



MIC2253
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 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 “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 MIC2253 Evaluation Board. Items discussed in this chapter include:

- [Document Layout](#)
- [Conventions Used in this Guide](#)
- [Recommended Reading](#)
- [The Microchip Website](#)
- [Customer Support](#)
- [Document Revision History](#)

DOCUMENT LAYOUT

This document describes how to use the MIC2253 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”** – provides important information about the MIC2253 Evaluation Board.
- **Chapter 2. “Installation and Operation”** – includes instructions on powering up the MIC2253 Evaluation Board.
- **Appendix A. “Schematic and Layouts”** – shows the schematic and layout diagrams for the MIC2253 Evaluation Board.
- **Appendix B. “Bill of Materials (BOM)”** – lists the parts used to build the MIC2253 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 the MIC2253 Evaluation Board. Other useful document is listed below. The following Microchip document is available and recommended as a supplemental reference resource:

MIC2253 Data Sheet – “3.5A 1 MHz High Efficiency Boost Regulator with OVP and Softstart”

THE MICROCHIP WEBSITE

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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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- Field Application Engineer (FAE)
- Technical Support

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Technical support is available through the website at:
<http://www.microchip.com/support>.

DOCUMENT REVISION HISTORY

Revision A (August 2018)

- Initial release of this document.

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NOTES:

Chapter 1. Product Overview

1.1 INTRODUCTION

This chapter provides an overview of the MIC2253 Evaluation Board and covers the following topics:

- [MIC2253 Device Overview](#)
- [MIC2253 Evaluation Board Overview](#)
- [MIC2253 Evaluation Board Kit Contents](#)

1.2 MIC2253 DEVICE OVERVIEW

The MIC2253 device is a high-power density, 1 MHz Pulse-Width Modulation (PWM) DC/DC boost regulator. The 3.5A switch current minimum limit, combined with a 1 MHz switching frequency, enables the MIC2253 device to use smaller inductors and deliver high power in a very small solution size.

The 2.5V to 10V input voltage range of the MIC2253 device enables direct operation from 1-cell and 2-cell Li-Ion or 3-cell to 4-cell NiCd, NiMH or Alkaline batteries. Maximum battery life is assured with a low 0.1 mA shutdown current.

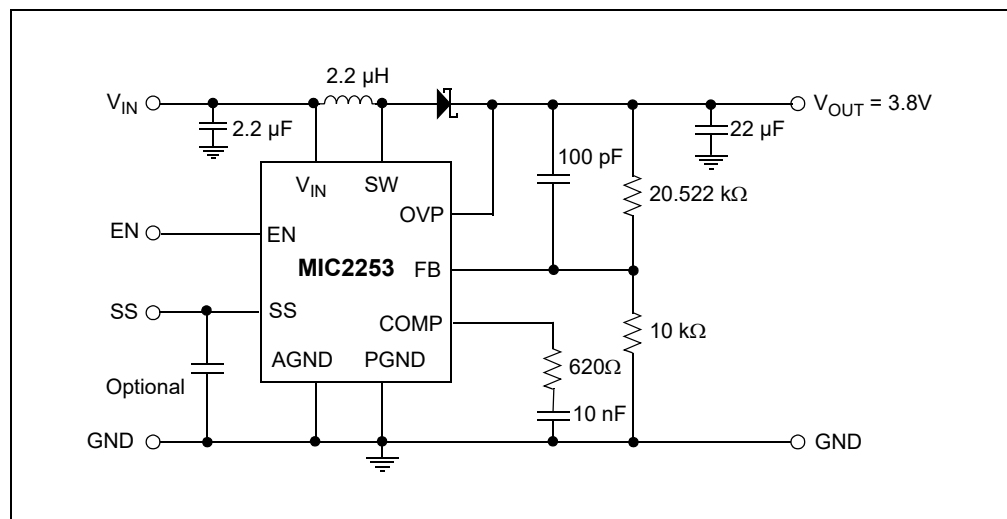


FIGURE 1-1: MIC2253 Typical Application.

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1.3 MIC2253 EVALUATION BOARD OVERVIEW

The MIC2253 Evaluation Board is developed to evaluate the capabilities of the MIC2253 device. The board is populated with the MIC2253-06YML-TR device and the output voltage is set to 5V.

The MIC2253 Evaluation Board features an independent Enable connector. To disable the regulator, the enable jumper (JP2) must be removed from header. The MIC2253 Evaluation Board features an 100 k Ω pull-down resistor. It is not recommended to leave the Enable (EN) pin floating; therefore, the default value is OFF when the board is powered up.

The MIC2253 devices have an external soft start pin control, which is dependent on the capacitor (C2) value. The default soft start capacitor value of the MIC2253 Evaluation Board is set to 100 nF. An oscilloscope can be used to detect and measure the Soft Start capacitor voltage or ramp by connecting the probe between the J3 test point and ground.

1.4 MIC2253 EVALUATION BOARD KIT CONTENTS

The MIC2253 Evaluation Board kit contains the following items:

- MIC2253 Evaluation Board (ADM00891)
- Important Information Sheet

Chapter 2. Installation and Operation

2.1 INTRODUCTION

The MIC2253 device is a nonsynchronous, fixed frequency step-up DC/DC converter which has been developed for applications that require high output voltage.

The MIC2253 device can regulate the output up to 30V and can deliver up to 250 mA load. At light loads, the MIC2253 device uses the low-power switching mode (see [Figure 2-1](#)) instead of the PWM mode (see [Figure 2-2](#)) to reduce the input power consumption.

The MIC2253 Evaluation Board can be powered from 2.5V to 4.5V to obtain 5V output.

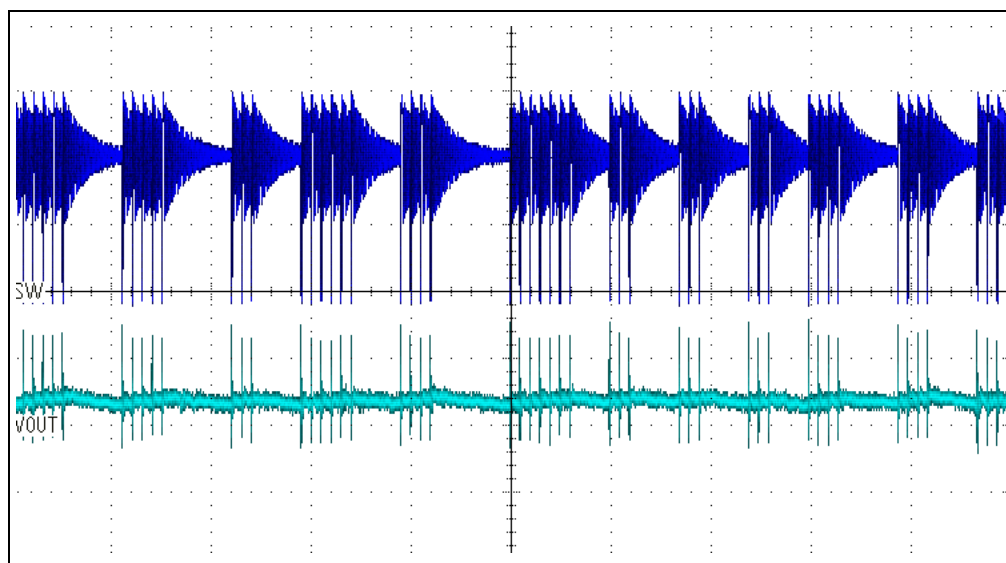


FIGURE 2-1: *Waveform in Low-Power Switching Mode.*

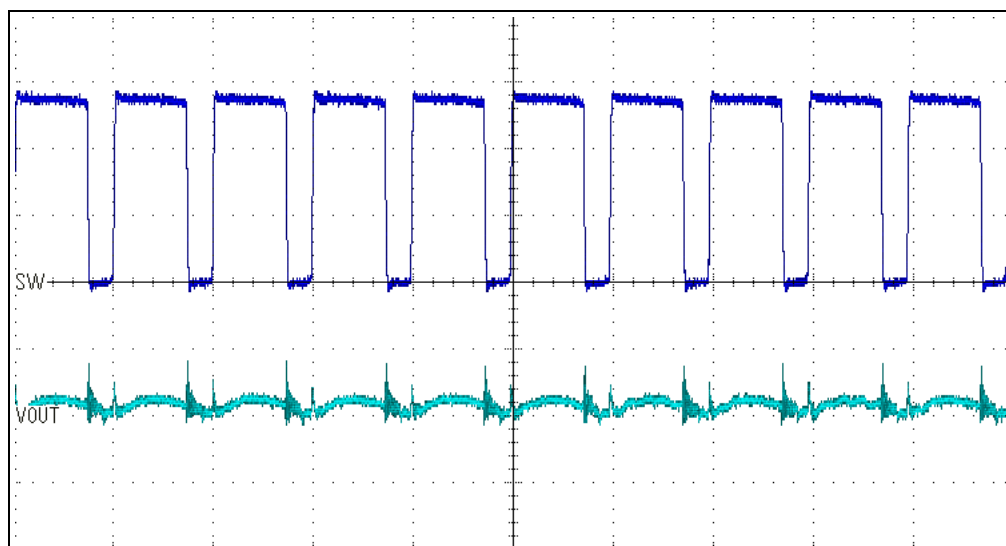


FIGURE 2-2: *Waveform in PWM Switching Mode.*

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2.2 MIC2253 DEVICE FEATURES

The MIC2253 device includes the following key features:

- 2.5V to 10V Input Voltage Range
- Fixed 1 MHz Operation
- 1.245V $\pm$ 3% Feedback Voltage
- Output Voltage up to 30V (Maximum)
- Externally Programmable Soft Start
- Fixed 1 MHz Operation
- <1% Line Regulation
- 0.1 mA Shutdown Current
- Overtemperature Protection
- Undervoltage Lockout (UVLO)
- -40°C to +125°C Junction Temperature Range

2.3 MIC2253 EVALUATION BOARD DESCRIPTION

2.3.1 Soft Start Time Capacitor (C2)

The MIC2253 device has a programmable soft start time, which is determined by both the C_{SS} capacitor and the compensation capacitor values. As the C_{COMP} has a fixed value for stable operation (typically 10 nF), the C_{SS} capacitor must be used instead, if any increases in the soft start time are desired. The approximate total start-up time is calculated in [Equation 2-1](#).

EQUATION 2-1:

$$T_{SS} = 1ms + 85k \times C_{SS}$$

2.3.2 Feedback Resistors

The Feedback pin (FB) provides the control path to the control output. The FB pin is used to compare the output to an internal reference. Output voltages are adjusted by selecting the appropriate feedback network values. The desired output voltage can be calculated as shown in [Equation 2-2](#).

EQUATION 2-2:

$$V_{OUT} = V_{REF} \left(\frac{R1}{R2} + 1 \right)$$

Where:

$$V_{REF} = 1.245V$$

2.3.3 Overvoltage Protection (OVP)

The MIC2253 device provides a fixed 5.6V overvoltage protection (OVP). The overvoltage functionality clamps the sensed voltage on the OVP pin to a safe level (5.6V) when a fault condition causes the output voltage to increase beyond control or if the OVP pin exceeds 5.6V. To ensure the highest level of protection, the MIC2253 OVP pin shuts the switch off and regulates to the OVP set point when an overvoltage condition is detected. The OVP set point must be set below the rating of the output capacitor to ensure protection. Two external resistors can be used to change the OVP from the range 5.7V to 30V. Careful consideration must be given as not to exceed the 30V rating of the switch. The OVP feature may be disabled by grounding the OVP pin.

The OVP pin is internally connected to a reference voltage through a voltage divider circuit. For a 5.6V OVP setting, directly connect the OVP pin to the output voltage with a 0Ω resistor at R3. To increase the OVP voltage above 5.6V, replace the R3 and R6 resistor values on the MIC2253 Evaluation Board with the calculated values as shown in [Equation 2-3](#).

EQUATION 2-3:

$$V_{OVP} = 1.245 \times \frac{67kx(R3 + R6)}{(15k \times R6)}$$

TABLE 2-1: OVP EXAMPLE RESISTOR TABLE

V _{OVP} (V)	R3 (kΩ)	R6 (kΩ)
8	13.0	30.1
10	23.7	30.1
12	34.8	30.1
15	51.1	30.1
18	66.5	30.1
20	78.7	30.1
25	105.0	30.1
30	130.0	30.1

2.3.4 Output Noise and Ripple Measurements

To accurately measure the voltage ripple on either the input or the output of any regulator with a switching regulator nearby, a proper ground spring is required. Standard oscilloscope probes come with a grounding clip or with a long wire with an alligator clip. Careful consideration must be given to the high-frequency measurements as this ground clip can pick up high-frequency noise and erroneously inject it into the measured output ripple.

2.3.5 Board Layout Considerations

It is recommended that the switching trace (from the switching node) is kept as short as possible to decrease the noise generated by the MIC2253 device and improve performance.

It is also recommended that a copper plane is immediately placed under the MIC2253 device and it must be connected to the GND copper plane using a path under the device. As the MIC2253 device has an exposed pad, this copper plane helps conduct the heat away from the device and improves thermal performance. Moreover, doing this also helps shield the device and improve output ripple performance.

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2.4 POWERING UP THE MIC2253 EVALUATION BOARD

To power-up the MIC2253 Evaluation Board, complete the following steps:

1. Connect an external supply between the V_{IN} and the GND terminals. The polarity must be taken into consideration.
2. Disable the output of the power supply, then set its value to the desired input test voltage ($2.5V \leq V_{IN} \leq 4.5V$). An ammeter may be placed between the input supply and the V_{IN} terminals. Ensure to monitor the supply voltage at the V_{IN} terminal as the ammeter or the power lead resistance, or both can reduce the voltage supplied to the device.
3. Connect a load to the V_{OUT} and the GND terminals. The load can be either passive (resistive) or active (electronic load). An ammeter may be placed between the load and the output terminals.
4. The MIC2253 Evaluation Board has a pull-down resistor from the Enable (EN) pin to GND. By default, the MIC2253 device is disabled. By placing a jumper at JP2, the EN pin is tied to V_{IN} and the board is enabled when the input supply of $>2.5V$ is applied. To enable the device, it is necessary to apply a voltage higher than 1.5V on the EN pin. To put in shutdown, apply less than 0.4V on the EN pin.

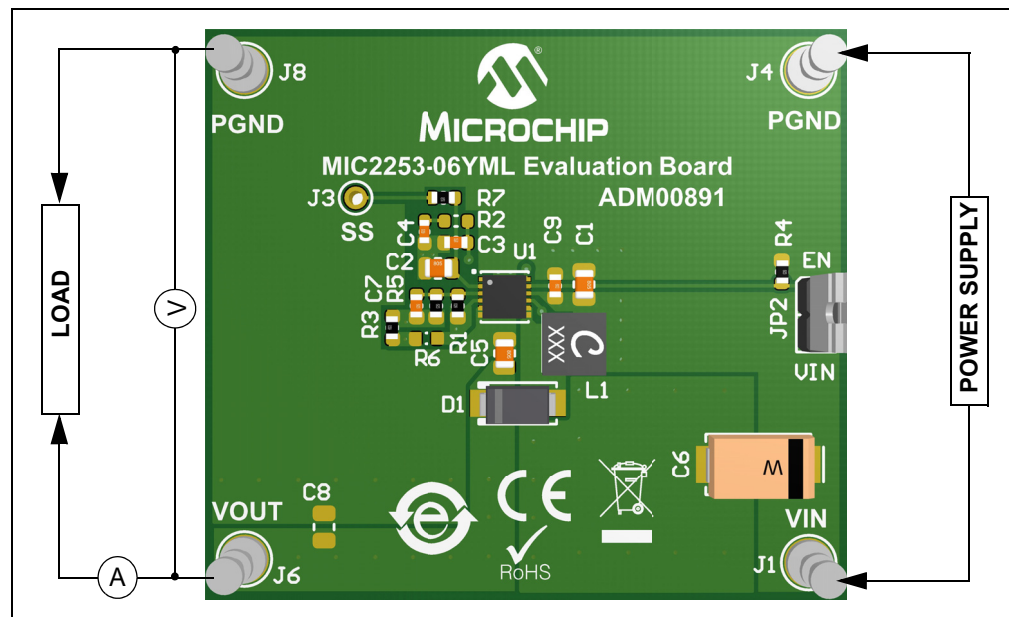


FIGURE 2-3: MIC2253 Evaluation Board - Test Points Description.

Appendix A. Schematic and Layouts

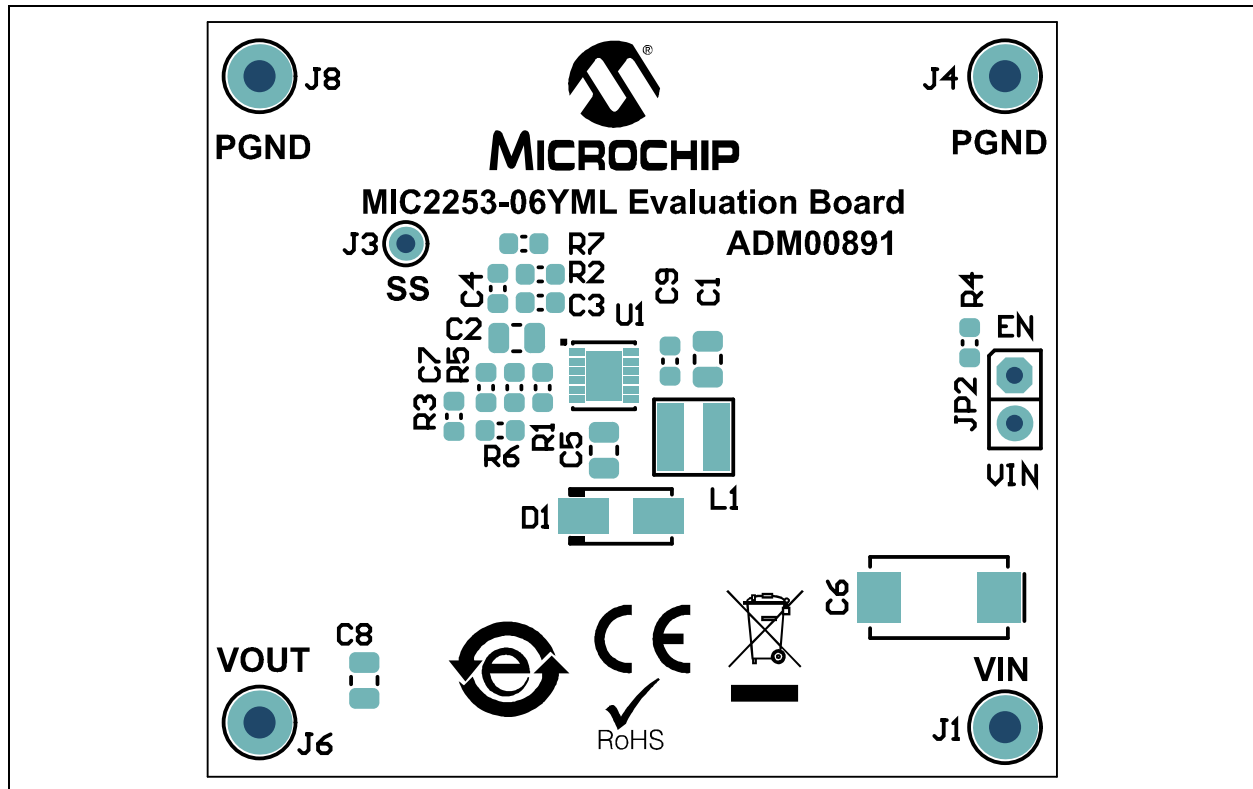
A.1 INTRODUCTION

This appendix contains the following schematics and layouts for the MIC2253 Evaluation Board.

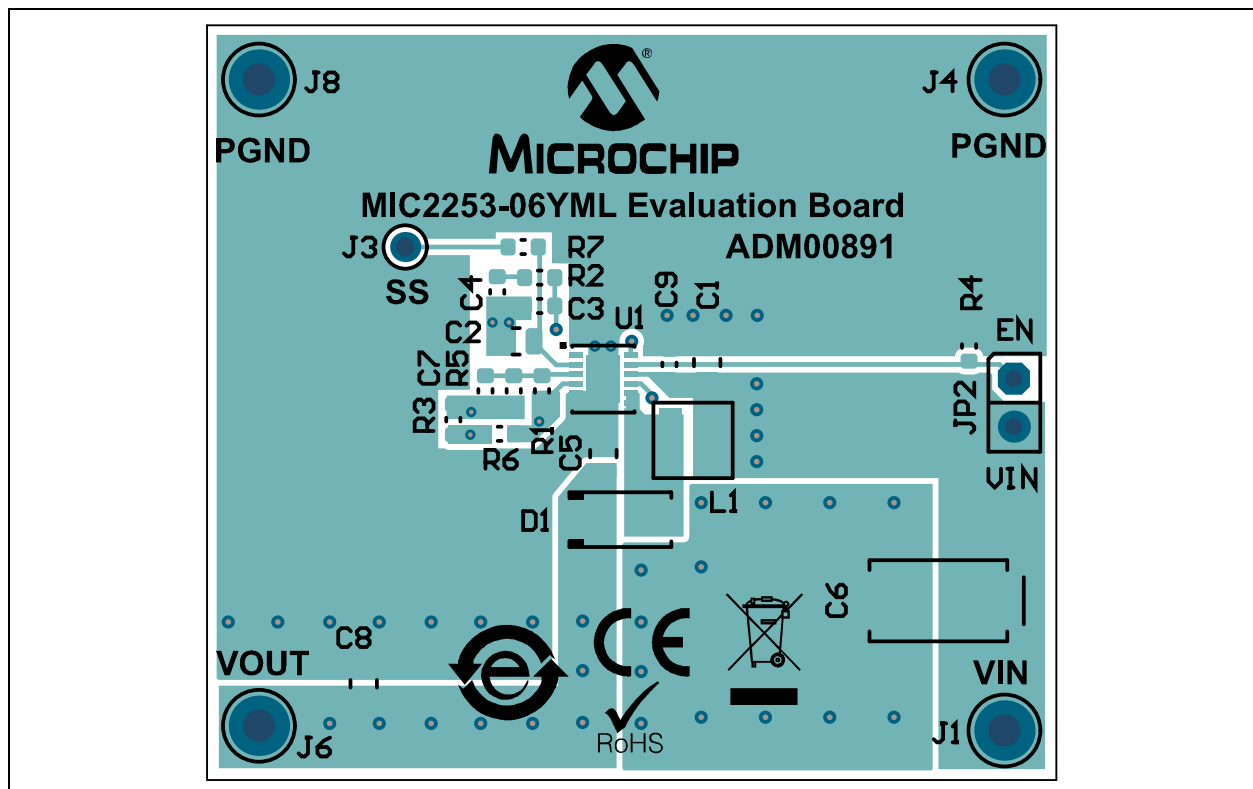
- [Board – Schematic](#)
- [Board – Top Silk](#)
- [Board – Top Copper and Silk](#)
- [Board – Top Copper](#)
- [Board – Bottom Copper](#)
- [Board – Bottom Copper and Silk](#)
- [Board – Bottom Silk](#)

The schematic diagram illustrates a buck converter circuit. The input voltage (VIN) is connected to the VIN pin (pin 10) of the MIC2253 IC. A 100µF 16V TANT-E capacitor (C6) and a 2.2µF 25V capacitor (C1) are connected in parallel to the input. The enable pin (EN, pin 11) is connected to a 100k resistor (R4) and a 0.01µF capacitor (C9), both tied to ground. The NC pin (pin 1) is also connected to ground. The SS pin (pin 2) is connected to a 49.9k resistor (R7) and a 0.1µF capacitor (C2), both tied to ground. The AGND pin (pin 4) is connected to ground. The PGND pin (pin 5) is connected to ground. The EP pin (pin 6) is connected to ground. The COMP pin (pin 12) is connected to a 620R resistor (R2) and a 100pF capacitor (C3), both tied to ground. The SW pin (pin 7) is connected to an inductor (L1, 2.2µH) and a MOSFET (D1, SSA24). The OVP pin (pin 9) is connected to a 30.1k resistor (R6) and a 0.01µF capacitor (C4), both tied to ground. The FB pin (pin 3) is connected to a 30.9k resistor (R5) and a 100pF capacitor (C7), both tied to ground. The VOUT pin (pin 8) is connected to a 30.9k resistor (R5) and a 100pF capacitor (C7), both tied to ground. The output voltage (VOUT) is connected to a 22µF 10V capacitor (C5) and a 0.1µF 50V capacitor (C8), both tied to ground. The output is also connected to a 10k resistor (R1) tied to ground. The circuit is powered by a 5V supply (J1) and a 5V supply (J3). The ground connections are labeled PGND and AGND. A net tie (NT1) is shown at the bottom, connecting PGND and AGND.

A.3 BOARD – TOP SILK

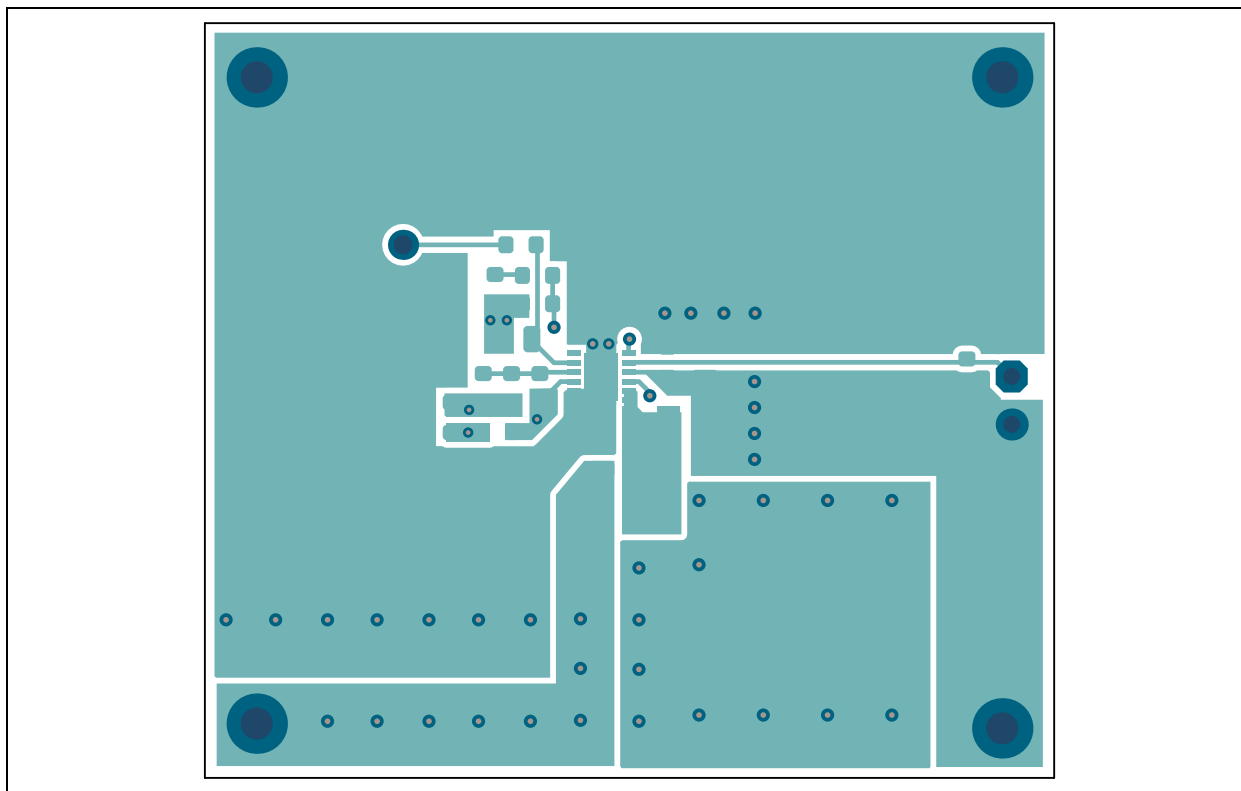


A.4 BOARD – TOP COPPER AND SILK

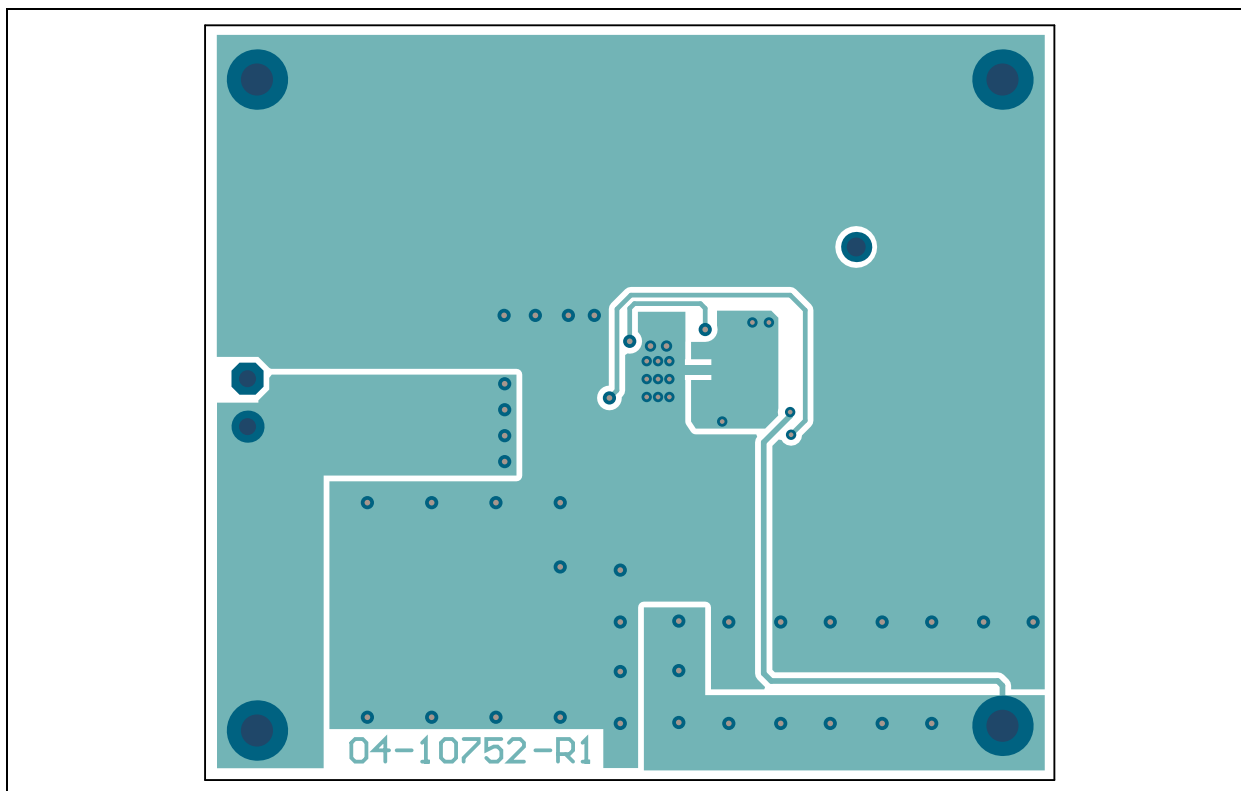


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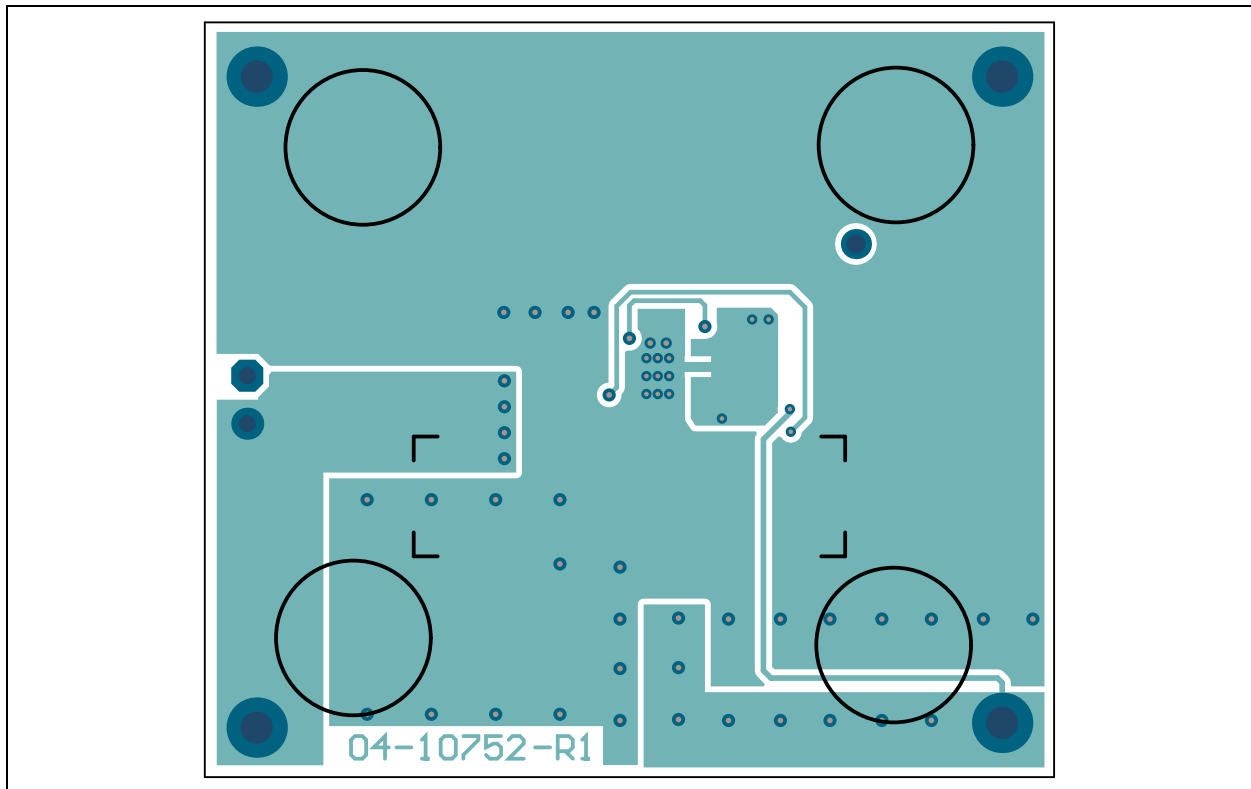
A.5 BOARD – TOP COPPER



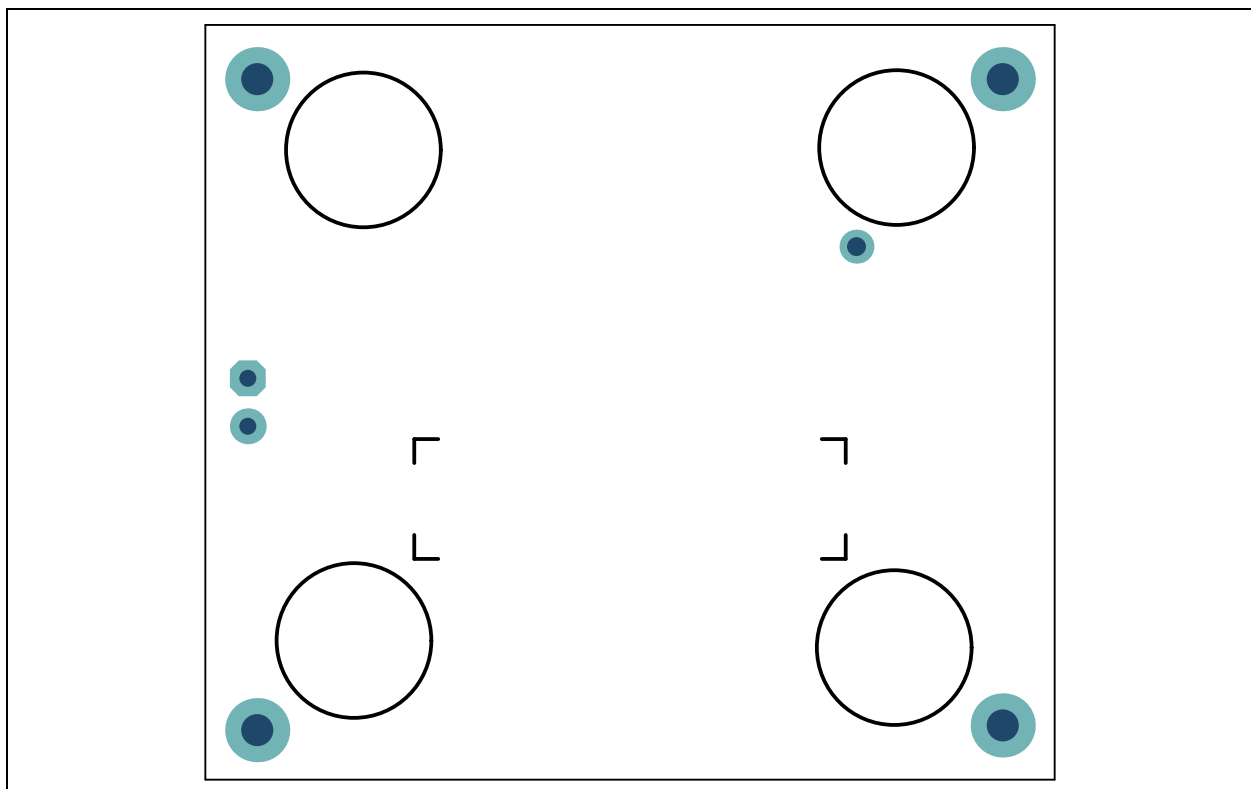
A.6 BOARD – BOTTOM COPPER



A.7 BOARD – BOTTOM COPPER AND SILK



A.8 BOARD – BOTTOM SILK



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NOTES:

Appendix B. Bill of Materials (BOM)

B.1 INTRODUCTION

This appendix provides the Bill of Materials (BOM) for the MIC2253 Evaluation Board.

TABLE B-1: MIC2253 EVALUATION BOARD BILL OF MATERIALS (BOM)

Qty.	Reference	Description	Manufacturer	Part Number
2	C4, C9	Capacitor, Ceramic, 0.01 μ F, 100V, 10%, X7R, SMD, 0603	TDK Corporation	C1608X7R2A103K080AA
1	C2	Capacitor, Ceramic, 0.1 μ F, 25V, 10%, X7R, SMD, 0805	Murata Electronics North America, Inc.	GRM21BR71E104KA01L
1	C7	Capacitor, Ceramic, 100 pF, 50V, 5%, NP0, SMD, 0603	Cal-Chip Electronics Inc.	GMC10CG101J50NTLF
1	C1	Capacitor, Ceramic, 2.2 μ F, 25V, 10%, X5R, SMD, 0805	Murata Electronics North America, Inc.	GRM21BR61E225KA12L
1	C5	Capacitor, Ceramic, 22 μ F, 10V, 20%, X5R, SMD, 0805	Taiyo Yuden Co., Ltd.	LMK212BJ226MG-T
1	C6	Capacitor, Tantalum, 100 μ F, 16V, 20%, 0.07 Ω , SMD, E	KEMET	T491X107M016AS
1	JP2	Conductor, HDR-2.54 Male, 1x2, Tin, 6.10 MH, TH, VERT	Molex®	0022284020
4	J1, J4, J6, J8	Conductor, TP, Pin, Tin, TH	Harwin Plc.	H2121-01
1	D1	Diode, Schottky, 40V, 2A, DO214AC	Vishay Intertechnology, Inc.	SSA24-E3/61T
1	L1	Inductor, 2.2 μ H, 5.5A, 20%, SMD, L4W4H2.1	Coilcraft	XAL4020-222MEC
1	U1	MCHP Analog Switcher, Boost 2.5V to 10V, 3.5A, 1 MHz, MIC2253, MLF-12	Microchip Technology Inc.	MIC2253-06YML-TR
1	PCB1	MIC2253 Evaluation Board – Printed Circuit Board	Microchip Technology Inc.	04-10752-R1
1	R3	Resistor, TKF, 0R, 1/10W, SMD, 0603	Panasonic® - ECG	ERJ-3GSY0R00V
1	R4	Resistor, TKF, 100 k Ω , 1%, 1/10W, SMD, 0603	Panasonic - ECG	ERJ-3EKF1003V
1	R1	Resistor, TKF, 10 k Ω , 1%, 1/10W, SMD, 0603	Panasonic - ECG	ERJ-3EKF1002V
1	R5	Resistor, TKF, 30.9 k Ω , 1%, 1/10W, SMD, 0603	Panasonic - ECG	ERJ-3EKF3092V
1	R7	Resistor, TKF, 49.9R, 1%, 1/10W, SMD 0603	Panasonic - ECG	ERJ-3EKF49R9V
1	R2	Resistor, TKF, 620R, 1%, 1/10W, SMD, 0603	Panasonic - ECG	ERJ-3EKF6200V

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TABLE B-2: BILL OF MATERIALS – MECHANICAL PARTS

Qty.	Reference	Description	Manufacturer	Part Number
1	JP1	Mechanical HW Jumper, 2.54 mm, 1x2, Phosphor Bronze, with Handle	Jameco® Electronics	2012JH-R
1	LABEL1	Label, Assy W/Rev Level (Small Modules) Per MTS-0002	—	—
4	PAD1, PAD2, PAD3, PAD4	Mechanical HW Rubber Pad, Cylindrical, D7.9, H5.3, Black	3M	SJ61A11

TABLE B-3: BILL OF MATERIALS – DO NOT POPULATE PARTS

Qty.	Reference	Description	Manufacturer	Part Number
1	C3	Capacitor, Ceramic, 100 pF, 50V, 5%, NP0, SMD, 0603	Cal-Chip Electronics Inc.	GMC10CG101J50NTLF
0	C8	Capacitor, Ceramic, 0.1 µF, 50V, 10%, X7R, SMD, 0805	Cal-Chip Electronics Inc.	GMC21X7R104K50NTLF
0	R6	Resistor, TF, 30.1 kΩ, 0.5%, 1/10W, SMD, 0603	Yageo Corporation	RT0603DRD0730K1L

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