Subject **OB6611 Demo Board Manual**	Board Model: OB6611_1902 Doc. No.: OB_DOC_DBM_A_661100
	**Key Feature:** • Sensorless motor control • Continuous average current: 12V/2.0A, 24V/1.0A • High speed motor support • Motor start fast, stuck restart • High precision and wide range speed control • OCP support • Fast phase to phase SCP • Small PCB size, simple BOM and assemble conveniently

Revision history:

Revise Date	Version	Reason/Issue
2019-01-21	00	First Issue

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1. System Electrical Specification

1.1 Input Characteristic

■ DC input voltage	5V to 24V

1.2 System parameters

■ PWM frequency	20 KHz
■ MCU supply voltage	5V
■ Current sampling resistance	47mΩ±1%
■ Gate driver supply voltage(P MOS)	6V(max)
■ Gate driver supply voltage(N MOS)	5V
■ Max of MOSFET drain source voltage value	30V

1.3 Output characteristic

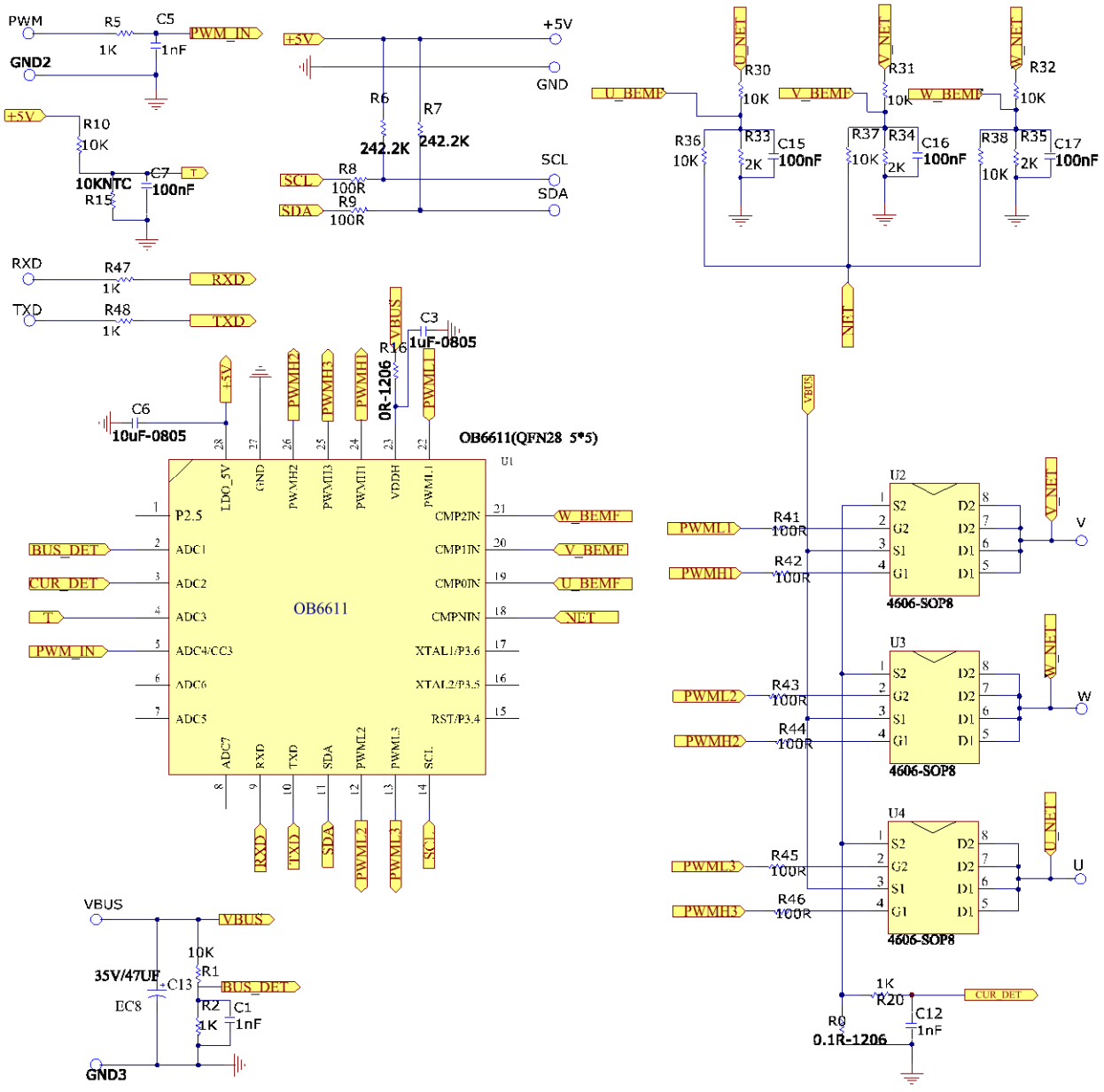
■ Phase to phase shortcuit average current	7A 0.5mS
■ Over average current	5A 5S
■ Maximum of PWM duty	100%
■ Minimum of PWM duty	10%

1.4 Environmental

■ Operating Ambient Temperature	-20 ℃ ~ 45 ℃
■ Storage Temperature	-40 ℃ ~ 100 ℃
■ Storage Humidity	0 ~ 95% R.H.

2. Board Information

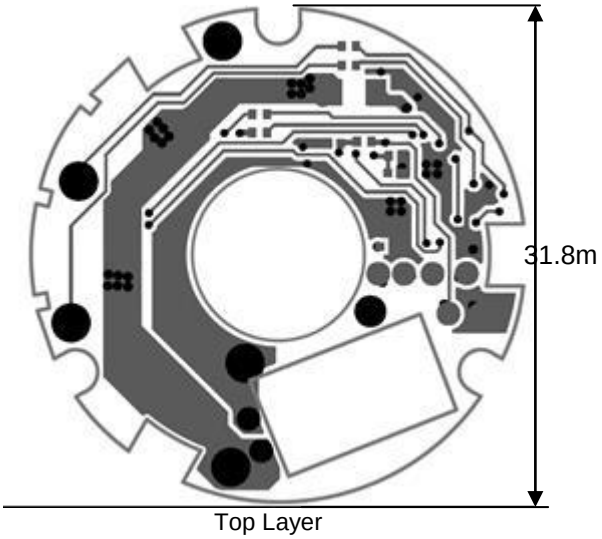
2.1 Schematic



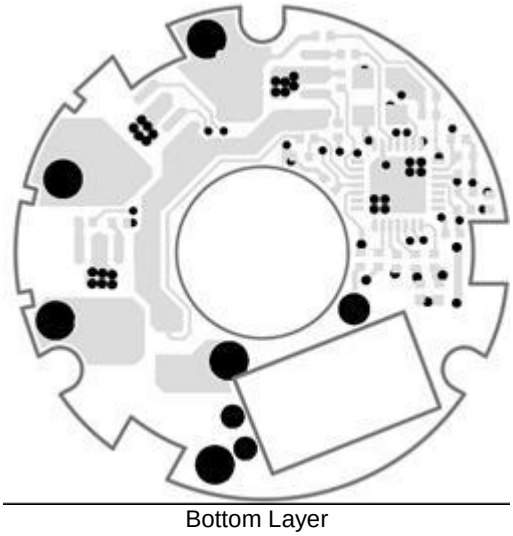
2.1.1 Bill of material

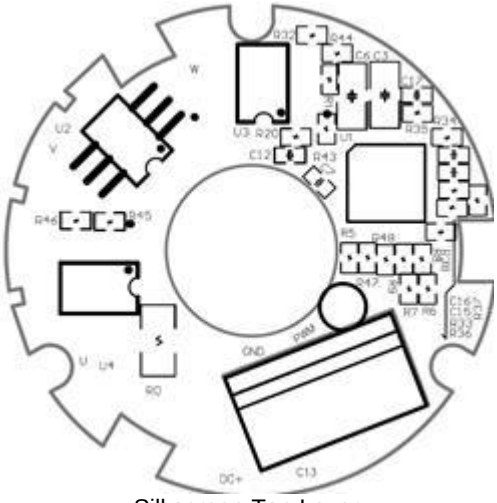
Designator	Package	Description	QTY
C13	EC8	Capacitor,electrolyte,47uf/50V	1
C6	C0805	Capacitor,ceramic,10uF/25V	1
C3	C0805	Capacitor,ceramic,1uF/25V	1
C7	C0805	Capacitor,ceramic,100nF/25V	1
C15,C16,C17	C0402	Capacitor,ceramic,100nF/25V	3
C1,C5,C12	C0402	Capacitor,ceramic,1nF/25V	3
R1, R10,R30,R31,R32,R36,R37,R38	R0402	Resistor,chip,10K,1%	8
R33, R34, R35	R0402	Resistor,chip,2K,1%	3
R2, R5,R20,R47,R48	R0402	Resistor,chip,1K,1%	5
R6,R7	R0402	Resistor,chip,242.2K,1%	2
R8,R9,R41,R42,R43,R44,R45,R46	R0402	Resistor,chip,100R,1%	8
R15	R0402	NTC,chip,10K,B=3950,1%	1
R0	R1206	Resistor,chip,47mR,1%	1
R16	R1206	Resistor,chip,0.0R,1%	1
PCB	31.8mm*31.8mm	1OZ，thickness 1.6mm	1
U2, U3, U4	SOP-8	OBS3006CPS	3
U1	QFN28	OB6611FIP	1

2.2 PCB Gerber File

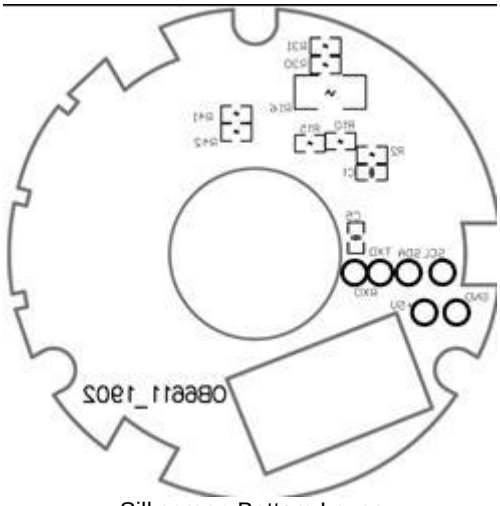


Top Layer


Bottom Layer

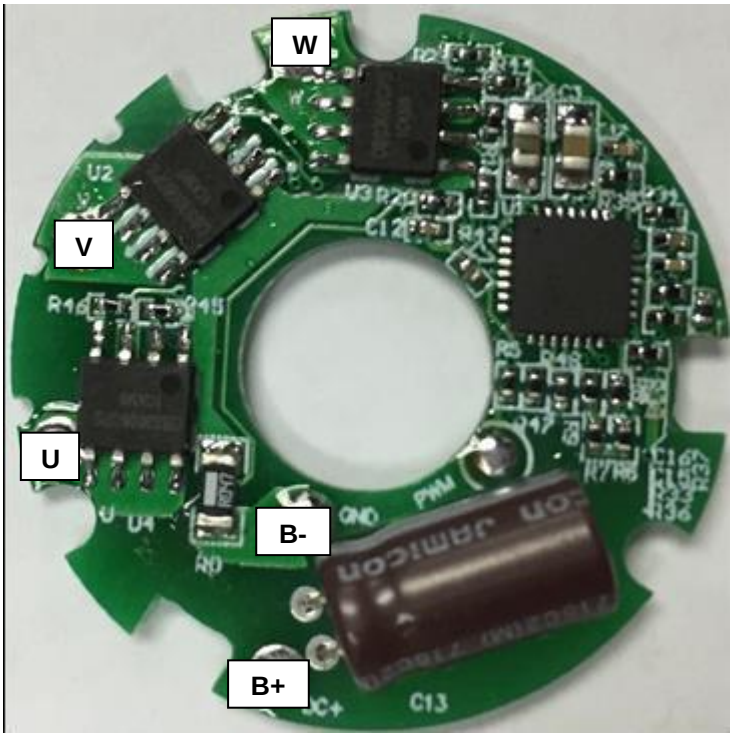


Silkscreen Top Layer



Silkscreen Bottom Layer

2.3 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

2.4 BLDC Controller Board Snapshot

3. Performance Evaluation

This session presents the test results of OB6611 24.0V/1.0A electronic trimmer 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=20℃

No	Parameter	Symbol	Min	Type	Max	Unit	Corresponding Fig.
1	MCU supply	V	4.9	5	5.1	V	Fig.1,Fig.2
3	MOSFET gate voltage	V_{gs}	4.0	5	6.0	V	Fig.4-1/ Fig.4-2
4	Highside MOSFET rise time(P/N)	T_{r_h}		200/400		ns	Fig.4-1/ Fig.4-2
5	Highside MOSFET fall time(P/N)	T_{f_h}		210/220		ns	Fig.4-1/ Fig.4-2
6	Lowside MOSFET rise time(P/N)	T_{r_l}		490/480		ns	Fig.4-1/ Fig.4-2
7	Lowside MOSFET fall time(P/N)	T_{f_l}		580/510		ns	Fig.4-1/ Fig.4-2
8	Bus supply voltage spike	V_{spike}		1.5		V	Fig.5-1/ Fig.5-2
9	PWM frequency	f_{PWM}		20		kHz	Fig.6-1/ Fig.6-2
10	Motor stuck protect time	T_{STP}		0.7		s	Fig.10
11	Over Current protect time	T_{STP}		5		s	Fig.11
12	Short Circuit Protection time	T_{STP}		0.5		ms	Fig.12

Test Equipments

Item	Module
DC source	LW-12050KD
Oscilloscope	LeCroy 4024
Current meter	/
Differential probe	/
Thermo meter	DT-847U
Digital multimeter	FLUKE 15B+

3.1 Voltage Test

3.1.1 Power ON/OFF & MCU Supply

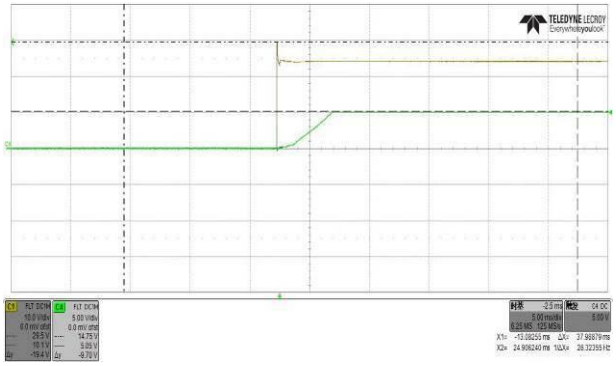


Fig. 1 Measured MCU supply voltage and DC input voltage @ input voltage =24.0V

CH1:V_{DC} CH4:V_{MCU}

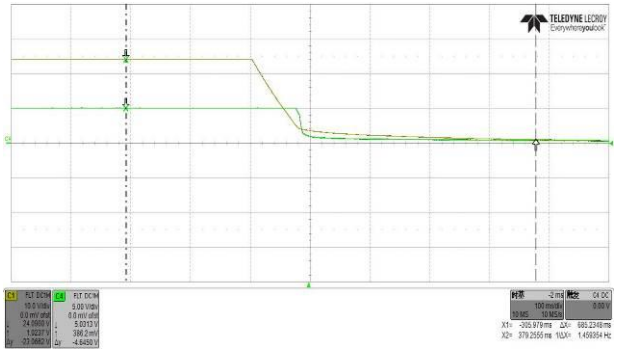


Fig. 2 Measured MCU supply voltage and DC input voltage @ input voltage =24.0V

CH1:V_{DC} CH4:V_{MCU}

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

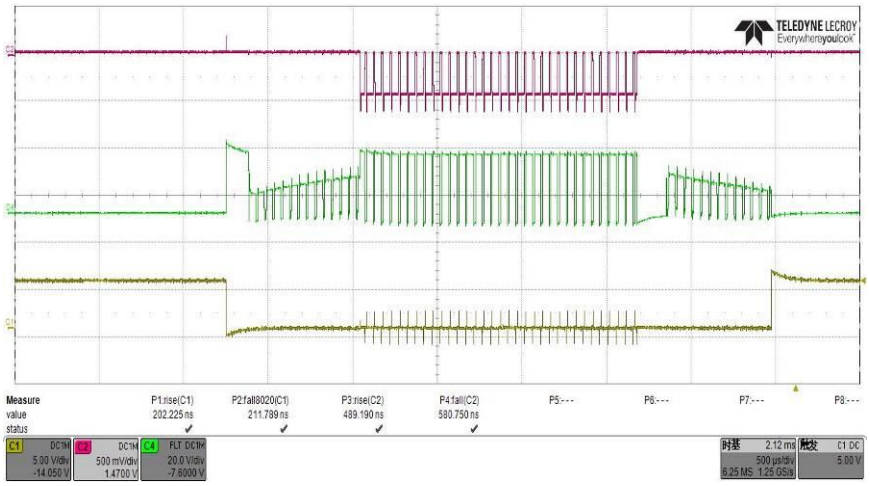


Fig. 3-1(P MOS Modulation)Measured phase U highside and lowside MOSFET $V_{gs}/T_{r\_h}/T_{r\_l}/T_{f\_h}/T_{f\_l}$

CH1:V_{GL} CH2:V_{GH} CH4:V_{MTR_PHS}

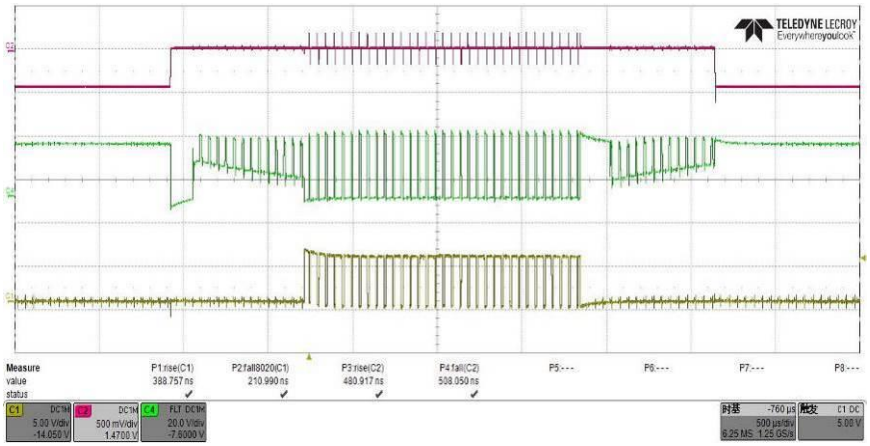


Fig. 4-2(N MOS Modulation)Measured phase U highside and lowside MOSFET V_{gs}/T_{r_h}/T_{r_l}/T_{f_h}/T_{f_l}

CH1:V_{GL} CH2:V_{GH} CH4:V_{MTR_PHS}

3.1.3 V_{bat} Spike Voltage

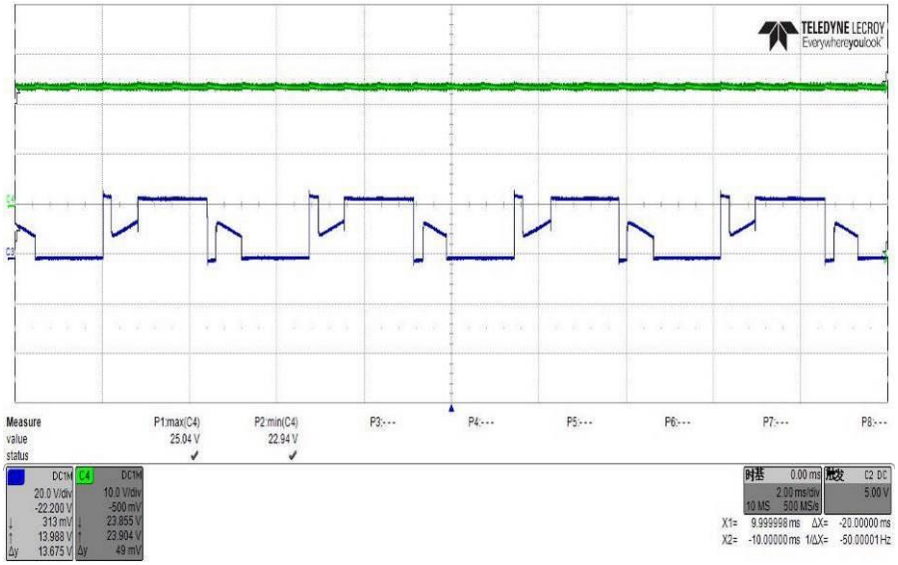


Fig. 5-1(P MOS Modulation)Measured V_{DC}/ U phase voltage

CH1:V_{DC} CH3:V_{MTR_PHS}

100%占空比运行，母线电压波形

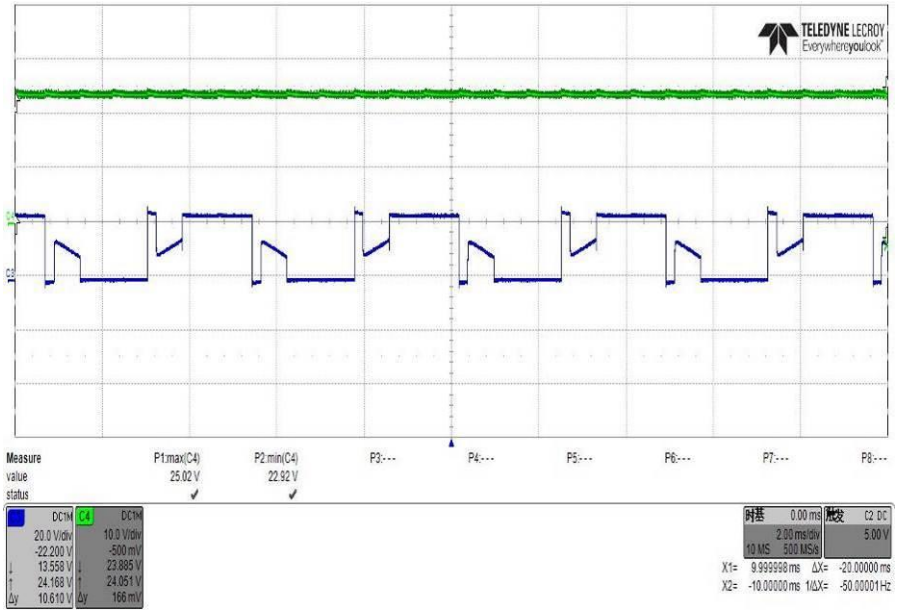


Fig. 6-2(N MOS Modulation)Measured V_{DC}/ U phase voltage

CH1:V_{DC} CH3:V_{MTR_PHS}

100%占空比运行，母线电压波形

3.2 PWM Test

3.2.1 PWM Frequency

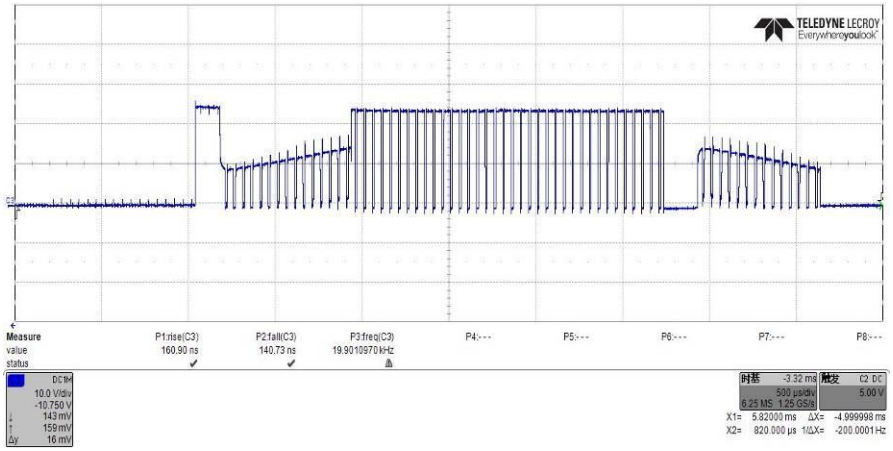


Fig. 7-1(P MOS Modulation)Measured phase U voltage

CH3: V_{MTR_PHS}

20.0KHz PWM 频率波形

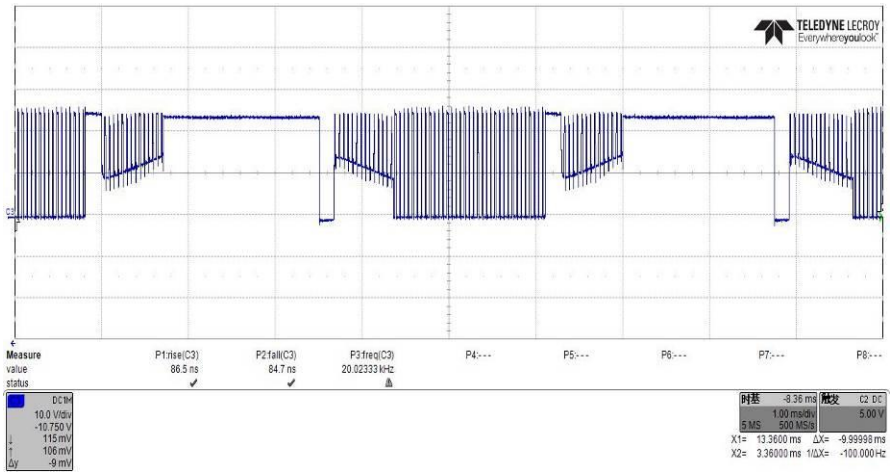


Fig. 8-2(N MOS Modulation)Measured phase U voltage

CH3: V_{MTR_PHS}

20.0KHz PWM 频率波形

3.2.2 Power On

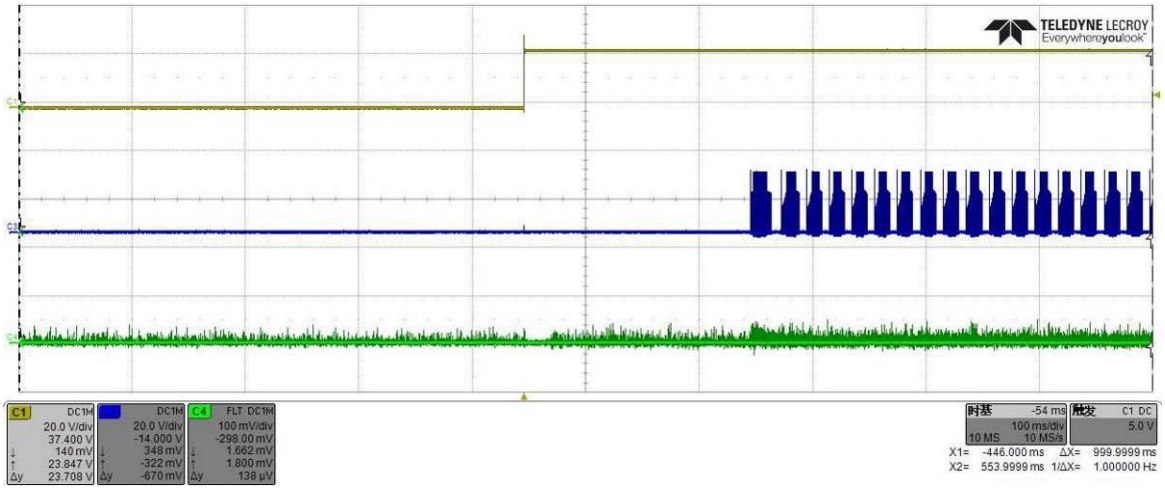


Fig. 9-1(P MOS Modulation)Measured V_{DC} voltage / phase U voltage and R_{cs} voltage

CH1:V_{DC} CH3:V_{MTR_PHS} CH4:I_{CS}

电机起动相电压和相电流波形

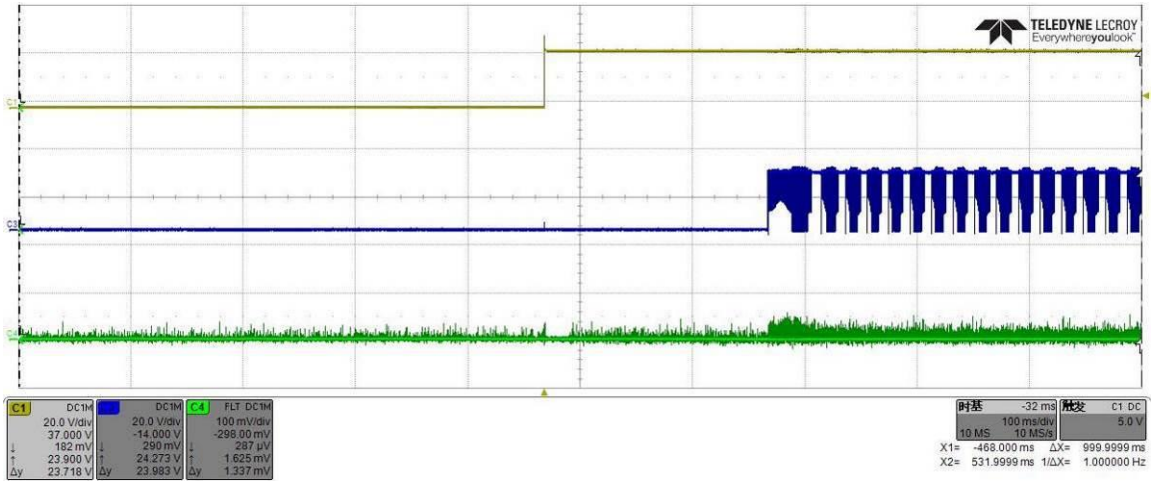


Fig. 10-2(N MOS Modulation)Measured V_{bat} voltage / phase U voltage and R_{cs} voltage

CH1:V_{DC} CH3:V_{MTR_PHS} CH4:I_{CS}

电机起动相电压和相电流波形

3.2.3 Power Off

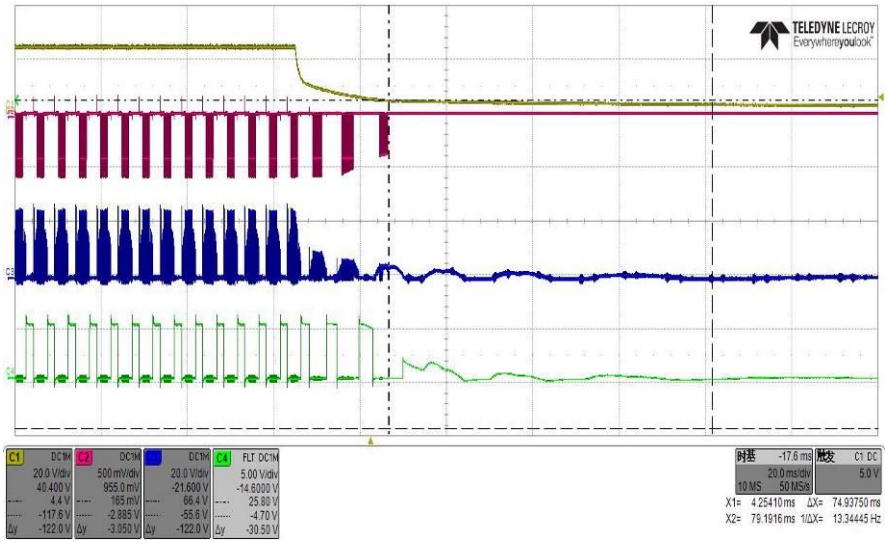


Fig. 11-1(P MOS Modulation)Measured V_{DC} voltage / phase U voltage and highside / lowside gate drive voltage

CH1:V_{DC} CH2:V_{GH} CH3:V_{MTR_PHS} CH4:V_{GL}

电池掉电过程电机相电压和上下管驱动波形

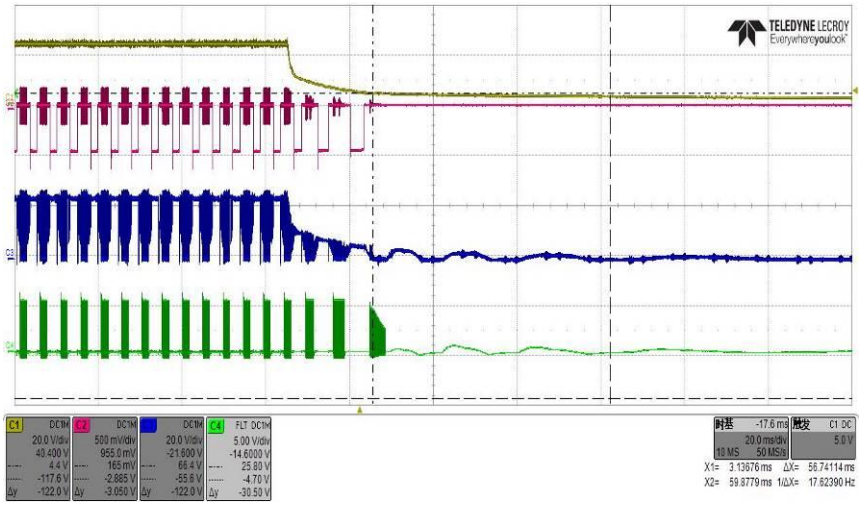


Fig. 12-2(N MOS Modulation)Measured V_{DC} voltage / phase U voltage and highside / lowside gate drive voltage

CH1:V_{DC} CH2:V_{GH} CH3:V_{MTR_PHS} CH4:V_{GL}

电池掉电过程电机相电压和上下管驱动波形

3.3 Current sampling

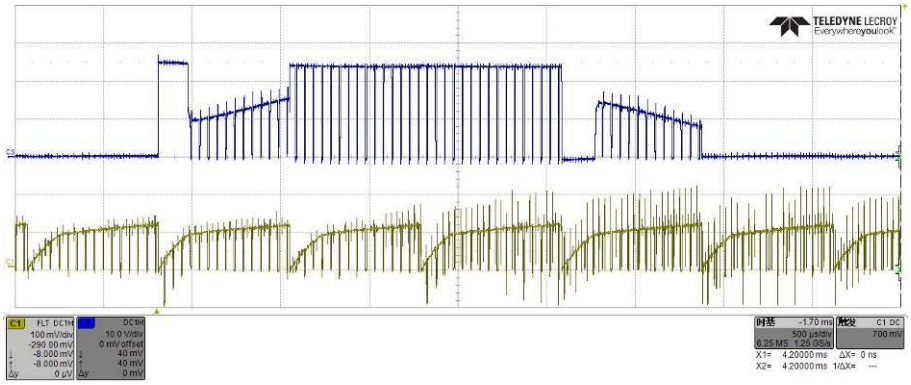


Fig. 13-1(P MOS Modulation)Measured phase U voltage and R_{cs} voltage

CH1: I_{CS} CH3: V_{MTR_PHS}

电机驱动时电机相电压和电流采样电阻两端电压波形

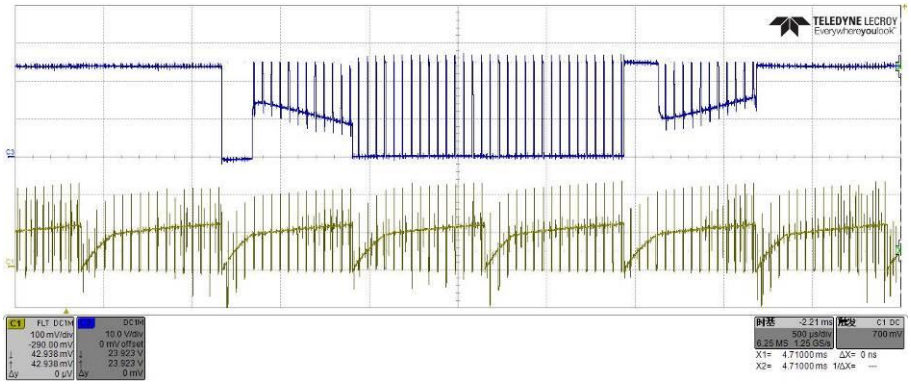


Fig. 14-2(N MOS Modulation)Measured phase U voltage and R_{cs} voltage

CH1: I_{CS} CH3: V_{MTR_PHS}

电机驱动时电机相电压和电流采样电阻两端电压波形

3.4 Motor Stuck Protect

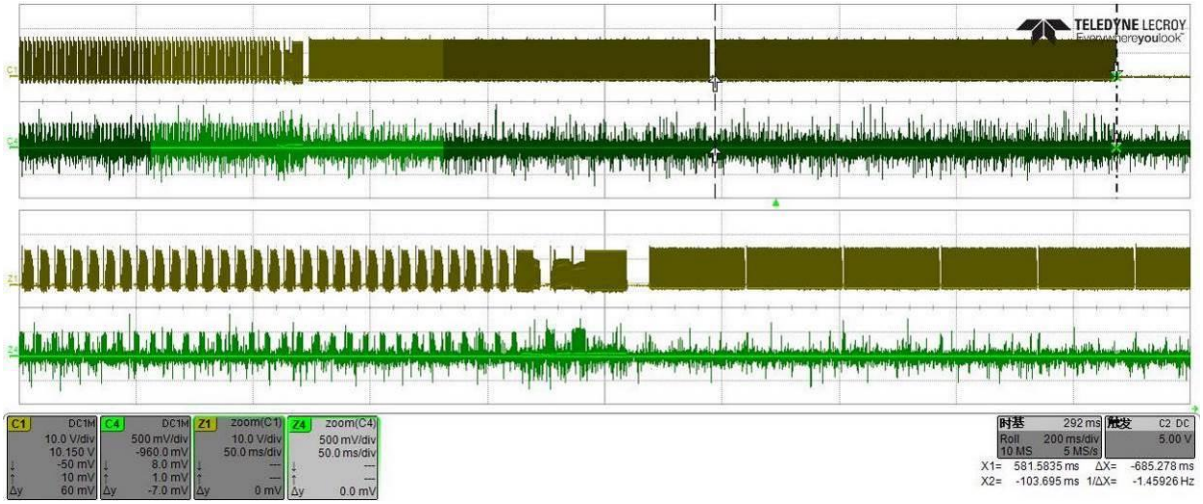


Fig. 15 phase U voltage/motor stuck protect flag and R_{cs} voltage

CH1:V_{MTR_PHS} CH4:I_{CS}

电机运行过程中堵住电机（堵转三次进入保护）

3.5 Over Average Current Protect

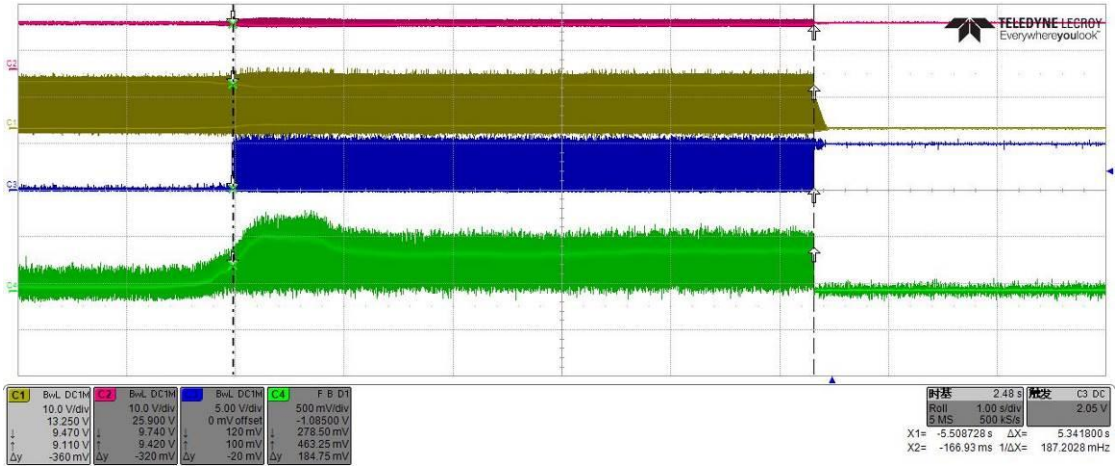


Fig. 16 Measured V_{bat} / phase U voltage/OCP debounce toggle counter and R_{cs} voltage

CH1: V_{MTR_PHS} CH2: V_{BAT} CH3:OCP debounce counter CH4:I_{CS}

过流保护（5A）波形

3.6 Motor Short Circuit Protection

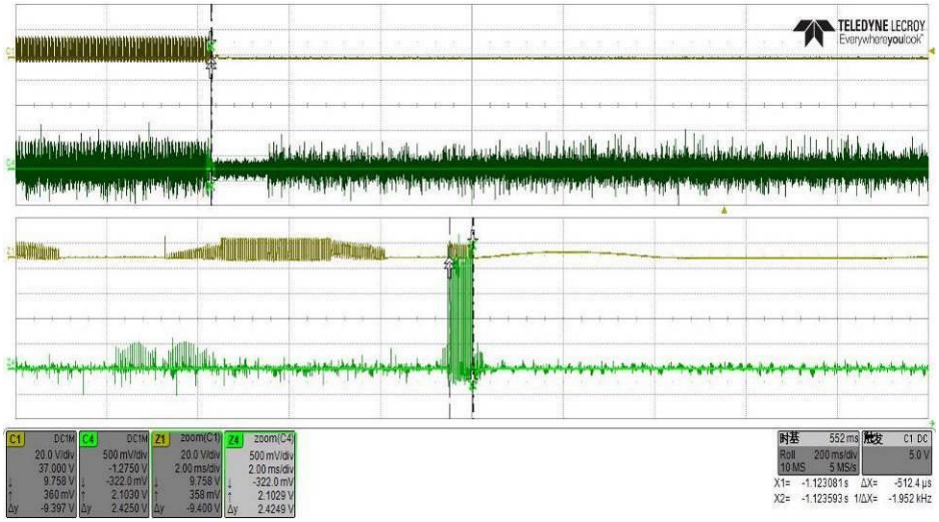


Fig. 12(P MOS Modulation)Measured phase U voltage and R_{cs} voltage @ input voltage =12.0V

CH1:V_{MTR_PHS} CH4:I_{CS}

相间短路时电流采样电阻两端电压和短路保护波形

3.7 Mosfet Temperature Rise

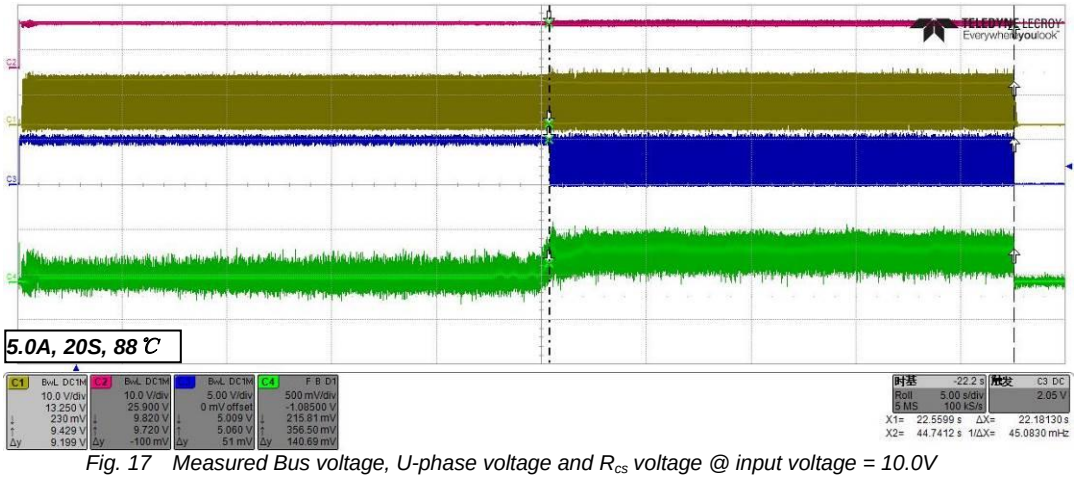


Fig. 17 Measured Bus voltage, U-phase voltage and R_{cs} voltage @ input voltage = 10.0V

CH1: V_{MTR_PHS} CH2: V_{BAT} CH3:OCP debounce counter CH4:I_{CS}

室温 20℃下 5.0A 平均电流持续工作 20S， MOS 最高温度约为 88℃

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