Is Now Part of

ON Semiconductor®

To learn more about ON Semiconductor, please visit our website at
www.onsemi.com

AN-4189

Guidance of Using Self Valley Fill Calculation Tool for FL77904/FL77944/FL77905

Overview

This application note provides a step-by-step guide for using the Self Valley Fill (SVF) calculation Tool to assign capacitance for alleviating flicker problem of direct-AC driven LED-lighting fixtures.

Design Flow

The flow chart of using the SVF calculation tool is drawn in Figure 1. The tool is used to determine required SVF capacitance for a well-designed system to meet specific flicker requirement [1]. Before using the tool, the system design needs to be completed except placing the capacitors. You may use LED Direct-AC Driver Design Tool [2] to generate the pre-defined system design.

The calculation tool's looks like Figure 2. It can be separates into four parts with assistive figures. How to use these four parts are explained in the following subsections.

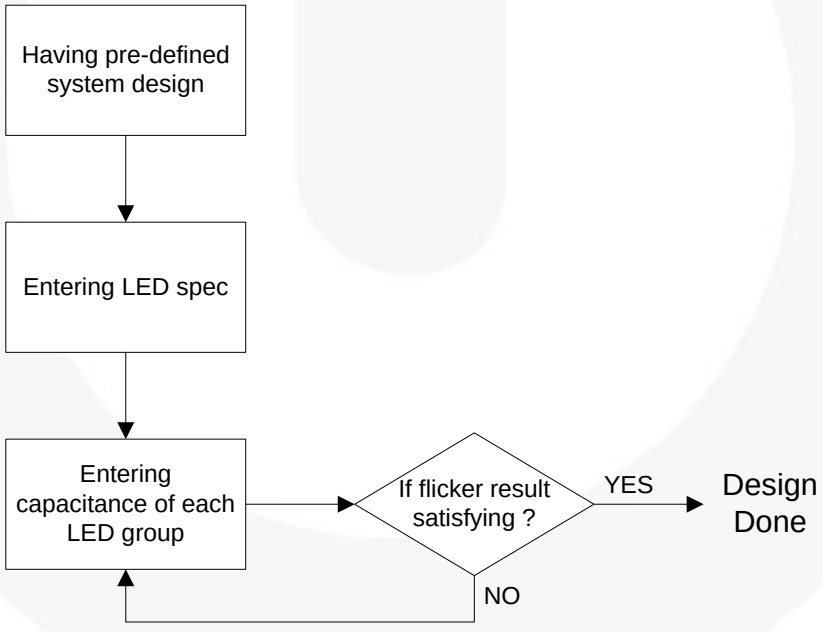

Figure 1. Flow Chart of Using SVF Calculation Tool

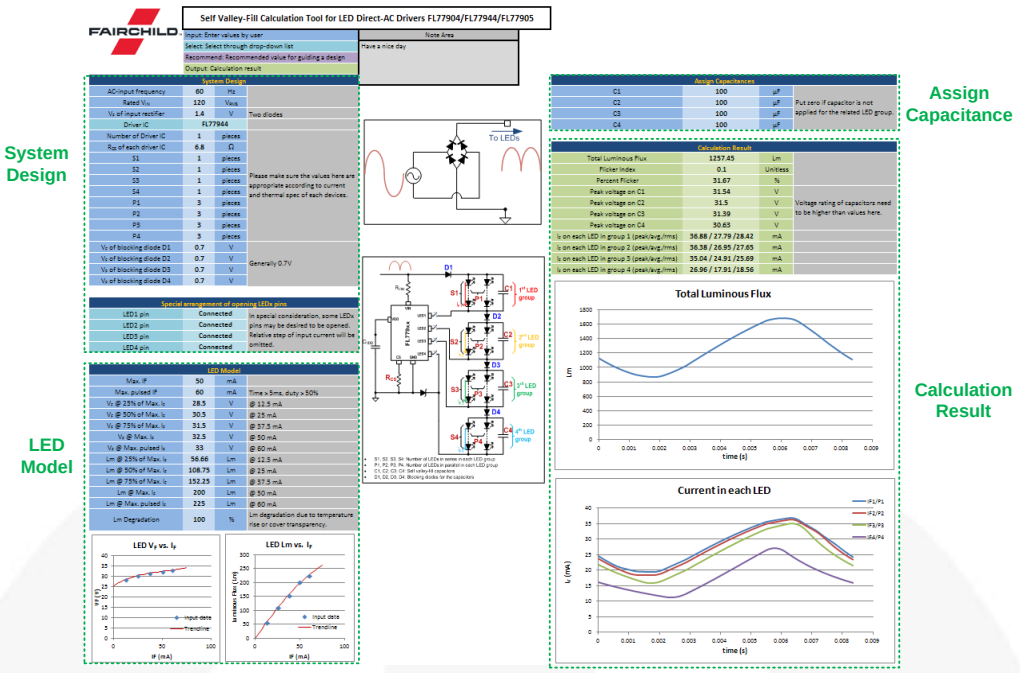

Figure 2. Appearance of the DACD Design Tool

Step 1: Entering Pre-defined System Design

In the system-design section, completed design details of driver and LED string need to be entered. The driver IC grid and special arrangement section are drop-down lists. You can choose which driver IC you want to design with and which pin you want it to be opened. Refer to [1] for more explanation.

Blocking diodes (D1~D4) are required part when applying SVF circuit. These diodes can be general-purpose diodes or LED. Forward voltage of the blocking diodes also needs to be filled into the tool.

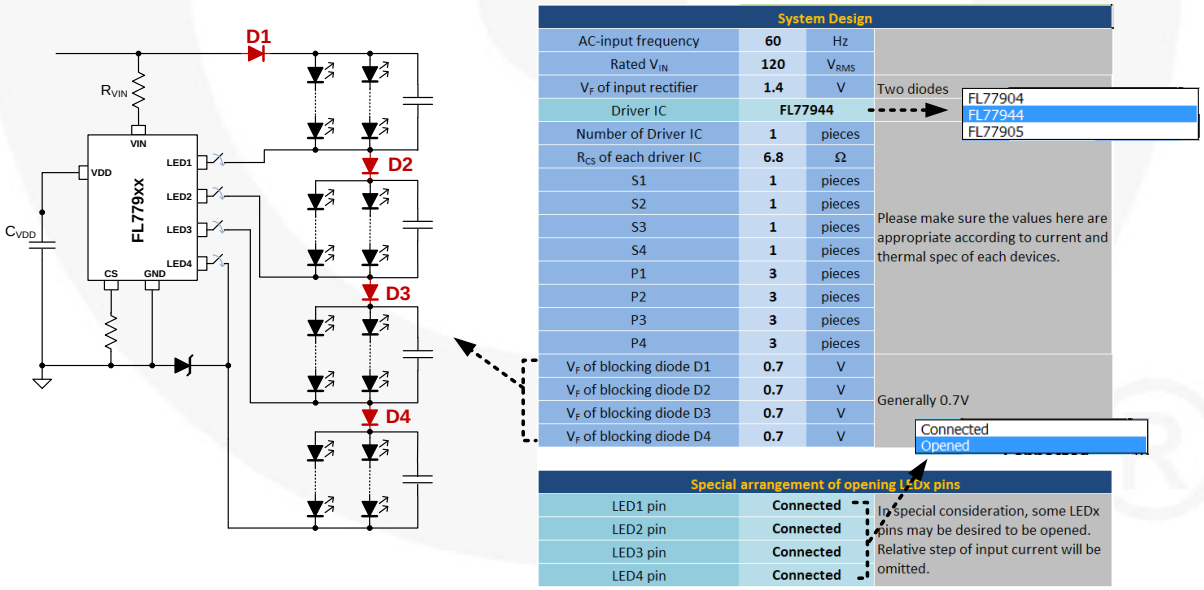

Figure 3. System-Specification Section

Step 2: Entering Specification of Chosen LED

Inputs in the LED-model section are used for generating much realistic LED model for further calculation. This information can be got from data sheet of the LED. Correct input is needed to have much realistic result.

LED Model			
Max. IF	50	mA	
Max. pulsed IF	60	mA	Time > 5ms, duty > 50%
V_F @ 25% of Max. I_F	28.5	V	@ 12.5 mA
V_F @ 50% of Max. I_F	30.5	V	@ 25 mA
V_F @ 75% of Max. I_F	31.5	V	@ 37.5 mA
V_F @ Max. I_F	32.5	V	@ 50 mA
V_F @ Max. pulsed I_F	33	V	@ 60 mA
Lm @ 25% of Max. I_F	56.66	Lm	@ 12.5 mA
Lm @ 50% of Max. I_F	108.75	Lm	@ 25 mA
Lm @ 75% of Max. I_F	152.25	Lm	@ 37.5 mA
Lm @ Max. I_F	200	Lm	@ 50 mA
Lm @ Max. pulsed I_F	225	Lm	@ 60 mA
Lm Degradation	100	%	Lm degradation due to temperature rise or cover transparency.

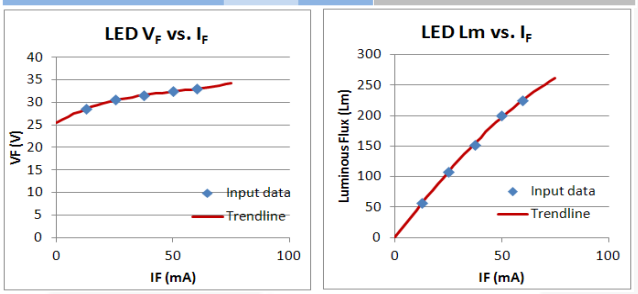

Figure 4. LED-Model Section

Step 3: Assign Capacitance

Enter the capacitance for SVF circuit for each LED group. The capacitor filters the LED current to be smooth, which alleviates flickering of light output. Larger capacitance results in lower flicker index and percent flicker. It is recommended to have same capacitance for each LED group, but you can also try different capacitance for them. Enter "0" if you do not want to put capacitance for a specific LED group.

Assign Capacitances			
C1	100	µF	Put zero if capacitor is not applied for the related LED group.
C2	100	µF	
C3	100	µF	
C4	100	µF	

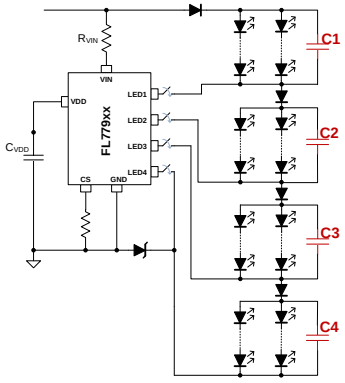

Figure 5. Assign-Capacitance Section

Step 4: Check Design Result

According to inputs in previous steps, the calculation tool shows predicted luminous flux, flicker index, percent flicker, peak voltage on capacitors, and current on each LED. You may need to change the inputs in the assign-capacitance section of the result of this section cannot meet system requirement.

With smoothed current, peak current of each LED will be reduced. It is a better driving condition for LEDs. Efficacy is possibly slightly better with this condition.

Calculation Result			
Total Luminous Flux	1257.45	Lm	
Flicker Index	0.1	Unitless	
Percent Flicker	31.67	%	
Peak voltage on C1	31.54	V	Voltage rating of capacitors need to be higher than values here.
Peak voltage on C2	31.5	V	
Peak voltage on C3	31.39	V	
Peak voltage on C4	30.63	V	
I_F on each LED in group 1 (peak/avg./rms)	36.88 / 27.79 /28.42	mA	
I_F on each LED in group 2 (peak/avg./rms)	36.38 / 26.95 /27.65	mA	
I_F on each LED in group 3 (peak/avg./rms)	35.04 / 24.91 /25.69	mA	
I_F on each LED in group 4 (peak/avg./rms)	26.96 / 17.91 /18.56	mA	

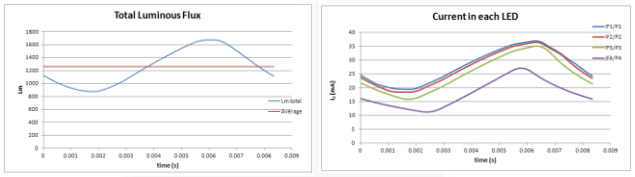

Figure 6. Predicted Outcomes of the Design Result

References

[1] *"AN-4190 Improve Flicker Performance of Direct AC Driven LED Fixtures with Self Valley Fill," Fairchild Semiconductor, July 2016.*

[2] *"AN-4188 Guidance of Using LED Direct-AC Driver Design Tool for FL77904/FL77944/FL77905," Fairchild Semiconductor, July 2016.*

Related Datasheets

FL77904 Phase-cut Dimmable Compact LED Direct AC Driver

FL77905 Analog/PWM/Phase-cut Dimmable Compact LED Direct AC Driver

FL77944 Analog/PWM Dimmable High Power LED Direct AC Driver

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81−3−5817−1050

ON Semiconductor Website: **www.onsemi.com**

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative