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### FEATURES

- IrDA 115 kbit/s, 1 meter Transceiver
- Small Package Design
  - W 9.21 x D 3.86 x H 2.71 mm
- Receiver Output Provides a Gated Output Pulse for the Received Input Signal
- Fits Within Mobile Phone Connector Dimensions
- Low Power Consumption and Built-in Shut-Down Mode (1  $\mu$ A MAX.)
- Wide Range Operating Voltage
  - VCC = 2.4 V - 5.5 V
- Wide Operating Temperature Range
  - -20°C to +85°C
- Split Voltage Design
  - LED Voltage Separate from Operating Voltage
- Internal Echo-Cancel Function
  - RX Data Output Disabled when the Transmit LED is Active
- LED Disabled During Shutdown Mode
- Solder Reflow Capability for Automated Production Process
- GP2W0004YP is Electrically and Mechanically Compatible with IRMS5000, HSDL-3000, CHX1010, MiniSIR2-1
- Top View Version: GP2W0004XP

### DESCRIPTION

The SHARP GP2W0004YP has a wide operating voltage range and is one of the smallest IrDA one-meter transceiver modules. 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.

This part features an integral Electro-Magnetic Interference (EMI) shield. IR energy is inherently immune to EMI; however, the receiving devices are sensitive to EMI. The shield provides additional protection in noisy environments such as PCs and other digital products.

The SHARP GP2W0004YP infrared transceiver module contains a high speed, high efficiency, low power consumption AlGaAs LED, silicon PIN photodiode, and low power bipolar integrated circuit. The IC contains an LED driver circuit and a receiver, which provides the RX output. IrDA data rates of 2.4 kbit/s to 115.2 kbit/s are supported at both the 20 cm and one meter distances. Emitter current is approximately  $I_F = 100$  mA at the one meter range, and the IrDA low power option communication mode is  $I_F = 27$  mA. This dual mode communication capability provides wider application use in a final product, such as a wireless data link with PCs, PDAs, or any other IrDA compliant application already introduced to the marketplace.

The GP2W0004YP transceiver module operates over a power supply range of 2.4 V to 5.5 V without any performance degradation. This provides a single part with a wide variety of design applications. The LED voltage is separate and may be provided from a second source, allowing the main power supply voltage to directly interface to the IC controller. The LED may be connected to the device battery or some other higher level source.

The GP2W0004YP also includes an integral echo-cancel function that disables the RX Data Output when the Transmit LED is driven by TX data.

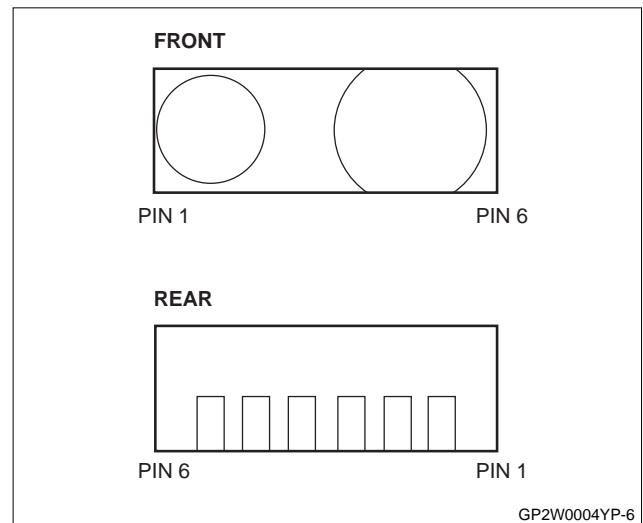
The transceiver module has a built-in shutdown mode for those applications that are very conscious about current consumption. This reduces the current consumption of the receiver circuit to 1  $\mu$ A (MAX.) during shutdown mode. During shutdown, the transmitter output is disabled so that data on the input will not drive the LED when the IrDA transceiver is one of several devices on an I/O line.

## PACKAGE

The dimensional drawing is available in the specification, which is available from your Sharp Components representative. The specification will have the most up-to-date information.

**Table 1. Pin Names**

PIN NO.	DESCRIPTION	SYMBOL
1	LED Anode	LEDA
2	Transmitter Data Input	TxD
3	Receiver Data Output	RxD
4	Shut Down Circuit Input	SD
5	Supply Voltage	V <sub>CC</sub>
6	Ground	GND



**Figure 1. Package Orientation**

## ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Supply Voltage	V <sub>DD</sub>	0	6.0	V
LED Supply Voltage	V <sub>LEDA</sub>	0	7.0	V
Operating Temperature	T <sub>OPR</sub>	-10	+70	°C
Storage Temperature	T <sub>STG</sub>	-20	+85	°C
Soldering Temperature*	T <sub>SOL</sub>		240	°C

**NOTE:** \*Solder reflow time is 5 seconds.

## RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	OPERATING CONDITIONS	UNIT	CONDITIONS
Supply Voltage	V <sub>DD</sub>	2.4 to 5.5	V	
LED Supply Voltage	V <sub>LEDA</sub>	V <sub>CC</sub> + 4.0 (MAX.)	V	V <sub>CC</sub> + 2.4 V to 5.5 V
Logic HIGH Transmitter Input Voltage (TX <sub>IN</sub> )	V <sub>IHTXD</sub>	2/3 × V <sub>CC</sub>	V	
Logic LOW Transmitter Input Voltage (TX <sub>IN</sub> )	V <sub>ILTXD</sub>	1/3 × V <sub>CC</sub>	V	
Data Rate	BR	9.6 to 115.2	kbit/s	
Shutdown circuit HIGH level input voltage	V <sub>IHSD</sub>	V <sub>CC</sub> - 0.5	V	
Shutdown circuit LOW level input voltage	V <sub>ILSD</sub>	0	V	
Operating Temperature	T <sub>OPR</sub>	-25 to +85	°C	

### NOTES:

- An in-band optical signal is a pulse/sequence where the peak wavelength,  $\lambda_p$ , is defined as  $850 \text{ nm} \leq \lambda_p \leq 900 \text{ nm}$ , and the pulse characteristics are compliant with the IrDA Serial Infrared Physical Layer Link Specifications.
- See IrDA Serial Infrared Physical Layer Link Specification Appendix A for ambient light.

### ELECTRICAL AND OPTICAL SPECIFICATIONS

Specifications hold over the Recommended Operating Conditions, unless otherwise noted. All typical values are at 25°C. Figure 2 through Figure 5 show typical signals and test conditions.

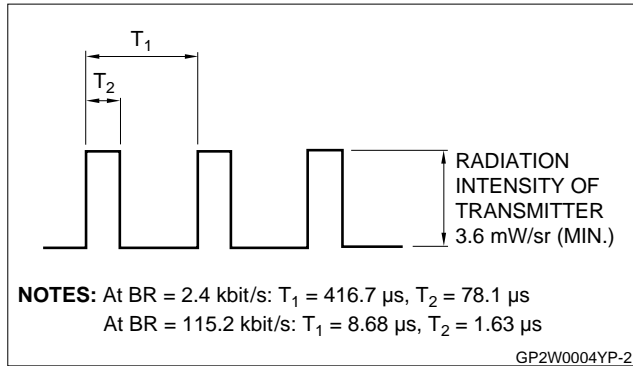


Figure 2. Input Signal Waveform, Detector Side

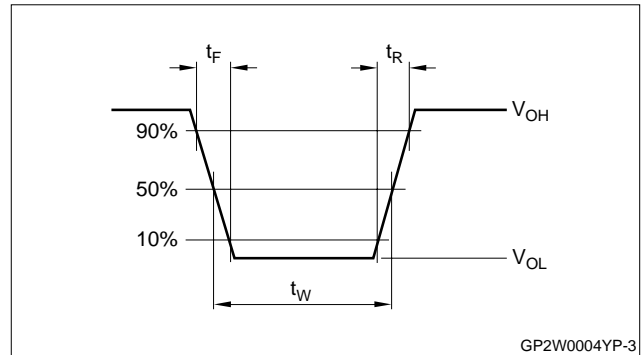


Figure 3. Output Waveform

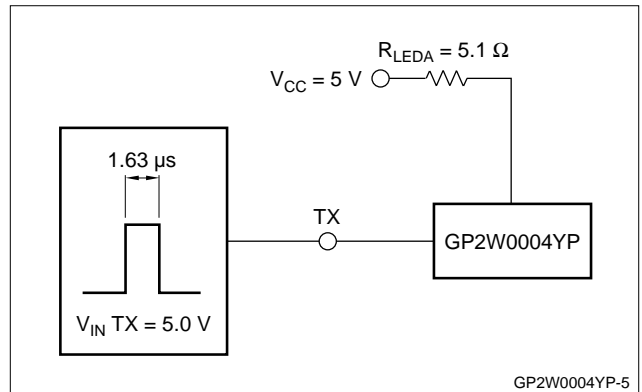


Figure 4. Recommended Circuit, Emitter Side

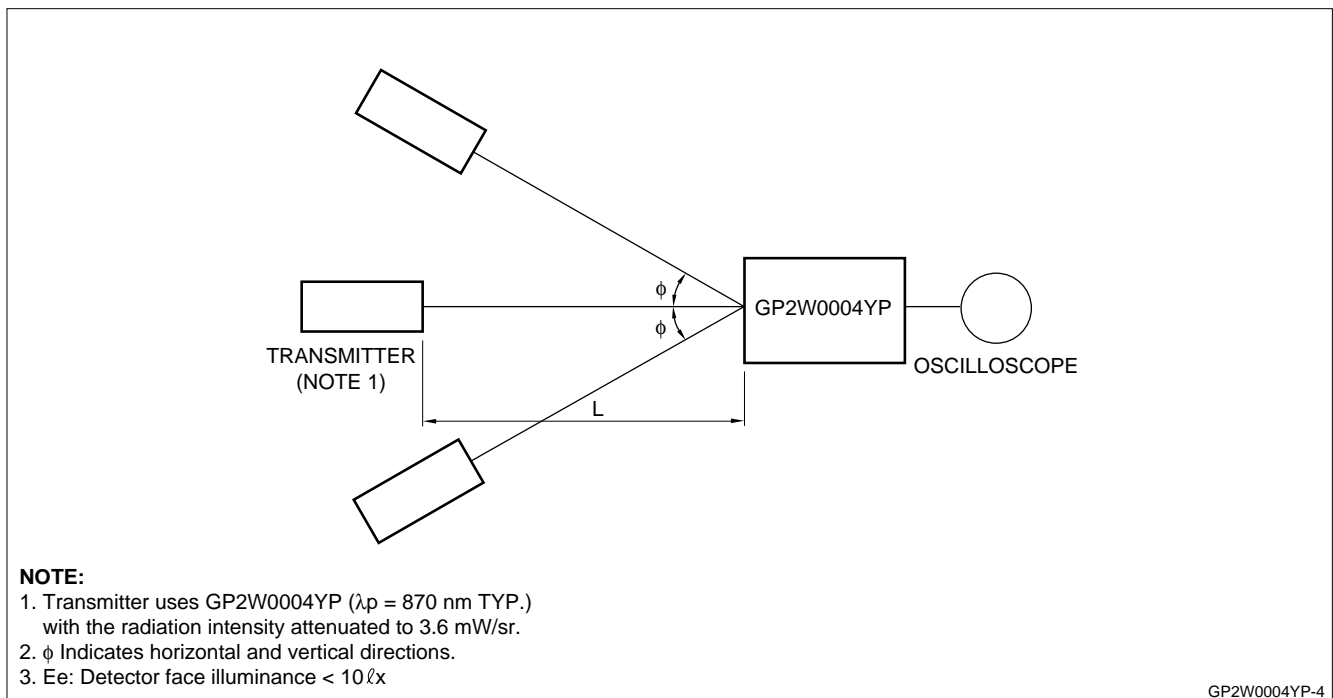


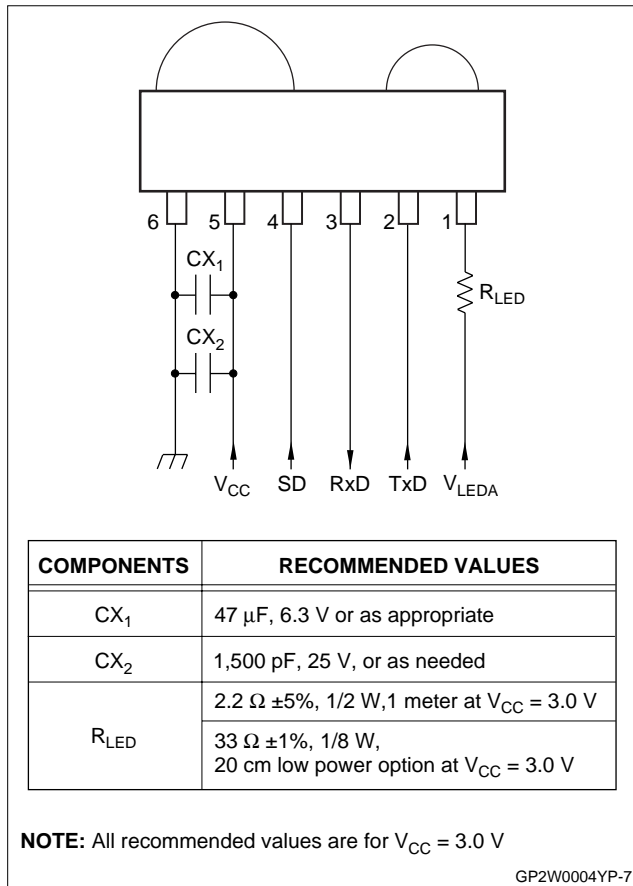
Figure 5. Standard Optical System, Detector Side

**ELECTRICAL DESIGN APPLICATION TIPS**

Figure 6 shows the recommended application circuit and passive values for GP2W0004YP. The table in Figure 6 provides some approximate external passive values for design reference. See the specification for complete optical/electrical characteristic data.

**Application Circuit and External Passives**

The application circuit and external passives shown in Figure 6 enable GP2W0004YP to operate at both one meter and in 20 cm low power option communication mode at  $V_{CC} = 3.0\text{ V}$ .



**Figure 6. Application Circuit**

**Shutdown Mode**

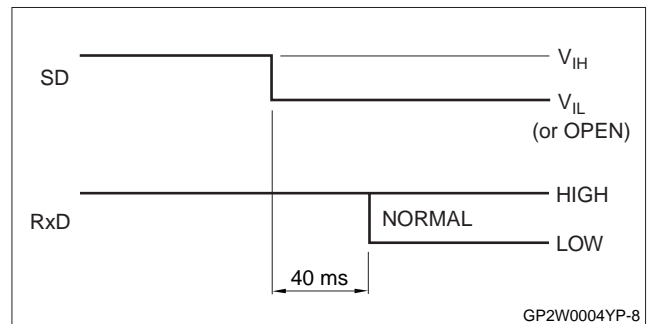
The ‘Shutdown’ pin (Pin 4) is an active HIGH terminal and controls the power saving mode as shown in Table 2 and Figure 7.

Shutdown mode affects the power consumption of the Receiver circuits and inhibits the transmitter LED. The two circuits are internally connected. The transmitter circuit does not conduct current during the shutdown mode.

After shutdown, the Receiver circuits require 40 ms to wakeup.

**Table 2. Shutdown Pin Functions**

INPUT	PERFORMANCE
LOW	Normal Mode
HIGH	Shutdown Mode
Open	Shutdown Mode



**Figure 7. Shutdown-Receiver Wakeup Time**

### Signal Waveform Example

Figure 9 provides examples of each waveform when correctly operating the GP2W0004YP in a manner conforming to IrDA standards. Refer to the Basic System Block Diagram in Figure 8 for the positions that correspond to each waveform. Note that the IrDA bit stream is inverted in the encoder and decoder circuits, and the output pulse is sent during a '0' bit time. The waveform examples are applicable as a design and evaluation reference only, for understanding the GP2W0004YP hardware implementation, as well as for performing measurements.

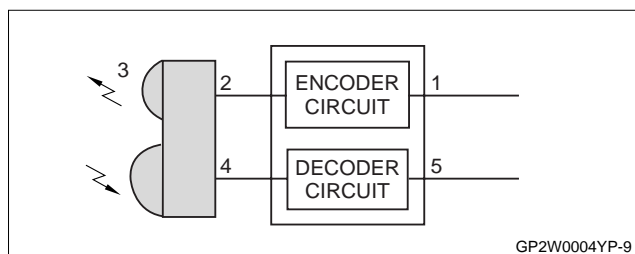


Figure 8. Basic System Block Diagram

### MECHANICAL DESIGN TIPS Recommended Footprint

Figure 10 shows the recommended footprint for PCB design when using the SHARP GP2W0004YP infrared transceiver module. All values in the figure are applicable as a design reference and are in mm.

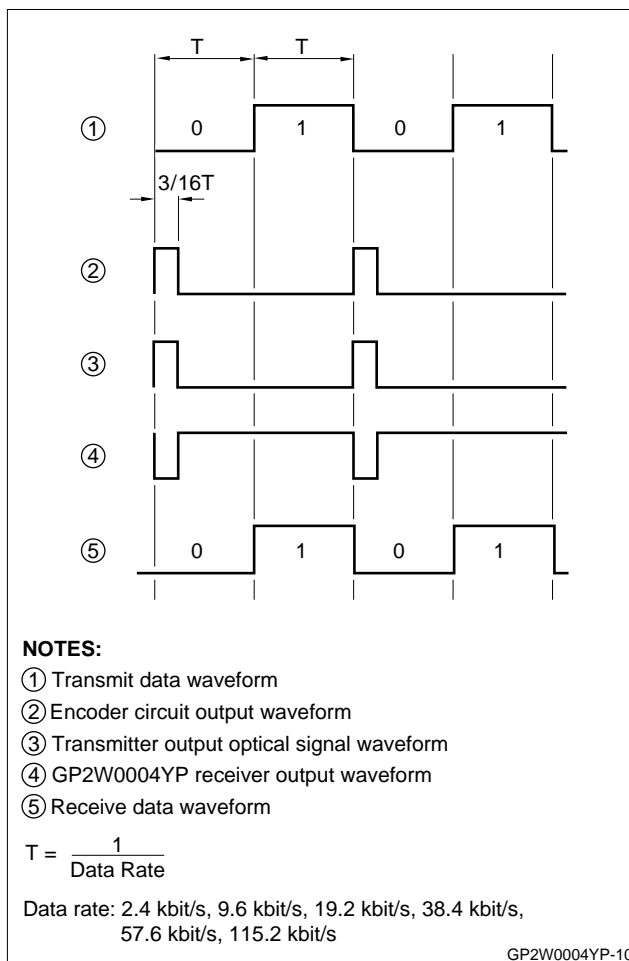


Figure 9. Basic System Waveforms

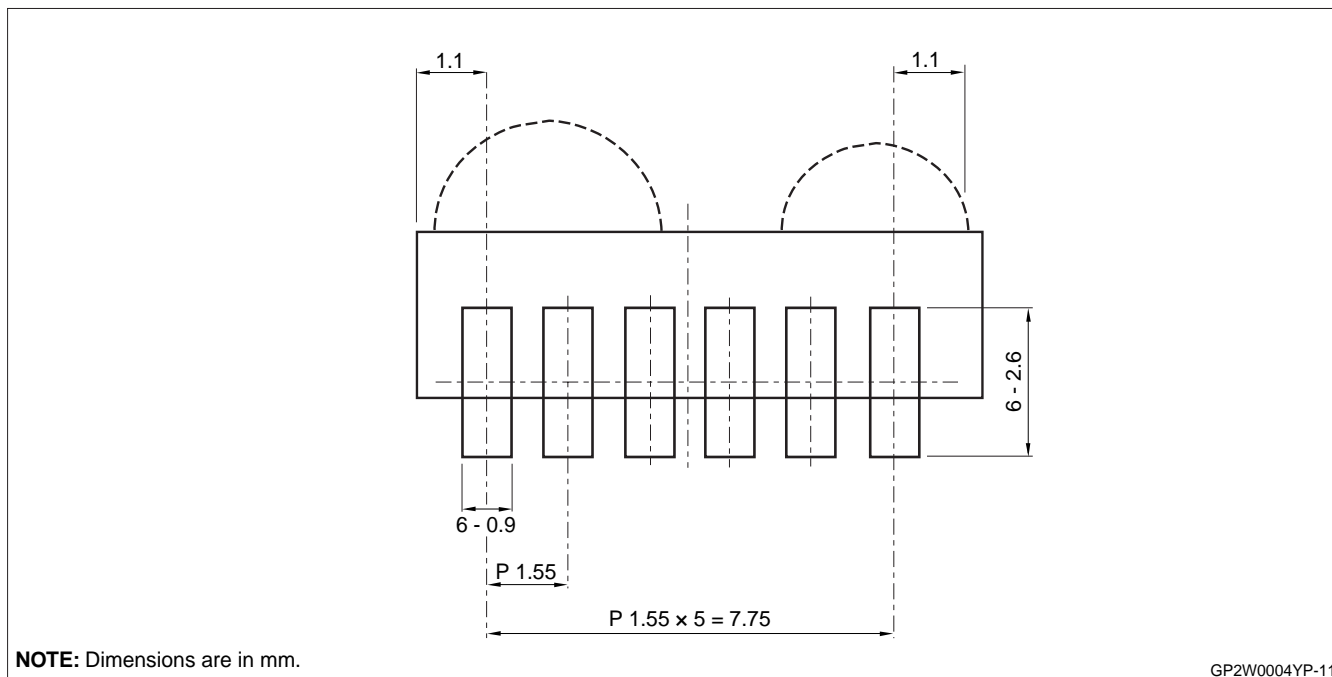


Figure 10. Recommended Footprint

### Solder Paste Footprint

The solder paste footprint drawing for GP2W0004YP is shown in Figure 11. Note that the shield contact for GP2W0004YP is applied through the Ground pin in position 6. The shield is soldered to the back of the transceiver at the ground pin, and a separate contact for a ground tab is not required.

The solder paste footprint drawing for GP2W0004XP is shown in Figure 12.

For complete mechanical dimensions, refer to the full specification.

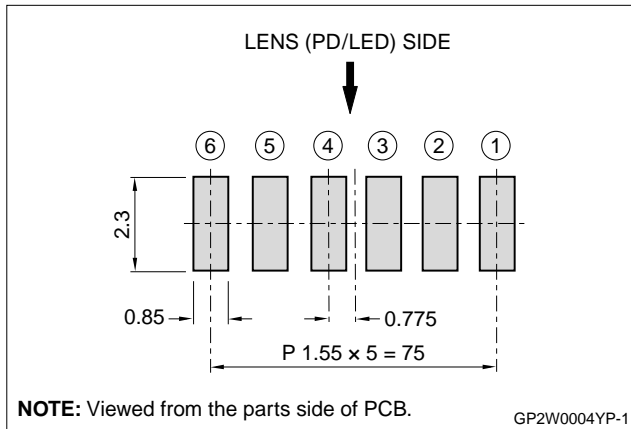


Figure 11. GP2W0004YP Solder Paste Footprint

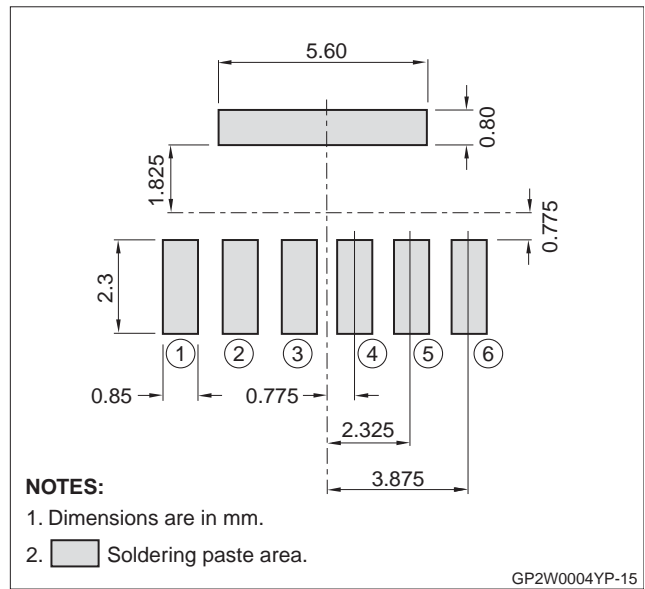


Figure 12. GP2W0004XP Solder Paste Footprint

## Designing the IR Cosmetic Window

Figure 13 provides example calculations and design hints for IR cosmetic windows with viewing angles of  $\pm 18^\circ$  in both the vertical and horizontal axes. All values given here for the transceiver dimensions are only for design reference and are in mm.

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

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

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

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

in the case where the viewing angle is  $+18^\circ$ , which conforms to or exceeds the IrDA Serial Infrared Physical Layer Link Specification. Any values to be calculated with these formula must be given in mm.

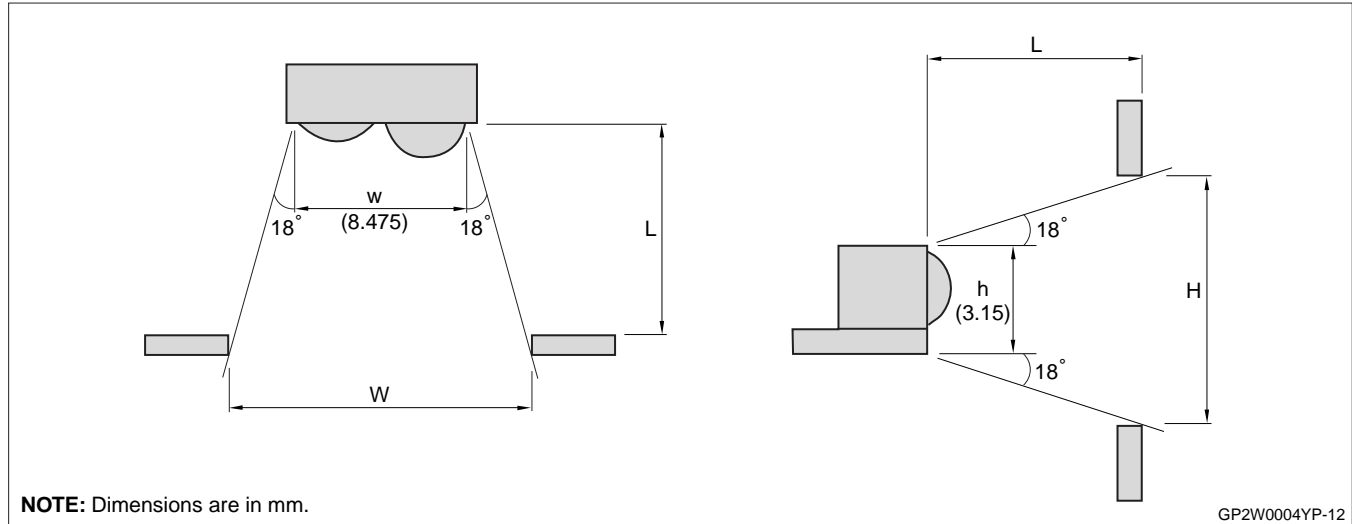


Figure 13. IR Window Cosmetic Design



## 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 range 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 can be formulated to act 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 communication is 880 nm.

The characteristic of any plastic used in a final product should be kept in mind and not attenuated at this wavelength.

Figure 14 shows the basic characteristic of a high-pass filter. The exact position of the slope and increasing response will depend on the material selected. The intent is to suppress visible light and neighboring wavelengths, and pass the desired 880 nm.

Plastic filters are available on the market, and vendors carry plastic materials that may be cut, bent, or molded. The key to selecting a plastics vendor is to ask about the wavelength characteristics of the materials. The more the vendor knows, the more likely the vendor will be able to help you in a knowledgeable manner when working on both the industrial design and wavelength pass characteristics of your IR window. If the vendor does not know what you are talking about, you need to find a knowledgeable source for filter materials.

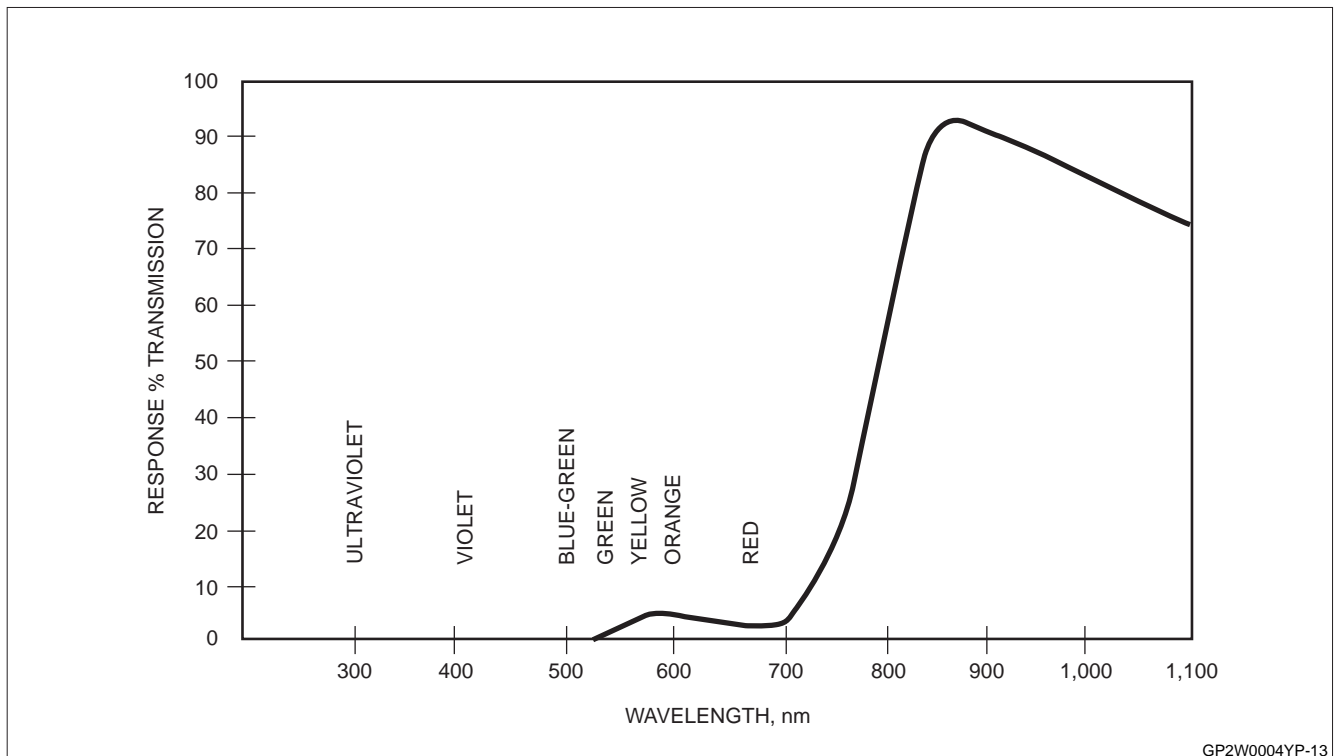


Figure 14. Highpass Filter Characteristics

GP2W0004YP-13

## Soldering Reflow Profile

Figure 15 is a straight-line representation of the recommended temperature profile for the IR solder reflow process. The temperature profile is divided into four process sections with three temperature/time change rates. The temperature/time details are described in Table 3.

In process section 1, the PCB and SMD GP2W0004YP molded pinout joints are heated to a temperature of 165°C to activate the flux in the solder paste. The temperature ramp-up rate R1 should be within the range of 1°C to 5°C per second. Package temperature must be kept within the temperature range specified in order to avoid localized temperature rise in the resin.

In process section 2, sufficient time to dry the solder paste should be provided, a maximum of 120 seconds is recommended for optimum results. A stable temperature is recommended with little temperature increase, preferably staying at the level of 165°C.

Process section 3 is solder reflow. The temperature should be raised to 240°C for 10 seconds, at the rate of 1°C to 4°C per second (R2) for the desired result. The dwell time above 200°C must not exceed 60 seconds. Beyond 60 seconds, weak and unreliable connections will result.

Process section 4 is cooling. After solder reflow, the temperature should then be reduced at the rate of -1°C to -4°C per second (R3). Please note that deformation of the PCB can also affect the pins of the package, which may break the gold wire used in the transceiver module. Full confirmation of the soldering reflow machine condition is highly recommended for optimal results.

Hand soldering should be conducted with a soldering iron of less than 25 W, at less than 300°C. Soldering time is less than 5 seconds per contact, with a second or two between soldering each contact. The device being soldered by hand should be at room temperature. Use 60/40 or 63/37 solder, or Ag solder if it is available.

**Table 3. Process Section Information**

PROCESS SECTION	TEMPERATURE	SYMBOL	TEMPERATURE/TIME MAX.
1. Heat Up	~165°C	R1	1°C - 5°C/sec. MAX.
2. Solder Paste Dry	165°C		
3. Solder Reflow	165°C - 240°C	R2	1°C - 5°C/sec. MAX.
4. Cooling	~200°C	R3	-1°C - 4°C/sec. MAX.

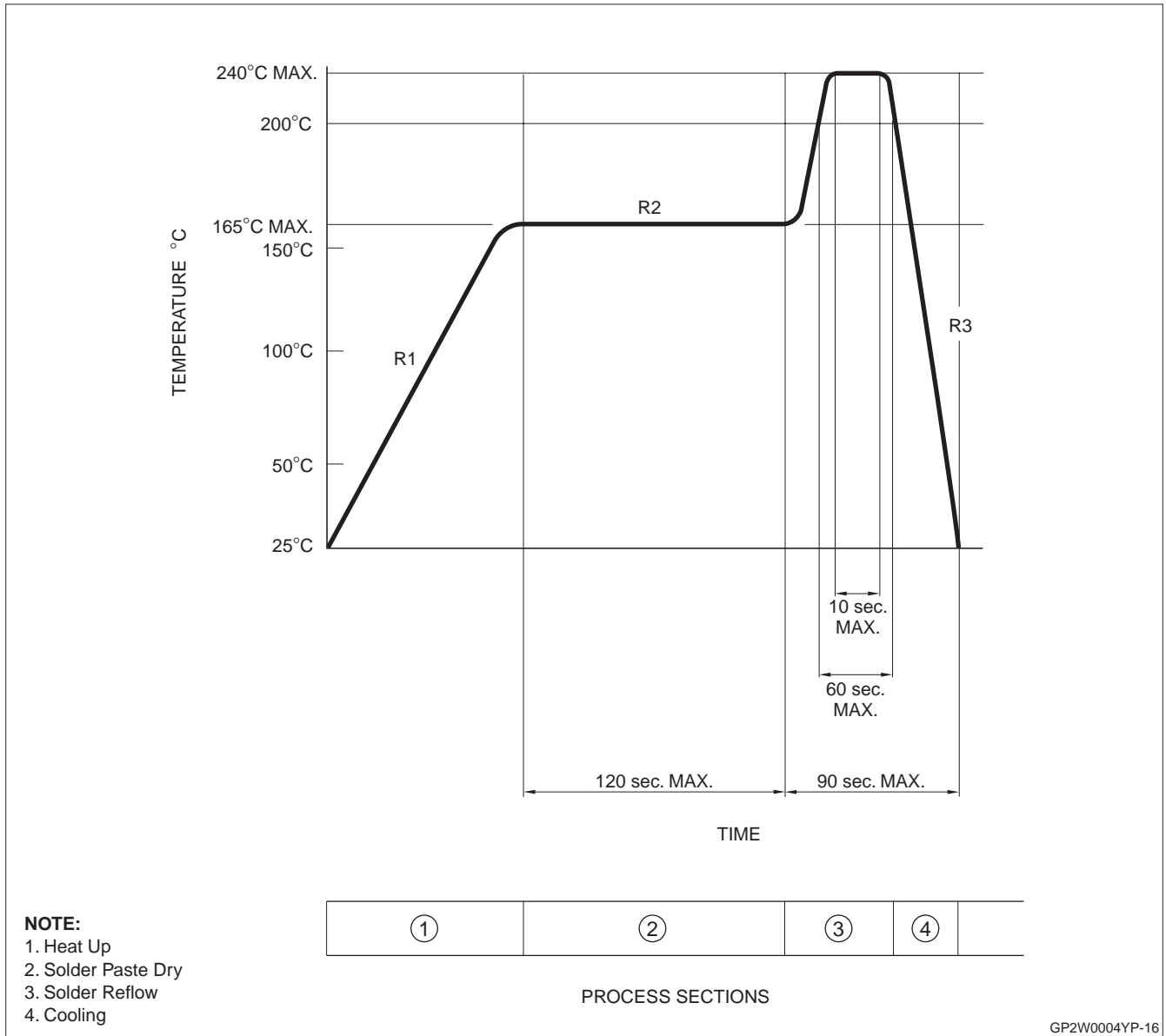


Figure 15. IR Solder Reflow Temperature Profile

## Evaluation Board

The circuit diagram in Figure 16 is the recommended evaluation circuit for the GP2W0004YP. This circuit is provided on an evaluation board for test and evaluation purposes. Samples are available through your Sharp support office, Sales Representative, or Distributor.

The resistor value for  $R_L$  is selected based on the supply voltage. The  $5.1 \Omega$  value is selected for  $V_{LEDA}$  between 3.6 V and 4.5 V, and has been loaded on the test boards as a nominal value. Adjust it for your operating conditions per Table 4.

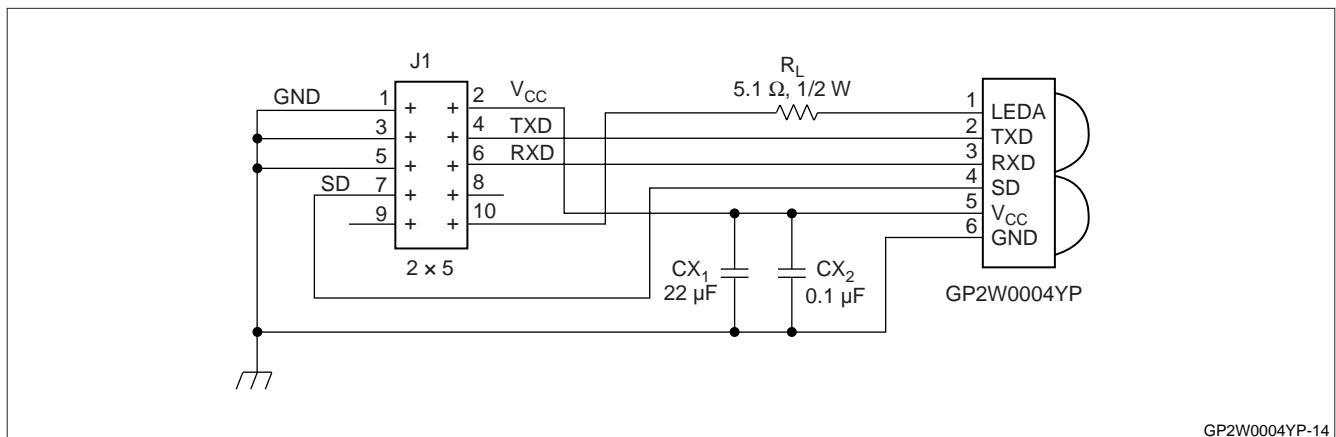
The forward current through the LED is adjusted by the resistor value and directly controls the operating range of the LED.

The capacitor values shown on the board are nominal for this test application. The final values are dependent on the amount and frequency of noise in the final system. Capacitor values need to be properly tailored for the end application.

This test and evaluation board is not intended for production applications and should be used for test and evaluation purposes only.

**Table 4.  $R_L$  Value**

RESISTOR VALUE	LED SUPPLY VOLTAGE ( $V_{LEDA}$ ) RANGE
1.0 $\Omega$ at 0.5 Watt	$2.4 \leq V_{LEDA} \leq 3.3$ V
3.0 $\Omega$ at 0.5 Watt	$3.0 \leq V_{LEDA} \leq 3.6$ V
5.1 $\Omega$ at 0.5 Watt	$3.6 \leq V_{LEDA} \leq 4.5$ V
7.5 $\Omega$ at 0.5 Watt	$4.5 \leq V_{LEDA} \leq 5.5$ V



**Figure 16. GP2W0004YP Recommended Evaluation Circuit**

GP2W0004YP-14

## PACKING INFORMATION

This section describes the GP2W0004YP moisture-proof packing and is only for reference. The same section of the official specifications should be consulted for detailed packing information.

### Packing Specifications

#### PACKING MATERIAL

The GP2W0004YP reel is moisture-proof packed for shipment. Table 5 describes the materials used for each item of the moisture-proof packing.

Table 5. Packing Materials

ITEM	MATERIAL
Aluminum Laminate Bag	Aluminum Polyethylene
Label	Paper
Desiccant	
Outer Case	Paper
Pads	Paper

### TAPE AND REEL

Figures 17 through 19 show the reel dimensions and product orientation in the reel.

GP2W0004YP is the side view device, and GP2W0004XP is the top view device. Note that the device orientation in the reel is not the same for both devices.

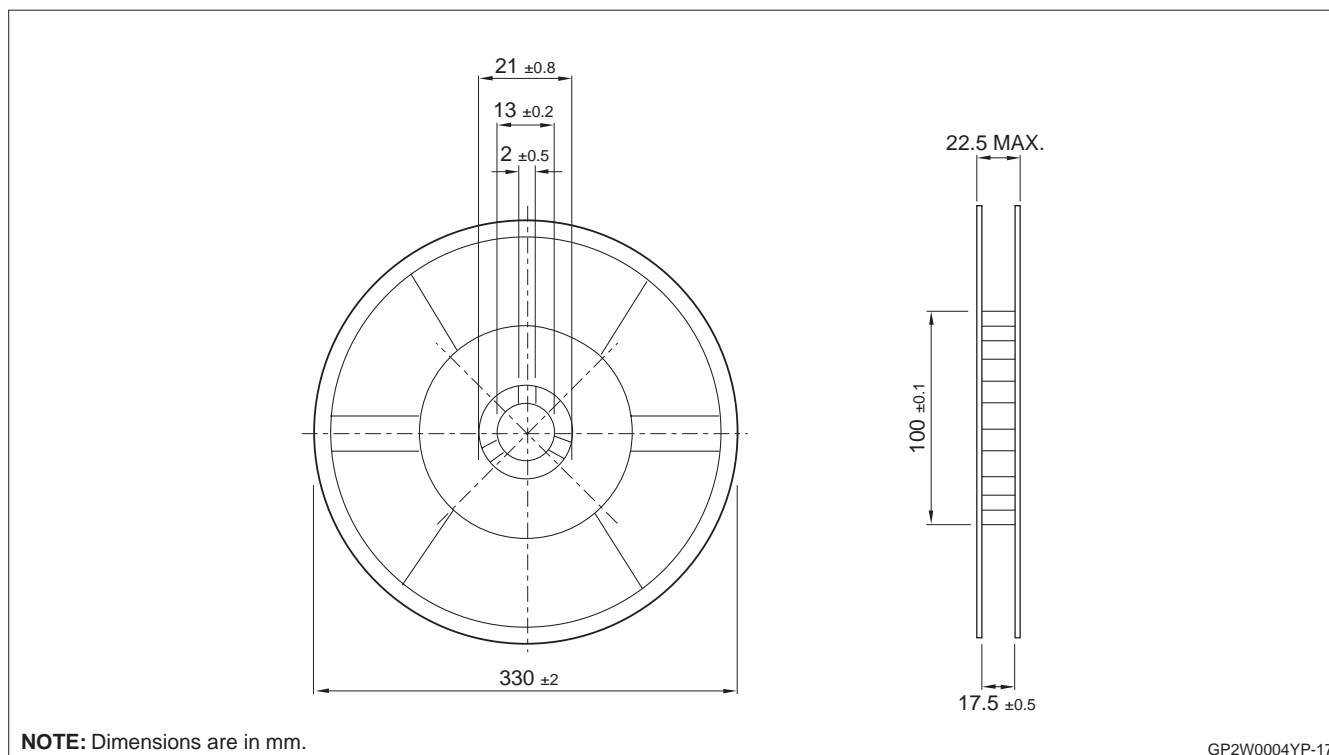


Figure 17. Reel Structure and Dimensions

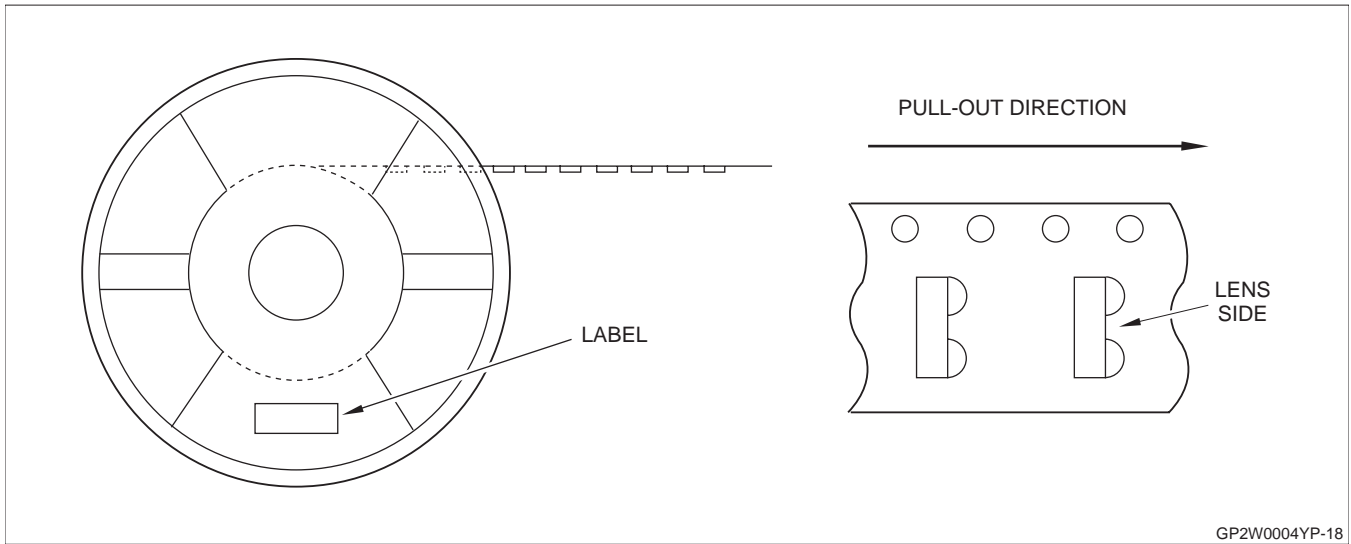


Figure 18. Direction of Product Insertion (GP2W0004YP)

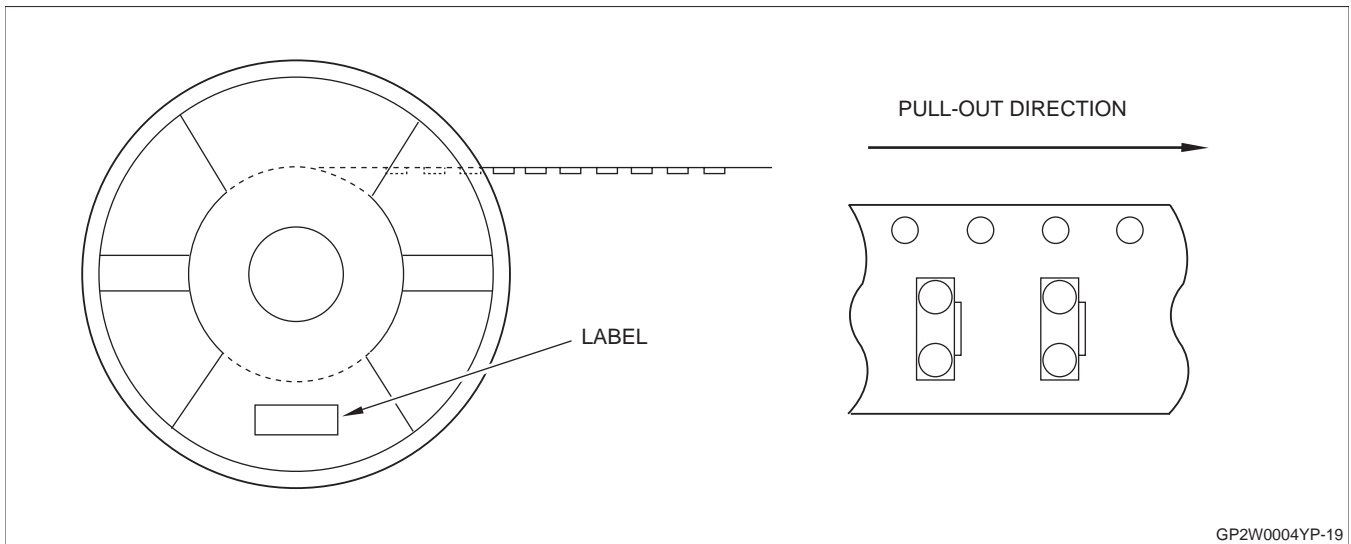


Figure 19. Direction of Product Insertion (GP2W0004XP)

**ORDERING INFORMATION**

Table 6 shows the correct ordering information for the device in both the top view and side view orientation.

**Table 6. Ordering Information**

MODEL NUMBER	ORIENTATION	PACKAGING
GP2W0004YP	Side View	Tape and Reel
GP2W0004XP	Top View	Tape and Reel

## Packing Method

Table 7 provides information on how each tape reel is packaged. Each aluminum laminate bag contains one reel (2,000 devices per reel) and desiccant. Four reels in their bags are packed per carton (4 reels/carton; 8,000 transceivers per carton).

The outer carton will then be sealed with craft tape, with indication of model name, quantity, and outgoing inspection date on the case.

## Storage Conditions

The product should be stored with these conditions:

- Storage temperature: 10°C to 30°C
- Humidity: below 60% RH

### CAUTION

These devices are hygroscopic, in that the plastic resin will absorb moisture. If the resin absorbs too much moisture, it will undergo rapid mechanical expansion when passed through the IR reflow process. This can cause device failures. The resin material from all device vendors has this characteristic.

## Treatment After Opening

After unsealing, devices should be mounted within the temperature condition of 10°C to 30°C, at the humidity condition below 60% RH, within 3 days

(72 hours).

If long-term storage is needed, devices should either be stored in a dry box or re-sealed in a moisture-proof bag with desiccant and stored in an environment where the temperature is 10°C to 30°C at the humidity condition of below 60% RH. Devices must be mounted within two weeks.

## Baking Before Mounting

In the event that the devices are not maintained in the storage conditions described, or the enclosed desiccant indicator has turned pink in color, baking must be done before devices are to be mounted. Also note that devices should only be baked once.

### CAUTION

Baking should be done with the devices removed from the reel, as the reel will melt. To complete the baking properly, devices should either be temporarily mounted to a PCB with adhesive or placed in a metal tray. Any device that has been out of dry pack for more than 72 hours should be dried in some manner prior to any surface mount reflow process. Otherwise these devices should be mounted and soldered by hand.

Recommended temperature: 100°C, 12 to 24 hours.

Table 7. Packing Methods

PACKING SHAPE	PRODUCT	QUANTITY PER REEL	QUANTITY PER BAG	QUANTITY PER CARTON
Tape reel (∅ 300 mm)	1 model	2,000 pieces per reel	1 reel per laminated bag	4 reels per carton

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