



Features

- Complaint with IEEE 802.3ae 10GBASE-LR
- Simplex LC connector
- Electrical interface compliant to SFF-8431 specifications for enhanced 8.5 and 10 Gigabit small form factor pluggable module "SFP+"
- 1270/1330nm DFB transmitter, PIN photo-detector
- Compliant with SFF8472 Digital Diagnostic Standard
- 2-wire interface for management specifications compliant with SFF 8472 digital diagnostic
- ROHS compliant

Applications

- Data Center Interconnect
- CPRI/OBASI Wireless Backhaul
- LTE eNode B Interconnect

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Units	Note
Storage Temperature	T_s	-40	85	°C	
Supply Voltage	V_{cc}	0	3.6	V	
Relative Humidity	RH	5	95	%	
RX Input Average Power	P_{max}	---	0	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}	---	300	mA	

Diagnostics Monitoring

Parameter	Accuracy	Unit	Calibration
Temperature	± 3	$^{\circ}\text{C}$	Internal
Voltage	± 0.08	V	
Bias Current	$\pm 10\%$	mA	
TX Power	$\pm 3 \text{ dB}$	dBm	
RX Power	$\pm 3 \text{ dB}$	dBm	

Transmitter Electro-optical Characteristics

$V_{CC} = 3.1 \text{ V to } 3.5 \text{ V}$, $T_C = 0^{\circ}\text{C to } 70^{\circ}\text{C}$ ($-40^{\circ}\text{C to } 85^{\circ}\text{C}$)

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Data Rate		---	10.3125	---	Gbps	
Output Optical Power	P_{out}	-4	---	+1	dBm	Average
Center Wavelength	λ_C	1265	---	1275	nm	
Side mode Suppression Ratio	SSR_{min}	30			dB	
Relative Intensity Noise	RIN	---	---	-128	dB/Hz	12dB reflection
Max. P_{out} TX-DISABLE Asserted	P_{OFF}	---	---	-30	dBm	
Extinction Ratio	ER	3.5	---	---	dB	
Transmitter Dispersion Penalty	TDP	---	---	3.2	dB	
Optical Return Loss Tolerance		---	---	12	dB	
Power consumption		---	800	1000	mW	
Single Ended Output Voltage Tolerance		-0.3	---	4	V	
Differential Input Voltage	V_I	180	---	700	mV	
Commonmode voltage tolerance		15	---	---	mV	
TX Fault	VoL	-0.3		0.4	V	At 0.7mA
Data Dependent Input Jitter	DDJ			0.1	UI	
Data Input Total Jitter	TJ			0.28	UI	

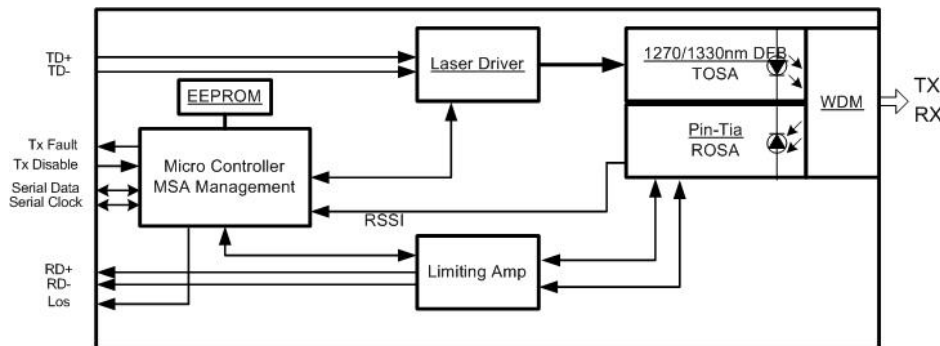
Receiver Electro-optical Characteristics

$V_{CC} = 3.1 \text{ V to } 3.5 \text{ V}$, $T_C = 0^\circ \text{C to } 70^\circ \text{C}$ ($-40^\circ \text{C to } 85^\circ \text{C}$)

Parameter	Symbol	Min.	Typ.	Max.	Units	Note
Operating Center Wavelength	λ_C	1325	---	1335	nm	
Overload	P_{IN}	---	---	0.5	dB	
Receiver Reflectance		---	---	-14		
Vertical eye closure penalty		2.2			dB	Note 1
Loss of Signal-Assert	P_D	-30	---	---	dBm	
Loss of Signal-Deasserted	P_D	---	---	-14	dBm	
Loss of Signal-Hysteresis	P_H	0.5	---	---		
Stressed eye jitter		0.3			UIP-p	BER < 10^{-12}
Receive electrical 3dB upper cutoff frequency				12.3	GHz	
Receiver power				1.5	dBm	
Differential Output Voltage	V_{DIFF}	300	---	850	mV	
Single Ended Output Voltage Tolerance		-0.3	---	4	V	
Output Rise and Fall time	T_r/T_f	30			ps	20% to 80%
Total Jitter	TJ			0.7	UI	
Deterministic Jitter	DJ			0.42	UI	

Note 1: 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



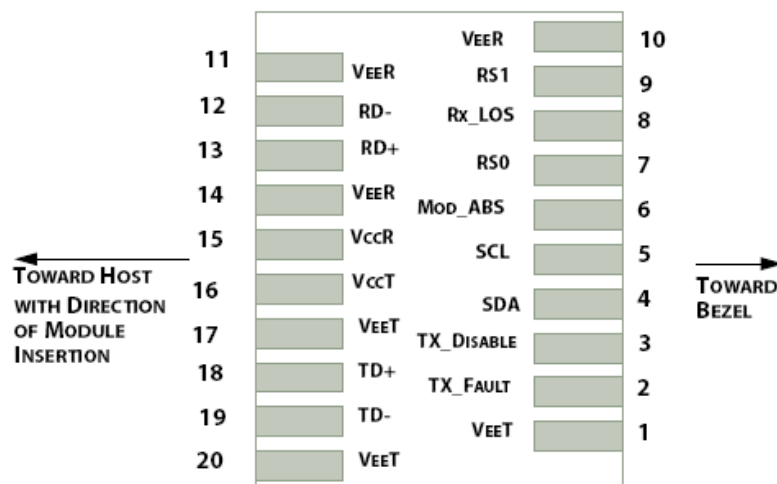
This 10Gigabit SFP+ BiDi transceiver is designed to transmit and receive optical data over single mode optical fiber for link length 10km.

The SFP+BiDi 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 10Gbit/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. A logic "1," or no connection on this pin will disable the laser from transmitting. A 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 a 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 10Gbit/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

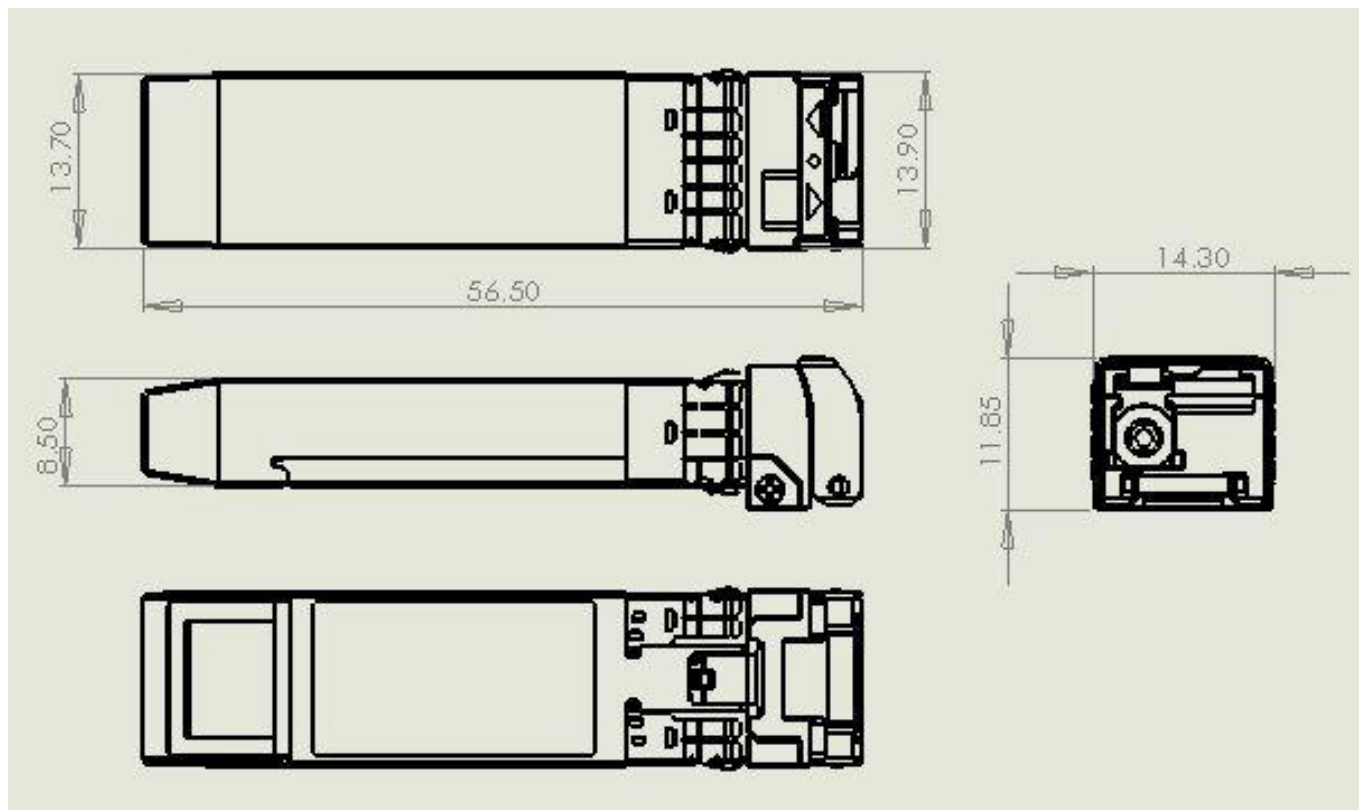


PIN	Logic	Symbol	Name / Description	Note
1		VeeT	Module Transmitter Ground	1
2	LVTTL-O	TX_Fault	Module Transmitter Fault	
3	LVTTL-I	TX_Dis	Transmitter Disable; Turns off transmitter laser output	
4	LVTTL-I/O	SDA	2-Wire Serial Interface Data Line	2
5	LVTTL-I	SCL	2-Wire Serial Interface Clock	2
6		MOD_DEF0	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



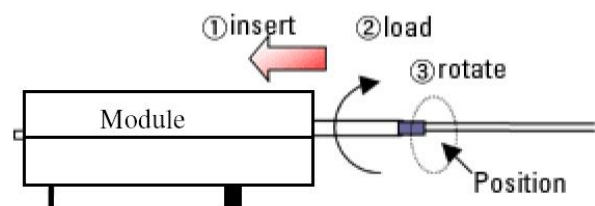
Optical Receptacle Cleaning Recommendations :

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

OP	6	C	-	S	10	-	13	-	C	M
	↑	↑		↑	↑		↑		↑	↑
Product Code:	Data Rate:	Type:		Reach:	Wavelength:		Operating Temperature:		Additional Feature:	
5=GBIC;	A=155Mb/s;	S=Single-mode;		Normal:	Normal:		C=Commercial Purpose		M=Digital Optical Monitoring	
6=SFP-LC;	B=622Mb/s;	M=Multi-mode;		X1=Under 150m;	85=850nm;		(0~70℃);		(DOM)	
7=XFP;	C=1.25Gb/s;	W=BWDM;		X3=300m;	13=1310nm;		I= Industrial Purpose		(RX_LOS for Copper TX);	
8=XENPAK;	D=2.125Gb/s;	C=CWDM;		X5=550m;	15=1550nm;		(Extended Range)		F=with Fiber Stub;	
9=X2;	E=2.5Gb/s;	D=DWDM;		02=2km,	00=Copper T (RJ-45)				I=with Isolator;	
A=SFP+;	F=4.25Gb/s;	T=Copper-T (RJ-45)		10=10km;	CWDM:				S=Customized Style	
C=QSFP;	G=3.1Gb/s;	E=GEPON ONU;		70=70km;	27=1270nm;					
P=SFP-SC;	J=2.97G	F=GEPON OLT;		A0=100km;	47=1470nm;					
Q=SFP-MTRJ	P=6.144G;	G=GPON ONU;		C0=120km	61=1610nm					
	Q=7.37G;	H=GPON OLT			BWDM:					
	H=8.5Gb/s;			CWDM:	B3=Tx1310/Rx1550; B5=Tx1550/Rx1310;					
	K=10Gb/s;			20=20dB;	B4=Tx1310/Rx1490; B9=Tx1490/Rx1310;					
	R=20Gb/s;			24=24dB;	51=Tx1510/Rx1570; 57=Tx1570/Rx1510;					
	S=40Gb/s;			28=28dB	27=Tx1270/Rx1330; 33=Tx1330/Rx1270;					
	M=100Base-X SGMII;				B2=Tx1270/Rx1577; B7=Tx1577/Rx1270					
	N=100/1000Base-X SGMII;				T2=2TX1310nm; T3=TX1310nm;					
					T5=TX1550nm					
					DWDM:					
					17=Channel 17					
					34= Channel 34					

Model Number	Part Number	Reach	Input/Output	TX/RX	Signal Detect	Voltage	Temperature
SFP-10G-BWDM-10-27	OPAK-W10-27-CB	10 km	AC/AC	1270/1330	TTL	3.3V	0°C to 70 °C
SFP-10G-BWDM-10-27-I	OPAK-W10-27-IB	10 km	AC/AC	1270/1330	TTL	3.3V	-40°C to 85 °C

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