APPLICATION NOTE

Infrared Receiver Module (IRM) Application Note

1. Introduction：

The earth is filled with electromagnetic waves of various wavelengths. The so-called visible (color) light is the electromagnetic spectrum visible to the human eye, and its wavelength is 380nm to 770 nm. In order to avoid human eye discomfort caused by the light emitted by the remote controller and reduce the interference caused by general artificial light sources, so choose the human eye invisible infrared wavelength. In the industry currently almost 940 nm wavelengths are used for the remote control transmitter devices.

Figure 1.Electromagnetic Wavelength Distribution

The application of infrared remote control is also belong to wireless signal transmission, it’ s similar to wireless transmission technologies. In order to avoid the interference of electromagnetic waves of the same wavelength in the environment, the carrier signal shown in Figure 2 is added to the transmission signal (carrier frequency). The bandwidth of carrier frequency for remote control applications is 30 to 60 kHz, and 38 kHz is the most to use for carrier frequency.

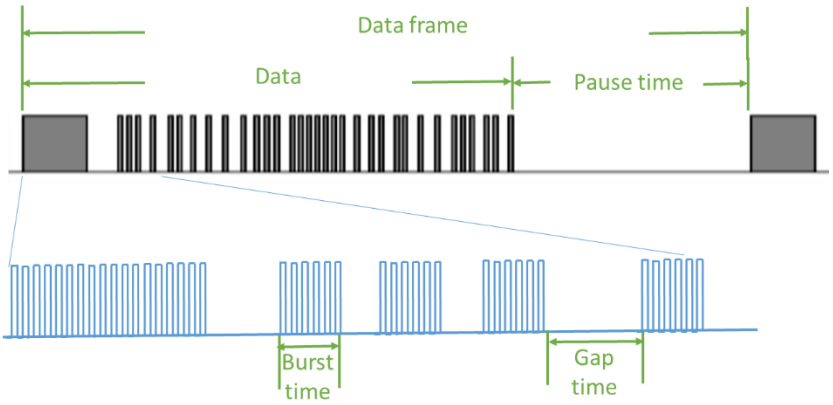

Figure 2. Definition of infrared emission signal

2. Instructions for IRM selection：

The most of infrared remote control system has its own carrier frequency and IR protocol. Different IRM support different type protocols correspondingly. Please refer the support protocol list in Figure 3 of specification before selecting the IRM. Also note that the carrier frequency and the IRM model of the protocol match. (The IRM products of Everlight have different frequencies but same chip of IRM models are sharing the same one specification). The IRM carrier frequency will be decided at the factory. If the IRM setup with a center frequency of 38kHz, it can also receive the infrared protocol of 36kHz or 40KHz. However, the receiving distance will be shorter than the protocol of 38 kHz carrier frequency, so choosing the right center frequency IRM can optimize the best receiving distance. For the IRM selectable of center frequency for each model, please refer to the specification in Figure 4. Supported Carrier Frequency and Relative Sensitivity

Protocol	Suitable	Protocol	Suitable	Protocol	Suitable
NEC	Yes	Cisco	Yes	Sony 12 Bit	Yes
Panasonic	Yes	Toshiba	Yes	Sony 15 Bit	Yes
RC5	Yes	XMP	Yes	Sony 20 Bit	No
RC6	Yes	r-step	Yes	Mitsubishi	No
Sharp	Yes	JVC	No	Continuous	No

Table 1. Support Protocol Table

1.) Supported infrared protocol of IRM is support repeat control.

2.) Generally, Continuous Code points at Pause time less than 1ms continuous emitting signal.

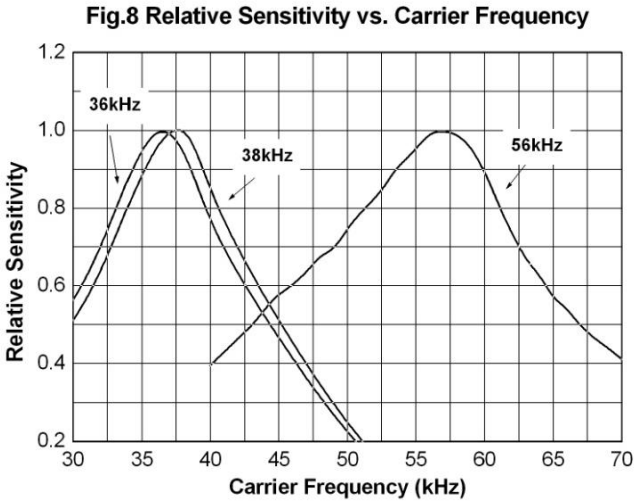

Figure 3. Support Carrier Frequency vs. Relative Sensitivity

General IRM is not able to receive continuing signal, besides Figure 2, it defines gap time(less than 1ms). Passing each completed data needs a longer pause time (> 9ms). If the infrared protocol used is not listed in the table of the specification or special considerations for customized requirements protocol, the minimum requirements listed below of specifications should be noted. For the definitions of burst length and gap length, please refer to Figure 2.

	IRM-3636Z3 IRM-3638Z3 IRM-3640Z3
Min burst length T_B	10 cycles
Min gap length T_G	10 cycles
Min. data pause time T_{Pause}	Min. 22ms

Table 2. Support IR signal sequence

3. Other supplementary notes：

Infrared transmission and reception are inverting shown in Figure 5. When the IR LED is not transmitting, the IRM receiver will output high level; Once IRM received the IR signal, IRM receiver will output low level. IR LED emission timing and the IRM signal output timing will be delayed and not equal, thus Tburst ≠ TpwL and TpwL will change with distance. Each model has a different variation trend. The variation trend like fig.6 can be found in the specification. When the difference between Tburst and TpwL is greater than the specification value, we

define the distance is the receiving distance.

Due to the pluse width variation will affect the MCU decode accuracy, so user define MCU IR protocol decode tolerance should consider the IRM pulse width variation trend.

Figure 4. Infrared emission and Reception signals

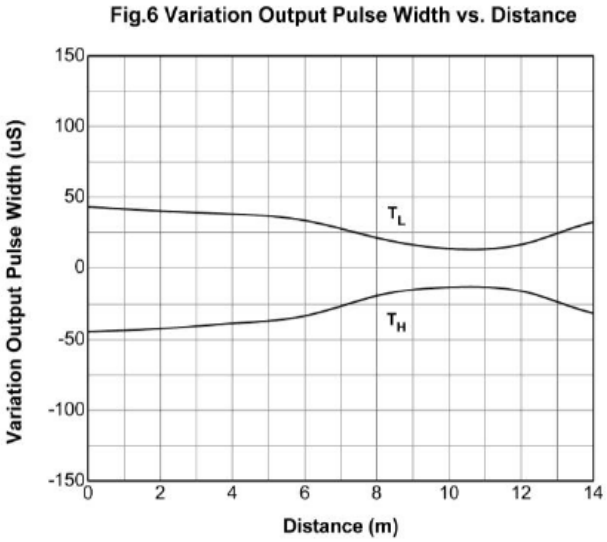

Figure 5. Variation Output Pulse Width vs. Distance

The test signal of pulse width variation is as shown in Figure 7 and specification of pulse width variation is shown in figure 8. Due to the different encoding specifications of each IR remote control protocol, when designing the remote control decoding tolerances, please refer to the IRM pulse width variation trend, which will affect the distance of the remote control receiving distance.

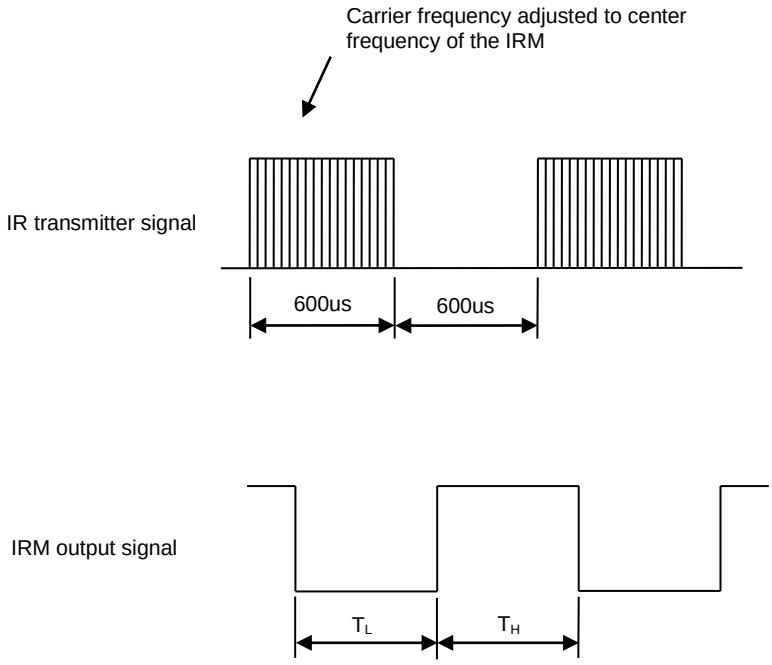

Figure 6. IR transmitter signal and IRM output signal

Output low pulse	T_L	450	600	750	us	See chapter test method, L_0 = 0.1m ~ 20m
Output high pulse	T_H	450	600	750	us	

Figure 7. Specification of pulse width variation

The reception of IRM will be interfered by Wifi, sunlight or other light sources which containing infrared that will shorten the IRM receiving distance or even worst. The IRM may not be able to work. Therefore, please try to stay away from the source of interference or increase the shielding barrier to isolate the interference source.

4. Plastic material suggestion:

Infrared remote control components are often used in consumer electronics. For the beauty of product appearance, to avoid the exposure of the transmitter or receiver(IRMs), plastic cover/sheets or light guides (strips) are often used in the product casing and housing. Because infrared remote control uses 940nm, the infrared transmittance of the plastic sheet is very important, affecting the receiving distance and performance of infrared remote control. It is generally recommended that the infrared transmittance of the plastic sheet should be greater than 70%. It is recommended to use PC (Polycarbonate, Polycarbonate) and PMMA

(poly (methyl methacrylate), commonly known as acrylic material, PC has good impact resistance, high refractive index, and good processing performance, also Acrylic has the advantages of high transparency, low price, and easy machining. Both are very popular used as substitute materials for glass. For detailed specifications, please consult your plastic material supplier.

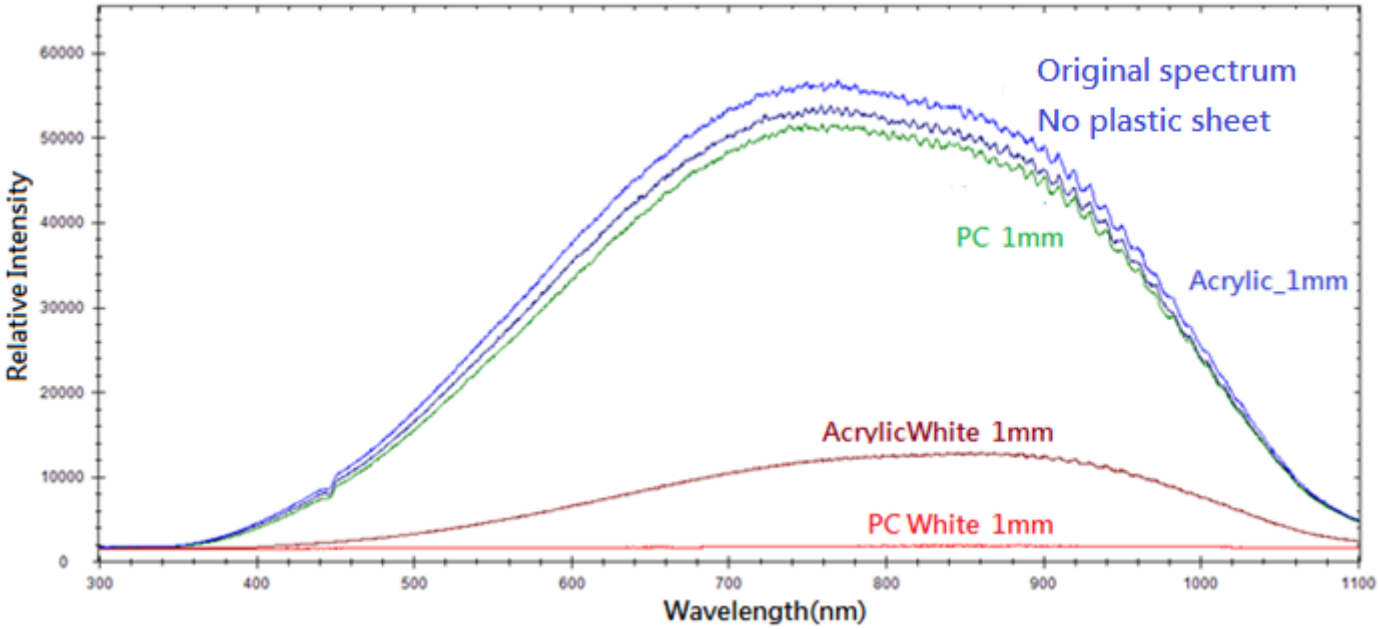

Fig 8.、Different plastic material spectrum response

5. Mechanism design consideration：

The design and opening of the product mechanism should pay attention to avoid blocking the light path of IRM and affecting the light receiving performance. If possible the larger aperture size, the better receiving performance. IRM should be placed in the center of the hole as possible. If the size of the opening of the mechanism is restricted, it is recommended to use the top of the LENs(IRM) as the origin point and avoid the interference of the mechanism within the+/- 45-degree light-receiving angle to ensure the IRM receiving light path is clear. Please refer to the figure below. If the IRM is deep inside the product, it can combine with a light guide to improve the light collection effect.

if the product is for outdoor using, the mechanism design should avoid direct sunlight to the IRM, to avoid the interference of sunlight causing the IRM malfunction.

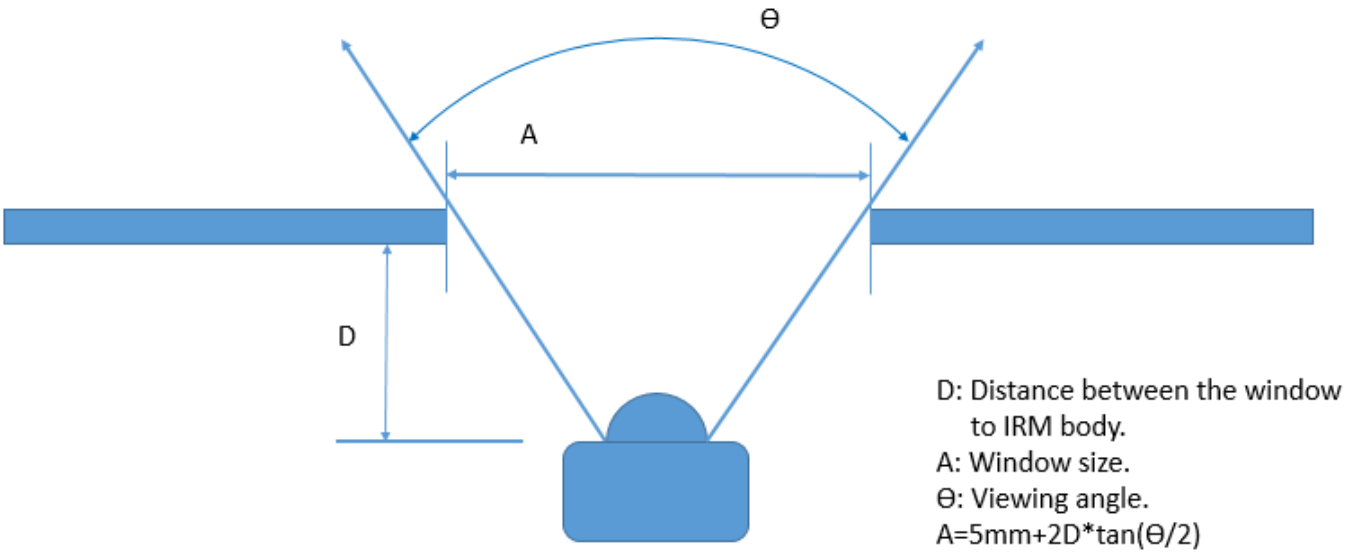

Fig 9. Mechanism illustration

6. Reference circuit：

The application circuit as following figure. Most infrared receiver modules (IRMs) already have built-in pull-up resistors, so the pull-up resistor 10k in the figure below can be connected or not. In addition, the RC circuit between Vcc and Gnd is designed to eliminate noise ripple on the power supply, and can also be adjusted according to the actual application.

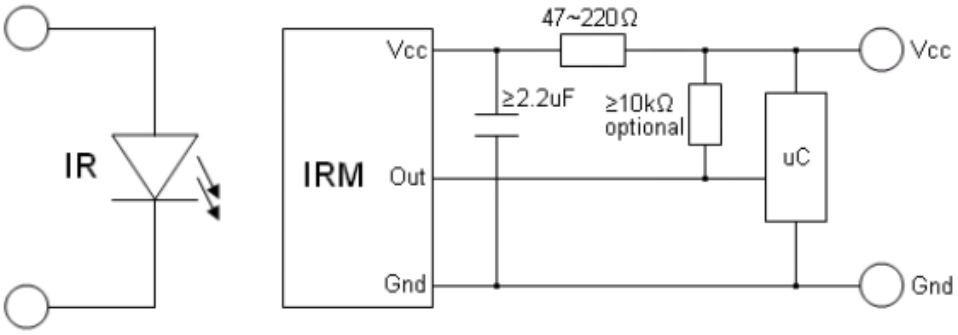

Fig 10. Reference circuit

The information in this application note provides for customers design reference only. Please verify the actual application of the product. If you have any other questions, please contact Everlight Electronics for advanced technical support.