DEMO BOARD TEST REPORT

High Performance Low Cost 12V2A Adapter with Current Mode PWM Controller KP201

FEATURES

- High Precision 12V CV Regulation with Fast Dynamic Response
- High Efficiency Meet DoE Level VI and CoC V5 Tier2
- Less than 75mW Standby Power
- Very Low Startup and Operation Current
- Multi-Mode Control with Audio Noise Free Operation
- Good EMI Performance
- Built-in Protections with Auto Recovery:
  - VDD Under Voltage Lockout (UVLO)
  - VDD Over Voltage Protection (OVP)
  - On-Chip Thermal Shutdown (OTP)
  - Cycle-by-Cycle Current Limiting
  - Over Load Protection (OLP)
  - Short Circuit Protection (SCP)
  - Leading Edge Blanking (LEB)

APPLICATIONS

- Adapter
- Small Home Appliance

INTRODUCTION

KP201 is a high performance current mode PWM controller for offline fly-back converter applications. The IC has built-in General Primary Side CC control, which simplifies isolated power supply design that requires CC regulation of the output.

In KP201, PWM switching frequency with shuffling is fixed to 65KHz and is trimmed to tight range. The IC has built-in green and burst mode control for light and zero loadings, which can achieve less than 75mw standby power for sub 30W applications.

The Demo Board of KP201-D03 is typically designed for the application of 12V/2A with universal input (90-265Vac, 60/50Hz). Besides the multi-protection function, this demo also has very good efficiency, line & load regulation, low standby power loss and meets the EN55022B Conduction and Radiation requirement.

DEMO BOARD SEPCIFICATION

Description	Symbol	Min.	Typ.	Max.	Unit	Note
Input Voltage	Vin	90		265	Vac	50/60Hz
Output Voltage	Vout		12		Vdc	
Output Current	Iout		2		A	OCP>2.3A
Output Power	Pout		24		W	
Efficiency	η		88.9		%	Average value tested at 230Vac/50Hz, board side
Standby Power Consumption	Pst			75	mW	@265Vac
Startup Time	Tst			2.0	s	Tested at 90Vac/60Hz
Conduction EMI Margin		4			dB	EN55022 Class B
Radiation EMI Margin		5			dB	EN55015 CDN
Surge Test		2			kV	Typical differential surge value tested at 230Vac/50Hz

The table above shows the minimum acceptable performance of the design. Actual performance is listed in the results section.

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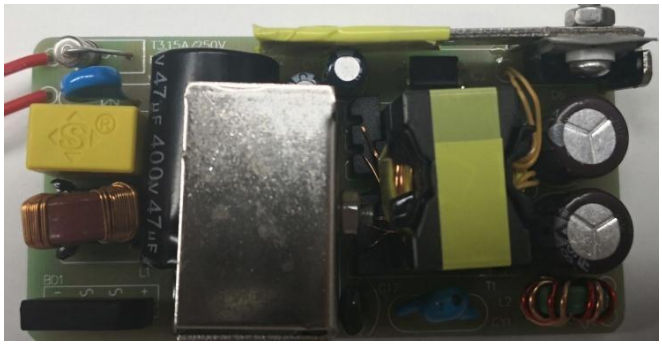
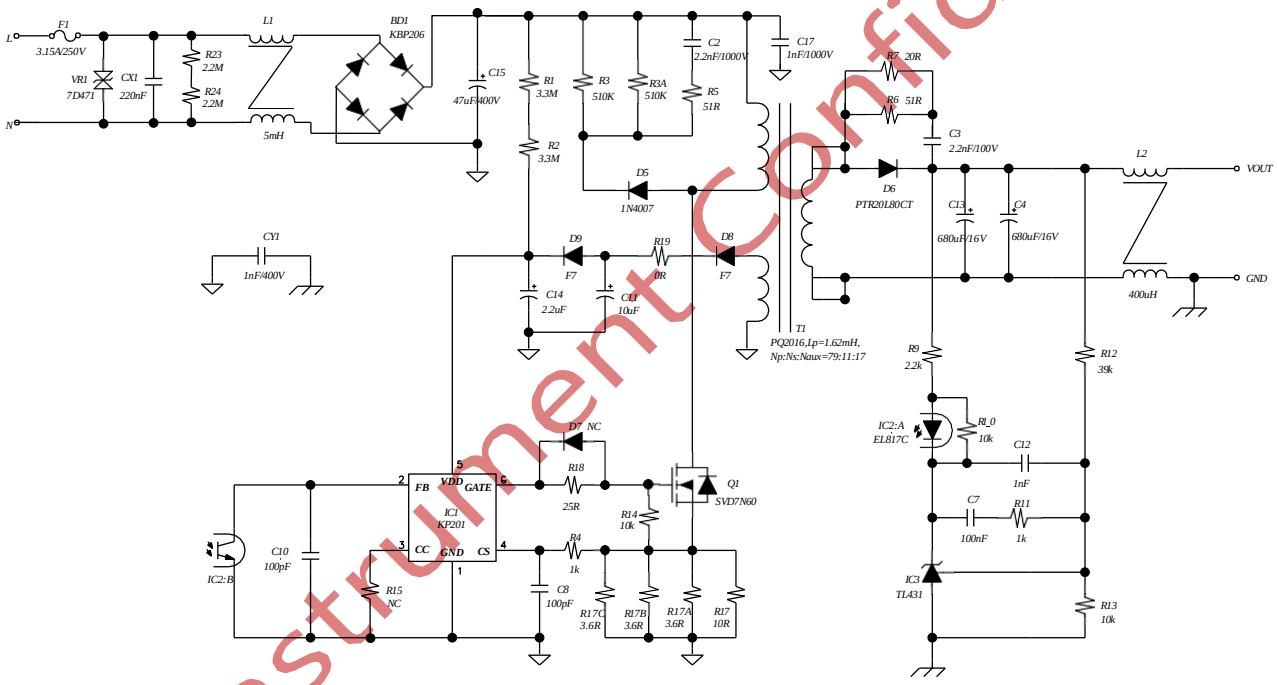
Demo Board of KP201LG_D03_REV1.1



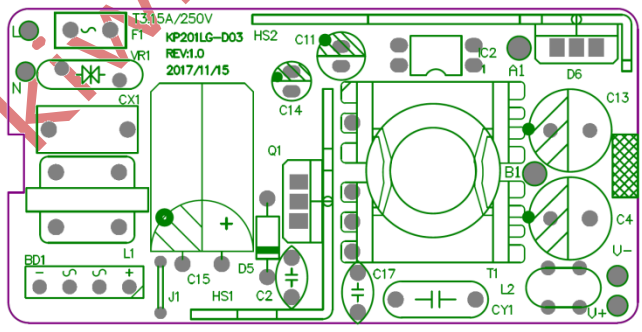
Board Size(in mm): L x W x H=102 x 45 x26

Schematic

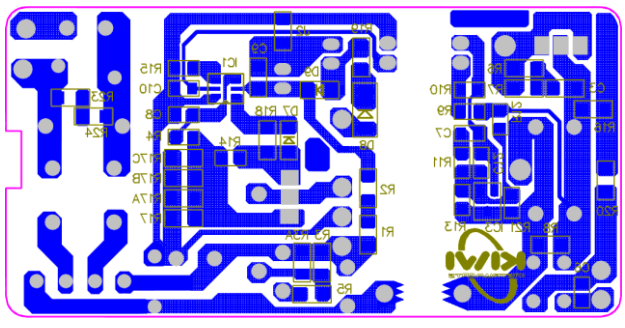


Printed Circuit Board Layout

Top Layer



Bottom Layer



Circuit Description

The Demo Board of KP201-D03 is configured in a single stage flyback topology, which combines a current mode PWM controller KP201LG. KP201-D03 is typically designed for the application of 12V/2A adapter with universal input (90-265Vac, 50/60Hz). Additionally, the demo board can achieve high efficiency, low standby power loss and precise constant voltage control.

1. Input Rectification and EMI filtering

The circuit input stage is composed by the components of F1, VR1, CX1, L1, BD1 and C15. F1 and VR1 provide the inrush current limitation and surge protection in the event of component failure, surge or short circuit. CX1 and L1 are used to suppress EMI noise to meet EN55022B standard. The bridge diode of BD1 rectifies the AC input to DC output, which is followed by a bulk cap C15.

2. Current Mode PWM Controller KP201 Operation

IC1 is the current mode PWM controller KP201, which is used for offline flyback converter applications. The IC has built-in General Primary Side CC control, which simplifies isolated power supply design that requires CC regulation of the output.

R1, R2, R19, D8, D9, C11 and C14 are used as VDD power supply for KP201. KP201 uses opto-coupler IC2 to generate FB Pin voltage on primary side to regulate the output voltage within full load range. R17, R17A, R17B and R17C are sensing resistors to set maximum output power. C2, D5, R3, R3A, R5 compose snubber circuit to depress the drain-source voltage spike.

3. Output Voltage Regulation

R9, R11, C7, C12 and IC3 TL431 compose output voltage regulation network. R12 and R13 are the output voltage resistor dividers for TL431's reference compare. C4 and C13 are the output capacitors used to supply output current and lower output voltage ripple.

Bill of Material

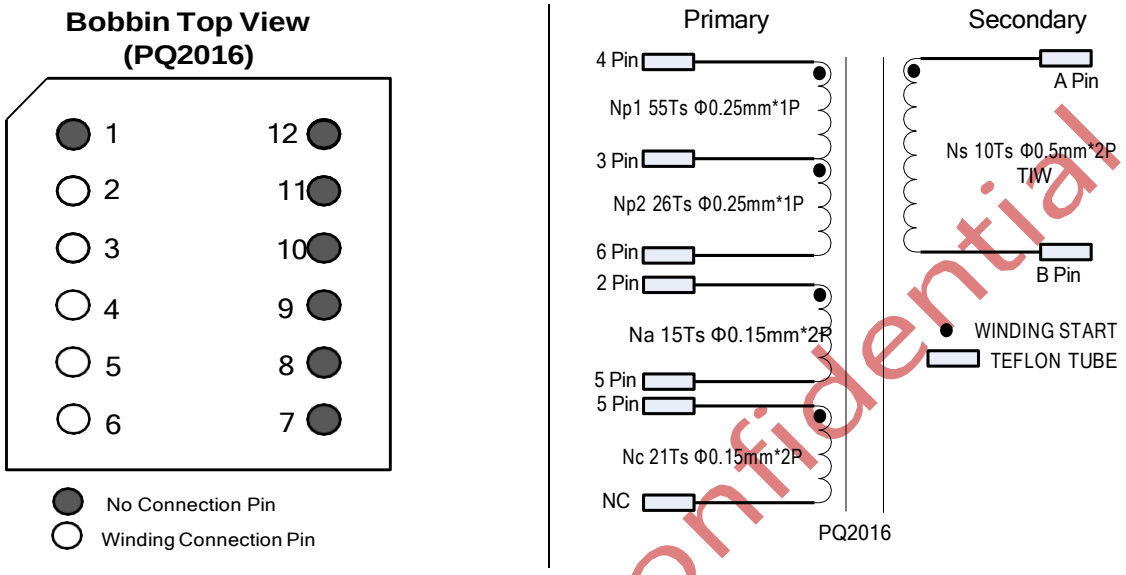
Bill of Material

No.	Designator	Value	Description	Package	Manufacturer	Part Number
1	BD1	KBP206	2.0A GLASS PASSIVATED BRIDGE RECTIFIER	TH	HY	KBP206
2	C2	2.2nF/1kV	Polyester Cap, 1kV	TH	Any	
3	C3	2.2nF/100V	Ceramic Cap, 100V X7R	1206	Murata	
4	C4	680uF/16V	Electrolytic Cap, 16V,10*16	TH	Jianghai	
5	C7	100nF/50V	Ceramic Cap, 50V X7R	0805	Murata	
6	C8	100pF/50V	Ceramic Cap, 50V X7R	0805	Murata	
7	C10	100pF/50V	Ceramic Cap, 50V X7R	0805	Murata	
8	C11	10uF/50V	Electrolytic Cap, 50V,5*12	TH	Jianghai	
9	C12	1nF/50V	Ceramic Cap, 50V X7R	0805	Murata	
10	C13	680uF/16V	Electrolytic Cap, 16V,10*16	TH	Jianghai	
11	C14	2.2uF/50V	Electrolytic Cap, 50V,5*12	TH	Jianghai	
12	C15	47uF/400V	Electrolytic Cap, 400V,18*20	TH	Jianghai	
13	C17	1nF/1kV	Polyester Cap, 1kV	TH	Any	
14	CX1	220nF	MKP62,275Vac~X2, P=10mm, T=8mm	TH	Fala	
15	CY1	1nF	CD/Y1 Y5U Cap,400VAC, P=10mm, T=5.0mm	TH	STE	
16	D5	1KV/1A	1N4007	DO-41	Any	
17	D6	20A/80V	PTR20L80CT	TO-220	PFC	PTR20L80CT
18	D8	FF1MS	Fast Recovery Rectifiers	SOD123	Any	
19	D9	FF1MS	Fast Recovery Rectifiers	SOD123	Any	
20	F1	250V/3.15A	Fuse 250V/3.15A	TH	Any	
21	L1	5mH	Common Mode Power Line Choke	TH	Wurth	744821150
22	L2	150uH	EMI FILTER T9*5*3 6Ts 150uH	TH	Any	
23	Q1	SVD7N60F	N Mosfet, 600V/7A, Rdson=1.2ohm	TO-220	SL	SVD7N60F
24	R1	3.3M	Film Resistor, 5%	1206	Yageo	
25	R2	3.3M	Film Resistor, 5%	1206	Yageo	
26	R3	510K	Film Resistor, 5%	1206	Yageo	
27	R3A	510K	Film Resistor, 5%	1206	Yageo	
28	R4	1K	Film Resistor, 5%	0805	Yageo	
29	R5	51R	Film Resistor, 5%	1206	Yageo	
30	R6	51R	Film Resistor, 5%	1206	Yageo	

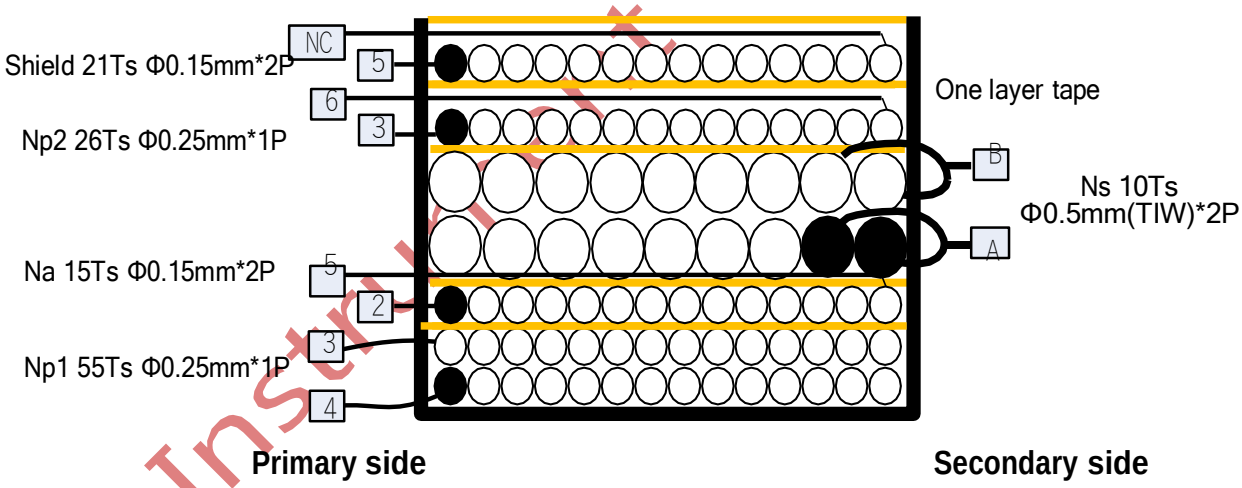
31	R7	20R	Film Resistor, 5%	1206	Yageo	
32	R9	2.2K	Film Resistor, 5%	0805	Yageo	
33	R10	10K	Film Resistor, 5%	0805	Yageo	
34	R11	1K	Film Resistor, 5%	0805	Yageo	
35	R12	39K	Film Resistor, 5%	0805	Yageo	
36	R13	10K	Film Resistor, 5%	0805	Yageo	
37	R14	10K	Film Resistor, 5%	0805	Yageo	
38	R15	NC				
39	R17	12R	Film Resistor, 1%	1206	Yageo	
40	R17A	3.6R	Film Resistor, 1%	1206	Yageo	
41	R17B	3.6R	Film Resistor, 1%	1206	Yageo	
42	R17C	3.6R	Film Resistor, 1%	1206	Yageo	
43	R18	25R	Film Resistor, 5%	1206	Yageo	
44	R19	0R	Film Resistor, 5%	1206	Yageo	
45	R23	2.2M	Film Resistor, 5%	1206	Yageo	
46	R24	2.2M	Film Resistor, 5%	1206	Yageo	
47	VR1	7D471	7D471	7D	STE	
48	T1	PQ2016	PQ2016 (Lp=1.62mH , Np:Ns:Naux=81:10:15)	PQ2016	TDG	
49	IC2	PC817C	Opto-coupler	DIP	Everlight	
50	IC3	TL431	Regulator, TL431ALP	SOT23-6L	Any	
51	IC1	KP201	Current Mode PWM Controller with CC/CV	SOT23-6L	Kiwi Instruments	KP201LG
52	J1	copper wire				
53	J2	0R	Film Resistor, 5%	1206	Yageo	

Transformer Manufacture Guide

1. Electrical Diagram



2. Winding Diagram



3. Winding Order

Number	Winding	Layer	Start	End	Wire Size	Turns	Note
1	Np1	Primary	4	3	0.25*1P	55Ts	Close Wound
2	Na	Auxiliary	2	5	0.15*2P	15Ts	Close Wound
3	Ns	Secondary	A	B	0.5 TIW*2P	10Ts	Close Wound
4	Np2	Primary	3	6	0.25*1P	26Ts	Close Wound
5	shielding	Auxiliary	5	Nc	0.15*2P	21Ts	Close Wound

4. Electrical Specification

Items	Test Condition	Test Pin	Specification
Primary Inductance	Measured at 40kHz,1.0 VRMS	Pins 4 - 6; all other windings open	1.62mH±5%
Leakage Inductance	Measured at 40kHz,1.0 VRMS	Pins 4 - 6; all other windings shorted	20uH Max
HI-POT HV Test	3000Vac/50Hz, One minute	Primary to Secondary	3000Vac,5mA
	1500Vac/50Hz, One minute	Primary to Core	1500Vac,5mA
	1500Vac/50Hz, One minute	Secondary to Core	1500Vac,5mA
Insulation Resistance	500Vdc	All windings to core	100MΩ Min
	500Vdc	Between windings	100MΩ Min
DC Resistance	-	Pins 4 - 6	1.5R Max

5. BOM Transformer

Items	Description
1	**Core:** PQ2016， PC40 or equivalent
2	**Bobbin:** PQ2016, 6+6Pin
3	**Wire:** Φ0.25mm, 2UEW, Class B
4	**Wire:** Φ0.15mm, 2UEW, Class B
5	**Triple Insulation Wire:** Φ0.5mm TIW
6	**Tape:** 10mm(W)×0.06mm(TH)

Test Result

1. Input characteristics

1.1 Maximum rated input AC current

Standard: 2Amax. @ 90Vac input & full load

Result: Pass

VIN(AC)	90Vac	Iin_max limit(A)	**Result**
Iout	0.56A	2A	**PASS**

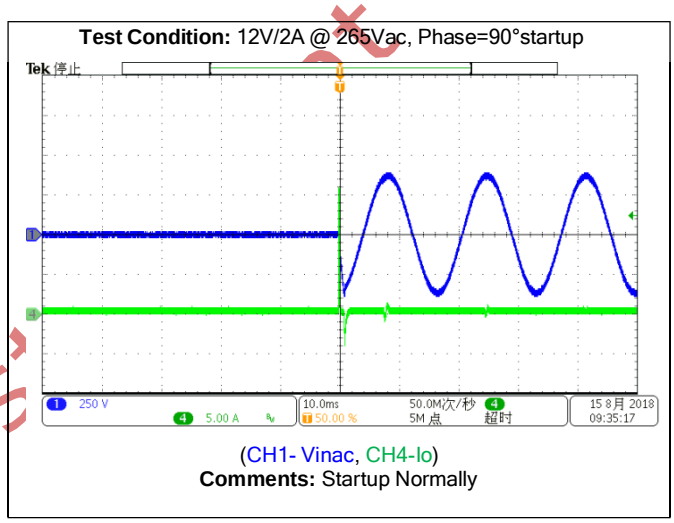
1.2 Inrush current (cold start)

Standard: 30Amax. @ 265Vac input

Result: Pass

VIN(AC)	Iinrush	Iin_max limit(A)	**Result**
265Vac	16A	30A	**PASS**

Waveforms：

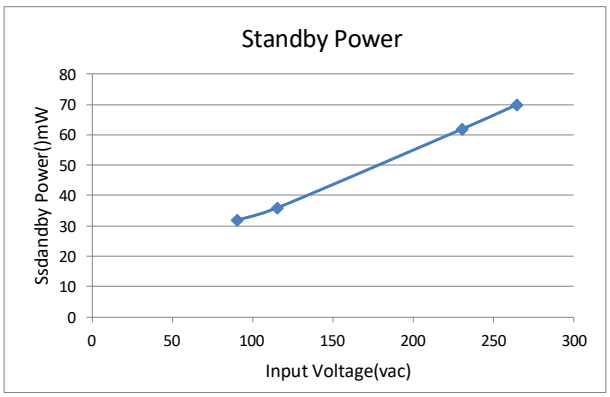


1.3 No load input power dissipation

Standard: while input 90Vac~265Vac and the output is no load, the input power loss must be less than 75mW.

Result: Pass

VIN(AC)	90	115	230	265	green mode limit(A)	**Result**
Po=0W	32	36	62	70	mW	**PASS**

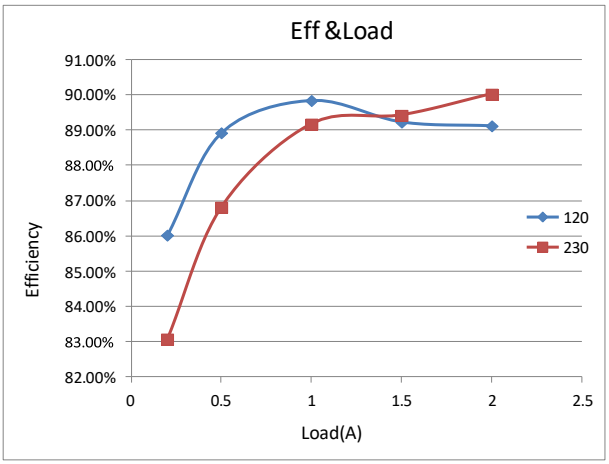


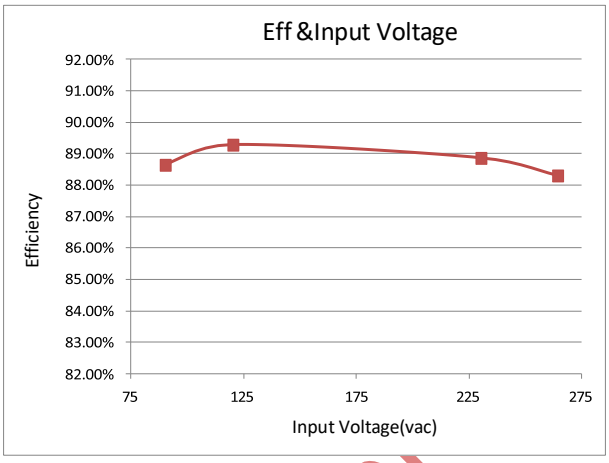
1.4 Average efficiency

Standard: The average efficiency tested on board end meets CoC V5 tier 2 with 2% margin @115Vac and 230Vac, CoC V5 requirement for 12V2A system is 86.8%.

Result: Pass

Vin(Vac)	Fline(Hz)	Pin(W)	Vout(V)	Iout(A)	Pout(W)	Eff	Eff_AVG	CoC V5
90	60	2.82	12.13	0.2	2.426	86.03%	/	76.8%
		6.81	12.13	0.5	6.065	89.06%	88.64%	86.8%
		13.6	12.12	1	12.12	89.12%		
		20.51	12.1	1.5	18.15	88.49%		
		27.54	12.1	2	24.2	87.87%		
120		2.82	12.13	0.2	2.426	86.03%	/	76.8%
		6.82	12.13	0.5	6.065	88.93%	89.28%	86.8%
		13.49	12.12	1	12.12	89.84%		
		20.34	12.1	1.5	18.15	89.23%		
		27.13	12.09	2	24.18	89.13%		
230	50	2.92	12.13	0.2	2.426	83.08%	/	76.8%
		6.98	12.12	0.5	6.06	86.82%	88.86%	86.8%
		13.58	12.11	1	12.11	89.18%		
		20.28	12.09	1.5	18.135	89.42%		
		26.86	12.09	2	24.18	90.02%		
265		2.98	12.13	0.2	2.426	81.41%	/	76.8%
		7.01	12.12	0.5	6.06	86.45%	88.30%	86.8%
		13.83	12.1	1	12.1	87.49%		
		20.26	12.09	1.5	18.135	89.51%		
		26.92	12.08	2	24.16	89.75%		





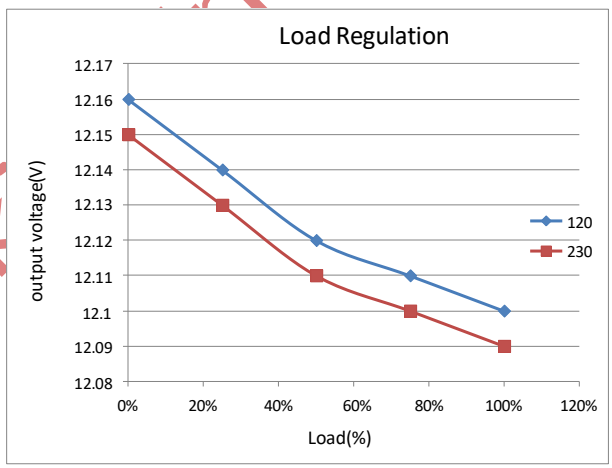
2. Output characteristics

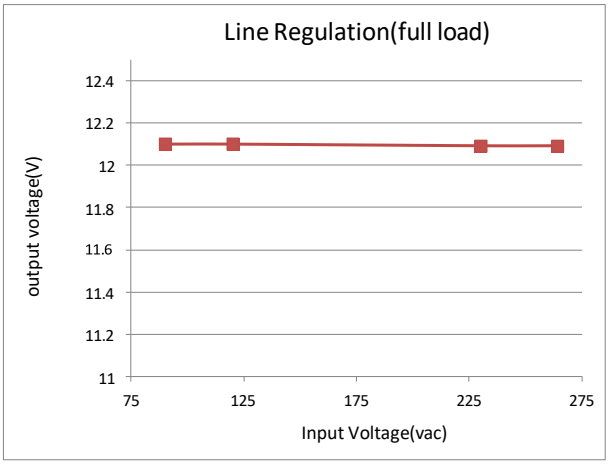
2.1 Output line regulation and load regulation

Standard: under the input voltage 90Vac~265Vac, Line regulation <6%, Load regulation <6%. The output voltage was tested at board end.

Result: Pass

Input Voltage	Output Voltage					Load Regulation
	0% Load	25% Load	50% Load	75% Load	Full Load	
90Vac/60Hz	12.15	12.14	12.13	12.11	12.10	0.4%
115Vac/60Hz	12.16	12.14	12.12	12.11	12.10	0.5%
230Vac/50Hz	12.15	12.13	12.11	12.10	12.09	0.5%
264Vac/50Hz	12.15	12.13	12.11	12.10	12.09	0.5%
Line Regulation	0.08%	0.08%	0.08%	0.08%	0.08%	





2.2 Ripple & noise

Standard: under the input voltage 90Vac~265Vac, Vripple_max<150mVpp

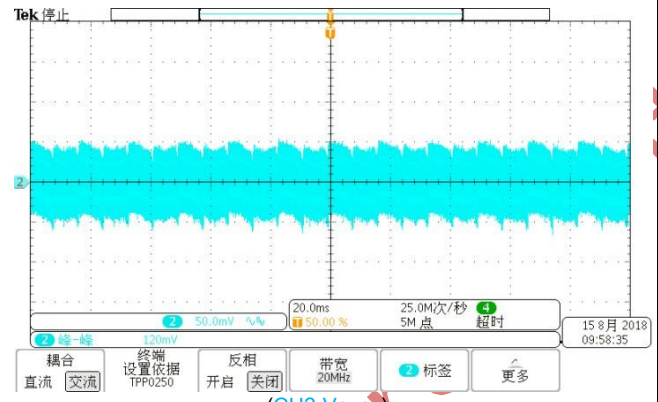
Result: Pass

Note: Ripple & noise were measured at board end with a 0.1uF/50V ceramic cap connected in parallel with a 10uF/50V electrolytic cap. Bandwidh was limited to 20Mhz.

Input Voltage	Ripple & noise	
	No Load(mV)	Full Load(mV)
90Vac/60Hz	70	140
115Vac/60Hz	48	120
230Vac/50Hz	64	108
264Vac/50Hz	64	110

Waveforms (115Vac & 230Vac):

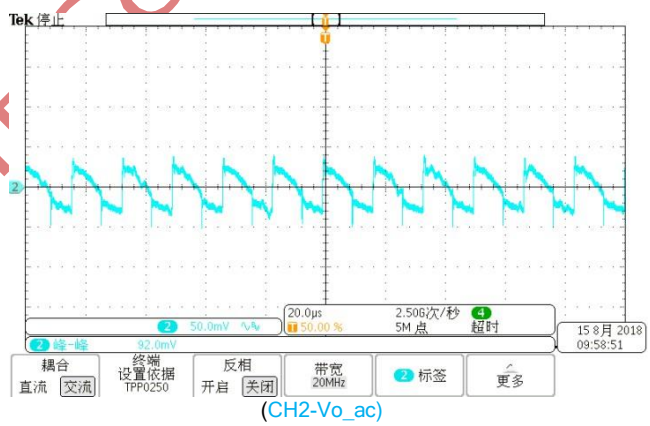
Test Condition: 115Vac/50Hz Input, 12V2A Output



(CH2-Vo_ac)

Comments: Vo_ripple_pp=120mV

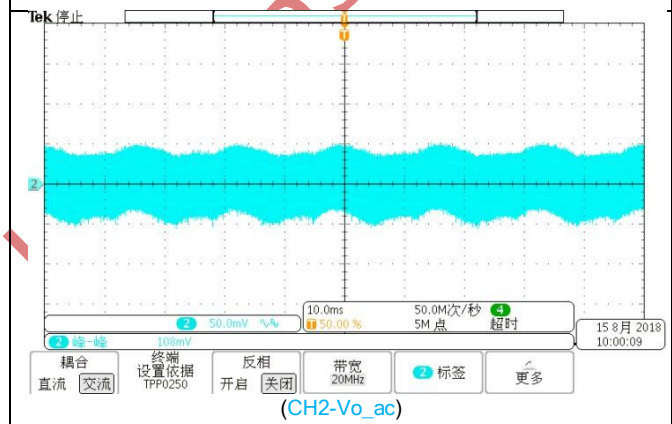
Test Condition: 115Vac/50Hz Input, 12V2A Output



(CH2-Vo_ac)

Comments: Vo_ripple_pp=92mV

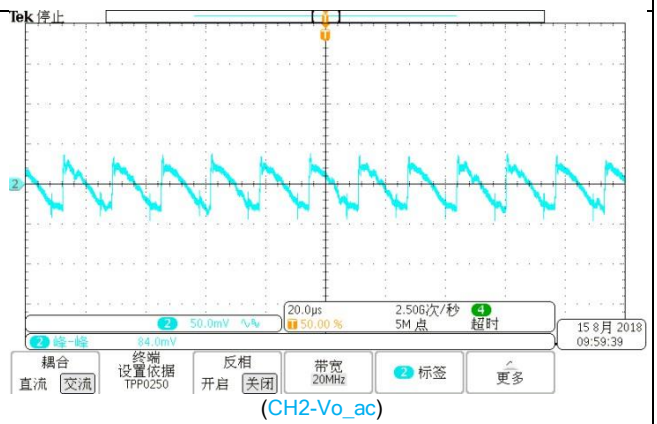
Test Condition: 230Vac/50Hz Input, 12V2A Output



(CH2-Vo_ac)

Comments: Vo_ripple_pp=108mV

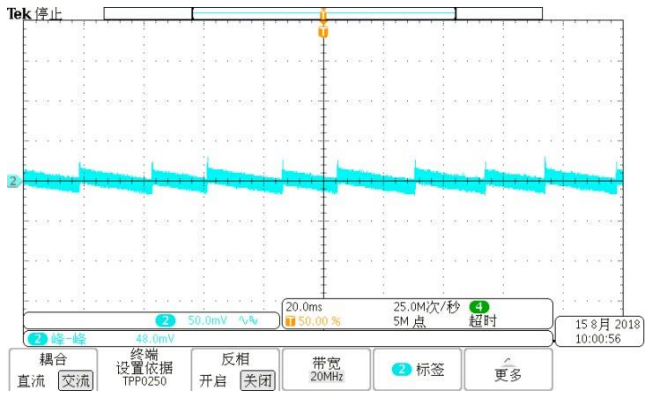
Test Condition: 230Vac/50Hz Input, 12V2A Output



(CH2-Vo_ac)

Comments: Vo_ripple_pp=84mV

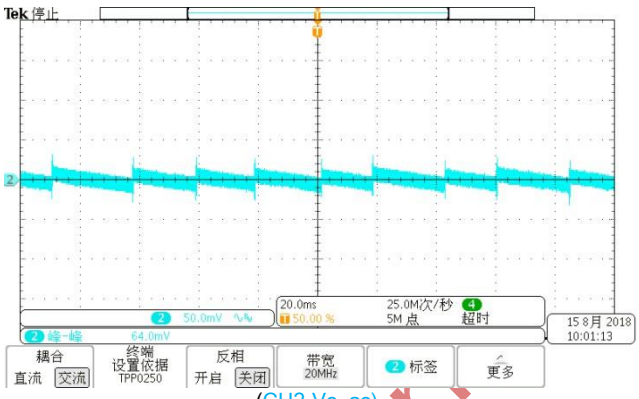
Test Condition: 115Vac/50Hz Input, 12V0A Output



(CH2-Vo_ac)

Comments: Vo_ripple_pp=48mV

Test Condition: 230Vac/50Hz Input, 12V0A Output



(CH2-Vo_ac)

Comments: Vo_ripple_pp=64mV

2.3 Overshoot and Undershoot

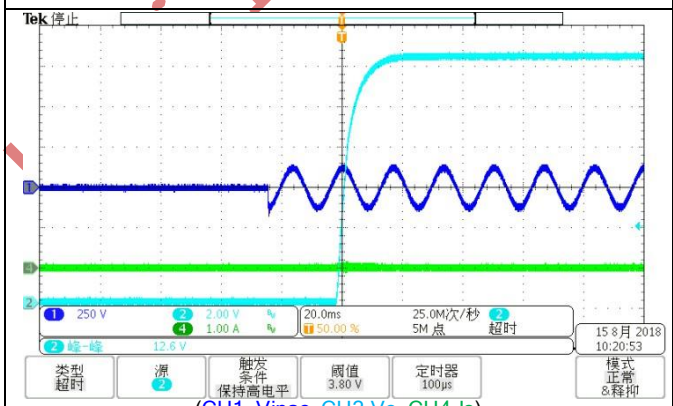
Standard: under the input voltage 90Vac~265Vac, the overshoot and undershoot should less than ±5% normal voltage.

Result: Pass

Input Voltage	Load	Item	Test Result	Remark
90Vac/60Hz	Full Load	Overshoot	None	Pass
		Undershoot	None	Pass
	No Load	Overshoot	None	Pass
264Vac/50Hz	Full Load	Overshoot	None	Pass
		Undershoot	None	Pass
	No Load	Overshoot	None	Pass

Waveforms:

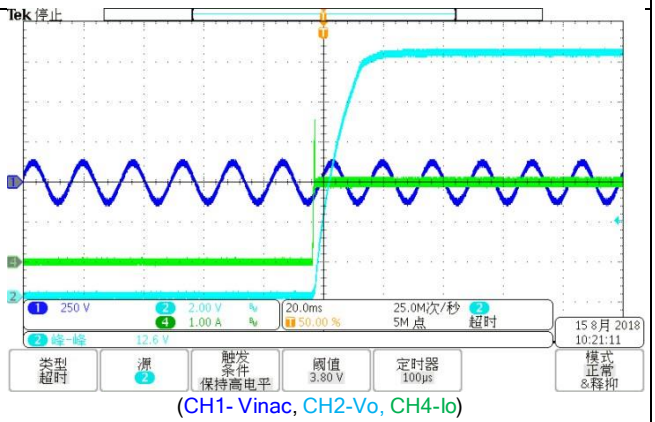
Test Condition: 12V/0A @ 90Vac



(CH1- Vinac, CH2-Vo, CH4-Io)

Comments: No overshoot

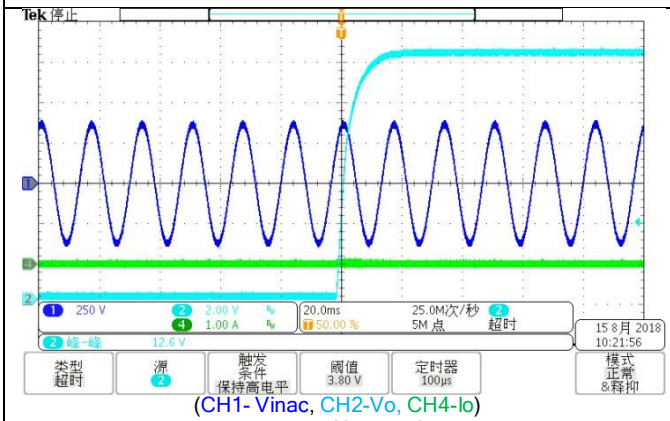
Test Condition: 12V/2A @ 90Vac



(CH1- Vinac, CH2-Vo, CH4-Io)

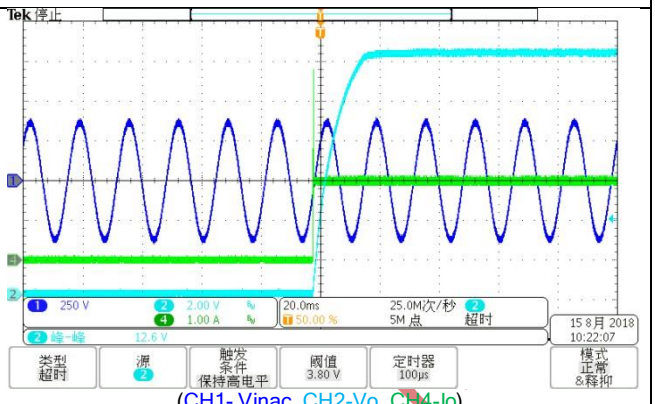
Comments:,No overshoot

Test Condition: 12V/0A @ 265Vac



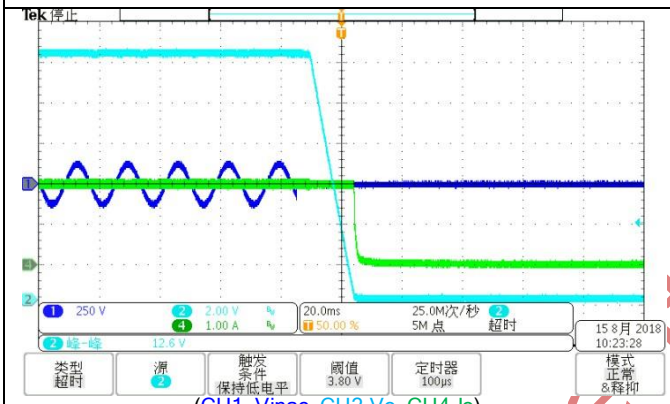
(CH1- Vinac, CH2-Vo, CH4-Io)
Comments: No overshoot

Test Condition: 12V/2A @ 265Vac



(CH1- Vinac, CH2-Vo, CH4-Io)
Comments:,No overshoot

Test Condition: 12V/2A @ 90Vac



(CH1- Vinac, CH2-Vo, CH4-Io)
Comments: No Undershoot

(

2.4 Load Transient Test

Standard: under the input voltage 90Vac~265Vac, the output Voltage transient response should be within ±10% normal voltage.

Result: Pass

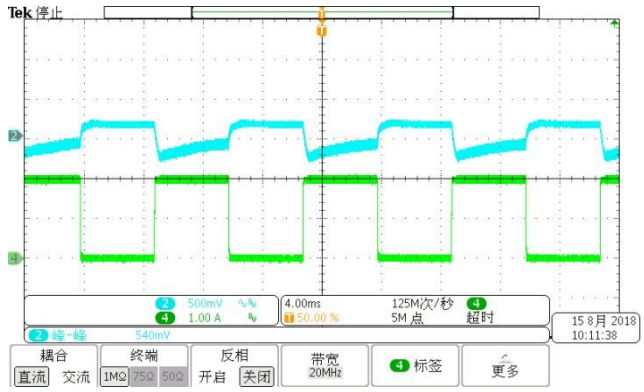
Note: 1.0% load shift to 100% load with 1A/us changing ramp and 100Hz changing frequency.

Input Voltage	Output Voltage(~ac)	Remark
90Vac/60Hz	540mv	Pass
115Vac/60Hz	520mv	Pass
230Vac/50Hz	500mv	Pass
264Vac/50Hz	500mv	Pass

Waveforms:

Test condition: Load 0-2A, frequency 100Hz, duty Cycle=50%, slew rate=1A/us

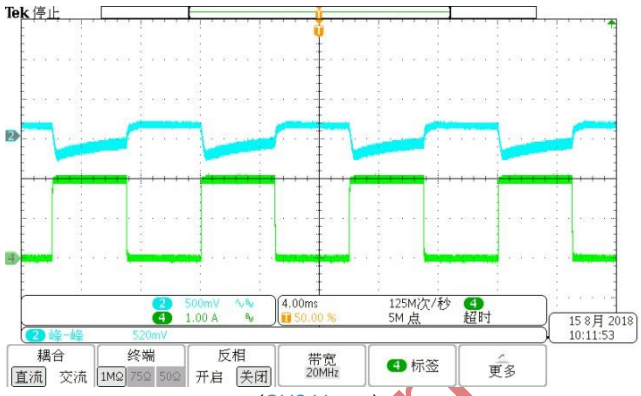
90Vac/60Hz Input



(CH2-Vo_ac)

Comments: Vo_ripple_pp=540mV

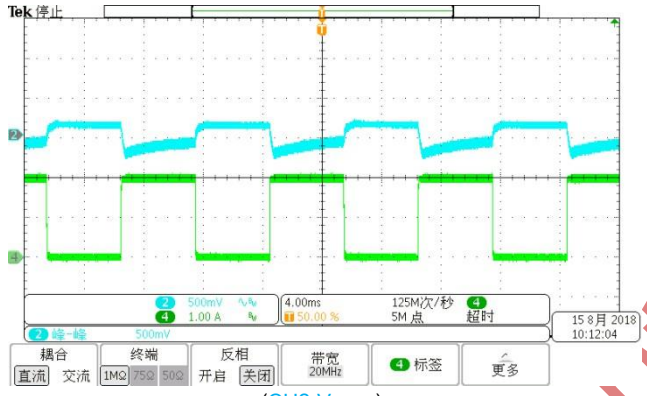
115Vac/60Hz Input



(CH2-Vo_ac)

Comments: Vo_ripple_pp=520mV

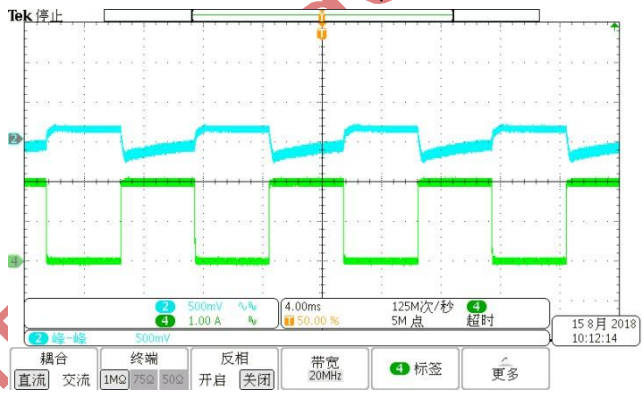
230Vac/50Hz Input



(CH2-Vo_ac)

Comments: Vo_ripple_pp=500mV

265Vac/50Hz Input



(CH2-Vo_ac)

Comments: Vo_ripple_pp=500mV

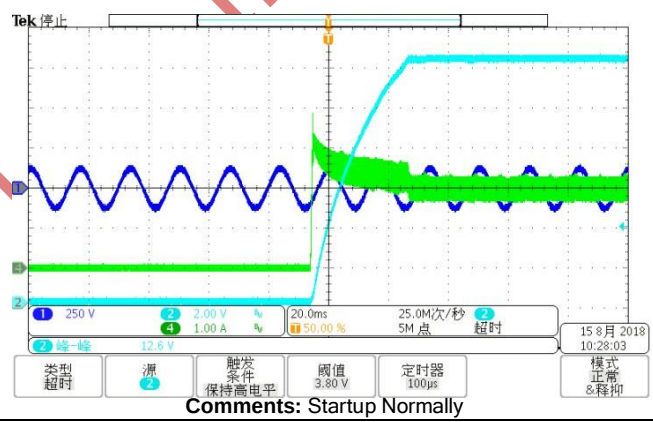
2.5 Capacitive Load Startup Test

Standard: while capacitance load is 1500uF, the power supply can turn on normally and the output is in the rated range.

Result: Pass

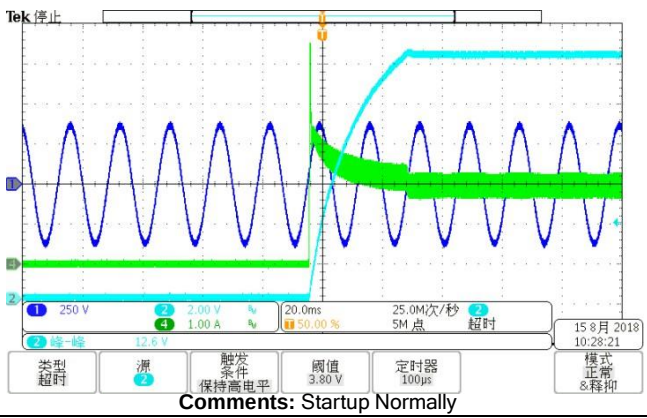
Waveforms:

Test Condition: Load=1500uF, 12V/2A @ 90Vac



Comments: Startup Normally

Test Condition: Load=1500uF, 12V/2A @ 265Vac



Comments: Startup Normally

2.6 Startup Time and Holdup Time

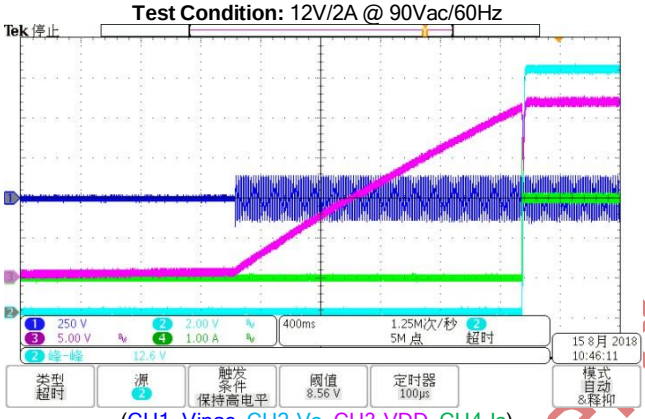
Standard: 1.the startup time should be less than 3s @90Vac. 2. The holdup time should be larger than 10ms @115Vac;

Result: Pass

Item	Input Voltage	Test Data	Remark	Note
Startup Time	90Vac	2s	Pass	Full Load
Holdup Time	115Vac	13ms	Pass	Cut off the Vac while Vbus voltage reached the lowest voltage

Waveforms:

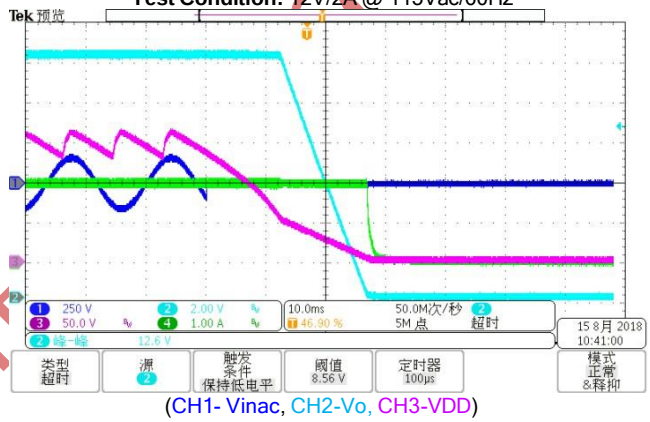
Test Condition: 12V/2A @ 90Vac/60Hz



(CH1- Vinac, CH2-Vo, CH3-VDD, CH4-Io)

Comments: Tfall=2s

Test Condition: 12V/2A @ 115Vac/60Hz



(CH1- Vinac, CH2-Vo, CH3-VDD)

Comments: Tfall=13ms,No overshoot

2.7 Output Voltage Rise Time and Fall Time

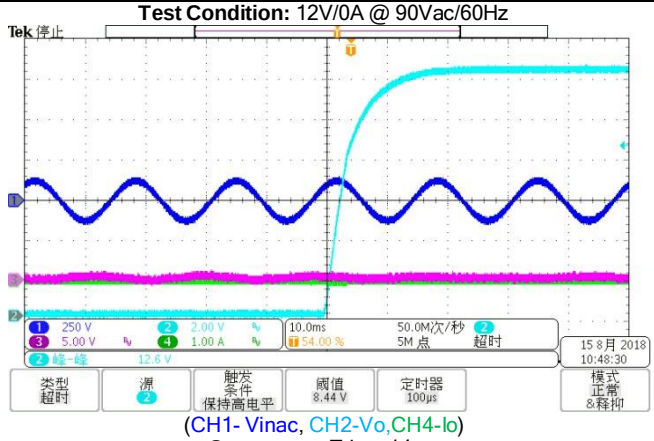
Standard: Under full load test, the output voltage rise time should be less than 50ms and the fall time should be less than 20ms.

Result: Pass

Input Voltage	Load	Item	Test Result	Note
90Vac/60Hz	Full Load	Trise	15ms	
		Tfall	15ms	
	No Load	Trise	14ms	
264Vac/50Hz	Full Load	Trise	16ms	
		Tfall	15ms	
	No Load	Trise	14ms	

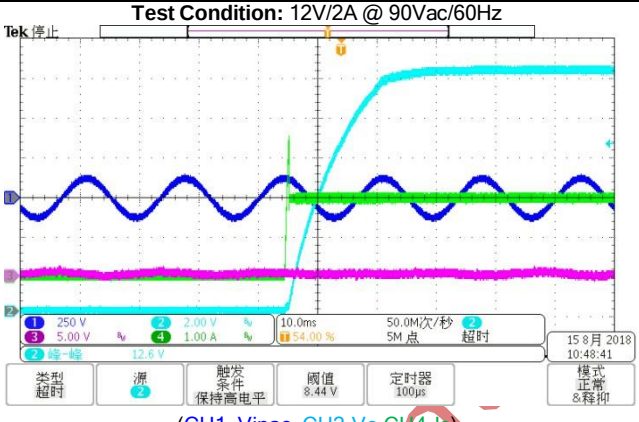
Waveforms:

Test Condition: 12V/0A @ 90Vac/60Hz



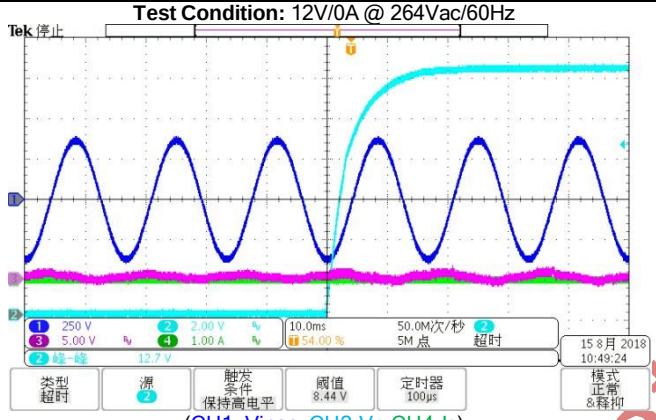
(CH1- Vinac, CH2-Vo,CH4-Io)
Comments: Trise=14ms

Test Condition: 12V/2A @ 90Vac/60Hz



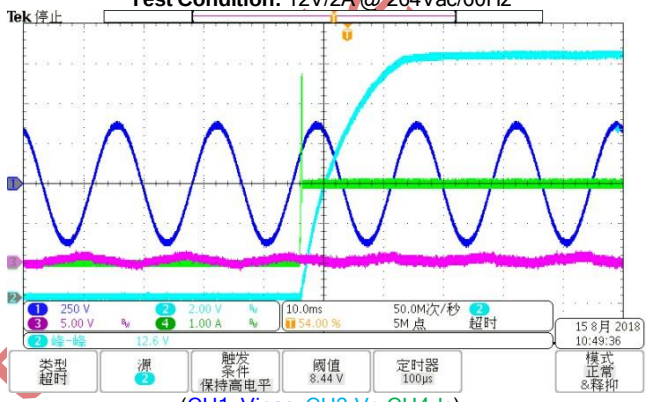
(CH1- Vinac, CH2-Vo,CH4-Io)
Comments: Trise=15ms

Test Condition: 12V/0A @ 264Vac/60Hz



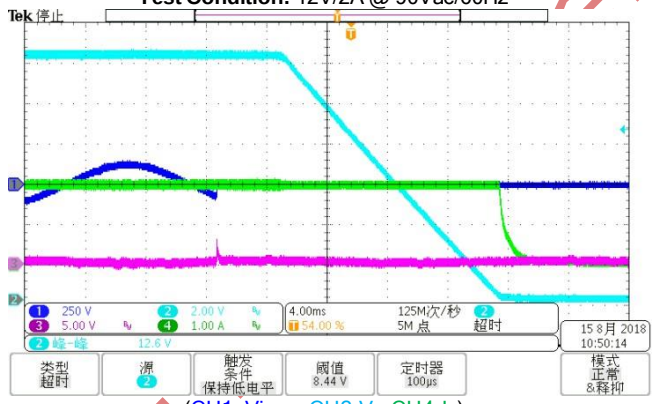
(CH1- Vinac, CH2-Vo,CH4-Io)
Comments: Trise=14ms

Test Condition: 12V/2A @ 264Vac/60Hz



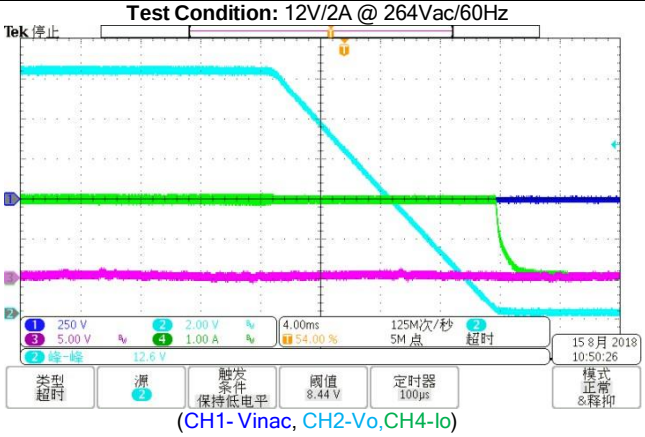
(CH1- Vinac, CH2-Vo,CH4-Io)
Comments: Trise=16ms

Test Condition: 12V/2A @ 90Vac/60Hz



(CH1- Vinac, CH2-Vo,CH4-Io)
Comments: Tfall=15ms

Test Condition: 12V/2A @ 264Vac/60Hz



(CH1- Vinac, CH2-Vo,CH4-Io)
Comments: Trise=15ms

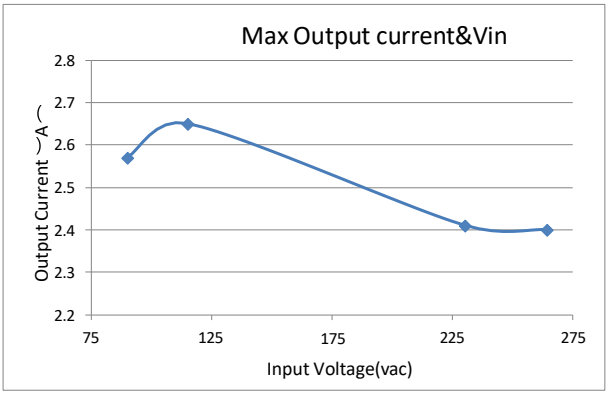
3. Output characteristics

1.1 Over current protection

Standard: OCP point limited is between 110%~130% full load current.

Result: Pass

Input Voltage(Vac)	90	115	230	265	**Remark**
OCP Current(A)	2.57	2.65	2.41	2.40	



1.2 Short circuit protection

Standard: the power supply must shut-down in the event of a short circuit and automatically return to normal operating condition once the fault condition has been removed. And the peak input power should be less than 5W.

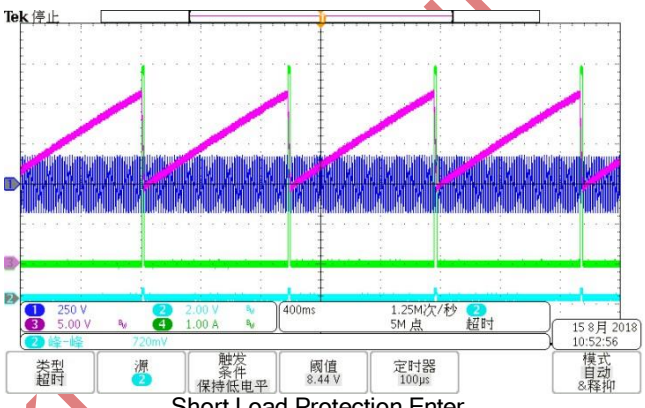
Result: Pass

Test Data:

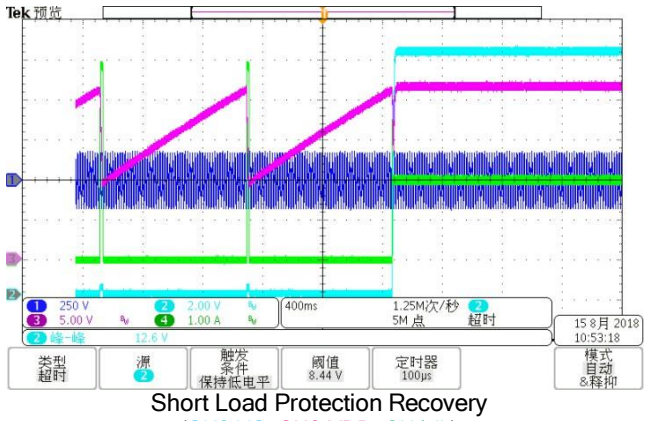
Input Voltage(Vac)	90	115	230	265	**result**
Pin(W)	0.41	0.44	0.71	1.05	**PASS**

Waveforms:

Test Condition: 115Vac/60Hz Input, Output short

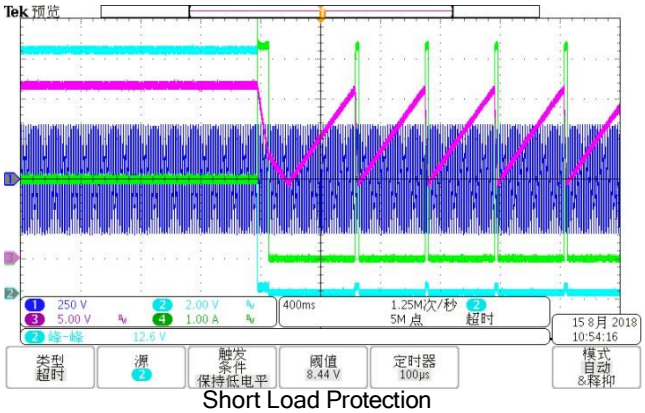


Short Load Protection Enter
(CH2-VO, CH3-VDD, CH4-IL)
Comments: OK

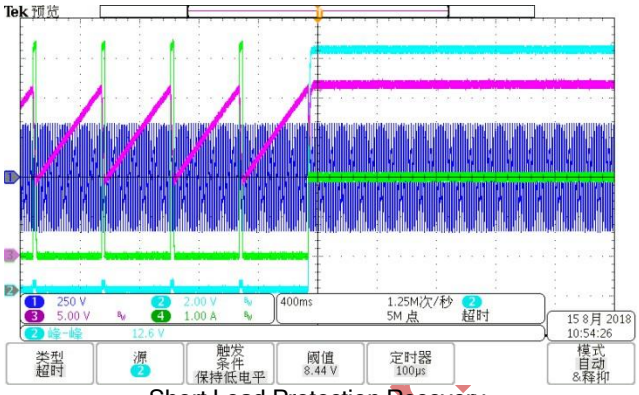


Short Load Protection Recovery
(CH2-VO, CH3-VDD, CH4-IL)
Comments: OK

Test Condition: 230Vac/50Hz Input, Output short



Short Load Protection
(CH2-VO, CH3-VDD, CH4-IL)
Comments: OK



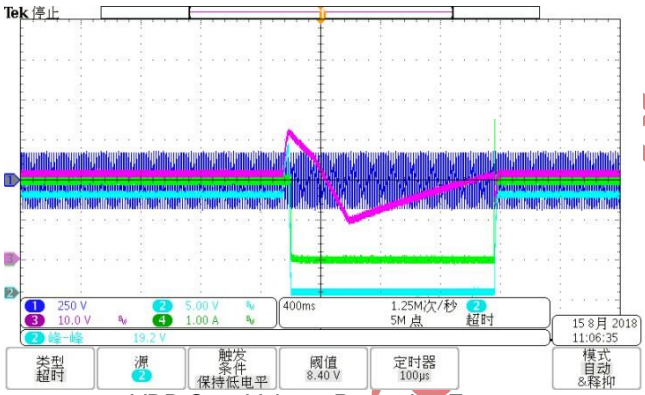
Short Load Protection Recovery
(CH2-VO, CH3-VDD, CH4-IL)
Comments: OK

1.3 Over voltage protection

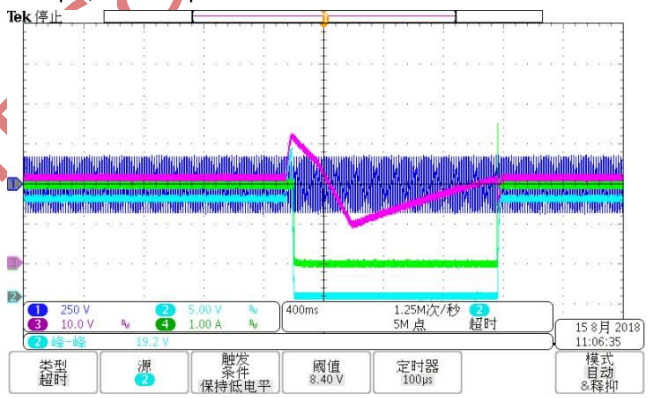
Standard: OVP point limit: <150%.

Result: Pass

Test Condition: 115Vac60Hz Input, 12VA Output

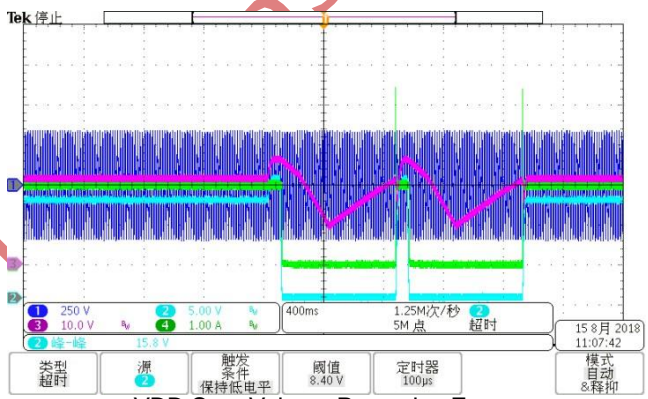


VDD Over Voltage Protection Enter
(CH2-VO, CH3-VDD, CH4-IL)
Comments: OK

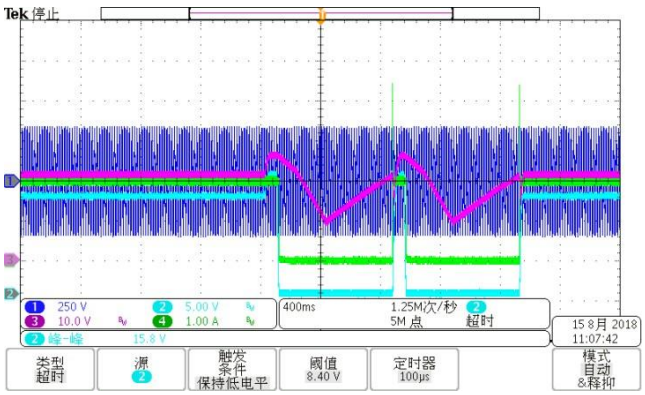


VDD Over Voltage Protection Recovery
(CH2-VO, CH3-VDD, CH4-IL)
Comments: OK

Test Condition: 230Vac/50Hz Input, Output short



VDD Over Voltage Protection Enter
(CH2-VO, CH3-VDD, CH4-IL)
Comments: OK



VDD Over Voltage Protection Recovery
(CH2-VO, CH3-VDD, CH4-IL)
Comments: OK

2. Reliability requirements

2.1 Device Maximum Rating Test

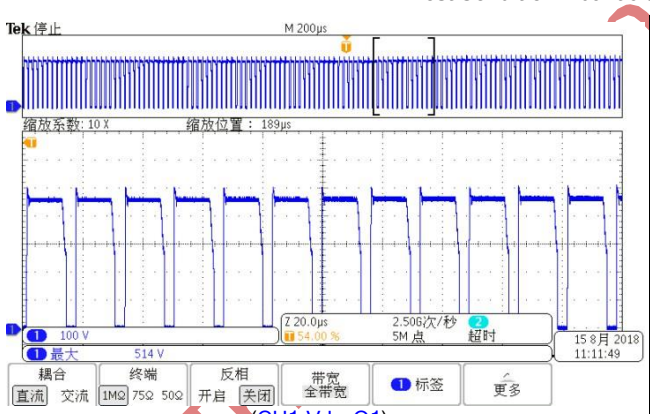
Standard: MOSFET and Diode<95% Vrrm; Bmax<0.31T.

Result: Pass

Input Voltage	Component	Test Condition	Test Result	Note
264Vac/50Hz	Q1 AM12N65	Startup	518V	
		Steady State	514V	
		Output Short	470V	
	D6 PTR20L80CT	Startup	71.2V	
		Steady State	74.4V	
		Output Short	61.6V	
	Transformer Core	Startup	0.24T	
		Steady State	0.31T	

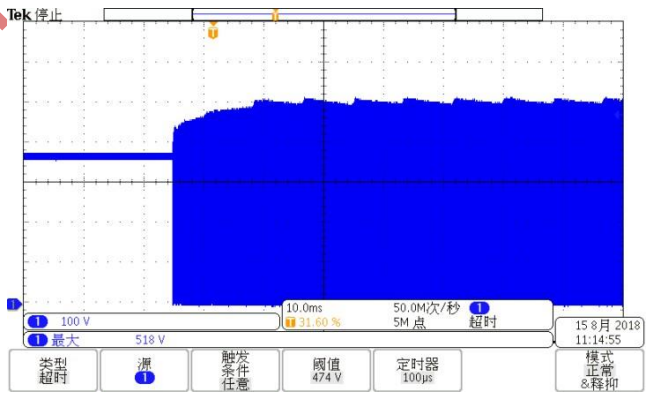
Waveforms:

Test Condition: 265Vac/50Hz Input, 12V2A Output,



(CH1-Vds_Q1)

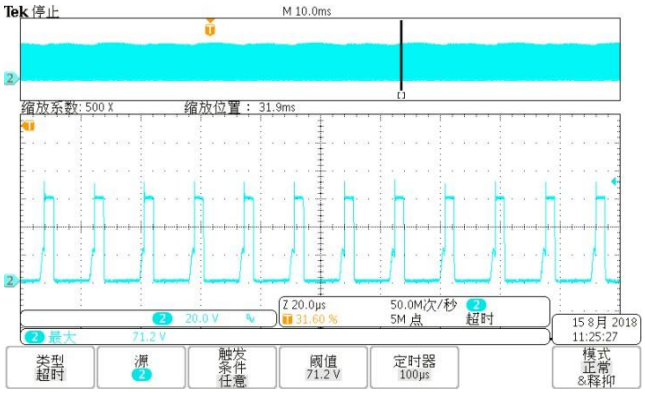
Comments: Vds_Q1=514V



(CH1-Vds_Q1)

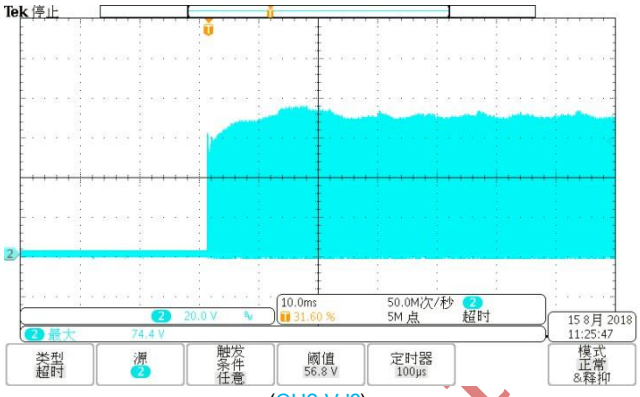
Comments: Vds_Q1=518V

Test Condition: 265Vac/50Hz Input, 12V2A Output



(CH2-Vd6)

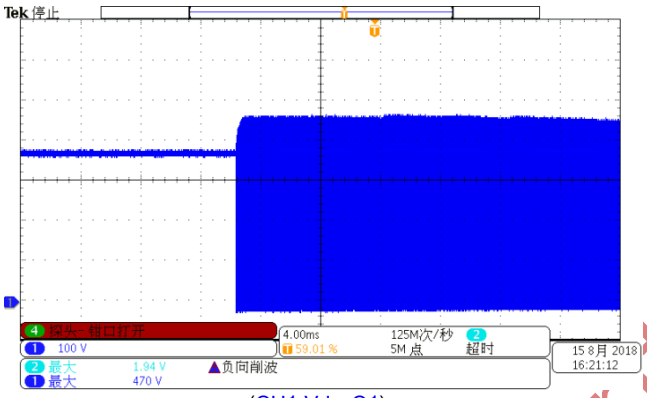
Comments: Vdiode=71.2V



(CH2-Vd6)

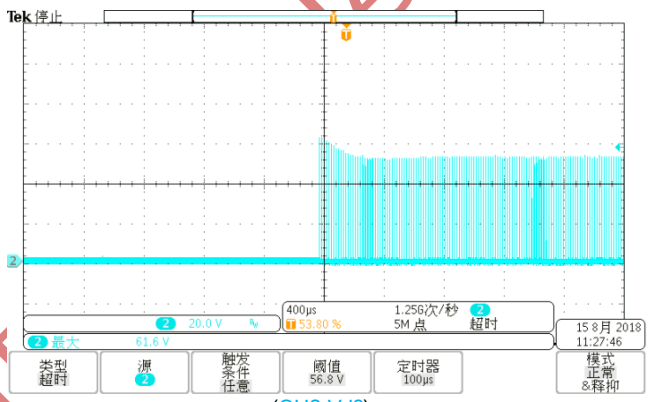
Comments: Vdiode=74.4V

Test Condition: 265Vac/50Hz Input, 12V2A Output short



(CH1-Vds_Q1)

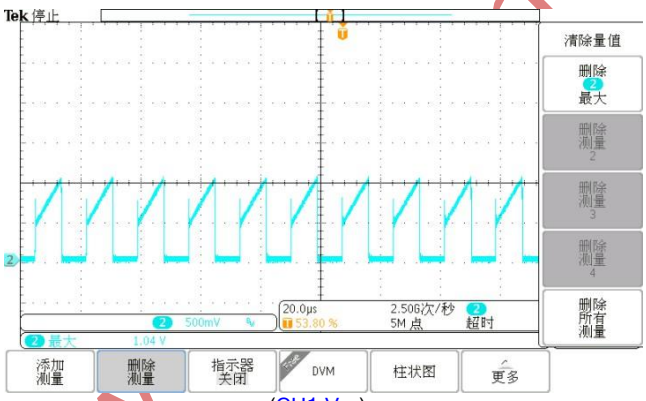
Comments: Vds_Q1=470V



(CH2-Vd6)

Comments: Vdiode =61.6V

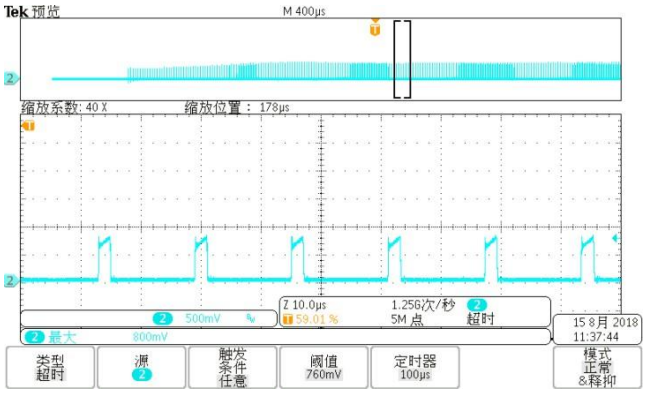
Test Condition: 90Vac/50Hz Input, 12VA Output Steady State



(CH1-Vcs)

Comments: ILpk=1.04V/1.1R=0.95A,Bmax=0.31T

Test Condition: 90Vac/50Hz Input, 12V2A Output Startup



(CH1-Vcs)

Comments: ILpk=0.8V/1.1R=0.73A,Bmax=0.24T

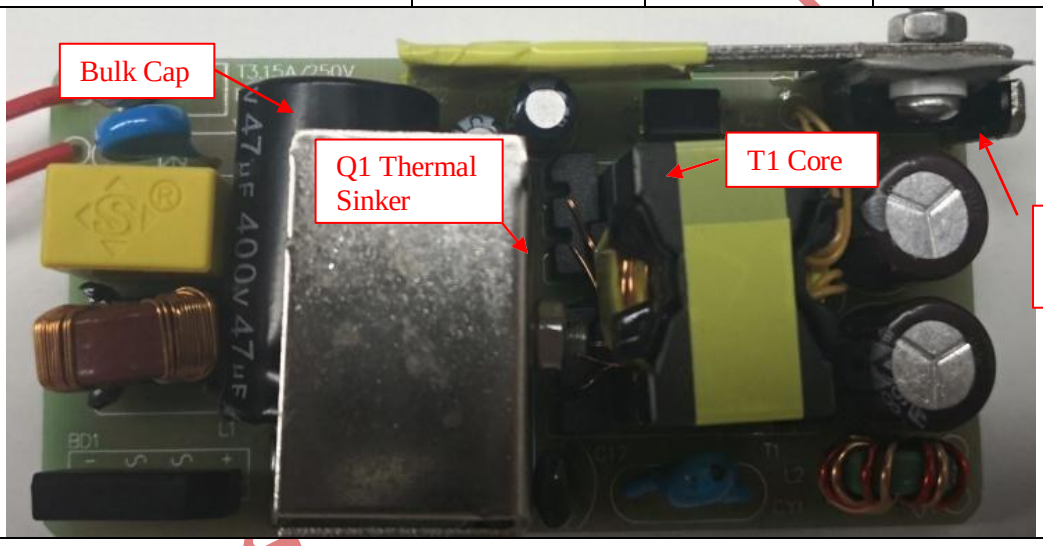
2.2 Thermal Test

Standard: MOS, IC and Diode: Ta=40℃,Δ T<75℃. Transformer: Ta=40℃, Δ T<70℃.

Result: Pass

Test Condition: 90Vac/60Hz, 265Vac/50Hz; 12V2A output; Burn-in 1Hour @ confined container (25cm*17cm*10cm cardboard box) and steady environment with no airflow, Ta is the temperature inside the cardboard box.

Component	90Vac		265Vac	
	Ta=36℃		Ta=35℃	
	T(ºC)	Trise(ºC)	T(ºC)	Trise(ºC)
Bulk Cap	60	24	55	20
Q1Thermal Sinker	63	27	59	24
T1 Core	68	32	70	35
D6 Diode	72	36	71	36



3. EMC/EMS Test Result

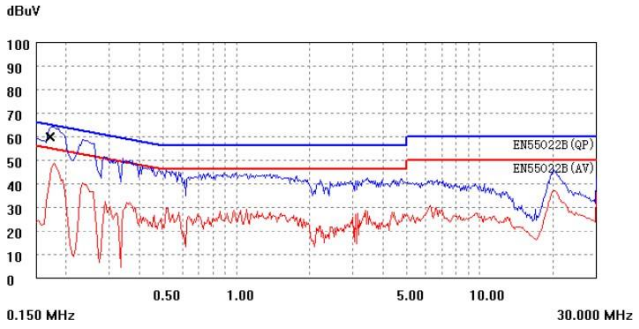
Standard：

standard	EN55022B/55032B
content	CE & RE
requirement	6dB margin

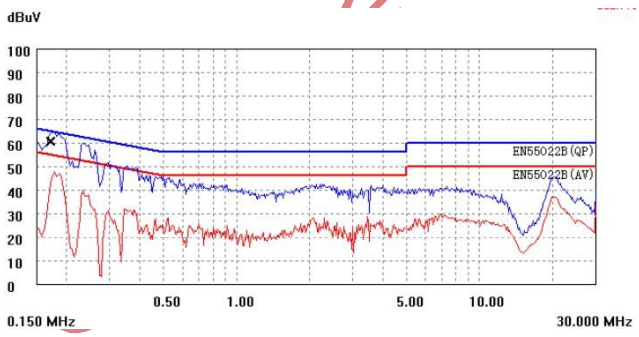
3.1 Conducted Emissions

Result：Pass

Test Condition: Vin=110VAC/60Hz, Vout=12V, Io=2A

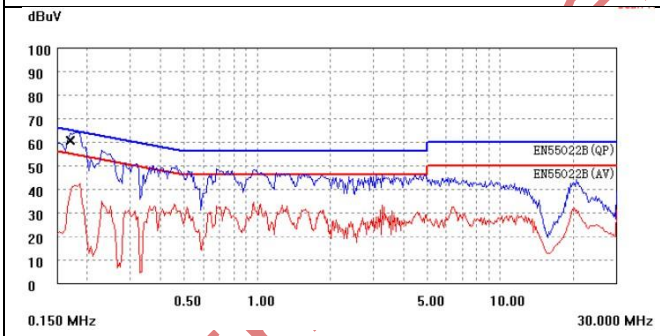


Conduction EMI---LINE

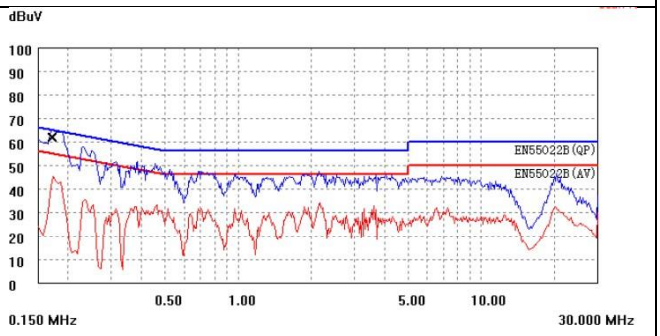


Conduction EMI---NEUTRAL

Test Condition: Vin=230VAC/50Hz, Vout=12V, Io=2A

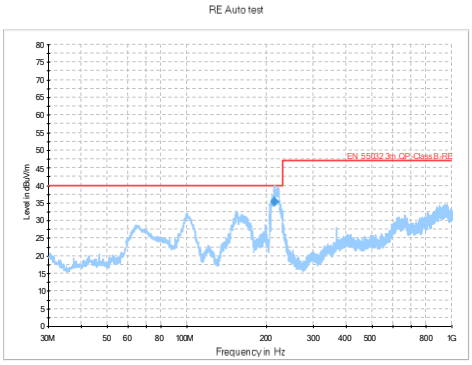
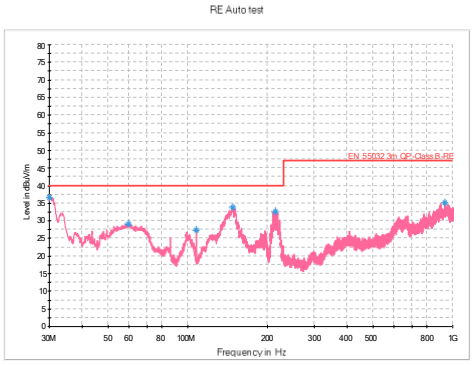
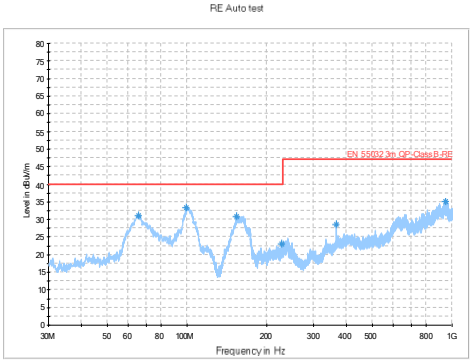
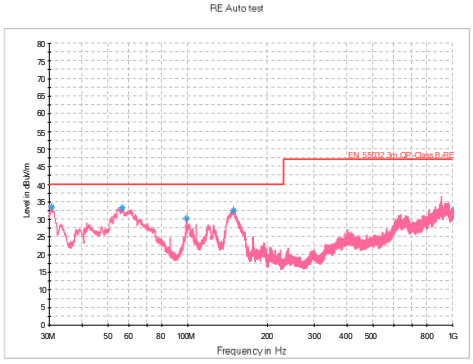


Conduction EMI---LINE



Conduction EMI---NEUTRAL

3.2 Radiated Emissions

Test Condition: Vin=110VAC/50Hz, Vout=12V, Io=2A	
 Radiation (Horizontal)	 Radiation (Vertical)
Test Condition: Vin=110VAC/50Hz, Vout=12V, Io=2A	
 Radiation (Horizontal)	 Radiation (Vertical)

3.3 Surge Test

Line to Line 2kV surge testing was completed according to IEC61000-4-5. Input voltage was set at 230VAC/50Hz. Output was loaded at full load and operation was verified following each surge event. Each injection phase below is tested with 5 times and hold for 60 seconds before next one.

Input Voltage (VAC)	Surge Level (V)	Injection Location	Injection Phase (°)	Test Result (Pass/Fail)
230Vac/50Hz	+2000	L to N	0	Pass
	+2000	L to N	90	Pass
	+2000	L to N	180	Pass
	+2000	L to N	270	Pass
	-2000	L to N	0	Pass
	-2000	L to N	90	Pass
	-2000	L to N	180	Pass
	-2000	L to N	270	Pass
	+1000	L to N	5	Pass
	-1000	N to L	5	Pass
	-1000	N to L	5	Pass

Test Setup Guide

1. Connect the “V+” and “V-” terminal to the positive and negative end of the load.
2. Set the AC Power Source between 90VAC and 265VAC.
3. Connect the AC Power Source terminal to the “L” and “N” terminals on the Demo Board
4. Turn on the AC Power Source to make system startup; and Turn off the AC Power Source to make system shutdown.

Revision History

DATE	REV	DESCRIPTION
2017/12/18	1.0	First Release
2018/08/15	1.1	Optimize efficiency and EMI, Update Test Result

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