MCP165X 3W White LED Demo Board (Rev. 1) User's Guide

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MCP165X 3W WHITE LED DEMO BOARD USER'S GUIDE

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MCP165X 3W WHITE LED 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 MCP165X 3W White LED Demo Board (Rev. 1). Items discussed in this chapter include:

- About This Guide
- Recommended Reading
- The Microchip Web Site
- Customer Support

ABOUT THIS GUIDE

Document Layout

This document describes how to use MCP165X 3W White LED Demo Board (Rev. 1) as a development tool to emulate and debug firmware on a target board. The manual layout is as follows:

- **Chapter 1: MCP165X 3W White LED Demo Board (Rev. 1) -** Describes how to use the various features of the MCP165X 3W White LED Demo Board (Rev. 1).
- **Appendix A: Schematic and Board Layouts** – Shows the schematic and Printed Circuit Board (PCB) layout diagrams for the MCP165X 3W White LED Demo Board (Rev. 1).
- **Appendix B: Bill-of-Materials (BOM)** – Shows the parts used to build the MCP165X 3W White LED Demo Board (Rev. 1).

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
'b*nnnn*	A binary number where *n* is a digit	'b00100, 'b10
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
Courier font:		
Plain Courier	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`
Italic Courier	A variable argument	*`file`*`.o`, where *`file`* can be any valid filename
`0x`*`nnnn`*	A hexadecimal number where *n* is a hexadecimal digit	`0xFFFF`, `0x007A`
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 MCP165X 3W White LED Demo Board (Rev. 1). Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

MCP1650 750 kHz Boost Controller Data Sheet (DS21876)

The data sheet provides detailed information regarding the MCP1650/51/52/53 family of boost controllers.

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 (FAQ), technical support requests, online discussion groups, Microchip consultant program member listing
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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 (FAE) 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

In addition, there is a Development Systems Information Line which lists the latest versions of Microchip's development systems software products. This line also provides information on how customers can receive currently available upgrade kits.

The Development Systems Information Line numbers are:

1-800-755-2345 – United States and most of Canada

1-480-792-7302 – Other International Locations

NOTES:

Chapter 1. Product Overview

1.1 INTRODUCTION

The MCP1650/1/2/3 Boost Controller family is a 750 kHz gated oscillator controller in an 8 or 10-pin MSOP package. The family includes peak current limit, adjustable output voltage/current, low battery detection and power good indication.

This board uses Microchip Technology's MCP1650/1/2/3 boost controller as a constant-current source to drive a 3W white LED. The application features the MCP1651R-option (8-pin MSOP) with the low-battery detect feature. The input voltage for the MCP165X 3W White LED Demo Board is 2.0V to 4.5V and the output current is set at 700 mA.

1.2 EVALUATION BOARD DESCRIPTION

The MCP165X 3W White LED Demo Board is fully assembled, tested and ready for evaluation and demonstration. This board is capable of functioning without any extra lab supplies or loads. A three-socket AA battery holder is attached to the board. However, there are terminals provided to allow the use of an external voltage supply. The input is fused for overcurrent protection.

If an external voltage supply is used, the MCP165X 3W White LED Demo Board requires 2.0V to 4.5V for proper operation. Connect the positive terminal of the external supply to TP1 and the ground terminal of the external supply to TP2. Care must be taken so that the input voltage does not exceed the maximum voltage rating of 6.0V that is specified in the MCP1650/1/2/3 data sheet (DS21876). The MCP1651R is the specific device used on the board.

There are two switches on the board. Switch S_1 is an on/off switch used to disconnect the input voltage. Switch S_2 is a momentary switch that triggers the PIC10F206 microcontroller to activate the Demonstration mode or the Flashing mode. **Section 1.3 "How it is used"** describes how to put the MCP165X 3W White LED Demo Board in the different modes of operation. The flowchart in Figure 1-1 shows the sequence of events triggered by pressing the momentary switch.

The Flashing mode consists of three different operating states for the LED. The brightness of the LED is approximately 50% dimmed in the first state. This is accomplished by applying a 50% square wave to the shutdown pin of the MCP1651R. The second and third states of operation consist of flashing the LED at two different rates. The second state is a fast flash rate, while the third state is a slow flash rate. These rates of flash are predetermined and are accomplished by toggling the shutdown pin with a square wave.

The Demonstration mode automatically cycles through the three flashing modes.

The MCP1651R has a low input voltage status indicator that will provide visual indication (via a red LED) when the input voltage is approaching 2.8V.

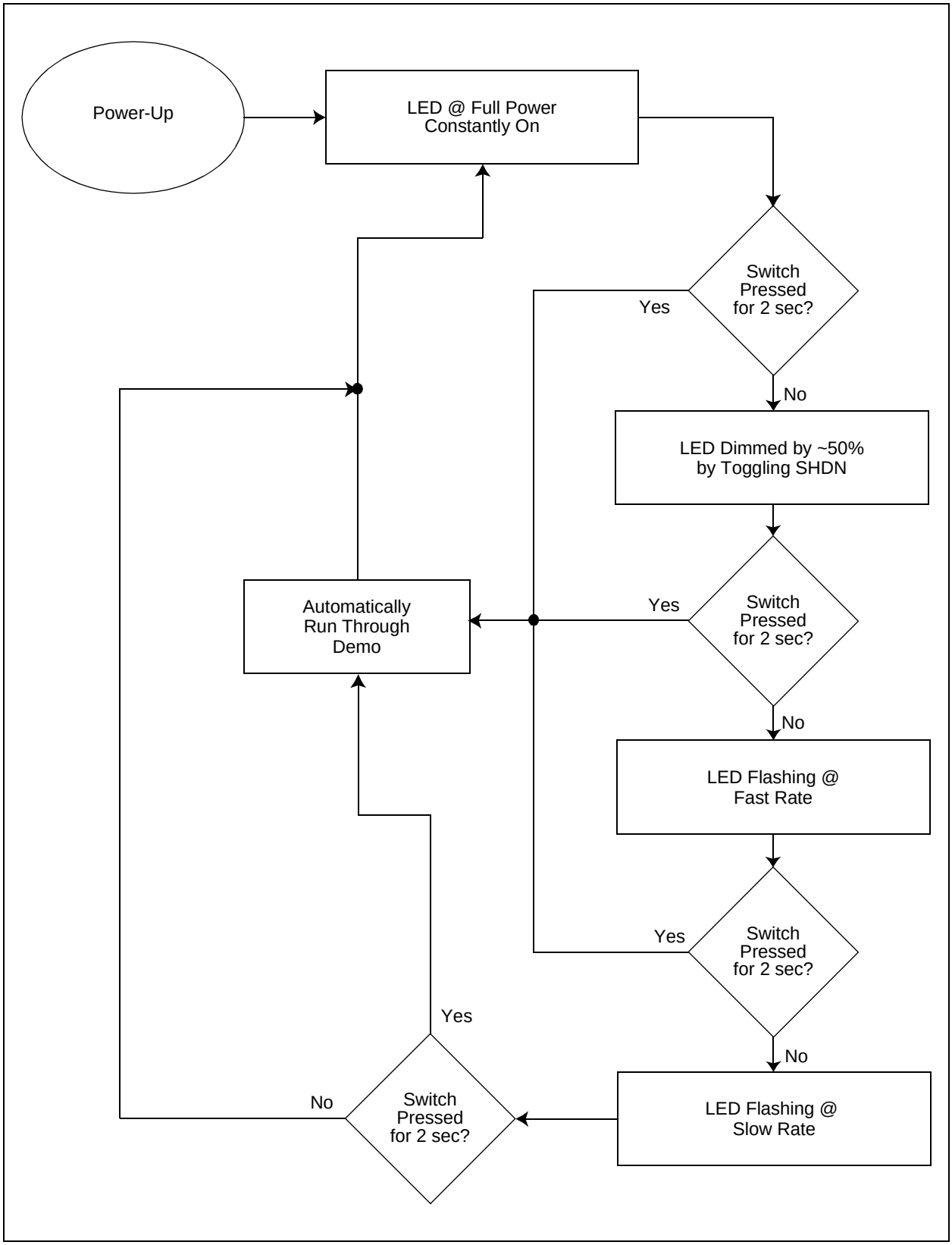


FIGURE 1-1: *MCP165X 3W White LED Demo Board Flow Chart*

1.3 HOW IT IS USED

1.3.1 Standard Operation

1. Verify that the on/off switch S_1 is in the off position.
2. Insert three fully-charged batteries into the battery holder. The combined voltage of the three batteries can not exceed 6.0V. The recommended range of the input voltage is 2.0V to 4.5V.
3. Move the S_1 switch to the on position. The 3W white LED should now be powered.

Note 1: Alternately, the input voltage can be provided by a lab power supply. Apply a 2.0V to 4.5V supply voltage to the V_{IN} (TP1) pin and the GND (TP2) pin.

2: Before connecting a lab power supply, remove any batteries from the battery holder located on the bottom of the board.

1.3.2 Demonstration Mode Operation

As described in **Section 1.2 "Evaluation Board Description"**, the MCP165X 3W White LED Demo Board can be set into a demonstration mode of operation. The following procedure describes how to initiate the demonstration mode.

1. Refer to **Section 1.3.1 "Standard Operation"** to verify the proper connection of the input voltage supply.
2. Move the S_1 switch to the ON position. The LED should be powered.
3. Press and hold the momentary switch S_2. Release the switch after a minimum of two seconds. The MCP165X 3W White LED Demo Board will enter the Demonstration mode. Once the Demonstration mode is complete, the LED will be powered at full brightness.

Note: See **Section 1.2 "Evaluation Board Description"** for a description of the brightness and flashing sequences preprogrammed into the on-board PIC10F206.

1.3.3 Flashing Mode Operation

1. Refer to **Section 1.3.1 "Standard Operation"** to verify the proper connection of the input voltage supply.
2. Move the S_1 switch to the on position. The LED should be powered.
3. Press and release the momentary switch S_2. The 3W LED will now be in a dimmed state and stay in this state until the momentary switch is pressed again.
4. Press and release the momentary switch S_2 again. The 3W LED will now begin to flash at a predetermined rate.
5. Press and release the momentary switch S_2 again. The 3W LED will now begin to flash slower predetermined rate.
6. Press and release the momentary switch S_2 again. The 3W LED will return to full brightness.

Note: Anytime the momentary switch S_2 is pressed for more than two seconds, the MCP165X 3W White LED Demo Board will enter the Demonstration mode of operation.

1.4 HOW IT WORKS

1.4.1 MCP1650/1/2/3 Functions

The MCP1650/1/2/3 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 compatibility and the MSOP package. The MCP1650 is the base device in an 8-pin MSOP package. The MCP1651 includes all of the features of the MCP1650, with the addition of a low-battery detect and a low-battery output indicator. The MCP1652 includes all of the features of the MCP1650, with the addition of a power good indicator. The MCP1653 has all the features of the MCP1650/1/2 and is offered in a 10-pin MSOP package.

1.4.2 Power Topology and Output Regulation

The topology used to convert the wide ranging input voltage into a regulated output voltage is the SEPIC topology. This topology allows the input voltage to be stepped-up or stepped-down and provides protection if the switching FET fails.

The output current is regulated by using a sense resistor to change the white LED current into a voltage. This voltage is then fed into the voltage reference pin on the MCP1651R. Please refer to the MCP1650/1/2/3 data sheet (DS21876) for more information regarding output regulation.

Appendix A. Schematic and Board Layouts

A.1 INTRODUCTION

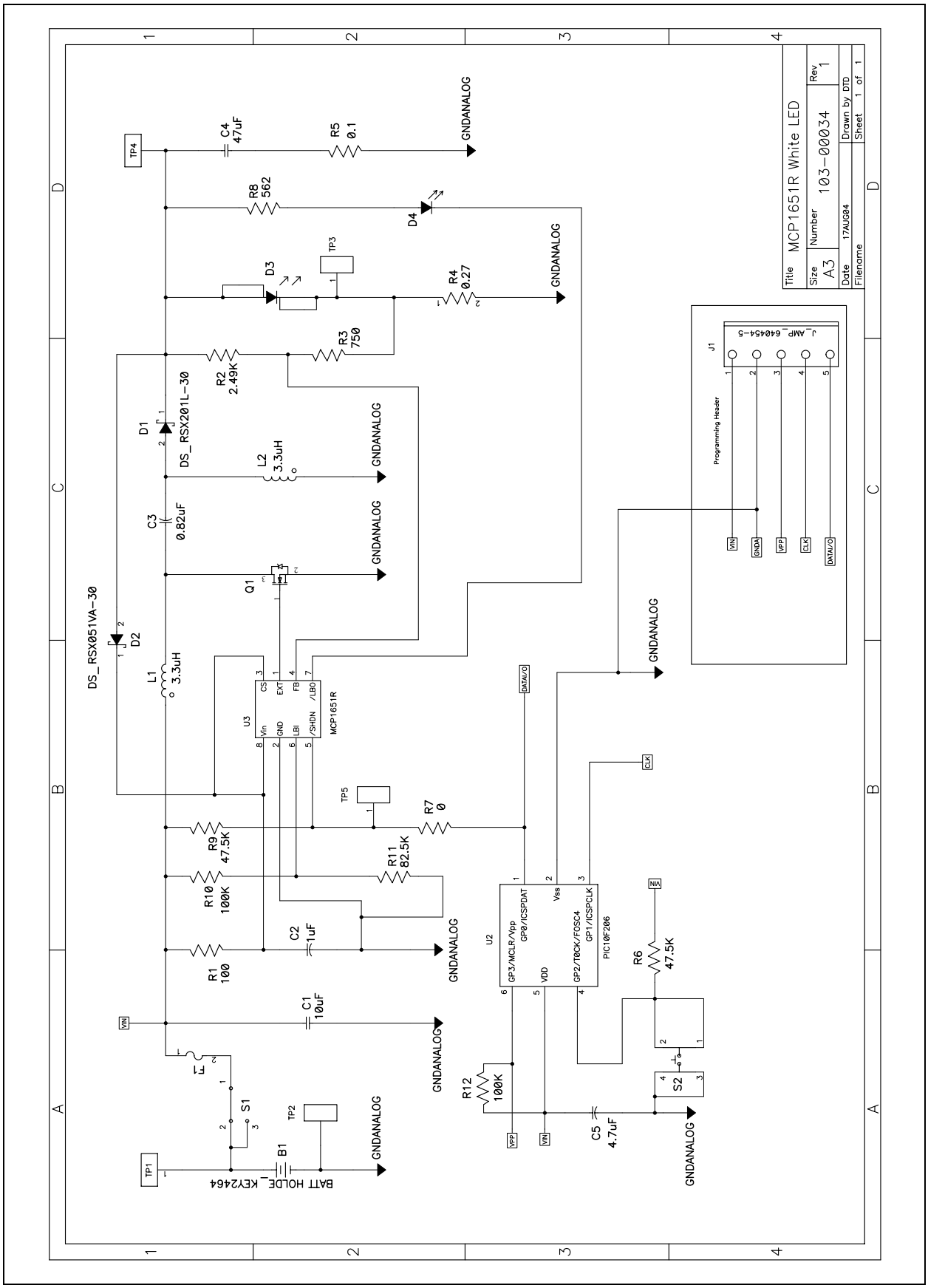
This appendix contains the schematic and printed circuit board (PCB) layout diagrams for the MCP165X 3W White LED Evaluation Board (Rev. 1).

The MCP165X 3W White LED Evaluation Board (Rev. 1) is constructed using a two-layer printed circuit board. The top and bottom layers are for components and traces.

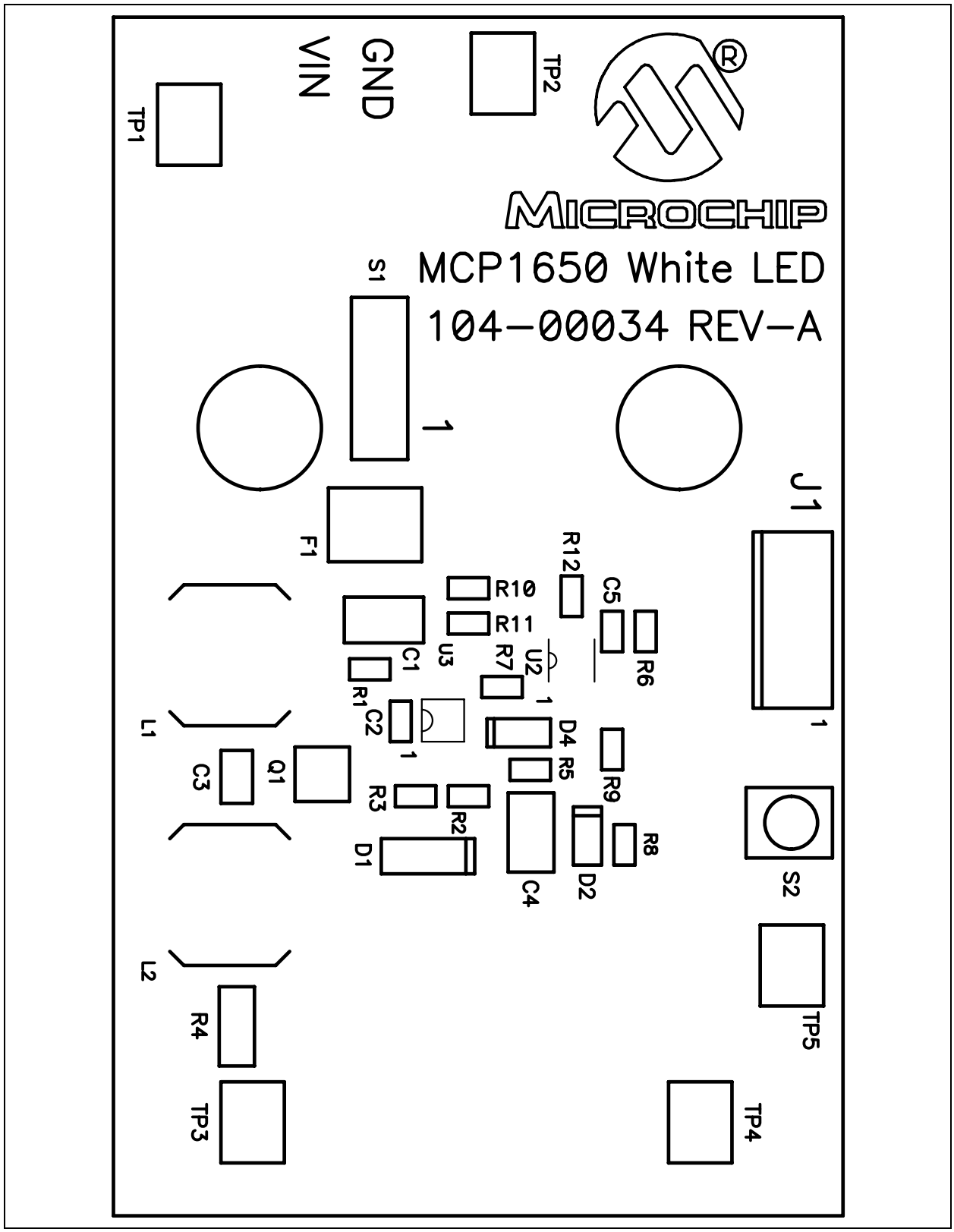
Diagrams included in this appendix:

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

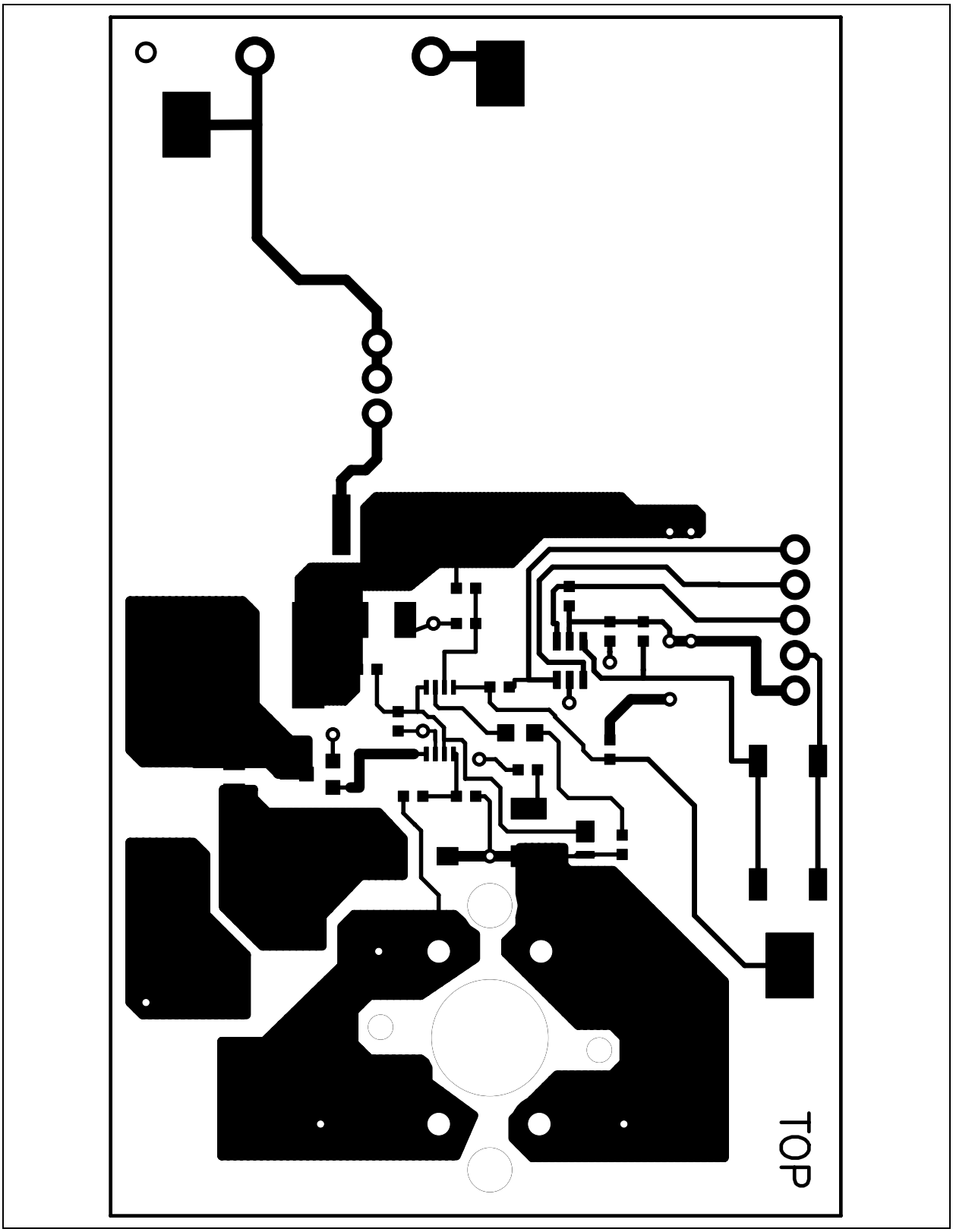
A.2 BOARD SCHEMATIC



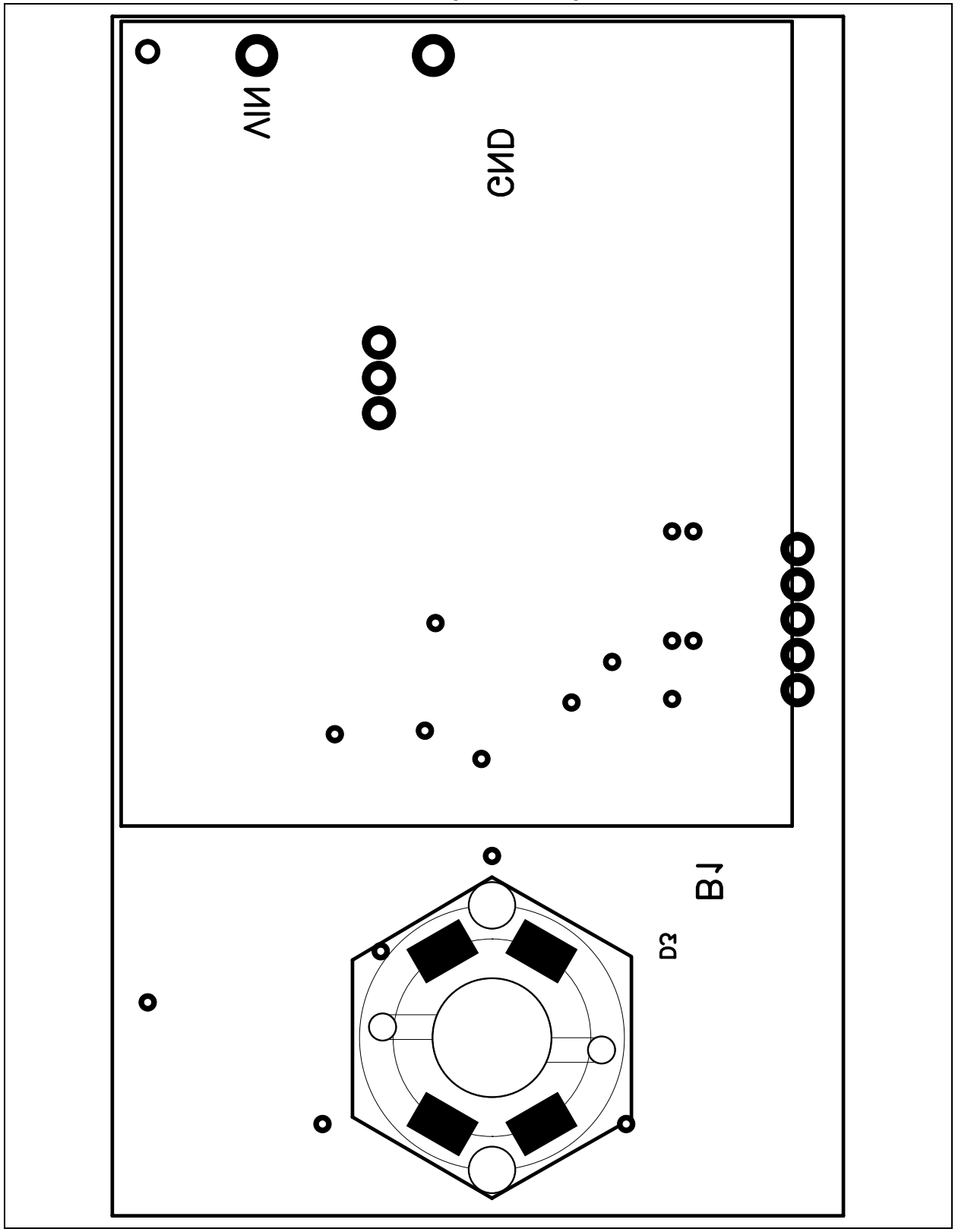
A.3 TOP SILK-SCREEN



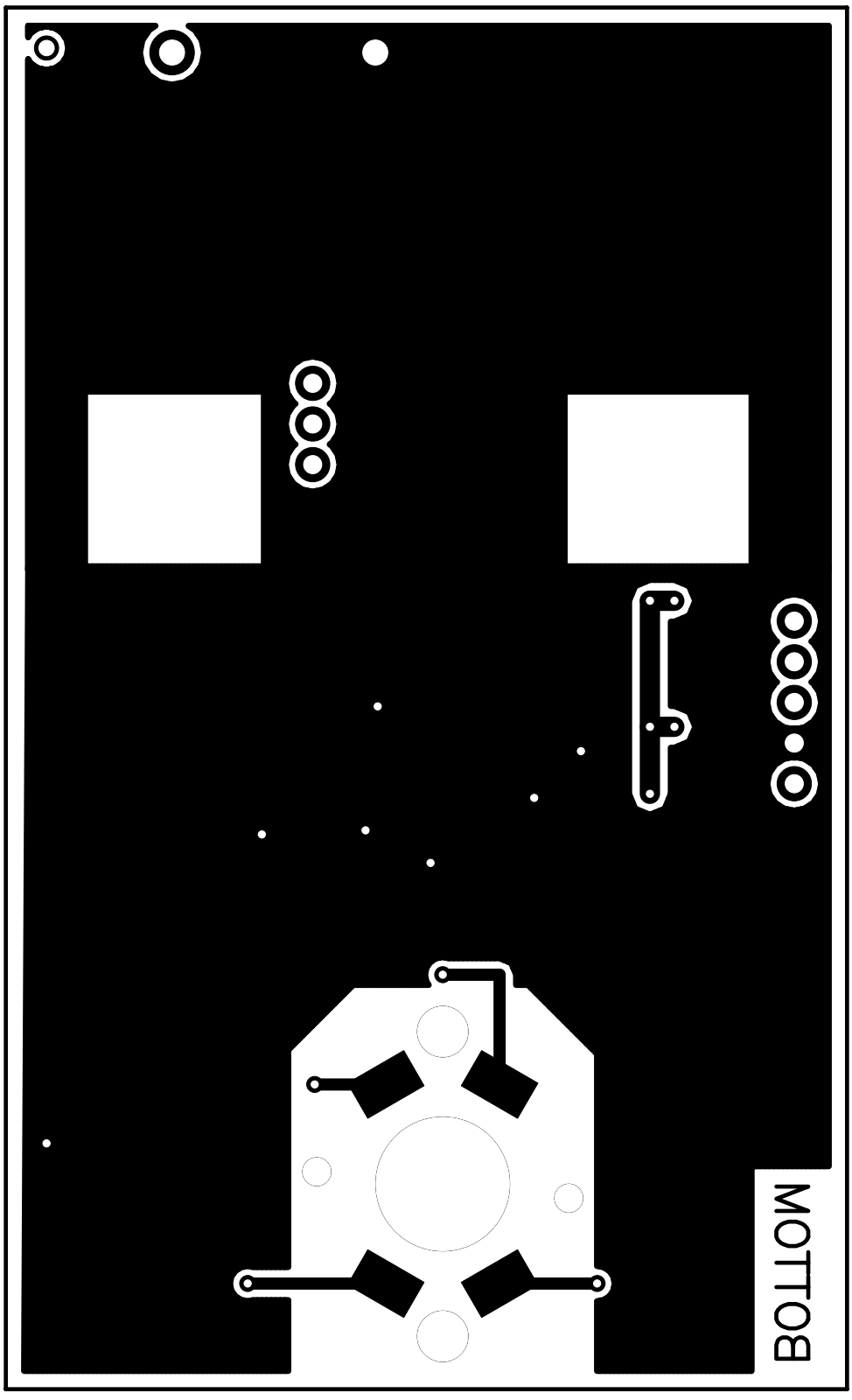
A.4 TOP METAL LAYER



A.5 BOTTOM SILK-SCREEN LAYER (TOP VIEW)



A.6 BOTTOM METAL LAYER



Appendix B. Bill-of-Materials (BOM)

TABLE B-1: BILL-OF-MATERIALS (BOM)

Qty	Reference	Description	Manufacturer	Part Number
1	Battery Holder	3 AA holder	Keystone Electronics®	2464
1	S1	ON/OFF Switch	E-Switch Inc.	EG1903
1	S2	Momentary Switch	E-Switch Inc.	TL3301NF260QG
1	F1	Polyswitch Reset Fuse	Raychem® Corp.	MINISMDC200-2
5	TP1, TP2, TP3, TP4, TP5	SMT Test Point	Keystone Electronics	5016
1	C1	Capacitor, 10 µF, 1210	Kemet®	C1210C106K8PACTU
1	C2	Capacitor, 1.0 µF, 0603	Panasonic® - ECG	ECJ-1VB1C105K
1	C3	Capacitor, 0.82 µF, 0805	Panasonic - ECG	ECJ-2YB1A824K
1	C4	Capacitor, 47 µF, 1210	muRata®	GJ232CF50J476ZD01K
1	C5	Capacitor, 4.7 µF, 0603	Panasonic - ECG	ECJ-1VB0J475M
1	R1	Resistor, 100Ω, 0603	Panasonic - ECG	ERJ-3EKF1000V
1	R2	Resistor, 2.49 kΩ, 0603	Panasonic - ECG	ERJ-3EKF2491V
1	R3	Resistor, 750Ω, 0603	Panasonic - ECG	ERJ-3EKF7500V
1	R4	Resistor, 0.27Ω, 1206	Panasonic - ECG	ERJ-8RQFR27V
1	R5	Resistor, 0.10Ω, 0603	Panasonic - ECG	ERJ-3RSJR10V
2	R6, R9	Resistor, 47.5 kΩ, 0603	Panasonic - ECG	ERJ-3EKF4752V
1	R7	Resistor, 0Ω, 0603	Panasonic - ECG	ERJ-3GEY0R00V
1	R8	Resistor, 562Ω, 0603	Panasonic - ECG	ERJ-3EKF5620V
2	R10, R12	Resistor, 100 kΩ, 0603	Panasonic - ECG	ERJ-3EKF1003V
1	R11	Resistor, 82.5 kΩ, 0603	Panasonic - ECG	ERJ-3EKF8252V
1	D1	Schottky Diode	ON Semiconductor®	MBRA130LT3
1	D2	Schottky Diode	Panasonic - ECG	MBRA130LT3
1	D3	Luxeon III LED	Lumileds®	LXHL-LW3C
1	D4	Red LED, 0805	Lumex® Opto/Components Inc.	SML-LX0805SIC-TR
2	L1, L2	3.3 µH Inductor	Coilcraft®	DO3316P-332
1	Q1	N Channel MOSFET	Fairchild® Semiconductor	FDN337N
1	U2	PIC10F206 6-pin SOT-23	Microchip Technology Inc.	PIC10F206
1	U3	MCP1651 8-pin MSOP	Microchip Technology Inc.	MCP1651R
1	J1	CONN HEADER VERT 5POS .100 TIN	AMP	640454-5
1	HS1	Heatsink	International Electronic Research Corp.	BDN09-3CB/A01

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Fax: 86-532-502-7205

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Fax: 91-80-2229-0062

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Fax: 82-2-558-5932 or
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Fax: 65-6334-8850

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France - Massy
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