Light Emitting Diode

Controlling Luminous Intensity of LEDs

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The part number NECW425B, NSCR426B in this document are the part number of our product, and do not have any relevance or similarity to other companies' products that may have trademark rights.

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1. Overview

It is very important to control the luminous intensity of LED depending on the application.
This note explains two methods of controlling luminous intensity with Nichia LEDs by:
1) Adjusting current value
2) Pulse-width modulation (PWM)

2. Adjusting Current Value

Changing the current supply to the LED can directly control the luminous intensity as shown by the graph below.

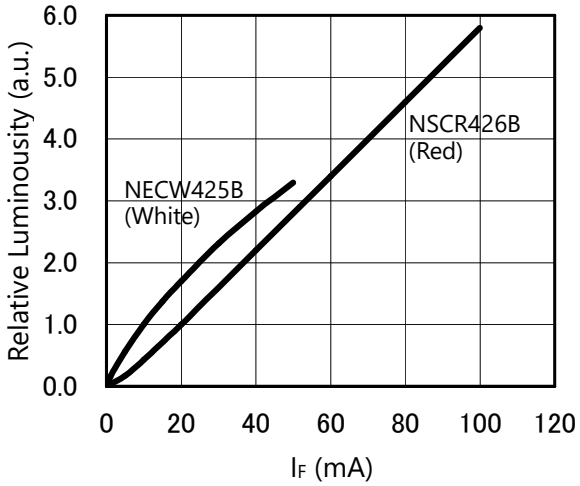

Fig. 1: Forward Current vs. Relative Luminosity of NECW425B and NSCR426B

i) Please refer to Fig.1 for NECW425B.
a) The Fig.1 shows:
I_F = 10mA : Relative Luminosity (a.u.) 1.0
I_F = 20mA : Relative Luminosity (a.u.) 1.7
I_F = 50mA : Relative Luminosity (a.u.) 3.3
The luminous intensity is directly related to the current.

b) Also the Fig.1 shows:
The intensity of NECW425B is not a linear function of current.
The intensity of NSCR426B is a linear function of current.
This is because of the characteristic difference in blue[1] and red chip.
Table.1 shows luminous intensity rank table of NECW425B.

Table.1: Luminous Intensity of NECW425B (Ta=25°I_F=10mA)

Rank		
O	P	Q
Typ.	Typ.	Typ.
175	250	350

[Unit:mcd]

[1] : White LEDs contain blue chip.

As for rank P, the luminous intensity is 250mcd at 10mA.

The following is derived from 2-i)-a),

20mA 250mcd x 1 = 425mcd

50mA 250mcd x 3.3 = 825mcd

3. Shift of Chromaticity Coordinate

Although the luminous intensity can be controlled by changing forward current, the change in forward current will also change the color of the LED.

Fig.2 shows: the chromaticity coordinate changes according to the change in forward current. (1mA-50mA)

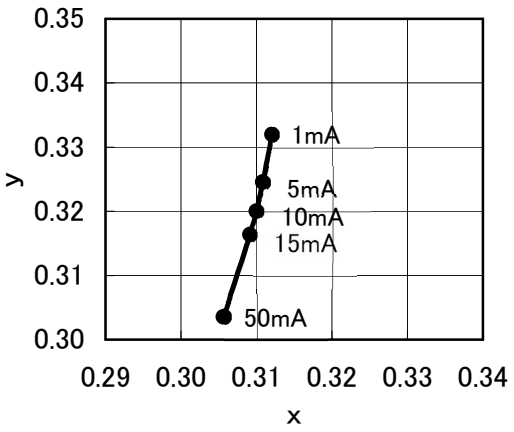

Fig. 2: Forward current vs. Chromaticity NECW425B

4. Pulse-Width Modulation (PWM)

As explained in 3, luminous intensity can be modified by controlling the current to the LED. However, this causes the color of the LED to shift. This section explains how to change luminous intensity without changing the color of the LED.

The Fig.3 shows the examples of a circuit with a “switch” which opens and closes the circuit. Essentially, turning the LED is on and off. As we understand from motion pictures, the human eye has a limit of 60 frames per second. By increasing the frequency to 100 frames per second, you can deceive the eye into believing a pulsing light source is constantly on.

Additionally, by modulating the amount of time “on” and “off”, the luminous intensity can be controlled. To increase intensity one must increase the time “on”. To decrease intensity one must decrease the time “on”. Please refer to Fig.4:

Fig.4 shows the relation between current value and time.

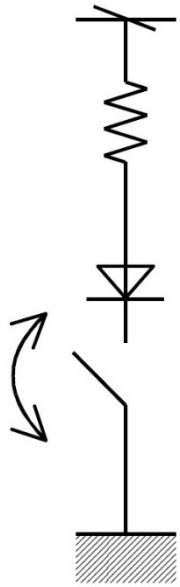

Fig. 3: Circuit Diagram

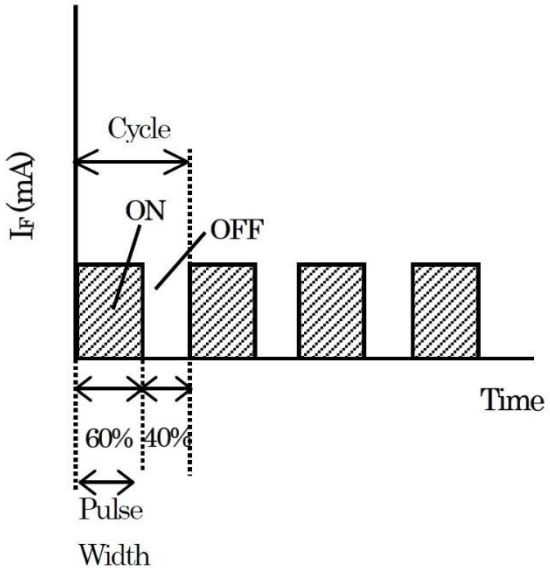

Fig. 4: Pulse-width modulation (PWM)

The shaded portion shows the time period of "on." The color of the LED is not changed because the current value is constant. One cycle is composed of one "on" and one "off" time period. The period of time that the current flows in one cycle is called a pulse width. Duty ratio refers to the ratio of pulse width in one cycle. Fig.4 shows: 60/100 (60%) of duty ratio.

5. Summary

There are current value and pulse-width as a method of controlling Luminous Intensity of LED. It is necessary to use it properly according to the purpose.

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