

# Switching Type LED Driver QX9910

## General Description

The QX9910 is a high efficient LED driver control IC. It is a universal control LED driver and can be configured to operate as a step-up, step-down and step-up/step-down LED driver. The input and output voltage can be extended beyond 450V.

The QX9910 uses a fixed off time and 2MHz switching frequency can be achieved. The minimum off time can be set by an external capacitor and resistor.

The LED current is programmable and is set from 20mA to 2.0A by an external resistor.

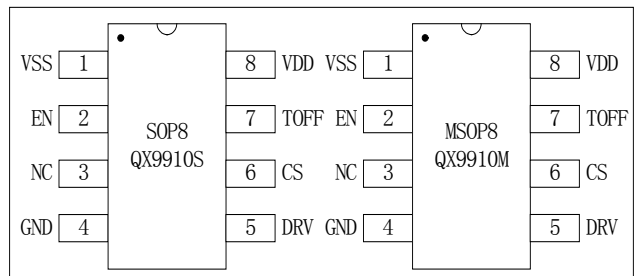
## Applications

- LED driver application

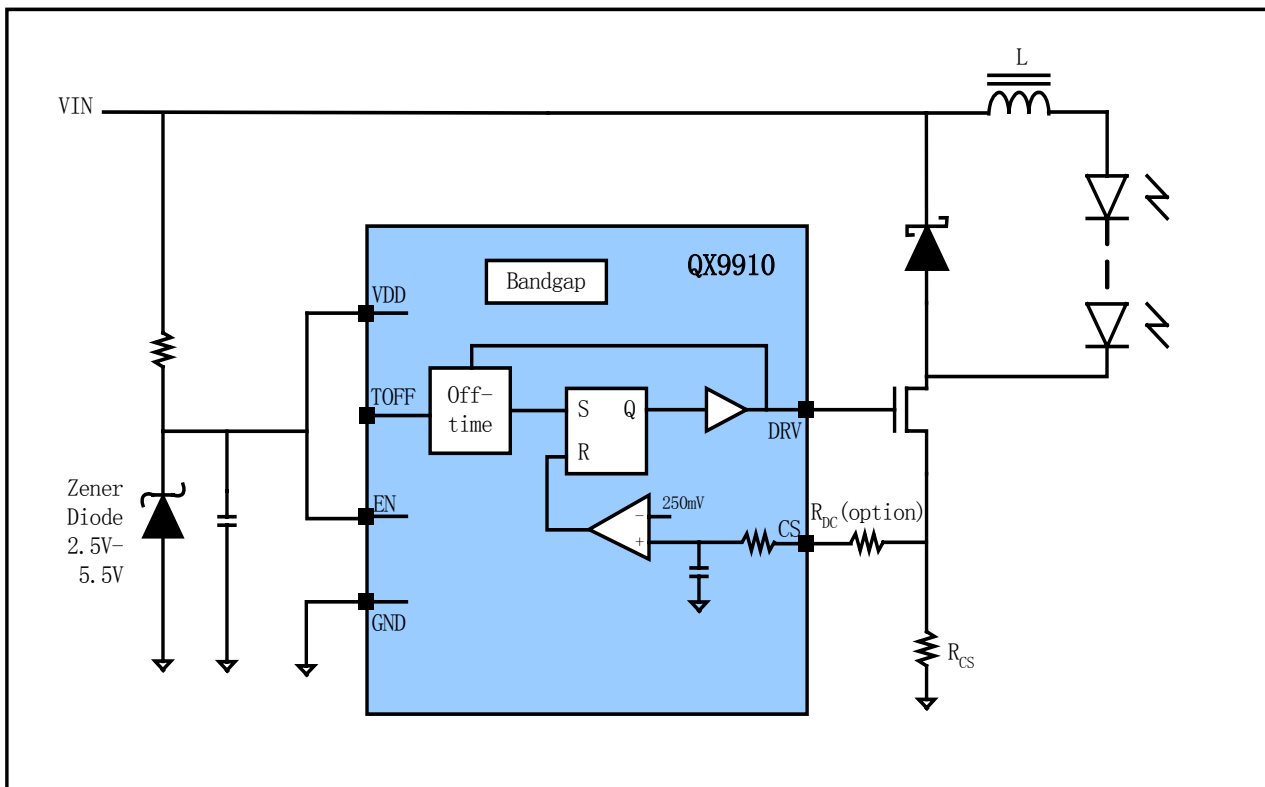
## Features

- Constant current LED driver: 20mA to 2A programmable
- Step-up, step-down, step-up/step-down operation
- >90 efficiency
- Input and output voltage: 2.5V to 450V
- Up to 2MHz switching frequency

## Package



## Block Diagram



## Pin Assignment

Pin No.	Pin Name	Description
1	VSS	Ground
2	EN	Chip Enable
3	NC	No connection
4	GND	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
<b>Voltage</b>	Vmax	Maximum voltage on VDD pins	8	V
	Vmin-max	Voltage range on EN, CS and FB pins	-0.3-VDD+0.3	V
<b>Thermal</b>	Tmin-max	Operation temperature range	-20-85	°C
	Tstorage	Storage temperature range	-40-165	°C
<b>ESD</b>	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 <sub>CS</sub>		240	250	260	mV
Operation current	IDD			0.5	1	mA
Off time (without R <sub>OFF</sub> and C <sub>OFF</sub> )	T <sub>OFF0</sub>			620		ns
Standby current	IDDQ				1	uA
EN pin high level voltage	V <sub>ENH</sub>		2.0			V
EN pin low level voltage	V <sub>ENL</sub>				0.8	V
DRV Rising Time	T <sub>RISE</sub>	500pF cap on DRV pin			50	ns
DRV Falling Time	T <sub>FALL</sub>	500pF cap on DRV pin			50	ns

**Detail Description**

**Peak Current Detect and Fixed Off-Time Control**

The QX9910 uses peak current detect and fixed off-time control scheme. The circuit works in two states:

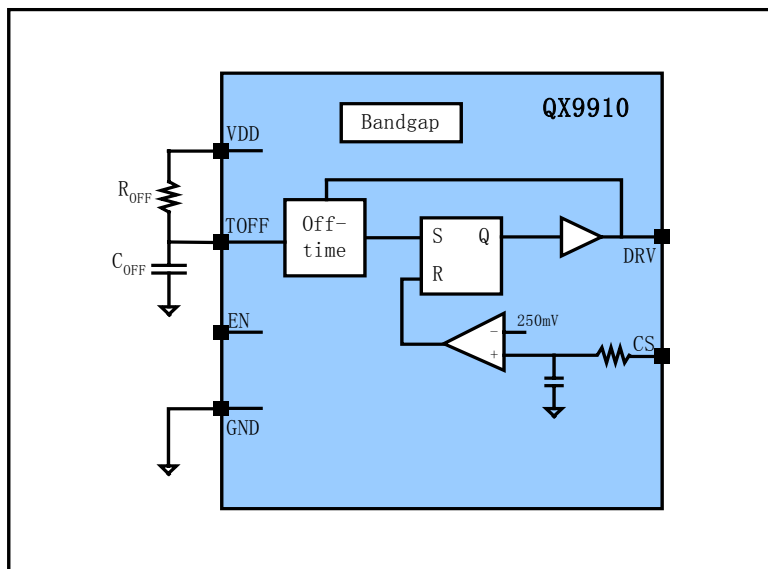
- ON State: The switch is on and the inductor L is charged until the inductor current reaches the peak current:  $250\text{mV}/R_{CS}$ , the circuit goes to OFF state.
- OFF State: The switch remains off until a fixed off time determined by  $R_{OFF}$  and  $C_{OFF}$  as discussed below.

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

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

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

$$T_{OFF} = 612\text{ns}$$



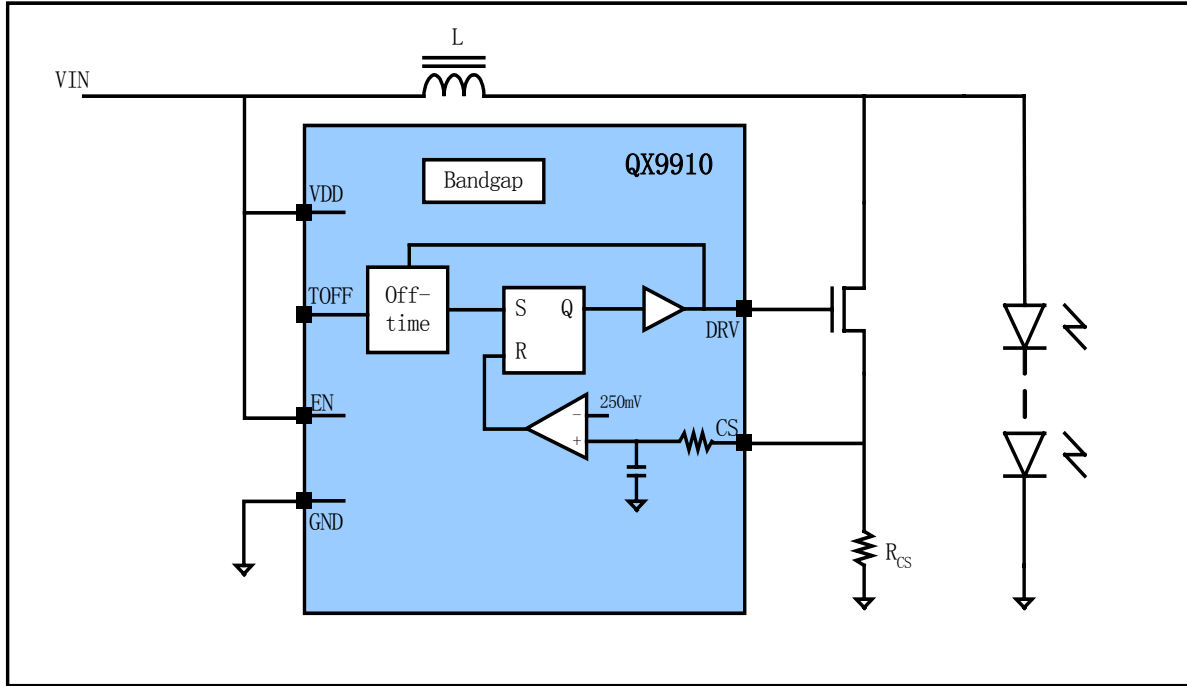
The  $T_{OFF}$  can be reduced by adding  $R_{OFF}$  and be increased by adding  $C_{OFF}$ .

**Typical Applications**

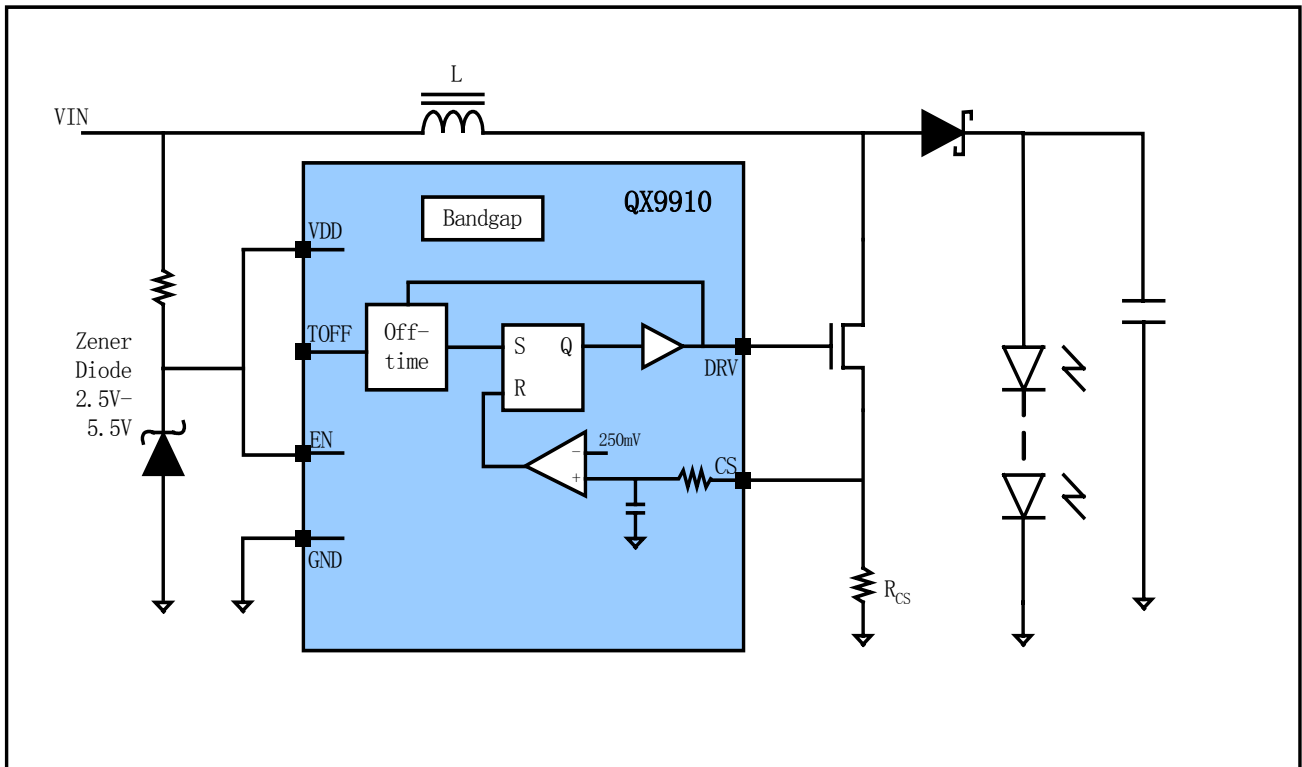
**Step-Down LED Driver**

The step-down LED driver application is shown in the block diagram.

**Step-Up LED Driver Without Schottky Diode**

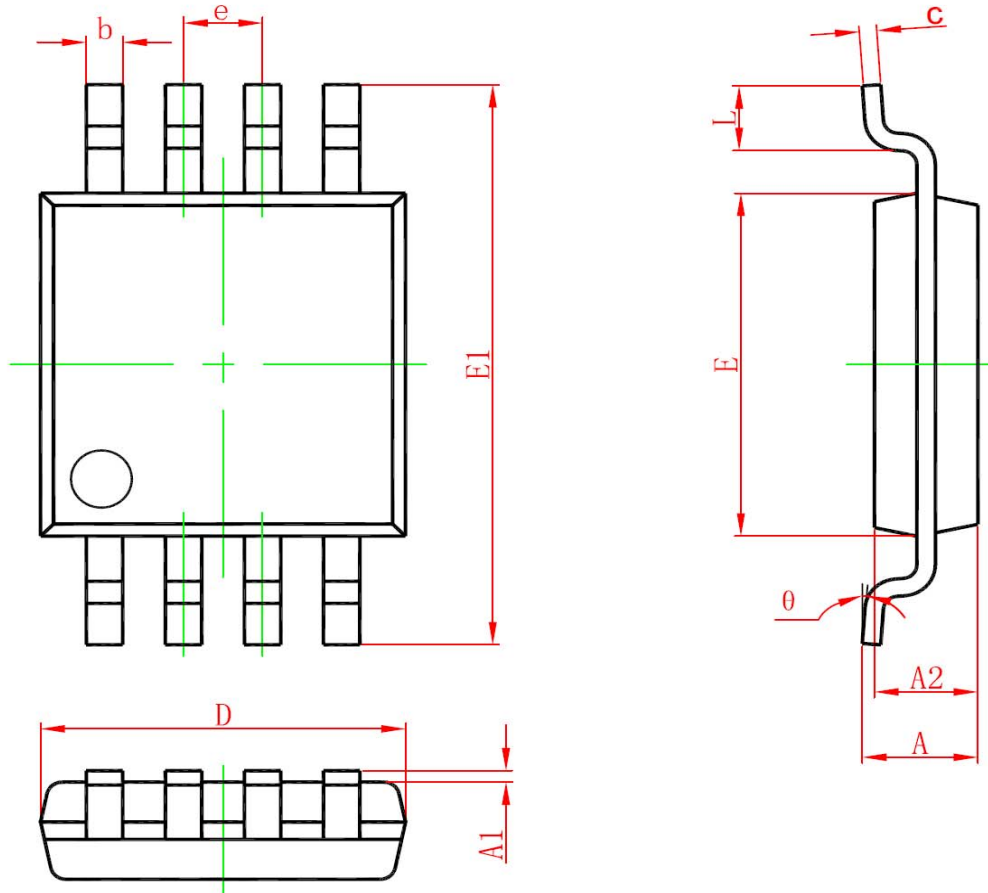


**Step-Up LED Driver With Schottky Diode**



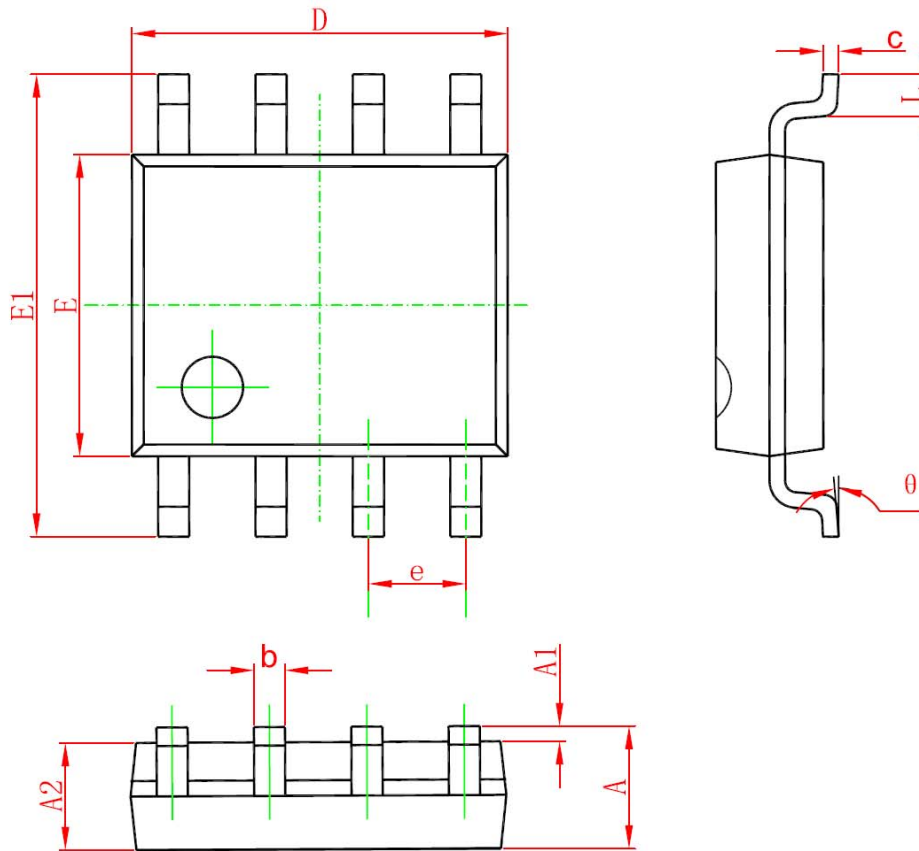
**Package Information**

**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°