

# Infrared Transceiver

## Technical Data

### Features

- Fully Compliant to IrDA 1.1 – 4 Mbps
- Compatible with ASK, HP-SIR, and TV Remote
- Backward Compatible to Slower Speeds
- Excellent Nose to Nose Operation
- Excellent Noise Immunity
- No Programming to Switch Speeds
- Available in Several Mounting Options
- Designed to Compensate for Light Loss Due to Cosmetic Windows
- Fully Supported by All Interface Chips

### Description

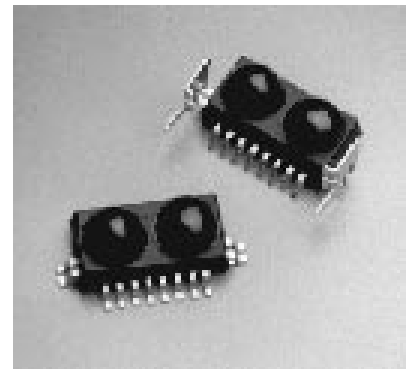
The HSDL-1100 infrared transceiver provides the interface between logic and IR signals for through-air, serial, half-duplex IR data links and is designed to satisfy the IrDA Physical Layer Specification.

The HSDL-1100 contains a high speed, high efficiency, TS AlGaAs 870 nm LED, a silicon PIN photodiode, and a bipolar, silicon integrated circuit. The IC contains an LED driver and a receiver providing two output signals, RXD-A for signal rates from 2.4 to

115.2 Kb/s and RXD-B for signal rates of 576 Kb/s and 4.0 Mb/s.

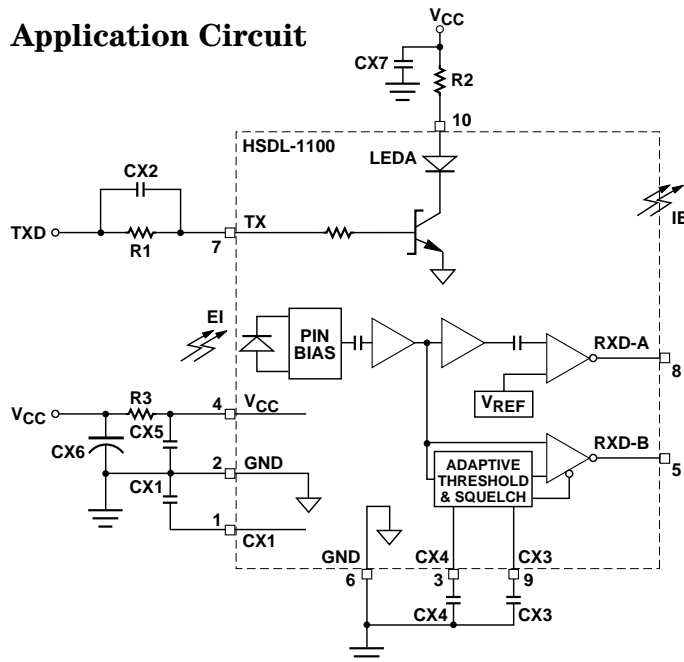
The receiver is designed for maximum sensitivity to IrDA signals and minimum sensitivity to signals outside the IrDA optical wavelength and frequency modulation of interest. A receiver lens magnifies the effective area of the PIN diode to enhance sensitivity. The lens is integral with the molded package and contains a dye which absorbs visible light. Receiver outputs pulse low when the IR signal is present. The power supply for the PIN and preamplifier are filtered to attenuate noise conducted from external sources.

### HSDL-1100



Applications for the HSDL-1100 include notebook PCs, LANs, telephones, pagers, printers, cameras, and industrial handheld devices.

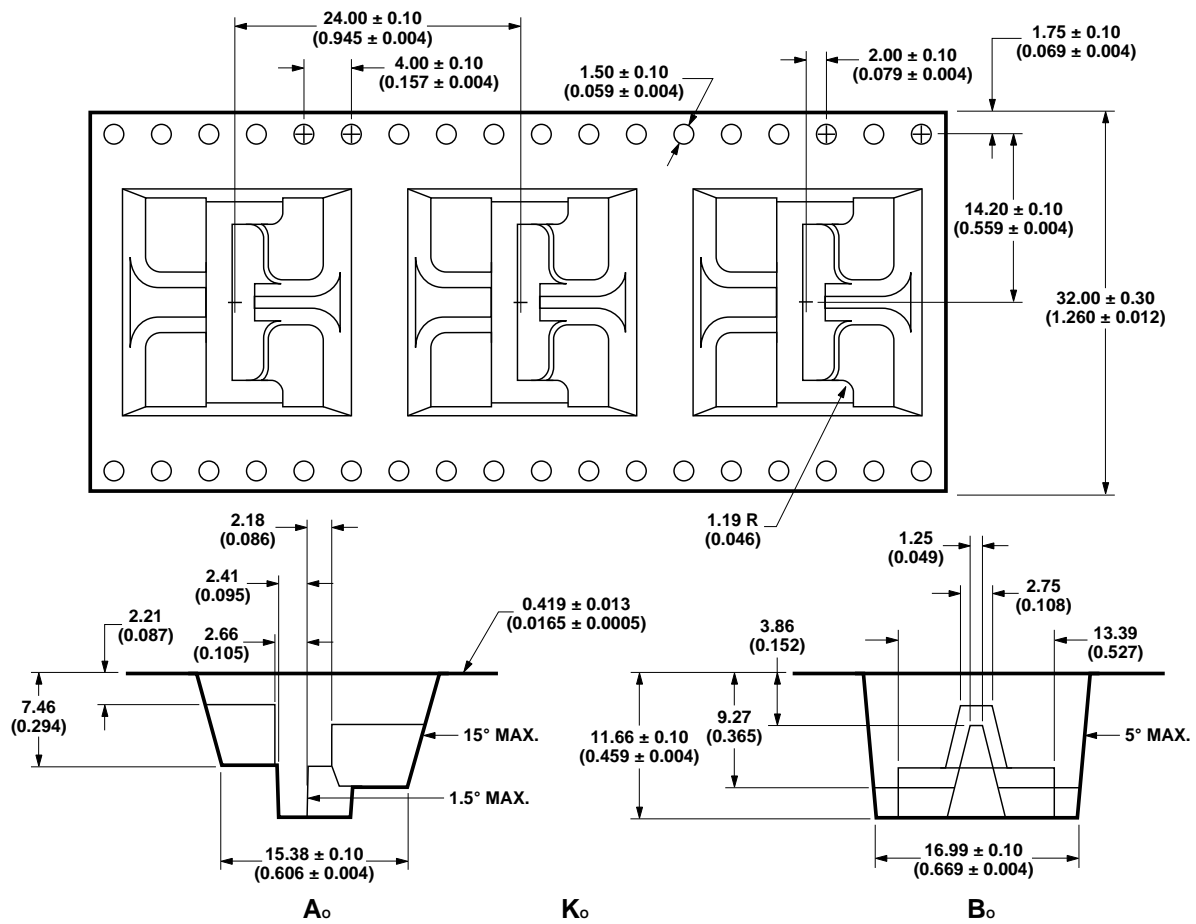
### Application Circuit





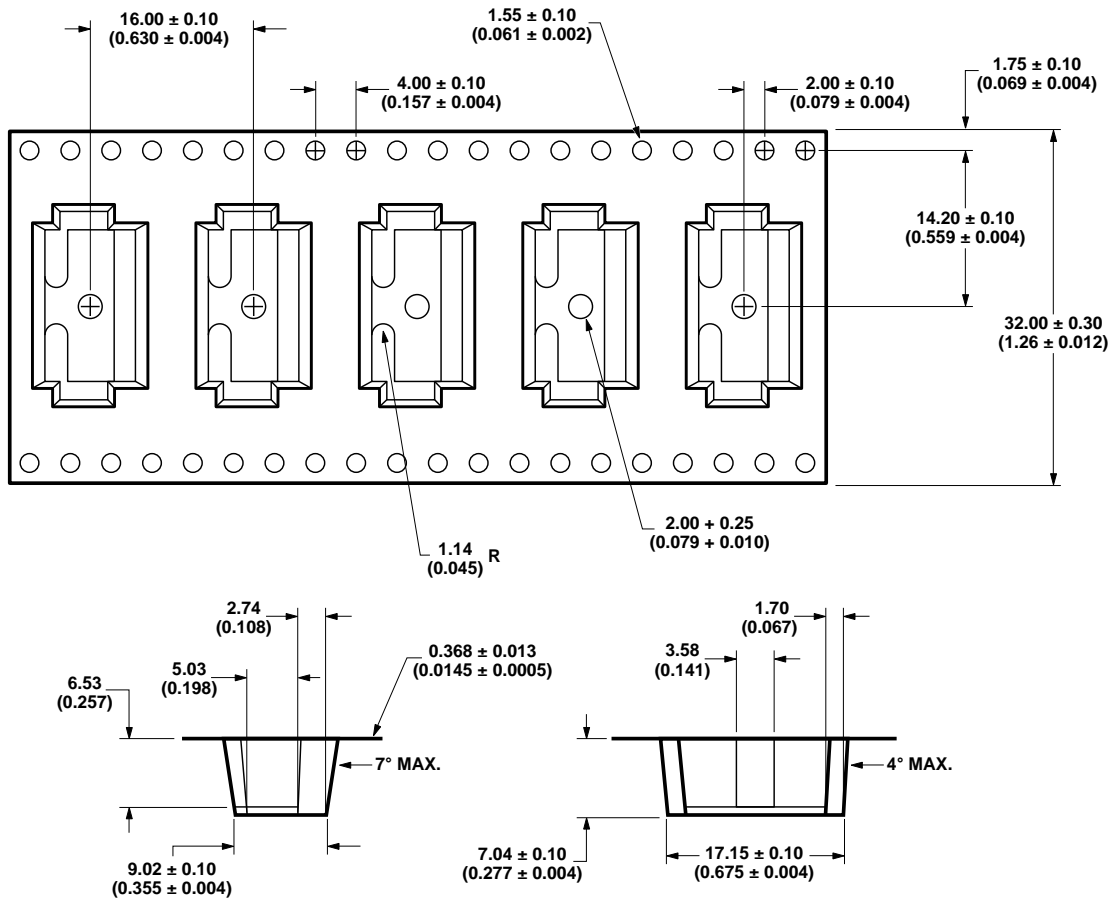


## Tape and Reel Dimensions Option #0x7



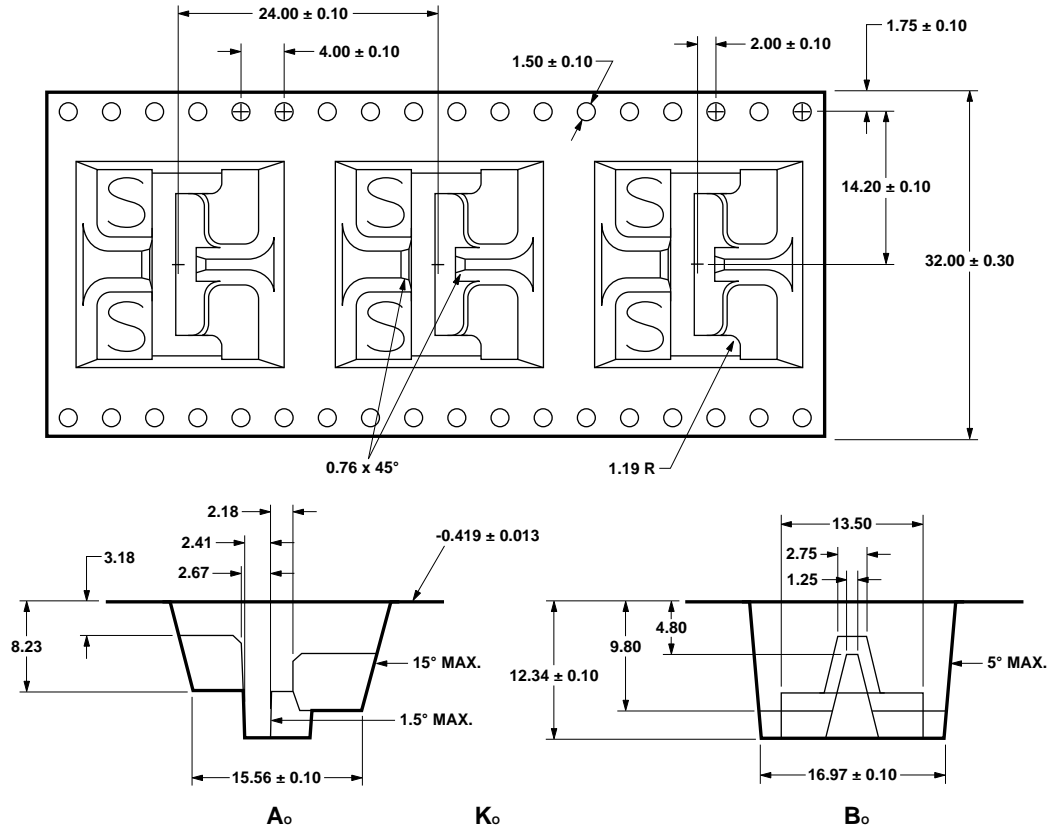
DIMENSIONS ARE IN MILLIMETERS (INCHES).

## Tape and Reel Dimensions Option #0x8



DIMENSIONS ARE IN MILLIMETERS (INCHES).

## Tape and Reel Dimensions Option #S07



DIMENSIONS ARE IN MILLIMETERS.

**Table 1. Recommended Application Circuit Components**

Component	Recommended Value	Notes
R1	$560 \Omega$ , $\pm 5\%$ , 0.125 Watt	
R2	$4.7 \Omega$ , $\pm 5\%$ , 0.5 Watt	
R3	$10 \Omega$ , $\pm 5\%$ , 0.125 Watt	1
CX1	$0.47 \mu\text{F}$ , $\pm 10\%$ , X7R Ceramic	2
CX2	$220 \text{ pF}$ , $\pm 10\%$ , X7R Ceramic	
CX3	$4700 \text{ pF}$ , $\pm 10\%$ , X7R Ceramic	
CX4	$0.010 \mu\text{F}$ , $\pm 10\%$ , X7R Ceramic	
CX5	$0.47 \mu\text{F}$ , $\pm 20\%$ , X7R Ceramic $\leq 5 \text{ mm}$ lead length	2
CX6	$6.8 \mu\text{F}$ Tantalum. Larger value recommended for noisy supplies or environments	
CX7	$0.47 \mu\text{F}$ , $\pm 20\%$ , X7R Ceramic	3

**Notes:**

- In environments with noisy power supplies, supply rejection can be enhanced by including R3 as shown in application circuit on page 1.
- CX1 and CX5 must be placed within 0.7 cm of the HSDL-1100 to obtain optimum noise immunity.
- Only necessary in applications where transmitter switching causes more than a 50 mV ripple on  $V_{CC}$ .

## Truth Table

Inputs		Outputs		
TXD	EI	IE (LED)	RXD-A	RXD-B
V <sub>IH</sub>	X	High	NV	NV
V <sub>IL</sub>	EI <sub>H</sub> <sup>[4]</sup>	Low	Low <sup>[6]</sup>	NV
V <sub>IH</sub>	EI <sub>H</sub> <sup>[5]</sup>	Low	NV	Low <sup>[6]</sup>
V <sub>IL</sub>	EI <sub>L</sub>	Low	High	High

X = Don't care

NV = Not Valid

### Notes:

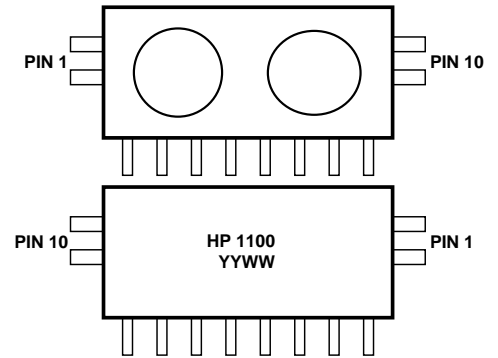
4. In-Band EI ≤ 115.2 Kb/s.

5. In-Band EI ≥ 576 Kb/s.

6. Logic Low is a pulsed response. The condition is maintained for a duration dependent on pattern and strength of the incident intensity.

## Pinout

Pin	Description	Symbol
1	PIN Bypass Capacitor	CX1
2	Ground (Analog)	GND
3	Averaging Capacitor	CX4
4	Supply Voltage	V <sub>CC</sub>
5	Receiver Data Output – Channel B	RXD-B
6	Ground	GND
7	Transmitter Data Input	TX
8	Receiver Data Output – Channel A	RXD-A
9	Threshold Capacitor	CX3
10	LED Anode	LEDA



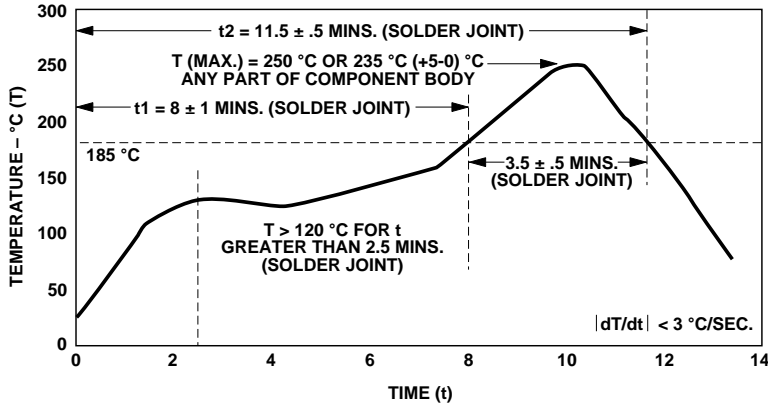
NOTE: PINS 1 AND 10 ARE COMPRISED OF TWO PHYSICAL LEADS EACH. THE TWO PHYSICAL LEADS OF EACH PAIR SHOULD BE TIED TOGETHER ELECTRICALLY ON THE APPLICATION PC BOARD.

## Absolute Maximum Ratings

For implementations where case to ambient thermal resistance ≤ 50°C/W.

Parameter	Symbol	Min.	Max.	Units	Conditions
Storage Temperature	T <sub>S</sub>	-20	85	°C	
Operating Temperature	T <sub>A</sub>	0	70	°C	
Average LED Current	I <sub>LED</sub> (DC1)		100	mA	
Average LED Current	I <sub>LED</sub> (DC2)		165	mA	≤ 90 μs Pulse Width, ≤ 25% Duty Cycle
Repetitive Pulsed LED Current	I <sub>LED</sub> (RP)		660	mA	≤ 90 μs Pulse Width, ≤ 25% 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	
Supply Voltage	V <sub>CC</sub>	0	7.0	V	
Transmitter Data Input Current	I <sub>TXD</sub> (DC)	-12	12	mA	
Receiver Data Output Voltage	V <sub>RXD-A</sub> V <sub>RXD-B</sub>	-0.5 -0.5	V <sub>CC</sub> + 0.5 V <sub>CC</sub> + 0.5	V V	

## Infrared Reflow Profile



## Recommended Operating Conditions

Parameter	Symbol	Min.	Max.	Units	Conditions	Notes
Operating Temperature	T <sub>A</sub>	0	70	°C	Case to Ambient Thermal Resistance ≤ 50°C/W	9
Supply Voltage	V <sub>CC</sub>	4.75	5.25	V		
Logic High Transmitter Input Voltage (TXD)	V <sub>IH</sub>	4.25	5.25	V		8
Logic Low Transmitter Input Voltage (TXD)	V <sub>IL</sub>	0.0	0.3	V		8
Logic High Receiver Input Irradiance	E <sub>IH</sub>	0.0036 0.0090	500 500	mW/cm <sup>2</sup> mW/cm <sup>2</sup>	For in-band signals ≤ 116 Kb/s For in-band signals ≤ 576 Kb/s	7
Logic Low Receiver Input Irradiance	E <sub>IL</sub>		0.3	μW/cm <sup>2</sup>	For in-band signals	7
LED (Logic High) Current Pulse Amplitude	I <sub>LEDA</sub>	400	660	mA		9
Receiver Setup Time			1.0	ms	For full sensitivity after transmitting	
Receiver Signal Rate RXD-A		2.4	116	Kb/s		
Receiver Signal Rate RXD-B		0.576	4	Mb/s		
Ambient Light					See IrDA Serial Infrared Physical Layer Link Specification, Appendix A for ambient levels.	

### 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 Specification.
- With RI, CX2 Input network and where  $t_r(V_I)$  and  $t_f(V_I) \leq 5 \text{ ns}$ . See Application Circuit (Table 1) for component values. The driver gate for this input should be able to source and sink  $\pm 6 \text{ mA}$  (DC) and  $\pm 50 \text{ mA}$  (pk). TXD refers to the node on the driver gate side of R1, CX2 on application circuit.
- See the thermal derating curves on pages 8 and 9 for maximum operating conditions in order to maintain T junction < 125°C.

All HSDL-1100 IR transceivers are classified as IEC 825-1 Accessible Emission Limit (AEL) Class 1 based upon the current proposed draft scheduled to go into effect on January 1, 1997. AEL Class 1 LED devices are considered eye safe. See Hewlett-Packard Application Note 1094 for more information.



## Electrical and Optical Specifications

Specifications hold over the Recommended Operating Conditions unless otherwise noted. Test Conditions represent worse case values for the parameters under test. Unspecified test conditions can be anywhere in their operating range. All typicals are at 25°C and 5 V unless otherwise noted.

Parameter		Symbol	Min.	Typ.	Max.	Unit	Conditions	Notes
Receiver Data Output Voltage	Logic Low	$V_{OL}$ (RXD-A)			0.5	V	$I_O$ (RXD-A) = 1.0 mA, For in-band EI $\geq 3.6 \mu\text{W}/\text{cm}^2$ , $\phi^{1/2} \leq 15^\circ$	11
	Logic Low	$V_{OL}$ (RXD-B)			0.5	V	$I_O$ (RXD-B) = 1.0 mA, For in-band EI $\geq 9.0 \mu\text{W}/\text{cm}^2$ , $\phi^{1/2} \leq 15^\circ$	11
	Logic High	$V_{OH}$ (RXD-A)	$V_{CC}-0.6$			V	$I_{OH}$ (RXD-A) = -20 $\mu\text{A}$ , For in-band EI $\leq 0.3 \mu\text{W}/\text{cm}^2$	
	Logic High	$V_{OH}$ (RXD-B)	$V_{CC}-1.2$			V	$I_{OH}$ (RXD-B) = -20 $\mu\text{A}$ , For in-band EI $\leq 0.3 \mu\text{W}/\text{cm}^2$	
	Viewing Angle	$2\phi^{1/2}$	30			degrees		
Effective Detector Area				0.2		$\text{cm}^2$		
Transmitter Radiant Intensity	Logic High	EI	100	177		mW/SR	$V_{IH}$ (TXD) = 4.25 V $I_{LEDA}$ = 400 mA $T_A = 25^\circ\text{C}$ , $\theta^{1/2} \leq 15^\circ$	10
		EI	80	177	324	mW/SR	$V_{IH}$ (TXD) = 4.25 V $I_{LEDA}$ = 400 mA $0^\circ\text{C} \leq T_A \leq 70^\circ\text{C}$ , $\theta^{1/2} \leq 15^\circ$	10
	Peak Wavelength	$\lambda_p$		875		nm		
	Spectral Line Half Width	$\Delta\lambda^{1/2}$		35		nm		
	Viewing Angle	$2\theta^{1/2}$	30		60	degrees		
Transmitter Data Input Current	Logic Low	$I_{IL}$ (TXD)	-2.0		2.0	$\mu\text{A}$	$\text{GND} \leq V_{IL}$ (TXD) $\leq 0.3$ V	10
	Logic High	$I_{IH}$ (TXD)	5.4		6.6	mA	$V_{IH}$ (TXD) = 4.25 V	10
LED Anode	On State Voltage	$V_{ON}$ (LEDA)			2.78	V	$I_{LEDA}$ = 400 mA, 25°C $V_{IH}$ (TXD) = 4.25 V	10
	Off State Leakage	$I_{LK}$ (LEDA)			250	$\mu\text{A}$	$V_{LEDA} = V_{CC} = 5.25$ V, $V_{IL}$ (TXD) = 0.3 V	10
Supply Current	Idle	$I_{CC1}$		3	5.1	mA	$V_{CC} = 5.25$ V, $V_I$ (TXD) = $V_{IL}$ , EI = 0	
	Active Receiver	$I_{CC2}$		4	18	mA	$V_{CC} = 5.25$ V, $V_I$ (TXD) = $V_{IL}$ , EI $\leq 500$ mW/cm <sup>2</sup>	
Receiver Peak Sensitivity Wavelength		$\lambda_p$		880		nm		

### Notes:

- With R1, CX2 input network. See Application Circuit (Table 1) for component values. TXD refers to driver gate of R1, CX2 on application circuit.
- Logic Low is a pulsed response. The condition is maintained for a duration dependent on pattern and strength of the incident intensity.

## Switching Specifications

Specifications hold over the Recommended Operating Conditions unless otherwise noted. Test Conditions represent worst case values for the parameters under test. Unspecified test conditions can be anywhere in their operating range. All typicals are at 25°C and 5 V unless otherwise noted.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Notes
Transmitter Radiant Intensity Pulse Width	tpw (IE)	1.5	1.6	1.8	μs	tpw (TXD) = 1.6 μs at 115.2 K pulses/second	12
		115	125	135	ns	tpw (TXD) = 125 ns at 2.0 M pulses/second	12
Transmitter Radiant Intensity Rise and Fall Times	t <sub>r</sub> (IE), t <sub>f</sub> (IE)			40	ns	tpw (TXD) = 125 ns at 2.0 M pulses/second	
RXD-A Pulse Width	tpw (RXD-A)	1.0		7.5	μs	φ <sup>1/2</sup> ≤ 15°	13
RXD-B Pulse Width	tpw (RXD-B)	75		185	ns	φ <sup>1/2</sup> ≤ 15°	14
RXD-B Pulse Width (ASK)		0.7	1.0	1.3	μs	500 kHz/50% duty cycle carrier ASK	15
Receiver Latency Time	t <sub>L</sub> (RXD-B)		0.50	1.0	ms		13, 14
	t <sub>L</sub> (RXD-A)						

### Notes:

12. Pulse widths measured at 1.4 volts.

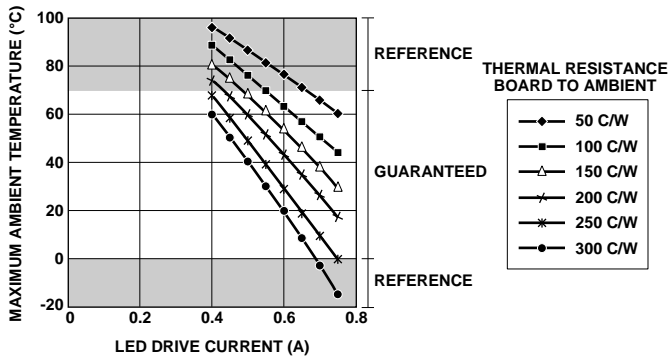
13. For In-Band signals ≤ 115.2 Kb/s where 3.6 μW/cm<sup>2</sup> ≤ EIL ≤ 500 mW/cm<sup>2</sup>.

14. For In-Band signals, 125 ns PW, 4 Mb/s, 4 PPM where 9.0 μW/cm<sup>2</sup> ≤ EI ≤ 500 mW/cm<sup>2</sup>.

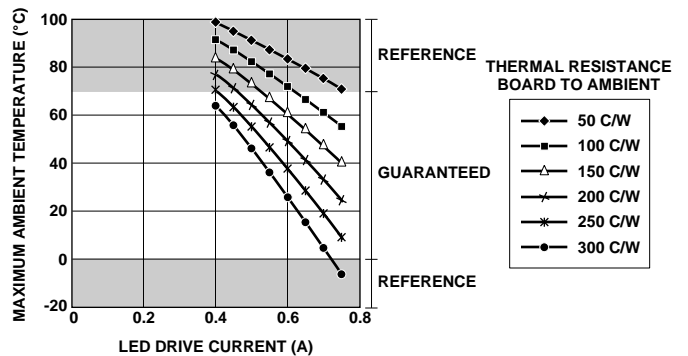
15. Pulse width specified is the pulse width of the second 500 kHz carrier pulse received in a data bit. The first 500 kHz carrier pulse may exceed 2 μs in width, which will not affect correct demodulation of the data stream. An ASK and DASK system using the HSDL-1100 has been shown to correctly receive all data bits for 9 μW/cm<sup>2</sup> < EI < 500 mW/cm<sup>2</sup> incoming signal strength. ASK or DASK should use the RXD-B channel only.

## Thermal Derating Curves

These 2 graphs show maximum allowable LED drive current as a function of ambient temperature and the designer's PCB-to-ambient thermal resistance.

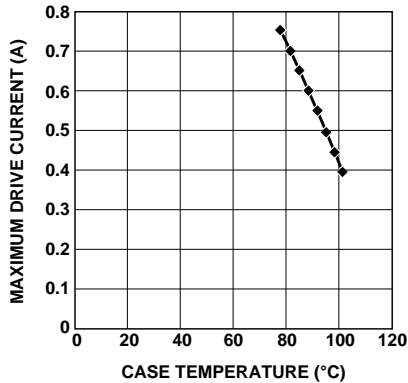


HSDL-1100#0x7 Leadform  
Max. Ambient vs. LED Drive Current



HSDL-1100#0x8 Leadform  
Max. Ambient vs. LED Drive Current

\*Note: Performance is guaranteed in the operating temperature range of 0°C - 70°C. The information provided outside of this range is for reference only.



**HSDL-1100#0x7 Leadform Max. LED Drive Current vs. Case Temperature**

**JUNCTION TO CASE MEASUREMENTS FOR HSDL-1100#0X7**

If (mA)	MAX. CASE TEMPERATURE (°C)
400	101.3
450	98.4
500	95.3
550	92.1
600	88.7
650	85.2
700	81.6
750	77.9

## 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.



*www.hp.com/go/ir*

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Obsoletes 5967-6063E

5968-1408E (7/98)