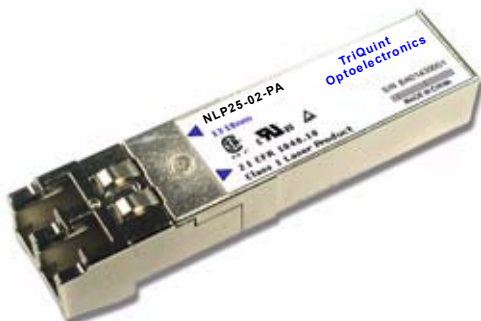


## **NetLight<sup>®</sup> NLP25 Small Form-Factor Pluggable (SFP) 2.5 Gb/s Laser Transceivers for 2 km—80 km Applications**

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Available in a small form-factor, LC receptacle connector metal package, the NLP25 SFP transceiver is a high-performance, cost-effective, optical transceiver for SONET/SDH applications.

### **Features**

- Multisource agreement compliant SFP package
- LC duplex receptacle
- Metal package for superior EMI performance
- Optional bail latch
- Uncooled 1310 nm or 1550 nm laser transmitter with automatic power control
- Transmitter disable input
- Hot-pluggable electrical interface
- Wide dynamic range InGaAs PIN receiver for 2 km and 15 km reaches
- Wide dynamic range avalanche photodiode (APD) receiver with internal dc-dc converter and APD bias control for 40 km and 80 km reaches
- LVTTTL loss-of-signal output
- Low power dissipation
- Single 3.3 V power supply
- ac-coupled LVPECL/CML compatible data inputs and outputs

- Extended operating temperature range of –40 °C to +85 °C available for 2 km—40 km reaches
- Serial identification (EEPROM)
- Diagnostic monitoring per SFF-8472 standard

### **Benefits**

- Upgrade path:
  - OEMs can offer longer-reach and higher-speed solutions, as the end user needs upgrades.

### **Applications**

- SONET GR-253-CORE OC-48 SR; ITU-T G.957 STM-16 I-16
- SONET GR-253-CORE OC-48 IR; ITU-T G.957 STM-16 S16.1
- SONET GR-253-CORE OC-48 LR-1; ITU-T G.957 STM-16 L16.1
- SONET GR-253-CORE OC-48 LR-2; ITU-T G.957 STM-16 L16.2

### **Description**

The NLP25 is a line of high-speed, cost-effective, small form-factor pluggable (SFP) optical transceivers intended for 2.488 Gb/s optical interface applications from 2 km—80 km. The transceivers feature TriQuint Optoelectronics' optics and are packaged in a narrow-width metal housing with an LC duplex receptacle. The package outline and pinout conform to the multisource SFP transceiver agreement.

The transmitter features ac-coupled differential data inputs, and LVTTTL logic level disable input and fault indicator output. The receiver features differential ac-coupled data outputs and a LVTTTL logic level loss-of-signal output. Diagnostic monitoring is implemented per the SFF committee document SFF-8472.

## 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.

Parameter	Symbol	Min	Max	Unit
Storage Temperature Range	Tstg	−40	85	°C
Case Temperature Range	Tc	−40	85	°C
Supply Voltage	VccT, R	0	3.8	V

## Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
Case Temperature Range:	Tc				
NLP25-02-AA		0	—	85	°C
NLP25-02-PA		−40	—	85	°C
NLP25-15-PA		−40	—	85	°C
NLP25-40-PA		−40	—	85	°C
NLP25-80-PA		−5	—	70	°C
Supply Voltage	VccT, R	3.135	—	3.465	V
Data Rate	—	—	2.488	—	Gb/s

## Transceiver Timing Characteristics

**Table 1. Transceiver Timing Characteristics** (see Timing Diagrams, page 8)

Parameter	Symbol	Min	Max	Unit
Time to Initialize, Including Reset of Tx_Fault <sup>1</sup>	t_init	—	300	ms
Transmit Disable Assert Time <sup>2</sup>	t_off	—	10	μs
Transmit Disable Negate Time <sup>3</sup>	t_on	—	1	ms
Transmit Fault Assert Time <sup>4</sup>	t_fault	—	100	μs
Transmit Fault Reset Time <sup>5</sup>	t_reset	10	—	μs
Loss-of-signal Assert Time <sup>6</sup>	t_loss_on	—	100	μs
Loss-of-signal Deassert Time <sup>7</sup>	t_loss_off	—	100	μs
Serial ID Clock Rate	f-serial-clock	—	100	kHz

1. Condition: from power on or negation of Tx\_Fault using Tx\_Disable.

2. Time from rising edge of Tx\_Disable to when the optical output falls below 10% of nominal.

3. Time from falling edge of Tx\_Disable to when the modulated optical output rises above 90% of nominal.

4. Time from fault to Tx\_Fault on.

5. Time Tx\_Disable must be held high to reset Tx\_Fault.

6. Time from LOS state to Rx LOS assert.

7. Time from non-LOS state to Rx LOS deassert.

## Transceiver Optical and Electrical Characteristics, NLP25-02-AA

**Table 2. Transmitter Optical and Electrical Characteristics** (Tc = 0 °C to +85 °C, Vcc = 3.135 V to 3.465 V)

Parameter	Symbol	Min	Max	Unit
Average Optical Output Power	PO	−10	−3	dBm
Average Optical Output Power (Tx Disabled)	PDIS	—	−40	dBm
Optical Wavelength	λc	1266	1360	nm
Spectral Width	Δλ <sub>RMS</sub>	—	4	nm
Dynamic Extinction Ratio	EXT	8.2	—	dB
Optical Output Rise/Fall Time (20%—80%)	tr/TF	—	150	ps
Optical Output Eye	Compliant with <i>Telcordia</i> ™ GR-253-CORE and ITU-T G.957			
Jitter Generation	p-p	—	0.07	UI
	RMS	—	0.007	UI
Power Supply Current	ICCT	—	125	mA
Input Data Voltage—Differential <sup>1</sup>	V <sub>INp-p</sub>	300	1600	mVp-p
Transmit Disable Voltage <sup>2</sup>	V <sub>D</sub>	V <sub>CC</sub> −0.7	V <sub>CC</sub>	V
Transmit Enable Voltage <sup>2</sup>	V <sub>EN</sub>	V <sub>EE</sub>	V <sub>EE</sub> + 0.8	V
Transmit Fault Output Voltage Level	V <sub>FAULTH</sub>	V <sub>CC</sub> − 1.0	V <sub>CC</sub>	V
	V <sub>FAULTL</sub>	V <sub>EE</sub>	V <sub>EE</sub> + 0.5	V

1. Differential operation is necessary for optimum performance.

2. TTL compatible interface.

**Table 3. Receiver Optical and Electrical Characteristics** (Tc = 0 °C to +85 °C, Vcc = 3.135 V to 3.465 V)

Parameter	Symbol	Min	Max	Unit
Average Sensitivity <sup>1</sup>	PI	—	−18	dBm
Maximum Input Power (Overload) <sup>1</sup>	P <sub>MAX</sub>	−3	—	dBm
Power Supply Current	ICCR	—	125	mA
Output Data/Clock Voltage—Differential <sup>2</sup>	V <sub>OUTp-p</sub>	400	1200	mVp-p
Data Output Rise/Fall Time	tr/TF	—	175	ps
Data Output Skew	T <sub>SKEW</sub>	—	50	ps
Loss-of-signal Voltage Level	V <sub>LOSH</sub>	V <sub>CC</sub> − 1.0	V <sub>CC</sub>	V
	V <sub>LOSL</sub>	V <sub>EE</sub>	V <sub>EE</sub> + 0.8	V
Loss of Signal: Assert	P <sub>LOSA</sub>	−45	−19	dBm
	P <sub>LOSD</sub>	—	−18.5	dBm
LOS Hysteresis	PHYS	0.5	6	dB

1. 2<sup>23</sup> − 1 PRBS with a BER of 1 x 10<sup>−10</sup>.

2. Differential operation is necessary for optimum performance.

## Transceiver Optical and Electrical Characteristics, NLP25-02-PA

**Table 4. Transmitter Optical and Electrical Characteristics** (Tc = –40 °C to +85 °C, Vcc = 3.135 V to 3.465 V)

Parameter	Symbol	Min	Max	Unit
Average Optical Output Power	PO	–10	–3	dBm
Average Optical Output Power (Tx Disabled)	PDIS	—	–40	dBm
Optical Wavelength	lc	1266	1360	nm
Spectral Width	$\Delta\lambda_{RMS}$	—	4	nm
Dynamic Extinction Ratio	EXT	8.2	—	dB
Optical Output Rise/Fall Time (20%—80%)	tr/tf	—	150	ps
Optical Output Eye	Compliant with <i>Telcordia</i> ™ GR-253-CORE and ITU-T G.957			
Jitter Generation	p-p	—	0.07	UI
	RMS	—	0.007	UI
Power Supply Current	ICCT	—	125	mA
Input Data Voltage—Differential <sup>1</sup>	VINp-p	200	1600	mVp-p
Transmit Disable Voltage <sup>2</sup>	VD	2	VCC	V
Transmit Enable Voltage <sup>2</sup>	VEN	VEE	VEE + 0.8	V
Transmit Fault Output Voltage Level	VFAULTH	VCC – 1.0	VCC	V
	VFAULTL	VEE	VEE + 0.5	V

1. Differential operation is necessary for optimum performance.

2. TTL compatible interface.

**Table 5. Receiver Optical and Electrical Characteristics** (Tc = –40 °C to +85 °C, Vcc = 3.135 V to 3.465 V)

Parameter	Symbol	Min	Max	Unit
Average Sensitivity <sup>1</sup>	PI	—	–18	dBm
Maximum Input Power (Overload) <sup>1</sup>	PMAX	–3	—	dBm
Power Supply Current	ICCR	—	125	mA
Output Data/Clock Voltage—Differential <sup>2</sup>	VOUtp-p	600	1200	mVp-p
Data Output Rise/Fall Time	tr/tf	—	175	ps
Data Output Skew	TSKEW	—	50	ps
Loss-of-signal Voltage Level	VLOSH	VCC – 1.0	VCC	V
	VLOSL	VEE	VEE + 0.8	V
Loss of Signal: Assert Deassert	PLOSA	–45	–19	dBm
	PLOSD	—	–18.5	dBm
LOS Hysteresis	PHYS	0.5	6	dB

1.  $2^{23}$  – 1 PRBS with a BER of  $1 \times 10^{-10}$ .

2. Differential operation is necessary for optimum performance.

## Transceiver Optical and Electrical Characteristics, NLP25-15-PA

**Table 6. Transmitter Optical and Electrical Characteristics** ( $T_c = -40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ ,  $V_{cc} = 3.135\text{ V}$  to  $3.465\text{ V}$ )

Parameter	Symbol	Min	Max	Unit
Average Optical Output Power	$P_O$	-5	0	dBm
Average Optical Output Power (Tx Disabled)	$P_{DIS}$	—	-40	dBm
Optical Wavelength	$\lambda_c$	1260	1360	nm
Spectral Width	$\Delta\lambda_{RMS}$	—	4	nm
Dynamic Extinction Ratio	EXT	8.2	—	dB
Optical Output Rise/Fall Time (20%—80%)	$t_R/t_F$	—	150	ps
Output Optical Eye	Compliant with <i>Telcordia</i> ™ GR-253-CORE and ITU-T G.957			
Jitter Generation	p-p	—	0.07	UI
	RMS	—	0.007	UI
Power Supply Current	$I_{CCT}$	—	125	mA
Input Data Voltage—Differential <sup>1</sup>	$V_{INp-p}$	200	2400	mVp-p
Transmit Disable Voltage <sup>2</sup>	$V_D$	2	$V_{CC}$	V
Transmit Enable Voltage <sup>2</sup>	$V_{EN}$	$V_{EE}$	$V_{EE} + 0.8$	V
Transmit Fault Output Voltage Level	$V_{FAULTH}$	$V_{CC} - 1.0$	$V_{CC}$	V
	$V_{FAULTL}$	$V_{EE}$	$V_{EE} + 0.5$	V

1. Differential operation is necessary for optimum performance.

2. TTL compatible interface.

**Table 7. Receiver Optical and Electrical Characteristics** ( $T_c = -40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ ,  $V_{cc} = 3.135\text{ V}$  to  $3.465\text{ V}$ )

Parameter	Symbol	Min	Max	Unit
Average Sensitivity <sup>1</sup>	$P_I$	—	-18	dBm
Maximum Input Power (Overload) <sup>1</sup>	$P_{MAX}$	0	—	dBm
Power Supply Current	$I_{CCR}$	—	125	mA
Output Data/Clock Voltage—Differential <sup>2</sup>	$V_{OUTp-p}$	600	1200	mVp-p
Data Output Rise/Fall Time	$t_R/t_F$	—	175	ps
Data Output Skew	$T_{SKEW}$	—	50	ps
Loss-of-signal Voltage Level	$V_{LOSH}$	$V_{CC} - 1.0$	$V_{CC}$	V
	$V_{LOSL}$	$V_{EE}$	$V_{EE} + 0.8$	V
Loss of Signal: Assert	$P_{LOSA}$	-45	-19	dBm
	$P_{LOSD}$	—	-18.5	dBm
LOS Hysteresis	PHYS	0.5	6	dB

1.  $2^{23} - 1$  PRBS with a BER of  $1 \times 10^{-10}$ .

2. Differential operation is necessary for optimum performance.

## Transceiver Optical and Electrical Characteristics, NLP25-40-PA

**Table 8. Transmitter Optical and Electrical Characteristics** ( $T_c = -40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ ,  $V_{cc} = 3.135\text{ V}$  to  $3.465\text{ V}$ )

Parameter	Symbol	Min	Max	Unit
Average Optical Output Power	$P_O$	-2.0	3.0	dBm
Average Optical Output Power (Tx Disabled)	$P_{DIS}$	—	-40	dBm
Optical Wavelength	$\lambda_C$	1280	1335	nm
Spectral Width	$\Delta\lambda_{RMS}$	—	1	nm
Side-mode Suppression Ratio	SMSR	30	—	dB
Dynamic Extinction Ratio	EXT	8.2	—	dB
Optical Output Rise/Fall Time (20%—80%)	$t_R/t_F$	—	150	ps
Output Optical Eye	Compliant with <i>Telcordia</i> ™ GR-253-CORE and ITU-T G.957			
Jitter Generation	p-p	—	0.07	UI
	RMS	—	0.007	UI
Power Supply Current	$I_{CCT}$	—	150	mA
Input Data Voltage—Differential <sup>1</sup>	$V_{INp-p}$	200	2400	mVp-p
Transmit Disable Voltage <sup>2</sup>	$V_D$	2	$V_{CC}$	V
Transmit Enable Voltage <sup>2</sup>	$V_{EN}$	$V_{EE}$	$V_{EE} + 0.8$	V
Transmit Fault Output Voltage Level	$V_{FAULTH}$	$V_{CC} - 1.0$	$V_{CC}$	V
	$V_{FAULTL}$	$V_{EE}$	$V_{EE} + 0.5$	V

1. Differential operation is necessary for optimum performance.

2. LVTTTL compatible interface.

**Table 9. Receiver Optical and Electrical Characteristics** ( $T_c = -40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$ ,  $V_{cc} = 3.135\text{ V}$  to  $3.465\text{ V}$ )

Parameter	Symbol	Min	Max	Unit
Average Sensitivity <sup>1</sup>	$P_I$	—	-27	dBm
Maximum Input Power <sup>1</sup> (Overload)	$P_{MAX}$	-9	—	dBm
Power Supply Current	$I_{CCR}$	—	200	mA
Output Data/Clock Voltage—Differential <sup>2</sup>	$V_{OUTp-p}$	600	1200	mVp-p
Data Output Rise/Fall Time	$t_R/t_F$	—	175	ps
Data Output Skew	$T_{SKEW}$	—	50	ps
Loss-of-signal Voltage Level	$V_{LOSH}$	$V_{CC} - 1.0$	$V_{CC}$	V
	$V_{LOSL}$	$V_{EE}$	$V_{EE} + 0.8$	V
Loss of Signal: Assert	$P_{LOSA}$	-45	-28	dBm
	$P_{LOSD}$	—	-27.5	dBm
LOS Hysteresis	$P_{HYS}$	0.5	6	dB

1.  $2^{23} - 1$  PRBS with a BER of  $1 \times 10^{-10}$ .

2. Differential operation is necessary for optimum performance.

## Transceiver Optical and Electrical Characteristics, NLP25-80-PA

**Table 10. Transmitter Optical and Electrical Characteristics** ( $T_c = -5\text{ }^{\circ}\text{C}$  to  $+70\text{ }^{\circ}\text{C}$ ,  $V_{cc} = 3.135\text{ V}$  to  $3.465\text{ V}$ )

Parameter	Symbol	Min	Max	Unit
Average Optical Output Power	$P_O$	-2.0	3.0	dBm
Average Optical Output Power (Tx Disabled)	$P_{DIS}$	—	-40	dBm
Optical Wavelength	$\lambda_C$	1500	1580	nm
Spectral Width	$\Delta\lambda_{RMS}$	—	1	nm
Side-mode Suppression Ratio	SMSR	30	—	dB
Dynamic Extinction Ratio	EXT	8.2	—	dB
Optical Output Rise/Fall Time (20%—80%)	$t_R/t_F$	—	150	ps
Output Optical Eye	Compliant with <i>Telcordia</i> ™ GR-253-CORE and ITU-T G.957			
Jitter Generation	p-p	—	0.07	UI
	RMS	—	0.007	UI
Power Supply Current	$I_{CCT}$	—	150	mA
Input Data Voltage—Differential <sup>1</sup>	$V_{INp-p}$	200	2400	mVp-p
Transmit Disable Voltage <sup>2</sup>	$V_D$	2	$V_{CC}$	V
Transmit Enable Voltage <sup>2</sup>	$V_{EN}$	$V_{EE}$	$V_{EE} + 0.8$	V
Transmit Fault Output Voltage Level	$V_{FAULTH}$	$V_{CC} - 1.0$	$V_{CC}$	V
	$V_{FAULTL}$	$V_{EE}$	$V_{EE} + 0.5$	V

1. Differential operation is necessary for optimum performance.

2. LVTTTL compatible interface.

**Table 11. Receiver Optical and Electrical Characteristics** ( $T_c = -5\text{ }^{\circ}\text{C}$  to  $+70\text{ }^{\circ}\text{C}$ ,  $V_{cc} = 3.135\text{ V}$  to  $3.465\text{ V}$ )

Parameter	Symbol	Min	Max	Unit
Average Sensitivity <sup>1</sup>	$P_I$	—	-28	dBm
Maximum Input Power <sup>1</sup> (Overload)	$P_{MAX}$	-9	—	dBm
Power Supply Current	$I_{CCR}$	—	200	mA
Output Data/Clock Voltage—Differential <sup>2</sup>	$V_{OUTp-p}$	600	1200	mVp-p
Data Output Rise/Fall Time	$t_R/t_F$	—	175	ps
Data Output Skew	$T_{SKEW}$	—	50	ps
Loss-of-signal Voltage Level	$V_{LOSH}$	$V_{CC} - 1.0$	$V_{CC}$	V
	$V_{LOSL}$	$V_{EE}$	$V_{EE} + 0.8$	V
Loss of Signal: Assert	$P_{LOSA}$	-45	-29	dBm
	$P_{LOSD}$	—	-28.5	dBm
LOS Hysteresis	$PHYS$	0.5	6	dB

1.  $2^{23} - 1$  PRBS with a BER of  $1 \times 10^{-10}$ .

2. Differential operation is necessary for optimum performance.

## Transceiver Timing Diagrams

Module installed except where noted.

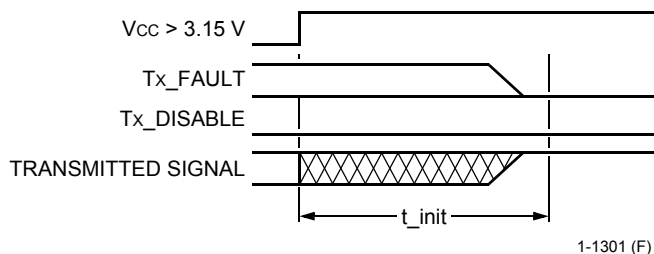


Figure 1.  $t_{init}$ : Tx\_DISABLE Negated

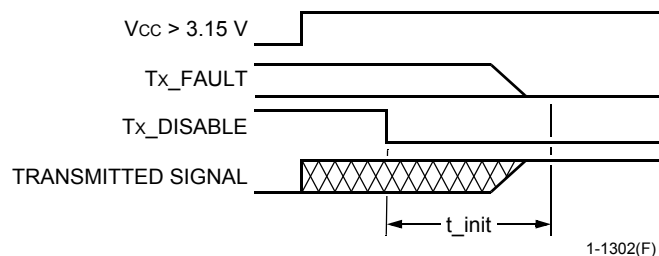


Figure 2.  $t_{init}$ : Tx\_DISABLE Asserted

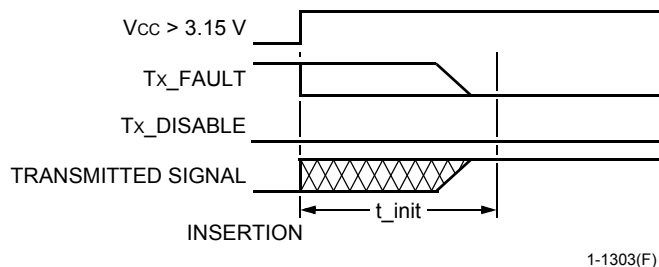


Figure 3.  $t_{init}$ : Tx\_DISABLE Negated Module Hot Plugged

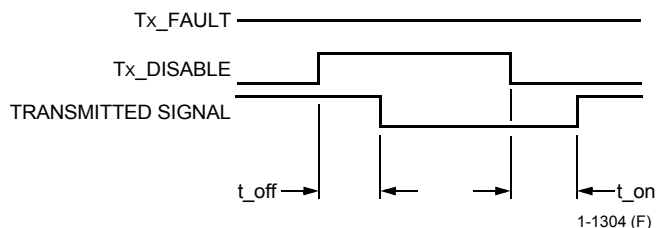


Figure 4.  $t_{off}$  and  $t_{on}$ : Tx\_DISABLE Asserted Then Negated

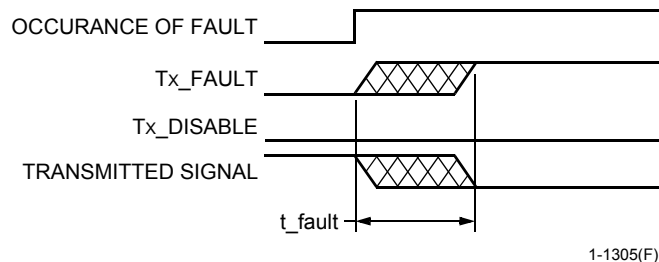
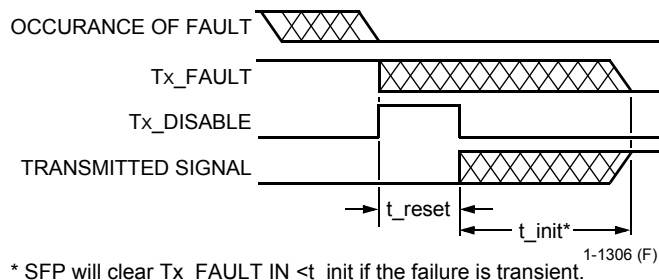
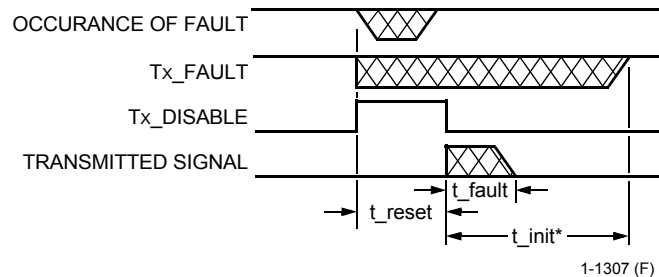


Figure 5.  $t_{fault}$ : Tx\_FAULT Asserted, Tx Signal Not Recovered



\* SFP will clear Tx\_FAULT IN  $< t_{init}$  if the failure is transient.

Figure 6.  $t_{reset}$ : Tx Disable Asserted Then Negated, Tx Signal Recovered



\* SFP will clear Tx\_FAULT IN  $< t_{init}$  if the failure is transient.

Figure 7.  $t_{fault}$ : Tx Disable Asserted Then Negated, Tx Signal Not Recovered

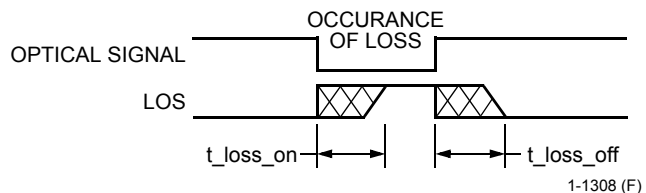


Figure 8.  $t_{loss\_on}$  and  $t_{loss\_off}$



## Power Supply Information

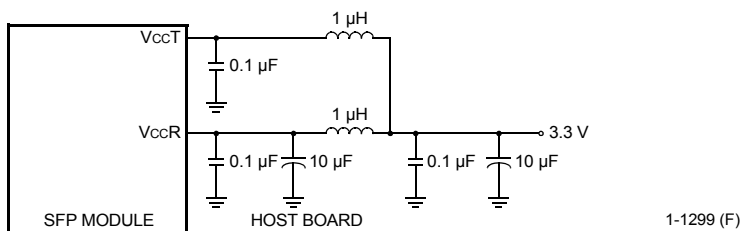


Figure 9. Power Supply Filtering of SFP Transceiver

## Electrical Schematic

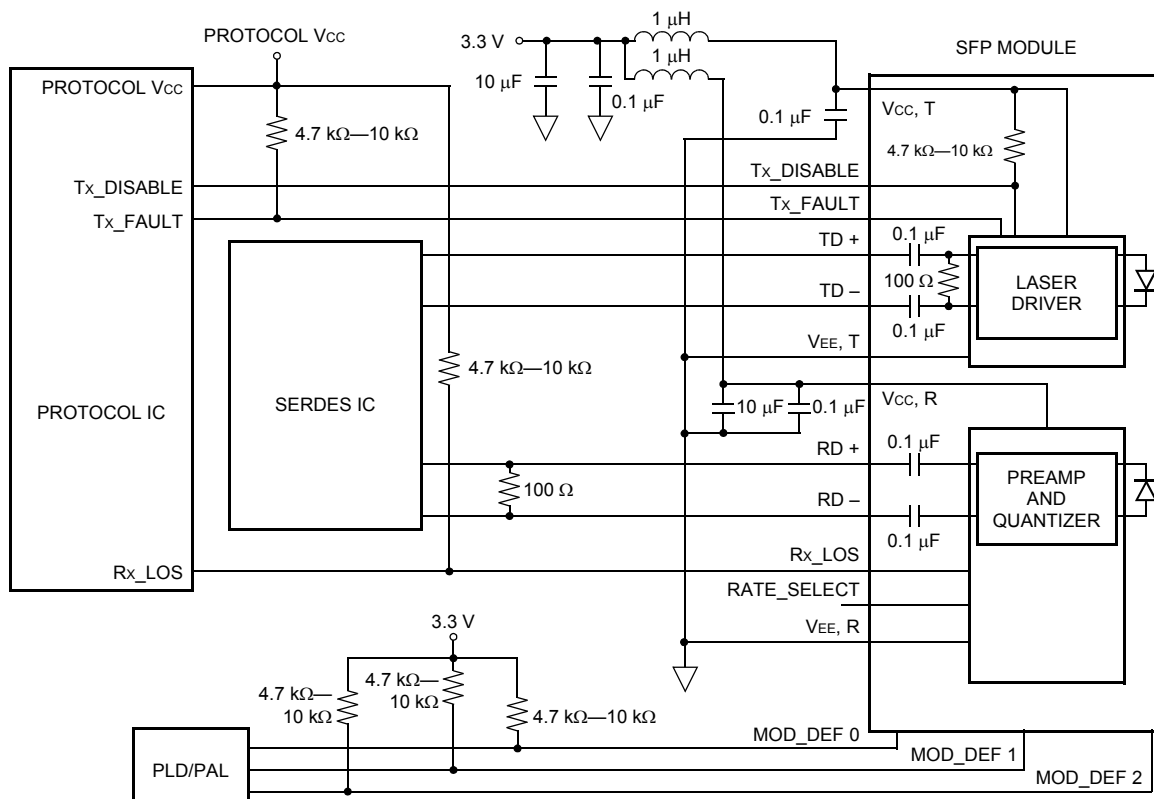


Figure 10. Example SFP Host Board Schematic

## Pin Information

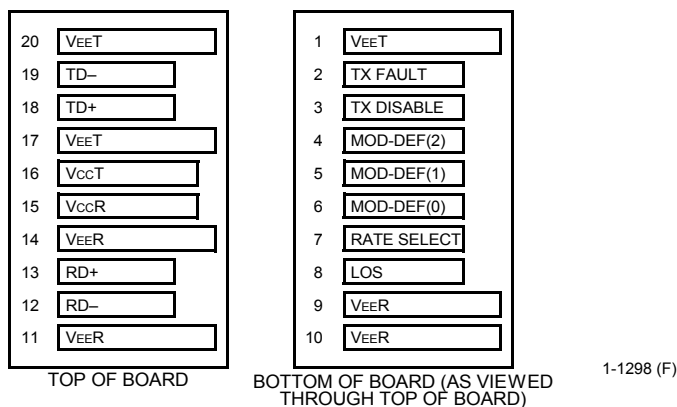


Figure 11. NLP25 SFP Transceiver, 20-Pin Configuration, Top View

## Pin Information (continued)

**Table 12. Transceiver Pin Descriptions**

Pin Number	Symbol	Functional Description	Plug Sequence	Notes
1	VEET	Transmitter Ground	1	—
2	TX Fault	Transmitter Fault Indication	3	Note 1.
3	TX Disable	Transmitter Disable	3	Note 2, Module Disables on High or Open.
4	MOD-DEF2	Module Definition 2	3	Note 3, Two-Wire Serial ID Interface.
5	MOD-DEF1	Module Definition 1	3	Note 3, Two-Wire Serial ID Interface.
6	MOD-DEF0	Module Definition 0	3	Note 3, Grounded in Module.
7	Rate Select	Select Between Full or Reduced Receiver Bandwidth	3	Note 4.
8	LOS	Loss of Signal	3	Note 5.
9	VEER	Receiver Ground	1	Note 6.
10	VEER	Receiver Ground	1	Note 6.
11	VEER	Receiver Ground	1	Note 6.
12	RD–	Inv. Received Data Out	3	Note 7.
13	RD+	Received Data Out	3	Note 7.
14	VEER	Receiver Ground	1	Note 6.
15	VCCR	Receiver Power	2	Note 8.
16	VCCT	Transmitter Power	2	Note 8.
17	VEET	Transmitter Ground	1	Note 6.
18	TD+	Transmit Data In	3	Note 9.
19	TD–	Inv. Transmit Data In	3	Note 9.
20	VEET	Transmitter Ground	1	Note 6.

- TX fault is an open collector/drain output, which should be pulled up with a 4.7 k $\Omega$ —10 k $\Omega$  resistor on the host board. Pull-up voltage between 2.0 V and V<sub>ccT</sub>, R + 0.3 V. When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to <0.8 V.
- TX disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7 k $\Omega$ —10 k $\Omega$  resistor. Its states are as follows:
  - Low (0 V—0.8 V): transmitter on; (>0.8 V, <2.0 V): undefined.
  - High (2.0 V—3.465 V): transmitter disabled.
  - Open: transmitter disabled.
- MOD-DEF 0, 1, 2. These are the module definition pins. They should be pulled up with a 4.7 k $\Omega$ —10 k $\Omega$  resistor on the host board. The pull-up voltage shall be V<sub>ccT</sub> or V<sub>ccR</sub>:
  - MOD-DEF 0 is grounded by the module to indicate that the module is present.
  - MOD-DEF 1 is the clock line of two-wire serial interface for serial ID.
  - MOD-DEF 2 is the data line of two-wire serial interface for serial ID.
- The rate-select option is not implemented. This pin should be left open on the host board.
- LOS (loss of signal) is an open collector/drain output, which should be pulled up with a 4.7 k $\Omega$ —10 k $\Omega$  resistor. Pull-up voltage between 2.0 V and V<sub>ccT</sub>, R + 0.3 V. When high, this output indicates the received optical power is below the worst-case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to <0.8 V.
- V<sub>EE</sub>R and V<sub>EE</sub>T may be internally connected within the SFP module.
- RD–/+ : These are the differential receiver outputs. They are ac-coupled 100  $\Omega$  differential lines, which should be terminated with 100  $\Omega$  (differential) at the user SERDES. The ac coupling is done inside the module and is thus not required on the host board.
- V<sub>cc</sub>R and V<sub>cc</sub>T are the receiver and transmitter power supplies. Recommended host board power supply filtering is shown below. When the recommended supply filtering network is used, hot plugging of the SFP transceiver module will result in an inrush current of no more than 30 mA greater than the steady-state value. V<sub>cc</sub>R and V<sub>cc</sub>T may be internally connected within the SFP transceiver module.
- TD–/+ : These are the differential transmitter inputs. They are ac-coupled, differential lines with 100  $\Omega$  differential termination inside the module. The ac coupling is done inside the module and is thus not required on the host board.

## EEPROM Information

Table 13. EEPROM Serial ID Memory Contents, NLP25-02-AA

Address	Hex	ASCII	Address	Hex	ASCII	Address	Hex	Address	Hex
0	3	—	34	20	—	68	Note 1	98	Note 4
1	4	—	35	20	—	69	Note 1	99	Note 4
2	7	—	36	0	—	70	Note 1	100	Note 4
3	0	—	37	0	—	71	Note 1	101	Note 4
4	1	—	38	0	—	72	Note 1	102	Note 4
5	0	—	39	0	—	73	Note 1	103	Note 4
6	0	—	40	4E	N	74	Note 1	104	Note 4
7	0	—	41	4C	L	75	Note 1	105	Note 4
8	0	—	42	50	P	76	Note 1	106	Note 4
9	0	—	43	32	2	77	Note 1	107	Note 4
10	0	—	44	35	5	78	Note 1	108	Note 4
11	3	—	45	2D	—	79	Note 1	109	Note 4
12	19	—	46	30	0	80	Note 1	110	Note 4
13	0	—	47	32	2	81	Note 1	111	Note 4
14	2	—	48	2D	—	82	Note 1	112	Note 4
15	14	—	49	41	A	83	Note 1	113	Note 4
16	0	—	50	41	A	84	Note 2	114	Note 4
17	0	—	51	20	—	85	Note 2	115	Note 4
18	0	—	52	20	—	86	Note 2	116	Note 4
19	0	—	53	20	—	87	Note 2	117	Note 4
20	54	T	54	20	—	88	Note 2	118	Note 4
21	72	r	55	20	—	89	Note 2	119	Note 4
22	69	i	56	Note 5	—	90	20	120	Note 4
23	51	Q	57	Note 5	—	91	20	121	Note 4
24	75	u	58	Note 5	—	92	0	122	Note 4
25	69	i	59	Note 5	—	93	0	123	Note 4
26	6E	n	60	0	—	94	0	124	Note 4
27	74	t	61	0	—	95	Note 3	125	Note 4
28	20	—	62	0	—	96	Note 4	126	Note 4
29	4F	O	63	Note 3	—	97	Note 4	127	Note 4
30	50	P	64	0	—				
31	54	T	65	1A	—				
32	4F	O	66	0	—				
33	20	—	67	0	—				

- Addresses 68—83 specify a unique device serial number.
- Addresses 84—89 specify the date code in the form of two-digit year, two-digit month, and two-digit day of the month.
- Addresses 63 and 95 are checksums. Address 63 is the checksum for bytes 0—62, and address 95 is the checksum for bytes 64—94.
- MSA-defined, vendor-specific data, read only.
- Addresses 56—59 specify module revision level.

## EEPROM Information (continued)

**Table 14. EEPROM Serial ID Memory Contents, NLP25-02-PA**

Address	Hex	ASCII	Address	Hex	ASCII	Address	Hex	Address	Hex
0	3	—	34	20	—	68	Note 1	98	Note 4
1	4	—	35	20	—	69	Note 1	99	Note 4
2	7	—	36	0	—	70	Note 1	100	Note 4
3	0	—	37	0	—	71	Note 1	101	Note 4
4	1	—	38	0	—	72	Note 1	102	Note 4
5	0	—	39	0	—	73	Note 1	103	Note 4
6	0	—	40	4E	N	74	Note 1	104	Note 4
7	0	—	41	4C	L	75	Note 1	105	Note 4
8	0	—	42	50	P	76	Note 1	106	Note 4
9	0	—	43	32	2	77	Note 1	107	Note 4
10	0	—	44	35	5	78	Note 1	108	Note 4
11	3	—	45	2D	—	79	Note 1	109	Note 4
12	19	—	46	30	0	80	Note 1	110	Note 4
13	0	—	47	32	2	81	Note 1	111	Note 4
14	2	—	48	2D	—	82	Note 1	112	Note 4
15	14	—	49	50	P	83	Note 1	113	Note 4
16	0	—	50	41	A	84	Note 2	114	Note 4
17	0	—	51	20	—	85	Note 2	115	Note 4
18	0	—	52	20	—	86	Note 2	116	Note 4
19	0	—	53	20	—	87	Note 2	117	Note 4
20	54	T	54	20	—	88	Note 2	118	Note 4
21	72	r	55	20	—	89	Note 2	119	Note 4
22	69	i	56	Note 5	—	90	20	120	Note 4
23	51	Q	57	Note 5	—	91	20	121	Note 4
24	75	u	58	Note 5	—	92	68	122	Note 4
25	69	i	59	Note 5	—	93	80	123	Note 4
26	6E	n	60	05	—	94	01	124	Note 4
27	74	t	61	1E	—	95	Note 3	125	Note 4
28	20	—	62	0	—	96	Note 4	126	Note 4
29	4F	O	63	Note 3	—	97	Note 4	127	Note 4
30	50	P	64	0	—				
31	54	T	65	1A	—				
32	4F	O	66	0	—				
33	20	—	67	0	—				

1. Addresses 68—83 specify a unique device serial number.
2. Addresses 84—89 specify the date code in the form of two-digit year, two-digit month, and two-digit day of the month.
3. Addresses 63 and 95 are checksums. Address 63 is the checksum for bytes 0—62, and address 95 is the checksum for bytes 64—94.
4. MSA-defined, vendor-specific data, read only.
5. Addresses 56—59 specify module revision level.

## EEPROM Information (continued)

**Table 15. EEPROM Serial ID Memory Contents, NLP25-15-PA**

Address	Hex	ASCII	Address	Hex	ASCII	Address	Hex	Address	Hex
0	3	—	34	20	—	68	Note 1	98	Note 4
1	4	—	35	20	—	69	Note 1	99	Note 4
2	7	—	36	0	—	70	Note 1	100	Note 4
3	0	—	37	0	—	71	Note 1	101	Note 4
4	0A	—	38	0	—	72	Note 1	102	Note 4
5	0	—	39	0	—	73	Note 1	103	Note 4
6	0	—	40	4E	N	74	Note 1	104	Note 4
7	0	—	41	4C	L	75	Note 1	105	Note 4
8	0	—	42	50	P	76	Note 1	106	Note 4
9	0	—	43	32	2	77	Note 1	107	Note 4
10	0	—	44	35	5	78	Note 1	108	Note 4
11	3	—	45	2D	—	79	Note 1	109	Note 4
12	19	—	46	30	1	80	Note 1	110	Note 4
13	0	—	47	32	5	81	Note 1	111	Note 4
14	0F	—	48	2D	—	82	Note 1	112	Note 4
15	96	—	49	50	P	83	Note 1	113	Note 4
16	0	—	50	41	A	84	Note 2	114	Note 4
17	0	—	51	20	—	85	Note 2	115	Note 4
18	0	—	52	20	—	86	Note 2	116	Note 4
19	0	—	53	20	—	87	Note 2	117	Note 4
20	54	T	54	20	—	88	Note 2	118	Note 4
21	72	r	55	20	—	89	Note 2	119	Note 4
22	69	i	56	Note 5	—	90	20	120	Note 4
23	51	Q	57	Note 5	—	91	20	121	Note 4
24	75	u	58	Note 5	—	92	68	122	Note 4
25	69	i	59	Note 5	—	93	80	123	Note 4
26	6E	n	60	05	—	94	01	124	Note 4
27	74	t	61	1E	—	95	Note 3	125	Note 4
28	20	—	62	0	—	96	Note 4	126	Note 4
29	4F	O	63	Note 3	—	97	Note 4	127	Note 4
30	50	P	64	0	—				
31	54	T	65	1A	—				
32	4F	O	66	0	—				
33	20	—	67	0	—				

- Addresses 68—83 specify a unique device serial number.
- Addresses 84—89 specify the date code in the form of two-digit year, two-digit month, and two-digit day of the month.
- Addresses 63 and 95 are checksums. Address 63 is the checksum for bytes 0—62, and address 95 is the checksum for bytes 64—94.
- MSA-defined, vendor-specific data, read only.
- Addresses 56—59 specify module revision level.

## EEPROM Information (continued)

**Table 16. EEPROM Serial ID Memory Contents, NLP25-40-PA**

Address	Hex	ASCII	Address	Hex	ASCII	Address	Hex	Address	Hex
0	3	—	34	20	—	68	Note 1	98	Note 4
1	4	—	35	20	—	69	Note 1	99	Note 4
2	7	—	36	0	—	70	Note 1	100	Note 4
3	0	—	37	0	—	71	Note 1	101	Note 4
4	14	—	38	0	—	72	Note 1	102	Note 4
5	0	—	39	0	—	73	Note 1	103	Note 4
6	0	—	40	4E	N	74	Note 1	104	Note 4
7	0	—	41	4C	L	75	Note 1	105	Note 4
8	0	—	42	50	P	76	Note 1	106	Note 4
9	0	—	43	32	2	77	Note 1	107	Note 4
10	0	—	44	35	5	78	Note 1	108	Note 4
11	3	—	45	2D	—	79	Note 1	109	Note 4
12	19	—	46	34	4	80	Note 1	110	Note 4
13	0	—	47	30	0	81	Note 1	111	Note 4
14	28	—	48	2D	—	82	Note 1	112	Note 4
15	FF	—	49	50	P	83	Note 1	113	Note 4
16	0	—	50	41	A	84	Note 2	114	Note 4
17	0	—	51	20	—	85	Note 2	115	Note 4
18	0	—	52	20	—	86	Note 2	116	Note 4
19	0	—	53	20	—	87	Note 2	117	Note 4
20	54	T	54	20	—	88	Note 2	118	Note 4
21	72	r	55	20	—	89	Note 2	119	Note 4
22	69	i	56	Note 5	—	90	20	120	Note 4
23	51	Q	57	Note 5	—	91	20	121	Note 4
24	75	u	58	Note 5	—	92	68	122	Note 4
25	69	i	59	Note 5	—	93	80	123	Note 4
26	6E	n	60	05	—	94	01	124	Note 4
27	74	t	61	1E	—	95	Note 3	125	Note 4
28	20	—	62	0	—	96	Note 4	126	Note 4
29	4F	O	63	Note 3	—	97	Note 4	127	Note 4
30	50	P	64	0	—				
31	54	T	65	1A	—				
32	4F	O	66	0	—				
33	20	—	67	0	—				

1. Addresses 68—83 specify a unique device serial number.

2. Addresses 84—89 specify the date code in the form of two-digit year, two-digit month, and two-digit day of the month.

3. Addresses 63 and 95 are checksums. Address 63 is the checksum for bytes 0—62, and address 95 is the checksum for bytes 64—94.

4. MSA-defined, vendor-specific data, read only.

5. Addresses 56—59 specify module revision level.

## EEPROM Information (continued)

**Table 17. EEPROM Serial ID Memory Contents, NLP25-80-PA**

Address	Hex	ASCII	Address	Hex	ASCII	Address	Hex	Address	Hex
0	3	—	34	20	—	68	Note 1	98	Note 4
1	4	—	35	20	—	69	Note 1	99	Note 4
2	7	—	36	0	—	70	Note 1	100	Note 4
3	0	—	37	0	—	71	Note 1	101	Note 4
4	0C	—	38	0	—	72	Note 1	102	Note 4
5	0	—	39	0	—	73	Note 1	103	Note 4
6	0	—	40	4E	N	74	Note 1	104	Note 4
7	0	—	41	4C	L	75	Note 1	105	Note 4
8	0	—	42	50	P	76	Note 1	106	Note 4
9	0	—	43	32	2	77	Note 1	107	Note 4
10	0	—	44	35	5	78	Note 1	108	Note 4
11	3	—	45	2D	—	79	Note 1	109	Note 4
12	19	—	46	38	8	80	Note 1	110	Note 4
13	0	—	47	30	0	81	Note 1	111	Note 4
14	50	—	48	2D	—	82	Note 1	112	Note 4
15	FF	—	49	50	P	83	Note 1	113	Note 4
16	0	—	50	41	A	84	Note 2	114	Note 4
17	0	—	51	20	—	85	Note 2	115	Note 4
18	0	—	52	20	—	86	Note 2	116	Note 4
19	0	—	53	20	—	87	Note 2	117	Note 4
20	54	T	54	20	—	88	Note 2	118	Note 4
21	72	r	55	20	—	89	Note 2	119	Note 4
22	69	i	56	Note 5	—	90	20	120	Note 4
23	51	Q	57	Note 5	—	91	20	121	Note 4
24	75	u	58	Note 5	—	92	68	122	Note 4
25	69	i	59	Note 5	—	93	80	123	Note 4
26	6E	n	60	06	—	94	01	124	Note 4
27	74	t	61	0E	—	95	Note 3	125	Note 4
28	20	—	62	0	—	96	Note 4	126	Note 4
29	4F	O	63	Note 3	—	97	Note 4	127	Note 4
30	50	P	64	0	—				
31	54	T	65	1A	—				
32	4F	O	66	0	—				
33	20	—	67	0	—				

- Addresses 68—83 specify a unique device serial number.
- Addresses 84—89 specify the date code in the form of two-digit year, two-digit month, and two-digit day of the month.
- Addresses 63 and 95 are checksums. Address 63 is the checksum for bytes 0—62, and address 95 is the checksum for bytes 64—94.
- MSA-defined, vendor-specific data, read only.
- Addresses 56—59 specify module revision level.

## 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 Optoelectronics 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 k $\Omega$ , capacitance = 100 pF) is widely used and, therefore, can be used for comparison purposes. The HBM ESD threshold established for the NLP25 is  $\pm 1000$  V.

## Qualification and Reliability

To help ensure high product reliability and customer satisfaction, TriQuint Optoelectronics is committed to an intensive quality program that starts in the design phase and proceeds through the manufacturing process. Optoelectronic modules are qualified to our internal standards using MIL-STD-883 test methods and procedures and using sampling techniques consistent with *Telcordia Technologies*™ requirements.

In addition, TriQuint Optoelectronics has been certified to be in full compliance with the latest *ISO*® 9001 Quality System Standards.

**Table 18. Regulatory Compliance**

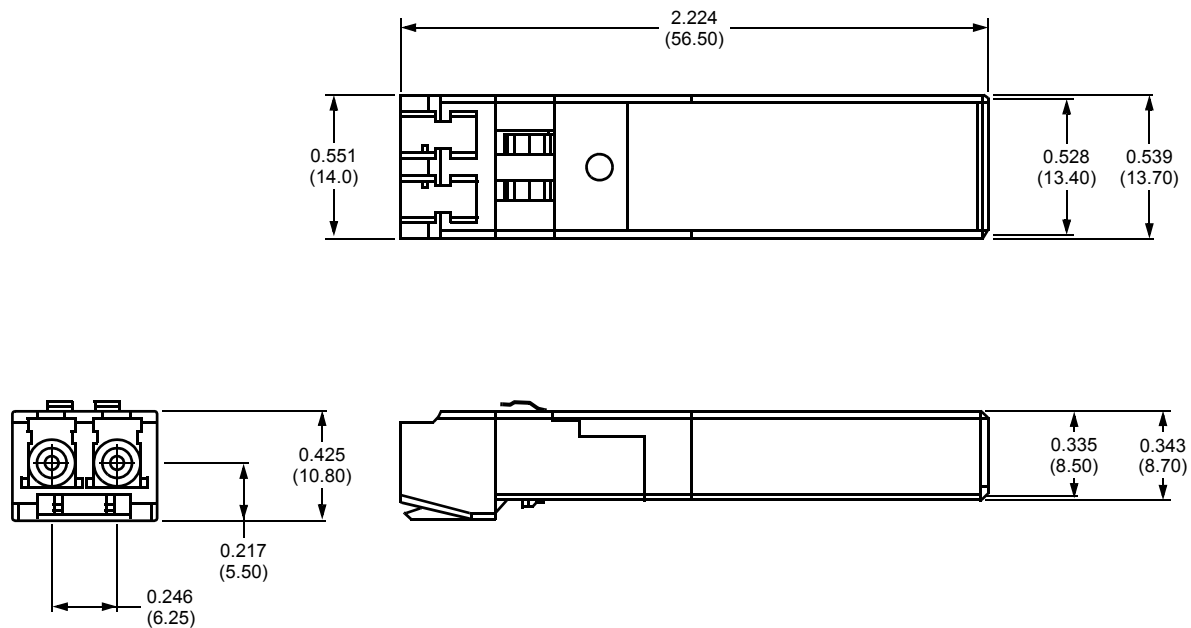
Feature	Test Method	Performance
Laser Eye Safety	U.S. 21 CFR (J) 1040.10 and 1040.11, <i>IEC</i> ® 60825-1 1988, <i>IEC</i> 60825-2 1997	CDRH compliant and Class 1 laser safe.
Electrostatic Discharge (ESD) to Electrical Pins	MIL-STD 883C, Method 3015.4	Class 1 (>1000 V).
Electrostatic Discharge (ESD) to Optical Connector	<i>IEC</i> 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	<i>IEC</i> 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	<i>UL</i> ® 1950, <i>CSA</i> ® C22.2 #950, <i>IEC</i> 60950: 1999	<i>UL</i> File No., <i>CSA</i> File No., TUV Certificate No.
Flammability	<i>UL</i> 94 V-0	—



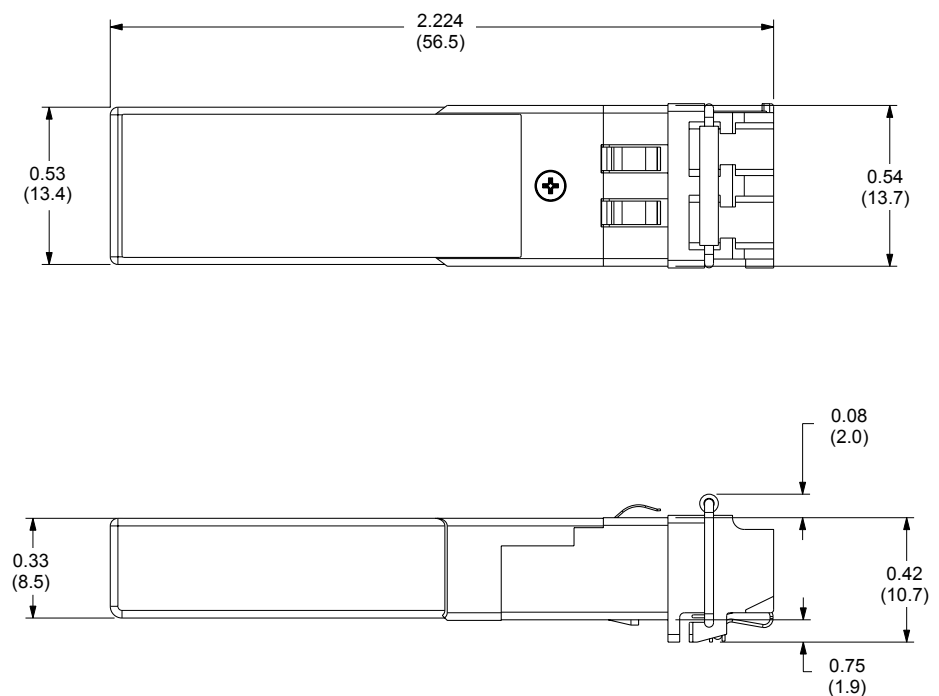
## Outline Drawings

Dimensions are in inches and (millimeters).

### Package Outline (standard latch)



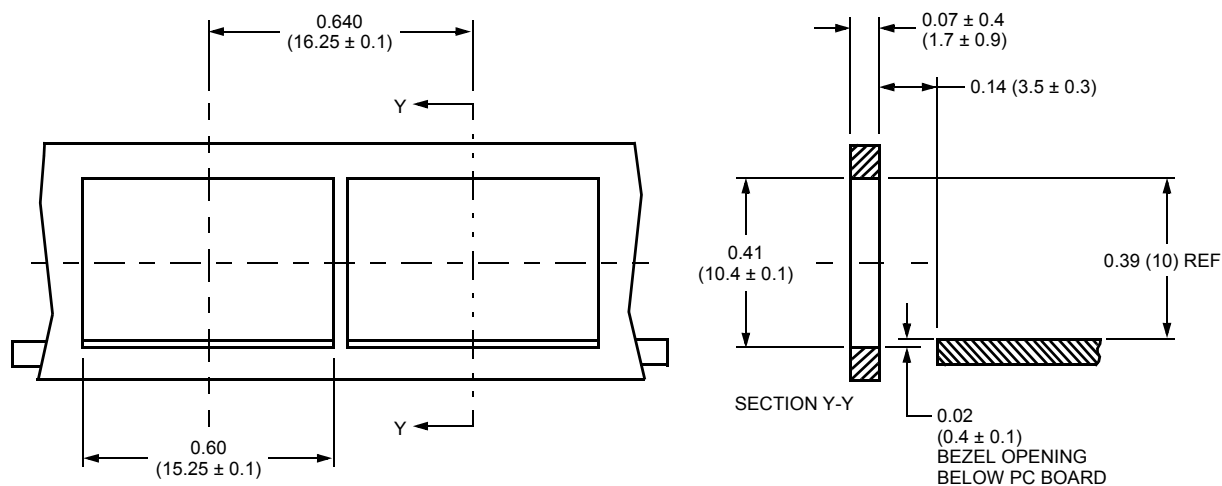
### Package Outline (optional bail latch)



## Outline Drawings (continued)

Dimensions are in inches and (millimeters).

### Recommended Panel Opening



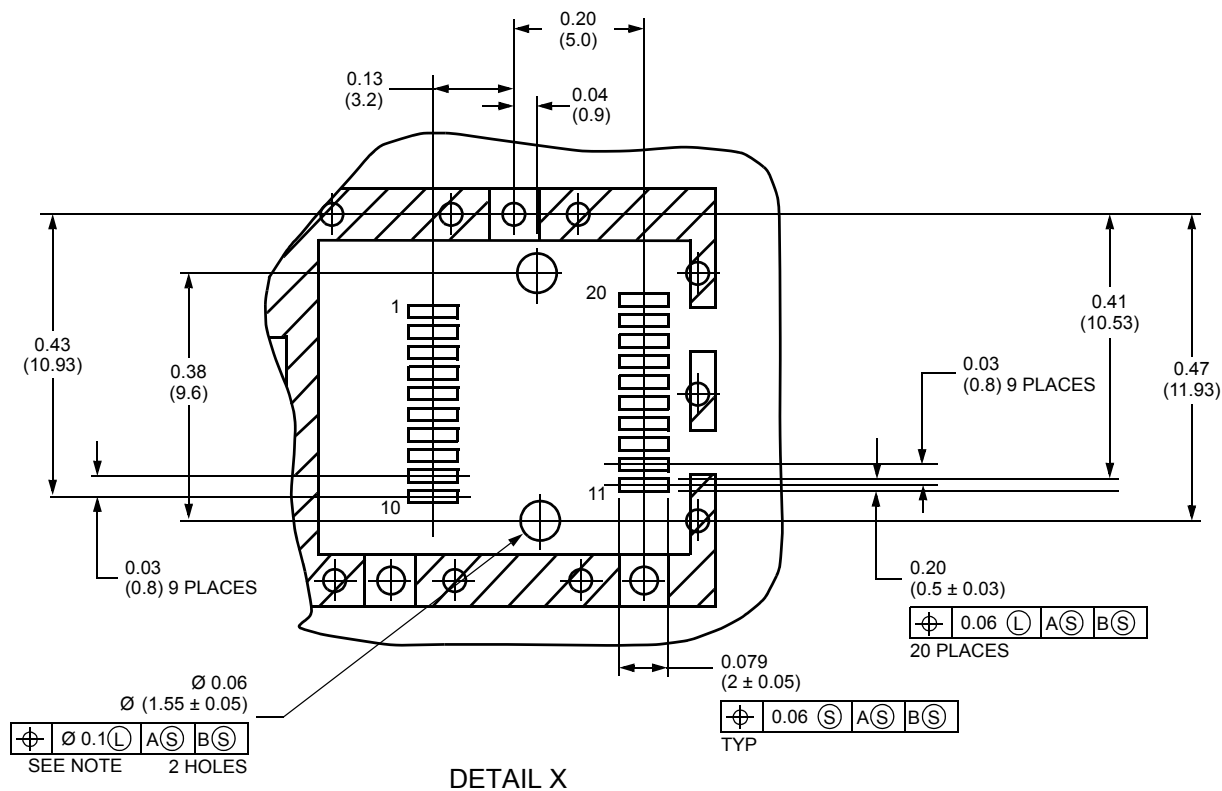
1-1309 (F)



## Outline Drawings (continued)

Dimensions are in inches and (millimeters).

## Printed-Wiring Board Layout (continued)



Note: Through holes, plating optional.

## 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* 60825-1:1993. 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: 1310 nm (NLP25-02-AA, NLP25-02-PA, NLP25-15-PA, and NLP25-40-PA);  
1550 nm (NLP25-80-PA)

Maximum power = 2 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 19. Ordering Information**

Description	Device Code	Comcode
SFP LC receptacle transceiver for 2.488 Gb/s, 2 km applications	NLP25-02-AA	700001804
SFP LC receptacle transceiver with extended operating temperature range and diagnostic monitors for 2.488 Gb/s, 2 km applications	NLP25-02-PA	700018959
SFP LC receptacle transceiver with extended operating temperature range and diagnostic monitors for 2.488 Gb/s, 15 km applications	NLP25-15-PA	700018960
SFP LC receptacle transceiver with extended operating temperature range and diagnostic monitors for 2.488 Gb/s, 15 km applications	NLP25-40-PA	700027918
SFP LC receptacle transceiver with diagnostic monitors for 2.488 Gb/s, 80 km applications	NLP25-80-PA	700018961
SFP LC receptacle transceiver with extended operating temperature range, bail latch, and diagnostic monitors for 2.488 Gb/s, 2 km applications	NLP25-02-PB	TBD
SFP LC receptacle transceiver with extended operating temperature range, bail latch, and diagnostic monitors for 2.488 Gb/s, 15 km applications	NLP25-15-PB	TBD
SFP LC receptacle transceiver with extended operating temperature range, bail latch, and diagnostic monitors for 2.488 Gb/s, 15 km applications	NLP25-40-PB	TBD
SFP LC receptacle transceiver with bail latch and diagnostic monitors for 2.488 Gb/s, 80 km applications	NLP25-80-PB	TBD

EIA is a registered trademark of The Electronic Industries Association.

IEC is a registered trademark of The International Electrotechnical Commission.

UL is a registered trademark of Underwriters Laboratories, Incorporated.

CSA is a registered trademark of Canadian Standards Association.

Telcordia Technologies is a trademark of Telcordia Technologies, Inc.

ISO is a registered trademark of The International Organization for Standardization.

NetLight is a registered trademark of TriQuint Optoelectronics, Inc.

## Additional Information

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

**Web:** [www.triquint.com](http://www.triquint.com)

**Tel:** (503) 615-9000

**E-mail:** [info\\_opto@tqs.com](mailto:info_opto@tqs.com)

**Fax:** (503) 615-8902

For technical questions and additional information on specific applications:

**E-mail:** [info\\_opto@tqs.com](mailto:info_opto@tqs.com)

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