

# Infrared IrDA Compliant Transceiver

## Technical Data

### HSDL-1001

#### Features

- Fully Compliant to IrDA 1.0 – 115 Kb/s
- Compatible with ASK, Consumer IR/TV Remote
- Superb Nose-to-Nose Operation
- Low Power Consumption 3  $\mu$ A in Shutdown
- Supply Voltage Range 2.7 V – 5.5 V
- Operational Down to 2 V
- Free Netlist for IrDA Modulation Circuitry
- Low Latency 100  $\mu$ s
- Available in Tape & Reel for Auto Insertion
- Drop in Replacement for HSDL-1000

#### Description

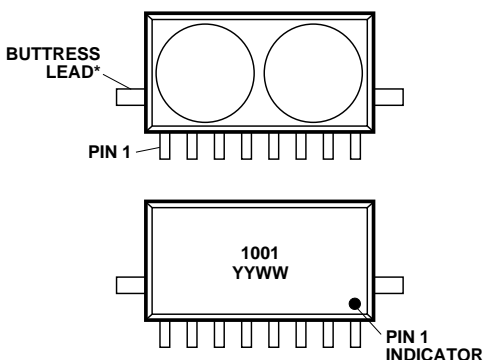
The HSDL-1001 infrared transceiver provides the interface between logic and IR signals for through-air, serial, half-duplex IR data links and is designed to satisfy the IrDA Physical Layer Specification for data rates up to 115 Kb/s.

The HSDL-1001 contains a high speed, high efficiency TS AlGaAs 875 nm LED, a silicon PIN photodiode and a bipolar, silicon

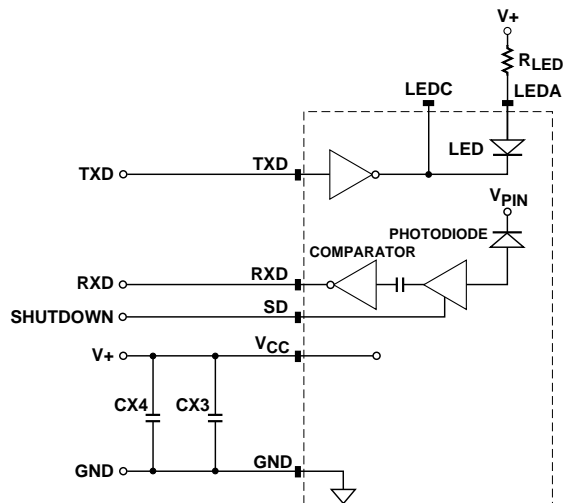
integrated circuit. The IC contains an LED driver, amplifiers and a quantizer.

The shutdown function permits operating the receiver in a low current mode to minimize battery drain.

Applications for the HSDL-1001 include notebook PCs, telephones, pagers, printers, cameras, and industrial handheld devices.

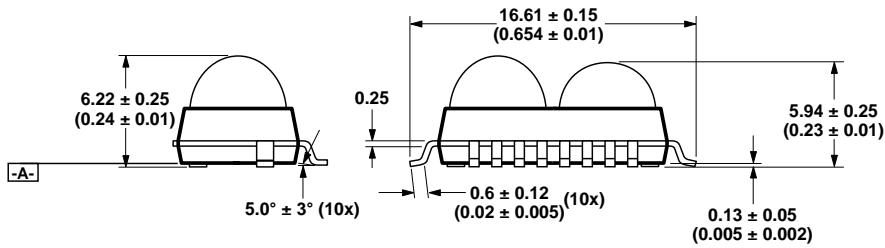
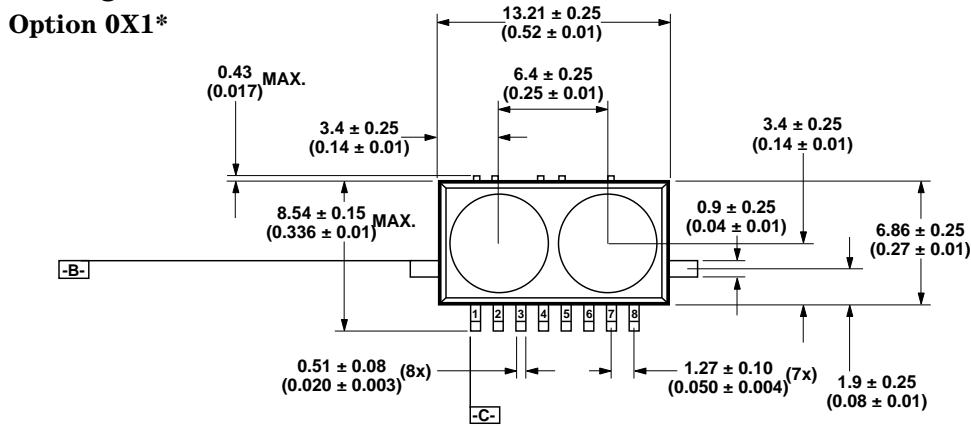


\* SIDE BUTTRESS LEADS ARE FOR MECHANICAL STABILITY AND SHOULD NOT BE CONNECTED TO ANY ELECTRICAL POTENTIAL.



### Package Dimensions

#### Option 0X1\*



DIMENSIONS IN MILLIMETERS (INCHES).

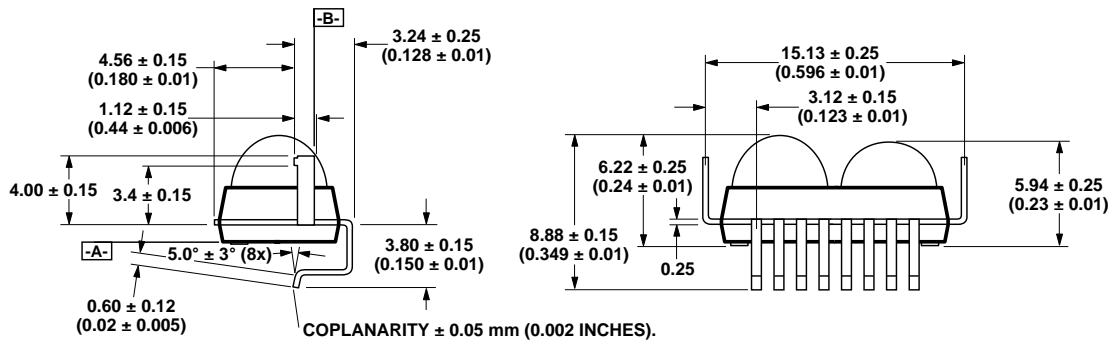
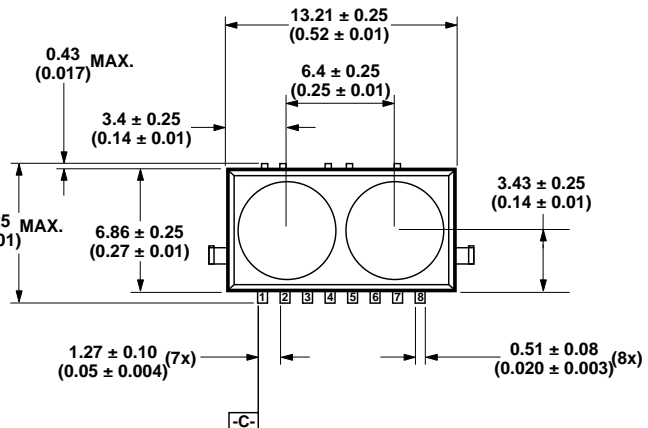
#### Option 0X2\*

NOTE:  
THE -B- DATUM IS FORMED BY THE TWO HIGHEST POINTS OF THE COMBINED SURFACE FORMED BY THIS SURFACE AND THE CORRESPONDING SURFACE OF THE SAME LEAD ON THE OPPOSITE SIDE OF THE PACKAGE.

0 = TAPE AND REEL.

X = STRIP OF 10.

1 = JEDEC STANDARD ARRAY.



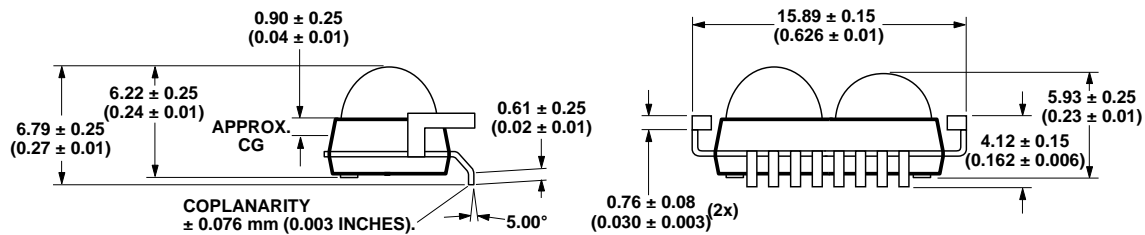
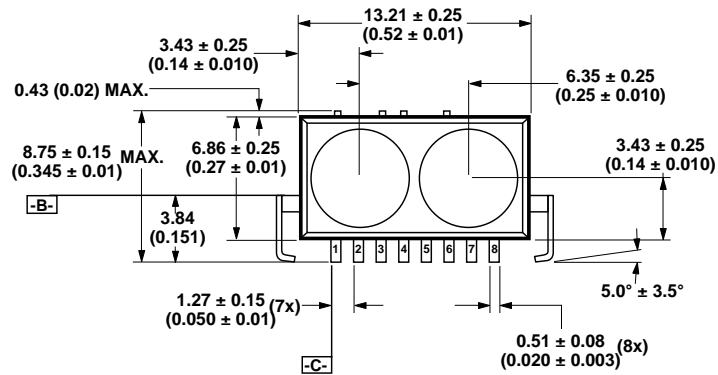
DIMENSIONS IN MILLIMETERS (INCHES).

## Package Dimensions (continued)

### Option X04

NOTE:  
THE -B- DATUM IS FORMED BY THE TWO HIGHEST POINTS OF THE COMBINED SURFACE FORMED BY THIS SURFACE AND THE CORRESPONDING SURFACE OF THE SAME LEAD ON THE OPPOSITE SIDE OF THE PACKAGE.

\*X POSITION INDICATES PACKAGING.  
0 = TAPE AND REEL.  
1 = JEDEC STANDARD ARRAY.



DIMENSIONS IN MILLIMETERS (INCHES).

## Truth Table

Inputs			Outputs		
TXD	EI <sup>[1]</sup>	SD	IE(LED)	LEDA	RXD
V <sub>IH</sub>	X	X	High (On)	Low	NV
V <sub>IL</sub>	EI <sub>IH</sub> <sup>[2]</sup>	V <sub>IL</sub>	Low (Off)	High	Low <sup>[3]</sup>
V <sub>IL</sub>	EI <sub>IL</sub>	V <sub>IL</sub>	Low (Off)	High	High
V <sub>IL</sub>	X	V <sub>IH</sub>	Low (Off)	High	High

X = Don't care

NV = Not Valid

### Notes:

- EI – Irradiance (light intensity) present at detector surface.
- For in-band IrDA signals  $\leq 115$  kb/s.
- RXD Low is a pulsed response. The condition is maintained for a duration dependent on the pattern and strength of the incident signal.

## Pinout

Pin	Description	Symbol
1	Shutdown	SD
2	No Connection	
3	Supply Voltage	V <sub>CC</sub>
4	Receiver Data Output	RXD
5	Ground	Gnd
6	Transmitter Data Input	TXD
7	LED Cathode	LEDC
8	LED Anode	LEDA

## Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Units	Conditions
Storage Temperature	T <sub>S</sub>	-20	85	°C	
Operating Temperature	T <sub>A</sub>	0	70	°C	
Lead Solder Temperature			260	°C	For 10 s (1.6mm below seating plane)
Average LED Current	I <sub>LED</sub> (DC)		100	mA	
Repetitive Pulsed LED Current	I <sub>LED</sub> (RP)		500	mA	≤ 90 μs Pulse Width, ≤ 20% Duty Cycle
Peak LED Current	I <sub>LED</sub> (PK)		1.0	A	≤ 2 μs Pulse Width, ≤ 10% Duty Cycle
LED Anode Voltage	V <sub>LEDA</sub>	-0.5	7.0	V	
LED Cathode Voltage	V <sub>LEDC</sub>	-0.5	V <sub>LEDA</sub>	V	
Supply Voltage	V <sub>CC</sub>	0	7.0	V	
Transmitter Data Input Voltage	V <sub>TXD</sub>	-0.5	V <sub>CC</sub> , 5.5	V	
Receiver Data Output Voltage	V <sub>RXD</sub>	-0.5	(V <sub>CC</sub> + 0.5), 5.5	V	
Shutdown	V <sub>SD</sub>	-0.5	V <sub>CC</sub> , 5.5	V	

## Recommended Operating Conditions

Parameter	Symbol	Min.	Max.	Units	Conditions
Operating Temperature	$T_A$	0	70	°C	
Supply Voltage	$V_{CC}$	2.7	5.5	V	
Logic High Transmitter Input Voltage	$V_{IH}(TXD)$	2.5	$V_{CC}$	V	
Logic Low Transmitter Input Voltage	$V_{IL}(TXD)$	0.0	0.8	V	
Logic Low Shutdown Input Voltage	$V_{IL}(SD)$	0.0	0.8	V	
Logic High Shutdown Input Voltage	$V_{IH}(SD)$	2.5	$V_{CC}$	V	
Logic High Receiver Input Irradiance	$E_{IH}$	0.0036	500	mW/cm <sup>2</sup>	For in-band signals*
Logic Low Receiver Input Irradiance	$E_{IL}$		0.3	μW/cm <sup>2</sup>	For in-band signals*
LED (Logic High) Current Pulse Amplitude	$I_{LEDA}$	240		mA	For one metre links with daylight filters
Receiver Set-up Time		200		μs	For full sensitivity after transmitting
Signal Rate RXD		2.4	115	Kp/s	
Ambient Light					See IrDA Serial Infrared Physical Layer Link Specification, Appendix A for ambient levels.

**\*Note:** An in-band optical signal is a pulse/sequence where the peak wavelength,  $\lambda_p$ , is defined as  $850 \text{ nm} \leq \lambda_p \leq 900 \text{ nm}$ , the pulse repetition rate, PRR, is defined as  $2.4 \text{ Kp/s} \leq \text{PRR} \leq 115.2 \text{ Kp/s}$  and the pulse width, PW, is defined as  $1.6 \text{ μs} \leq \text{PW} \leq (3/16)/\text{PRR}$ .

## Electrical & Optical Specifications

Specifications hold over  $3.0\text{ V} \leq V_{CC} \leq 5.5\text{ V}$  and  $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$  and all typicals are at  $V_{CC} = 5.0\text{ V}$  and  $T_A = 25^\circ\text{C}$  unless otherwise specified. Listed conditions represent worst case values for the parameters under test. Unspecified test conditions can be anywhere in their recommended operating range.

Parameter		Symbol	Min.	Typ.	Max.	Unit	Conditions
Receiver Data Output Voltage	Logic Low <sup>[2]</sup>	$V_{OL}(\text{RXD})^{[1,2]}$			0.4	V	For in-band EI $\geq 3.6\ \mu\text{W}/\text{cm}^2$ , $\phi^{1/2} \leq 15^\circ$
	Logic High	$V_{OH}(\text{RXD})$	$V_{CC}-0.6$			V	$I_o = -20\ \mu\text{A}$ , for in-band EI $\leq 0.3\ \mu\text{W}/\text{cm}^2$
Receiver Field of View	Twice Half-Angle	$2\phi^{1/2}$	30			°	Half-angle, $\phi^{1/2}$ , is the angle where receiver sensitivity = $3.6\ \mu\text{W}/\text{cm}^2$ .
Receiver Peak Sensitivity Wavelength		$\lambda_p(\text{EI})$		880		nm	
Effective Detector Area				0.16		$\text{cm}^2$	
Transmitter Radiant Intensity	Logic High Intensity	IEH	55 44	109	250	mW/SR mW/SR	$I_{LEDA} = 240\ \text{mA}$ , $V_I = 2.5\ \text{V}$ $T_A = 25^\circ\text{C}$ $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$
	Peak Wavelength	$\lambda_p(\text{IE})$		875		nm	
	Spectral Line Half Width	$\Delta\lambda^{1/2}$		35		nm	
Transmitter Field of Emission	Twice Half-Angle	$2\theta^{1/2}$	30		60	°	Half-angle, $\theta^{1/2}$ , is the angle where radiant intensity = $44\ \text{mW}/\text{SR}$ .
Transmitter Data Input Current	Logic Low	$I_{IL}(\text{TXD})$	-1.0		5.0	$\mu\text{A}$	$0 \leq V_I \leq 0.8\ \text{V}$
	Logic High	$I_{IH}(\text{TXD})$		40 125	100 250	$\mu\text{A}$ $\mu\text{A}$	$V_I = 2.5\ \text{V}$ $V_I = 5.0\ \text{V}$
LED Anode On State Voltage		$V_{ON}(\text{LEDA})$		2.1	2.50	V	$I_{LEDA} = 240\ \text{mA}$ , $T_j = 25^\circ\text{C}$
LED Anode Off State Leakage		$I_{LK}(\text{LEDA})$		<0.2	10	$\mu\text{A}$	$V_{LEDA} = V_{CC} = 5.5\ \text{V}$ , $V_I = 0.3\ \text{V}$
Supply Current	Idle	$I_{CC1}$		190 210	260 290	$\mu\text{A}$ $\mu\text{A}$	$V_{CC} = 3.6\ \text{V}$ $V_{CC} = 5.5\ \text{V}$ , EI = EI <sub>IL</sub> , $V_I(\text{TXD}) = V_{IL}$
	Active Receiver	$I_{CC2}$		0.22	25	mA	$V_{CC} = 5.5\ \text{V}$ , EI = EI <sub>IH</sub> , $V_I(\text{TXD}) = V_{IL}$
	Active Transmitter	$I_{CC3}$			10	mA	$V_{CC} = 5.5\ \text{V}$ , EI = EI <sub>IL</sub> , $V_I(\text{TXD}) = V_{IH}$
	Shutdown	$I_{CC}(\text{SD})$		3 5	14 20	$\mu\text{A}$ $\mu\text{A}$	$V_{CC} = 3.6\ \text{V}$ $V_{CC} = 5.5\ \text{V}$ , EI = EI <sub>IL</sub> , $V_I(\text{TXD}) = V_{IL}$ , $V_{SD} = V_{IH}$
Shutdown Input Current	Logic High	$I_{IH}(\text{SD})$		2.5	10	$\mu\text{A}$	$V_{CC} = 5.5\ \text{volts}$ $V_{SD} = 5.5\ \text{volts}$
		$I_{IH}(\text{SD})$		2	8	$\mu\text{A}$	$V_{CC} = 3.6\ \text{volts}$ $V_{SD} = 3.6\ \text{volts}$
	Logic Low	$I_{IL}(\text{SD})$	-1.0		1	$\mu\text{A}$	$3.0\ \text{V} \leq V_{CC} \leq 5.5\ \text{V}$ $0\ \text{V} \leq V_{SD} \leq 0.8\ \text{V}$

### Notes:

- Pulsed Response — Logic Low is a pulsed response. A receiver output low state  $V_{OL}(\text{RXD})$  is not indefinitely maintained but is instead a pulsed response. The output low state is maintained for a duration dependent on the incident bit pattern and incident intensity (EI).
- The  $E_I \geq 3.6\ \mu\text{W}/\text{cm}^2$  condition guarantees the IrDA minimum receiver sensitivity of  $4.0\ \mu\text{W}/\text{cm}^2$  while allowing for 10% light loss through a cosmetic window placed in front of the HSDL-1001.

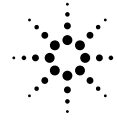
## Switching Specifications

Specifications hold over  $3.0\text{ V} \leq V_{CC} \leq 5.5\text{ V}$  and  $0 \leq T_A \leq 70^\circ\text{C}$  and all typicals are at  $V_{CC} = 5.0\text{ V}$  and  $T_A = 25^\circ\text{C}$  unless otherwise specified. Listed conditions represent worst case values for the parameters under test. Unspecified test conditions can be anywhere in their recommended operating range.

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Transmitter Optical Pulse Width	$t_{pw}(SD)$	1.45	1.7	2.15	$\mu\text{s}$	$R_{LED} = \text{Recommended Value}$ $2.5\text{ V} \leq V_{IH}(TXD) \leq V_{CC}$ $t_{pw}(TXD) = 1.6\text{ }\mu\text{s}$
Transmitter Optical Rise Time	$t_r(SD)$		0.05	0.6	$\mu\text{s}$	
Transmitter Optical Fall Time	$t_f(SD)$		0.1	0.6	$\mu\text{s}$	
Receiver Pulse Width	$t_{pw}(RXD)$	0.5		8.2	$\mu\text{s}$	For in-band EI $\leq 115.2\text{ Kb/s}$
Receiver Latency Time	$t_L(RXD)$		100	200	$\mu\text{s}$	
Receiver Wake-Up Time	$t_{wu}(RXD)$		40	100	$\mu\text{s}$	
Receiver Shutdown Time	$t_{sd}(RXD)$		10	100	$\mu\text{s}$	

## Application Circuit

Component	Recommended Value
$R_{LED}$	9.1 $\Omega$ , $\pm 5\%$ , 0.5 W, for $4.5\text{ V} \leq V_{CC} \leq 5.5\text{ V}$ 3.3 $\Omega$ , $\pm 5\%$ , 0.5 W, for $3.0\text{ V} \leq V_{CC} \leq 3.6\text{ V}$
CX3	0.10 $\mu\text{F} \pm 22\%$ . XR7 Ceramic, Lead Length $\leq 5\text{ mm}$ .
CX4	4.7 $\mu\text{F}$ minimum. Larger values recommended for noisy supplies or environments.



## **Appendix A. Test Methods**

### **A.1. Background Light and Electromagnetic Field**

There are four ambient interference conditions in which the receiver is to operate correctly. The conditions are to be applied separately:

1. Electromagnetic field: 3 V/m maximum (refer to IEC 801-3, severity level 3 for details)

2. Sunlight: 10 kilolux maximum at the optical port

This is simulated with an IR source having a peak wavelength within the range 850 nm to 900 nm and a spectral width less than 50 nm biased to provide  $490 \mu\text{W}/\text{cm}^2$  (with no modulation) at the optical port. The light source faces the optical port.

This simulates sunlight within the IrDA spectral range. The effect of longer wavelength radiation is covered by the incandescent condition.

3. Incandescent Lighting: 1000 lux maximum

This is produced with general service, tungsten-filament, gas-filled, inside-frosted lamps in the 60 Watt to 150 Watt range to generate 1000 lux over the horizontal surface on which the equipment under test rests. The light sources are above the test area. The source is expected to have a filament temperature in the 2700 to 3050 degrees Kelvin range and a spectral peak in the 850 nm to 1050 nm range.

4. Fluorescent Lighting: 1000 lux maximum

This is simulated with an IR source having a peak wavelength within the range 850 nm to 900 nm and a spectral width of less than 50 nm biased and modulated to provide an optical square wave signal ( $0 \mu\text{W}/\text{cm}^2$  minimum and  $0.3 \mu\text{W}/\text{cm}^2$  peak amplitude with 10% to 90% rise and fall times less than or equal to 100 ns) over the horizontal surface on which the equipment under test rests. The light sources are above the test area. The frequency of the optical signal is swept over the frequency range from 20 kHz to 200 kHz.

Due to the variety of fluorescent lamps and the range of IR emissions, this condition is not expected to cover all circumstances. It will provide a common floor for IrDA operation.