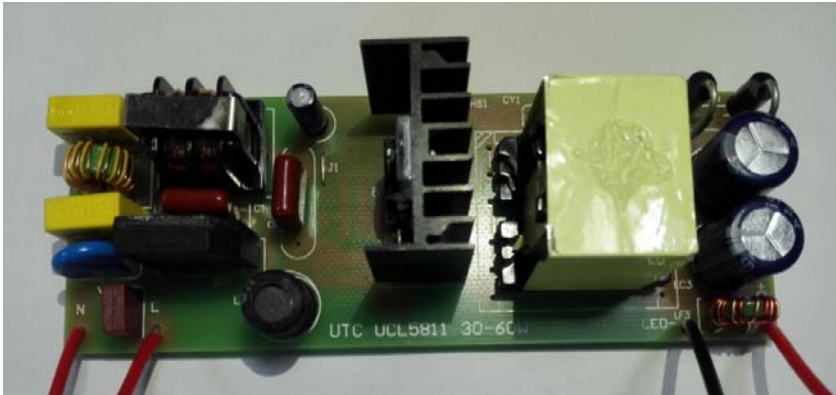




60W LED Driver Module Using UCL5811



Subject

UCL5811 Isolated LED Driver_60W_1.25A_Demo Board Manual

Key features:

- AC Input Range 90Vac~264Vac
 - High Efficiency(90%@230Vac,full load)
 - High PF(0.951@230Vac,full load)
 - Excellent line voltage regulation and load regulation($\pm 3\%$)
 - Multiple protection functions and high reliability
-

Revision History

Revise Date	Version	Reason/Issue
2016/12/28	A	First Issue



60W LED Driver Module Using UCL5811

Contents Index		Page
1	LED Demo Board Specification	3
1.1	Input Characteristics	3
1.2	Output Characteristics	3
1.3	Performance Specifications	3
1.4	Protection Function	3
1.5	Environment	3
2	LED Demo Board Information	4
2.1	Schematic	4
2.2	BOM	5
2.3	Transformer Design	5
2.3.1	Transformer Specification	5
2.3.2	Transformer Diagram	6
2.4	Demo Board Snapshot	
3	Performance Evaluation	7
3.1	Input Current	7
3.2	PF&THD	7
3.3	Efficiency	8
3.4	Line Regulation&Load Regulation	8
3.5	Thermal Testing	9
3.6	Protection	9
3.6.1	Open Loop Protection	9
3.6.2	Short Circuit Protection	9
4	Waveforms	10
4.1	VIN&IO startup waveform	10
4.2	VDS waveform	10
4.3	VCS waveform	11
4.4	VCC waveform	11
4.5	VD4 waveform	12
5	EMI	13
5.1	Live Conduction	13
5.2	Netural Conduction	13
5.3	Vertical Radiated	



60W LED Driver Module Using UCL5811

1. LED Demo Board Specification

1.1. Input Characteristics

- AC input voltage rating 100Vac ~ 240Vac
- AC input frequency range 90Vac~264Vac
- AC input frequency range 47Hz ~ 63Hz

1.2. Output Characteristics

- Output Voltage 36Vdc~48Vdc
- Typical output current 1.25A

1.3. Performance Specifications

- Maximum Output Power 60W

1.4. Protection Function

- Short Circuit Protection Shut down and auto recovery
- Open Loop Protection Shut down and auto recovery
- OTP Shut down and auto recovery

1.5. Environment

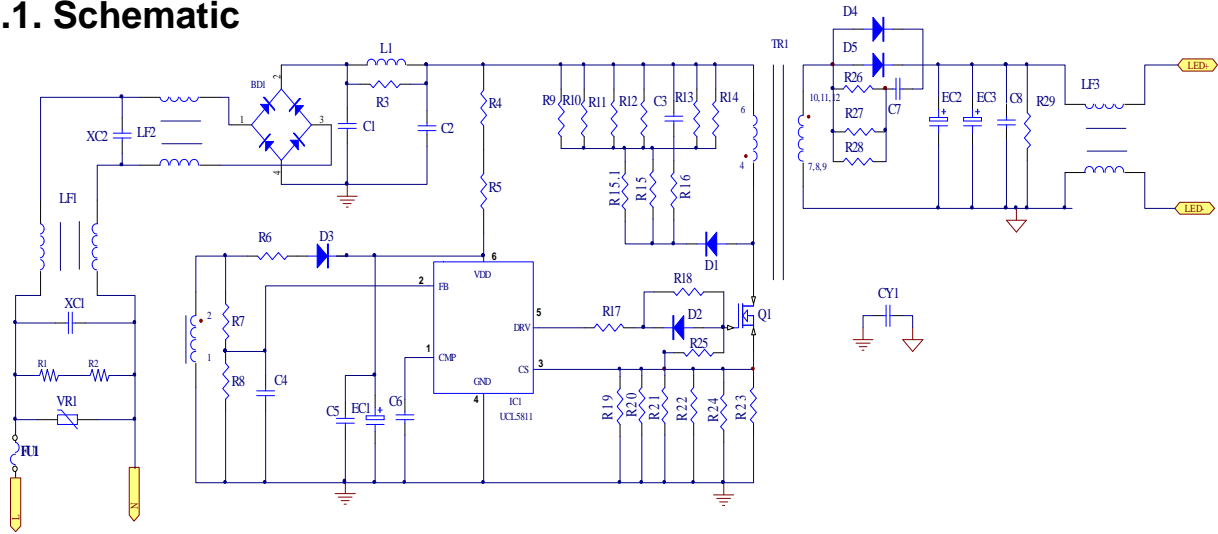
- Operation Temperature 0°C to 40 °C
- Operation Humidity 20% to 90% R.H
- Storage Temperature -40°C to 60 °C
- Storage Humidity 0% to 90% R.H



60W LED Driver Module Using UCL5811

2. LED Demo Board Information

2.1. Schematic



2.2. BOM

No.	Position	Description	Quantity
1	R1/R2	820KR, 5%, 1206	2
2	R3	5.1KR, 5%, 0805	1
3	R4/R5	200KR, 5%, 1206	2
4	R6	4.7R, 5%, 0805	1
5	R7	68KR, 1%, 0805	1
6	R8	14.3KR, 1%, 0805	1
7	R9/R10/R11/ R12/R13/R14	560KR, 5%, 1206	6
8	R15/R16	100R, 5%, 1206	2
9	R17	27R, 5%, 0805	1
10	R18	100R, 5%, 0805	1
11	R19/R20/R21/ R22/R23	0.75R, 1%, 1206	5
12	R25	10KR, 5%, 0805	1
13	R26/R27/R28	100R, 5%, 1206	3
14	R29	100K, 5%, 1206	1
15	C3	1nF, 1000V, 10%, 1206, X7R	1
16	C6	220nF, 50V, 10%, 0805, X7R	1
17	C7	330pF, 1000V, 10%, 1206, X7R	1
18	C8	100nF, 63V, 10%, 1206, X7R	1
19	FU1	FUSE 3.15A, 250V	1
20	EC1	10uF, 50V, 5*11, 105°, 5000H	1
21	EC2/EC3	560uF, 50V, 10*16, 105°, 5000H	2
22	C1/C2	0.22uF, 400V, F=10mm	2
23	BD1	KBP406	1
24	VR1	10D471K, P=7.5mm	1
25	XC1, XC2	0.22uF, 275V, P=10mm	2



60W LED Driver Module Using UCL5811

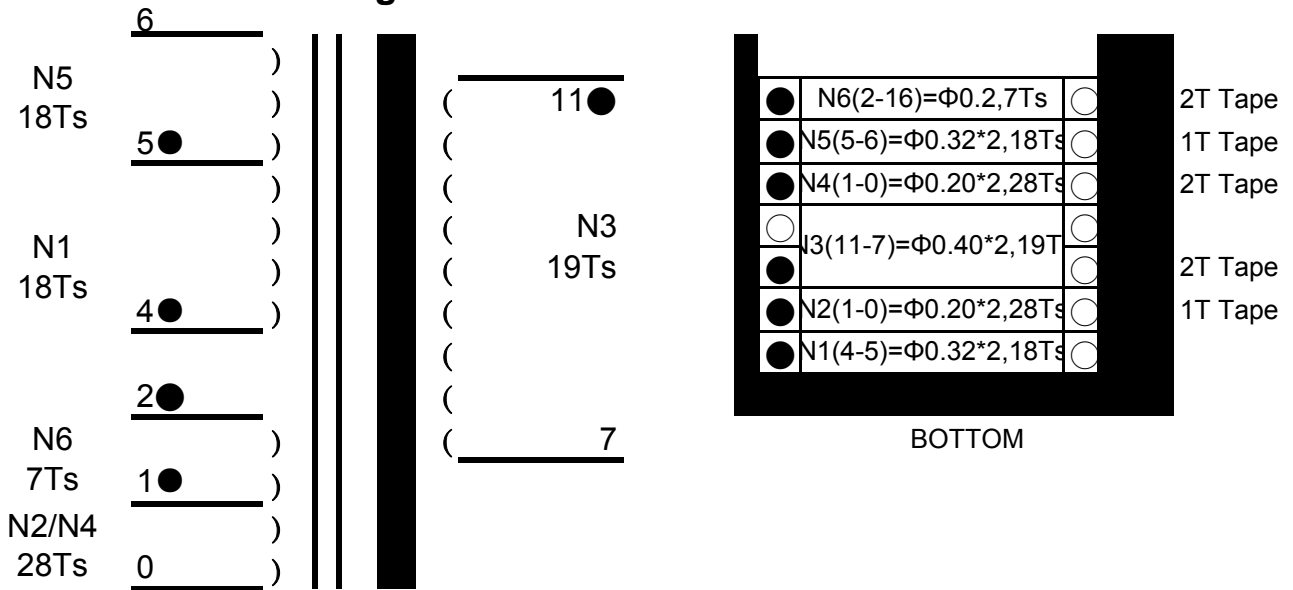
26	D1	UTC FR207G, DO-41	1
27	D4/D5	UTC SF56G (5A 400V), DO-201AD	2
28	D2	UTC 1N4148, SOD-323	1
29	D3	UTC F7, SOD-123	1
30	IC1	UTC UCL5811 SOP-8	1
31	Q1	UTC 10N65KL-MT TO-220F1	1
32	L1	1.0mH, 12*16, $\phi=0.4\text{mm}$	1
33	LF1	1.3mH, T10*6*5, $\phi=0.4\text{mm}$	1
34	LF2	20mH, UU10.5, $\phi=0.35\text{mm}$	1
35	LF3	300uH, T9*5*3, $\phi=0.4\text{mm}$	1
36	TR1	UTR-PQ2625 0.24mH	1
37	CY1	2.2nF, 400VAC, $\pm 20\%$, P=10mm	1
38	HS1	HEAT SINK	1
39	J1	Jump Wire 0.6X7mm	1
40	SCREW	M3.0*5.0mm	1

2.3. Transformer Design

2.3.1. Transformer Specification

- 1) Bobbin: PQ2625 6+6
- 2) Core material: PC40 (TDK or equivalent)
- 3) L_p 4-6: 0.24mH $\pm 5\%$ (10KHz/1.0V)

2.3.2. Transformer Diagram

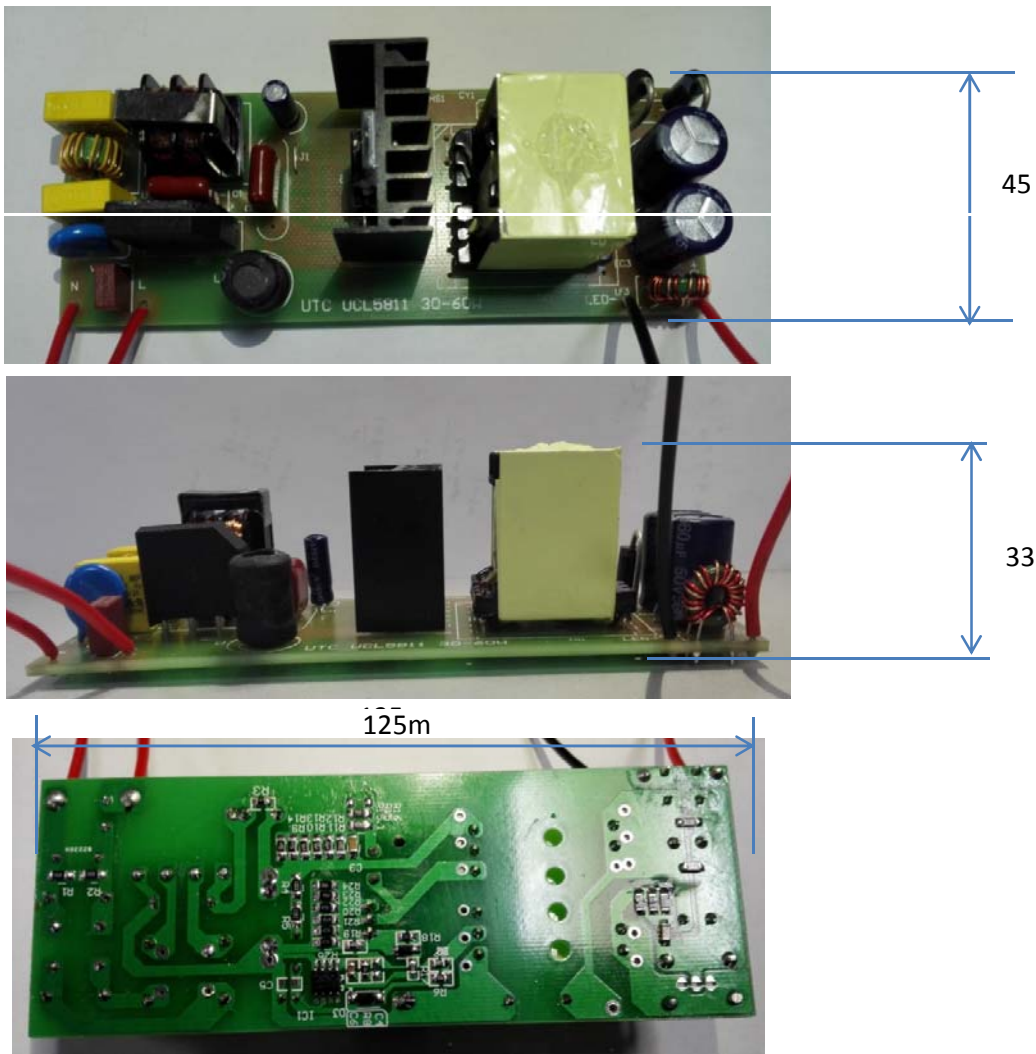


60W LED Driver Module Using UCL5811

Transformer Winding Data

Layer No.	Winding	Material	Start	Turns	Finish
1	N1	0.32Φ X 2 2 UEW	4	18	5
2	Tape	Tape		1	
3	N2	0.2Φ X 2 2 UEW	1	28	0
4	Tape	Tape		2	
5	N3	Triple Insulated Wire 0.40Φ X2	11	19	7
6	Tape	Tape		2	
7	N4	0.2Φ X 2 2 UEW	1	28	0
8	Tape	Tape		1	
9	N5	0.32Φ X 2 2 UEW	5	18	6
10	Tape	Tape		2	
11	N6	0.2Φ 2 UEW	2	7	1
12	Tape	Tape		2	

2.4. Demo Board Snapshot



UNISONIC TECHNOLOGIES CO., LTD

www.unisonic.com.tw

60W LED Driver Module Using UCL5811

3. Performance Evaluation

This document presented here is to describe the LED Driver Module performance.

The measuring data are tested at the PCB end, unless otherwise specified.

The Summarized Result :

Item	Test result
1. Input Characteristics	
Input Voltage rating	100Vac ~ 240Vac
Input Current (@Vin=90Vac, full load)	770mA
2. Output characteristics	
Maximum Output Power	60W
Output Typical Voltage	36Vdc~48Vdc
Output Typical Current	1.25A
3. Protection	
Short Circuit Protection	Auto Recovery
Open Loop Protection	Auto Recovery

Test Equipment:

Item	Vendor	Model No:
1.AC Source	GW INSTRON	APS-9501
2.Digital Power meter	DECTECH	3330S
3.Electronic Load	PRODIGIT	3302C
4.Digital Oscilloscope	Tektronics	DPO3012
5.Multi-meter	Keithley	2000

3.1 Input Current(@FULL LOAD)

Input Voltage	Irms (mA)	SPEC	RESULT
90Vac/60Hz	770	N/A	N/A
110Vac/60Hz	600		
220Vac/50Hz	310		
264Vac/50Hz	280		

3.2 PF&THD(@FULL LOAD)

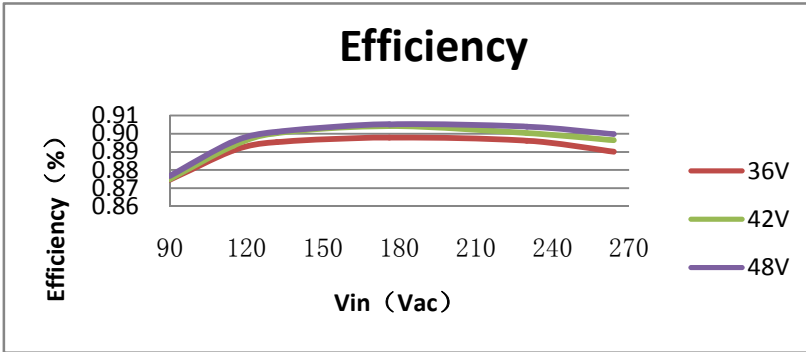
VIN (Vac)	PF	THD (%)	SPEC	RESULT
90	0.994	8.4	PF>0.9 THD<15%	OK
115	0.991	9.2		
230	0.951	9.9		
264	0.929	10.6		



60W LED Driver Module Using UCL5811

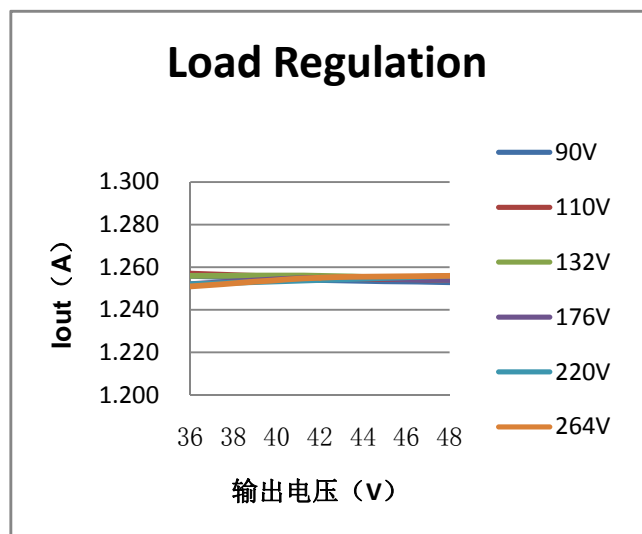
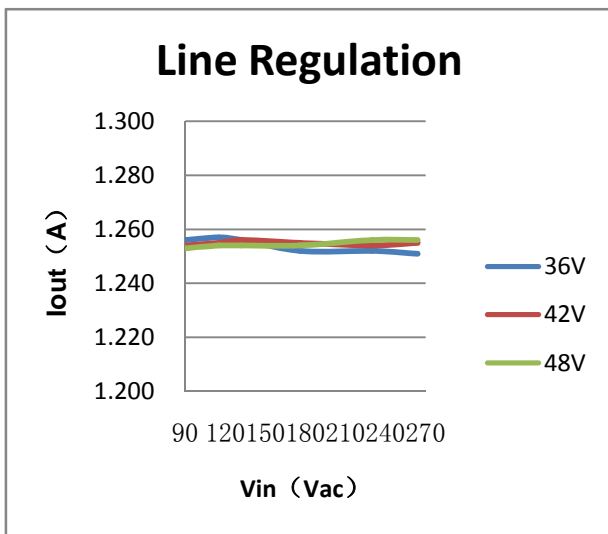
3.3 Efficiency

load (V) \ Vin (Vac)	90	115	132	176	230	264
36	0.87	0.89	0.90	0.90	0.90	0.89
42	0.87	0.89	0.90	0.90	0.90	0.90
48	0.88	0.90	0.90	0.91	0.90	0.90



3.4 Line Regulation & Load Regulation

Input Voltage (Vac)	Pin (W) & Iout (A)						Load Regulation
	Vout=36V		Vout=42V		Vout=48V		
90	51.7	1.256	60.2	1.254	68.6	1.253	0.12%
115	50.8	1.257	59.0	1.255	67.2	1.254	0.12%
132	50.5	1.256	58.6	1.256	66.8	1.254	0.08%
176	50.2	1.252	58.3	1.255	66.5	1.254	0.12%
230	50.3	1.252	58.5	1.254	66.7	1.256	0.16%
264	50.6	1.251	58.8	1.255	67.0	1.256	0.20%
Line	0.24%		0.08%		0.12%		\



60W LED Driver Module Using UCL5811

3.5 Thermal Testing

Test@FULL LOAD Ambient 30 °C

input voltage	90Vac	264Vac
IC1	61.4°C	52.1°C
TR1 Wire	74.4°C	79.5°C
TR1 Core	64.2°C	69.5°C
D4(SF56)	79.5°C	84.1°C
Q1(10N65)	74.2°C	58.7°C
BD1	84.5°C	50.4°C
EC2	50.2°C	56.2°C

3.6. Protection

3.6.1. Open Loop Protection

When LED connection is opened , the Output will be limited to 60V.Once the condition is removed, and the power will be back to normal output Voltage .

Input Voltage	Output Voltage (V)	Spec	Result
90Vac/60Hz	53.4	60V	OK
115Vac/60Hz	53.2		
230Vac/50Hz	54.3		
264Vac/50Hz	54.2		

3.6.2. Short Circuit Protection

When Short Circuit Protection condition is removed and restart the power,the power will recover

Input Voltage	Pi(mW)	Remark
90Vac/60Hz	0.24	—
115Vac/60Hz	0.24	—
230Vac/50Hz	0.24	—
264Vac/50Hz	0.24	—



60W LED Driver Module Using UCL5811

4 Waveforms

4.1 VIN&IO startup waveform

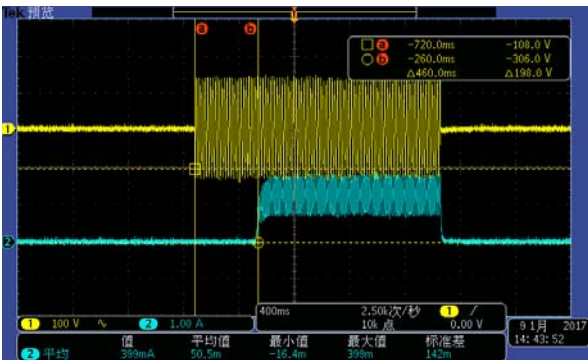


Fig1.VIN&IO startup waveform@90Vac FULL LOAD
CH1=VIN,CH2=IO,Startup time=460ms

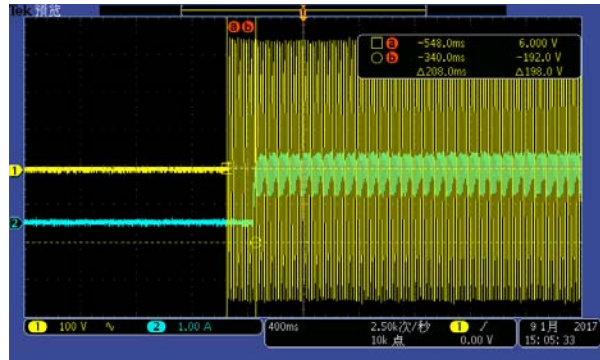


Fig2.VIN&IO startup waveform@264Vac FULL LOAD
CH1=VIN,CH2=IO,Startup time=208ms

4.2 VDS waveform



Fig3.VDS waveform@90Vac FULL LOAD

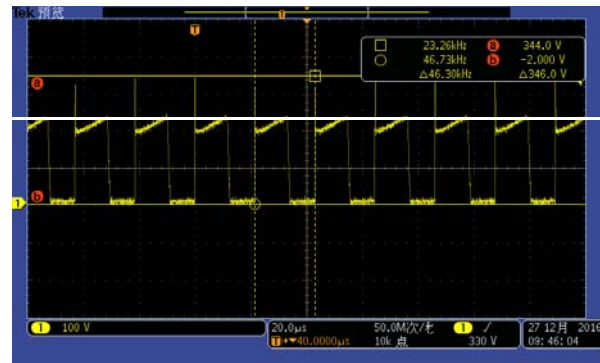


Fig4.Spread VDS waveform@90Vac FULL LOAD
CH1=Vds, Vds (P-P) =346V, f=46.30KHz

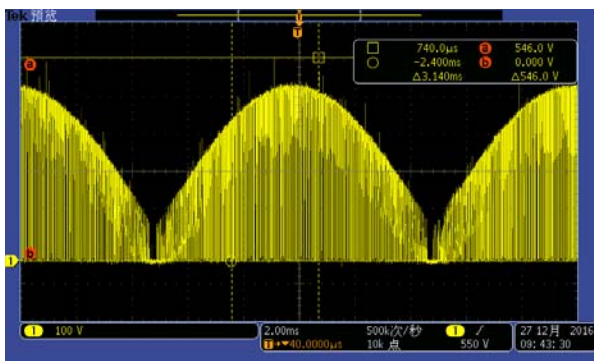


Fig5.VDS waveform@264Vac FULL LOAD

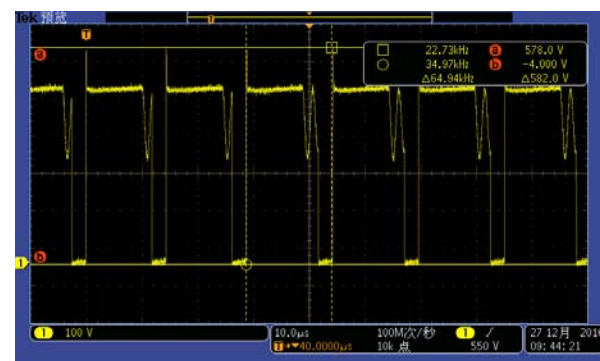


Fig6.Spread VDS waveform@264Vac FULL LOAD
CH1=Vds, Vds (P-P) =582V, f=64.94KHz



60W LED Driver Module Using UCL5811

4.3 VCS waveform

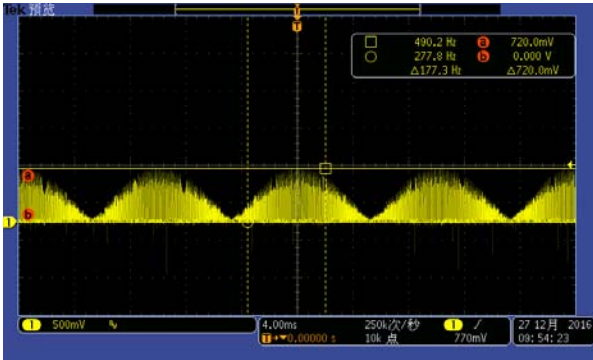


Fig7.VCS waveform@90Vac FULL LOAD

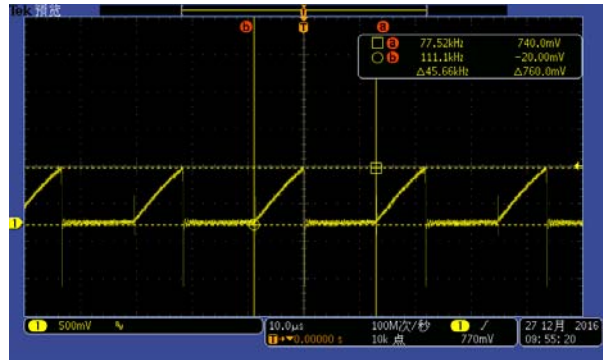


Fig8.Spread VCS waveform@90Vac FULL LOAD

CH1=Vcs, Vcs (P-P) =760mv, f=45.66KHz

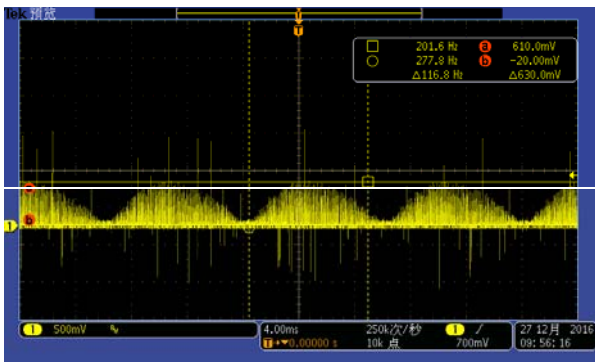


Fig9.VCS waveform@264Vac FULL LOAD

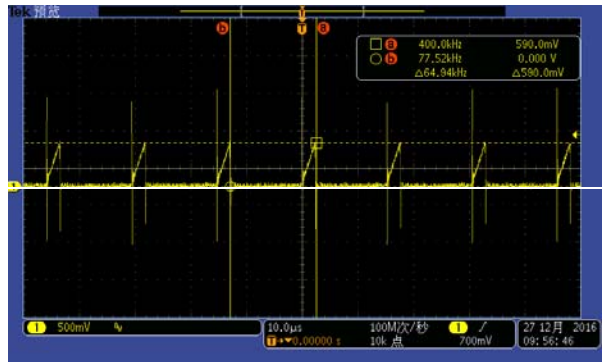


Fig10.Spread VCS waveform@264Vac FULL LOAD

CH1=Vcs, Vcs (P-P) =590mv, f=64.94KHz

4.4 VCC waveform

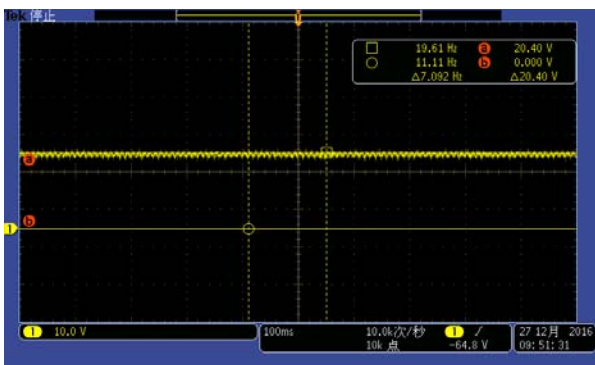


Fig11.VCC waveform@90Vac FULL LOAD
CH1=VCC, VCC (P-P) =20.4V

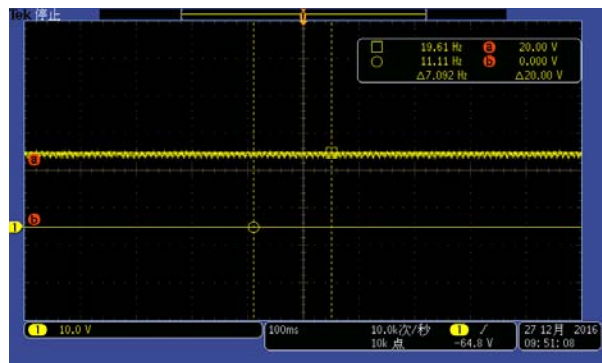


Fig12.VCC waveform@264Vac FULL LOAD
CH1=VCC, VCC (P-P) =20.00V



60W LED Driver Module Using UCL5811

4.5 VD4 waveform

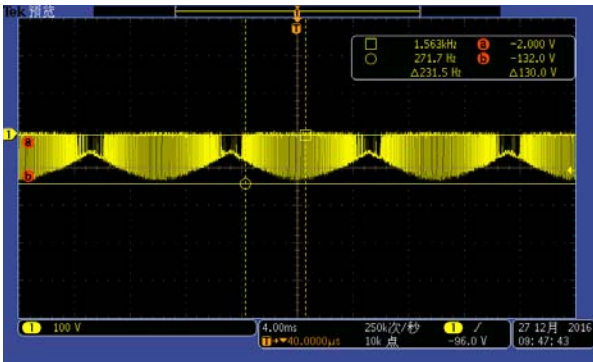


Fig13.VD4 waveform@90Vac FULL LOAD

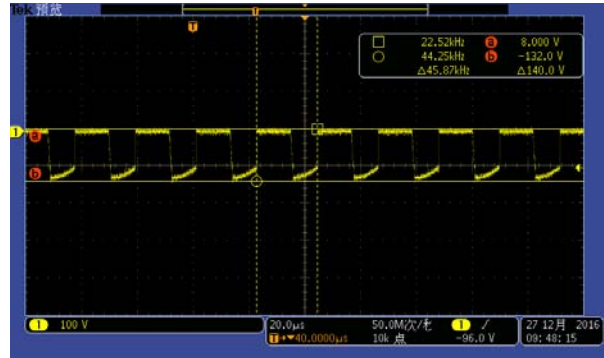


Fig14.Spread VD4 waveform@90Vac FULL LOAD
CH1=VD4, VD4 (P-P) =140v, f=45.87KHz

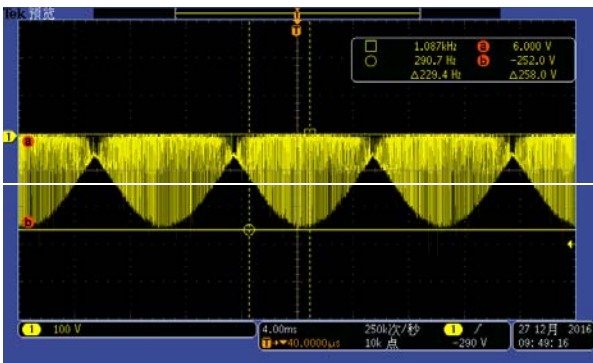


Fig15.VD4 waveform@264Vac FULL LOAD

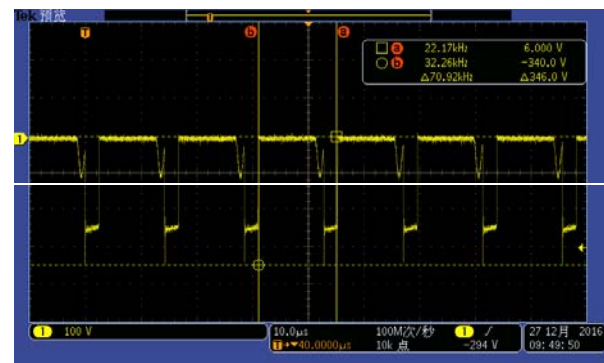


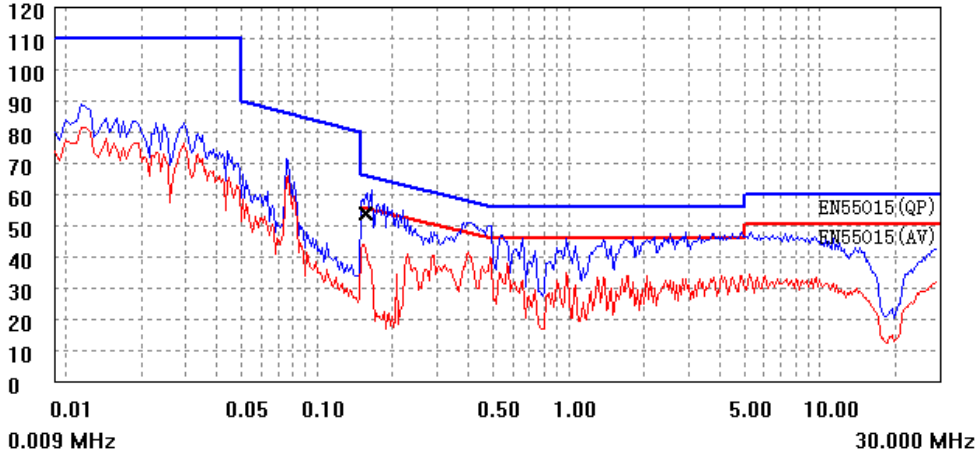
Fig16.Spread VD4 waveform@264Vac FULL LOAD
CH1=VD4, VD4 (P-P) =346v, f=70.92KHz

60W LED Driver Module Using UCL5811

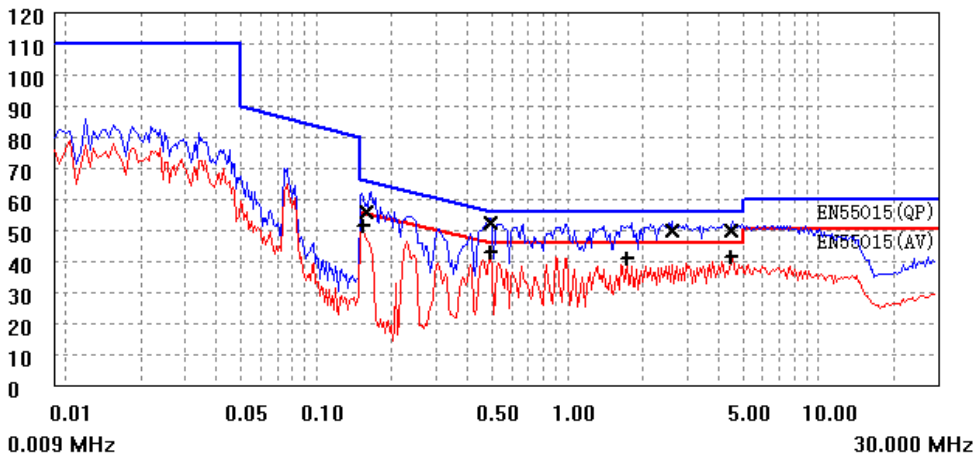
5 EMI

(Test @Vin=230Vac/50Hz, FULL Load)

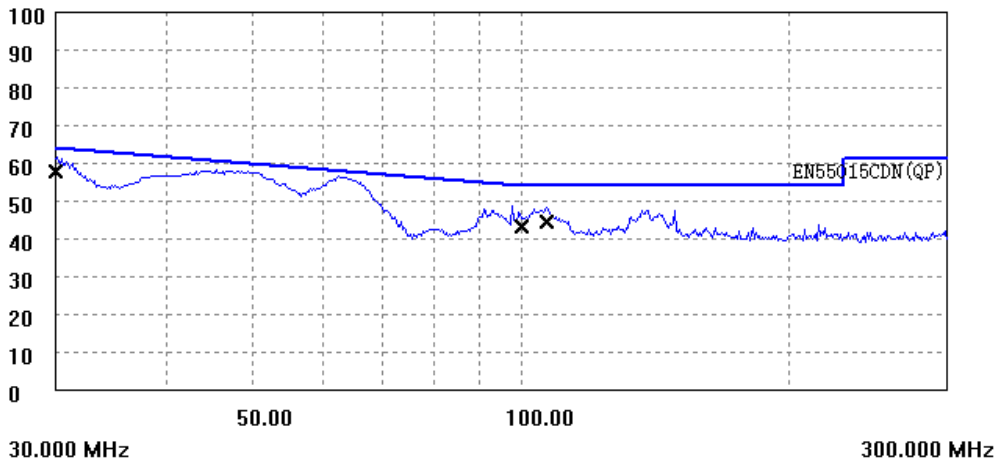
5.1 Live Conduction



5.2 Natural Conduction



5.2 Vertical Radiated



UNISONIC TECHNOLOGIES CO., LTD

www.unisonic.com.tw