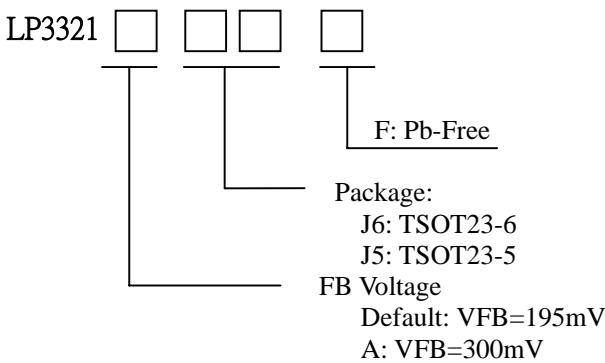


**High Performance, Constant Current Switching
Regulator For 10PCS White LED In Series**

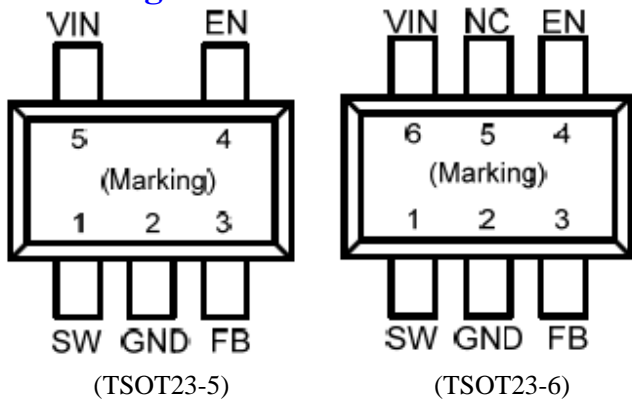
General Description

The LP3321 is a 1.3MHz PWM boost switching regulator designed for constant- current white LED driver applications. The LP3321 can drive a string of up to 10 white LEDs in series, ensuring uniform brightness and eliminating several ballast resistors. The LP3321 implements a constant frequency 1.3MHz PWM control scheme. The high frequency PWM operation also saves board space by reducing external component sizes. To improve efficiency, the feedback voltage is set to 195 mV and 300mV, which reduces the power dissipation in the current setting resistor. Highly integration and internal compensation network minimizes as 5 external component counts. Optimized operation frequency can meet the requirement of small LC filters value and low operation current with high efficiency.

Ordering Information



Pin Configurations



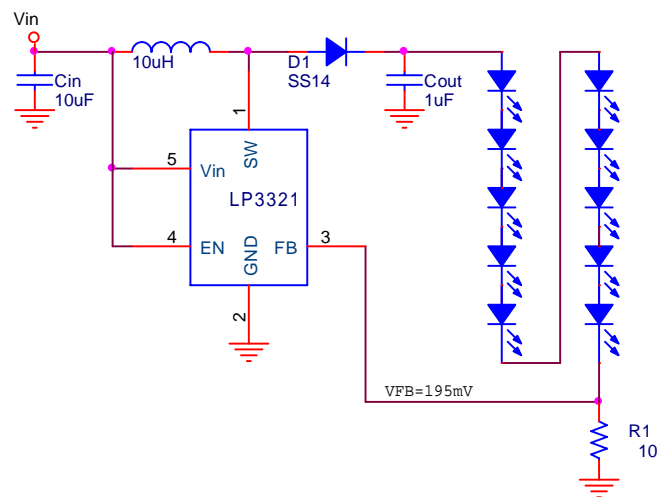
Features

- ✧ High Efficiency: 90%
- ✧ 1.3MHzFixed-Frequency PWM Operation
- ✧ Maximum Output Voltage up to 40V
- ✧ Operating Range : 2.7V to 5.5V
- ✧ Shutdown Supply Current:<1uA
- ✧ Available in TSOT23-5/TSOT23-6 Package
- ✧ Built-in 40V Over Voltage Protection
- ✧ Minimize the External Component
- ✧ RoHS Compliant and 100% Lead (Pb)-Free

Applications

- ✧ WLED Backlight driver
- ✧ OLED Backlight driver
- ✧ PDA
- ✧ MID/PTV

Typical Application Circuit



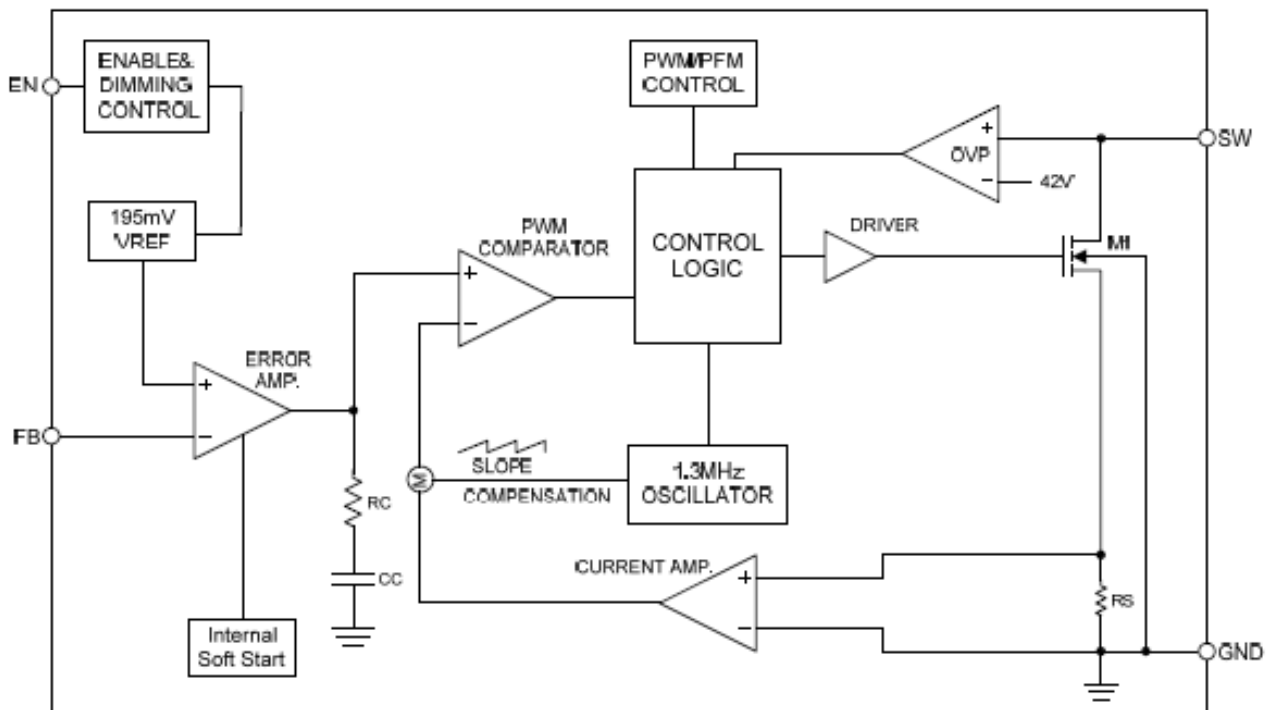
Marking information

Please view website.

Functional pin description

TSOT-23-5	TSOT-23-6	Pin Name	Pin Function
1	1	SW	Switch Pin. Connect this Pin to inductor and catch diode. Minimize the track area to reduce EMI.
2	2	GND	Ground Pin
3	3	FB	Feedback Reference Voltage Pin. Series connect a resistor between WLED and ground as a current sense. Sense the current feedback voltage to set the current rating.
4	4	EN	Chip Enable (Active High). Voltage sensing input to trigger the function of over voltage protection. Note that this pin is high impedance. There should be a pull low 100k Ω resistor connected to GND when the control signal is floating.
	5	NC	No connected.
5	6	Vin	Supply Input Voltage Pin. Bypass 1uF capacitor to GND to reduce the input noise.

Function Block Diagram



Absolute Maximum Ratings

Supply Input Voltage-----0.3V to 6.0V
 SW Input Voltage -----0.3V to 43V
 The Other Pins -----0.3V to 5.5V
 Power Dissipation, P_D @ T_A = 25°C TSOT-23-5/6-----0.455W
 Lead Temperature (Soldering, 10 sec.) ----- 260°C
 Operation Temperature Range -----40°C to 80°C
 Storage Temperature Range -----65°C to 150°C

Electrical Characteristics

Parameter	Symbol	Test Condition	Min	Typ.	Max	Units
System Supply Input						
Operation voltage Range	V _{DD}		2.7		6	V
Under Voltage Lock Out	V _{DD}		2.2	2.4	2.6	V
Supply Current	I _{DD}	FB=0.2V, Switch		430	550	uA
Shut Down Current	I _{DD}	V _{EN} < 0.4V		0.1	1	uA
Line Regulation		V _{IN} : 3.0~4.3V		2		%
Oscillator						
Operation Frequency	F _{osc}		1.0	1.3	1.5	MHz
Maximum Duty Cycle			93			%
Feedback Voltage	LP3321		185	195	205	mV
	LP3321A		285	300	315	mV
MOSFET						
On Resistance of MOSFET	R _{DS(ON)}			0.5		Ω
SW Current Limit	I _{LM}			1.4		A
Protection						
OVP Threshold	V _{OVP}			42		V
OVP Sink Current				5		μA
Shut Down Voltage	V _{EN}		0.4			V
Enable on Voltage	V _{EN}				0.6	V
Minimum EN Dimming Threshold		V _{FB} =0 V		0.7		V
Minimum EN Dimming Threshold		V _{FB} =195mV		1.4		V

Typical Operating Characteristics

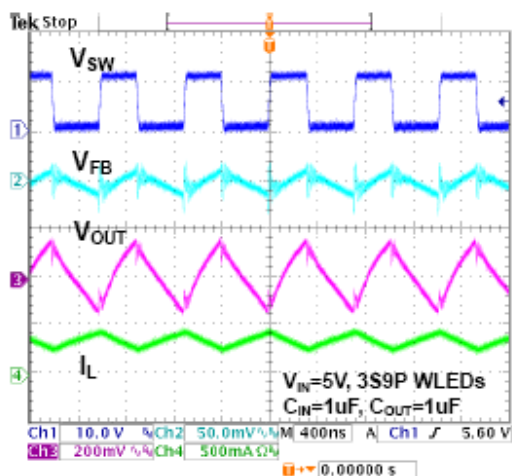


Figure 4. Switch waveforms

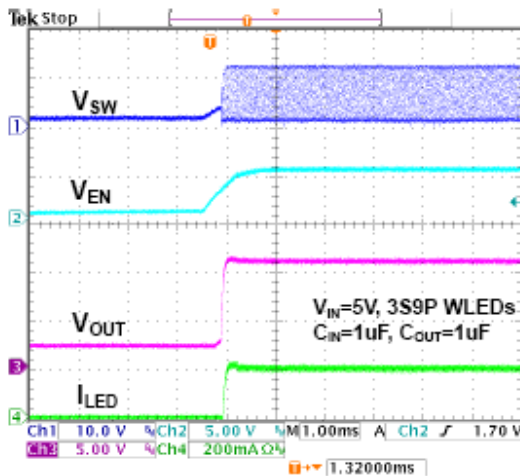


Figure 5. Enable Startup Response Waveforms

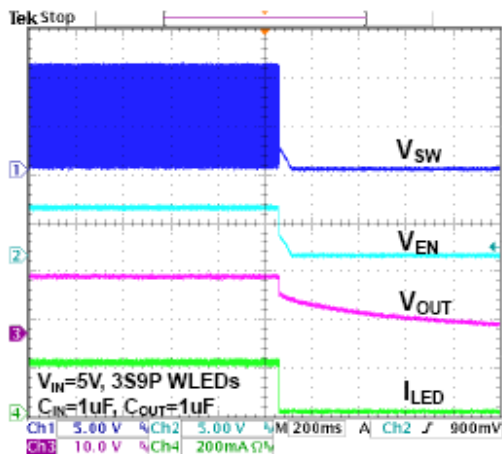


Figure 6. Enable Shutdown Response Waveforms

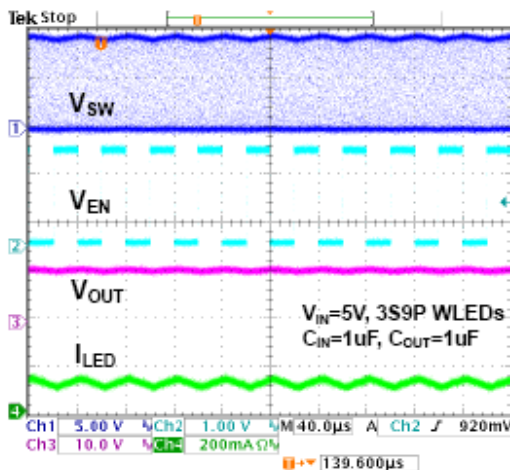


Figure 7. PWM Dimming Response Waveforms at a frequency of 25kHz

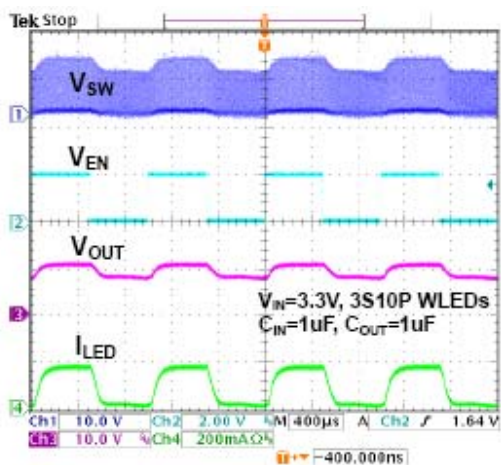


Figure 8. PWM Dimming Response Waveforms at a frequency of 1kHz

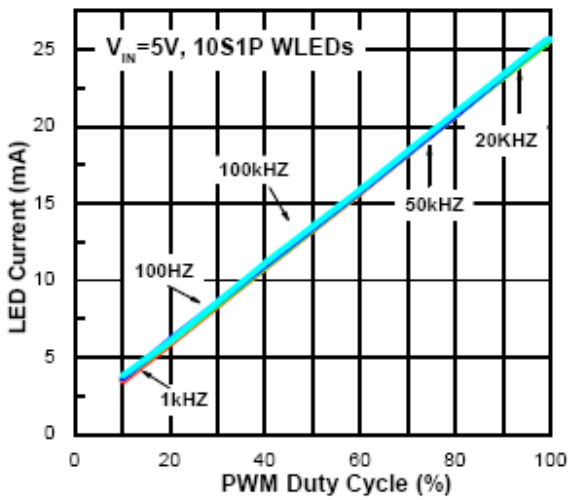


Figure10. LED Current vs. Duty Cycle

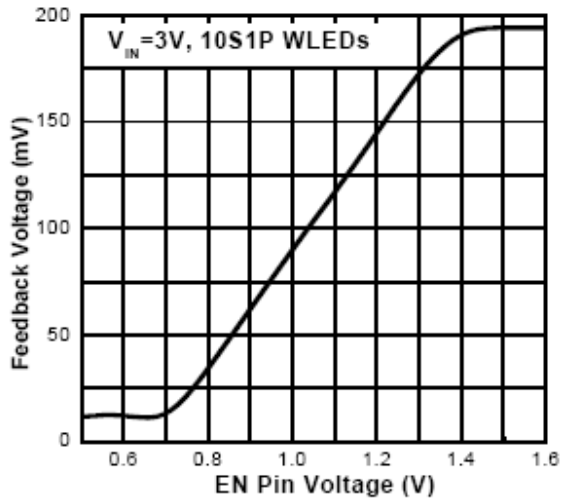


Figure11. Feedback Voltage vs. EN Voltage

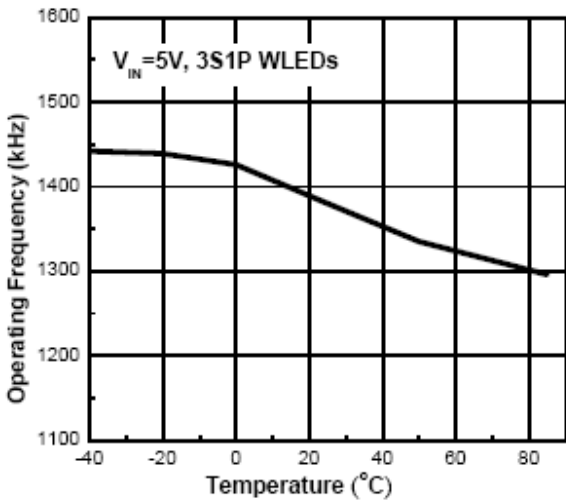


Figure12. Operating frequency vs. Temperature.

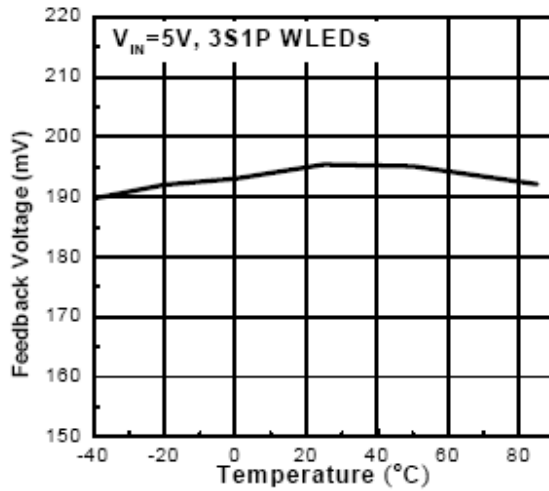


Figure13. Feedback Voltage vs. Temperature.

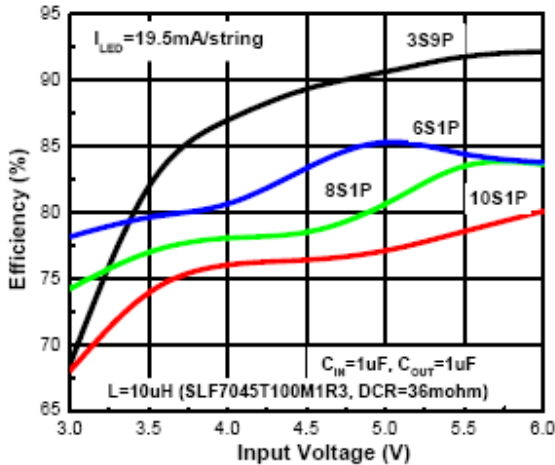


Figure14. Efficiency vs. Input Voltage.

Applications Information

LED Current Control

The LP3321 regulates the LED current by setting the current sense resistor (R1) connecting to feedback and ground. The internal feedback reference voltage is 195mV or LP3321A is 300mV. The LED current can be set from following equation easily.

$$I_{LED} = 195\text{mV}/R1 \text{ (LP3321)}$$

$$I_{LED} = 300\text{mV}/R1 \text{ (LP3321A)}$$

In order to have an accurate LED current, precision resistors are preferred (1% is recommended). The table for R1 selection is shown below.

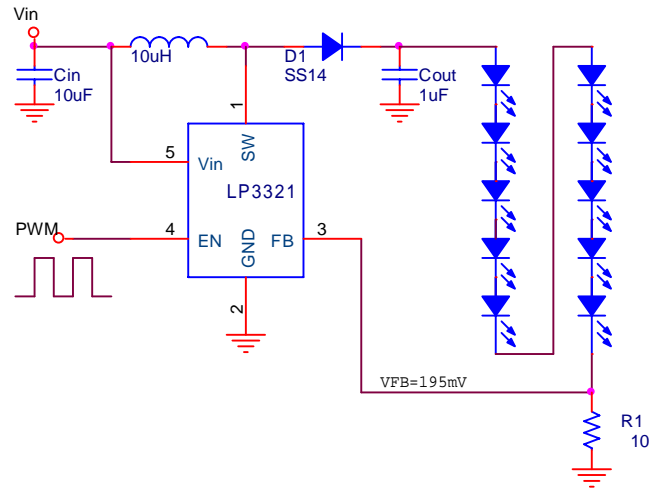
Inductor Selection

The recommended value of inductor for 2 to 10 WLEDs applications are 4.7 to 22μH. Small size and better efficiency are the major concerns for portable device, such as LP3321 used for mobile phone. The inductor should have low core loss at 1.3MHz and low DCR for better efficiency. To avoid inductor saturation current rating should be considered.

Dimming control

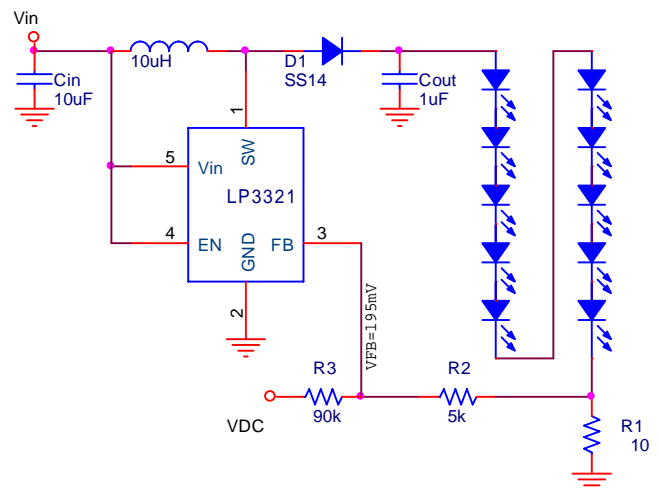
a. Using a PWM Signal to EN Pin

For controlling the LED brightness, the LP3321 can perform the dimming control by applying a PWM signal to EN pin. The internal soft-start and wide range dimming frequency from 100Hz to 100KHz can insignificantly reduce audio noise when dimming. The average LED current is proportional to the PWM signal duty cycle. The magnitude of the PWM signal should be higher than the maximum enable voltage of EN pin, in order to let the dimming control perform correctly.



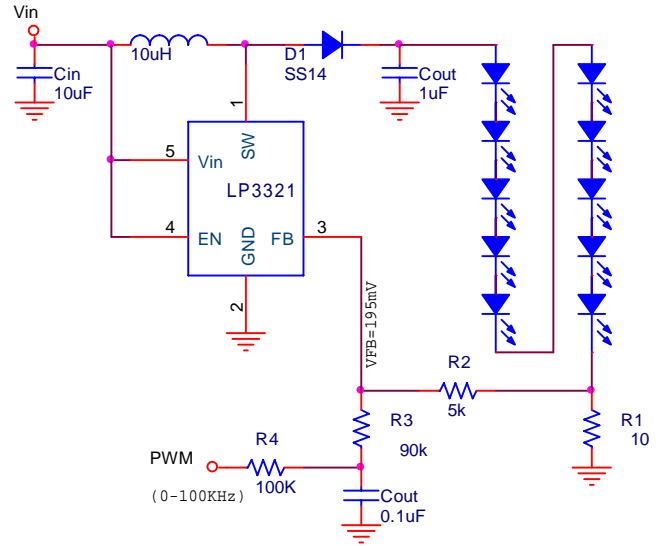
b. Using a DC Voltage

Using a variable DC voltage to adjust the brightness is a popular method in some applications. The dimming control using a DC voltage circuit is shown in Figure 4. According to the Superposition Theorem, as the DC voltage increases, the voltage contributed to VFB increases and the voltage drop on R2 decreases, i.e. the LED current decreases. For example, if the VDC range is from 0V to 2.8V, the selection of resistors in Figure 4 sets dimming control of LED current from 20mA to 0mA.



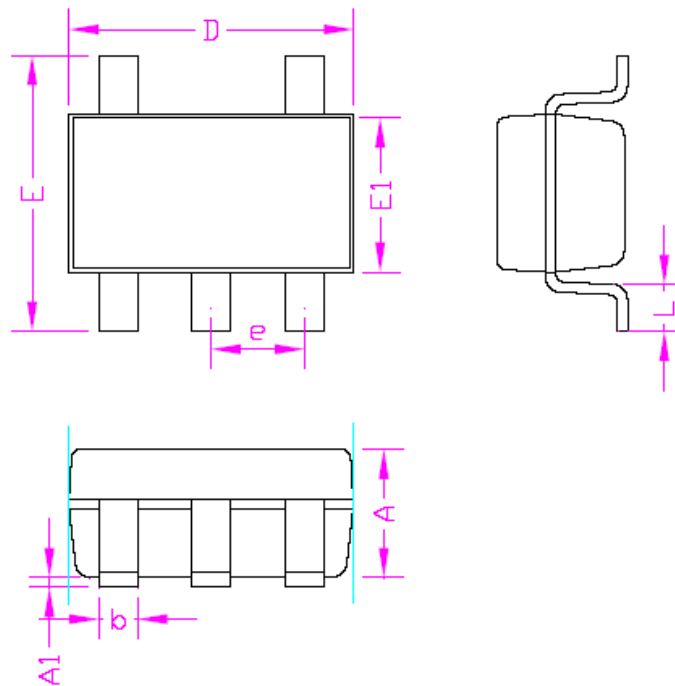
c. Using a Filtered PWM signal

Another common application is using a filtered PWM signal as an adjustable DC voltage for LED dimming control. A filtered PWM signal acts as the DC voltage to regulate the output current. The recommended application circuit is shown in the Figure 6. In this circuit, the output ripple depends on the frequency of PWM signal. For smaller output voltage ripple (<100mV), the recommended frequency of PWM signal should be above 2kHz. To fix the frequency of PWM signal and change the duty cycle of PWM signal can get different output current. According to the application circuit of Figure 5, output current is from 20.5mA to 5.5mA by adjusting the PWM duty cycle from 10% to 90%.

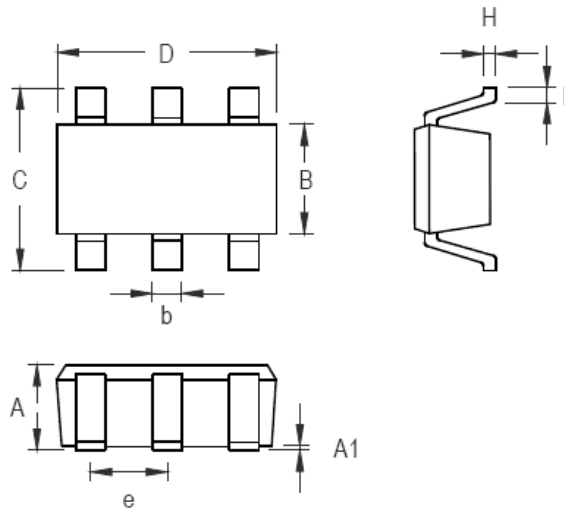


Packing information

TSOT23-5



SYMBOLS	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	-	1.00	-	0.039
A1	0.00	0.15	0.000	0.006
D	2.90		0.114	
E1	1.60		0.063	
E	2.60	3.00	0.102	0.118
L	0.30	0.60	0.012	0.024
b	0.30	0.50	0.012	0.020
e	0.95		0.037	



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.700	1.000	0.028	0.039
A1	0.000	0.100	0.000	0.004
B	1.397	1.803	0.055	0.071
b	0.300	0.559	0.012	0.022
C	2.591	3.000	0.102	0.118
D	2.692	3.099	0.106	0.122
e	0.838	1.041	0.033	0.041
H	0.080	0.254	0.003	0.010
L	0.300	0.610	0.012	0.024

TSOT-23-6 Surface Mount Package