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MCP1603
Buck Converter
Evaluation Board
User's Guide

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MCP1603 BUCK CONVERTER EVALUATION BOARD USER'S 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 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 “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 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.

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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'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>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'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.

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:

- **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
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- Distributor or Representative
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- Field Application Engineer (FAE)
- Technical Support

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 (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."

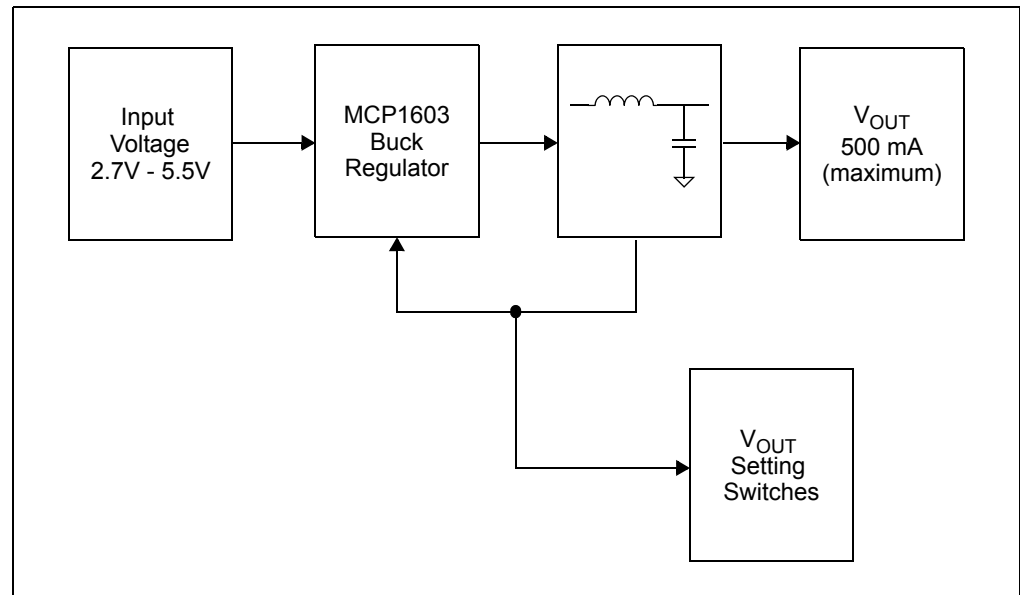


FIGURE 1-1: MCP1603 Buck Converter Evaluation Board Block Diagram.

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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)

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.

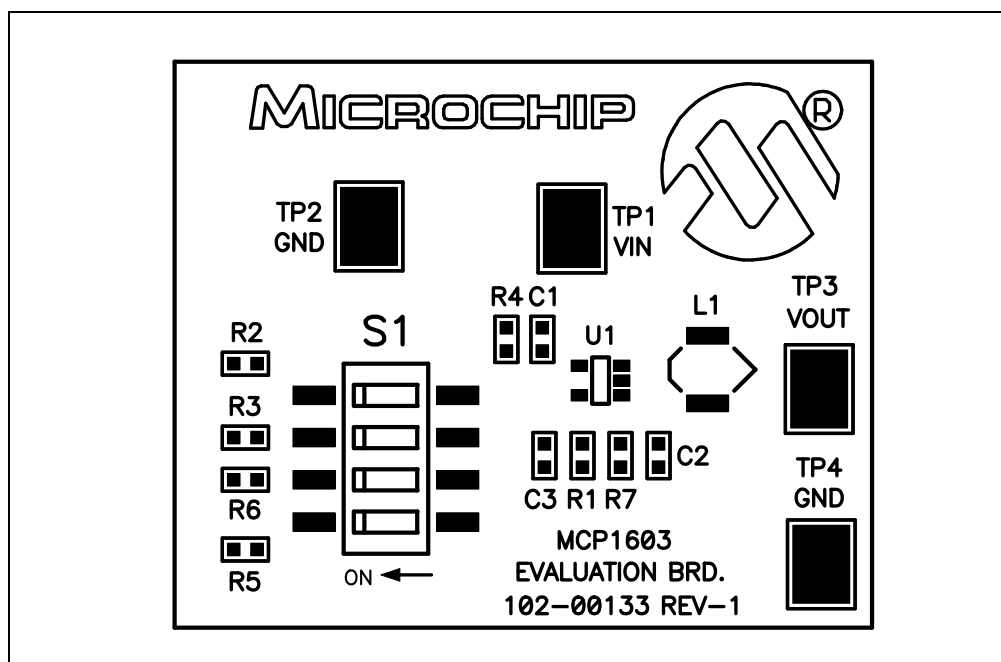


FIGURE 2-1: Setup Configuration Diagram.

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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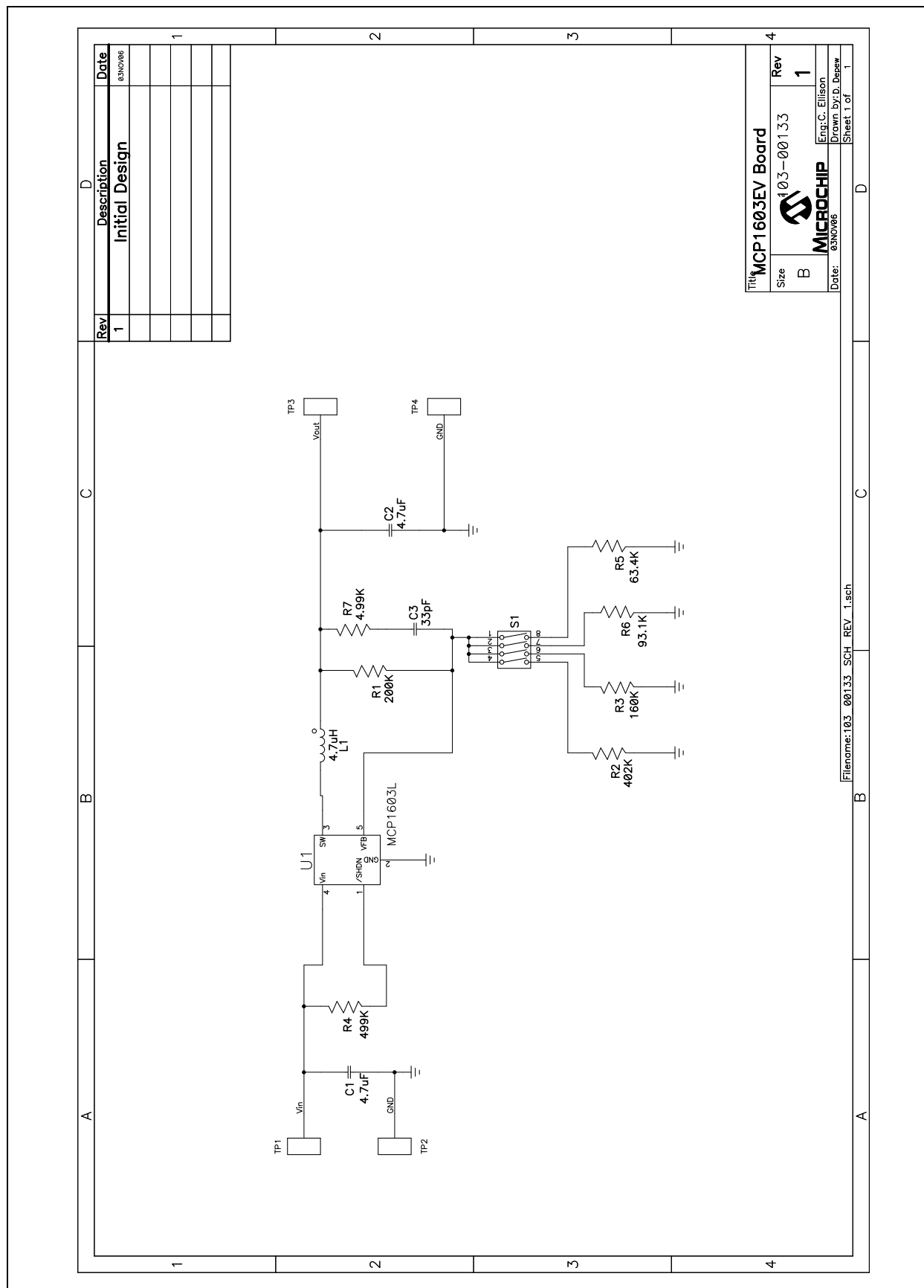
Appendix A. Schematic and Layouts

A.1 INTRODUCTION

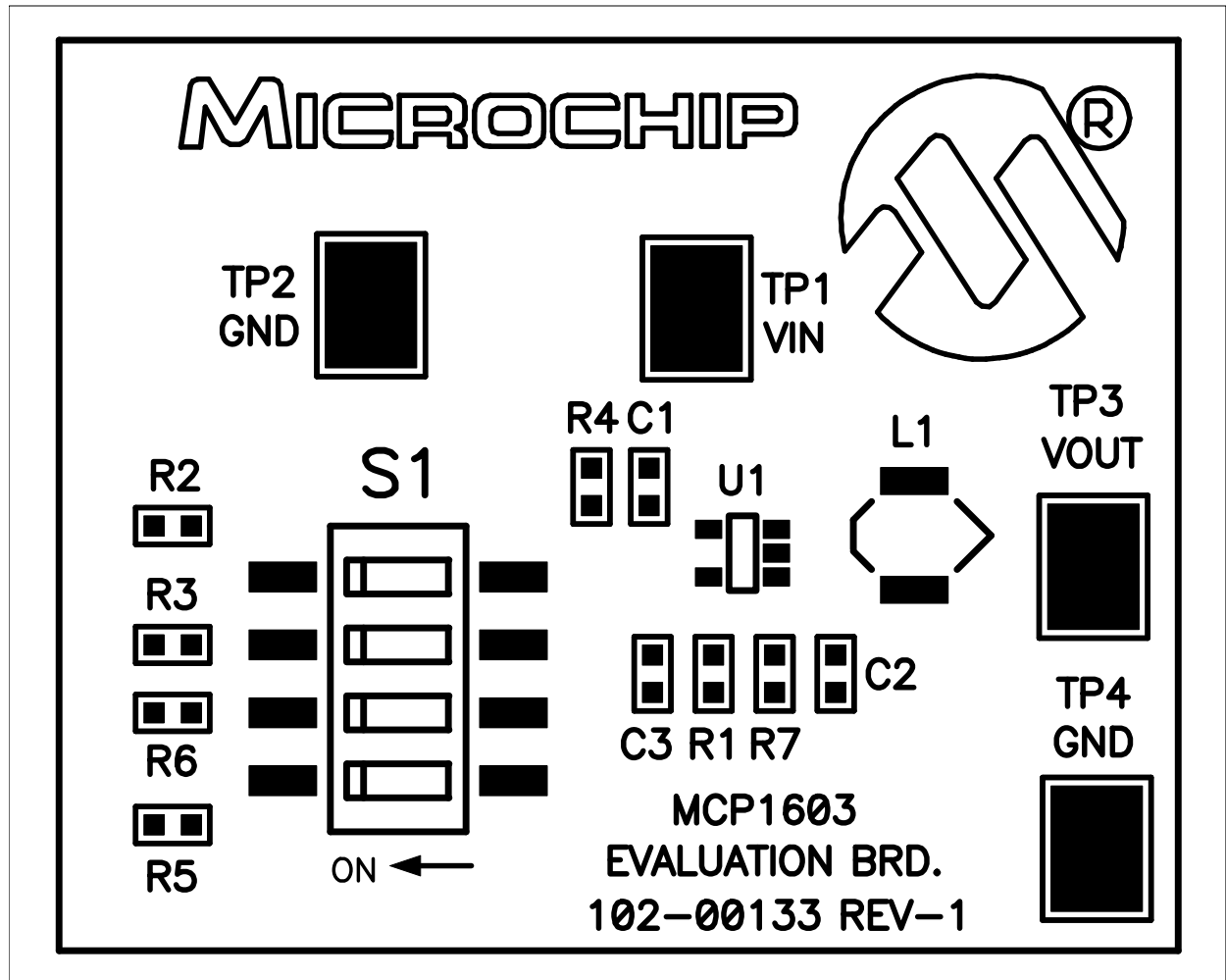
This appendix contains the following schematics and layouts for the MCP1603 Buck Converter Evaluation Board:

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

A.2 BOARD - SCHEMATIC

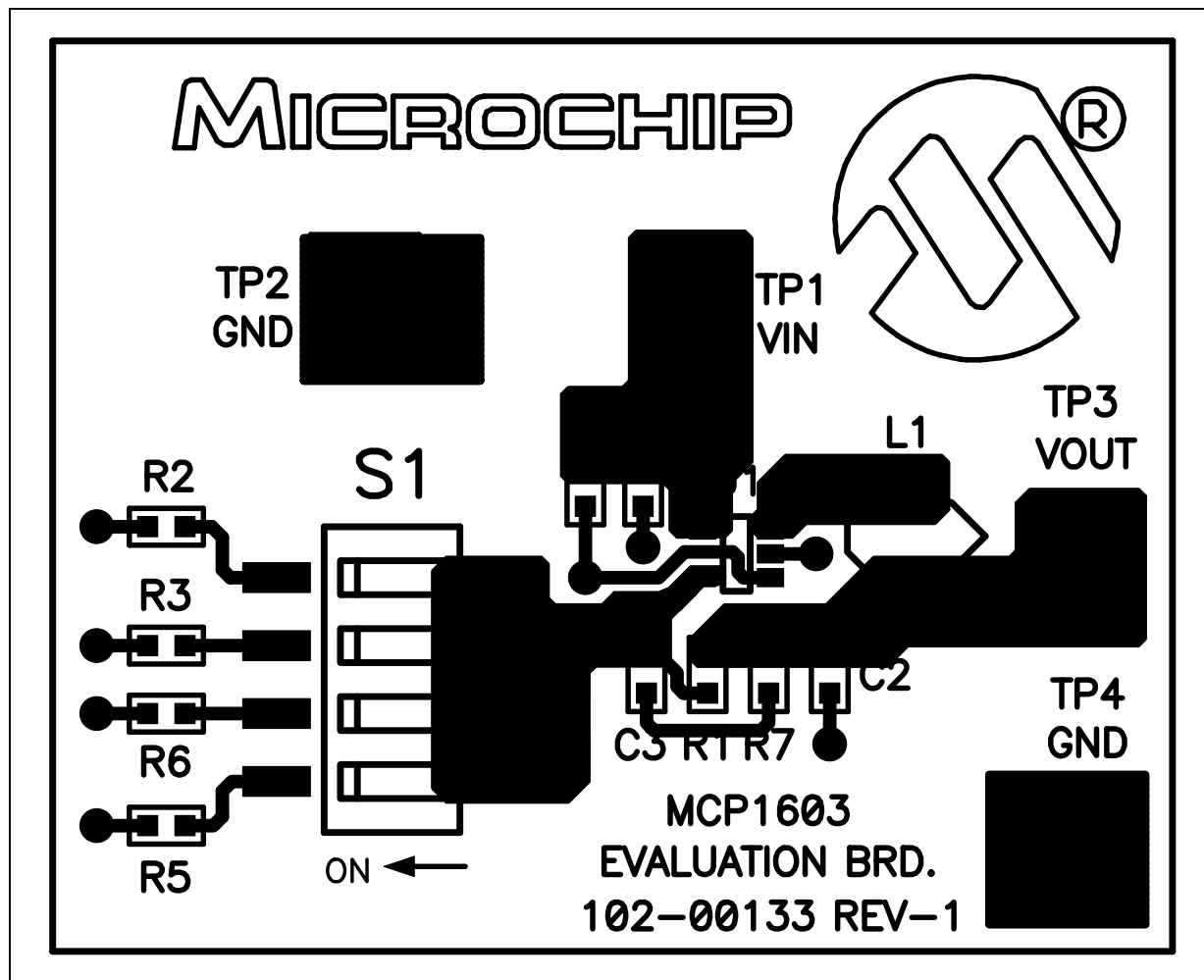


A.3 BOARD - TOP SILK LAYER

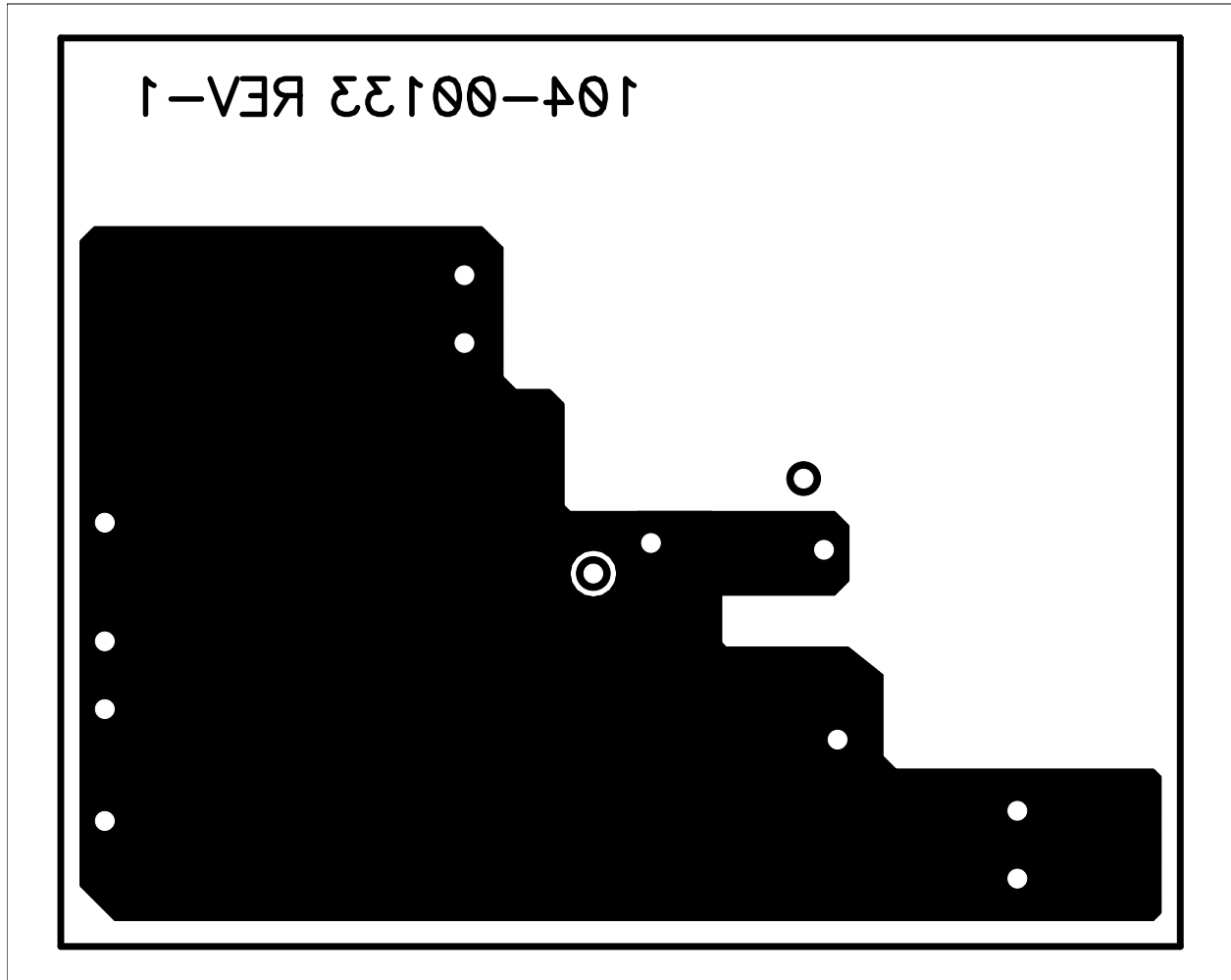


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A.4 BOARD - TOP METAL LAYER



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 4.7 μ F 6.3V X5R 0603 | Panasonic® - ECG | ECJ-1VB0J475K |
| 1 | C3 | Cap Ceramic 33 pF 50V 0603 | Panasonic - ECG | ECJ-1VC1H330J |
| 1 | L1 | 4.7 μ H Inductor | Coiltronics | SD3812-4R7-R |
| 1 | R1 | Res 200 k Ω 1/10W 1% 0603 | Panasonic - ECG | ERJ-3EKF2003V |
| 1 | R2 | Res 402 k Ω 1/10W 1% 0603 | Panasonic - ECG | ERJ-3EKF4023V |
| 1 | R3 | Res 160 k Ω 1/10W 5% 0603 | Panasonic - ECG | ERJ-3GEYJ164V |
| 1 | R4 | Res 499 k Ω 1/10W 1% 0603 | Panasonic - ECG | ERJ-3EKF4993V |
| 1 | R5 | Res 63.4 k Ω 1/10W 1% 0603 | Panasonic - ECG | ERJ-3EKF6342V |
| 1 | R6 | Res 93.1 k Ω 1/10W 1% 0603 | Panasonic - ECG | ERJ-3EKF9312V |
| 1 | R7 | Res 4.99 k Ω 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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Fax: 91-11-4160-8632

India - Pune

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Japan - Yokohama

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Korea - Gumi

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Korea - Seoul

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82-2-558-5934

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