



## 2.5Gbps 1270nm~1450nm SMF 30dB CWDM SFP Optical Transceiver with Duplex LC Connector

### CS13xxD-48F-3U1-TC-LD



#### DESCRIPTION

The CS13xxD-48F-3U1-TC-LD duplex SFP (Small Form Pluggable) optical transceivers are high performance, cost effective optical transceiver modules support data rates up to 2.5Gb/s. They provide 30dB power budget over single mode fiber. There are ten center wavelengths available from 1270nm to 1450nm with 20nm channel spacing.

#### FEATURES

- Compliant with SFF8472 diagnostic monitoring interface
- Industry standard small form pluggable (SFP) package
- Multi-Rate
- With APD
- Duplex LC connector
- Differential inputs and outputs
- Hot pluggable
- Class 1 laser product compliant with EN 60825-1
- Single power supply 3.3V
- TTL signal detect indicator
- Input/Output: AC/AC
- Operating case temperature range: 0°C to 70°C
- 30dB power budget

#### APPLICATIONS

- CWDM Network

#### PRODUCT OVERVIEW

| PART NUMBER           | WAVELENGTH | OPERATING TEMPERATURE |
|-----------------------|------------|-----------------------|
| CS1327D-48F-3U1-TC-LD | 1270nm     | 0°C to 70°C           |
| CS1329D-48F-3U1-TC-LD | 1290nm     | 0°C to 70°C           |
| CS1331D-48F-3U1-TC-LD | 1310nm     | 0°C to 70°C           |
| CS1333D-48F-3U1-TC-LD | 1330nm     | 0°C to 70°C           |
| CS1335D-48F-3U1-TC-LD | 1350nm     | 0°C to 70°C           |
| CS1337D-48F-3U1-TC-LD | 1370nm     | 0°C to 70°C           |
| CS1339D-48F-3U1-TC-LD | 1390nm     | 0°C to 70°C           |
| CS1341D-48F-3U1-TC-LD | 1410nm     | 0°C to 70°C           |
| CS1343D-48F-3U1-TC-LD | 1430nm     | 0°C to 70°C           |
| CS1345D-48F-3U1-TC-LD | 1450nm     | 0°C to 70°C           |

**DIAGNOSTICS**

| PARAMETER    | RANGE      | ACCURACY | UNIT | CALIBRATION |
|--------------|------------|----------|------|-------------|
| Temperature  | -10 to 85  | ±3       | °C   | External    |
| Voltage      | 3.1 to 3.5 | ±0.1     | V    |             |
| Bias Current | 0 to 90    | ±10%     | mA   |             |
| TX Power     | 0 to +5    | ±3 dB    | dBm  |             |
| RX Power     | -28 to -9  | ±3 dB    | dBm  |             |

**ABSOLUTE MAXIMUM RATINGS**

| PARAMETER           | SYMBOL          | MIN  | MAX             | UNIT |
|---------------------|-----------------|------|-----------------|------|
| Storage Temperature | T <sub>S</sub>  | -40  | 85              | °C   |
| Supply Voltage      | V <sub>CC</sub> | -0.5 | 4.0             | V    |
| Input Voltage       | V <sub>IN</sub> | -0.5 | V <sub>CC</sub> | V    |

**RECOMMENDED OPERATING CONDITIONS**

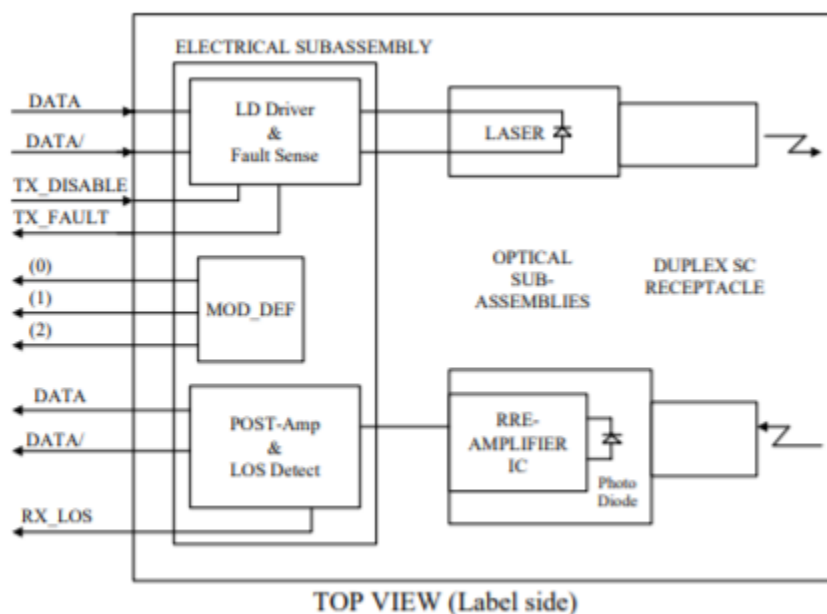
| PARAMETER                  | SYMBOL                            | MIN | MAX | UNIT |
|----------------------------|-----------------------------------|-----|-----|------|
| Case Operating Temperature | T <sub>C</sub>                    | 0   | 70  | °C   |
| Supply Voltage             | V <sub>CC</sub>                   | 3.1 | 3.5 | V    |
| Supply Current             | I <sub>TX</sub> + I <sub>RX</sub> | -   | 300 | mA   |

**TRANSMITTER ELECTRO-OPTICAL CHARACTERISTICS (V<sub>CC</sub> = 3.1V to 3.5V, T<sub>C</sub> = 0°C to 70°C)**

| PARAMETER                                 | SYMBOL                                                                      | MIN    | TYP. | MAX    | UNIT  | NOTES   |
|-------------------------------------------|-----------------------------------------------------------------------------|--------|------|--------|-------|---------|
| Output Optical Power<br>9/125um fiber     | P <sub>out</sub>                                                            | +0     | -    | +5     | dBm   | Average |
| Extinction Ratio                          | ER                                                                          | 8.2    | -    | -      | dB    |         |
| Center Wavelength (1270nm)                | λ <sub>C</sub>                                                              | 1264.5 | -    | 1277.5 | nm    |         |
| Center Wavelength (1290nm)                |                                                                             | 1284.5 | -    | 1297.5 |       |         |
| Center Wavelength (1310nm)                |                                                                             | 1304.5 | -    | 1317.5 |       |         |
| Center Wavelength (1330nm)                |                                                                             | 1324.5 | -    | 1337.5 |       |         |
| Center Wavelength (1350nm)                |                                                                             | 1344.5 | -    | 1357.5 |       |         |
| Center Wavelength (1370nm)                |                                                                             | 1364.5 | -    | 1377.5 |       |         |
| Center Wavelength (1390nm)                |                                                                             | 1384.5 | -    | 1397.5 |       |         |
| Center Wavelength (1410nm)                |                                                                             | 1404.5 | -    | 1417.5 |       |         |
| Center Wavelength (1430nm)                |                                                                             | 1424.5 | -    | 1437.5 |       |         |
| Center Wavelength (1450nm)                |                                                                             | 1444.5 | -    | 1457.5 |       |         |
| Spectral Width (-20dB)                    | Δλ                                                                          | -      | -    | 0.7    | nm    |         |
| Side Mode Suppression Ratio               | SMSR                                                                        | 30     |      |        | dB    |         |
| Output Eye                                | Compliant with Telcordia GR-253-CORE Issue 3 and ITU-T recommendation G-957 |        |      |        |       |         |
| Differential Input Voltage                | V <sub>DIFF</sub>                                                           | 0.4    | -    | 2.0    | V     |         |
| Max. P <sub>out</sub> TX-DISABLE Asserted | P <sub>OFF</sub>                                                            | -      | -    | -45    | dBm   |         |
| Optical Path Dispersion Penalty           |                                                                             |        |      | 2      | dB    |         |
| Maximum Dispersion                        |                                                                             |        |      | 1680   | ps/nm |         |

**RECEIVER ELECTRO-OPTICAL CHARACTERISTICS ( $V_{CC} = 3.1V$  to  $3.5V$ ,  $T_c = 0^{\circ}C$  to  $70^{\circ}C$ )**

| PARAMETER                                  | SYMBOL      | MIN  | TYP. | MAX      | UNIT | NOTES                    |
|--------------------------------------------|-------------|------|------|----------|------|--------------------------|
| Optical Input Power – maximum              | $P_{IN}$    | -8   | -    | -        | dBm  | $BER < 10^{-12}$         |
| RX Sensitivity @2.67 Gb/s                  | $P_{IN}$    | -    | -    | -30      | dBm  | PRBS23, $BER < 10^{-10}$ |
| RX Sensitivity @OC-48                      | $P_{IN}$    | -    | -    | -30      | dBm  | PRBS23, $BER < 10^{-10}$ |
| RX Sensitivity @2xFC                       | $P_{IN}$    | -    | -    | -30      | dBm  | PRBS7, $BER < 10^{-12}$  |
| RX Sensitivity @GbE                        | $P_{IN}$    | -    | -    | -30      | dBm  | PRBS7, $BER < 10^{-12}$  |
| RX Sensitivity @OC-12                      | $P_{IN}$    | -    | -    | -30      | dBm  | PRBS23, $BER < 10^{-10}$ |
| RX Sensitivity @OC-3                       | $P_{IN}$    | -    | -    | -30      | dBm  | PRBS23, $BER < 10^{-10}$ |
| RX Sensitivity @Fast Ethernet              | $P_{IN}$    | -    | -    | -30      | dBm  | PRBS7, $BER < 10^{-10}$  |
| Operating Center Wavelength                | $\lambda_c$ | 1260 | -    | 1460     | nm   |                          |
| Optical Return Loss                        | ORL         | -27  | -    | -        | dB   |                          |
| Signal Detect-Asserted                     | $P_A$       | -    | -    | -28      | dBm  |                          |
| Signal Detect-Deasserted                   | $P_D$       | -45  | -    | -        | dBm  |                          |
| Differential Output Voltage                | $V_{DIFF}$  | 0.5  | -    | 1.2      | V    |                          |
| Receiver Loss of Signal Output Voltage-Low | RX_LOSL     | 0    | -    | 0.5      | V    |                          |
| Receiver Loss of Signal Output-High        | RX_LOSH     | 2.4  | -    | $V_{CC}$ | V    |                          |

**BLOCK DIAGRAM OF TRANSCEIVER**

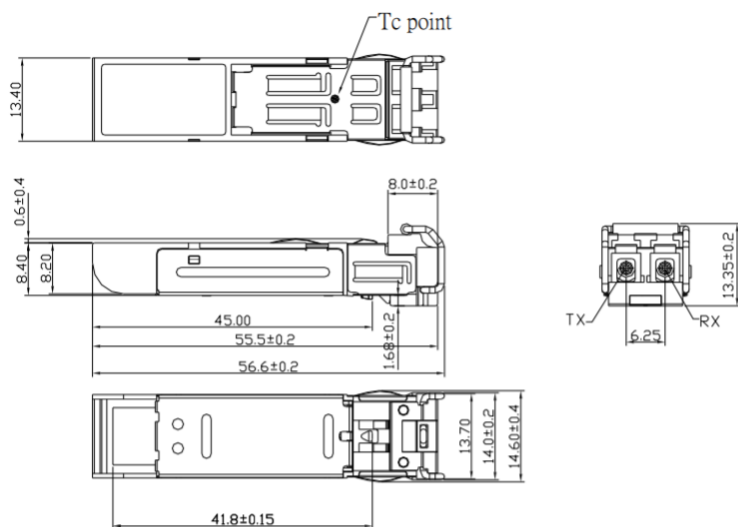
**Transmitter Section** - The transmitter section consists of an InGaAsP laser in an eye safe optical subassembly (OSA) which mates to the fiber cable. The laser OSA is driven by a LD driver IC which converts differential input LVPECL logic signals into an analog laser driving current.

**TX\_DISABLE** - The TX\_DISABLE signal is high (TTL logic “1”) to turn off the laser output. The laser will turn on when TX\_DISABLE is low (TTL logic “0”).

**Receiver Section** - The receiver utilizes an APD photodiode mounted together with a trans-impedance preamplifier IC in an OSA. This OSA is connected to a circuit providing post-amplification quantization, and optical signal detection.

**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.

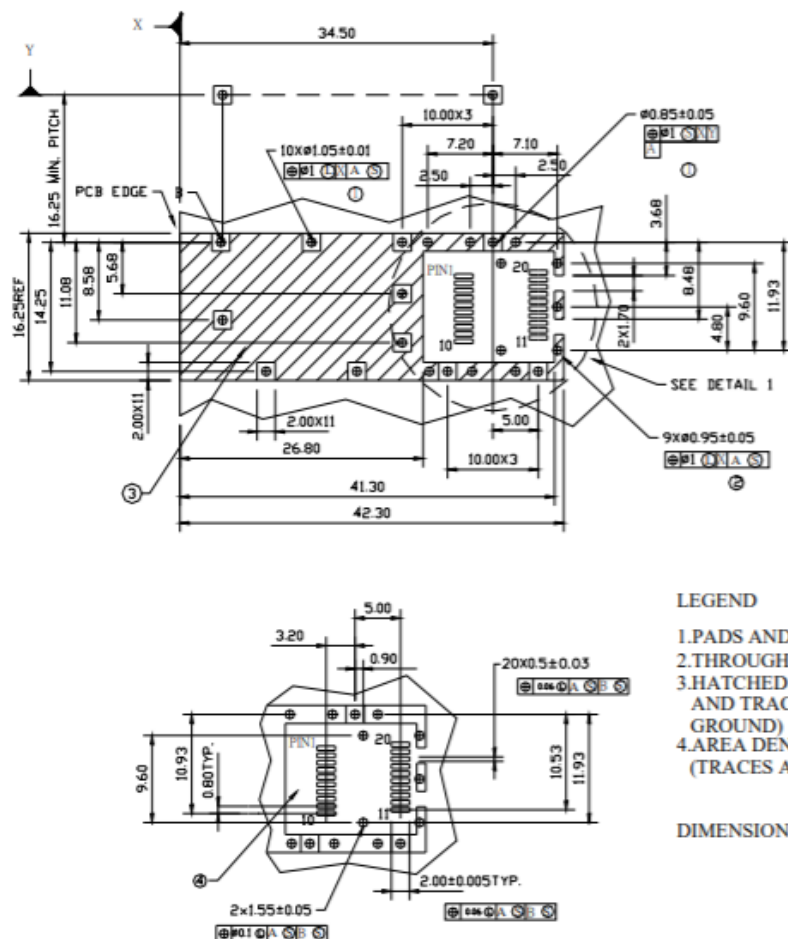
## DIMENSIONS



DIMENSIONS ARE IN MILLIMETERS

ALL DIMENSIONS ARE  $\pm 0.1\text{mm}$  UNLESS OTHERWISE SPECIFIED

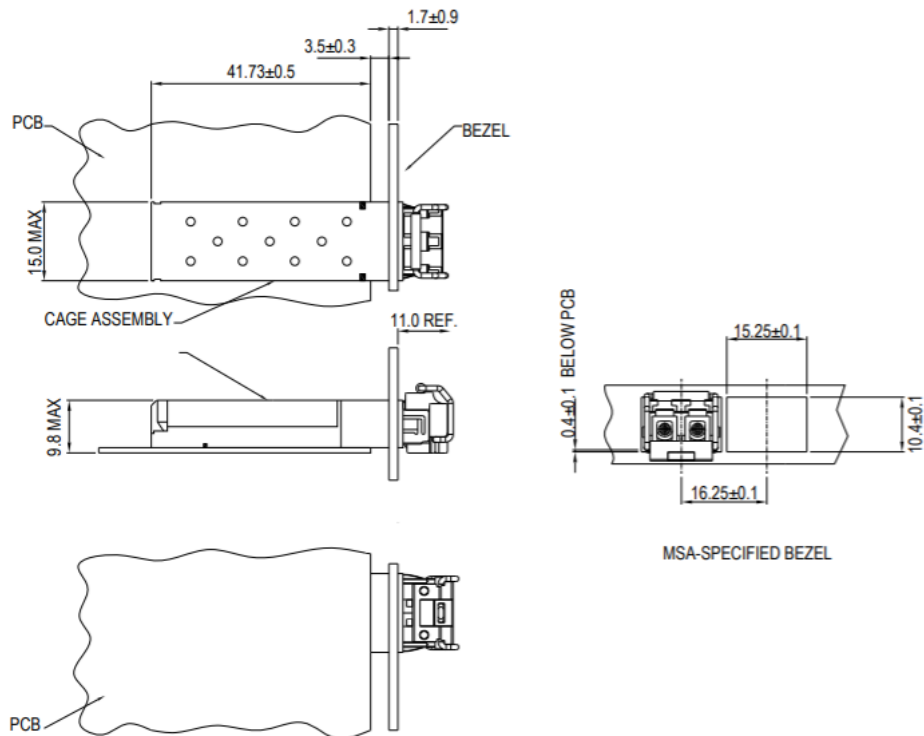
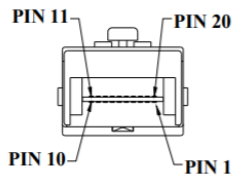
## SFP HOST BOARD MECHANICAL LAYOUT



## 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

**ASSEMBLY DRAWING (unit: mm)****PIN ASSIGNMENT**

| PIN | SIGNAL NAME      | DESCRIPTION                                       | PIN | SIGNAL NAME      | DESCRIPTION                                 |
|-----|------------------|---------------------------------------------------|-----|------------------|---------------------------------------------|
| 1   | T <sub>GND</sub> | Transmit Ground                                   | 11  | R <sub>GND</sub> | Receiver Ground                             |
| 2   | TX_FAULT         | Transmit Fault                                    | 12  | RX-              | Receive Data Bar, Differential, ac coupled  |
| 3   | TX_DISABLE       | Transmit Disable                                  | 13  | RX+              | Receive Data, Differential, ac coupled      |
| 4   | MOD_DEF (2)      | SDA Serial Data Signal                            | 14  | R <sub>GND</sub> | Receiver Ground                             |
| 5   | MOD_DEF (1)      | SCL Serial Clock Signal                           | 15  | V <sub>CCR</sub> | Receiver Power Supply                       |
| 6   | MOD_DEF (0)      | TTL Low                                           | 16  | V <sub>CCT</sub> | Transmitter Power Supply                    |
| 7   | RATE SELECT      | Open Circuit                                      | 17  | T <sub>GND</sub> | Transmitter Ground                          |
| 8   | RX_LOS           | Receiver Loss of Signal, TTL High, open collector | 18  | TX+              | Transmit Data, Differential, ac coupled     |
| 9   | R <sub>GND</sub> | Receiver Ground                                   | 19  | TX-              | Transmit Data Bar, Differential, ac coupled |
| 10  | R <sub>GND</sub> | Receiver Ground                                   | 20  | T <sub>GND</sub> | Transmitter Ground                          |

**ADDITIONAL NOTES**

- Avoid eye or skin exposure to laser radiations.
- The device is sensitive to electro-static discharge (ESD). The device should be handled with ESD proof tools. To assemble the device on PCB, proper grounding is required to prevent ESD.
- Specifications are subject to change without notice.

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