Development of Low Power LED Driver Using LTSpice Software

Muhammad Ikram Mohd Rashid
Sustainable Energy & Power Electronics Research Group(SuPER)
Faculty of Electrical and Electronics Engineering
Universiti Malaysia Pahang
26600 Pekan, Pahang, Malaysia
mikram@ump.edu.my

Aim Izzuddin Hakimi Mohamad Bekri
Faculty of Electrical and Electronics Engineering
Universiti Malaysia Pahang
26600 Pekan, Pahang, Malaysia
hakimibekri@yahoo.com

***Abstract*— LED driver is regulated power supply designed to match the characteristics of an LED or array of LEDs in our application. The LED current can vary substantially over the battery voltage range even in normal operation device, thus affect the brightness and reduce the life of the lighting device. This project present a method for the system that provides more efficient solution for driving a low power LED driver by control the LED current and to improve the usage of LEDs in good luminosity, efficiency and long life service. The current mode PWM controlled boost converter for power LEDs application is introduced. According to the characteristic of the power LEDs, they are current controlled device. Typically, the switching converters are used as the driver for power LED. For this project, the boost topology is selected as the power LEDs driver. Besides, the current mode PWM controller is used to ensure the system is stable. The project used LTC 3783 as PWM control IC and connected to driver circuit to drive low power LED. The calculations are based on design specifications. Pspice software is used for the simulation before built hardware implementation. The hardware built was tested and finally the waveform and result is recorded.**

Keywords—Low Power LED; Pspice; LTspice

I. INTRODUCTION

Currently, the advancement in the high-power LED are increasingly finding new application in emergency light, street lighting, traffic lights, automobiles, cars, flashlight and general purpose lighting. Because of their superior longevity, low maintenance requirement, improved luminance, there is no mercury inside the devices. Therefore, they perform an extremely long operating life. LEDs come in two basic categories which is Low Power LED and High Power LED. Low power LEDs commonly come in 3mm, 5mm and 8mm sizes. These are fractional wattage devices, typically 0.1 watt, operate at low current (~20mA) and low voltage (3.2 volt DC), and produce a small amount of light, perhaps two to four lumens. For high power LEDs, it commonly comes in 1-3 watt packages. They are driven at much higher current, typically 350,700 or 1000MA, and with technology can produce 40- 80 lumens per 1-watt package. High power LEDs come in many different shapes and sizes [1].

LEDs offer many advantages over traditional lighting sources. Exactly which ones are important will depend on the specific application, they include but not limited to: very long life times (50,000 hours), lower maintenance cost, more efficient than incandescent and halogen lamps, light up instantly, fully dimmable without filters, directly emit colored light without filters, complete spectrum of colors, dynamic color control tune able white point, total design freedom with hidden light, directed light for more efficient systems, vibration-proof lighting, no mercury, no IR or UV radiation in visible light [2].LEDs have many advantages such as low power consumption, high efficiency, and long life. They are not only energy efficient, but also environmentally friendly [3].

Directional light emission; LEDs are mounted on a flat surface, they emit light hemispherical, rather than spherically. For task lighting and other directional applications, this reduces wasted light. Low compact size; The small size and directional light emission of LEDs offer the potential for innovative, low-profile, compact lighting design. To produce luminance levels equivalent to high output traditional luminaries requires grouping multiple LEDs, each of which increases the heat sinking needed to maintain light output and useful life. Breakage resistance; LEDs are largely impervious to vibration because they do not have filaments or glass enclosures. LED's inherent vibration resistance may be beneficial in applications such as transportation (planes, trains, and automobiles), lighting on and near industrial equipment, elevators and escalators, and ceiling fan light kits. Instant on; LEDs come on at full brightness almost instantly, with no re-strike delay. This characteristic of LEDs is notable in vehicle brake lights, where they come on 170 to 200 milliseconds faster than standard incandescent lamps, providing an estimated 19 feet of additional stopping distance at highway speeds (65 mph). In general illumination applications, instant on can be desirable for safety and convenience.

Rapid cycling; LED life and lumen maintenance is unaffected by rapid cycling. In addition to flashing light displays, this rapid cycling capability makes LEDs well-suited to use with occupancy sensors or daylight sensors. No IR or UV emissions; HID lamps can emit significant ultraviolet radiation (UV), requiring special shielding and diffusing to