

MCP73871 Evaluation Board User's Guide

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MCP73871 EVALUATION BOARD USER'S GUIDE

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MCP73871 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.

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 MCP73871 Evaluation Board User's Guide. 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 MCP73871 Evaluation Board User's Guide as a development tool to emulate and debug firmware on a target board. The manual layout is as follows:

- **Chapter 1. "Product Overview"** – Important information about the MCP73871 Evaluation Board User's Guide.
- **Chapter 2. "Installation and Operation"** – Includes instructions on how to get started with this user's guide and a description of the user's guide.
- **Appendix A. "Schematic and Layouts"** – Shows the schematic and layout diagrams for the MCP73871 Evaluation Board User's Guide.
- **Appendix B. "Bill Of Materials (BOM)"** – Lists the parts used to build the MCP73871 Evaluation Board User's Guide.

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 MCP73871 Evaluation Board User's Guide. The following Microchip documents are available and recommended as supplemental reference resources.

MCP73871 Data Sheet, *"Stand-Alone Linear Li-Ion / Li-Poly Battery Charge and System Load Sharing Management Controller"*, DS22090

This data sheet provides detailed information regarding the MCP73871 product family.

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- Technical Support

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 (August 2008)

- Initial Release of this Document.

NOTES:

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Chapter 1. Product Overview

1.1 INTRODUCTION

Space and complexity are two key concerns in portable electronic design. The highly integrated MCP73871 device has overcome the hurdles by including the required elements to meet the design challenges when developing new Li-Ion / Li-Polymer battery powered products.

The MCP73871 requires minimum external components to power the system load and charge single cell Li-Ion batteries independently. When input power is absent or insufficient, the Li-Ion battery becomes the primary power source or in help mode to support the required system load current. The MCP73871 Evaluation Board is developed to assist product designers in reducing product design cycle and time by utilizing Microchip's favorite stand-alone Li-Ion battery charger and system load sharing management controller.

This chapter provides an overview of the MCP73871 Evaluation Boardand covers the following topics:

- "What is the MCP73871 Evaluation Board?"
- "What the MCP73871 Evaluation Board Kit includes"

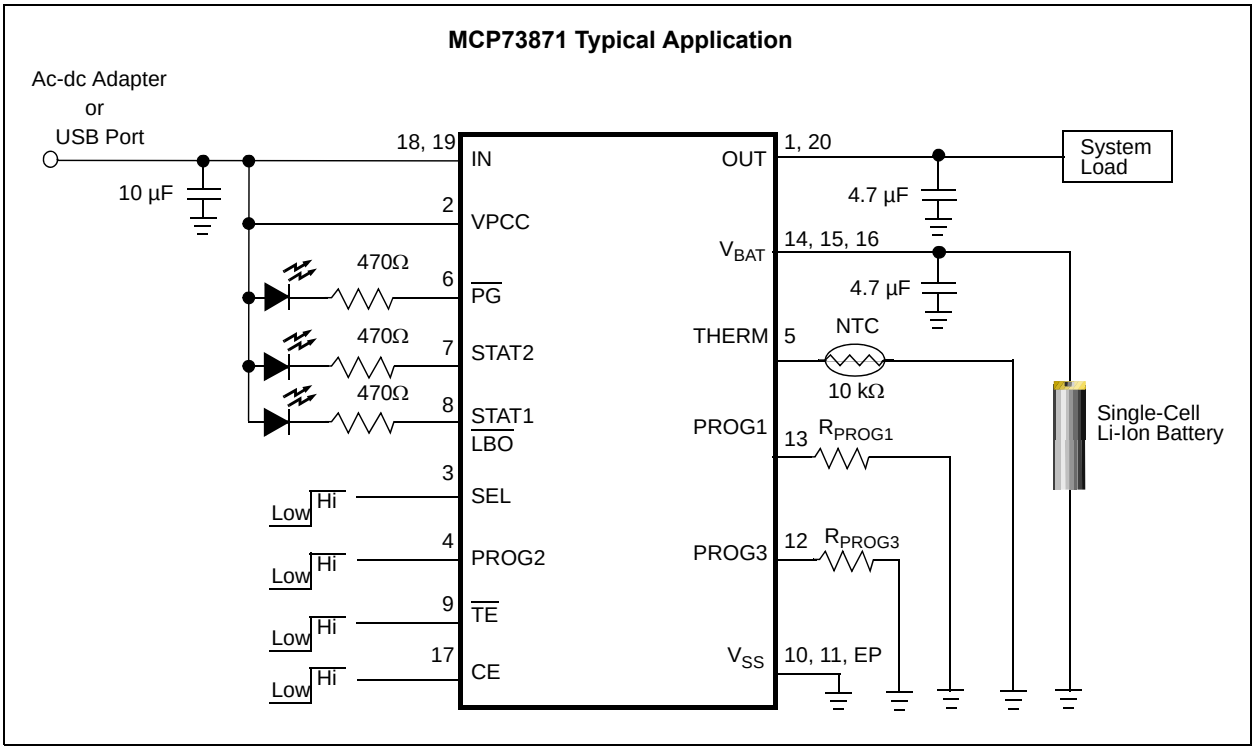


FIGURE 1-1: *MCP73871 With System Power Path Management Application.*

1.2 WHAT IS THE MCP73871 EVALUATION BOARD?

The MCP73871 Evaluation Board demonstrates the features of Microchip's MCP73871 *"Stand-alone Linear Li-Ion / Li-Poly Battery Charge and System Load Sharing Management Controller"*.

The MCP73871 Evaluation Board is designed to deliver minimum 1.5A total current to system load and to a single cell Li-Ion battery at 4.2V preset voltage regulation. (4.1V, 4.35V and 4.4V options are also available for MCP73871) The MCP73871 Evaluation Board has two dip switches to control input current limits. First dip switch (SW2) determines input power source between ac-dc adapter and USB port (AC/USB). Second dip switch (SW1) determines 500 mA high power USB port or 100 mA low power USB port (High/Low). The input current limit is governed by USB specification when selecting USB on SW2.

The maximum fast current when AC is selected on SW2 is programmed by resistor (R_{PROG1}) at 1A and termination current is set at 100 mA by (R_{PROG3}).

The MCP73871 Evaluation Board offers three status LED for two charge status outputs and a power good indicator.

Note:	Please refer to Table 2-1 for charge status outputs and Figure 2-1 for charge current setups.

The MCP73871 Evaluation Board comes with factory preset low battery indicator (LBO) when input is absent. The preset value is 3.1V and STAT1 LED turns on when battery voltage is below the threshold voltage.

The MCP73871 Evaluation Board is designed to observe the performance and features on the circuits via multiple test points. Circuits can also be implemented into suitable applications without additional work.

Note:	For evaluation LBO purpose, connect a DC power supply and set V_{DD} below UVLO. The LBO lights up when V_{BAT} drops below threshold voltage.

1.3 WHAT THE MCP73871 EVALUATION BOARD KIT INCLUDES

This MCP73871 Evaluation Board kit includes:

- MCP73871 Evaluation Board, 102-00183
- Analog and Interface Products Demonstration Boards CD-ROM (DS21912)
  - MCP73871 Evaluation Board User's Guide User's Guide (DS51755)
  - MCP73871 Data Sheet, *"Stand-Alone Linear Li-Ion / Li-Poly Battery Charge and System Load Sharing Management Controller"* (DS22090)

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Chapter 2. Installation and Operation

2.1 INTRODUCTION

The MCP73871 Evaluation Board demonstrates Microchip's stand-alone linear Li-Ion battery charger with system power path and load sharing management control solution. The system load is also supported by the Li-Ion battery when the input power is disconnected. A number of device options allow the MCP73871 to be utilized in a variety of applications. Refer to the MCP73871 Data Sheet (DS22090) and/or contact local Microchip supports for additional device options.

Typical applications for the reference design are Smart Phones, PDA, Portable Media Players, MP3 Players, Digital Cameras, Handheld Medical devices, Bluetooth head-sets, Ultra-Mobile PC and Portable Communicators.

2.2 FEATURES

The MCP73871 Evaluation Board has the following features:

- Integrated System Load Sharing
- Input Current Limit Control with dip switches between ac-dc adapter (Typical 1650 mA), USB-High (Maximum 500 mA) and USB-Low (Maximum 100 mA)
- Three LED indicates charge status, low battery and power good signal
- Preset Li-Ion battery charge voltage: 4.2V ±0.5%
- Temperature monitoring is disabled by default, but can be enabled to use with NTC thermister
- Factory preset 0.1C preconditioning current of deeply depleted cells
- Factory preset 6 hour Safety Timer with Timer Enable feature
- Constant Current / Constant Voltage (CC/CV) charge algorithm
- Resistor programmed maximum charge current: 1A
- Resistor programmed termination set point: 100 mA
- Automatic Charge Termination
- Automatic Recharge
- Internal Thermal Regulation
- Exposed Pad with extra via underneath for better heat dissipations

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2.3 GETTING STARTED

The MCP73871 Evaluation Board is fully assembled and tested for charging a single-cell Li-Ion or Li-Polymer battery with or without system load.

2.3.1 Power Input and Output Connection

2.3.1.1 POWERING THE MCP73871 EVALUATION BOARD

1. Connect the positive battery terminal to V_{BAT+} (TP4) and negative battery terminal to V_{SS} (TP1 or TP5).
2. Connect the 5V - 6V DC power supply Negative Terminal to V_{SS} (TP1 or TP5).
3. Connect the 5V - 6V DC power supply Positive Terminal to V_{DD} (TP2).
4. Connected positive of load to OUT (TP3) on the board and negative of load to either V_{SS} (TP1 or TP5). The system load can be a power resistor or E-Load.
5. The maximum current that system load requires should not violate the specification of Li-Ion battery manufacturer (Typical at 1C or less) or 1A for safety and performance concerns.
6. It should initiate the battery charging cycle when drive CE (TP6) high. Drive CE (TP6) low disables the Li-Ion battery charger function.
7. Position the DIP Switch #2 (SW2) to "AC" allows maximum input current of 1.8A to support both system load and Li-Ion battery charger at 1000 mA fast charge current rate.
8. Position the DIP Switch #2 (SW2) to "USB" limits the input current to meet USB specifications.
9. When DIP Switch #2 (SW2) is positioned at USB; position the DIP Switch #1 (SW1) to "High" limits total input current to 500 mA and "Low" for maximum input current at 100 mA.

Note: Fast Charge Current and Termination Current can be easily programmed with various resistors that based on the Figure 2-1.
The Li-Ion battery pack can be replaced with test circuit or electronic load that can sink current with DC power supply. Please refer to Figure 2-2.

10. Remove DC power supply, the load should be supported by the Li-Ion battery now.

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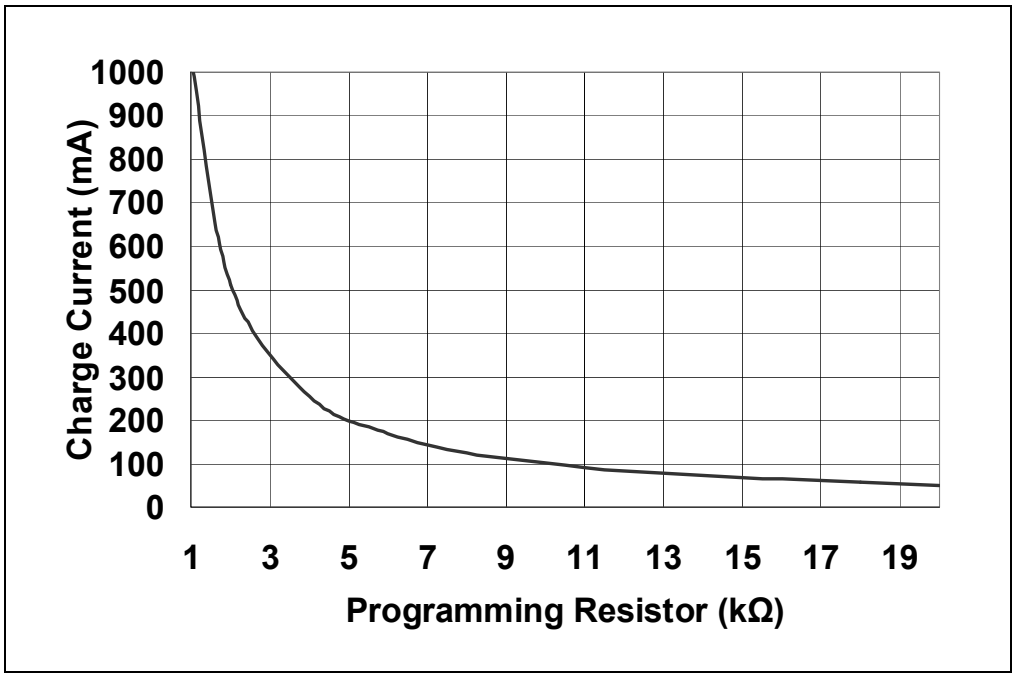


FIGURE 2-1: *MCP73833 Charge Current (I_{OUT}) vs. Programming Resistor (R_{PROG}).*

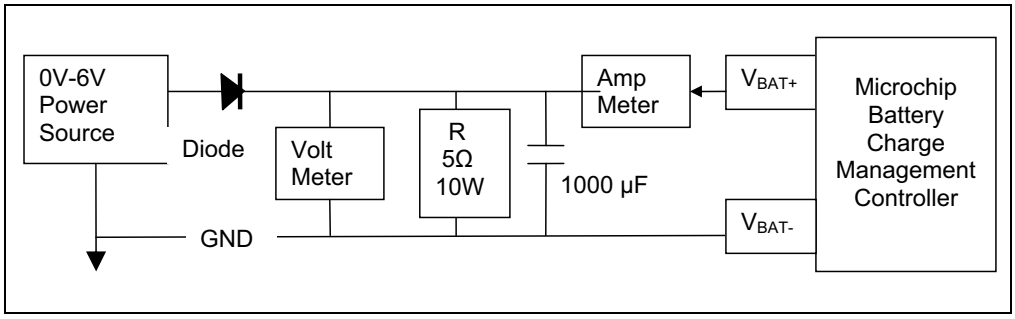


FIGURE 2-2: *Simulated Battery Load.*

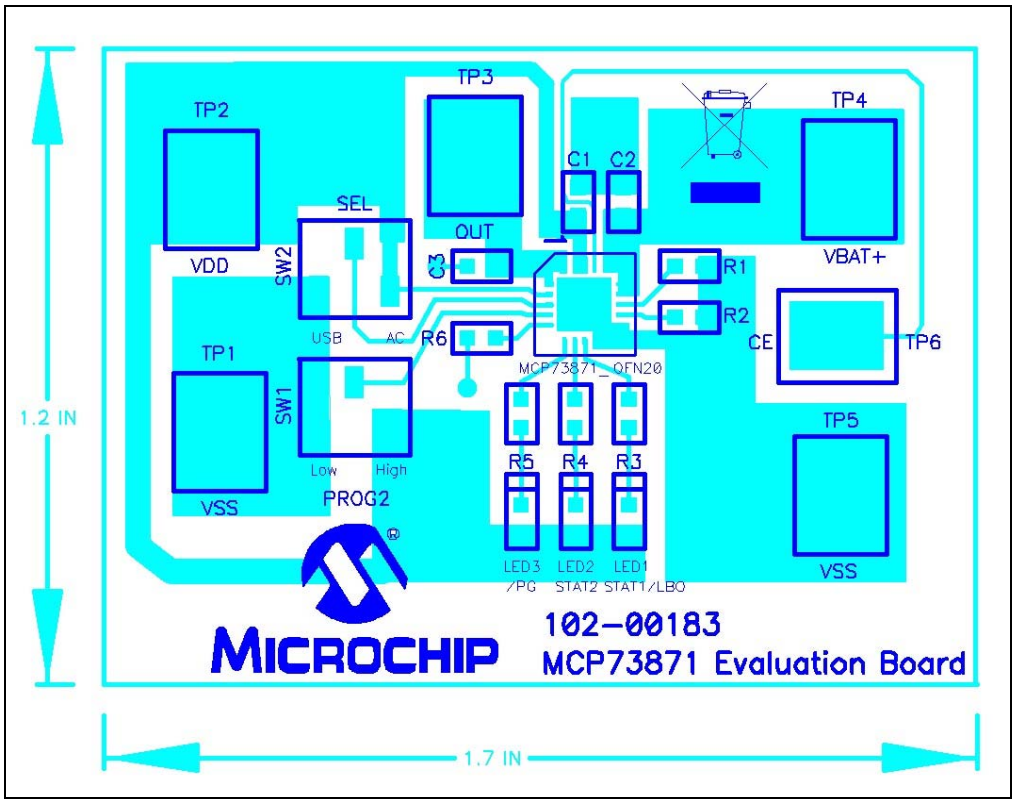


FIGURE 2-3: *MCP73871 Board Layout and Dimensions.*

TABLE 2-1: MCP73871 CHARGE STATUS OUTPUTS

CHARGE CYCLE STATE	STAT1 (Green)	STAT2 (Red)	$\overline{PG}$ (Blue)
Shutdown	OFF	OFF	OFF
Standby	OFF	OFF	ON
Charge in Progress	ON	OFF	ON
Charge Complete (EOC)	OFF	ON	ON
Temperature Fault	ON	ON	ON
Timer Fault	ON	ON	ON
Low Battery Indicator (LBO)	ON	OFF	OFF
No Battery Present	OFF	OFF	ON
No Input Power	OFF	OFF	OFF

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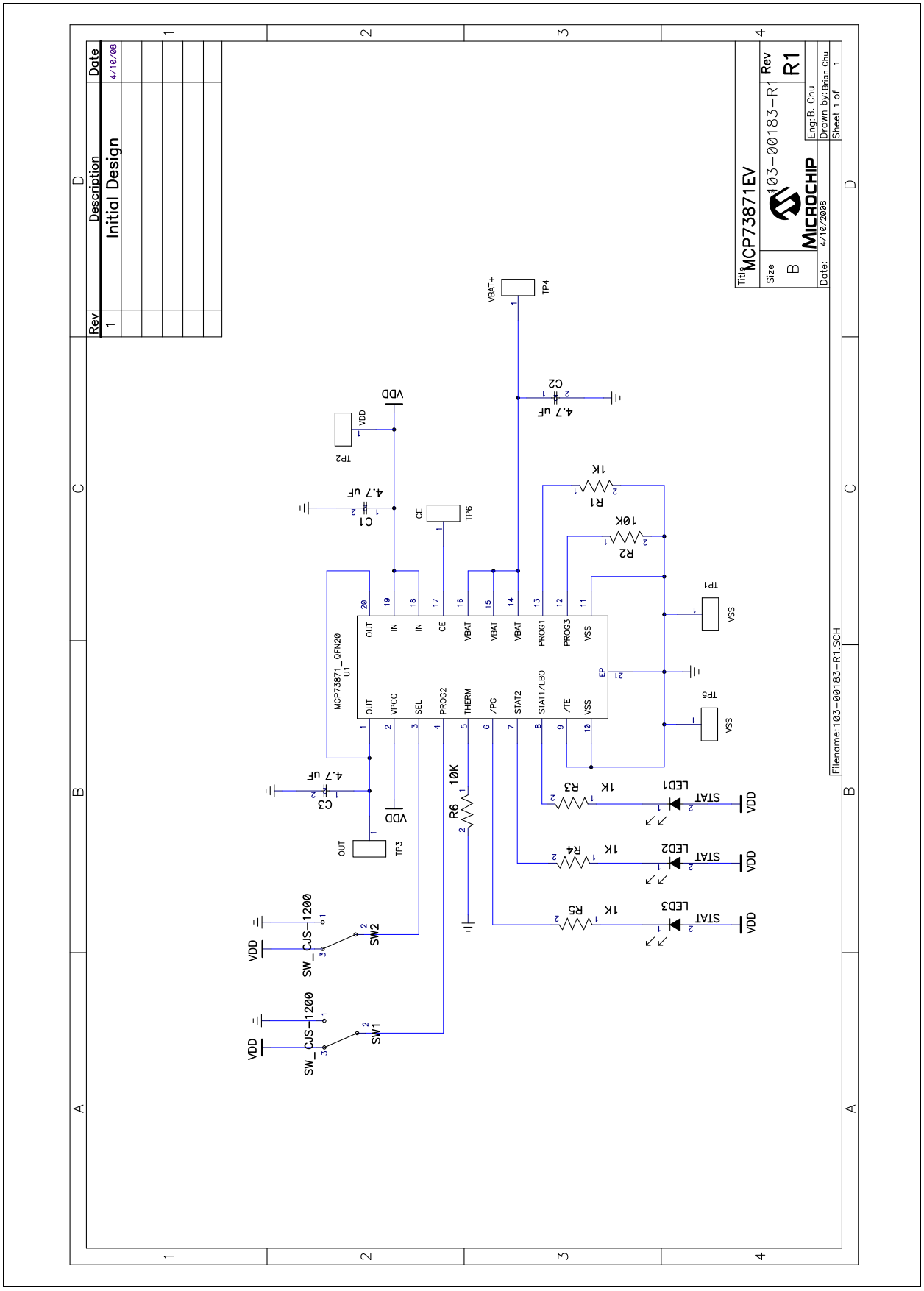
Appendix A. Schematic and Layouts

A.1 INTRODUCTION

This appendix contains the following schematics and layouts for the MCP73871 Evaluation Board:

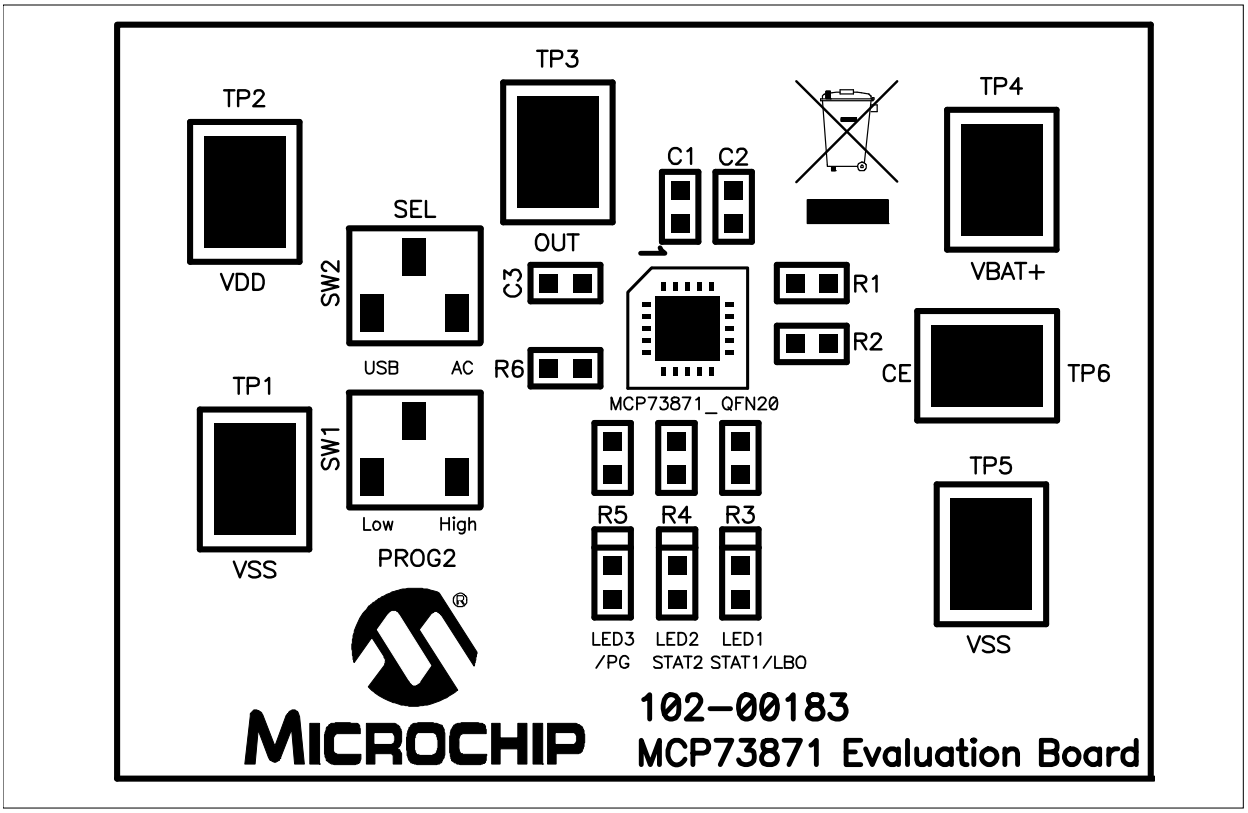
- Board – Schematic Sheet
- Board – Top Layer
- Board – Top Metal Layer
- Board – Bottom Layer

A.2 BOARD – SCHEMATIC

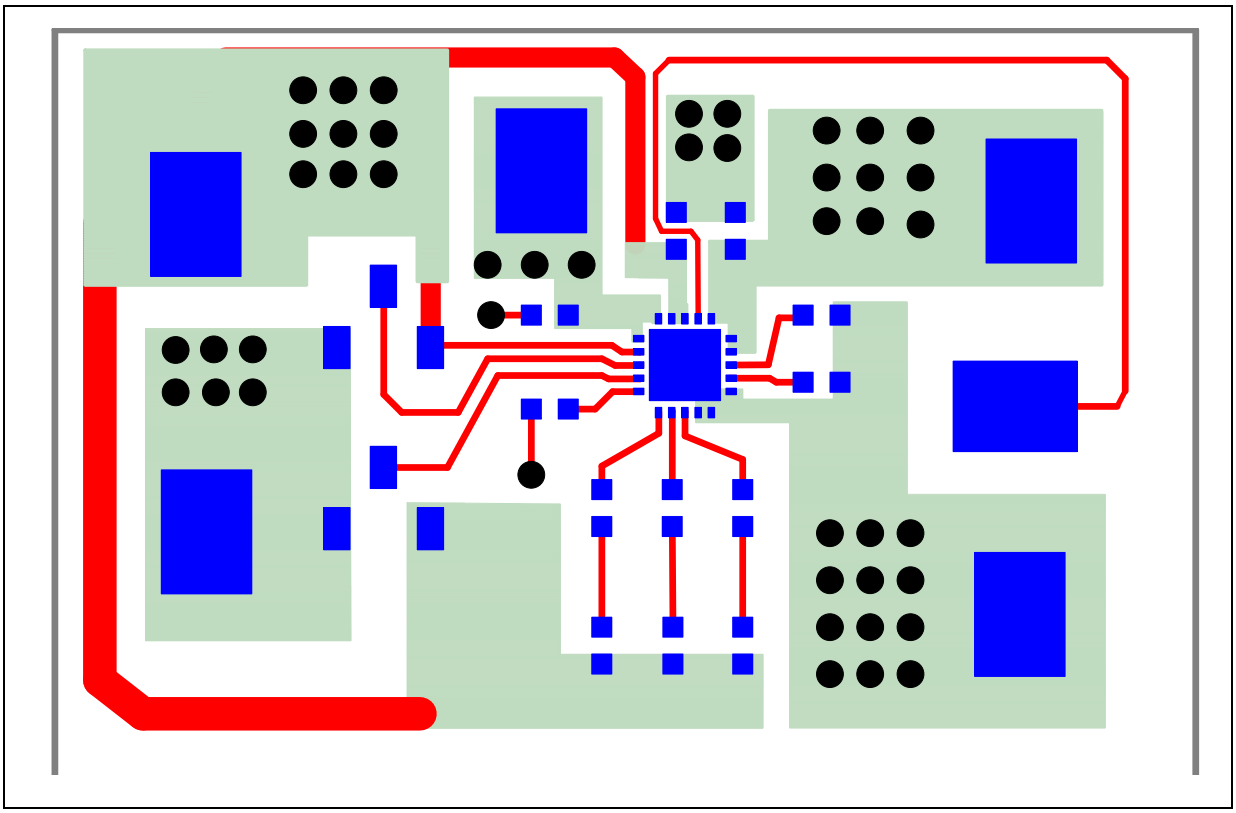


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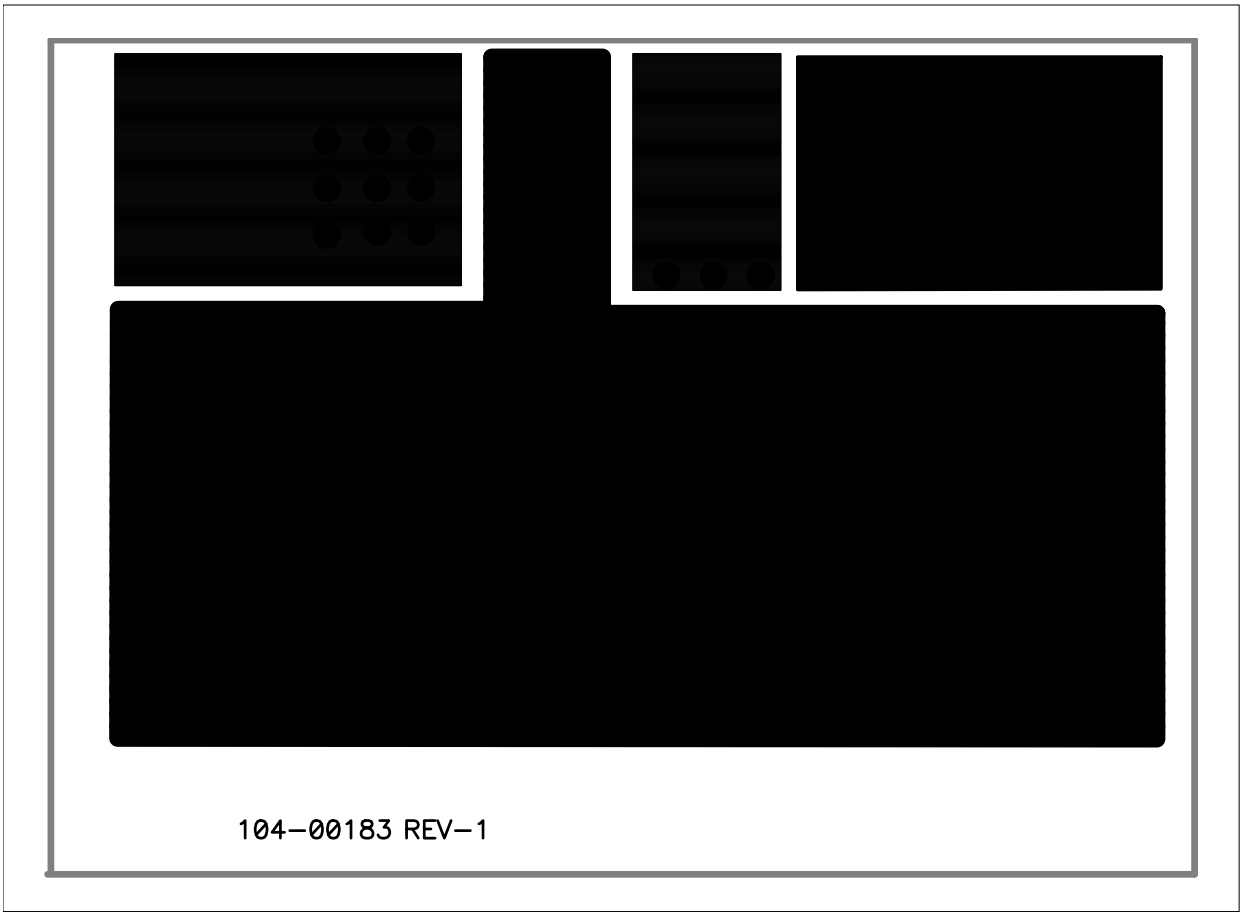
A.3 BOARD – TOP LAYER



A.4 BOARD – TOP METAL 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	Manufacturer	Part Number
4	Bump	BUMPON HEMISPHERE 0.44 X 0.20 WHITE	3M	SJ5003-9-ND
3	C1, C2, C3	CAP CERAMIC 4.7 µF 10 X5R 0603	Taiyo Yuden®	LMK107BJ475KA-T
1	LED1	True Green Water Clear 0603 SMD LED	Para Light USA	L-C191LGCT-U1
1	LED2	Super Red Water Clear 0603 SMD LED	Para Light USA	L-C191KRCT-U1
1	LED3	Blue Water Clear 0603 SMD LED	Para Light USA	L-C191LBCT-U1
1	PCB	Printed Circuit Board	Microchip Technology Inc.	104-00183-R1
4	R1, R3, R4, R5	RES 1K OHM 1/10W 1% 0603 SMD	Panasonic® - ECG	ERJ-3EKF1001V
2	R2, R6	RES 10K OHM 1/10W 1% 0603 SMD	Panasonic - ECG	ERJ-3EKF1002V
2	SW1, SW2	SWITCH SLIDE SPDT SMD J-LEAD	Copal Electronics Inc	CJS-1200TA
6	TP1, TP2, TP3, TP4, TP5, TP6	PC Test Point Compact SMT	Keystone Electronics®	5016
1	U1	Stand-Alone System Load Sharing and Li-Ion / Li-Polymer Battery Charge Management Controller; 4.2V Charge Voltage Regulation Option	Microchip Technology, Inc	MCP73871-2CCI/ML

Note: 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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