iWatt
Power Management Simplified Digitally™

Dimmable LED Driver with iW3602-00

(AC input 90V~135Vac,Output 3 LEDs)

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General Design Specification:

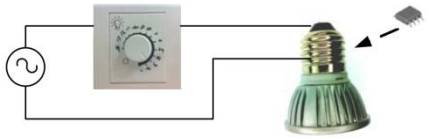
1.AC Input Range 90~135Vac

2.DC Output 10V, 450mA(Constant Current)

3.Non-isolated High efficiency

1. Design Purpose and Feature

- Isolated ac-dc offline , Input 100Vac, 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

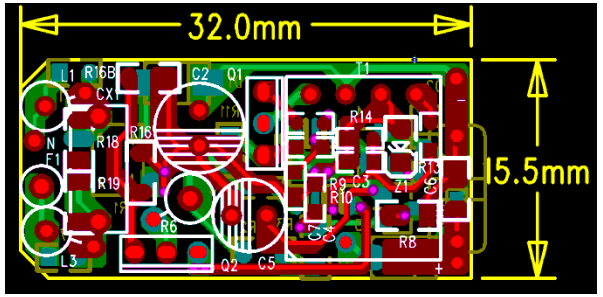


- Wide dimming range from 1% up to 100%
- No visible flicker
- Resonant control to achieve high efficiency
- High Power Factor, 0.5-0.8 without dimmer
- Temperature degrade control to adjust the LED
- Primary-only Sensing eliminates opto-isolator feedback and simplifies design

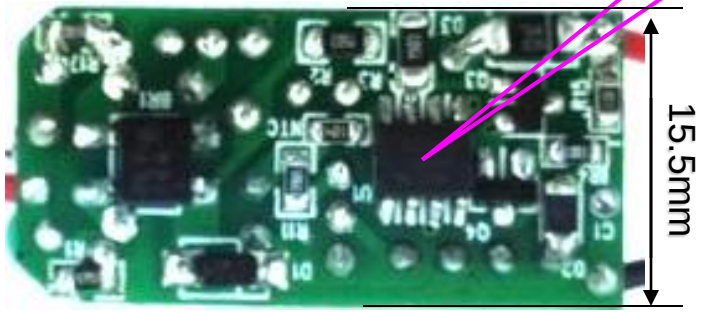
2.PCB Layout

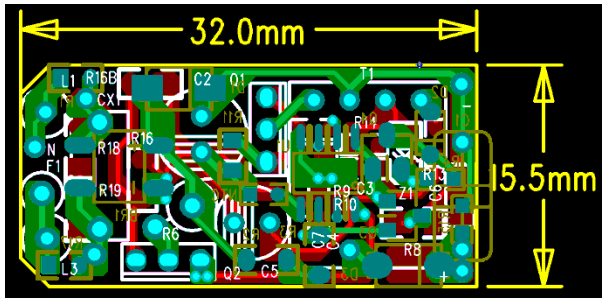
AC Input

DC output To LED

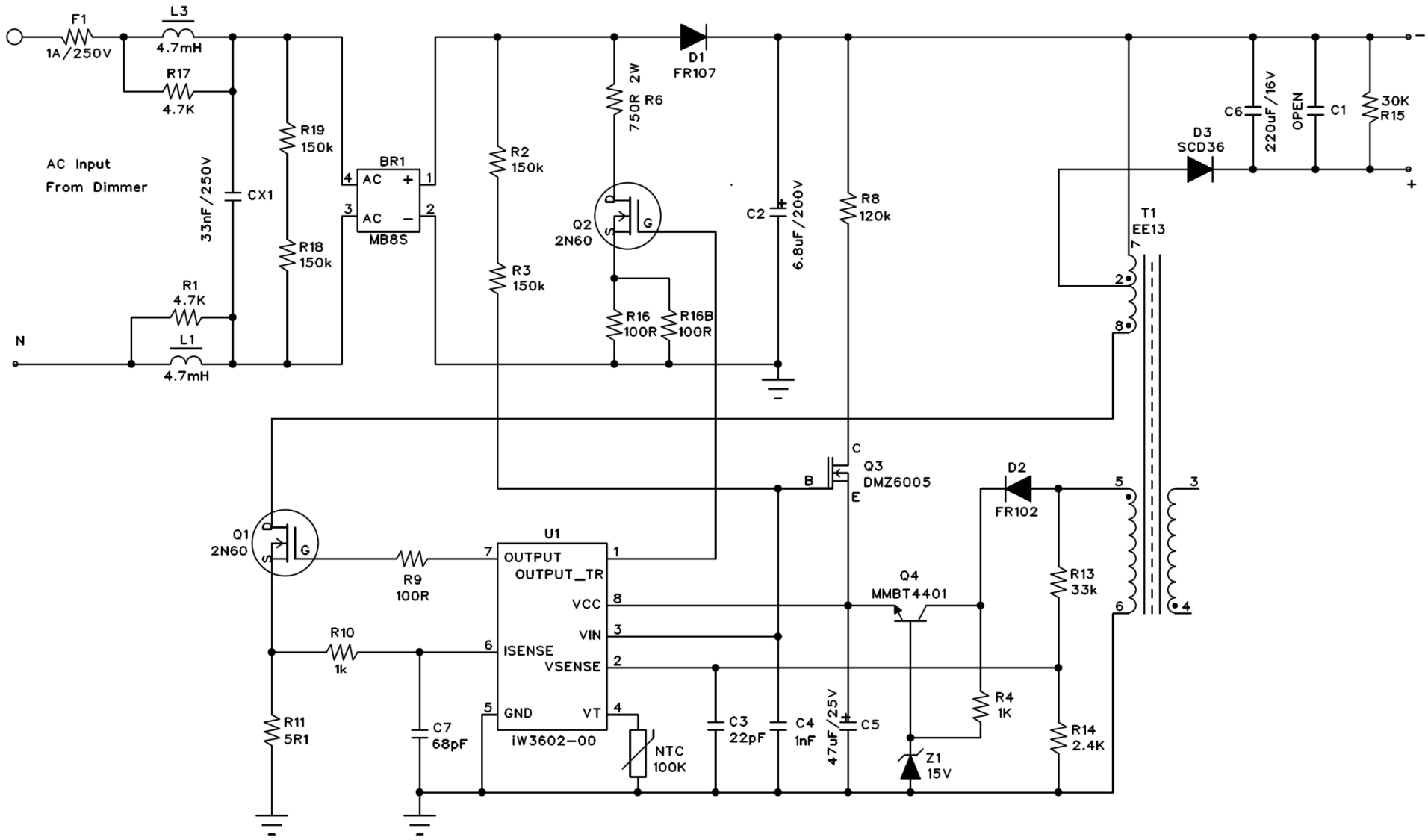


iw3602-00





3. Schematic circuit__10V450mA_120Vac



4. Bill of Material

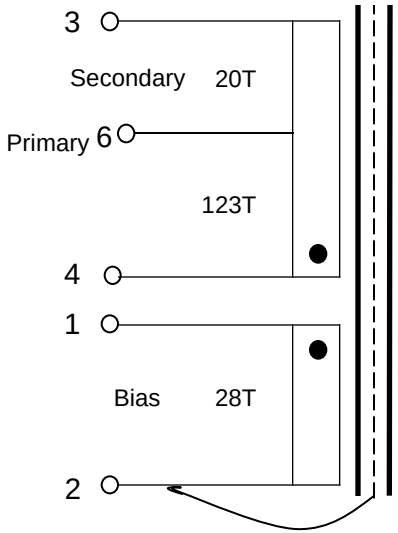
3	1	C3	22pF,25V,X7R	SMD 0603	TDK
4	1	C4	1nF,25V,X7R	SMD 0603	TDK
5	1	C5	47uF,25V,E-CAP,105℃	Φ5*11	Rubycon 红宝石
6	1	C6	220uF,16V,E-CAP,105℃	Φ5*11	Rubycon 红宝石
7	1	C7	68pF,25V,X7R	SMD 0603	TDK
8	1	D1	FR107/SRGC10MH	SMD	TAIWAN SEMICONDUCTOR 台半
9	1	D2	FR102	SMD 1206	zowie
10	1	D3	SCD36	SMD 1206	zowie
11	1	Z1	15V	SMD ZMM15	ST
12	1	FR1	1A 250V Fuse	Fuse	TAIWAN SEMICONDUCTOR 台半
13	2	L1,L3	4.7mH	0510	xinyuanxiang
14	2	R1,R17	4.7K	SMD 0805	yageo
15	4	R18,R19,R2,R3	150k	SMD 1206	yageo
16	1	R4	1k	SMD 0805	yageo
17	1	R6	750R	2W	yageo

5. Bill of Material

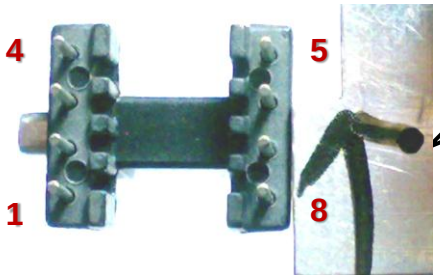
Item	Qty.	Ref.	Description	Type specification	suppliers
18	1	R8	120K	SMD 1206	yageo
19	2	R16,R16B	100R	SMD 1206	yageo
20	1	R9	100R	SMD 0603	yageo
21	1	R10	1k	SMD 0603	yageo
22	1	R11	5R1	SMD 0603	yageo
23	1	R13	13K	SMD 0603	yageo
24	1	R14	2.4k	SMD 0603	yageo
25	1	R15	30k	SMD 0805	yageo
26	1	NTC	100K	SMD 0603	yageo
27	1	Q1,Q2	2N60	TO-251	ARK
28	1	Q3	DMZ6005	SMD SOT-23	ARK
29	1	Q4	4401	SMD SOT-23	PJ
30	1	T1	EE13	8PIN	xinyuanxiang
31	1	IC	IW3602-00	SOIC-8	IWATT

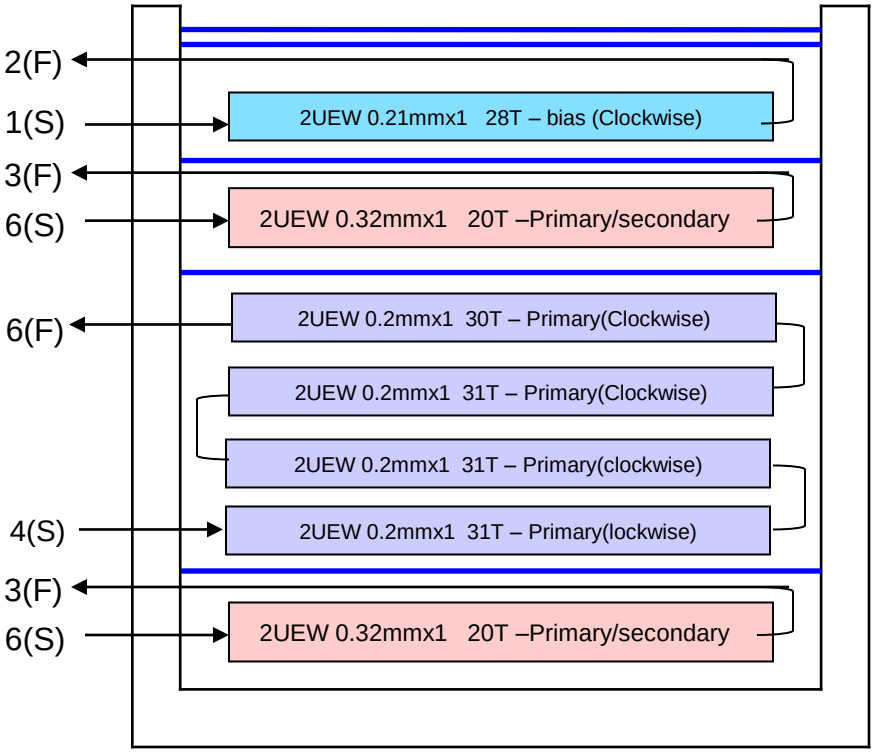
6. Transformer Design

SCHEMATIC



Note:
- Dot (●) denote electrical start.
- Electrical start could be different to Mechanical/Winding start.





ELECTRICAL SPECIFICATIONS:

1. Primary Inductance (Lp) = 2.7mH @10KHz
2. Primary Leakage Inductance (Lk)< = 100uH @10KHz
3. Electrical Strength = 3KV, 50/60Hz,1Min

MATERIALS:

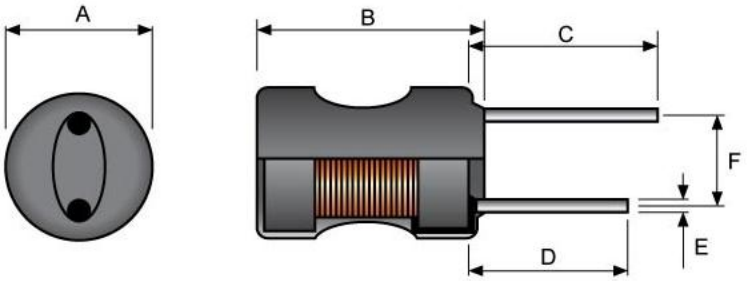
1. Core : EE13(Ferrite Material TDK PC40 or equivalent)
2. Bobbin :EE13Horizontal. Primary=5, Secondary=5
3. Magnet Wires (Pri) : Type 2-UEW
4. Magnet Wire (Sec) : Triple Insulated Wires
5. Layer Insulation Tape :3M1298 or equivalent.

FINISHED :

1. Cut remained of Pin 5,7,8. after wires termination
2. Varnish the complete assembly

7.EMI Inductor Design

Differential Mode Inductor_L1、L3



Ferrite core size : AxB 5x7mm

Wire gauge: 0.09mm, 450Turns

Inductance @10kHz, 1V: 4.7mH +/-10%

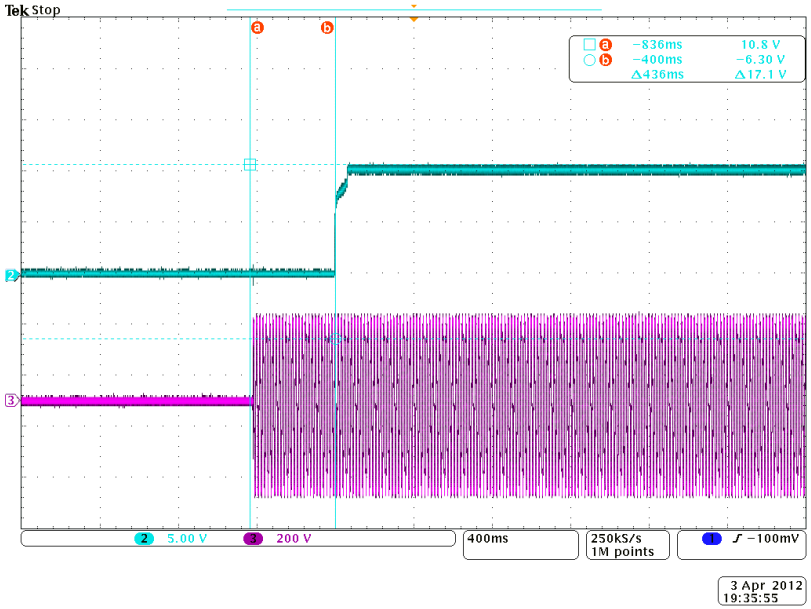
DCR: 7.5 OHM +/-20%

8.Constant Current and Efficiency __No Dimmer

(AC input 90~135Vac,Output 3 LEDs)

#of LEDs	Vin (V)	Pin (W)	Vout (V)	Iout (A)	efficiency	PF
3LEDs	90	5.570	9.88	0.446	79.11%	0.648
	100	5.490	9.88	0.446	80.26%	0.628
	110	5.450	9.88	0.445	80.67%	0.610
	115	5.430	9.87	0.445	80.89%	0.601
	120	5.420	9.87	0.445	81.04%	0.593
	130	5.410	9.87	0.445	81.19%	0.578
	135	5.410	9.87	0.445	81.19%	0.571

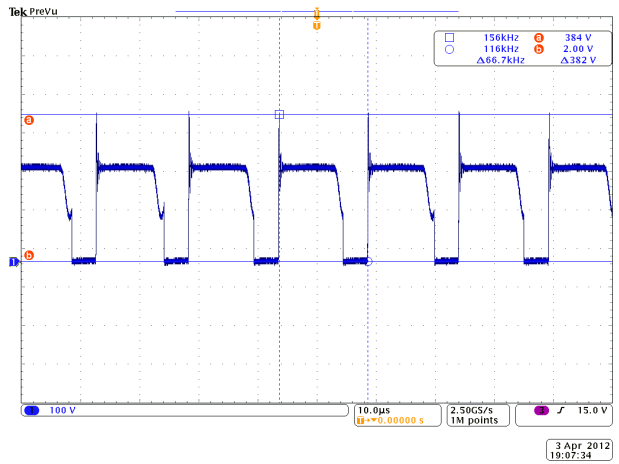
9.Start up and turn on delay time



100V_{AC}, Full Load

T_{ST_DELAY}= 436mS

10. V_{ds} Waveform for MOSFET



Test Condition:

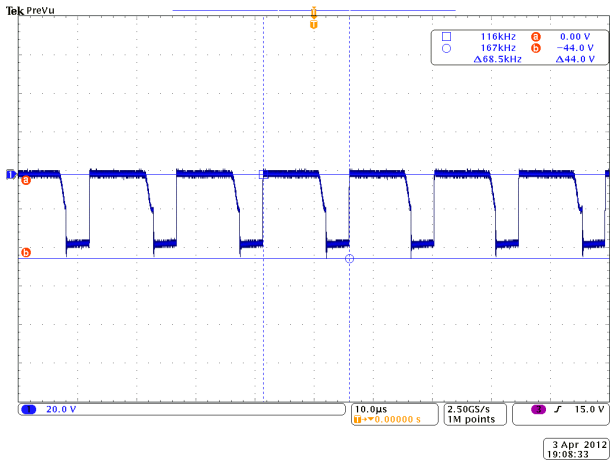
Vin=135Vac, I_{OUT}=0.45A

Result:

$V_{ds\ MAX}$=**382V**

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	
I_{DM}	Pulsed Drain Current, V_{GS}@10V [2]	Figure 6	
P_D	Power Dissipation	43	W
	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}=135VAC, Iout=450mA

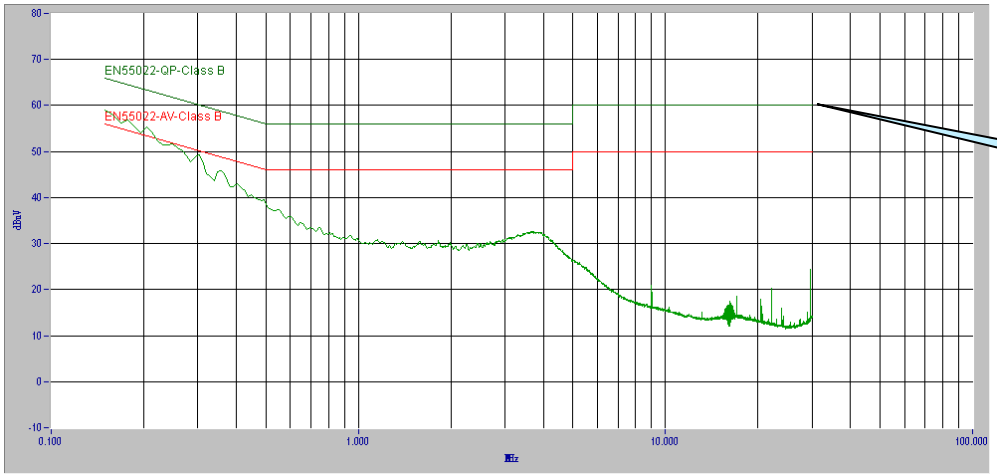
Result:

$V_{R\ (pk—pk)}$=44V

Output rectifier diode: SCD36 (3A 60V)

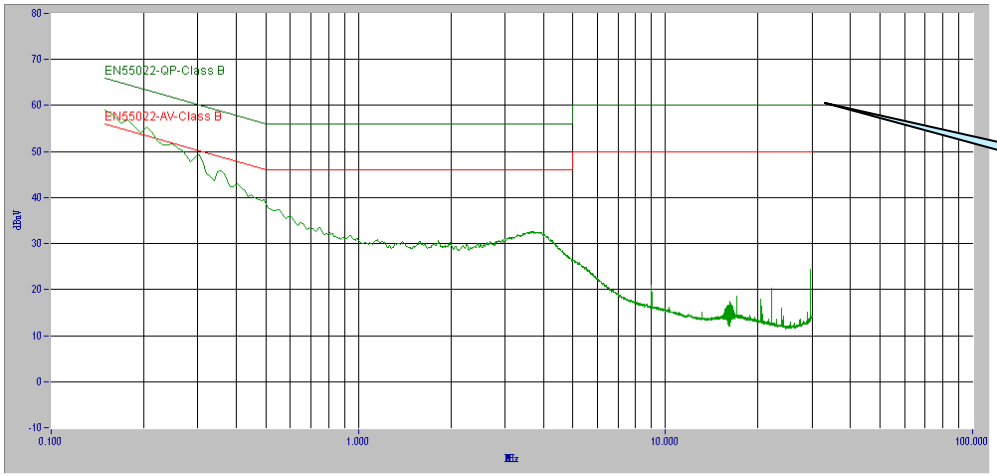
ITEM	Symbol	Conditions	Rating				Unit
			SCD22H	SCD24H	SCD26H	SCD210H	
Repetitive peak reverse voltage	VRRM		20	40	60	100	V
Average forward current	IF(AV)		2.0				A
Peak forward surge current	IFSM	8.3ms single half sine-wave	50				A
Operating junction temperature Range	Tj		-55 to +125		-55 to +150		°C
Storage temperature Range	TSTG		-55 to +150				°C

12.Conducted EMI (input 115Vac)



Peak Scan
QP Limit line

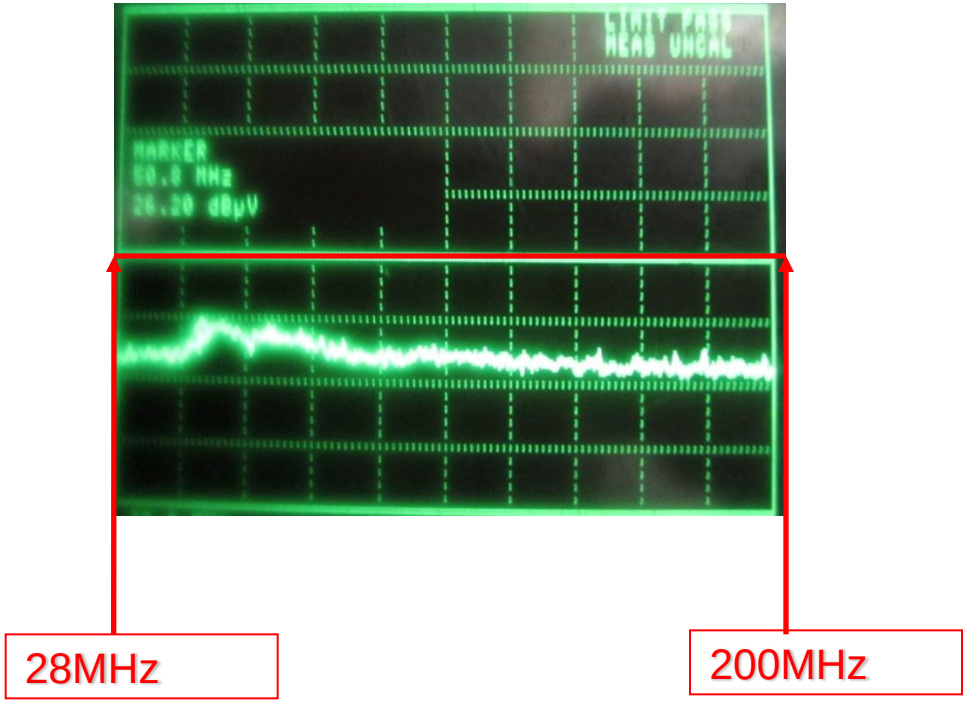
Peak scan N



Peak Scan
QP Limit line

Peak scan L

13. Radiated EMI (for reference)



Input:115VAC Output:3LED