



MIC4605 Evaluation Board User's Guide

**85V Half-Bridge MOSFET Drivers
with Adaptive Dead Time and
Shoot-Through Protection**

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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 “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 MIC4605 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 MIC4605 Evaluation Board as a demonstration board to evaluate the MIC4605 device. The manual layout is as follows:

- **Chapter 1. “Product Overview”** – Provides a general description of the MIC4605 Evaluation Board.
- **Chapter 2. “Installation and Operation”** – Includes a detailed description of the evaluation board and instructions on how to use it.
- **Appendix A. “Schematic and Layouts”** – Schematic and layout diagrams of the MIC4605 Evaluation Board.
- **Appendix B. “Bill of Materials (BOM)”** – Lists the parts used to build the MIC4605 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 MIC4605 Evaluation Board. The following Microchip document is available and recommended as a supplemental reference resource:

- **MIC4605 Data Sheet - “85V Half-Bridge MOSFET Drivers with Adaptive Dead Time and Shoot-Through Protection”**

This data sheet provides detailed information regarding the MIC4605 device.

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- Field Application Engineer (FAE)
- Technical Support

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

DOCUMENT REVISION HISTORY

Revision A (October 2022)

- Converted Micrel document MIC4605 Evaluation Board to Microchip User's Guide DS50003430A.
- Minor text changes throughout.

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NOTES:

Chapter 1. Product Overview

1.1 GENERAL DESCRIPTION

The MIC4605 is an 85V half-bridge MOSFET driver that features adaptive-dead-time and shoot-through protection. The adaptive-dead-time circuitry actively monitors the half-bridge outputs to minimize the time between high-side and low-side MOSFET transitions, thus maximizing power efficiency.

Anti-shoot-through circuitry prevents erroneous inputs and noise from turning both MOSFETs on at the same time. Additionally, the MIC4605's adjustable gate drive sets the gate drive voltage to VDD for optimal MOSFET $R_{DS(ON)}$, which minimizes power loss due to the MOSFET's $R_{DS(ON)}$.

1.1.1 Requirements

At a minimum, the evaluation board requires a 5.5V to 16V power supply to power the VDD terminal (J1) of the MIC4605 and another supply (up to 85V) may be used to power the MOSFETs connected to the VIN terminal (J2). A pulse generator or the output of a PWM control IC may be connected to the HI and LI terminals (-1), or PWM single input (-2).

1.1.2 Precautions

There is no reverse input protection on this board. When connecting the input sources, make sure that the correct polarity is observed.

Under extreme load conditions and with a high supply voltage (>48V) connected to the VIN terminal (J2), input transients can be quite large if long test leads are used. In such cases a 100 μ F, 100V electrolytic capacitor is needed across the VIN terminals to prevent overvoltage damage to the IC. This can be removed if a clean supply voltage on VIN is always guaranteed.

Data sheets and support documentation are available on the Microchip website:
www.microchip.com

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Chapter 2. Installation and Operation

2.1 GETTING STARTED

1. **Connect VIN supply between the VIN and GND terminals and VDD supply between the VDD and GND terminals.**

Connect a supply between the VIN terminal (J2) and the GND terminal (J3), paying careful attention to polarity and supply range ($V_{IN} \leq 85V$). Do not apply power until Step 5.

Connect a supply between the VDD terminal (J1) and the GND terminal (J3), paying careful attention to polarity and supply range ($5.5V \leq V_{DD} < 16V$). Do not apply power until Step 5.

2. **Connect the TTL-compatible HI and LI inputs (-1), or the PWM single input (-2).**

Connect the HI input (JP2) and LI input (JP3) to a pulse generator or the output of a PWM control IC. Ensure that they are non-overlapping signals and are TTL compatible logic-levels. The PWM single input replaces the HI input (JP2) for the -2 option.

3. **Monitor inputs and outputs.**

Monitor the inputs HI (JP2) and LI (JP3) or PWM (JP2) and outputs HO (JP1) and LO (JP4) with an oscilloscope.

4. **Connect motor across HS and GND or connect HS to GND.**

The simplest way to observe the MIC4605 operation is to connect a motor across the HS terminal (J8) and GND (J9). Alternatively the HS terminal (J8) can be shorted to GND (J9) with the VIN supply turned OFF. DC and AC parameters can be easily measured in this configuration.

5. **Turn-on supplies and HI/LI inputs.**

Turn-on the VDD power supply, followed by the VIN power supply. Turn on the HI and LI inputs (-1) or PWM single input (-2).

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2.2 ORDERING INFORMATION

Part Number	Description
MIC4605-1YMT EV	Evaluation board featuring the MIC4605-1YMT Half-Bridge MOSFET Driver with Dual-TTL Inputs.
MIC4605-2YMT EV	Evaluation board featuring the MIC4605-2YMT Half-Bridge MOSFET Driver with Single-PWM Input.
MIC4605-1YM EV	Evaluation board featuring the MIC4605-1YM Half-Bridge MOSFET Driver with Dual-TTL Inputs.
MIC4605-2YM EV	Evaluation board featuring the MIC4605-2YM Half-Bridge MOSFET Driver with Single-PWM Input.

2.3 EVALUATION BOARD PERFORMANCE

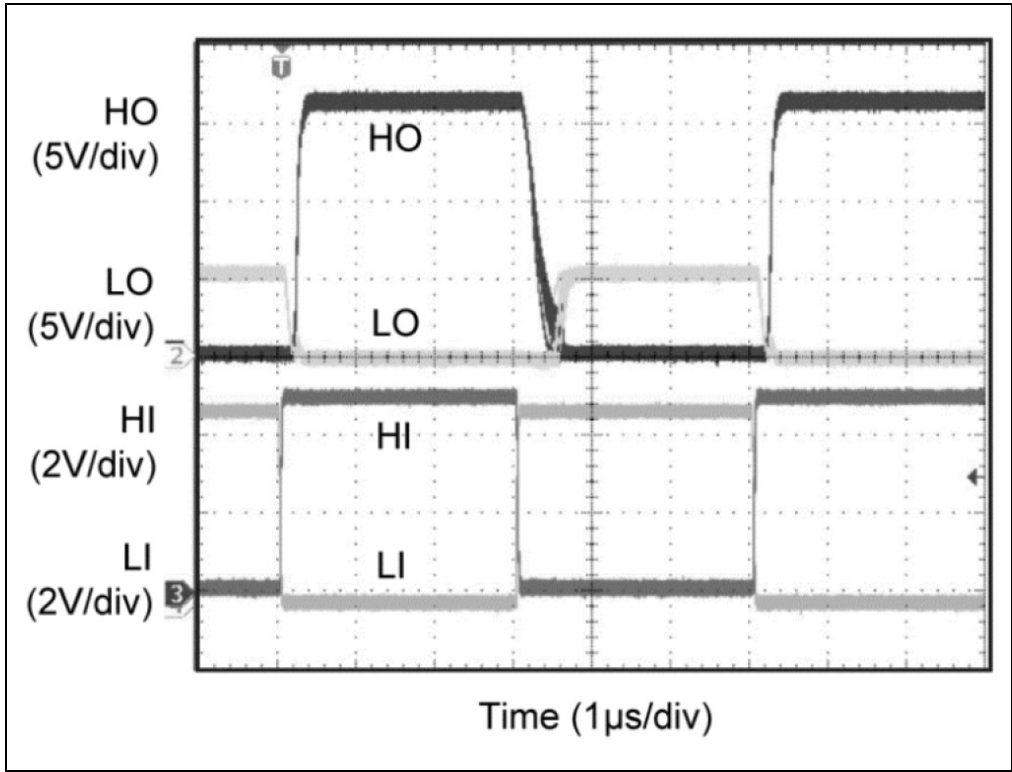


FIGURE 2-1: MIC4605-1 166 kHz Operation Fan Load Showing LI, HI, LO, and HO Signals.

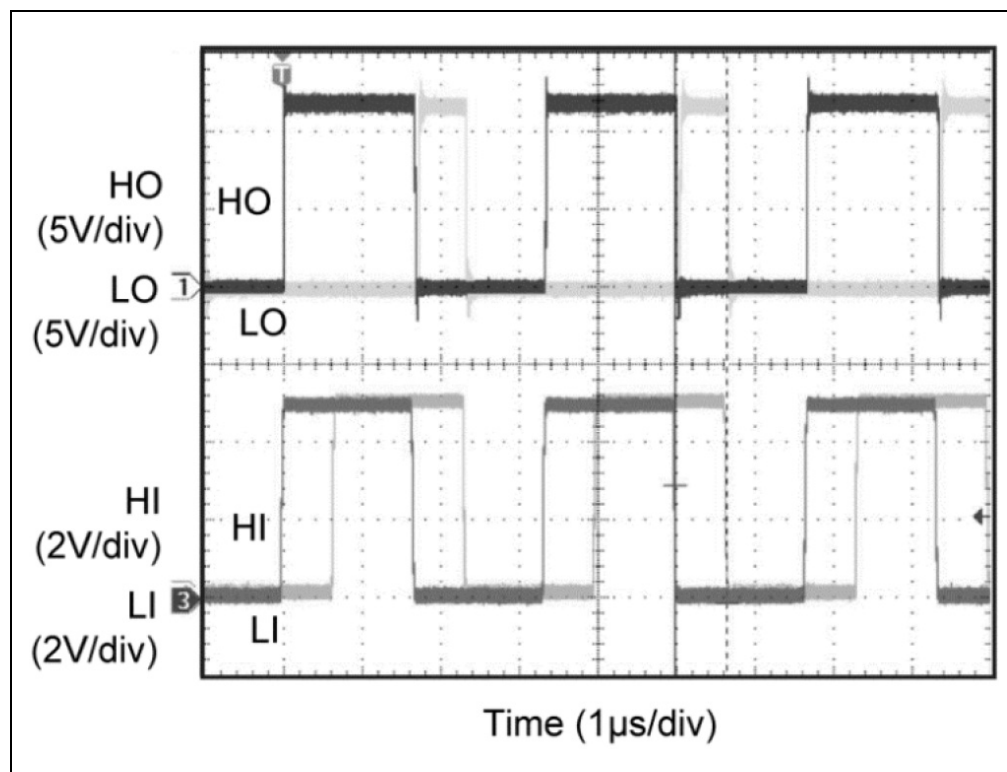


FIGURE 2-2: MIC4605-1 166 kHz Overlapping Inputs Fan Load Showing LI, HI, LO, and HO Signals.

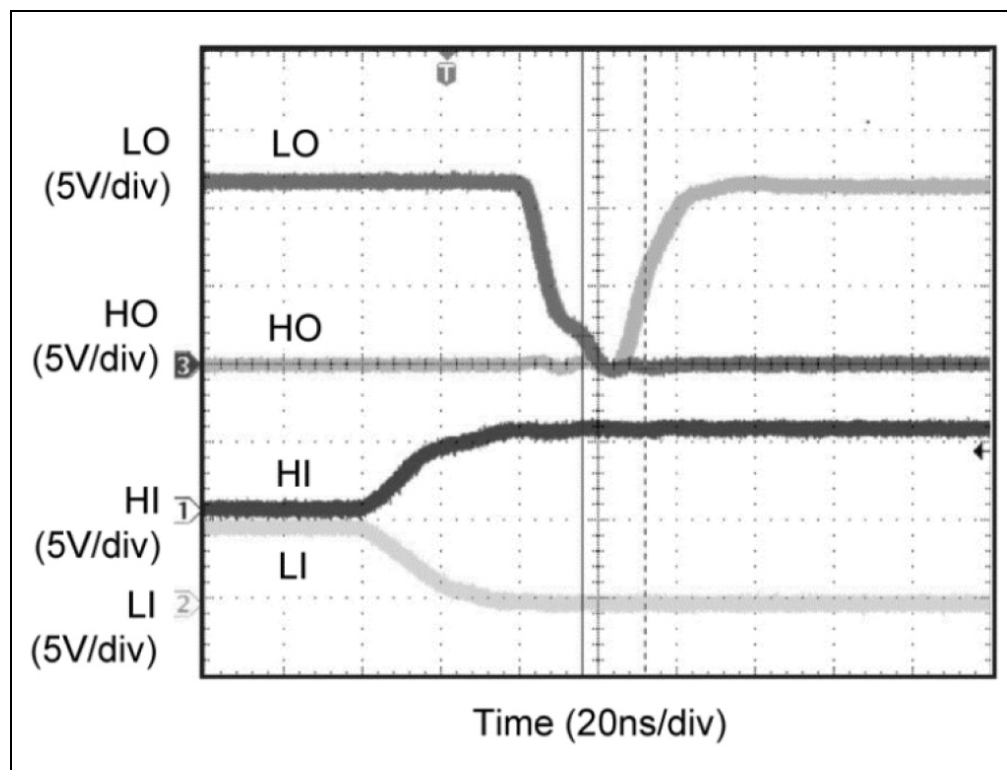


FIGURE 2-3: MIC4605-1 Adaptive Dead Time (HS Ground) Showing LI, HI, LO, and HO Signals.

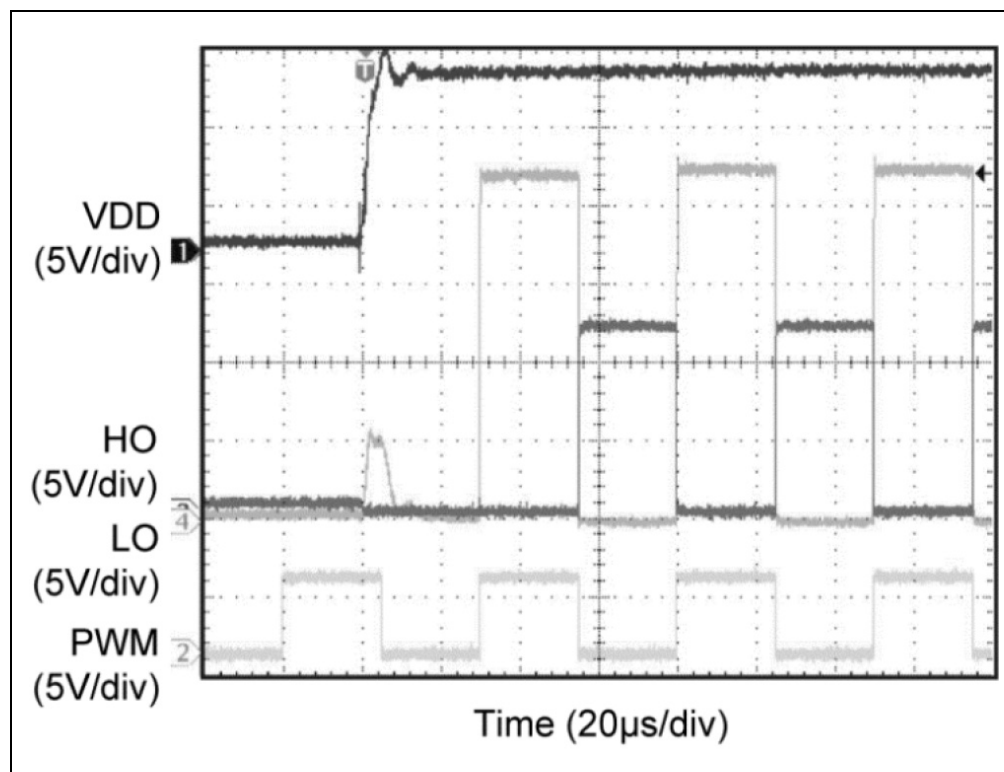
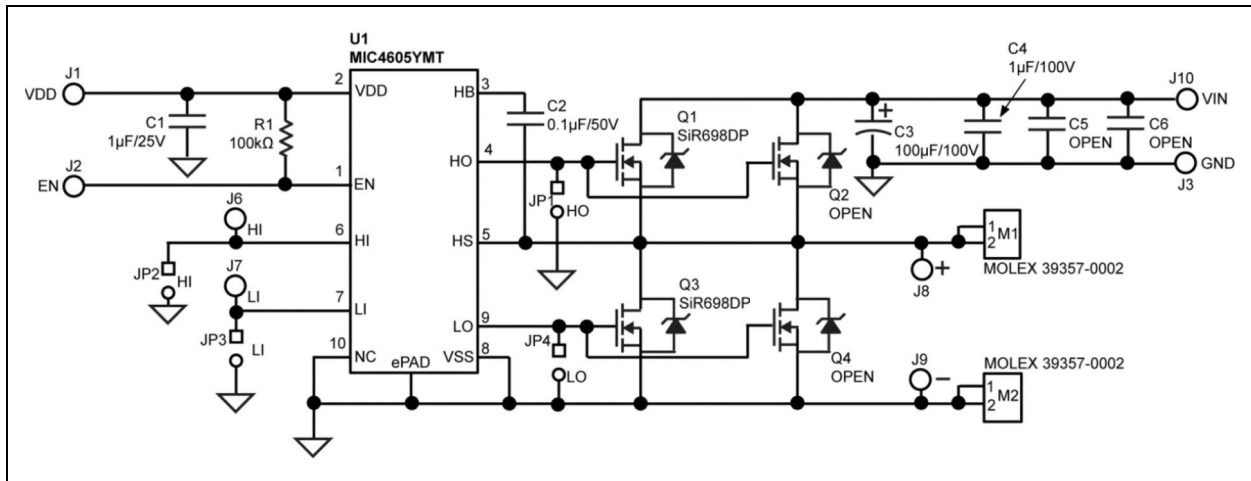


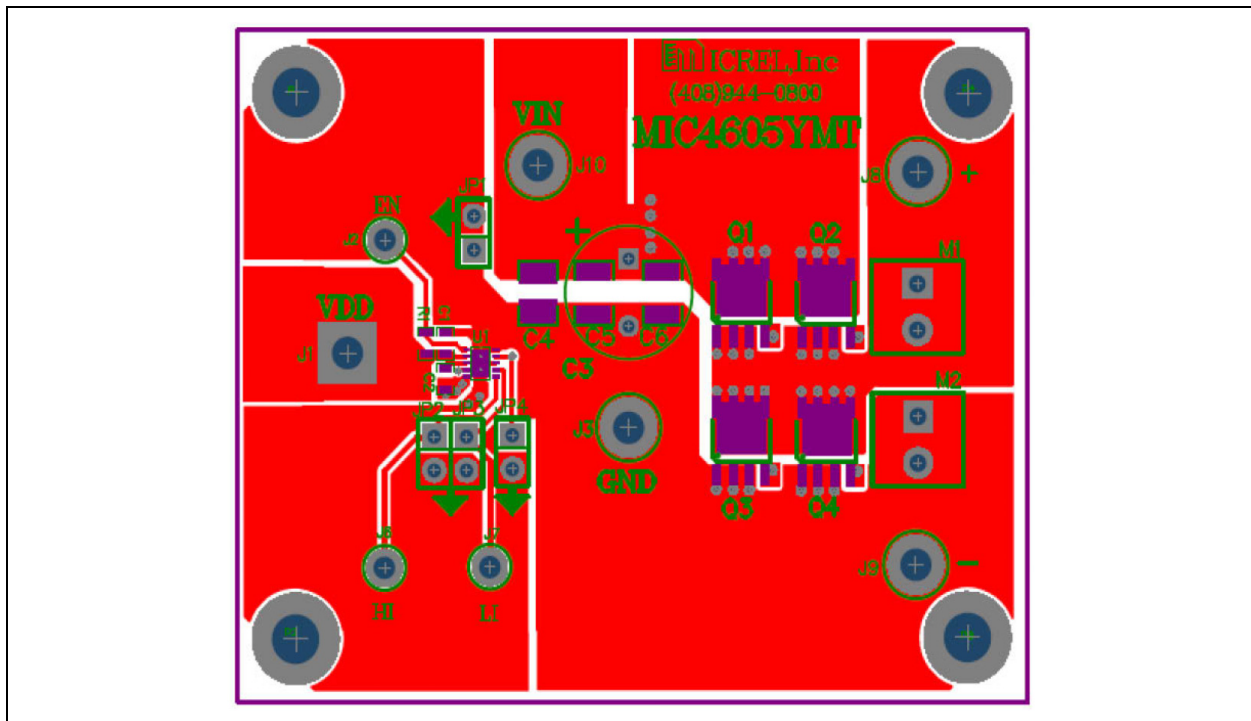
FIGURE 2-4: MIC4605-1 VIN Turn-On (Hot Plug) Fan Load Showing LI, HI, LO, and HO Signals.

Appendix A. Schematic and Layouts

A.1 EVALUATION BOARD SCHEMATIC (MIC4605YMT)

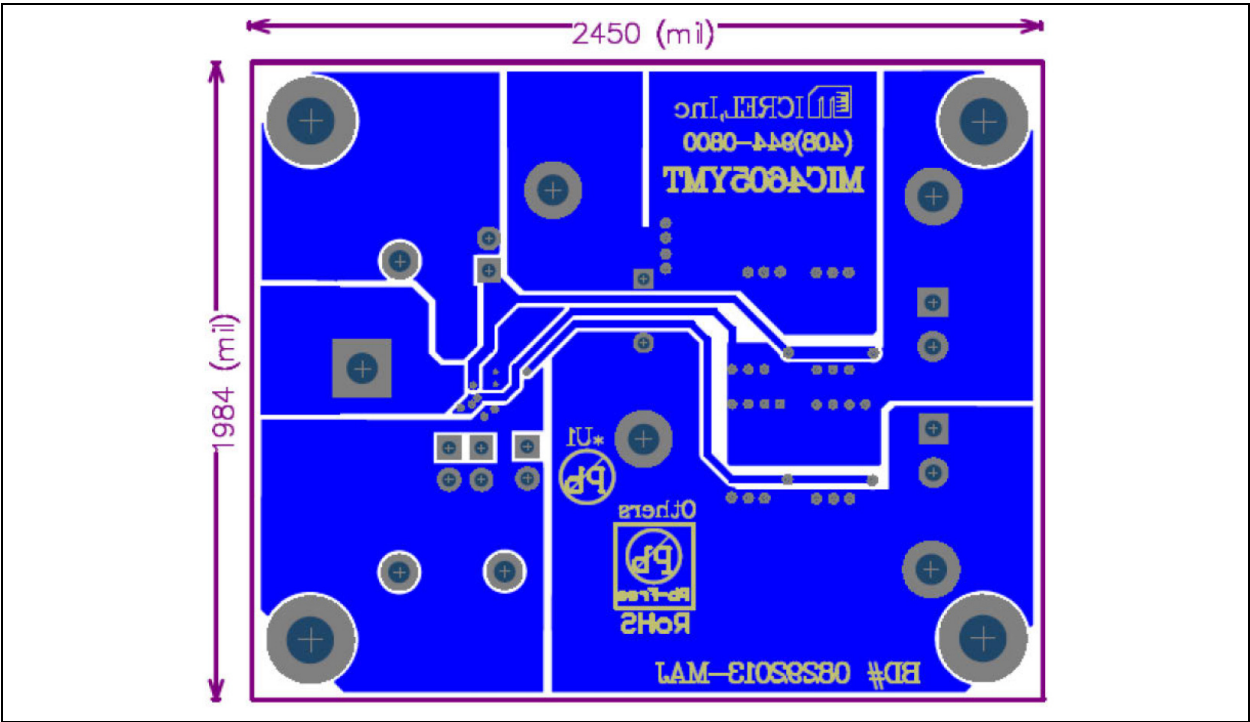


A.2 MIC4605YMT EVALUATION BOARD - TOP LAYER

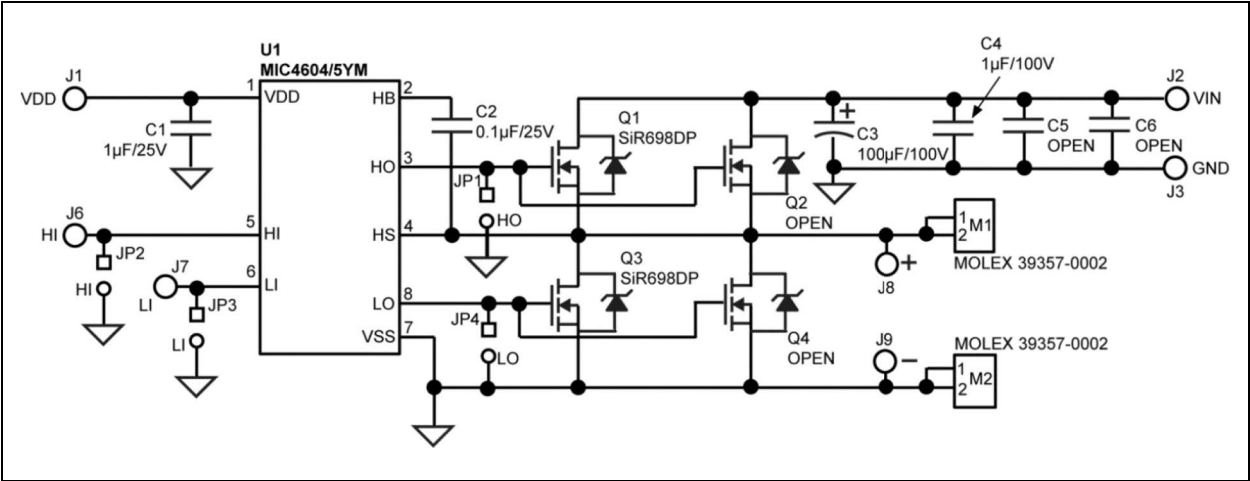


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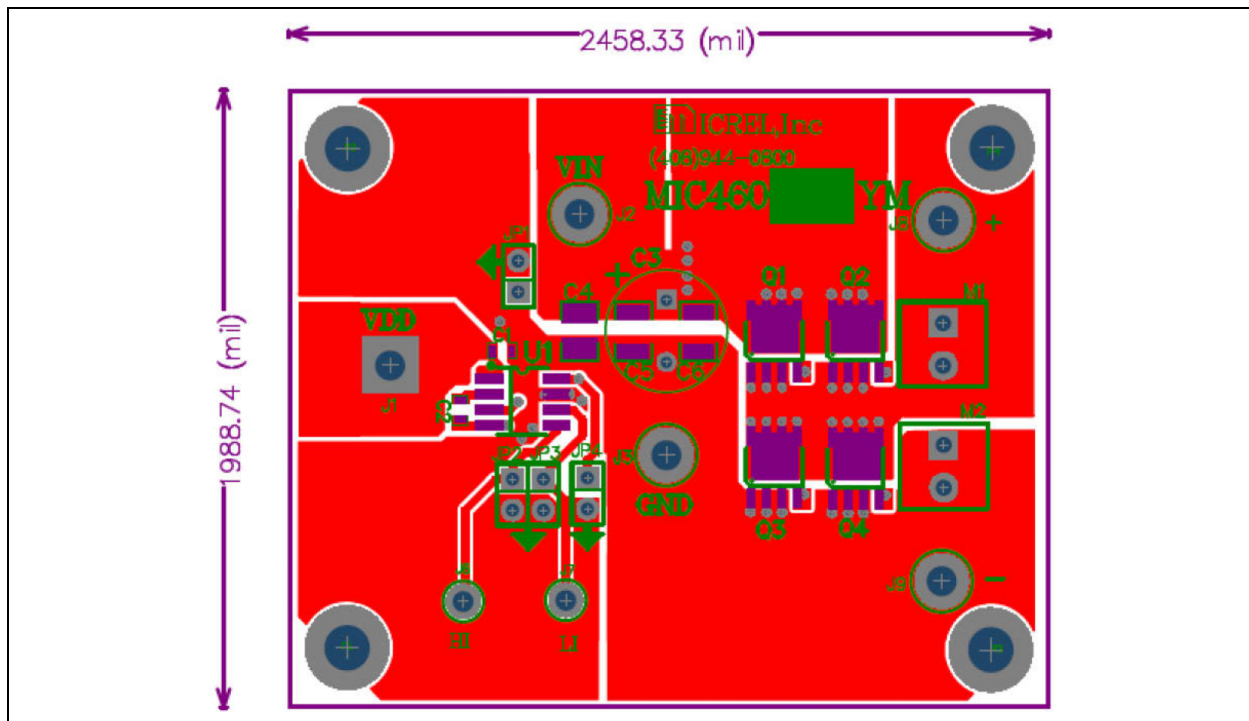
A.3 MIC4605YMT EVALUATION BOARD - BOTTOM LAYER



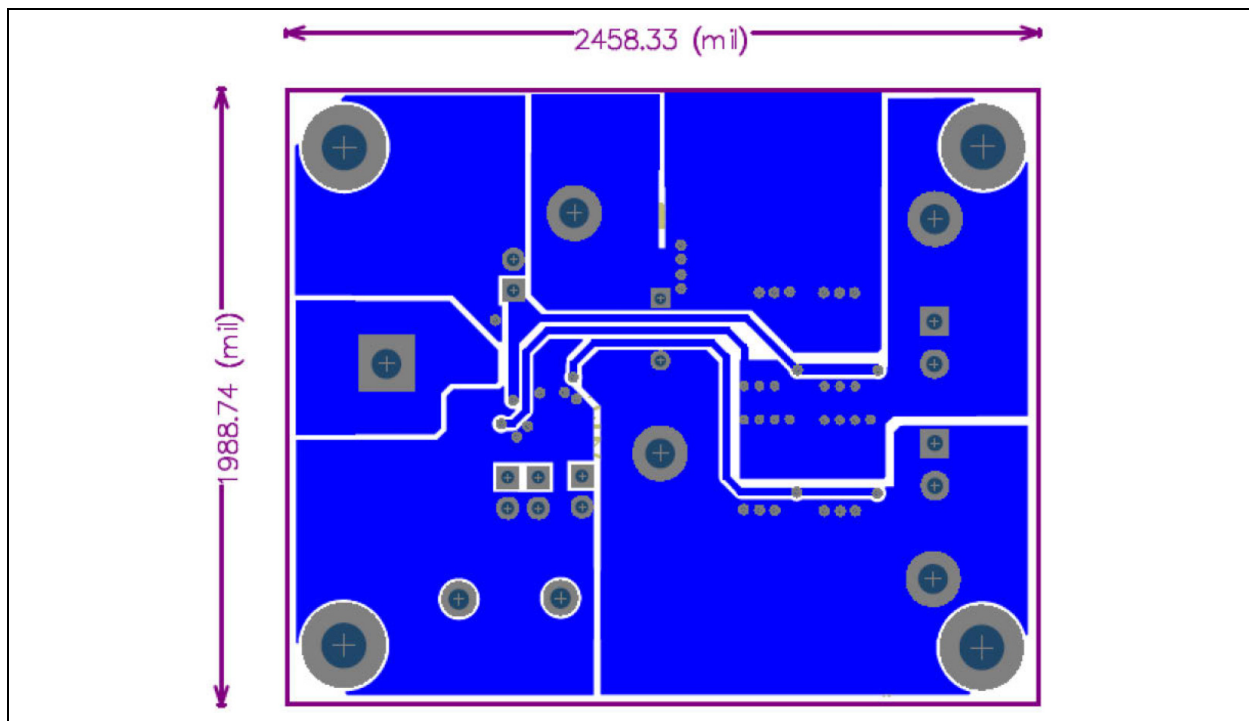
A.4 EVALUATION BOARD SCHEMATIC (MIC4605YM)



A.5 MIC4605YM EVALUATION BOARD - TOP LAYER



A.6 MIC4605YM EVALUATION BOARD - BOTTOM LAYER



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Appendix B. Bill of Materials (BOM)

TABLE B-1: BILL OF MATERIALS FOR MIC4605YMT

Item	Part Number	Manufacturer	Description	Qty.
C1	C1608X7R1E105K	TDK	1.0 μ F Ceramic Capacitor, 25V, X7R, Size 0603	1
	GRM188R71E105KA12D	Murata		
C2	C1608X7R1E104K	TDK	0.1 μ F Ceramic Capacitor, 25V, X7R, Size 0603	1
	06033C104KAT2A	Kyocera AVX		
	GFM188R71E104KA01D	Murata		
C3	B41851-A9107-M008	TDK	100 μ F, 100V, Radial Electrolytic Capacitor	1
C4	CGA5L2X7R2A105K	TDK	1.0 μ F Ceramic Capacitor, 100V, X7R, Size 1206	1
	12061C105K4Z4A	Kyocera AVX		
	GRF31CR72A105KA01L	Murata		
Q1, Q3	AM7414NA	Analog Power	100V , N-Channel MOSFET , SO8	2
	SiR698DP-T1-GE3	Vishay		
U1	MIC4605YMT	Microchip Technology Inc.	85V Half-Bridge MOSFET Drivers with 5.5V to 16V Gate Drive	1

- Note 1:** TDK: www.tdk.com
2: Murata: www.murata.com
3: Kyocera AVX: www.kyocera-avx.com
4: Analog Power: www.analogpowerinc.com
5: Vishay: www.vishay.com
6: Microchip Technology Inc.: www.microchip.com

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TABLE B-2: BILL OF MATERIALS FOR MIC4605YM

Item	Part Number	Manufacturer	Description	Qty.
C1	C1608X7R1E105K	TDK	1.0 μ F Ceramic Capacitor, 25V, X7R, Size 0603	1
	GRM188R71E105KA12D	Murata		
C2	C1608X7R1E104K	TDK	0.1 μ F Ceramic Capacitor, 25V, X7R, Size 0603	1
	06033C104KAT2A	Kyocera AVX		
	GFM188R71E104KA01D	Murata		
C3	B41851-A9107-M008	TDK	100 μ F, 100V, Radial Electrolytic Capacitor	1
C4	CGA5L2X7R2A105K	TDK	1.0 μ F Ceramic Capacitor, 100V, X7R, Size 1206	1
	12061C105K4Z4A	Kyocera AVX		
	GRF31CR72A105KA01L	Murata		
Q1, Q3	AM7414NA	Analog Power	100V , N-Channel MOSFET , SO8	2
	SiR698DP-T1-GE3	Vishay		
U1	MIC4605YM	Microchip Technology Inc.	85V Half-Bridge MOSFET Drivers with 5.5V to 16V Gate Drive	1

Note 1: TDK: www.tdk.com

2: Murata: www.murata.com

3: Kyocera AVX: www.kyocera-avx.com

4: Analog Power: www.analogpowerinc.com

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