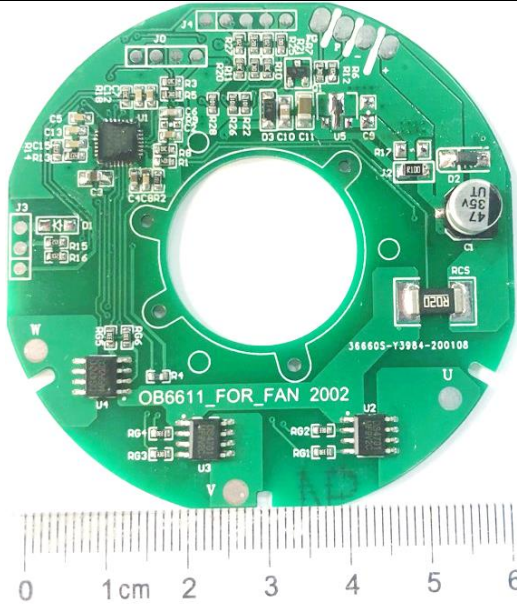


Subject
OB6611 Demo Board Manual

Board Model: OB6611_FOR_FAN 2002

Doc. No.: OB_DOC_DBM_B_661100



Key Feature:

- Single chip controller solution
- High integration of MCU, pre-driver, LDO.
- SVPWM control with hall sensor feedback.
- 19% duty start.
- temperature sensing and thermal protection.
- Two levels battery under voltage protection
- PCB size small, can be integrated with the motor.

Revision history:

Revise Date	Version	Reason/Issue
2020-02-28	00	First Issue

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1. System Electrical Specification

1.1 Input Characteristic

- DC input voltage rating 12V/24V
- DC input voltage 9V to 26V
- Handle working voltage 0 to 4.5V
- Hall sensor working voltage 9V to BUS Voltage

1.2 System parameters

- PWM frequency 21.6 KHz
- MCU supply voltage $5V \pm 2\%$
- 5V supply current 15mA
- Current sampling resistance 20m Ω
- Current sampling amplification 1
- Current sampling amplifier offset 0
- Gate driver supply voltage 5V
- Max of MOSFET drain source voltage value 40V
- MOSFET thermal sensor precision 1%

1.3 Output characteristic

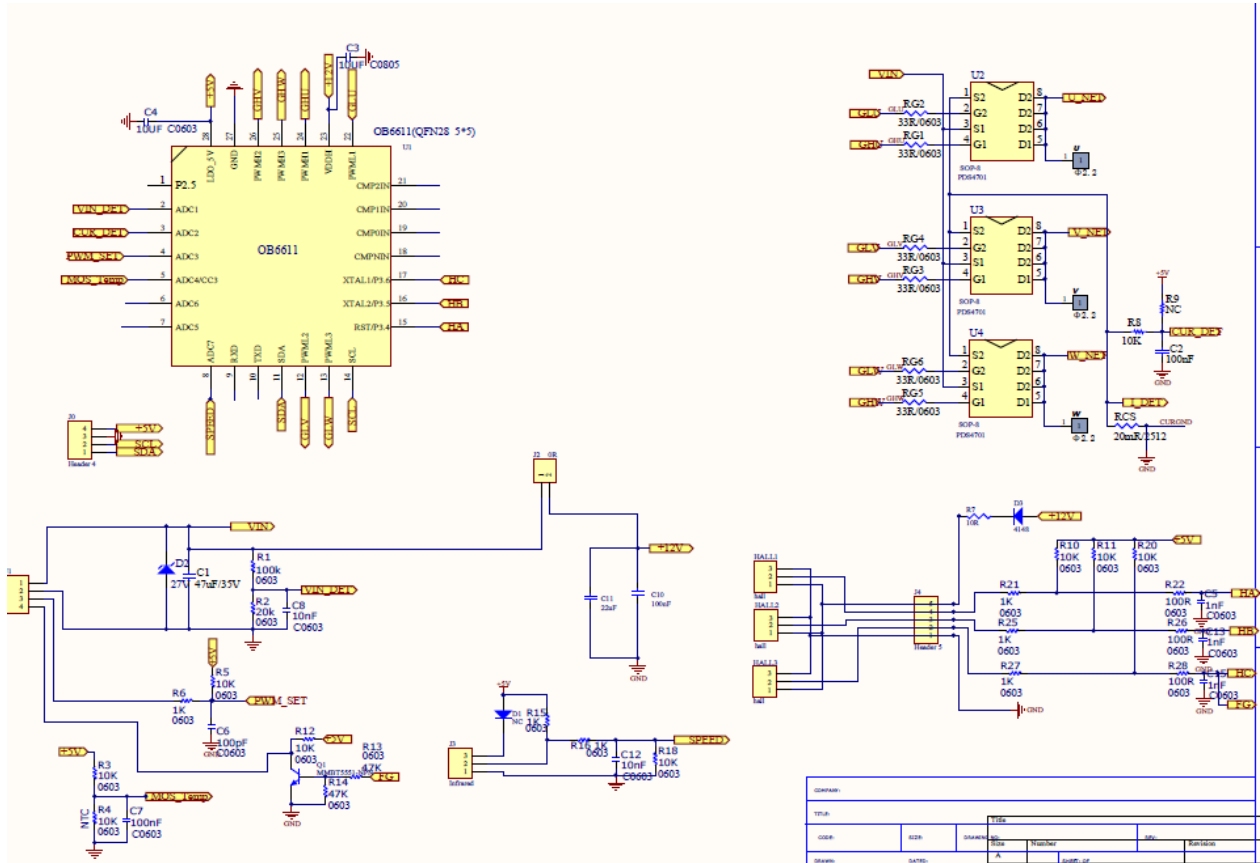
- Maximum of PWM duty 99%
- Minimum of PWM duty 30%

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

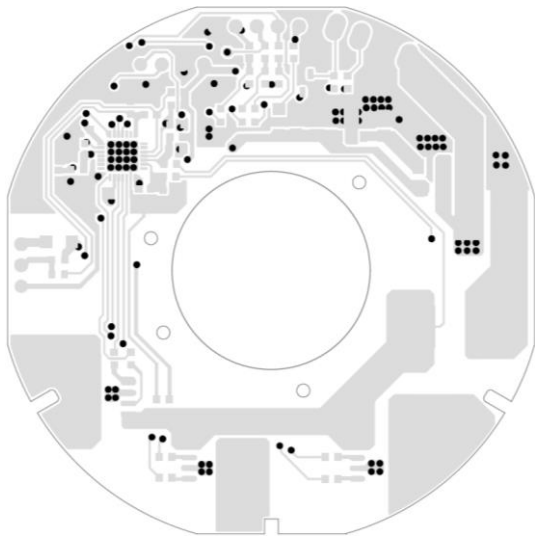
2.1 Schematic



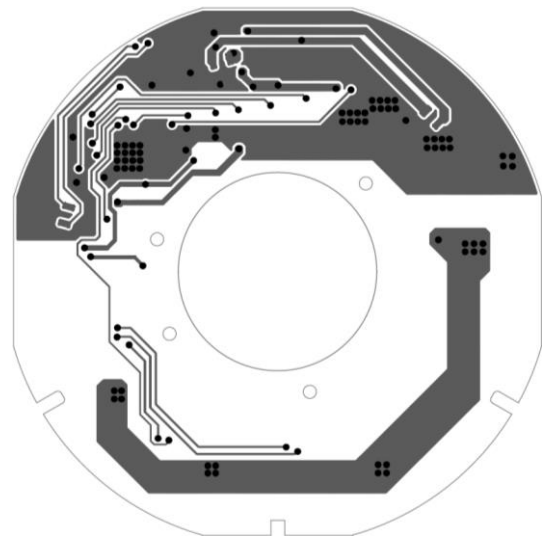
2.2 Bill of material

名称	规格	位号	封装	数量
贴片铝电解电容	47uF/35V	C1	SMD 6.3*5.4mm	1
贴片电容	100nF	C2, C7	C0603	2
贴片电容	10uF	C3	C0805	1
贴片电容	10uF	C4	C0603	1
贴片电容	1nF	C5, C13, C15	C0603	3
贴片电容	100pF	C6	C0603	1
贴片电容	10nF	C8, C12	C0603	2
贴片电容	100nF	C10	C0805	1
贴片电容	10uF	C11	C1206	1
稳压管	27V	D2	SOD123	1
二极管	4148	D3	SOD123	1
NPN 贴片三极管	MMBT5551	Q1	SOT-23	1
霍尔	SS41F	HALL1, HALL2, HALL3	SOT-23	3
贴片电阻	0R	J2	R1206	1
贴片电阻	100K	R1	R0603	1
贴片电阻	20K	R2	R0603	1
贴片电阻	10K	R3, R5, R8, R10, R11, R12, R18, R20	R0603	8
NTC 贴片电阻	10K	R4	R0603	1
贴片电阻	1K	R6, R15, R16, R21, R25, R27	R0603	6
贴片电阻	10R	R7	R0603	1
贴片电阻	47K	R13, R14	R0603	2
贴片电阻	100R	R22, R26, R28	R0603	3
贴片电阻	33R	RG1, RG2, RG3, RG4, RG5, RG6	R0603	6
合金采样电阻	20mR	RCS	R2512	1
IC	OB6611	U1	QFN28 5*5mm	1
P/N-MOSFET	PDS4701	U2, U3, U4	SOP-8	3
PCBA	OB6611_FOR_FAN 2002	PCBA	63.5*63.5mm	1

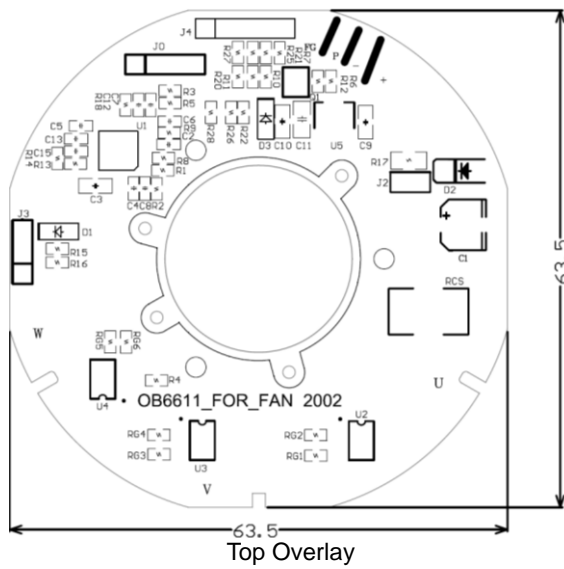
2.3 PCB Garber File



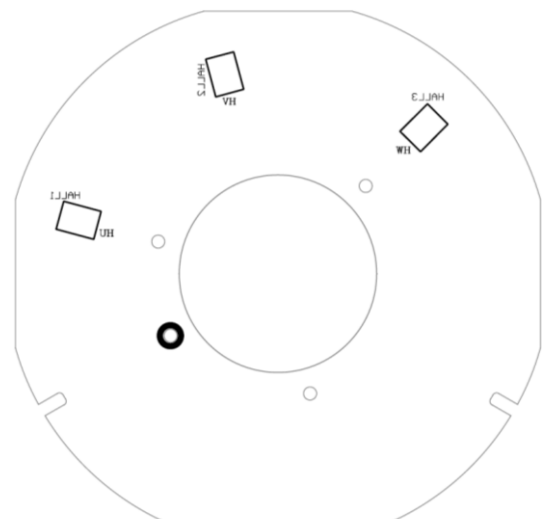
Top Layer



Bottom Layer

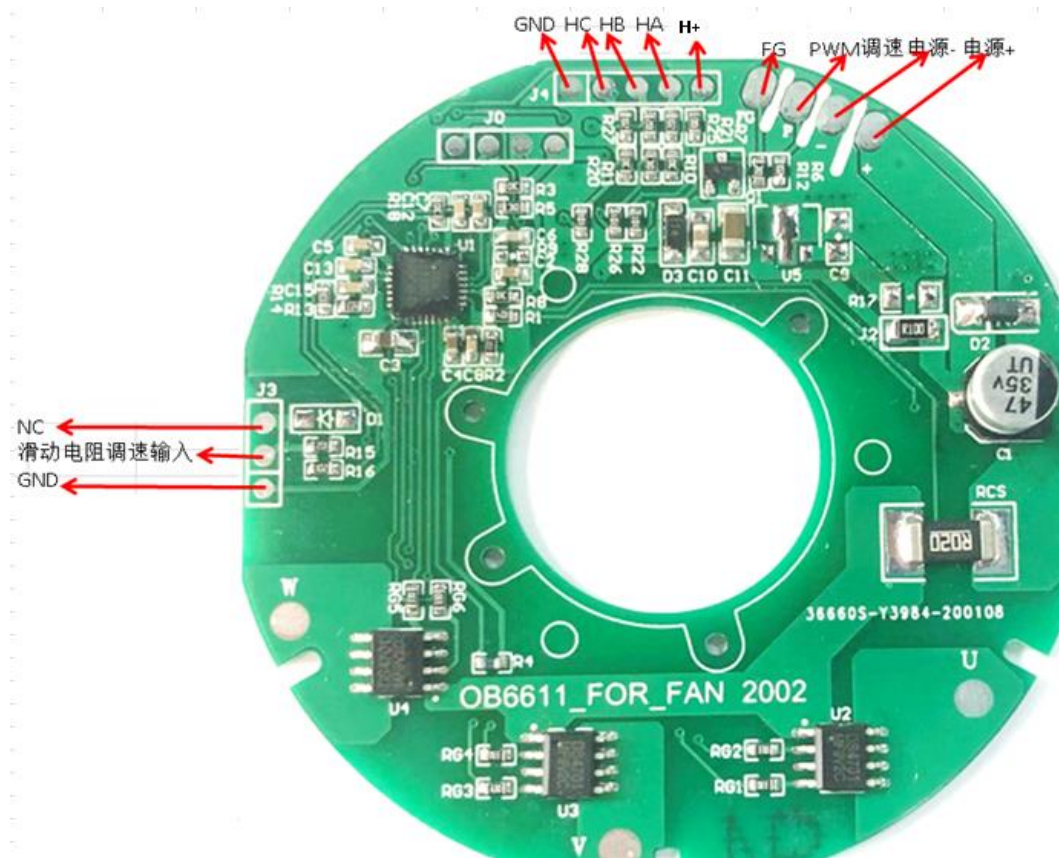


Top Overlay



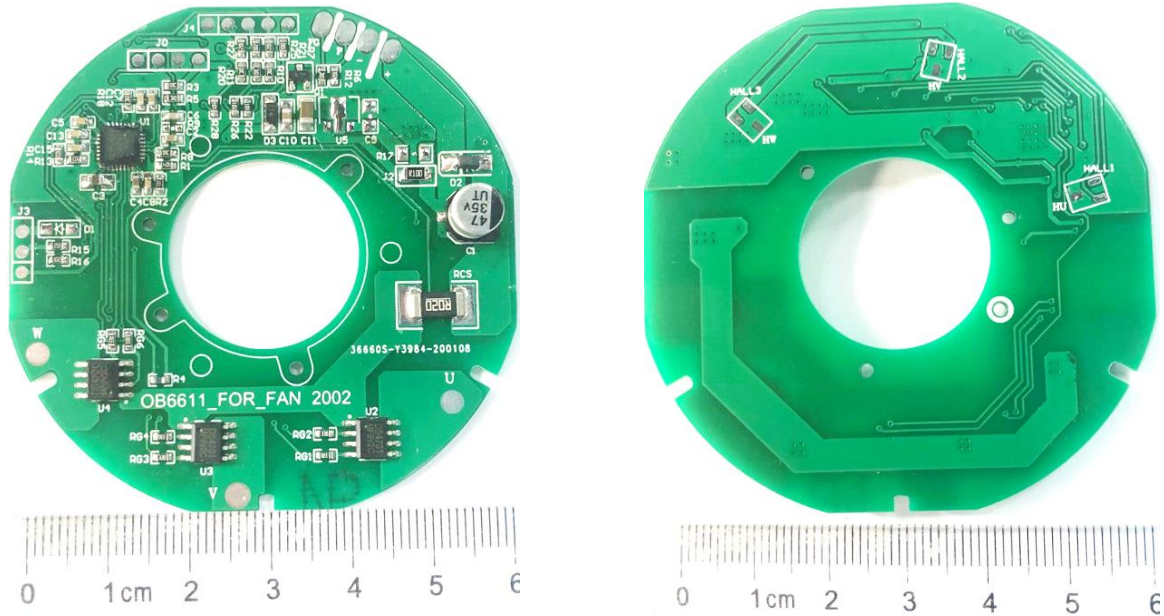
Bottom Overlay

2.4 Connector Function Description



HoleName	Description
电源+	Bus+
电源-	地线
PWM 调速输入	PWM 调速输入（高电平宽 19us-100us），默认
FG	速度显示，HALLC 信号输出
H+	和 Bus+ 电压相同
HA	HALLA 信号输入
HB	HALLB 信号输入
HC	HALLC 信号输入
GND	地线
NC	NC
滑动电阻调速输入	滑动电阻调速输入（AD 检测分压电压 0-4.5V）
GND	地线
U	Motor U phase output
V	Motor V phase output
W	Motor W phase output

2.5 Controller Board Snapshot



3. Performance Evaluation

This session presents the test results of OB6611 12/24V FAN 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	5.1	V	Fig.1, Fig.2 Fig.3, Fig.4
2	MOSFET gate voltage	Vgs		5		V	Fig.5
3	Highside MOSFET Rise time	Tr_h		0.161		us	Fig.6
4	Highside MOSFET Fall time	Tf_h		0.401		us	Fig.7
5	Lowside MOSFET Rise time	Tr_l		0.118		us	Fig.8
6	Lowside MOSFET Fall time	Tf_l		0.274		us	Fig.9
7	HighsideOff/LowsideOn Deadtime	DT1		1.055		us	Fig.10
8	HighsideOn/LowsideOff Deadtime	DT2		1.133		us	Fig.11
9	MOSFET Vds in MOTOR Stall	Vds		29.08		V	Fig.12, Fig.13
10	Bus Current in MOTOR Stall	Bus_Cur		1.94		A	Fig.14, Fig.15

Test Equipments

Item	Module
DC source	LW12050KD
Oscilloscope	LeCroy wavesurfer424
Current meter	Tek TCPA300
Differential probe	CATIII
Multi-meter	VC9808

3.1 Voltage Test

3.1.1 Gate Driver & MCU Supply Power ON/OFF

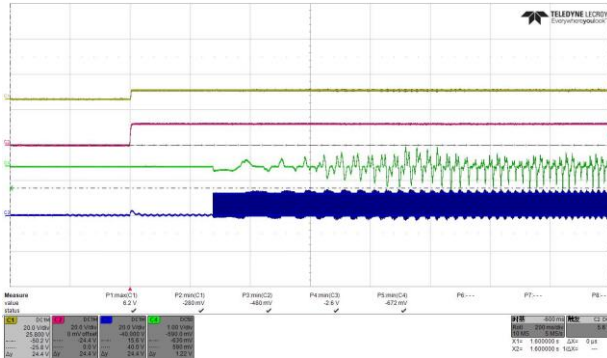


Fig. 1 Measured gate driver and MCU supply voltage @ 12V

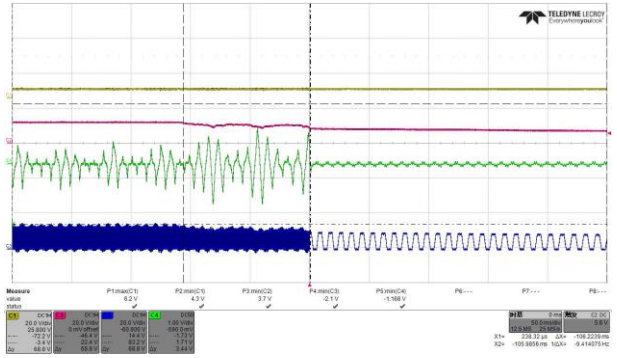


Fig. 2 Measured gated river and MCU supply voltage @ 12V

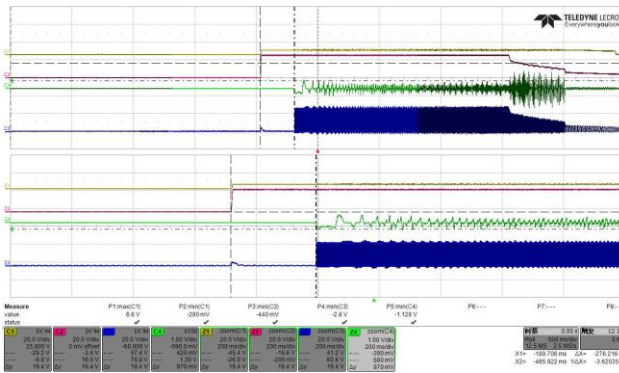


Fig. 3 Measured gate driver and MCU supply voltage @ 25V

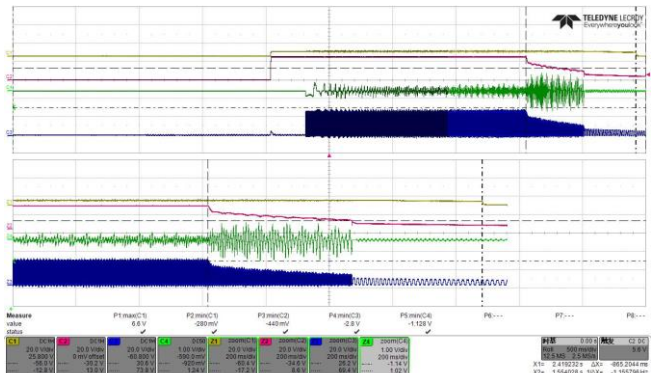


Fig. 4 Measured gated river and MCU supply voltage @ 25V

3.1.2 MOSFET Vgs

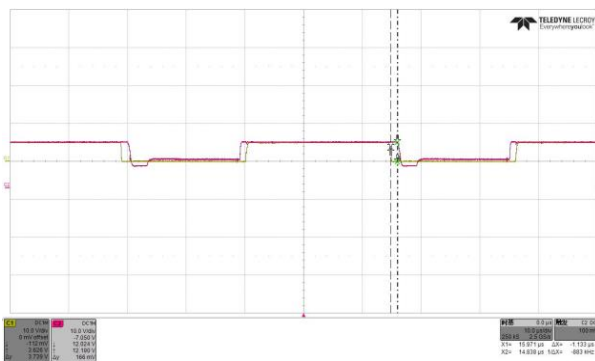


Fig. 5 Measured highside and lowside MOSFET Vgs

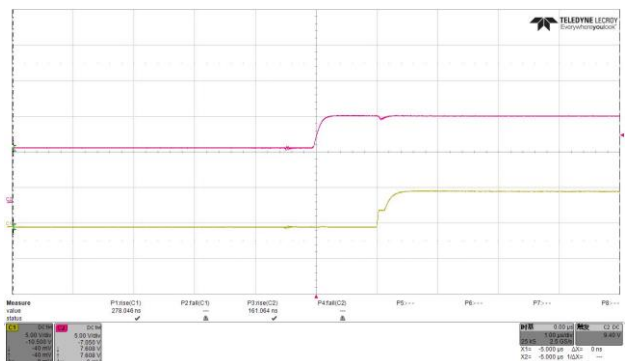


Fig. 6 Measured highside MOSFET Vgs

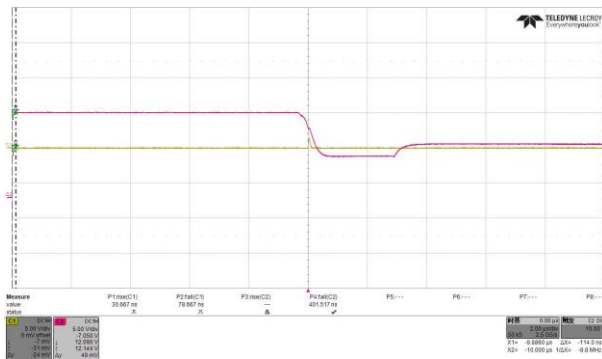


Fig. 7 Measured highside MOSFET Vgs

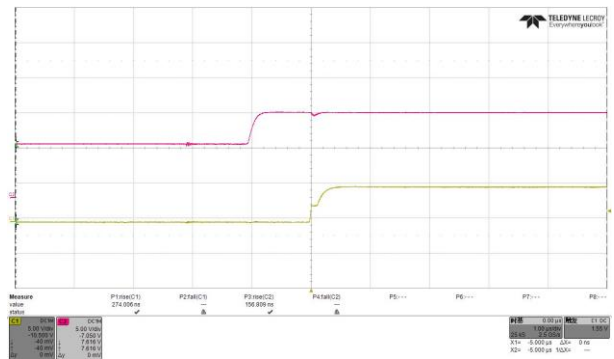


Fig. 8 Measured lowside MOSFET Vgs

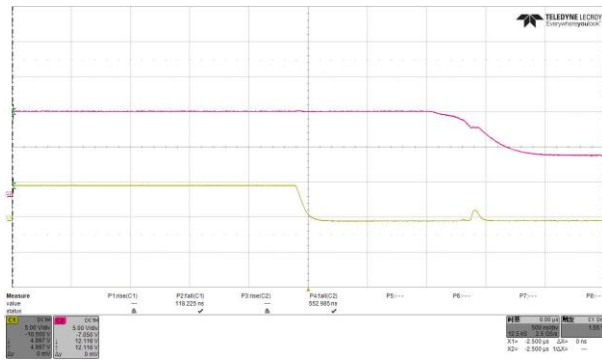


Fig. 9 Measured lowside MOSFET Vgs

3.1.3 Dead Time

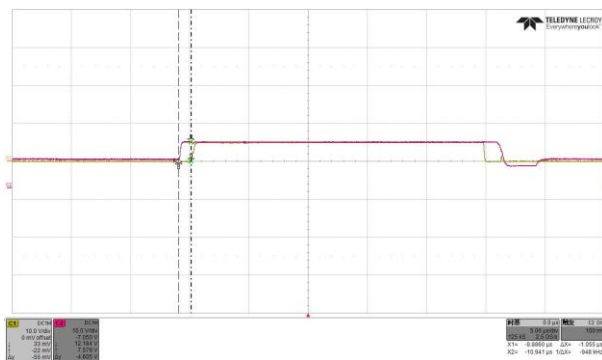


Fig.10 Measured high side off and low side on Dead Time

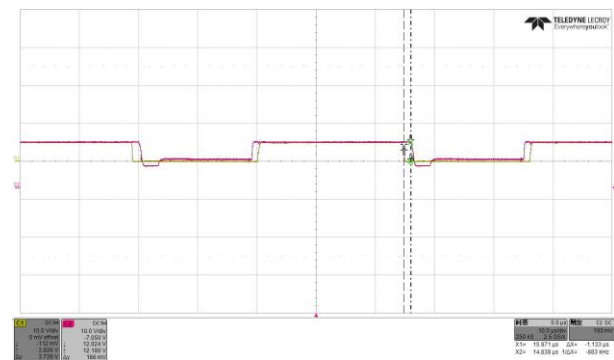


Fig.11 Measured high side on and low side off Dead Time

3.1.4 MOSFET Vds

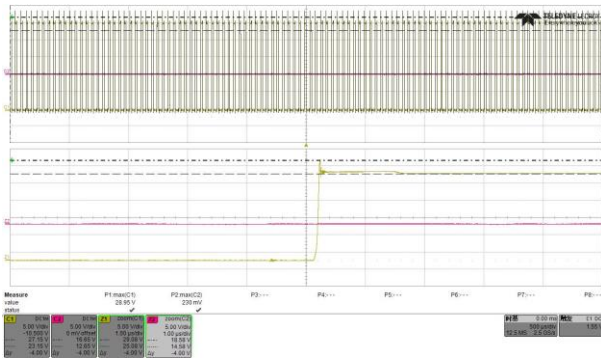


Fig. 12 Measured low side MOSFET Vds in motor stall @ 25V

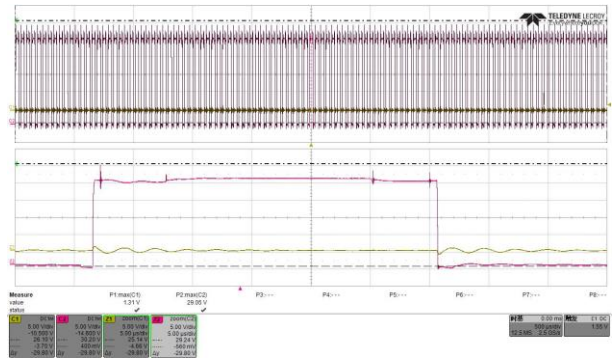


Fig. 13 Measured high side MOSFET Vds in motor stall @ 25V

3.2 BUS Current Test

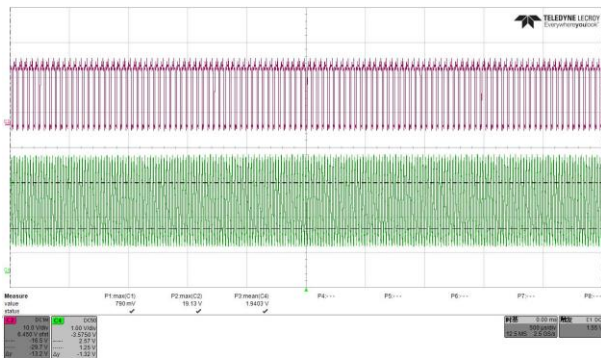


Fig. 34 Measured U phase voltage, Bus current

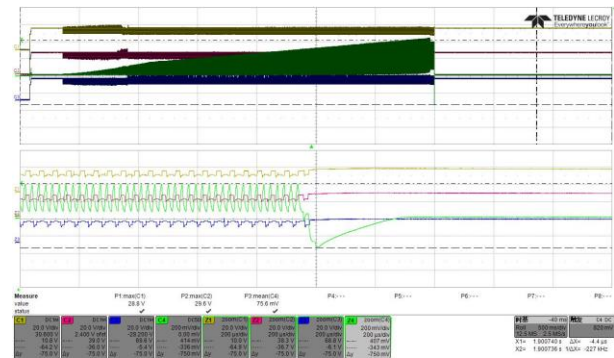


Fig. 45 Measured U phase voltage, Bus current

3.3 Temperature Test

不同角速度计算的滤波系数下，常温正常带扇叶全速工作 2 小时，各器件温升情况如下：

	滤波系数 = 15		滤波系数 = 7		滤波系数 = 1	
	1 小时	2 小时	1 小时	2 小时	1 小时	2 小时
MCU (U1)	39.3°C	38.6°C	39.1°C	38.1°C	38.5°C	39.0°C
MOS(U4)	36.8°C	36.6°C	36.2°C	35.8°C	37.0°C	37.3°C
MOS(U3)	36.7°C	36.4°C	36.4°C	35.5°C	36.2°C	36.8°C
MOS(U2)	35.2°C	35.3°C	34.5°C	34.1°C	33.6°C	35.0°C
电容 (C1)	27.1°C	27.6°C	28.3°C	28.7°C	28.5°C	29.5°C

器件温度比较低，测试通过。

3.4 Hall Error Test

- 运行中, HALL 供电, 电源电压断电, 测试 HALL 信号没有变化, 1S 后进入堵转保护。
- 运行中, HALL 信号断开任何一根, HALL 出错 (程序读出 0 或 7), 保护。

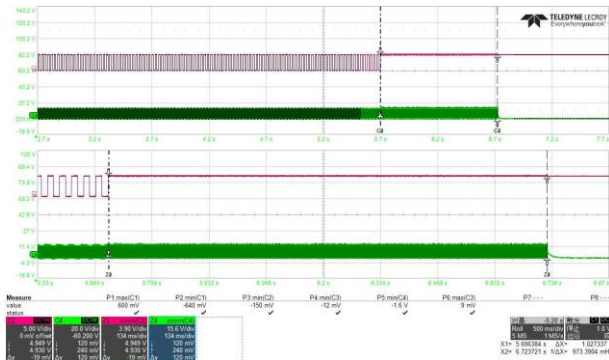


Fig. 56 Measured U phase voltage, HallA

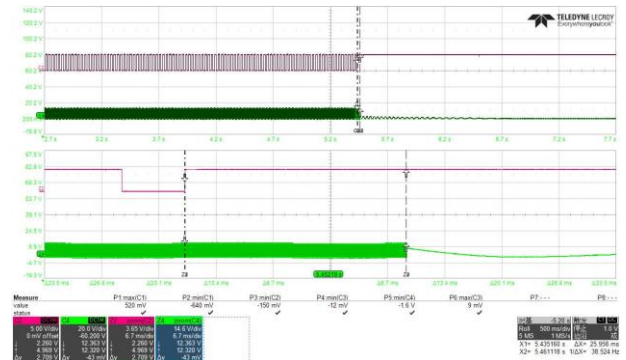


Fig. 67 Measured U phase voltage, HallA

- 运行中, HALL 地线断开, HALL 信号没有变化, 堵转保护。

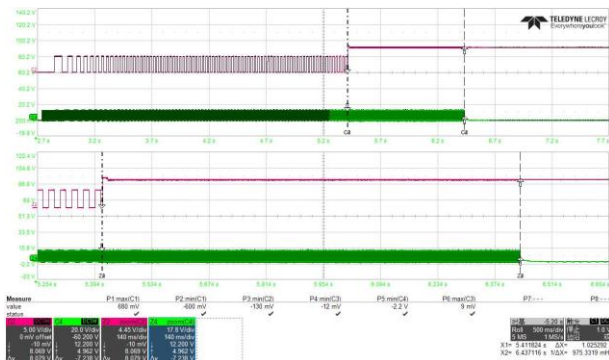


Fig. 78 Measured U phase voltage, HallA

3.5 SCP

- 运行中，U,V 两相短路，在 500us 内连续判断母线电流大于 3A，保护。从开始短路到判断出保护时间 2.1ms。

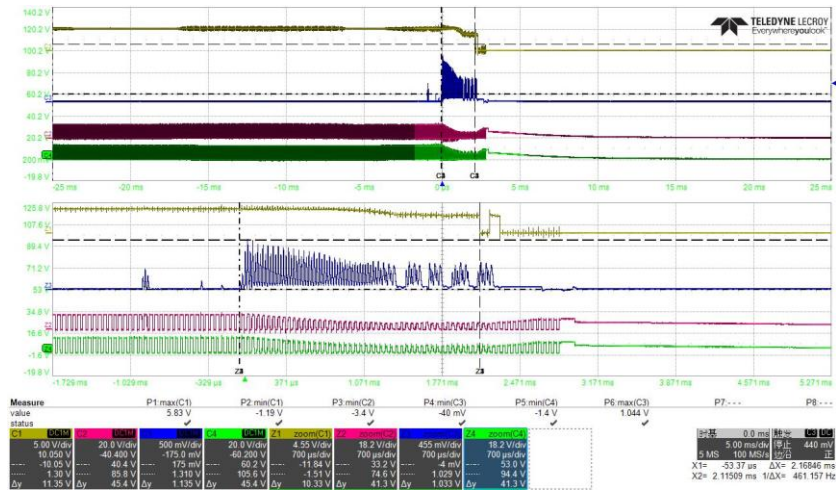


Fig. 89 Measured U phase voltage, V phase voltage, Current, SCP Pointer

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