



## **EPON ONU PX20+ 1.25G-Tx / 1.25G-Rx SFP Transceiver**

### **Hot Pluggable, BiDi SC, Tx1310nm FP / Rx1490nm PIN-TIA, SMF 20KM, DDM**

**Part Number: FSFP-C2-PE3-201**



### **Overview**

FSFP-C2-PE3-201 Small Form Factor Pluggable SFP transceivers are compliant with the current SFP Multi-Source Agreement (MSA) Specification. The high performance uncooled 1310nm FP transmitter and high sensitivity 1490nm PIN-TIA receiver provide superior performance for Giga EPON ONU applications.

### **Applications**

- GEAPON ONU IEEE802.3-ah 1000BASE-PX20+
- FTTx Application

### **Features**

- Compliant with SFP MSA
- Compliant with SFF8472 diagnostic monitoring interface
- 1310nm FP laser transmitter
- 1490nm PIN-TIA receiver
- 1.25 Gbps Burst mode transmission
- 1.25 Gbps Continuous mode receiver
- Simplex SC/UPC connector
- Transmitter Burst On (optional high active or low active)
- Transmitter state indication (Tx\_SD)
- Industrial temperature -40~85°C available
- Single +3.3V power supply
- Link distance 20km over SM fiber
- RoHS Compliant

### **Laser Safety**

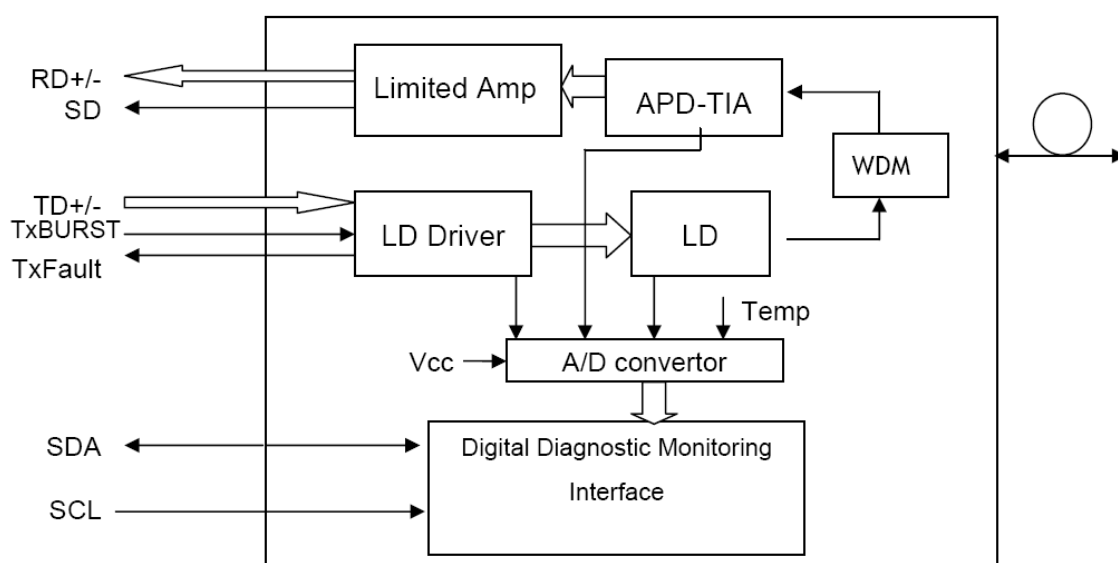
- This is a Class 1 Laser Product complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019.
- Caution: Use of control or adjustments or performance of procedure other than those specified herein may result in hazardous radiation exposure.



## Absolute Maximum Ratings

| Parameters                | Symbol          | Min. | Max. | Unit |
|---------------------------|-----------------|------|------|------|
| Storage Temperature       | T <sub>ST</sub> | -40  | +85  | °C   |
| Storage Relative Humidity | RH              | 5    | 95   | %    |
| Supply Voltage            | V <sub>CC</sub> | -0.5 | +4.0 | V    |

## Function Diagram



## Recommended Operating Conditions

| Parameters                              | Symbol          | Min.  | Typ. | Max.  | Unit |
|-----------------------------------------|-----------------|-------|------|-------|------|
| Case Operating Temp. (FSFP-C2-PE3-201)  | T <sub>OP</sub> | 0     | -    | +70   | °C   |
| Case Operating Temp. (FSFP-C2-PE3-201i) | T <sub>OP</sub> | -40   | -    | +85   | °C   |
| Supply Voltage                          | V <sub>CC</sub> | +3.13 | +3.3 | +3.47 | V    |
| Supply Current                          | I <sub>CC</sub> |       | 200  | 350   | mA   |



## Transmitter Electro-optical Characteristics

$V_{CC} = 3.13V$  to  $3.47V$ ,  $T_{OP} = 0^{\circ}C$  to  $70^{\circ}C$  (FSFP-C2-PE3-201);  $T_{OP} = -40^{\circ}C$  to  $85^{\circ}C$  (FSFP-C2-PE3-201i)

| Parameters                                     | Symbol                           | Min. | Typ. | Max.            | Unit | Note |
|------------------------------------------------|----------------------------------|------|------|-----------------|------|------|
| Operating Data Rate                            | DR                               |      | 1.25 |                 | Gb/s |      |
| Optical Launch Power                           | Po                               | +0   |      | +4              | dBm  | 1    |
| Optical Center Wavelength                      | $\lambda$                        | 1260 | 1310 | 1360            | nm   |      |
| Spectrum Width (RMS)                           | $\Delta\lambda$                  |      |      | 2.8             | nm   |      |
| Optical Extinction Ratio                       | ER                               | 9    |      |                 | dB   |      |
| Average Launch power of OFF Transmitter        | P <sub>OFF</sub>                 |      |      | -45             | dBm  |      |
| Optical Eye Mask (PRBS <sup>27</sup> -1@1.25G) | Compliant With IEEE Std 802.3 ah |      |      |                 |      |      |
| Optical Return Loss Tolerance                  |                                  | -15  |      |                 | dB   |      |
| Transmitter and dispersion Penalty             |                                  |      |      | 2               | dB   |      |
| Data Input Differential Voltage                | V <sub>IN-PP</sub>               | 200  |      | 2000            | mV   |      |
| Input Differential Impedance                   | Z <sub>IN</sub>                  | 90   | 100  | 110             | ohm  |      |
| Tx_Burst Input Voltage - High                  | V <sub>TDS-H</sub>               | 2.0  |      | V <sub>CC</sub> | V    |      |
| Tx_Burst Input Voltage - Low                   | V <sub>TDS-L</sub>               | GND  |      | 0.8             | V    |      |

**Note1:** The optical power is launched into a 9/125 $\mu$ m single mode fiber.



## Receiver Electro-optical Characteristics

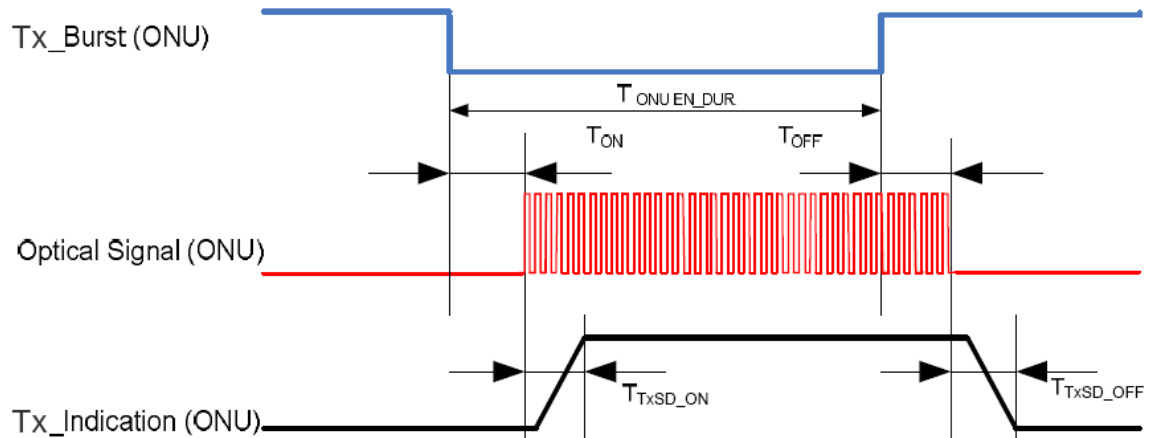
$V_{CC} = 3.13V$  to  $3.47V$ ,  $T_{OP} = 0^{\circ}C$  to  $70^{\circ}C$ (FSFP-C2-PE3-201);  $T_{OP} = -40^{\circ}C$  to  $85^{\circ}C$ (FSFP-C2-PE3-201i)

| Parameters                          | Symbol                | Min. | Typ. | Max.            | Unit | Note |
|-------------------------------------|-----------------------|------|------|-----------------|------|------|
| Operating Data Rate                 | DR                    |      | 1.25 |                 | Gb/s |      |
| Optical Center Wavelength           | $\lambda_c$           | 1480 | 1490 | 1500            | nm   |      |
| Receiver Sensitivity                | SEN                   |      |      | -27             | dBm  | 1    |
| Maximum Receive Power               | P <sub>Rx-MAX</sub>   | -3   |      |                 | dBm  | 1    |
| LOS De-Assert                       | LOS <sub>D</sub>      |      |      | -28             | dBm  |      |
| LOS Assert                          | LOS <sub>A</sub>      | -39  |      |                 | dBm  |      |
| LOS Hysteresis                      | LOS <sub>HY</sub>     | 0.5  |      | 6               | dB   |      |
| Data Output Differential Voltage    | V <sub>OUT-PP</sub>   | 400  |      | 1600            | mV   |      |
| Signal Detect Output Voltage - High | V <sub>SD-H</sub>     | 2.4  |      | V <sub>CC</sub> | V    |      |
| Signal Detect Output Voltage - Low  | V <sub>SD-L</sub>     | GND  |      | 0.4             | V    |      |
| Timing Characteristics              |                       |      |      |                 |      |      |
| Turn On Time at Burst mode          | T <sub>ON</sub>       |      |      | 30              | ns   |      |
| Turn Off Time at Burst mode         | T <sub>OFF</sub>      |      |      | 30              | ns   |      |
| Tx-SD Assert Time                   | T <sub>TxSD_ON</sub>  |      |      | 100             | ns   |      |
| Tx-SD De-assert Time                | T <sub>TxSD_OFF</sub> |      |      | 100             | ns   |      |
| LOS Assert Time                     | T <sub>LOSA</sub>     |      |      | 100             | us   |      |
| LOS De-assert Time                  | T <sub>LOSD</sub>     |      |      | 100             | us   |      |

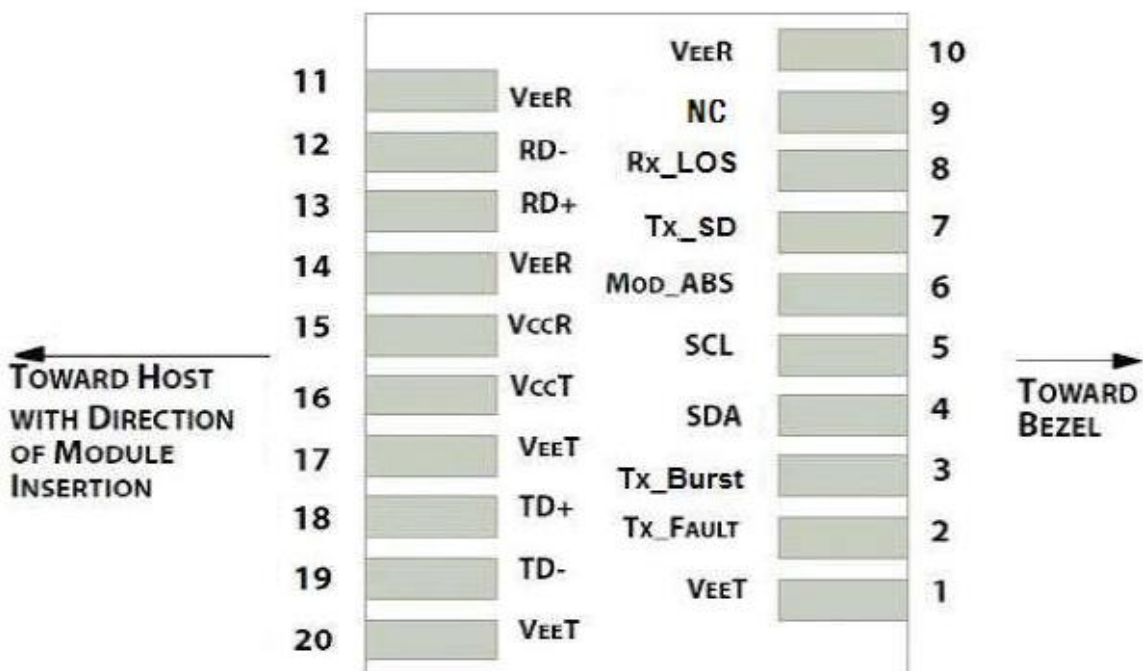
**Note1:** Measured with a PRBS 2<sup>7</sup>-1 test pattern @1.25Gbps ER=9 BER<10<sup>-12</sup> continuous mode.



## Burst Mode Transmitter Timing



## Pin Assignment



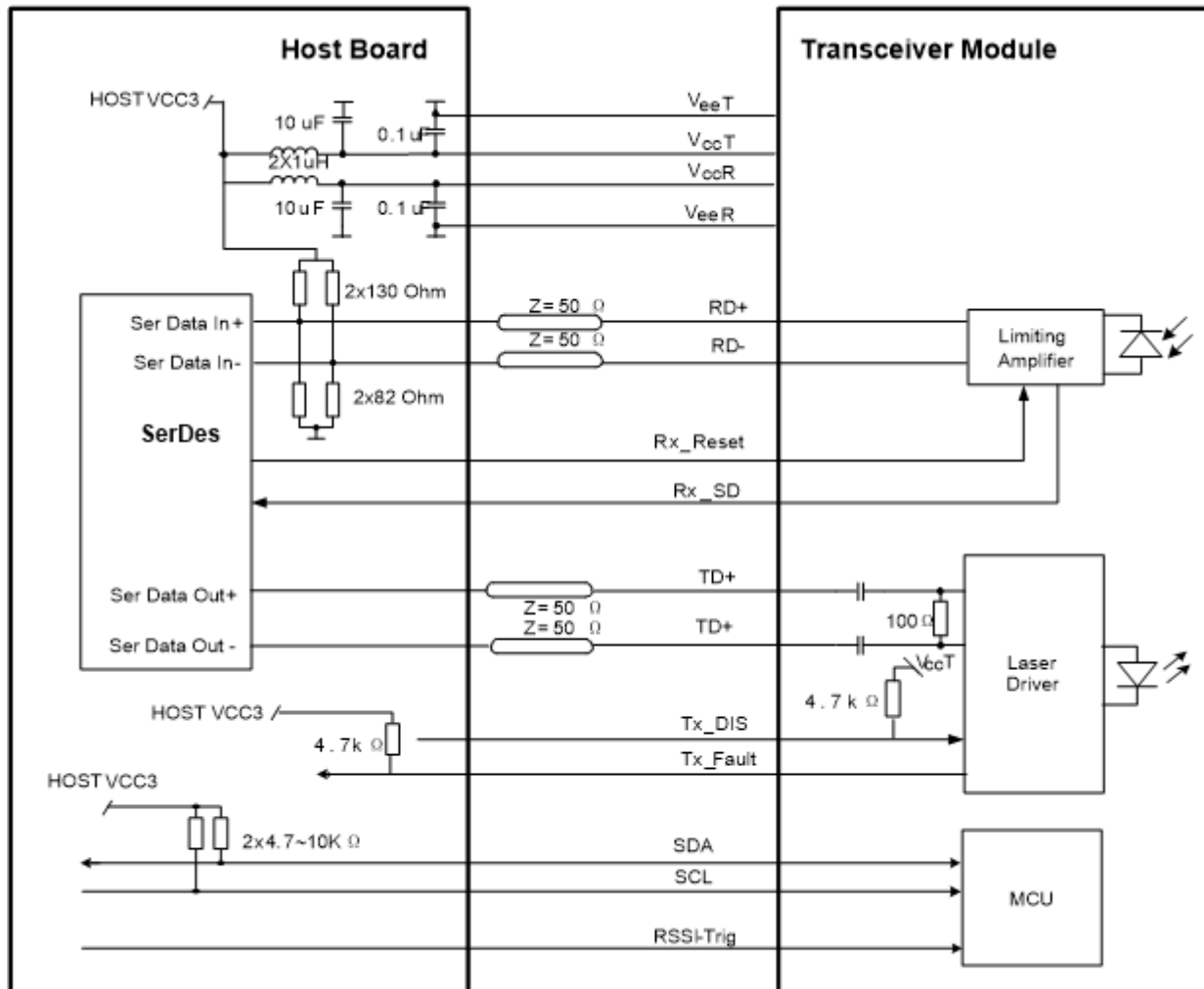


## Pin Description

| Pin | Name     | Function / Description                                            |
|-----|----------|-------------------------------------------------------------------|
| 1   | VEET     | Transmitter Ground                                                |
| 2   | Tx_Fault | Transmitter Fault Indication (LVTTTL Output level, High=Tx Fault) |
| 3   | Tx_Burst | Transmitter Burst Mode Control (Logic '1' or Logic '0' Tx_ON)     |
| 4   | SDA      | 2-wire Serial Interface Data Line (SDA: Serial Data Signal)       |
| 5   | SCL      | 2-wire Serial Interface Clock (SCL: Serial Clock Signal)          |
| 6   | MOD-ABS  | Module Absent, connected to VEET or VEER in the module            |
| 7   | Tx_SD    | Tx transmitter State Indication, assert when Tx_ON                |
| 8   | Rx_LOS   | Rx_LOS, Loss of Receiver signal indication                        |
| 9   | NC       |                                                                   |
| 10  | VEER     | Receiver Ground                                                   |
| 11  | VEER     | Receiver Ground                                                   |
| 12  | RD-      | Receiver Inverted Data output, AC-coupled                         |
| 13  | RD+      | Receiver Non-Inverted Data output, AC-coupled                     |
| 14  | VEER     | Receiver Ground                                                   |
| 15  | VccR     | Receiver Power 3.3V Supply                                        |
| 16  | VccT     | Transmitter Power 3.3V Supply                                     |
| 17  | VEET     | Transmitter Ground                                                |
| 18  | TD+      | Transmitter Non-Inverted Data Input, AC-coupled                   |
| 19  | TD-      | Transmitter Inverted Data Input, AC-coupled                       |
| 20  | VEET     | Transmitter Ground                                                |



## Recommended Application Circuit





## Digital Diagnostic Functions

As defined by the SFP MSA (SFF-8472) Ficer's SFP transceivers provide digital diagnostic functions via a 2-wire serial interface, which allows real-time access to the following operating parameters:

- Transceiver temperature
- Laser bias current
- Transmitted optical power
- Received optical power
- Transceiver supply voltage

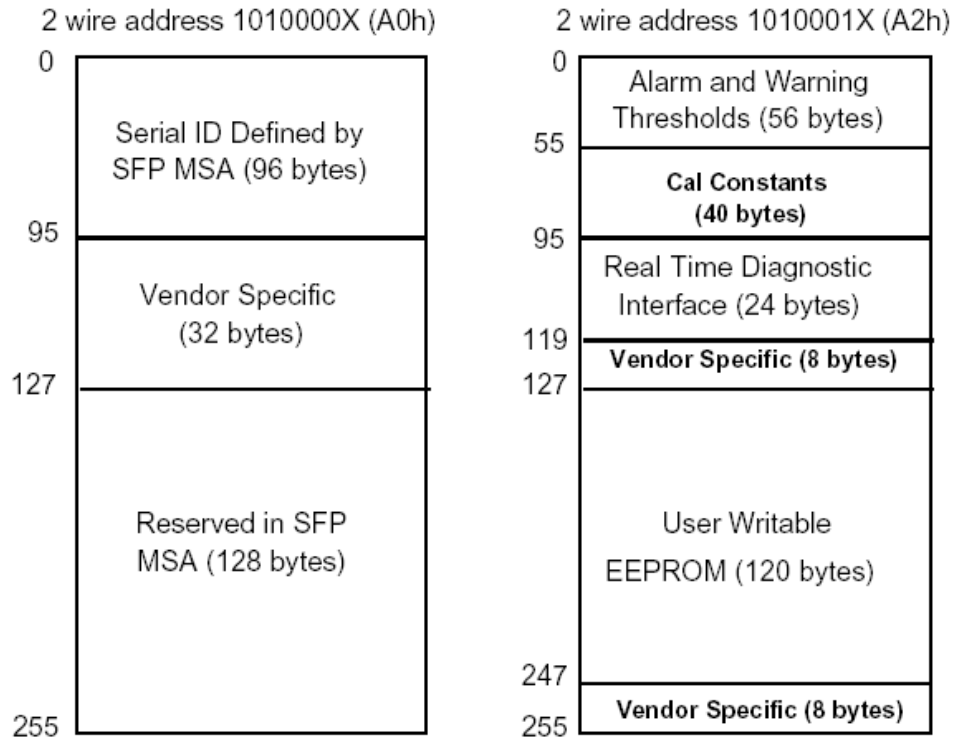
It also provides a sophisticated system of alarm and warning flags, which may be used to alert end-users when particular operating parameters are outside of a factory-set normal range.

The operating and diagnostics information is monitored and reported by a Digital Diagnostics Controller (DDC) inside the transceiver, which is accessed through the 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL pin) is generated by the host. The positive edge clocks data into the SFP transceiver into those segments of its memory map that are not write-protected. The negative edge clocks data from the SFP transceiver. The serial data signal (SDA pin) 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.

For more detailed information including memory map definitions, please see the SFP MSA (SFF-8472) Specification.



## Digital Diagnostic Memory Map

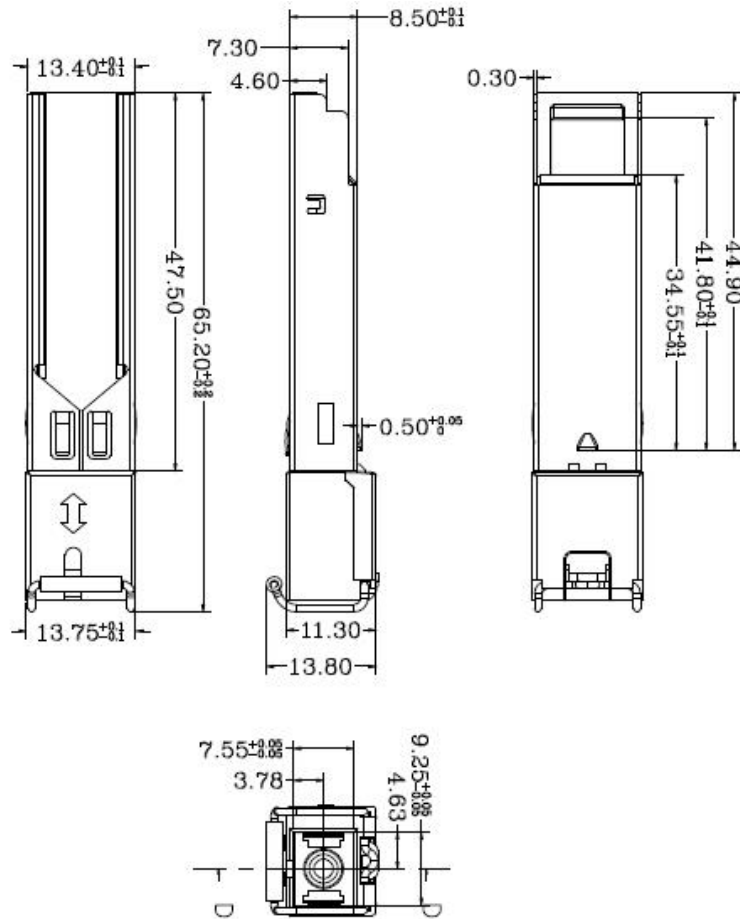


## Digital Diagnostic Monitoring Characteristics

| Parameter                 | Accuracy | Unit | Note                 |
|---------------------------|----------|------|----------------------|
| Temperature               | ±3       | °C   | Internal Calibration |
| Supply Voltage            | ±0.1     | V    | Internal Calibration |
| Tx Bias Current           | ±5       | mA   | Internal Calibration |
| Tx Output Power           | ±3       | dB   | Internal Calibration |
| Rx Received Optical Power | ±3       | dB   | Internal Calibration |



## Mechanical Dimensions



(All Dimensions are  $\pm 0.20\text{mm}$  Unless Otherwise Specified, Unit: mm)



## Ordering Information

| Part No.          | Tx     | Rx     | Link        | DDM | Option                     | Temp.     |
|-------------------|--------|--------|-------------|-----|----------------------------|-----------|
| FSFP-C2-PE3-201Y  | 1310nm | 1490nm | SMF<br>20km | Yes | Tx_ON when Tx_Burst = Low  | 0~+70°C   |
| FSFP-C2-PE3-201T  | 1310nm | 1490nm | SMF<br>20km | Yes | Tx_ON when Tx_Burst = High | 0~+70°C   |
| FSFP-C2-PE3-201Yi | 1310nm | 1490nm | SMF<br>20km | Yes | Tx_ON when Tx_Burst = Low  | -40~+85°C |
| FSFP-C2-PE3-201Ti | 1310nm | 1490nm | SMF<br>20km | Yes | Tx_ON when Tx_Burst = High | -40~+85°C |

**Note:** Distances are indicative only. To calculate a more precise link budget based on specific conditions in your application, please refer to the optical characteristics.