

LED Driver Design with Iw3620-00

(AC input 90V~264Vac, Output 4 LED)

Summary and Features :

- 1. LED driver, 12V, CC@1.5A ; Wide range AC input range @90-264Vac**
- 2 For isolated Applications**
- 3 Meet EMI EN55015B-QP limits**

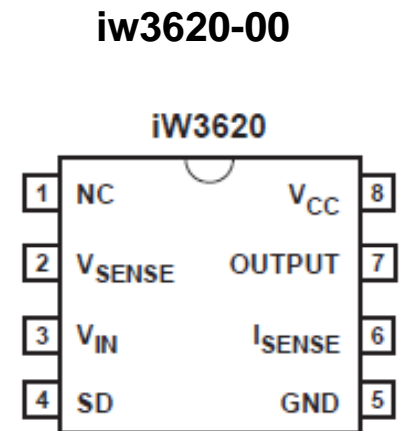
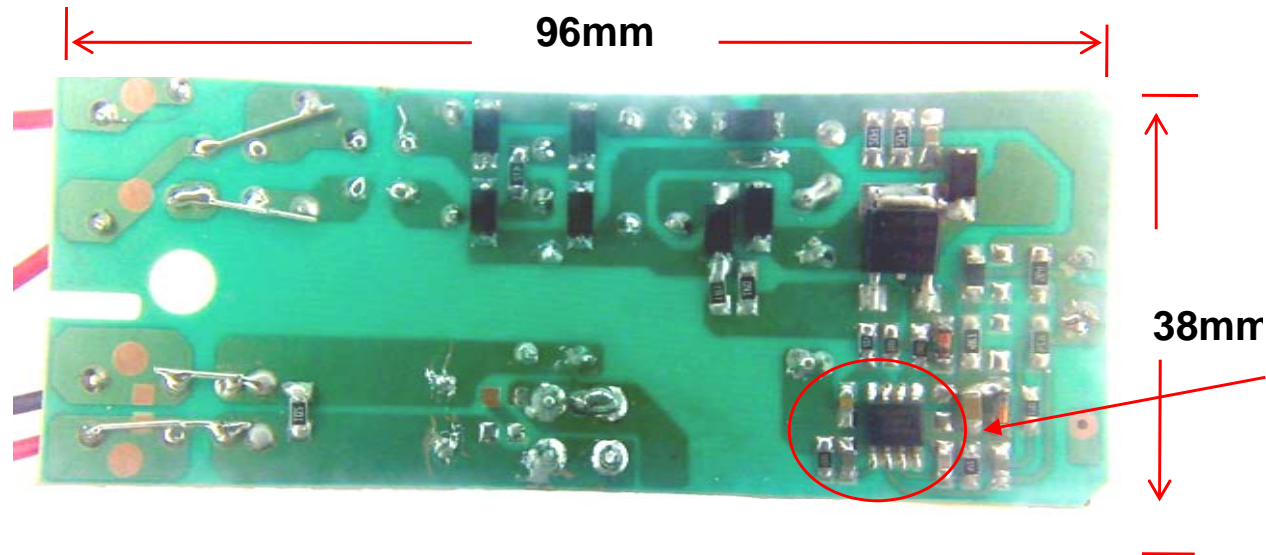
1. Specification

Description		Symbol	Min	Typ	Max	Units	Comment
Input							
Voltage		V_{IN}	90	230	264	V _{AC}	2 Wire
Frequency		f_{LINE}			50	Hz	
Open-load Input Power (264V _{AC})						W	
Output							
Const Voltage	Output Voltage	V_{OUT_CV}		12		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}		1500		mA	
Total Output Power							
Continuous Output Power		P_{OUT}		18		W	
Over Current Protection		I_{OUT_MAX}				A	Auto-restart
Efficiency		η		82		%	Measured at end of PCB
Power Fact		PF		0.9			Harmonic meet IEC61000-3-2
Turn on Delay Time						Sec	
Conducted EMI			Meets EN55015B				
Hi-pot test				3		KV	
Operation temperature		T_{opr}		40		° C	Free convection, sea level

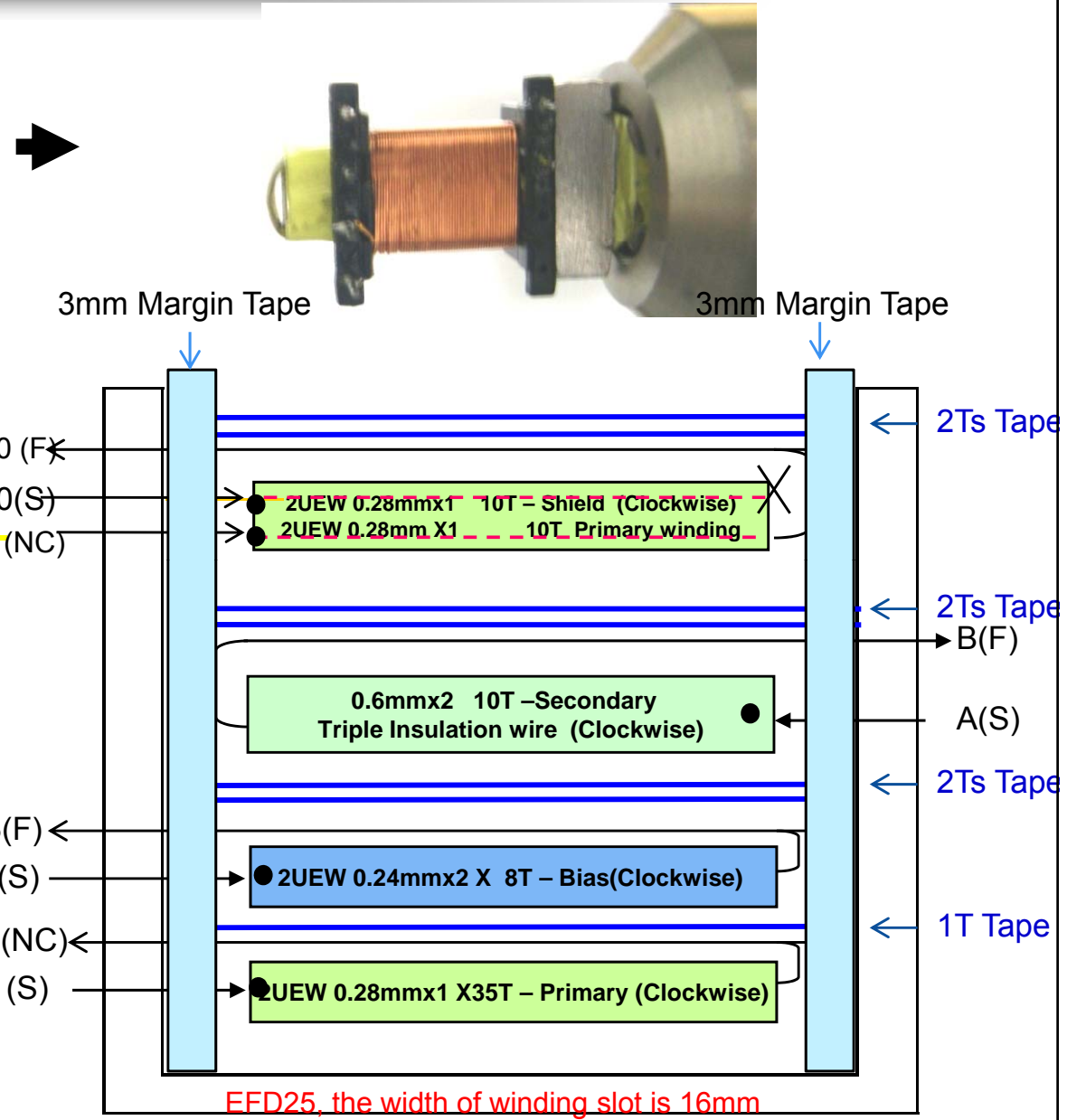
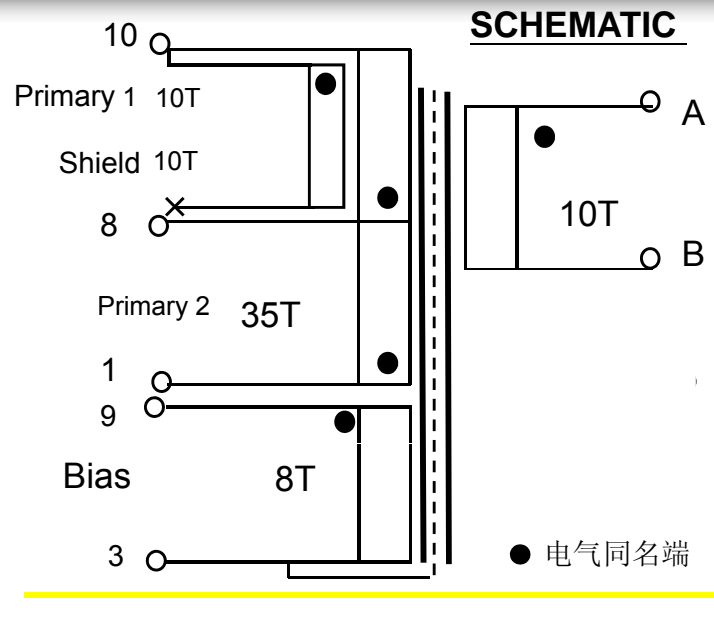
3. Bill of Material

Ref.	Description	Qty	Ref.	Description	Qty
U1	iW3620-00, Digital PWM Controller, Dimmable, SO-8	1	R17	4Ω7 ±5%, SMD-1206	1
CX1,CX2	0.1uF,275V, X2	2	R18	4K7Ω ±1%, SMD-0805	1
C2	22uF, 450V, E-CAP, 105°C,12*25mm	1	R20	1KΩ ±5%, SMD-1206	1
C3	1nF/250V, SMD 1206	1	L5	800uH, EE13	1
C5	1nF, 50V,X7R, 0805	1	T1	EFD25, Transformer,4+4PIN,2.0mH	1
C6	68pF,25V, X7R, SMD 0805	1	F1	T2A250V	1
C7	470pF,25V, X7R, SMD 0805	1	D4,D9,D10,D11,D12	RS1M,SMD	5
C8	100nF,50V, X7R, SMD 0805	1	D1,D2,D3	ES1J, SMD	3
C9	4.7uF,25V, X7R, SMD 0805	1	D5	1N4148	1
R1	4.7KΩ ±5%, SMD-0805	1	D6	FR102,	1
R4,R5	560KΩ,±5%, SMD-1206	2	D7,D8	MBR30200	2
R6,R7	200KΩ,±5%, SMD-1206	2	Z1	Zener, 15V, SMD	1
R9	22KΩ,±5%, SMD-1206	1	CY1	Y1,2200pF,400V	1
R10	1.2KΩ,±5%, SMD-0805	1	Q1	4N65,TO-251	1
R11	1.0Ω,±1%, SMD-1206	1	L5	800uH, Drum choke, 8X10mm,	1
R12	1.1Ω,±1%, SMD-1206	1	L4	0.3*10TS,100uH	1
R13	10Ω ±5%, SMD-0805	1	C1	220nF,400V,CBB	1
R14	22KΩ ±5%, SMD-0805	1	C10	470uF, 25V, E-CAP, 105°C,10*16mm	1
R16	27KΩ ±1%, SMD-0805	1			

4.PCB Layout



5. Transformer Design



ELECTRICAL SPECIFICATIONS:

1. Primary Inductance (L_p) = 860uH @10KHz
2. Primary Leakage Inductance (L_k) ≤ 50uH @10KHz

MATERIALS:

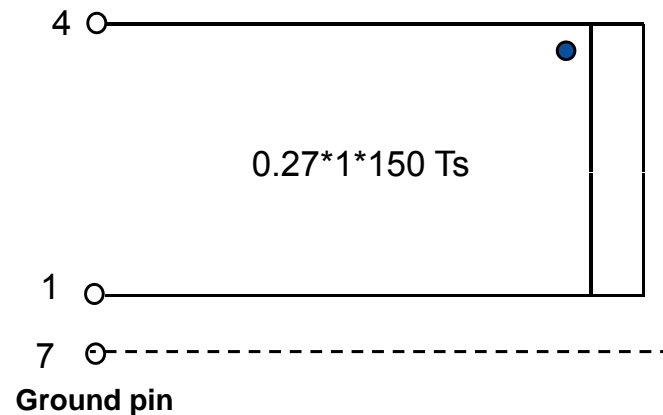
1. Core : EFD25 (Ferrite Material TDK PC40 or equivalent)
2. Bobbin : EFD25,5+5PIN
3. Magnet Wires : Type 2-UEW
4. Layer Insulation Tape : 3M1298 or equivalent.

FINISHED :

1. Cut remained of Pin 2,4,6,7
2. Varnish the complete assembly
3. Core is connected to pin4(primary ground)

6. PFC choke and EMI Inductor__ For input 230Vac

L4 SCHEMATIC



ELECTRICAL SPECIFICATIONS:

1. Inductance (L_p) = 800uH @10KHz
2. Core : EE13 (Ferrite Material TDK PC40 or equivalent)
3. Bobbin : EE13 Horizontal
4. Ferrite core is connected to Pin 7 after assembling
5. Cut Pin 2 ,3,5,6,8 after wires termination
6. Varnish the complete assembly

Common Mode Inductor L2



Core size:T8*4*3

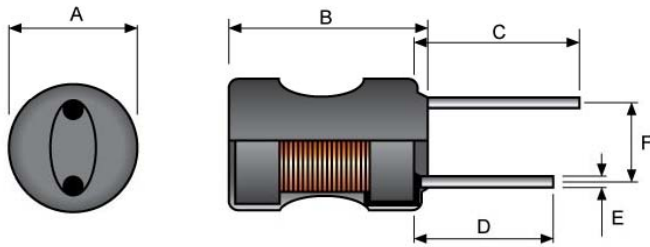
Wire gauge:0.3mm*2(insulation&2-UEW wire)

Turns 10.5

inductance@10kHz,1V:100uH+/-10%

7. Differential Mode Inductor L5

EMI Inductor L5

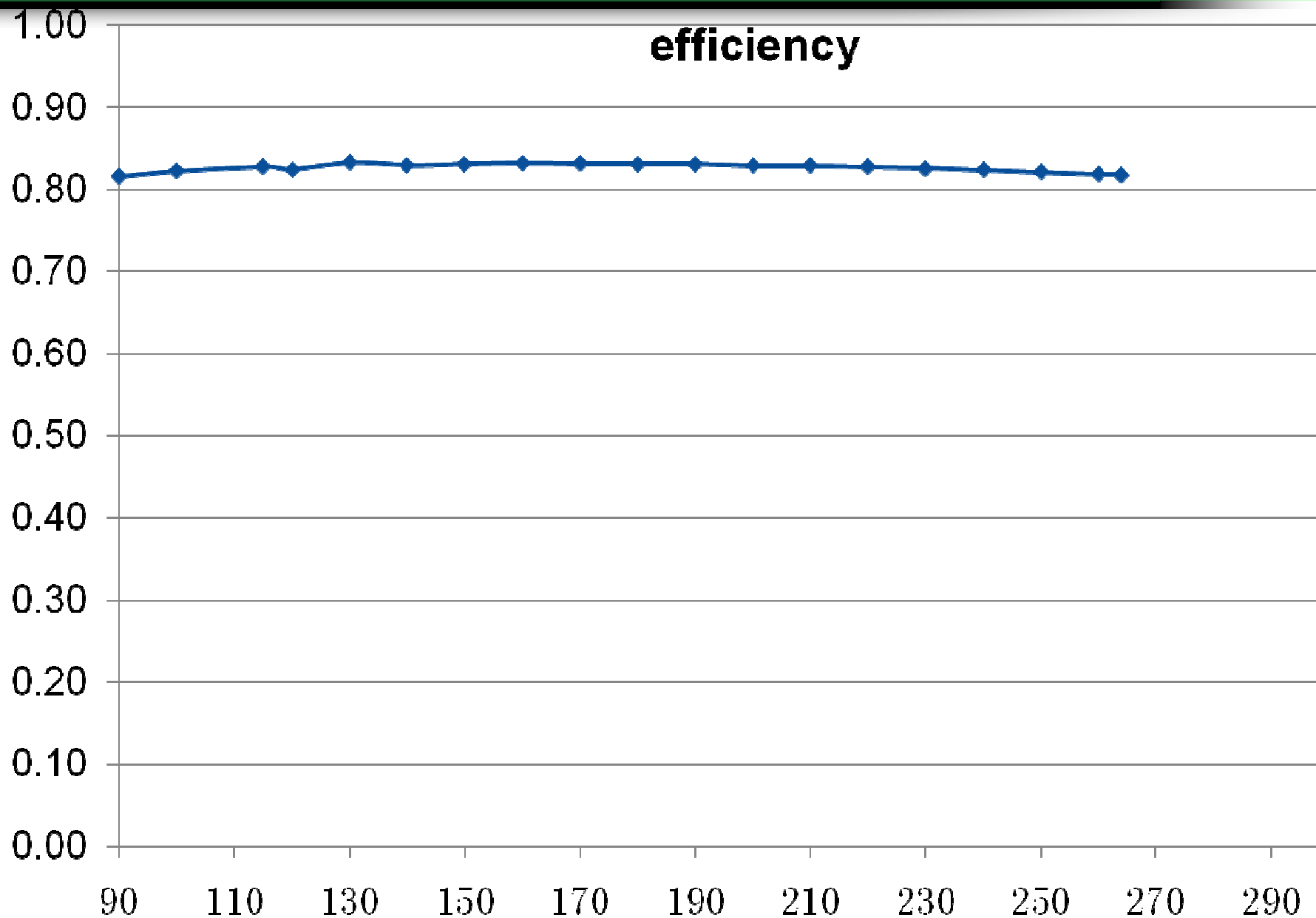


Ferrite core size : AxB 8x10mm 0.27*150T

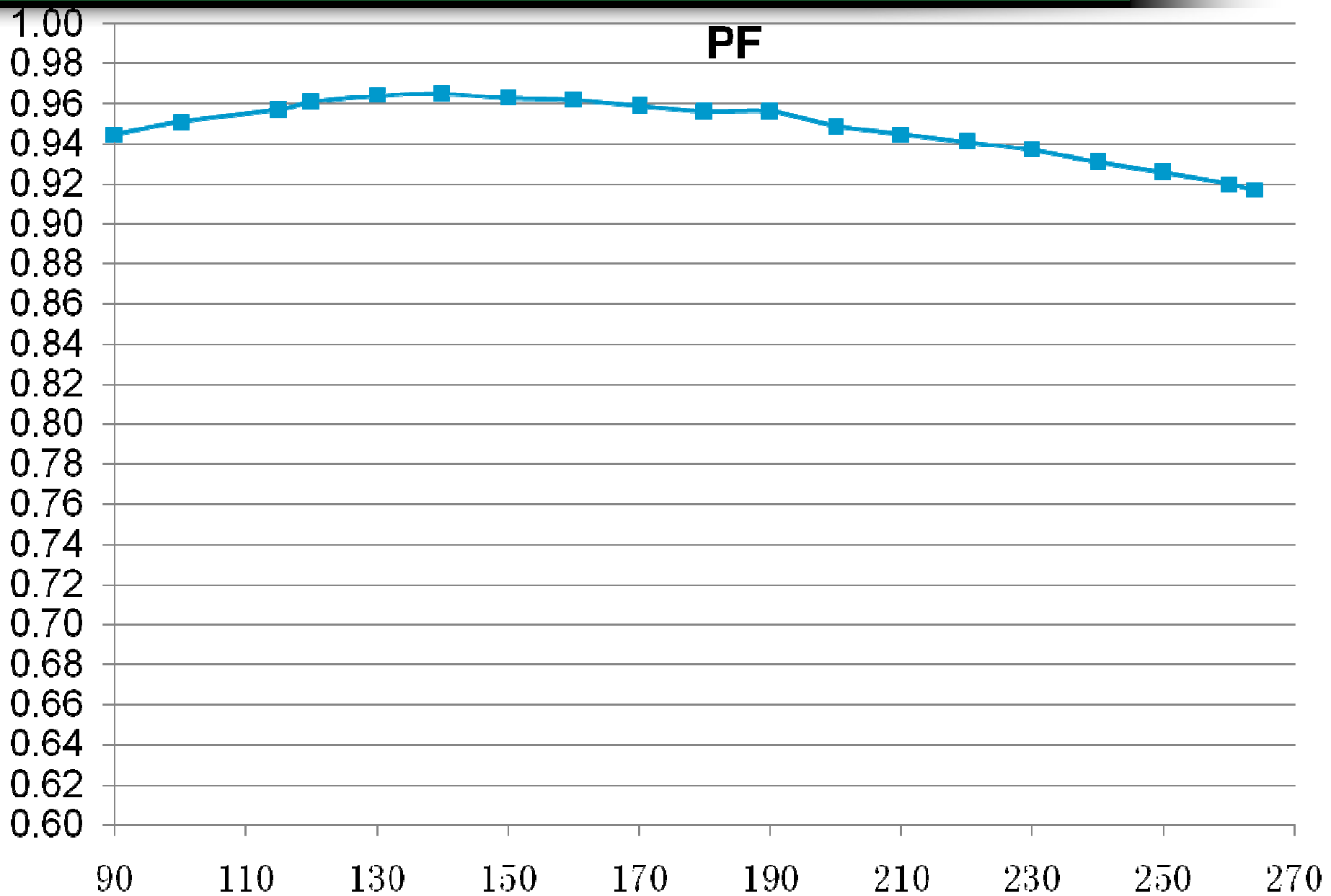
Inductance @10kHz, 1V: 800uH +/-20%

DCR: 2.0 OHM +/-20%

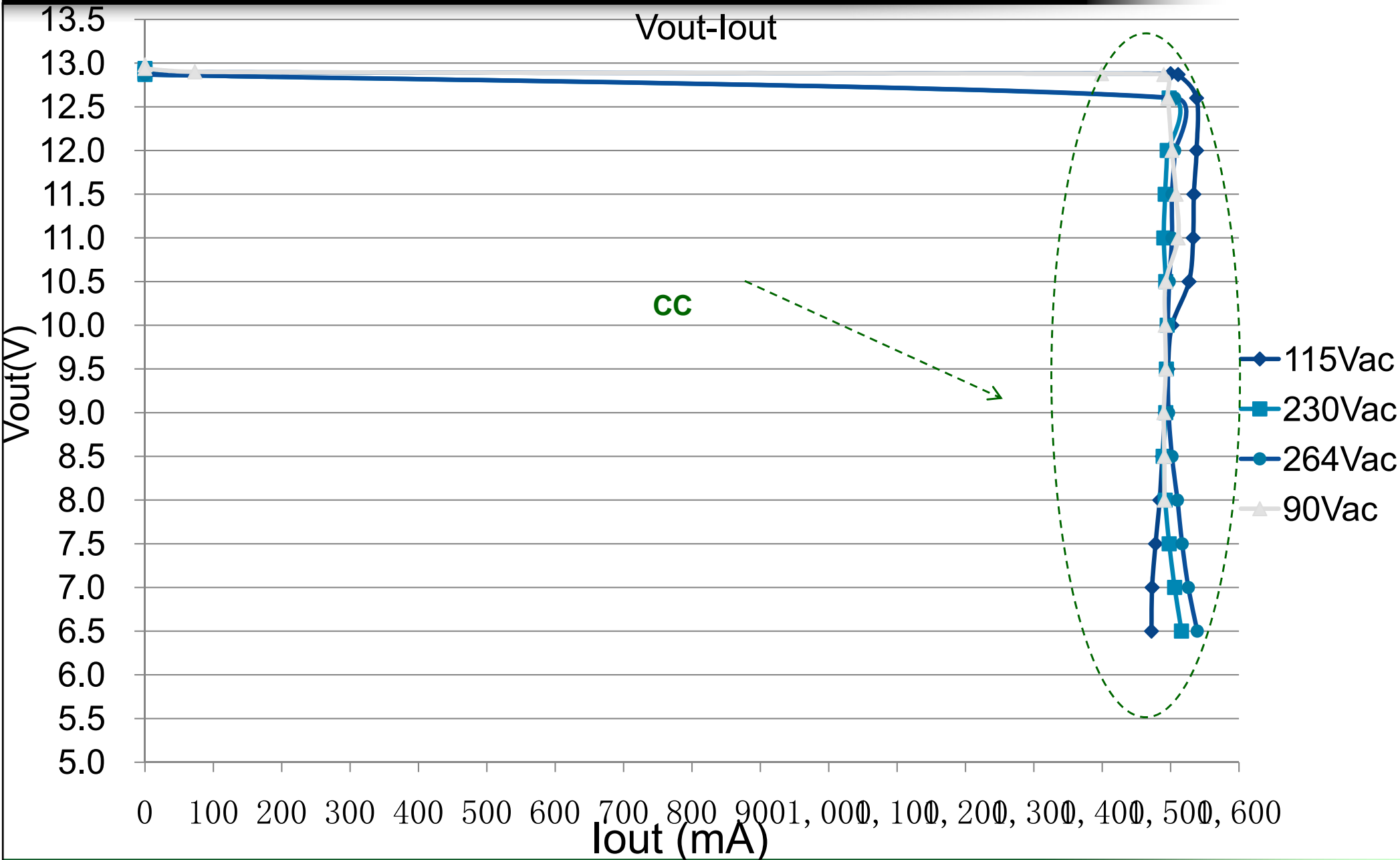
8. Efficiency and V-I Curve .



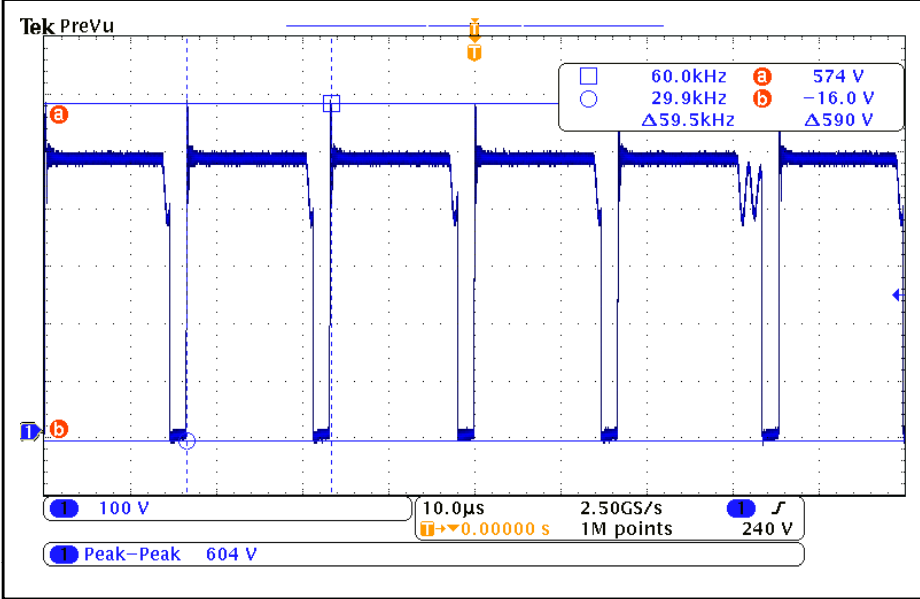
9. PF Curve .



10. Regulation, Vout-Iout Measurement



11. Vds Waveform



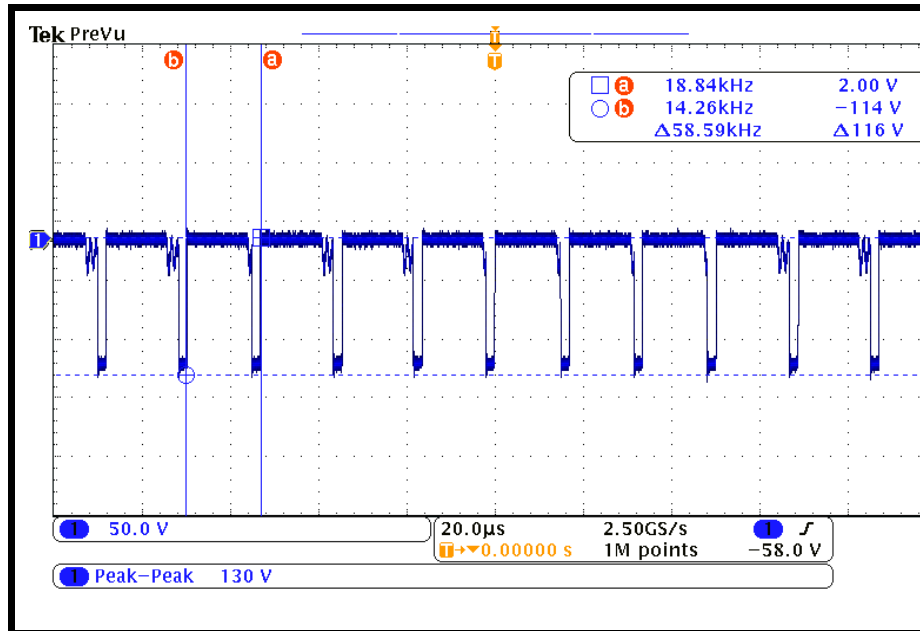
Test Condition:

$V_{in}=264V_{ac}$, $I_{OUT}=1.5A$

Result:

$V_{CE_MAX}=590V$

12. Vdiode waveform



Test Condition:

$V_{IN}=264VAC$, $I_{out}=1.5A$

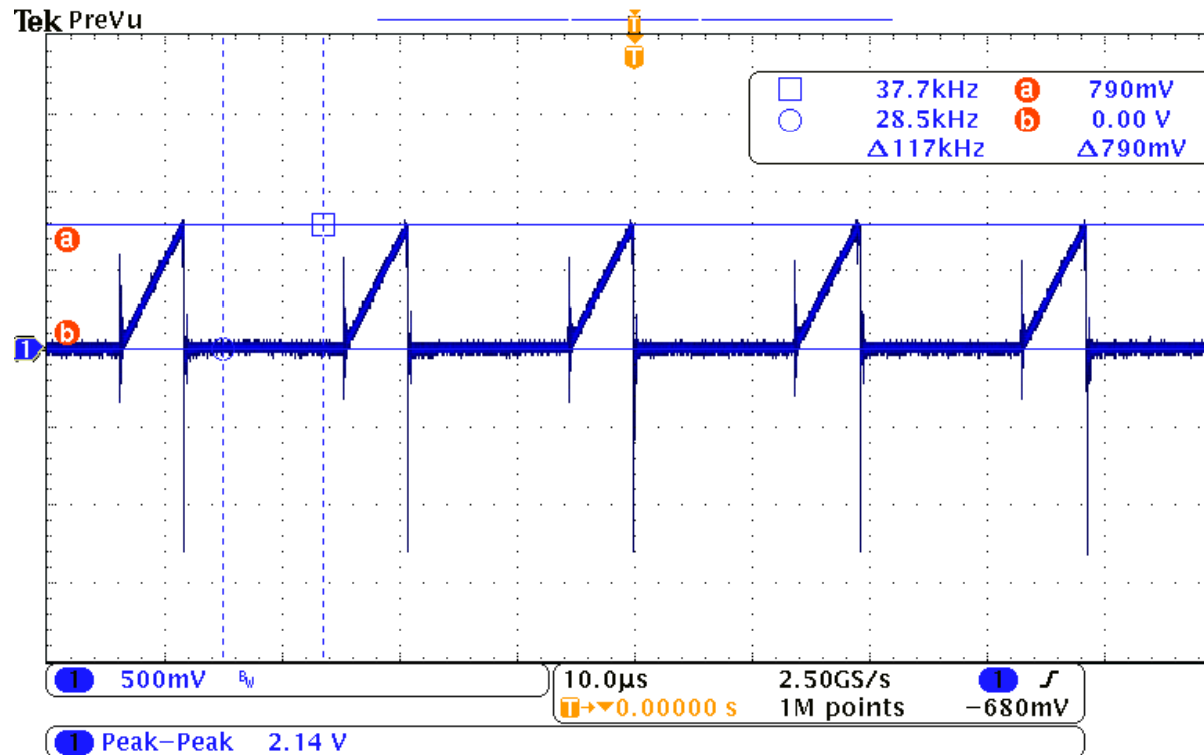
Result:

$V_R (pk-pk) = 116V$

Output rectifier diode:
MBR3200,3A,200V at least

13. Transformer Flux Density

($N_p=45T_s, L_m=810\mu H, A_e=58mm^2, EFD25, 5+5.$)

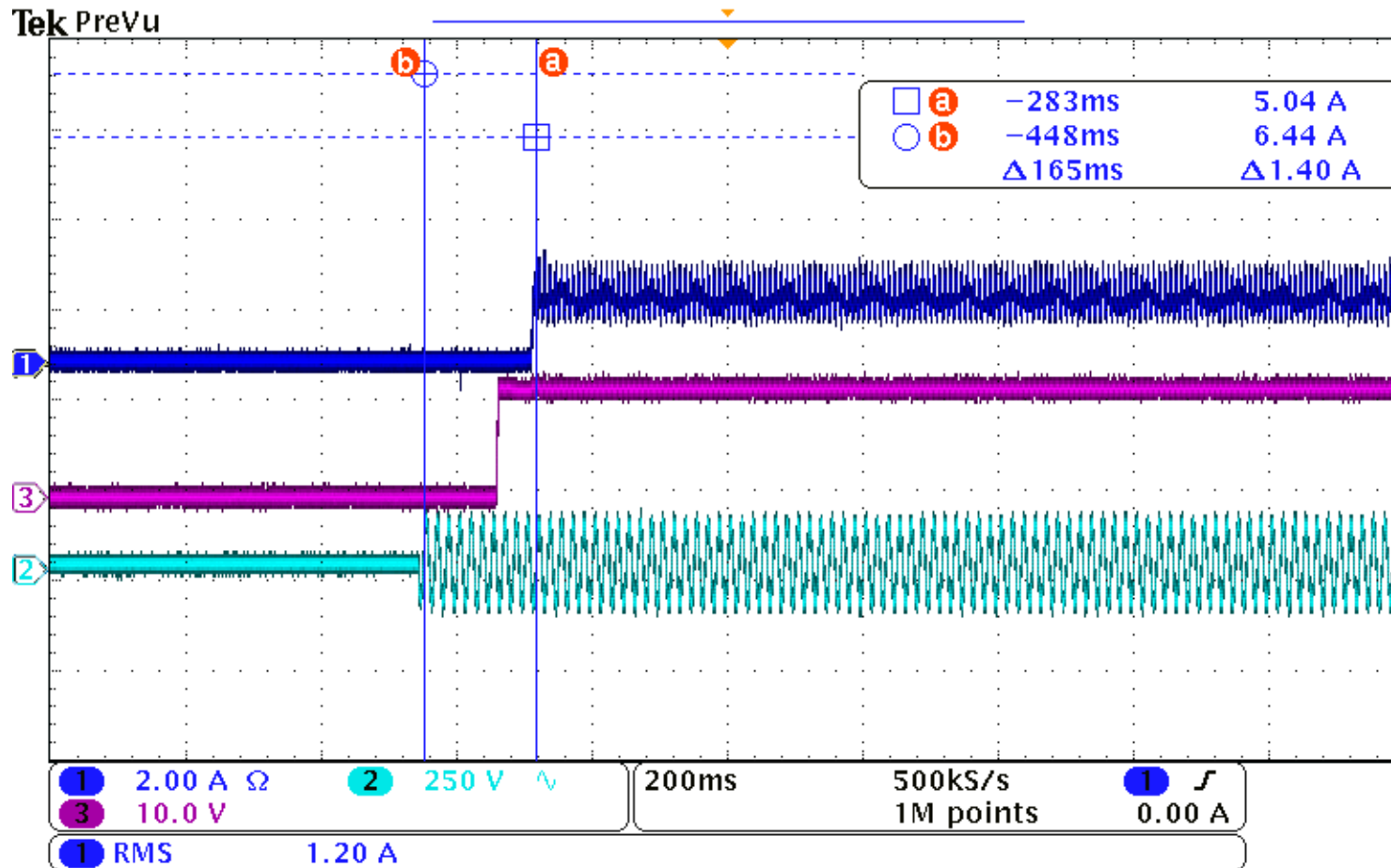


I_p is monitored at 90 Vac and full Load.

$$I_p = 0.79V / 1R = 790mA,$$

$$B_{max} = L_m * I_p / (N_p * A_e) = 0.81 * 790 / (45 * 58) = \underline{0.24} \text{ Tesla}$$

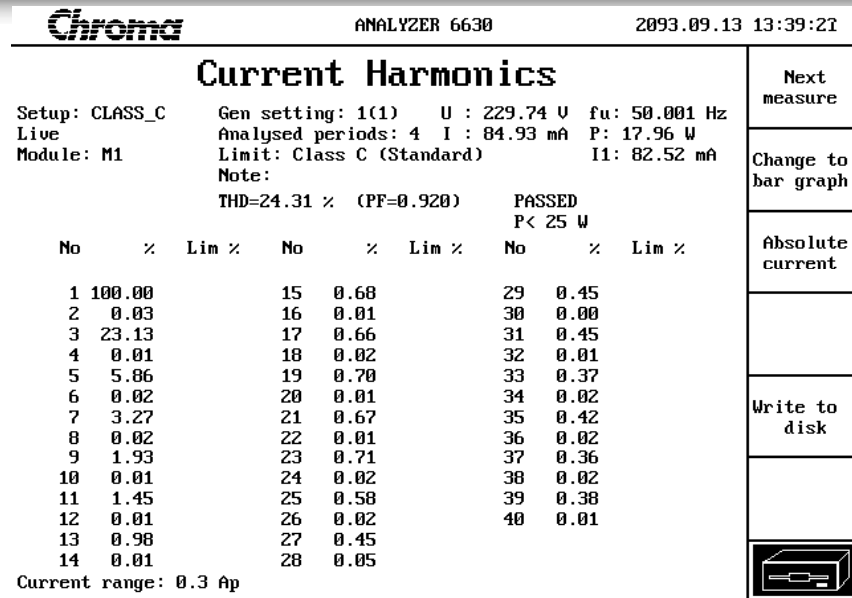
14. Turn On Delay Time



90V_{AC}, Full Load

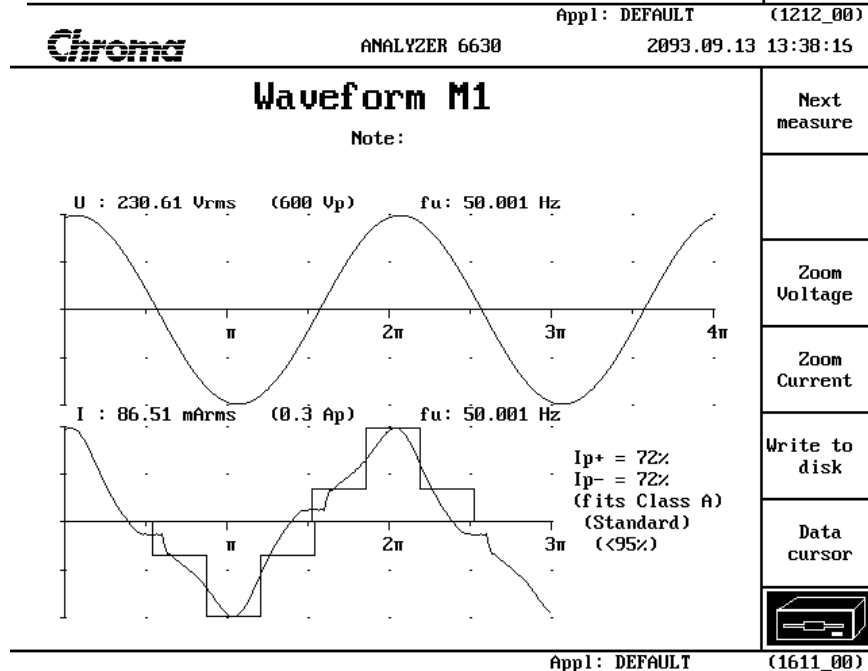
T_{ST_DELAY} = 165mS

15. Harmonic waveform



Harmonics current
@230Vac

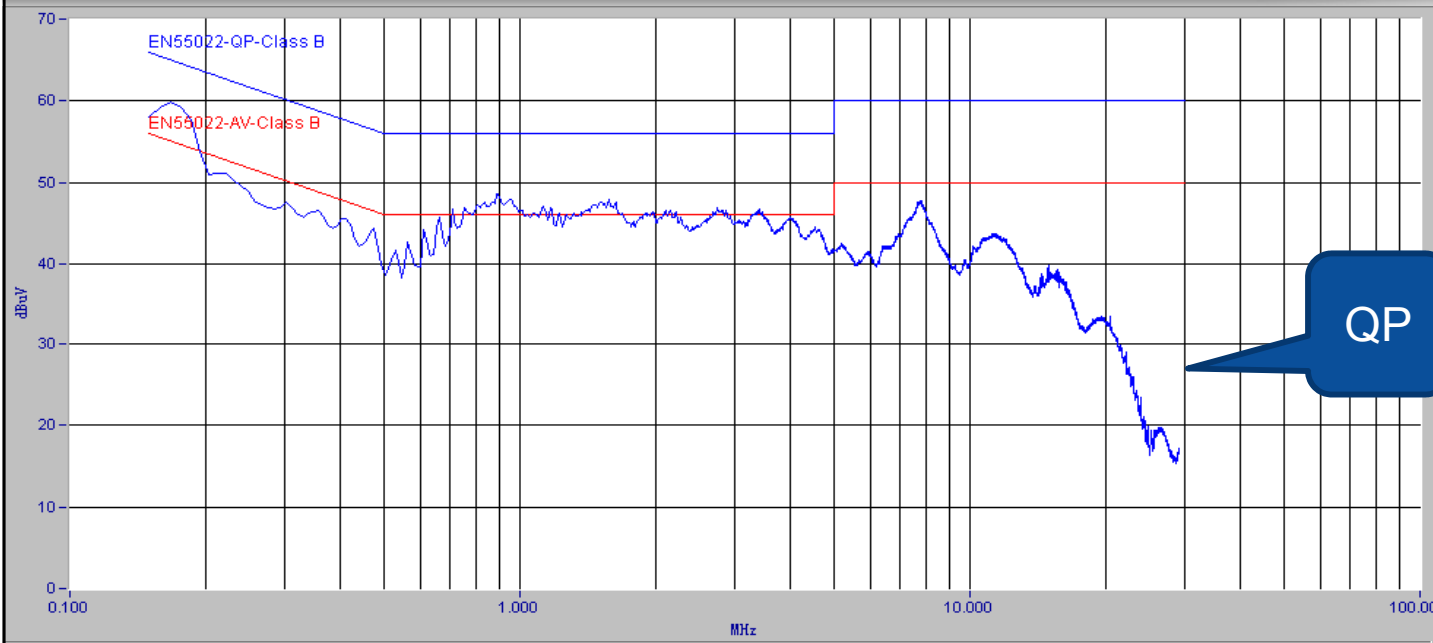
Meet IEC61000-3-2
requirement



Ac current waveform
@230Vac

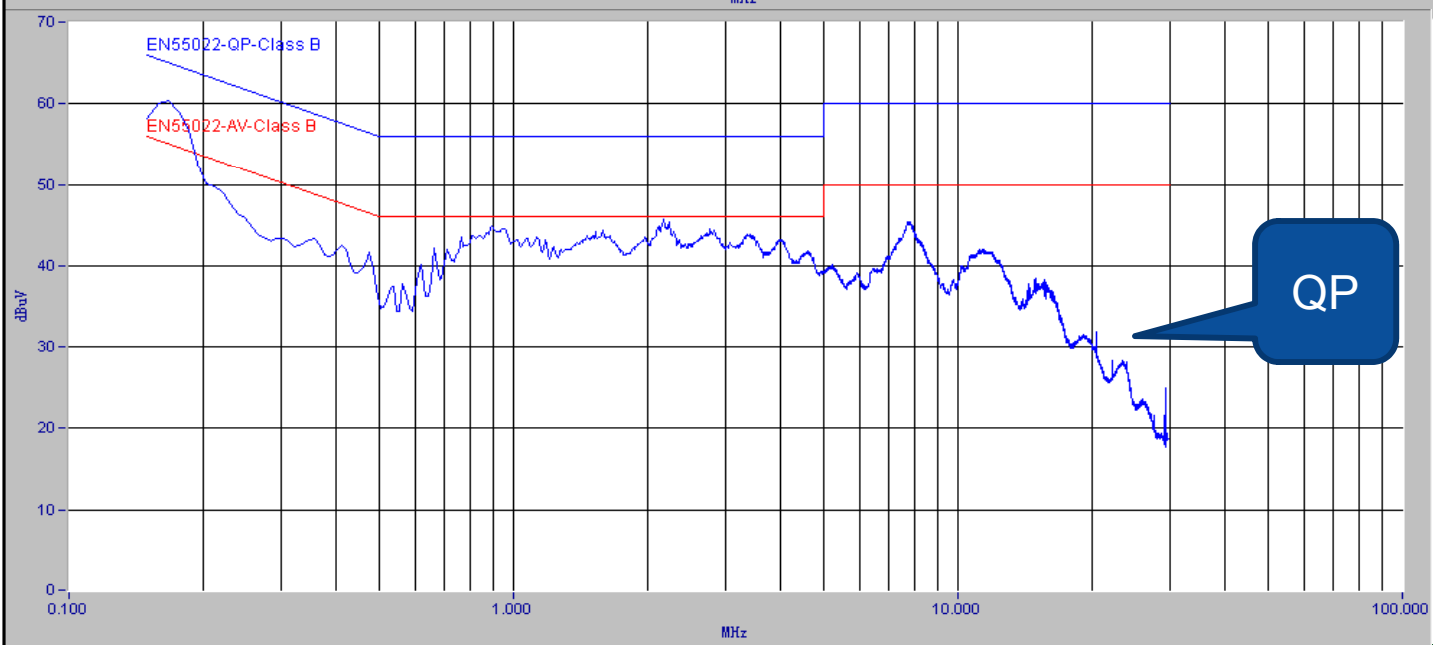
PF=0.928

16. Conducted EMI (Input 230Vac)



Peak Scan
QP Limit line

QP scan L
230V/50Hz, 12V 1.5A



Peak Scan
QP Limit line

Peak scan N
230V/50Hz, 12V, 1.5A

17. Radiated EMI (Input 230Vac)

