



XGPON Asymmetric OLT SFP+ Transceiver

Hot Pluggable, BiDi SC, Tx1577nm EML / Rx1270nm APD, SMF 20KM, DDM

Part Number: FSPP-H2-PX5-20x



Overview

FSPP-H2-PX5-20x Small Form Factor Pluggable SFP+ transceivers are compliant with the current SFP+ Multi-Source Agreement (MSA) Specification. The high performance uncooled 1577nm DFB transmitter and high sensitivity APD-TIA receiver provides superior performance for XGPON applications up to 20km optical links in FTTx projects.

Applications

- XGPON OLT for P2MP applications
- FTTx projects

Features

- Compliant with ITU-T G.9807.1 XGPON OLT
- Compliant with SFF-8431, SFF-8432 SFP+ MSA
- XGPON upstream signals are in Time Division Multiplex mode
- 9.953G continuous mode transmission with 1570nm EML laser transmitter
- 2.488G burst-mode receiver with APD-TIA receiver (with RESET, TDM)
- Digital receiving signal strength indication (RSSI)
- Hot Pluggable
- Simplex SC/UPC connector
- 2-wire interface for management and diagnostic monitor compliant with SFF-8472
- 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 _{ST}	-40	+85	°C
Storage Relative Humidity	RH	5	95	%
Supply Voltage	V _{CC}	-0.5	+4.0	V

Recommended Operating Conditions

Parameters	Symbol	Min.	Typ.	Max.	Unit
Case Operating Temperature	T _{OP}	0	-	+70	°C
Supply Voltage	V _{CC}	+3.13	+3.3	+3.47	V
Supply Current	I _{CC}			750	mA
Power Consumption	P			2.5	W

Transmitter Electro-optical Characteristics

V_{CC} = 3.13V to 3.47V, T_{OP} = 0 °C to 70 °C

Parameters	Symbol	Min.	Typ.	Max.	Unit	Note
Operating Data Rate	DR		9.953		Gb/s	
Optical Launch Power (N1 BOL)	P _o	+2.5		+5	dBm	1
Optical Launch Power (N1 EOL)	P _o	+2		+5	dBm	1
Optical Launch Power (N2a BOL)	P _o	+4.5		+7	dBm	1
Optical Launch Power (N2a EOL)	P _o	+4		+7	dBm	1
Optical Center Wavelength	λ _c	1575	1577	1580	nm	
Spectral Width (-20dB)	Δλ			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Optical Extinction Ratio	ER	8.2			dB	
Optical Eye Mask (PRBS2 ³¹ -1@9.953G)		ITU-T G.987.2				
Average Launch Power OFF	P _{OFF}			-39	dBm	
Differential Data Input Swing	V _{IN}	120		850	mV	
Tx Disable Input Voltage-Low (Tx ON)	TDISV _L	GND		0.8	V	
Tx Disable Input Voltage-High (Tx OFF)	TDISV _H	2.0		V _{CC}	V	

Note1: The optical power is launched into a 9/125μm single mode fiber.

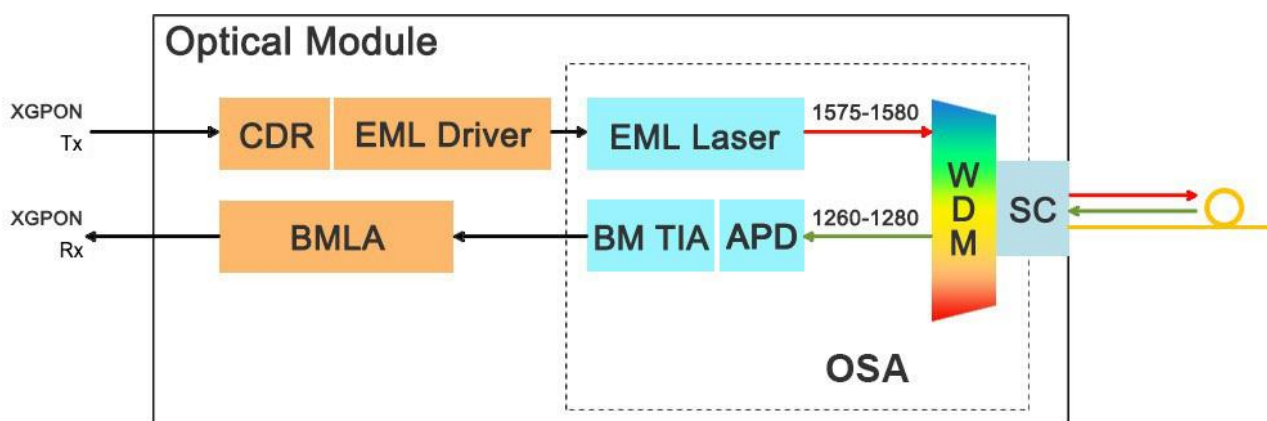
Receiver Electro-optical Characteristics

$V_{CC} = 3.13V$ to $3.47V$, $T_{OP} = 0\text{ }^{\circ}C$ to $70\text{ }^{\circ}C$

Parameters	Symbol	Min.	Typ.	Max.	Unit	Note
Operating Data Rate	DR		2.488		Gb/s	
Receiver Sensitivity (N1 BOL)	SEN			-28.5	dBm	1
Receiver Sensitivity (N1 EOL)	SEN			-28	dBm	1
Receiver Sensitivity (N2a BOL)	SEN			-30.5	dBm	1
Receiver Sensitivity (N2a EOL)	SEN			-30	dBm	1
Maximum Input Power (N1)	P_{RX_MAX}	-6.5			dBm	
Maximum Input Power (N2a)	P_{RX_MAX}	-8.5			dBm	
Optical Center Wavelength	λ_c	1260	1270	1280	nm	
Setting time	ns			100		
LOS De-Assert	LOS _D			-31	dBm	
LOS Assert	LOS _A	-45			dBm	
LOS Hysteresis	LOS _{HY}	0.5		6	dB	
Differential Data Output Swing	V_{OUT}	340		850	mV	
Receiver LOS Signal Output Voltage-Low	LOS _{VL}	GND		0.8	V	
Receiver LOS Signal Output Voltage-High	LOS _{VH}	2.4		V_{CC}	V	

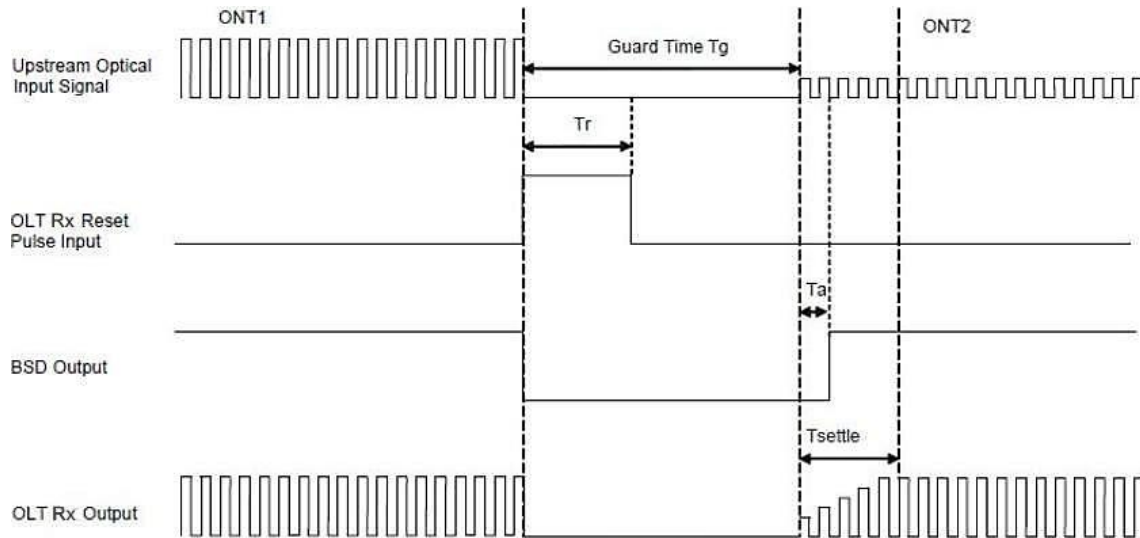
Note1: Measured with a PRBS 2²³-1 test pattern @2.488Gbps, ER=8.2dB, BER<10⁻⁴.

Function Diagram





Timing Sequence for Burst Receiver



Note: Rx RESET pulse should both works well when it is in the guard time or preamble time.

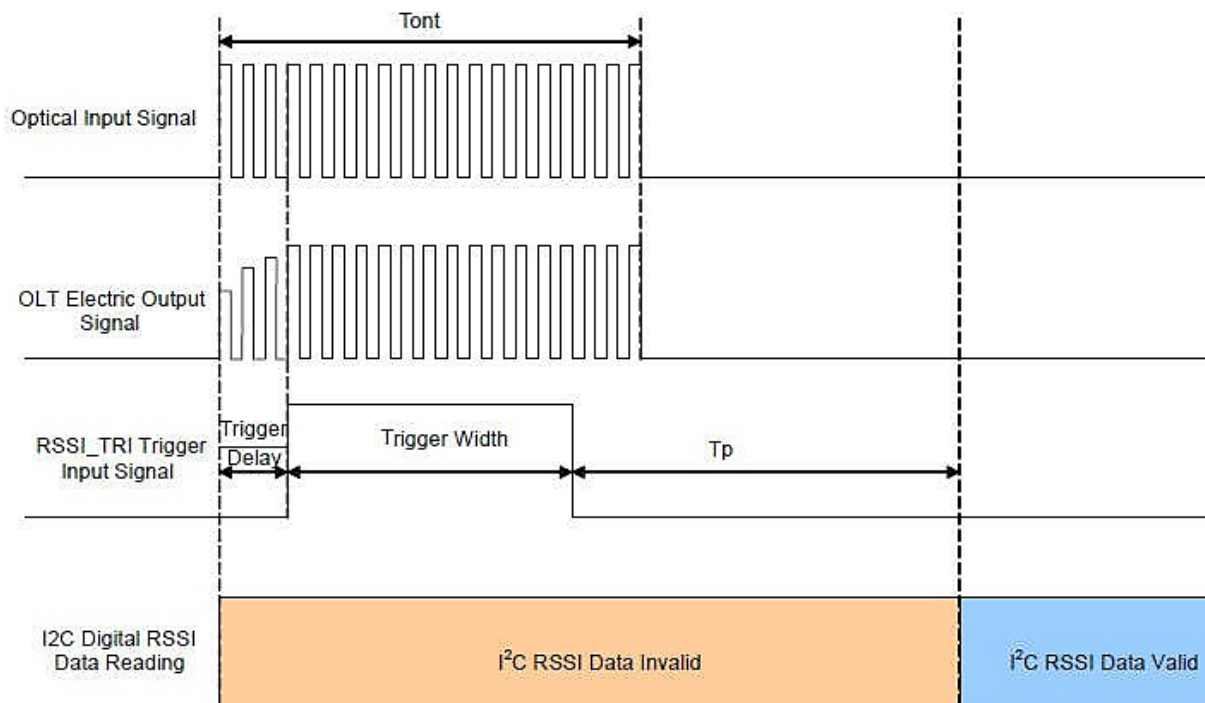
Burst Timing Characteristics

Parameters	Symbol	Min.	Typ.	Max.	Unit	Note
XGPON Guard Time	T_g		TBD		ns	
XGPON Setting Time	T_s		100		ns	
XGPON Reset Pulse Width	T_r		12.8		ns	1
XGPON SD De-assert Time	T_{SD}			10	ns	2

Note1: The XGPON OLT Rx RESET signal can be effective when in the Guard Time duration (Ranging Mode) or in the Preamble Time duration (Working Mode).

Note2: The XGPON OLT Rx SD signal will be level '0' when the Rx RESET signal equals to '1', and it will be level '1' after the input ONU optical signal detected, and its level will be held before the next Rx RESET pulse coming.

Timing Sequence for RSSI

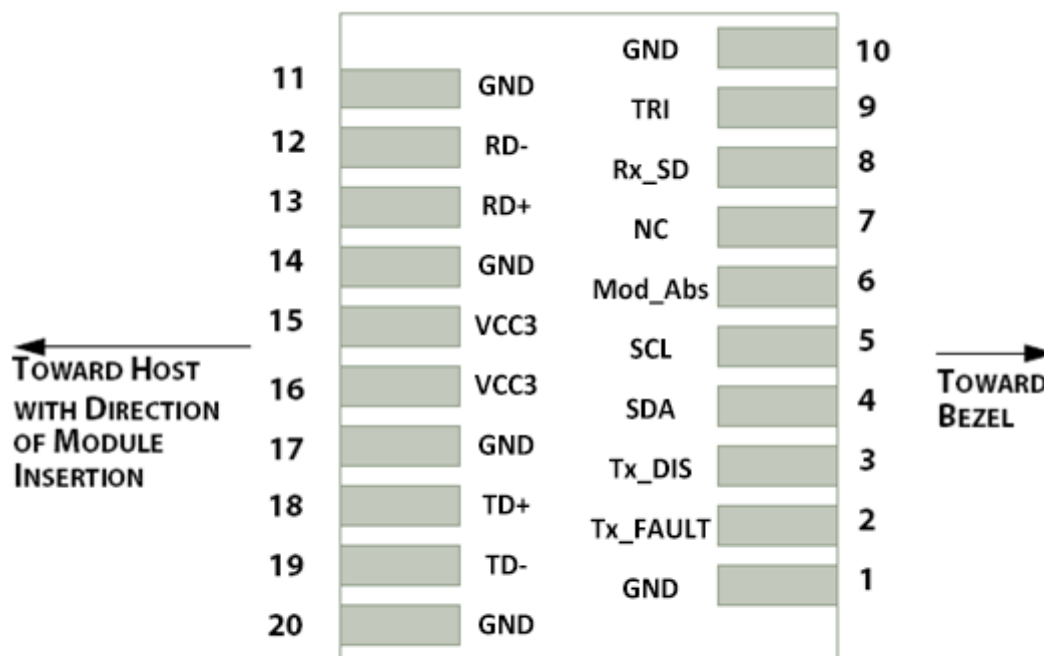


RSSI Timing Characteristics

Parameters	Symbol	Min.	Typ.	Max.	Unit	Note
ONU Package Length	T_{ont}	500				
RSSI Trigger Delay	T_{td}	500		3000	ns	
RSSI Trigger Pulse Width	T_w	600		$T_{ont} - T_{td}$	ns	
Internal I2C Delay	T_p			500	ns	
XGPON ONU Power Range	P_{ont}	-31		-11	dBm	
RSSI Monitoring Error		+/-2			dB	



Pin Assignment



Host PCB SFP+ pad assignment top view

Pin Description

Pin	Name	Function / Description
1	GND	Module Ground
2	TX_FAULT	Transmitter Fault Indication (1)
3	TX_DIS	Transmitter Disable – Turns off transmitter laser output (2)
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 Ground in the module (3)
7	NC	Not connected inside the module
8	Rx_SD	Receiver Loss of Signal Indication (4)
9	TRI	Receiver Signal Strength Indication trigger input
10	GND	Module Ground
11	GND	Module Ground
12	RD-	Receiver Inverted Data output, Differential DC coupled



13	RD+	Receiver Non-Inverted Data output, Differential DC coupled
14	GND	Module Ground
15	VCC3	3.3V Power Supply
16	VCC3	3.3V Power Supply
17	GND	Module Ground
18	TD+	Transmitter Non-Inverted Data Input, Differential AC coupled
19	TD-	Transmitter Inverted Data Input, Differential AC coupled
20	GND	Module Ground

Note1: Tx Fault is open collector/drain output which should be pulled up externally with a 4.7K~10KΩ resistor on the host board to supply $<V_{ccT}+0.3V$ or $V_{ccR}+0.3V$. When high, this output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to $<0.8V$.

Note2: Tx Disable input is used to shut down the laser output per the state table below. It is pulled up within the module with a 4.7K~10KΩ resistor. 1) Low(0~0.8V): Transmitter on; 2) Between (0.8V and 2V): Undefined; 3) High (2.0~ V_{ccT}): Transmitter Disabled; 4) Open: Transmitter Disabled.

Note3: These are the module definition pins. They should be pulled up with a 4.7K~10KΩ resistor on the host board to supply less than $V_{ccT}+0.3V$ or $V_{ccR}+0.3V$. Mod-AbS is grounded by the module to indicate that the module is present.

Note4: LOS (Loss of signal) is an open collector/drain output which should be pulled up externally with a 4.7K~10KΩ resistor on the host board to supply $<V_{ccT}+0.3V$ or $V_{ccR}+0.3V$. When high, this output indicates the received optical power is below the worst case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to $<0.8V$.

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.

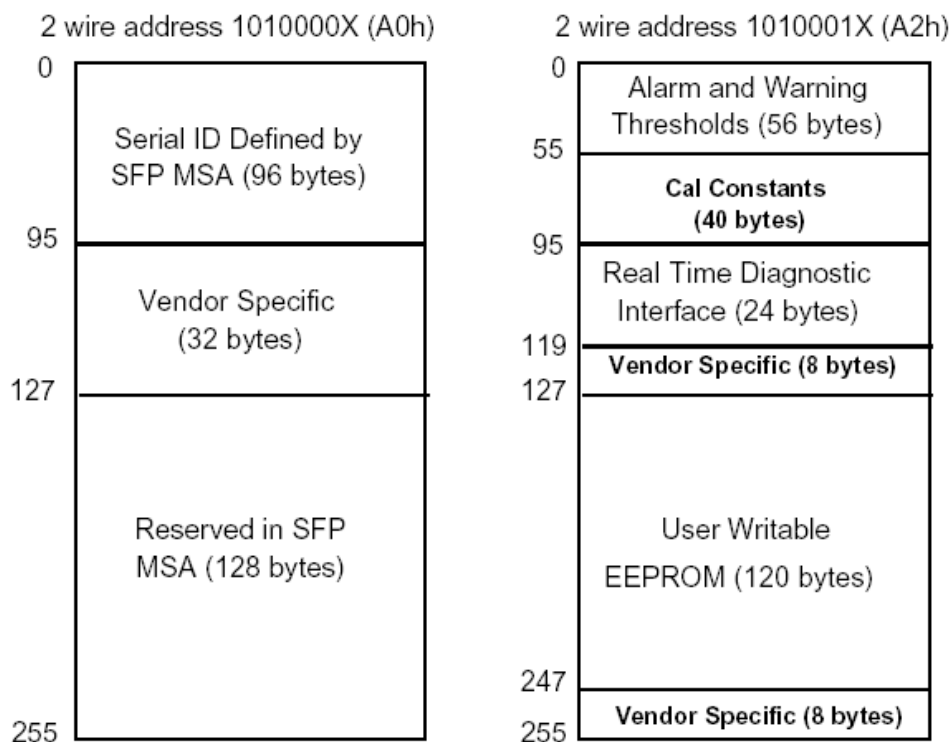
The operating and diagnostics information is monitored and reported by a Digital Diagnostics Controller (DDC) inside the transceiver, which is accessed through the 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL pin) is generated by the host. The positive 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

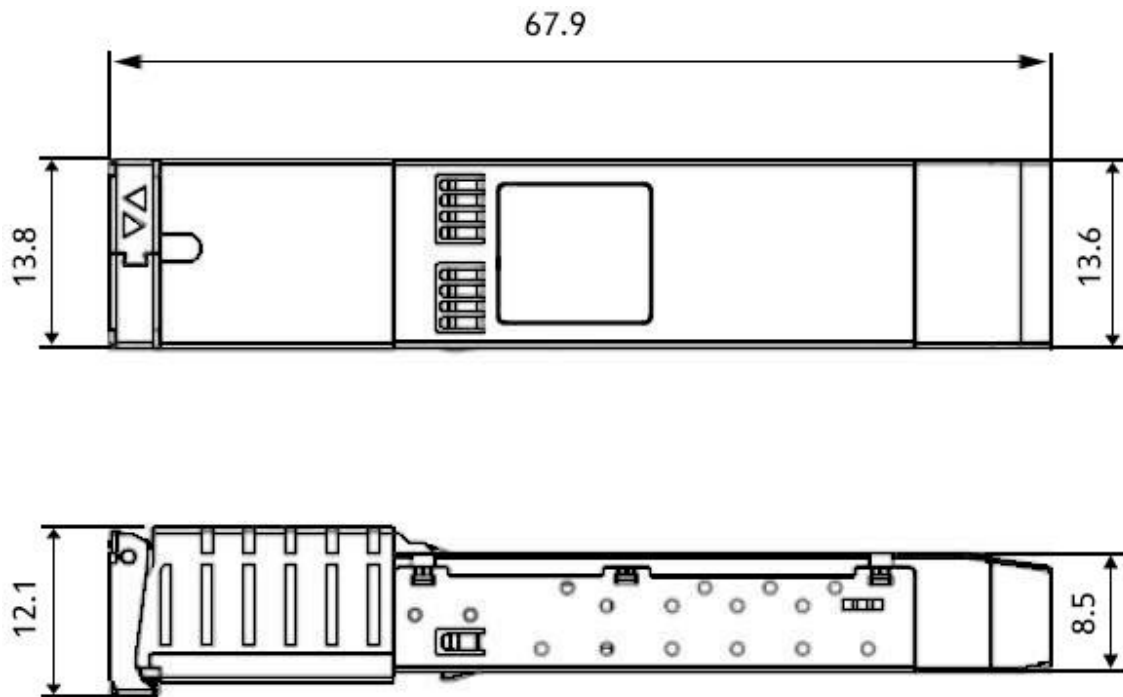
Parameter	Accuracy	Unit	Note
Temperature	±3	°C	Internal Calibration
Supply Voltage	±0.1	V	Internal Calibration
Tx Bias Current	±5	mA	Internal Calibration
Tx Output Power	±3	dB	Internal Calibration
Rx Received Optical Power	±3	dB	Internal Calibration



EEPROM(0xA2) RSSI selection

Address	Bit	Name	Description
118	7	RSSI select	Writing "1" for XGPON RSSI Monitor. Default power-up value is "0".
118	6	RSSI/TX dis able Select	When set "0", PIN9 input as TX Disable input; When set "1", PIN9 as RSSI input. Default power-up value is "0".

Mechanical Dimensions



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



Ordering Information

Part No.	Tx	Rx	Link	DDM	ODN Class	Temp.
FSPH-H2-PX5-201	1577nm	1270nm	SMF 20km	Yes	N1	0~70°C
FSPH-H2-PX5-205					N2a	

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.