MCP1603 Buck Converter Evaluation Board User's Guide

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MCP1603 BUCK CONVERTER EVALUATION BOARD USER'S GUIDE

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MCP1603 BUCK CONVERTER EVALUATION BOARD USER'S GUIDE

Preface

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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 MCP1603 Buck Converter Evaluation 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 MCP1603 Buck Converter Evaluation Board as a development tool to evaluate the MCP1603. The manual layout is as follows:

- **Chapter 1. "Product Overview"** – Important information about the MCP1603 Buck Converter Evaluation Board.
- **Chapter 2. "Installation and Operation"** – Includes instructions on how to get started with this user's guide and a description of the user's guide.
- **Appendix A. "Schematic and Layouts"** – Shows the schematic and layout diagrams for the MCP1603 Buck Converter Evaluation Board.
- **Appendix B. "Bill Of Materials (BOM)"** – Lists the parts used to build the MCP1603 Buck Converter Evaluation Board.

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 MCP1603 Buck Converter Evaluation Board. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

MCP1603 Data Sheet, *"2.0 MHz, 500 mA Synchronous Buck Regulator"* (DS22042)

This data sheet provides detailed information regarding the MCP1603 Buck Regulator product.

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

DOCUMENT REVISION HISTORY

Revision A (May 2007)

- Initial Release of this Document.

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Chapter 1. Product Overview

1.1 INTRODUCTION

Step-down converter choices include a variety of linear and switching regulators. The MCP1603 500 mA synchronous buck regulator provides a low profile, cost effective, and efficient solution for devices like cellular telephones, USB-powered devices and hand held instruments. The device provides a solution with minimal board space because of the high-frequency operation, which reduces the size requirements of the external inductor and capacitor and the 1 mm maximum height TSOT package.

The MCP1603 switches at a fixed frequency of 2.0 MHz when operating at a heavy load. This provides a low-noise, small size solution. When operating at light loads, the MCP1603 changes operation to a pulse frequency modulation (PFM) mode to minimize quiescent current drawn from the input source. No intervention is necessary for smooth transition from one mode to another.

This chapter covers the following topics.

- "What is the MCP1603 Buck Converter Evaluation Board?"
- "What the MCP1603 Buck Converter Evaluation Board Kit includes."

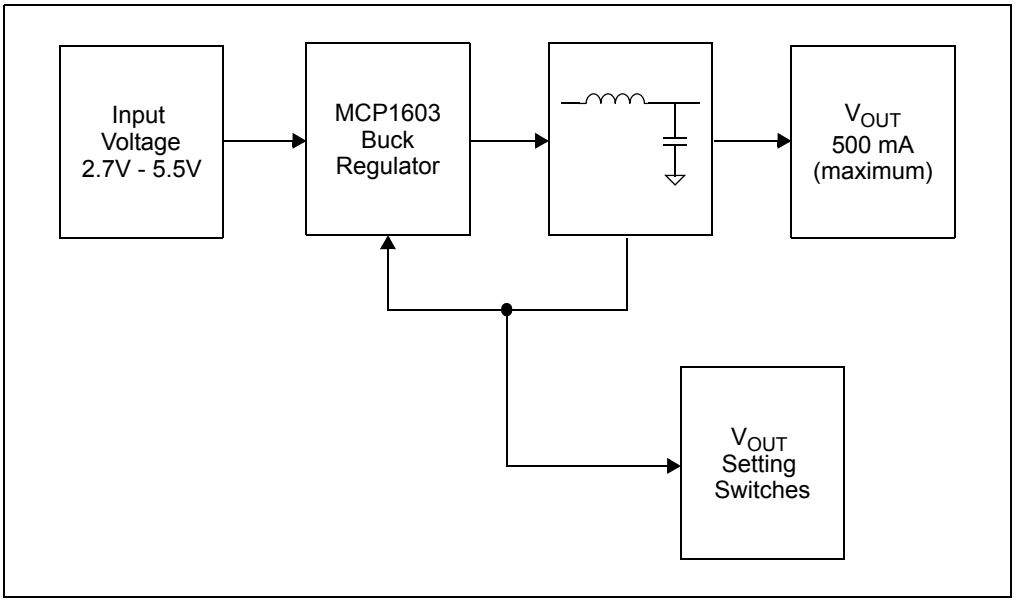

FIGURE 1-1: *MCP1603 Buck Converter Evaluation Board Block Diagram.*

1.2 WHAT IS THE MCP1603 BUCK CONVERTER EVALUATION BOARD?

The MCP1603 Buck Converter Evaluation Board demonstrates the use of Microchip's MCP1603 device in a step-down application. The evaluation board is a fully functional platform to evaluate the MCP1603 buck regulator over the input voltage, output voltage and current range of the device.

Test points are provided to allow easy connection of the input voltage source and the output load.

1.3 WHAT THE MCP1603 BUCK CONVERTER EVALUATION BOARD KIT INCLUDES

This MCP1603 Buck Converter Evaluation Board kit includes:

- MCP1603 Buck Converter Evaluation Board (102-00133)
- Analog and Interface Products Demonstration Boards CD-ROM (DS21912)
  - MCP1603 Buck Converter Evaluation Board User's Guide (DS51652)

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Chapter 2. Installation and Operation

2.1 INTRODUCTION

The MCP1603 Buck Converter Evaluation Board is designed to demonstrate Microchip's MCP1603 in an adjustable output voltage configuration. The MCP1603 is a 500 mA synchronous buck regulator that features both Pulse Frequency Modulation (PFM) and Pulse Width Modulation (PWM). The PFM mode is used at light loads to improve system efficiency while the 2.0 MHz PWM mode is entered at heavy loads. The transition between PFM and PWM modes automatically occurs without any external intervention. The MCP1603 is available in both adjustable parts that require an external divider to set the output voltage and fixed output voltage parts.

The high switching speed and TSOT package (1 mm maximum height) make the MCP1603 ideal for space constrained applications that require an efficient stepped down voltage.

2.2 FEATURES

The MCP1603 Buck Converter Evaluation Board has the following features:

- Compact size and low profile 500 mA converter design.
- Wide Input voltage range from 2.7V to 5.5V.
- Five different output voltage settings: 0.8V, 1.2V, 1.8V, 2.5V, and 3.3V.
- Test points for connecting input voltage source and external load.

2.3 GETTING STARTED

The MCP1603 Buck Converter Evaluation Board is fully assembled and tested for evaluating the MCP1603 device. The board requires the use of an external input voltage source of 2.7V to 5.5V and an external load capable of 500 mA.

2.3.1 Power Input and Output Connection

2.3.1.1 POWERING THE MCP1603 BUCK CONVERTER EVALUATION BOARD

1. Connect the positive side of the input source (+) to TP1 (VIN).
2. Connect the negative or return side (-) of input source to TP2 (GND). Refer to Figure 2-1. The input voltage should be limited from 2.7V to 5.5V range.

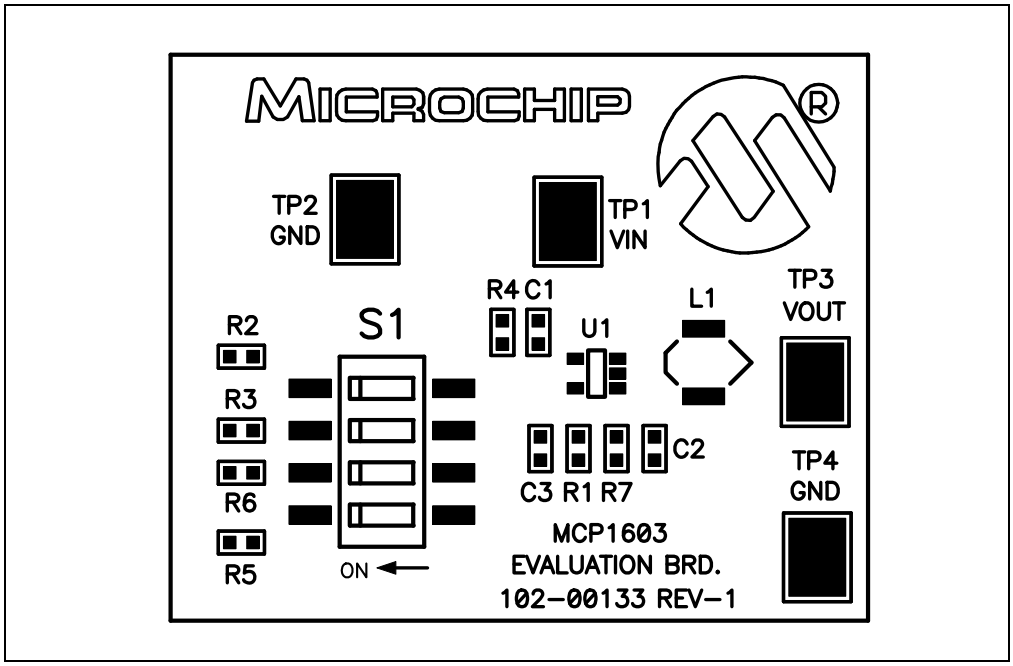

FIGURE 2-1: *Setup Configuration Diagram.*

2.3.1.2 APPLYING LOAD TO MCP1603 BUCK CONVERTER EVALUATION BOARD

1. Connect the positive side of the load (+) to TP3 (VOUT).
2. Connect the negative side of the load (-) to TP4 (GND). Refer to Figure 2-1. The maximum load current should not exceed 500 mA.

As an alternative, a resistor can be connected between TP3 and TP4. The value of this resistor must be sized such that the maximum load current does not exceed 500 mA for the selected output voltage.

2.3.1.3 SETTING THE OUTPUT VOLTAGE ON THE MCP1603 BUCK CONVERTER EVALUATION BOARD

The output voltage of the MCP1603 Buck Converter Evaluation Board is set by the position of switch S1 locations. Table 2-1 shows the position of the four S1 switch locations to achieve the five different standard output voltages.

TABLE 2-1: SETTING THE OUTPUT VOLTAGE

Output Voltage	S1 - POS1	S1 - POS2	S1 - POS3	S1 - POS4
0.8V	Off	Off	Off	Off
1.2V	Off	Off	Off	On
1.8V	Off	Off	On	Off
2.5V	Off	On	Off	Off
3.3V	On	Off	Off	Off

Evaluating the Application

The best way to evaluate the MCP1603 Buck Converter Evaluation Board is to dig into the circuit. Measure voltages and currents with a DVM and probe the board with an oscilloscope.

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Appendix A. Schematic and Layouts

A.1 INTRODUCTION

This appendix contains the following schematics and layouts for the MCP1603 Buck Converter Evaluation Board:

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

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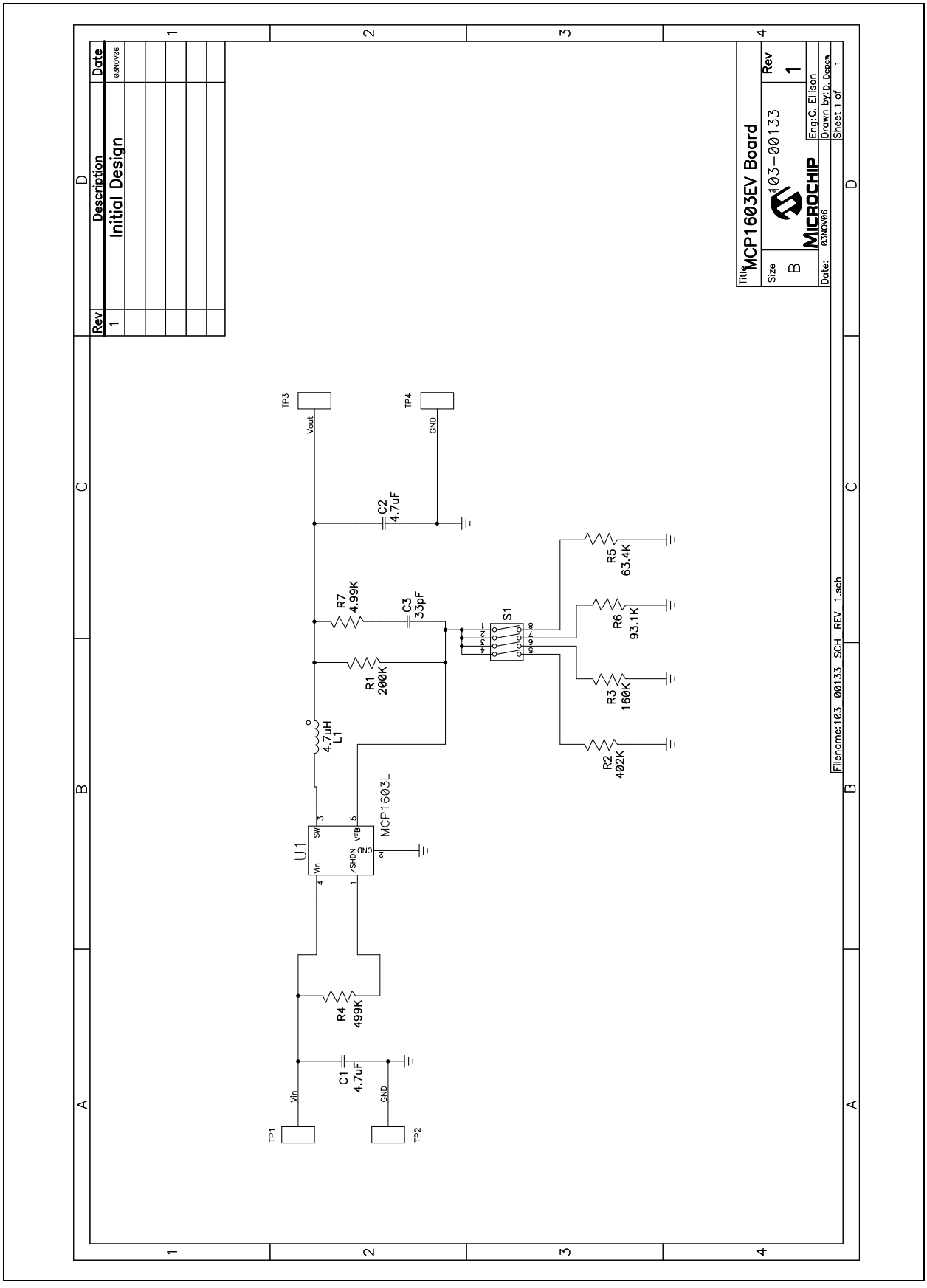
A.2 BOARD - SCHEMATIC



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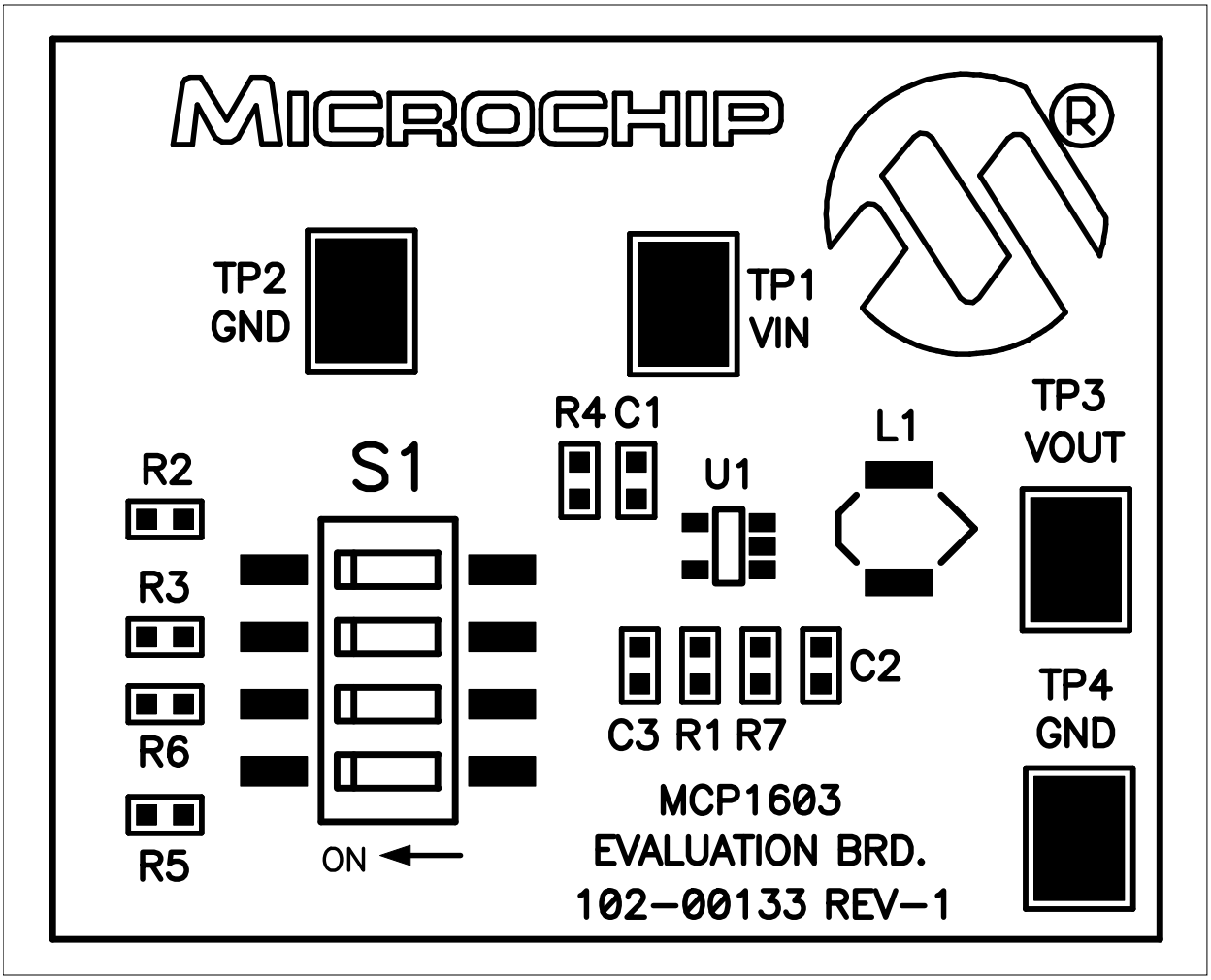
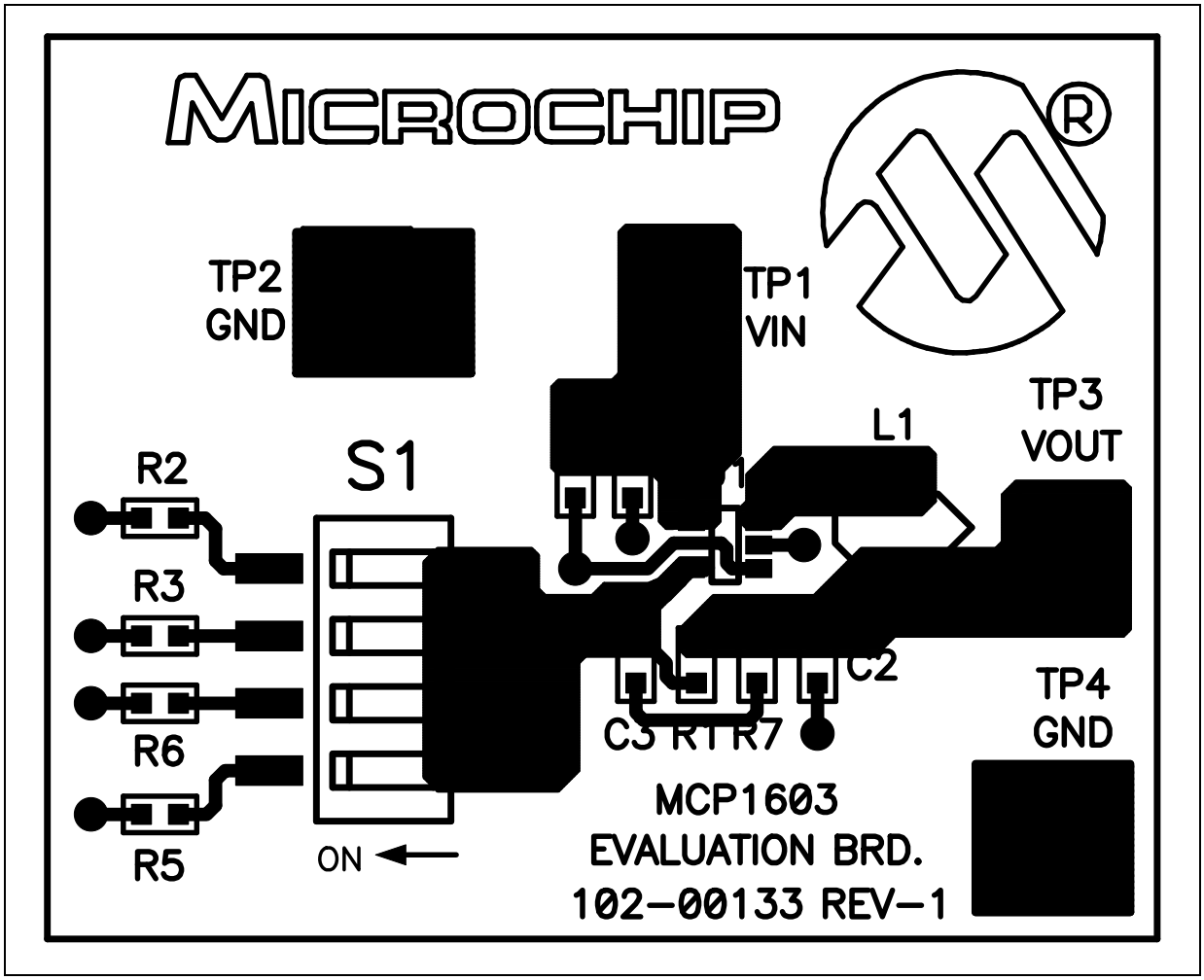
A.3 BOARD - TOP SILK LAYER



A.4 BOARD - TOP METAL LAYER



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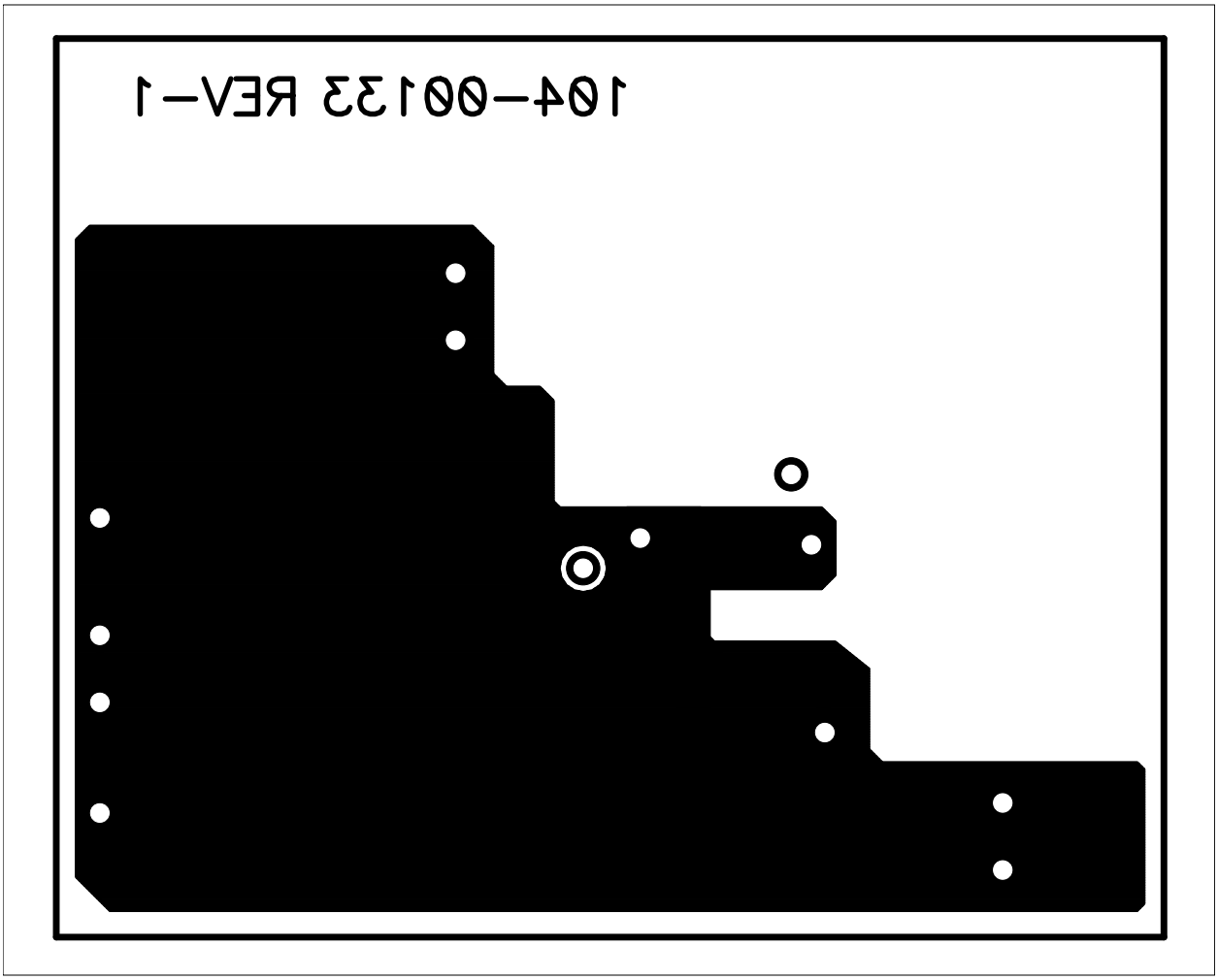
A.5 BOARD - BOTTOM METAL LAYER



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Appendix B. Bill Of Materials (BOM)

TABLE B-1: BILL OF MATERIALS (BOM)

Qty	Reference	Description	Manufacturer	Part Number
2	C1, C2	Cap Ceramic 4.7µF 6.3V X5R 0603	Panasonic® - ECG	ECJ-1VB0J475K
1	C3	Cap Ceramic 33 pF 50V 0603	Panasonic - ECG	ECJ-1VC1H330J
1	L1	4.7 µH Inductor	Coiltronics	SD3812-4R7-R
1	R1	Res 200 kΩ 1/10W 1% 0603	Panasonic - ECG	ERJ-3EKF2003V
1	R2	Res 402 kΩ 1/10W 1% 0603	Panasonic - ECG	ERJ-3EKF4023V
1	R3	Res 160 kΩ 1/10W 5% 0603	Panasonic - ECG	ERJ-3GEYJ164V
1	R4	Res 499 kΩ 1/10W 1% 0603	Panasonic - ECG	ERJ-3EKF4993V
1	R5	Res 63.4 kΩ 1/10W 1% 0603	Panasonic - ECG	ERJ-3EKF6342V
1	R6	Res 93.1 kΩ 1/10W 1% 0603	Panasonic - ECG	ERJ-3EKF9312V
1	R7	Res 4.99 kΩ 1/10W 1% 0603	Panasonic - ECG	ERJ-3EKF4991V
1	S1	Switch DIP SPST Sealed 4POS SMD	ITT Industries / C&K Div	SD04H1SK
4	TP1, TP2, TP3, TP4	PC Test Point Compact SMD	Keystone Electronics®	5016
1	U1	500 mA Synchronous Buck Regulator	Microchip Technology Inc.	MCP1603L-ADJI/OS

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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