MCP1650 SEPIC Demo Board User's Guide

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MCP1650 SEPIC DEMO 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 "DSXXXXXA", where "XXXXX" is the document number and "A" is the revision level of the document.

INTRODUCTION

This chapter contains general information that will be useful to know before using the MCP1650 SEPIC 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 MCP1650 SEPIC Demo Board. The manual layout is as follows:

- **Chapter 1. "Product Overview"** – Important information about the MCP1650 SEPIC Demo Board.
- **Chapter 2. "Installation and Operation"** – Includes a description of the evaluation board, as well as instructions on how to get started.
- **Appendix A. "Schematic and Layout"** – Shows the schematic and layout diagrams for the MCP1650 SEPIC Demo Board.
- **Appendix B. "Bill Of Materials (BOM)"** – Lists the parts used to build the MCP1650 SEPIC Demo 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
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 the MCP1650 SEPIC Demo Board. The following Microchip documents are available and recommended as supplemental reference resources.

MCP1650/51/52/53 Data Sheet, *"750 kHz Boost Controller"* (DS21876)

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

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- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

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- 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

DOCUMENT REVISION HISTORY

Revision A (September 2005)

- Initial Release of this Document.

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Chapter 1. Product Overview

1.1 INTRODUCTION

The MCP1650 SEPIC Demo Board is used to evaluate Microchip's MCP1650 boost controller in a low-power application that requires a regulated output voltage from an input voltage that can be greater than, less than or equal to the output voltage. As provided, the MCP1650 SEPIC Demo Board generates a 5.0V output from a 3V to 7V source.

This chapter covers the following topics:

- What is the MCP1650 SEPIC Demo Board?
- What the MCP1650 SEPIC Demo Board Kit Includes.

1.2 WHAT IS THE MCP1650 SEPIC DEMO BOARD?

The MCP1650 SEPIC Demo Board is a complete, step-up or step-down, Switch mode, DC-DC power converter. The MCP1650 SEPIC Demo Board generates a regulated 5.0V output at load currents up to 160 mA. The SEPIC topology has the ability to step-up or step-down the input voltage. The input voltage range for the MCP1650 SEPIC Demo Board is from 3.0V to 7.0V.

Test points are provided for input power, output load and shutdown control.

1.3 WHAT THE MCP1650 SEPIC DEMO BOARD KIT INCLUDES

This MCP1650 SEPIC Demo Board kit includes:

- The MCP1650 SEPIC Demo Board (102-00079)
- The MCP1650 SEPIC Demo Board User's Guide (DS51581)
- MCP1650/51/52/53 Data Sheet, *"750 kHz Boost Controller"* (DS21876)

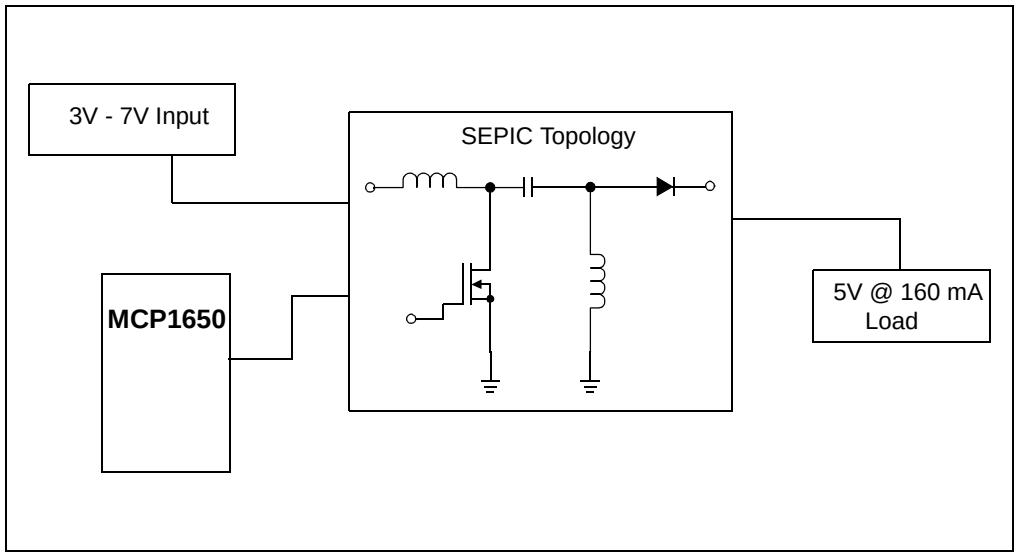

FIGURE 1-1: *MCP1650 SEPIC Demo Board Block Diagram.*

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Chapter 2. Installation and Operation

2.1 INTRODUCTION

The MCP1650 SEPIC Demo Board demonstrates Microchip's MCP1650 750 kHz Boost Controller in an application that requires a regulated output voltage from a source that is greater than, less than or equal to the regulated output voltage. The MCP1650 is a gated oscillator boost controller developed for high-power, portable applications. By driving an external MOSFET, the MCP1650 controller can deliver 5 watts of power to the load. The high switching frequency minimizes the size of the external inductor and capacitor, saving both board space and cost.

The Single-Ended Primary Inductance Converter (SEPIC) topology utilized on this board has the ability to produce a regulated output from a wide-ranging source. Some advantages of the SEPIC topology versus other topologies are the low-ripple input current, the ability to step-up or step-down the input voltage without inverting the output voltage, no required transformer and the output is capacitively isolated from the input to protect against switch failure.

2.2 FEATURES

The MCP1650 SEPIC Demo Board has the following features:

- Wide input voltage range: 3.0V to 7.0V
- Regulated 5.0V output voltage
- Maximum output current: 160 mA
- Complete low-profile, space-saving power supply
- Test point to apply external Enable signal

2.3 GETTING STARTED

The MCP1650 SEPIC Demo Board is fully assembled and tested for generating a regulated 5.0V output voltage. The MCP1650 SEPIC Demo Board requires the use of an external input voltage source (3.0V–7.0V).

2.3.1 Power Input and Output Connections

2.3.1.1 POWERING THE MCP1650 SEPIC DEMO BOARD

Apply the input voltage to the V_{IN} (TP1) and GND (TP2) test points. The input voltage should be limited to the 0V to +7.0V range. For normal operation, the input voltage must be between +3.0V and +7.0V.

2.3.1.2 APPLY THE LOAD TO THE REGULATED OUTPUT VOLTAGE TEST POINTS

1. To apply a load to the MCP1650 SEPIC Demo Board, the positive side (+) of the load should be connected to the V_{OUT} test point (TP4). The negative side (–) of the load should be connected to the GND test point (TP5).
2. The maximum load current for the MCP1650 SEPIC Demo Board is 160 mA. Applying a load greater than the stated maximum will cause the output voltage to pull out of regulation.

2.3.1.3 ENABLING/DISABLING THE MCP1650 SEPIC DEMO BOARD

The $\overline{\text{SHDN}}$ pin of the MCP1650 is pulled-up to V_{IN} so that the device is always enabled. The $\overline{\text{SHDN}}$ test point (TP3) can be used to apply an external Enable signal to the device. Pulling TP3 to ground will disable the part.

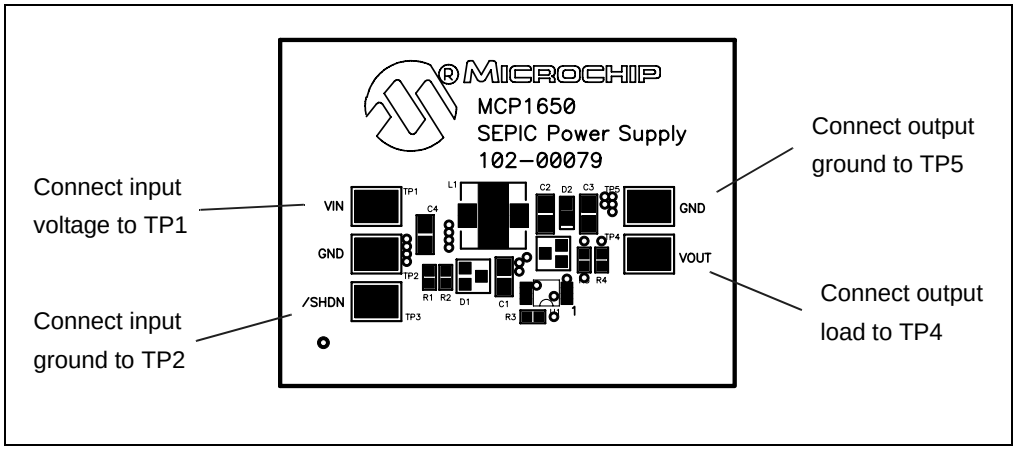

FIGURE 2-1: *MCP1650 SEPIC Demo Board Assembly Drawing.*

2.3.2 Evaluating the Application

The MCP1650 SEPIC Demo Board can be used to provide a low-cost, minimal size, low-power bias circuit. A well-regulated 5V at 160 mA output is produced from a 3.0V to 7.0V input source. This voltage range allows the source to be a single Li-Ion battery or three to four NiMH batteries.

The SEPIC topology is employed to convert this wide-ranging input source to a well-regulated 5 volts. The SEPIC has the ability to automatically buck or boost the input source. By coupling the two inductors onto one magnetic core, a small footprint, low parts-count, low-power step-up or step-down converter is developed.

To truly evaluate the effectiveness of the MCP1650 SEPIC Demo Board, the input voltage must be varied over the entire operating range, while the load is varied from 0A to 160 mA. Test points are provided for connecting the variable input voltage source (TP1 and TP2) and a variable load (TP4 and TP5). An additional test point (TP3) is connected to the shutdown pin ($\overline{SHDN}$) of the MCP1650. On the board, the $\overline{SHDN}$ pin is pulled-up to V_{IN}. However, by connecting TP3 to GND, the converter can be disabled.

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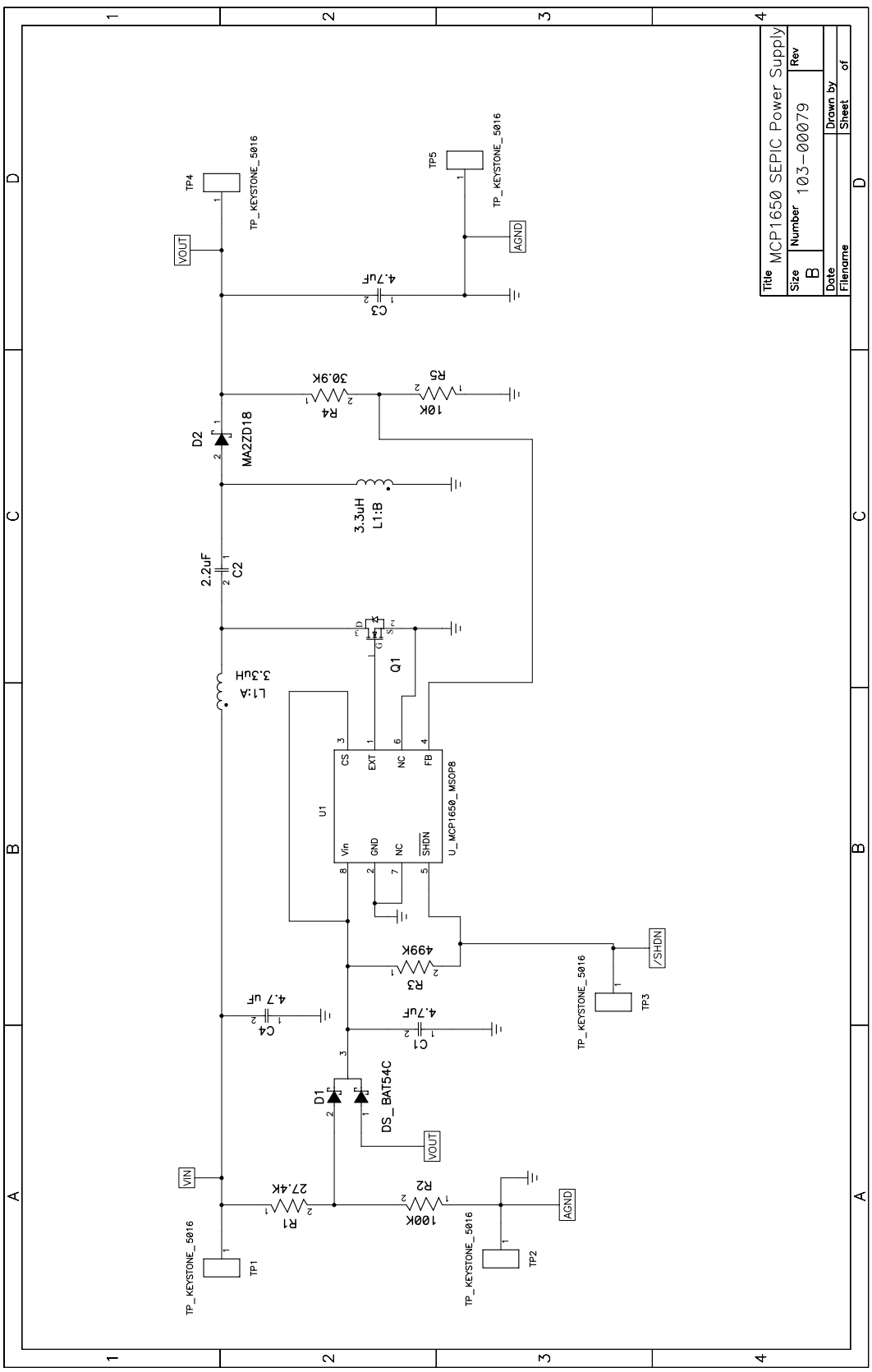
Appendix A. Schematic and Layout

A.1 INTRODUCTION

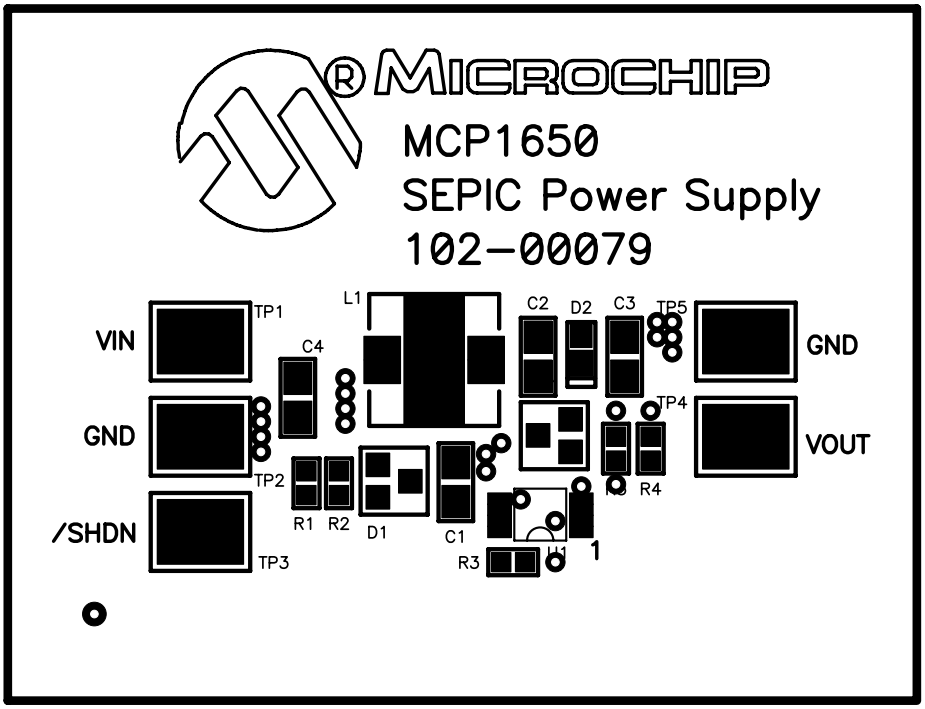
This appendix contains the following schematic and layout diagrams for the MCP1650 SEPIC Demo Board:

- Board Schematic
- Board – Top Overlay
- Board – Top Layer
- Board – Bottom Layer

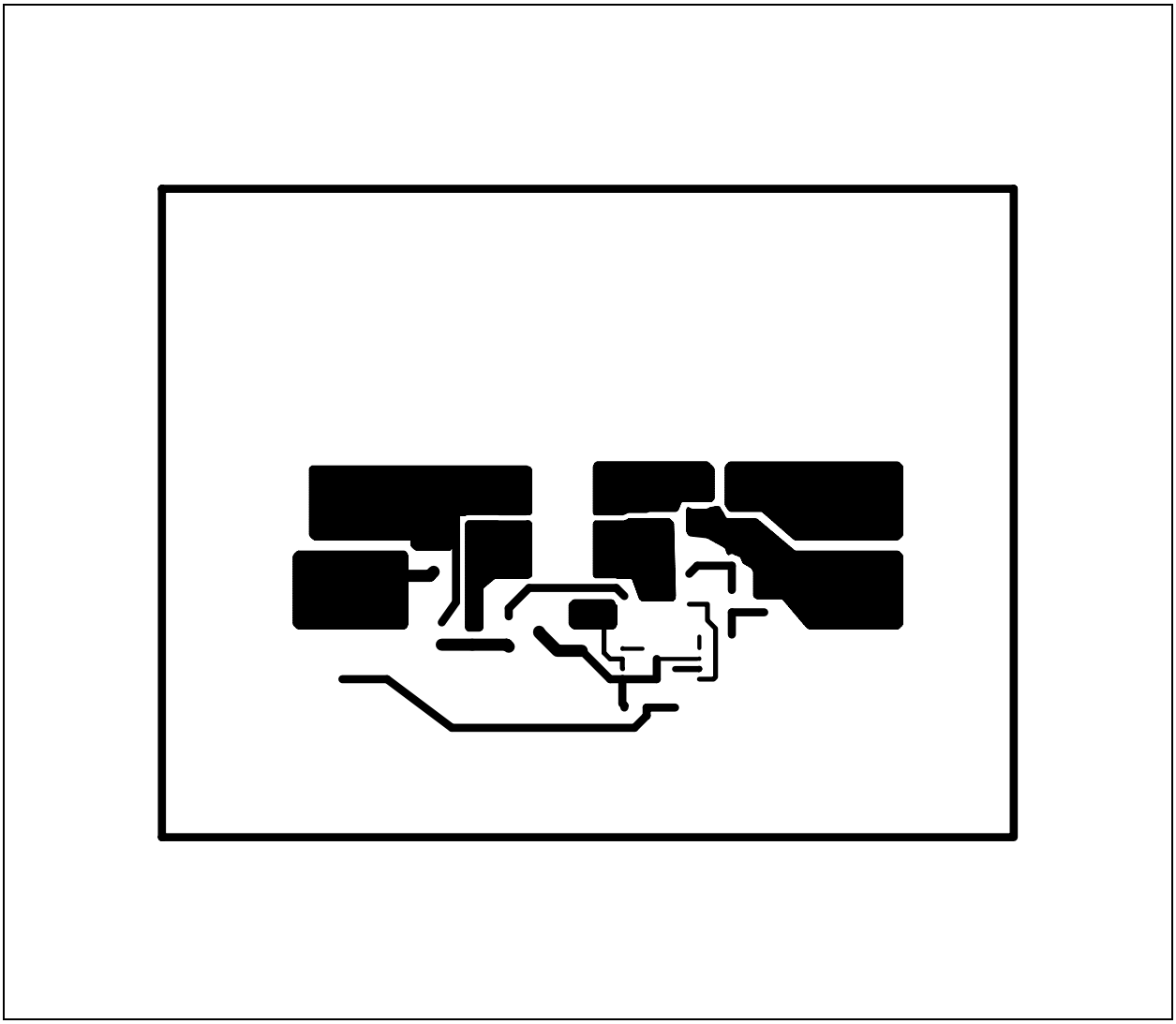
A.2 BOARD SCHEMATIC



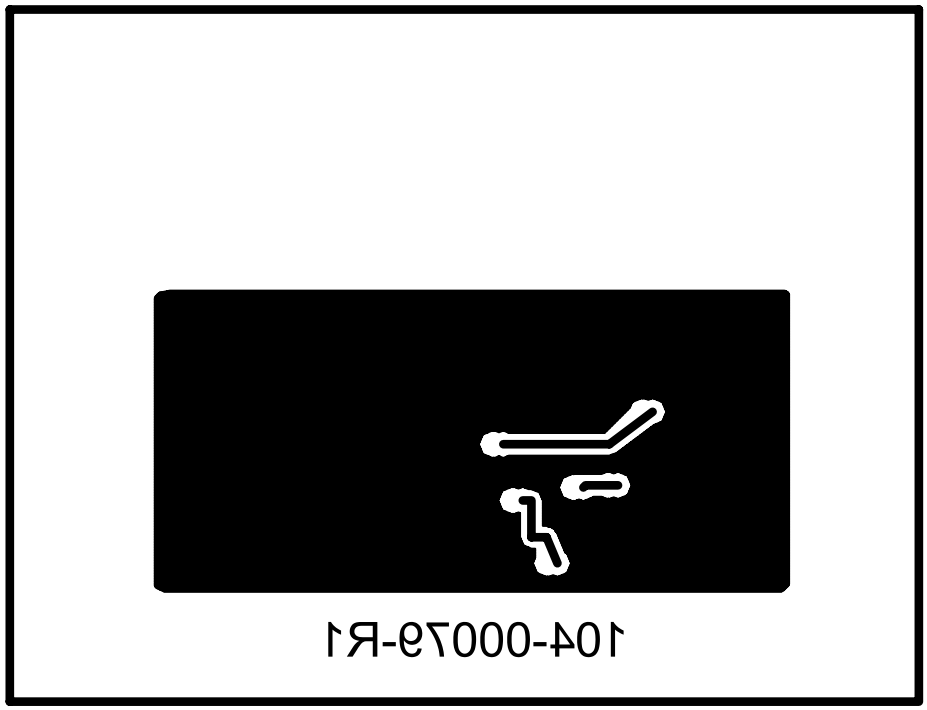
A.3 BOARD – TOP OVERLAY



A.4 BOARD – TOP LAYER



A.5 BOARD – BOTTOM LAYER



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Appendix B. Bill Of Materials (BOM)

TABLE B-1: BILL OF MATERIALS (BOM)

Qty.	Reference	Description	Mfgr.	Part Number
3	C1, C3, C4	4.7 µF, X5R Ceramic, 16V, 0805	Panasonic®	ECJ-2FB1C475K
1	C2	2.2 µF, X5R Ceramic, 16V, 0805	Panasonic	ECJ-2FB1C225K
1	L1	3.3 µH, Dual Inductor	Coiltronics®	DRQ73-3R3
1	D1	Schottky Diode, 30V, Dual	Philips Electronics	BAT54C
1	D2	Schottky Diode, 20V	Panasonic	MA2ZD1800L
1	Q1	N-Channel 20V 4.2A MOSFET	International Rectifier	IRLML2502
1	R5	10 KΩ, 1/10W, 1%, 0603	Rohm	MCR03EZPJ103
1	R1	27.4 KΩ, 1/10W, 1%, 0603	Rohm	MCR03EZPFX2742
1	R4	30.9 KΩ, 1/10W, 1%, 0603	Rohm	MCR03EZPFX3092
1	R2	100 KΩ, 1/10W, 1%, 0603	Rohm	MCR03EZPFX1003
1	R3	499 KΩ, 1/10W, 1%, 0603	Rohm	MCR03EZPFX4993
5	TP1,TP2, TP3, TP4, TP5	Test Point	Keystone Electronics®	5016
1	U1	750 kHz, Boost Controller, MSOP	Microchip Technology Inc.	MCP1650R-E/MS

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