

High performance, Current Source for White-LED

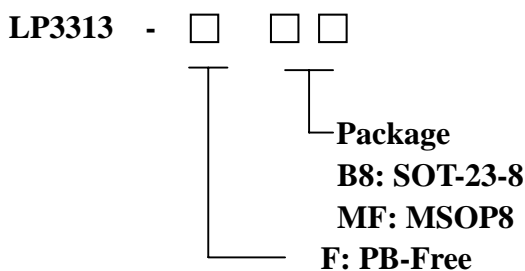
With Regulated Charge Pump

General Description

The LP3313 is a high efficiency and cost effective charge pump white LED driver. It supports up to 3 white LEDs with regulated constant current for uniform intensity. The LP3313 maintains the highest efficiency by utilizing a x1/x2 charge pump and low dropout current regulators.

User can easily configure each LED current up to 20mA by a pulse dimming control. The dimming of white LEDs current can be achieved by applying a pulse signal to the EN pin. There are totally 16 steps of current could be set by users.

Ordering Information



Features

- ◆ Support up to 3 White LEDs
- ◆ Support up to 60mA Output Current
- ◆ 4% Typical LED Current Matching
- ◆ Soft Start Function
- ◆ Short Circuit Protection Function
- ◆ 1MHz Fixed Frequency Oscillator
- ◆ Auto Charge Pump Mode Selection
- ◆ Output Over Voltage Protection
- ◆ Low Input Noise and EMI
- ◆ RoHS Compliant and 100% Lead (Pb)-Free
- ◆ 16-Step Brightness Control
- ◆ Very High Efficiency Over 80% of Battery Life

Applications

- ✧ Portable Media Players/MP3 players
- ✧ Cellular and Smart mobile phone
- ✧ PDA
- ✧ DSC
- ✧ LEDs for Backlight
- ✧ LCD Display

Marking Information

Please view website.

Pin Configurations



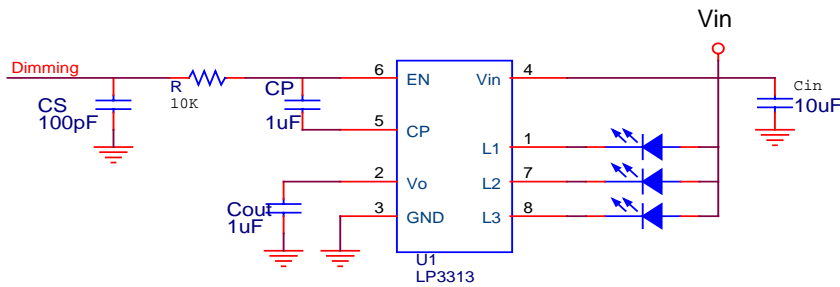
SOT23-8/MSOP8

Pin	1	2	3	4	5	6	7	8
Funtion	L1	Vo	Gnd	Vin	CP	EN	L2	L3

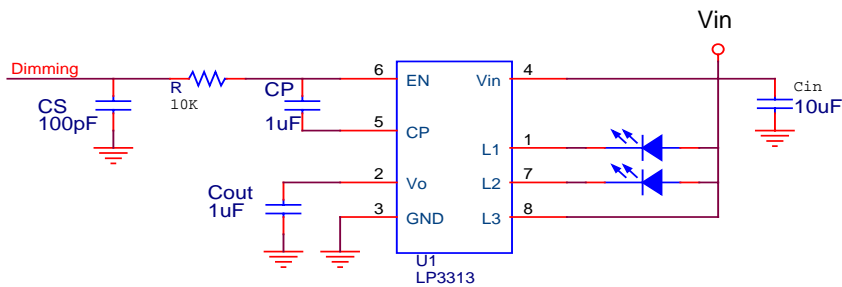
Functional Pin Description

Pin Number	Pin Name	Pin Function
1	L1	Current Sink for LED1. (If not in use, this pin must be connected to VIN)
2	VOUT	Output Voltage Source for LED1~3.
3	GND	Power Ground.
4	VIN	Input Voltage.
5	CP	Positive Terminal of Bucket Capacitor.
6	EN	Active High Enable. And connects 10k resistor to GPIO pin of MCU.
7	L2	Current Sink for LED2. (If not in use, this pin must be connected to VIN)
8	L3	Current Sink for LED3. (If not in use, this pin must be connected to VIN)

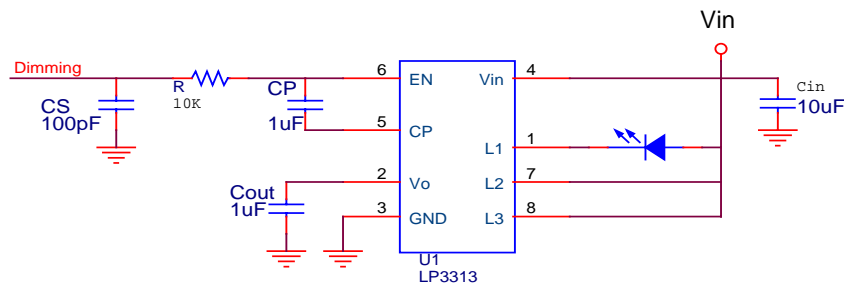
Typical Application Circuit



LP3313 For 3pcs WLED Application Circuit



LP3313 For 2pcs WLED Application Circuit



LP3313 For 1pcs WLED Application Circuit

Function Block Diagram

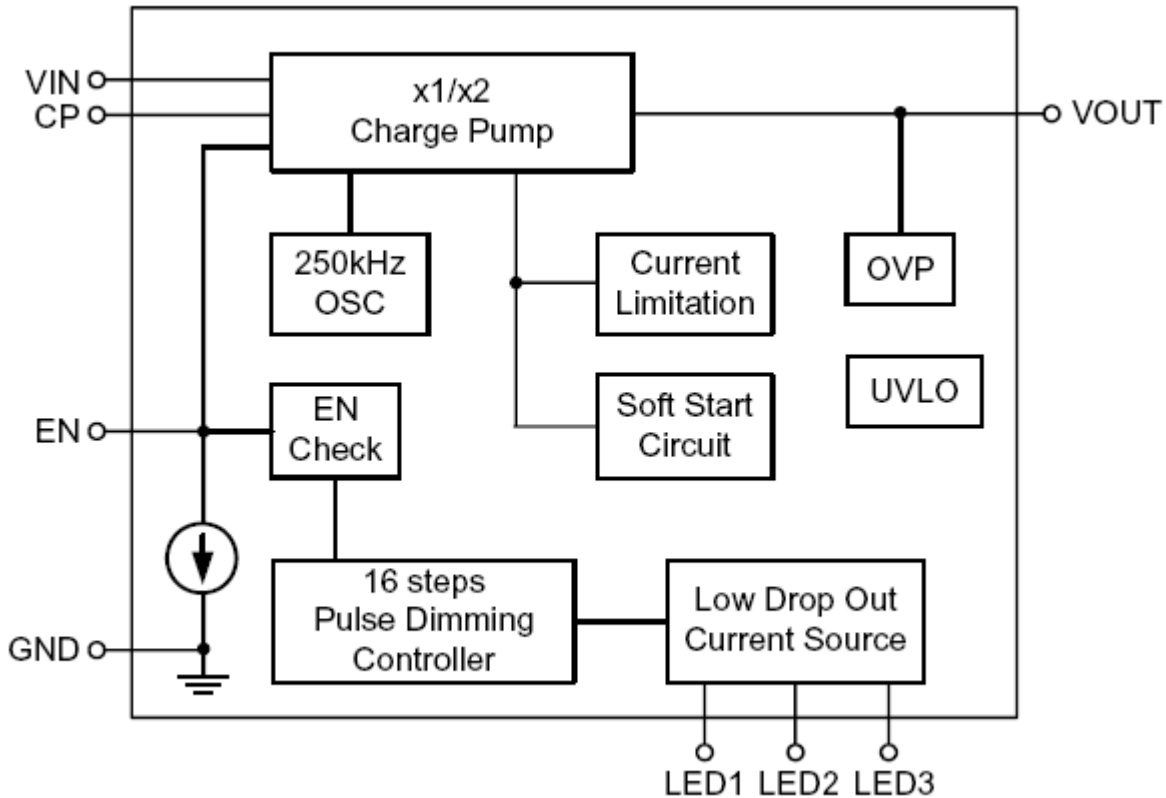
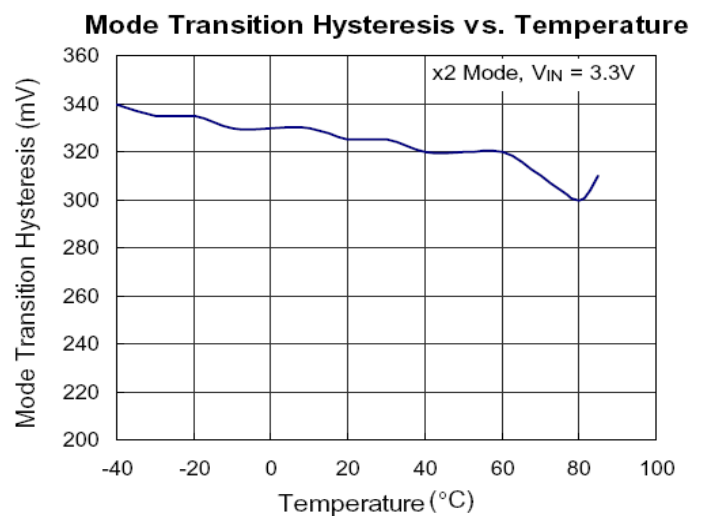
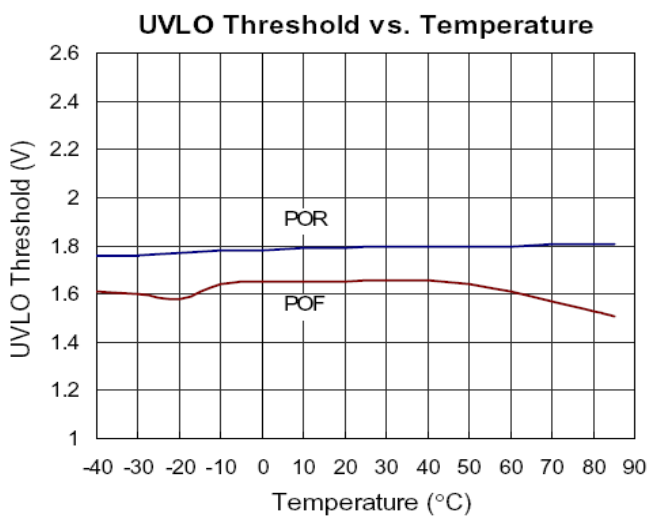
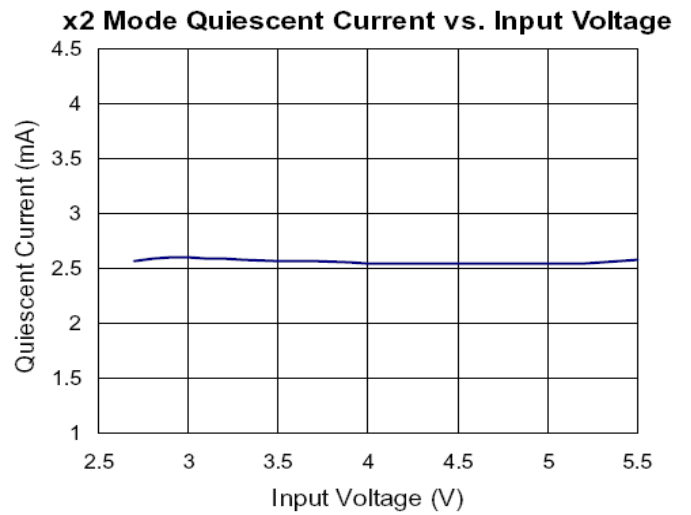
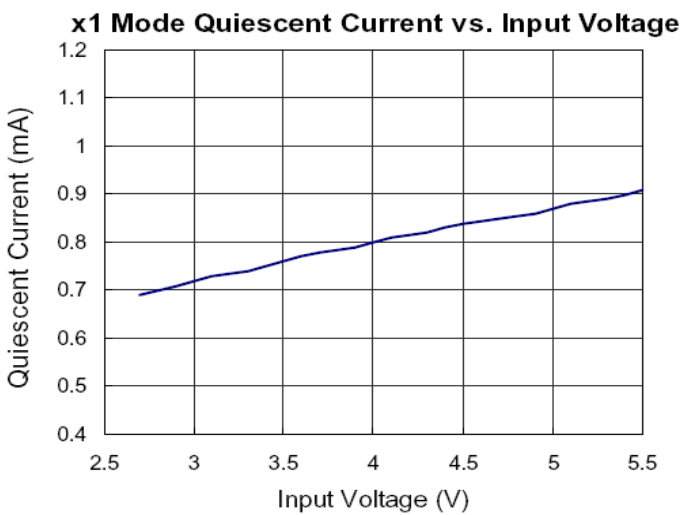
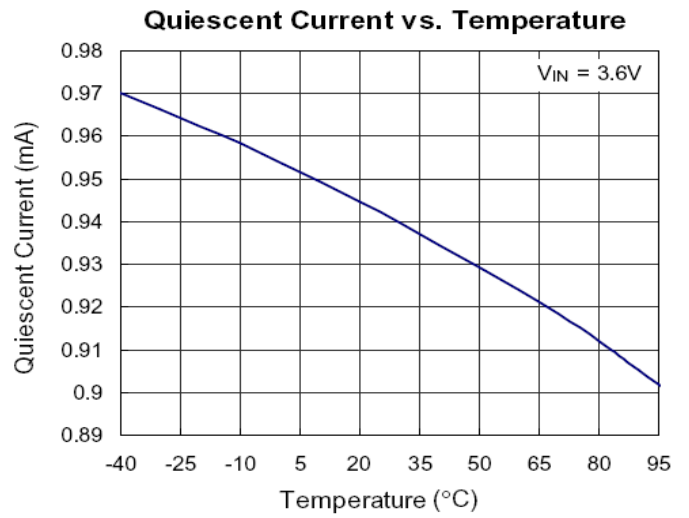
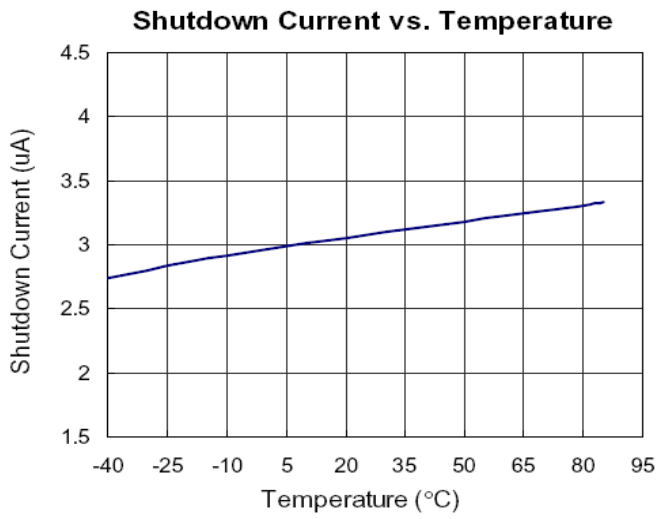


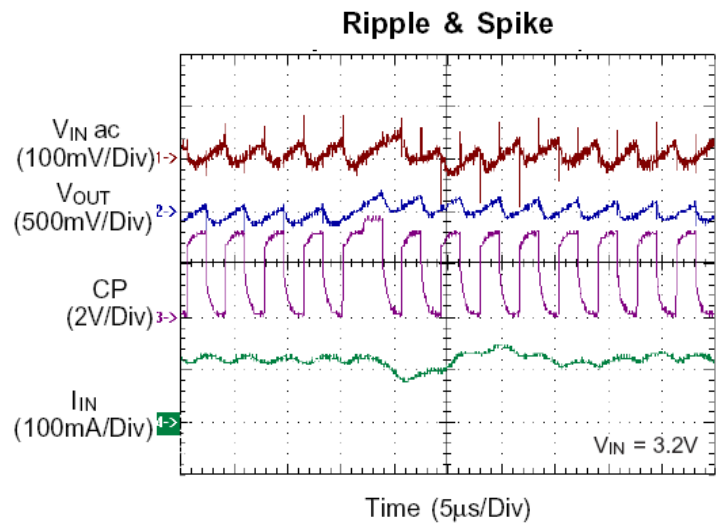
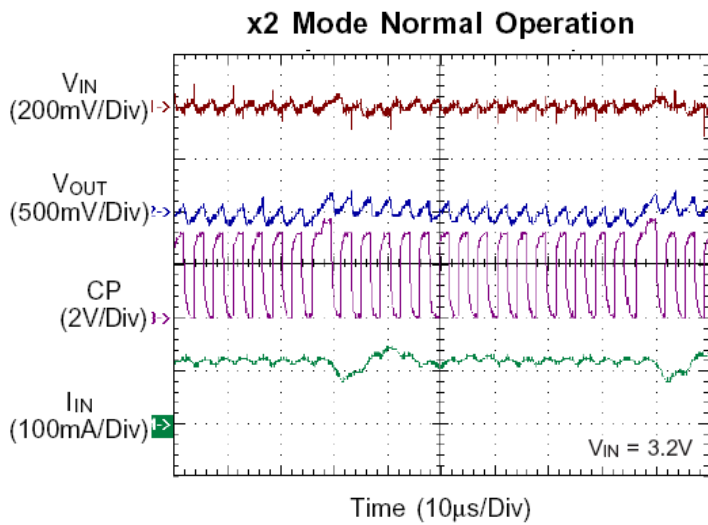
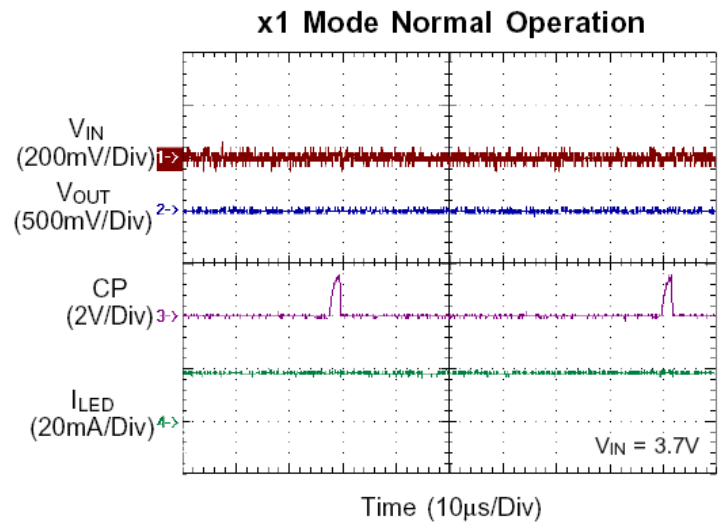
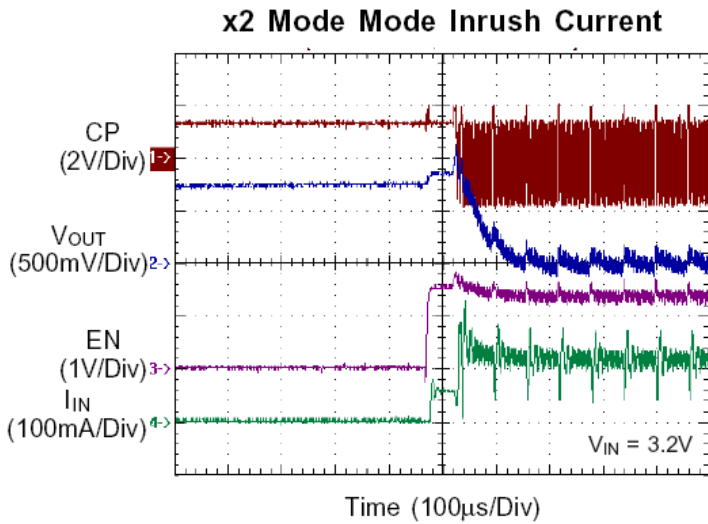
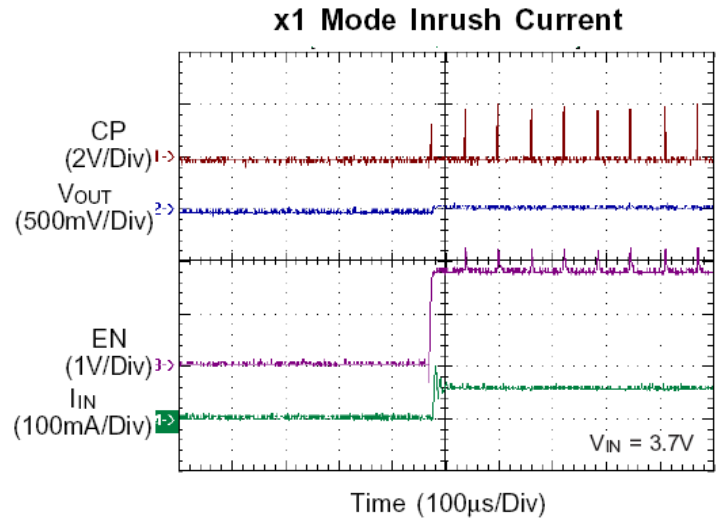
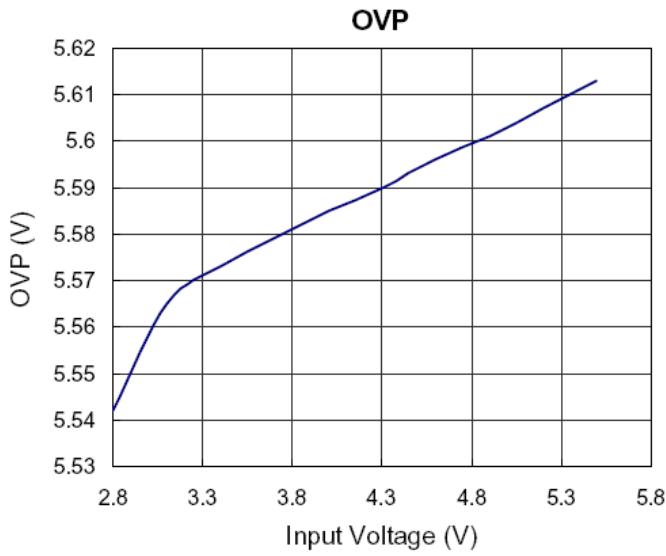
Fig1. LP3313 Block Diagram

Electrical Characteristics

Symbol	Description	Conditions	Min	Typ	Max	Units
VIN	Input Voltage	VOUT=5.0V	2.8		5VOUT	V
IQ	No Load Supply Current ³	2.7V < VIN < 5V, IOU=0mA, SHDN=VIN		1		mA
ISHDN	Shutdown Supply Current	Vin=3.6V, EN=0V		3	10	μA
		EN=High, Vin=3.6V, No Load		1		
fOSC	Frequency	Oscillator Free Running		1		MHz
ILED	LEDs Current			20		mA
TSHDN	EN Low to shutdown Delay				2	mS
TLO	EN Low Time for Dimming		0.1		0.3	mS
VIL	SHDN Input Threshold Low			2.2		V

Typical Operating Characteristics





Applications Information

The LP3313 is a high efficiency charge pump white LED driver. It provides low drop-out voltage current source to regulate 3 white LEDs current. For high efficiency, the LP3313 implements x1/x2 mode charge pump with auto mode selection. In the application with Li-ion battery, it provides a very cost-effective and high efficiency solution for driving white LEDs.

High Efficiency x1/x2 Charge Pump

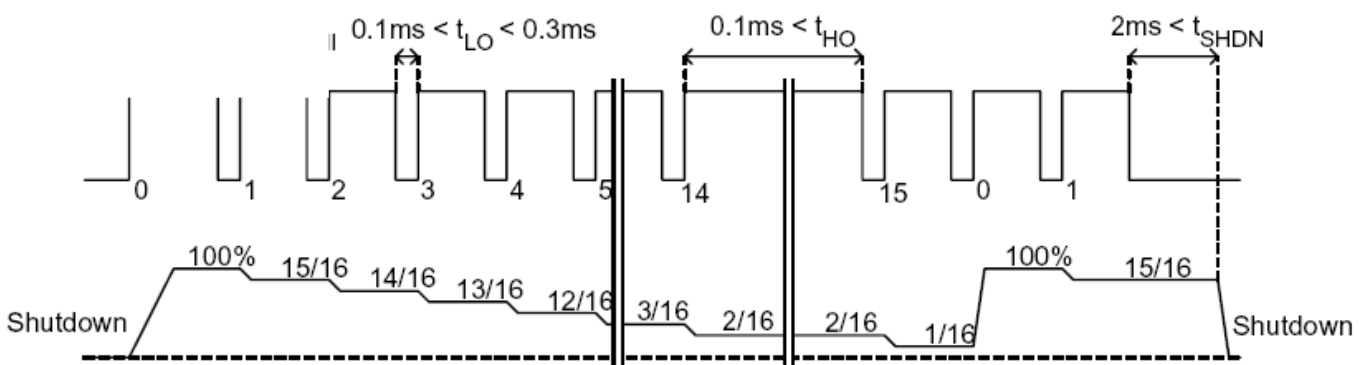
Before the discussion of efficiency in LP3313, two things need to be illustrated. One is the Li-ion battery life time, the other is the forward voltage of white LED.

The Li-ion battery energy is not linearly proportion to battery voltage. In the Figure 2, It shows the 80% battery life of Liion is arranged in 3.65V to 4.0V. The other voltage range occupies less than 20% battery energy and is insignificant. In the backlight application, the forward voltage of white LEDs most likely falls in 3.2 to 3.5V @ILED = 20mA.

The development concept of LP3313 is based on the backlight application with Li-ion battery. LP3313 is very cost-effective product for driving white LEDs in backlight. It extends the 80% battery life by the reduction of open loop resistance at x1 mode and current source drop out voltage. Figure 3 is the efficiency diagram of LP3313, 80% battery life is marked by red rectangle. The LP3313 maximize the x1 mode operating range in the 80% battery life. Therefore, the efficiency is not significant different to that without x1.5 mode charge pump. The peak efficiency of LP3313 is 93% and average is 84%. Comparing to the LED drivers with x1.5 mode, only 1 to 2% efficiency loss by x2 mode. (Assume 5% battery life in charge pump mode and the efficiency difference of x1.5 and x2 modes is 25%, the efficiency loss thus is 5%x25% = 1.25%)

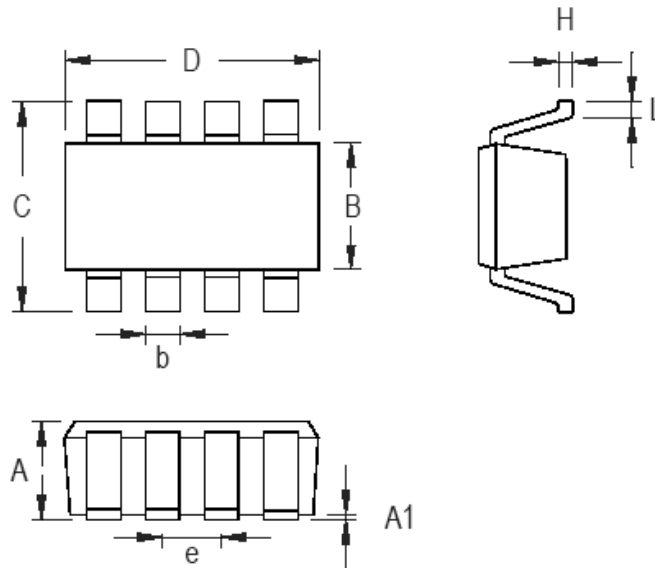
Dimming Control

LP3313 implements the pulse dimming method being used to control the brightness of white LEDs. There are 16 steps to set the current of white LEDs. The maximum LED current is up to 20mA that is sufficient for most application in backlight. The detail operation of brightness dimming is showed in the Figure 2.



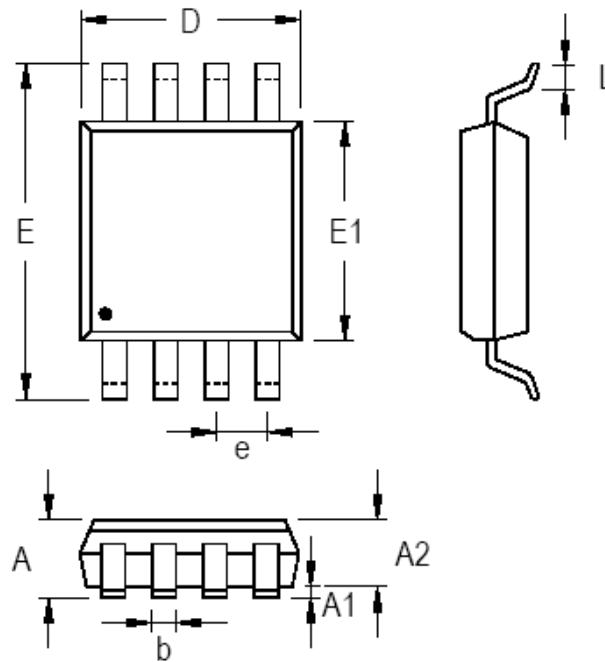
Layout Consideration

The LP3313 is a high-frequency switched-capacitor converter. Careful PCB layout is necessary. For best performance, place all peripheral components as close to the IC as possible. Place C_{IN}, C_{OUT}, and C_P near to V_{IN}, V_{OUT}, C_P, EN, and GND pin respectively. A short connection is highly recommended. The following guidelines should be strictly followed when designing a PCB layout for the LP3313.

Packing information


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.700	1.000	0.028	0.039
A1	0.000	0.100	0.000	0.004
B	1.397	1.803	0.055	0.071
b	0.220	0.380	0.009	0.015
C	2.591	3.000	0.102	0.118
D	2.692	3.099	0.106	0.122
e	0.585	0.715	0.023	0.028
H	0.080	0.254	0.003	0.010
L	0.300	0.610	0.012	0.024

TSOT-23-8 Surface Mount Package



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.810	1.100	0.032	0.043
A1	0.000	0.150	0.000	0.006
A2	0.750	0.950	0.030	0.037
b	0.220	0.380	0.009	0.015
D	2.900	3.100	0.114	0.122
e	0.650		0.026	
E	4.800	5.000	0.189	0.197
E1	2.900	3.100	0.114	0.122
L	0.400	0.800	0.016	0.031

8-Lead MSOP Plastic Package