

高效能發光二極管照明系統

An Energy-Saving High-Brightness LED Lighting System

使用二級脈衝寬度調整的高光度輸出、低熱損耗、高能源效率的照明系統

Higher luminous output, lower heat loss, more energy-efficient LED driver using two-level pulse-width-modulated current

專利申請編號及國家：12/366,304 (美國)

特色與優點

- 總體發光功效提高，因而提升能源節約和符合環保產品的設計概念
- 減少二極管的熱損耗繼而延長其壽命
- 促進環球能源的有效使用
- 概念簡易和便於以低成本普遍實踐在二極管驅動器上
- 驅動器可從現有的集成電路作輕微的修改後直接採用，使其易被照明工業所採納

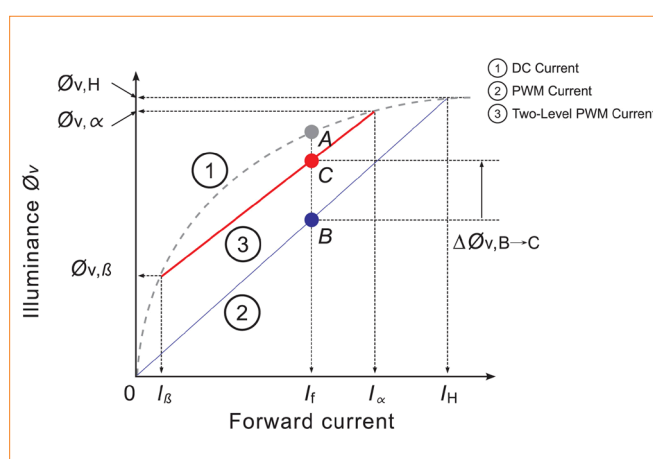
應用

- 便於普遍實踐在一般已有的驅動器上
- 透過此項發明理清業界對二極管的驅動和光控特性的認識

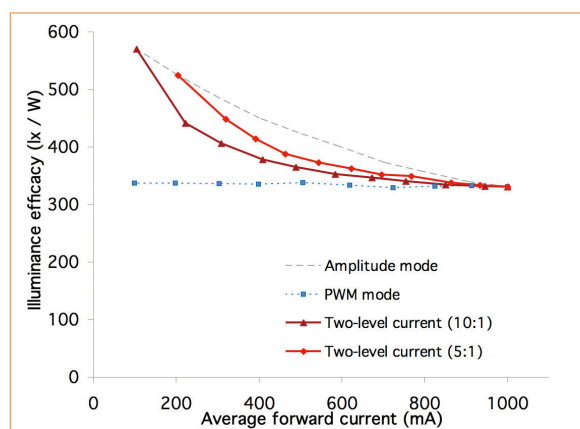
獎項

第三十七屆瑞士日內瓦國際發明及創新技術與產品展覽 - 評審團特別嘉許金獎 (2009年4月)

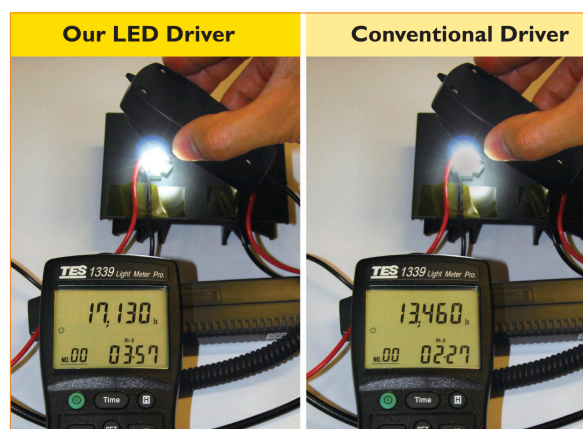
此照明系統採用嶄新的電流波形設計以達致提升發光二極管的發光效能和減少二極管本體的發熱效用。傳統二極管驅動器利用週期性的開關技術調光，這方法雖然能達到光控的效果，卻同時降低發光效能。我們發現若把低平電流從零點提高，在發光效能上產生顯著的改善。由於電流維持脈衝的波形，傳統驅動器的光控效果和顏色穩定性仍然能夠被保留。我們根據此概念設計並開發了一款驅動器以作檢驗，並利用兩種不同品牌的發光二極管進行測試，結果顯示在發光效能上達至約18%的提升。



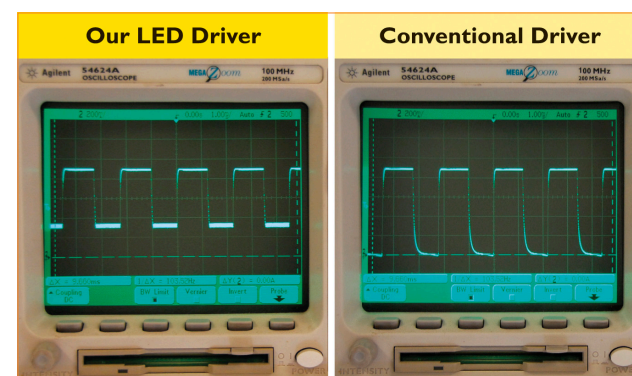
二級脈衝電流寬度調整的操作原理
Operating principle for driving LEDs based on two-level PWM current



CREE 二極管在不同的驅動方法下的發光效能測量
Measured illuminance efficacy of CREE XLAMP LED sample under various driving techniques



理大的二極管照明系統(左)在發光效能上有顯著的提升
A noticeable improvement of luminous efficacy is obtained with our LED driver (left)



理大的二級脈衝寬度調整的電流波形(左)與傳統的電流波形(右)
Our two-level PWM current waveform(left) vs conventional PWM current waveform(right)

A new energy-efficient LED driver with dimming function increases luminous output and lowers heat loss by using two-level pulse-width-modulated (PWM) current. In the conventional PWM technique, the low-level current is set to zero and the LED is driven by periodic on-off pulses to give better dimming functionality. However, this simple approach degrades the luminous efficacy of the LED. By raising the low-level current above zero, noticeable improvement is obtained in the luminous efficacy. Since the current waveform remains pulsating, the outstanding dimming functionality and color stability available from the PWM technique is retained. A prototype of the power supply capable of producing the required two-level pulsating current waveform was constructed and the idea was tested on high-brightness LEDs produced by two leading manufacturers, CREE and Philips. On average a noticeable improvement of 18% of luminous efficacy was obtained.

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Special Features and Advantages

- Overall luminous efficacy of lighting systems can be improved thus promoting energy saving and green product design
- Heat loss is lowered and thermal stress on the LED is reduced
- More efficient energy utilization is possible
- The idea is simple and easy to implement on LED drivers at low cost
- The method can be easily adopted by the lighting industry because the existing PWM driver ICs need only minor modification for incorporating the new technique

Applications

- Incorporation into any LED drivers
- The impact of driving technique on the luminosity of LEDs can be studied and clarified

Award

Gold Award with the congratulations of the jury - 37th International Exhibition of Inventions, New Techniques and Products, Geneva (April 2009)