



KP 1560

Low Dropout LED Driver For White, Blue or Any Color LED

OVERVIEW

KP 1560 generates matched current source drivers for a maximum of four white, blue or any color LEDs. The current in the LEDs can be programmed by an external resistor. The individual LED current are $200 \times I_{SET}$, where I_{SET} is the current through the external resistor connected to CTRL pin. In any case, at least I_I should be always connected to an LED in order to have the other LEDs driven with a matched current to I_I .

FEATURES

- LED driver for parallel-connected LEDs
- Up to 91% maximum efficiency
- Ultra-low voltage drop (<300mV) to support direct Li-ion applications
- No electromagnetic interference
- No switching noise
- No external components needed for current matching
- Analog PWM brightness control
- Up to 160mA bias current (up to 40mA for each LED)
- Small footprint SC-70 and SOT-26 package

ORDERING INFORMATION

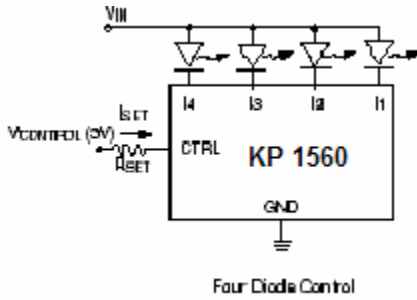
KP 1560-T – 6 lead SOT-26 package

KP 1560-S – 6 lead SC-70 package

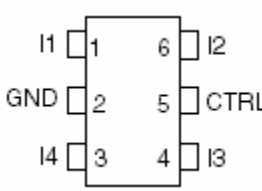
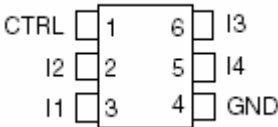
APPLICATIONS

- Cell phones
- PDA, DSC, MP3 Players
- Handheld Computers
- LCD Display Modules
- Keyboard/Keypad Backlight
- LED Displays

TYPICAL APPLICATIONS



PIN ASSIGNMENTS

6-LEAD SOT-26 PACKAGE (KP 1560-T)	6-LEAD SC-70 PACKAGE (KP 1560-S)
	

PIN DESCRIPTION

FOR KP 1560-S (6-LEAD SC-70 PACKAGE):

Pin No.	Symbol	Description
1	<i>CTRL</i>	Sets LED current and provide on/off function
2	<i>I₂</i>	Connect to cathode of LED
3	<i>I₁</i>	Connect to cathode of LED
4	<i>GND</i>	Ground
5	<i>I₄</i>	Connect to cathode of LED
6	<i>I₃</i>	Connect to cathode of LED

FOR KP 1560-T (6-LEAD SOT-26 PACKAGE):

Pin No.	Symbol	Description
1	<i>I₁</i>	Connect to cathode of LED
2	<i>GND</i>	Ground
3	<i>I₄</i>	Connect to cathode of LED
4	<i>I₃</i>	Connect to cathode of LED
5	<i>CTRL</i>	Sets LED current and provide on/off function
6	<i>I₂</i>	Connect to cathode of LED

RECOMMENDED OPERATING CONDITIONS

Parameter	Min.	Typ.	Max.	Unit
LED Cathode Voltage	0.3	0.5	1.0	V
Ambient Temperature	-40	25	85	°C

ABSOLUTE MAXIMUM RATINGS

Parameter	Min.	Max.	Unit
V _{I1} , V _{I2} , V _{I3} , V _{I4} and ENABLE voltage to GND	-0.3	6.0	V
CTRL voltage to GND	-0.3	3.0	V
Power dissipated at T _A = 85°C for 6-Lead SC-70	-	190	mW
Power dissipated at T _A = 85°C for 6-Lead SOT-26	-	680	mW
I ₁ , I ₂ , I ₃ , I ₄ Steady State Current	-	40	mA
Lead Temperature	-	300	°C
Junction Temperature	-	150	°C
Storage Temperature	-55	150	°C
ESD Protection Level for HBM	4	-	kV
ESD Protection Level for CDM	1	-	kV

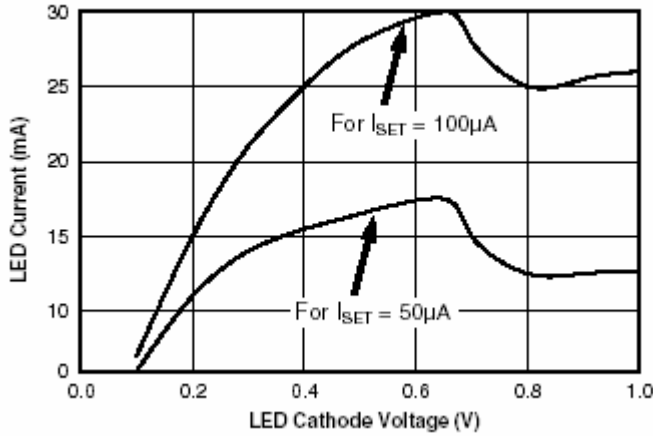
DC ELECTRICAL CHARACTERISTICS

(V_{IN}=3.3V~5.5V, ENABLE=V_{IN}, T_A=85°C)

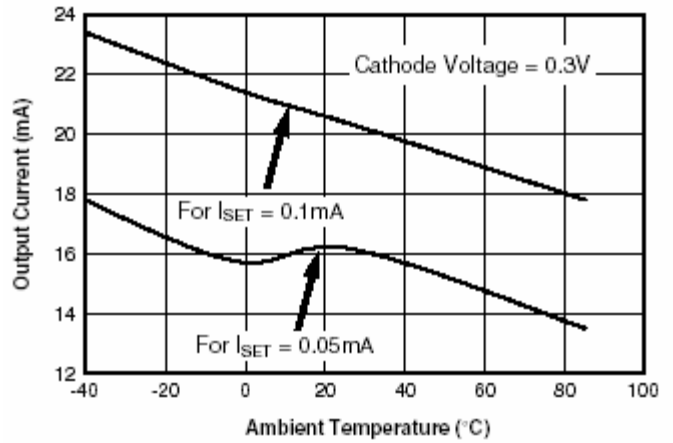
Parameter	Conditions	Min.	Typ.	Max.	Unit
Output Current Multiplication Ratio	I _{SET} = 100μA V _{SAT} = 300mV	140	200	260	-
LED Current per Diode	V _{SAT} = 300mV I _{SET} = 100μA	-	20	-	mA
LED to LED Current Matching	V _{SAT} = 300mV I _{SET} = 100μA T _A = -40~85°C	-3	-	3	%
Peak Efficiency	V _{IN} = 3V	-	91	-	%
Current in OFF Mode	V _{EN} = 0V	-	-	1	μA

TYPICAL PERFORMANCE CHARACTERISTICS

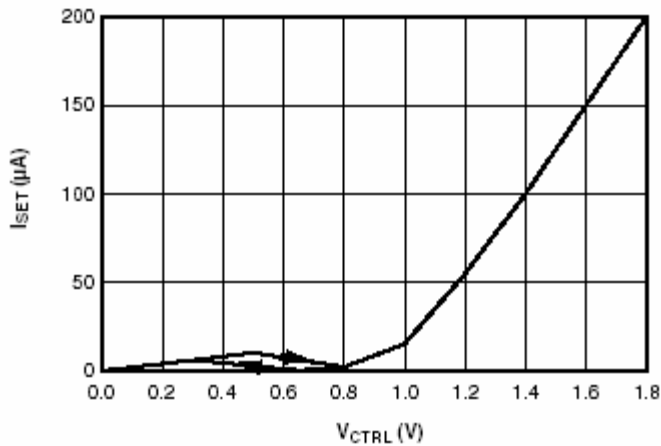
LED Current vs. LED Cathode Voltage



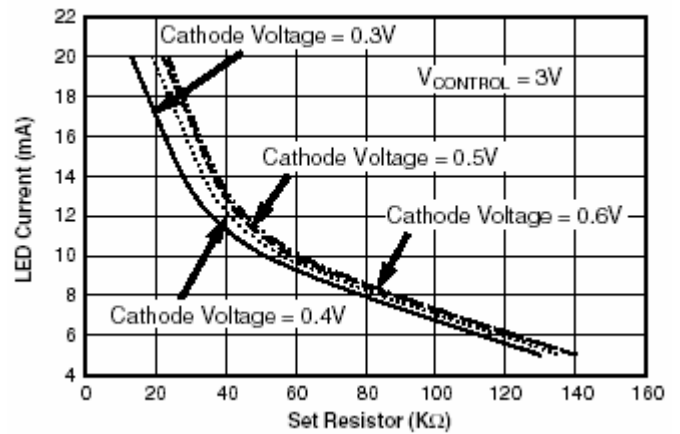
Output Current vs. Temperature



I_{SET} vs. V_{CTRL}



LED Current vs. Set Resistor



APPLICATION INFORMATION

Setting the LED Current

The current flowing into LEDs is approximately 200 times greater than the current ISET. The LED current is controlled by VCONTROL and RSET according to the formula:

$$I_{LED} = 200 \times (V_{CONTROL} - V_{CTRL}) / R_{SET}$$

For VCONTROL = 3V and a specified LED current, the RSET value can be evaluated using the diagram shown in the Typical Performance Characteristics section. For any other option, ISET value can be determined using the graph ISET vs. VCTRL. The LED's brightness can also be adjusted by driving ENABLE or the CTRL pin with a PWM signal. The driving signal frequency should be greater than 100Hz to avoid flickering, increasing to more than 1MHz, if necessary.

Efficiency Considerations

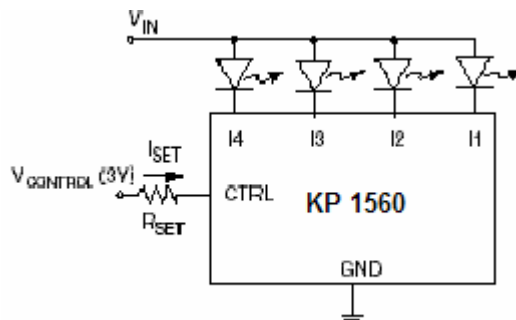
KP 1560 driver's low dropout architecture can significantly improve the efficiency compared to using simple ballast resistors. The system efficiency, defined as the ratio between the LEDs power and the input supplied power can be calculated as follows:

$$\text{Efficiency} = (V_{IN} - V_{CATHODE}) / V_{IN}$$

The lower is the $V_{CATHODE}$, the higher is the system efficiency. Efficiency can be further improved using a higher VIN with more LEDs.

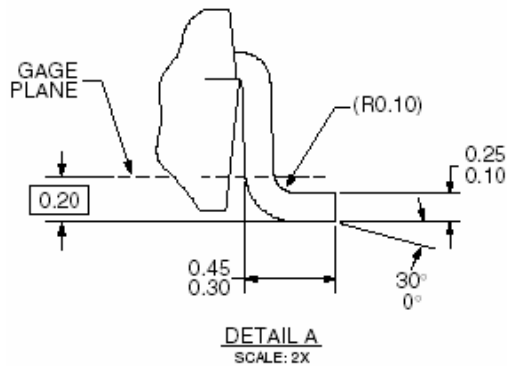
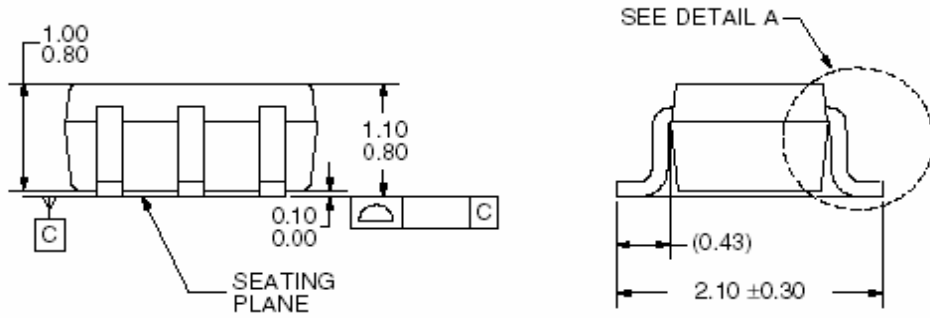
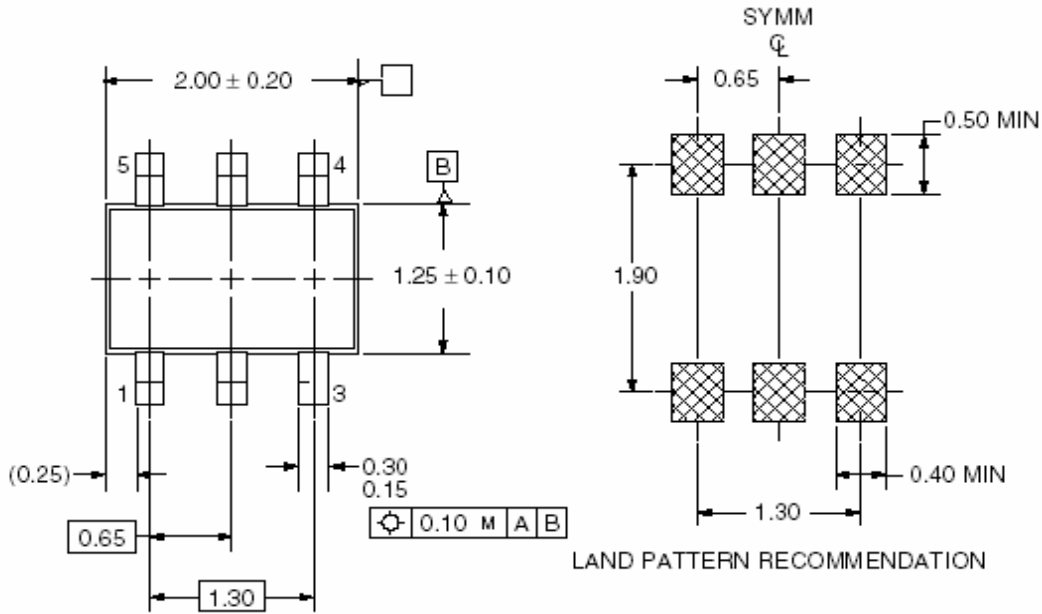
LED Brightness Control

KP 1560 features analog and PWM control to give designers flexible brightness control. These control methods can be applied to the circuit in two different ways, to provide more flexibility than any other solution. To determine the value of RSET, use the "ISET vs. VCTRL" graph under the Typical Performance Characteristics section.

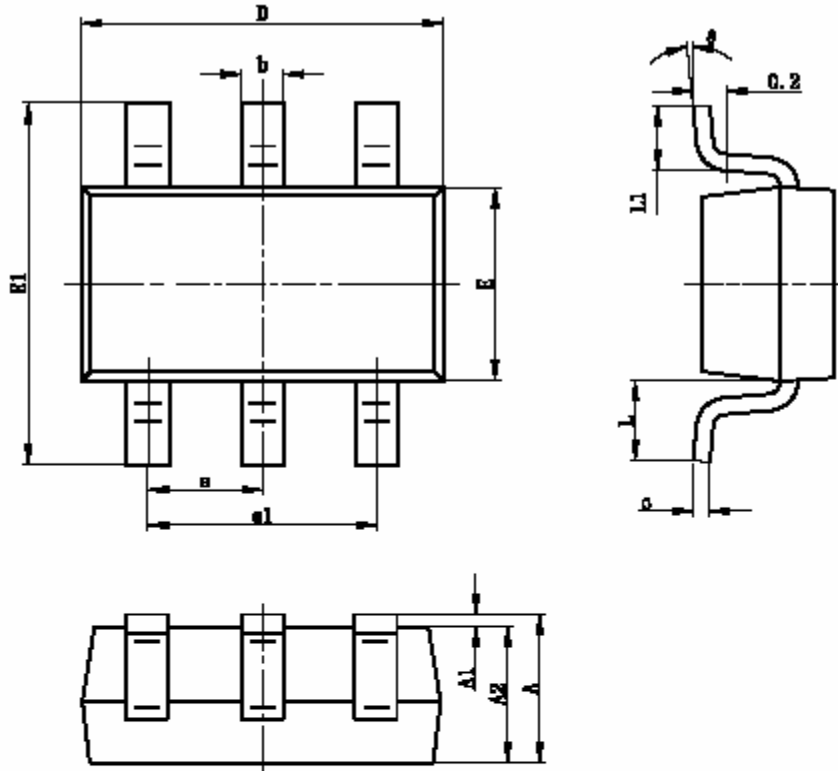


MECHANICAL DIMENSIONS

KP 1560-S: 6-LEAD SC-70 PACKAGE



KP 1560-T: 6-LEAD SOT-26 PACKAGE



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	0.400	0.012	0.016
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	0.950TYP		0.037TYP	
e1	1.800	2.000	0.071	0.079
L	0.700REF		0.028REF	
L1	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°