

# 10 GB/s 10Km CWDM SFP+ Transceivers



The RTX228-5XX 10Gigabit DFB laser with CWDM transceiver is designed to transmit and receive serial optical data links up from 8.5 Gb/s to 10.52 Gb/s data rate over 10km singlemode fiber. The Transceiver is compliant with SFF-8432, 10GFC, FC-PI-4, IEEE802.3ae and applicable portions of SFF-8431. Digital diagnostics functions are available via a 2-wire serial interface, as specified in SFF-8472.

## Specifications

(tested under recommended operating conditions, unless otherwise noted)

## Features

- Link lengths at 10G 10Km
- LC duplex connector
- Low power consumption <1.0W
- 0°C to 70°C operating temperature range
- Single +3.3V±5% power supply
- Digital Monitoring SFF-8472 compliant
- High sensitivity PIN photodiode and TIA
- Uncooled directly modulated DFB Laser with CWDM wavelengths

## Applications

- 10GBASE-LR/LW 10G Ethernet
- 10GFC
- 8GFC

## Standards

- IEEE 802.3ae
- SFF-8431 Rev 3.0
- SFF-8472 Rev 10.2
- 10GFC Rev 4.0
- FC-PI-4 Rev 7.0

| Parameter                               | Symbol           | Unit  | Min   | Typ | Max   | Note |
|---|------------------|-------|---|-----|-------|------|
| Transmitter                             |                  |       |   |     |       |      |
| Nominal Wavelength                      | $\lambda$        | nm    | 1271,1291,1311,1331,<br>The confirmation of the else wavelength is according to the future study. |     |       | CWDM |
| Wavelength Drift                        | $\Delta \lambda$ | nm    | -6.5  |     | +6.5  |      |
| Side Mode Suppression Ratio             | SMSR             | dB    | 30  |     |       |      |
| Optical Output Power                    | $P_{AV}$         | dBm   | -2.4  |     | +5    | 1    |
| Extinction Ratio                        | ER               | dB    | 3.5   |     |       |      |
| Average launch power of OFF transmitter | $P_{OFF}$        | dBm   |   |     | -35   |      |
| Relative Intensity Noise                | RIN              | dB/Hz |   |     | -128  |      |
| Optical Return Loss Tolerance           | ORLT             | dB    |   |     | 12    |      |
| Receiver                                |                  |       |   |     |       |      |
| Center Wavelength                       | $\lambda$        | nm    | 1260  |     | 1610  |      |
| Average Receiver Power                  | $P_{AVG}$        | dBm   | -14.4   |     | +0.5  | 2    |
| Receiver Sensitivity (OMA)              | $R_{SENSE1}$     | dBm   |   |     | -12.6 | 2    |
| Stressed Receiver Sensitivity (OMA)     | $R_{SENSE2}$     | dBm   |   |     | -10.3 | 3    |
| Receiver Reflectance                    | $R_{REFL}$       | dB    |   |     | -12   |      |
| Assert LOS                              | $LOS_A$          | dBm   | -30   |     |       |      |
| De-Assert LOS                           | $LOS_D$          | dBm   |   |     | -15   |      |
| LOS Hysteresis                          |                  | dB    | 0.5   |     |       |      |

**Note 1:** Demand of customer

**Note 2:** Sensitivity for 10G PRBS 2<sup>31</sup>-1 and BER better than or equal to 10E-12

**Note 3:** The stressed sensitivity value in the table are for system level BER measurements which include the effects of CDR circuit.

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## Ordering Information

| Part No.    | Specifications |                 |             |                     |          |                       |         |            |       | Application               |
|-------------|----------------|-----------------|-------------|---------------------|----------|-----------------------|---------|------------|-------|---------------------------|
|             | Package        | Data rate(Gb/s) | Laser       | Optical Power (dBm) | Detector | Sensitivity (OMA) dBm | Top     | Reach (km) | Other |                           |
| RTXM228-5XX | SFP+           | 8.5<br>~10.52   | CWDM<br>DFB | -2.4 ~+5            | PIN      | < -12.6               | 0~70 °C | 10km       | DDM   | 10GBASE-LR/LW<br>8G/10GFC |

| Part NO.    | Wavelength(nm) |      |        |
|-------------|----------------|------|--------|
|             | min            | type | max    |
| RTXM228-501 | 1263.5         | 1271 | 1278.5 |
| RTXM228-502 | 1283.5         | 1291 | 1298.5 |
| RTXM228-503 | 1303.5         | 1311 | 1318.5 |
| RTXM228-504 | 1323.5         | 1331 | 1338.5 |

## Absolute Maximum Ratings

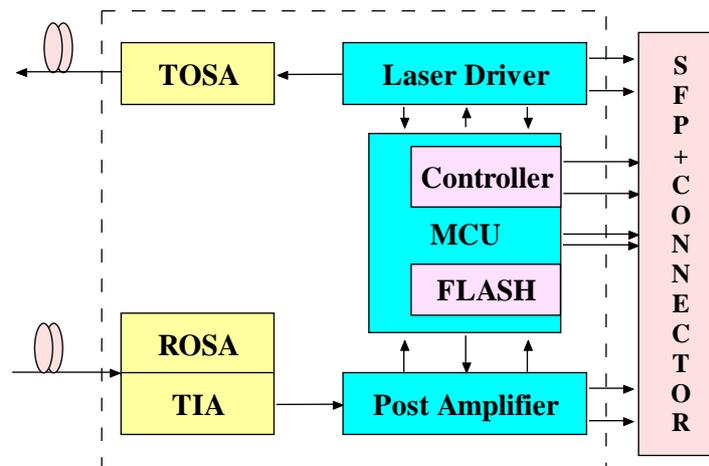
| Parameter                 | Symbol          | Unit | Min  | Max |
|---------------------------|-----------------|------|------|-----|
| Storage Temperature Range | Ts              | °C   | -40  | 85  |
| Relative Humidity         | RH              | %    | 0    | 95  |
| Supply Voltage            | V <sub>CC</sub> | V    | -0.3 | 4.0 |

## Recommended Operating Conditions

| Parameter                        | Symbol          | Unit | Min  | Typ | Max               |
|----------------------------------|-----------------|------|------|-----|-------------------|
| Operating Case Temperature Range | Tc              | °C   | 0    |     | 70                |
| Power Supply Voltage             | V <sub>CC</sub> | V    | 3.14 | 3.3 | 3.46              |
| Bit Rate                         | BR              | Gb/s | 8.5  |     | 10.52             |
| Bit Error Ratio                  | BER             |      |      |     | 10 <sup>-12</sup> |
| Max Supported Link Length        | L               | km   |      |     | 10                |

# 10 GB/s 10Km CWDM SFP+ Transceivers

## Principle diagram



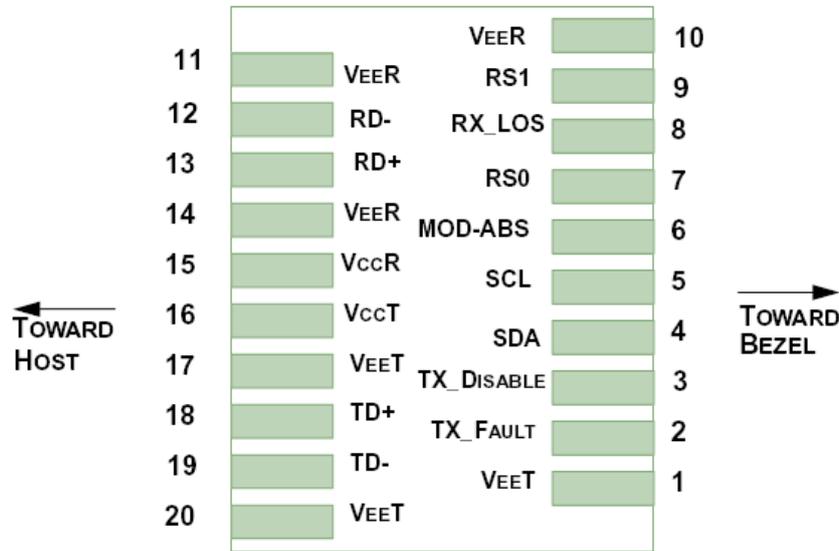
## Electric Ports Definition

| Parameter                        | Symbol      | Unit     | Min      | Typ | Max          | Note |
|----------------------------------|-------------|----------|----------|-----|--------------|------|
| Supply Voltage                   | $V_{CC}$    | V        | 3.14     | 3.3 | 3.46         |      |
| Supply Current                   | $I_{CC}$    | mA       |          |     | 300          |      |
| <b>Transmitter</b>               |             |          |          |     |              |      |
| Input Differential Impedance     | $R_{IN}$    | $\Omega$ | 80       | 100 | 120          | 1    |
| Differential Data Input Swing    | $V_{IN}$    | mVp-p    | 180      |     | 700          |      |
| Transmit Disable Voltage         | $V_{DIS}$   | V        | 2        |     | $V_{CCHOST}$ |      |
| Transmit Enable Voltage          | $V_{EN}$    | V        | $V_{EE}$ |     | $V_{EE}+0.8$ |      |
| Transmit Fault Assert Voltage    | $V_{FA}$    | V        | 2.2      |     | $V_{CCHOST}$ |      |
| Transmit Fault De-Assert Voltage | $V_{FDA}$   | V        | $V_{EE}$ |     | $V_{EE}+0.4$ |      |
| <b>Receiver</b>                  |             |          |          |     |              |      |
| Differential Data Output Swing   | $V_{OD}$    | mVp-p    | 450      | 600 | 850          |      |
| Output Rise Time                 | $t_{RISE}$  | ps       | 25       |     |              |      |
| Output Fall Time                 | $t_{FALL}$  | ps       | 25       |     |              |      |
| LOS Fault                        | $V_{LOSFT}$ | V        | 2        |     | $V_{CCHOST}$ |      |
| LOS Normal                       | $V_{LOSNR}$ | V        | $V_{EE}$ |     | $V_{EE}+0.8$ |      |

**NOTE 1:** Differential between TD+ / TD-

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## Pin function definitions

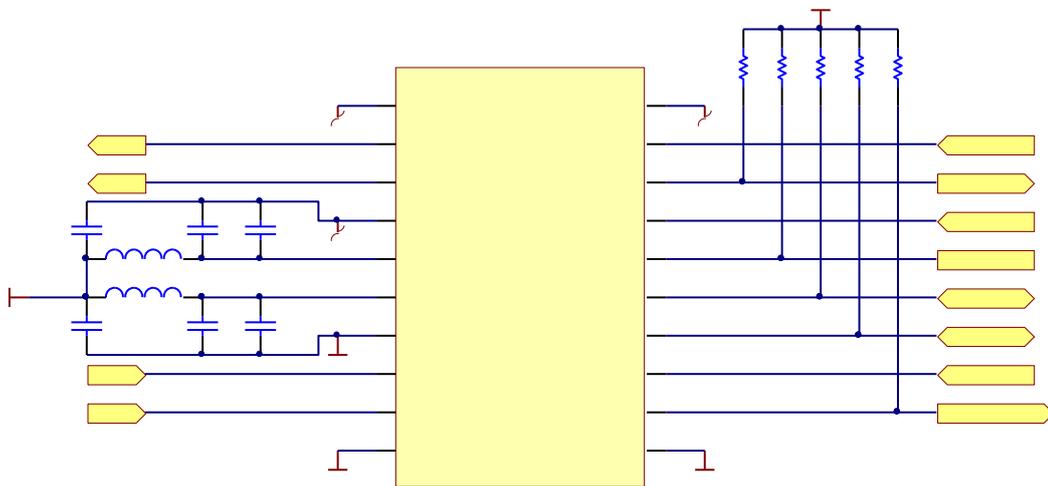


| Pin Number | Symbol     | Name                             | Description  |
|------------|------------|----------------------------------|--|
| 1,17,20    | VeeT       | Transmitter Signal Ground        | These pins should be connected to signal ground on the host board.   |
| 2          | TX Fault   | Transmitter Fault Out (OC)       | Logic "1" Output = Laser Fault (Laser off before t_fault)<br>Logic "0" Output = Normal Operation<br>This pin is open collector compatible, and should be pulled up to Host Vcc with a 10kΩ resistor.   |
| 3          | TX Disable | Transmitter Disable In (LVTTTL)  | Logic "1" Input (or no connection) = Laser off<br>Logic "0" Input = Laser on<br>This pin is internally pulled up to VccT with a 10 kΩ resistor.  |
| 4          | SDA        | Module Definition Identifiers    | Serial ID with SFF 8472 Diagnostics<br>Module Definition pins should be pulled up to Host Vcc with 10 kΩ resistors.  |
| 5          | SCL        |                                  |  |
| 6          | MOD-ABS    |                                  |  |
| 7          | RS0        | Receiver Rate Select (LVTTTL)    | These pins have an internal 33kΩ pull-down to ground. A signal on either of these pins will not affect module performance.   |
| 9          | RS1        | Transmitter Rate Select (LVTTTL) |  |
| 8          | LOS        | Loss of Signal Out (OC)          | Sufficient optical signal for potential BER < 1x10 <sup>-12</sup> = Logic "0"<br>Insufficient optical signal for potential BER < 1x10 <sup>-12</sup> = Logic "1"<br>This pin is open collector compatible, and should be pulled up to Host Vcc with a 10kΩ resistor. |
| 10,11,14   | VeeR       | Receiver Signal Ground           | These pins should be connected to signal ground on the host board.   |
| 12         | RD-        | Receiver Negative DATA Out (CML) | Light on = Logic "0" Output Receiver DATA output is internally AC coupled and series terminated with a 50Ω resistor.   |
| 13         | RD+        | Receiver Positive DATA Out (CML) | Light on = Logic "1" Output Receiver DATA output is internally AC coupled and series terminated with a 50Ω resistor.   |

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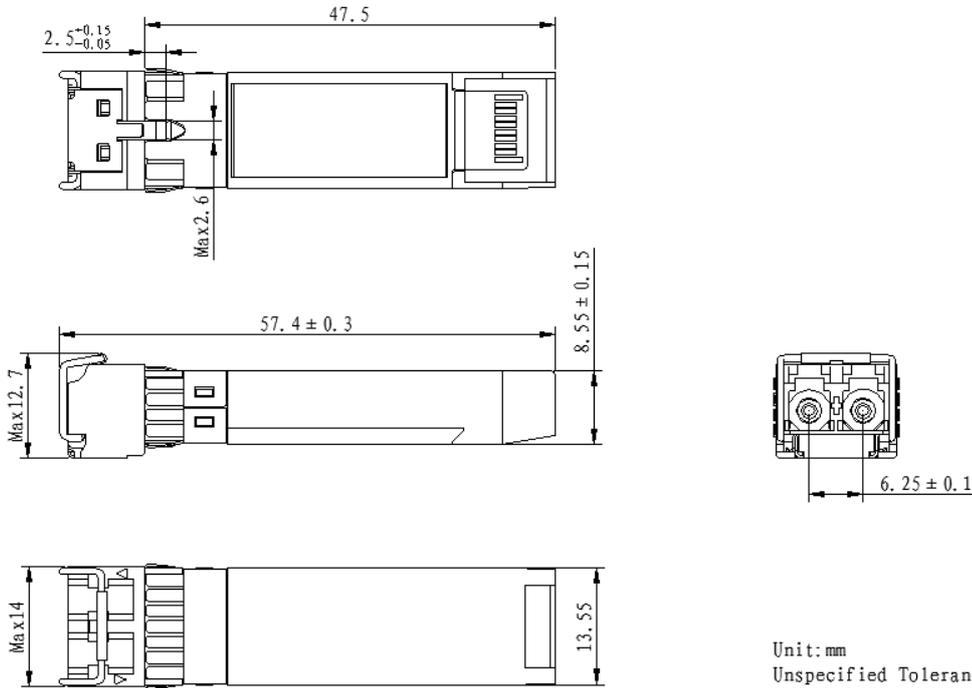
|    |      |                                    |  |
|----|------|------------------------------------|--|
| 15 | VccR | Receiver Power Supply              | This pin should be connected to a filtered +3.3V power supply on the host board. See Figure 3. Recommended power supply filter |
| 16 | VccT | Transmitter Power Supply           | This pin should be connected to a filtered +3.3V power supply on the host board. See Figure 3. Recommended power supply filter |
| 18 | TD+  | Transmitter Positive DATA In (CML) | Logic "1" Input = Light on Transmitter DATA inputs are internally AC coupled and terminated with a differential 100Ω resistor. |
| 19 | TD-  | Transmitter Negative DATA In (CML) | Logic "0" Input = Light on Transmitter DATA inputs are internally AC coupled and terminated with a differential 100Ω resistor. |

## Typical Application Circuit



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## Package Outline



## Regulatory Compliance

| Feature  | Test Method   | Performance  |
|--|---|--|
| Electrostatic Discharge (ESD) to the Electrical Pins | MIL-STD-883C Method 3015.7                            | Class 1 (> 1500 Volts)   |
| Electrostatic Discharge (ESD) Immunity               | Variation of IEC 61000-4-2                            | LV 4(Air discharge :15KV;Contact discharge:8 KV)<br>Performance criterion:B  |
| Electromagnetic Interference (EMI)                   | CISPR22 ITE Class B<br>EN55022 Class B<br>FCC Class B | Compliant with standards   |
| Immunity   | IEC61000-4-3 Class 2<br>EN55024                       | Typically show no measurable effect from a 3V/m field swept from 80 to 1000MHz applied to the transceiver without a chassis enclosure. |