EV6539C-V-00A

80V, Three-Phase BLDC Motor Pre-Driver Evaluation Board

DESCRIPTION

The EV6539C-V-00A is an evaluation board designed to demonstrate the capabilities of the MP6539C, a 3-phase brushless DC (BLDC) motor pre-driver.

The MP6539C is capable of driving three half-bridges consisting of 6 N-channel power MOSFETs, up to 80V. The MP6539C uses a bootstrap (BST) capacitor (C_{BST}) to generate a supply voltage for the high-side MOSFET (HS-FET) driver. An internal charge pump maintains the high-side (HS) gate drive if the output is held high for an extended period.

Internal safety features include shoot-through protection, adjustable dead-time (DT) control, under-voltage lockout (UVLO), and thermal shutdown.

The driving control signals are generated by the external controller, such as the microcontroller unit (MCU) or field-programmable gate array (FPGA).

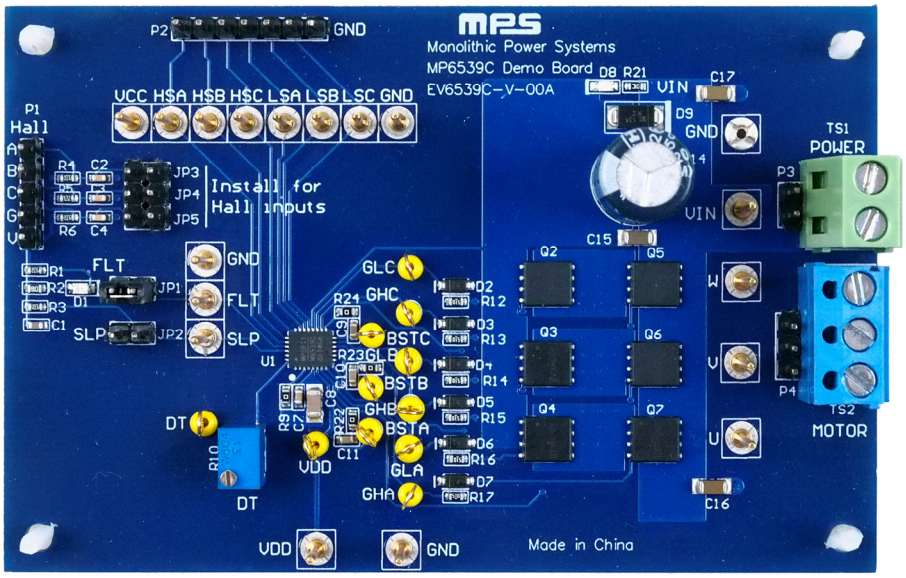
The MP6539C is available in a QFN-28 (4mmx5mm) package with an exposed thermal pad.

PERFORMANCE SUMMARY

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

Parameters	Conditions	Value
Driver power supply voltage (V_{DD}) range		8.5V to 14V
Input power supply voltage (V_{IN}) range		8V to 80V
Logic input voltage (V_{CC})		3.3V or 5V
Gate driver maximum source current	V_{DD} = 12V	0.8A
Gate driver maximum sink current	V_{DD} = 12V	1A

EV6539C-V-00A EVALUATION BOARD



LxWxH (11.7cmx7.8cmx1cm)

Board Number	MPS IC Number
EV6539C-V-00A	MP6539CGV

QUICK START GUIDE

1. Connect the VDD voltage (8.5V ≤ V_{DD} ≤ 14V) and input ground to the VDD and GND connectors, respectively.
2. Connect the input voltage (8V ≤ V_{IN} ≤ 80V) and input ground to the VIN and GND connectors, respectively.
3. Connect the VCC voltage (V_{CC} = 3.3V or 5V) and input ground to the “V” and “G” terminal of the P1 connector, respectively.
4. Connect the driving control signals (HSx and LSx) (where x = A, B, or C) generated by the external controller to the P2 connector.

   Table 1 shows the input logic for HSx and LSx.

Table 1: Input Logic for HSx and LSx

LSx	HSx	SHx
Low	Low	Hi-Z
Low	High	VIN
High	Low	GND
High	High	Hi-Z

5. Figure 1 shows the measurement equipment set-up.

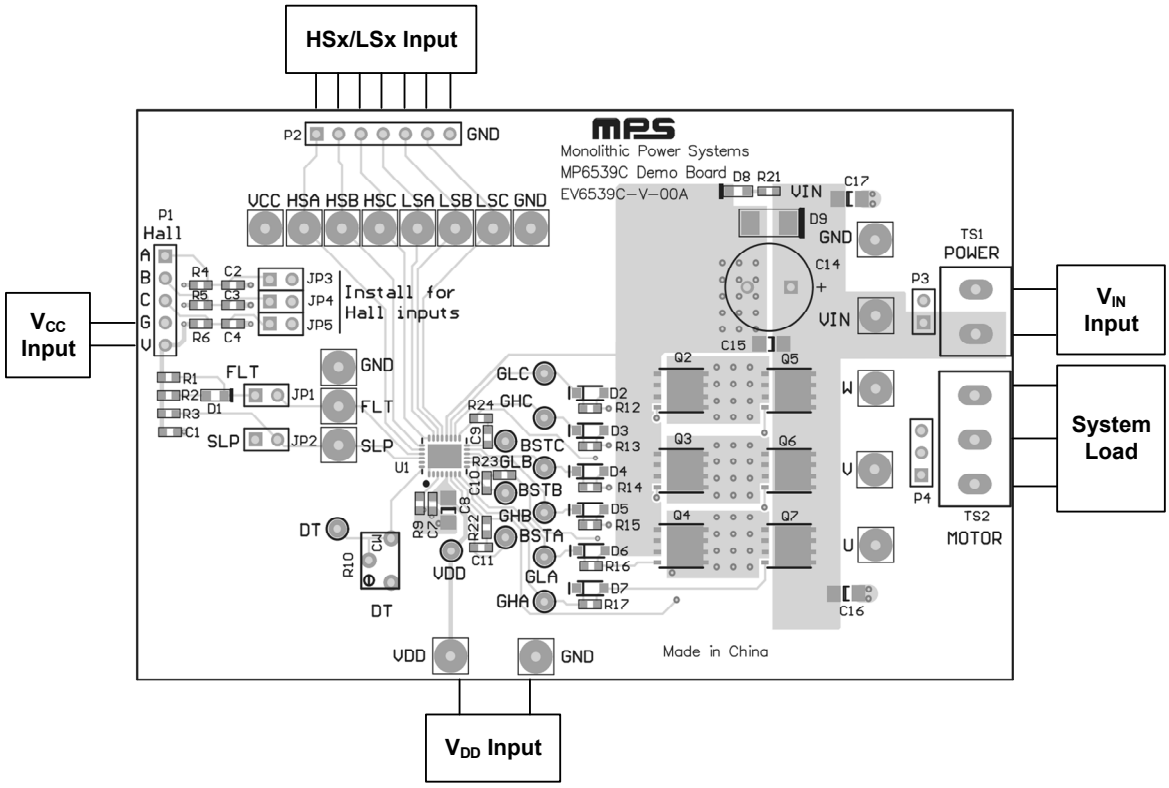


Figure 1: Measurement Equipment Set-Up

EVALUATION BOARD SCHEMATIC

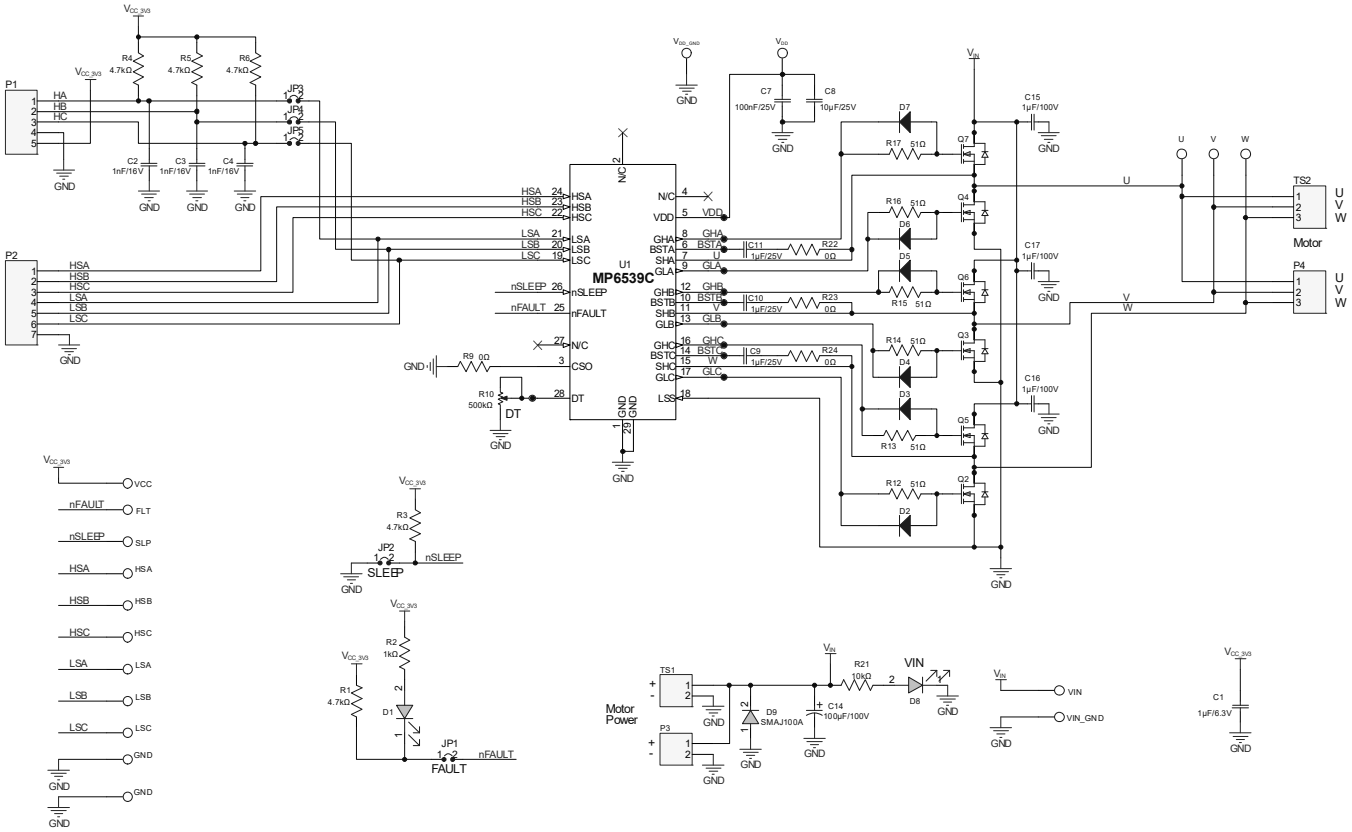


Figure 2: Evaluation Board Schematic

EV6539C-V-00A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
1	C1	1μF	Ceramic capacitor, 6.3V, X5R	0603	Murata	GRM188R60J105KA01D
3	C2, C3, C4	1nF	Ceramic capacitor, 16V, X7R	0603	Wurth	885012206034
1	C7	100nF	Ceramic capacitor, 25V, X7R	0603	Wurth	885012206071
1	C8	10μF	Ceramic capacitor, 25V, X7R	1206	Murata	GRM31CR71E106KA12
3	C9, C10, C11	1μF	Ceramic capacitor, 25V, X7R	0603	Murata	GRM188R71E105KA12D
1	C14	100μF	Electrolytic capacitor, 100V	DIP	Jianghai	CD263-100V100
3	C15, C16, C17	1μF	Ceramic capacitor, 100V, X7R	1206	Murata	GRM31CR72A105KA01L
5	R1, R3, R4, R5, R6	4.7kΩ	Film resistor ,1%	0603	Yageo	RC0603FR-074K7L
1	R2	1kΩ	Film resistor ,1%	0603	Yageo	RC0603FR-071KL
4	R9, R22, R23, R24	0Ω	Film resistor ,1%	0603	Yageo	RC0603FR-070RL
1	R10	500kΩ	Adjustable resistor	DIP	Bourns	3266W-1-504LF
6	R12, R13, R14, R15, R16, R17	51Ω	Film resistor, 1%	0603	Yageo	RC0603FR-0751RL
1	R21	10kΩ	Film resistor ,1%	0603	Yageo	RC0603FR-0710KL
2	D1, D8	0.1W	Green LED	0805	Baihong	BL-HGE35A-AV-TRB
6	D2, D3, D4, D5, D6, D7	0.15A	Schottky diode, 75V	SOD-123	Diodes, Inc.	1N4148W
1	D9	2.5A	TVS diode, 100V	SMA	Diodes, Inc.	SMAJ100A
6	Q2, Q3, Q4, Q5, Q6, Q7	8.3A	N-channel MOSFET, 150V, 48mΩ, Q_G = 58nC	DFN5*6-8L	Analog Power	AM7490N-T1-PF
1	P1	2.54mm	Header, 5-pin	DIP	Any	
1	P2	2.54mm	Header, 7-pin	DIP	Any	
1	P3	2.54mm	Header, 2-pin	DIP	Any	
1	P4	2.54mm	Header, 3-pin	DIP	Any	
1	TS1	5mm	Header, 2-pin	DIP	KEFA	KF128-5.0-02P
1	TS2	5mm	Header, 3-pin	DIP	Wurth	691101710003
5	JP1, JP2, JP3, JP4, JP5	2.54mm	Header, 2-pin	DIP	Any	
1	JP1	2.54mm	Short jumper	2.54mm	Any	
18	HSA, HSB, HSC, LSA, LSB, LSC, VCC, VDD, VIN, FLT, SLP, U, V, W, 4 x GND	1mm	Male needle	DIP	Any	

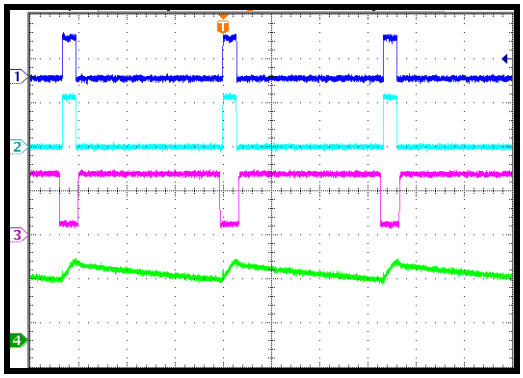
EV6539C-V-00A BILL OF MATERIALS *(continued)*

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
11	DT, VDD, BSTA, BSTB, BSTC, GLA, GLB, GLC, GHA, GHB, GHC	1mm	Test point	DIP	Any	
1	U1	MP6539C	80V, three-phase BLDC motor pre-driver	QFN-28 (4mmx 5mm)	MPS	MP6539CGV

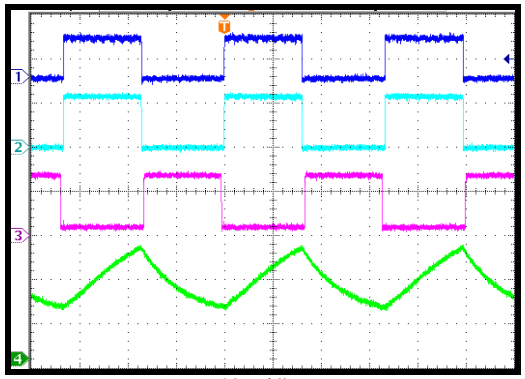
EVB TEST RESULTS

V_{IN} = 48V, V_{DD} = 12V, phase A switching, phase B's LS gate drive on, f_{PWMA} = 30kHz, T_A = 25°C, resistor + inductor load: 5Ω + 1mH/phase with a star connection, unless otherwise noted.

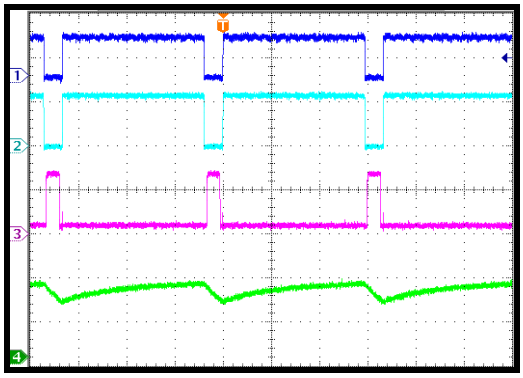
Steady State
Duty cycle = 10%



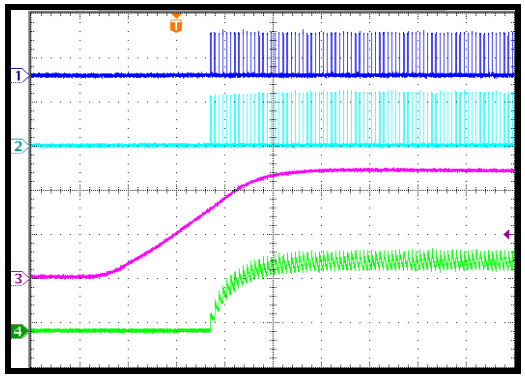
Steady State
Duty cycle = 50%



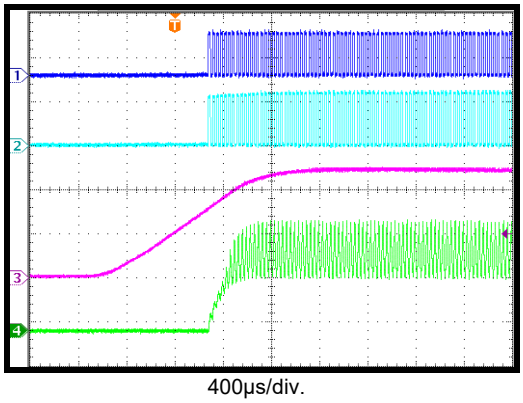
Steady State
Duty cycle = 90%



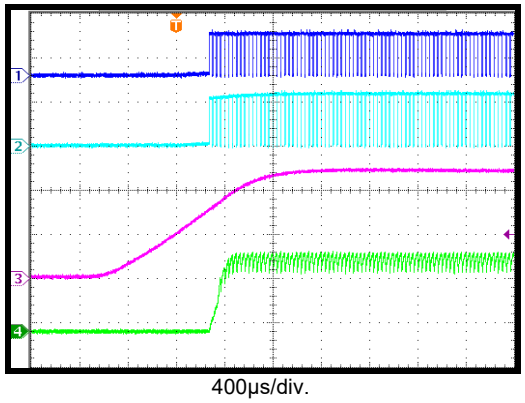
Power Ramping Up
Duty cycle = 10%



Power Ramping Up
Duty cycle = 50%



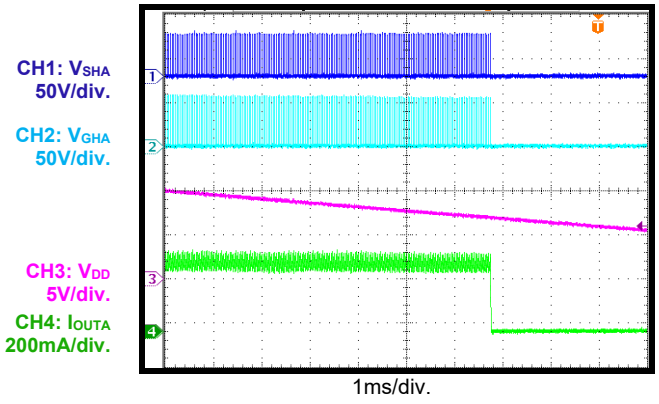
Power Ramping Up
Duty cycle = 90%



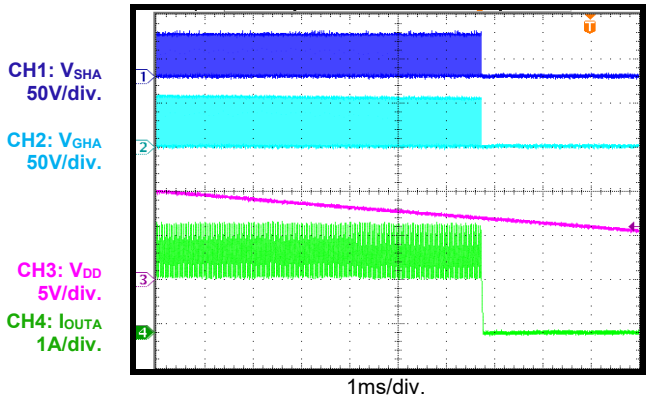
EVB TEST RESULTS *(continued)*

V_{IN} = 48V, V_{DD} = 12V, phase A switching, phase B's LS gate drive on, f_{PWMA} = 30kHz, T_A = 25°C, resistor + inductor load: 5Ω + 1mH/phase with a star connection, unless otherwise noted.

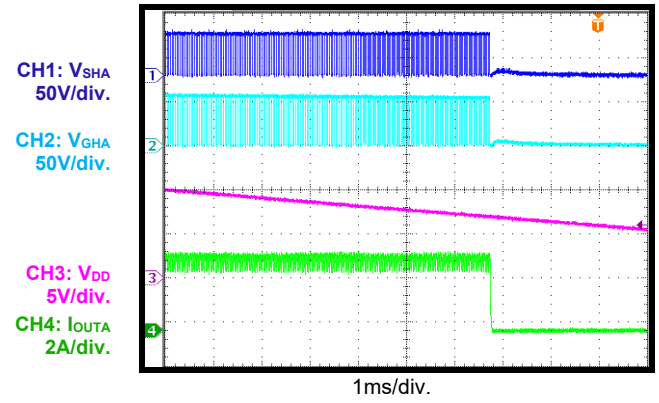
Power Ramping Down
Duty cycle = 10%



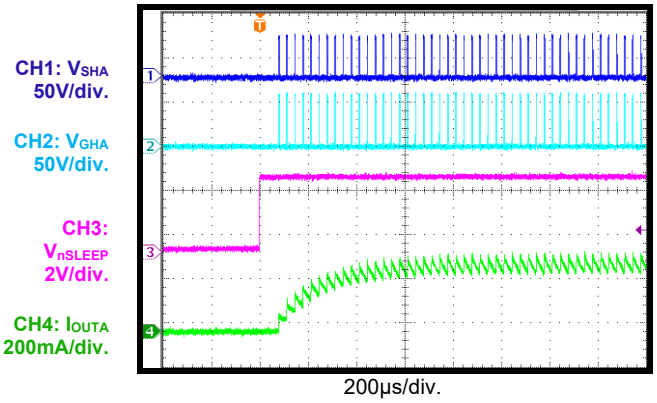
Power Ramping Down
Duty cycle = 50%



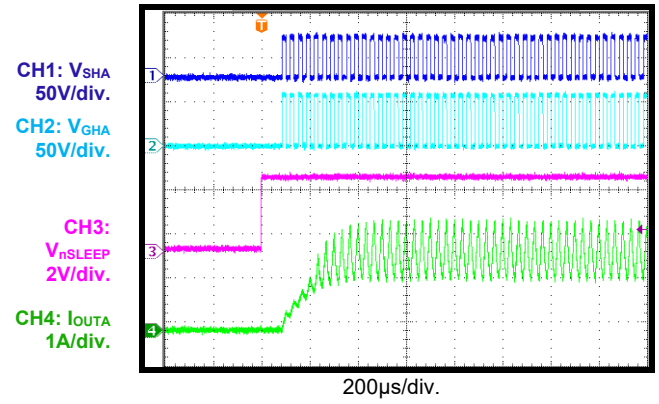
Power Ramping Down
Duty cycle = 90%



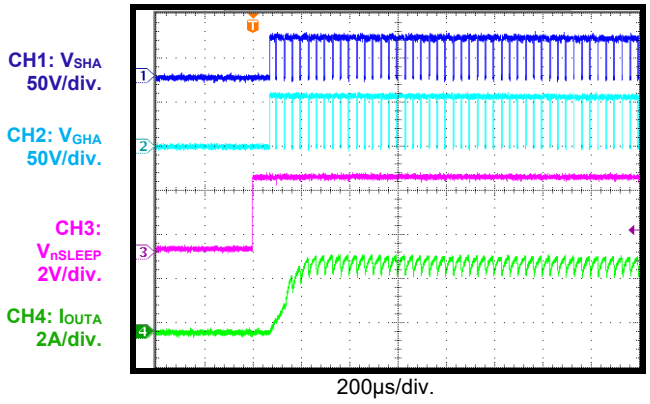
Sleep Recovery
Duty cycle = 10%



Sleep Recovery
Duty cycle = 50%



Sleep Recovery
Duty cycle = 90%

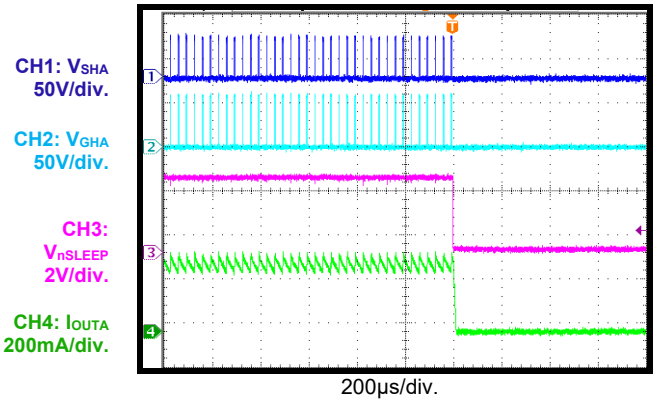


EVB TEST RESULTS *(continued)*

V_{IN} = 48V, V_{DD} = 12V, phase A switching, phase B's LS gate drive on, f_{PWMA} = 30kHz, T_A = 25°C, resistor + inductor load: 5Ω + 1mH/phase with a star connection, unless otherwise noted.

Sleep Entry

Duty cycle = 10%



Sleep Entry

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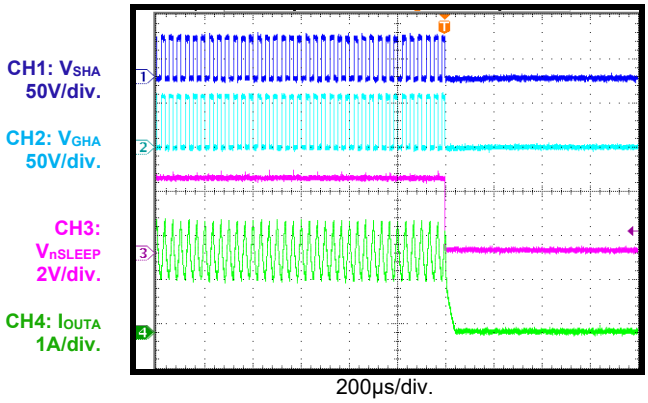
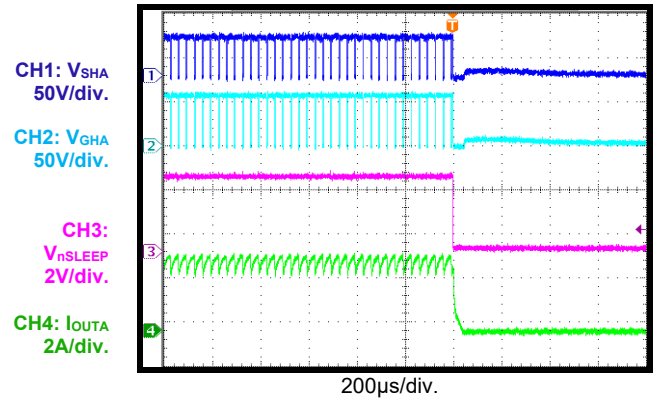


Sleep Entry

Duty cycle = 90%



PCB LAYOUT

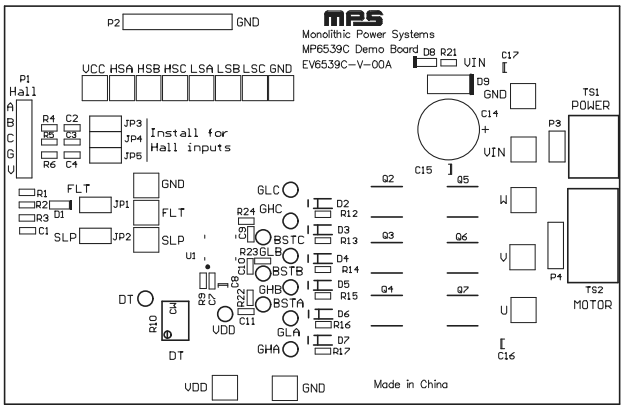


Figure 3: Top Silk

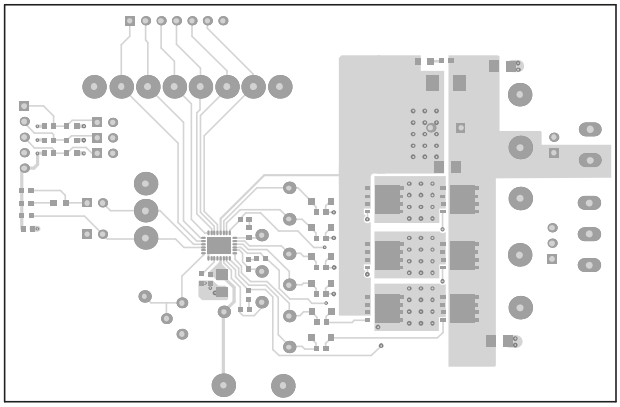


Figure 4: Top Layer

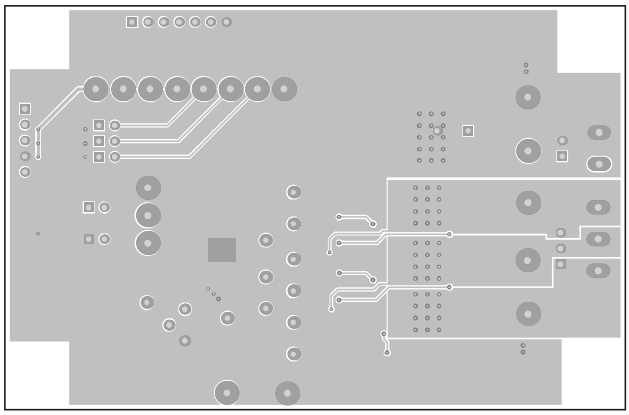


Figure 5: Bottom Layer

REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	4/18/2024	Initial Release	-