Fast Ethernet 100BASE-LX10 SFP Transceivers with Digital Diagnostics

TRXAFEEX/ZX

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Product Description

The TRXAFEEX/ZX SFP fiber optic transceivers provide a quick and reliable interface for 100BASE-LX10 Fast Ethernet single mode applications. The transceivers are compliant with IEEE802.3ah/D3.3 standard. The diagnostic functions, alarm and warning features as described in the Multi-Source Agreement (MSA) document, SFF-8472 (Rev. 9.4), are provided via an I²C serial interface. All transceiver modules satisfy Class I Laser Safety requirements in accordance with the U.S. FDA/CDRH and international IEC-60825 standards.

The 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 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 incorporates a highly reliable 1310nm InGaAsP laser and an integrated driver circuit. The receiver features a transimpedance amplifier IC optimized for high sensitivity and wide dynamic range. The transmitter and receiver DATA interfaces are AC-coupled internally. LV-TTL Transmitter Disable control input and Loss of Signal (LOS) output interfaces are also provided.

The transceivers operate from a single +3.3V power supply over operating case temperature range of -5°Cto +70°C ("B" option) or -40°C to +85°C ("A" option). The housing is made of plastic and metal for EMI immunity.

Features

☑ Lead Free Design & Fully RoHS Compliant

☑ Compatible with SFP MSA

☑ Compatible with IEEE802.3ah/D3.3 (100BASE-LX10)

☑ 1310nm FP & 1550nm DFB Laser Transmitters to Support Distances of 40km and 80km

☑ Eye Safe (Class I Laser Safety)

☑ Duplex LC Optical Interface

☑ Hot-pluggable

☑ TX Fault & Loss of Signal Outputs

☑ TX Disable Input

☑ Single +3.3V Power Supply

Absolute Maximum Ratings

Parameter		Symbol	Minimum	Maximum	Units
Storage Temperature		T_{st}	- 40	+ 85	°C
Operating Case Temperature [1]	"B" option	T_{op}	- 5	+ 70	°C
	"A" option		- 40	+ 85	
Supply Voltage		V_{cc}	0	+ 4.5	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	-	125	-	Mb/s
Optical Output Power [2]	EX	P_O	- 5.0	-	0	dBm
	ZX		- 3.0	-	+ 2.0	
Center Wavelength	EX	λ_C	1260	1310	1360	nm
	ZX		1480	1550	1580	
Spectral Width (RMS)	EX	$\Delta\lambda_{RMS}$	-	-	3.0	nm
Spectral Width (-20dB)	ZX	$\Delta\lambda_{20}$	-	-	1.0	nm
Side Mode Suppression Ratio	ZX	$SMSR$	30	-	-	dB
Extinction Ratio		P_{hi}/P_{lo}	9	-	-	dB
Optical Output Power of OFF Transmitter		P_{OFF}	-	-	- 45	dBm
Duty Cycle Distortion (Peak-to-Peak)		DCD	-	-	0.6	ns
Deterministic Jitter		DJ	-	-	2.44	ns
Optical Return Loss Tolerance		$ORLT$	-	-	12	dB
Total Jitter		TJ	-	-	2.48	ns
Transmitter and Dispersion Penalty		-	-	-	4.5	dB
Optical Output Eye [3]		Compliant with IEEE802.3ah/D3.3				

[1] Data rate ranges from 50Mb/s to 200Mb/s. However, some degradation may be incurred in overall performance.
[2] Measured average power coupled into single mode fiber. The minimum power specified is at Beginning-of-Life.
[3] When tested with unbalanced pattern stated in IEEE802.3ah/D3.3 table 60-11.

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	-	125	-	Mb/s
Receiver Sensitivity (10^{-12} BER) [2]		EX	P_{min}	- 28.0	- 31.0	-	dBm
		ZX		- 29.0	- 32.0	-	
Maximum Input Optical Power (10^{-12} BER)[2]			P_{max}	- 8.0	- 5.0	-	dBm
LOS Thresholds	Increasing Light Input	EX	P_{los+}	-	-	- 28.0	dBm
		ZX		-	-	- 29.0	
	Decreasing Light Input		P_{los-}	- 45.0	-	-	
LOS Hysteresis			-	0.5	-	-	dB
LOS Thresholds	Increasing Light Input		t_loss_off	-	-	100	μs
	Decreasing Light Input		t_loss_on	2.3	-	100	
Wavelength of Operation			λ	1100	-	1600	nm
Jitter Tolerance			JT	-	-	3.54	ns
Total Contributed Jitter			TJ	-	-	0.5	ns
Jitter Corner Frequency			-	-	20	-	kHz
Receiver Reflectance		EX	-	-	-	- 12	dB
		ZX		-	-	- 21	

[1] Data rate ranges from 50Mb/s to 200Mb/s. However, some degradation may be incurred in overall performance.
[2] Specified in average optical input power and measured at 1310nm (EX) and 1550nm (ZX) wavelengths, and at 125Mb/s with 2^{23}-1 PRBS.

Please refer to page 4 for Laser Safety information

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]	$V_{PP\text{-}DIF}$	0.25	-	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)

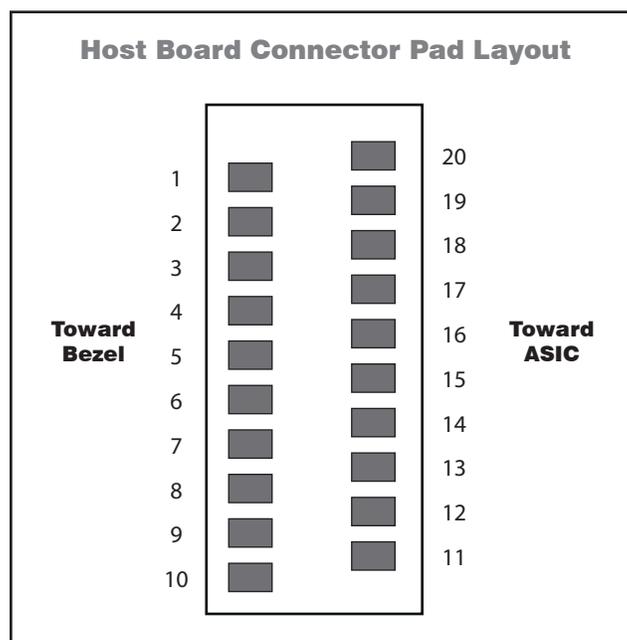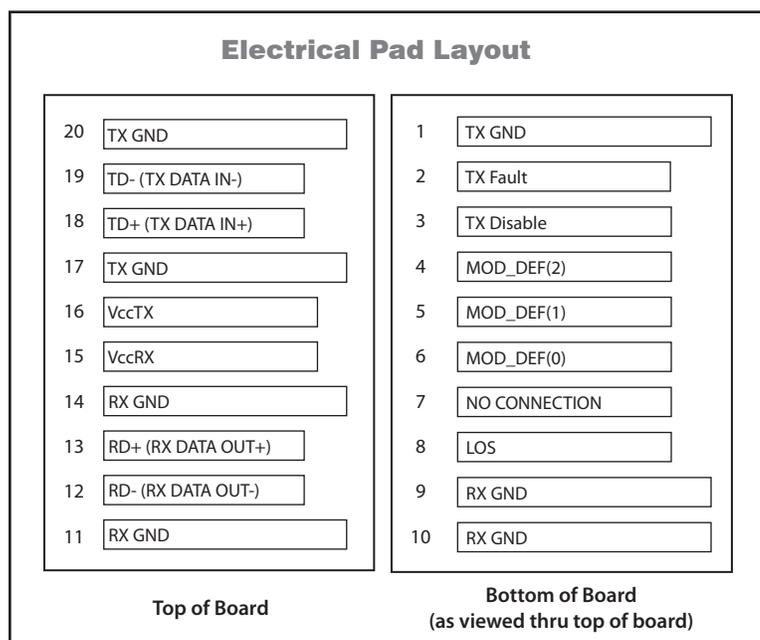| Parameter	Symbol	Minimum	Typical	Maximum	Units
Output Voltage Swing (RD+ & RD-) [1]	$V_{PP\text{-}DIF}$	0.6	-	2.0	Vp-p
Output HIGH Voltage (LOS) [2]	V_{OH}	2.0	-	$V_{CC} + 0.3$	V
Output LOW Voltage (LOS) [2]	V_{OL}	0	-	0.5	V

[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)

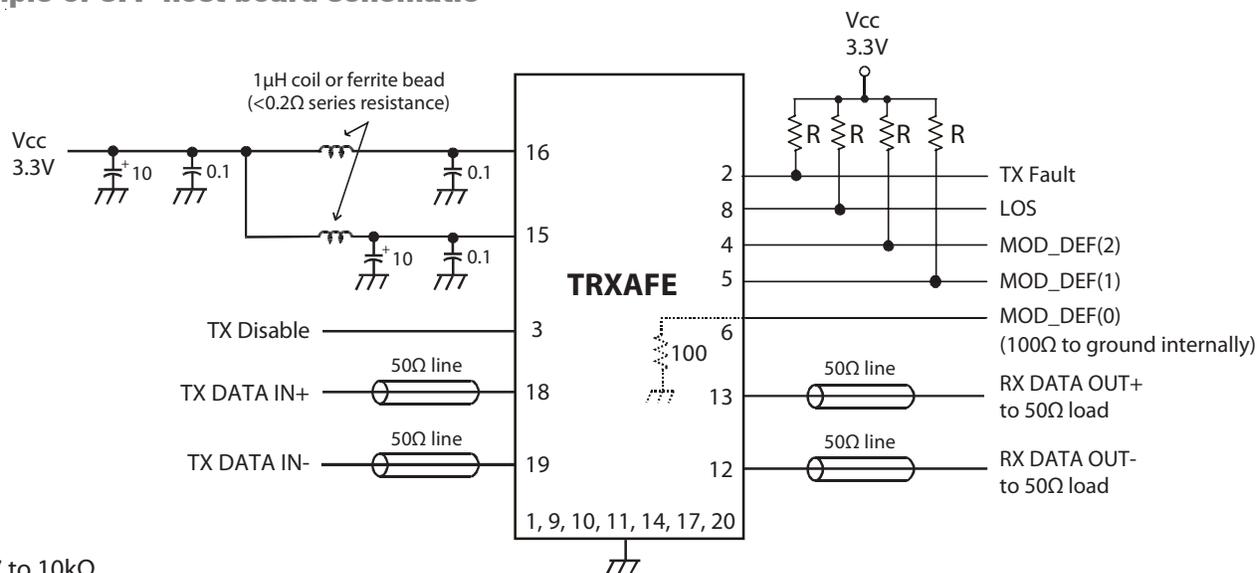| Parameter	Symbol	Minimum	Typical	Maximum	Units
Supply Voltage	V_{CC}	3.13	3.3	3.47	V
Supply Current	I_{CC}	-	185	275	mA

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

20	TX GND		1	TX GND
19	TD- (TX DATA IN-)		2	TX Fault
18	TD+ (TX DATA IN+)		3	TX Disable
17	TX GND		4	MOD_DEF(2)
16	VccTX		5	MOD_DEF(1)
15	VccRX		6	MOD_DEF(0)
14	RX GND		7	NO CONNECTION
13	RD+ (RX DATA OUT+)		8	LOS
12	RD- (RX DATA OUT-)		9	RX GND
11	RX GND		10	RX GND

Top of Board

Bottom of Board
(as viewed thru top of board)

Host Board Connector Pad Layout

Toward Bezel — 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Toward ASIC — 20, 19, 18, 17, 16, 15, 14, 13, 12, 11

Example of SFP host board schematic

R: 4.7 to 10kΩ

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 and should be pulled up with a 4.7 - 10kΩ 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, 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^{2}C 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 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. 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.

Laser Safety: All transceivers are Class I Laser products per FDA/CDRH and IEC-60825 standards. They must be operated under specified operating conditions.
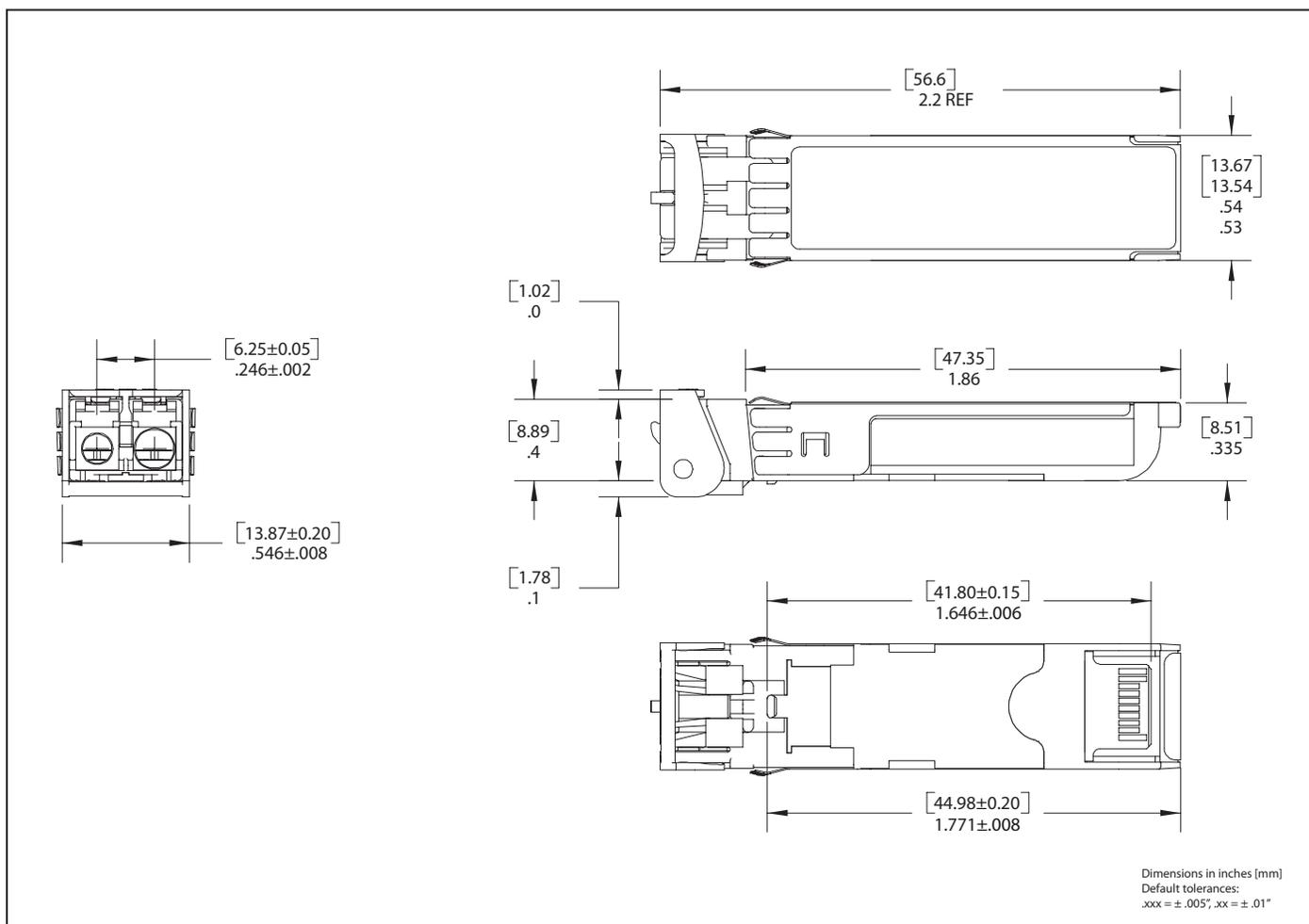
Oplink Communications, Inc.
DATE OF MANUFACTURE:

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

OPLINK
your DESIGN & OMS partner

Package Outline

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

Ordering Information

Model Name	Operation Case Temperature	Latch Color	Nominal Wavelength	Distance [1]
TRXAFEEXEBGS	- 5°C to +70°C	Green	1310nm FP	40km
TRXAFEEXEAGS	- 40°C to +85°C	Green	1310nm FP	40km
TRXAFEZXGBMS	- 5°C to +85°C	Magenta	1550nm DFB	80km
TRXAFEZXGAMS	-- 40°C to +85°C	Magenta	1310nm DFB	80km