

DIO8650 buck boost-80V235mA- THD<5% for LED T-tube lighting

General Design Specification:

1. AC Input Voltage : 100~277Vac
2. DC Output Voltage: 80V
3. DC Output Current: 235mA
4. Min Power Factor > 0.95
5. Total Harmonic Distortion < 5%



1. Introduction

This Demo evaluation report describes a 80V DC output, universal input (100~277V_{AC}) single stage Flyback & PFC power supply for isolated LED applications. DIO8650 is used for this design. This document contains the complete specification of the LED driver, a detailed circuit diagram, an entire BOM to build the LED driver, a drawing of the power transformer, and test data of the most important performance.

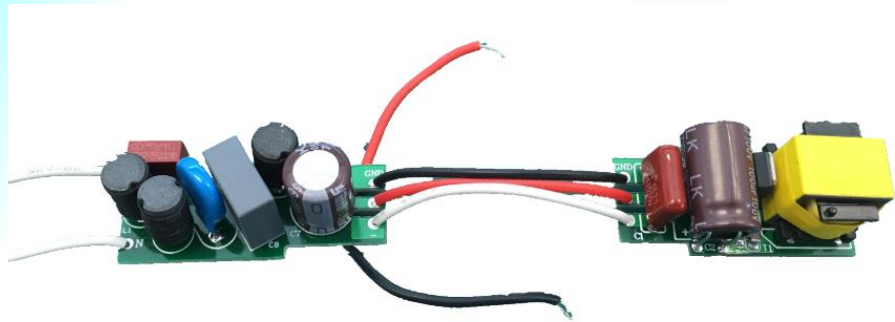


Figure 1.1 PCB Top view

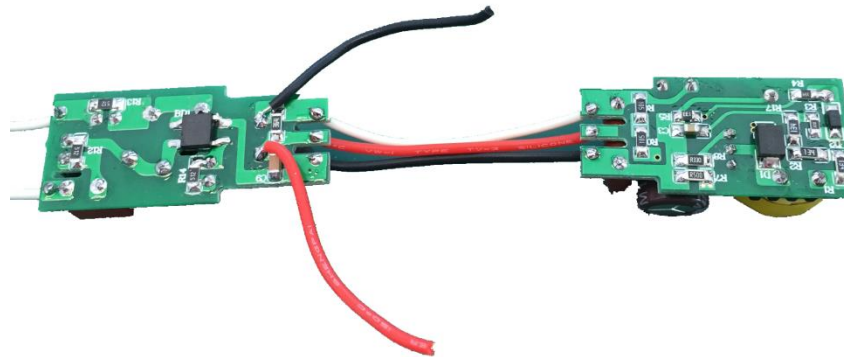


Figure 1.2 PCB Bottom view

2. Specification

Table 2.1 Performance Specification Summary

Description	Symbol	Min	Typ	Max	Units	Comment
Input						
Voltage	V_{IN}	100		277	V _{AC}	2 Wire
Frequency	F_{IN}	47	50/60	63	Hz	
Output						
Output Voltage	V_{OUT}		80		V	Measured at the end of PCB
Output Current	I_{OUT}		235		mA	
Continuous Output Power	P_{OUT}		18.8		W	
Efficiency	η	90			%	Measured at $V_{IN} = 115V_{AC}$ and $230V_{AC}$
Power Factor	PF	0.95				
THD	THD			5	%	Measured at $V_{IN} = 115V_{AC}$ and $230V_{AC}$
Reliability	Full Protection					
Ambient Temperature	T_{AMB}	0		40	°C	Free convection, sea level

4. Bill of Material

Table 4.1 BOM List

Type	Description	Qty.	Unit	Ref.	Remark
SMD Resistor	RES-SMD-1206-130.00K-1%-0.250W	3	Pcs	R1,R2,R3	
	RES-SMD-1206-360.00K-1%-0.250W	2	Pcs	R16,R21	
	RES-SMD-1206-000.82R-1%-0.250W	2	Pcs	R7,R8	
	RES-SMD-1206-001.00M-5%-0.250W	2	Pcs	R22,R23	
	RES-SMD-0805-002.00K-5%-0.125W	1	Pcs	R24	
	RES-SMD-0805-100.00R-1%-0.125W	1	Pcs	R10	
	RES-SMD-0805-022.00R-1%-0.125W	1	Pcs	R9	
	RES-SMD-0805-030.00R-1%-0.125W	1	Pcs	R3	
	RES-SMD-0805-150.00K-5%-0.125W	1	Pcs	R4	
	RES-SMD-0805-009.10K-1%-0.125W	1	Pcs	R5	
	RES-SMD-0805-005.10K-5%-0.125W	3	Pcs	R12,R13,R14	
	RES-SMD-0805-002.00K-5%-0.125W	1	Pcs	R6	
	RES-SMD-0805-010.00K-5%-0.125W	1	Pcs	R11	
SMD Capacitor	CAP-SMD-0805-X7R-004.70uF-10%-25V	1	Pcs	C4	
	CAP-SMD-1206-X7R-002.20uF-10%-50V	1	Pcs	C3	
	CAP-SMD-0805-X7R-330.00nF-10%-25V	1	Pcs	C10	
	CAP-SMD-1206-X7R-001.00nF-10%-1000V	2	Pcs	C5,C9	
Varistor	VAR-Φ10-560V-Φ10D561K	1	Pcs	VR1	
Safety Capacitor	CAP-X2-100.00nF-305Vac P10	1	Pcs	C8	
Electrolytic Capacitor	CAP-AEC-033.00uF-160V 10*12.5 P5	2	Pcs	C2,C7	
Film Capacitor	CAP-MPP-100.00nF-520V-10*12 P10	1	Pcs	C1	
SMD Diode	DIO-USF-SMA-002.00A-800V-ES2K	1	Pcs	D1	
DM inductor	Ld-G6*10-1.1mH	3	Pcs	L1,L2,L3	
Transformer	TI-EE13-900uH	1	Pcs	T1	
Fuse	FUS-AXIAL0.5-1.0A-250V	1	Pcs	F1	
MOSFET	MOS-4.0A-700V-4N70_TO251	1	Pcs	Q1	
Rectifier bridge	BR-0.6A-1000V-MB10S	1	Pcs	BD1	
IC	IC-DIO8650-SOT23-6	1	Pcs	U1	
PCB		1	EA		

5. PCB Layout

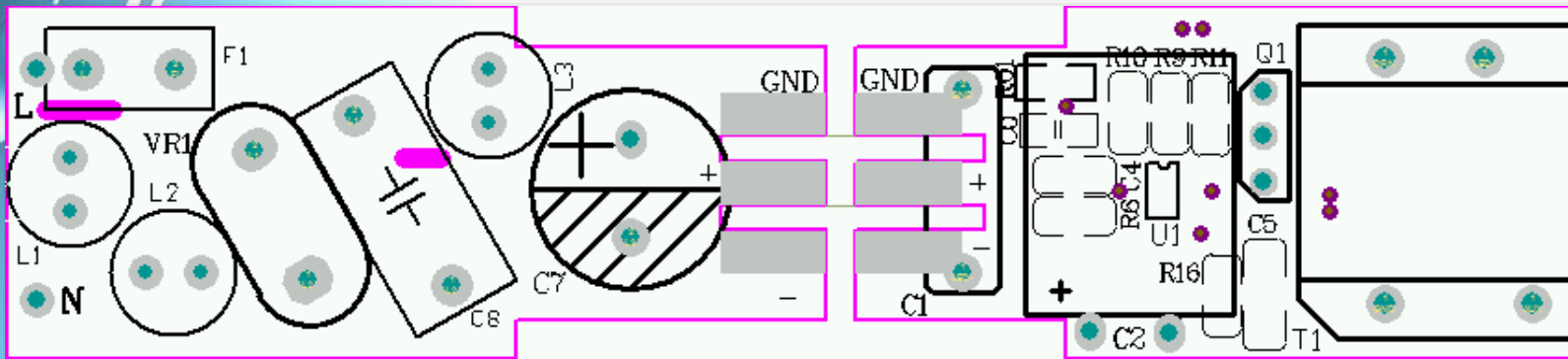


Figure 5.1 PCB Silkscreen Layout Top View

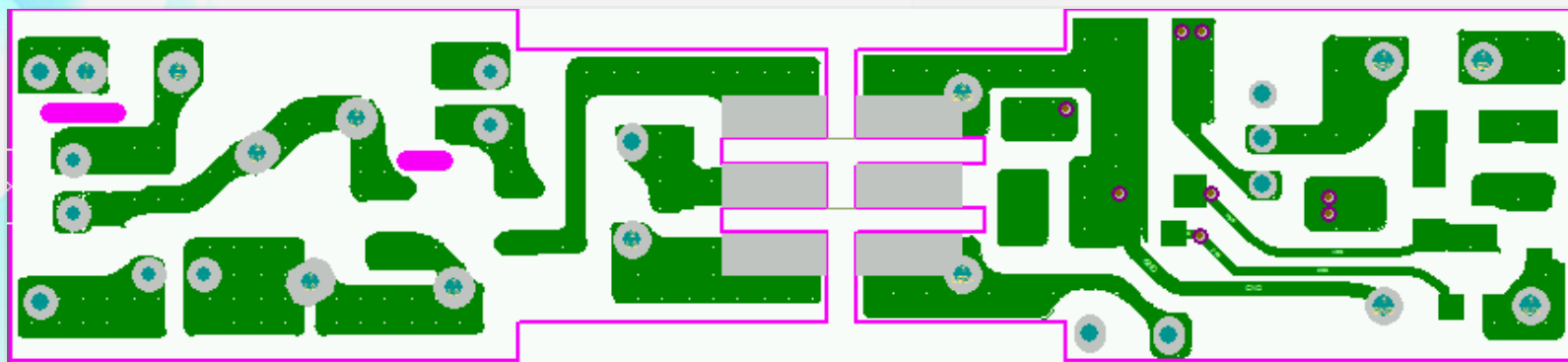
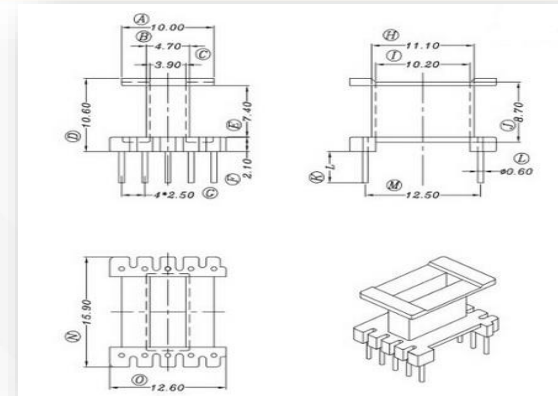


Figure 5.2 PCB Copper Foil Layout Bottom View

6. Transformer Drawing



a) Transformer schematic



b) Transformer view

Figure 6.1 Transformer Drawing

Table 6.1 Transformer Drawing Specification

Electrical Specifications:	
1	Primary inductance (L_p) = $420\mu\text{H} \pm 5\%$ @ 10kHz, $1V_{\text{RMS}}$
2	Primary leakage inductance (L_k) = $42\mu\text{H}$ @ 10kHz, $1V_{\text{RMS}}$
Materials:	
1	Core : EE13W (ferrite material TDK PC40)
2	Bobbin : EE13 widen
3	Magnet wires (Pri): 2UEW0.35 ϕ , 2UEW0.15 ϕ ($T > 130^\circ\text{C}$)
4	Magnet wire (Sec) : triple insulated wires
5	Layer insulation tape : 3M1298 or equivalent

7. Line Regulation

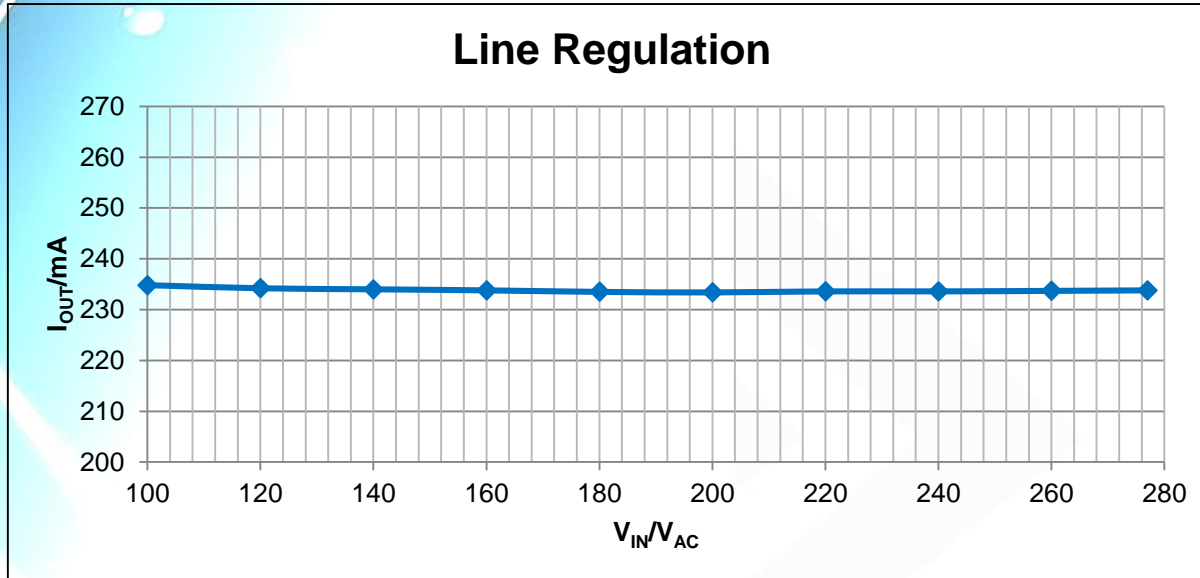


Figure 7.1 Line Regulation curve

Table 7.1 Line Regulation test data

Line Regulation												
Load (V _{DC})	V _{IN} (V _{AC})											Line Regulation
	100	110	120	140	160	180	200	220	240	260	277	
80	234.8	234.3	234.2	234	233.8	233.5	233.4	233.6	233.6	233.7	233.8	0.6%

8. Efficiency

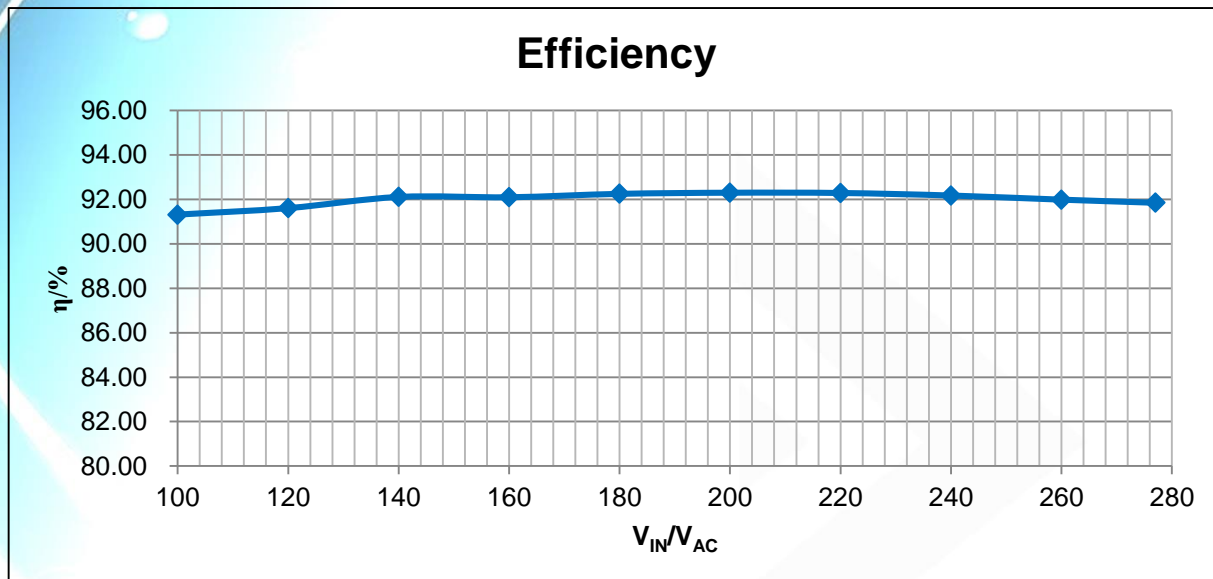


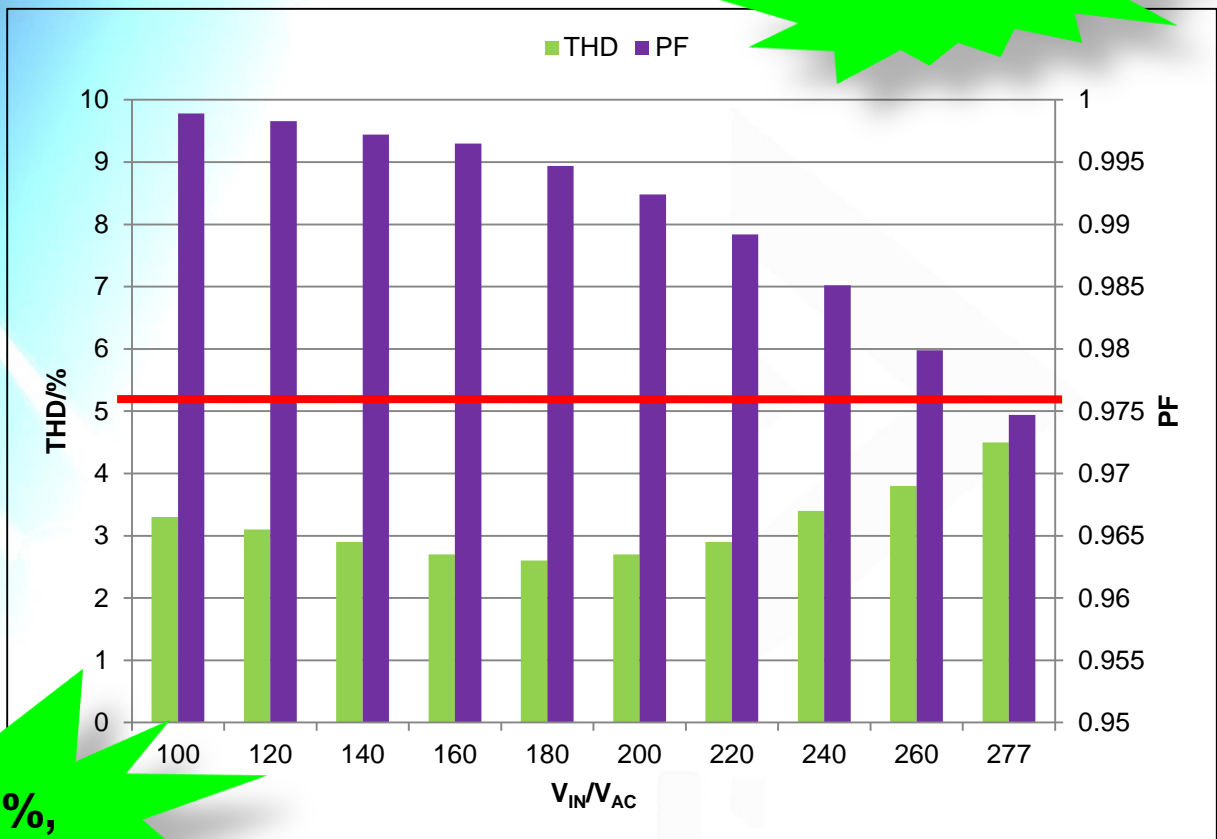
Figure 8.1 Efficiency curve

Table 8.1 Efficiency test data

$V_{IN}(V_{AC})$	$P_{IN}(W)$	$V_{OUT}(V)$	$I_{OUT}(mA)$	η
100	20.7	80.5	234.8	91.31%
120	20.53	80.3	234.2	91.60%
140	20.4	80.3	234	92.11%
160	20.36	80.2	233.8	92.10%
180	20.3	80.2	233.5	92.25%
200	20.28	80.2	233.4	92.30%
220	20.3	80.2	233.6	92.29%
240	20.3	80.1	233.6	92.17%
260	20.35	80.1	233.7	91.99%
277	20.39	80.1	233.8	91.85%

9. PF & THD

PF > 0.95



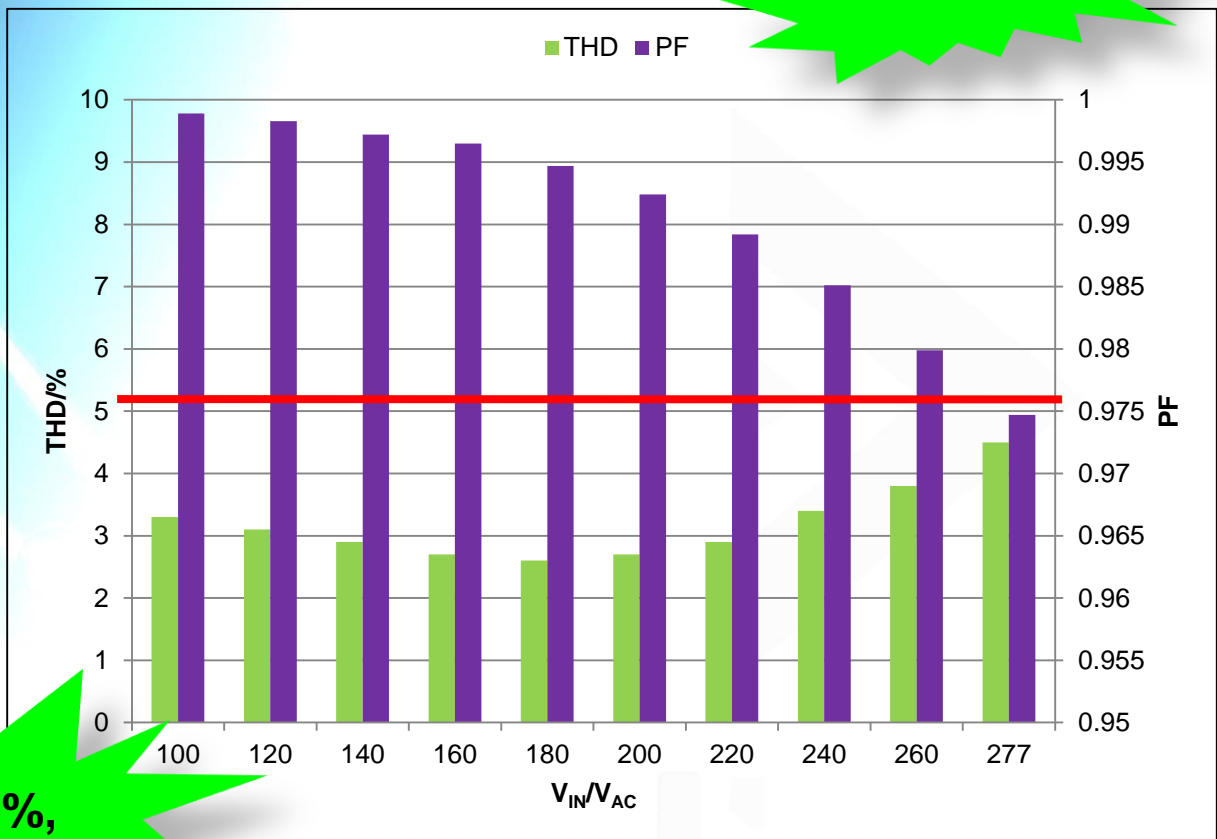
**THD < 5%,
业界领先**

Figure 9.1 Total Harmonics Distribution & Power Factor VS V_{IN}/V_{AC}



9. PF & THD

PF > 0.95



**THD < 5%,
业界领先**

Figure 9.1 Total Harmonics Distribution & Power Factor VS V_{IN}/V_{AC}

