SINGLE STAGE PRIMARY SIDE REGULATION PFC CONTROLLER FOR LED DRIVER

DESCRIPTION

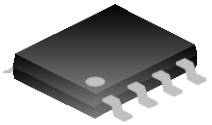
The SD6804S is a single stage primary side regulation (PSR) power factor correction (PFC) controller, built-in 600V high voltage power MOSFET, specially designed for LED driver.

The Device adopts constant on time operation to achieve high power factor.

The SD6804S provides accurate constant current control and operates in boundary conduction mode (BCM) with high efficiency.

The Device adopts primary side regulation eliminating the opto-couple, secondary feedback control and loop compensation for reducing design and cost.

The SD6804S provides completed protections such as short LED protection, open LED protection and over temperature protection, etc.



SOP-7-225-1.27

FEATURES

- PSR Flyback topology
- Boundary Conduction Mode
- Low start-up current
- Built-in 600V high voltage power MOSFET
- Leading edge blanking
- Constant on time control
- VCC overvoltage protection
- VCC undervoltage lockout
- Overtemperature protection
- Cycle by cycle current limiting
- Peak current compensation
- Short LED protection and Open LED protection

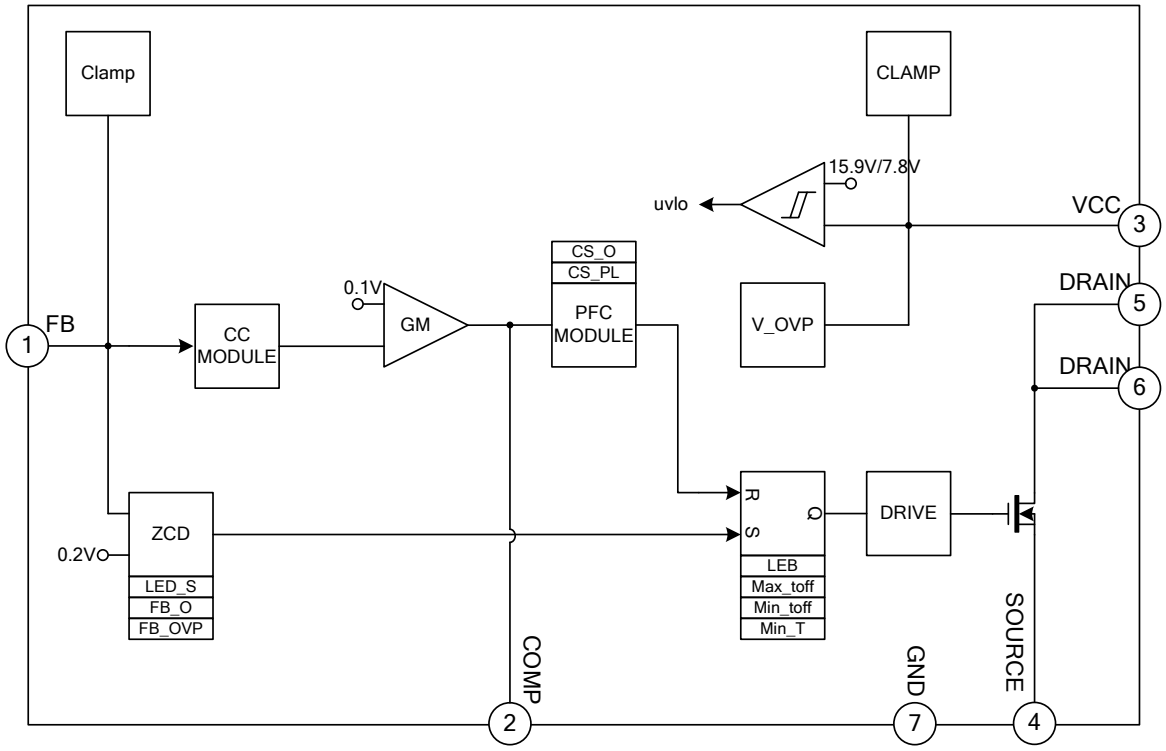
APPLICATIONS

- LED lamp
- LED illumination with AC input

ORDERING INFORMATION

Part No.	Package	Marking	Material	Packing
SD6804S	SOP-7-225-1.27	--	Halogen free	Tube
SD6804STR	SOP-7-225-1.27	--	Halogen free	Tape & reel

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATING

Characteristics	Symbol	Rating	Unit
Drain -Source Breakdown Voltage	BV_{DSS}	600	V
Gate-Source (GND) voltage	V_{GS}	±30	V
Drain current pulse Note *	I_{DM}	12	A
Drain continuous current (Tamb=25°C)	I_D	3.0	A
Drain continuous current (Tamb=100°C)		1.8	
Signal pulse Avalanche energy	EAS	**70**	mJ
High voltage input	$V_{DRAIN,MAX}$	600	V
Supply voltage	V_{CC}	-0.3 ~ 26.5	V
Analog input voltage	-	-0.3 ~ 5.5	V
Junction temperature	T_j	-40~+150	°C
Storage temperature Range	T_{stg}	-55~+150	°C

*Pulse width is decided by max. junction temperature.

ELECTRICAL CHARACTERISTICS (for MOSFET, unless otherwise specified, Tamb=25°C)

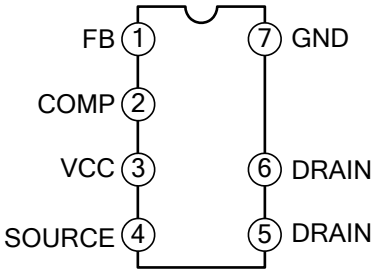
Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Drain-source breakdown voltage	BV_{DSS}	V_{GS}=0V, I_D=250μA	600	--	--	V
Drain current with zero gate voltage	I_{DSS}	V_{DS}=600V, V_{GS}=0V	--	--	1.0	μA
Gate-source leakage current	I_{GSS}	V_{GS}=±30V, V_{DS}=0V	--	--	±100	nA
Static drain-source on State resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=1.5A	--	1.8	2.25	Ω
Input capacitance	C_{ISS}	V_{GS}=0V, V_{DS}=25V, f=1MHz	--	150	--	pF
Output capacitance	C_{OSS}		--	169	--	pF
Reverse transfer capacitance	C_{RSS}		--	3.6	--	pF
Turn-on delay time	$T_{D(ON)}$	V_{DS}=300V, R_G=25Ω, I_D=3.0A	--	6.4	--	ns
Rise time	T_R		--	22.3	--	ns
Turn-off delay time	$T_{D(OFF)}$		--	13.2	--	ns
Fall time	T_F		--	22.5	--	ns

ELECTRICAL CHARACTERISTICS (unless otherwise specified, VCC=18V, Tamb=25°C)

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Supply voltage						
Operating voltage	V_{CC}	After IC starts	9	--	20	V
Turn on threshold voltage	V_{CCON}		14.3	15.9	17.5	V
Turn off threshold voltage	V_{CCOFF}		7.0	7.8	8.6	V
Clamp voltage	V_Z	I_{CC}=20mA	--	30	--	V
VCC over voltage threshold	V_{CCOVP}		24.8	26.5	27.8	V
Start-up current	I_{start}	V_{CC}=15V	0	3	10	μA
Operating current	I_{op}		400	680	1000	μA
FB Feedback						
OVP threshold value	V_{FBOVP}		1.38	1.46	1.54	V
Short-circuit detect voltage	V_{SHT}		--	0.29	--	V
Short-circuit detect timing	T_{SHT}	After 768 switching periods	--	768	--	--
Zero-crossing detection	V_{zcs}		--	0.2	--	V
FB open loop switching times	N		--	768	--	--
Dynamitic characteristic						
Leading-edge blanking time	T_{LEB}		0.60	0.75	0.90	μs
Max. on time	T_{onmax}	COMP connected to 4V via 20K	24	33	42	μs
Max. off time	T_{offmax}		25	34	43	μs
Min. off time	T_{offmin}		3.2	4.2	5.2	μs
Min.period	T_{min}		6.3	8.3	10.3	μs

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Current Limit						
CS peak limit	V_{CSPL}		0.49	0.60	0.71	V
Gm amplifier						
CS CC compare point	Vcscc		0.097	0.100	0.103	V
Drive						
DR rise time	T_R	C=1nF	100	200	400	ns
DR fall time	T_F	C=1nF	60	100	120	ns
DR high clamp voltage	V_{DRC}		16	17.5	19	V
Peak drive source current	I_{srcpk}	C=1nF	0.2	--	--	A
Peak drive sink current	I_{snkpk}	C=1nF	0.45	--	--	A
DR high level	V_{DRH}	Isource=25mA	14	15.6	--	V
DR low level	V_{DRL}	Isink=20mA	--	0.5	0.8	V
Over Temperature Protection						
Over temperature detection	T_{sd}		--	150	--	°C
Over temperature hysteresis	T_{sdhys}		--	20	--	°C

PIN CONFIGURATION



PIN DESCRIPTION

Pin No.	Pin Name	I/O	Description
1	FB	I	Feedback voltage detect pin
2	COMP	I/O	RC loop compensation, output of Gm amplifier
3	VCC	I/O	Power supply
4	SOURCE	I/O	Source of MOSFET and current sense pin of IC
5 6	DRAIN	I/O	Drain of MOSFET
7	GND	I/O	Ground

FUNCTION DESCRIPTION

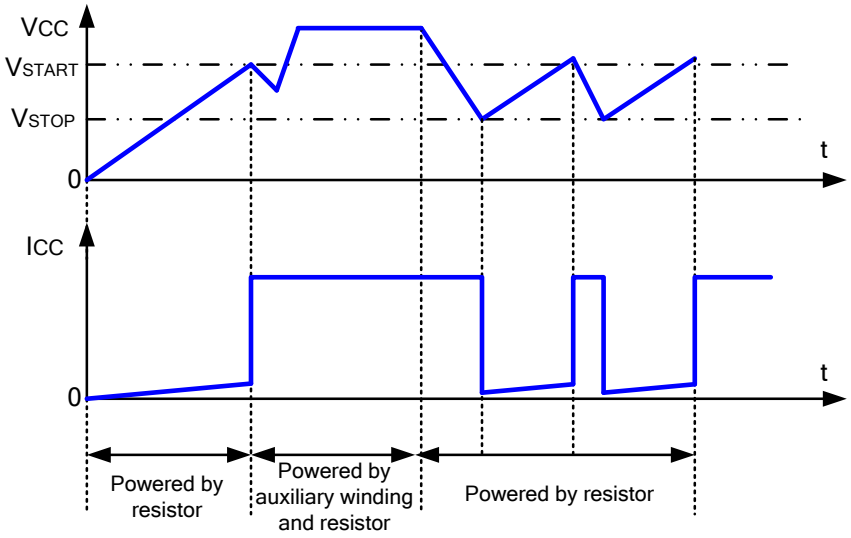
The SD6804S is a single stage primary side regulation (PSR) power factor correction (PFC) controller, built-in 600V high voltage power MOSFET, specially designed for LED driver. The device adopts constant on time operation to achieve high power factor.

The SD6804S provides accurate constant current control and operates in boundary conduction mode (BCM) with high efficiency. The device adopts primary side regulation eliminating the opto-couple, secondary feedback control and loop compensation for reducing design and cost.

The SD6804S provides completed protections such as short LED protection, open LED protection and over temperature protection, etc.

1. Start-up and under voltage lockout

After AC supply is powered on, the capacitor connected to pin VCC is charged by AC supply through a start resistor. Once VCC voltage rises up to 15.9V, the circuit starts to work. VCC voltage will be pulled down by internal consumption of IC until the auxiliary winding of Flyback transformer could supply enough energy to maintain VCC voltage above 7.8V. If the protection occurs, the output of circuit is off, VCC voltage starts to decrease. If VCC voltage is decreased to 7.8V, the capacitor connected to pin VCC is recharged through start resistor.



2. Drive circuit

Drive circuit is power by VCC. When DR＝1, MOSFET is on; When DR＝0, MOSFET is off. T_{LEB}＝0.75μs is set to avoid the burr which will cause error at the turn-on transient of MOSFET.

3. Peak current detection and sense holding

When MOSFET is on, the primary current, which is detected by sense resistor, increases linearly. If this current exceeds the threshold value 0.6V, the current limit comparator acts to turn off MOSFET and DR＝0.

When it is normal, primary peak current is I_{pk}, and the secondary diode on time is T_{off1}, hence, the output current is given by:

$$I_{out} = 0.5 \cdot n \cdot I_{pk} \cdot T_{off1} / T$$

Where, n is the primary/secondary turns ratio.

$I_{pk} \cdot T_{off1} / T$ is calculated in integral mode, and $I_{pk} \cdot T_{off1} / T = V_{cscc} / R_{sen}$ is realized through loop control.

Where, R_{sen} is the sense resistor.

That is,

$$I_{out} = 0.5 \cdot n \cdot V_{cscc} / R_{sen}$$

The output of error amplifier COMP is used for control switch on time. When the on time is up, DR＝0, MOSFET is off.

4. Boundary Conduction Mode

The pin FB detects the voltage across the auxiliary winding by a resistor divider. When the secondary current turns to zero, FB voltage starts to decrease. If FB voltage is decreased to 0.2V, the MOSFET would be turned on.

5. VCC over voltage protection and Open LED protection

The output voltage is reflected by the auxiliary winding voltage of the Flyback transformer, and both pin FB and pin VCC provide over voltage protection function. When VCC voltage exceeds 26.5V, or FB voltage exceeds 1.46V, the over voltage protection is triggered and the IC will discharge, VCC voltage start to decrease. If VCC voltage is decreased to 7.8V, the capacitor connected to pin VCC is recharged through start resistor. If the over voltage condition still exists, the system will operate in hiccup mode.

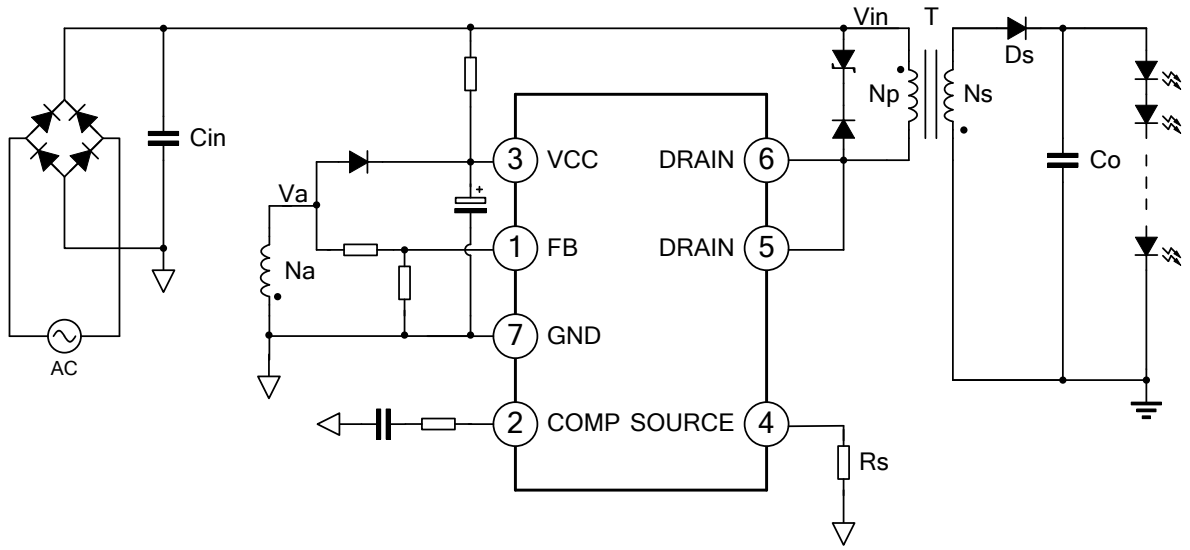
6. Over Temperature Protection

If the circuit is over temperature, the output is shut down to prevent the circuit from damage. The over temperature protection has the hysteresis characteristic. The temperature should be decreased lower than the threshold temperature by 20°C for normal operation. This is adopted to avoid frequently change between normal and protection modes.

7. LED short-circuit protection

When LED is short-circuit and held for 768 periods, the protection acts and the circuit restarts after the protection.

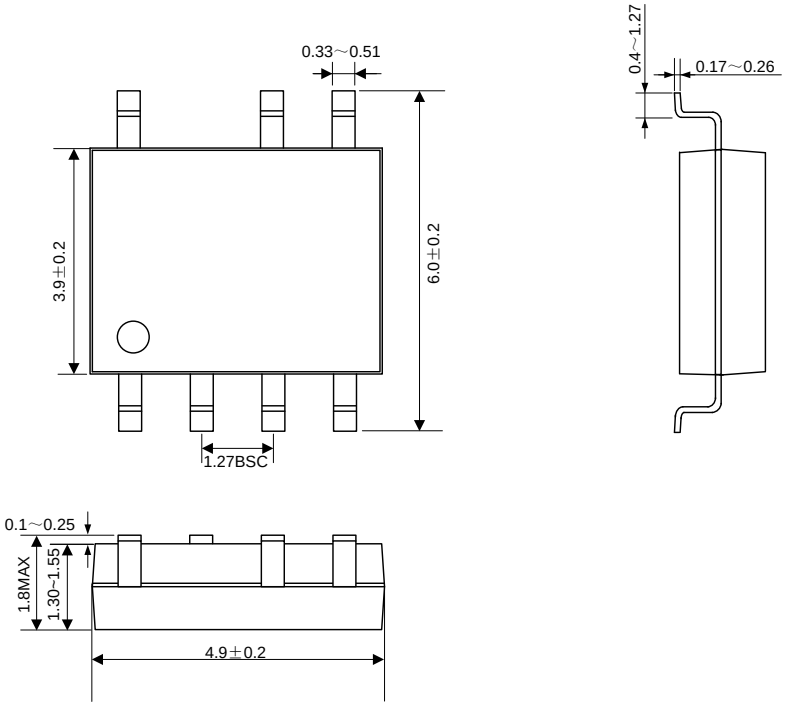
TYPICAL APPLICATION CIRCUIT



Note: The circuit and parameters are for reference only; please set the parameters of the real application circuit based on the real test.

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.

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Revision History:

1. First release