Tiny Package Low Dropout Current Source

■ General Description

The LN9310 low-dropout bias supply for white LEDs is a high-performance alternative to the simple ballast resistors used in conventional white LED designs. The LN9310 uses a internal resistor to set the bias current for six LEDs, which are matched to 3%. The LN9310's advantages over ballast resistors include much lower bias variation with supply voltage variation, significantly lower dropout voltage, and in some applications, significantly improved efficiency. The LN9310 requires a 60mV dropout at a 20mA load on each output to match the LED brightness.

The LN9310 is suitable for single cell Li-ion battery power device that using low forward voltage white LEDs. The white LEDs can be powered directly from battery without extra external components. This takes an advantage of highest efficiency and creates no EMI problem.

■ Applications

- Next-Generation wireless handsets
- PDAs, palmtops and handy terminals
- Digital cameras and camcorders
- Battery-Powered equipment

■ Features

- Ultra low 60mV dropout at 20mA
- 3% High accuracy current matching
- 20mA full scale current
- PWM brightness control
- 2.5V to 5.5V supply voltage range
- Thermal shutdown protection
- Under-voltage protection

■ Package

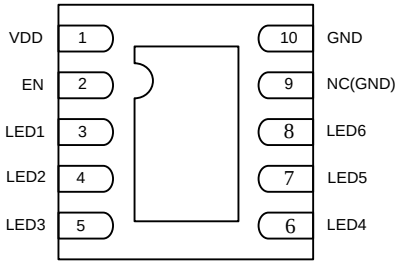
- DFN3×3-10
- QFN3×3-16

■ Ordering Information

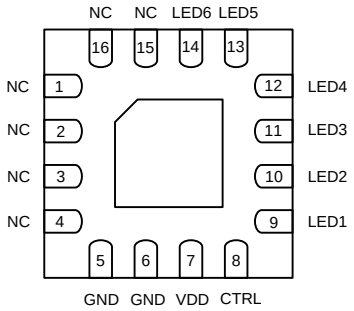
LN9310 ①②③ **(Eg:** LN9310SRG**)**

Item	Symbol	Function
①	S	Denotes Package Type: DFN3×3-10
	D	Denotes Package Type: QFN3×3-16
②	R	Embossed Tape :Standard Feed
	L	Embossed Tape :Reverse Feed
③	N	Normal package
	P	Pb Free package
	G	Green package

■ Pin Assignment



DFN3*3-10

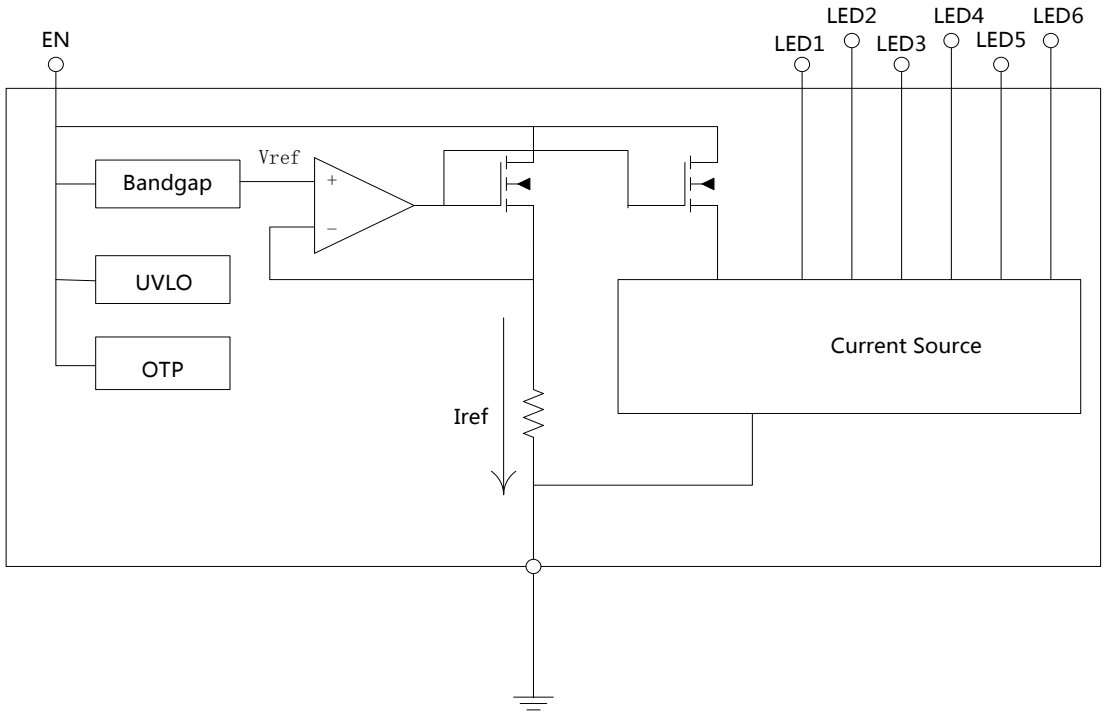


QFN3*3-16

■ Pin Function Description

Pin Number		Pin Name	Function
DFN3*3-10	QFN3*3-16		
1	7	VDD	Power Supply
2	—	EN	Control pin, can input PWM or pulse signal
3	9	LED1	LED1 bias current input.
4	10	LED2	LED2 bias current input.
5	11	LED3	LED3 bias current input.
6	12	LED4	LED4 bias current input.
7	13	LED5	LED5 bias current input.
8	14	LED6	LED6 bias current input.
9	1、2、3、4 15、16	NC	Not Connect
10	5、6	GND	Ground

■ Function Block Diagram



■ Absolute Maximum Ratings

(Ta=25°C)

Item	Symbol		Absolute maximum ratings	Unit
VIN to GND	V_{IN}		GND-0.3～7	V
EN to GND	V_{EN}		GND-0.3～VDD+0.3	V
Power Dissipation	P_D	DFN3×3-10	1000	mW
		QFN3×3-16	1000	mW
Operating Temperature range	Topr		-40～＋85	℃
Storage Temperature range	Tstg		-65～＋150	
Lead Temperature (Soldering, 10 sec.)	Tlead		260	

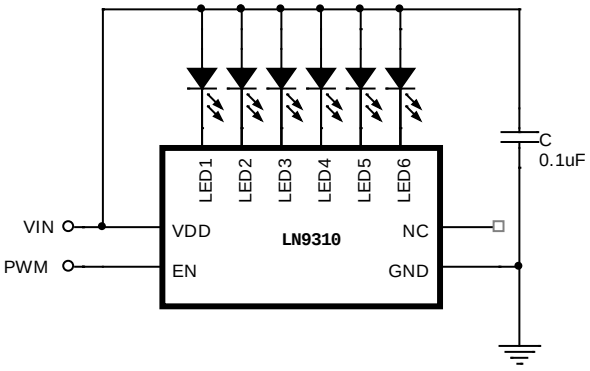
Caution: The absolute maximum ratings are rated values exceeding which the product could suffer physical damage. These values must therefore not be exceeded under any conditions.

■ Electrical Characteristics

VIN= 3.7V (Ta=25℃, unless otherwise noted)

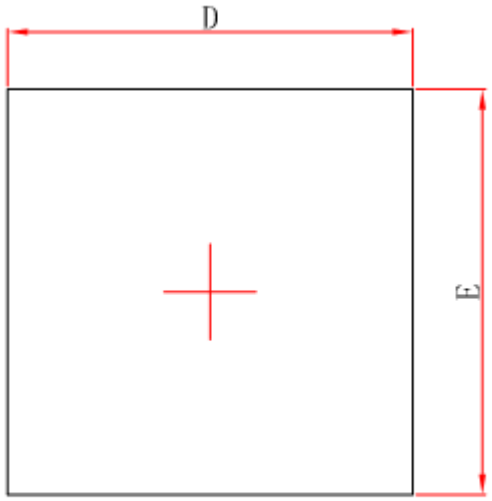
Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Units
Input supply voltage	V_{DD}		2.5		5.5	V
Undervoltage lockout threshold	V_{UVLO}		-	2.1	-	V
UVLO hysteresis			-	100	-	V
Shutdown current	I_{SHDN}	EN<0.4V	-	-	1	μA
Quiescent current	I_Q	Iout=0mA	-	450	-	μA
initial current	I_{LED}		18	20	22	mA
LED pin voltage dropout	$V_{LED-DROP}$	VLED(DROP), 90% Max ILED	-	60	-	mV
Current matching				3	5	%
Thermal shutdown threshold				160		℃
Thermal shutdown hysteresis				10		℃
EN Pin input voltage high	V_{IH}	V_{EN}>V_{IH},ON	2.5	-	-	V
EN Pin input voltage low	V_{IL}	V_{EN}<V_{IL}, OFF	--	--	0.7	V

■ Typical Application Circuit

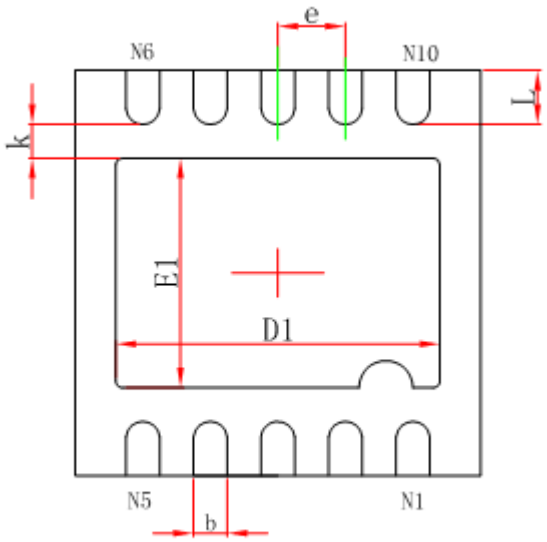


■ Package Information

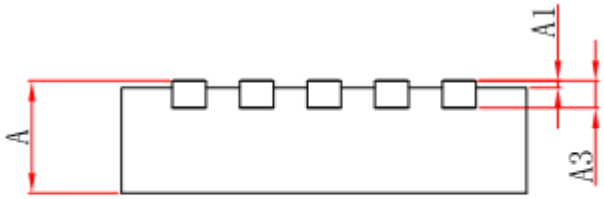
- **DFN3×3-10**



Top View



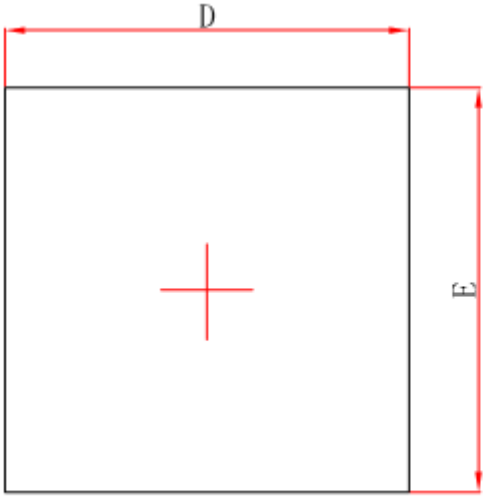
Bottom View



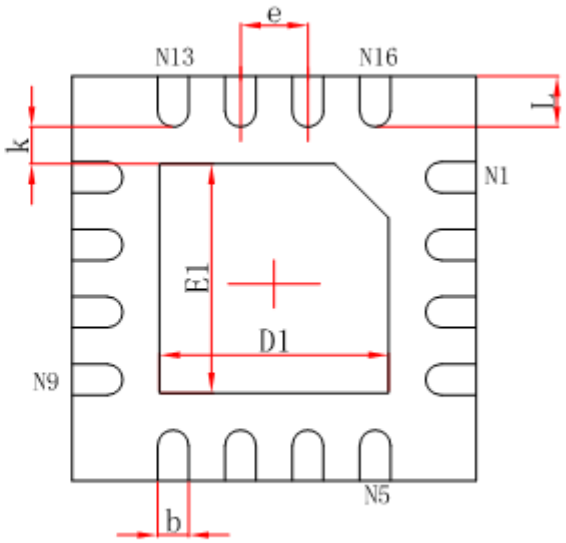
Side View

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
D1	2.300	2.500	0.091	0.098
E1	1.600	1.800	0.063	0.071
k	0.200MIN.		0.008MIN.	
b	0.180	0.300	0.007	0.012
e	0.500TYP.		0.020TYP.	
L	0.300	0.500	0.012	0.020

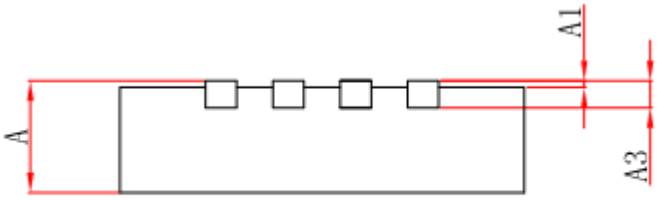
- **QFN3×3-16**



Top View



Bottom View



Side View

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
D1	1.600	1.800	0.063	0.071
E1	1.600	1.800	0.063	0.071
k	0.200MIN.		0.008MIN.	
b	0.180	0.300	0.007	0.012
e	0.500TYP.		0.020TYP.	
L	0.300	0.500	0.012	0.020