



85~265V AC Input LED Constant Current Driver

General Description

The LN2543 is a high voltage buck control IC for constant LED current regulation. The LN2543 operates constant off-time mode. It allow efficient operation of High Brightness (HB) LEDs from voltage sources ranging from 8VDC up to 450VDC or 12VAC~265VAC.

LN2543 is available by SOT23-6L packages.

Applications

- DC/DC or AC/DC LED driver applications
- RGB backlighting LED driver
- General purpose constant current source
- Signal and decorative LED lighting

Typical Application Circuit

Features

- Switch mode constroller for single switch LED Drivers
- Open loop peak current controller
- Wide Input range from 8VDC~450VDC or 12VAC~265VAC
- Application from a few mA to more than 1A output
- Up to hundreds of LEDs
- Constant off-time operation
- Requires few external components for operation

Package

• SOT23-6L



Note: 1. The Rcs depends on the number of LED in parallel.

2、VREF floating。



Ordering Information

LN2543 12

Designator	Symbol	Description		
1	M Package :SOT23-6L			
		Device Orientation		
2	R	Embossed Tape: Standard Feed		
	L	Embossed Tape: Reverse Feed		

■ Pin Configuration



Pin Assignment

Pin Number	Pin Name	Function		
2	GND	Ground.		
3	GATE	This pin is the output gate driver for an external N-channel power MOSFET.		
1	CS	This pin is the current sense pin used to sense the FET current by means of an external sense resistor.		
5	TOFF	This pin sets the off time of the power mos and this chip operates in constant off time mode. It can be floating with the internal set off time 510ns. When a resistor is connected between TOFF and GND, the off time is increased.		
6	VIN	This pin is the input of an 8V – 450V voltage supply through a resistor, it must be bypassed with a capacitor to GND.		
4	VREF	The internal reference voltage is 1.25V and the normal application can be suspension.		

Marking Rule

SOT-23-5L



①② Represents the product name

Symbol	Description
43	LN2543

③ Represents die code, can be modified according to the actual situation within the company.

(4) Represents quality tracking information, it is defined by production.

0~9, A~Z repeated (G, I, J, O, Q, W are excepted)



Function Block Diagram



■ Absolute Maximum Ratings

Parameter	Symbol	Maximum Rating	Unit
VIN pin voltage to GND	Vin	-0.3—14	V
CS, TOFF pin voltage to GND		-0.3—6	V
GATE pin to GND	V _{GATE}	-0.3—12	V
VIN pin Input Current Range	I _{VIN}	1—20	mA
Storage temperature range	T _{STG}	-40—150	°C
Operating junction temperature	TJ	-40—150	°C
ESD Human Model		4000	V

Electrical Characteristics

(TA=25℃ unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Тур.	Max.	Unit
VINDC	Input DC supply voltage range	-	8	-	450	V
$V_{\text{IN_clamp}}$	VIN clamp voltage	-	5.5	6.5	7.5	-
I _{IN}	Operation current range	VIN=5.5V GATE floating	-	0.4	1	mA
UVLO	Under voltage lockout threshold	VIN rising	-	5.5	-	V
∆ UVLO	Under voltage lockout hysteresis	VIN falling	-	700	-	mV
V _{CSTH}	Current sense pull-in threshold voltage		-	500	-	mV
T _{OFF}	Off time	Rosc=200K	-	6	-	uS
VREF	The Internal Reference Voltage	VIN=6.0V	-	1.2	-	V



Application Information

The LN2543 is optimized to drive buck LED drivers using open-loop peak current mode control. This method of control enables fairly accurate LED current control without the need for high side current sensing or the design of any closed loop controllers. The IC uses very few external components and enables both Linear and PWM dimming of the LED current.

A capacitor connected to the Toff pin programs the off-time. The oscillator produces pulses at regular intervals. These pulses set the SR flip-flop in the LN2543 which causes the GATE driver to turn on. When the FET turns on, the current through the inductor starts ramping up. This current flows through the external sense resistor RCS and produces a ramp voltage at the CS pin. The comparators are constantly comparing the CS pin voltage to both the voltage at the LD pin and the internal 500mV. Once the blanking timer is complete, the output of these comparators is allowed to reset the flip flop. When the output of either one of the two comparators goes high, the flip flop is reset and the GATE output goes low. The GATE goes low until the SR flip flop is set by the oscillator. Assuming a 30% ripple in the inductor, the current sense resistor RCS can be set using:

$$R_{CS} = \frac{0.5V}{(1+0.3/2)*I_{LIMT}} \approx \frac{0.43}{I_{LIMT}}$$

A constant off-time peak current control scheme can easily operate at duty cycles greater than 0.5 and also gives inherent input voltage rejection making the LED current almost insensitive to input voltage variations.

Input Voltage Regulator

When a voltage is applied at the decent resistor, the LN2543 maintains a constant 6.5V at the VIN pin. This voltage is used to power the IC and any external resistor dividers needed to control the IC. The VIN pin must be bypassed by a low ESR capacitor to provide a low impedance path for the high frequency current of the output GATE driver.

The input current draw from the VIN pin is a sum of the 1.0mA current draw by the internal circuit and the current drawn by the GATE driver (which in turn depends on the switching frequency and the GATE charge of the external FET).

The ic is allowed of input maximum current draw from the VIN pin is about 20mA, so the resistor between VIN pin and VIN input can be set using:

$$R_{\text{max}} = \frac{V_{DC \min} - 6.5V}{1mA}; \quad R_{\min} = \frac{V_{DC \max} - 6.5V}{20mA}$$



The RIN's value must be between Rmax and Rmin.

Current Sense

The current sense input of the LN2543 goes to the noninverting inputs of two comparators. The inverting terminal of one comparator is tied to an reference from DIM pin whereas the inverting terminal of the other comparator is connected to the



RNTC pin. The outputs of both these comparators are fed into an OR GATE and the output of the OR GATE is fed into the reset pin of the flip-flop. Thus, the comparator which has the lowest voltage at the inverting terminal determines when the GATE output is turned off.

The outputs of the comparators also include a 50-280ns blanking time which prevents spurious turn-offs of the external FET due to the turn-on spike normally present in peak current mode control. In rare cases, this internal blanking might not be enough to filter out the turn-on spike. In these cases, an external RC filter needs to be added between the external sense resistor (RCS) and the CS pin.

Please note that the comparators are fast (with a typical 80ns response time). A proper layout minimizing external inductances will prevent false triggering of these comparators.

Oscillator

The oscillator in the LN2543 is controlled by a single resistor connected at the Toff pin. The equation governing the Toff-time of oscillation period is given by:

$$T_{OFF-TIME} = 45 \times 10^{-12} \times R_{OSC}$$









Symbol	Dimensions In Millimeters		Dimensions In Inches		
	Min	Max	Min	Max	
Z	1.050	1.250	0.041	0.049	
A1	0.000	0.100	0.000	0.004	
A2	1.050	1.150	0.041	0.045	
b	0.300	0.500	0.012	0.020	
С	0.100	0.200	0.004	0.008	
D	2.820	3.020	0.111	0.119	
E	1.500	1.700	0.059	0.067	
E1	2.650	2.950	0.104	0.116	
е	0.950(BSC)		0.037(BSC)		
e1	1.800	2.000	0.071	0.079	
L	0.300	0.600	0.012	0.024	
θ	0°	8°	0°	8°	