SL7303

3W High Power White LED Driver

Description

SL7303 is a PWM power LED driver IC. The driving current from few milliamps up to 1.5A. It allows high brightness power LED operating at high efficiency from 3.0Vdc to 40Vdc. Up to 200KHz external controlled operation frequency. External resistor controlled the maximum output current to single LED or a LED string.

Features

- **Only 6 external components required.**
- **Output driving current up to 1.5A.**
- **3.0V~40V wide operation voltage range.**
- **Space Saving Package SOP-8FD**

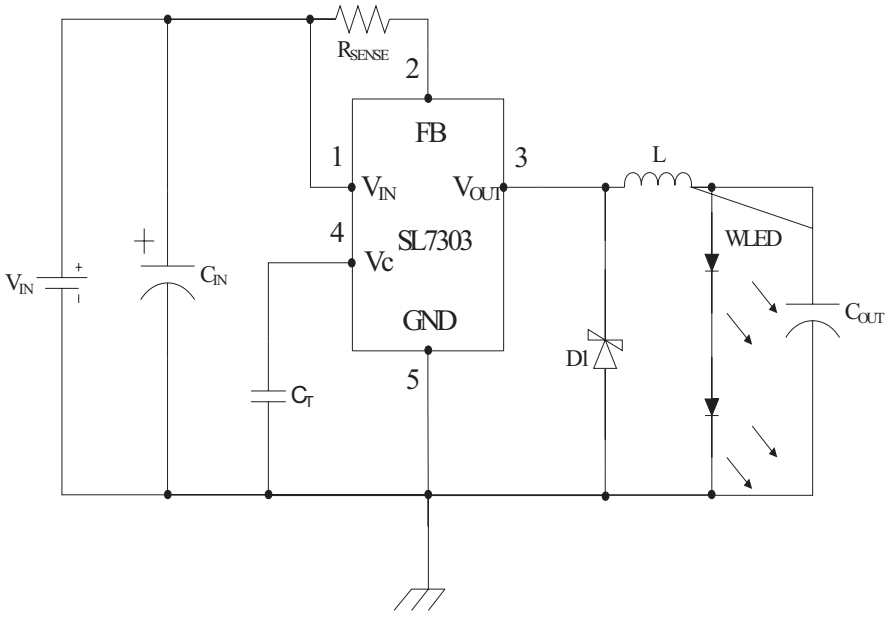
Application

DC/DC LED driver

Automotive

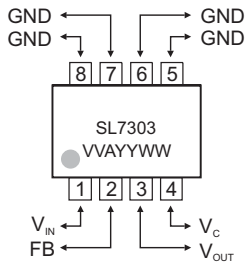
Lighting

TYPICAL APPLICATIONS



◆ MARKING INFORMATION & PIN CONFIGURATIONS

SOP- 8FD



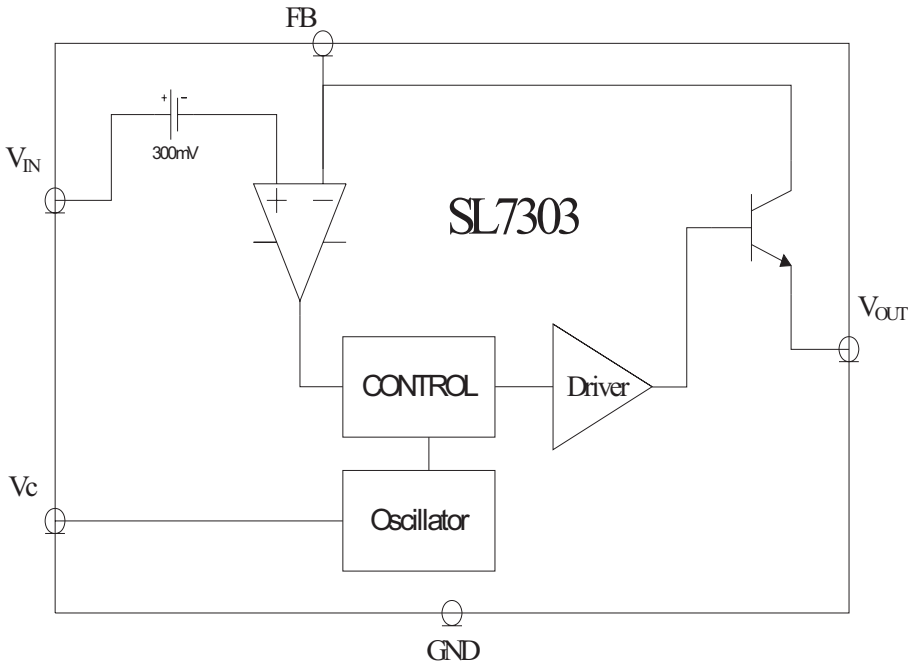
V V / VVV = Output Voltage (33=3.3V , 120=12V, A=Adj)
A = Assembly Location
YY = Year
W W = Weekly

◆ ORDERING INFORMATION (Green Package Products are available now!)

Ordering Number	Output Voltage	Package	Shipping
SL7303-SF8DR	N / A	SOP-8FD	2,500 Units / Tape & Reel

* For detail Ordering Number identification, please see last page.

◆ Block Diagram



◆ ABSOLUTE MAXIMUM RATINGS

Rating	Value	Unit
V_{IN} Voltage	40	V
FB Pin Voltage	40	V
V_{OUT} Voltage	40	V
Maximum Output Current Range	1.5	A
Storage Temperature Range	-65 ~ +150	°C
Lead Temperature (Soldering, 5 sec.)	300	°C

◆ OPERATING CONDITIONS

Rating	Value	Unit
V_{IN} Voltage Range	3.0 ~ 40	V
Operating Ambient Temperature Range	0 ~ +70	°C
Operating Junction Temperature	150	°C

◆ ELECTRICAL CHARACTERISTICS:

T_A=25 C, V_{IN}=5.0V,unless otherwise noted.

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Oscillator						
Oscillator Frequency	C_T=1.0nF	F_{OSC}	24	33	42	KHz
Charge Current	V_{IN} = 5.0 ~ 40V	I_{CHG}	24	33	42	uA
Discharge Current	V_{IN} = 5.0 ~ 40V	I_{DISCHG}	140	200	260	uA
Discharge to Charge Current Ratio	FB to V_{IN}	$\frac{I_{DISCHG}}{I_{CHG}}$	5.2	6.5	7.5	
Current Limit Sense Voltage	I_{CHG}=I_{DISCHG}	$V_{FB(sense)}$	250	300	350	mV
Output Switch (Note1)						
Saturation Voltage, Darlington Connection	I_{FB}=1.0A, V_{OUT}=0V	$V_{CE(SAT)}$	-	1.0	1.3	V
Saturation Voltage, Emitter Follower	V_{OUT}=1.0A, V_{FB}=V_{IN}	$V_{CE1(SAT)}$	-	1.3	2.0	V
Efficiency		η	-	80	-	%

▲ Note 1: Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient temperature as possible.

Application Information

The SL7303 was designed for power LED driving application. Only 6 external components were required for low voltage application. Fig.1 shows the typical application circuit for input voltage range from 3.0V to 40V. Buck power conversion topology was used and total forward voltage (at expecting current) of the LED string should lower than supply voltage by 1.6V at least.

Input Bypass Capacitor

The input by-pass capacitor C_{IN} holds the input voltage and filters out the switching noise of SL7303.

Flywheel Diode

The fast recovery diode was recommended for flywheel diode D1. This is because the high reverse recovery current will cause the voltage drop across R_{SENSE} being higher than 300mV, and consequently the switch will be turned off which has just been turned on.

LED Driving Current

The peak current I_{PK} flow though LEDs was decided by:

$$I_{PK} = \frac{300\ mV}{R_{SENSE}}$$

The average current on LEDs was determined by the peak-to-peak ripple current that was decided by inductor L. Assume the target average current 750mA on LEDs and ripple current 100mA then the R_{SENSE} should be:

$$R_{SENSE} = \frac{300\ mV}{700\ mA + 0.5 \cdot 100\ mA} = 0.400\Omega$$

The R_{SENSE} value should higher than 200mΩ so that driving current won't over the recommended maximum driving current 1.5A.

Inductor

The Inductor L stores energy during switch turn-on period and discharge driving current to LEDs via flywheel diode while switch turn-off. In order to reduce the current ripple on LEDs, the L value should high enough to keep the system working at continuous-conduction mode that inductor current won't fall to zero.

Since in steady-state operation the waveform must repeat from one time period to the next, the integral of the inductor voltage V_L over one time period must be zero:

$$\int_0^{Ts} V_L dt = \int_0^{ton} V_L dt + \int_{ON}^{Ts} V_L dt = 0 \quad \textit{Where } T_S = t_{ON} + t_{OFF}$$

Therefore

$$\frac{t_{ON}}{t_{OFF}} = \frac{V_{LED} + V_F}{V_{IN} - V_{RSENSE} - V_{SET} - V_{LED}}$$

Where, V_{LED} is the total forward voltage (at expecting current) of the LED string, V_F is the forward voltage of the flywheel diode D1, V_{RSENSE} is the peak value of the voltage drop across R_{SENSE} which is 250mV, and V_{SAT} is the saturation voltage of the switch which has a typical value of 1.0V.

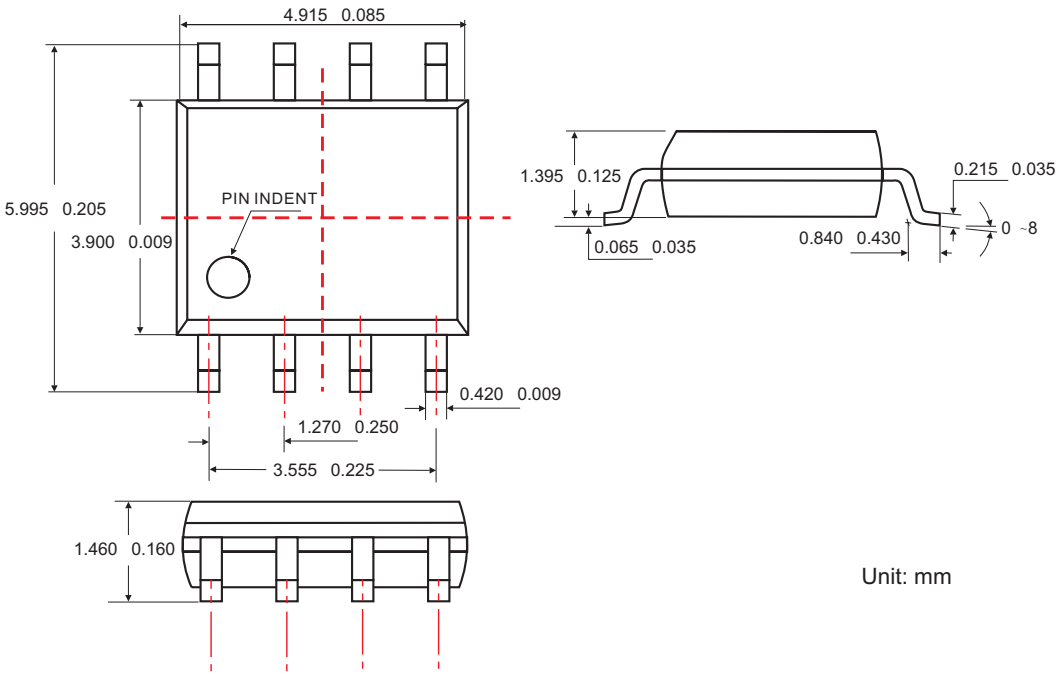
Since the operation frequency f is determined by choosing appropriate value for timing capacitor C_T, the switch turn-on time can also be known by

$$t_{ON} = D \times T_S = \frac{D}{f} \qquad \text{Where D (Dutycycle)} = \frac{t_{ON}}{t_{ON} + t_{OFF}}$$

With knowledge of the peak switch current and switch on time, the value of inductance can be calculated.

$$L = \frac{V_{IN} - V_{RSENSE} - V_{CE(SAT)} - V_{LED}}{I_{PK}} \times t_{ON}$$

SOP-8FD PACKAGE OUTLINE DIMENSIONS



Unit: mm

ORDERING NUMBER