IrDA 1.1 / IrDA 1.3 Low Power Compact Type

GP2W1001YP Technical Data

GP2W1001YP

Infrared Data Association™ MEMBER

1. Features

- Implements IrDA 1.1 and IrDA 1.3 Low Power Option Standards (~ 4 Mbps) for Mobile Devices.
- Small Package Design for IrDA 1.1/1.3 Transceiver including Shield Case. (*W 10.0 x D 4.4 x H 3.5 mm*)
- Wide Range Operating Voltage (*V_{CC} = 2.4V ~ 5.5V*)
- Low Power Consumption @ Operation (*max. 1.2 mA at 4 Mbps operation*)
- Few External Passives for small occupied area (*Only 1 resistor and 1 capacitor*)
- Built-in Stand-by Mode (*typ. 0.1 μA at stand-by*)
- *Built-in "Power-Down" Adjustment by "MODE" pins (new feature!)*
- Electrically compatible with Agilent HSDL-3600 (Design flexibility for VISHAY TFDU6100E - see section 9)
- *No Specific Device Driver Needed - Operable with Existing Driver either from Agilent or VISHAY*
- Solder Reflow Capability for Automated Production Process
- SMD Lead-less Package Design

<Applications>

Mobile Products
- Notebook PCs
- Windows CE Hand-held
- PDAs

Imaging Products
- Digital Still Cameras
- Portable Printers
- Portable Scanners

Telecommunication Products
- Cellular Phones
- Smart Phones

2. Description

The SHARP GP2W1001YP is a low operating voltage, small infrared transceiver module which implements IrDA 1.1 / IrDA 1.3 low power option standards. It provides the interface between logic and IR signals for through-air, serial, half-duplex IR wireless data links and is designed to satisfy the IrDA physical layer specifications.

The SHARP GP2W1001YP infrared transceiver module contains a high speed, high efficiency, low power consumption AlGaAs LED, silicon PIN photodiode, and a low power bipolar integrated circuit. The IC contains an LED driver circuit and a receiver, supporting 9.6k to 115.2 kb/s SIR signals as well as 1.152 Mb/s and 4 Mb/s FIR signals at the IrDA 1.1 standard. (IrDA 1.2 / 1.3 low power standard - link distance of 0.2m with low powered devices and 0.3m link with standard devices are also supported.)

GP2W1001YP may be operated over the range of 2.4V to 5.5V without any performance degradation. Electrical design engineers have many design options for power supply wiring, and the overall system can achieve 2 significant merits related to power consumption - "Shutdown" and "Power-Down" adjustment.

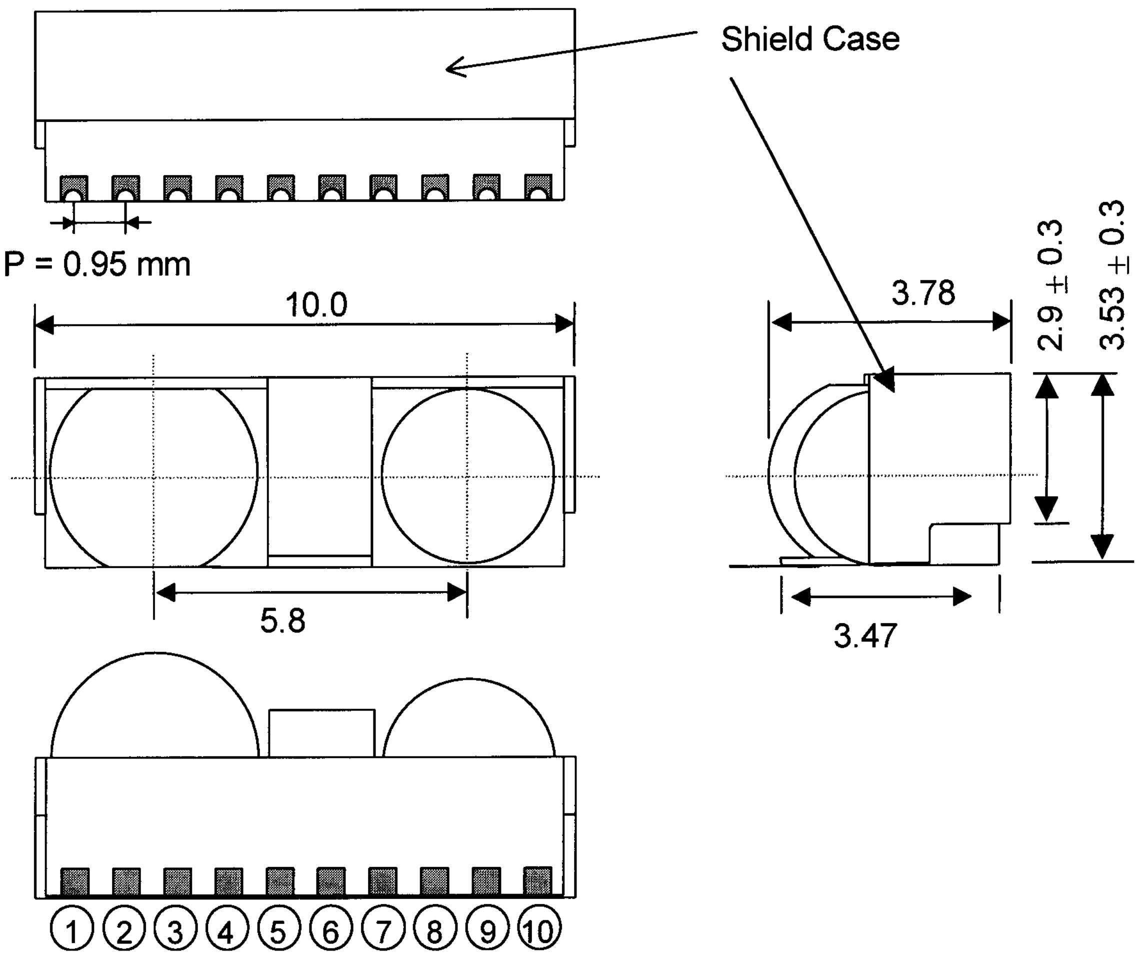
The "Power-Down" adjustment is a new feature accommodated in the GP2W1001YP, with which the system can adjust the transmission power of the transceiver depending on the link distance. At short distance, the transmission power may be reduced to as little as 1/3 of the standard power consumption. "Shutdown", as many transceivers now have minimizes the current consumption while the IR subsystem is not in use. With these 2 functions, GP2W1001YP helps conserve battery life of the overall system.

Additionally, the GP2W1001YP transceiver does not require any special driver software. The existing driver can be used, or those for use with HP or VISHAY transceivers. This flexibility minimizes the engineering effort required to write or modify a specific driver, and helps to shorten the time period to implement IrDA capability.

3. Outline Dimensions

All dimensions given below are in mm. The dimensions below are only applicable for design reference, and subject to change without notice. Contact your local SHARP office for the device specifications to ensure the outline dimensions.

(GP2W1001YP [with Shield Case])



1. See Section 8 for Pinouts.

4. Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit	Conditions
Supply Voltage	V_{DD}	0	6.0	V	
Operating Temperature	T_{OP}	-10	+70	°C	
Storage Temperature	T_{ST}	-20	+85	°C	
Soldering Temperature	T_{SOL}		240	°C	Maximum of 10 seconds.
Peak Forward LED Current	I_{FM}		600	mA	

5. Recommended Operating Conditions

Parameter	Symbol	Min.	Max.	Unit	Conditions
Operating Temperature	T_{OP}	0	70	°C	Typ. 25° C
Supply Voltage	V_{DD}	2.7	5.5	V	
Logic High FIR_SEL, MD0, and MD1 Terminal Input Voltage	V_{IHMD}	V_{DD}-0.5	V_{DD}	V	
Logic Low FIR_SEL, MD0, and MD1 Terminal Input Voltage	V_{ILMD}	0.0	0.4	V	
Logic High Transmitter Input Voltage (TXD)	V_{IHTXD}	V_{DD}-0.5	V_{DD}	V	
Logic Low Transmitter Input Voltage (TXD)	V_{ILTXD}	0.0	0.4	V	
Logic High Receiver Input Irradiance	E_{IH}	0.0036	500	mW/cm^2	Bit Rate =2.4k ~ 115 kb/s (in band signals)[*1]
	E_{IH}	0.0090	500	mW/cm^2	Bit Rate =1.152 M / 4.0 Mb/s (in band signals)[*1]
Receiver Signal Rate	BR	2.4	4,000	kb/s	Includes Sharp ASK
Ambient Light					[*2]

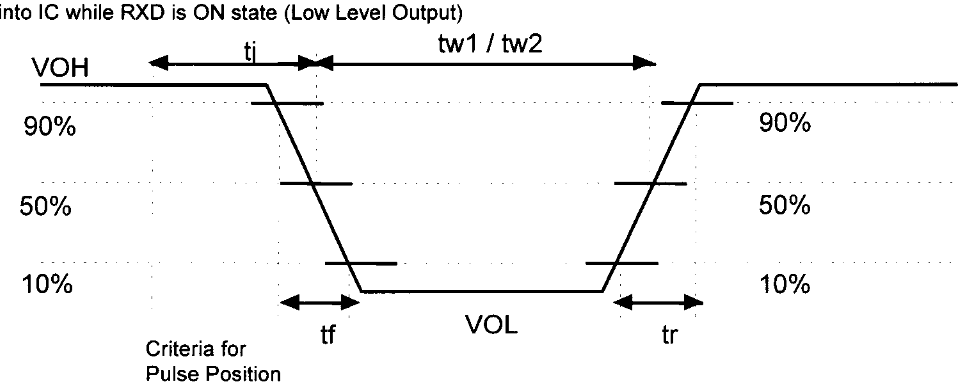
1. An in-band optical signal is a pulse/sequence where the peak wavelength, λp, is defined as 850 nm $\leq \lambda p \leq$ 900 nm, and the pulse characteristics are compliant with the IrDA Serial Infrared Physical Layer Link Specifications.
2. See IrDA Serial Infrared Physical Layer Link Specification Appendix A for ambient lights.
3. Sharp ASK reception supported - 9.6 to 57.6 kbps. Refer to complete specification for more details.

6. Electrical and Optical Specifications

Specifications hold over the Recommended Operating Conditions, unless otherwise noted herein. All typical values are at 25° C and 3.3V, ambient light on the receiver surface under 10 lz, unless otherwise noted herein.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Supply Voltage	V_{DD}	2.4	-	5.5	V	
Maximum Reception Distance	L1	≥ 0.2	-	-	m	$2\Theta_{1/2} \leq 15°$, I_E =3.6 mW/sr (below 115.2 kb/s) I_E = 9.0 mW/sr (above 115.2 kb/s)
	L2	≥ 1.0	-	-	m	$2\Theta_{1/2} \leq 15°$, I_E = 40 mW/sr (below 115.2 kb/s) I_E = 100 mW/sr (above 115.2 kb/s)
Data Rate	BR	2.4	-	4,000	kb/s	Includes Sharp ASK
Operating Temperature	T_{OP}	0	-	70	°C	
RECEIVER SIDE						
High Level Output Voltage	V_{OHRXD}	V_{DD}-0.4	-	-	V	
Low Level Output Voltage	V_{OLRXD}	-	-	0.8	V	I_{OL} = 400 μA
Viewing Angle	2Θ	30	-	-	degrees	
Low Level Pulse Width	tw1	1.0	-	6.0	μsec	BR = 115.2 kb/s
	tw2	85	-	165	nsec	BR = 4.0 Mb/s
Current Consumption	I_{CC}	-	-	1.2	mA	With no input signal, at 4.0 Mb/s
	$I_{CC(SD)}$	-	0.1	1.0	μA	Shut-Down Mode
Rise Time	tr	-	-	40	nsec	see below
Fall Time	tf	-	-	40	nsec	see below
Latency	t_{TAT}	-	-	0.5	msec	
TRANSMITTER SIDE						
Radiant Intensity	$I_{EF\varnothing}$	100	-	500	mW/sr	$2\Theta_{1/2} \leq 15°$
Peak Emission Wavelength	λp	-	870	-	nm	I_F = 400 mA
Peak LED Current	I_{LEDp}	-	450	-	mA	
Rise Time	$tr_{(IE)}$	-	-	40	nsec	
Fall Time	$tf_{(IE)}$	-	-	40	nsec	
Transmitter Data Input Current (Logic High)	I_{IH}	-	-	50	μA	V_{IHTXD} = 2.4V
Transmitter Data Input Current (Logic Low)	I_{IL}	-	-	0.1	μA	V_{IHTXD} = 0.0V
High Level Input Voltage	V_{IHTXD}	V_{DD}-0.5	-	V_{DD}	V	
Low Level Input Voltage	V_{ILTXD}	0.0	-	0.4	V	

*I_{OL}: Current goes into IC while RXD is ON state (Low Level Output)



GP2W1001YP Infrared Transceiver Module Output Waveform

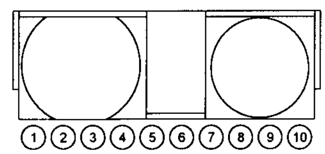
7. Truth Table

INPUTS					OUTPUTS		
TXD	EI	MD0	MD1	FIR_SEL	IE (LED)	RXD	
V_{IH}	X	V_{IL}	V_{IL}	V_{IL}	SIR Full Power (High)	NV	
V_{IH}	X	V_{IL}	V_{IH}	V_{IL}	SIR 2/3 Power (High)	NV	
V_{IH}	X	V_{IH}	V_{IH}	V_{IL}	SIR 1/3 Power (High)	NV	
V_{IH}	X	V_{IL}	V_{IL}	V_{IH}	FIR Full Power (High)	NV	
V_{IH}	X	V_{IL}	V_{IH}	V_{IH}	FIR 2/3 Power (High)	NV	
V_{IH}	X	V_{IH}	V_{IH}	V_{IH}	FIR 1/3 Power (High)	NV	
V_{IL}	E_{IL}	V_{IH}	V_{IL}	X	OFF (Low)	High	Shutdown
V_{IL}	E_{IH}	V_{IH}	V_{IL}	X	Low (OFF)	High	Shutdown
V_{IL}	E_{IH}	V_{IL}	X	X	Low (OFF)	High	

X ... Don't care NV ... Not Valid E_{IH} ... Optical inputs to Receiver E_{IL} ... No Optical inputs to Receiver

8. Pinouts

PIN #	Description	Symbol
1	Analog VCC	AVCC
2	Analog Ground	AGND
3	Channel Select	FIR_SEL
4	Mode Select 0	MD0
5	Mode Select 1	MD1
6	Digital VCC	DVCC
7	Digital Ground	DGND
8	Receiver Output	RXD
9	Transmission Data Input	TXD
10	LED Anode	LEDA



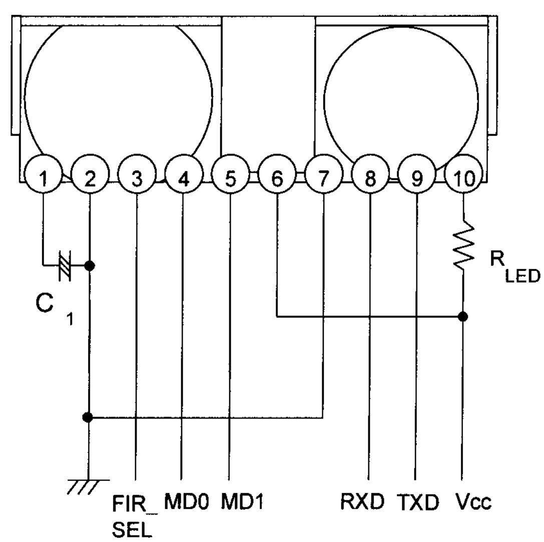
9. Application Electrical Design Hints

9-1. Application Circuit

The following figure and table shows the recommended application circuit and passive values for GP2W1001YP. The following table only provides an idea for external passive values and is only applicable to customers' design reference.

Symbol	Description
C_1	4.7 µF ± 10% (Note)
R_{LED}	2.4 Ω ± 5% ½ W @ Vcc = 3.3V
	6.8 Ω ± 5% ½ W @ Vcc = 5.0V

Note: A suitable C_1 value should be selected to minimize line noise depending on your power supply noise level and frequency. The C_1 value listed above is a nominal value.



9-2. Design Flexibility

The following information describes how to connect GP2W1001YP in a design compatible with other transceivers. The GP2W1001YP provides a very flexible electrical design, so that engineering work can be minimized. The GP2W1001YP and HSDL3600 (Agilent) are electrically compatible and use the same pin order. The footprint spacing is not identical between the two devices, though the electrical functions are implemented in the same manner. Pins 9 and 10 are not used on the Vishay devices.

PIN #	GP2W1001YP	HSDL3600
1	AVCC	AVCC
2	AGND	AGND
3	FIR_SEL	FIR_SEL
4	MD0	MD0
5	MD1 [3]	MD1
6	DVCC [1]	NC
7	DGND	DGND
8	RXD	RXD
9	TXD	TXD
10	LEDA	LEDA

TFDU6100E	TFDT6500E	TFDS6500E
IRED Anode	IRED Anode	IRED Cathode
IRED Cathode	IRED Cathode	RXD
TXD	TXD	VCC
RXD	RXD	GND
SD/Mode [2]	SD/Mode [2]	NC
VCC	VCC	SD/Mode [2]
NC	NC	TXD
GND	GND	IRED Anode

Notes:

1. Apply Vcc on this pin for GP2W1001YP.
2. Vishay SD/Mode pin connects to Sharp GP2W1001YP Pin 4.
3. For compatibility with the Vishay devices, connect GP2W1001YP pin 5 (MD1) to GND.

These transceivers power up in a no-default mode and must be programmed prior to use. The lower data rate modes (SIR) cover up to 115 kbps and provide the output at the RXD pin. In the GP2W1001YP the FIR_SEL pin selects the data rate that is received through the RXD Received Data output. Data rates of 115 kbps and lower are selected when FIR_SEL is set to logic low. The higher data rates above 115 kbps up to 4 Mbps are selected when FIR_SEL is set to logic high. A software driver is required to set the data rate in the I/O device in the end product and to select the condition of FIR_SEL.

Compatible encoder/decoder products are available from National Semiconductor, such as the PC97338-series, and the SMSC FDC37C669FR or FDC37N769. An example for a National device is as follows:

I/O Device	Connects to	GP2W1001YP
IRTX Output	→	TXD Pin 9
IRRX1 Input	←	RXD Pin 8
IRSL0 Output	→	FIR_SEL pin

Refer to the data sheets for the device for the most up-to-date information.
Pin connections for three SMSC devices are:

	TXD (output)	RXD (input)	IRMODE (output)
FDC37C669FR	89	88	23
FDC37C957	204	203	145 or 190
FDC37N769	87	86	21

Transmitter Mode Programming

The transmit LED output power level can be programmed by two methods. The purpose for setting the output power is to provide transmit power flexibility for a variety of applications with a single transceiver, and to allow for adaptive power control while in use. The LED transmit power may be set to several conditions as provided in the Truth Table in section 7.

A combination of the mode select pins MD0, MD1 and FIR_SEL are used to set the LED power modes. Connecting MD0 and MD1 to the logic levels shown in the Truth Table will set the output power. These two inputs may be tied to Vcc or ground, or to the logic outputs of a device used to set their condition in a dynamic fashion. The benefit of this is the ability to change the power setting during an active IR transmission session to lower the overall battery usage.

The received data is tested for check sum errors on a regular basis during data transmission. The IR application may desire the flexibility to lower the LED power level and check if any errors have occurred. If not, the lower LED power setting may be used until such time as the communication session is complete, or errors occur. In the case where new errors occur, the LED power should be set to maximum until the error condition is resolved. At that time it may be desired to test for a stable lower LED power condition, or to not change the output power setting.

The second programming method uses the MD0 mode in the same manner as the SD/Mode pin on the Vishay devices.

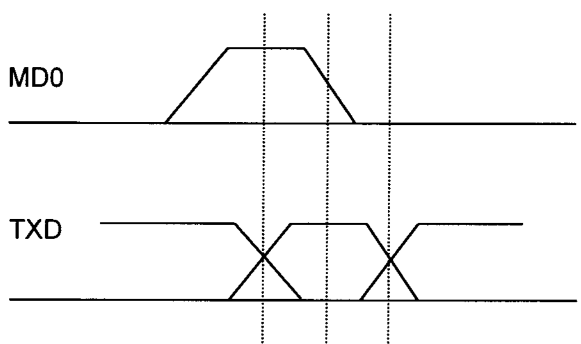
To set the device to the high bandwidth mode:

1. Set MD0 to logic high.
2. Set the TXD input to logic high and wait a minimum of 200 ns.
3. Set MD0 to logic low, which latches the level of TXD at this transition time. Latching the condition of TXD = high indicates the high bandwidth mode.
4. After 200 ns past step 3, TXD may be taken low. The TXD input is now enabled as the normal TXD input.

To set the device to the low bandwidth mode (from the high bandwidth mode):

1. Set MD0 to logic high.
2. Set the TXD input to logic low and wait a minimum of 200 ns.
3. Set MD0 to logic low to latch the condition of the TXD input.
4. TXD waits for 200 ns before changing condition as the normal TXD input.

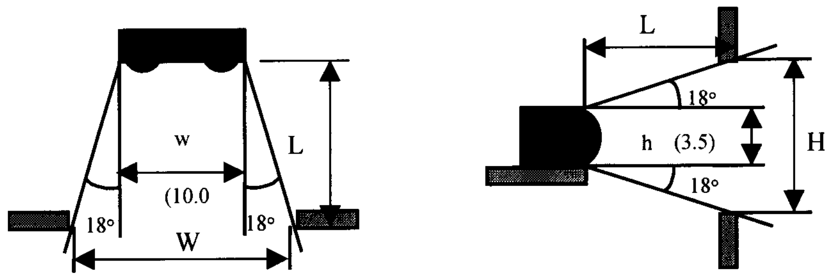
An example of the timing for the above:



10. Mechanical Design Hints

10-1 Designing the IR Cosmetic Window

The following figure and calculation explain the example and designing hints for cabinet and IR cosmetic window with $\pm 18°$ viewing angles, in vertical and horizontal axis. All values for the transceiver dimensions are applicable only for design reference, and in mm (UNIT). The IrDA specifications require a $\pm 15°$ viewing angle at the transceiver. The $\pm 18°$ angle shown is to provide a little extra clearance to allow for slight manufacturing variations and so that the required angle is always met.



The optical window size should be the minimum size of W x H rectangular or elliptical in order not to reduce the IrDA data transfer performance. The dimensions for W can be calculated by the formula of:

$$W = 2 \times L \times \tan 18 + w$$

and the dimensions for H can be calculated by the formula of:

$$H = 2 \times L \times \tan 18 + h$$

in case of having viewing angle of + 18, which conforms or exceeds the IrDA Serial Infrared Physical Layer Link Specifications. Any values to be calculated with above formula must be given in mm.
The dimension "10.0" as listed above is the physical length of the transceiver. This distance includes the side angles of the optical lenses to simplify the overall calculation. The height of the transceiver is 3.5 mm with the shield however the actual transceiver face in the optical resin is about 0.1 mm shorter. These dimensions are listed in the mechanical drawings.

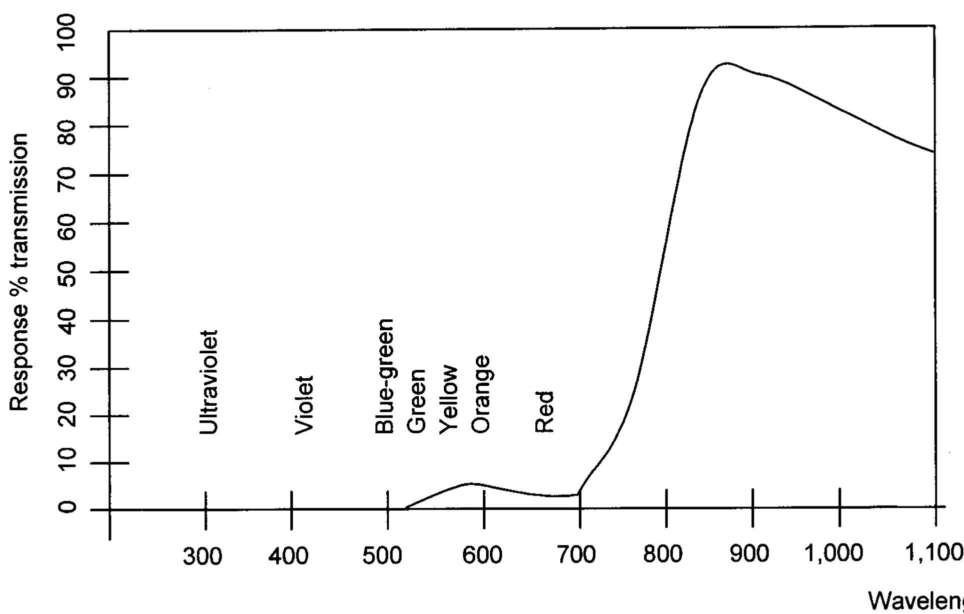
Product Packaging

Many products that use infrared communication locate their reception component behind dark plastic. This often fits in with the overall design and coloring of the product, and has an intentional design purpose as well.

The photodiode that is used in optical receivers is sensitive to a variety of light wavelengths, not only the wavelength intended for reception. Visible light has many component factors and sources in a room. The dark plastic used in product faceplates acts as a highpass filter, reducing the amount of visible light and other wavelengths landing on the photodiode and raising the internal noise currents.

The reduction of unwanted wavelengths provides for a quieter and more sensitive receiver. The wavelength used for IrDA Data communications is 880 nm. The characteristic of any plastic used in a final product should keep this in mind and not attenuate this wavelength. A simple material for test purposes is to obtain a roll of 100 ASA color film. Pull the film all of the way out of the can and expose it to outdoor light for 5 seconds or so. Have the film developed, but first inform the person operating the developer what you are doing so that your intent is understood, and the material is processed correctly. Otherwise you may be informed that the roll have been overexposed and the material was discarded as unusable. The resulting developed negative stock should be dark and difficult to see through. Use of one or more layers will provide a variable attenuation filter that you can tailor for experimental purposes.

Other light sources may produce different results. The graph shown here was produced by exposing the film to



a "cool white" fluorescent lamp for five seconds. The filter transmission data is excerpted from an article in Electronic Design, December 2, 1996, written by David A. Johnson. The response of the material is fairly steep near 830 nm, and has reasonable pass characteristics above 880 nm.

The drawing above shows the basic characteristic of the highpass filter. The exact position of the slope and increasing response will depend on the material selected. The intent is to supress visible light, and neighboring wavelengths, and pass the desired 880 nm.

Other glass and plastic filters are available on the market, and many vendors carry plastic materials that may be cut, bent or molded. The key to selecting a plastics vendor is to ask them about the wavelength characteristics of their materials. The more they know, the more likely they will be to help you in a knowledgeable manner when working on both the industrial design and wavelength pass characteristics of your IR window.