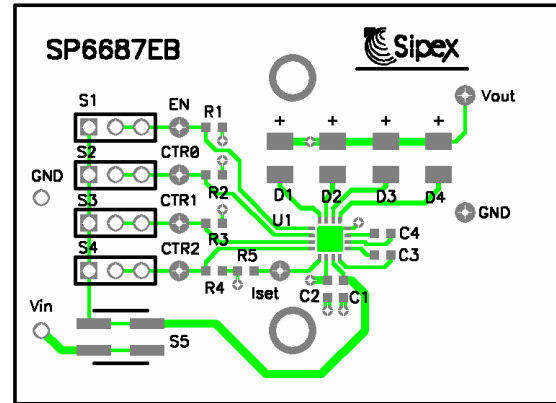# Evaluation Board Manual

- High Efficiency > 90%
- Support up to 4 white LEDs
- Soft Start Function
- Short Circuit Protection
- Three Charge Pump Modes: X1, X1.5, X2
- 1MHz Fixed Frequency Oscillator

DESCRIPTION AND BOARD SCHEMATIC

The **SP6687 Evaluation Board** is designed to help the user evaluate the performance of the SP6687 for use as a 4 LED Driver with matched currents. The evaluation board is a completely assembled and tested surface mount board which provides easy probe access points to all SP6687 inputs and outputs so that the user can quickly connect and measure electrical characteristics and waveforms. The Evaluation Board schematic diagram is shown at Figure 1.
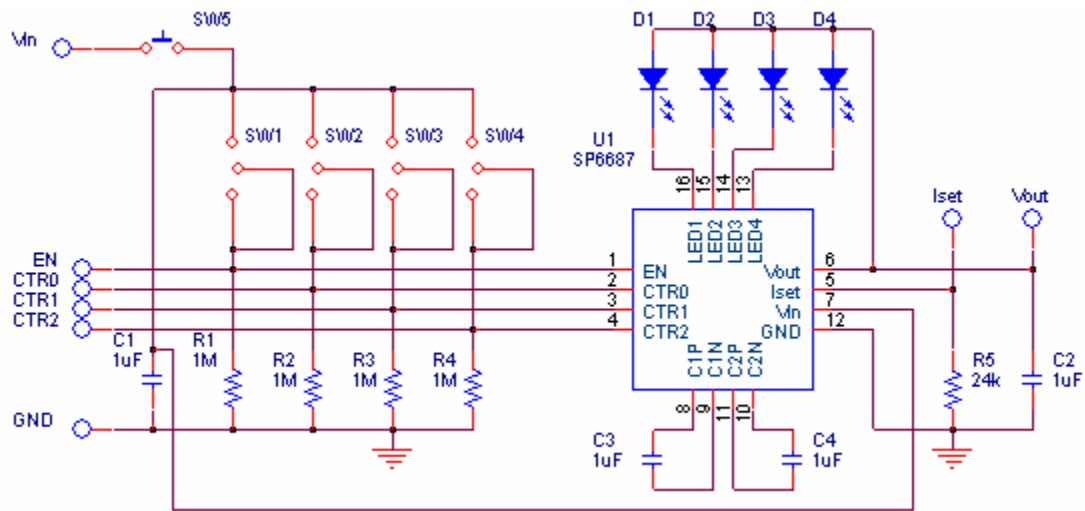

Figure 1. SP6687 Evaluation board Schematic Diagram

The SP6687 is a high efficiency charge pump white LED driver. It provides 4 channels of low drop-out voltage current source to regulate the current for 4 white LEDs. For high efficiency, the SP6687 implements a 3 mode charge pump: x1, x1.5, and x2. An external resistor R5 is used to set the current of the white LEDs. SP6687 has an input current regulation to reduce the input ripple. Users can control white LED on/off via three programming bits: CTRL0, CTRL1 and CTRL2. When an external PWM signal is connected to the control pin, the brightness of white LEDs is adjusted by the duty cycle. Each channel can support up to 30mA of current. A current limiting circuit is also included in the SP6687 for short circuit protection. Whenever the output sources a dangerously high current, the current limiting circuit takes over the output regulation circuit and reduces the output current to an acceptable level. This device is available in a 4mm x 4mm, 16 pin QFN package.

Capacitor C1 is a decoupling capacitor. Resistors R1 – R4 are used to pull down inputs if they are left floating. Capacitors C2 – C4 are used by the charge pump.

USING THE EVALUATION BOARD

1) Powering Up the SP6687 Circuit

The SP6687 Evaluation Board can be powered from a 4.5V power supply or from 3 alkaline cells. Connect 4.5V source pin with short lead directly to the "Vin" and -4.5V /GND pin to the "GND" posts.

2) Selecting the Bias Resistor

LED current can be adjusted up to 30mA per string with an external resistor R5. The R5 value may be determined as $I_{LED} = 440 \times$ (Voltage at I_{SET} /R5), where I_{LED} is required LED current, and Voltage at $I_{SET} = 1.1V$. R5 = 32 kΩ is installed.

3) Selecting the number of illuminated LEDs

The number of illuminated LEDs can be selected using CTRL0 – CTRL2 programming bits (see Table 1).

Table 1. Programming Table

Control Inputs			Output Status			
CTRL2	CTRL1	CTRL0	LED4	LED3	LED2	LED1
0	0	0	OFF	OFF	OFF	ON
0	0	1	OFF	OFF	ON	OFF
0	1	0	OFF	ON	OFF	OFF
0	1	1	ON	OFF	OFF	OFF
1	0	0	OFF	OFF	ON	ON
1	0	1	OFF	ON	ON	ON
1	1	0	ON	ON	ON	ON
1	1	1	OFF	OFF	OFF	OFF
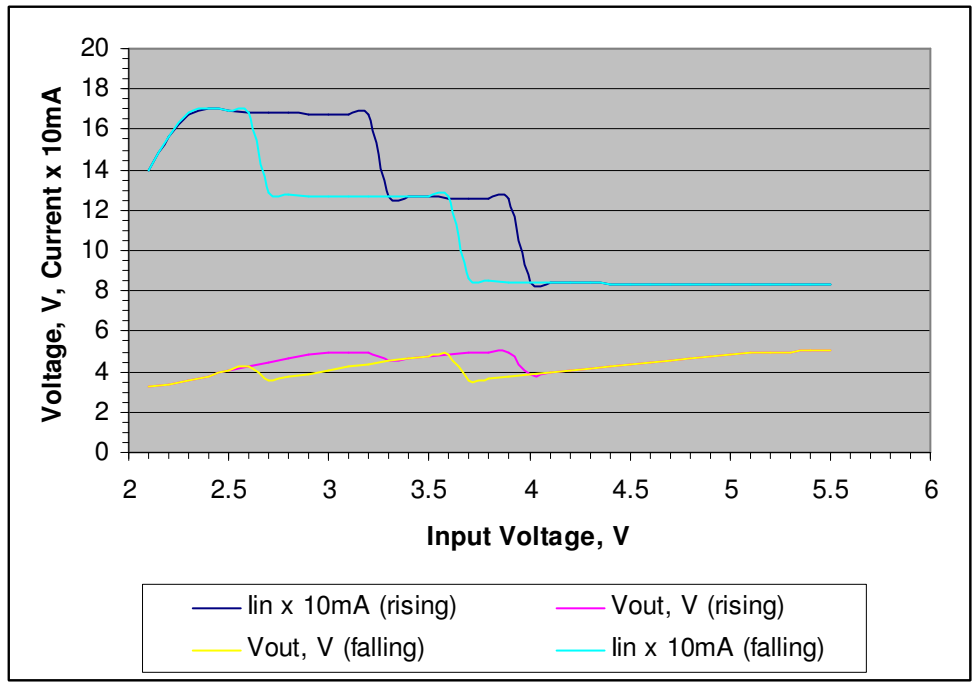
Graph 1. Input Current and Vout Voltage vs. rising and falling Input Voltage at R5 = 20 kΩ (4 LEDs are on)
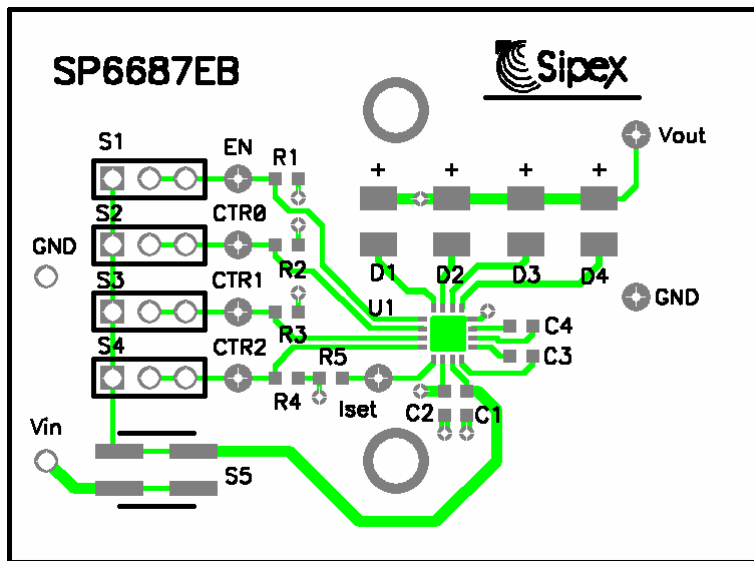
EVALUATION BOARD LAYOUT

Figure 2. SP6687 Evaluation Board Layout top side

Table2. SP6687EB List of Materials

Reference	Quantity	Value	Description
C1 – C4	4	1uF	06033D105KAT2 AVX
D1 – D4	4		SML-LX2832UWC-TR Vishay
P1 – P9	9		1001-0-15-01-30-02-04-0 Mill-Max
R1 – R4	4	1M	CRCW0603105J100RT6 Vishay
R5	1	24k	CRCW0603243J100RT6 Vishay
S1 – S4	4		Header 4030-22-10-2031 Molex
U1	1		SP6687 Sipex

ORDERING INFORMATION

Model	**Temperature Range**	**Package Type**

SP6687EB .... -40℃ to +85℃ .... SP6687 Evaluation Board
SP6687ER-L/TR .... -40℃ to +85℃ ....Lead Free 16 Pin 4mmx4mm QFN
/TR = Tape and Reel
Pack quantity is 2,500 for QFN.

For further assistance:

Email: Sipexsupport@sipex.com
WWW Support page: http://www.sipex.com/content.aspx?p=support
Live Technical Chat: http://www.geolink-group.com/sipex/
Sipex Application Notes: http://www.sipex.com/applicationNotes.aspx

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