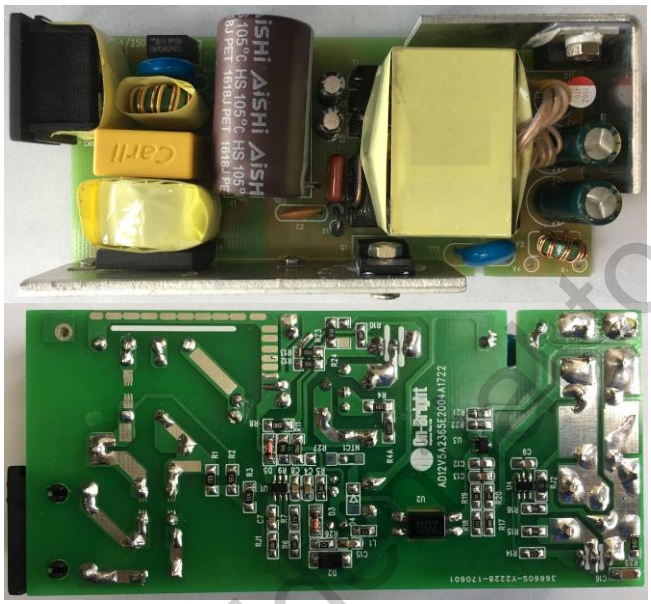
Subject

OB2365E+2004A Demo Board Manual

Board Model: AD12V5A 2365E+2004A
Doc. No.: OB_DOC_DBM_2365E+2004A01



Key Features

- Standby Power ＜ 60mW(230Vac input, no load）
- Averaged efficiency more than 89.0% @115/230Vac at AWG16 1.5M cable end
- High performance OCP compensation
- Frequency shuffling technology for improved EMI performance
- EMI passed EN55022 and FCC Part15 Class B test with more than 6dB margin
- Average efficiency meet COC V5 tier2, 1.5% margin
- Offers comprehensive protection coverage with auto-recovery including OCP, OLP, UVLO, OVP, and Brownout protection.

Revision History

Revise Date	Version	Reason/Issue
2017-4-6	00	First issue
2017-7-27	01	Updated BOM & PCB

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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 1.8 Arms max.

1.2 Output Characteristics

- Output Voltage 12V
- Output Tolerance ±5%
- Min. load current 0A
- Max. load current 5A

1.3 Performance Specifications

- Max. Output Power 60W
- Standby Power <60mW @ 230V/50Hz, no load
- Efficiency >89.0%，Meet COC Ⅴ5 tier2
- Line Regulation ±2%
- Load Regulation ±5%
- Ripple and Noise <120mVpk-pk
- 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

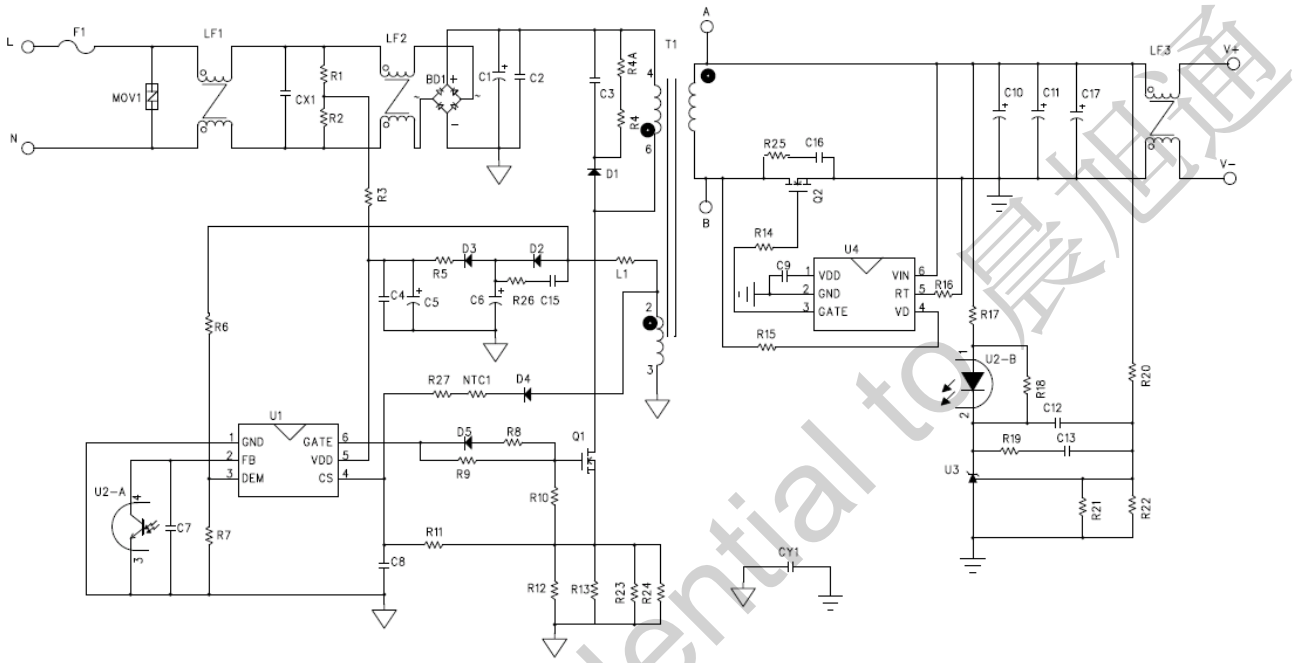
- Short Circuit Protection Output shut down with auto-recovery
- Over Voltage Protection Output shut down with auto-recovery
- Over Current Protection Output shut down with auto-recovery
- Secondary Rectifier Short Protection Output shut down with auto-recovery

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

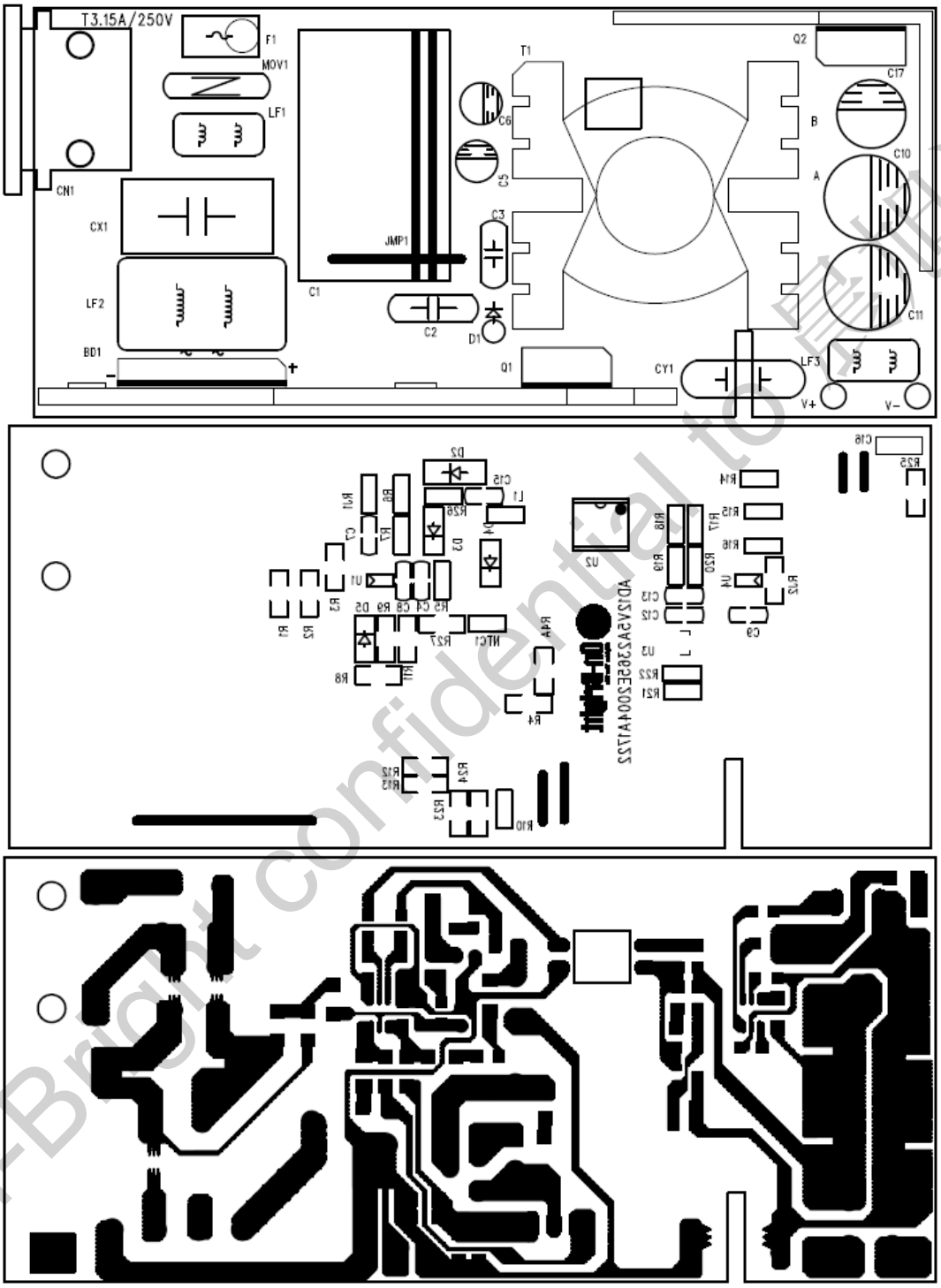


2.2 Bill of material

Position	Description	QTY
BD1	Diode, bridge recovery, GBL406, 4A/ 600V	1
C1	Capacitor, aluminum electrolytic, AiSHi 120uF/400V, 16mm*25mm ,105℃,±20%	1
C2	Capacitor, ceramic,10nF /1KV, -40/105℃,±20%	1
C3	Capacitor, metal poly, CBB,3.3nF/630V, 105℃,±20%	1
C4	Capacitor, ceramic,100nF/50V, X7R, ±10%,SMD0805	1
C5	Capacitor, aluminum electrolytic, 3.3uF/50V, 105℃,±20%	1
C6	Capacitor, aluminum electrolytic, 22uF/50V, 105℃,±20%	1
C7	Capacitor, ceramic,1nF/50V, X7R, ±10%,SMD0805	1
C8	Capacitor, ceramic,150pF/50V, X7R, ±10%,SMD0805	1
C9	Capacitor, ceramic,1uF/50V, X7R,±10%,SMD0805	1
C10,C11	Capacitor, aluminum electrolytic, 1000uF/16V, 105℃,±20%	2
C12	Capacitor, ceramic,47pF/50V, X7R, ±10%,SMD0805	1
C13	Capacitor, ceramic,22nF/50V, X7R, ±10%,SMD0805	1
C15	Capacitor, ceramic,470pF/50V, X7R, ±10%,SMD0805	1
C16	Capacitor, ceramic,2.7nF/1kV, X7R, ±10%,SMD1206	1
C17	EC, 470uF 16V Low ESR, Φ6.3*11mm	1
CON1	AC SOCKET,2.5A/250Vac,2PIN	1
CX1	Capacitor, X2, 0.47uF/275VAC, 105℃,±20%	1
CY1	Capacitor, Y1,disk, 2.2nF /250VAC, 105℃,±20%	1
D1	Diode , 1N4007, 1A/1kV	1
Bead core	For cathode of D1, Φ3.5*1.5*4mm	1

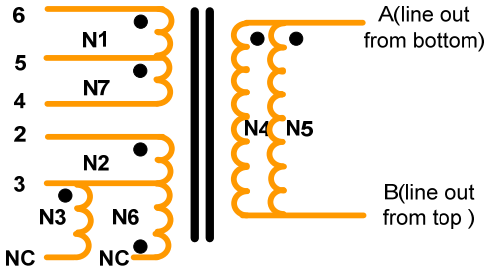
D2	Diode , RS1J, 1A/600V SMD	1
D3,D5	Diode , 1N4148 0.5A/75V SMD	2
F1	Oblong(长方形) Fuse, 3.15A250V	1
LF1	Inductor, choke, dual winding,420uH min, core12*6*4mm, Φ0.5mm*2P*10Ts	1
LF2	Inductor, choke,dualwinding,30Mh min, TDG core18*10*8mm , Φ0.5mm*50Ts*2	1
LF3	Inductor, choke, dual winding,15uH min, core8*4*3mm, Φ0.5mm*2P*7Ts	1
MOV1	MOV 471KD10	1
Q1	MOSFET,MOS power N-channel, SK2843, 10A/600V, TO-220	1
Q2	MOSFET,MOS power N-channel, FDP036N10A, 100V/3.6mΩ, TO-220	1
RJ1,	Resistor, chip, 20R,1/8W,±5%,SMD0805	1
RJ2	Resistor, chip, 0R ,1/4W,±5%,SMD1206	1
R1,R2	Resistor, chip, 1.5M ,1/4W,±5%,SMD1206	2
R3	Resistor, chip, 510K ,1/4W,±5%,SMD1206	1
R4	Resistor, chip, 100K,1/4W,±5%,SMD1206	1
R4A	Resistor, chip, 68K,1/4W,±5%,SMD1206	1
R5	Resistor, chip, 2R ,1/8W,±5%,SMD0805	1
R6	Resistor, chip, 100K ,1/8W,±5%,SMD0805	1
R7	Resistor, chip, 27K,1/8W,±5%,SMD0805	1
R8	Resistor, chip, 20R,1/4W,±1%,SMD1206	1
R9	Resistor, chip, 100R,1/4W,±1%,SMD1206	1
R10	Resistor, chip, 20K ,1/8W,±5%,SMD0805	1
R11	Resistor, chip, 390R ,1/4W,±1%,SMD1206	1
R12,R13	Resistor, chip, 1R ,1/4W,±1%,SMD1206	2
R14,R26,L1	Resistor, chip, 0R ,1/8W,±5%,SMD0805	3
R15	Resistor, chip, 56R ,1/8W,±5%,SMD0805	1
R16	Resistor, chip, 33K ,1/8W,±5%,SMD0805	1
R17	Resistor, chip, 680R ,1/8W,±5%,SMD0805	1
R18	Resistor, chip, 15K ,1/8W,±5%,SMD0805	1
R19	Resistor, chip, 3K ,1/8W,±5%,SMD0805	1
R20	Resistor, chip, 180K,1/8W,±5%,SMD0805	1
R21	Resistor, chip, 51K,1/8W,±1%,SMD0805	1
R22	Resistor, chip, 560K ,1/8W,±1%,SMD0805	1
R23	Resistor, chip, 0.91R ,1/4W,±1%,SMD1206	1
R25	Resistor, chip, 20R,1/4W,±1%,SMD1206	1
T1	Transformer, Lp=660uH ,10KHz/1V, PQ3220, PC40	1
U1	IC,PWM controller, OB2365E, SOT-6	1
U2	IC, photo coupler ,PC817B	1
U3	IC, AS431, SOT-23	1
U4	IC, synchronous rectification controller, OB2004A, SOT-6	1
PCB	AD12V5A 2365E2004A 1722	1
Jump	JUMP1 (Tube)	1
R24,R27,D4,NTC1	N.C.	4

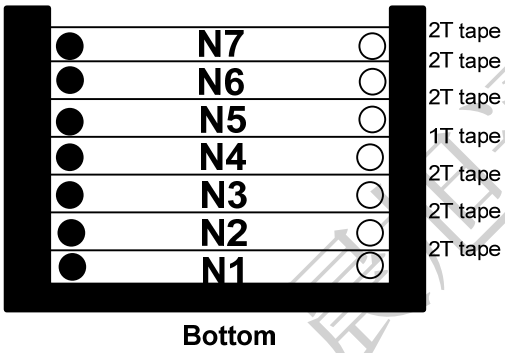
2.3 PCB Gerber File



2.4 Transformer Design

2.4.1 Transformer Specification





Note:

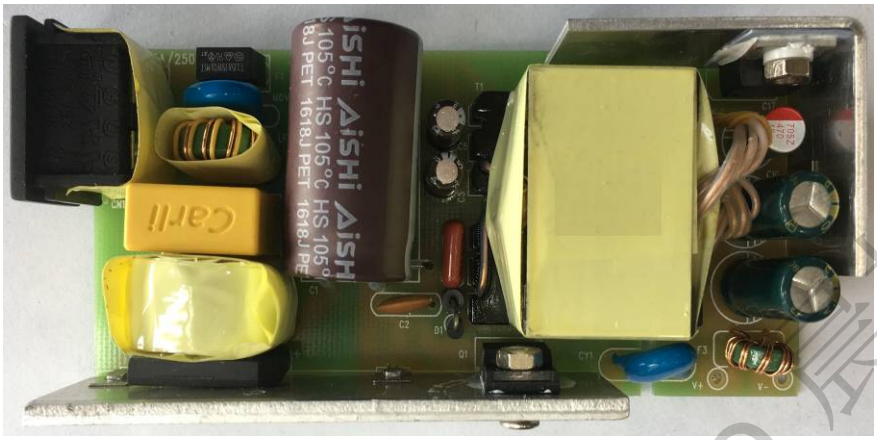
1. Bobbin: PQ3220
2. Core material: TDK PC 40
3. L6-4=660u H +/- 5%. (at: 10 K Hz, 1 V)

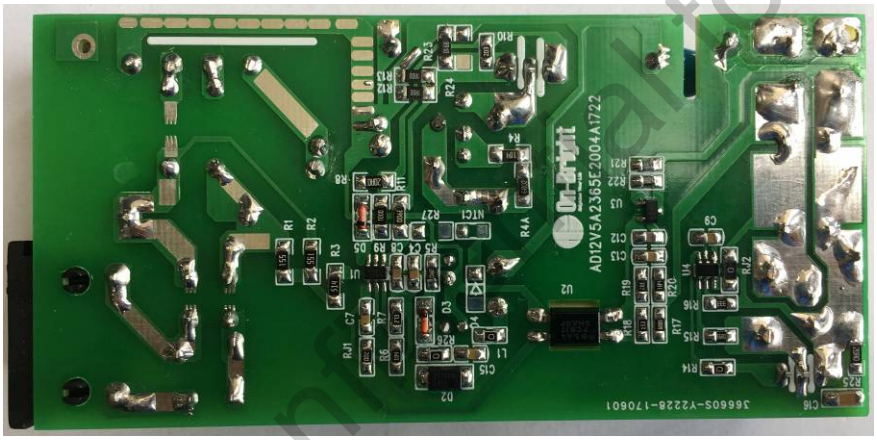
2.4.2 Transformer Winding data

No.	Winging	Material	Start	Turns	Finish	Remark
1	N1	Φ0.55*1 2UEW	6	16	5	
2	TAPE	TAPE W=10mm (Y)		2		
3	N2	Φ0.18*4 2UEW	2	4	3	居中密绕
4	TAPE	TAPE W=10mm (Y)		2		
5	N3	Φ0.18*3 2UEW	3	15	NC	
6	TAPE	TAPE W=10mm (Y)		2		
7	N4	Φ0.5*3 triple insulated wire	A	4	B	
8	TAPE	TAPE W=10mm (Y)		1		
9	N5	Φ0.5*3 triple insulated wire	A	4	B	
10	TAPE	TAPE W=10mm (Y)		2		
11	N6	Φ0.18*3 2UEW	NC	15	3	
12	TAPE	TAPE W=10mm (Y)		2		
13	N7	Φ0.55*1 2UEW	5	16	4	
14	TAPE	TAPE W=10mm (Y)		2		

备注：变压器铁芯必须用胶带完全包住，且包 2 层，所有进出线都要加 tube，铁芯外包一圈 copper 接 Pin3。

2.5 Adapter Module Snapshot





3 Performance Evaluation

All measurements were taken at room temperature, AWG16 1.5m Cable end.

Performance Highlights

- No load standby power under 60mW@230VAC
- Averaged efficiency more than 89.0%@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)	1.3497A
Standby power at no load (230Vac)	55mW
Averaged Efficiency (115/230 Vac, 25%~100% load for Cable end)	90.61%/91.06%
2 .Output characteristics	
Line regulation	0.05%
Load regulation	2.76%
Ripple & noise	<120mV
Over shoot	5% Max
Dynamic test	±372mV
3. Time sequence (100Vac, Full load)	
Turn on delay time	1.9S
Hold up time	10.13mS
4. Protections	
Over Voltage protection	OK
Over Current protection (90Vac ~264Vac)	OK
Short Circuit protection	OK
Secondary Rectifier Short 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	HS2

3.1 Input Characteristics

3.1.1 Input current and Standby power

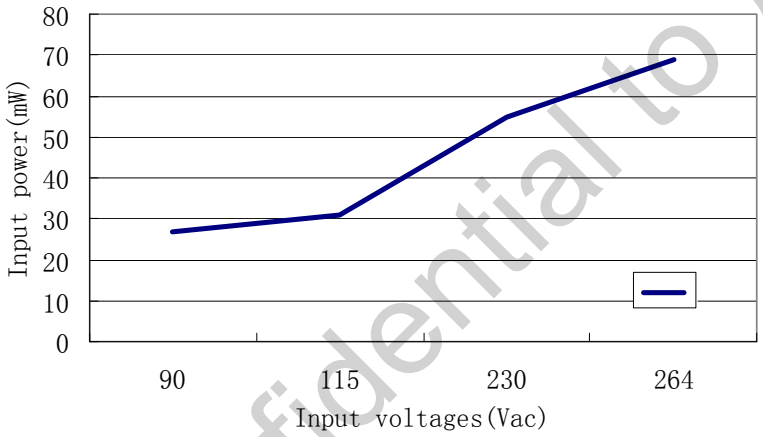
The module was tested at different input voltages (from 90Vac to 264Vac)

Table 1 Input current at full load

Input Voltage	90V/60Hz	115V/60Hz	230V/50Hz	264V/50Hz
Input Current(A)	1.3497	1.1442	0.6680	0.5948

Table 2 Standby power at no load

Input Voltage	90V/60Hz	115V/60Hz	230V/50Hz	264V/50Hz
Pin (mW)	27	31	55	69

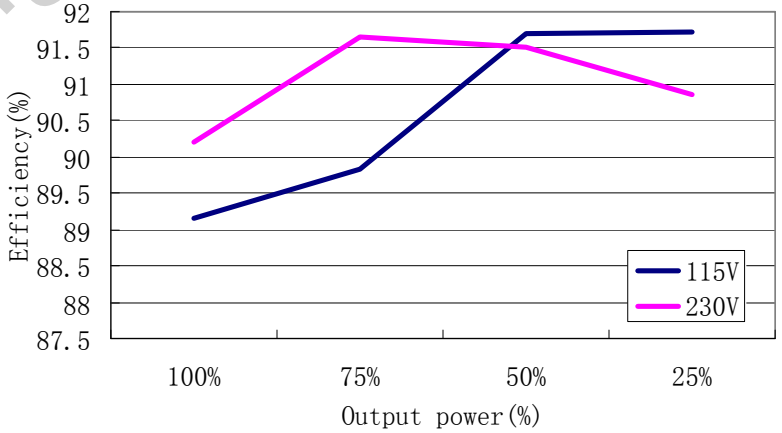


No-load Input Power vs. Input Line Voltage

3.1.2 Efficiency

Table 3 Efficiency

Input voltage	100%	75%	50%	25%	Aver. Eff.	Spec. COC V5 tier2
115Vac/60HZ	89.15	89.84	91.70	91.73	90.61%	>89.0%
230Vac/50HZ	90.20	91.66	91.51	90.85	91.06%	



Efficiency vs. Percent of Rated Output Power

3.2 Output Characteristics

3.2.1 Line Regulation & Load Regulation

Table 4 Line Regulation & Load Regulation

Input Voltage	Output Voltage (V)			Load Regulation（≤5%)
	No Load	Half Load	Full Load	
90V/47Hz	12.282	12.142	11.999	2.35
115V/60Hz	12.282	12.141	11.999	2.35
230V/50Hz	12.282	12.141	12.000	2.35
264V/63Hz	12.282	12.140	11.999	2.35
Line Regulation（≤2%)	0.00	0.02	0.01	

3.2.2 Ripple & Noise

Table 5 Ripple & Noise measure results

Input Voltage	R&N (mV)		Waveform
	No Load	Full Load	
90Vac/60HZ	34	98	Fig.1, Fig.2
115Vac/60HZ	35	85	
230Vac/50HZ	43	86	
264Vac/50HZ	42	86	Fig.3,Fig.4

Note: Ripple & noise were measured at AWG16 1.5M CABLE end with a 0.1uF/100V ceramic cap connected in parallel with a 10uF/50V Electrolytic cap. Bandwidth was limited to 20MHz.

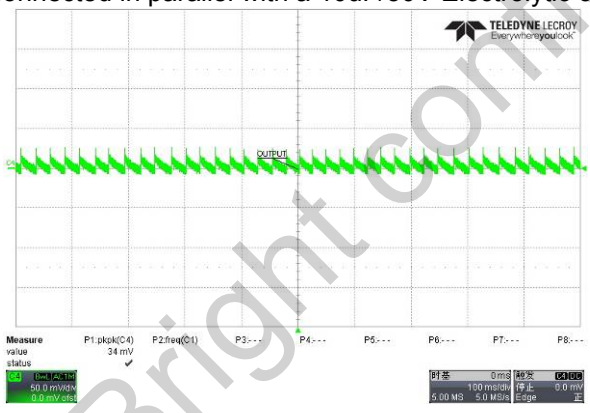


Fig. 1 R&N waveform@90Vac; no load

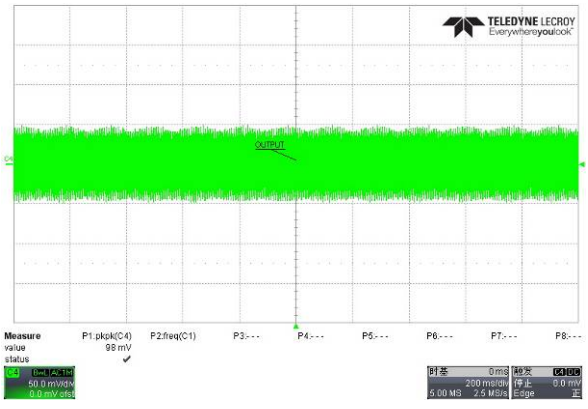


Fig. 2 R&N waveform@90Vac; full load

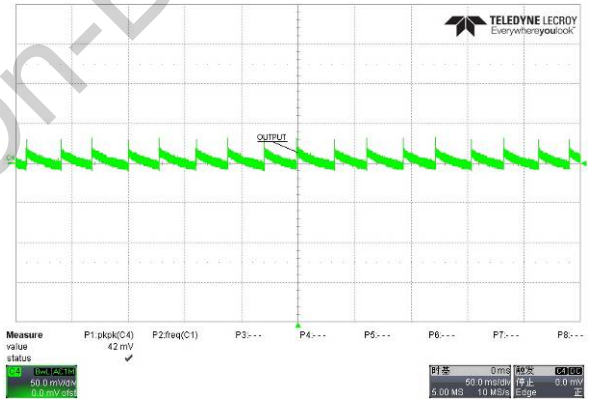


Fig. 3 R&N waveform@264Vac; no load

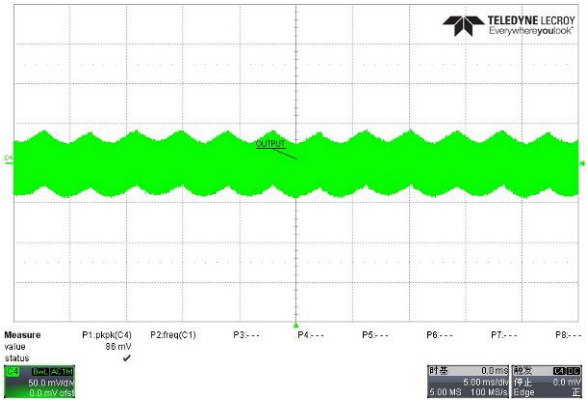


Fig. 4 R&N waveform@264Vac; full load

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	1.6	Fig.5
		undershoot	2.2	Fig.9
	No load	overshoot	1.6	Fig.6
		undershoot		
264V/50Hz	Full load	overshoot	1.6	Fig.7
		undershoot	2.2	Fig.10
	No load	overshoot	1.6	Fig.8
		undershoot		

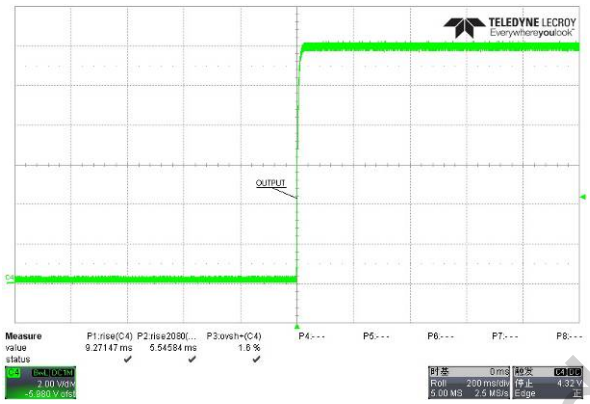


Fig. 5 Overshoot waveform@90Vac; full load

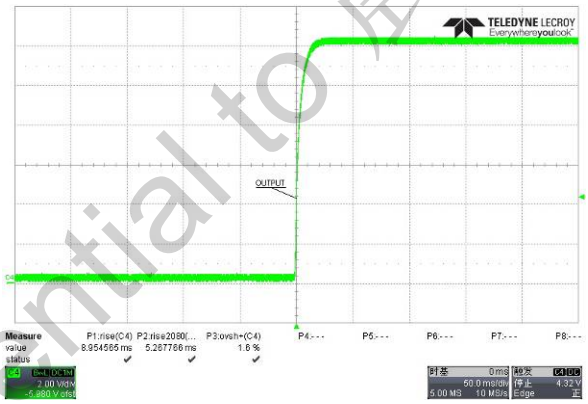


Fig. 6 Overshoot waveform @90Vac; no load

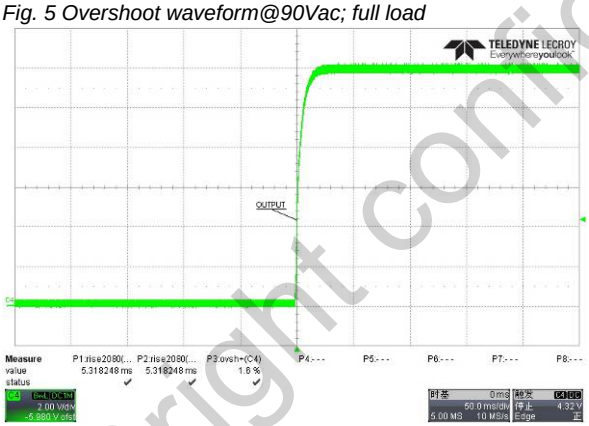


Fig. 7 Overshoot waveform @264Vac; full load

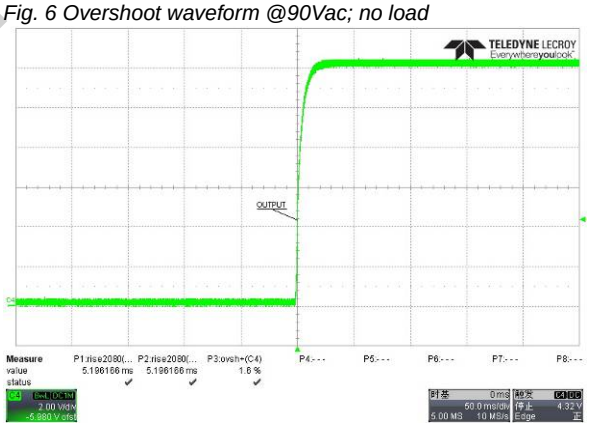


Fig. 8 Overshoot waveform @264Vac; no load

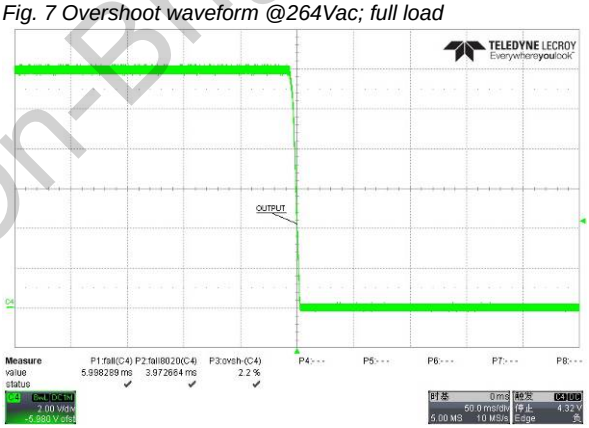


Fig. 9 Undershoot waveform@90Vac; full load

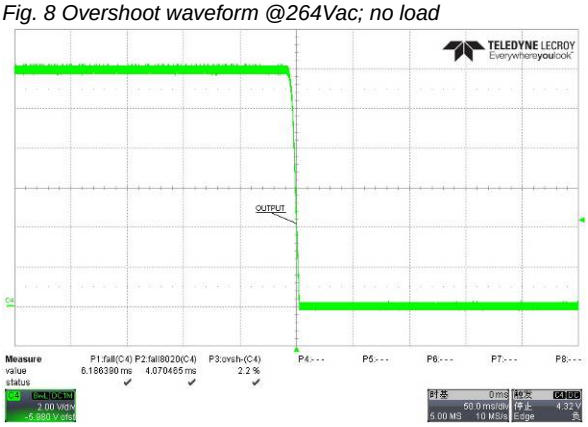


Fig. 10 Undershoot waveform @264Vac; full load

3.2.4 Dynamic Test

A dynamic loading with low set at 10% load lasting for 20mS and high set at 100% load lasting for 20mS is added to output. The ramp is set at 0.25A/uS at transient.
All data was measurement at AWG16 1.5M CABLE end.

Table 7 Output voltage under dynamic test

Input voltage	Output voltage (mV)	Waveform
90V/60HZ	±372	Fig.11
264V/50HZ	±349	Fig.12

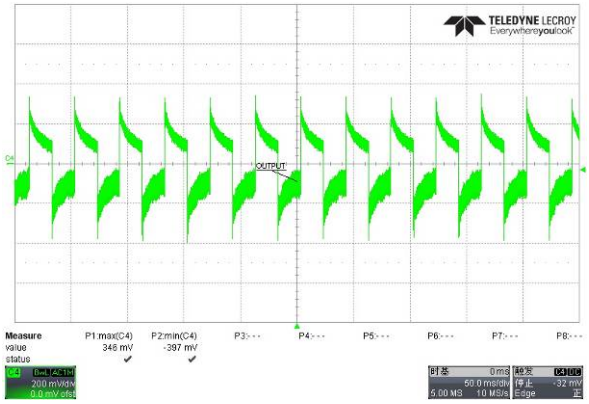


Fig. 11 Dynamic waveform@90Vac input

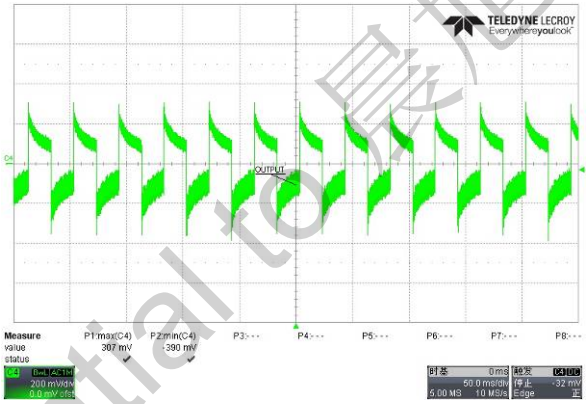


Fig. 12 Dynamic waveform@264Vac input

3.2.5 Time Sequence

Load condition: Full load

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

Item	Input voltage	Meas. Data (mS)	Remark
Turn-on delay time	100V/60Hz	1906	Fig.13
Turn-on delay time	240V/50Hz	710	Fig.14
Hold-up time	100V/60Hz	10.13	Fig.15
Hold-up time	240V/50Hz	94.60	Fig.16

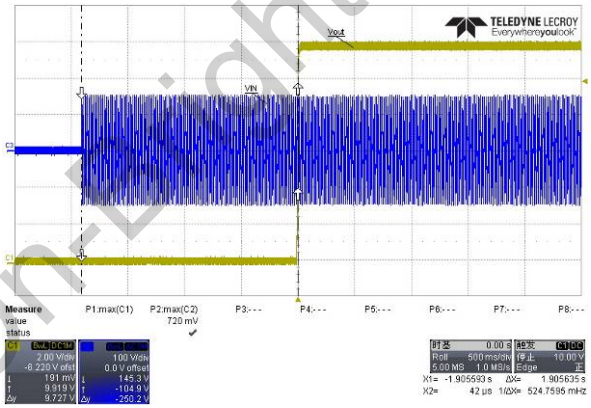


Fig. 13 Turn on delay waveform @90Vac; full load

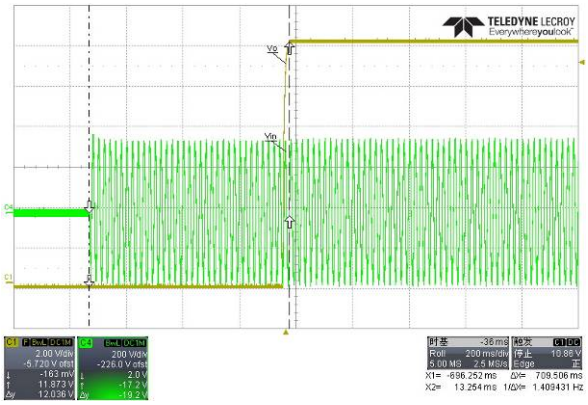


Fig. 14 Turn on delay waveform @240Vac; full load

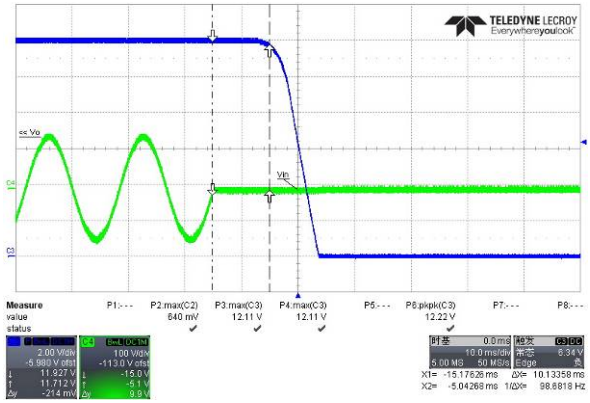


Fig. 15 Hold up time waveform @100Vac; full load

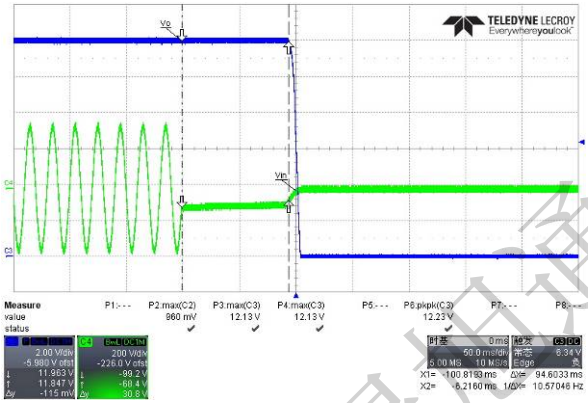


Fig. 16 Hold up time waveform @240Vac; full load

3.3 Protections

3.3.1 Over Current Protection (OCP)

The power supply will shut down with auto-recovery when output current exceeds 5.5A～7.5A, 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)	6.38	6.83	6.76	6.73
Max.Start Up Current(A)	6.36	6.75	6.74	6.70

3.3.2 Over Voltage Protection (OVP)

The power supply will shut down with auto-recovery when feedback circuit is disabled, and the output voltage can not be over 16V, and it should recover when the over voltage condition is removed.

Table 10 Load OVP test result

Input Voltage	OVP Trigger Voltage (V)
	No Load
90V/60Hz	14.77V
264V/50Hz	14.71V

Fig. 17 OVP waveform @90Vac; no load

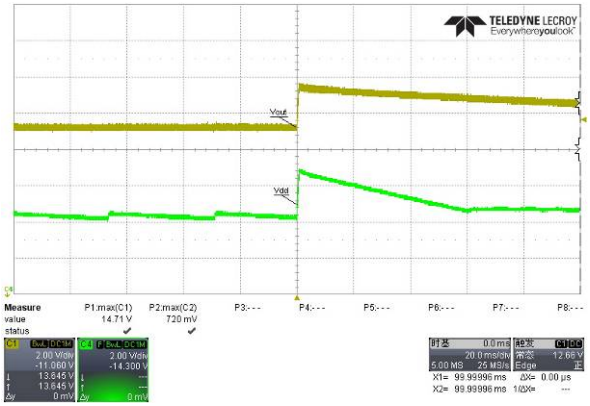


Fig. 18 OVP waveform @264Vac;no load

3.3.3 Over Load Protection (OLP)

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

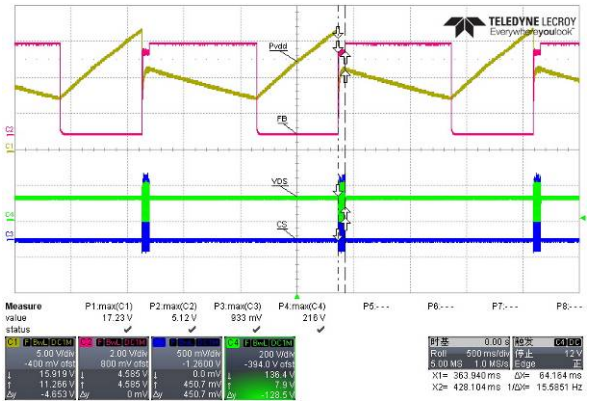


Fig. 19 OLP waveform @90Vac; over load

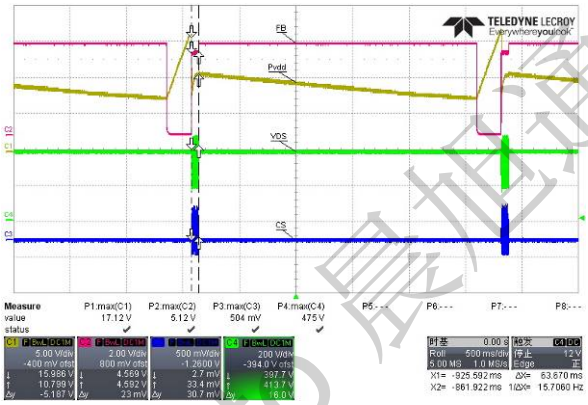


Fig. 20 OLP waveform @264Vac;over load

3.4 Thermal Test

The thermal test is under 40℃ ambiance after 4hour full load ruining with 90Vac & 264Vac input
In the box 60CM*60CM*60CM.

Table 11 Thermal test result

Position	Description	90Vac input	264Vac Input
BD1	GBL406	107.4	76.9
T1	T1(wire)	91.8	79.9
T1	T1(core)	89.8	77.8
U1	IC(OB2365E)	80.4	67.7
U2	IC(OB2004A)	93.6	82.9
Q1	K2843	98.3	79.0
Q2	FDP036N10A	89.4	84.9

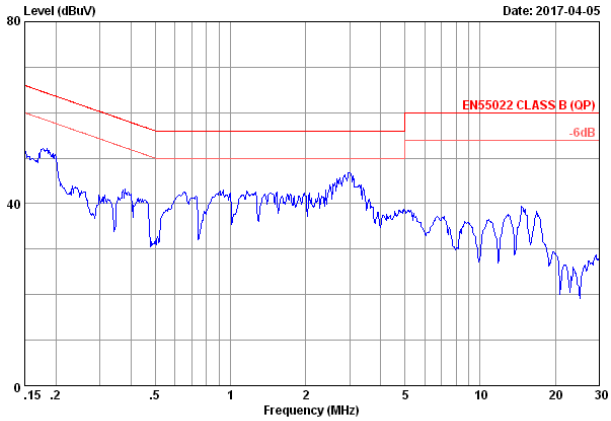
Case:132.6(L) x 65.9(W) x 43.2(H)mm

3.5 EMI Test

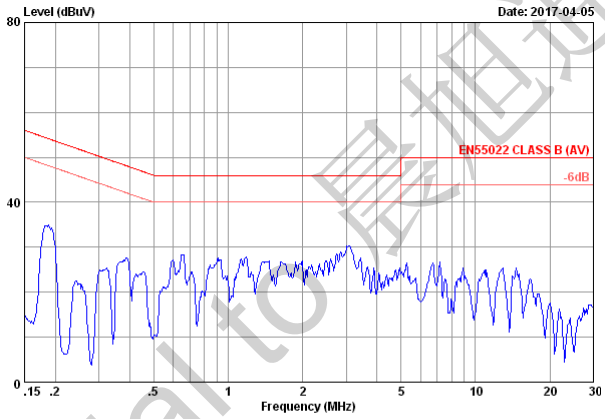
The Power supply passed EN55022 Class B & FCC class B EMI requirement with more than 6dB margin

3.5.1 Conduction EMI Test

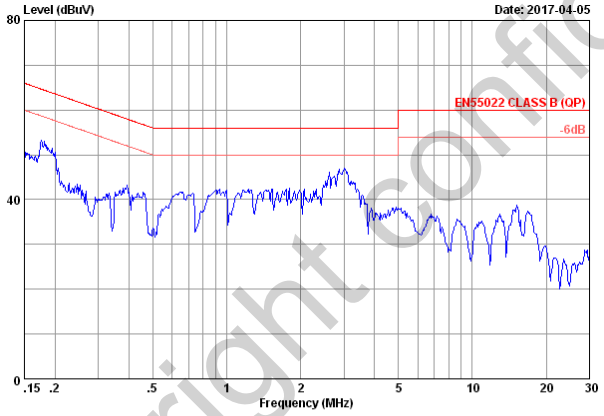
EN55022 CLASS B @ full load report



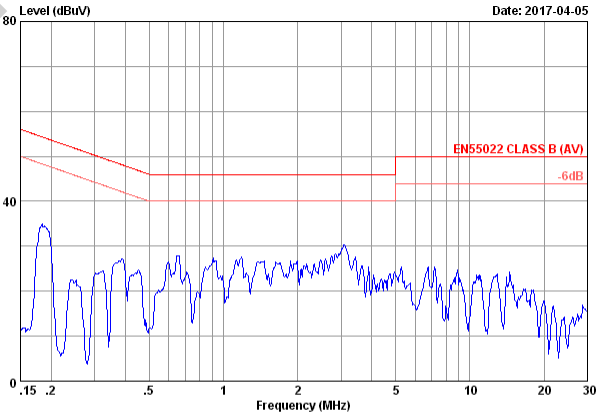
Site no	: Audix(Shanghai) Shielded1	Data no	:291
AMN	: ESH2-Z5-2016	AMN Phase	:NEUTRAL
Limit	: EN55022 CLASS B (QP)		
Env/Ins	: 22'C 48%RH / ESCI	Engineer	:Kalsi
EUT	: OB2365E2004A		
M/N	: 12V 5A		
S/N	:		
Power Rating	: 230V/50Hz		
Test Mode	: Full Load		
Memo	:		



Site no	: Audix(Shanghai) Shielded1	Data no	:292
AMN	: ESH2-Z5-2016	AMN Phase	:NEUTRAL
Limit	: EN55022 CLASS B (AV)		
Env/Ins	: 22'C 48%RH / ESCI	Engineer	:Kalsi
EUT	: OB2365E2004A		
M/N	: 12V 5A		
S/N	:		
Power Rating	: 230V/50Hz		
Test Mode	: Full Load		
Memo	:		

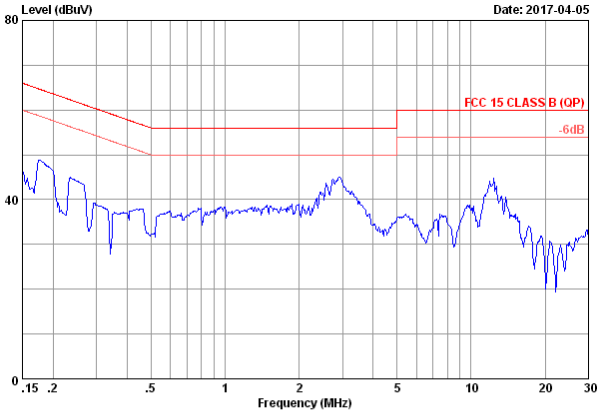


Site no	: Audix(Shanghai) Shielded1	Data no	:293
AMN	: ESH2-Z5-2016	AMN Phase	:LINE
Limit	: EN55022 CLASS B (QP)		
Env/Ins	: 22'C 48%RH / ESCI	Engineer	:Kalsi
EUT	: OB2365E2004A		
M/N	: 12V 5A		
S/N	:		
Power Rating	: 230V/50Hz		
Test Mode	: Full Load		
Memo	:		

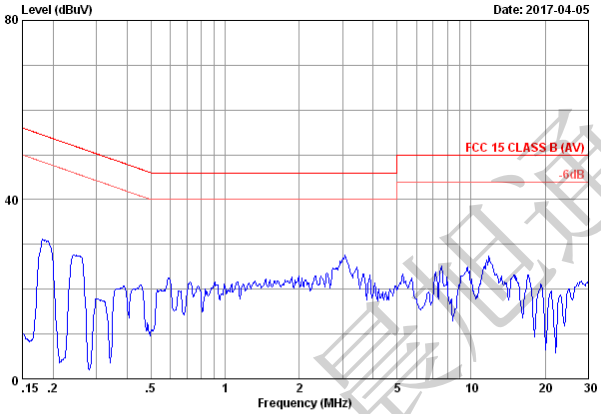


Site no	: Audix(Shanghai) Shielded1	Data no	:294
AMN	: ESH2-Z5-2016	AMN Phase	:LINE
Limit	: EN55022 CLASS B (AV)		
Env/Ins	: 22'C 48%RH / ESCI	Engineer	:Kalsi
EUT	: OB2365E2004A		
M/N	: 12V 5A		
S/N	:		
Power Rating	: 230V/50Hz		
Test Mode	: Full Load		
Memo	:		

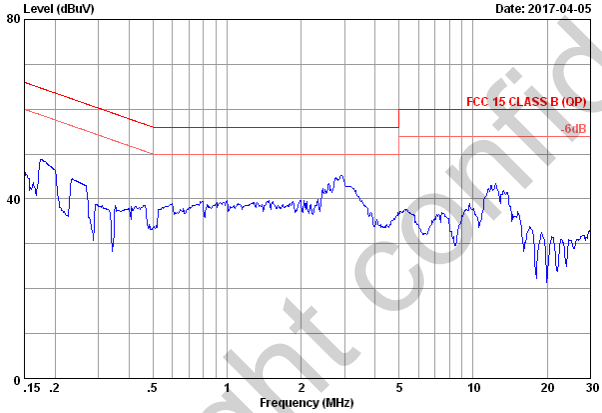
FCC CLASS B @ full load report



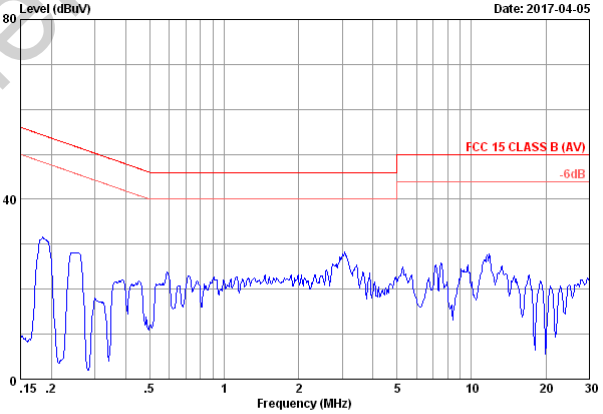
Site no : Audix(Shanghai) Shielded1 Data no :287
AMN : ESH2-Z5-2016 AMN Phase :NEUTRAL
Limit : FCC 15 CLASS B (QP)
Env/Ins : 22'C 48%RH / ESCI Engineer :Kalsi
EUT : OB2365E2004A
M/N : 12V 5A
S/N :
Power Rating : 120V/60Hz
Test Mode : Full Load
Memo :



Site no : Audix(Shanghai) Shielded1 Data no :288
AMN : ESH2-Z5-2016 AMN Phase :NEUTRAL
Limit : FCC 15 CLASS B (AV)
Env/Ins : 22'C 48%RH / ESCI Engineer :Kalsi
EUT : OB2365E2004A
M/N : 12V 5A
S/N :
Power Rating : 120V/60Hz
Test Mode : Full Load
Memo :



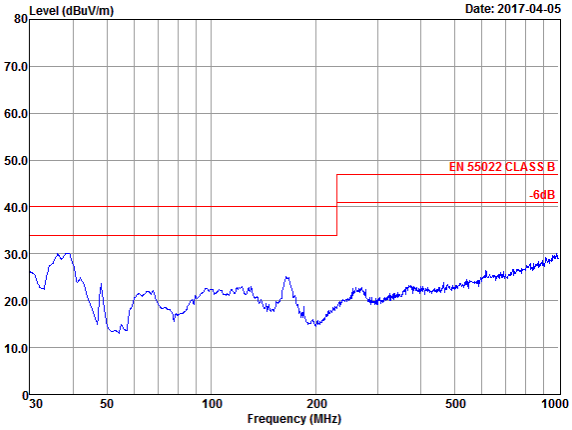
Site no : Audix(Shanghai) Shielded1 Data no :289
AMN : ESH2-Z5-2016 AMN Phase :NEUTRAL
Limit : FCC 15 CLASS B (QP)
Env/Ins : 22'C 48%RH / ESCI Engineer :Kalsi
EUT : OB2365E2004A
M/N : 12V 5A
S/N :
Power Rating : 120V/60Hz
Test Mode : Full Load
Memo :



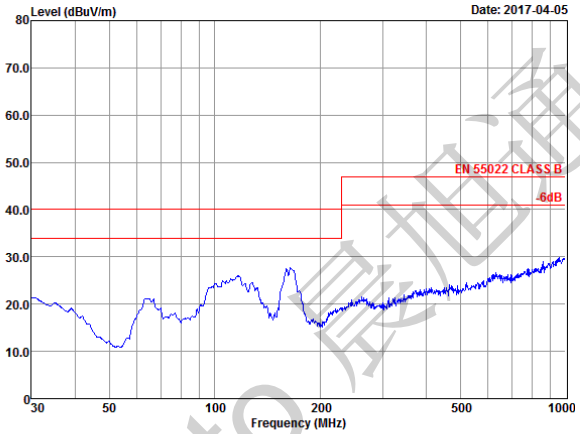
Site no : Audix(Shanghai) Shielded1 Data no :290
AMN : ESH2-Z5-2016 AMN Phase :NEUTRAL
Limit : FCC 15 CLASS B (AV)
Env/Ins : 22'C 48%RH / ESCI Engineer :Kalsi
EUT : OB2365E2004A
M/N : 12V 5A
S/N :
Power Rating : 120V/60Hz
Test Mode : Full Load
Memo :

3.5.2 Radiation EMI Test

EN55022 CLASS B @ full load report

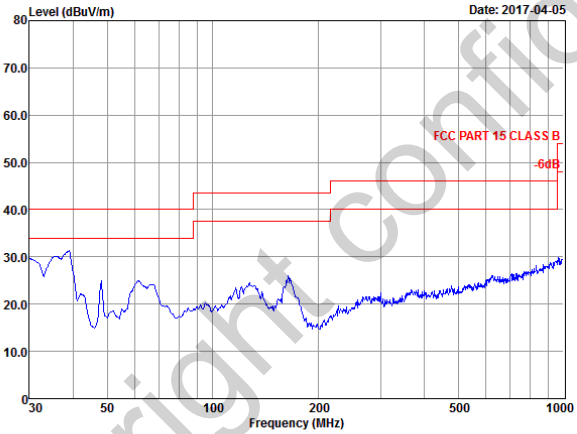


Site : Audix(Shanghai) Chamber3
Condition : EN 55022 CLASS B VERTICAL
Project No. :
Applicant :
EUT :
M/N : OB2365E2004A
S/N :
Power Supply : 230V/50Hz
Ambient : 22'C 60%RH
Test Mode : 12V 5A
Test Engineer: Sunny
Memo :

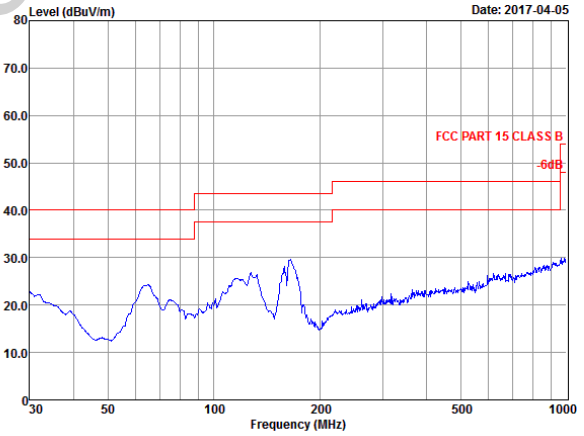


Site : Audix(Shanghai) Chamber3
Condition : EN 55022 CLASS B HORIZONTAL
Project No. :
Applicant :
EUT :
M/N : OB2365E2004A
S/N :
Power Supply : 230V/50Hz
Ambient : 22'C 60%RH
Test Mode : 12V 5A
Test Engineer: Sunny
Memo :

FCC CLASS B @ full load report



Site : Audix(Shanghai) Chamber3
Condition : FCC PART 15 CLASS B VERTICAL
Project No. :
Applicant :
EUT :
M/N : OB2365E2004A
S/N :
Power Supply : 120V/60Hz
Ambient : 22'C 60%RH
Test Mode : 12V 5A
Test Engineer: Sunny
Memo :



Site : Audix(Shanghai) Chamber3
Condition : FCC PART 15 CLASS B HORIZONTAL
Project No. :
Applicant :
EUT :
M/N : OB2365E2004A
S/N :
Power Supply : 120V/60Hz
Ambient : 22'C 60%RH
Test Mode : 12V 5A
Test Engineer: Sunny
Memo :

4 Other important waveform

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

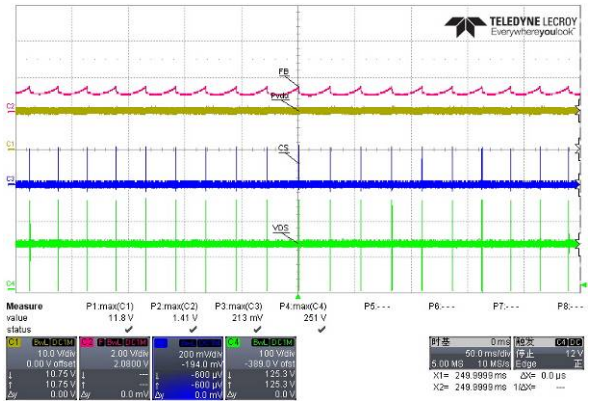


Fig. 21 CS,FB,Vdd&Vds wave form@90Vac; no load

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

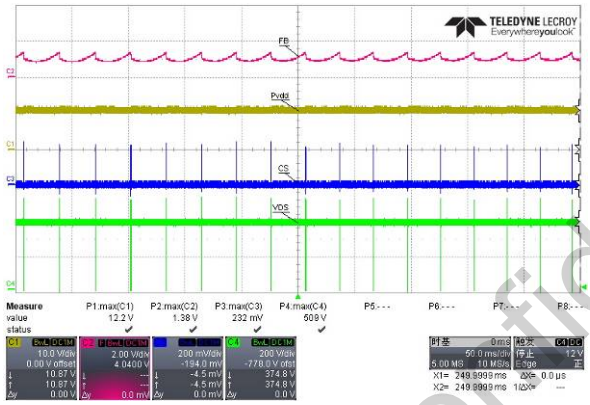


Fig. 23 CS,FB,Vdd&Vds wave form@264Vac; no load

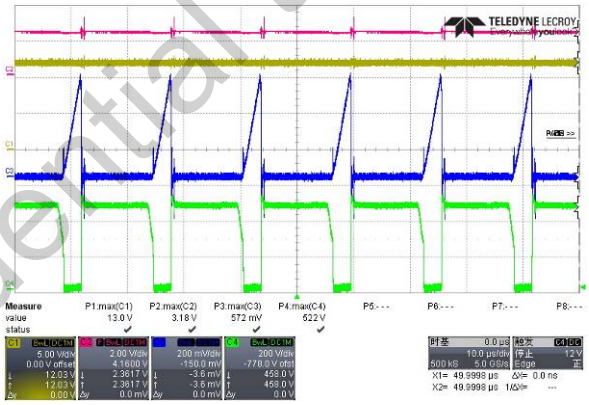


Fig. 24 CS,FB,Vdd&Vds wave form@264Vac; full load

4.2 Synchronous rectification Sgate,Svdd & Vd at no load/full load

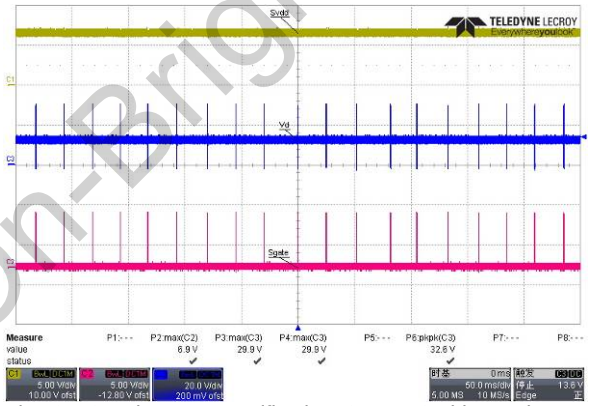


Fig. 25 Synchronous rectification Sgate, Svdd & Vd wave form@90Vac; no load

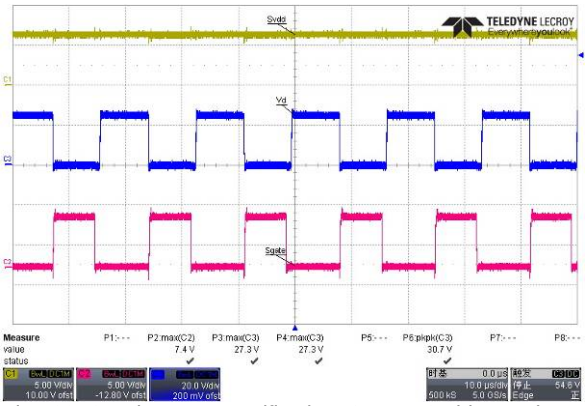


Fig. 26 Synchronous rectification Sgate, Svdd & Vd wave form@90Vac; full load

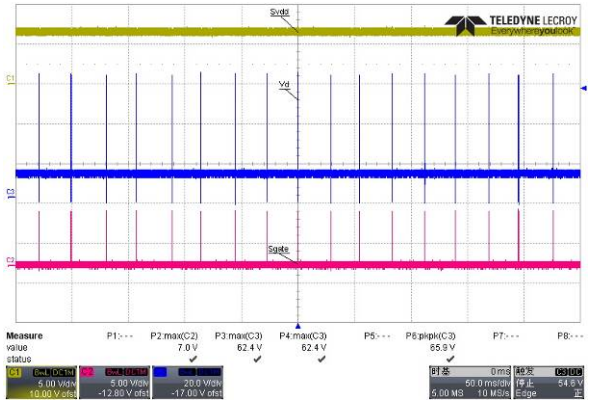


Fig. 27 Synchronous rectification Sgate, Svdd & Vd wave form@264Vac; no load

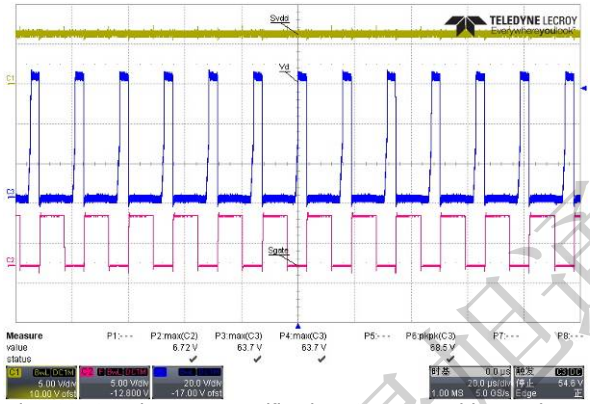


Fig. 28 Synchronous rectification Sgate, Svdd & Vd wave form@264Vac; full load

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

4.3.1 Vds at full load, start/normal/output short

MOSFET measurement results

Item	Input voltage	Meas. Data（Vds_max）	Remark
Start Full load	264V/50HZ	550V	Fig. 29
Normal full load	264V/50HZ	546V	Fig. 31
Short work	264V/50HZ	466V	Fig. 33

Synchronous rectification MOSFET measurement results

Item	Input voltage	Meas. Data (Vds_sr_max)	Remark
Start Full load	264V/50HZ	63.2V	Fig. 30
Normal full load	264V/50HZ	62.2V	Fig. 32
Short work	264V/50HZ	57.7V	Fig. 34

4.3.2 Vds, Vds_sr at full load, start waveform

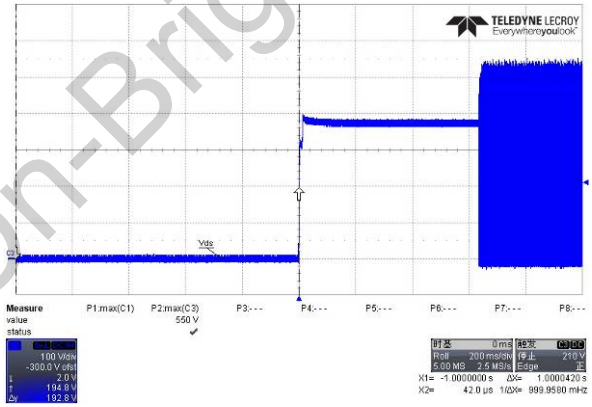


Fig. 29 Vds start up wave form@264Vac; full load

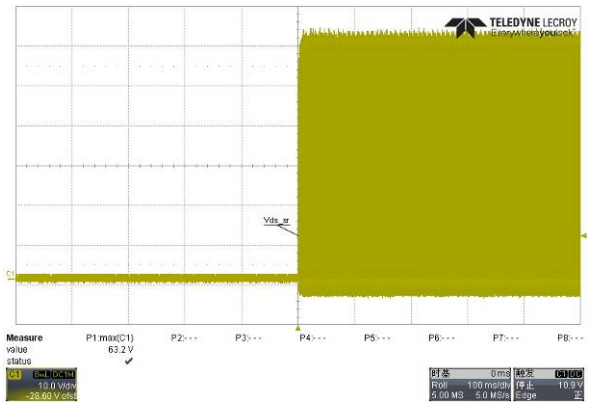


Fig. 30 Vds_sr start up wave form@264Vac; full load

4.3.3 Vds,Vds_sr at full load, normal waveform

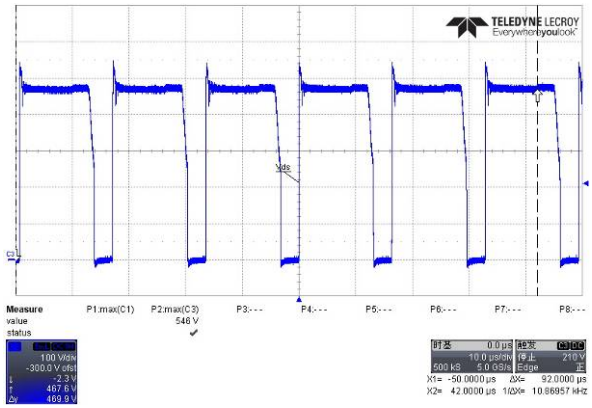


Fig. 31 Vds normal wave form@264Vac; full load

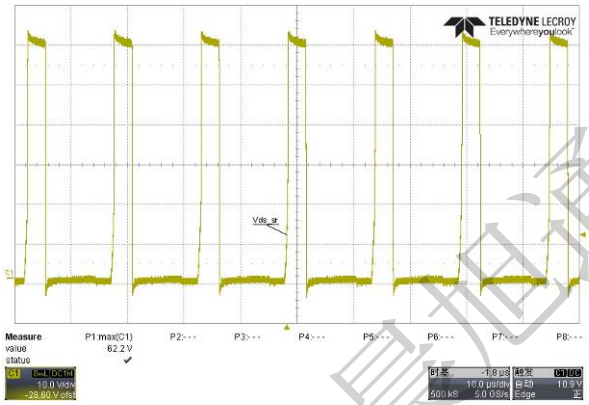


Fig. 32 Vds_sr normal wave form@264Vac; full load

4.3.4 Vds,Vds_sr at full load, output short waveform

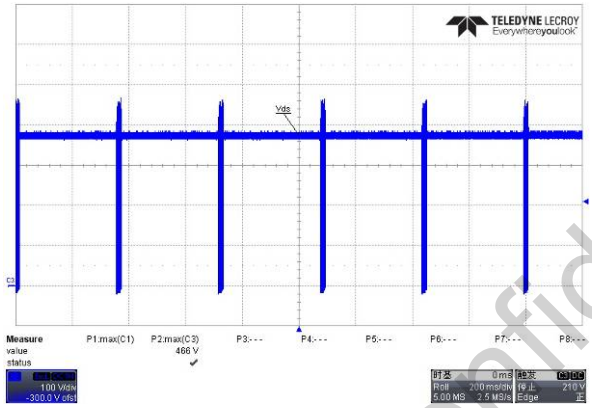


Fig. 33 Vds output short wave form@264Vac; full load

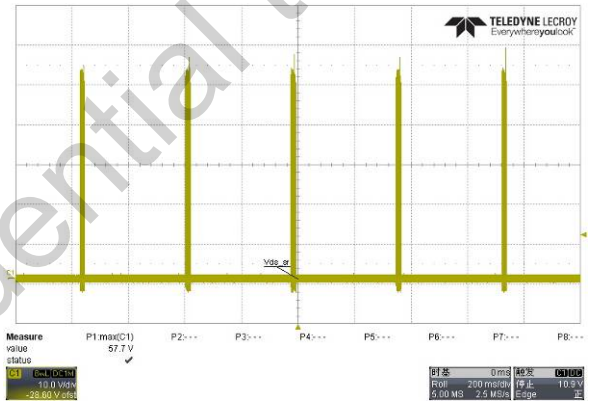


Fig. 34 Vds_sr output short wave form@264Vac; full load

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