

# Application of infrared emitting diode (IR LED) in remote control

## 1. Introduction

Electromagnetic waves of different wavelengths are all around us. Visible light (colors) is the part of the electromagnetic waves that the human eye can detect, which is about 380~770nm. In order to prevent the remote control from causing discomfort to human eyes, almost all the remote control transmitters in the industry use the 940nm wavelength which is invisible to human eyes.



Figure 1. Spectral wavelength classification

Like most wireless transmission technologies, in order to avoid interference from electromagnetic waves of the same wavelengths in the environment, a carrier wave is added to the transmission signal (as shown in figure 2). The frequency range of the carrier wave is 30k~60kHz, and 38kHz is the most common carrier frequency.

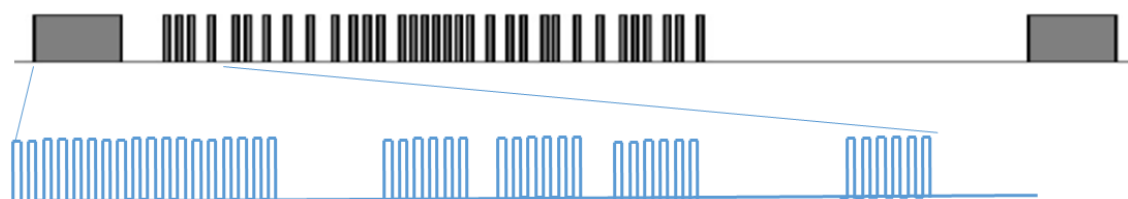


Figure 2. Infrared signal and carrier wave

## 2. IR LED Characteristics

In the absence of interference(light, radiation and circuits), the relationship between IR emission intensity and transmission distance in Figure 3 can refer to the following formula:

$$d_{max} = \sqrt{\frac{I_e}{E_{e \min}}}$$

In the above formula,  $I_e$  is Radiant Intensity, unit: mW/sr

$E_{emin}$  is the receiver sensitivity, unit: mW/m<sup>2</sup>

$d_{max}$  is the farthest transmission distance, unit: m

Take Everlight IR26-61C/L510 as an example, if it is operated at IF=20mA and the ambient temperature is 25°C, the radiation intensity is about 20mW/sr, and the sensitivity of general IR receiver is about 0.25mW/m<sup>2</sup>. Distance  $d$  is approximately

$$d = \sqrt{\frac{20}{0.25}} = 8.94\text{m}$$

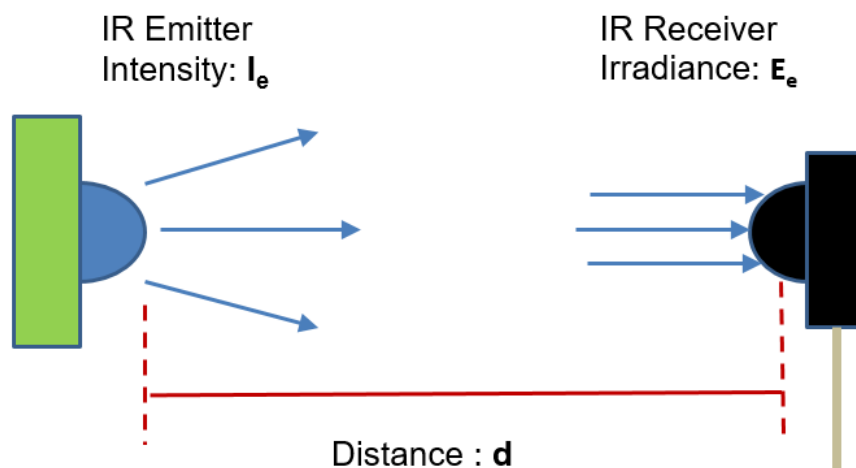


Figure 3. IR transmission distance

The IR LED specification defines the radiation intensity at a 0 degree angle under a fixed current. Its value will attenuate as the angle changes. The viewing angle is the angle at which the intensity is attenuated to 1/2. For the definition, please refer to the red area in Figure 4.

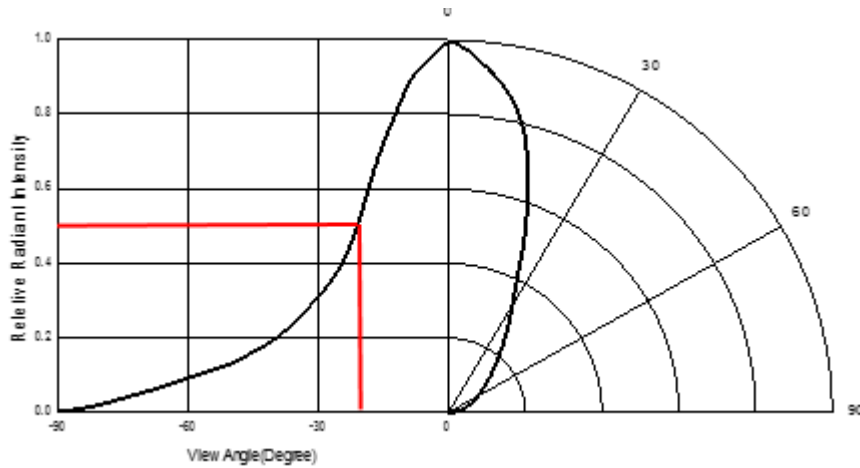


Figure 4. The relationship between radiation intensity and emission angle

The IR specification will indicate the maximum continuous output current (Continuous Forward Current), this value is usually defined in the ambient temperature  $T_A=25^{\circ}\text{C}$ . If you need to operate at different ambient temperatures, you need to refer to the relationship between the maximum DC forward current and ambient temperature in Figure 5 in the specification. In addition, if the receiving distance needs to be greater than the receiving distance when transmitting with the maximum continuous output current, you can refer to the graph of the relationship between the maximum forward current and the duty cycle (this graph will have different curves at different ambient temperatures) to increase the emission current. Taking Figure 6 as an example, the maximum operating current is 50mA in the case of continuous emission. If the maximum operating current can be 100mA when the duty ratio is 50%, and the maximum operating current can be 150mA when the duty ratio is 30%.

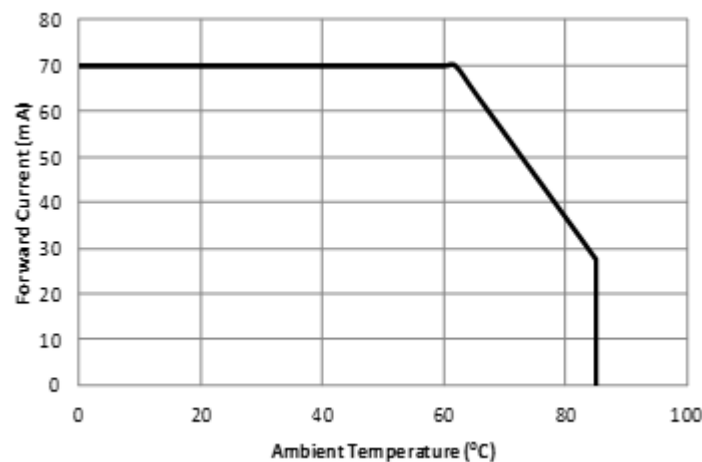


Figure 5. Maximum DC forward current and ambient temperature

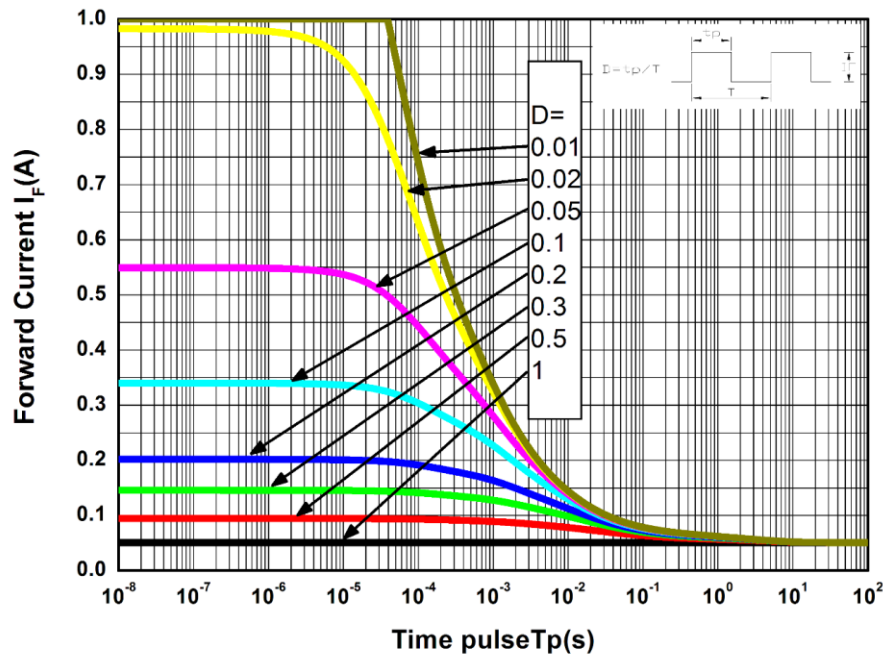








Figure 6. Relationship between maximum forward current and duty cycle

As mentioned above, the IR transmission of the remote controller is by a carrier wave, so it will not be continuously transmitted. If the duty cycle is lower, the maximum operating current will be increased. The relationship is similar to the diagram in Figure 6. The duty cycle (Duty cycle:  $D$ ) of the general carrier wave can be set to  $1/2$ ,  $1/3$  and  $1/4$ . The lower the duty cycle, the shorter the transmission time and the more power saving, but the receiving distance of the remote control receiver under the same driving current will also be shorter. If you do not care about power consumption, you can set the duty cycle to  $1/2$  to get better reception. If you need to take into account power saving and receiving distance, it is recommended to set the duty cycle to  $1/3$ .

### 3. Everlight Recommence Part List (SMD)

The following table shows the SMD IR models and simple specifications recommended by Everlight.

	IR26-61C /L261	IR26-61C /L510	IR29-01C /L510
Fig.			 <span style="color: red;">New!</span>
Size (mm)	3x2.65x1.2	3x2.65x1.2	3x2.76x1.2
SMT type	Side view	Side view	Side view
$\lambda_p$	940nm	940nm	940nm
Intensity	5mW/sr	20mW/sr	26mW/sr
View Angle	30°	20°	15°
	IR89-01C /L447	IR91-01C /L491	IR16-213C /L510
Fig.			
Size (mm)	3.1x2.25x1.6	2.2x1.95x0.9	1.0x0.5x0.45
SMT type	Top view	Top view	Top view
$\lambda_p$	940nm	940nm	940nm
Intensity	14mW/sr	13mW/sr	2.35mW/sr
View Angle	30°	40°	120°

The information in this application manual is only for customers' design reference. Please verify by yourself when you actually use it. If you have any other questions, please contact Everlight for further technical support.