Introduction

The typical source of light in a flashlight is a small incandescent bulb or light-emitting diode (LED). These are powered by disposable or rechargeable batteries, turning a crank, shaking, or solar panels to recharge a battery. This application note describes the design of a current control for an LED version flashlight.

Flashlight circuit design

The circuit shown in Fig 1 includes one SLG46721 CMIC IC, two transistors, a switch, two capacitors, six resistors, one 3W LED and six 5mm LEDs. Fig 2 shows the internal structure of the SLG46721 CMIC, which controls all functions of the flashlight. This design utilizes three analog comparators, two 2-bit LUTs, two 3-bit LUTs, two inverters, two delays and one 4-bit LUT.

The design can be divided into 4 operational blocks: power ON/OFF, Low battery detection, constant current block for a 3W LED, and a constant current block for driving 6 LED's.

The power ON/OFF block is implemented by 2-bit LUT4 and INV0. Low battery detection is implemented using ACMP0 and 3-bit LUT0, INV1, Delay0 and Delay1. Constant current block for 3W LED is implemented using ACMP3 and 3-bit LUT1. And the 6 LED's block is implemented using ACMP2, 2-bit LUT5 and 4-bit LUT0.

Flashlight circuit analysis

This flashlight uses a special button with four states. This button has one input and four outputs. An input connects to each output in cycle with each button push. With the switch in the OFF position, the current draw from the battery is <1uA. If the switch is in 3W_LED_ON position, 2-bit LUT4 output will be HIGH. In this case all ACMPs will be turned ON, PIN7 will go LOW and it turns on the external divider which checks if the battery has >3.2V. If the battery is charged >3.2V, the CMIC will turn ON 3W LED usinga constant current block. The same functionality will be with 6 LED's when the switch is in 6LED_ON position.

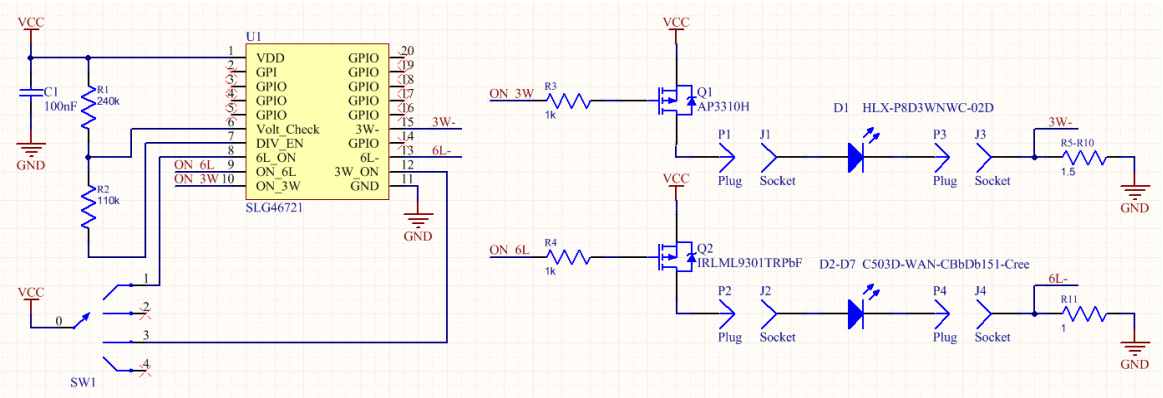

Fig 1. Flashlight circuit

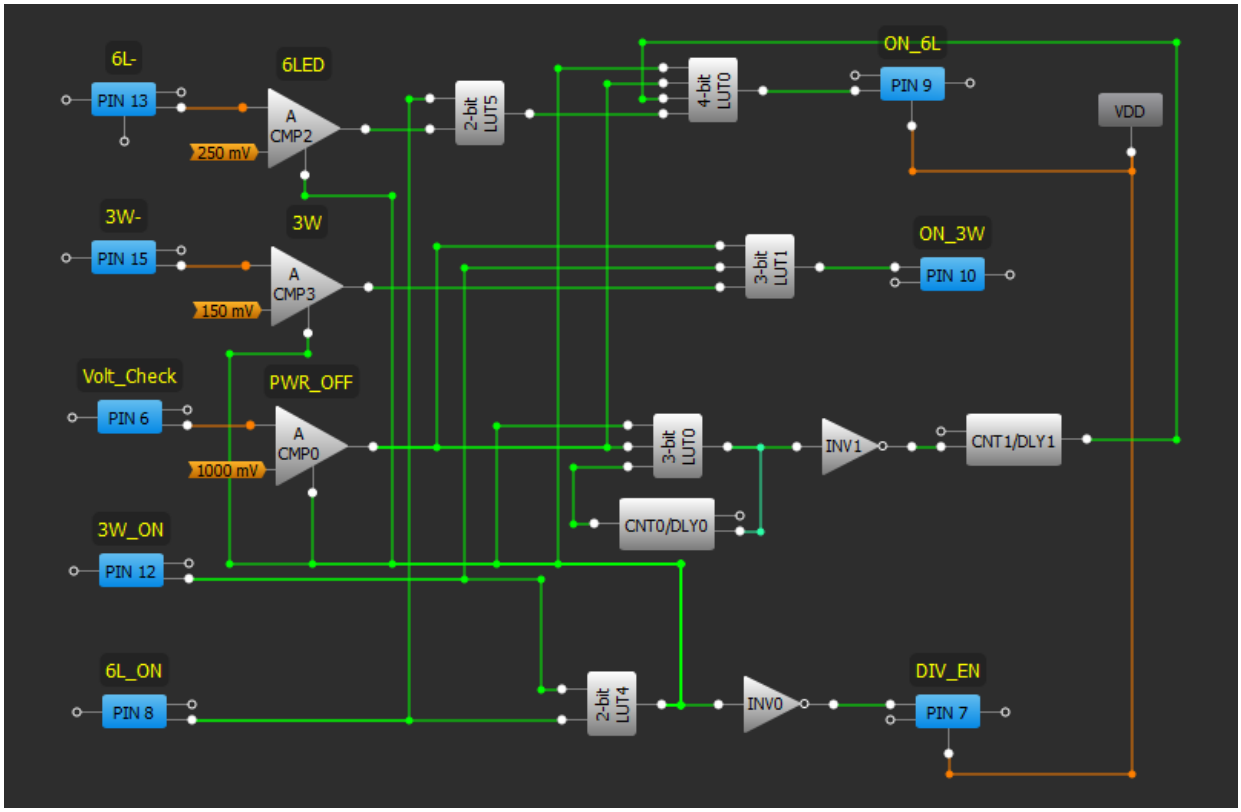

Fig 2. Flashlight GPAK schematic

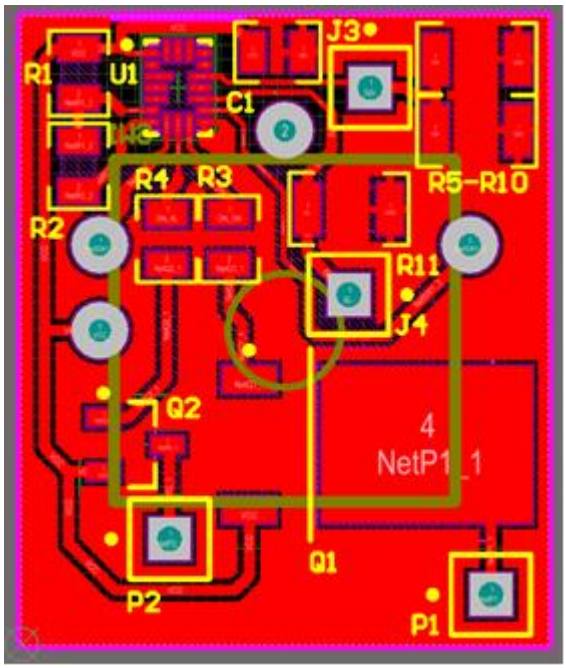

Fig 3. Flashlight PCB

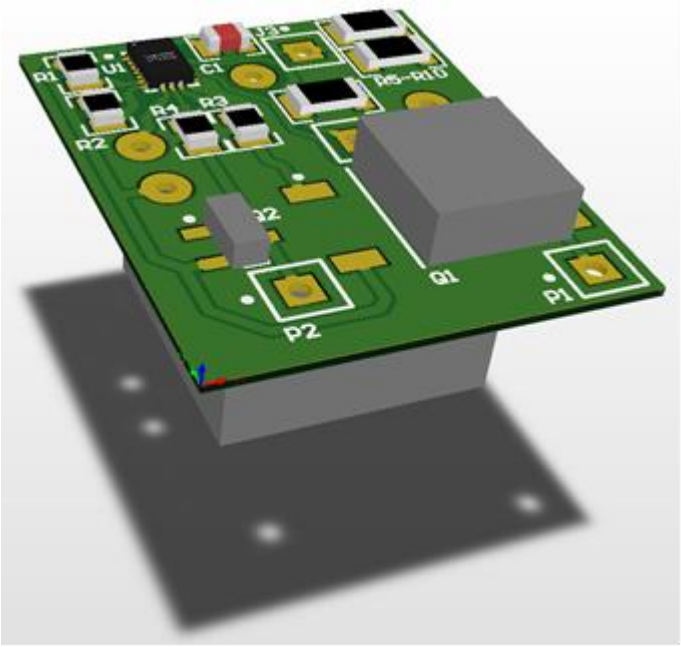

Fig 4. Flashlight PCB 3D view

In the case where the flashlight in any of the ON positions and battery voltage drops below ~3.2V, the CMIC will enter a third mode: 6 LEDs will start blinking with 1Hz (100ms ON, 900ms OFF) frequency, which means that the battery is low and should be recharged.

Fig 5. Complete Flashlight

Conclusion

Using constant current blocks in flashlight controls is very useful because it is effective, reduces current consumption, and extends run time.

About the Author

Name: Oleg Basovych

Background: Oleg Basovych graduated from Lviv Polytechnic University in 2011, studying at the Institute of Computer Science, department of Automatic Control Systems. He has 3 years' experience working as an engineer and his particular sphere of interest includes microcontrollers, the construction of high-class acoustic systems and amplifiers. At the moment he is working with the analog and digital circuits and investigating the specifics of its application

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A	Oleg Basovych	05/14/2015	New application note

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