Boost LED DRIVER QX5305

General Description

The QX5305 is a high efficient boost type LED driver IC.

The QX5305 uses fixed off-time control scheme and 2MHz switching frequency can be achieved. The off-time can be set by an external capacitor and resistor.

The LED current can be set by an exteranal resistor.

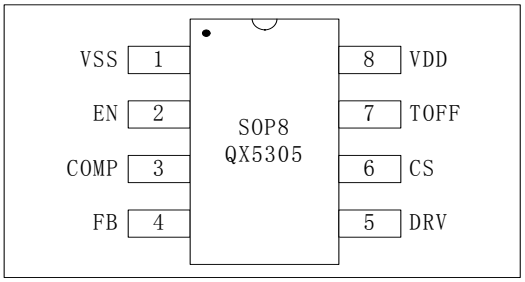
Applications

- **LED driving**

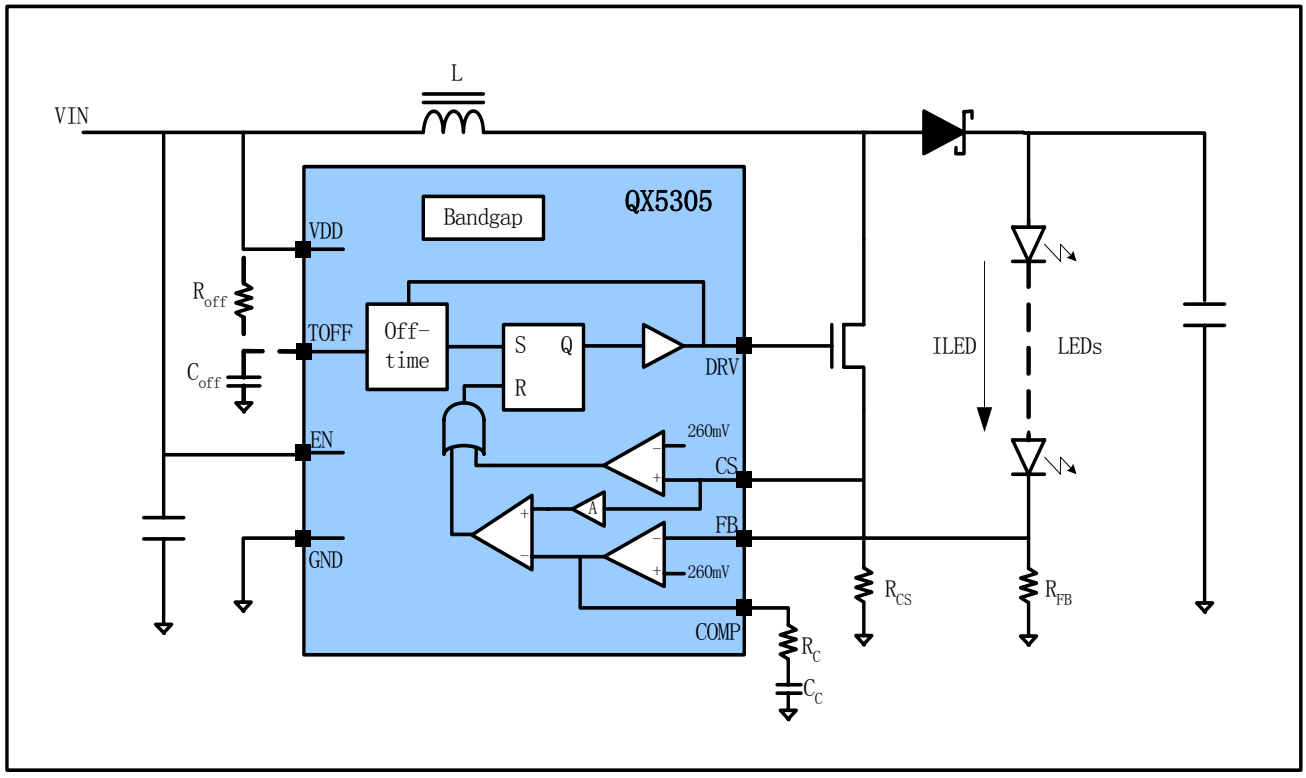
Features

- Wide LED current range: 5mA to 2A
- Wide input voltage range: >2.5V
- Up to 90% efficiency
- Up to 2MHz switching frequency

Package



Block Diagram



Pin Assignment

Pin No.	Pin Name	Description
1	VSS	Ground
2	EN	Chip Enable
3	COMP	Compensation
4	FB	Voltage feedback
5	DRV	Driver
6	CS	Current sensing
7	TOFF	Off time selection
8	VDD	Power supply (2V-6.5V)

Absolute Maximum Ratings

Type	**Symbol**	**Description**	**Value**	**Unit**
Voltage	Vmax	Maximum voltage on VDD pins	8	V
	Vmin-max	Voltage range on EN, CS and FB pins	-0.3-VDD+0.3	V
Thermal	Tmin-max	Operation temperature range	-20-85	^{o}C
	Tstorage	Storage temperature range	-40-165	^{o}C
ESD	VESD	ESD voltage for human body model	2000	V

Electronic Characteristics

Parameter	**Symbol**	**Test Condition**	**Min**	**Typ**	**Max**	**Unit**
Power supply	VDD		2.5		6.5	V
CS pin feedback voltage	V_{CS}		250	260	270	mV
FB pin feedback voltage	V_{FB}		250	260	270	mV
Operation current	IDD			0.5	1	mA
Off time (without R_{OFF} and C_{OFF})	T_{OFF0}			640		ns

Standby current	IDDQ				1	uA
EN pin high level voltage	V_{ENH}		2.0			V
EN pin low level voltage	V_{ENL}				0.8	V
DRV Rising Time	T_{RISE}	500pF cap on DRV pin			50	ns
DRV Falling Time	T_{FALL}	500pF cap on DRV pin			50	ns

Detail Description

The QX5305 works in two states:

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

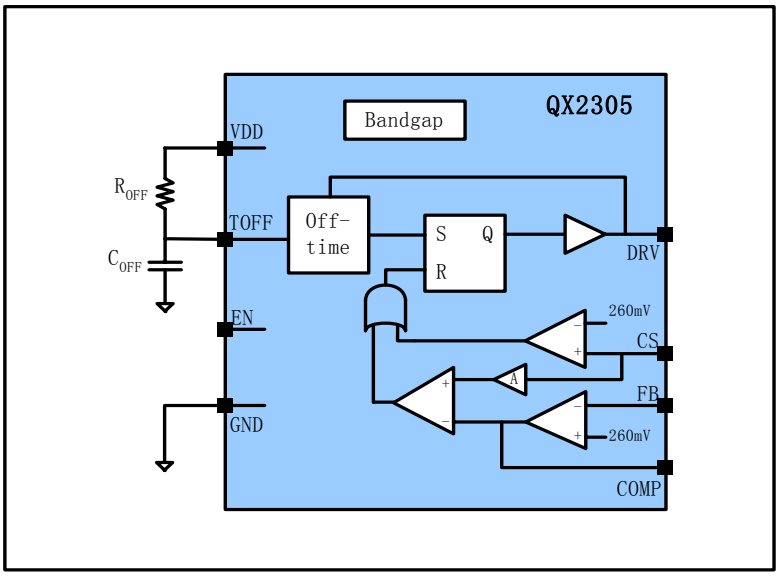
Fixed Off-Time

The fixed off time T_{OFF} is determined by R_{OFF} and C_{OFF} as:

$$T_{OFF} = 0.51 \bullet \frac{100K\Omega \bullet R_{OFF}}{R_{OFF} + 100K\Omega} \bullet (C_{OFF} + 12pF)$$

If TOFF pin is left open, the typical value of T_{OFF} is:

$$T_{OFF} = 612ns$$



The T_{OFF} can be reduced by adding R_{OFF} and be increased by adding C_{OFF}.

It 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 one connected to FB is used for voltage feedback.

Setting LED Current

The LED current is set by the external resistor R_{FB}:

$$ILED=260mV/R_{FB}$$

Compensation

The output (COMP) of the transconductance error amplifier is used to compensate the regulator control loop. The system uses two poles and one zero to stabilize the loop.

$$f_{p1}=\frac{1}{\pi\times R_{LOAD}\times C_{OUT}}$$

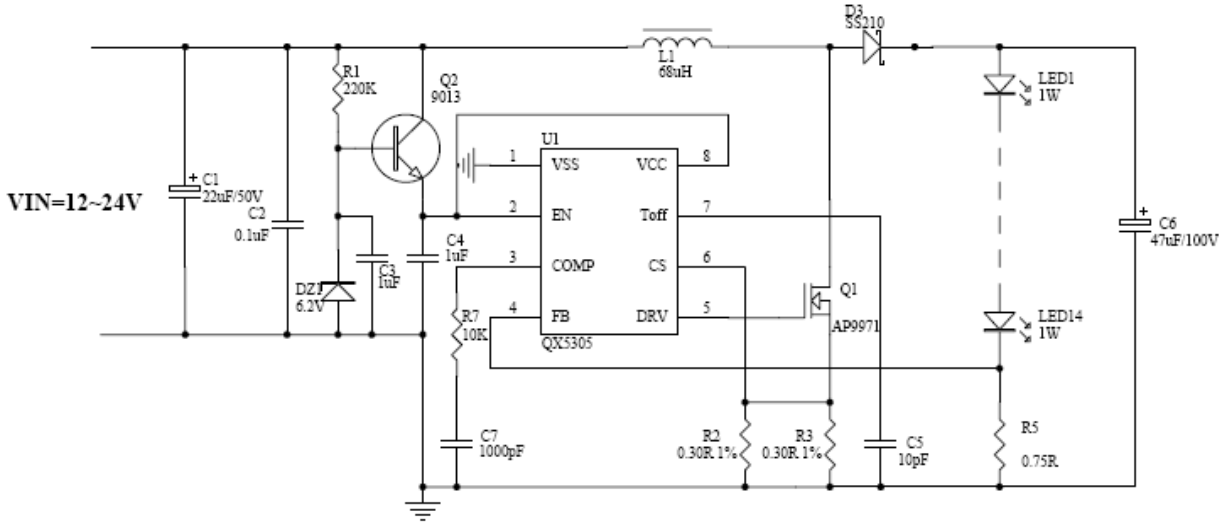
$$f_{p2}=\frac{G_{EA}}{2\times\pi\times C_C\times A_{VEA}}$$

$$f_{z1}=\frac{1}{2\times\pi\times C_C\times R_C}$$

$$AVDC=\frac{1.5\times A_{VEA}\times VIN\times R_{LOAD}\times V_{FB}}{VOUT^2}$$

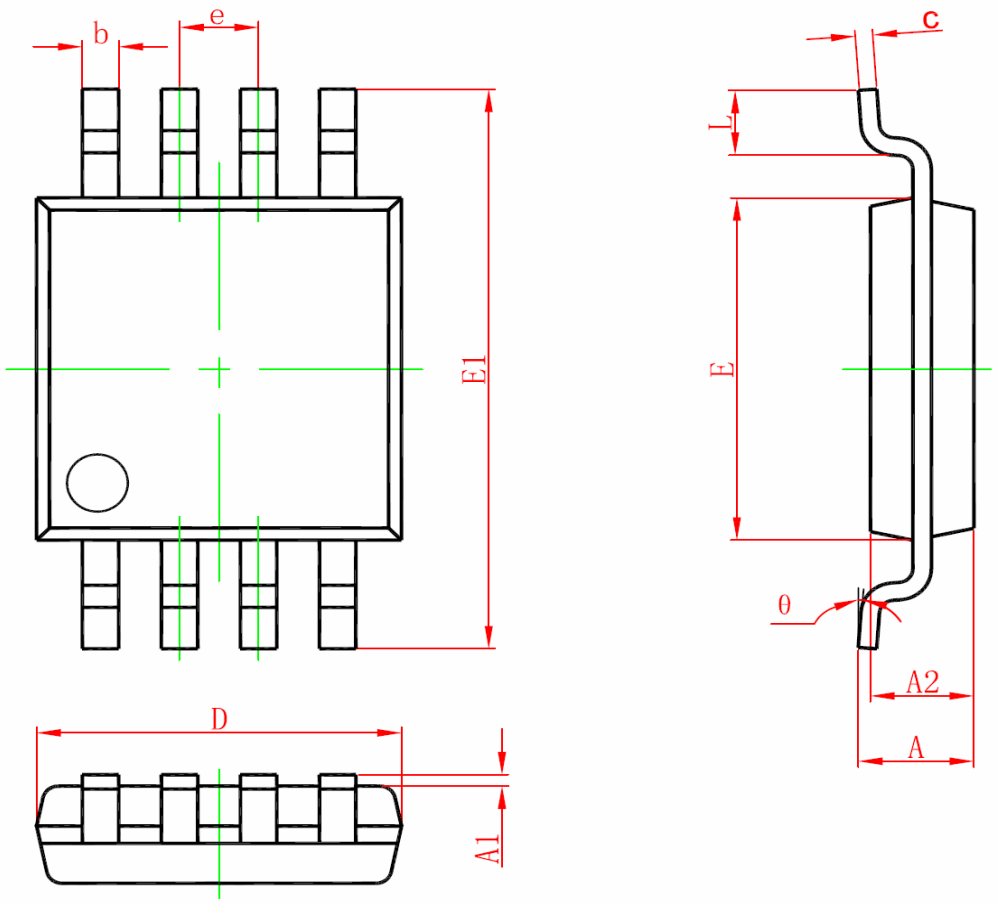
Where, A_{VEA}=200V/V and G_{EA}=30uV/A.

Typical Application



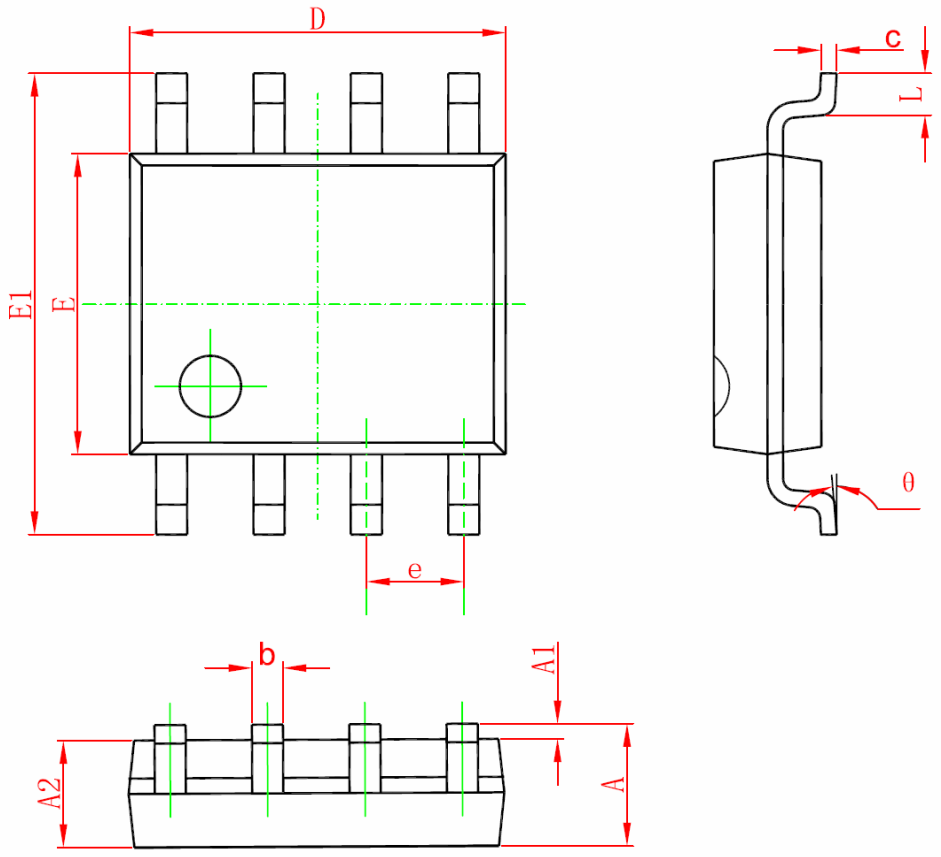
Package Information

MSOP8 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
e	0.650(BSC)		0.026(BSC)	
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

SOP8 PACKAGE OUTLINE DIMENSIONS



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°