MCP1711 Demonstration Board User's Guide

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Signed for and on behalf of Microchip Technology Inc. at Chandler, Arizona, USA

Derek Carlson
VP Development Tools

12-Sep-14
Date

NOTES:

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Preface

NOTICE TO CUSTOMERS

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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 "DSXXXXXXXXA", where "XXXXXXXX" 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 online help. Select the Help menu, and then Topics to open a list of available online help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using the MCP1711 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 MCP1711 Demo Board as a development tool to emulate and debug firmware on a target board, as well as how to program devices. The document is organized as follows:

- **Chapter 1. "Product Overview"** – Provides important information about the MCP1711 Demo Board and shows the hardware details of its components.
- **Chapter 2. "Installation and Operation"** – Includes instructions on how to use, power and test the MCP1711 Demo Board.
- **Appendix A. "Schematics and Layouts"** – Shows the schematic and layout diagrams for the MCP1711 Demo Board.
- **Appendix B. "Bill of Materials (BOM)"** – Lists the parts used to build the MCP1711 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
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 MCP1711 Demo Board. Another useful document is listed below. The following Microchip document is available and recommended as a supplemental reference resource:

- **MCP1711 Data Sheet – *"150 mA Ultra-Low Quiescent Current, Capacitorless LDO Regulator"* (DS20005415)**

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- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing
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- Technical Support

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

DOCUMENT REVISION HISTORY

Revision A (September 2015)

- Initial release of this document.

NOTES:

Chapter 1. Product Overview

1.1 INTRODUCTION

This chapter provides an overview of the MCP1711 Demo Board and covers the following topics:

- MCP1711 Short Overview
- What is the MCP1711 Demo Board?
- MCP1711 Demo Board Kit Contents

1.2 MCP1711 SHORT OVERVIEW

1.2.1 MCP1711 Key Features

The key features of the MCP1711 include:

- Input operating voltage range: 1.4V to 6V
- Ultra-low 0.6 µA (typical) quiescent current
- Ultra-low Shutdown supply current: 10 nA (typical)
- 150 mA output current capability for all input operating voltage range
- Standard output voltages (V_R): 1.2V, 1.8V, 2.5V, 3.3V, 4.2V, 5.0V
- Stable with no output capacitor (1.0 µF or more recommended for better transient response)
- Protection circuits: current limiter, short circuit, foldback
- Available packages:
  - 4-Lead 1 x 1 mm UQFN
  - 5-Lead SOT-23

1.2.2 MCP1711 Overview

The MCP1711 device has been developed to provide ultra-low power applications with a precise, regulated rail. It is a highly-accurate CMOS low dropout (LDO) voltage regulator that can deliver up to 150 mA of current while consuming only 0.6 µA of quiescent current (typical). The input operating range is specified from 1.4V to 6.0V, making it an ideal choice for mobile applications and one-cell Li-Ion-powered applications.

The MCP1711 is capable of delivering 150 mA output current with only 0.32V (typical) for V_R = 5.0V, and 1.41V (typical) for V_R = 1.2V of input-to-output voltages differential. The output voltage accuracy of the MCP1711 is typically ± 0.02V for V_R < 2.0V and ±1% for V_R > 2.0V at +25°C. The temperature stability is about ±50 ppm/°C. Line regulation is ±0.01%/V typical at +25°C.

The output voltages available for the MCP1711 device range from 1.2V to 5.0V. The LDO output is stable even if an output capacitor is not connected, due to an excellent internal phase compensation. However, for better transient responses, the output capacitor should be used. The MCP1711 is compatible with low equivalent series resistance (ESR) ceramic output capacitors.

Overcurrent limit and short circuit protection embedded into the device provide a robust solution for any application.

The MCP1711 has a true current foldback feature. When the load increases beyond the MCP1711 load rating, the output current and output voltage will foldback toward 80 mA (typical) at about 0V output. When the load impedance increases and returns to the rated load, the MCP1711 will follow the same foldback curve as the device comes out of current foldback.

If the device is in Shutdown mode, by inputting a low-level signal to the $\overline{SHDN}$ pin, the current consumption is reduced to less than 0.1 µA (typically 0.01 µA). In Shutdown mode, if the output capacitor is used, it will be discharged via the internal dedicated switch and, as a result, the output voltage quickly returns to 0V.

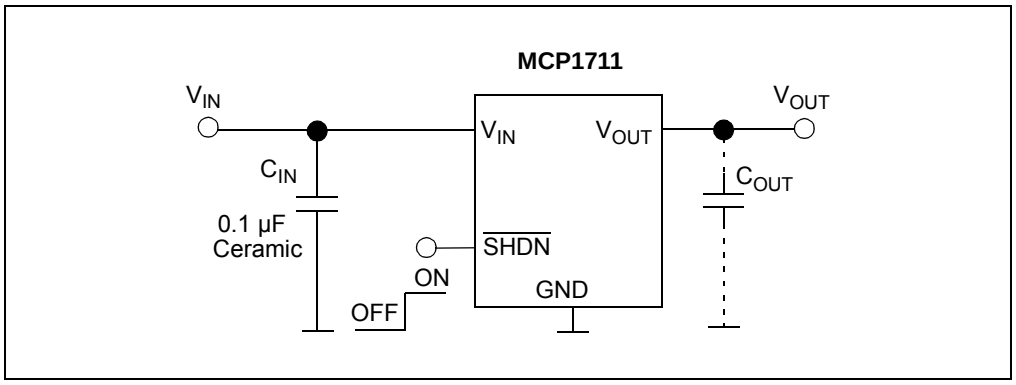


FIGURE 1-1: *Typical Application Circuit.*

1.3 WHAT IS THE MCP1711 DEMO BOARD?

The MCP1711 Demo Board has been developed to demonstrate the capabilities of the MCP1711 device with two voltage options and two package options:

- 1.8V in 5-Lead SOT-23
- 3.3V in 4-Lead 1x1 UQFN

Two circuits have been developed on the same board; they are electrically isolated and can be tested independently. Thus the MCP1711 Demo Board is meant to show how the MCP1711 device operates over a wide input voltage and load range.

Test points for input voltage and output voltage are provided to demonstrate the capability of the demo board over the entire range, allowing the board to be connected directly to a system.

The MCP1711 device can also be used without any input and output capacitors. To test the capacitorless feature, remove the C_{IN} and C_{OUT} capacitors from the desired circuit using a soldering iron set to 400°C or a hot-air gun set to the same temperature. Take care not to damage the LDOs in the process.

CAUTION

Removing the capacitors can damage them. For further usage, it is recommended to resolder untouched capacitors.

The board is equipped with a 3-pin 2.54 mm male header to allow the MCP1711 to be shut down or enabled with a jumper. To enable the device without an external signal, connect a jumper between the pins indicated by the EN silkscreen.

The MCP1711 can also be enabled and disabled by applying an external voltage (V_{EN}) between the second and the third terminals of this header.

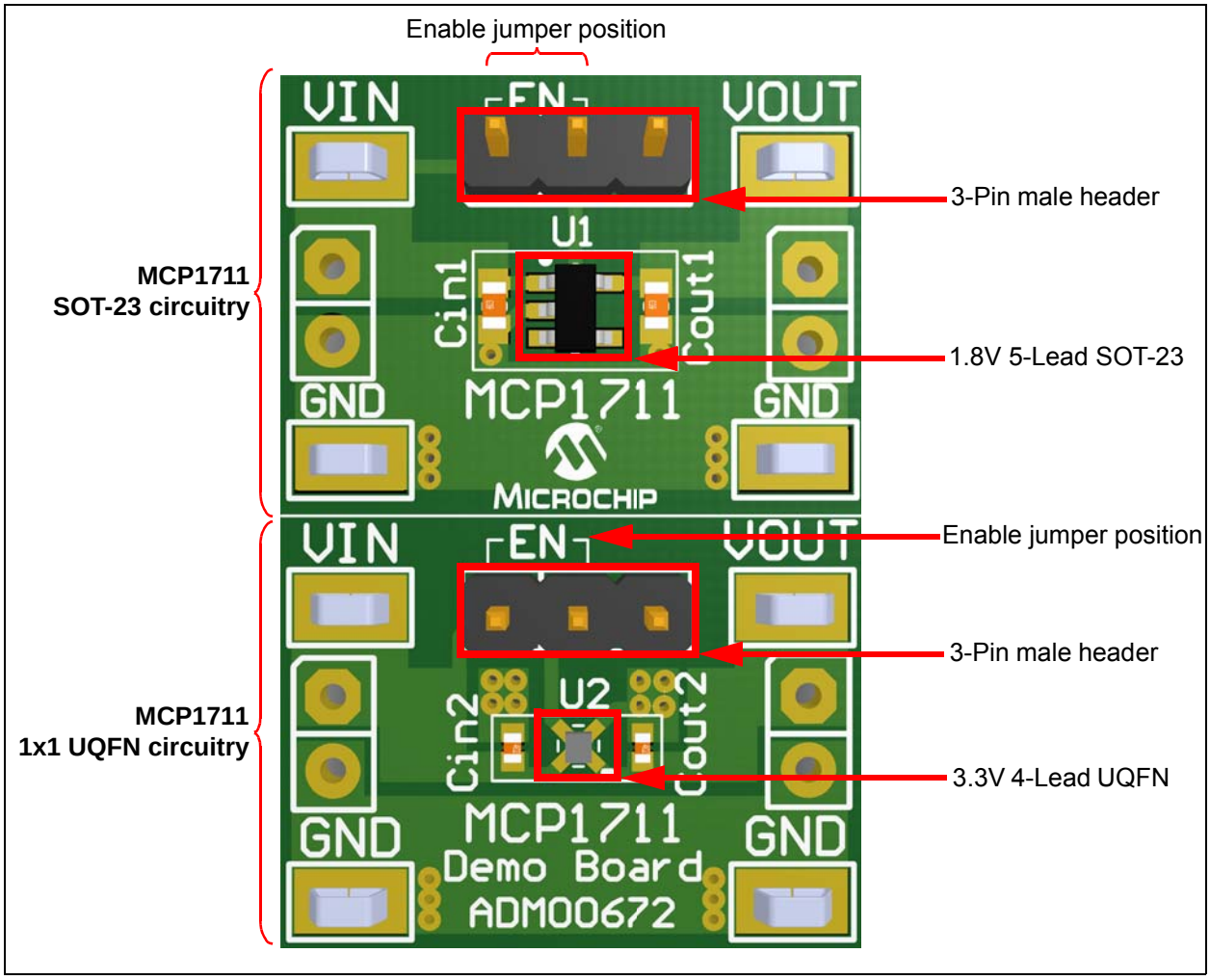


FIGURE 1-2: *MCP1711 Demo Board - 3D Top View.*

When V_{EN} is higher than 0.91V, the MCP1711 is turned on. When the V_{EN} voltage is less than 0.38V, the device output is turned off.

It is strongly recommended not to leave the $\overline{SHDN}$ pin floating as this will cause output voltage instability.

The MCP1711 Demo Board is designed to operate from 3.2V to 6.0V input voltage when V_R = 1.8V (SOT-23) and from 4.0V to 6.0V input voltage when V_R = 3.3V (1x1 UQFN) and regulate the output voltage to the specified value over the entire current and temperature range.

The MCP1711 Demo Board was designed using small surface-mount components to show power supply size for ultra-low power, high-current applications.

If space-saving is a priority, the MCP1711 is stable even if an output capacitor in not present, reducing cost and board area.

1.4 MCP1711 DEMO BOARD KIT CONTENTS

This MCP1711 Demo Board kit includes the following items:

- MCP1711 Demo Board (ADM00672)
- Important Information Sheet

Chapter 2. Installation and Operation

2.1 GETTING STARTED

The following sections describe how to use the MCP1711 Demo Board to fully evaluate and demonstrate the capabilities of the MCP1711 device.

2.2 POWER INPUT AND OUTPUT CONNECTIONS

2.2.1 Powering the MCP1711 Demo Board

The MCP1711 Demo Board is fully assembled, tested and ready to begin evaluating the MCP1711device.

Apply positive input voltage to the desired V_{IN} terminal on the demonstration board and its return to the corresponding GND terminal. The maximum input voltage should not exceed 6.0V.

An electronic load or resistive load can be used to evaluate the MCP1711 Demo Board or the intended system load can be connected. Electronic loads can attempt to sink current at 0V during start-up, therefore a resistive load or constant resistance electronic load is recommended for start-up evaluation. **Do not use** the electronic load in Constant Current mode.

Connect the positive voltage terminal of the load at the V_{OUT} terminal on the demonstration board, and connect the negative, or return side of the load, to the corresponding GND terminal.

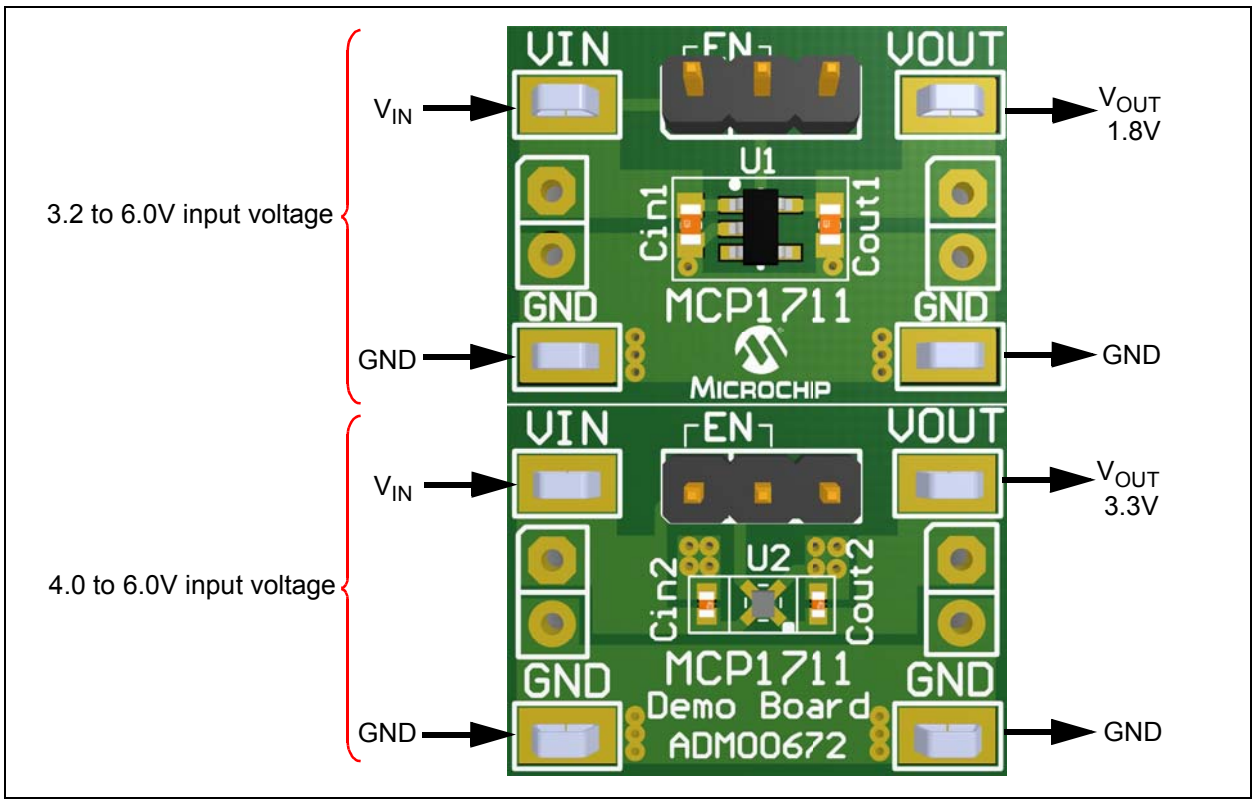


FIGURE 2-1: *MCP1711 Demo Board - Powering Sequence.*

2.3 BOARD TESTING

To test the board, follow these steps:

1. Apply input voltage.
2. If the EN jumper is connected as indicated in Figure 1-2 in **Chapter 1. "Product Overview"**, the output voltage of MCP1711 will start to rise and it will stabilize after some time, depending on the output current.
3. Adjusting the input voltage and load should not cause the output to vary over the operating range of the linear regulator by more than a few tens of mV, in a steady state condition.

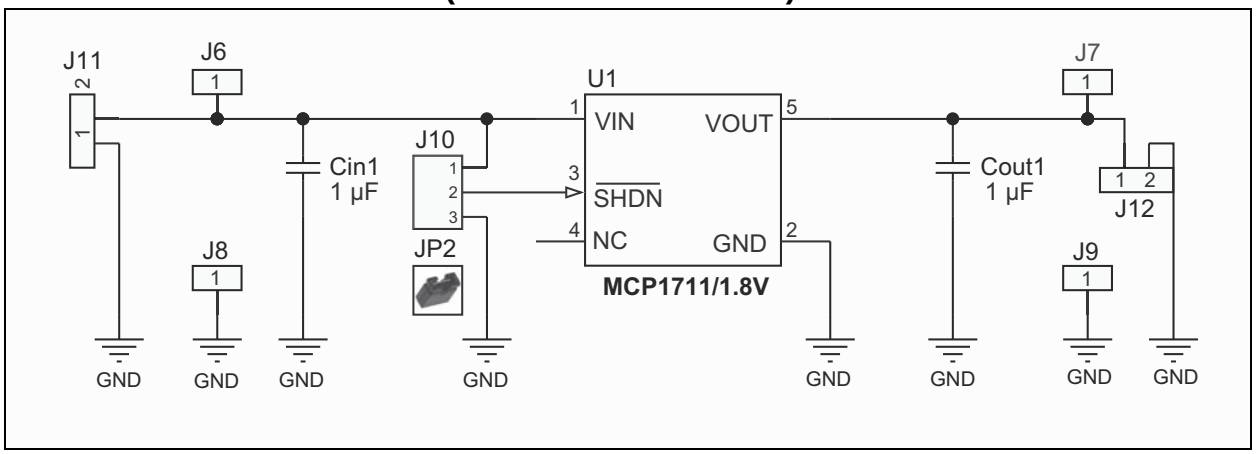
Appendix A. Schematics and Layouts

A.1 INTRODUCTION

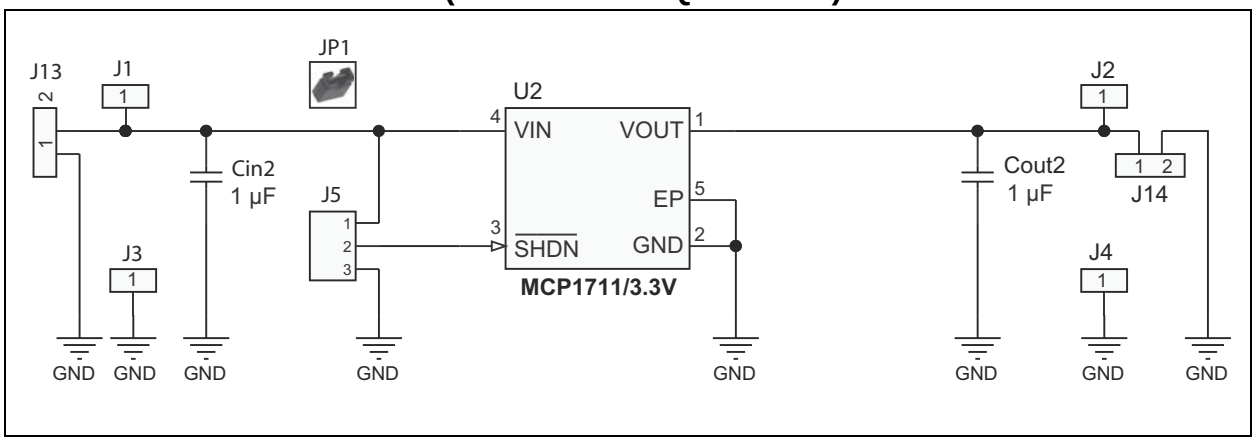
This Appendix contains the following schematics and layouts for the MCP1711 Demo Board (ADM00672):

- Board - Schematic (5-Lead SOT-23 Part)
- Board - Schematic (4-Lead 1x1 UQFN Part)
- Board - Top Silk
- Board - Top Copper and Silk
- Board - Top Copper
- Board - Bottom Copper
- Board - Bottom Copper and Silk
- Board - Bottom Silk

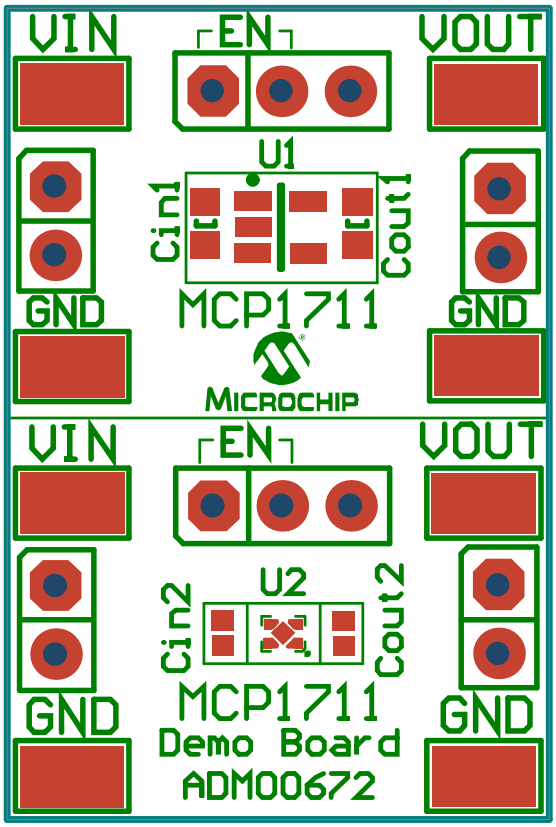
A.2 BOARD - SCHEMATIC (5-LEAD SOT-23 PART)



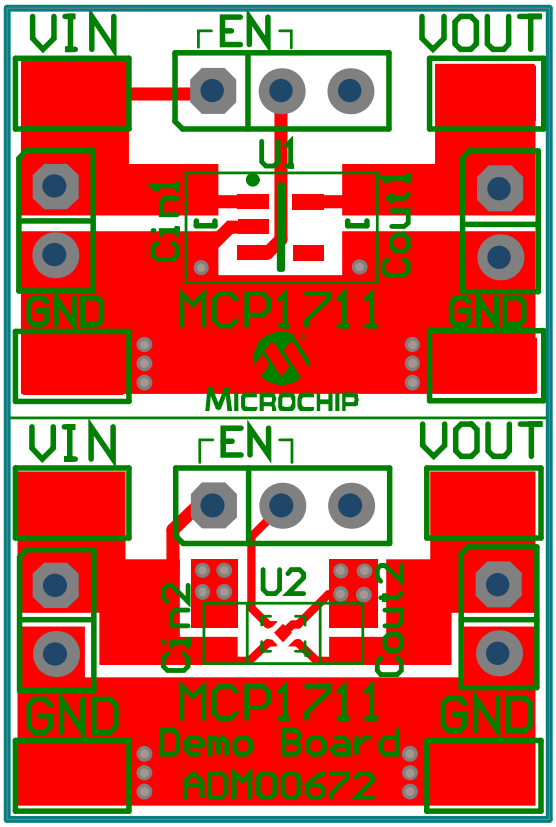
A.3 BOARD - SCHEMATIC (4-LEAD 1X1 UQFN PART)



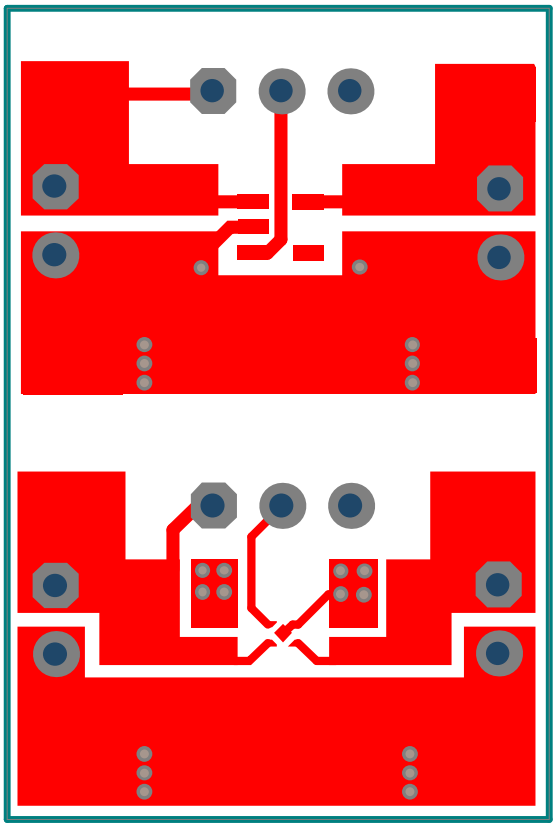
A.4 BOARD - TOP SILK



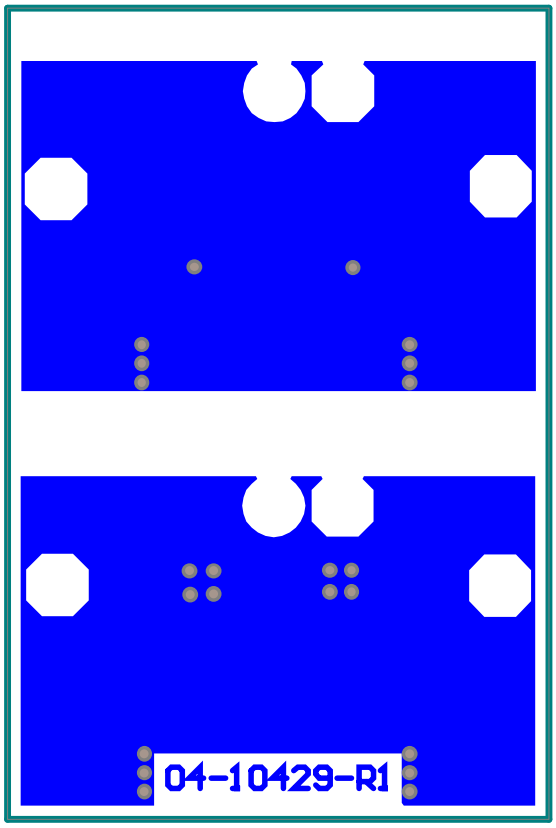
A.5 BOARD - TOP COPPER AND SILK



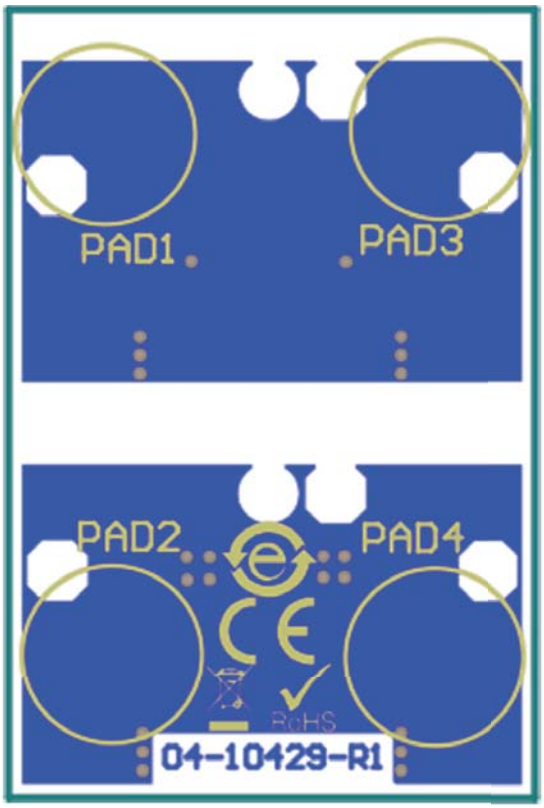
A.6 BOARD - TOP COPPER



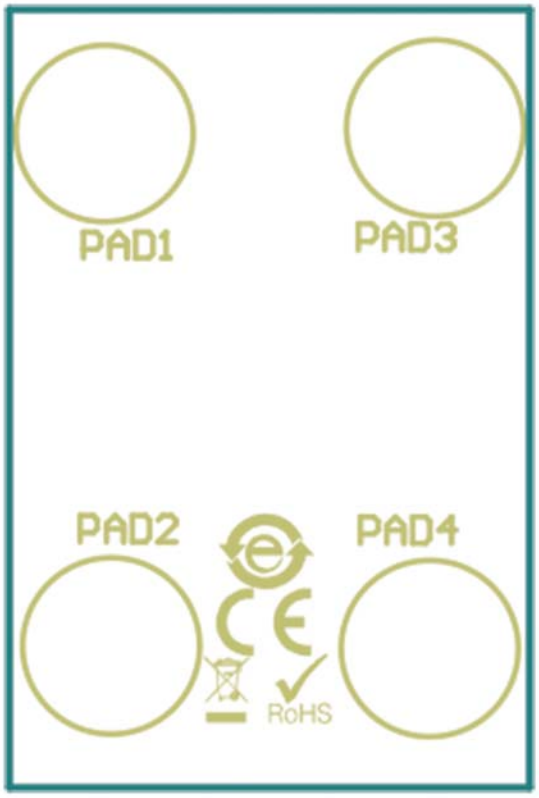
A.7 BOARD - BOTTOM COPPER



A.8 BOARD - BOTTOM COPPER AND SILK



A.9 BOARD - BOTTOM SILK



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Appendix B. Bill of Materials (BOM)

TABLE B-1: BILL OF MATERIALS (BOM)

Qty.	Reference	Description	Manufacturer	Part Number
2	Cin1, Cout1	Cap. ceramic 1 µF 16V 10% X5R SMD 0402	TDK Corporation	C1005X5R1C105K
2	Cin2, Cout2	Cap. ceramic 1 µF 25V 10% X7R SMD 0603	TDK Corporation	C1608X7R1E105K
8	J1, J2, J3, J4, J6, J7, J8, J9	Conn. TP Loop Tin SMD	Harwin Plc.	S1751-46R
2	J5, J10	Conn. header-2.54 male 1x3 Tin 5.84 MH TH vert.	Samtec, Inc.	TSW-103-07-T-S
0	J11, J13	**DO NOT POPULATE**	—	—
0	J12, J14	**DO NOT POPULATE**	—	—
2	JP1, JP2	Mech. HW jumper 2.54 mm 1x2	3M	969102-0000-DA
1	PCB	MCP1711 1.8 VOUT /3.3VOUT Printed Circuit Board	—	04-10429-R1
1	U1	150 mA Capacitorless Ultra-low Quiescent Current LDO 5-Lead SOT-23	Microchip Technology Inc.	**MCP1711T-18I/OT**
1	U2	150 mA Capacitorless Ultra-low Quiescent Current LDO 4-Lead UQFN	Microchip Technology Inc.	**MCP1711T-33I/5X**
4	PAD1, PAD2, PAD3, PAD4	Mech. HW Rubber Pad Hemisphere D6.4 H1.9 Clear	3M	**SJ5382**

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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07/14/15

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Мы молодая и активно развивающаяся компания в области поставок электронных компонентов. Мы поставляем электронные компоненты отечественного и импортного производства напрямую от производителей и с крупнейших складов мира.

Благодаря сотрудничеству с мировыми поставщиками мы осуществляем комплексные и плановые поставки широчайшего спектра электронных компонентов.

Собственная эффективная логистика и склад в обеспечивает надежную поставку продукции в точно указанные сроки по всей России.

Мы осуществляем техническую поддержку нашим клиентам и предпродажную проверку качества продукции. На все поставляемые продукты мы предоставляем гарантию .

Осуществляем поставки продукции под контролем ВП МО РФ на предприятия военно-промышленного комплекса России , а также работаем в рамках 275 ФЗ с открытием отдельных счетов в уполномоченном банке. Система менеджмента качества компании соответствует требованиям ГОСТ ISO 9001.

Минимальные сроки поставки, гибкие цены, неограниченный ассортимент и индивидуальный подход к клиентам являются основой для выстраивания долгосрочного и эффективного сотрудничества с предприятиями радиоэлектронной промышленности, предприятиями ВПК и научно-исследовательскими институтами России.

С нами вы становитесь еще успешнее!

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