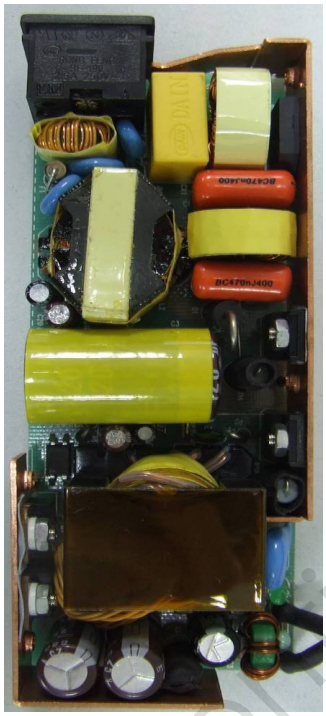
Subject
OB2203 Demo Board Manual

Board Model: AD19V4.73B2203.00
Doc. No.: OB_DOC_DBM_B_0300



Key features:

- PFC is shut down when system goes to standby
- No load standby power under 0.40W@230VAC
- Averaged efficiency more than 88%@115VAC at AWG16 CABLE end
- High performance Quasi-resonant control
- Programmable soft start
- High precision OVP
- Meet EN55022 EMI

Revision History

Revise Date	Version	Reason/Issue
2008-03-26	00	First issue

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1. Adapter Module Specification

1.1. Input Characteristics

- AC input voltage rating: 100Vac ~ 240Vac
- AC input voltage range: 90Vac ~ 264Vac
- AC input frequency range: 47Hz ~ 63Hz

1.2. Output Characteristics

- Output Voltage: 19.0V
- Output Tolerance: ±5%
- Min. load current: 0A
- Max. load current: 4.73A

1.3. Performance Specifications

- Max. Output Power: 90W
- Standby Power: <0.5W @ 230V/50Hz, no load, 25°C
- Efficiency: >87% @ Averaged. 25/50/75/100%Load, normal line, 25°C
- Line Regulation: ±2% Max
- Load Regulation: ±5% Max
- Ripple & Noise: 380mVpp Max
- Hold up Time: 10m Sec. Min. @100Vac with full load
- Turn on Delay Time: 2 Sec. Max. @100Vac with full load

1.4. Protection Features

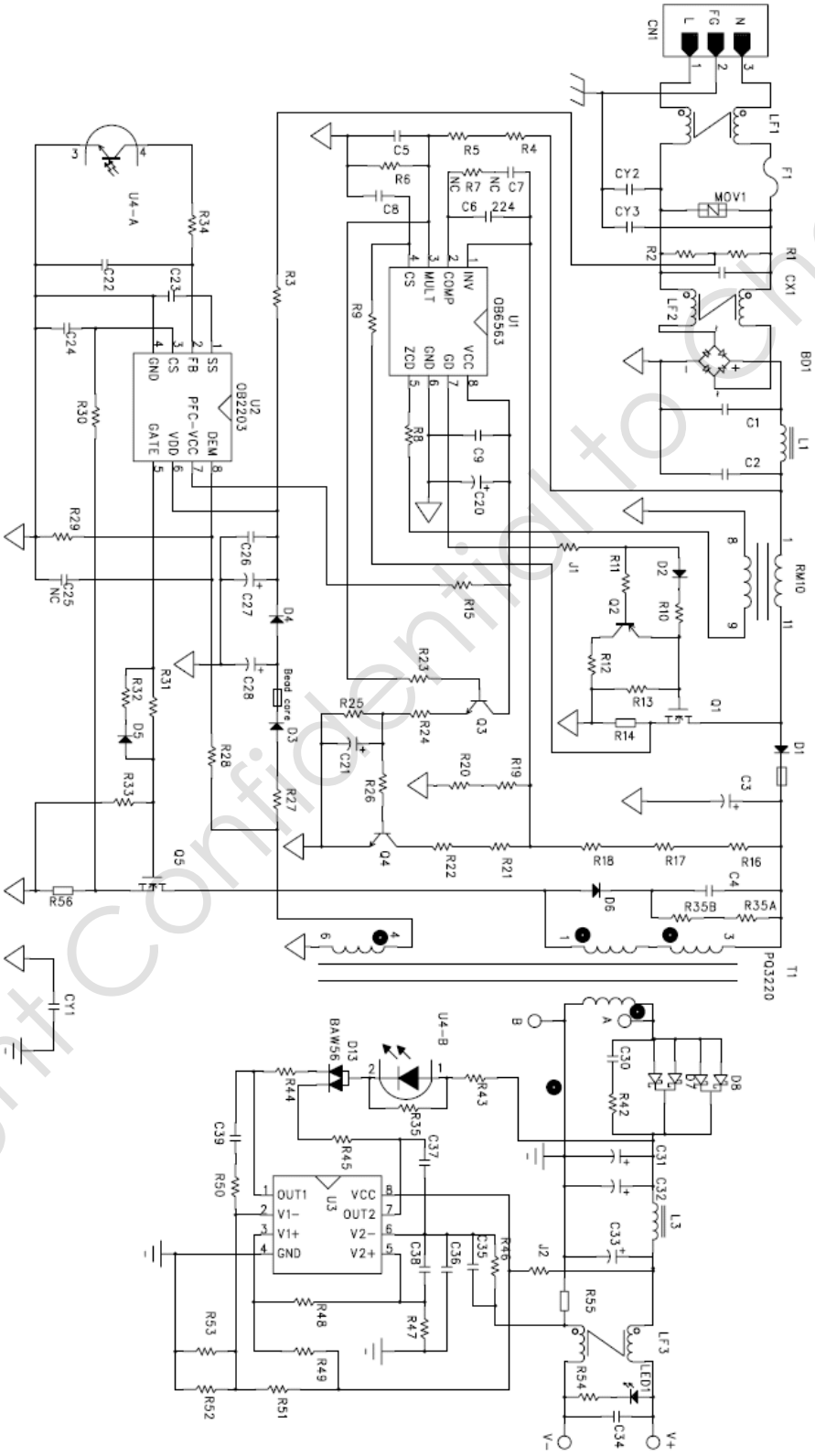
- Short circuit Protection: Output shut down with automatic recovery
- Over Voltage Protection: Output shut down without automatic recovery
- Over Current Protection: Output shut down with automatic recovery

1.5. Environments

- Operating Temperature: 0℃ to +40℃
- Operating Humidity: 20% to 90% R.H.
- Storage Temperature: -40℃ to +60℃
- Storage Humidity: 0% to 95% R.H.

2. Adapter Module Information

2.1. Schematic

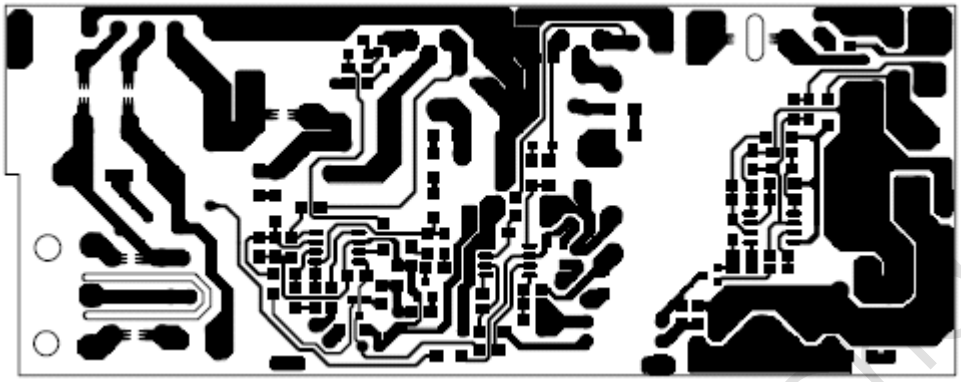


2.2. Bill of material

Position	Description	QTY
BD1	Diode, bridge recovery, GBP306, 3A/ 600V	1
C1.C2	Capacitor, metal poly, 0.47U/400V, -40/105℃,±20%	2
C3	Capacitor, aluminum electrolytic, 120uF/420V, -40/105℃,±20%,Φ18*30mm	1
C4	Capacitor, metal poly, 4.7nF/630V, -40/105℃,±20%	1
C5	Capacitor, ceramic,4.7nF/25V, X7R, ±10%,SMD1206	1
C6	Capacitor, ceramic,220nF/25V, X7R, ±10%,SMD0805	1
C8.C24	Capacitor, ceramic,470PF/25V, X7R, ±10%,SMD1206	2
C9.C26.C39	Capacitor, ceramic,100nF/50V, X7R, ±10%,SMD0805	3
C20.	Capacitor, aluminum electrolytic, 2.2uF/50V, -40/105℃,±20%	1
C21.C28	Capacitor, aluminum electrolytic, 22uF/50V, -40/105℃,±20%	2
C22.C37	Capacitor, ceramic,1nF/25V, X7R, ±10%,SMD0805	2
C23	Capacitor, ceramic,18nF/25V, X7R, ±10%,SMD0805	1
C27	Capacitor, aluminum electrolytic, 4.7uF/50V, -40/105℃,±20%	2
C30	Capacitor, ceramic,1nF/200V, X7R, ±10%,SMD1206	1
C31.C32	Capacitor, aluminum electrolytic, 680uF/25V, -40/105℃,±20%,Φ10*20mm	2
C33	Capacitor, aluminum electrolytic, 330uF/25V, -40/105℃,±20%,Φ8*16mm	1
C34	Capacitor, film,100nF/50V, -40/105℃,±10%,	1
C35.C38	Capacitor, ceramic,10nF/25V, X7R, ±10%,SMD0805	2
C36	Capacitor, ceramic,1uF/25V, X7R, ±10%,SMD0805	1
CON1	Connect, AC SOCKET,2.5A/250Vac,3PIN	1
CX1	Capacitor,X2, 0.33uF/275VAC, -40/105℃,±20%	1
CY1	Capacitor,Y1,disk,2200PF/250VAC, -40/105℃,±20%	1
CY2.CY3.	Capacitor,Y2,disk,2200PF/250VAC, -40/105℃,±20%	2
D1	Diode,ultra fast recovery,MUR460, 4A/600V, DO-201	1
D2.D4.D5	Diode ,fast recovery, 1N4148, 0.1A /100V, SOD-323	3
D3	Diode ,fast recovery, FR104, 1A/600V,DO-401	1
D6	Diode ,general recovery, 1N4007, 1A/1000V,DO-401	1
D7.D8	Diode,dual schottky, STPS20H100CT, 2*10A/100V,TO-220	2
D13	Diode,dual diode, common anode,BAW56, 2*0.125A/75V,SOT-23	1
F1	Fuse, 3.15A/250V, Φ4*10mm	1
L1	Inductor, choke,580uH min, core15.5*11.5*6.5mm, Φ0.60mm*100Ts	1
L3	Inductor,power choke,2.2uH,±10%,core, Φ4*15mm, Φ0.90mm*8.5Ts	1
L3	Bead Core,for D1 cathode,3.5*9*1.3mm	1
L4	Bead Core,for D3 cathode,3.5*8*0.8mm	1
LED	LED, Φ5mm	1
LF1	Inductor, choke,dual winding,4mH min, core12.5*9 *4.5mm, Φ0.50mm*2P*24Ts	1
LF2	Inductor, choke,dual winding,18mH min, core18.5*9.5*7.5mm, Φ0.55mm*42Ts*2	1
LF3	Inductor, choke,dual winding, 70uH min, core10.5*5.5*4.5mm, Φ0.80mm*2*3Ts	1
MOV1	Varistor ,disk, 7D471,300Vac rms max,385Vdc rms max, 600Amax,Φ7mm	1
Q1	MOSFET,MOS power N-channel, 2SK2842, 12A/500V,0.4R,TO-220	1
Q2	Transistor, PNP,2N3906,0.2A/40V,SMD,SOT-23	1
Q3.Q4	Transistor, NPN,2N3904,0.2A/40V,SMD,SOT-23	2

Q5	MOSFET,MOS power N-channel, 2SK2843, 10A/600V,0.54R,TO-220	1
J0.J1	Resistor,chip, 0R ,1/2W,±5%,SMD1206	2
R1.R2.R4.R5.R16.R17	Resistor,chip, 1.5M ,1/2W,±5%,SMD1206	6
R1B	Resistor,chip, 1M ,1/2W,±5%,SMD1206	1
R3	Resistor,chip, 100K ,1/2W,±5%,SMD1206	1
R6.R54	Resistor,chip, 20K ,1/4W, ±5%,SMD0805	2
R8.R51	Resistor,chip, 33K ,1/4W,±1%,SMD0805	2
R9.R30	Resistor,chip, 510R ,1/4W,±5%,SMD0805	2
R10.R27	Resistor,chip, 10R,1/4W,±5%,SMD0805	2
R11	Resistor,chip, 5R1 ,1/4W,±5%,SMD0805	1
R12	Resistor,chip, 1R,1/4W,±5%,SMD0805	1
R13.R33.R50	Resistor,chip, 10K ,1/4W,±5%,SMD0805	3
R14.R56	Resistor,metal film,axial,RN55,0R15, 2W, ±1%	2
R15	Resistor,chip,2R,1/4W,±5%,SMD0805	1
R19	Resistor,chip, 39K,1/4W,±5%,SMD0805	1
R20.R24	Resistor,chip, 4.7K,1/4W,±5%,SMD0805	2
R21	Resistor,chip, 56K,1/4W,±5%,SMD0805	1
R22	Resistor,chip, 8.2K,1/4W,±5%,SMD0805	1
R25	Resistor,chip, 22K,1/4W,±5%,SMD0805	1
R26	Resistor,chip, 300R,1/4W,±5%,SMD0805	1
R28	Resistor,chip, 160K,1/4W,±5%,SMD0805	1
R29	Resistor,chip, 30K,1/4W,±1%,SMD0805	1
R31.R34.R42	Resistor,chip, 20R ,1/2W,±5%,SMD1206	3
R32	Resistor,chip, 4.7R,1/2W,±5%,SMD1206	1
R35A.R35B	Resistor,chip, 33K ,1/2W,±5%,SMD1206	2
R35.R47	Resistor,chip, 2K,1/4W,±5%,SMD0805	2
R43	Resistor,chip, 100R,1/4W,±5%,SMD0805	1
R44.R45.46	Resistor,metal, 1K,1/4W,±5%,SMD0805	3
R48	Resistor,chip, 91K,1/4W,±5%,SMD0805	1
R49	Resistor,chip, 6.2K,1/4W,±5%,SMD0805	1
R52	Resistor,chip, 5.1K,1/4W,±1%,SMD0805	1
R53	Resistor,chip, 130K,1/4W,±1%,SMD0805	1
R55	Resistor, manganin, 0.01R , Φ0.85mm	1
T1	QR Transformer, 477uH,10KHz/1V,PQ3220	1
T2	PFC boost inductor,580uH,10KHz/1V,RM10	1
U1	IC, PFC controller,OB6563,SO-8	1
U2	IC,QR controller, OB2203, SO-8	1
U3	IC,dual operational amplifier and voltage reference,TSM103W,SO-8	1
U4	IC,Photocoupler ,PC817B, DIP4	1
PCB	OBPD90W,49.2*125.9mm	1

2.3. PCB Gerber File



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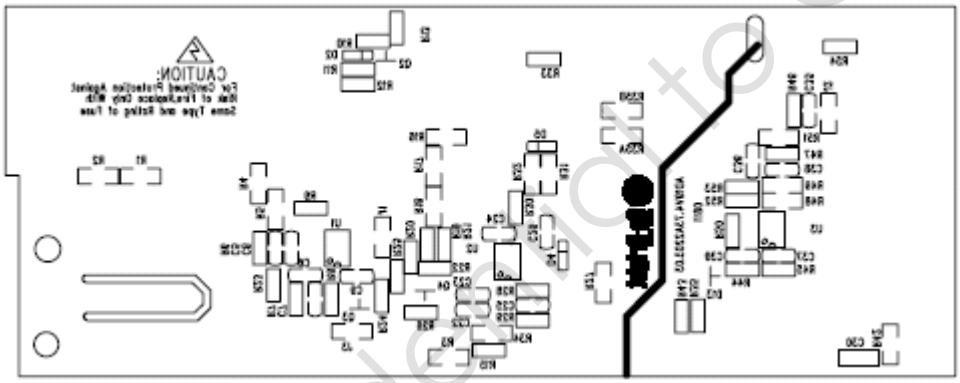

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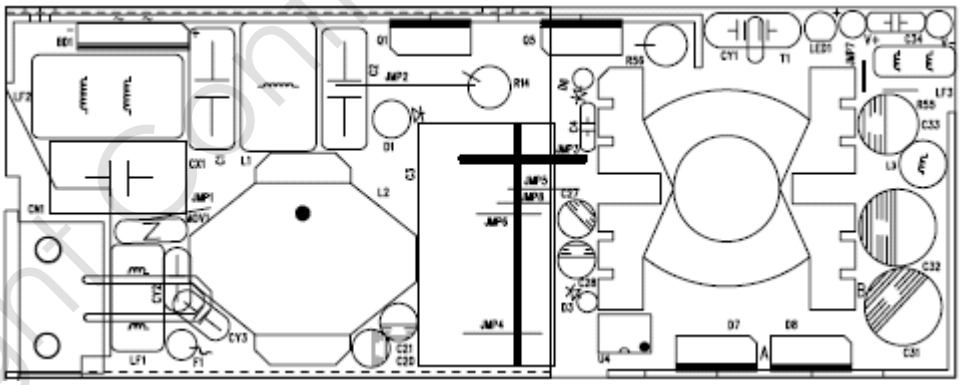

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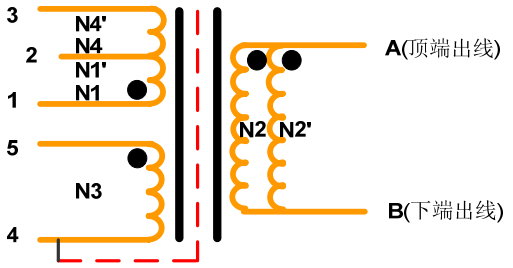
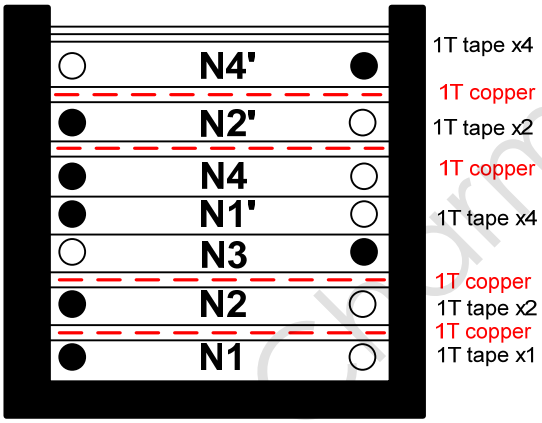
2.4. Adapter Module Snapshot

2.4.1. Transfomer Specification





Bottom

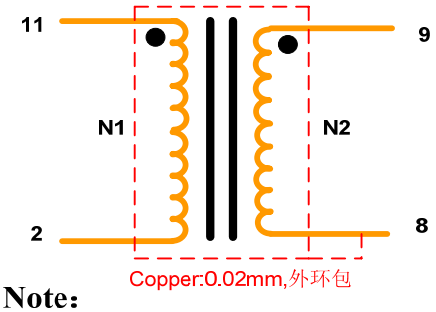
Note:

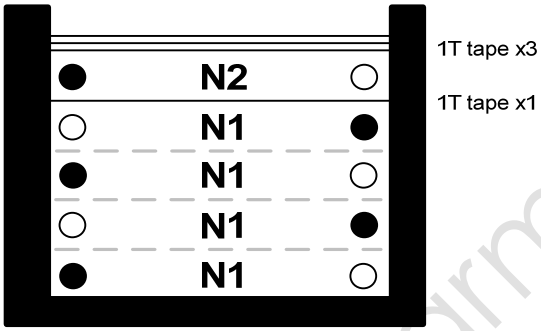
1. Bobbin: PQ3220 (12 Pin) ;Pin6.9~12cut off
2. Core 材质: TDK PC 40~44或等同.
3. L1-3=477u H +/- 5%. (at: 10 K Hz, 0.3 V)
4. HI-POT: (60 Hz/5 m A/2 SET)
   Pri to Sec 3750 Vac; Pri to core 1800Vac

2.4.2. Transformer Winding data

c	Winging	Material	Start	Turns	Finish	Remark
1	**N1**	Φ0.45*2 2UEW	1	**9**	→	不断线
2	TAPE	TAPE W=10mm (Y)		1.3		
3	Copper	Copper W=9mm P=0.02mm		1.1	4	
4	TAPE	TAPE W=10mm (Y)		1.3		
5	**N2**	Φ0.55*2 三层绝缘线	A	**6**	B	
6	TAPE	TAPE W=10mm (Y)		1.3		
7	Copper	Copper W=9mm P=0.02mm		1.1	4	
8	TAPE	TAPE W=10mm (Y)		1.3		
9	**N3**	Φ0.12*3 2UEW	5	**6**	4	间绕
10	TAPE	TAPE W=10mm (Y)		1.3		
11	**N1'**	Φ0.45*2 2UEW	→	**8**	2	
12	TAPE	TAPE W=10mm (Y)		1.3		
13	**N4**	Φ0.45*2 2UEW	2	**9**	→	不断线
14	TAPE	TAPE W=10mm (Y)		1.3		
15	Copper	Copper W=9mm P=0.02mm		1.1	4	
16	TAPE	TAPE W=10mm (Y)		1.3		
17	**N2'**	Φ0.55*2 三层绝缘线	A	**6**	B	
18	TAPE	TAPE W=10mm (Y)		1.3		
19	Copper	Copper W=9mm P=0.02mm		1.1	4	
20	TAPE	TAPE W=10mm (Y)		1.3		
21	**N4'**	Φ0.45*2 2UEW	→	**8**	3	
22	TAPE	TAPE W=10mm (Y)		3		

2.4.3. Boost inductor Specification





Bottom

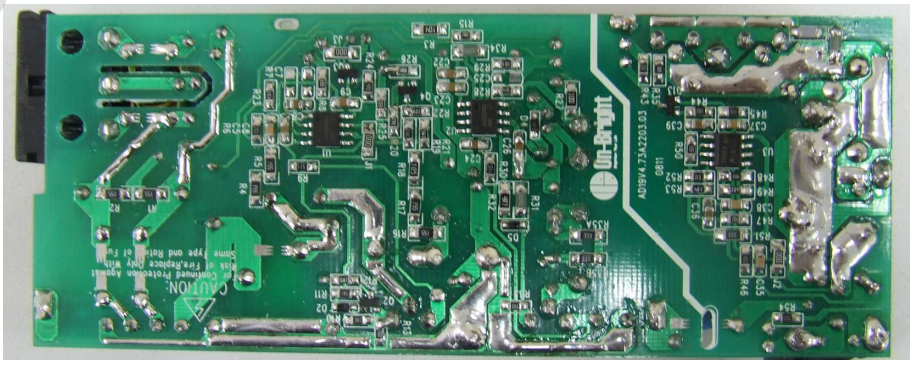
Note:

1. Bobbin: RM10 (12 Pin) ;其中Pin3,4,5,7,10,12 cut off
2. Core 材质: TDK PC40/ 44.
3. L7-11=580u H +/- 5%. (at: 10 K Hz, 0.3 V)
4. HI-POT: (60 Hz/5 m A/2 SET)
   Pri to Sec 3750 Vac; Pri to core 1500Vac

2.4.4. Boost inductor Winding data

C	Winging	Material	Start	Turns	Finish	Remark
1	N1	Φ0.20*10 利兹线	11	**61**	2	
2	TAPE	TAPE W=10mm (Y)		1.3		
3	N2	Φ0.20*2 2UEW	9	**8**	8	
4	TAPE	TAPE W=10mm (Y)		3		

2.5. Adapter Module Snapshot



3. Performance Evaluation

This session presents the test results of OBPD90W module up to date. Results on inrush current and safety test are not included and will be added when they become available.
Overall, the module meets design specifications.
All data was measurement at AWG16 CABLE end.

Performance Highlights

- No load standby power under 0.42W@230VAC
- Averaged efficiency more than 88%@115VAC&230VAC
- EMI passed EN55022 and FCC15 Class B test with more than 6dB margin

Characterization Results Summary

Test Item	Test result
1. Input characteristics	
Input current (90V/60Hz, full load)	1.17A Max
Standby power at no load With LED (230Vac, With PFC)	0.40W
Average Efficiency (115Vac, 25%/50%/75%/100% load,)	88.75%
2 .Output characteristics	
Line regulation	0.47%
Load regulation	1.82%
Ripple & noise	70mV
Over shoot	3.5% Max
Under shoot	2.1% Max
Dynamic test	328mV
3. Time sequence (90Vac with Full load)	
Turn on delay time	1230mS
Hold up time	23mS
Rise time	15mS
Fall time	12mS

Test Equipments

Item	Vender	Module
AC Source	WEST	WEW1010
Digital Power Meter	YOKOGAWA	WT210
Electrical Load	Prodigit	3315C
Oscilloscope	LeCroy	WS424
Multimeter	VICTORY	VC9807A
Thermal	FLUKE	HS 2

3.1. Input Characteristics

3.1.1. Standby power

Table. 1 Standby power

Input voltage	Pin(W)	Vo(V)	Specification	Test result
90Vac/60Hz	0.26	19.25	Line=230Vac<500mW	Pass
115Vac/60Hz	0.28	19.25		
132Vac/60Hz	0.30	19.25		
180Vac/50Hz	0.34	19.24		
230Vac/50Hz	0.40	19.24		
264Vac/50Hz	0.45	19.24		

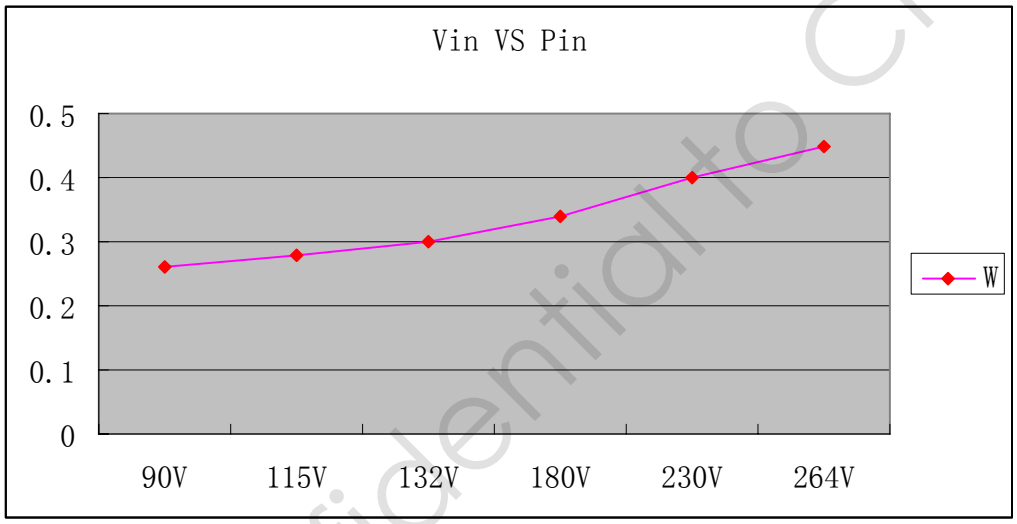


Fig. 1 No-load Input Power vs. Input Line Voltage

3.1.2. Efficiency

Table. 2 Efficiency

Input voltage	25%	50%	75%	100%	Aver. Eff.	Spec.
90Vac/60Hz	88.09	88.68	87.99	86.63	87.84	115Vac&230Vac. Aver Eff>87%
115Vac/60Hz	88.82	89.29	88.87	88.02	88.75	
132Vac/60Hz	89.03	89.90	88.05	87.89	88.71	
180Vac/50Hz	89.14	90.31	88.58	88.60	89.15	
230Vac/50Hz	88.66	90.01	88.80	88.98	89.11	
264Vac/50Hz	88.13	89.64	88.97	89.13	88.96	

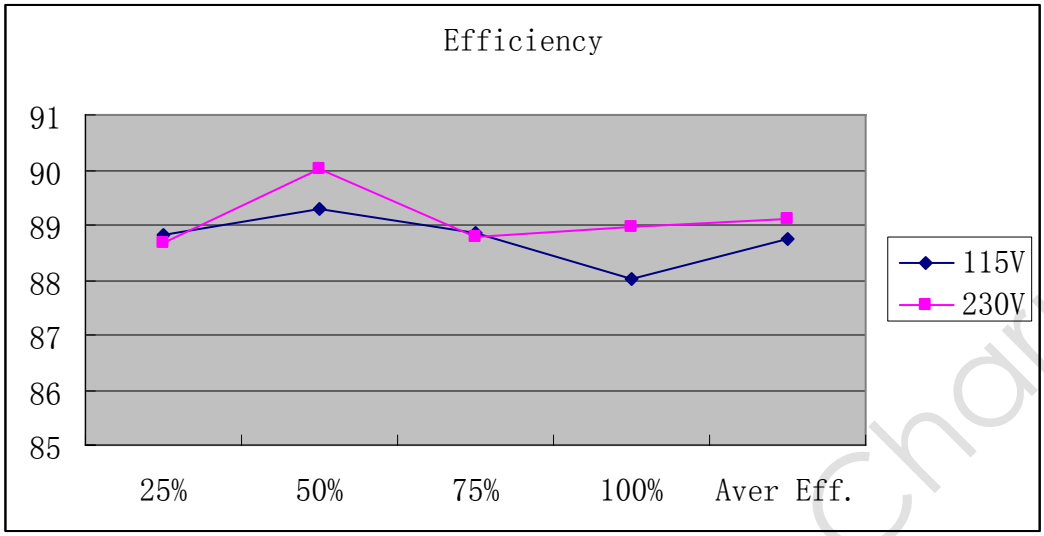


Fig. 2 Efficiency vs. Percent of Rated Output Power

3.2. Output Characteristics

3.2.1. Line Regulation & Load Regulation

Table. 3 Line Regulation & Load Regulation

Input voltage	No load	Half load	Full load	Specification	Test result
90Vac/60Hz	19.25	19.18	18.90		
132Vac/60Hz	19.25	19.19	18.92		
180Vac/50Hz	19.24	19.19	18.98		
264Vac/50Hz	19.24	19.19	18.99		
Line Regulation	0.47%			2%	**Pass**
Load Regulation	1.82%			5%	**Pass**

3.2.2. Ripple & Noise

Table. 4 Ripple & Noise

Input voltage	R&N (mV)		
	No load	Full load	Remark
90Vac/60Hz	34mV	70mV	Fig. 3,4
132Vac/60Hz	30mV	47mV	
180Vac/50Hz	33mV	31mV	
264Vac/50Hz	36mV	33mV	Fig. 5,6

Note: Ripple & noise were measured at DC CABLE end with a 0.1uF/100V ceramic cap connected in parallel with a 10uF/50V Electrolytic cap. Bandwidth was limited to 20MHz.

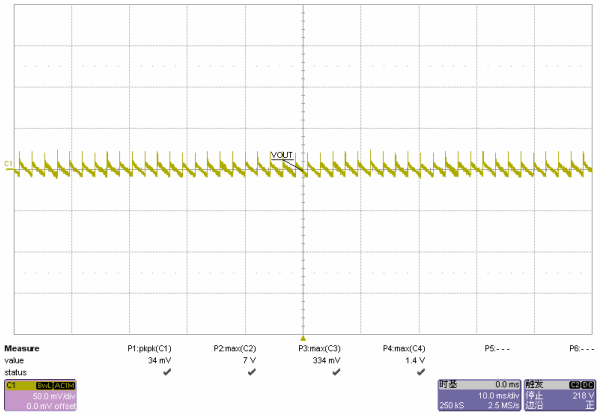


Fig. 3 Measured ripple& noise waveform@90Vac/60Hz, no load

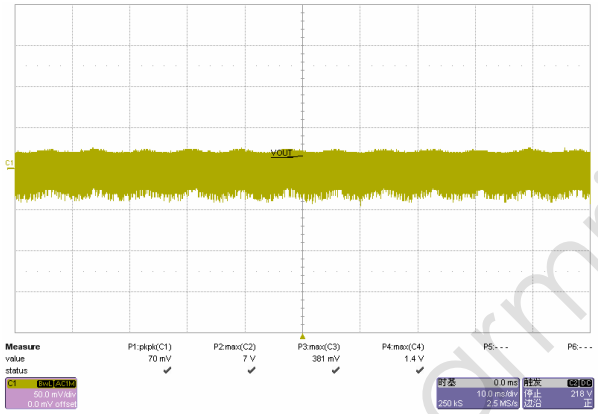


Fig. 4 Measured ripple& noise waveform@90Vac/60Hz, full load

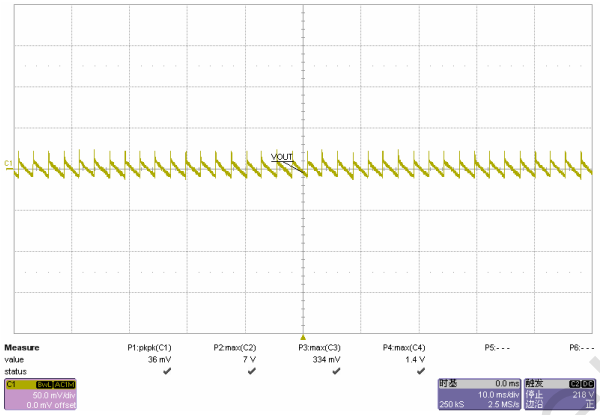


Fig. 5 Measured ripple& noise waveform@264Vac/50Hz, no load

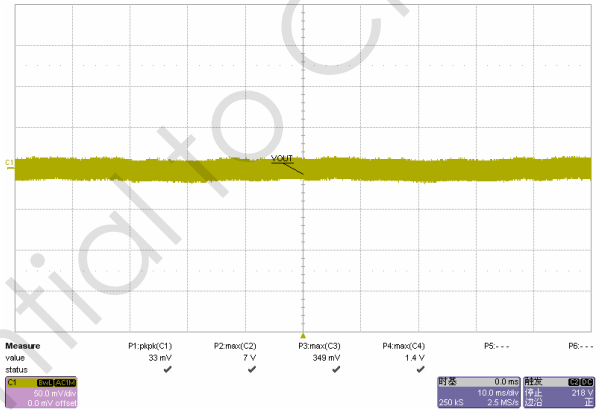


Fig. 6 Measured ripple& noise waveform@264Vac/50Hz, full load

3.2.3. Over Shoot & Under Shoot

Over shoot and under shoot were measured under below conditions.

a. AC input switch on for over shoot and off for under shoot.

b. Input voltage ranges from 90Vac/60Hz~264Vac/50Hz.

Table. 5 Over shoot & under shoot measurement results

Input	load		Remark
90V/60HZ	Full load	over shoot	Fig. 7
		under shoot	
	No load	over shoot	Fig. 8
		under shoot	
264V/50HZ	Full load	over shoot	Fig. 9
		under shoot	
	No load	over shoot	Fig. 10
		under shoot	

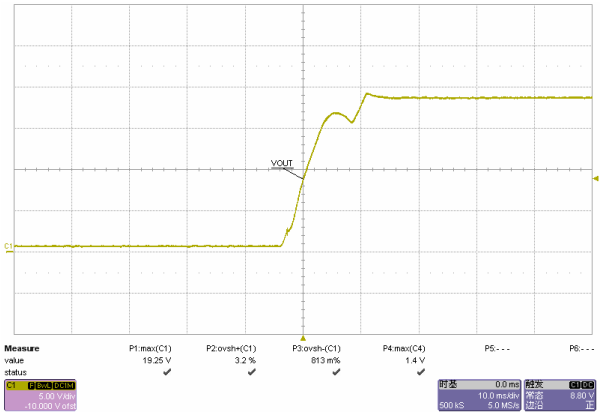


Fig. 7 Measured overshoot waveform@90Vac/60Hz, full load

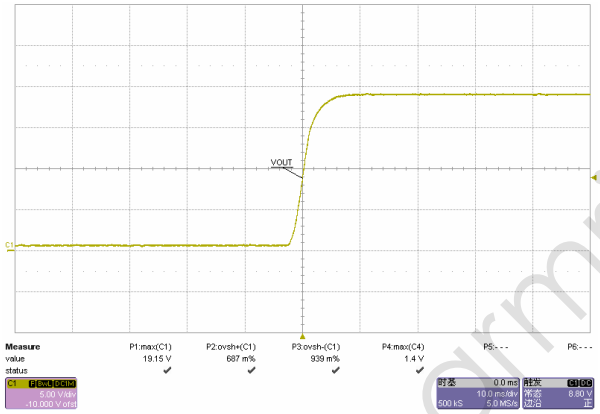


Fig. 8 Measured overshoot waveform@90Vac/60Hz, no load

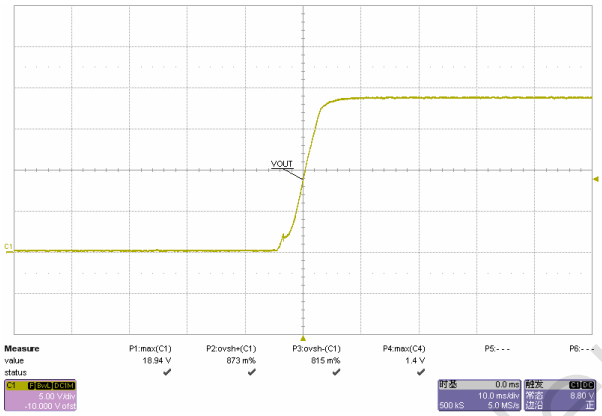


Fig. 9 Measured overshoot waveform@264Vac/50Hz, full load

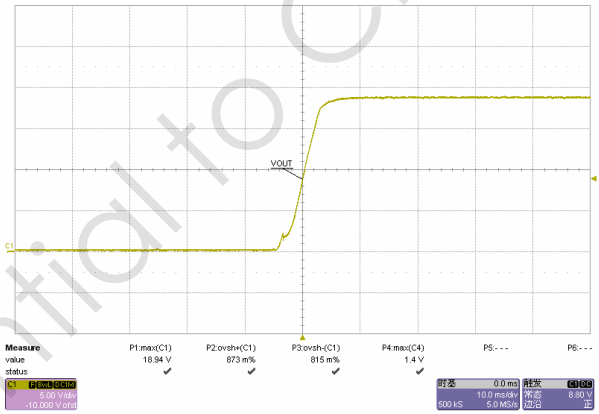


Fig. 10 Measured overshoot waveform@264Vac/50Hz, no load

3.2.4. Dynamic Test

A dynamic loading with low set at 20% load lasting for 50ms and high set at 80% load lasting for 50mS is added to output. The ramp is set at 0.25A/us at transient. Measurement was taken at CABLE end(Same as R&N measurement)

Table. 6 Output voltage under dynamic test

Input	Output (mV)	Remark
264V/50HZ	±325mV	Fig. 11
180V/50HZ	±325mV	
115V/60HZ	±315mV	
90V/60HZ	±315mV	Fig. 12

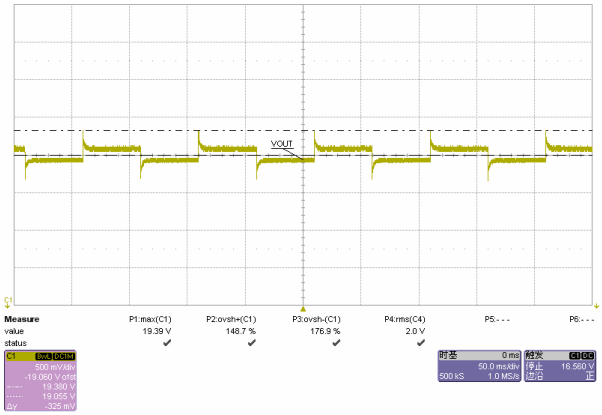


Fig. 11 Output voltage waveform under Dynamic test @264Vac/50Hz

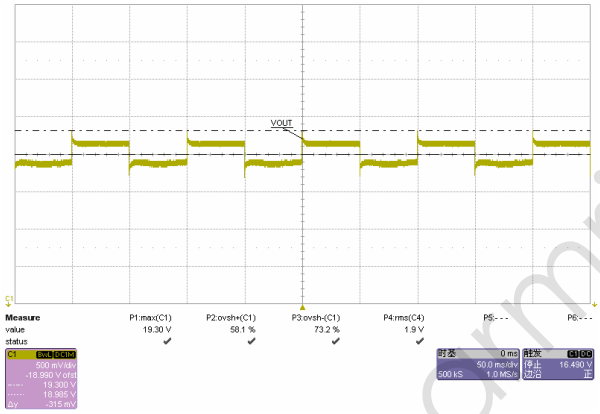


Fig. 12 Output voltage waveform under Dynamic test @90Vac/60Hz

3.2.5. Time Sequence (Full load)

Table. 7 Turn-on delay/hold-up/rise/fall time measurement results

Item	Input voltage	Meas. Data	Test spec.	Test results	Remark
Turn-on delay time	90V/60Hz	1230mS	<2S	Pass	Fig. 13
	264V/50Hz	366 mS		Pass	Fig. 14
Hold-up time	90V/60Hz	23 mS	>10mS	Pass	Fig. 15
	264V/50Hz	79 mS		Pass	Fig. 16
Rise Time	90V/60Hz	15 mS		Pass	Fig. 17
	264V/50Hz	9.5 mS		Pass	Fig. 18
Fall Time	90V/60Hz	12.5 mS		Pass	Fig. 19
	264V/50Hz	12.8 mS		Pass	Fig. 20

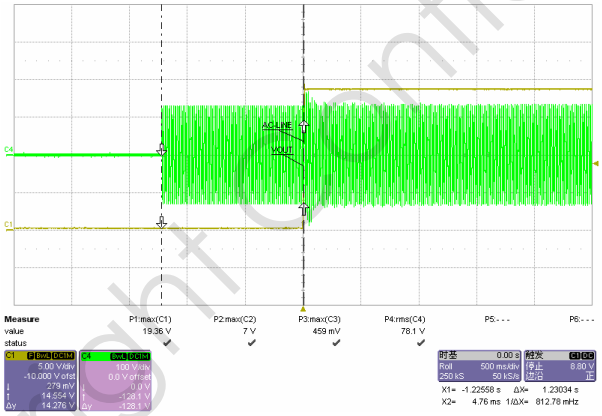


Fig. 13 Turn on delay time measured waveform @90Vac/60Hz,full load

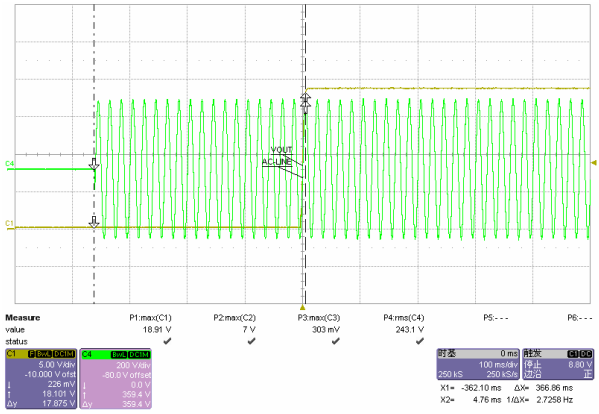


Fig. 14 Turn on delay time measured waveform @264Vac/50Hz,full load

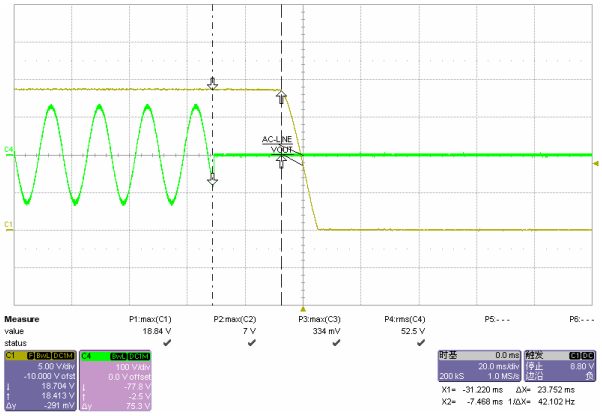


Fig. 15 Hold-up time measured waveform@90Vac/60Hz,full load

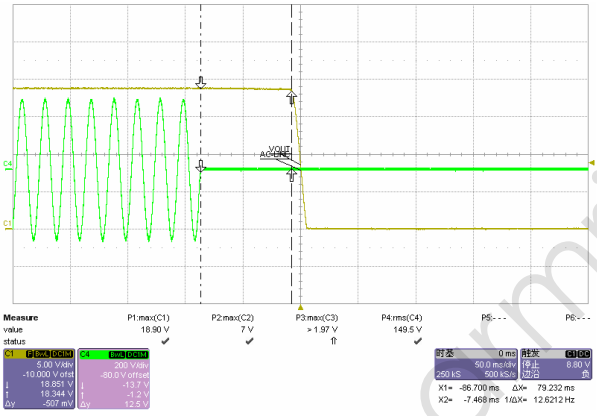


Fig. 16 Hold-up time measured waveform@264Vac/50Hz,full load

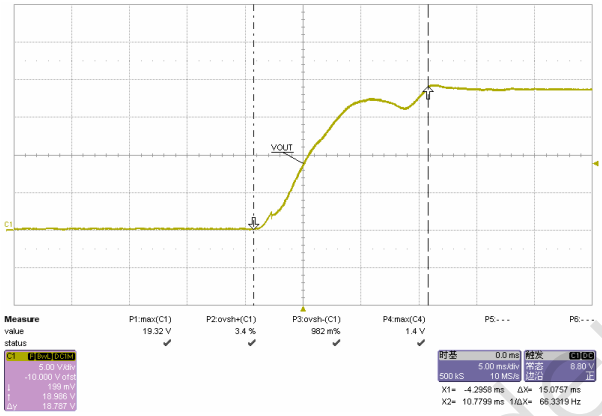


Fig. 17 Rise time measured waveform@90Vac/60Hz,full

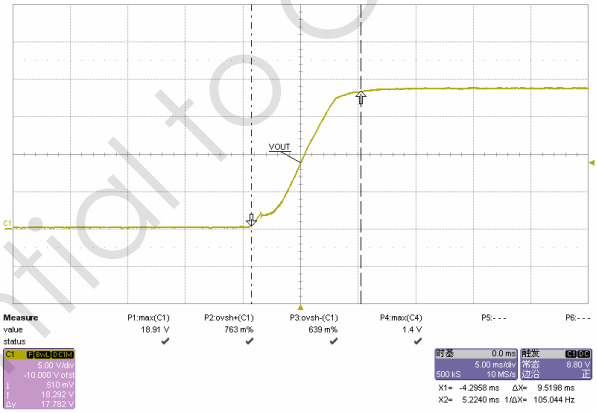


Fig. 18 Rise time measured waveform@264Vac/50Hz,full load

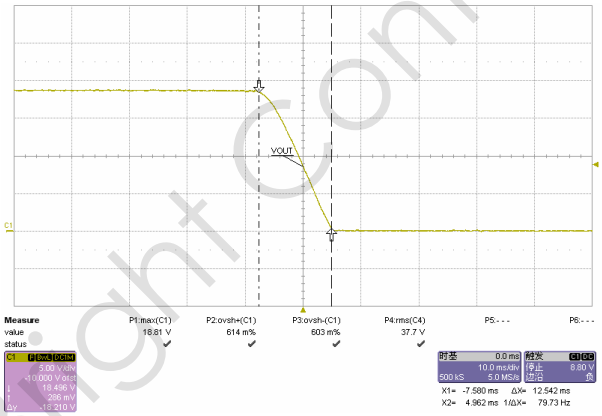


Fig. 19 Fall time measured waveform@90Vac/60Hz,full load

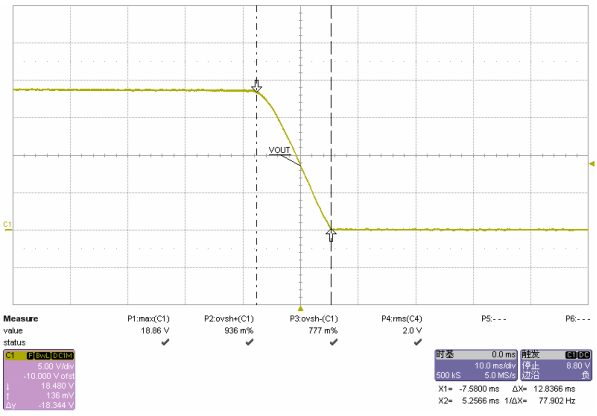


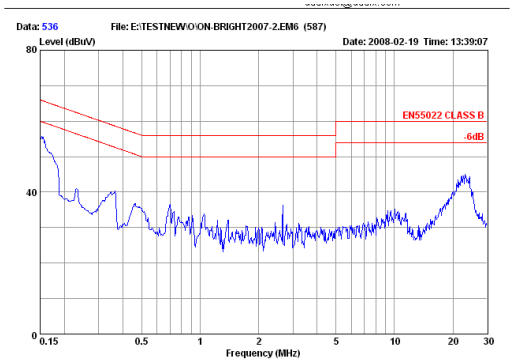
Fig. 20 Fall time measured waveform@264Vac/50Hz,full load

3.3. EMI Test

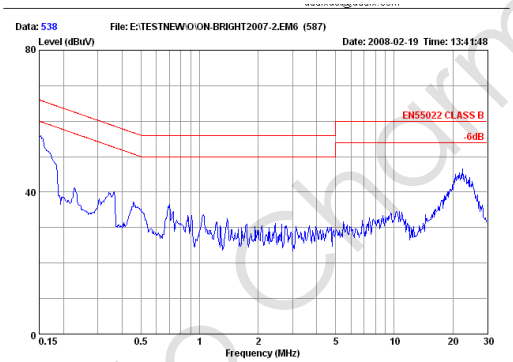
The Power supply passed EN55022 Class B & FCC class B EMI requirement with more than 6dB margin

3.3.1. Conduction EMI Test

EN55022 CLASS B @ full load report

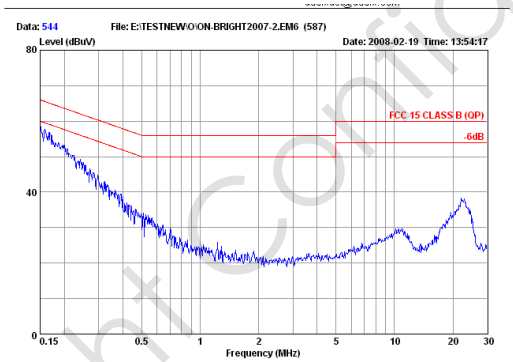


Site	: Audix ACI(Conducted Emission) , Project:
Condition	: EN55022 CLASS B ESH3-Z5-07.04.06 LINE
Project No.	:
Applicant	:
EUT	: LIPS
M/N	: OB2203
S/N	: 2#
Power Supply	: 230V/50Hz
Ambient	: 25℃ 55%RH
Test line	: L
Test Mode	: Full Load
Test Engineer	: Tom
Memo	: 90W

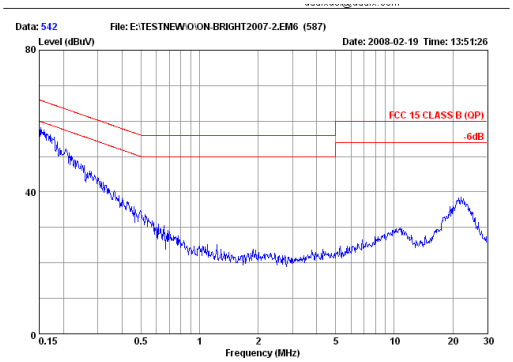


Site	: Audix ACI(Conducted Emission) , Project:
Condition	: EN55022 CLASS B ESH3-Z5-07.04.06 NEUTRAL
Project No.	:
Applicant	:
EUT	: LIPS
M/N	: OB2203
S/N	: 2#
Power Supply	: 230V/50Hz
Ambient	: 25℃ 55%RH
Test line	: N
Test Mode	: Full Load
Test Engineer	: Tom
Memo	: 90W

FCC CLASS B @ full load report



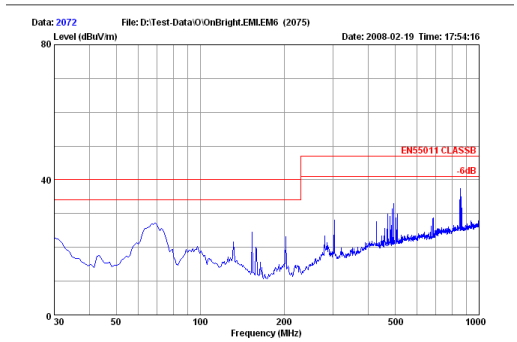
Site	: Audix ACI(Conducted Emission) , Project:
Condition	: FCC 15 CLASS B (QP) ESH3-Z5-07.04.06 LINE
Project No.	:
Applicant	:
EUT	: LIPS
M/N	: OB2203
S/N	: 2#
Power Supply	: 120V/60Hz
Ambient	: 25℃ 55%RH
Test line	: L
Test Mode	: Full Load
Test Engineer	: Tom
Memo	: 90W



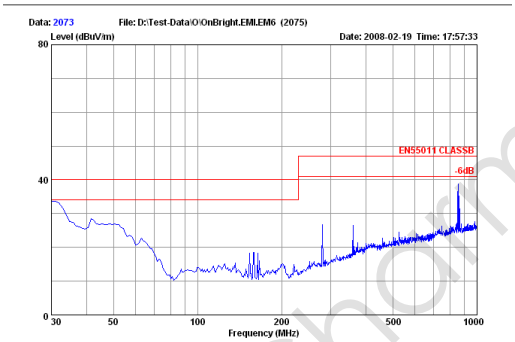
Site	: Audix ACI(Conducted Emission) , Project:
Condition	: FCC 15 CLASS B (QP) ESH3-Z5-07.04.06 NEUTRAL
Project No.	:
Applicant	:
EUT	: LIPS
M/N	: OB2203
S/N	: 2#
Power Supply	: 120V/60Hz
Ambient	: 25℃ 55%RH
Test line	: N
Test Mode	: Full Load
Test Engineer	: Tom
Memo	: 90W

3.3.2. Radiation EMI Test

EN55022 CLASS B @ full load report



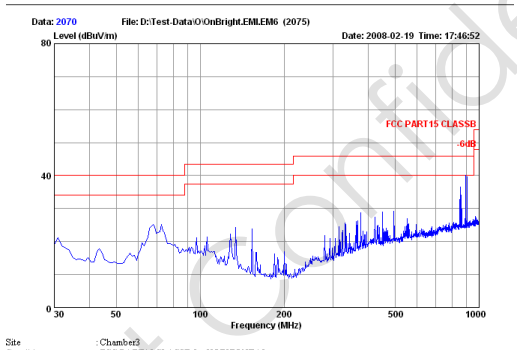
Site : Chamber3
Condition : EN55011 CLASSB 3m HORIZONTAL
Project No. :
Applicant : On Bright
EUT : POWER
M/N : OB2203
S/N : 90W 2#
Power Supply : 230V/50Hz
Ambient : 22C 60%RH
Test Mode : FULL LOAD
Test Engineer : Leo
Memo :
Memo :



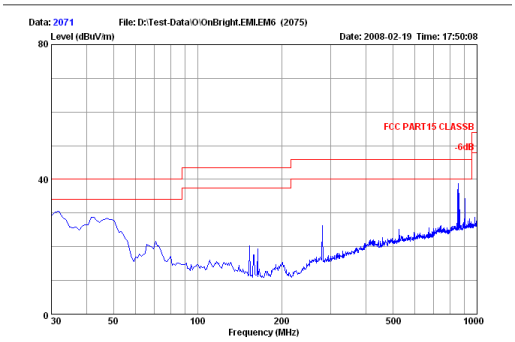
Site : Chamber3
Condition : EN55011 CLASSB 3m VERTICAL
Project No. :
Applicant : On Bright
EUT : POWER
M/N : OB2203
S/N : 90W 2#
Power Supply : 230V/50Hz
Ambient : 22C 60%RH
Test Mode : FULL LOAD
Test Engineer : Leo
Memo :
Memo :

	Freq	Level	Read Level	Antenna Factor	Cable Loss	Limit Line	Over Limit	Remark
	MHz	dBuV/m	dBuV	dB/m	dB	dBuV/m	dB	
1	30.00	31.71	12.60	18.20	0.91	40.00	-8.29	QP

FCC CLASS B @ full load report



Site : Chamber3
Condition : FCC PART15 CLASSB 3m HORIZONTAL
Project No. :
Applicant : On Bright
EUT : POWER
M/N : OB2203
S/N : 90W 2#
Power Supply : 120V/60Hz
Ambient : 22C 60%RH
Test Mode : FULL LOAD
Test Engineer : Leo
Memo :
Memo :



Site : Chamber3
Condition : FCC PART15 CLASSB 3m VERTICAL
Project No. :
Applicant : On Bright
EUT : POWER
M/N : OB2203
S/N : 90W 2#
Power Supply : 120V/60Hz
Ambient : 22C 60%RH
Test Mode : FULL LOAD
Test Engineer : Leo
Memo :
Memo :

3.3.3. Temperature Test

The thermal test is under 40℃ ambiance after 5hour full load ruining with 90VAC input.
Case: 132mm*28mm*31mm

Table. 8 temperature test result

Position	Description	Value
BD1	Commute diode	104.7℃
T2	PFC boost inductor	97.2℃
Q1	PFC mosfet	102.9℃
D1	PFC boost diode	107.9℃
Q5	QR mosfet	105.4℃
T1	QR transformer	101.6℃
D8	Commute diode	102.3℃
case	Exterior temperature	68.6℃

4. Protection

4.1. Over current protection

Table. 9 OCP @ full load

Input Voltage	OCP Trigger Current (A)
90V/60Hz	5.93
115V/60Hz	5.93
132V/60Hz	5.93
180V/50Hz	5.93
230V/50Hz	5.93
264V/50Hz	5.93

4.2. Over voltage protection

Table. 10 OVP @ no load/full load

Input Voltage	OVP Trigger Voltage (V)	
	No load	Full load
90V/60Hz	22.4	22.1
132V/60Hz	22.4	22.1
180V/50Hz	22.7	22.1
264V/50Hz	23.1	22.7

4.3. Short circuit protection

The system is protected during output short circuit condition and recovered when short circuit condition is removed.

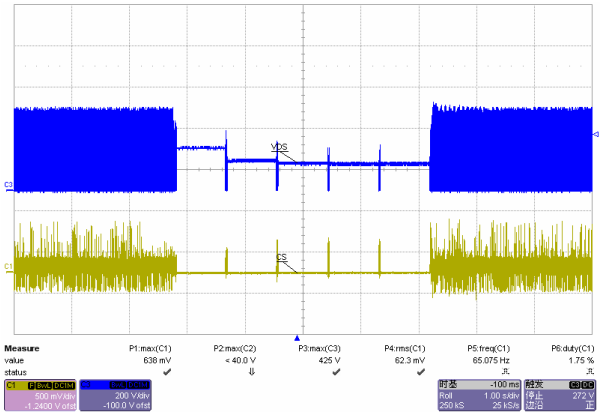


Fig. 21 Output short, Vds waveform@90 Vac/60Hz, full load

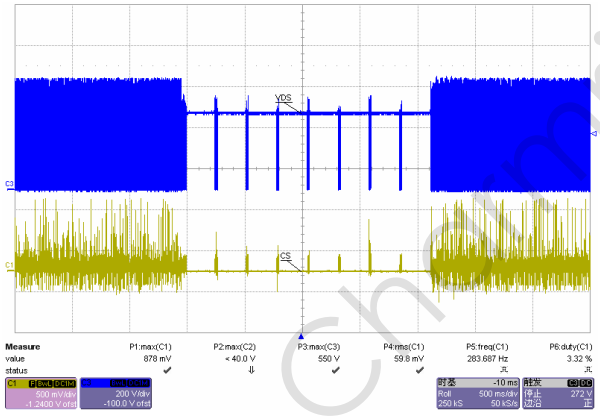


Fig. 22 Output short, Vds waveform@264 Vac/50Hz, full load

5. Other Important Waveform

5.1. Vdd, Sense&Gate waveform @ no load /full load

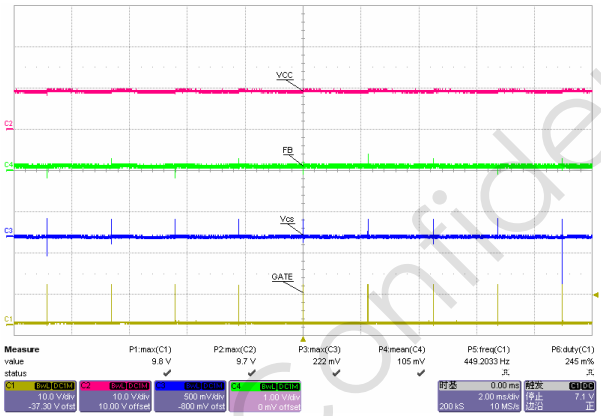


Fig. 23 Vdd, Sense&Gate waveform@90Vac/60Hz,no load

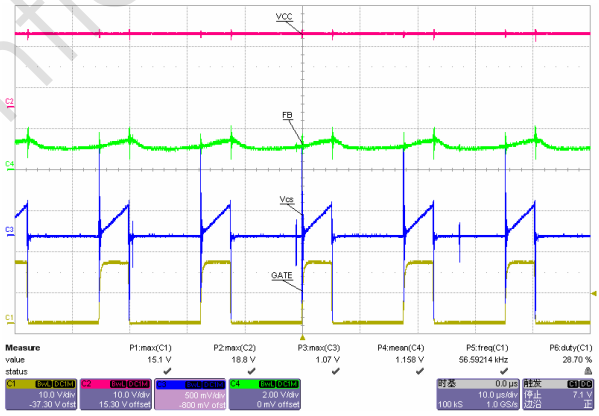


Fig. 24 Vdd, Sense&Gate waveform @90Vac/60Hz, full load

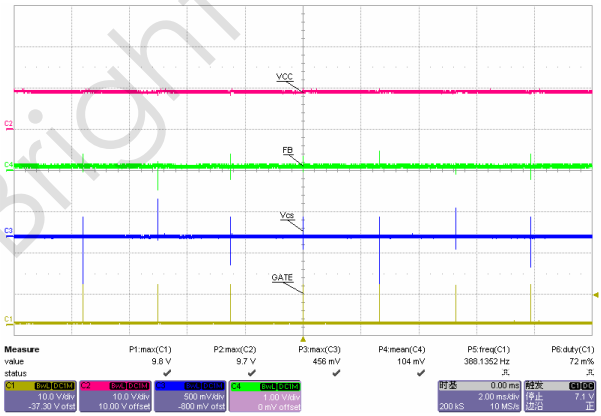


Fig. 25 Vdd, Sense&Gate waveform @264Vac/50Hz, no load

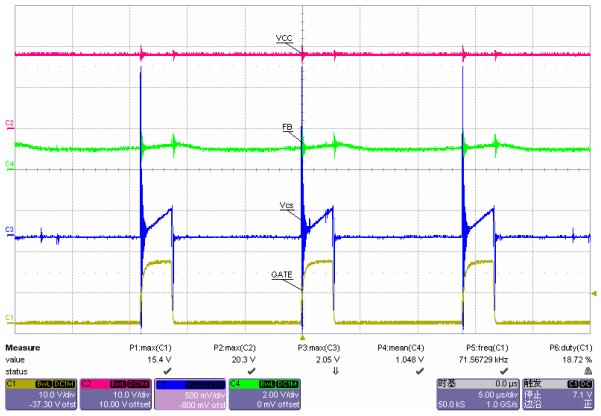


Fig. 26 Vdd, Sense&Gate waveform @264Vac/50Hz,full load

5.2. MOSFET Vds waveform @ start/normal

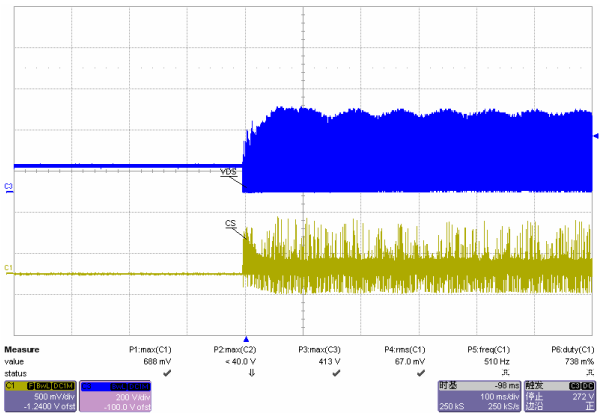


Fig. 27 Start, Vds waveform@90 Vac/60Hz, full load

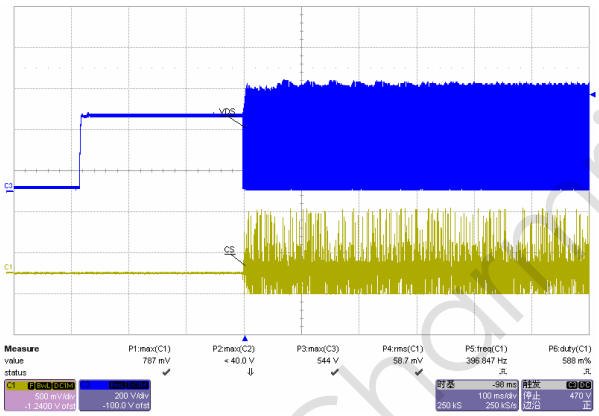


Fig. 28 Start, Vds waveform@264 Vac/50Hz, full load

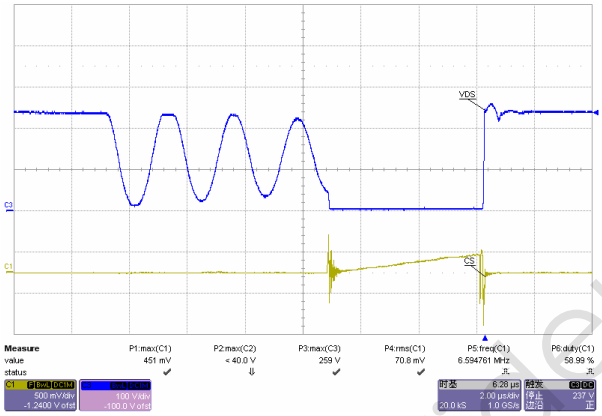


Fig. 29 Normal, Vds waveform@90 Vac/60Hz, 25% load

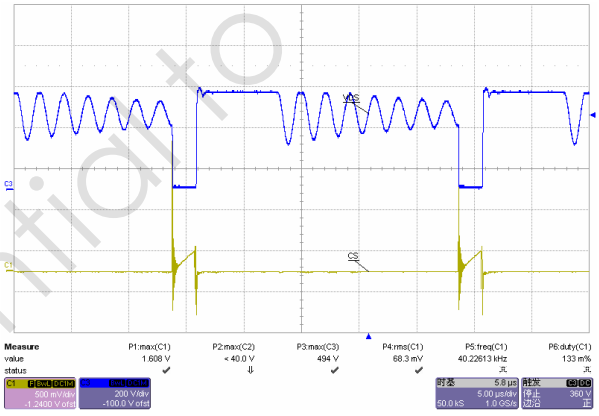


Fig. 30 Normal, Vds waveform@264 Vac/50Hz, 25% load

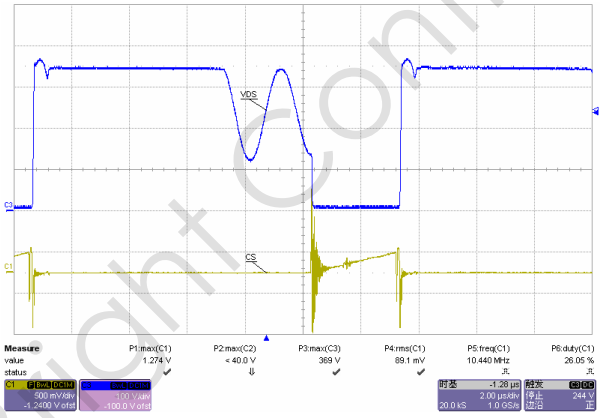


Fig. 31 Normal, Vds waveform@90 Vac/60Hz, 50% load

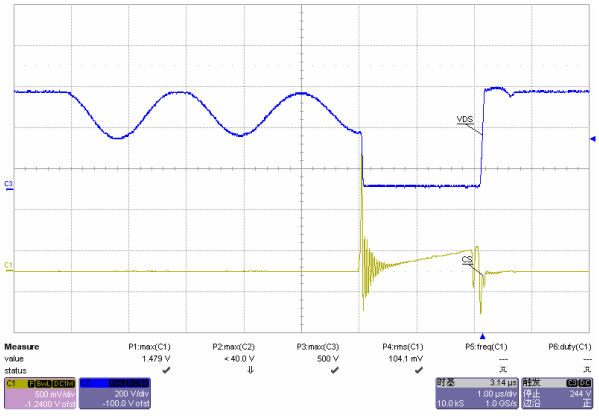


Fig. 32 Normal, Vds waveform@264 Vac/50Hz, 50% load

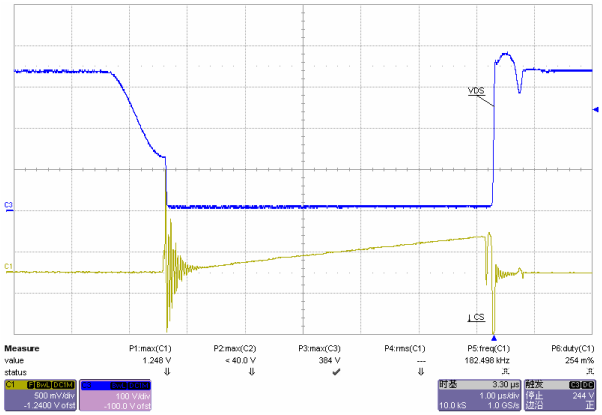


Fig. 33 Normal, Vds waveform@90 Vac/60Hz, full load

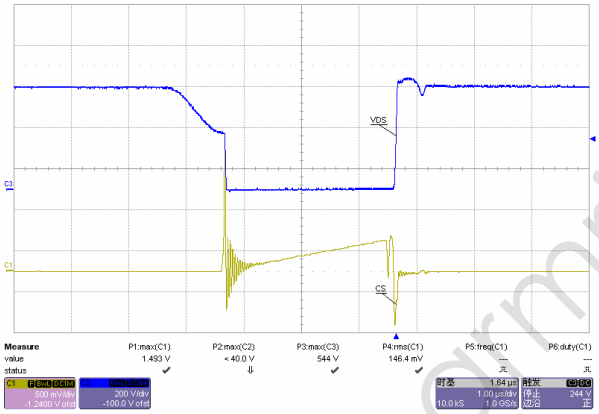


Fig. 34 Normal, Vds waveform@264 Vac/50Hz, full load

Table. 11 Vds_max @ Start/Normall/Output short

Input	Vds_max(V)
264Vac/50Hz @Start	544
264Vac/50Hz @ Normall (Full load)	544
264Vac/50Hz @ Output short	550

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