iWatt
Power Management Simplified Digitally™

Dimmable LED Driver with iW3602-01

(AC input 180V~264Vac,Output 4 LEDs)

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(AC input180V~264Vac,Output 4 LEDs)

General Design Specification:

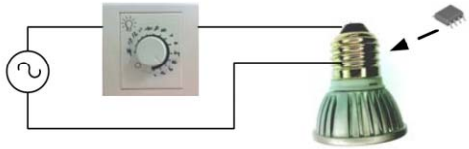
1.AC Input Range 180~264Vac

2.DC Output 13V, 400mA(Constant Current)

3.isolated High efficiency

1. Design Purpose and Feature

- Isolated ac-dc offline , Input 230Vac, Output 4 LEDs 400mA
- 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

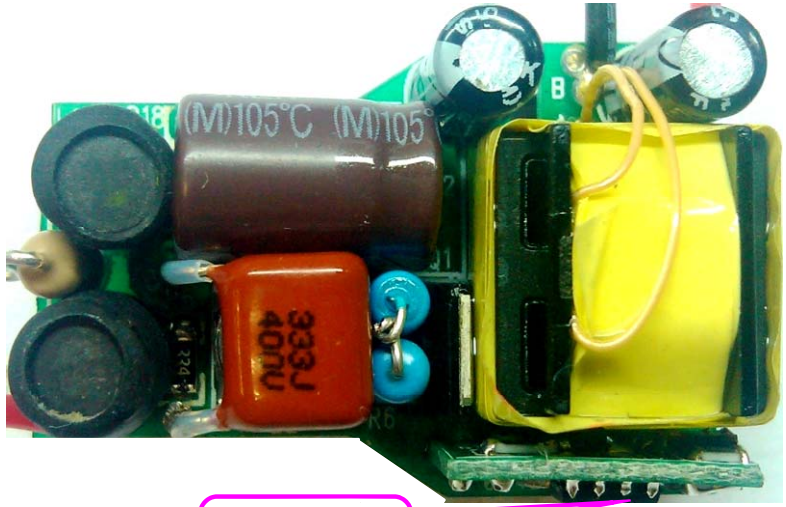


- Wide dimming range from 1% up to 100%
- No visible flicker
- Resonant control to achieve high efficiency
- High Power Factor, 0.7-0.9 without dimmer
- Temperature degrade control to adjust the LED
- Primary-only Sensing eliminates opto-isolator feedback and simplifies design

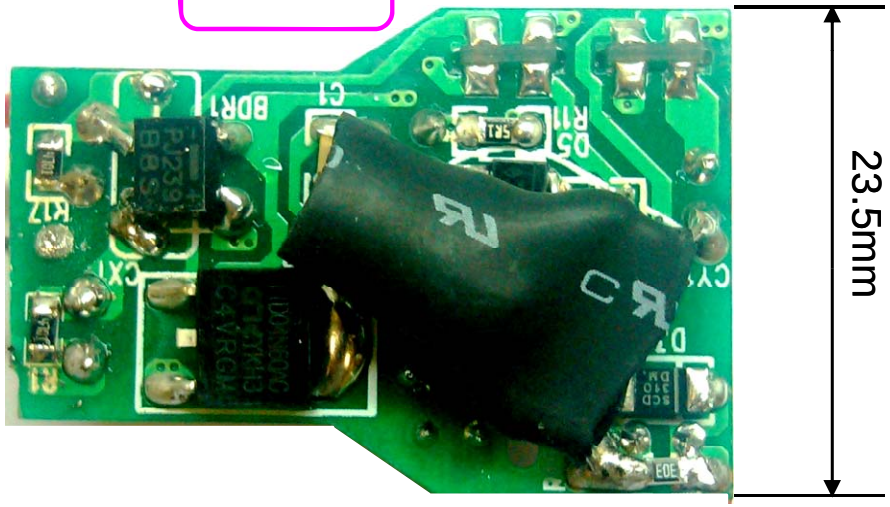
2.PCB Layout

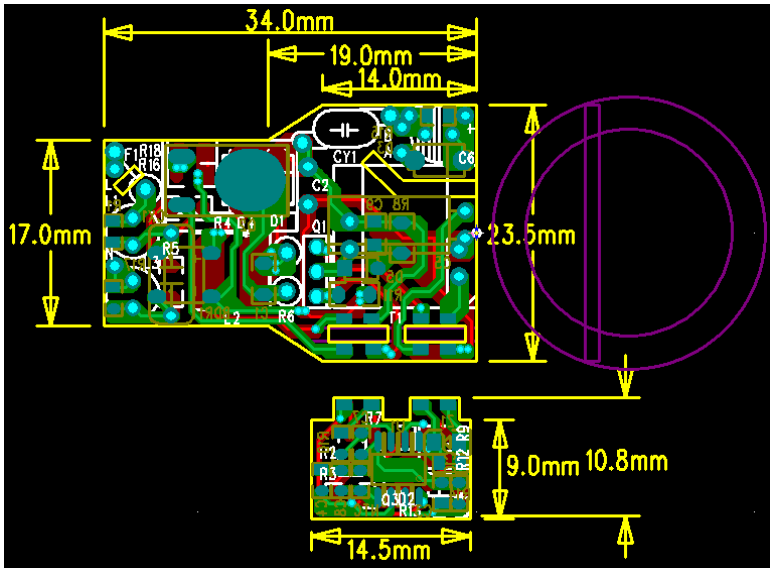
DC output To LED

AC Input

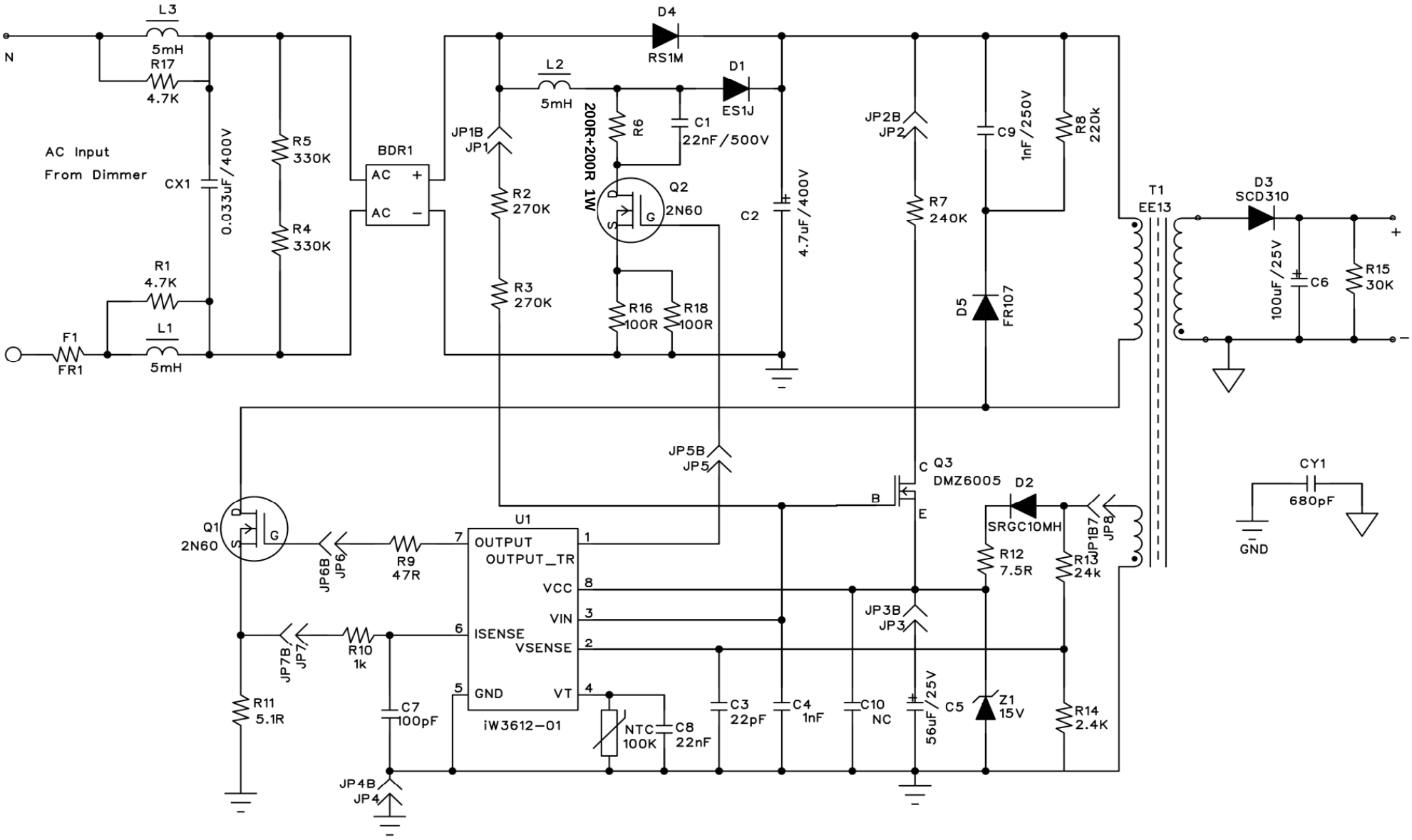


iw3602-01



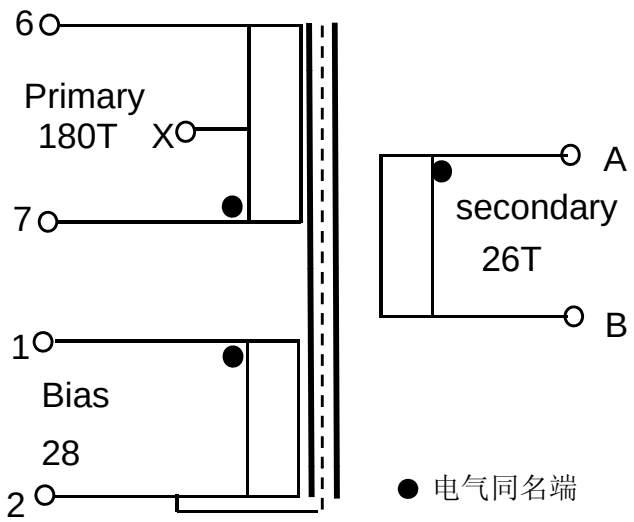


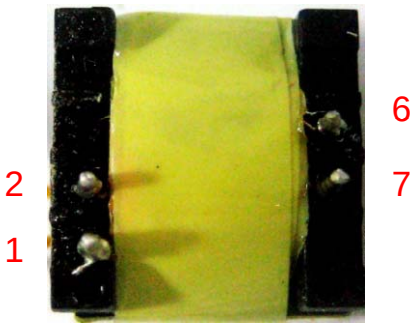
3. Schematic circuit__13V400mA_230Vac

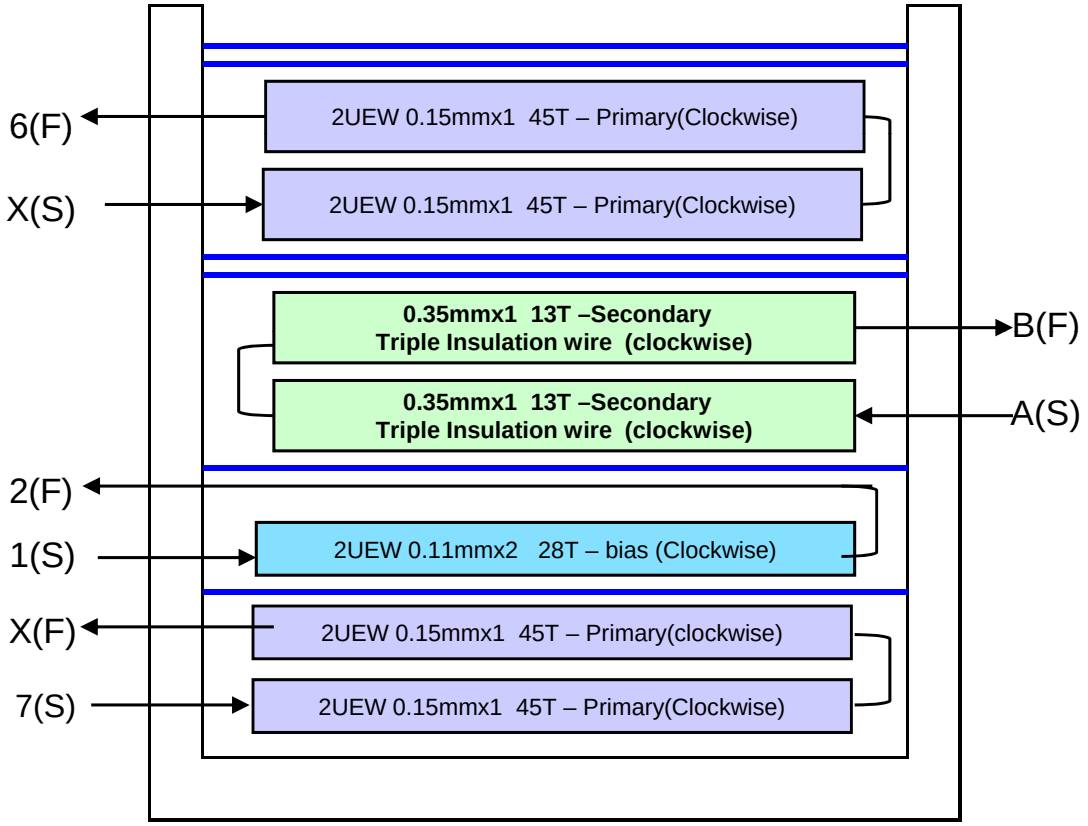


4. Transformer Design

SCHEMATIC







ELECTRICAL SPECIFICATIONS:

1. Primary Inductance (Lp) = 4.4mH @10KHz
2. Primary Leakage Inductance (Lk)< = 100uH @10KHz
3. Electrical Strength = 3KV, 50/60Hz,1Min

MATERIALS:

1. Core : EE13(Ferrite Material TDK PC40 or equivalent)
2. Bobbin :EE13 Horizontal. 4+4pin
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 Pin 3,4.5,8. after wires termination
2. Varnish the complete assembly

5. Bill of Material

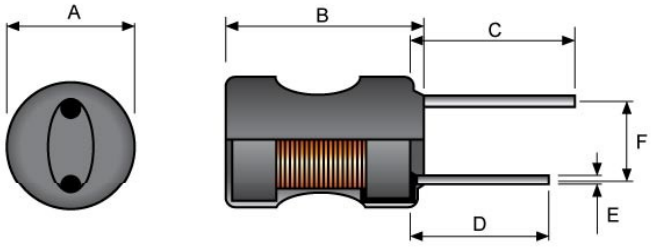
Item	Qty.	Ref.	Description	Type specification	suppliers
1	1	CX1	33nF 400V	PX333K3IC39H200D9H	CARLI 凯励
2	1	C2	4.7uF,400V,E-CAP,105℃	Φ8*12	Rubycon 红宝石
3	1	C3	22pF,25V,X7R	SMD 0603	TDK
4	1	C4	1nF,25V,X7R	SMD 0603	TDK
5	1	C5	56uF,25V,E-CAP,105℃	Φ5*11	Rubycon 红宝石
6	1	C6	100uF,25V,X7R	Φ5*11	TDK
7	1	C7	100pF,25V,X7R	SMD 0603	TDK
8	1	C8	22nF,25V,X7R	SMD 0805	TDK
9	1	C9	1nF,250V,X7R	SMD 0805	TDK
10	1	D1	ES1J	SMD	TAIWAN SEMICONDUCTOR 台半
11	1	D2	SRGC10MH / FR102	SMD	zowie
12	1	D3	SCD310	SMD	zowie
13	1	D4	RS1M	SMD	TAIWAN SEMICONDUCTOR 台半
14	1	D5	SRGC10RH /RS1M	SMD	TAIWAN SEMICONDUCTOR 台半
15	1	Z1	15V	SMD ZMM15	ST
16	1	FR1	1A 250V Fuse	Fuse	TAIWAN SEMICONDUCTOR 台半
17	2	L1,L3	4.7mH	0510	xinyuanxiang
18	1	L2	5mH	SMD	fengfa
19	2	R1,R17	4.7K	SMD 0805	yageo
20	2	R2,R3	270k	SMD 1206	yageo

6. Bill of Material

Item	Qty.	Ref.	Description	Type specification	suppliers
21	2	R4,R5	330k	SMD 1206	yageo
22	1	R6	200R+200R	1W	yageo
23	1	R7	240K	SMD 1206	yageo
24	1	R8	220k	SMD 1206	yageo
25	2	R16,R16B	100R	SMD 1206	yageo
26	1	R9	47R	SMD 0603	yageo
27	1	R10	1k	SMD 0603	yageo
28	1	R11	5.1R	SMD 0805	yageo
29	1	R12	7.5R	SMD 0805	yageo
30	1	R13	24K	SMD 0603	yageo
31	1	R14	2.4k	SMD 0603	yageo
32	1	R15	30k	SMD 0805	yageo
33	1	NTC	100K	SMD 0603	yageo
34	1	Q1,Q2	2N60	TO-251	ARK
35	1	Q3	DMZ6005	SMD SOT-23	ARK
36	1	T1	EE13	8PIN	xinyuanxiang
37	1	IC	IW3602-01	SOIC-8	IWATT
38	1	BR1	MB8S		taiban
39	1	CY1	680PF		Vishay

7.Chopping Inductor__ For input 230Vac

1.EMI Inductor L1,L3



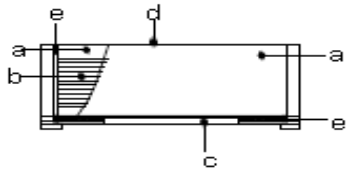
Ferrite core size : Ax B 6x8mm 0.11*450T

Inductance @10kHz, 1V: 5.6mH +/-5%

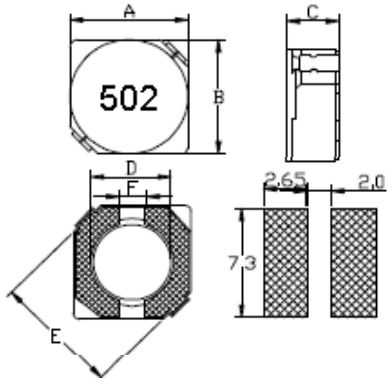
DCR: 14 OHM +/-20%

II .MATERIALS:

NO.	DESCRIPTION
a.	CORE
b.	WIRE
c.	BASE
d.	INKING
e.	EPOXY



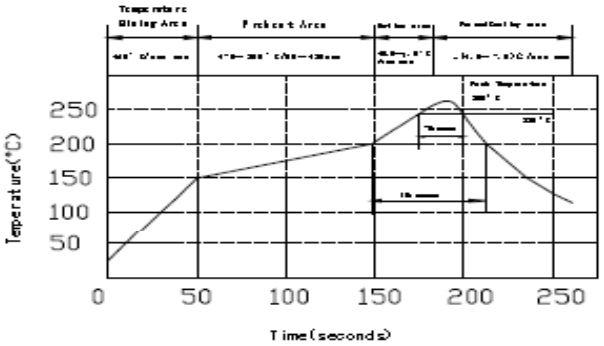
2.chopping Inductor L2 奋发



III.GENERAL SPECIFICATION:

1. Tested at 100KHz,0.25Vrms,0 Adc.
2. DC current at which the inductance drops 35% max. from its value without current.
3. Average current for 40℃ temperature rise from 20℃.
4. Electrical specifications at:20℃
5. Storage temp range:-40℃----+85℃
6. Operating temp range:-40℃----+125℃

PeakTemp:260℃ max
Max time above230° C:50secmax
Max time above200° C:70secmax



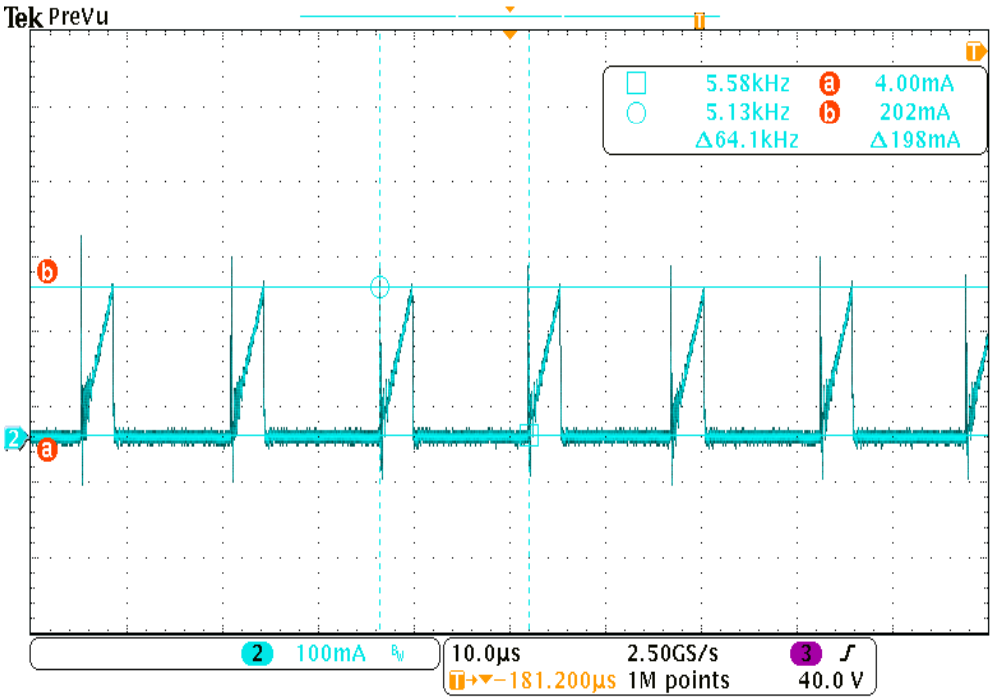
8.Constant Current and Efficiency __No Dimmer

(AC input 180~264Vac,Output 4 LEDs)

#of LEDs	Vin (V)	Pin (W)	Vout (V)	Iout (A)	Ripple (mA)	efficiency	3rd Harmonic	PF
4LEDs	**180**	6.670	12.867	0.405		78.03%		0.784
	190	6.634	12.843	0.405		78.09%		0.795
	200	6.610	12.791	0.405		78.37%		0.791
	210	6.610	12.79	0.405		78.18%		0.822
	220	6.637	12.759	0.405		77.80%		0.810
	230	6.640	12.75	0.404		77.58%		0.790
	240	6.663	12.727	0.406		77.49%		0.785
	250	6.659	12.717	0.406		77.54%		0.822
	264	6.690	12.717	0.407		77.37%		0.679

9.Transformer Flux Density

(Np=180Ts, Lm=4.4 mH, Ae=17.2mm EE13)



Ip is monitored at 180Vac and *400mA* load

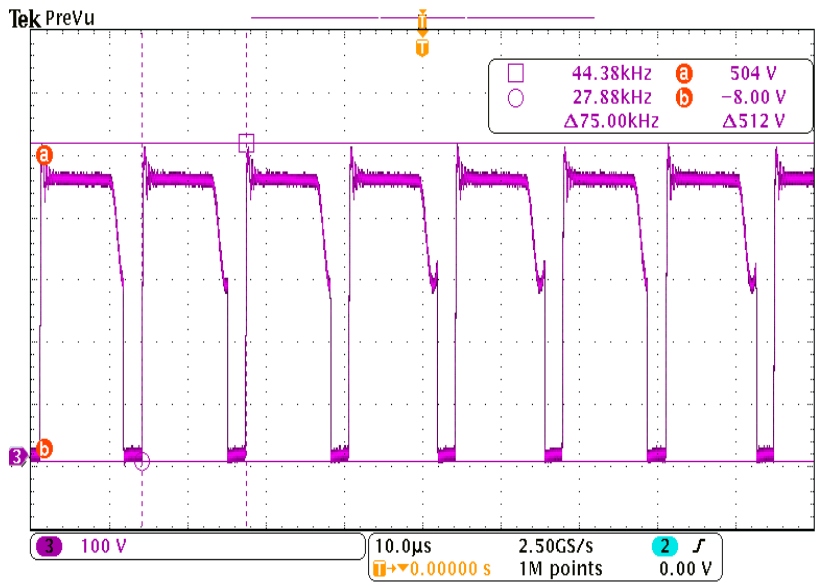
Ip=198mA

$B_{MAX} = I_P * L_m / (N_P * A_e)$

=(198*4.4)/(180*17.2)

=0.281Tesla

10. V_{ds} Waveform for MOSFET



Test Condition:

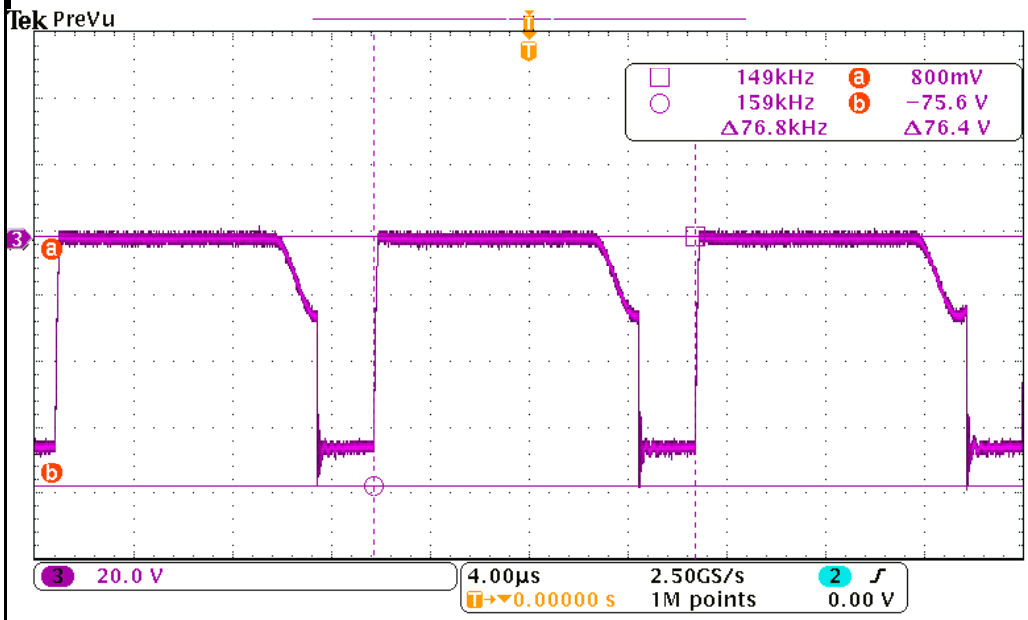
Vin=264Vac, I_{OUT}=0.4A

Result:

$V_{ds\ MAX}$=**512V**

Symbol	Parameter	FTU02N60B / FTD02N60B	Unit
V_{DSS}	Drain-to-Source Voltage[1]	600	V
I_D	Continuous Drain Current	1.9	A
I_D@100℃	Continuous Drain Current	Figure 3	A
I_{DM}	Pulsed Drain Current, V_{GS}@10V[1]	Figure 6	A
P_D	Power Dissipation	43	W
P_D	Derating Factor above 25℃	0.34	W/℃
V_{GS}	Gate-to-Source Voltage	±30	V
E_{AS}	Single Pulse Avalanche Energy L=45mH, I_D=1.8A	73	mJ
dv/dt	Peak Diode Recovery dv/dt[3]	4.5	V/ns
T_L	Soldering Temperature Distance of 1.6mm from case for 10 seconds	300	℃
T_J and T_{STG}	Operating and Storage Temperature Range	-55 to 150	℃

11.V_R waveform for Rectifier Diode



Test Condition:

V_{IN}=264VAC, Iout=400mA

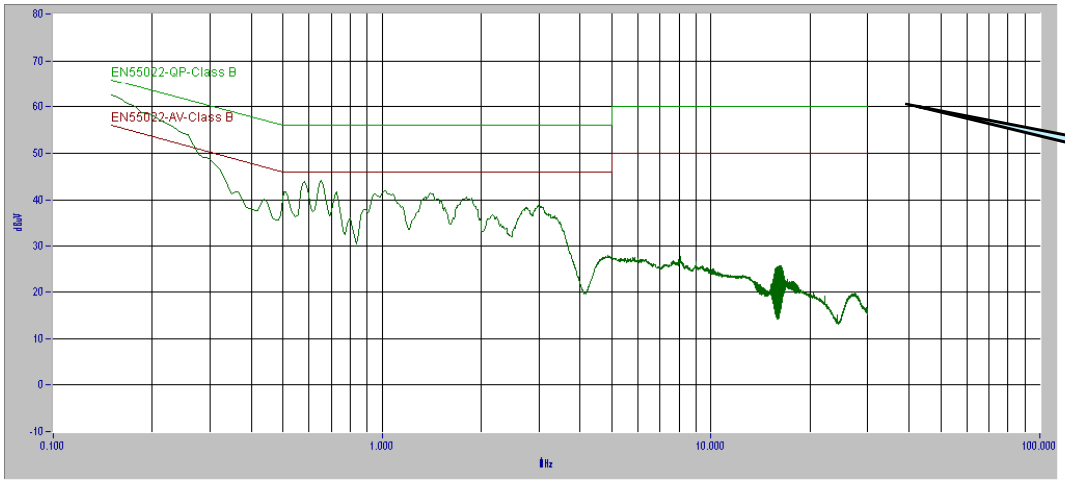
Result:

$V_{R\ (pk—pk)}$=76.4V

Output rectifier diode: SCD3100 (3A 100V)

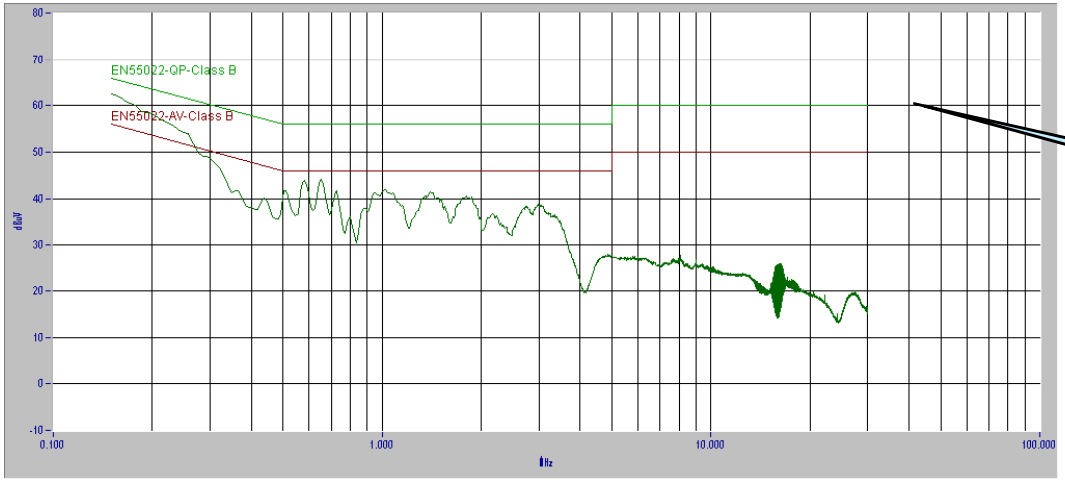
ITEM	Symbol	Conditions	Rating				Unit
			WSCD32H	WSCD34H	WSCD36H	WSCD310H	
Repetitive peak reverse voltage	VRRM		20	40	60	100	V
Average forward current	IF(AV)		3.0				A
Peak forward surge current	IFSM	8.3ms single half sine-wave	80				A
Operating junction temperature Range	Tj		-55 to +125		-55 to +150		°C
Storage temperature Range	TSTG		-55 to +150				°C

12.EMI (input 230Vac)



Peak Scan
QP Limit line

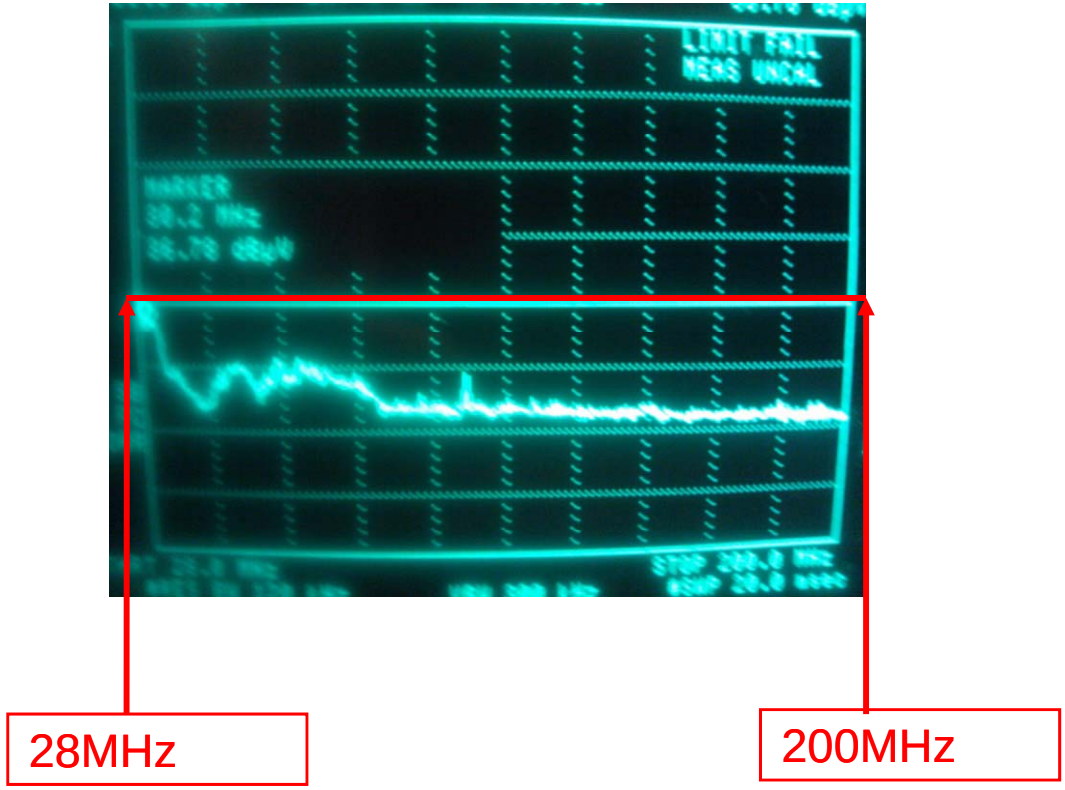
Peak scan N



Peak Scan
QP Limit line

Peak scan L

13. Radiated EMI (for reference)



Input:230VAC Output:4LED