**RoHS Compliant**
**TX-1550/RX-1310 nm Single-mode Bi-directional (60km)**
**SFP SC Simplex Connector, with Diagnostic Monitoring**
**1.0625Gbd Fiber Channel/1.25 Gigabit Ethernet**

## Features

- Compliant with IEEE802.3z Gigabit Ethernet Standard
- Compliant with Fiber Channel 100-SM-LC-L standard
- Multi rate 125Mbps, 1.06Gbps and 1.25Gbps
- Industry standard small form pluggable (SFP) package
- Simplex SC connector
- Differential LVPECL inputs and outputs
- Single power supply 3.3V
- TTL signal detect indicator
- Hot Pluggable
- Class 1 laser product complies with EN 60825-1

## Ordering Information

| PART NUMBER | TX/RX | TEMPERATURE | LD Type | Distance |
|---|---|---|---|---|
| LS48-C3U-TC-N-P5 | 1550/1310 | $0^{\circ}$C to 70 $^{\circ}$C | 1550 DFB | 60km |
| LS48-C3U-TI-N-P5 | 1550/1310 | $-40^{\circ}$C to 85 $^{\circ}$C | 1550 DFB | 60km |

## Diagnostics

| Parameter | Range | Accuracy | Unit | Calibration |
|---|---|---|---|---|
| Temperature | -20 to 95 | ± 3 | $^{o}$C | |
| Voltage | 0 to VCC | ± 0.1 | V | |
| Bias Current | 0 to 120 | ± 5 | mA | External |
| TX Power | -6 to +5 | ± 3 dB | dBm | |
| RX Power | -21 to –3 | ± 3 dB | dBm | |

Website: www.apacoe.com.tw

## Absolute Maximum Ratings

| PARAMETER | SYMBOL | MIN | MAX | UNITS | NOTE |
|---|---|---|---|---|---|
| Storage Temperature | $T_S$ | −40 | 85 | $^\circ$C | |
| Supply Voltage | $Vcc$ | −0.5 | 4.0 | V | |
| Input Voltage | $V_{IN}$ | −0.5 | $Vcc$ | V | |

## Recommended Operating Conditions

| PARAMETER | SYMBOL | MIN | MAX | UNITS | NOTE |
|---|---|---|---|---|---|
| Case Operating Temperature | $T_C$ | 0 / -40 | 70 / 85 | $^\circ$C | |
| Supply Voltage | $Vcc$ | 3.1 | 3.5 | V | |
| Supply Current | $I_{TX} + I_{RX}$ | --- | 300 | mA | |

## Transmitter Electro-optical Characteristics

$Vcc$ = 3.1 V to 3.5 V, $T_C$ = 0 °C to 70 °C (-40 °C to 85 °C)

| PARAMETER | SYMBOL | MIN | TYP. | MAX | UNITS | NOTE |
|---|---|---|---|---|---|---|
| Output Optical Power 9/125 $\mu$m fiber | $P_{out}$ | −2 | --- | +4 | dBm | Average |
| Extinction Ratio | $ER$ | 9 | --- | --- | dB | |
| Center Wavelength | $\lambda_C$ | 1530 | 1550 | 1570 | nm | |
| Spectral Width (-20dB) | $\Delta\lambda$ | --- | --- | 1 | nm | |
| Side Mode Suppression Ratio | $SMSR$ | 30 | --- | --- | dB | |
| Rise/Fall Time, (20–80%) | $T_{r, f}$ | --- | --- | 260 | ps | |
| Relative Intensity Noise | $RIN$ | --- | --- | −120 | dB/Hz | |
| Total Jitter | $TJ$ | --- | --- | 227 | ps | |
| Output Eye | Compliant with IEEE802.3z | | | | | |
| Max. $P_{out}$ TX-DISABLE Asserted | $P_{OFF}$ | --- | --- | −45 | dBm | |
| Differential Input Voltage | $V_{DIFF}$ | 0.4 | --- | 2.0 | V | |
| Transmit Fault Output-Low | $TX\_FAULT_L$ | 0.0 | --- | 0.5 | V | |
| Transmit Fault Output-High | $TX\_FAULT_H$ | 2.4 | --- | $V_{CC}$ | V | |
| Time to initialize, include reset of TX_FAULT | $t\_init$ | --- | --- | 300 | ms | |
| TX_FAULT from fault to assertion | $t\_fault$ | --- | --- | 100 | $\mu$s | |
| TX_DISABLE time to start reset | $t\_reset$ | 10 | --- | --- | $\mu$s | |

## Receiver Electro-optical Characteristics

$Vcc$ = 3.1 V to 3.5 V, $T_C$ = 0 °C to 70 °C (-40 °C to 85 °C)

| PARAMETER | SYMBOL | MIN | TYP. | MAX | UNITS | NOTE |
|---|---|---|---|---|---|---|
| Optical Input Power-maximum | $P_{IN}$ | 0 | --- | --- | dBm | BER < $10^{-12}$ |
| RX Sensitivity @GbE | $P_{IN}$ | --- | --- | −25 | dBm | PRBS7, BER < $10^{-12}$ |
| RX Sensitivity @1x FC | $P_{IN}$ | --- | --- | −25 | dBm | PRBS7, BER < $10^{-12}$ |
| RX Sensitivity @125Mbps | $P_{IN}$ | --- | --- | −25 | dBm | PRBS7, BER < $10^{-10}$ |
| Operating Center Wavelength | $\lambda_C$ | 1260 | --- | 1360 | nm | |
| Optical Return Loss | ORL | 14 | --- | --- | dB | λ=1260~1360nm |
| Optical isolation | ISO | --- | --- | -45 | dB | λ=1480~1600nm |
| Signal Detect-Asserted | $P_A$ | --- | --- | −25 | dBm | |
| Signal Detect-Deasserted | $P_D$ | −40 | --- | --- | dBm | |
| Differential Output Voltage | $V_{DIFF}$ | 0.5 | --- | 1.2 | V | |
| Data Output Rise, Fall Time (20–80%) | $T_{r,f}$ | --- | --- | 0.35 | ns | |
| Receiver Loss of Signal Output Voltage-Low | $RX\_LOS_L$ | 0 | --- | 0.5 | V | |
| Receiver Loss of Signal Output Voltage-High | $RX\_LOS_H$ | 2.4 | --- | $V_{CC}$ | V | |

## Block Diagram of Transceiver
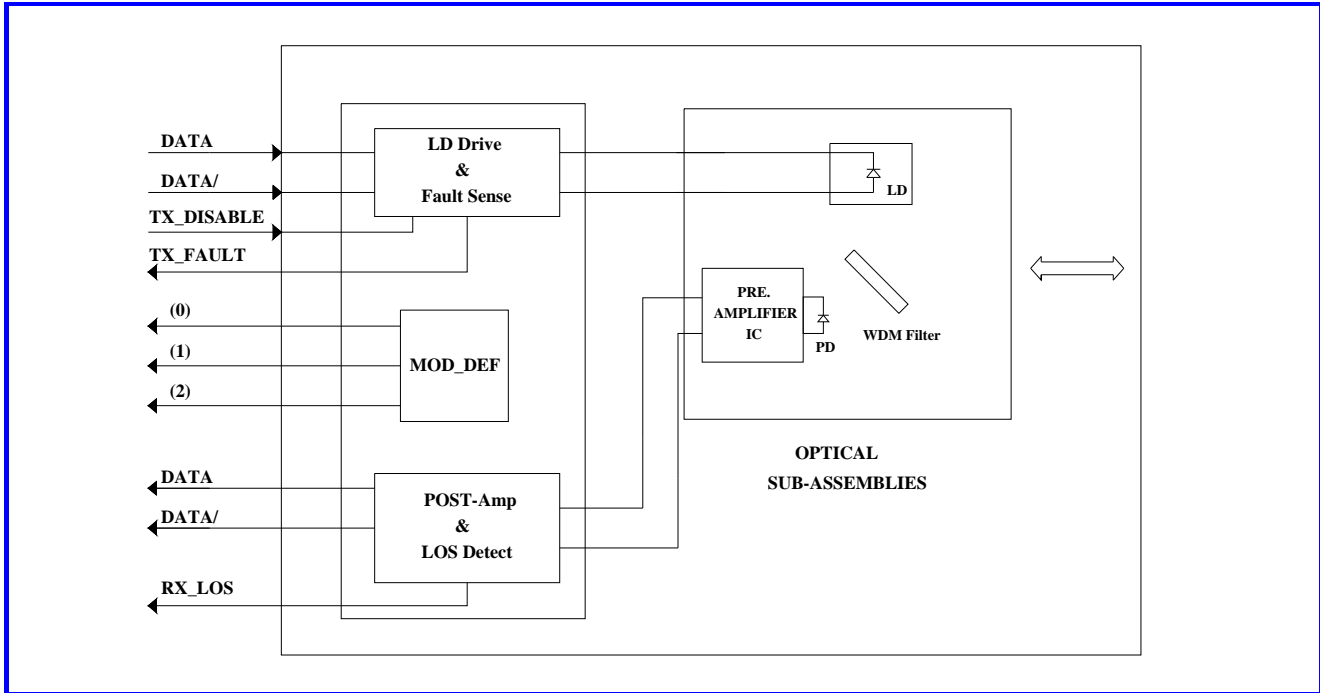


**Transmitter and Receiver Optical Sub-assembly Section**

A 1550 nm InGaAsP laser and an InGaAs PIN photodiode integrate with an WDM filter to form a bi-directional single fiber optical subassembly (OSA). The laser of OSA is driven by a LD driver IC which converts differential input LVPECL logic signals into an analog laser driving current. And, The photodiode of OSA is connected to a circuit providing post-amplification quantization, and optical signal detection.

**TX_FAULT**

When sensing an improper power level in the laser driver, the SFP set this signal high and turns off the Laser. TX_FAULT can be reset with the TX_DISABLE line. The signal is in TTL level.

**TX_DISABLE**

The TX_DISABLE signal is high (TTL logic "1") to turn off the laser output.
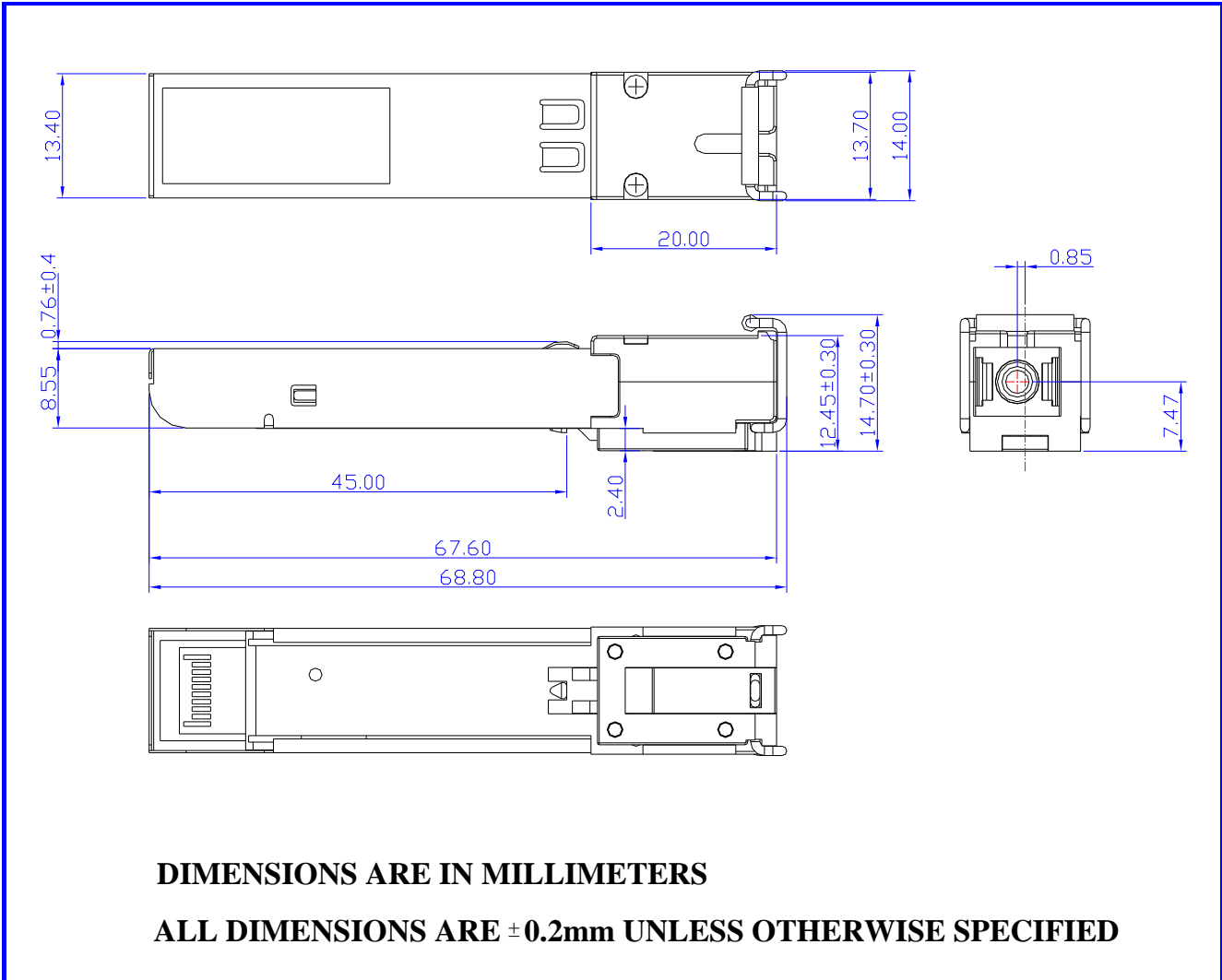
**Receive Loss (RX_LOS)**

The RX_LOS is high (logic "1") when there is no incoming light from the companion transceiver. This signal is normally used by the system for the diagnostic purpose. The signal is operated in TTL level.

**Dimensions**



**DIMENSIONS ARE IN MILLIMETERS**

**ALL DIMENSIONS ARE ± 0.2mm UNLESS OTHERWISE SPECIFIED**

## SFP host board mechanical layout



LEGEND

1. PADS AND VIAS ARE CHASSIS GROUND
2. THROUGH HOLES, PLATING OPTIONAL
3. HATCHED AREA DENOTES COMPONENT
   AND TRACE KEEPOUT(EXCEPT CHASSIS
   GROUND)
4. AREA DENOTES COMPONENT KEEPOUT
   (TRACES ALLOWED)

DIMENSIONS ARE IN MILLIMETERS

DETAIL 1

Unit: mm

## Pin Assignment

Pin-Out

**PIN 11** — — **PIN 20**

**PIN 10** — — **PIN 1**
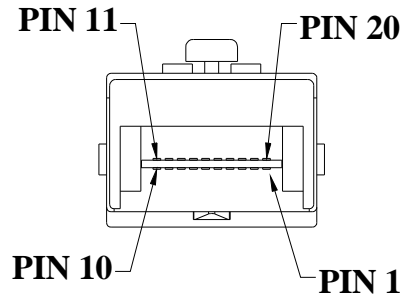
| Pin | Signal Name | Description |
|-----|-------------|-------------|
| 1 | $T_{GND}$ | Transmit Ground |
| 2 | TX_FAULT | Transmit Fault |
| 3 | TX_DISABLE | Transmit Disable |
| 4 | MOD_DEF (2) | SDA Serial Data Signal |
| 5 | MOD_DEF (1) | SCL Serial Clock Signal |
| 6 | MOD_DEF (0) | TTL Low |
| 7 | RATE SELECT | Open Circuit |
| 8 | RX_LOS | Receiver Loss of Signal, TTL High, open collector |
| 9 | $R_{GND}$ | Receiver Ground |
| 10 | $R_{GND}$ | Receiver Ground |
| 11 | $R_{GND}$ | Receiver Ground |
| 12 | RX− | Receive Data Bar, Differential PECL, ac coupled |
| 13 | RX+ | Receive Data, Differential PECL, ac coupled |
| 14 | $R_{GND}$ | Receiver Ground |
| 15 | $V_{CCR}$ | Receiver Power Supply |
| 16 | $V_{CCT}$ | Transmitter Power Supply |
| 17 | $T_{GND}$ | Transmitter Ground |
| 18 | TX+ | Transmit Data, Differential PCEL, ac coupled |
| 19 | TX− | Transmit Data Bar, Differential PCEL, ac coupled |
| 20 | $T_{GND}$ | Transmitter Ground |

## Eye Safety Mark

The LS4 series singlemode transceiver is a class 1 laser product. It complies with EN 60825-1 and FDA 21 CFR 1040.10 and 1040.11. In order to meet laser safety requirements the transceiver shall be operated within the Absolute Maximum Ratings.

*Caution*
**All adjustments have been done at the factory before the shipment of the devices. No maintenance and user serviceable part is required. Tampering with and modifying the performance of the device will result in voided product warranty.**

**Required Mark**

Class 1 Laser Product
Complies with
21 CFR 1040.10 and 1040.11

Note : All information contained in this document is subject to change without notice.