GL7201

1W High Power White LED Driver

Description

The GL7201 is a step-up DC-DC converter that delivers a regulated output current. The device switches at a 1.0MHz constant frequency, allowing for the use of small value external inductor and ceramic capacitors.

The GL7201 is targeted to be used for driving 1W white LED from a 0.9V to 3.2V input. The LED current can be programmed by the external current sense resistor, Rs, connected between the feedback pin (FB) and ground. A low 95mV feedback voltage reduces the power loss in the Rs for better efficiency. With its internal 2A, 100mΩ NMOS switch, the device can provide high efficiency even at heavy load.

LED dimming can be done by using a DC voltage applied to the FB pin and a pulse width modulation (PWM) signal applied to the FB pin or SHDN pin. During the shutdown mode, the feedback resistor Rs and the load are completely disconnected and the current consumption is reduced to less than 1uA.

The GL7201 is available in the 6-lead SOT-23-6 package.

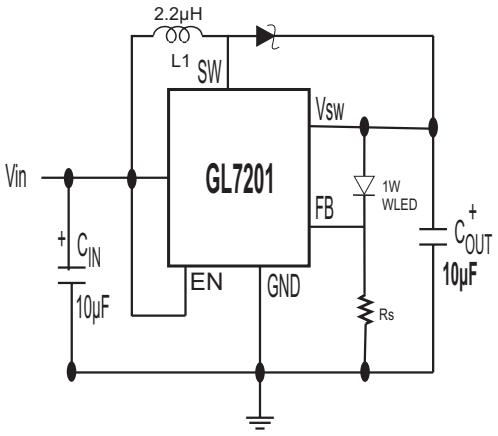
Features

- **LED Power Efficiency: up to 90%**
- **Internal 2A MOSFET Switch**
- **1.0MHz Switching Frequency**
- **Low Start-Up Voltage: 0.9V**
- **Low $R_{DS(ON)}$: 100mΩ (TYP.)**
- **Open LED Protection**
- **Over Temperature Protection**
- **Low Profile SOT-26 Package**

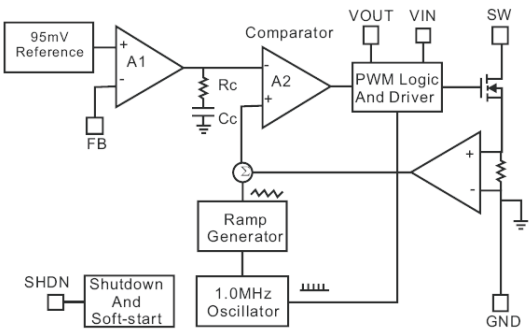
Application

- White LED Torch (Flashlight)
- White LED Camera Flash
- DSC(Digital Still Camera)Flash
- Cellular Camera Phone Flash
- PDA Camera Flash
- Camcorder Torch(Flashlight) Lamp

TYPICAL APPLICATIONS

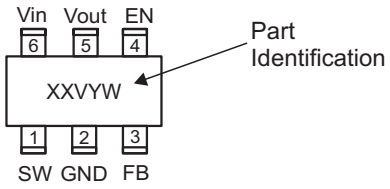


Block Diagram



MARKING INFORMATION & PIN CONFIGURATIONS

SOT-26 (SOT-23-6)



Adjustable Voltage

XX = Marking Code(CD = GL7201)
V = Voltage Code
Y = Year
W = Weekly

ORDERING INFORMATION (Green Package Products are available now!)

Ordering Number	Output Voltage	Package	Shipping
GL7201-ST26R	N / A	SOT-23-6	3000 Units / Reel

* For detail Ordering Number identification, please see last page.

ABSOLUTE MAXIMUM RATINGS

Rating	Value	Unit
Supply Voltage	-0.3 to 6	V
SW Pin Voltage	-0.3 to 6	V
EN, FB Pin Voltage	-0.3 to 6	V
Storage Temperature Range	-65 to + 125	°C
Junction Temperature	-40 to +125	°C
Lead Temperature (Soldering, 5 sec.)	+300	°C
Thermal Resistance (Junction to Case)	+130	°C/W

OPERATING CONDITIONS

Rating	Value	Unit
Temperature Range	$-40 \leq T_J \leq +85$	°C
Supply Voltage	0.9 to 5.8	V

ELECTRICAL CHARACTERISTICS: All Output Voltage Versions

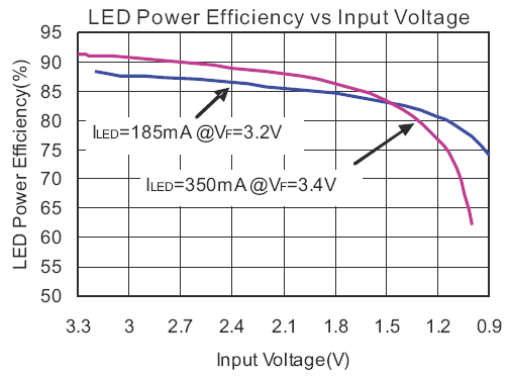
Specifications with standard type face are for T_A = 25 ℃, V_{IN}= 2.4V, I_{LED}= 350mA, C_{IN}= 10uF, C_{OUT}= 10uF, L=2.2uH

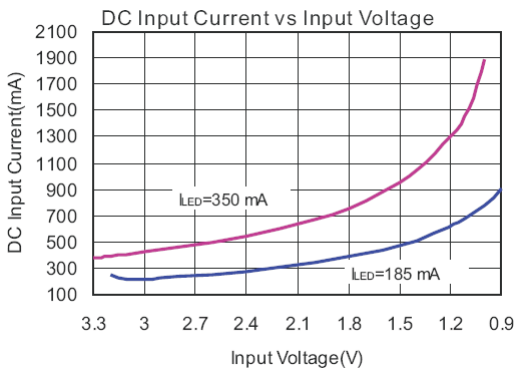
Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Input Voltage Range		V_{IN}	0.9	-	VF-0.2 (Note1)	V
Feedback Voltage		V_{FB}	90	95	100	mV
Oscillator Frequency		F_{OSC}	0.85	1.0	1.15	MHz
EN Thershold High	V_{IN} =1.8V	V_{EH}	1.0			V
EN Thershold Low	V_{IN} =1.8V	V_{EL}			0.4	V
Max. Output Current Range		$I_{O(Max)}$	350			mA
Quiescent Current	No Load	I_Q		1	3	mA
Shutdown Current	V_{EN} =0	I_{SD}			1	μA
Switch on Resistance	V_{OUT} =3.4V	$R_{DS(ON)}$		0.1		Ω
Current Limit	V_{OUT} =3.4V	I_{LIM}	2			A

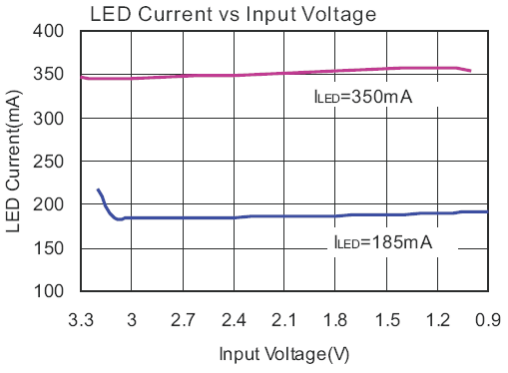
Note 1: V_F- LED forward Voltage

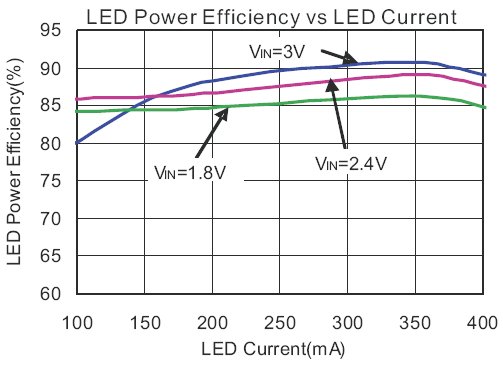
Typical Performance Characteristics

Test Environment: T_A = 25 C, C_{IN}= 10uF, C_{OUT}= 10uF, L=2.2uH

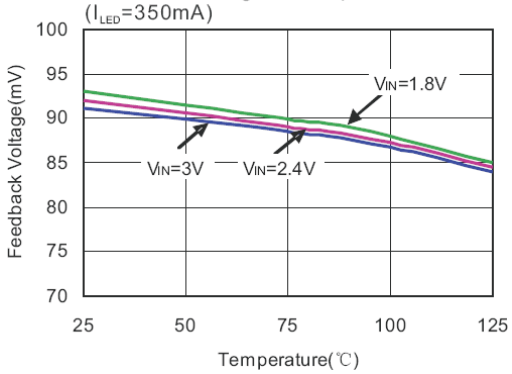




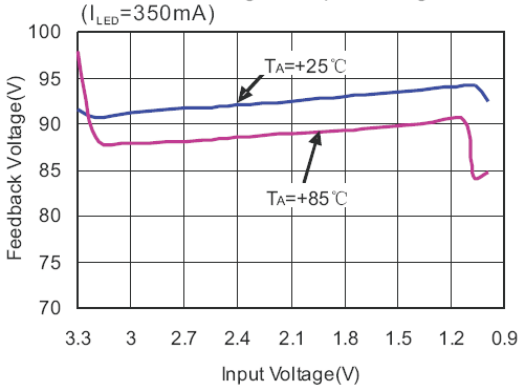




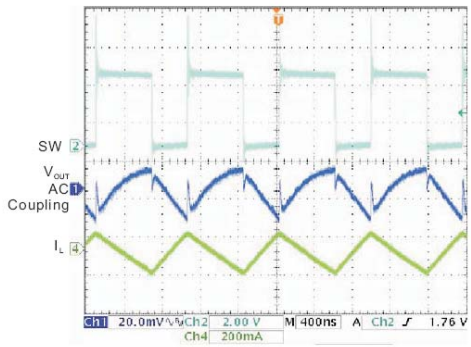
Feedback Voltage vs Temperature
(I_{LED}=350mA)



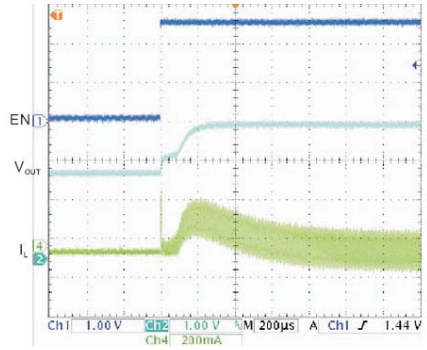
Feedback Voltage vs Input Voltage
(I_{LED}=350mA)



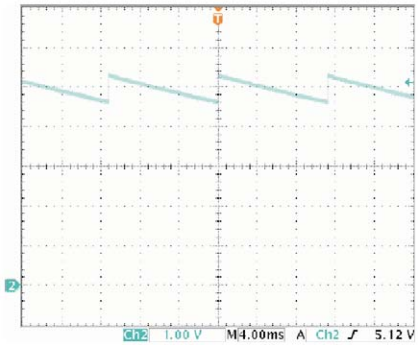
Switching Waveform



Start-Up Waveform



Overvoltage Protection



Application Information

Inductor Selection

The GL7201 can use a small value inductor due to its switching frequency of 1MHz. The value of inductor focuses in the range of 1.5uH to 4.7uH for most GL7201 applications. In typical high current white LED applications, it is recommended to use a 4.7uH inductor. The inductor should have low DCR (DC resistance) to minimize the I^2*R power loss, and it requires a current rating of 2A to handle the peak inductor current without saturating.

Capacitor Selection

An input capacitor is required to reduce the input ripple and noise for proper operation of theGL7201. For good input decoupling, Low ESR (Equivalent series resistance) capacitors should be used at the input. At least 2.2uF input capacitor is recommended for most applications. A minimum output capacitor value of 4.7uF is recommended under normal operating conditions, while a 10uF-22uF capacitor may be required for higher power LED current. A reasonable value of the output capacitor depends on the LED current. The ESR of the output capacitor is the important parameter to determine the output voltage ripple of the converter, so low ESR capacitors should be used at the output to reduce the output voltage ripple. The small size of ceramic capacitors is an excellent choice for GL7201 applications. The X5R and X7R types are preferred because they maintain capacitance over wide voltage and temperature ranges.

Diode Selection

It's indispensable to use a Schottky diode rated at 2A with the GL7201. Using a Schottky diode with a lower forward voltage drop is better to improve the power LED efficiency, and its voltage rating should be greater than the output voltage.

LED current setting

The LED current is set by the single external Rs resistor connected to the FB pin as shown in the typical application circuit on page 1. The typical FB reference is internally regulated to 95mV. The LED current is 95mV/Rs. It's recommended to use a 1% or better precision resistor for the better LED current accuracy. The formula and table 1 for Rs selection are shown as follows:

$Rs=95mV/I_{LED}$

Table 1. Rs Resistor Value Selection

I_{LED}(mA)	Rs(Ω)
200	0.475
300	0.317
350	0.270
400	0.238

LED Dimming Control

Dimming Control Using a DC Voltage to FB Pin

One method for dimming the LEDs is to apply a variable DC voltage through a resistor to the FB pin of the GL7201. The dimming control with a DC voltage is shown in the Figure1. The DC voltage artificially raises the FB pin voltage, with the DC voltage increasing, the voltage across R2 increases and the voltage Rs decreases, which therefore lowers the LED current. The values of resistor R1 and R2 should be large enough to make the current from the DC source much smaller than the LED current while much larger than the FB leakage current. When Vdc ranges from 0V to 2V, the resistors in the Figure will set the LED current from 0mA to 350mA.

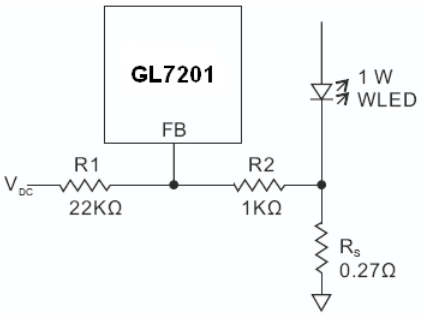


Figure 1. Dimming Control Using a DC Voltage to FB Pin

Application Information (continued)

Dimming Control Using a PWM Signal to FB Pin

By using the PWM signal to FB pin as shown in the Figure 2, the LED turns on or off and its current operates at either 0mA or the set maximum current. The PWM signal can be considered as an adjustable DC voltage. As the PWM duty cycle increases, the LED current decreases. Typically, the PWM frequency ranges from 5KHz to 40KHz.

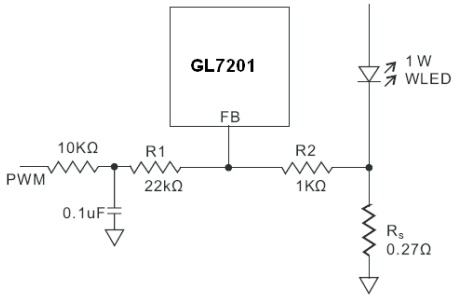
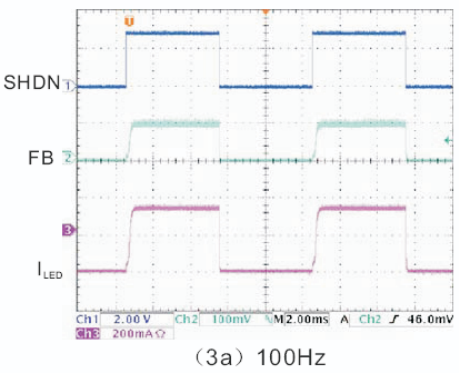


Figure 2. Dimming Control Using a PWM Signal to FB Pin

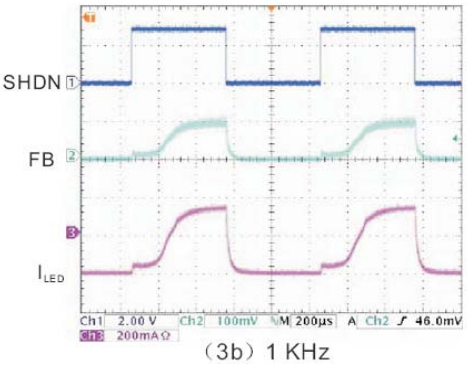
Dimming Control Using a PWM Signal to EN Pin

With the PWM signal applied to the EN pin of the GL7201, the LED turns on or off. When the SHDN pin is high, the LED turn on and its current is at the set maximum current; when the EN pin is low, the LED turn off and its current turns to 0mA. The average LED current increase proportionally with the PWM duty cycle. A 0% duty cycle produces 0mA of LED current; a 100% duty cycle corresponds to the set maximum current. The magnitude of the PWM signal should be higher than the EN input high (V)

The typical frequency of the PWM signal ranges from 100Hz to 1KHz. Figure 3 shows the LED current with the PWM duty cycle set to 50% and the PWM frequency set respectively to 100Hz and 1KHz. Figure 4 shows the LED current versus the PWM duty cycle, setting the PWM frequency to 100Hz.



（3a）100Hz



（3b）1 KHz

Figure 3. Dimming Control Using a PWM Signal to EN Pin

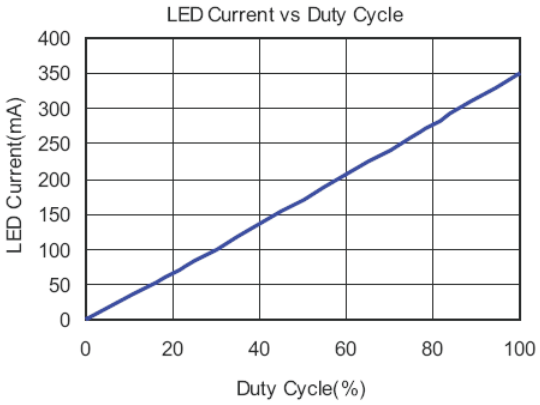
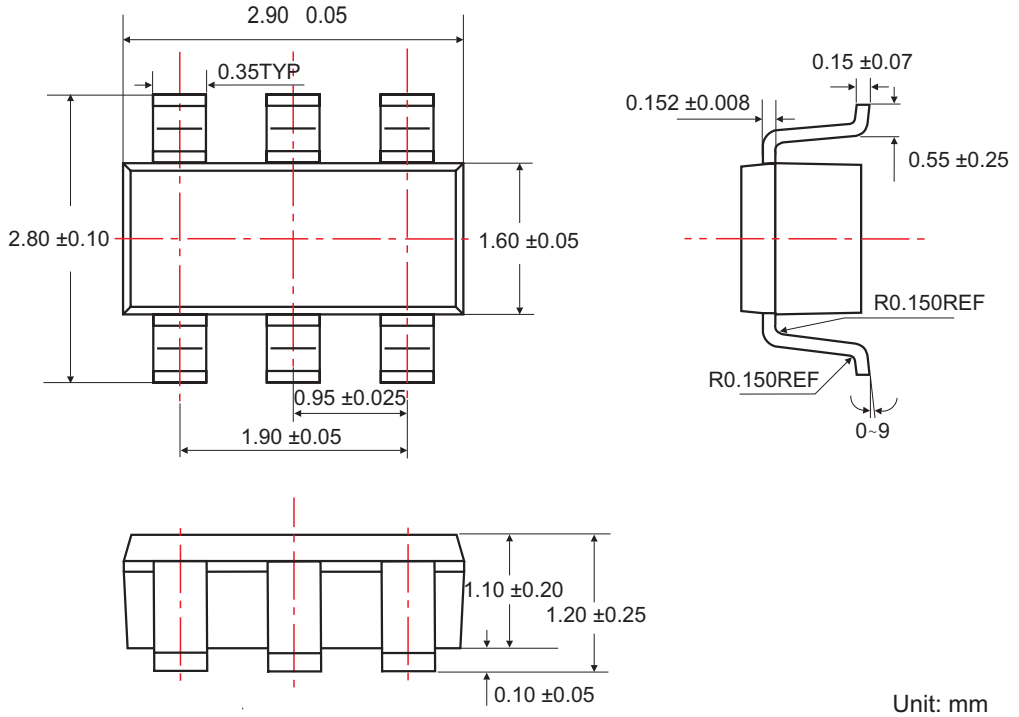


Figure 4. LED Current vs Duty Cycle

◆ SOT-25(SOT-23-5) PACKAGE OUTLINE DIMENSIONS



Unit: mm

◆ ORDERING NUMBER

GL7201 ST26 R

- GL7201 → Circuit Type
- R → Shipping: R: Tape & Reel
- ST26 → Package: ST26: SOT-26