ZHX2022

FIR Transceiver

Product Specification

PS021802-1005

ZiLOG Worldwide Headquarters • 532 Race Street • San Jose, CA 95126-3432
www.ZiLOG.com

This publication is subject to replacement by a later edition. To determine whether a later edition exists, or to request copies of publications, contact:

ZiLOG Worldwide Headquarters
532 Race Street
San Jose, CA 95126-3432
www.ZiLOG.com

Document Disclaimer

Table of Contents

List of Figures

List of Tables

Description

Whether you need to mount the IrDA transceiver so that its communication is parallel or perpendicular to the plane of the PCB, the ZiLOG ZHX2022 is the solution for applications in portable products, such as USB Adapters, notebook PCs, printers, mobile phones, digital cameras, handheld devices, or personal data assistants (PDAs). Designed to support all IrDA data rates up to 4 Mbits/second as well as LocalTalk™ and Sharp ASK™ modes, the transceiver combines an infrared emitting diode (IRED) emitter, a PIN photodiode detector, an IRED driver, and an integrated AGC (Automatic Gain Control) and amplification receive circuit in a single, miniature package.

The ZiLOG ZHX2022 provides an efficient implementation of the IrDA-Data 1.4 standard in a small footprint format. Application circuit space is also minimized, as only three external components (current-limiting resistor, terminating resistor, and a decoupling capacitor) are required to implement a complete IrDA transceiver solution.

The ZHX2022 is capable of both mode select and legacy-mode bandwidth switching.

Features

- Supply voltage 2.7 V to 5.5 V, operating idle current (receive mode) < 3 mA, shutdown current < 5 µA over full temperature range
- Surface mount package, top and side view, 9.7 mm x 4.7 mm x 4.0 mm
- Operating temperature: –30 °C to 85 °C
- Storage temperature: –40 °C to 85 °C
- Transmitter wavelength typically 886 nm, supporting IrDA® and Remote Control
- Tri-state-receiver output, floating in shut down with a weak pull-up
- Eye safety class 1 (IEC60825-1, ed. 2001), limited LED on-time, LED current is controlled, no single fault to be considered

Applications

- Notebook computers, desktop PCs, palmtop computers (Win CE, Palm PC), PDAs
- Digital still and video cameras
- Printers, fax machines, photocopiers, screen projectors
- Telecommunication products (cellular phones, pagers)
- Internet TV boxes, video conferencing systems
- External infrared adapters (dongles)
- Medical and industrial data collection

Parts Table

Part	Description	Quantity/ Reel
ZHX2022MV040THTR	Oriented in carrier tape for side-view surface mounting	1,000 pieces
ZHX2022TV040THTR	Oriented in carrier tape for top-view surface mounting	1,000 pieces

Note: All ZiLOG devices are available lead free. ZHX2022 has always been lead free. These devices meet or exceed RoHS Directive 2002/95/EC. For additional information, please see the ZiLOG Quality and Reliability web page at http://www.zilog.com/quality/index.asp.

Block Diagram

Figure 1 is the block diagram for the FIR transceiver.

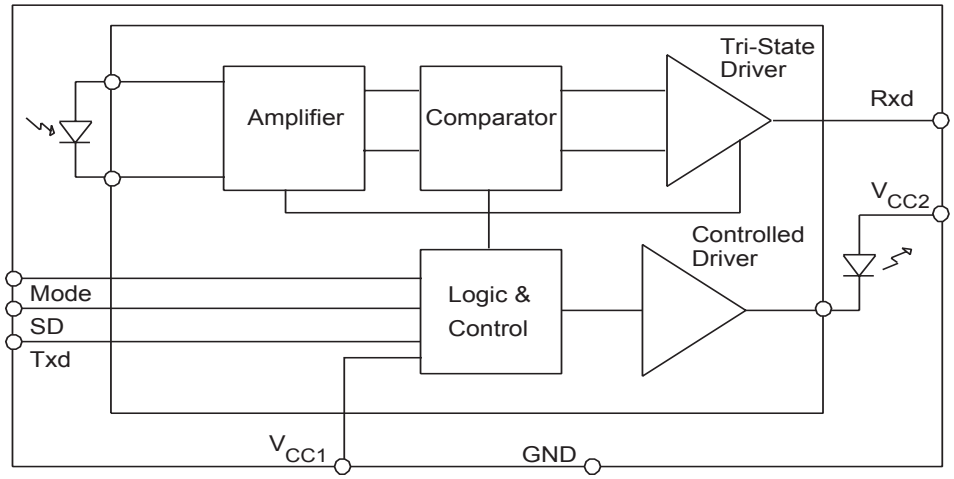

Figure 1. FIR Transceiver Block Diagram

Pinout and Pin Description

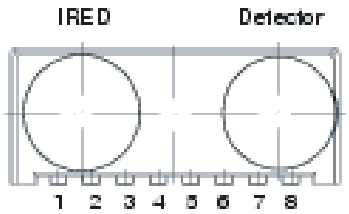

Figure 2. Pinout

Table 1. Pin Description

Pin Number	Function	Description	I/O	Active
1	V_{CC2} LEDA	Connect LEDA directly to either V_{CC1} (regulated) or to V_{CC2} (unregulated) or battery. For voltages higher than 3.6 V, an external resistor might be necessary for reducing the internal power dissipation.		
2	LEC	IRED cathode, internally connected to driver transistor. *Do not connect.*		
3	Txd	This input is used to transmit serial data when SD is low. An on-chip protection circuit disables the LED driver if the Txd pin is asserted for longer than 80 µs. When used in conjunction with the SD pin, this pin is also used to receiver speed mode.	I	HIGH
4	Rxd	Received Data Output, push-pull CMOS driver output capable of driving a standard CMOS or TTL load. No external pull-up or pull-down resistor is required. **Floating with a weak pull-up of 500 kΩ (typical) in shutdown mode.**	O	LOW
5	SD	Shutdown, also used for dynamic mode switching. Setting this pin active places the module into shutdown mode. On the falling edge of this signal, the state of the Txd pin is sampled and used to set receiver low bandwidth (Txd=Low, SIR) or high bandwidth (Txd=High, MIR and FIR) mode. Will be overwritten by the mode pin input, which must float, when dynamic programming is used.	I	HIGH
6	V_{CC1}	Supply voltage (regulated)		
7	Mode	HIGH: High speed mode, MIR and FIR; LOW: Low speed mode, SIR only (see “Mode Switching” on page 13).	I	
7	Mode	The mode pin can also be used to indicate the dynamically programmed mode. The maximum load is limited to 50 pF. High indicates FIR/MIR mode, low indicates SIR mode	O	
8	GND	Ground		

Electrical and Timing Specifications

Notes: Reference point: Ground Pin 8, unless otherwise noted

Typical values are for *design aid only,* not guaranteed nor subject to production testing.

Table 2. Absolute Maximum Ratings

Parameter	Test Conditions	Symbol	Min	Typical	Max	Unit
Supply voltage range, transceiver	0 V < V_{CC2} < 6 V	V_{CC1}	–0.5		+6	V
Supply voltage range, transmitter	0 V < V_{CC1} < 6 V	V_{CC2}	–0.5		+6.5	V
Input currents	For all pins, except IRED anode pin				10	mA
Output sinking current					25	mA
Power dissipation	See derating curve (Figure 6).	P_D			500	mW
Junction temperature		T_J			125	°C
Ambient temperature range (operating)		T_{amb}	–30		+85	°C
Storage temperature range		T_{stg}	–40		+85	°C
Soldering temperature	See “ZHX2022 Soldering and Cleaning Recommendations” on page 16.				240	°C
Average output current		I_{RED}(DC)			125	mA
Repetitive pulse output current	< 90 µs, t_{on} < 20%	I_{RED}(RP)			600	mA
IRED anode voltage		V_{IREDA}	–0.5		+6.5	V
Voltage at all inputs and outputs	V_{in} > V_{CC1} is allowed	V_{IN}			5.5	V
Load at mode pin when used as mode indicator					50	pF

Notes: Reference point pin: GND, unless otherwise noted

Typical values are for *design aid only,* not guaranteed nor subject to production testing.

Table 3. Eye Safety Information

Parameter	Test Conditions	Symbol	Min	Typical	Max	Unit
Virtual source size	Method: (1 - 1/e) encircled energy	d	2.5	2.8		mm
Maximum Intensity for Class 1	IEC60825-1 or EN60825-1, edition January 2001	I_e			* 500**	mW/sr

* Due to the internal limitation measures, the device is a “class1” device.
** IrDA specifies the maximum intensity with 500 mW/sr.

Notes: T_{amb}=25 °C, V_{CC}=2.7 V to 5.5 V, unless otherwise noted.

Typical values are for *design aid only,* not guaranteed nor subject to production testing.

Table 4. Electrical Characteristics—Transceiver

Parameter	Test Conditions	Symbol	Min	Typical	Max	Unit
Supply voltage		V_{CC}	2.7		5.5	V
Dynamic supply current (Idle)[1]	SD=Low, E_e=0 klx	I_{CC}		2	3	mA
Dynamic supply current (Idle)[1]	SD=Low, E =1 klx[2]	I_{CC}		2	3	mA

1) Receive mode only. In transmit mode, add additional 85 mA (typical) for IRED current. Add Rxd output current depending on Rxd load.
2) Standard Illuminant A
3) The typical threshold level is between 0.5 x V_{CC2} (V_{CC}=3 V) and 0.4 x V_{CC} (V_{CC}=5.5 V). It is recommended to use the specified min/max values to avoid increased operating current.
ESD > 4000 V (HBM), Latchup > 200 mA
EMI immunity > 550 V/m for GSM frequency and other mobile telephone bands / (700 MHz to 2000 MHz, no external shield)

Table 4. Electrical Characteristics—Transceiver (Continued)

Parameter	Test Conditions	Symbol	Min	Typical	Max	Unit
Shutdown supply current	SD=High, Mode=Floating E_e=0 klx	I_{SD}			2.0	µA
	SD=High, Mode=Floating E_e=1 klx[2]	I_{SD}			2.5	µA
	SD=High, T=85 °C, Mode=Floating, not ambient light sensitive	I_{SD}			5	µA
Operating temperature range		T_A	–25		+85	°C
Output voltage low	I_{OL}=1 mA, C_{load}=15 pF	V_{OL}			0.4	V
Output voltage high	I_{OH}=500 µA, C_{load}=15 pF	V_{OH}	0.8 x V_{CC}			V
	I_{OH}=250 µA, C_{load}=15 pF	V_{OH}	0.9 x V_{CC}			V
Output Rxd current limitation high state	Short to Ground				20	mA
Output Rxd current limitation low state	Short to V_{CC1}				20	mA
Rxd to VCC1 impedance	SD=High	R_{Rxd}	400	500	600	kΩ
Input voltage low (Txd, SD, Mode)		V_{IL}	0.5		0.5	V
Input voltage high (Txd, SD, Mode)	CMOS level[3]	V_{IH}	V_{CC} – 0.5		V_{CC}+0.5	V
	TTL level, V_{CC1}=4.5 V	V_{IH}	2.4			V
Input leakage current (Txd, SD)		I_L	–10		+10	µA
Input leakage current Mode		I_{ICH}	–2		+2	µA
Input capacitance (Txd, SD, Mode)		C_I			5	pF

1) Receive mode only. In transmit mode, add additional 85 mA (typical) for IRED current. Add Rxd output current depending on Rxd load.
2) Standard Illuminant A
3) The typical threshold level is between 0.5 x V_{CC2} (V_{CC}=3 V) and 0.4 x V_{CC} (V_{CC}=5.5 V). It is recommended to use the specified min/max values to avoid increased operating current.
ESD > 4000 V (HBM), Latchup > 200 mA
EMI immunity > 550 V/m for GSM frequency and other mobile telephone bands / (700 MHz to 2000 MHz, no external shield)

Notes: T_{amb}=25 °C, V_{CC}=2.7 V to 5.5 V, unless otherwise noted.

Typical values are for *design aid only,* not guaranteed nor subject to production testing.

Table 5. Optoelectronic Characteristics—Receiver

Parameter	Test Conditions	Symbol	Min	Typical	Max	Unit
Minimum detection threshold irradiance, SIR mode	9.6 kbit/s to 115.2 kbit/s λ=850 nm to 900 nm	E_e		25 (2.5)	35 (3.5)	mW/m^2 (μW/cm^2)
Minimum detection threshold irradiance, MIR mode	1.152 Mbit/s λ=850 nm to 900 nm	E_e		65 (6.5)		mW/m^2 (μW/cm^2)
Minimum detection threshold irradiance, FIR mode	4.0 Mbit/s λ=850 nm to 900 nm	E_e		80 (8.0)	90 (9.0)	mW/m^2 (μW/cm^2)
Maximum detection threshold irradiance	λ=850 nm to 900 nm	E_e		5 (500)		kW/m^2 (mW/cm^2)
No detection receiver input irradiance	*	E_e	4 (0.4)			mW/m^2 (μW/cm^2)
Rise time of output signal	10% to 90%, 15 pF	$t_{r\ (Rxd)}$	10		40	ns
Fall time of output signal	90% to 10%, 15 pF	$t_{f\ (Rxd)}$	10		40	ns
Rxd pulse width of output signal, 50% SIR mode	input pulse length 1.4 μs < P_{Wopt} < 25 μs	t_{PW}	1.5	1.8	2.1	μs
Rxd pulse width of output signal, 50% MIR mode	input pulse length P_{Wopt}=217 ns, 1.152 kbit/s	t_{PW}	110	250	270	ns
Rxd pulse width of output signal, 50% FIR mode	input pulse length P_{Wopt}=125 ns, 4.0 Mbit/s	t_{PW}	100		140	ns
	input pulse length P_{Wopt}=250 ns, 4.0 Mbit/s	t_{PW}	225		275	ns
Stochastic jitter, leading edge	input irradiance=100 mW/m^2, 4.0 Mbit/s				20	ns

Note: All timing data measured with 4 Mbit/s are measured using the IrDA® FIR transmission header. The data given here are valid 5 μs after starting the preamble.
*This parameter reflects the backlight test of the IrDA physical layer specification to guarantee immunity against light from fluorescent lamps.

Table 5. Optoelectronic Characteristics—Receiver (Continued)

Parameter	Test Conditions	Symbol	Min	Typical	Max	Unit
	input irradiance=100 mW/m^2, 1.152 Mbit/s				40	ns
	input irradiance=100 mW/m^2, 576 kbit/s				80	ns
	input irradiance=100 mW/m^2, $\leq$ 115.2 kbit/s				350	ns
Receiver start up time	After completion of shutdown programming sequence Power on delay				500	µs
Latency		t_L		170	300	µs

Note: All timing data measured with 4 Mbit/s are measured using the IrDA® FIR transmission header. The data given here are valid 5 µs after starting the preamble.
*This parameter reflects the backlight test of the IrDA physical layer specification to guarantee immunity against light from fluorescent lamps.

Notes: T_{amb}=25 °C, V_{CC}=2.7 V to 5.5 V, unless otherwise noted.

Typical values are for *design aid only,* not guaranteed nor subject to production testing.

Table 6. Optoelectronic Characteristics—Transmitter

Parameter	Test Conditions	Symbol	Min	Typical	Max	Unit
IRED operating current, switched current limiter	See derating curve (Figure 6). For 3.3 V operations, no external resistor needed. For 5 V application, that might be necessary depending on operating temperature range.	I_D	500	550	600	mA
Output leakage IRED current		I_{IRED}	–1		1	µA

*Typically, the output pulse duration will follow the input pulse duration t and will be identical in length t. However, at pulse duration larger than 80 µs, the optical output pulse duration is limited to 85 µs. This pulse duration limitation can already start at 20 µs.

Table 6. Optoelectronic Characteristics—Transmitter (Continued)

Parameter	Test Conditions	Symbol	Min	Typical	Max	Unit
Output radiant intensity recommended application circuit	α=0 °, 15 ° Txd=High, SD=Low, VCC1=VCC2=3.3 V Internally current-controlled, no external resistor	I_e	120	170	350	mW/m^2 (μW/cm^2)
Output radiant intensity	VCC1=5.0 V, a=0 °, 15 ° Txd=Low or SD=High, (Receiver is inactive as long as SD=High)	I_e			0.04	kW/m^2 (mW/cm^2)
Output radiant intensity, angle of half intensity		α		$\pm$24		mW/m^2 (μW/cm^2)
Peak - emission wavelength		λ_P	880		900	ns
Spectral bandwidth		$\Delta\lambda$		40		ns
Optical rise time, fall time		t_{ropt}, t_{fopt}	10		40	µs
Optical output pulse duration	input pulse width 217 ns, 1.152 kbit/s	t_{opt}	207	217	227	ns
	input pulse width 125 ns, 4.0 Mbit/s	t_{opt}	117	125	133	ns
	input pulse width 250 ns, 4.0 Mbit/s	t_{opt}	242	250	258	ns
	input pulse width 0.1 µs < t_{Txd} < 80 µs *	t_{opt}		t_{Txd}		ns
	input pulse width t_{Txd} > 80 µs *	t_{opt}	20		85	ns
Optical overshoot					25	ns

*Typically, the output pulse duration will follow the input pulse duration t and will be identical in length t. However, at pulse duration larger than 80 µs, the optical output pulse duration is limited to 85 µs. This pulse duration limitation can already start at 20 µs.

Recommended Circuit Diagram

ZiLOG transceivers integrate a sensitive receiver and a built-in power driver. The combination of both needs a careful circuit board layout. The use of thin, long, resistive, and inductive wiring should be avoided. The inputs (Txd, SD, Mode) and the output Rxd should be directly (DC) coupled to the I/O circuit. See Figure 3 and Table 7.

The resistor R1 is only necessary for higher operating voltages and elevated temperatures (see derating curve in Figure 6) to avoid too high internal power dissipation.

The capacitor C1 combined with the resistor R2 is the low pass filter for smoothing the supply voltage. R2 and C1 are optional and dependent on the quality of the supply voltage V_{CCx} and injected noise. An unstable power supply with dropping voltage during transmission may reduce sensitivity (and transmission range) of the transceiver.

The placement of these parts is critical. It is strongly recommended to position C1 as near as possible to the transceiver power supply pins.

In addition, when connecting the described circuit to the power supply, low impedance wiring should be used.

Keep in mind that basic RF-design rules for circuit design should be taken into account. Especially longer signal lines should not be used without termination. For example, see *The Art of Electronics*, Paul Horowitz, Wienfield Hill, 1989, Cambridge University Press, ISBN: 0521370957.

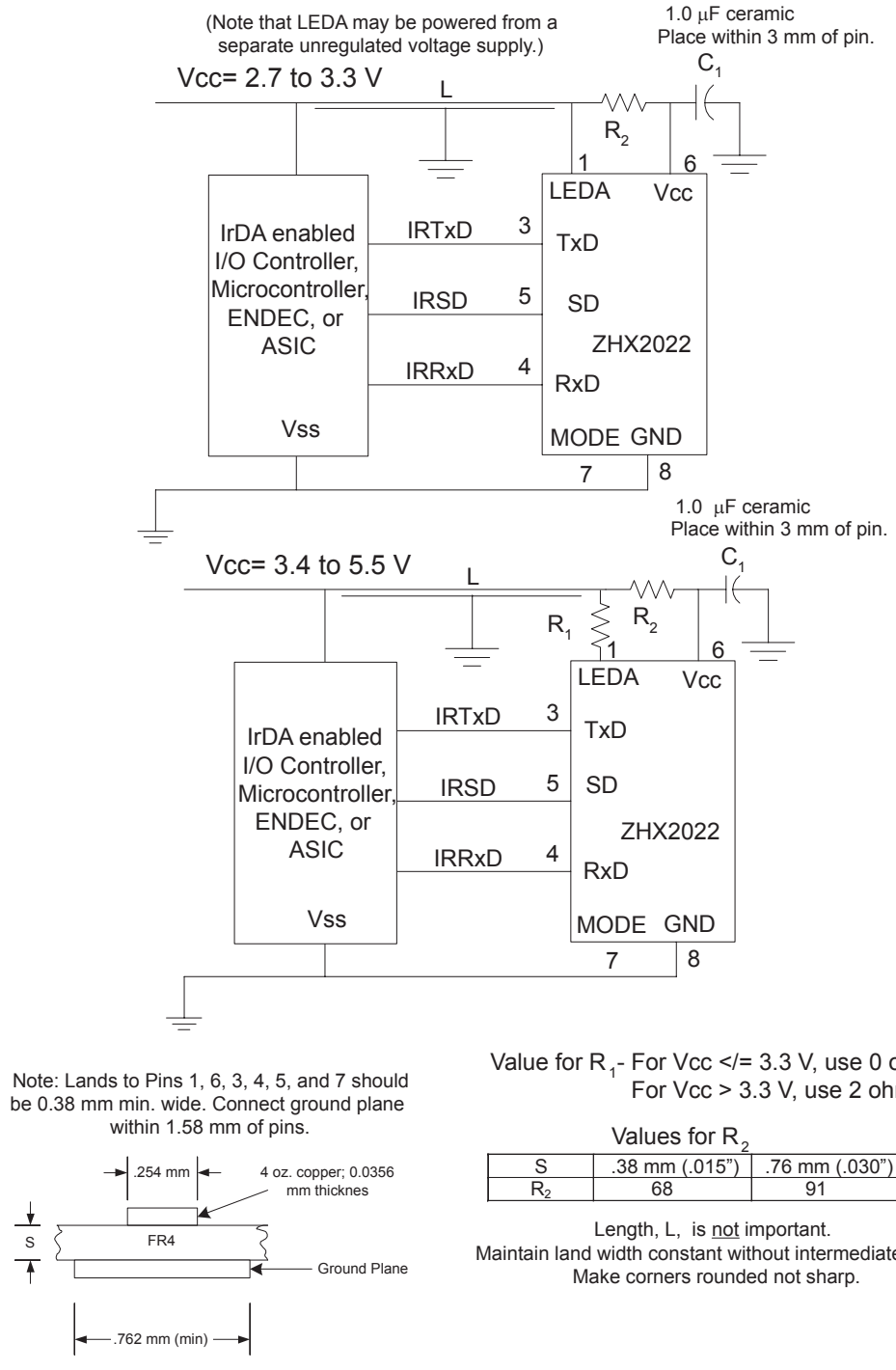

Figure 3. Application Block Diagram

Table 7. Recommended Application Circuit Components

Component	Recommended Value
C1	1.0 µF, Ceramic
R1	**5 V supply voltage:** 2 Ω, 0.25 W (recommended using two 1 Ω, 0.125 W resistor in series) **3.3 V supply voltage:** no resistors necessary; the internal controller is able to control the current
R2	68 or 91 Ω, 0.125 W

I/O and Software

In the description, already different I/Os are mentioned. Different combinations are tested and the function verified with the special drivers available from the I/O suppliers. In special cases, refer to the I/O manual, the ZiLOG application notes, or contact directly ZiLOG Sales, Marketing or Application.

Mode Switching

The ZHX2022 is in the SIR mode after power on as a default mode; therefore, the FIR data transfer rate has to be set by a programming sequence using the Txd and SD inputs as described in the following sections or selected by setting the Mode Pin. The Mode Pin can be used to statically set the mode (Mode Pin: LOW: SIR, HIGH: 0.576 Mbit/s to 4.0 Mbit/s). If not used or in standby mode, the mode input should float or should not be loaded with more than 50 pF. The low frequency mode covers speeds up to 115.2 kbit/s. Signals with higher data rates should be detected in the high frequency mode. Lower frequency data can also be received in the high frequency mode but with reduced sensitivity. See Figure 4 and Table 8.

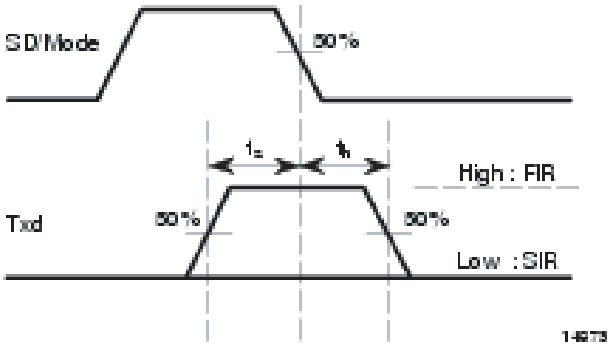

Figure 4. Mode Switching Timing Diagram

Table 8. Truth Table

Inputs			Outputs	
SD	**Txd**	**Optical Input Irradiance mW/m^2**	**Rxd**	**Transmitter**
high	x	x	weakly pulled (500 kΩ to VCC1)	0
low	high	x	high	I_e
low	high > 80 µs	x	high	0
low	low	< 4	high	0
low	low	> Min. Detection Threshold Irradiance < Max. Detection Threshold Irradiance	low (active)	0
low	low	> Max. Detection Threshold Irradiance	x	0

To switch the transceivers from low frequency mode to the high frequency mode and vice versa, the programming sequences described in the following sections are required.

Setting to the High Bandwidth Mode (0.576 Mbit/s to 4.0 Mbit/s)

1. Set SD input to logic “HIGH”.
2. Set Txd input to logic “HIGH”. Wait t_s > 200 ns.
3. Set SD to logic “LOW” (this negative edge latches state of Txd, which determines the speed setting).

4. After waiting t_h > 200 ns, Txd can be set to logic “LOW”. The hold time of Txd is limited by the maximum allowed pulse length.

After that, Txd is enabled as normal Txd input, and the transceiver is set for the high bandwidth (576 kbit/s to 4 Mbit/s) mode.

Setting to the Lower Bandwidth Mode (2.4 kbit/s to 115.2 kbit/s)

1. Set SD input to logic “HIGH”.
2. Set Txd input to logic “LOW”. Wait t_s > 200 ns.
3. Set SD to logic “LOW” (this negative edge latches state of Txd, which determines speed setting).
4. Txd must be held for t_h > 200 ns.

After that Txd is enabled as normal Txd input and the transceiver is set for the lower bandwidth (9.6 kbit/s to 115.2 kbit/s) mode.

Recommended SMD Pad Layout

The leads of the device should be soldered in the center position of the pads. For more configurations, see inside the device drawing.

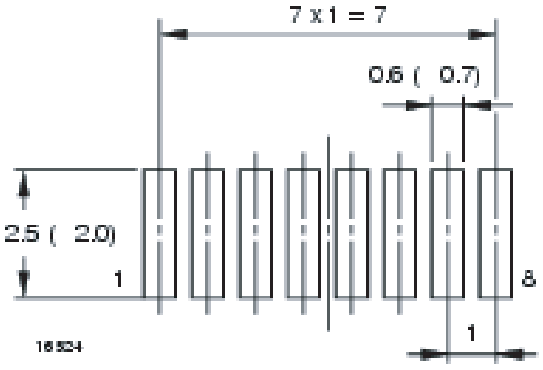

Figure 5. Pad Layout (mm)

Note: Leads of the device should be at least 0.3 mm within the ends of the pads.

ZHX2022 Soldering and Cleaning Recommendations

Follow these recommendations to maintain the performance of the ZHX2022 transceivers.

Reflow Soldering

Note: Please refer to ZiLOG's Lead-Free Solder Reflow: Packaging Application Note (AN0161, http://www.zilog.com/docstools.asp) for more information about the solder profile.

Manual Soldering

- Use 63/37 or silver solder.
- Temperature at solder iron tip: no more than 280 °C
- Finish soldering within 3 seconds.
- Handle only after the ZHX2022 transceivers have cooled off.

Cleaning

Perform cleaning under the following conditions:

- Cleaning agent: alcohol
- Temperature and time 30 seconds below 50 °C or 3 minutes below 30 °C
- Ultrasonic cleaning: below 20 W

Current Derating Diagram

Figure 6 shows the maximum operating temperature when the device is operated without external current limiting resistor. A power dissipating resistor of 2 Ω is recommended from the cathode of the IRED to Ground for supply voltages above 4 V. In that case the device can be operated up to 85 °C, too.

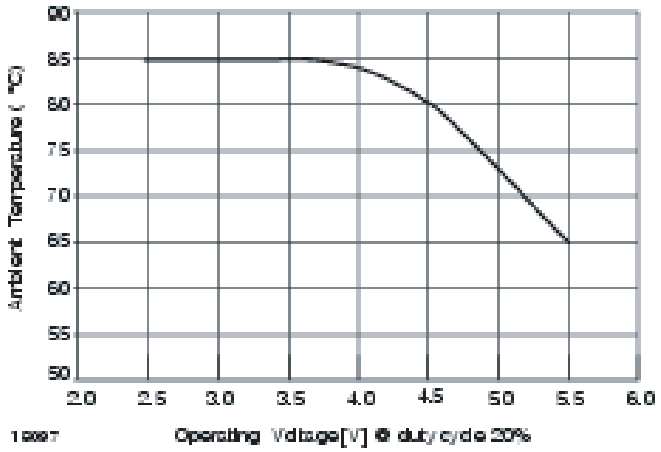

Figure 6. Temperature Derating Diagram

Mechanical Specifications

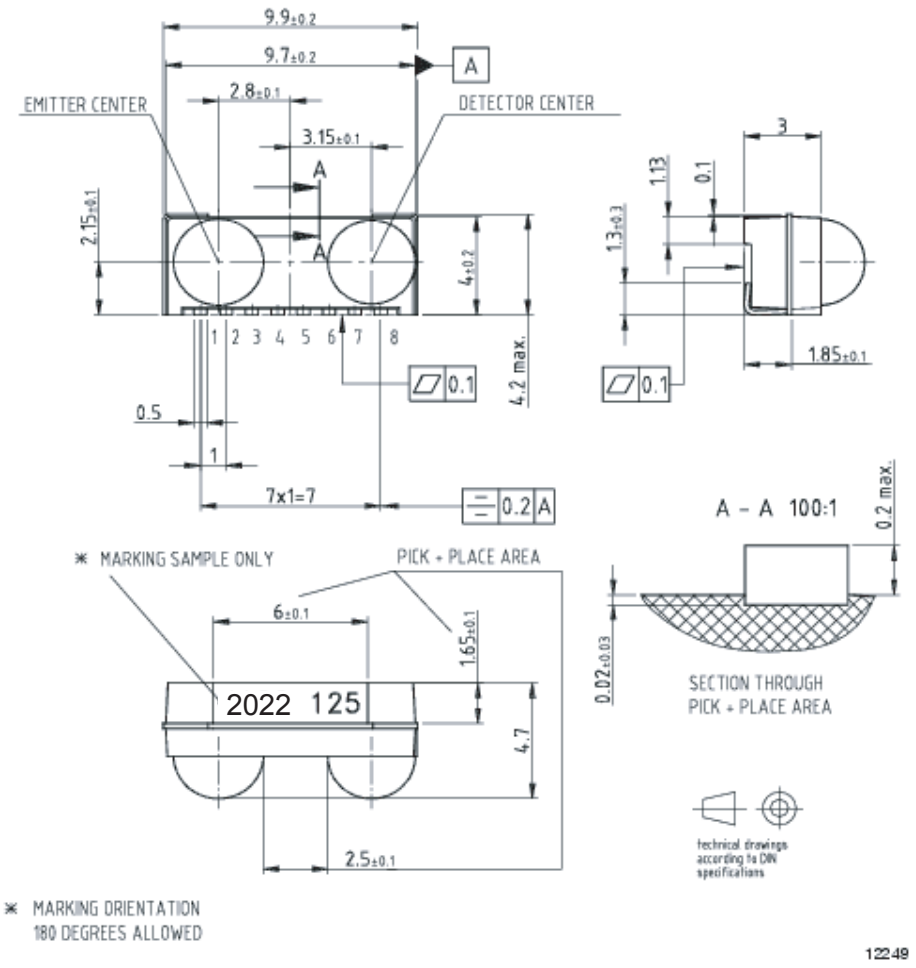

Figure 7. Package Dimensions in mm

Taping Specifications

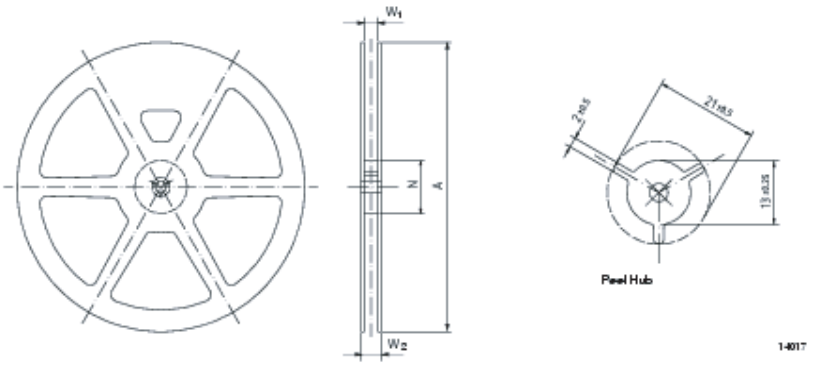

Figure 8. Reel Dimensions in mm

Version	Tape Width	A max.	N	W_1 min.	W_2 max.	W_3 min.	W_3 max.
mm	mm	mm	mm	mm	mm	mm	mm
C	24	330	60	24.4	30.4	23.9	27.4

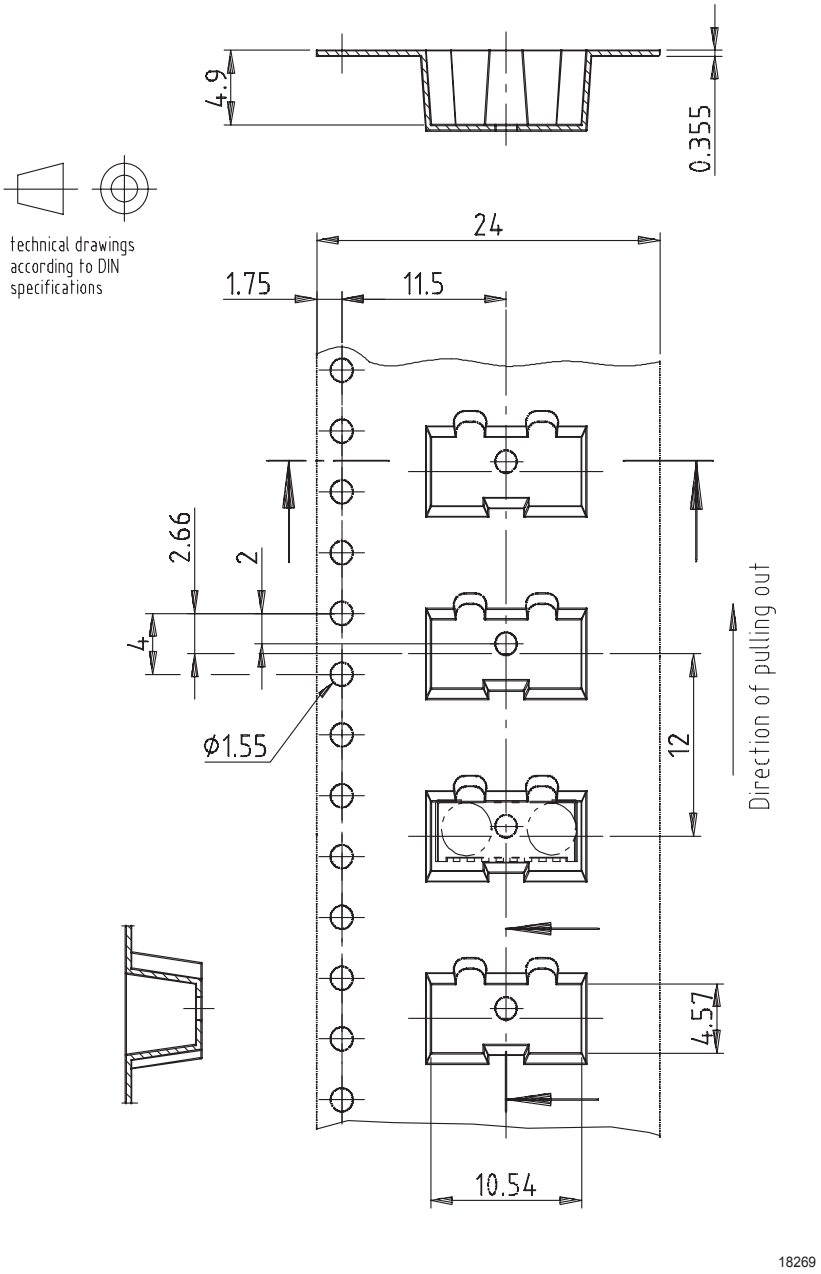

Figure 9. Tape Dimensions in mm

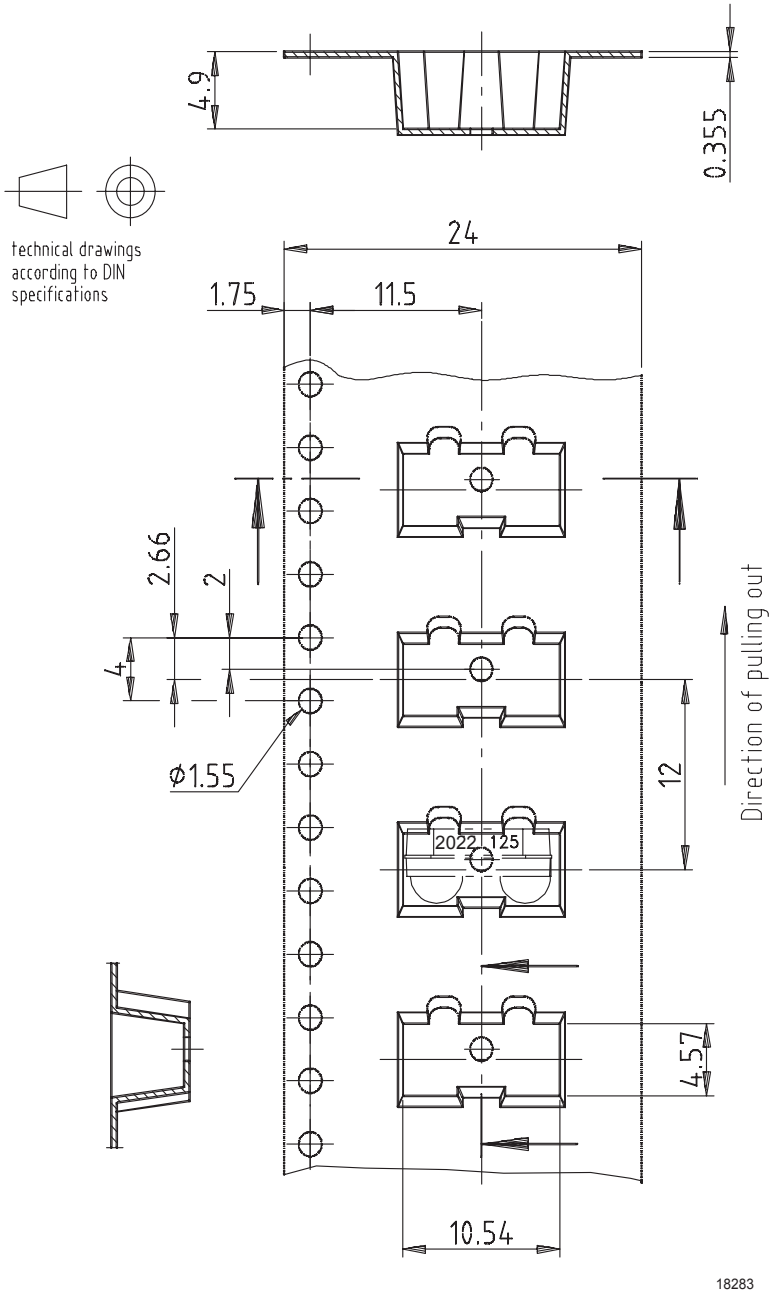

Figure 10. Tape Dimensions in mm

Customer Feedback Form

If you experience any problems while operating this product, or if you note any inaccuracies while reading this product specification, please copy and complete this form, then mail it to ZiLOG (see *Return Information*, below). We also welcome your suggestions!

Customer Information

Name	Country
Company	Phone
Address	Fax
City/State/Zip	email

Product Information

Serial # or Board Fab #/Rev #
Software Version
Document Number
Host Computer Description/Type

Return Information

ZiLOG
System Test/Customer Support
532 Race Street
San Jose, CA 95126-3432
Web site: www.zilog.com

Problem Description or Suggestion

Provide a complete description of the problem or your suggestion. If you are reporting a specific problem, include all steps leading up to the occurrence of the problem. Attach additional pages as necessary.

_____

_____

_____