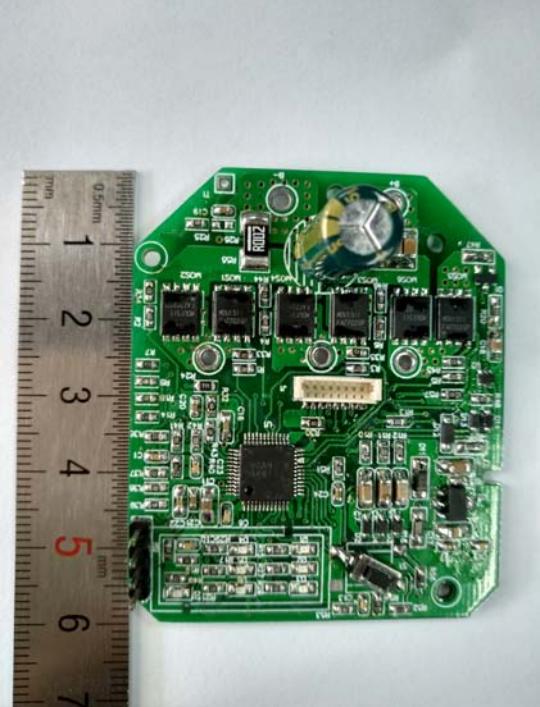


Subject OB6617 Demo Board Manual	Board Model: OB6617_6MOS_1735 Doc. No.: OB_DOC_DBM_A_661702
	<p>Key Feature:</p> <ul style="list-style-type: none"> • Sensor-less motor control • Single chip BLDC controller solution • High integration of MCU, pre-driver, high speed rail-to-rail operation amplifier, high precision LDO, current protection comparator. • Step-less speed regulation • Forward/Reverse selection • 10% 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
2016-04-27	00	First Issue
2017-09-01	01	Sensor-less mode version
2017-11-13	02	Updated BOM list

Contents Index

1.	System Electrical Specification	3
1.1	Input Characteristic.....	3
1.2	System parameters	3
1.3	Output characteristic.....	3
1.4	Environmental.....	3
2.	Board Information	4
2.1	Schematic	4
2.2	Bill of material	5
2.3	PCB Garber File	6
2.4	Heat-sink Three View Drawing	8
2.5	Connector Function Description	9
2.6	BLDC Controller Board Snapshot	10
3.	Performance Evaluation.....	11
3.1	Bus Current With MOSFET NTC Temperature	12
3.2	Voltage Test	12
3.2.1	Gate Driver & MCU Supply Power ON/OFF	12
3.2.2	Battery under voltage lockout	12
3.2.3	MOSFET Vgs	13
3.3	PWM Test	13
3.3.1	PWM Frequency	13
3.3.2	Speed Regulator	14
3.3.3	PWM Initial duty	14
3.3.4	PWM Duty ON.....	15
3.4	Current sampling	15
3.5	Motor Short Circuit Protection	16
3.5.1	U-V phase short circuit.....	16
3.5.2	U-W phase short circuit.....	16
3.5.3	V-W phase short circuit	17

Figures Index

Fig. 1	Measured gate driver and MCU supply voltage @ battery=18V	12
Fig. 2	Measured gated river and MCU supply voltage @ battery=18V	12
Fig. 3	Measured UVW output voltage @ battery=12.5V	12
Fig. 4	Measured highside and lowside MOSFET Vgs.....	13
Fig. 5	Measured highside and lowside MOSFET Vgs.....	13
Fig. 6	Measured U-phase and throttle voltage	14
Fig. 7	Measured highside and lowside MOSFET Vgs.....	14
Fig. 8	Measured UVW phase voltage	15
Fig. 9	Measured hall input and U phase voltage.....	错误!未定义书签。
Fig. 10	Measured U phase voltage,U phase current and EA out.....	15
Fig. 11	Measured thermal sensor voltage and U phase voltage	错误!未定义书签。
Fig. 12	Measured motor sensor voltage and U phase voltage.....	错误!未定义书签。
Fig. 13	Measured U-phase voltage, V-phase voltage, Bus voltage, phase current @ battery voltage = 21V..	16
Fig. 14	Measured U-phase voltage, W-phase voltage, Bus voltage, phase current @ battery voltage = 21V.	16
Fig. 15	Measured V-phase voltage, W-phase voltage, Bus voltage, phase current @ battery voltage = 21V.	17

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 23V
▪ 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±1%
▪ 5V supply current	100mA
▪ Current sampling resistance	2mΩ
▪ Current sampling amplification	16
▪ Current sampling amplifier offset	Self-calibration
▪ Gate driver supply voltage	12V
▪ Max of MOSFET drain source voltage value	30V
▪ MOSFET thermal sensor precision	1%

1.3 Output characteristic

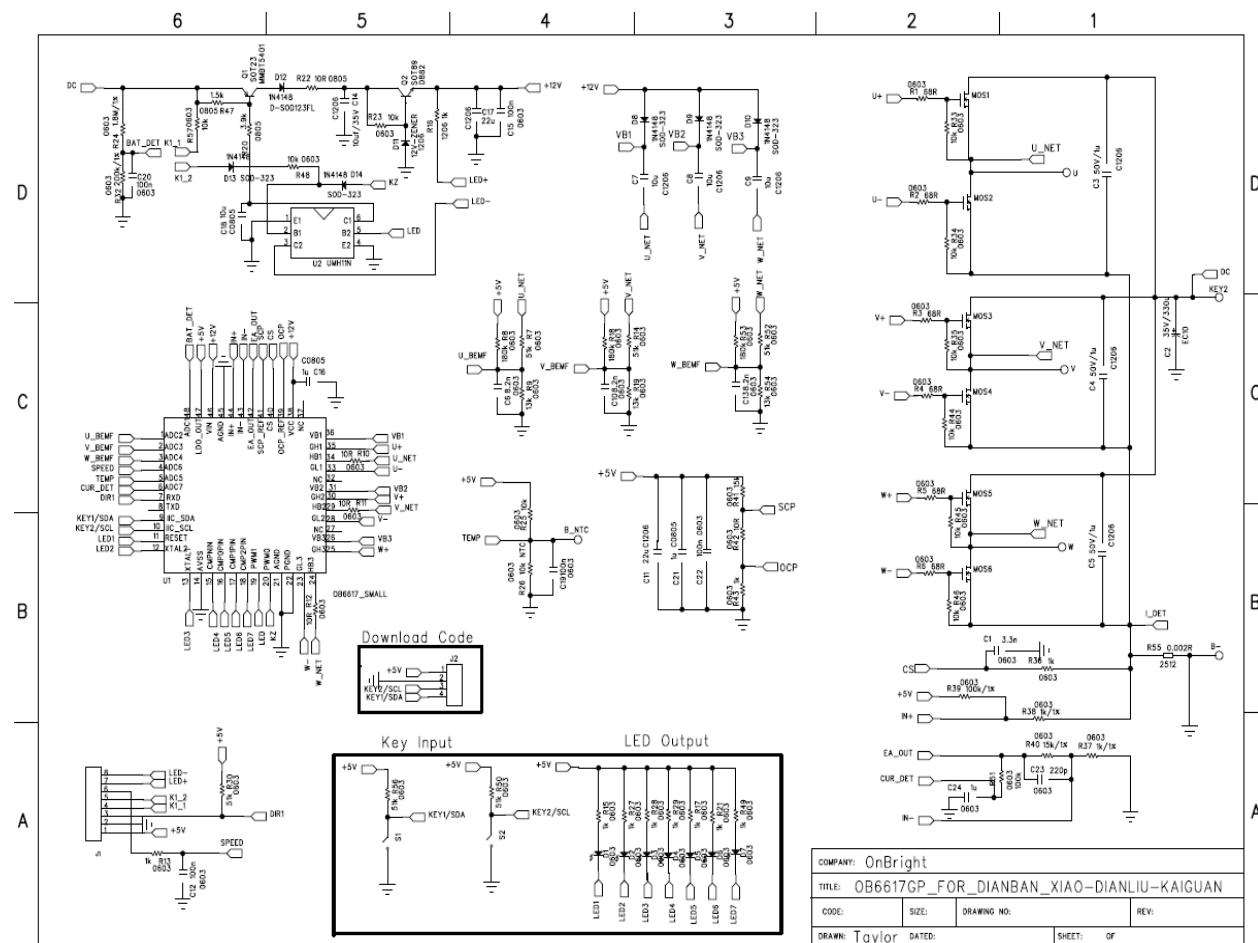
▪ Phase current limitation	100A
▪ Maximum of PWM duty	100%
▪ Minimum of PWM duty	10%

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

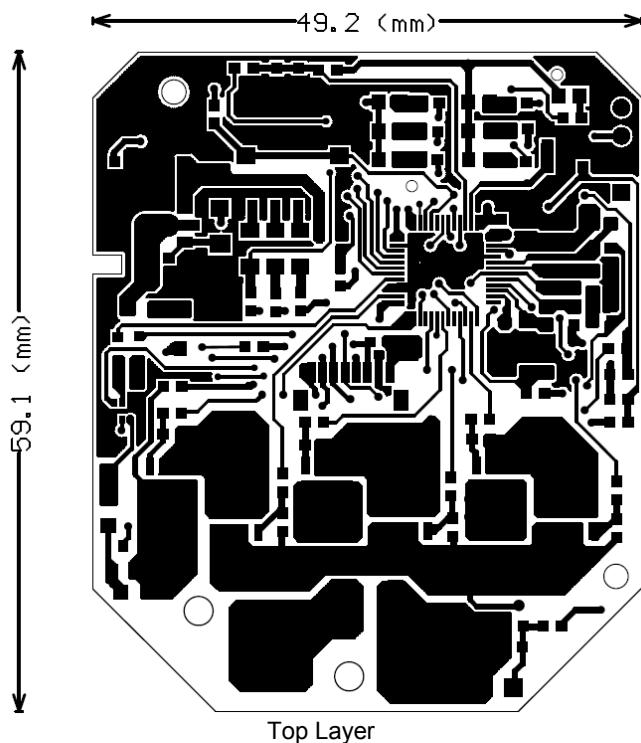


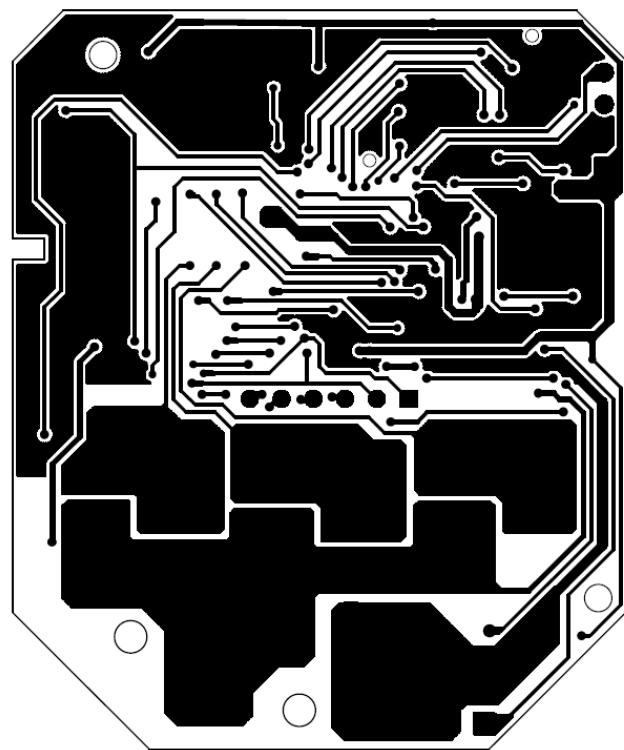
2.2 Bill of material

Position	Description	Package	QTY
C2	Capacitor,aluminum electrolytic,330uf/35V,-40/105°C	EC10	1
C1	Capacitor,ceramic,3.3nf/25V,X7R,10%	0603	1
C6,C10,C13	Capacitor,ceramic,8.2nf/25V,X7R,10%	0603	3
C12,C15,C19,C20, C22,C24	Capacitor,ceramic,100nf/25V,X7R,10%	0603	6
C23	Capacitor,ceramic,220pf/25V,X7R,10%	0603	1
C16,C21	Capacitor,ceramic,1uf/25V,X7R,10%	0805	2
C18	Capacitor,ceramic,10uf/25V,X7R,10%	0805	1
C7,C8,C9	Capacitor,ceramic,10uf/25V,X7R,10%	1206	3
C14	Capacitor,ceramic,10uf/35V,X7R,10%	1206	1
C11,C17	Capacitor,ceramic,22uf/25V,X7R,10%	1206	2
C3,C4,C5	Capacitor,ceramic,1uf/35V,X7R,10%	1206	3
D8,D9,D10,D13,D1 4	1N4148	SOD323	5
D12	1N4148	SOD123	1
D11	1N4106,12V zener	1206	1
D1,D2,D3,D4,D5,D 6,D7	LED,Green	0603	7
MOS1,MOS2,MOS 3,MOS4,MOS5,MO S6	Power MOS,MDU1511	DFN5*6	6
Q1	PNP,MMBT5401	SOT23	1
Q2	NPN,D882	SOT89	1
U1	OB6617GP	LQFP48	1
U2	UMH11N	TES6	1
R32	Resistor,chip,200k,1%	0603	1
R24	Resistor,chip,1.8M,1%	0603	1
R39	Resistor,chip,100k,1%	0603	1
R40	Resistor,chip,15k,1%	0603	1
R37,R38	Resistor,chip,1k,1%	0603	2
R10,R11,R12,R42	Resistor,chip,10R,5%	0603	4
R1,R2,R3,R4,R5,R 6	Resistor,chip,68R,5%	0603	6
R23,R25,R30,R33, R34,R35,R44,R45, R46,R48,R57	Resistor,chip,10k,5%	0603	11
R41	Resistor,chip,11k,5%	0603	1
R13,R15,R17,R21, R27,R28,R29,R36, R43,R49	Resistor,chip,1k,5%	0603	10

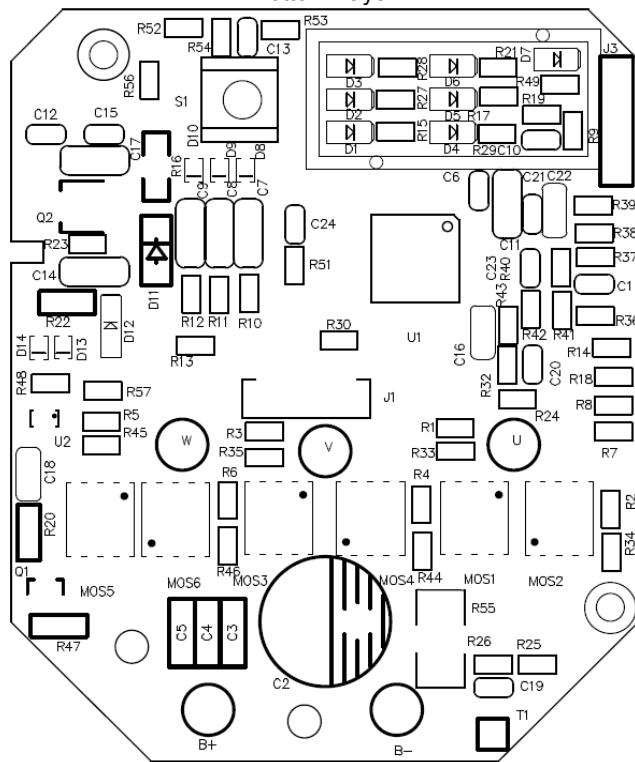
R8,R18,R53	Resistor,chip,180k,5%	0603	3
R7,R14,R52,R56	Resistor,chip,51k,5%	0603	4
R9,R19,R54	Resistor,chip,13k,5%	0603	3
R51	Resistor,chip,100k,5%	0603	1
R26	10k,NTC	0603	1
R22	Resistor,chip,10R,5%	0805	1
R47	Resistor,chip,1.5k,5%	0805	1
R20	Resistor,chip,3.9k,5%	0805	1
R16	Resistor,chip,1k,5%	1206	1
R55	Resistor,chip,2mR,1%	2512	1
J1	1mm,8pin Connector		1
S1	SWITCH	6*6	1

2.3 PCB Garber File

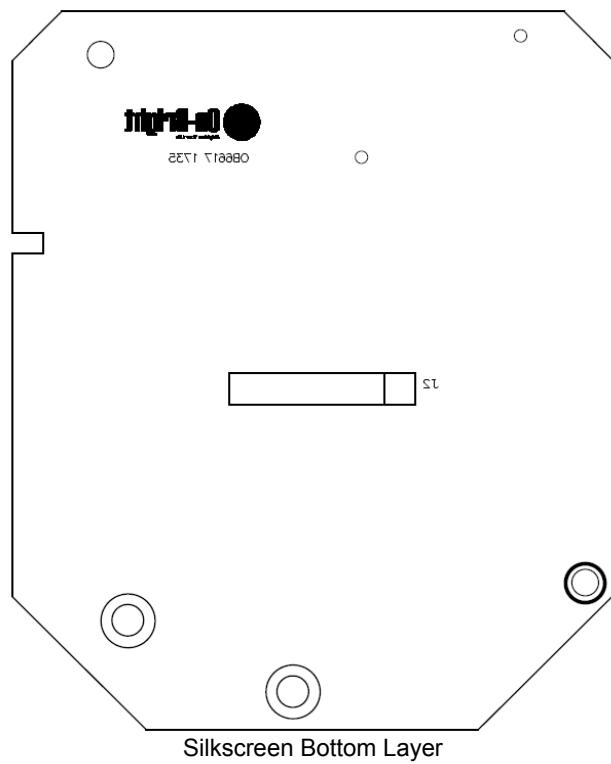




Bottom Layer



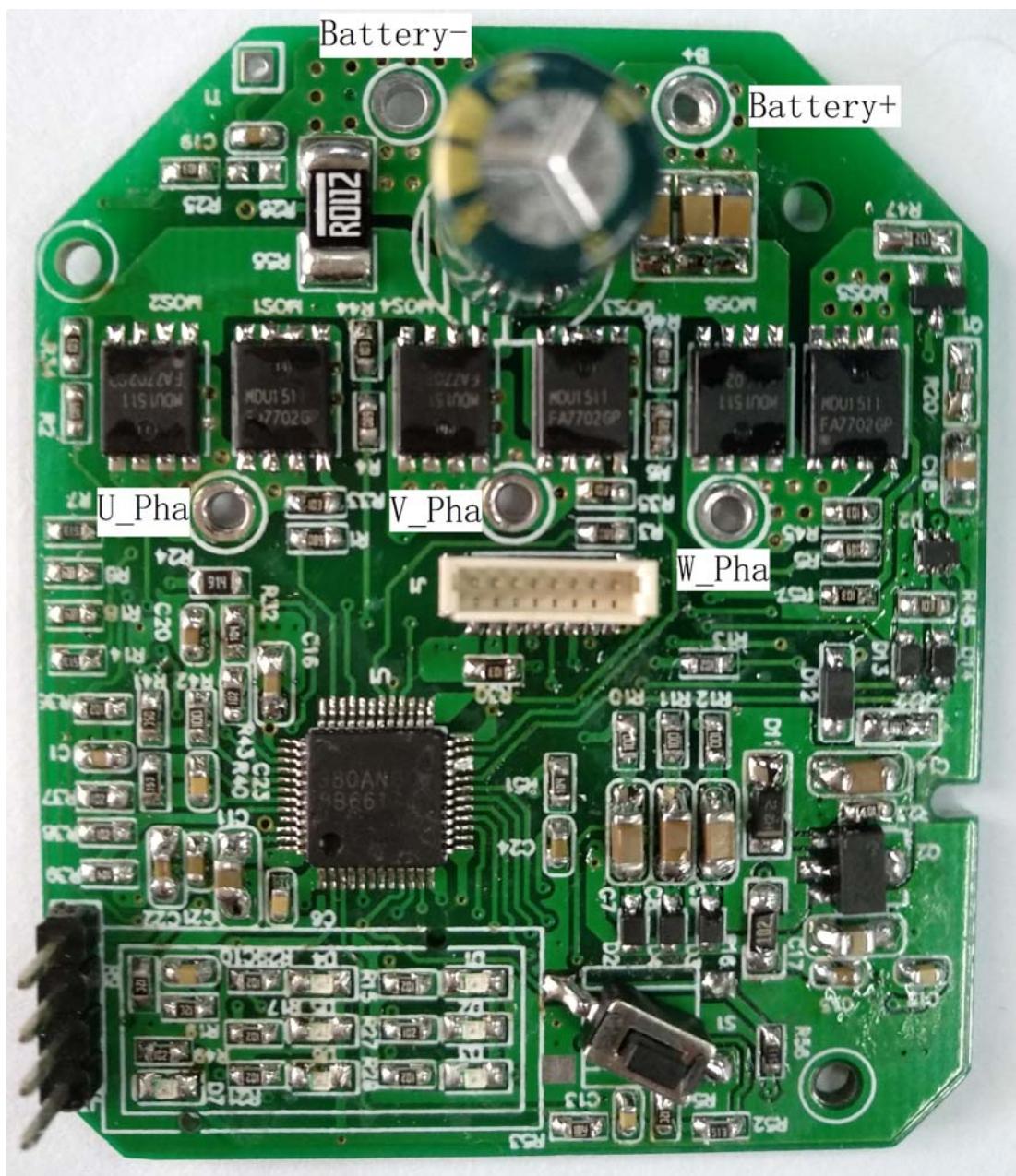
Silkscreen Top Layer



2.4 Heat-sink Three View Drawing

N/A

2.5 Connector Function Description

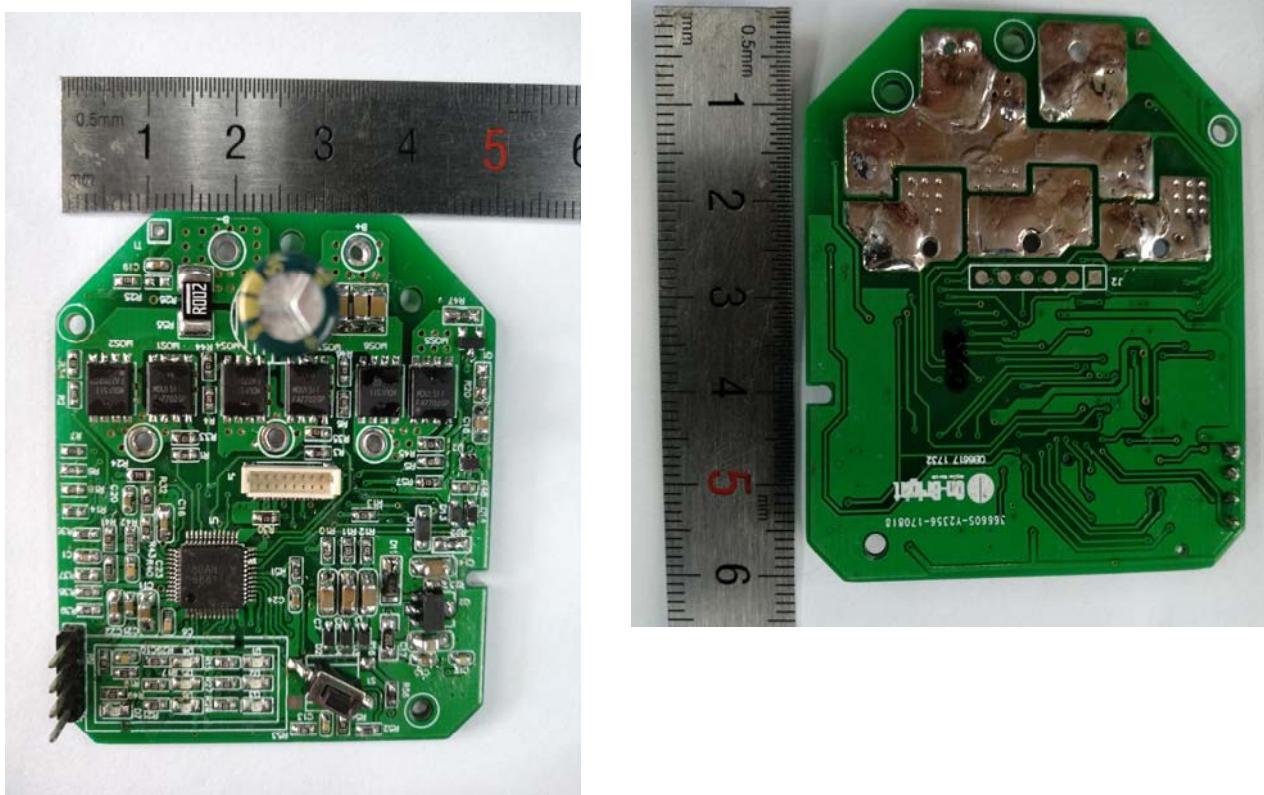


HoleName	Description
Battery+	Battery input, Bus+
Battery-	Battery input, GND
U_Pha	Motor U phase output
V_Pha	Motor V phase output
W_Pha	Motor W phase output

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	13.5V~22V
8	Working LED cathode	13.5V~22V

2.6 BLDC Controller Board Snapshot



3. Performance Evaluation

This session presents the test results of OB6617GP 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	Gate driver supply	LDO_12V		12		V	Fig.1, Fig.2
4	MOSFET gate voltage	V _{gs}		12		V	Fig.4
5	Highside MOSFET Rise time	T _{r_h}		0.96		us	Fig.4
6	Highside MOSFET Fall time	T _{f_h}		1.26		us	Fig.4
7	Lowside MOSFET Rise time	T _{r_l}		0.93		us	Fig.4
8	Lowside MOSFET Fall time	T _{f_l}		0.79		us	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
13	Current amplify coefficient			16			Fig.9
16	MOSFET current shutdown time in MOTOR short circuit				10	us	Fig.10, Fig.11, Fig.12
17	MOSFET V _{ds} in MOTOR short circuit				23	V	Fig.10, Fig.11, Fig.12

Test Equipments

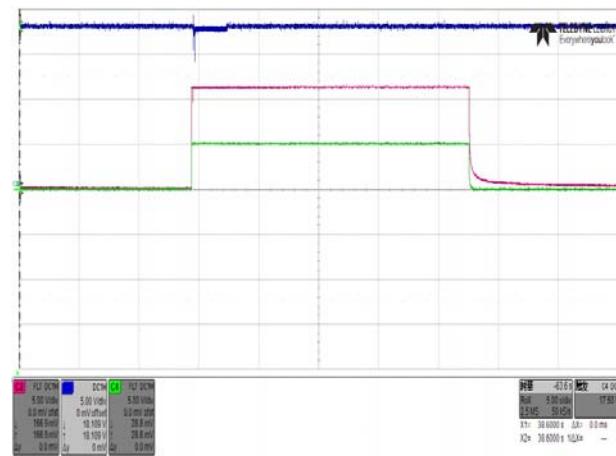
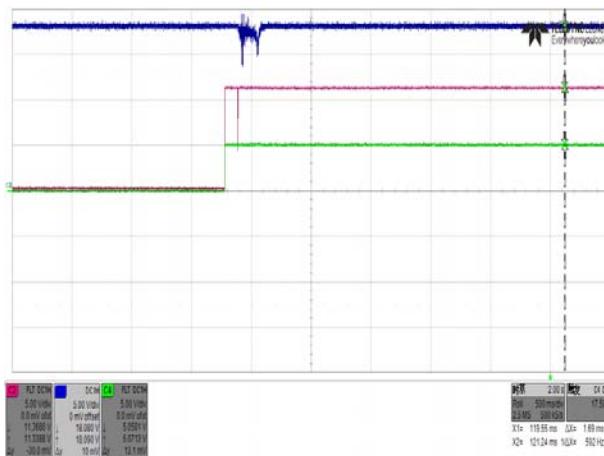
Item	Module
DC source	LW12050KD
Oscilloscope	LeCroy wavesurfer424
Current meter	Tek TCPA300
Differential probe	CATIII
Multi-meter	VC9808

3.1 Bus Current With MOSFET NTC Temperature

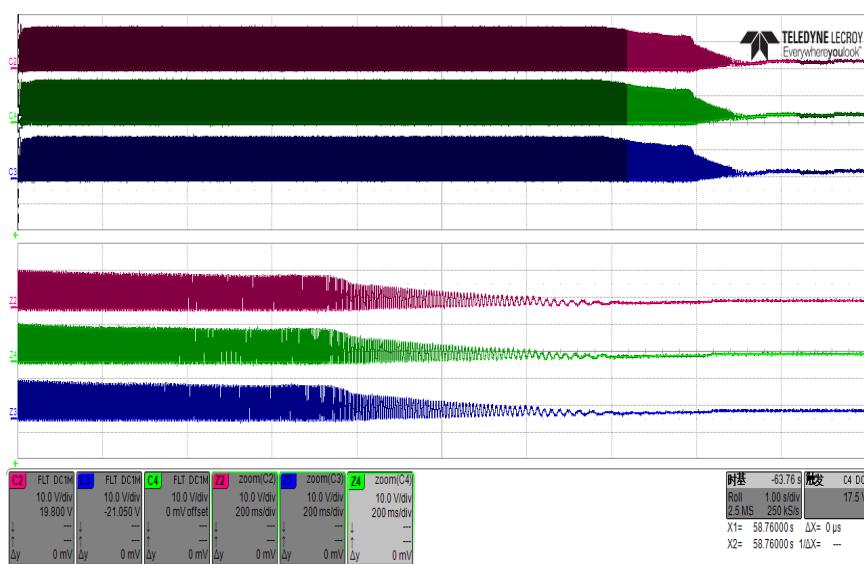
N/A

3.2 Voltage Test

3.2.1 Gate Driver & MCU Supply Power ON/OFF



3.2.2 Battery under voltage lockout



3.2.3 MOSFET Vgs

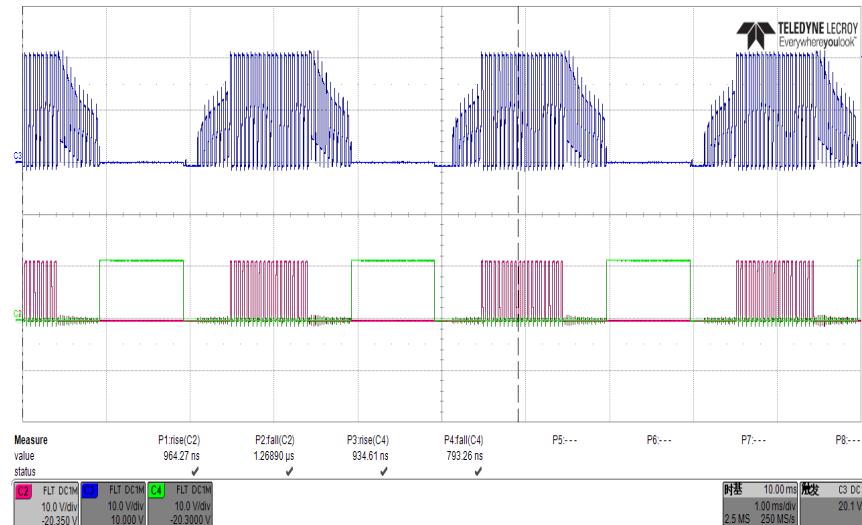


Fig. 4 Measured highside and lowside MOSFET Vgs

3.3 PWM Test

3.3.1 PWM Frequency

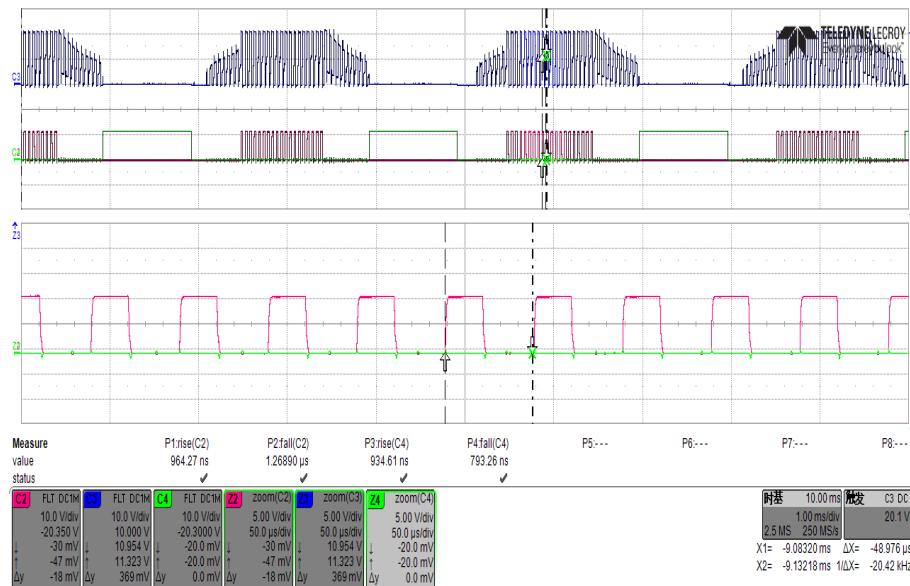


Fig. 5 Measured highside and lowside MOSFET Vgs

3.3.2 Speed Regulator

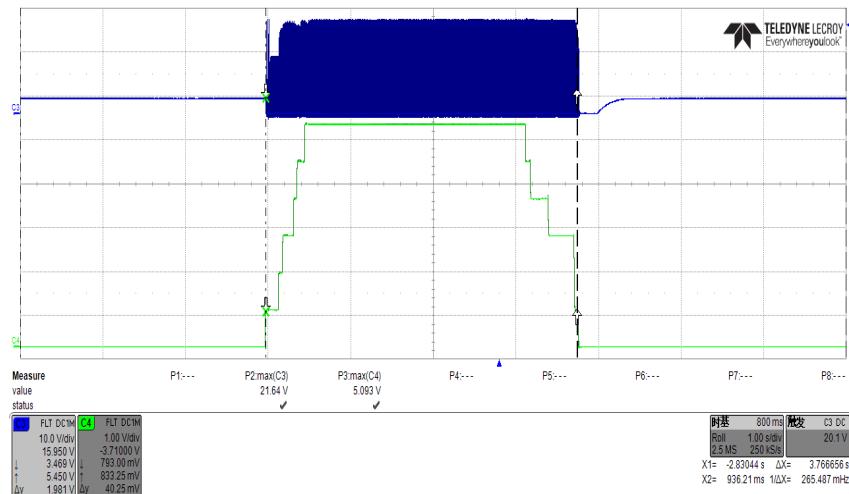


Fig. 6 Measured U-phase and throttle voltage

3.3.3 PWM Initial duty

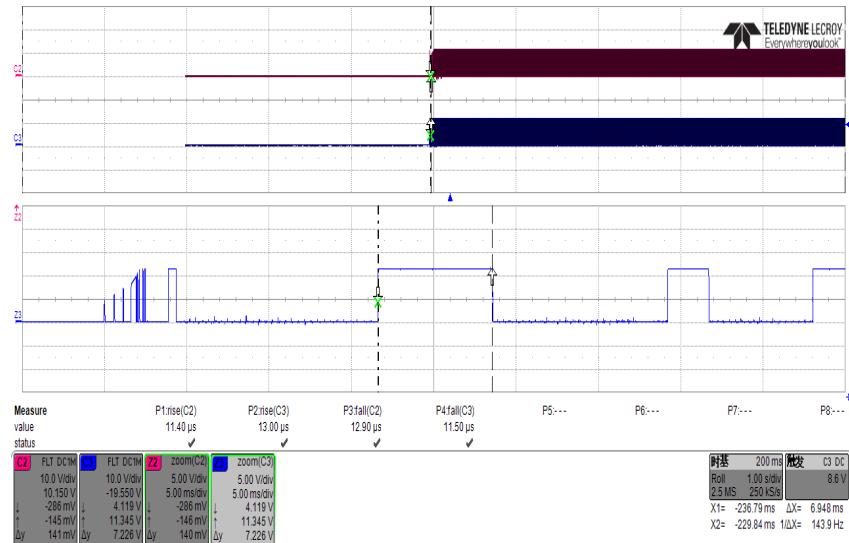


Fig. 7 Measured highside and lowside MOSFET Vgs

3.3.4 PWM Duty ON

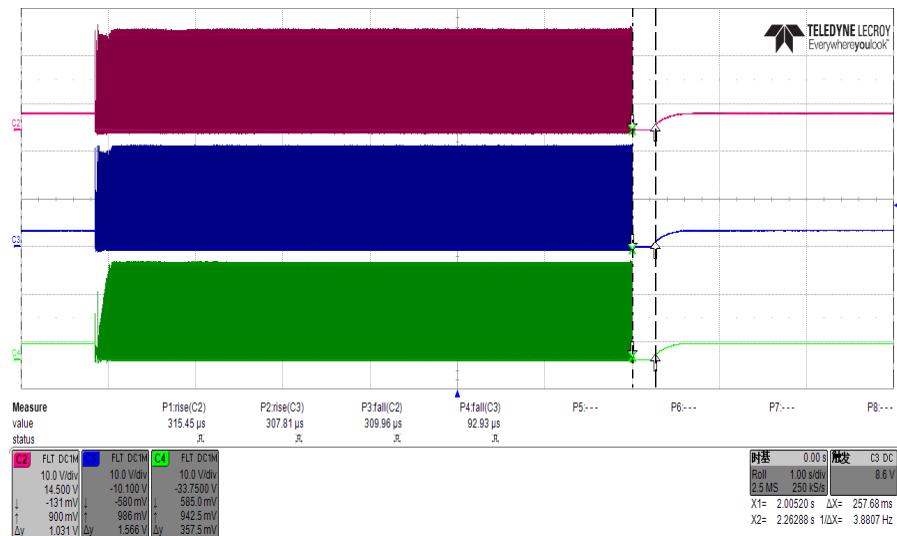


Fig. 8 Measured UVW phase voltage

3.4 Current sampling

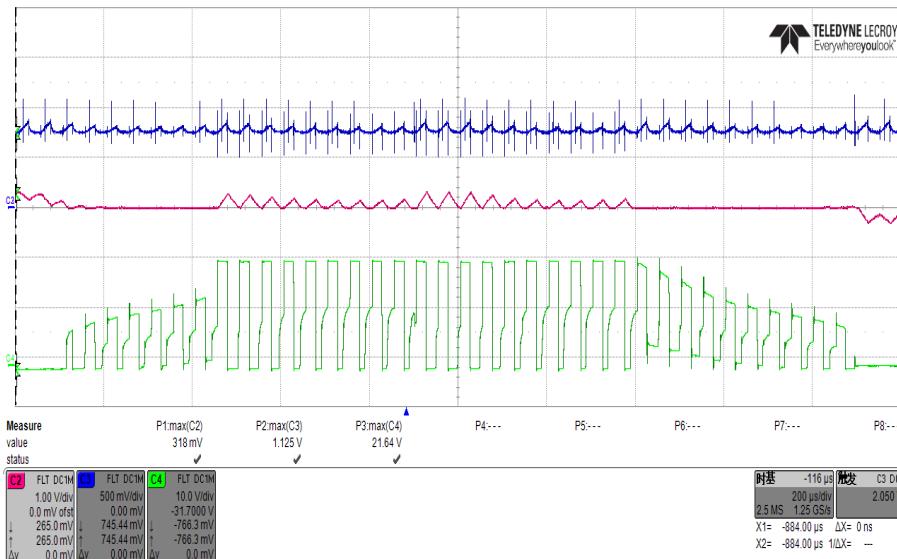


Fig. 9 Measured U phase voltage, U phase current and EA out

3.5 Motor Short Circuit Protection

3.5.1 U-V phase short circuit

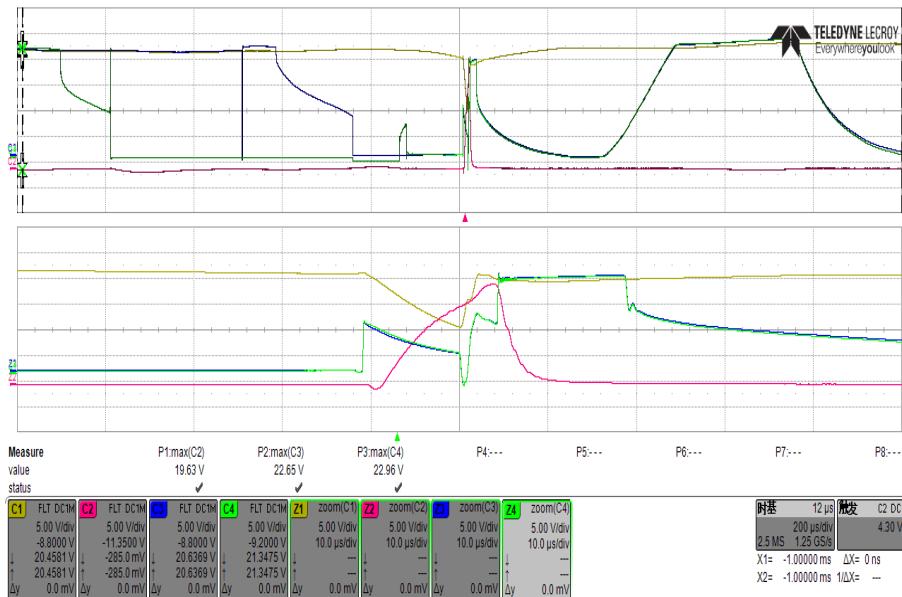


Fig. 10 Measured U-phase voltage, V-phase voltage, Bus voltage, phase current @ battery voltage = 21V

3.5.2 U-W phase short circuit

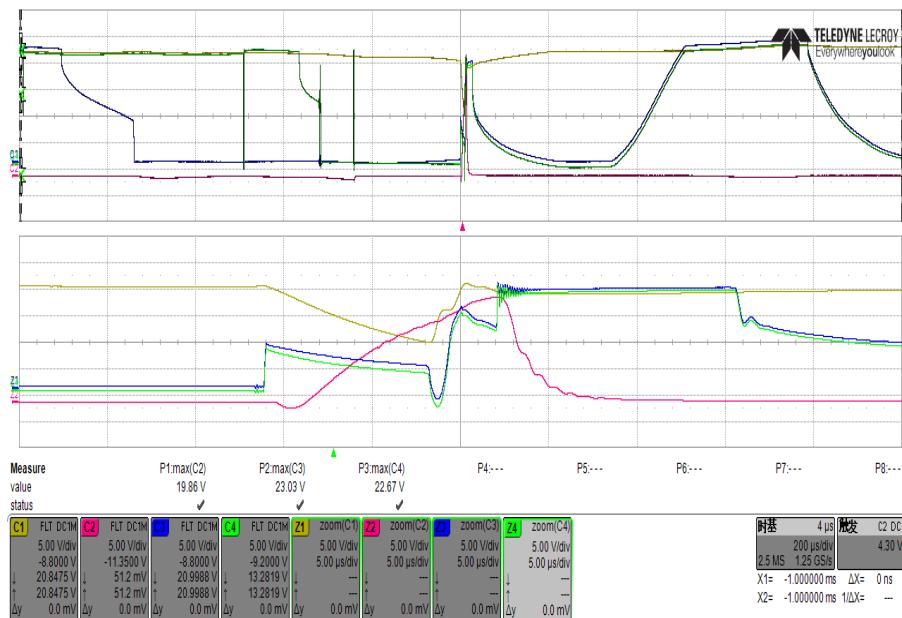


Fig. 9 Measured U-phase voltage, W-phase voltage, Bus voltage, phase current @ battery voltage = 21V

3.5.3 V-W phase short circuit

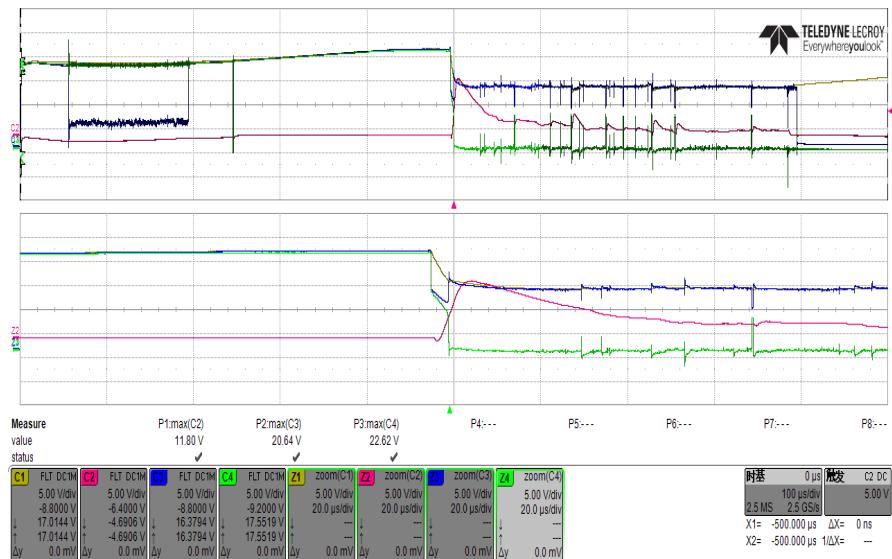


Fig. 10 Measured V-phase voltage, W-phase voltage, Bus voltage, phase current @ battery voltage = 21V

Disclaimer

On-Bright Electronics reserves the right to make corrections, modifications, enhancements, improvements, and other changes to its documents, products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete.

This document is under copy right protection. None of any part of document could be reproduced, modified without prior written approval from On-Bright Electronics.