

VERY LONG HAUL MULTI-RATE GIGABIT ETHERNET SFP CWDM TRANSCEIVERS WITH DIGITAL DIAGNOSTICS

TRPAG1VXM CWDM

Product Description

The TRPAG1VXM CWDM SFP series of multi-rate fiber optic transceivers with integrated digital diagnostics monitoring functionality provide a quick and reliable interface for 100BASE-LX Gigabit Ethernet and 1.062GBd Fibre Channel applications. The transceivers are designed to support data rates ranging from 1.25Gb/s down to 125Mb/s. The diagnostic functions, alarm and warning features as described in the Multi-Source Agreement (MSA) document, SFF-8472 (Rev. 9.3), are provided via an I²C serial interface.

The transceivers use a high power DFB laser and an ultra high sensitivity Avalanche Photodiode (APD) receiver to provide a minimum optical link power budget of 32dB, corresponding to a minimum transmission distance of 120km of single mode fiber, assuming a total connector/splice/CWDM mux and demux loss of 4.6dB, allocated system penalty of 1dB and fiber loss of 0.22dB/km. There are eight (8) wavelengths available: 1471nm, 1491nm, 1511nm, 1531nm, 1551nm, 1571nm, 1591nm and 1611nm. All transceivers are Class I Laser products per U.S. FDA/CDRH and international IEC-60825 standards.

The TRPAG1VXM CWDM 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 transceivers have colored 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 an operating case temperature range of -5°C to +70°C ("B" option) or -5°C to +85°C ("E" option). The housing is made of metal for EMI immunity.



Features

- Up to 120km with Single Mode Fiber
- Eight (8) Wavelength CWDM Transceivers
- Compatible with SFP MSA
- Compatible with IEEE 802.3z Gigabit Ethernet 100BASE-LX PMD Specifications
- Compatible with 1.062GBd Fibre Channel 100-SM-LC-L FC-PI Standards
- Digital Diagnostics through Serial Interface
- Internal Calibration for Digital Diagnostics
- APD Receiver
- Eye Safe (Class I Laser Safety)
- Duplex LC Optical Interface
- Loss of Signal Output & TX Disable Input
- Hot-pluggable

Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Storage Temperature	T_{st}	- 40	+ 85	°C
Operating Case Temperature ¹	"B" option	- 5	+ 70	°C
	"E" option	- 5	+ 85	
Supply Voltage	V_{cc}	0	+ 4.5	V
Maximum Input Optical Power (30 seconds max.)	$P_{in,max}$	-	+ 3.0	dBm
Input Voltage	V_{in}	0	V_{cc}	V

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 $3.47V$)

Parameter		Symbol	Minimum	Typical	Maximum	Units
Operating Data Rate		B	125	-	1250	Mb/s
Optical Output Power ¹		P_O	0	-	+ 5.0	dBm
Center Wavelength	1471	λ_c	1464.5	1471	1477.5	nm
	1491		1484.5	1491	1497.5	
	1511		1504.5	1511	1517.5	
	1531		1524.5	1531	1537.5	
	1551		1544.5	1551	1557.5	
	1571		1564.5	1571	1577.5	
	1591		1584.5	1591	1597.5	
	1611		1604.5	1611	1617.5	
Spectral Width (-20dB)		$\Delta\lambda_{20}$	-	-	1.0	nm
Side Mode Suppression Ratio		$SMSR$	30	-	-	dB
Extinction Ratio		P_{hi}/P_{lo}	9	-	-	dB
Deterministic Jitter		DJ	-	-	80	ps
Total Jitter		TJ	-	-	227	ps
Relative Intensity Noise		RIN	-	-	- 120	dB/Hz
Dispersion Penalty ²		-	-	-	1.0	dB
Transmitter Output Eye		Compliant with Eye Mask Defined in IEEE 802.3z Standard				

¹ Measured average power coupled into single mode fiber.
² Specified at 2600ps/nm dispersion, which corresponds to the approximate worst-case dispersion for 120km G.652 fiber over the wavelength range of 1464.5 to 1617.5nm.

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

Parameter		Symbol	Minimum	Typical	Maximum	Units
Operating Data Rate		B	125	-	1250	Mb/s
Minimum Input Optical Power (10^{-12} BER) ¹		P_{min}	- 32.0	- 35.0	-	dBm
Maximum Input Optical Power (10^{-12} BER) ¹		P_{max}	- 10.0	-	-	dBm
LOS Thresholds	Increasing Light Input	P_{los+}	-	-	- 32.0	dBm
	Decreasing Light Input	P_{los-}	- 45.0	-	-	
LOS Timing Delay	Increasing Light Input	t_{loss_off}	-	-	100	μ s
	Decreasing Light Input	t_{loss_on}	-	-	100	
LOS Hysteresis		-	0.5	-	-	dB
Deterministic Jitter		DJ	-	-	170	ps
Total Jitter		TJ	-	-	266	ps
Wavelength of Operation		λ	1100	-	1620	nm
Optical Return Loss		ORL	12	-	-	dB
Electrical 3dB Upper Cutoff Frequency		-	-	-	1500	MHz

¹ When measured with 2⁷-1 PRBS at 125Mb/s, 1062.5Mb/s and 1250Mb/s.

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-DIF}	0.35	-	1.75	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 V_{CC} .
³ Open collector compatible, 4.7 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
Output Voltage Swing (RD+ & RD-) ¹	V_{PP-DIF}	0.4	-	1.75	V
Output HIGH Voltage (LOS) ²	V_{OH}	$V_{CC} - 0.3$	-	$V_{CC} + 0.3$	V
Output LOW Voltage (LOS) ²	V_{OL}	0	-	0.5	V

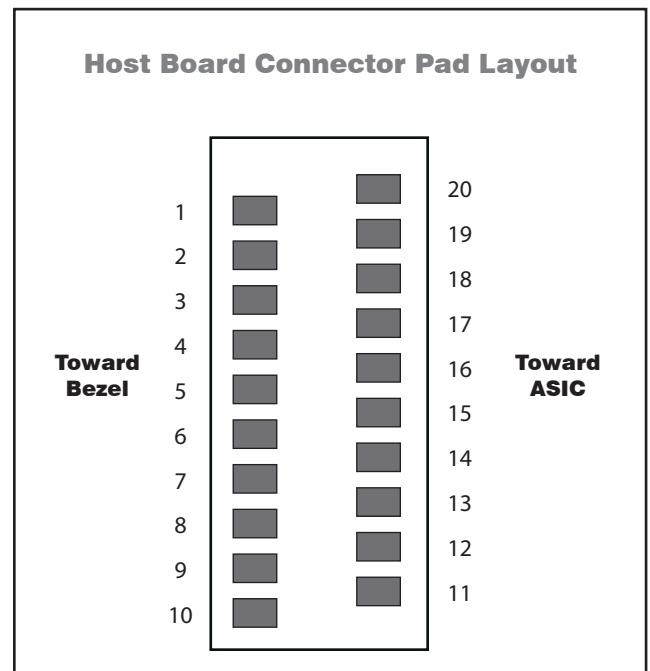
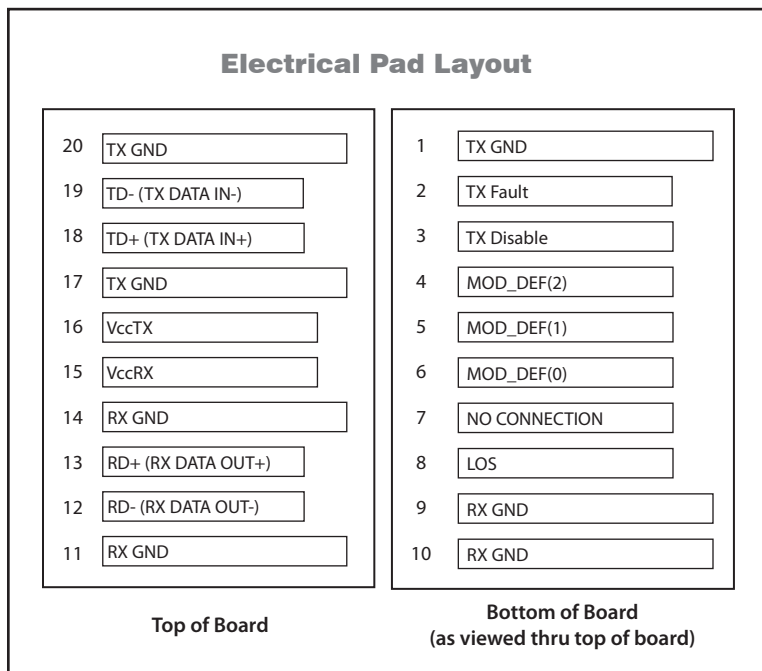
¹ Differential peak-to-peak voltage across external 100Ω load.
² Open collector compatible, 4.7 to 10kΩ pull-up resistor to V_{CC} (Host Supply Voltage).

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

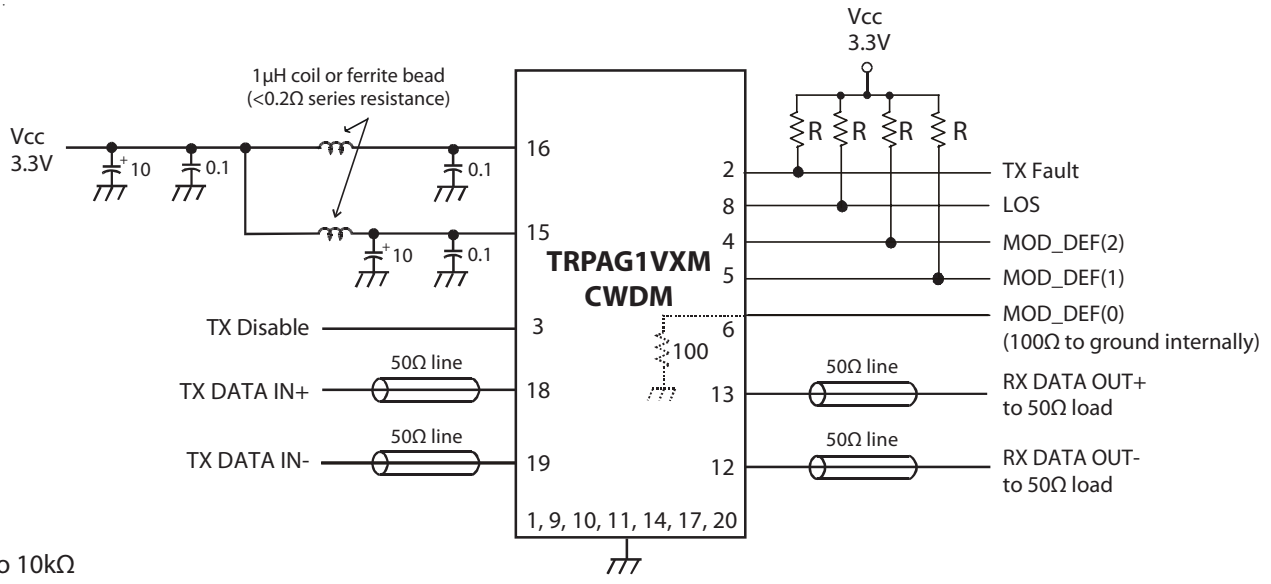
Parameter	Symbol	Minimum	Typical	Maximum	Units
Supply Voltage	V_{CC}	3.13	3.3	3.47	V
Supply Current	I_{CC}	-	210	300	mA

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 with 0.1µF 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

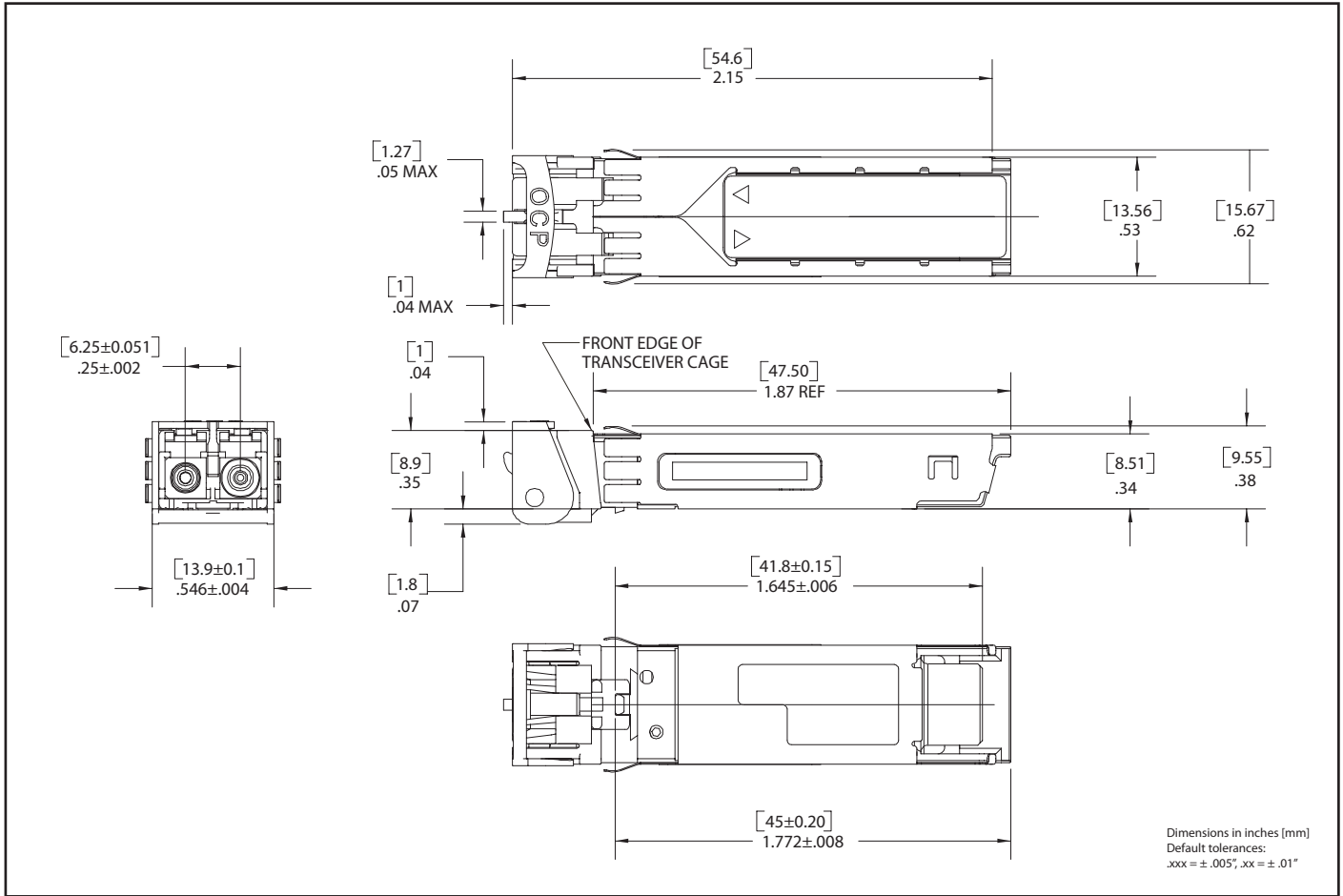
up, MOD_DEF(1:2) appear as NC (no connection), and MOD_DEF(0) is TTL LOW. When the host system detects this condition, it activates the serial protocol (standard two-wire I²C serial interface) and generates the serial clock signal (SCL). The positive edge clocks data into the EEPROM segments of the SFP 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 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. 9.3.

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.

Package Outline



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.