FSP3307

Tiny SOT23-6, 1.4A, 1MHz LED Driver DC/DC

General Description

The FSP3307 is an inductor-based DC/DC boost converter designed to drive LED arrays. 1.4A switching current allows FSP3307 to be used in different 7' to 10' LCD panel backlights (3*13 LED arrays typically).

A constant frequency 1MHz PWM control scheme is employed in this IC, which means tiny external components can be used. Specifically, 1mm tall 4.7µH inductor and 0.47µF output capacitor for the typical application is sufficient.

The over output voltage protection is equipped in FSP3307, which protects the IC under open load condition. The FSP3307 includes UVLO, soft-start, current limit and OTSD to protect the circuit.
The FSP3307 is available in standard SOT-23-6.

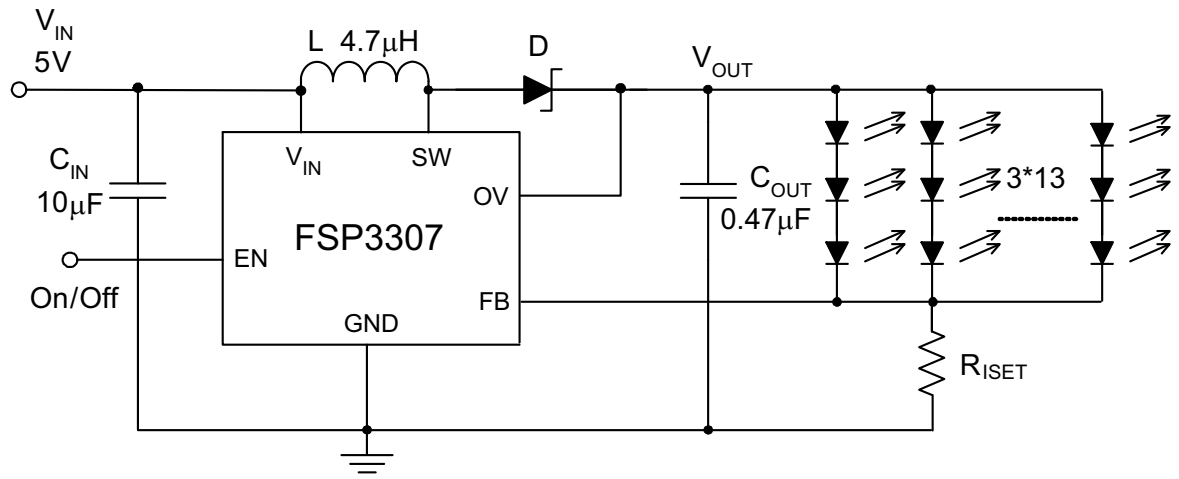
Features

- VIN Operating Range : 2.7V to 16V
- Low 200mV Feedback Voltage
- Cycle by Cycle Current Limit: 1.4A
- Internal Power N-MOSFET Switch
- Wide Range for PWM Dimming
- Internal Soft Start
- Over Voltage Protection
- Over Temperature Protection
- Small SOT23-6 Packages
- RoHS Compliant and Halogen Free

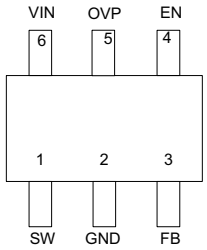
Application

- 7’-10’ LED Panel Backlight
- Portable DVD/TV
- GPS
- Digital Photo Frame
- EPC

Typical Application



Pin Configuration and Description



Pin#	Symbol	Function
1	SW	Switching Pin.
2	GND	Ground Pin. The exposed pad must be soldered to a large PCB and connected to GND for maximum power dissipation.
3	FB	Feedback Pin, put a resistor to GND to setting the current.
4	EN	Enable and Dimming Control Pin. (*note1)
5	OVP	Over-voltage Protection Input Pin. Connect to the output directly. On OVP condition, the output voltage will be clamped
6	VIN	Input Supply.

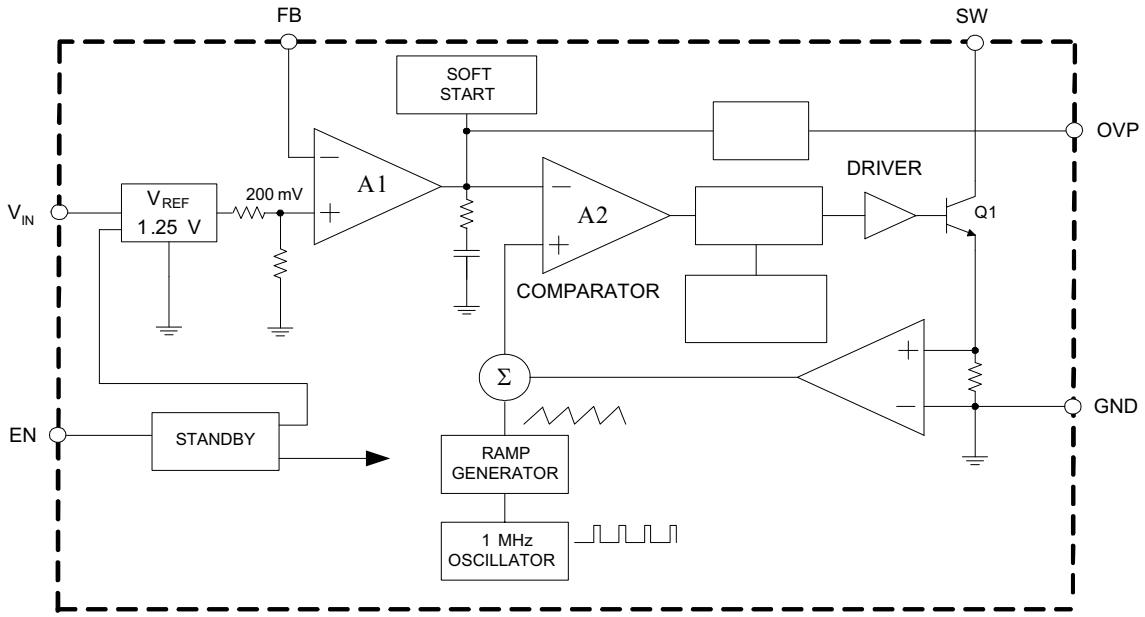
Note1: Connect to a high input to enable the IC or a low input to disable the IC. If logic low time is more than about 0.7ms and then enable the IC, the IC will soft start to protect system departments. If logic low time is less than about 0.7ms and then enable the IC, the IC will hold on standby mode and start directly to achieve high frequency dimming.

Ordering and Marking Information

Standard Part NO.	VFB	Package	Packing	Min. Quantity	RoHS
FSP3307CAG	200mV	SOT23-6	Tape&Reel	3000PCS	Pb Free

Remark: for marking information,please see sample or contact our sales for more detail infomation.

Function Block



Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Input Voltage	V_{IN}	-0.3 to 20	V
SW Voltage	V_{SW}	-0.3 to 38	V
FB Voltage	V_{FB}	-0.3 to 20	V
EN Voltage	V_{EN}	-0.3 to V_{IN}	V
Thermal Resistance (Junction to Ambient, No Heat Sink)	θ_{JA}	265	℃/W
Junction Temperature	T_J	150	℃
Storage Temperature Range	T_{STG}	-65 to 150	℃
Lead Temperature (Soldering, 10sec)	T_{LEAD}	260	℃
ESD (Machine Model)		600	V
ESD (Human Body Model)		4000	V

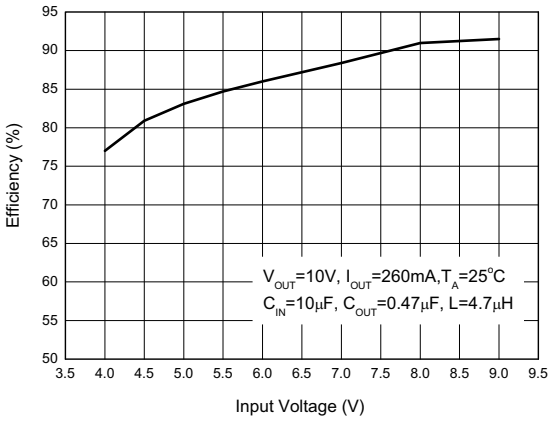
Electrical Characteristics

(V_{IN}=5.0V, V_{CTRL}=5.0V, T_A=25°C, unless otherwise specified.)

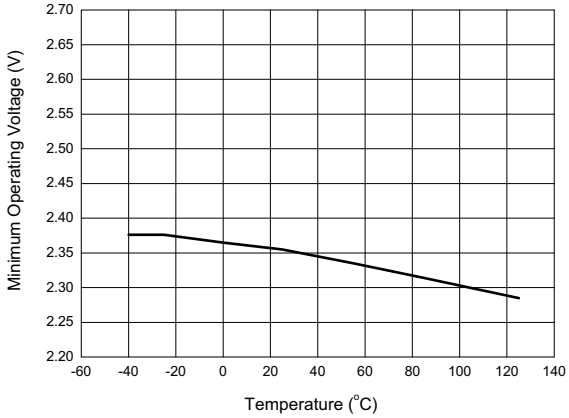
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operating Voltage	V_{IN}		2.7		16	V
Feedback Voltage (Note 2)	V_{FB}	I_{OUT}=20mA, T_A=-40℃ to 85℃	188	200	212	mV
FB Pin Bias Current	I_{FB}			35	100	nA
Quiescent Current	I_Q	V_{FB}=V_{IN}, no switching	1.5	3.0	5.0	mA
Shutdown Quiescent Current	I_{SHDN}	V_{CTRL}=0V	20	50	80	μA
Switching Frequency	f		0.75	1	1.3	MHz
Maximum Duty Cycle	D_{MAX}		90	93		%
Switch Current Limit	I_{LIMIT}	D=60%	1.0	1.2		A
Switch V_{CE} Saturation Voltage	V_{CESAT}	I_{SW}=0.6A		300		mV
Switch Leakage Current		V_{SW}=35V		0.01	5	μA
EN Pin Voltage	V_{EN}	Active high	1.8			V
		Active low			0.5	
EN Pin Bias Current	I_{EN}		40	55	72	μA
OVP Voltage	V_{OVP}			17		V
Soft-start Time	t_{SS}			300		μs
Standby Time	t_{STB}			0.7		ms
Thermal Shutdown	T_{OTSD}			160		℃

Typical Operating Characteristics

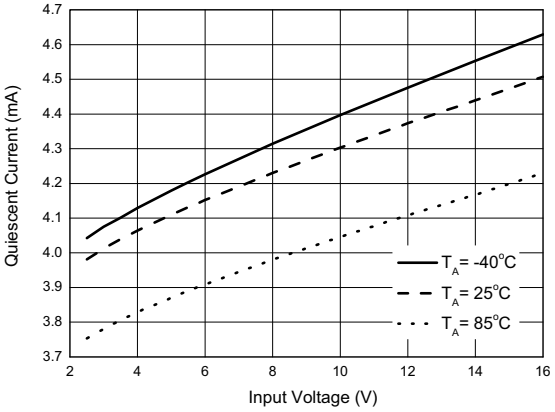
(WLED forward voltage (V_F)=3.2V at I_F=20mA, unless otherwise noted.)



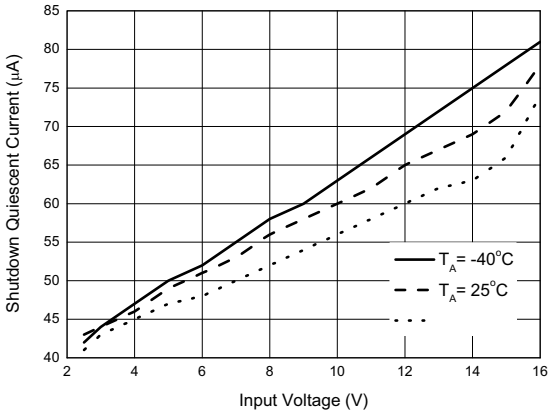
Efficiency vs. Input Voltage



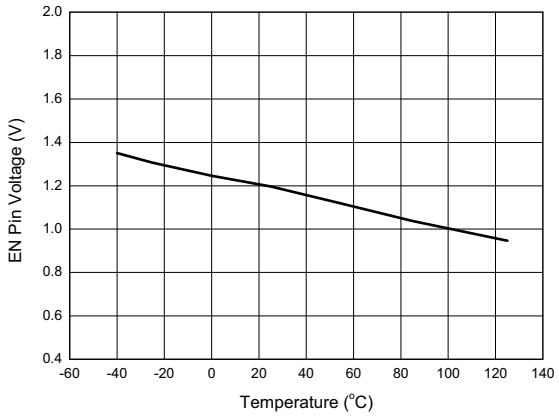
Minimum Operating Voltage vs. Temperature



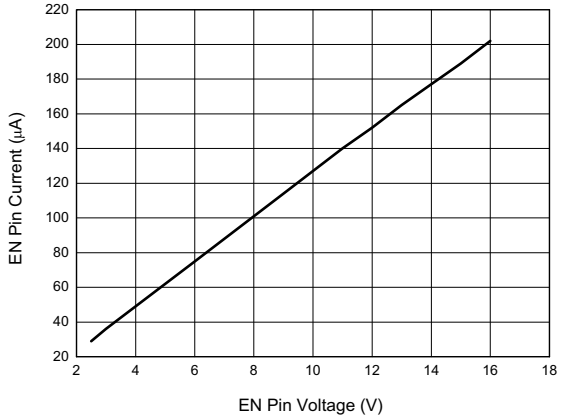
Quiescent Current vs. Input Voltage



Shutdown Quiescent Current vs. Input Voltage

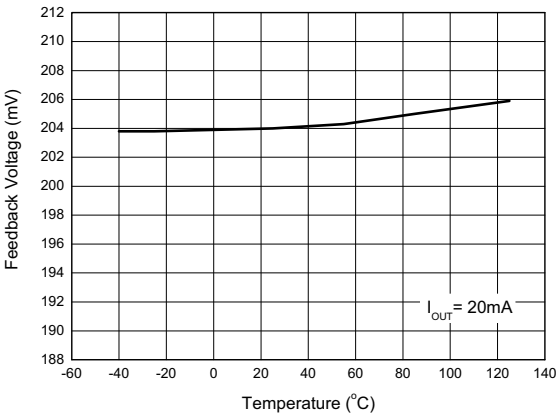


EN Pin Voltage vs. Temperature

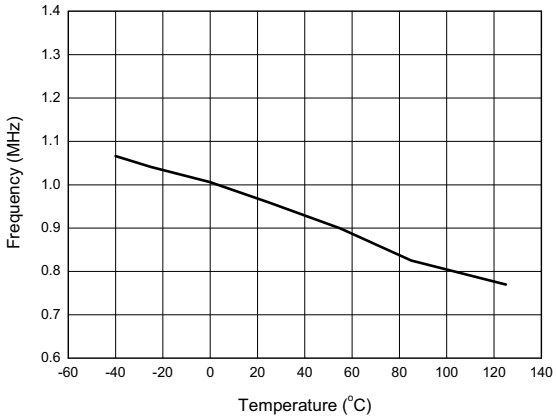


EN Current vs. EN Voltage

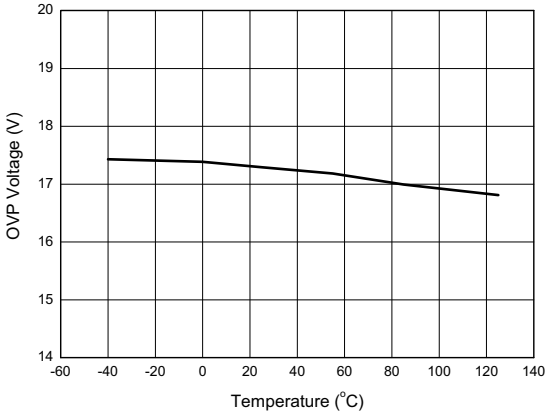
Typical Operating Characteristics (continued)



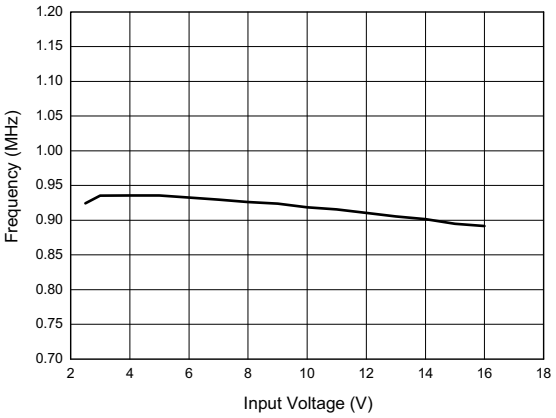
Feedback Voltage vs. Temperature



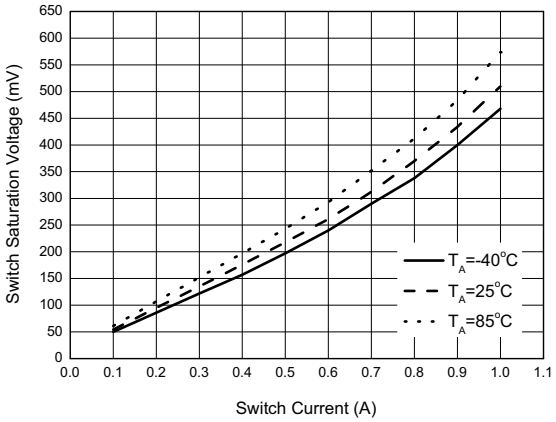
Frequency vs. Temperature



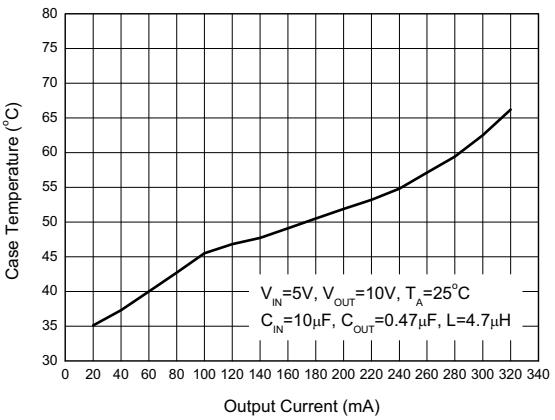
OVP Voltage vs. Temperature



Frequency vs. Input Voltage



Switch Saturation Voltage vs. Switch Current



Case Temperature vs. Output Current

Application Information

●Operation

The FSP3307 is a boost DC-DC converter which uses a constant frequency, current mode control scheme to provide excellent line and load regulation.

At the start of each oscillator cycle, switch Q1 turns on. The switch current will increase linearly. The voltage on sense resistor is proportional to the switch current. The output of the current sense amplifier is added to a stabilizing ramp and the result is fed into the non-inversion input of the PWM comparator A2. When this voltage exceeds the output voltage level of the error amplifier A1, the switch is turned off.

It is clear that the voltage level at inversion input of A2 sets the peak current level to keep the output in regulation. This voltage level is the output signal of error amplifier A1, and is the amplified signal of the voltage difference between feedback voltage and reference voltage of 200mV. So, a constant output current can be provided by this operation mode.

●LED Current Control

The LED current is controlled by the feedback resistor R_{ISET}. LEDs' current accuracy is determined by the feedback voltage and resistor R_{ISET}, so the precise resistors are preferred. The resistance of R_{ISET} is in inverse proportion to the LED current since the feedback reference is fixed at 200mV. The relation for R_{ISET} and LED current (I_{LED})can be expressed as below:

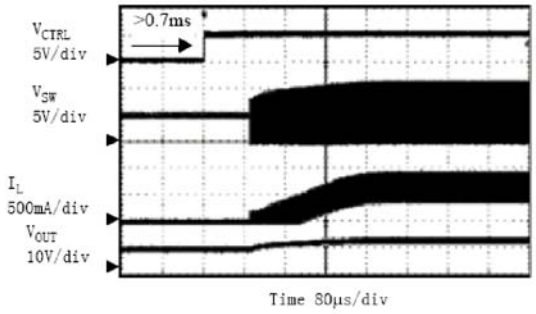
$$R_{ISET} = \frac{200\ mV}{I_{LED}}$$

●Over Voltage Protection

The FSP3307 has an internal open load protection circuit. When the LEDs are disconnected from circuit or fail open, the output voltage is clamped at about 17V. The FSP3307 will switch at a low frequency, and minimize current to avoid input voltage drop.

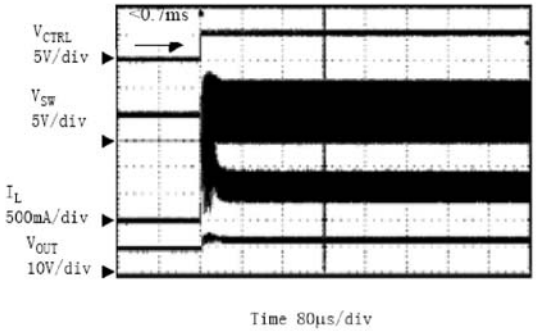
●Soft Start

The FSP3307 has an internal soft start circuit to limit the inrush current during startup. If logic low time on EN pin is more than about 0.7ms and then enable the IC, the FSP3307 will start smoothly to protect the supplier. The time of startup is controlled by internal soft-start capacitor. Details please refer to Figure as follow:



●Standby and Dimming

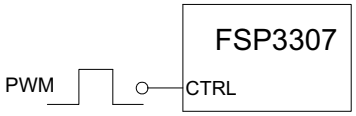
To avoid audio noise and achieve high frequency dimming, FSP3307 is equipped with standby function. If logic low time on EN pin is less than about 0.7ms and then enable the IC, the FSP3307 will hold on standby mode and start directly to achieve high frequency dimming. Details please refer to Figure as follow:



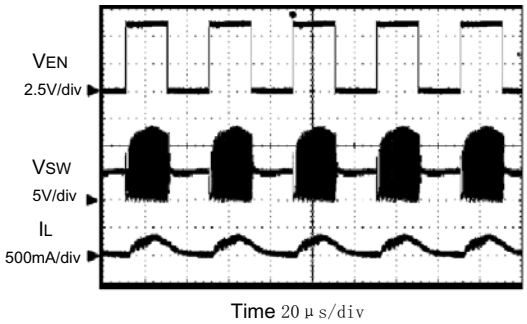
Two typical types of dimming control circuit are present as below. First, controlling EN Pin voltage to change operation state is a good choice. Second, changing the feedback voltage to get appropriate duty and luminous intensity is also useful.

(1) Adding a Control Signal to CTRL Pin

Adding a PWM signal to ENL pin directly, the FSP3307 is turned on and off by this signal. When the PWM frequency is lower than 1kHz(Typ.), the IC works in the soft-start mode to dimming the light. On contrary, when the PWM frequency is higher than 1kHz(Typ.), the IC works in the standby mode: the converter ceaselessly switches off and directly starts to achieve light dimming. This standby function allows FSP3307 to support high frequency dimming (up to 25kHz or higher) to avoid audio noise. More details please refer to Figures as follows:



●Brightness control using a PWM signal applies to EN



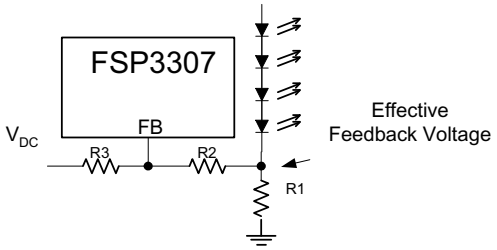
●High Frequency (25kHz) Dimming Waveform

(2) Changing the Effective Feedback Voltage

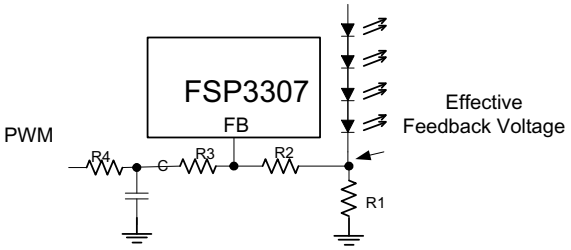
There are two popular methods to change the effective feedback voltage.

First, adding a constant DC voltage through a resistor divider to FB pin can control the dimming. Changing the DC voltage or resistor between the FB Pin and the DC voltage can get appropriate luminous intensity.
Comparing with all kinds of PWM signal control, this method features a stable output voltage and LEDs current.

Second, using a filtered PWM signal can do it. The filtered PWM signal can be considered as a varying and adjustable DC voltage, please refer to Figure as follow:



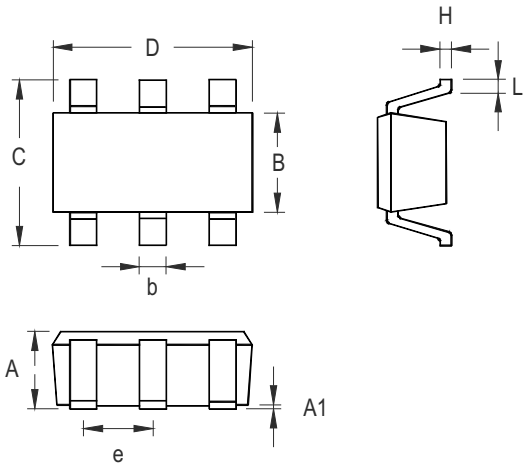
●Dimming Control Using DC Voltage



●Dimming Control Using Filtered PWM Signal

Package Information

SOT23-6



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.889	1.295	0.031	0.051
A1	0.000	0.152	0.000	0.006
B	1.397	1.803	0.055	0.071
b	0.250	0.560	0.010	0.022
C	2.591	2.997	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

SOT-23-6 Surface Mount Package