MCP661 Line Driver Demo Board User's Guide

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MCP661 LINE DRIVER DEMO BOARD USER'S GUIDE

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MCP661 LINE DRIVER DEMO BOARD 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) 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 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 MCP661 Line Driver Demo Board. 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 MCP661 Line Driver Demo Board. The manual layout is as follows:

- **Chapter 1. "Product Overview"** - Important information about the MCP661 Line Driver Demo Board.
- **Chapter 2. "Installation and Operation"** – Covers the initial set-up of the MCP661 Line Driver Demo Board. It lists the required tools, shows how to set up the board and how to connect lab equipment. It then demonstrates how to use this board.
- **Appendix A. "Schematics and Layouts"** – Shows the schematic and board layouts for the MCP661 Line Driver Demo Board.
- **Appendix B. "Bill Of Materials (BOM)"** – Lists the parts used to populate the MCP661 Line Driver Demo Board. Also lists alternate components.

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 MCP661 Line Driver Demo Board. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

MCP661/2/3/5 Data Sheet, *"60 MHz, 6 mA Op Amps"*, (DS22194)

Gives detailed information on the op amp family that is used as the DUT on the MCP661 Line Driver Demo Board.

THE MICROCHIP WEB SITE

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

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Technical support is available through the web site at: http://support.microchip.com

DOCUMENT REVISION HISTORY

Revision A (November 2009)

- Initial Release of this Document.

NOTES:

Chapter 1. Product Overview

1.1 INTRODUCTION

The MCP661 Line Driver Demo Board is described by the following:

- Assembly # : 114-00270-R1
- Order # : MCP661DM-LD
- Name: MCP661 Line Driver Demo Board

Items discussed in this chapter include:

- Kit Contents
- Intended Use
- Description

1.2 KIT CONTENTS

- Assembled printed circuit board, 102-00270
- Important Information "Read First"

FIGURE 1-1: *MCP661 Line Driver Demo Board Kit Contents.*

1.3 INTENDED USE

The MCP661 Line Driver Demo Board shows the MCP661 used in a very basic application for high speed op amps; a 50Ω line (coax) driver. It gives:

- A 30 MHz solution
- High speed PCB layout techniques
- A means to test AC response, step response and distortion

The application circuit implemented on this PCB is discussed briefly in the MCP661/2/3/5 data sheet's application circuit section.

1.4 DESCRIPTION

1.4.1 Simplified Circuit

Figure 1-2 shows a simplified circuit diagram of the MCP661 Line Driver Demo Board. Details of the power supply and connectors have been left out.

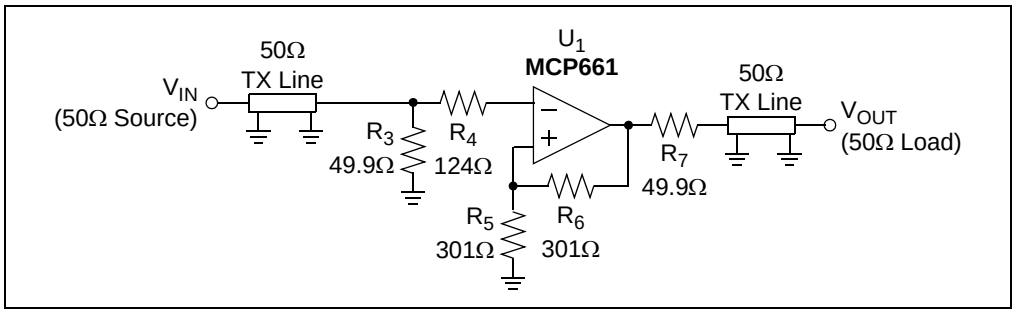


FIGURE 1-2: *Simplified Circuit Diagram.*

The 50Ω source drives the matched 50Ω transmission line at the input; R_3 provides this match. Thus, the input transmission line can be treated as a simple connection for circuit analysis (ignoring the time delay).

R_4 provides matched input resistances for U_1's inputs. It also set a pole around 100 MHz, since U_1's C_{CM} is about 9 pF.

U_1 (MCP661) is set at a gain of 2 V/V so that the overall gain is 1 V/V (R_7 and the Load attenuate the signal by 0.5 V/V). U_1's large output current makes it possible to drive the back-matched output transmission line (R_7, the 50Ω line and the 50Ω load at the far end) to more than ±2V (the load at the far end sees ±1V).

U_1's output headroom limits would be V_{OL} = -2.3V and V_{OH} = +2.3V, leaving some design room for the ±2V signal. The open-loop gain (A_{OL}) typically does not decrease significantly with a 100Ω load. The maximum power dissipated by the op amp is about 48 mW, so the temperature rise (for the MCP661 in the SOIC-8 package) is under 8°C.

The output transmision line can be treated as a simple connection for circuit analysis (ignoring the time delay).

1.4.2 Power Supply

Figure 1-3 shows the power supply circuitry. R_1 and R_2 provide high frequency isolation of the supply lines. They also help with series resonances in the supplies. C_1 and C_2 provide the bulk bypassing, while C_3 and C_4 provide the local bypassing, for U_1 (MCP661).

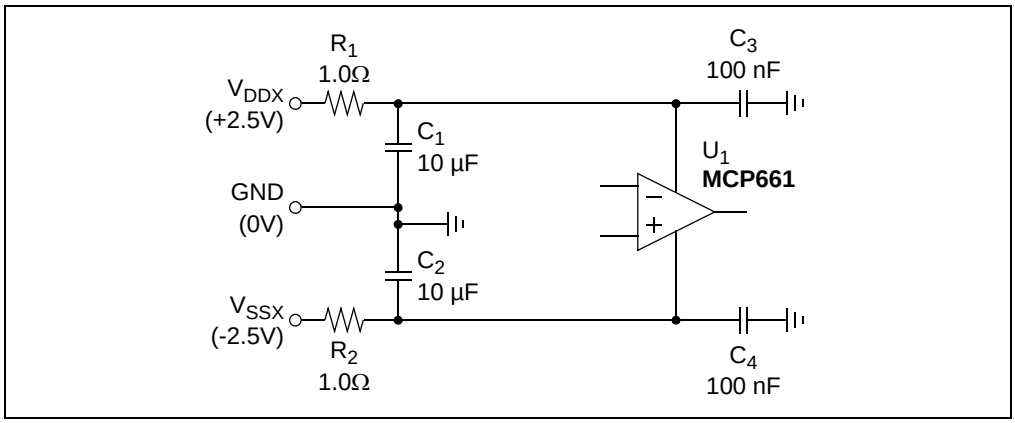


FIGURE 1-3: *Power Supply.*

1.4.3 Connectors and Transmission Lines

The power supplies use surface mount test points to connect to the lab supplies. The signal input and output are connected via BNC recepticles (and coax cables) to 50Ω lab equipment.

The PCB has two 50Ω transmission lines between the BNC recepticles and the matching resistors (R_3 and R_7 in Figure 1-2). They are 100 mils (2.54 mm) wide, which is a value commonly used for standard FR4 PCBs with only two layers. These lines are as long as possible; they end at the matching resistors (to avoid parasitic capacitance issues).

NOTES:

Chapter 2. Installation and Operation

2.1 INTRODUCTION

This chapter shows how to set up and operate the MCP661 Line Driver Demo Board. Items discussed in this chapter include:

- Required Tools
- Configuring the Lab Equipment and PCB

2.2 REQUIRED TOOLS

- Lab Power Supply with dual outputs (one tracks the other):
  - For +2.5V, 0V and -2.5V
- Sine Wave Source (function generator, network analyzer, spectrum analyzer, etc):
  - Sine wave output to 100 MHz, or so
  - 50Ω output impedance
  - -2.5V to +2.5V minimum range
- Signal Analyzer (oscilloscope, network analyzer, spectrum analyzer, etc):
  - 50Ω input impedance
  - At least 100 MHz bandwidth

2.3 CONFIGURING THE LAB EQUIPMENT AND PCB

Lab equipment is connected to this board as shown in Figure 2-1. The BNC recepticles and (surface mount) test points allow lab equipment to be connected to these boards.

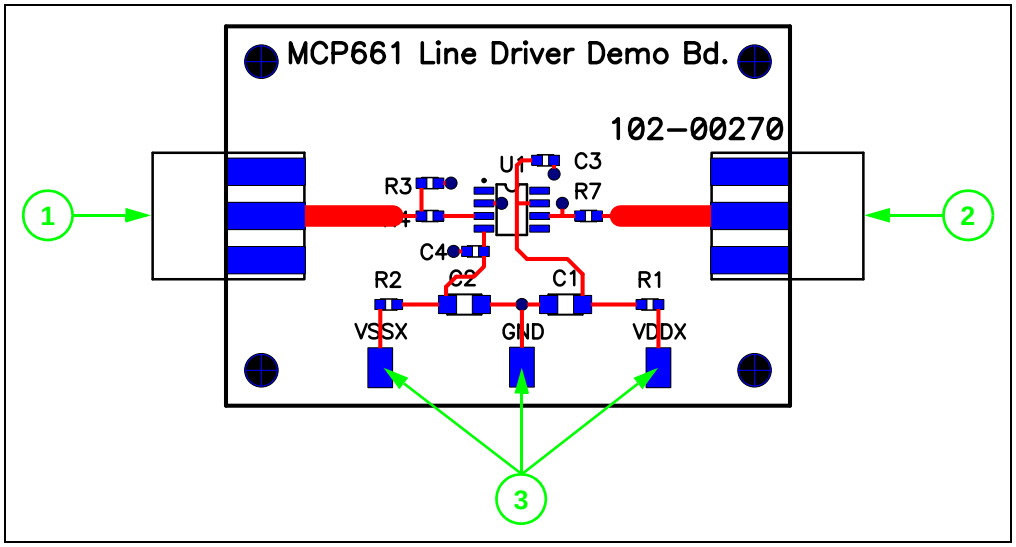


FIGURE 2-1: *Lab Equipment Connections.*

The arrows and numbers in the drawing signify the following:

1. BNC Recepticle for V_{IN}.
2. BNC Recepticle for V_{OUT}.
3. ±2.5V Power Supplies, with GND, for U1 (MCP661).
   a) VDDX = +2.5V.
   b) GND = 0V.
   c) VSSX = -2.5V.

Appendix A. Schematics and Layouts

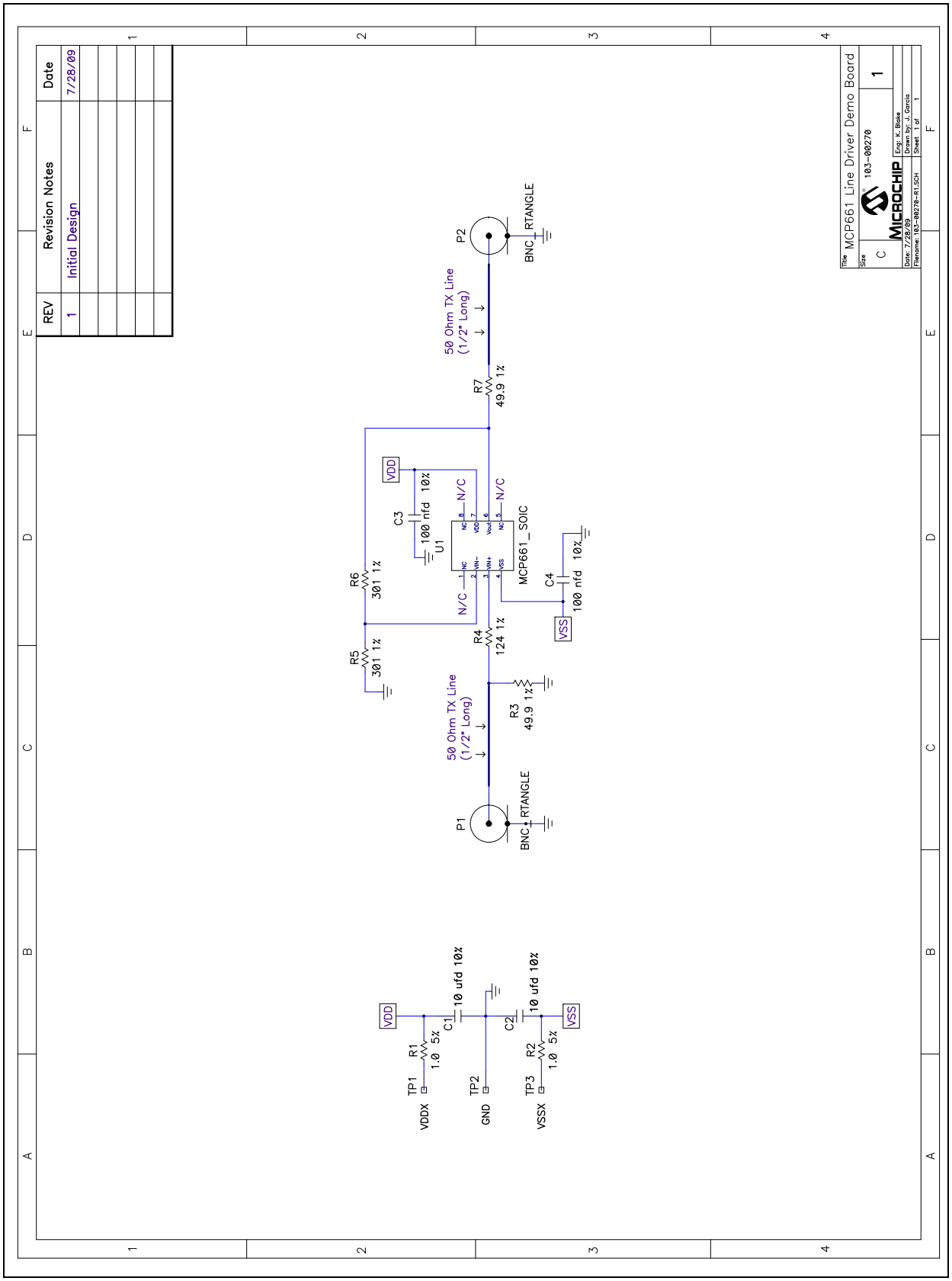
A.1 INTRODUCTION

This appendix contains the schematic and layouts for the MCP661 Line Driver Demo Board.

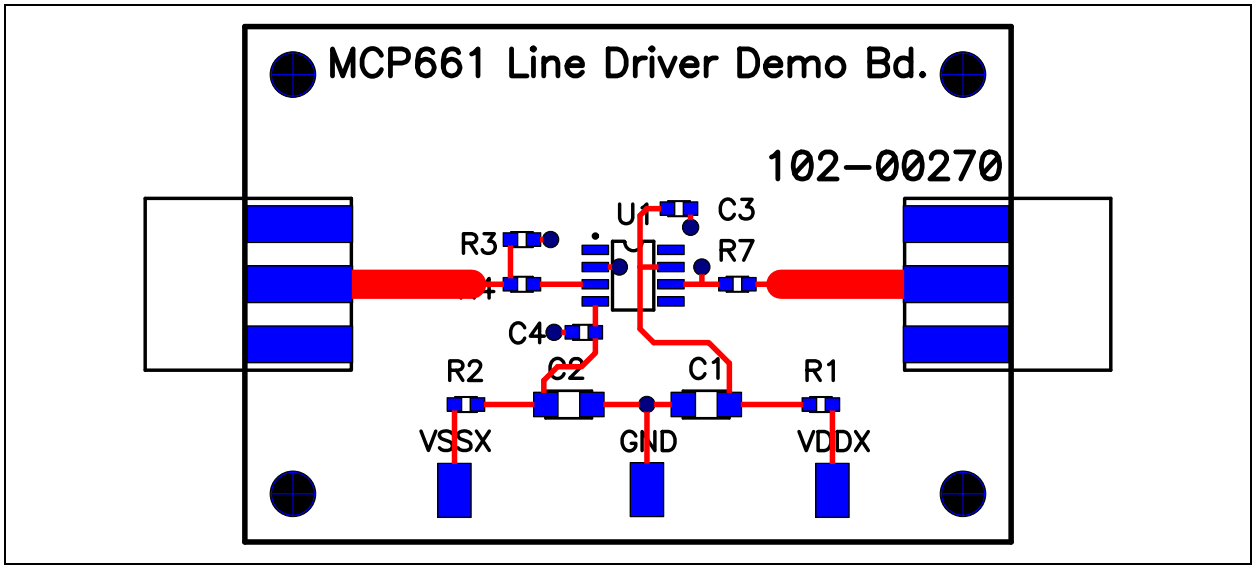
- Board – Schematic
- Board – Top Silk Screen, Top Solder Mask and Top Metal
- Board – Top Silk Screen and Top Solder Mask
- Board – Bottom Metal (Top View)
- Board – Bottom Metal (Bottom View)

The Gerber files for this board are available on the Microchip website (www.microchip.com) and are contained in the zip file "`00270R1_Gerbers.zip`".

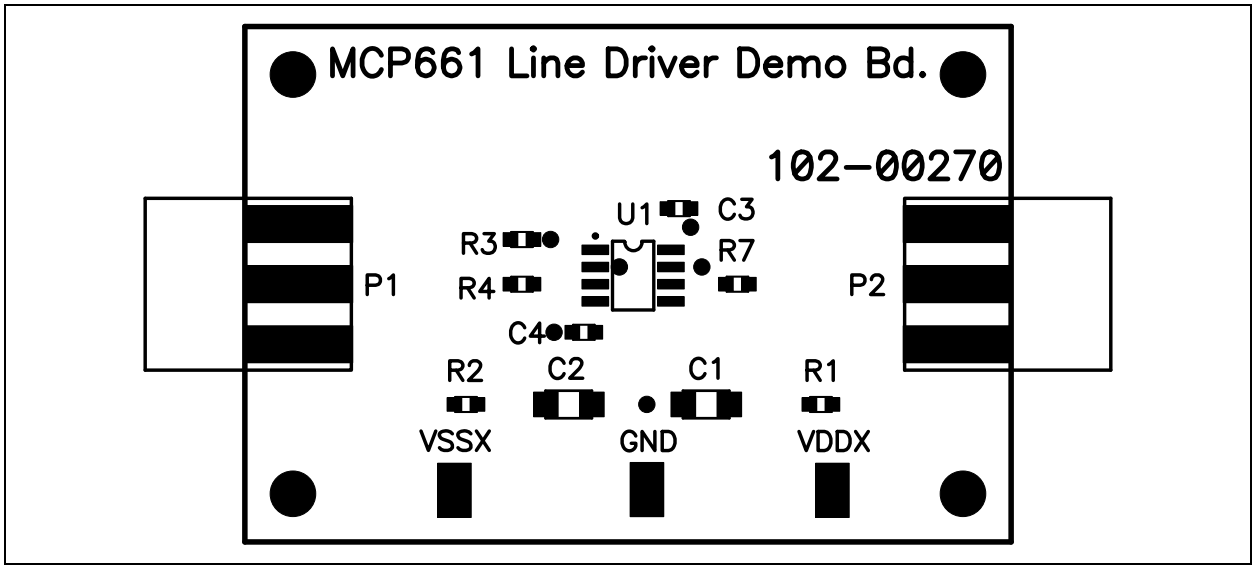
A.2 BOARD – SCHEMATIC



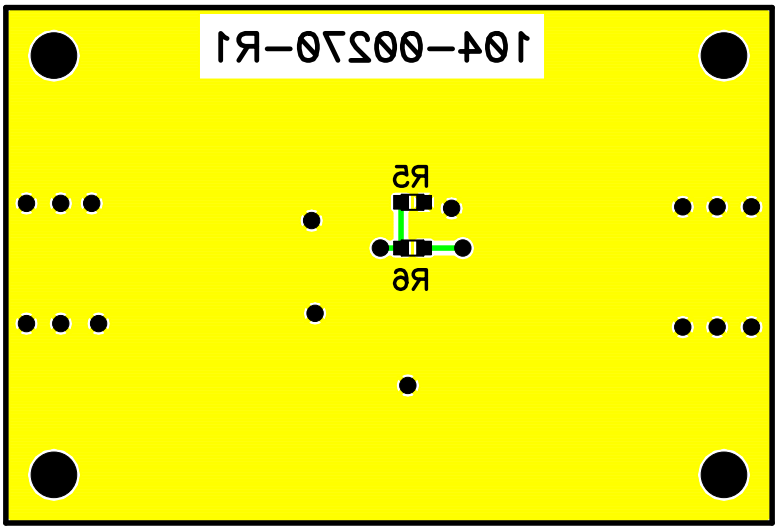
A.3 BOARD – TOP SILK SCREEN, TOP SOLDER MASK AND TOP METAL



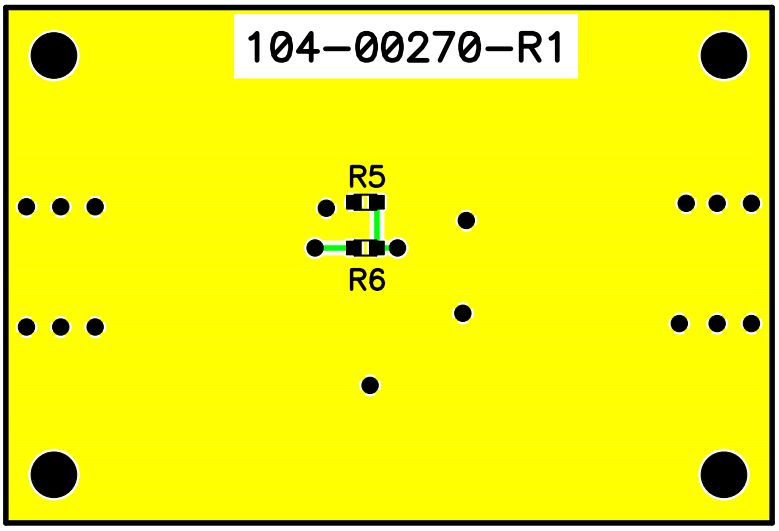
A.4 BOARD – TOP SILK SCREEN AND TOP SOLDER MASK



A.5 BOARD – BOTTOM METAL LAYER (TOP VIEW)



A.6 BOARD – BOTTOM METAL LAYER (BOTTOM VIEW)



Appendix B. Bill Of Materials (BOM)

B.1 MCP661 LINE DRIVER DEMO BOARD BOM

The BOM in Table B-1 shows all of the components assembled on the PCB. Table B-2 shows alternate components that can be placed on this PCB (after modification).

TABLE B-1: BILL OF MATERIALS FOR ASSEMBLED PCB

Qty.	Reference Designator	Description	Manufacturer	Part Number
2	C3, C4	100 nF, 0603 SMD, X7R, 16V, 10%	Panasonic®-ECG	ECJ-1VB1C104K
2	C1, C2	10 µF, 1206 SMD, X7R, 16V, 10%	Panasonic-ECG	ECJ-3YX1C106K
2	P1, P2	BNC Recepticle, 50Ω, Top Mount **(1)**	Amphenol	031-5329-52RFX
2	R3, R7	49.9Ω, 0603 SMD, 1%, 1/10W	Yageo®	RC0603FR-0749R9L
1	R4	124Ω, 0603 SMD, 1%, 1/10W	Yageo	RC0603FR-07124RL
2	R5, R6	301Ω, 0603 SMD, 1%, 1/10W	Yageo	RC0603FR-07301RL
2	R1, R2	1.0Ω, 0603 SMD, 5%, 1/10W	Yageo	RC0603JR-071RL
3	TP1 – TP3	SMD, Test Point	Keystone Electronics®	5016
1	U1	MCP661, SOIC-8, Single Op Amp	Microchip Technology Inc.	MCP661-E/SN
1	PCB	2 layer PCB (2.23 in × 1.50 in)	Microchip Technology Inc.	102-00270
4	(for PCB mounting)	Hemispherical Bumpon Standoff, 0.44 in × 0.20 in	3M	SJ-5003 (BLACK)

Note 1: These are mounted on the side to reduce strain on the cables in the lab.

2: 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.

TABLE B-2: BILL OF MATERIALS FOR ALTERNATE COMPONENTS

Qty.	Reference Designator	Description	Manufacturer	Part Number
0	(for PCB mounting)	Stand-off, Hex, 0.500", 4 × 40 Thread, Nylon, 0.285" max. O.D.	Keystone Electronics	1902C
0	(for PCB mounting)	Machine Screw, Phillips, 4 × 40 Thread, 1/4" long, Nylon	Building Fasteners	NY PMS 440 0025 PH

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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