



### Features

- Compliant with SFF-8431 SFP+ MSA
- Compliant with IEEE802.3ae 10G BASE-LR
- PIN photo-detector
- 2-wire interface for management specifications compliant with SFF 8472
- Transmitter supports one of Eighteen CWDM channels
- Advanced firmware allow customer system encryption information to be stored in transceiver
- Cost effective SFP+ solution, enables higher port densities and greater bandwidth
- RoHS Compliant

### Applications

- 4G LTE wireless backhails
- Data Center interconnects
- High speed point-to-point links

### Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Units	Note
Storage Temperature	$T_c$	-40	85	°C	
Operating Case Temperature	$T_c$	0	70	°C	
Supply Voltage	$V_{cc}$	0	3.6	V	
Relative Humidity	$RH$	5	95	%	
RX Input Average Power	$P_{max}$	---	5	dBm	

### Recommended Operating Conditions

Parameter	Symbol	Min.	Max.	Units	Note
Case Operating Temperature	$T_c$	0	70	°C	
Supply Voltage	$V_{cc}$	3.135	3.465	V	
Supply Current	$I_{cc}$	---	420	mA	

**Diagnostics**

<i>Parameter</i>	<i>Symbol</i>	<i>Accuracy</i>	<i>Unit</i>	<i>Notes</i>
Temperature	Temp	$\pm 3$	$^{\circ}\text{C}$	Over operating Temp
Voltage	VCC	$\pm 0.08$	V	Full operating range
Bias Current	Bias	$\pm 10$	mA	
TX Power	TX	$\pm 3$ dB	dBm	
RX Power	RX	$\pm 3$ dB	dBm	-1dBm to -15dBm range

### Transmitter Electro-optical Characteristics

V<sub>CC</sub> = 3.135 V to 3.465 V, T<sub>C</sub> = 0 °C to 70 °C

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Data Rate			10.3125		Gb/s	
Launched power	P <sub>o</sub>	-1		3	dBm	
Center Wavelength	λ <sub>C</sub>	Ref order information			nm	
Optical spectrum width (-20dB)				1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Laser Off Power	P <sub>OFF</sub>	---	---	-30	dBm	
Center Wavelength Stability	Δλ <sub>D</sub>	-6.5		6.5	nm	
Extinction Ratio	ER	3.5	---	---	dB	
Transmitter Dispersion Penalty	DP	---	---	2	dB	1
Launched power in OMA		-3.2			dBm	
RIN	RIN			-128	dB/Hz	
Optical Return Loss Tolerance	RL	12			dB	
Single Ended Output Voltage Tolerance		-0.3	---	4	V	
C common mode voltage tolerance		15	---	---	mV	
TX Input Diff Voltage	V <sub>I</sub>	180		700	mV	
TX Fault	V <sub>oL</sub>	-0.3		0.4	V	
Data Dependent Input Jitter	DDJ			0.1	UI	
Data Input Total Jitter	TJ			0.28	UI	

Note 1: Path penalty is intended as the power penalty of the interface between back-to-back and the maximum applied dispersion.

## Receiver Electro-optical Characteristics

$V_{CC} = 3.135\text{ V to }3.465\text{ V}$ ,  $T_C = 0\text{ }^\circ\text{C to }70\text{ }^\circ\text{C}$

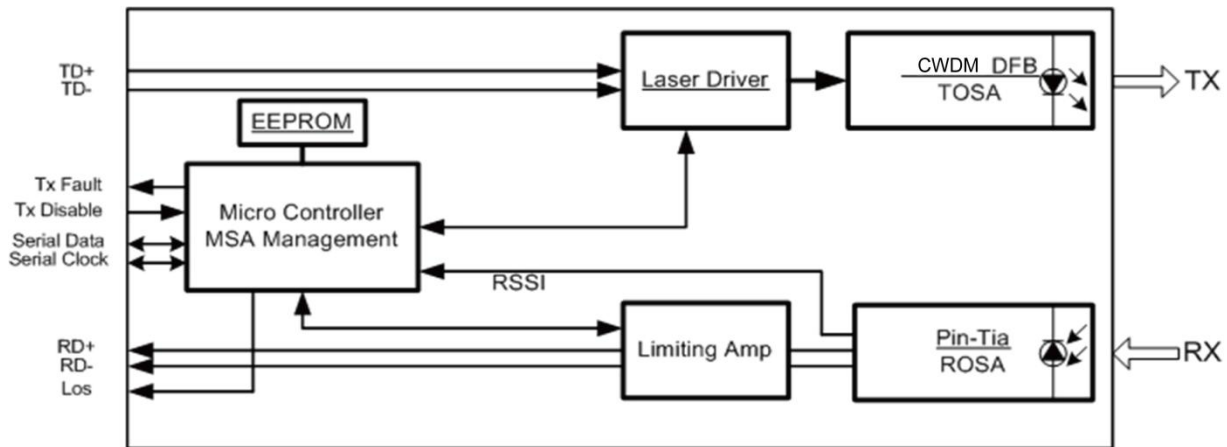
Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Receiver Overload		0.5			dB	
Receiver Sensitivity	$R_{SEN}$	---	---	-15	dBm	1
Receiver Sensitivity in OMA		---	---	-14.6	dBm	2
Receiver Reflectance	$R_f$			-12	dB	
Stressed receiver Sensitivity in OMA		---	---	-12	dBm	
Operating Center Wavelength	$\lambda_C$	1260		1620	nm	
Vertical eye closure penalty				2.2	dB	3
Receiver power damage				5	dBm	
Stressed eye jitter		0.3			UI	2
Receive electrical 3dB upper cutoff frequency				12.5	GHz	
Loss of Signal-Asserted	$P_A$	-28	---	---	dBm	
Loss of Signal-Deasserted	$P_D$	---	---	-16	dBm	
Loss of Signal-Hysteresis	$P_H$	0.5	---	---	dB	
Single Ended Output Voltage Tolerance		-0.3		4	V	
RX Output Diff Voltage	$V_o$	300		850	mV	
RX Output Rise and Fall Time	$T_r/T_f$	30			ps	20% to 80%
Total Jitter	$T_J$			0.7	UI	
Deterministic Jitter	$DJ$			0.42	UI	

Note 1: Average optical power shall be measured using the methods specified in TIA/EIA-455-95.

Note 2: Receiver sensitivity is informative. Stressed receiver sensitivity shall be measured with conformance test signal for  $BER = 1 \times 10^{-12}$ .

Note 3: Vertical eye closure penalty and stressed eye jitter are the test conditions for measuring stressed receiver sensitivity. They are not the required characteristic of the receiver.

**Block Diagram of Transceiver**



This SFP+ CWDM transceiver is designed to transmit and receive optical data over single mode optical fiber for link length 10km. (for longer wavelength, maybe need EML TOSA solution) The SFP+ CWDM module electrical interface is compliant to SFI electrical specifications. The transmitter input and receiver output impedance is 100 Ohms differential. Data lines are internally AC coupled. The module provides differential termination and reduce differential to common mode conversion for quality signal termination and low EMI. SFI typically operates over 200 mm of improved FR4 material or up to about 150mm of standard FR4 with one connector.

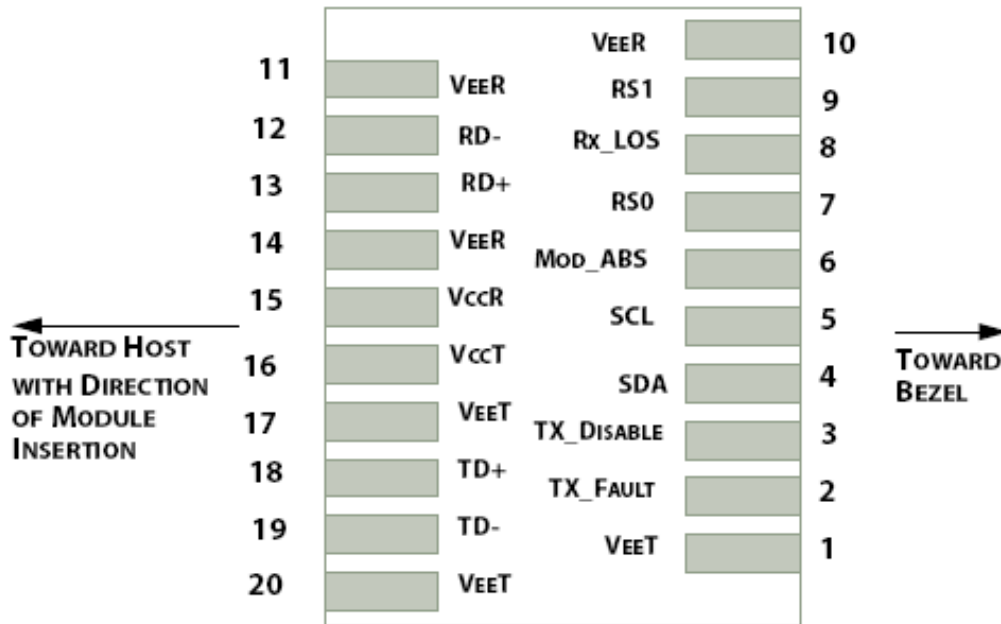
The transmitter converts up to 10 Gb/s serial PECL or CML electrical data into serial optical data compliant with the 10GBASE-LR standard. An open collector compatible Transmit Disable (Tx\_Dis) is provided. Logic “1” or no connection on this pin will disable the laser from transmitting. Logic “0” on this pin provides normal operation. The transmitter has an internal automatic power control loop (APC) to ensure constant optical power output across supply voltage and temperature variations. An open collector compatible Transmit Fault (Tx\_Fault) is provided.

TX\_Fault is module output contact that when high, indicates that the module transmitter has detected a fault condition related to laser operation or safety. The TX\_Fault output contact is an open drain/collector and shall be pulled up to the Vcc\_Host in the host with a resistor in the range 4.7-10 kΩ. TX\_Disable is a module input contact. When TX\_Disable is asserted high or left open, the SFP+ module transmitter output shall be turned off. This contact shall be pulled up to VccT with a 4.7 kΩ to 10 kΩ resistor

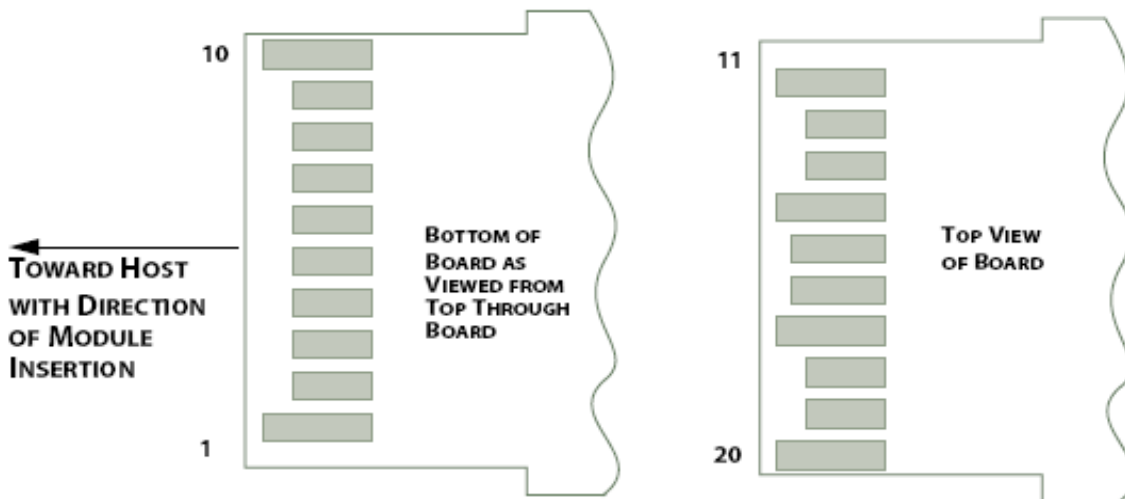
The receiver converts up to 10G/s serial optical data into serial PECL/CML electrical data. An open collector compatible Loss of Signal is provided. Rx\_LOS when high indicates an optical signal level below that specified in the relevant standard. The Rx\_LOS contact is an open drain/collector output and shall be pulled up to Vcc\_Host in the host with a resistor in the range 4.7-10 kΩ, or with an active termination. Power supply filtering is recommended for both the transmitter and receiver. The Rx\_LOS signal is intended as a preliminary indication to the system in which the SFP+

is installed that the received signal strength is below the specified range. Such an indication typically points to non-installed cables, broken cables, or a disabled, failing or a powered off transmitter at the far end of the cable.

**Pin Assignment**



**Module Interface to Host**



**Module Contact Assignment**

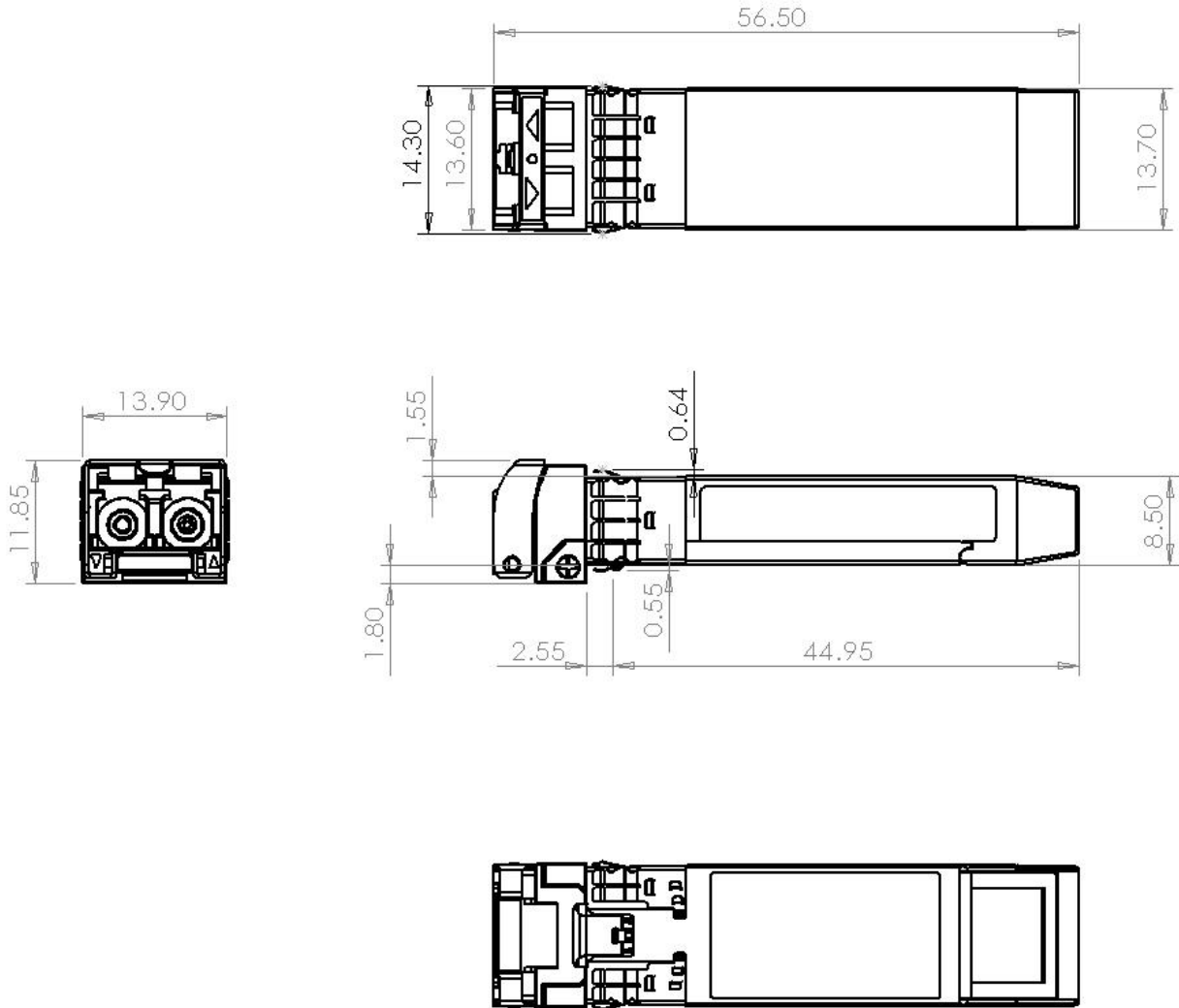
**Pin Descriptions**

<i>PIN</i>	<i>Logic</i>	<i>Symbol</i>	<i>Name / Description</i>	<i>Note</i>
1		VeeT	Module Transmitter Ground	1
2	LVTTL-O	TX_Fault	Module Transmitter Fault	
3	LVTTL-I	TX_Dis	Transmitter Disable; Turns off transmitter laser output	
4	LVTTL-I/O	SDA	2-Wire Serial Interface Data Line	2
5	LVTTL-I	SCL	2-Wire Serial Interface Clock	2
6		MOD_DEF0	Module Definition, Grounded in the module	
7	LVTTL-I	RS0	Not used	
8	LVTTL-O	RX_LOS	Receiver Loss of Signal Indication Active High	
9	LVTTL-I	RS1	Not used	
10		VeeR	Module Receiver Ground	1
11		VeeR	Module Receiver Ground	1
12	CML-O	RD-	Receiver Inverted Data Output	
13	CML-O	RD+	Receiver Data Output	
14		VeeR	Module Receiver Ground	1
15		VccR	Module Receiver 3.3 V Supply	
16		VccT	Module Receiver 3.3 V Supply	
17		VeeT	Module Transmitter Ground	1
18	CML-I	TD+	Transmitter Non-Inverted Data Input	
19	CML-I	TD-	Transmitter Inverted Data Input	
20		VeeT	Module Transmitter Ground	1

Note:

1. Module ground pins GND are isolated from the module case.
2. Shall be pulled up with 4.7K-10Kohms to a voltage between 3.15V and 3.45V on the host board.

**Dimensions**





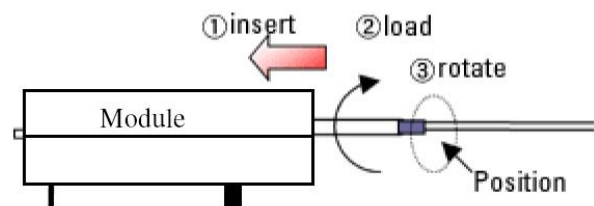
**Optical Receptacle Cleaning Recommendations :**

All fiber stubs inside the receptacle portions were cleaned before shipment. In the event of contamination of the optical ports, the recommended cleaning process is the use of forced nitrogen. If contamination is thought to have remained, the optical ports can be cleaned using a NTT international Cletop® stick type and HFE7100 cleaning fluid. Before the mating of patch-cord, the fiber end should be cleaned up by using Cletop® cleaning cassette.

**Cleaning of patch-cord**



**Cleaning of fiber stub**

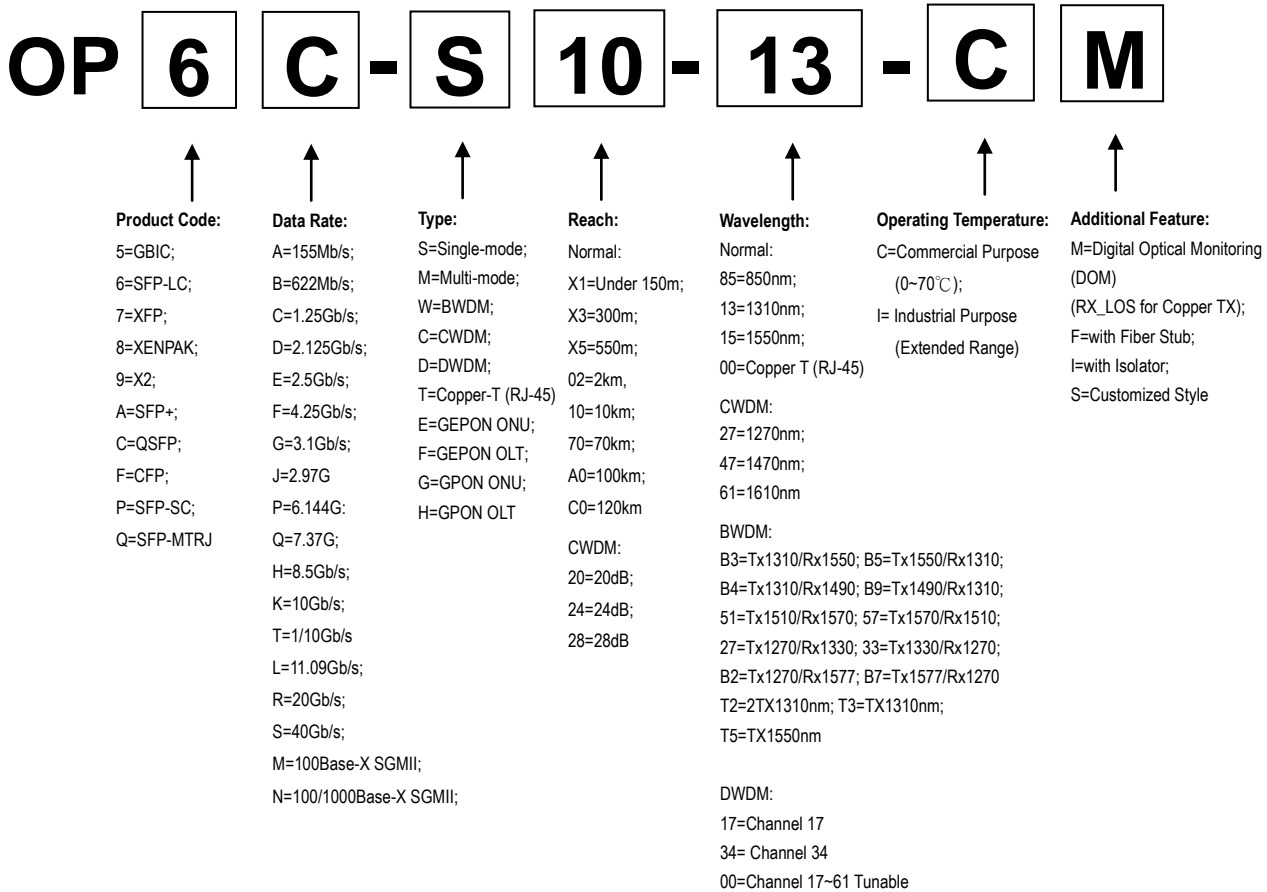


1. Insert  
Ensure that stick is held straight when inserting into sleeve.
2. Load  
Apply sufficient pressure (approx 600-700g) to ensure ferrule a little depressed in sleeve.
3. Rotate  
Rotate stick clockwise 4-5 times, while ensuring direct contact with ferrule end-face is maintained.

*Notice: Number of possible wipes:  
Maintenance (repair) ~1 use / piece  
Equipment construction: 4 uses / piece (max.)*

Note: The pictures were extracted from NTT-ME website. And the Cletop® is a trademark registered by NTT-ME

**Ordering Information**



Model Number	Part Number	Power Budget	Voltage	Temperature
SFP+10G-CWDM-14-yy	OPAK-C14-yy-CB	14dB	3.3V	0°C to 70 °C

Note: yy=27, Center Wavelength=1270nm ,yy=29, Center Wavelength=1290nm  
 yy=31, Center Wavelength=1310nm ,yy=33, Center Wavelength=1330nm  
 yy=35, Center Wavelength=1350nm ,yy=37, Center Wavelength=1370nm  
 yy=39, Center Wavelength=1390nm ,yy=41, Center Wavelength=1410nm

**Note: All information contained in this document is subject to change without notice.**