Orient Semiconductor

DF6610E

Switch dimming/color adjustment linear constant current led Control chi

Overview

DF6610E is a linear dimming/color-adjusting linear LED constant current driver chip, which integrates high-voltage MOS tube and JFET high-voltage power supply function. Mainly used to drive high-voltage, low-current LED light strings powered by commercial power. Since electrolytic capacitors and magnetic components are not required, LED drivers can achieve small size, long life, and comply with EMI regulations.

DF6610E turns on and off the power switch, according to the SEL pin configuration, sequentially switches the on-off state of the two constant current outputs in the chip, and achieves the effect of dimming or color adjustment through different peripheral CS resistance connections.

Features

- The peripheral circuit is very simple, the driver is very small
- No electrolytic capacitors and magnetic components
- 500V built-in high voltage MOS tube
- Ultra fast LED boot
- ±5% LED Output current accuracy
- LED current can be set externally
- Overtemperature adjustment function
- Switchable within 3 seconds
- Dimming ratio 100%, 50%, X%
- Compatible with 2 state and 3 state switching
- Available in SOP8-EP package

application

- GU10/E27 LED bulb, spot light
- LED candle light
- Other LED lighting

typical application

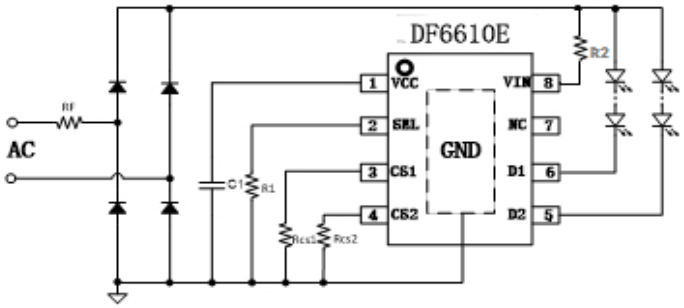


Figure 1 Typical application diagram of DF6610E high PF color temperature

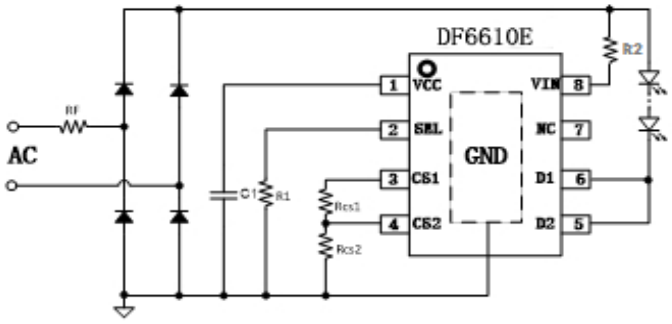


Figure 2 DF6610E high PF dimming typical application diagram

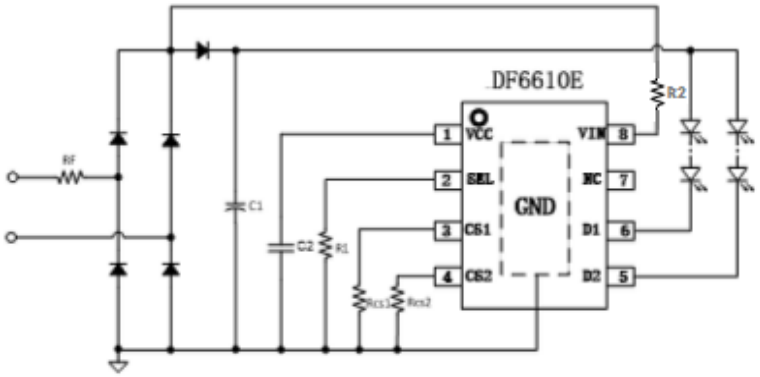


Figure 3 Typical application diagram of DF6610E low PF color temperature

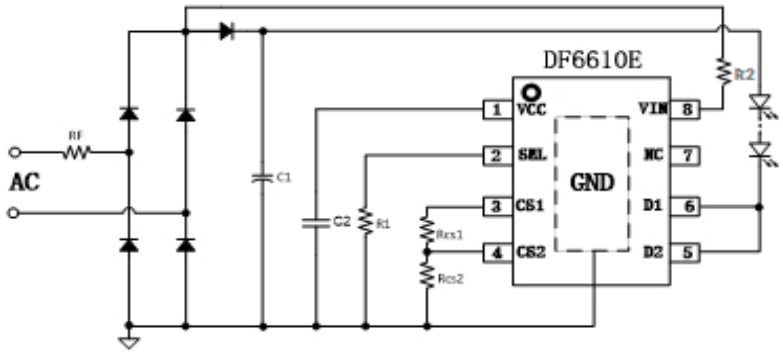
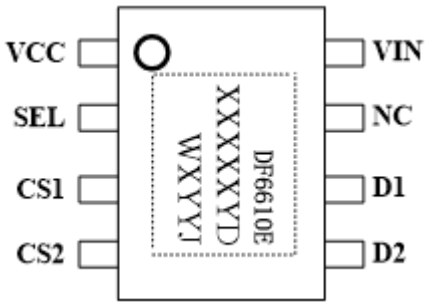


Figure 4 DF6610E low PF dimming typical application diagram

Order information

Order model	Package	temperature range	package style	print
DF6610E	SOP8_EP	- 40 ℃ to 105 ℃	Taping 4,000 pcs/disk	DF6610E XXXXX LXXYYF

Pin package



XXXXX: lot code L: chip factory code XXYY: lot number F: packaging factory code

Figure 5 pin package diagram

Pin description

Pin number	Pin name	description
1	VCC	Power port
2	SEL	Switch logic selection control terminal
3	CS1	Chip current sampling port 1
4	CS2	Chip current sampling port 2
5	D2	Constant current output port 2
6	D1	Constant current output port 1
7	NC	Dangling
8	VIN	Power port
Substrate	GND	Chip ground

Limit parameters (Note 1)

symbol	parameter	Parameter Range	Unit
D1, D2 high voltage output port		500	V
VIN	High voltage power supply interface	500	V
I_{D-MAX}	Drain maximum saturation current @ $T_{J,max}$	80	mA
VCC	Chip internal power supply	8	V
CS1, CS2, SEL	Chip low voltage interface	- 0.3~6	V
P_{DMAX}	Power consumption (Note 2)	1.25	W
θ_{JA}	PN junction to ambient thermal resistance	100	℃/W
T_J	Operating junction temperature range	-40 to 150	℃
T_{STG}	Storage temperature range	-55 to 150	℃

Note 1 : Maximum limit It means that beyond this working range, the chip may be damaged. The recommended operating range means that within this range, the device functions normally, but it does not fully guarantee that individual performance indicators are met. Electrical parameters define the DC and AC parameter specifications of the device within the operating range and under test conditions that guarantee specific performance indicators. For parameters that do not give upper and lower limits, the specification does not guarantee its accuracy, but its typical values reasonably reflect device performance

Note 2 : The maximum power consumption will decrease when the temperature rises, which is also caused by T_{JMAX}, θ_{JA}, And ambient temperature T_A Decided. The maximum allowable powe (T_{JMAX} - T_{AJ} θ_{JA} Or the lower value of the numbers given in the limit range. Note 3 : Human body model, 100pF capacitor is discharged through 1.5KΩ resistor.

Recommended working range

symbol	parameter	Parameter range	unit
I_{led}	LED output current @220V	<40	mA
I_{led}	LED output current @110V	<80	mA

Electrical parameters (Note 4, 5) (Unless otherwise specified, T_A= 25 ℃)

symbol	description	Conditional	minimum	typical value	maximum	unit
I_{JFET}	JFET maximum current			2.0		mA
I_{DD}	Static working current	VIN=30V		110		uA
V_{DET_CLR}	Switch detection clear			2.3		V
V_{CC_ON}	VCC start voltage			6.5		V
V_{CC_UVLO}	VCC undervoltage protection threshold			5.4		V
I_{SEL}	Mode selection current			30		uA
V_{CS1} / V_{CS2}	CS port operating voltage	VIN=30V, VD1=VD2= 10V		600/300		mV
T_{REG}	Over temperature adjustment temperature starting point			140		℃

Note 4 : Typical parameter value is 25 ° The parameter standard measured under C.

Note 5 : The minimum and maximum specifications of the specifications are guaranteed by testing, and the typical values are guaranteed by design, testing, or statistical analysis.

Internal structure diagram

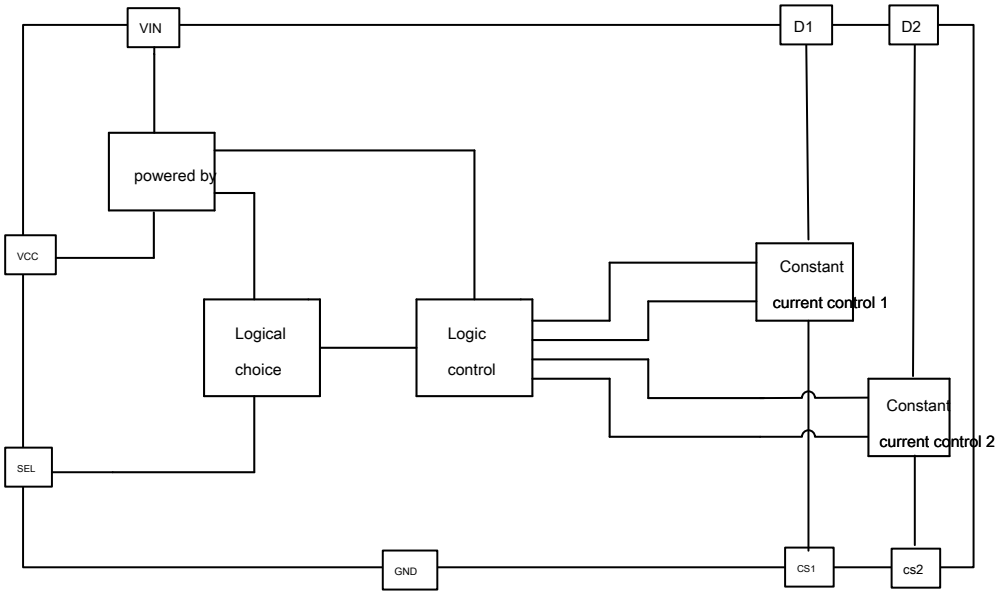


Figure 6 DF6610E internal block diagram

Application Information

DF6610E is a constant current LED driver chip with on/off brightness and color temperature adjustment, integrated high voltage MOS tube and JFET high voltage power supply function. Mainly used to drive high-voltage, low-current LED light strings powered by commercial power.

1 powered by

After the system is powered on, VIN supplies power to the chip through the internal high-voltage JFET. When the voltage of VCC exceeds 7V, the chip starts to work.

2 Mode selection

The DF6610E can set the switch toning/dimming mode through the SEL pin. The mode settings are as follows:

SEL	State switching sequence
SEL floating	D2→D1+D2→D1→D2
SEL ground	D2→D1→D2
SEL to resistor	D2→D1→D1+D2→D2
D2: D2 is turned on, with a constant current of 0.6V reference; D1+D2: D1, D2 is turned on, with a constant current of 0.3V reference; D1: D1 is turned on, with a constant current of 0.6V reference. The selection of SEL grounding resistance is recommended to 75KΩ.	

3 Color temperature

When the DF6610E is used to adjust the color temperature, the power switch can be turned off according to the power on and off, and the switch state of the two output ports can be changed in sequence, so that the two LED lights of different colors can be alternately turned on and off to achieve the purpose of adjusting the color temperature. Adjusting the external CS resistor can output the system The power is adjusted.

The output current of the chip is adjusted by the CS resistor.

When SEL is floating, the switch is turned on for the first time (D2 is turned on, D1 is turned off Off), the output current I_{D2} • $\frac{0.6}{Rcs\ 2}$, The switch turns on for the second time (D1, D2 is turned on), the output current I_{D1+D2} • $\frac{0.3}{Rcs}$ • $\frac{0.3}{Rcs\ 2}$, Switch Three times turn on (D1 turn on, D2 turn off), output current I_{D1} • $\frac{0.6}{Rcs\ 1}$.

When SEL is grounded, the switch is turned on for the first time (D2 is turned on, D1 is turned off Off), the output current I_{D2} • $\frac{0.6}{Rcs\ 2}$, The switch is turned on for the second time (D1 Turn on, D2 turns off), output current I_{D1} • $\frac{0.6}{Rcs\ 1}$.

When SEL is connected to the resistor, the switch is turned on for the first time (D2 is turned on, D1

Off), output current $I_{D2} = \frac{0.6}{Rcs \times 2}$, The switch is turned on for the second time (D1

Turn on, D2 turns off), output current $I_{D1} = \frac{0.6}{Rcs \times 1}$, Switch for the third time

Turn on (D1, D2 turn on), output current $I_{D1\,D2} = \frac{0.3}{Rcs1} + \frac{0.3}{Rcs2}$.

4 Switch dimming

When the DF6610E is used to adjust brightness, the power switch can be turned on and off according to the output current to change the brightness of the LED lamp. The adjustment ratio can be adjusted by an external CS resistor.

When SEL is floating, the switch is turned on for the first time (D2 is turned on, D1 is turned off

Off), the output current $I_{D2} = \frac{0.6}{Rcs \times 2}$, The switch turns on for the second time (D1,

D2 is turned on), the output current $I_{D1} = \frac{0.3}{Rcs \times 2}$, The switch is turned on for the third time

Turn on (D1 turns on, D2 turns off), output current $I_{D1} = \frac{0.6}{Rcs1 + Rcs2}$,

The dimming ratio is 100%, 50%, X%, $X\% = \frac{Rcs2}{Rcs1 + Rcs2}$.

When SEL is grounded, the switch is turned on for the first time (D2 is turned on, D1 is turned off

Off), the output current $I_{D2} = \frac{0.6}{Rcs \times 2}$, The switch is turned on for the second time (D1

Turn on, D2 turns off), output current $I_{D1} = \frac{0.6}{Rcs1 + Rcs2}$,

The dimming ratio is 100%, X%, $X\% = \frac{Rcs2}{Rcs1 + Rcs2}$.

When SEL is connected to the resistor, the switch is turned on for the first time (D2 is turned on, D1

Off), output current $I_{D2} = \frac{0.6}{Rcs \times 2}$, The switch is turned on for the second time (D1

Turn on, D2 turns off), output current $I_{D1} = \frac{0.6}{Rcs1 + Rcs2}$,switch

The third turn on (D1, D2 turn on), the output current $I_{D2} = \frac{0.3}{Rcs \times 2}$,

The dimming ratio is 100%, X%, 50%, $X\% = \frac{Rcs2}{Rcs1 + Rcs2}$.

5 System switch switching and reset time

The switching time and reset time of the DF6610E system solution are controlled by the VCC port of the chip. The VCC capacitor value and the system switching time curve are shown in Figure 7; and the system reset time curve is shown in Figure 8:

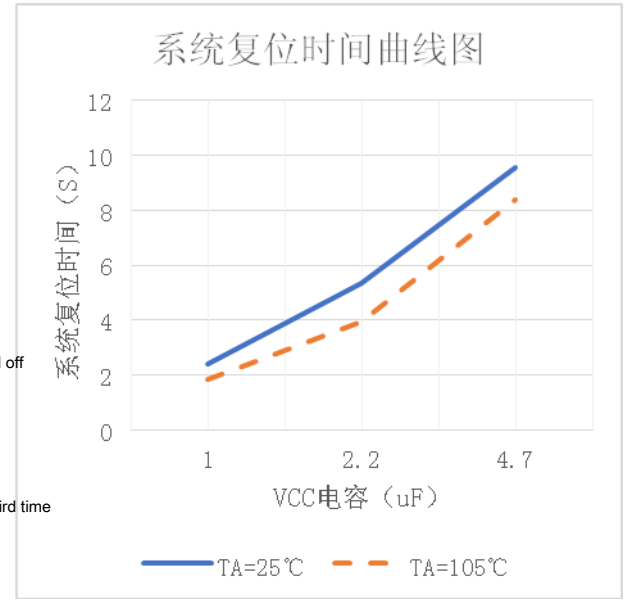


Figure 7 System switching time curve

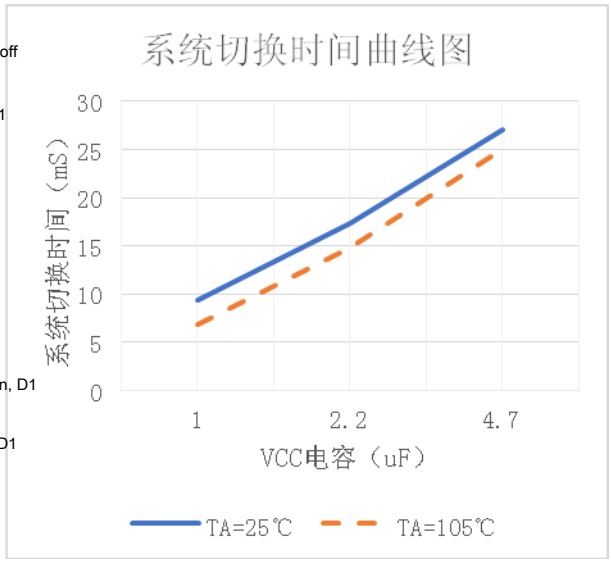


Figure 8 System reset time curve

Recommended capacitor value is 2.2uF, withstand voltage value is 16V

6 Overtemperature adjustment function

DF6610E has an over-temperature adjustment function, which gradually reduces the output current when the drive power is overheated, thereby controlling the output power and temperature rise

The power supply temperature is kept at the set value to improve the reliability of the system.

7 PCB design

When designing the DF6610E PCB board, you need to pay attention to the following:

Ground

The power ground of the current sampling resistor is as short as possible. The area of

ground/Drain should be as large as possible to reduce thermal resistance and enhance heat dissipation capacity.

Chip heat sink

DF6610E has a heat sink with enhanced heat dissipation capacity at the bottom of

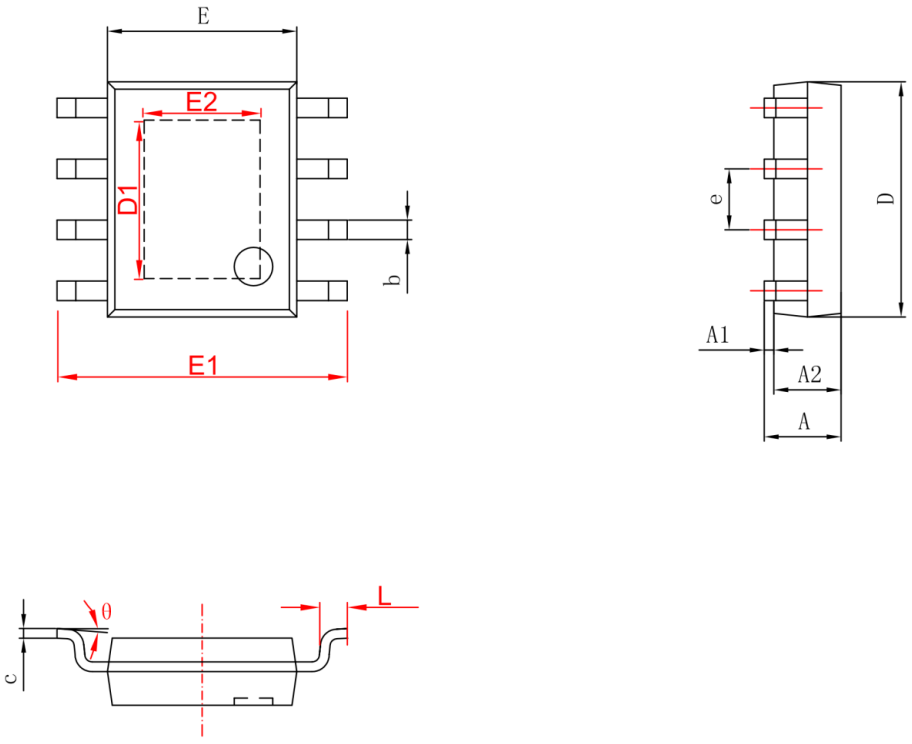
the chip, which has been connected to the GND pin inside the chip. When designing

the PCB, connect the heat sink to the PCB ground. In order to achieve a good heat

dissipation effect, the area of the copper skin connected to the heat sink needs to be as large as possible.

Package information

SOP8-PP(EXP PAD) PACKAGE OUTLINE DIMENSIONS



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	0.002	0.006
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	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°