CWDM 40km SFP+ Transceivers

TPC1XGJERxG

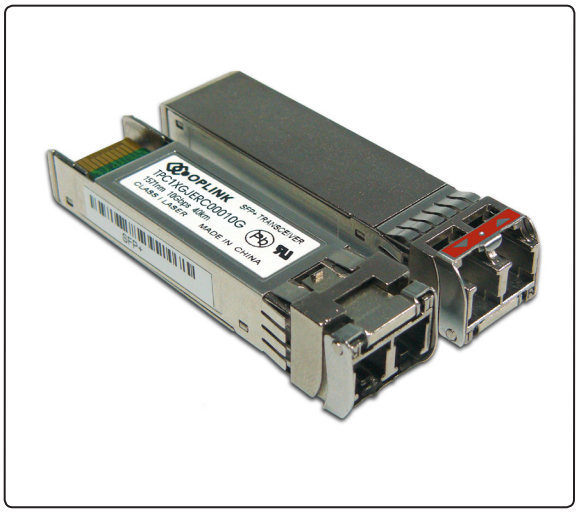
Product Description

The TPC1XGJERxG is an enhanced small form factor pluggable (SFP+) fiber optic transceiver with digital diagnostics monitoring functionality (DDM). Supporting Ethernet and Fiber Channel standards makes it ideally suited for high capacity data-com and storage area network applications. DDM functionality (alarm and warning features) is integrated into the design via an I^2C serial interface per the Multi-Source Agreement (MSA) SFF-8472, Rev. 10.4.

Each transceiver utilizes an electro absorption modulator integrated laser (EML) with an operating wavelength with 100GHz (0.8nm) spacing per the ITU-grid. The transceiver supports data rates ranging from 11.3Gbps down to 8Gbps. It provides an excellent solution for data transmission at CWDM wavelength over up to 40km single mode fiber. The low power consumption and excellent EMI performance enable system design with high port density. The product is RoHS compliant and is designed and tested in accordance with industry safety standards. The transceiver is Class I Laser product per U.S. FDA/CDRH and international IEC-60825 standards.

The TPC1XGJERxG transceiver connects to standard 20-pad SFP+ connectors for hot plug capability. This allows the system designer to make configuration changes or maintenance by simply plugging in different transceivers without removing the power supply from the host system. The transmitter and receiver DATA interfaces are internally AC-coupled. LV-TTL Transmitter Disable control input and Loss of Signal (LOS) output interfaces are also provided. The transceiver has bail-type latch, which offers an easy and convenient way to release the modules.

The transceiver operates from a single +3.3V power supply over an operating case temperature range of -5°C to +70°C (Commercial), or -5°C to +85°C (Extended) or -40°C to +85°C (Industrial).



Features

- ☑ Temperature-stablized CWDM EML transmitter
- ☑ Multi-rate for Ethernet & Fiber Channel
- ☑ Transmission distance up to 40km (SM Fiber)
- ☑ Low power consumption
- ☑ Wide case operating temperature range
- ☑ Compliant with SFP+ Electrical MSA SFF-8431
- ☑ Compliant with SFP+ Mechanical MSA SFF-8432
- ☑ Compliant with 10GBASE-E specifications
- ☑ Digital Diagnostics Monitoring (DDM) through Serial Interface comply with SFF-8472, Rev. 10.4
- ☑ RoHS 6/6 Compliant
- ☑ Laser Class 1 IEC/CDRH compliant

Absolute Maximum Ratings

Parameter		Symbol	Minimum	Maximum	Units
Storage Temperature Range		T_{ST}	- 40	+ 85	°C
Operating Case Temperature [1]	"Commercial"	T_{OP}	- 5	+ 70	°C
	"Extended"		- 5	+ 85	
	"Industrial"		- 40	+ 85	
Operating Relative Humidity [2]		RH	0	85	%
Supply Voltage Range		V_{CC}	- 0.5	+ 3.6	V

[1] Measured on top side of SFP+ module at the front center vent hole of the cage.
[2] Non condensing

Transmitter Performance Characteristics (Over Operating Case Temperature. V_{CC} = 3.13 to 3.47V)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Data Rate	B	8.0	-	11.3	Gb/s
Center Wavelength	λ_C	See Ordering Information Table			nm
Center Wavelength Tolerance	-	- 6.5	-	+ 6.5	nm
Spectral Width (-20dB)	$\Delta\lambda_{20}$	-	-	1.0	nm
Average Optical Output Power [1]	P_{Avg}	- 1	-	+ 4	dBm
Extinction Ratio	ER	4.5	-	-	dB
Relative Intensity Noise in OMA	$RIN_{21}OMA$	-	-	- 128	dB/Hz
Side Mode Suppression Ratio	$SMSR$	30	-	-	dB
Optical Return Loss Tolerance	-	-	-	- 21	dB
Transmitter and Dispersion Penalty @ 10.3125Gb/s	TDP	-	-	3	dB
Optical Output Eye	*Compliant with IEEE 802.3ae*				

[1] Average power figures are informative only, per IEEE 802.3ae.

Receiver Performance Characteristics (Over Operating Case Temperature. V_{CC} = 3.13 to 3.47V)

Parameter		Symbol	Minimum	Typical	Maximum	Units
Data Rate		B	8.0	-	11.3	Gb/s
Wavelength of Operation		λ	1450	-	1620	nm
Receiver Sensitivity	@ 10.3125Gb/s [1]	P_{min}	-	-	- 14.0	dBm
Maximum Input Power (10 $^{-12}$ BER)		P_{max}	- 1	-	-	dBm
Receiver Reflectance		-	-	-	- 26	dB
LOS Hysteresis		-	0.5	-	-	dB
LOS Thresholds	Increasing Light Input	P_{los+}	-	-	- 16	dBm
	Decreasing Light Input	P_{los-}	- 30	-	-	

[1] Specified with BER <1x10^{-12} and PRBS 2^{31}-1.

Note: The specified characteristics are met within the recommended range of operation. Unless otherwise noted typical data are quoted at nominal voltage and +25°C ambient temperature.

Laser Safety:
All transceivers are Class 1 Laser products per FDA/CDRH and IEC-60825 standards. They must be operated under specified operating conditions.

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Oplink Communications, Inc.

This product complies with
21 CFR 1040.10 and 1040.11
Meets Class 1 Laser Safety Requirements

Transmitter Electrical Characteristics (Over Operating Case Temperature. V_{CC} = 3.13 to 3.47V)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Differential Input Impedance	Z_d	-	100	-	Ω
Differential Input Voltage Swing	$V_{PP-DIFF}$	180	-	700	mV
Input HIGH Voltage (TX Disable) [1]	V_{IH}	2.0	-	V_{CC}	V
Input LOW Voltage (TX Disable) [1]	V_{IL}	0	-	0.8	V
Output HIGH Voltage (TX Fault) [2]	V_{OH}	2.0	-	V_{CC} + 0.3	V
Output LOW Voltage (TX Fault) [2]	V_{OL}	0	-	0.8	V

[1] There is an internal 4.7kΩ to 10kΩ pull-up resistor to VccT.
[2] Open collector compatible, 4.7kΩ to 10kΩ pull-up resistor to Vcc (Host Supply Voltage).

Receiver Electrical Interface (Over Operating Case Temperature. V_{CC} = 3.13 to 3.47V)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Differential Output Impedance	Z_d	-	100	-	Ω
Differential Output Swing	$V_{PP-DIFF}$	300	450	850	mV
Output Rise and Fall time (20% to 80%)	t_{RH}, t_{FH}	28	-	-	ps
Output HIGH Voltage (LOS) [1]	V_{OH}	V_{CC} - 1.3	-	V_{CC} + 0.3	V
Output LOW Voltage (LOS) [1]	V_{OL}	0	-	0.8	V

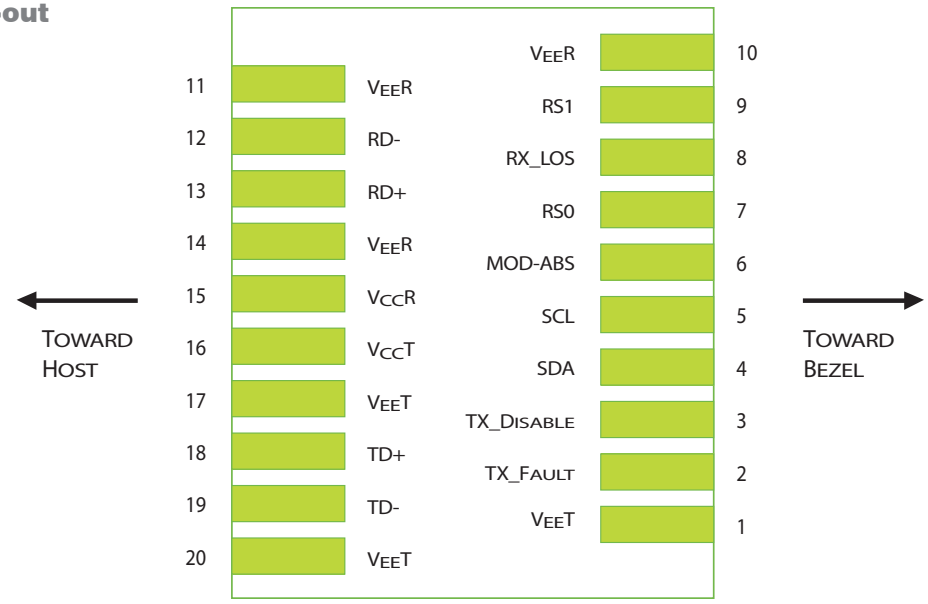
[1] Open collector compatible, 4.7kΩ to 10kΩ pull-up resistor to Vcc (Host Supply Voltage).

Electrical Power Supply Characteristics (Over Operating Case Temperature. V_{CC} = 3.13 to 3.47V)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Power Supply Voltage	V_{CC}	3.13	3.30	3.47	V
DC Common Mode Voltage	V_{CM}	0	-	3.60	V
Supply Current	I_{VCC}	-	310	-	mA
Power Consumption	P_W	-	1.0	-	W

Note: The specified characteristics are met within the recommended range of operation. Unless otherwise noted typical data are quoted at nominal voltage and +25°C ambient temperature.

Connector Pin-out



Module Pin Description

Pin	Logic	Symbol	Description
1	-	*VeeT*	Module Transmitter Ground
2	*LVTTL-O*	*TX_Fault*	Module Transmitter Fault
3	*LVTTL-I*	*TX_Disable*	Transmitter Disable; Turns off transmitter laser output
4	*LVTTL-I/O*	*SDA*	2-Wire Serial Interface Data Line
5	*LVTTL-I/O*	*SCL*	2-Wire Serial Interface Clock
6	-	*MOD-ABS*	Module Definition, Grounded in the module
7	*LVTTL-I*	*RS0*	No function implemented
8	*LVTTL-O*	*RX_LOS*	Receiver Loss of Signal Indication
9	*LVTTL-I*	*RS1*	No function implemented
10	-	*VeeR*	Module Receiver Ground
11	-	*VeeR*	Module Receiver Ground
12	*CML-O*	*RD-*	Receiver Inverted Data Output
13	*CML-O*	*RD+*	Receiver Data Output
14	-	*VeeR*	Module Receiver Ground
15	-	*VccR*	Module Receiver 3.3V Supply
16	-	*VccT*	Module Transmitter 3.3V Supply
17	-	*VeeT*	Module Transmitter Ground
18	*CML-I*	*TD+*	Transmitter Non-Inverted Data Input
19	*CML-I*	*TD-*	Transmitter Inverted Data Input
20	-	*VeeT*	Module Transmitter Ground

Application Notes

Electrical Interface: All signal interfaces are compliant with the SFP+ MSA specification. The high speed DATA interface is differential AC-coupled internally and can be directly connected to a 3.3V SERDES IC. All low speed control and sense output signals are open collector TTL compatible and should be pulled up with a 4.7kΩ - 10kΩ resistor on the host board.

Loss of Signal (LOS): The Loss of Signal circuit monitors the level of the incoming optical signal and generates logic HIGH when an insufficient photocurrent is produced.

TX_Fault: The output indicates LOW when the transmitter is operating normally and HIGH with a laser fault including laser end-of-life. TX Fault is an open collector/drain output and should be pulled up with a 4.7kΩ - 10kΩ resistor on the host board.

TX_Disable: When the TX Disable pin is at logic HIGH, the transmitter optical output is disabled. The laser is also disabled if this line is left floating, as it is pulled high inside the transceiver.

Serial Identification and Monitoring: The module definition of SFP is indicated by the MOD_ABS pin and the 2-wrie serial interface. Upon power up, the 2-wrie interface appears as NC (no connection), and MOD_ABS is TTL LOW. When the host system detects this condition, it activates the serial protocol (standard two-wire I^2C serial interface) and generates the serial clock signal (SCL). The positive edge clocks data into the EEPROM segments of the device that are not write protected, and the negative edge clocks data from the device. The serial data signal (SDA) is for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The supported monitoring functions are temperature, voltage, bias current, transmitter power, average receiver signal, all alarms and warnings, and software monitoring of TX Fault/LOS. The device is internally calibrated.

The data transfer protocol and the details of the mandatory and vendor specific data structures are defined in the SFP MSA, and SFF-8472, Rev. 10.4.

Power Supply and Grounding: The power supply line should be well-filtered. All power supply bypass capacitors should be as close to the transceiver module as possible.

Interfacing the Transceivers

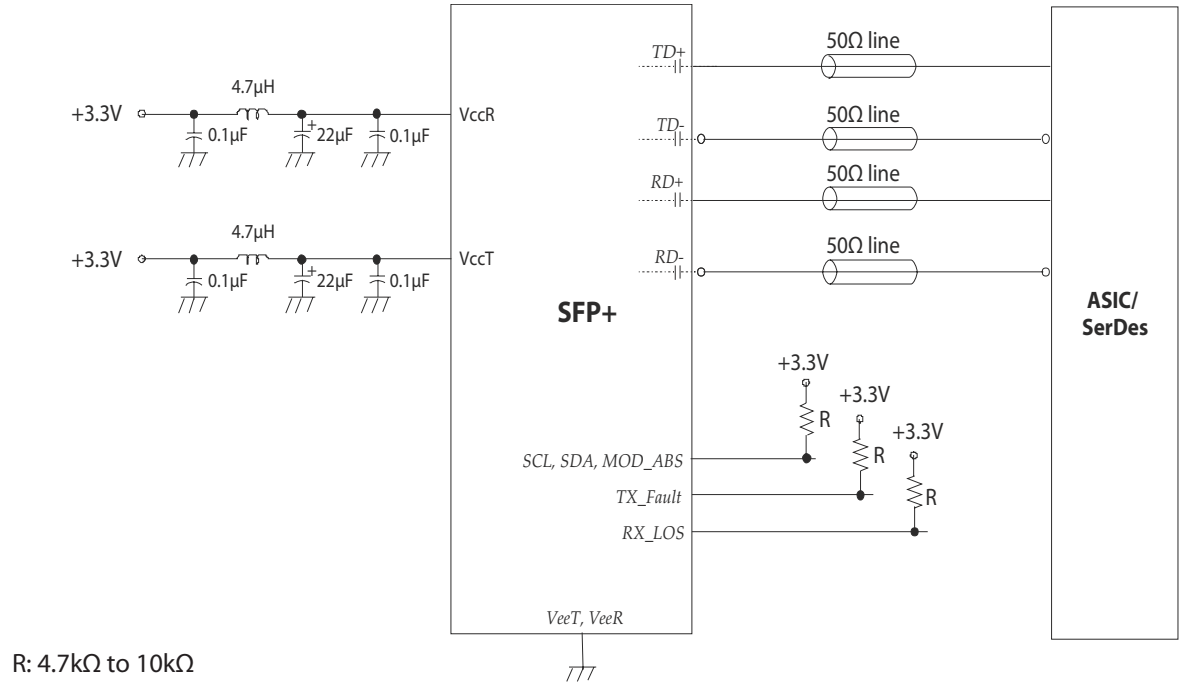
Communication is via a serial 2-wire serial interface. As described in the document SFF-8472 (REV. 10.4) there are two distinct address spaces:

Base Address A0(hex)	
Byte Address	**Content**
0 – 95	Serial Transceiver ID as defined in SFP MSA
96 – 127	OPLINK Specific
128 – 255	Reserved

Base Address A2(hex)	
Byte Address	**Content**
0 - 55	Alarm & Warnings thresholds & limits
56 - 95	External calibration constants (not used)
96 – 119	Values from real time diagnostic monitoring
120 – 127	Not used
128 – 247	Customer specific, writable area
248 - 255	Not used

Application Schematics

Recommended electrical connections to transceiver are shown below.

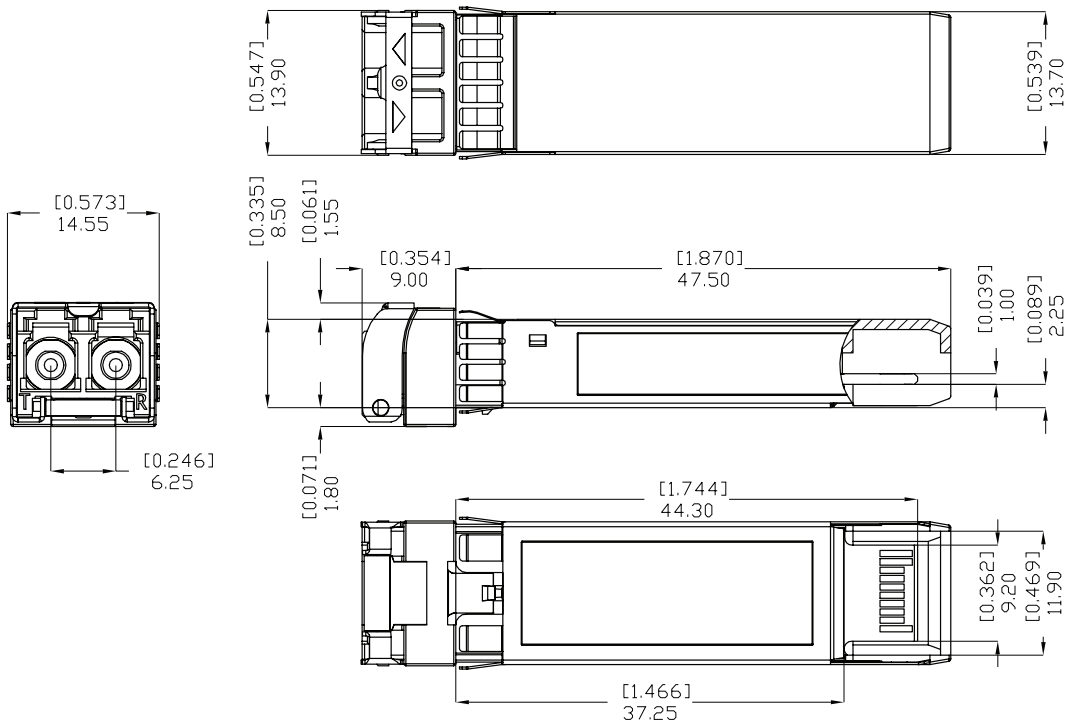


R: 4.7kΩ to 10kΩ

ESD & Electromagnetic Compatibility

Requirements	Standard	Status
Electro Static Discharge to the Electrical Pins (ESD)	EIA/JESD22-A114-B MIL-STD 883C Method 3015.7	Exceeds requirements Class 1B (>1000V)
Immunity to ESD (housing, receptacle)	IEN 61000-4-2	Exceeds requirements Discharges ranging from 2kV to 15kV without damages to the transceiver
Electromagnetic Emission (EMI)	FCC Part 15, Class B EN 55022 Class B CISPR 22	Exceeds requirements Class B

Package Outline



Dimensions in [inches] mm
Millimeters are the primary units.
Tolerances are in accordance with SFF-8432 Rev.5

Ordering Information

Oplink can provide a remarkable range of customized optical solutions. For detail, please contact Oplink's Sales and Marketing for your requirements and ordering information (510) 933-7200 or Sales@oplink.com.

Model Name	Operating Temperature		Center Wavelength	Distance
TPC1XGJERC00010G	- 5°C to +70°C	Commercial	1471nm	40km
TPC1XGJERC00020G	- 5°C to +70°C	Commercial	1491nm	40km
TPC1XGJERC00030G	- 5°C to +70°C	Commercial	1511nm	40km
TPC1XGJERC00040G	- 5°C to +70°C	Commercial	1531nm	40km
TPC1XGJERC00050G	- 5°C to +70°C	Commercial	1551nm	40km
TPC1XGJERC00060G	- 5°C to +70°C	Commercial	1571nm	40km
TPC1XGJERC00070G	- 5°C to +70°C	Commercial	1591nm	40km
TPC1XGJERC00080G	- 5°C to +70°C	Commercial	1611nm	40km

Model Name	Operating Temperature		Center Wavelength	Distance
TPC1XGJERE00010G	- 5°C to +85°C	Extended	1471nm	40km
TPC1XGJERE00020G	- 5°C to +85°C	Extended	1491nm	40km
TPC1XGJERE00030G	- 5°C to +85°C	Extended	1511nm	40km
TPC1XGJERE00040G	- 5°C to +85°C	Extended	1531nm	40km
TPC1XGJERE00050G	- 5°C to +85°C	Extended	1551nm	40km
TPC1XGJERE00060G	- 5°C to +85°C	Extended	1571nm	40km
TPC1XGJERE00070G	- 5°C to +85°C	Extended	1591nm	40km
TPC1XGJERE00080G	- 5°C to +85°C	Extended	1611nm	40km
TPC1XGJERI00010G	- 40°C to +85°C	Industrial	1471nm	40km
TPC1XGJERI00020G	- 40°C to +85°C	Industrial	1491nm	40km
TPC1XGJERI00030G	- 40°C to +85°C	Industrial	1511nm	40km
TPC1XGJERI00040G	- 40°C to +85°C	Industrial	1531nm	40km
TPC1XGJERI00050G	- 40°C to +85°C	Industrial	1551nm	40km
TPC1XGJERI00060G	- 40°C to +85°C	Industrial	1571nm	40km
TPC1XGJERI00070G	- 40°C to +85°C	Industrial	1591nm	40km
TPC1XGJERI00080G	- 40°C to +85°C	Industrial	1611nm	40km

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