

Oplink TPP4XGDS0x000E2G 850nm SFP+ Transceiver

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The TPP4XGDS0x000E2G 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 10Gbps data-com and storage area network applications. DDM functionality (alarm and warning features) is integrated into the design via an I2C serial interface per the Multi-Source Agreement (MSA) SFF-8472, Rev. 10.4.



The transceiver supports data rates ranging from 11.3Gbps down to 8Gbps. It provides an excellent solution for transmission at 850nm over up to 300m 2000MHz km multimode fiber. The sub-watt power consumption and excellent EMI performance allow 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 1 Laser product per U.S. FDA/CDRH and international IEC-60825 standards.

The TPP4XGDS0x000E2G 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 latch is compliant with the SFP MSA. 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). The housing is made of metal for EMI immunity.

Features and Advantages

850nm VCSEL laser

Transmission distance up to 300m on OM3 MM fiber

Low power consumption

Wide case operating temperature range

Compliant with SFP+ Electrical MSA SFF-8431

Compliant with SFP+ Mechanical MSA SFF-8432

Digital Diagnostics Monitoring (DDM) through Serial Interface compliant with SFF-8472, Rev. 10.4

RoHS 6/6 compliant

Compliant with product safety standards

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Absolute Maximum Ratings

Parameter		Symbol	Minimum	Maximum	Units
Storage Temperature Range		T_{ST}	-40	85	°C
Case Operating Temperature ¹	"Commercial"	T_{OP}	-5	70	°C
	"Extended"		-5	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	2.0	-	11.3	Gb/s
Center Wavelength	λ_C	840	850	860	nm
Spectral Width	$\Delta\lambda_{rms}$	-	-	0.45	nm
Average Optical Output Power ¹	P_{Avg}	- 5	-	- 1	dBm
Launch Power in OMA ¹	P_{OMA}	-	- 1.5	-	dBm
Extinction Ratio	ER	3	-	-	dB
Relative Intensity Noise	RIN_{12_OMA}	-	-	- 128	dB/Hz
Average Launch Power of OFF transmitter	P_{OFF}	-	-	- 30	dBm
Transmitter and Dispersion Penalty @ 10.3125Gb/s	TDP	-	-	3.9	dB

¹ Launch 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	2	-	11.3	Gb/s
Wavelength of Operation	λ	840	-	860	nm
Receiver Sensitivity	$P_{Avg} @ 10.3125Gb/s$ ¹	P_{min}	-	-9.9	dBm
	OMA @ 10.3125Gb/s ¹		-	-11.1	
Stressed Receiver Sensitivity in OMA (@10.3125Gb/s) ²	-	-	-	-7.5	dBm
Maximum Input Power (10 ⁻¹² BER)	P_{max}	0.5	-	-	dBm
LOS Hysteresis	-	0.5	-	-	dB
LOS Thresholds	Increasing Light Input	P_{los+}	-	-11	dBm
	Decreasing Light Input	P_{los-}	-30	-	

¹ Specified with BER <1x10⁻¹² and PRBS 2³¹-1.

² Compliant with IEEE 802.3ae.

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

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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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	-	V _{cc}	V
Input LOW Voltage (TX Disable) ¹	V _{IL}	0	-	0.8	V
Output HIGH Voltage (TX Fault) ²	V _{OH}	2	-	V + 0.3 _{cc}	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 V_{cc}T.
² Open collector compatible, 4.7kΩ to 10kΩ pull-up resistor to V_{cc} (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}	24	-	-	ps
Output HIGH Voltage (LOS) ¹	V _{OH}	V _{cc} - 1.3	-	V + 0.3 _{cc}	V
Output LOW Voltage (LOS) ¹	V _{OL}	0	-	0.8	V

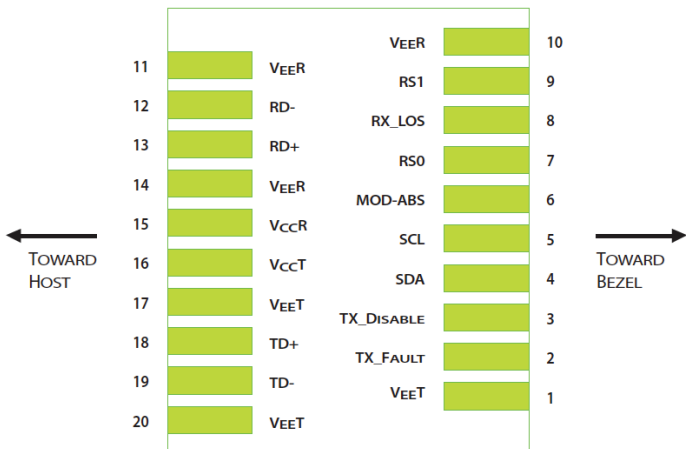
¹ Open collector compatible, 4.7kΩ to 10kΩ pull-up resistor to Vcc (Host Supply Voltage).

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	3.3	3.47	V
DC Common Mode Voltage	V _{CM}	0	-	3.6	V
Supply Current	I _{VCC}	-	-	300	mA
Power Consumption	P _W	-	-	1	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



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Electrical 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 Non-Inverted 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: AAll 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 4.7 k Ω – 10 k Ω 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 that should be pulled up with a 4.7 - 10k Ω resistor on the host board. TX Fault is non-latching (automatically deasserts when fault goes away).

TX_Disable: When the TX Disable pin is at logic HIGH, the transmitter optical output is disabled (less than -45dBm).

Serial Identification and Monitoring: The module definition of SFP is indicated by the three module definition pins, MOD_DEF(0), MOD_DEF(1) and MOD_DEF(2). Upon power up, the 2-wire 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 I2C 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. 12.0.

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.

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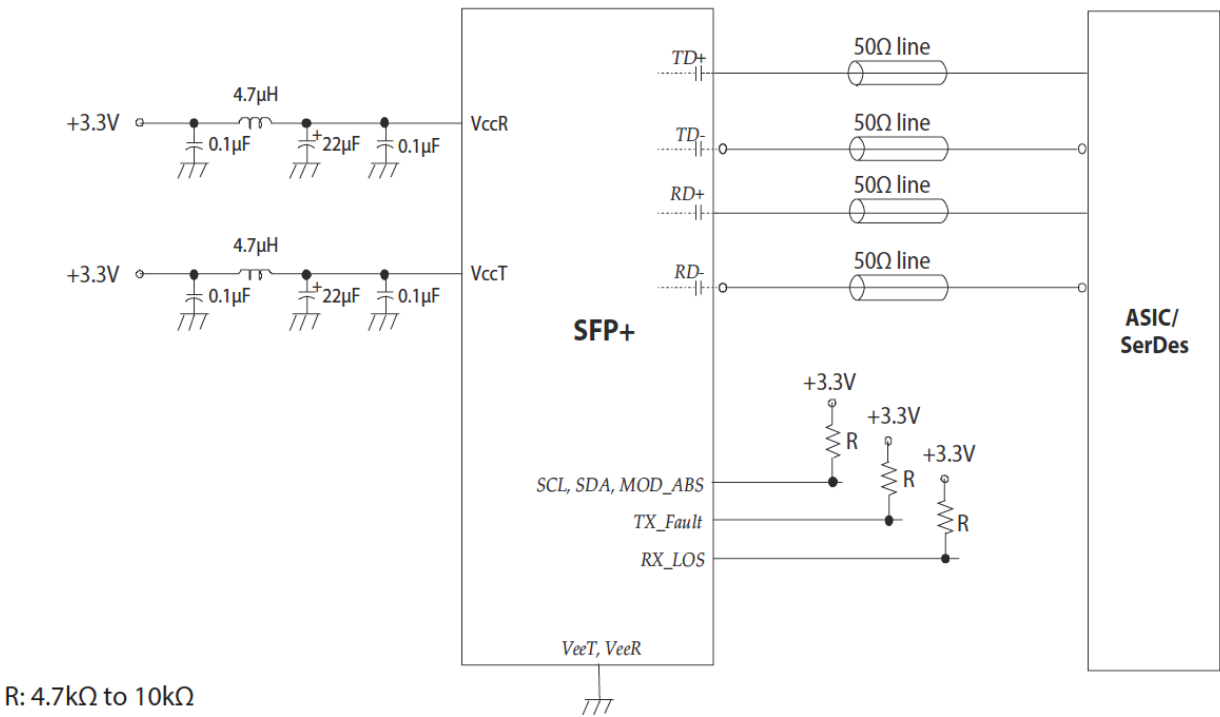
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Interfacing the Transceivers

Communication is via a serial 2-wire serial interface. As described in the document SFF-8472 (REV. 12.0) there are two distinct address spaces:

Base Address A0 (hex)		Base Address A2 (hex)	
Byte Address	Content	Byte Address	Content
0 – 95	Serial Transceiver ID as defined in SFP MSA	0 - 55	Alarm & Warnings thresholds & limits
96 – 127	OPLINK Specific	56 - 95	External calibration constants (not used)
128 – 255	Reserved	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.



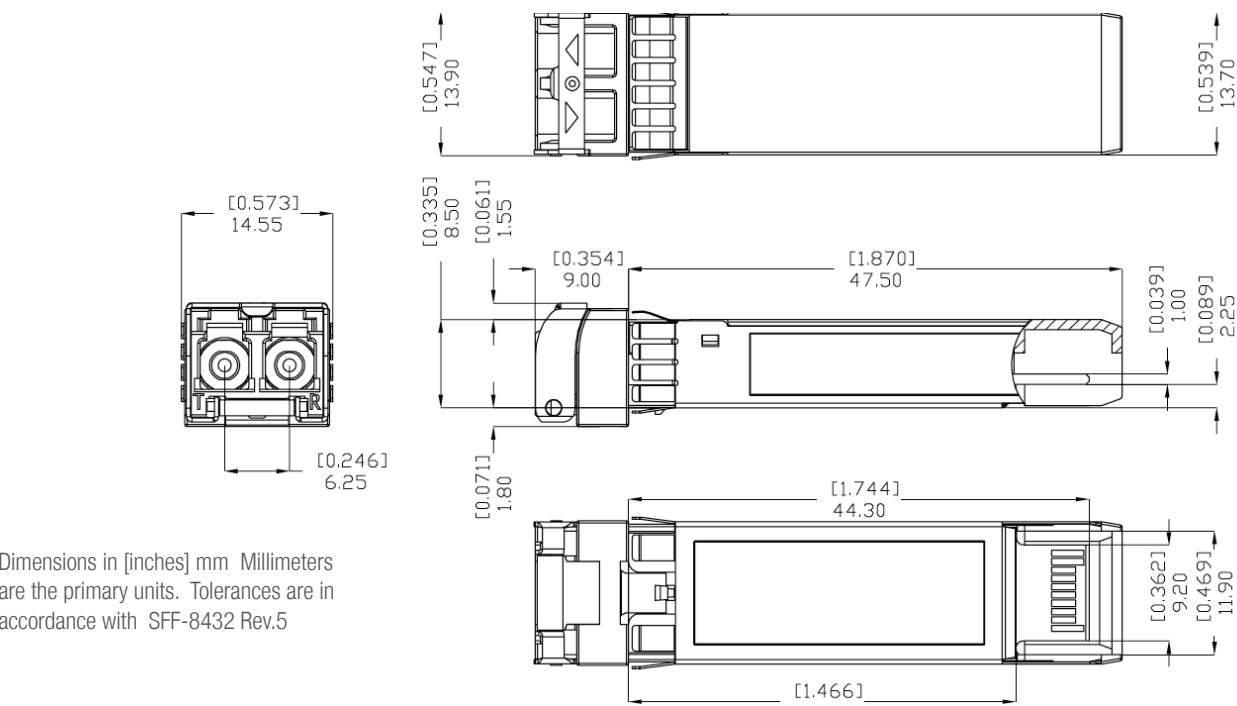
ESD and Electromagnetic Compatibility

Requirements		
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

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Package Outline



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

Ordering Information

Model Name	Operating Temperature		Nominal Wavelength	Distance	
TPP4XGDS0C000E2G	- 5°C to +70°C	Commercial	850nm	300m	Beige
TPP4XGDS0E000E2G	- 5°C to +85°C	Extended	850nm	300m	Beige

Differential peak-to-peak voltage across external 100Ω load.
Open collector compatible, 4.7 to 10kΩ pull-up resistor to Vcc (Host Supply Voltage).