Subject

OB2273 Demo Board Manual

Board Model: AD19V2.1A2273.00

Doc. No.: OB_DOC_DBM_227302

Key Features

- No load standby power under 100mW@264Vac
- Averaged efficiency more than 87%@115/230Vac at AWG20 Cable end
- Programmable OTP/OVP with latch Shutdown
- High performance OCP compensation
- Y cap only 100PF
- EMI passed EN55022 and FCC Part15 Class B test with more than 6Db margin
- Meet EPS2.0 level 5

Revision History

Revise Date	Version	Reason/Issue
2010-6-29	00	First issue
2010-9-10	01	BOM update C12
2011-4-01	02	Performance improve

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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
- Input current 1.0 Arms max.

1.2 Output Characteristics

- Output Voltage 19.0V
- Output Tolerance ±5%
- Min. load current 0A
- Max. load current 2.1A

1.3 Performance Specifications

- Max. Output Power 40W
- Standby Power <100mW @ 264V/50Hz, no load
- Efficiency >87%，Meet EPS2.0 level 5
- Line Regulation ±2%
- Load Regulation ±5%
- Ripple and Noise <200mVpk-pk
- Hold up Time 10m Sec. Min. @100Vac with full load
- Turn on Delay Time 3 Sec. Max. @90Vac with full load

1.4 Protection Features

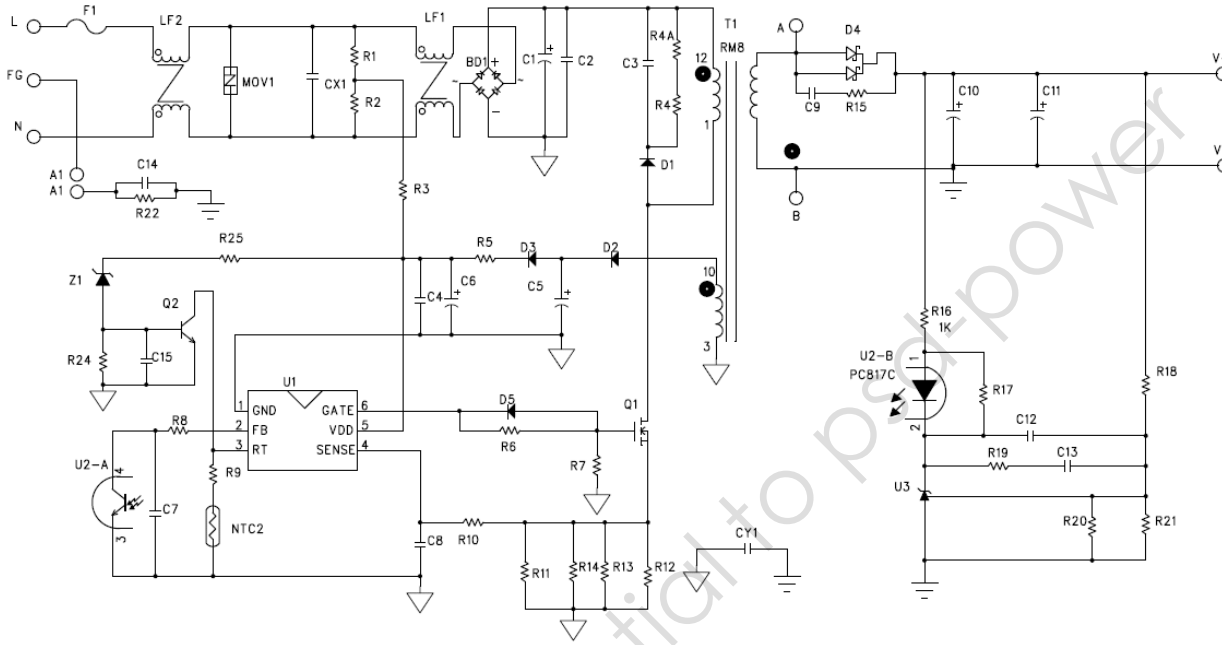
- Short Circuit Protection Output shut down with auto-recovery
- Over Voltage Protection Output shut down with latch
- Over Current Protection Output shut down with auto-recovery
- Over Temperature Protection Output shut down with latch

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



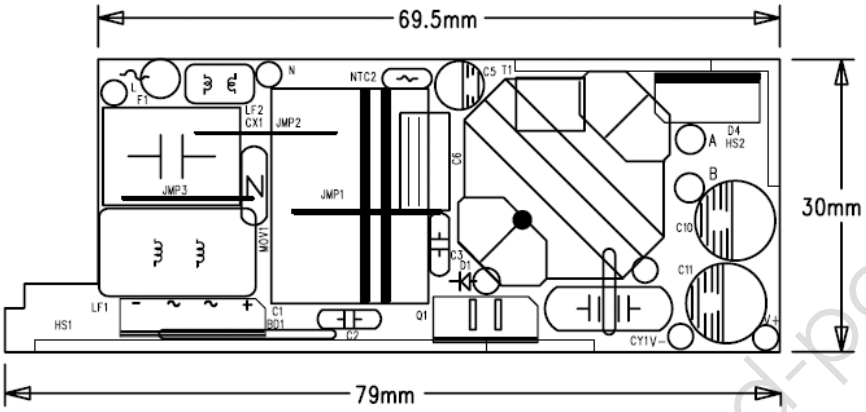
Notes: Input 3pin ,RC（C14/R22）for customer requirement !Input 2pin no use RC

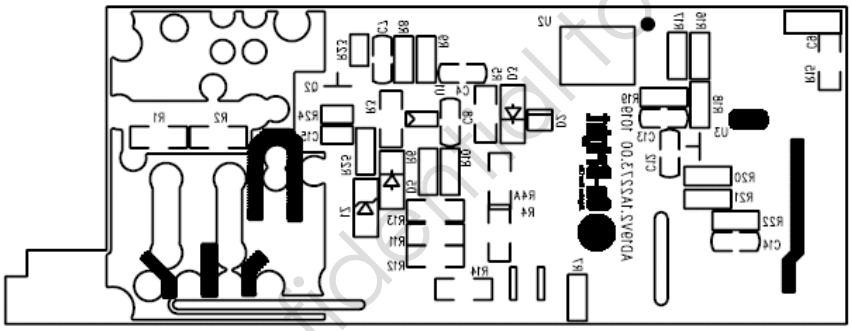
2.2 Bill of material

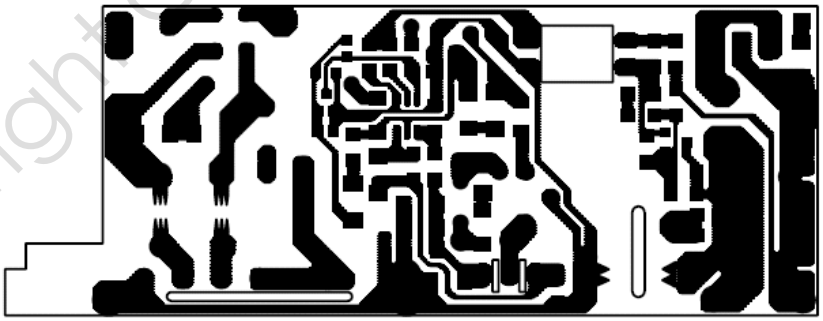
Position	Description	QTY
BD1	Diode, bridge recovery, KBP307, 3A/ 700V	1
C1	Capacitor, aluminum electrolytic, 68uF/400V, 105℃ ,Φ16*25mm	1
C2	Capacitor, metal poly, 10nF/1KV, 105℃,±20%	1
C3	Capacitor, metal poly, 4.7nF/1KV, 105℃,±20%	1
C4	Capacitor, ceramic,100nF/50V, SMD0805	1
C5	Capacitor, aluminum electrolytic, 22uF/50V, 105℃,±20%	1
C6	Capacitor, aluminum electrolytic, 4.7uF/50V, 105℃,±20%	1
C7	Capacitor, ceramic,1nF/50V, SMD0805	1
C8	Capacitor, ceramic,200pF/50V, SMD0805	1
C9	Capacitor, ceramic,1nF/100V, SMD1206	1
C10,C11	Capacitor, aluminum electrolytic, 470uF/25V, 105℃,Φ8*16mm	2
C12	Capacitor, ceramic,47pF/50V, SMD0805	1
C13	Capacitor, ceramic,22nF/50V, SMD0805	1
C15	Capacitor, ceramic,100pF/50V, SMD0603	1
CON1	AC SOCKET,2.5A/250Vac,2PIN	1
CX1	Capacitor, X2, 0.33uF/275VAC, 105℃,±20%	1
CY1	Capacitor,Y1,disk, 100pF /250VAC, 105℃,±20%	1
MOV1	MOV 10D471	1
D1,	Diode ,fast recovery, 1N5398, 1.5A/800V	1
D2	Diode ,fast recovery, RS1004FL ,1A/400V SMD	1
D3	Diode ,fast recovery, 1N4148, 0.15A/75V,SMD1206	1

D4	Diode, dual Schottky, MBR20H120CT, 2*10A/120V,TO-220	1
F1	Fuse, 2.5A250V, Φ4*10mm	1
LF1	Inductor, choke, dual winding,25mH , core14 *8*7.5mm, Φ0.35mm*55Ts*2	1
LF2	Filter;od:6.1/id:2.8/h:3.3Φ0.35*2/11T, L=150uH	1
NTC2	NTC thermistor, 150K / 20℃, Φ3mm	1
Q1	MOSFET,MOS power N-channel, TK6A60D, 6A/600V, TO-220	1
Q2	MMBT3904 ,NPN ,SMD SOT-3	1
R1,R2	Resistor, chip, 1.5M ,1/4W,±5%,SMD1206	2
R3	Resistor, chip, 200K ,1/4W,±5%,SMD1206	1
R4,R4A	Resistor, chip, 100K,1/4W,±5%,SMD1206	2
R5	Resistor, chip, 0R ,1/4W,±5%,SMD1206	1
R6,R8	Resistor, chip, 0R ,1/8W,±5%,SMD0805	2
R7	Resistor, chip, 10K,1/8W,±5%,SMD0805	1
R9	Resistor, chip, 4.7K,1/8W,±5%,SMD0805	1
R10	Resistor, chip, 430R,1/8W,±5%,SMD0805	1
R11,R12	Resistor, chip, 2R,1/4W,±1%,SMD1206	2
R13,R14	Resistor, chip, 2.2R,1/4W,±1%,SMD1206	2
R15	Resistor, chip, 10R,1/4W,±5%,SMD1206	1
R16	Resistor, chip, 620R,1/8W,±5%,SMD0805	1
R18	Resistor, chip, 180K,1/8W,±1%,SMD0805	1
R19	Resistor, chip, 3K,1/8W,±5%,SMD0805	1
R21	Resistor, chip, 27K,1/8W,±1%,SMD0805	1
R25	Resistor, chip, 1K,1/8W,±1%,SMD0805	1
T1	Transformer, 680uH 10KHz/1V,RM8	1
U1	IC,PWM controller, OB2273, SOT-6	1
U2	IC, photo coupler ,PC817B	1
U3	IC, TL431, SOT-3 ±1%	1
Z1	Zener 20V 1/2W ,SMD1206	1
PCB	OBPD40W,30*78.7mm	1
Jump	JUMP1,JUMP2	2
NC	D5,C14,R17,R20,R22,R24	0

2.3 PCB Gerber File

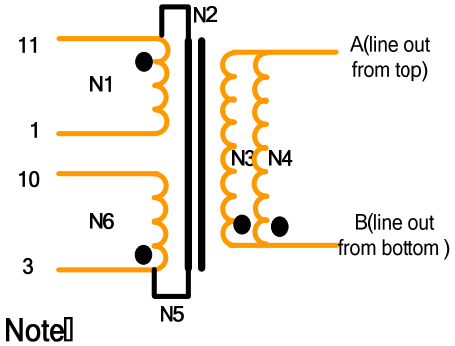






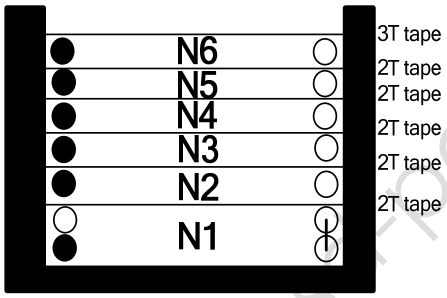
2.4 Transformer Design

2.4.1 Transformer Specification



Note：

1. Bobbin: RM8
2. Core material: TDK PC 40
3. L1-11=680u H +/- 7%. (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

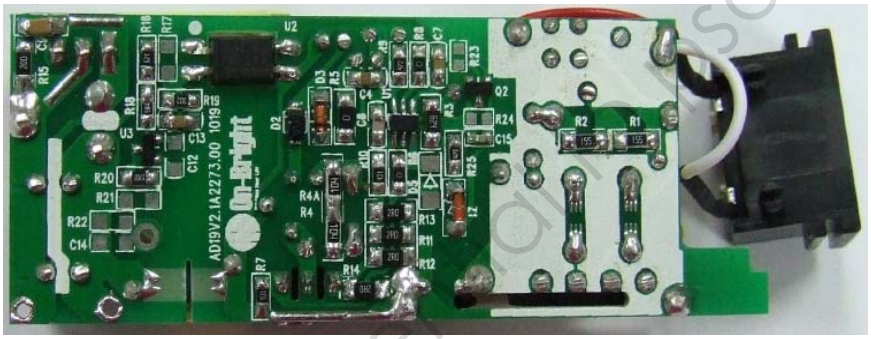


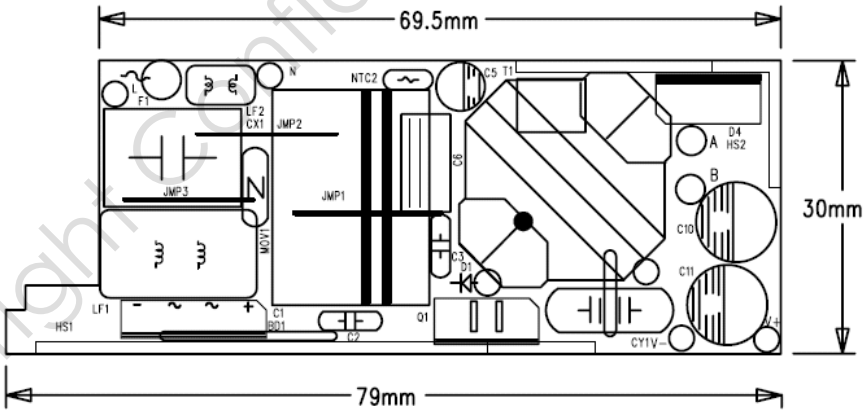
Bottom

2.4.2 Transformer Winding data

No.	Winging	Material	Start	Turns	Finish	Remark
1	N1	Φ0.27 2UEW	11	58	1	
2	TAPE	TAPE W=9mm (Y)		2		
3	N2	Φ0.20*4 2UEW	11	10	NC	
4	TAPE	TAPE W=9mm (Y)		2		
5	N3	Φ0.60 triple insulated wire	B	10	A	
6	TAPE	TAPE W=9mm (Y)		2		
7	N4	Φ0.60 triple insulated wire	B	10	A	
8	TAPE	TAPE W=9mm (Y)		2		
9	N5	Φ0.20*4 2UEW	3	10	NC	
10	TAPE	TAPE W=9mm (Y)		2		
11	N6	Φ0.20*4 2UEW	3	8	10	
12	TAPE	TAPE W=9mm (Y)		3		
Notes: Core connected to GND(PIN3)						

2.2 Adapter Module Snapshot





3 Performance Evaluation

This session presents the test results of AD19V2.1A2273 module up to data. 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 AWG20 1.8m Cable end.

Performance Highlights

- No load standby power under 100mW@264VAC
- Averaged efficiency more than 87%@115VAC&230VAC
- EMI passed EN55022 and FCC Part15 Class B test with more than 6dB margin.

Characterization Results Summary

Test Item	Test result
1. Input characteristics	
Input current (90V/60Hz, full load)	0.90A Max
Standby power at no load (264Vac)	87mW
Averaged Efficiency (115/230 Vac, 25%~100% load for Cable end)	87.26%/87.40%
2 .Output characteristics	
Line regulation	0.1%
Load regulation	1.32%
Ripple & noise	<200mV
Over shoot	5% Max
Dynamic test	±354mV
3. Time sequence (90Vac, Full load)	
Turn on delay time	2.37S
Hold up time	12.20mS(100Vac, full)
4. Protections	
Over Voltage protection	26.8V
Over Current protection (90Vac ~264Vac)	OK
Short Circuit protection	OK
Over Temperature protection	OK

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 Input current and Standby power

The module was tested at different input voltages (from 90Vac to 264Vac)

Table 1 Input current at full load

Input Voltage	90V/60Hz	115V/60Hz	230V/50Hz	264V/50Hz
Input Current(A)	0.8747	0.7287	0.4830	0.4397

Table 2 Standby power at no load

Input Voltage	90V/60Hz	115V/60Hz	230V/50Hz	264V/50Hz
Pin (mW)	41.5	44.5	71	87

3.1. 2 Efficiency

Table 3 Efficiency

Input voltage	25%	50%	75%	100%	Aver. Eff.	Spec.Level5
115Vac/60HZ	87.98	87.80	87.07	86.20	87.26	>87%
230Vac/50HZ	87.29	88.23	87.30	86.78	87.40	

3.2 Output Characteristics

3.2.1 Line Regulation & Load Regulation

Table 4 Line Regulation & Load Regulation

Input Voltage	Output Voltage (V)			Load Regulation (%)
	No Load	Half Load	Full Load	
90V/47Hz	19.100	18.974	18.848	1.32
115V/60Hz	19.100	18.974	18.852	1.30
230V/50Hz	19.100	18.974	18.850	1.31
264V/63Hz	19.098	18.974	18.850	1.30
Line Regulation (%)	0.01	0.00	0.02	

3.2.2 Ripple & Noise

Table 5 Ripple & Noise measure results

Input Voltage	R&N (mV)		Waveform
	No Load	Full Load	
90Vac/60HZ	26	109	Fig.1, Fig.2
132Vac/60HZ	28	110	
180Vac/50HZ	39	108	
264Vac/50HZ	40	109	Fig.3,Fig.4

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.

R&N Waveform

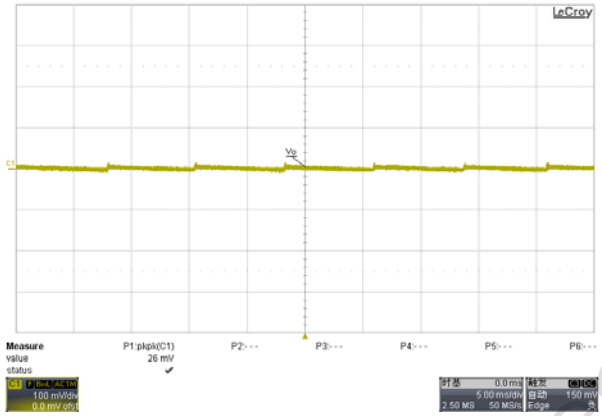


Fig. 1 R&N waveform@90Vac; no load

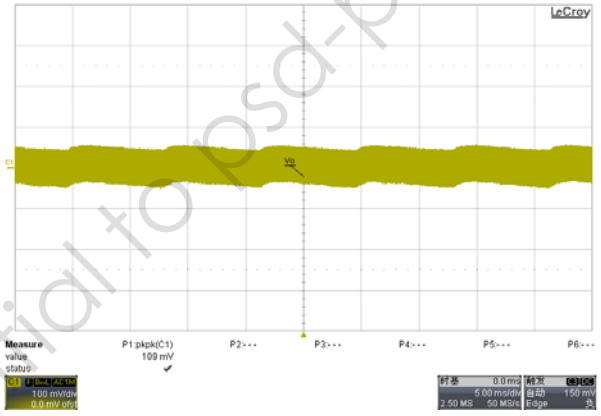


Fig. 2 R&N waveform@90Vac; full load

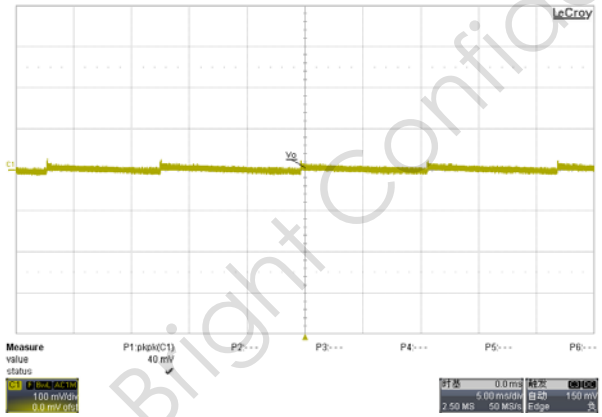


Fig. 3 R&N waveform@264Vac; no load

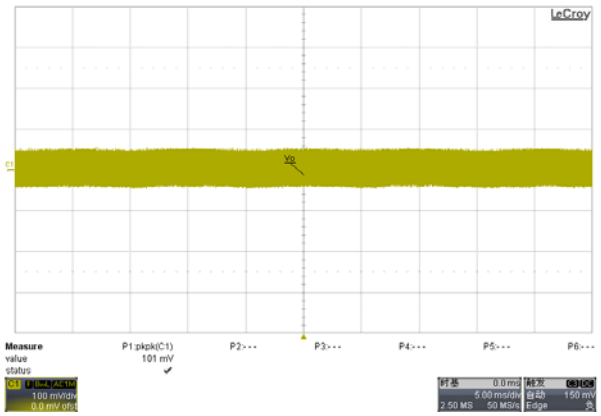


Fig. 4 R&N waveform@264Vac; full load

3.2.3 Overshoot & Undershoot

Ac input switches ON for overshoot and OFF for undershoot

Table 6 Overshoot/undershoot measurement results

Input Voltage	Load	Item	Measure Data (%)	Waveform
90V/60Hz	Full load	overshoot	2.6	Fig.5
		undershoot	3.3	Fig.9
	No load	overshoot	2.5	Fig.6
		undershoot		
264V/50Hz	Full load	overshoot	1.5	Fig.7
		undershoot	3.2	Fig.10
	No load	overshoot	1.9	Fig.8
		undershoot		

Overshoot and undershoot waveform

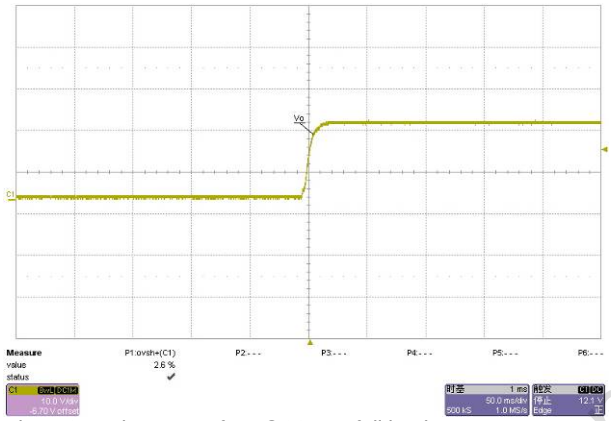


Fig. 5 Overshoot waveform@90Vac; full load

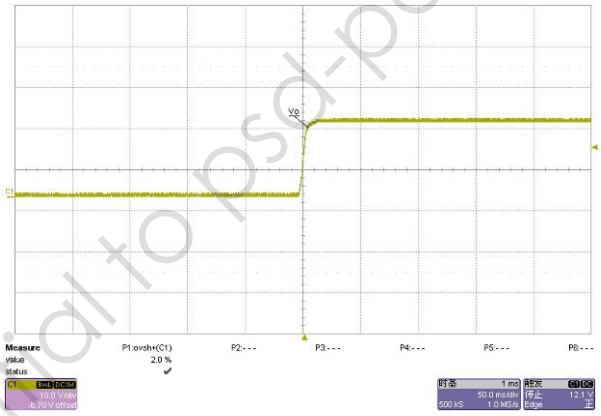


Fig. 6 Overshoot waveform @90Vac; no load

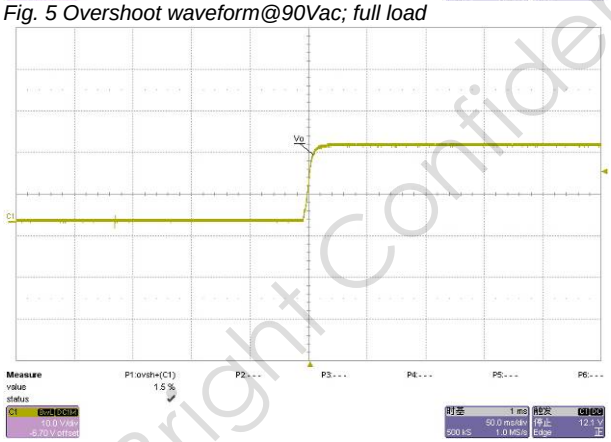


Fig. 7 Overshoot waveform @264Vac; full load

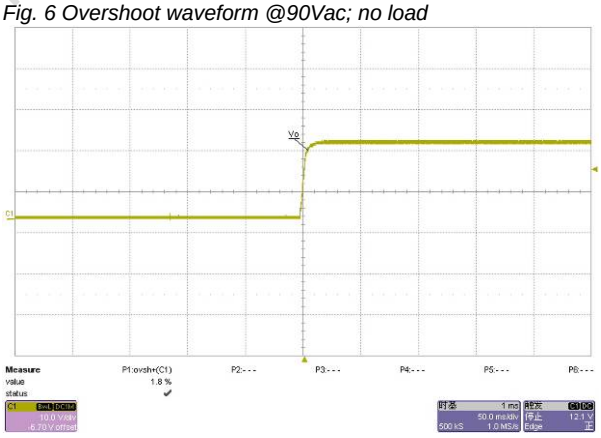


Fig. 8 Overshoot waveform @264Vac; no load

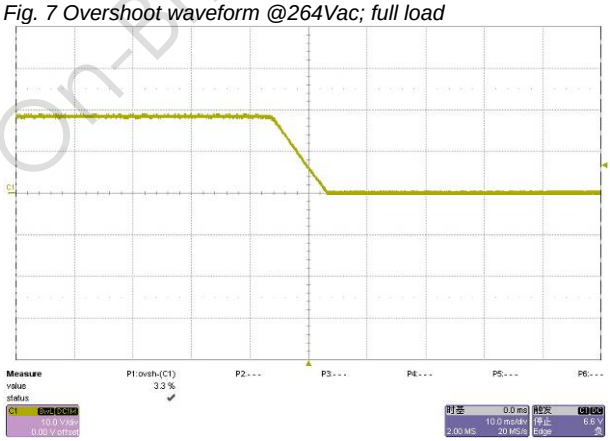


Fig. 9 Undershoot waveform@90Vac; full load

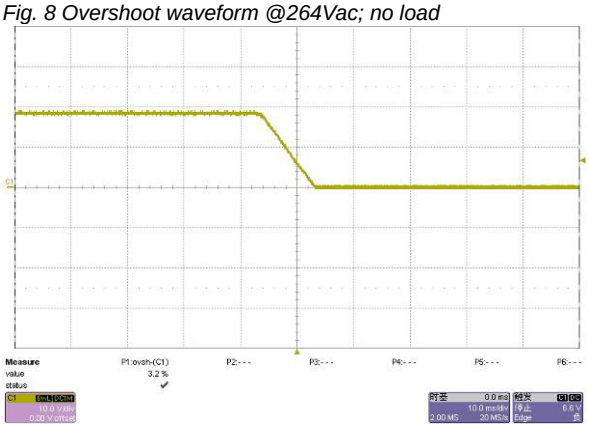


Fig. 10 Undershoot waveform @264Vac; full load

3.2.4 Dynamic Test

A dynamic loading with low set at 0 A lasting for 50mS and high set at 2.10A lasting for 50mS is added to output. The ramp is set at 0.25A/uS at transient.
All data was measurement at CABLE end.

Table 7 Output voltage under dynamic test

Input voltage	Output voltage (mV)	Waveform
90V/60HZ	±354	Fig.11
264V/50HZ	±326	Fig.12

Dynamic waveform

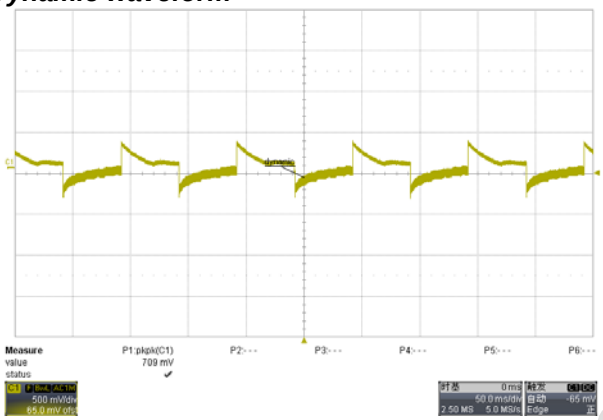


Fig. 11 Dynamic waveform@90Vac input

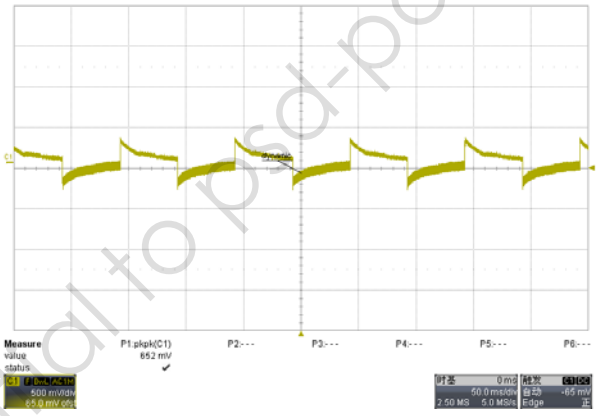


Fig. 12 Dynamic waveform@264Vac input

3.2.5 Time Sequence

Load condition: Full load

Table 8 Turn-on delay /hold-up/Rise time measurement results

Item	Input voltage	Meas. Data (S)	Remark
Turn-on delay time	90V/60Hz	2.37	Fig.13
Turn-on delay time	100V/60Hz	2.02	Fig.14
Hold-up time	100V/60Hz	12.20mS	Fig.15
Hold-up time	240V/60Hz	77.94mS	Fig.16

Time sequence waveform

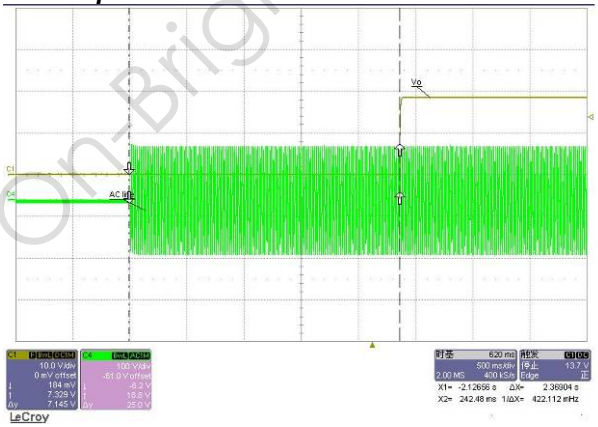


Fig. 13 Turn on delay waveform @90Vac; full load

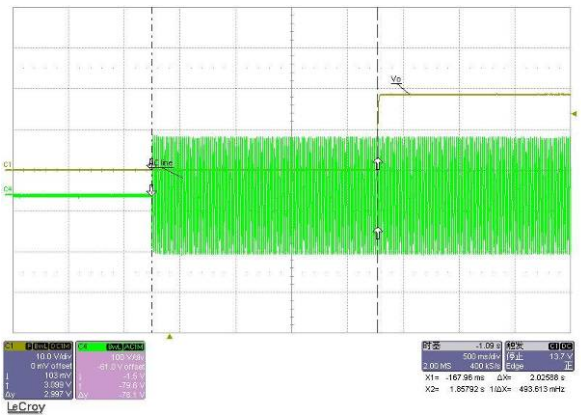


Fig. 14 Turn on delay waveform @100Vac; full load

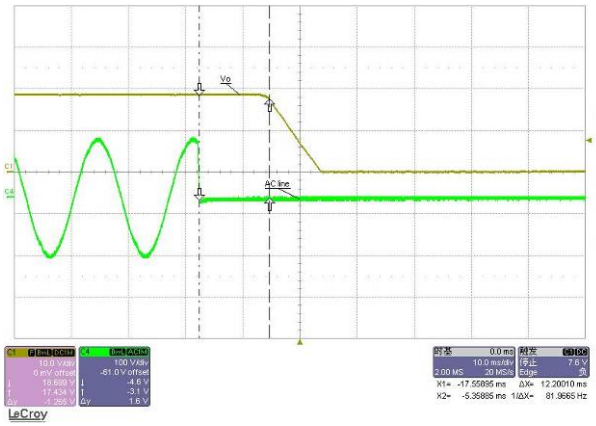


Fig. 15 Hold up time waveform @100Vac; full load

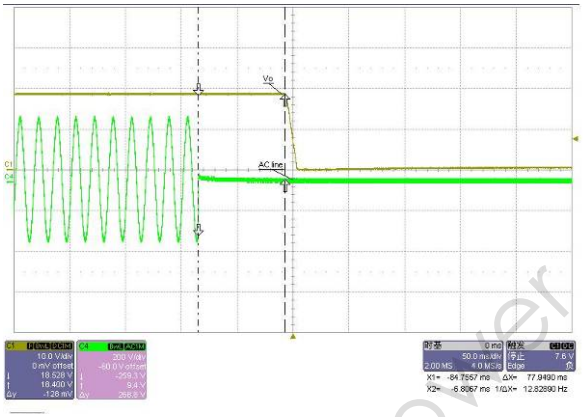


Fig. 16 Hold up time waveform @240Vac; full load

3.3 Protections

3.3.1 Over Current Protection (OCP)

The power supply will shut down auto-recovery when output current exceeds 2.50～3.15A, and it should recover when the over current condition is removed.

Table 9 OCP value vs. input voltage

Input Voltage	90V/60Hz	115V/60Hz	230V/50Hz	264V/50Hz
OCP (A)	2.67A	2.72A	2.78A	2.78A
Recovery(A)	2.66A	2.71A	2.77A	2.77A

3.3.2 Over Voltage Protection (OVP)

The power supply will shut down and latch when feedback circuit is disabled, and the output voltage can not be over 29V. The unit should recover when the protection condition is removed and restart input.

Table 10 Load OVP test result

Input Voltage	OVP Trigger Voltage (V)
	No Load
90V/60Hz	26.8
264V/50Hz	26.8

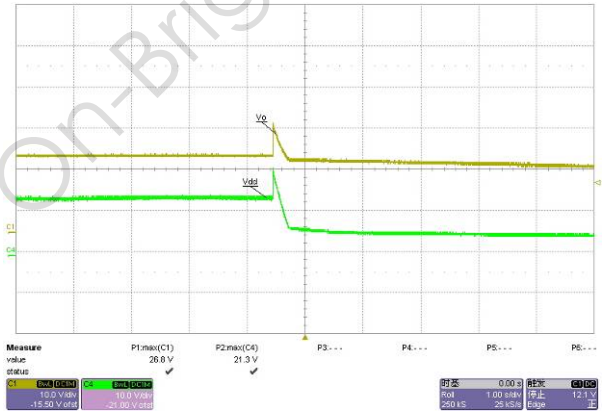


Fig. 17 OVP waveform @90Vac; no load

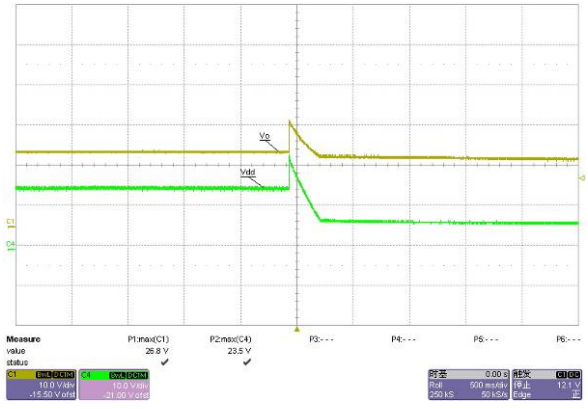


Fig. 18 OVP waveform @264Vac;no load

3.3.3 Over Load Protection (OLP)

The power supply will shut down auto-recovery when output current exceeds OCP and it should recover when the over current condition is removed.

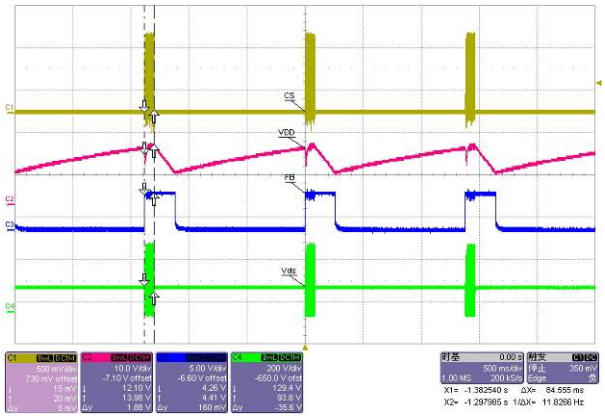


Fig. 19 OLP waveform @90Vac; over load

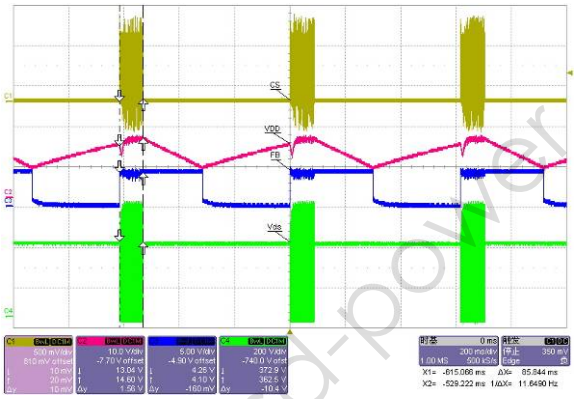


Fig. 20 OLP waveform @264Vac;over load

3.3.4 Over Temperature Protection (OTP)

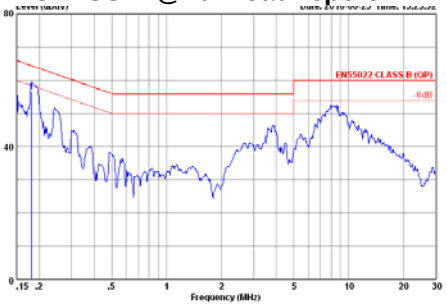
The power supply will shut down and latch when RT pin exceeds 1.0V(OTP),The unit should recover when the protection condition is removed and restart input.

3.4 EMI Test

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

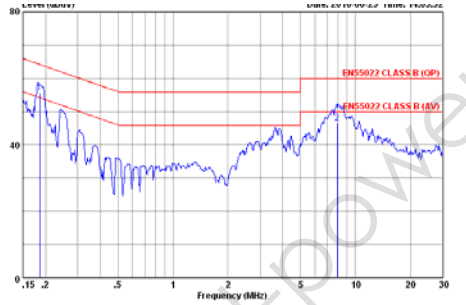
3.4.1 Conduction EMI Test

EN55022 CLASS B @ full load report




```
Site                : Audix(Shanghai) Shielded1
Condition           : EN55022 CLASS B (QP) NNLK8129-09.08.11 L1
Project No.         :
Applicant           :
EUT                 :
M/N                 : OB2273
S/N                 : 19V/2.1A
Power Supply        : 230V/50Hz
Ambient             : 22'C 48%RH
Test line           : L1
Test Mode           :
Test Engineer       : Ted
Memo                : 1# N
```

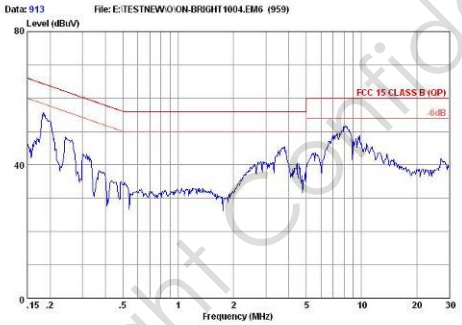
	Freq	Level	Read Level	Cable Loss	LISN Factor	Factor	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dB	dB	dBuV	dB	
1	0.182	56.53	56.30	0.07	0.16	0.23	64.42	-7.89	QP



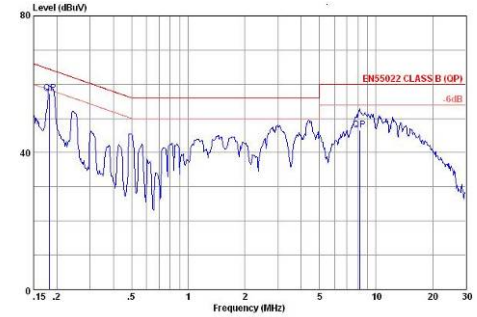

```
Site                : Audix(Shanghai) Shielded1
Condition           : EN55022 CLASS B (QP) NNLK8129-09.08.11 L2
Project No.         :
Applicant           :
EUT                 :
M/N                 : OB2273
S/N                 : 40W19V2.1A
Power Supply        : 230V/50Hz
Ambient             : 22'C 48%RH
Test line           : L2
Test Mode           :
Test Engineer       : Ted
Memo                : 1#
```

	Freq	Level	Read Level	Cable Loss	LISN Factor	Factor	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dB	dB	dBuV	dB	
1	0.185	55.78	55.56	0.07	0.15	0.22	64.25	-8.47	QP
2	7.935	46.60	46.00	0.38	0.22	0.60	60.00	-13.40	QP

FCC CLASS B @ full load report




```
Site                : Audix(Shanghai) Shielded1
Condition           : FCC 15 CLASS B (QP) NNLK8129-09.08.11 L1
Project No.         :
Applicant           :
EUT                 :
M/N                 : OB2273
S/N                 : 40W19V2.1A
Power Supply        : 120V/60Hz
Ambient             : 22'C 48%RH
Test line           : L1
Test Mode           :
Test Engineer       : Ted
Memo                :
```

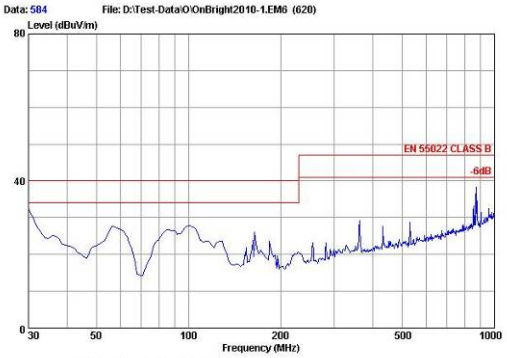



```
Site                : Audix(Shanghai) Shielded1
Condition           : EN55022 CLASS B (QP) ESH2-Z5-09.04.02(2) NEUTRAL
Project No.         :
Applicant           :
EUT                 :
M/N                 : OB2273
S/N                 : 19V2.1A
Power Supply        : 230V/50Hz
Ambient             : 22'C 48%RH
Test line           : N
Test Mode           :
Test Engineer       : Ted
Memo                : 2PIN
```

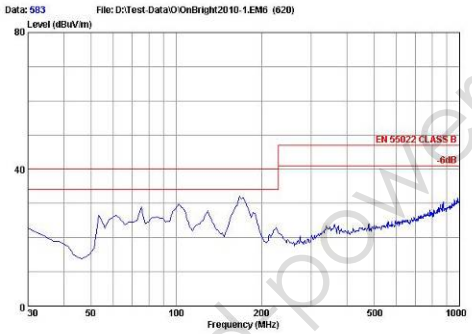
	Freq	Level	Read Level	Cable Loss	LISN Factor	Factor	Limit Line	Over Limit	Remark
	MHz	dBuV	dBuV	dB	dB	dB	dBuV	dB	
1	0.183	57.20	56.95	0.07	0.18	0.25	64.36	-7.16	QP
2	8.148	46.50	45.78	0.38	0.34	0.72	60.00	-13.50	QP

3.4.2 Radiation EMI Test

EN55022 CLASS B @ full load report

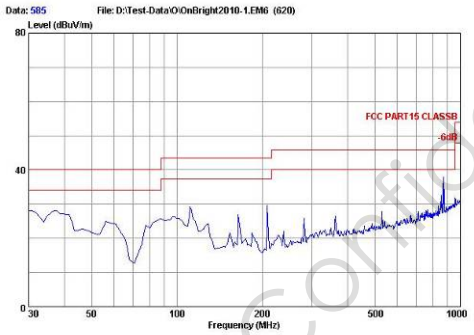


Site : Audix(Shanghai) Chamber3
Condition : EN 55022 CLASS B VERTICAL
Project No. :
Applicant :
EUT :
M/N : OB2273
S/N : 40W 19V 2.1A
Power Supply : 230V/50Hz
Ambient : 25C, 60%
Test Mode : FULL LOAD
Test Engineer: Wency

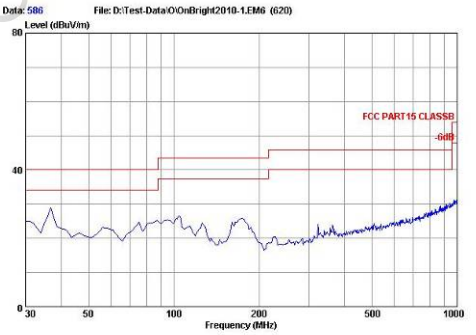


Site : Audix(Shanghai) Chamber3
Condition : EN 55022 CLASS B HORIZONTAL
Project No. :
Applicant :
EUT :
M/N : OB2273
S/N : 40W 19V 2.1A
Power Supply : 230V/50Hz
Ambient : 25C, 60%
Test Mode : FULL LOAD
Test Engineer: Wency
Memo : 2#

FCC CLASS B @ full load report



Site : Audix(Shanghai) Chamber3
Condition : FCC PART15 CLASSB VERTICAL
Project No. :
Applicant :
EUT :
M/N : OB2273
S/N : 40W 19V 2.1A
Power Supply : 120V/60Hz
Ambient : 25C, 60%
Test Mode : FULL LOAD
Test Engineer: Wency
Memo : 2#



Site : Audix(Shanghai) Chamber3
Condition : FCC PART15 CLASSB HORIZONTAL
Project No. :
Applicant :
EUT :
M/N : OB2273
S/N : 40W 19V 2.1A
Power Supply : 120V/60Hz
Ambient : 25C, 60%
Test Mode : FULL LOAD
Test Engineer: Wency
Memo : 2#

4 Other important waveform

4.1 CS, FB, Vdd & Vds waveform at no load/full load.

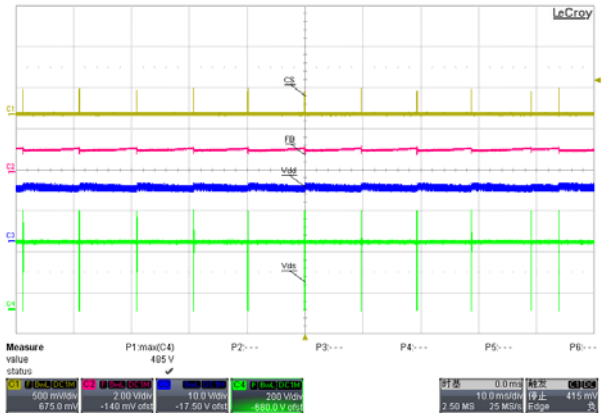


Fig. 21 CS,FB,Vdd&Vdswave form@90Vac; no load

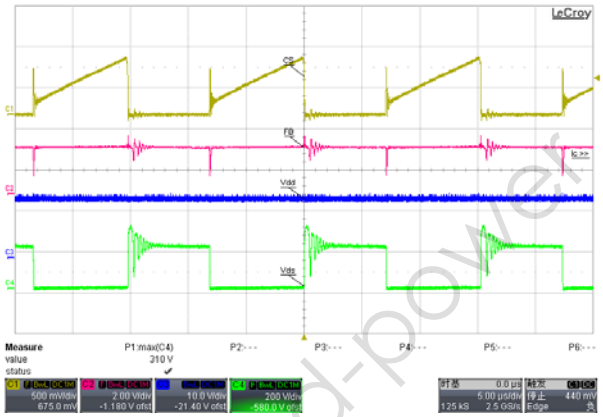


Fig. 22 CS,FB,Vdd&Vdswave form@90Vac; full load

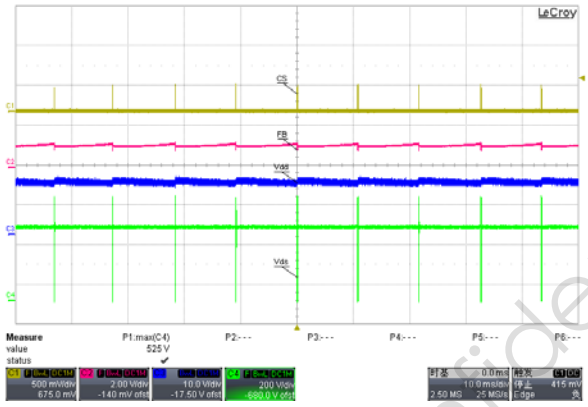


Fig. 23 CS,FB,Vdd&Vdswave form@264Vac; no load

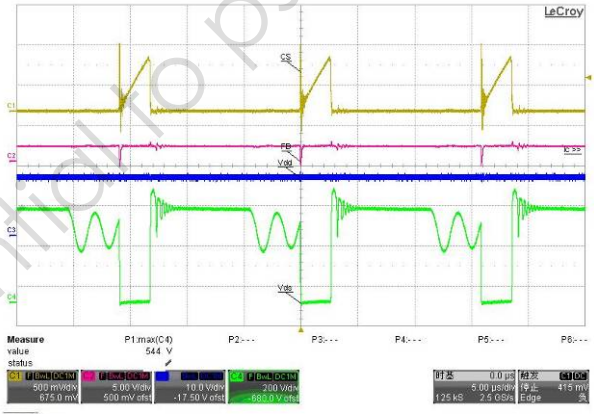


Fig. 24 CS,FB,Vdd&Vdswave form@264Vac; full load

4.2 Vds waveform at full load, start/normal/output short

4.2.1 VDS at full load, start/normal/output short

MOSFET measurement results

Item	Input voltage	Meas. Data	Remark
Start Full load	264V/50HZ	555V	Fig. 25
Normal full load	264V/50HZ	549V	Fig. 27
Short work	264V/50HZ	493V	Fig. 29

Diode measurement results

Item	Input voltage	Meas. Data	Remark
Start Full load	264V/50HZ	101V	Fig. 26
Normal full load	264V/50HZ	94V	Fig. 28
Short work	264V/50HZ	93V	Fig. 30

4.2.2 Vds at full load, start waveform

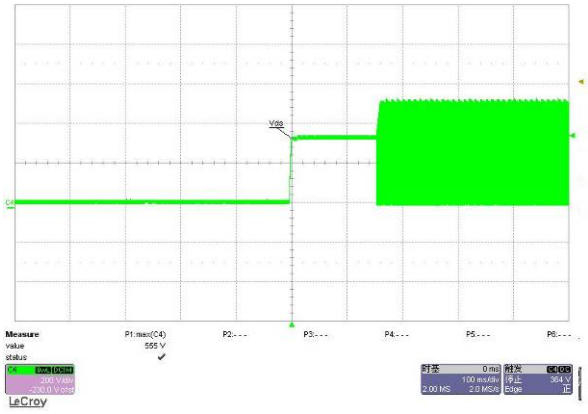


Fig. 25 Vds start up wave form@264Vac; full load

Fig. 26 Vdiode start up wave form@264Vac; full load

4.2.3 Vds at full load, normal waveform

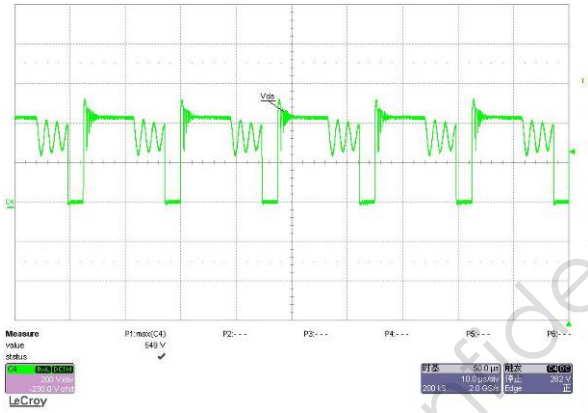


Fig. 27 Vds normal wave form@264Vac; full load

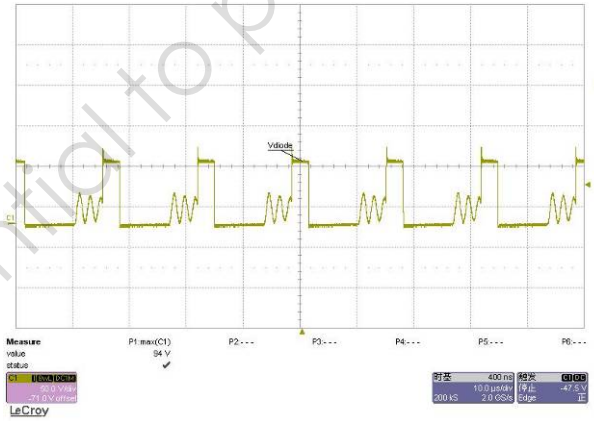


Fig. 28 Vdiode normal wave form@264Vac; full load

4.2.4 Vds at full load, output short waveform

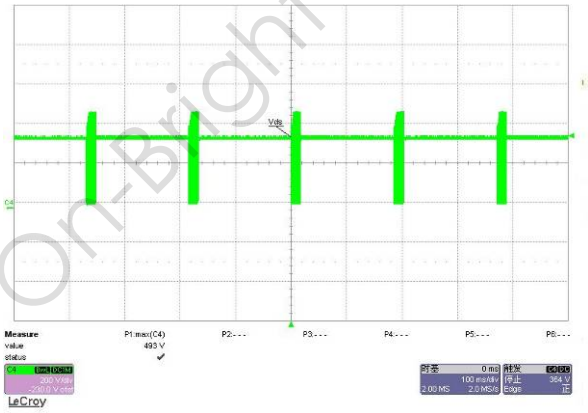


Fig. 29 Vds output short wave form@264Vac; full load

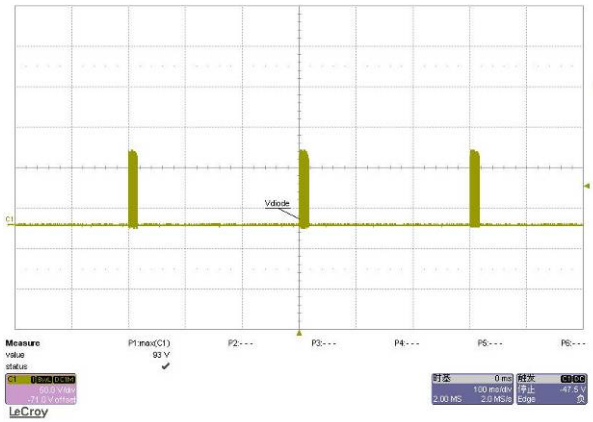


Fig. 30 Vdiode output short wave form@264Vac; full load

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