High Precision PSR Constant Current LED Driver

Features

- Built-in600V Power MOSFET
- Constant current control without secondary sense and feedback circuit.
- ±3% LED current accuracy
- Ultra low operating current to improve efficiency
- High resistance feedback resistor to improve efficiency
- Universal input voltage
- LED short and open circuit protection
- VCC under-voltage protection
- Feedback loop short circuit protection
- Current sense resistor open circuit protection
- Over temperature protection
- No external loop compensation component required
- Available in DIP-7 package

Applications

- LED bulb, spot light
- OtherLED lighting

Description

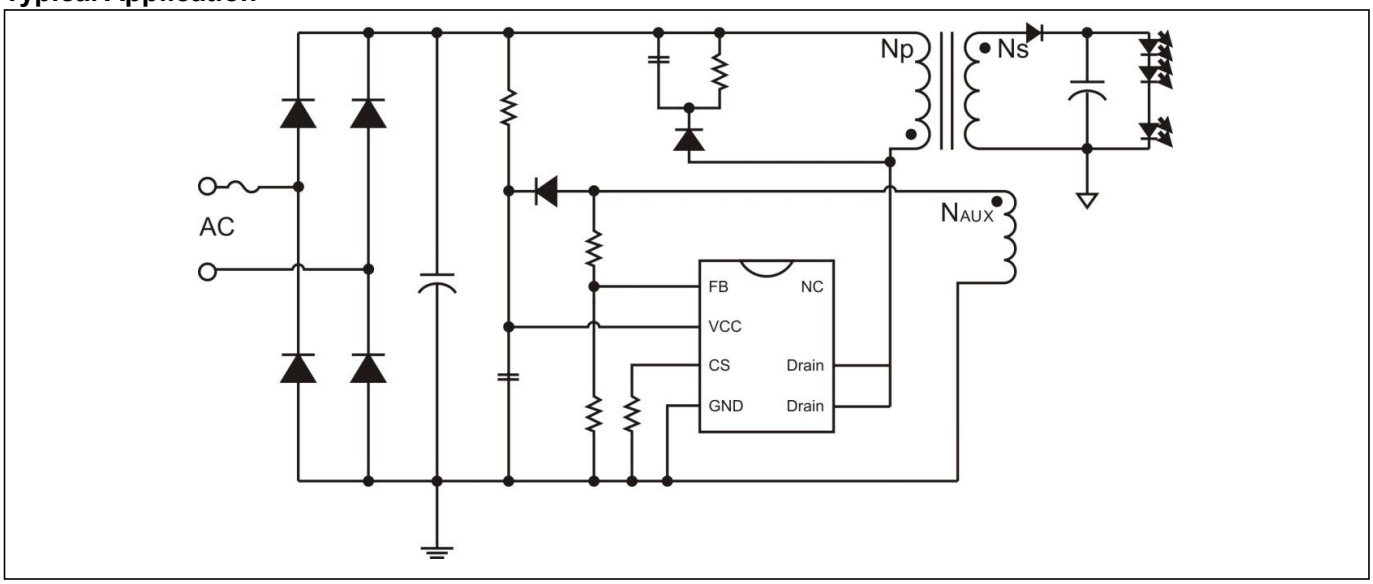
The WS9254 is a high precision primary-side feedback and regulation controller for LED lighting, it operates in constant current control mode and is designed to work in inductor current discontinuous conduction mode and extremely suitable for flyback convertor under universal input, the output power of system should be less than 12W.

The WS9254integrates 600V power MOSFET. Since adopting primary sense and feedback control technology, the secondary sense and feedback circuit is eliminated. The loop compensation components are also removed while maintaining stability overall operating conditions. The low component counts and low BOM cost are realized.

Since using the proprietary high accurate current sense method, theWS9254 realizes ±3% accuracy of LED current along with excellent line regulation and load regulation.

The WS9254 offers rich protection functions including LED short circuit protection, LED open circuit protection, die over-temperature protection, VCC over voltage protection, VCC under voltage protection and FB short circuit protection. All the protection features are auto-recovery.

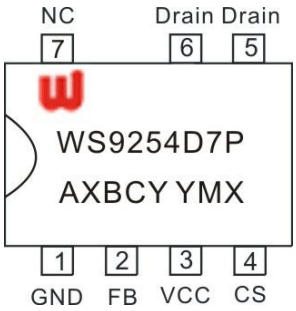
Typical Application



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Pin Configuration and Marking Information

WS9254is offered in DIP7 package, as bellows:

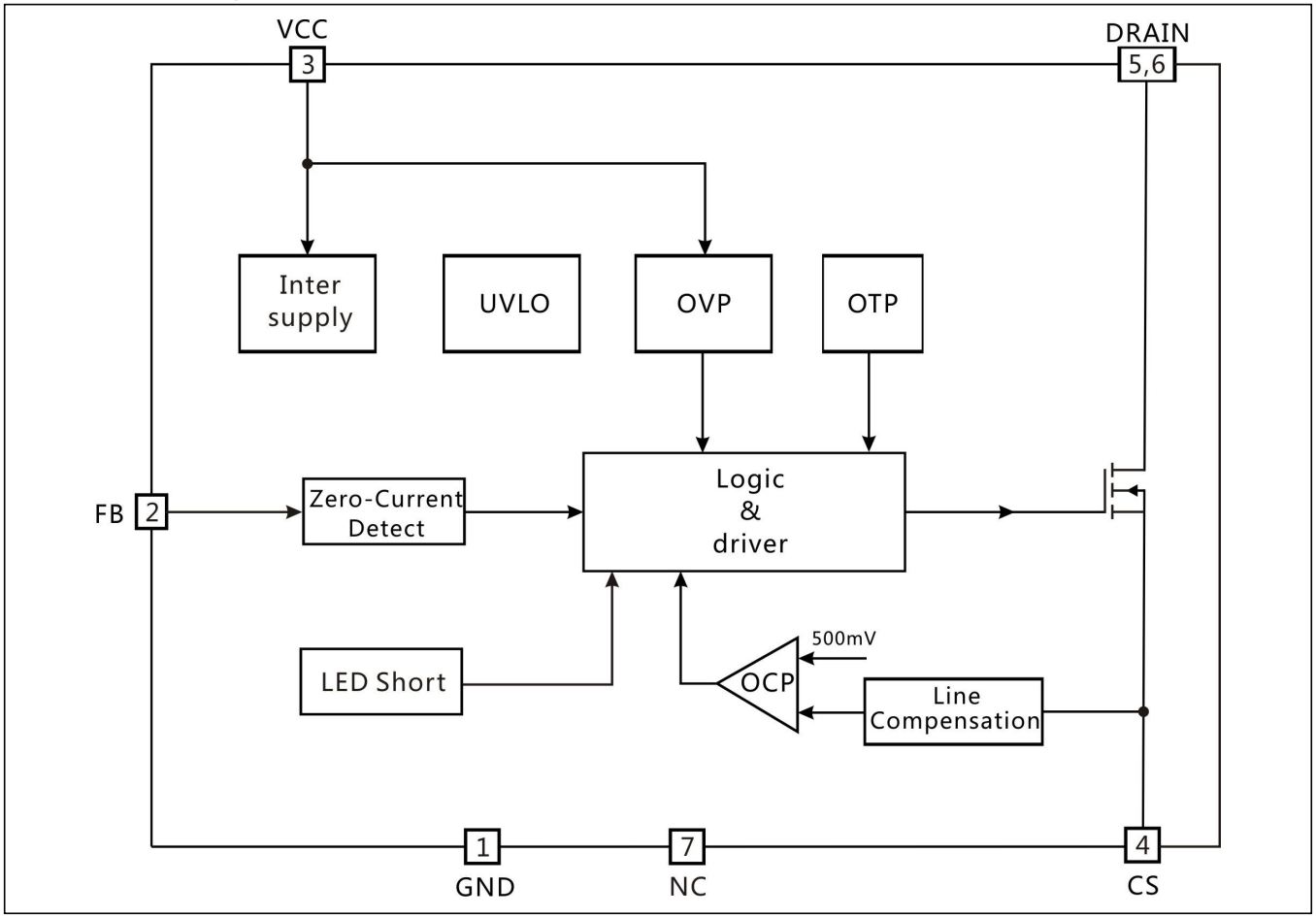


WS9254D7P
A：Product Code
X：Internal Code
BCY：Internal Code For QC
YMX：D/C

Pin Definition

Pin No.	Pin Name	Function Description
1	GND	Ground.
2	FB	Feedback. This pin detects the output information from auxiliary winding.
3	VCC	Power suppl.
4	CS	Current sense. This pin connects a current sense resistor to GND to detect the primary current of transformer.
5,6	Drain	Internal high voltage MOSFET drain.
7	NC	No connection, must be floated.

Internal Block Diagram



Ordering Information

Package	Marking	Part Number
7-Pin DIP-7, Pb-free	WS9254D7P	WS9254D7P

Recommended Operation Conditions

Symbol	Parameter	Value	Unit
Fmax	Maximumworking frequency	100	khz
TA	Operation temperature	-20~85	℃
VCC	Power supply voltage	10~17.5	V
POUT1	Output power(Input voltage230V±15%)	<18	W
POUT2	Output power(Input voltage85V～265V)	<12	W

Absolute Maximum Ratings (Note1)

Symbol	Paramete	Limites	Unit
VCC	VCC pin input voltage	-0.3~20	V
FB	Feedback pin input voltage	-0.3~6	V
Drain	Internal MOSFET drain voltage	-0.3~600	V
CS	Current sense pin input voltage	-0.3~6	V
PDMAX	Power dissipation (note2)	0.9	W
Tjo	Operating junction temperature	-40~150	℃
θJA	Thermal resistance (Junction to Ambient)	80	℃/W
TSTG	Storage temperature range	-55~150	℃

Note 1: Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. Under "recommended operating conditions" the device operation is assured, but some particular parameter may not be achieved. The electrical characteristics table defines the operation range of the device, the electrical characteristics is assured on DC and AC voltage by test program. For the parameters without minimum and maximum value in the EC table, the typical value defines the operation range, the accuracy is not guaranteed by spec.

Note 2: The maximum power dissipation decrease if temperature rise, it is decided by TJMAX, θ JA, and environment temperature (TA). The maximum power dissipation is the lower one between PDMAX = (TJMAX - TA)/ θ JA and the number listed in the maximum table.

Electrical Characteristics (Unless otherwise specified, VCC=8V and TA =25 ℃)

Symbol	Parameter	Test condition	Min	Typ	Max	Units
Supply Voltage Section						
VDD_CLAMP	VDD Clamping Voltage	4mA	17.4	18.3	19.4	V
UVLO_on	VDD Power Supply		16.1	17.1	18.1	V
UVLO_off	VDD Under Voltage Lockout		8.5	9	9 .5	V
VCC_OVP	VCCover voltage protection level		17.9	18.9	19.9	V
Ist	Start up current			35		uA
Iop	Operating current			152		uA
Current Sense Section						
Ipp	Primary Peak Current		484	508	531	mV
T_{LEB}	Lead Edge Blanking			500		ns
T_{DELAY}	Shutdown Delay			200		ns
D_max	Maximum Duty Cycle			42		%
FeedbackInputSection						
Toff_max	MaximumDemagnetization time			420		us
Toff_min	MinimumDemagnetizationtime			4		us
Ton_max	MaxmiumON time			100		us
Vfb	FB voltage sense level			1		V
Power MOSFET						
Idss	Drain-source leakage current	Vgs=0V,Vds=600V			10	uA
BVdss	Drain-source breakdown voltage		600			V
Ron	Static drain-source on-resistance			6.8	8.5	Ω
Over TemperatureProtection						
T_comp	Thermal Regulation Temperature			147		℃

Application Information

The WS9254 is a high performance power switch specially designed for LED lighting, it uses the patent constant current control technology of WINSEMI. The WS9254 integrates a 600V power MOSFET. The accurate LED current can be realized without opto-coupler and TL431 feedback circuit while minimizing the external component count, lowering the total bill of material cost.

Start Up

The VCC capacitor will be charged through the start-up resistor when the system is powered on, once the voltage on VCC reaches the start-up threshold, the WS9254 will start to operate, and then the VCC is supplied by the auxiliary winding.

Constant Current Control

Cycle-by-Cycle current sense is offered in WS9254, the CS is connected to the current sense comparator, and the voltage on CS will be compared with the internal 500mV reference voltage, the MOSFET will be switched off when the voltage on CS reaches the threshold. The output of the comparator also includes a 500nS leading edge blanking time

The primary peak current is given by:

$$I_{P_PK} = \frac{508}{R_{CS}}(mA)$$

The current in LED can be calculated by the equation:

$$I_{OUT} = \frac{I_{P_PK}}{4} \times \frac{N_P}{N_S}$$

Where,

NP: primary winding turns of transformer

NS: secondary winding turns of transformer

IP_PK: peak current in MOSFET

Feedback Network

The WS9254 senses the output information through the feedback network and the FB threshold voltage is set to 1V. The ratio of FB upper resistor to lower resistor is recommended to about 4.0. The FB upper resistor can be set to 300KΩ~750KΩ to improve efficiency of convertor.

Operation Switching Frequency

The WS9254 is designed to work in discontinuous conduction mode and no external loop compensation component is required while maintaining stability. The maximum duty cycle is limited to 42%. The maximum switching frequency should be set to less than 100KHz and the minimum switching frequency should be set to more than 20KHz. The maximum and minimum switching frequency is limited in WS9254 to ensure the stability of system.

The switching frequency can be set by the formula:

$$f = \frac{Np^2 \times V_{LED}}{8 \times Ns^2 \times Lp \times I_{LED}}$$

Where, LP is the primary winding inductance of transformer.

Protection Function

The WS9254 has several protection functions. The internal MOSFET will be shut down immediately when the voltage on VCC reaches the threshold of OVP and the device will not recover until the protection condition is removed. A 18V zener diode is designed in the WS9254 to prevent the chip damage from the abnormal situation.

The thermal protection circuitry in the WS9254 senses the die temperature after start up, and the thermal protection threshold is set to 147℃

The system will work in low consumption mode when the output LED short circuit or open circuit is detected. While the WS9254 continuous to detect output status until the LED recover to normal condition, and then the device will be operate in normal mode.

PCB Layout

The following rules should be followed in WS9254 PCB layout:

Bypass Capacitor

The bypass capacitor on VCC should be as close as possible to the VCC pin

Ground Path

The power ground path for current sense should be short, and the power ground path should be separated from small signal ground path before the negative of the bulk capacitor.

The Area of Power Loop

The area of main current loop should be as small as possible to reduce EMI radiation, such as the primary current loop, the snubber circuit and the secondary rectifying loop.

NC Pin

The NC pin must be left floating to satisfy the requirement of creepage distance.

Drain pin

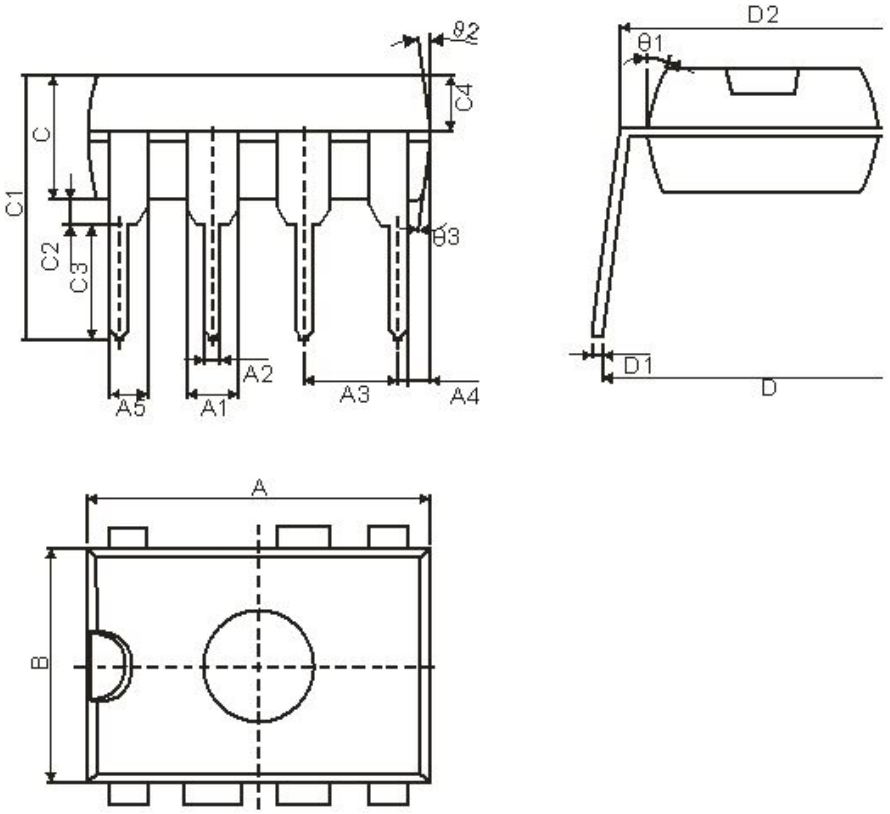
To increase the copper area of drain for thermal consideration.

FB Pin

The feedback divider should be as close as possible to FB Pin and the node must keep away from dynamic node of transformer.

Package Information

DIP7 Package Outline Dimensions



Winsemi				
Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	9.00	9.50	0.354	0.374
B	6.10	6.60	0.240	0.260
C	3.0	3.4	0.118	0.134
A1	1.474	1.574	0.058	0.062
A2	0.41	0.53	0.016	0.021
A3	2.44	2.64	0.096	0.104
A4	0.51TYP		0.02TYP	
A5	0.99TYP		0.04TYP	
C1	6.6	7.30	0.260	0.287
C2	0.50TYP		0.02TYP	
C3	3.00	3.40	0.118	0.134
C4	1.47	1.65	0.058	0.065
D	7.62	9.3	0.300	0.366
D1	0.24	0.32	0.009	0.013
D2	7.62TYP		0.3TYP	

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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