

## **TS-XP-DXX10-40D**

### **10Gb/s DWDM Single-mode SFP+ Transceiver**

#### **PRODUCT FEATURES**

- Compliant with SFP+ MSA
- Compliant to 802.3ae 10GBASE-ER
- Compliant to SFP+ SFF-8431 and SFF-8432.
- Hot-pluggable SFP footprint
- Built-in digital diagnostic functions
- Maximum Link Length of 40 km
- Single power supply 3.3V
- Class 1 laser product complies with EN 60825-1
- Case temperature range: -5°C to 70°C.
- Power dissipation < 1.5W

#### **APPLICATIONS**

- 10GBASE-ER / EW

#### **DESCRIPTION**

The TRANSCOM TS-XP-DXX10-40D transivers are designed to transmit and receive optical data over single mode optical fiber for link length 40km. Digital diagnostic functions are available via an I2C.This module is designed for single mode fiber and operates at a nominal wavelength of ITU Grid, C Band DWDM wavelength. It is with the SFP+ 20-pin connector to allow hot plug capability. The transmitter section uses a DWDM EML laser and is a class 1 laser compliant according to International Safety Standard IEC-60825.The receiver section uses a PIN detector and a limiting post-amplifier IC.

#### **PRODUCT SELECTION**

TS-XP-DXX10-40D

### C-band $\lambda_c$ Wavelength Guide Pin Descriptions

| Channel | Wavelength (nm)                           | Frequency (THZ) | Channel | Wavelength (nm) | Frequency (THZ) |
|---------|---|-----------------|---------|-----------------|-----------------|
| C13     | 1567.13                                   | 191.30          | C37     | 1547.72         | 193.70          |
| C14     | 1566.31                                   | 191.40          | C38     | 1546.92         | 193.80          |
| C15     | 1565.50                                   | 191.50          | C39     | 1546.12         | 193.90          |
| C16     | 1564.68                                   | 191.60          | C40     | 1545.32         | 194.00          |
| C17     | 1563.86                                   | 191.70          | C41     | 1544.53         | 194.10          |
| C18     | 1563.05                                   | 191.80          | C42     | 1543.73         | 194.20          |
| C19     | 1562.23                                   | 191.90          | C43     | 1542.94         | 194.30          |
| C20     | 1561.42                                   | 192.00          | C44     | 1542.14         | 194.40          |
| C21     | 1560.61                                   | 192.10          | C45     | 1541.35         | 194.50          |
| C22     | 1559.79                                   | 192.20          | C46     | 1540.56         | 194.60          |
| C23     | 1558.98                                   | 192.30          | C47     | 1539.77         | 194.70          |
| C24     | 1558.17                                   | 192.40          | C48     | 1538.98         | 194.80          |
| C25     | 1557.36                                   | 192.50          | C49     | 1538.19         | 194.90          |
| C26     | 1556.55                                   | 192.60          | C50     | 1537.40         | 195.00          |
| C27     | 1555.75                                   | 192.70          | C51     | 1536.61         | 195.10          |
| C28     | 1554.94                                   | 192.80          | C52     | 1535.82         | 195.20          |
| C29     | 1554.13                                   | 192.90          | C53     | 1535.04         | 195.30          |
| C30     | 1553.33                                   | 193.00          | C54     | 1534.25         | 195.40          |
| C31     | 1552.52                                   | 193.10          | C55     | 1533.47         | 195.50          |
| C32     | 1551.72                                   | 193.20          | C56     | 1532.68         | 195.60          |
| C33     | 1550.92                                   | 193.30          | C57     | 1531.90         | 195.70          |
| C34     | 1550.12                                   | 193.40          | C58     | 1531.12         | 195.80          |
| C35     | 1549.32                                   | 193.50          | C59     | 1530.33         | 195.90          |
| C36     | 1548.51                                   | 193.60          | C60     | 1529.55         | 196.00          |
| Non-ITU | Peak wavelength between 1528.77nm-1567.13 |                 | C61     | 1528.77         | 196.10          |

## I. Absolute Maximum Ratings

| Parameter                  | Symbol | Min  | Typ | Max | Unit | Ref. |
|----------------------------|--------|------|-----|-----|------|------|
| Maximum Supply Voltage     | Vcc    | -0.5 |     | 3.6 | V    |      |
| Storage Temperature        | TS     | -40  |     | 85  | °C   |      |
| Case Operating Temperature | Tcase  | -5   |     | 70  | °C   |      |

## II. Electrical Characteristics (Tcase = -5 to 70°C, VCC = 3.14 to 3.46 Volts)

| Parameter | Symbol | Min | Typ | Max | Unit | Ref. |
|-----------|--------|-----|-----|-----|------|------|
|-----------|--------|-----|-----|-----|------|------|

|                                |            |         |     |          |    |   |
|--------------------------------|------------|---------|-----|----------|----|---|
| Supply Voltage                 | Vcc        | 3.14    | 3.3 | 3.46     | V  |   |
| Supply Current                 | Icc        |         | 350 | 450      | mA |   |
| <b>Transmitter</b>             |            |         |     |          |    |   |
| Input differential impedance   | ohm        |         | 100 |          | Ω  | 1 |
| Differential data input swing  | Vin,pp     | 120     |     | 850      | mV |   |
| Transmit Disable Voltage       | VD         | Vcc-1.3 |     | Vcc      | V  |   |
| Transmit Enable Voltage        | VEN        | Vee     |     | Vee+ 0.8 | V  | 2 |
| TX_FAULT Voltage-High          |            | Vcc-1.3 |     | Vcc      | V  |   |
| TX_FAULT Voltage-Low           |            | Vee     |     | Vee+ 0.8 | V  |   |
| Transmit Disable Assert Time   |            |         |     | 10       | us |   |
| <b>Receiver</b>                |            |         |     |          |    |   |
| Differential data output swing | Vout,pp    | 350     |     | 850      | mV | 3 |
| Data output rise time          | tr         | 30      |     |          | ps | 4 |
| Data output fall time          | tf         | 30      |     |          | ps | 4 |
| LOS Fault                      | VLOS fault | Vcc-1.3 |     | VcchOST  | V  | 5 |
| LOS Normal                     | VLOS norm  | Vee     |     | Vee+0.8  | V  | 5 |

**Notes:**

1. Connected directly to TX data input pins. AC coupled thereafter.
2. Or open circuit.
3. Into 100 ohms differential termination.
4. These are unfiltered 20-80% values
5. Loss Of Signal is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.

**III. Optical Characteristics** (T<sub>case</sub> = -5 to 70°C, VCC = 3.14 to 3.46 Volts)

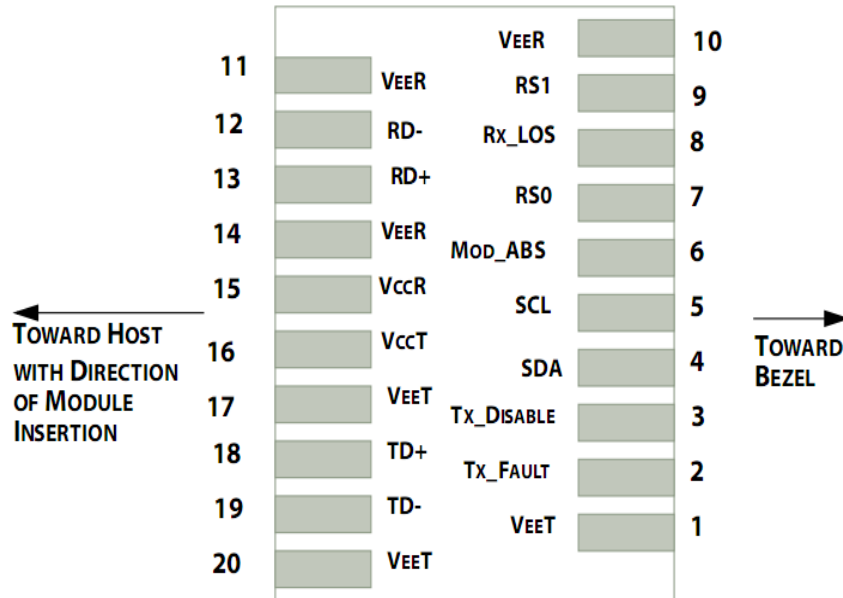
| Parameter             | Symbol | Min | Typ | Max | Unit | Ref. |
|-----------------------|--------|-----|-----|-----|------|------|
| <b>Transmitter</b>    |        |     |     |     |      |      |
| Average Optical Power | Pavg   | -1  |     | +4  | dBm  | 1    |

|                                    |                              |                   |     |                   |     |   |
|------------------------------------|------------------------------|-------------------|-----|-------------------|-----|---|
| Optical Wavelength                 | $\lambda_c$                  | $\lambda_c - 0.1$ |     | $\lambda_c + 0.1$ | nm  |   |
| Center Wavelength Spacing          |                              |                   | 100 |                   | GHz | 2 |
| Optical Extinction Ratio           | ER                           | 3.5               | 7   |                   | dB  |   |
| Transmitter and Dispersion Penalty | TDP                          |                   |     | 3.0               | dB  |   |
| Side mode Suppression ratio        | SMSR                         | 30                |     |                   | dB  |   |
| Optical Rise/Fall Time             | tr/ tf                       |                   | 0.1 | 0.26              | ns  |   |
| Average Launch Power               | P <sub>off</sub>             |                   |     | -40               | dBm |   |
| Output Eye Mask                    | Compliant with IEEE 0802.3ae |                   |     |                   |     |   |
| <b>Receiver</b>                    |                              |                   |     |                   |     |   |
| Rx Sensitivity                     | R <sub>SENS</sub>            |                   |     | -15.8             | dBm | 3 |
| Input Saturation Power (Overload)  | P <sub>sat</sub>             | 0.5               |     |                   | dBm |   |
| Wavelength Range                   | $\lambda_c$                  | 1270              |     | 1610              | nm  |   |
| LOS De -Assert                     | LOSD                         |                   |     | -17               | dBm |   |
| LOS Assert                         | LOSA                         | -30               |     |                   | dBm |   |
| LOS Hysteresis                     |                              | 0.5               |     |                   | dB  |   |

**Notes:**

1. Output power is power coupled into a 9/125 mm single-mode fiber.
2. Corresponds to approximately 0.8 nm.
3. With worst-case extinction ratio. Measured with a PRBS 2<sup>31</sup>-1 test pattern, @ 10.325Gb/s, BER < 10<sup>-12</sup>.

## IV. Pin Descriptions



**Pin out of Connector Block on Host Board**

| Pin | Symbol      | Name/Description   | Ref. |
|-----|-------------|--|------|
| 1   | $V_{EET}$   | Transmitter Ground (Common with Receiver Ground)               | 1    |
| 2   | $T_{FAULT}$ | Transmitter Fault.   | 2    |
| 3   | $T_{DIS}$   | Transmitter Disable. Laser output disabled on high or open.    | 3    |
| 4   | SDA         | 2-wire Serial Interface Data Line                              | 4    |
| 5   | SCL         | 2-wire Serial Interface Clock Line                             | 4    |
| 6   | MOD_ABS     | Module Absent. Grounded within the module                      | 4    |
| 7   | RS0         | Rate Select 0  | 5    |
| 8   | LOS         | Loss of Signal indication. Logic 0 indicates normal operation. | 6    |
| 9   | RS1         | No connection required   | 1    |
| 10  | $V_{EER}$   | Receiver Ground (Common with Transmitter Ground)               | 1    |
| 11  | $V_{EER}$   | Receiver Ground (Common with Transmitter Ground)               | 1    |
| 12  | RD-         | Receiver Inverted DATA out. AC Coupled                         |      |
| 13  | RD+         | Receiver Non-inverted DATA out. AC Coupled                     |      |
| 14  | $V_{EER}$   | Receiver Ground (Common with Transmitter Ground)               | 1    |
| 15  | $V_{CCR}$   | Receiver Power Supply  |      |
| 16  | $V_{CCT}$   | Transmitter Power Supply                                       |      |
| 17  | $V_{EET}$   | Transmitter Ground (Common with Receiver Ground)               | 1    |
| 18  | TD+         | Transmitter Non-Inverted DATA in. AC Coupled.                  |      |
| 19  | TD-         | Transmitter Inverted DATA in. AC Coupled.                      |      |
| 20  | $V_{EET}$   | Transmitter Ground (Common with Receiver Ground)               | 1    |

**Notes:**

1. Circuit ground is internally isolated from chassis ground.
2.  $T_{FAULT}$  is an open collector/drain output, which should be pulled up with a 4.7k – 10k Ohms resistor on the host board if intended for use. Pull up voltage should be between 2.0V to  $V_{cc} + 0.3V$ . A high output indicates a transmitter fault caused by either the TX bias current or the TX output power exceeding the preset alarm thresholds. A low output indicates normal operation. In the low state, the output is pulled to <0.8V.

3. Laser output disabled on  $T_{DIS} > 2.0V$  or open, enabled on  $T_{DIS} < 0.8V$ .
4. Should be pulled up with 4.7k $\Omega$ - 10k $\Omega$  host board to a voltage between 2.0V and 3.6V. MOD\_ABS pulls line low to indicate module is plugged in.
5. Internally pulled down per SFF-8431 Rev 4.1.
6. LOS is open collector output. It should be pulled up with 4.7k $\Omega$  – 10k $\Omega$  on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

## V. Digital Diagnostic Functions

TRANSCOM TS-XP-DXX10-40D transceivers support the 2-wire serial communication protocol as defined in the SFP MSA.

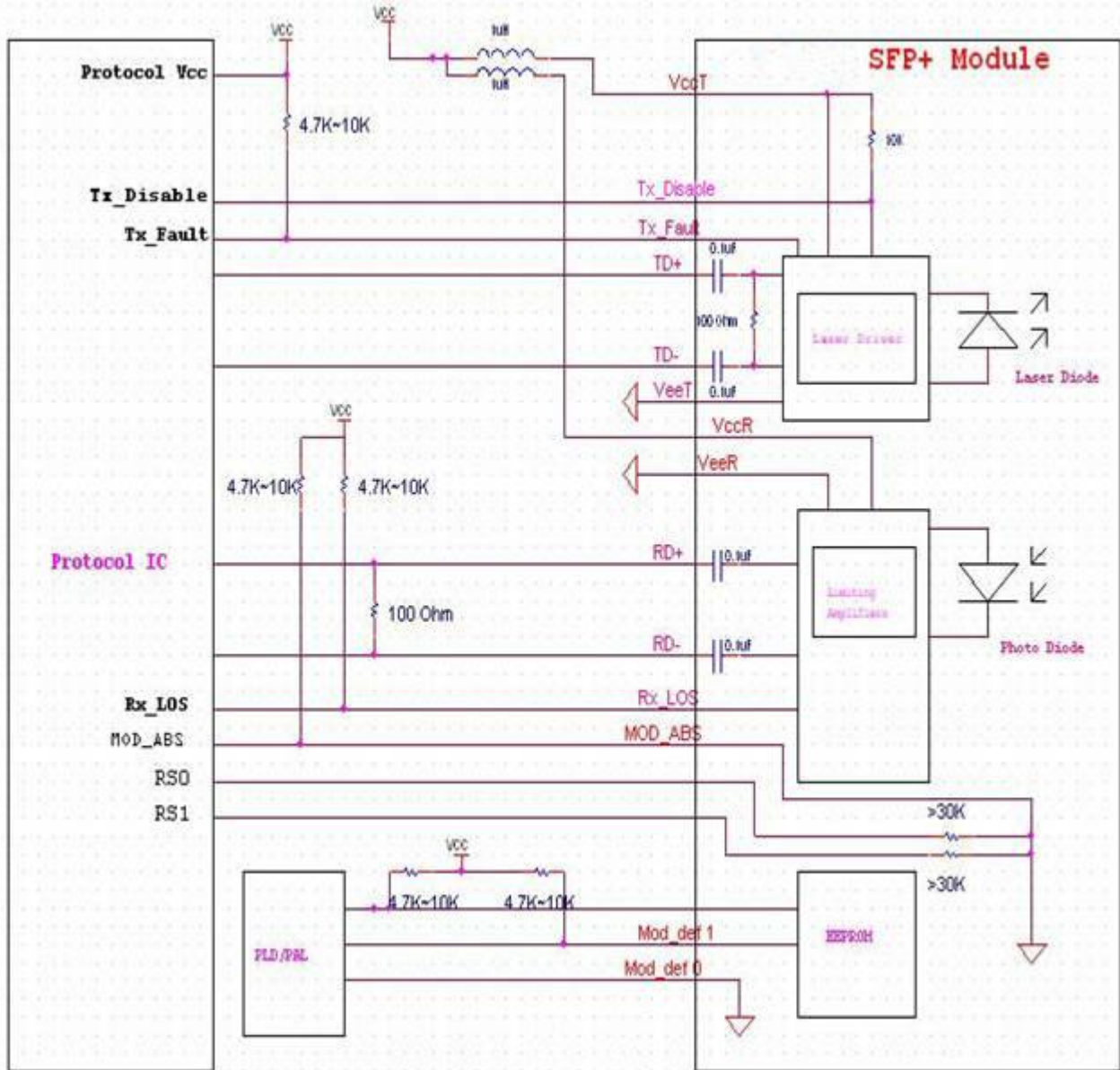
The standard SFP serial ID provides access to identification information that describes the transceiver's capabilities, standard interfaces, manufacturer, and other information.

Additionally, TRANSCOM SFP+ transceivers provide a unique enhanced digital diagnostic monitoring interface, which allows real-time access to device operating parameters such as transceiver temperature, laser bias current, transmitted optical power, received optical power and transceiver supply voltage. It also defines a sophisticated system of alarm and warning flags, which alerts end-users when particular operating parameters are outside of a factory set normal range.

The SFP MSA defines a 256-byte memory map in EEPROM that is accessible over a 2-wire serial interface at the 8 bit address 1010000X (A0h). The digital diagnostic monitoring interface makes use of the 8 bit address 1010001X (A2h), so the originally defined serial ID memory map remains unchanged.

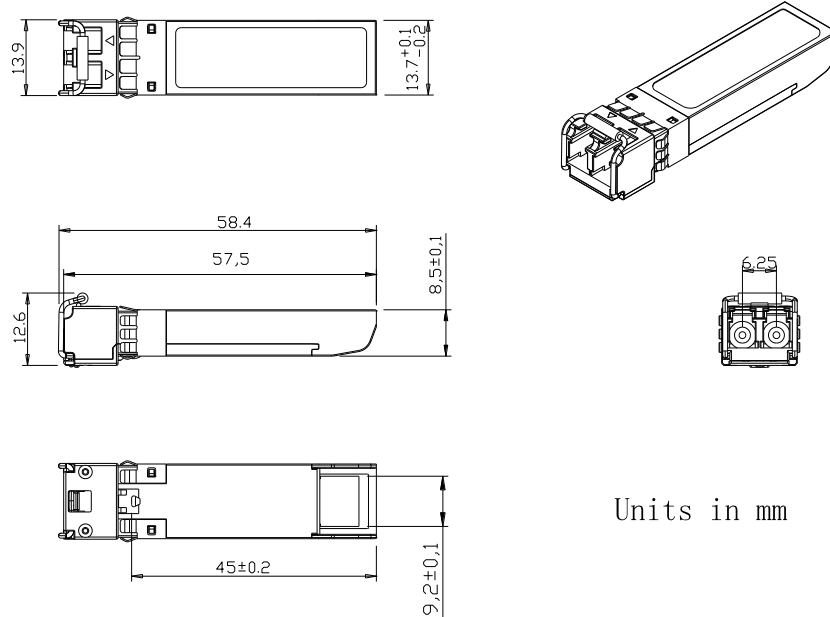
The operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller (DDTC) inside the transceiver, which is accessed through a 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL, Mod Def 1) is generated by the host. The positive edge clocks data into the SFP transceiver into those segments of the E2PROM that are not write-protected. The negative edge clocks data from the SFP transceiver. The serial data signal (SDA, Mod Def 2) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially.

## VI. Host - Transceiver Interface Block Diagram



## VII. Outline Dimensions

Comply to SFF-8432 rev5.0, the improved Pluggable form factor specification.



Units in mm

## VIII. Regulatory Compliance

| Feature                            | Reference  | Performance               |
|------------------------------------|--|---------------------------|
| Electrostatic discharge (ESD)      | IEC/EN 61000-4-2                                 | Compatible with standards |
| Electromagnetic Interference (EMI) | FCC Part 15 Class B EN 55022 Class B (CISPR 22A) | Compatible with standards |
| Laser Eye Safety                   | FDA 21CFR 1040.10, 1040.11<br>IEC/EN 60825-1, 2  | Class 1 laser product     |
| Component Recognition              | IEC/EN 60950 , UL                                | Compatible with standards |
| ROHS                               | 2002/95/EC                                       | Compatible with standards |
| EMC                                | EN61000-3  | Compatible with standards |

## Appendix A. Document Revision

| Version No. | Date       | Description                      |
|-------------|------------|----------------------------------|
| 1.0         | 2010-09-01 | Preliminary datasheet            |
| 2.0         | 2011-09-10 | Update format and company's logo |