



## LED Driver Design with iW3620\_38V400mA

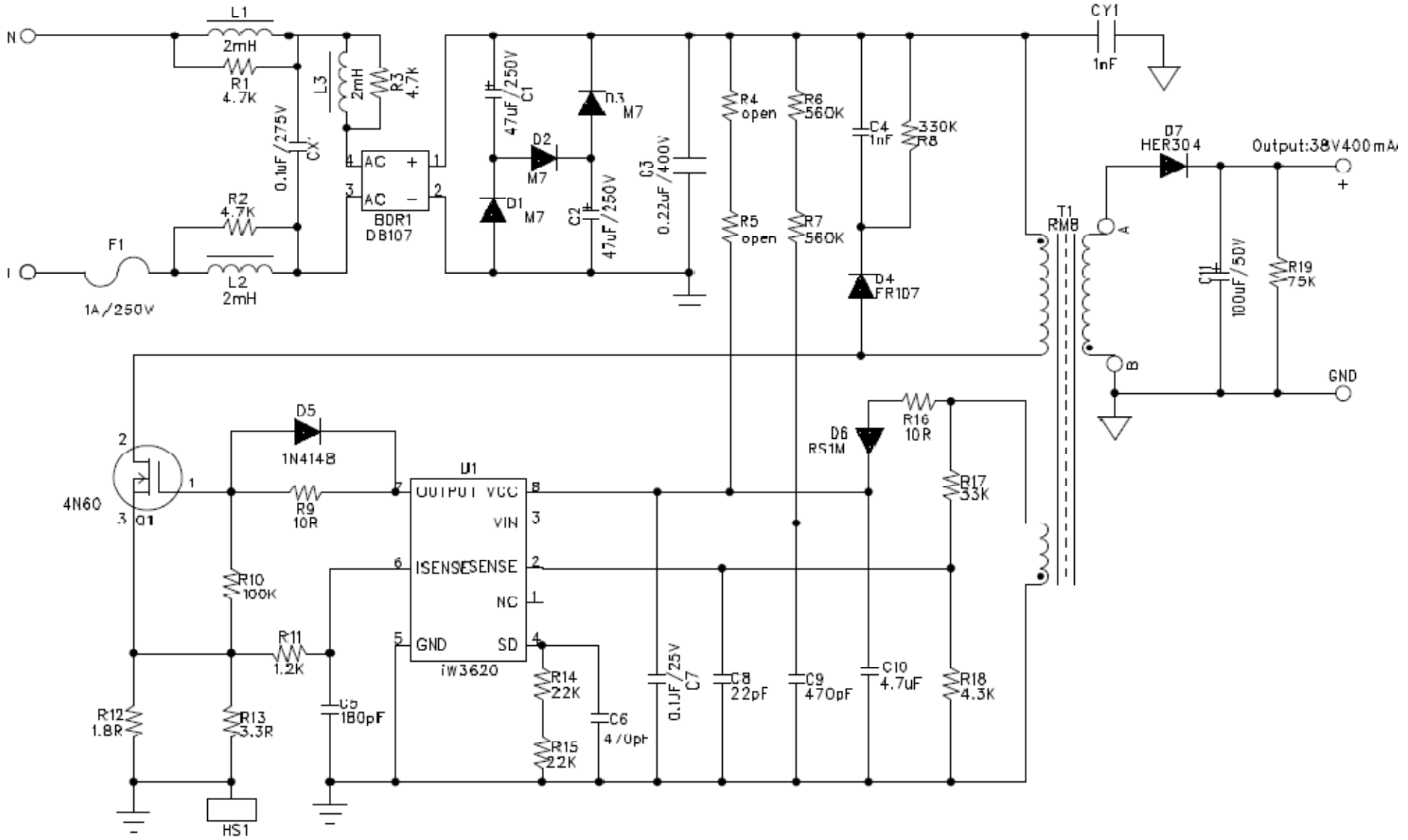
### **Summary and Features :**

- 1. LED driver, 38V, CC@400mA ; Wide AC input range @90Vac- 264Vac**
- 2 For Isolated Applications**
- 3. High Efficiency and Minimum Parts count**
- 4. Meet EMI EN55015B-QP & AV limits**
- 5. Fully protected against AC input UV, OV, O/P Short/Open, meet single point failure test.**

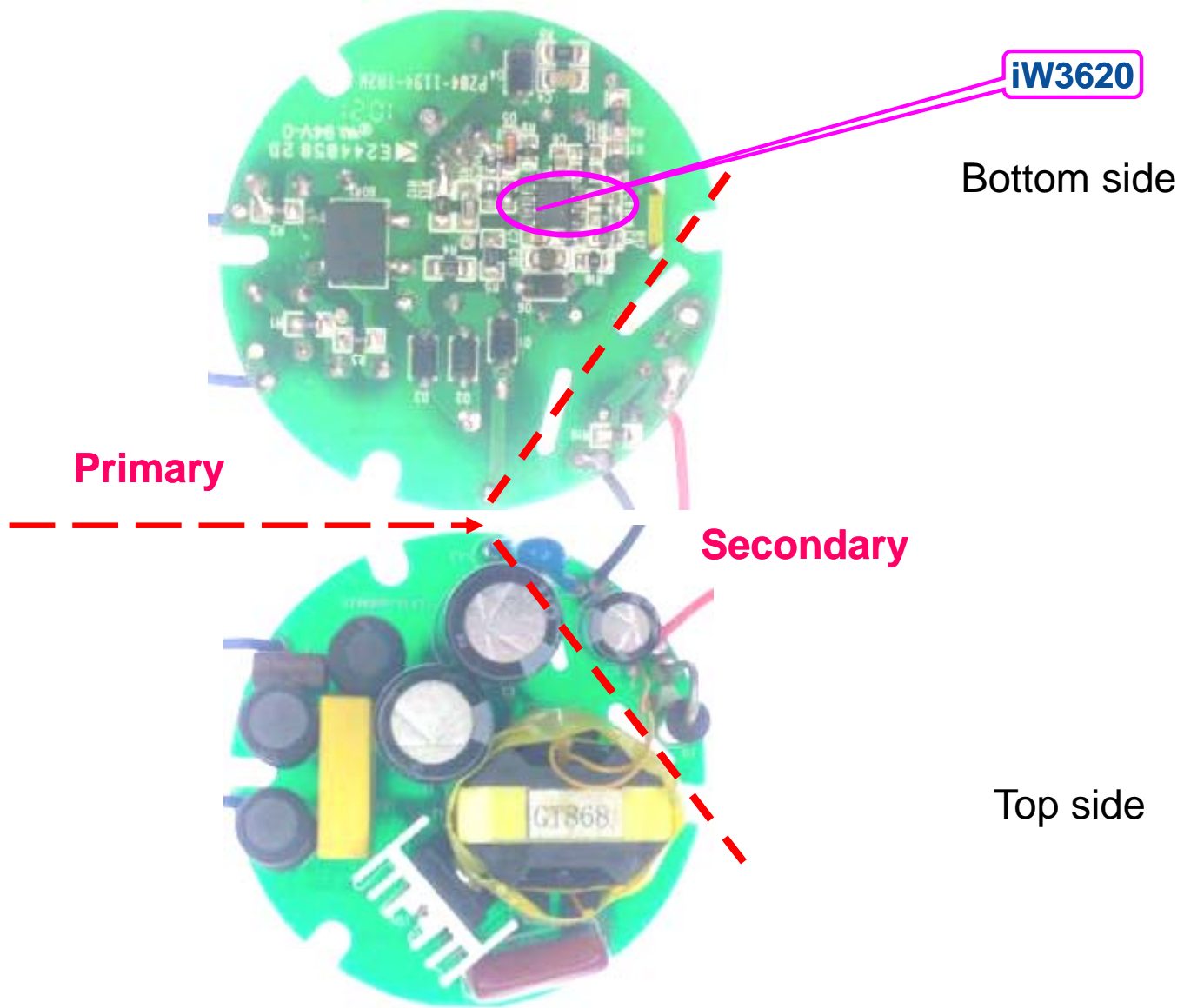
# 1. Specification

Description		Symbol	Min	Typ	Max	Units	Comment
Input							
Voltage		$V_{IN}$	90	100/230	264	V <sub>AC</sub>	2 Wire
Frequency		$f_{LINE}$	47	50	63	Hz	
Open-load Input Power (264V <sub>AC</sub> )						W	
Output							
Const Voltage	Output Voltage	$V_{OUT\_CV}$		38		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	$I_{OUT\_CV}$		400		mA	
Total Output Power							
Continuous Output Power		$P_{OUT}$		18		W	
Over Current Protection		$I_{OUT\_MAX}$				mA	Auto-restart
Efficiency		$\eta$		88		%	
Power Fact		$PF$		0.88			Harmonic meet IEC61000-3-2
Turn on Delay Time						Sec	Vin=230Vac
Conducted EMI			Meets EN55015B				
Hi-pot test				3		KV	
Operation temperature		$T_{opr}$		40		° C	Free convection, sea level

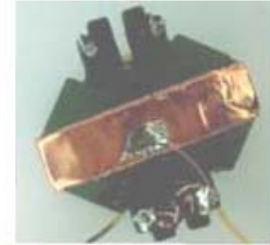
# 2.Schematic circuit



# 3.Circuit Board Photograph

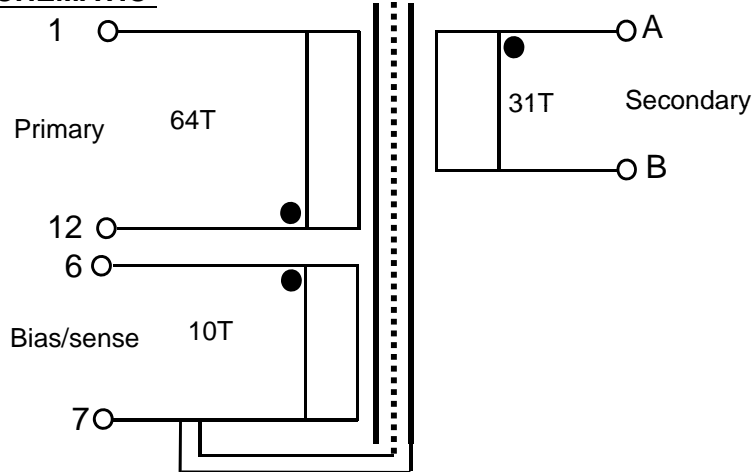


# 4. Transformer Design



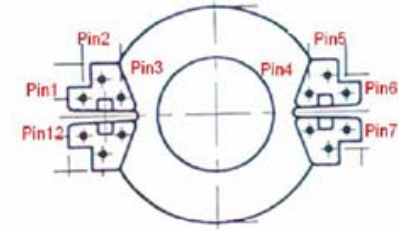
**Natt**

## SCHMATIC



Slot at secondary side

Pin 7



## ELECTRICAL SPECIFICATIONS:

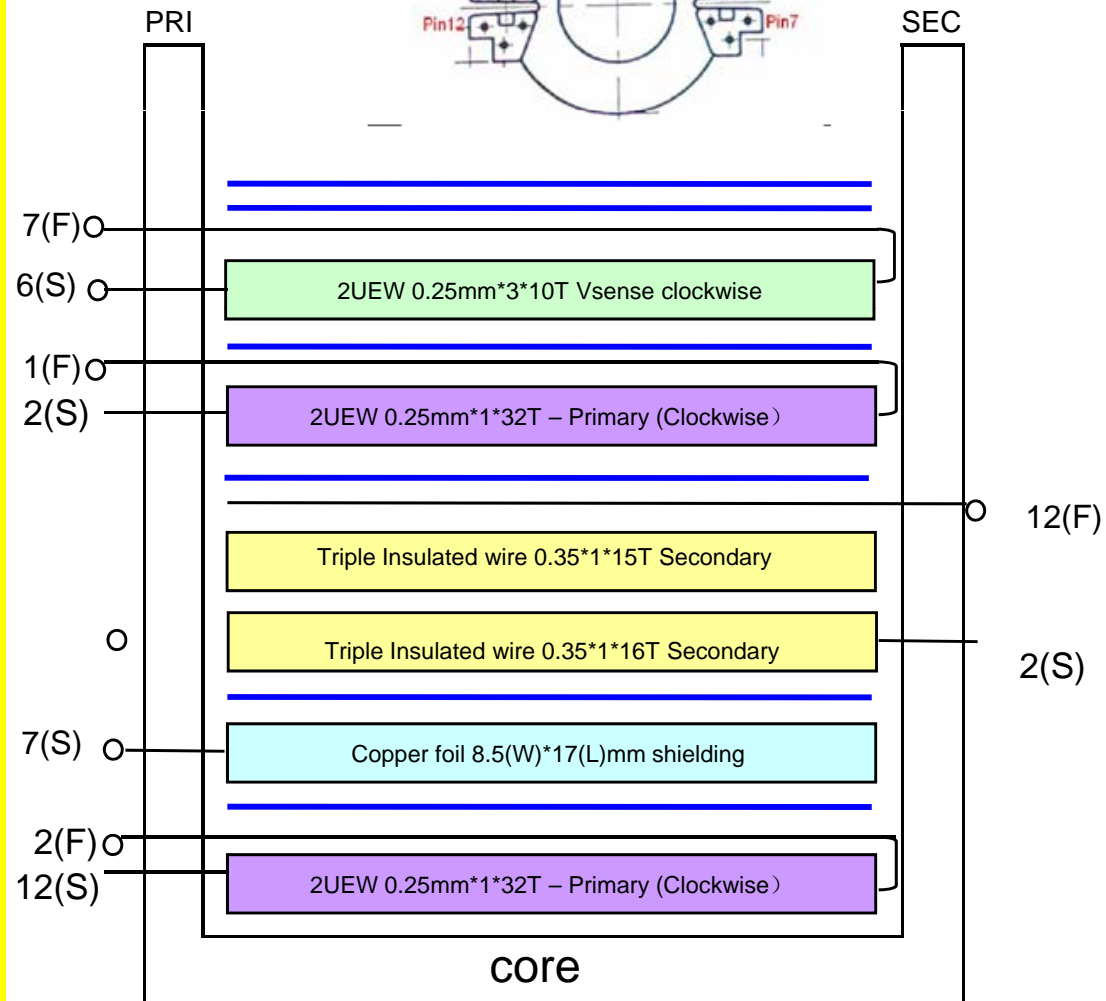
1. Primary Inductance ( $L_p$ ) = 650uH @10KHz
2. Primary Leakage Inductance ( $L_k$ ) <= 10uH @10KHz
3. Electrical Strength = 3KV, 50/60Hz, 1Min

## MATERIALS:

1. Core : RM8 (Ferrite Material TDK PC40 or equivalent)
2. Bobbin : RM8 Horizontal. Primary=6, Secondary=6
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. Core is connected to PRI-GND pin5.
3. Varnish the complete assembly



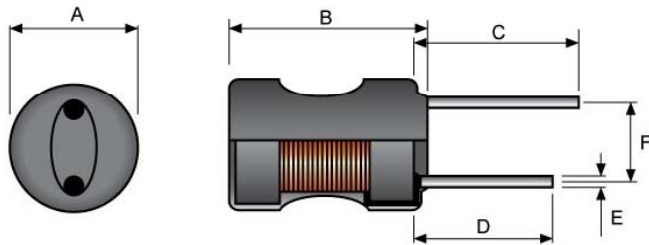
# 5. Bill of Material

Item	Qty.	Ref.	Description
1	2	C1,C2	47uF,250V,E-CAP,105°C
2	1	C3	0.22uF,400V
3	1	C4	1nF,1KV,Capacitor
4	1	C5	180pF,50V,NPO,SMD-0603
5	1	C6	470pF,50V,X7R,SMD-0805
6	1	C7	0.1uF,50V,NPO,SMD-0805
7	1	C8	22pF,50V,SMD-0603
8	1	C9	470pF,50V, SMD-0805
9	1	C10	4.7uF,50V,SMD-1206
10	1	C11	100uF,50V ,E-CAP,105°C
11	1	CX1	0.1uF/275V X Capacitor
12	1	CY1	Y-CAP1nF 250V
13	3	D1,D2,D3	M7/ES1J
14	1	D4	FR107,Rectifier Diode,DO-41
15	1	D5	1N4148
16	1	D6	RS1M
17	1	D7	HER304
18	1	F1	1A/250Vac Fuse
19	1	BDR1	DB107

Item	Qty.	Ref.	Description	U/P (RMB)
19	3	L1,L2,L3	2mH(8*10) (0.18*1 50T)	
20	1	Q1	4N60	
21	3	R1,R2,R3	4.7K,SMD-1206	
22	2	R4.R5.R6,R7	560K $\Omega$ +/-5%,SMD-1206	
23	1	R8	330K $\Omega$ +/-5%,SMD-1206	
24	1	R9	10 $\Omega$ +/-5%,SMD-0603	
25	1	R10	100K $\Omega$ +/-5%,SMD-0603	
26	1	R11	1.2K $\Omega$ +/-5%,SMD-0603	
27	1	R12	1.8R +/-1%,SMD-0805	
28	1	R13	3.3 $\Omega$ +/-1%,SMD-0805	
29	1	R14	22K $\Omega$ +/-5%,SMD-0603	
30	1	R15	22K $\Omega$ +/-5%,SMD-0603	
31	1	R16	10 $\Omega$ +/-5%,SMD-0805	
32	1	R17	33K $\Omega$ +/-1%,SMD-0805	
33	1	R18	4.3K $\Omega$ +/-1%,SMD-0603	
34	1	R19	75K $\Omega$ +/-5%,SMD-0805	
35	1	T1	RM8 Transformer	
36	1	U1	lw3620,Off-line digital PWM controller,SOT-8	

## 6. Differential Mode Inductor

### Differential mode inductor L1,L2,L3



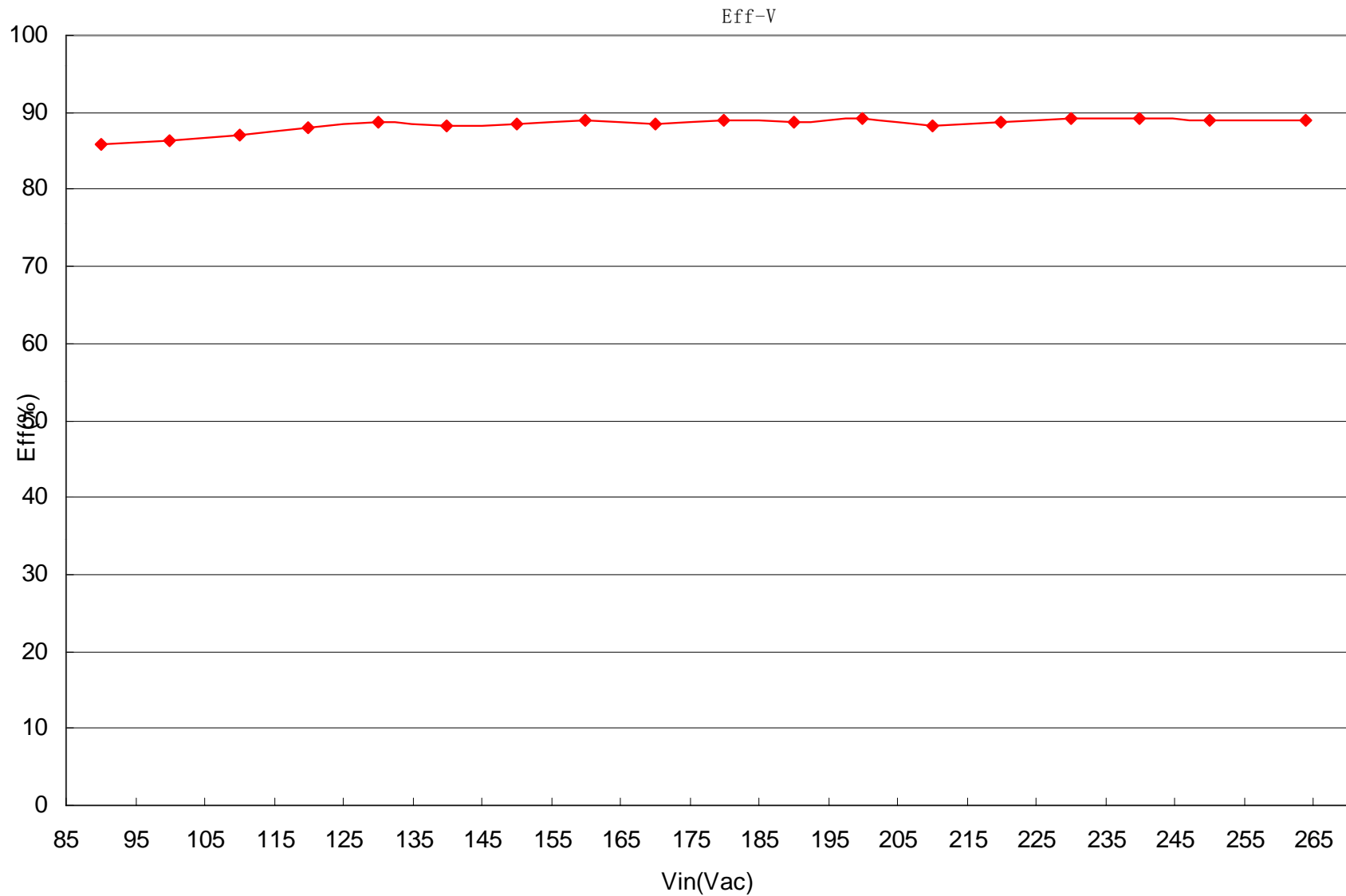
Ferrite core size : Ax B 8x10mm

Wire gauge: 0.18mm, 245 Turns

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

ICR: xxx OHM +/-20%

# 7. Regulation, Efficiency Measurement



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

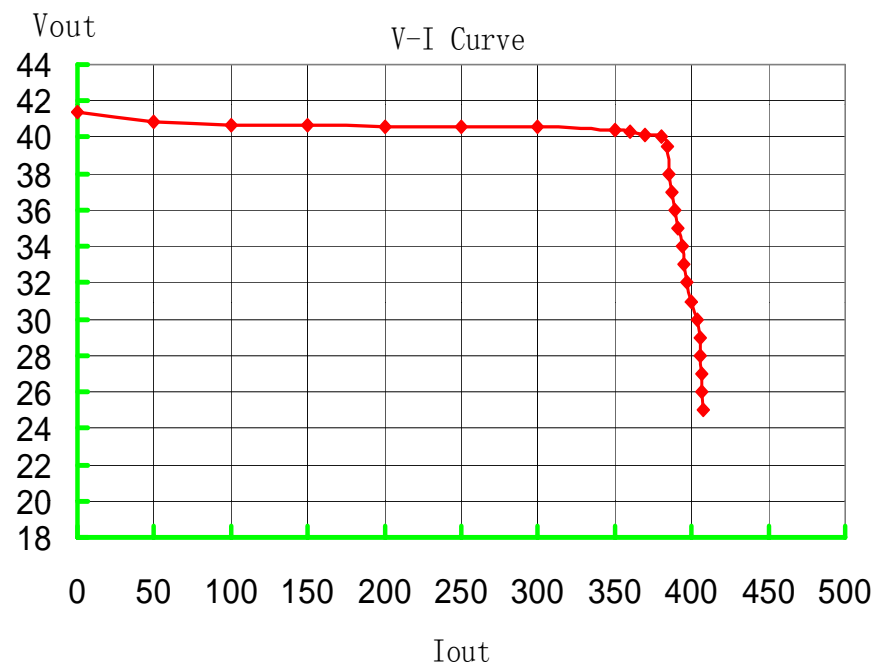


# 8. Output VI Characteristics

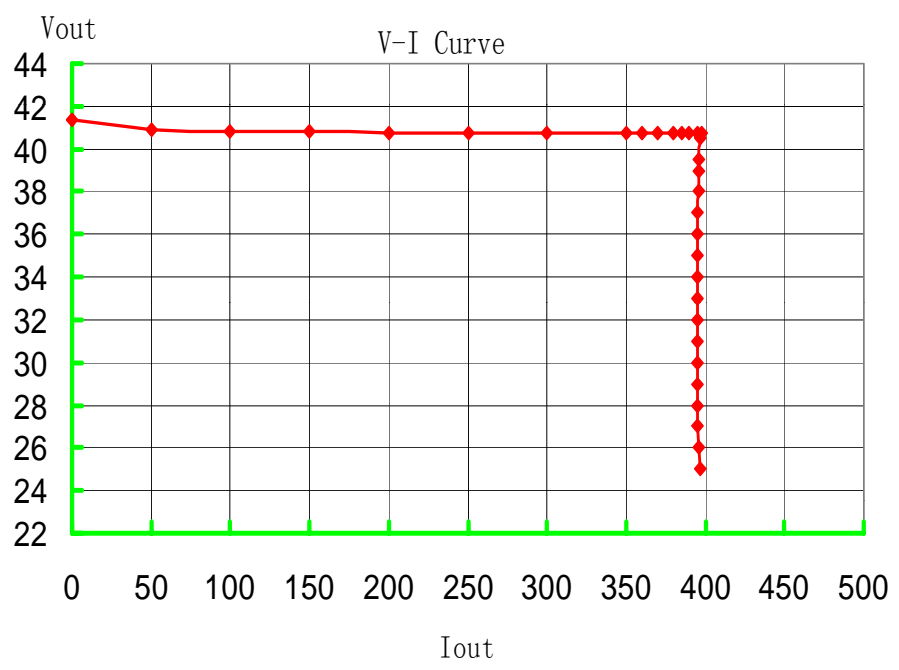


\* Note: Output voltage measured at PCB end,  $T_{AMB}=25\text{ }^{\circ}\text{C}$

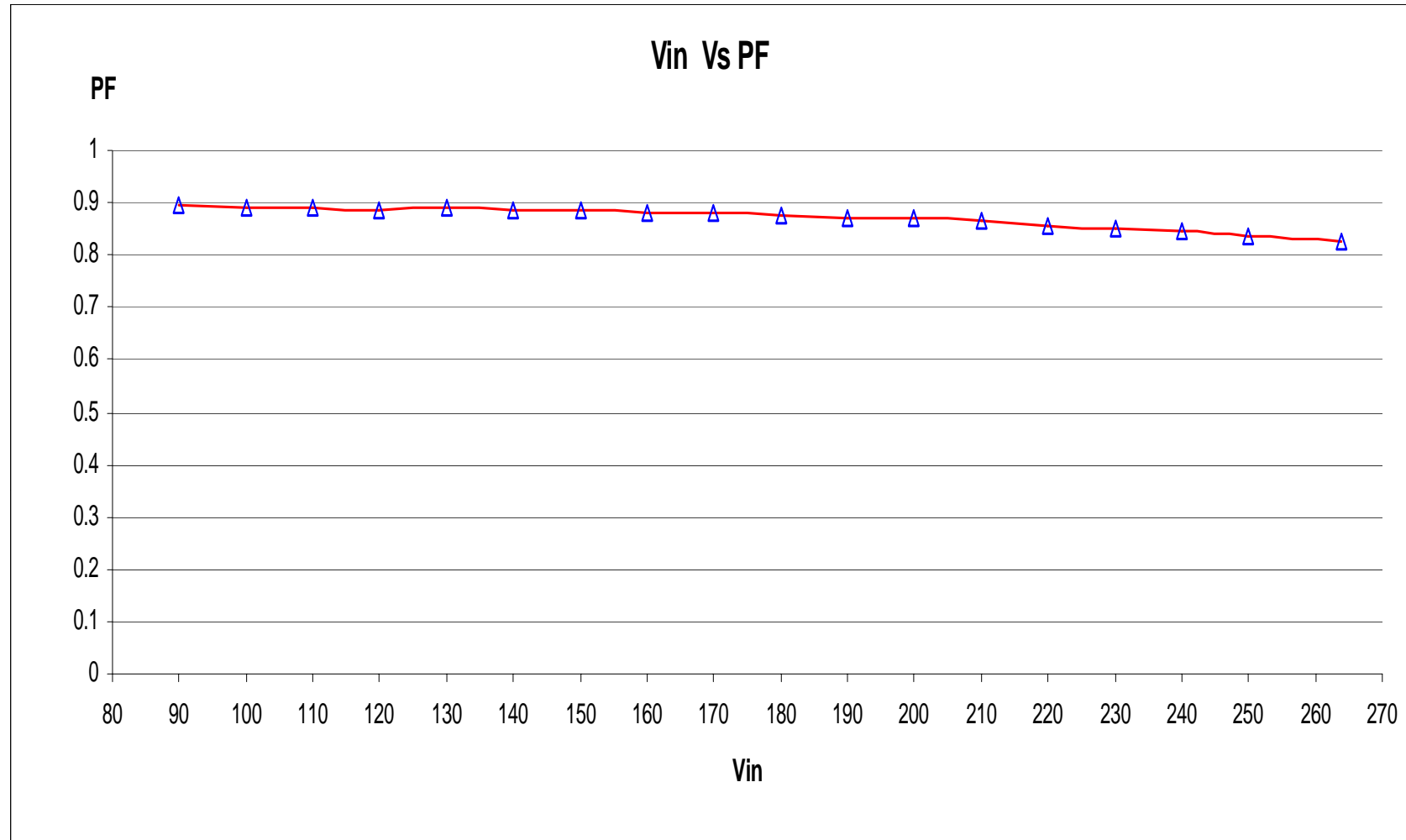
$V_{IN}=100V_{AC}$ ,  $T_{AMB}=25\text{ }^{\circ}\text{C}$



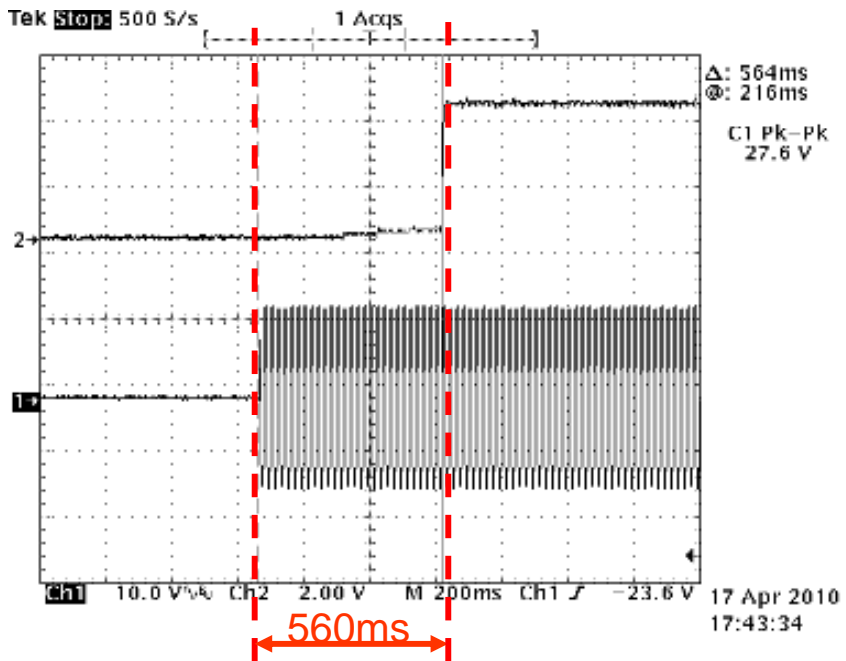
$V_{IN}=230V_{AC}$ ,  $T_{AMB}=25\text{ }^{\circ}\text{C}$



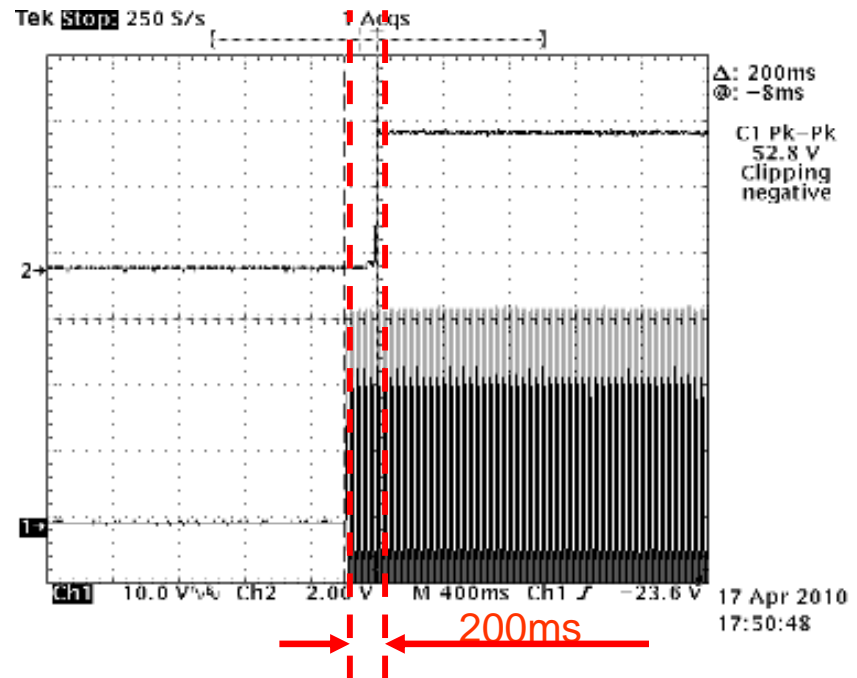
# 9. Input voltage VS Power Fact curve



# 10.Start up time \_ No dimmer

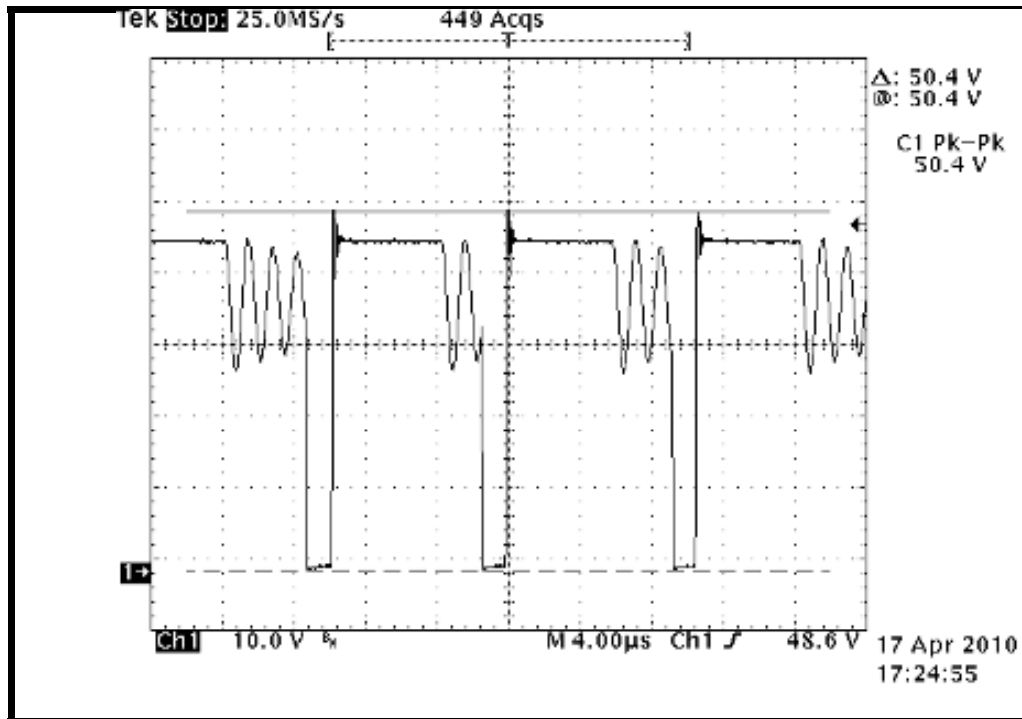


INPUT=100VAC



INPUT=230VAC

# 11. $V_{DS}$ waveform



Test Condition:

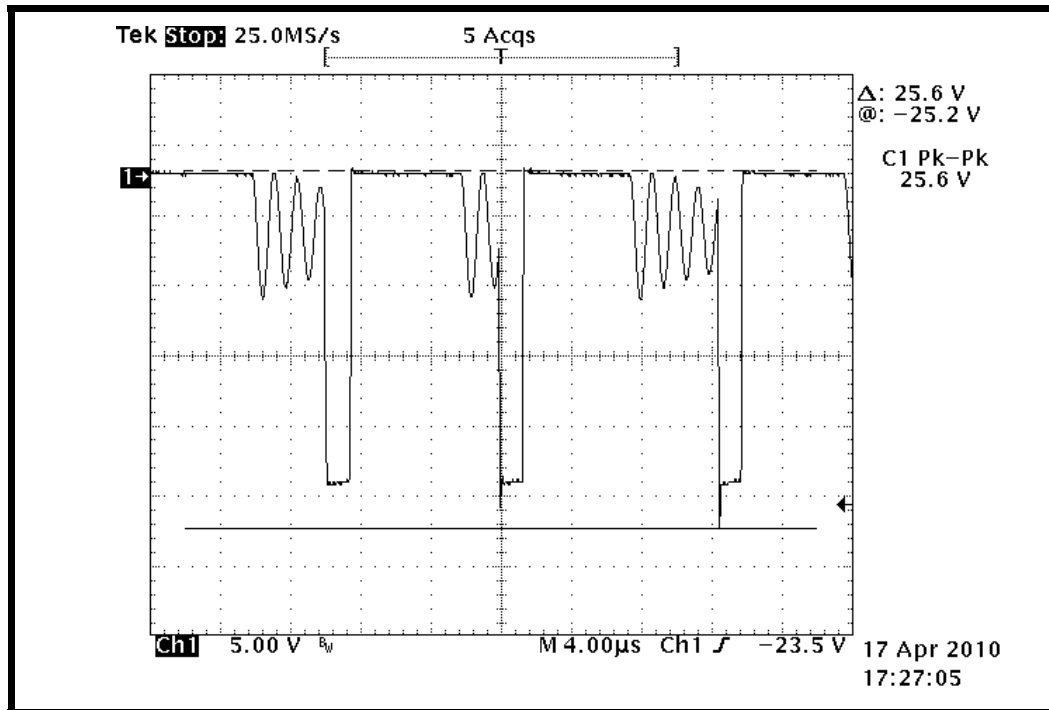
$V_{IN}=264VAC$ ,  $I_{out}=400mA$

Result:

$V_{DS\_MAX}=50.4*10=504V$

Remark: Mosfet Spec\_\_4A 600V

## 12. $V_R$ waveform



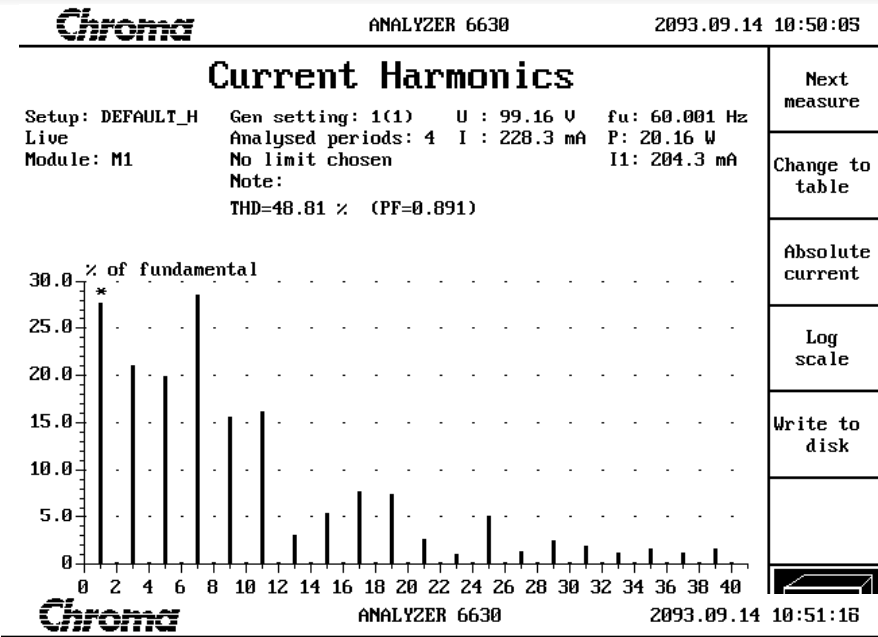
Test Condition:

$V_{IN}=264VAC$ ,  $I_{out}=400mA$

Result:

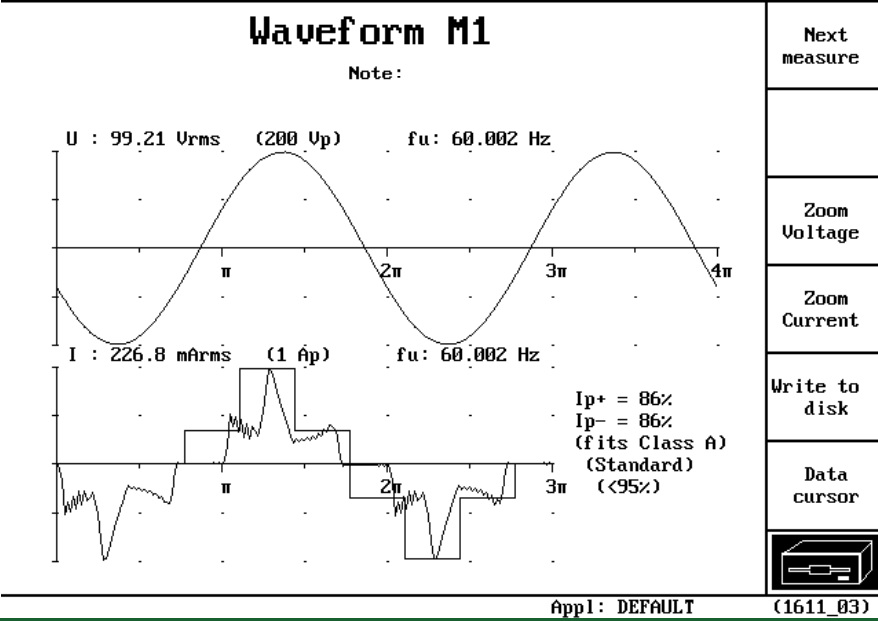
$V_{R\_MAX}=25.6*10=256V$

# 13 . Harmonic and current waveform\_ No dimmer \_3620



- Next measure
- Change to table
- Absolute current
- Log scale
- Write to disk

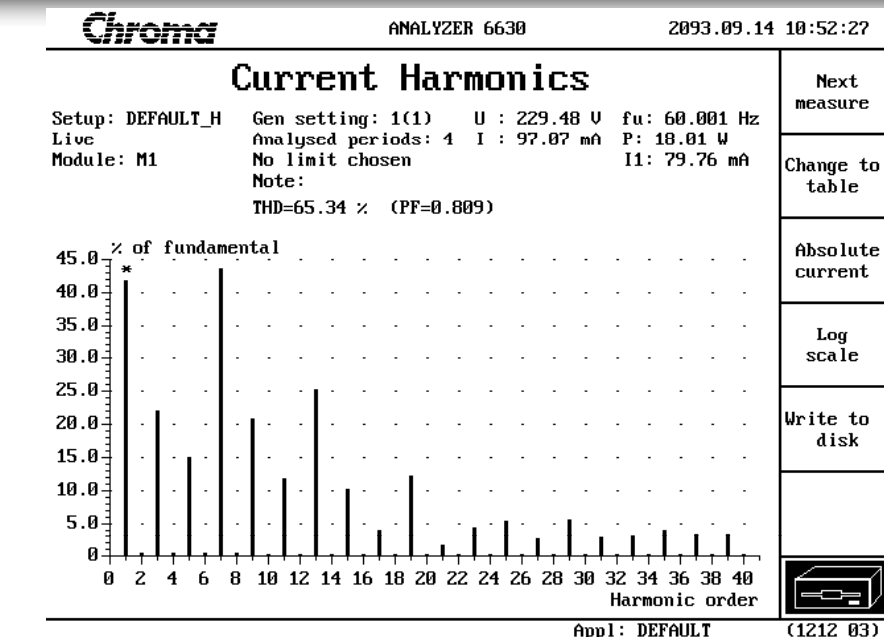
Harmonics current @100Vac  
Meet IEC61000-3-2 requirement



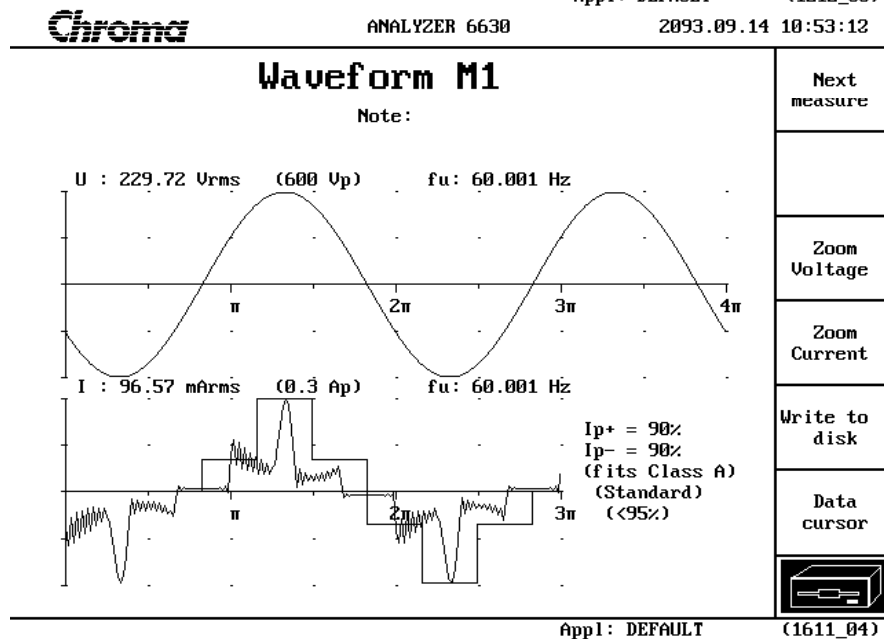
- Next measure
- Zoom Voltage
- Zoom Current
- Write to disk
- Data cursor

Ac current waveform @100Vac  
PF=0.891

# 14 . Harmonic and current waveform\_ No dimmer \_3620 **iWatt**

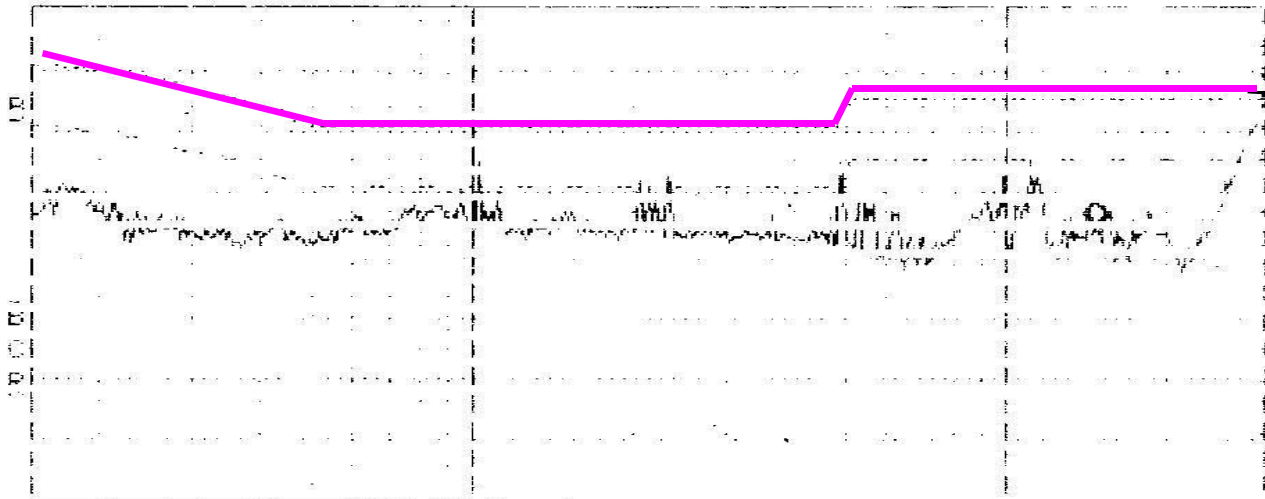


Harmonics current @230Vac  
 Meet IEC61000-3-2 requirement



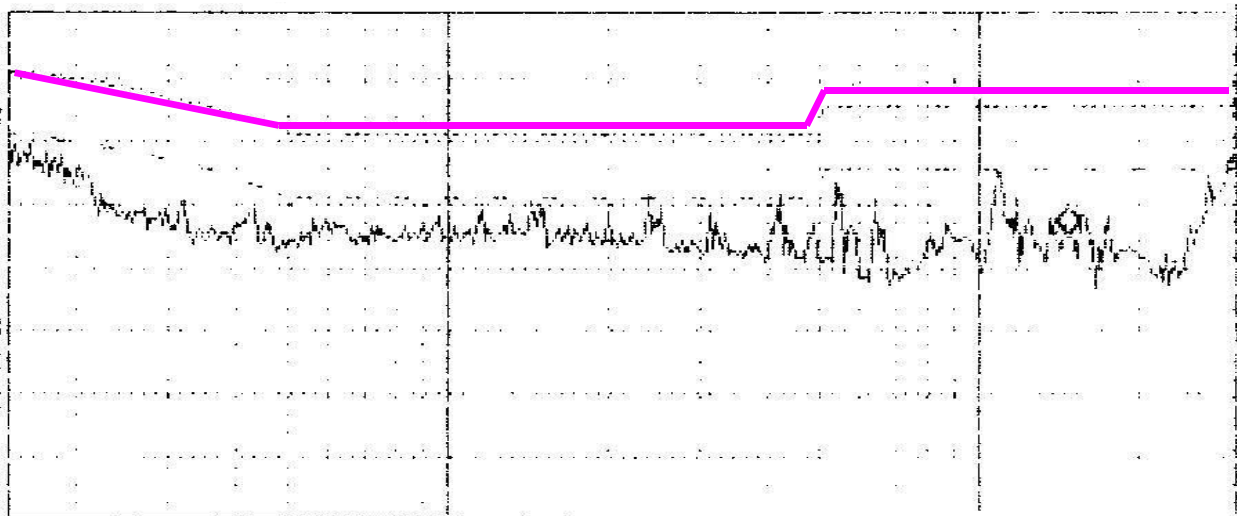
Ac current waveform @230Vac  
 PF=0.809

# 15. Conducted EMI (Full Load, output floating )



Peak Scan  
QP Limit line

Input=230VAC  
L line PK scan



Peak Scan  
QP Limit line

Input=230VAC  
N line PK scan



# 16. Temperature Rise Test

Circuit code	90VAC		230VAC		277VAC	
	Temperature	Temperature rise	Temperature	Temperature rise	Temperature	Temperature rise
Transformer (Core)	87.7	62.2	83	57.5	83.9	57.3
IC (U1 IW3620)	82.6	57.1	77.1	51.6	79	52.4
Output diode(D7)	92.4	66.9	89.7	64.2	90.4	63.8
Input Capacitor(C1)	79.7	54.2	72.2	46.7	73.2	46.6
output Capacitor (C11)	82.2	56.7	78	52.5	78.9	52.3
Mosfet (Q1)5N60	91.2	65.7	80.2	54.7	81.9	55.3
Ambient temperature	25.5 ° C		25.5 ° C		26.6 ° C	

\* Put the driver in plastic housing and measure the temperature

