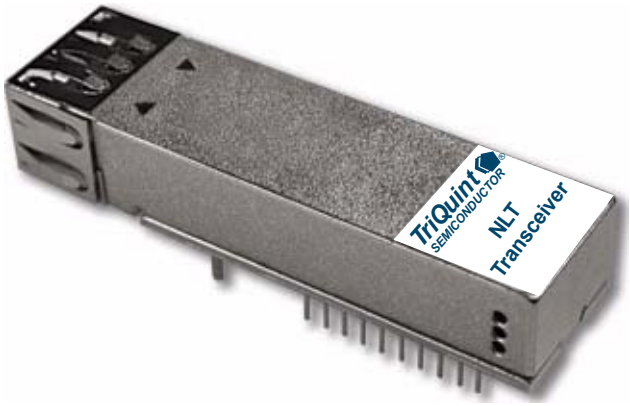
Preliminary Data Sheet
February 2003

TriQuint Optoelectronics

NetLight® NLT06-80-RA 622 Mb/s 1550 nm Laser Transceiver with CDR for Extended Long Reach



Available in a small form-factor, metal package with LC receptacle connector, the NLT06-80-RA transceiver is a high-performance, cost-effective, optical transceiver for SONET/SDH applications.

Features

- Small form-factor, 20-pin package
- LC duplex receptacle
- Uncooled 1550 nm DFB laser transmitter with automatic output power control
- Transmitter disable input
- Wide dynamic range receiver with InGaAs PIN photodetector
- Laser bias and back-facet PIN monitors
- Integrated clock recovery
- LVTTL signal-detect output
- Low power dissipation
- Single 3.3 V power supply
- LVPECL compatible data inputs and outputs
- Operating temperature range of –40 °C to +85 °C
- Telecom reliability (GR-468-CORE RT)
- Wave solderable and aqueous wash compatible

Applications

- SONET LR-2 OC-12, ITU L-4.2 80 km applications

Description

The NLT06-80-RA transceiver is a high-speed, cost-effective optical transceiver that is intended for 622 Mb/s SONET LR-2 OC-12 and ITU L-4.2 80 km applications. The transceiver features TriQuint optics and is packaged in a narrow-width metal housing with an LC duplex receptacle. The 20-pin package pinout conforms to a multisource transceiver agreement.

The transmitter features the ability to interface to LVPECL differential logic level data inputs. The transmitter also features an LVTTL logic level disable input, and laser bias and back-facet monitor outputs. The receiver features differential LVPECL logic level data and clock outputs, an LVTTL logic level signal-detect output, and direct access to the PIN photodetector bias input for photocurrent monitoring purposes.

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operations sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Table 1. Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V_{CC}	0	5	V
Operating Case Temperature Range	T_C	–40	85	°C
Storage Temperature Range	T_S	–40	85	°C
Lead Soldering Temperature/Time	—	—	260/10	°C/s
Operating Wavelength Range	λ	1.2	1.6	µm

Pin Information

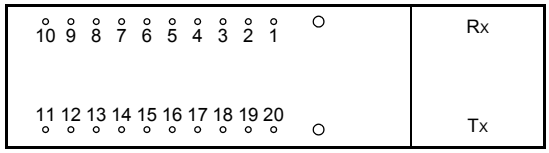


Figure 1. Top View of the NLT06-80-RA Transceiver, 20-Pin Configuration

Table 2. Receiver Pin Descriptions

Pin #	Symbol	Functional Description	Logic Family
MS	MS	**Mounting Studs.** The mounting studs are provided for transceiver mechanical attachment to the circuit board. They can also provide an optional connection of the transceiver to the equipment chassis ground.	NA
1	V_{PD}	**Photodetector Bias Input**. This lead supplies bias for the PIN photodetector diode.	NA
2	V_{EER}	**Receiver Signal Ground.**	NA
3	V_{EER}	**Receiver Signal Ground.**	NA
4	CLK–	**Received Recovered $\overline{\text{Clock}}$ Out.** The rising edge occurs at the rising edge of the received data output. The falling edge occurs in the middle of the received data baud period	LVPECL
5	CLK+	**Received Recovered Clock Out.** The falling edge occurs at the rising edge of the received data output. The rising edge occurs in the middle of the received data baud period.	LVPECL
6	V_{EER}	**Receiver Signal Ground.**	NA
7	V_{CCR}	**Receiver Power Supply.**	NA
8	SD	**Signal Detect.** Normal operation: logic one output. Fault condition: logic zero output.	LVTTL
9	RD–	**Received $\overline{\text{Data}}$ Out.**	LVPECL
10	RD+	**Received Data Out.**	LVPECL

Pin Information (continued)

Table 3. Transmitter Pin Descriptions

Pin #	Symbol	Functional Description	Logic Family
11	VCCT	**Transmitter Power Supply.**	NA
12	VEET	**Transmitter Signal Ground.**	NA
13	TDIS	**Transmitter Disable.**	LVTTL
14	TD+	**Transmitter Data In.**	LVPECL
15	TD–	**Transmitter $\overline{\text{Data}}$ In**.	LVPECL
16	VEET	**Transmitter Signal Ground.**	NA
17	BMON(–)	**Laser Diode Bias Current Monitor—Negative End.** Optional feature. If feature is not used, do not connect. The laser bias current is accessible as a dc voltage by measuring the voltage developed across pins 17 and 18.	NA
18	BMON(+)	**Laser Diode Bias Current Monitor—Positive End**. Optional feature. If feature is not used, do not connect. See pin 17 description.	NA
19	PMON(–)	**Laser Diode Optical Power Monitor—Negative End.** Optional feature. If feature is not used, do not connect. The back-facet diode monitor current is accessible as a voltage proportional to the photocurrent through a 200 Ω resistor between pins 19 and 20.	NA
20	PMON(+)	**Laser Diode Optical Power Monitor—Positive End.** Optional feature. If feature is not used, do not connect. See pin 19 description.	NA

Electrostatic Discharge

Caution: This device is susceptible to damage as a result of electrostatic discharge (ESD). Take proper precautions during both handling and testing. Follow *EIA*® Standard *EIA*-625.

Although protection circuitry is designed into the device, take proper precautions to avoid exposure to ESD.

TriQuint employs a human-body model (HBM) for ESD susceptibility testing and protection-design evaluation. ESD voltage thresholds are dependent on the critical parameters used to define the model. A standard HBM (resistance = 1.5 kΩ, capacitance = 100 pF) is widely used and, therefore, can be used for comparison purposes. The HBM ESD threshold established for the NLT06-80-RA is ±1000 V.

Application Information

The NLT receiver section is a highly sensitive fiber-optic receiver. Although the data outputs are digital logic levels, the device should be thought of as an analog component. When laying out system application boards, the NLT transceiver should receive the same type of consideration given to a sensitive analog component.

Printed-Wiring Board Layout Considerations

A fiber-optic receiver employs a very high gain, wide-bandwidth transimpedance amplifier. This amplifier detects and amplifies signals that are only tens of nA in amplitude when the receiver is operating near its sensitivity limit. Any unwanted signal currents that couple into the receiver circuitry cause a decrease in the receiver's sensitivity and can also degrade the performance of the receiver's signal-detect (SD) circuit.

Application Information (continued)

Printed-Wiring Board Layout Considerations (continued)

To minimize the coupling of unwanted noise into the receiver, careful attention must be given to the printed-wiring board.

At a minimum, a double-sided printed-wiring board (PWB) with a large component-side ground plane beneath the transceiver must be used. In applications that include many other high-speed devices, a multilayer PWB is highly recommended. This permits the placement of power and ground on separate layers, which allows them to be isolated from the signal lines.

Multilayer construction also permits the routing of sensitive signal traces away from high-level, high-speed signal lines. To minimize the possibility of coupling noise into the receiver section, high-level, high-speed signals such as transmitter inputs and clock lines should be routed as far away as possible from the receiver pins.

Noise that couples into the receiver through the power supply pins can also degrade performance. It is recommended that the pi filter, shown in Figure 3, be used for both the transmitter and receiver power supplies.

Data, Clock, and Signal-Detect Outputs

Due to the high switching speeds of LVPECL outputs, transmission line design must be used to interconnect components. To ensure optimum signal fidelity, both data and clock outputs should be terminated identically. The signal lines connecting the data outputs to the next device should be equal in length and have matched impedances. Controlled-impedance stripline or microstrip construction must be used to preserve the quality of the signal into the next component and to minimize reflections back into the receiver, which could degrade its performance. Excessive ringing due to reflections caused by improperly terminated signal lines makes it difficult for the component receiving these signals to decipher the proper logic levels and can cause transitions to occur where none were intended. Also, by minimizing high-frequency ringing, possible EMI problems can be avoided.

The signal-detect output is positive LVTTL logic. A logic low at this output indicates that the optical signal into the receiver has been interrupted or that the light level has fallen below the minimum signal-detect threshold. This output should not be used as an error rate indicator since its switching threshold is determined only by the magnitude of the incoming optical signal.

Transceiver Processing

When the process plug is placed in the transceiver's optical port, the transceiver and plug can withstand normal wave soldering and aqueous spray cleaning processes. However, the transceiver is not hermetic, and should not be subjected to immersion in cleaning solvents. The transceiver case should not be exposed to temperatures in excess of 125 °C. The transceiver pins can be wave soldered at 260 °C for up to 10 seconds. The process plug should only be used once. After removing the process plug from the transceiver, it must not be used again as a process plug; however, if it has not been contaminated, it can be reused as a dust cover.

Transceiver Optical and Electrical Characteristics

Table 4. Transmitter Optical and Electrical Characteristics (T_C = –40 °C to +85 °C, V_{CC} = 3.135 V—3.465 V. All parameters must meet the specifications over the entire lifetime.)

Parameter	Symbol	Min	Max	Unit
Average Optical Output Power (EOL)	P_O	–3	2	dBm
Optical Wavelength	λc	1480	1580	nm
Side-mode Suppression Ratio	SMSR	30	—	dB
Dynamic Extinction Ratio	EXT	10	—	dB
Output Optical Eye	Compliant with SONET GR-253-CORE and ITU-T G.957 Eye Mask Requirements			
Power Supply Current	I_{CCT}	—	150	mA
Input Data Voltage: High Low	 V_{IH} V_{IL}	 V_{CC} – 1.165 V_{CC} – 1.810	 V_{CC} – 0.880 V_{CC} – 1.475	 V V
Transmit Disable Voltage[1]	V_D	Vcc – 0.9	Vcc	V
Transmit Enable Voltage[1]	V_{EN}	V_{EE}	V_{EE} + 0.8	V
Transmit Enable Time	T_{EN}	—	1	ms
Transmit Disable Time	T_{DIS}	—	10	µs
Laser Bias Voltage	V_{BIAS}	0.0	0.7	V
Laser Back-facet Monitor Voltage	V_{BF}	0.01	0.2	V

1. TTL compatible interface.

Table 5. Receiver Optical and Electrical Characteristics (T_C = –40 °C to +85 °C, V_{CC} = 3.135 V—3.465 V)

Parameter	Symbol	Min	Max	Unit
Average Sensitivity[1]	P_I	—	–28	dBm
Maximum Input Power[1]	P_{MAX}	–8	—	dBm
Power Supply Current	I_{CCR}	—	200	mA
Output Data and Clock Voltage: High Low	 V_{OH} V_{OL}	 V_{CC} – 1.025 V_{CC} – 1.810	 V_{CC} – 0.880 V_{CC} – 1.620	 V V
Clock Duty Cycle	DC	45	55	%
Output Clock Random Jitter	J_C	—	0.01	UI
Output Clock Random Jitter Peaking	J_P	—	0.1	UI
Clock/Data Alignment[2]	T_{CDA}	–200	200	ps
Jitter Tolerance/Jitter Transfer	*Telcordia Technologies*™ GR-253-Core and ITU-T G.958 Compliant			
Signal-detect Switching Threshold: Assert Deassert	 LSTD LSTI	 –45 —	 –29.0 –28.5	 dBm dBm
Signal-detect Hysteresis	HYS	0.5	6	dB
Signal-detect Voltage: Low High	 V_{OL} V_{OH}	 0.0 2.4	 0.8 V_{CC}	 V V
Signal-detect Response Time	SDRT	—	100	µs

1. $2^{23} – 1$ PRBS with a BER of $1x10^{-10}$.
2. See Figure 2.

Transceiver Optical and Electrical Characteristics (continued)

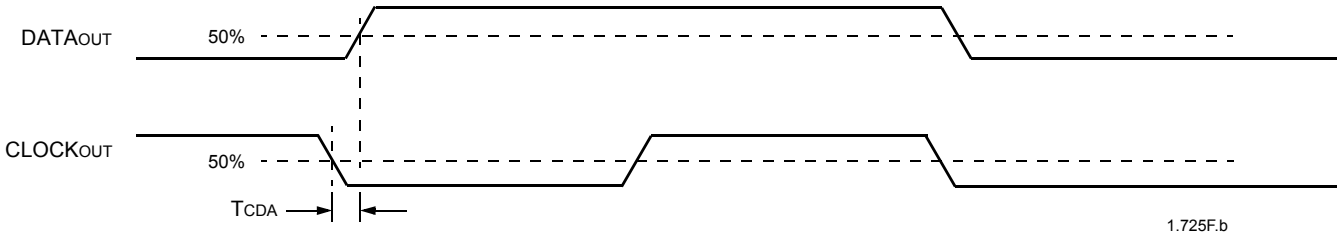


Figure 2. Clock/Data Alignment

Qualification and Reliability

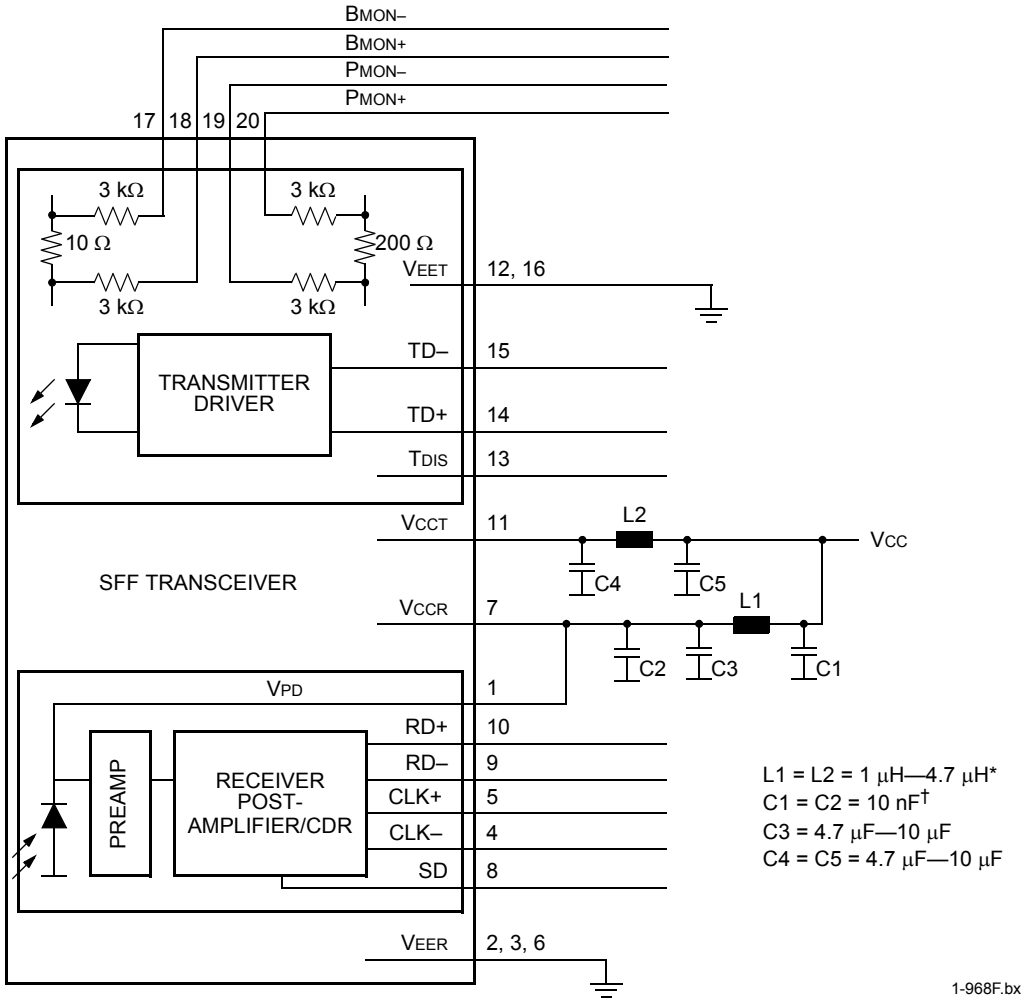
To help ensure high product reliability and customer satisfaction, TriQuint is committed to an intensive quality program that starts in the design phase and proceeds through the manufacturing process. Optoelectronic modules are qualified to ITU GR-468-CORE remote terminal standards, using sampling techniques consistent with *Telcordia Technologies* requirements.

In addition, TriQuint design, development, and manufacturing facilities have been certified to be in full compliance with the latest *ISO*®-9001 Quality System Standards

Table 6. Regulatory Compliance

Feature	Test Method	Performance
Laser Eye Safety	U.S. 21 CFR (J) 1040.10 and 1040.11, *IEC*® 60825-1 1988, *IEC* 60825-2 1997	CDRH compliant and Class 1 laser safe
Electrostatic Discharge (ESD) to Electrical Pins	MIL-STD 883C, Method 3015.4	Class 1 (>1000 V)
Electrostatic Discharge (ESD) to Optical Connector	*IEC* 61000-4-2; 1999	Withstand discharges of 15 kV using an air-discharge probe
Electromagnetic Interference (EMI)	FCC Part 15 Subpart J Class B, CISPR 22: 1997; EN 55022: 1998 Class B, VCCI Class I	Compliant with standards
Immunity	*IEC* 61000-4-3-1998	Less than 1 dB change in receiver sensitivity with field strength of 3 V/m RMS, from 10 MHz to 1 GHz
Component	*UL*® 1950, *CSA*® C22.2 #950, *IEC* 60950: 1999	—
Flammability	*UL* 94 V-0	—

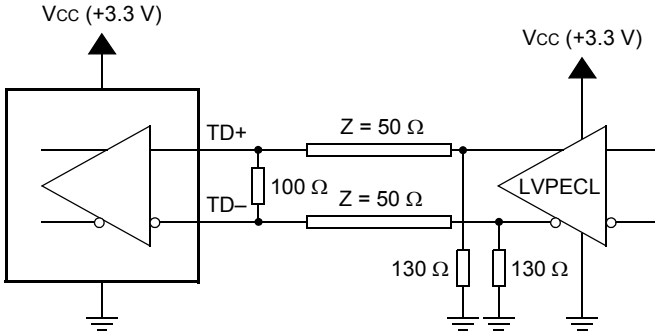
Electrical Schematic



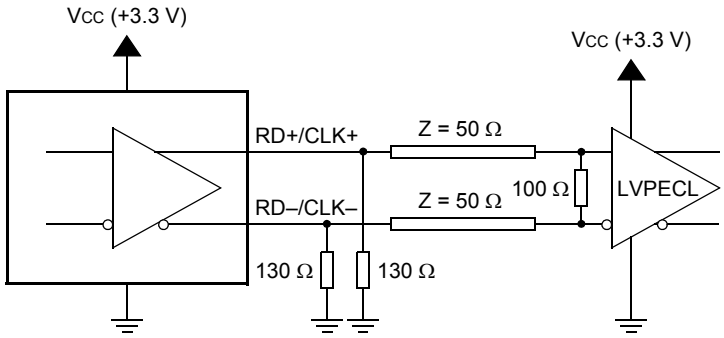
* Ferrite beads can be used as an option.
† For all capacitors, MLC caps are recommended.

Figure 3. Power Supply Filtering for the Small Form-Factor Transceiver

Application Schematics



A. Transmitter Interface (LVPECL to LVPECL)



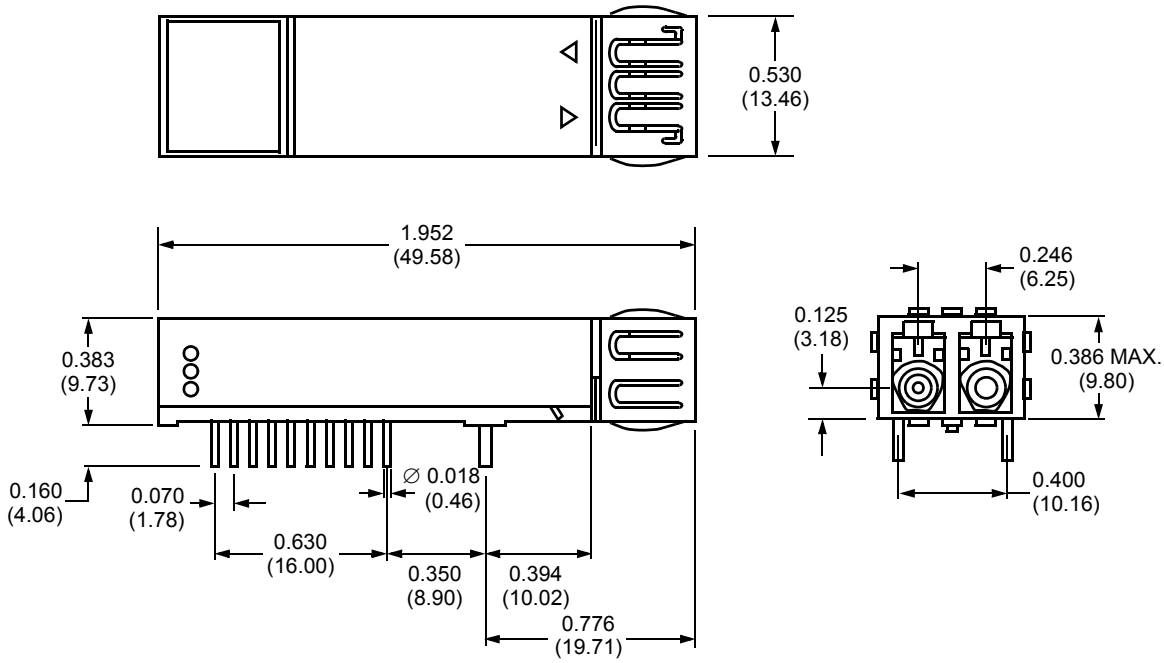
B. Receiver Interface (LVPECL to LVPECL)

Figure 4. 3.3 V Transceiver Interface with 3.3 V ICs

Outline Diagrams

Package Outline

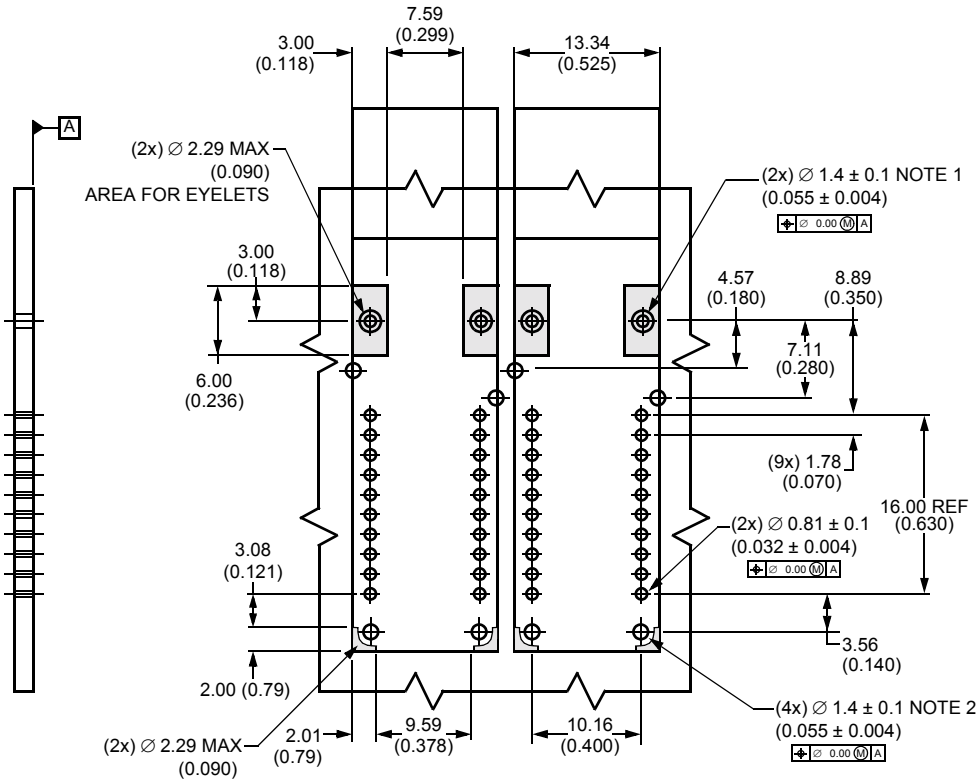
Dimensions are in inches and (millimeters).



Outline Diagrams (continued)

Printed-Wiring Board Layout

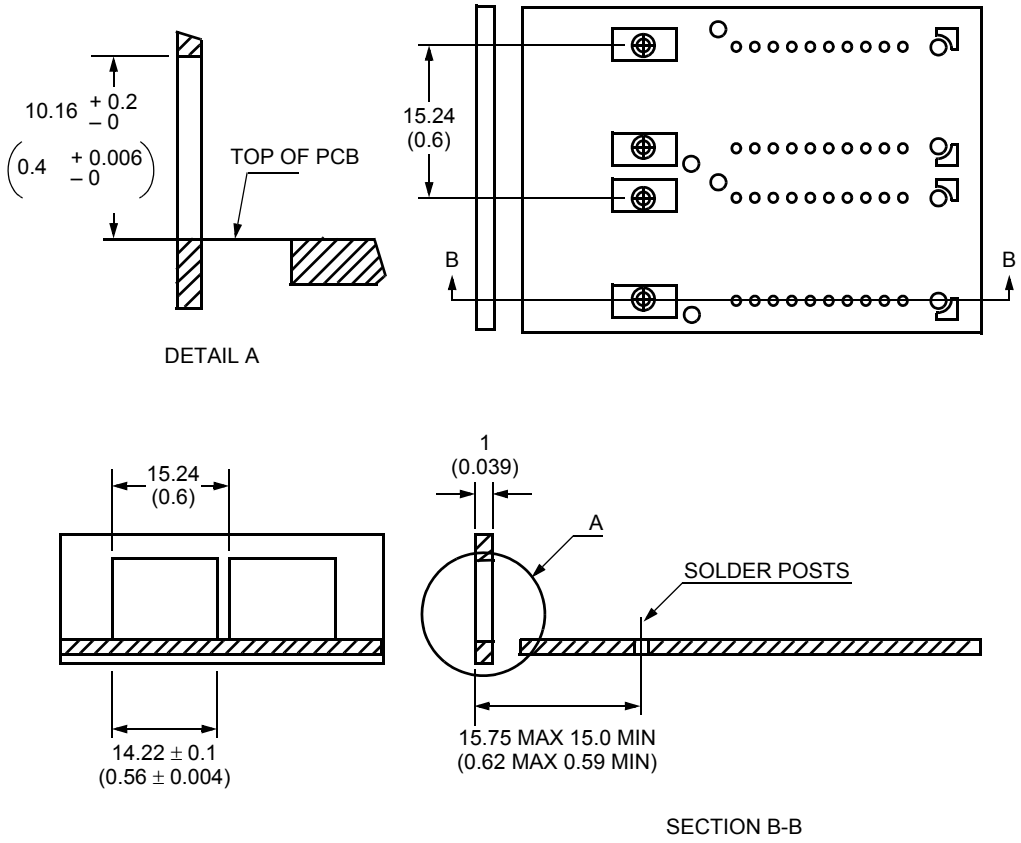
Dimensions are in millimeters and (inches).



Notes:
1. Holes for mounting studs must be tied to chassis ground.
2. Holes for housing leads must be tied to signal ground.

Recommended Panel Opening

Dimensions in millimeters and (inches).



Laser Safety Information

Class I Laser Product

All versions of the transceiver are Class I laser products per CDRH, 21 CFR 1040 Laser Safety requirements. All versions are Class I laser products per *IEC* 60825-2:1997. The transceiver will be classified with the FDA.

Caution: Use of controls, adjustments, and procedures other than those specified herein may result in hazardous laser radiation exposure.

This product complies with 21 CFR 1040.10 and 1040.11.

Wavelength = 1550 nm

Maximum power = 1.58 mW

Product is not shipped with power supply.

NOTICE

Unterminated optical connectors can emit laser radiation.

Do not view with optical instruments.

Ordering Information

Table 7. Ordering Information

Description	Device Code	Comcode
2 x 10 622 Mb/s 1550 nm laser transceiver with CDR for extended long-reach applications	NLT06-80-RA	700010613

EIA is a registered trademark of the Electronic Industries Association.
IEC is a registered trademark of The International Electrotechnical Commission.
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Additional Information

For the latest specifications, additional product information, worldwide sales and distribution locations, and information about TriQuint:

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E-mail: info_opto@tqs.com **Fax: (503) 615-8902**

For technical questions and additional information on specific applications:

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