

OC-3/STM-1 SFP CWDM TRANSCEIVERS WITH DIGITAL DIAGNOSTICS

TRPE03-G CWDM



Product Description

The TRPE03-G CWDM SFP series of fiber optic transceivers with integrated digital diagnostics monitoring functionality provide a quick and reliable interface for long reach (LR) applications. 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.

Products under this series are compatible with SONET/SDH standards for OC-3/STM-1 LR-2/L-1.2 and are available in eight (8) wavelengths: 1471nm, 1491nm, 1511nm, 1531nm, 1551nm, 1571nm, 1591nm and 1611nm. Two optical link power budgets are available, 32dB and 34dB, providing an extra 3dB and 5dB over SONET/SDH link budgets, respectively, to accommodate the wavelength multiplexing and de-multiplexing insertion losses. All modules satisfy Class I Laser Safety requirements in accordance with the U.S. FDA/CDRH and international IEC-60825 standards.

The TRPE03-G CWDM transceivers connect to standard 20-pad 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 (Commercial) or -5°C to +85°C (Extended). The housing is made of metal for EMI immunity.



Features

- Eight (8) Wavelength CWDM Transceivers
- Lead Free Design & Fully RoHS Compliant
- Compatible with SFP MSA
- Compatible with SONET/SDH OC-3/STM-1 (155Mb/s) LR-2/L-1.2 Long Reach Specifications
- Digital Diagnostics through Serial Interface
- Internal Calibration for Digital Diagnostics
- Optical Link Power Budgets of 32dB & 34dB Minimum
- Eye Safe (Class I Laser Safety)
- Duplex LC Optical Interface
- Loss of Signal Output & TX Disable Input
- Hot-pluggable
- TX Fault & Loss of Signal Outputs
- TX Disable Input

Absolute Maximum Ratings

Parameter		Symbol	Minimum	Maximum	Units
Storage Temperature		T_{ST}	- 40	+ 85	°C
Operating Case Temperature ¹	Commercial	T_{OP}	- 5	+ 70	°C
	Extended		- 5	+ 85	
Supply Voltage		V_{CC}	0	+ 5.0	V
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 ¹		B	-	156	-	Mb/s
Average Optical Output Power (coupled into single mode fiber), 50% duty cycle	TRPE03HL2xG	P_O	-2.0	-	+3.0	dBm
	TRPE03KL2xG		0	-	+5.0	
Extinction Ratio		ER	10	-	-	dB
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
Optical Output Eye		Compliant with Telcordia GR-253-CORE and ITU-T Recommendation G.957				

¹ Specified through EOL.

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


Parameter		Symbol	Minimum	Typical	Maximum	Units
Operating Data Rate ¹		B	-	156	-	Mb/s
Receiver Sensitivity (10^{-10} BER) ²		P_{min}	-34.0	-37.0	-	dBm
Maximum Input Optical Power (10^{-12} BER) ²		P_{max}	0	-	-	dBm
LOS Thresholds	Increasing Light Input	P_{los+}	-	-	-34.0	dBm
	Decreasing Light Input	P_{los-}	-45.0	-	-	
LOS Timing Delay	Increasing Light Input	$t_{loss\ off}$	-	-	100	μs
	Decreasing Light Input	$t_{loss\ on}$	2.3	-	100	
LOS Hysteresis		-	1.0	-	-	dB
Wavelength of Operation		λ	1100	-	1620	nm
Receiver Reflectance		-	-	-	-25.0	dB

¹ Data rate ranges from 50Mb/s to 266Mb/s. However, some degradation may be incurred in overall performance.


² Measured with $2^{23}-1$ PRBS at 156Mb/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.



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



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-) ¹	V_{PP-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 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}	0.6	-	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

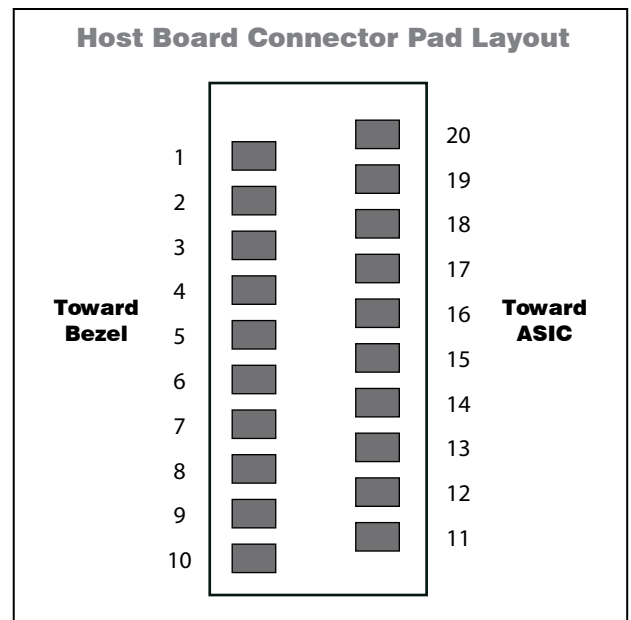
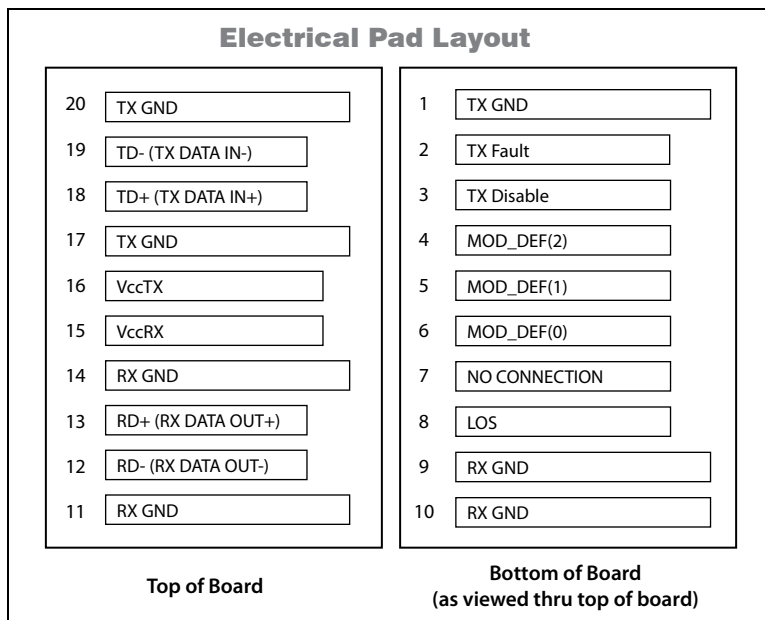
¹ Differential peak-to-peak voltage across external 100Ω load.
² Open collector compatible, 4.7 to 10kΩ pull-up resistor to V_{CC} (Host Supply Voltage).

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

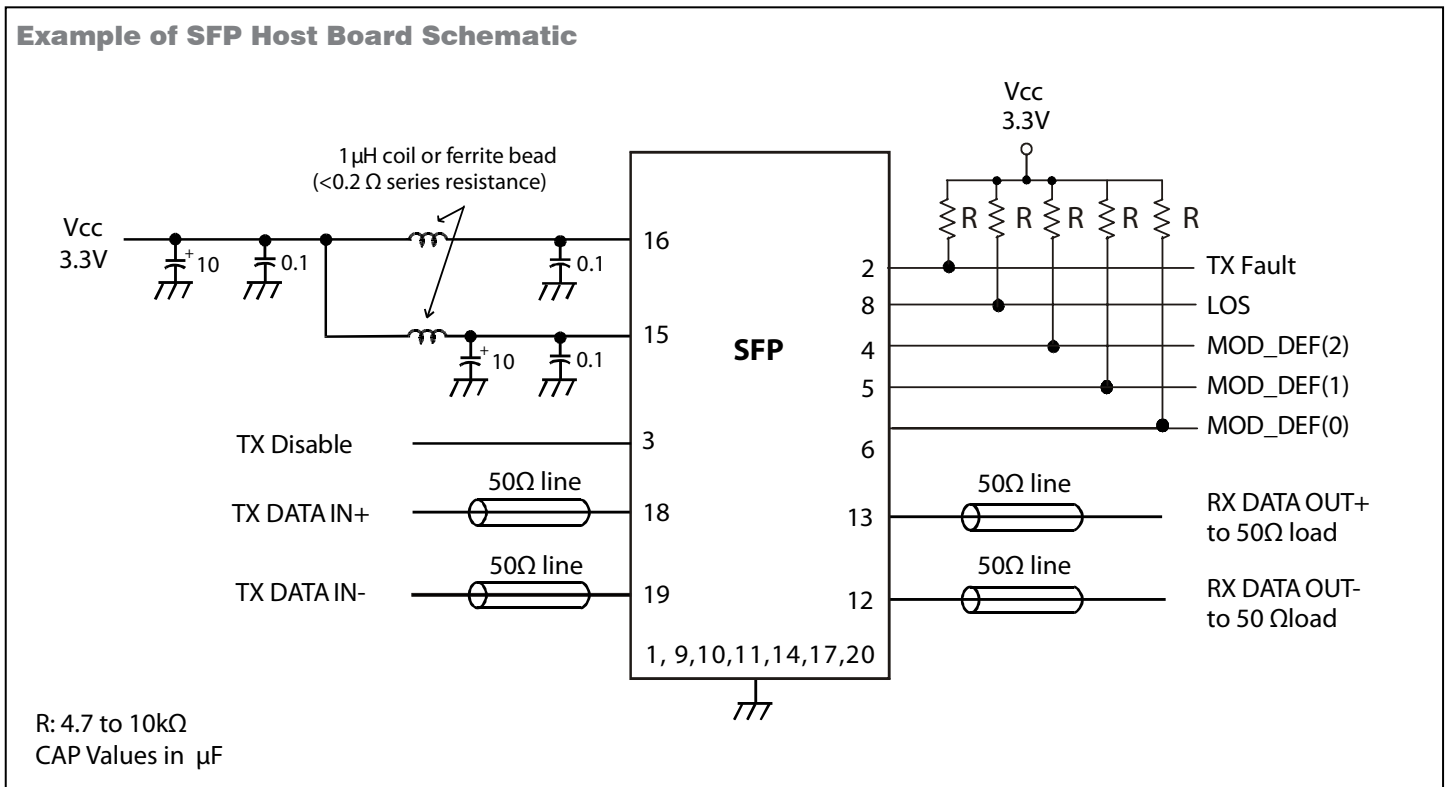
Parameter	Symbol	Minimum	Typical	Maximum	Units
Power Supply Voltage	V_{CC}	3.13	3.3	3.47	V
Supply Current	I_{CC}	-	235	285	mA

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 with 1 μF 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 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).

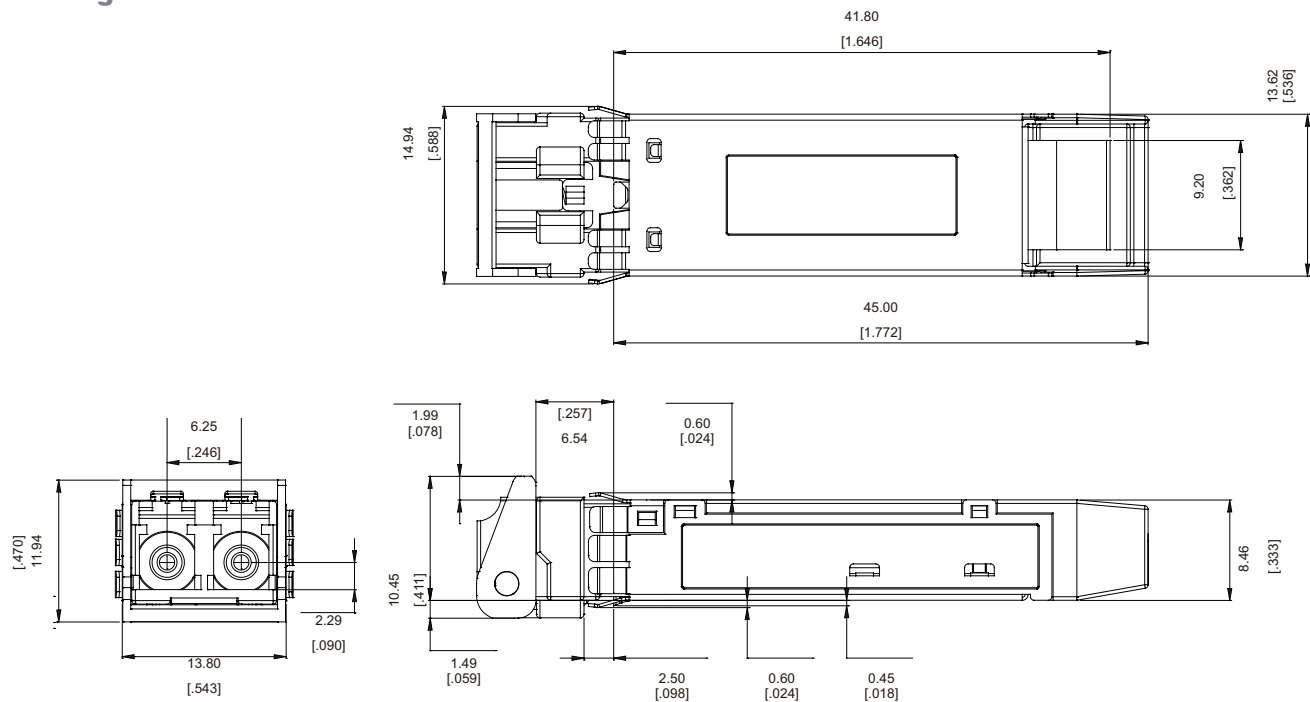
Serial Identification and Monitoring: The module definition of SFP is indicated by the three module definition pins, MOD_DEF(0), MOD_DEF(1) and MOD_DEF(2).

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 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 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 SFPMSA, and SFF-8472, Rev. 9.4

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

Package Outline

Ordering Information

Model Name		Operating Temperature		Nominal Wavelength (nm)	Latch Color
32dB Link Budget (100/80km Distance) ¹	34dB Link Budget (100/80km Distance) ¹				
TRPE03HL2C00010G	TRPE03KL2C00010G	-5°C to +70°C	Commercial	1471	Gray
TRPE03HL2C00020G	TRPE03KL2C00020G	-5°C to +70°C	Commercial	1491	Violet
TRPE03HL2C00030G	TRPE03KL2C00030G	-5°C to +70°C	Commercial	1511	Blue
TRPE03HL2C00040G	TRPE03KL2C00040G	-5°C to +70°C	Commercial	1531	Green
TRPE03HL2C00050G	TRPE03KL2C00050G	-5°C to +70°C	Commercial	1551	Yellow
TRPE03HL2C00060G	TRPE03KL2C00060G	-5°C to +70°C	Commercial	1571	Orange
TRPE03HL2C00070G	TRPE03KL2C00070G	-5°C to +70°C	Commercial	1591	Red
TRPE03HL2C00080G	TRPE03KL2C00080G	-5°C to +70°C	Commercial	1611	Brown
TRPE03HL2E00010G	TRPE03KL2E00010G	-5°C to +85°C	Extended	1471	Gray
TRPE03HL2E00020G	TRPE03KL2E00020G	-5°C to +85°C	Extended	1491	Violet
TRPE03HL2E00030G	TRPE03KL2E00030G	-5°C to +85°C	Extended	1511	Blue
TRPE03HL2E00040G	TRPE03KL2E00040G	-5°C to +85°C	Extended	1531	Green
TRPE03HL2E00050G	TRPE03KL2E00050G	-5°C to +85°C	Extended	1551	Yellow
TRPE03HL2E00060G	TRPE03KL2E00060G	-5°C to +85°C	Extended	1571	Orange
TRPE03HL2E00070G	TRPE03KL2E00070G	-5°C to +85°C	Extended	1591	Red
TRPE03HL2E00080G	TRPE03KL2E00080G	-5°C to +85°C	Extended	1611	Brown

¹ The indicated transmission distance is for guidelines only, not guaranteed per Telcordia GR-253-CORE/ITU-T Recommendation G.957. Longer distances can be supported if the optical link power budget is satisfied.

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