



**MCP1256/7/8/9**  
**Charge Pump Evaluation Board**  
**User's Guide**

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# MCP1256/7/8/9 CHARGE PUMP EVALUATION BOARD USER'S GUIDE

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# **MCP1256/7/8/9 Charge Pump Evaluation Board User's Guide**

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NOTES:



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# MCP1256/7/8/9 CHARGE PUMP 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](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 “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 MCP1256/7/8/9 Charge Pump 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 MCP1256/7/8/9 Charge Pump Evaluation Board. The manual layout is as follows:

- **Chapter 1. “Product Overview”** – Important information about the MCP1256/7/8/9 Charge Pump Evaluation Board.
- **Chapter 2. “Installation and Operation”** – Includes instructions on how to get started and a description of the MCP1256/7/8/9 Charge Pump Evaluation Board.
- **Appendix A. “Schematic and Layouts”** – Shows the schematic and board layout diagram for the MCP1256/7/8/9 Charge Pump Evaluation Board.
- **Appendix B. “Bill Of Materials (BOM)”** – Lists the parts used to build the MCP1256/7/8/9 Charge Pump Evaluation Board.

# MCP1256/7/8/9 Charge Pump 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® 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 the MCP1256/7/8/9 Charge Pump Evaluation Board. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

**MCP1256/7/8/9 Data Sheet, "Regulated 3.3V, Low-Ripple Charge Pump with Low-Operating Current SLEEP Mode or BYPASS Mode" (DS21989)**

This data sheet provides detailed information regarding the MCP1256/7/8/9 product family.

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- **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
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing
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- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support
- Development Systems Information Line

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 (March 2006)

- Initial Release of this Document.

# **MCP1256/7/8/9 Charge Pump Evaluation Board User's Guide**

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NOTES:



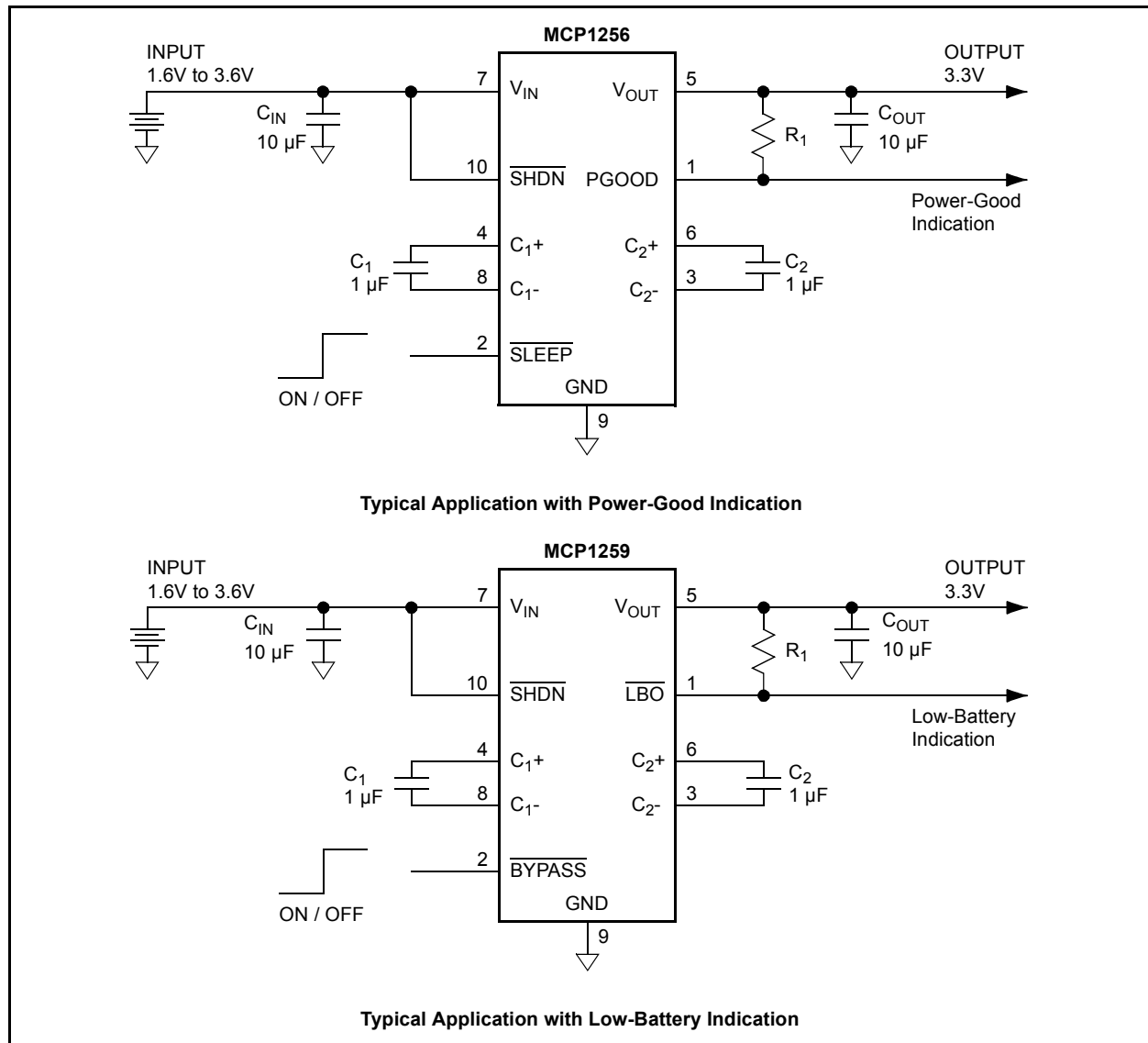
## Chapter 1. Product Overview

### 1.1 INTRODUCTION

The MCP1256/7/8/9 Charge Pump Evaluation Board is used to evaluate Microchip's MCP1256/7/8/9 Regulated 3.3V, Low-Ripple Charge Pumps with low-operating current SLEEP mode or BYPASS mode.

This chapter covers the following topics:

- What is the MCP1256/7/8/9 Charge Pump Evaluation Board?
- What the MCP1256/7/8/9 Charge Pump Evaluation Board Includes



**FIGURE 1-1:** Typical MCP1256/7/8/9 Applications.

# MCP1256/7/8/9 Charge Pump Evaluation Board User's Guide

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## 1.2 WHAT IS THE MCP1256/7/8/9 CHARGE PUMP EVALUATION BOARD?

The MCP1256/7/8/9 Charge Pump Evaluation Board is an evaluation and demonstration tool for Microchip Technology's MCP1256/7/8/9 Regulated 3.3V, Low-Ripple Charge Pumps with low-operating current SLEEP mode or BYPASS mode. The design provides for dynamic versatility.

The MCP1256/7/8/9 Charge Pump Evaluation Board is setup to evaluate simple, stand-alone, DC-to-DC conversion. Two evaluation circuits are provided, demonstrating the versatility of the MCP1256/7/8/9 device family. One evaluation circuit utilizes the MCP1256, demonstrating the SLEEP mode feature along with a power good indication. The other evaluation circuit utilizes the MCP1259, demonstrating the unique BYPASS mode feature, along with a low battery indication.

When connected, the MCP1256/7/8/9 devices can be evaluated in a variety of applications.

## 1.3 WHAT THE MCP1256/7/8/9 CHARGE PUMP EVALUATION BOARD INCLUDES

This MCP1256/7/8/9 Charge Pump Evaluation Board includes:

- MCP1256/7/8/9 Charge Pump Evaluation Board, 102-00099
- MCP1256/7/8/9 Charge Pump Evaluation Board User's Guide, DS51603
- MCP1256/7/8/9 Data Sheet, *"Regulated 3.3V, Low-Ripple Charge Pump with Low-Operating Current SLEEP Mode or BYPASS Mode"*, DS21989



# MCP1256/7/8/9 CHARGE PUMP EVALUATION BOARD USER'S GUIDE

## Chapter 2. Installation and Operation

### 2.1 INTRODUCTION

The MCP1256/7/8/9 Charge Pump Evaluation Board demonstrates Microchip's MCP1256/7/8/9 devices. The MCP1256/7/8/9 devices are positive regulated charge pumps that accept an input voltage from +1.8V to +3.6V and convert it to a regulated 3.3V output voltage. The MCP1256/7/8/9 provide a low-cost, compact and simple solution for step-up DC/DC conversions, primarily in battery applications that do not want to use switching regulator solutions because of EMI noise and inductor size.

The MCP1256/7/8/9 are designed to offer the highest possible efficiency under common operating conditions, i.e.  $V_{IN} = 2.4V$  or  $2.8V$ ,  $V_{OUT} = 3.3V$ ,  $I_{OUT} = 100$  mA. A fixed switching frequency, 650 kHz (typically), allows for easy external filtering.

The MCP1256/7 provide a unique SLEEP mode feature. SLEEP mode reduces the current drawn from the input supply while maintaining a regulated bias on external peripherals. SLEEP mode can substantially increase battery run-time in portable applications.

The MCP1258/9 provide a unique BYPASS mode feature. BYPASS virtually eliminates the current drawn from the input supply by the device, while maintaining an unregulated bias on external peripherals. BYPASS connects the input supply voltage to the output. All remaining functions of the device are shutdown. BYPASS mode can substantially increase battery run-time in portable applications.

The devices supply up to 100 mA of output current for input voltages,  $V_{IN}$ , greater than or equal to 2.2V.

### 2.2 FEATURES

The MCP1256/7/8/9 Charge Pump Evaluation Board is used to evaluate various device options. Two evaluation circuits are provided as a guide to external component selection and board layout. Emphasis has been placed on cost, board area, thermal management and performance. One evaluation circuit utilizes the MCP1256, demonstrating the SLEEP mode feature along with a power good indication. The other evaluation circuit utilizes the MCP1259 demonstrating the unique BYPASS mode feature along with a low-battery indication.

The MCP1256/7/8/9 Charge Pump Evaluation Board has the following features:

- Evaluation of the MCP1256 in a 10-pin MSOP package
- Evaluation of the MCP1259 in a 10-pin MSOP package
- Simple, stand-alone operation
- Powered from external bench supply or compatible battery input
- Surface-mount design
- Fully assembled and tested

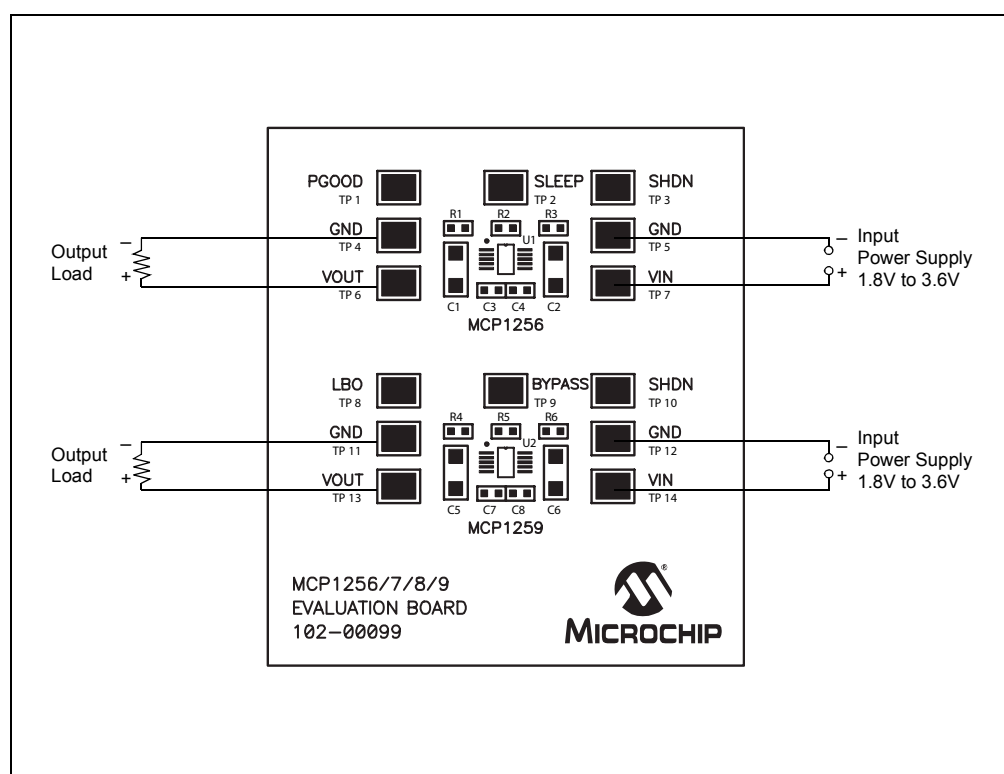
## 2.3 GETTING STARTED

The MCP1256/7/8/9 Evaluation Board is fully assembled and tested for generating a regulated 3.3V output voltage from a 1.8V to 3.6V input at load currents up to 100 mA. The board requires the use of an external input voltage source and external load.

### 2.3.1 Power Input and Output Connections

#### 2.3.1.1 POWERING THE MCP1256/7/8/9 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 +3.6V range. For normal operation, the input voltage should be between +1.8V and +3.6V. The input voltage must not exceed an absolute maximum of +3.8V.
2. Connect the positive side of the input source (+) to  $V_{IN}$  of the circuit being evaluated. Connect the negative or return side of the input source (-) to GND 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 MCP1256/7/8/9 EVALUATION BOARD

1. To apply a load to a MCP1256/7/8/9 Evaluation Board, the positive side of the load (+) should be connected to  $V_{OUT}$  of the circuit being evaluated.
2. The negative or return side of the load (-) should be connected to GND of the circuit being evaluated. Care should be taken when using electronic loads or ground referenced loads.

## 2.3.2 Shutdown Mode ( $\overline{\text{SHDN}}$ )

Driving  $\overline{\text{SHDN}}$  low puts the MCP1256/7/8/9 in a low-power Shutdown mode. This disables the charge-pump switches, oscillator and control logic, reducing the quiescent current to 0.1  $\mu\text{A}$  (typical). The PGOOD output and LBO are in a high impedance state during shutdown.

## 2.3.3 SLEEP Mode ( $\overline{\text{SLEEP}}$ )

The MCP1256/7 provide a unique SLEEP mode feature. SLEEP mode reduces the current drawn from the input supply, while maintaining a regulated bias on external peripherals. SLEEP mode can substantially increase battery run-time in portable applications.

The regulation control is hysteretic, otherwise referred to as a bang-bang control. The output is regulated around a fixed reference with some hysteresis. As a result, some amount of peak-to-peak ripple will be observed at the output independent of load current. The frequency of the output ripple, however, will be influenced heavily by the load current and output capacitance.

## 2.3.4 BYPASS Mode ( $\overline{\text{BYPASS}}$ )

The MCP1258/9 provide a unique BYPASS mode feature. BYPASS virtually eliminates the current drawn from the input supply by the device, while maintaining an unregulated bias on external peripherals. BYPASS connects the input supply voltage to the output. All remaining functions of the device are shutdown. BYPASS mode can substantially increase battery run-time in portable applications.

## 2.3.5 Device Support Options

The MCP1256/7/8/9 Charge Pump Evaluation Board supports the entire MCP1256/7/8/9 family. The MCP1256/7/8/9 Charge Pump Evaluation Board is provided with two evaluation circuits utilizing the MCP1256 and MCP1259. Alternate devices can be substituted in order to evaluate the different MCP1256/7/8/9 family options.

# **MCP1256/7/8/9 Charge Pump Evaluation Board User's Guide**

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# **MCP1256/7/8/9 CHARGE PUMP EVALUATION BOARD USER'S GUIDE**

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## **Appendix A. Schematic and Layouts**

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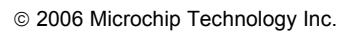
### **A.1 INTRODUCTION**

This appendix contains the following schematic and layouts for the MCP1256/7/8/9 Charge Pump Evaluation Board.

Diagrams included in this appendix:

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

## A.2 BOARD SCHEMATIC





## A.3 BOARD - ASSEMBLY DRAWING

A	B	C	D
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NOTES:

MATERIAL: FR-4. THICKNESS 0.062 COPPER 1 OZ – SIG LYRS

TWO LAYER BOARD

FINISH: ☒ SOLDERMASK OVER BARE COPPER(SMOBC) WITH HOT-AIR-LEVELED SOLDER  
☐ SMOBC WITH SELECTIVE GOLD PLATING ON LANDS INDICATED. 10uI GOLD OVER 50–100uI NICKEL.  
☐ 60/40 TIN–LEAD REFLOW

SOLDERMASK – DYNACHEM EPIC 200 LPI OR EQUIVALENT.  
 COLOR–Green High Gloss  
 SILKSCREEN – White

USE ARTWORK SET NO. 105–00099 REV 1

ANY ALTERNATIVES TO THE ABOVE SPECIFICATIONS MUST BE APPROVED BY THE ENGINEERING DEPARTMENT AT MICROCHIP.  
 THIS PCB TO BE MANUFACTURED TO MEET ALL ACCEPTANCE LEVELS OF A CLASS 2 PCB PER ANSI/IPC–A–600F.

Title MCP1256/7/8/9EV

Size B	Number 104–00099	Rev 1	
<b>MICROCHIP</b>		Engineer S. Deebom	
Date 13FEB06	Drawn by S. Deebom	Sheet 1 of 1	
Filename 104–00099–R1.pcb		D	

1

2

3

1

2

3

A
 B | C | D |

1

2

3

1

2

3

### ASSEMBLY NOTES:

1. ALL UNUSED COMPONENTS SHALL BE FREE OF SOLDER
2. ALL COMPONENTS SHALL BE MOUNTED FLUSH TO THE BOARD, EXCEPT AS NOTED.
3. MAXIMUM COMPONENT HEIGHT NOT TO EXCEED: 0.500 TOP SIDE, 0.048 BOTTOM SIDE
4. FINISHED BOARD SHALL BE FREE OF ALL RESIDUES.

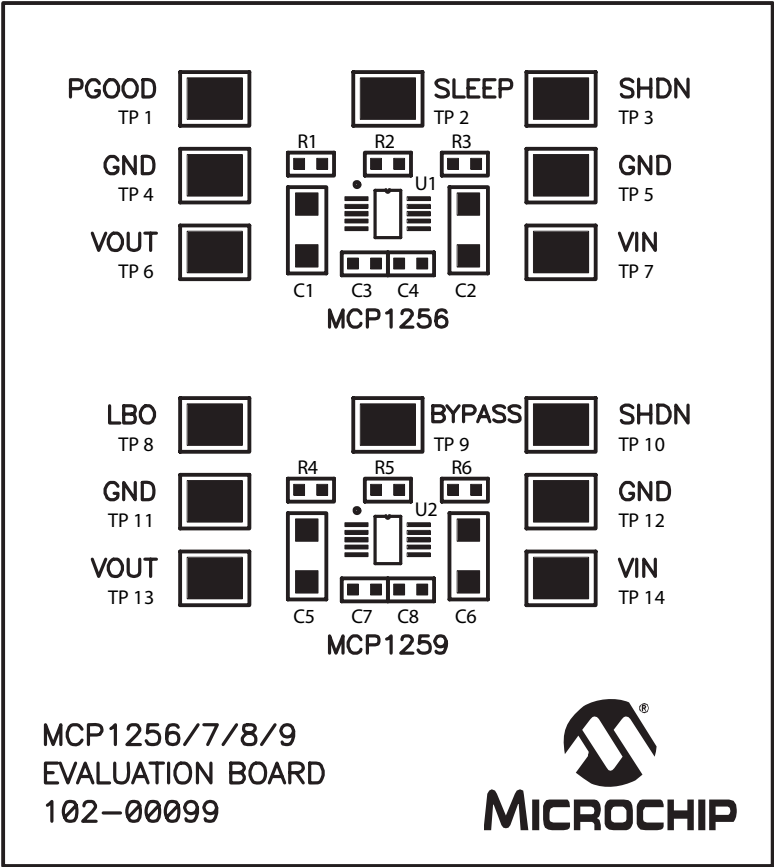
The diagram shows a top-down view of the PCB layout with dimensions 2.25 and 2.00 indicated. It includes component footprints for MCP1256, MCP1259, and MCP1257, along with various passive components like resistors and capacitors.

Hole Dia (inch)	Symbol	Quantity	Plated
0.014	+	24	Yes

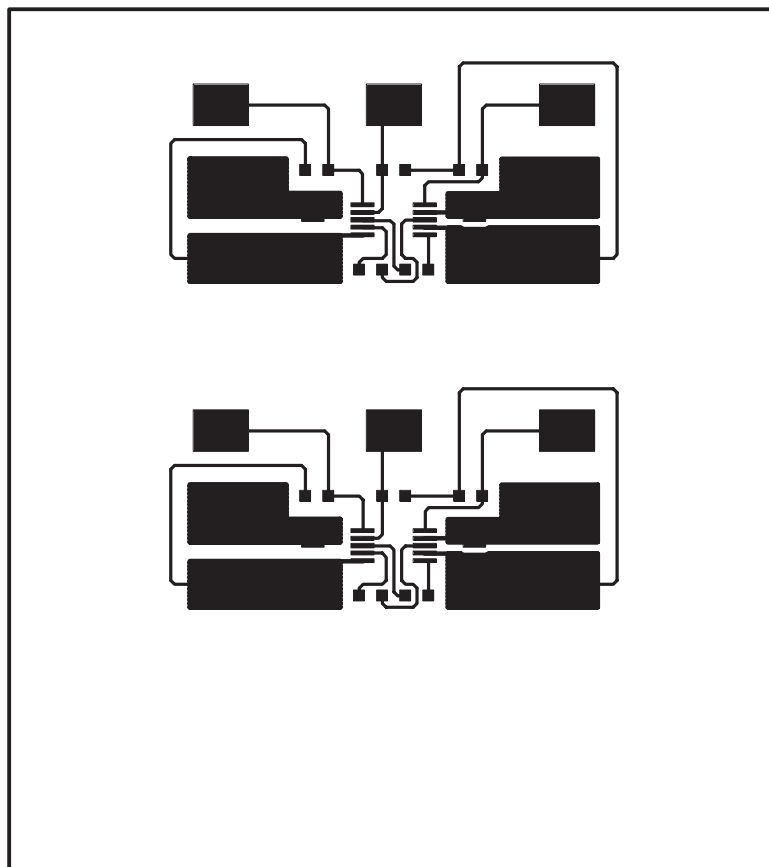
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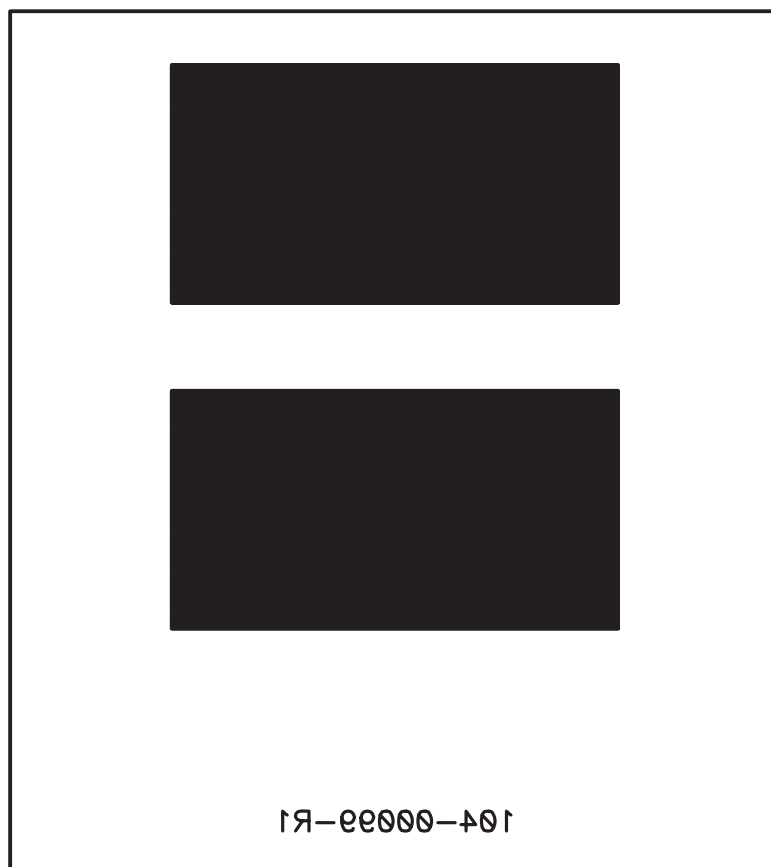
A.4 BOARD - TOP OVERLAY



## A.5 BOARD - TOP LAYER



## A.6 BOARD - BOTTOM LAYER





# MCP1256/7/8/9 CHARGE PUMP EVALUATION BOARD USER'S GUIDE

## Appendix B. Bill Of Materials (BOM)

TABLE B-1: BILL OF MATERIALS (BOM)

Qty.	Reference	Description	Mfgr.	Part Number
4	C1,C2,C5,C6	10uF, X5R Ceramic, 10V, 1206	Taiyo Yuden®	LMK316BJ106KL-T
4	C3,C4,C7,C8	1uF, X7R Ceramic, 16V, 0603	Taiyo Yuden	EMK107BJ105KA-TR
6	R1,R2,R3,R4,R5,R6	100k, 1/10W, Chip Resistor, 0603	Panasonic®-ECG	ERJ-3EK1003V
12	TP1-TP12	Surface Mount Test Point, 5016	Keystone® Electronics	5016
1	U1	Positive Regulated Charge Pump, MSOP10	Microchip Technology, Inc.	MCP1256-I/MS
1	U2	Positive Regulated Charge Pump, MSOP10	Microchip Technology, Inc.	MCP1259-I/MS
4	—	Bump-ons	3M	SJ5003
1	—	Printed Circuit Board	Advanced Circuits	104-00099-R1



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