

**Low-Dropout, Constant-Current  
White LED Bias Supply**

**FEATURES**

- Up to 400mA LED Bias Current
- 3% LED Current Matching
- Simple LED Brightness Control
- Low 0.05uA Shutdown Current
- 2.7V to 5V Supply Voltage Range
- SOP-8 Package and Lead-free
- VSET Resistor Option :  
 T6316A : External Resistor  
 T6316B : 20, 85, 100, 125, 150, 175, 200,  
 250, 300 and 350mA Output  
 Current Option by Internal  
 Resistor
- Build in Thermat Protect 160 °C

**Applications**

- Portable Communication Devices
- Handheld Electronics
- LED/Display Back Light Driver
- Lightings

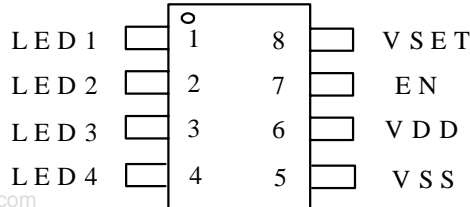
**GENERAL DESCRIPTION**

The T6316A/B low-dropout bias supply for white LEDs is a high-performance alternative to the simple ballast resistors used in conventional white LED designs. The T6316A uses a single resistor to set the bias current for four LEDs, which are matched to 3%. The T6316B build in internal resistor to set the bias current for four LED. The T6316A/B advantages over ballast resistors include significantly better LED to LED bias matching, much lower bias variation with supply voltage variation, significantly lower dropout voltage, and in some applications, significantly improved efficiency. The T6316A/B is available in SOP-8 package and lead-free.

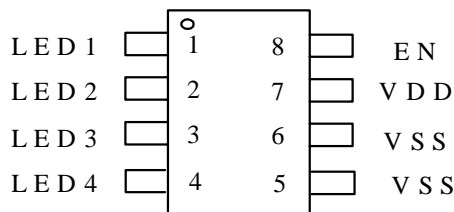
**PART NUMBER EXAMPLES**

<b>PART NO.</b>	<b>PACKAGE</b>	<b>Output Current</b>	<b>Vset resistor</b>
T6316A-D	SOP-8	-	External
T6316A-DG	SOP-8 lead-free	-	External
T6316B-20D	SOP-8	20mA	Internal
T6316B-20DG	SOP-8 lead-free	20mA	Internal
T6316B-75D	SOP-8	75mA	Internal
T6316B-75DG	SOP-8 lead-free	75mA	Internal
⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮
T6316B-350D	SOP-8	350mA	Internal
T6316B-350DG	SOP-8 lead-free	350mA	Internal

**PIN ARRANGEMENT(Top view)**



**SOP-8  
T6316A-D**



**SOP-8  
T6316B-D**

**PIN DESCRIPTION**

SYMBOL	T6316A	T6316B	DESCRIPTION
LED1	1	1	LED 1 Cathode Connection. Current flowing into LED1 is 270/250 times the current flowing into SET. LED1 is high impedance when EN is low.
LED2	2	2	LED 2 Cathode Connection. Current flowing into LED2 is 270/250 times the current flowing into SET. LED2 is high impedance when EN is low.
LED3	3	3	LED 3 Cathode Connection. Current flowing into LED3 is 270/250 times the current flowing into SET. LED3 is high impedance when EN is low.
LED4	4	4	LED 4 Cathode Connection. Current flowing into LED4 is 270/250 times the current flowing into SET. LED4 is high impedance when EN is low.
VSS	5	5,6	Ground
VDD	6	7	Power supply
EN	7	8	Enables PN6316A/B signal , H: Active , L : Power Down .
VSET	8	-	VSET terminal is used to connect an external resistor to set output current. The current flowing into VSET sets the bias current into each LED by $I_{LED} = 250 \times I_{SET}$ . VSET is internally biased to 0.306V. VSET is high impedance when EN is low.

**ABSOLUTE MAXIMUM RATINGS**

Parameter	Symbol	Value	Unit
Voltage on any pin relative to GND	V <sub>IN</sub>	-0.3 to 6	V
Operating Temperature Rang	T <sub>A</sub>	-40 to +85	°C
Maximum Soldering Temperature (at leads, 10 sec)	T <sub>LEAD</sub>	300	°C
Storage Temperature Rang	T <sub>S</sub>	-65 to +150	°C
Continuous Power Dissipation ( T <sub>A</sub> = +70°C )		1	W

**Electrical Characteristics**

(T<sub>A</sub> = -40 to 85°C unless otherwise noted. Typical values are at T<sub>A</sub> =25°C, V<sub>EN</sub> =3.3V, V<sub>LED1</sub> = V<sub>LED2</sub>= V<sub>LED3</sub>= V<sub>LED4</sub>= 1V)

Symbol	Description	Conditions	Min.	Typ.	Max	Unit
V <sub>EN</sub>	Operating voltage range	EN is power supply input	2.7		5	V
I <sub>SET</sub>	SET input current range			1400	1600	uA
I <sub>SETR</sub>	SET to LED current ratio	I <sub>LED</sub> / I <sub>SET</sub> , I <sub>SET</sub> =400uA	T6316A	270		A/A
			T6316B	250		
V <sub>SET</sub>	SET bias voltage	I <sub>SET</sub> =400uA, no loading		0.306		V
ICM	LED to LED current matching	I <sub>SET</sub> =400uA, 100mA loading		3		%
I <sub>LED</sub>	Maximum LED sink current	Each LED		350	400	mA
I <sub>LSD</sub>	LED leakage current in shutdown	V <sub>LED1</sub> =V <sub>LED2</sub> =V <sub>LED3</sub> =V <sub>LED4</sub> = 3.3V, EN=GND, T <sub>A</sub> =+25°C, each LED		0.01	1	uA
V <sub>IH</sub>	Input high voltage	V <sub>EN</sub> >V <sub>IH</sub> for enable, VDD=5V	2.0			V
V <sub>IL</sub>	Input low voltage	V <sub>EN</sub> <V <sub>IL</sub> for disable, VDD=5V			0.8	V
T <sub>TP</sub>	Thermat Protect			160		°C

### Functional Description

The T6316A/B provides constant current bias supply for white LED designs. The T6316A uses a single resistor to set the bias current for up to four LEDs. LED bias currents are matched to 3%. The T6316B build in internal resistor to set the bias current for four LED. The T6316A/B offers several advantages over using ballast resistors, such as improved LED to LED brightness matching, lower bias variation with supply voltage changes, significantly lower dropout voltage, and in some applications, significantly improved efficiency.

### Enable Input

EN powers the input of the T6316A/B. Drive EN high (> 2.0V) to enable the device; drive EN low (< 0.8V) to disable the device. Driving EN low forces LED1, LED2, LED3, LED4 and SET into a high-impedance state.

### Setting the Output Current

SET controls the LED bias current. Current flowing into LED1, LED2, LED3 and LED4 is 270/250 times greater than the current flowing into SET. Set the output current as follows:

T6316A

$$I_{LED} = 270 (0.306V / R_{SET})$$

T6316B

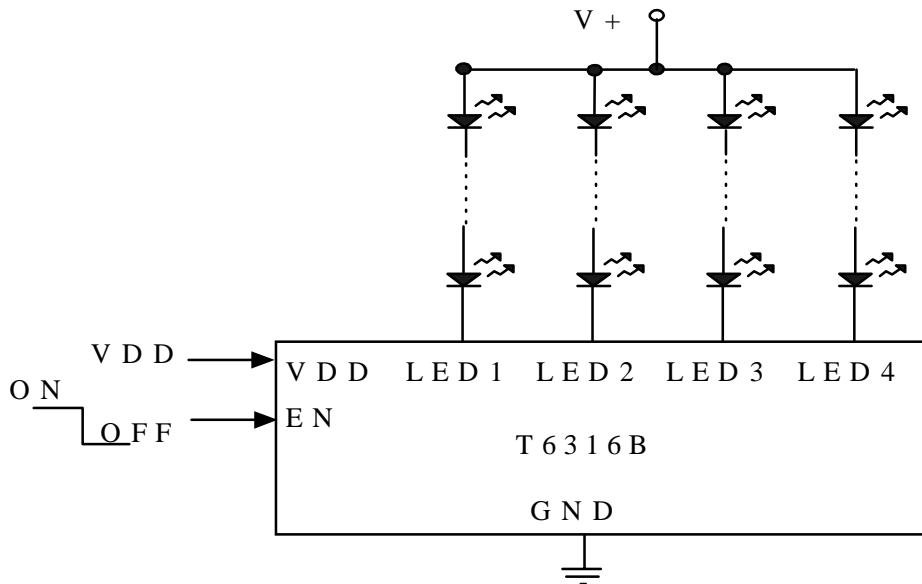
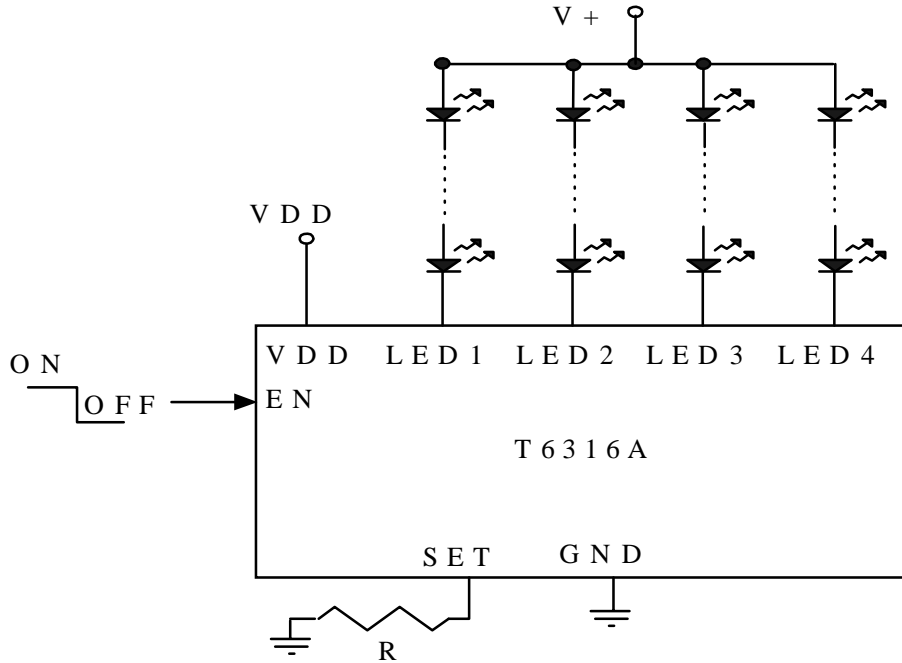
$$I_{LED} = 250 (0.306V / R_{SET})$$

### Applications Information

Very Low-Cost, High-Efficiency Solution . A battery (single Li+ or three NiMH cells) powers the LEDs directly. This is the least expensive and most efficient architecture. Due to the high forward voltage of white LEDs, the LED brightness may dim slightly at the end of battery life. The T6316A/B current regulating architecture and low dropout greatly minimize this effect compared to using simple ballast resistors. The enable function of the T6316A/B turns on and off the LEDs.

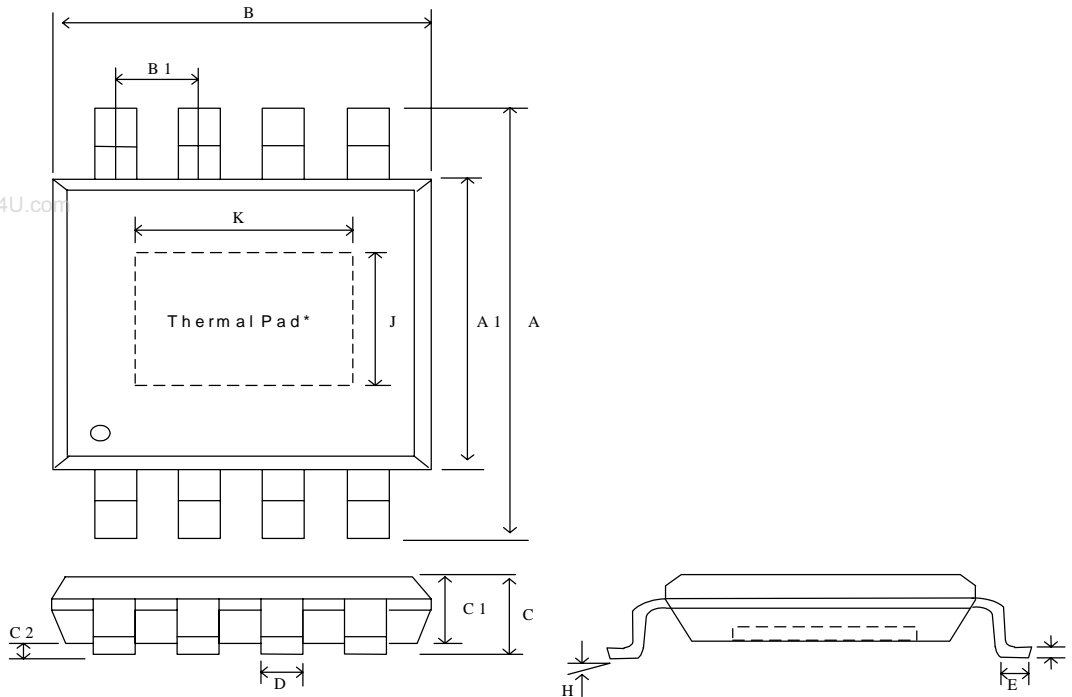
**TYPICAL APPLICATION CIRCUITS**

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Very low-cost, high-efficiency solution

**PACKAGE DIMENSIONS**  
**8-LEAD SOP**



Symbol	Dimension in mm			Dimension in inch		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	5.70	6.00	6.30	0.224	0.236	0.248
A1	3.75	3.95	4.10	0.148	0.156	0.164
B	-	-	5.13	-	-	0.202
B1	-	1.27	-	-	0.050	-
C	-	-	1.80	-	-	0.071
C1	1.35	1.55	1.75	0.052	0.061	0.069
C2	0.10	-	0.25	0.001	-	0.004
D	0.31	0.41	0.51	0.012	0.016	0.020
E	0.30	0.50	0.70	0.012	0.020	0.028
F	0.10	0.15	0.25	0.004	0.006	0.010
J		2.23 REF			0.088 REF	
K		2.97 REF			0.117 REF	
H	0~8°			0~8°		

**\*Note :**

The thermal pad on the IC's bottom has to be mounted on the copper foil.

To eliminate the noise influence, the thermal pad is suggested to be connected to GND on PCB.

In addition, desired thermal conductivity will be improved, if a heat-conducting copper foil on PCB is soldered with thermal pad. The thermal pad enhances the power dissipation. As a result, a large amount of current can be sunk safely in one package.