



MICROCHIP

**MCP1665
12V Output
Boost Regulator
Evaluation Board
User's Guide**

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

Information contained in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION, INCLUDING BUT NOT LIMITED TO ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. Microchip disclaims all liability arising from this information and its use. Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

Microchip received ISO/TS-16949:2009 certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona; Gresham, Oregon and design centers in California and India. The Company's quality system processes and procedures are for its PIC® MCUs and dsPIC® DSCs, KEELOQ® code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.

**QUALITY MANAGEMENT SYSTEM
CERTIFIED BY DNV
= ISO/TS 16949 =**

Trademarks

The Microchip name and logo, the Microchip logo, AnyRate, AVR, AVR logo, AVR Freaks, BeaconThings, BitCloud, CryptoMemory, CryptoRF, dsPIC, FlashFlex, flexPWR, Helder, JukeBlox, KEELOQ, KEELOQ logo, Klear, LANCheck, LINK MD, maXStylus, maXTouch, MediaLB, megaAVR, MOST, MOST logo, MPLAB, OptoLyzer, PIC, picoPower, PICSTART, PIC32 logo, Prochip Designer, QTouch, RightTouch, SAM-BA, SpyNIC, SST, SST Logo, SuperFlash, tinyAVR, UNI/O, and XMEGA are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

ClockWorks, The Embedded Control Solutions Company, EtherSynch, Hyper Speed Control, HyperLight Load, IntelliMOS, mTouch, Precision Edge, and Quiet-Wire are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Adjacent Key Suppression, AKS, Analog-for-the-Digital Age, Any Capacitor, AnyIn, AnyOut, BodyCom, chipKIT, chipKIT logo, CodeGuard, CryptoAuthentication, CryptoCompanion, CryptoController, dsPICDEM, dsPICDEM.net, Dynamic Average Matching, DAM, ECAN, EtherGREEN, In-Circuit Serial Programming, ICSP, Inter-Chip Connectivity, JitterBlocker, KlearNet, KlearNet logo, Mindi, MiWi, motorBench, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICkit, PICtail, PureSilicon, QMatrix, RightTouch logo, REAL ICE, Ripple Blocker, SAM-ICE, Serial Quad I/O, SMART-I.S., SQI, SuperSwitcher, SuperSwitcher II, Total Endurance, TSHARC, USBCheck, VariSense, ViewSpan, WiperLock, Wireless DNA, and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

Silicon Storage Technology is a registered trademark of Microchip Technology Inc. in other countries.

GestIC is a registered trademark of Microchip Technology Germany II GmbH & Co. KG, a subsidiary of Microchip Technology Inc., in other countries.

All other trademarks mentioned herein are property of their respective companies.

© 2017, Microchip Technology Incorporated, All Rights Reserved.
ISBN: 978-1-5224-2267-9



MCP1665 12V OUTPUT BOOST REGULATOR EVALUATION BOARD USER'S GUIDE

Table of Contents

Preface	3
Introduction.....	3
Document Layout	3
Conventions Used in this Guide	4
Recommended Reading.....	5
The Microchip Web Site	5
Customer Support	5
Document Revision History	5
Chapter 1. Product Overview	
1.1 Introduction	7
1.2 MCP1665 Device Overview	7
1.3 What Is the MCP1665 12V Output Boost Regulator Evaluation Board?	8
1.4 What Does the MCP1665 12V Output Boost Regulator Evaluation Board Kit Contain?	8
Chapter 2. Installation and Operation	
2.1 Introduction	9
2.1.1 MCP1665 12V Output Boost Regulator Evaluation Board Features	9
2.2 Getting Started	10
2.2.1 Power Input and Output Connection	10
2.3 Test Results for Typical Application using MCP1665	11
2.3.1 Test Results for MCP1665	11
2.4 Battery Considerations	14
2.5 Extra Input Capacitance	15
2.6 RT Spare Resistors Area	15
Appendix A. Schematic and Layouts	
A.1 Introduction	17
A.2 Board – Schematic	18
A.3 Board – Top Silk and pads	19
A.4 Board – Top Silk And Copper	19
A.5 Board – Top Copper	20
A.6 Board – Bottom Copper	20
Appendix B. Bill of Materials (BOM)	27
Worldwide Sales and Service	28

MCP1665 12V Output Boost Regulator Evaluation Board User's Guide

NOTES:



MCP1665 12V OUTPUT BOOST REGULATOR 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 website (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 “DSXXXXXXA”, where “XXXXXX” 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 MCP1665 12V Output Boost Regulator 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 MCP1665 12V Output Boost Regulator Evaluation Board as a development tool. The manual layout is as follows:

- **Chapter 1. “Product Overview”** – Important information about the MCP1665 12V Output Boost Regulator Evaluation Board.
- **Chapter 2. “Installation and Operation”** – Includes instructions on how to get started with the MCP1665 12V Output Boost Regulator Evaluation Board and a description of the user's guide.
- **Appendix A. “Schematic and Layouts”** – Shows the schematic and layout diagrams for the MCP1665 12V Output Boost Regulator Evaluation Board.
- **Appendix B. “Bill of Materials (BOM)”** – Lists the parts used to build the MCP1665 12V Output Boost Regulator Evaluation Board.

MCP1665 12V Output Boost Regulator 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	<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 MCP1665 12V Output Boost Regulator Evaluation Board. Another useful document is listed below. The following Microchip document is available and recommended as a supplemental reference resource.

- **MCP1665 Data Sheet - “High-Voltage 3.6A Integrated Switch PFM/PWM Boost Regulator” (DS20005872A)**

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
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- 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://www.microchip.com/support>.

DOCUMENT REVISION HISTORY

Revision A (October 2017)

- Initial Release of this Document.

MCP1665 12V Output Boost Regulator Evaluation Board User's Guide

NOTES:

Chapter 1. Product Overview

1.1 INTRODUCTION

This chapter provides an overview of the MCP1665 12V Output Boost Regulator Evaluation Board and covers the following topics:

- MCP1665 Device Overview
- What is the MCP1665 12V Output Boost Regulator Evaluation Board?
- What DOES the MCP1665 12V Output Boost Regulator Evaluation Board Kit Contain?

1.2 MCP1665 DEVICE OVERVIEW

The MCP1665 is a compact, high-efficiency, fixed-frequency, nonsynchronous step-up DC/DC converter that integrates a 36V, 100 mΩ NMOS switch. This product provides a space-efficient high-voltage step-up, easy-to-use power supply solution. The MCP1665 was developed for applications powered by Li-Ion or Li-Polymer batteries, three-cell alkaline, Energizer® Lithium Primary, Ni-Cd, Ni-MH or two-cell Lead-acid batteries.

The MCP1665 operates in Pulse-Width Modulation (PWM), at a fixed 500 kHz switching frequency. The device features an undervoltage lockout (UVLO) which prevents fault operation below 2.7V (UVLO_{STOP}) corresponding to the value of three discharged batteries. The MCP1665 starts its normal operation at 2.9V input voltage (UVLO_{START}), then the operating input voltage ranges from 2.7V up to 5V.

For standby applications, MCP1665 can be set in Shutdown by pulling the EN pin to GND. The device will stop switching and will consume tens of μA of input current including the feedback divider (the chip itself consumes approx. 1 μA). In the Boost configuration, the input voltage will be bypassed to output through the inductor and the Schottky diode.

MCP1665 also provides two protection features:

- An open-load protection (OLP) in the event of:
 - Short-circuit of the feedback pin to GND
 - Disconnected feedback divider

In these conditions, the OLP function stops the internal driver and prevents damaging the device and load. This feature is disabled during start-up sequence and Thermal Shutdown state.

- An overvoltage protection (OVP) in the event of feedback voltage increasing more than 5% above its nominal value, meant to protect the device and the load against excessive overshoots during load steps.

The goal of the MCP1665 12V Output Boost Regulator Evaluation Board is to demonstrate the higher output voltage and output current capabilities of the MCP1665 Boost Converter.

1.3 WHAT IS THE MCP1665 12V OUTPUT BOOST REGULATOR EVALUATION BOARD?

The MCP1665 12V Output Boost Regulator Evaluation Board was developed to help engineers reduce product design cycle time. It comes fully populated and ready to be tested with a typical 5V input and a 12V output.

Powering the board with a lower voltage in the permitted range can be done after inspecting the MCP1665 data sheet and adjusting the output current expectations accordingly.

The output voltage is set to the proper value using an external resistor divider, resulting in a simple and compact solution.

1.4 WHAT DOES THE MCP1665 12V OUTPUT BOOST REGULATOR EVALUATION BOARD KIT CONTAIN?

This MCP1665 12V Output Boost Regulator Evaluation Board kit includes:

- MCP1665 12V Output Boost Regulator Evaluation Board (ADM00865)
- Information Sheet

Chapter 2. Installation and Operation

2.1 INTRODUCTION

MCP1665 is a non-synchronous, fixed-frequency step-up DC/DC converter that has been developed for applications that require higher output voltage capabilities. MCP1665 can regulate the output voltage up to 32V and can deliver up to 1A to the load at 5V input and 12V output (see [Figure 2-3](#)).

At light loads, there are two ways the MCP1665 keeps its input current low. The first one is SKIPPING pulses to keep the output ripple low (this happens when the MODE pin is pulled to GND). The second one (when the MODE pin is pulled up to V_{IN}) is the PFM mode. This reduces the input current even further by completely stopping the switching as long as the output voltage remains within the permitted range. It comes at the cost of a higher output ripple, in the range of hundreds of millivolts.

The regulated output voltage (V_{OUT}) should be at least one volt higher than the input voltage (V_{IN}).

Another important feature is that the device integrates the compensation and protection circuitry, such that the final solution lowers total system cost, eases implementation and requires a minimum number of additional components and board area.

2.1.1 MCP1665 12V Output Boost Regulator Evaluation Board Features

The MCP1665 12V Output Boost Regulator Evaluation Board has the following features:

- Typical 12V Output when supplied from a low-input voltage source
- Input Voltage range (V_{IN}): 3V to 5V, with $V_{IN} < V_{OUT} - 1V$
- Output Current: max 1 A @ 12V Output with 5V Input
- Enabled state is selectable by using EN jumper
- Light-load power saving method is selectable by toggling the MODE switch
- Undervoltage Lockout (UVLO)
 - UVLO Start: 2.9V
 - UVLO Stop: 2.7V
- PWM/PFM Operation
- PWM Switching Frequency: 500 kHz
- Peak Input Current Limit of 3.6A (typical)
- Internal Compensation, so no compensation network is needed on the board
- Soft Start
- Protection in case of feedback pin shorted to GND
- Overtemperature Protection (if the die temperature exceeds +150°C, with 15°C hysteresis)

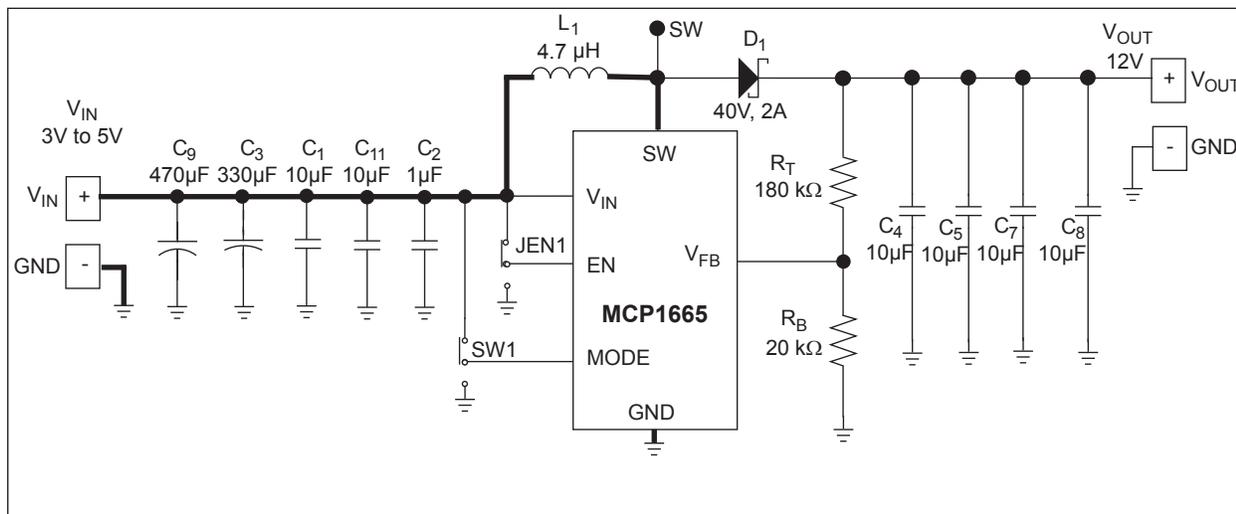


FIGURE 2-1: MCP1665 Evaluation Board Schematic.

2.2 GETTING STARTED

The MCP1665 12V Output Boost Regulator Evaluation Board is fully assembled and tested to evaluate and demonstrate the MCP1665 product capabilities. This board requires the use of external laboratory supplies and load.

2.2.1 Power Input and Output Connection

2.2.1.1 POWERING THE MCP1665 12V OUTPUT BOOST REGULATOR EVALUATION BOARD

The MCP1665 12V Output Boost Regulator Evaluation Board was designed to evaluate the MCP1665 device.

Soldered test points and screw terminal blocks are available for the input voltage connections and for load connections. The switch peak current limit will provide a safe maximum current value. The maximum output current for the converter varies with input and output voltages; refer to [Figure 2-3](#) or the MCP1665 data sheet for more information on the maximum output current.

2.2.1.2 BOARD POWER-UP PROCEDURE

1. Connect the input supply as shown in [Figure 2-2](#). The input voltage should not be higher than 5V.
2. Connect system load to V_{OUT} and GND terminals; maximum load varies with input and output voltage. Connect the (+) side of the load to V_{OUT} and the negative (-) side to ground (GND).
3. The MODE SELECT switch SW1 can be used to change between the two power saving modes:
 - PFM/PWM when the switch is in PFM position
 - PWM only, when the switch is in PWM position

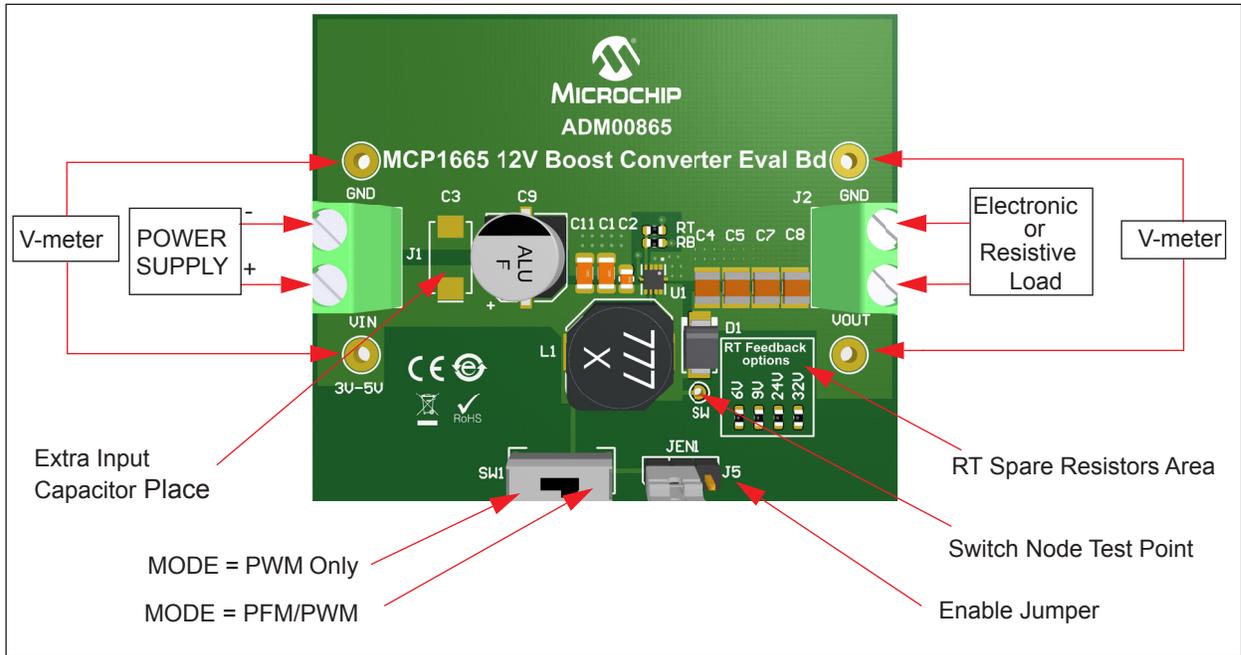


FIGURE 2-2: MCP1665 12V Output Boost Regulator Evaluation Board Setup.

2.2.1.3 ADJUSTABLE V_{OUT} SETTING

The top circuit comes with the output voltage set to 12V. If a different output is desired, recalculate the resistor divider (RT1 and RB1) using [Equation 2-1](#).

Note that V_{IN} must be lower than V_{OUT} by at least 1 volt.

EQUATION 2-1:

$$RT = RB \times \left[\left(\frac{V_{OUT}}{V_{FB}} \right) - 1 \right]$$

Where: $V_{FB} = 1.2V$

For output voltages higher than 15V, the inductor value should be increased. See [Table 2-1](#) for more information.

TABLE 2-1: RECOMMENDED RESISTOR DIVIDER AND INDUCTOR VALUES

V_{OUT}	Inductor Value	RT	RB
6.0V	4.7 μ H	80.6 k Ω	20 k Ω
9.0V	4.7 μ H	130 k Ω	20 k Ω
12V	4.7 μ H	180 k Ω	20 k Ω
24V	10 μ H	383 k Ω	20 k Ω
32V	10 μ H	513 k Ω	20 k Ω

2.3 TEST RESULTS FOR TYPICAL APPLICATION USING MCP1665

2.3.1 Test Results for MCP1665

This chapter provides specific operation waveforms and graphs. Refer to the MCP1665 Data Sheet (DS20005872A) for more information.

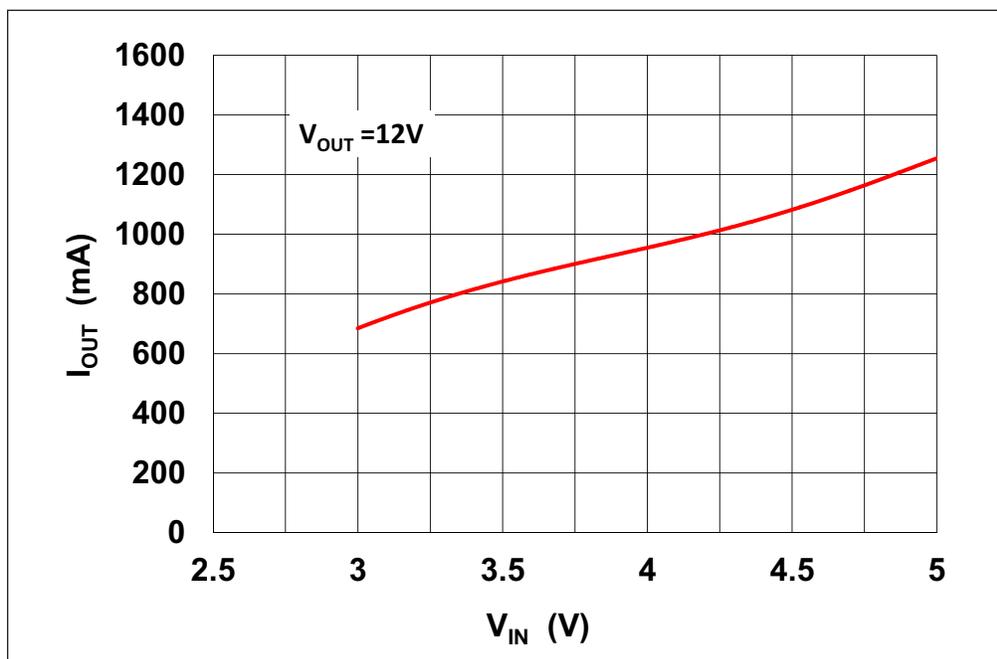


FIGURE 2-3: MCP1665 Boost 12.0 V_{OUT} Maximum I_{OUT} vs. V_{IN} with Maximum 5% Output Drop.

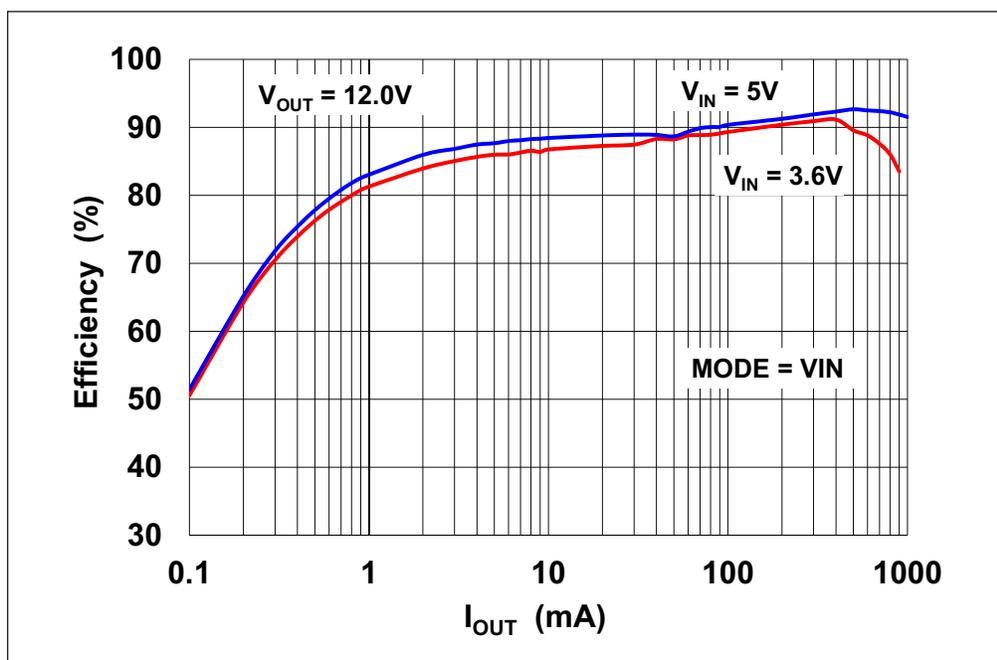


FIGURE 2-4: MCP1665 12V Output Efficiency vs. I_{OUT}.

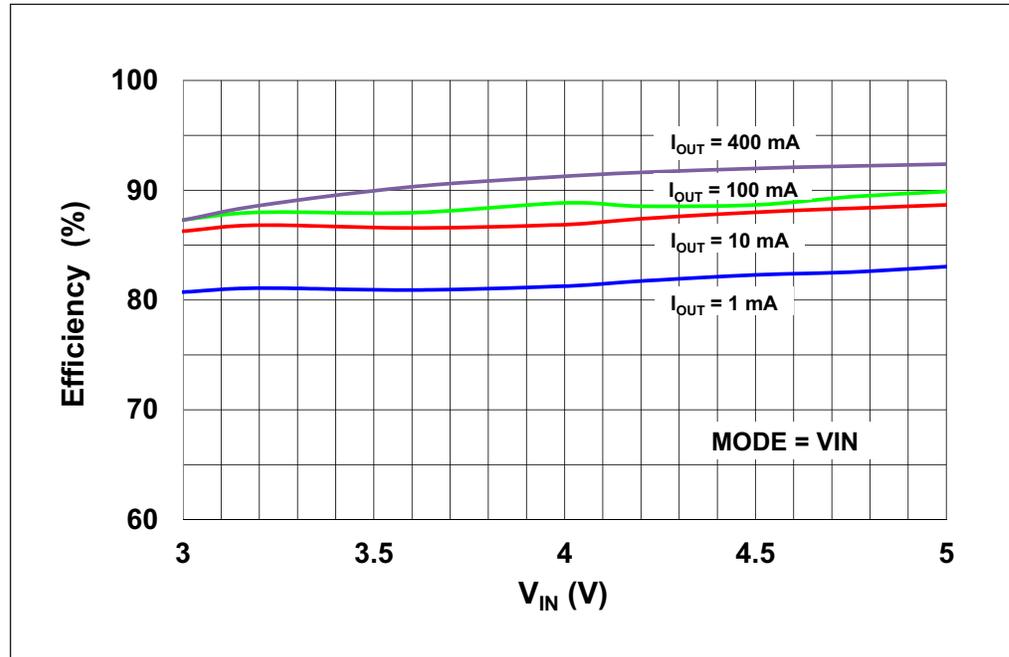


FIGURE 2-5: MCP1665 12V Output Efficiency vs. V_{IN}.

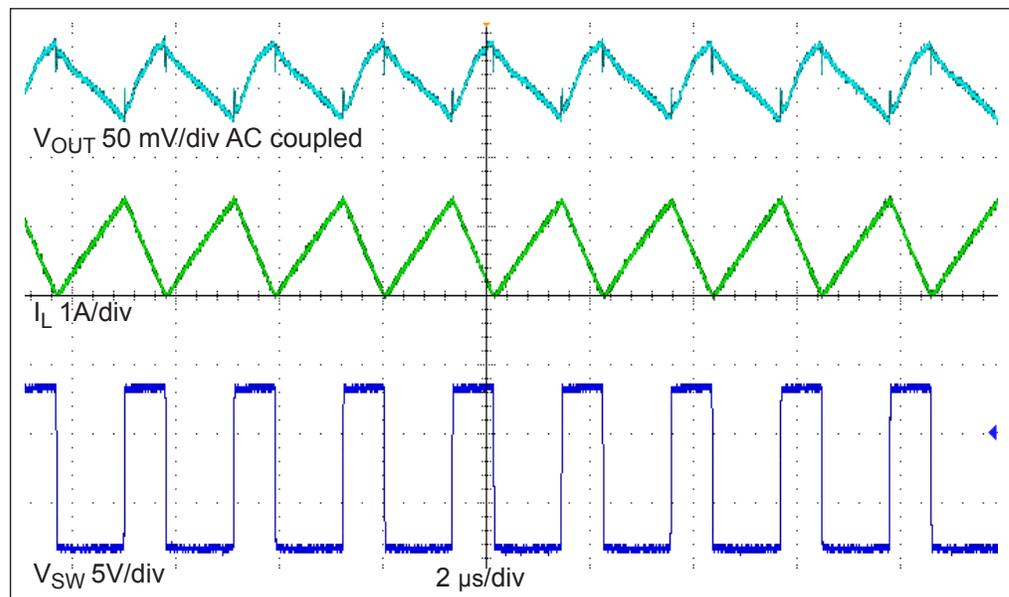


FIGURE 2-6: MCP1665 12V Output 3.6V Input 1A Load Operation Waveform.

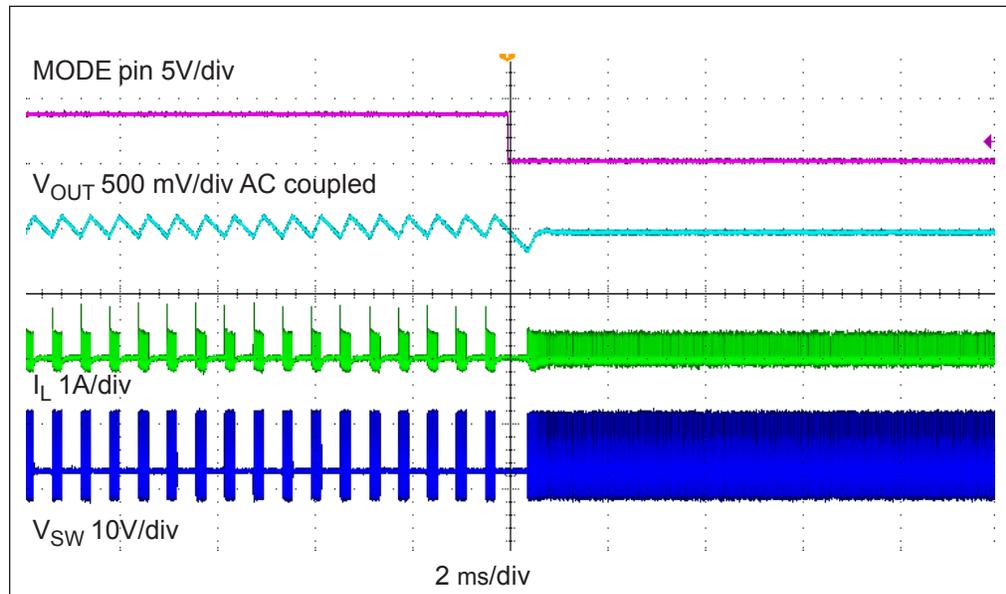


FIGURE 2-7: MCP1665 PFM (MODE =HIGH) to Skipping (MODE=LOW) Transition at 12V Output 5V Input 10 mA Load.

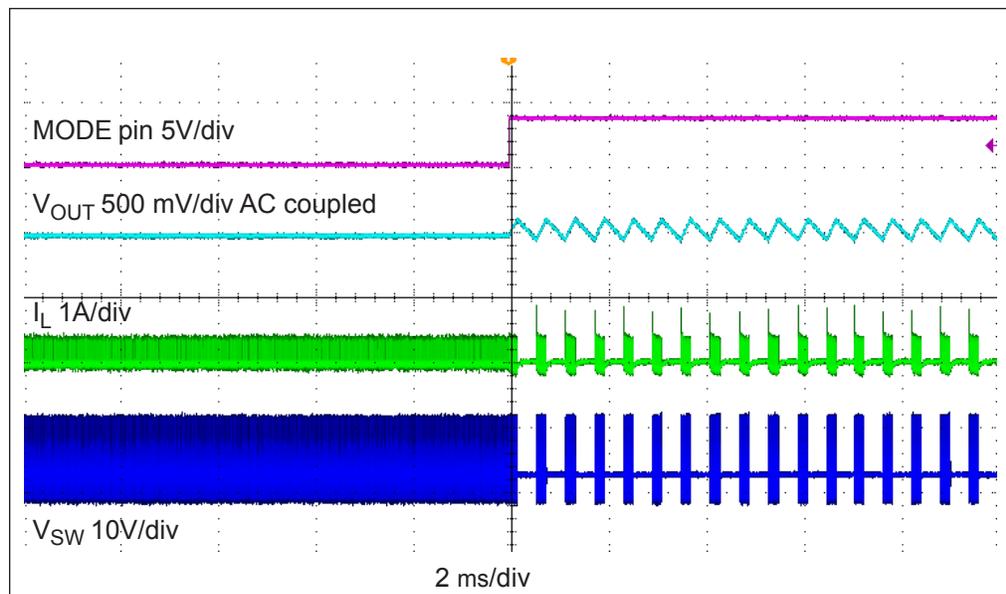


FIGURE 2-8: MCP1665 Skipping (MODE=LOW) to PFM (MODE =HIGH) Transition at 12V Output 5V Input 10 mA Load.

2.4 BATTERY CONSIDERATIONS

When considering the power solution for this design, select a battery carefully. The battery should be able to sustain the boost converter's input voltage even under the heaviest load expected. Currents in excess of 3 amps can be drawn by the MCP1665 boost converter's input and the power supply should be able to sustain its voltage.

Weak batteries may cause the MCP1665 input voltage to drop under the UVLO threshold and force the converter to work intermittently. Lithium and nickel cells are recommended. Input connections should be kept short and thick to maintain the boost converter's performance within the expected range.

2.5 EXTRA INPUT CAPACITANCE

An extra capacitor place (C3) is available on the MCP1665 12V Output Boost Regulator Evaluation Board (see [Figure 2-2](#)).

It is useful for input decoupling if, for some reason, the power supply's impedance can not be kept as low as needed. This includes, but is not limited to: longer wires, V_{IN} being derived from another power supply with a slow response, fast load, as well as stepping, causing high-input current spikes.

If intermittent operation or a bus-pumping behavior is noticed, this should be one of the first steps in troubleshooting. Check to see if the input voltage of the MCP1665 is permanently above the UVLO threshold. Probing the input voltage should be done by attaching the oscilloscope probes to the GND and VIN test points on the board.

The recommended BOM part to be soldered in the DNP position is a tantalum polymer 330 μ F/10V capacitor with a low ESR.

2.6 RT SPARE RESISTORS AREA

The RT Feedback options board area contains the four spare R Top feedback resistors. The resistor values are chosen to closely match the four output voltage options labeled next to them (6V, 9V, 24V, 32V). These resistors should be soldered in the RT position on the board, by replacing the 12V option resistor provided by default.

MCP1665 12V Output Boost Regulator Evaluation Board User's Guide

NOTES:



MCP1665 12V OUTPUT BOOST REGULATOR EVALUATION BOARD USER'S GUIDE

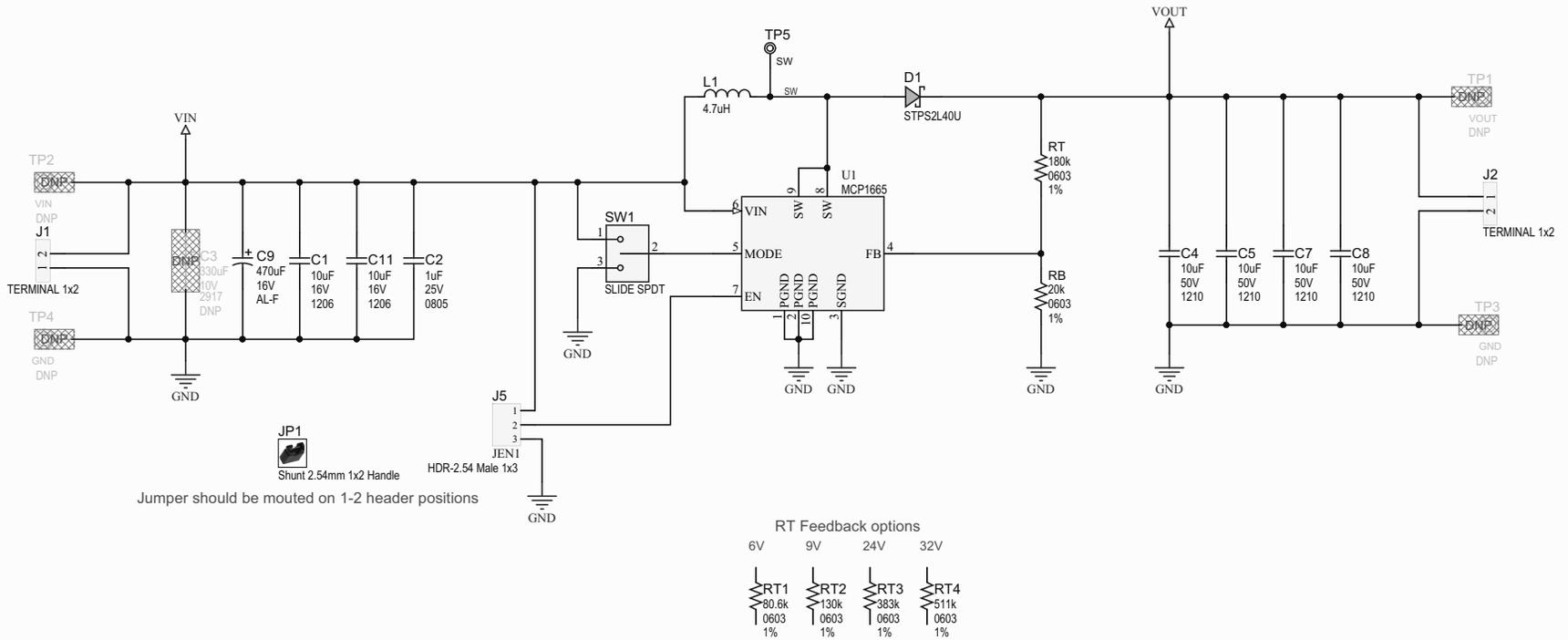
Appendix A. Schematic and Layouts

A.1 INTRODUCTION

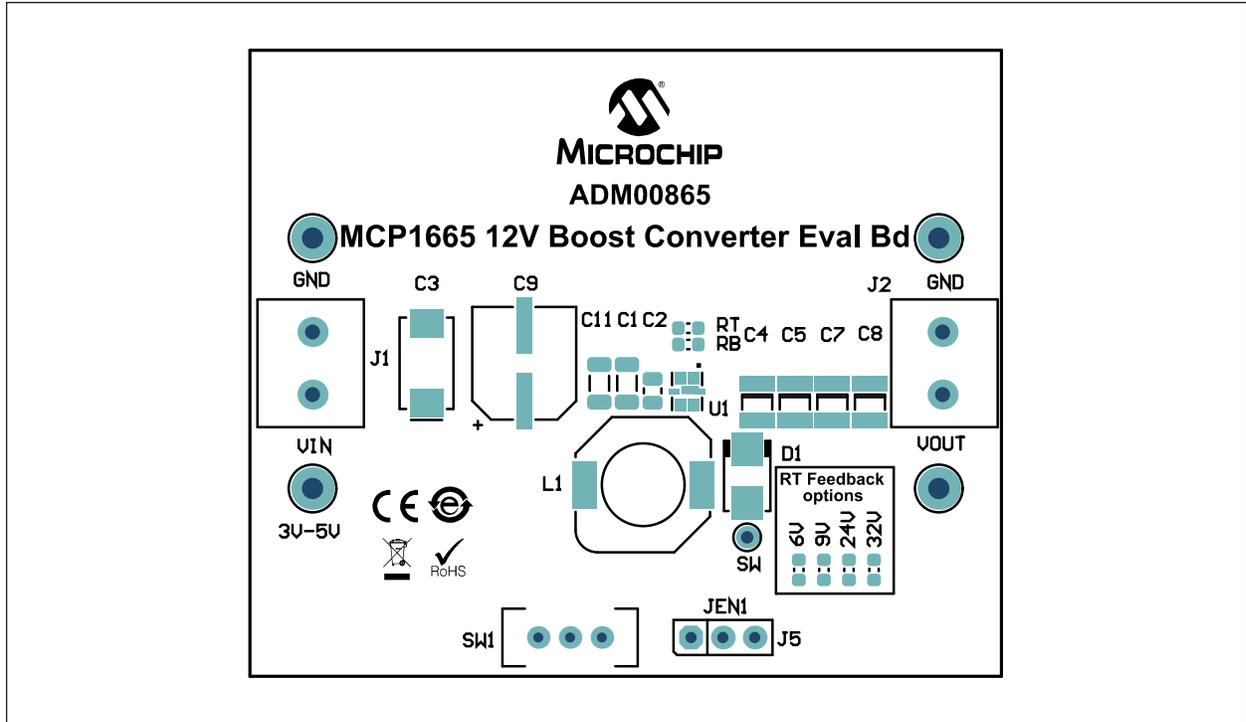
This appendix contains the following schematics and layouts for the MCP1665 12V Output Boost Regulator Evaluation Board:

- Board – Schematic
- Board – Top Silk and pads
- Board – Top Silk And Copper
- Board – Top Copper
- Board – Bottom Copper

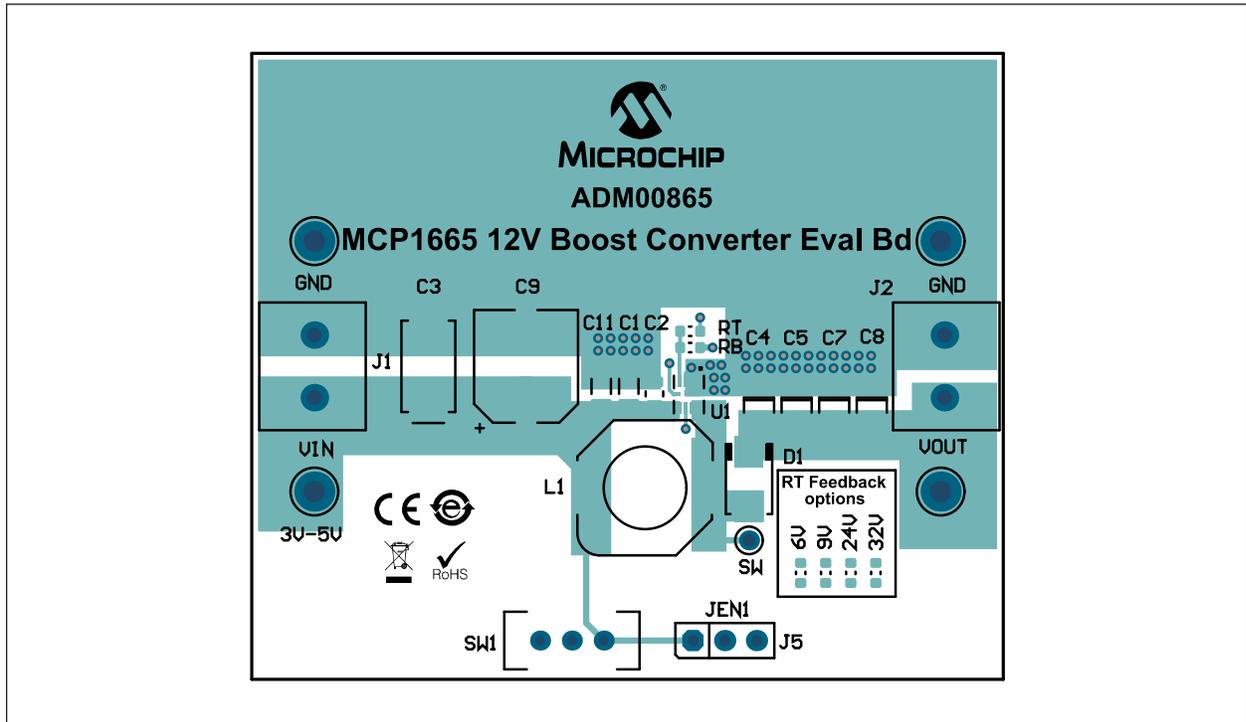
A.2 BOARD – SCHEMATIC



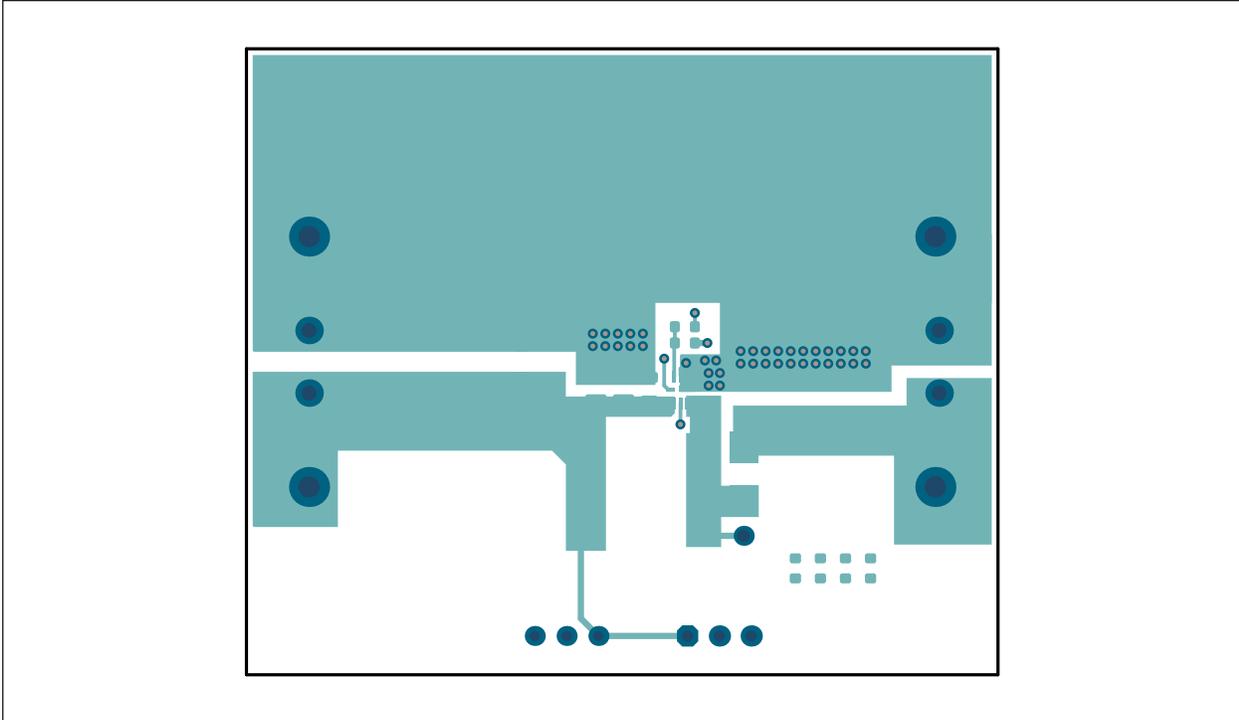
A.3 BOARD – TOP SILK AND PADS



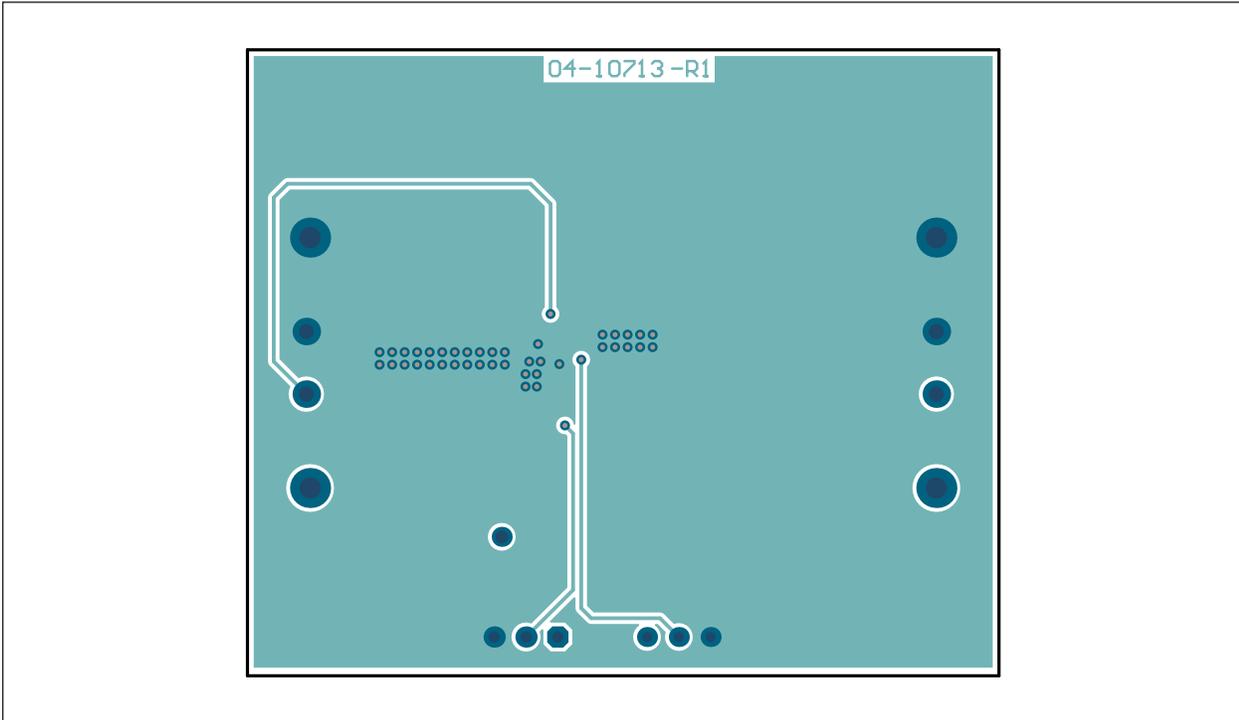
A.4 BOARD – TOP SILK AND COPPER



A.5 BOARD – TOP COPPER



A.6 BOARD – BOTTOM COPPER





MCP1665 12V OUTPUT BOOST REGULATOR EVALUATION BOARD USER'S GUIDE

Appendix B. Bill of Materials (BOM)

TABLE B-1: BILL OF MATERIALS (BOM)

Qty.	Reference	Description	Manufacturer	Part Number
2	C1, C11	CAP CER 10 μ F 16V 10% X7R SMD 1206	TDK Corporation	C3216X7R1C106K
1	C2	CAP CER 1 μ F 25V 10% X5R SMD 0805	Murata Electronics North America, Inc.	GRM216R61E105KA12D
0	C3	CAP TANT 330 μ F 10V 20% 2917	Panasonic [®] - ECG	10TPE330M
4	C4, C5, C7, C8	CAP CER 10 μ F 50V 20% X7R SMD 1210	TDK Corporation	C3225X7R1H106M250AC
1	C9	CAP ALU 470 μ F 16V 20% SMD F	Panasonic - ECG	EEE-1CA471UP
1	D1	DIO SCKY STPS2L40U 340 mV 2A 40V DO-214AA_SMB	STMicroelectronics	STPS2L40U
2	J1, J2	CON TERMINAL 5 mm 1x2 Female 12-26AWG 18A TH R/A	PHOENIX CONTACT	1935161
1	J5	CON HDR-2.54 Male 1x3 Tin 6.75 MH TH VERT	Molex [®]	90120-0123
1	L1	INDUCTOR 4.7 μ H 6.9A 30% SMD L10W10.2H4.8	Coilcraft	MSS1048-472NL
1	LABEL1	Label, AIPD Board Assembly		
4	PAD1, PAD2, PAD3, PAD4	MECH HW RUBBER PAD CYLINDRICAL D7.9 H5.3 BLACK	3M	SJ61A11
1	PCB1	Printed Circuit Board		04-10713-R1
1	R1	RES TKF 180k 1% 1/10W SMD 0603	Yageo Corporation	RC0603FR-07180KL
1	R2	RES TKF 20k 1% 1/10W SMD 0603	Panasonic [®] - ECG	ERJ-3EKF2002V
1	RT1	RES TKF 80.6k 1% 1/10W SMD 0603	Panasonic [®] - ECG	ERJ3EKF8062V
1	RT2	RES TKF 130k 1% 1/10W SMD 0603	Panasonic [®] - ECG	ERJ3EKF1303V
1	RT3	RES TKF 383k 1% 1/10W SMD 0603	Panasonic [®] - ECG	ERJ3EKF3833V
1	RT4	RES TKF 511k 1% 1/10W SMD 0603	Panasonic [®] - ECG	ERJ3EKF5113V
1	SW1	SWITCH SLIDE SPDT 30V 0.1A SS12SDP2 TH	NKK Switches	SS12SDP2
0	TP1, TP2, TP3, TP4	CON TP PIN Tin TH	Harwin Plc.	H2121-01
1	U1	MCHP ANALOG BOOST CONVERTER 12V MCP1665T-E/MRA VQFN-10	Microchip Technology Inc.	MCP1665T-E/MRA

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.



MICROCHIP

Worldwide Sales and Service

AMERICAS

Corporate Office
2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7200
Fax: 480-792-7277
Technical Support:
<http://www.microchip.com/support>
Web Address:
www.microchip.com

Atlanta
Duluth, GA
Tel: 678-957-9614
Fax: 678-957-1455

Austin, TX
Tel: 512-257-3370

Boston
Westborough, MA
Tel: 774-760-0087
Fax: 774-760-0088

Chicago
Itasca, IL
Tel: 630-285-0071
Fax: 630-285-0075

Dallas
Addison, TX
Tel: 972-818-7423
Fax: 972-818-2924

Detroit
Novi, MI
Tel: 248-848-4000

Houston, TX
Tel: 281-894-5983

Indianapolis
Noblesville, IN
Tel: 317-773-8323
Fax: 317-773-5453
Tel: 317-536-2380

Los Angeles
Mission Viejo, CA
Tel: 949-462-9523
Fax: 949-462-9608
Tel: 951-273-7800

Raleigh, NC
Tel: 919-844-7510

New York, NY
Tel: 631-435-6000

San Jose, CA
Tel: 408-735-9110
Tel: 408-436-4270

Canada - Toronto
Tel: 905-695-1980
Fax: 905-695-2078

ASIA/PACIFIC

Asia Pacific Office
Suites 3707-14, 37th Floor
Tower 6, The Gateway
Harbour City, Kowloon

Hong Kong
Tel: 852-2943-5100
Fax: 852-2401-3431

Australia - Sydney
Tel: 61-2-9868-6733
Fax: 61-2-9868-6755

China - Beijing
Tel: 86-10-8569-7000
Fax: 86-10-8528-2104

China - Chengdu
Tel: 86-28-8665-5511
Fax: 86-28-8665-7889

China - Chongqing
Tel: 86-23-8980-9588
Fax: 86-23-8980-9500

China - Dongguan
Tel: 86-769-8702-9880

China - Guangzhou
Tel: 86-20-8755-8029

China - Hangzhou
Tel: 86-571-8792-8115
Fax: 86-571-8792-8116

China - Hong Kong SAR
Tel: 852-2943-5100
Fax: 852-2401-3431

China - Nanjing
Tel: 86-25-8473-2460
Fax: 86-25-8473-2470

China - Qingdao
Tel: 86-532-8502-7355
Fax: 86-532-8502-7205

China - Shanghai
Tel: 86-21-3326-8000
Fax: 86-21-3326-8021

China - Shenyang
Tel: 86-24-2334-2829
Fax: 86-24-2334-2393

China - Shenzhen
Tel: 86-755-8864-2200
Fax: 86-755-8203-1760

China - Wuhan
Tel: 86-27-5980-5300
Fax: 86-27-5980-5118

China - Xian
Tel: 86-29-8833-7252
Fax: 86-29-8833-7256

ASIA/PACIFIC

China - Xiamen
Tel: 86-592-2388138
Fax: 86-592-2388130

China - Zhuhai
Tel: 86-756-3210040
Fax: 86-756-3210049

India - Bangalore
Tel: 91-80-3090-4444
Fax: 91-80-3090-4123

India - New Delhi
Tel: 91-11-4160-8631
Fax: 91-11-4160-8632

India - Pune
Tel: 91-20-3019-1500

Japan - Osaka
Tel: 81-6-6152-7160
Fax: 81-6-6152-9310

Japan - Tokyo
Tel: 81-3-6880-3770
Fax: 81-3-6880-3771

Korea - Daegu
Tel: 82-53-744-4301
Fax: 82-53-744-4302

Korea - Seoul
Tel: 82-2-554-7200
Fax: 82-2-558-5932 or
82-2-558-5934

Malaysia - Kuala Lumpur
Tel: 60-3-6201-9857
Fax: 60-3-6201-9859

Malaysia - Penang
Tel: 60-4-227-8870
Fax: 60-4-227-4068

Philippines - Manila
Tel: 63-2-634-9065
Fax: 63-2-634-9069

Singapore
Tel: 65-6334-8870
Fax: 65-6334-8850

Taiwan - Hsin Chu
Tel: 886-3-5778-366
Fax: 886-3-5770-955

Taiwan - Kaohsiung
Tel: 886-7-213-7830

Taiwan - Taipei
Tel: 886-2-2508-8600
Fax: 886-2-2508-0102

Thailand - Bangkok
Tel: 66-2-694-1351
Fax: 66-2-694-1350

EUROPE

Austria - Wels
Tel: 43-7242-2244-39
Fax: 43-7242-2244-393

Denmark - Copenhagen
Tel: 45-4450-2828
Fax: 45-4485-2829

Finland - Espoo
Tel: 358-9-4520-820

France - Paris
Tel: 33-1-69-53-63-20
Fax: 33-1-69-30-90-79

Germany - Garching
Tel: 49-8931-9700

Germany - Haan
Tel: 49-2129-3766400

Germany - Heilbronn
Tel: 49-7131-67-3636

Germany - Karlsruhe
Tel: 49-721-625370

Germany - Munich
Tel: 49-89-627-144-0
Fax: 49-89-627-144-44

Germany - Rosenheim
Tel: 49-8031-354-560

Israel - Ra'anana
Tel: 972-9-744-7705

Italy - Milan
Tel: 39-0331-742611
Fax: 39-0331-466781

Italy - Padova
Tel: 39-049-7625286

Netherlands - Drunen
Tel: 31-416-690399
Fax: 31-416-690340

Norway - Trondheim
Tel: 47-7289-7561

Poland - Warsaw
Tel: 48-22-3325737

Romania - Bucharest
Tel: 40-21-407-87-50

Spain - Madrid
Tel: 34-91-708-08-90
Fax: 34-91-708-08-91

Sweden - Gothenberg
Tel: 46-31-704-60-40

Sweden - Stockholm
Tel: 46-8-5090-4654

UK - Wokingham
Tel: 44-118-921-5800
Fax: 44-118-921-5820

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

[Microchip:](#)

[ADM00865](#)