

Title	GT5311 I Version AVT Report
Application	LED
Electrical Spec	Input 90~264Vac, 3W 10V/300mA LED
Author	Application Engineering Department
Document NO.	
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Revision	

Feature:

- **Cost effective solution for low cost LED Lamp**
- **Primary side controller, eliminate Opto-Coupler and secondary circuit**
- **Accurate CC regulation versus Line and Load variation**
- **Small size for GU10/E27**
- **Short Circuit Protection and Open load Protection**

Prepare By AE/FAE	Approval By AE/FAE Leader	Approval By PM	Approval By MKT/Sales

1. Introduction

This manual describes a 3W 10V/300mA constant current universal input power supply for LED driver applications. The system design is based on Giantec's cost effective Primary Side Regulation (PSR) controller, GT5311. Very tight output constant current regulation is realized by GT5311 patented current sampling technology eliminating Opto-coupler and secondary CC control circuit. Programmable Lm and VIN variation compensation could guarantee the CC requirements in mass production. The system always works in discontinued current mode. Designed PFM/PWM multi-mode operations and proprietary Sleeping-mode are utilized to achieve low Power loss, high efficiency. The frequency jittering could also greatly reduce EMI filter cost.

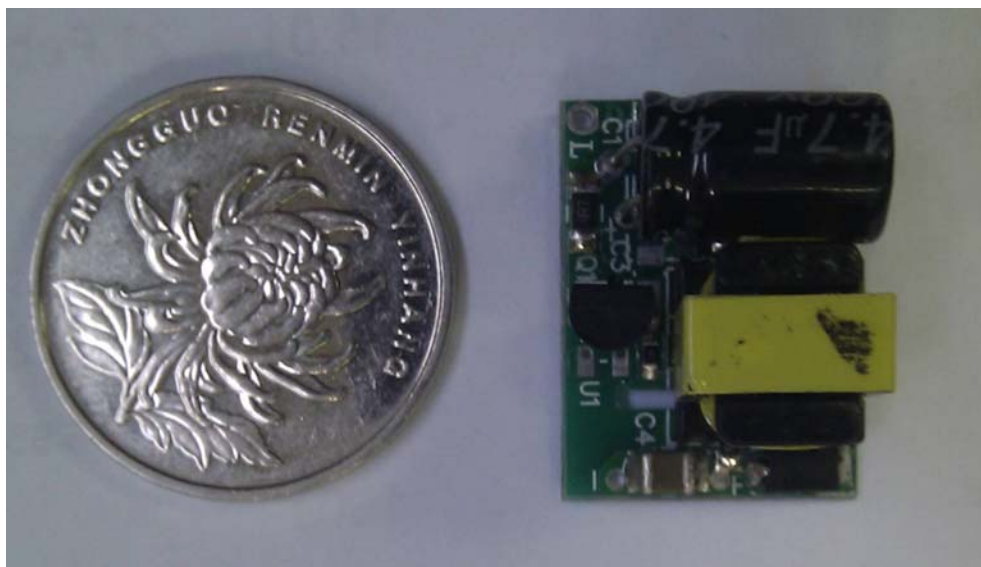


Figure 1 Demo Board Top Views

The system has rich protection features including Cycle-by-Cycle peak current limiting, SCP, VDD UVLO, Open load protection. The system continues attempting start-up until the fault condition is removed. Every restart is a soft start.

2. Application Circuit

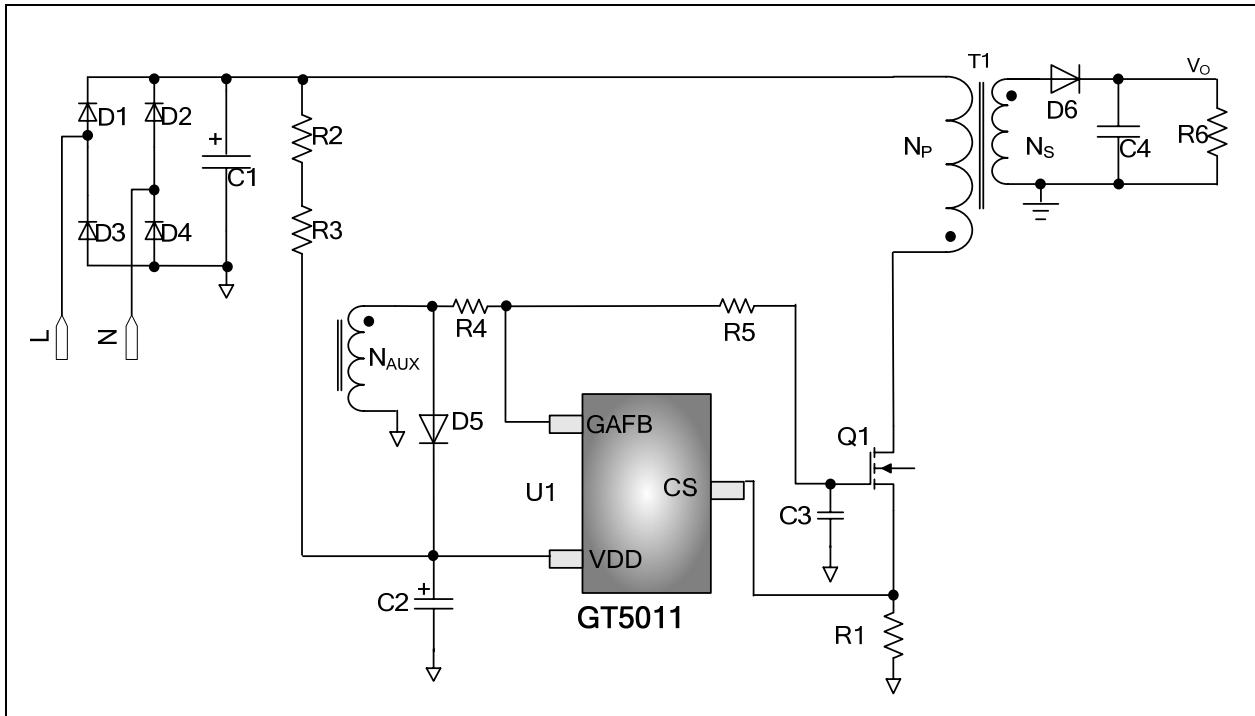


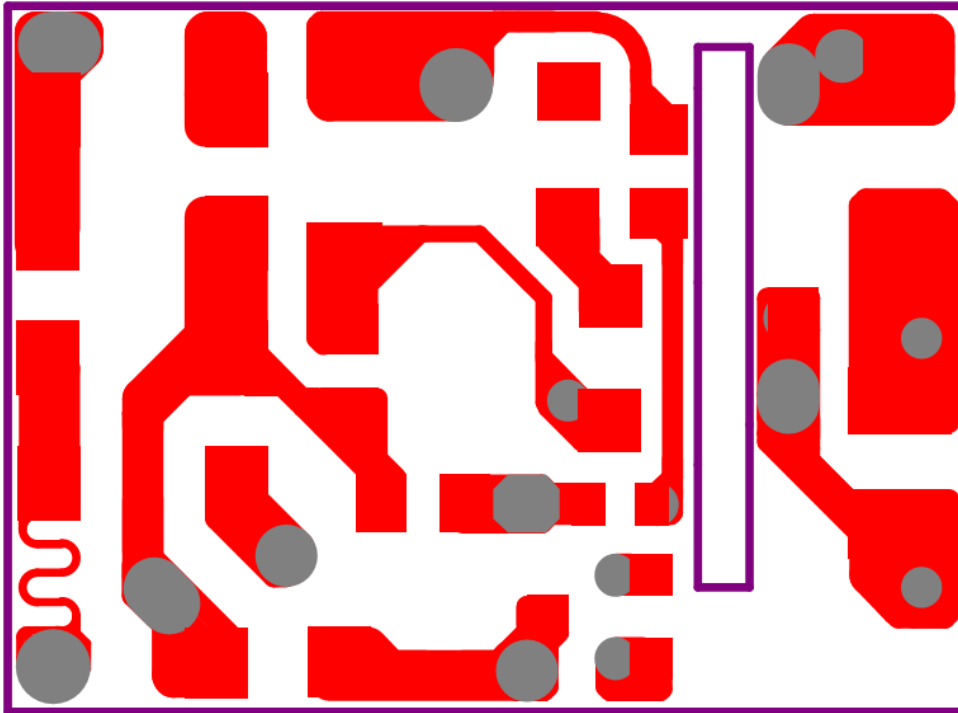
Fig 2 Application circuit schematic

3. BOM List:

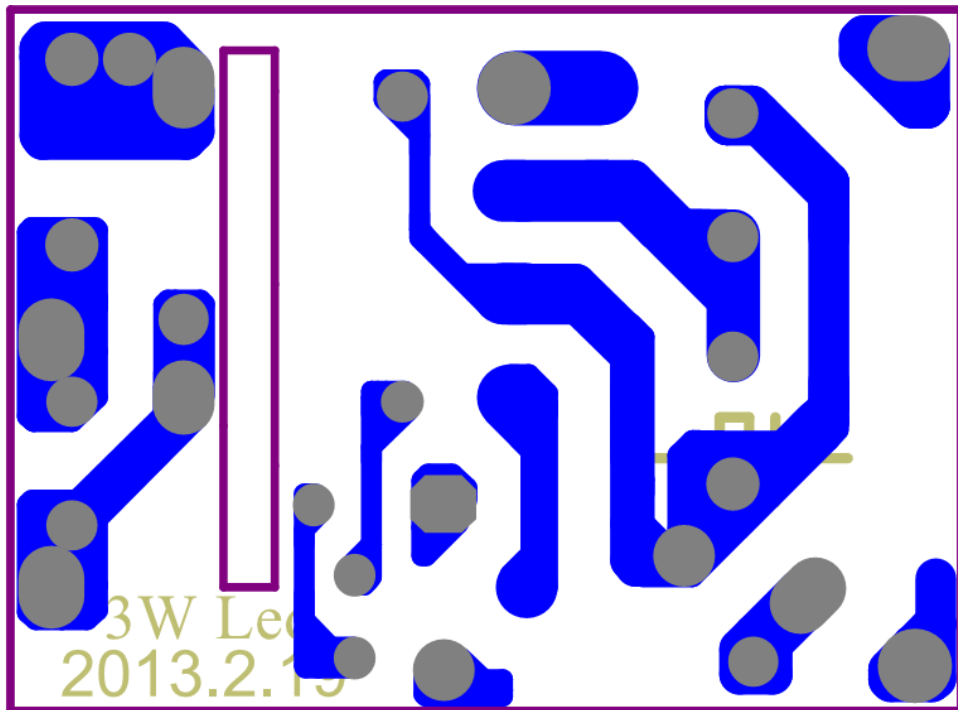
Designator	Parts	QTY
R2, R3	Resistor, 3M Ω , \pm 5%, SMD 1206	2
R4	Resistor, 120K Ω , \pm 5%, SMD 0805	1
R5	Resistor, 47 Ω , \pm 5%, SMD 0805	1
R1	Resistor, 4.3 Ω , \pm 1%, SMD 1206	1
R6	Resistor, 4.3k Ω , \pm 5%, SMD 0805	1
C1	Capacitor, Electrolytic, 4.7uF/400V, 8*15	1
C3	Capacitor, 47pF/50V, SMD0805	1
C2	Capacitor, 1uF/50V, SMD0805	1
C4	Capacitor, 22uF/16V, SMD1210	1
D1,D2,D3,D4,D5	Diode, M7, SMA	5
D6	Diode, Fast Recovery, ES1D, SMA	1
TR1	Transformer, Lp=1.7mH, EE10, 4+4P	1
Q1	Mosfet, 1A/700V, GT1N70, TO-92	1
U1	GT5311 Version I, SOT23-3	1
Total		19

4. PCB Layout

Top Layer:

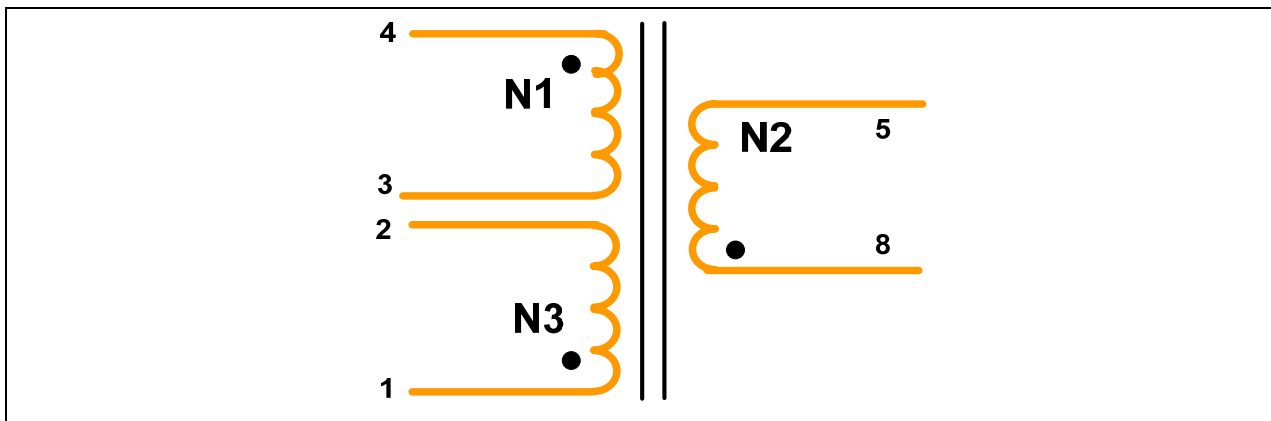


Bottom Layer:



5. Transformer Specification

- 1, Bobbin: EE10 Pin4+Pin4
- 2, Core Material: PC40 (TDK)
- 3, $L_m=1.7mH\pm 5\%$ (measured at 50KHz,1Vrms)



Winding	Material	Start	Turns	Finish
N1	0.13Φ*1, 2UEW	4	65T	
	0.13Φ*1, 2UEW		65T	
	0.13Φ*1, 2UEW		65T	3
Tape	Width=6.7mm		2T	
N2	0.25Φ*1, TIW	8	14T	
	0.25Φ*1, TIW		14T	5
Tape	Width=6.7mm		2T	
N3	0.13Φ*1, 2UEW	1	43T	2
Tape	Width=6.7mm		2T	

6. Evaluation Summary

Test Summary:

Test Item		Test Result
Efficiency test		75.86% at 230Vac
CC regulation vs AC line		5.5% Line Regulation
SCP		OK
Open load protection		OK
Start up time		512ms Max at 90Vac
Current Over shoot		No
Voltage stress		Pri: 680V at 264Vac Sec: 120V at 264Vac
Half current issue when AC ON/OFF		OK
LED Flicker Issue		OK

Test equipment:

Item	Vender	Module
AC Source	Chroma	61601
Digital Power Meter	Chroma	66202
Electrical Load	Chroma	6314A
Oscilloscope	LeCroy	24MXs-B

7. Electrical Test

7.1 Efficiency Test

Test Condition: Measurements were taken at board end at room temperature, using electrical load.

Vac	Pin	Vout	Iout	frequency	Efficiency
90	3.628	9.98	0.275	55K	75.65%
110	3.606	9.98	0.276	55K	76.39%
115	3.612	9.98	0.277	55K	76.54%
130	3.594	9.98	0.277	55K	76.92%
150	3.617	9.98	0.28	55K	77.26%
170	3.712	9.98	0.286	55K	76.89%
190	3.778	9.98	0.289	54K	76.34%
210	3.725	9.98	0.283	54K	75.82%
220	3.717	9.98	0.282	54K	75.72%
230	3.723	9.98	0.283	53K	75.86%
240	3.738	9.98	0.283	53K	75.56%
264	3.793	9.98	0.286	52K	75.25%

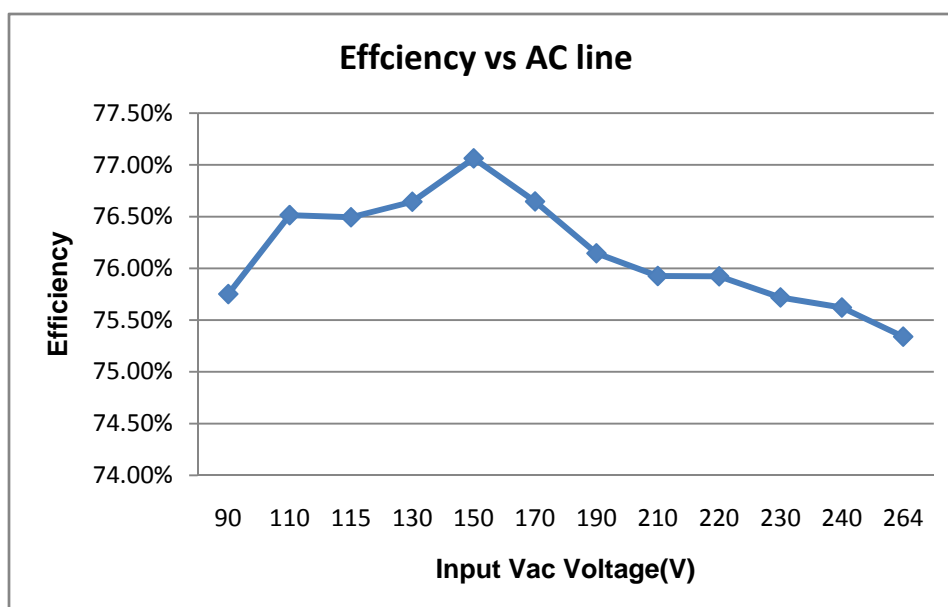


Fig xx, Typical CC Characteristic VS AC line

7.2 CC regulation vs line variation test

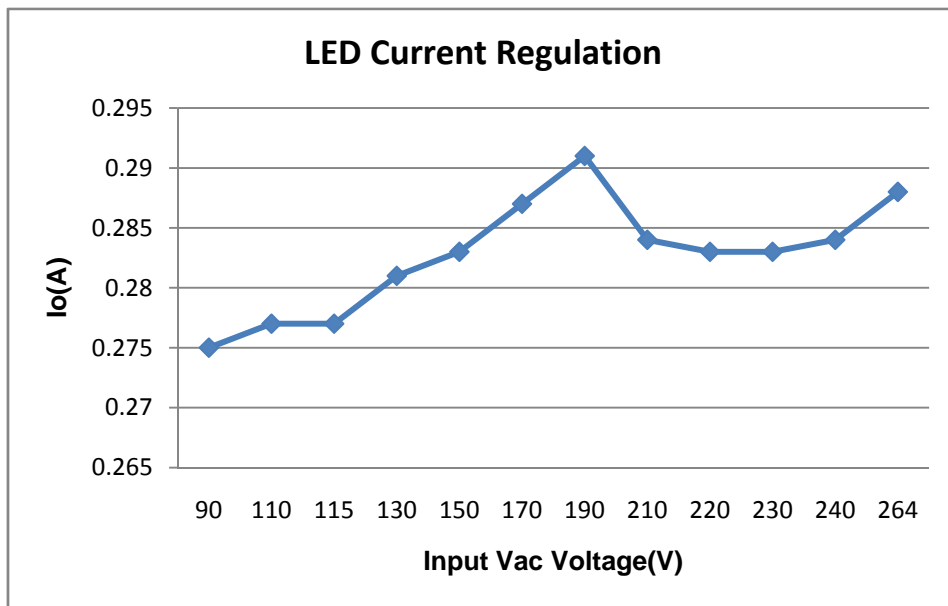


Fig xx Typical efficiency Characteristic Vs AC line

7.3 CC regulation vs Temp test

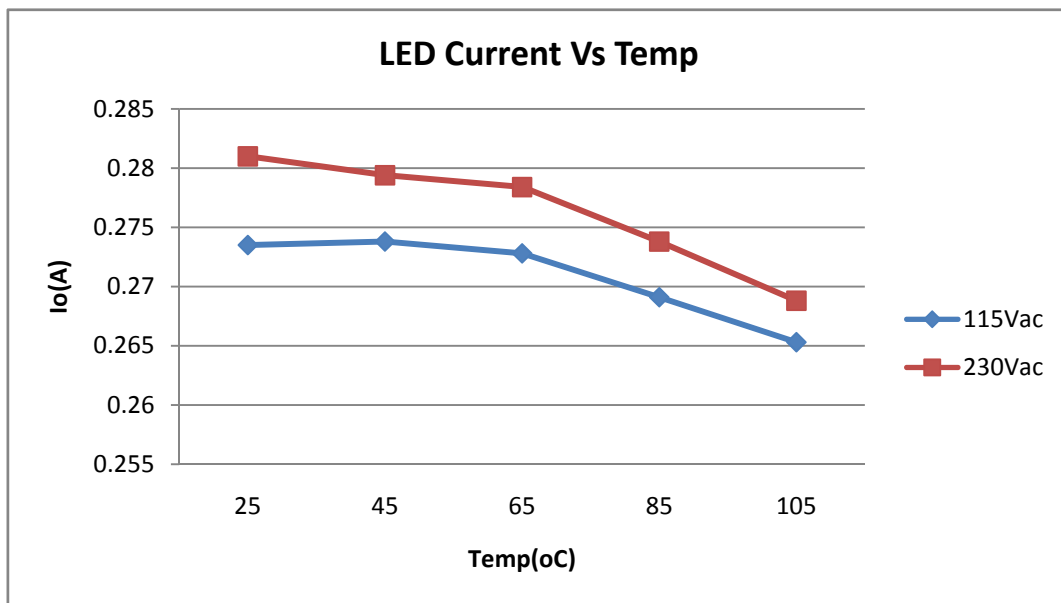
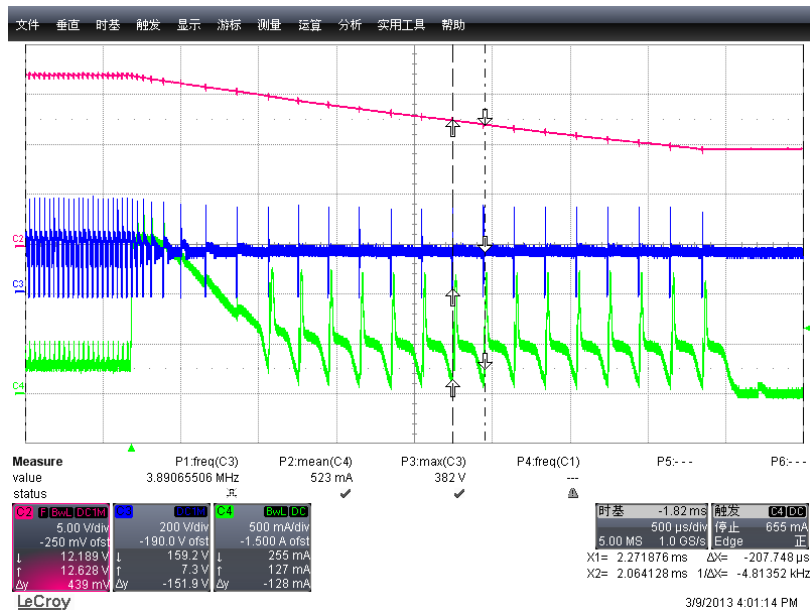
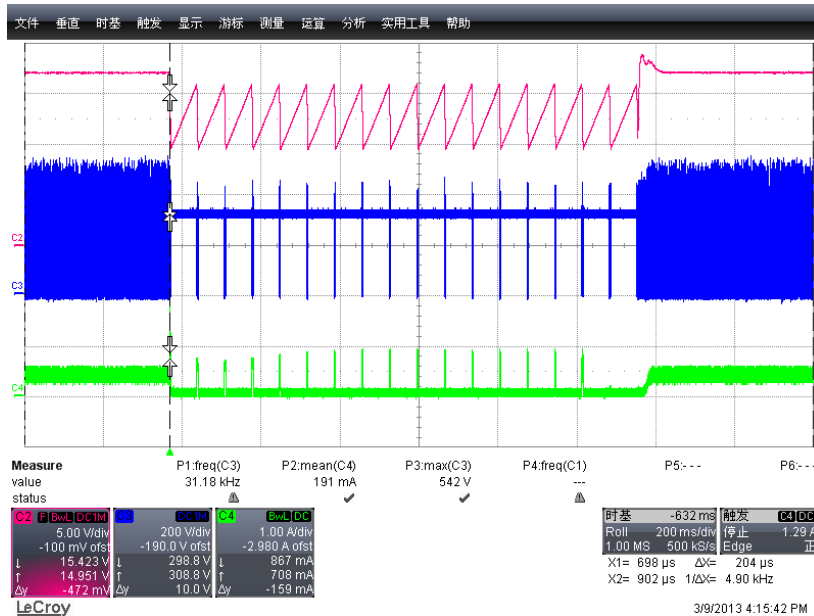


Fig xx Typical CC Regulation Vs Temp

8. SCP and Open load Protection Test

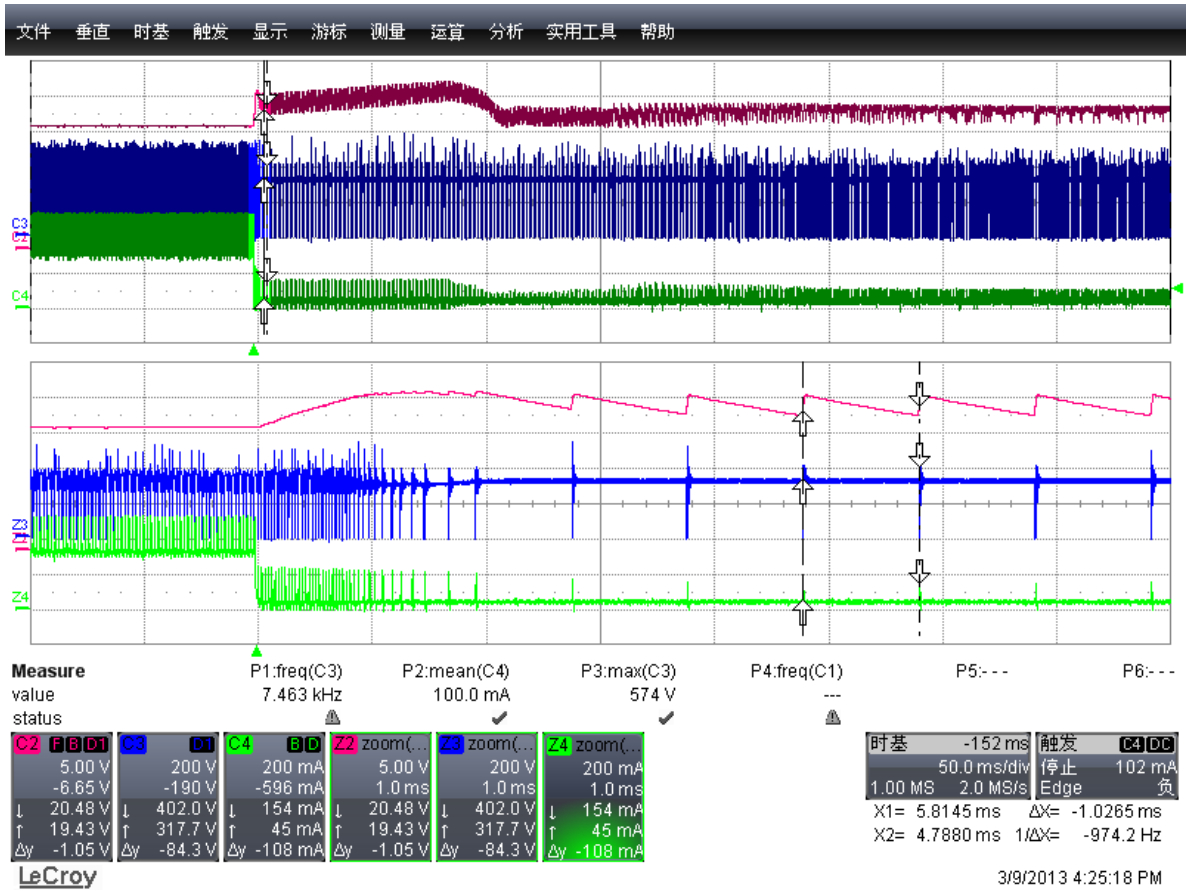
8.1 SCP:

Test Condition: Short was performed at end of PCB at 230Vac, Short and Recovery

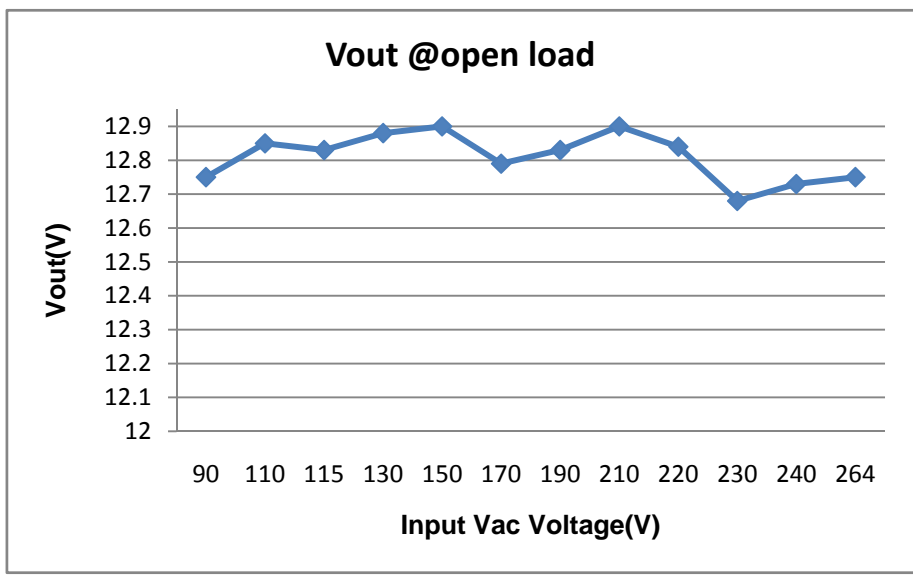


- Red Curve: VCC
- Blue Curve: Vaux
- Green Curve: ILED

8.2 Open load Protection:

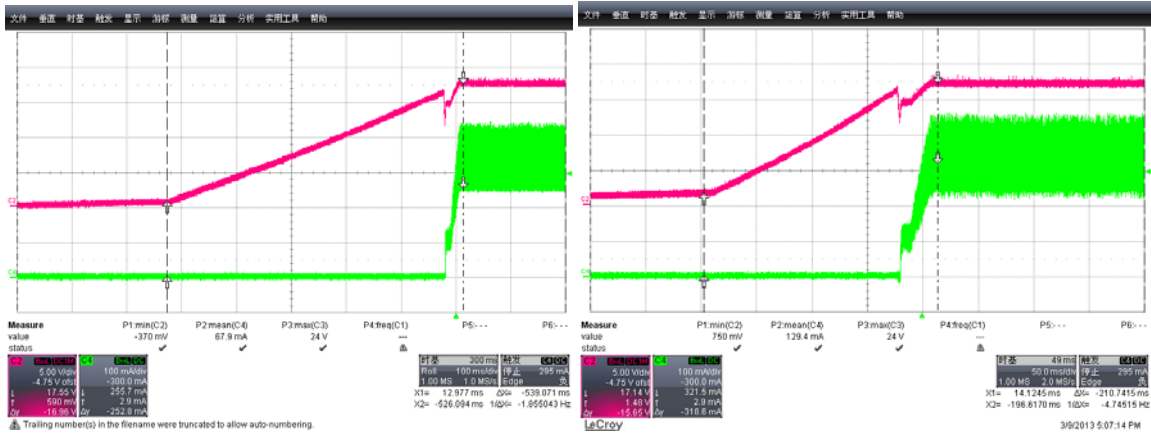


- Red Curve: VCC
- Blue Curve: Vaux
- Green Curve: ILED



9. Start up and Normal operation

9.1 Start up waveform



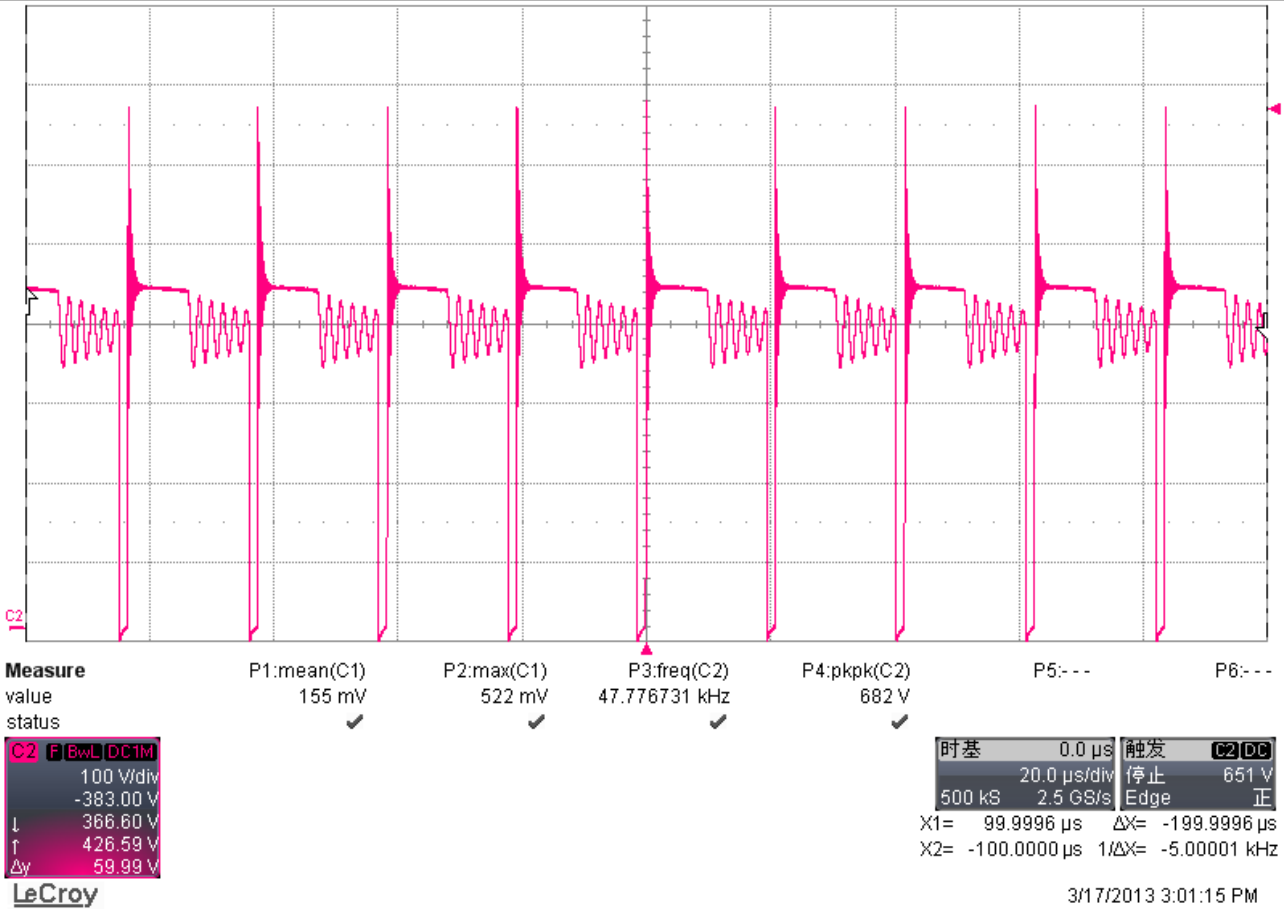
- **Red Curve: VCC**
- **Green Curve: ILED**

90Vac start up waveform

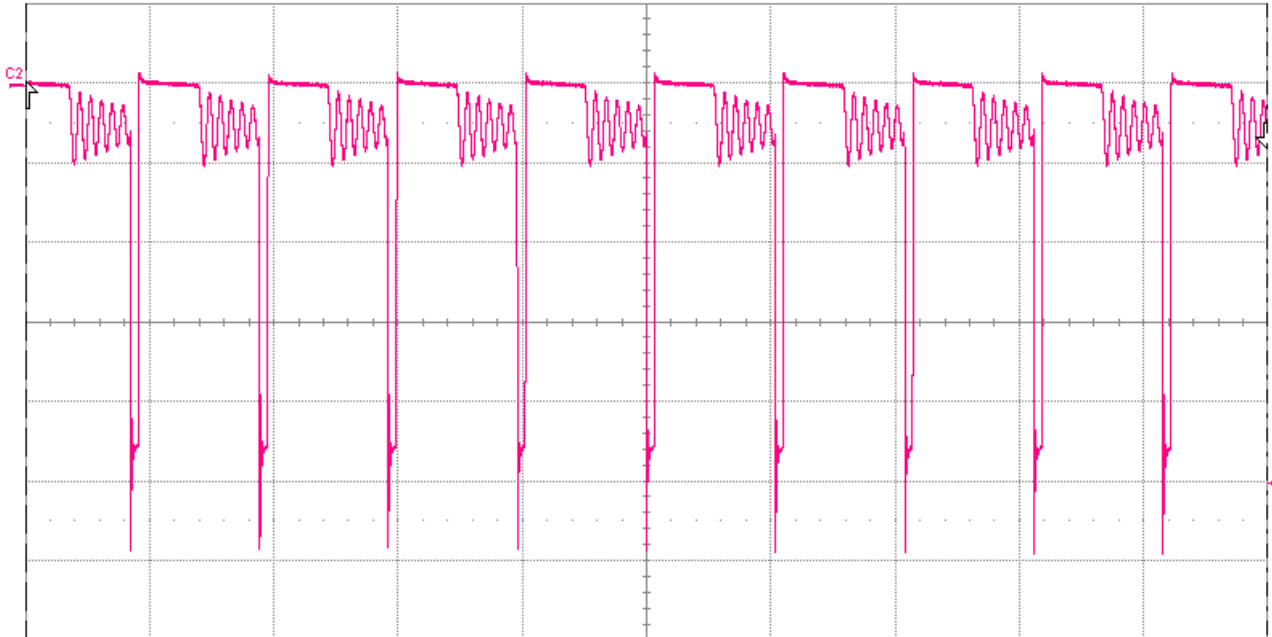
264Vac start up waveform

	Start up time	Current Over shoot
90Vac	526ms	No
264Vac	210ms	No

9.2 Primary MOSFET 1N70 Vds stress, 680V peak at 264Vac



9.3 Secondary rectification diode ES1D Voltage stress,104V peak at 264Vac



Measure

value
status

P1:mean(C1)

187 mV



P2:max(C1)

330 mV



P3:freq(C2)

48.055721 kHz



P4:pkpk(C2)

120.9 V



P5:---

P6:---

C2 F BwL DC1M
20.0 V/div
59.00 V ofst
↓ -15.01 V
↑ 920 mV
Δy 15.93 V

时基	0.0 μs	触发	C2 DC
	20.0 μs/div	停止	-100.2 V
	500 kS	Edge	正
	2.5 GS/s		
X1=	99.9996 μs	ΔX=	-199.9996 μs
X2=	-100.0000 μs	1/ΔX=	-5.00001 kHz

LeCroy

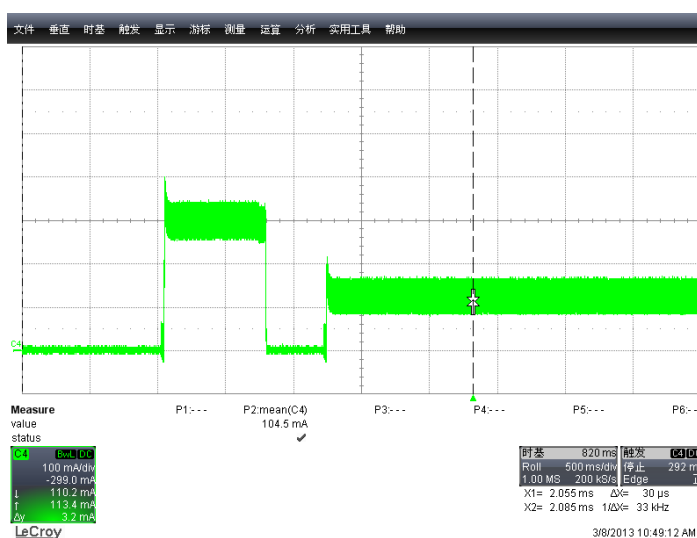
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10. Half current when fast switching ON/OFF AC input

Half current issue test was performed on four PCB board which easy to recurrence with Version E. To verify this issue with Version I, every 10Pcs was performed on 3 PCB board respectively, so far, no half current issue found on above mentioned “Golden board”.

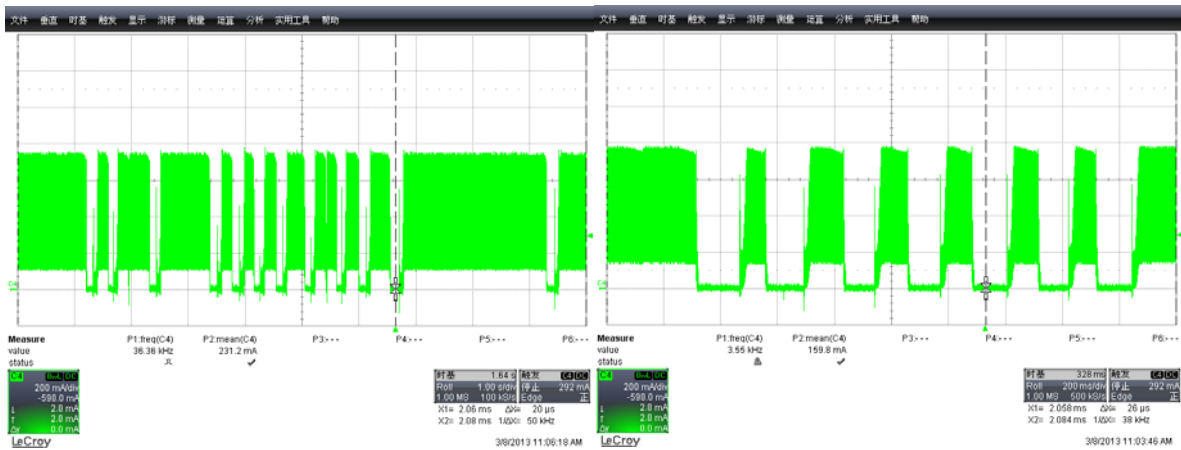
PCB board	Test method	Half current Issue	LED Flicker
1# 3W Board	20Pcs IC, 3 Pcs PCB board	No	No
2# Customer board	20Pcs IC, 3 Pcs PCB board	No	
3# 5W Board	20Pcs IC, 3 Pcs PCB board	No	No
4# 5-7W Board	20Pcs IC, 3 Pcs PCB board	No	

10.1 Issue Recurrence with Version E on Board 1#



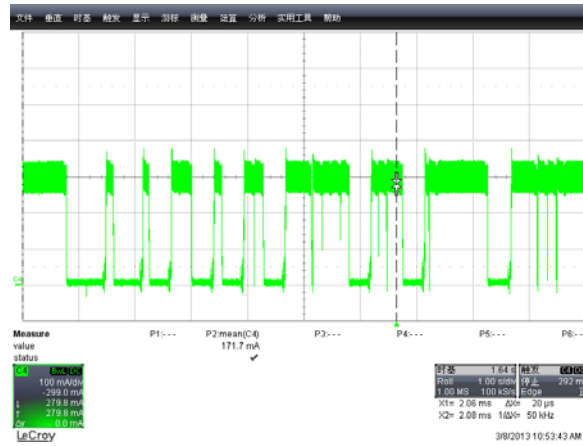
- Green Curve: ILED

10.2 Version I Test result on Board 1#



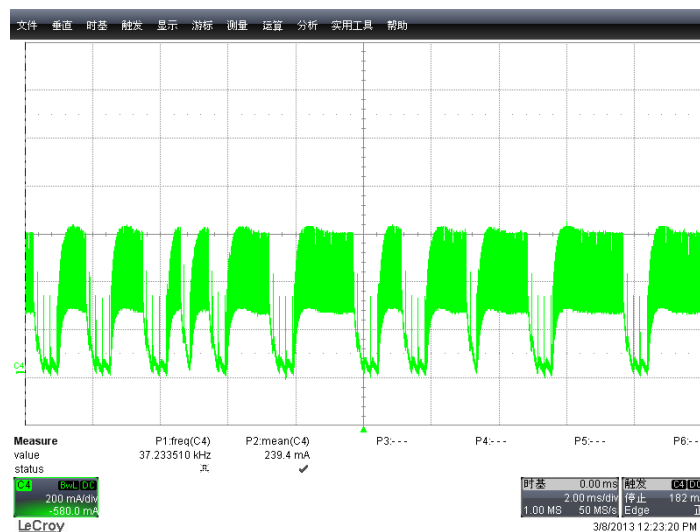
3W

5W



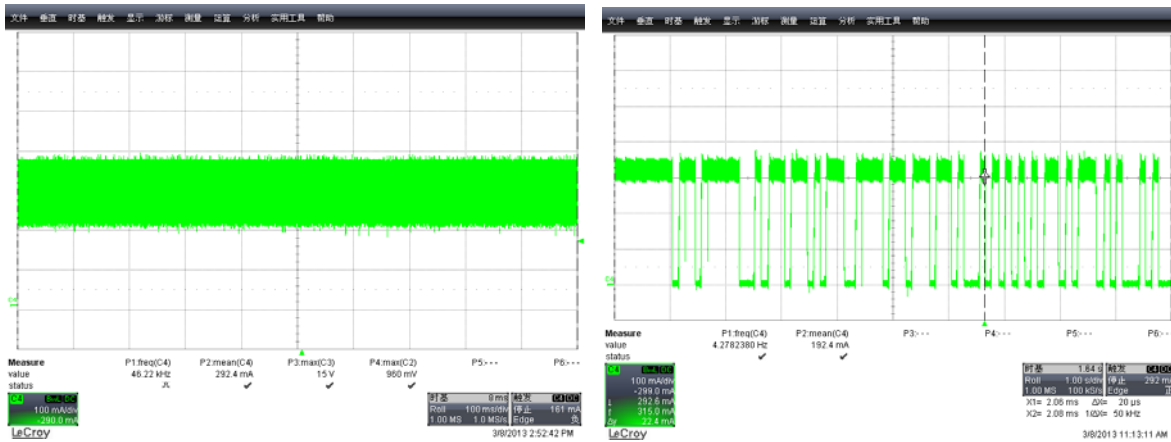
Increase out capacitor to 330uF

10.3 Issue Recurrence with Version E on Board 2#



● Abnormal operation

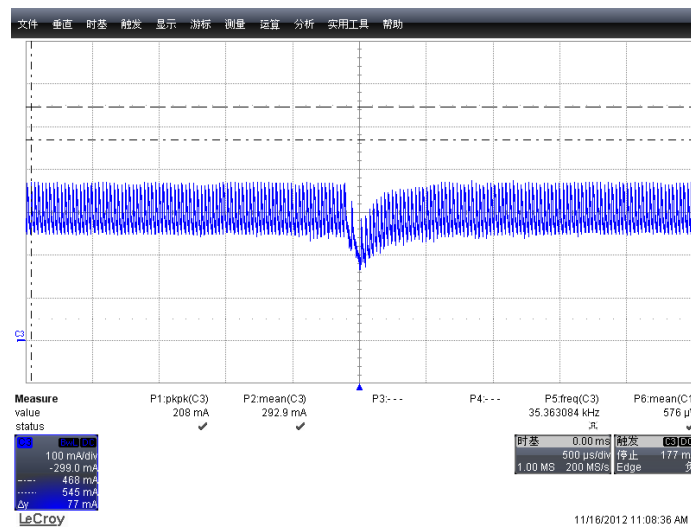
10.4 Version I Test result on Board 2#



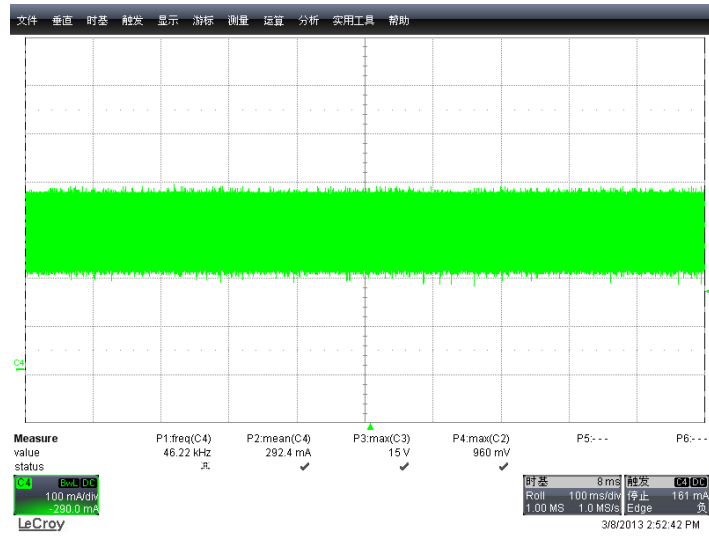
- No half current decrease when AC switch on/off.

10.5 LED Flicker Issue

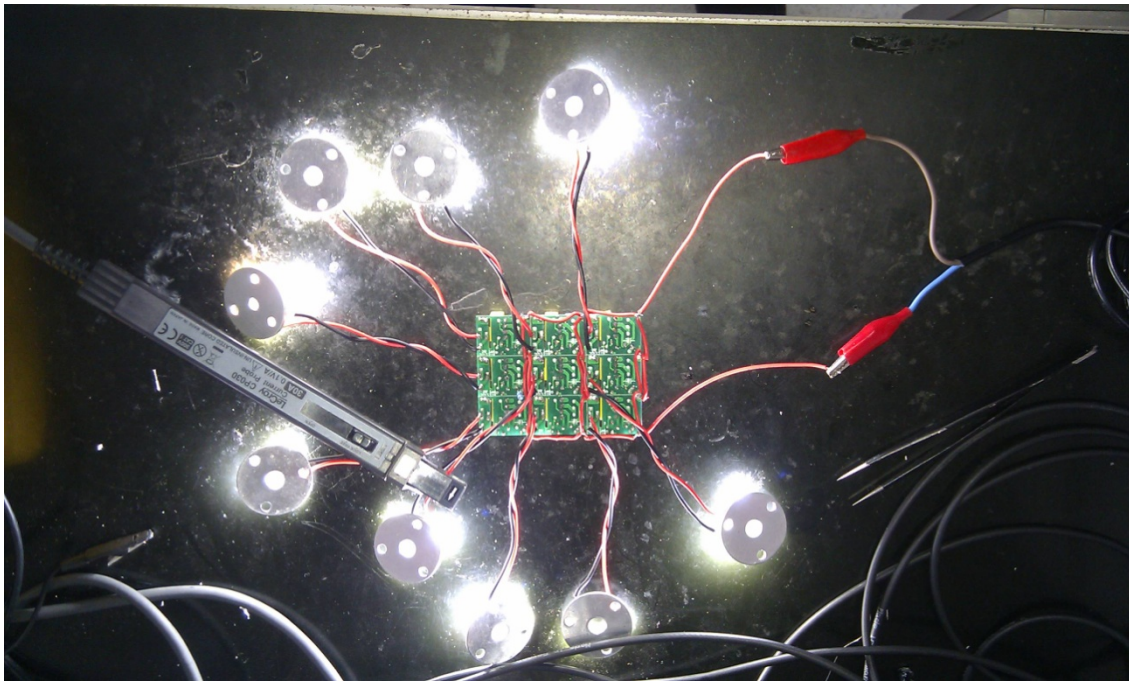
Issue Recurrence with Version E on Board 1#, LED drop sharply when module put together.



Version I Test result on Board 1#



- No current drop



- Test Setup to simulate customer field condition. Nine module put together.