

NON-ISOLATED BUCK LED LIGHTING DRIVE IC WITH LOW POWER ANG 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 (<±3%)
- Output open circuit protection
- CS open circuit protection
- VCC undervoltage protection
- Over temperature protection
- Cycle-by-cycle current protection
- No auxiliary winding

APPLICATION

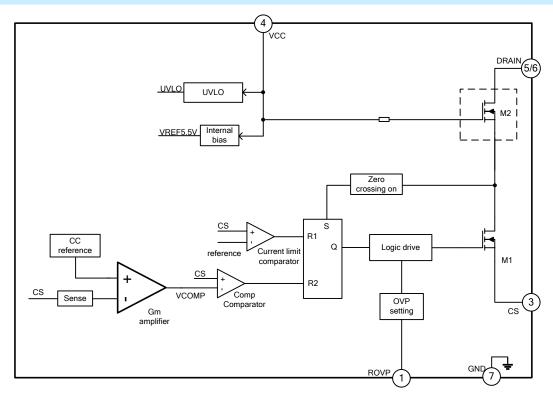
- **Bulb Lamp**
- T5/T8 LED Lamp
- Various LED Lighting

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} =1MW)		V_{DGR}	600	V
Gate-Source V	olyage	V_{GS}	±30	V
	SD6701AS		2.4	
Duian accument	SD6701S		4	
Drian current	SD6702S	I_{DM}	8	Α
pulse	SD6703S		10	
	SD6704S		12	
	SD6701AS		0.8	
Drain 	SD6701S		1	
continuous	SD6702S	I_D	2	Α
current (Tamb=25°C)	SD6703S		3	
(Tallib=25 C)	SD6704S		4	
Supply voltage		Vcc	-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		Tj	-40~150	°C
Storage temperature Range		Ts	-55~150	°C





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

VCC clamp voltage VCC_CLAMP VCC=CLAMP VCC=CLAMP VCC=CLAMP VCC=CLAMP VCC=CLAMP VCC=CC=CC=CC=CC=CC=CC=CC=CC=CC=CC=CC=CC=	Cha	racteristics	Symbol	Test condition	Min.	Тур.	Max.	Unit
UVLO VL Start-up current	VCC clamp voltage		VCC _{CLAMP}	I _{VCC} =0.5mA	14	16	17	V
Start-up current	UVLO VH		UVLO _H		11.3	12.7	14.1	V
Operating current I_VCC CS=1V 100 150 200 μA	UVLO VL		UVLO _L		7	8	9	V
Protection current I I I I I I I I I	Start-up current		I _{START}	V _{CC} =10V	50	95	125	μA
CC parameters CS reference voltage CS _{REF} 388 400 412 mV CS peak protection voltage CS _{PEAK} 450 550 650 mV Time Parameters Max. on time TON.MAX 30 38 47 μs LEB TLEB 0.45 0.6 0.75 μs Min. off time TOFFMAX 40 52 64 μs Min. off time TOFFMAX 3.7 5 6.3 μs Min. period TIMIN 3.7 5 6.3 μs ROVP voltage VROVP 2 2.4 2.8 V Internal high voltage MOSFET TOT.5 8.6 3.3 4.5 μs SD6701AS SD6701AS SD6701AS TOT.5 8.6 3.3 4.5 μs SD6701AS SD6701AS SD6701AS TOT.5 8.6 5.0 TOT.5 4.0 4.0 V SD6701AS	Operating c	urrent	Ivcc	CS=1V	100	150	200	μA
CS reference voltage CS geak protection voltage CS geak 450 550 650 mV Time Parameters Max. on time To M.MAX 30 38 47 μs LEB Tiles 0.45 0.6 0.75 μs Max. off time Tope,MAX 40 52 64 μs Min. off time Tope,MAX 3.7 5 4.5 μs Min. off time Tope,MAX 3.7 5 4.5 μs Min. off time Tope,MAX 3.7 5 6.3 μs ROVP voltage Vorope 2 2.4 2.8 V Internal high voltage MOSFET Bof701AS Rbson Vos=12V,Ib=0.1A	Protection c	urrent	I _{PRO}	CS=5V	800	1200	2000	μA
CS peak protection voltage CS peak Time Parameters	CC parame	eters						
Max. on time Max. on time Ton.Max Ton.Max Max. on time Top. Max. on time	CS reference	e voltage	CS _{REF}		388	400	412	mV
Max. on time Ton, max 30 38 47 μs LEB TLEB 0.45 0.6 0.75 μs Max. off time TOFF, max 40 52 64 μs Min. off time TOFF, max 2.5 3.5 4.5 μs Min. period ToFF, max 3.7 5 6.3 μs ROVP voltage VROVP 2 2.4 2.8 V On resistance SD6701AS SD6701S 13 14.5 SD6701S SD6703S SD6704S 1.9 2.5 SD6704S SD6701AS 1.9 2.5	CS peak pro	otection voltage	CS _{PEAK}		450	550	650	mV
LEB T LEB 0.45 0.6 0.75 μs Max. off time T OFF,MAX 40 52 64 μs Min. off time T OFF,MIN 2.5 3.5 4.5 μs Min. period T MilN 3.7 5 6.3 μs CONTROL OF TOTAL OF	Time Paran	neters	•					
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Min. off time TOFEMIN 4.5 μs Min. period 7 Imin 3.7 5 6.3 μs ROVP voltage VROVP 2 2.4 2.8 V Internal high voltage MOSFET SD6701AS Page 12V, Ip=0.1A 3.7 13 14.5 Page 12V, Ip=0.1A 13 14.5 Page 12V, Ip=0.1A 14.5 14.5 Page 12V, Ip=0.1A 14.5 14.5 Page 12V, Ip=0.1A 14.5 14.5 14.5 14.5 Page 12V, Ip=0.1A 14.5 14.5 14.5 14.5 14.5 14.5 14.5 14.5 14.5 14.5 14.5 14.5 14.5 <t< td=""><td>LEB</td><td></td><td>T_{LEB}</td><td></td><td>0.45</td><td>0.6</td><td>0.75</td><td>μs</td></t<>	LEB		T _{LEB}		0.45	0.6	0.75	μs
Min. period T _{MIN} 3.7 5 6.3 μs ROVP voltage V _{ROVP} 2 2.4 2.8 V V Internal high voltage MOSFET	Max. off time	е	T _{OFF,MAX}		40	52	64	μs
No	Min. off time	;	T _{OFF,MIN}		2.5	3.5	4.5	μs
Netronal high voltage MOSFET	Min. period		T _{MIN}		3.7	5	6.3	μs
SD6701AS SD6701S SD6703S SD6704S SD6701S SD6704S SD6701S SD6701S SD6701S SD6701S SD6701S SD6701S SD6701S SD6704S SD6704S SD6704S SD6704S SD6704S SD6701S SD6704S SD6704S SD6704S SD6704S SD6701S SD6704S SD6701S SD6704S SD6704S SD6701S SD6701S SD6704S SD6701S SD6701S SD6704S SD6701S SD6704S SD6704S SD6704S SD6704S SD6704S SD6704S SD6701S S	ROVP volta	ge	V _{ROVP}		2	2.4	2.8	V
SD6701S SD6702S SD6703S SD6704S	Internal hig	gh voltage MOSFE	Г		-			
On resistance SD6702S RDSON VGS=12V,ID=0.1A 5 5.7 Ω SD6703S SD6704S 1.9 2.5 1.9 2.5 withstand voltage at voltage at Parain (urrent) SD6701S BVDSS VGS=0V,ID=50uA 500 550 V SD6703S SD6704S BVDSS VGS=0V,ID=50uA 500 550 V SD6704S SD6704S FG 500 550 V SD6701AS SD6701AS SD6701AS FG 1.0 SD6703S SD6704S FG 1.0 Gate-Source Leakage Current SD6701S SD6701S		SD6701AS				13	14.5	
SD6702S SD6703S SD6703S SD6704S SD6704S SD6701AS SD6701AS SD6701AS SD6701AS SD6701AS SD6701AS SD6701AS SD6703S SD6704S SD6704S SD6704S SD6704S SD6704S SD6701AS	0	SD6701S	1	V _{GS} =12V,I _D =0.1A		7.5	8.6	Ω
SD6703S SD6704S SD6704S SD6701AS SD6701S SD6702S SD6701AS SD6		SD6702S	R _{DSON}			5	5.7	
SD6701AS SD6701S SD6702S SD6702S SD6703S SD6701AS SD6702S SD6701AS SD6	resistance	SD6703S				2.8	3.3	
withstand voltage at Orain SD6701S BVDSS VGS=0V,Ip=50uA 500 550 V SD6703S SD6703S 500 550 V SD6704S SD6701AS 500 550 SD6701AS SD6701AS 1.0 SD6702S SD6703S 1.0 1.0 SD6704S SD6701AS 1.0 1.0 Gate-Sour Current SD6701AS SD6701S 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 </td <td></td> <td>SD6704S</td> <td></td> <td></td> <td></td> <td>1.9</td> <td>2.5</td> <td></td>		SD6704S				1.9	2.5	
voltage at Drain SD6702S BV _{DSS} V _{GS} =0V,I _D =50uA 500 550 V SD6703S SD6704S 500 550 V SD6704S SD6701AS T 1.0 T </td <td></td> <td>SD6701AS</td> <td></td> <td></td> <td>500</td> <td>550</td> <td></td> <td></td>		SD6701AS			500	550		
Drain SD6703S 500 550 SD6704S 500 550 SD6701AS 506701AS 1.0 1.0 1.0 1.0 μΑ μΑ μΑ 1.0 1.0 μΑ μΑ 1.0 1.0 μΑ 1.0 1.0 μΑ μΑ 1.0 1.0 μΑ 1.0 1.0 1.0 μΑ 1.0 <	withstand	SD6701S			500	550		
SD6704S SD6701AS SD6701AS SD6701S SD6702S SD6704S SD6704S SD6704S SD6704S SD6704S SD6704S SD6704S SD6704S SD6701AS	voltage at	SD6702S	BV _{DSS}	V _{GS} =0V,I _D =50uA	500	550		V
SD6701AS SD6701AS SD6701S SD6702S SD6703S SD6704S SD6701AS SD6701AS SD6701AS SD6704S SD6701AS SD	Drain	SD6703S			500	550		
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SD6702S I _{DSS} V _{DS} =500V, V _{GS} =0V 1.0 μA	ŭ	SD6701S					1.0	
SD6703S SD6704S SD6704S SD6701AS SD6701S SD6702S SD6702S SD6703S SD6703S SD6704S SD6	-	SD6702S	I _{DSS}	V _{DS} =500V, V _{GS} =0V			1.0	μА
SD6704S		SD6703S	1				1.0	
SD6701S SD6702S SD6702S SD6703S SD6704S SD67	current	SD6704S					1.0	
SD6701S Leakage Current SD6702S I _{GSS} V _{GS} =±30V, V _{DS} =0V ±100 SD6703S ±100 SD6704S ±100	00	SD6701AS					±100	
Leakage Current SD6703S IGSS VGS=±30V, VDS=0V ±100 nA SD6704S SD6704S ±100 ±100 ±100 ±100 ±100 ±100 ±100 ±100	ce	SD6701S	I _{GSS}	V _{GS} =±30V, V _{DS} =0V			±100	nA
SD6703S ±100 SD6704S ±100		SD6702S					±100	
SD6704S ±100		SD6703S					±100	
	Current	SD6704S	1				±100	
Temperature characteristics	Temperatu	re characteristics						

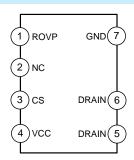
http://www.silan.com.cn



SD670X Datasheet

Characteristics	Symbol	Test condition	Min.	Тур.	Max.	Unit
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, connected to GND through a resistor	
2	NC	-	-	
3	CS	I	Sense current pin	
4	VCC	POWER	Power supply	
5, 6	DRAIN	0	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 M1is 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

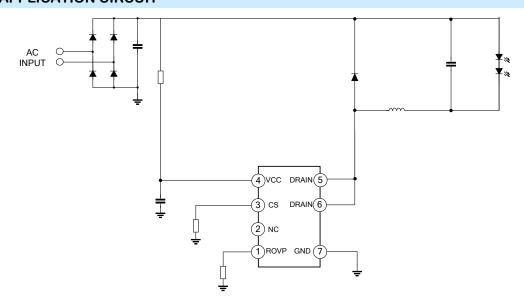
There is no signal which reflects the output, the IC detects the discharge time for judging over voltage. The over voltage protection threshold value is set through pin ROVP. ROVP pin should be grounded via a pull-down resistor, floated is not allowed. Please refer to application note for resistance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

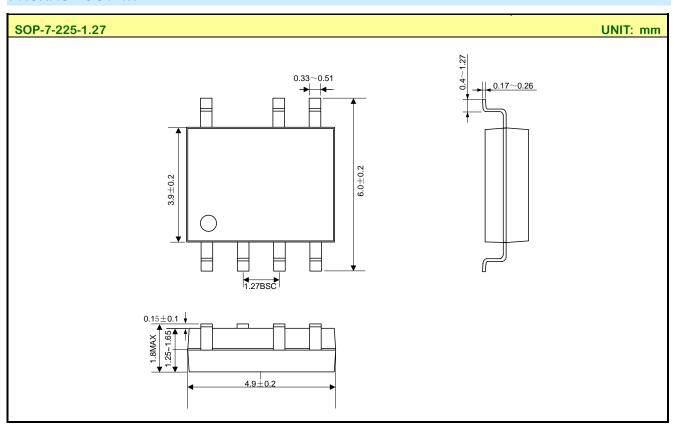
The output current will be reduced of the IC temperature exceeds the certain value.

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.

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.
- All semiconductor products malfunction or fail with some probability under special conditions. When using Silan products in system design or complete machine manufacturing, it is the responsibility of the buyer to comply with the safety standards strictly and take essential measures to avoid situations in which a malfunction or failure of such Silan products could cause loss of body injury or damage to property.
- Silan will supply the best possible product for customers!

HANGZHOU SILAN MICROELECTRONICS CO.,LTD



SD670X_Datasheet

Part No.:	SD670X	Document Type:	Datasheet		
Copyrigh	nt: HANGZHOU SILAN MICROELECTRONICS CO.,LTD	Website:	http://www.silan.com.cn		
Rev.:	1.5	Author:	Yao Feng		
Revision	History:				
1.	Modify the electrical characteristics				
Rev.:	1.4	Author:	Yao Feng		
Revision	History:				
1.	Modify the absolute maximum ratings				
2.	Modify the electrical characteristics				
Rev.:	1.3	Author:	Yao Feng		
Revision	History:				
1.	Modify the absolute maximum ratings				
2.	Modify the electrical characteristics				
Rev.:	1.2	Author:	Yao Feng		
Revision	History:				
1.	Modify the package outline of SOP-7				
2.	Modify the electrical characteristics				
Rev.:	1.1	Author:	Yao Feng		
Revision	History:				
1.	Add the information of SD6701BS and SD6702AS				
Rev.:	1.0	Author:	Yao Feng		
Revision	History:				
1.	First release				

Rev.:1.5 Page 7 of 7