



## **PON OLT B+ 2.5G-Tx / 1.25G-Rx SFP Transceiver**

**Hot Pluggable, BiDi SC, Tx1490nm DFB / Rx1310nm APD, SMF 20KM, DDM**

**Part Number: FSFP-E2-PG4-20B**



### **Overview**

FSFP-E2-PG4-20B Small Form Factor Pluggable SFP transceivers are compliant with the current SFP Multi-Source Agreement (MSA) Specification. The high performance uncooled 1490nm DFB transmitter and high sensitivity 1310nm APD receiver provide superior performance for GPON ONU Class B+ applications.

### **Applications**

- GEAPON OLT for P2MP Application
- FTTx Application

### **Features**

- Compliant with ITU-T G.984.2 GPON OLT B+
- Compliant with SFP MSA
- Compliant with SFF8472 diagnostic monitoring interface
- 2488 Mbps Continuous mode transmission
- 1244 Mbps Burst mode receiver
- 1490nm DFB laser transmitter
- 1310nm APD-TIA receiver
- Simplex SC/UPC connector
- Receiver RESET, Signal Detect, RSSI function indication (RESET, Rx\_SD, RSSI)
- Single +3.3V power supply
- Link distance 20km over SM fiber
- RoHS Compliant

### **Laser Safety**

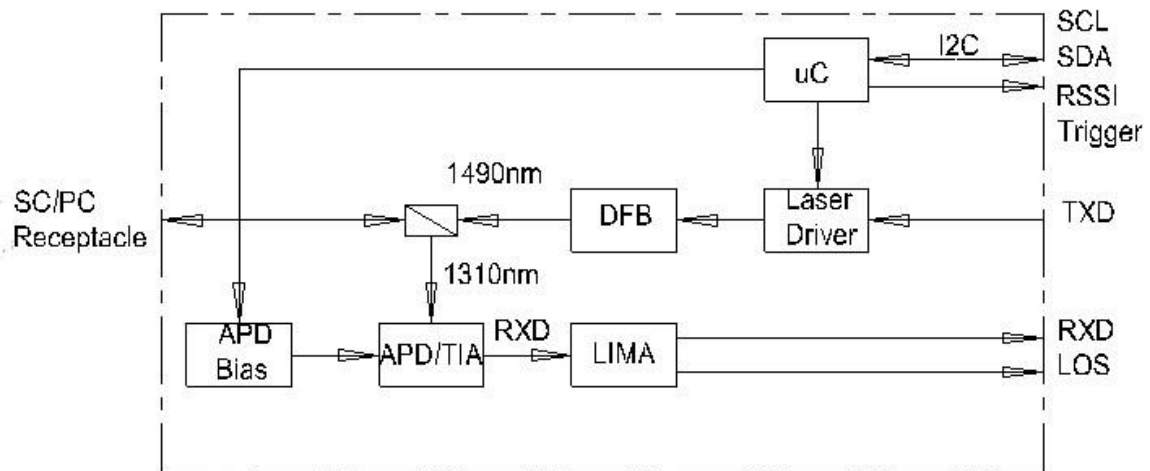
- This is a Class 1 Laser Product complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019.
- Caution: Use of control or adjustments or performance of procedure other than those specified herein may result in hazardous 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-E2-PG4-20B)	T <sub>OP</sub>	0	-	+70	°C
Case Operating Temp. (FSFP-E2-PG4-20Bi)	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>			500	mA
Damage Threshold for Receiver				+5	dBm



## Transmitter Electro-optical Characteristics

$V_{CC} = 3.13V$  to  $3.47V$ ,  $T_{OP} = 0^{\circ}C$  to  $70^{\circ}C$  (FSFP-E2-PG4-20B);  $T_{OP} = -40^{\circ}C$  to  $85^{\circ}C$  (FSFP-E2-PG4-20Bi)

Parameters	Symbol	Min.	Typ.	Max.	Unit	Note
Operating Data Rate	DR		2.488		Gb/s	1
Optical Launch Power	Po	+1.5		+5	dBm	1
Optical Center Wavelength	$\lambda$	1480	1490	1500	nm	
Spectrum Width (-20dB)	$\Delta\lambda$			1.0	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Optical Extinction Ratio	ER	8.2			dB	
Average Launch power of OFF Transmitter	P <sub>OFF</sub>			-45	dBm	
Optical Eye Mask (PRBS2 <sup>23-1</sup> @2.488G)	ITU-T G.984.2					
Optical Return Loss Tolerance				-12	dB	
Transmitter and dispersion Penalty				1	dB	
Data Input Differential Voltage	V <sub>IN-PP</sub>	200		2000	mV	
Input Differential Impedance	Z <sub>IN</sub>	90	100	110	ohm	

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



## Receiver Electro-optical Characteristics

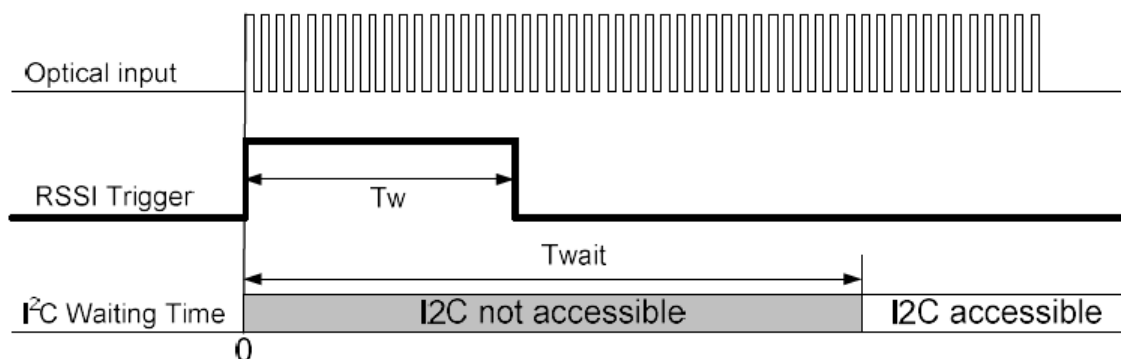
**V<sub>CC</sub> = 3.13V to 3.45V, T<sub>OP</sub> = 0 °C to 70 °C(FSFP-E2-PG4-20B); T<sub>OP</sub> = -40 °C to 85 °C(FSFP-E2-PG4-20Bi)**

Parameters	Symbol	Min.	Typ.	Max.	Unit	Note
Operating Data Rate	DR		1.244		Gb/s	
Optical Center Wavelength	$\lambda_c$	1290	1310	1330	nm	
Receiver Sensitivity	SEN			-28	dBm	1
Maximum Receive Power	P <sub>Rx-MAX</sub>	-8			dBm	1
Receiver Burst Mode Dynamic Range		15			dB	
SD Assert	LOSA			-30	dBm	
SD De-assert	LOSD	-45			dBm	
SD Hysteresis	LOSHY	0.5		6	dB	
Data Output Differential Voltage	V <sub>OUT-PP</sub>	400		1600	mV	
LVTTL Output High	V <sub>SD-H</sub>	2.4		V <sub>CC</sub>	V	
LVTTL Output Low	V <sub>SD-L</sub>	GND		0.4	V	
Timing Characteristics						
Guard Time (T <sub>g</sub> )	T <sub>g</sub>	25.6			ns	
Reset Pulse Width (T <sub>r</sub> )	T <sub>r</sub>			12.8	ns	
Reset Delay (T <sub>rd</sub> )	T <sub>rd</sub>			12.8	ns	
Receiver Preamble Time (T <sub>p</sub> )	T <sub>p</sub>			140	ns	
SD Assert Time (T <sub>SDA</sub> )	T <sub>SDA</sub>			100	ns	
SD De-assert Time (T <sub>SDD</sub> )	T <sub>SDD</sub>			12.8	ns	
RSSI Trigger Delay (T <sub>td</sub> )	T <sub>td</sub>	25			ns	
RSSI Trigger Pulse Width (T <sub>w</sub> )	T <sub>w</sub>	500			ns	
Internal I2C Delay (T <sub>wait</sub> )	T <sub>wait</sub>			500	ns	

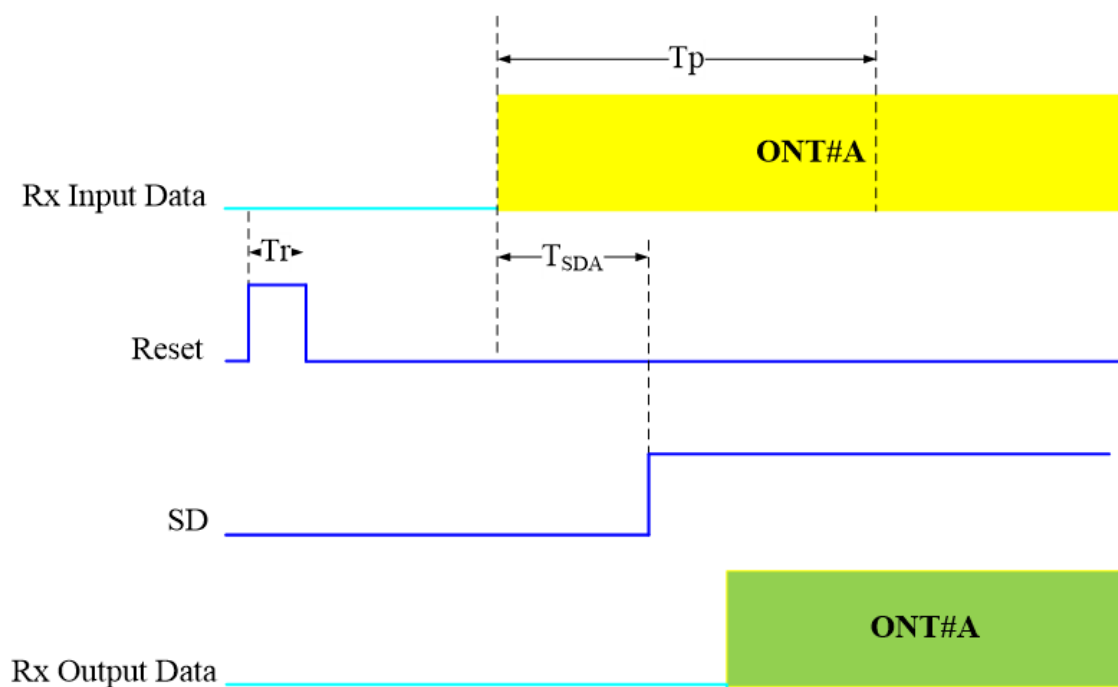
**Note1:** Measured with a PRBS 2<sup>23</sup>-1 test pattern @1.244Gbps ER=10 BER<10<sup>-10</sup> continuous mode.



## RSSI Trigger Timing Sequence

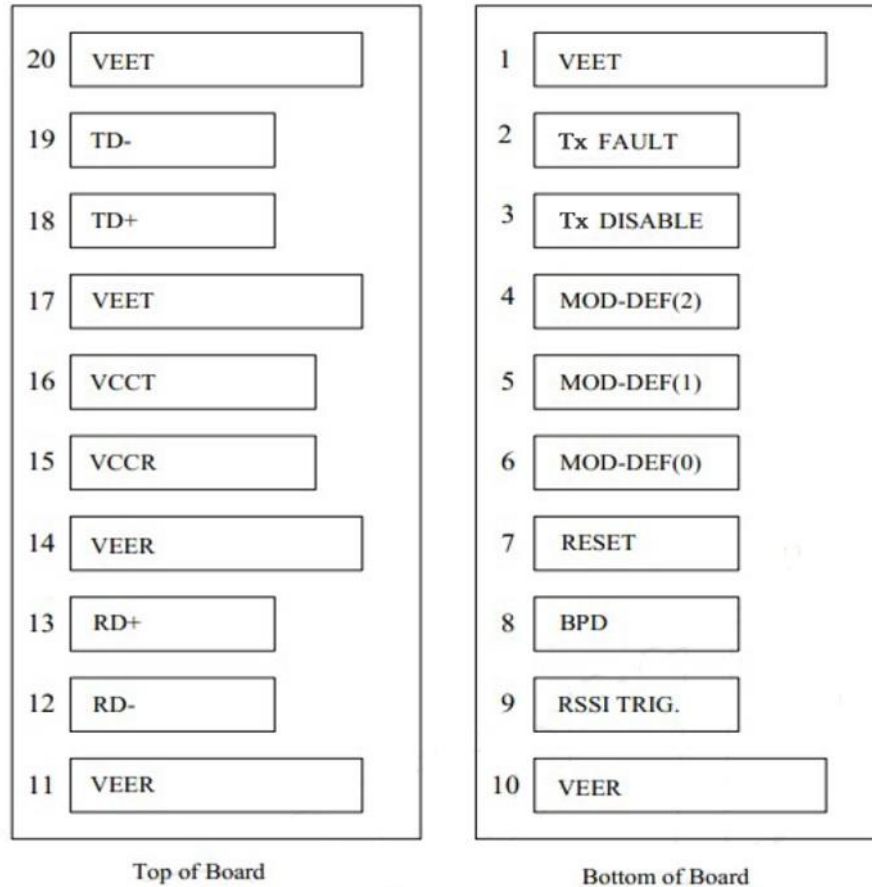


## Timing Sequence for Ranging Mode





## Pin Assignment



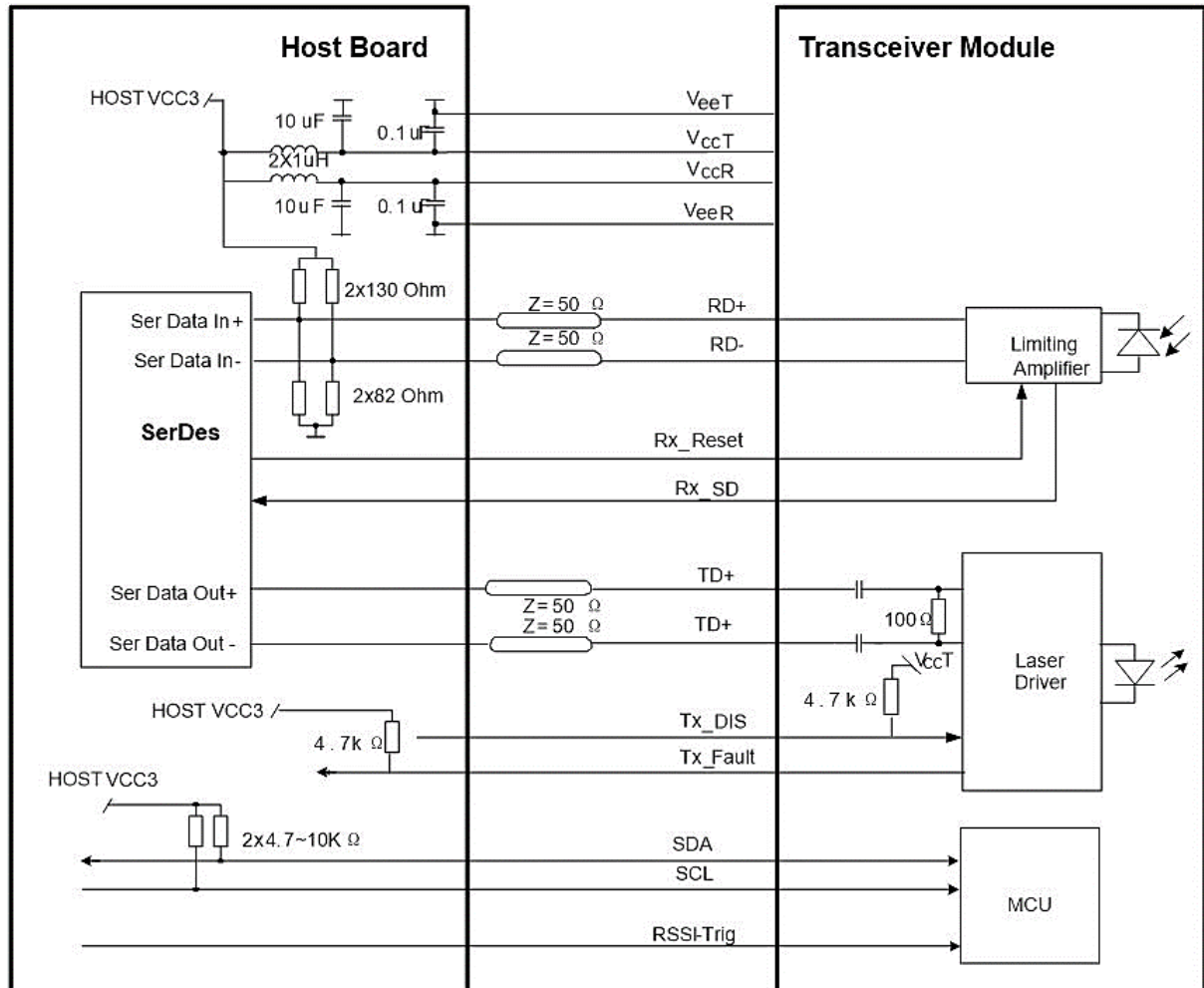


## Pin Description

Pin	Name	Function / Description
1	VEET	Transmitter Ground
2	Tx Fault	Transmitter Fault Indication (LVTTL Output level, High=Tx Fault)
3	Tx DISABLE	Laser output is disabled when this pin is asserted high or left unconnected
4	MOD-DEF(2)	2-wire Serial Interface Data Line (SDA: Serial Data Signal)
5	MOD-DEF(1)	2-wire Serial Interface Clock (SCL: Serial Clock Signal)
6	MOD-DEF(0)	Module Absent, connected to VeeT or VeeR in the module
7	RESET	Receiver RESET signal
8	BPD	Receiver Signal Detected Indication
9	RSSI TRIG	Receiver RSSI Trigger signal
10	VEER	Receiver Ground
11	VEER	Receiver Ground
12	RD-	Receiver Inverted Data output, DC-coupled
13	RD+	Receiver Non-Inverted Data output, DC-coupled
14	VEER	Receiver Ground
15	VCCR	Receiver Power
16	VcCT	Transmitter Power 3.3V Supply
17	VEET	Transmitter Ground 3.3 Supply
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

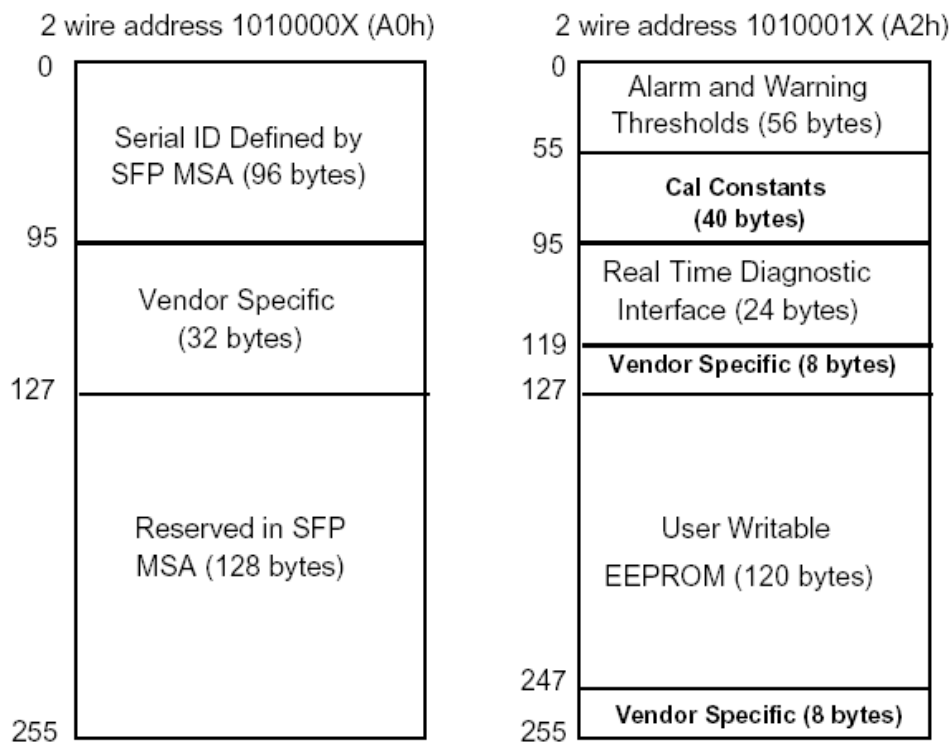
It also provides a sophisticated system of alarm and warning flags, which may be used to alert end-users when particular operating parameters are outside of a factory-set normal range.

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

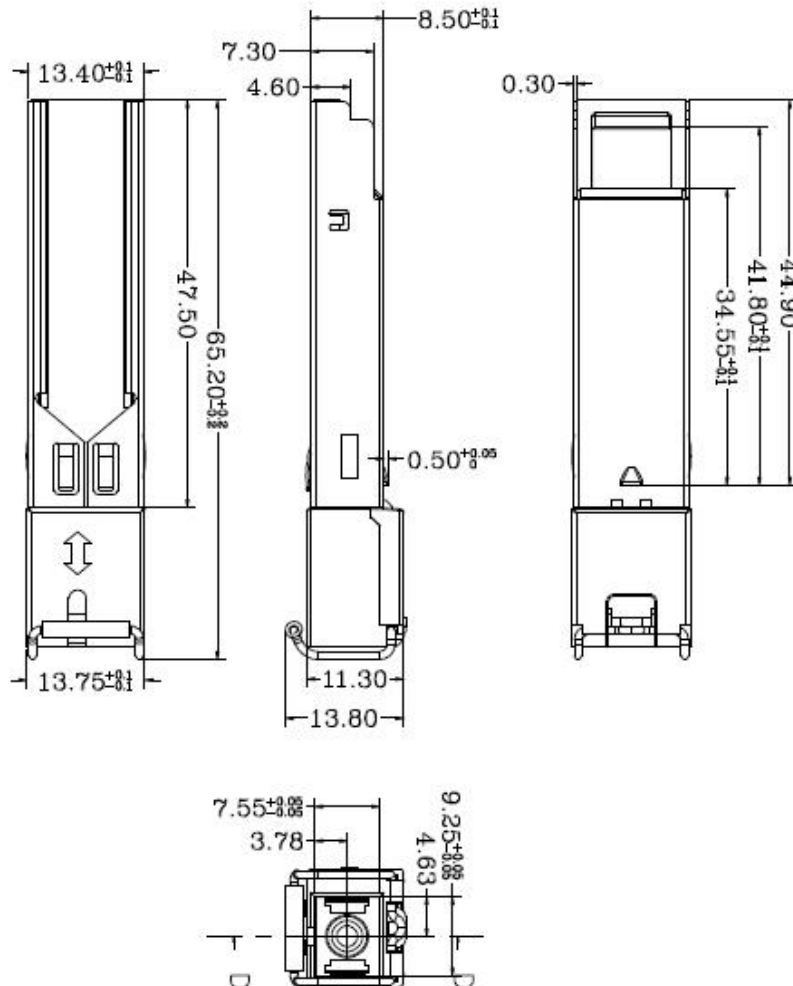


## Digital Diagnostic Monitoring Characteristics

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-E2-PG4-20B	1490nm	1310nm	SMF 20km	Yes	GPON OLT B+, Tx:2.488Gbps, Rx:1.244Gbps	0~70°C
FSFP-E2-PG4-20Bi	1490nm	1310nm	SMF 20km	Yes	GPON OLT B+, Tx:2.488Gbps, Rx:1.244Gbps	-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.