NON-ISOLATED BUCK LED LIGHTING DRIVE IC WITH LOW POWER AND HIGH CONSTANT CURRENT ACCURACY

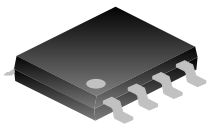
DESCRIPTION

SD670XSC is designed for non-isolated LED driving with Buck structure, high constant current accuracy and high linear/load regulation available with assistant of special sense technology.

SD670XSC integrates various protections, such as output open/short circuit protection, cycle-by-cycle current limit protection and over temperature protection.

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

SD670XSC integrates high voltage power MOSFET, reducing the system cost and the whole volume.



SOP-7-225-1.27

FEATURES

- Built-in 500V high voltage power MOSFET
- Constant current with high accuracy for LED (<±3%)
- Output open/short circuit protection
- CS open/short circuit protection
- VCC undervoltage protection
- Over temperature protection
- Cycle-by-cycle current protection
- No auxiliary winding

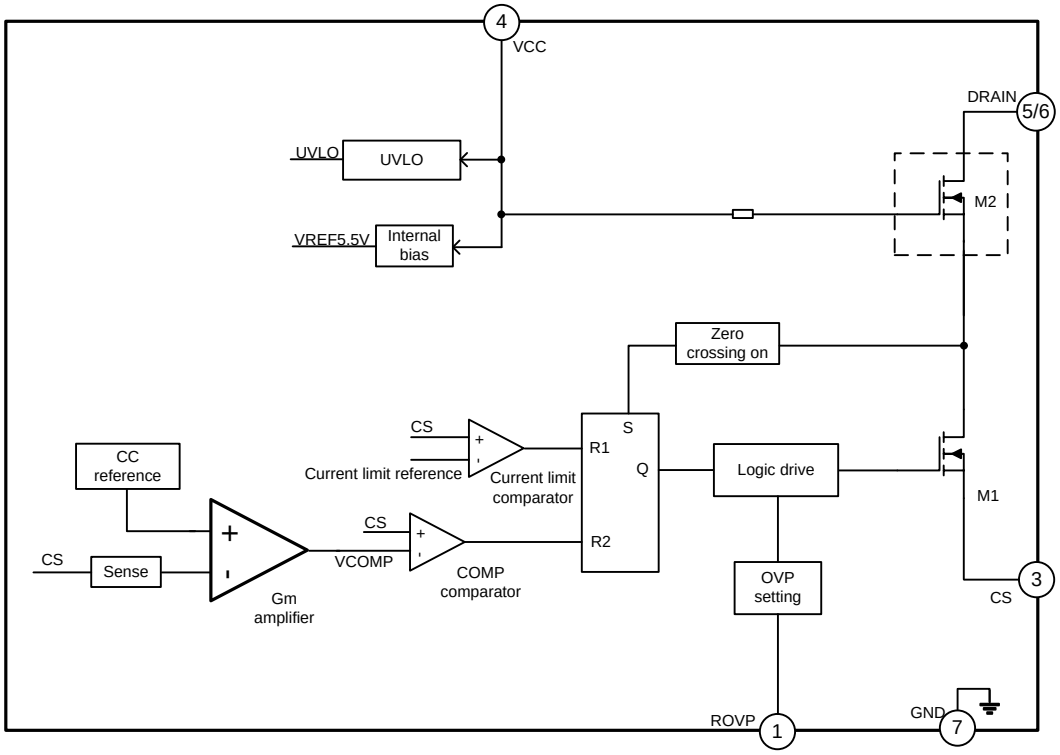
APPLICATION

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

ORDERING INFORMATION

Part No.	Package	Material	Packing
SD6701ASC	SOP-7-225-1.27	Halogen free	Tube
SD6701SC	SOP-7-225-1.27	Halogen free	Tube
SD6702SC	SOP-7-225-1.27	Halogen free	Tube
SD6701ASCTR	SOP-7-225-1.27	Halogen free	Tape&Reel
SD6701SCTR	SOP-7-225-1.27	Halogen free	Tape&Reel
SD6702SCTR	SOP-7-225-1.27	Halogen free	Tape&Reel

BLOCK DIAGRAM



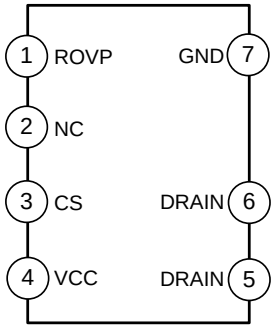
ABSOLUTE MAXIMUM RATINGS

Characteristics		Symbol	Rating	Unit
Drain-Gate voltage (R_{GS}=1MW)		V_{DGR}	500	V
Gate-Source Voltage		V_{GS}	±30	V
Drain current pulse	SD6701ASC	I_{DM}	2.4	A
	SD6701SC		4	
	SD6702SC		8	
Drain continuous current (Tamb=25°C)	SD6701ASC	I_D	0.8	A
	SD6701SC		1	
	SD6702SC		2	
Supply voltage		V_{CC}	-0.3~17	V
ROVP voltage		V_{ROVP}	-0.3~6.5	V
Sense voltage		V_{CS}	-0.3~6.5	V
DRAIN voltage		V_{DRAIN}	-0.3~500	V
Junction temperature Range		T_j	-40~150	°C
Storage temperature Range		T_S	-55~150	°C

ELECTRICAL CHARACTERISTICS (Unless otherwise stated, V_{CC}=12V,T_{amb}=25°C)

Characteristics		Symbol	Test condition	Min.	Typ.	Max.	Unit
VCC clamp voltage		VCC_{CLAMP}	I_{VCC}>2mA	14	16	17	V
UVLO VH		$UVLO_H$		10.5	12	13.5	V
UVLO VL		$UVLO_L$		6.5	7.5	8.5	V
Start-up current		I_{START}	V_{CC}=10V	50	95	125	μA
Operating current		I_{VCC}	CS=1V	100	150	200	μA
Protection current		I_{PRO}	CS=5V	800	1200	2000	μA
CC parameters							
CS reference voltage		CS_{REF}		388	400	412	mV
CS current limit reference voltage		CS_{PEAK}		420	450	480	mV
Time Parameters							
Max. on time		$T_{ON,MAX}$		40	50	60	μs
LEB		T_{LEB}		0.45	0.6	0.75	μs
Max. off time		$T_{OFF,MAX}$		180	220	260	μs
Min. off time		$T_{OFF,MIN}$		2	3	4	μs
Min. period		T_{MIN}		3.7	5	6.3	μs
Internal OVP control		T_{OVP}		3.6	4.5	5.4	μs
ROVP voltage		V_{ROVP}		2	2.4	2.8	V
Internal high voltage MOSFET							
On resistance	SD6701ASC	R_{DSON}	V_{GS}=12V,I_D=0.1A	--	13	14.5	Ω
	SD6701SC			--	7.5	8.6	
	SD6702SC			--	5	5.7	
withstand voltage at Drain	SD6701ASC	BV_{DSS}	V_{GS}=0V,I_D=50uA	500	550	--	V
	SD6701SC			500	550	--	
	SD6702SC			500	550	--	
Zero gate voltage drain current	SD6701ASC	I_{DSS}	V_{DS}=500V, V_{GS}=0V	--	--	1.0	μA
	SD6701SC			--	--	1.0	
	SD6702SC			--	--	1.0	
Gate-Source Leakage Current	SD6701ASC	I_{GSS}	V_{GS}=±30V, V_{DS}=0V	--	--	±100	nA
	SD6701SC			--	--	±100	
	SD6702SC			--	--	±100	
Temperature characteristics							
Regulatory temperature threshold value		T_{REG}		125	140	155	°C
Over temperature protection threshold value		T_{SD}		135	150	165	°C
Over temperature protection release point		$T_{RECOVERY}$		115	130	145	°C

PIN CONFIGURATIONS



PIN DESCRIPTION

Pin No.	Pin Name	I/O	Description
1	ROVP	I/O	OVP pin, short-circuited or connected to GND through a resistor
2	NC	--	No connection
3	CS	I	Sense current pin
4	VCC	POWER	Power supply
5, 6	DRAIN	O	Drain of internal high voltage MOSFET
7	GND	GND	GND

FUNCTION DESCRIPTION

SD670XSC is a non-isolated LED driver IC adopting BUCK structure with internal high voltage power MOSFET. The function is described below.

Start control

For SD670XSC, no auxiliary winding is needed. The bus voltage charges capacitor of VCC through start resistor. The operating current should be as low as possible for high conversion efficiency. It features undervoltage protection at VCC and the on/off threshold value are 12V and 7.5V. The hysteresis characteristic guarantees that the IC can be powered by the capacitor during the start.

Constant current accuracy control

IC senses the MOSFET current, which is input to Gm amplifier together with internal reference voltage for error amplification, to obtain high constant current accuracy and high linear/load regulation rate.

CS voltage and 400mV reference voltage are the inputs of Gm amplifier, and then the output is integrated through internal COMP capacitor.

Output current is given by:

$$I_{OUT}=400mV/2*R_{CS}.$$

Boundary-conduction mode

SD670XSC works in boundary-conduction mode with strong anti-interference and high conversion efficiency. Auxiliary winding is unnecessary to detect zero-crossing current and the peripheral circuit is simple. Due to the boundary-conduction mode, part of harmonic oscillation energy generated by external switch is transferred to VCC.

Current detection and LEB

With the cycle-by-cycle current limit function, internal switch M1 will be turned off if CS voltage exceeds 0.45V. System still works and internal switch M1 is turned on in the next period. There is no LEB for current limit comparator.

CS voltage and COMP voltage are compared by COMP comparator, if CS voltage is higher than COMP, internal switch M1 is off and system keeps work. During the instant of turning on internal switch M1, 0.6μs LEB is used for avoiding the error operation on internal switch M1.

CS open/short circuit protection

If CS is open, open circuit protection actives and the IC stops; if CS resistor is shorted, there is no limit for inductor current, voltage on pin CS is zero, and the short-circuit status is judged by checking drain voltage during on of internal OUT signal. If short-circuit protection actives, output is shutdown, VCC decreases and IC restarts.

Source driver

Source drive is adopted for this IC. Gate of M2 is connected to VCC through a resistor, Source is connected to Drain of internal switch M1. When Gate of internal switch M1 is driven by IC, the IC current can be reduced because of the low gate capacitance of M1, and hence no auxiliary winding is needed.

Output short/open circuit protection

There is no signal which reflects the output, the IC detects the discharge time for judging over voltage. The over voltage protection threshold value is set through pin ROVP. Please refer to application note for details.

There is no signal which reflects the output, the IC detects the discharge time for judging over voltage.

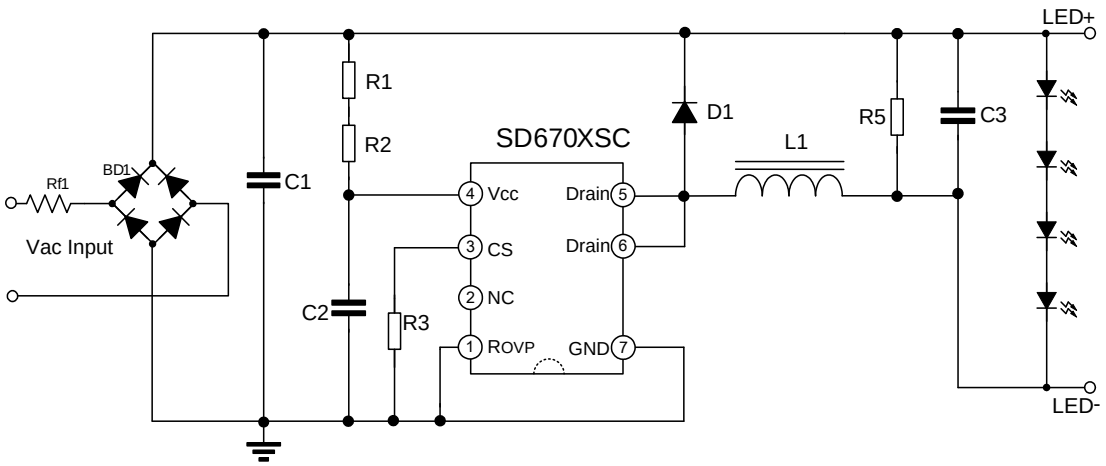
When ROVP is connected to GND via resistor, the over voltage protection threshold value is set through resistance adjustment;

when ROVP is shorted connected to GND, the over voltage protection threshold is set by the IC. Internal Tovp is set as 4.5 us, the over voltage protection actives if Toff<Tovp, please refer to application note for details. It is recommended to connect ROVP to GND.

Internal temperature regulatory

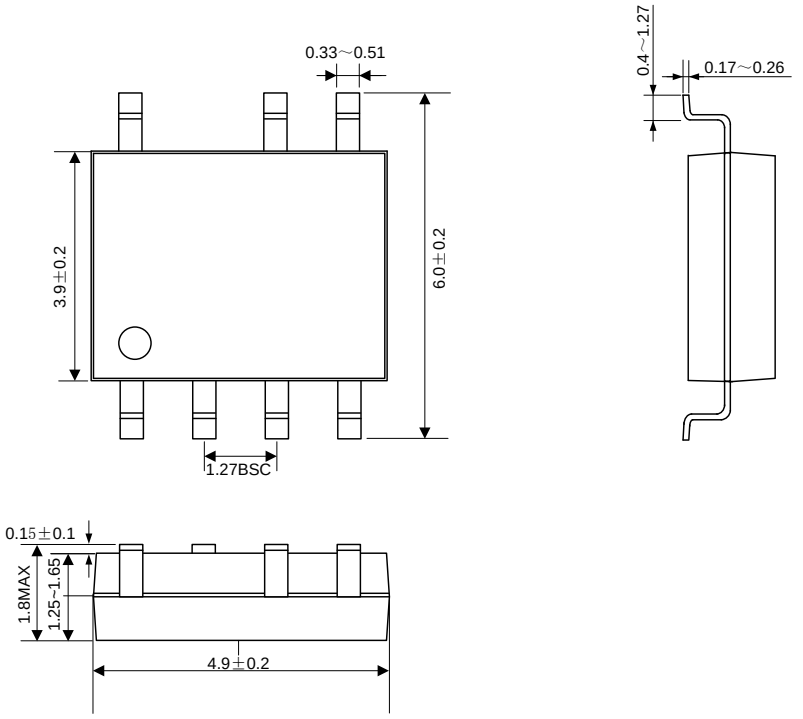
The output current will be reduced if the IC temperature exceeds the certain value.

TYPICAL APPLICATION CIRCUIT



PACKAGE OUTLINE

SOP-7-225-1.27 UNIT: mm



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.

Part No.:	SD670XSC	Document Type:	Datasheet
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Rev.:	1.2	Author:	Zhu Xiaojie

Revision History:

1. Modify the ordering information
2. Modify the package outline

Rev.:	1.1	Author:	Zhu Xiaojie

Revision History:

1. Modify the absolute maximum ratings, V_{DGR}
2. Modify the electrical characteristics, T_{OVP}
3. Modify the function description
4. Modify the typical application circuit

Rev.:	1.0	Author:	Zhu Xiaojie

Revision History:

1. First release