



MCP7381X
Low-Cost Li-Ion Battery
Charger Evaluation Board
User's Guide

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MCP7381X LI-ION BATTERY CHARGER EVALUATION 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 “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 MCP7381X 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 MCP7381X Li-Ion Battery Charger Evaluation Board 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 MCP7381X Li-Ion Battery Charger Evaluation Board.
- **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 MCP7381X Li-Ion Battery Charger Evaluation Board.
- **Appendix B. “Bill Of Materials (BOM)”** – Lists the parts used to build the MCP7381X Li-Ion Battery Charger Evaluation Board.

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CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	<i>MPLAB[®] 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>Save</i></u>
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	<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 MCP7381X Li-Ion Battery Charger Evaluation Board. The following Microchip documents are available and recommended as supplemental reference resources.

MCP73811/2 Data Sheet, "Simple, Miniature Single-Cell, Fully Integrated Li-Ion / Li-Polymer Charge Management Controllers", DS22036

This data sheet provides detailed information regarding the MCP73811/2 product family.

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
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- Field Application Engineer (FAE)
- 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 (April 2008)

- Initial Release of this Document.

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Chapter 1. Product Overview

1.1 INTRODUCTION

The MCP7381X Li-Ion Battery Charger Evaluation Board demonstrates the features and abilities for Microchip's MCP7381X Li-Ion Battery Charger Evaluation Board Simple, Miniature Single-Cell, Fully Integrated Li-Ion / Li-Polymer Charge Management Controllers. The MCP73811/2 are standalone highly integrated linear Li-Ion battery chargers that employ a constant current/constant voltage (CCCV) charge algorithm for cost sensitive and space limited applications.

The MCP7381X Li-Ion Battery Charger Evaluation Board has two independent circuits that are available to evaluate an USB port powered Li-Ion / Li-Polymer battery charger and an ac-dc wall adapter powered Li-Ion / Li-Polymer battery charger. For an ac-dc wall adapter powered battery charger, an external resistor (R_{PROG}) sets the magnitude of the charge current up to 500 mA. When the USB port provides power to the battery charger, the MCP73811 specifically adheres to the current limits governed by the USB specification. The PROG pin selects two preset charge current rates of typical 85 mA (Low) or 450 mA (High) and does not exceed 100 mA (Low) or 500 mA (High) maximum charge current. As for USB regulation, a device may draw either low-power at one unit load or high-power at 5 unit loads. A unit load is defined to be 100 mA. The drawn current per unit load is an absolute maximum value, not an average over time.

This chapter covers the following topics:

- "What is the MCP7381X Li-Ion Battery Charger Evaluation Board?"
- "What the MCP7381X Li-Ion Battery Charger Evaluation Board Kit includes."

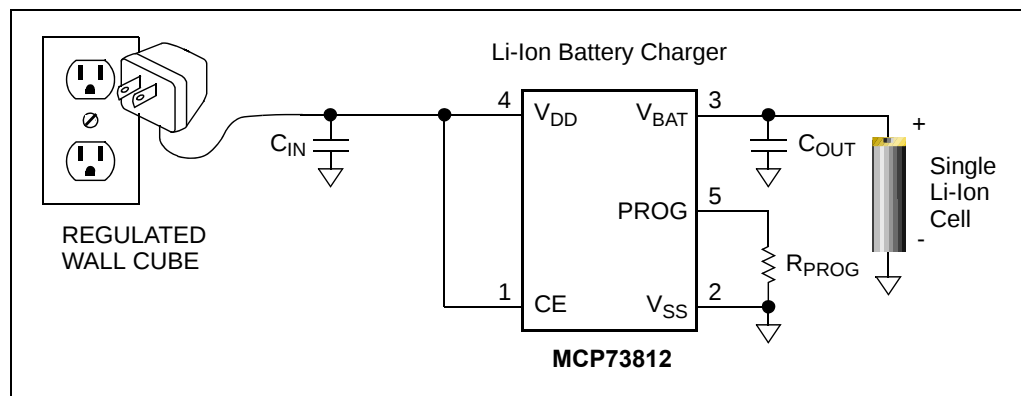


FIGURE 1-1: MCP73812 Typical Application.

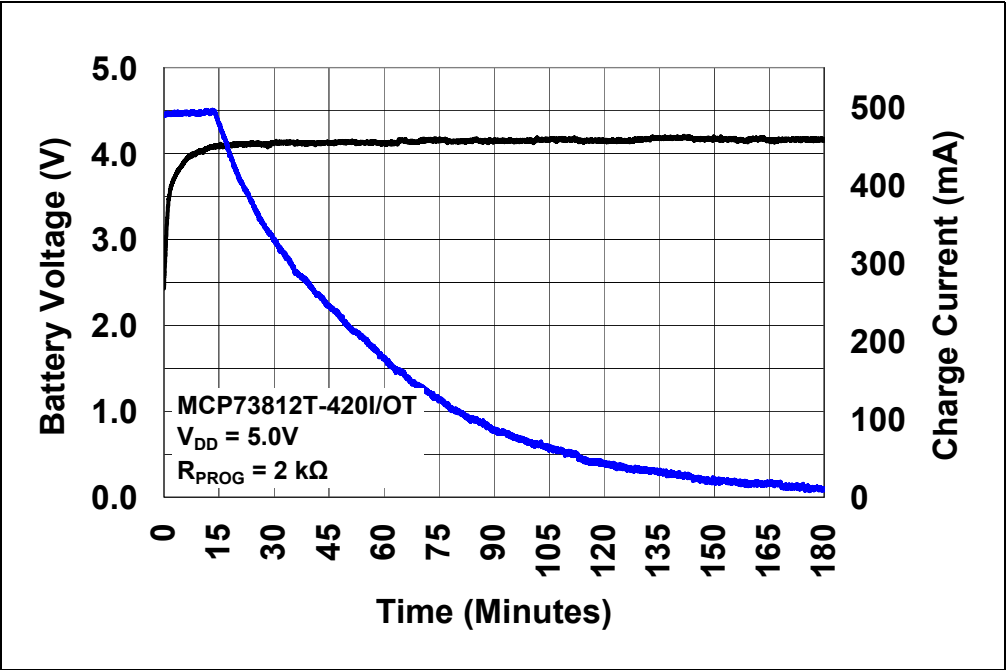


FIGURE 1-2: Typical MCP73812 Charge Profile (950 mAh Li-Ion Battery Pack).

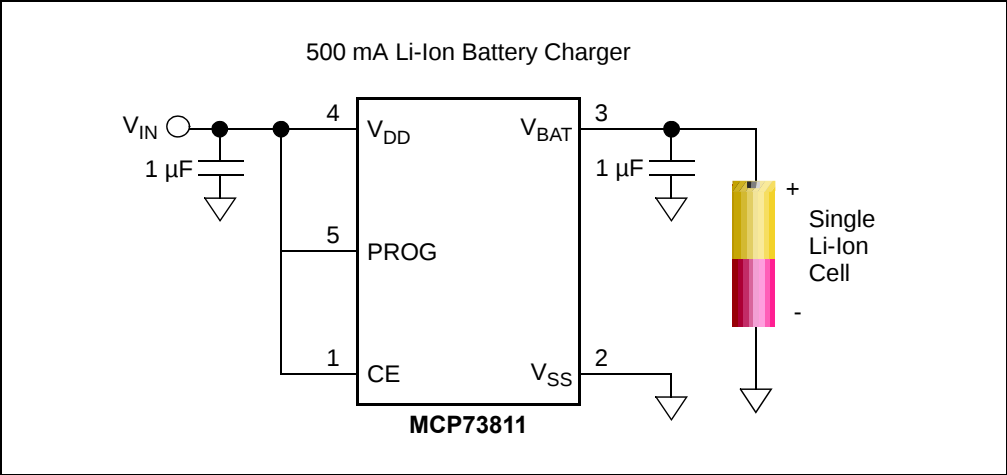


FIGURE 1-3: Typical MCP73811 Applications.

1.2 WHAT IS THE MCP7381X LI-ION BATTERY CHARGER EVALUATION BOARD?

The MCP7381X Li-Ion Battery Charger Evaluation Board demonstrates the use of the MCP73811/2 Simple, Miniature Single-Cell, Fully Integrated Li-Ion / Li-Polymer Charger Management Controllers.

The MCP7381X Li-Ion Battery Charger Evaluation Board is setup to evaluate low cost single-cell Li-Ion / Li-Polymer battery chargers. This board utilizes Microchip's MCP7381X Li-Ion Battery Charger Evaluation Board that efficiently charge Li-Ion / Li-Polymer batteries with a preset $\pm 1\%$ voltage accuracy regulation at 4.2V. The MCP7381X Li-Ion Battery Charger Evaluation Board comes with two pre-installed circuits: An ac-dc adapter powered Li-Ion / Li-Polymer battery charger and an USB port powered Li-Ion / Li-Polymer battery charger.

The MCP73811 is available for the USB port powered circuit while the MCP73812 is designed for the ac-dc wall adapter powered circuit. A SOT-23-5 MCP73811 is pre-installed on the evaluation board with a mechanical dip switch which selects charge current High (450 mA) or Low (85 mA) for the USB port powered battery charger system. A SOT23-5 MCP73812 is pre-installed on the evaluation board with a programming resistor R_{PROG} which delivers 500 mA from the ac-dc wall adapter source. When the Chip Enable (CE) pin is in "High" condition, that particular circuit is ready to charge single-cell Li-Ion batteries.

Note: The systems are designed in operation mode with CE pin High and can be disabled when driving CE pin Low.

The two dashed silk screen areas on the evaluation board show the required circuit size for the printed circuit board (PCB) layout and provide system / product designers a visual aid prior design the system.

The MCP7381X Li-Ion Battery Charger Evaluation Board is designed to observe the performance and features via multiple test points that are available on the circuits. Users are able to discover the compact size of the layout in addition to the device itself. The circuit can also be implemented into suitable applications without any additional works.

1.3 WHAT THE MCP7381X LI-ION BATTERY CHARGER EVALUATION BOARD KIT INCLUDES

The MCP7381X Li-Ion Battery Charger Evaluation Board kit includes:

- MCP7381X Li-Ion Battery Charger Evaluation Board, 102-00172
- Pre-installed 5-Lead SOT-23 MCP73811, 5-Lead SOT-23 MCP73812 and required components.
- Analog and Interface Products Demonstration Boards CD-ROM (DS21912)
 - MCP7381X Li-Ion Battery Charger Evaluation Board User's Guide, (DS51729)
 - MCP73811/2 Data Sheet, "Simple, Miniature Single-Cell, Fully Integrated Li-Ion / Li-Polymer Charge Management Controllers", (DS22036)

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Chapter 2. Installation and Operation

2.1 INTRODUCTION

The MCP7381X Low-Cost Li-Ion Battery Charger Evaluation Board demonstrates Microchip's Simple, Miniature Single-Cell, Fully Integrated Li-Ion / Li-Polymer Charge Management Controllers, MCP73811 and MCP73812. The MCP73811 is powered from USB port to charge Li-Ion / Li-Polymer batteries. The charge current is logic selectable between High (500 mA) and Low (100 mA). The MCP73812 is designed to charge Li-Ion / Li-Polymer batteries with programmable charging current up to 500 mA by a single resistor from a regulated 5V ac-dc wall adapter.

The MCP73811/2 require only minimum components to implement a completed circuit of Li-Ion / Li-Polymer battery charge management in any systems. The development of MCP73811/2 meets the challenges of today's cost-sensitive and space-limited applications.

The MCP7381X Low-Cost Li-Ion Battery Charger Evaluation Board comes with a pre-installed 5-Lead SOT-23 MCP73811 and a pre-installed 5-Lead SOT-23 MCP73812.

Typical applications for MCP73811/2 are Rechargeable Toys, Low-Cost Lithium-Ion / Lithium-Polymer Battery Chargers, Electronic Cigarettes, Rechargeable Portable Electronic Devices, Bluetooth Headsets or USB Chargers.

2.2 FEATURES

The MCP7381X Low-Cost Li-Ion Battery Charger Evaluation Board has the following features:

- Color coded test points ensuring the proper connections: Red for V_{DD} and V_{BAT+} ; Black for GND & V_{BAT-} ; White for CE (Chip Enable).
- 2-position Dip Switch for charge current selections between USB_Low and USB_High.
- Chip Enable (CE) Pin to disable the system when drive Low.
- Evaluating different charge current rates by changing R_{PROG} (Programming Resistor) values. See Figure 2-1

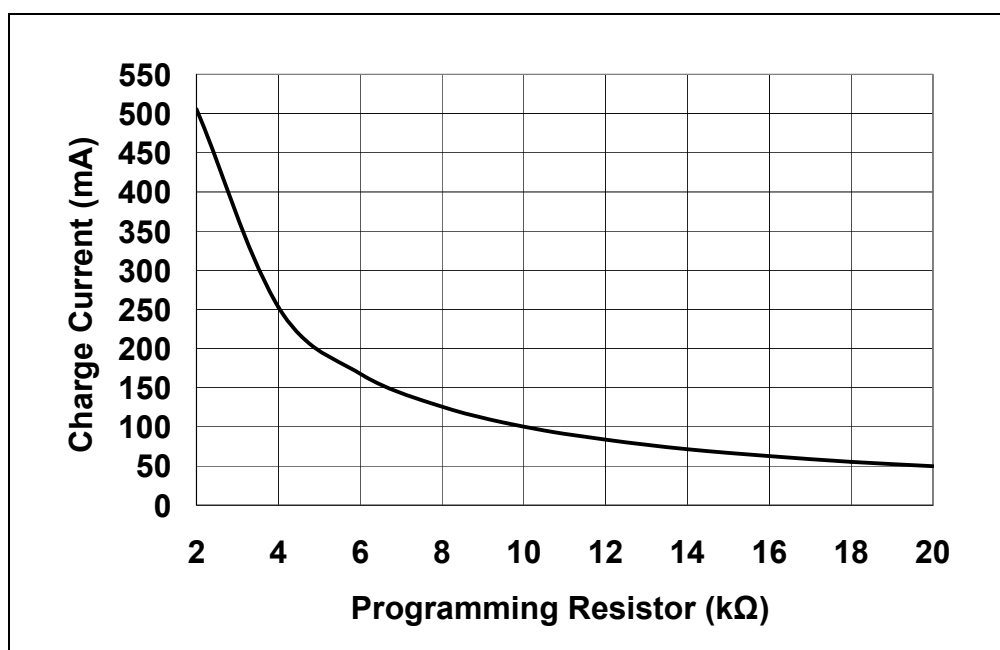


FIGURE 2-1: Charge Current (I_{OUT}) vs. Programming Resistor (R_{PROG}).

2.3 GETTING STARTED

The MCP7381X Low-Cost Li-Ion Battery Charger Evaluation Board is fully assembled and tested for charging single-cell Li-Ion / Li-Polymer batteries with a regulated 5V DC source or USB port.

2.3.1 Power Input and Output Connection

2.3.1.1 POWERING THE MCP7381X LOW-COST LI-ION BATTERY CHARGER EVALUATION BOARD

1. Connect the negative battery terminal to V_{BAT-} pin on the evaluation board and positive battery terminal to V_{BAT+} pin on the evaluation board.
2. Connect 5V DC power supply negative terminal to GND pin on the evaluation board.
3. Connect 5V DC power supply positive terminal to V_{DD} pin on the evaluation board. Slowly increase the supply voltage to 5V.

Note: Make sure the current limit of the DC power supply is not set below the charge current.

4. The battery charge cycle initiates when minimum supply voltage is present. The charge current can be measured by placing a current meter in series between V_{BAT+} pin on the evaluation board and positive battery terminal.
5. Position the DIP Switch to USB_Hi for a maximum charge rate up to 500 mA and USB_Low for maximum charge rate up to 100 mA.

Note: Remove protection film before using the DIP Switch. This may be done by the manufacturer prior shipping.

6. Fast Charge Current for MCP73812 can be programmed with various resistors that based on the Figure 2-1. R_{PROG} is represented as R1 on the evaluation board.

Note: The battery can be replaced with test circuit or electronic load that can sink current with DC power supply.

7. Pull CE pin on the evaluation board Low to disable the system or terminate the charge.

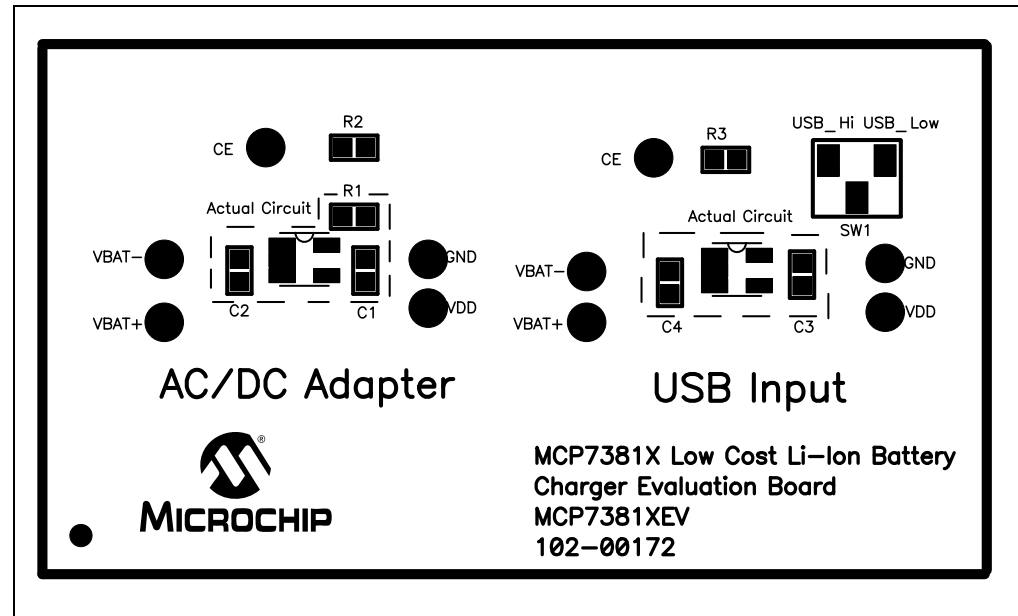


FIGURE 2-2: MCP7381X Low Cost Li-Ion Battery Charger Evaluation Board Top Silk Layout.

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Appendix A. Schematic and Layouts

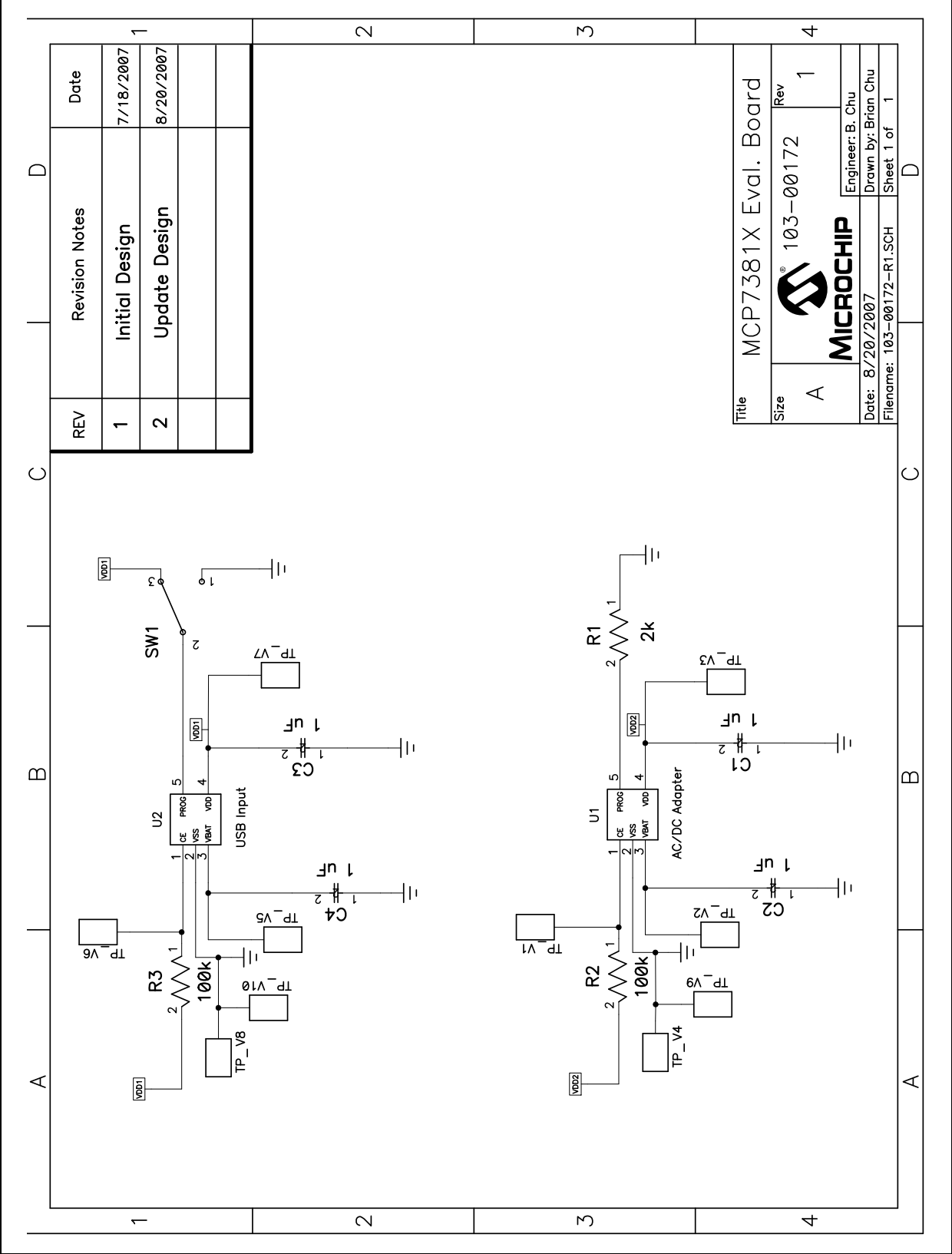
A.1 INTRODUCTION

This appendix contains the following schematics and layouts for the MCP7381X Low Cost Li-Ion Battery Charger Evaluation Board:

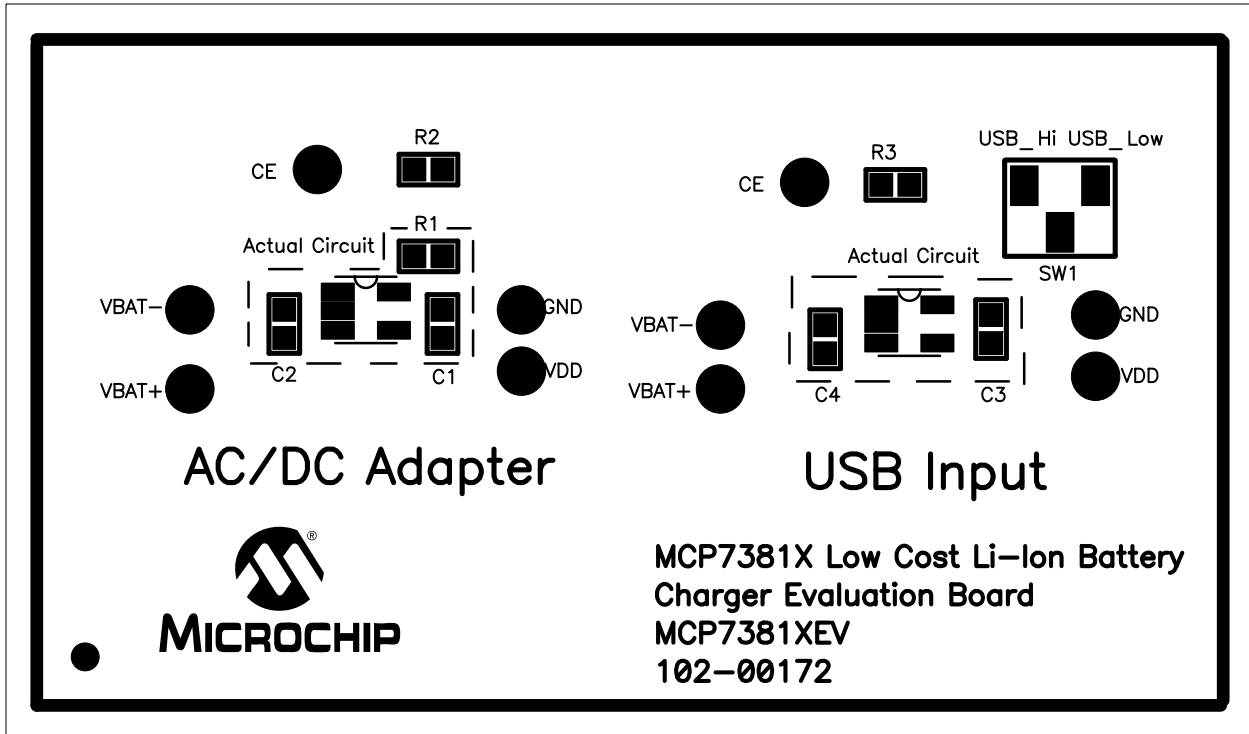
- Board – Schematic
- Board – Top Layer
- Board – Top Metal Layer
- Board – Bottom Layer

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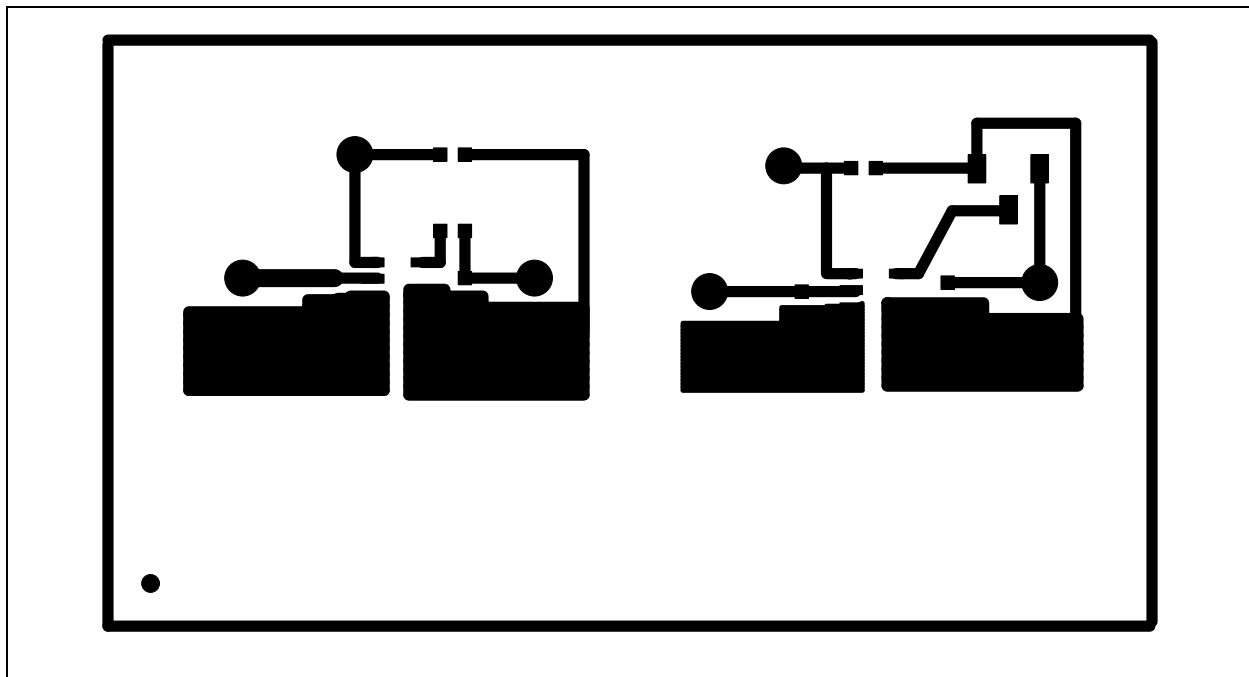
A.2 BOARD – SCHEMATIC



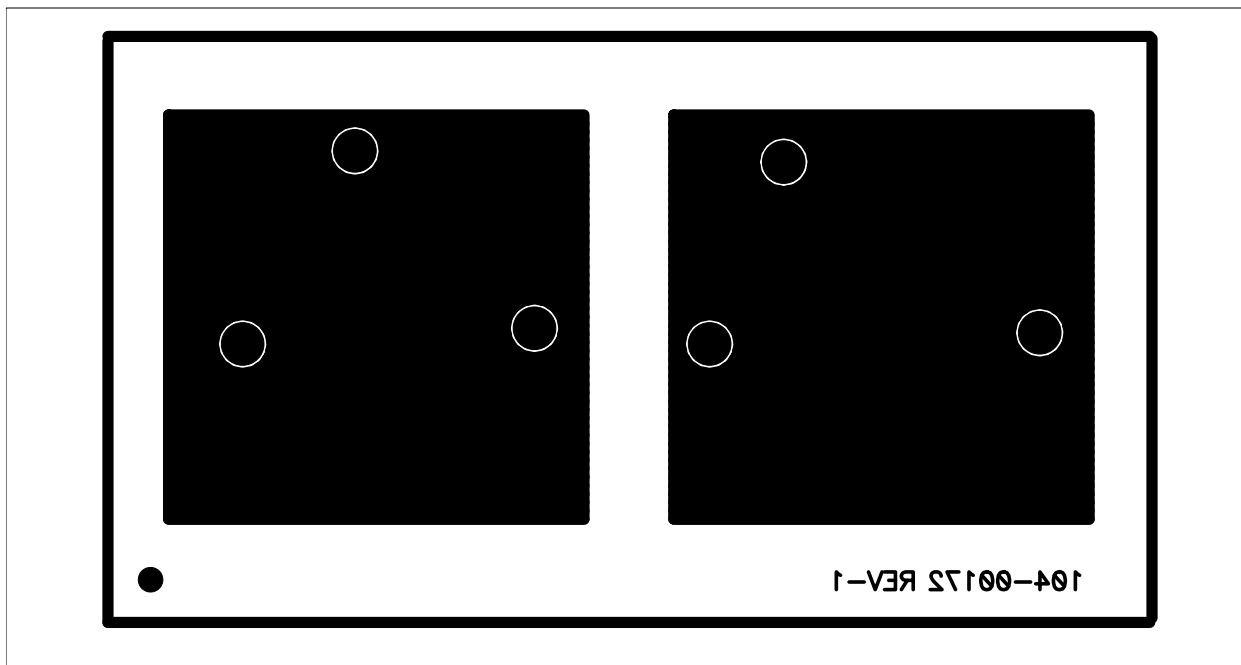
A.3 BOARD – TOP LAYER



A.4 BOARD – TOP METAL LAYER



A.5 BOARD – BOTTOM LAYER



Appendix B. Bill Of Materials (BOM)

TABLE B-1: BILL OF MATERIALS (BOM)

QTY	Reference	Description	Manufacture	MFG PART #
4	C1, C2, C3, C4	CAP CERAMIC 2.2 μ F 10V X5R 0603 SMD	Taiyo Yuden	LMK107BJ225KA-T
1	R1	RES 2K OHM 1/10W 1% 0603 SMD	Yageo Corp.	RC0603FR-072KL
2	R2, R3	RES 100K OHM 1/10W 1% 0603 SMD	Panasonic - ECG	ERJ-3EKF1003V
1	SW1	SWITCH SLIDE SPDT SMD J-LEAD	COPAL ELECTRONICS INC	CJS-1200TA
4	Bump	BUMPON HEMISPHERE.44X.20 WHITE	3M	SJ5003-9-ND
1	U1	Simple, Miniature Single-Cell, Fully Integrated Li-Ion / Li-Polymer Charge Management controllers: Programmable Charge Current	Microchip Technology, Inc	MCP73812T-420I/OT
1	U2	Simple, Miniature Single-Cell, Fully Integrated Li-Ion / Li-Polymer Charge Management controllers: Selectable Charge Current	Microchip Technology, Inc	MCP73811T-420I/OT
1	PCB	Printed Circuit Board	—	104-00172-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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