

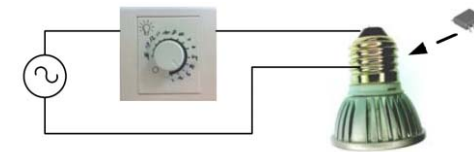


Dimmable LED Driver with iW3614 (Input 180~264Vac Output 40V700mA)

Design Purpose and Feature

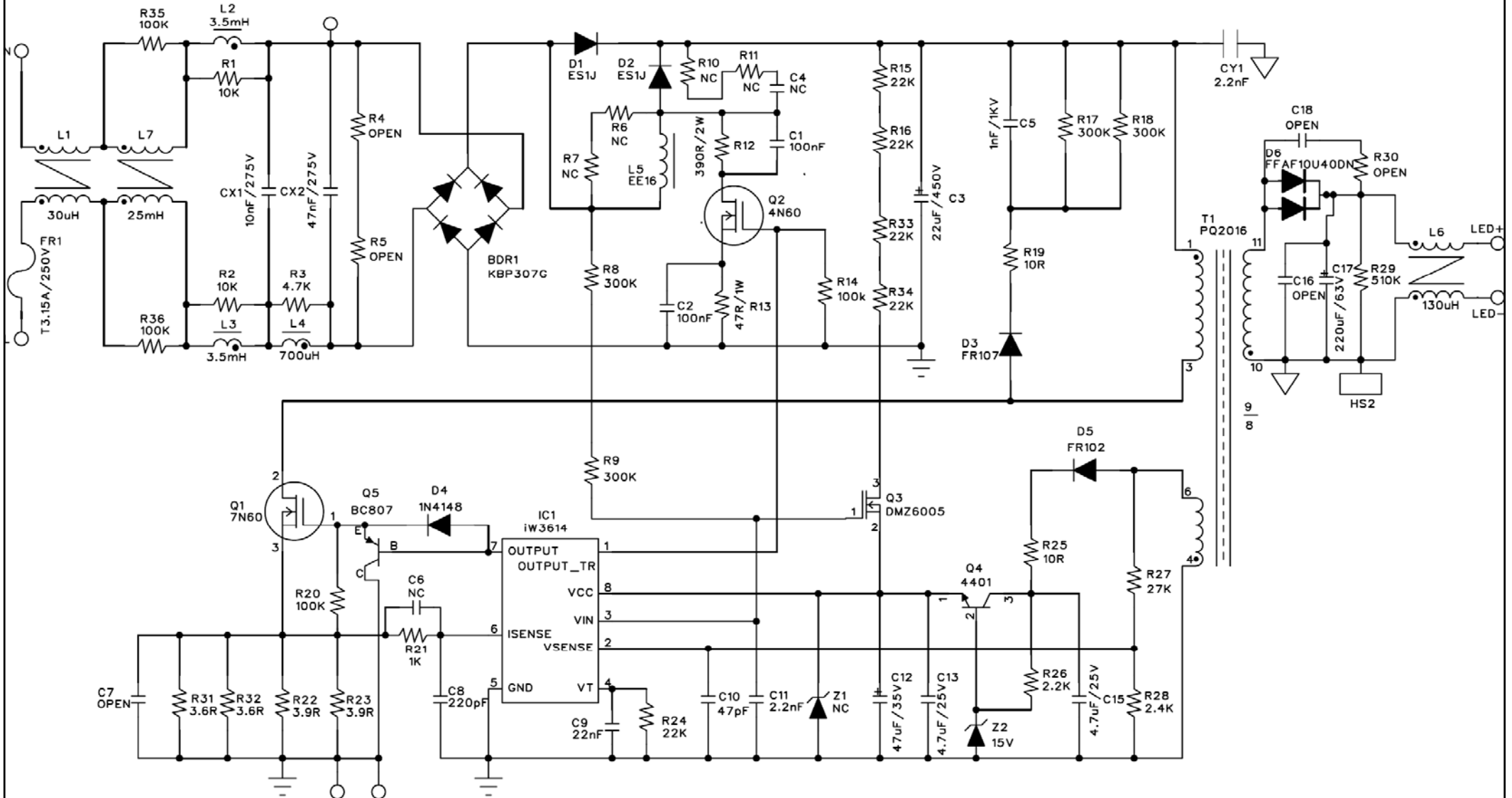
(AC input 180~264Vac, Output 40V700mA 12 LEDs_iW3614)

- Isolated ac-dc offline Input 230Vac, Output 12 LEDs 700mA
- Intelligent wall dimmer detections
 - Leading-edge dimmer , Trailing-edge dimmer , No-dimmer
- Multiple dimming control scheme
 - Hybrid dimming scheme
 - PWM dimming scheme,900Hz
 - Amplitude dimming scheme
- Wide dimming range from 1% up to 100%
- No visible flicker
- Resonant control to achieve high efficiency
- High Power Factor, 0.95 without dimmer
- Temperature degrade control to adjust the LED
- Primary-only Sensing eliminates opto-isolator feedback and simplifies design



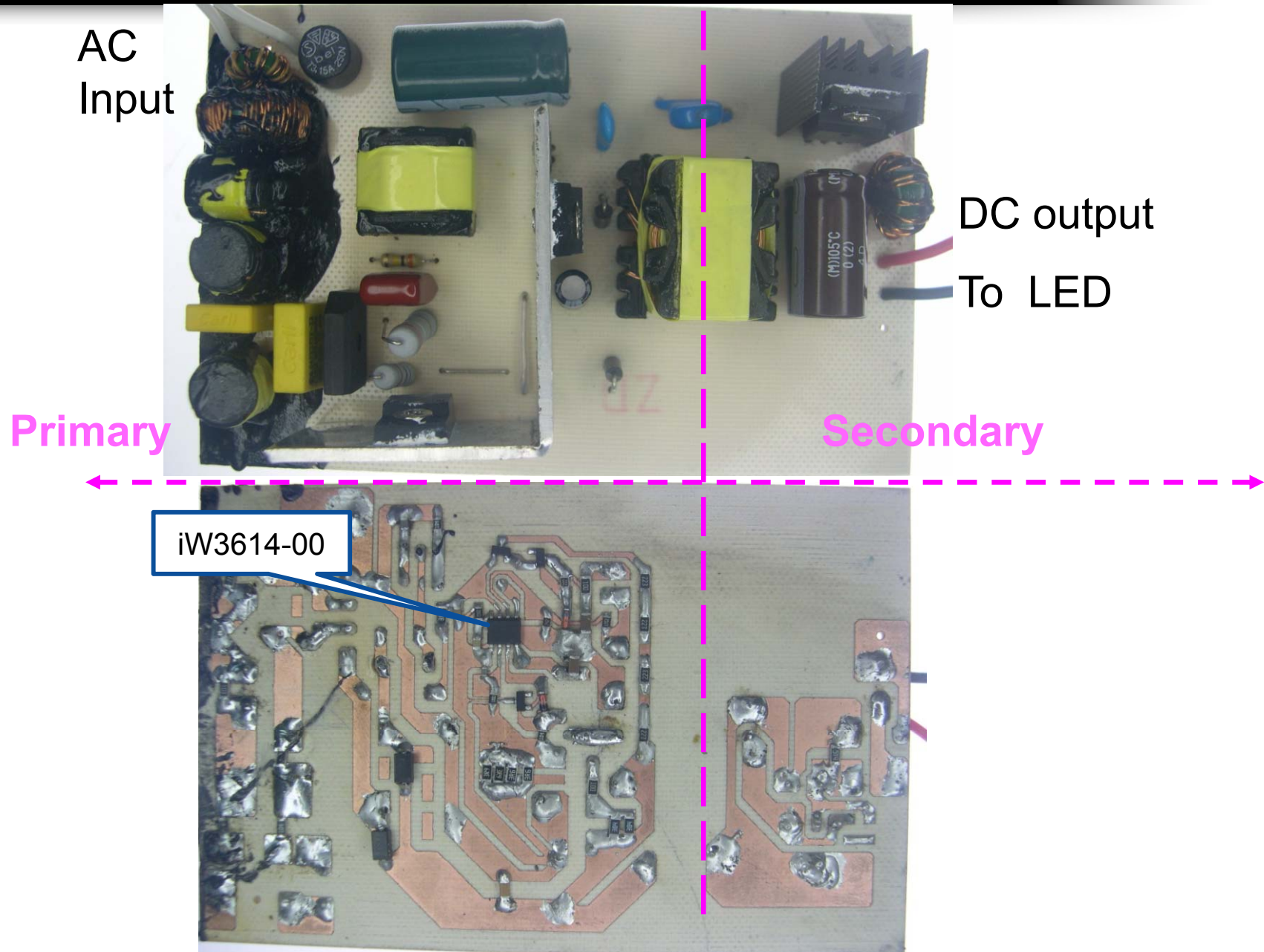
1.Schematics

(AC input 180~264Vac, Output 40V700mA 12 LEDs_iW3614)



2.PCB Layout

(AC input 180~264Vac, Output 40V700mA 12 LEDs_iW3614)



3.BOM

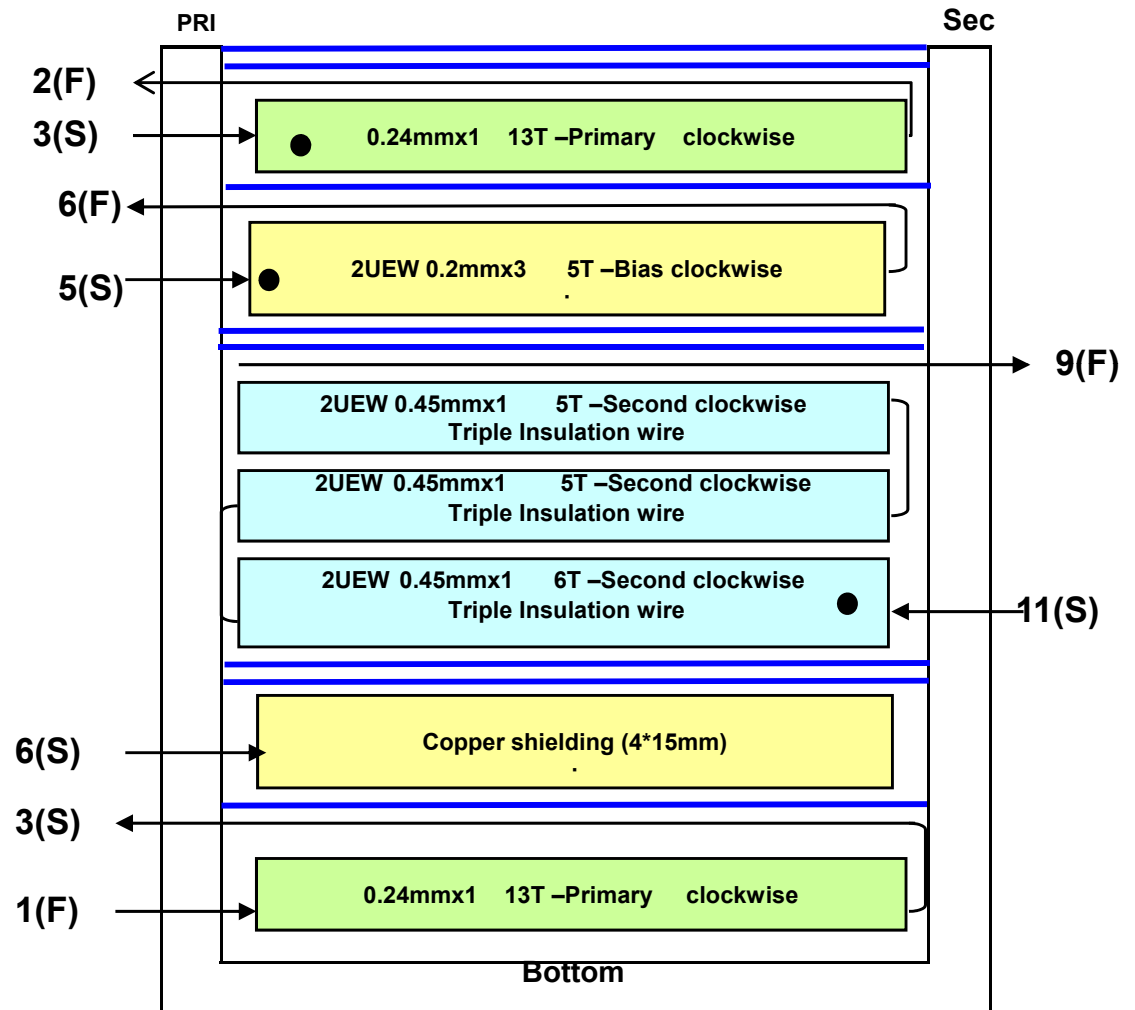
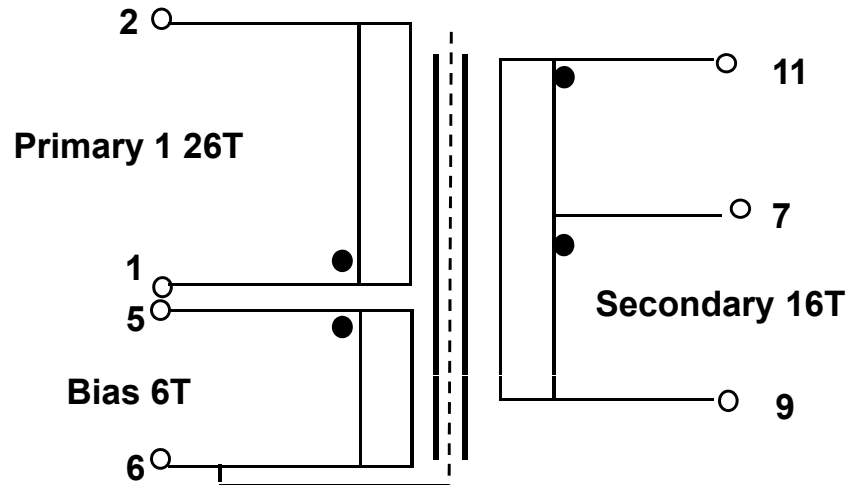
(AC input 180~264Vac, Output 40V700mA 12 LEDs_iW3614)

Item	Reference	Description	Qty	Item	Reference	Description	Qty
1	IC1	iW3614, Digital PWM Controller, Dimmable, SO-8	1	29	R31,R32	3.6Ω ±1 %, SMD-1206	2
2	CX1	10nF,275V, X2	1	30	R8	300KΩ, ±5%, 1/4W	1
3	CX2	47nF,275V, X2	1	31	R13	47Ω, ±5%, 1W	1
4	C1	100nF,450V,P=7.5mm	1	32	R12	390Ω, ±5%, 2W	1
5	C3	22uF, 450V, E-CAP, 105°C	1	33	FR1	T3.15A 250V	1
6	C12	47uF, 35V, E-CAP, 105°C	1	34	BDR1	KBP307G KBP	1
7	C17	220uF,63V, E-CAP	1	35	D3	FR107, 1A/1000V, DO-41	1
8	C5	1nF,1kV,P=5.0mm	1	36	D5	FR102 1A/200V, DO-41	1
9	C10	47pF,50V, X7R, SMD-0805	1	37	D1,D2	ES1J 1A/600V, SMD	2
10	C11	2.2nF,50V, X7R, SMD-0805	1	38	D4	1N4148 0.1A/100V, SMD LL-34	1
11	C8	220pF,25V, X7R, SMD-0805	1	39	D6	FFAF10U40DN 10A 400V TO-220F	1
12	C9	22nF,50V, X7R, SMD-0805	1	40	Z2	Zener, 15V, LL-34	1
13	C2	100nF,50V, X7R, SMD-0805	1	41	CY1	Y1,2.2nF,400V	1
14	C15,C13	4.7uF/25V, SMD-1206	2	42	Q1	7N60, TO-220F 7A 600V	1
15	R26	2.2KΩ ±5%, SMD-0805	1	43	Q2	4N60, TO-220F 4A 600V	1
16	R24	22KΩ ±5%, SMD-0805	1	44	Q3	DMZ6005, N-Depletion, 600V, SOT-23	1
17	R14,R20	100KΩ ±5%, SMD-0805	2	45	Q4	MMBT4401, NPN, SOT-23	1
18	R19,R25	10Ω ±5%, SMD-1206	2	46	Q5	BC807, PNP, SOT-23	1
19	R3	4.7KΩ ±5%, SMD-1206	1	47	L2,L3	Drumchoke 10X12mm 3.5mH	2
20	R1,R2	10KΩ ±5%, SMD-1206	2	48	L4	Drumchoke 10X12mm 700uH	1
21	R15,R16,R33,R34	22KΩ ±5%, SMD-1206	4	49	L7	Common Mode Inductor T14*8*5.5 25mH	1
22	R35,R36	100KΩ ±5%, SMD-1206	2	50	L1	Common Mode Inductor T9*4.5*3 30uH	1
23	R9,R17,R18	300KΩ ±5%, SMD-1206	3	51	L6	Common Mode Inductor T10*5*5 130uH	1
24	R29	510KΩ ±5%, SMD-1206	1	52	L5	EE16 L=1.5mH	1
25	R21	1KΩ ±1%, SMD-0805	1	53	T1	Transformer FQ2016 L=0.75mH	1
26	R28	2.4KΩ ±1%, SMD-0805	1	54	HS1	copper 45+35*2*20mm	1
27	R27	27KΩ ±1%, SMD-0805	1	55	HS2	copper 10*15*20mm	1
28	R22,R23	3.9Ω ±1%, SMD-1206	2	56	FOR HS1,HS2	screw FVB*8	3

4. Transformer Design

(AC input 180~264Vac, Output 52V700mA 14 LEDs_iW3614)

SCHEMATIC



ELECTRICAL SPECIFICATIONS:

1. Primary Inductance (L_p) = 0.62mH @10KHz
2. Primary Leakage Inductance (L_k) ≤ 40uH@10KHz

MATERIALS:

1. Core : PQ3216 (Ferrite Material TDK PC40 or equivalent)
2. Bobbin : PQ3216 Vertical Primary=6, Secondary=5
3. Magnet Wires (Pri) : Type 2-UEW
4. Magnet Wire (Sec) : Triple Insulated Wires
5. Layer Insulation Tape : 3M1298 or equivalent.

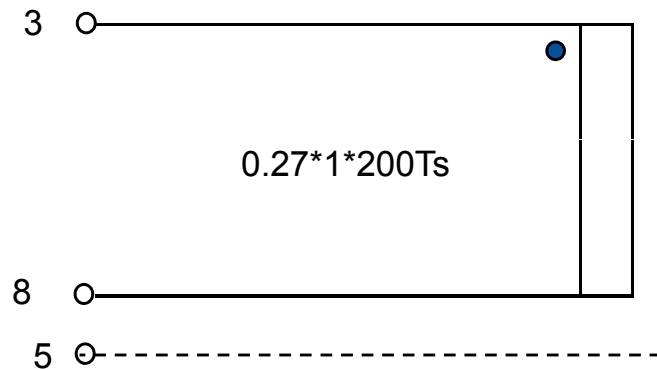
FINISHED :

1. Cut remained of Pin4,7,8,10 after wires termination
2. Varnish the complete assembly
3. Core is connected to primary pin4

5.PFC Inductor L3 Design

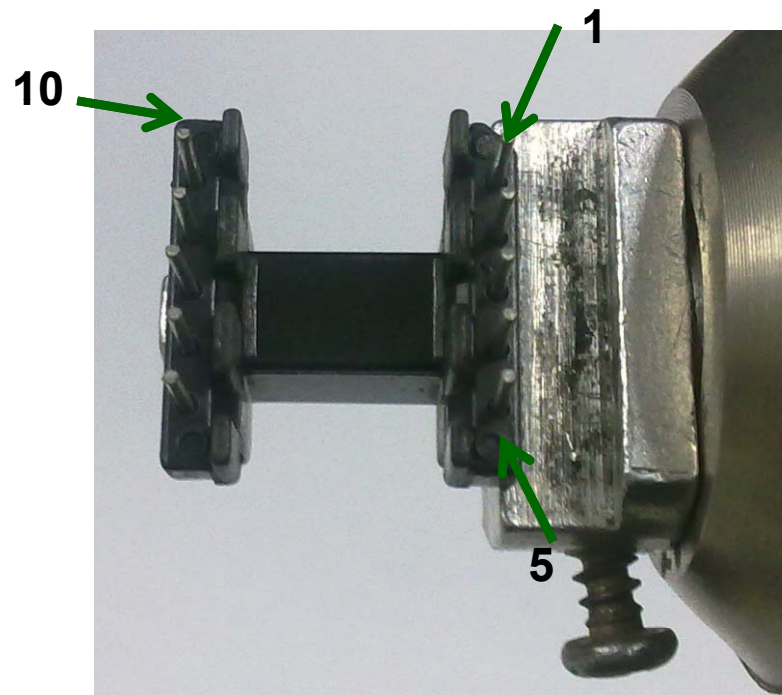
(AC input 180~264Vac, Output 53V700mA 14 LEDs_iW3614)

SCHEMATIC



ELECTRICAL SPECIFICATIONS:

1. Inductance (L_p) = 1.25mH @10KHz
2. Core : EE16 (Ferrite Material TDK PC40 or equivalent)
3. Bobbin : EE10 horizontal
4. Ferrite core is connected to Pin 5 after assembling
5. Cut remained of Pin1,4,6,7,9,10 after wires termination
6. Varnish the complete assembly



6. Common Mode Inductor

(AC input 180~264Vac, Output 40V700mA 12 LEDs_iW3614)

6. 1 Common Mode Inductor L1



core size:T9*4.5*3

Wire gauge: 0.35mm*2(Insulation& 2-UEW wire) 9 Turns

Inductance @10kHz, 1V: 30uH +/-20%

ICR: 0.3 OHM +/-20%

6. 2 Common Mode Inductor L7



core size : T 14*8*5.5

Wire gauge: 0.35mm, 60 Turns

Inductance @10kHz, 1V: 25mH +/-20%

ICR: 3.5 OHM +/-20%

6. 3 Common Mode Inductor L6



core size : T 10*5*5

Wire gauge: 0.35mm, 9 Turns

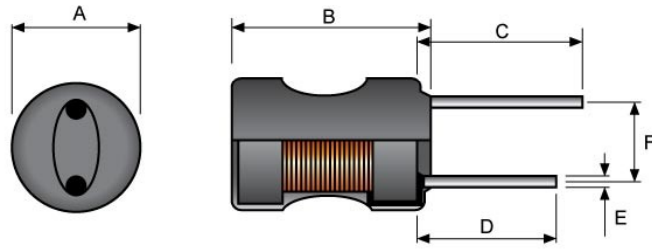
Inductance @10kHz, 1V: 130uH +/-20%

ICR: 0.1 OHM +/-20%

7. Differential Mode Inductor

(AC input 180~264Vac, Output 40V700mA 12 LEDs_iW3614)

7.1 Differential Mode Inductor L2,L3



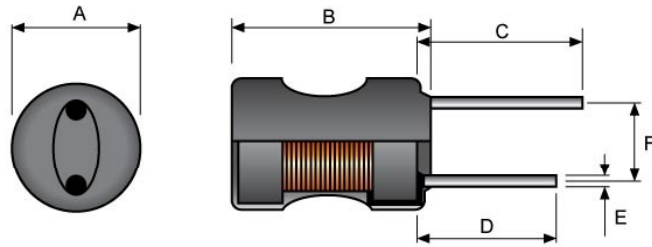
Ferrite core size : Ax B 10x12mm

Wire gauge: 0.24mm, 290 Turns

Inductance @10kHz, 1V: 3.5mH +/-20%

ICR: 2.6 OHM +/-20%

7.2 Differential Mode Inductor L4



Ferrite core size : Ax B 10x12mm

Wire gauge: 0.35mm, 130 Turns

Inductance @10kHz, 1V: 700uH +/-20%

ICR: 0.5 OHM +/-20%

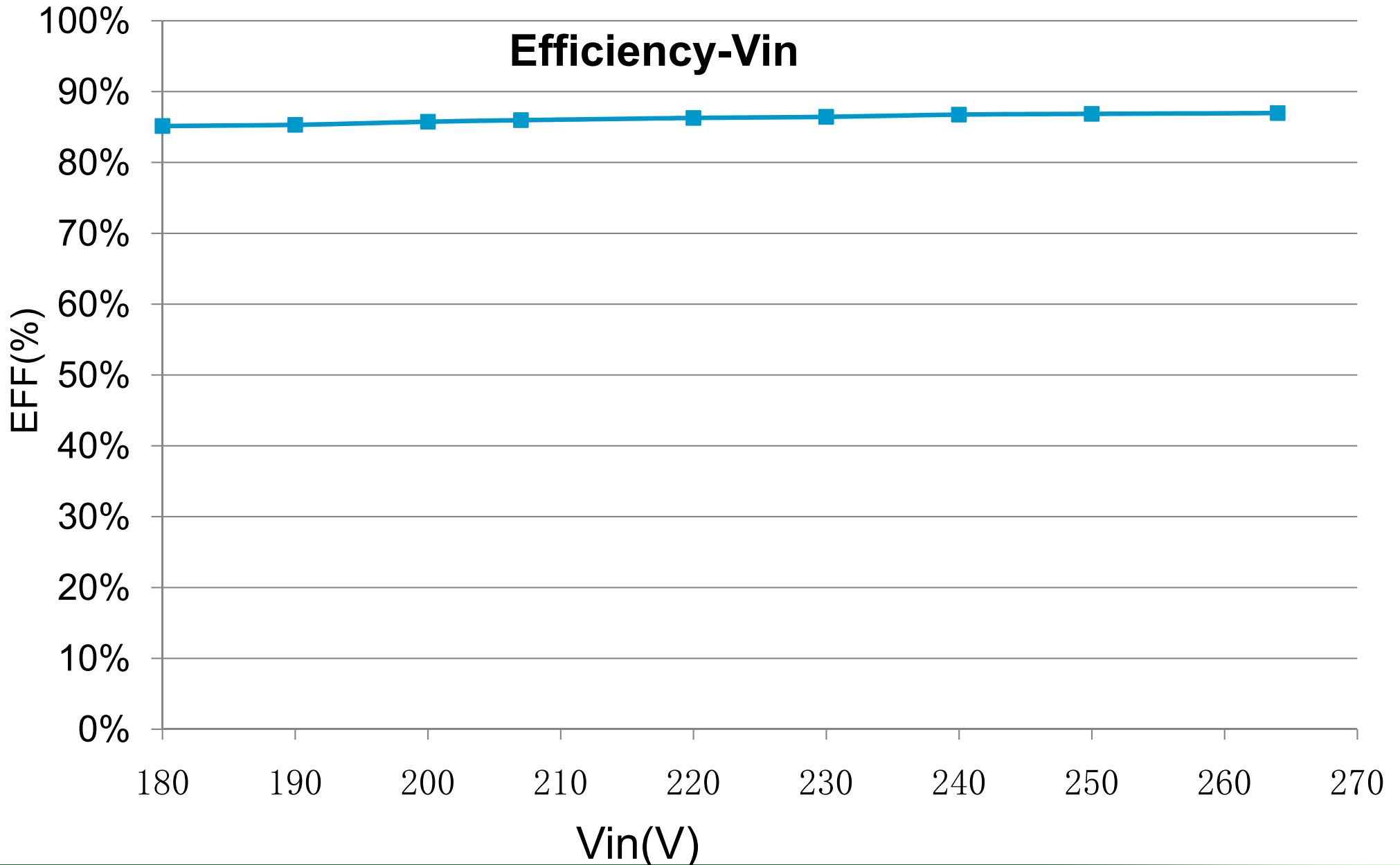
8.Constant Current and Efficiency

(AC input 180~264Vac,Output 40V700mA 12 LEDs_iW3614)

#of LEDs	Vin	Pin	Vout	Iout	Ripple(PK)	efficiency	PF	Vcc
	(V)	(W)	(V)	(mA)	(mA)			(V)
12LEDS	180	35.20	42.75	701	40	85.14%	0.974	14.64
	190	34.91	42.43	702	40	85.32%	0.981	14.65
	200	34.60	42.27	702	40	85.76%	0.988	14.66
	207	34.42	42.15	702	40	85.97%	0.990	14.67
	220	34.24	42.03	703	40	86.29%	0.991	14.68
	230	34.10	41.93	703	40	86.44%	0.990	14.69
	240	33.96	41.85	704	40	86.76%	0.987	14.70
	250	33.86	41.72	705	40	86.87%	0.982	14.71
	264	33.84	41.69	706	40	86.98%	0.965	14.72

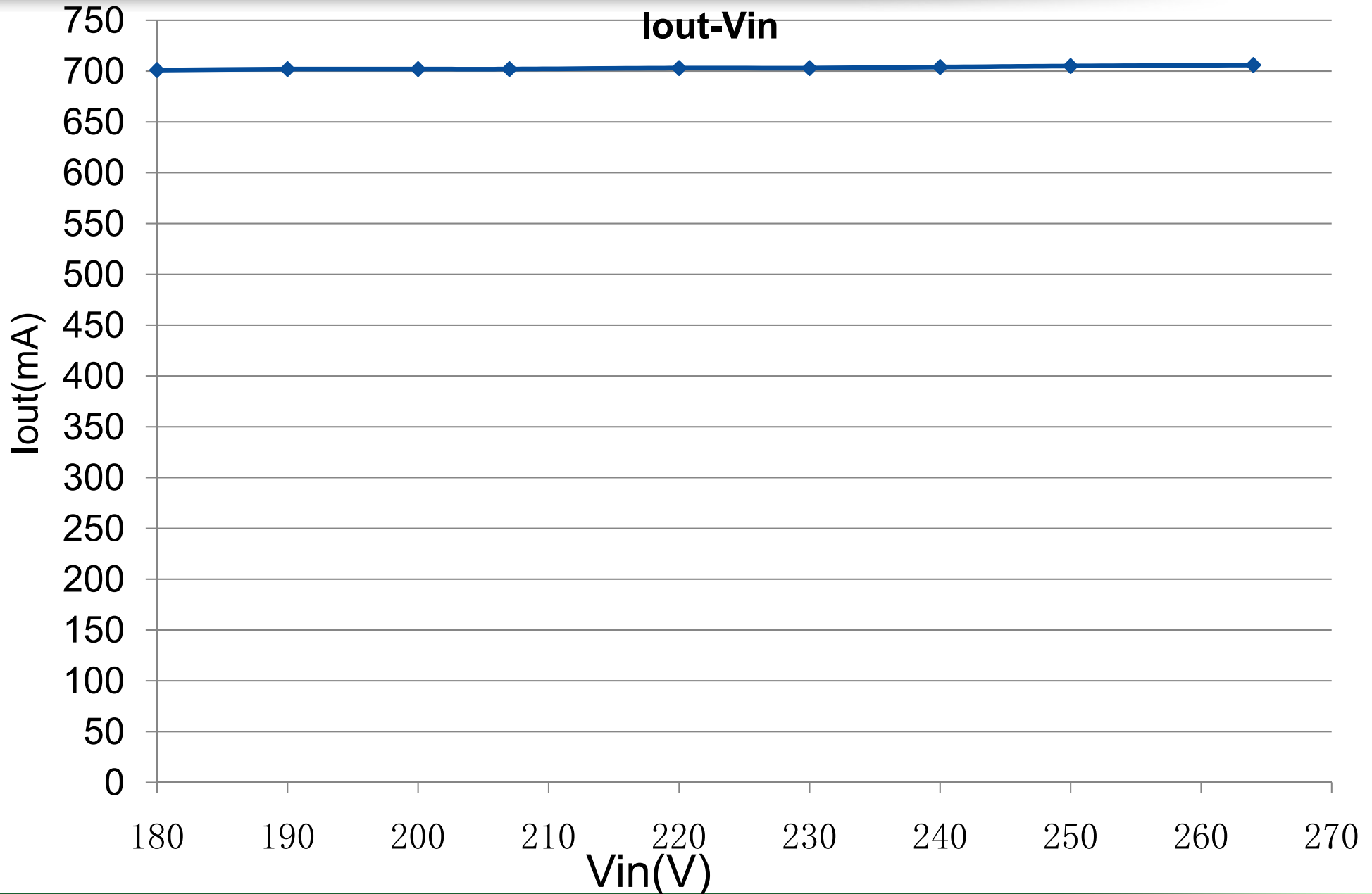
9. Regulation, Efficiency Measurement

(AC input 180~264Vac, Output 40V700mA 12 LEDs_iW3614)



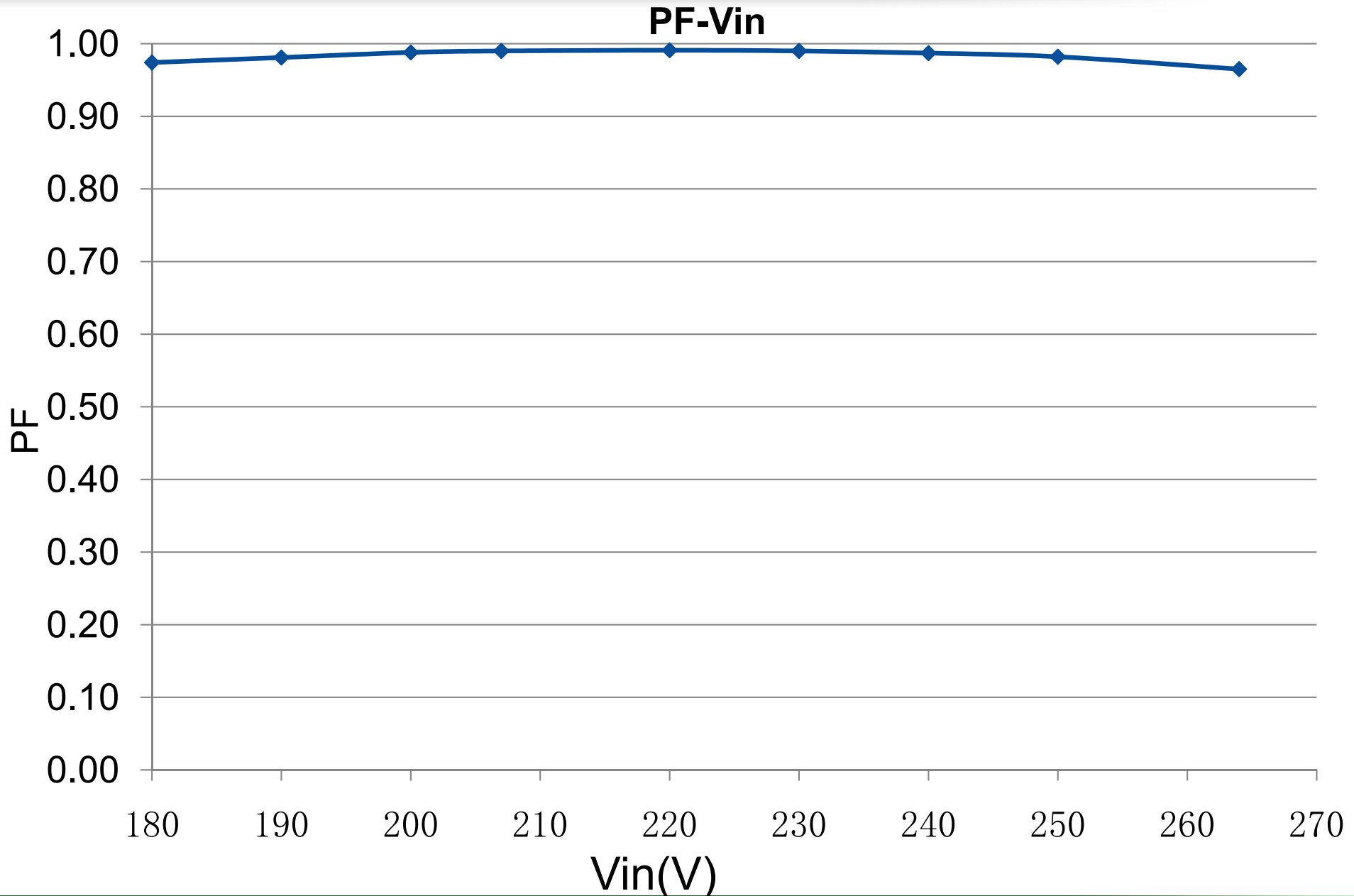
10. Regulation, Iout Measurement

(AC input 180~264Vac, Output 40V700mA 12 LEDs_iW3614)



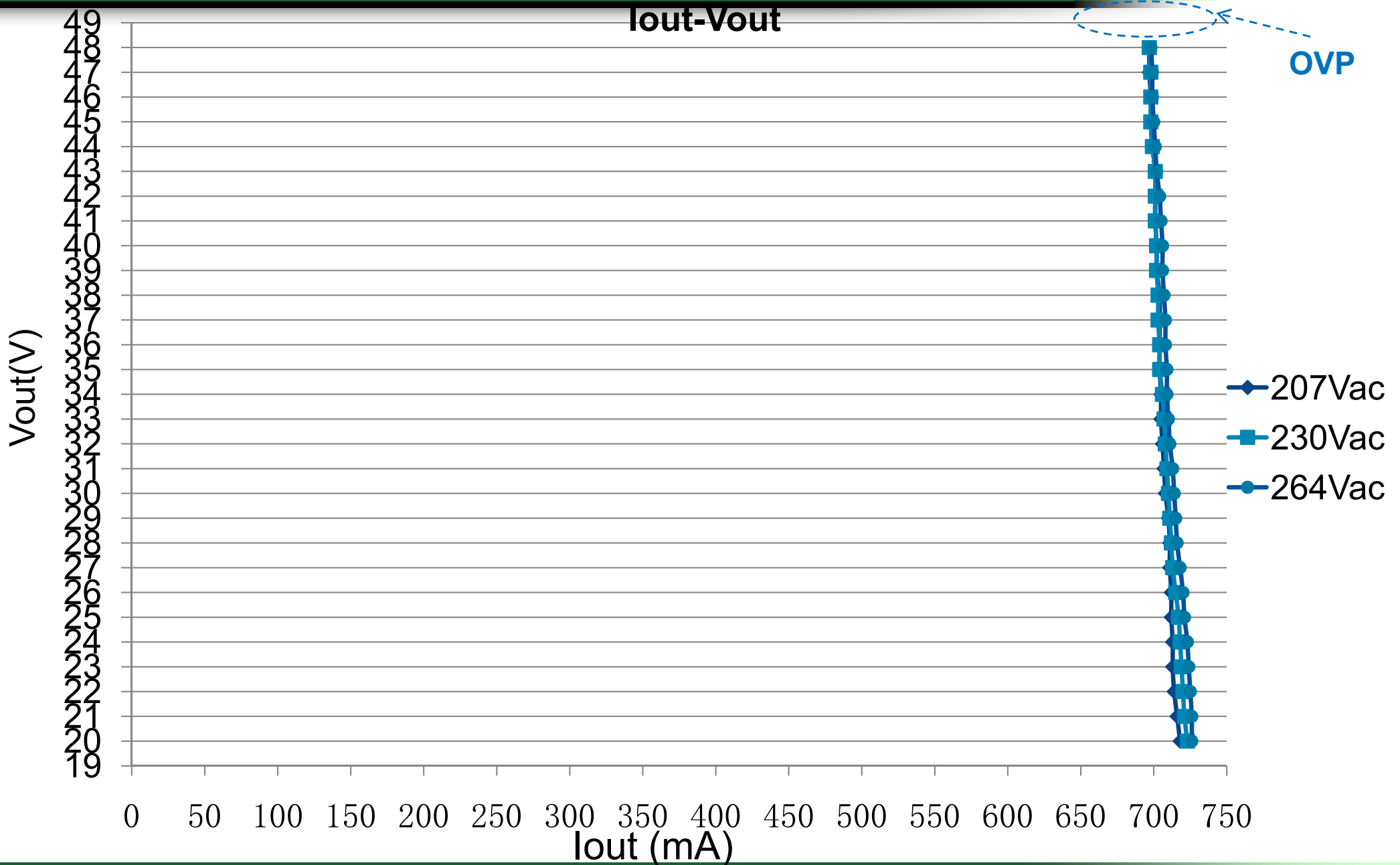
11. Regulation, PF Measurement

(AC input 180~264Vac, Output 40V700mA 12 LEDs_iW3614)



12. Regulation, Vout-Iout Measurement

(AC input 180~264Vac, Output 40V700mA Electrical Load _iW3614)



13.Constant Current and Efficiency_ with dimmer

(AC input 180~264Vac,Output 40V700mA 12 LEDs_iW3614)

Leading edge dimmer

_ WUYOU 400W

_ 12 LEDs

Vin	DIM Level	Pin	LED Voltage	LED current	Pout	Eff	ripple current	VCC	DIM mode
(V)		(W)	(V)	(mA)	(W)	(%)	(mA)	(V)	
207	Max.	34.95	43.28	701	30.34	86.8%	40	14.60	Amp.
		18.38	40.85	359	14.67	79.8%	28	14.57	Amp.
	Min.	0.67	31.75	5	0.16	23.7%	/	10.04	Amp.&PWM
230	Max.	34.50	43.08	702	30.24	87.7%	40	14.61	Amp.
		18.16	40.49	349	14.13	77.8%	28	14.59	Amp.
	Min.	0.85	32.03	7	0.22	26.4%	/	11.10	Amp.&PWM
264	Max.	34.59	43.20	704	30.41	87.9%	40	14.61	Amp.
		19.10	40.87	356	14.55	76.2%	30	14.58	Amp.
	Min.	0.90	32.04	7	0.22	24.9%	/	11.10	Amp.&PWM

Trailing edge dimmer

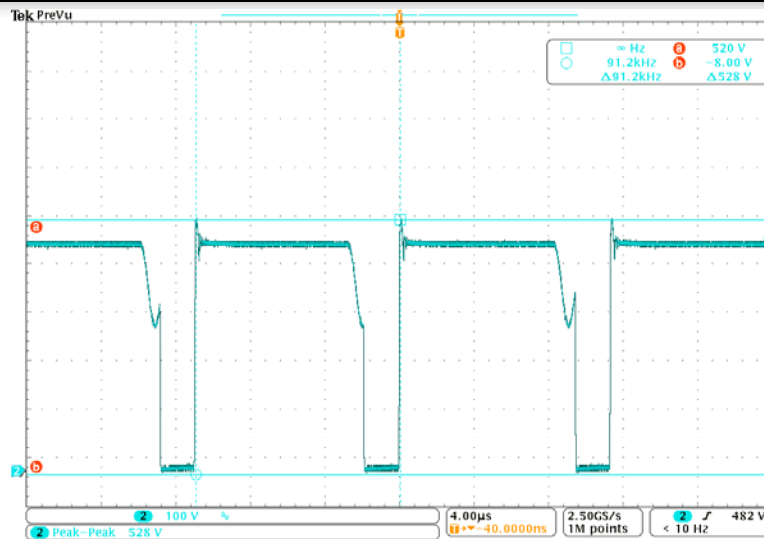
___ Etman ETM321S 315W

___ 12 LEDs

Vin	DIM Level	Pin	LED Voltage	LED current	Pout	Eff	ripple current	VCC	DIM mode
(V)		(W)	(V)	(mA)	(W)	(%)	(mA)	(V)	
207	Max.	35.24	43.30	701	30.35	86.1%	40	14.59	Amp.
		17.92	40.74	345	14.06	78.4%	28	14.55	Amp.
	Min.	3.37	34.58	35	1.21	35.9%	/	12.99	Amp.&PWM
230	Max.	35.10	43.13	702	30.28	86.3%	40	14.61	Amp.
		18.85	40.70	362	14.73	78.2%	28	14.60	Amp.
	Min.	3.88	34.67	40	1.39	35.7%	/	13.12	Amp.&PWM
264	Max.	35.36	43.30	704	30.48	86.2%	40	14.62	Amp.
		19.12	40.85	354	14.46	75.6%	28	14.59	Amp.
	Min.	4.26	34.75	38	1.32	31.0%	/	13.11	Amp.&PWM

14. V_{DS} waveform

(AC input 264Vac, Output 40V700mA Electrical Load _iW3614)

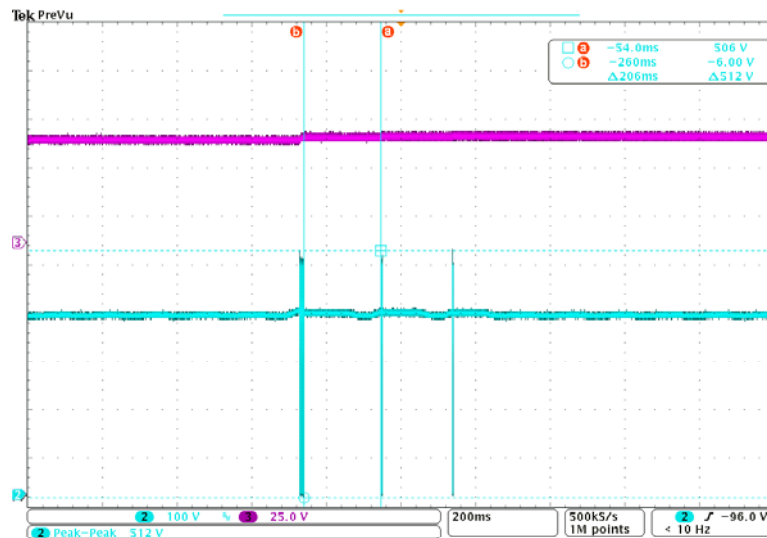


Test Condition:

$V_{IN}=264VAC$, $V_{OUT_CV}=43V$

Result:

$V_{DS_MAX}=\mathbf{528V}$



Test Condition:

$V_{IN}=264VAC$, NO LOAD

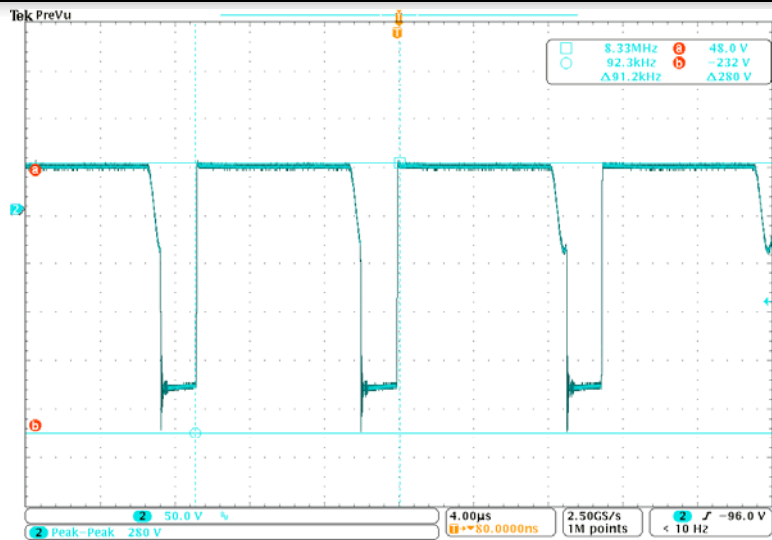
Result:

$V_{DS_MAX}=\mathbf{512V}$

Remark: Mosfet Spec__7A 600V

15.Secondary rectifying tube waveform

(AC input 264Vac,Output 40V700mA Electrical Load _iW3614)

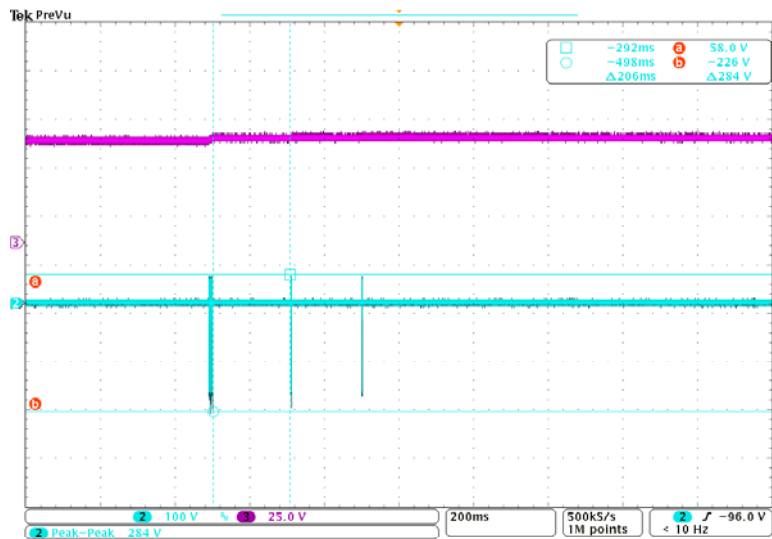


Test Condition:

$V_{IN}=264VAC$, $V_{OUT_CV}=43V$

Result:

$V_{RRM_MAX}=\underline{280V}$



Test Condition:

$V_{IN}=264VAC$, NO LOAD

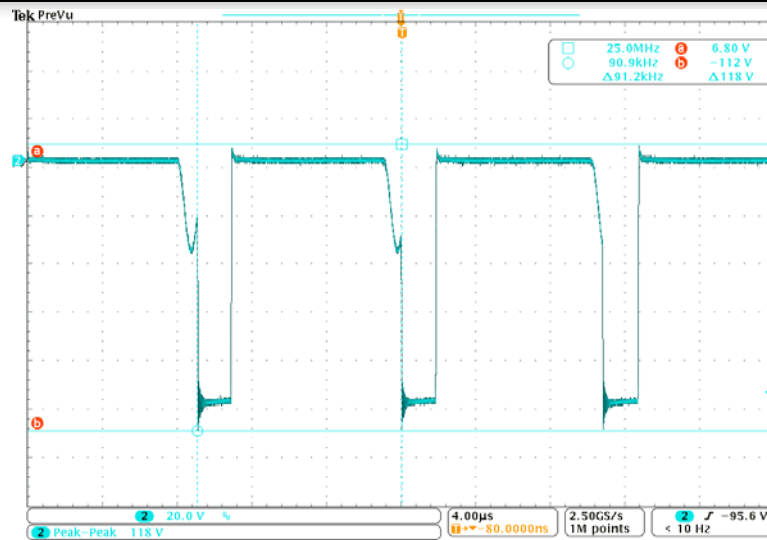
Result:

$V_{RRM_MAX}=\underline{284V}$

Remark: Diode Spec__10A 400V

16.Vcc rectifying tube waveform

(AC input 264Vac, Output 40V700mA Electrical Load _iW3614)

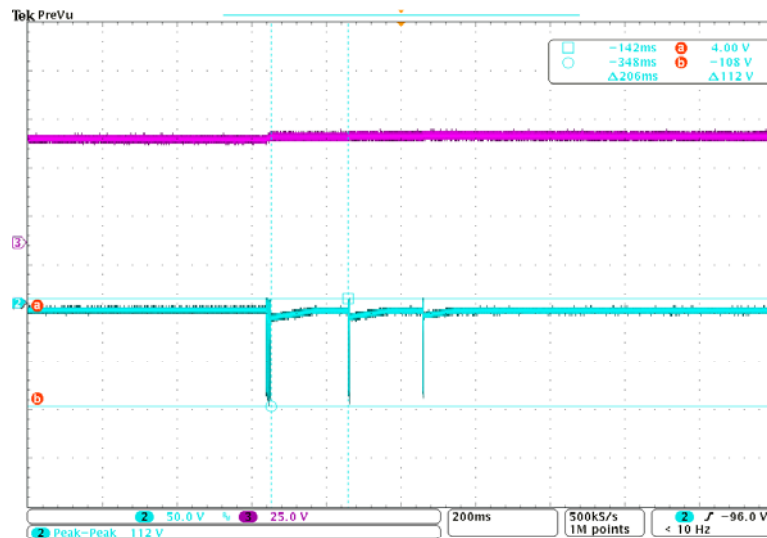


Test Condition:

$V_{IN}=264VAC$, $V_{OUT_CV}=43V$

Result:

$V_{RRM_MAX}=\underline{118V}$



Test Condition:

$V_{IN}=264VAC$, NO LOAD

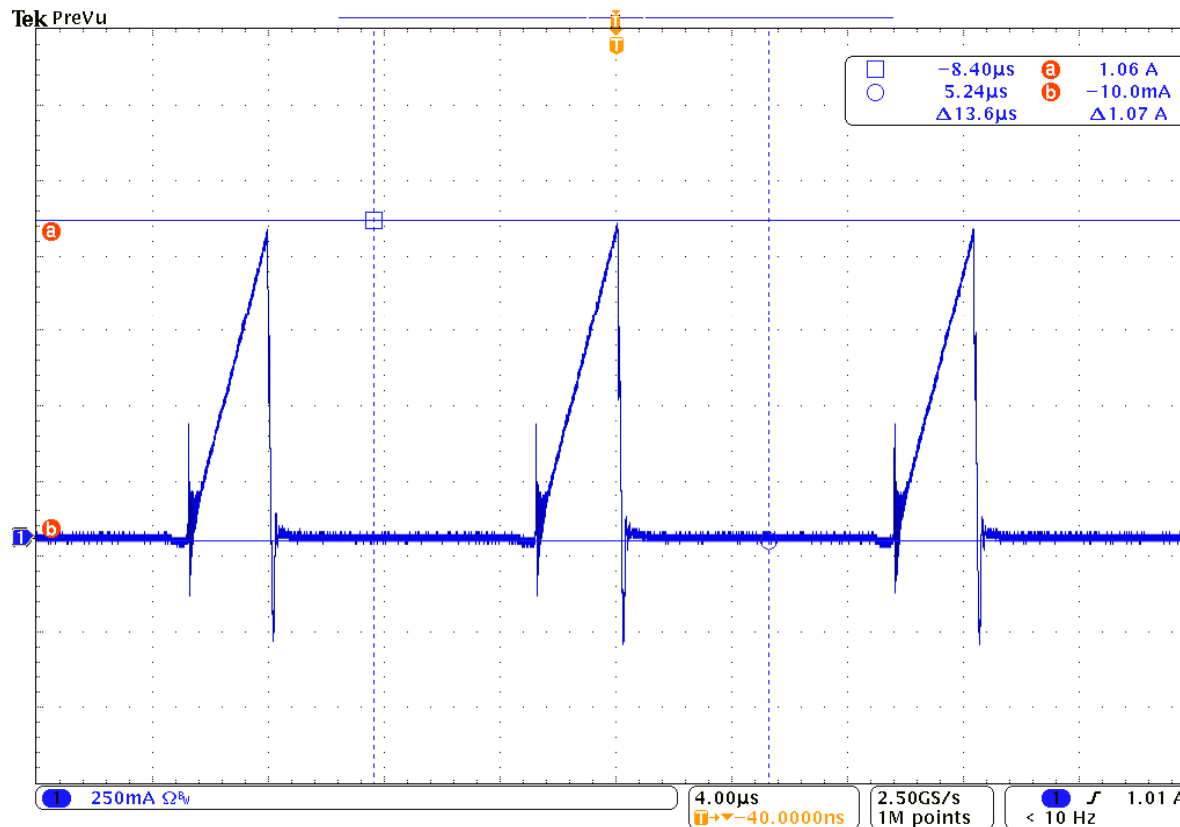
Result:

$V_{RRM_MAX}=\underline{112V}$

Remark: Diode Spec _1A 200V

17. Transformer Flux Density

(AC input 180Vac, Output 40V700mA Electrical Load _iW3614)



Transformer information: $N_p = 52$ Ts,
 $L_p = 0.75$ mH, $A_e = 62$ mm² (PQ2016)

I_p is monitored at 180Vac and
701mA load (Max Output Power).

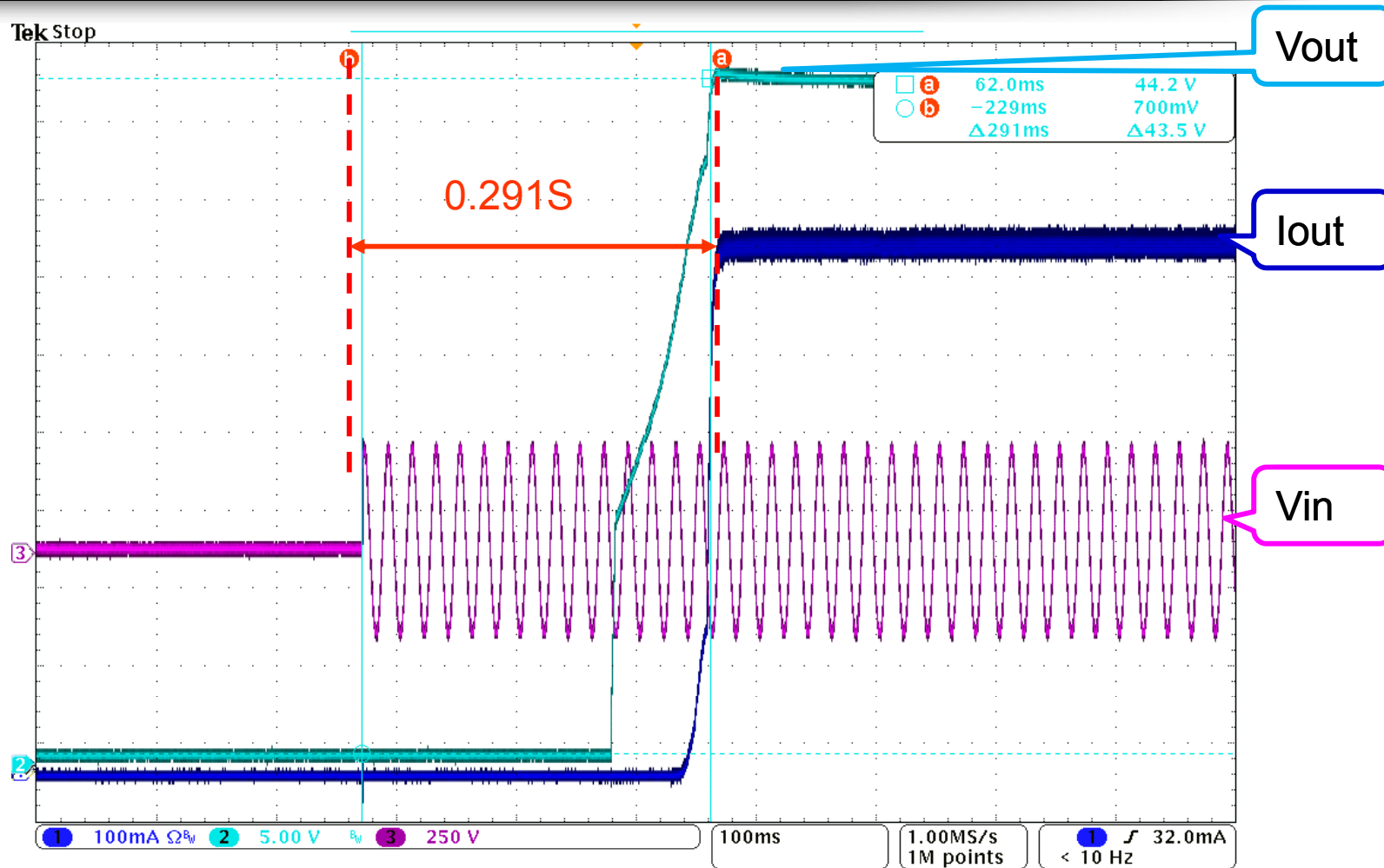
$I_p = 1070$ mA

$$B_{MAX} = (I_p * L_p) / (N_p * A_e)$$
$$= (1070 * 0.75) / (52 * 62)$$

= 0.249 Tesla

18.Start up time

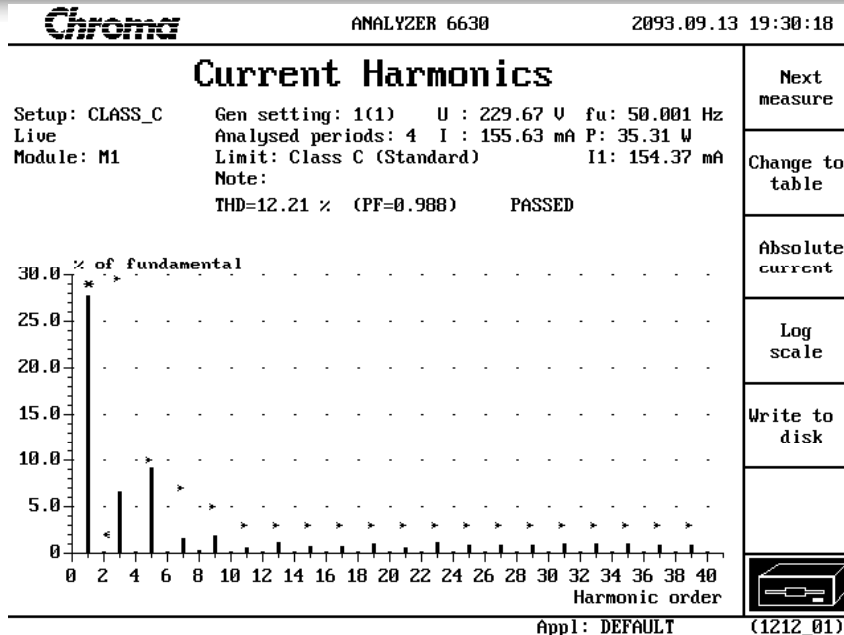
(AC input 230Vac,Output 40V700mA 12 LEDs_iW3614)



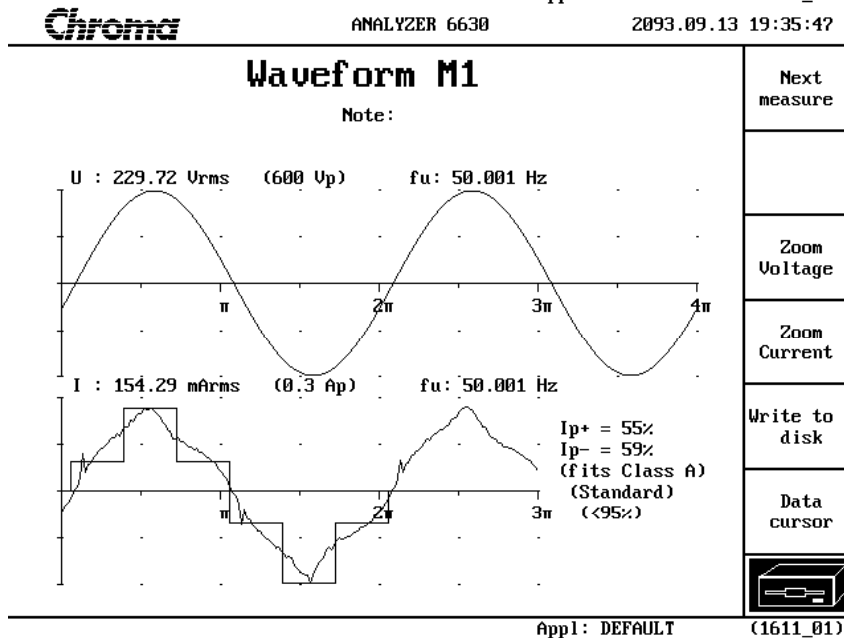
Adjust R15,R16,R33, R34 will adjust power on delay time, Please pay attention to input power of short circuit when there is a litter resistance on R15&R16&R33&R34.

19. Harmonic and current waveform

(AC input 230Vac, Output 40V700mA 12 LEDs_iW3614)



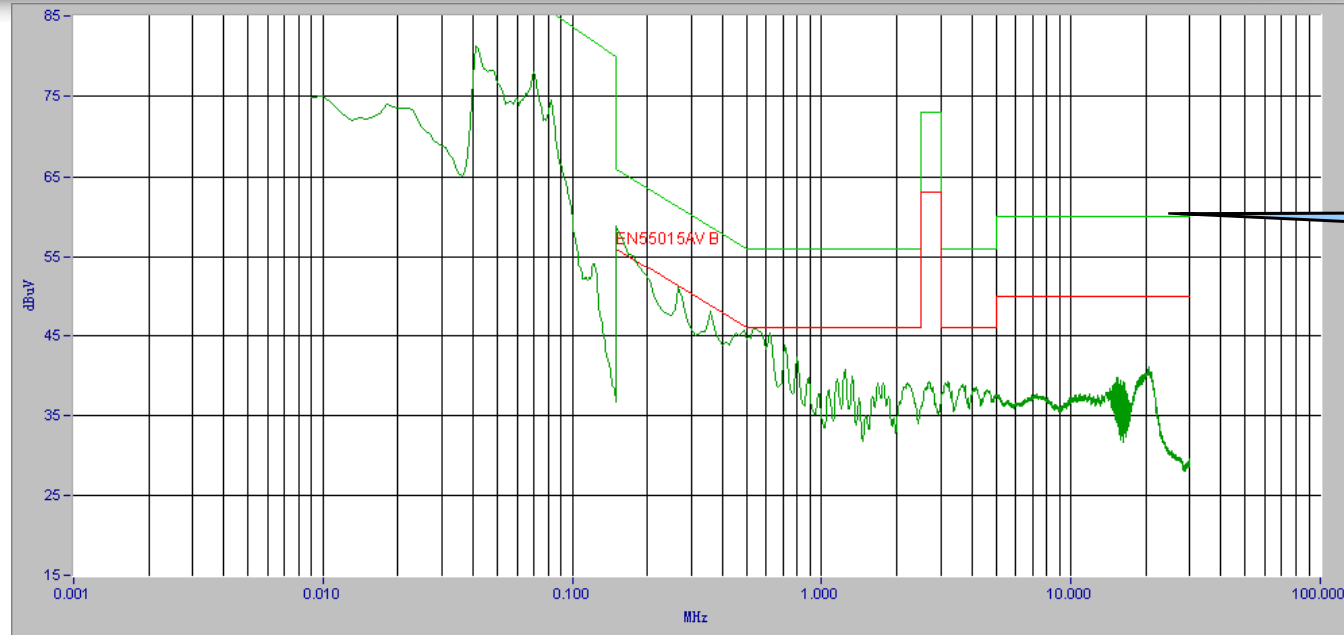
Harmonics current @230Vac THD=12.21%



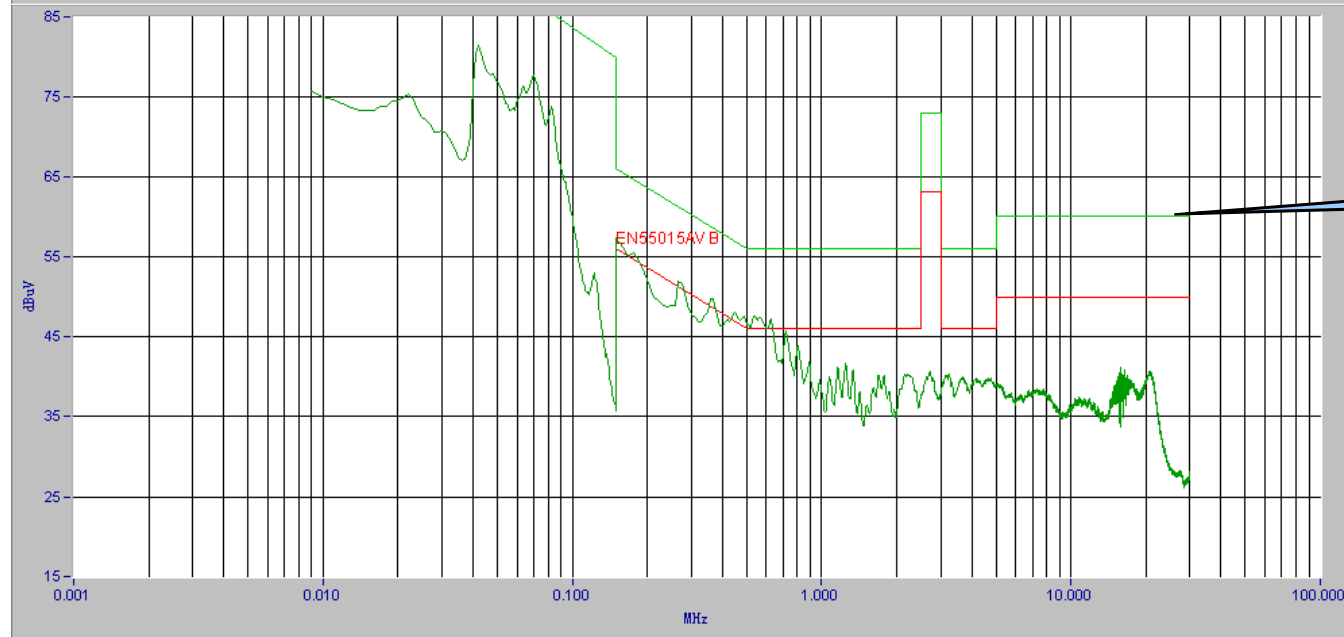
AC current waveform @230Vac PF=0.988

20. Conducted EMI (Full Load, output floating)

(AC input 230Vac, Output 40V700mA 12 LEDs_iW3614)



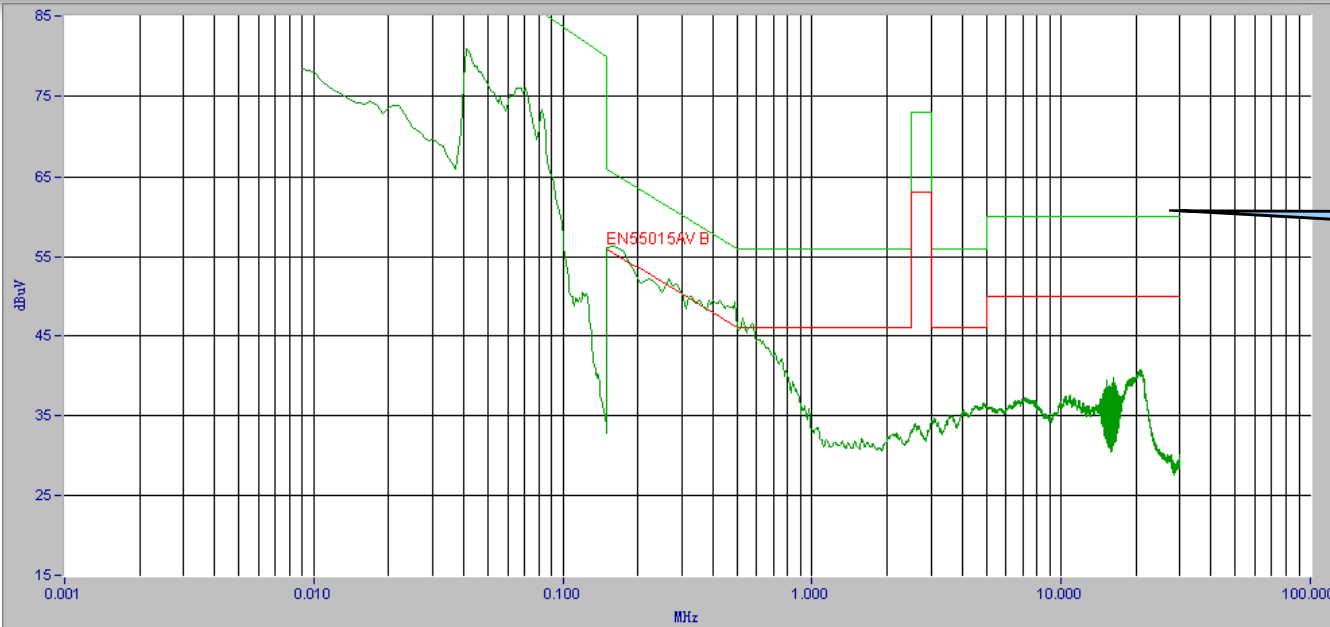
Input=230VAC
L line QP scan



Input=230VAC
N line QP scan

21. Conducted EMI (Full Load, Output is earthing)

(AC input 230Vac, Output 40V700mA 12 LEDs_iW3614)



Peak Scan
QP Limit line

Input=230VAC
L line QP scan

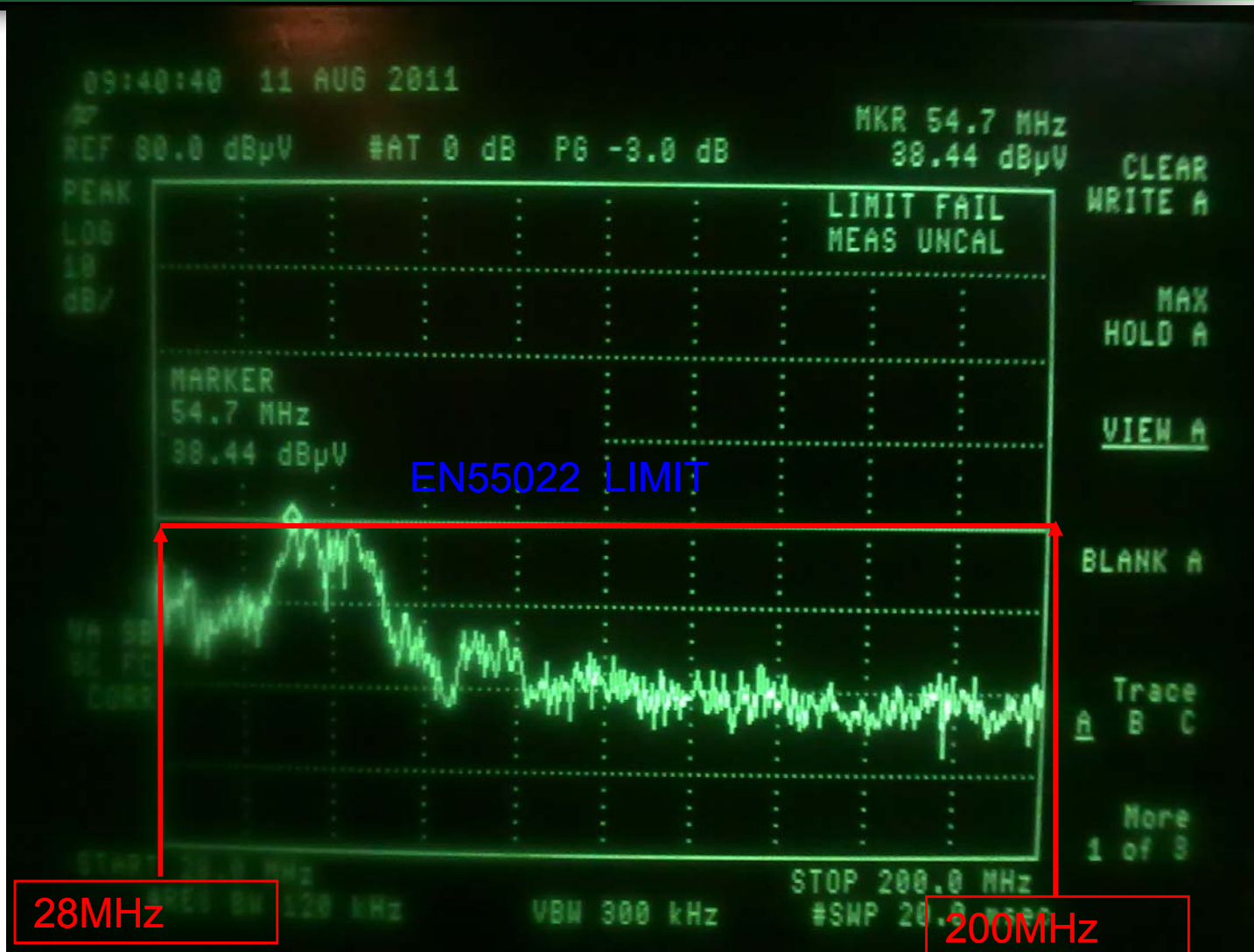


Peak Scan
QP Limit line

Input=230VAC
N line QP scan

22. Radiated IEM (for reference)

(AC input 230Vac, Output 40V700mA 12 LEDs_iW3614)

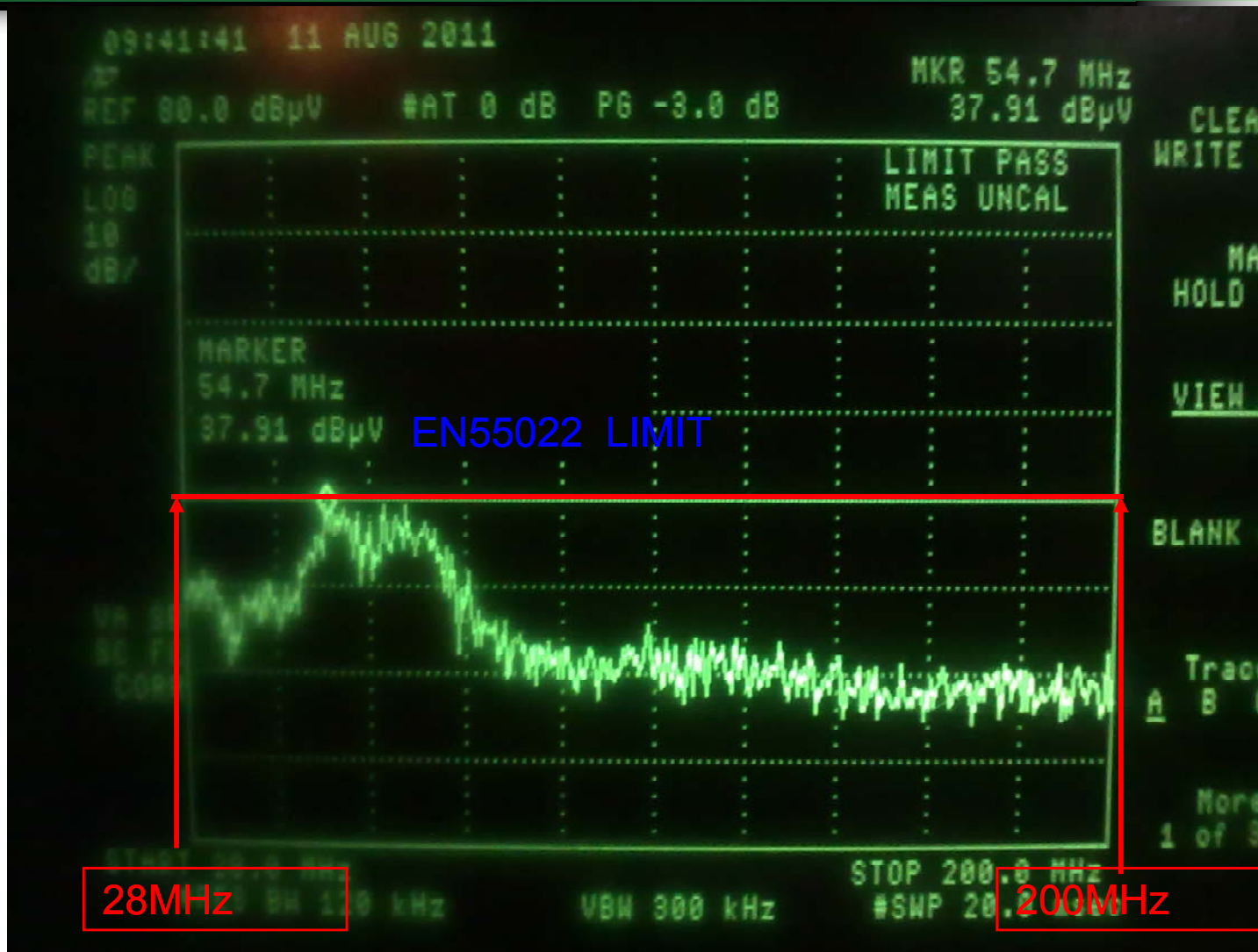


Note: 1, $V_{in}=230V_{ac}$

2, Output is floating

23. Radiated IEM (for reference)

(AC input 230Vac, Output 40V700mA 12 LEDs_iW3614)



Note: 1, Vin=230Vac

2, Output is earthing

24.iW3614驱动板工作后, 首先检查的项目

检查项目	检查内容	判断标准		结论
MOSFET	在输入电压最高的时候的 Vds 值	0.8~0.9*Vds Max.		
输出整流管	反向电压及Trr 的参数范围	低输出电压	肖特基	FFAF10 U40DN
		较高输出电压	HER	
		高电压小电流	超快恢复	
Vcc 整流管	反向电压及Trr的参数范围	推荐用1N4148或FR102/FR103		FR102
Vcc 电压	调光最大位置和最小位置时的Vcc	最大亮度/最多灯数	<16V	14.72V
		最小亮度/最小灯数	>8V	10.10V
变压器	Bmax.			0.249 Tesla
Vsense	正常工作时的 Vsense电压	最高输出电压时的 Vsense (Knee) 应该低于1.4V, 以确保工作于CC mode(<1.538V)		
OVP	输出开路时 Vsense 电压	OVP 是1.7V,确认 输出开路时 MOSFET Vds是安全的, 输出整流管电压及 Vcc 的值		