General Description

QX5305 is a high efficient boost type LED driver IC. It is especially suited to drive several high power and high luminance LEDs in series.

QX5305 uses fixed off-time control scheme, and 1MHz switching frequency can be achieved.

QX5305 set the off-time by an external capacitor, the minimum off-time is 620ns and the off-time can be adjusted by changing the external capacitor, and the operating frequency also can be adjusted according to the need of customers.

QX5305 regulates the current flowing through LEDs to set the luminance of LEDs by changing the external resistor, on the other hand, the luminance of LEDs also can be regulated by a PWM signal applied to EN pin.

Features

- High Efficiency: up to 95%
- Switching Frequency: up to 1MHz
- Wide Range Input Voltage:3.6V to 100V
- UVLO Voltage: 2.5V
- Peak Current Sense Voltage: 250mV
- Adjustable Luminance With PWM Signal Applied to EN Pin
- Adjustable Off-time
- Internal Current Sampling Leading Edge Blanking Circuit

Applications

- Battery-powered LED lights
- Flat panel display LED backlight
- Constant current charger control
- Power LED lighting

Typical Application

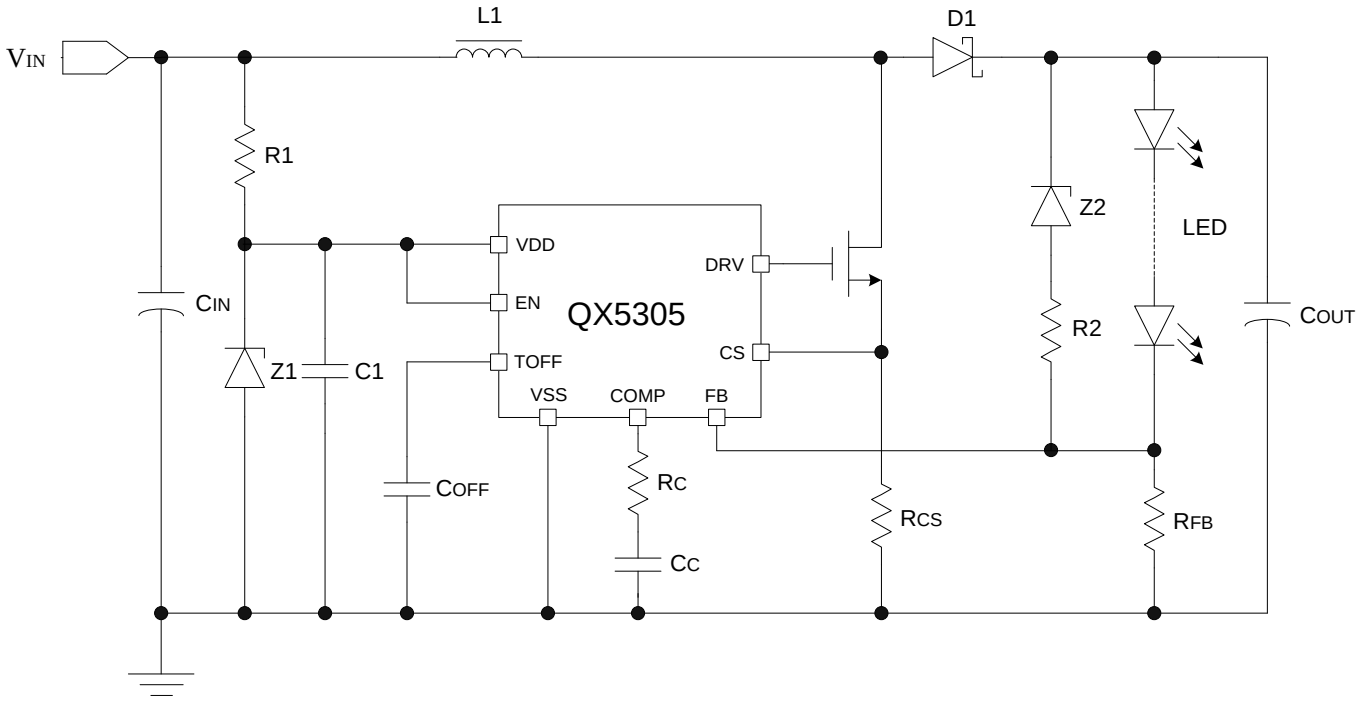


Figure 1：Typical Application Circuit Diagrams of QX5305

Ordering Information

Type Number

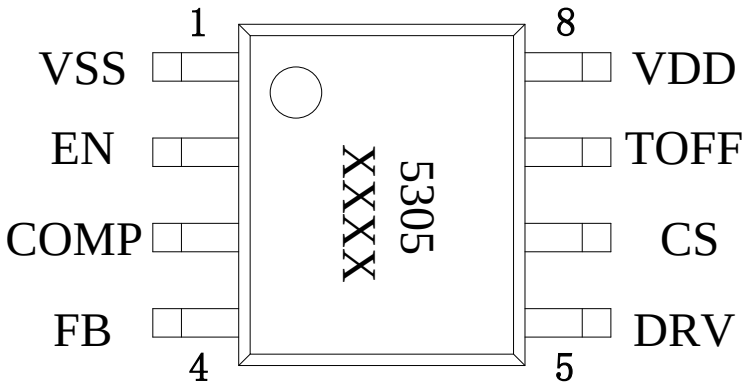
QX5305

Package Marking

5305
XXXX

Lot Number
Date

Pin Assignments



SOP8

Pin Description

Pin	Pin Name	Pin Type	Description
1	VSS	Ground	Chip Ground Pin
2	EN	Input	Chip Enable Pin（Active High）
3	COMP	Output	Compensation
4	FB	Input	Voltage Feedback pin
5	DRV	Output	Driver pin
6	CS	Input	Current sense
7	TOFF	Input	Off time set pin
8	VDD	Power	Chip Power Pin

Functional Block Diagram

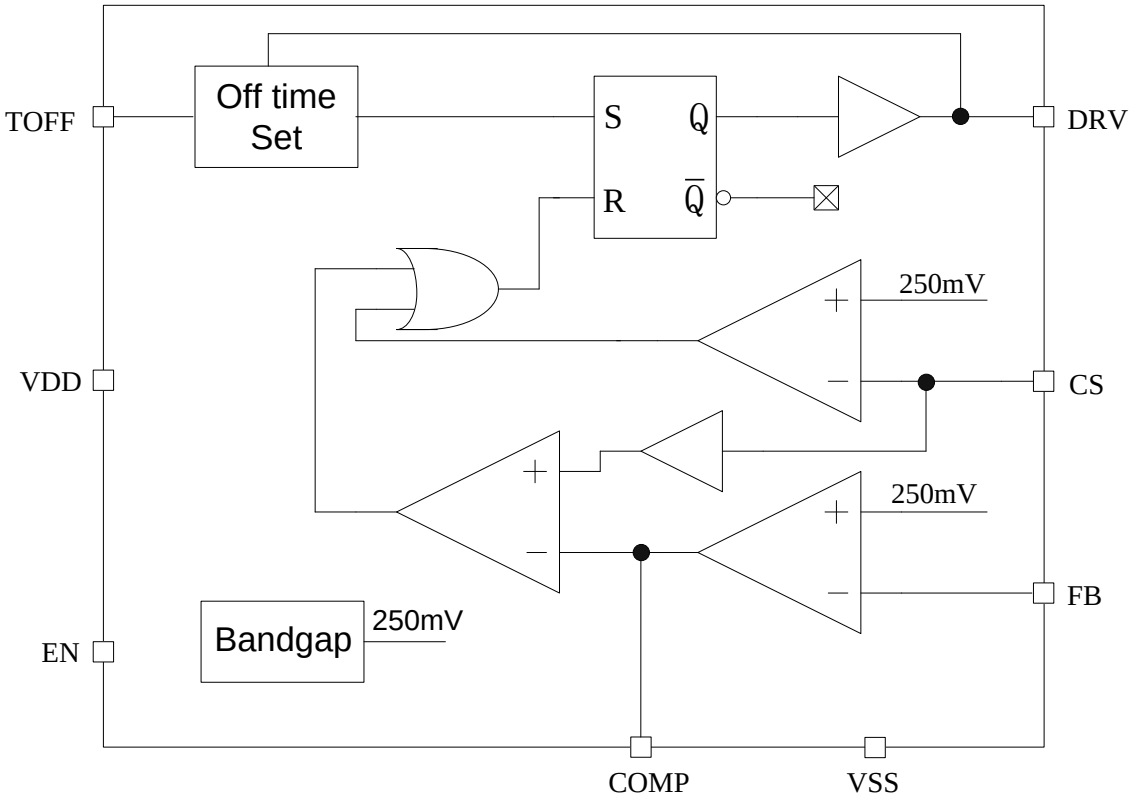


Figure 2：Functional Block Diagram of QX5305

Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Description	Min	Max	Unit
Voltage	V_{MAX}	Maximum Voltage On VDD Pins		7	V
	V_{MIN_MAX}	The Voltage On EN,COMP,FB,DRV,CS and TOFF Pin	-0.3	V_{DD}+0.3	V
Power Dissipation	P_{SOP8}	Maximum Power Dissipation for P_{SOP8} Package		0.75	W
Thermal	T_J	Junction Temperature Range	-20	125	^oC
	T_A	Operating Temperature Range	-20	85	^oC
	T_{STG}	Storage Temperature Range	-40	120	^oC
	T_{SD}	Soldering Temperature Rang（less than 30 sec）	230	240	^oC
ESD	V_{ESD}	ESD Voltage for Human Body Mode		2000	V

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability.

Recommended Operating Conditions(Note 2)

Parameter	Symbol	Min	Typ	Max	Unit
VDD Voltage	V_{DD}	2.5	5	5.5	V
OSC frequency	F_{OP}	20	200	1000	KHz

Note 2: The Recommended Operating Conditions are required in order to ensure the normal operation of the IC, but does not guarantee completely meeting the individual performance characteristics.

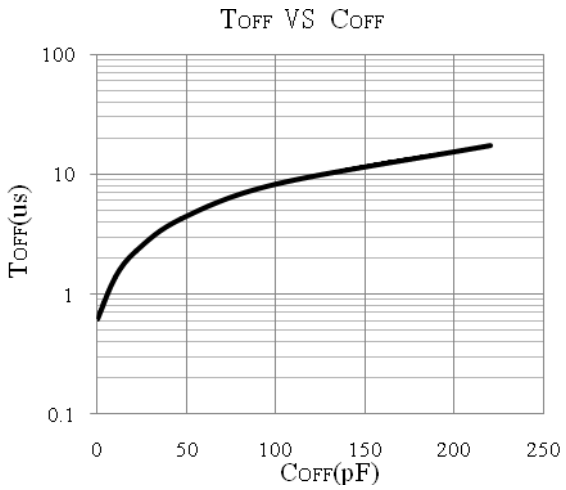
Electronic Characteristics

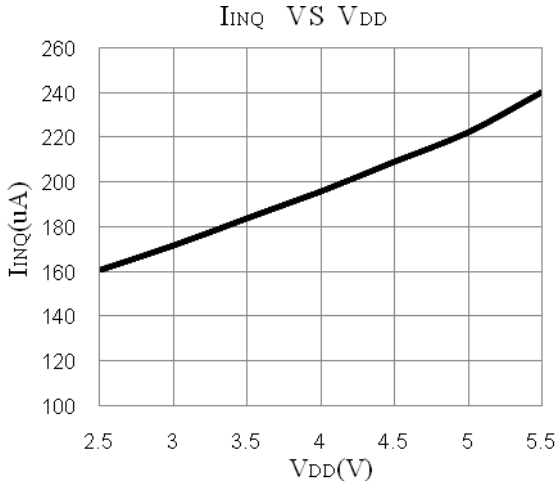
T_A =25 °C, VDD =5V, unless otherwise specified

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Supply Voltage						
Maximum Input Voltage	V_{IN_MAX}			5	6	V
UVLO Voltage	V_{UVLO}	V_{DD} rises from 0V		2.5		V
Supply Current						
Current Limiting	I_{OP}	FOP =200KHz		1.3		mA
Standby Input Current	I_{INQ}	Without Load，EN=“Low”		220		uA
MOSFET Parameters						
Over current threshold	V_{CS_TH}		240	250	260	mV
Shut down delay	T_D			61		ns
DRV Time						
DRV rise time	T_{RISE}	DRV connect a 500pFcapacitor			50	ns
DRV fall time	T_{FALL}	DRV connect a 500pFcapacitor			50	ns
Output Current Sense						
FB Pin Voltage	V_{FB}		240	250	260	mV
T-Off Time						
Minimum Off Time	T_{OFF_MIN}	TOFF without capacity		620		ns
Enable Input On EN Pin						
“High” Voltage Level On EN Pin			0.4× V_{DD}			V
“Low” Voltage Level On EN Pin					0.8	V
OSC						
Maximum frequency	F_{MAX}				1000	KHz

Typical Electrical Curves

V_{IN} =5V, T_A =25 °C, unless otherwise specified





Applications Information

Detailed Description

QX5305 is a highly efficient constant current driver for high luminance LED with built-in high accuracy comparator, fixed off-time controller and constant current driver etc.

QX5305 uses fixed off-time and peak current control mode, and the system of circuit operates with a switching transistor in the turn-on or turn-off states.

QX5305 works in two states, that is, ON State and OFF State. In ON State, the external switch is on until one of the comparators outputs a high level voltage, QX5305 goes to OFF state. In OFF State, the external switch remains off until a fixed off time and the outputs of the two comparators are low, QX5305 goes to ON state and repeat the ON and OFF process.

QX5305 works like a traditional current mode PWM DC-DC converter except that the off time is fixed and the working frequency is variable due to the values of VIN and VOUT. The comparator connected to CS pin is used for current limiting and the comparator connected to FB is used for voltage feedback.

T_{OFF} Setting

The fixed off-time T_{OFF} is determined by the capacitor C_{OFF} connected to the pin T_{OFF}:

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

where T_D equals 61ns. If T_{OFF} pin is left open, the typical value of T_{OFF} is 620us.

Output Current Setting

The LED current is determined by the formula below:

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

where R_{FB} is the feedback resistance.

R_{CS} Setting

R_{CS} should be set reasonable to prevent the input current is limited on normal load conditions, R_{CS} is determined by the formula below:

$$V_{IN} \times I_{IN} \times \eta = V_{OUT} \times I_{LED}$$

$$I_{IN} = \frac{V_{CS}}{R_{CS}} - \frac{\Delta I_L}{2}$$

$$I_{IN} = \frac{V_{CS}}{R_{CS}} - \frac{V_{LED} - V_{IN}}{2L} \times T_{OFF}$$

R_{CS} should be less than the theoretical value in practical applications.

Inductor Selection

To ensure the system output constant current, the inductor must operate in CCM mode, the minimum inductance needed is

$$L\text{critical} > \frac{V_{IN} * (V_{OUT} - V_{IN}) * T_{OFF}}{2V_{OUT} * I_{LED}}$$

Operating Frequency of System

The operating frequency of system is determined by the formula below:

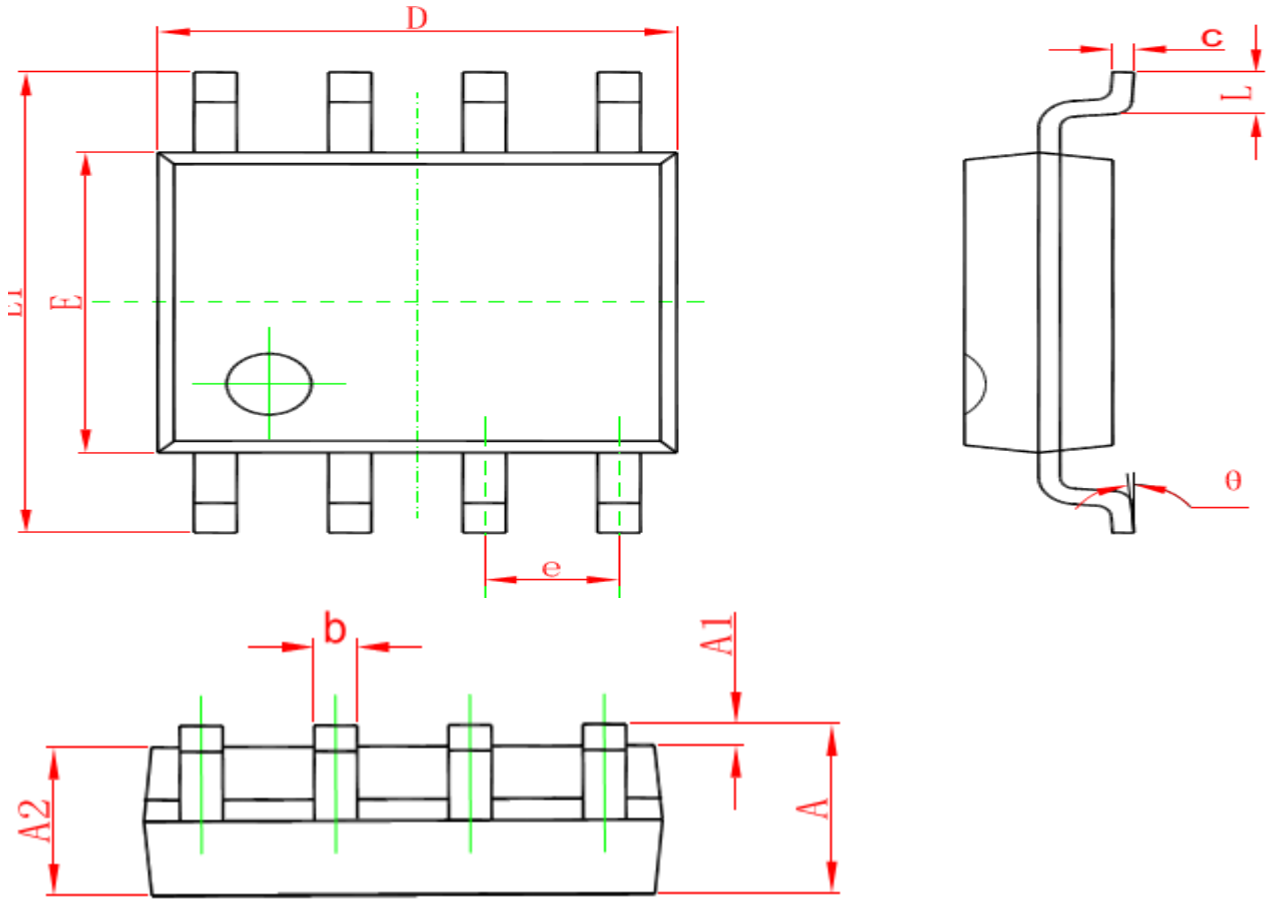
$$F_S = \frac{V_{IN}}{V_{OUT} * T_{OFF}}$$

MOS Selection

The MOS withstand voltage requires more than 1.5 times the maximum output voltage. And the MOS should be selected according to the LED current and maximum peak inductor current, the maximum I_{DS} should be more than 2 times the maximum peak inductor current. In addition, chip operating voltage determines the DRV drive voltage, typical chip drive voltage is 5V, it should ensure that the MOS conduction resistance is low enough.

Package Information

Physical Dimensions for SOP8 Package:



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	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
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

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