

## RoHS Compliant 1X9 SC Duplex Receptacle Transceiver Module for Gigabit Ethernet



### Features

- Industry Standard 1 x 9 Footprint and duplex SC Connector interface
- Compliant with Specifications for IEEE 802.3z Gigabit Ethernet
- OPT-1250Bxxx compliant with the 1.0625GBd Fibre Channel 100-SM-LC-L FC-PI Rev.13
- OPT-1250Axxx compliant with the 1.0625GBd Fibre Channel FC-PI 100-M5-SN-I Rev.13
- Single +3.3V or 5V Power Supply
- PECL or TTL Receiver Signal Detect Indicator
- Wave Solderable and Aqueous Washable
- Laser Class 1 Product which comply with the requirements of IEC 60825-1 and IEC 60825-2

### Description

The OPT-1250xxxx series from DELTA is a 1X9 transceiver module designed expressly for high-speed communication applications that require rates of up to 1.25Gbit/sec. It is compliant with the Gigabit Ethernet standards as well as 1x Fiber channel standards.

The OPT-1250xxxx transceivers are provided with the SC receptacle that is compatible with the industry standard SC connector.

The post-amplifier of the OPT-1250xxxx also includes a Signal Detect circuit that provides a PECL or TTL logic-Low output when an unusable optical signal level is detected. (see order information)

The OPT-1250xxxx transceiver is a Class 1 eye safety product. The optical power levels, under normal operation, are at eye safe level.

### Applications

- Gigabit Ethernet/Fast Ethernet
- Switched backplane applications

### Performance

#### OPT-1250AxFxx:

- 850nm VCSEL, up to 500m in 50/125  $\mu$  m MMF
- 850nm VCSEL, up to 220m in 62.5/125  $\mu$  m MMF

#### OPT-1250B2I1x:

- 1310nm FP laser, Data Link up to 5km in 9/125um SMF

#### OPT-1250BxQxx:

- 1310nm FP laser, Data Link up to 10km in 9/125um SMF
- 1310nm FP laser, up to 550m in 50/125  $\mu$  m MMF
- 1310nm FP laser, up to 550m in 62.5/125  $\mu$  m MMF

**Absolute Maximum Ratings**

| Parameter                  | Symbol            | Min. | Typ. | Max. | Unit | Note |
|----------------------------|-------------------|------|------|------|------|------|
| Storage Temperature        | T <sub>S</sub>    | -40  |      | 85   | °C   |      |
| Lead Soldering Temperature | T <sub>SOLD</sub> |      |      | 260  | °C   |      |
| Lead Soldering Time        | t <sub>SOLD</sub> |      |      | 10   | sec. |      |
| Supply Voltage             | V <sub>CC</sub>   | 0    |      | 6    | V    |      |

**Recommended Operating Conditions**

| Parameter                     | Symbol          | Min.  | Typ. | Max.  | Unit | Note |
|-------------------------------|-----------------|-------|------|-------|------|------|
| Ambient Operating Temperature | T <sub>A</sub>  | 0     |      | 70    | °C   | 1    |
| Supply Voltage                | V <sub>CC</sub> |       |      |       | V    |      |
| OPT-1250x1xx                  |                 | 4.75  |      | 5.25  |      |      |
| OPT-1250x2xx, OPT-1250x4xx    |                 | 3.135 |      | 3.465 |      |      |

Note: See ordering information for detail

**Electrical Characteristics**

(At recommended ambient operating temperature, T<sub>A</sub> and supply voltage, V<sub>CC</sub>)

| Parameter                              | Symbol                            | Min.   | Typ. | Max.            | Unit | Note |
|--|-----------------------------------|--------|------|-----------------|------|------|
| Total Supply Current                   | I <sub>CCT</sub>                  |        |      | 300             | mA   |      |
| <b>Transmitter</b>                     |                                   |        |      |                 |      |      |
| Transmitter Data Input Voltage-Low     | V <sub>IL</sub> -V <sub>CC</sub>  | -1.810 |      | -1.475          | V    | 1    |
| Transmitter Data Input Voltage-High    | V <sub>IH</sub> -V <sub>CC</sub>  | -1.165 |      | -0.880          | V    | 1    |
| Transmitter Differential Input Voltage | V <sub>DT</sub>                   | 0.3    |      | 1.6             | V    | 2    |
| <b>Receiver</b>                        |                                   |        |      |                 |      |      |
| Data Output Voltage-Low                | V <sub>OL</sub> -V <sub>CC</sub>  | -1.95  |      | -1.62           | V    | 1    |
| Data Output Voltage-High               | V <sub>OH</sub> -V <sub>CC</sub>  | -1.045 |      | -0.74           | V    | 1    |
| Receiver Differential Output Voltage   | V <sub>DR</sub>                   | 0.5    | 0.7  | 1.2             | V    | 2    |
| Output Data Rise/Fall Time             | t <sub>r</sub> /t <sub>f</sub>    |        |      | 0.4             | ns   | 3    |
| PECL SD Output                         |                                   |        |      |                 |      |      |
| LOW level output voltage               | V <sub>SDH</sub> -V <sub>CC</sub> | -1.84  |      | -1.60           | V    | 4    |
| HIGH level output voltage              | V <sub>SDL</sub> -V <sub>CC</sub> | -1.1   |      | -0.9            |      |      |
| TTL SD Output                          |                                   |        |      |                 |      |      |
| LOW level output voltage               | V <sub>SDH</sub>                  | 2      |      | V <sub>CC</sub> | V    | 5    |
| HIGH level output voltage              | V <sub>SDL</sub>                  | 0      |      | 0.8             |      |      |

**Notes:**

1. For OPT-1250A1F1x, OPT-1250A4F1x, OPT-1250B211x, OPT-1250B2Q1x and OPT-1250B1Q1x.
2. For OPT-1250A2F2x and OPT-1250B4Q2x.
3. These are 20%~80% values
4. For OPT-1250A1F1x, OPT-1250A2F2x, OPT-1250B211x, OPT-1250B1Q1x and OPT-1250B2Q1x
5. For OPT-1250A4F1x and OPT-1250B4Q2x

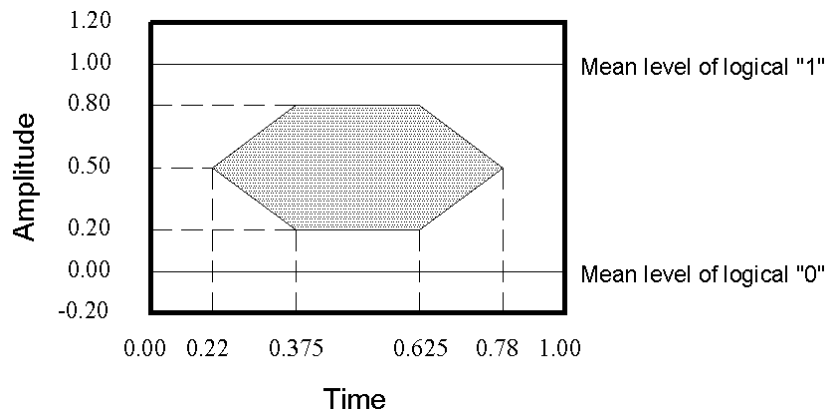
**Single Mode Transceiver (OPT-1250B211x, OPT-1250B1Q1x, OPT-1250B2Q1x, OPT-1250B4Q2x)**

(At recommended ambient operating temperature,  $T_A$  and supply voltage,  $V_{CC}$ ; Data Rate=1.25Gb/sec, PRBS= $2^7-1$  NRZ, 9/125um SMF)

| Parameter   | Symbol  | Min.        | Typ. | Max.     | Unit  | Note |
|---|---|-------------|------|----------|-------|------|
| <b>Transmitter</b>  |   |             |      |          |       |      |
| Output Optical Power (Avg.)<br>OPT-1250Bx1x<br>OPT-1250BxQx | $P_O$   | -12<br>-9.5 |      | -3<br>-3 | dBm   |      |
| Optical Extinction Ratio                                    | ER  | 9           |      |          | dB    |      |
| Center Wavelength   | $c$   | 1270        | 1310 | 1355     | nm    |      |
| Spectral Width (RMS)  |   |             |      | 2.8      | nm    |      |
| Optical Rise/Fall time                                      | $t_r/t_f$   |             |      | 0.26     | ns    | 1    |
| Relative Intensity Noise                                    | RIN   |             |      | -120     | dB/Hz |      |
| Output Eye  | Complies with the IEEE 802.3z/D2 specification, and is class 1 laser eye safety |             |      |          |       |      |
| <b>Receiver</b>   |   |             |      |          |       |      |
| Sensitivity (Avg.)  | $P_{IN}$  |             |      | -19      | dBm   | 2    |
| Input Optical Wavelength                                    |   |             | 1310 |          | nm    |      |
| Signal Detect-Asserted (Avg.)                               | $P_A$   |             |      | -19      | dBm   |      |
| Signal Detect-De-asserted (Avg.)                            | $P_D$   | -35         |      |          | dBm   |      |
| Signal Detect-Hysteresis                                    | $P_A-P_D$   | 0.5         |      |          | dB    |      |
| Receiver saturation power                                   | $P_{SAT}$   | -3          |      |          | dBm   |      |

**Notes:**

- These are 20%~80% values
- The sensitivity is provided at a BER of  $1 \times 10^{-10}$  or better with an input signal consisting of 1250Mb/s,  $2^7-1$  PRBS.


**Mask of the eye diagram for the optical transmit signal**

**Multi-Mode Series Transceiver (OPT-1250A1F1x, OPT-1250A2F2x, OPT-1250A4F1x)**

(At recommended ambient operating temperature,  $T_A$  and supply voltage,  $V_{CC}$ ; Data Rate=1.25Gb/sec, PRBS= $2^7-1$  NRZ, 62.5/125um MMF)

| Parameter                        | Symbol  | Min. | Typ. | Max. | Unit  | Note |
|----------------------------------|---|------|------|------|-------|------|
| <b>Transmitter</b>               |   |      |      |      |       |      |
| Output Optical Power (Avg.)      | $P_O$   | -9.5 |      | -4   | dBm   |      |
| Optical Extinction Ratio         | ER  | 9    |      |      | dB    |      |
| Center Wavelength                | $\lambda_c$   | 830  | 850  | 860  | nm    |      |
| Spectral Width (RMS)             |   |      |      | 0.85 | nm    |      |
| Optical Rise/Fall time           | $t_r/t_f$   |      |      | 0.26 | ns    | 1    |
| Relative Intensity Noise         | RIN   |      |      | -117 | dB/Hz |      |
| Output Eye                       | Complies with the IEEE 802.3z/D2 specification, and is class 1 laser eye safety |      |      |      |       |      |
| <b>Receiver</b>                  |   |      |      |      |       |      |
| Sensitivity (Avg.)               | $P_{IN}$  |      |      | -17  | dBm   | 2    |
| Input Optical Wavelength         |   |      | 850  |      | nm    |      |
| Signal Detect-Asserted (Avg.)    | $P_A$   |      |      | -17  | dBm   |      |
| Signal Detect-De-asserted (Avg.) | $P_D$   | -30  |      |      | dBm   |      |
| Signal Detect-Hysteresis         | $P_A-P_D$   | 0.5  |      |      | dB    |      |
| Receiver saturation power        | $P_{SAT}$   | -4   |      |      | dBm   |      |

**Notes:**

8. These are 20%~80% values
9. The sensitivity is provided at a BER of  $1 \times 10^{-10}$  or better with an input signal consisting of 1250Mb/s,  $2^7-1$  PRBS.


**Mask of the eye diagram for the optical transmit signal**

## Pin Out Table

| PIN | Symbol | Functional description                 |
|-----|--------|--|
| 1   | GND    | Receiver Signal Ground                 |
| 2   | RD (+) | Receiver Data Out (LVPECL)             |
| 3   | RD (-) | Receiver Data Out Bar (LVPECL)         |
| 4   | SD     | Receiver Signal Detect (LVPECL or TTL) |
| 5   | VccR   | Receiver Power Supply,                 |
| 6   | VccT   | Transmitter Power Supply               |
| 7   | TD (-) | Transmitter Data In Bar (LVPECL)       |
| 8   | TD (+) | Transmitter Data In (LVPECL)           |
| 9   | GND    | Transmitter Signal Ground              |

## Pin Descriptions:

### Pin 1 Receiver Signal Ground, GND

Directly connect these pins to the ground plane.

### Pin 2 Receiver Data Out (LVPECL), RD (+)

Receiver Data output (LVPECL), RD (+).

### Pin 3 Receiver Data Out Bar (LVPECL), RD (-)

Receiver Data output (LVPECL), RD (-).

**Pin 4 Receiver Signal Detect (LVPECL/TTL), SD**  
PECL/TTL logic family. Normal Operation: Logic "1" Output  
Fault Condition: Logic "0" Output.

### Pin 5 Receiver Power Supply, VccR

Provide +3.3/5V dc power supply.

### Pin 6 Transmitter Power Supply, VccT

Provide +3.3/5V dc power supply.

### Pin 7 Transmitter Data In Bar (LVPECL), TD (-)

Transmitter Data Input (LVPECL), TD (-)

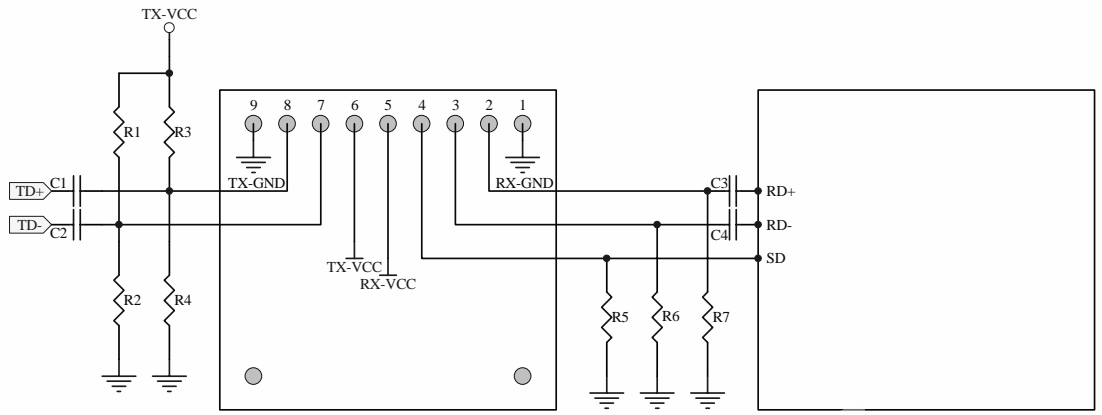
### Pin 8 Transmitter Data In (LVPECL), TD (+)

Transmitter Data Input (LVPECL), TD (+)

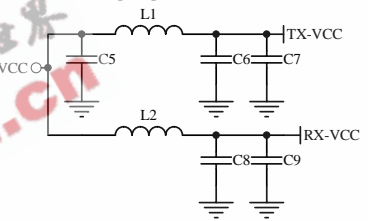
### Pin 9 Transmitter Signal Ground, GND

Directly connect these pins to the ground plane.

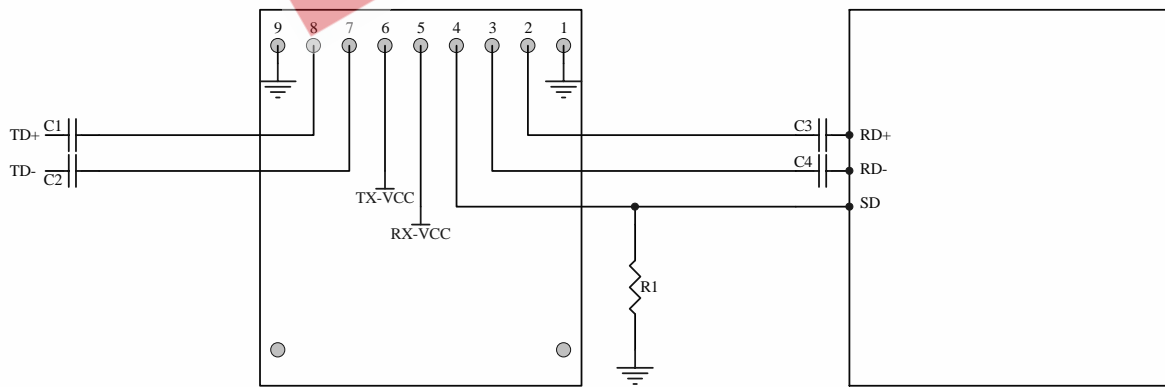
**Recommend Circuit Schematic for Internal DC Coupled Transceivers**



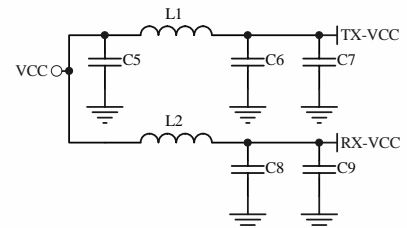
- R1=R3=82 Ohm (3.3V), 68 Ohm (5V)
- R2=R4=130 Ohm (3.3V), 191 Ohm (5V)
- R5=270 Ohm (3.3V, PECL), 510 Ohm (5V, PECL)
- NC (TTL)
- R6=R7=274 Ohm (5V)
- C1=C2=C3=C4=C6=C8=100 nF
- C5=100 uF
- C7=C9=10 uF
- L1=L2=1 uH or ferrite inductor



**Recommend Circuit Schematic for Internal AC Coupled Transceivers**



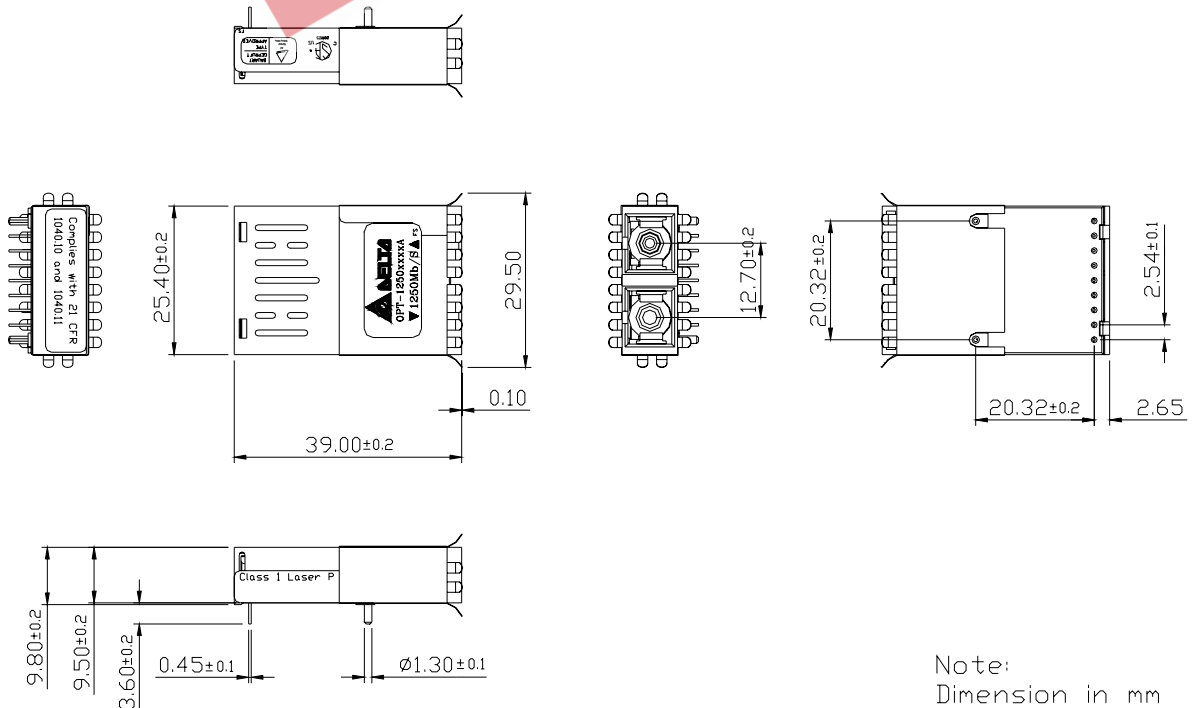
- R1=270 Ohm(3.3V, PECL), 510 Ohm (5V, PECL)
- NC(TTL)
- C1=C2=C3=C4=C6=C8=100 nF
- C5=100 uF
- C7=C9=10 uF
- L1=L2=1 uH or ferrite inductor



Package Outline Drawing (without shielding)



Package Outline Drawing (A type shielding)



Package Outline Drawing (B type shielding)



Package Outline Drawing (C type shielding)





**Regulatory Compliance**

| Feature   | Reference   | Performance  |
|---|---|--|
| Electromagnetic Interference (EMI)                  | FCC Class B<br>EN 55022 Class B (CISPR 22A)   | (1) Satisfied with electrical characteristics of product spec.<br><br>(2) No physical damage |
| Radio Frequency Electromagnetic Field               | EN 61000-4-3<br>IEC 1000-4-3  |  |
| Electrostatic Discharge to the Duplex LC Receptacle | EN 61000-4-2<br>IEC 1000-4-2<br>IEC 801.2   |  |
| Electrostatic Discharge to the Electrical Pins      | MIL-STD-883E Method 3015.7  |  |
| Eye Safety  | US FDA CDRH AEL Class 1<br>EN 60950: 2000<br>EN 60825-1: 1994+A11+A2<br>EN 60825-2: 2000  | CDRH File # 0321539-00<br>TUV Certificate No. R50032471                                      |
| Component Recognition                               | Underwriters Laboratories and Canadian Standards Association Joint Component Recognition for Information Technology Equipment Including Electrical Business Equipment | UL File # E239394  |

**Ordering information**OPT- 1250X<sub>1</sub>X<sub>2</sub>X<sub>3</sub>X<sub>4</sub>X<sub>5</sub>X<sub>6</sub>X<sub>7</sub>**X<sub>1</sub>: Fiber**

A: Multi-mode 850nm  
B: Single-mode 1310nm

**X<sub>5</sub>:**

**RoHS Compliant**  
**Blank:** Non-RoHS Compliant  
**R:** RoHS Compliant

**X<sub>2</sub>: Power Supply Voltage and SD Level**

1: 5.0V, PECL SD Level  
2: 3.3V, PECL SD Level  
4: 3.3V, TTL SD Level

**X<sub>6</sub>: Shielding Type**

**Blank:** Plastic housing  
**A:** A type shielding  
**B:** B type shielding  
**C:** C type shielding

**X<sub>3</sub>: Distance**

F: 500m, 50/125 μm MMF  
I: 5km, 9/125 μm SMF  
Q: 10km, 9/125 μm SMF

**X<sub>7</sub>:**

**Temperature**  
**Blank:** 0 to +70 degree C  
**H:** -10 to +85 degree C

**X<sub>4</sub>:****Data Coupling**

1: 1x9SC DC/DC  
2: 1x9SC AC/AC

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