Technical Data Sheet

SEOUL SEMICONDUCTOR

Z-POWER LED Series
Electrical Drive Management

Z-Power is developed for the application requiring high optical power.
Thermal management should be considered as it generates much heat due to high current consumption. Although Z-Power package is designed with superior thermal characteristics, additional thermal systems should be taken in account to minimize any possible effects by heat and for best performance.
(See thermal management guide)

To optimize thermal and other characteristics of Z Power, appropriate driving current must be chosen in advance. Allowable current for LED is closely related with heat generated during operation and ambient temperature.

Excessive driving current can deteriorate LED performance which will affect LED lifetime so constant current driving is strongly recommended.

In this document, you can find the information about constant cur rent driving including general information about current control an d PWM (Pulse Width Modulation). Also, general characteristics of Z Power are listed for user's convenience

Rev. 01
March 2008
www.ZLED.com
서식번호 : SSC-QP-7-07-24 (Rev.00)

Controlling constant current

1. Why constant current?

LED is the component that allows current through itself according to input voltage. In other words, it is close to voltage control component. General LED, especially Z-POWER LED must be driven by constant current. There are two main reasons.

Firstly, LED is an optical device. How much luminous flux we can get from LED is very important. Generally luminous flux is closely related to driving current. It is easy to recognize and control optical characteristics by current constant. Secondly, LED is more sensitive to voltage than current. As you can see in Figure 2, the slope of voltage is higher steeper than that of current. So, it is easier to fix current that we want and we can maintain characteristic of LED this way. The reason we must drive LED by constant current is obvious, especially when considering thermal characteristic of POWER LED.

For these two reasons, Z-POWER LED must be driven by constant current.

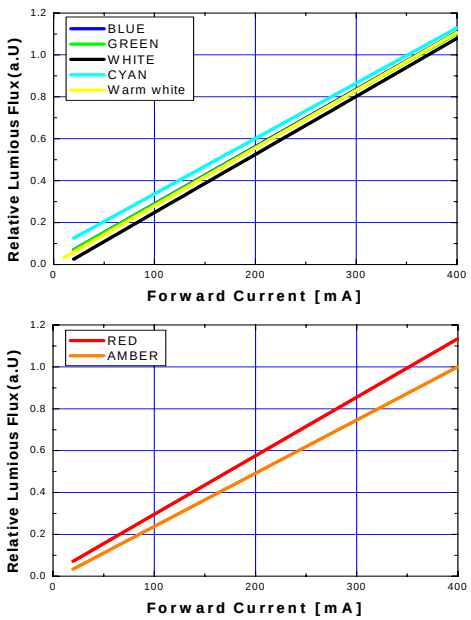

Figure1. Forward Voltage vs Forward Current

Ta=25°C P3 series

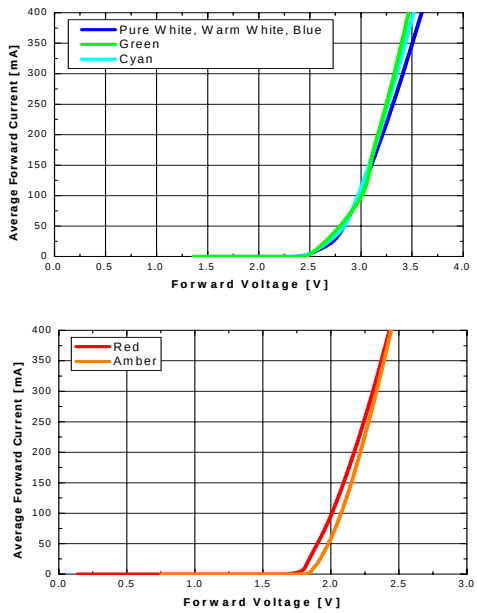

Figure2. Forward Voltage vs Normalied Relative Luminous Flux

Ta=25°C P3 series

2. Operating method

There are two ways to drive Z-POWER LED by constant current. One is to use constant current source and another is to use constant voltage source. The merit of former one is that we can drive LED by exact current, but it is difficult to drive and is expensive.

The latter one is to connect LED to power supply or a dry cell, control resistance and get the desirable current. It is the easiest and most popular way to drive LED. LED and resistance must be connected in series when we are using constant voltage source.

This way resistance plays a role not only to control current and protect LED, but also to prevent LED from getting sudden shock. It needs to check what is the maximum current limit of the power supply before we drive LED with constant voltage source or a dry cell. If not, and we are not using proper resistance, LED can be destroyed. On the table 1 are proper resistance values by voltages.

(refer to Specification management for product spec by each driving method)

Table 1

Bin code	Forward voltage	Power supply & batteries 6V		Power supply & batteries 9V	
		Optimized resistance	Permissible resistance	Optimized resistance	Permissible resistance
D	2~2.25V	11Ω	10Ω	19.5Ω	19Ω
E	2.25~2.5V	10Ω		19Ω	
F	2.5~2.75V	9.5Ω		18Ω	
G	2.75~3V	9Ω		17.5Ω	
H	3~3.25V	8Ω	7Ω	16.5Ω	16Ω
I	3.25~3.5V	7.5Ω		16Ω	
J	3.5~3.75V	7Ω		15Ω	
K	3.75~4V	6Ω		14.5Ω	

at I_F=350mA, T_A=25°C

PWM(Pulse Width Modulation)

1. PWM?

The human eyes perceive an object in motion when it is moving more than 16 times a second. This useful principal has been used in theater film. Although a film is constantly showing 24 different images in a second, the human brain recognizes it as a single moving image. This phenomenon is called persistence of vision.

Pulse Width Modulation of LED is a LED driving method, using this persistence of vision of human eyes. In PWM operation, input current doesn't flow through LED continuously. Instead, input current is provided during fixed time for a certain period of time and not provided the rest of time for a certain period, so called Duty. The time that current flows through LED depends on its applications and user's objectives. When LED is driven in PWM, we are able to save unnecessary power supplied to LED, and reduce heat emitting from the devices. But less current means less luminous flux. So PWM must be reconsidered when user needs much luminous flux. For the reason, driving method should be properly adopted according to the applications.

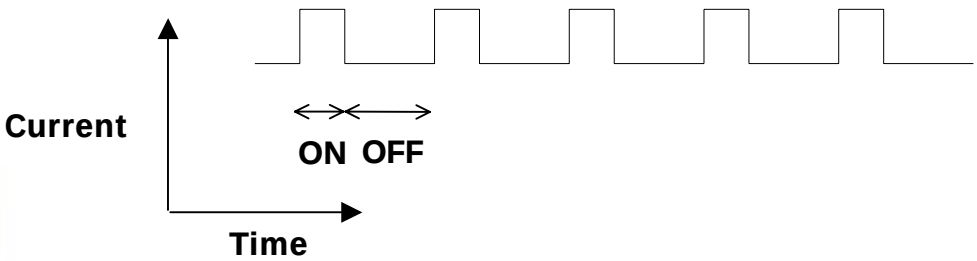

Figure3. Duty operation

2. Features of PWM

- Power Consumption and Thermal Characteristic

Power Consumption and Thermal Characteristic when LED is driven with the same current, PWM can reduce electrical power consumption as much as duty ratio(rate of duration that current flows through LED in a fixed period). It's much less than the power consumption when LED is continuously provided with current. That is, PWM's power consumption, operated by the current as high as the rate of duty, is the same as the power consumption when LED is continuously operated by the previous current. Usually, PWM generates less heat. But, LED's thermal characteristics are related to the ambient temperature in operation as well as its thermal characteristics of the applications,so the current provided by PWM is limited depending on kind of heat radiation structure each application has and the ambient temperature of products in operation.

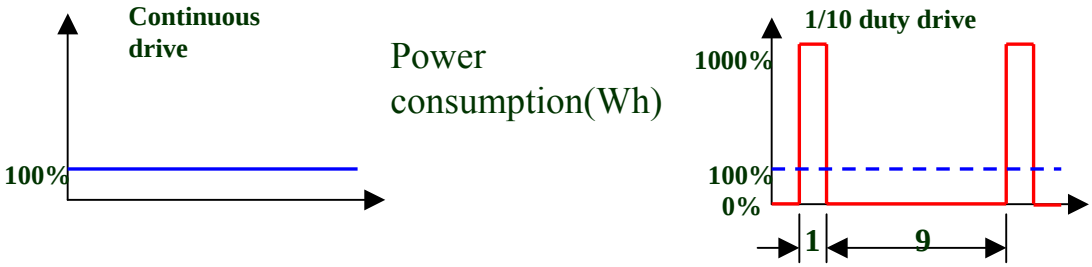

Figure4. Power consumption

-Luminous Flux

Luminous flux varies depending on measuring methods and application of LED. When Luminous flux is measured with general integral sphere, luminous flux of LED driven by PWM is the same as duty ratio by luminous flux of LED driven continuously. When LED is applied for camera or flash operated momentarily for high brightness, brightness of LED at the turn-on moment is more important. In this case, luminous flux of LED by PWM is more.

AMERICA

▪ Los Angeles
Tel : +1-310-324-7151
Fax : +1-678-550-8374
E-mail : karl@acriche.com

▪ Detroit
Tel : +1-248-649-5381
Fax : +1-248-649-5541
E-mail charlie@acriche.com

▪ New Jersey
Tel : +1-617-869-6779
Fax : +1-201-585-1711
E-mail : pcj77@acriche.com

▪ Atlanta
Tel : +1-201-956-3609
Fax : +1-201-632-4807
E-mail : jason@acriche.com

EUROPE

▪-Frankfurt, Germany
(Seoul Semiconductor Europe GmbH)
Tel : +49-69716-750111
Fax : +49-69716-750120
E-mail : dykim@acriche.com

▪ Dusseldorf, Germany
(Branch of Seoul Semiconductor Europe GmbH)
Tel : +49-211-507-385-2
E-mail : andrew@acriche.com

▪ Nurnberg, Germany
(Branch of Seoul Semiconductor Europe GmbH)
Tel : +49-911999-5860
Fax : +49-911999-5865
E-mail : info@seoul-semicon.de

▪ London, UK
Tel : + 44-1256-818004
E-mail : elliet@acriche.com

▪ Manchester, UK
Tel : +44-1229-861-104
E-mail : richard@acriche.com

▪ Copenhagen, Denmark
Tel : +45-3512-5081
E-mail : bchyun@acriche.com

▪ Rotterdam, Netherlands
Tel. : +31-10-251-8668
Fax : +31-10-251-8669
E-mail : wim@seoulsemicon.nl

▪ Paris, France
Tel : +33-671-461-341
Fax : +33-1-6980-9269
E-mail : italia@seoulsemicon.it

▪ Milan, Italy
Tel : +39-039-599-503
Fax : +39-039-598-4930
E-mail : italia@seoulsemicon.it

▪ Madrid, Spain
Tel : +34-91-268-7694
Fax : +34-91-268-7694
E-mail italia@seoulsemicon.it

▪ Warsaw, Poland
Tel : +48-22-498-75-10
Fax : +48-22-435-51-44
E-mail : jhnam@acriche.com

JAPAN

▪ Tokyo
Tel: +81-3-5360-7620
Fax : +81-3-5360-7622
E-mail : smyi@acriche.com

▪ Nagoya
Tel : +81-52-251-1861
Fax : +81-52-784-5888
E-mail : b2yttark@acriche.com

CHINA

▪ Shanghai
Tel : +86-21-3223-0032
Fax : +86-21-6208-5754
E-mail : Johnsun82@acriche.com

▪ Shenzhen
Tel : +86-755-8204-2307
Fax : +86-755-8204 7531
E-mail : kevin@acriche.com

TAIWAN

▪ Taiwan
Tel : +886-28226-7678
Fax : +886-28226-6211
E-mail : peter@acriche.com

SINGAPORE

▪ Singapore
Tel : +65-6853-9593
Fax : +65-6853-9591
E-mail : sansanaw@acriche.com

INDIA

▪ NewDelhi
Tel : +91-98711-55223
Fax : +91-11-2989-3764
E-mail : gopal.shukla@acriche.com

▪Mombai
Tel : +91-22-4012-3695
E-mail : kuldeep.gupta@acriche.com

HEAD OFFICE

Tel : +82-31-364-3790
Fax : +82-2-6915-7776