



T8 LED Driver Module with the Active Power Factor Correction

AC Input Voltage Range	LED DC Output Voltage/Current	Output Power
90V _{AC} /60Hz ~ 285V _{AC} /50Hz	70V/230mA	16.1W

Key Features

- Universal input from 90V_{AC}/60Hz to 285V_{AC}/50Hz, LED DC 70V/230mA output
- One cycle control Power Factor Correction (PFC) and typical PF value > 0.94
- Fixed frequency buck converter and maximum efficiency : 88%
- LED output current variation within ±3%
- Dimension : 62mm×18mm×19mm
- Typical application : T8

Introduction

This application note describes a constant current T8 power module with one cycle control active power factor correction for full range input voltage from 90V_{AC} ~ 285V_{AC} by adopting the SQ6211. Based on buck PFC topology, the SQ6211 is able to achieve high power factor value for T8 lighting application. This application provides multiple advanced fault protections to enhance the systems safety, including Open Loop Protection (OLP), Short Circuit Protection (SCP), V_{DD} under-voltage lockout and thermal shut down. All protections have auto-restart mechanisms. Schematics, PCB Gerber, BOM, as well as typical performance are covered in details by this application note. A complete application circuit is depicted in Figure 5, which can work on universal input voltage range from 90V_{AC} ~ 285V_{AC}.

Specification

The Table 1 represents the specification that this design intends to achieve.

Performance

It is to drive output at 70V/230mA targeting to achieve high efficiency ($\eta_{MAX}=88\%$), high power factor (typical PF > 0.94) and current accuracy for AC universal input voltage range 90V_{AC} ~ 285V_{AC}. Actual performance is shown on Table 2. Figure 1, 2, 3 and 4 depict power factor, output current, current variation and efficiency at AC input voltage range 90V_{AC} ~ 285V_{AC} for this module that system designer can adopt it to achieve corresponding performance.

BOM

BOM is shown in Table 3.

PCB Layout

The PCB layout has dimension at 62mm × 18mm × 1mm in order to fit bulb lamp space.

Power Module Photo

Pictures of power module and key components are shown in Figure 6 and 7.



Table 1. Related Specification

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
AC input voltage	V _{AC}	90		285	V	
LED DC output voltage	V _{OUT}		70		V	
LED output current	I _{OUT(SET)}		230		mA	

Table 2. Actual Performance

AC Input	Input Power (W)	Output Current (I _{OUT} , mA)	Output Voltage (V _{OUT} , V)	Current Variation (%) ^(Note)	Efficiency (η, %)	PF
90V _{AC} /60Hz	17.91	224	70	-2.6	87.5	0.944
100V _{AC} /60Hz	17.82	224	70	-2.6	88.0	0.957
110V _{AC} /60Hz	17.81	225	70	-2.2	88.4	0.964
120V _{AC} /60Hz	17.80	225	70	-2.2	88.5	0.967
132V _{AC} /60Hz	17.74	226	70	-1.7	89.2	0.968
180V _{AC} /50Hz	17.68	227	70	-1.3	89.9	0.963
200V _{AC} /50Hz	17.68	228	70	-0.9	90.3	0.957
220V _{AC} /50Hz	17.75	230	70	0.0	90.7	0.951
240V _{AC} /50Hz	17.76	230	70	0.0	90.7	0.944
264V _{AC} /50Hz	17.78	231	70	0.4	90.9	0.933
285V _{AC} /50Hz	17.90	231	70	0.4	90.3	0.931

Note :

Current Variation is defined as follows :

$$\% = \frac{I_{OUT} - I_{OUT(SET)}}{I_{OUT(SET)}} \times 100\%$$

where I_{OUT(SET)} = 230 mA

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Figure 1. Power Factor for AC Input Voltage Range $90V_{AC} \sim 285V_{AC}$

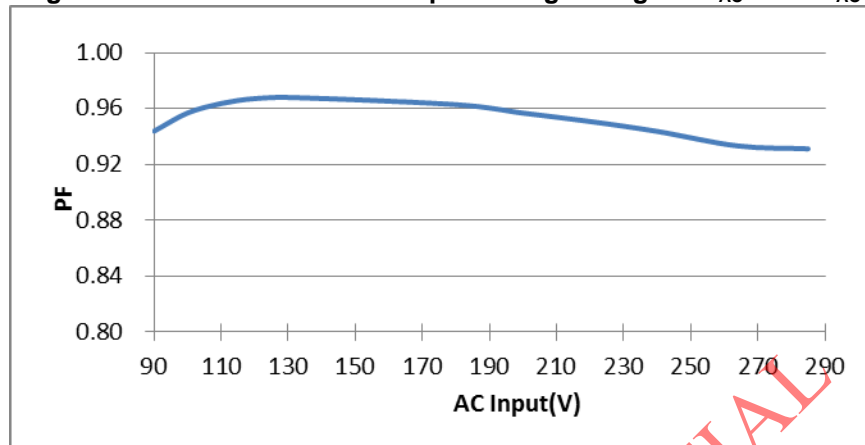


Figure 2. Output Current for AC Input Voltage Range $90V_{AC} \sim 285V_{AC}$

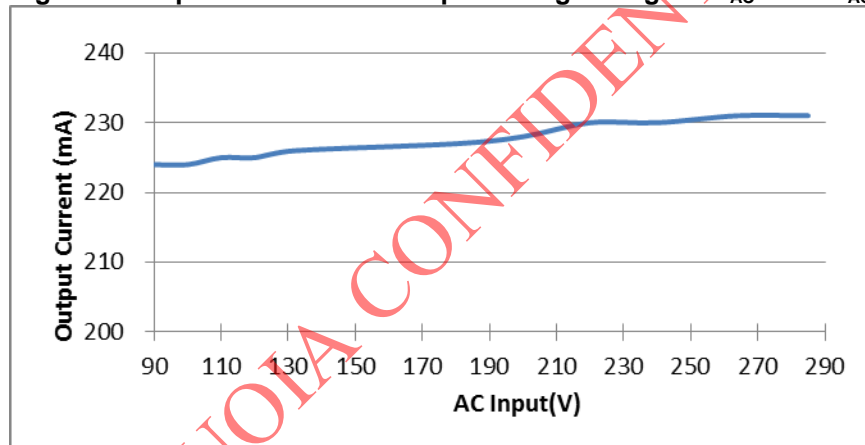


Figure 3. Current Variation for AC Input Voltage Range $90V_{AC} \sim 285V_{AC}$

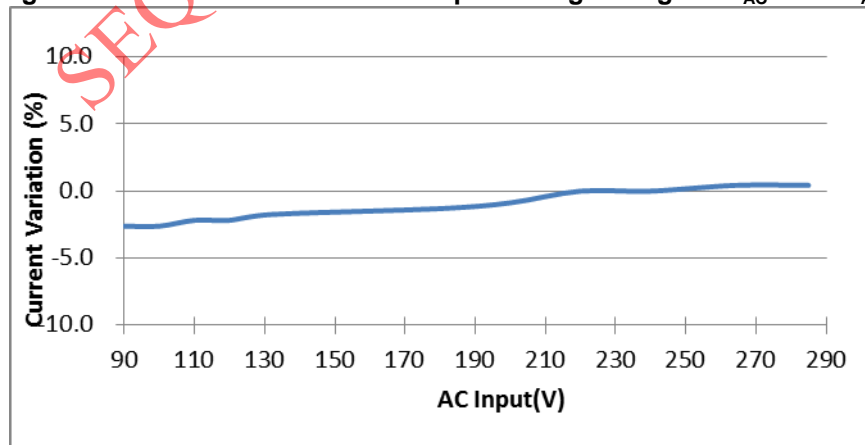


Figure 4. Efficiency for AC Input Voltage Range 90V_{AC} ~ 285V_{AC}

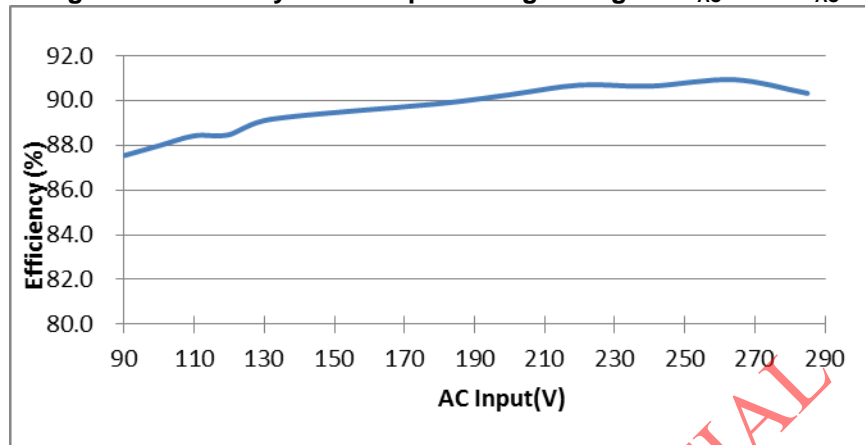


Figure 5. A Complete Application Circuit by Adopting SQ6211

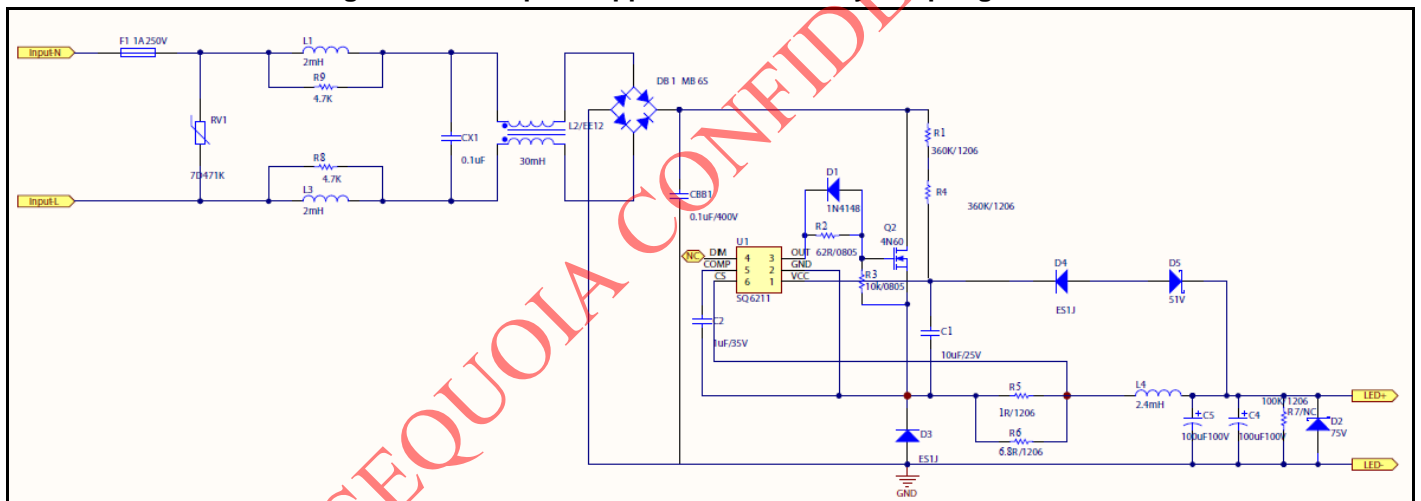




Table 3 : Bill of Material

Item	Symbol	Description	Category	Qty	Note
1	R9 R8	4.7K/0805/J	Resistor	2	
2	R1 R4	360k/1206/F	Resistor	2	
3	R2	62R/0805/J	Resistor	1	
4	R3	10K/0805/F	Resistor	1	
5	R7	NC	Resistor	1	
6	R5	1R/0805/J	Resistor	1	
7	R6	6.8R/1206/J	Resistor	1	
8	R10	10R/0805/J	Resistor	1	NC
9	CB1	104/400V CBB PIN:10mm	Capacitor	1	
10	C1	10uF 0805 25V	Capacitor	1	
11	C2	1uF 1206 25V	Capacitor	1	
12	C4、C5	100uF 100V 8*16mm 105°C	Capacitor	2	
11	DB1	DB106S 1A600V	BRIDGE	1	
12	CX1	104/275V CX2 PIN:10mm	Capacitor	1	
13	D1	1N4148 LL34 SOT-123	Diode	1	
14	D5	51V 1/2W LL34 Glass packaging	Diode	1	
15	D2	75V 1/2W LL34 Glass packaging	Diode	1	
16	D3,D4	ES1J 1A/600V SMA	Diode	2	
17	Q2	mosfet 4A/600V TO-251	MOSFET	1	
17	L1,L3	DR8*12 Lp=2mH	CHOKE	2	
18	L2	EE12 30mH Common Mode Inductor	Choke	1	
19	T1	EE13 2.4mH±5%	Choke	1	
20	RV1	7D 471 PIN: 5mm	MOV	1	
21	F1	1A/250V Slow 3.6*10mm	FUSE	1	
22	PCB	PCB : FR-4 L62mm*W18mm*T1.0mm	PCB	1	
23	U1	SQ6211 SOT-26	IC	1	

Figure 6. Picture of Top Side of the Power Module

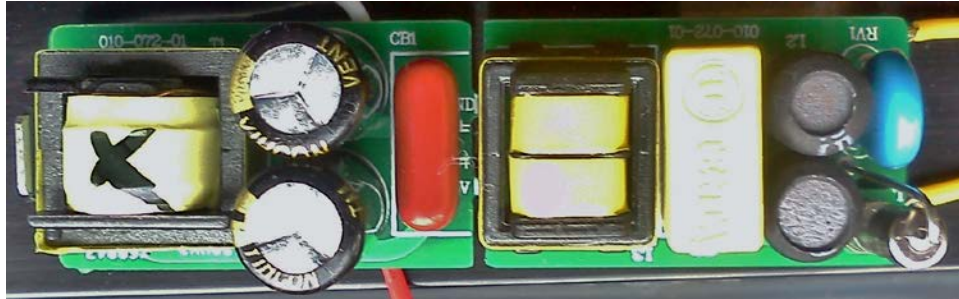
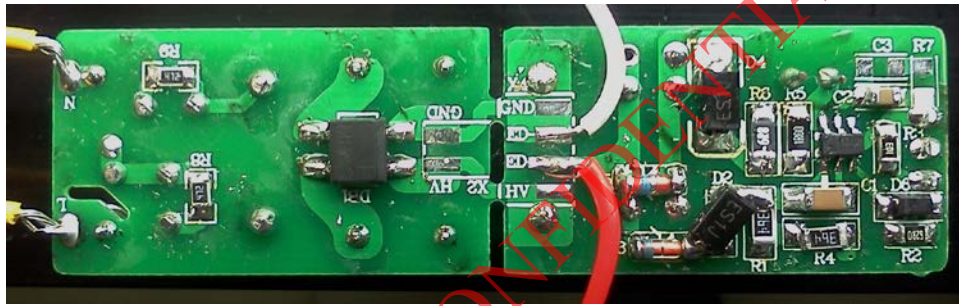


Figure 7. Picture of Bottom Side of the Power Module



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