



3W LED Driver Module using SQ9920 with low BoM- GU10

AC Input Voltage Range	LED DC Output Voltage/Current	Output Power
180V _{AC} /50Hz ~ 264V _{AC} /50Hz	80V/30mA	2.4W

Key Features

- Input from 180V_{AC}/50Hz to 264V_{AC}/50Hz, LED DC 80V/30mA output
- Fixed frequency 65kHz buck converter and maximum efficiency > 81%
- Peak current mode control and LED output current variation within $\pm 3\%$
- Built-in EMI solution (optional)
- Minimum Bill of Material (BOM) for as few as 7 or 9(with EMI) external components
- Dimension : 26mm \times 15mm \times 10mm
- Typical application : GU10 lighting

Introduction

This application note describes a constant current power module with high integration for full range input voltage from 180V_{AC} ~ 264V_{AC} by adopting the SQ9920. Based on buck topology, the SQ9920 is able to achieve high current accuracy for lighting application. This application provides multiple advanced fault protections to enhance the systems safety, including natural open loop protection, 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 4, which can work on input voltage range from 180V_{AC} ~ 264V_{AC}.

Specification

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

Performance

It is to drive output at 80V/30mA targeting to achieve high efficiency ($\eta_{MAX} > 81\%$) for AC input voltage range 180V_{AC} ~ 264V_{AC}. Actual performance is shown on Table 2. Figure 1, 2 and 3 depict output current, current variation and efficiency at AC input voltage range 180V_{AC} ~ 264V_{AC} for this module that system designer can adopt it to achieve corresponding performance.

BOM

BOM is shown in Table 3 on page 4.

PCB Layout

The PCB layout has dimension at 26mm \times 15mm \times 1.6mm in order to fit candle light space.

Power Module Photo

Pictures of power module and key components are shown in Figure 5 and 6.



Table 1. Related Specification

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
AC input voltage	V _{AC}	180		264	V	
LED DC output voltage	V _{OUT}		80		V	
LED output current	I _{OUT(SET)}		30		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, %)
180V _{AC} /50Hz	2.98	31	80	3.3	83.2
200V _{AC} /50Hz	2.96	31	80	3.3	83.8
220V _{AC} /50Hz	2.96	30	80	0.0	81.1
240V _{AC} /50Hz	2.96	30	80	0.0	81.1
264V _{AC} /50Hz	3.01	30	80	0.0	79.7

Note :

Current Variation is defined as follows :

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

where I_{OUT(SET)} = 30mA



Figure 1. Output Current for AC Input Voltage Range 180V_{AC} ~ 264V_{AC}

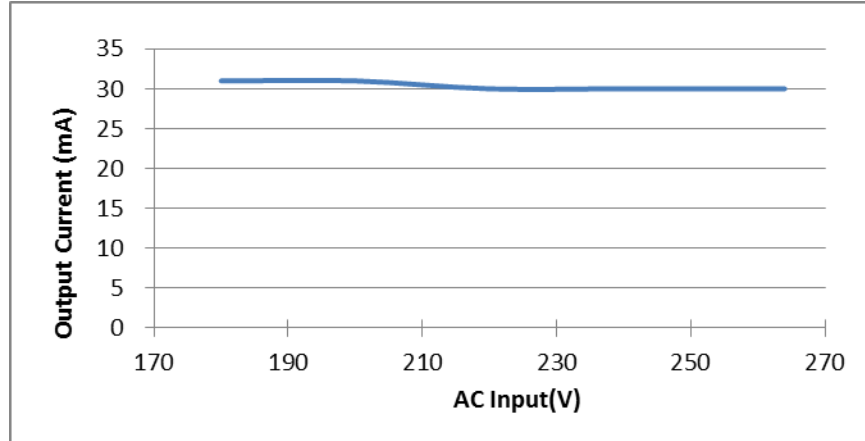


Figure 2. Current Variation for AC Input Voltage Range 180V_{AC} ~ 264V_{AC}

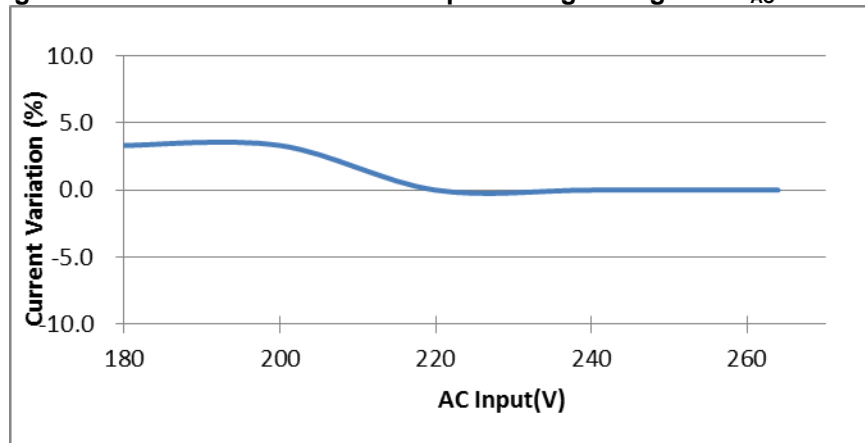


Figure 3. Efficiency for AC Input Voltage Range 180V_{AC} ~ 264V_{AC}

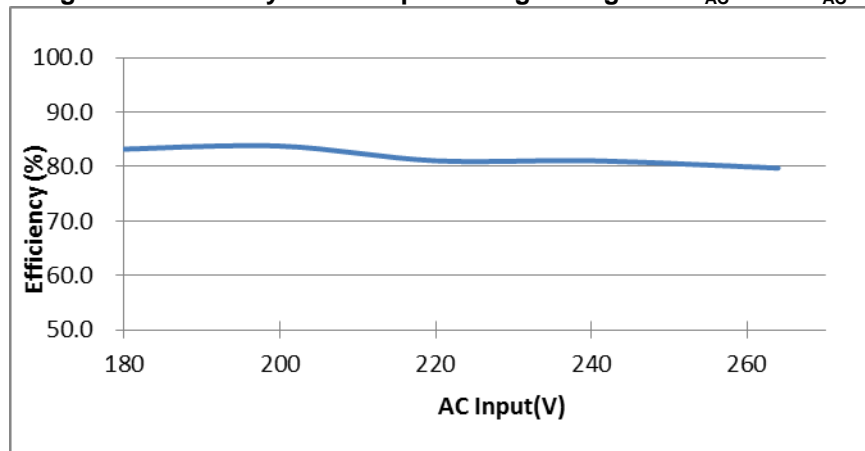




Figure 4. A Complete Application Circuit by Adopting the SQ9920

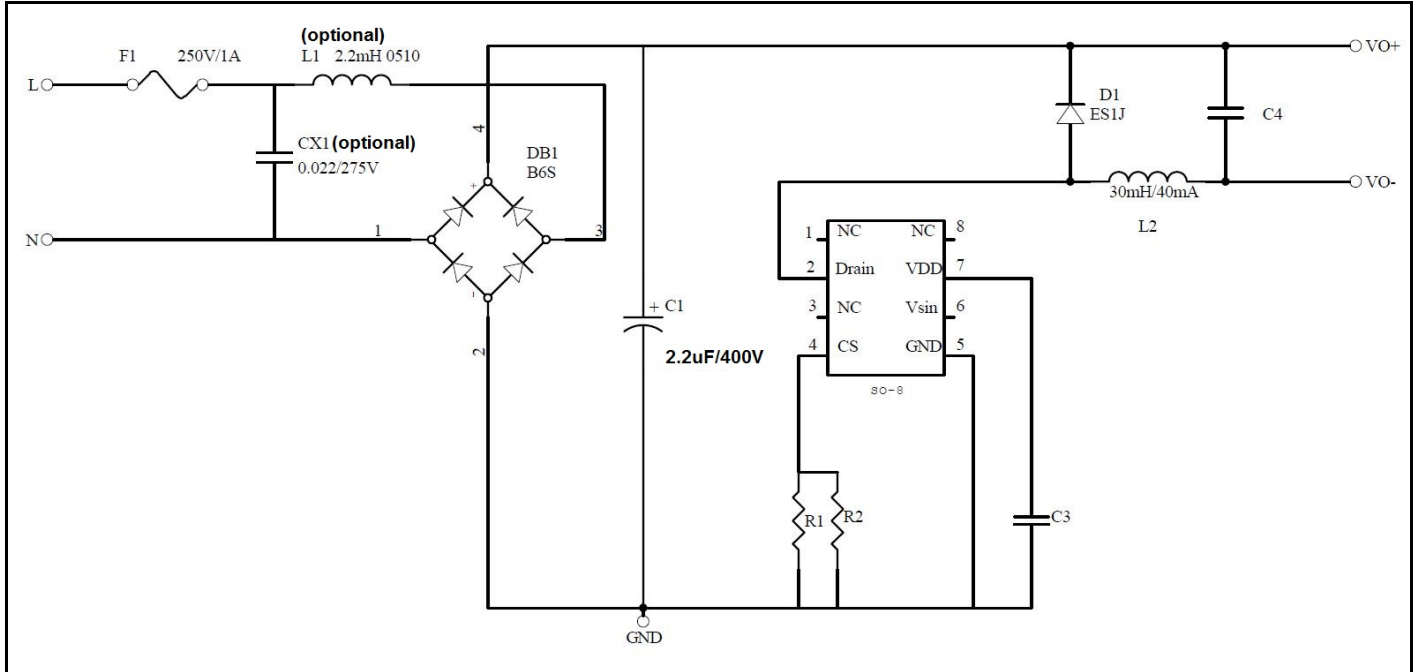


Table 3 : Bill of Material

Item	Symbol	Description	Category	Qty	Note
1	R1	10Ω/1206, 0.125W, 5%	Resistor	1	
2	R2	15Ω/1206, 0.125W, 5%	Resistor	0	
3	C1	2.2µF/400V	Capacitor	1	
4	C3	1µF/25V	Capacitor	1	
5	D1	ES1J	Diode	1	
6	DB1	B6S, 600V/0.5A	Bridge	1	
7	F1	250V/1A, Slow action, 3.6*10mm	Fuse	1	
8	L2	30mH/40mA	Inductor	1	
9	U1	SQ9920 MPT, SO8-EP	IC	1	
10	CX1	0.022/275V	Capacitor	1	Optional for EMI
11	L1	2.2mH 0510	Inductor	1	Optional for EMI
12	PCB	L26mm x W15mm x T1.6mm	PCB	1	FR-4

Figure 5. Picture of Front side of the power module

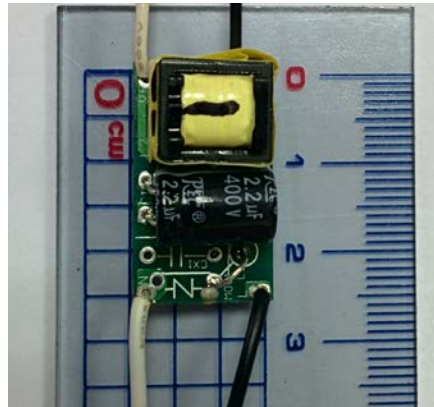


Figure 6. Picture of Backside of the power module

