# 2.5 Gbps Single Mode SFF LC Transceiver

## C-1X-2500(C)-FDFB-SLC4

**Features**

- Duplex LC Single Mode Transceiver
- Small Form Factor Multi-sourced 2x5 Pin Package
- Complies with SONET OC48 / SDH STM-16
- 1310 nm / 1550 nm Wavelength, DFB Laser
- Single +3.3V Power Supply
- LVPECL / CML Differential Inputs and Outputs
- LVTTL Signal Detection Output (C-1X-2500C-FDFB-SLC4)
- LVPECL Signal Detection Output (C-1X-2500-FDFB-SLC4)
- LVTTL Tx Disable Input
- Temperature Range: 0 to 70 °C
- Class 1 Laser International Safety Standard IEC 825 Compliant
- Solderability to MIL-STD-883, Method 2003
- Pin Coating is Sn / Pb with minimum 2% Pb content
- Flammability to UL94V0
- Humidity RH 5-85% (5-95% short term) to IEC 68-2-3
- Complies with Bell core GR-468
- Uncooled laser diode with MQW structure

**Absolute Maximum Rating**

| Parameter | Symbol | Min. | Max. | Unit | Note |
|---|---|---|---|---|---|
| Power Supply Voltage | $V_{cc}$ | 0 | 3.6 | V | |
| Output Current | $I_{out}$ | 0 | 30 | mA | |
| Soldering Temperature | - | - | 260 | °C | 10 seconds on leads only |
| Storage Temperature | $T_{stg}$ | -40 | 85 | °C | |

**Recommended Operating Condition**

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Power Supply Voltage | $V_{cc}$ | 3.1 | 3.3 | 3.5 | V |
| Operating Temperature | $T_{opr}$ | 0 | - | 70 | °C |
| Data rate | | - | 2488 | - | Mbps |

**Transmitter Specifications**

| Parameter | Symbol | Min | Typical | Max | Unit | Notes |
|---|---|---|---|---|---|---|
| **Optical** | | | | | | |
| Optical Transmit Power | $P_o$ | 0 | - | +5 | dBm | |
| Output center Wavelength | λ | 1260 | 1310 | 1360 | nm | C-13-2500(C)-FDFB-SLC4 |
| Output center Wavelength | λ | 1500 | 1550 | 1580 | nm | C-15-2500(C)-FDFB-SLC4 |
| Output Spectrum Width | Δλ | - | - | 1 | nm | -20 dB width |
| Side Mode Suppression Ratio | Sr | 30 | 35 | - | dBm | CW, $P_O$=5mW |
| Extinction Ratio | ER | 8.2 | - | - | dB | |
| Output Eye | | Compliant with GR-253-CORE | | | | |
| Optical Rise Time | tr | - | - | 130 | ps | 20% to 80% Values |
| Optical Fall Time | tf | - | - | 130 | ps | 20% to 80% Values |
| Relative Intensity Noise | RIN | - | - | -120 | dB/Hz | |
| Total Jitter | TJ | - | - | 0.18 | ns | Measured with $2^{23}$-1 PRBS with 72 ones and 72 zeros |


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**Transmitter Specifications**

| Parameter | Symbol | Min | Typical | Max | Unit | Notes |
|---|---|---|---|---|---|---|
| **Electrical** | | | | | | |
| Power Supply Current | Icc | - | - | 160 | mA | Maximum current is specified at Vcc= Maximum @ maximum temperature |
| TX_DISABLE Input Voltage-Low | $V_{IL}$ | 0 | - | 0.8 | V | Transmitter on |
| TX_DISABLE Input Voltage-High | $V_{IH}$ | 2 | - | Vcc | V | Transmitter Disabled |
| Data Input Voltage-Single Ended | VDIN | 250 | | 1200 | mV (p-p) | AC coupled inputs |

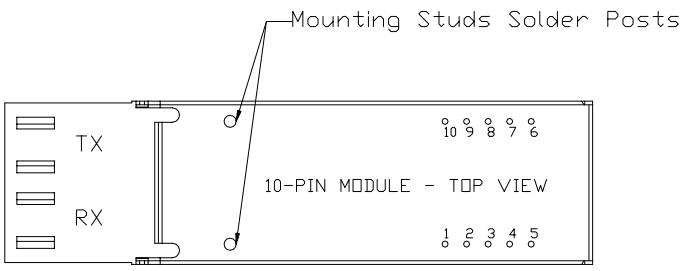
**Receiver Specifications**

| Parameter | Symbol | Min | Typical | Max | Unit | Notes |
|---|---|---|---|---|---|---|
| **Optical** | | | | | | |
| Sensitivity | - | - | - | -20 | dBm | Measured with $2^{23}$-1 PRBS, BER = $10^{-10}$ |
| Maximum Input Power | $P_{in}$ | 0 | - | - | dBm | |
| Signal Detect-Asserted | Pa | - | - | -20 | dBm | Measured on transition: low to high |
| Signal Detect-Deasserted | Pd | -38 | - | - | dBm | Measured on transition: high to low |
| Signal Detect-Hysteresis | Pa-Pd | 1 | - | - | dB | |
| Wavelength of Operation | | 1100 | - | 1600 | nm | |
| Reflectance | | - | - | -27 | dB | |

**Receiver Specifications**

| Parameter | Symbol | Min | Typical | Max | Unit | Note |
|---|---|---|---|---|---|---|
| **Electrical** | | | | | | |
| Power Supply Current | $I_{CC}$ | - | - | 100 | mA | The current excludes the output load current |
| Data Output Voltage-Single-ended | $V_{OH}$- $V_{oL}$ | 300 | - | 900 | mV | AC coupled |
| Signal Detect Output Voltage-Low | $V_{SDL}$-$V_{cc}$ | -2.0 | - | -1.58 | V | C-1X-2500-FDFB-SLC4 |
| Signal Detect Output Voltage-High | $V_{SDH}$- $V_{cc}$ | -1.1 | - | -0.74 | V | |
| Signal Detect Output Voltage-Low | $V_{SDL}$-$V_{cc}$ | - | - | 0.5 | V | C-1X-2500C-FDFB-SLC4 |
| Signal Detect Output Voltage-High | $V_{SDH}$- $V_{cc}$ | 2.0 | - | - | V | |

## Connection Diagram




| PIN | Symbol | Notes |
|---|---|---|
| 1 | RxGND | Directly connect this pin to the receiver ground plane |
| 2 | TxVcc | +3.3 V dc power for the receiver section |
| 3 | SD | Active high on this indicates a received optical signal(LVPECL/LVTTL) |
| 4 | RD- | Receiver Data Out Bar (LVPECL) |
| 5 | RD+ | Receiver Dat Out (LVPECL) |
| 6 | TxVcc | +3.3 V dc power for the transmitter section |
| 7 | TxGND | Directly connect this pin to the transmitter ground plane |
| 8 | TxDIS | Transmitter disable (LVTTL) |
| 9 | TD+ | Transmitter Data In (LVPECL) |
| 10 | TD- | Transmitter Data In Bar (LVPECL) |
| Attaching Posts | | The attaching posts are at case potential and may be connected to chassis ground. They are isolated from circuit ground. |

## Recommended Circuit Schematic

Inputs to the C-1X-2500(C)-FDFB-SLC4 series transmitters are AC coupled and internally terminated through 50 ohms to AC ground. These transceivers can operate with LVPECL or CML logic levels. The input signal must have at least a 200 mV peak to (single ended) signal swing. Output from the receiver section of the module is also AC coupled and is expected to drive into 50 ohm load. Different termination strategies may be required depending on the particular Serializer / Deserializer chip set used.

The C-1X-2500(C)-FDFB-SLC4 series product family are designed with AC coupled data inputs and outputs to provide the following advantages:

- Close positioning of SERDES with respect to transceiver; allows for shorter line lengths and at gigabit speeds reduces EMI.
- Minimum number of external components.
- Internal termination reduces the potential for unterminated stubs which would otherwise increase jitter and reduce transmission margin.

Figure 1 & Figure 2 illustrates the recommended transmit and receive data line trminations for SERDES with CML and LVPECL Inputs / Outputs respectively.

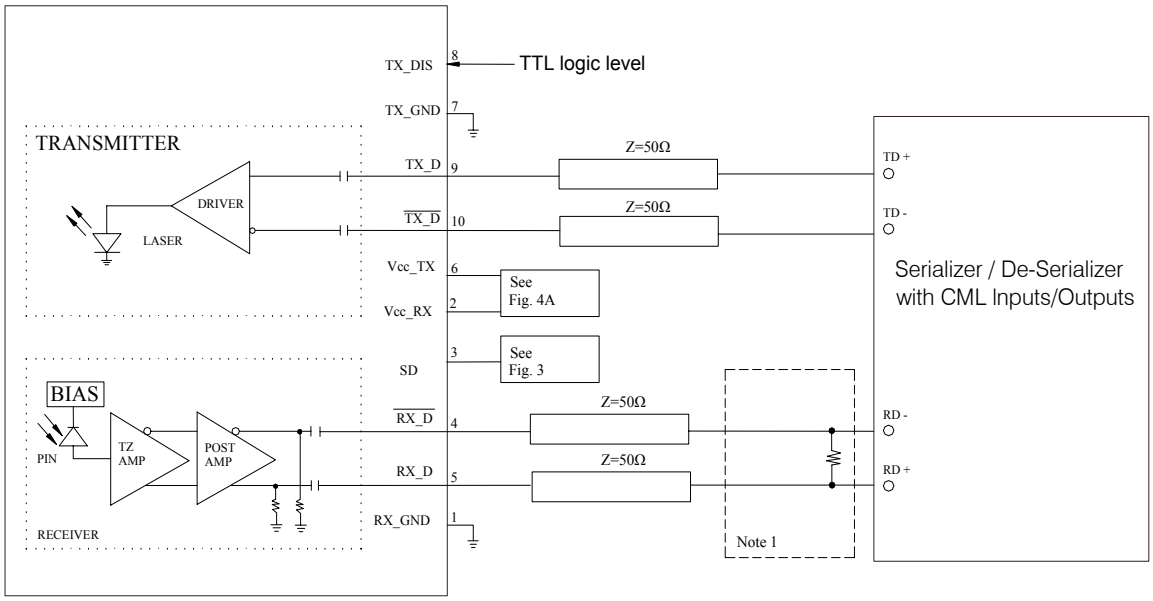



Figure 1.Recommended TRANSMIT and RECEIVE Data Terminations for SERDES with CML I/Os.

Note 1. Consult SERDES manufacturer's data sheet and application data for appropriate receiver input biasing network. Some deserializer inputs are internally terminated and may not need external termination resistors.

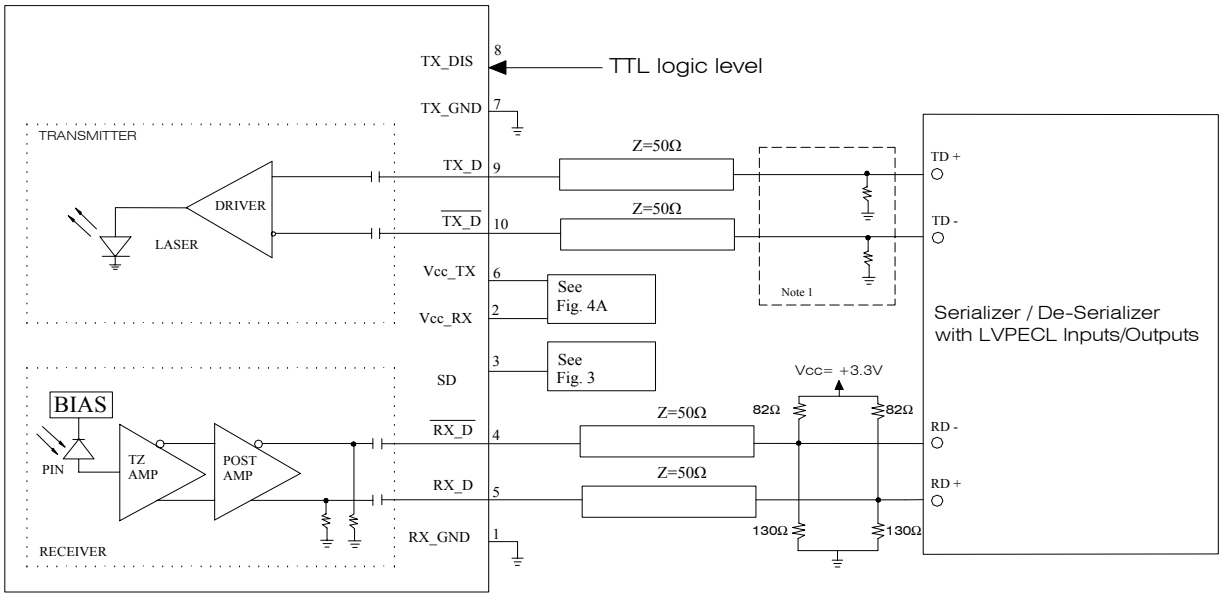



Figure 2.Recommended TRANSMIT and RECEIVE Data Terminations for SERDES with LVPRCL I/Os.

Note 1. Consult SERDES manufacturer's application information for biasing required for Tx outputs. Some serializer outputs are internally biased and may not need external bias resistors.

## Signal Detect

The C-1X-2500(C)-FDFB-SLC4 transceivers are equipped with LVTTL / LVPECL signal detect outputs. The standard LVTTL output eliminates the need for a LVPECL to LVTTL level shifter in most in most applications.

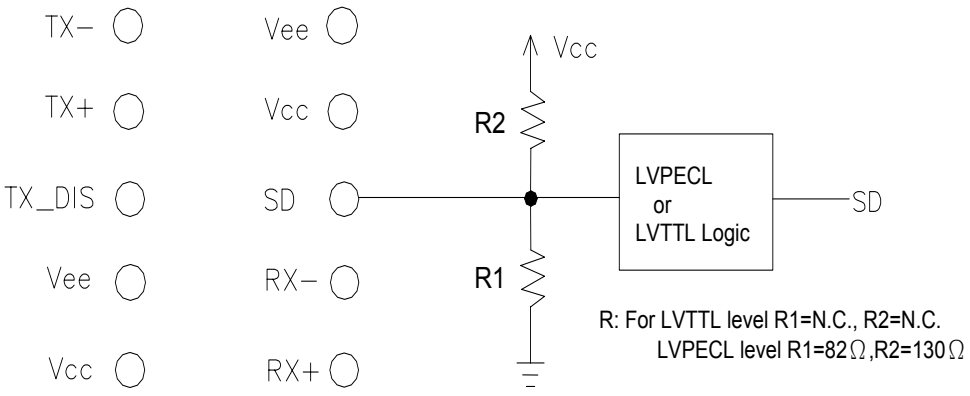
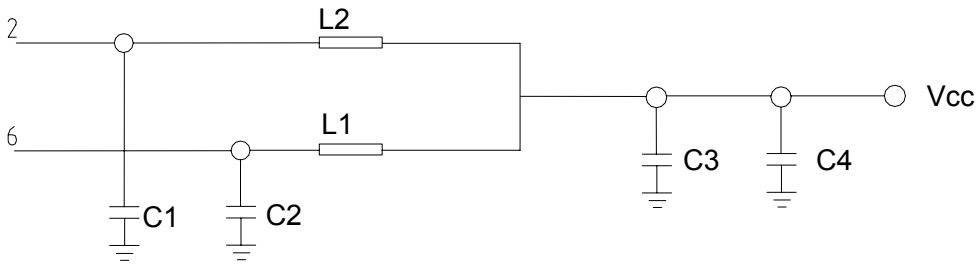



Figure 3: Signal Detect

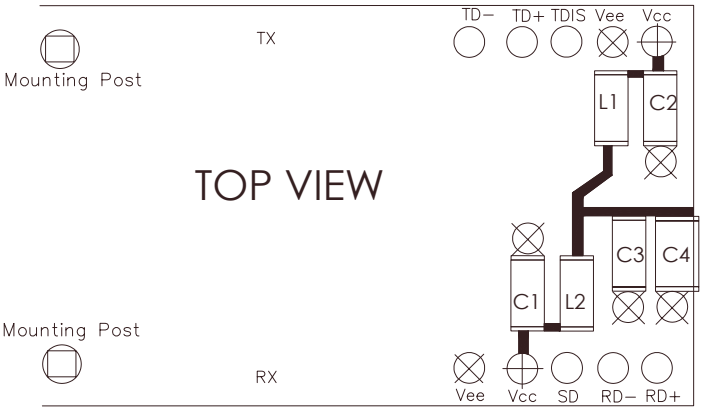
## Power Coupling

A suggested layout for power and ground connections is given in figure 4B below. Connections are made via separate voltage and ground planes. The mounting posts are at case ground and should not be connected to circuit ground. The mounting posts are at case ground and should not be connected to circuit ground. The ferrite bead should provide a real impedance of 50 to 100 ohms at 100 to 1000 MHz. Bypass capacitors should be placed as close to the 10-pin connector as possible.




VALUES:
C1, C2 = 1000pF,
C3, = 0.1 uF
C4, = 10 uF,
L1, L2 = Real impednce of 50 to 100 Ohms to 1000 MHz.

Figure 4A: Suggested Power Coupling-Electrical Schematic




VALUES:
C1, C2 = 1000pF,
C3, = 0.1uF
C4, = 10uF,
L1, L2 = Real impedance of 50 to 100 Ohms to 1000MHz.

NOTE :
1.) Components shown ore placed on the bottom layer and are viewed through the board.

LEHEND:
Vcc PLANE CONNECTION
CIRCUIT GROUND PLANE CONNECTION
CASE GROUND

Figure 4B: Suggested Power Coupling-Component Placement

## Printed Circuit Board Layout Consideration

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 limit. Any unwanted signal currents that couple into the receiver circuitry causes a decrease in the receiver's sensitivity and can also degrades the of the receiver's signal detect (SD) circuit. To minimize the coupling of unwanted noise into the receiver, careful attention must be given to the printed circuit board.

At a minimum, a double-sided printed circuit board (PCB) with a large component side ground plane beneath the transceiver must be used. In applications that include many other high speed devices, a multi-layer PCB is highly recommended. This permits the placement of power and ground on separate layers, which all them to be isolated from the signal lines. Multilayer construction also permits the routing of 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 a pi filter in both the transmitter and receiver power supplies.

## EMI and ESC Consideration

LuminentOIC transceivers offer a metalized plastic case and a special chassis grounding clip. As shown in the drawing, this clip connects the module case to chassis ground then installed flush through the panel cutout. The grounding clip in this way brushes the edge of the cutout in order to make a proper contact. The use of a grounding clip also provides increased electrostatic protection and helps reduce radiated emissions from the module or the host circuit board through the chassis faceplate. The attaching posts are at case potential and may be connected to chassis ground. They should not be connected to circuit ground.

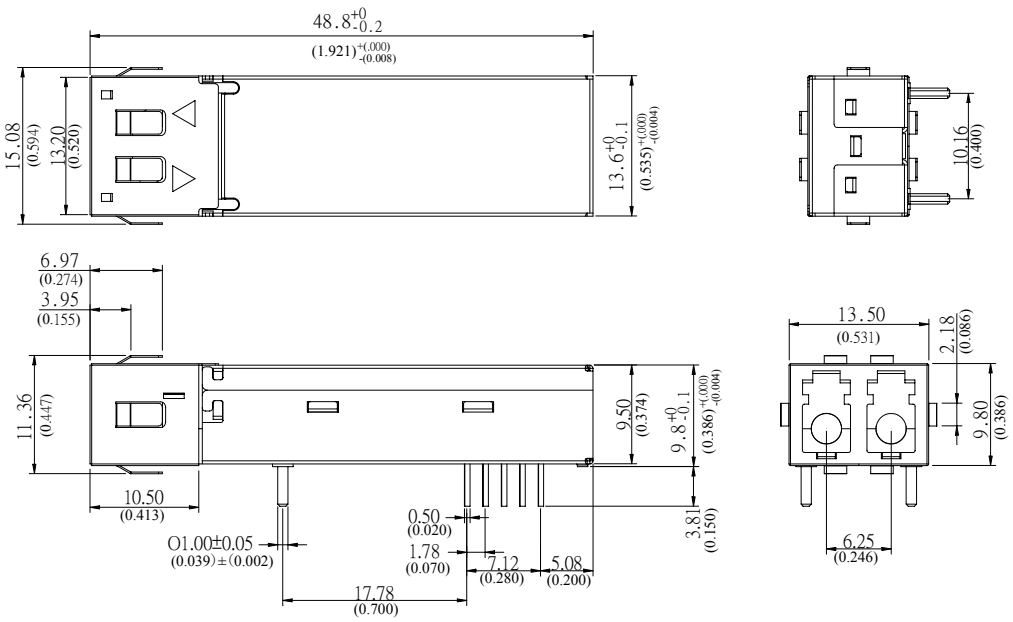
Plastic optical subassemblies are used to further reduce the possibility of radiated emissions by eliminating the metal from the transmitter and receiver diode housings, which extend into connector space. By providing a non-metal receptacle for the optical cable ferrule, the gigabit speed RF electrical signal is isolated form the connector area thus preventing radiated energy leakage from these surfaces to the outside of the panel.

## Laser Safety

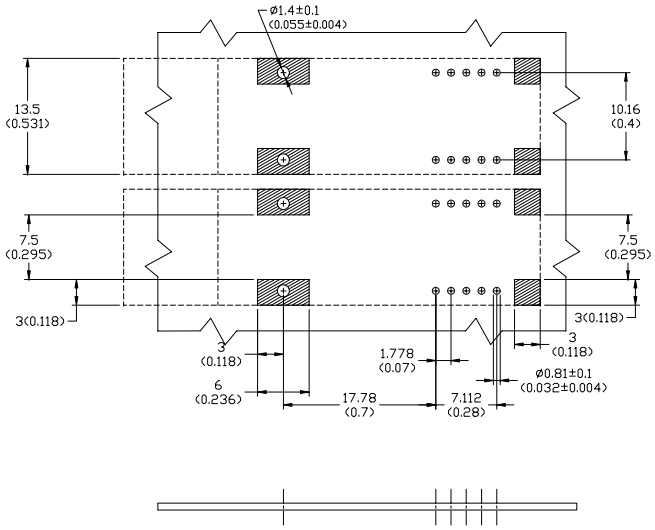
This single mode transceiver is a Class1 laser product. It complies with IEC 825 and FDA 21 CFR 1040.10 and 1040.11.The transceiver must be operated within the specified temperature and voltage limits. The optical ports of the module shall determinate with an optical connector or with a dust plug.

## Package Diagram

Units: mm (inches)



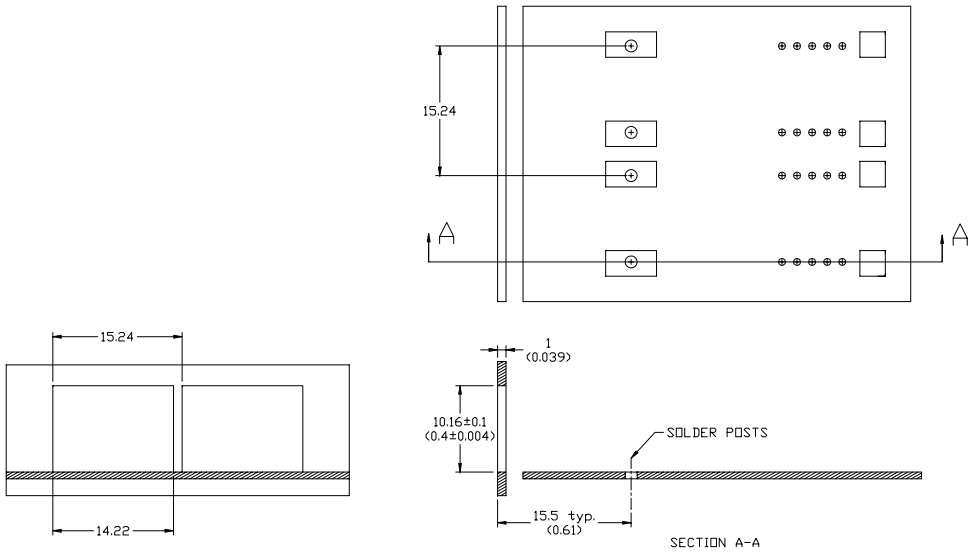
## Recommended Board Layout Hole Pattern




DIMENSION IN MILLIMETER (INCHES)

NOTES:
1.THIS FIGURE DESCRIBE THE RECOMMAND CIRCUIT BOARD LAYOUT FOR THE SFF TRANSCEIVER.
2.THE HATCHED AREAS ARE KEEP-OUT AREAS RESERVED FOR HOUSING STANDOFF. NO METAL TRACES OR GROUND CONNECTION IN KEEP-OUT AREAS.
3.THE MOUNTING STUDS SHOULD BE SOLDERED TO CHASSIS GROUND FOR MECHANICAL INTEGRITY.

## Recommended Panel mounting




DIMENSION IN MILLIMETER (INCHES)

## Ordering Information

Available Options:
C-13-2500-FDFB-SLC4
C-13-2500C-FDFB-SLC4
C-15-2500-FDFB-SLC4
C-15-2500C-FDFB-SLC4

Part numbering Definition:

**C - 1X - 2500(C) - FDFB - S LC 4**

- **13 = Wavelength 1310 nm**
  **15 = Wavelength 1550 nm**
- **Communication protocol**
  **2500 = LVPEVL SD Output**
  **2500C = LVTTL SD Output**
- **+3.3V SFF Transceiver, DFB**
- **Single mode fiber**
- **Connector options**
- **4 = Tx Power 0 to +5 dBm**

## Warnings:

**Handling Precautions:** This device is susceptible to damage as a result of electrostatic discharge (ESD). A static free environment is highly recommended. Follow guidelines according to proper ESD procedures.
**Laser Safety:** Radiation emitted by laser devices can be dangerous to human eyes. Avoid eye exposure to direct or indirect radiation.

## Legal Notes:

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