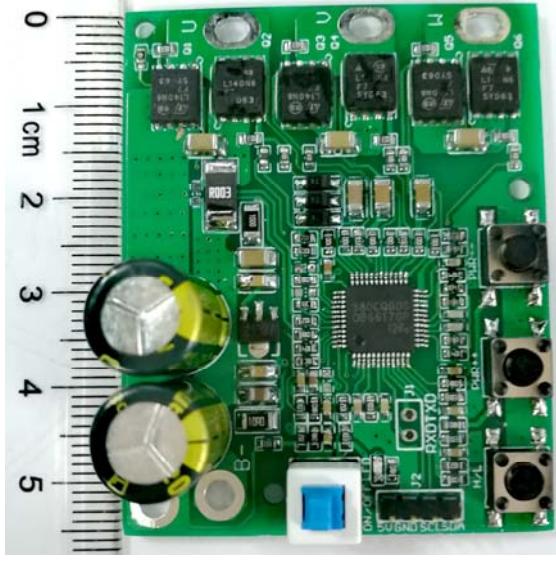


<b>Subject</b> <b>OB6617-001 Demo Board Manual</b>	Board Model: OB6617_VCN_1823  Doc. No.: OB_DOC_DBM_D_661700
	<p><b>Key Feature:</b></p> <ul style="list-style-type: none"> <li>• Sensorless motor control</li> <li>• Single chip BLDC controller solution</li> <li>• High integration of MCU, pre-driver, high speed rail-to-rail operation amplifier, high precision LDO, current protection comparator</li> <li>• Support high speed motor</li> <li>• High precision and wide range power control</li> <li>• Fast motor start</li> <li>• High/Low power gear change</li> <li>• Power gear increase/decrease fine-tuning</li> <li>• MOSFET temperature sensing and thermal protection</li> <li>• Support GUI: MotorFigure_3-1004_Demo_Setup</li> <li>• PCB size small, and assemble conveniently</li> </ul>

### Revision history:

Revise Date	Version	Reason/Issue
2018-08-06	00	First Issue

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# 1. System Electrical Specification

## 1.1 Input Characteristic

▪ DC input voltage rating	7 cells Li-Iron battery of 3.7V
▪ DC input voltage	19.2V to 30.0V
▪ Motor start and stop key voltage	0 and 5.0V
▪ High and low power change key voltage	5.0V to 0V
▪ Power increase fine-tuning key voltage	5.0V to 0V
▪ Power decrease fine-tuning key voltage	5.0V to 0V

## 1.2 System parameters

▪ PWM frequency	25 KHz
▪ MCU supply voltage	5.0V±1.0%
▪ 12.0V supply current	100mA
▪ 5.0V supply current	100mA
▪ Current sampling resistance	3mΩ
▪ Current sampling gain	16
▪ Current sampling amplifier offset	Self-calibration
▪ Gate driver supply voltage	12.0V
▪ Max of MOSFET drain source voltage value	60.0V
▪ MOSFET thermal sensor precision	1%

## 1.3 Output characteristic

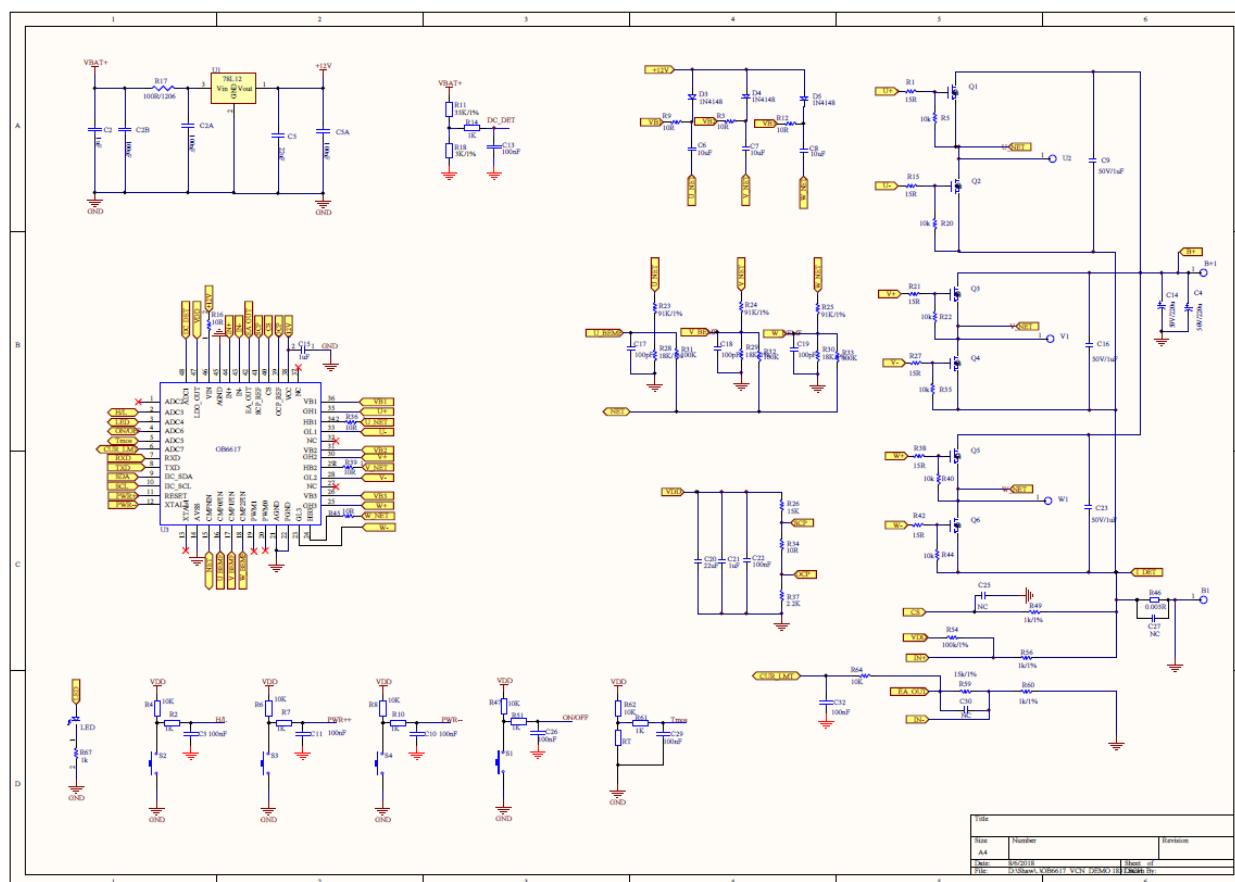
▪ Phase current limitation	80A
▪ Maximum of PWM duty	100%
▪ Minimum of PWM duty	13%

## 1.4 Environmental

▪ Operating Ambient Temperature	-20 °C ~ 45 °C
▪ Storage Temperature	-40 °C ~ 100 °C
▪ Storage Humidity	0 ~ 95% R.H.

## 2. Board Information

## 2.1 Schematic

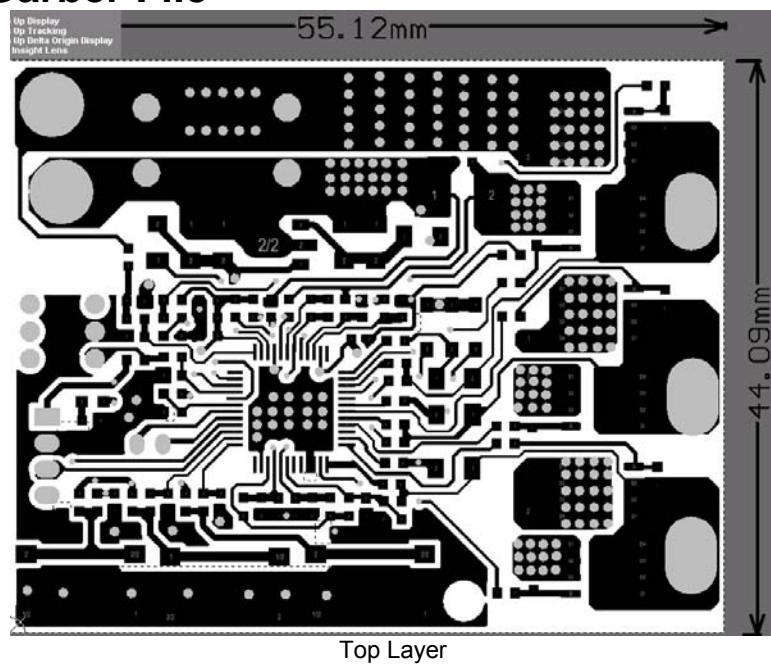


## 2.2 Bill of material

Designator	Package	Description	QTY
B+, B-, U, V, W	HOLE	Assembly holes	5
C2	C0805	Capacitor,ceramic,1uF/50V	1
C2A, C2B, C3, C5A, C10, C11, C13, C22, C26, C29,C32	C0603	Capacitor,ceramic,100nF/50V	11
C4, C14	EC8	Capacitor,aluminum electrolytic,220uf/50V	2
C5	C1206	Capacitor,ceramic,22uF/50V	1
C6, C7, C8	C1206	Capacitor,ceramic,10uF/25V	3
C9, C15, C16,C23	C0805	Capacitor,ceramic,1uF/50V	4
C17, C18, C19	C0603	Capacitor,ceramic,100pF/25V	3
C20	C0603	Capacitor,ceramic,22uF/25V	1
C21	C0603	Capacitor,ceramic,1uF/25V	1
C25, C27, C30	C0603	NC	0
D3, D4, D5	SOD-323	1N4148	3
LED	R0805	Green	1
Q1, Q2, Q3, Q4, Q5, Q6	PowerFLAT 5*6	STL140N6F7	6
R1, R15, R21, R27, R38, R42	R0603	Resistor,chip,15R,1%	6
R2, R7, R10, R14, R49, R56, R60, R51, R61, R67	R0603	Resistor,chip,1K,1%	10
R3, R9, R12	R0603	Resistor,chip,10R,5%	3
R4, R5, R6, R8, R20, R22, R35, R40, R44, R47, R62, R64	R0603	Resistor,chip,10K,1%	12
R11	R0603	Resistor,chip,33K,1%	1
R16	R1206	Resistor,chip,10R,5%	1
R34, R36, R39, R45	R0603	Resistor,chip,10R,5%	4
R17	R1206	Resistor,chip,100R,5%	1
R18	R0603	Resistor,chip,3K,1%	1
R23, R24, R25	R0805	Resistor,chip,91K,1%	3
R26, R59	R0603	Resistor,chip,15K,1%	2
R28, R29, R30	R0603	Resistor,chip,18K,1%	3
R31, R32, R33, R54	R0603	Resistor,chip,100K,1%	4

R37	R0603	Resistor,chip,2.2K,1%	1
R46	R2512	Resistor,chip,0.003R,1%	1
RT	0603	NTC,TSM1A103-34D,10K,B=3435,1%	1
S1	SWPB	Key,7mm*7mm,auto-lock	
S2, S3, S4	SWPB	Key,6mm*7mm,auto-release	4
U1	SOT-89	78L12	1
U3	LQFP48	OB6617GPA-001	1
J2	4P,2.00mm	NC	0

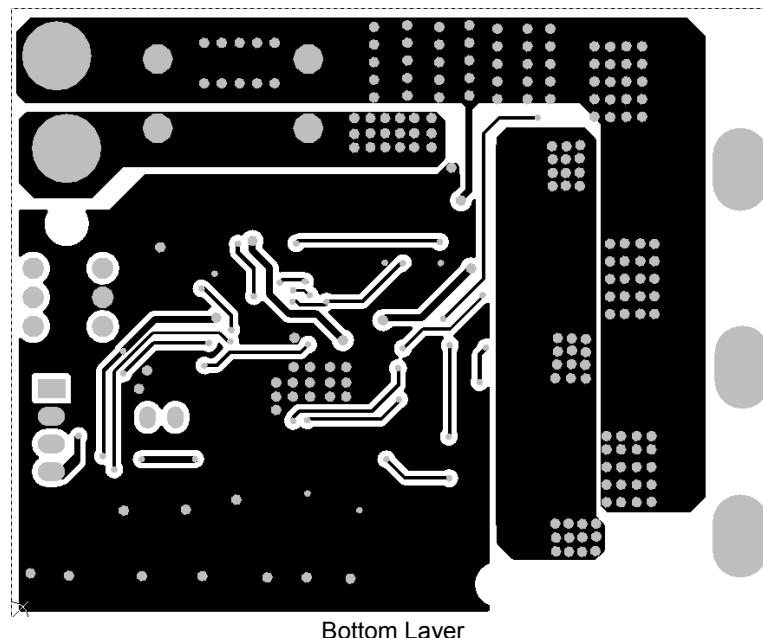
## 2.3 PCB Garber File



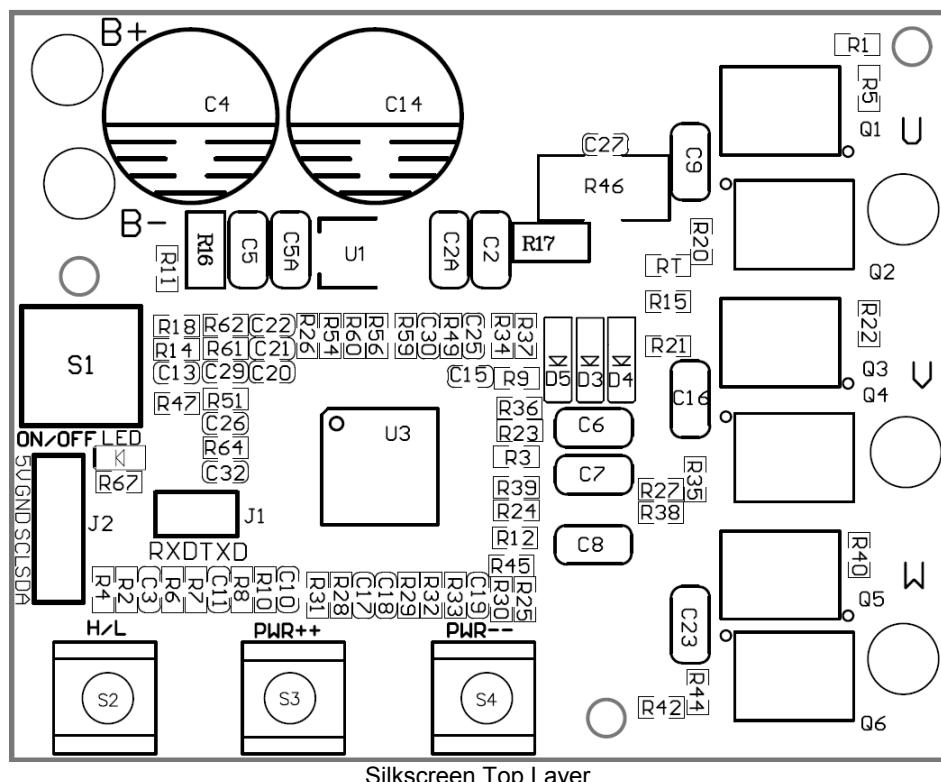
**On-Bright**  
 Brighten Your Life

OB6617\_VCN\_1823

Silkscreen Bottom Layer

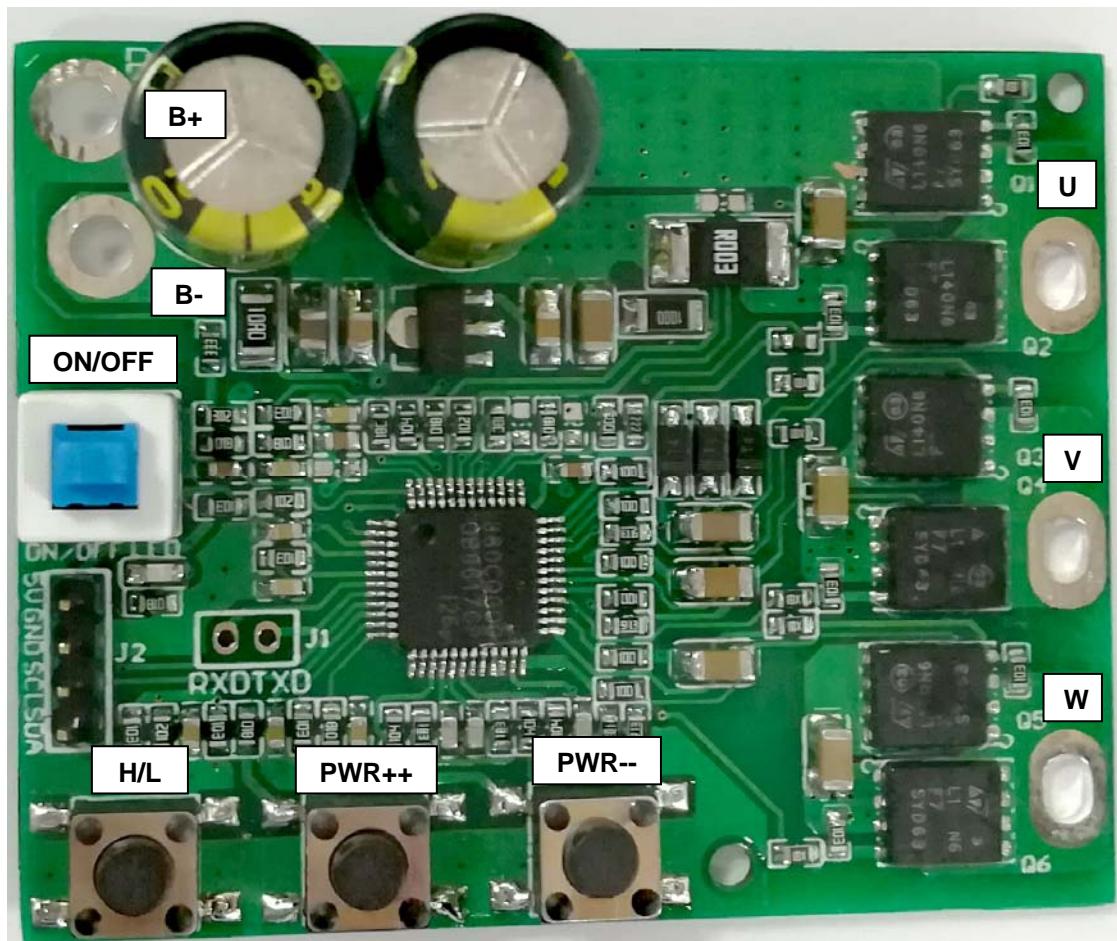


## Bottom Layer



### Silkscreen Top Layer

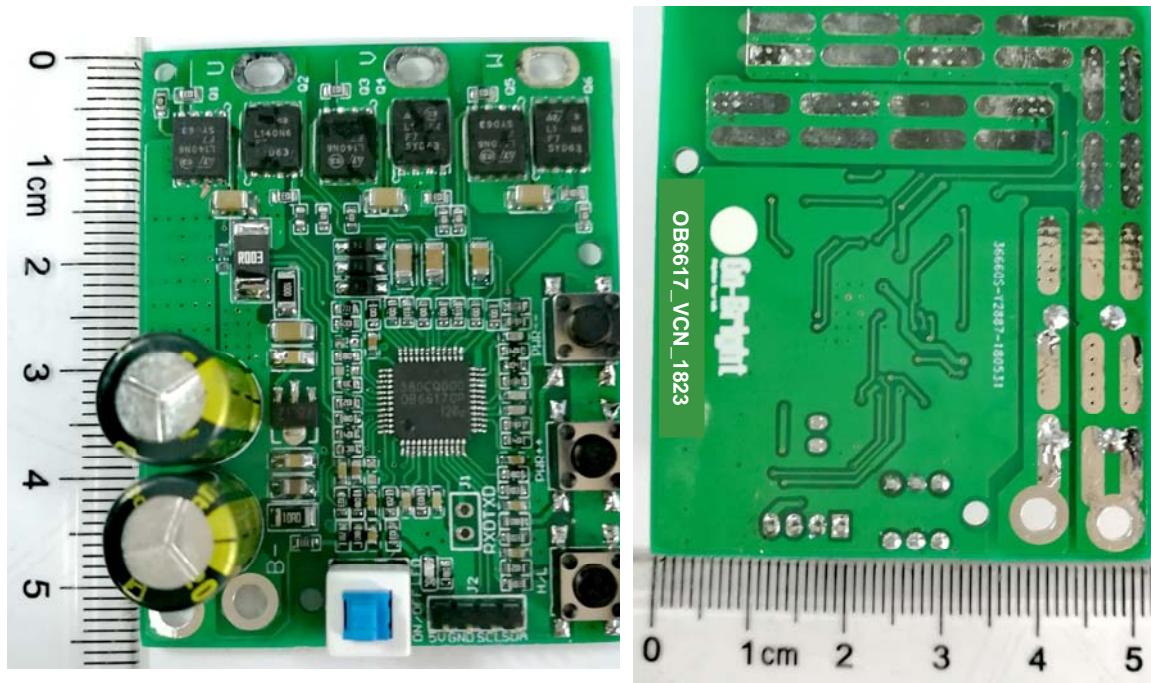
## 2.4 Interface Function Description



HoleName	Description
B+	Battery input, Bus+
B-	Battery input, GND
U	Motor U phase output
V	Motor V phase output
W	Motor W phase output

Keys	Description	Voltage Range
ON/OFF	Motor start and stop, auto-lock button High level:stop Low level:start	0V/5V
H/L	Power gear change,auto-release button Level high to low trigger	0V/5V
PWR++	Power increase fine-tuning,auto-release button Level high to low trigger	0V/5V
PWR--	Power decrease fine-tuning,auto-release button Level high to low trigger	0V/5V

## 2.5 BLDC Controller Board Snapshot



### 3. Performance Evaluation

This session presents the test results of OB6617GP 001 25V/15A vacuum cleaner controller demo. Results on inrush current and safety test are not included and will be added when they become available. Overall, the module meets design specifications.

TA=25°C

No	Parameter	Symbol	Min	Type	Max	Unit	Corresponding Fig.
1	MCU supply	LDO_5V	4.9	5.0	5.1	V	Fig.1, Fig.2
2	Gate driver supply	LDO_12V		12.0		V	Fig.1, Fig.2
3	Battery UVP	V <sub>bus_UVLO</sub>		17.0		V	Fig.3
4	MOSFET gate voltage	V <sub>gs</sub>		12.0		V	Fig.4
5	Highside MOSFET rise time	T <sub>r_h</sub>		0.29		us	Fig.4
6	Highside MOSFET fall time	T <sub>f_h</sub>		0.24		us	Fig.4
7	Lowside MOSFET rise time	T <sub>r_l</sub>		0.29		us	Fig.4
8	Lowside MOSFET fall time	T <sub>f_l</sub>		0.19		us	Fig.4
9	PWM frequency	f <sub>PWM</sub>		25.2		kHz	Fig.5
10	Current sampling gain			16			Fig.7
11	MOSFET current shutdown time in motor short circuit				10	us	Fig.10, Fig.11, Fig.12

#### Test Equipments

Item	Module
DC source	Ainuo DC POWER
Oscilloscope	LeCroy 4024
Current meter	/
Differential probe	三华科技 S1-9101
Digital multimeter	FLUKE 15B+

## 3.1 Voltage Test

### 3.1.1 Gate Driver & MCU Supply Power ON/OFF

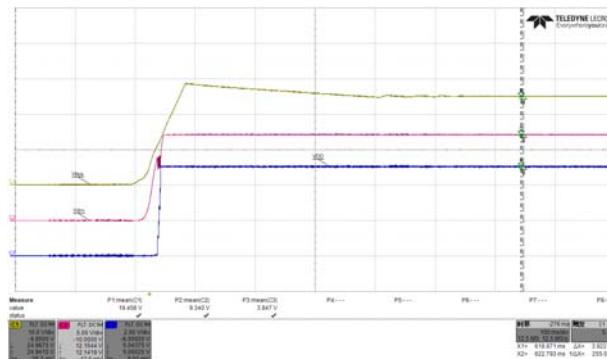


Fig. 1 Measured gate driver and MCU supply voltage @ battery=25V

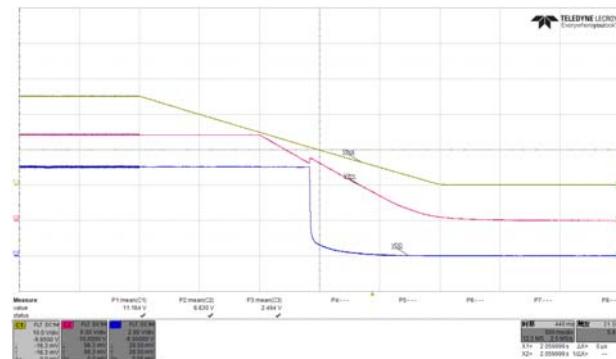


Fig. 2 Measured gated river and MCU supply voltage @ battery=25V

### 3.1.2 Battery under voltage lockout

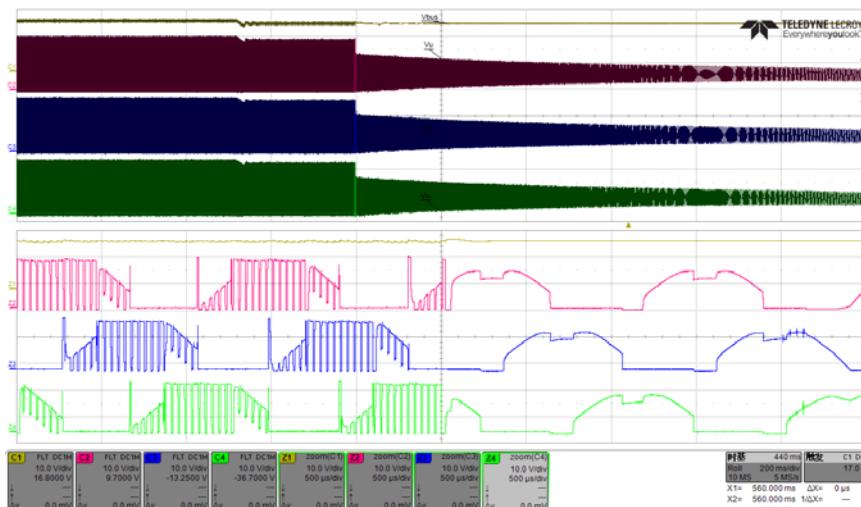


Fig. 3 Measured U/V/W phase voltage @ battery=17V

### 3.1.3 MOSFET $V_{gs}$ / $T_{r\_h}$ / $T_{r\_l}$ / $T_{f\_h}$ / $T_{f\_l}$

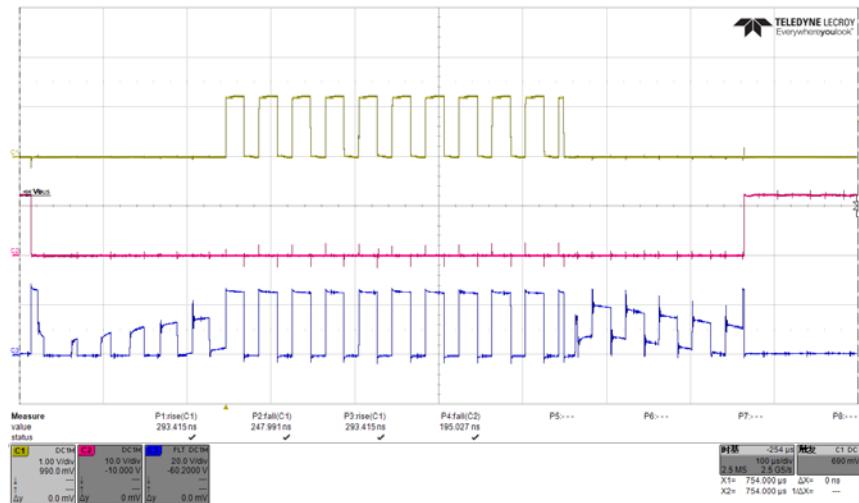


Fig. 4 Measured phase U highside and lowside MOSFET  $V_{gs}$ / $T_{r\_h}$ / $T_{r\_l}$ / $T_{f\_h}$ / $T_{f\_l}$

## 3.2 PWM Test

### 3.2.1 PWM Frequency

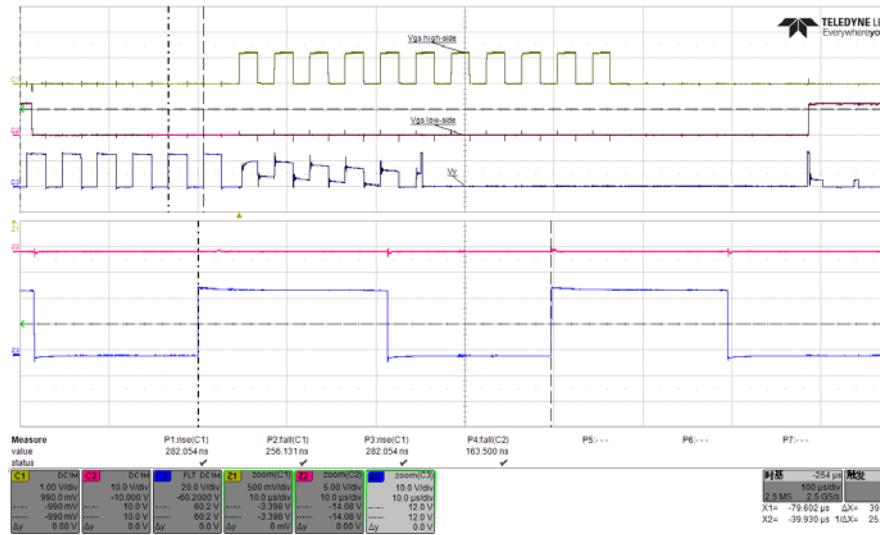


Fig. 5 Measured highside MOSFET  $V_{gs}$  rising edge period

### 3.2.2 Start/Stop Control

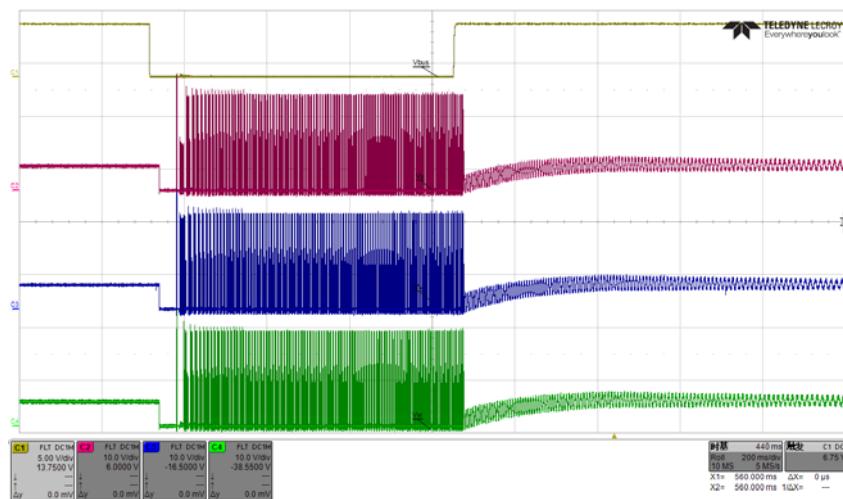


Fig. 6 Measured U/V/W-phase voltage and ON/OFF key voltage

### 3.3 Current sampling

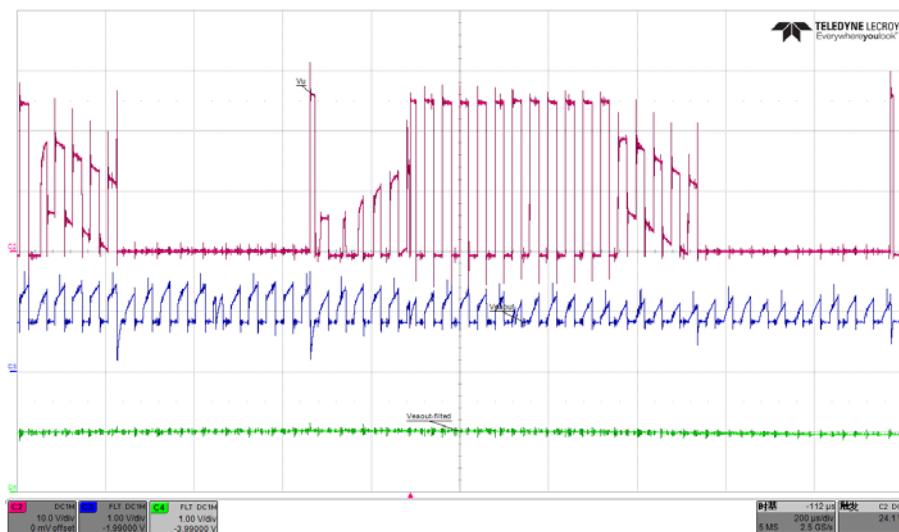


Fig. 7 Measured U-phase voltage, EA out and filtered EA out voltage

## 3.4 Motor Short Circuit Protection

### 3.4.1 U-V phase short circuit

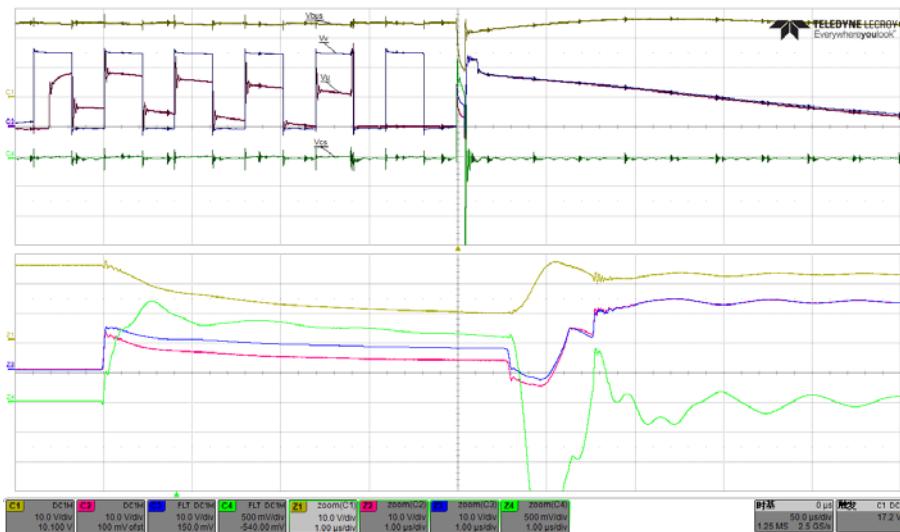


Fig. 8 Measured U/V-phase voltage, Bus voltage,  $R_{cs}$  voltage @ battery voltage = 25V

### 3.4.2 U-W phase short circuit

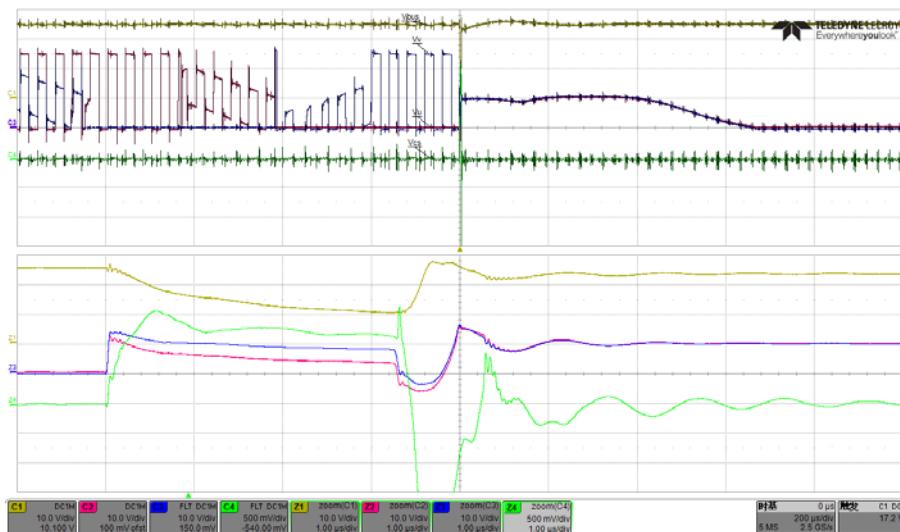


Fig. 9 Measured U/W-phase voltage, Bus voltage,  $R_{cs}$  voltage @ battery voltage = 25V

### 3.4.3 V-W phase short circuit

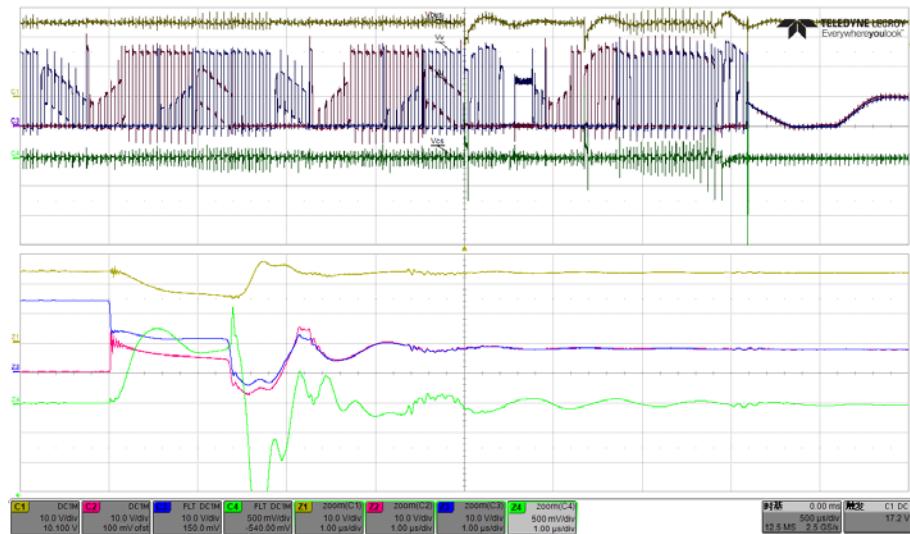


Fig. 10 Measured V/W-phase voltage, Bus voltage, R<sub>cs</sub> voltage @ battery voltage = 25V

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