

## Step-up DC/DC Converter —Backlight Driver

### General Description

The LN5121 Series is a fixed frequency, constant current step-up DC/DC converter ideal for driving LEDs used in backlighting applications on cellular phones, PDAs and digital cameras etc. Output voltage of up to 15V can be derived, and from a 2.5V input three white Led's cab be driven in series. Luminance of the LED's is controlled by changing the duty cycle of a PWM signal applied to the CE pin.

In addition, an internal MOSFET with an RDS-on of 2Ω is used. Allow profile and small board are solutions can be achieved by using a chip coil and an ultra small ceramic output capacitor (CL) of 0.22uF.

### Features

- Input voltage range : 2.5V—6V
- Output voltage range : up to 15V externally set-up reference voltage 0.2V
- Oscillation frequency : 1.0MHZ±20%
- On resistance : 2.0Ω
- Efficiency : 88%(When driving 3 white LEDs in series VIN=3.6V ILED=20mA)
- Control : PWM control
- Stand-by Current : ISTB=1.0uA(MAX)
- Load capacitor: 0.22uF,ceramic
- Lx limit Current : 300mA

### Ordering Information

LN5121 ①②③④⑤⑥

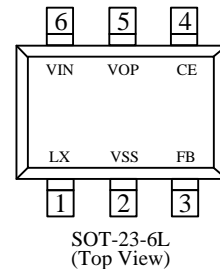
Item	Symbol	Function
①	B	Denotes Lx Overvoltage Limit: Yes Denotes Oscillation Frequency:1MHZ
②③④	010-149	Denotes FB Voltage e.g: ②=1 ③=2 ④=3 → 1.23V
⑤	M	Denotes Package Type : SOT-23-6
⑥	R	Embossed Tape :Standard Feed
	L	Embossed Tape :Reverse Feed

### Applications

- For White LED Drivers
- Mobil phones, PHS
- PDAs
- Digital still cameras

### Package

- SOT-23-6L



## Typical Application Circuit

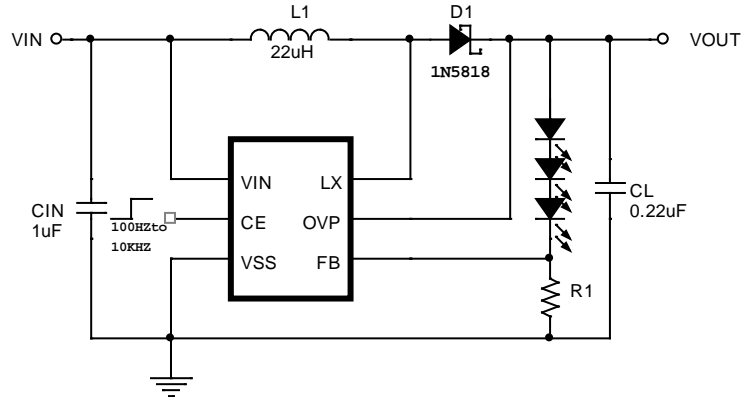


Figure 1. Application For Driving 3 Series WLEDs

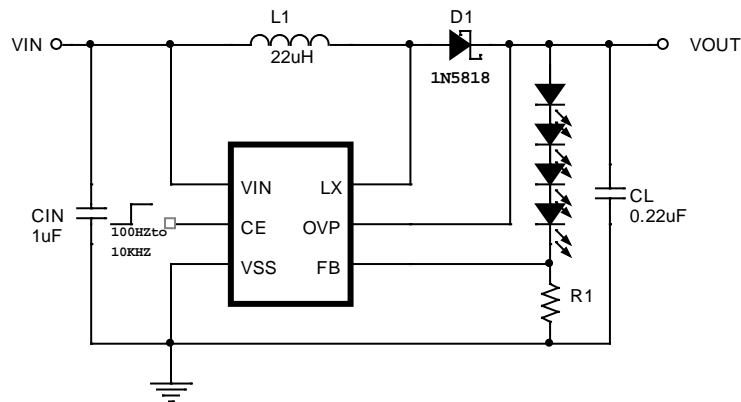
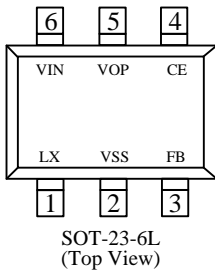


Figure 2. Application For Driving 4 Series WLEDs

**Caution:** The value of the resistance named RLED:  $RLED = VFB / ILED$ ; VFB is the voltage of the FB pin; ILED is the current of LED and equal to 20mA usually.

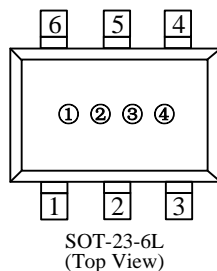
## Functional Pin Description



Pin Number	Pin Name	Function
1	LX	SWITCH
2	VSS	Ground
3	FB	Voltage Feedback
4	CE	Chip Enable
5	OVP	Over voltage protect
6	VIN	Power Input

## ■ Marking Rule

- SOT-23-6L



① Represents the product name

Symbol	Part Number
Z	LN5121****M*

② Represents the type of regulator

Symbol	Vfb(V)	Part Number
S	0.050-0.195	LN5121B****M*
L	0.20-0.49	LN5121B****M*
H	1.20-1.49	LN5121B****M*

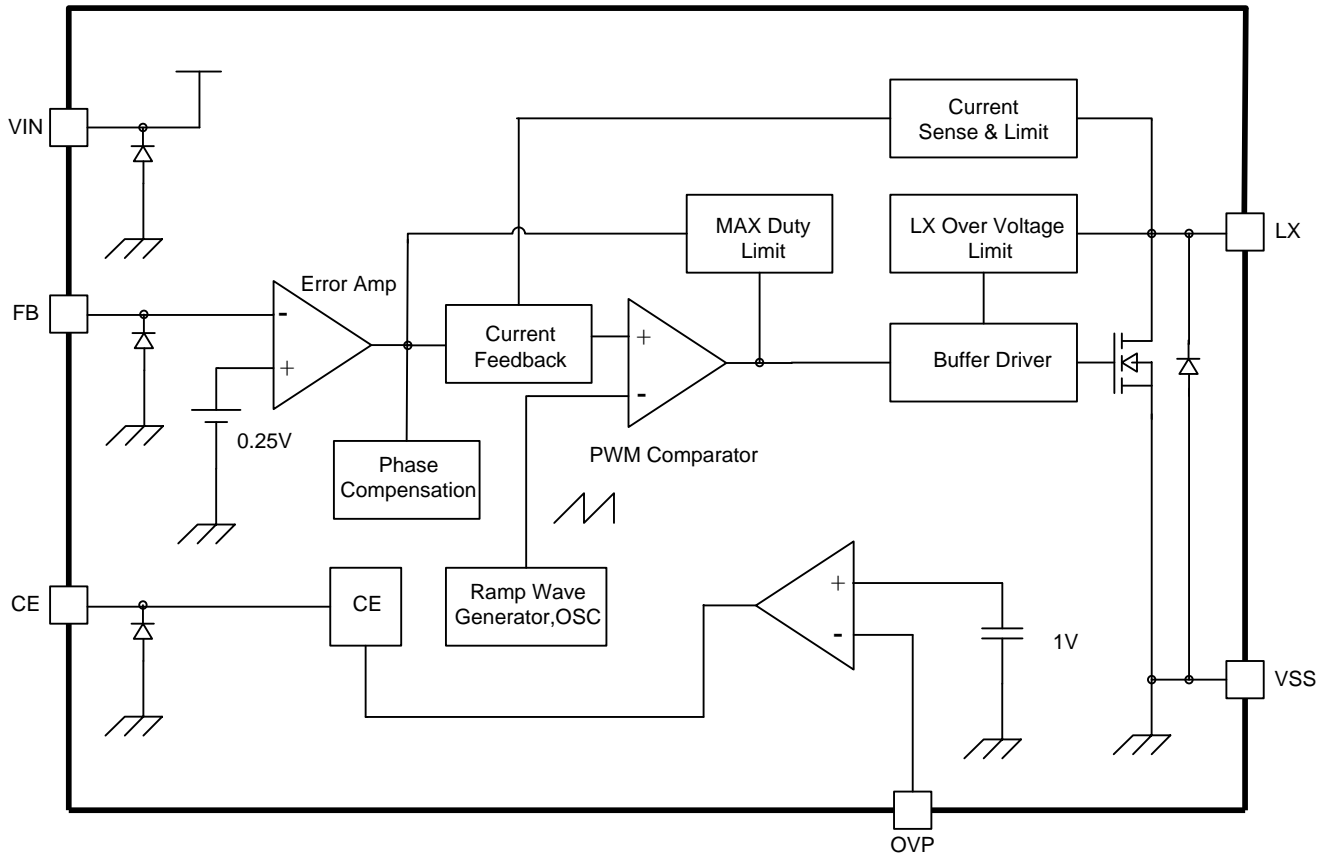
③ Represents the voltage of FB pin

Symbol	Vfb(V)			Symbol	Vfb(V)		
0	0.20	0.050	1.20	F	0.35	0.125	1.35
1	0.21	0.055	1.21	H	0.36	0.130	1.36
2	0.22	0.060	1.22	K	0.37	0.135	1.37
3	0.23	0.065	1.23	L	0.38	0.140	1.38
4	0.24	0.070	1.24	M	0.39	0.145	1.39
5	0.25	0.075	1.25	N	0.40	0.150	1.40
6	0.26	0.080	1.26	P	0.41	0.155	1.41
7	0.27	0.085	1.27	R	0.42	0.160	1.42
8	0.28	0.090	1.28	S	0.43	0.165	1.43
9	0.29	0.095	1.29	T	0.44	0.170	1.44
A	0.30	0.100	1.30	U	0.45	0.175	1.45
B	0.31	0.105	1.31	V	0.46	0.180	1.46
C	0.32	0.110	1.32	X	0.47	0.185	1.47
D	0.33	0.115	1.33	Y	0.48	0.190	1.48
E	0.34	0.120	1.34	Z	0.49	0.195	1.49

④ Represents the assembly lot No.

0-9, A-Z; 0-9, A-Z mirror writing, repeated (G, I, J, O, Q, W exception)

## Function Block Diagram



## Absolute Maximum Ratings

Item	Symbol	Absolute Maximum Ratings	Unit	
VIN Pin Voltage	$V_{IN}$	$V_{SS}-0.3 \sim V_{SS}+7$	V	
OUT Pin Voltage	$V_{OUT}$	$V_{SS}-0.3 \sim V_{SS}+15$		
LX Pin Voltage	$V_{LX}$	$V_{SS}-0.3 \sim V_{SS}+15$		
FB Pin Voltage	$V_{FB}$	$V_{SS}-0.3 \sim V_{SS}+7$	V	
CE Pin Voltage	$V_{CE}$	$V_{SS}-0.3 \sim V_{SS}+7$	V	
OVP Pin Voltage	$V_{ovp}$	$V_{SS}-0.3 \sim V_{SS}+15$	V	
LX Pin Current	$I_{LX}$	1000	mA	
Power Dissipation	$P_D$	SOT-23-6L	250	mW
Operating Temperature range	$T_{opr}$	-40 ~ +85	°C	
Storage Temperature range	$T_{stg}$	-55 ~ +125		

**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**

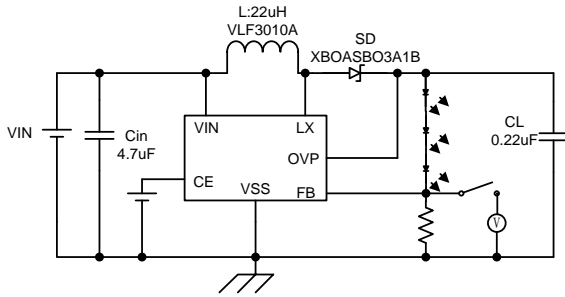
(Ta=25°C, unless otherwise noted)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Circuits
FB Control Voltage (*1)	V <sub>FB</sub>	-	0.225	0.250	0.275	V	1
Output Voltage range	V <sub>OUT</sub>	-	V <sub>IN</sub>	-	15		
Lx Operating Voltage range	V <sub>LX</sub>		-	-	15		
Operating Voltage range	V <sub>IN</sub>		2.5	-	6		
Stand-by Current	I <sub>STB</sub>	V <sub>CE</sub> =0V、V <sub>LX</sub> =5V	—		1	μA	3
Supply Current 1	I <sub>DD1</sub>			550		μA	2
Supply Current 2	I <sub>DD2</sub>	V <sub>IN</sub> =V <sub>LX</sub> 、V <sub>FB</sub> =0.4V	—	65			3
Oscillation Frequency	F <sub>OSC</sub>		0.8	1.0	1.2	MHz	2
Maximum Duty Cycle	M <sub>AXDTY</sub>	V <sub>CONT</sub> =0.4V	86	92	98	%	2
Efficiency	EFFI	V <sub>IN</sub> =3.6V;R <sub>LED</sub> =20Ω	—	88	—	%	1
Current Limit	I <sub>LIM</sub>	V <sub>IN</sub> =3.6		300		mA	4
OVP Overvoltage Limit	O <sub>VPVL</sub>			15		V	2
LX On Resistance		V <sub>IN</sub> =3.6V、V <sub>LX</sub> =0.4V		2.0		Ω	2
LX Leak Current	I <sub>LXL</sub>			0	1	μA	3
CE 'H' Voltage	V <sub>CEH</sub>		0.65			V	2
CE 'L' Voltage	V <sub>CEL</sub>				0.2	V	2
CE 'H' Current	I <sub>CEH</sub>	V <sub>IN</sub> =V <sub>LX</sub> 、V <sub>FB</sub> =0.4V			0.1	μA	3
CE 'L' Current	I <sub>CEL</sub>	V <sub>IN</sub> =V <sub>LX</sub> 、V <sub>FB</sub> =0.4V			-0.1	μA	3
FB 'H' Current	I <sub>CEH</sub>	V <sub>IN</sub> =V <sub>LX</sub> 、V <sub>FB</sub> =0.4V			0.1	μA	3
FB 'L' Current	I <sub>CEL</sub>	V <sub>IN</sub> =V <sub>LX</sub> 、V <sub>FB</sub> =0.4V			-0.1	μA	3

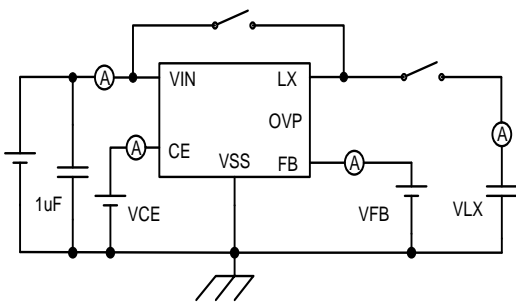
 (\*1) V<sub>f</sub> may take between 0.01V-1.49V certain value, now a major center value 0.01V, 0.2V,0.23V,0.25V;

■ Test Circuits

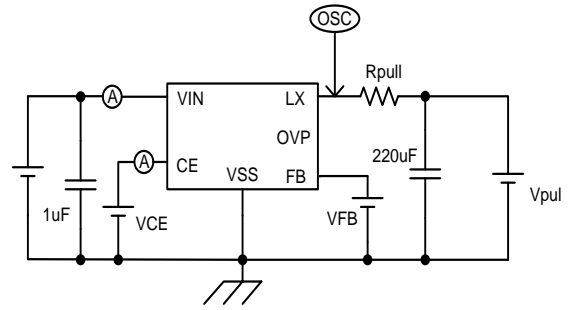
Circuit 1



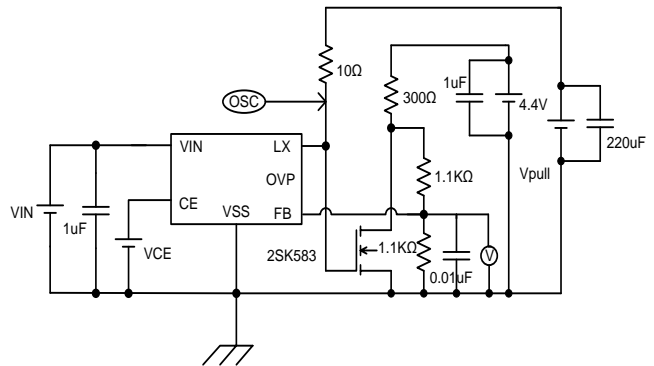
Circuit 3



Circuit 2



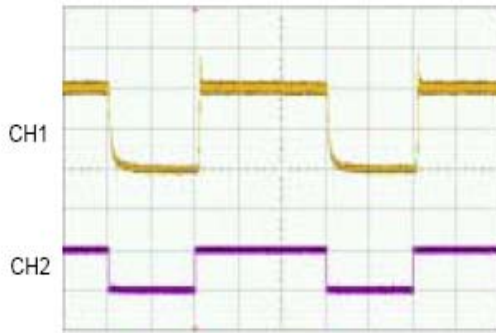
Circuit 4



**Caution** The value of the resistance named RLED:  $R_{LED} = V_{FB} / I_{LED}$ ;  $V_{FB}$  is the voltage of the FB pin;  $I_{LED}$  is the current of LED and equal to 20mA usually.

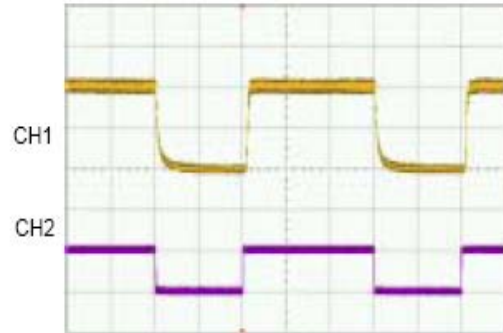
## Typical Performance Characteristics

1kHz, 3 series LED, ILED = 20mA



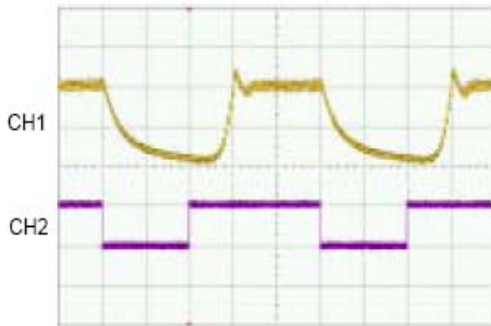
200µsec / div  
CH1 : FB, 100mV / div, CH2 : CE, 1V / div

1kHz, 3 series LED, ILED = 20mA



200µsec / div  
CH1 : FB, 100mV / div, CH2 : CE, 1V / div

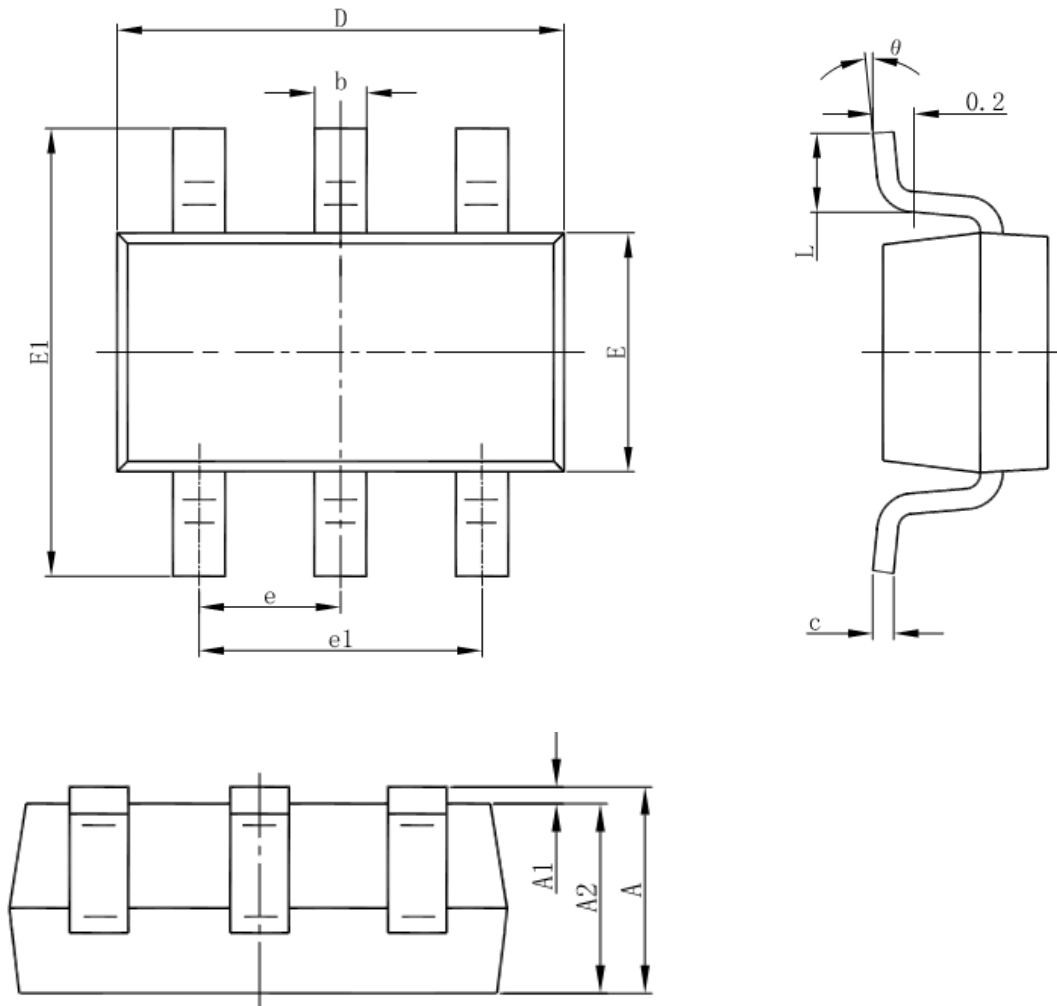
10kHz, 3 series LED, ILED = 20mA



20µsec / div  
CH1 : FB, 100mV / div, CH2 : CE, 1V / div

Package Information

- SOT-23-6L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°