

PWM/PFM Automatic Controlled DC-DC Converters—Backlight Driver

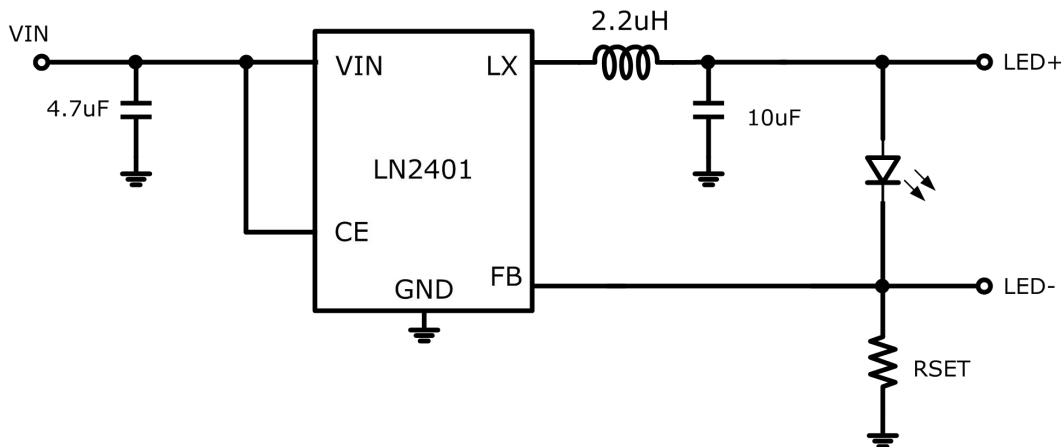
General Description

LN2401 series is a group of high efficiency synchronous-rectification type buck regulator using a constant frequency, current mode architecture. Automatic PWM/PFM mode operation increases efficiency and decreases output voltage ripple at light loads, further extending battery life. Switching frequency is internally set at 1.4MHz, allowing the use of small surface mount inductors and capacitors. 100% duty cycle provides low dropout operation.

Features

- Output Current : 800mA
- Shutdown Current : <math><1\mu\text{A}</math>
- Oscillation Frequency : 1.4MHz

Typical Application Circuit



Note: $I_{LED} = 100\text{mV}/R_{SET}$

Functional Pin Description

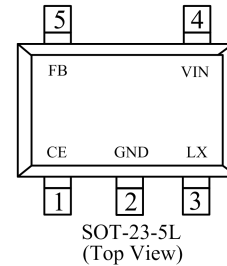
Pin Number	Pin Name	Function
1	CE	Chip Enable Pin
2	GND	Common Ground
3	LX	Switching Output
4	VIN	Power Input
5	FB	Feedback Voltage Pin

Applications

- LED driver

Package

- SOT-23-5L



Ordering Information

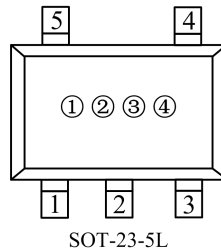
LN2401 ①②③

Designator	Symbol	Description
①	A	$V_{FB}=0.1V$
②	M	Package Types: SOT-23-5L
③	R	Embossed Tape : Standard Feed
	S	Embossed Tape : Reverse Feed

For example: LN2401AMR is defined as LN2401, the feedback voltage is 0.1V, the oscillator frequency of 1.4MHz, Package SOT-23-5L, Reverse Feed.

Marking Rule

● SOT-23-5L



① Represents the product name

Designator	Symbol	Product Name
①	3	LN2401◆◆◆

② Represents the feedback voltage

Designator	Symbol	Description
②	A	$V_{FB}=0.1V$

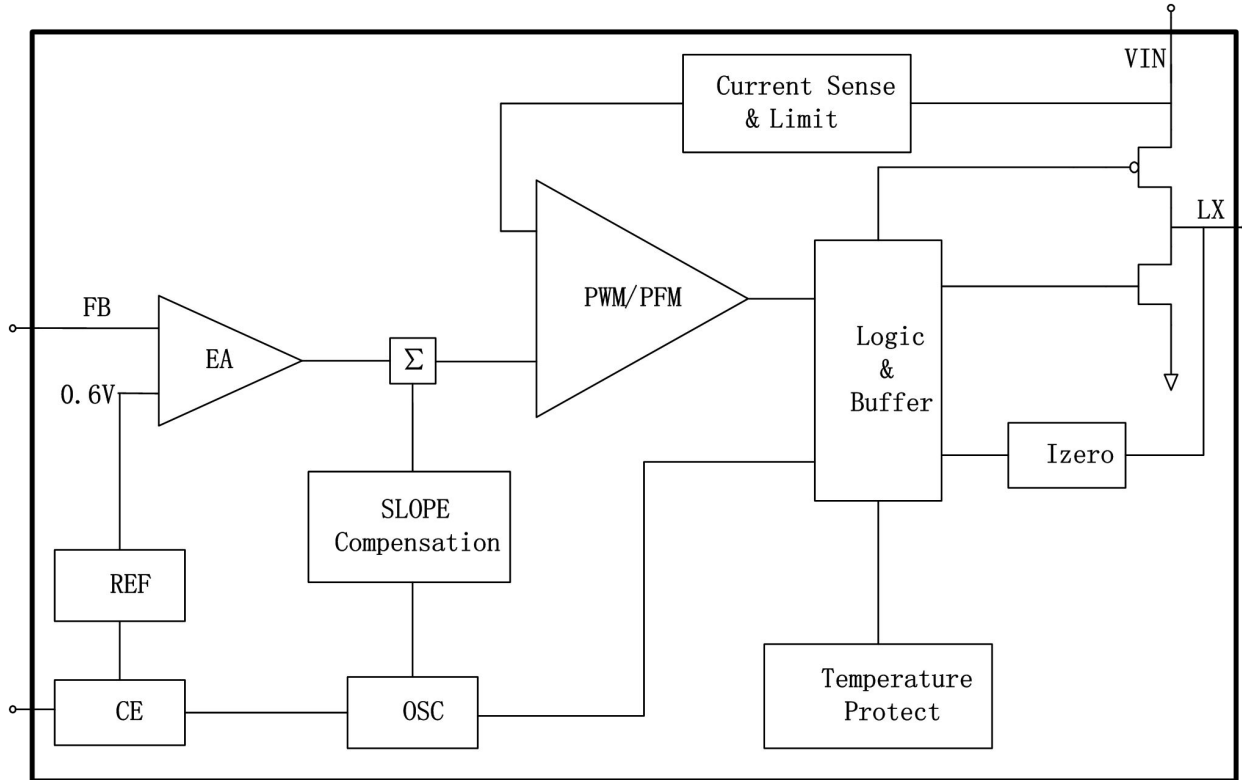
③ Represents the product package type

Designator	Symbol	Description
③	M	Package Types: SOT-23-5L

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

Parameter	Symbol	Ratings	Units
Input Supply Voltage	V _{IN}	-0.3~6.5	V
Output Voltage	V _{OUT}	-0.3~6.5	
	V _{LX}	-0.3~V _{IN} + 0.3	
CE Voltage	V _{CE}	-0.3~V _{IN} + 0.3	V
Peak LX Current	I _{LX}	1200	mA
Power Dissipation	SOT-23-5L P _d	250	mW
Operating Temperature Range	T _{opr}	-40~+85	°C
Storage Temperature Range	T _{stg}	-55~+125	

Note: Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

Electrical Characteristics

VIN=5V, L=2.2uH (Ta=25°C, unless otherwise noted)

Parameter	Symbol	Conditions	Min	Type	Max	Units
Feedback Voltage	V _{FB}	-	0.09	0.1	0.11	V
Input Voltage Range	V _{IN}	-	2	-	6	
Line regulation	ΔV _{OUT}	I _{LED} =300mA	-	0.45	-	%
Efficiency	E _{FFI}	I _{LED} =200mA	-	92	-	%
CE "Low" voltage	V _{CEL}	-	-	-	0.9	V
CE "High" voltage	V _{CEH}	-	1.1	-	-	V
Shutdown Current	I _{SHDN}	V _{CE} =0V	-	-	1	μA
Quiescent Current	I _{DD}	V _{FB} =0.1V*0.9	-	300	-	μA
Switch Current Limit	I _{LIM}	-	-	1200	-	mA
PFM switching point	I _{PFM}	V _{IN} =5V	-	100	-	mA
Oscillation Frequency	F _{OSC}	I _{LED} =500mA	-	1.4	-	MHz
Max Duty Circle	M _{AXDTY}	-	100	-	-	%
Thermal Shutdown	T _{SD}	-	-	150	-	°C
Thermal Hysteresis	T _{HYST}	-	-	20	-	°C

Typical Application

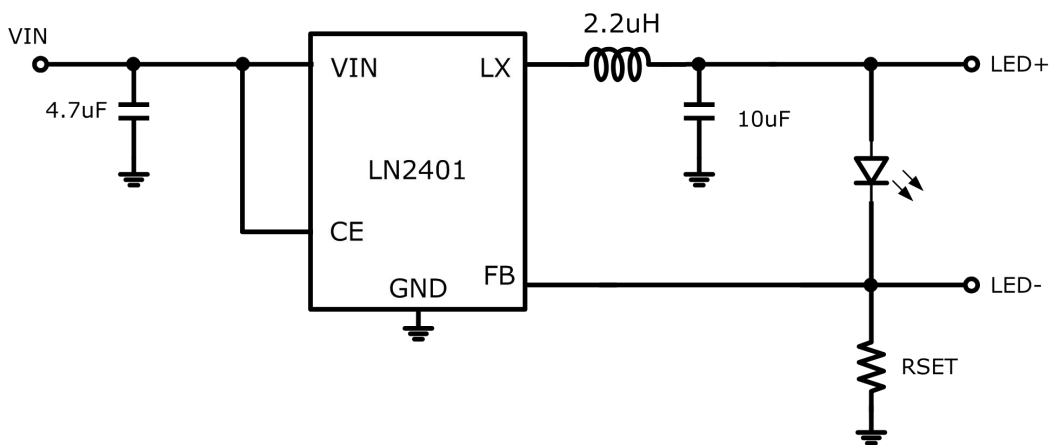


Figure 1 Typical application circuit

Note: I_{LED}=100mV/RSET

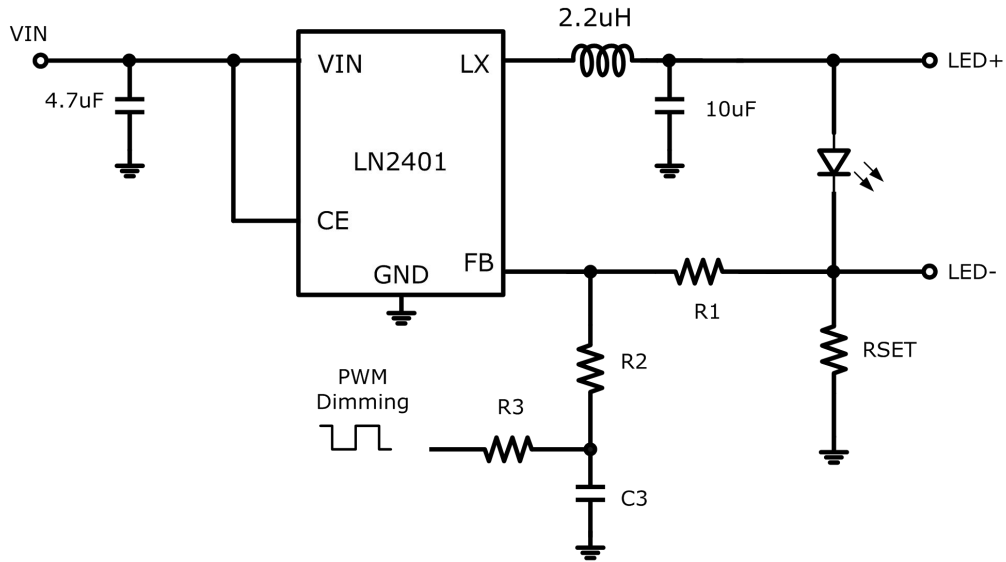


Figure 2 Typical application circuits with PWM dimming signal

Calculate I_{LED} using the following equations

$$I_{LED} = \frac{0.1 - \frac{R1 \times (VPWM \times DUTY - 0.1)}{(R2 + R3)}}{RSET}$$

Where $VPWM$ is the amplitude of PWM signal.

For example, for 3.3V $VPWM$, $R1=4.7K$, $R2=100K$, $R3=47K$.

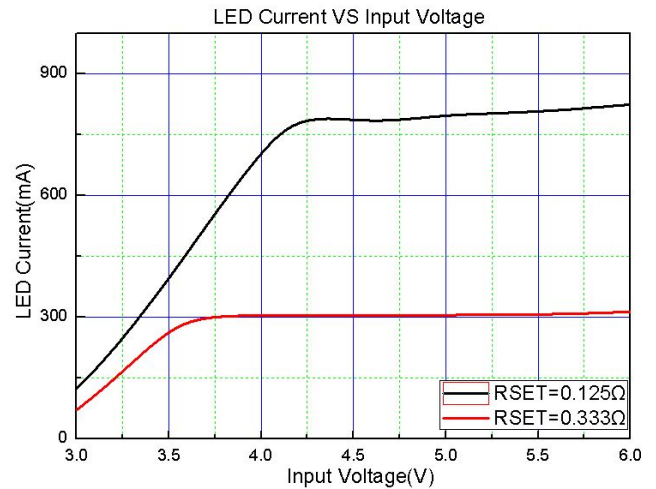
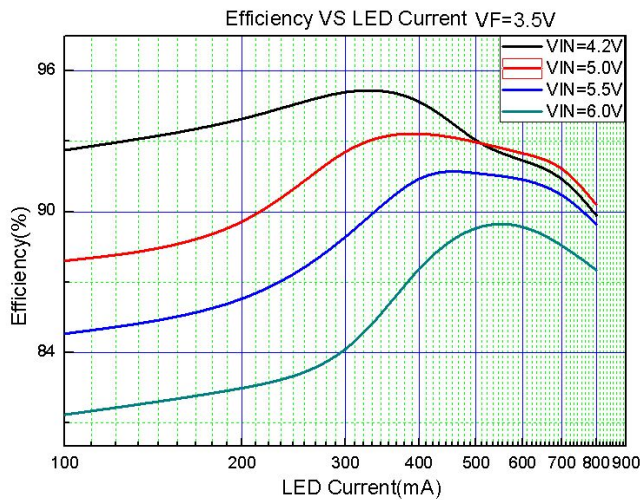
The value of $C3$ depends on the frequency of PWM dimming; an empirical suggestion is around 0.1uF for MHz and 10uF for low frequency under KHz.

Typical Performance Characteristics

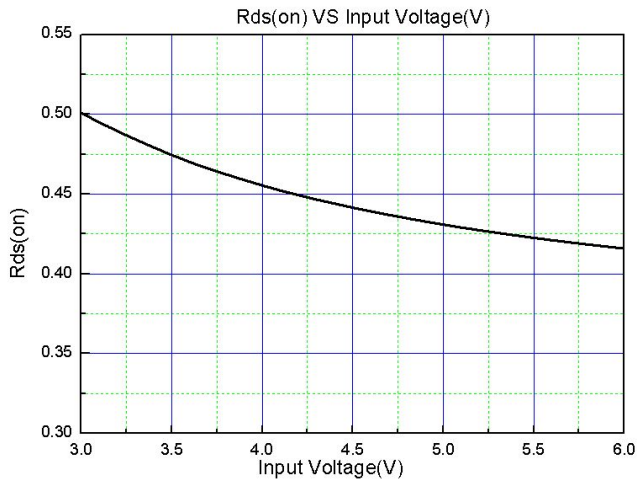
Efficiency VS Input Voltage

LED Current VS Input Voltage

$VIN=5V$, $VF=3.5V$

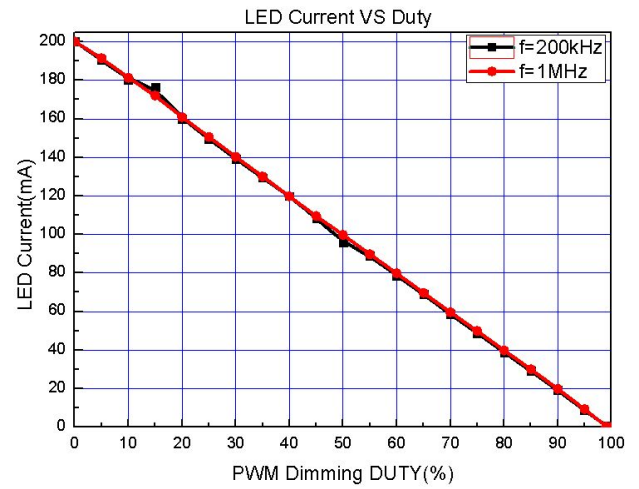


● R_{ON} of power MOS VS VIN

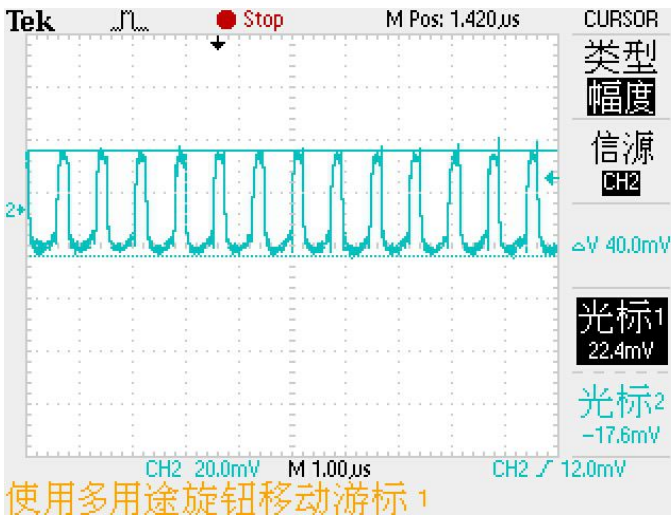


● LED Current VS PWM Duty

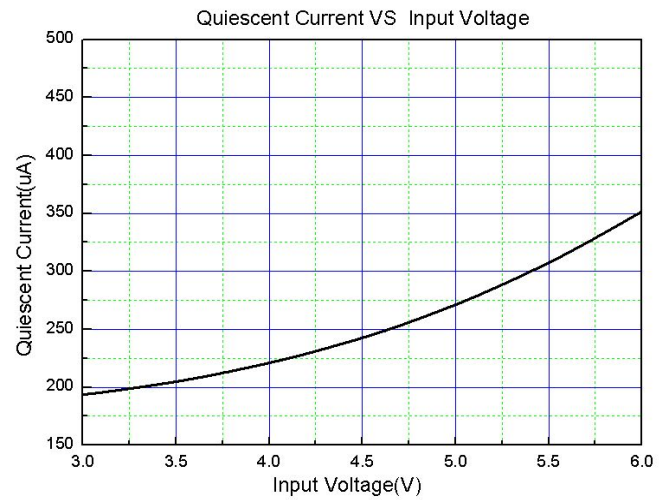
● VIN=5V, VF=3.5V



● Voltage ripple of LED+, VIN=5V, I_{LED}=200mA

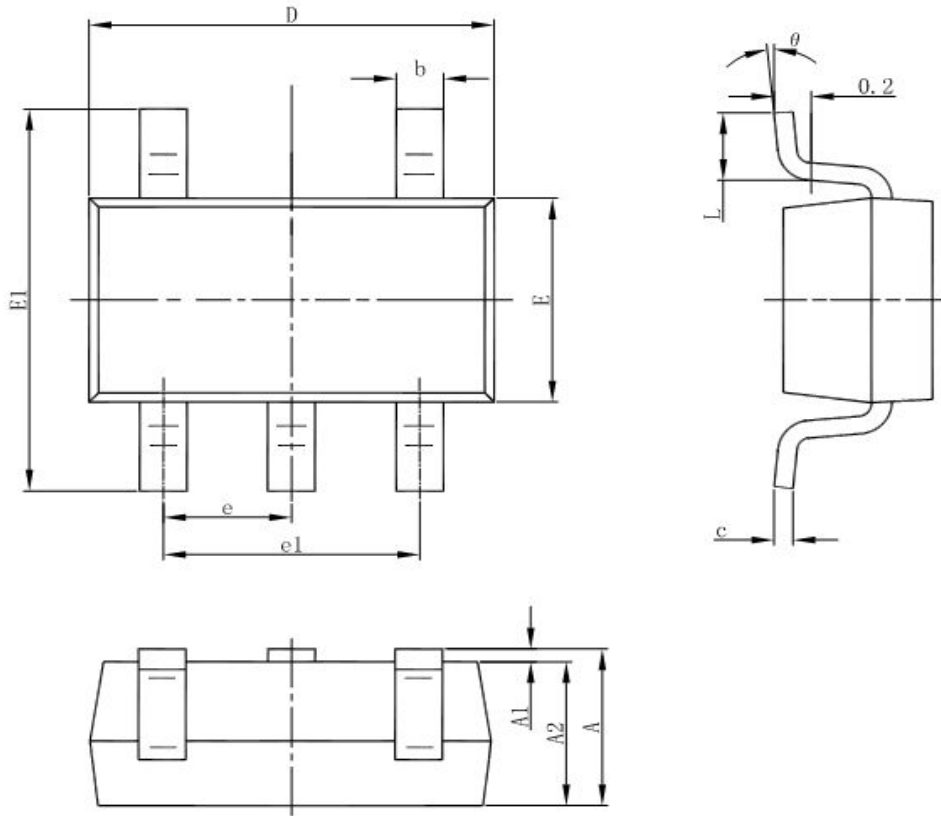


● Quiescent Current VS Input Voltage



■ Package Information

- SOT-23-5L



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°