MTD6508
3-Phase BLDC Sensorless Fan Controller Demonstration Daughter Board User's Guide

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Object of Declaration: MTD6508 3-Phase BLDC Sensorless Fan Controller Demonstration Daughter Board

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12-Sep-14
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NOTES:

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Preface

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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 MTD6508 3-Phase BLDC Sensorless Fan Controller Demonstration Daughter 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 MTD6508 3-Phase BLDC Sensorless Fan Controller Demonstration Daughter Board as a development tool to emulate and debug firmware on a target board. The manual layout is as follows:

- **Chapter 1. "Product Overview"** – Important information about the MTD6508 3-Phase BLDC Sensorless Fan Controller Demonstration Daughter Board.
- **Chapter 2. "Installation and Operation"** – Includes instructions on how to get started with the MTD6508 3-Phase BLDC Sensorless Fan Controller Demonstration Daughter Board.
- **Appendix A. "Schematics and Layouts"** – Shows the schematic and layout diagrams for the MTD6508 3-Phase BLDC Sensorless Fan Controller Demonstration Daughter Board.
- **Appendix B. "Bill of Materials (BOM)"** – Lists the parts used to build the MTD6508 3-Phase BLDC Sensorless Fan Controller Demonstration Daughter 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 MTD6508 3-Phase BLDC Sensorless Fan Controller Demonstration Daughter Board. Another useful document is listed below. The following Microchip document is available and recommended as a supplemental reference resource.

- **MTD6508 Data Sheet – "*3-Phase Sinusoidal Sensorless Brushless Fan Motor Driver*" (DS20005359)**

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DOCUMENT REVISION HISTORY

Revision A (June 2016)

- Initial Version of this Document.

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Chapter 1. Product Overview

1.1 INTRODUCTION

In order to easily use the MTD6508 device, Microchip Technology provides a daughter board containing a MTD6508-ADJE/JQ (16-Lead UQFN with EP version of the MTD6508).

The MTD6508 Daughter Board is a small board with the minimal required components to operate with the MTD6508 device.

The MTD6508 Daughter Board has been designed to be used with the ADM00633 motherboard, but can also be used as a stand-alone board using its connectors.

The MTD6508 Daughter Board comes with a kit of three boards.

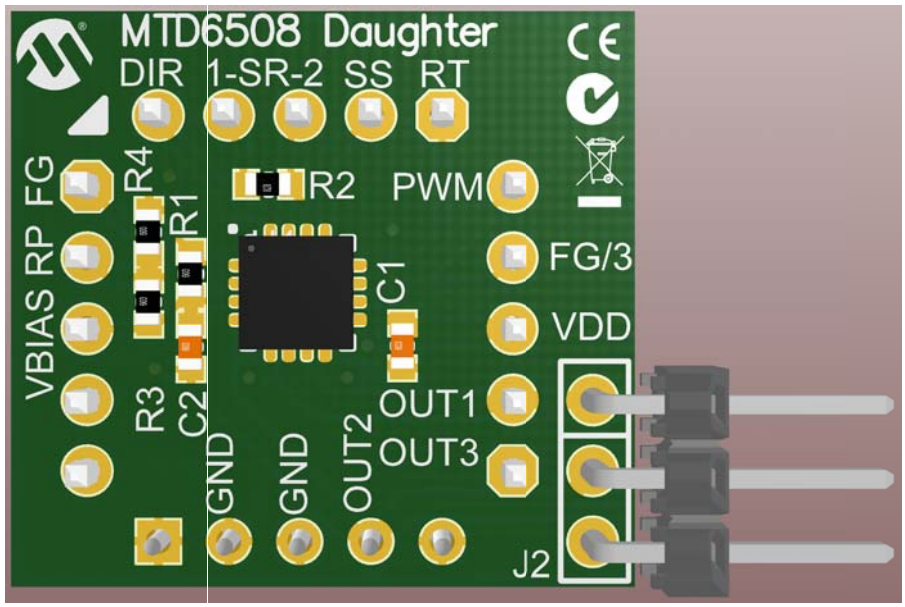

FIGURE 1-1: *MTD6508 3-Phase BLDC Sensorless Fan Controller Demonstration Daughter Board (ADM00631) Overview.*

1.2 MTD6508 DAUGHTER BOARD HARDWARE DESCRIPTION

These daughter boards have been designed specifically for the MTD6508 Demonstration Board. However, they can also be used independently as stand-alone boards. This section provides a brief description of these boards.

Figure 1-2 provides an overview of the MTD6508 Daughter Board.

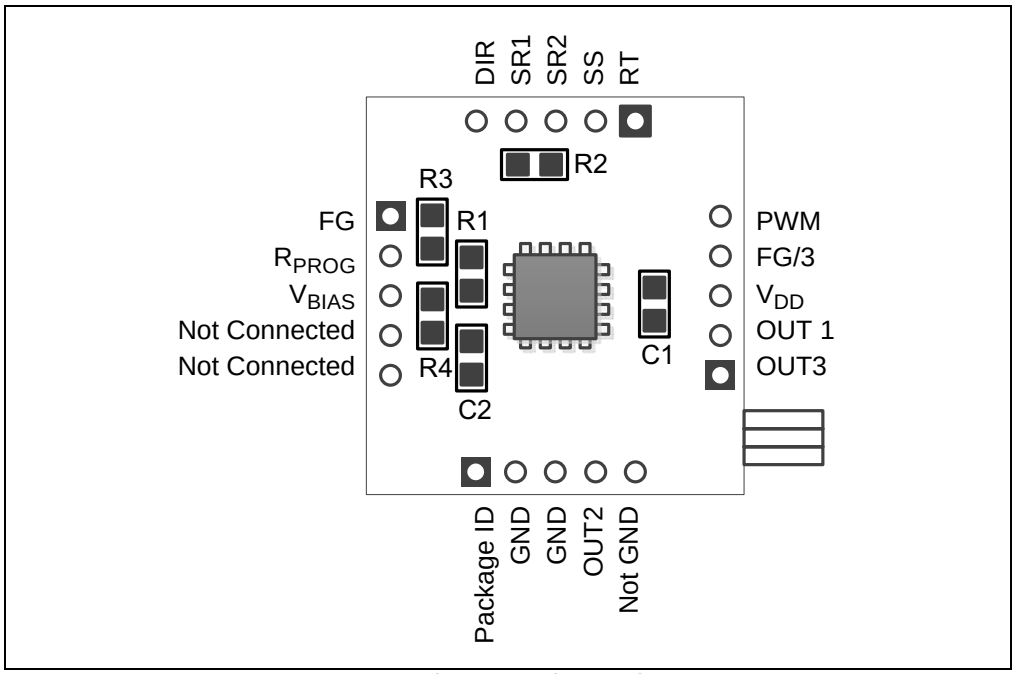

FIGURE 1-2: *MTD6508 Daughter Board Overview.*

- R1 is the FG pull-up resistor.
- C1 and C2 are respectively the V_{DD} and the V_{BIAS} decoupling capacitors.
- R2 is the Slew Rate Resistor (R_{SR}) and is available only for the MTD6508 Daughter Board with a 4x4 16-Lead UQFN MTD6508 (ADM00631). This resistor is handled by the MTD6508 Demonstration Board via the MTD6508 Demonstration Board Software GUI. This footprint only has to be assembled if the MTD6508 Daughter Board is not plugged into a MTD6508 Demonstration Board. A 4.7K to 47K resistor has to be used.
- R3 allows connecting the R_{PROG} pin to GND. This resistor is handled by the MTD6508 Demonstration Board via the MTD6508 Demonstration Board Software GUI. This footprint only has to be assembled if the R_{PROG} resistor is not set by the MTD6508 Demonstration Board Software GUI. A 0R resistor must be used.
- R4 allows setting the R_{PROG} resistor. This resistor is handled by the MTD6508 Demonstration Board via the MTD6508 Demonstration Board Software GUI. This footprint only has to be assembled if the R_{PROG} resistor is not set by the MTD6508 Demonstration Board Software GUI. A 24K, 3.9K or 0R resistor must be used to connect the R_{PROG} pin to V_{BIAS}.

More details of the schematic are available in **Appendix A. "Schematics and Layouts".**

1.3 WHAT THE MTD6508 DEMONSTRATION BOARD KIT INCLUDES

The MTD6508 3-Phase BLDC Sensorless Fan Controller Demonstration Daughter Board Package (ADM00631) includes:

- 3 x MTD6508 Daughter Board with a 4x4 16-Lead UQFN MTD6508
- Important Information Sheet

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Chapter 2. Installation and Operation

2.1 GETTING STARTED

In order to use the MTD6508 Daughter Board, follow the steps below:

1. Connect a power supply between V_{DD} and a GND connector on the daughter board (see Figure 2-1). The device maximum voltage on V_{DD} is 5.5V. The power supply should support up to 800 mA continuous (device current limitation is 750 mA). Please note that it is possible that applications may not need that much current to run at full speed.
2. Connect a 3-phase BLDC fan on Outputs 1, 2 and 3 of the daughter board.
3. Connect a function generator on the PWM pin in order to modulate the input voltage in order to adjust the maximum speed of the fan; this step is optional. If the PWM is left open, the IC will act as if PWM = 100%. This a duty cycle modulation. This signal frequency range is from 1 kHz to 100 kHz. The maximum voltage on this signal is V_{DD}.
4. Connect a frequency meter on the FG pin in order to measure the speed signal; this step is optional. The signal frequency is gives the electrical speed in RPM. This is an open-drain signal, pulled up by the resistor, R1.

Please see the *"MTD6508 Data Sheet"* (DS20005359) for more information on pin specifications.

2.2 USING THE MTD6508 DEMONSTRATION BOARD KIT WITH THE MTD6508 DEMONSTRATION BOARD SOFTWARE GUI

The MTD6508 Demonstration Board Software GUI provides several features, such as V_{DD} control and monitoring, Pulse-Width Modulation (PWM) control, as well as speed and current consumption monitoring. The MTD6508 Demonstration Board Software GUI allows the user to control the following parameters:

- The R_{PROG} resistor value for fan fitting
- The R_{SR} resistor value for output slew rate control for all remaining digital pins

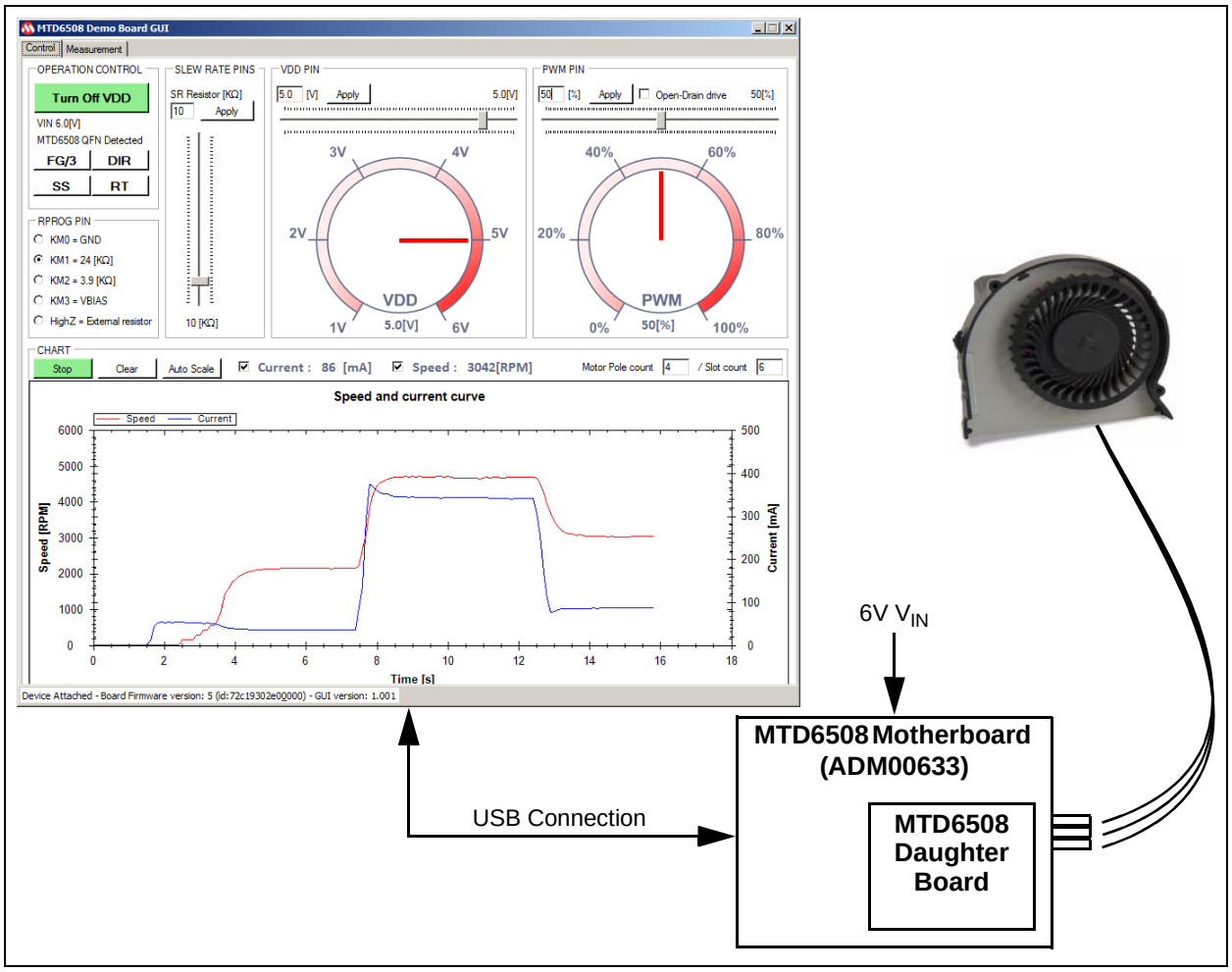

FIGURE 2-1: *System Overview.*

To use the MTD6508 Demonstration Board Kit with the MTD6508 Demonstration Board Software GUI, these steps should be followed:

1. Plug the MTD6508 Daughter Board into its dedicated socket on the MTD6508 Demonstration Board (see Figure 2-1).
2. To plug in a 3-phase BLDC sensorless fan, choose one of these connections:
   - The 3-phase fan connector on the MTD6508 Demonstration Board (J1)
   - The fan connector on the MTD6508 Daughter Board
3. Connect the power supply to the V_{IN} test point. The required V_{IN} value is +6V ±5%. The power supply has to deliver up to 1.0A.
4. Turn on the power switch. The Power LED and the MCU LED should light up.
5. Plug a mini-USB cable attached to the USB port of a computer to the MTD6508 Demonstration Board connector.
6. If required, let the computer identify the MTD6508 Demonstration Board.
7. Restart the computer if necessary.
8. Start the MTD6508 Demonstration Board Software GUI.

Note: The order of these steps is provided as an example and can be changed. It is also possible to start the MTD6508 Demonstration Board Software GUI before enabling the board.

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Appendix A. Schematics and Layouts

A.1 INTRODUCTION

This appendix contains the schematics and layouts for the following devices, which are included in the MTD6508 3-Phase BLDC Sensorless Fan Controller Demonstration Daughter Board (ADM00673):

- MTD6508 Daughter Board 4x4 16-Lead UQFN (ADM00631):
  - ADM00631 Board 4x4 16-Lead UQFN – Schematic
  - ADM00631 Board 4x4 16-Lead UQFN – Top Silk
  - ADM00631 Board 4x4 16-Lead UQFN – Top Copper and Silk
  - ADM00631 Board 4x4 16-Lead UQFN – Bottom Copper and Silk

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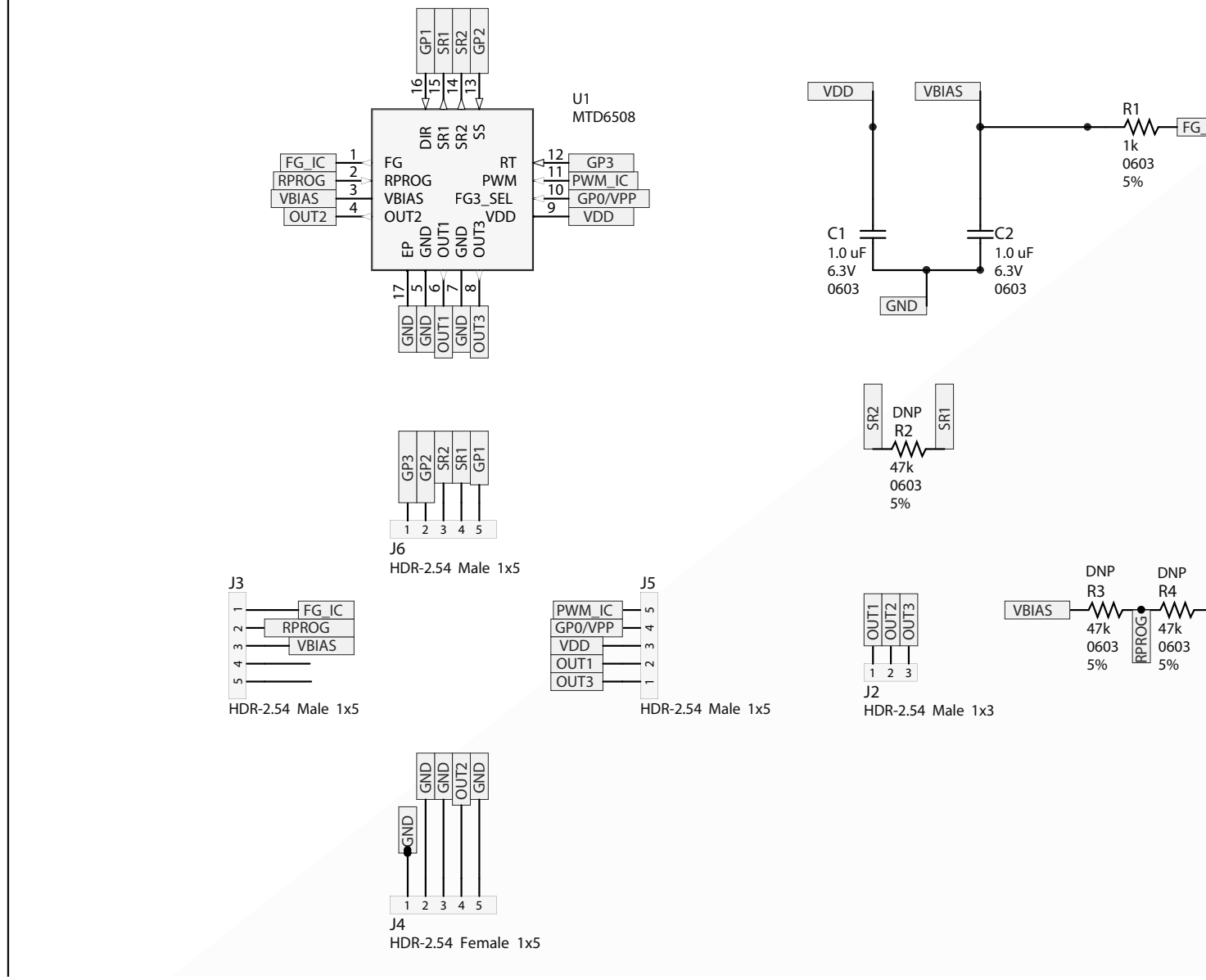
A.2 ADM00631 BOARD 4X4 16-LEAD UQFN – SCHEMATIC



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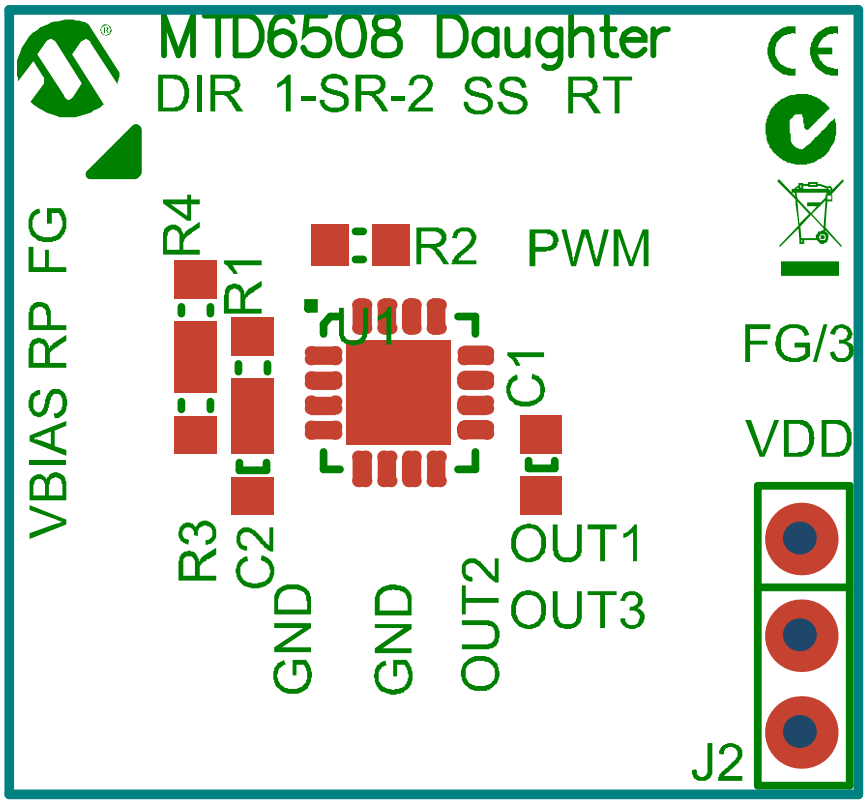
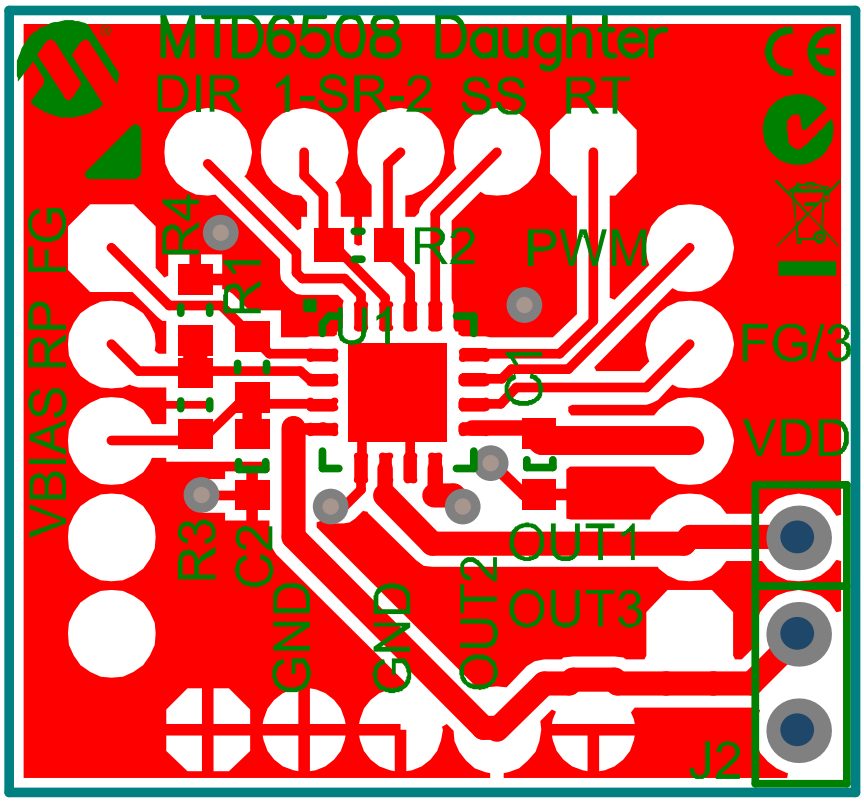
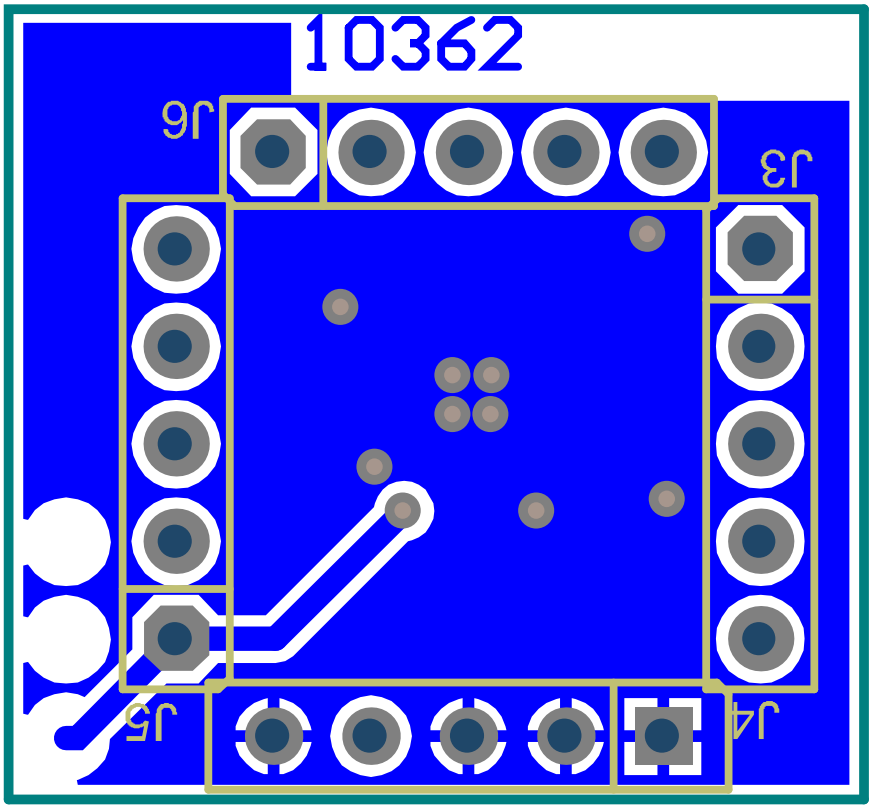
A.3 ADM00631 BOARD 4x4 16-Lead UQFN – TOP SILK



A.4 ADM00631 BOARD 4x4 16-Lead UQFN – TOP COPPER AND SILK



A.5 ADM00631 BOARD 4X4 16-LEAD UQFN – BOTTOM COPPER AND SILK



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Appendix B. Bill of Materials (BOM)

TABLE B-1: BILL OF MATERIALS (BOM) – MTD6508 4x4 16-LEAD UQFN DAUGHTER BOARD (ADM00631)(1)

Qty	Reference	Description	Manufacturer	Part Number
2	C1, C2	Capacitor Ceramic, 0.001 uF, 50V, 20%, X7R, SMD, 0603	KEMET®	C0603C102M5RAC
1	J2	Connector Header – 2.54 Male, 1x3, Gold, 5.84 MH TH, R/A	Samtec, Inc.	TSW-103-08-F-S-RA
3	J3, J5, J6	Connector Header – 2.54 Male, 1x5, Tin, 5.84 MH TH, Vertical	Samtec, Inc.	TSW-105-07-T-S
1	J4	Connector Header – 2.54 Female, 1x5, Gold, TH	Mill-Max Mfg. Corporation	801-43-005-10-001000
1	R1	Resistor TKF, 10k, 5%, 1/10W, SMD, 0603	Panasonic® – ECG	ERJ-3GEYJ103V
1	U1	Microchip Analog Motor Driver, MTD6508-ADJE/JQ, 16-Lead UQFN	Microchip Technology Inc.	**MTD6508-ADJE/JQ**

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.

TABLE B-2: BILL OF MATERIALS (BOM) – MTD6508 3x3 10-LEAD UDFN DAUGHTER BOARD (ADM00632)(1)

Qty	Reference	Description	Manufacturer	Part Number
2	C1, C2	Capacitor Ceramic, 0.001 uF, 50V, 20%, X7R, SMD, 0603	KEMET®	C0603C102M5RAC
1	J2	Connector Header – 2.54 Male, 1x3, Gold, 5.84 MH TH, R/A	Samtec, Inc.	TSW-103-08-F-S-RA
3	J3, J5, J6	Connector Header – 2.54 Male, 1x5, Tin, 5.84 MH TH, Vertical	Samtec, Inc.	TSW-105-07-T-S
1	J4	Connector Header – 2.54 Female, 1x5, Gold, TH	Mill-Max Mfg. Corporation	801-43-005-10-001000
1	R1	Resistor TKF, 10k, 5%, 1/10W, SMD, 0603	Panasonic® - ECG	ERJ-3GEYJ103V
1	U1	Microchip Analog Motor Driver, MTD6508T-E/NA, 10-Lead UDFN	Microchip Technology Inc	**MTD6508T-E/NA**

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.

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