EVQ6615-QK-00A

40V, 8A, H-Bridge DC Motor Driver Evaluation Board, AEC-Q100 Qualified

DESCRIPTION

The EVQ6615-QK-00A is an evaluation board designed to demonstrate the capabilities of the MPQ6615-AEC1, an H-bridge DC motor driver.

The MPQ6615-AEC1 operates from an input voltage (V_{IN}) up to 40V. The H-bridge consists of four N-channel power MOSFETs. The internal charge pump generates the gate driver test2supply voltages for the high-side MOSFETs (HS-FETs), and a trickle charge circuit maintains sufficient gate driver voltages for 100% duty cycle operation.

The current flowing through the two Sx outputs is sensed by the internal current-sensing circuits. Each phase has an output pin (SOx) that sources or sinks a current proportional to each phase's output current (I_{OUT}). Only the current flowing through the low-side MOSFET (LS-FET) is sensed. This current is sensed in both the forward and reverse directions.

Internal safety features include over-current protection (OCP), under-voltage lockout (UVLO) protection, and thermal shutdown.

The input control signals for the MPQ6615-AEC1 are applied through the connector on the board.

The MPQ6615-AEC1 is designed to drive brushed DC motors, door lock and latch motors, and seat actuators. The MPQ6615-AEC1 is available in a TQFN-26 (6mmx6mm) package with wettable flanks, and it is AEC-Q100 qualified.

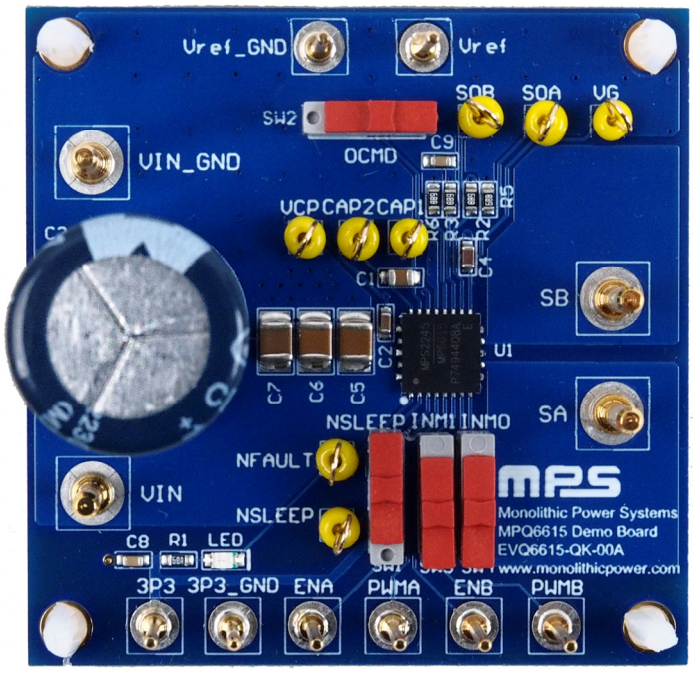
PERFORMANCE SUMMARY

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

Parameters	Conditions	Value
Input power voltage (V_{IN}) range		4.75V to 40V
Maximum continuous output current (I_{OUT})		8A
VREF voltage (V_{REF})		3.3V or 5V

MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.

EVQ6615-QK-00A EVALUATION BOARD



LxWxH (5.08cmx5.08cmx4.2cm)

Board Number	MPS IC Number
EVQ6615-QK-00A	MPQ6615GQKTE-AEC1

MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.

QUICK START GUIDE

The EVQ6615-QK-00A evaluation board is easy to set up and use to evaluate the performance of the MPQ6615-AEC1. For proper measurement equipment set-up, refer to Figure 1 on page 4 and follow the steps below:

1. Connect the input voltage (4.75V ≤ V_{IN} ≤ 40V) and input ground to the VIN and VIN_GND connectors, respectively.
2. Connect the 3P3 voltage (V_{3P3} = 3.3V or 5V) and input ground to the 3P3 and 3P3_GND connectors, respectively.
3. Set the SW1 pin to position 1 (top side) to enable the chip.
4. To set the current-sense output reference voltage, connect the VREF voltage (V_{REF} = 3.3V or 5V) and input ground to the VREF connector and VREF_GND connectors, respectively.
5. Select the over-current protection (OCP) mode and input mode via the SW2 pin (see Table 1).

Table 1: Selecting the OCP Mode (Set via SW2)

OCMD	OCP Mode
Open or drive logic high	Retry
GND	Latch off

6. Set the input mode via SW3 and SW4 (see Table 2, Table 3, and Table 4).

Table 2: Input Logic for INM[1:0] = 00 (Set via SW3 and SW4)

ENx	PWMx	Sx
High	High	V_{IN}
High	Low	GND
Low	High or low	Hi-Z

Table 3: Input Logic for INM[1:0] = 01 (Set via SW3 and SW4)

ENBL	DIR	BRK	BMOD	SA	SB
Low	High or low	High or low	High or low	Hi-Z	Hi-Z
High	High or low	High	Low	GND	GND
High	High or low	High	High	V_{IN}	V_{IN}
High	Low	Low	High or low	GND	V_{IN}
High	High	Low	High or low	V_{IN}	GND

Table 4: Input Logic for INM[1:0] = 10 (Set via SW3 and SW4)

INHx	INLx	Sx
Low	Low	Hi-Z
Low	High	GND
High	Low	V_{IN}
High	High	Hi-Z

7. Attach the input control signals generated by the external controller to the ENx and PWMx connectors.

MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.

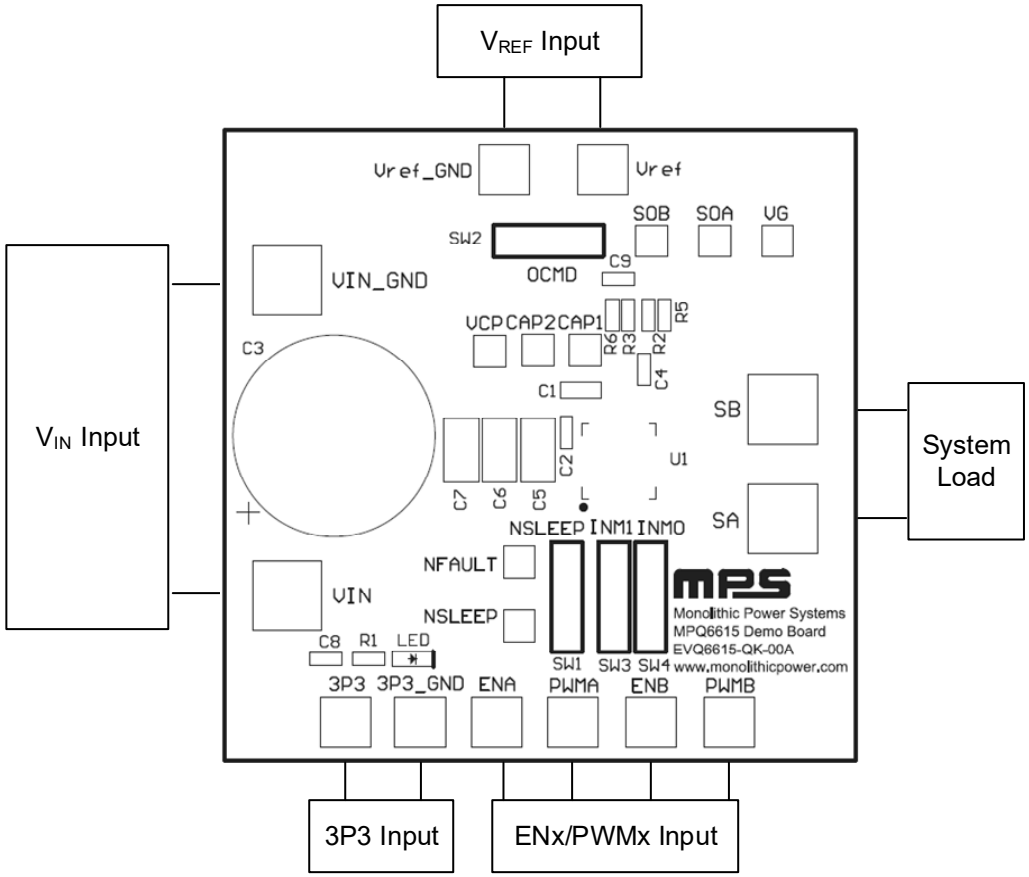


Figure 1: Measurement Equipment Set-Up for the MPQ6615GQKTE-AEC1

MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.

EVALUATION BOARD SCHEMATIC

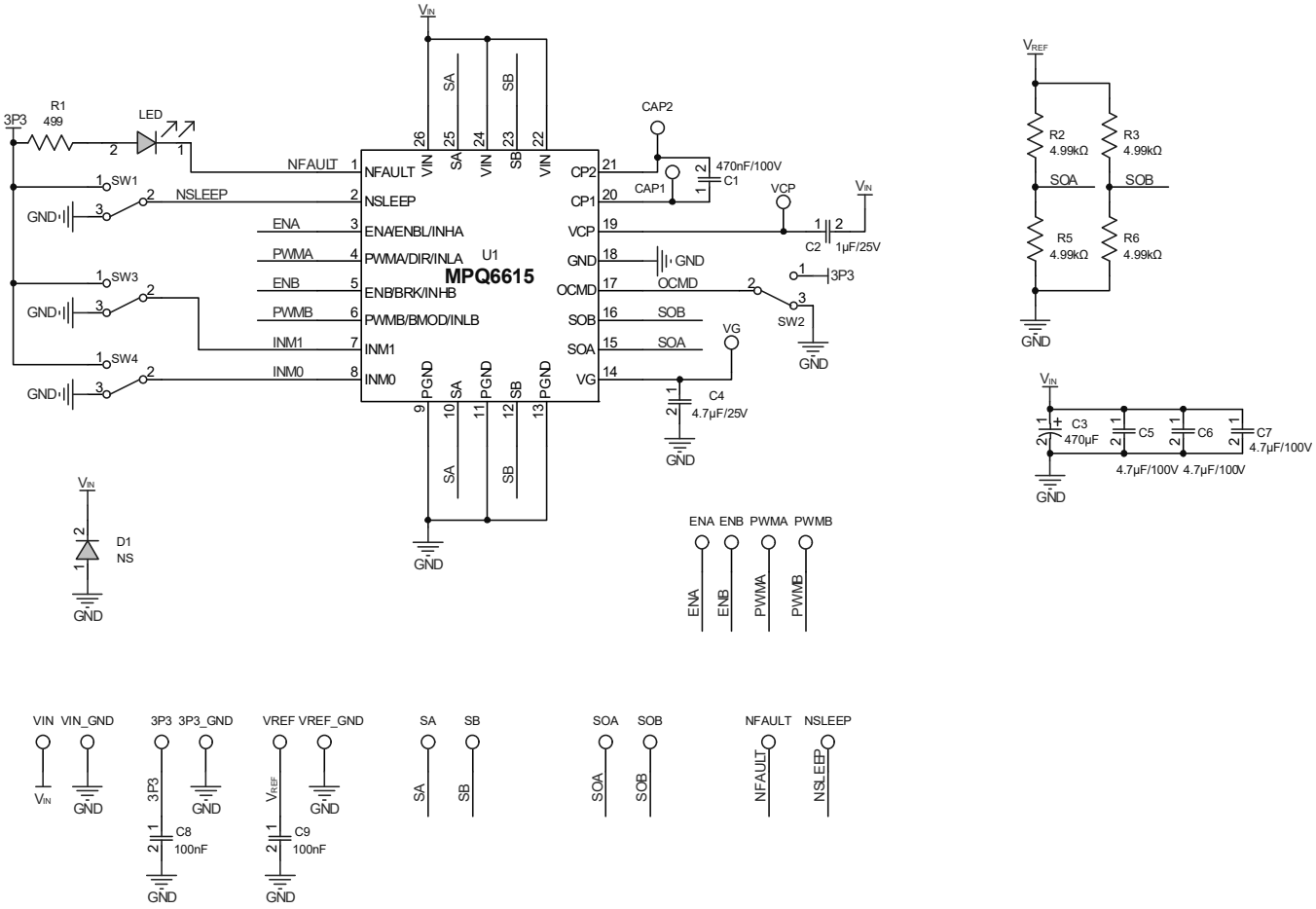


Figure 2: Evaluation Board Schematic

MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.

EVQ6615-QK-00A BILL OF MATERIALS

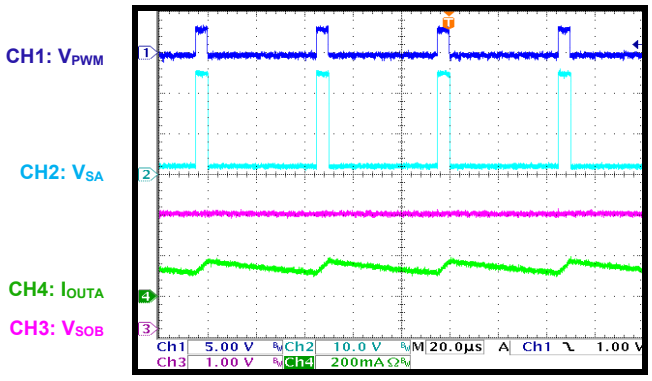
Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
1	R1	499	Film resistor, 1%	0603	Yageo	RC0603FR-07499RL
4	R2, R3, R5, R6	4.99kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-074K99L
1	C1	470nF	Ceramic capacitor, 100V, X7R	0805	Murata	GRM21BR72A474KA73L
1	C2	1μF	Ceramic capacitor, 25V, X7R	0603	Murata	GRM188R71E105KA12D
1	C3	470μF	Electrolytic capacitor, 100V	DIP	Jianghai	CD263-100V470
1	C4	4.7μF	Ceramic capacitor, 25V, X6S	0603	Murata	GRM188C81E475KE11D
3	C5, C6, C7	4.7μF	Ceramic capacitor, 100V, X8L	1210	Murata	GCM32DL8EL475KE07L
2	C8, C9	100nF	Ceramic capacitor, 16V, X7R	0603	Murata	GRM188R71C104KA01D
1	LED	2.6V	Red LED	0805	Bai Hong	BL-HUE35A-AV-TRB
1	U1	MPQ6615	40V, H-bridge DC motor driver, AEC-Q100 qualified	TQFN-26 (6mmx 6mm)	MPS	MPQ6615GQKTE-AEC1
1	D1	NS				
4	SW1, SW2, SW3, SW4	2.54mm	Button	DIP	Wurth	450301014042
8	CAP1, CAP2, VCP, VG, NFAULT, NSLEEP, SOA, SOB	1mm	Test point, yellow	DIP	Any	
4	VIN, VIN_GND, SA, SB	2mm	Connector	DIP	Any	
8	3P3, 3P3_GND, VREF, VREF_GND, ENA, ENB, PWMA, PWMB	1mm	Connector	DIP	Any	

MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.

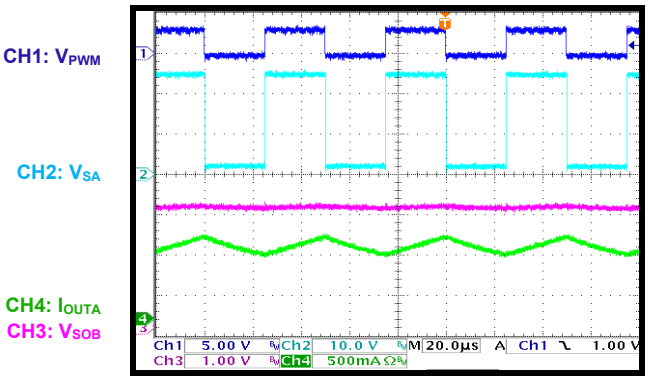
EVB TEST RESULTS

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 24V, V_{INM0} = V_{INM1} = 0V, V_{ENA} = V_{ENB} = 5V, f_{PWMA} = 20kHz, V_{PWMB} = 0V, V_{REF} = 5V, current-sense resistor divider = 5kΩ, T_A = 25°C, resistor + inductance: 10Ω + 2mH, unless otherwise noted.

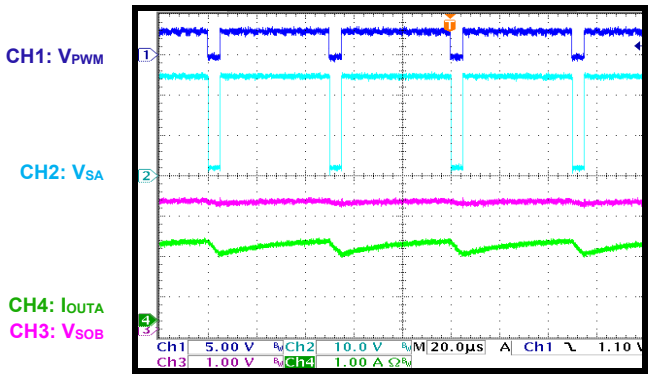
Steady State
Duty = 10%



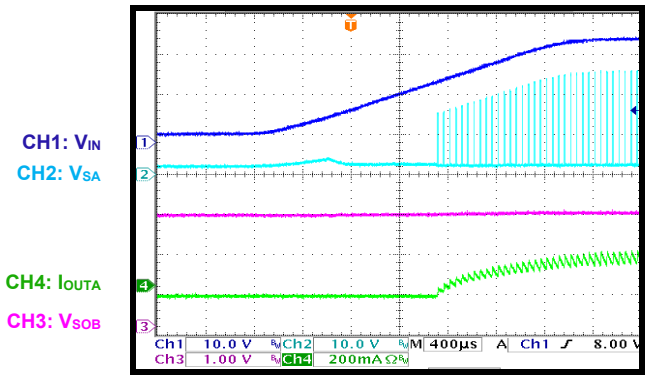
Steady State
Duty = 50%



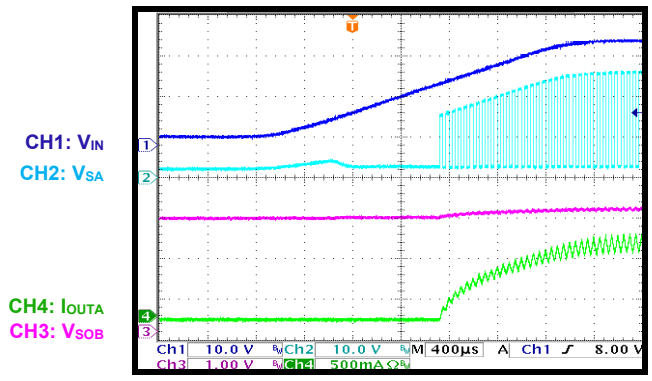
Steady State
Duty = 90%



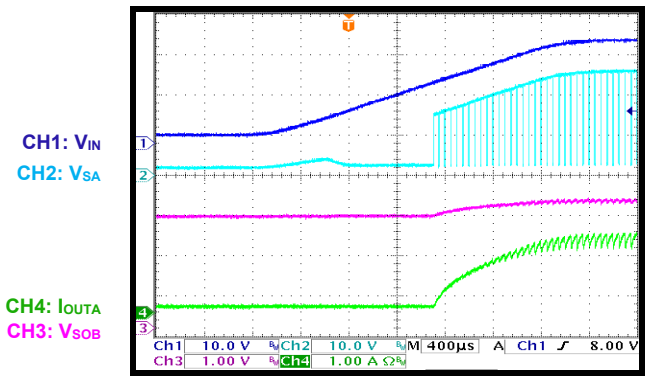
Start-Up
Duty = 10%



Start-Up
Duty = 50%



Start-Up
Duty = 90%

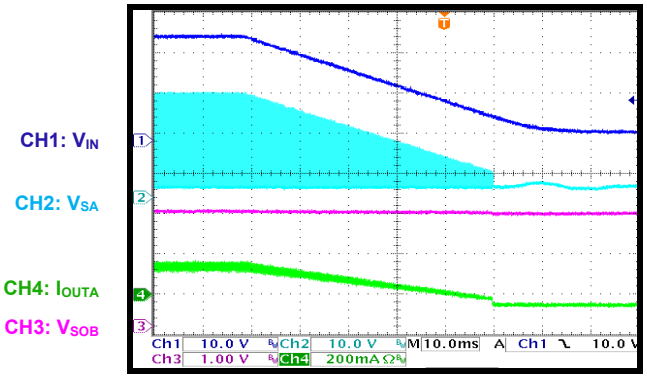


MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.

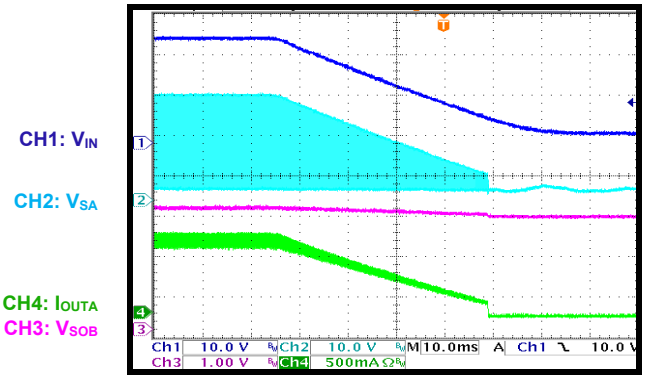
EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 24V, V_{INM0} = V_{INM1} = 0V, V_{ENA} = V_{ENB} = 5V, f_{PWMA} = 20kHz, V_{PWMB} = 0V, V_{REF} = 5V, current-sense resistor divider = 5kΩ, T_A = 25°C, resistor + inductance: 10Ω + 2mH, unless otherwise noted.

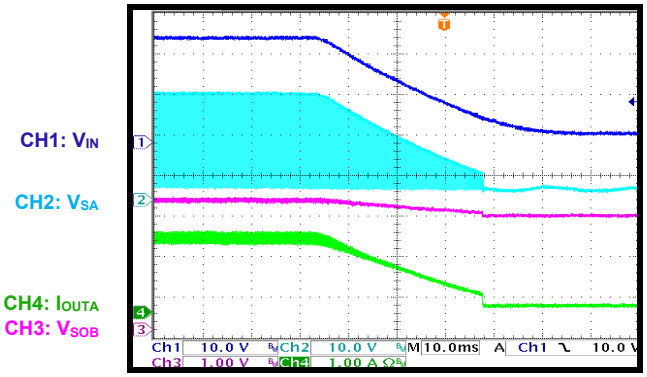
Shutdown
Duty = 10%



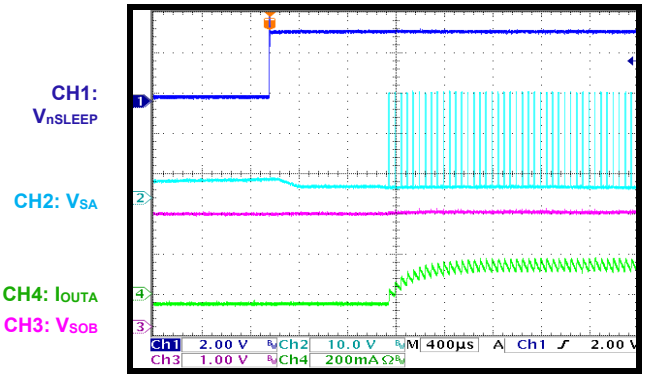
Shutdown
Duty = 50%



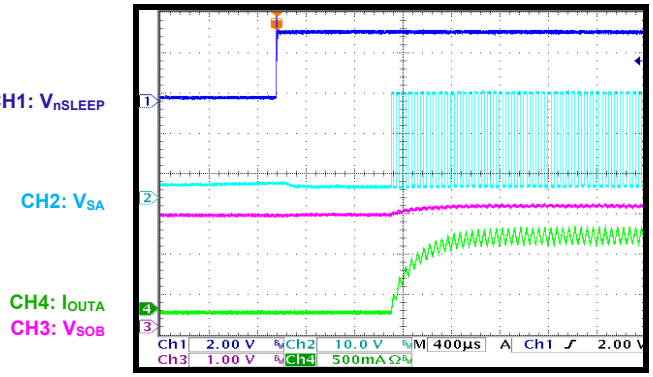
Shutdown
Duty = 90%



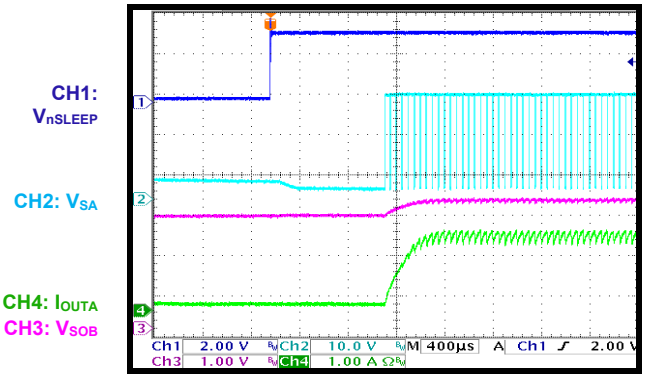
Sleep Recovery
Duty = 10%



Sleep Recovery
Duty = 50%



Sleep Recovery
Duty = 90%

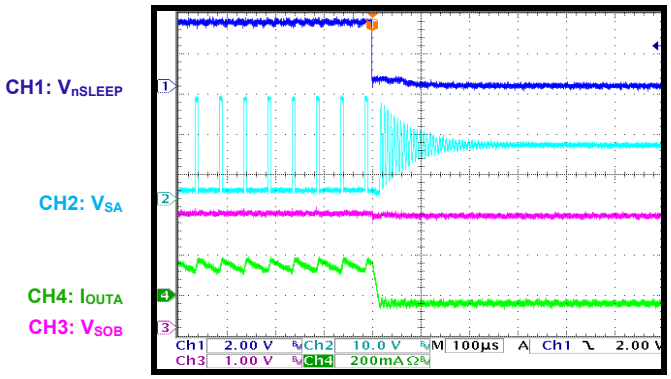


MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.

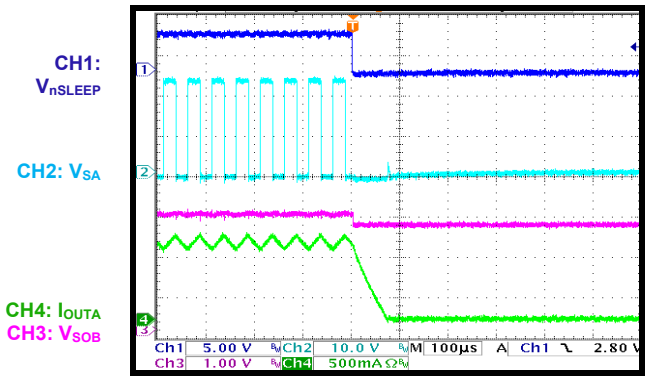
EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 24V, V_{INM0} = V_{INM1} = 0V, V_{ENA} = V_{ENB} = 5V, f_{PWMA} = 20kHz, V_{PWMB} = 0V, V_{REF} = 5V, current-sense resistor divider = 5kΩ, T_A = 25°C, resistor + inductance: 10Ω + 2mH, unless otherwise noted.

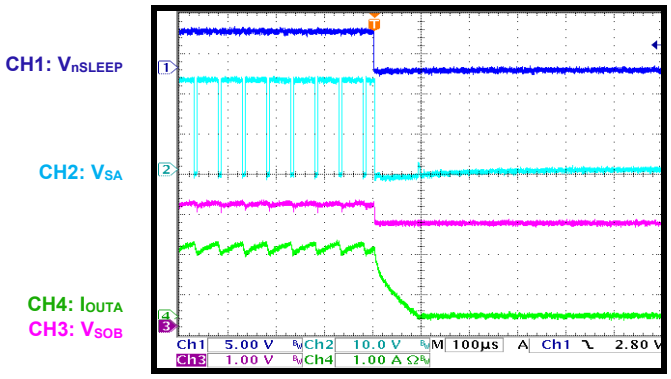
Sleep Entry
Duty = 10%



Sleep Entry
Duty = 50%



Sleep Entry
Duty = 90%



MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.

PCB LAYOUT

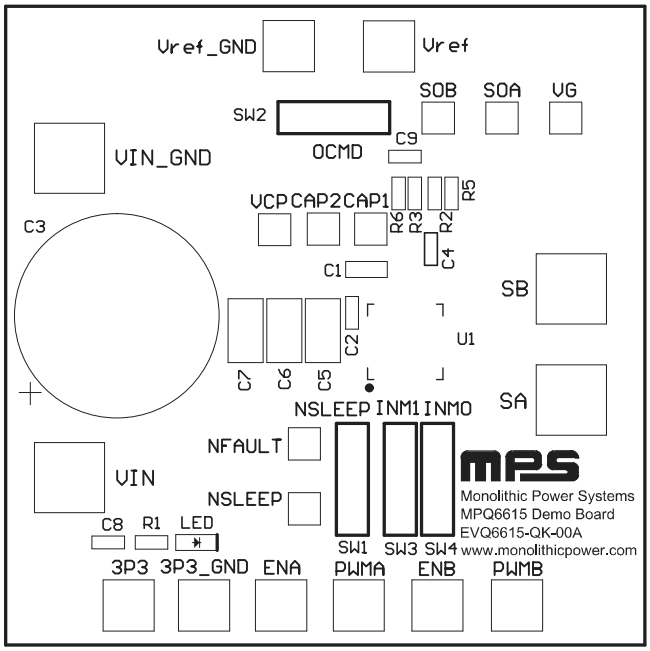


Figure 3: Top Silk

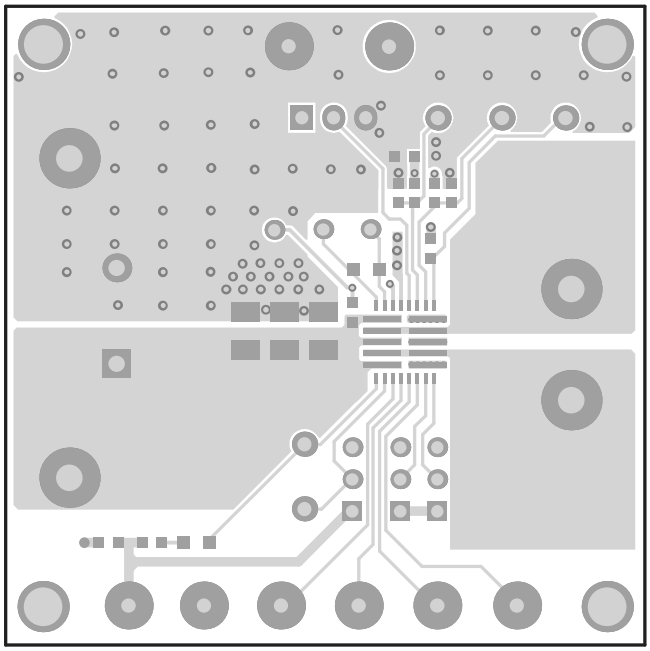


Figure 4: Top Layer

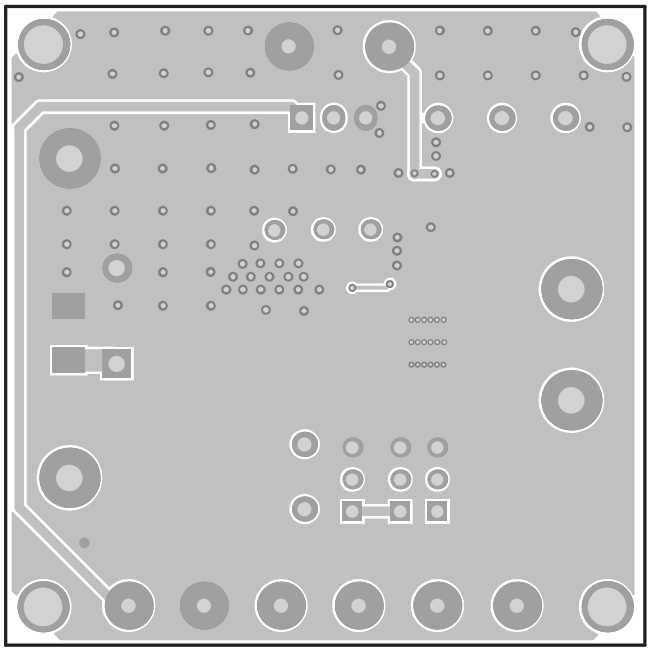


Figure 5: Bottom Layer

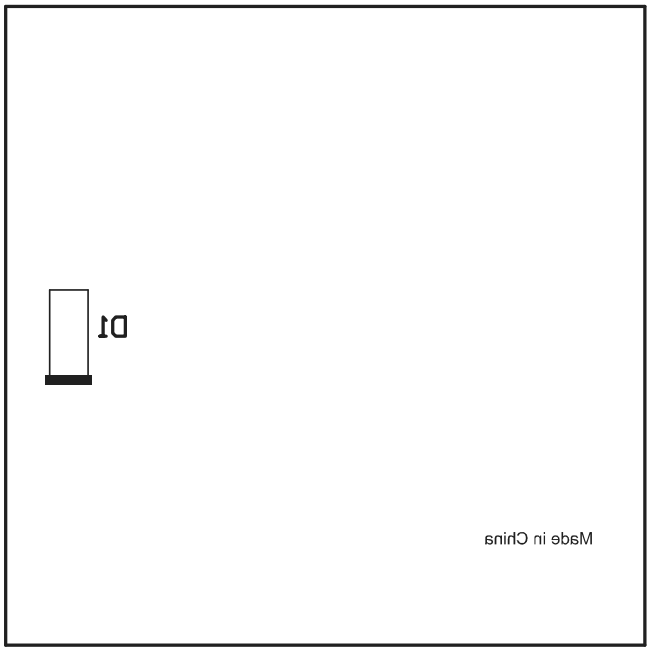


Figure 6: Bottom Silk

MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.

REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	06/26/2023	Initial Release	-

Notice: The information in this document is subject to change without notice. Please contact MPS for current specifications. Users should warrant and guarantee that third-party Intellectual Property rights are not infringed upon when integrating MPS products into any application. MPS will not assume any legal responsibility for any said applications.

MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2023 MPS. All Rights Reserved.