EV6638-RPU-00A

15V, 1.7A Peak, Three-Phase Sensorless BLDC Motor Driver Evaluation Board

DESCRIPTION

The EV6638-RPU-00A is an evaluation board designed to demonstrate the capabilities of the MP6638, a three-phase sensorless and brushless (BLDC) motor driver with integrated power MOSFETs. It features sinusoidal sensorless control for better efficiency and low vibration, with up to 1.7A of peak phase current. The input voltage (V_{IN}) ranges from 2.5V to 15V.

The MP6638 controls the motor speed through the pulse-width modulation (PWM) signal with a PWM input frequency from 50Hz to 100kHz.

The MP6638 also has a rotational speed detector feature. The rotational speed detector (the FG/RD pin) is an open-drain output.

Rich protection features include input over-voltage protection (OVP), under-voltage lockout (UVLO), locked-rotor protection, over-current protection (OCP), and thermal shutdown protection.

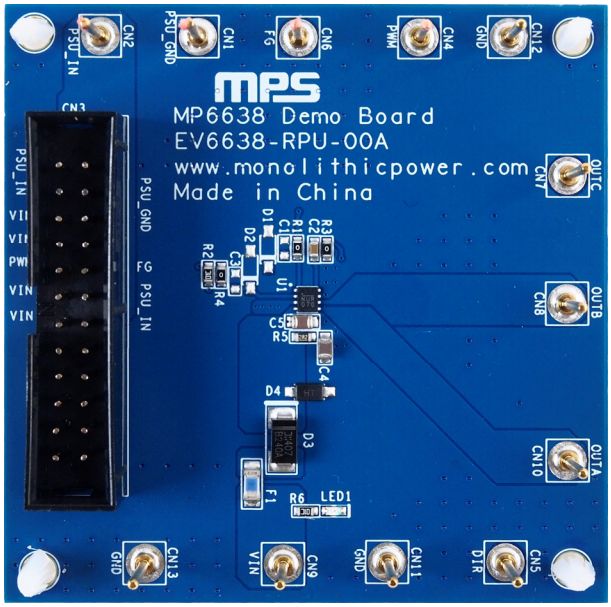
The MP6638 is available in a UTQFN8-2mmx2.5mm package.

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C, unless otherwise noted.

Parameters	Conditions	Value
Input voltage (V_{IN}) range		2.5V to 15V
Phase peak current		Maximum 1.7A
Input PWM frequency		50Hz to 100kHz
Switching frequency (f_{SW})		30kHz

EVALUATION BOARD



LxWxH (6cmx6cmx2cm)

Board Number	MPS IC Number
EV6638-RPU-00A	MP6638GRPU-0000

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QUICK START GUIDE

Quick Start Using the MPS Fan Driver Communication Kit

1. Preset the DC power supply, then turn the power supply off.
2. Connect the power supply output terminals to (see Figure 1):
   a. Positive (+): PSU_IN
   b. Negative (-): PSU_GND
3. Connect the communication kit to the EV6638-RPU-00A via CN3.
4. Connect the motor phase terminals to:
   a. Motor phase A: OUTA
   b. Motor phase B: OUTB
   c. Motor phase C: OUTC
5. Connect the communication kit to the computer.
6. Turn on the power supply.
7. Run the MPS BLDC Virtual Bench GUI and select the MP6638. (1)

Figure 1 shows the equipment set-up with the communication kit.

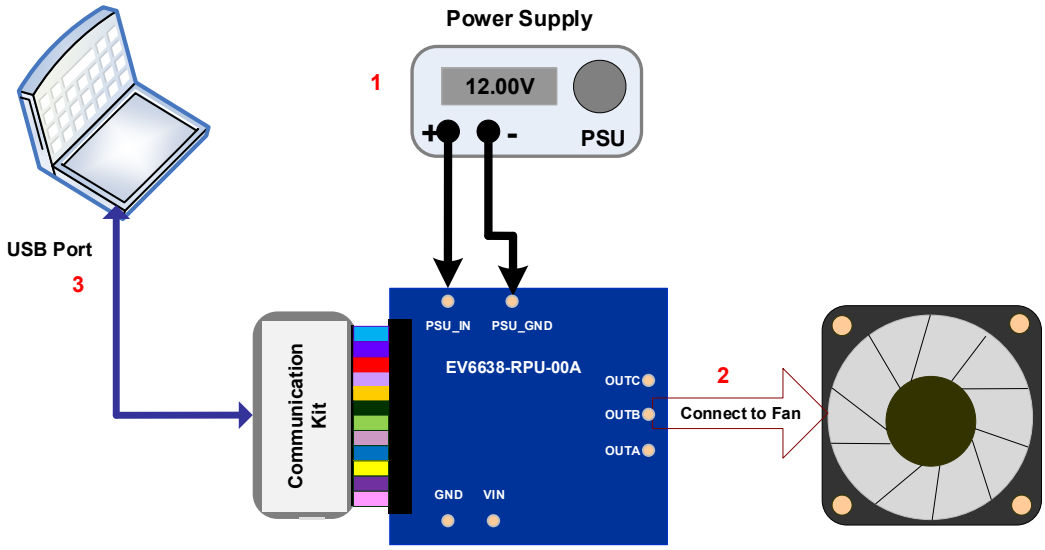

Figure 1: EVB Connection with Communication Kit

Note:

1) Contact an MPS FAE to obtain the MPS BLDC Virtual Bench GUI.

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Quick Start without the Communication Kit

1. Connect the power supply's output terminals to:
   a. Positive (+): VIN
   b. Negative (-): GND
2. Connect the motor phase terminals to:
   a. Motor phase A: OUTA
   b. Motor phase B: OUTB
   c. Motor phase C: OUTC
3. Turn on the power supply. The motor should begin working.
4. Set the function generator to pulse mode, such that the high level is 3.3V and the low level is 0V. Adjust the pulse duty cycle to change the motor's speed.

Figure 2 shows the equipment set-up without the communication kit.

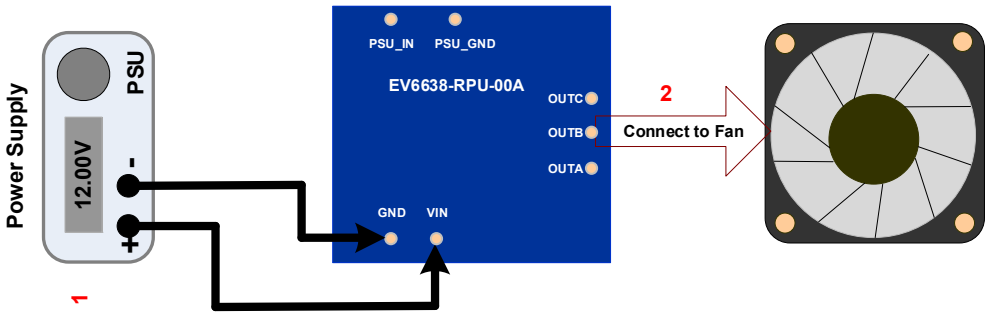

Figure 2: EVB Connection without Communication Kit

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GUI Operation Guide

1. Install the MPS BLDC Virtual Bench GUI.
2. Double-click on “MPSFan.exe” to start the GUI, then click “Select Chip” (see Figure 3).

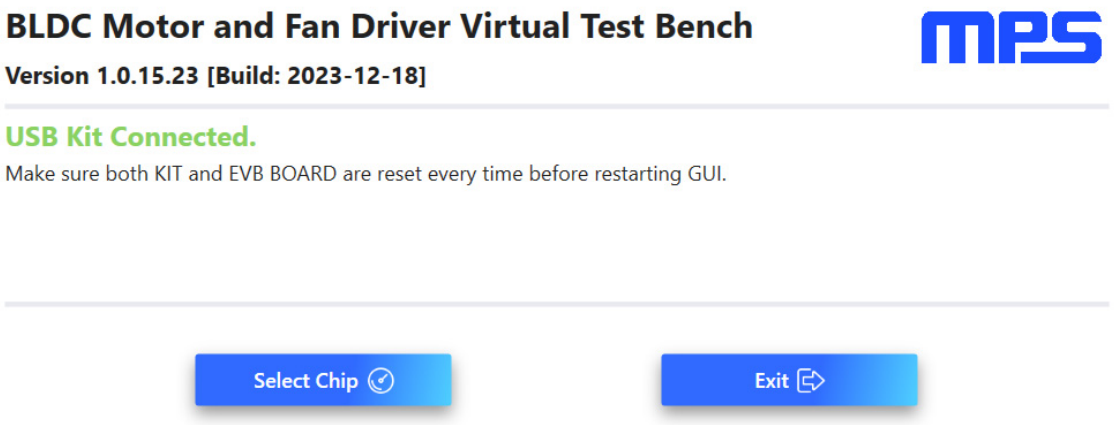

Figure 3: MPS BLDC Virtual Test Bench GUI

3. Click on “Details” to enter the test mode interface (see Figure 4).

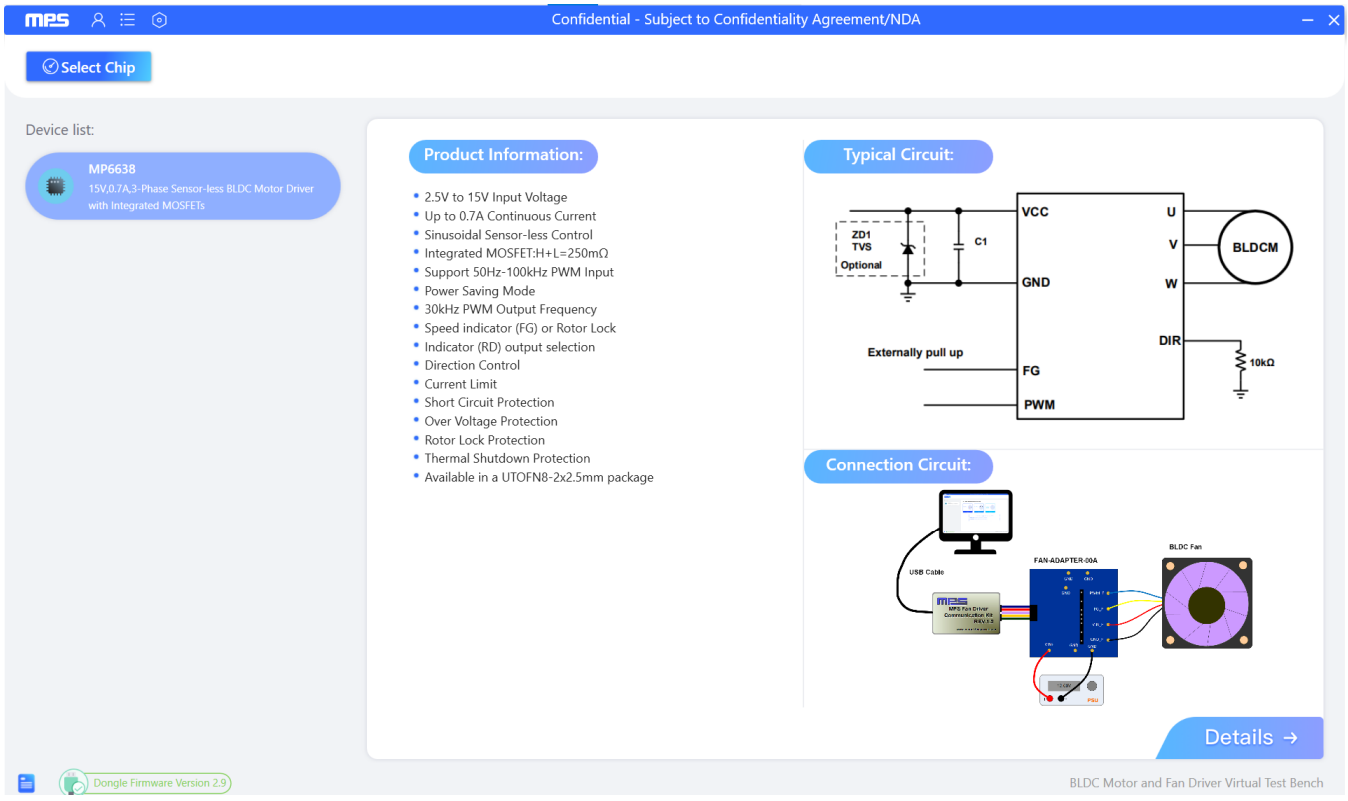

Figure 4: MPS BLDC Virtual Test Bench GUI Interface

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EVALUATION BOARD SCHEMATIC

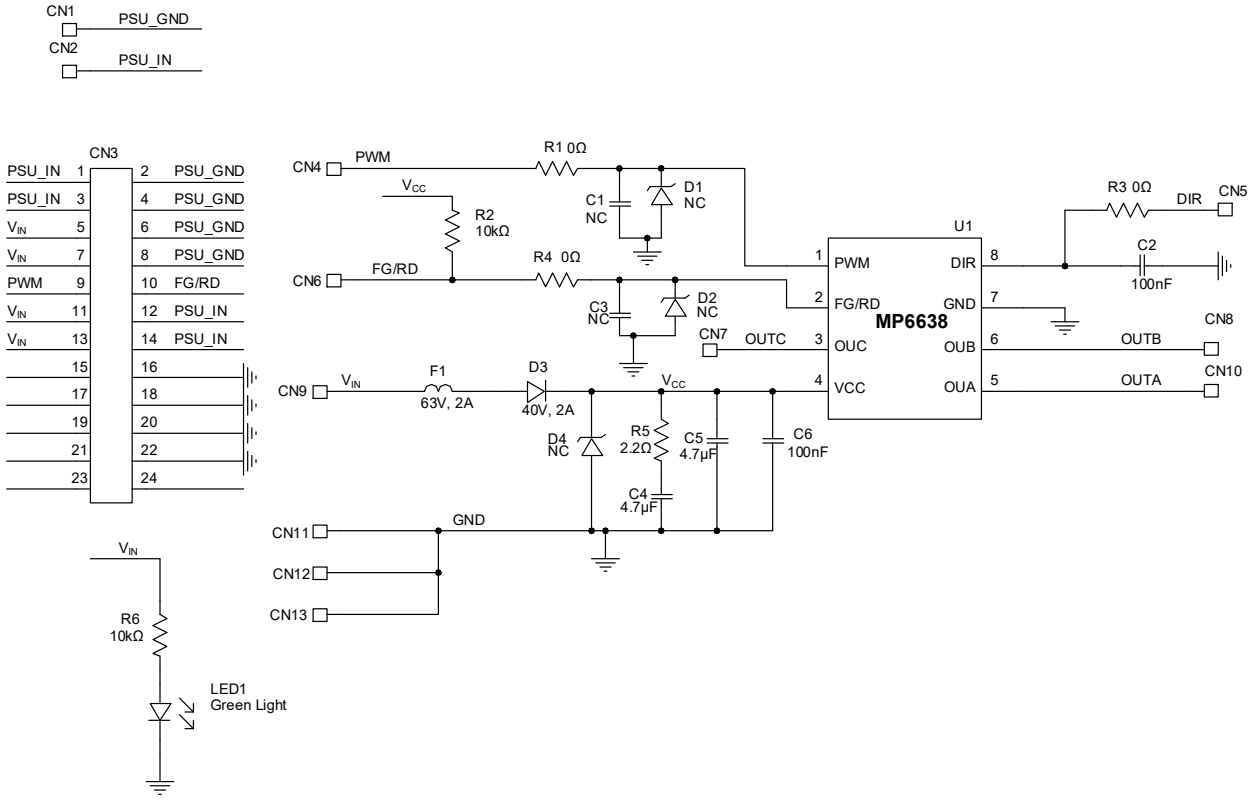

Figure 5: Evaluation Board Schematic

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EV6638-RPU-00A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
12	CN1, CN2, CN4, CN5, CN6, CN7, CN8, CN9, CN10, CN11, CN12, CN13	1mm	1mm connector	DIP	Any	
1	CN3	2.54mm	12-pin, dual-row header with frame	DIP	Any	
2	C2, C6	100nF	Ceramic capacitor, 25V, X7R	0603	TDK	C1608X7R1E104K
2	C4, C5	4.7µF	Ceramic capacitor, 25V, X7R	0805	TDK	C2012X7R1E475K
1	D4	18V	TVS diode	SOD-123FL	Sunmate	SMF18CA
1	D3	40V	Diode, 2A	SMA	Diodes, Inc.	B240A-13-F
1	F1	63V	2A fuse	1206	Bel	0685-2000-01
1	LED1	Green	Green LED	0603	Baihong	BL-HGE36A-AV-TRB
3	R1, R3, R4	0Ω	Film resistor, 1%	0603	Yageo	RC0603FR-070RL
2	R2, R6	10kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0710KL
1	R5	2.2Ω	Film resistor, 1%	0603	Yageo	RC0603FR-072R2L
1	U1	MP6638	15V, 1.7A peak, three-phase, sensorless BLDC motor driver	UTQFN-8 (2mmx 2.5mm)	MPS	MP6638GRPU-0000

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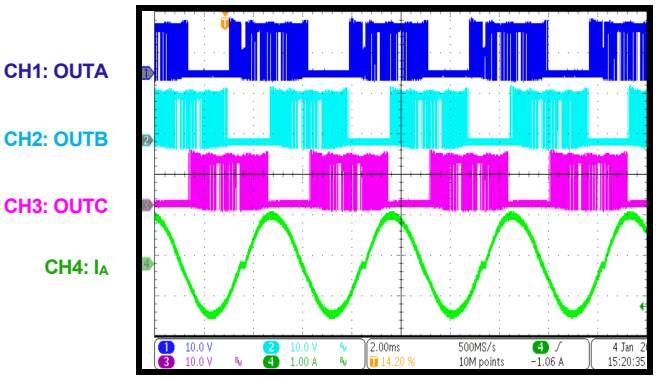
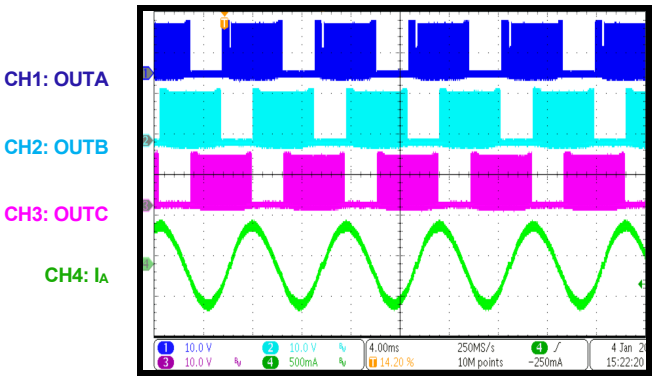
EVB TEST RESULTS

Performance waveforms are tested on the evaluation board. V_{IN} = 12V, PWM frequency = 20kHz, T_A = 25°C, unless otherwise noted.

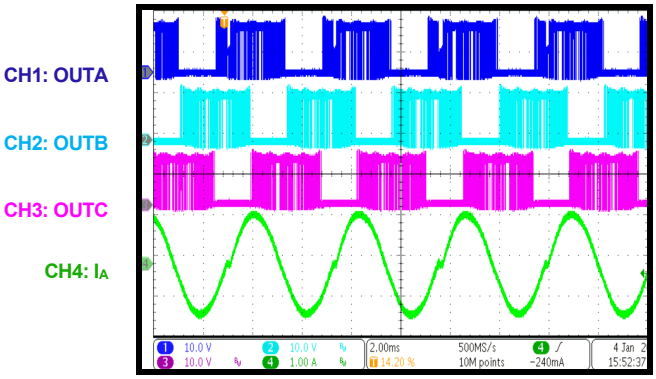
Steady State
PWM duty = 100%, DIR = low



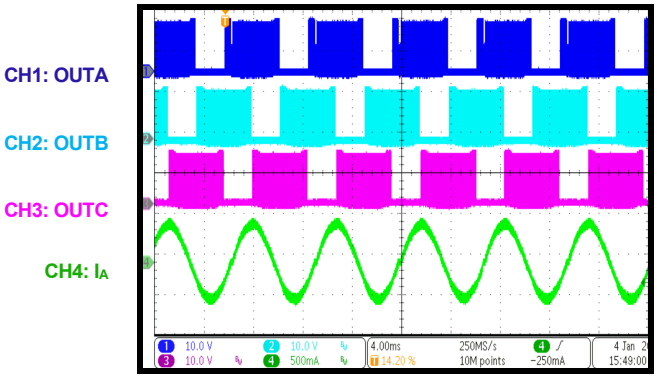
Steady State
PWM duty = 50%, DIR = low



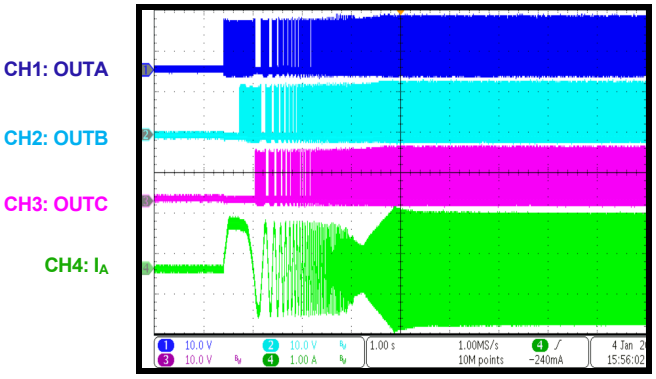
Steady State
PWM duty = 100%, DIR = high



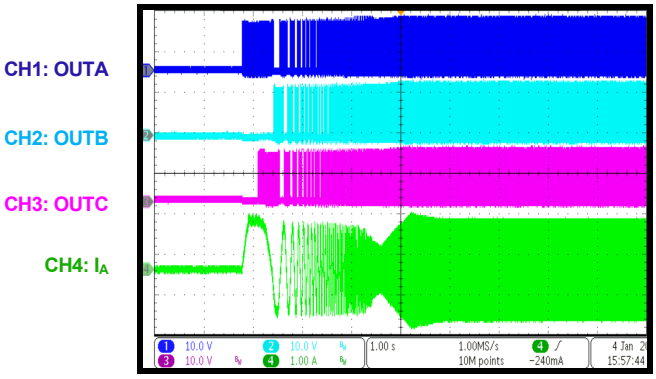
Steady State
PWM duty = 50%, DIR = high



PWM On
PWM duty = 10% to 100%, DIR = low



PWM On
PWM duty = 10% to 100%, DIR = high



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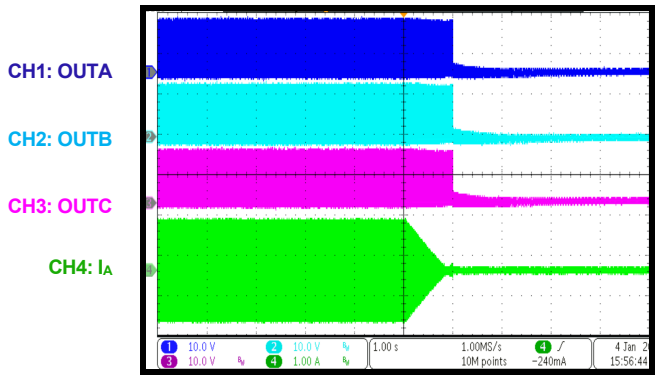
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board. V_{IN} = 12V, PWM frequency = 20kHz, T_A = 25°C, unless otherwise noted.

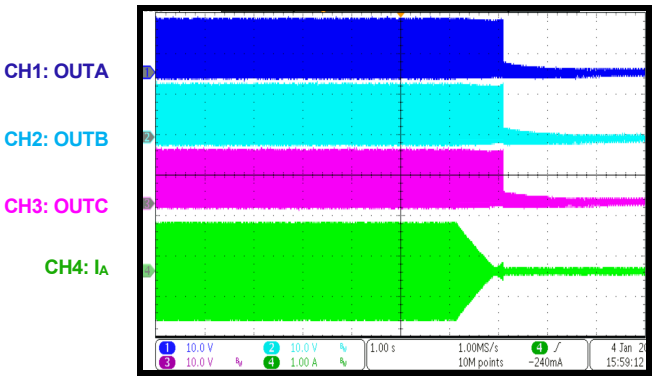
PWM Off

PWM duty = 100% to 10%, DIR = low



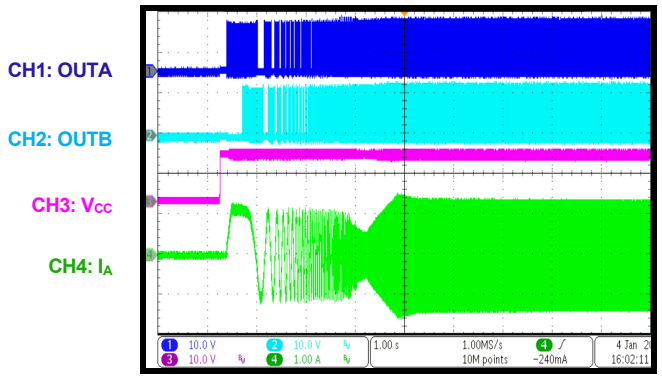
PWM Off

PWM duty = 100% to 10%, DIR = high



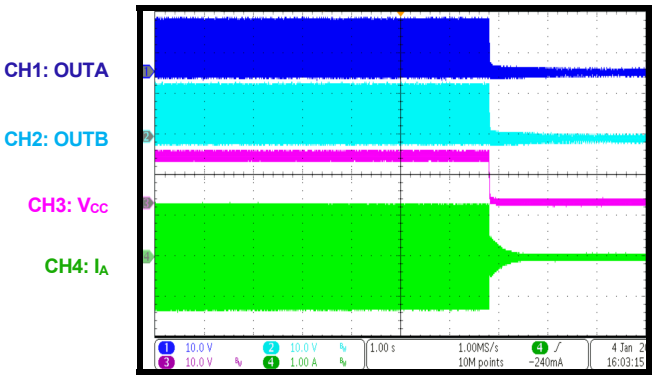
Start-Up through VCC

V_{CC} = 0V to 12V, PWM duty = 100%, DIR = low



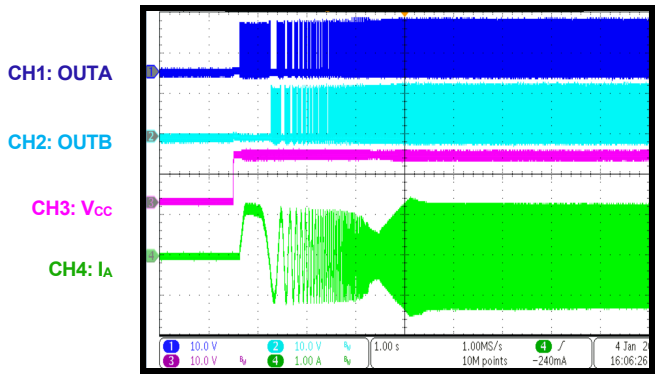
Shutdown through VCC

V_{CC} = 12V to 0V, PWM duty = 100%, DIR = low



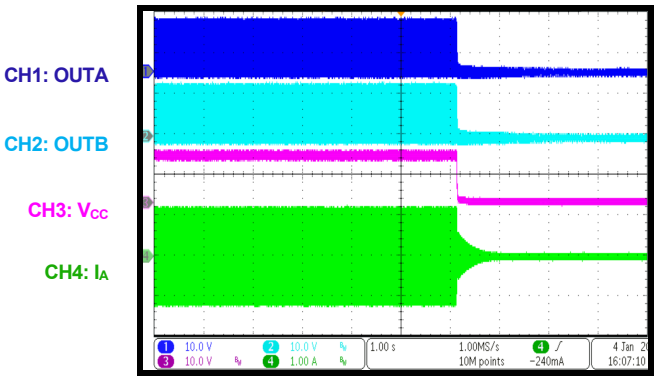
Start-Up through VCC

V_{CC} = 0V to 12V, PWM duty = 100%, DIR = high



Shutdown through VCC

V_{CC} = 12V to 0V, PWM duty = 100%, DIR = high



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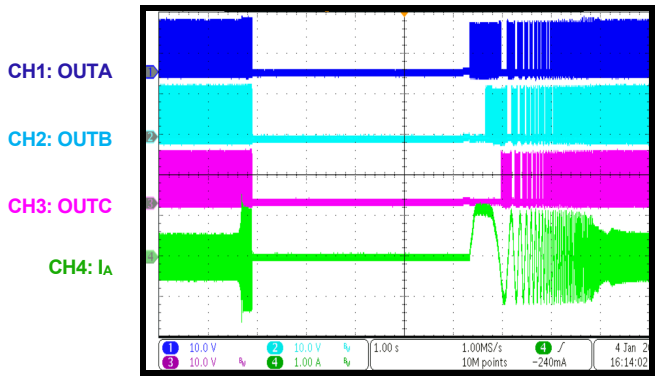
EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board. V_{IN} = 12V, PWM frequency = 20kHz, T_A = 25°C, unless otherwise noted.

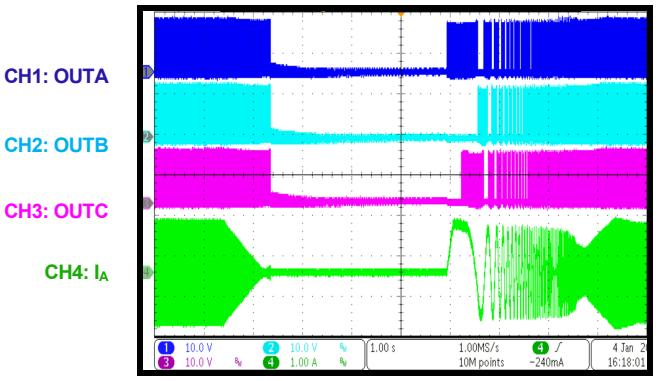
Rotor Lock and Retry

PWM duty = 50%, lock rotor then release



Direction Change

PWM duty = 100%, DIR = low to high



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PCB LAYOUT

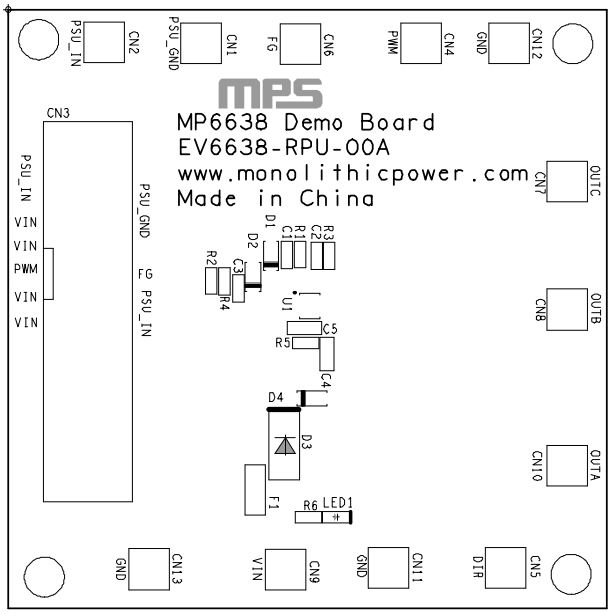

Figure 6: Top Silk

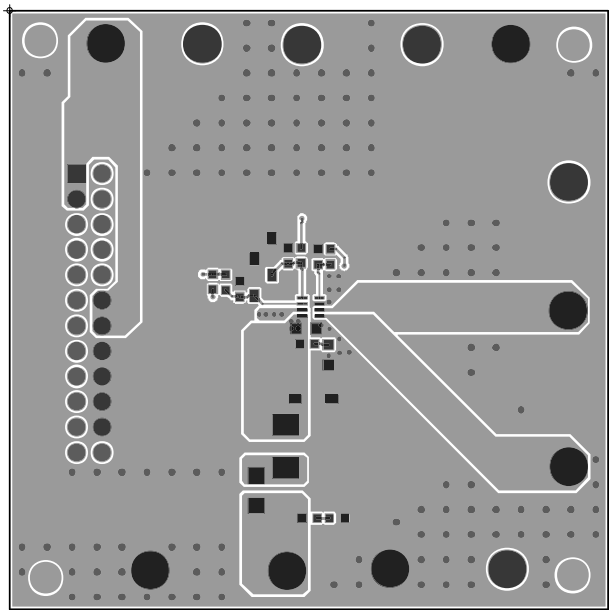

Figure 7: Top Layer

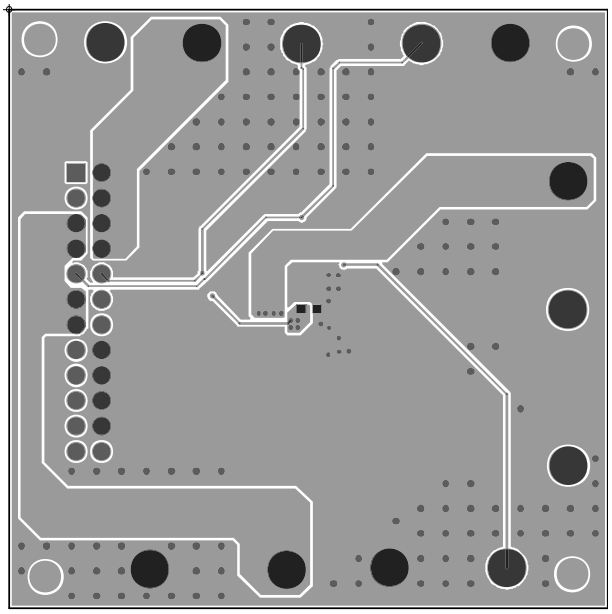

Figure 8: Bottom Layer

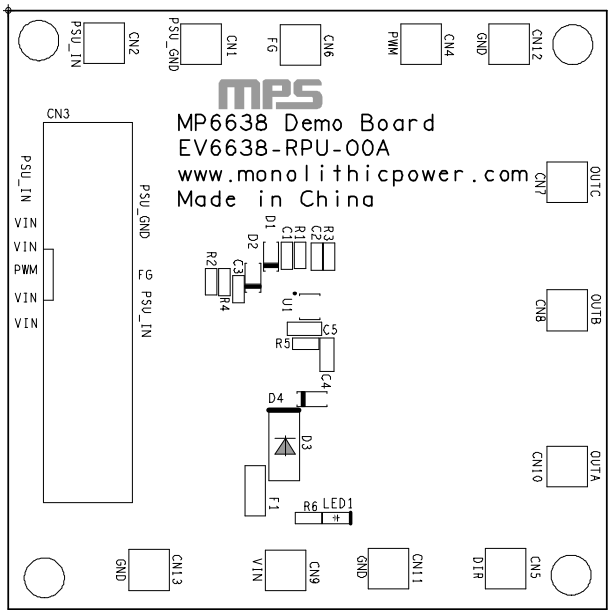

Figure 9: Bottom Silk

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REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	5/31/2024	Initial Release	-

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