

# MULTI-RATE OC-12/STM-4 SFP MULTIMODE TRANSCEIVERS WITH DIGITAL DIAGNOSTICS

## TRXA12MM Multi-Rate



### Product Description

The TRXA12MM Multi-rate SFP fiber optic transceivers with integrated digital diagnostics monitoring functionality provide a quick and reliable interface for Fast Ethernet, OC-3/STM-1 and OC-12/STM-4 multimode applications. The diagnostic monitoring functions, alarm and warning features are provided via an I<sup>2</sup>C serial interface. The transceivers are designed to be compatible with the ATM requirements at OC-3/STM-1 (156Mb/s) and OC-12/STM-4 (622Mb/s) data rate, and is suitable for Fast Ethernet applications.

The TRXA12MM Multi-rate 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 transmitter design incorporates a highly reliable 1310nm LED and an integrated driver circuit. The receiver features a transimpedance amplifier IC 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 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 ("B" option), -5°C to +85°C ("E" option), or -40°C to +85°C ("A" option). The housing is made of plastic and metal for EMI enhancement.



### Features

- Lead Free Design & Fully RoHS Compliant
- Compatible with Fast Ethernet (125Mb/s) and ATM/ SONET Specifications for OC-3/STM-1 (156Mb/s) & OC-12/STM-4 (622Mb/s)
- Compatible with SFP MSA
- Digital Diagnostics Monitoring through Serial Interface
- Distances up to 500m
- Hot-pluggable
- Three Operating Case Temperature Options
- Loss of Signal Output
- TX Disable Input
- Duplex LC Optical Interface
- Single +3.3V Power Supply

### Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Storage Temperature	$T_{ST}$	-40	+85	°C
Operating Case Temperature <sup>1</sup>	"B" option	-5	+70	°C
	"E" option	-5	+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	-

<sup>1</sup> 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	$B$	125	-	622	Mb/s
Optical Output Power <sup>1</sup>	$P_O$	- 20.0	-	- 14.0	dBm
Center Wavelength	$\lambda_C$	1270	-	1380	nm
Spectral Width (RMS)	$\Delta\lambda_{RMS}$	-	140	200	nm
Optical Rise and Fall Time (10% to 90%)	$t_r, t_f$	-	1.0	1.25	ns
Extinction Ratio	$P_{hi} / P_{lo}$	10	-	-	dB
Transmitter OFF Power	$P_{OFF}$	-	-	-45.0	dBm
Systematic Jitter (DCD & DDJ, peak-to-peak)	$SJ$	-	-	0.4	rs
Random Jitter (peak-to-peak)	$RJ$	-	-	0.15	rs

<sup>1</sup> Measured average power coupled into 62.5/125 $\mu$ m, 0.275 NA graded-index multimode fiber. The minimum power specified is at Beginning-of-Life.

**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	$B$	125	-	622	Mb/s
Receiver Sensitivity ( $10^{-10}$ BER) <sup>1</sup>	$P_{min}$	-26.0	-28.0	-	dBm
Maximum Input Optical Power ( $10^{-10}$ BER) <sup>1</sup>	$P_{max}$	-14.0	-6.0	-	dBm
LOS Thresholds	Increasing Light Input	$P_{los+}$	-	-	dBm
	Decreasing Light Input	$P_{los-}$	-40.0	-	
LOS Hysteresis	-	0.5	1.0	-	dB
LOS Timing Delay	Increasing Light Input	$t_{loss\_off}$	-	-	100
	Decreasing Light Input	$t_{loss\_on}$	-	-	350
Wavelength of Operation	$\lambda$	1100	-	1600	nm

<sup>1</sup> Measured with  $2^7-1$  PRBS at 125Mb/s for Fast Ethernet, and with  $2^{23}-1$  PRBS at 156Mb/s & 622Mb/s for OC-3 & OC-12.

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

<p><b>Oplink Communications, Inc.</b> DATE OF MANUFACTURE:</p> <p>This product complies with 21 CFR 1040.10 and 1040.11 <b>Meets Class I Laser Safety Requirements</b></p>
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**Transmitter Performance Characteristics** (Over Operating Case Temperature.  $V_{CC} = 3.13$  to  $3.47V$ )

Parameter	Symbol	Minimum	Typical	Maximum	Units
Input Voltage Swing (TD+ & TD-) <sup>1</sup>	$V_{PP-DIF}$	0.25	-	2.4	V
Input HIGH Voltage (TX Disable) <sup>2</sup>	$V_{IH}$	2.0	-	$V_{CC}$	V
Input LOW Voltage (TX Disable) <sup>2</sup>	$V_{IL}$	0	-	0.8	V

<sup>1</sup> Differential peak-to-peak voltage.  
<sup>2</sup> There is an internal 4.7 to 10kΩ pull-up resistor to VccT.

**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-) <sup>1</sup>	$V_{PP-DIF}$	0.6	-	2.0	V
Output HIGH Voltage (LOS) <sup>2</sup>	$V_{OH}$	2.0	-	$V_{CC} + 0.3$	V
Output LOW Voltage (LOS) <sup>2</sup>	$V_{OL}$	0	-	0.5	V

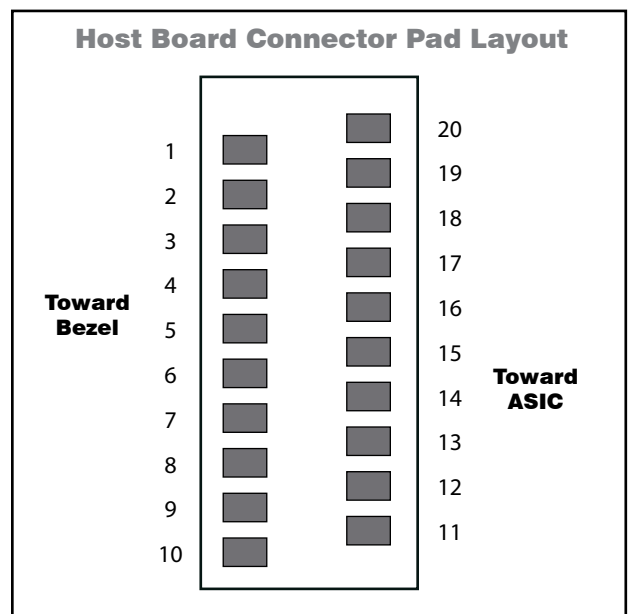
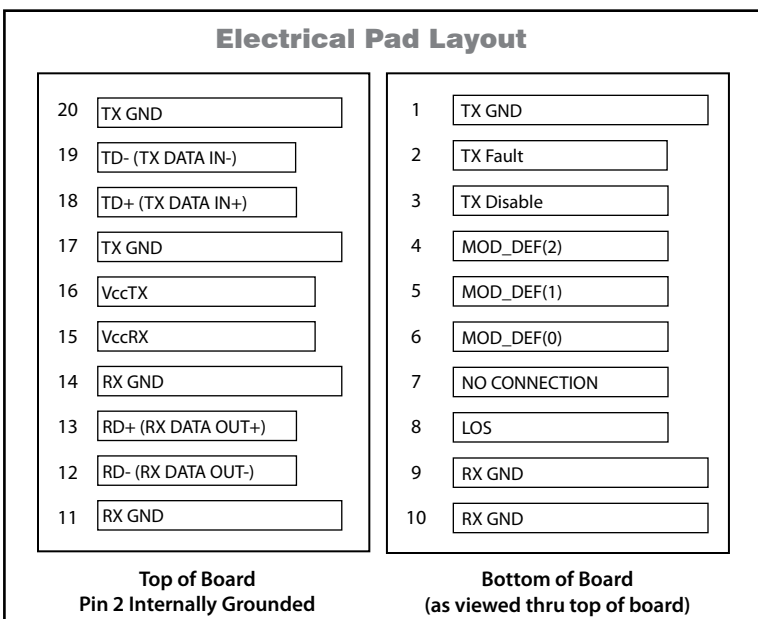
<sup>1</sup> Differential peak-to-peak voltage across external 100Ω load.  
<sup>2</sup> Open collector compatible, 4.7 to 10kΩ pull-up resistor to Vcc (Host Supply Voltage).

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

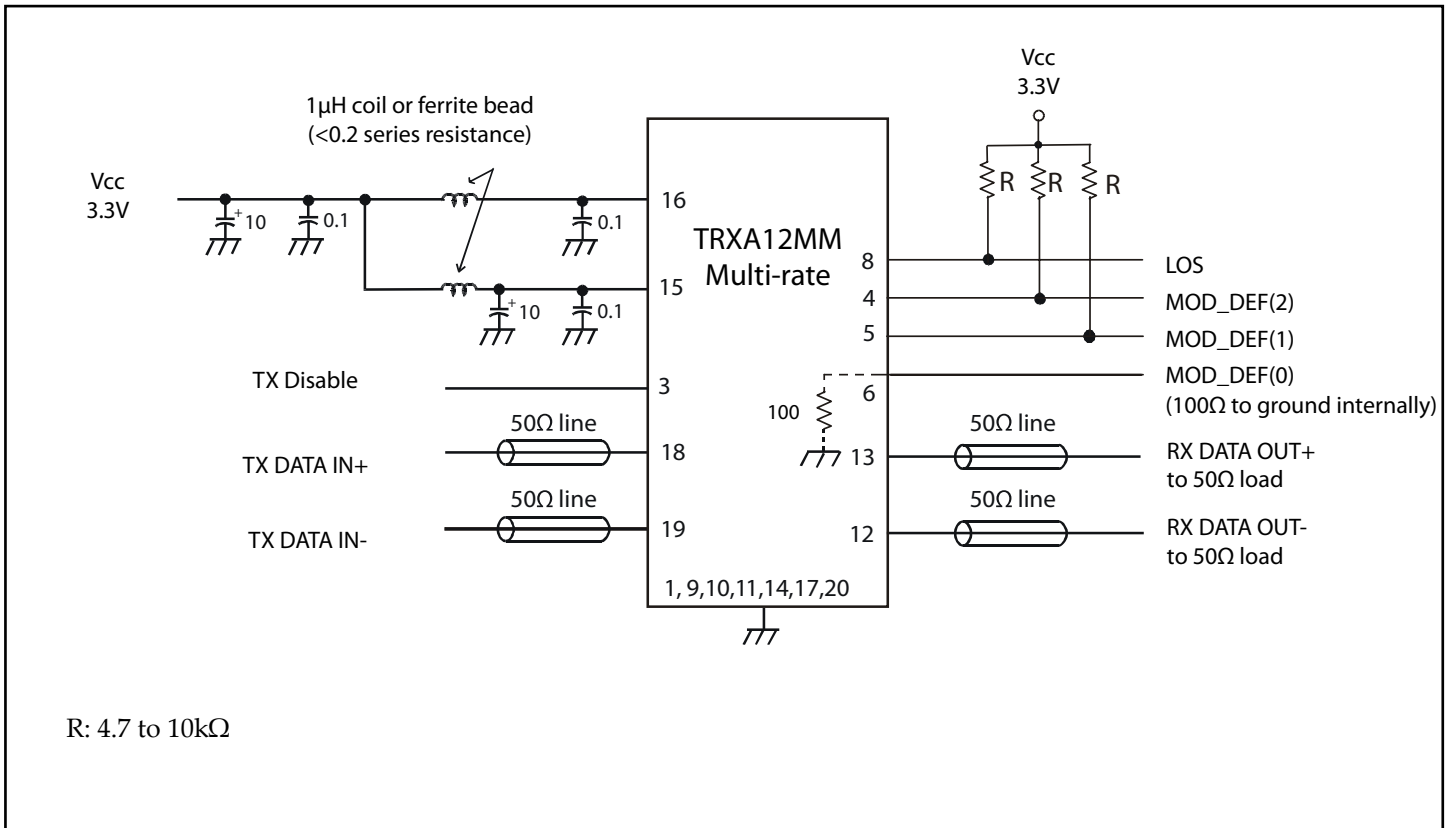
Parameter	Symbol	Minimum	Typical	Maximum	Units
Supply Voltage	$V_{CC}$	3.13	3.3	3.47	V
Supply Current	$I_{CC}$	-	210	285	mA

**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



## Example of SFP host board schematic



## 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:** Per SFP MSA, pin 2 is TX Fault. This transceiver is LED based and does not support TX Fault. Pin 2 is internally connected to transmitter circuit ground (TX GND) to indicate normal operation.

**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).

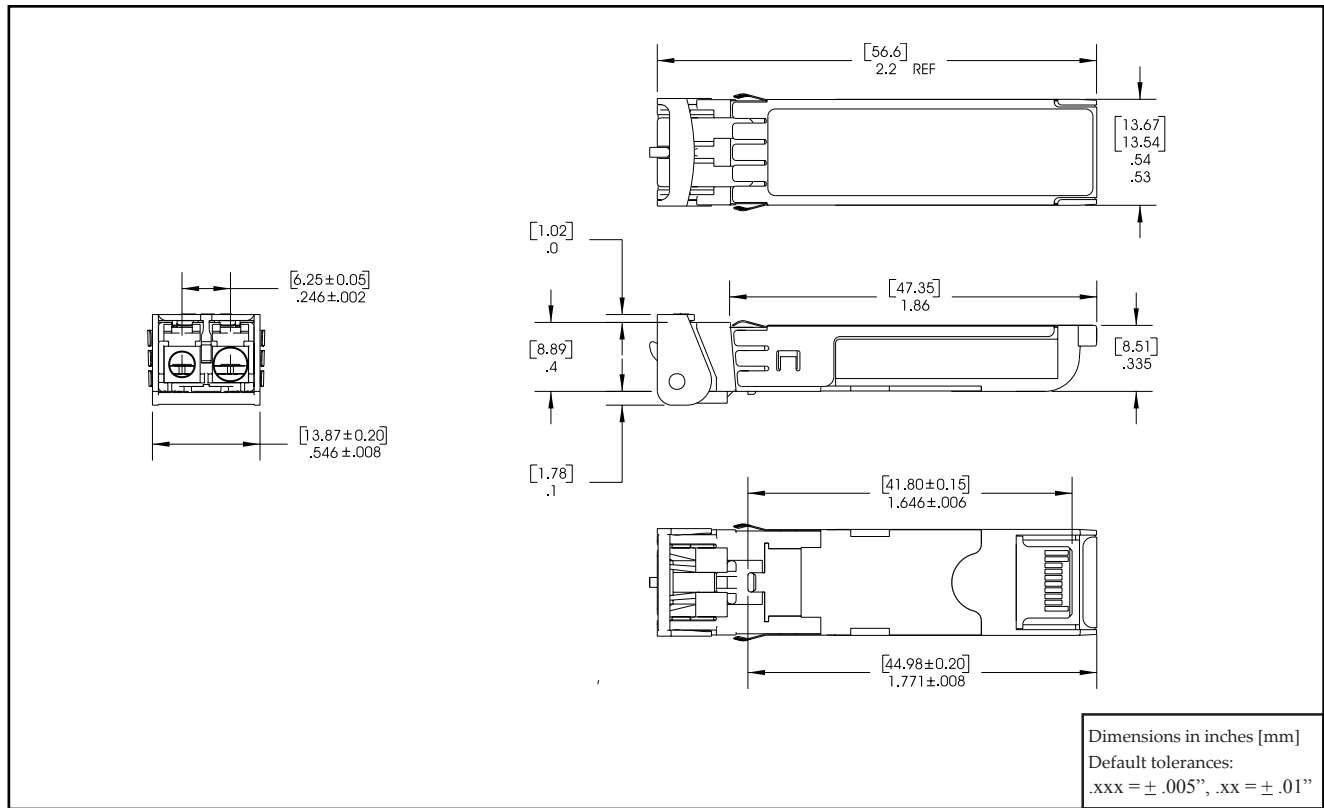
Upon power up, MOD\_DEF(1:2) appear as NC (noconnection), and MOD\_DEF(0) is TTL LOW. When the host system detects this condition, it activates the serial protocol (standard two-wire I<sup>2</sup>C serial interface) and generates the serial clock signal (SCL). The positive edge clocks data into the EEPROM segments of the SFP that are not write protected, and the

negative edge clocks data from the SFP.

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 RPM (receiver power monitor), internal temperature and module supply voltage. 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**

**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.