

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

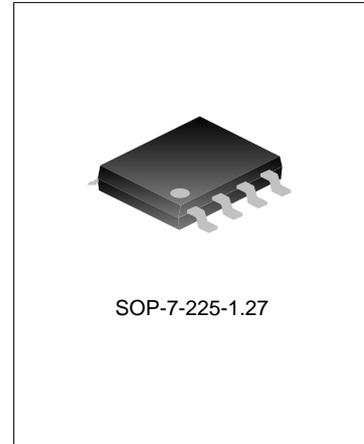
### DESCRIPTION

SD670XS is designed for non-isolated LED driving with floating Buck structure, and high constant current accuracy and high linear/load regulation available with assistant of special sense technology.

SD670XS integrates various protections, such as output open 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).

SD670XS integrates high voltage power MOSFET, reducing the system cost and the whole volume.



### FEATURES

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

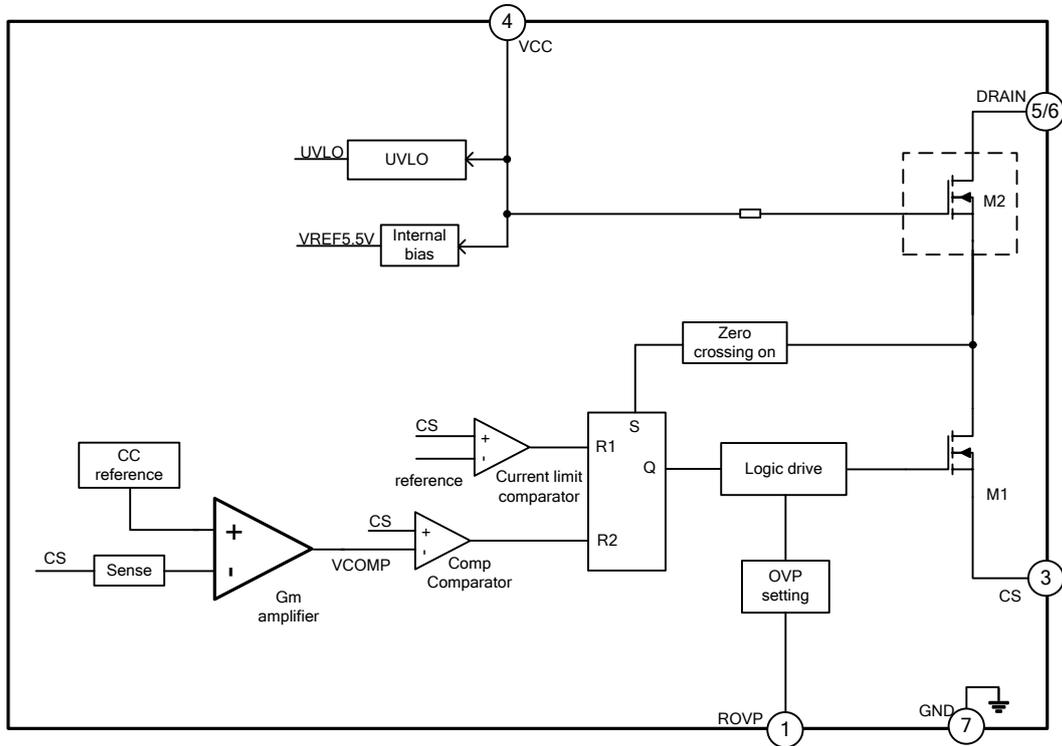
### APPLICATION

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

### ORDERING INFORMATION

Part No.	Package	Material	Packing
SD6701ASTR	SOP-7-225-1.27	Halogen free	Tape&Reel
SD6701STR	SOP-7-225-1.27	Halogen free	Tape&Reel
SD6702STR	SOP-7-225-1.27	Halogen free	Tape&Reel
SD6703STR	SOP-7-225-1.27	Halogen free	Tape&Reel
SD6704STR	SOP-7-225-1.27	Halogen free	Tape&Reel

**BLOCK DIAGRAM**



**ABSOLUTE MAXIMUM RATINGS**

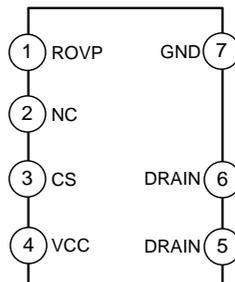
Characteristics	Symbol	Rating	Unit
Drain-Gate voltage ( $R_{GS}=1M\Omega$ )	$V_{DGR}$	600	V
Gate-Source Volyage	$V_{GS}$	$\pm 30$	V
Drian current pulse	SD6701AS	2.4	A
	SD6701S	4	
	SD6702S	8	
	SD6703S	10	
	SD6704S	12	
Drain continuous current ( $T_{amb}=25^{\circ}C$ )	SD6701AS	0.8	A
	SD6701S	1	
	SD6702S	2	
	SD6703S	3	
	SD6704S	4	
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	$^{\circ}C$
Storage temperature Range	$T_s$	-55~150	$^{\circ}C$

**ELECTRICAL CHARACTERISTICS (Unless otherwise stated,  $V_{CC}=12V, T_{amb}=25^{\circ}C$ )**

Characteristics	Symbol	Test condition	Min.	Typ.	Max.	Unit	
VCC clamp voltage	$V_{CCCLAMP}$	$I_{VCC}=0.5mA$	14	16	17	V	
UVLO VH	$UVLO_H$		11.3	12.7	14.1	V	
UVLO VL	$UVLO_L$		7	8	9	V	
Start-up current	$I_{START}$	$V_{CC}=10V$	50	95	125	$\mu A$	
Operating current	$I_{VCC}$	$CS=1V$	100	150	200	$\mu A$	
Protection current	$I_{PRO}$	$CS=5V$	800	1200	2000	$\mu A$	
<b>CC parameters</b>							
CS reference voltage	$CS_{REF}$		388	400	412	mV	
CS peak protection voltage	$CS_{PEAK}$		450	550	650	mV	
<b>Time Parameters</b>							
Max. on time	$T_{ON,MAX}$		30	38	47	$\mu s$	
LEB	$T_{LEB}$		0.45	0.6	0.75	$\mu s$	
Max. off time	$T_{OFF,MAX}$		40	52	64	$\mu s$	
Min. off time	$T_{OFF,MIN}$		2.5	3.5	4.5	$\mu s$	
Min. period	$T_{MIN}$		3.7	5	6.3	$\mu s$	
ROVP voltage	$V_{ROVP}$		2	2.4	2.8	V	
<b>Internal high voltage MOSFET</b>							
On resistance	SD6701AS	$R_{DSON}$	$V_{GS}=12V, I_D=0.1A$	--	13	14.5	$\Omega$
	SD6701S			--	7.5	8.6	
	SD6702S			--	5	5.7	
	SD6703S			--	2.8	3.3	
	SD6704S			--	1.9	2.5	
withstand voltage at Drain	SD6701AS	$BV_{DSS}$	$V_{GS}=0V, I_D=50\mu A$	500	550	--	V
	SD6701S			500	550	--	
	SD6702S			500	550	--	
	SD6703S			500	550	--	
	SD6704S			500	550	--	
zero gate voltage drain current	SD6701AS	$I_{DSS}$	$V_{DS}=500V, V_{GS}=0V$	--	--	1.0	$\mu A$
	SD6701S			--	--	1.0	
	SD6702S			--	--	1.0	
	SD6703S			--	--	1.0	
	SD6704S			--	--	1.0	
Gate-Source Leakage Current	SD6701AS	$I_{GSS}$	$V_{GS}=\pm 30V, V_{DS}=0V$	--	--	$\pm 100$	nA
	SD6701S			--	--	$\pm 100$	
	SD6702S			--	--	$\pm 100$	
	SD6703S			--	--	$\pm 100$	
	SD6704S			--	--	$\pm 100$	
<b>Temperature characteristics</b>							

Characteristics	Symbol	Test condition	Min.	Typ.	Max.	Unit
Regulatory temperature threshold value	T <sub>REG</sub>		125	140	155	°C
Over temperature protection threshold value	T <sub>SD</sub>		135	150	165	°C
Over temperature protection release point	T <sub>RECOVERY</sub>		115	130	145	°C

## PIN CONFIGURATIONS



## PIN DESCRIPTION

Pin No.	Pin Name	I/O	Description
1	ROVP	I/O	OVP pin, connected to GND through a resistor
2	NC	-	-
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

SD670XS is a non-isolated LED driver IC adopting BUCK structure with internal high voltage power MOSFET. The function is described below.

### Start control

For SD670XS, 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 13V and 8V. 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.

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

### Boundary-conduction mode

SD670XS 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 0.55V. 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, 0.6us LEB is used for avoiding the error operation on internal switch M1.

### CS open/short circuit protection

If CS resistor is shorted, there is no limit for inductor current, voltage on pin CS is zero, and the short-circuit is judged by checking voltage during on of internal OUT signal.

### Gate driver

Gate 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

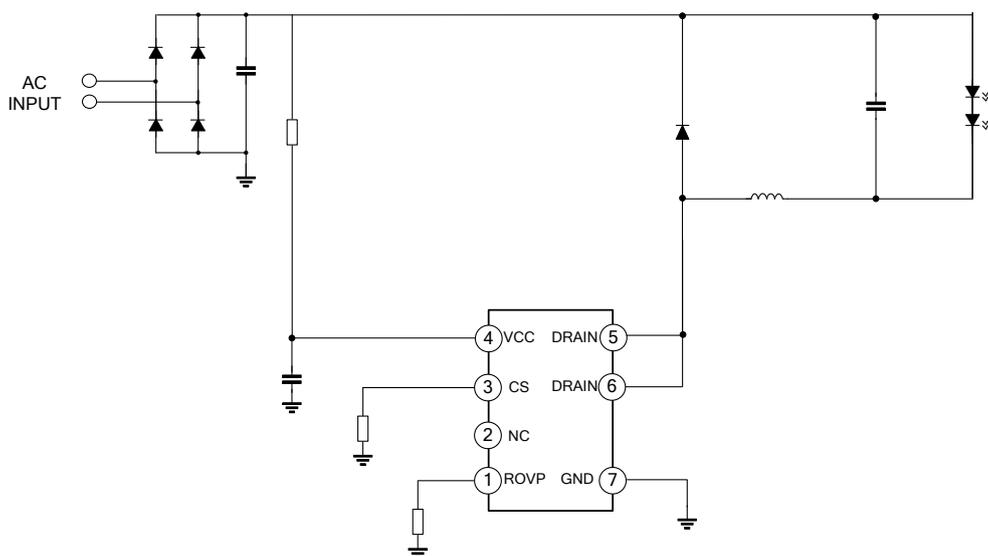
There is no signal which reflects the output, the IC detects the discharge time for judging over voltage. The over voltage protection threshold value is set through pin ROVP. ROVP pin should be grounded via a pull-down resistor, floated is not allowed. Please refer to application note for resistance range and detailed operations..

If IC detect the output short and counts for 16T, it is judged as output short, the system is turned off for restart.

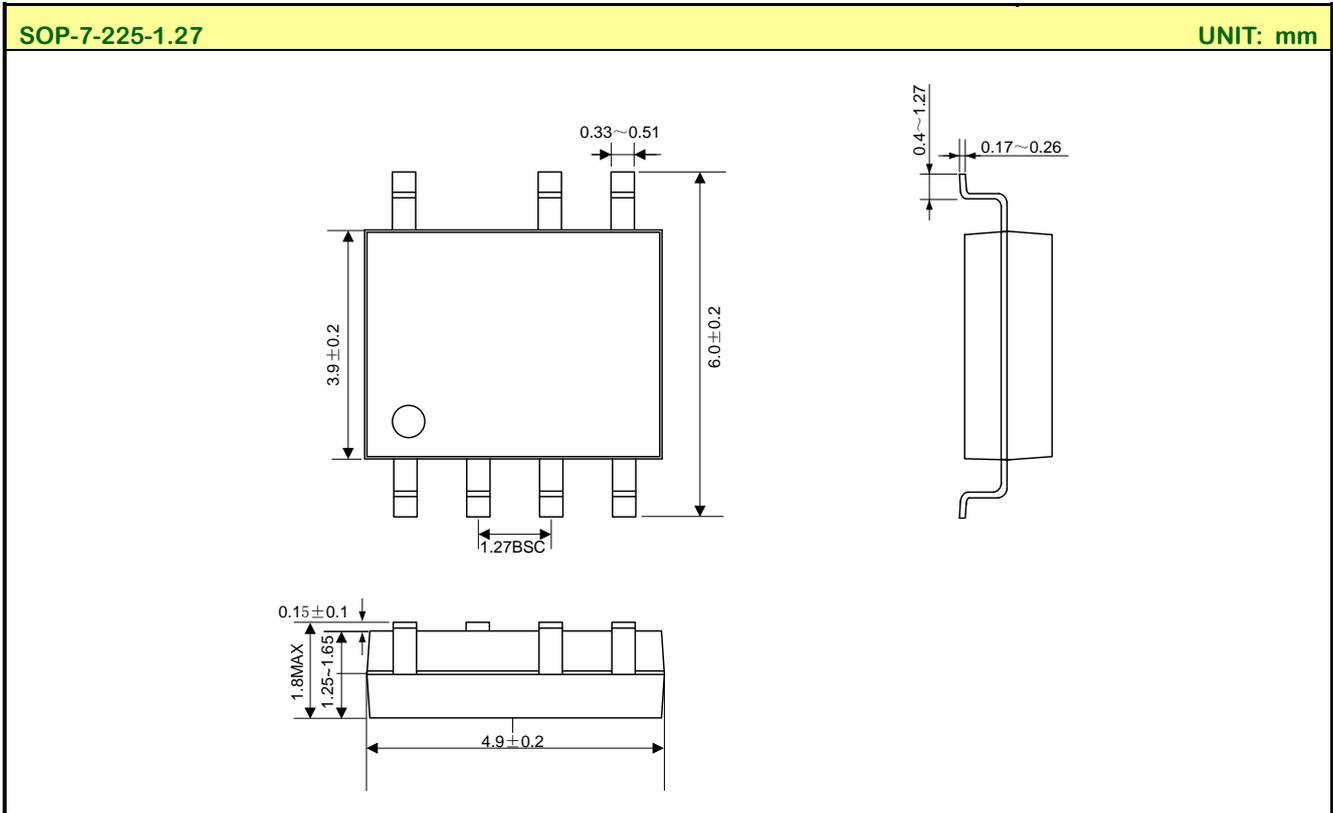
### Internal temperature regulatory

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

## TYPICAL APPLICATION CIRCUIT



**PACKAGE OUTLINE**



**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.

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Revision History:			
1. Modify the electrical characteristics			

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Rev.:	1.4	Author:	Yao Feng
Revision History:			
1. Modify the absolute maximum ratings			
2. Modify the electrical characteristics			

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Rev.:	1.3	Author:	Yao Feng
Revision History:			
1. Modify the absolute maximum ratings			
2. Modify the electrical characteristics			

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Rev.:	1.2	Author:	Yao Feng
Revision History:			
1. Modify the package outline of SOP-7			
2. Modify the electrical characteristics			

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Revision History:			
1. Add the information of SD6701BS and SD6702AS			

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Rev.:	1.0	Author:	Yao Feng
Revision History:			
1. First release			

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