

Subject
OB6612 Demo Board Manual

Board Model: OB6612_for 18V 电扳手_2021

Doc. No.: OB_DOC_DBM_A_661201


Key Feature:

- Sensor-less motor control
- Single chip BLDC controller solution
- High integration of MCU, pre-driver, high speed rail-to-rail operation amplifier, high precision LDO, current protection comparator.
- Step-less speed regulation
- Forward/Reverse selection
- 20% duty start, and motor fast sop
- Automatic power off with time delay
- MOSFET temperature sensing and thermal protection.
- Tow levels battery under voltage protection
- Battery residual capacity display
- PCB size small, and assemble conveniently

Revision history:

Revise Date	Version	Reason/Issue
2019-12-04	00	First Issue
2020-05-29	01	BOM updated

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1. System Electrical Specification

1.1 Input Characteristic

▪ DC input voltage rating	5 cells Li-Iron battery of 3.7V
▪ DC input voltage	12.5V to 24V
▪ Handle working voltage	0 to 5V
▪ Hall sensor working voltage	0 to 5V
▪ Motor steering signal type	Differential signal

1.2 System parameters

▪ PWM frequency	20 KHz
▪ MCU supply voltage	5V±2%
▪ 5V supply current	100mA
▪ Current sampling resistance	2mΩ
▪ Current sampling amplification	16
▪ Current sampling amplifier offset	Self-calibration
▪ Gate driver supply voltage	11V
▪ Max of MOSFET drain source voltage value	30V
▪ MOSFET thermal sensor precision	1%

1.3 Output characteristic

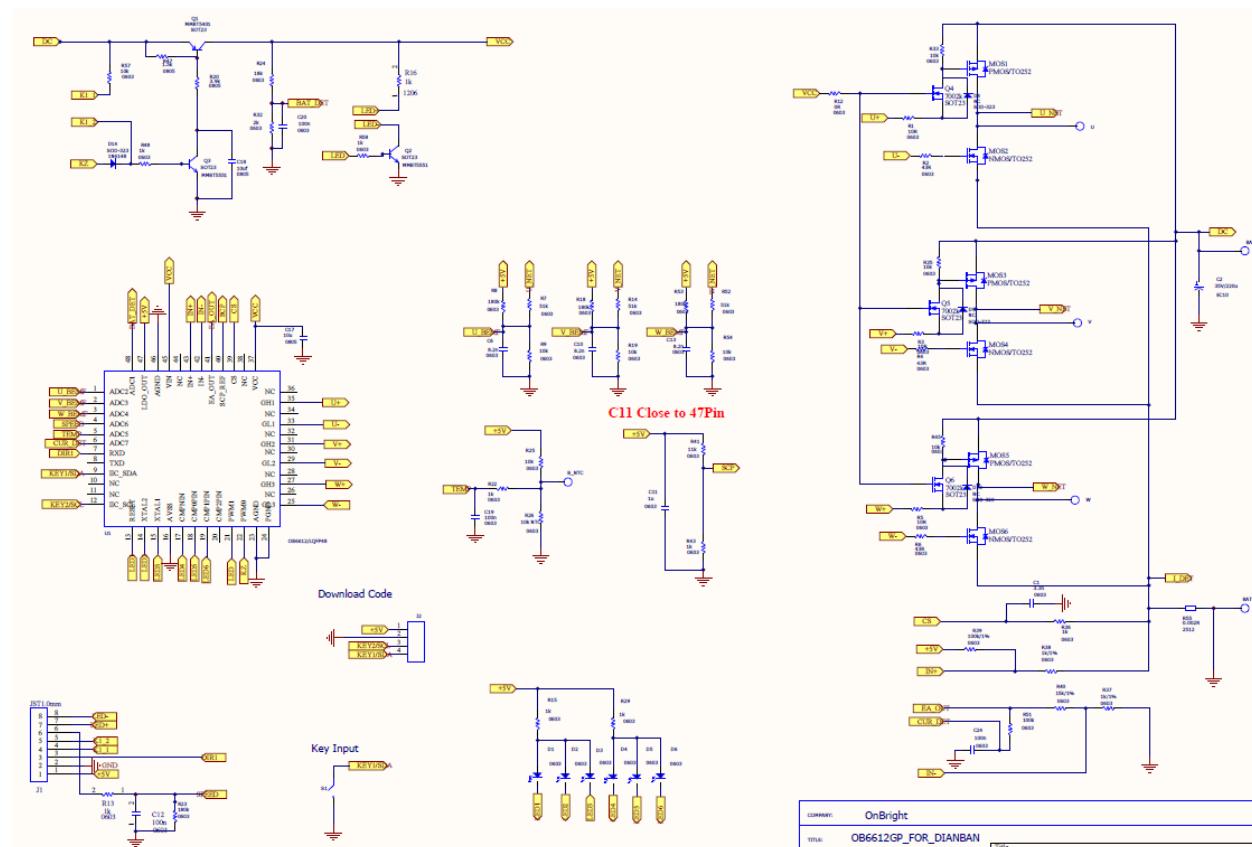
▪ Phase current limitation	50A
▪ Maximum of PWM duty	100%
▪ Minimum of PWM duty	20%

1.4 Environmental

▪ Operating Ambient Temperature	-20°C to 60°C
▪ Storage Temperature	-40 °C to 100 °C
▪ Storage Humidity	0% to 95% R.H.

2. Board Information

2.1 Schematic



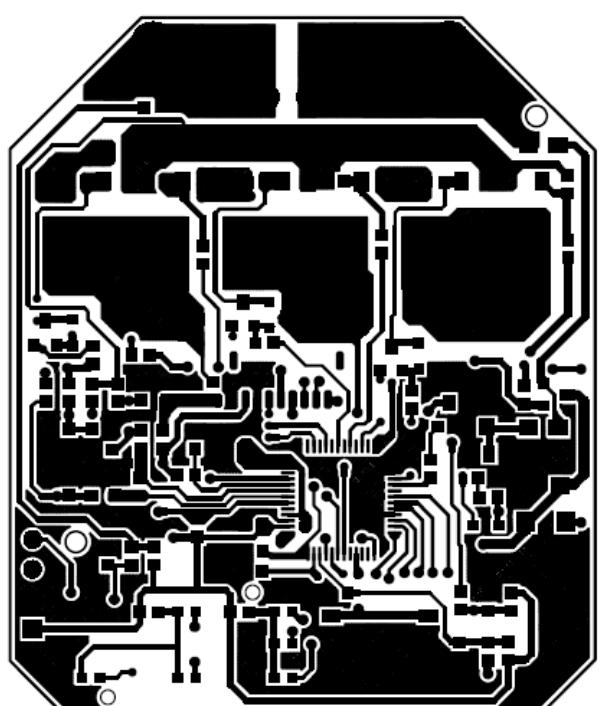
2.2 Bill of material

BOM 中 PMOS/NMOS 型号供参考，非指定。

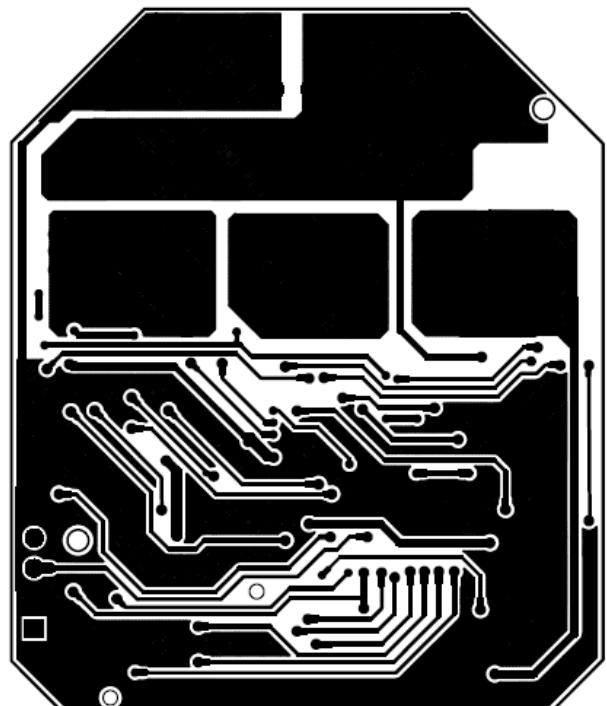
Position	Description	Package	QTY
C2	Capacitor, aluminum electrolytic,220uf/35V,-40/105°C	EC8	1
C1	Capacitor,ceramic,3.3nf/25V,X7R,10%	0603	1
C6,C10,C13	Capacitor,ceramic,8.2nf/25V,X7R,10%	0603	3
C12,C19,C20,C24	Capacitor,ceramic,100nf/25V,X7R,10%	0603	4
C11	Capacitor,ceramic,1uf/25V,X7R,10%	0603	1
C17,C18	Capacitor,ceramic,10uf/25V,X7R,10%	0805	2
D8,D9,D10	NC	SOD323	
D14	1N4148	SOD323	1
D1,D2,D3,D4,D5,D6	LED, Green	0603	6
MOS1,MOS3,MOS5	P-Channel Power MOS RU30L70L(30V/70A,TO252,深圳锐骏) KS3307DA(30V/65A,TO252,深圳冠禹)	TO252	3
MOS2,MOS4,MOS6	N-Channel Power MOS RU3075L(30V/75A,TO252,深圳锐骏) KS3210DB(30V/85A,TO252,深圳冠禹)	TO252	3
Q1	PNP,MMBT5401	SOT23	1
Q2,Q3	NPN,MMBT5551	SOT23	2
Q4,Q5,Q6	NMOS,2N7002	SOT23	3
U1	OB6612GQP	LQFP48	1
R39	Resistor,chip,100k,1%	0603	1
R40	Resistor,chip,15k,1%	0603	1
R37,R38	Resistor,chip,1k,1%	0603	2
R24	Resistor,chip,18k,1%	0603	1
R32	Resistor,chip,2k,1%	0603	1
R7,R14,R52	Resistor,chip,51k,1%	0603	3
R9,R19,R54	Resistor,chip,10k,1%	0603	3
R8,R18,R53	Resistor,chip,180k,1%	0603	3
R1,R3,R5	Resistor,chip,10R,5%	0603	3
R2,R4,R6	Resistor,chip,68R,5%	0603	3
R12	Resistor,chip,0R,5%	0603	1
R23	Resistor,chip,180k,5%	0603	1
R25, R33, R35,R45, R48,R57	Resistor,chip,10k,5%	0603	6
R13, R15,R22,R29, R36, R43, R58	Resistor,chip,1k,5%	0603	7

R41	Resistor,chip,11k,5%	0603	1
R51	Resistor,chip,100k,5%	0603	1
R26	NTC,TSM1A103-34D,10k,B=3545,1%	0603	1
R47	Resistor,chip,1.5k,5%	0805	1
R20	Resistor,chip,3.9k,5%	0805	1
R16	Resistor,chip,1k,5%	1206	1
R55	Resistor,chip,2mR,1%	2512	1
J1	1mm,8pin Connector		1
SW1	SWITCH	6*6	1

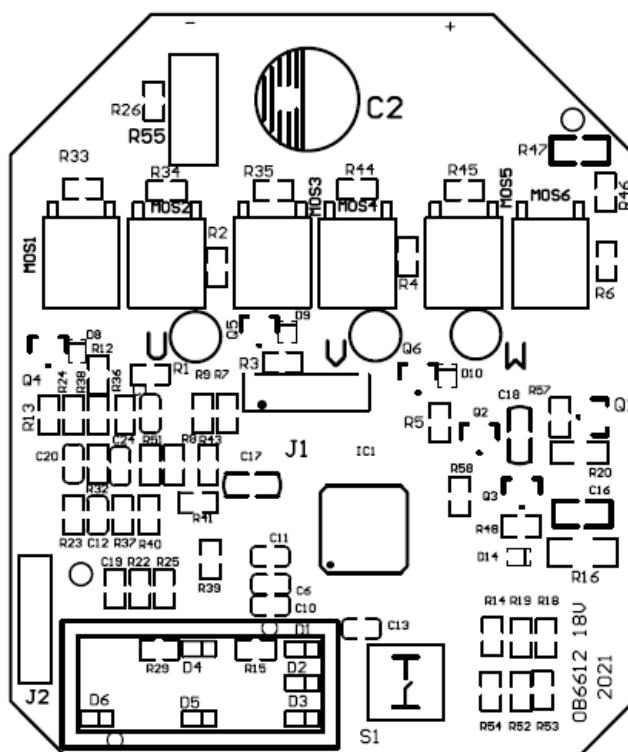
2.3 PCB Garber File



Top Layer



Bottom Layer



Silkscreen Top Layer

2.4 Heat-sink Three View Drawing

N/A

2.5 Connector Function Description

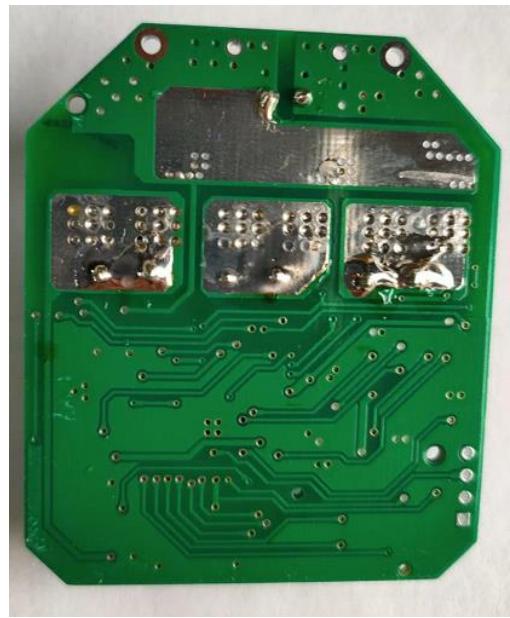


HoleName	Description
BAT+	Battery input, Bus+
BAT-	Battery input, GND
U_Pha	Motor U phase output
V_Pha	Motor V phase output
W_Pha	Motor W phase output

J1- 8pin connector

Pin Num	Description	Voltage Range
1	Speed signal supply	5V
2	GND	0V
3	Turn direction signal	0~5V
4	Motor steering signal 1	0~5V
5	Motor steering signal 2	0~5V
6	Speed signal input	0~5V
7	Working LED anode	0~22V
8	Working LED cathode	0~22V

2.6 BLDC Controller Board Snapshot



3. Performance Evaluation

This session presents the test results of OB6612GQP 18V/30A electric wrench 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	Battery UVP	V_{bus_UVLO}	12.5			V	Fig.3
2	MCU supply	LDO_5V	4.9	5	5.1	V	Fig.1, Fig.2
3	High Side Gate Driver Voltage			-11		V	Fig.1, Fig.2
4	Low Side Gate Driver Voltage			11		V	Fig.4
5	Highside MOSFET Rise time	T_{r_h}		693		ns	Fig.4
6	Highside MOSFET Fall time	T_{f_h}		471		ns	Fig.4
7	Lowside MOSFET Rise time	T_{r_l}		538		ns	Fig.4
8	Lowside MOSFET Fall time	T_{f_l}		647		ns	Fig.4
9	PWM frequency	f_{PWM}		20		kHz	Fig.5
10	PWM duty	Duty	10		100	%	Fig.7
11	Throttle voltage	$V_{throttle}$	0.8		5	V	Fig.6
12	Current amplify coefficient			16			Fig.9

Test Equipments

Item	Module
DC source	LW12050KD
Oscilloscope	LeCroy HDO4024
Current meter	Tek TCPA300
Differential probe	CATIII
Multi-meter	VC9808

3.1 Voltage Test

3.1.1 Gate Driver & MCU Supply Power ON/OFF

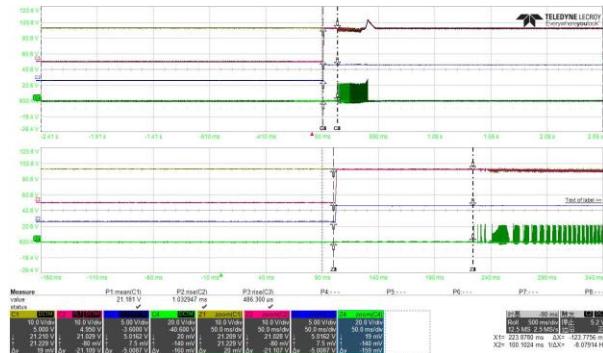


Fig. 1 Measured gate driver and MCU supply voltage @ battery=18V

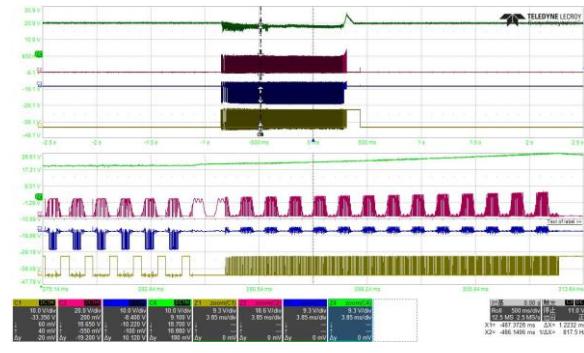


Fig. 2 Measured gated river and Phase voltage @ battery=18V

3.1.2 Battery under voltage lockout

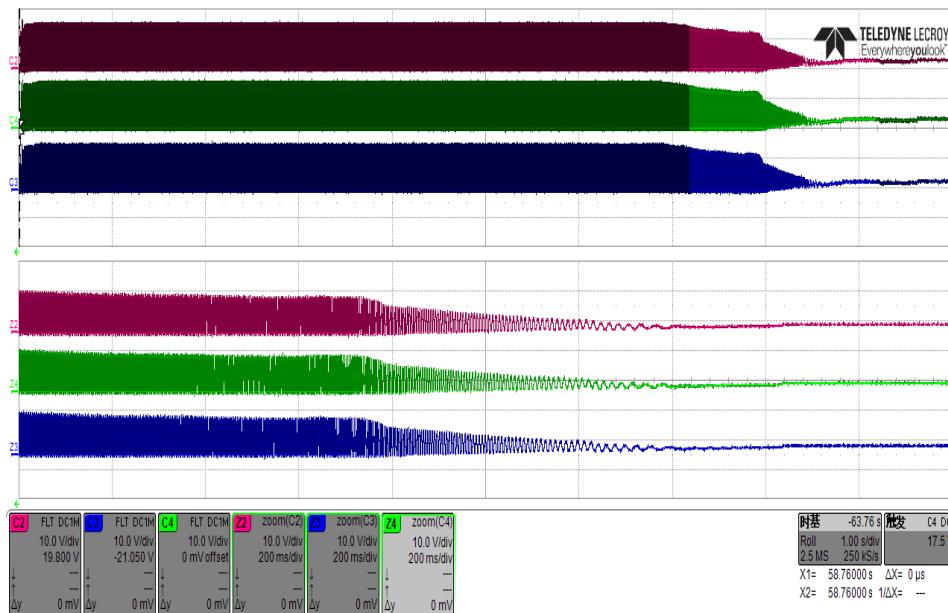


Fig. 3 Measured UVW output voltage @ battery=12.5V

3.1.3 MOSFET Vgs

	GH1	GH2	GH3	GL1	GL2	GL3
Tr/ns	576	628	555	575	460	478
Tf/ns	480	406	427	701	582	582

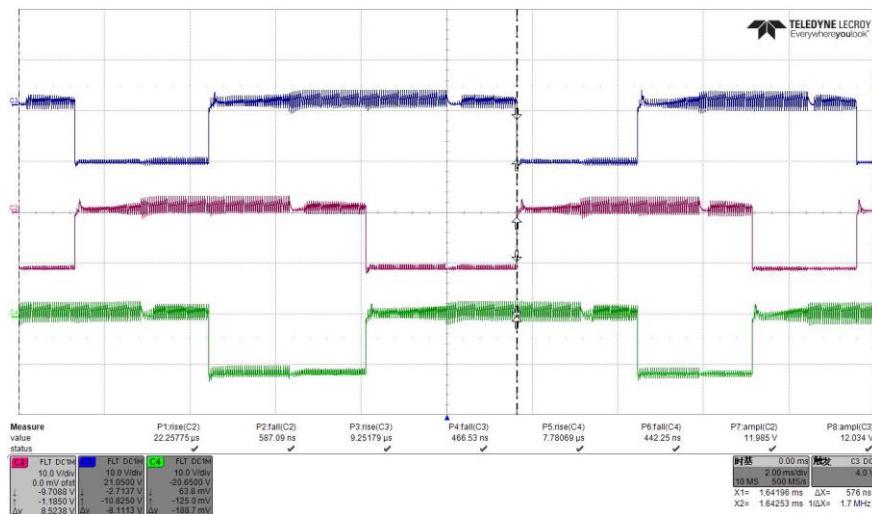


Fig. 4 Measured highside MOSFET Vgs

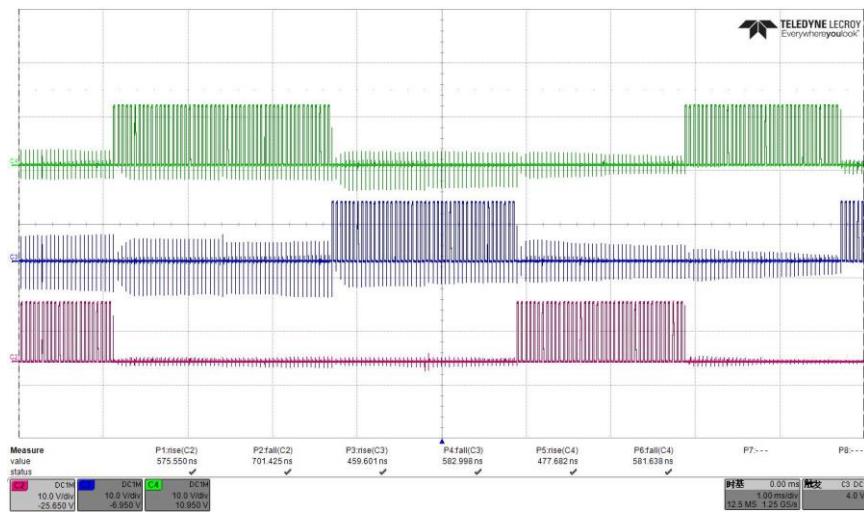


Fig. 5 Measured lowside MOSFET Vgs

3.1.4 MOSFET Vds

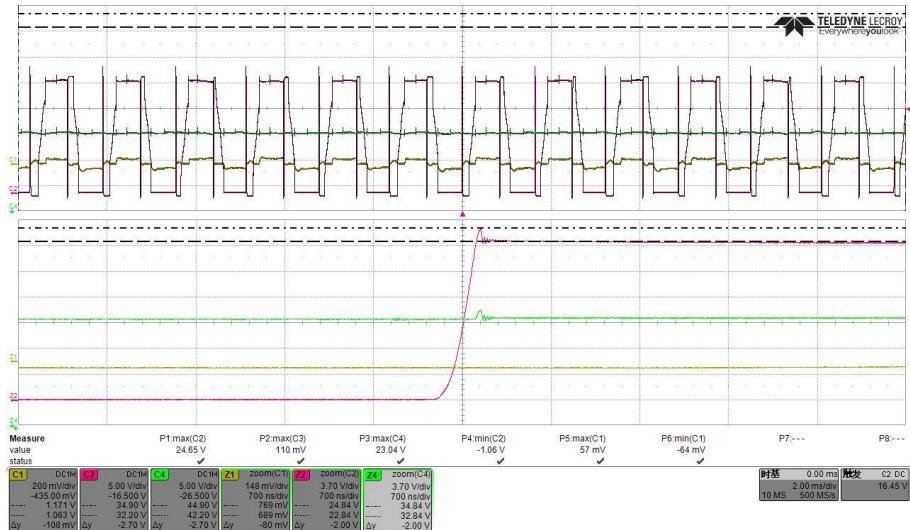


Fig. 6 Measured UVW phase voltage

3.2 PWM Test

3.2.1 PWM Frequency

PWM Frequency : 20kHz

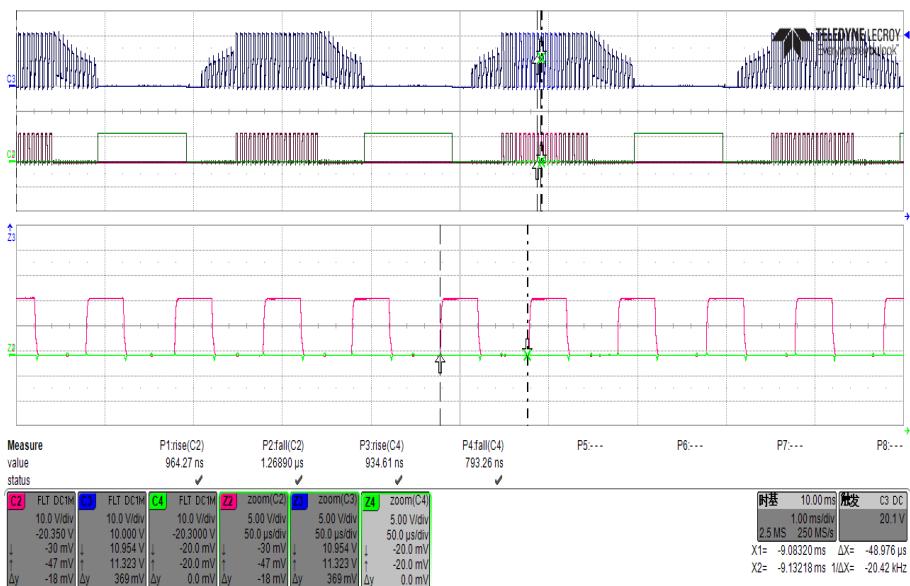


Fig. 7 Measured PWM Frequency

3.2.2 Speed Regulator

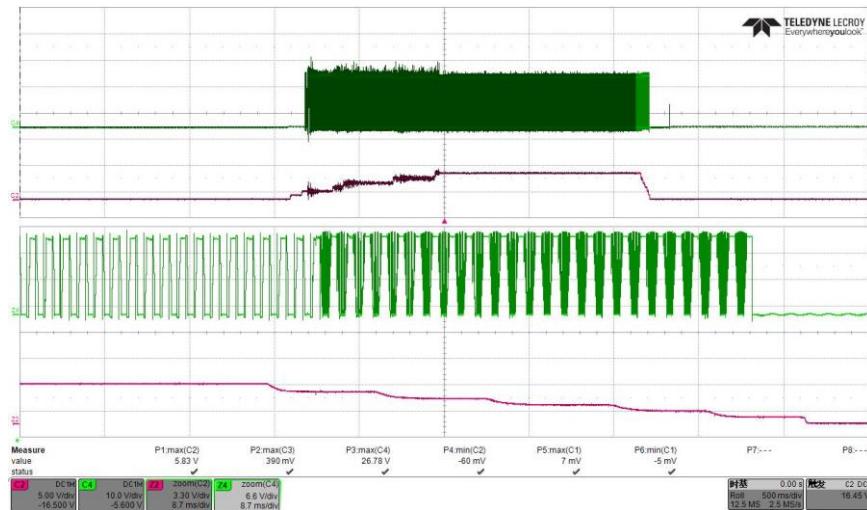


Fig. 8 Measured U-phase and throttle voltage

3.2.3 PWM Initial duty

Initial duty = 20%

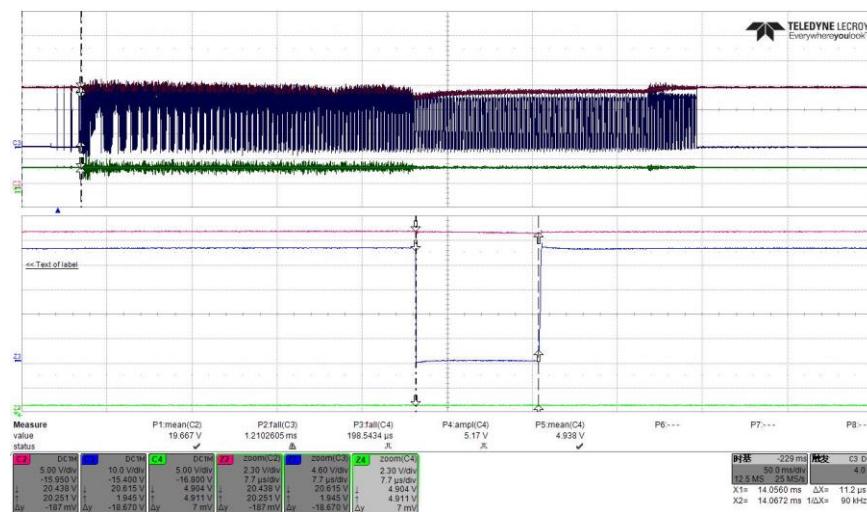


Fig. 9 Measured PWM Initial Duty

3.3 Current sampling

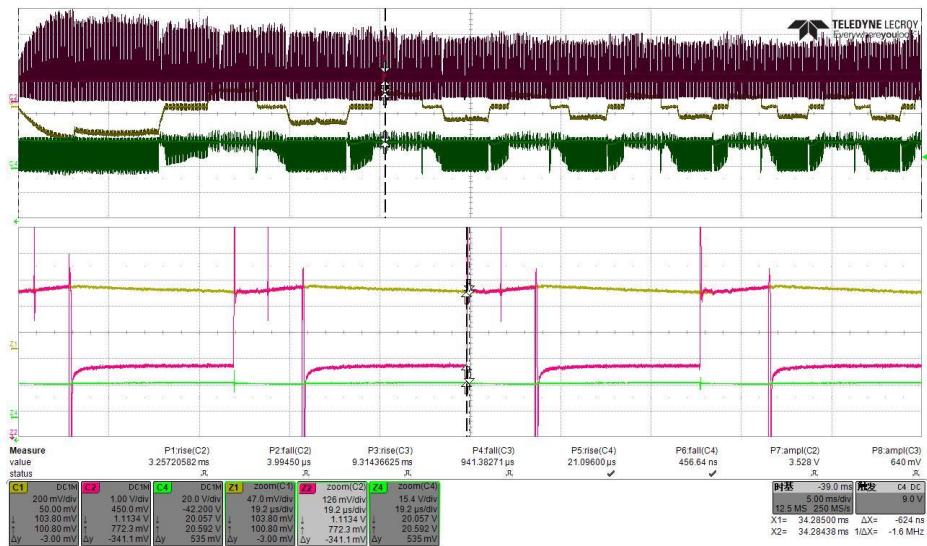


Fig. 10 Measured U phase voltage, U phase current and EA out

3.4 Motor Brake

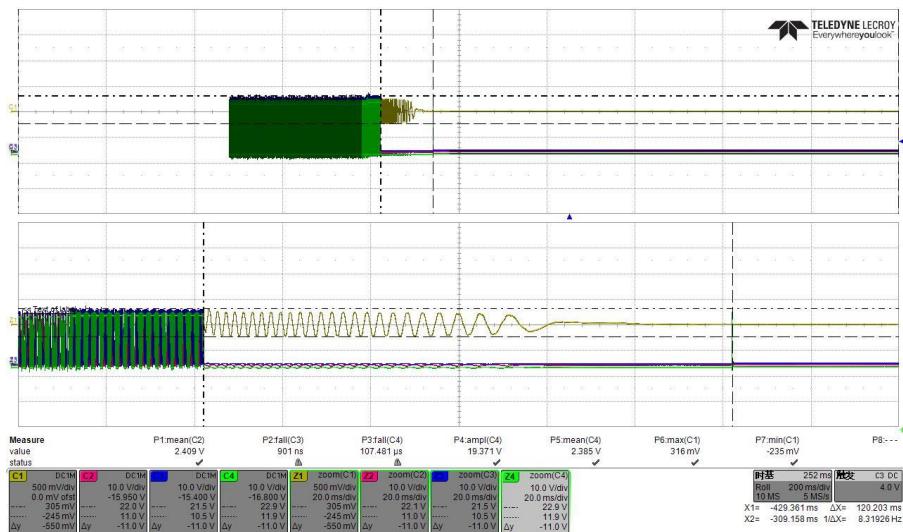


Fig. 11 Measured Phase Voltage and Phase current when Moto Brake

3.5 Motor Short Circuit Protection

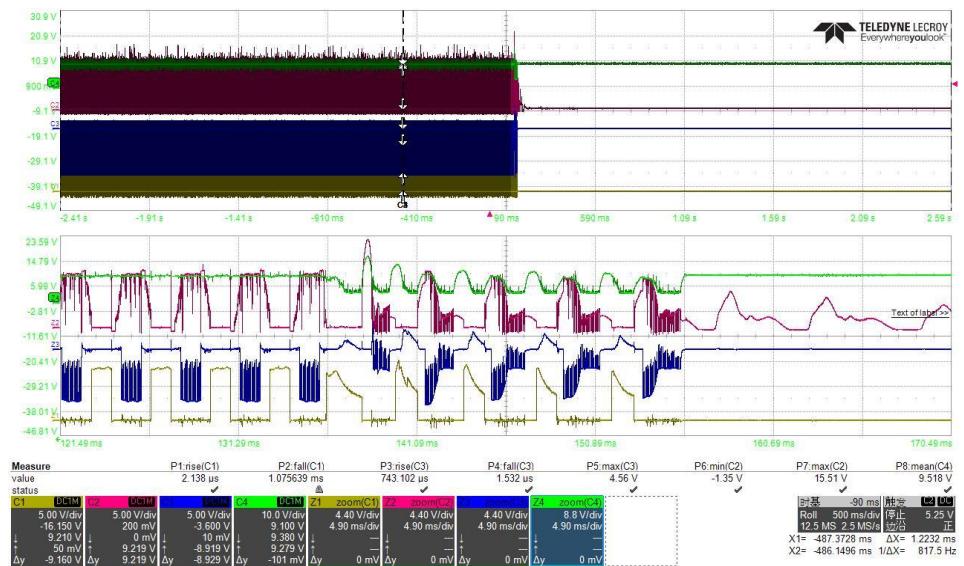


Fig. 10 Measured U-phase voltage, V-phase voltage, W-phase voltage, Bus voltage @ battery voltage = 21V

3.6 Temperature

PCB MOSFET Temperature protection setup: 85°C

	U+MOS	U-MOS	V+MOS	V-MOS	W+MOS	W-MOS	OB6612	Cap
Temp°C	103	99	114	117	101	102	67	86

3.7 待机电流

唤醒模式电流: 45mA

睡眠模式电流: ≤10uA

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