Gigabit Ethernet SFP Multimode Transceivers with Digital Diagnostics

TRXAG1SX

Product Description

The TRXAG1SX series of fiber optic transceivers with integrated digital diagnostics monitoring functionality provide a quick and reliable interface for Gigabit Ethernet 1000BASE-SX multimode applications. The diagnostic functions, alarm and warning features are provided via an I^2C serial interface.

A highly reliable 850nm wavelength Vertical Cavity Surface Emitting Laser (VCSEL) is used in the transmitter. The transceivers satisfy Class I Laser Safety requirements in accordance with the U.S. FDA/CDRH and international IEC-60825 standards.

The TRXAG1SX transceivers connect 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 types of transceivers without removing the power supply from the host system.

The transceivers have bail-type latches, which offer an easy and convenient way to release the modules. The latch is compliant with the SFP MSA.

The transmitter and receiver DATA interfaces are AC-coupled internally. LV-TTL Transmitter Disable control input and Loss of Signal output interfaces are also provided.

The transceivers operate from a single +3.3V power supply over three operating case temperature ranges of -5°C to +70°C, -10°C to +85°C, or -40°C to +85°C. The housing is made of plastic and metal for EMI immunity.



Features

- ☑ Lead Free Design & Fully RoHS Compliant
- ☑ Compatible with SFP MSA
- ☑ Compliant with IEEE 802.3z Gigabit Ethernet 1000BASE-SX PMD Specifications
- ☑ Digital Diagnostics through Serial Interface
- ☑ Internal Calibration for Digital Diagnostics
- ☑ 275m Distance with 62.5µm Multimode Fiber
- ☑ 550m Distance with 50µm Multimode Fiber
- ☑ Loss of Signal & TX Fault Outputs
- ☑ TX Disable Input
- ☑ Hot-pluggable
- ☑ Eye Safe (Class I Laser Safety)
- ☑ Duplex LC Optical Interface

Absolute Maximum Ratings

Parameter		Symbol	Minimum	Maximum	Units
Storage Temperature		T_{ST}	- 40	+ 80	°C
Operating Case Temperature[1]	"B" option	T_{OP}	- 5	+ 70	°C
	"D" option		- 10	+ 85	
	"A" option		- 40	+ 85	
Supply Voltage		V_{CC}	0	+ 5.0	V
Input Voltage		V_{IN}	0	V_{CC}	V
Lead Terminal Finish, Reflow Profile Limits and MSL		-	-	NA	-

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

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

All parameters guaranteed only at typical data rate

Parameter	Symbol	Minimum	Typical	Maximum	Units
Operating Data Rate [1]	B	-	1250	-	Mb/s
Optical Output Power [2]	P_O	- 9.5	- 7.0	- 4.0	dBm
Center Wavelength	λ_C	820	-	860	nm
Spectral Width (RMS)	$\Delta\lambda_{RMS}$	-	-	0.85	nm
Extinction Ratio	P_{hi}/P_{lo}	9	-	-	dB
Deterministic Jitter	DJ	-	-	80	ps
Total Jitter	TJ	-	-	227	ps
Relative Intensity Noise	RIN	-	-	- 117	dB/Hz
Coupled Power Ratio	CPR	9	-	-	dB
Transmitter Output Eye	*Compliant with Eye Mask Defined in IEEE 802.3z Standard*				

[1] Data rate ranges from 1000Mb/s to 1300Mb/s. However, some degradation may be incurred in overall performance.
[2] Measured average power coupled into either 50µm or 62.5µm multimode fiber.

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

All parameters guaranteed only at typical data rate

Parameter		Symbol	Minimum	Typical	Maximum	Units
Operating Data Rate [1]		B	-	1250	-	Mb/s
Minimum Input Optical Power (10^{-12} BER) [2]		P_{min}	- 17.0	-	-	dBm
Maximum Input Optical Power (10^{-10} BER) [2]		P_{max}	0	-	-	dBm
LOS Thresholds	Increasing Light Input	P_{los+}	-	-	- 17.0	dBm
	Decreasing Light Input	P_{los-}	- 30.0	-	-	
LOS Hysteresis		-	0.5	-	-	dB
Deterministic Jitter		DJ	-	-	170	ps
Total Jitter		TJ	-	-	266	ps
Wavelength of Operation		λ	770	-	860	nm
Optical Return Loss		ORL	12	-	-	dB
Electrical 3dB Upper Cutoff Frequency		-	-	-	1500	MHz
Stressed Receiver Sensitivity		*Compliant with 802.3z Standard*				

[1] Data rate ranges from 1000Mb/s to 1300Mb/s. However, some degradation may be incurred in overall performance.
[2] Measured with 2^7-1 PRBS at 1250Mb/s & at 850nm wavelength.

Laser Safety

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

Oplink Communications, Inc.
DATE OF MANUFACTURE:

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

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

Parameter	Symbol	Minimum	Typical	Maximum	Units
Input Voltage Swing (TD+ & TD-) [1]	$V_{PP-DIFF}$	0.5	-	2.4	V
Input HIGH Voltage (TX Disable) [2]	V_{IH}	2.0	-	V_{CC}	V
Input LOW Voltage (TX Disable) [2]	V_{IL}	0	-	0.8	V
Output HIGH Voltage (TX Fault) [3]	V_{OH}	2.0	-	V_{CC} + 0.3	V
Output LOW Voltage (TX Fault) [3]	V_{OL}	0	-	0.8	V

[1] Differential peak-to-peak voltage
[2] There is an internal 4.7 to 10kΩ pull-up resistor to VccT.
[3] Open collector compatible, 4.7 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 Voltage Swing (RD+ & RD-) [1]	V_{PP-DIF}	0.6	-	2.0	V
Output HIGH Voltage (LOS) [2]	V_{OH}	2.0	-	V_{CC} + 0.3	V
Output LOW Voltage (LOS) [2]	V_{OL}	0	-	0.5	V

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

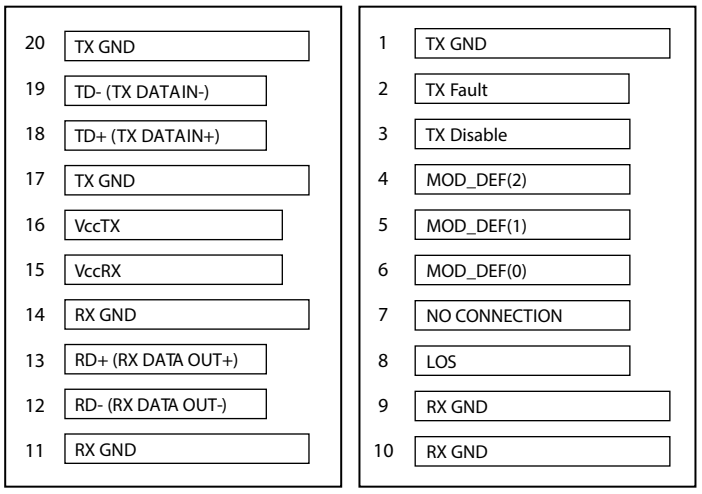
Electrical Power Supply Characteristics (Over Operating Case Temperature. V_{CC} = 3.13 to 3.47V))

Parameter	Symbol	Minimum	Typical	Maximum	Units
Supply Voltage	V_{CC}	3.13	3.30	3.47	V
Supply Current	I_{CC}	-	175	245	mA

Module Definition

MOD_DEF(0) pin 6	MOD_DEF(1) pin 5	MOD_DEF(2) pin 4	Interpretation by Host
TTL LOW	SCL	SDA	Serial module definition protocol

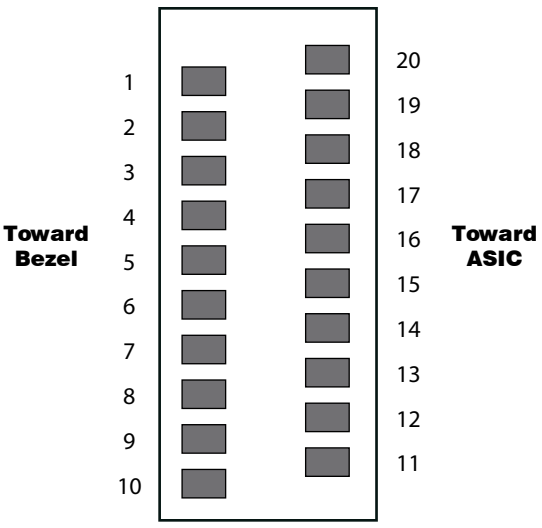
Electrical Pad Layout



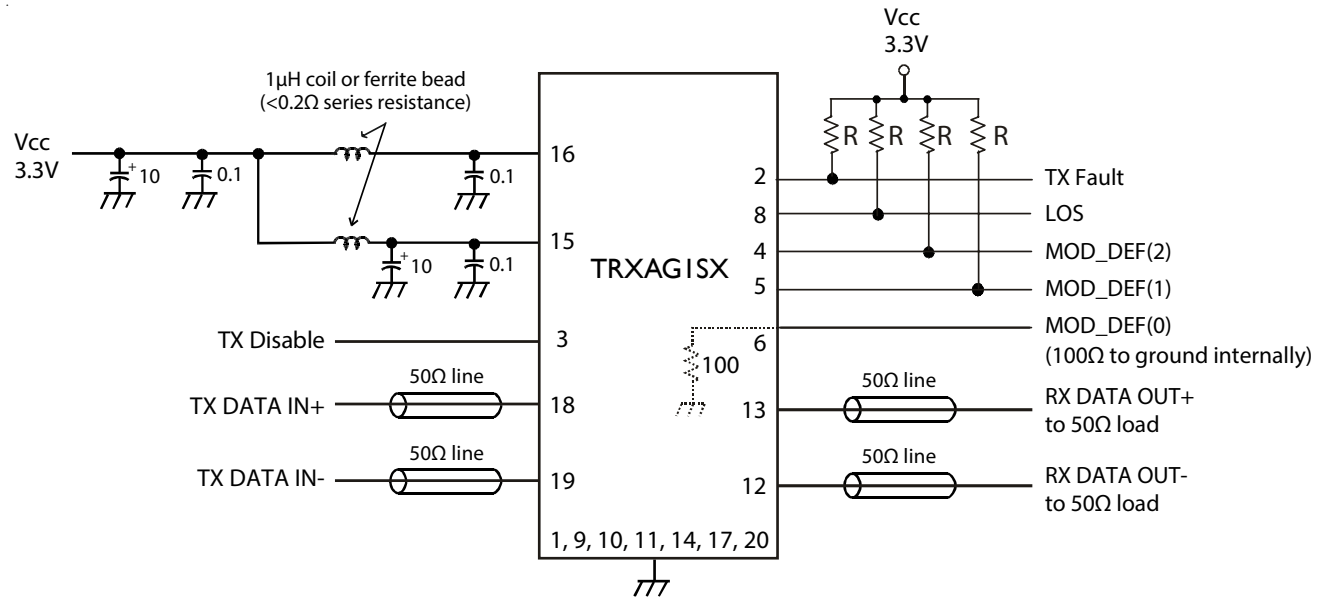
Top of Board

Bottom of Board
(as viewed thru top of board)

Host Board Connector Pad Layout



Example of SFP host board schematic



R: 4.7 to 10kΩ
CAP Values in µF

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 4.7 - 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 a 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 - 10kΩ resistor on the host board. TX Fault is latched per SFP MSA.

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).

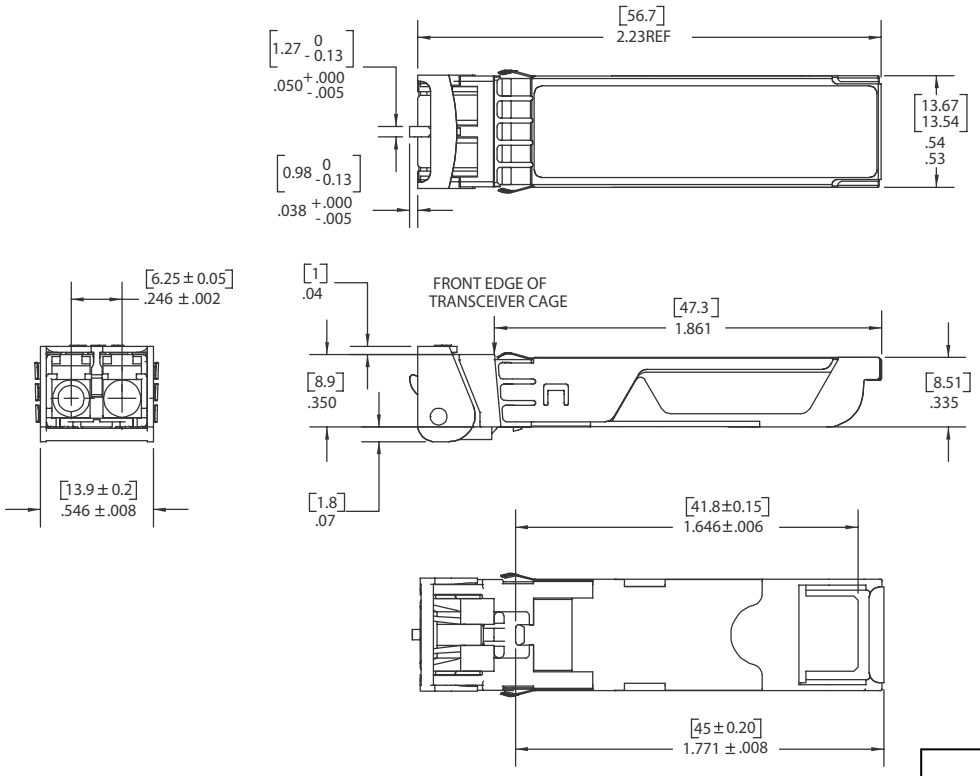
Upon power up, MOD_DEF(1:2) appear as NC (no connection), and MOD_DEF(0) is TTL LOW. When the host system detects this condition, it activates the serial protocol (standard two-wire I^2C serial interface) and generates the serial clock signal (SCL). The positive edge clocks data into the EEPROM segments of the SFP that are not write protected, and the negative edge clocks data from the SFP. This device does not require clock stretching.

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 internal temperature, supply 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. 9.4

Power supply and grounding: The power supply line should be well-filtered. All 0.1µF power supply bypass capacitors should be as close to the transceiver module as possible.

Mechanical Package



Dimensions in inches [mm]
Default tolerances:
.xxx = ± .005", .xx = ± .01"

Ordering Information

Model Name		Operating Temperature	Nominal Wavelength	Latch Color
Oplink Order Number	For Reference (OCP Part Number)			
TRP1G10V1C00000G	TRXAG1SXLBES	- 5 °C to + 70 °C	850nm	Beige
TRP1G1AV1D000E1G	TRXAG1SXLDES	- 10 °C to +85 °C	850nm	Beige
TRP1G10V1I00000G	TRXAG1SXLAES	- 40 °C to + 85 °C	850nm	Beige

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