LED Ripple Current Elimination Controller

Features

- Eliminate ripple current for single stage LED driver
- Without external COMP capacitor
- Built-in soft-start
- Max Output current is up to 300mA
- Internal intelligent over temperature protection
- Operating temperature range from -40℃to135℃

Description

The WS9931 is an adaptive linear current regulator to eliminate LED low frequency ripple current. It adopts an adaptive control solution without additional circuit design. It can realize the function of LED light non-filtering with very few external components, so the system cost and size are minimized. The WS9931 is mainly applied in bulb lights and tube lights, especially suitable for COB (chip on board) mode.

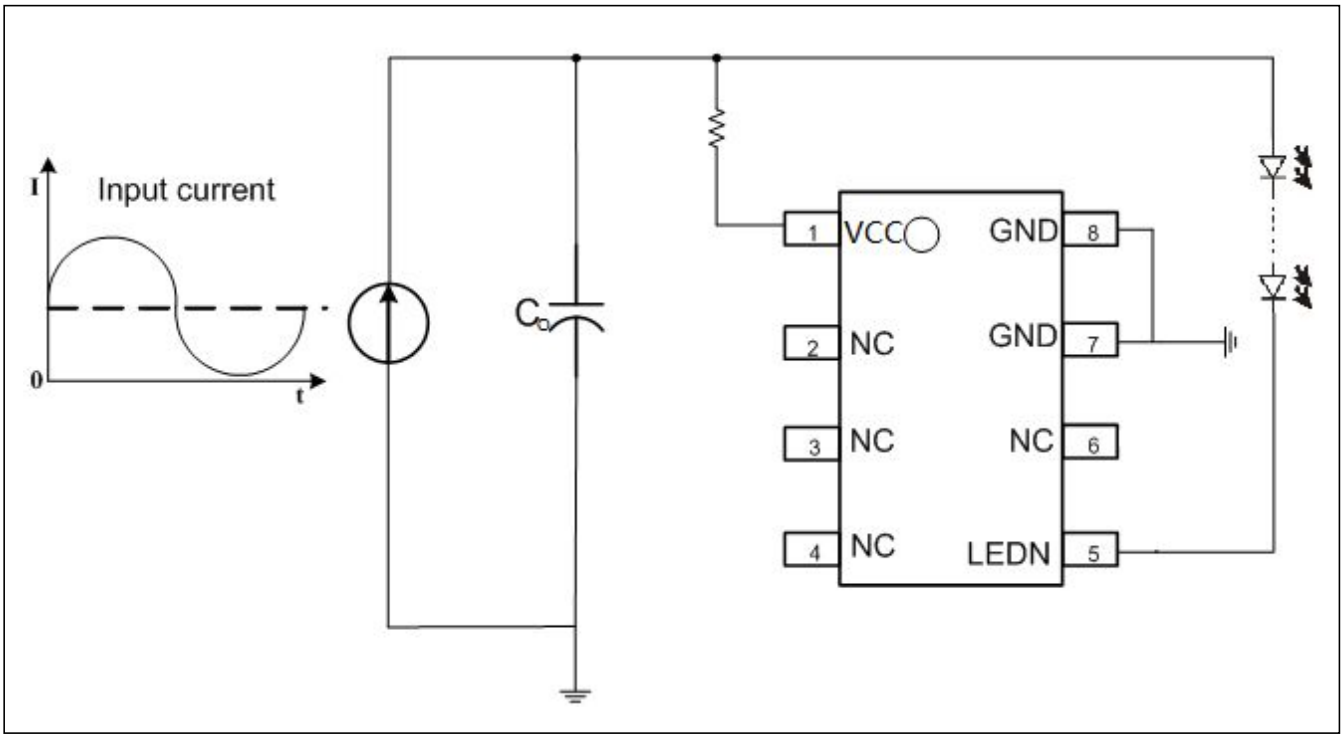
The operating temperature range of the WS9931 is from -40℃to135℃.

The WS9931 is available in ESOP8 Package.

Applications

- LED Tube Lights
- LED Bulb Lights

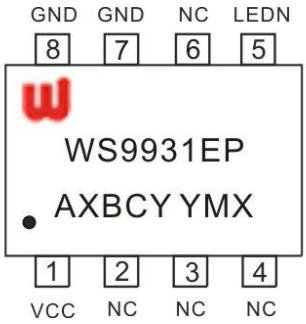
Typical Application Circuit



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Pin Configuration and Marking Information

The WS9931 is available in ESOP-8 Package. The top marking is shown as below:

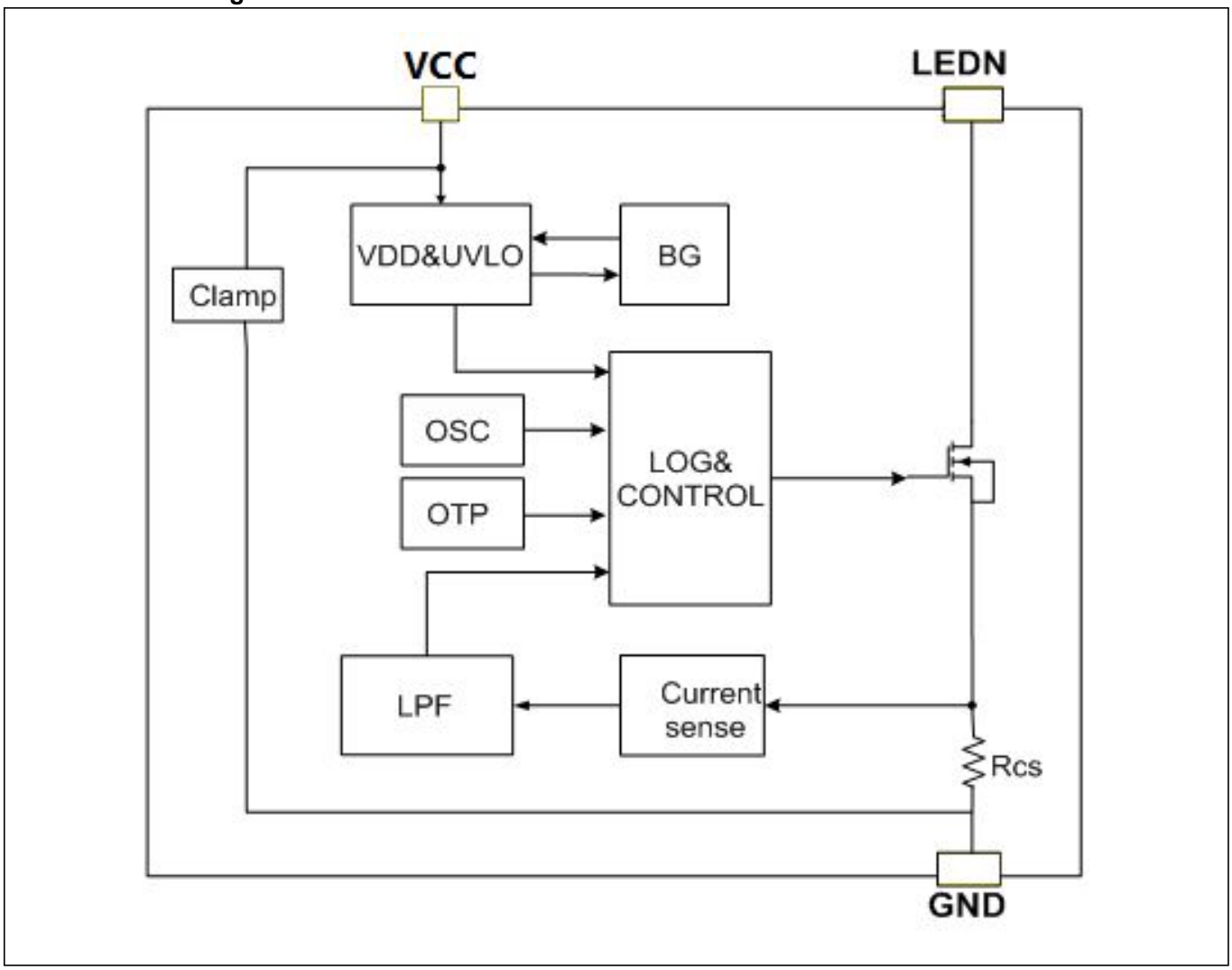


WS9931EP：Product Code
A：Product Code
X：Internal Code
BCY：Internal Code for QC
YMX：D/C

Pin Definition（Note: the heat sink at the bottom is connected to Pin 5.）

Name	Pin No.	Description
VCC	1	Power Supply
NC	2/3/4/6	NA
LEDN	5	The negative pin of LED series
GND	7/8	Ground Pin

Internal Block Diagram



Ordering Information

Package	Marking	Part Number
8-Pin ESOP8,Pb-free	WS9931EP	WS9931EP

Suggestion operating range:

Symbol	parameter	value	unit
TA	Operating temperature	-50-135	℃

Absolute Maximum Ratings

Parameter	Range	unit
VIN	-0.3~6	V
LEDN	-0.3~60	V
Junction Temperature	-40~150	℃
Lead Temperature（Soldering, 10 sec.）	260	℃
Storage Temperature	-55~150	℃

Note : Stresses above those listed Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, functional operation of the device should not over these or any of these absolute maximum ratings. Operating above the absolute maximum-rated conditions may affect device reliability.

Electrical Characteristics

VIN=5V and T=25℃, unless otherwise stated.

Symbol	Parameter	Test condition	Min	Typ	Max	Unit
Supply Voltage Section						
V_{IN}	VIN clamp voltage		4.8	5	5.2	V
I_{OP}	VIN operation current		400	500	600	uA
V_{OVP}-V_{O_MIN}	The maximum voltage drop between OVP voltage and minimum load voltage			50	60	V
Io	Adaptive output current		100	240	300	mA
Thermal Section						
T_{TC}	Thermal Regulation Temperature			120		℃
T_{SD}	Thermal Shutdown Temperature			135		℃
T_{HYS}	Thermal Hysteresis Temperature			18		℃

Application Information

The WS9931 is an adaptive linear current regulator to eliminate LED low frequency ripple current. It adopts adaptive control method and integrates MOS and current sense resistor to eliminate ripple current without additional electrical design.

The maximum output current of the WS9931 can be up to 300mA, and the value of V_{OVP}-V_{O_MIN} should be less than 60V.

Theory of Current Ripple Removing

The WS9931 acquires the sense voltage signal through sampling the output currents signal of the load, and makes the signals filter. Then it magnifies the error between sense voltage signals and filter voltage signals, and outputs the signal of error compensation to regulate output current signals. The WS9931 drives MOSFET to transfer the LED ripple current to voltage ripple on MOSFET, and ensures the constant voltage across LED string and the current flow through LED string, thus eliminating ripple current.

Start Up

The WS9931 integrates soft-start function and is supplied by the preceding stage system. When V_{VIN} rises up over 5V, the WS9931 starts to work. At first, it has 350ms blanking time without current filter function to build up stable reference internally. Then the LED ripple current is decreased by WS9931 gradually.

The typical value of the startup current is 500uA, and the start-up resistor can be calculated by the equation:

$$R_{ST} < \frac{V_O - V_{IN_MAX}}{I_{VIN_TYP}} \approx \frac{V_O - 5.2V}{500uA}$$

Where,

Vo is the load voltage in practical application;

V_{IN_MAX} is the maximum clamp voltage, about 5.2V;

I_{VIN_TYP} is the operating current, about 500uA.

Over Thermal Protection

The WS9931 has temperature regulator control. When the temperature goes to 120 ℃ , the temperature compensation is turned on to increase LED current ripple and reduce the maximum voltage of LEDN. When the temperature goes to 135 ℃ , over temperature protection starts, and the MOSFET will be in On-State all the time without suppresses function.

PCB Layouts

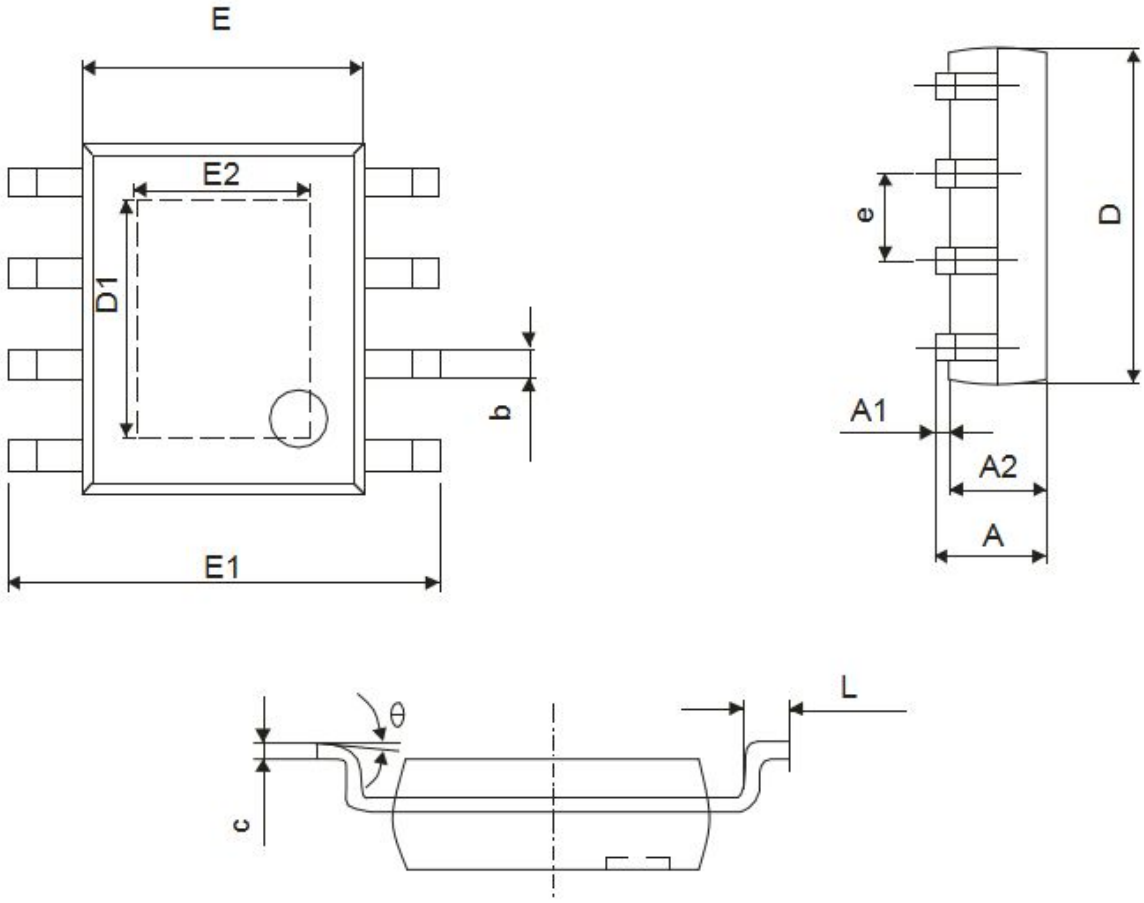
The following advices should be followed in WS9931 PCB layout:

IC Layout： The IC should be away from heating devices, such as driver MOSFET, freewheeling diodes, inductor and so on.

LEDN Pin： To increase the copper area of LEDN pin or to connect to other NC pins for better thermal dissipation.

Package Information

ESOP8 Package Outline Dimensions



Symbol	Winsemi			
	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.050	0.150	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
D1	3.202	3.402	0.126	0.134
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
E2	2.313	2.513	0.091	0.099
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

NOTE:

1.We strongly recommend customers check carefully on the trademark when buying our product, if there is any question, please don't be hesitate to contact us.

2.Please do not exceed the absolute maximum ratings of the device when circuit designing.

3.Winsemi Microelectronics Co., Ltd reserved the right to make changes in this specification sheet and is subject to change without prior notice.

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