MCP73831 Evaluation Board User's Guide

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MCP73831 EVALUATION BOARD USER'S GUIDE

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MCP73831 EVALUATION 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.

INTRODUCTION

This chapter contains general information that will be useful to know before using the MCP73831 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 MCP73831 Evaluation Board. The manual layout is as follows:

- **Chapter 1. "Product Overview"** – Important information about the MCP73831 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 MCP73831 Evaluation Board.
- **Appendix B. "Bill Of Materials (BOM)"** – Lists the parts used to build the MCP73831 Evaluation 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
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	*`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 MCP73831 Evaluation Board. The following Microchip documents are available and recommended as supplemental reference resources.

MCP73831 Data Sheet, *"Miniature Single-Cell, Fully-Integrated Li-Ion, Li-Polymer Charge-Management Controller", (*DS21984)

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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- Field Application Engineer (FAE)
- 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 (December 2005)

- Initial Release of this Document.

Chapter 1. Product Overview

1.1 INTRODUCTION

The MCP73831 Evaluation Board is used to evaluate Microchip's MCP73831 in simple, stand-alone Li-Ion battery charging applications. Two circuit boards are provided in the MCP73831 Evaluation Kit for evaluation of various device options.

This chapter covers the following topics:

- What is the MCP73831 Evaluation Board?
- What the MCP73831 Evaluation Kit Includes

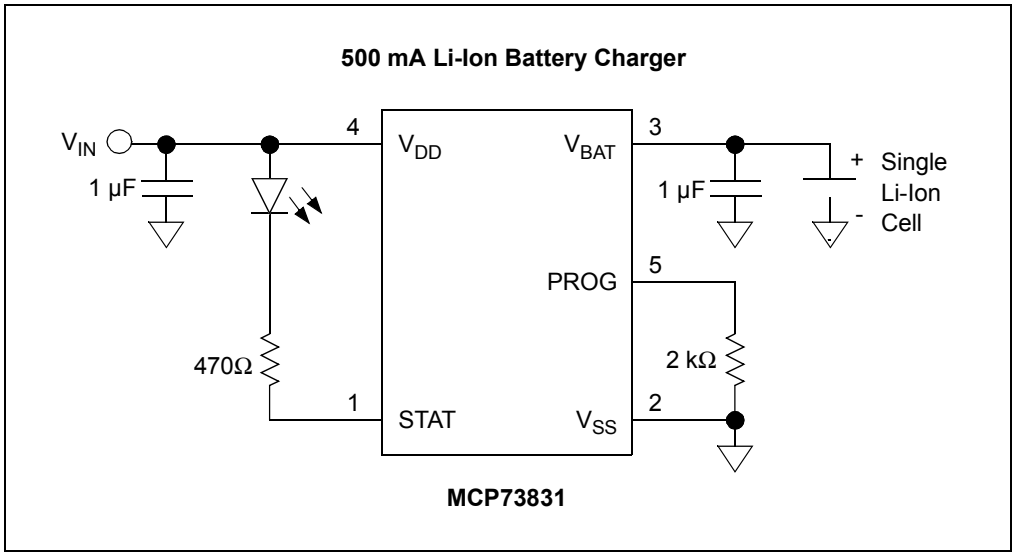

FIGURE 1-1: *Typical MCP73831 Application.*

1.2 WHAT IS THE MCP73831 EVALUATION BOARD?

The MCP73831 Evaluation Board is an evaluation and demonstration tool for Microchip's MCP73831 miniature single-cell, fully-integrated Li-Ion, Li-Polymer charge-management controllers.

Two evaluation boards are provided in the MCP73831 Evaluation Kit. The boards are set up to evaluate simple, stand-alone, linear charging of single-cell Li-Ion / Li-Polymer battery packs (the battery packs are not included). Each board design provides constant current charging followed by constant voltage charging with automatic charge termination. In addition, the MCP73831-2AC board provides preconditioning of deeply depleted cells.

Each board design provides evaluation of the MCP73831 in two package options: a SOT23-5 and a 2 mm x 3 mm, 8-Lead DFN for higher power handling capability.

When connected, these evaluation boards allow for the evaluation of the MCP73831 devices in a variety of applications.

1.3 WHAT THE MCP73831 EVALUATION KIT INCLUDES

This MCP73831 Evaluation Kit includes:

- Two MCP73831 Evaluation Boards, 102-00085
- MCP73831 Evaluation Board User's Guide, DS51596
- MCP73831 Data Sheet, *"Miniature Single-Cell, Fully-Integrated Li-Ion, Li-Polymer Charge-Management Controller",* DS21984
- AN947, *"Power Management in Portable Applications: Charging Lithium-Ion/Lithium-Polymer Batteries",* DS00947
- AN971, *"USB Port-Powered Li-Ion/Li-Polymer Battery Charging",* DS00971

Chapter 2. Installation and Operation

2.1 INTRODUCTION

The MCP73831 Evaluation Board demonstrates Microchip's MCP73831. The MCP73831 is a miniature single-cell, fully-integrated Li-Ion/Li-Polymer charge-management controller. A number of device options allow the MCP73831 to be utilized in a variety of applications. Refer to the MCP73831 data sheet (DS21984) for device options.

2.2 FEATURES

The MCP73831 Evaluation Kit contains two boards for evaluation of various device options. The boards have the following features with the factory installed devices:

- Charge Voltage: 4.20V
- Programmable Fast Charge Current up to 500 mA
- Preconditioning of deeply depleted cells (MCP73831-2AC)
  - Preconditioning Threshold Voltage: 2.8V
  - Preconditioning Current: 10% of Programmed Fast Charge Current
- No Preconditioning (MCP73831-2DC)
- Automatic Charge Termination
  - Charge termination by minimum current in Constant Voltage Mode
  - Termination Current: 7.5% of Programmed Fast Charge Current
- Automatic Recharge
  - Recharge Threshold Voltage: 4.05V
- Charge Current Monitor for Fuel Gauging
- Thermal Regulation
- Reverse Discharge Protection
- Evaluation in SOT23-5 Package
- Evaluation in 2 mm x 3 mm, 8-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
- Fully Assembled and Tested

2.3 GETTING STARTED

The MCP73831 Evaluation Boards are fully assembled and tested for charging single-cell, Li-Ion/Li-Polymer battery packs. The boards provide the appropriate charge algorithm for simple, stand-alone operation.

The boards require the use of an external input voltage source (5V ±10%, recommended) and external load (battery pack or simulated battery load).

2.3.1 Power Input and Output Connections

2.3.1.1 POWERING A MCP73831 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 V_{DD} of the circuit being evaluated. Connect the negative or return side of the input source (-) to V_{SS} of the circuit being evaluated. Refer to Figure 2-1.

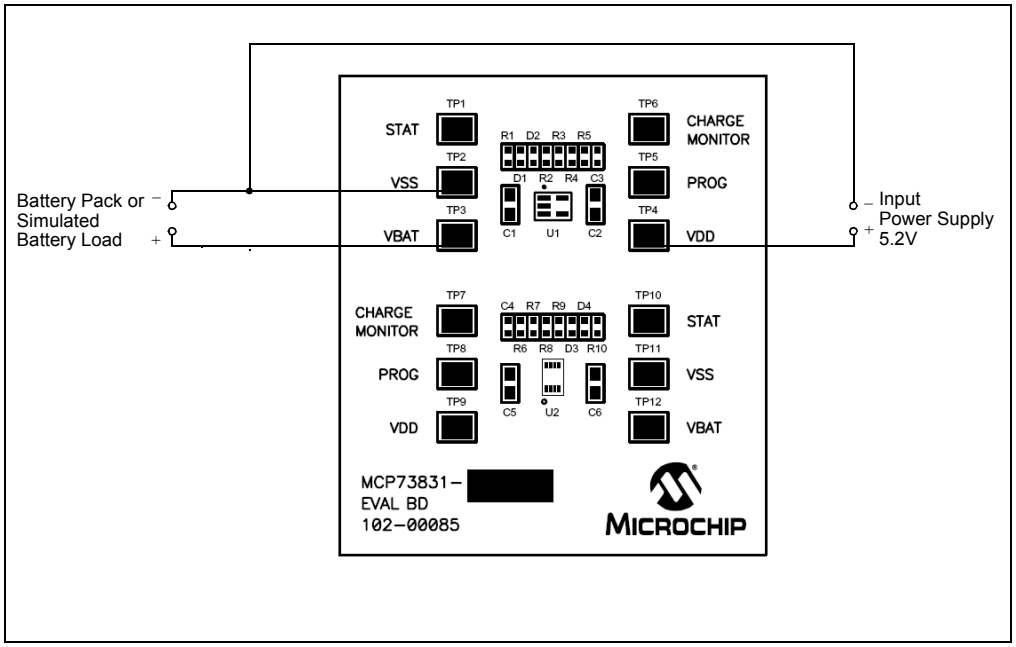

FIGURE 2-1: *Setup Configuration Diagram.*

2.3.1.2 APPLYING THE LOAD TO A MCP73831 EVALUATION BOARD

1. To apply a load to a MCP73831 Evaluation Board, the positive side of the load (B+) should be connected to V_{BAT} of the circuit being evaluated. The negative or return side of the load (B-) should be connected to V_{SS} of the circuit being evaluated. Care should be taken when using electronic loads or ground referenced loads.
2. For the MCP73831-2AC board, the charge management controller will only provide 10% of the programmed fast charge current if the battery terminal voltage (V_{BAT}) is less than 2.8V with respect to V_{SS}. Using a purely resistive 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.

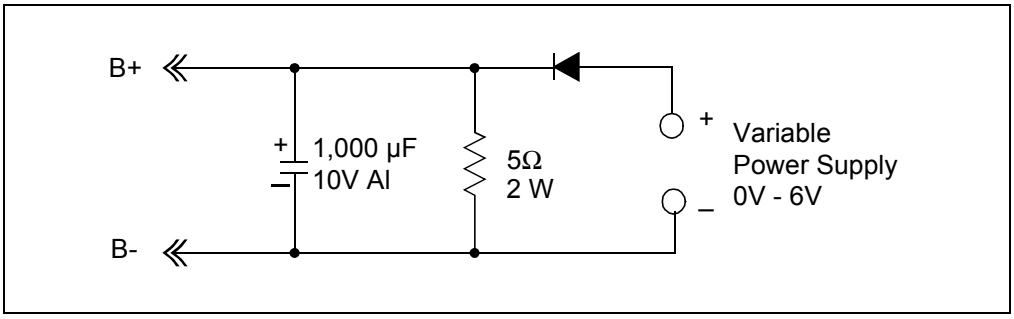

FIGURE 2-2: *Simulated Battery Load.*

2.3.1.3 SETTING THE FAST CHARGE CURRENT

1. As provided, the MCP73831 Evaluation Boards have two fast charge current settings: 100 mA and 500 mA. The default fast charge current setting is 100 mA. By jumpering PROG to V_{SS} of the circuit being evaluated, the fast charge current is set to 500 mA.
2. Alternatively, the appropriate programming resistor can be changed in the hardware to obtain the desired fast charge current setting. Resistor R3 should be changed for the SOT23 circuit, and resistor R8 should be changed for the DFN circuit. Refer to the MCP73831 data sheet for choosing the appropriate value programming resistor for the desired fast charge current.

2.3.1.4 STATUS INDICATORS

1. The MCP73831 Evaluation Boards have two 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	Red LED	Green LED
Qualification	ON	ON
Preconditioning	ON	OFF
Constant Current Fast Charge	ON	OFF
Constant Voltage	ON	OFF
Charge Complete	OFF	ON
Battery Disconnected	ON	ON
Input Voltage Source Removed	OFF	OFF
Input Voltage Source Below UVLO	ON	ON
Shutdown	ON	ON

2.3.1.5 CHARGE CURRENT MONITOR

1. The MCP73831 Evaluation Boards have a charge current monitor for each circuit being evaluated. The charge current monitor can be used as a coulomb counter for fuel gauging. The charge current is equivalent to the voltage at CHARGE MONITOR with respect to V_{SS} divided by the value of the programming resistor in kilo-ohms. For example, the default programming resistor is 10 kΩ. If the measured voltage at CHARGE MONITOR is 1V, the charge current is equal to 1 divided 10, or 100 mA. If the measured voltage at CHARGE MONITOR is 100 mV, the charge current is 0.1 divided by 10, or 10 mA.

2.3.1.6 DEVICE SUPPORT OPTIONS

1. The MCP73831 Evaluation Boards are capable of supporting all of the available MCP73831 device options. The factory installed devices are the MCP73831-2AC and the MCP73831-2DC. Refer to the MCP73831 data sheet for available device options and details regarding the installed device options.

Appendix A. Schematic and Layouts

A.1 INTRODUCTION

This appendix contains the following schematic and layouts for the MCP73831 Evaluation Boards.

Diagrams included in this appendix:

- Board Schematic
- Board - Assembly Drawing
- Board - Top Overlay
- Board - Top Layer
- Board - Bottom Layer

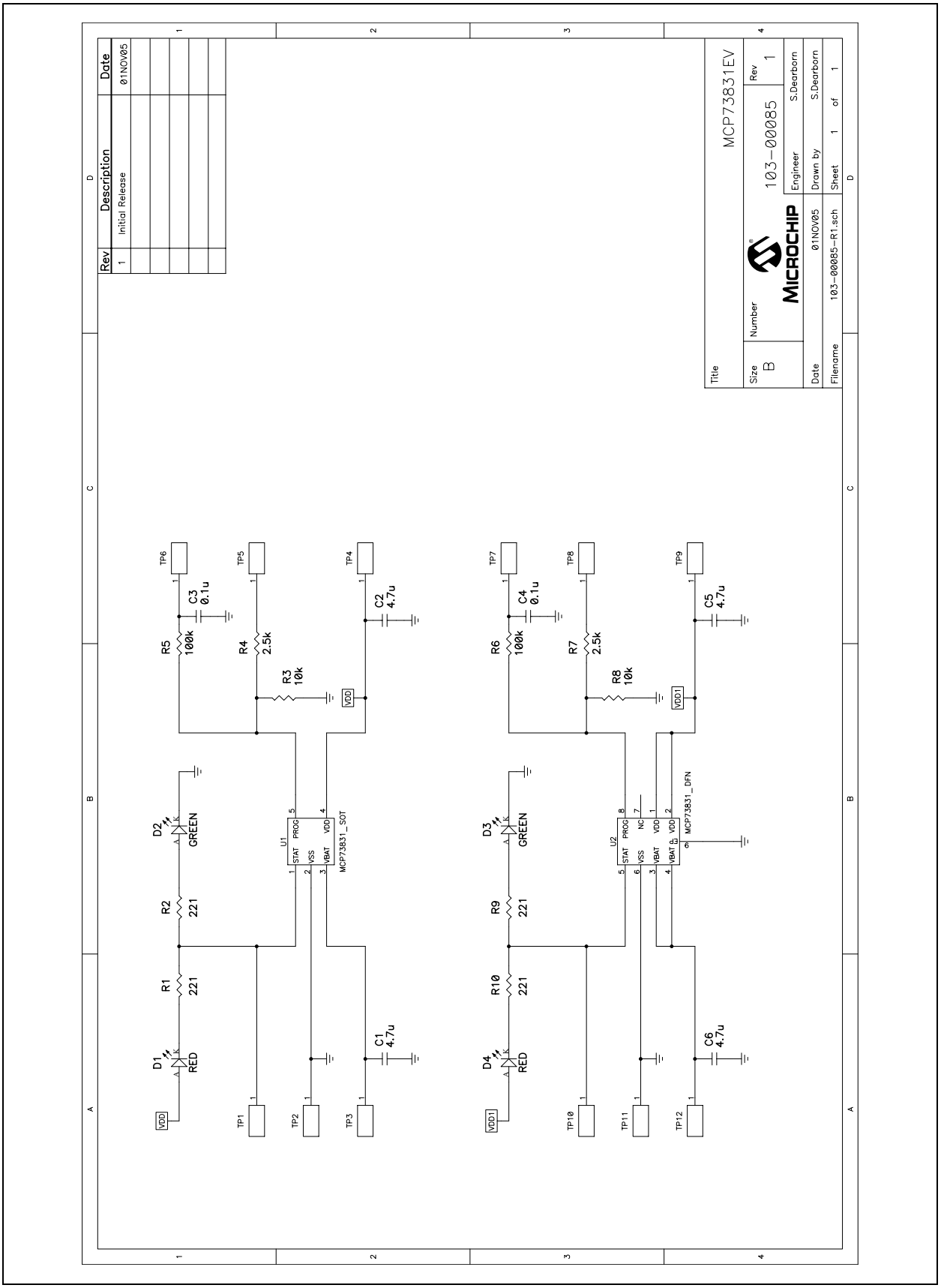

FIGURE A-1: *Board Schematic.*

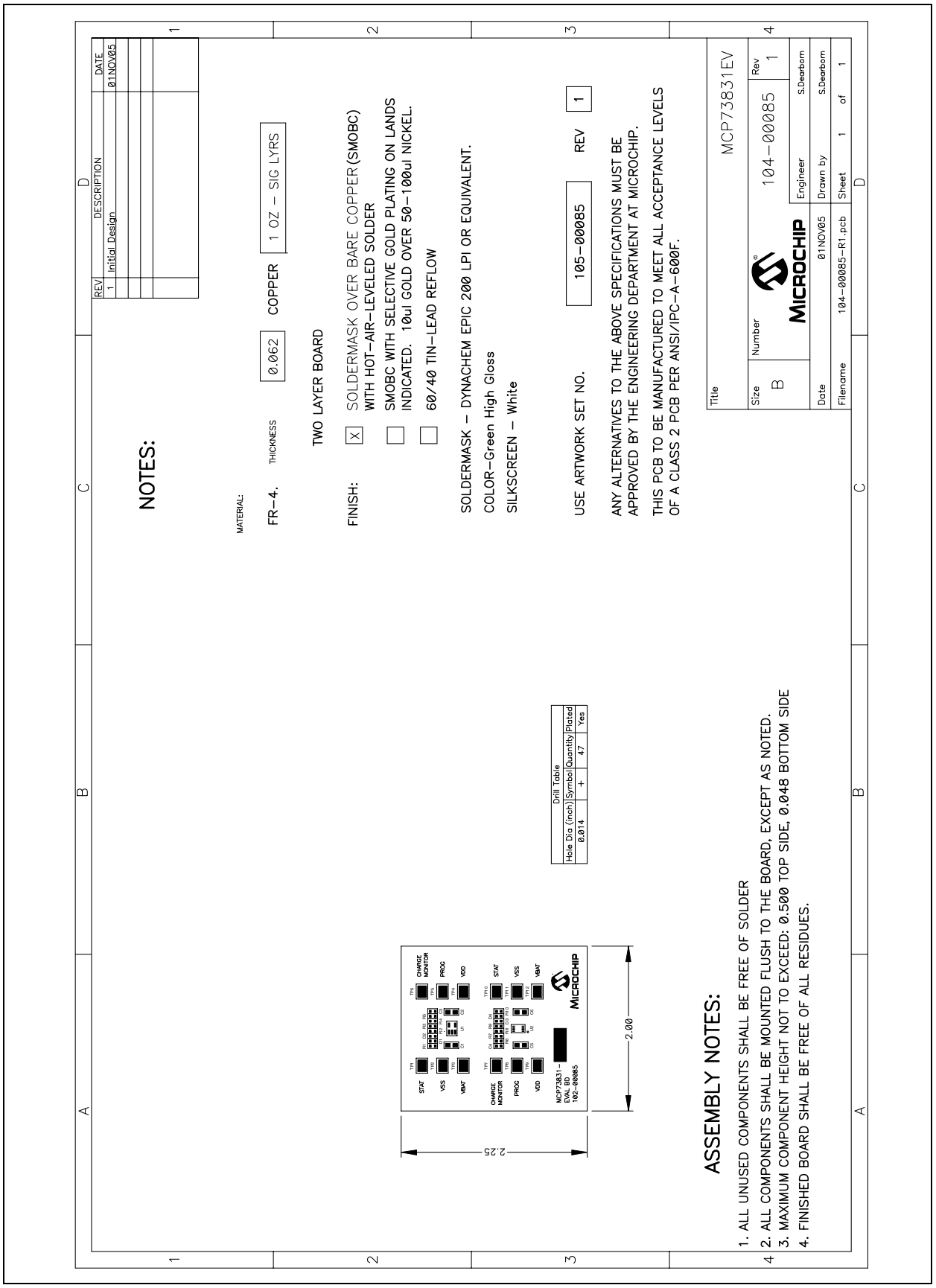

FIGURE A-2: *Board - Assembly Drawing.*

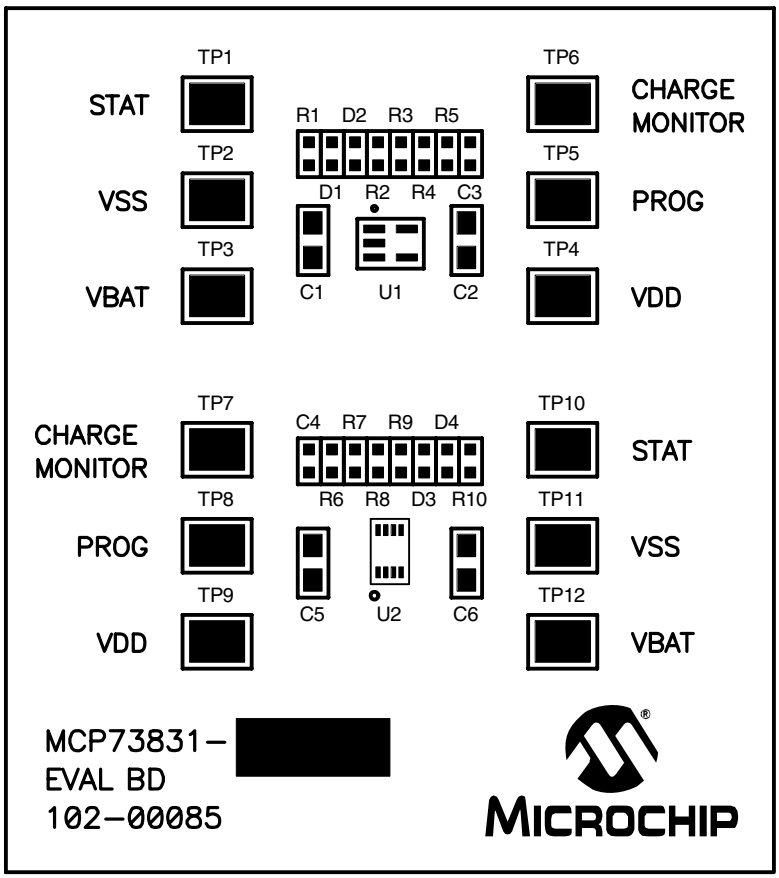

FIGURE A-3: *Board - Top Overlay.*

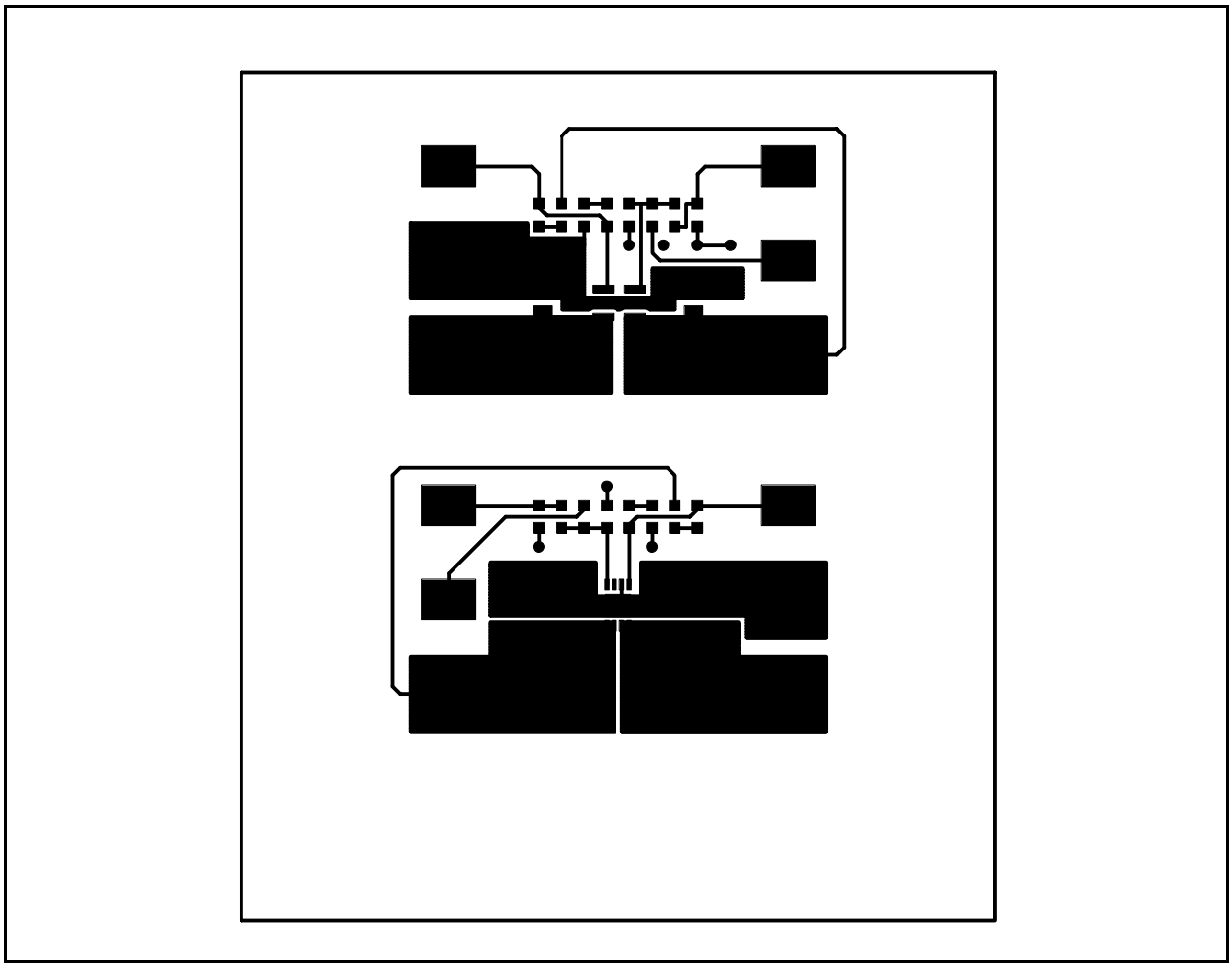

FIGURE A-4: *Board - Top Layer.*

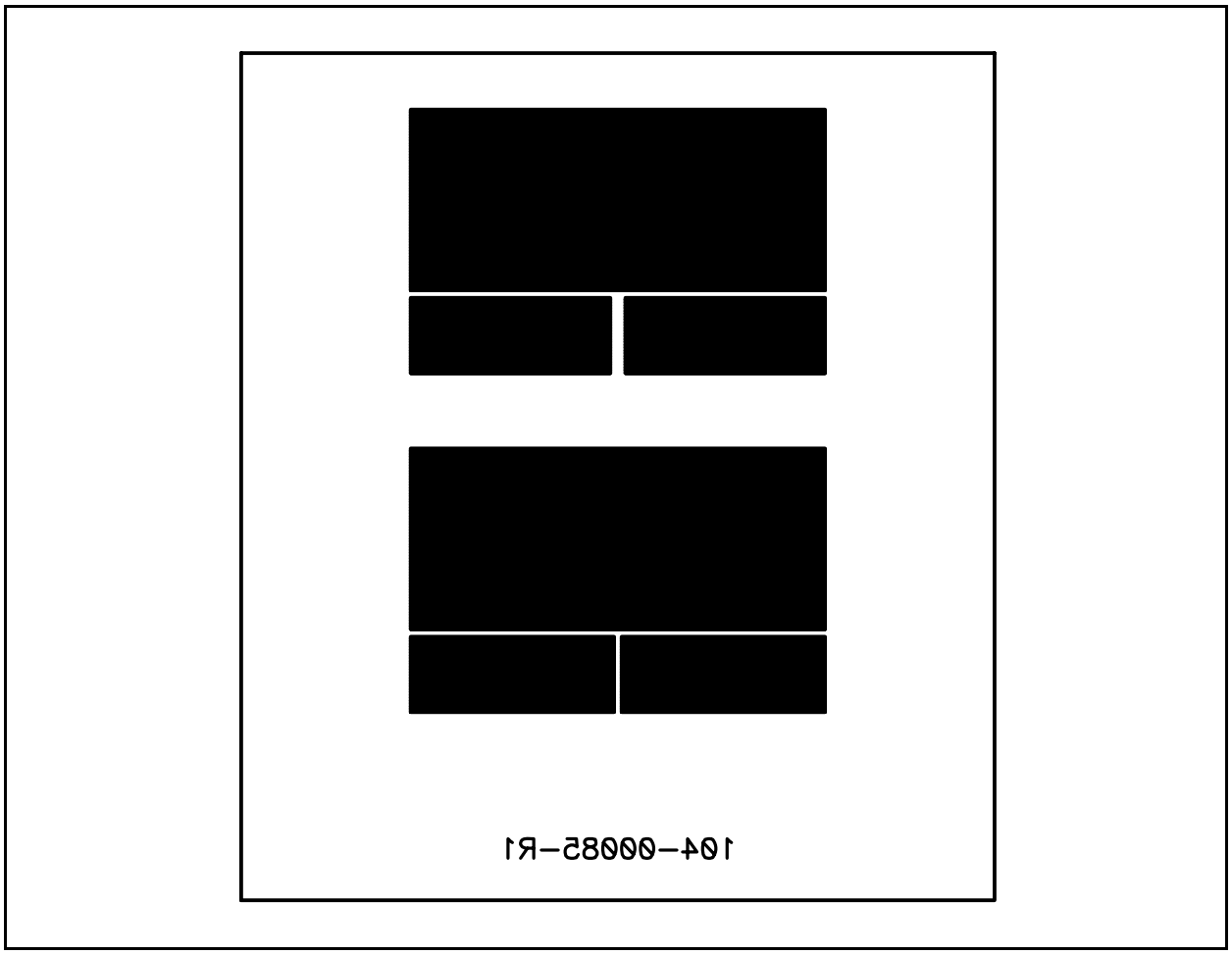

FIGURE A-5: *Board - Bottom Layer.*

Appendix B. Bill Of Materials (BOM)

TABLE B-1: BILL OF MATERIALS (BOM)

Qty.	Reference	Description	Mfgr.	Part Number
4	C1,C2,C5,C6	4.7uF, X5R Ceramic, 10V, 0805	Panasonic®-ECG	ECJ-GVB1A475M
2	C3,C4	0.1uF, X7R Ceramic, 16V, 0603	Panasonic-ECG	ECJ-1VB1C104K
2	D1,D4	Super Red LED, 0603	Lumex	LTST-C190KRKT
2	D2,D3	Green LED, 0603	Lumex	LTST-C190KGKT
4	R1,R2,R9,R10	221, 1/10W, Chip Resistor, 0603	Panasonic-ECG	ERJ-3EK2210V
2	R3,R8	10.0k, 1/10W, Chip Resistor, 0603	Panasonic-ECG	ERJ-3EK1002V
2	R4,R7	2.49k, 1/10W, Chip Resistor, 0603	Panasonic-ECG	ERJ-3EK2491V
2	R5,R6	100k, 1/10W, Chip Resistor, 0603	Panasonic-ECG	ERJ-3EK1003V
12	TP1-TP12	Surface Mount Test Point, 5016	Keystone	5016
1	U1	Miniature Li-Ion Charger, SOT23-5	Microchip Technology Inc.	MCP73831-2ACI/OT MCP73831-2DCI/OT (1)
1	U2	Miniature Li-Ion Charger, 2X3DFN8	Microchip Technology Inc.	MCP73831-2ACI/MC MCP73831-2DCI/MC (1)
4		Bump-ons	3M	SJ5003
1		Printed Circuit Board	Advanced Circuits	104-00085-R1

Note 1: Installed device option is indicated on board.

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