iWatt

LED Driver Design with iW1706

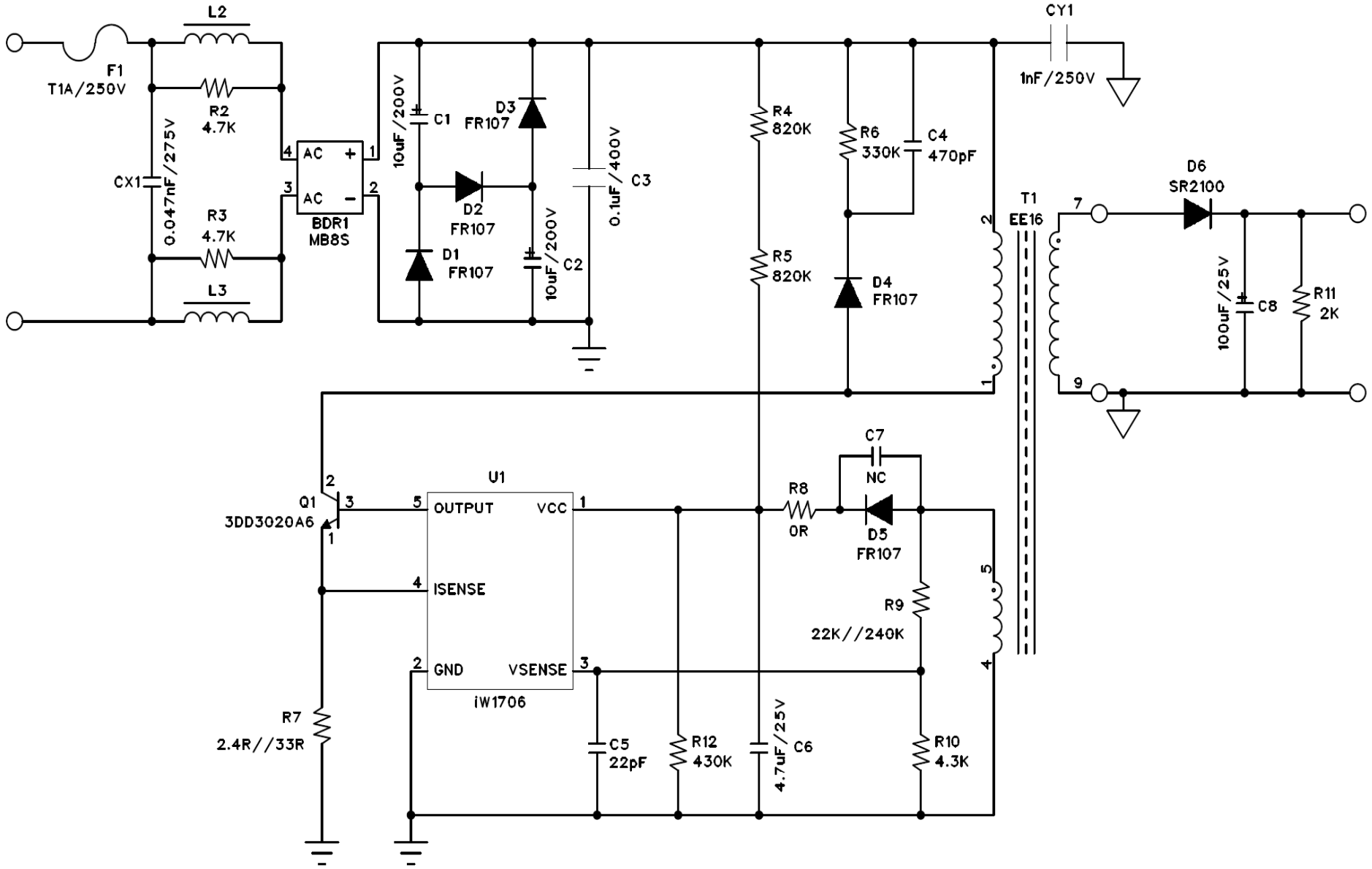
Summary and Features :

1. **LED driver, 12V, 520mA ; Wide AC input range: 90Vac-264Vac**
2. **Valley Fill PFC , PF>0.85 @230Vac**
3. **High Efficiency and Isolated Applications**
4. **Meet EMI Requirement (EN55015BQP&AV scan)**

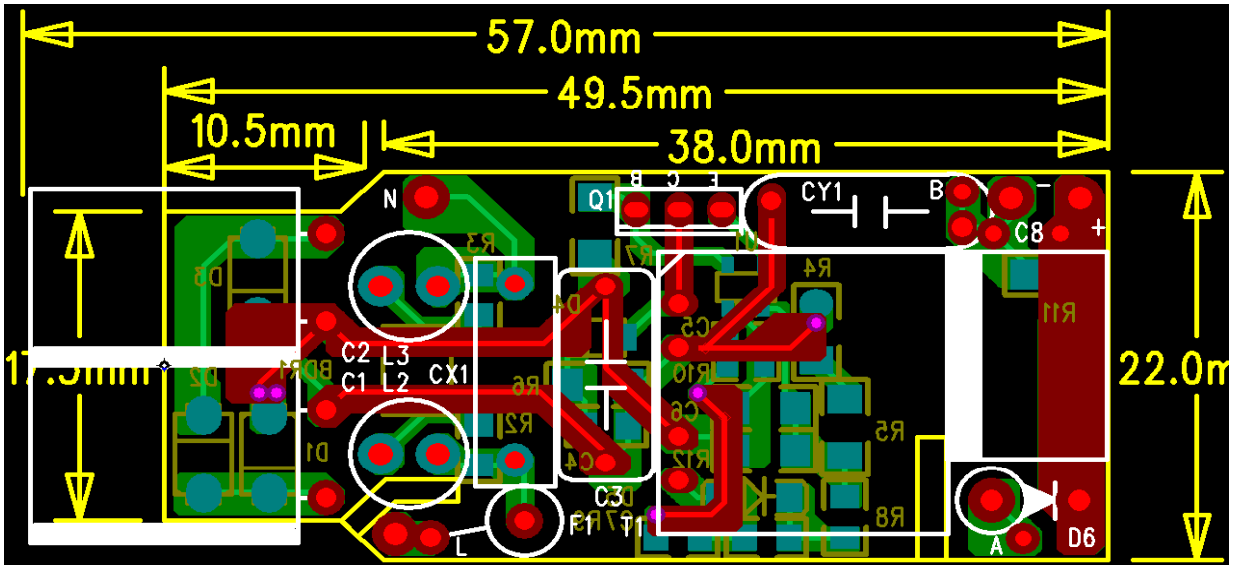
1. Specification

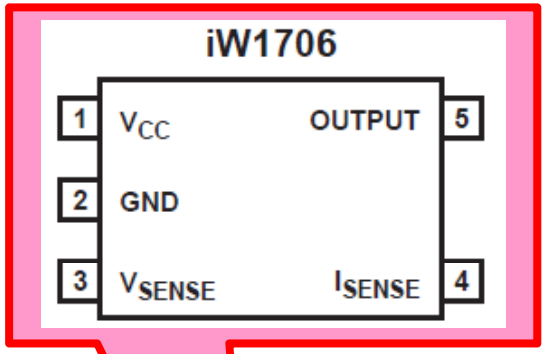
Description		Symbol	Min	Typ	Max	Units	Comment
Input							
Voltage		V	90	100-240	264	V_{AC}	2 Wire
Frequency		f_{LINE}	47	50	63	Hz	
Open-load Input Power (264V_{AC})						W	
Output							
Const Voltage	Output Voltage	V_{OUT_CV}	11.6	12	12.6	V	Measured at the PCB connector
	Output Current	I_{OUT_CV}				A	
Const Current	Output Voltage	V_{OUT_CV}				V	Min Vout is depend on Vcc
	Output Current	I_{OUT_CV}		0.5		A	
Total Output Power							
Continuous Output Power		P_{OUT}		6		W	
Over Current Protection		I_{OUT_MAX}				A	Auto-restart
Efficiency		η		80		%	Measured at end of PCB
Power Fact		PF		0.85			Harmonic meet IEC61000-3-2 @120Vac
Turn on Delay Time						Sec	
Conducted EMI				Meets EN55015B			
Hi-pot test				3		KV	
Operation temperature		T_{opr}		40		°C	Free convection, sea level

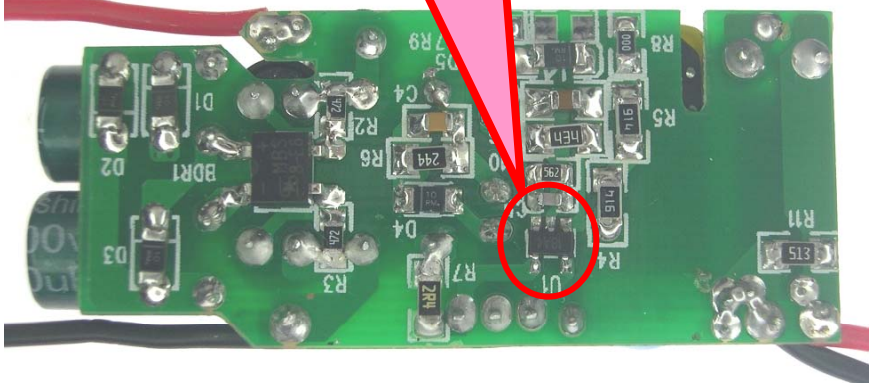
2. Schematic


L2
F1
T1A/250V
R2
4.7K
CX1
0.047nF/275V
R3
4.7K
L3
BDR1
MB8S
AC +
AC -
10uF/200V
C1
D3
FR107
D2
FR107
D1
FR107
10uF/200V
C2
0.1uF/400V
C3
R4
820K
R5
820K
R6
330K
C4
470pF
D4
FR107
CY1
1nF/250V
T1
EE16
D6
SR2100
100uF/25V
C8
R11
2K
U1
Q1
3DD3020A6
OUTPUT
VCC
ISENSE
GND
VSENSE
iW1706
C7
NC
R8
0R
D5
FR107
R9
22K//240K
R7
2.4R//33R
C5
22pF
R12
430K
4.7uF/25V
C6
R10
4.3K

3.Circuit Board Photograph





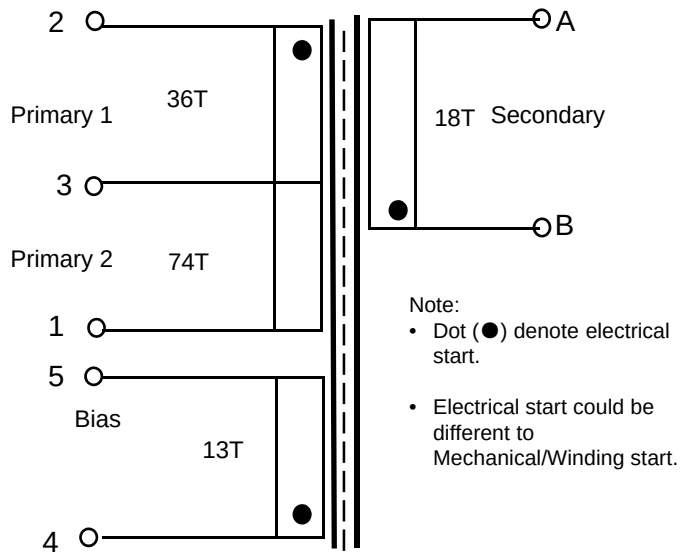


4. Bill of Material

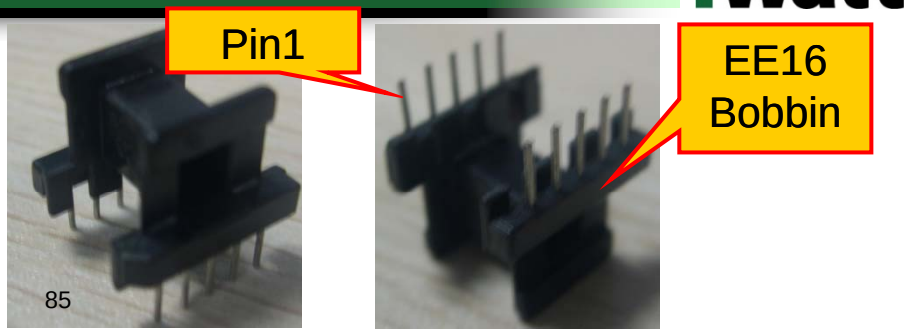
Item	Qty.	Ref.	Description	Type specification	suppliers
1	2	C1，C2	15uF,100V,E-CAP,105℃	Φ 10*15	Rubycon 红宝石
2	1	C8	100uF,25V,E-CAP,105℃	Φ 8*12	Rubycon 红宝石
3	1	CX1	0.047uF,275V		CARLI 凯励
4	1	CY1	Y-CAP1nF 250V		Vishay
5	1	C3	0.1uF,400V,CBB		CARLI 凯励
6	1	C4	470PF,1kV,X7R	SMD 0805	TDK
7	1	C5	22pF,50V,X7R,	SMD 0805	TDK
8	1	C6	4.7uF,25V，	SMD 1206	TDK
9	2	L3,L2	6*8 （0.1mmx1 430T）		
10	1	F1	1A/250Vac Fuse	1A	LITTEELFUSE
12	1	Q1	3DD3020A6	TO-126	Huajing
13	1	T1	EE16 Transformer		
14	1	D6	SR2100		
15	5	D1,D2,D3	1N4007/FR107	SMA	TAIWAN SEMICONDUCTOR 台半
16	1	D4,D5	FR107	SMA	TAIWAN SEMICONDUCTOR 台半
17	2	R2,R3	4.7KΩ+/-5%,	SMD-0805	YACEO 国巨
18	1	R10	4.3KΩ+/-1%,	SMD-0805	YACEO 国巨
19	2	R8	0Ω+/-1%,	SMD-0805	YACEO 国巨
20	1	R9	22KΩ+/-1%, //240K Ω	SMD-0805	YACEO 国巨
21	1	R12	560KΩ+/-5%,	SMD-0603	YACEO 国巨
22	1	R6	430KΩ+/-5%,	SMD-1206	YACEO 国巨
23	1	R11	36KΩ+/-5%,	SMD-1206	YACEO 国巨
24	2	R5,R4	820KΩ+/-5%,	SMD-1206	YACEO 国巨
25	1	R7	2.4Ω+/-1%, //33R	SMD-1206	YACEO 国巨
26	1	BDR	MBS8	SMD	
27	2	C7，Z1	NC		
28	1	U1	IW1706	SOT-23	IWATT

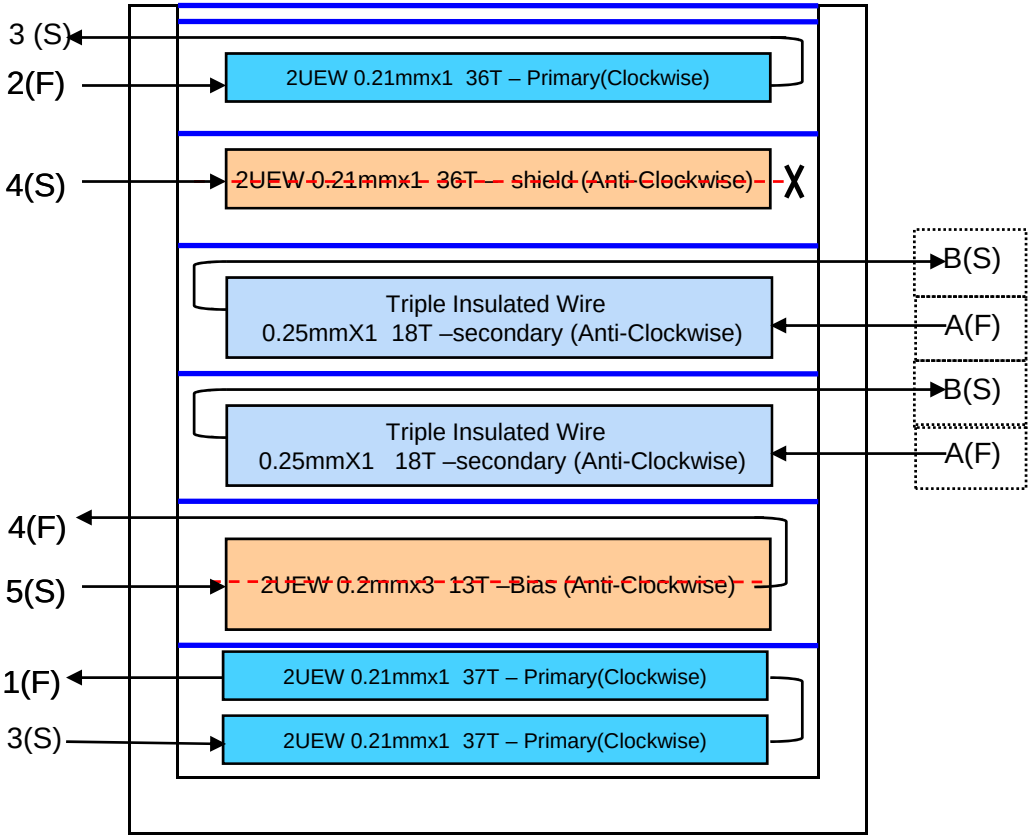
5. Transformer Design (12V 500mA)

SCHEMATIC



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





ELECTRICAL SPECIFICATIONS:

1. Primary Inductance (Lp) = 1.2mH @10KHz
2. Primary Leakage Inductance (Lk)< = 100uH @10KHz
3. Electrical Strength = 3KV, 50/60Hz,1Min

MATERIALS:

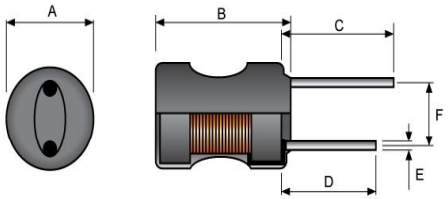
1. Core : EE16 (Ferrite Material TDK PC40 or equivalent)
2. Bobbin :EE16 Horizontal. Primary=5, Secondary=5
3. Magnet Wires (Pri) : Type 2-UEW
4. Magnet Wire (Sec) : Triple Insulated Wires
5. Layer Insulation Tape :3M1298 or equivalent.

FINISHED :

1. Cut remained of Pin after wires termination
2. Varnish the complete assembly

Differential Mode Inductor L3,L2

SCHEMATIC



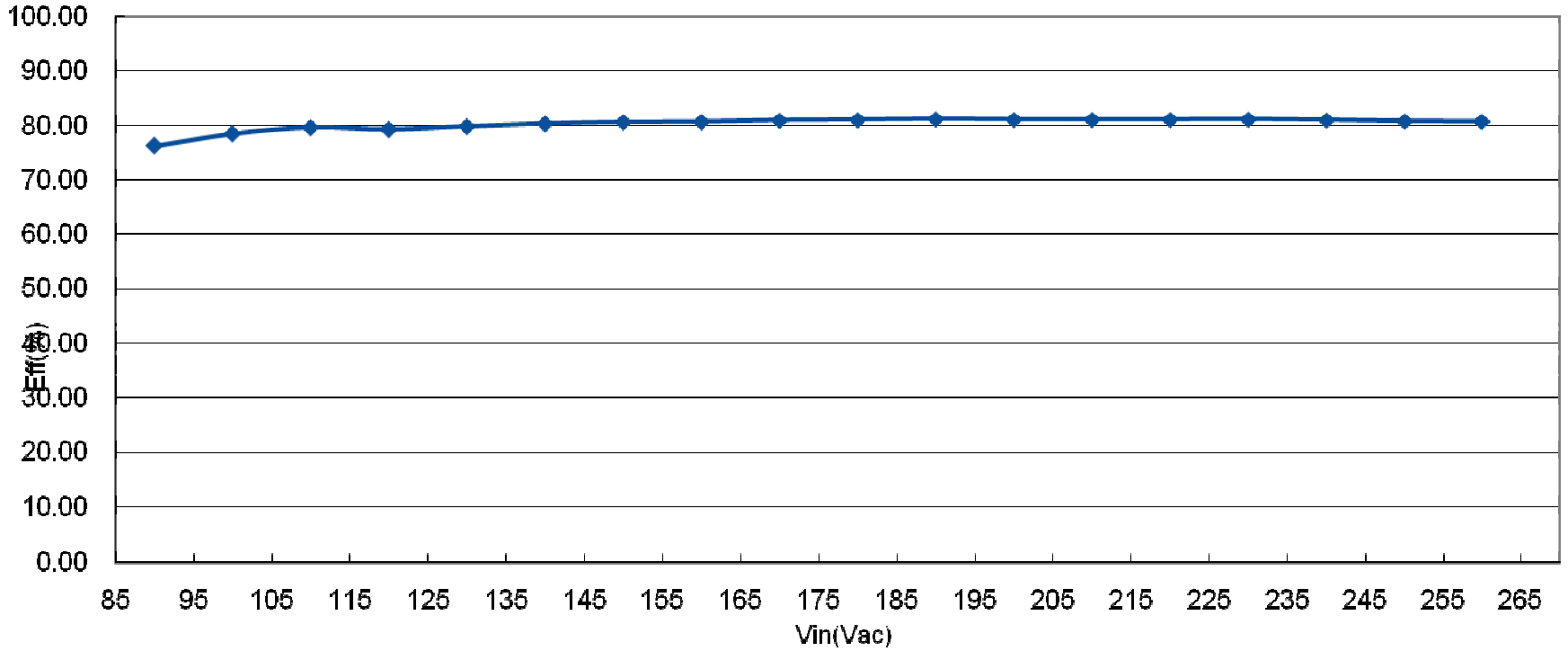
Ferrite core size : AxB 6x8mm

Wire gauge: 0.1mm, 430 Turns

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

DCR: 1.5 OHM +/-20%

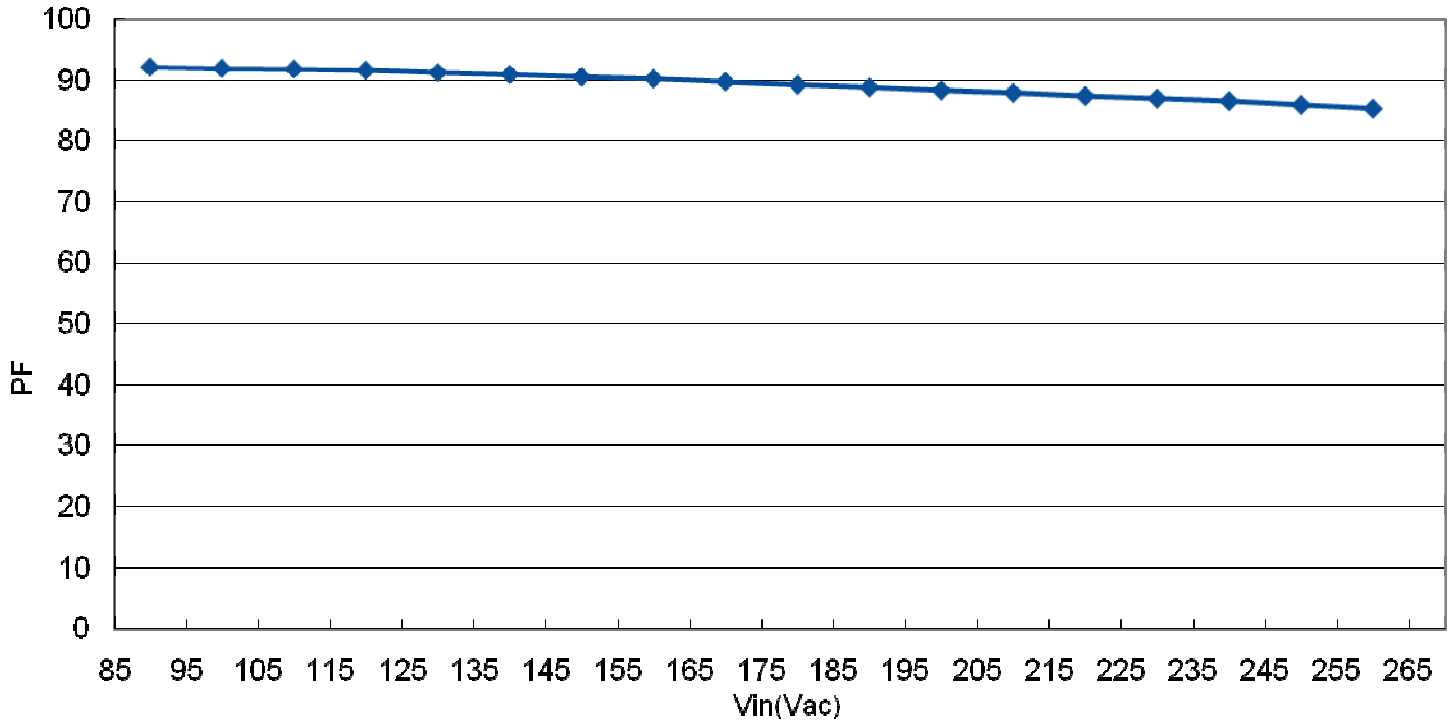
7. Efficiency Measurement



Vin	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	264
Eff	76.32	78.50	79.64	79.29	79.85	80.36	80.67	80.73	80.99	81.09	81.25	81.14	81.14	81.14	81.19	81.04	80.83	80.78

*** Note: Output voltage measured at end of PCB.**

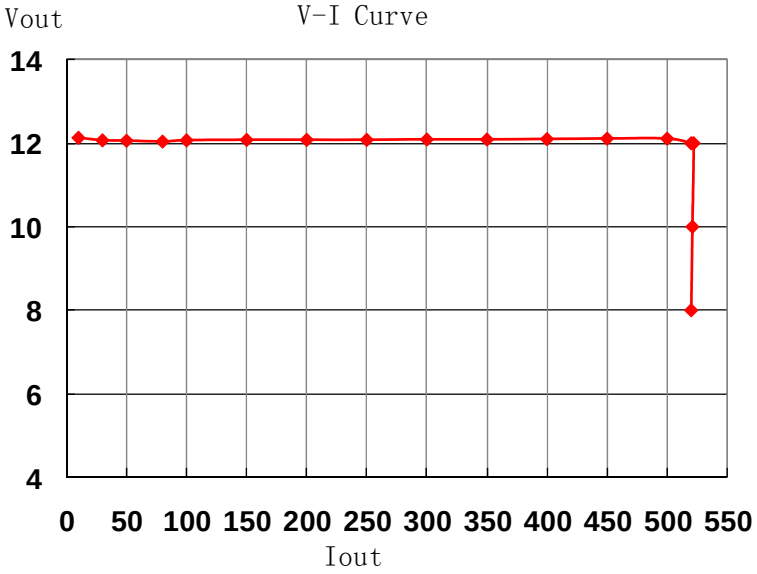
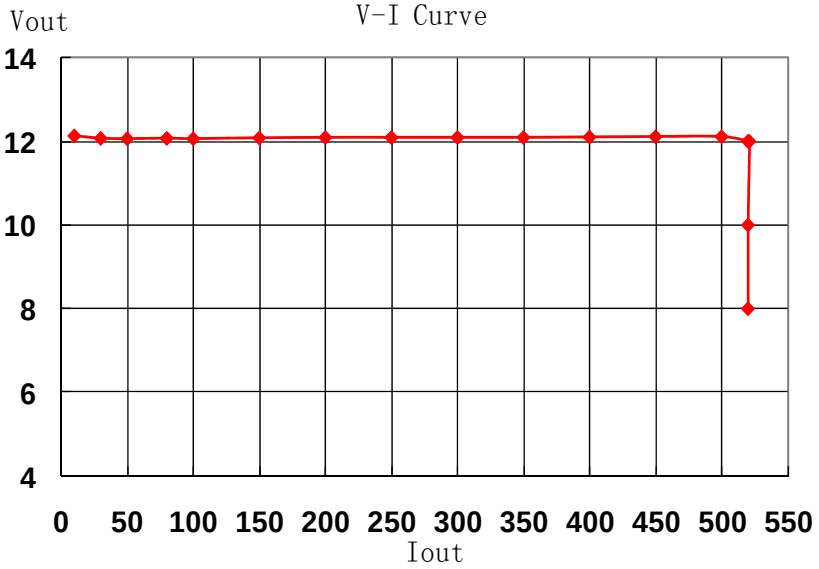
8. Input voltage VS Power Fact curve



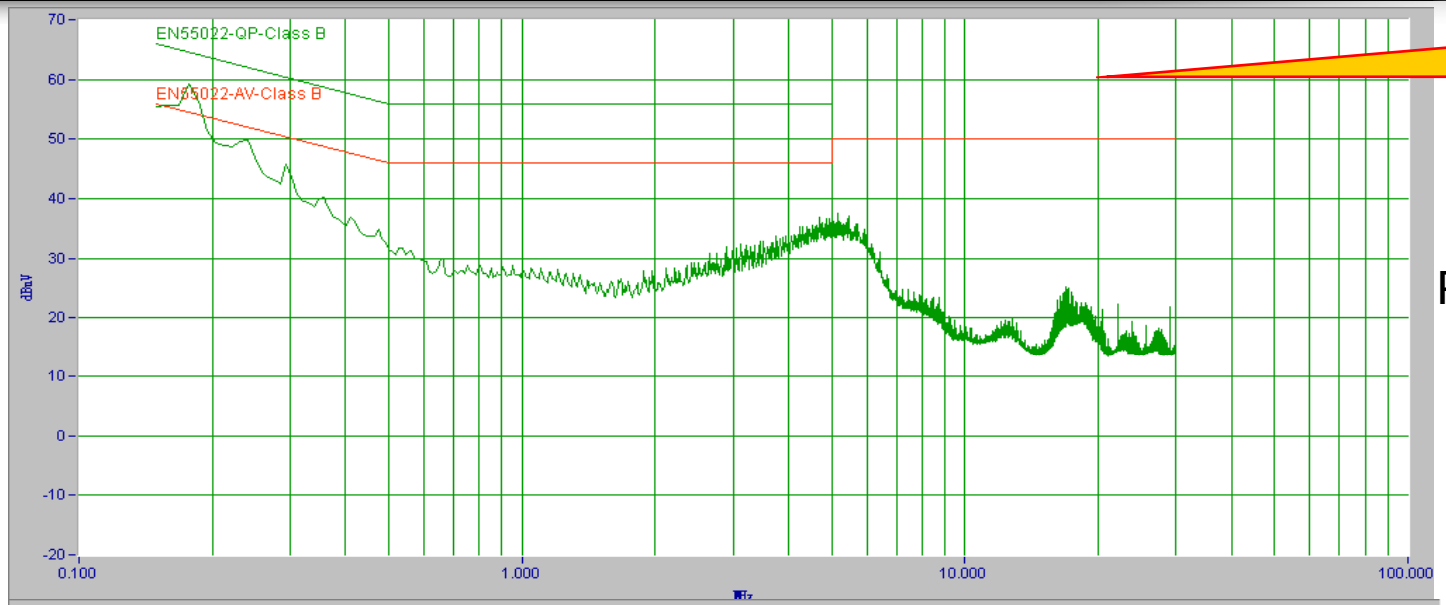
Vin	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	264
PF	92.1	91.9	91.8	91.6	91.2	90.9	90.5	90.2	89.7	89.2	88.8	88.3	87.9	87.4	87	86.6	86	85.4

9. Output VI Characteristics

*** Note: Output voltage measured at PCB end, T_{AMB}=25 ℃**

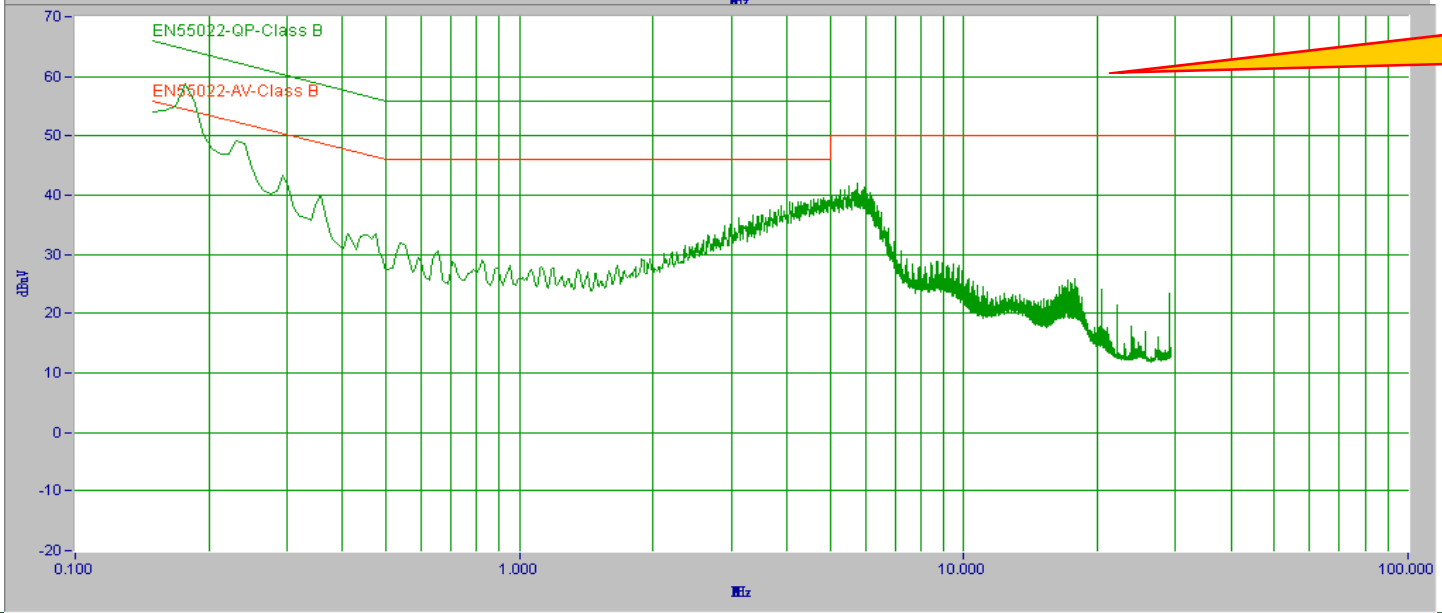
V_{IN}=120V_{ac}, T_{AMB}=25℃	V_{IN}=230V_{ac}, T_{AMB}=25℃
	
CC limit :515-525mA	CC limit :515-525mA

14.Conducted EMI (Input 230Vac Full Load, output floating)



Peak Scan
QP Limit line

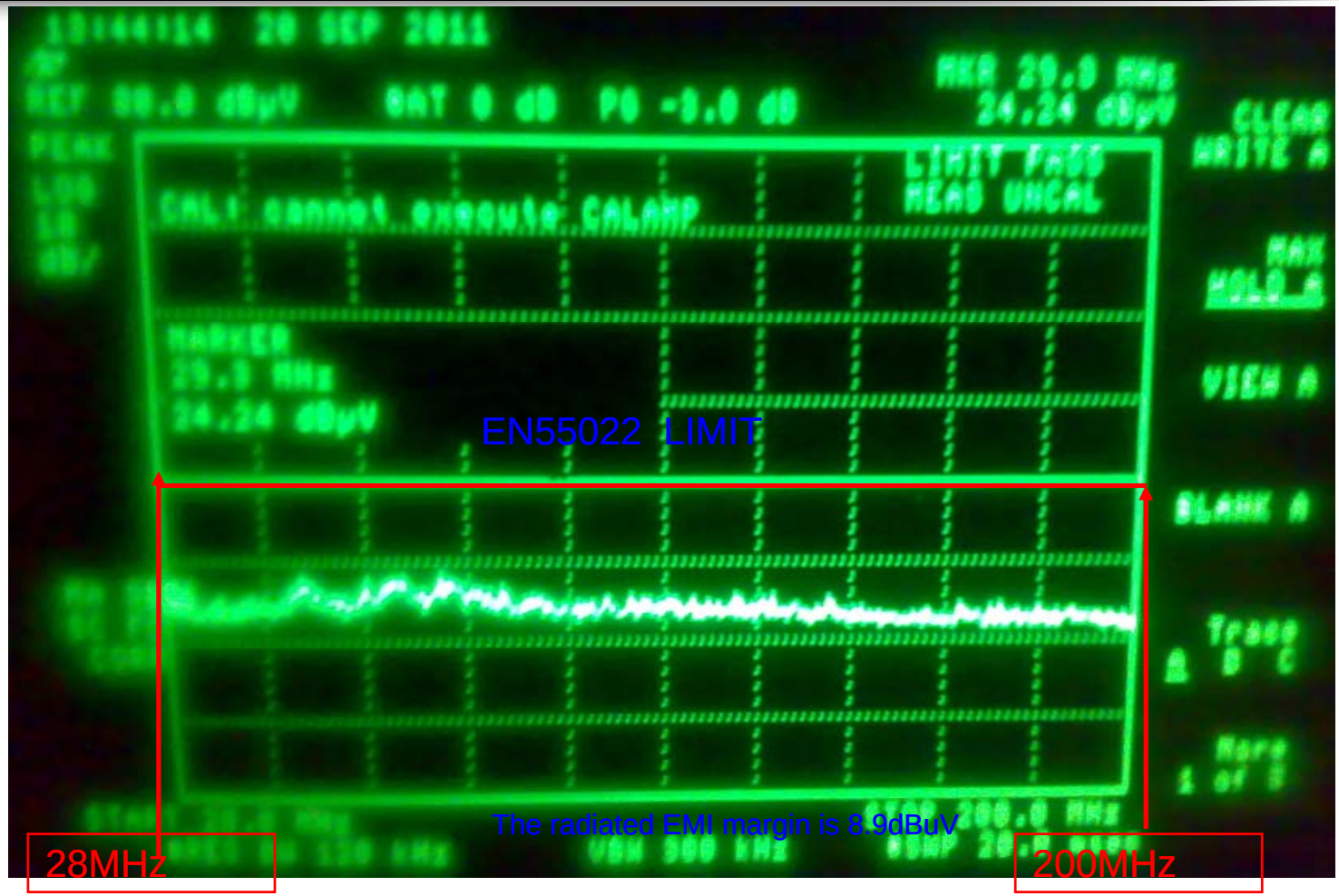
Peak scan N



Peak Scan
QP Limit line

Peak scan L

15. Radiated IEM (for reference) 230Vac



Note: 1, Vin=120Vac

2, Output is floating, with LED load