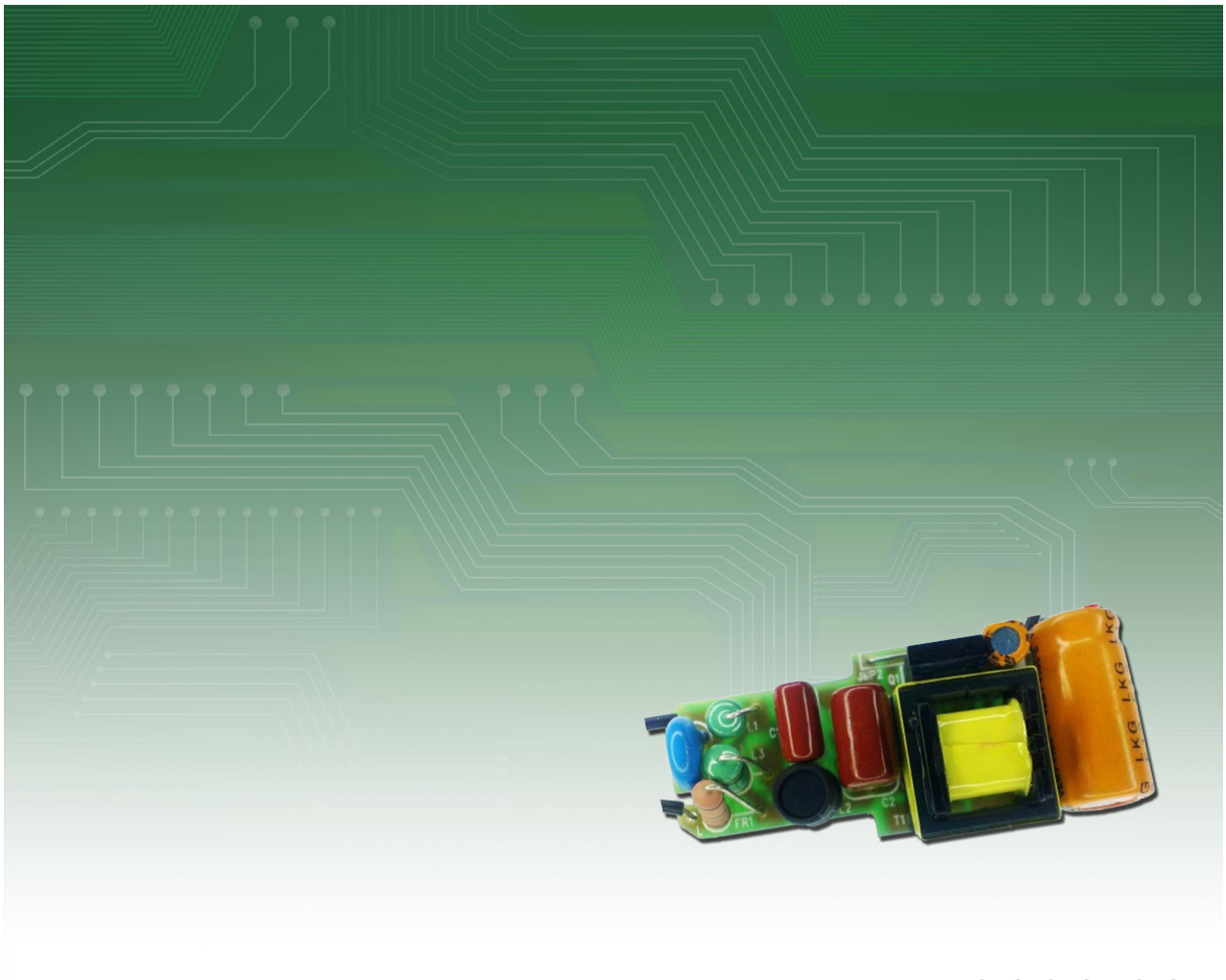
Reference Design

EBC932

iWatt
Power Management Simplified Digitally™



LED Driver with iW3626-00

(AC input 90-264 V_{AC}, Output 100V 80mA)

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1.0 Introduction

This reference design describes a 33 LEDs output, universal input (90–264V_{AC}) power supply for non-dimmable LED applications. For this design the iW3626-00 is used. This document contains the complete specification of the LED driver, a detailed circuit diagram, an entire bill of materials required to build the LED driver, a drawing of the power transformer, and test data of the most important performance.

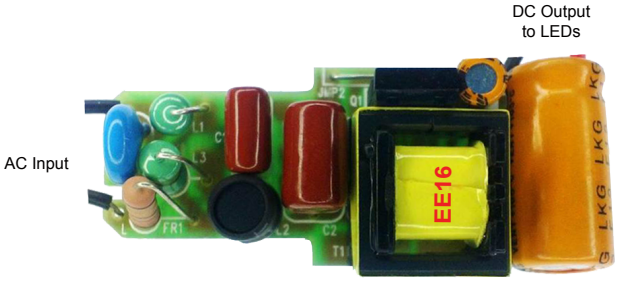


Figure 1.1 PCB Top View

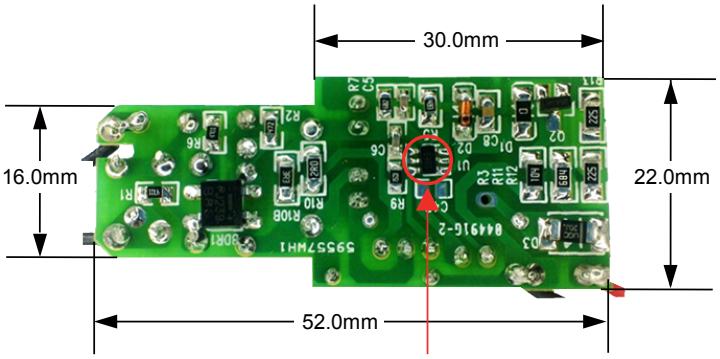


Figure 1.2 PCB Bottom View

2.0 Design Features

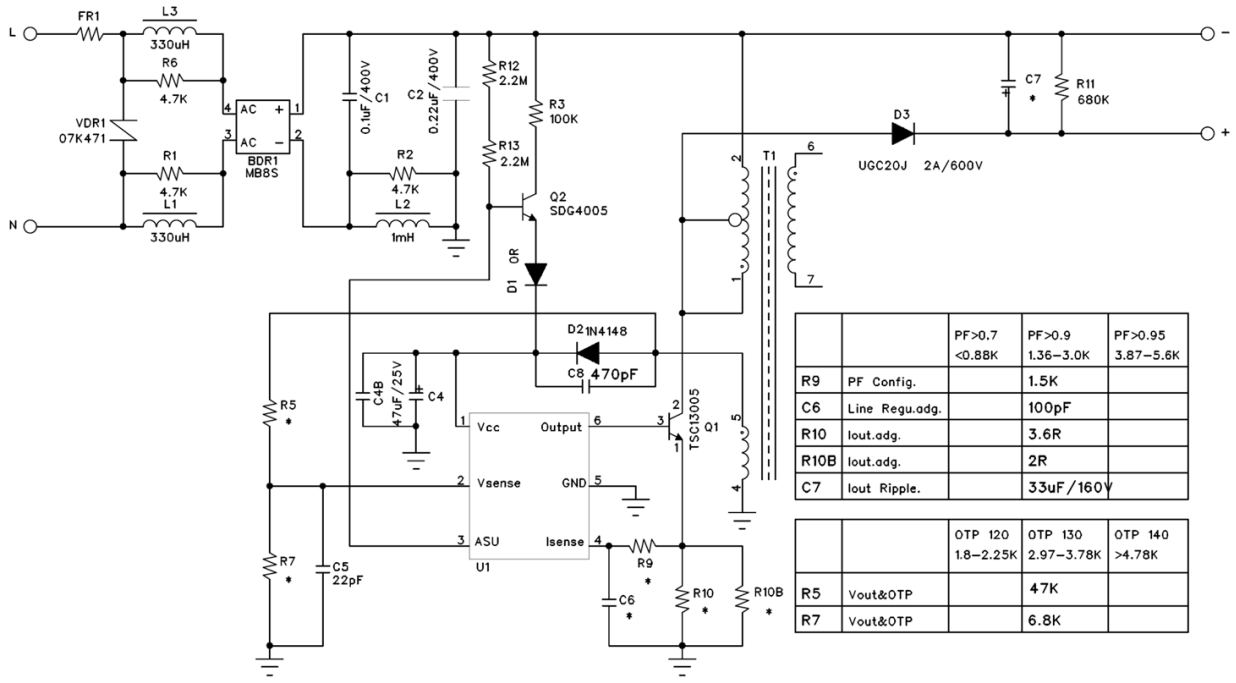
- AC input range 90-264V_{AC}
- DC output 100V 80mA(constant current)
- Non-isolated high efficiency
- Single stage high PF with buck boost

3.0 Design Specification

The table below represents the minimum acceptable performance of the design.

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})			150		mW	
Output						
Output voltage	V_{OUT}		100		V	Measured at the PCB connector
Output current	I_{OUT}		0.08		A	
Total Output Power						
Continuous output power	P_{OUT}		8		W	
Over current protection	I_{OUT_MAX}				A	Auto-restart
Power factor	*PF*	0.7				Harmonic meet IEC61000-3-2
Efficiency	η		88		%	Measured at end of PCB V_{IN}=100V_{AC} (T_{AMB}=25°C)
Turn on delay time					Sec	
Environmental						
Conducted EMI			Meets EN55015B			
Hi-pot test					KV	
Operation temperature	T_{OPR}		40		°C	Free convection, sea level

4.0 Schematic

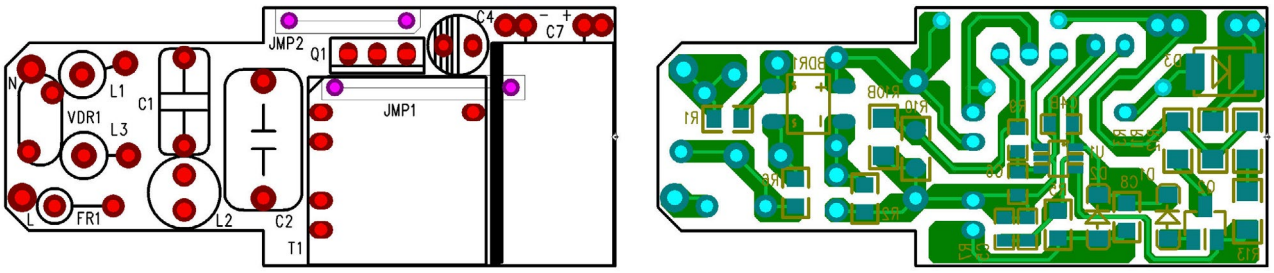


		PF>0.7 <0.88K	PF>0.9 1.36–3.0K	PF>0.95 3.87–5.6K
R9	PF Config.		1.5K	
C6	Line Regu.adg.		100pF	
R10	Iout.adg.		3.6R	
R10B	Iout.adg.		2R	
C7	Iout Ripple.		33uF/160V	

		OTP 120 1.8–2.25K	OTP 130 2.97–3.78K	OTP 140 >4.78K
R5	Vout&OTP		47K	
R7	Vout&OTP		6.8K	

Figure 4.1 Design Schematic

5.0 PCB Layout



a) PCB Top b) PCB Bottom

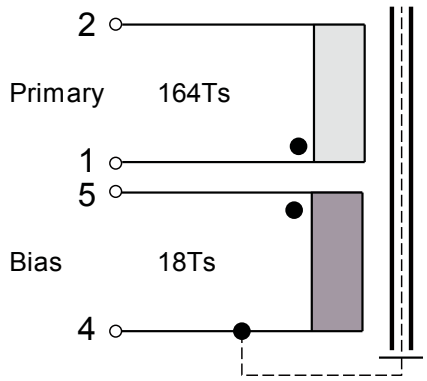
Figure 5.1 PCB Layout 52.0 mm x 22.0 mm

6.0 Bill of Materials

Item	Qty.	Ref.	Description	Manufacturer P/N	Manufacturer
1	1	U1	iW3626-00, off-line digital power controller for LED driver, SOT23-6	iW3626-00	iWatt, Inc
2	1	C1	0.1μF, 400V, CBB, pin=7.5mm	AF104J2G079L250D9R	Carli
3	1	C2	0.22μF, 400V,CBB, pin=10mm	AF224J2G109L250D9R	Carli
4	1	C4	47μF/25V, E-Cap, (Φ5mm×11mm)	47UFLK25V	Yongming
5	1	C7	33μF/160V, E-Cap, (Φ13mm×20mm)	33UFLK200V	Yongming
6	1	C5	22pF/50V, NPO, SMD-0603	CL10C220JB8NNNC	Samsung
7	1	C6	100pF/50V, NPO, SMD-0603	CL10C100JB8NNNC	Samsung
8	1	C8	470pF/50V, X7R, SMD-0805	CL21C471KB8NNNC	Samsung
9	2	L1 ,L2	330μH, 0510	330UF0510	DAXING
10	1	L3	6x8mm, 1.0mH	6X8MM1.0MH	DAXING
11	1	BR1	B8S	B8S	PANJIT Semiconductor
12	1	D1	0Ω, ±5%, SMD-1206	RC1206JR-070RL	YAGEO
13	1	D2	IN4148, LL34	IN4148	PANJIT Semiconductor
14	1	D3	UGC20J, 2A/600V	UGC20J	ZOWEI
15	3	R1,R2,R6	4.7kΩ, ±5%, SMD-0805	RC0805JR-074K7L	YAGEO
16	1	R3	100kΩ, ±5%, SMD-1206	RC1206JR-07100KL	YAGEO
17	1	R5	47kΩ, ±5%, SMD-0805	RC0805JR-0739KL	YAGEO
18	1	R7	6.8kΩ, ±1%, SMD-0603	RC0603FR-075K6L	YAGEO
19	1	R9	1.5kΩ, ±1%, SMD-0603	RC0603FR-074K3L	YAGEO
20	1	R10	2Ω, ±1%, SMD-0805	RC0805FR-071R5L	YAGEO
21	1	R10B	3.6Ω, ±1%, SMD-0805	RC0805FR-075R6L	YAGEO
22	1	R11	680kΩ, ±5%, SMD-0805	RC0805JR-07100KL	YAGEO
23	2	R12 ,R13	2.2MΩ, ±5% SMD-1206	RC1206JR-072M2L	YAGEO
24	1	VDR1	VDR, 07D471	TVR07471KSY	Thingking Electronic
25	1	FR1	10Ω, 1W fusible resistor wirewound resistor	KNP1WST-52-J-10R	ShunChi Electronic
26	1	Q2	3DG4005	33DG40005AS-H	Huajing
27	1	JMP1	15mm, 0.5mm		
28	1	JMP2	10mm, 0.5mm		
29	1	Q1	BTR13005GD, TO-126	BTR13005GD	IPS
30	3	"L,N,+"	UL3239/24AWG, L=60mm, striped and tin plated 3mm, red color		
31	1	"-"	UL3239/24AWG, L=60mm, striped and tin plated 3mm, black color		
32	1	PCB	FR-4, single sided board, 60*23*1.5mm,1oZ		
33	1	Transformer	EE-16 horizontal type		Xingyuanyang

7.0 Transformer Drawing

Schematic:



Note:
- Dot (●) denotes electrical start.
- Electrical start could be different from mechanical or winding start.
- Ferrite core is to be connected to Pin 4 with copper.

Electrical Specifications:

1.	Primary Inductance (Lp) = 1.5mH @10KHz
2.	Primary Leakage Inductance (Lk)≤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)

8.0 Performance

8.1 Constant Current and Efficiency

* Note: AC input 90-264V_{AC}, Output 33 LEDs, PF configuration R=1.3KΩ/C=100pF

V_{IN} (V_{AC})	P_{IN} (W)	V_{OUT} (V)	I_{OUT} (mA)	Ripple(PK) (mA)	η (%)	Power Factor
90	8.830	98.16	80.0	91	88.93%	0.94
100	8.770	97.96	80.1	91	89.47%	0.94
110	8.730	97.9	80.3	90	90.05%	0.93
120	8.710	97.85	80.6	90	90.55%	0.93
135	8.800	97.92	81.9	90	91.13%	0.91
150	8.920	97.98	83.2	90	91.39%	0.89
160	8.910	97.98	83.4	90	91.71%	0.88
170	8.880	97.96	83.4	88	92.00%	0.87
180	8.820	97.92	83.0	88	92.15%	0.87
190	8.730	97.87	82.3	87	92.26%	0.87
200	8.630	97.82	81.4	87	92.27%	0.86
210	8.630	97.84	81.4	86	92.28%	0.84
220	8.610	97.83	81.2	86	92.26%	0.83
230	8.590	97.82	81.0	86	92.24%	0.82
240	8.550	97.8	80.8	86	92.42%	0.8
250	8.540	97.8	80.6	86	92.30%	0.79
264	8.510	97.78	80.3	86	92.26%	0.77

8.2 Harmonic

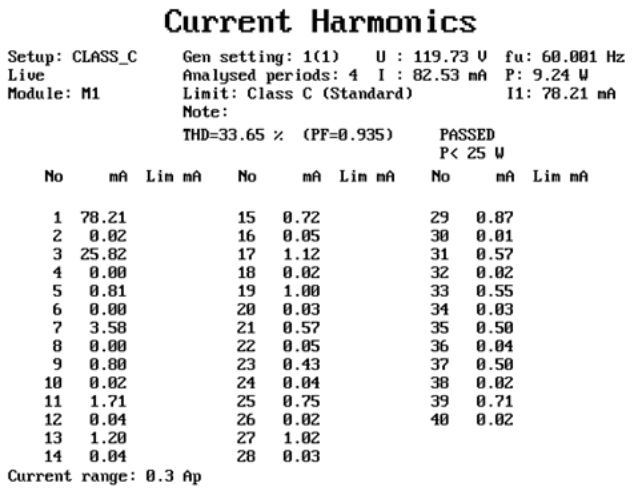


Figure 8.2.1 Current Harmonics, PF>0.9, V_{IN}=110V_{AC}

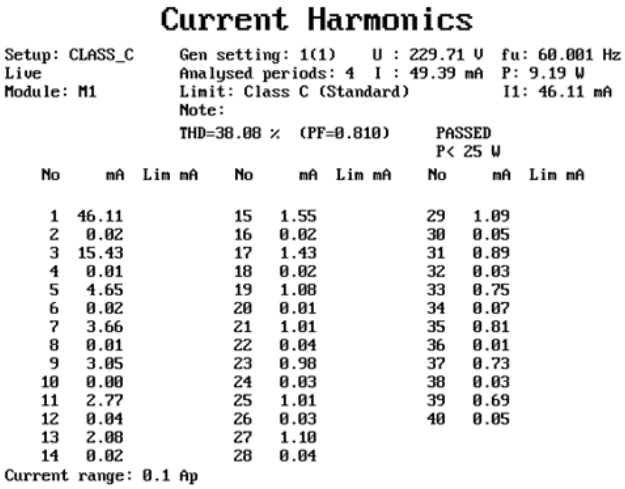
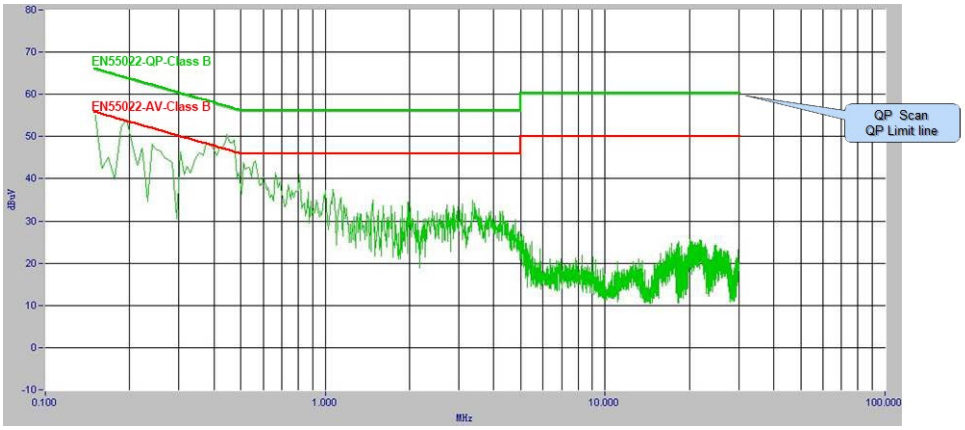


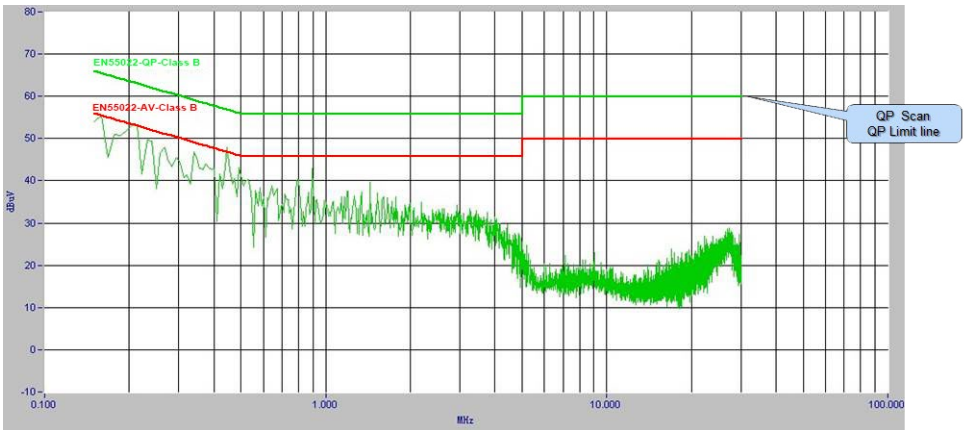
Figure 8.2.2 Current Harmonics, PF>0.9, V_{IN}=230V_{AC}

8.0 Performance (Cont.)

8.3 Conducted EMI



a) QP Scan L



b) QP Scan N

Figure 8.3 EMI Results

Trademark Information

Contact Information

Web: http://www.iwatt.com
E-mail: info@iwatt.com
Phone: +1 (408) 374-4200
Fax: +1 (408) 341-0455

iWatt Inc.

675 Campbell Technology Parkway, Suite 150
Campbell, CA 95008

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