



EVQ6634-LTE-00A

35V, 2A Peak, 3-Phase, Sensorless BLDC Motor Driver Evaluation Board, AEC-Q100 Qualified

DESCRIPTION

The EVQ6634-LTE-00A is an evaluation board designed to demonstrate the capabilities of the MPQ6634, a 3-phase, sensorless brushless DC (BLDC) motor driver with integrated power MOSFETs. The MPQ6634 provides sensorless field-oriented control (FOC) to achieve improved efficiency and low vibration with up to 2A of peak current. The input voltage (V_{IN}) range is between 4.5V and 35V.

The MPQ6634 controls the motor speed through the pulse-width modulation (PWM) signal with a 50Hz to 20kHz PWM input frequency. The device supports DC input speed control. It also provides closed-/open-loop speed control and a built-in configurable speed curve function.

The MPQ6634 provides rotational speed detection. The rotational speed detector (the FG/RD pin) is an open-drain output. In addition to rotation speed detection, the direction is controlled via the DIR pin input.

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

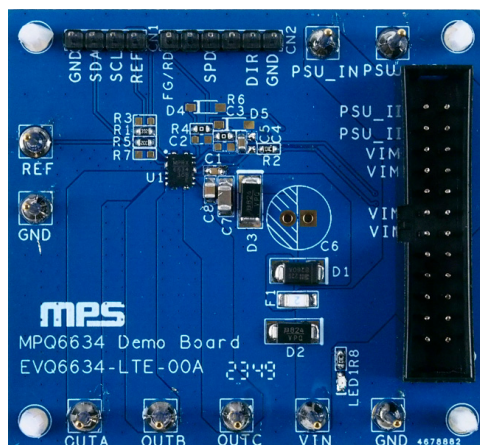
The MPQ6634 is available in a TQFN-12 (3mmx4mm) package with wettable flanks, and it is available in AEC-Q100 Grade 1.

PERFORMANCE SUMMARY

Specifications are at $T_A = 25^\circ\text{C}$, unless otherwise noted.

Parameters	Conditions	Value
Input voltage (V_{IN}) range		4.5V to 35V
Peak phase current		Maximum 2A
Input PWM frequency	Configured to pulse-width modulation (PWM) mode	50Hz to 20kHz
PWM voltage range	Configured to DC mode	0V to 3.3V
Switching frequency (f_{sw})		24kHz

EVQ6634-LTE-00A EVALUATION BOARD



LxWxH (6cmx5.5cmx2.2cm)

Board Number	MPS IC Number
EVQ6634-LTE-00A	MPQ6634GLTE-0000-AEC1

QUICK START GUIDE

Quick Start Using the Communication Kit (MPS Fan Driver Communication Kit)

1. Preset the DC power supply, then turn the power supply off.
2. Connect the power supply outputs to PSU_IN and PSU_GND (see Figure 1).
3. Connect the communication kit to the EVQ6634-LTE-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 the power supply on.
7. Run the MPS BLDC Virtual Bench GUI and select the MPQ6634. ⁽¹⁾
8. Figure 1 shows the equipment set-up with the communication kit.

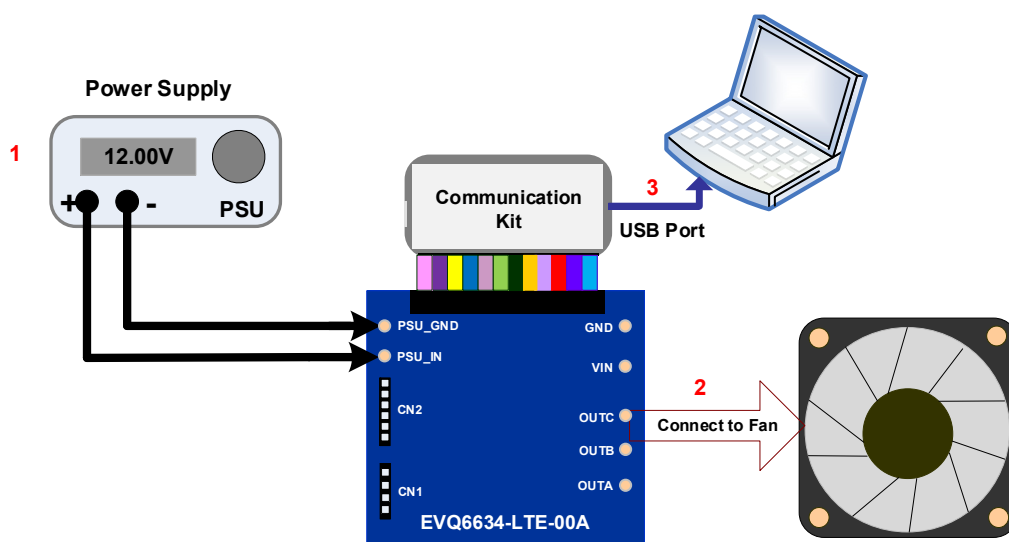


Figure 1: EVB Connection with the Communication Kit

Note:

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

Quick Start without the Communication Kit

1. Ensure that the IC code is the configured code based on the fan to be tested.
2. Connect the power supply's output terminals to VIN and GND.
3. Connect the motor phase terminals to:
 - a. Motor phase A: OUTA
 - b. Motor phase B: OUTB
 - c. Motor phase C: OUTC

4. Turn the power supply on. The motor should begin working.
5. 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 control the motor's speed.
6. Figure 2 shows the equipment set-up without the communication kit.

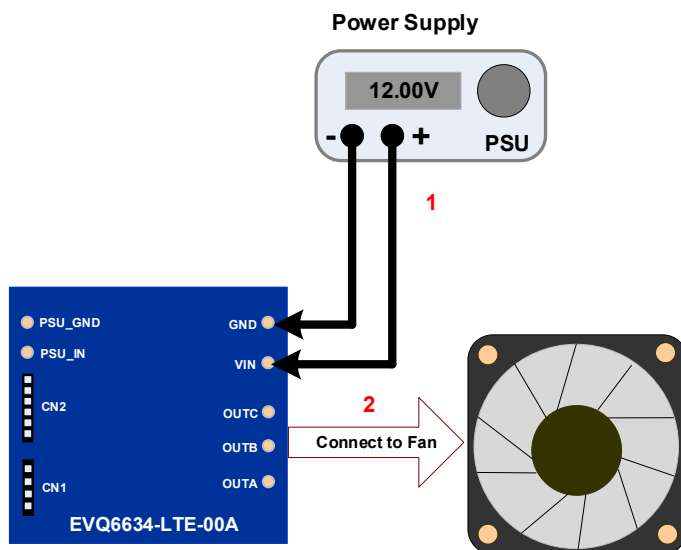


Figure 2: EVB Connection without the Communication Kit

Measurement of Motor Parameters

The motor phase resistance and phase inductance are two important parameters for sensorless field-oriented control (FOC). The motor phase resistance or inductance refers to the resistance or inductance from the phase output to the center tap.

To determine the phase resistance, measure the resistance between the two-phase terminals via the multimeter or LCR meter, then divide the resistance by two.

To determine the phase inductance, measure the inductance between the two-phase terminals via the LCR meter, then divide the inductance by two. The LCR frequency is 1kHz, and the LCR voltage is 1V.

GUI Operation Guide

1. Install the MPS BLDC Virtual Bench GUI.
2. Start up the GUI software, then click “Select Chip” (see Figure 3).

BLDC Motor and Fan Driver Virtual Test Bench

Version 1.0.15.23 [Build: 2023-12-18]



USB Kit Connected.

Make sure both KIT and EVB BOARD are reset every time before restarting GUI.

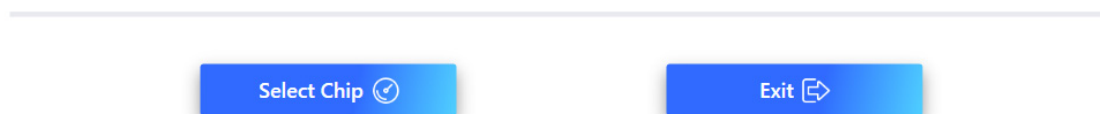


Figure 3: Select Chip

3. Click “Details” on the bottom-right corner to enter the test mode (see Figure 4).

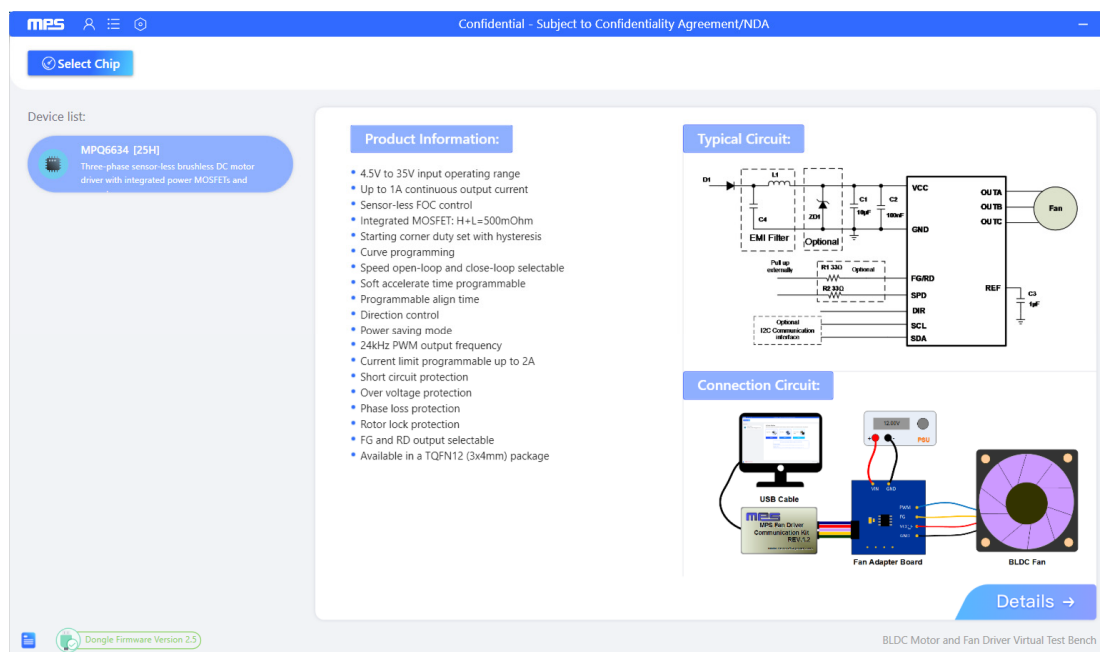


Figure 4: Enter the Test Mode

EVALUATION BOARD SCHEMATIC

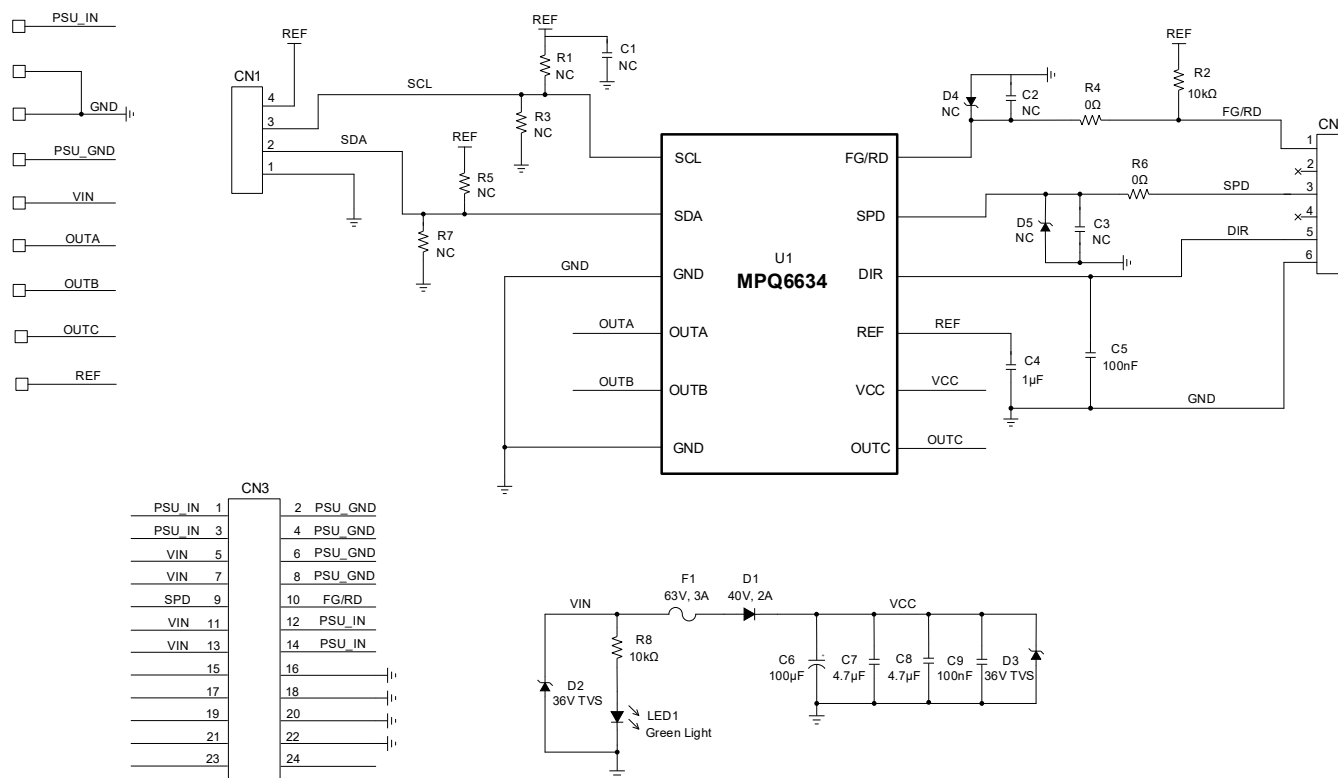


Figure 5: Evaluation Board Schematic

EVQ6634-LTE-00A BILL OF MATERIALS

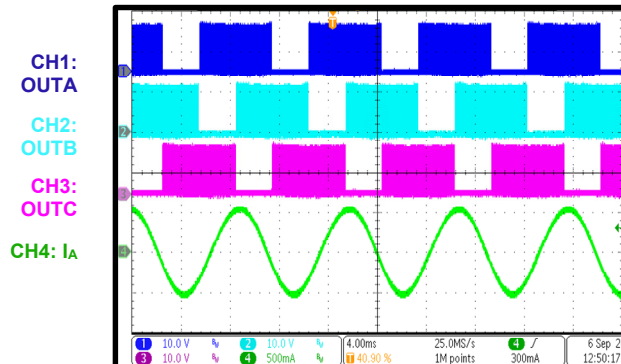
Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
2	CN1, CN2	2.54mm	Connector, 1 x 40-pin	DIP	Any	
1	CN3	2.54mm	Socket with frame, 180°, 2 x 12-pin	DIP	Any	
1	C1	1µF	Ceramic capacitor, 16V, X7R	0603	Wurth	885012206052
1	C5	100nF	Ceramic capacitor, 16V, X7R	0603	Murata	GRM188R71C104KA01D
1	C7	4.7µF	Ceramic capacitor, 50V, X7R	1206	TDK	C3216X7R1H475K
1	C8	4.7µF	Ceramic capacitor, 50V, X5R	0805	Murata	GRM21BR61H475KE51L
1	C9	100nF	Ceramic capacitor, 50V, X7R	0603	Murata	GRM188R71H104KA93D
1	D1	2A	Schottky diode, 60V	SMA	Diodes, Inc.	B260A-13-F
2	D2, D3	36V	TVS diode	DO-214AC	Bourns	SMAJ36CA-Q
1	F1	2A	Surface-mount fuse, 63V	1206	Cooper Bussmann	3216FF2-R
9	VIN, REF, PSU_IN, OUTA, OUTB, OUTC, GND1, GND2, PSU_GND	1mm	Connector	DIP	Any	
1	LED1	Green	Green LED	0603	Baihong	BL-HGE36A-AV-TRB
2	R1, R5	3.3kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-073K3L
2	R2, R8	10kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0710KL
2	R4, R6	0Ω	Film resistor, 1%	0603	Yageo	RC0603FR-070RL
1	U1	MPQ6634	35V, 2A peak, 3-phase sensorless BLDC motor driver, AEC-Q100 qualified	TQFN-12 (3mmx4mm)	MPS	MPQ6634GLTE-0000-AEC1

EVB TEST RESULTS

Performance waveforms are tested on the evaluation board. $V_{IN} = 12V$, PWM input frequency = 100Hz, load = seat fan, unless otherwise noted.

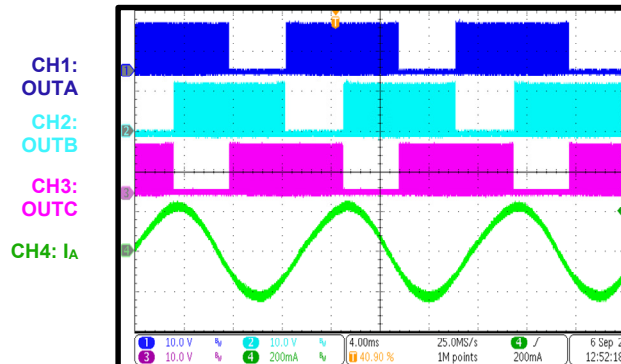
Steady State

PWM duty = 100%, DIR = low



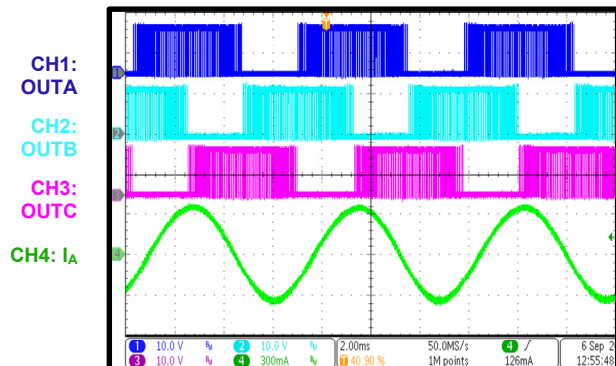
Steady State

PWM duty = 50%, DIR = low



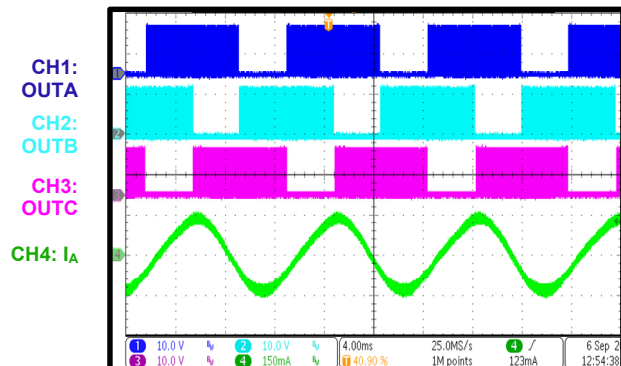
Steady State

PWM duty = 100%, DIR = high



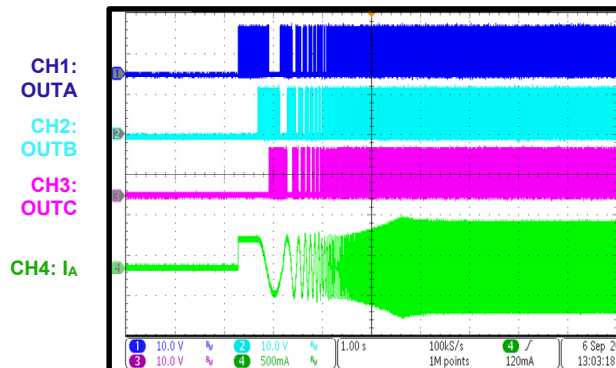
Steady State

PWM duty = 50%, DIR = high



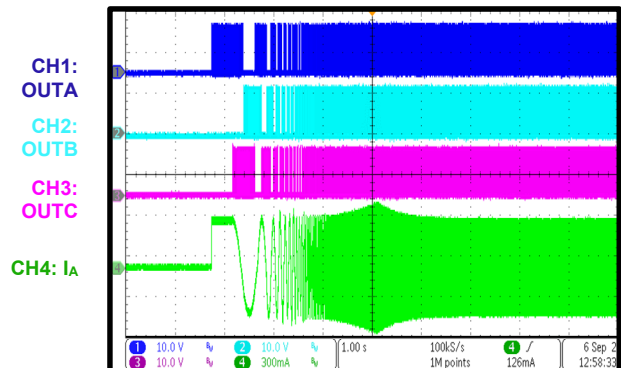
PWM On

PWM duty = 0% to 100%, DIR = low



PWM On

PWM duty = 0% to 100%, DIR = high

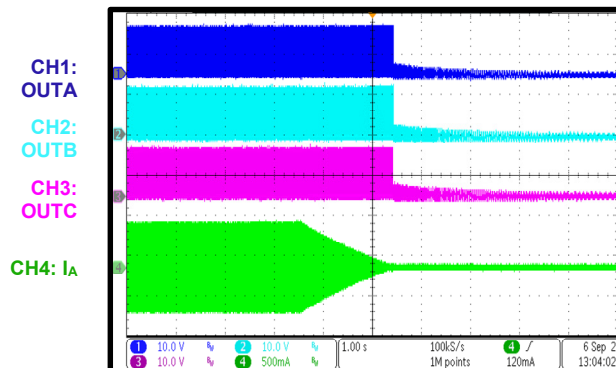


EVb TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board. $V_{IN} = 12V$, PWM input frequency = 100Hz, load = seat fan, unless otherwise noted.

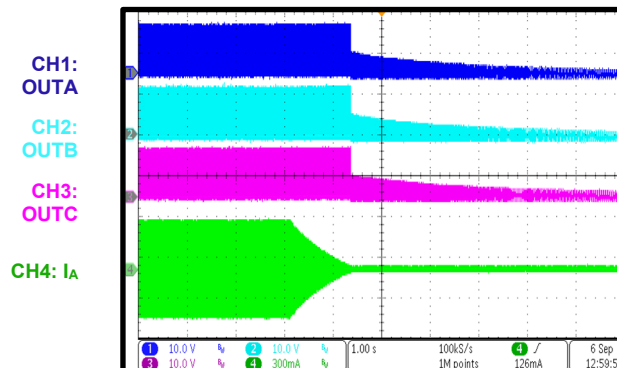
PWM Off

PWM duty = 100% to 0%, DIR = low



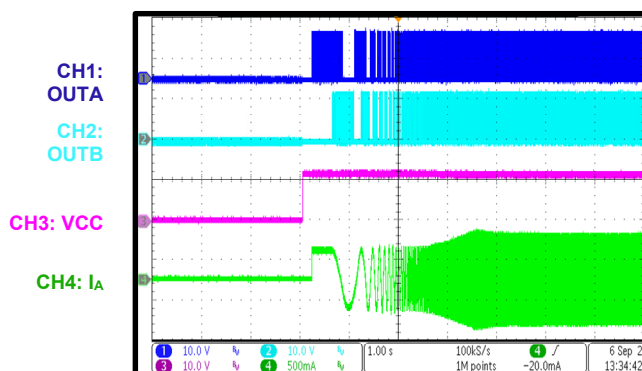
PWM Off

PWM duty = 100% to 0%, DIR = high



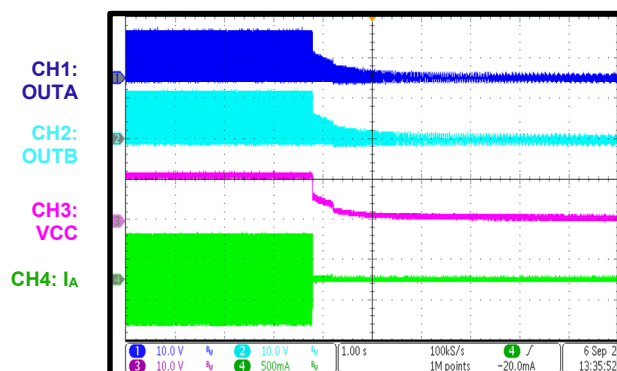
Start-Up through VCC

VCC = 0V to 12V, PWM duty = 100%, DIR = low



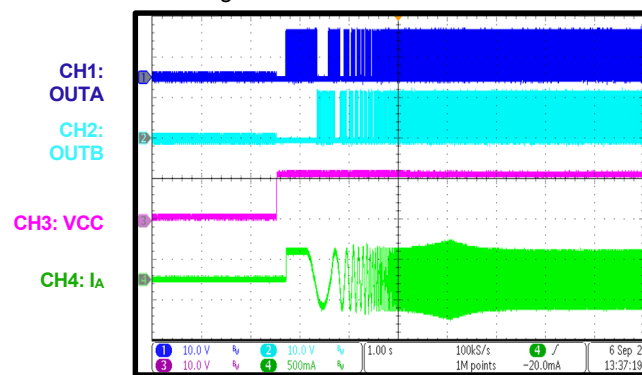
Shutdown through VCC

VCC = 12V to 0V, PWM duty = 100%, DIR = low



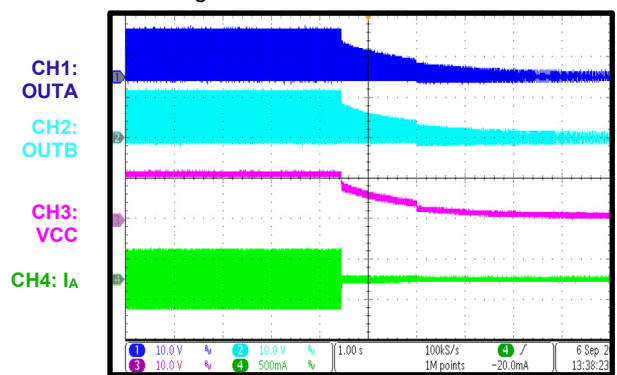
Start-Up through VCC

VCC = 0V to 12V, PWM duty = 100%, DIR = high



Shutdown through VCC

VCC = 12V to 0V, PWM duty = 100%, DIR = high

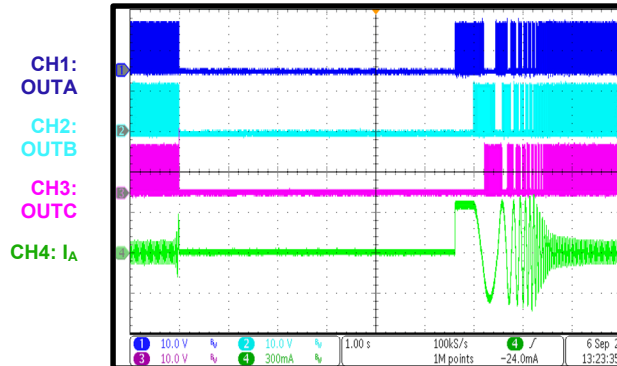


EVb TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board. $V_{IN} = 12V$, PWM input frequency = 100Hz, load = seat fan, unless otherwise noted.

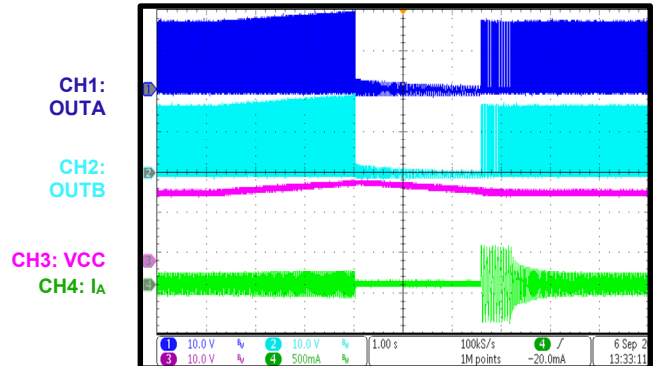
Rotor Lock and Retry

PWM duty = 20%, enable RD_MODE1 and RD_MODE2



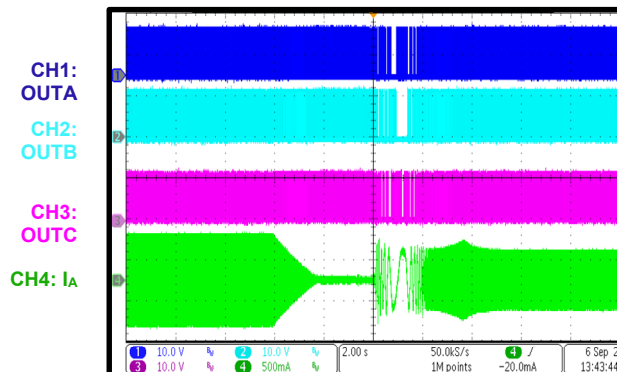
Over-Voltage Protection

PWM duty = 20%, UIN_SEL = 0



Direction Change

PWM duty = 100%, enable soft shutdown, DIR = low to high



PCB LAYOUT

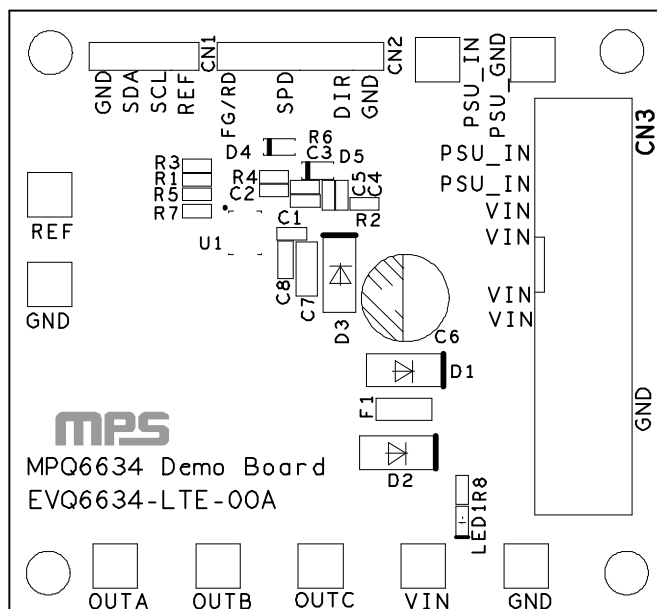


Figure 6: Top Silk

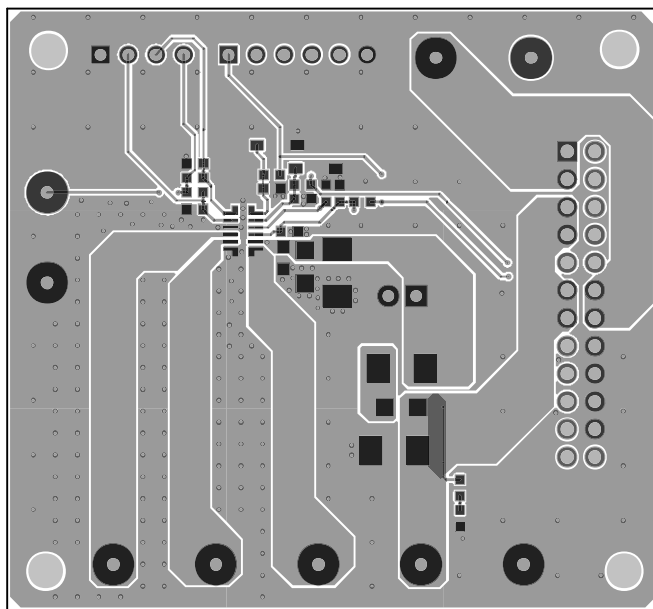


Figure 7: Top Layer

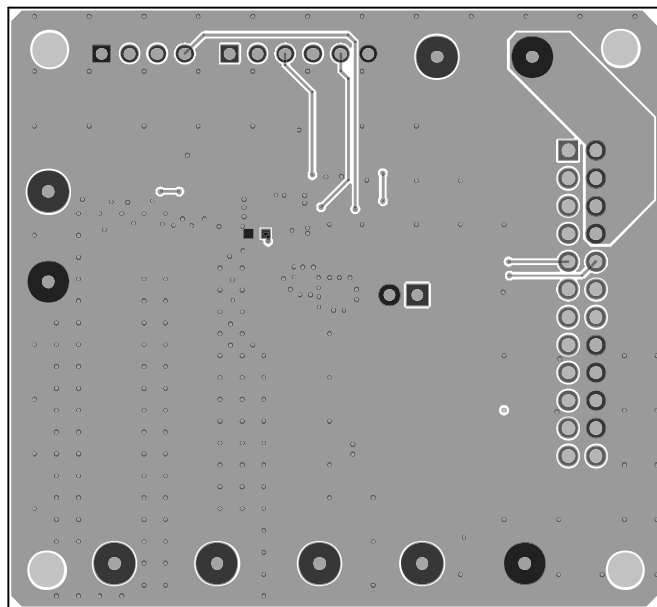


Figure 8: Bottom Layer

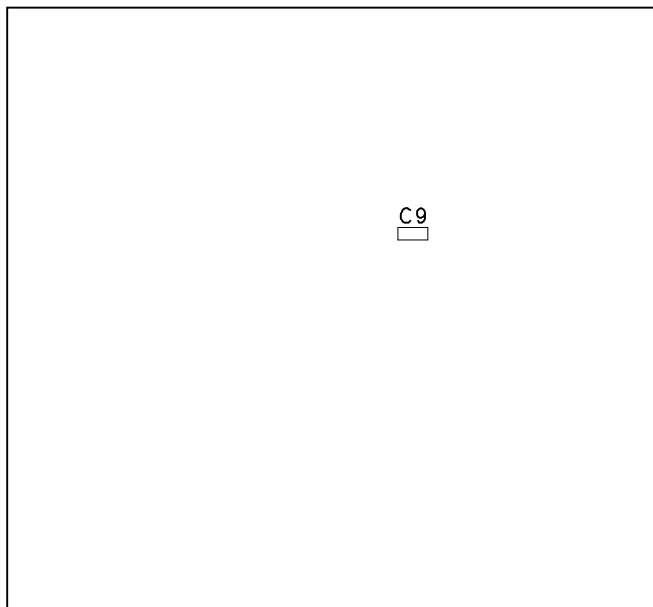


Figure 9: Bottom Silk



REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	3/19/2024	Initial Release	-

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