DT0010
Design tip

Adding the analog dimming to EVL6564H-25W-BB.

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Main components	
EVL6564H-25W-BB	25 W wide-range high power factor buck-boost converter demonstration board using the L6564H

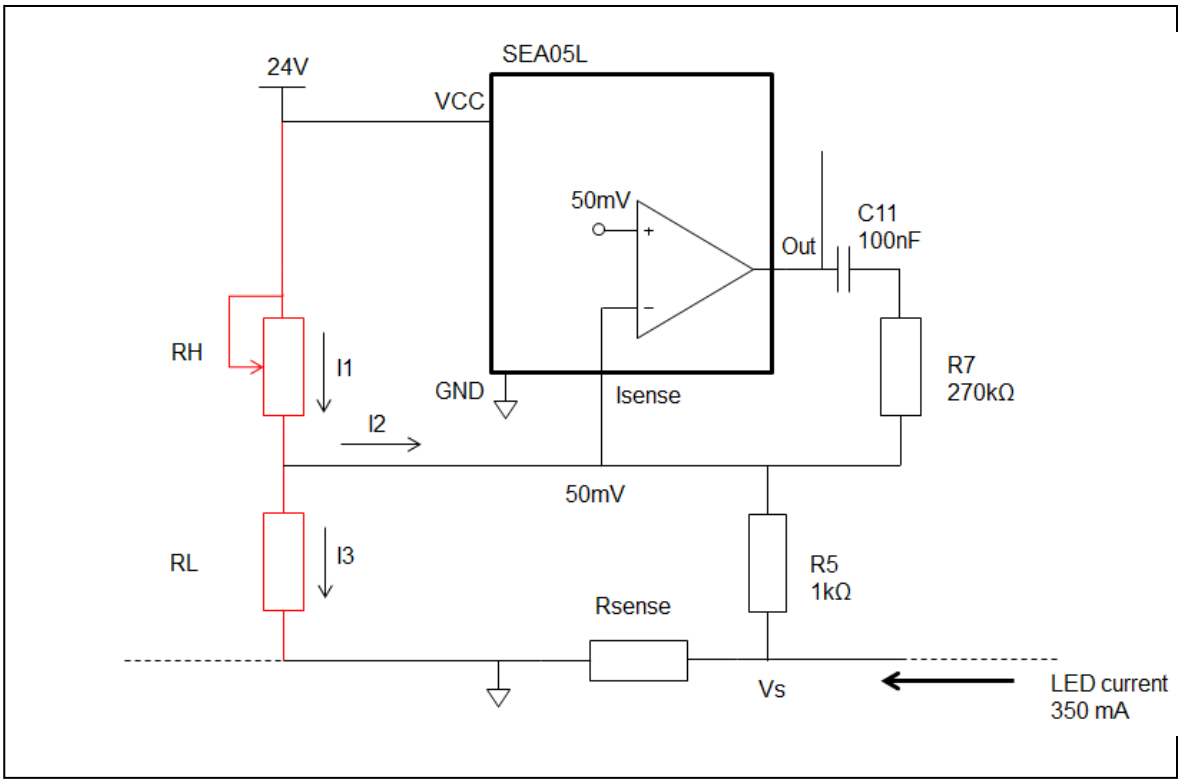
Purpose and benefits

The purpose is to increase the performance of the ST LED driver EVL6564H-25W-BB:
If the dimming function is required, there is a simple way to modify the LED current acting on a trimmer of an added divider.
The benefit is an analog dimming of the LED light in to the range 25% to 100%.

Description

Referring to the electrical schematic of AN4314 the current loop is controlled by the internal comparator of the SEA05L, the internal reference is 50mV and, externally, the inverting pin of the current loop op-amp is connected to the sense resistor (R7=3.3Ω//R6=0.15Ω) through the decoupling resistor R5 (Figure 1).

Figure 1. Circuit diagram



The current loop keeps the Isense node at 50mV (see SEA05L datasheet) and since no current flows in R5, the Isense pin is at the same voltage of the Rsense node (Vs).

But if a current ids forced in to the R5, the sum of the voltage drop on Rsense and R5 is always the same. The LED current will be reduced in order to have:

$$V_{R5} + V_S = 50mV$$

Consider, for example that no current is flowing on the R5 resistor so VR5=0V, the node Vs=50mV and the LED current is calculated as:

$$I_{LED} = \frac{Vs}{Rsense} = \frac{50mV}{0.145\Omega} = 350mA$$

But if a current is flowing through R5, the node Vs will assume a value between few millivolts to maximum 50mV depending on the current I2 injected through the divider RL and RH. Suppose for example that I2=20µA, the voltage drop on R5 is 20mV, the Vs will be 30mV and the LED current will be:

$$I_{LED} = \frac{Vs}{Rsense} = \frac{30mV}{0.145\Omega} = 200mA$$

With RL=500Ω (470Ω+30Ω), and RH=240kΩ (43kΩ + a 200kΩ trimmer), the I1=I3=100µA, no current I2 is flowing on R5 and the LED current remains at its maximum level of 350mA, the LED driver will work at 25W.

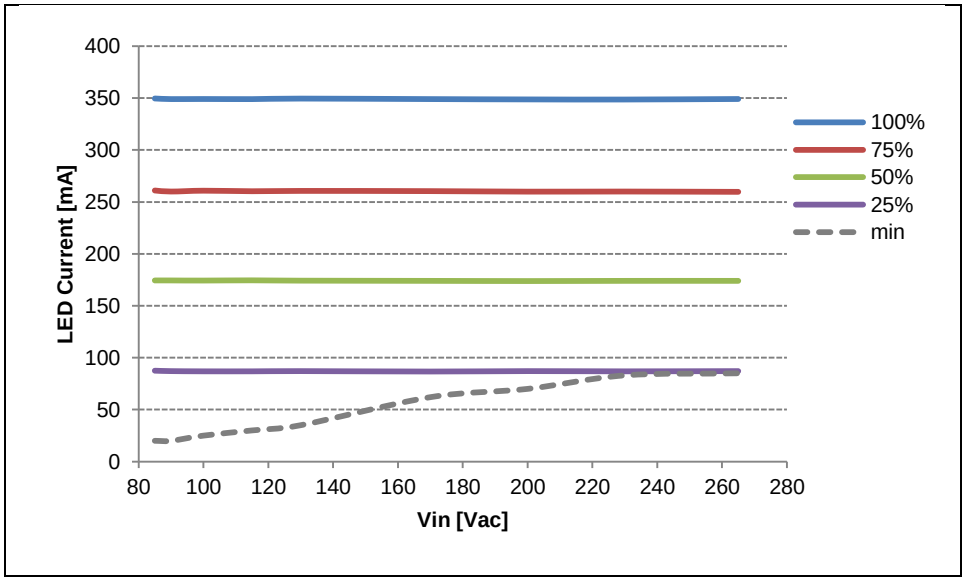
Trimming and lowering the 200kΩ resistor, the extra current I2 will modify the sense resistor voltage drop Vs, decreasing the LED current and of course the converter output power.

Dimmed performance

Simply acting on the 200kΩ trimmer, it is possible to modify continuously the LED current, the LED light and of course the output converter power.

In Figure2, LED current has been dimmed from 100% to 25% with a 25 % step and the control loop has been checked over all the input mains.

Figure 2. Circuit Lime regulation vs Line voltage fixing different values of LED current



A good Line regulation has been observed at every output power level. Till 25% of the load the converter starts up properly.

Finally it has been studied the minimum current level achievable, fixing the input mains voltage. Due to the closed current loop, pin COMP of the L6564H is moving in its dynamic range proportionally with the Load sensed.

When the LED current is too low and the converter is working at very light load, the COMP pin is reaching its Burst Mode threshold switching ON and OFF the LED driver with a jittering effect of the light.

In Figure 2, the LED current, just before observing this light jittering, has been considered as the minimum dimming level achievable.

Due to the characteristic of the entire control loop the dashed line is slightly varying with the input mains voltage.

As conclusion, with this simple trimming method, the LED dimming can be considered effective in the range 25% to 100% load.

Support material

Documentation
SEA05L datasheet , “Advanced constant voltage and constant current controller with very efficient LED pilot-lamp driver”
L6564H datasheet, “High voltage start-up transition-mode PFC”
AN4314: “25W wide range high power factor buck-boost converter demonstration board using the L6564H”

Revision history

Date	Version	Changes
1-Aug-2013	1	Initial release

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