CMOS White LED Driver Boost Converter

Description

The CAT37 is a DC/DC step up converter that delivers a regulated output current. Operation at a constant switching frequency of 1.2 MHz allows the device to be used with very small value external inductor and ceramic capacitors.

The CAT37 is targeted to drive multiple white light emitting diodes (LEDs) connected in series and provides the necessary regulated current to control the brightness and the color purity. An external resistor R1 controls the output current level. LED currents of up to 40 mA can be supported over a wide range of input supply voltages from 2.5 V to 7 V,

making8(y.tF(/TT6 1 TfHcomplia70)32 283.32 Tm.0095 Tw[Input V)132(oltage Operation down to 2.5 V)**T**JF1 1 Tf12 0 0 12 59.76 26 2. NiPdAu Plated Finish (RoHS-compliant).

Typical Application Circuit



ess White LEDs

		runction
I	300	connected to this pin.
2	GND	Ground pin. Connect pin 2 to ground.
3	FB	LED (cathode) connection pin.
4	SHDN	Shutdown pin.
5	VIN	Input supply pin. This pin should be bypassed with a capacitor to ground. A 1 μF capacitor mounted close to the pin is recommended.

Table 2. ABSOLUTE MAXIMUM RATINGS

Parameter	Rating	Unit
V _{IN} , FB, SHDN voltage	8	V
SW voltage	20	V
Storage Temperature Range	-65 to +160	°C
Junction Temperature	125	°C
Lead Soldering Temperature (10 secs)	300	°C
ESD Rating – Human Body Model	2000	V

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

Table 3. RECOMMENDED OPERATING CONDITIONS

Parameter

Range

Table 4. ELECTRICAL OPERATING CHARACTERISTICS

(Over recommended operating conditions unless otherwise specified. T_A = 25°C, V_{IN} = 3 V and V_{SHDN} = 3 V.)

Sy	ymbol	Parameter	Conditions	Min	Тур	Max	Units	
		Input Voltage Range		2.5		7	V	
	lQ	Quiescent Current	V _{FB} = 0.2 V		0.5	0.7	mA	
	I _{SD}	Shutdown Current	V _{SHDN} = 0 V		0.05	1	μA	







Figure 12. Enable Power–Up Waveforms

Operation

The CAT37 device is a high efficiency, constant frequency, current regulating boost driver for white LEDs.

The device includes a switch and an internally compensated loop for the regulation of the current in the LEDs.

Operation can be best understood by examining the block diagram. The FB pin is regulated at 95 mV and the current through the external resistor will set the regulated current in the LEDs at:

I

Application Information

Capacitor Selection

Low ESR (equivalent series resistance) capacitors should be used at the output to minimize the output ripple voltage. The low ESR and small package options available with multilayer ceramic capacitors make them excellent choices. The X5R and X7R capacitor types are preferred because

LED Dimming with DC Signal

Dimming the LEDs can be done by applying a variable DC voltage as shown on Figure 14. As the V_{DC} increase the voltage across R1 decreases and therefore lower the LED current. The resistors R2 and R3 must be large enough so that their current (tens of μ A) is much smaller than the LED current but much larger than the FB leakage current (I_{FB}). When adjusting V_{DC} between 0 V and 2 V, the resistors shown on Figure 14 will set the LED current between 0 mA and 15 mA.

LED Dimming with PWM Signal

PWM brightness control provides the widest dimming range (greater than 20:1). By turning the LEDs ON and OFF

TYPICAL APPLICATION CIRCUITS



Figure 17. Two LEDs with DC Level Dimming Control



Figure 19. Three LEDs with DC Level Dimming Control



Figure 20. Efficiency - Three LEDs

Figure 21. Four LEDs with PWM Dimming Control

Figure 22. Efficiency – Four LEDs

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