NON-ISOLATED LED LIGHTING DRIVE IC WITH BUILT-IN HIGH-VOLTAGE MOSFET, HIGH PFC AND HIGH CONSTANT CURRENT ACCURACY

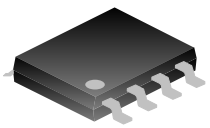
DESCRIPTION

SD692XS is designed for non-isolated LED driving with floating Buck structure and built-in MOSFET. With this structure, inductor current is 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.

SD692XS integrates various protections, such as output open circuit protection, output short circuit protection, cycle-by-cycle current limit protection, and over temperature protection.

SD692XS has a built-in VCC regulator, which allows periphery operating without auxiliary winding and makes output voltage range maximized.

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



SOP-7-225-1.27

APPLICATION

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

FEATURES

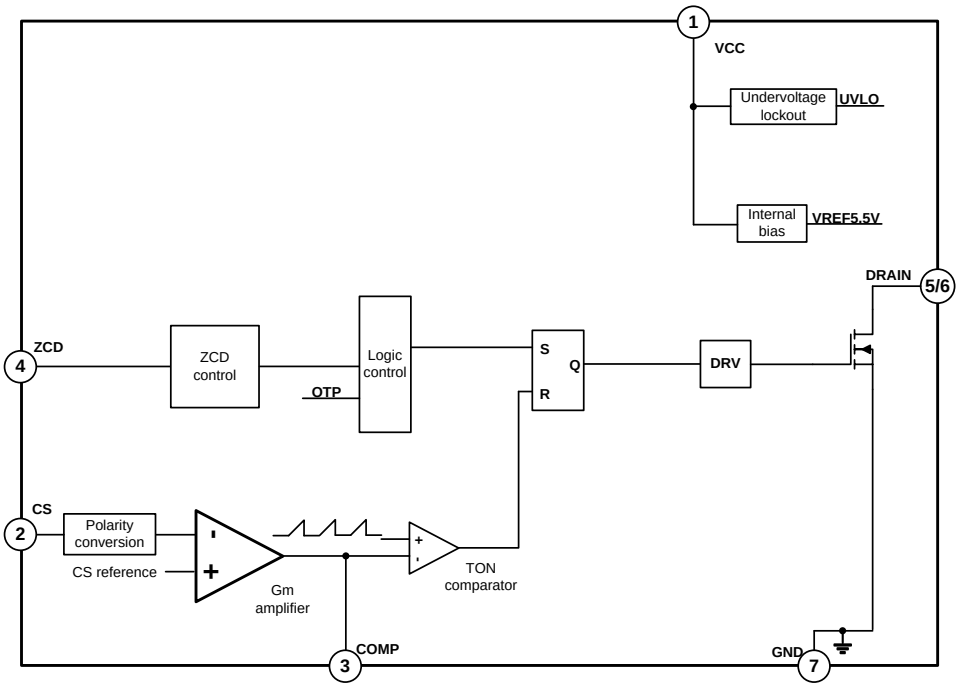
- Proprietary constant control method (Patent)
- Built-in 500/550V/600V MOSFET
- Constant current with high accuracy for LED (<±3%)
- PF>0.9 in full voltage range
- Boundary-Conduction mode
- LED short circuit protection
- LED open circuit protection
- VCC undervoltage protection
- Built-in VCC clamping diode
- Over temperature protection
- Over current protection
- Current dropping in high temperature condition

ORDERING INFORMATION

Part No.	Package	Material	Packing
SD6921ASTR	SOP-7-225-1.27	Halogen free	Tape&Reel
SD6921BSTR	SOP-7-225-1.27	Halogen free	Tape&Reel
SD6921STR	SOP-7-225-1.27	Halogen free	Tape&Reel
SD6922ASTR	SOP-7-225-1.27	Halogen free	Tape&Reel
SD6922BSTR	SOP-7-225-1.27	Halogen free	Tape&Reel
SD6922STR	SOP-7-225-1.27	Halogen free	Tape&Reel

Part No.	Package	Material	Packing
SD6923ASTR	SOP-7-225-1.27	Halogen free	Tape&Reel
SD6923BSTR	SOP-7-225-1.27	Halogen free	Tape&Reel
SD6923STR	SOP-7-225-1.27	Halogen free	Tape&Reel
SD6924ASTR	SOP-7-225-1.27	Halogen free	Tape&Reel
SD6924STR	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 Voltage		V_{GS}	±30	V
Drain Current Pulsed[Note1]	SD6921AS	I_{DM}	4.0	A
	SD6921BS		4.0	
	SD6921S		4.0	
	SD6922AS		8.0	
	SD6922BS		8.0	
	SD6922S		8.0	
	SD6923AS		10.0	
	SD6923BS		10.0	
	SD6923S		10.0	
	SD6924AS		10.0	
	SD6924S		12.0	

Characteristics		Symbol	Rating	Unit
Drain Continuous Current (T_{amb}=25°C)	SD6921AS	I_D	1.0	A
	SD6921BS		1.0	
	SD6921S		1.0	
	SD6922AS		2.0	
	SD6922BS		2.0	
	SD6922S		2.0	
	SD6923AS		3.0	
	SD6923BS		3.0	
	SD6923S		3.0	
	SD6924AS		3.0	
	SD6924S		4.0	
Supply voltage[Note2]		V_{CC}	-0.3~24	V
Feedback voltage		V_{ZCD}	-0.3~6.5	V
Sense voltage		V_{CS}	-6.5~6.5	V
COMP voltage		V_{COMP}	-0.3~6.5	V
DRAIN voltage		V_{DRAIN}	-0.3~500/600	V
Operation Junction Temperature Range		T_j	-40~150	°C
Storage Temperature Range		T_S	-55~150	°C

Notes: 1. Pulse width is determined by max. junction temperature;
2. Current flowing through VCC is not over 3mA.

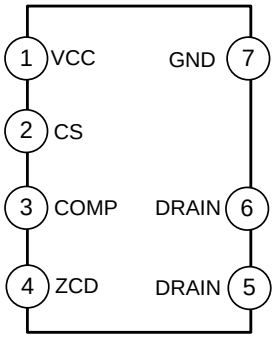
ELECTRICAL CHARACTERISTICS (Unless otherwise stated, V_{CC}=19V, T_{amb}=25°C)

Characteristics	Symbol	Test condition	Min.	Typ.	Max.	Unit
VCC Clamping Voltage	$V_{CCCLAMP}$	I_{VCC}=2mA	20	22	24	
UVLO VH	$UVLO_H$		15	16.8	18.6	V
UVLO VL	$UVLO_L$		7	8.2	9.5	V
Start-up current	I_{START}	Before start, V_{CC}=15V	0	1	10	μA
Quiescent current	I_{CC}	After start, no switching waveform, no protection	400	550	800	μA
Protection current	I_{PRO}	After start, no switching waveform	750	1050	1350	μA
Voltage feedback						
ZCD OVP voltage	ZCD_{OVP}	Increase ZCD to the threshold value	4	4.2	4.4	V
ZCD OVP delay			--	1400	--	ns
ZCD VL			--	0.1	--	V
ZCD VH			--	0.3	--	V
ZCD Short Voltage	ZCD_{SL}		--	0.5	--	V
Operational amplifier						

Characteristics		Symbol	Test condition	Min.	Typ.	Max.	Unit
Input reference voltage of transconductance Amplifier		CS_{REF}		162	167	172	mV
CS peak protection voltage				--	1000	--	mV
Time parameter							
Max. on time		$T_{ON,MAX}$	V_{COMP}=3.5V	--	35	--	μs
Min. on time		$T_{ON,MIN}$	V_{COMP}=0V	650	900	1150	ns
Max. off time		$T_{OFF,MAX}$		--	90	--	μs
Min. off time		$T_{OFF,MIN}$		--	3	--	μs
Max. switching frequency		F_{MAX}		--	120	--	KHz
High-voltage MOSFET							
Static Drain-Source On State Resistance	SD6921AS	RDS(ON)	V_{GS}=10V, I_D=0.1A	--	7.5	8.6	Ω
	SD6921BS			--	6.1	7.0	
	SD6921S			--	7.3	8.4	
	SD6922AS			--	4.5	5	
	SD6922BS			--	3.2	3.8	
	SD6922S			--	4	4.7	
	SD6924AS			--	2.1	2.5	
	SD6923AS			--	2.8	3.3	
	SD6923BS			--	2.4	2.9	
	SD6923S			--	2.9	3.5	
	SD6924S			--	1.8	2.7	
Gate-Source Leakage Current	SD692XAS	I_{GSS}	V_{GS}=±30V, V_{DS}=0V	--	--	±100	nA
	SD692XBS			--	--	±100	
	SD692XS			--	--	±100	
Drain -Source Breakdown Voltage	SD692XAS	BV_{DSS}	V_{GS}=0V, I_D=50uA	500	550	--	V
	SD692XBS			550	600	--	
	SD692XS			600	650	--	
Temperature characteristics							
Over temperature protection threshold value		T_{SD}		--	150	--	°C
Over temperature protection release point		$T_{RECOVERY}$		--	140	--	°C
Temperature at which current drops		T_{DROP}		--	130	--	°C

Note: SD692XAS includes SD6921AS, SD6922AS, SD6923AS, and SD6924AS; SD692XBS contains SD6921BS, SD6922BS and SD6923BS; SD692XS consists of SD6921S, SD6922S SD6923S and SD6924S.

PIN CONFIGURATIONS



PIN DESCRIPTION

Pin No.	Pin Name	I/O	Description
1	VCC	POWER	Power supply
2	CS	I/O	Current sense pin
3	COMP	O	Output of trans-conductance amplifier, connected to GND through a capacitor
4	ZCD	I	Zero-crossing detection input pin
5,6	DRAIN	O	Drain output
7	GND	GND	Ground pin

FUNCTION DESCRIPTION

SD692XS 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 16.8V and 8.2V. Hysteresis characteristics guarantee that IC can be powered by input capacitor during start-up. When the output voltage increases to a certain value after start, VCC will be charged by output through Zener Diode.

Built-in VCC regulator

A regulator is built in VCC pin, when output voltage feedback to VCC exceeds 22V, VCC keeps at 22V to realize maximized output voltage range at no auxiliary winding condition.

Boundary-conduction mode

Power MOSFET is turned on by inductor current zero-crossing detection. The zero-crossing of current can be detected by ZCD voltage which can be measured through auxiliary winding or resistance voltage 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 167mV reference voltage are the inputs of Gm amplifier, 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.

Over temperature protection and current dropping g in high temperature condition

When the temperature within IC exceeds a certain value, the system output current drops automatically. If the temperature continues to rise, the over temperature protection is activated to shut off MOSFET, the system restarts automatically.

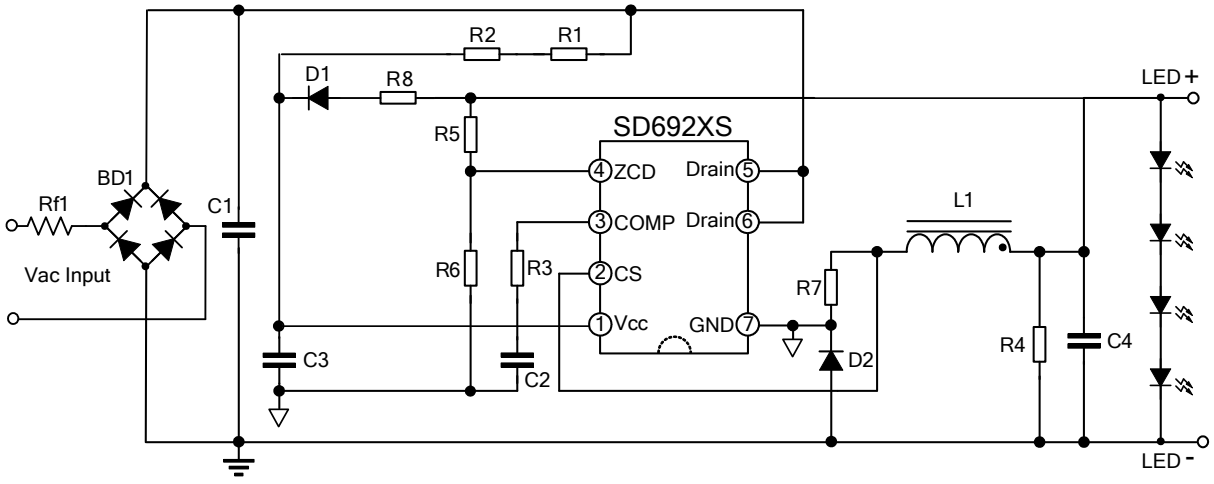
Output over voltage protection

Output voltage is reflected to pin ZCD through resistor divider. When ZCD voltage is higher than the over voltage protection threshold value by 4.2V, protection occurs, MOSFET is off and the system will restart.

Output short circuit protection

When ZCD voltage is lower than the short circuit protection threshold value by 0.5V, and lasts for 48 switch periods, short circuit protection occurs, CS limit point drops to 0.3V and the system still works normally.

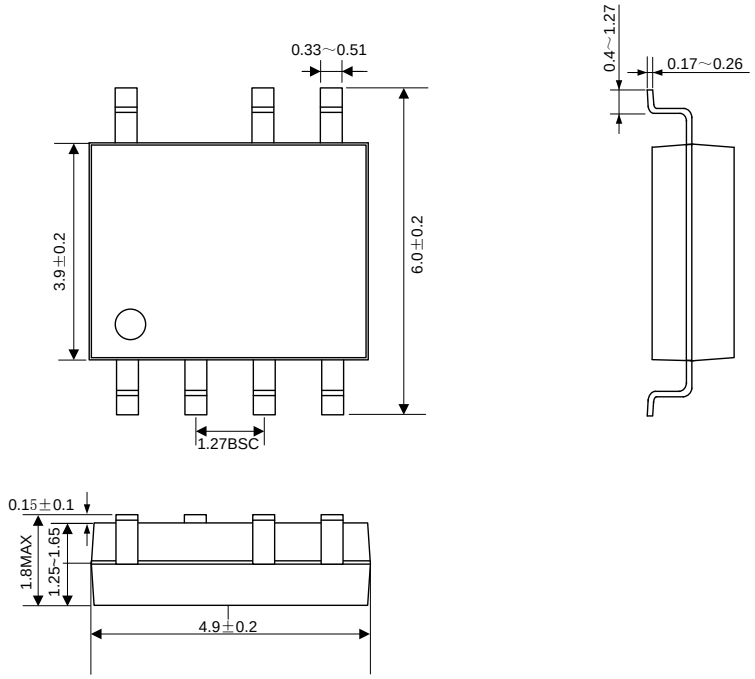
TYPICAL APPLICATION CIRCUIT



Note: The above circuit and parameters are for reference only; please set the parameters of real application circuit based on real test. SD692XS includes SD692XAS/SD692XBS/SD692XS.

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.

Disclaimer :

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Part No.:	SD692XS	Document Type:	Datasheet
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Rev.:	1.2	Author:	Yao Feng

Revision History:

1. Add the product information about SD692XBS

Rev.:	1.1	Author:	Yao Feng

Revision History:

1. Change the typical application circuit
2. Add the product information about SD6921AS and 6922AS

Rev.:	1.0	Author:	Yao Feng

Revision History:

1. First release