Built-in 60V power MOS boost LED constant current driver

Overview

OC6700 is a built-in 60V power NMOS High-efficiency, high-precision boost high-power LED constant current driver chip.

The OC6700 uses a fixed off-time control method type, the off time can be adjusted by an external capacitor, The operating frequency can be changed according to user requirements.

OC6700 adjusts the external current sampling circuit resistance, can control the driving current of high-brightness LED lights, so that The LED light brightness reaches the expected constant brightness. on the EN side By adding PWM signal, LED light dimming can also be performed.

OC6700 integrates a VDD voltage regulator, soft start-up and over-temperature protection circuits, reduce peripheral components and Improve system reliability.

The OC6700 is available in an ESOP8 package. Inside the heat sink Set to SW pin.

Features

Wide input voltage range: 3.6V~60V

Built-in 60V power MOS

High efficiency: up to 95%

Maximum operating frequency: 1MHz

FB current sampling voltage: 250mV

Chip power supply under-voltage protection: 3.2V

Off-time adjustable

Intelligent over temperature protection

soft start

Built-in VDD regulator

application

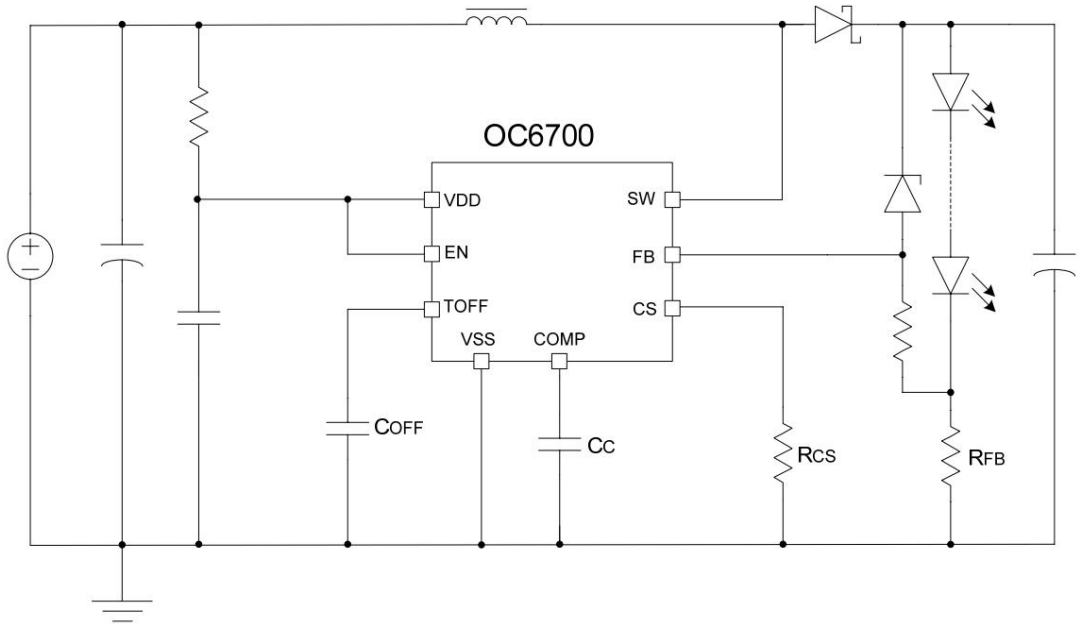
LED light cup

Battery Powered LED String Lights

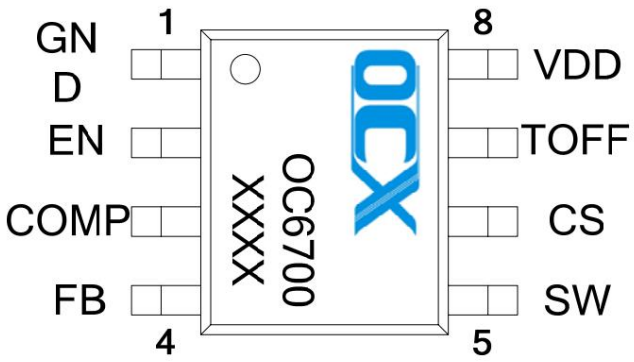
Flat Panel Display LED Backlight

High Power LED Lighting

Typical Application Circuit Diagram



Package and Pin Assignment



ESOP8

Pin Definition

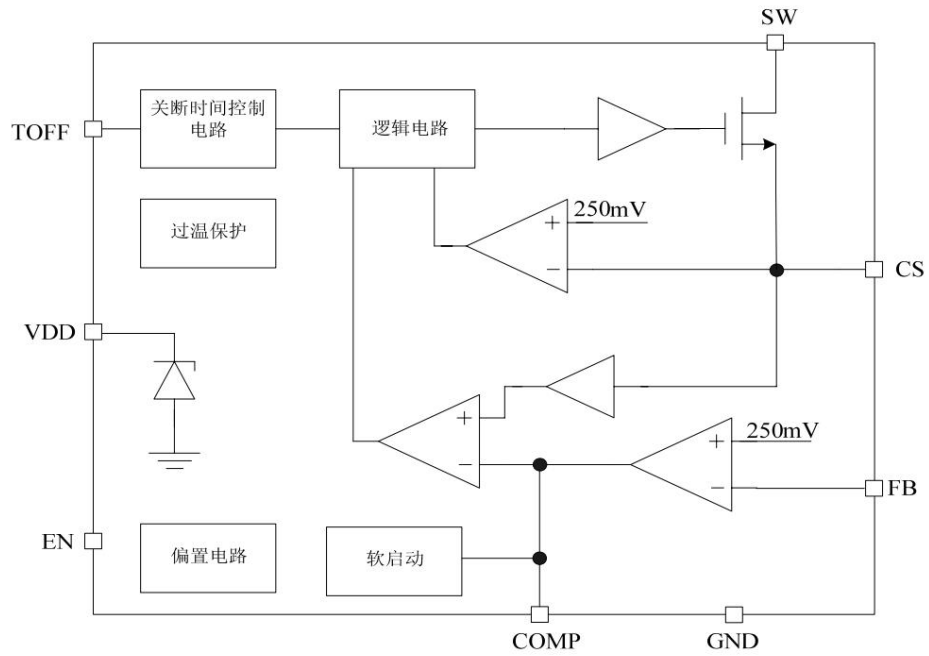
pin number	pin name	describe
1	GND	ground
2	EN	chip enable, active high; can be used as PWM dimming pin.
3	COMP	Frequency compensation pin
4	FB	Output current detection feedback pin
5	SW	Power MOS transistor drain
6	CS	Input current limit detection pin
7	TOFF	Off time setting
8	VDD	Chip power

Limit parameters (Note 1)

symbol	describe	parameter range	unit
VSW	VSW terminal maximum voltage	60	IN
VDD	VDD terminal maximum voltage	5.5	IN
VMAX	EN, COMP, FB, TOFF and CS pin voltage	-0.3 ~ VDD + 0.3 V	
PESOP8	Maximum power dissipation in ESOP8 package	0.8	In
PER	range of working temperature	-20~85	™C
TSTG	Storage temperature range	-40~120	™C
TSD	Soldering temperature range (time less than 30 seconds)	240	™C
VESD	Electrostatic withstand voltage (human body model)	2000	IN

Note 1: The limit parameter is that exceeding the operating range specified in the above table may cause damage to the device. While working under the above limit conditions may affect the reliability of parts.

Internal circuit block diagram



Electrical characteristics (unless otherwise specified, VDD =5.5V, TA =25o C)

parameter	Symbol	Test Conditions	Min	Typ	Max	Units
voltage						
VDD clamp voltage	VDD	IVDD<10mA		5.5		IN
Under- voltage protection voltage	VDD_UVLO	VDD rises		3.2		IN
Brown-out protection hysteresis	VDD_HYS			0.5		IN
supply current						
Working current	IOP	FOP =200KHz		1.3		mA
Standby input current	IINQ	has no load, EN is low		200		uA
Input peak current sampling						
Overcurrent protection threshold	VCS_TH		240	250	260 mV	
Output current sampling						
FB pin voltage	VFB		240	250	260 mV	
off time						
Minimum off time	TOFF_MIN	No external capacitor on TOFF pin		620		ns
EN enable input						
EN input high level			0.4*VDD			IN
EN input low level					0.8	IN
Built-in MOS tube						
MOS tube withstand voltage	VDS		60			IN
MOS tube on-resistance	RDSON	VGS=5V		50		mÿ
Over temperature protection						
Over temperature regulation	OTP_TH			135		™C

Application Note

Overview

OC6700 is a built-in 60V power NMOS step-up high-power LED constant current driver IC.
between peak current mode control.

The chip consists of error amplifier, PWM comparator, inductor peak current limiting, fixed off-time control circuit,
It is composed of circuit units such as PWM logic, power tube drive, and benchmark.

The chip samples the LED output current through the FB pin. When the system is in a steady state, the FB pin voltage VFB is constant at about
250mV. When the VFB voltage is lower than 250mV, the output voltage of the error amplifier, that is, the COMP pin voltage, increases, so that the
It is necessary to increase the peak current of the inductor during the conduction period of the power tube, thus increasing the input power, and the VFB voltage will increase. on the contrary,
When the VFB voltage is higher than 250mV, the output voltage of the error amplifier will gradually decrease, so that during the conduction period of the power tube
The peak current of the inductor is reduced, and therefore the input power is reduced, and the VFB voltage is reduced accordingly.

The chip samples the inductor current through the CS pin to achieve peak current control. In addition, the CS pin is also used to limit the maximum input
current to achieve overcurrent protection.

The system off-time can be set by the capacitor COFF connected to the TOFF pin. By setting the off time, the system can be set
system operating frequency.

The COMP pin is the output end of the error amplifier, and an external resistor and capacitor should be connected to the COMP pin to achieve frequency compensation.

The OC6700 integrates a VDD voltage regulator, as well as soft-start and over-temperature protection circuits.

LED current setting

The LED output current is set by the feedback resistor RFB connected to the FB pin:

$$I_{LED} = \frac{0.25}{R_{FB}}$$

TOFF setting

The off-time can be set by a capacitor COFF connected to the TOFF pin:

$$T_{OFF} = 0.51 \times 150 \times (K \times C_{OFF} + 7.3pF) \times T_D$$

where TD = 61ns.

If there is no external COFF, the OC6700 will internally set the turn-off time to 620ns. For most applications, COFF power is recommended
The value of capacitance is 22~33pF or more.

System operating frequency **FS**

The system operating frequency FS is determined by the following formula:

$$F_S = \frac{IN}{V_{OUT} \times T_{OFF}}$$

Where VIN, VOUT are the system input and output voltages, respectively.

Inductance value

The magnitude of the ripple current flowing through the inductor is related to the value of the inductor. When operating in continuous mode, the inductor ripple current is determined by

Certainly:

$$I_L = \frac{VV_{OUT} - V_{IN}}{L} \times T_{OFF}$$

Increasing the inductance value will reduce the ripple current, and vice versa.

The peak current of the inductor in continuous mode is determined by:

$$I_{pk} = \frac{WE_{About\ LED}}{IN_{IN} \times the} + \frac{1}{2} I_L$$

The critical value of inductor current operating in continuous mode and discontinuous mode is determined by the following formula:

$$Lcri = \frac{VV_{IN} \times (VT_{OUT\ IN}) \times T_{OFF}}{2\ WE_{OUT\ LED}}$$

If the inductance value is greater than Lcri, the system works in continuous mode, and if the inductance value is smaller than Lcri, the system works in discontinuous mode.

When selecting the inductor, it should be ensured that the peak current flowing through the inductor does not cause magnetic saturation of the inductor. Inductor saturation is usually required

The current is more than 1.5 times the peak inductor current. At the same time, a power inductor with low ESR should be selected, and the inductor should be under high current conditions.

Its own ESR can significantly affect the conversion efficiency of the system.

RCS settings

The resistance value of the RCS resistor needs to be set reasonably to prevent the output power from being limited by the input current limit under normal load.

$$R_{CS} = \frac{0.2}{\frac{VI_{OUT\ LED}}{the \times IN_{IN}} + \frac{VV_{OUT\ IN}}{2L} \times T_{OFF}}$$

where ÿ represents the conversion efficiency, which is typically 90%. The RCS value should be calculated at the lowest input voltage.

The maximum peak current IPK of the system is limited by the resistor RCS:

$$I_{PK} = \frac{0.25}{R_{CS}}$$

Power supply resistor selection

The OC6700 supplies power to the chip VDD through the power supply resistor RVDD.

$$R_{VDD} = \frac{In\ VDD_{IN}}{I_{VDD}}$$

Among them, VDD is 5.5V, the typical value of IVDD is 2mA, and VIN is the input voltage. When the switching frequency is set higher, the chip works

The current will increase, and the value of the power supply resistor should be reduced accordingly.

The maximum clamping current of the voltage regulator tube connected to the VDD pin inside the chip does not exceed 10mA. It should be noted that the value of RVDD cannot be too small to avoid

Do not allow the current flowing into VDD to exceed the allowable value, otherwise an external voltage regulator tube is required to clamp.

Over temperature protection

When the chip temperature is too high, the system will limit the peak value of the input current.

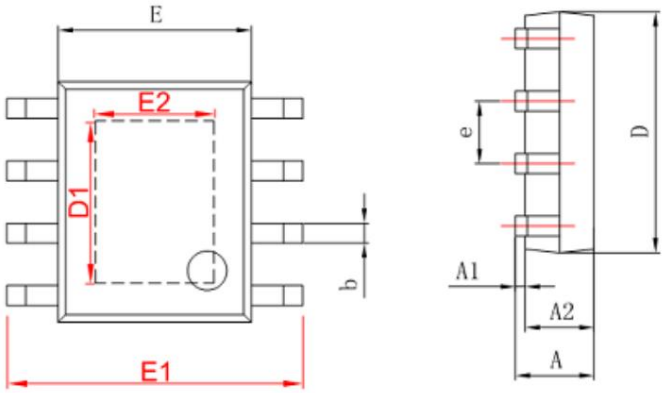
When the temperature rises, the over-temperature regulation begins to work: as the temperature increases, the input peak current gradually decreases, thereby limiting the input power and enhancing the system.

System reliability.

Package information

ESOP8 Package Parameters

- **SOP-8/PP**



字符	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.050	0.150	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
D1	3.202	3.402	0.126	0.134
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
E2	2.313	2.513	0.091	0.099
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°