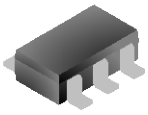
NON-ISOLATED LED LIGHTING DRIVE IC WITH HIGH PFC AND HIGH CONSTANT CURRENT ACCURACY

DESCRIPTION

SD6900 is designed for non-isolated LED driving with floating Buck structure. With this structure, inductor current will be sensed and closed-loop is formed with the internal error amplifier for high constant current accuracy and high input/output regulation rate. Also, high PF in full range is available as its own PFC control. Boundary Conduction mode is adopted for decreasing switching loss and improving the conversion efficiency.

SD6900 integrates various protections, such as output open circuit protection, output short circuit protection, cycle-by-cycle current limit protection, over temperature protection and VCC over voltage protection.

The start-up current and operating current are low and highlight LED can be driven with high efficiency in full range (85VAC~265VAC).



SOT-23-6L

APPLICATION

* Bulb Lamp
* T5/T8 LED Lamp
* Various LED Lighting

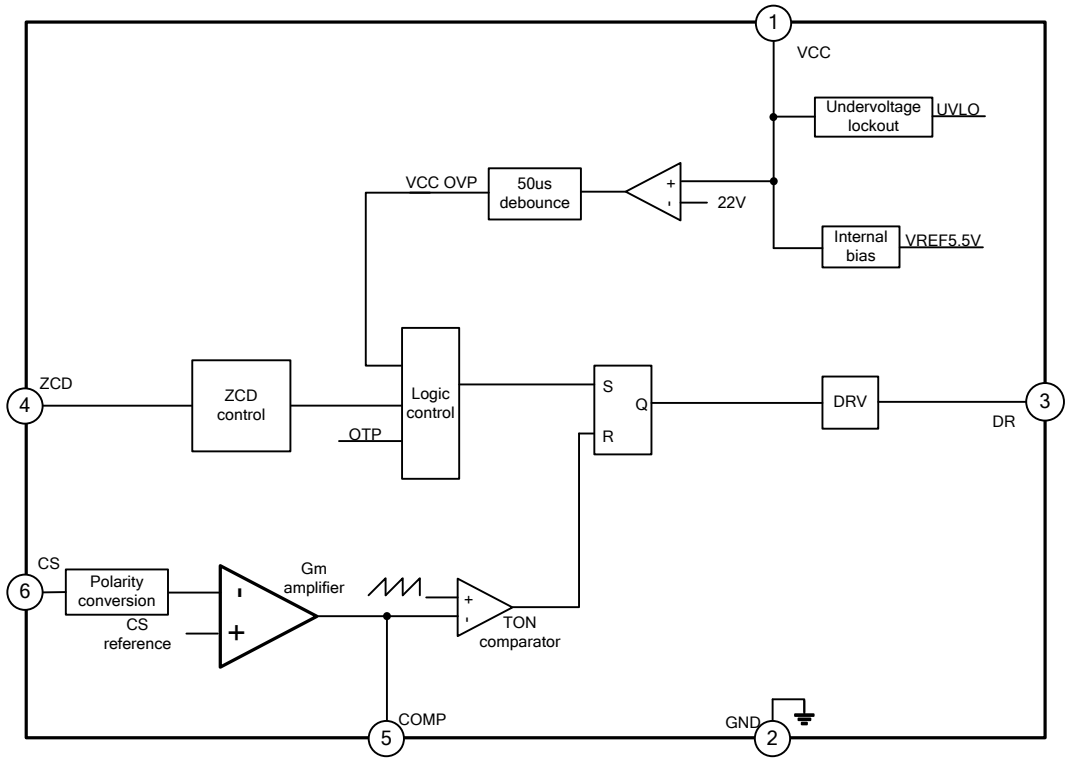
FEATURES

* Proprietary constant control method (Patent)
* Constant current with high accuracy for LED (<±3%)
* PF>0.9 in full voltage range
* High efficiency >93% (18W)
* Boundary-Conduction mode
* LED short circuit protection (Patent)
* LED open circuit protection
* VCC over/under voltage protection
* Over temperature protection
* Over current protection

ORDERING INFORMATION

Part No.	Package	Marking	Material	Packing
SD6900TR	SOT-23-6L	SD6900	Pb free	Tape&Reel

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

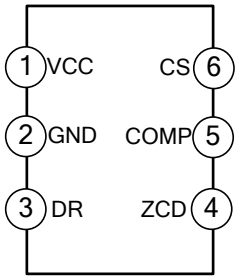
Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	-0.3~22	V
Feedback voltage	V_{ZCD}	-0.3~6.5	V
Sample voltage	V_{CS}	-6.5~6.5	V
COMP voltage	V_{COMP}	-0.3~6.5	V
DR voltage	V_{DR}	-0.3~15	V
Junction temperature Range	T_j	-40~125	°C
Storage temperature Range	T_S	-65~150	°C

ELECTRICAL CHARACTERISTICS (Unless otherwise stated, V_{CC}=16V, CS=-0.3V, DR Pin Float, T_{amb}=25°C)

Characteristics	Symbol	Test condition	Min.	Typ.	Max.	Unit
Operating Voltage	V_{CC}	After start	10	16	18	V
UVLO VH	$UVLO_H$		15	16	17	V
UVLO VL	$UVLO_L$		7.5	8.5	9.5	V
VCC OVP	VCC_{OVP}		21	22	23	V
Start-up current	I_{START}	Before start, V_{CC}=15V	0	1	10	μA
Operating current	I_{VCC}	After start, Switching	600	750	900	μA
ZCD Pin Section						

Characteristics	Symbol	Test condition	Min.	Typ.	Max.	Unit
ZCD OVP voltage	ZCD_{OVP}	Increase ZCD to the threshold value	4.15	4.25	4.35	V
ZCD OVP delay			--	900	-	ns
ZCD VL			--	0.1	--	V
ZCD VH			--	0.3	--	V
ZCD short circuit detect voltage	ZCD_{SL}		0.35	0.5	0.65	V
Error Amplifier Section						
Input reference voltage of transconductance Amplifier	CS_{REF}		165	170	175	mV
Transconductance of transconductance Amplifier	Gm		--	270	--	μA/V
COMP high clamp voltage			--	3.5	--	V
CS peak protection voltage			--	1000	--	mV
Time Parameters Section						
Max. on time	$T_{ON,MAX}$	V_{COMP}=3.5V	--	33	--	μs
Min. on time	$T_{ON,MIN}$	V_{COMP}=0V	--	0.4	--	μs
Max. off time	$T_{OFF,MAX}$		--	38	--	μs
Min. off time	$T_{OFF,MIN}$		--	3.2	--	μs
Max. switching frequency	F_{MAX}		--	120	--	KHz
GATE Driver Section						
Output low	V_{OL}	V_{CC}=16V, I_O=-20mA	--	--	0.8	V
Output high	V_{OH}	V_{CC}=16V, I_O=20mA	10	--	--	V
High Clamp voltage at high level	V_{OH_CLAMP}		--	15	--	V
Output rising time	T_R	V_{CC}=16V, C_L=1nF	--	180	--	ns
Output falling time	T_F	V_{CC}=16V, C_L=1nF	--	60	--	ns
Thermal Section						
Over temperature protection threshold value	T_{SD}		--	150	--	°C
Over temperature protection release point			--	130	--	°C

PIN CONFIGURATIONS



PIN DESCRIPTIONS

Pin No.	Pin Name	I/O	Description
1	VCC	POWER	Power supply
2	GND	GND	Ground pin
3	DR	O	Drive output, connect this pin to the Gate of Power MOSFET
4	ZCD	I	Inductor current zero-crossing detection pin
5	COMP	O	Output of trans-conductance amplifier, connected to GND through a capacitor
6	CS	I/O	current sense pin input

FUNCTION DESCRIPTION

SD6900 is a non-isolated LED driver IC adopting BUCK structure. The function is described below.

Start control

Fast start-up is achieved due to very low start-up current. Large resistor can be used for external start-up resistor. It features undervoltage protection at VCC and the on/off threshold values are 16V and 8V. Hysteresis characteristics guarantee that IC can be powered by input capacitor during start-up. When the output voltage increases to a certain value, VCC will be charged by output through auxiliary winding or Zener Diode. $Vz=V_{LED}-V_{CC}$.

Boundary-conduction mode

Power MOSFET is turned on by inductor current zero-crossing detection. The zero-crossing of current can be detected by ZCD pin which can be measured through auxiliary winding and outside resistor divider.
When inductor current is zero crossing, voltage at pin ZCD drops rapidly; IC detects the falling edge and turns on Power MOSFET. Boundary-conduction mode provides low turn-on switching losses and high conversion efficiency.

Constant current accuracy control

IC senses the whole inductor current and forms the closed-loop with internal error amplifier to obtain high constant current accuracy and high regulation rate.
CS voltage and 0.17V reference voltage are the inputs of Gm amplifier, and then the output is integrated

through external Comp capacitor. The on time of MOSFET is controlled by Comp voltage for adjusting output current.

Current detection and LEB

With the cycle-by-cycle current limit function, Power MOSFET will be turned off if CS voltage exceeds a certain value. System still works and Power MOSFET is turned on in the next period.
During LEB, limit comparator stops, and MOSFET is on during this time.

Gate driver

GATE Pin is connected to gate of external MOSFET for controlling its on/off. Too weak driving of GATE will increase power dissipation on MOSFET and too strong driving will bring EMI. A good tradeoff is achieved through the totem pole gate drive design with appropriate output ability and dead time control.
Output high level of GATE is clamped at 15V to protect external MOSFET.

VCC over voltage protection

Over voltage protection occurs when the voltage at VCC Pin is high, MOSFET is off and the system restarts automatically.

Output over voltage protection

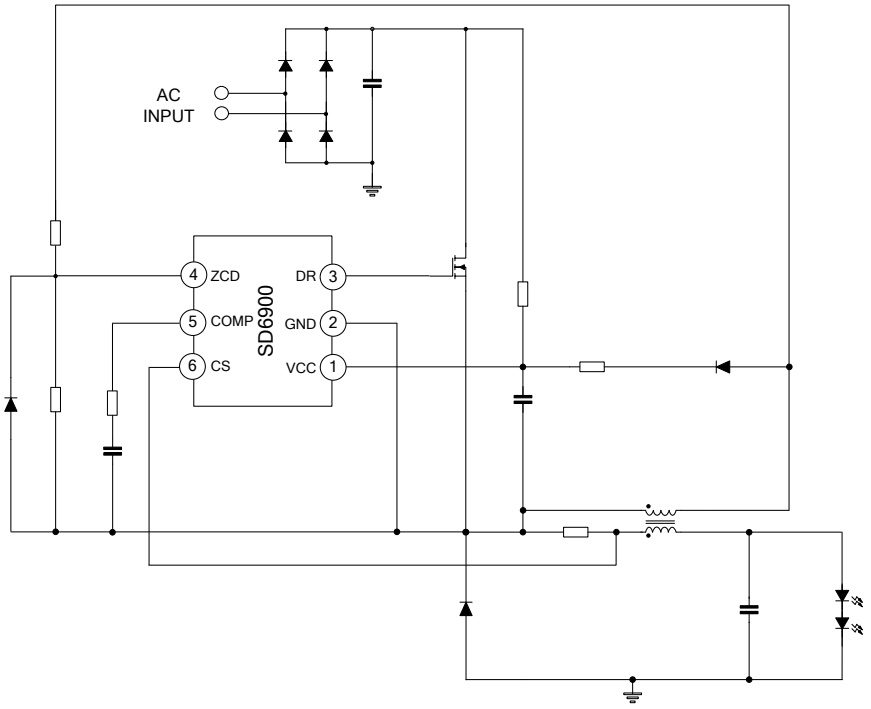
When the MOSFET is off, Output voltage is sensed by pin ZCD . When ZCD voltage is higher than 4.25V, Output OVP occurs, MOSFET is off and the system will restart.

Output short circuit protection

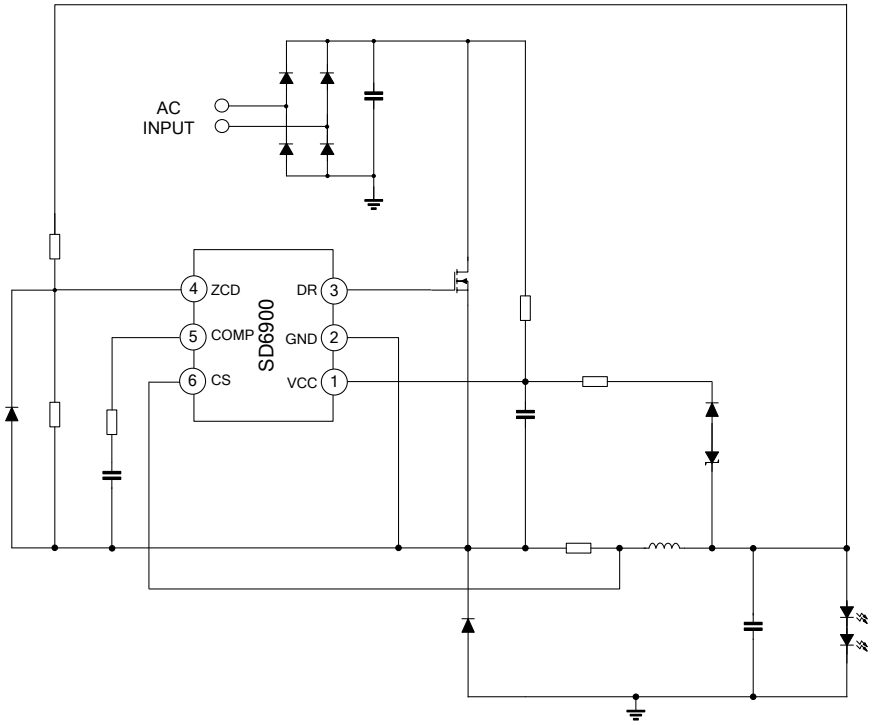
When voltage on pin ZCD is below 0.5V and the state holds on for 448 on/off cycles, OUTPUT short circuit protection occurs, MOSFET is off and the system will restart.

TYPICAL APPLICATION CIRCUIT

Use transformer to supply Vcc



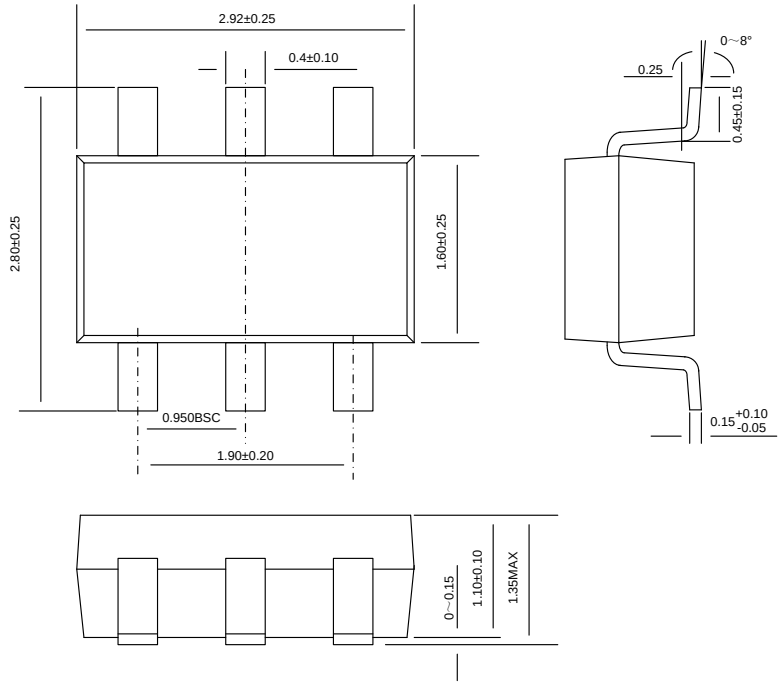
Use Zenner Diode to supply Vcc



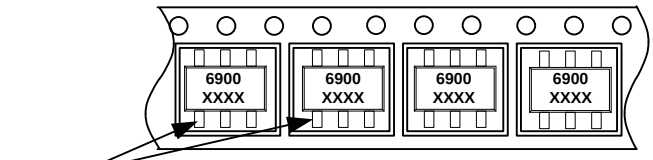
Note: The circuit and parameters are for reference only; please set the parameters of the real application circuit based on the real test.

PACKAGE OUTLINE

SOT-23-6L Unit: mm



IC POSITION IN THE TAPE



Pin 1

SOT-23-6L seal character direction and transfer hole position of carrier tape

MOS DEVICES OPERATE NOTES:

Electrostatic charges may exist in many things. Please take following preventive measures to prevent effectively the MOS electric circuit as a result of the damage which is caused by discharge:

- The operator must put on wrist strap which should be earthed to against electrostatic.
- Equipment cases should be earthed.
- All tools used during assembly, including soldering tools and solder baths, must be earthed.
- MOS devices should be packed in antistatic/conductive containers for transportation.

Disclaimer :

- **Silan reserves the right to make changes to the information herein for the improvement of the design and performance without further notice! Customers should obtain the latest relevant information before placing orders and should verify that such information is complete and current.**
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ATTACHMENT

Revision History

Date	REV	Description	Page
2012.12.13	1.0	Initial release	