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**MCP73833**  
**Li-Ion Battery Charger**  
**Evaluation Board**  
**User's Guide**

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# MCP73833 LI-ION BATTERY CHARGER EVALUATION BOARD USER'S GUIDE

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# **MCP73833 Li-Ion Battery Charger Evaluation Board User's Guide**

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# MCP73833 LI-ION BATTERY CHARGER EVALUATION BOARD USER'S GUIDE

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## Preface

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### 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](http://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 MCP73833 Li-Ion Battery Charger 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 MCP73833 Li-Ion Battery Charger Evaluation Board. The manual layout is as follows:

- **Chapter 1. "Product Overview"** – Important information about the MCP73833 Li-Ion Battery Charger Evaluation Board.
- **Chapter 2. "Installation and Operation"** – Includes instructions on how to get started with this evaluation kit and a description of the evaluation boards.
- **Appendix A. "Schematic and Layouts"** – Shows the schematic and layout diagrams for the MCP73833 Li-Ion Battery Charger Evaluation Board.
- **Appendix B. "Bill Of Materials (BOM)"** – Lists the parts used to build the MCP73833 Li-Ion Battery Charger Evaluation Board.

# MCP73833 Li-Ion Battery Charger Evaluation Board User's Guide

## CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

### DOCUMENTATION CONVENTIONS

Description	Represents	Examples
<b>Arial font:</b>		
Italic characters	Referenced books	<i>MPLAB<sup>®</sup> 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&gt;Save</i></u>
Bold characters	A dialog button	Click <b>OK</b>
	A tab	Click the <b>Power</b> 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>
<b>Courier New font:</b>		
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 MCP73833 Li-Ion Battery Charger Evaluation Board. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

**MCP73833 Data Sheet, “Stand-Alone Linear Li-Ion / Li-Polymer Charge Management Controller” (DS22005)**

This data sheet provides detailed information regarding the MCP73831 product family.

**AN947, “Power Management in Portable Applications: Charging Lithium-Ion / Lithium-Polymer Batteries” (DS00947)**

This application note provides general information regarding charging Li-Ion batteries.

**AN971, “USB Port-Powered Li-Ion/Li-Polymer Battery Charging” (DS00971)**

This application note provides general information regarding charging Li-Ion batteries from a USB port.

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- Technical Support
- Development Systems Information Line

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

## DOCUMENT REVISION HISTORY

**Revision A (September 2006)**

- Initial Release of this Document.

# **MCP73833 Li-Ion Battery Charger Evaluation Board User's Guide**

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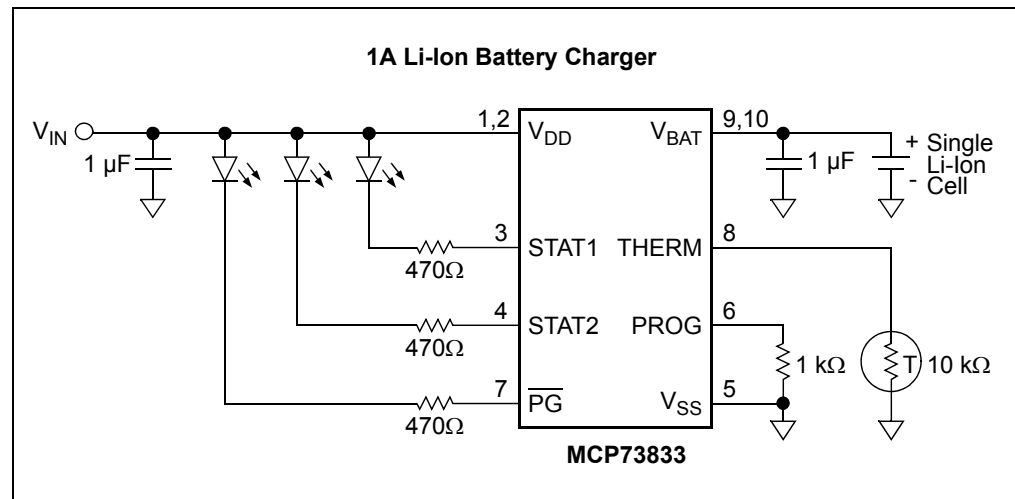
## Chapter 1. Product Overview

### 1.1 INTRODUCTION

The MCP73833 Li-Ion Battery Charger Evaluation Board is used to evaluate Microchip Technology's MCP73833/4 in simple, stand-alone Li-Ion battery charging applications. Two circuit layouts are provided for evaluation of various device options in either the DFN or MSOP package.

This chapter covers the following topics:

- What is the MCP73833 Li-Ion Battery Charger Evaluation Board?
- What the MCP73833 Evaluation Kit Includes



**FIGURE 1-1:** Typical MCP73833 Application.

## 1.2 WHAT IS THE MCP73833 LI-ION BATTERY CHARGER EVALUATION BOARD?

The MCP73833 Li-Ion Battery Charger Evaluation Board is an evaluation and demonstration tool for Microchip's MCP73833/4 Stand-Alone Linear Li-Ion/Li-Polymer Charge Management Controllers.

The evaluation board has two circuits provided with one circuit fully assembled and tested. Each circuit is set up to evaluate simple, stand-alone, linear charging of single cell Li-Ion / Li-Polymer battery packs (the battery packs are not included). The circuits can be evaluated independently. Each circuit design provides constant current charging followed by constant voltage charging with automatic charge termination and battery temperature monitoring. In addition, the assembled MCP73833/4-FC circuit provides preconditioning of deeply depleted cells.

Each board design provides evaluation of the MCP73833/4 in two package options: a MSOP-10 (not assembled) and a 3mm x 3mm, 10-Lead DFN (assembled) for higher power handling capability.

When connected, this evaluation board allows for the evaluation of the MCP73833/4 devices in a variety of applications.

## 1.3 WHAT THE MCP73833 EVALUATION KIT INCLUDES

This MCP73833 Li-Ion Battery Charger Evaluation Board Kit includes:

- MCP73833 Li-Ion Battery Charger Evaluation Board, 102-00117
- Analog and Interface Products Demonstration Boards CD-ROM, (DS21912)
  - MCP73833 Li-Ion Battery Charger Evaluation Board User's Guide, (DS51526)



# MCP73833 LI-ION BATTERY CHARGER EVALUATION BOARD USER'S GUIDE

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## Chapter 2. Installation and Operation

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### 2.1 INTRODUCTION

The MCP73833 Li-Ion Battery Charger Evaluation Board demonstrates Microchip Technology's MCP73833/4 devices. The MCP73833/4 is a Stand-Alone Linear Li-Ion/Li-Polymer Charge Management Controller. A number of device options allow the MCP73833/4 to be utilized in a variety of applications. Refer to the MCP73833/4 data sheet (DS22005) for device options.

### 2.2 FEATURES

The MCP73833 Li-Ion Battery Charger Evaluation Board contains two evaluation circuits for evaluation of various device options. The board has the following features with the factory installed device (MCP73833-FCI/MF):

- Charge Voltage: 4.20V
- Programmable Fast Charge Current up to 1000 mA
- Preconditioning of deeply depleted cells
  - Preconditioning Threshold Voltage: 3.0V
  - Preconditioning Current: 10% of Programmed Fast Charge Current
- Automatic Charge Termination
  - Charge termination by minimum current in Constant Voltage Mode
  - Charge termination by safety time period: 6 hours
  - Termination Current: 7.5% of Programmed Fast Charge Current
- Automatic Recharge
  - Recharge Threshold Voltage: 4.05V
- Cell Temperature Monitoring
- Charge Current Monitor for Fuel Guaging
- Thermal Regulation
- Reverse Discharge Protection
- Evaluation in 3mm x 3mm, 10-Lead DFN Package for higher power handling capability
- Simple Stand-Alone Operation
- Powered from external bench supply or voltage regulated wall cube
- Surface-Mount Design
- One Circuit Fully Assembled and Tested

# MCP73833 Li-Ion Battery Charger Evaluation Board User's Guide

## 2.3 GETTING STARTED

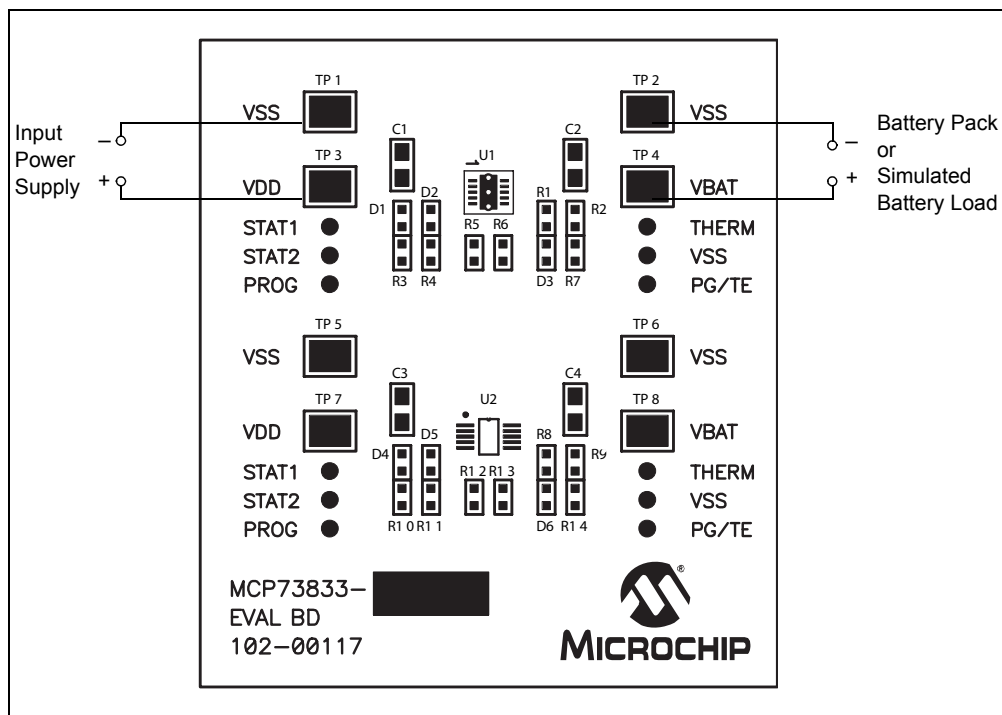
The MCP73833 Li-Ion Battery Charger Evaluation Board has one circuit fully assembled and tested for charging single cell, Li-Ion/Li-Polymer battery packs. The board provides the appropriate charge algorithm for simple, stand-alone operation.

The board requires the use of an external input voltage source ( $5V \pm 10\%$ , recommended) and external load (battery pack or simulated battery load).

### 2.3.1 Power Input and Output Connections

#### 2.3.1.1 POWERING THE MCP73833 LI-ION BATTERY CHARGER EVALUATION BOARD

1. Apply the input voltage source to the appropriate circuit for evaluation. The input voltage source should be limited to the 0V to +6V range. For normal operation, the input voltage should be between +4.5V and +6V. The input voltage must not exceed an absolute maximum of +7V.
2. Connect the positive side of the input source (+) to VDD of the circuit being evaluated. Connect the negative or return side of the input source (-) to VSS of the circuit being evaluated. Refer to [Figure 2-1](#).



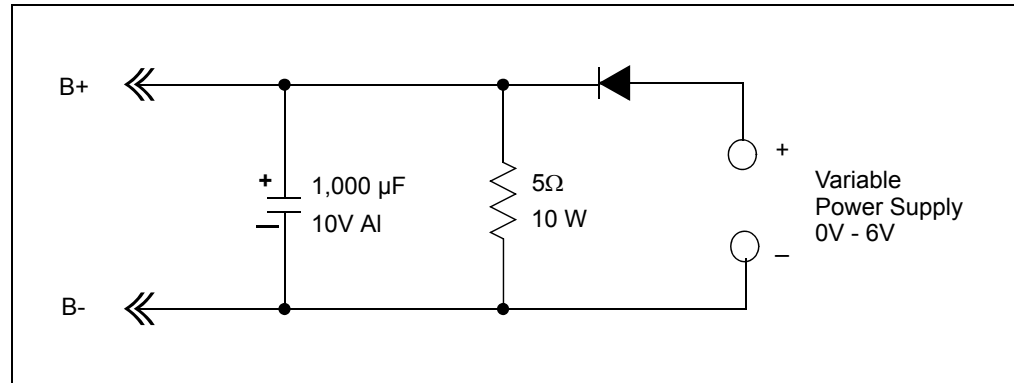
**FIGURE 2-1:** Setup Configuration Diagram.

#### 2.3.1.2 APPLYING THE LOAD TO THE MCP73833 LI-ION BATTERY CHARGER EVALUATION BOARD

1. To apply a load to the MCP73833 Li-Ion Battery Charger Evaluation Board, the positive side of the load (B+) should be connected to VBAT of the circuit being evaluated. The negative or return side of the load (B-) should be connected to VSS of the circuit being evaluated. Care should be taken when using electronic loads or ground referenced loads.
2. For the MCP73833-FCI/MF installed device, the charge management controller will only provide 10% of the programmed fast charge current if the battery terminal voltage (VBAT) is less than 3.0V with respect to VSS. Using a purely resistive

# Installation and Operation

load will not work for preconditioning and fast charge currents. The best way to evaluate the charge management circuit is to use a single cell Li-Ion battery pack, or the recommended simulated battery load. Refer to [Figure 2-2](#).



**FIGURE 2-2:** Simulated Battery Load.

### 2.3.1.3 SETTING THE FAST CHARGE CURRENT

1. As provided, the MCP73833 Li-Ion Battery Charger Evaluation Board has a fast charge current setting of 1A for the installed device.
2. Alternatively, for the installed device, resistors R5 and R6 can be changed in order to obtain the desired fast charge current. In addition, the PROG via can be interfaced to obtain two current settings or to utilize the PROG device enable feature. Refer to the MCP73833/4 data sheet for choosing the appropriate value programming resistor for the desired fast charge current.

### 2.3.1.4 STATUS INDICATORS

1. The MCP73833 Li-Ion Battery Charger Evaluation Board has three LED status indicators for each circuit being evaluated. [Table 2-1](#) represents the state of the status indicators during various states of the charge cycle. ON indicates that the respective LED is illuminated.

**TABLE 2-1: STATUS INDICATORS**

CHARGE CYCLE STATE	STAT1 (RED)	STAT2 (GREEN)	PG (GREEN)
Shutdown	OFF	OFF	OFF
Standby	OFF	OFF	ON
Charge in Progress	ON	OFF	ON
Charge Complete (EOC)	OFF	ON	ON
Temperature Fault	OFF	OFF	ON
Timer Fault	OFF	OFF	ON
System Test Mode	ON	ON	ON

### 2.3.1.5 BATTERY TEMPERATURE MONITOR

1. As provided, the installed circuit of the MCP73833 Li-Ion Battery Charger Evaluation Board has the battery temperature monitor disabled. To invoke battery temperature monitoring, an appropriate thermistor should be connected between the THERM via and VSS via. In addition, resistors R2 and R7 should be changed in order to obtain the desired charge inhibit window. Refer to the MCP73833/4 data sheet for choosing the appropriate resistor values. charge current monitor for each circuit being evaluated.

## 2.3.1.6 DEVICE SUPPORT OPTIONS

1. The MCP73833 Li-Ion Battery Charger Evaluation Board is capable of supporting all of the available MCP73833/4 device options. The factory installed device is the MCP73833-FCI/MF. Refer to the MCP73833/4 data sheet for available device options and details regarding the installed device options.



# MCP73833 LI-ION BATTERY CHARGER EVALUATION BOARD USER'S GUIDE

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## Appendix A. Schematic and Layouts

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### A.1 INTRODUCTION

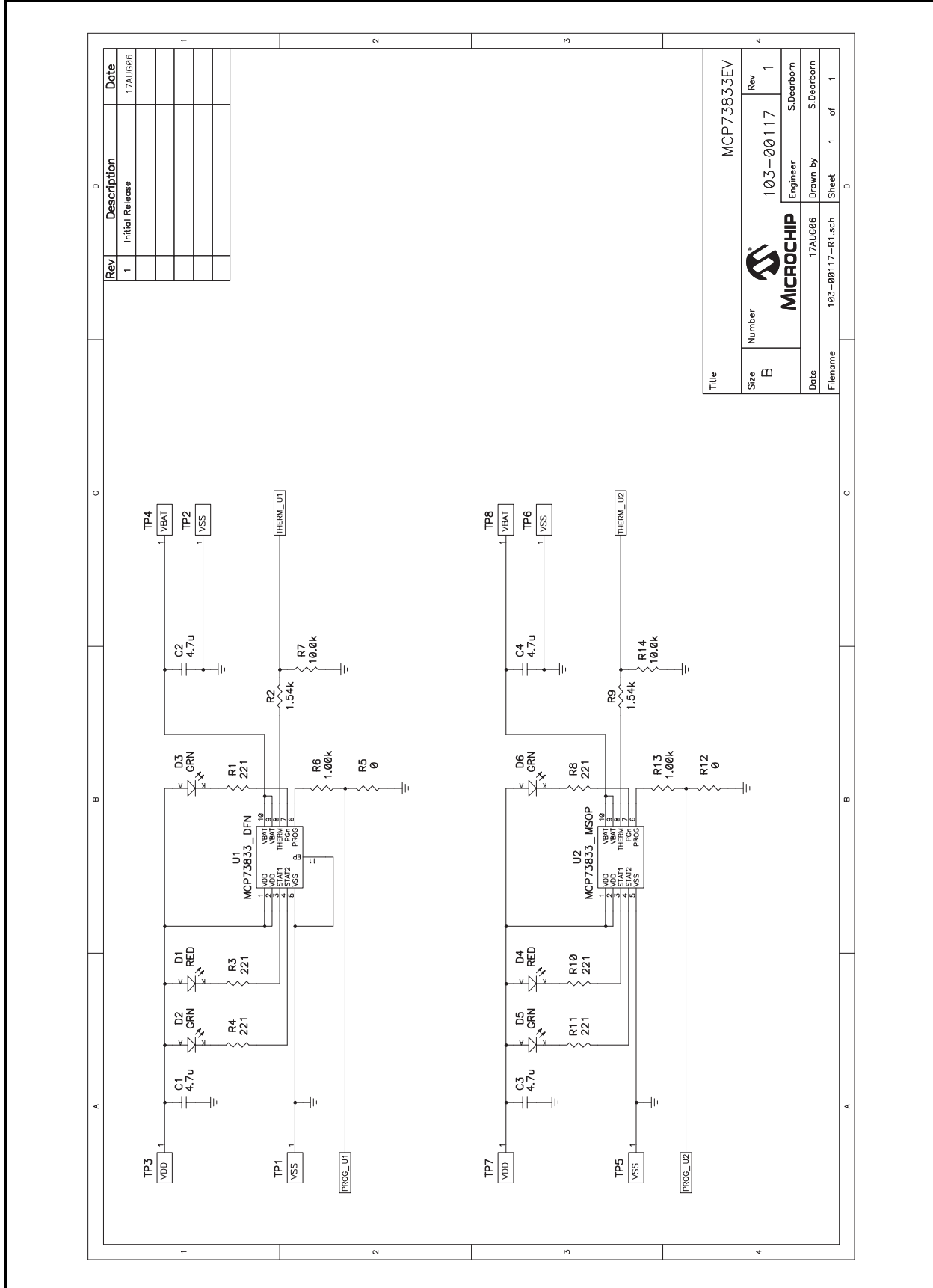
This appendix contains the following schematic and layouts for the MCP73833 Li-Ion Battery Charger Evaluation Board.

Diagrams included in this appendix:

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

# MCP73833 Li-Ion Battery Charger Evaluation Board User's Guide

## A.2 BOARD SCHEMATIC

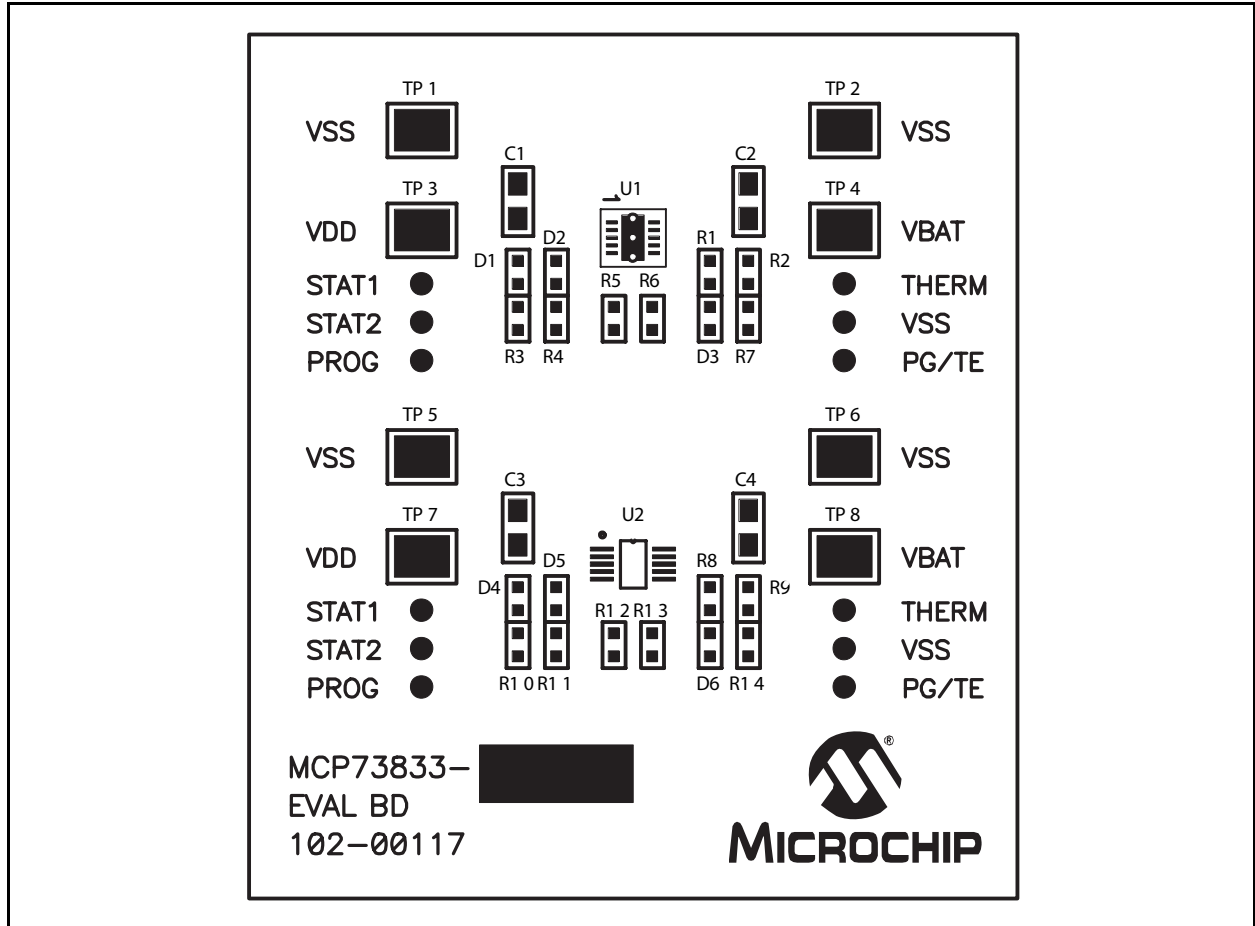


Rev	Description	Date
1	Initial Release	17AUG06

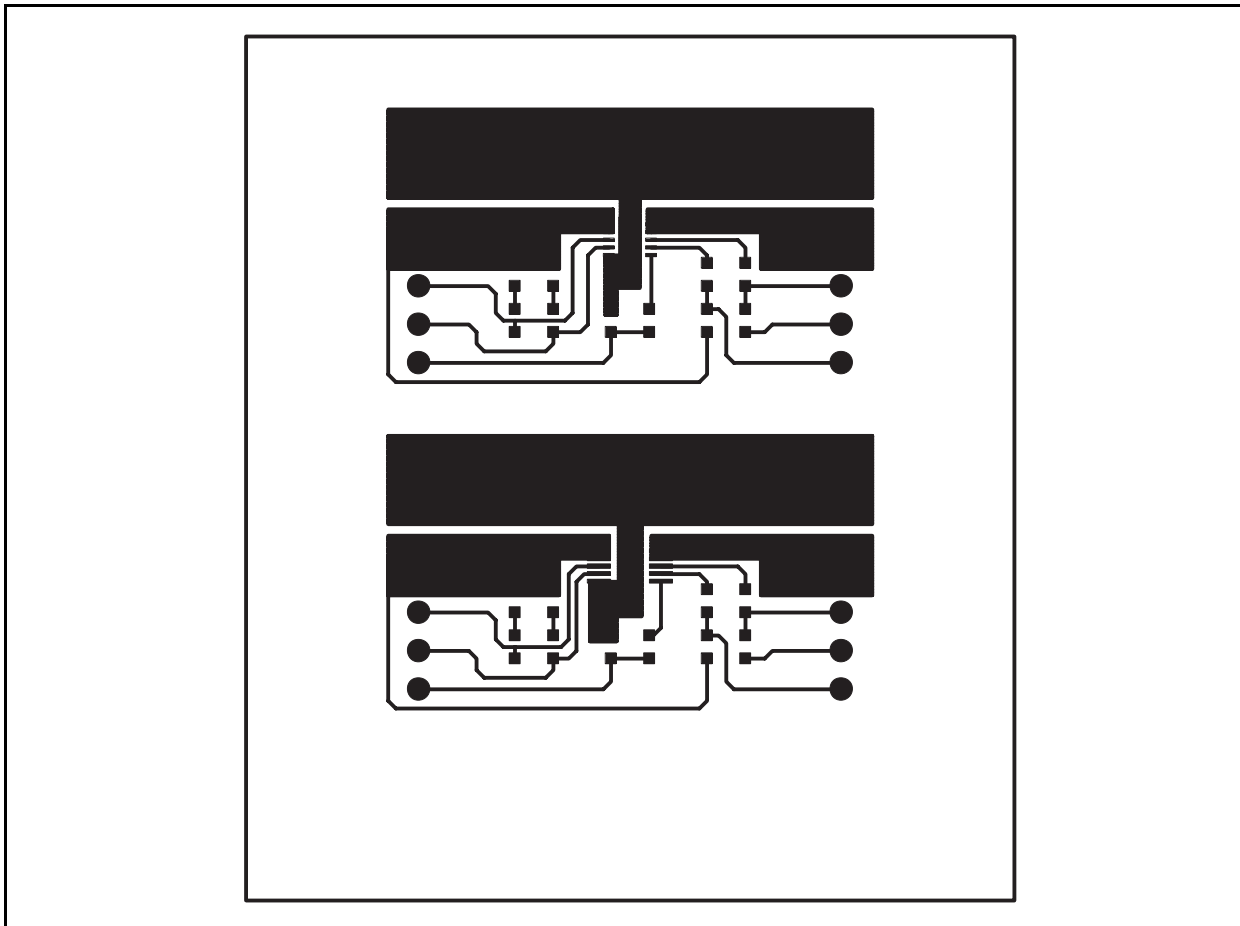
Title		MCP73833EV	
Size	B	Number	103-00117
Date	17AUG06	Engineer	S.Dearborn
Filename	103-00117-R1.sch	Drawn by	S.Dearborn
Sheet	1	of	1



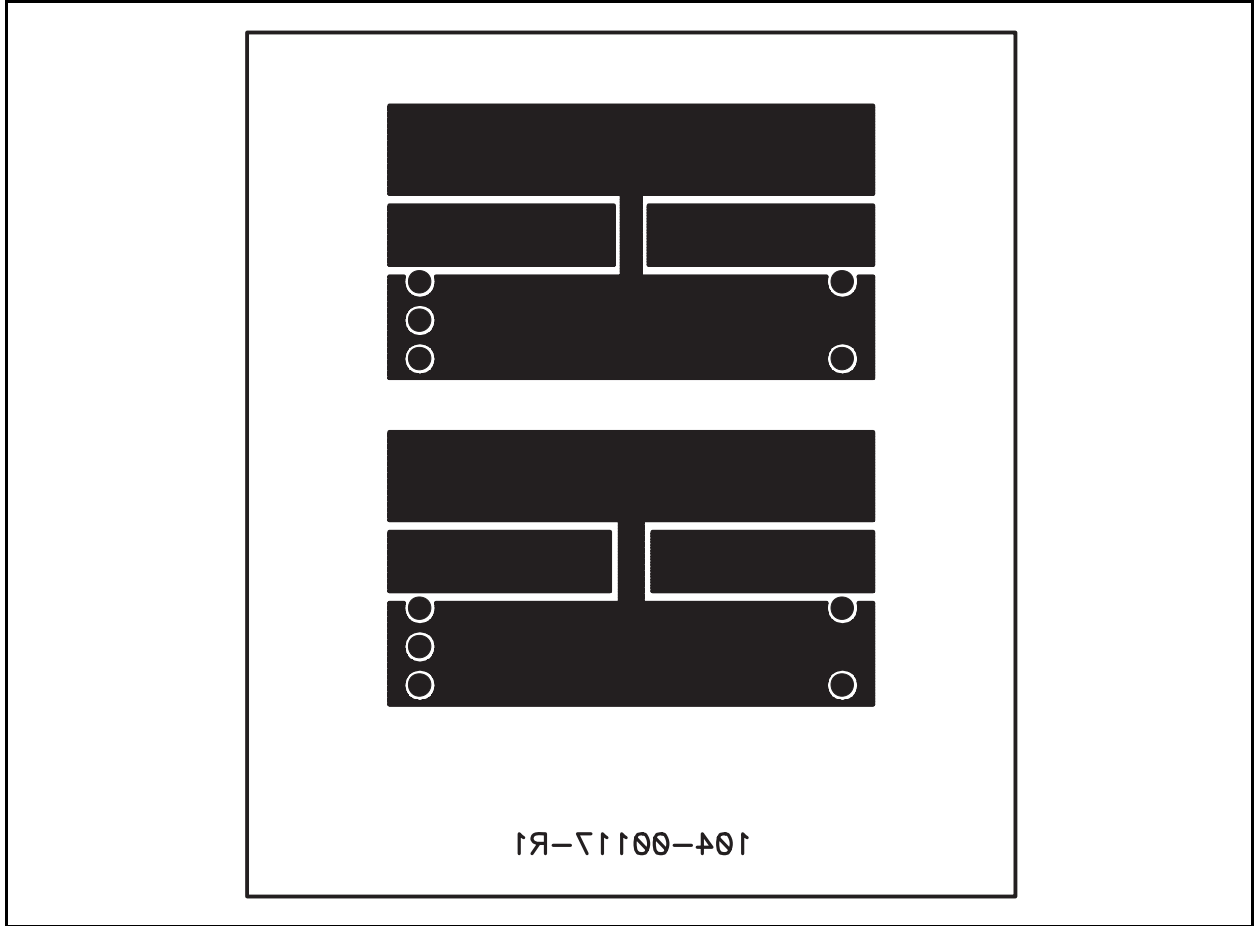
## A.3 BOARD - TOP OVERLAY



## A.4 BOARD - TOP LAYER



## A.5 BOARD - BOTTOM LAYER



# **MCP73833 Li-Ion Battery Charger Evaluation Board User's Guide**

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# MCP73833 LI-ION BATTERY CHARGER EVALUATION BOARD USER'S GUIDE

## Appendix B. Bill Of Materials (BOM)

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

Qty.	Reference	Description	Mfgr.	Part Number
2	C1,C2	4.7uF, X7R Ceramic, 10V, 0805	Taiyo Yuden®	LMK212BJ475KG-TR
1	D1	Super Red LED, 0603	Lumex®	LTST-C190KRKT
2	D2,D3	Green LED, 0603	Lumex	LTST-C190KGKT
3	R1,R3,R4	221, 1/10W, Chip Resistor, 0603	Panasonic®-ECG	ERJ-3EKF2210V
1	R2	1.54k, 1/10W, Chip Resistor, 0603	Panasonic-ECG	ERJ-3EKF1541V
1	R5	0, 1/10W, Chip Resistor, 0603	Panasonic-ECG	ERJ-3GEY0R00V
1	R6	1.00k, 1/10W, Chip Resistor, 0603	Panasonic-ECG	ERJ-3EKF1001V
1	R7	10.0k, 1/10W, Chip Resistor, 0603	Panasonic-ECG	ERJ-3EKF1002V
4	TP1-TP4	Surface Mount Test Point, 5016	Keystone Electronics®	5016
1	U1	1A Fully Integrated Charger, 3X3DFN10	Microchip Technology Inc.	MCP73833-FCI/MF
4		Bump-ons	3M™	SJ5003
1		Printed Circuit Board	Advanced Circuits	104-00117-R1

**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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