Parameter Design Guide for Universal Non-Isolation LED module

INTRODUCTION

This applicaiton note is to assist novice engineer to start calculation for key components including current sense resistor, inductor, input bulky capacitor, and output capacitor to adopt SQ9910/SQ9910A, the universal HV switching regulator, that is tailored to meet LED lighting application.

Calculation Table

I_{LED}	=	0.31	A	10.1	W	
Fosc	=	60	KHz	60.68	KHz	
		25KHz	~	300KHz		
				use		
R1	=	394.7	KΩ	390	KΩ	R2=
R2//R3	=	0.717	Ω	0.07	W	1
L1	≧	9.52	mH	9523.3	uH	R3=
C1	≧	67.81	uF	15%		2.5316
		50.86	uF	20%		
		33.90	uF	30%		
C4	=	15.50	uF			≧T_{BLANK}
Ton	=	2.287	uS	2286.6	nS	360nS
L1	=	0.314	mm	0.314	mm	1
Diameter						

Table 1.0

Description

In order to do calculation, input parameters are necessary to keyin by double clicking enties in red, and output parameters will be automatically generated in blue entries the in the table 1.0.

One standard reference circuit is alo presented with corresponding components as follows:

Operating frequecny resistor setting resistor (Rosc)

$$F_{osc} = \frac{25000}{R1 + 22}$$

R_{OSC}	F_{OSC} in KHz
390 kΩ	60.67
510 kΩ	46.99

Current sense resistor (R_{SENSE})

$$R_{sense} = \frac{0.25}{I_{LED} + (0.5 \times (I_{LED} \times 0.2))}$$

, two surface mount resistors (1206 package, with 1/4watt rating) in parallel is highly suggested to constitute R_{SENSE} to ensure power dissipation across it.

Inductor (L1)

$$L \geq \frac{(V_{in} - V_{LEDs(VF)}) \times T_{on}}{0.2 \times I_{LED}}$$

To simplify the design, 2.6mH is sugested for design with output less than 10W, and 5.2mH for 10-20W with the assumption of r,current ripple, equal to 0.2.

Input bulky capacitor (C1)

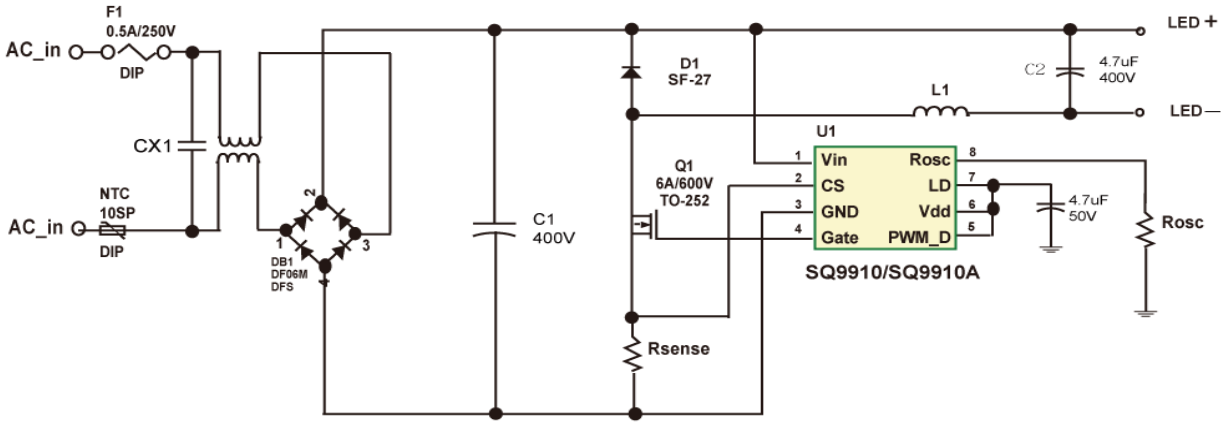
The following equation yields input bulky cap:

$$C_{in} \geq \frac{P_{in} \times (1 - D_{ch})}{\sqrt{2V_{Line\_min}} \times 2 f_L \times \Delta V_{DC\_max}}$$

,where D_{CH} = T1 / T2, the ratio of time interval of input capacitor being charge with respect to the total rectified period.

Output capacitor (C4)

This output capacitor, along with L1, is to provide energy while MOSFET is off. A high voltage rating (400V) electrolytic capacitor is suggested in this case to avoid LED open which will cause instant high voltage.



1-25W typical circuit without passive PFC

No. of W-LEDs in Single Series String	Input capacitor C1	Value of Total Inductor L1 (mH)	Current Sense Resistor R_{SENSE} (mΩ) Note1	Oscillator Resistor (KΩ) Rosc	Output capacitor	
1	4.7uF /400 V	2	650	1000 (1MΩ)	4.7uF/400V	
2	4.7uF /400 V	2	650	820	4.7uF/400V	
3	4.7uF /400 V	2	650	470	4.7uF/400V	
4	4.7uF /400 V	2	650	470	4.7uF/400V	
5	4.7uF /400 V	2	650	470	4.7uF/400V	
6	10uF /400 V	3	650	470	4.7uF/400V	
7	10uF /400 V	3	650	470	4.7uF/400V	
8	10uF /400 V	3	650	470	4.7uF/400V	
9	10uF 400 V	3	650	470	4.7uF/400V	
10	10uF /400V	3	650	470	4.7uF/400V	
11	15uF 400 V	6	650	430	4.7uF/400V	
12	15uF 400 V	6	650	430	4.7uF/400V	
13	15uF /400 V	6	650	430	4.7uF/400V	
14	15uF /400 V	6	650	430	4.7uF/400V	
15	15uF /400 V	6	650	430	4.7uF/400V	
16	22uF 400 V	6	650	430	4.7uF/400V	
17	22uF /400 V	6	650	430	4.7uF/400V	
18	22uF /400 V	6	650	430	4.7uF/400V	
19	22uF /400 V	6	650	430	4.7uF/400V	
20	22uF /400 V	6	650	430	4.7uF/400V	
21	22uF /400 V	9	650	430	4.7uF/400V	
22	22uF /400 V	9	650	430	4.7uF/400V	
23	22uF 400 V	9	650	430	4.7uF/400V	
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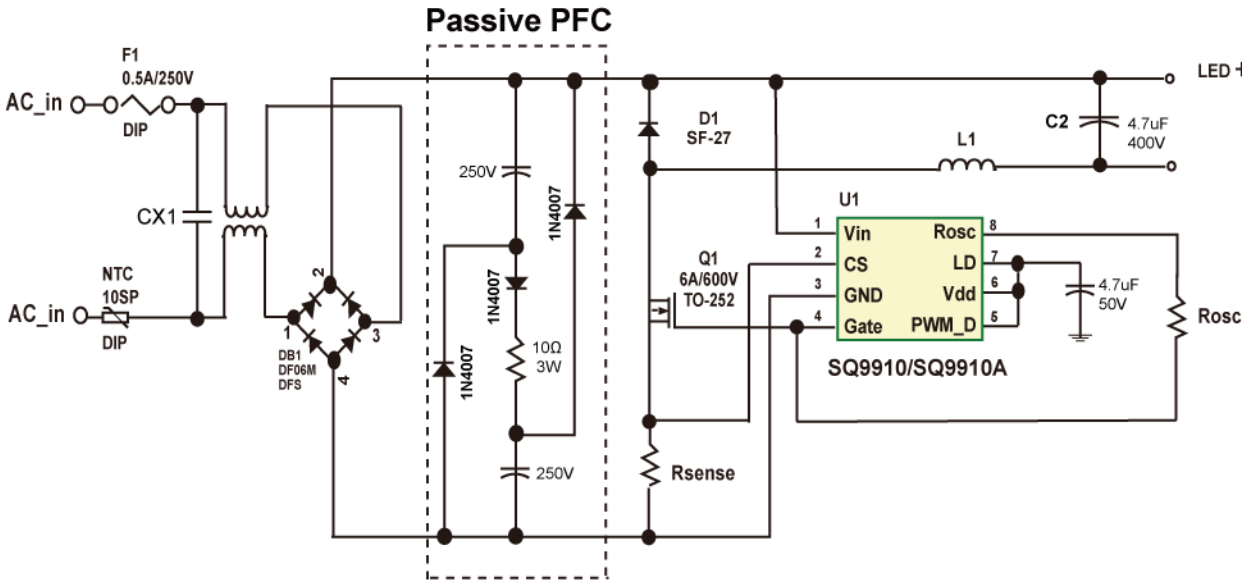
25	22uF /400 V	9	650	430	4.7uF/400V	



1-25W typical circuit with passive PFC

No. of W-LEDs in Single Series String	Input capacitor	Value of Total Inductor (mH)	Current Sense Resistor R_{SENSE} (mΩ)	Oscillator Resistor (K)	Output capacitor C2	
1	10uF /250 V	2	650	1000 (1MΩ)	4.7uF/400V	
2	10uF /250 V	2	650	820	4.7uF/400V	
3	10uF /250 V	2	650	470	4.7uF/400V	
4	10uF /250 V	2	650	470	4.7uF/400V	
5	10uF /250 V	2	650	470	4.7uF/400V	
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