

iW1689 Design for 3W LED

(GU10 type mounting)

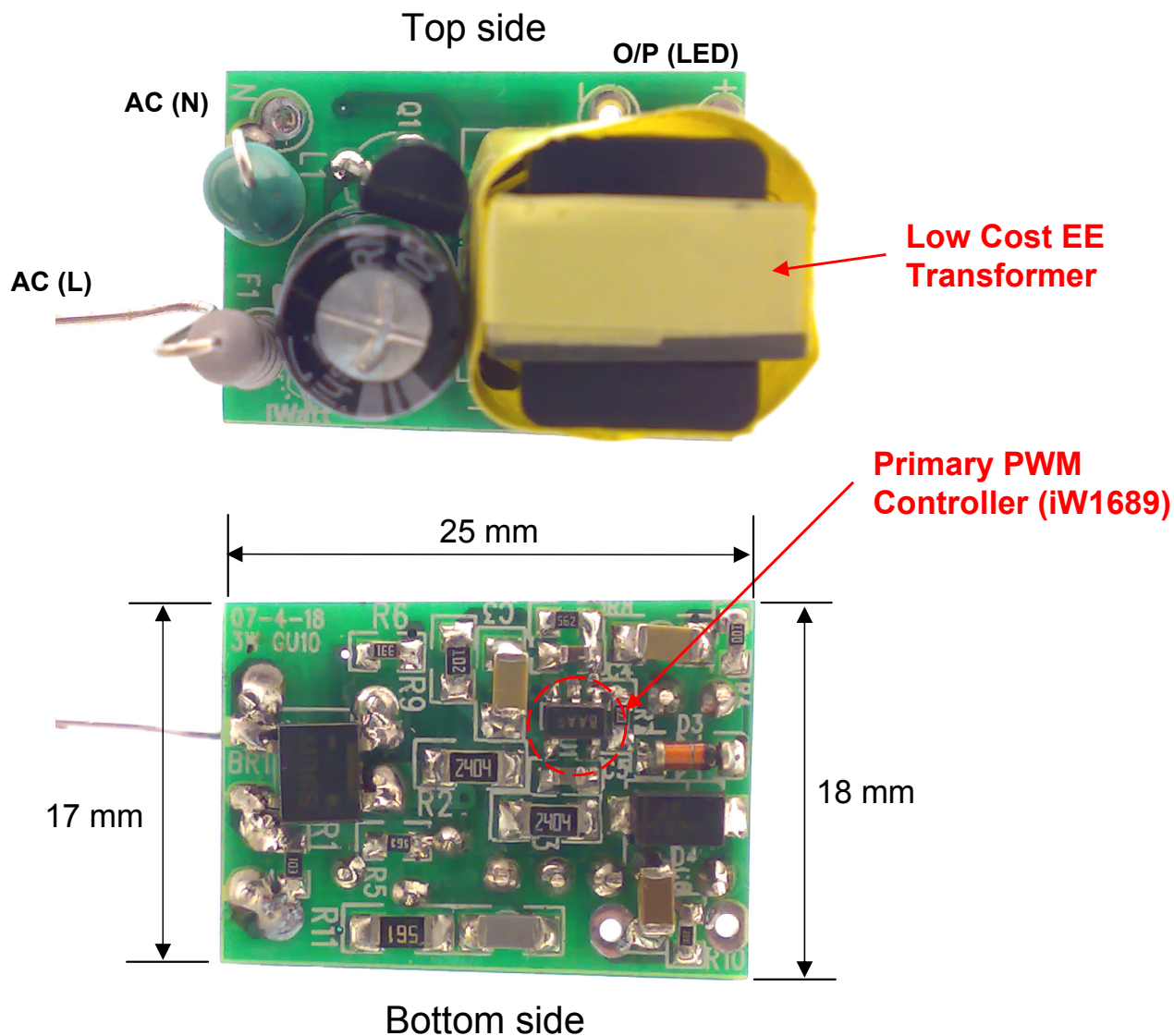
Summary and Features :

- **For Isolated or non-Isolated Applications**
- **Meet EN55015B (QP & AV scan)**
- **Smallest and least parts count than any available solution**
- **Wide AC input range : 90Vac ~ 264Vac**
- **High efficiency (@ 67% 220Vac)**
- **Fully protected against AC input UV/OV, O/P Short & Open**

1. Specification

Description		Symbol	Min	Typ	Max	Units	Comment
Input							
Voltage		V_{IN}	90		264	V _{AC}	2 Wire
Frequency		f_{LINE}	47	50/60	63	Hz	
No-load Input Power (264V _{AC})						W	
Output							
Constant Voltage	Output Voltage	$V_{OUT_{CV}}$	4.75	5.00	5.25	V	Measured at the end of PCB
	Output Current	$I_{OUT_{CV}}$	0		700	mA	
Constant Current	Output Voltage	$V_{OUT_{CC}}$		2.50		V	Min V _{OUT} is dependence of V _{CC} supply voltage
	Output Current	$I_{OUT_{CC}}$	600	700	800	mA	
Total Output Power							
Continuous Output Power		P_{OUT}			3	W	
Over Current Protection		$I_{OUT_{MAX}}$			800	mA	Auto-restart
Efficiency		η	65			%	Measured at end of PCB, V _{IN} = 90V _{AC} LED Load. (T _A = 25 °C)
Environmental							
Conducted EMI			Meets CISPR15B / EN55015B				
Safety			Designed to meet IEC950, UL1950 Class II				
Ambient Temperature		T_{AMB}	0		50	° C	Free convection, sea level

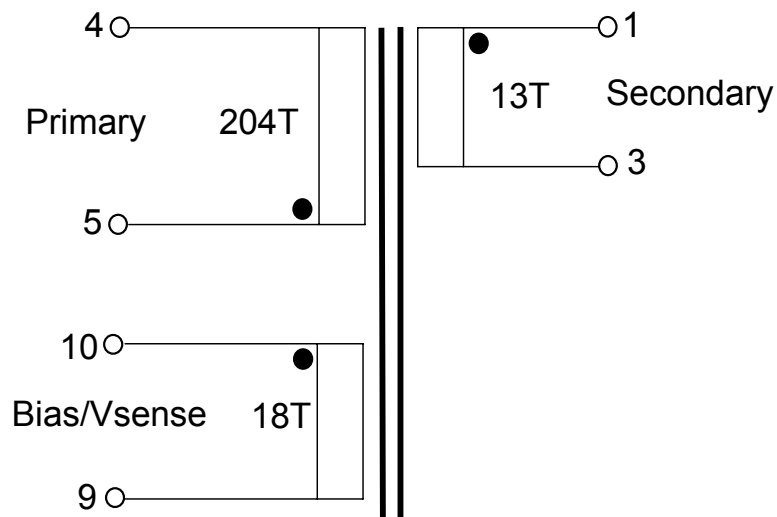
3. Circuit Board Photograph



- For GU-10, E27 Lamp Housing
- Double Sided PCB

4 Transformer Design

SCHEMATIC



ELECTRICAL SPECIFICATIONS:

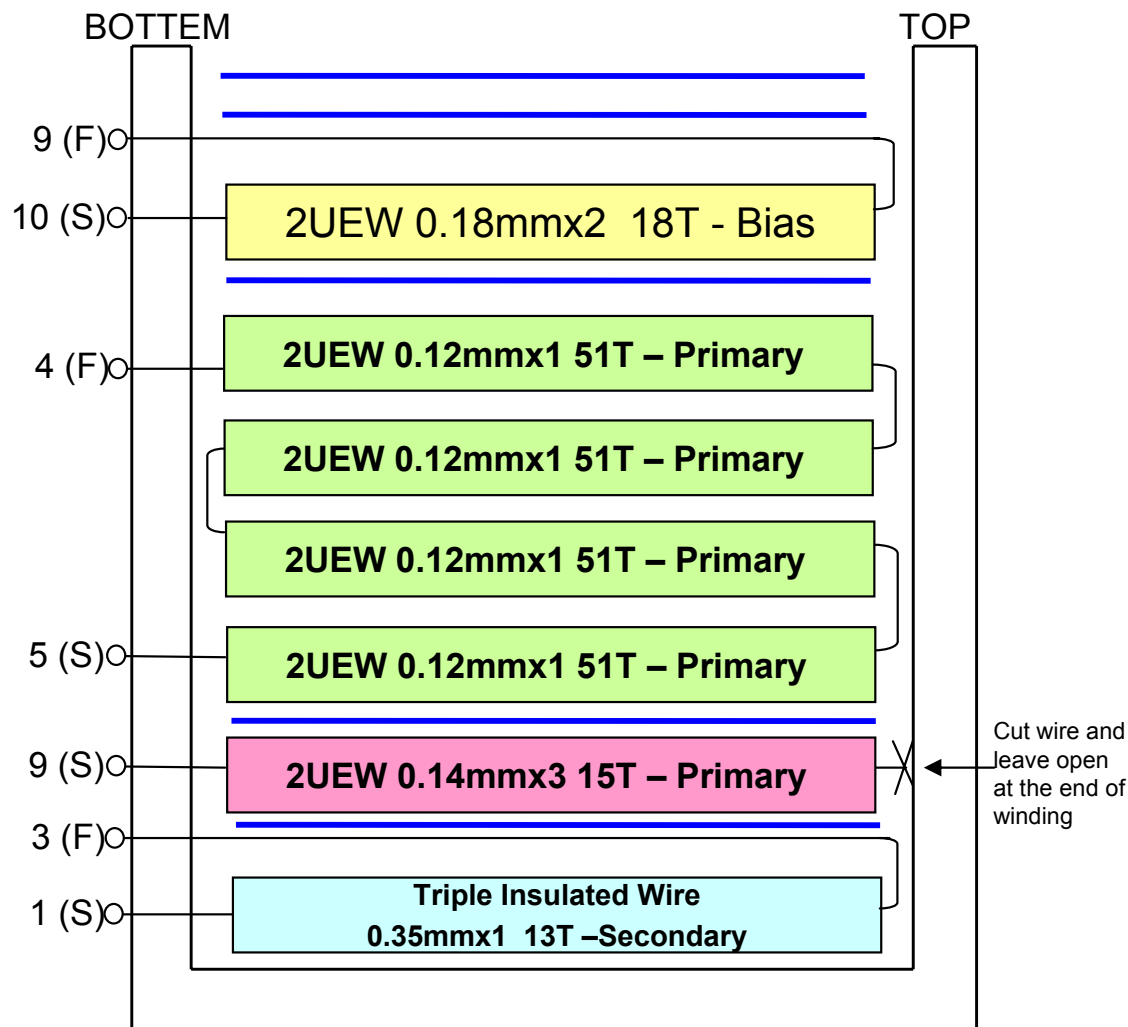
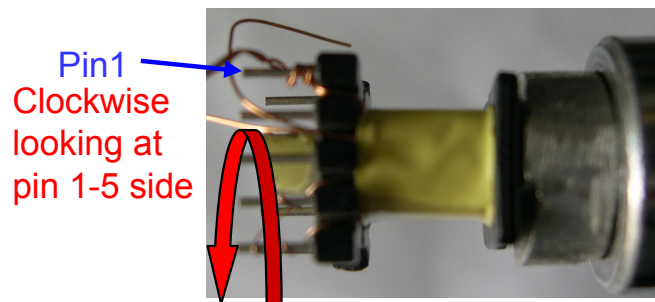
1. Primary Inductance (L_p) = 3.45-3.85mH@10KHz
2. Primary Leakage Inductance (L_k) = 50uH@10KHz

MATERIALS:

1. Core : EE13 (Ferrite Material TDK PC40 or equivalent)
2. Bobbin : EE13 Vertical.
3. Magnet Wires : Type 2-UEW
4. Layer Insulation Tape : 3M1298 or equivalent.

FINISHED :

1. Cut remained of Pin2,6-8 after wires termination
2. Core shield to Pin9 with bare wire
3. Varnish the complete assembly

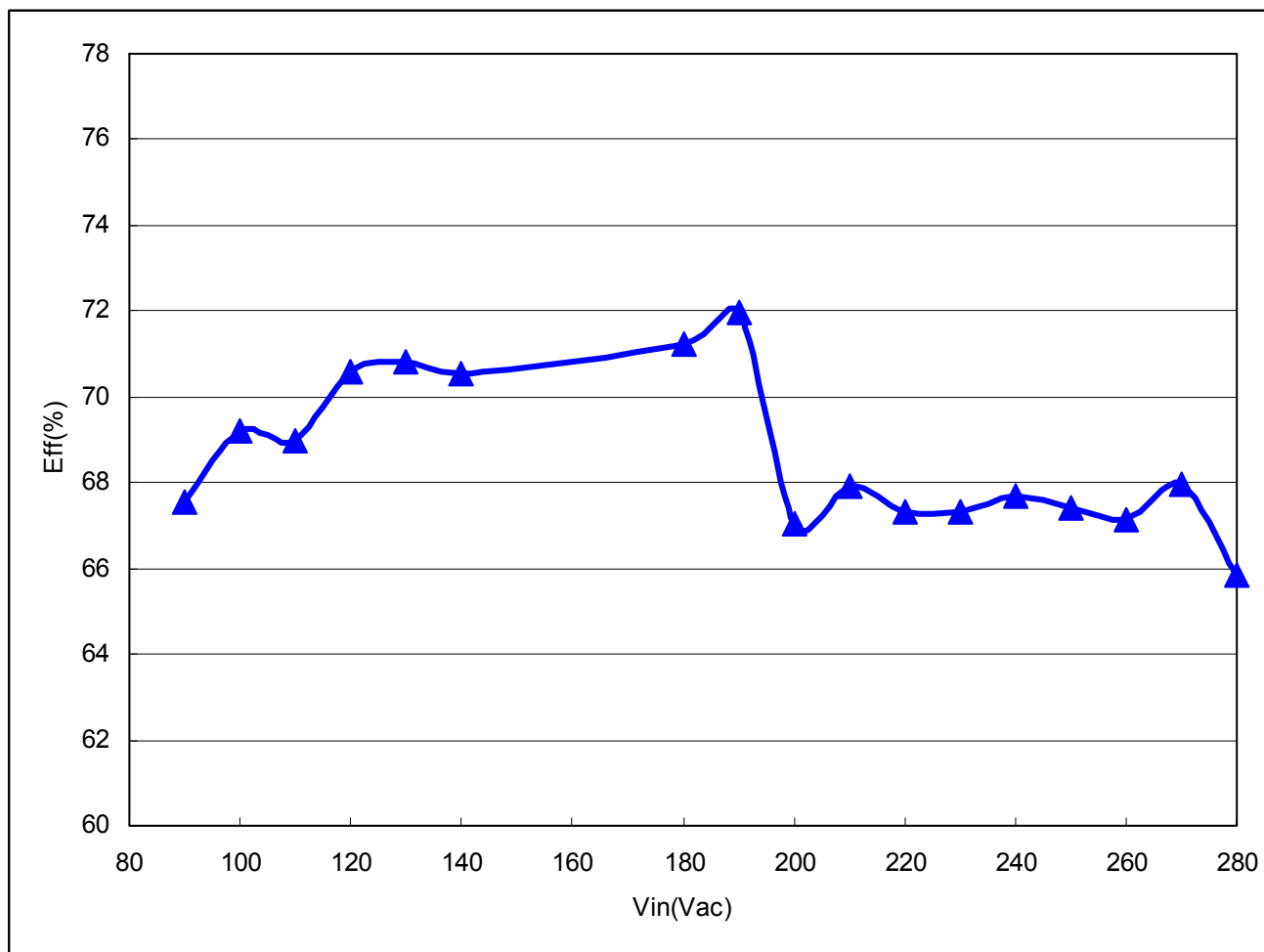


5. Bill of Material

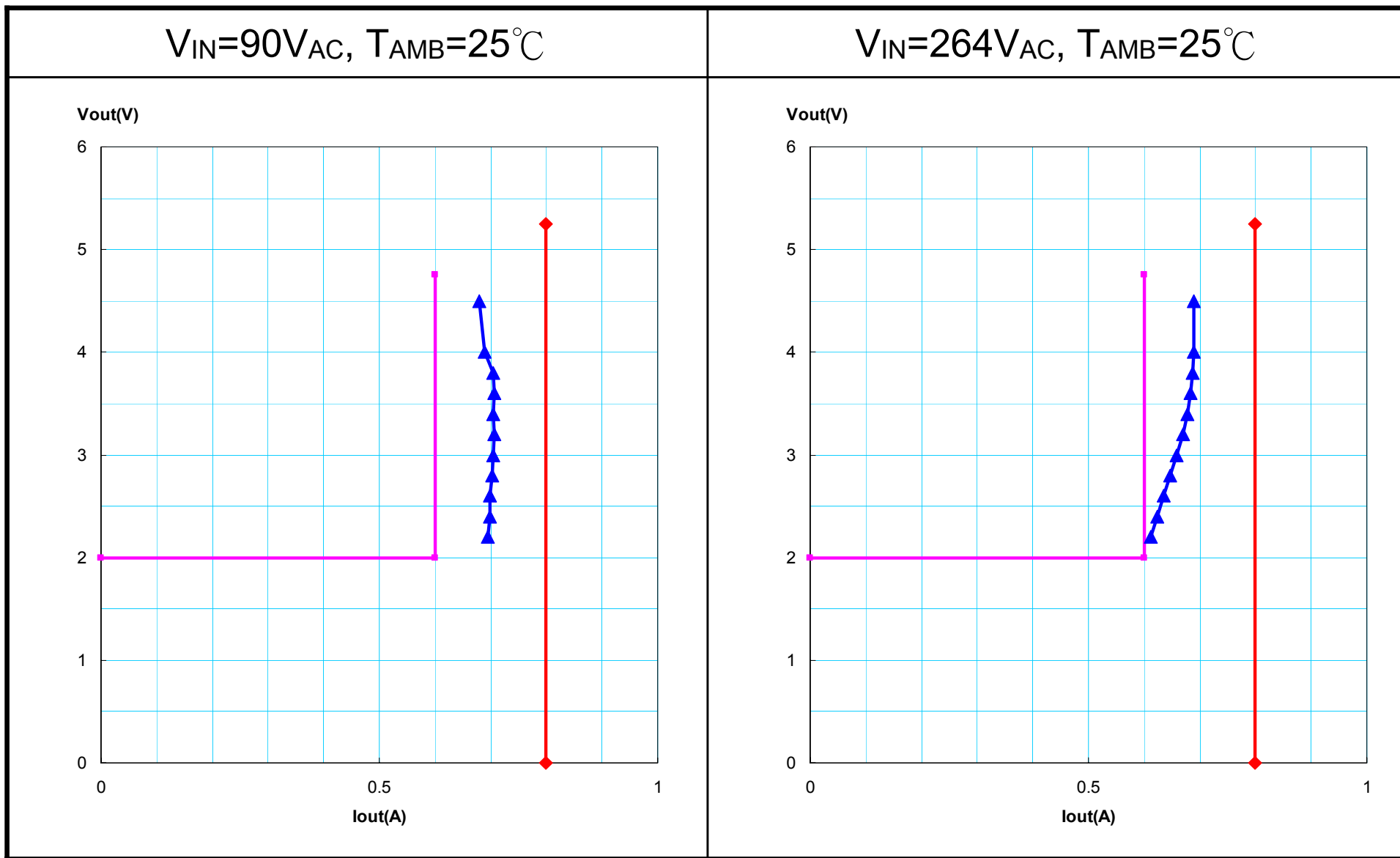


Item	Qty.	Ref.	Description	Cost (US Cent) / unit	Sub-Total (Cent)
1	1	F1	10Ω, Fuse Resistor, 1W		
2	1	L1	4.7mH, Filter Inductor		
3	1	BR1	MBR8S		
4	1	C1	4.7uF, 400V, E-CAP, 8X10		
5	1	U1	iW1689, Off-line digital PWM Controller, SOT-5		
6	2	R2,R3	2.4MΩ ±1%, SMD-1206		
7	1	C4	100pF, 25V, NPO, SMD-0603		
8	1	C5	470pF, 25V, NPO, SMD-0603		
9	1	C8	47pF, 1KV, X7R, SMD-1206		
10	2	C2,C3	2.2UF, 16V, X7R, SMD-1206		
11	1	R1	10KΩ ±5%, SMD-0805		
12	1	R4	10Ω ±5%, SMD-0603		
13	1	R5	56KΩ ±5%, SMD-0603		
14	1	R6	330Ω ±5%, SMD-0603		
15	1	R7	22KΩ ±5%, SMD-0603		
16	1	R8	5.6KΩ ±5%, SMD-0603		
17	1	R9	1KΩ±5%, SMD-0603		
18	1	R11	560RΩ±5%, SMD-1206		
19	1	D3	1N4148, Fast rectifier diode, DL-35		
20	1	Q1	SW1N60A, 0.5A/600V		
21	1	D7	SS24, Schotkky Diode, DL-35		
22	1	C6	4.7uF, 16V, SMD-1206		
23	1	R10	1KΩ ±5%, SMD-0603		
24	1	T1	EE13, Transformer		
25	1	PCB	Double Board, FR-4, 24(L)x18(W)x0.8(T)		

6. Efficiency



7. Output VI Characteristics

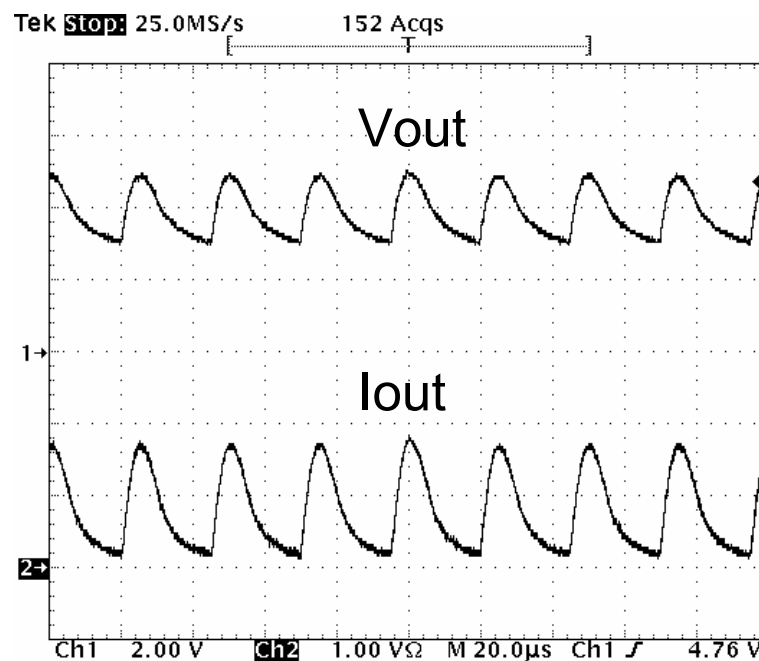
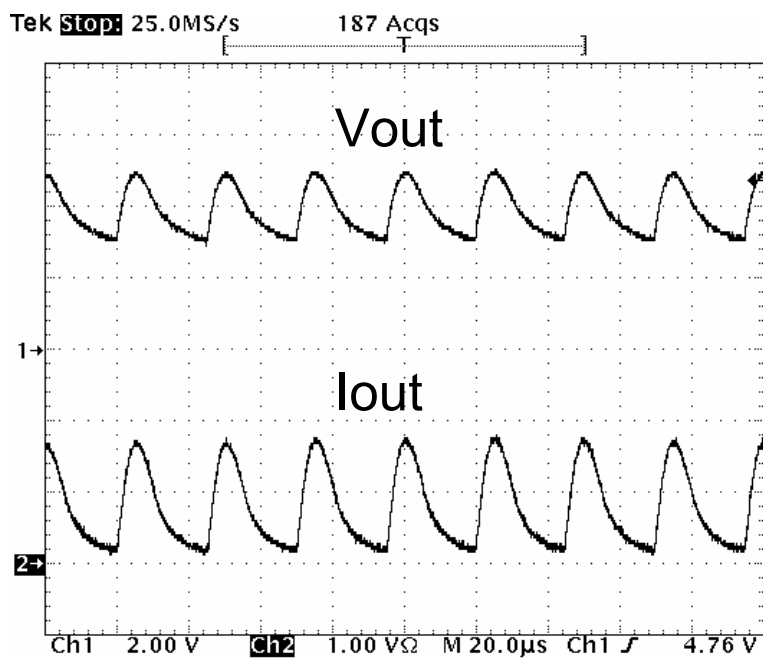


***Note: Output voltage measured at PCB end.**

8. Output Waveform

Vin=90Vac LED Load

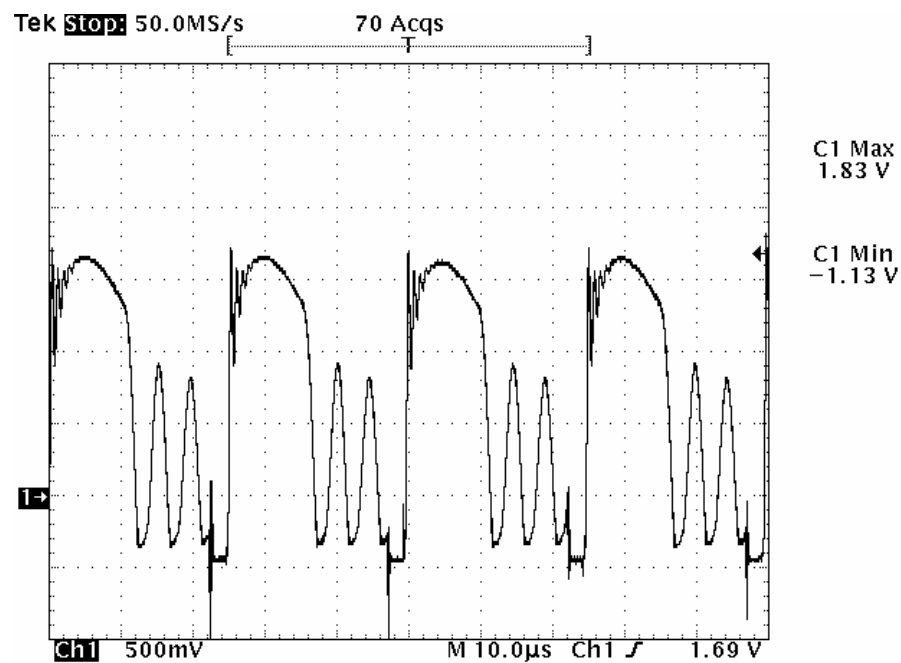
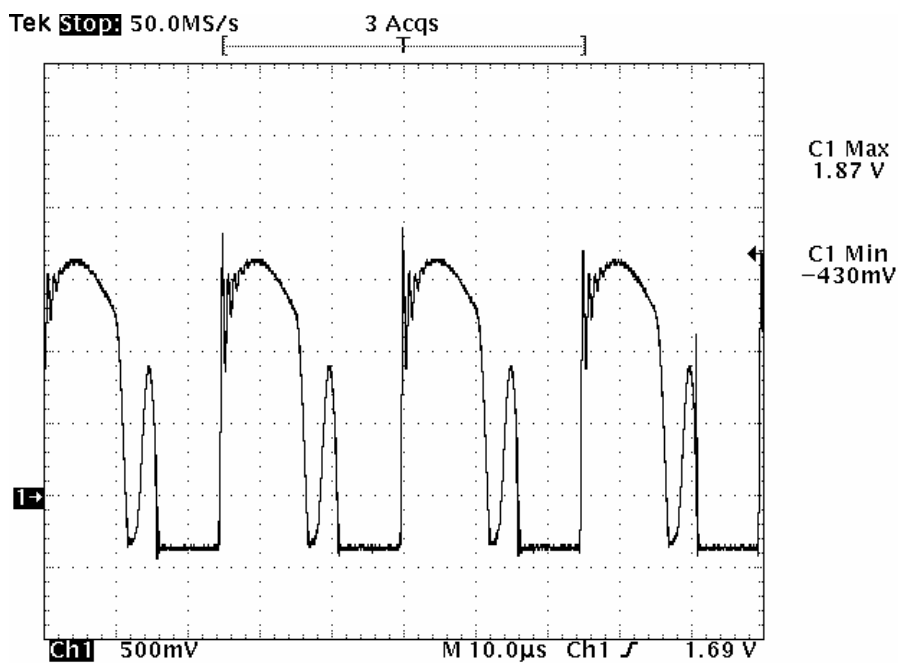
Vin=264Vac LED Load



9. V_{SENSE} Waveform

$V_{in}=90V_{ac}$ LED Load

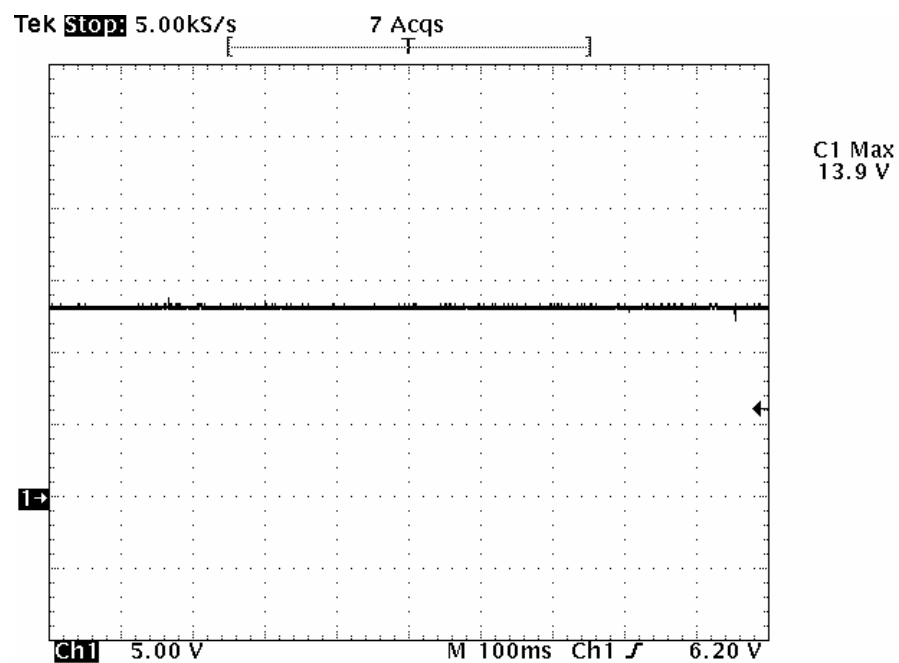
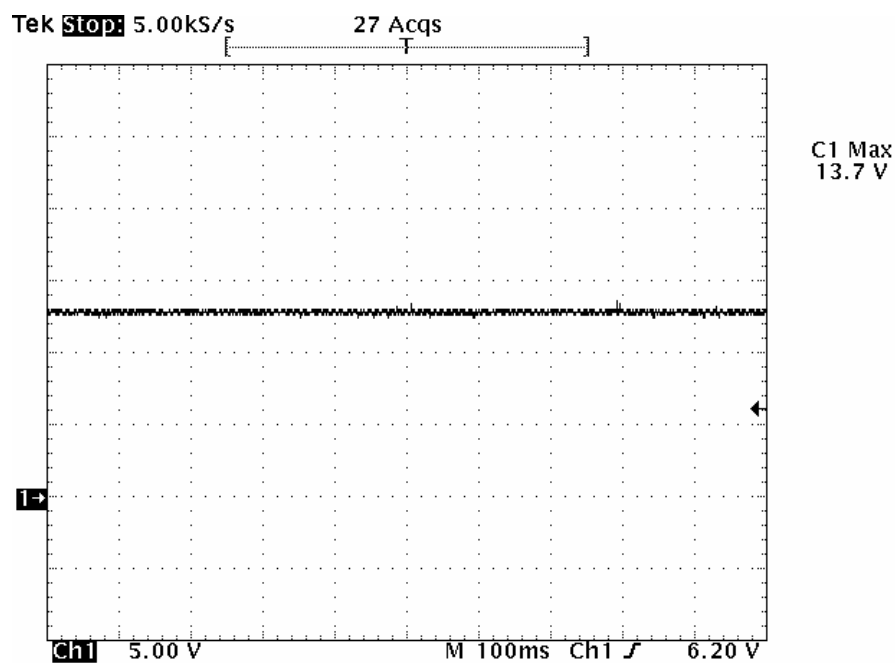
$V_{in}=264V_{ac}$ LED Load



10. V_{cc}

$V_{in}=90Vac$ $V_{cc}= 13.7 V$

$V_{in}=264Vac$ $V_{cc}= 13.9 V$



11. V_{DS} waveform



Test Condition:
 $V_{IN}=264VAC, LED$ Load

Result:
 $V_{DS_MAX} = \mathbf{575\ V}$

Appendix – Simple Specification for used MOSFET(SW1N60A)

Parameter	Symbol	Limit	Units
Drain-Source Voltage	V_{DS}	600	V
Gate-Source Voltage	V_{GS}	± 30	V
Drain Current-Continuous	I_D	0.5	A
Drain Current-Pulsed ^a	I_{DM}	2	A
Maximum Power Dissipation	P_D	3	W
Operating and Store Temperature Range	T_J, T_{stg}	-55 to 150	$^{\circ}C$
Thermal Resistance, Junction-to-Ambient ^b	$R_{\theta JA}$	120	$^{\circ}C/W$

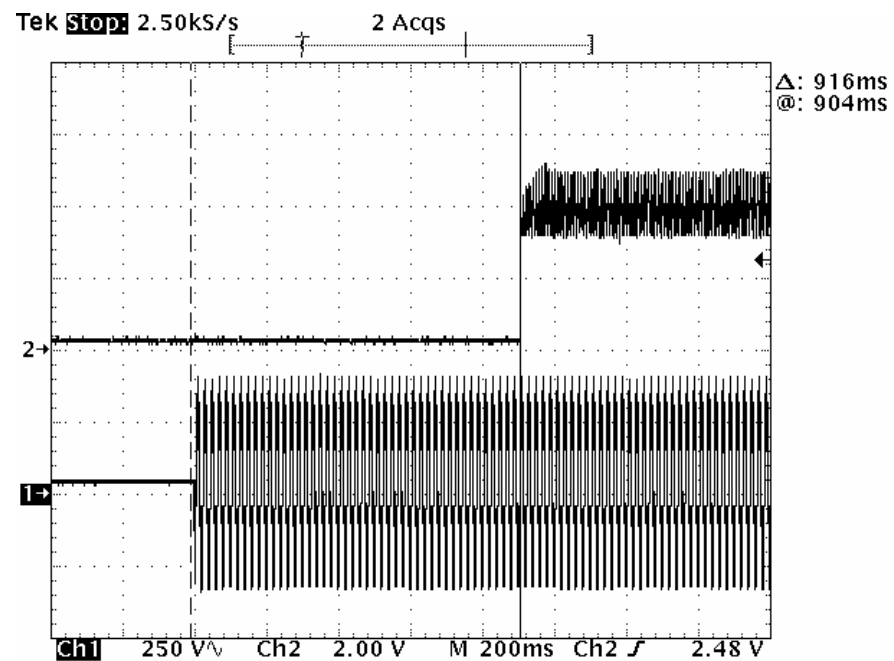
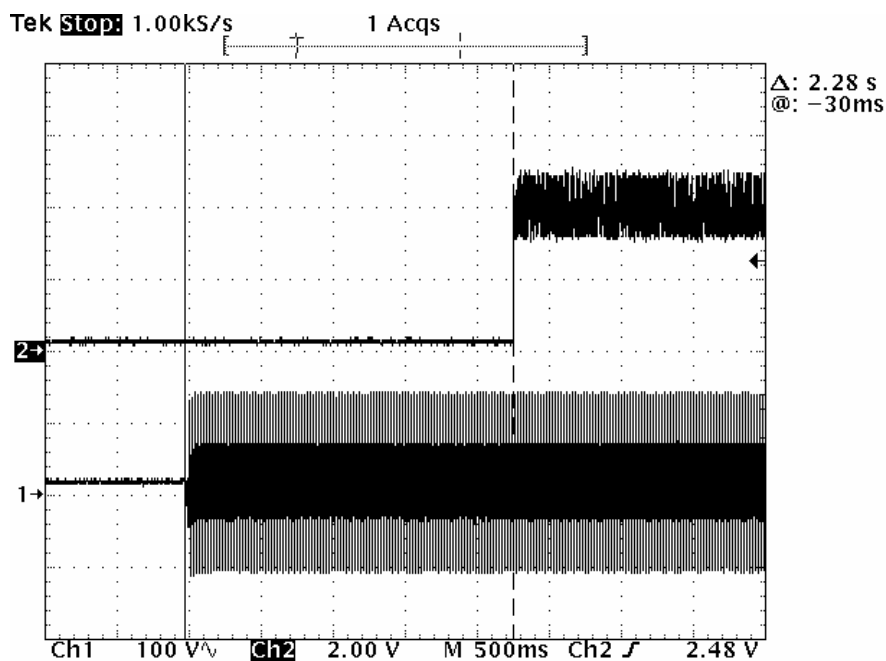
12. Start Up & Turn On Delay Time

90V_{AC},LED Load

T_{ST_DELAY}= 2.28 S

264V_{AC},LED Load

T_{ST_DELAY}= 916 mS



13. OVP Performance

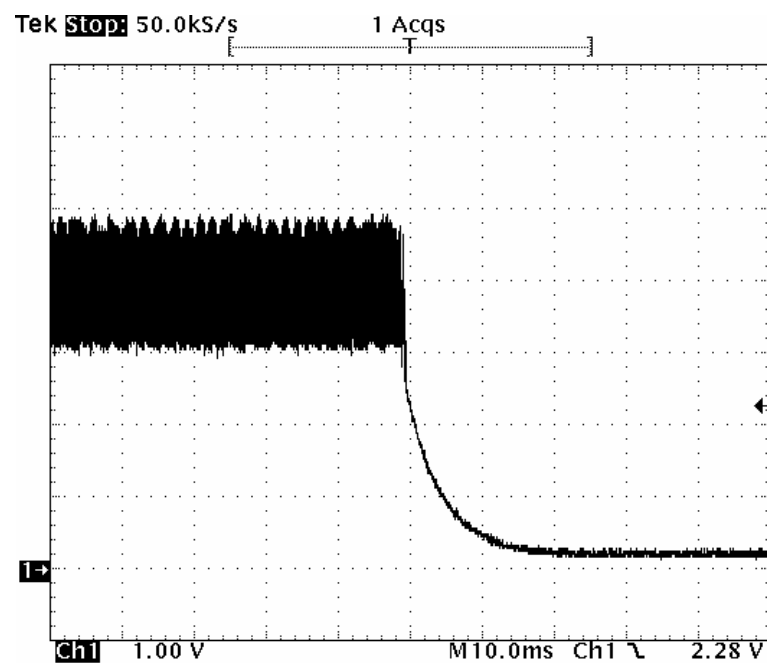
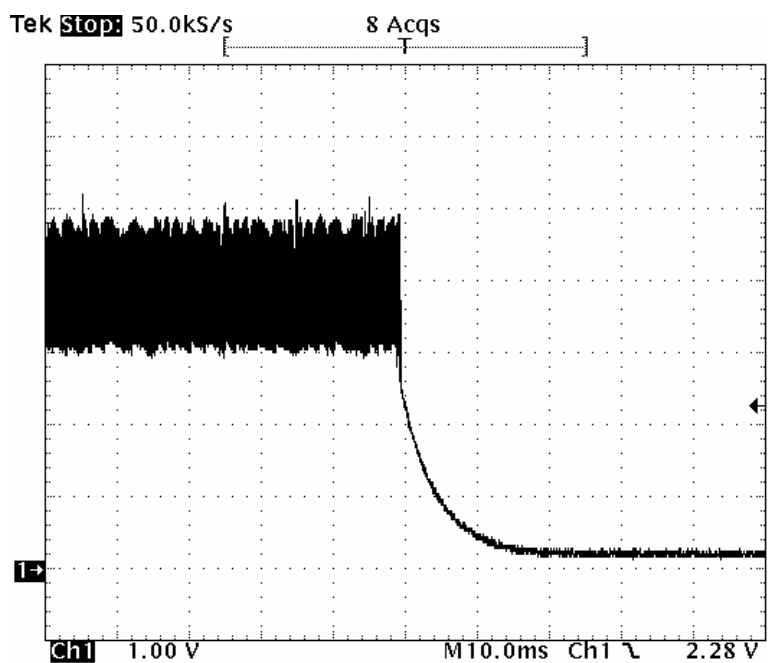
(Simulate with R8 shorted, or R7 opened)

90V_{AC}, LED Load

V_{MAX_OVP} = 5.22 V

264V_{AC}, LED Load

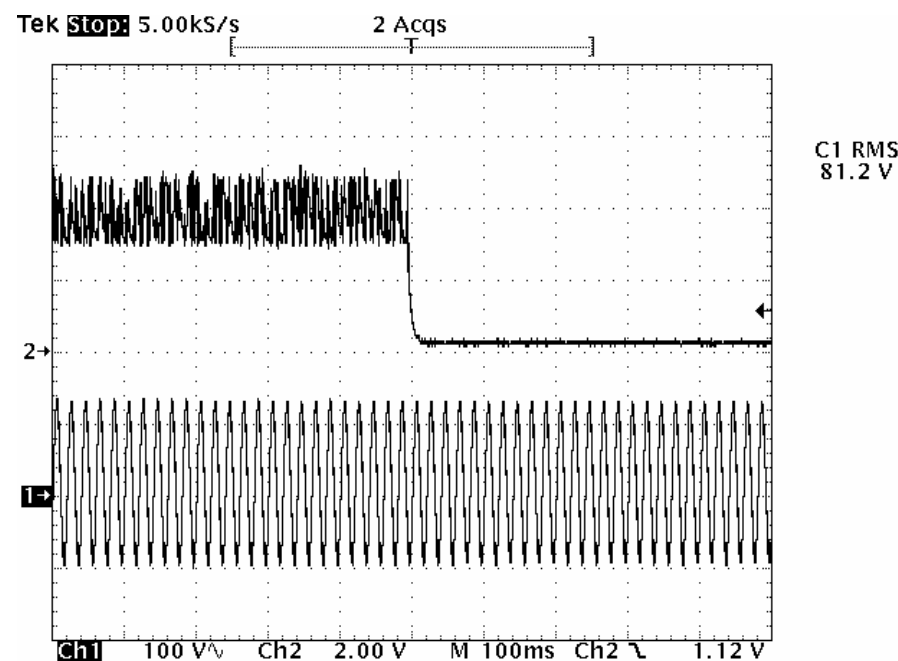
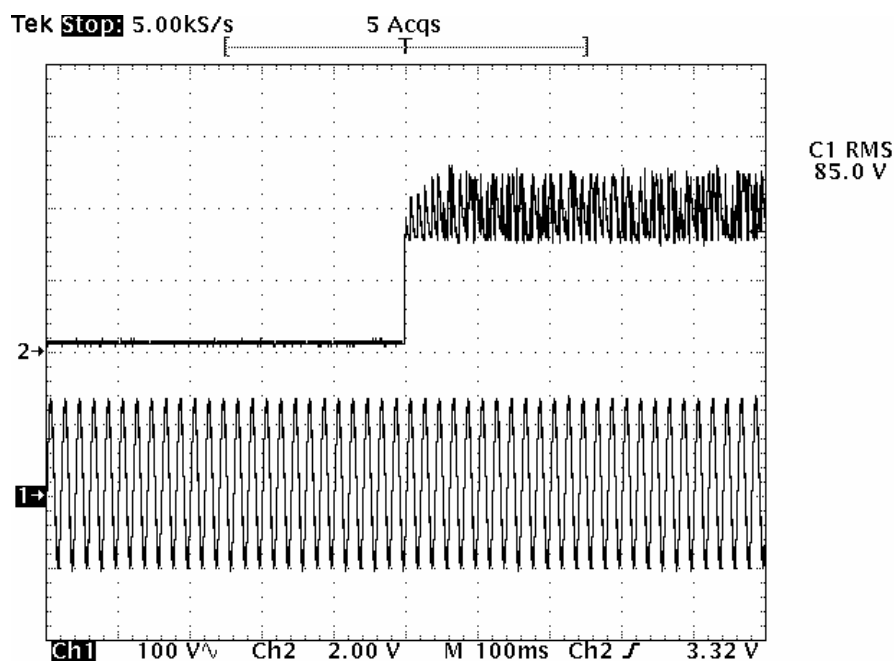
V_{MAX_OVP} = 4.94 V



14. AC Startup & Brownout Voltage Characteristic

LED Load, $V_{IN_STARTUP} = 85.0 \text{ V}_{AC}$

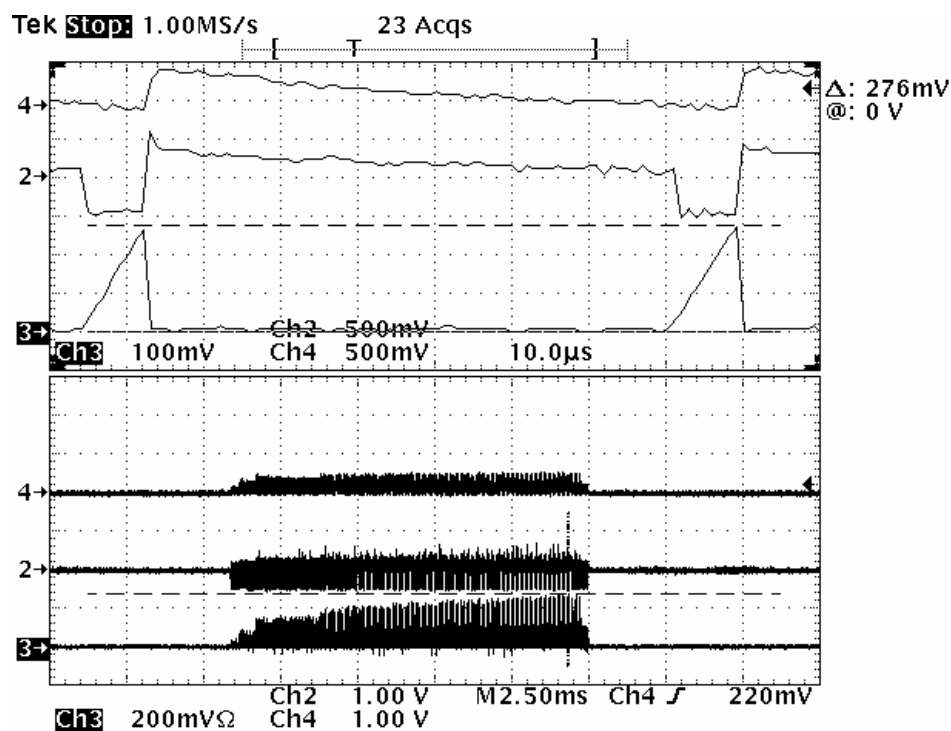
LED Load, $V_{IN_BROWNOUT} = 81.2 \text{ V}_{AC}$



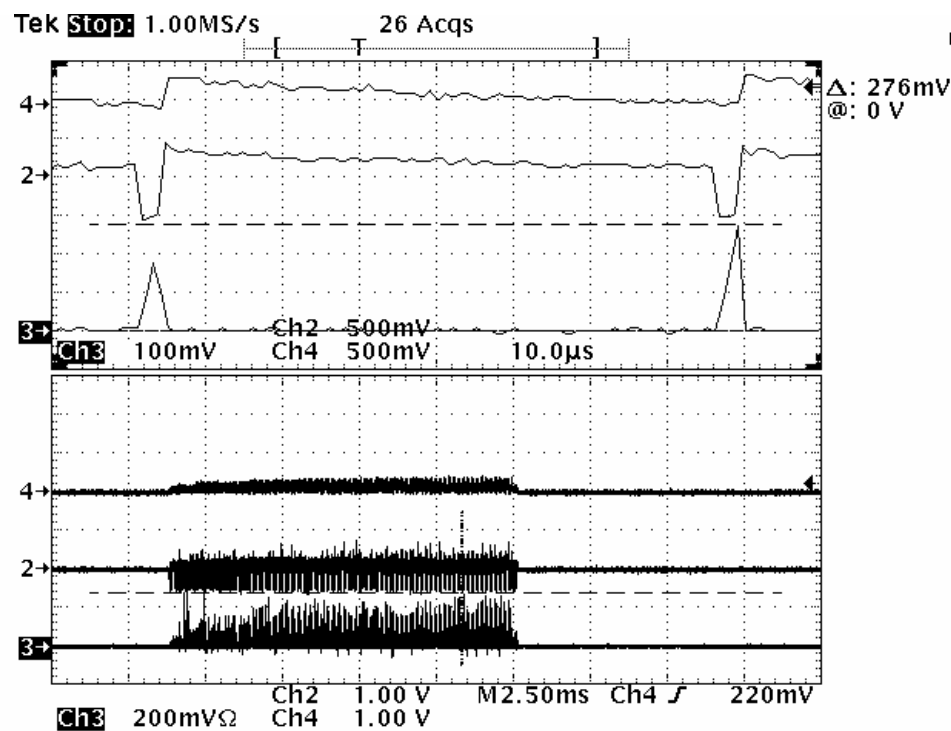
15. Start up with Short O/P

(Simulate short condition at end of PCB)

90 V_{AC}



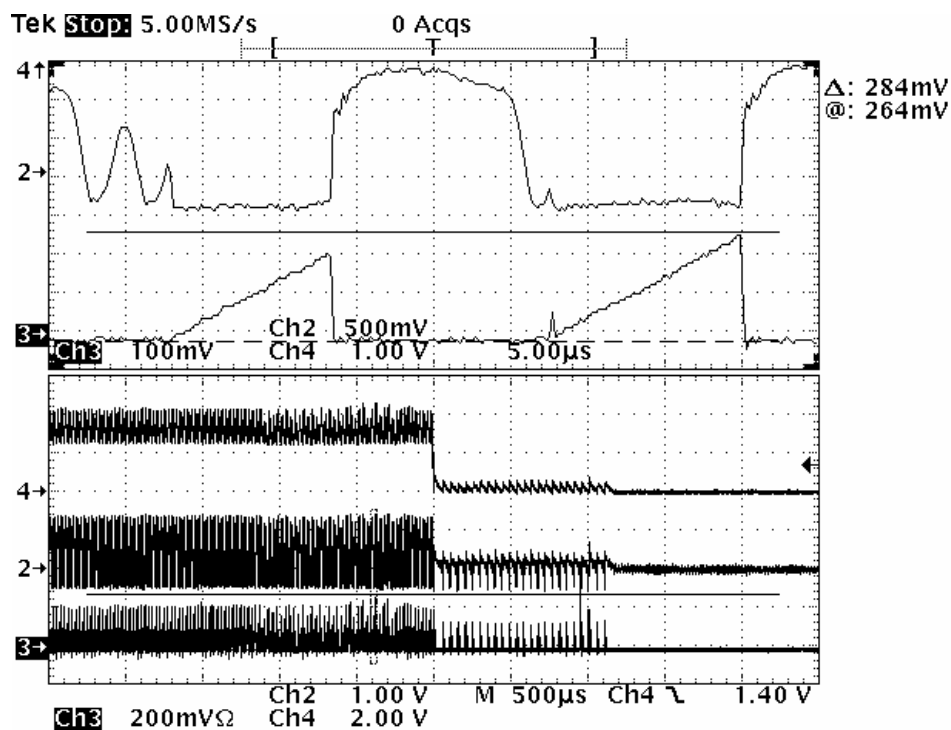
264 V_{AC}



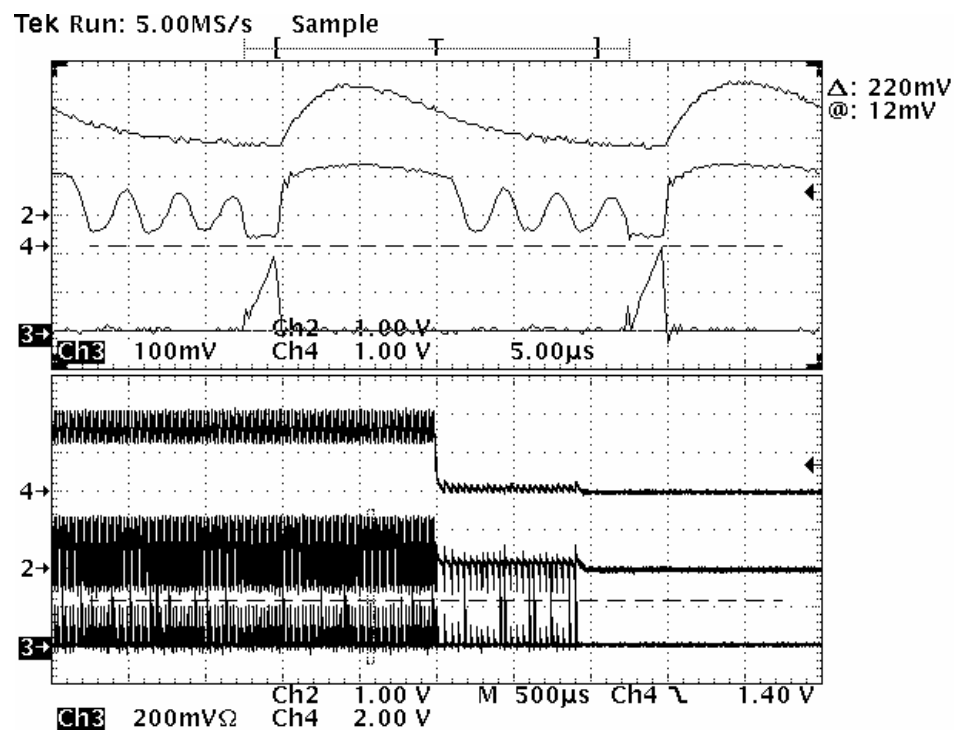
16. Apply Short during operation

(Simulate short condition at end of PCB)

90 V_{AC}

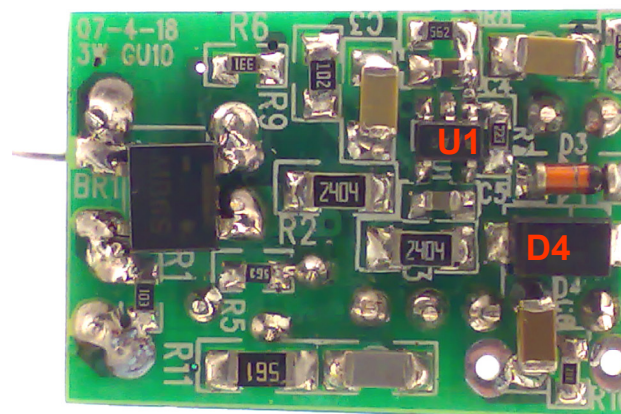
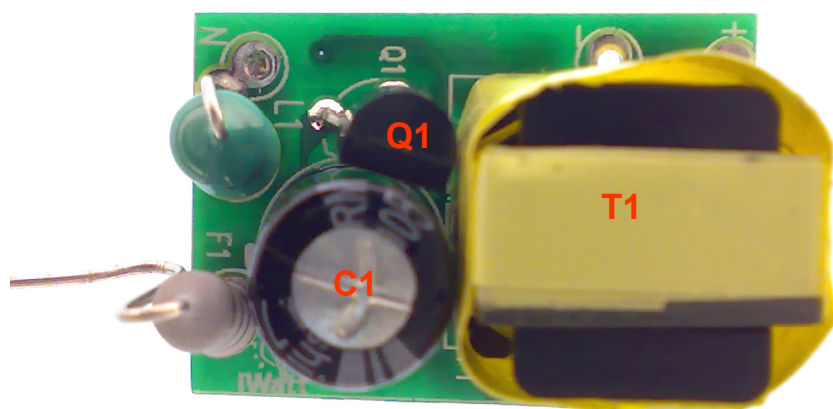


264 V_{AC}



17. Thermal Test for Major Critical Components

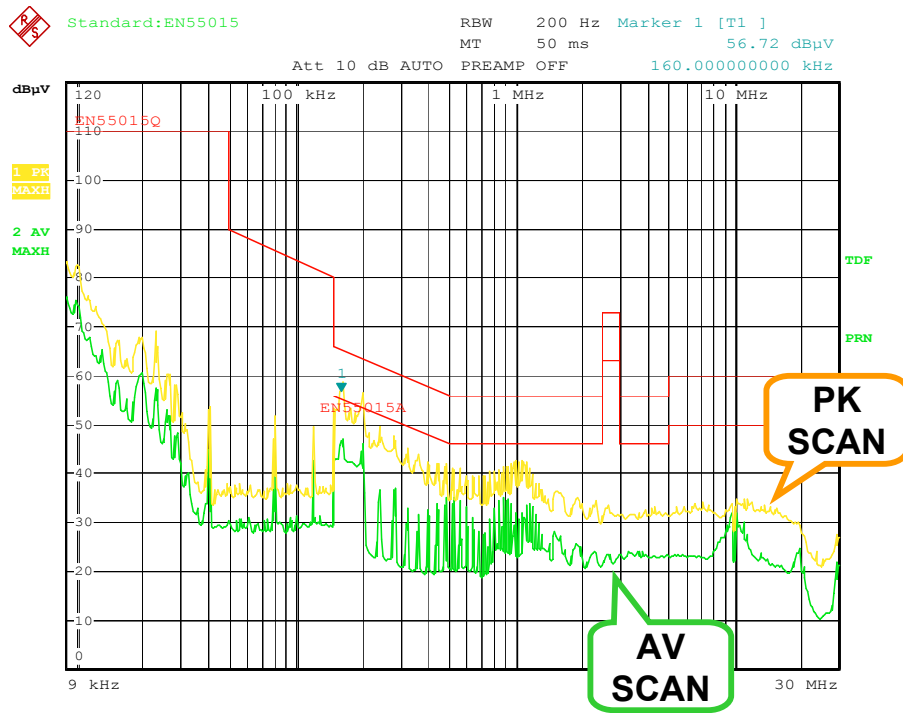
ITEM	Vin=90Vac		Vin=264Vac	
	T(°C)	Tr(°C)	T(°C)	Tr(°C)
Input CAP(C1)	77.6	34.5	74.8	32.2
Transformer(T1)	83.3	40.2	85.2	42.6
CEK01N6A(Q1)	77.5	34.4	81.2	38.6
IW1689(U1)	76.8	33.7	78	35.4
Output SK-Diode(D4)	87.4	44.3	88.3	45.7
Ambient Temperature	43.1		42.6	



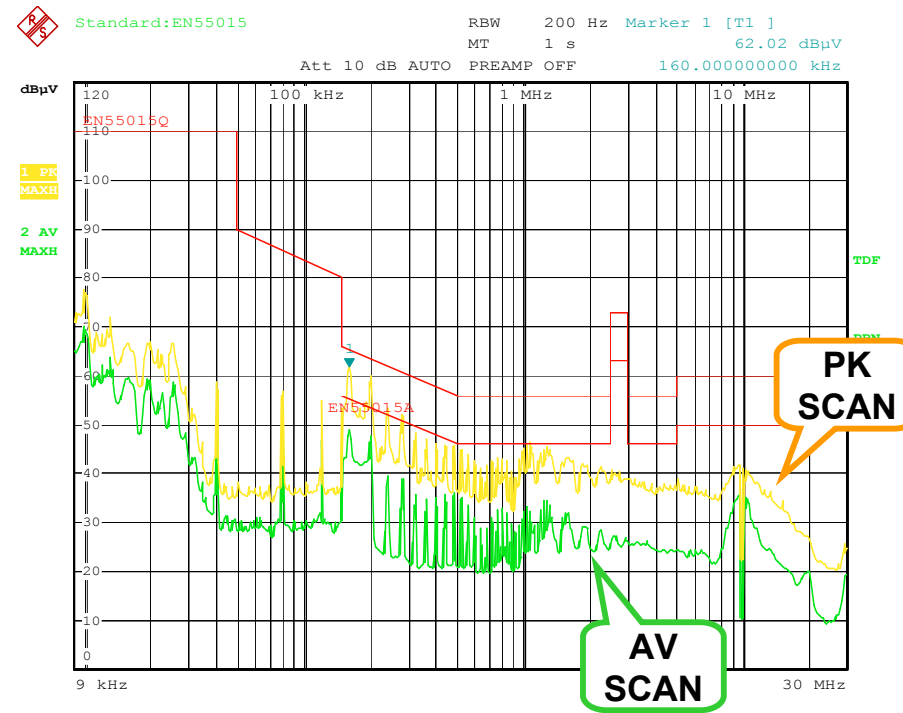
18. Conducted EMI (per EN55015B)

230V_{AC}/50Hz, Live

230V_{AC}/50Hz, Neutral



Comment B: Manuf: IWATT EUT: LED LAMP M/N: LED 3W-4 Memo: ON Power: L 23
0V/50Hz
Date: 25.APR.2007 14:57:33



Comment B: Manuf: IWATT EUT: LED LAMP M/N: LED 3W-4 Memo: ON Power: N 23
0V/50Hz
Date: 25.APR.2007 14:55:12

Test Conditions : 3W LED load.