

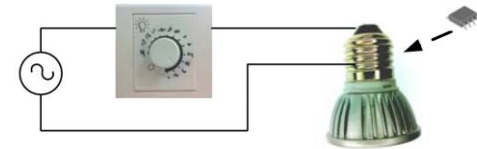
# Dimmable LED Driver with iW3614 (Input 180~264Vac Output 21V700mA)

**General Design Specification:**

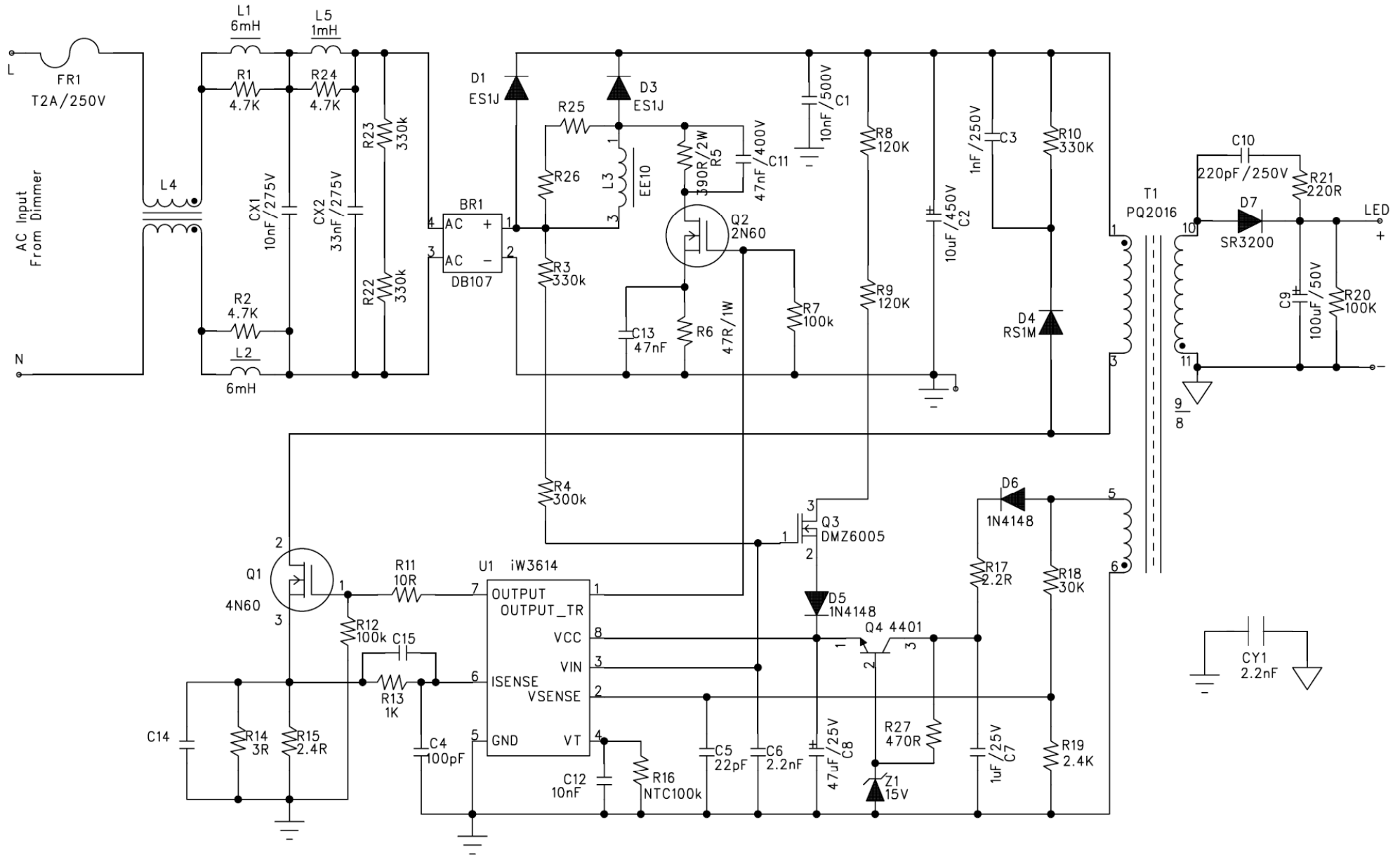
1. AC Input Range 180~264Vac
2. DC Output 21V, 700mA(Constant Current )
3. Non-isolated High efficiency

# Design Purpose and Feature

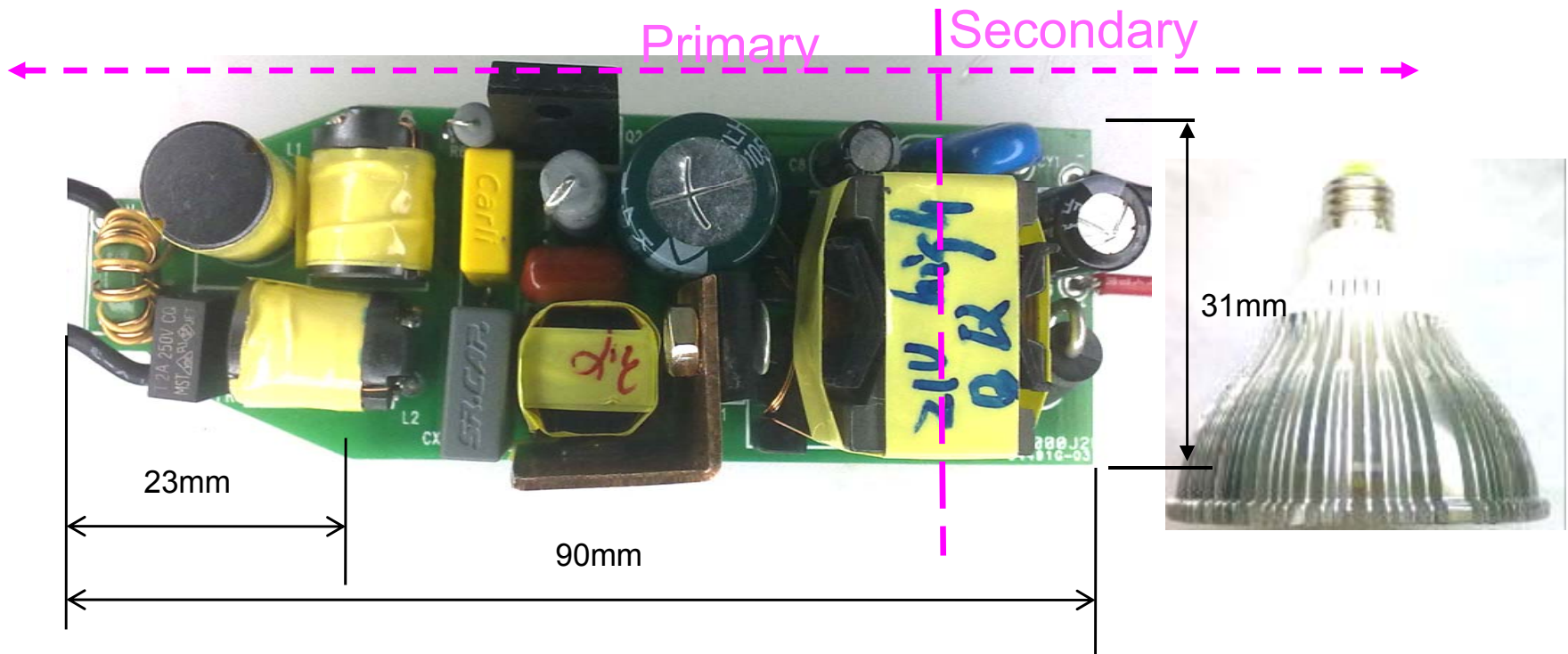
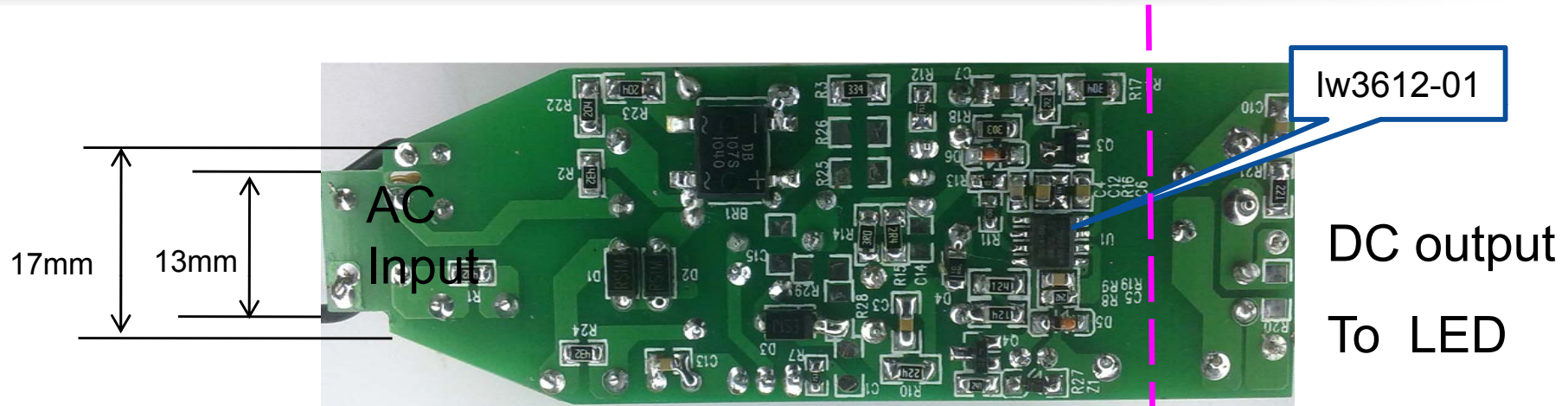
- Isolated ac-dc offline Input 230Vac, Output 6 LEDs 700mA
- Intelligent wall dimmer detections
  - Leading-edge dimmer , Trailing-edge dimmer , No-dimmer
- Multiple dimming control scheme
  - Hybrid dimming scheme
  - PWM dimming scheme,900Hz
  - Amplitude dimming scheme
- Wide dimming range from 1% up to 100%
- No visible flicker
- Resonant control to achieve high efficiency
- High Power Factor, 0.9~ 0.98 without dimmer(@ $V_{IN}=115V_{ac}$ )
- Temperature degrade control to adjust the LED
- Primary-only Sensing eliminates opto-isolator feedback and simplifies design



# 1.Schematics \_Nominal Input at 230Vac\_21V700mA

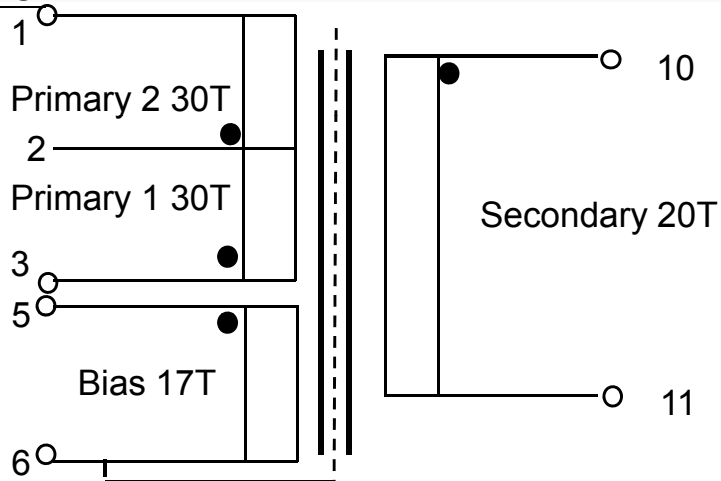


## 2.PCB Layout



# 3. Transformer Design

## SCHEMATIC



### ELECTRICAL SPECIFICATIONS:

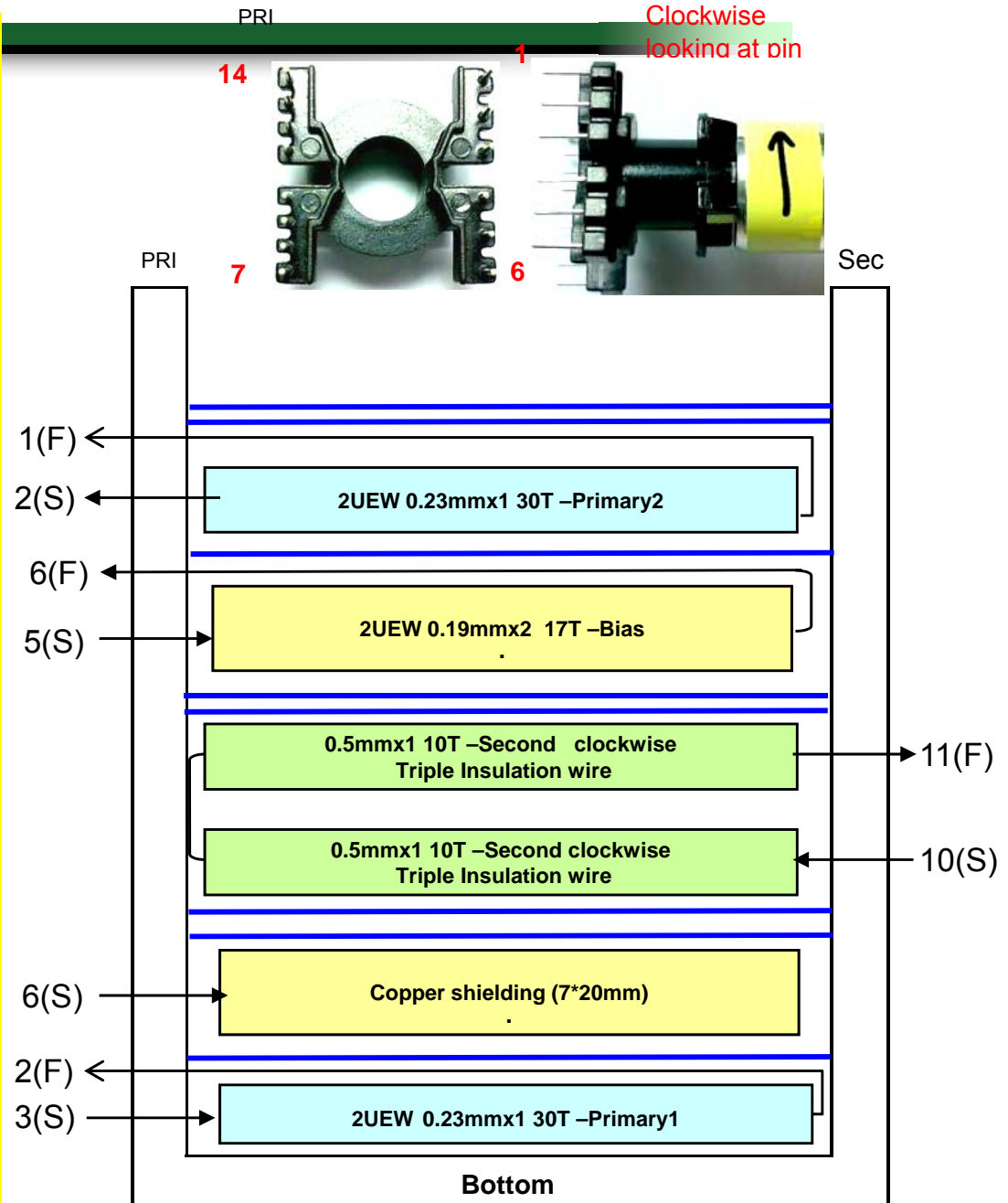
1. Primary Inductance ( $L_p$ ) = 1.3mH @10KHz
2. Primary Leakage Inductance ( $L_k$ ) ≤ 70uH@10KHz

### MATERIALS:

1. Core : PQ2016 (Ferrite Material TDK PC40 or equivalent)
2. Bobbin : PQ2016
3. Magnet Wires (Pri) : Type 2-UEW
4. Magnet Wire (Sec) : Triple Insulated Wires
5. Layer Insulation Tape :3M1298 or equivalent.

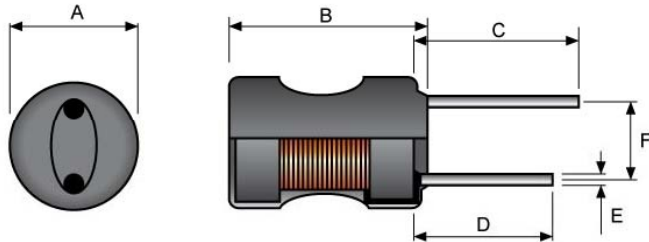
### FINISHED :

1. Cut remained of Pin2,4,7,8,9,12,13,14 after wires termination
2. Varnish the complete assembly
3. Core is connected to primary pin6



## 4. Differential Mode Inductor L1,L2 ,L5

### 4.1 Differential Mode Inductor L1,L2



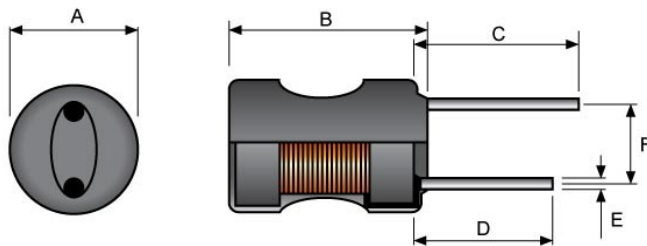
Ferrite core size : Ax B 10x12mm

Wire gauge: 0.20mm, 400 Turns

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

ICR: 5 OHM +/-20%

### 4.2 Differential Mode Inductor L5



Ferrite core size : Ax B 10x12mm

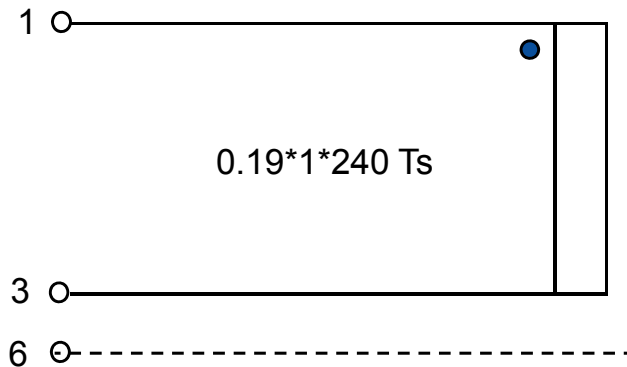
Wire gauge: 0.32mm, 160 Turns

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

ICR: 1 OHM +/-20%

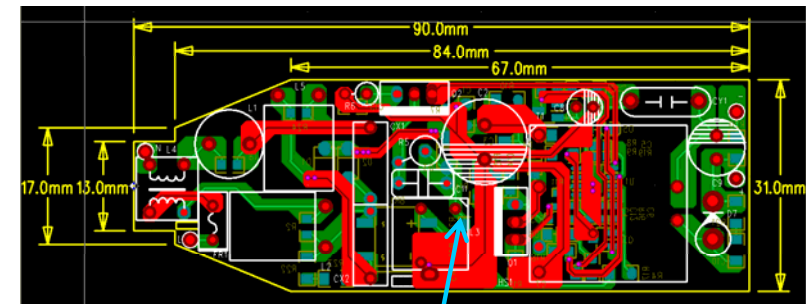
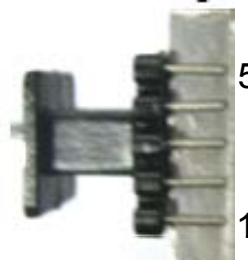
## 5.PFC Inductor L3 Design

### SCHEMATIC



### ELECTRICAL SPECIFICATIONS:

1. Inductance ( $L_p$ ) = 3.6mH @10KHz
2. Core : EE10 (Ferrite Material TDK PC40 or equivalent)
3. Bobbin : EE10 Vertical
4. Ferrite core is connected to Pin 6 after assembling
5. Cut remained of Pin=2,4,5,7,8 after wires termination
6. Varnish the complete assembly



Pin 1

core size:T8\*4\*3

Wire gauge: 0.3mm\*2(Insulation& 2-UEW wire)

Turns10.5T

Inductance @10kHz, 1V: 30uH +/-20%

## 6. Common Mode Inductor L4



# 6.BOM \_\_Input 230Vac \_\_21V700mA

Ref.	Description	Qty	Ref.	Description	Qty
U1	iW364-00, Digital PWM Controller,Dimmable, SO-8	1	R22,R23	330kΩ,±5%, SMD-1206	2
CX1	0.01uF,275V, X2	1	R27	470Ω±5%, SMD-0805	1
CX2	0.033uF,275V, X2	1	R16	100KΩ ±5%, SMD-0603 (100K NTC)	1
C11	47nF/250V, SMD 1206	1	R11	10Ω ±5%, SMD-0805	1
C2	10uF, 450V, E-CAP, 105°C	1	R18	30KΩ ±1%, SMD-0805	1
C3	1nF, 250V, X7R, SMD1206	1	R19	2.4KΩ ±1%, SMD-0603	1
C4	100pF,25V, X7R, SMD 0603	1	C13	47nF,50V, X7R, SMD 0805	1
C5	22pF,50V, X7R, SMD 0603	1	R20	100KΩ ±5%, SMD-1206	1
C6	2.2nF,50V, X7R, SMD 0603	1	R21	220Ω,±5%, SMD-1206	1
C7	1uF, 25V, X7R, SMD 1206	1	F1	T2A250V	1
C8	47uF, 25V, E-CAP	1	BR1	DB107S, SMD	1
C9	100uF,50V,E-CAP	1	D1,D2,D4	RS1M, SMD	3
R1, R2,R24	4.7KΩ ±5%, SMD-1206	3	D3	ES1J, SMD	1
R3	330KΩ,±1%, SMD-1206	1	D5,D6	1N4148 0.1A/100V, SMD	2
R4	300KΩ,±1%, SMD-1206	2	C10	220pF, 250V, X7R, SMD1206	1
R5	390Ω,±5%, 2W	1	D7	SR320 3A/200V D0-201AD	1
R6	47Ω,±5%, 1W	1	Z1	Zener, 15V, SMD	1
R10	330KΩ,±5%, SMD-1206	1	CY1	Y1,2.2nF250V	1
R7,R12	100KΩ±5%, SMD-0805	2	L4	Common Mode Inductor T8*4*3 30uH	1
R8,R9	120KΩ,±5%, SMD-1206	2	Q1	4N60, TO-220F	1
R13	1KΩ ±1%, SMD-0603	1	Q2	2N60, TO-220F	1
R14	3Ω ±1%, SMD-1206	1	Q3	DMZ6005, N-Depletion, 600V, SOT-23	1
R15	2.4Ω ±1%, SMD-1206	1	L1,L2	6mH, Drum choke, 10X12mm, 0.20mm,400Ts	2
L3	3.6mH, EE10	1	L5	900uH, Drum choke, 10X12mm, 0.35mm 140Ts	1
T1	PQ2016, Transformer	1	C12	10nF,50V, X7R, SMD 0603	1

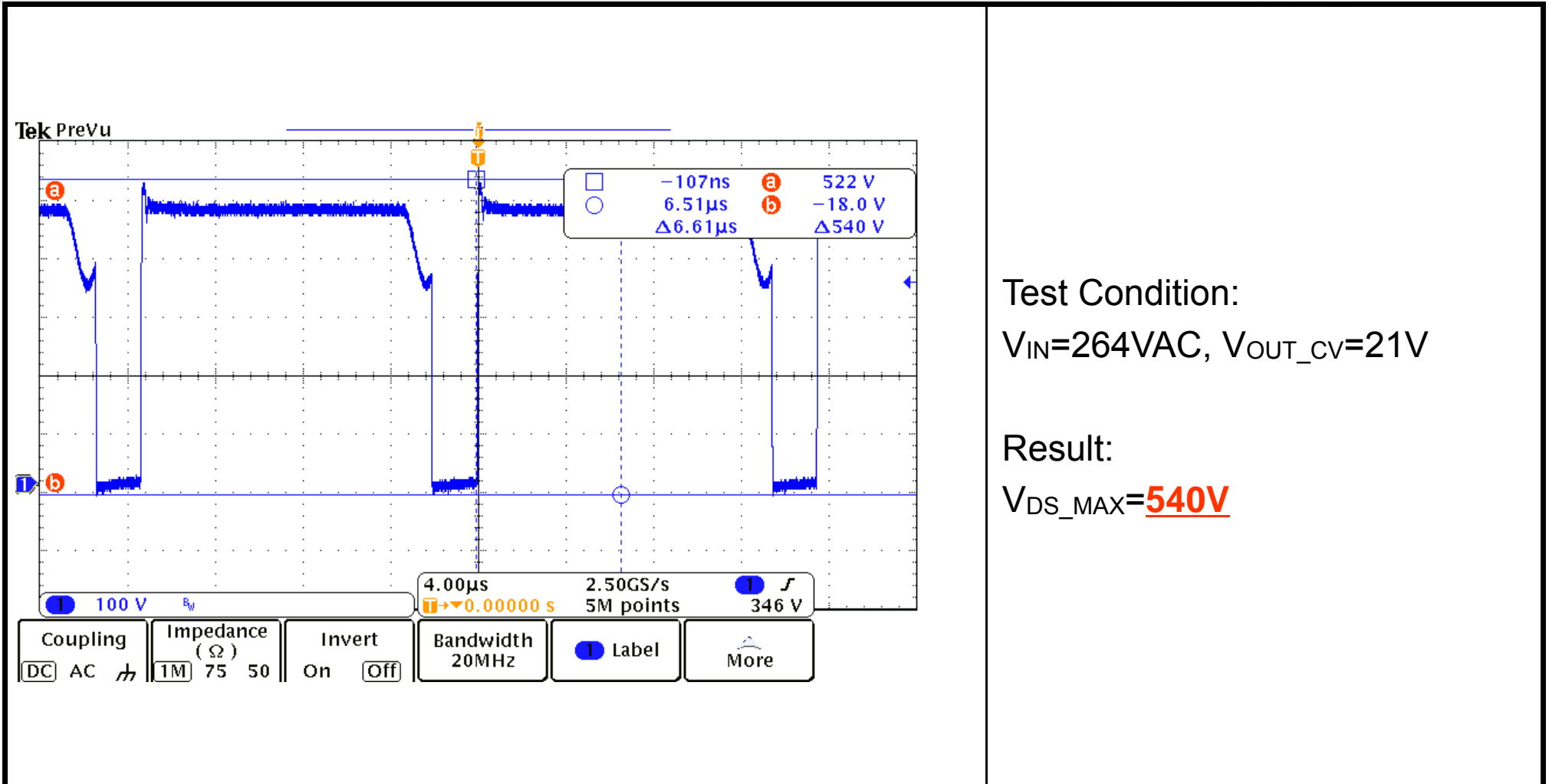


## 7.Constant Current and Efficiency \_\_No Dimmer

AC input 180~264Vac,Output 6 LEDs

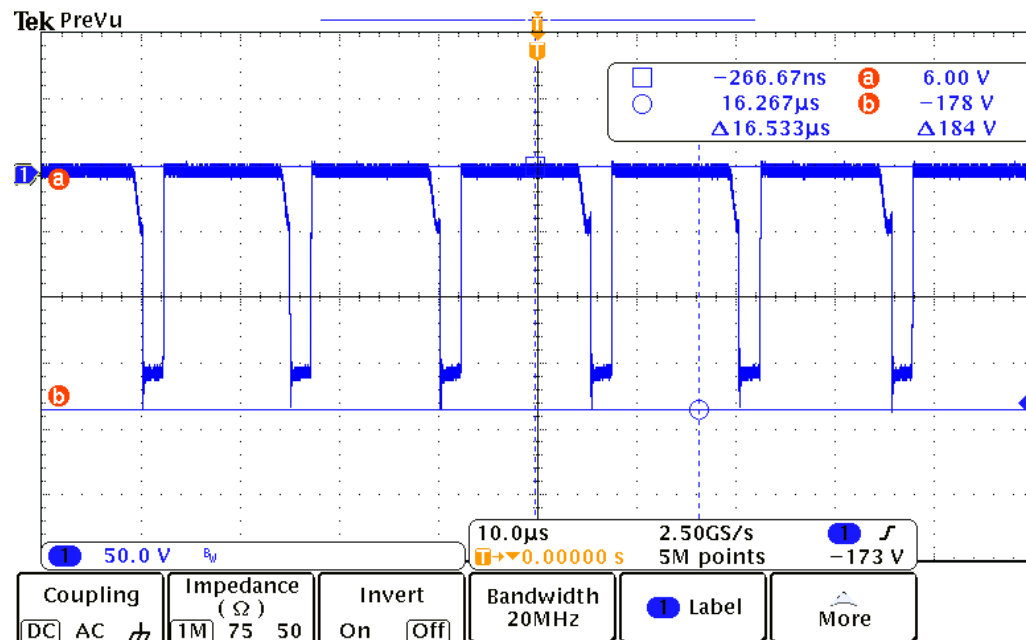
#of LEDs	Vin	Pin	Vout	Iout	Ripple	efficiency	PF
	(V)	(W)	(V)	(A)	(mA)		
11LEDS	180	18.82	22.36	0.705		83.76%	0.954
	190	18.69	22.33	0.703		84.03%	0.962
	200	18.61	22.31	0.702		84.19%	0.970
	210	18.56	22.30	0.702		84.37%	0.974
	220	18.50	22.28	0.700		84.35%	0.976
	230	18.41	22.26	0.699		84.47%	0.976
	240	18.37	22.24	0.698		84.47%	0.972
	250	18.36	22.22	0.697		84.35%	0.965
	260	18.32	22.21	0.696		84.40%	0.956
	264	18.35	22.20	0.696		84.20%	0.952

## 8. $V_{ds}$ waveform



Remark: Mosfet Spec\_\_4A 600V

## 9. $V_R$ waveform



Test Condition:

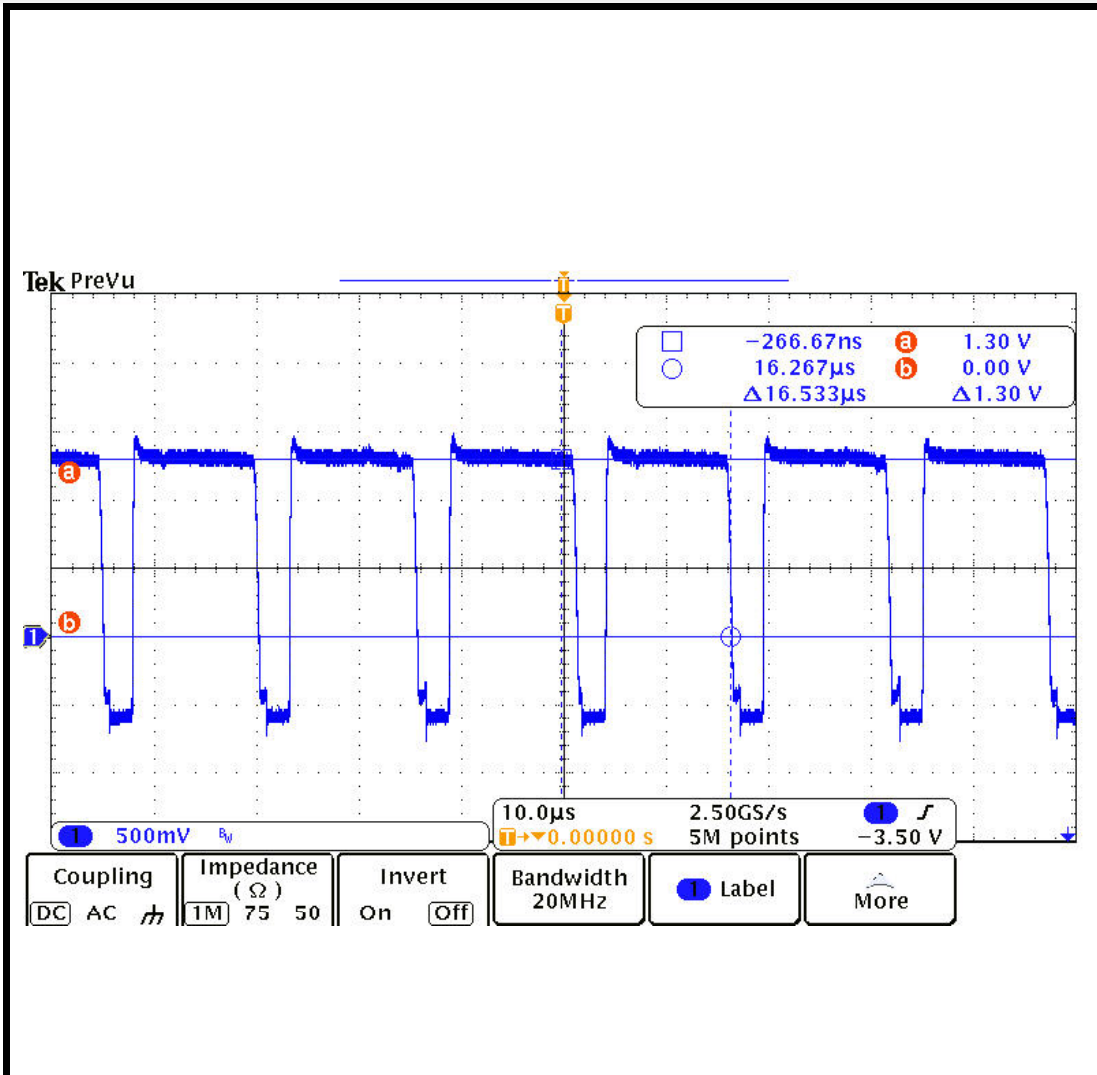
$V_{IN}=264VAC$ , CV 21V load

Result:

$V_R$  (pk—pk) = **184V**

Output rectifier diode: SR320(2A 200V)

# 10. $V_R$ waveform

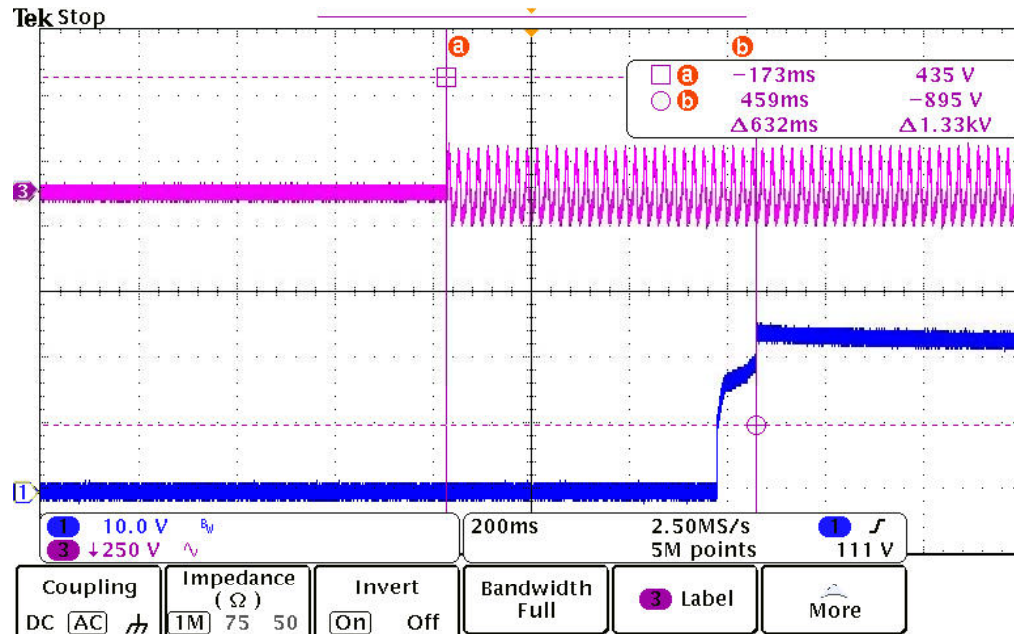


Test Condition:

$V_{\text{IN}}=230\text{VAC}$ , CV 21V load

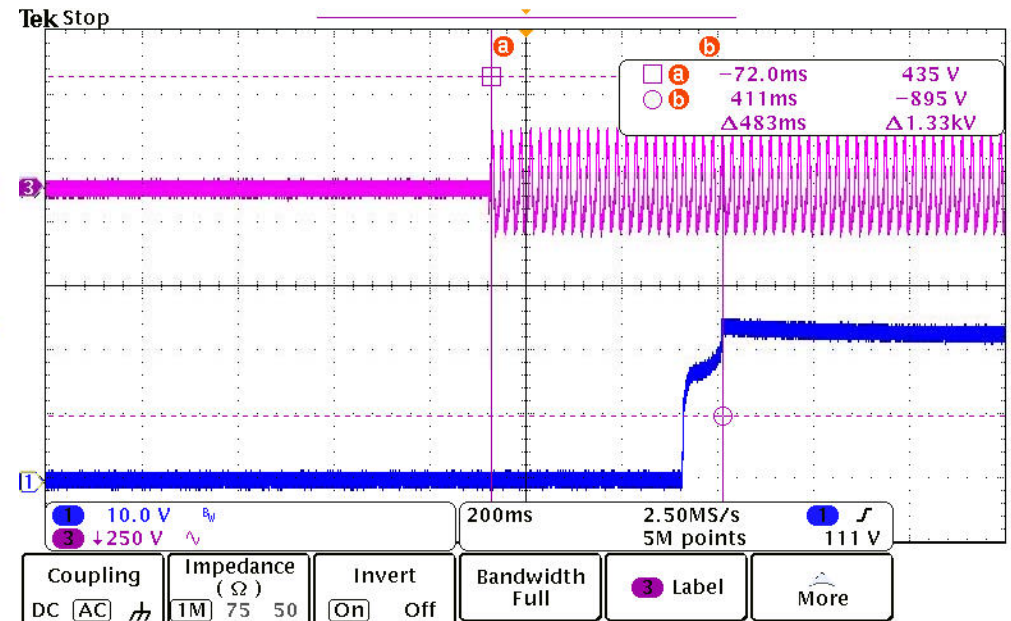
$V_{\text{sense}}$  voltage = 1.30V

# 11. Start up and turn on delay time



180V<sub>AC</sub>, Full Load

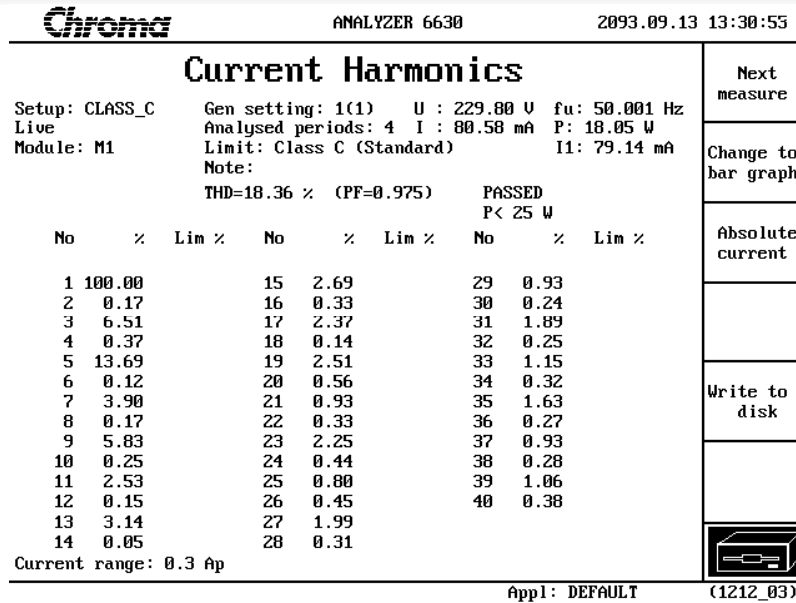
T<sub>ST\_DELAY</sub>=**632mS**



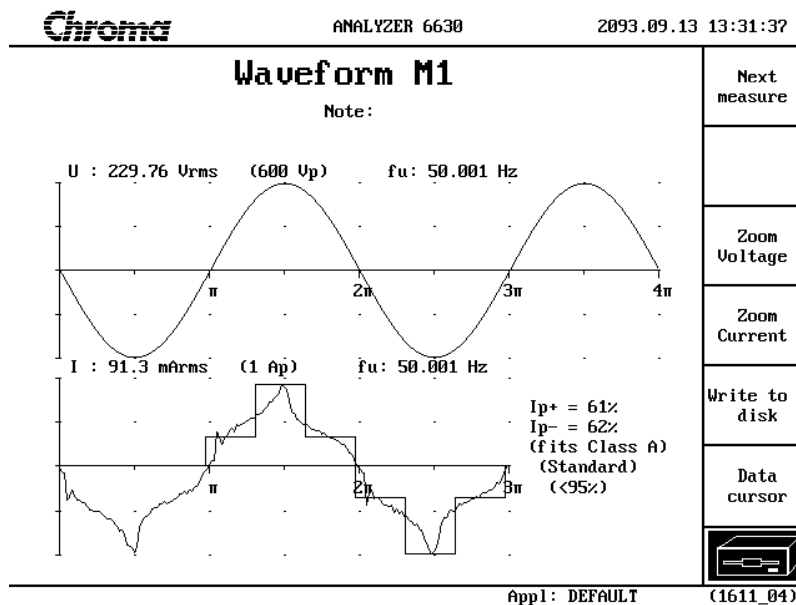
264V<sub>AC</sub>, Full Load

T<sub>ST\_DELAY</sub>=**483mS**

# 12.Harmonic and current waveform\_ No dimmer

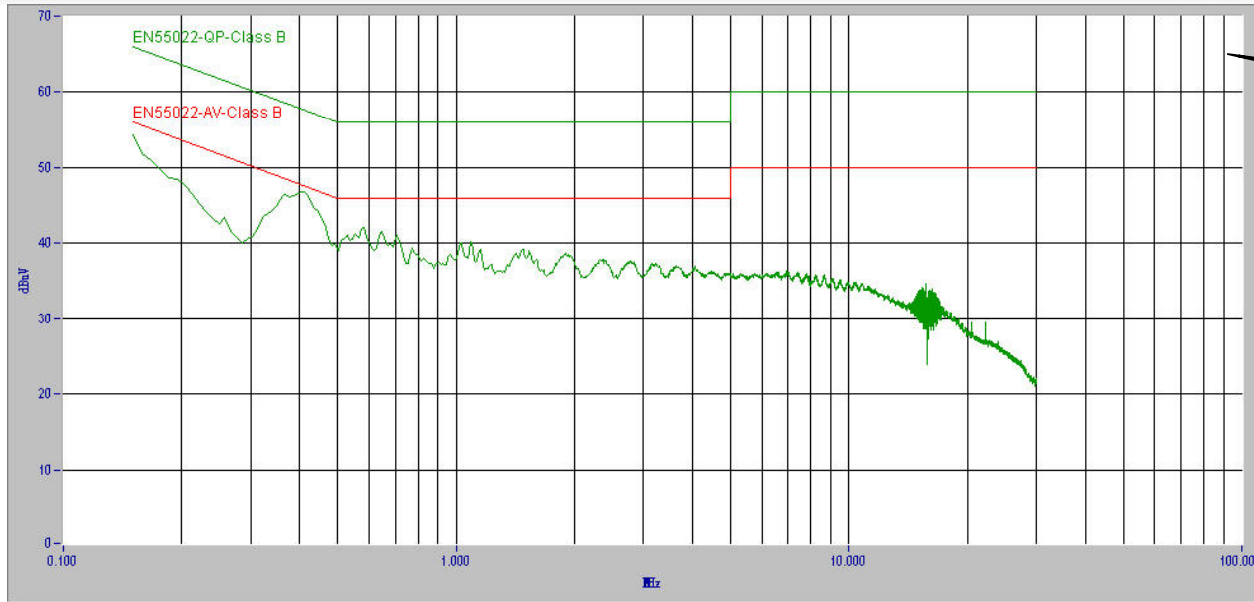


Harmonics current @230Vac  
THD=18.36%

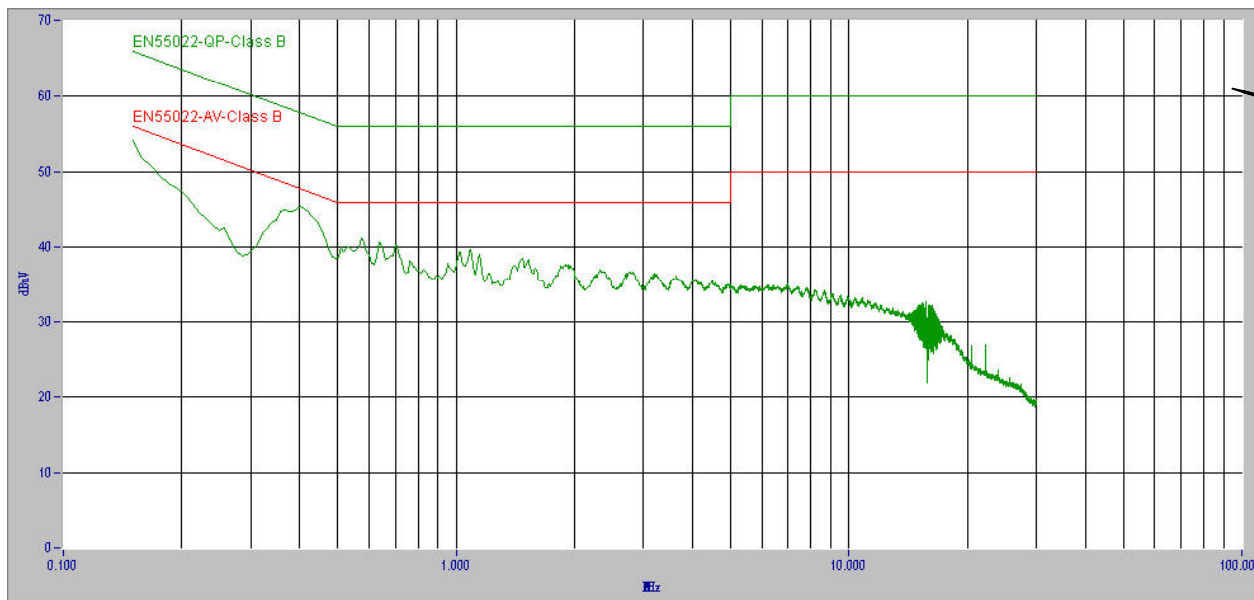


Ac current waveform @230Vac  
PF=0.975

# 13. Conducted EMI (230Vac)



QP scan N



QP scan L