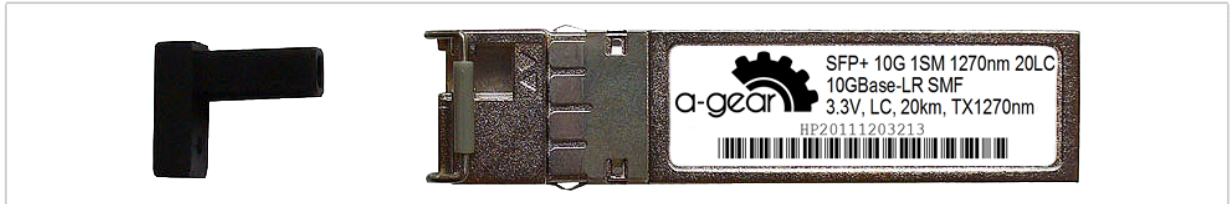**A-GEAR World Wide Manufacturing**

Product Specification
SFP+ WDM LR 20km Transceiver

1. Features

- Up to 10.7Gbps Data Links
- Single Mode LC Receptacle Bi-directional Transceiver
- Up to 20km transmission on SMF
- Power dissipation <1.0W
- 1270 nm DFB laser and 1330nm PIN receiver
- 2-wire interface with integrated Digital Diagnostic monitoring
- EEPROM with Serial ID Functionality
- Compliant with FC_PI_4 REV 7.0
- Compliant with SFP+ MSA with duplex LC connector
- Single + 3.3 V Power Supply and LVTTL Logic
- Operating case temperature: 0°C ~ +70°C

2. Applications

- 10GBASE-BX at 10.3125 Gb/s
- 10GBASE-BX at 9.953 Gb/s
- 1000 Base-LX Ethernet
- 8XFC at 8.5Gbps
- 4XFC at 4.25Gpbs
- 2XFC at 2.125Gpbs
- 1xFC at 1.0625Gbps

3. PRODUCT SELECTION

- **SFP+ WDM LR 20km**

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4. Product Description

SFP+ WDM LR 20km is hot pluggable 3.3 V Small-Form-Factor transceiver module. It designed expressly for high-speed communication applications that require rates up to 10.7Gb/s, it designed to be compliant with SFF-8472 SFP+ MSA. The module data link up to 20km in 9/125um single mode fiber.

The optical output can be disabled by a LVTTL logic high-level input of Tx Disable. Tx Fault is provided to indicate that degradation of the laser. Loss of signal(LOS) output is provided to indicate the loss of an input optical signal of receiver or the link status with partner.

5. Absolute Maximum Ratings

Rating	Symbol	Min.	Typical	Max.	Units
Storage Temperature	Ts	-40		85	°C
Storage Ambient Humidity	HA	5	-	95	%
Operating Relative Humidity	RH	-	-	85	%
Power Supply Voltage	V_{CC}	-0.3	-	4	V
Signal Input Voltage		V_{CC}-0.3	-	V_{CC}+0.3	V

6. Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Units
Ambient Operating Temperature	TA	0		70	°C [1]
Power Supply Voltage	V_{CC}	3.14	3.3	3.47	V
Power Supply Current	ICC	-	-	300	mA
Data Rate	BR		10.3125		Gbps
Transmission Distance	TD		-	20	km [2]
Coupled fiber		Single mode fiber [3]			

Notes:
[1]   **Without air flow**
[2]   **Measured with SMF**
[3]   **ITU-T G.652**

7. Specification of Transmitter

Parameter	Symbol	Min.	Typical	Max.	Units
Average Launched Power	PO	-6	-	-1	dBm
Average Launched Power (Laser Off)	POUT-OFF	-	-	-30	dBm [1]
Optical Modulation Amplitude	OMA	-3	-	-	dBm [1]
Center Wavelength Range	λC	1260	1270	1280	nm

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Parameter	Symbol	Min.	Typical	Max.	Units
Side mode suppression ratio	SMSR	30	-	-	dB
Spectrum Bandwidth(-20dB)	σ	-	-	1	nm
Extinction Ratio	ER	3.5	6	-	dB [2]
Output Eye Mask		Compliant with FC PI 4 REV 7.0 [2]			

Notes:
[1] The optical power is launched into SMF
[2] Measured with RPBS 2^{31}-1 test pattern @ 10.3125Gbs

8. Specification of Receiver

Parameter	Symbol	Min.	Typical	Max.	Units
Input Optical Wavelength	λIN	1320	1330	1340	nm
Receiver Sensitivity in average	PIN	-	-	-15	dBm [1]
Input Saturation Power (Overload)	PSAT	0.5	-	-	dBm [1]
LOS -Assert Power	PA	-30	-	-	dBm
LOS -Deassert Power	PD	-	-	-15	dBm
LOS -Hysteresis	PHys	0.5	-	4	dB

Notes:
[1] Measured with RPBS 2^{31}-1 test pattern @ 10.3125Gbs BER=<10^{-12}

9. Electrical Interface Characteristics

Parameter	Symbol	Min.	Typical	Max.	Units
Total power supply current	Icc			300	mA
TRANSMITTER					
Differential Data Input Voltage	VDT	180	-	700	mVp-p
Differential line input Impedance	RIN	85	100	115	Ohm
Transmitter Fault Output-High	VFaultH	2.4	-	Vcc	V
Transmitter Fault Output-Low	VFaultL	-0.3	-	0.8	V
Transmitter Disable Voltage- High	VDisH	2	-	V_{cc}+0.3	V
Transmitter Disable Voltage- low	VDisL	-0.3	-	0.8	V
RECEIVER					
Differential Data Output Voltage	VDR	300	-	850	mVp-p
Differential line Output Impedance	ROUT	80	100	120	Ohm
Receiver LOS Pull up Resistor	RLOS	4.7	-	10	KOhm
Data Output Rise/Fall time	tr/tf	20	-	-	ps
LOS Output Voltage-High	VLOSH	2	-	Vcc	V
LOS Output Voltage-Low	VLOSL	-0.3	-	0.4	V

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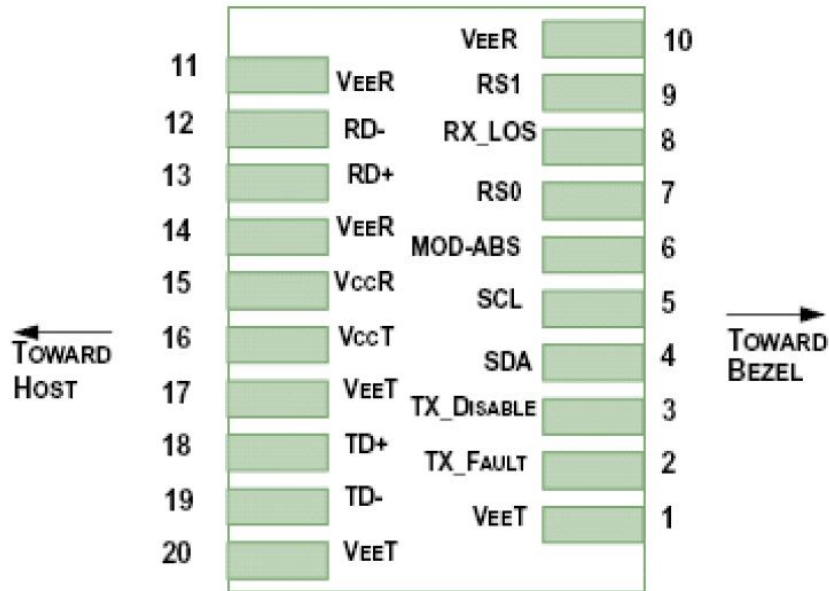
10. Pin Description

Figure 1. Electrical Pin-out Details

Pin	Symbol	Name/Description
1	VeeT	Transmitter Ground
2	TX_Fault	Module Transmitter Fault [1]
3	TX_Disable	Transmitter Disable; Turns off transmitter laser output [2] [9]
4	SDA	2-wire Serial Interface Data Line (Same as MOD-DEF2 as defined in the INF-8074i) [3] [10]
5	SCL	2-wire Serial Interface Clock (Same as MOD-DEF1 as defined in the INF-8074i) [3] [10]
6	MOD-ABS	Module Absent, connected to VeeT or VeeR in the module [3] [11]
7	RS0	Not used [12]
8	RX_LOS	Receiver Loss of Signal Indication (In FC designated as RX_LOS, in SONET designated as LOS, and in Ethernet designated at Signal Detect) [4]
9	RS1	Not used [12]
10	VeeR	Module Receiver Ground [5]
11	VeeR	Module Receiver Ground [5]
12	RD-	Receiver Inverted Data Output [6]
13	RD+	Receiver Non-Inverted Data Output [7]
14	VeeR	Module Receiver Ground [5]
15	VccR	Module Receiver 3.3 V Supply 3.3 ± 5% [7]
16	VccT	Module Transmitter 3.3 V Supply3.3 ± 5% [7]

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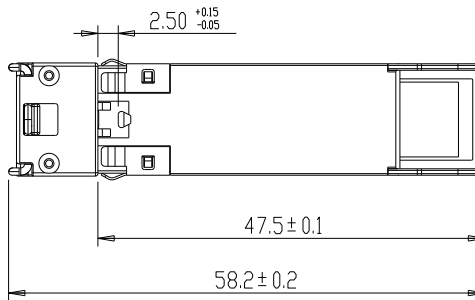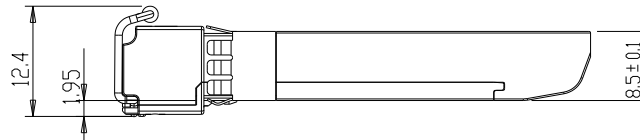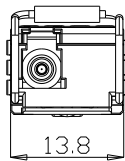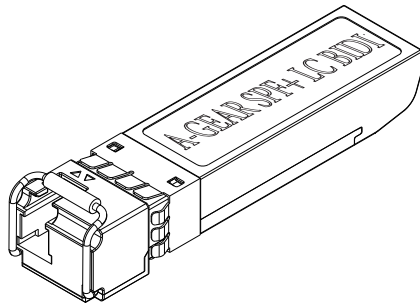| Pin	Symbol	Name/Description
17	VeeT	Module Transmitter Ground [5]
18	TD+	Transmitter Non-Inverted Data Input [8]
19	TD-	Transmitter Inverted Data Input [8]
20	VeeT	Module Transmitter Ground [5]

Notes:

[1] TX Fault is an open collector/drain output, which should be pulled up with a 4.7K - 10KΩ resistor on the host board. Pull up voltage between 2.0V and VccT, R+0.3V. When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to < 0.8 V.

[2] TX disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7 - 10KΩ resistor. Its states are:
Low (0 - 0.8 V):   Transmitter on
(>0.8, < 2.0V):   Undefined
High (2.0 - 3.465V):   Transmitter Disabled
Open: Transmitter Disabled

[3] Mod-Def 0,1,2. These are the module definition pins. They should be pulled up with a 4.7K - 10KΩ resistor on the host board. The pull-up voltage shall be VccT or VccR (see Section IV for further details). Mod-Def 0 is grounded by the module to indicate that the module is present Mod-Def 1 is the clock line of two wire serial interface for serial ID Mod-Def 2 is the data line of two wire serial interface for serial ID

[4] LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7K - 10KΩ resistor. Pull up voltage between 2.0V and VccT, R+0.3V. When high, this output indicates the received optical power is below the worst-case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to < 0.8 V.

[5] VeeR and VeeT may be internally connected within the SFP module.

[6] RD-/+: These are the differential receiver outputs. They are AC coupled 100Ω differential lines which should be terminated with 100Ω (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board. The voltage swing on these lines will be between 370 and 2000 mV differential (185 - 1000 mV single ended) when properly terminated.

[7] VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3 V ±5% at the SFP connector pin. Maximum supply current is 300mA. Recommended host board power supply filtering is shown below. Inductors with DC resistance of less than 1 ohm should be used in order to maintain the required voltage at the SFP input pin with 3.3 V supply voltage. When the recommended supply-filtering network is used, hot plugging of the SFP transceiver module will result in an inrush current of no more than 30mA greater than the steady state value. VccR and VccT may be internally connected within the SFP transceiver module.

[8] TD-/+: These are the differential transmitter inputs. They are AC-coupled, differential lines with 100Q differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board. The inputs will accept differential swings of 500 - 2400 mV (250 - 1200 mV single-ended), though it is recommended that values between 500 and 1200 mV differential (250 - 600 mV single-ended) be used for best EMI performance.

[9] Module disables on high or open

[10] 2-wire serial ID interface

[11] Grounded in Module

[12] Function not available

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11. Recommended Interface Circuit

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12. Outline Dimensions

Units in mm

13.55 ± 0.25

12.4

1.95

8.5 ± 0.1

13.8

2.50 +0.15 −0.05

47.5 ± 0.1

58.2 ± 0.2