

# 10Gbps CWDM SFP+ Transceivers, 40Km Reach FPCPPXX10GL-40D (1470~1610)

## Features

- 10Gb/s serial optical interface compliant to 802.3ae 10GBASE-ER
- CWDM EML Laser
- Up to 40km transmission
- Metal enclosure, for lower EMI
- Electrical interface compliant to SFF-8431
- 2-wire interface for management
- Specifications compliant with SFF 8472
- Single 3.3V power supply
- Case operating temperature range: 0°C to 70°C
- Class 1 Laser International Safety Standard IEC-60825

## Applications

- 10GBASE-ER/LR/LW 10G Ethernet

## Standard

- Compliant to 802.3ae 10GBASE-ER
- Compliant to SFP+ SFF-8431 and SFF-8432.
- Compliant to SFF 8472
- RoHS Compliant.

## Product Selection

FPCPPXX10GL-40D

Wavelength	xx	Wavelength	xx
1470 nm	47	1550 nm	55
1490 nm	49	1570 nm	57
1510 nm	51	1590 nm	59
1530 nm	53	1610 nm	61

## Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Maximum Supply Voltage	V <sub>cc</sub>	-0.5		3.6	V	
Storage Temperature	T <sub>S</sub>	-40		85	°C	
Case Operating Temperature	T <sub>case</sub>	0		70	°C	

## Electrical Characteristics (T<sub>case</sub> = -5°C to 70°C, V<sub>CC</sub> = 3.14 to 3.46 Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Supply Voltage	V <sub>cc</sub>	3.14	3.3	3.46	V	
Supply Current	I <sub>cc</sub>		300	450	mA	
<b>Transmitter</b>						
Input differential impedance	R <sub>in</sub>		100		Ω	1
Differential data input swing	V <sub>in,pp</sub>	180		1200	mV	
Transmit Disable Voltage	V <sub>D</sub>	V <sub>cc</sub> -1.3		V <sub>cc</sub>	V	
Transmit Enable Voltage	V <sub>EN</sub>	V <sub>ee</sub>		V <sub>ee</sub> + 0.8	V	2
Transmit Disable Assert Time				10	us	
<b>Receiver</b>						
Differential data output swing	V <sub>out,pp</sub>	300		850	mV	3
Data output rise time	t <sub>r</sub>	30			ps	4
Data output fall time	t <sub>f</sub>	30			ps	4
LOS Fault	V <sub>LOS fault</sub>	V <sub>cc</sub> -1.3		V <sub>cc</sub> HOST	V	5
LOS Normal	V <sub>LOS norm</sub>	V <sub>ee</sub>		V <sub>ee</sub> +0.8	V	5
Power Supply Rejection	PSR	100			mVpp	6

**Notes:**

1. Connected directly to TX data input pins. AC coupled thereafter.
2. Or open circuit.
3. Into 100 ohms differential termination.
4. These are unfiltered 20-80% values
5. Loss Of Signal is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.
6. Receiver sensitivity is compliant with power supply sinusoidal modulation of 20 Hz to 1.5 MHz up to specified value applied through the recommended power supply filtering network.

**Optical Characteristics ( $T_{case} = 0^{\circ}C$  to  $70^{\circ}C$ ,  $V_{CC} = 3.14$  to  $3.46$  Volts)**

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Transmitter						
Output Opt. Pwr	POUT	-1		+5	dBm	1
Optical Wavelength	$\lambda$	$\lambda$ -6.5		$\lambda$ +6.5	nm	2
Wavelength Temperature Dependence			0.08	0.125	nm/°C	
Spectral Width (-20dB)	$\sigma$			1	nm	
Optical Extinction Ratio	ER	8.2			dB	
Transmitter and Dispersion Penalty	TDP			3.0	dB	
Sidemode Suppression ratio	SSRmin	30			dB	
RIN	RIN			-128	dB/Hz	
Output Eye Mask		Compliant with IEEE 0802.3ae				
Receiver						
Rx Sensitivity @ 10.325G	RSENS			-15	dBm	3
Input Saturation Power (Overload)	Psat	0.5			dBm	
Wavelength Range	$\lambda$ C	1270		1610	nm	
LOS De -Assert	LOSD			-17	dBm	
LOS Assert	LOSA	-30			dBm	
LOS Hysteresis		0.5			dB	

**Notes:**

1. Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations.
2. " $\lambda$ " is: 1470, 1490, 1510, 1530, 1550, 1570, 1590, 1610, please the "product selection".
3. With worst-case extinction ratio. Measured with a PRBS  $2^{31}-1$  test pattern, @10.325Gb/s,  $BER < 10^{-12}$ .

## Pin Descriptions

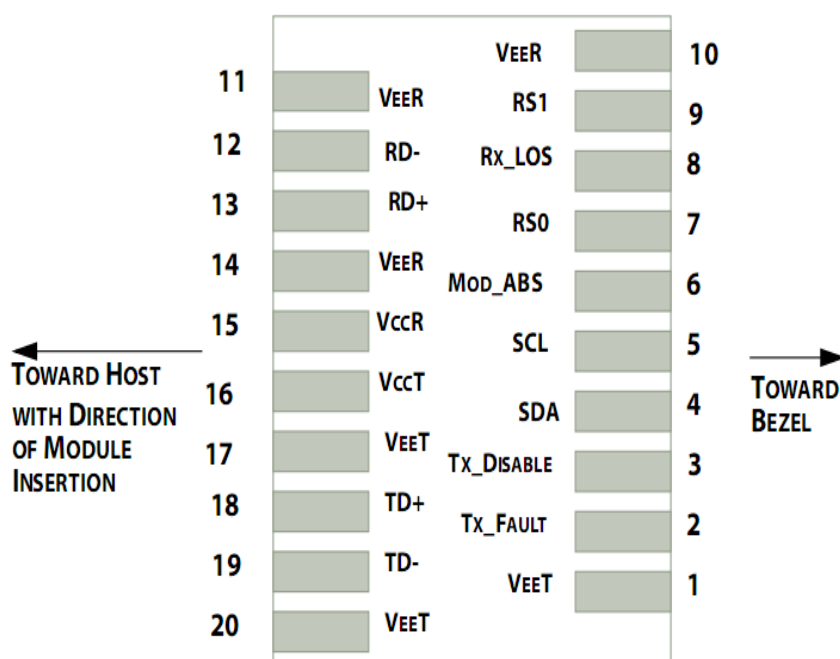


Figure 1 Transceiver pin descriptions

## Pin Function Definitions

Pin	Symbol	Name/Description	Ref.
1	V <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground)	1
2	T <sub>FAULT</sub>	Transmitter Fault.	2
3	T <sub>DIS</sub>	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 <sub>EER</sub>	Receiver Ground (Common with Transmitter Ground)	1
11	V <sub>EER</sub>	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 <sub>EER</sub>	Receiver Ground (Common with Transmitter Ground)	1
15	V <sub>CCR</sub>	Receiver Power Supply	
16	V <sub>CCT</sub>	Transmitter Power Supply	
17	V <sub>EET</sub>	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 <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground)	1

### Notes:

1. Circuit ground is internally isolated from chassis ground.
2.  $T_{\text{FAULT}}$  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  $V_{\text{cc}} + 0.3\text{V}$ . 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  $<0.8\text{V}$ .
3. Laser output disabled on  $T_{\text{DIS}} > 2.0\text{V}$  or open, enabled on  $T_{\text{DIS}} < 0.8\text{V}$ .
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

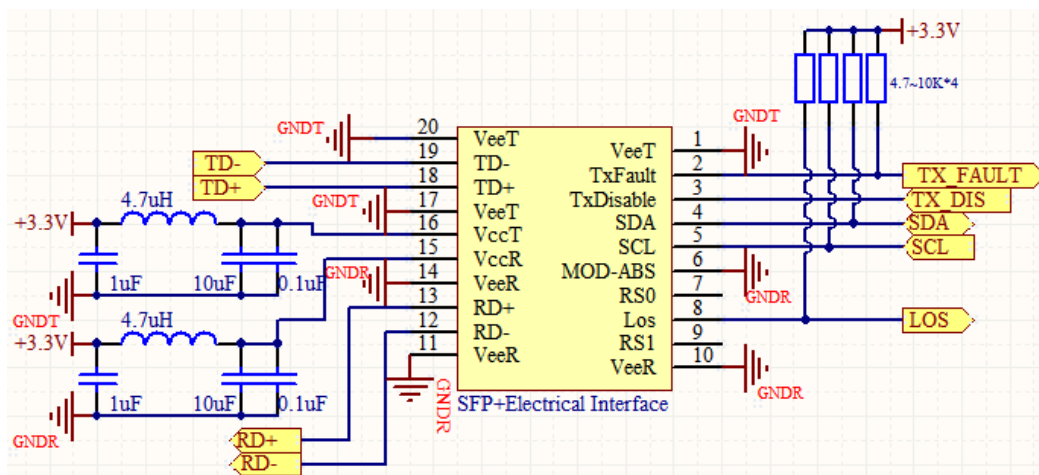


Figure 2 SFP+Electrical Interface

## Digital Diagnostic Functions

FPCPPXX10GL-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).

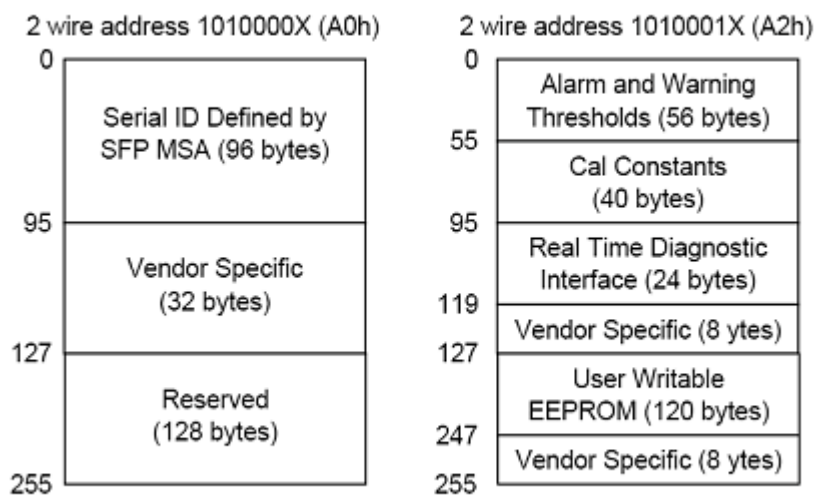
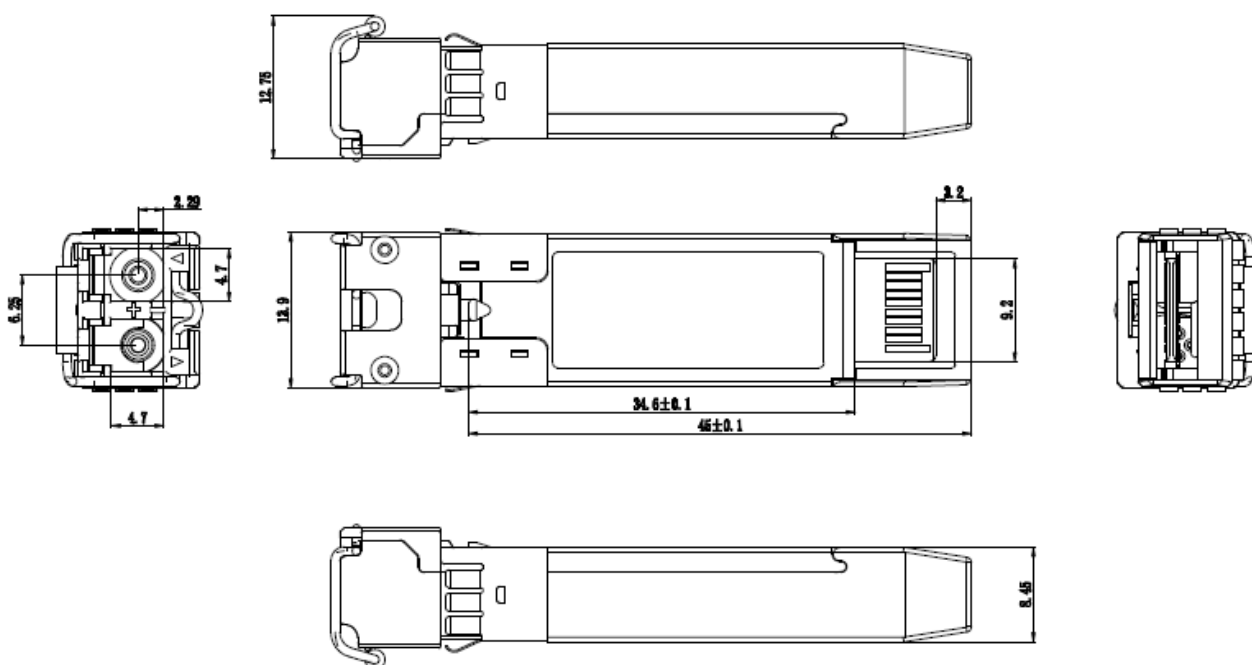


Figure 3 Digital Diagnostic Memory Map

## Outline Dimensions

Comply to SFF-8432 rev. 5.0, the improved Pluggable form factor specification.



## 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.

## Ordering information

Part No.	Data Rate	Laser	Receiver	Distance	Interface	DDM	Temp.
FPCPPXX10GL-40D	10.3Gbps	CWDM EML	PIN-TIA	40KM	LC	YES	C

\* XX ---1470,1490, 1510, 1530, 1550, 1570, 1590, 1610, please the “product selection”

\* 40D --- 40KM with SM 9/125um Fiber, with DDM Functional