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EV6636-R-00A

18V, 4A Peak, 3-Phase Sensorless BLDC Motor Driver in TQFN-10 (4mmx4mm) Package with Integrated MOSFETs Evaluation Board

DESCRIPTION

The EV6636-R-00A is an evaluation board designed to demonstrate the capabilities of the MP6636GRT, which is the TQFN-10 (4mmx4mm) package version of the MP6636. The MP6636 is a three-phase sensorless brushless DC motor driver with integrated power MOSFETs. It features sensorless field-oriented control (FOC) for improved efficiency and low vibration, with up to 2A of operating current. The input voltage (V_{IN}) ranges from 3.3V to 18V.

The MP6636 controls the motor speed through the pulse-width modulation (PWM) signal with a PWM input frequency between 50Hz and 50kHz. The device also supports a DC input for speed control.

The MP6636 features a rotational speed detector. The rotational speed detector (the FG pin) is an open-drain output.

The I^2C interface is available for internal parameter configurations in the non-volatile memory (NVM).

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

The MP6636 is available in SOIC-8 EP and TQFN-10 (4mmx4mm) packages.

PERFORMANCE SUMMARY (1)

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

Parameters	Conditions	Value
Input voltage (V_{IN}) range		3.3V to 18V
V_{IN}	Typical working voltage	12V
Input speed control signal type	Selectable via the SPD_IN_SEL bit setting	PWM duty cycle or DC voltage
Input speed control pulse-width modulation (PWM) frequency range (1)	PWM_FREQ_SEL = 0	50Hz to 3kHz
	PWM_FREQ_SEL = 1	1kHz to 50kHz
Input speed control DC voltage range	SPD_IN_SEL = 1	0.3V to 3.15V
Operating control mode	Selectable via the V_LOOP bit setting	Open loop, closed loop
Maximum output phase current (I_{OUT})		4.0A
Maximum output electrical frequency		1.5kHz

Note:

1) SPD_IN_SEL BIT = 0.

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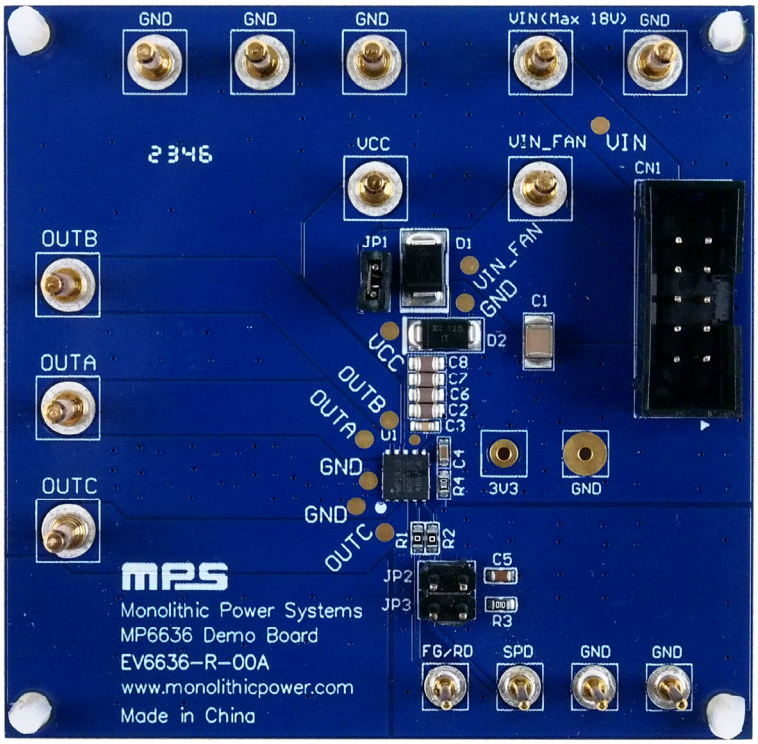
EVALUATION BOARD



LxWxH (6.7cmx6.5cmx2.1cm)

Board Number	MPS IC Number
EV6636-R-00A	MP6636GRT-0000-Z

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QUICK START GUIDE

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

1. Preset the DC power supply to 12V, then turn off the power supply.
2. Connect the power supply output terminals to (see Figure 1):
   a. Positive (+): VIN
   b. Negative (-): GND
3. Connect the MPS Fan Driver Communication Kit to the EV6636-R-00A via CN1.
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 MPS Fan Driver Communication Kit to the computer via the USB cable.
6. Turn on the power supply.
7. Run the Windows application “MPSfan.exe” in “MPS BLDC Virtual Bench GUI,” then select the correct chip for the MP6636. (2)

   Figure 1 shows the equipment set-up with the MPS Fan Driver Communication Kit.

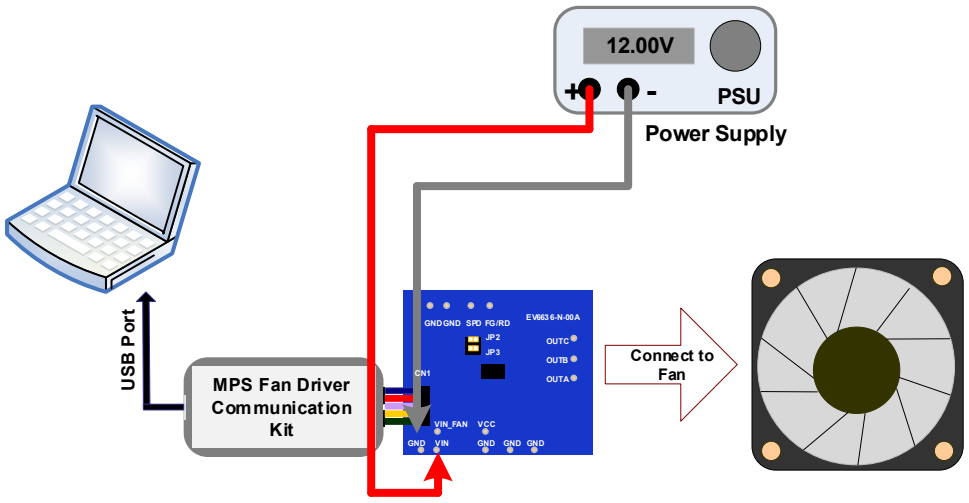

Figure 1: EVB Connection with the MPS Fan Driver Communication Kit

Note:

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

Quick Start without the Communication Kit (After Code Is Finalized)

1. Preset the DC power supply to 12V, then turn off the power supply.
2. Connect the power supply output terminals to:
   a. Positive (+): VIN_FAN
   b. Negative (-): GND

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3. Connect the motor phase terminals to:
   a. Motor phase A: OUTA
   b. Motor phase B: OUTB
   c. Motor phase C: OUTC
4. Turn on the power supply. The motor should begin operating.
5. Set the functional signal generator to pulse mode with a high level at 3.3V and a low level at 0V. Connect the functional signal generator to the SPD and GND pins, then adjust the pulse duty cycle to change the motor speed. Use a PWM frequency that corresponds to the MP6636's PWM frequency range.
6. For DC voltage speed control mode, it is recommended to short JP2 and JP3. Use a 0.3V to 3.15V voltage source to change the motor speed instead of a functional signal generator.

   Figure 2 shows the equipment set-up without an MPS Fan Driver Communication Kit.

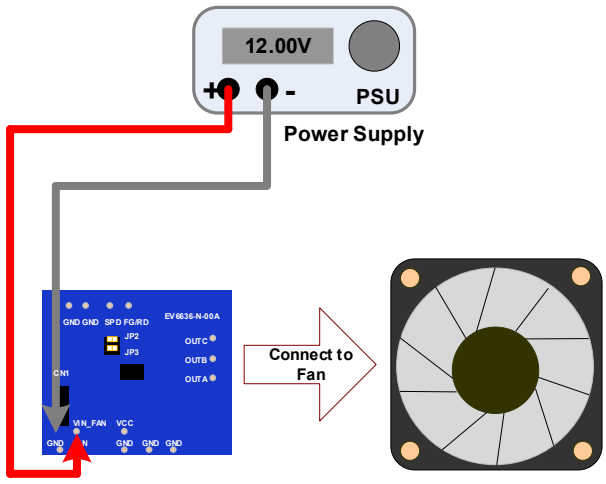

Figure 2: EVB Connection without the MPS Fan Driver Communication Kit

GUI Operation Guide

1. Install the "MPS BLDC Virtual Bench" GUI.
2. Prepare the hardware by following the steps from the Quick Start Using the Communication Interface (MPS Fan Driver Communication Kit) section on page 3.
3. Double click "MPSfan.exe" to start the GUI. The first page of GUI should show the connection status from the PC to the MPS communication kit (see Figure 3).

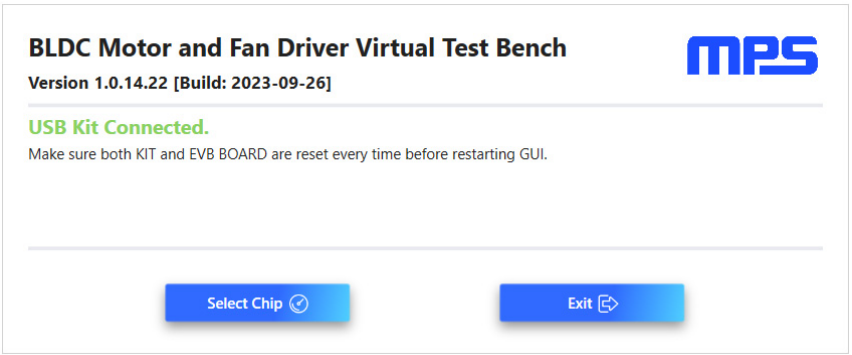

Figure 3: Start Page for the GUI

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4. Click “Select Chip” to move to the part number selection page.
5. Select the MP6636, then click “Go” to proceed (see Figure 4).

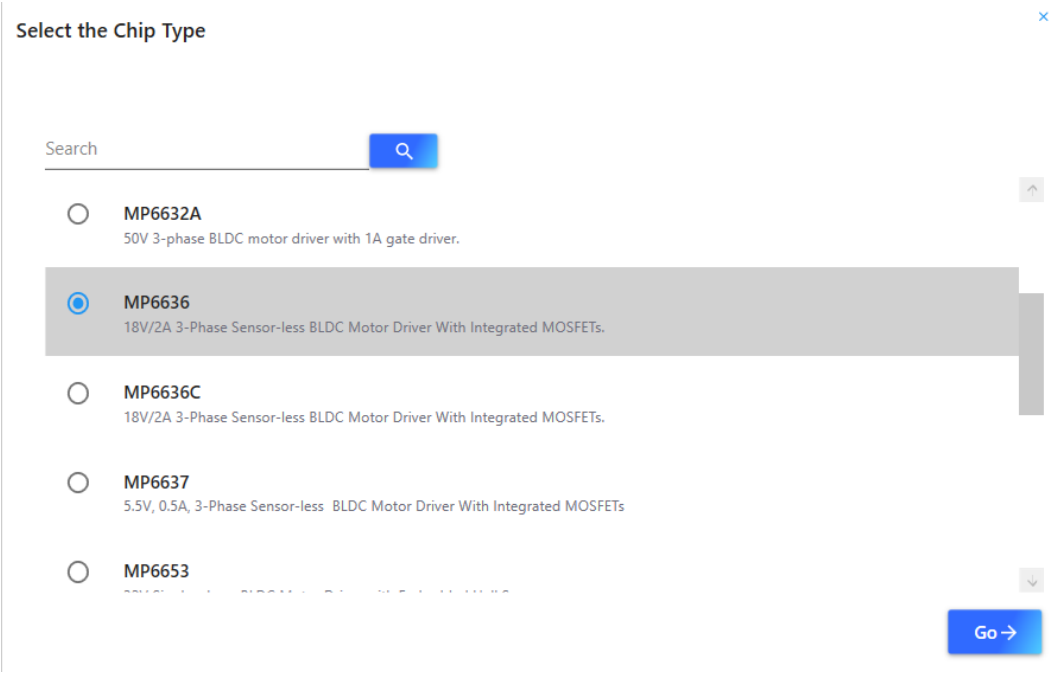

Figure 4: Part Number Selection Page

6. Click “MP6636” on the MP6636 GUI main page.
7. Check the evaluation system connection, then click “Details” to evaluate the MP6636 (see Figure 5).

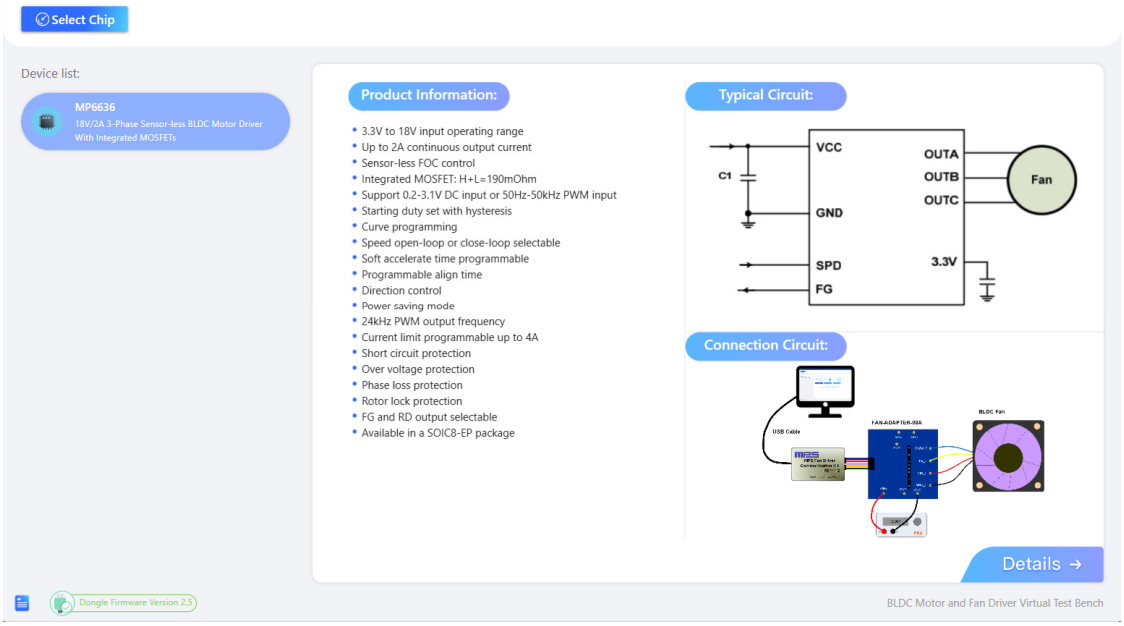

Figure 5: MP6636 GUI Main Page

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EVALUATION BOARD SCHEMATIC

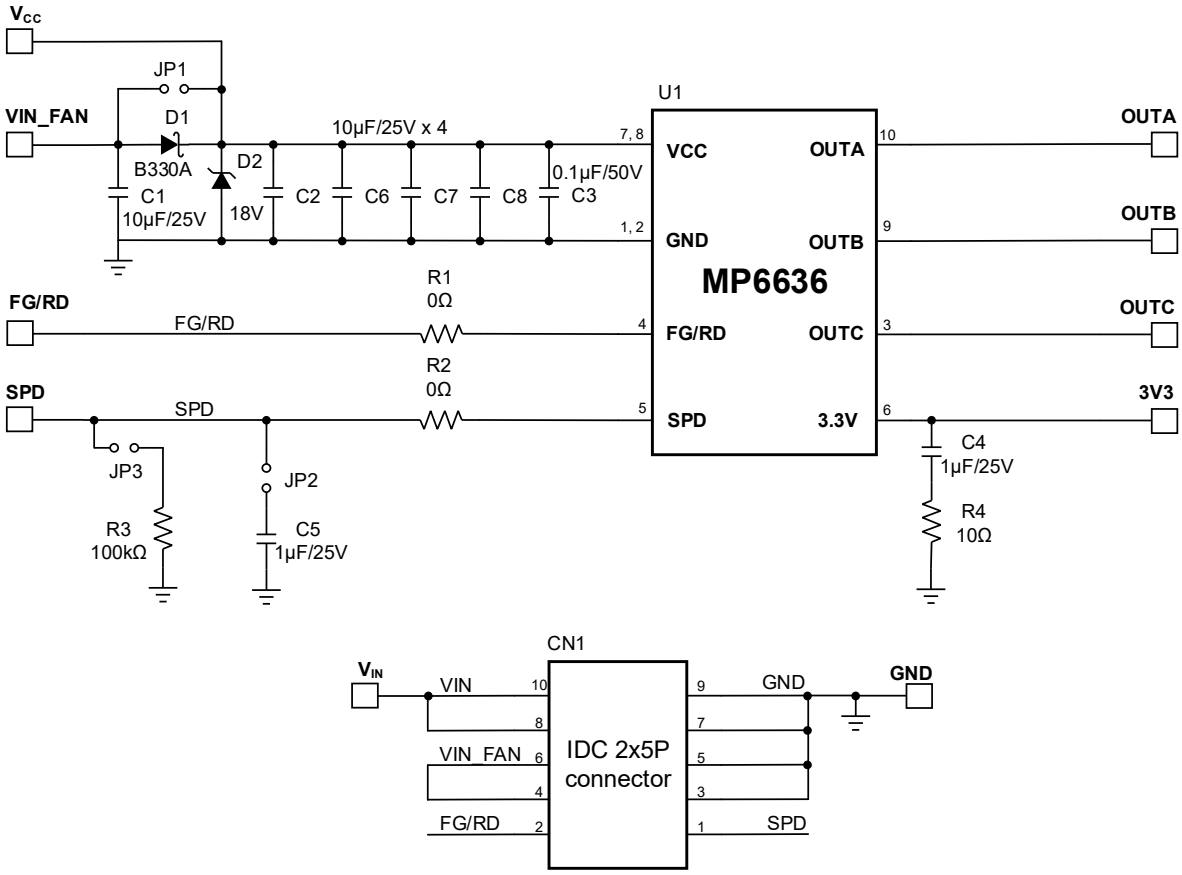

Figure 6: Evaluation Board Schematic

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EV6636-R-00A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
1	C1	10µF	Ceramic capacitor, 25V, X7R	1210	Murata	GRM32DR71E106KA12
4	C2, C6, C7, C8	10µF	Ceramic capacitor, 25V, X5R	0805	Murata	GRM21BR61E106KA73L
1	C3	100nF	Ceramic capacitor, 50V, X7R	0603	Murata	GCM188R71H104KA57D
1	C4	1µF	Ceramic capacitor, 25V, X7R	0603	Murata	GCM188R71E105KA64D
1	C5	4.7µF	Ceramic capacitor, 6.3V, X7R	0603	Murata	GRM185D70J475ME11D
2	R1, R2	0Ω	Film resistor, 5%	0603	Yageo	RC0603JR-070RL
1	R3	100kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07100KL
1	R4	10Ω	Film resistor, 1%	0603	Yageo	RC0603FR-0710RL
1	CN1	2.54mm	2.54mm pitch, IDC socket	DIP	Any	
3	JP1, JP2, JP3	2.54mm	2.54mm pitch, jumper	DIP	Any	
10	OUTA, OUTB, OUTC, GND, VIN, VCC, VIN_FAN	2mm	Test terminal, gold plated	DIP	Any	
4	GND1, GND2, FG/RD, SPD	1mm	Test terminal, gold plated	DIP	Any	
1	D1	30V	Schottky diode, 30V, 4A	SMB	onsemi	SSB43L-E3/52T
1	D2	18V	TVS diode, 18V	SMA	Little Fuse	SMAJ18A
1	U1	MP6636	18V, 4A peak current, 3-phase sensorless BLDC motor driver with integrated MOSFETs	TQFN-10 (4mmx 4mm)	MPS	MP6636GRT-0000

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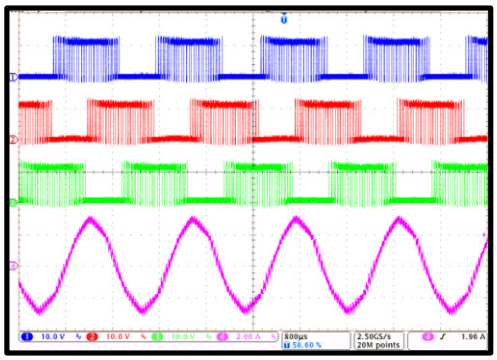
TYPICAL PERFORMANCE CHARACTERISTICS

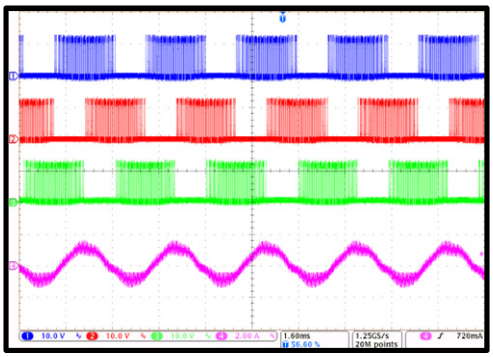
Steady State
Anti-over modulation disabled,
12V/2.1A, 16krpm, 6S4P cooling fan,
input PWM duty cycle = 100%, V_{IN} = 12V

CH1: V_{OUTA}
CH2: V_{OUTB}
CH3: V_{OUTC}
CH4: I_A



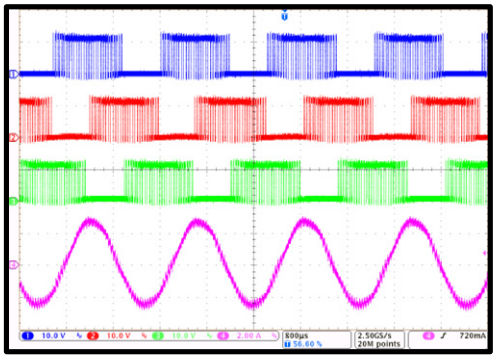
Steady State
Anti-over modulation disabled,
12V/2.1A, 16krpm, 6S4P cooling fan,
input PWM duty cycle = 50%, V_{IN} = 12V

CH1: V_{OUTA}
CH2: V_{OUTB}
CH3: V_{OUTC}
CH4: I_A



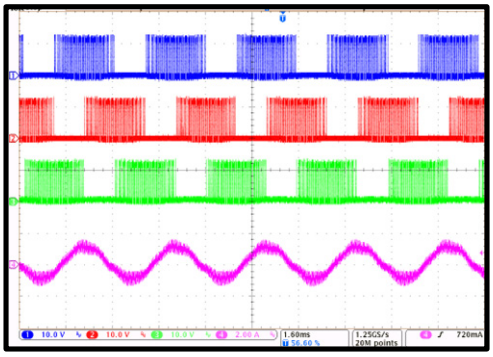
Steady State
Anti-over modulation enabled,
12V/2.1A, 16krpm, 6S4P cooling fan,
input PWM duty cycle = 100%, V_{IN} = 12V

CH1: V_{OUTA}
CH2: V_{OUTB}
CH3: V_{OUTC}
CH4: I_A



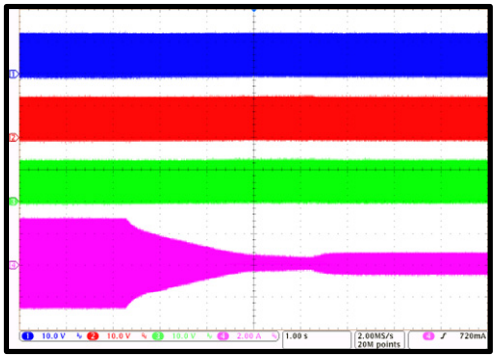
Steady State
Anti-over modulation enabled,
12V/2.1A, 16krpm, 6S4P cooling fan,
input PWM duty cycle = 50%, V_{IN} = 12V

CH1: V_{OUTA}
CH2: V_{OUTB}
CH3: V_{OUTC}
CH4: I_A



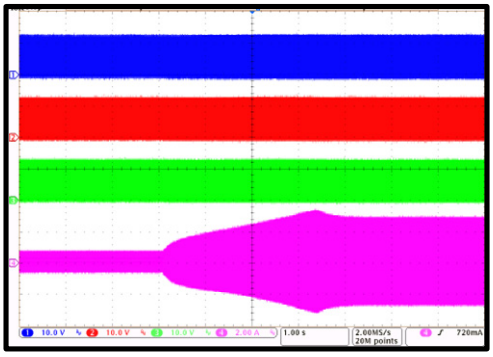
PWM Duty Transient
12V/2.1A, 16krpm, 6S4P cooling fan,
input PWM duty cycle = 100% to 25%,
V_{IN} = 12V

CH1: V_{OUTA}
CH2: V_{OUTB}
CH3: V_{OUTC}
CH4: I_A



PWM Duty Transient
12V/2.1A, 16krpm, 6S4P cooling fan,
input PWM duty cycle = 125% to 100%,
V_{IN} = 12V

CH1: V_{OUTA}
CH2: V_{OUTB}
CH3: V_{OUTC}
CH4: I_A



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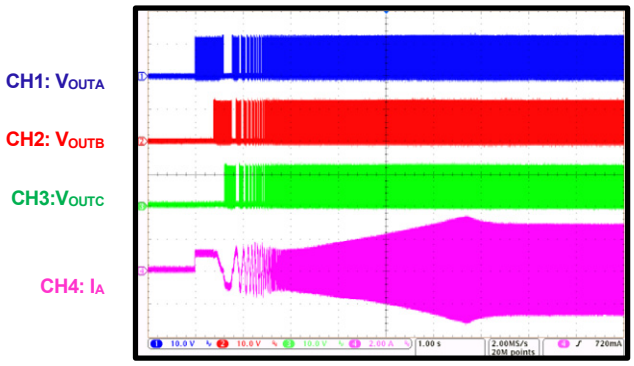
TYPICAL PERFORMANCE CHARACTERISTICS

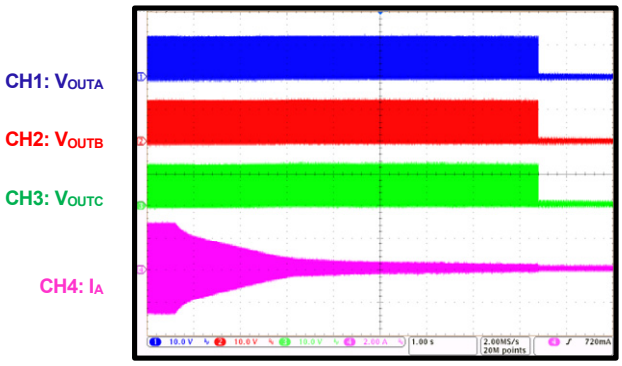
PWM On

12V/2.1A, 16krpm, 6S4P cooling fan,
soft-start time = 3.5s, V_{IN} = 12V,
input PWM duty cycle = 1% to 100%



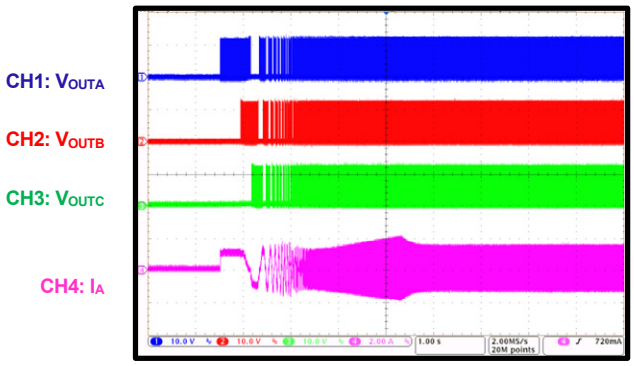
PWM Off

12V/2.1A, 16krpm, 6S4P cooling fan,
soft-brake enabled, V_{IN} = 12V,
input PWM duty cycle = 100% to 1%



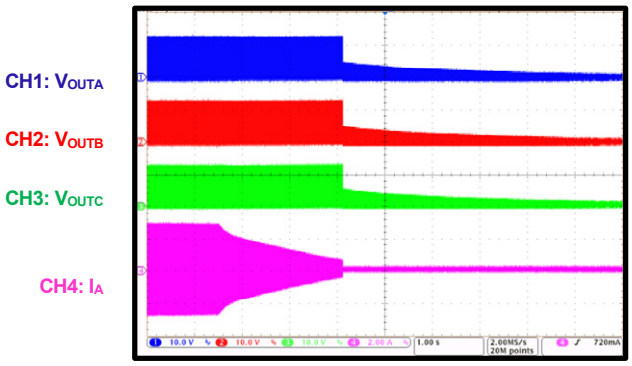
PWM On

12V/2.1A, 16krpm, 6S4P cooling fan,
soft-start time = 3.5s, V_{IN} = 12V,
input PWM duty cycle = 1% to 50%



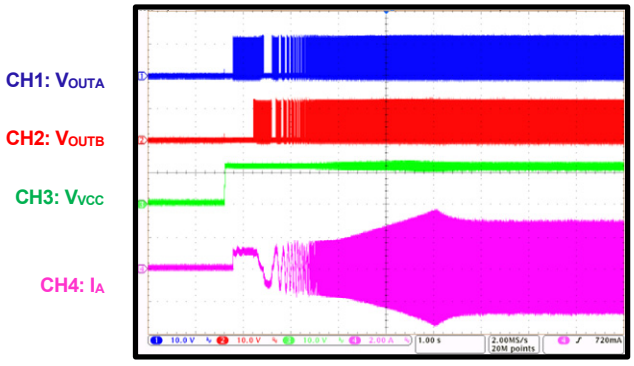
PWM Off

12V/2.1A, 16krpm, 6S4P cooling fan,
fast-stop enabled, V_{IN} = 12V,
input PWM duty cycle = 100% to 1%



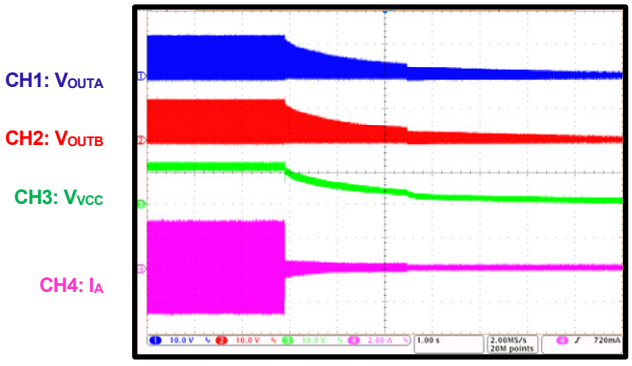
Power On

12V/2.1A, 16krpm, 6S4P cooling fan,
soft-start time = 3.5s, SPD = floating,
V_{IN} = 0V to 12V



Power Off

12V/2.1A, 16krpm, 6S4P cooling fan,
fast-stop enabled, soft-start time = 3.5s,
SPD = floating, V_{IN} = 12V to 0V



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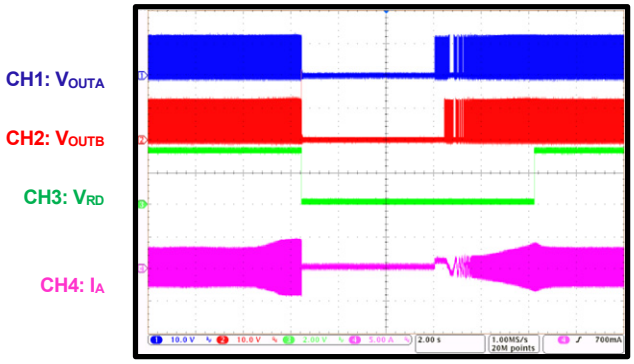
TYPICAL PERFORMANCE CHARACTERISTICS

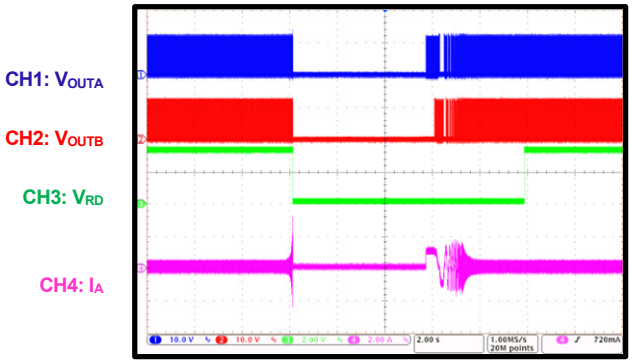
Rotor Lock Protection

12V/2.1A, 16krpm, 6S4P cooling fan, locked rotor at operation, then release
RD, M1 and M2 enabled, V_{IN} = 12V,
PWM = 100%



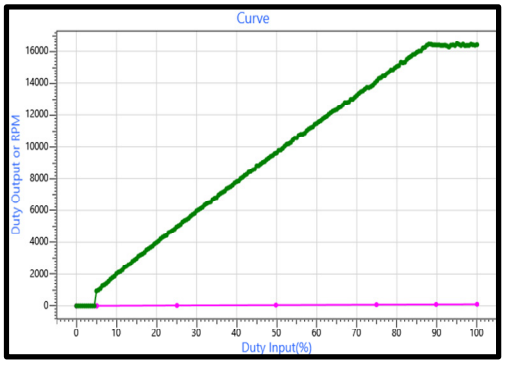
Rotor Lock Protection

12V/2.1A, 16krpm, 6S4P cooling fan, locked rotor at operation, then release
RD, M1 and M2 enabled, V_{IN} = 12V,
PWM = 10%



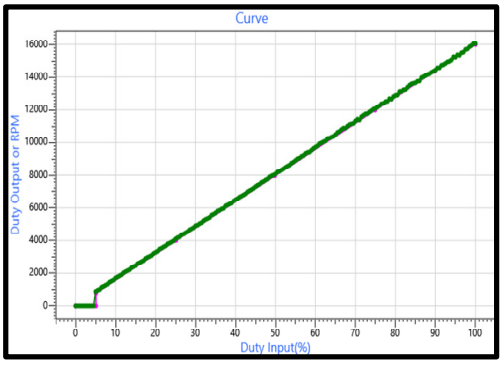
Open-Loop Curve

Default curve, captured with GUI,
12V/2.1A, 16000rpm, 6S4P cooling fan,
V_{IN} = 12V



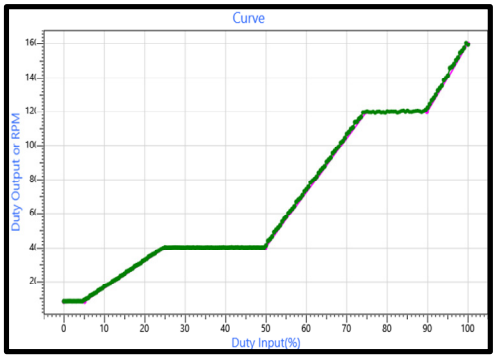
Closed-Loop Curve

Linear curve, captured with GUI,
12V/2.1A, 6S4P cooling fan,
MAX_SPEED = 16000rpm, V_{IN} = 12V



Closed-Loop Curve

Nonlinear curve, captured with GUI,
12V/2.1A, 6S4P cooling fan,
MAX_SPEED = 16000rpm, V_{IN} = 12V



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PCB LAYOUT

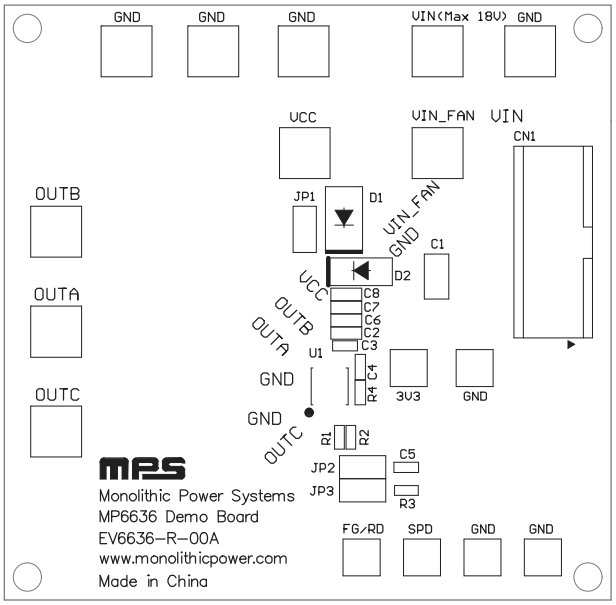

Figure 7: Top Silk

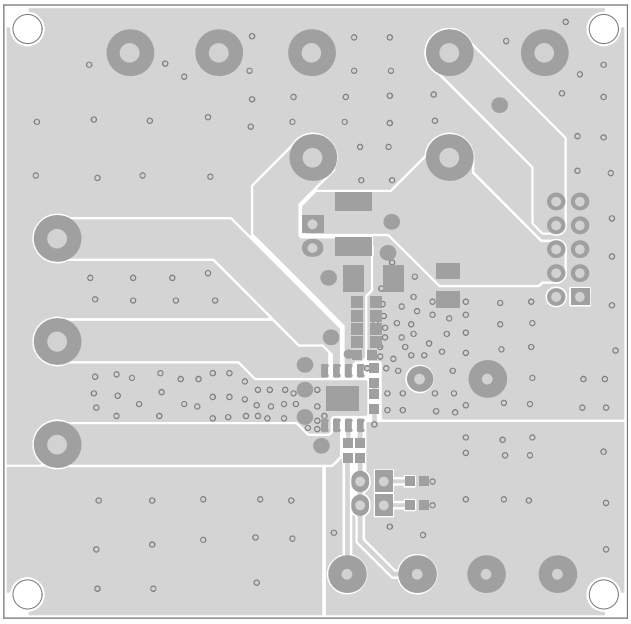

Figure 8: Top Layer

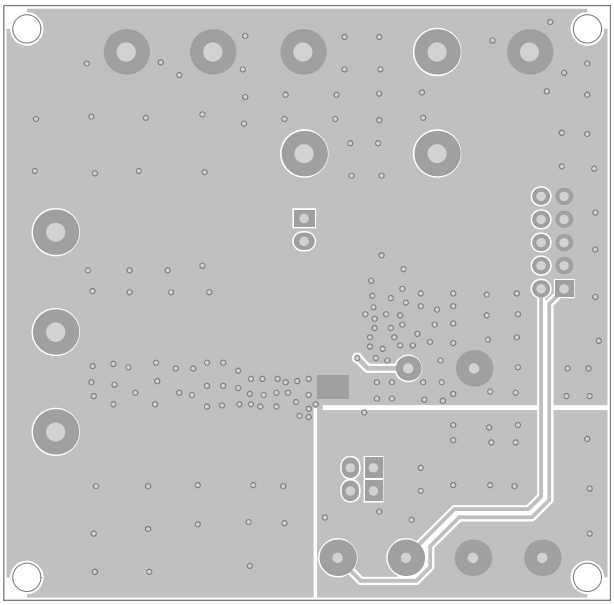

Figure 9: Bottom Silk

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REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	7/10/2025	Initial Release	-

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