

# 10Gbps SFP+ Bi-Directional Transceiver, 40km Reach TX1330nm/RX1270nm FPBPP3710GL-40D

## Features

- Compliant to SFP+MSA
- 1330nm DFB Transmitter, PIN Photodiode and TIA
- SM 9/125um up to 40Km
- Simplex LC Connector Bi-Directional SFP+ Optical Transceiver
- Built-in digital diagnostic monitoring functions
- All-Metal housing for superior EMI Performance
- Power dissipation < 1W, Single 3.3V power supply
- Operating Case Temperature Standard: 0°C~+70°C
- Electronic Interface compliant with SFF-8431
- Digital Diagnostic Monitor Function Compatible with SFF-8472
- Compliant with IEEE 802.3ae 10GBASE-LR/LW
- ROHS6 Compliant

## Applications

- 10G Ethernet
- 8G Fiber Channel
- 10G Fiber Channel

## Product Description

FPBPP3710GL-40D Single-Mode Transceiver is SFP+ modules for duplex data communication as 8G Fiber Channel, IEEE 802.3ae 10G Base-LR/LW It is SFP+ 20-PIN Connector to allow hot plug capability. Digital diagnostic monitor functions are available via I<sup>2</sup>C. This module is designed and operates at DFB Laser 1270nm wavelength.

## Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit
Storage Temperature	Ts	-40		85	°C
Operating Case Temperature	Tc	-5		70	°C
Supply Voltage	VCC	-0.5		3.6	V

## Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Ambient Operating Temperature	T <sub>A</sub>	0		70	°C
Supply Voltage	VCC	3.15	3.3	3.45	V
Data Rate	BR		10.3	11.3	Gbps
Total Supply Current	I <sub>cc</sub>			300	mA

## Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
<b>Transmitter</b>						
Input differential impedance	R <sub>i</sub>		100		Ω	1
Differential data input swing	V <sub>in,pp</sub>	180		700	mV	
Transmit disable voltage	V <sub>D</sub>	2		V <sub>cc</sub>	V	
Transmit enable voltage	V <sub>EN</sub>	V <sub>ee</sub>		V <sub>ee</sub> +0.8	V	
Data dependent input jitter	DDJ			0.1	U	
Data input Total Jitter	TJ			0.28	U	
<b>Receiver</b>						
Differential data output swing	V <sub>out,pp</sub>	300		850	mV	
Data output rise time, fall time	t <sub>r</sub>	30			P	2
Los Fault	V <sub>LOS fault</sub>	2		V <sub>CChost</sub>	V	3
Los Normal	V <sub>LOS norm</sub>	V <sub>ee</sub>		V <sub>ee</sub> +0.8	V	3
Total Jitter	TJ			0.70	U	
Deterministic Jitter	DJ			0.42	U	

### Notes:

1. Connected directly to TX data input pins, AC coupling from pins into laser drive
2. 20 – 80 % . Measured with Module Compliance Test Board and OMA test pattern. Use of four 1's and four 0's in sequence in the PRBS<sup>9</sup> is an acceptable alternative. SFF-8431 Rev 2.1
3. LOS is an open collector output. Should be pulled up with 4.7kΩ – 10kΩ on the host board. Normal operation is logic 0; loss of signal is logic 1. Maximum pull-up voltage is 3.6V

## Optical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
<b>Transmitter</b>						
Center Wavelength	$\lambda_t$	1320	1330	1340	nm	
Average Optical Power	P <sub>av</sub>	-1		4	dBm	
Extinction Ratio	ER	3.5			dB	
Transmitter and Dispersion Penalty	TDP			3.9	dB	
Relative Intensity Noise	RIN			-128	dB/Hz	
<b>Receiver</b>						
Center Wavelength	$\lambda_R$	1260	1270	1280	nm	
Receiver Sensitivity	RP <sub>sen</sub>			-15	dBm	1
Return Loss Tolerance				-12	dB	
Receiver Overload	RP <sub>max</sub>	0.8			dBm	2
LOS De-Assert	LOS <sub>D</sub>			-17	dBm	
LOS Assert	LOS <sub>A</sub>	-30			dBm	
LOS	High	2.0		V <sub>cc</sub> +0.3	V	
	Low	0		0.8		

### Notes:

1. Measured with a PRBS 2<sup>31</sup>-1 test pattern @10.3125Gbps, BER≤10<sup>-12</sup>
2. Receiver Overload specified in OMA and under the worst comprehensive stressed conditions

## Pin function definitions

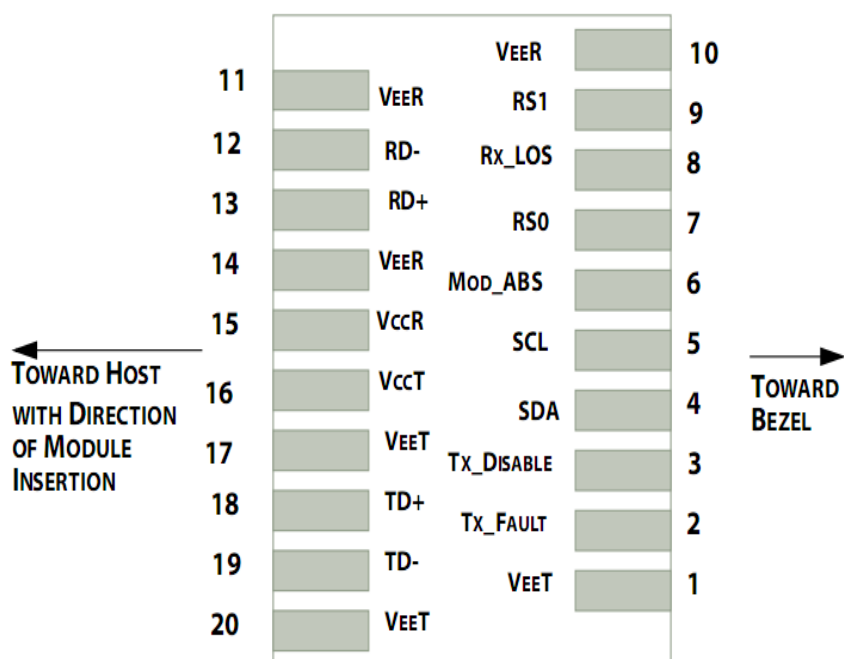


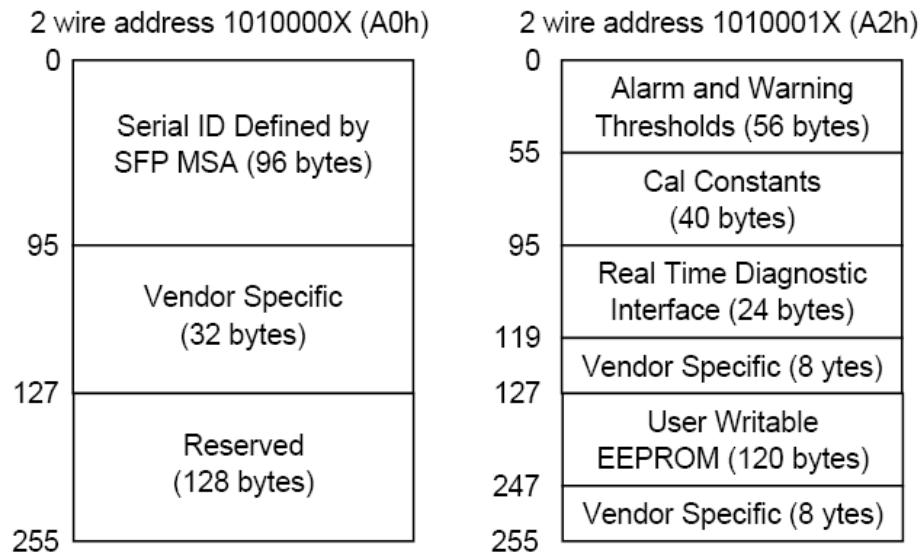
Figure 1 Transceiver pin descriptions

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	No connection required	1
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation.	5
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 4.7kΩ–10kΩ host board to a voltage between 2.0V and 3.6V. MOD\_ABS pulls line low to indicate module is plugged in.
5. LOS is open collector output. It should be pulled up with 4.7kΩ–10kΩ on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

## Typical application circuit

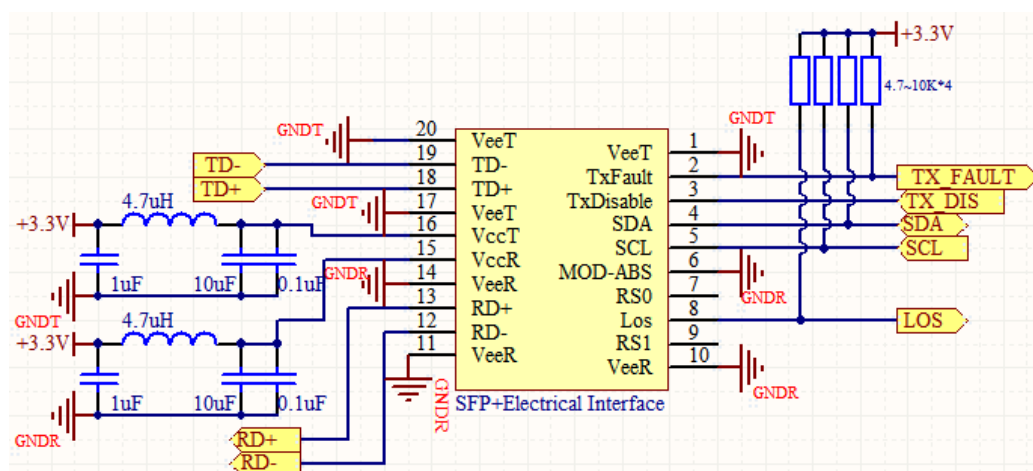


**Figure 2 SFP+Electrical Interface**

## Digital Diagnostic Functions

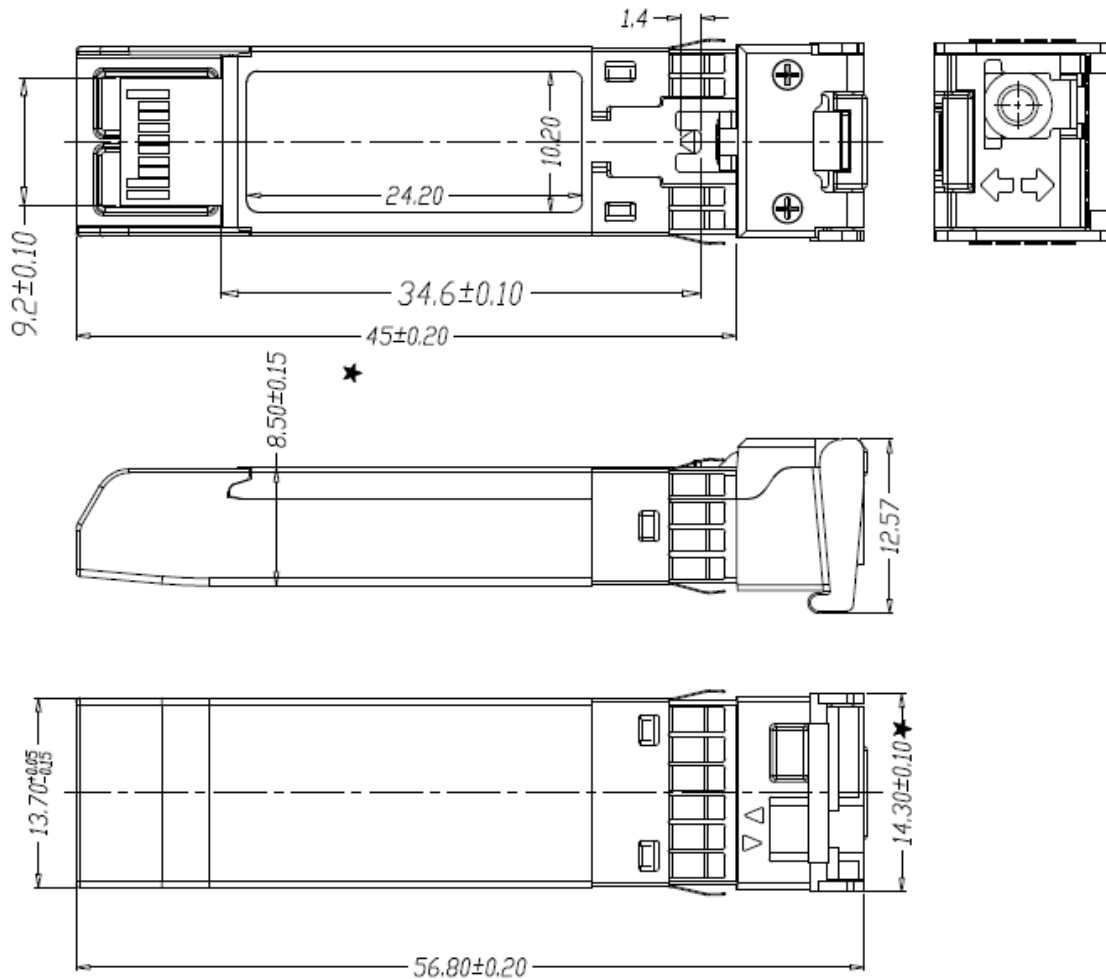
FPBPP3710GL-40D transceivers support the 2-wire serial communication protocol as defined in the SFP MSA.

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).



**Figure 3 Digital Diagnostic Memory Map**

## Mechanical Specifications



## ESD

This transceiver is specified as ESD threshold 2kV for all electrical input pins, tested per MIL-STD-883, Method 3015.4 /JESD22-A114-A (HBM). However, normal ESD precautions are still required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and handled only in an ESD protected environment.

## Laser Eye Safety

Class 1 Laser Product as defined by the Internal Standard IEC 60825-

1: 2014 and by USA regulations for

class 1 products per CDRH 21 CFR 1040.1 and 1040.11.

## Ordering information

Part No.	Data Rate	Laser	Receiver	Distance	Interface	DDM	Temp.
FPBPP3710GL-40D	10Gbps	DFB	PIN-TIA	40Km	LC	YES	C

\* 40D--- 40Km with SM 9/125um Fiber Transmission, with DDM/DOM Functional