

MCP1650/1/2/3 Evaluation Board User's Guide

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MCP1650/1/2/3 EVALUATION BOARD USER'S GUIDE

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MCP1650/1/2/3 EVALUATION BOARD USER'S GUIDE

Preface

INTRODUCTION AND HIGHLIGHTS

This section contains general information that will be useful to know prior to using the MCP1650 Boost Controller Evaluation Board. This board supports the MCP1650/51/52/53 device family.

This section covers the following topics:

- About this Guide
- Recommended Reading
- The Microchip Internet Web Site
- Customer Support

ABOUT THIS GUIDE

Document Layout

The User's Guide layout is as follows:

- **Chapter 1: Product Overview** – Important information about the MCP1650 Boost Controller Evaluation Board.
- **Chapter 2: Installation and Operation** – This chapter includes instructions on how to get started with this demo board and a detailed description of each function of the demo board.

Appendices:

- **Appendix A: Schematic and Layouts** – shows the schematic and layout diagrams for the MCP1650 Boost Controller Evaluation Board.
- **Appendix B: Bill of Materials** – lists the parts (and their respective manufacturers) used to build the MCP1650 Boost Controller Evaluation Board.
- **Worldwide Sales and Service** – gives the address, telephone and fax number for Microchip Technology Inc. sales and service locations throughout the world.

RECOMMENDED READING

For more information regarding the MCP1650/51/52/53 device, the following is recommended reading:

MCP1650/51/52/53 Data Sheet, (DS21876)

This data sheet provides detailed information regarding the MCP1650/51/52/53 product family.

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- Field Application Engineer (FAE)
- Corporate Applications Engineer (CAE)
- Hot line

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Corporate applications engineers (CAEs) may be contacted at:

- (480) 792-7627.

In addition, there is a Systems Information and Upgrade Line. This line provides system users a listing of the latest versions of all of Microchip's development systems software products. Plus, this line provides information on how customers can receive any currently available upgrade kits.

The Hot Line Numbers are:

- 1-800-755-2345 for U.S. and most of Canada, and
- 1-480-792-7302 for the rest of the world

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Chapter 1. Product Overview

1.1 INTRODUCTION AND HIGHLIGHTS

This chapter provides an overview of the MCP1650 Boost Controller Evaluation Board and covers the following topics:

- What the MCP1650 Boost Controller Evaluation Board Is
- What the MCP1650 Boost Controller Evaluation Board includes

1.2 WHAT THE MCP1650 BOOST CONTROLLER EVALUATION BOARD IS

The MCP1650 Boost Controller Evaluation Board is used to evaluate and demonstrate Microchip Technology's MCP1650/51/52/53 Boost Controller product family. This board uses the MCP1650/51/52/53 in two high-power, boost-converter applications. The first application features the MCP1651 (8-pin MSOP) with the low battery detect feature. The input voltage for the MCP1651 application is 2.8V to 4.8V, with the output boosted to 5V. The second application uses the MCP1653 (10-pin MSOP), which features both the low battery detect and power good features. The input voltage for this application is 3.3V, with the output boosted to 12V.

1.3 WHAT THE MCP1650 BOOST CONTROLLER EVALUATION BOARD INCLUDES

This MCP1650 Boost Controller Evaluation Board Kit includes:

- The MCP1650 Boost Controller Evaluation Board
- The MCP1650 Boost Controller Evaluation Board User's Guide
- The MCP1650/51/52/53 Data Sheet

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Chapter 2. Installation and Operation

2.1 INTRODUCTION

The MCP1650 Boost Controller Evaluation Board is designed to demonstrate Microchip's family of high-frequency boost controllers. The product family consists of four high-frequency, boost-converter devices having different combinations of features. All devices in the family feature 750 kHz high-frequency, low quiescent current, shutdown capability and the MSOP package. The MCP1650 8-pin MSOP is the base device. The MCP1651 8-pin MSOP includes all of the features of the MCP1650, with the addition of a low battery detect and low battery output ($\overline{LBO}$) indicator. The MCP1652 8-pin MSOP includes all of the features of the MCP1650, with the addition of a power good (PG) indicator. The PG indicator is an open-drain output that is high-impedance when the output voltage of the converter is within ±15% of its intended regulation range. When the output of the regulator is not within the ±15% range, the PG pin will sink up to 10 mA. The MCP1653 10-pin MSOP has all features; the $\overline{LBO}$ and PG, along with the base features of the MCP1650.

2.2 FEATURES

The MCP1650 Boost Controller Evaluation Board has the following features:

- Evaluation of the MCP1651 in a boost application configured in the Bootstrap mode. This application circuit will regulate the output to 5V while delivering 1A of current as the input voltage varies from 2.8V to 4.8V.
- Evaluation of the MCP1653 in a boost application configured in the non-Bootstrap mode. This application circuit will regulate the output voltage to 12V while delivering 400 mA of output current as the input voltage varies from 3.0V to 3.6V.

2.3 GETTING STARTED

The MCP1650 Boost Controller Evaluation Board is fully assembled and tested for evaluation and demonstration of the MCP1650 family of boost controllers. This board requires the use of external lab supplies and loads. Both application circuits have a fuse for input overcurrent protection. As with all boost converters, there is a path from V_{IN} to V_{OUT} through the boost inductor and output diode. In the case of a shorted output, there is no means of protecting the inductor and diode, so an external fuse is provided.

MCP1651R Application Circuit

1. Powering the MCP1651 bootstrap application circuit:
   - Apply the input voltage to the surface-mount test points provided. The input voltage source should be limited to the 2.8V to 4.8V range to regulate the 5V output. The input voltage must not exceed the +5.5V maximum rating of the MCP165X. The source current necessary to regulate the output voltage to +5V at 1A should be approximately 3A.
   - Connect the positive side of the input source (+) to the $+V_{IN}$–1 test point (TP1). Connect the negative, or return side, (-) of the input source to the GND test point (TP4) located next to $+V_{IN}$–1.

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- The Under Voltage Lockout (UVLO) feature will prevent the MCP1651 from starting the converter until the input voltage is above the minimum threshold. Once the input voltage is raised above the UVLO threshold, the converter will begin to boost the output voltage up to 5V. The output voltage is fed back to the input so that, once the Boost converter has started, it can run down to lower input voltages at reduced load currents.

2. Applying the load to the MCP1651 bootstrap application circuit:
   - To apply a load to the MCP1651 application circuit, the positive side of the load (+) should be connected to the $+V_{OUT}$–1 test point (TP2). The negative side of the load should be connected to the GND test point (TP3). The maximum load current should not exceed 1A while the input voltage is within the range specified for this application (2.8V to 4.8V).
3. Using the shutdown feature of the MCP1651 application circuit:
   - To shutdown the MCP1651, use a jumper wire to connect the $\overline{\text{SHDN}}$ test point (TP5) to the GND test point (TP4). By grounding the shutdown pin, the MCP1651 will enter the shutdown state and minimum quiescent current will be drawn from the input source. To resume normal operation, remove the jumper pin from the $\overline{\text{SHDN}}$ test point to ground and the MCP1651 will start.
4. Low Input Status LED:
   - The MCP1651 has a low input voltage status indicator that will provide visual indication (via a LED) when the input voltage is below 3V. This LED will illuminate to provide a warning that the input voltage is approaching the minimum 2.8V input voltage.

MCP1653S Application Circuit

1. Powering the MCP1653 non-bootstrap application circuit:
   - Apply the input voltage to the surface-mount test points provided. The input voltage source should be limited to the 3.0V to 3.6V range to regulate the 12V output. The input voltage must not exceed the +5.5V maximum rating of the MCP165X. The source current necessary to regulate the output voltage to +12V at 0.4A should be a minimum of approximately 3A.
   - Connect the positive side of the input source (+) to the $+V_{IN}$–2 test point (TP6). Connect the negative, or return side, (–) of the input source to the GND test point (TP8) located next to $+V_{IN}$–2.
   - The UVLO feature will prevent the MCP1653 from starting the converter until the input voltage is above the minimum threshold. Once the input voltage is raised above the UVLO threshold, the converter will begin to boost the output voltage up to 12V. To maintain regulation of the 12V output, the input voltage range should be between 3.0V and 3.6V.
2. Applying the load to the MCP1653 non-bootstrap application circuit:
   - To apply a load to the MCP1653 application circuit, the positive side of the load (+) should be connected to the $+V_{OUT}$–2 test point (TP7). The negative side of the load should be connected to the GND test point (TP10). The maximum load current should not exceed 0.4A while the input voltage is within the range specified for this application (3.0V to 3.6V).
3. Using the shutdown feature of the MC1653 application circuit:
   - To shutdown the MCP1653, use a jumper wire to connect the $\overline{\text{SHDN}}$ test point (TP9) to the GND test point (TP8). By grounding the shutdown pin, the MCP1653 will enter the shutdown state and minimum quiescent current will be drawn from the input source. To resume normal operation, remove the jumper pin from the $\overline{\text{SHDN}}$ test point to ground and the MCP1653 will start.

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4. Low Input Status LED:
   - The MCP1653 has a low input voltage status indicator that will provide visual indication (via a LED) when the input voltage is below 3V. This LED will illuminate to provide a warning when the input voltage is at the minimum 3.0V input voltage.
5. Power Good Status Indicator.
   - The MCP1653 has a power good status indicator that will provide a visual indication (via a LED) when the output voltage of the application circuit is more than ±15% out of regulation. D4 will illuminate to indicate that the output voltage is out of regulation.

NOTES:

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Appendix A. Schematic and Layouts

A.1 INTRODUCTION

This appendix contains the schematics and layouts for the MCP1650 Boost Controller Evaluation Board.

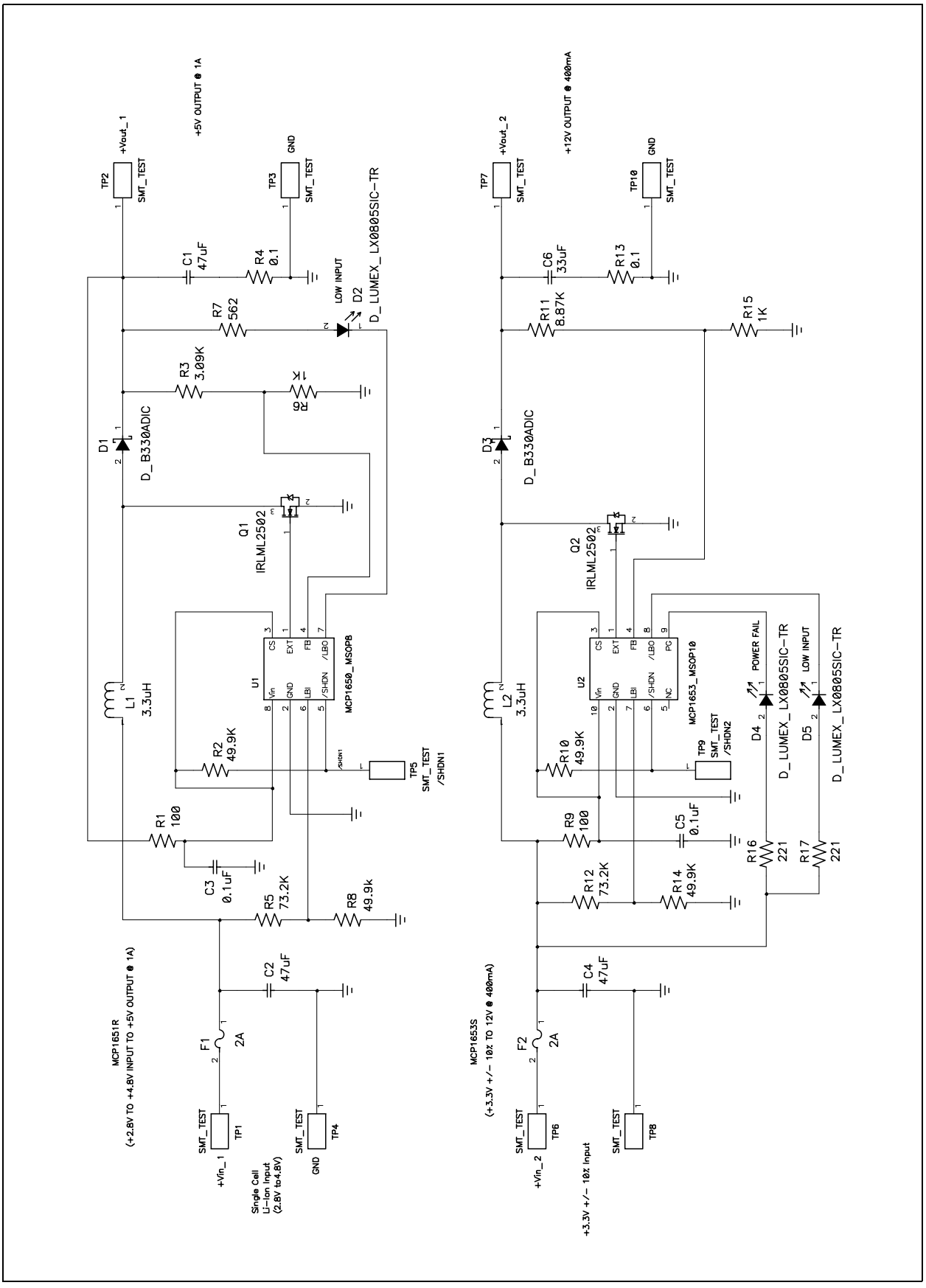
A.2 HIGHLIGHTS

Diagrams included in this appendix:

- Board Schematic
- Board – Top Assembly
- Board – Top Layer
- Board – Bottom Layer

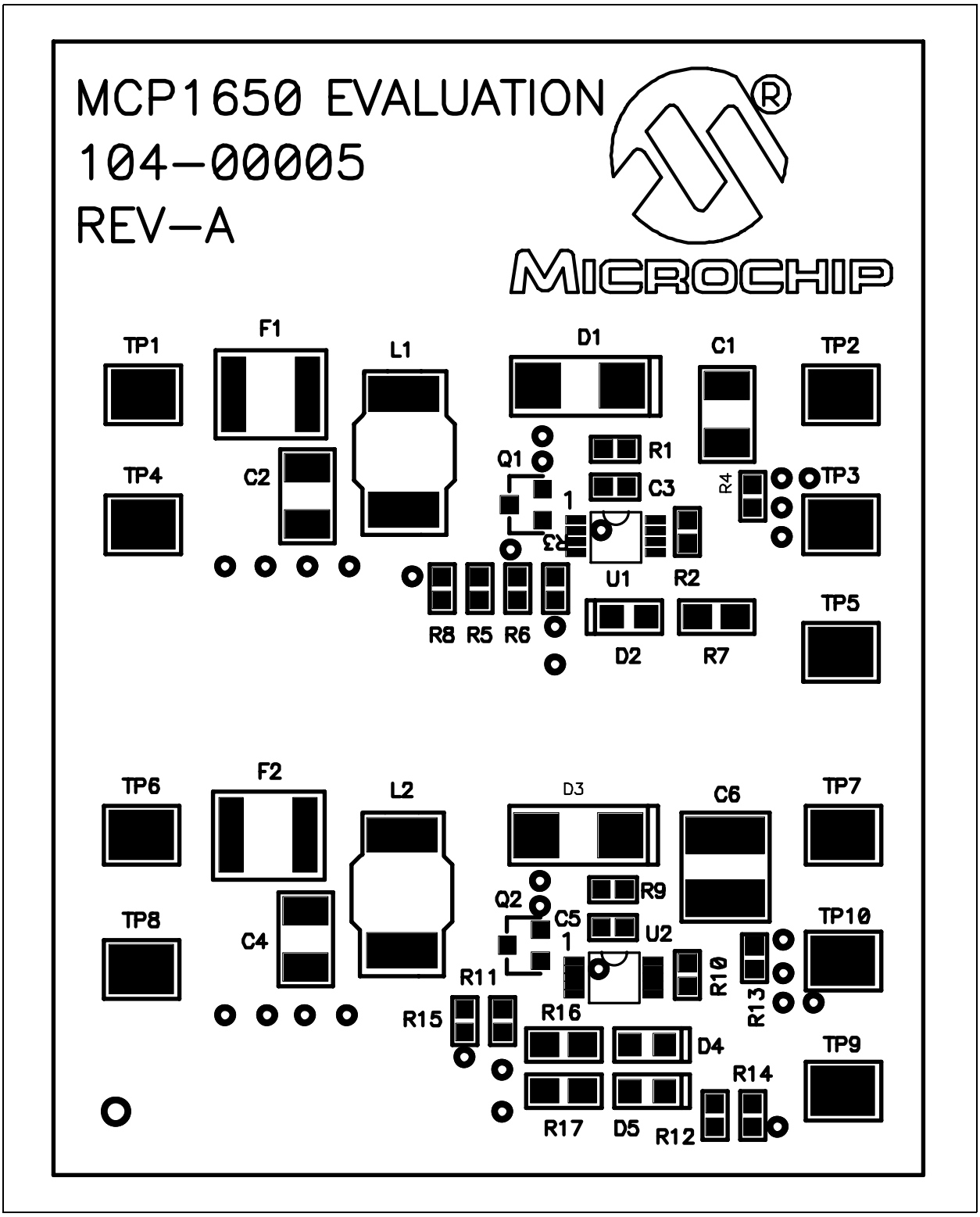
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A.3 BOARD SCHEMATIC

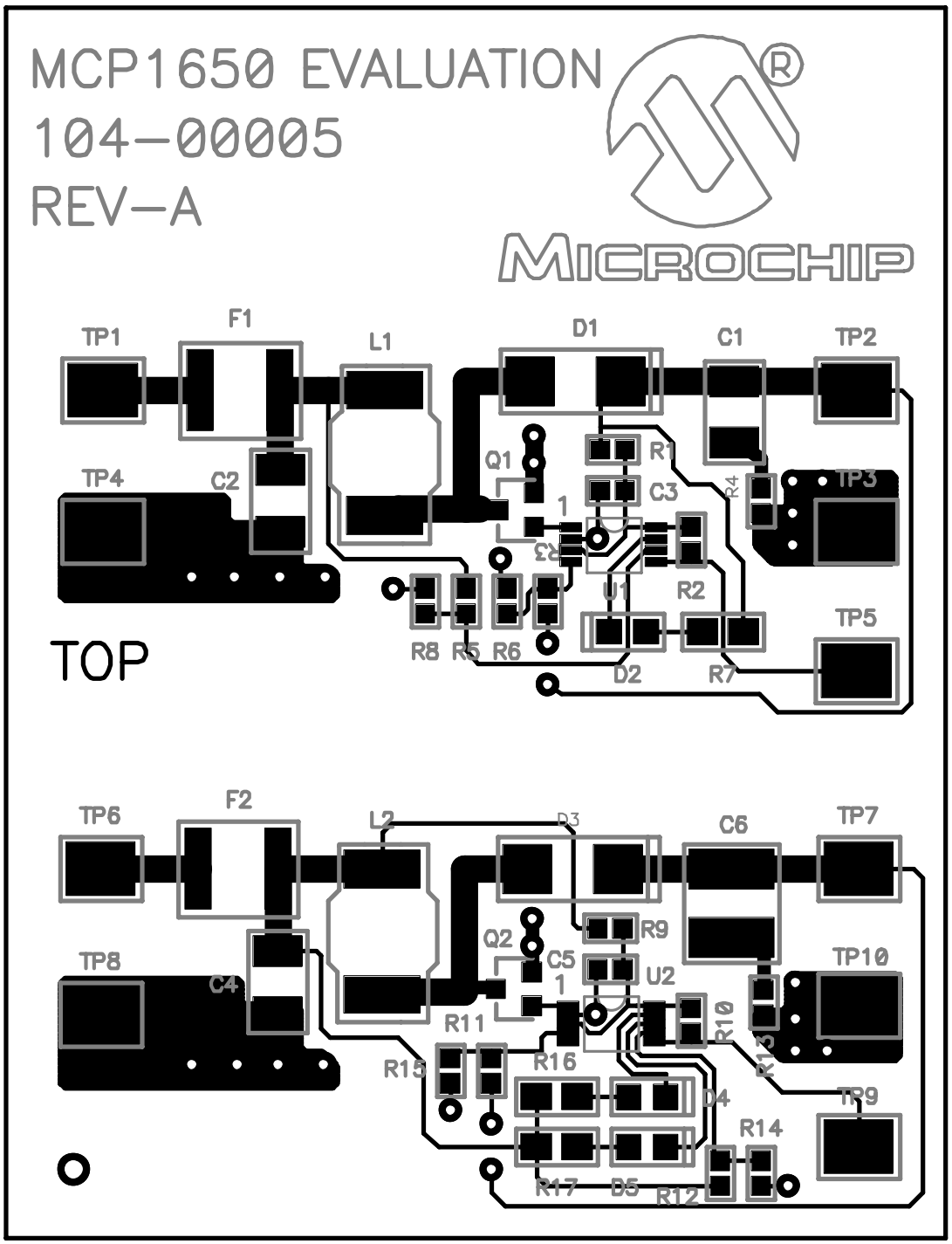


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A.4 BOARD - TOP ASSEMBLY

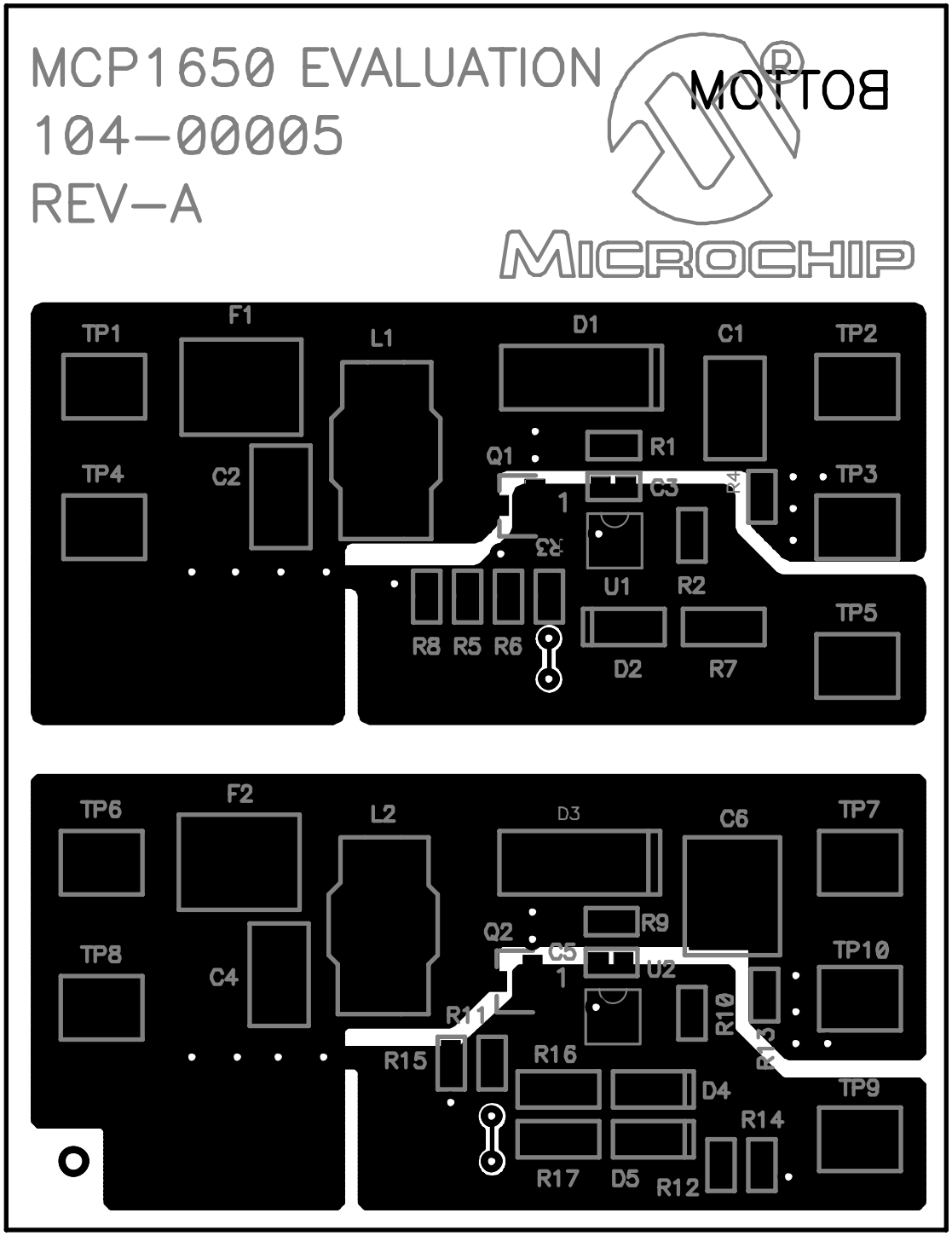


A.5 BOARD - TOP LAYER



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A.6 BOARD - BOTTOM LAYER



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Appendix B. Bill Of Materials (BOM)

TABLE B-1: BILL OF MATERIALS

Qty	Reference	Description	Distributor	Manufacturer	Part Number
3	C1, C2, C4	47 µF +80/-20%, 6.3VDC, 1210	NA	muRata®	GJ232CF50J476ZD01K
2	C3, C5	Capacitor, 10 µF, 10V, Ceramic, X7R 0603	Digi-Key®	Kemet®	C0603C104K8RACTU
1	C6	Capacitor, 33 mF, 16V, Ceramic, X5R 20% 1812	Digi-Key	TDK®	C4532X5R1C336M
2	D1, D3	Diode, Schottky, 30V, 3A, SMA	Digi-Key	Diodes Inc.	B330A-13
3	D2, D4, D5	LED, 636NM, Super RED, 0805 SMD	Digi-Key	Lumex® Opto/Components Inc.	SML-LX0805SIC-TR
2	F1, F2	Polyswitch, 2.0A, Reset Fuse, SMD	Digi-Key	Raychem® Corporation	MINISMDC200-2
2	L1, L2	Inductor, 3.3 µH, SMT	NA	Coilcraft®	DO1813HC
2	Q1, Q2	HEX/MOS, N-CH, 20V, 4.2A, SOT-23	Digi-Key	International Rectifier	IRLML2502TR
2	R1, R9	Resistor, 100Ω, 1/16W, 1%, 0603 SMD	Digi-Key	Panasonic® – ECG	ERJ-3EKF1000V
4	R2, R8, R10, R14	Resistor, 49.9 kΩ, 1/16W, 1%, 0603 SMD	Digi-Key	Panasonic – ECG	ERJ-3EKF4992V
1	R3	Resistor, 3.09 kΩ, 1/16W, 1%, 0603 SMD	Digi-Key	Panasonic – ECG	ERJ-3EKF3091V
2	R4, R13	Resistor, .10Ω, 1/10W, 5%, 0603	Digi-Key	Panasonic – ECG	ERJ-3RSJR10V
2	R5,R12	Resistor, 73.2 kΩ, 1/16W, 1%, 0603 SMD	Digi-Key	Panasonic – ECG	ERJ-3EKF7322V
2	R6, R15	Resistor, 1.00 kΩ, 1/16W, 1%, 0603 SMD	Digi-Key	Panasonic – ECG	ERJ-3EKF1001V
1	R7	Resistor, 562Ω, 1/10W, 1%, 0805 SMD	Digi-Key	Panasonic – ECG	ERJ-6ENF5620V
1	R11	Resistor, 8.87 kΩ, 1/16W, 1%, 0603 SMD	Digi-Key	Panasonic – ECG	ERJ-3EKF8871V
1	R16, R17	Resistor, 221Ω, 1/10W, 1%, 0805 SMD	Digi-Key	Panasonic – ECG	ERJ-6ENF2210V
10	TP1-TP10	PC Test Point, Compact, SMT	Digi-Key	Keystone® Electronics	5016
1	U1	Boost Controller, MCP1651	Microchip Technology Inc.	Microchip Technology Inc.	MCP1651R
1	U2	Boost Controller, MCP1653	Microchip Technology Inc.	Microchip Technology Inc.	MCP1653S
1	B1, B2, B3, B4	Bumpon, Hemisphere, .44x.20, Black	Digi-Key	3M®/ESM	SJ-5003 (BLACK)

Note: SMT denotes surface-mount package

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