

LED Driver with iW1678
(Input 90~135Vac Output 100V/60mA)
EBC885

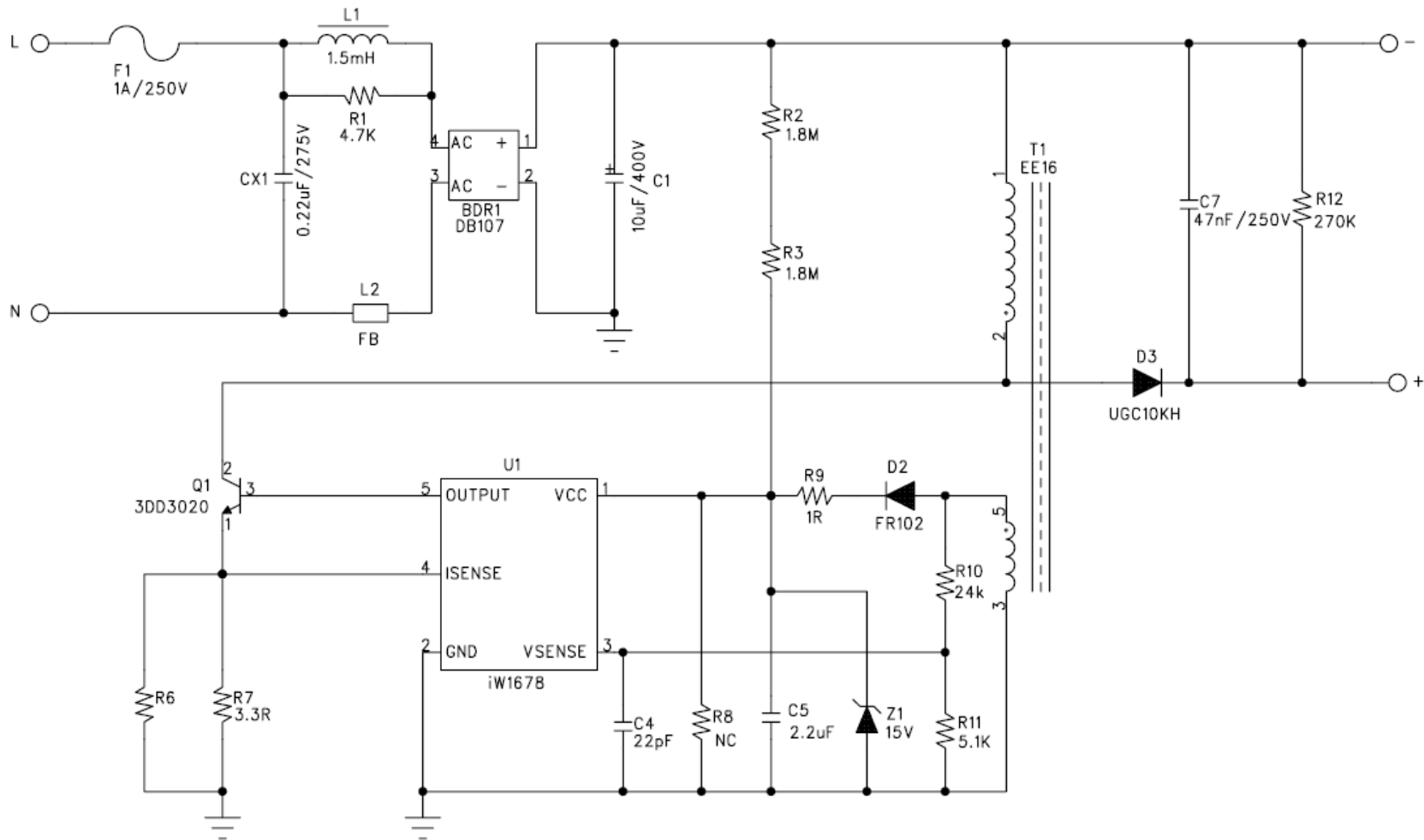
Summary and Features :

1. For Bulb LED lamp driver
2. LED driver, 100V, CC@0.06A ; AC input range @90-135Vac
3. For Non-isolated Applications
4. High Efficiency and Minimum Parts count
5. Meet EMI EN55015B-QP limits

1. Specification

Description		Symbol	Min	Typ	Max	Units	Comment
Input							
Voltage		V_{IN}	90	115	135	V _{AC}	2 Wire
Frequency		f_{LINE}	47	60	63	Hz	
Open-load Input Power (264V _{AC})				6		W	
Output							
Const Voltage	@ 0-60 m A	V_{OUT_CV}		90	110	V	Measured at the PCB connector
Const Current	@ 90--110V	I_{OUT_CV}		0.06		A	
Output Ripple Current						mA	Measured at the LED load
Continuous Output Power		P_{OUT}				W	
Output short circuit test		I_{OUT_MAX}				A	Auto-restart
Efficiency		η		88		%	Measured at end of PCB @ 115Vac
Others							
Turn on Delay Time				1		Sec	At rated input voltage <u>115</u> Vac
Inrush current				10		A	At rated input voltage <u>115</u> Vac
Hi-pot test						kV	<u>Isolated</u> / Non-isolated
Conducted EMI				Meets EN55015B			Floating / Grounding
Surge Test							Differential mode
Operation Temperature		T_{opr}			40	° C	Free convection, sea level

2. Schematic circuit



3. Bill of Material

Item	Qty.	Ref.	Description
1	1	F1	1A/250V FUSE Resistor
2	1	Q1	DD3020,1.5A800V
3	1	T1	EE-16
4	1	CX1	0.22uF/275V
5	1	L1	6*8mm 1.4mH
6	1	L2	FB SMD-0805
7	1	Q1	3020 TO-126
8	1	C1	10uF,400V E-CAP,105°C
9	1	C4	22pF,50V,SMD-0603
10	1	C5	2.2uF,25V,SMD-1206
11	1	D2	FR102,1A,200V,SMD,
12	1	D3	UGC10KH 1A 800V;SMD,recover time <35nS
13	1	R1	4.7KΩ +/-5%,SMD-0805
14	1	R12	270KΩ +/-5%,SMD-1206
15	2	R2,R3	1.8MΩ +/-5%,SMD-1206
16	1	C7	47nF/250V CBB CAP
17	1	R7	3.3Ω +/-1%,SMD-1206
18	1	R9	5.6Ω +/-1%,SMD-0805
19	1	R11	5.1KΩ +/-1%,SMD-0805
20	1	R10	24KΩ +/-1%,SMD-0805
21	1	Z1	ZD15V
22	1	U1	IW1678-00
23	1	BDR1	DB107

4. PCB Layout

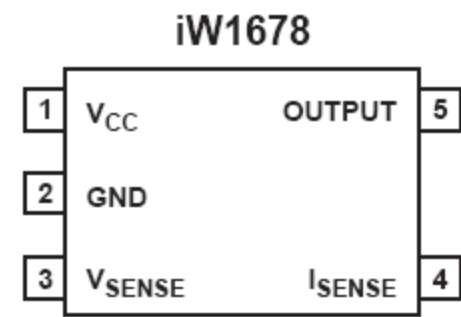
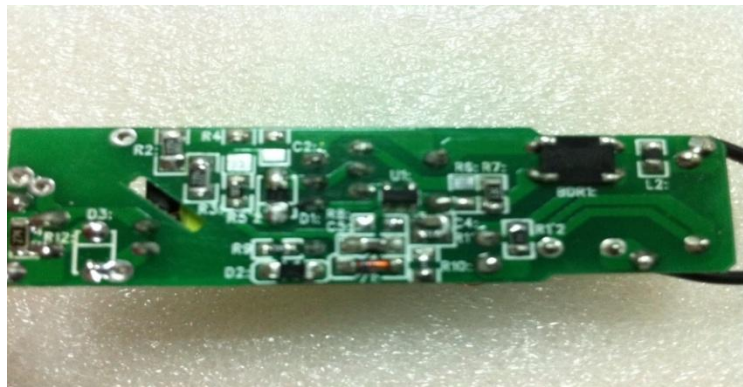
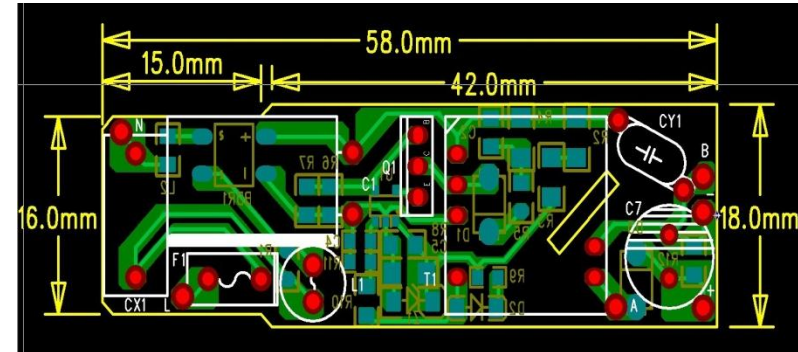
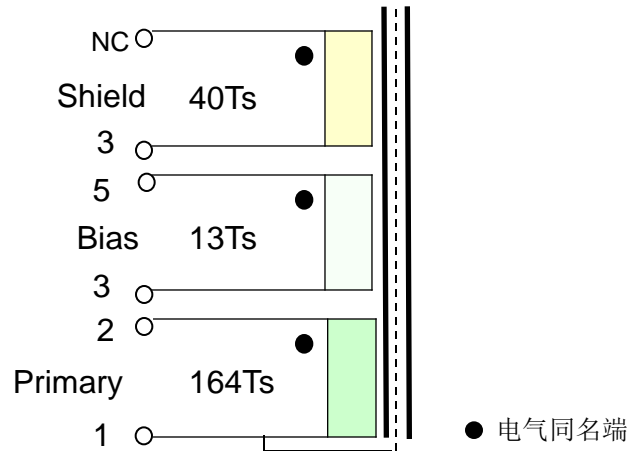


Figure 4.1: 5 Lead SOT-23 Package

5. Transformer Design

SCHEMATIC



ELECTRICAL SPECIFICATIONS:

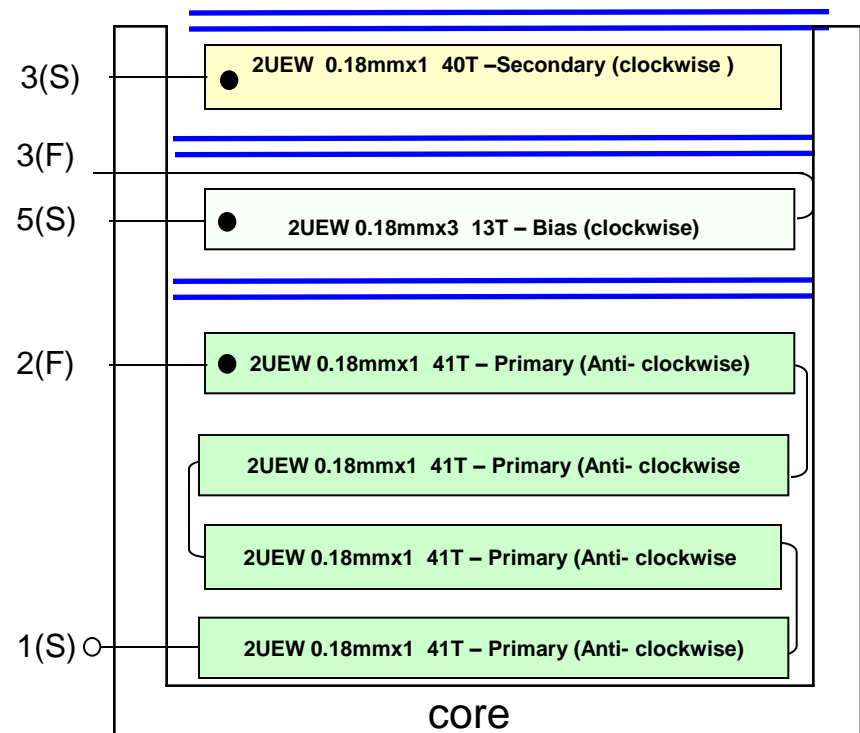
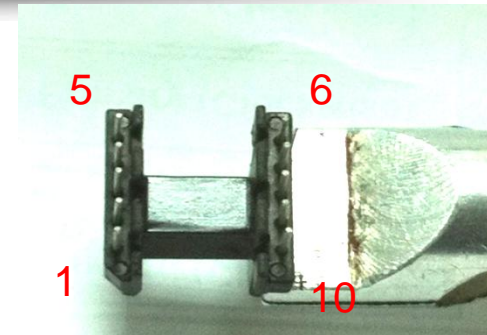
1. Primary Inductance (L_p) = 2.5mH @10KHz
2. Primary Leakage Inductance (L_k) ≤ 150uH @10KHz

MATERIALS:

1. Core : EE16 (Ferrite Material TDK PC40 or equivalent)
2. Bobbin : EE16
3. Magnet Wires : Type 2-UEW
4. Layer Insulation Tape : 3M1298 or equivalent.

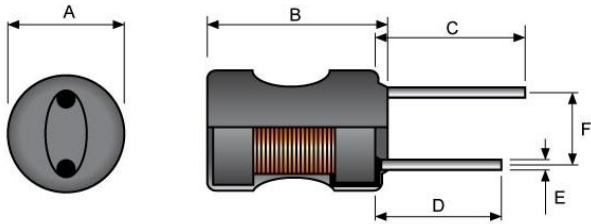
FINISHED :

1. Varnish the complete assembly
2. Core is connected to pin4 (primary ground)



6. Differential Mode Inductor

6.1 Differential Mode Inductor L1



Ferrite core size : Ax B 6x8mm

Wire gauge: 0.15mm, 230Turns

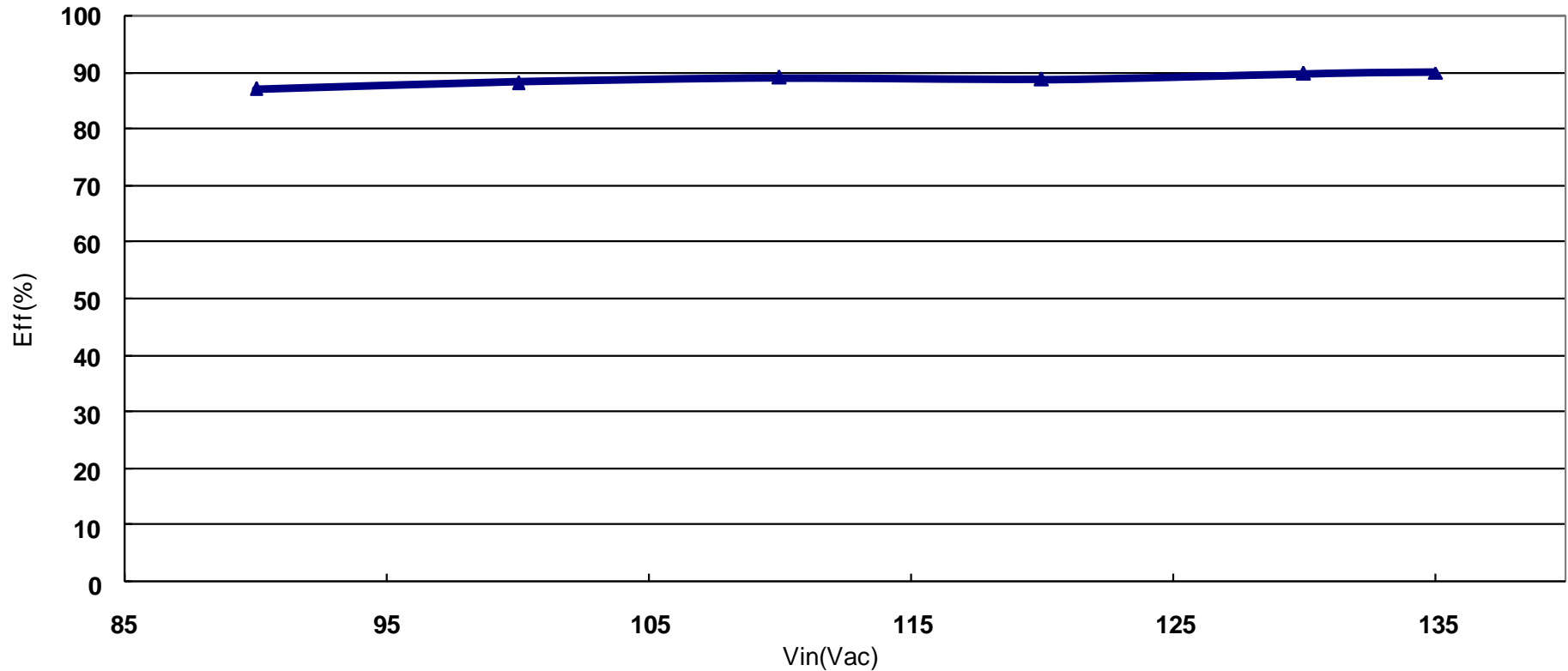
Inductance @10kHz, 1V: 1.4mH +/-20%

ICR: 2.5 OHM +/-20%

7.Constant Current and Efficiency

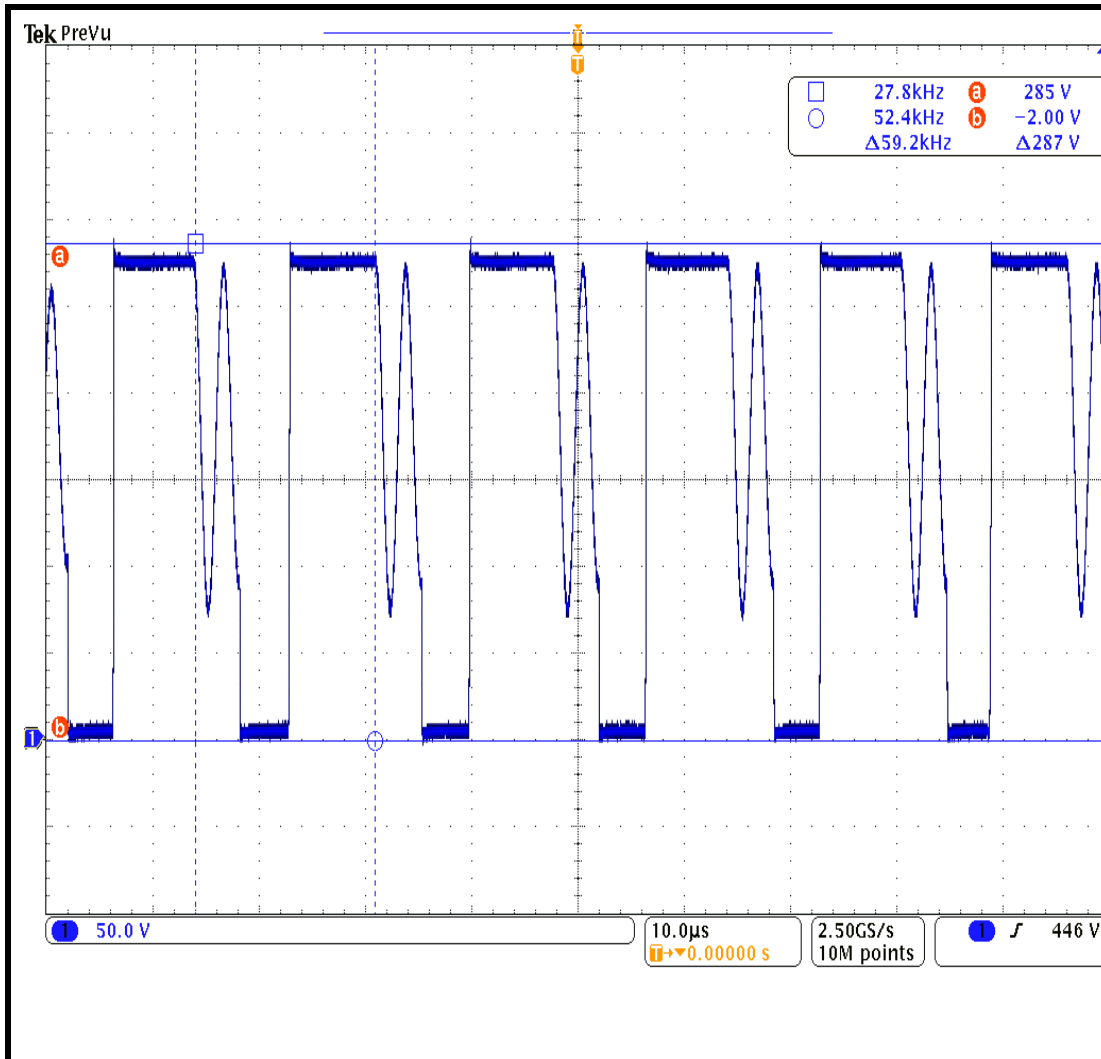
#of LEDs	Vin	Pin	Vout	Iout	efficiency	PF	Vcc
	(V)	(W)	(V)	(mA)			(V)
	90	6.77	99.13	59.4	86.98%	0.610	7.01
	100	6.83	100.20	60.3	88.46%	0.600	7.07
	110	6.99	101.00	61.2	88.43%	0.580	7.12
	115	6.72	99.80	59.9	88.96%	0.580	7.15
	120	6.72	99.80	60.2	89.40%	0.570	7.19
	135	6.85	100.20	61.6	90.12%	0.550	7.30

8. Efficiency Vs Input Voltage



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

9. V_{diode} waveform



Test Condition:

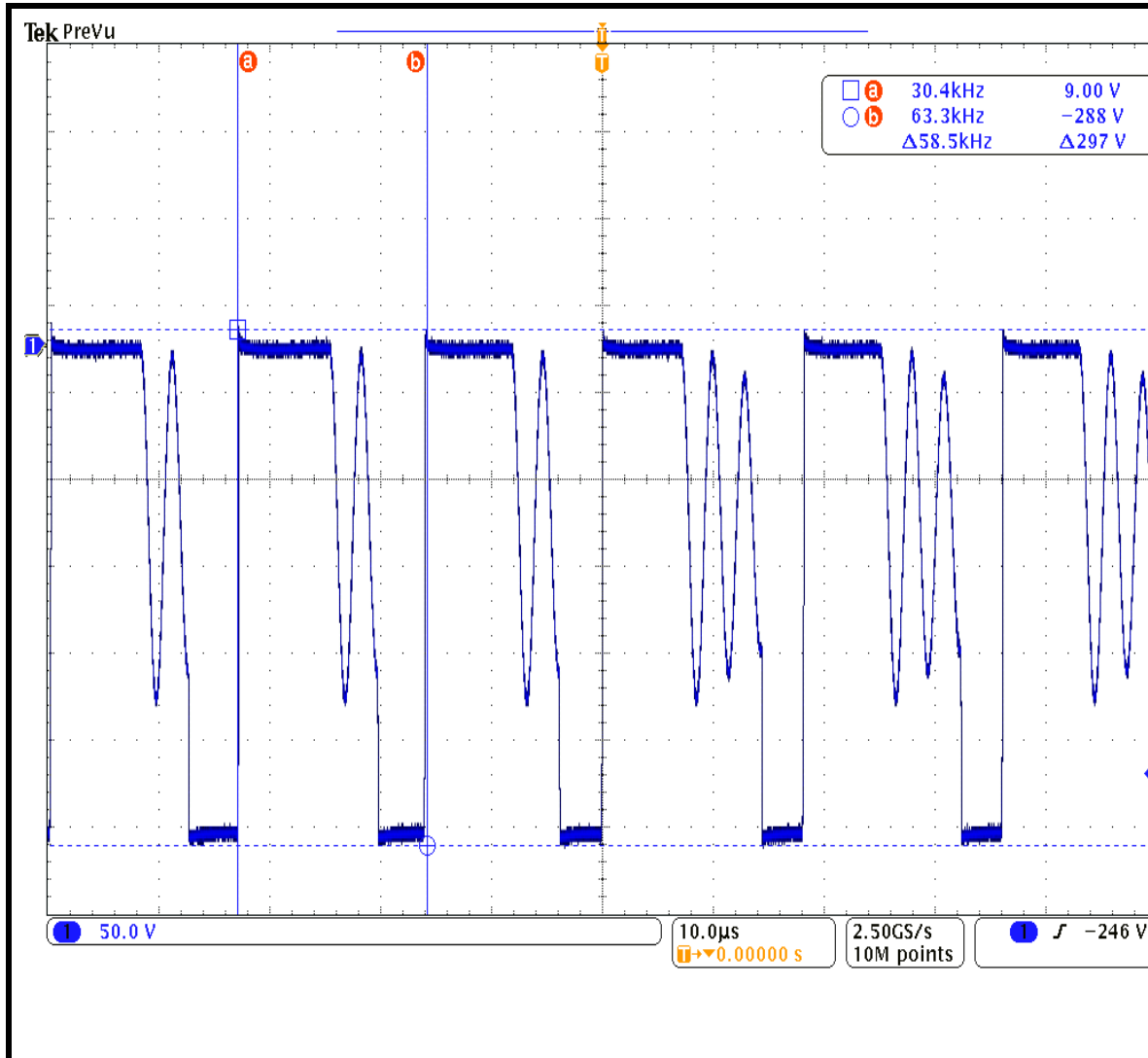
$V_{\text{IN}}=135\text{VAC}$,
 $I_{\text{out}}=60\text{mA}$

Result:

$V_{\text{R}} (\text{pk-pk})=287\text{V}$

Output rectifier diode:
UGC10KH, 1A, 800V

10. V_{CE} waveform



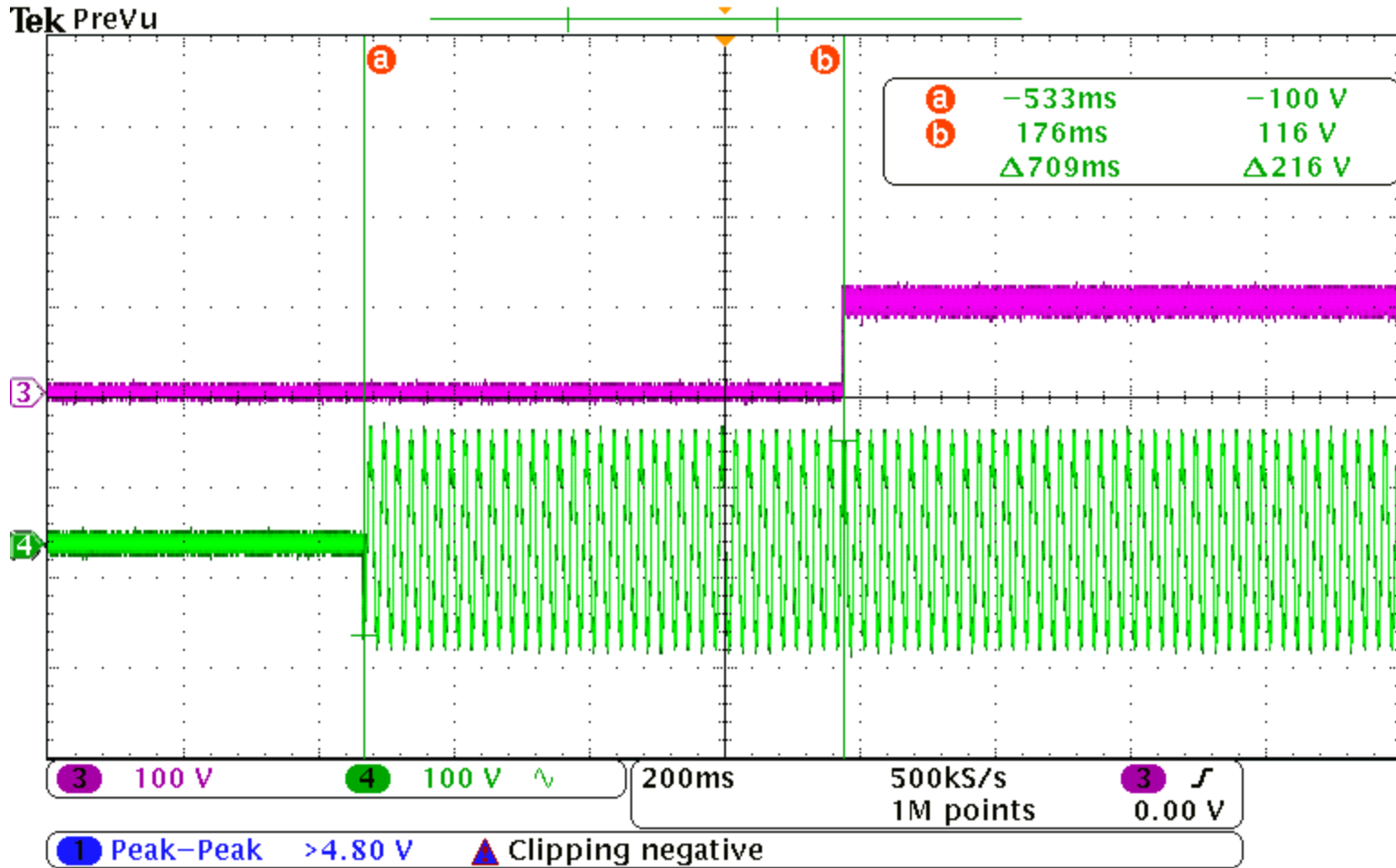
Test Condition:

$V_{IN}=135VAC$,
 $I_{out}=60mA$

Result:

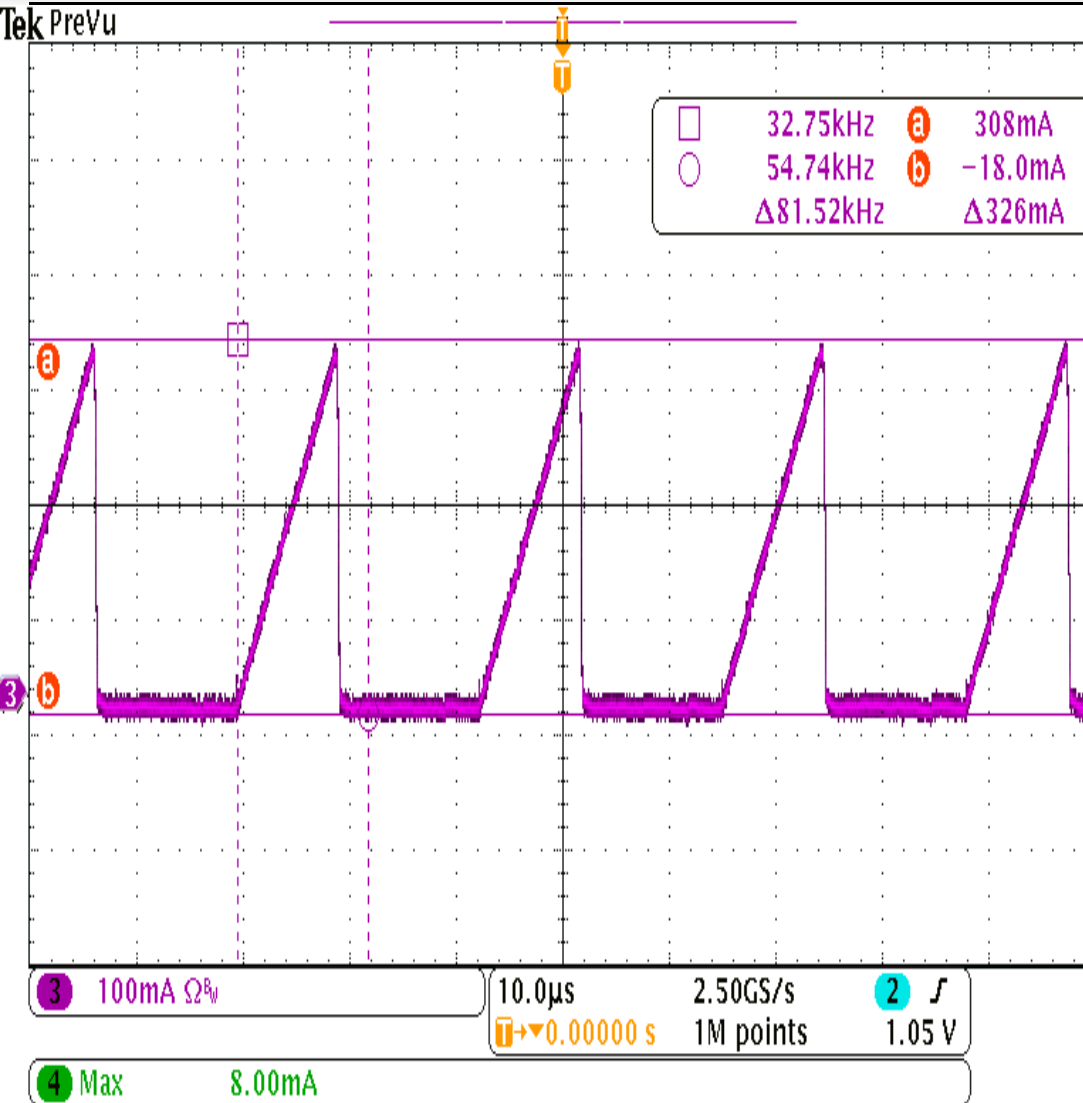
V_R (pk—pk)=**297V**

11. Turn on delay time



Vin 90V Turn on delay time 0.709S

12. Transformer Flux Density



Transformer information: $N_p = 164$ Ts,
 $L_p = 2.5$ mH, $A_e = 18.4$ mm² (EE-16)

I_p is monitored at 90Vac and 60mA
load (Max Output Power).

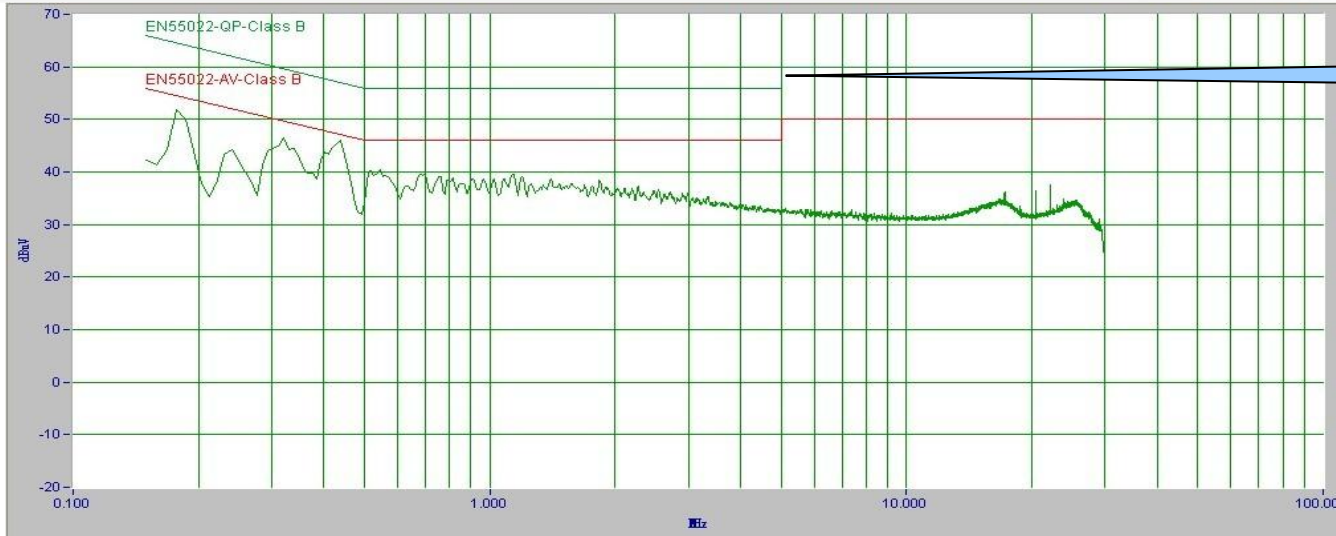
$I_p = 326$ mA

$$B_{MAX} = (I_p * L_p) / (N_p * A_e)$$

$$= (326 * 2.5) / (164 * 18.4)$$

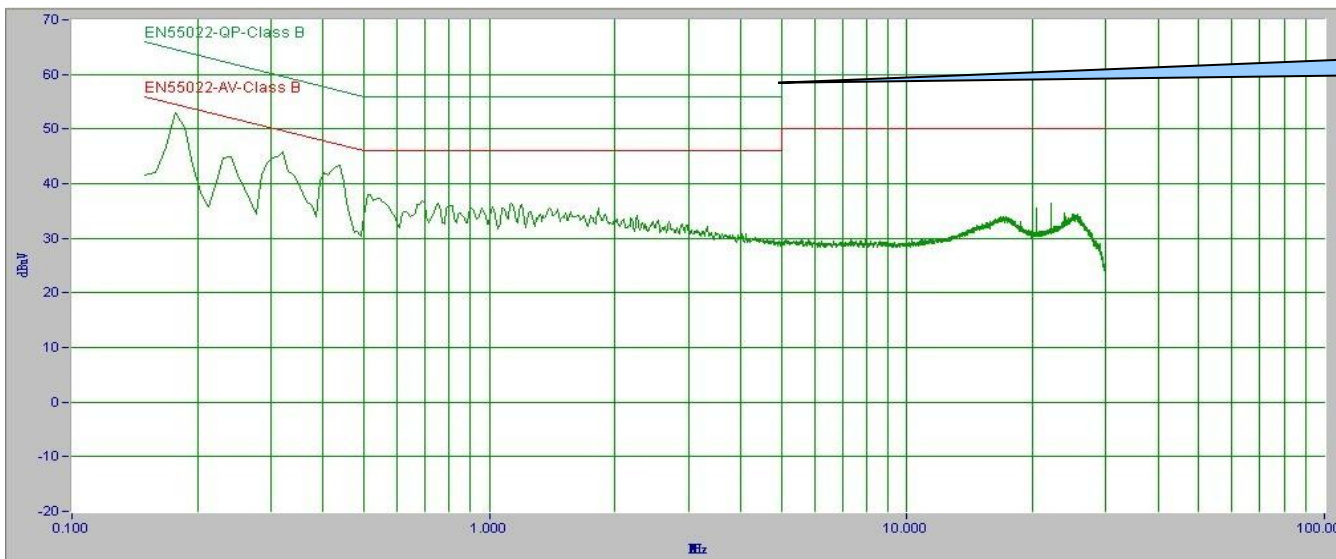
= 0.270 Tesla

13. Conducted EMI



Input=115VAC
L line QP scan

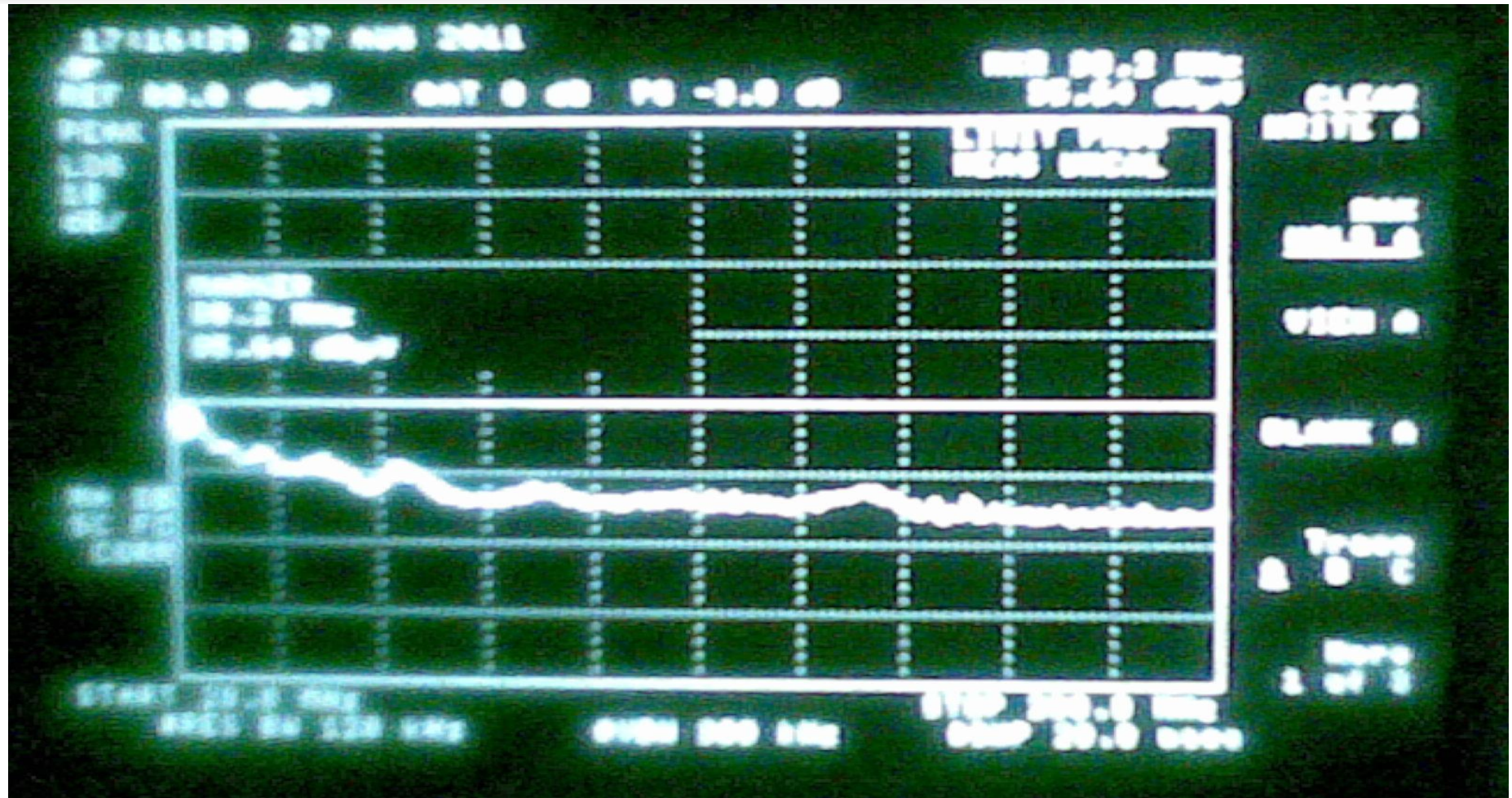
$V_{IN}=115V_{AC}/60Hz$, Live



Input=115VAC
N line QP scan

$V_{IN}=115V_{AC}/60Hz$, Neutral

14. Radiated EMI (Input 115Vac)



Input 115vac 60Hz