IrDA 115 kbit/s Standard 1 meter transceiver

GP2W0004YP / GP2W0004XP

Technical Data

GP2W0004XP is the TOP View version of GP2W0004YP.

1. Features
- IrDA 115 kbit/s, 1 meter Transceiver
- Small Package Design integrates this IrDA Compliant Infrared Transceiver (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 in the Mobile Phone Connector Dimensions
- Low Power Consumption and Built-in Shut-Down Mode (Max. 1 A)
- Wide Range Operating Voltage (VCC = 2.4V ~ 5.5V)
- Wide Operating Temperature Range: -20 C to +85 C
- Split Voltage Design, LED Voltage is 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
- Electrically and mechanically compatible with IRMS5000, HSDL-3000, CHX1010, MiniSIR2-1

2. Description

The SHARP GP2W0004YP is a wide operating voltage device, and 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.

An integral Electro-Magnetic Interference (EMI) shield is provided, as IR energy is inherently immune to EMI, however the receiving devices are very sensitive. 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 the low power driven bipolar integrated circuit. The IC contains an LED driver circuit, logic functions and receiver, providing the RX output. IrDA data rates of 2.4k to 115.2 kbit/s are supported at both the 20 cm and one meter distances. Emitter current of approximately I˙r = 100 mA is used at the one meter range and the IrDA Low Power Option communication mode I˙r = 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 market place.

The GP2W0004YP transceiver module may be operated over the power supply range of 2.4V to 5.5V 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 in this case 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 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 one of several devices on an I/O line.
3. Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Min.</th>
<th>Max.</th>
<th>Unit</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>$V_{CC}$</td>
<td>0</td>
<td>6.0</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>LED Supply Voltage</td>
<td>$V_{LEDA}$</td>
<td>0</td>
<td>7.0</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>$T_{OP}$</td>
<td>-10</td>
<td>+70</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>$T_{ST}$</td>
<td>-20</td>
<td>+85</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Soldering Temperature</td>
<td>$T_{SOL}$</td>
<td>240</td>
<td></td>
<td>°C</td>
<td>Solder reflow time 5 seconds.</td>
</tr>
</tbody>
</table>

4. Recommended Operating Conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Operating Condition</th>
<th>Unit</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>$V_{CC}$</td>
<td>2.4 to 5.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>LED Supply Voltage</td>
<td>$V_{LEDA}$</td>
<td>Max. $V_{CC} + 4.0$</td>
<td>V</td>
<td>$V_{CC} + 2.4$ to $5.5$V</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>$T_{OPR}$</td>
<td>-25 to +85</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Logic High Transmitter Input Voltage (TXIN)</td>
<td>$V_{IHTXD}$</td>
<td>$2/3 \times V_{CC}$</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Logic Low Transmitter Input Voltage (TXIN)</td>
<td>$V_{ILTXD}$</td>
<td>$1/3 \times V_{CC}$</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Data Rate</td>
<td>$BR$</td>
<td>9.6 to 115.2</td>
<td>kbit/s</td>
<td></td>
</tr>
<tr>
<td>Shutdown circuit high level input voltage</td>
<td>$V_{HSD}$</td>
<td>$V_{CC} - 0.5$</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Shutdown circuit low level input voltage</td>
<td>$V_{ILSD}$</td>
<td>0</td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>

1. An in-band optical signal is a pulse/sequence where the peak wavelength, $\lambda$, is defined as $850 \text{ nm} \leq \lambda \leq 900 \text{ nm}$, and the pulse characteristics are compliant with the IrDA Physical Layer Link Specifications.


5. Electrical and Optical Specifications

Specifications hold over the Recommended Operating Conditions, unless otherwise noted. All typical values are at $25^\circ$C. The following drawings are typical signals and test conditions.

Drawing 1. Input Signal Waveform, Detector Side.

![Signal Waveform Diagram]

Radiation intensity of transmitter 3.6 mW/sr minimum.

At $BR = 2.4$ kbit/s: $T_1 = 416.7$ s, $T_2 = 78.1$ s. At $BR = 115.2$ kbit/s: $T_1 = 8.68$ s, $T_2 = 1.63$ s.
IrDA 115 kbit/s 1 meter Infrared Transceiver

![Diagram of output waveform specification](image)

**Drawing 2, Output Waveform Specification**

**Drawing 3, Standard Optical System, Detector side.**

*1: Transmitter shall use GP2W0004YP (λ = 870 nm typical.) Radiated intensity is adjusted by inserting optical filter material in front of the transmitter to set a radiation intensity of 3.6 mW/sr.

Recommended circuit, emitter side.

*1: Transmitter Oscilloscope

Ø indicates horizontal and vertical directions

Ee: Detector face illuminance < 10 lx

V_{IN,TX} = 5.0 V

V_{CC} = 5V, RL = 5.1Ω
6. Pinouts

<table>
<thead>
<tr>
<th>PIN #</th>
<th>Description</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LED Anode</td>
<td>LEDA</td>
</tr>
<tr>
<td>2</td>
<td>Transmitter Data Input</td>
<td>TXD</td>
</tr>
<tr>
<td>3</td>
<td>Receiver Data Output</td>
<td>RXD</td>
</tr>
<tr>
<td>4</td>
<td>Shut Down Circuit Input</td>
<td>SD</td>
</tr>
<tr>
<td>5</td>
<td>Supply Voltage</td>
<td>V_{CC}</td>
</tr>
<tr>
<td>6</td>
<td>Ground</td>
<td>GND</td>
</tr>
</tbody>
</table>

7. Application Electrical Design Hints

The following figure and table shows the recommended application circuit and passive values for GP2W0004YP. The following table provides an idea for external passive values and is only applicable for design reference. See Section 3 for technical reference data in optical / electrical characteristics. Complete detail is provided in the device specification.

7-1 Application Circuit and External Passives

The following application circuit and external passives enables GP2W0004YP to operate at both one meter and 20 cm low power option communication mode at V_{CC} = 3.0V.

<table>
<thead>
<tr>
<th>Components</th>
<th>Recommended Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>CX1</td>
<td>47 F, 6.3 V or as appropriate</td>
</tr>
<tr>
<td>CX2</td>
<td>1500 pF, 25 V, or as needed</td>
</tr>
<tr>
<td>RL</td>
<td>2.2 Ω, 5%, 1/2W, 1 meter at V_{CC} = 3.0V</td>
</tr>
<tr>
<td></td>
<td>33 Ω, 1%, 1/8W, 20 cm Low Power option at V_{CC} = 3.0V</td>
</tr>
</tbody>
</table>

All recommended values are at V_{CC} = 3.0V.
7-2 Shutdown Mode

The “Shutdown” pin is an active high input terminal, and controls power saving and logic functions as described in the chart below. When Shutdown is asserted, the Receive Data output is in the pull-up mode (more than 200 k-Ω) which will hold the Received Data line high, and the radiated Infrared transmit output is disabled. Signals applied to the Transmit Data In pin will not create an output signal.

<table>
<thead>
<tr>
<th>HIGH</th>
<th>Shutdown Mode, RX output pulled high, TX inhibit asserted</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOW</td>
<td>Normal Mode, RX output and TX work normally</td>
</tr>
</tbody>
</table>

Shutdown mode affects the power consumption of the device. The transmitter and receiver circuits do not conduct current during the shutdown mode.

Echo Cancel Function

When the device is operating in the Normal mode, and Transmit data is applied to the device, the Receiver output will be inhibited. This prevents a local echo of the transmitted data from being received by the system microprocessor. The Received Data line again becomes active 200 µs after the Transmit Data line stays low.

7-3 Example of Signal Wave Form

The following drawing provides examples of each waveform when correctly operating GP2W0004YP in a manner conforming to IrDA standards. 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 following waveform examples are applicable as a design and evaluation reference only, to understand the GP2W0004YP hardware implementation, as well as performing system measurements.

<table>
<thead>
<tr>
<th>No.</th>
<th>Signal Description</th>
<th>Waveform</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Transmitting Data Waveform</td>
<td><img src="image1" alt="Waveform 1" /></td>
</tr>
<tr>
<td>2</td>
<td>Encoder Circuit Output Waveform</td>
<td><img src="image2" alt="Waveform 2" /></td>
</tr>
<tr>
<td>3</td>
<td>Transmitter Output Optical Signal Waveform</td>
<td><img src="image3" alt="Waveform 3" /></td>
</tr>
<tr>
<td>4</td>
<td>GP2W0004YP Receiver Output Waveform</td>
<td><img src="image4" alt="Waveform 4" /></td>
</tr>
<tr>
<td>5</td>
<td>Receiving Data Waveform</td>
<td><img src="image5" alt="Waveform 5" /></td>
</tr>
</tbody>
</table>

\[ T = \frac{1}{\text{Data Rate}} \]

Data Rate: 2.4 kbit/s, 9.6 kbit/s, 19.2 kbit/s, 38.4 kbit/s, 57.6 kbit/s, 115.2 kbit/s
8 Application Mechanical Design Hints

8-1. Recommended Foot Print
The following figure shows the basic recommended footprint for PCB design when using the SHARP GP2W0004YP infrared transceiver module. All values in the following figure are applicable as a design reference, and are in mm (UNIT). Confirm any design changes with the complete specification.

Solder Paste Footprint
Solder Paste footprint drawing for GP2W0004YP. Note that the shield contact for GP2W0004YP is now 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 no longer required.

For complete mechanical dimensions, refer to the full specification for GP2W0004YP. The footprint for GP2W0004XP does have an additional solder tab as shown below. The basic footprint is the same. For both, the distance L = 2.3 mm is used for metal solder masks of 0.152 mm thickness. When a mask of 0.127 mm must be used, then L = 2.7 mm.
8.2. Design Hints for Cabinet and IR Cosmetic Window

The following figure and calculations explain the example and design hints for the cabinet and IR cosmetic window with ±18° viewing angles, in the vertical and horizontal axes. All values for the transceiver dimensions are applicable only for design reference, and in mm (UNIT).

![Diagram of cabinet and IR cosmetic window with dimensions labeled.]

The optical window size should be the minimum size of W x H rectangular or elliptical in order not to reduce IrDA data transfer performance. The dimensions for W are calculated by the formula: \( W = 2 \times L \times \tan 18 + w \) and the dimensions for H can be calculated by the formula: \( H = 2 \times L \times \tan 18 + h \) in the case where the viewing angle is ±18°, which conforms to or exceeds the IrDA Serial Infrared Physical Layer Link Specifications. Any values to be calculated with above the formula must be given in mm.

**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 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 high-pass filter, reducing the amount of visible light and other wavelengths landing on the photodiode and raising the internal noise currents.

![Graph showing response % transmission vs. wavelength.]

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 keep this in mind and not attenuate this wavelength.

A simple material for test purposes is to obtain a roll of standard color film. (This is not an exact, quantitative...
test, however it can be used to determine a sense of what is happening.) Pull the film all the way out of the
can and expose it to indoor or 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 has been overexposed and the material was
discarded as unusable. The resulting developed negative stock should be dark and difficult to see through, and
will have some characteristics as an infrared filter, as shown below. One or more layers will provide a variable
attenuation filter that you can tailor for experimental purposes.

Other light sources may produce different filtering results. The graph above 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 film material selected, and the light used to expose it. The intent is to
suppress visible light, and neighboring wavelengths, and pass the desired 880 nm.

Other glass and 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 them about the wavelength characteristics of
their materials. The more they know, the more likely they 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.

8-3. Evaluation Board
The following circuit diagram is the recommended evaluation circuit for the GP2W0004YP devices. This circuit
is provided on an evaluation board for test and evaluation purposes. Please request samples through your
Sharp support office or Sales Representative, or Distributor.

The resistor value for RL is adjusted based on the supply voltage. The 5.1-Ohm value is selected for VLEDA
between 3.6 and 4.5 V. This has been loaded on the test boards as a nominal value. Change it for your
operating conditions per the table below.

<table>
<thead>
<tr>
<th>RL</th>
<th>VLEDA Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 Ω @ 0.5 Watt</td>
<td>2.4 ≤ VLEDA ≤ 3.3V Operation</td>
</tr>
<tr>
<td>3.0 Ω @ 0.5 Watt</td>
<td>3.0 ≤ VLEDA ≤ 3.6V Operation</td>
</tr>
<tr>
<td>5.1 Ω @ 0.5 Watt</td>
<td>3.6 ≤ VLEDA ≤ 4.5V Operation</td>
</tr>
<tr>
<td>7.5 Ω @ 0.5 Watt</td>
<td>4.5 ≤ VLEDA ≤ 5.5V Operation</td>
</tr>
</tbody>
</table>

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 final application. This test and evaluation board is not intended for production applications, and
should be used for test and evaluation purposes only.
9. Moisture-Proof Packing Information

9-1 Scope
This section describes the specifications of GP2W0004YP moisture-proof packing, and is only applicable for reference. The same section of the official specifications should be consulted for detailed packing information.

9-2 Packing Specifications

9-2-1. Packing Material
The GP2W0004YP reel will be moisture-proof packed for factory shipment. The following table describes the materials used for each item of the moisture-proof packing:

<table>
<thead>
<tr>
<th>Item</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum Laminate Bag</td>
<td>Aluminum Polyethylene</td>
</tr>
<tr>
<td>Label</td>
<td>Paper</td>
</tr>
<tr>
<td>Desiccant</td>
<td>-</td>
</tr>
<tr>
<td>Outer Case</td>
<td>Paper</td>
</tr>
<tr>
<td>Pads</td>
<td>Paper</td>
</tr>
</tbody>
</table>

9-2-2. Packing Method
1. Seal the aluminum laminate bag that contains tape reel (contains 2,000 devices per reel) and desiccant.
2. Fill necessary information on the label and paste it on the aluminum laminate bag.
3. Pack 4 aluminum laminated bags (contains 1 reel each) into the designated outer case. Paper pads are placed on the bottom and top of the outer case, as well as between each layer of the aluminum laminated bags.
4. The outer case is sealed with craft tape, with indication of model name, quantity, and out-going inspection date on the case. (total of 8,000 pieces per carton)

9-3 Storage, Treatment after Unsealing

9-3-1. Storage Conditions
The delivered product should be stored with the conditions shown below:
Storage temperature: 10 °C to 30 °C
Humidity: below 60% RH

9-3-2. Treatment after Unsealed
1. After unsealing, mount devices within the temperature condition of 10 °C to 30 °C, at the humidity condition of below 60% RH, within 3 days (72 hours).
2. If long-term storage is needed, devices should either be stored in 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. Mount devices within 2 weeks.

9-3-3. Baking before Mounting
In the event that the devices are not maintained in the storage conditions described above, or the enclosed desiccant indicator has turned pink, baking must be applied before the devices are to be mounted: Please also note that baking should only be applied once.

NOTICE)
Baking is not done with the devices in the reel, as it 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 Condition: 100 °C, 12 to 24 hours
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