Subject **OB3330 Demo Board Manual**	Board Model: LED48V0.4A-OB3330.00 Doc. No.: OB_DOC_DBM_A_333000

Key features:

- Primary-side control with single stage PFC for LED driver
- Minimum BOM component amount
- Power factor >0.9
- THD meet IEC61000-3-2 Class C
- Short circuit protection
- Meet EN55015 & FCC Part 15 EMI

Revision History

Revise Date	Version	Reason/Issue
2011-12-27	00	First issue

Contents Index

Figures Index

Tables Index

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 48.0V
- Output Current 0.4A type

1.3. Performance Specifications

- Output Power 20W
- Input Current 0.3A max
- Efficiency > 84%
- Line Regulation ±2% max
- Load Regulation ±5% max

1.4. Protection Features

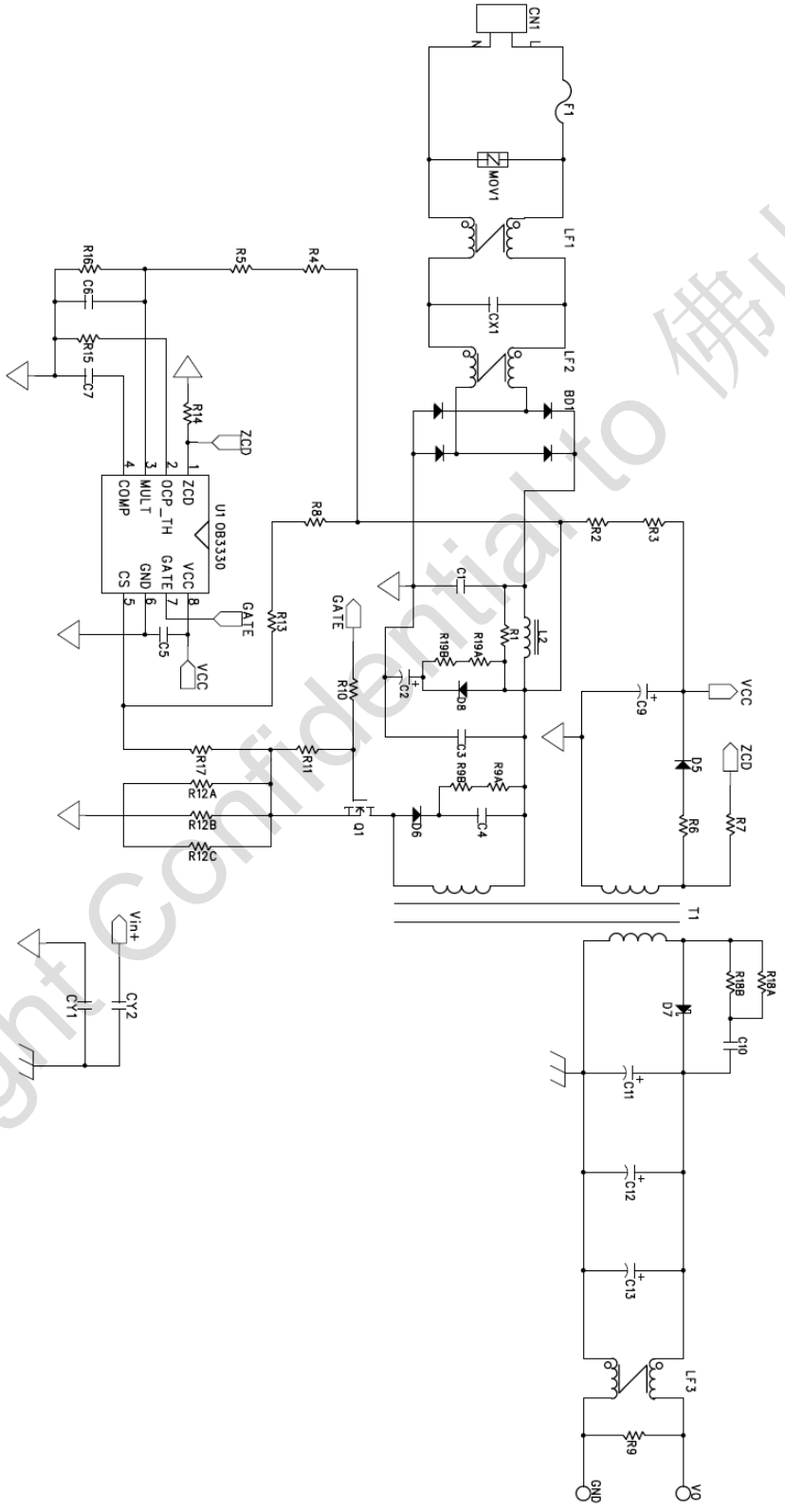
- Short Circuit Protection Output shut down with automatic recovery
- Over Voltage Protection Output shut down with automatic recovery

1.5. Environments

- Operating Temperature 0℃ to + 70℃
- Operating Humidity 20% to 90% R.H.
- Storage Temperature - 40℃ to + 85℃
- Storage Humidity 0% to 95% R.H.

2. LED Module Information

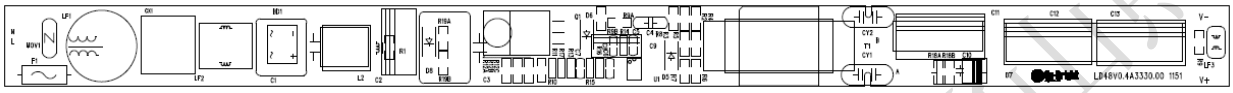
2.1. Schematic



2.2. Bill of material

No.	Position	Description	Quantity	Remark
1	F1	FUSE, T2.0AL/250V	1	
2	MOV1	MOV, 07D471	1	
3	T1	Transformer, ER3310, 700uH	1	
4	LF1	Common Choke, Core13*7*5mm, Φ0.3*22Ts*2, 2mH	1	
5	LF2	Common Choke, EE12, Φ0.21*106Ts*2, 30mH	1	
6	LF3	Common Choke, Core 8*4*3mm, Φ0.4x10Ts*2, 60uH	1	
7	L2	Induction, DR9*12mm, Φ0.23x230Ts, 1.8mH	1	
8	CX1	X2-CAP, 104P, +/-20%, 275Vac	1	
9	CY1,CY2	Y1-CAP, 101P, +/-20%, 250Vac	2	
10	C1	MPP, 473P/630V	1	
11	C2	E.C, 3.3uF/400V, DIP	1	
12	C3	MPP, 104P/400V	1	
13	C4	C.C, 222P/1KV, DIP	1	
14	C5	SMD, 104P/50V, 0805	1	
15	C6	SMD, 221P/50V, 0805	1	
16	C7	SMD, 474P/50V, 0805	1	
17	C9	E.C, 33uF/50V, DIP	1	
18	C10	C.C, 471P/500V, DIP	1	
19	C11-C13	E.C, 220uF/63V, Low ESR	3	
20	R1	SMD, 10K, 5%, 1206	1	
21	R2,R3	SMD, 330K, 5%, 1206	2	
22	R4,R5	SMD, 1.5M, 5%, 1206	2	
23	R6	SMD, 0R, 5%, 1206	1	
24	R7	SMD, 100K, 1%, 1206	1	
25	R8,R13	SMD, 1M, 5%, 1206	2	
26	R9	SMD, 33K, 5%, 1206	1	
27	R9A,R9B	SMD, 47K, 5%, 1206	2	
28	R10	SMD, 68R, 5%, 1206	1	
29	R11	SMD, 20K, 5%, 0805	1	
30	R12A,R12B	SMD, 3R3, 5%, 1206	2	
31	R12C	SMD, 3R9, 5%, 1206	1	
32	R14	SMD, 24K, 1%, 0805	1	
33	R15	SMD, 33K, 5%, 0805	1	
34	R16	SMD, 18K, 5%, 0805	1	
35	R17	SMD, 390R, 5%, 0805	1	
36	R18A,R18B	SMD, 47R, 5%, 1206	2	
37	R19A,R19B	SMD, 33K, 5%, 1206	2	
38	BD1	DF08S, 1A , 800V	1	
39	D5,D6	SMD Diode, RS1J	2	
40	D7	Diode, UF3004, 3A/400V	1	
41	D8	SMD Diode, M7	1	
42	U1	PFC controller, OB3330, SOP8	1	
43	Q1	MOSFET, TOSHIBA TK6A60, 6A/600V	1	
44	Bead core	For Q1 S pin	1	
45	PCB	FR-4, 277mm（L）*18mm（W）*1.0（T）	1	

2.3. PCB Gerber File



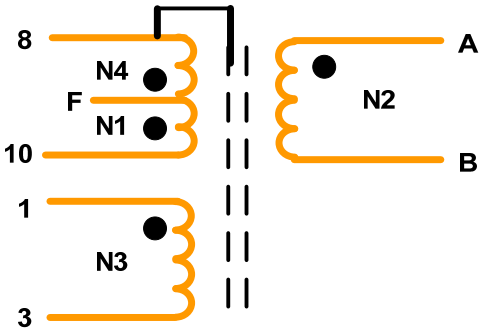
Top

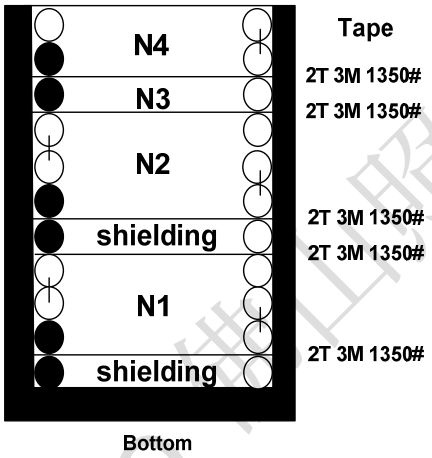
Top

Bottom

2.4. LED Module Snapshot

2.4.1. Transformer Specification



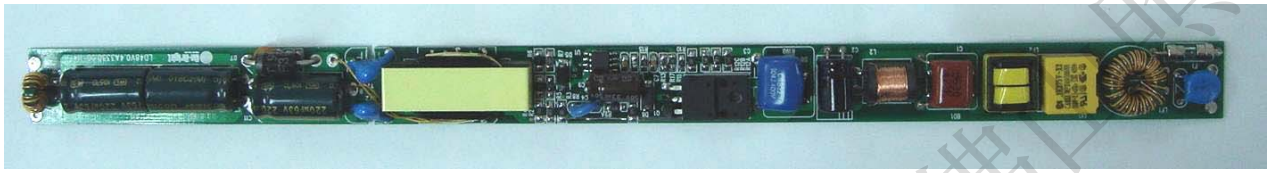


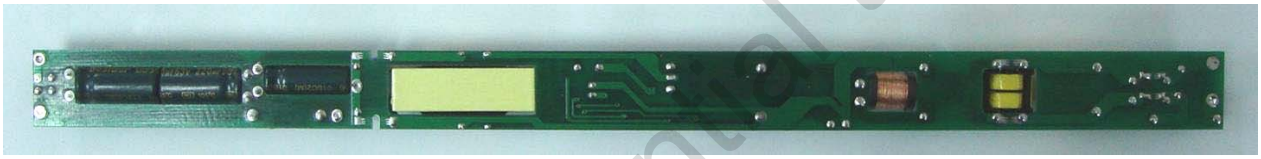
Note:
1) Bobbin: ER3310 (10Pin)
2) Core material: PC40 (TDK).or equivalent
3) L(10-8) =700uH ±5% (10KHz,1V,25℃)

2.4.2. Transformer Winding data

Winging	Material	Start	Turns	Finish
Shielding	0.18Φ*2 2UEW	8	9	NC
TAPE	TAPE W=4mm (Y)		2	
N1	0.27Φ*1 2UEW	10	35	F
TAPE	TAPE W=4mm (Y)		2	
Shielding	0.18Φ*2 2UEW	8	9	NC
TAPE	TAPE W=4mm (Y)		2	
N2	0.3Φ*1 triple insulated wire	A	22	B
TAPE	TAPE W=4mm (Y)		2	
N3	0.18Φ*2 2UEW	1	8	3
TAPE	TAPE W=4mm (Y)		2	
N4	0.27Φ*1 2UEW	F	23	8
TAPE	TAPE W=4mm (Y)		3	

2.5. LED Module Snapshot





SIZE： 277mm（L）x18mm（W）x10mm（H）

3. Performance Evaluation

This session presents the test results of 20W LED module up to date.
Overall, the module meets design specifications.
All data was measured at PCB end.

Test Equipments

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

3.1. Input Characteristics

3.1.1. Input current

Table. 1 Input current under full load

Input voltage	90V/60Hz	115V/60Hz	180V/50Hz	230V/50Hz	264V/50Hz	Spec.	Test result
Output 48V	0.25A	0.20A	0.13A	0.1A	0.09A	< **0.3A**	**Pass**

3.1.2. Efficiency

Table. 2 Efficiency under full load

Input voltage	90V/60Hz	115V/60Hz	180V/50Hz	230V/50Hz	264V/50Hz	Spec.	Test result
Output 48V	85.58%	86.90%	87.32%	86.00%	84.77%	> **84%**	**Pass**

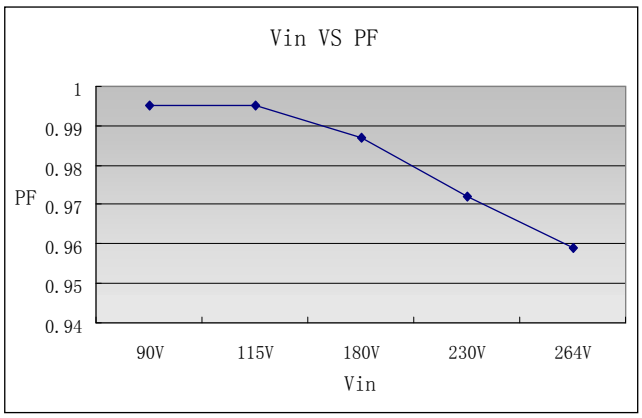
3.1.3. Power Factor & THD

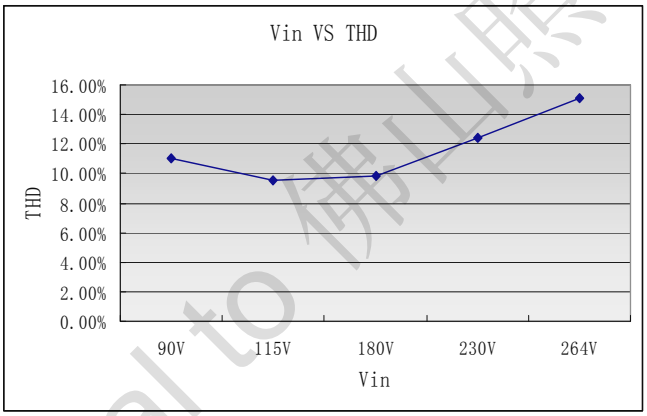
Table. 3 Power factor under full load

Input voltage	PF	Spec.	Test result
90V/60HZ	0.995	> **0.9**	**Pass**
115V/60HZ	0.995		
180V/50HZ	0.987		
230V/50HZ	0.972		
264V/50HZ	0.959		

Table. 4 THD test under full load

Input voltage	THD	Spec.	Test result
90V/60HZ	11.0%	< 18%	Pass
115V/60HZ	9.5%		
180V/50HZ	9.8%		
230V/50HZ	12.4%		
264V/50HZ	15.1%		





3.2. Output Characteristics

3.2.1. Output Current Regulation

Table. 5 Line Regulation & Load Regulation

Input voltage	Output 48V	Output 40V	Output 30V	Regulation	Spec.	Test result
90V/60Hz	402mA	411mA	416mA	+/−1.75%	Load Regulation < +/−5% Line Regulation < +/−2%	Pass
115V/60Hz	405mA	414mA	416mA			
180V/50Hz	405mA	415mA	416mA			
230V/50Hz	405mA	414mA	415mA			
264V/50Hz	404mA	413mA	415mA			
Regulation	+/−0.5 %					

3.2.2. Ripple & Noise

Table. 6 Output voltage, led current ripple & noise

Input voltage	Current R&N (mA)	Spec.	Test result	Remark
90V/60Hz	103	< 120mA	Pass	Fig. 1
115V/60Hz	102			Fig. 2
230V/50Hz	108			Fig. 3
264V/50Hz	108			Fig. 4

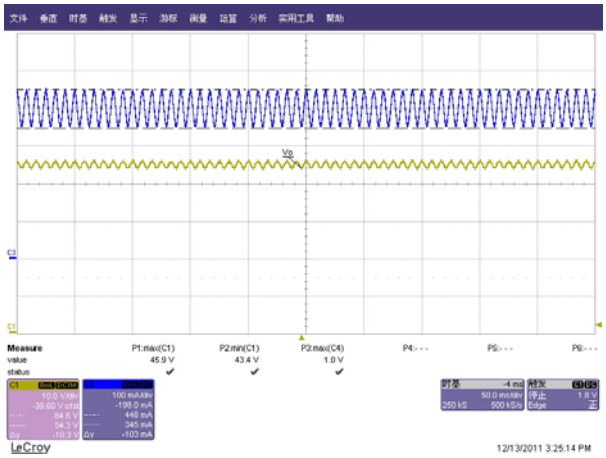


Fig. 1 Ripple & noise waveform @90Vac/60Hz

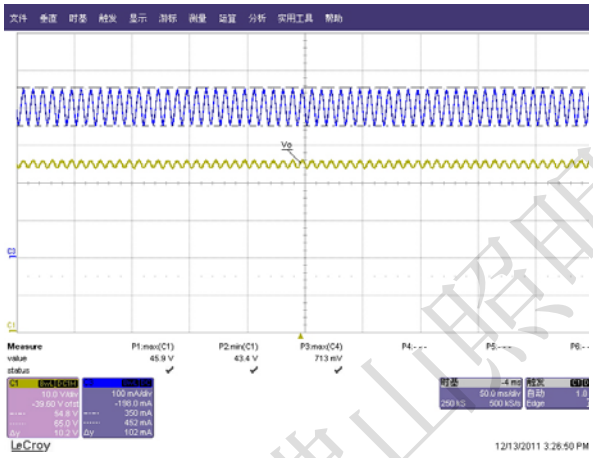


Fig. 2 Ripple & noise waveform @115Vac/60Hz

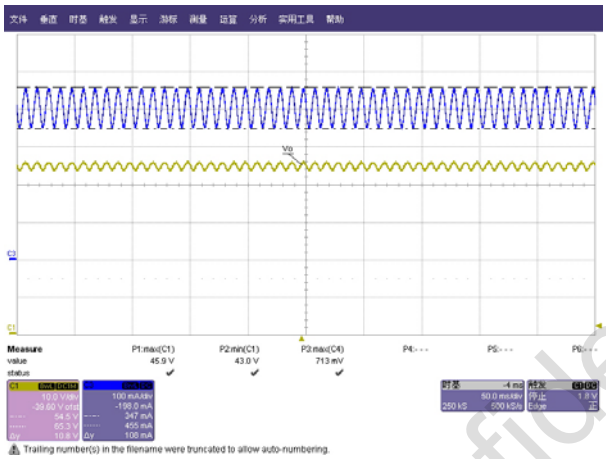


Fig. 3 Ripple & noise waveform @230Vac/50Hz

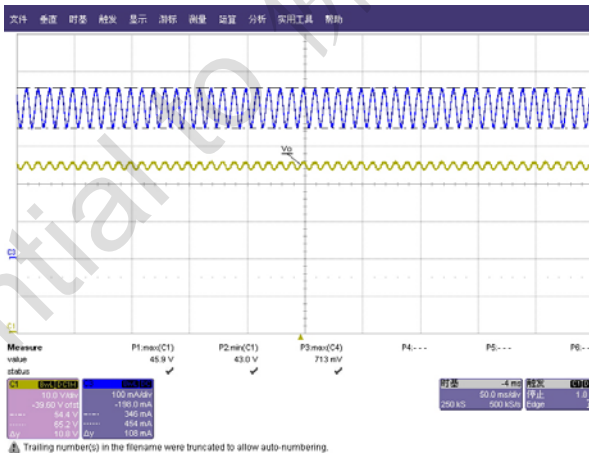


Fig. 4 Ripple & noise waveform @264Vac/50Hz

3.2.3. Output Voltage & Current Waveform

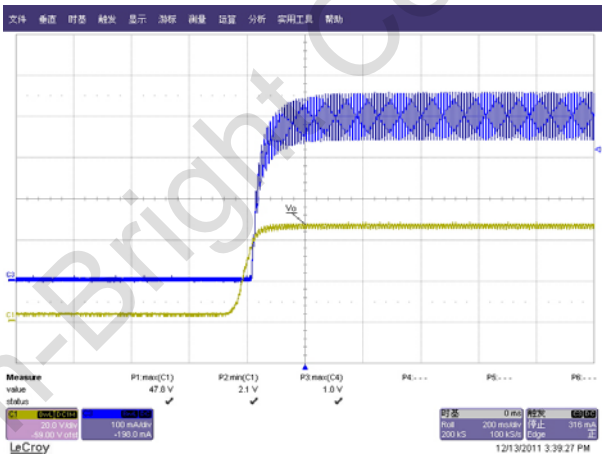


Fig. 5 Current & Voltage waveform @90Vac/60Hz, output start

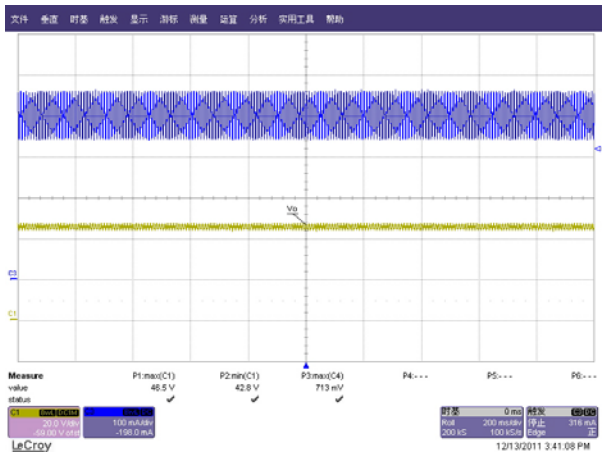


Fig. 6 Current & Voltage waveform @90Vac/60Hz, normal

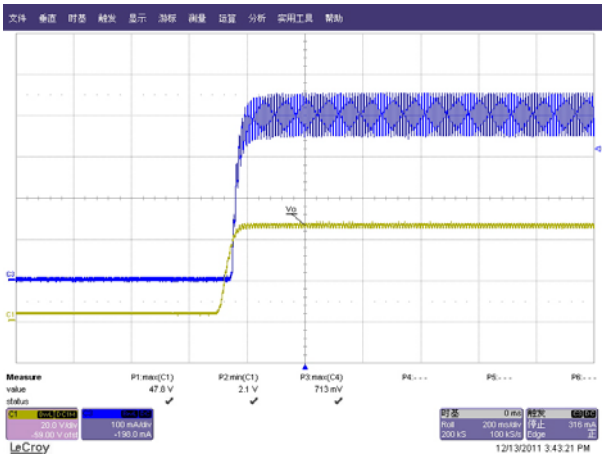


Fig. 7 Current & Voltage waveform @264Vac/50Hz, output start

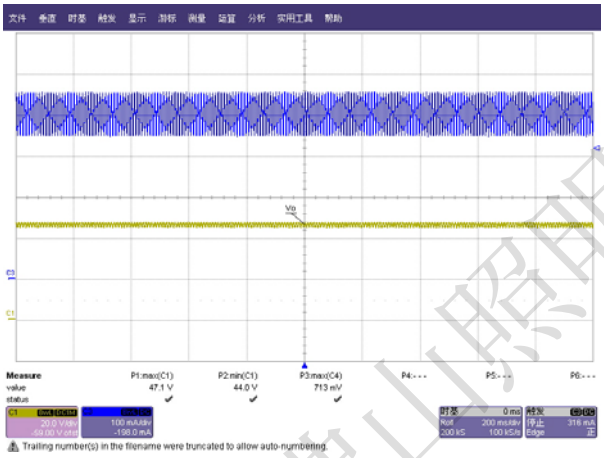


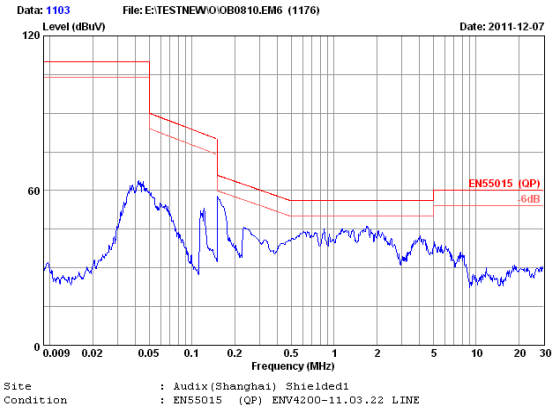
Fig. 8 Current & Voltage waveform @264Vac/50Hz, normal

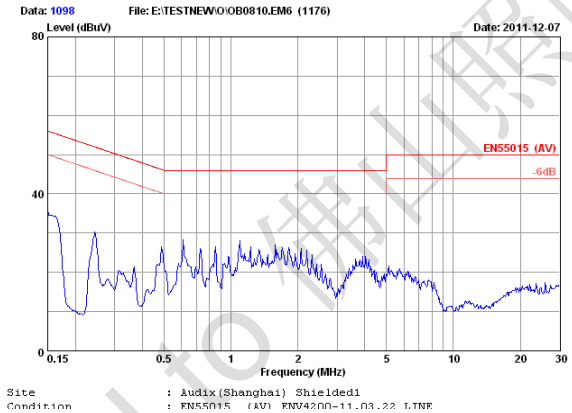
3.3. EMI Test

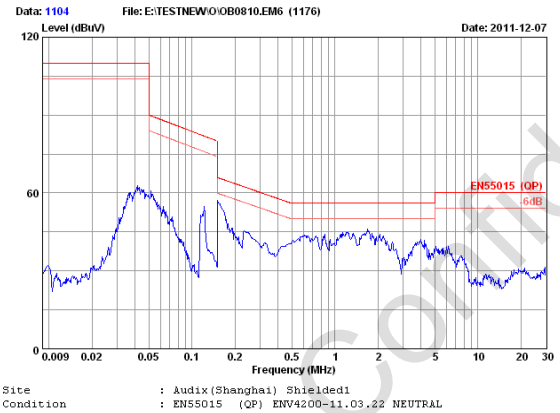
The Power supply passed EN55015 Class B & FCC Part 15 EMI requirement with more than 6dB margin

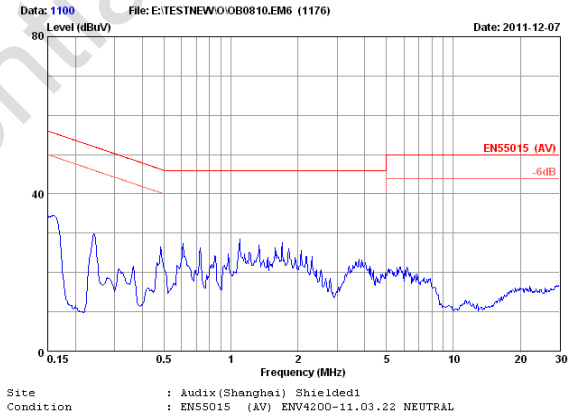
3.3.1. Conducted EMI Test

EN55015 CLASS B @ full load report

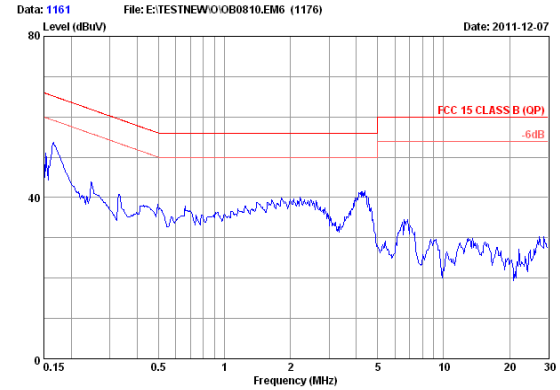




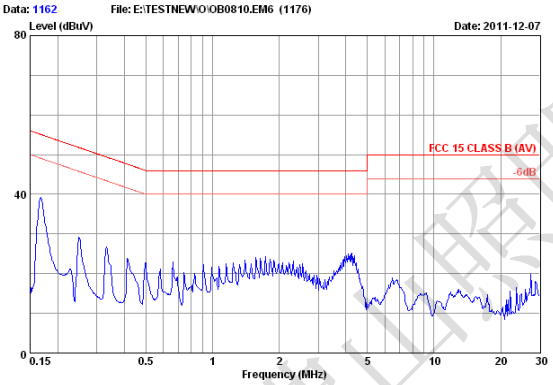




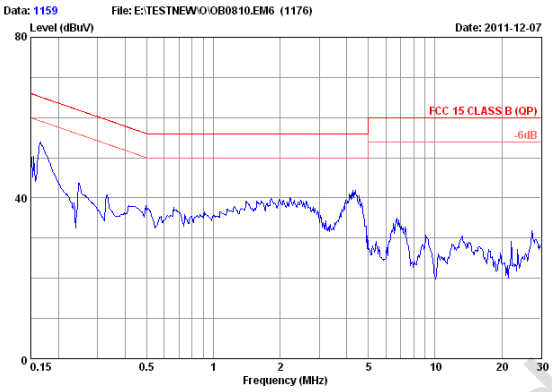
FCC Part 15 @ full load report



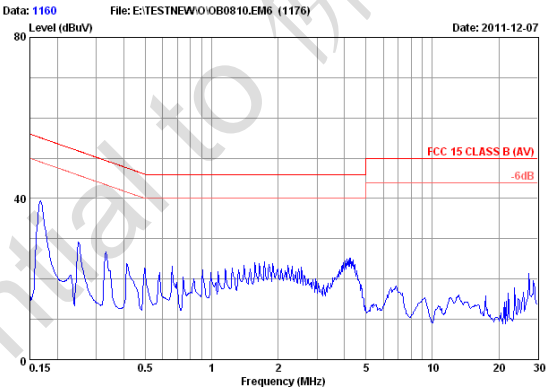
Site : Audix(Shanghai) Shielded1
Condition : FCC 15 CLASS B (QP) ENV4200-11.03.22 LINE



Site : Audix(Shanghai) Shielded1
Condition : FCC 15 CLASS B (AV) ENV4200-11.03.22 LINE



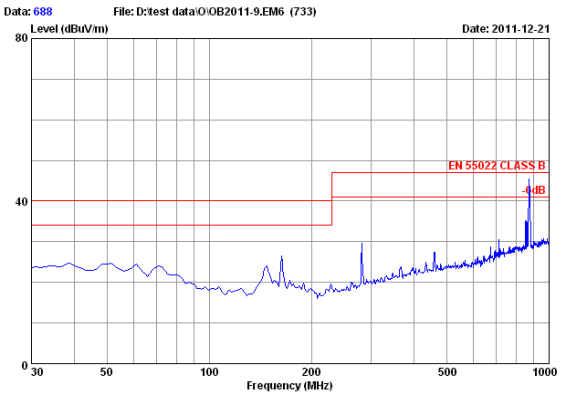
Site : Audix(Shanghai) Shielded1
Condition : FCC 15 CLASS B (QP) ENV4200-11.03.22 LINE



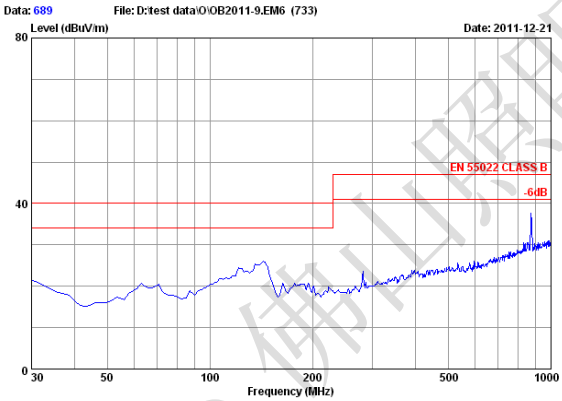
Site : Audix(Shanghai) Shielded1
Condition : FCC 15 CLASS B (AV) ENV4200-11.03.22 LINE

3.3.2. Radiation EMI Test

EN55015 CLASS B @ full load report

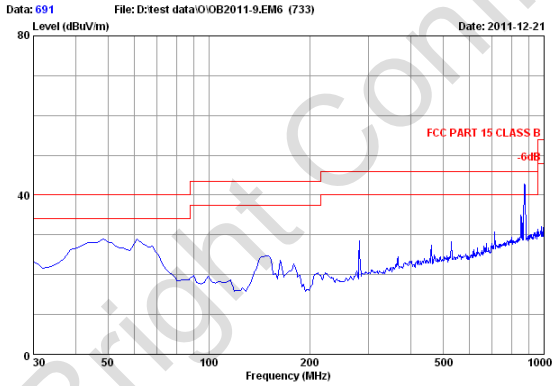



```
Site          : Audix(Shanghai) Chamber3
Condition     : EN 55022 CLASS B VERTICAL
Project No.   :
Applicant     :
EUT           :
M/N           : OB3330
S/N           : 48V 0.4A
Power Supply  : 230V/50Hz
Ambient       : 22'C  60%RH
Test Mode     :
Test Engineer: Raven
Memo          : 2#
```




```
Site          : Audix(Shanghai) Chamber3
Condition     : EN 55022 CLASS B HORIZONTAL
Project No.   :
Applicant     :
EUT           :
M/N           : OB3330
S/N           : 48V 0.4A
Power Supply  : 230V/50Hz
Ambient       : 22'C  60%RH
Test Mode     :
Test Engineer: Raven
Memo          : 2#
```

FCC Part 15 @ full load report

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Site          : Audix(Shanghai) Chamber3
Condition     : FCC PART 15 CLASS B VERTICAL
Project No.   :
Applicant     :
EUT           :
M/N           : OB3330
S/N           : 48V 0.4A
Power Supply  : 120V/60Hz
Ambient       : 22'C  60%RH
Test Mode     :
Test Engineer: Raven
Memo          : 2#
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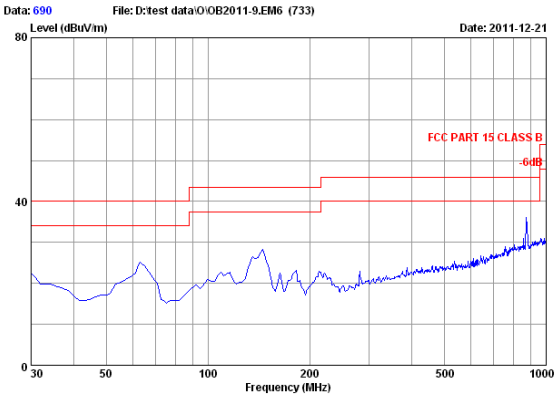


```
Site          : Audix(Shanghai) Chamber3
Condition     : FCC PART 15 CLASS B HORIZONTAL
Project No.   :
Applicant     :
EUT           :
M/N           : OB3330
S/N           : 48V 0.4A
Power Supply  : 120V/60Hz
Ambient       : 22'C  60%RH
Test Mode     :
Test Engineer: Raven
Memo          : 2#
```

3.4. Thermal Test

The thermal test is under 40℃ ambiance after 4hour full load running with 90Vac & 264Vac input.

Table. 7 Thermal test result

Position	Description	90Vac Input	264Vac Input	Spec.	Test result
Q1	TK6A60	75.6℃	76.8℃	△T< 40℃	Pass
T1	T1 core	63.4℃	61.5℃		
T1	T1 coil	73.1℃	72.8℃		
D7	UF3004	66.2℃	74.4℃		

3.5. OVP

Table.8 Output voltage under no-load condition

Input voltage	90V/60Hz	115V/60Hz	230V/50Hz	264V/50Hz	Spec.	Test result
Output voltage	55.0V	55.0V	55.0V	55.0V	< 63V	Pass

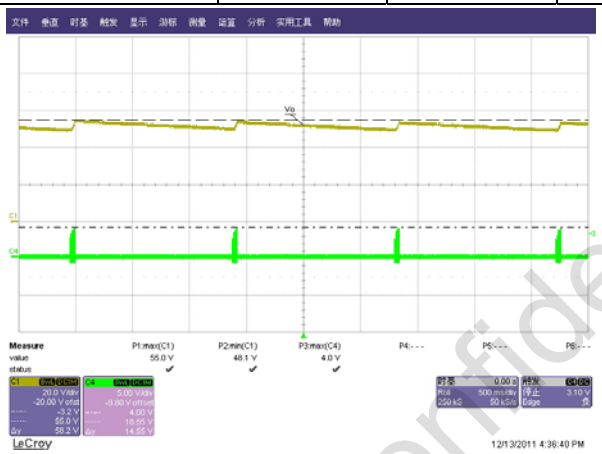

Fig. 9 Vout & Vzcd waveform @90Vac/60Hz, output no-load

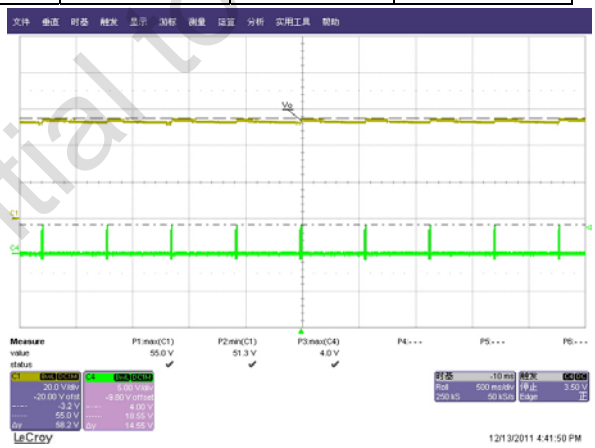

Fig. 10 Vout &Vzcd waveform @264Vac/50Hz, output no-load

3.6 Short Circuit Protection

Table. 9 Short protection & Input power

Input voltage	90V/60Hz	115V/60Hz	230V/50Hz	264V/50Hz	Spec.	Test result
Short protection	Shut down	Shut down	Shut down	Shut down	Shut down	Pass
Input Power (W)	0.32	0.53	1.36	1.60	< 2W	

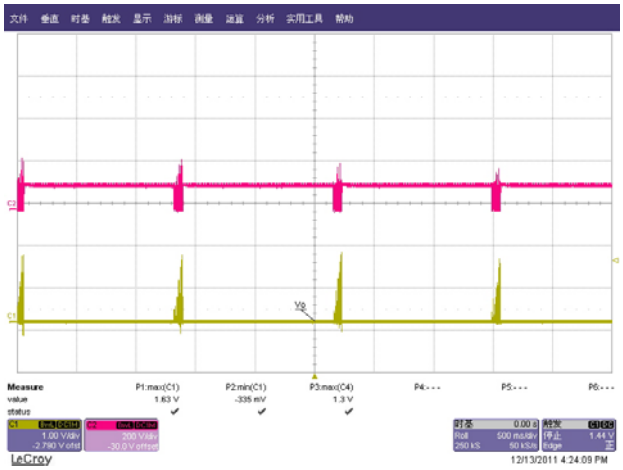

Fig. 11 Vds & Vcs waveform @90Vac/60Hz, output short

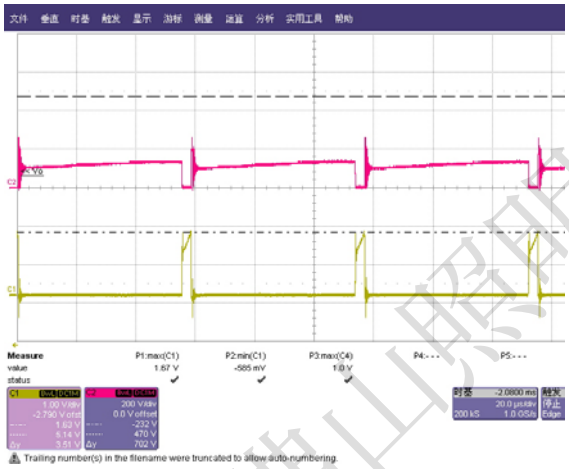

Fig. 12 Vds & Vcs waveform @90Vac/60Hz, spread

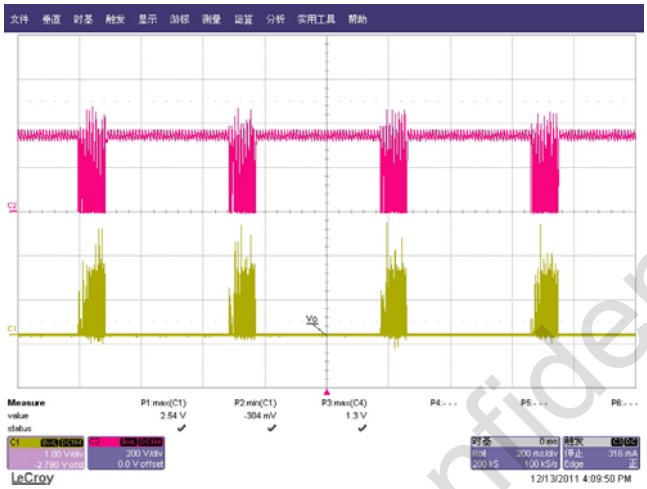

Fig. 13 Vds & Vcs waveform @264Vac/50Hz, output short

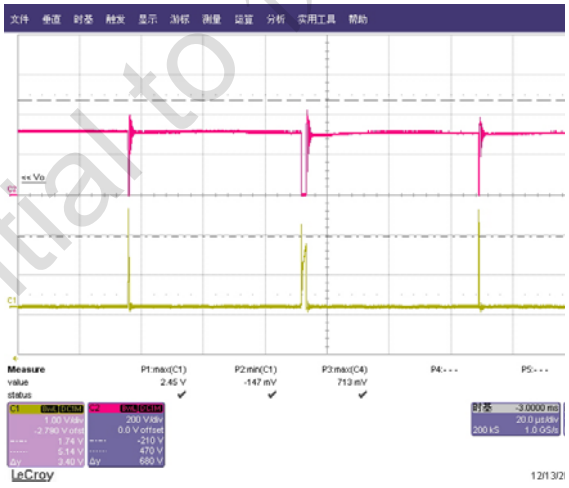

Fig. 14 Vds & Vcs waveform @264Vac/50Hz, spread

3.7 Other Important Waveform

3.7.1 MOSFET Vds & Rectifier Vak @output start / normal / short

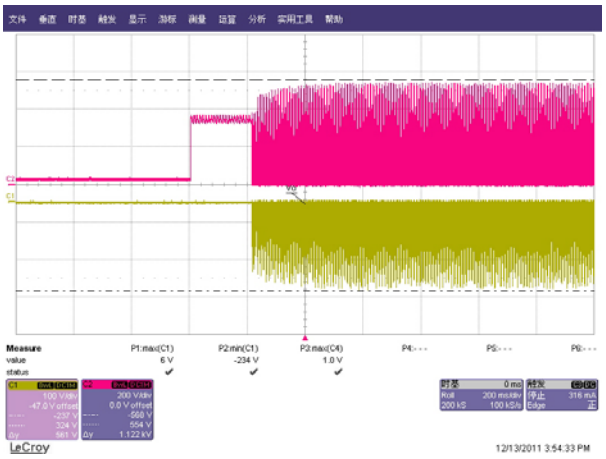

Fig. 15 Vds & Vak waveform @264 Vac/50Hz, output start

Fig. 16 Vds & Vak waveform @264 Vac/50Hz, output normal

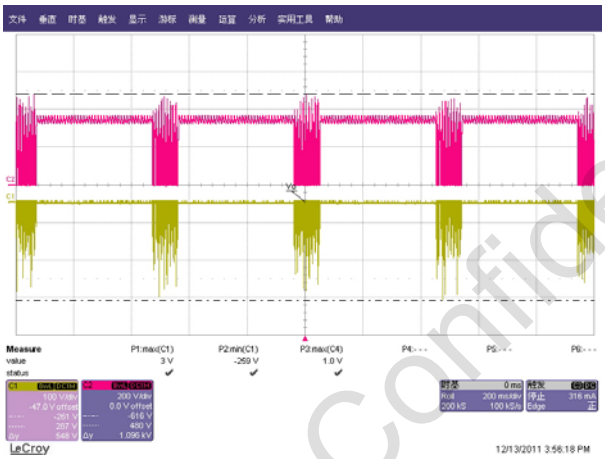

Fig.17 Vds & Vak waveform @264 Vac/50Hz, output short

Table.10 Vds_max, Vak_max @start/normal/output short

Input	Vds_max(V)	Vak_max(V)	Spec.	Test result
264V/50Hz @output start	554	237	**Vds_max < 600V** **Vak_max < 400V**	**Pass**
264V/50Hz @output normal	554	237		
264V/50Hz @output short	480	287		

3.7.2 MOSFET Voltage and Current waveform

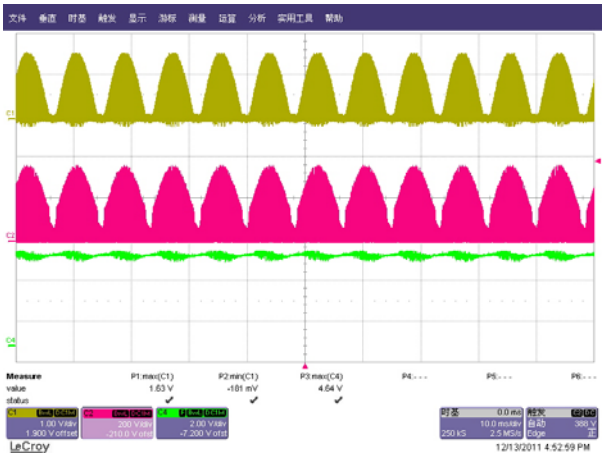

Fig. 18 Vcs&Vds&Vcomp waveform @90Vac/60Hz, full load

Fig.19 Vcs&Vds&Vcomp waveform @90Vac/60Hz, spread

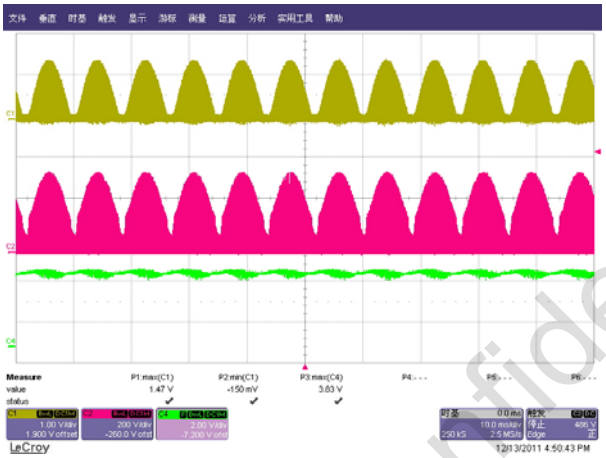

Fig.20 Vcs&Vds&Vcomp waveform @115Vac/60Hz, full load

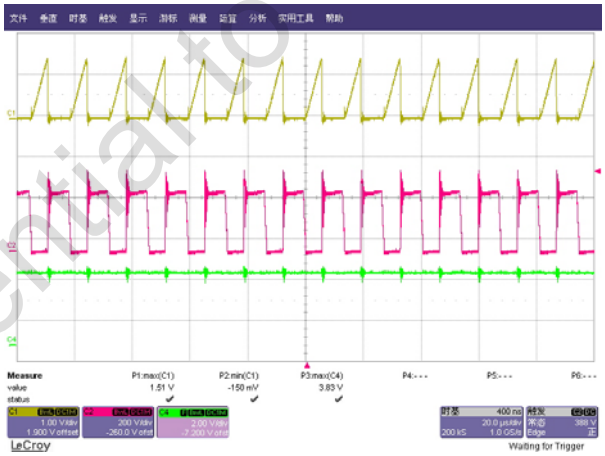

Fig.21 Vcs&Vds&Vcomp waveform @115Vac/60Hz, spread

Fig.22 Vcs&Vds&Vcomp waveform @230Vac/50Hz, full load

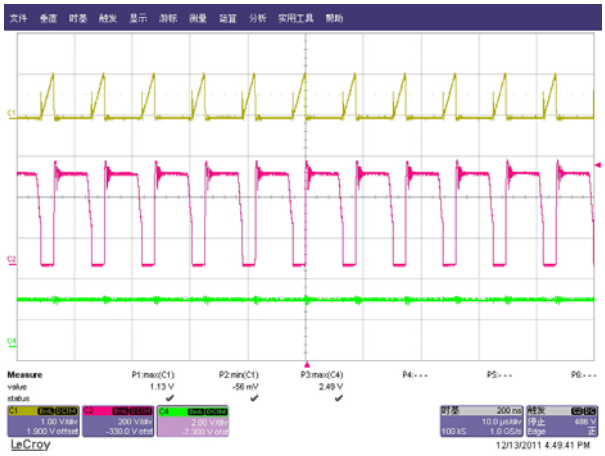

Fig.23 Vcs&Vds&Vcomp waveform @230Vac/50Hz, spread

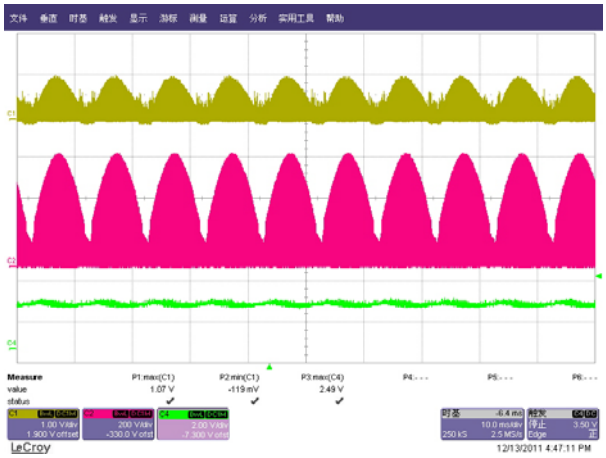

Fig.24 Vcs&Vds&Vcomp waveform @264Vac/50Hz, full load

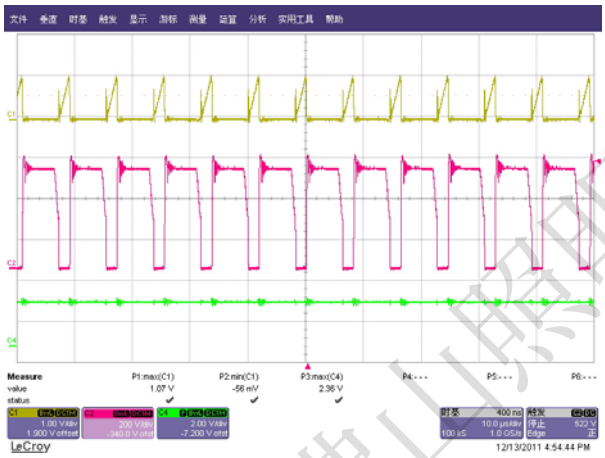

Fig.25 Vcs&Vds&Vcomp waveform @264Vac/50Hz, spread

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