: 81-45-471-6166  
Fax: 81-45-471-6122

#### Korea - Daegu

Tel: 82-53-744-4301  
Fax: 82-53-744-4302

#### Korea - Seoul

Tel: 82-2-554-7200  
Fax: 82-2-558-5932 or  
82-2-558-5934

#### Malaysia - Penang

Tel: 60-4-646-8870  
Fax: 60-4-646-5086

#### Philippines - Manila

Tel: 63-2-634-9065  
Fax: 63-2-634-9069

#### Singapore

Tel: 65-6334-8870  
Fax: 65-6334-8850

#### Taiwan - Hsin Chu

Tel: 886-3-572-9526  
Fax: 886-3-572-6459

#### Taiwan - Kaohsiung

Tel: 886-7-536-4818  
Fax: 886-7-536-4803

#### Taiwan - Taipei

Tel: 886-2-2500-6610  
Fax: 886-2-2508-0102

#### Thailand - Bangkok

Tel: 66-2-694-1351  
Fax: 66-2-694-1350

### EUROPE

#### Austria - Wels

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

#### Denmark - Copenhagen

Tel: 45-4450-2828  
Fax: 45-4485-2829

#### France - Paris

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

#### Germany - Munich

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

#### Italy - Milan

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

#### Netherlands - Drunen

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

#### Spain - Madrid

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

#### UK - Wokingham

Tel: 44-118-921-5869  
Fax: 44-118-921-5820

06/25/07