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

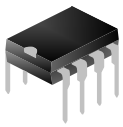
DESCRIPTION

SD670XD 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.

SD670XD 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).

SD670XD integrates high voltage power MOSFET, reducing the system cost and the whole volume.



DIP-7-300-2.54

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

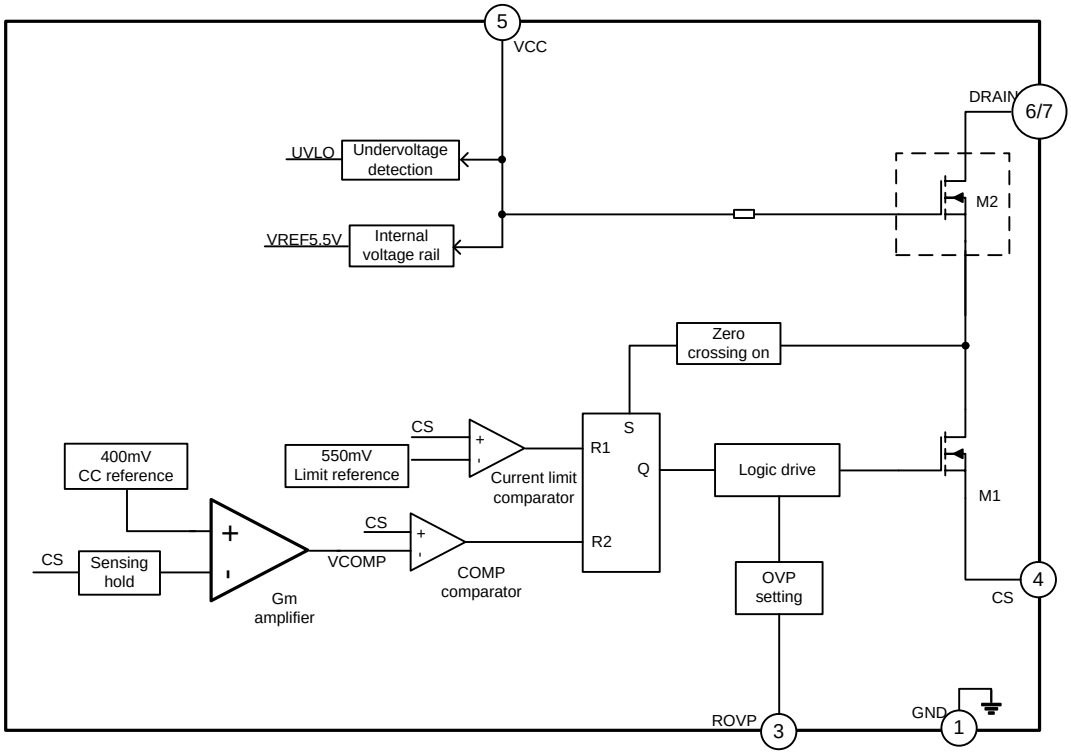
APPLICATION

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

ORDERING INFORMATION

Part No.	Package	Material	Packing
SD6701DTR	DIP-7-300-2.54	Halogen free	Tube
SD6702DTR	DIP-7-300-2.54	Halogen free	Tube
SD6703DTR	DIP-7-300-2.54	Halogen free	Tube
SD6704DTR	DIP-7-300-2.54	Halogen free	Tube

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	SD6701D	I_{DM}	4	A
	SD6702D		8	
	SD6703D		10	
	SD6704D		12	
Drain continuous current (Tamb=25°C)	SD6701D	I_D	1	A
	SD6702D		2	
	SD6703D		3	
	SD6704D		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	°C
Storage temperature Range		T_S	-55~150	°C

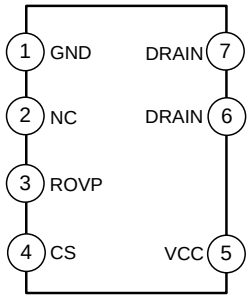
ELECTRICAL CHARACTERISTICS (Unless otherwise stated, V_{CC}=14V,T_{amb}=25°C)

Characteristics		Symbol	Test condition	Min.	Typ.	Max.	Unit
VCC clamp voltage		VCC_{CLAMP}	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	μA
Operating current		I_{VCC}	CS=1V	100	175	250	μA
Protection current		I_{PRO}	CS=5V	800	1200	2000	μA
Control loop parameters							
CS reference voltage[Note 1]		CS_{REF}		388	400	412	mV
CS peak protection voltage		CS_{PEAK}		400	525	650	mV
Time parameters							
Max. on time		$T_{ON,MAX}$		30	38	47	μs
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_{MIN}		3.7	5	6.3	μs
ROVP voltage		V_{ROVP}		2	2.4	2.8	V
Internal high voltage MOSFET							
On resistance	SD6701D	R_{DSON}	V_{GS}=12V,I_D=0.1A	--	7.5	8.6	Ω
	SD6702D			--	5	5.7	
	SD6703D			--	2.8	3.3	
	SD6704D			--	1.9	2.5	
withstand voltage at Drain	SD6701D	BV_{DSS}	V_{GS}=0V,I_D=50uA	500	550	--	V
	SD6702D			500	550	--	
	SD6703D			500	550	--	
	SD6704D			500	550	--	
Zero gate voltage drain current	SD6701D	I_{DSS}	V_{DS}=500V, V_{GS}=0V	--	--	1.0	μA
	SD6702D			--	--	1.0	
	SD6703D			--	--	1.0	
	SD6704D			--	--	1.0	
Gate-Source Leakage Current	SD6701D	I_{GSS}	V_{GS}=±30V, V_{DS}=0V	--	--	±100	nA
	SD6702D			--	--	±100	
	SD6703D			--	--	±100	
	SD6704D			--	--	±100	
Temperature characteristics							
Regulatory temperature threshold value		T_{REG}		125	140	155	°C
Over temperature protection threshold value		T_{SD}		135	150	165	°C

Characteristics	Symbol	Test condition	Min.	Typ.	Max.	Unit
Over temperature protection release point	$T_{RECOVERY}$		115	130	145	°C

Note 1: During test, the test results for CS reference voltage are theoretical values multiplied by 1.1, i.e., typical value 440mV, range 430mV~450mV.

PIN CONFIGURATIONS



PIN DESCRIPTION

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

FUNCTION DESCRIPTION

SD670XD is a non-isolated LED driver IC adopting BUCK structure with internal high voltage power MOSFET. The function is described below.

Start control

For SD670XD, 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 values are 12.7V and 8V. The hysteresis characteristic guarantees that the IC can be powered by the capacitor during 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

SD670XD 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.

Current detection and LEB

With the cycle-by-cycle current limit function, internal switch M1 will be turned off if CS voltage exceeds 525mV. 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 (also known as maximum output current limit)

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. SD670XD series products all have OUT limit voltage setting, the larger the area of high-voltage MOSFET packaged, the higher the OUT limit voltage setting, therefore the higher the output current limit. Please refer to application note for maximum output current limit of each product.

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.

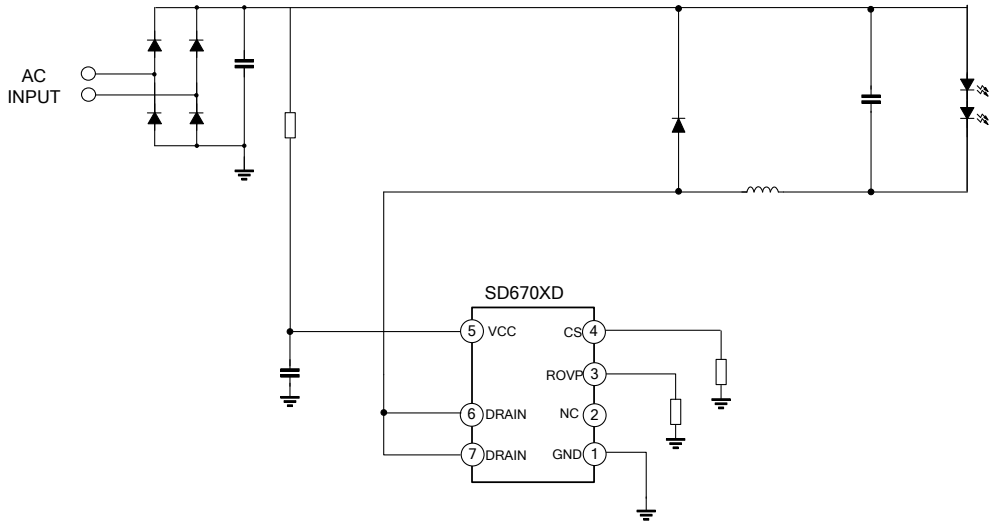
Output open circuit protection

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.

Internal temperature regulatory

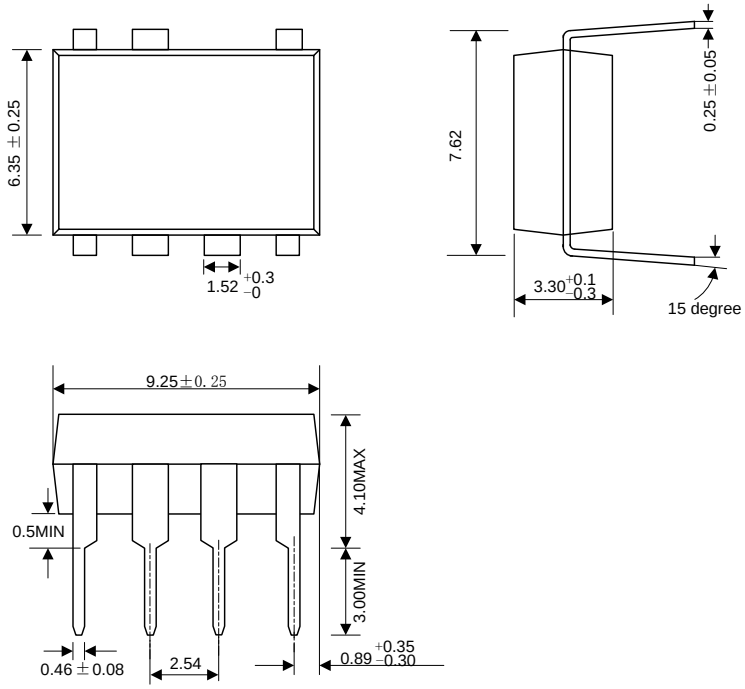
The output current will be reduced if the IC temperature exceeds the certain value.

TYPICAL APPLICATION CIRCUIT



PACKAGE OUTLINE

DIP-7-300-2.54 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.

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Rev.:	1.1	Date:		Author:	Yao Feng

Revision History:

1. Modify the function description

Rev.:	1.0	Date:		Author:	Yao Feng

Revision History:

1. First release