



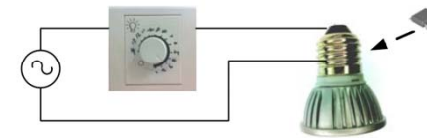
Dimmable LED Driver with iW3602-01

(AC input 180V~264Vac, Output 3 LEDs)

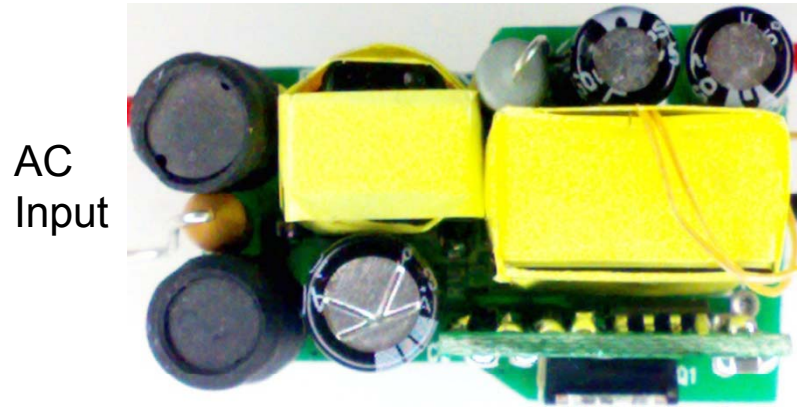
1. Design Purpose and Feature

iWatt

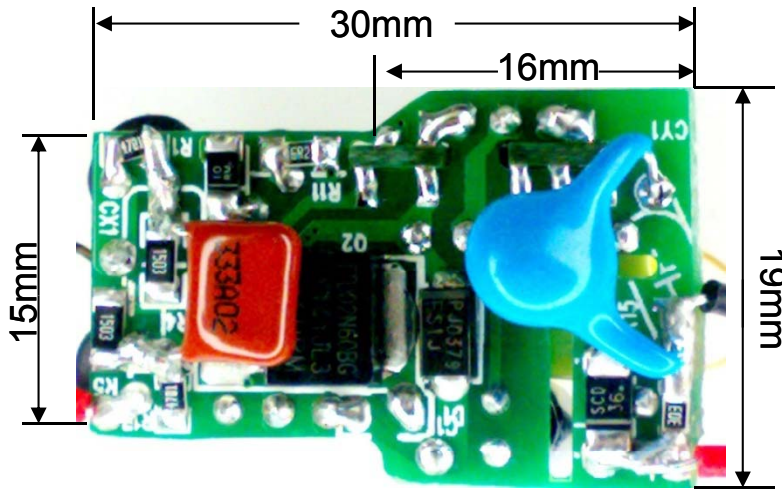
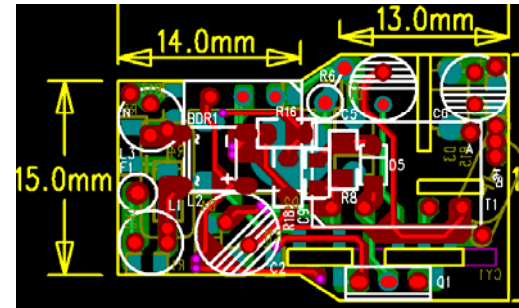
- Isolated ac-dc offline , Input 230Vac, Output 3 LEDs 450mA
- Intelligent wall dimmer detections
 - Leading-edge dimmer , Trailing-edge dimmer , No-dimmer
- Multiple dimming control scheme
 - Hybrid dimming scheme
 - PWM dimming scheme,900Hz
 - Amplitude dimming scheme
- Wide dimming range from 2% up 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



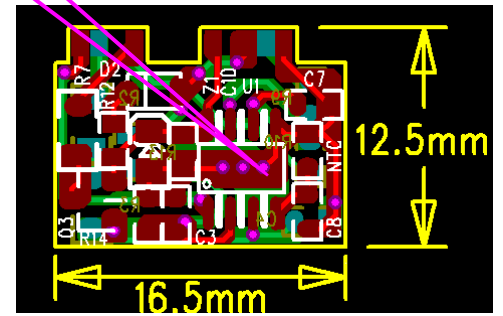
2.PCB Layout



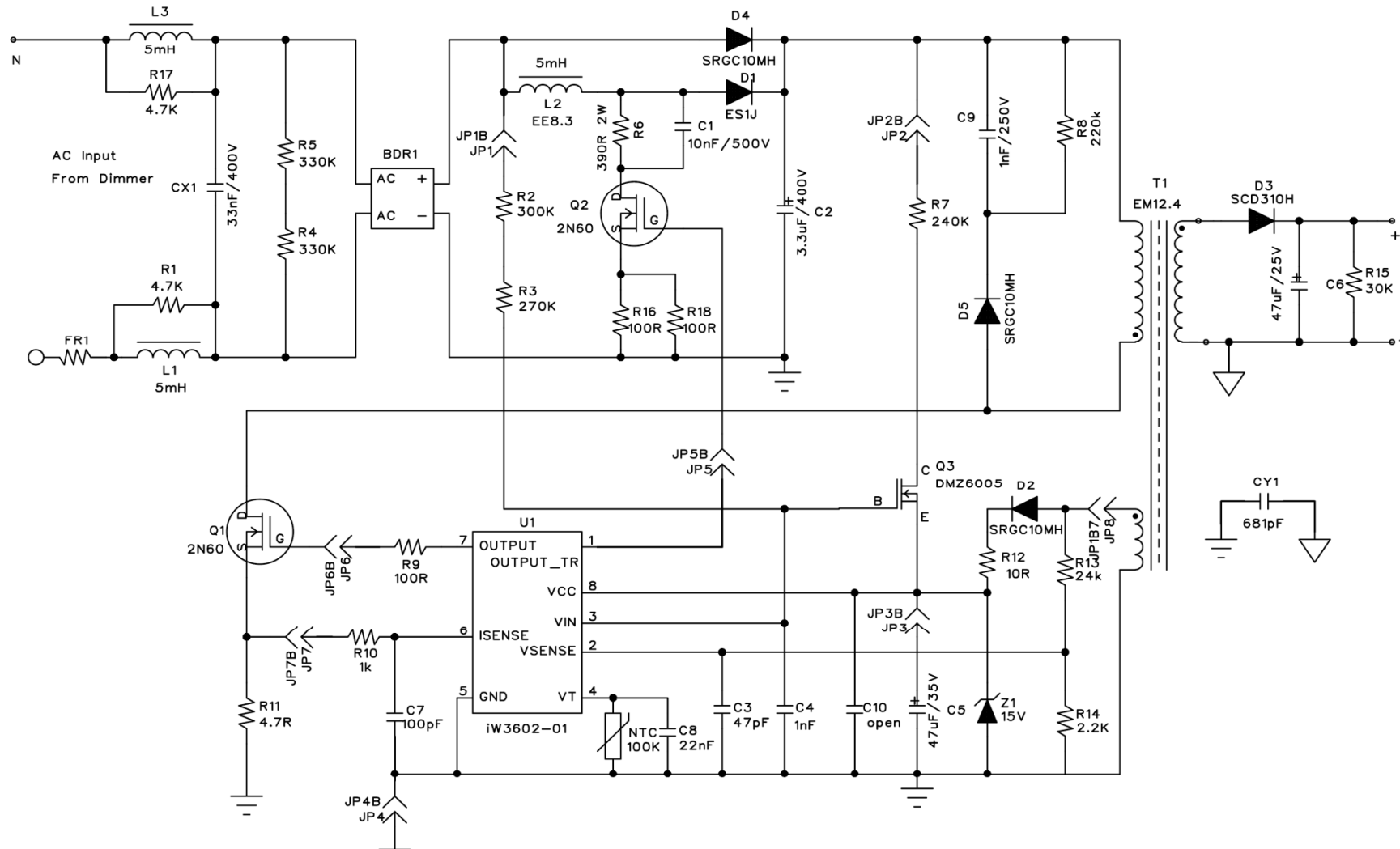
DC output
To LED



iw3602-01



3. Schematic circuit__10V450mA_230Vac



4. Bill of Material

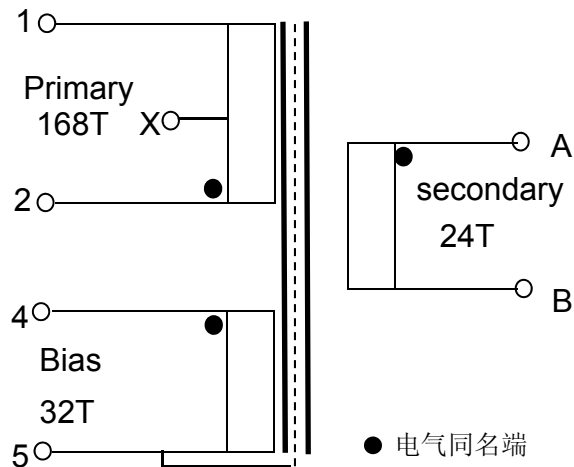
Item	Qty.	Ref.	Description	Type specification	suppliers
1	1	CX1	33nF 400V	PX104K31C39H200D9H	CARLI 凯励
2	1	C1	10nF,500V,NPOSMD	SMD	CARLI 凯励
3	1	C2	3.3uF,400V,E-CAP,105°C	φ6. 3*12. 5	Rubycon 红宝石
4	1	C3	47pF,50V,NPO	SMD 1206	TDK
5	1	C4	1nF,50V,X7R	SMD 0805	TDK
6	1	C5	47uF,25V,E-CAP,105°C	φ5*11	Rubycon 红宝石
7	1	C6	47uF,25V,E-CAP,105°C	φ5*11	Rubycon 红宝石
8	1	C7	100pF,50V,NPO	SMD 0603	TDK
9	1	C8	22nF,50V,NPO	SMD 0603	TDK
10	1	C9	1nF,1kV	SMD 0603	TDK
11	1	CY1	Y-CAP680pF 400V	Y1	Vishay
12	1	D1	ES1J	SMD	TAIWAN SEMICONDUCTOR 台半
13	3	D2,D4,D5	SRGC10MH	SMD 1206-S	zowie
14	1	D3	SCD3100	SMD	zowie
15	1	FR1	1A 250V Fuse	SMD	TAIWAN SEMICONDUCTOR 台半
16	2	L1,L3	5mH 0.11mm*430T	SMD	xinyuanxiang
17	1	L2	5mH 0.11mm*300T	SMD	xinyuanxiang
18	1	Z1	15V	SMD ZMM15	ST
19	2	R1,R17	4.7K	SMD 0805	guoju
20	1	R2	300k	SMD 1206	guoju
21	1	R3	270k	SMD 1206	guoju

5. Bill of Material

Item	Qty.	Ref.	Description	Type specification	suppliers
22	2	R4,R5	330K 1206	SMD 1206	GUOJU
23	1	R6	390R	2W	GUOJU
24	1	R7	240K 1206	SMD 1206	GUOJU
25	1	R8	220K 1206	SMD 1206	GUOJU
26	1	R9	100R	SMD 0603	GUOJU
27	1	R10	1K	SMD 0603	GUOJU
28	1	R11	4.7R	SMD 0805	GUOJU
29	1	R12	10R	SMD 1206	GUOJU
30	1	R13	24K	SMD 0603	GUOJU
31	1	R14	2.2K	SMD 0603	GUOJU
32	1	R15	30K	SMD 0805	GUOJU
33	2	R16,R18	100R	SMD 1206	GUOJU
34	2	Q1,Q2	2N60	TO-251	ARK
35	1	Q3	DMZ6005	SMD SOT-23	ARK
36	1	T1	EE12.4	5PIN	xinyuanxiang
37	1	IC	IW3602-01	SOIC-8	IWATT
38	1	BR1	MB8S		

6. Transformer Design ___ 230Vac_10V450mA

SCHEMATIC



ELECTRICAL SPECIFICATIONS:

1. Primary Inductance (L_p) = 3.2mH @10KHz
2. Primary Leakage Inductance (L_k) ≤ 100uH @10KHz

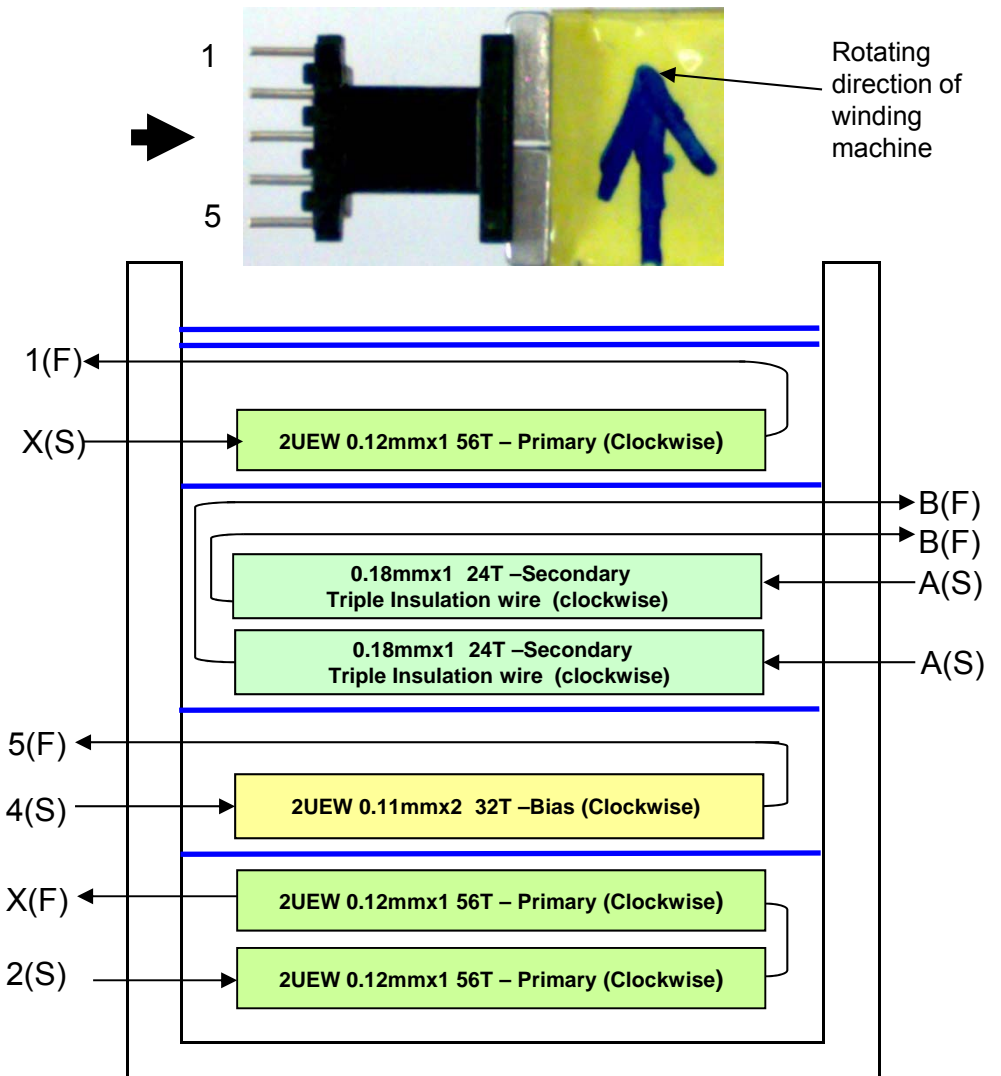
MATERIALS:

1. Core : EE12.4 (Ferrite Material TDK PC40 or equivalent)
2. Bobbin : EE12.4 Vertical
3. Magnet Wires : Type 2-U EW
4. Layer Insulation Tape : 3M1298 or equivalent.

FINISHED :

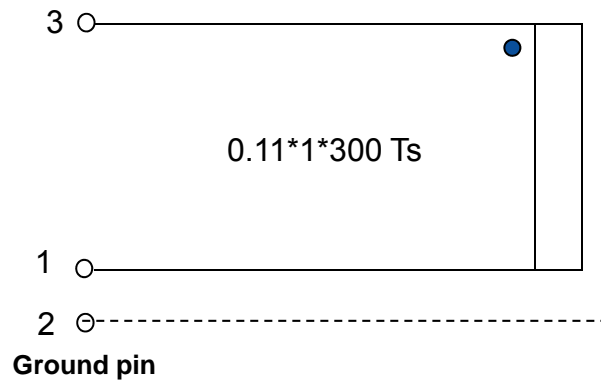
1. Cut remained of Pin3
2. Varnish the complete assembly
3. Core is connected to pin5(primary ground)

Instruction for start of first winding...



7.PFC choke and EMI Inductor__ For input 230Vac

1.L3 SCHEMATIC

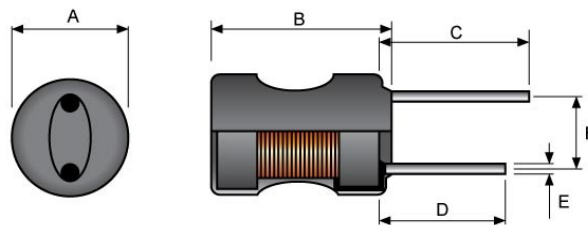


ELECTRICAL SPECIFICATIONS:

1. Inductance (L_p) = 5 mH \pm 5% @10KHz
2. Core : EE8.3 (Ferrite Material TDK PC40 or equivalent)
3. Bobbin : EE8.3 Horizontal
4. Ferrite core is connected to Pin 2 after assembling
5. Cut Pin4,5,6 after wires termination
6. Varnish the complete assembly



2.EMI Inductor L1,L2



Ferrite core size : Ax B 6x8mm 0.11*430T

Inductance @10kHz, 1V: 5mH \pm 5%

DCR: 13 OHM \pm 20%

8.Constant Current and Efficiency __No Dimmer



(AC input 180~264Vac,Output 3 LEDs)

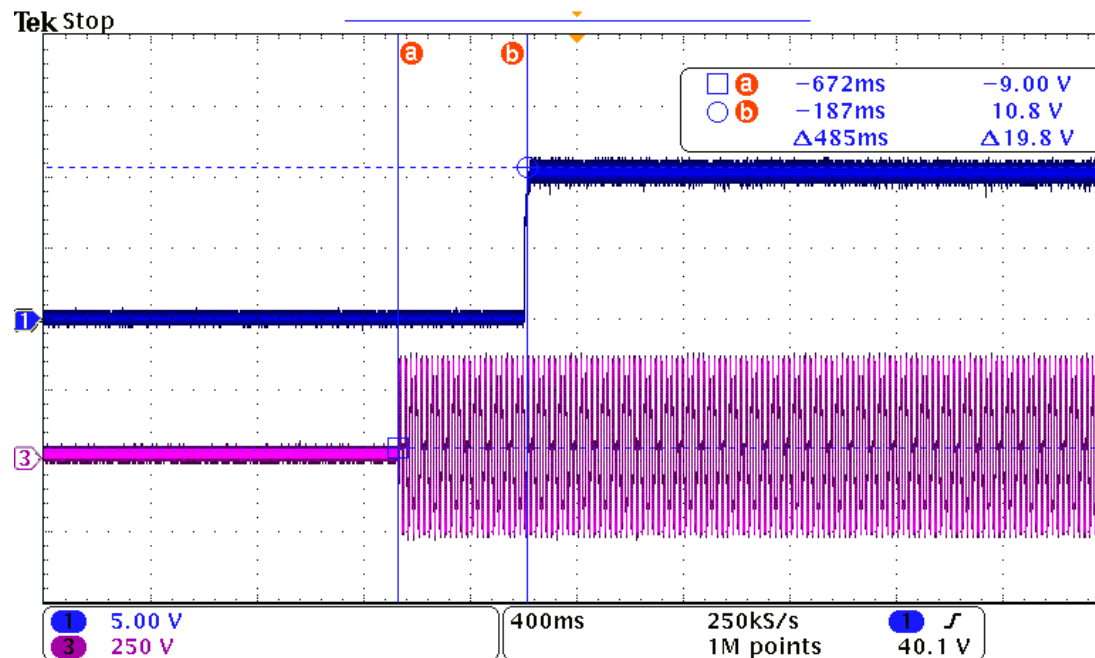
#of LEDs	Vin	Pin	Vout	Iout	Ripple	efficiency	3rd Harmonic	PF
	(V)	(W)	(V)	(A)	(mA)			
3LEDs	180	5.964	10.3	0.446		76.97%		0.812
	190	5.975	10.27	0.447		76.80%		0.814
	200	6.012	10.26	0.448		76.50%		0.825
	210	6.089	10.26	0.450		75.78%		0.819
	220	6.120	10.26	0.450		75.49%		0.797
	230	6.130	10.26	0.451		75.49%		0.804
	240	6.154	10.26	0.452		75.39%		0.825
	250	6.190	10.27	0.453		75.23%		0.800
	264	6.258	10.27	0.455		74.60%		0.772

9. Dimmer Compatibility Test---Leading edge dimmer



	Input	Minimum Level				Middle level					Maximum level			
Dimmer	Volt.	Pin	Pout	VLED	ILED	Pin	Pout	VLED	ILED	AC peak curr	Pin	Pout	VLED	ILED
	(V)	(W)	(W)	(V)	(mA)	(W)	(W)	(V)	(mA)	(mA)	(W)	(W)	(V)	(mA)
wuyun	180	0.56	0.05	7.84	6.547	3.82	2.30	9.48	242.8		6.58	4.57	10.28	445
400W	230	0.67	0.06	7.86	7.36	3.83	2.38	9.51	250.5		6.59	4.63	10.31	448.8
Leading	264	0.65	0.06	7.86	7.6	3.91	2.49	9.55	261		6.59	4.67	10.32	452.2
NIKO	180	2.25	0.20	8.21	23.9	4.96	2.31	9.47	244		6.15	3.44	9.90	347.8
	230	3.31	0.38	8.49	44.65	5.87	2.39	9.50	251.3		7.53	4.36	10.20	427.8
Trailing	264	4.05	0.46	8.63	52.9	6.27	2.38	9.50	250		8.61	4.67	10.33	452.3
Ivfeng	180	0.37	0.03	7.71	3.29	3.88	2.45	9.55	256.6		6.80	4.59	10.29	446.1
	230	0.47	0.05	7.81	5.84	3.79	2.39	9.53	251.2		6.29	4.64	10.31	449.9
Leading	264	0.57	0.08	7.94	10.68	3.85	2.39	9.51	251.1		6.52	4.67	10.32	452.9
TCL	180	0.45	0.01	7.61	1.618	4.01	2.45	9.52	257.4		6.39	4.61	10.33	445.9
	230	0.70	0.06	7.85	8.033	3.61	2.28	9.43	242.1		6.40	4.64	10.32	449.9
Leading	264	1.26	0.33	8.42	38.78	3.80	2.42	9.49	254.7		6.56	4.67	10.32	453

10. Start up and turn on delay time

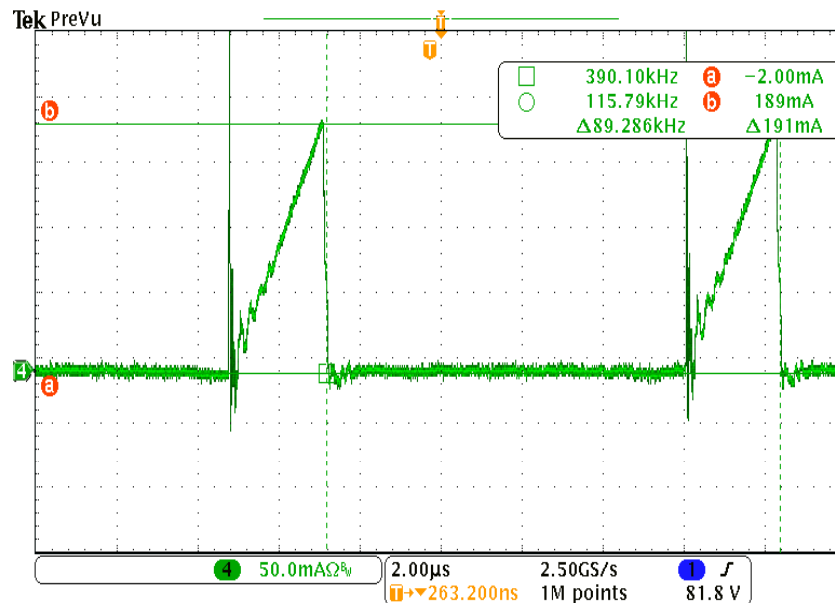


230V_{AC}, Full Load

$T_{ST_DELAY} = 464mS$

11. Transformer Flux Density

($N_p=168T_s$, $L_m=3.2\text{ mH}$, $A_e=12.4\text{mm}$ EE12.4)

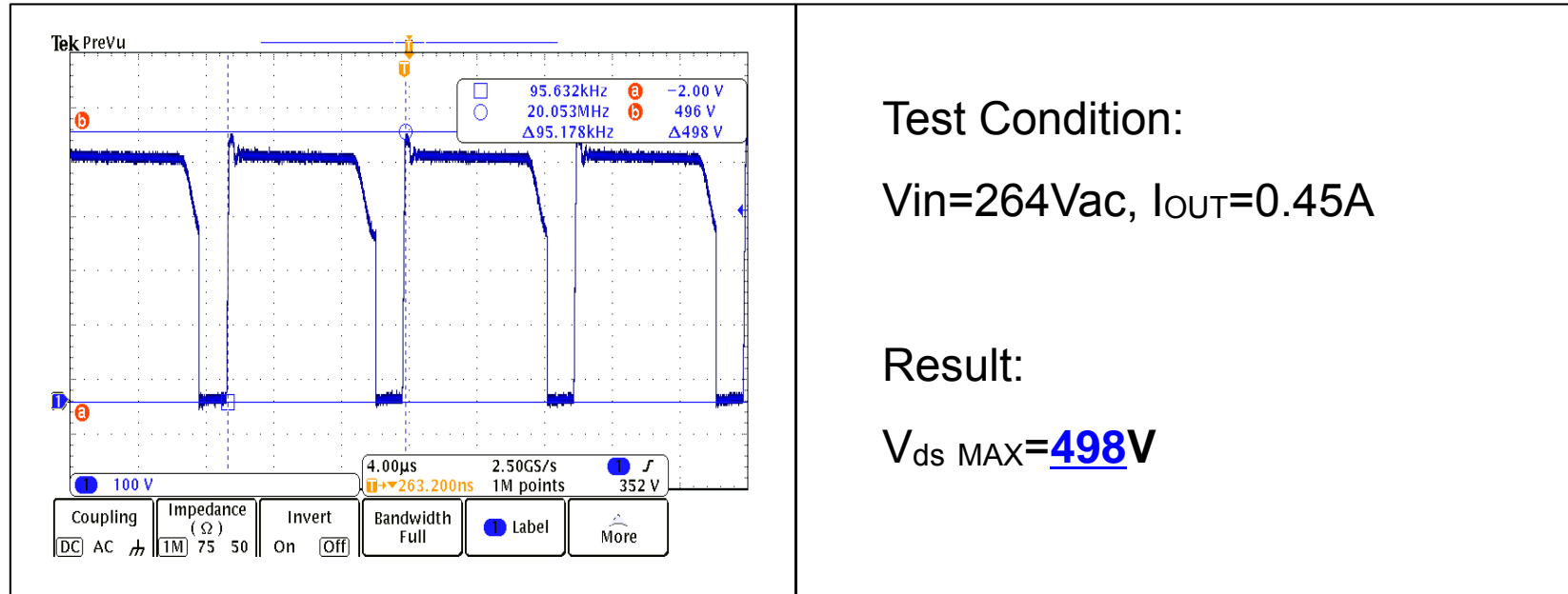


I_p is monitored at 180Vac and 450mA load

$I_p=191\text{mA}$

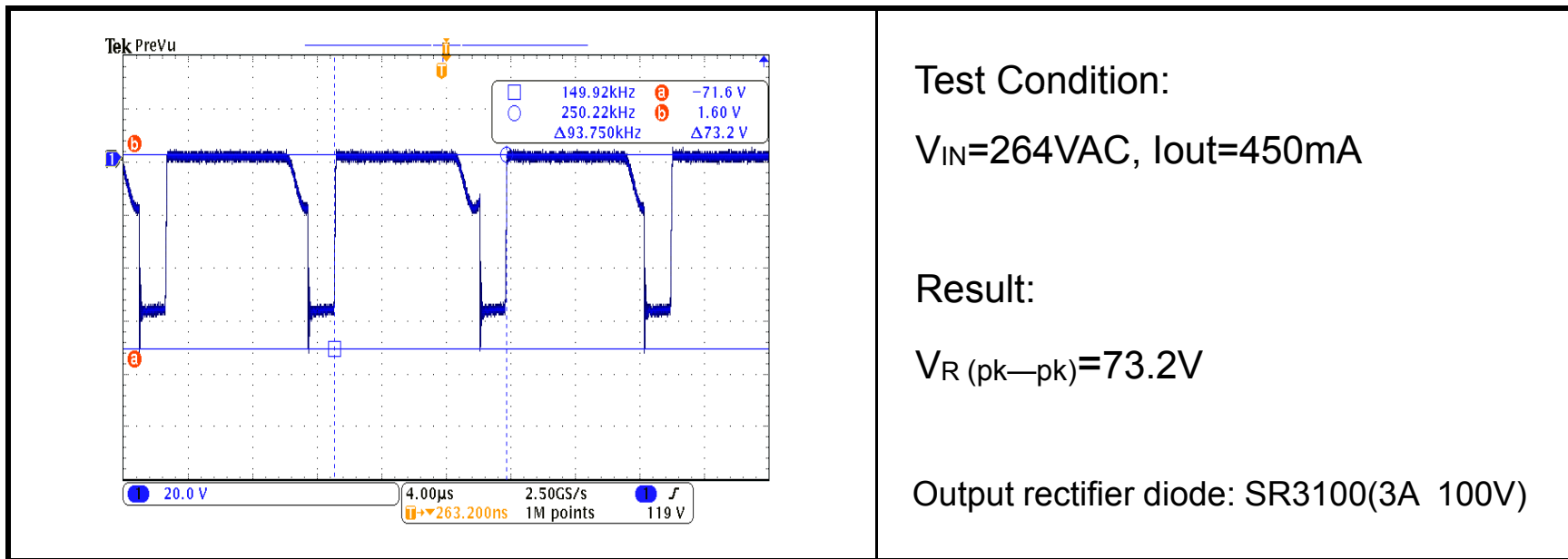
$$B_{MAX} = I_P * L_m / (N_P * A_e)$$
$$= (191 * 3.2) / (168 * 12.4)$$
$$= 0.293\text{Tesla}$$

12. V_{ds} Waveform for MOSFET



Symbol	Parameter	FTP02N60	FTA02N60	Unit
V_{DSS}	Drain-to-Source Voltage ^[1]	600		V
I_D	Continuous Drain Current	2.2	2.2*	A
$I_D@100^{\circ}C$	Continuous Drain Current	Figure 3		
I_{DM}	Pulsed Drain Current, $V_{GS}@10V^{[2]}$	Figure 6		
P_D	Power Dissipation	54	21	W
	Derating Factor above 25°C	0.43	0.17	W/°C
V_{GS}	Gate-to-Source Voltage	±30		V

13. V_R waveform for Rectifier Diode



Test Condition:

$V_{IN}=264VAC$, $I_{out}=450mA$

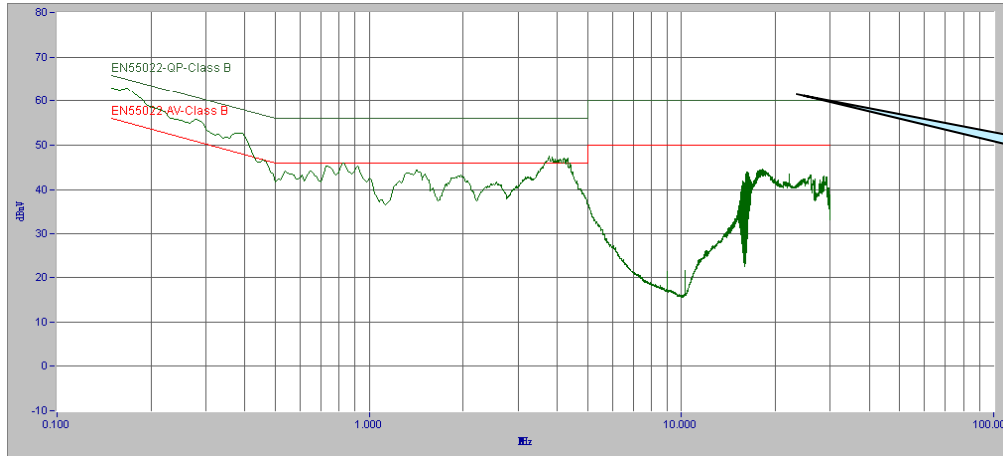
Result:

V_R (pk—pk)=73.2V

Output rectifier diode: SR3100(3A 100V)

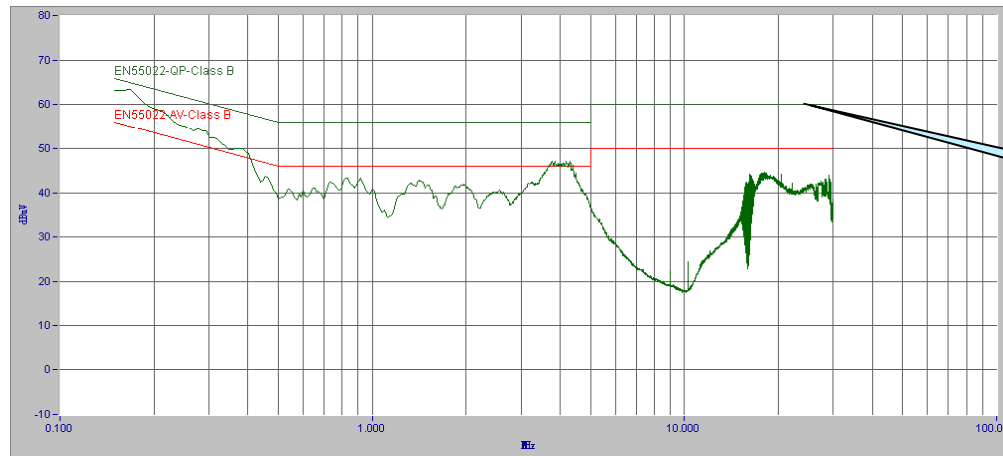
ITEM	Symbol	Conditions	Rating				Unit
			WSCD32H	WSCD34H	WSCD36H	WSCD310H	
Repetitive peak reverse voltage	VRRM		20	40	60	100	V
Average forward current	IF(AV)		3.0				A
Peak forward surge current	IFSM	8.3ms single half sine-wave	80				A
Operating junction temperature Range	Tj		-55 to +125		-55 to +150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

14. Conducted EMI (input 230Vac)



Peak Scan
QP Limit line

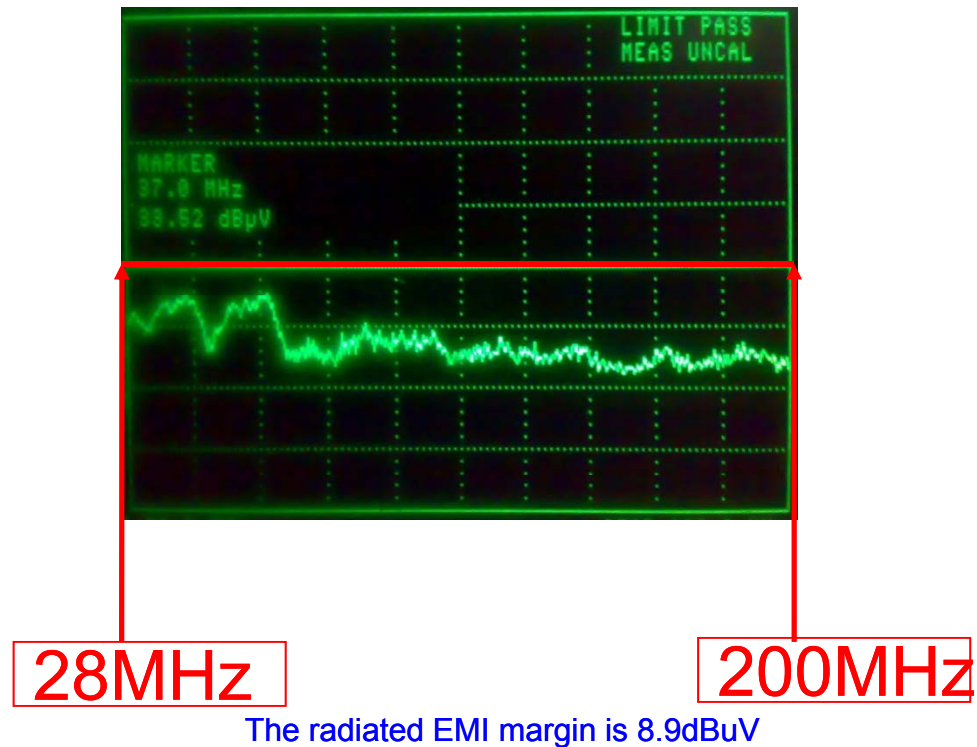
Peak scan N



Peak Scan
QP Limit line

Peak scan L

15. Radiated EMI (for reference)



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

2, Output is floating, with LED load