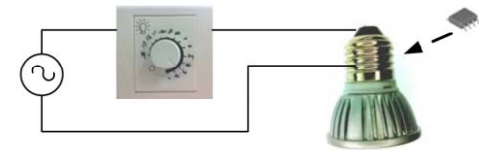




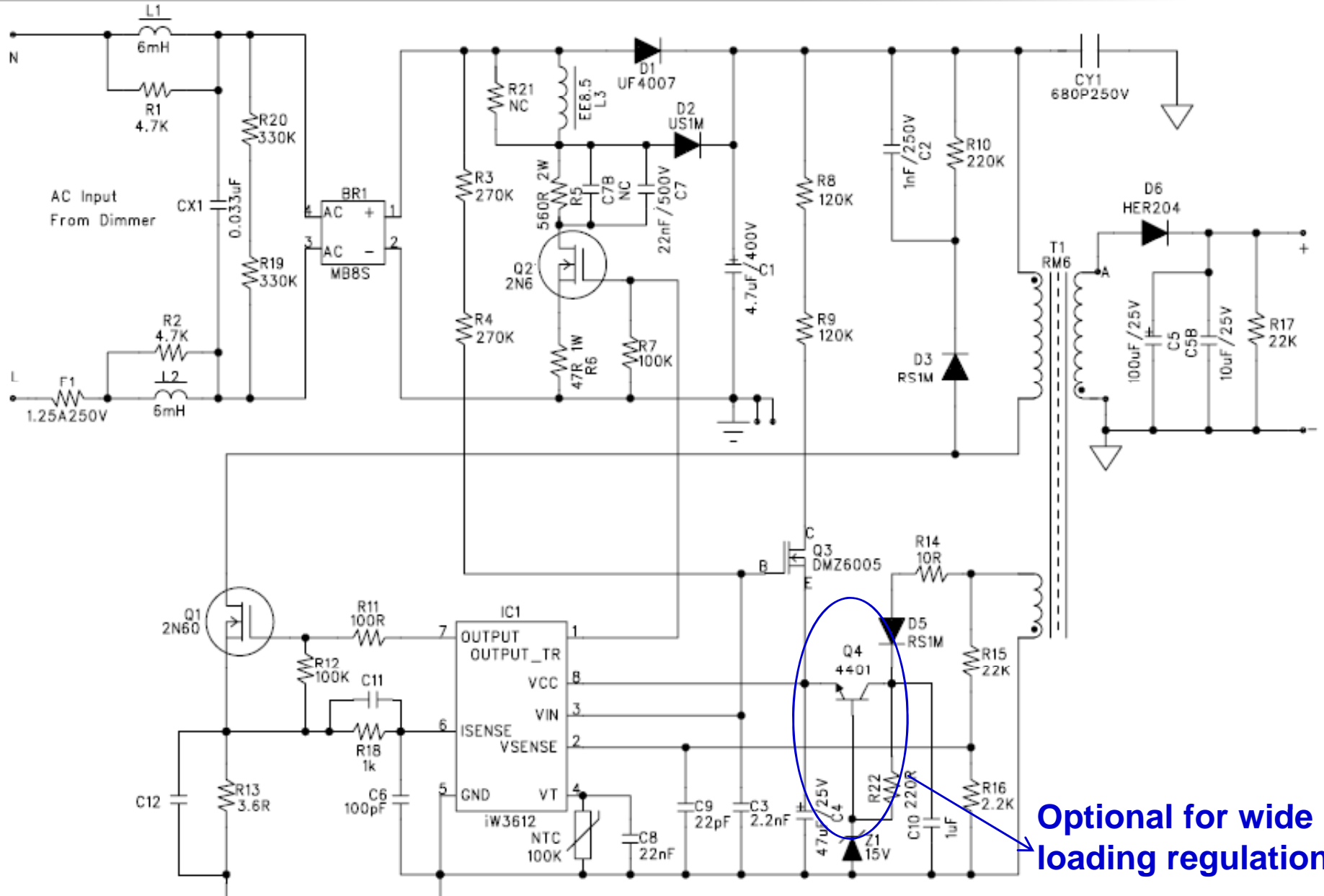
Dimmable LED Driver with iW3612-01  
(AC input 180V~264Vac, Output 6 LEDs)

# 1. Design Purpose and Feature

- Isolated ac-dc offline , Input 230Vac, Output 6 LEDs 350mA
- 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

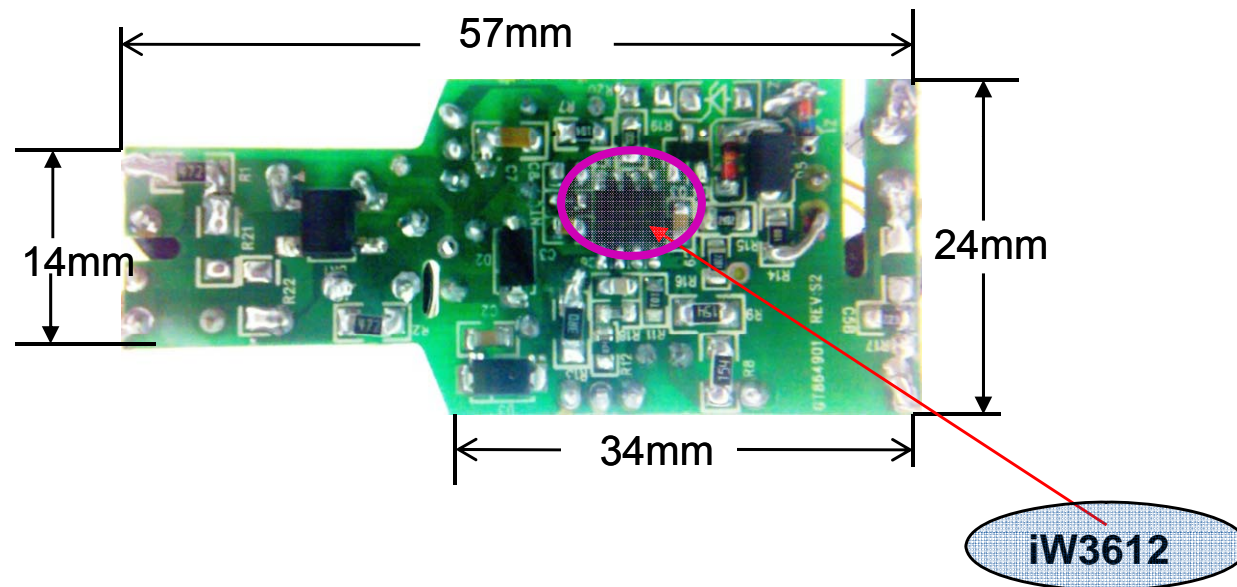
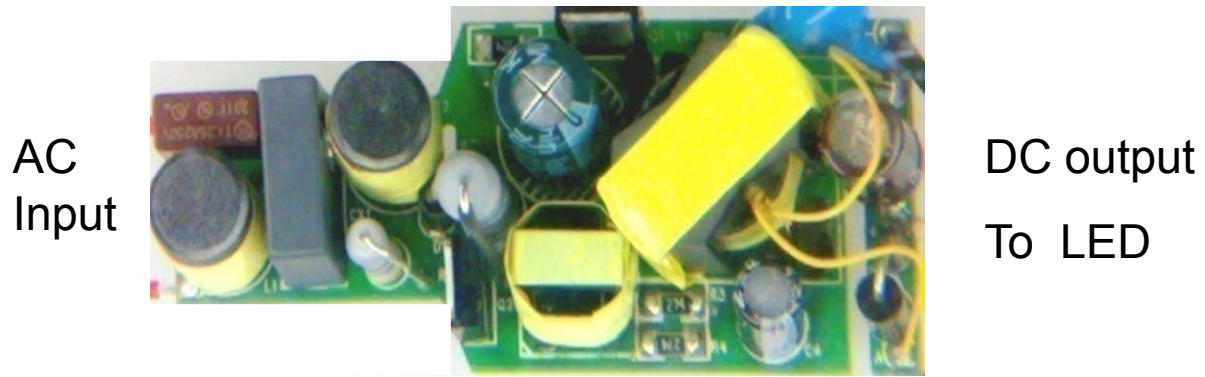


## 2. Schematic \_\_21V350mA\_230Vac



**Optional for wide loading regulation**

### 3.PCB Layout

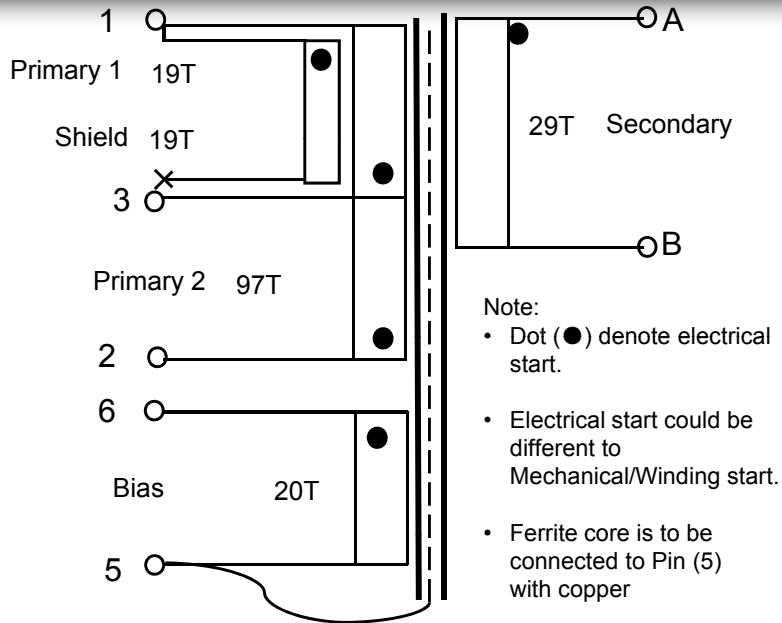


## 4.BOM\_\_21V350mA\_\_230Vac

Ref.	Description	Qty	Ref.	Description	Qty
IC1	iW3612-01, Digital PWM Controller,Dimmable, SO-8	1	R11	100Ω ±5 %, SMD-0805	1
CX1	0.033uF,275V, X2	1	R14	10Ω ±5 %, SMD-0805	1
C1	4.7uF, 400V, E-CAP, 105°C	1	R15	22KΩ ±1 %, SMD-0805	1
C2	1nF, 250V, X7R, SMD1206	1	R16	2.2KΩ ±1 %, SMD-0603	1
C3	2.2nF,50V, X7R, SMD 0603	1	NTC	100KΩ ±5 %, SMD-0603	1
C4	47uF, 25V, E-CAP	1	R17	22KΩ ±5 %, SMD-1206	1
C5	100uF,25V,E-CAP	1	R19,R20	330K, 1206	2
C6	100pF,25V, X7R, SMD 0603	1	FR1	T1A250V	1
C7	22nF/250V ,	1	BR1	BM8SS, SMD	1
C8	22nF,25V, X7R, SMD 0603	1	D1,D2	UF4007	2
C9	22pF,50V, X7R, SMD 0603	1	D3	FR107,1A1000V	1
C10	1uF, 25V, X7R, SMD 1206	1	D4	1N4148 0.1A/100V, SMD	1
R1, R2	4.7KΩ ±5 %, SMD-1206	1	D5	RS1M 1A 200V SMD	1
R3	270KΩ,±1 %, SMD-1206	3	D6	HER204	1
R4	270KΩ,±1 %, SMD-1206	1	Z1	Zener, 15V, SMD	1
R5	560Ω,±5 %, 2W	1	CY1	Y1,680pF,250V	1
R6	47Ω ,±5 %, 1W	1	Q1	4N60, TO-251	1
R10	220KΩ,±5 %, SMD-1206	1	Q2	2N60, TO-251	1
R7,R12	100KΩ±5 %, SMD-0805	1	Q3	DMZ6005, N-Depletion, 600V, SOT-23	1
R8,R9	120KΩ,±5 %, SMD-1206	2	Q4	SOT23 NPN 2SC4401	1
R18	1KΩ ±1 %, SMD-0603	2	L1	6mH, Drum choke, 8X10mm, 0.15mm,430Ts	1
R13	3.6Ω ±1 %, SMD-1206	1	L2	6mH, Drum choke, 8X10mm, 0.15mm,430Ts	1
L3	5mH, EE10, 0.11mmX300Ts	1			
T1	RM6, Transformer	1			

## 5. Transformer Design 21V350mA 230Vac

### SCHMATIC



### ELECTRICAL SPECIFICATIONS:

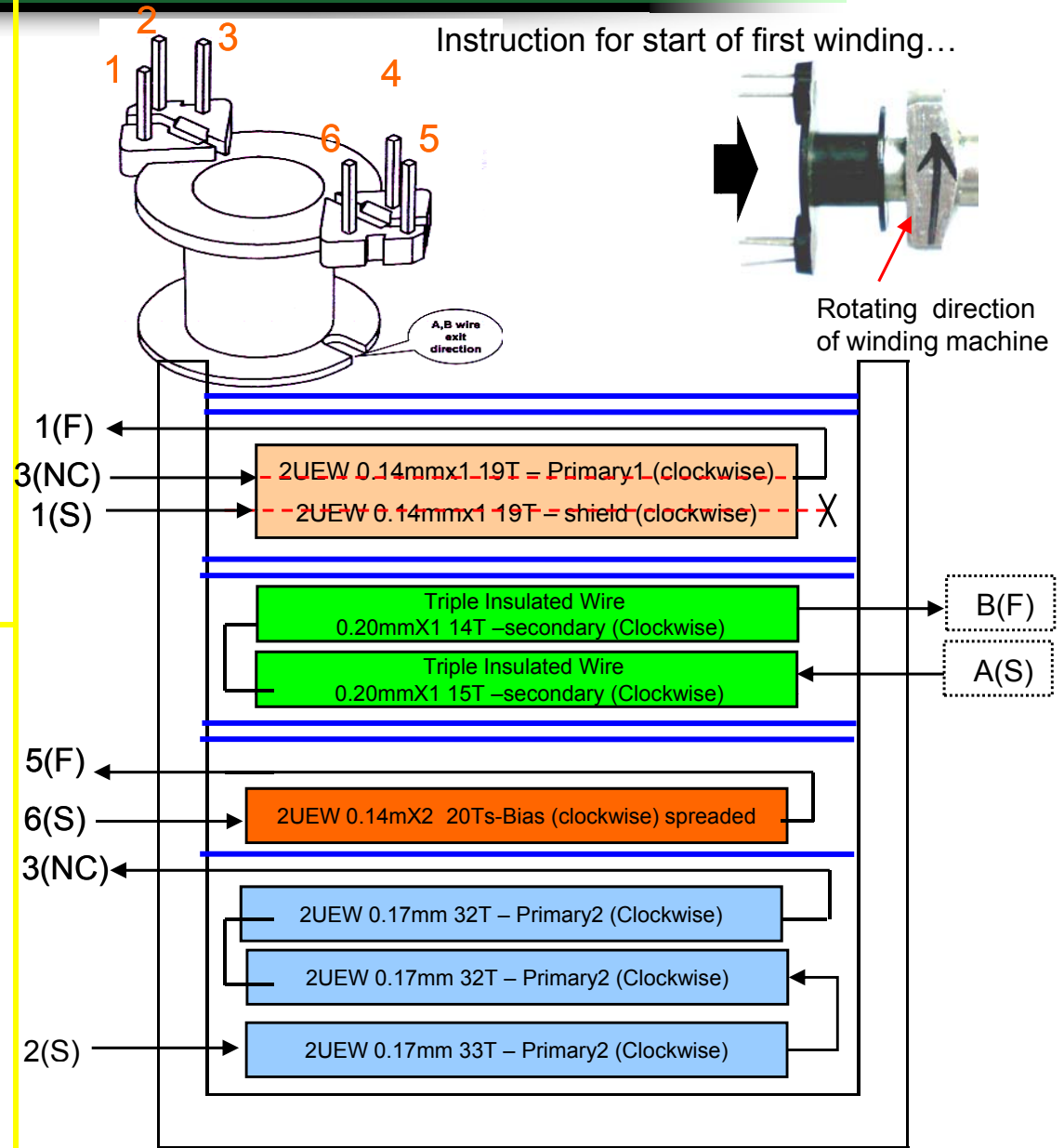
1. Primary Inductance ( $L_p$ ) = 4mH @10KHz
2. Primary Leakage Inductance ( $L_k$ ) <= 200uH @10KHz
3. Electrical Strength = 3KV, 50/60Hz, 1Min

### MATERIALS:

1. Core : RM6 (Ferrite Material TDK PC40 or equivalent)
2. Bobbin : RM6 Horizontal. Primary=3, Secondary=3
3. Magnet Wires (Pri) : Type 2-U EW
4. Magnet Wire (Sec) : Triple Insulated Wires
5. Layer Insulation Tape : 3M1298 or equivalent.

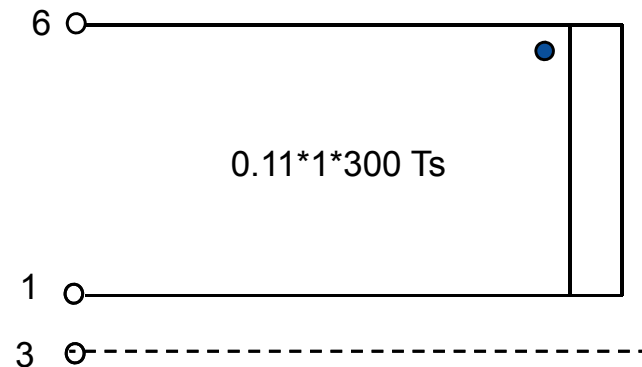
### FINISHED :

1. Cut remained of Pin after wires termination
2. Core is connected to PRI-GND pin5.
3. Varnish the complete assembly



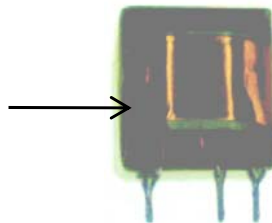
## 6.PFC choke and EMI Inductor\_\_ For input 230Vac

### L3 SCHEMATIC



Ground pin

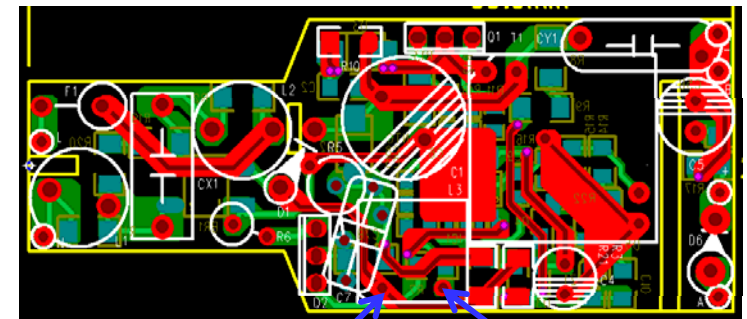
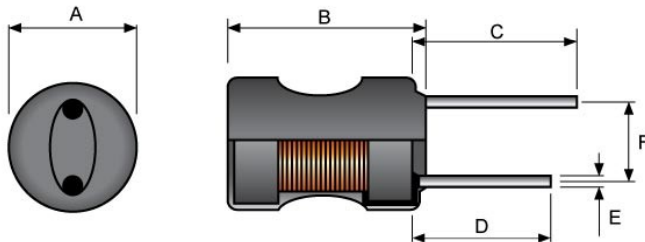
Copper shielding is connected to pin 3



### ELECTRICAL SPECIFICATIONS:

1. Inductance ( $L_p$ ) = 5.0 mH @10KHz
2. Core : EE8.3 (Ferrite Material TDK PC40 or equivalent)
3. Bobbin : EE8.3 Horizontal
4. Ferrite core is connected to Pin 3 after assembling
5. Cut Pin2 4 5 after wires termination
6. Varnish the complete assembly

### EMI Inductor L1,L2



Pin1

Pin3

Ferrite core size : Ax B 8x10mm 0.15\*430T

Inductance @10kHz, 1V: 6mH +/-20%

DCR: 14 OHM +/-20%

## 7.Constant Current and Efficiency \_\_No Dimmer

(AC input 180~264Vac,Output 6 LEDs)

#of LEDs	Vin (V)	Pin (W)	Vout (V)	Iout (A)	Ripple (mA)	efficiency	PF
6LEDs	180	8.620	19.81	0.351	55	80.66%	0.742
	190	8.620	19.81	0.351	54	80.66%	0.747
	200	8.630	19.78	0.351	55	80.45%	0.737
	210	8.650	19.78	0.351	55	80.26%	0.715
	220	8.610	19.78	0.352	52	80.87%	0.742
	230	8.610	19.77	0.352	52	80.83%	0.742
	240	8.670	19.77	0.353	52	80.49%	0.714
	250	8.710	19.77	0.353	51	80.12%	0.700
	260	8.600	19.77	0.353	48	81.15%	0.743



## 8.Constant Current and Efficiency\_ with dimmer

Leading edge dimmer

\_ Korea

\_ 6 LEDs



Vin	DIM Level	Pin	LED Voltage	LED current	Pout	Eff	ripple current
(V)		(W)	(V)	(mA)	(W)	(%)	( mA)
180	Max.	8.93	19.72	349	6.88	77.1%	24
		5.24	18.14	176	3.19	60.9%	28
	Min.	1.11	15.51	10.1	0.16	14.1%	12
230	Max.	8.83	19.71	349	6.88	77.9%	24
		5.88	18.08	173	3.13	53.2%	34
	Min.	2.51	16.38	44	0.72	28.7%	28
264	Max.	8.83	19.72	352	6.94	78.6%	22
		6.43	18.12	179	3.24	50.4%	38
	Min.	3.29	16.54	53	0.88	26.7%	34

Trailing edge dimmer

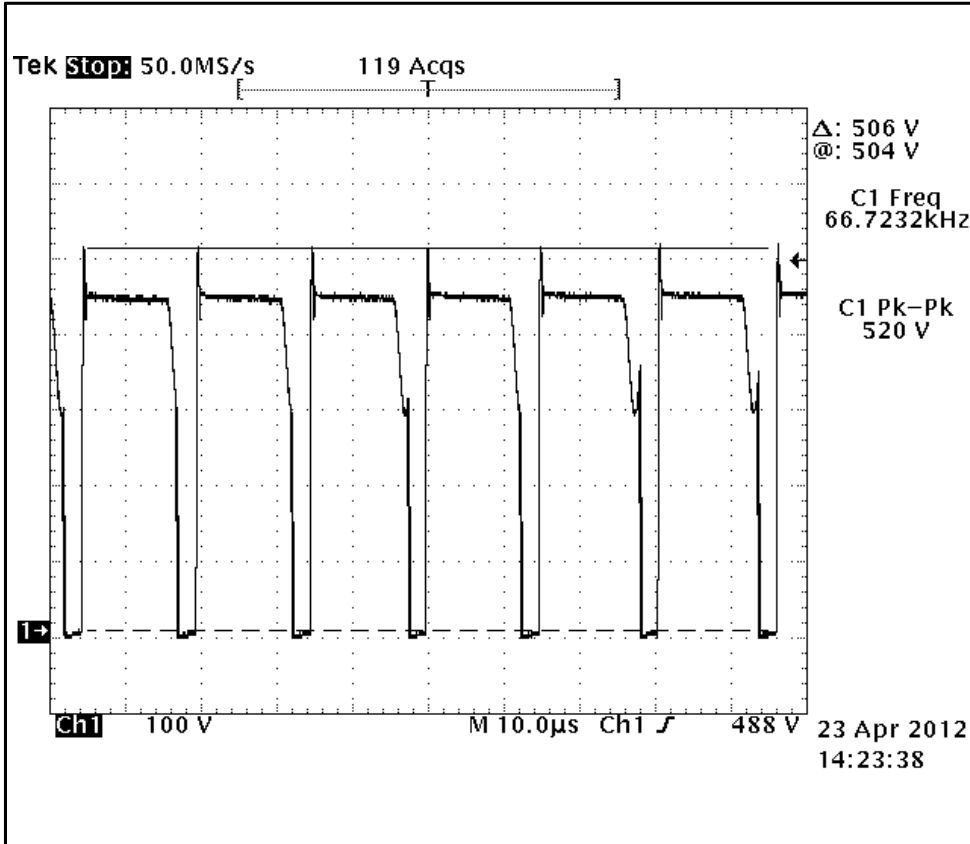
\_ TCL

\_ 6 LEDs



Vin	DIM Level	Pin	LED Voltage	LED current	Pout	Eff	ripple current
(V)		(W)	(V)	(mA)	(W)	(%)	( mA)
180	Max.	8.80	19.72	352	6.94	78.9%	26
		4.78	18.04	172	3.10	64.9%	20
	Min.	0.37	14.88	2.99	0.04	12.0%	10
230	Max.	8.73	19.71	353	6.96	79.7%	24
		5.51	18.16	185	3.36	61.0%	30
	Min.	1.91	16.49	52	0.86	44.9%	30
264	Max.	8.74	19.72	355	7.00	80.1%	24
		5.74	18.11	179	3.24	56.5%	34
	Min.	3.00	16.92	78.7	1.33	44.4%	20.8

## 9. Mosfet $V_{DS}$ Waveform



Test Condition:

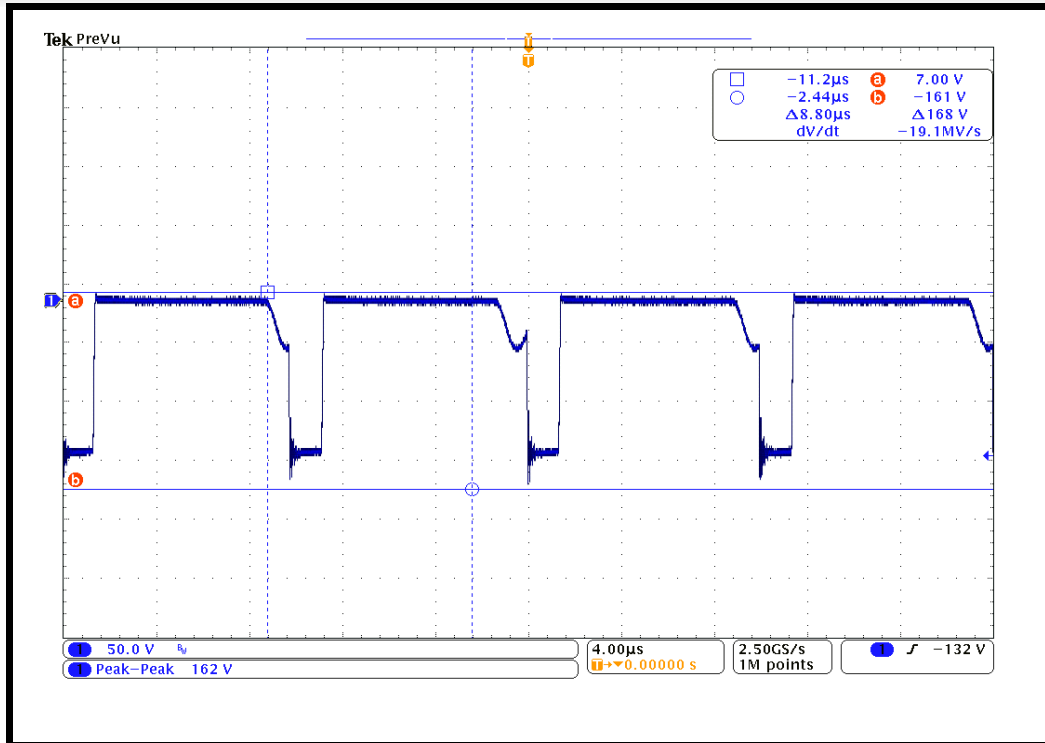
$V_{in}=264V_{ac}$ ,  $I_{OUT}=0.35A$

Result:

$V_{DS\_MAX}=520V$

Q1:2N60 2A600V

## 10. Out rectifier $V_R$ waveform



Test Condition:

$V_{IN}=264VAC$ ,  $I_{out}=350mA$

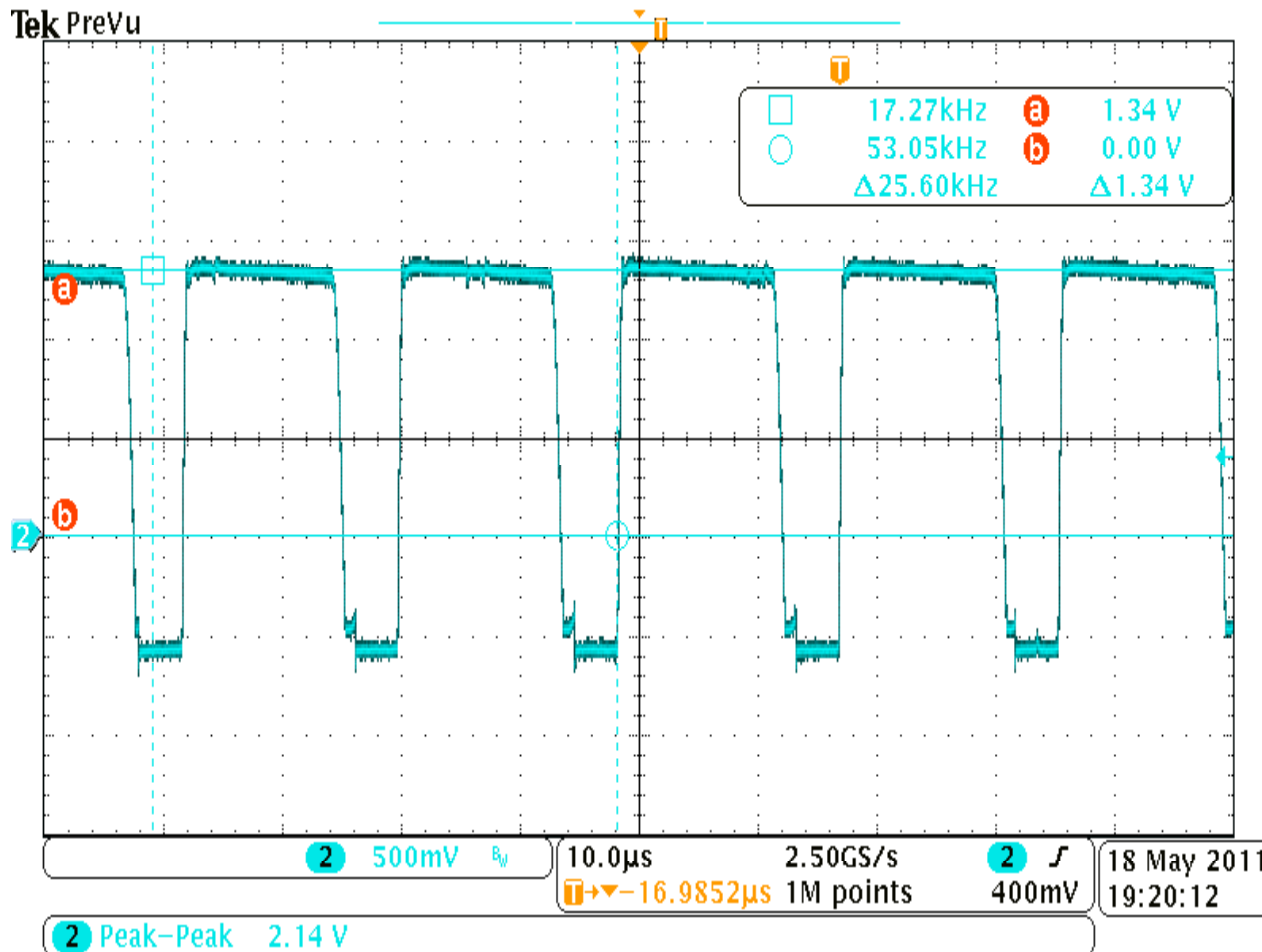
Result:

$V_R (pk-pk)=162V$

Output rectifier diode: HER204(2A 300V)

Characteristic	Symbol	HER 201	HER 202	HER 203	HER 204	HER 205	HER 206	HER 207	HER 208	Unit
Peak Repetitive Reverse Voltage	$V_{RRM}$									
Working Peak Reverse Voltage	$V_{RWM}$	50	100	200	300	400	600	800	1000	V
DC Blocking Voltage	$V_R$									
RMS Reverse Voltage	$V_{R(RMS)}$	35	70	140	210	280	420	560	700	V
Average Rectified Output Current (Note 1) @ $T_A = 55^\circ C$	$I_o$	2.0								A

# 11. Vsense PIN waveform



Test Condition:

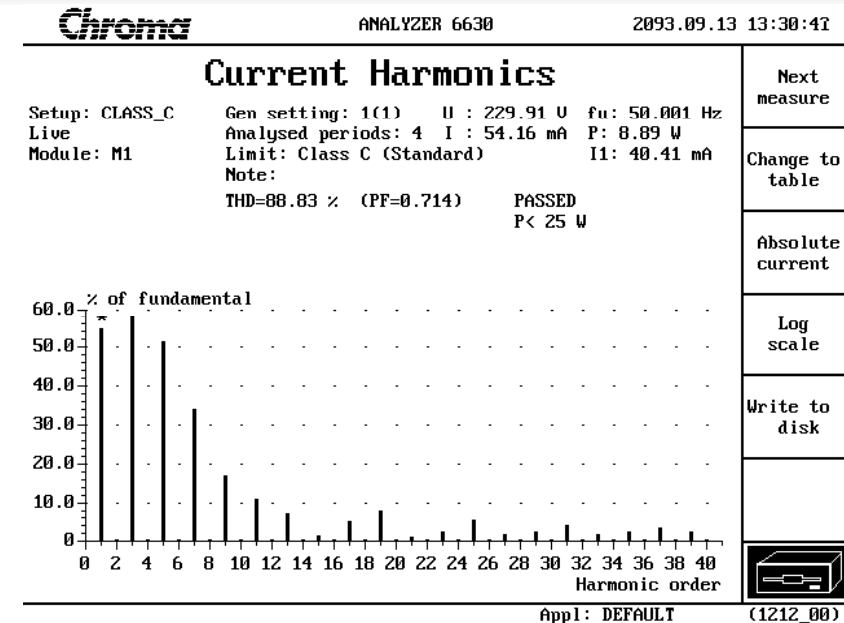
$V_{IN}=230VAC$ ,  $V_{OUT\_CV}=19.5V$

Result:

$V_{sense} = \mathbf{1.34V}$

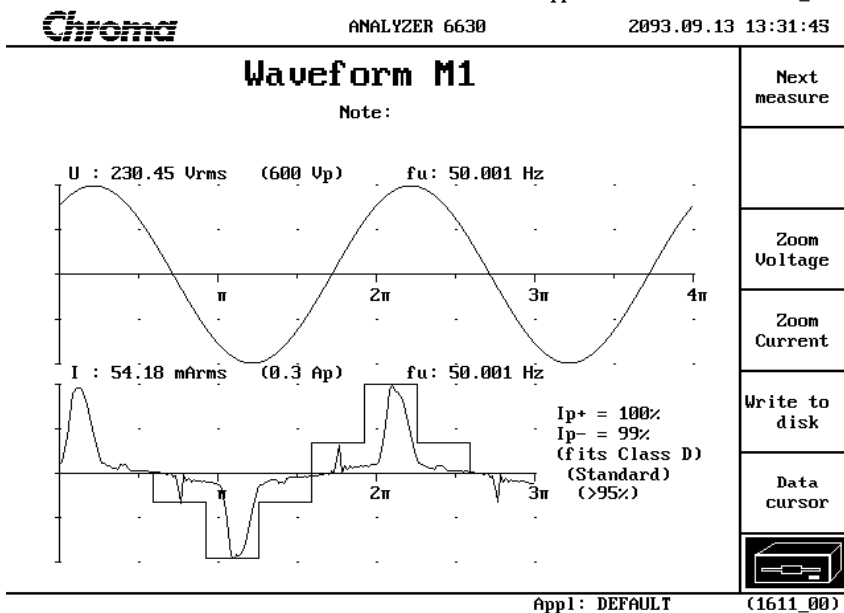
$V_{sens} < 1.538V$

# 12 . Harmonic and current waveform\_ NO dimmer



Harmonics current  
@230Vac

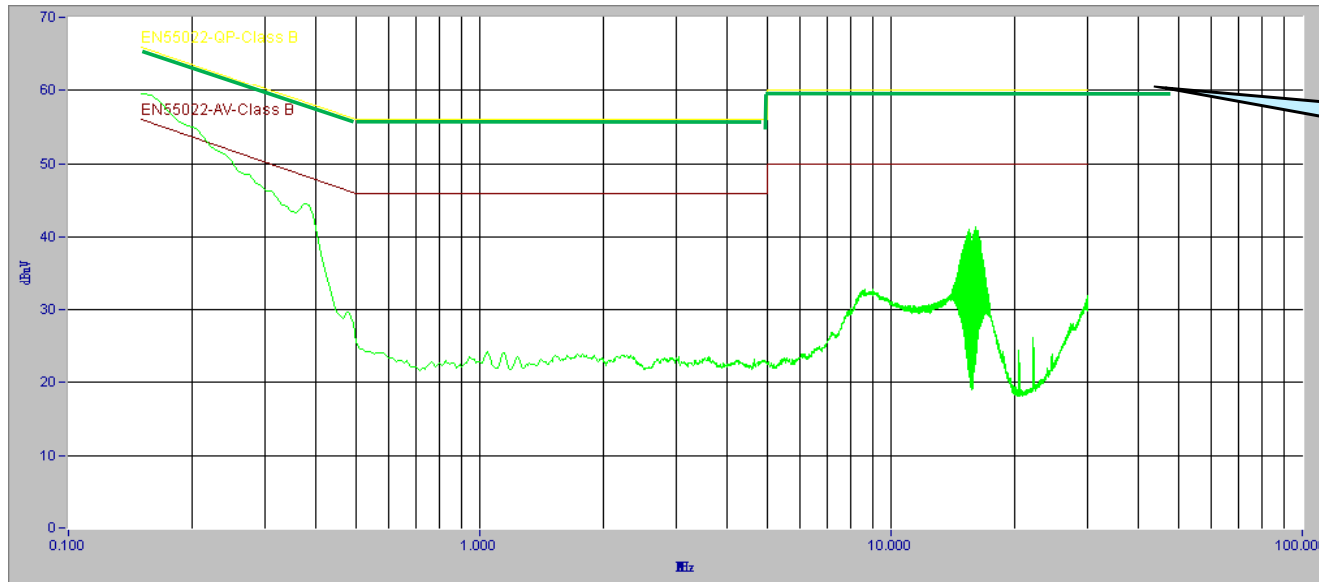
Meet IEC61000-3-2  
requirement



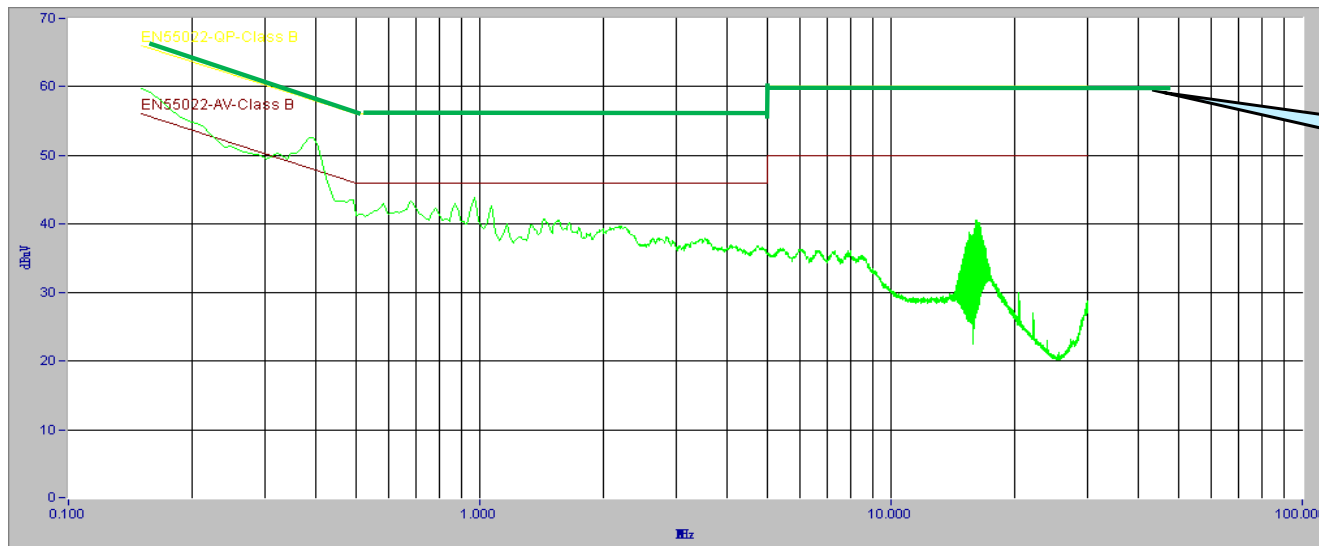
Ac current waveform  
@230Vac

PF=0.714

# 13. Conducted EMI ( Input 230Vac)

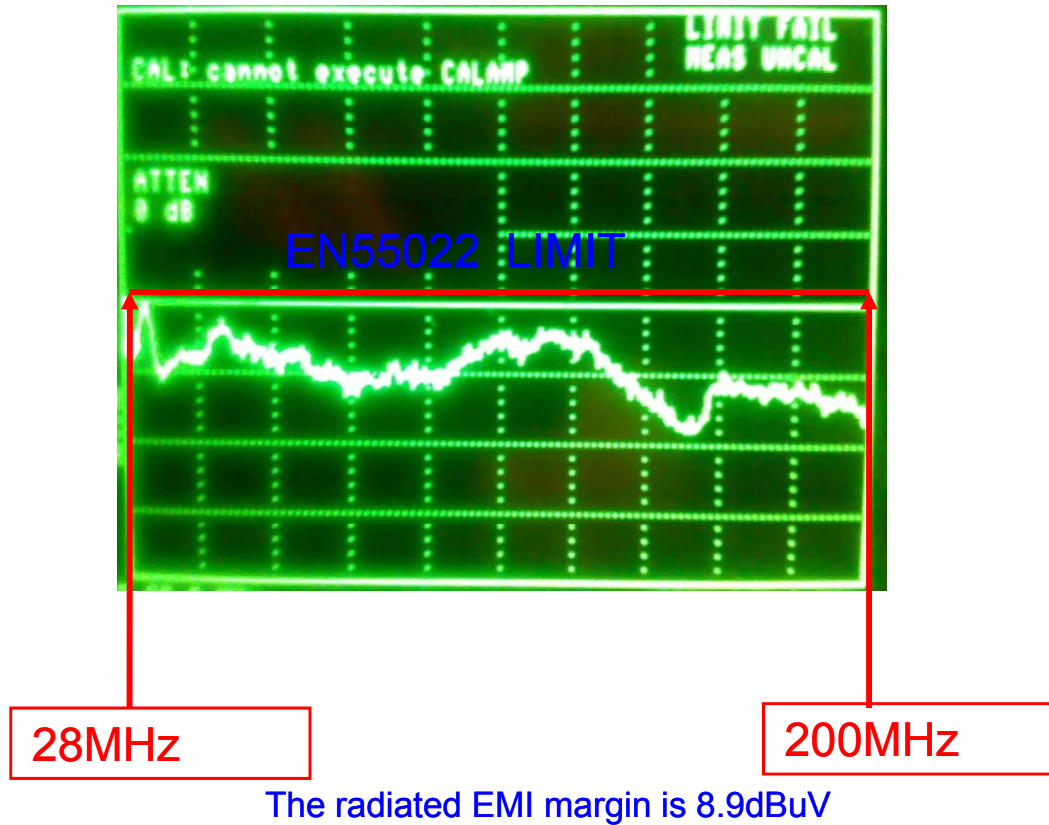


QP scan N



QP scan L

## 14. Radiated IEM (for reference)



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

2, Output :6\*1W