



FT831B 3W9.6V0.3A LED Driver Design Example Report

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1 SUMMARY AND FEATURES

- Input: 90VAC-264VAC
- Output: 12V, CC@ 300mA
- Efficiency >70%
- Accurate primary-side constant voltage/constant current (CV/CC) controller eliminates secondary side control and optocoupler
- $\pm 5\%$ output voltage and $\pm 5\%$ output current accuracy including line, load, temperature and component tolerance
- Auto-restart output short circuit and open-loop protection
- No-load consumption <250 mW
- Easy compliance to EN55015 Class B EMI

2 INTRODUCTION

This engineering report describes the design for a universal input, 12V, 300 mA CV/CC power supply for LED driver applications. This power supply utilizes the FT831B.

This report contains the power supply and transformer specifications, schematics, bill of materials, and typical performance characteristics pertaining to this power supply.

3 PROTOTYPE PHOTO

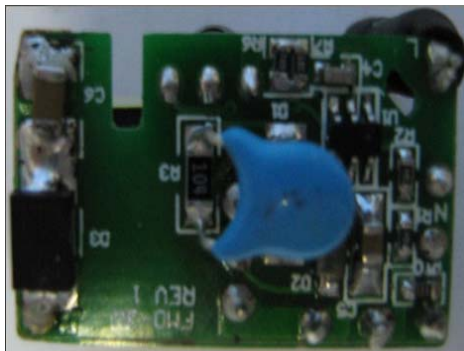


Figure 1: Prototype Photo

6 PCB LAYOUT

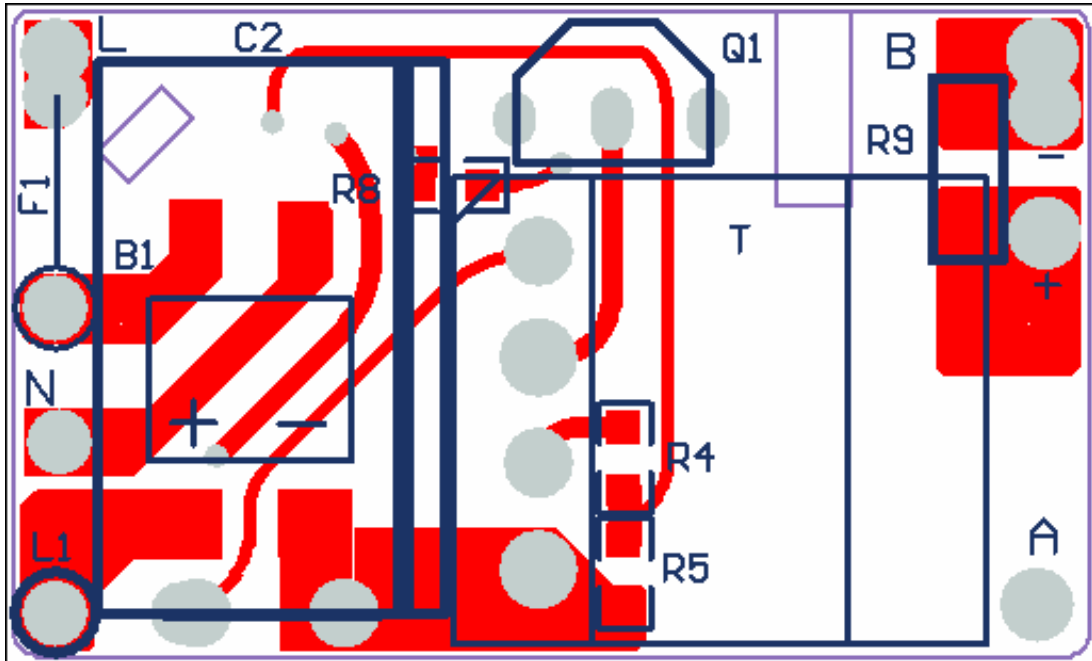


Figure 3: Top View

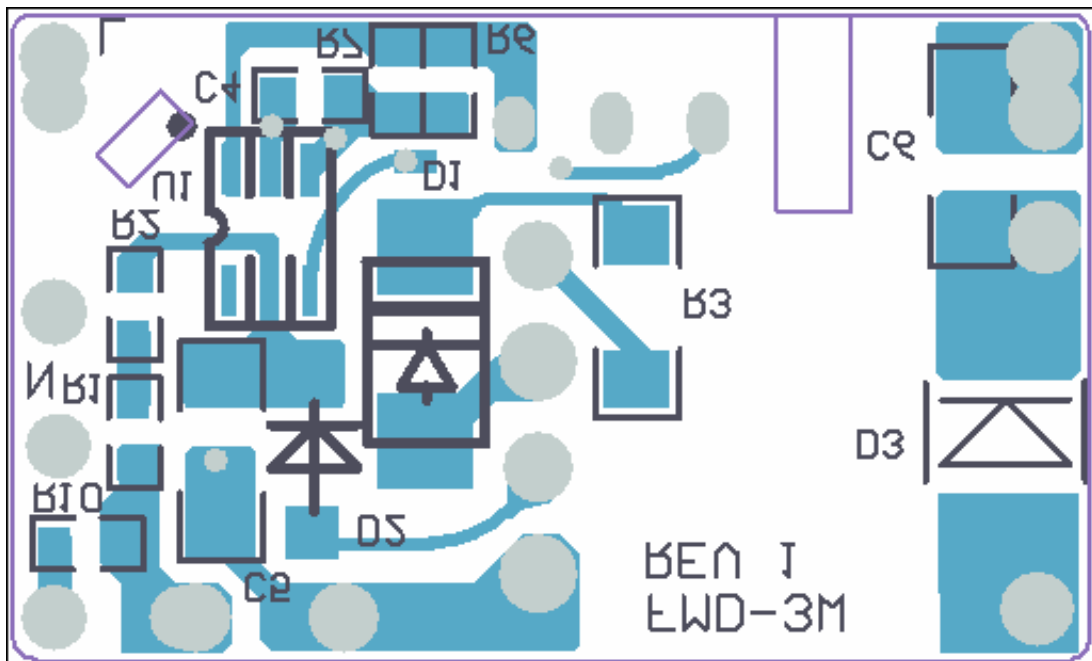


Figure 4: Bottom View

7 BILL OF MATERIALS

Ref Des.	Description	Package	Part Num.	QTY
U1	IC	SOT23-6	FT831B	1
F1	0.5A250Vac,Fuse	3.6x10mm		1
B1	0.5A600V,Bridge	SOIC-4	DB6S	1
L1	3.3mH,Inductor	4x10mm		1
Q1	1.5A700V,NPN	TO-92	13003	1
T	Transformer	EE11		1
C2	4.7uF400V,Electrolytic	8x12.5mm	RS1M	1
C3	470pF1kv,Disc Ceramic		RS1006FLH	1
C4	100pF25V,1%,Ceramic,X7R	0603	ES2C	1
C5	3.3uF25V,5%,Ceramic,X7R	0805		1
C6	10uF25V,5%,Ceramic,X7R	1206		1
D1	1A1kV,Fast Recovery Rectifier	DO-214AC	RS1M	1
D2	1A600V,Fast Recovery Rectifier	DO-219AB	RS1006FLH	1
D3	2A400V,Super Fast Recovery Rectifier	DO-214AA	ES2C	1
R1,R2	560k,1/16W,5%,Metal Film	0603		2
R3	100k,1/4W,5%,Metal Film	1206		1
R4	18k,1/16W,5%,Metal Film	0603		1
R5	12k,1/16W,5%,Metal Film	0603		1
R6	3R9,1/16W,1%,Metal Film	0603		1
R7	6R8,1/16W,1%,Metal Film	0603		1
R8	20,1/16W,5%,Metal Film	0603		1
R9	3k3,1/16W,5%,Metal Film	0603		1
R10	12k,1/16W,5%,Metal Film	0603		1

Table 2

8 TRANSFORMER SPECIFICATION

A) Electrical diagram

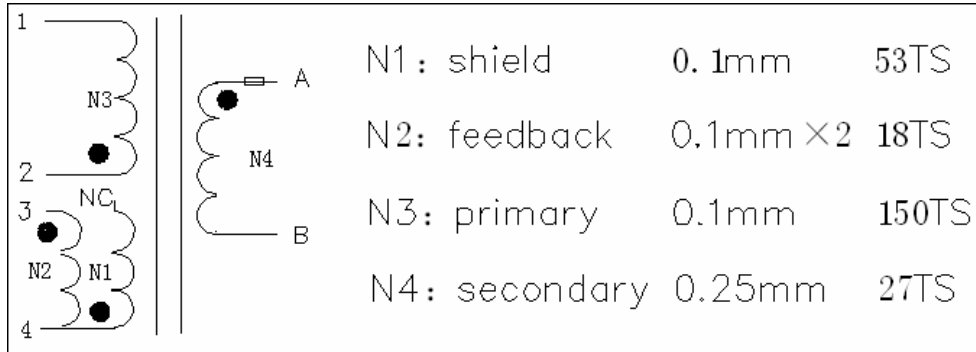


Figure 5

B) Electrical Specifications

- (1) Primary Inductance: $L=2000 \pm 200 \mu\text{H}$ (1KHZ, 0.25V, SER)
- (2) HI-POT: N1/N2/N3-N4: 3KVAC 5mA 3Sec
- (3) Primary Leakage Inductance: $L_2 < 750 \mu\text{H}$ (1KHZ, 0.25V, SER)

C) Materials

- (1) Core: PC40;
- (2) Bobbin: Horizontal 8 pin EE11;

D) Transformer Build Diagram

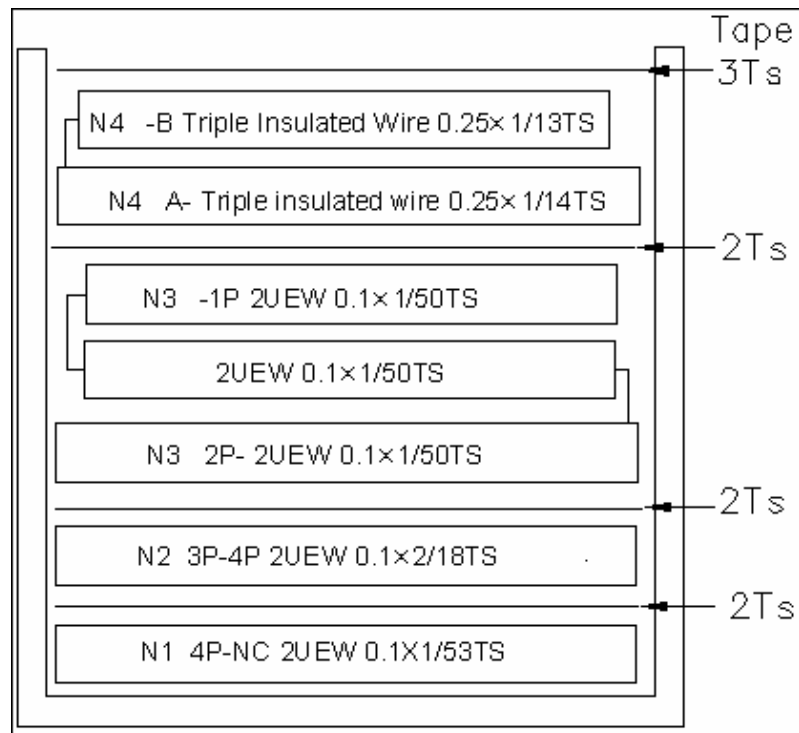


Figure 6

9 PERFORMANCE DATA

All measurements were taken at room temperature, 50 Hz input frequency.

A) Efficiency with LED Load – Full Load

This data was taken using three 350 mA, 3.2 V LEDs connected in a series string.

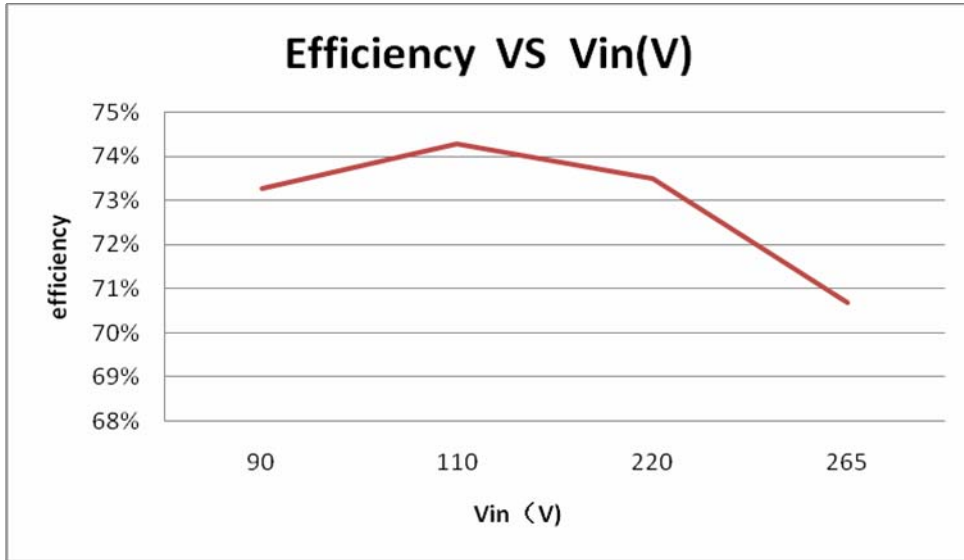


Figure 7

B) Line Regulation

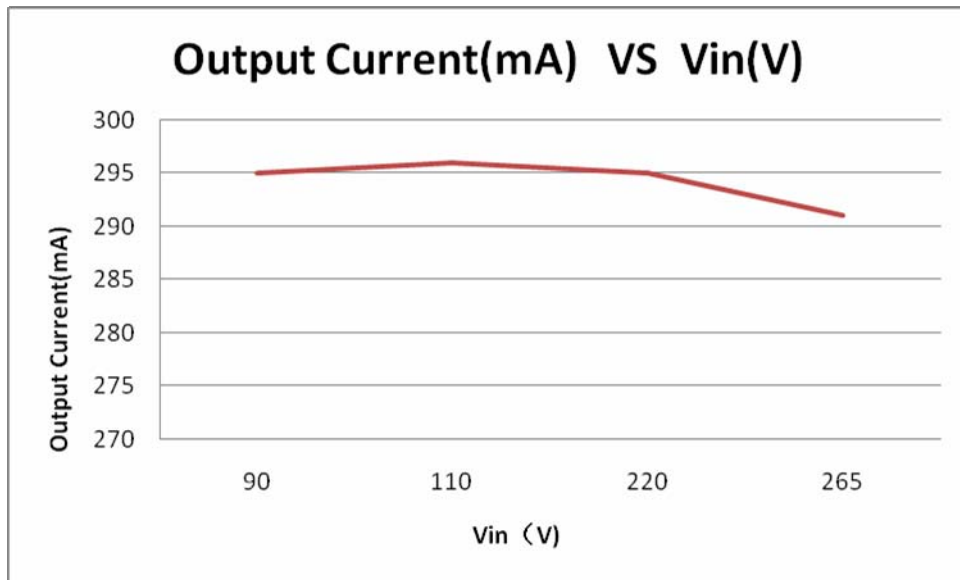


Figure 8

10 WAVEFORMS

A) Output Voltage Ripple

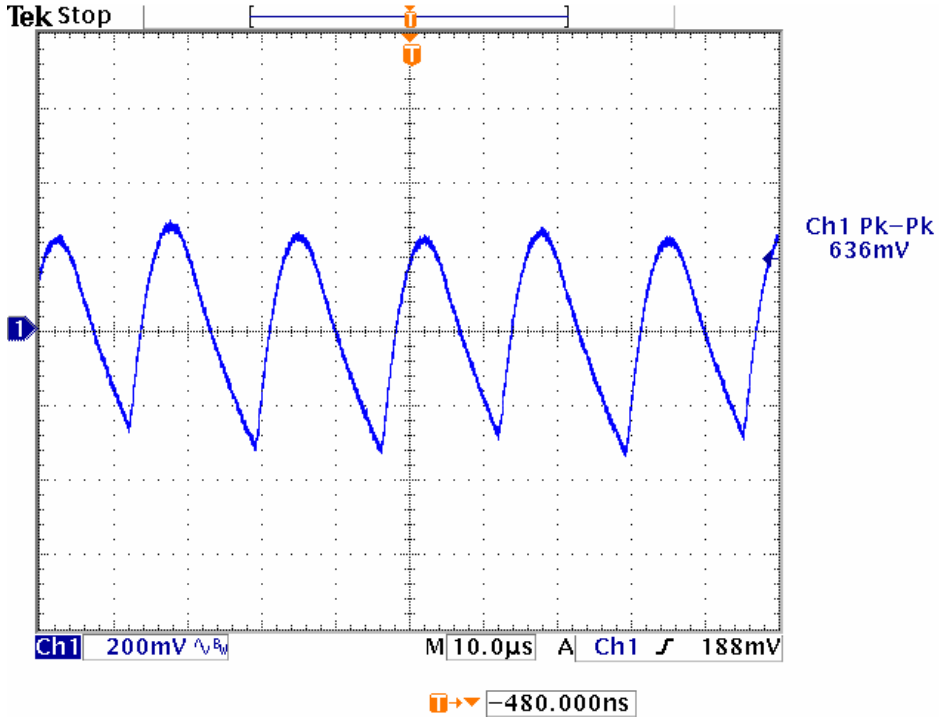


Figure 9: Output Ripple and Noise at 85Vac Input and Full Load

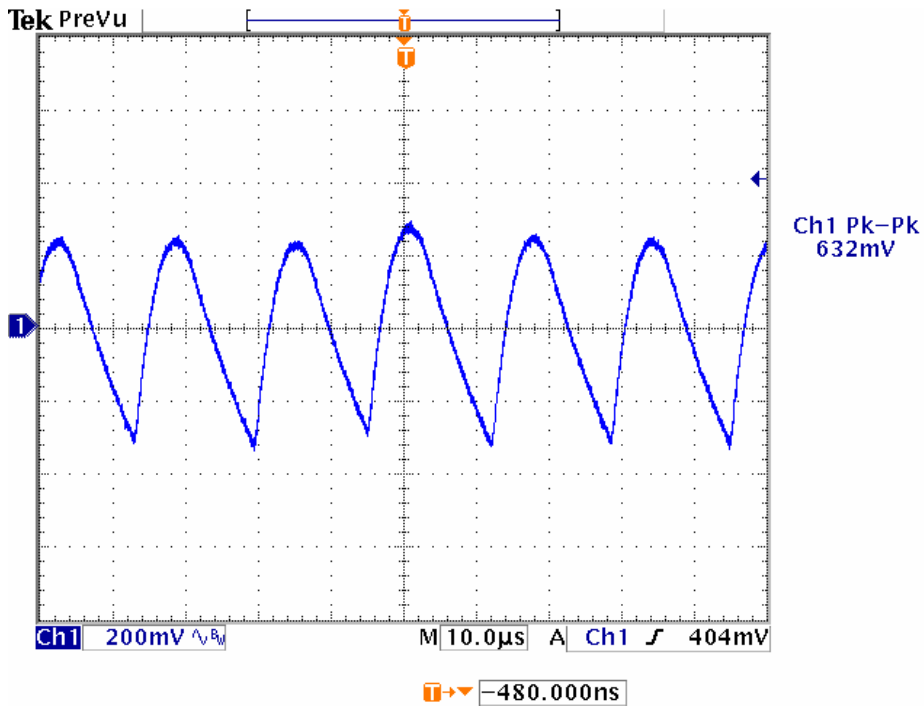


Figure 10: Output Ripple and Noise at 264Vac Input and Full Load

B) Output Current Ripple

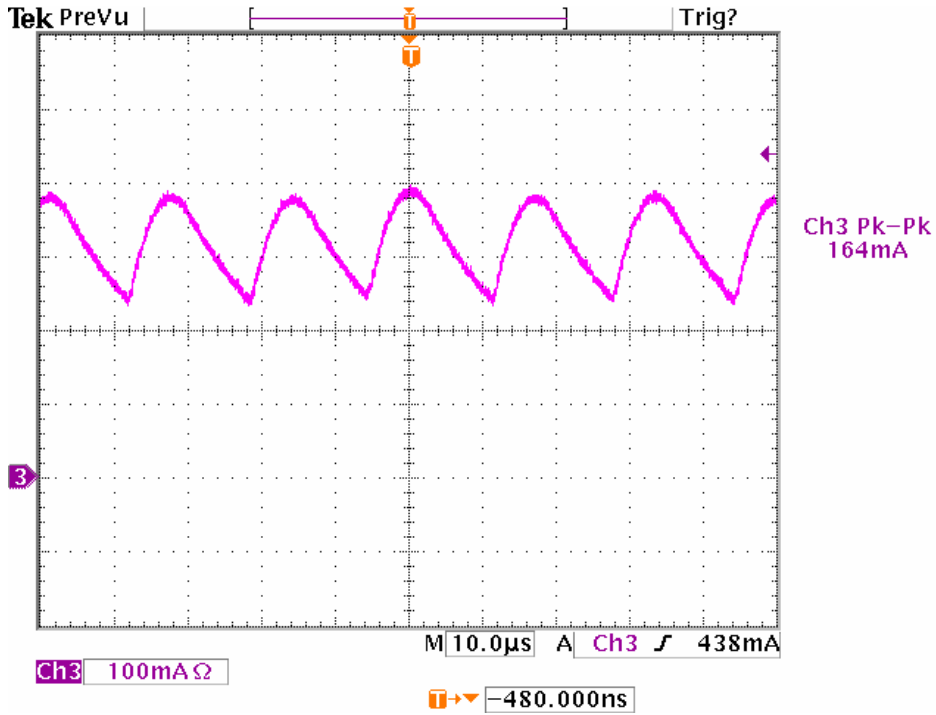


Figure 11: Output Current Ripple at 115Vac and Full Load

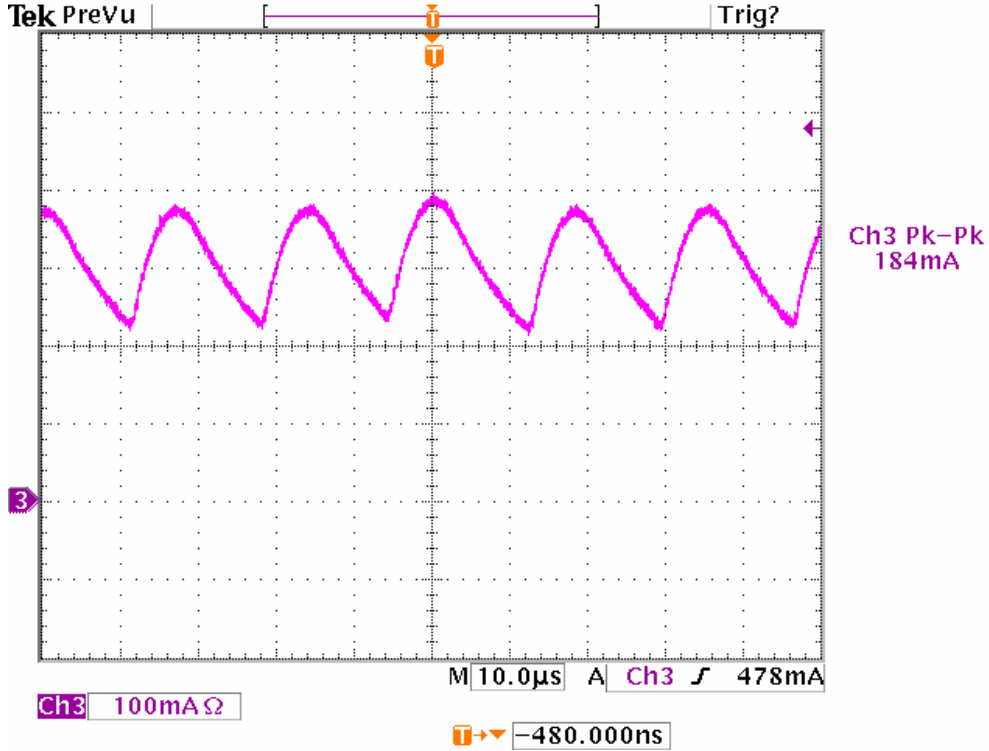


Figure 12: Output Current Ripple at 230Vac and Full Load

C) Output Voltage Startup Profile

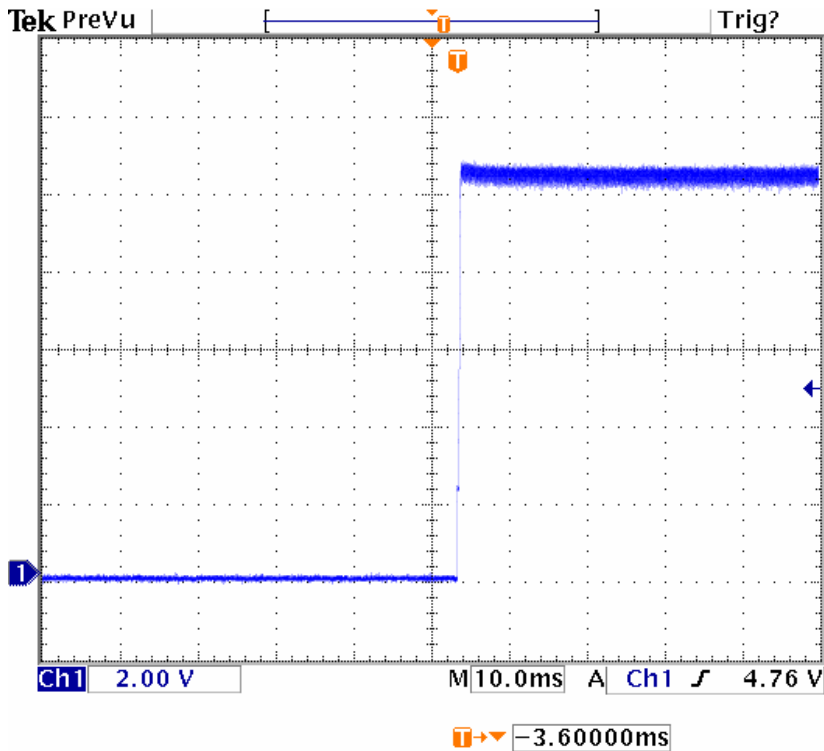


Figure 13: Output Voltage at Startup (115Vac), Full Load

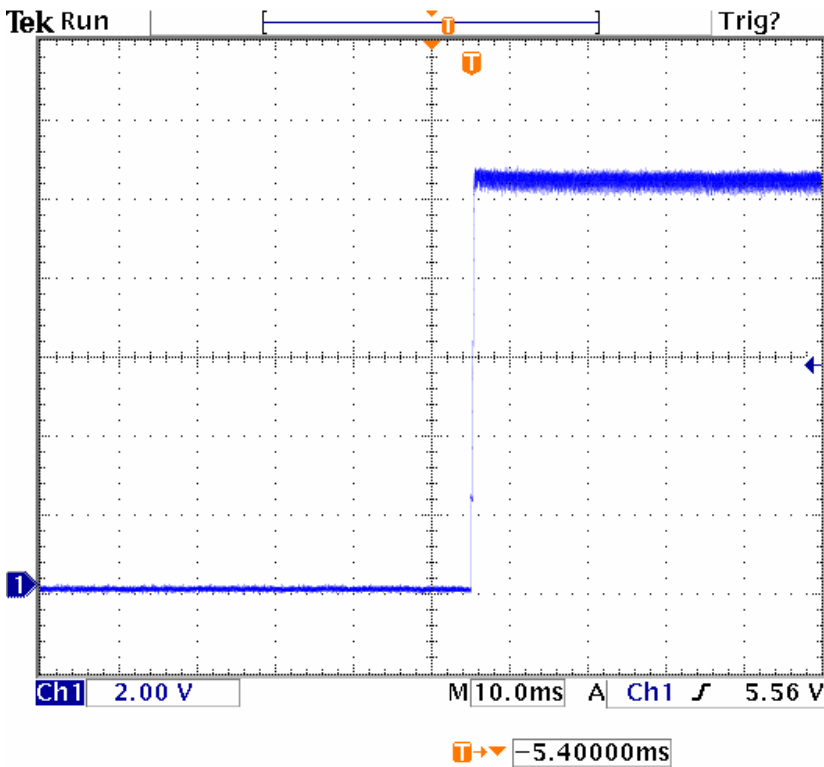


Figure 14: Output Voltage at Startup (230Vac), Full Load

D) Output Current Startup Profile

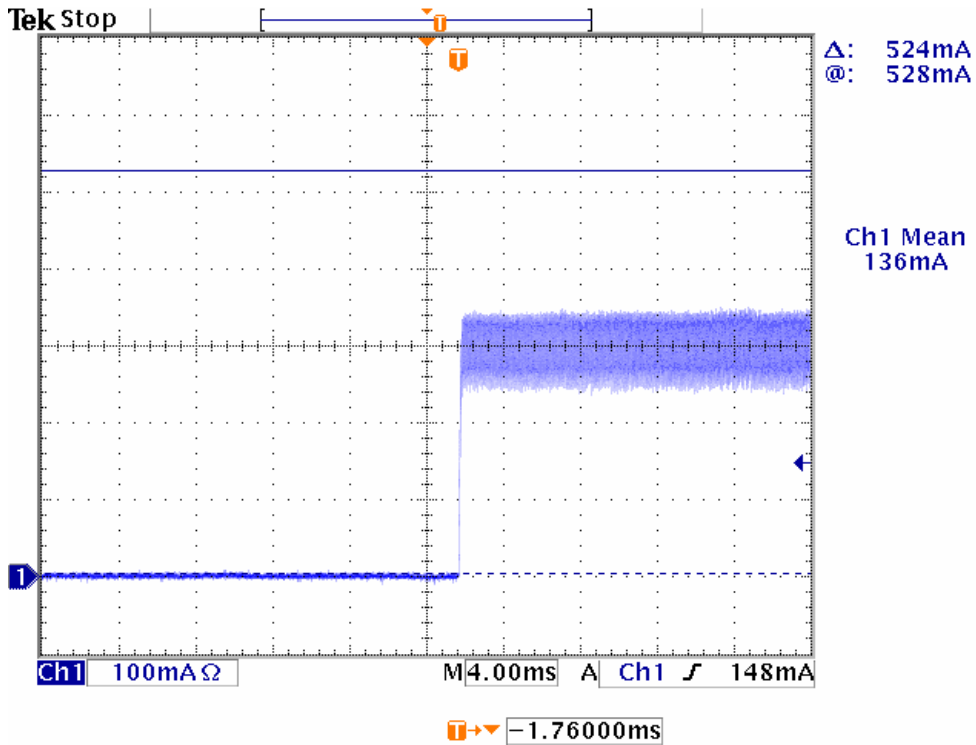


Figure 15: LED Current at 115Vac, Full Load

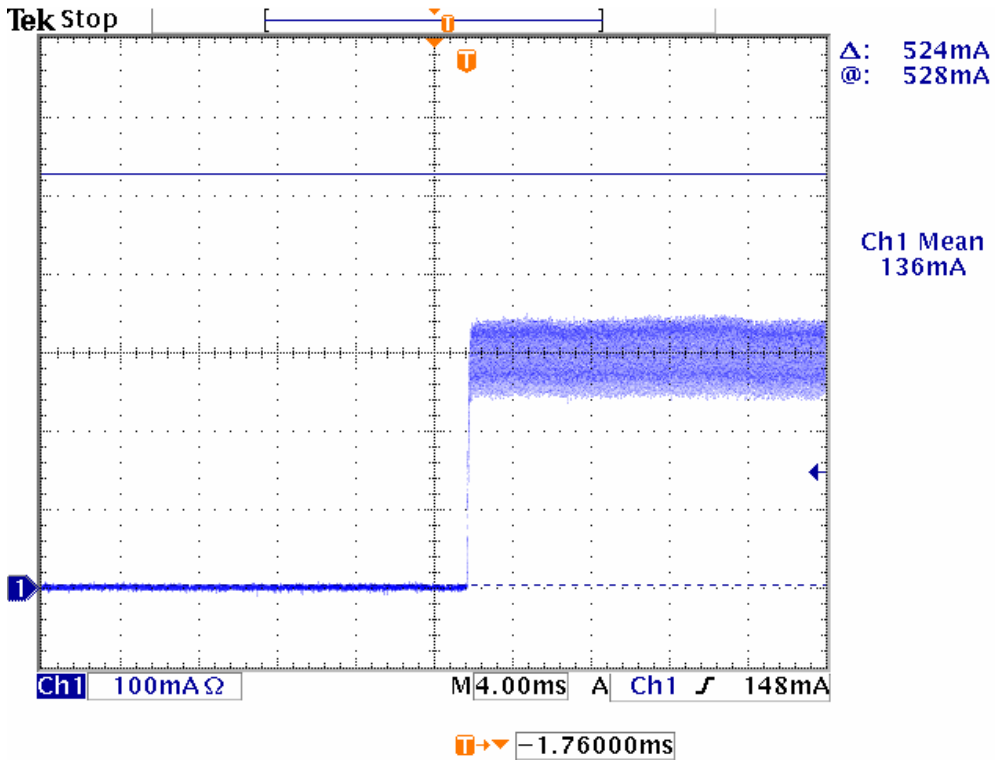


Figure 16: LED Current at 230Vac, Full Load

E) 10.5 Drain Voltage

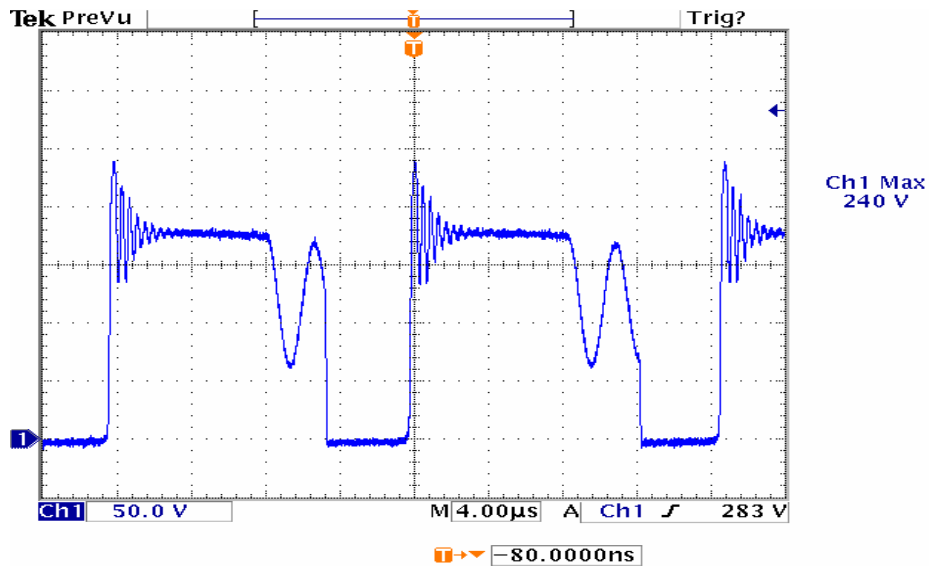


Figure 17: Collector Voltage at 85Vac

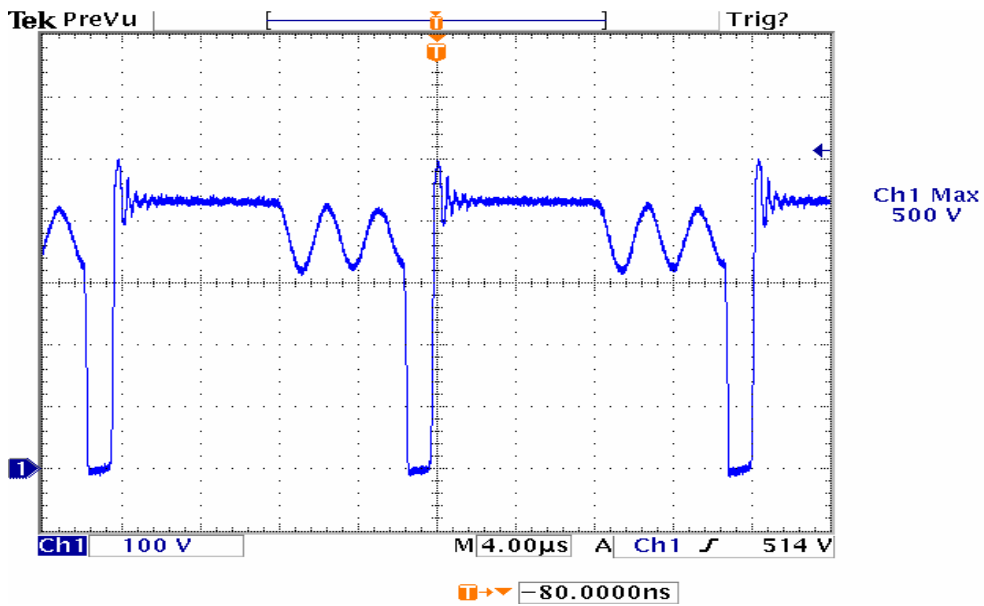


Figure 18: Collector Voltage at 264Vac

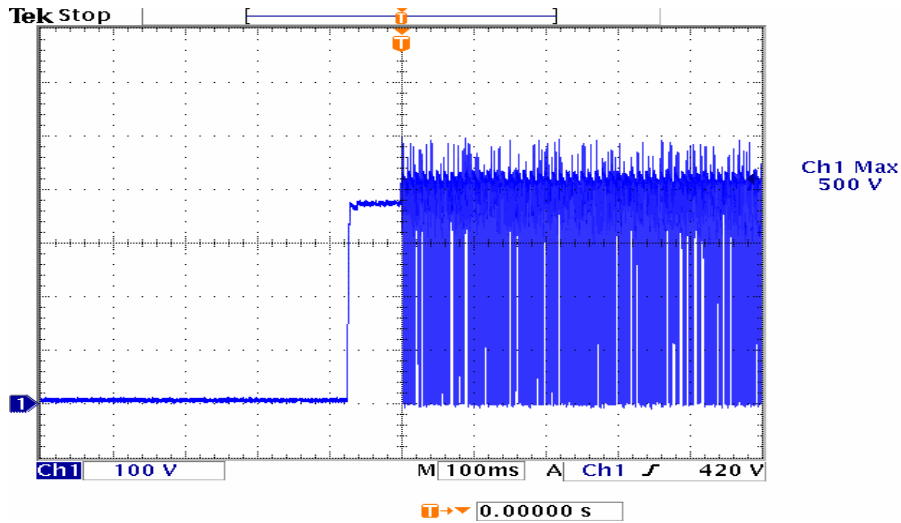


Figure 19: Collector Voltage during startup at 264Vac

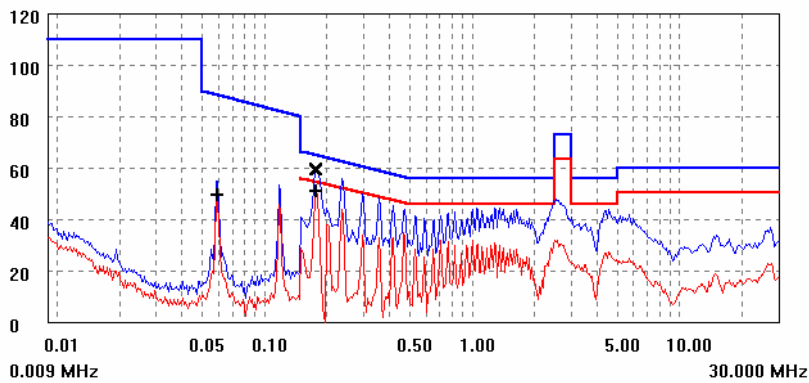
11 CONDUCTED EMI

EMI TEST REPORT

Organization: EMD	Operator: fx	EUT:	parameter
Place:	Time: 2009/9/10/18:23		
Detector: PK+AV	Test-time(ms): 30		
Limit: EN55022B	Transducer: PK		
Remark:			

Start(MHz)	End(MHz)	Step(MHz)	freq, step
0.009	0.150	0.000	
0.150	2.000	0.005	
2.000	10.000	0.010	
10.000	30.000	0.025	

dBuV scan result



(QP)	freq(MHz)	lev(dBuV)	Lim(dBuV)	Δ(lev-Lim)	final test
	0.177	59.3	65.2	-5.9	
(AV)	freq(MHz)	lev(dBuV)	Lim(dBuV)	Δ(lev-Lim)	
	0.059	49.0	0.0	49.0	
	0.178	50.9	55.2	-4.3	

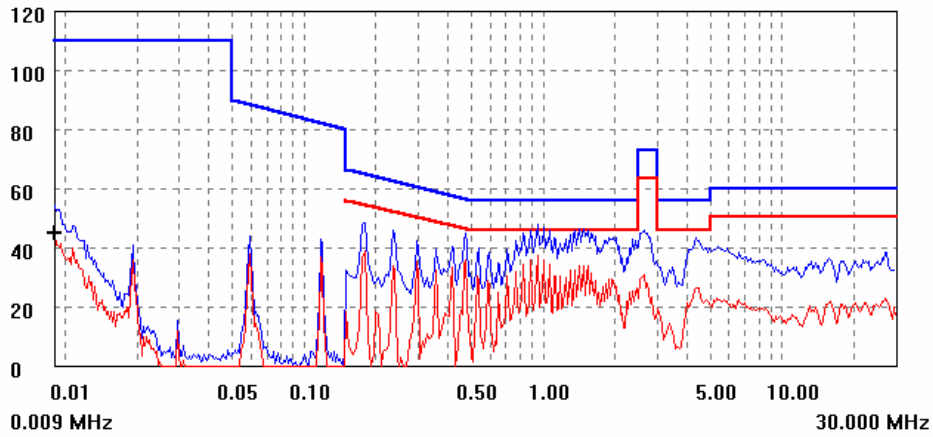
Figure 20: Vin = 120V Full load

EMI TEST REPORT

Organization: EMD	Operator: fx	EUT:	parameter
Place:	Time: 2009/9/10/18:29		
Detector: PK+AV	Test-time[ms]: 30		
Limit: EN55022B	Transductor: PK		
Remark:			

Start[MHz]	End[MHz]	Step[MHz]	freq, step
0.009	0.150	0.000	
0.150	2.000	0.005	
2.000	10.000	0.010	
10.000	30.000	0.025	

dBuV scan result



final test

[AV]	freq[MHz]	lev[dBuV]	Lim[dBuV]	Δ(lev-Lim)
	0.009	44.9	0.0	44.9

Figure 21: Vin = 230V Full load