



DEMO BOARD TEST REPORT

A 60W Universal Input High Performance Two Stage Dimmable LED Driver with KP2813A+KP1601+KP1402

FEATURES

- Universal Input Voltage Range From 100~300Vac
- High PF >0.95 & Low THD <10%
- Harmonics Meets IEC61000-3-2 Class C
- No flicker with Low Output Ripple
- Compatible with Multiple Dimming Methods:
 - Voltage Potential: 0/1V to 10V, 10-0/1V
 - PWM Dimming: 0.4k to 2kHz
 - Resistor Dimming: 0 to 100k Ohm
- Less than 150mW Standby Power
- Excellent Line Regulation and Load Regulation >6dB Margin for CE and CDN Test

APPLICATIONS

- LED Panel light
- LED Down Light & Spot light

INTRODUCTION

The DEMO board is a high performance two stage isolated dimmable LED driver. The 1st stage is a High PF flyback with primary constant voltage controller KP2813A, the 2nd stage is a high-precision step-down with dimmable controller KP1601, and dimming signal converter is a 3-in-1 dimming controller KP1402.

This DEMO board is controlled by multiple dimmer (as 0-10V dimmer, 10V PWM dimmer and resistor), and dimming range from 7%~100% , it supports dimming off mode and it consumes a very low standby power from Line.

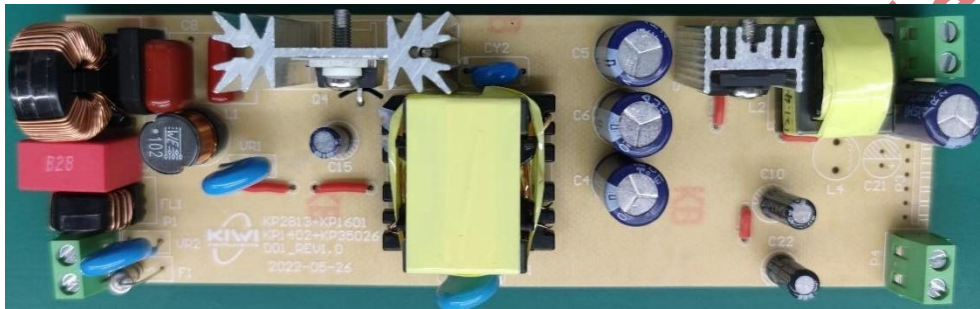
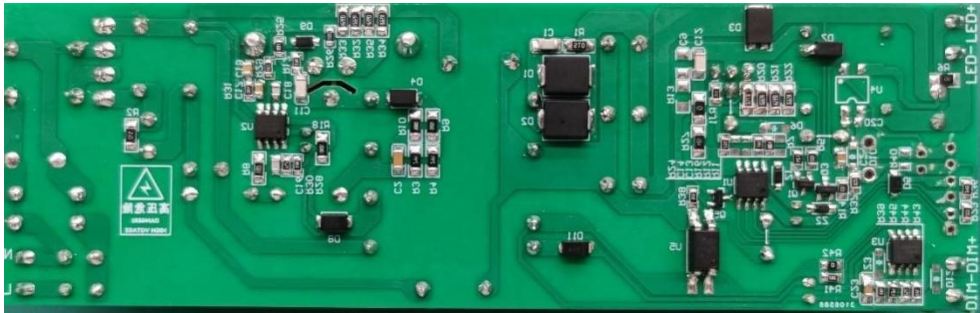
The Demo Board is typically designed for the 60W output and universal input from 100Vac to 300 Vac.

DEMO BOARD SEPCIFICATION

Description	Symbol	Min.	Typ.	Max.	Unit	Note
Input Voltage	V _{in}	100		300	Vac	50/60Hz
Output Voltage	V _{out}	20		40	Vdc	
Output Current	I _{out}		1.5		A	
Total Output Power	P _{out}	30		60	W	
Dimming Range	Dim	7		100	%	
System Power Factor	PF	>0.95			%	100Vac-277Vac 40V1.5A
System Harmonic	THD	<10%			%	100Vac-277Vac 40V1.5A
System Average Efficiency	η	>85			%	Full load
Standby Power	P _{loss}			150	mW	100Vac-277Vac
Startup Time	T _{st}			0.5	S	Tested at 100Vac/60Hz
EMI Margin		6			dB	EN55015
Surge Test		1			kV	Differential Mode @ 230Vac/50Hz

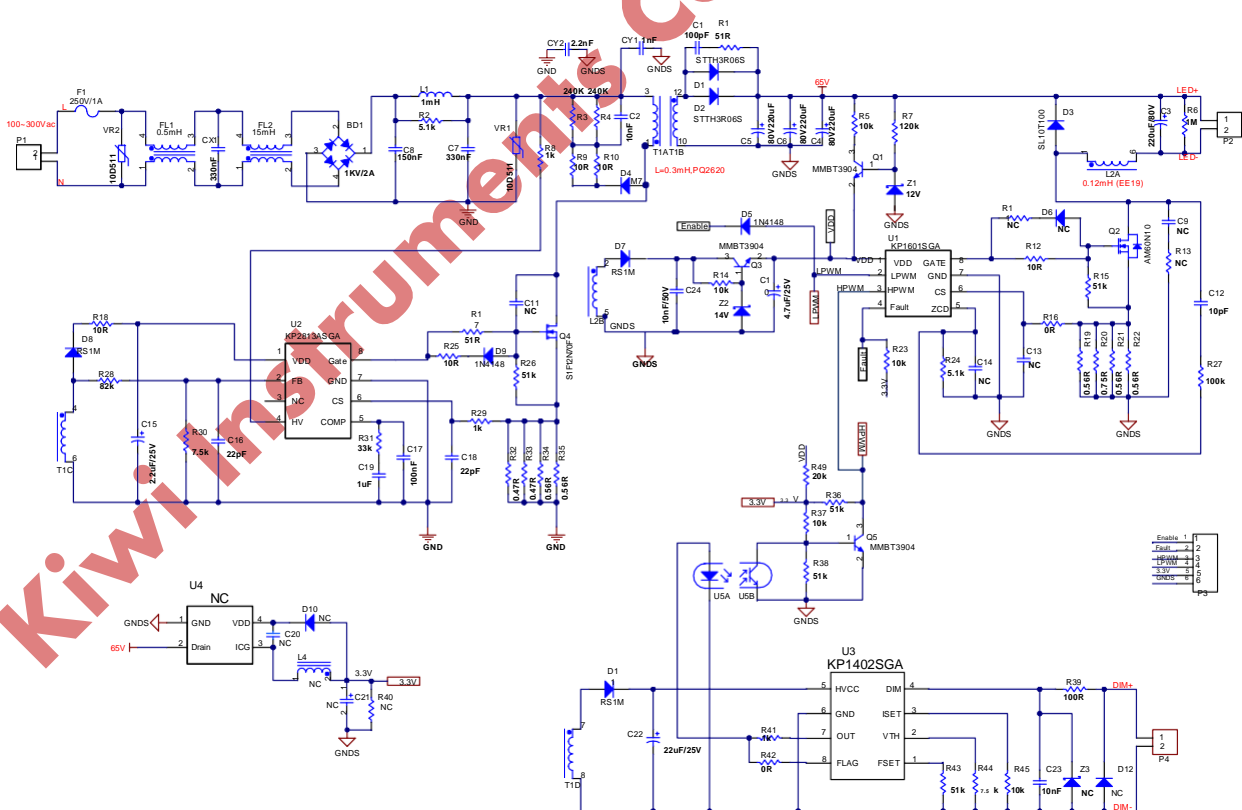
Note: The table above shows the minimum acceptable performance of the design. Actual performance is listed in the results section.

Demo Board of 60W Universal Input High Performance Two Stage Dimmable LED Driver

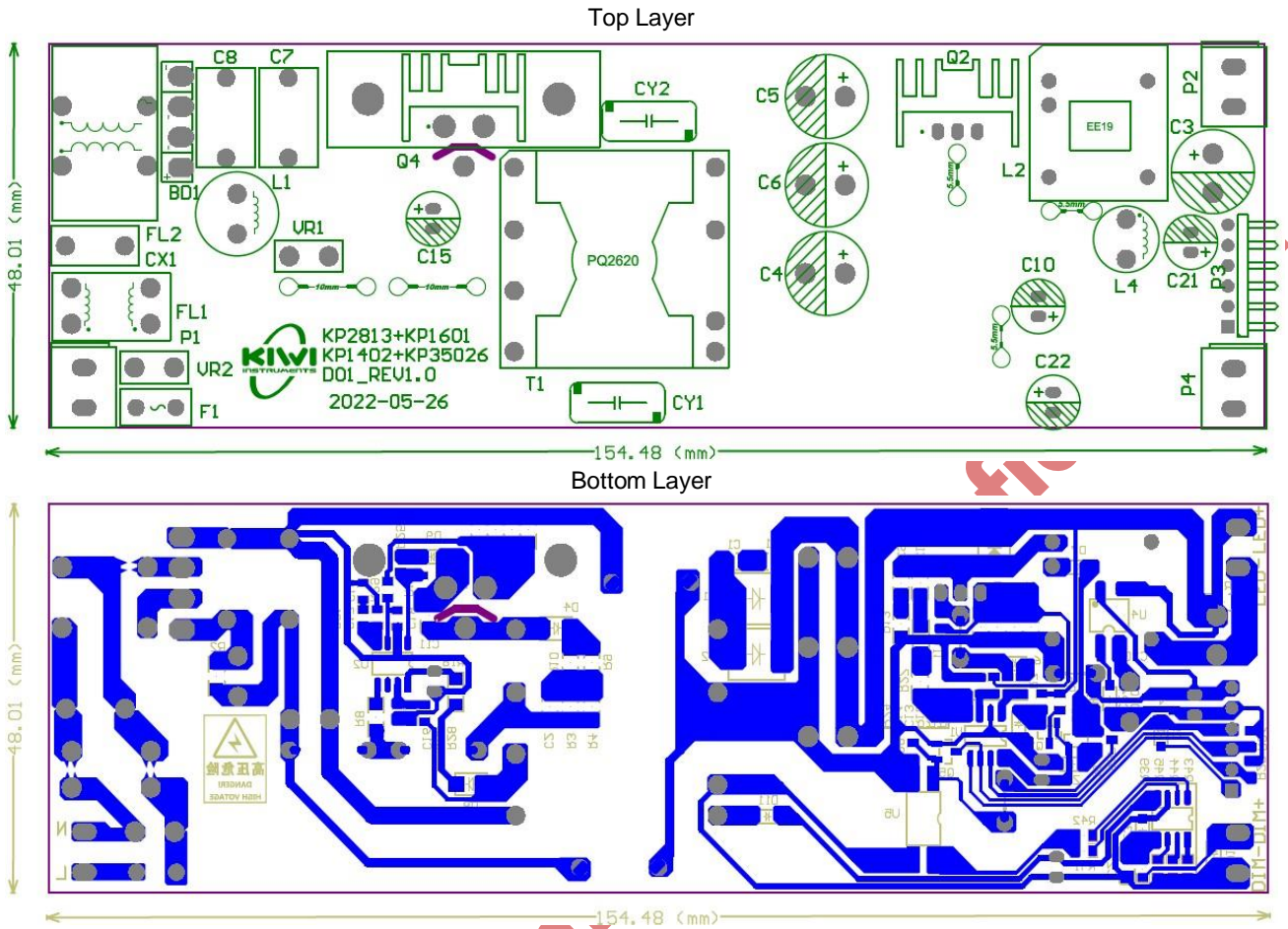


Board Size(in mm): L x W=155 x 48

Schematic



Printed Circuit Board Layout



Kiwi Instruments



**A 60W Universal Input High Performance Two Stage Dimmable
LED Driver with KP2813A+KP1601+KP1402**

Bill of Material

No.	Designator	Value	Description	Package	Manufacturer	Part Number
1	BD1	4A/600V	SINGLE PHASE SILICON BRIDGE,600/4A	TH	World	GBP406L
2	C1	100pF/1000V	Ceramic Cap, 1kV X7R	1206	WE	
3	C2	10nF/1000V	Ceramic Cap, 1kV X7R	1206	WE	
4	C3	220μF	Electrolytic Cap, 80V,10*20	TH	AISHI	
5	C4	220μF	Electrolytic Cap, 80V,10*20	TH	AISHI	
6	C5	220μF	Electrolytic Cap, 80V,10*20	TH	AISHI	
7	C6	220μF	Electrolytic Cap, 80V,10*20	TH	AISHI	
8	C7	470nF	CBB 400Vdc 12*8*15 P10	TH	STE	
9	C8	150nF	CBB 400Vdc 12*8*15 P10	TH	STE	
10	C10	4.7μF	Electrolytic Cap 50V 5*11 P2.0	TH	jianghai	
11	C11	10pF	Ceramic Cap, 1000V X7R	1206	WE	
12	C12	10pF	Ceramic Cap, 100V X7R	1206	WE	
13	C15	2.2μF	Electrolytic Cap 25V 5*11 P2.0	TH	jianghai	
14	C16	22pF	Ceramic Cap, 25V X7R	0805	WE	
15	C17	100nF	Ceramic Cap, 25V X7R	0805	WE	
16	C18	47pF	Ceramic Cap, 25V X7R	0805	WE	
17	C19	1μF	Ceramic Cap, 25V X7R	0805	WE	
18	C22	22μF	Electrolytic Cap 50V 5*12 P2.0	TH	AISHI	
19	C23	10nF	Ceramic Cap, 25V X7R	0805	WE	
20	C24	10nF	Ceramic Cap, 50V X7R	0805	WE	
21	CX1	330nF	Film Capacitor 310Vac X2 15*8.5*14 P12.5	TH	STE	
22	CY1	1nF	Y1 Capacitor 400Vac ±10% T5 P10	TH	STE	
23	CY2	2.2nF	Y1 Capacitor 400Vac ±10% T5 P10	TH	STE	
24	D1	600V/3A	ULTRAFAST HIGH VOLTAGE RECTIFIER , 600V/3A,VF=1.7V@IF=3A	SMC	ST	STTH3R06S
25	D2	600V/3A	ULTRAFAST HIGH VOLTAGE RECTIFIER , 600V/3A,VF=1.7V@IF=3A	SMC	ST	STTH3R06S
26	D3	100V10A	DIO SBD 10A 100V 0.64V	TO-277A	DIYI	SL10T100
27	D4	1000V1A	DIO FRD 1A 1000V 1.1V	SMA	MOD	M7
28	D5	100V0.15A	DIO FRD 0.15A 100V 8nS 1.25V	SOD-123	MOD	1N4148
29	D6	100V0.15A	DIO FRD 0.15A 100V 8nS 1.25V	SOD-123	MOD	1N4148
30	D7	1000V1A	DIO FRD 1A 1000V 500nS 1.3V	SMA	MOD	RS1M
31	D8	1000V1A	DIO FRD 1A 1000V 500nS 1.3V	SMA	MOD	RS1M
32	D9	100V0.15A	DIO FRD 0.15A 100V 8nS 1.25V	SOD-123	MOD	1N4148
33	D11	1000V1A	DIO FRD 1A 1000V 500nS 1.3V	SMA	MOD	RS1M
34	F1	250V/1A	Fuse 250V/1A	TH	Any	
35	FL1	0.5mH	COMMON INDUCTOR Isat 3.5A Rdc 33mΩ	TH	WE	
36	FL2	17mH	COMMON INDUCTOR Isat 4A Rdc 50mΩ	TH	WE	



A 60W Universal Input High Performance Two Stage Dimmable LED Driver with KP2813A+KP1601+KP1402

37	L1	1mH	Inductor Isat 0.80A Rdc 1.15Ω 10*14	TH	WE	
38	L2	120μH	EF19, Lp=0.12mH, Np:Ns=56(0.1mm*30):48(0.3mm)	TH	Any	
39	T1	PQ2620	PQ2620, Lp=0.3mH, Np:Ns:Na1:Na2=30(0.1mm*20):21(0.65mm):6(0.27mm):5(0.27mm)	TH	Any	
40	P1	Header 2	Connector, D=5.08mm, 2P	DIP	MG	
41	P2	Header 2	Connector, D=5.08mm, 2P	DIP	MG	
42	P4	Header 2	Connector, D=5.08mm, 2P	DIP	MG	
43	Q1	40V0.1A	Triode Transistor, 40V 0.1A NPN	SOT23	LGE	MMBT3904
44	Q2	100V51A	MOSFET 100V 51A 78mohm	TO-220	AnalogPower	AM60N10
45	Q3	40V0.1A	Triode Transistor, 40V 0.1A NPN	SOT23	LGE	MMBT3904
46	Q4	700V10A	MOSFET 700V 10A 850mohm	TO-220F	sisemi	SIF12N70
47	Q5	40V0.1A	Triode Transistor, 40V 0.1A NPN	SOT23	LGE	MMBT3904
48	R1	51R	Film Resistor, 5%	1206	Yageo	
49	R2	5.1K	Film Resistor, 5%	1206	Yageo	
50	R3	240k	Film Resistor, 5%	1206	Yageo	
51	R4	240k	Film Resistor, 5%	1206	Yageo	
52	R5	10k	Film Resistor, 5%	0805	Yageo	
53	R6	1M	Film Resistor, 5%	1206	Yageo	
54	R7	120k	Film Resistor, 5%	0805	Yageo	
55	R8	1k	Film Resistor, 5%	1206	Yageo	
56	R9	10R	Film Resistor, 5%	1206	Yageo	
57	R10	10R	Film Resistor, 5%	1206	Yageo	
58	R11	10R	Film Resistor, 5%	0805	Yageo	
59	R12	51R	Film Resistor, 5%	0805	Yageo	
60	R14	10k	Film Resistor, 5%	0805	Yageo	
61	R15	51k	Film Resistor, 5%	0805	Yageo	
62	R16	100R	Film Resistor, 5%	0805	Yageo	
63	R17	51R	Film Resistor, 5%	0805	Yageo	
64	R18	10R	Film Resistor, 5%	1206	Yageo	
65	R19	0.56R	Film Resistor, 1%	1206	Yageo	
66	R20	0.56R	Film Resistor, 1%	1206	Yageo	
67	R21	0.56R	Film Resistor, 1%	1206	Yageo	
68	R22	0.75R	Film Resistor, 1%	1206	Yageo	
69	R23	10k	Film Resistor, 5%	0805	Yageo	
70	R24	5.1k	Film Resistor, 5%	0805	Yageo	
71	R25	10R	Film Resistor, 5%	0805	Yageo	
72	R26	20k	Film Resistor, 5%	0805	Yageo	
73	R27	100k	Film Resistor, 5%	1206	Yageo	



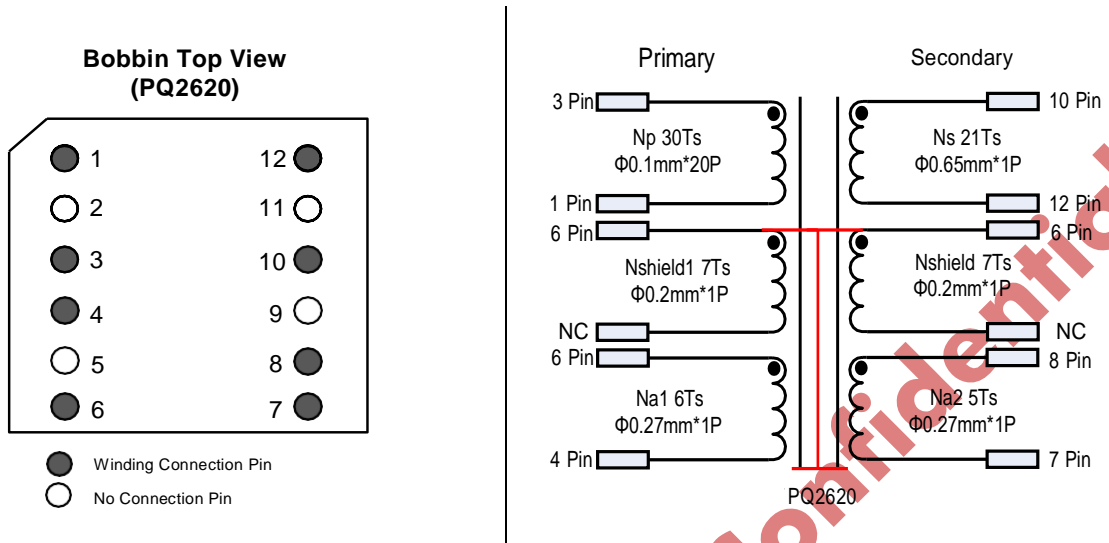
**A 60W Universal Input High Performance Two Stage Dimmable
LED Driver with KP2813A+KP1601+KP1402**

74	R28	82k	Film Resistor, 5%	0805	Yageo	
75	R29	1k	Film Resistor, 5%	0805	Yageo	
76	R30	7.5k	Film Resistor, 5%	0805	Yageo	
77	R31	33k	Film Resistor, 5%	0805	Yageo	
78	R32	0.56R	Film Resistor, 1%	1206	Yageo	
79	R33	0.56R	Film Resistor, 1%	1206	Yageo	
80	R34	0.47R	Film Resistor, 1%	1206	Yageo	
81	R35	0.47R	Film Resistor, 1%	1206	Yageo	
82	R36	24k	Film Resistor, 5%	0805	Yageo	
83	R37	10k	Film Resistor, 5%	0805	Yageo	
84	R38	51k	Film Resistor, 5%	0805	Yageo	
85	R39	100R	Film Resistor, 5%	0805	Yageo	
86	R41	2k	Film Resistor, 5%	0805	Yageo	
87	R42	0R	Film Resistor, 5%	0805	Yageo	
88	R43	51k	Film Resistor, 5%	0805	Yageo	
89	R44	7.5k	Film Resistor, 5%	0805	Yageo	
90	R45	10k	Film Resistor, 5%	0805	Yageo	
91	R49	20k	Film Resistor, 5%	0603	Yageo	
92	VR1	10D511	VARISTOR 320VAC 69J 1250A	TH	STE	10D571K
93	VR2	10D511	VARISTOR 320VAC 69J 1250A	TH	STE	10D571K
94	Z1	12V	Diode Zener 12V 2% 200mW	SOD323	PANJIT	BZT52-B12S
95	Z2	15V	Diode Zener 12V 2% 200mW	SOD323	PANJIT	BZT52-B15S
96	U1	KP1601SG	High Precision Deep Dimming Buck LED constant current driver	SOP8	Kiwi instruments	KP1601SG
97	U2	KP2813ASG	High PF, Low THD Flyback PFC Constant Voltage Controller	SOP8	Kiwi instruments	KP2813ASG
98	U3	KP1402SG	Dimming Signal Converter Compatible with 0-10V, 10-0V, Resistor, and PWM Dimming	SOP8	Kiwi instruments	KP1402SG
99	U5	PC817	Opto-coupler	SMD-4	Everlight	

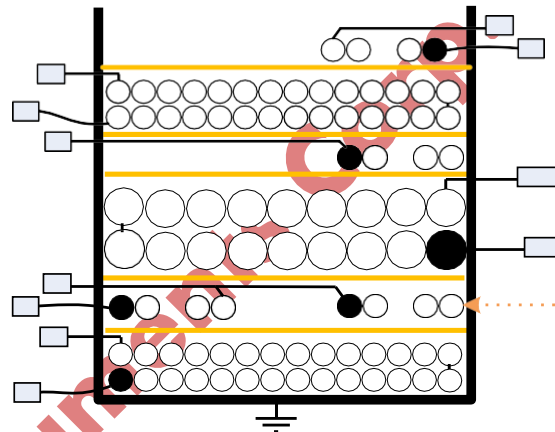
Kiwi Instruments Corp. Confidential

Transformer Manufacture Guide---T1

1. Electrical Diagram



2. Winding Diagram



3. Winding Order

Number	Winding	Layer	Start	End	Wire Size	Turns	Note
1	Np	Primary	1	3	0.1d*20P	30T	
2	Na1	Auxiliary1	4	6	0.27d*1P	6T	
3	Nshield1	Shield	NC	6	0.2d*1P	7T	
4	Ns	Secondary	12	10	0.65d*1P	21T	Triple Insulation Wire
5	Nshield2	Shield	NC	6	0.2d*1P	7T	
6	Na2	Auxiliary2	7	8	0.25d*1P	5T	Triple Insulation Wire

4. Electrical Specification

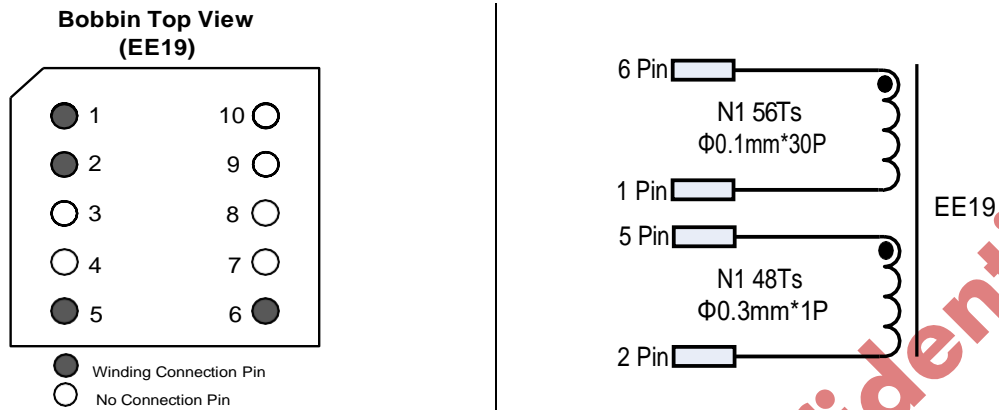
Items	Test Condition	Test Pin	Specification
Primary Inductance	Measured at 40kHz, 1.0 VRMS	Pins 3 - 1, all other windings open,	0.3mH±5%
Primary Leakage Inductance	Measured at 40kHz, 1.0 VRMS	Pins 3 - 1, all other windings shorted,	4.4uH Max
DC Resistance	Measured at 40kHz, 1.0 VRMS	Pins 3 - 1	0.4Ω Max

5. Transformer BOM

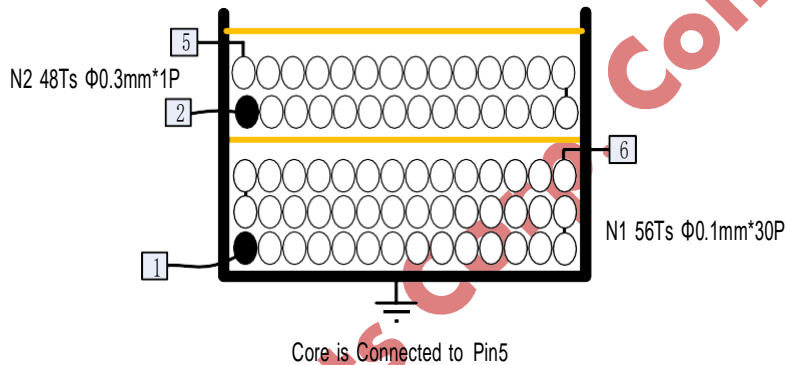
Items	Description
1	Core: PQ2620, PC44 or equivalent, AE=119mm ²
2	Bobbin: PQ2620, 6+6 Pin
3	Wire: Φ0.27mm, 2UEW, Class B
4	Wire: Φ0.18mm, 2UEW, Class B
5	Wire: Φ0.1mm*20P, 2UEW, Class B
6	Triple Insulation Wire: Φ0.65mm TIW
7	Triple Insulation Wire: Φ0.25mm TIW
8	Tape: 11mm(W)×0.06mm(TH)

Transformer Manufacture Guide---L2

6. Electrical Diagram



7. Winding Diagram



8. Winding Order

Number	Winding	Layer	Start	End	Wire Size	Turns	Note
1	N1	Primary	1	6	0.1d*30P	56T	
2	N2	Auxiliary	2	5	0.3d*1P	48T	

9. Electrical Specification

Items	Test Condition	Test Pin	Specification
Primary Inductance	Measured at 40kHz, 1.0 VRMS	Pins 6 - 1, all other windings open	0.12mH±5%
DC Resistance	Measured at 40kHz, 1.0 VRMS	Pins 6 - 1	0.2Ω Max

10. Transformer BOM

Items	Description
1	Core: EE19, PC44 or equivalent, AE=22.4mm ²
2	Bobbin: EE19, 5+5 Pin
3	Wire: Φ0.3mm, 2UEW, Class B
4	Wire: Φ0.1mm*30P, 2UEW, Class B
5	Tape: 4mm(W)×0.06mm(TH)



A 60W Universal Input High Performance Two Stage Dimmable LED Driver with KP2813A+KP1601+KP1402

Test Result

1. Steady State Characteristics

1.1 Efficiency, PF and THD

Test Conditions: Input: 100-300Vac; Output: 40V/1.5A, 20V/1.5A.

Standard: Eff>85%@100~300Vac; PF>0.95, THD<10% @100~277Vac & 40V/1.5A

Result: Pass

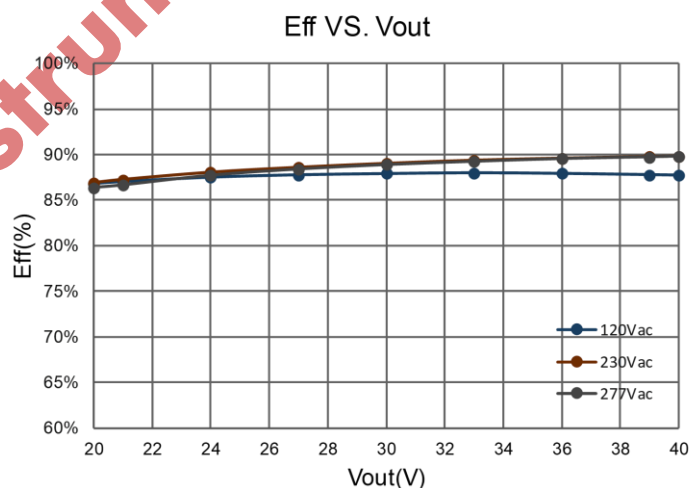
Vo(V)	Vin(V)	F(Hz)	PF	THD	Pin(W)	Vo(V)	Io(V)	Eff(%)
40V	100	60	1.00	5.00	69.24	40.37	1.491	86.93%
	120	60	1.00	3.22%	69.62	40.91	1.493	87.73%
	230	50	0.98	4.95%	68.03	40.91	1.493	89.79%
	277	60	0.95	8.25%	68.01	40.91	1.493	89.80%
	300	60	0.93	11.28%	68.03	40.91	1.493	89.76%
Vo(V)	Vin(V)	F(Hz)	PF	THD	Pin(W)	Vo(V)	Io(V)	Eff(%)
20V	100	60	1.00	4.40	34.94	20.35	1.49	86.95%
	120	60	0.99	4.6%	36.06	20.92	1.50	86.78%
	230	50	0.91	10.9%	36.03	20.94	1.50	86.89%
	277	60	0.83	17.0%	36.22	20.94	1.49	86.37%
	300	60	0.80	20.0%	36.31	20.94	1.49	86.17%

1.2 Efficiency VS. Vo Curve

Test Conditions: Input voltage: 120/230/277Vac; Output load: 20-40V/1.5A.

Standard: Eff > 85%

Result: Pass





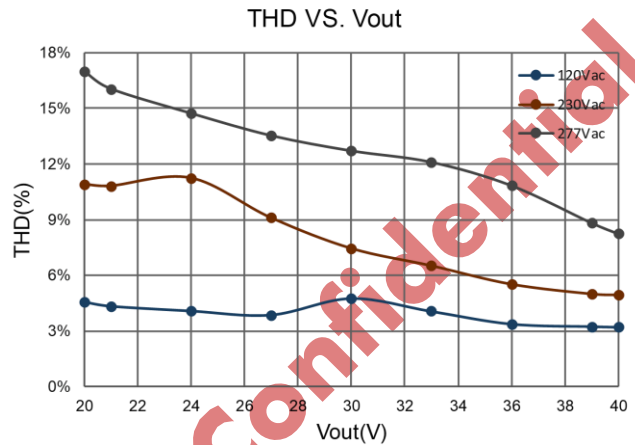
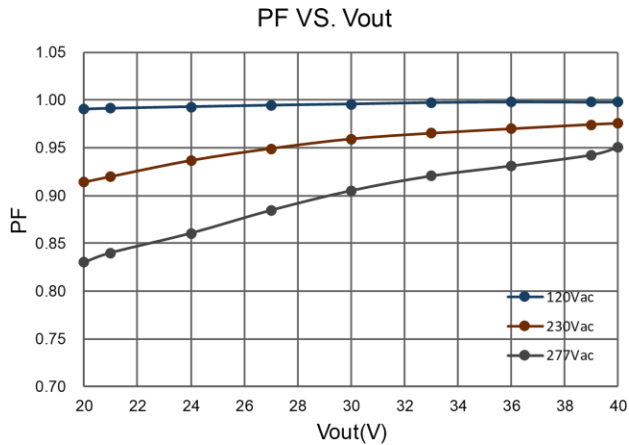
A 60W Universal Input High Performance Two Stage Dimmable LED Driver with KP2813A+KP1601+KP1402

1.3 PF, THD VS. Vout

Test Conditions: Input: 120/230/277Vac; Output: 20-40V/1.5A.

Standard: PF>0.95 @ 40V1.5A

Result: Pass



1.4 Line Regulation

Test Conditions: Input: 100-300Vac; Output: 20-40V/1.5A.

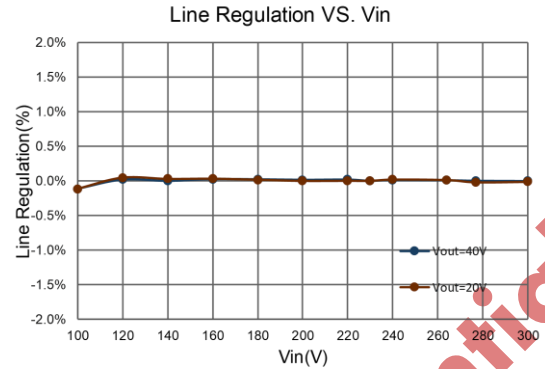
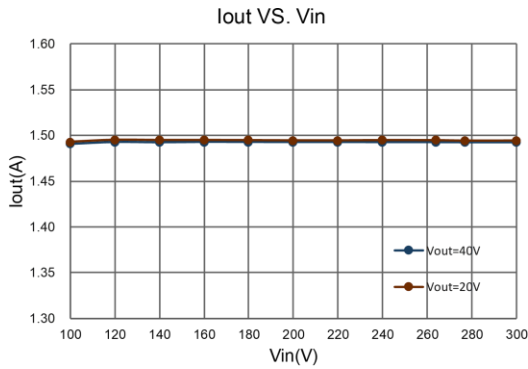
Standard: Line Regulation <1%

Result: Pass

Vin(V)	Io(A)						
	Vo=40V	Vo=36V	Vo=33V	Vo=30V	Vo=27V	Vo=24V	Vo=20V
100	1.491	1.489	1.492	1.492	1.493	1.492	1.493
120	1.493	1.492	1.494	1.496	1.497	1.496	1.495
140	1.493	1.492	1.494	1.495	1.497	1.496	1.495
160	1.493	1.492	1.494	1.495	1.497	1.496	1.495
180	1.493	1.493	1.493	1.495	1.496	1.496	1.495
200	1.493	1.493	1.494	1.495	1.496	1.495	1.495
220	1.493	1.493	1.494	1.495	1.496	1.496	1.495
240	1.493	1.493	1.493	1.495	1.496	1.496	1.495
264	1.493	1.493	1.493	1.495	1.495	1.496	1.495
277	1.493	1.493	1.493	1.494	1.496	1.497	1.494
300	1.493	1.493	1.493	1.495	1.496	1.496	1.494
Max	1.493	1.493	1.494	1.496	1.497	1.497	1.495
Ave	1.491	1.489	1.492	1.492	1.493	1.492	1.493
Min	1.493	1.492	1.493	1.495	1.496	1.496	1.495
Line Reg	0.14%	0.29%	0.15%	0.25%	0.26%	0.32%	0.16%



A 60W Universal Input High Performance Two Stage Dimmable LED Driver with KP2813A+KP1601+KP1402



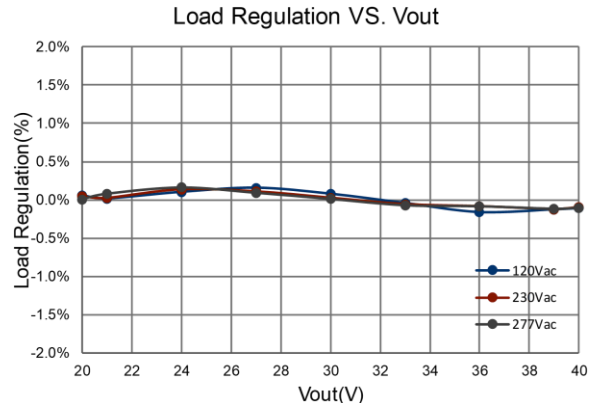
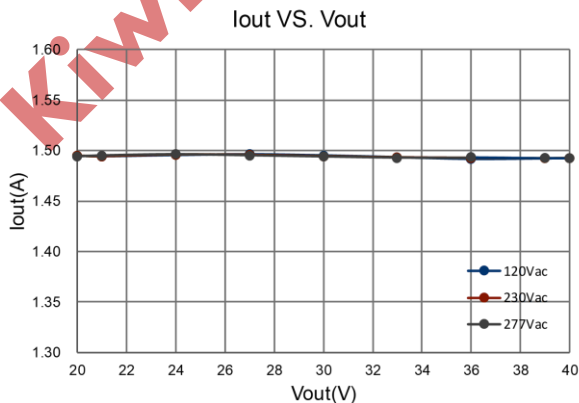
1.5 Output Current Regulation

Test Conditions: Input: 100-300Vac: Output: 20-40V/1.5A.

Standard: Load Regulation <1%

Result: Pass

Vin(V)	Io(A)										Load Reg
	Vo=40 V	Vo=36 V	Vo=33 V	Vo=30 V	Vo=27 V	Vo=24 V	Vo=20 V	Max	Ave	Min	
100	1.491	1.489	1.492	1.492	1.493	1.492	1.493	1.493	1.489	1.492	0.27%
120	1.493	1.492	1.494	1.496	1.497	1.496	1.495	1.497	1.492	1.495	0.31%
140	1.493	1.492	1.494	1.495	1.497	1.496	1.495	1.497	1.492	1.494	0.31%
160	1.493	1.492	1.494	1.495	1.497	1.496	1.495	1.497	1.492	1.494	0.27%
180	1.493	1.493	1.493	1.495	1.496	1.496	1.495	1.496	1.493	1.494	0.26%
200	1.493	1.493	1.494	1.495	1.496	1.495	1.495	1.496	1.493	1.494	0.24%
220	1.493	1.493	1.494	1.495	1.496	1.496	1.495	1.496	1.493	1.494	0.24%
240	1.493	1.493	1.493	1.495	1.496	1.496	1.495	1.496	1.493	1.494	0.23%
264	1.493	1.493	1.493	1.495	1.495	1.496	1.495	1.496	1.493	1.494	0.23%
277	1.493	1.493	1.493	1.494	1.496	1.497	1.494	1.497	1.492	1.494	0.28%
300	1.493	1.493	1.493	1.495	1.496	1.496	1.494	1.496	1.493	1.494	0.26%





A 60W Universal Input High Performance Two Stage Dimmable LED Driver with KP2813A+KP1601+KP1402

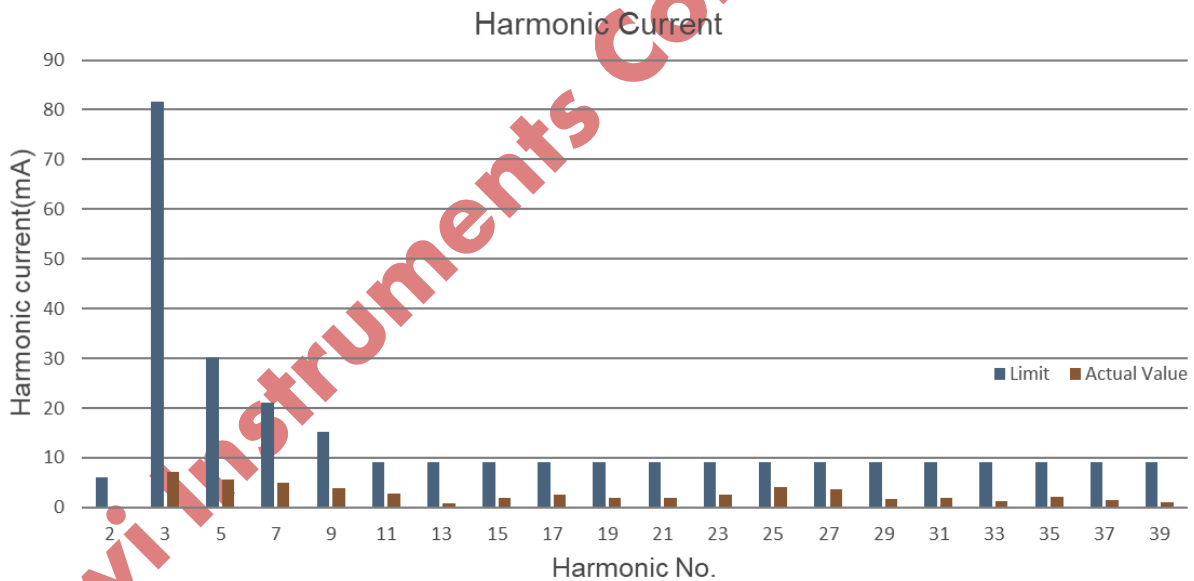
1.6 Harmonic Current

Test Conditions: Input: 230Vac; Output: 40V/1.5A.

Standard: IEC61000-3-2 Class C

Result: Pass

Harmonic NO.	Limit (mA)	Actual Value(mA)	Pass Fail	Harmonic NO.	Limit (mA)	Actual Value(mA)	Pass Fail
2	6.04	0.2	Pass	3	81.63	7.08	Pass
5	30.23	5.71	Pass	7	21.16	4.93	Pass
9	15.11	3.96	Pass	11	9.07	2.72	Pass
13	9.07	0.72	Pass	15	9.07	1.9	Pass
17	9.07	2.66	Pass	19	9.07	1.96	Pass
21	9.07	1.96	Pass	23	9.07	2.6	Pass
25	9.07	4.11	Pass	27	9.07	3.76	Pass
29	9.07	1.8	Pass	31	9.07	1.85	Pass
33	9.07	1.36	Pass	35	9.07	2.15	Pass
37	9.07	1.43	Pass	39	9.07	1.03	Pass



1.7 Output Current Ripple

Test Conditions: Input: 100-300Vac; Output: 40V/1.5A.

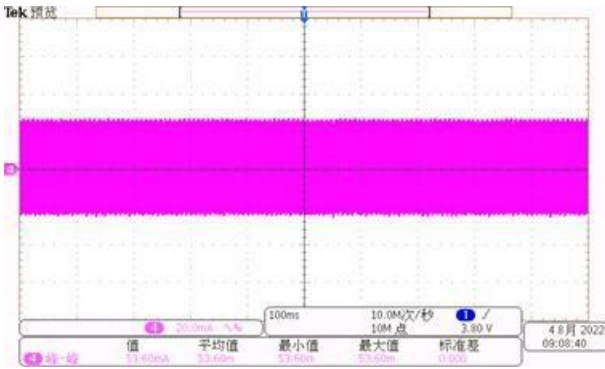
Standard: Pk-pk Ripple <5%

Result: Pass

Vin(V)	F(Hz)	Io(mA)	Current Ripple Ipeak-peak (mA)	Pk-pk Ripple (%)
100	60	1499	55.3	3.69%
120	60	1499	53.6	3.58%
230	50	1499	51.75	3.45%
277	60	1499	51.82	3.46%
300	60	1499	51.33	3.43%

Waveforms:

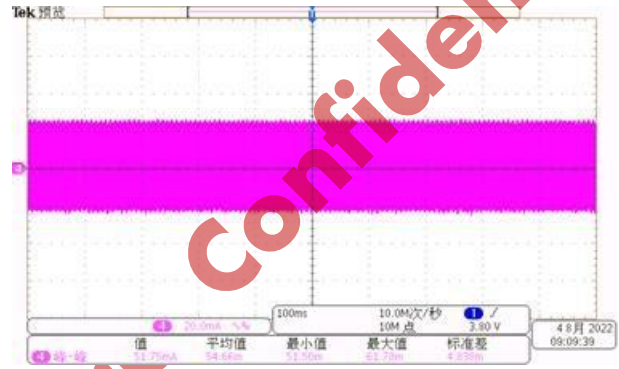
Test Condition: 120Vac/60Hz Input, 40V1.5A Output



(CH4-Io)

Comments: Ipeak-peak=53.6mA

Test Condition: 230Vac/50Hz Input, 40V1.5A Output



(CH4-Io)

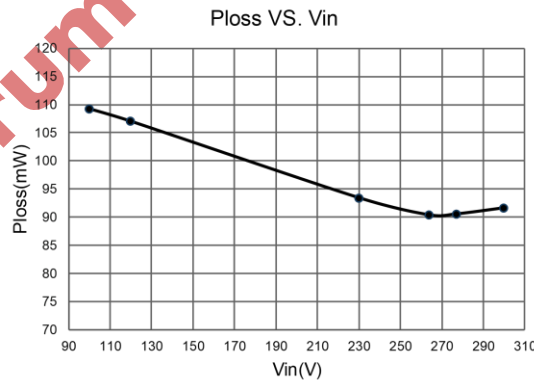
Comments: Ipeak-peak=51.75mA

1.8 Standby Power

Test Conditions: Input: 100-300Vac; Output: Dim OFF.

Standard: Ploss<150mW

Result: Pass

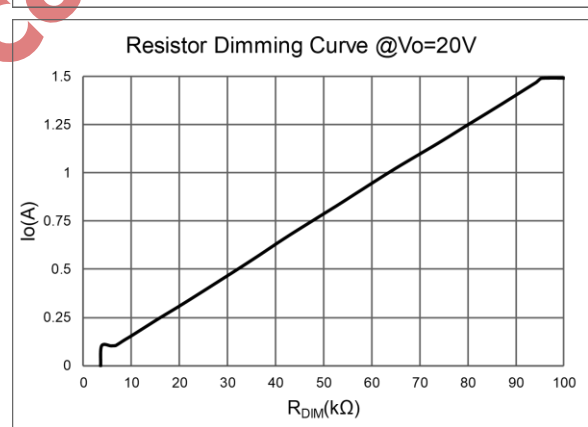
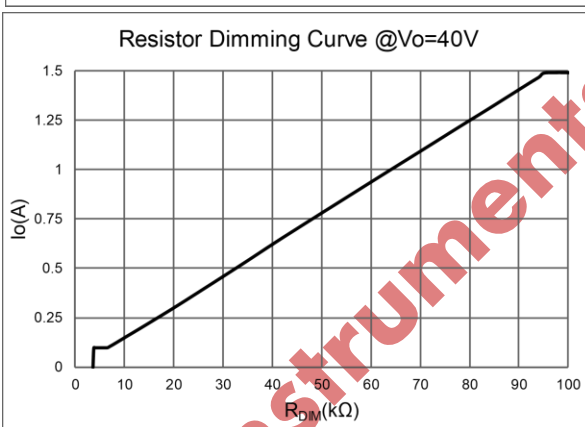
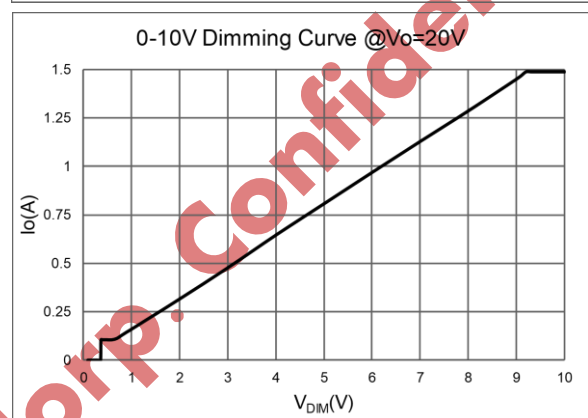
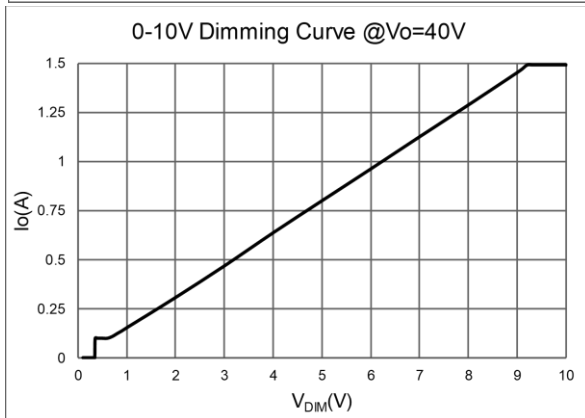
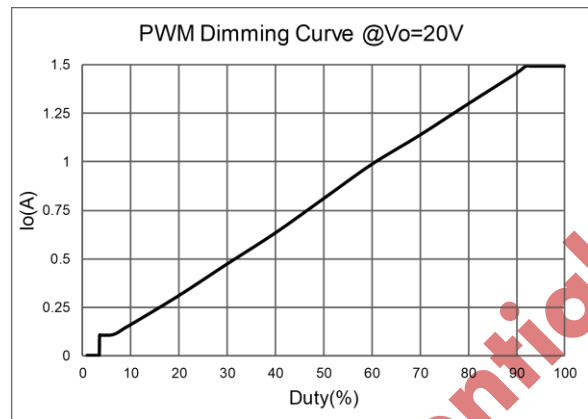
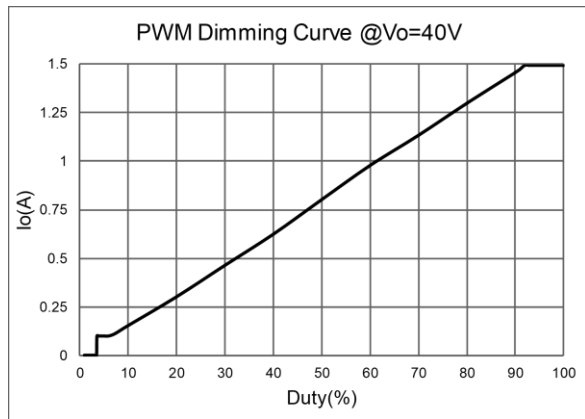


1.9 Dimming Curve

Test Conditions: Input: 120/300Vac; Output: 0-10V Dimming/PWM Dimming/Resistor Dimming.

Standard: High linearity of dimming curve

Result: Pass



2 Dynamic Characteristics

2.1 Start-up Characteristics

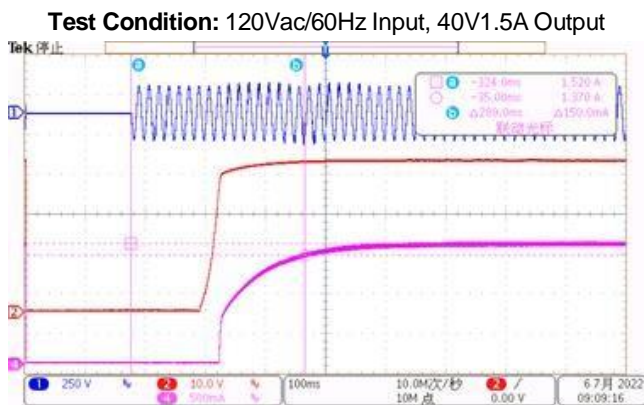
Test Conditions: Input: 100-300Vac; Output: 40V1.5A.

Standard: No flicker and no overshoot

Result: Pass

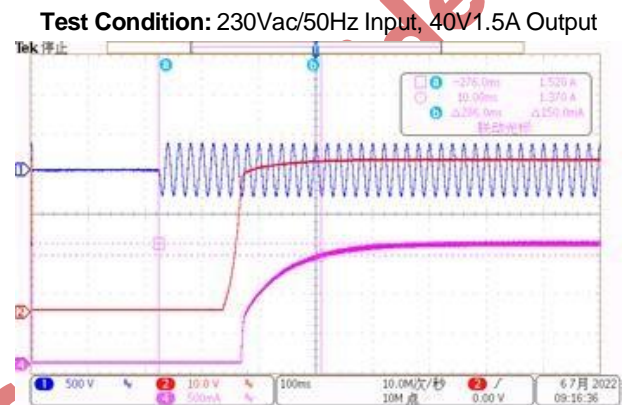
Vin (V)	F (Hz)	Io (A)	AC to Io reach 90% (ms)
100	60	1.5	288
120	60	1.5	289
230	50	1.5	286
277	60	1.5	287
300	60	1.5	283

Waveforms:



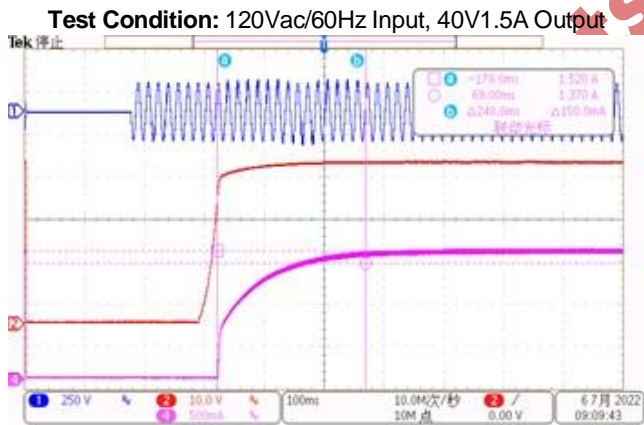
(CH1: Vin; CH2: Vo; CH4: Io)

Comments: No flicker and no overshoot



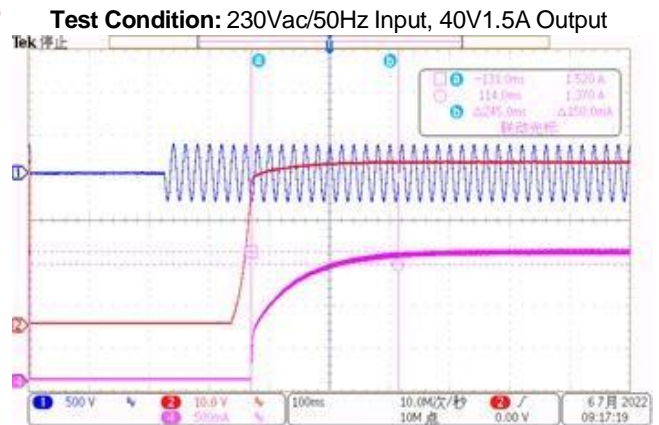
(CH1: Vin; CH2: Vo; CH4: Io)

Comments: Vo_ripple_pp=63mV



(CH1: Vin; CH2: Vo; CH4: Io)

Comments: Current rise time 248ms



(CH1: Vin; CH2: Vo; CH4: Io)

Comments: Current rise time 245ms

2.2 Power off Characteristics

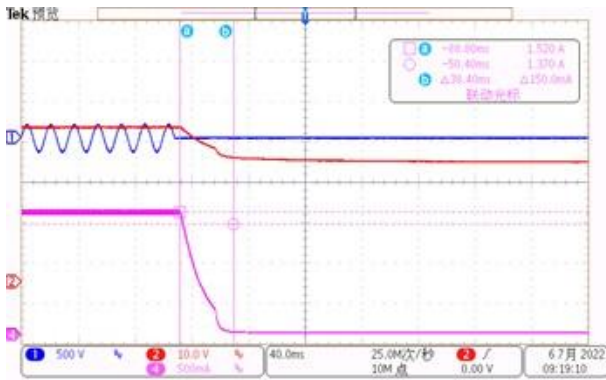
Test Conditions: Input: 100-300Vac; Output: 40V1.5A.

Standard: No flicker and no overshoot

Result: Pass

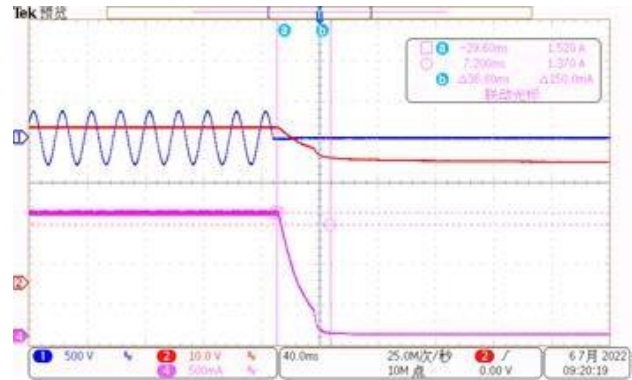
Waveforms:

Test Condition: 120Vac/60Hz Input, 40V1.5A Output



(CH1: Vin; CH2: Vo; CH4: Io)
Comments: No flicker and no overshoot

Test Condition: 230Vac/50Hz Input, 40V1.5A Output



(CH1: Vin; CH2: Vo; CH4: Io)
Comments: Vo_ripple_pp=63mV

2.3 Dim on/off Characteristics

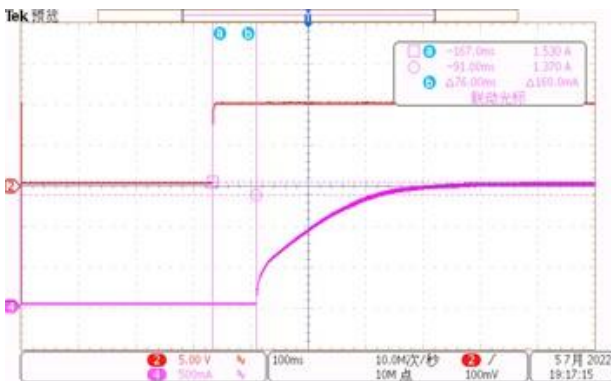
Test Conditions: Input: 100-300Vac; Output: 40V1.5A.

Standard: No flicker and no overshoot

Result: Pass

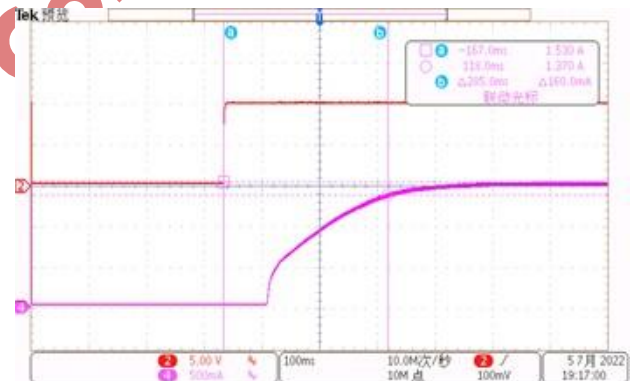
Waveforms:

Test Condition: 120Vac/60Hz Input, 40V1.5A Output



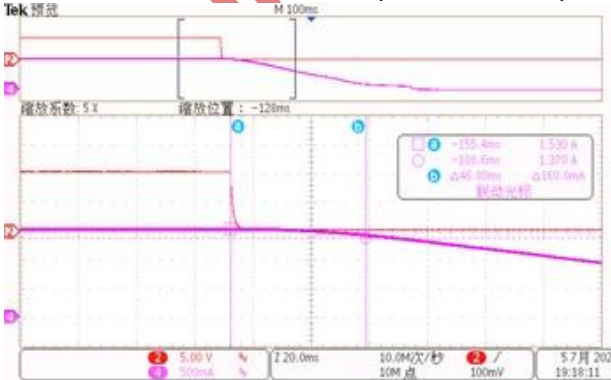
(CH2: DIM; CH4: Io)
Comments: Output current rise response time: 76ms

Test Condition: 120Vac/60Hz Input, 40V1.5A Output



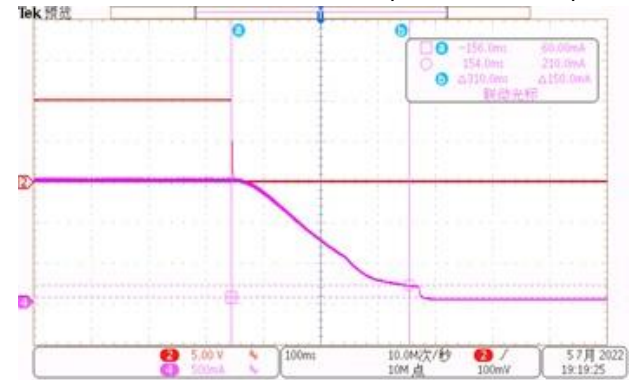
(CH2: DIM; CH4: Io)
Comments: Output current rise to 90% Io: 285ms

Test Condition: 230Vac/50Hz Input, 40V1.5A Output



(CH2: DIM; CH4: Io)
Comments: Output current down response time: 47ms

Test Condition: 230Vac/50Hz Input, 40V1.5A Output



(CH2: DIM; CH4: Io)
Comments: Output current rise to 10% Io: 310ms

3 Reliability Testing

3.1 Output Short Protection

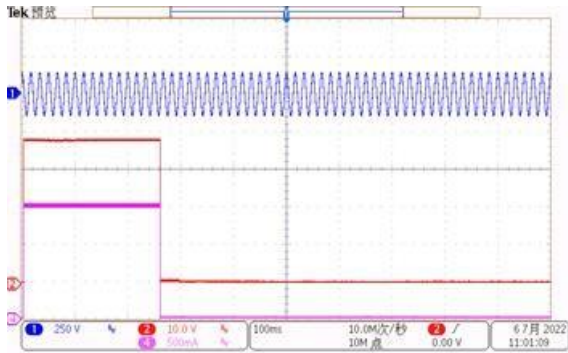
Test Conditions: Input: 100-300Vac; Output: 40V1.5A.

Standard: output is latched and no component damaged.

Result: Pass

Waveforms:

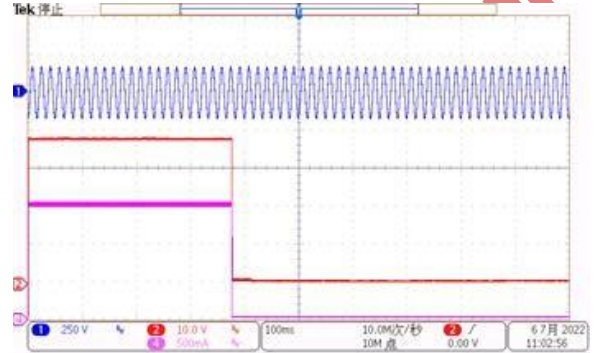
Test Condition: 100Vac/60Hz Input, 40V1.5A Output



(CH1::Vin; CH2: Vo; CH4: Io)

Comments: OK ,Pin=172.2mW

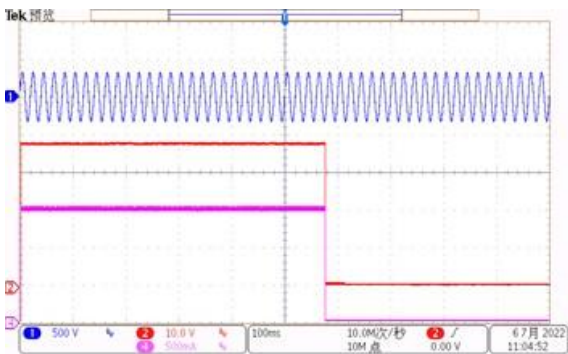
Test Condition: 120Vac/60Hz Input, 40V1.5A Output



(CH1::Vin; CH2: Vo; CH4: Io)

Comments: OK, Pin=164.1mW

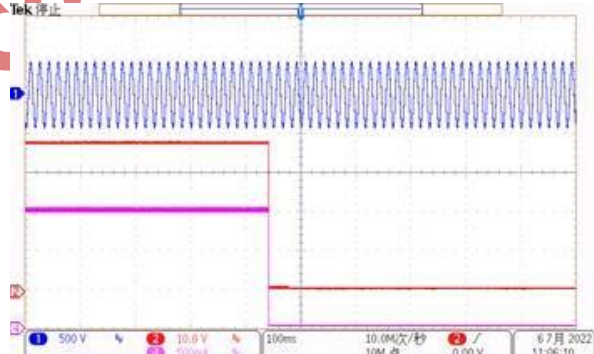
Test Condition: 230Vac/50Hz Input, 40V1.5A Output



(CH1::Vin; CH2: Vo; CH4: Io)

Comments: OK ,Pin=166.3mW

Test Condition: 300Vac/60Hz Input, 40V1.5A Output



(CH1::Vin; CH2: Vo; CH4: Io)

Comments: OK ,Pin=172.3mW

3.2 Open Load Protection

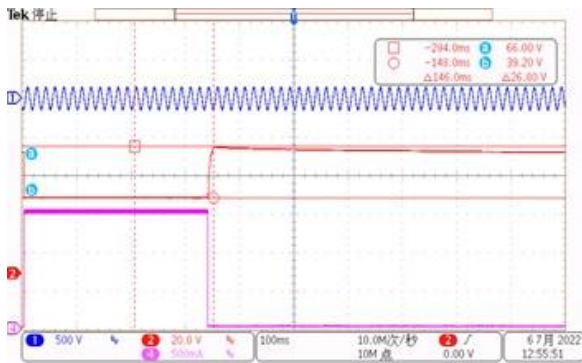
Test Conditions: Input: 100-300Vac; Output: 40V1.5A.

Standard: output is latched and no component damaged.

Result: Pass

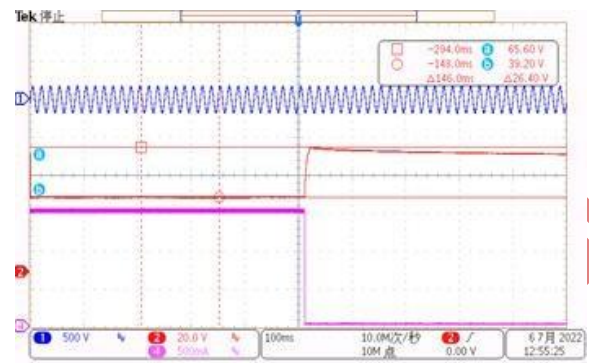
Waveforms:

Test Condition: 100Vac/60Hz Input, 40V1.5A Output



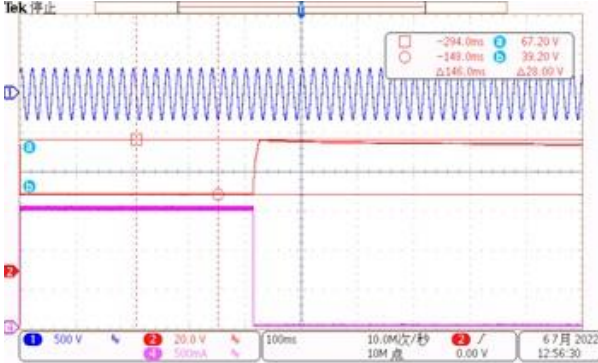
(CH1::Vin; CH2: Vo; CH4: Io)
Comments: OK ,Vo_peak=26.8V

Test Condition: 120Vac/60Hz Input, 40V1.5A Output



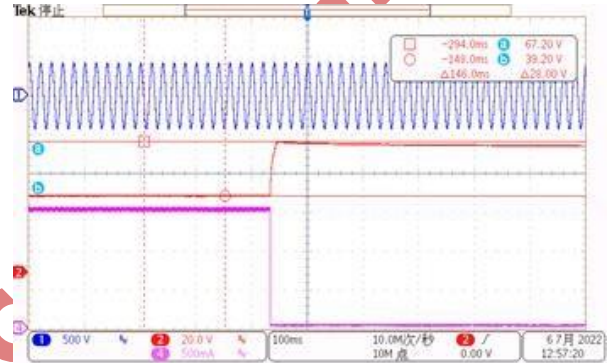
(CH1::Vin; CH2: Vo; CH4: Io)
Comments: OK, Vo_peak=26.4V

Test Condition: 230Vac/50Hz Input, 40V1.5A Output



(CH1::Vin; CH2: Vo; CH4: Io)
Comments: OK , Vo_peak=28V

Test Condition: 300Vac/60Hz Input, 40V1.5A Output



(CH1::Vin; CH2: Vo; CH4: Io)
Comments: OK , Vo_peak=28V

3.3 Maximum Stress of Flyback MOSFET

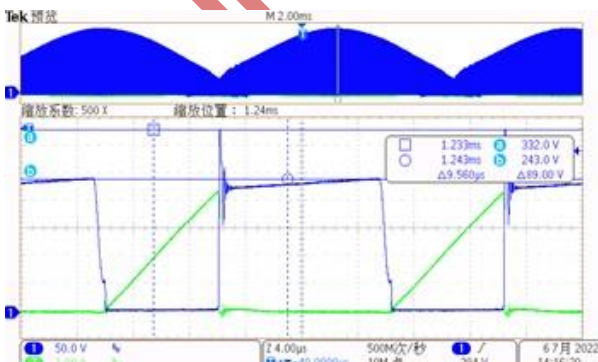
Test Conditions: Input: 100-300Vac; Output: 40V1.5A; MOSFET: SIF12N70F.

Standard: $VDS_peak < 90\% \cdot Vdsmax$

Result: Pass

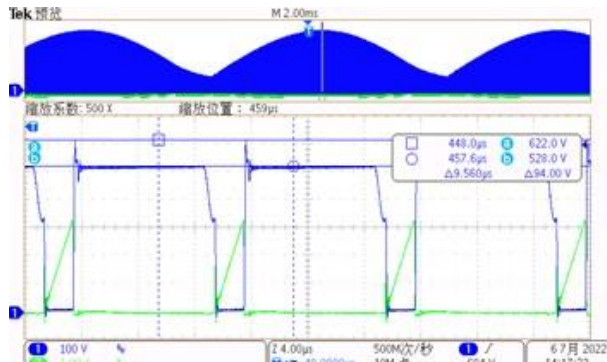
Waveforms:

Test Condition: 100Vac/60Hz Input, 40V1.5A Output



(CH1::VDS; CH3: ID)
Comments: OK VDS_peak=332V, ID_peak=4.46A

Test Condition: 300Vac/60Hz Input, 40V1.5A Output



(CH1::Vin; CH2: Vo; CH4: Io)
Comments: OK VDS_peak=448V, ID_peak=3.32A

3.4 Maximum Stress of Buck MOSFET

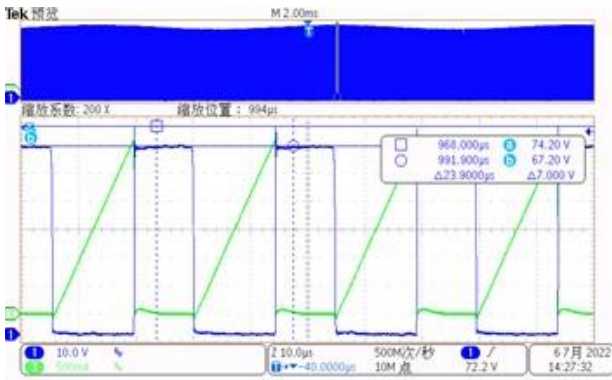
Test Conditions: Input: 100-300Vac; Output; 40V1.5A; MOSFET: AM60N10.

Standard: $V_{DS_peak} < 90\% * V_{dsmax}$

Result: Pass

Waveforms:

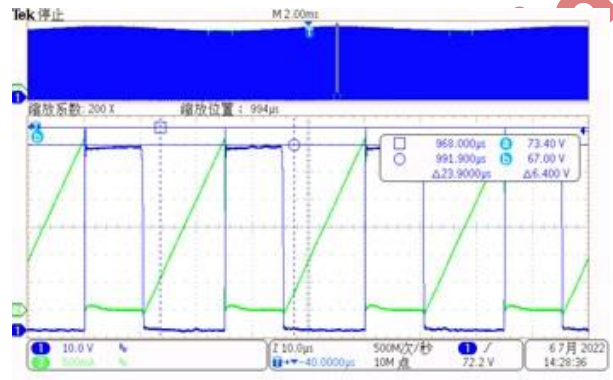
Test Condition: 100Vac/60Hz Input, 40V1.5A Output



(CH1::VDS; CH3: ID)

Comments: OK $V_{DS_peak}=74.2V$, $ID_peak=3.1A$

Test Condition: 300Vac/60Hz Input, 40V1.5A Output



(CH1::Vin; CH2: Vo; CH4: Io)

Comments: OK $V_{DS_peak}=73.4V$, $ID_peak=3.1A$

3.5 Maximum Stress of Flyback Output Diode

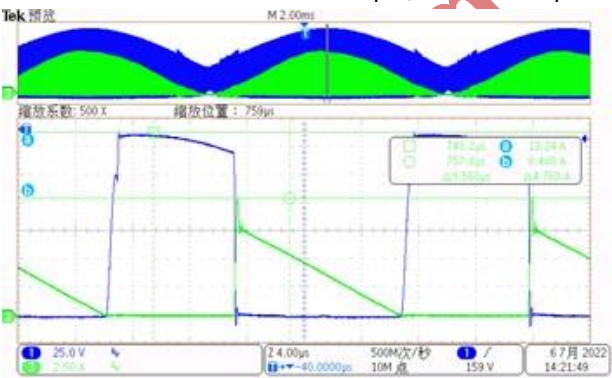
Test Conditions: Input: 100-300Vac; Output: 40V1.5A; Diode: STTH3R06S

Standard: $VD_peak < 90\% * VD_{max}$

Result: Pass

Waveforms:

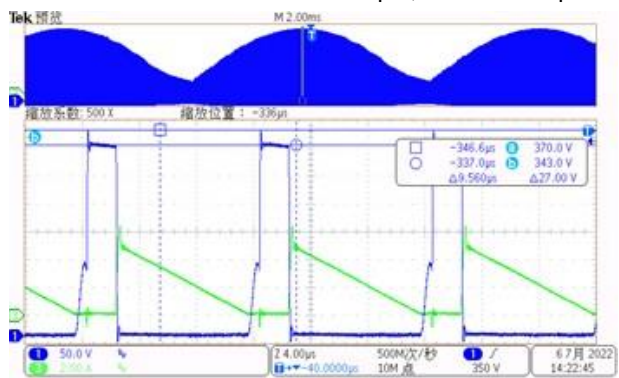
Test Condition: 100Vac/60Hz Input, 40V1.5A Output



(CH1::VD; CH3: ID)

Comments: OK $VD_peak=165.5V$, $ID_peak=8.48A$

Test Condition: 300Vac/60Hz Input, 40V1.5A Output



(CH1::Vin; CH2: Vo; CH4: Io)

Comments: OK $VD_peak=370V$, $ID_peak=6.44A$

3.6 Maximum Stress of Buck Output Diode

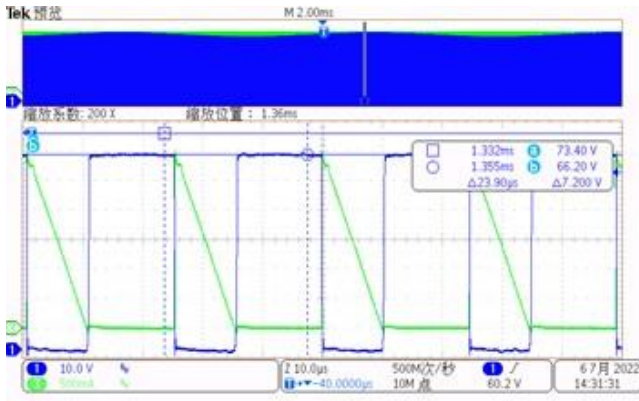
Test Conditions: Input: 100-300Vac; Output: 40V1.5A; Diode: SL10T100.

Standard: $VD_peak < 90\% * VD_{max}$

Result: Pass

Waveforms:

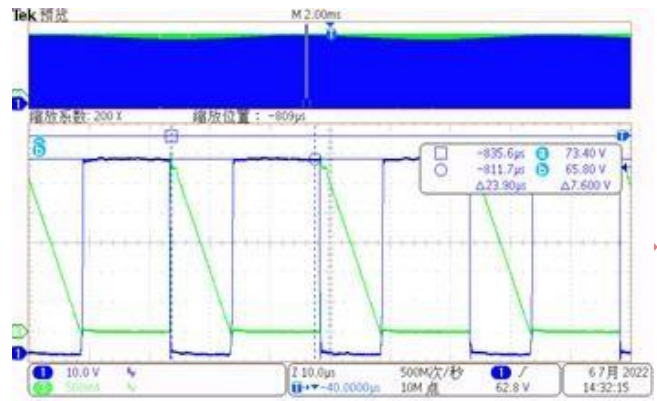
Test Condition: 100Vac/60Hz Input, 40V1.5A Output



(CH1::VD; CH3: ID)

Comments: OK VD_{peak}=73.4V, ID_{peak}=3A

Test Condition: 300Vac/60Hz Input, 40V1.5A Output



(CH1::Vin; CH2: Vo; CH4: Io)

Comments: OK VD_{peak}=73.4V, ID_{peak}=3A

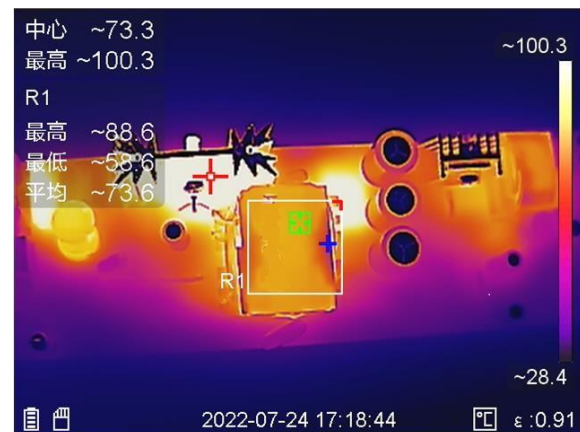
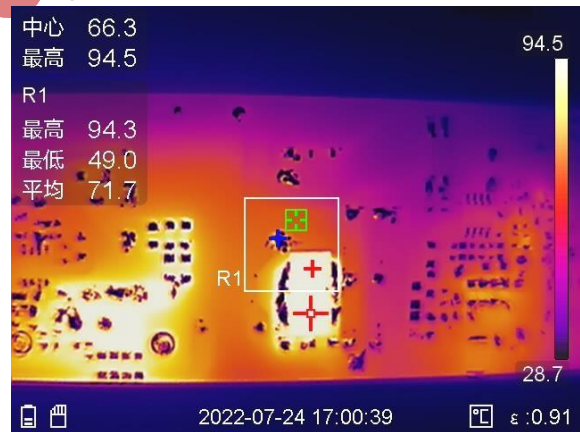
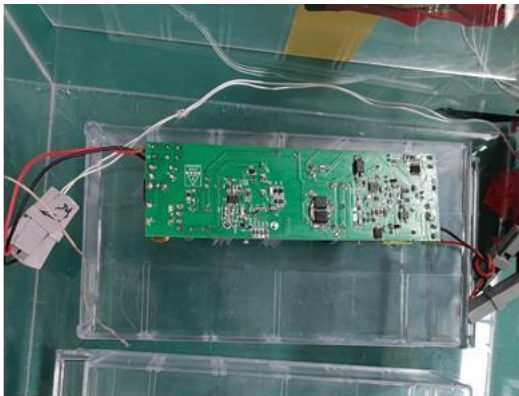
3.7 Thermal Test

Test Conditions: Input: 120/230/277Vac; Output: 40V1.5A. Burn-in 0.5Hour @ confined container and steady environment with no airflow, Ta is the temperature inside the cardboard box.

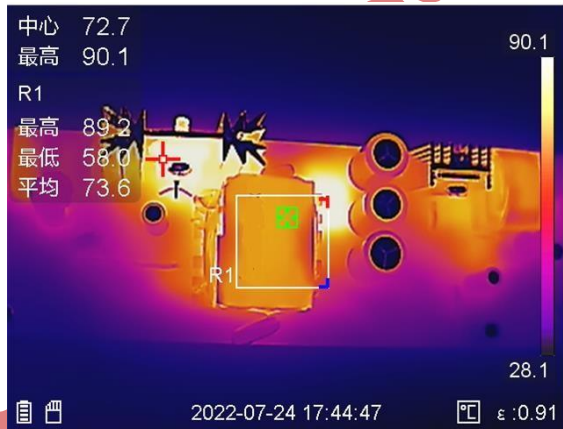
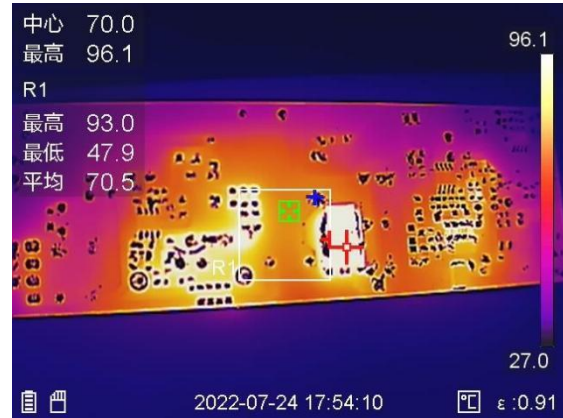
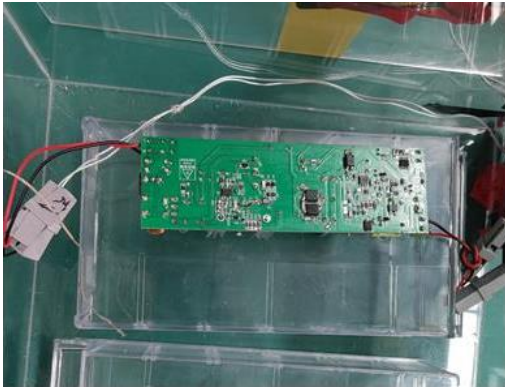
Standard: The maximum temperature is less than 110°C , and the temperature rise is lower than 80°C at room temperature.

Result: Pass

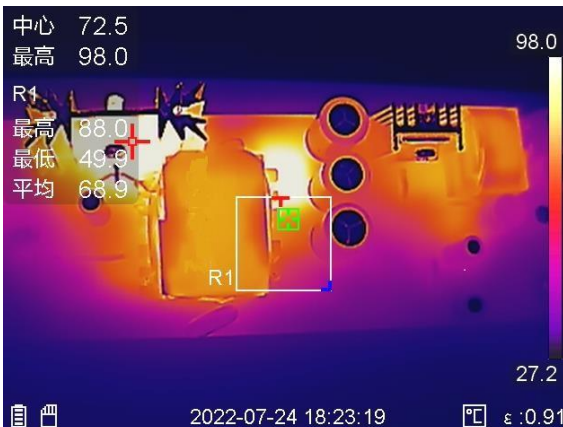
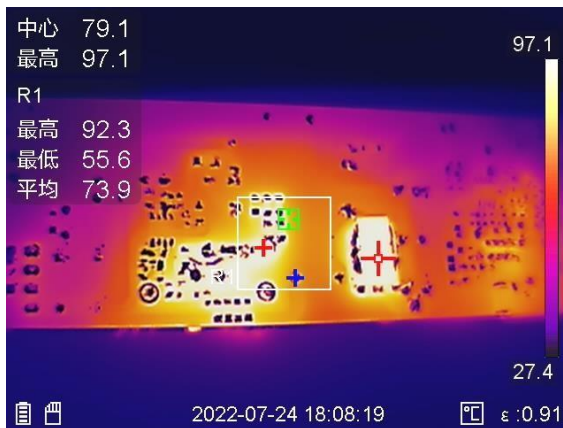
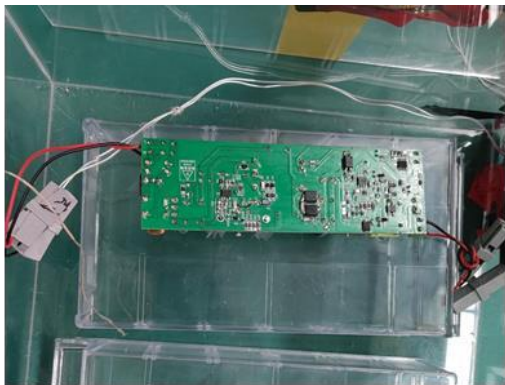
120V60Hz, Ta=28.5°C



230V50Hz, Ta=29.5°C



277V60Hz, Ta=30°C





A 60W Universal Input High Performance Two Stage Dimmable LED Driver with KP2813A+KP1601+KP1402

3.8 EMC Test

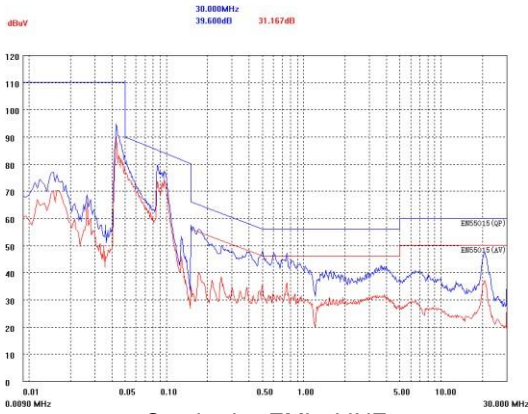
Test Conditions: Input: 110/220Vac; Output: 40V1.5A.

Standard:

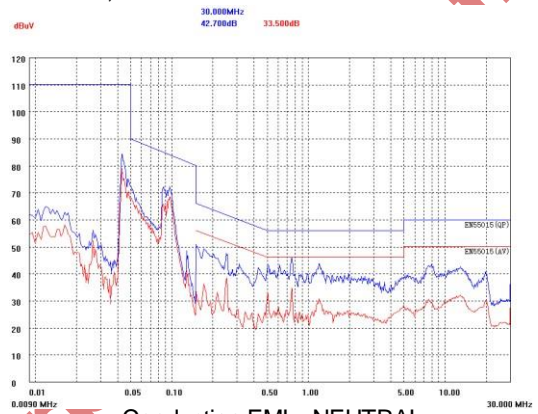
Standard	EN55015
Content	CE/CDN
Requirement	>6dB Margin

Result: Pass

Test Condition: Vin=110VAC/60Hz, CE

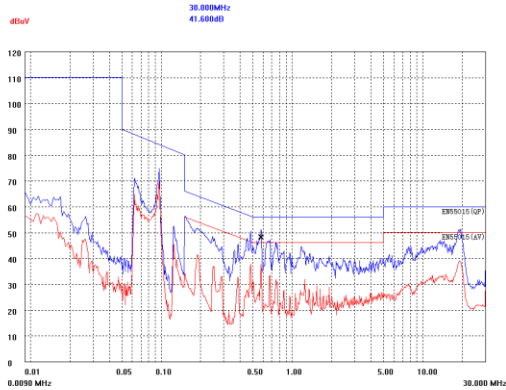


Conduction EMI---LINE

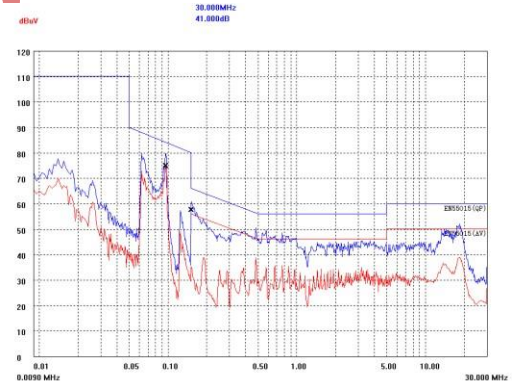


Conduction EMI---NEUTRAL

Test Condition: Vin=220VAC/50Hz, CE

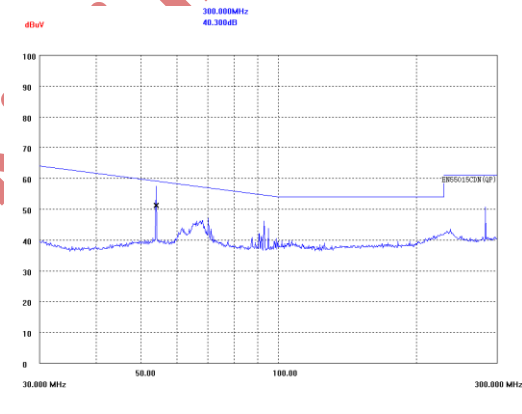


Radiation EMI---LINE

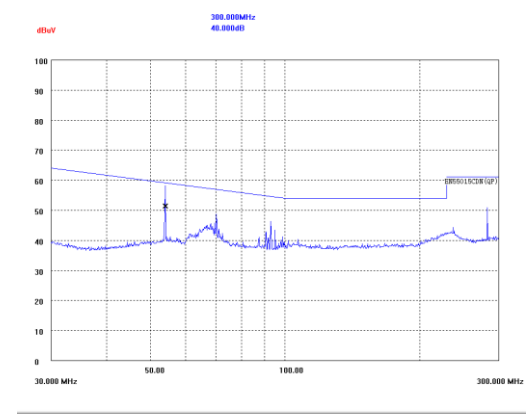


Radiation EMI---NEUTRAL

Test Condition: CDN



Conduction CDN---110VAC/60Hz



Conduction CDN---220VAC/50Hz



A 60W Universal Input High Performance Two Stage Dimmable LED Driver with KP2813A+KP1601+KP1402

3.9 Surge Test

Test Conditions: Input: 230Vac; Output: 40V1.5A.

Standard: >1000V

Result: Pass

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

A: Normal performance within limits specified by the manufacturer, requestor or purchaser;

B: Temporary loss of function or degradation of performance, which ceases after the disturbance ceases, and from which the equipment under test recovers its normal performance, without operation intervention;

C: Temporary loss of function or degradation of performance, the correction of which requires operator intervention;

D: Loss of function or degradation of performance which is not recoverable, owing to damage to hardware or software, or loss of data.

Test Result: A (A/B/C/D)

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 100VAC and 300VAC.
3. Connect the AC Power Source terminal to the "L" and "N" terminals on the Demo Board

Turn on the AC Power Source to make system startup; and Turn off the AC Power Source to make system shutdown.



**A 60W Universal Input High Performance Two Stage Dimmable
LED Driver with KP2813A+KP1601+KP1402**

Revision History

DATE	REV	DESCRIPTION
2022/08/01	1.0	First Release

Kiwi Instruments Corp. Confidential

Disclaimer

Kiwi reserves the right to make any change to its product, datasheet or specification without any notice. Users shall obtain the latest information before placing an order. Kiwi herein makes no guarantee or warranty, expressed or implied, including without limitation the warranties of merchantability, fitness for any purpose or non-infringement of third party rights, nor does Kiwi convey any license or permission including without limitation the intellectual property rights of Kiwi or any third party. Users should warrant that third party intellectual property right or other right is not infringed when integrating Kiwi products into any application or in use. Kiwi will not assume any liability arising from any said application or use, and especially disclaim any liability including without limitation any consequential or incidental damage. Without written declaration, Kiwi products are not designed for use in surgical device implant into the body or other life sustain systems. This disclaimer supersedes the disclaimers in previous versions.