

## Product Specification

### SFP+ CWDM 10G LR 20km LC 10Gb/s CWDM Single-mode SFP+ Transceiver



#### 1. Product Features

- 10Gb/s serial optical interface compliant to 802.3ae 10GBASE-LR
- Uncooled 18-Wavelength CWDM DFB LD
- Duplex LC connector
- Up to 20km transmission.
- Metal enclosure, for lower EMI
- Electrical interface compliant to SFF-8431 specifications for 10 Gigabit «SFP+»
- 2-wire interface for management specifications compliant with SFF 8472
- Single 3.3V power supply
- RoHS 6/6 Compliant
- Operating case temperature range: -5°C to 70°C
- Class 1 Laser International Safety Standard IEC-60825 compliant

#### 2. Applications

- 10GBASE-LR/LW 10G Ethernet
- 8XFC at 8.5Gb/s
- 4XFC at 4.25Gb/s
- 2XFC at 2.125Gb/s
- 1XFC at 1.0625Gb/s

#### 3. Standard

- Compliant to 802.3ae 10GBASE-LR
- Compliant to SFP+ SFF-8431 and SFF-8432.
- Compliant to SFF 8472
- RoHS Compliant.
- Class 1 Laser International Safety Standard IEC-60825 compliant

#### 4. Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Maximum Supply Voltage	V <sub>CC</sub>	-0.5	4.7	V
Storage Temperature	T <sub>S</sub>	-40	85	°C
Case Operating Temperature	T <sub>CASE</sub>	-5	70	°C

#### 5. Electrical Characteristics

(T<sub>CASE</sub> = -5°C to 70°C, V<sub>CC</sub> = 3.14 to 3.46 Volts)

Parameter	Symbol	Min.	Typical	Max.	Unit
Supply Voltage	V <sub>CC</sub>	3.14	3.3	3.46	V
Supply Current	I <sub>CC</sub>			350	mA
<b>Transmitter</b>					
Input differential impedance	R <sub>in</sub>		100		Ω <sup>[1]</sup>
Differential data input swing	V <sub>in, pp</sub>	180		1200	mV
Transmit Disable Voltage	V <sub>D</sub>	V <sub>CC</sub> -1.3		V <sub>CC</sub>	V
Transmit Enable Voltage	V <sub>EN</sub>	V <sub>EE</sub>		V <sub>EE</sub> + 0.8	V <sup>[2]</sup>
Transmit Disable Assert Time				10	us
<b>Receiver</b>					
Differential data output swing	V <sub>out, pp</sub>	300		850	Mv <sup>[3]</sup>
Data output rise time	t <sub>r</sub>			38	ps <sup>[4]</sup>
Data output fall time	t <sub>f</sub>			38	ps <sup>[4]</sup>
LOS Fault	V <sub>LOS fault</sub>	V <sub>CC</sub> -1.3		V <sub>CC</sub> H <sub>OST</sub>	V <sup>[5]</sup>
LOS Normal	V <sub>LOS norm</sub>	V <sub>EE</sub>		V <sub>EE</sub> +0.8	V <sup>[5]</sup>
Power Supply Rejection	PSR	100			mVpp <sup>[6]</sup>

**Notes:**

- [1] Connected directly to TX data input pins. AC coupled thereafter.
- [2] Or open circuit.
- [3] Into 100 ohms differential termination.
- [4] 20 - 80 %
- [5] Loss Of Signal is LVTTTL. Logic 0 indicates normal operation; logic 1 indicates no signal detected.
- [6] Receiver sensitivity is compliant with power supply sinusoidal modulation of 20 Hz to 1.5 MHz up to specified value applied through the recommended power supply filtering network.

## 6. Optical Characteristics

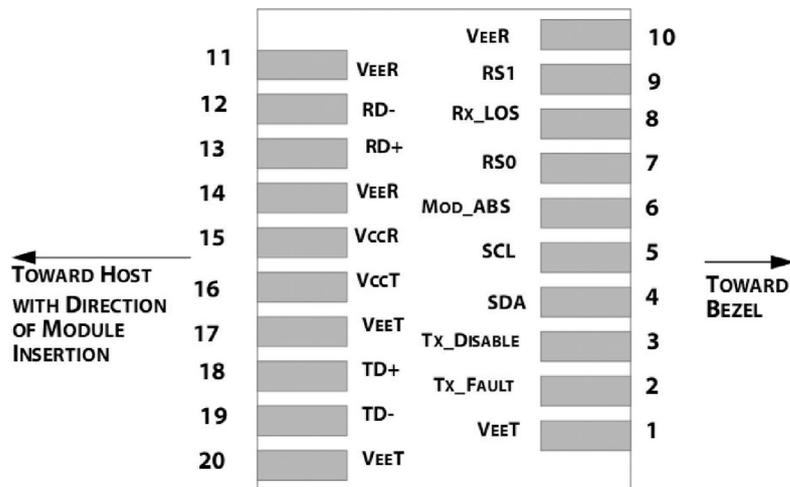
(T<sub>CASE</sub> = -5°C to 70°C, V<sub>CC</sub> = 3.14 to 3.46 Volts)

Parameter	Symbol	Min.	Typical	Max.	Unit
<b>Transmitter</b>					
Output Opt. Pwr	P <sub>OUT</sub>	-6		-1	dBm <sup>[1]</sup>
Optical Wavelength	λ	λ-5		λ+5	nm
Wavelength Temperature Dependance			0.08	0.125	nm/°C
Spectral Width (-20dB)	σ			0.4	nm
Optical Extinction Ratio	ER	3.5			dB
Transmitter and Dispersion Peanlty	TDP			3.2	dB
Sidemode Supression ratio	SSRmin	30			dB
Optical Rise/Fall Time	tr/ tf		0.1	0.26	ns
RIN	RIN			-128	dB/Hz
Transmitter Jitter (peak to peak)		IEEE 802.3.ae requirements			
<b>Receiver</b>					
Average Rx Sensitivity @ 10.325G	RSSENS3			-15	dBm <sup>[2]</sup>
Maximum Input Power	P <sub>MAX</sub>	0.5			dBm
Optical Center Wavelength	λ <sub>C</sub>	1260		1620	nm
LOS De -Assert	LOSD			-17	dBm
LOS Assert	LOSA	-30			dBm
LOS Hysteresis		0.5	1.0		dB

**Notes:**

- [1] Class 1 Laser Safety per FDA/CDRH and IEC-825-1 regulations.
- [2] With worst-case extinction ratio. Measured with a PRBS 2<sup>31</sup> -1 test pattern, @10.325Gb/s, BER<10<sup>-12</sup>

## 7. Pin Assignment



Pin out of Connector Block on Host Board

## 8. Pin Descriptions

Pin	Symbol	Name/Description
1	V <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground) <sup>[1]</sup>
2	T <sub>FAULT</sub>	Transmitter Fault. <sup>[2]</sup>
3	T <sub>DIS</sub>	Transmitter Disable. Laser output disabled on high or open. <sup>[3]</sup>
4	SDA	2-wire Serial Interface Data Line <sup>[4]</sup>
5	SCL	2-wire Serial Interface Clock Line <sup>[4]</sup>
6	MOD_ABS	Module Absent. Grounded within the module <sup>[4]</sup>
7	RS0	RS0 for Rate Select: Open or Low = Module supports 1.25 Gb/s High = Module supports 9.95 Gb/s to 10.3125 Gb/s <sup>[5]</sup>
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation. <sup>[6]</sup>
9	RS1	No connection required <sup>[1]</sup>
10	V <sub>EER</sub>	Receiver Ground (Common with Transmitter Ground) <sup>[1]</sup>
11	V <sub>EER</sub>	Receiver Ground (Common with Transmitter Ground) <sup>[1]</sup>
12	RD-	Receiver Inverted DATA out. AC Coupled
13	RD+	Receiver Non-inverted DATA out. AC Coupled
14	V <sub>EER</sub>	Receiver Ground (Common with Transmitter Ground) <sup>[1]</sup>
15	V <sub>CCR</sub>	Receiver Power Supply
16	V <sub>CCT</sub>	Transmitter Power Supply
17	V <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground) <sup>[1]</sup>
18	TD+	Transmitter Non-Inverted DATA in. AC Coupled.
19	TD-	Transmitter Inverted DATA in. AC Coupled.
20	V <sub>EET</sub>	Transmitter Ground (Common with Receiver Ground) <sup>[1]</sup>

### Notes:

- [1] Circuit ground is internally isolated from chassis ground.
- [2] T<sub>FAULT</sub> is an open collector/drain output, which should be pulled up with a 4.7k - 10k Ohms resistor on the host board if intended for use. Pull up voltage should be between 2.0V to V<sub>CC</sub> + 0.3V. A high output indicates a transmitter fault caused by either the TX bias current or the TX output power exceeding the preset alarm thresholds. A low output indicates normal operation. In the low state, the output is pulled to <0.8V.
- [3] Laser output disabled on T<sub>DIS</sub> >2.0V or open, enabled on T<sub>DIS</sub> <0.8V.
- [4] Should be pulled up with 4.7kΩ - 10kΩ host board to a voltage between 2.0V and 3.6V. MOD\_ABS pulls line low to indicate module is plugged in.
- [5] Transceiver data rate selected through the 2-wire bus in accordance with SFF-8472 Rev. 10.5. Soft RS0 is set at Bit3, Byte 110, Address A2h. Soft RS0 default state on power up is '0' LOW, and the state is reset following a power cycle. Writing '1' HIGH selects max data rate operation. Transceiver data rate is the logic OR of the input state of the RS0 pin and soft RS0 bit. Thus, if either the RS0 pin OR the soft RS0 bit is HIGH then the selected data rate will be 9.95 and 10.3 Gb/s.
- [6] Loss Of Signal is LVTTTL. It should be pulled up with 4.7kΩ - 10kΩ on host board to a voltage between 2.0V and 3.6V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.

## 9. Digital Diagnostic Functions

A-GEAR SFP+ CWDM 10G LR 20km LC transceivers support the 2-wire serial communication protocol as defined in the SFP MSAi.

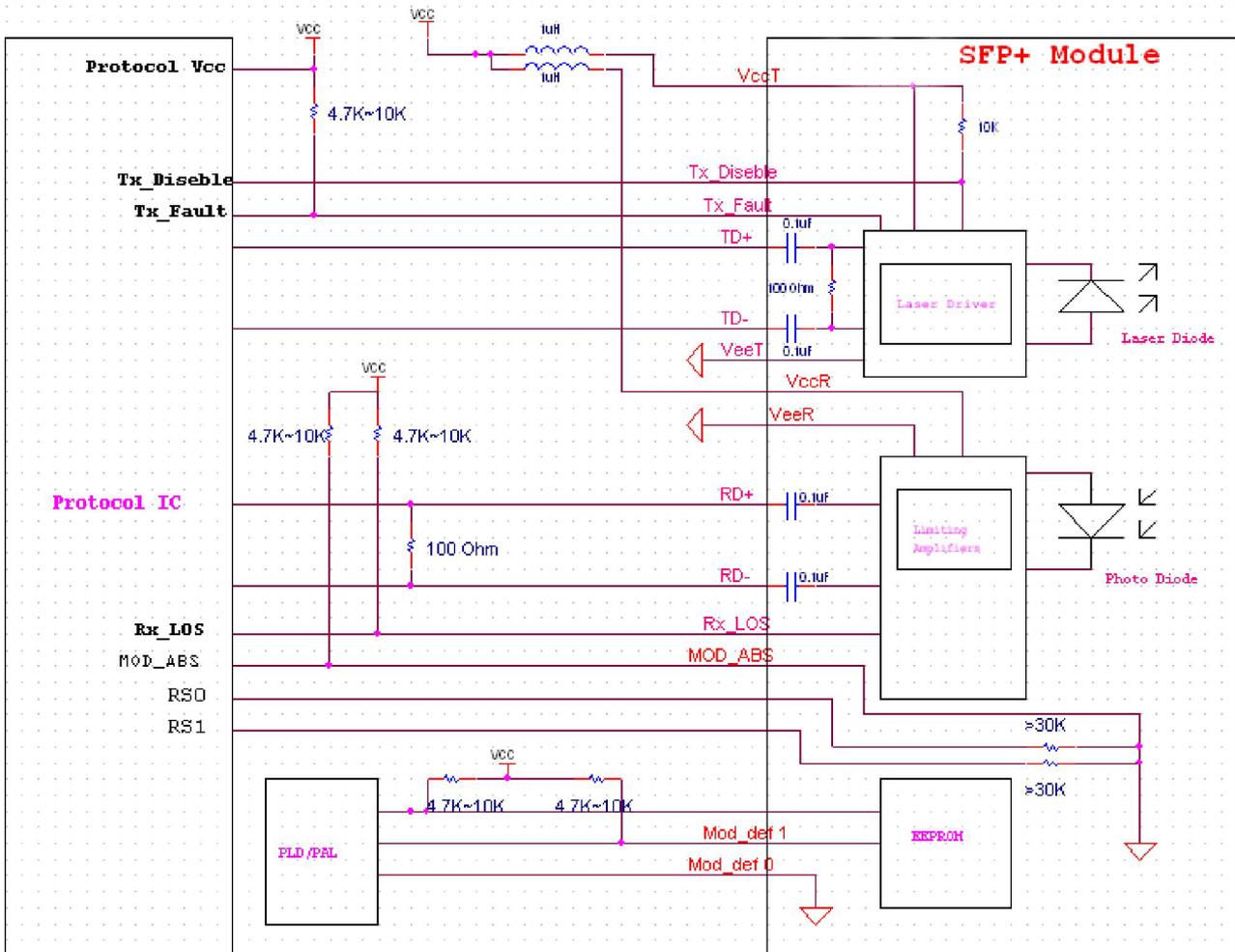
The standard SFP serial ID provides access to identification information that describes the transceiver's capabilities, standard interfaces, manufacturer, and other information. Additionally, A-GEAR SFP+ transceivers provide a unique enhanced digital diagnostic monitoring interface, which allows real-time access to device operating parameters such as transceiver temperature, laser bias current, transmitted optical power, received optical power and transceiver supply voltage. It also defines a sophisticated system of alarm and warning flags, which alerts end-users when particular operating parameters are outside of a factory set normal range.

The SFP MSA defines a 256-byte memory map in EEPROM that is accessible over a 2-wire serial interface at the 8 bit address 1010000X (A0h). The digital diagnostic monitoring interface makes use of the 8 bit address 1010001X (A2h), so the originally defined serial ID memory map remains unchanged.

The operating and diagnostics information is monitored and reported by a Digital Diagnostics Transceiver Controller (DDTC) inside the transceiver, which is accessed through a 2-wire serial interface. When the serial protocol is activated, the serial clock signal (SCL, Mod Def 1) is generated by the host. The positive edge clocks data into the SFP transceiver into those segments of the E2PROM that are not write-protected. The negative edge clocks data from the SFP transceiver. The serial data signal (SDA, Mod Def 2) is bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially.

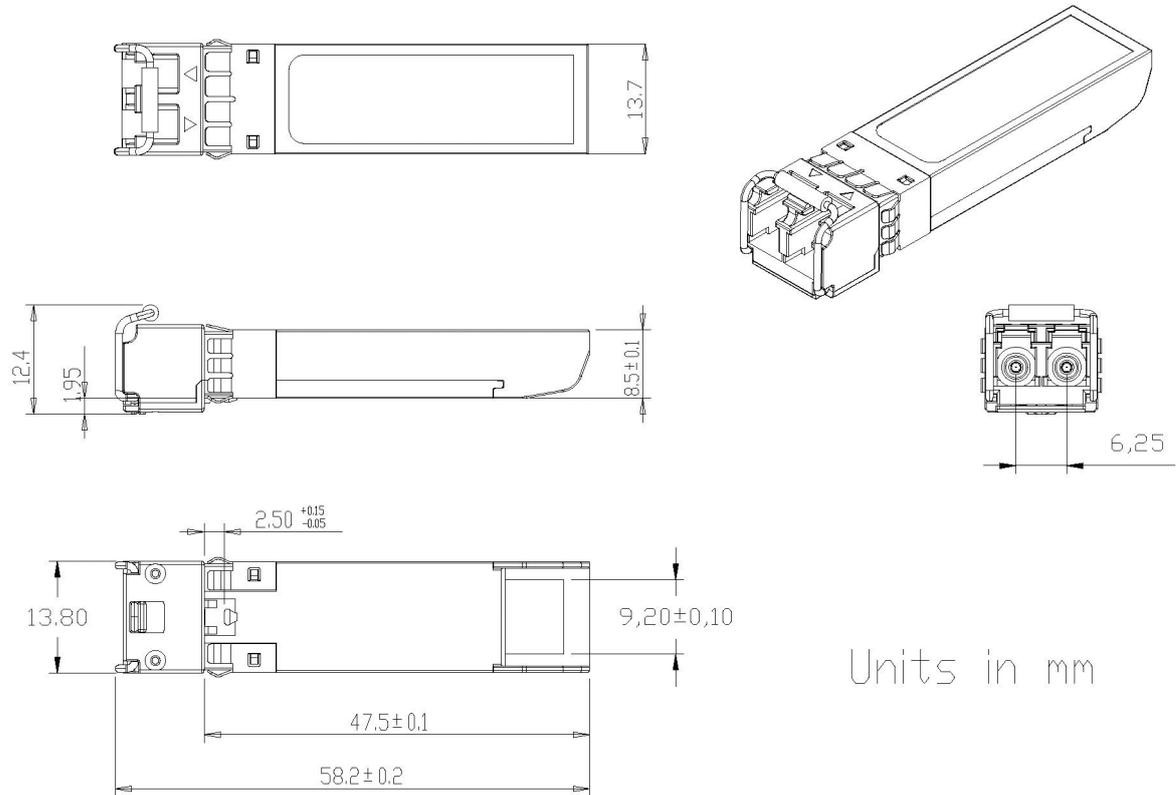
Digital diagnostics for the SFP+ CWDM 10G LR 20km LC are internally calibrated by default.

10. Host - Transceiver Interface Block Diagram



## 11. Outline Dimensions

Comply to SFF-8432 rev5.0, the improved Pluggable form factor specification.



Units in mm

## 12. Regulatory Compliance

Feature	Reference	Performance
Electrostatic Discharge (ESD) to the Electrical pin (HBM)	MIL-STD-883E Method 3015.7 EIA-JESD22-A114	Class 1
(ESD) to the Simplex Receptacle	IEC/EN 61000-4-2	Compatible with standards
Electromagnetic Interference (EMI)	FCC Part 15 Class B EN 55022 Class B (CISPR 22A)	Compatible with standards
Laser Eye Safety	FDA 21CFR 1040.10, 1040.11 IEC/EN 60825-1, 2	Class 1 laser product
Component Recognition	IEC/EN 60950, UL	Compatible with standards
ROHS	2002/95/EC	Compatible with standards