

## SFP10G-LR

SFP 10Gb/s 1310nm Single-mode 10(20)km DDM



## PRODUCT FEATURES

- Up to 11.3Gbps Data Links
- 1310nm DFB laser transmitter and PIN/TIA receiver
- Up to 10(20)km on 9/125μm SMF
- Hot-pluggable SFP footprint
- Duplex LC/UPC type pluggable optical interface
- Low power dissipation
- Metal enclosure, for lower EMI
- RoHS compliant and lead-free
- Support Digital Diagnostic Monitor interface
- Single +3.3V power supply
- Compliant with SFF-8472
- Case operating temperature
- Commercial: 0°C to +70°C

## APPLICATIONS

- 10G Ethernet 10GBASE-LR/-LW
- 1200-SM-LL-L 10G Fiber Channel

## Compliance

- SFF-8472 SFP+ MSA.
- SFP+ SFF-8431 and SFF-8432.
- Fiber Channel 1200-SM-LL-L
- IEEE802.3ae
- RoHS

## PRODUCT DESCRIPTION

SFP10G-LR SFP+ transceivers are compatible with the Small Form Factor Pluggable Multi-Sourcing Agreement (MSA). The transceiver consists of five sections: the LD driver, the limiting amplifier, the digital diagnostic monitor, the 1310nm DFB laser and the PIN/TIA. The module data link up to 20km in 9/125um Single-mode fiber.

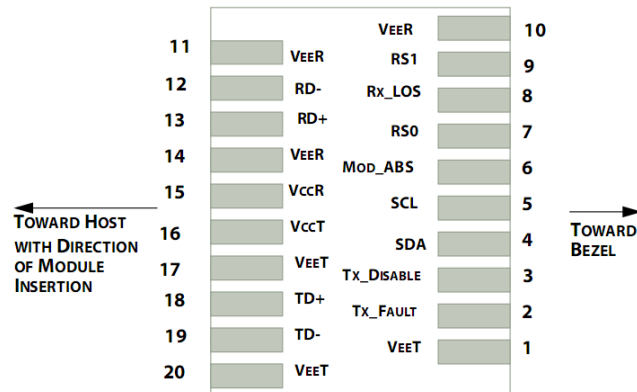
This transceiver meets the SFP+ industry standard package utilizing an integral LC-Duplex optical interface connector. An enhanced Digital Diagnostic Monitoring Interface compliant with SFF-8472 has been incorporated into the transceiver. It allows real time access to the transceiver operating parameters such as transceiver temperature, laser bias current, transmitted optical power, received optical power and transceiver supply voltage by reading a built-in memory with I<sup>2</sup>C interface.

The optical output can be disabled by a LVTTTL logic high-level input of Tx Disable, and the system also can disable the module via I<sup>2</sup>C. 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. The system can also get the LOS (or Link)/Disable/Fault information via I<sup>2</sup>C register access.

## Ordering information

Package	Product part NO.	Data Rate (Gbps)	Media	Wavelength (nm)	Transmission Distance (km)	Temperature Range (°C)	
SFP+	SFP10G-LR	10.3125	single-mode fiber	1310	10(20)	0~70	Commercial

## I. Pin Diagram



Pinout of Connector Block on Host Board

## II. Pin Descriptions

Pin	Symbol	Name/Description	Ref.
1	$V_{EET}$	Transmitter Ground (Common with Receiver Ground)	1
2	$T_{FAULT}$	Transmitter Fault.	2
3	$T_{DIS}$	Transmitter Disable. Laser output disabled on high or open.	3
4	SDA	2-wire Serial Interface Data Line	4
5	SCL	2-wire Serial Interface Clock Line	4
6	MOD_ABS	Module Absent. Grounded within the module	4
7	RS0	No connection required	
8	LOS	Loss of Signal indication. Logic "0" indicates normal operation.	5
9	RS1	No connection required	
10	$V_{EER}$	Receiver Ground (Common with Transmitter Ground)	1
11	$V_{EER}$	Receiver Ground (Common with Transmitter Ground)	1
12	RD-	Receiver Inverted DATA out. AC Coupled	
13	RD+	Receiver Non-inverted DATA out. AC Coupled	
14	$V_{EER}$	Receiver Ground (Common with Transmitter Ground)	1
15	$V_{CCR}$	Receiver Power Supply	
16	$V_{CCT}$	Transmitter Power Supply	
17	$V_{EET}$	Transmitter Ground (Common with Receiver Ground)	1
18	TD+	Transmitter Non-Inverted DATA in. AC Coupled.	
19	TD-	Transmitter Inverted DATA in. AC Coupled.	
20	$V_{EET}$	Transmitter Ground (Common with Receiver Ground)	1

## Notes:

1. Circuit ground is internally isolated from chassis ground.
2. TX Fault is an open drain output, which should be pulled up with 4.7K – 10KΩ resistor on the host board. Pull up voltage between 2.0V to  $V_{ccT/R}+0.3V$ . When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to  $< 0.8V$ . When sensing an improper power level in the laser driver, the SFP sets this signal high and turns off the laser. TX-FAULT can be reset with the TX-DISABLE line. The signal is in LVTTTL level.
3. TX disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with 4.7K – 10KΩ resistor. Its states are: Low (0 – 0.8V): Transmitter on; ( $>0.8, < 2.0V$ ): Undefined; High ( $2.0V$  to  $V_{ccT/R}+0.3V$ ): Transmitter Disabled; Open: Transmitter Disabled. The TX-DISABLE signal is high (LVTTTL logic “1”) to turn off the laser output. The laser will turn on when TX-DISABLE is low (LVTTTL logic “0”).
4. Should be pulled up with 4.7K - 10KΩ on host board to a voltage between 2.0V to  $V_{ccT/R}+0.3V$ . MOD\_ABS pulls line low to indicate module is plugged in.
5. LOS (Loss of Signal) is an open collector/drain output, which should be pulled up with 4.7K – 10KΩ resistor. Pull up voltage between 2.0V to  $V_{ccT/R}+0.3V$ . 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  $< 0.8V$ .

The RX-LOS is high (LVTTTL logic “1”) when there is no incoming light from the companion transceiver. This signal is normally used by the system for the diagnostic purpose. The signal is operated in LVTTTL level.

## III. Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit	Ref.
Storage Temperature	$T_s$	-40		85	°C	
Storage Ambient Relative Humidity	$H_A$	0		85	%	
Power Supply Voltage	$V_{cc}$	-0.5		4	V	
Signal Input Voltage		-0.3		$V_{cc}+0.3$	V	
Receiver Damage Threshold		+3			dBm	
Lead Soldering Temperature/Time	TSOLD			260/10	°C/sec	Note (1)
Lead Soldering Temperature/Time	TSOLD			360/10	°C/sec	Note (2)

Note (1): Suitable for wave soldering.

Note (2): Only for soldering by iron.

#### IV. Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit	Ref.	
Case Operating Temperature	$T_{case}$	0		70	°C	SFP10G-LR	
Ambient Humidity	$H_A$	5		70	%	Non-condensing	
Data Rate			10.3125/10.3125		Gbps	TX Rate/RX Rate	
Transmission Distance				20	km		
Coupled Fiber		Singlemode fiber					9/125um G.652

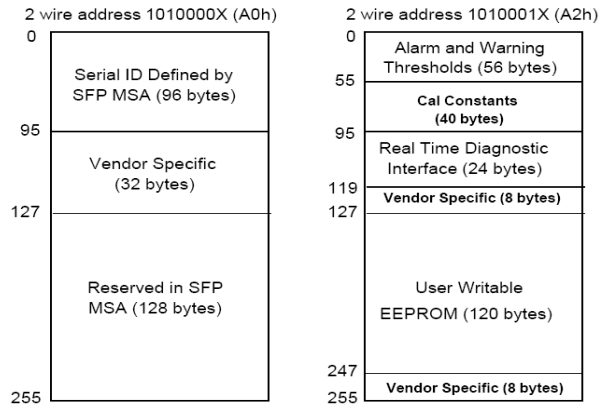
#### V. Optical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Ref.
<b>Transmitter</b>						
Average Output Power	$P_{OUT}$	-8.2		+0.5	dBm	SFP10G-LR
Extinction Ratio	ER	3			dB	
Center Wavelength	$\lambda_C$	1290	1310	1330	nm	DFB Laser
Side Mode Suppression Ratio	SMSR	30			dBm	
Spectrum Width (RMS)	$\sigma$			1	nm	
Transmitter OFF Output Power	$P_{OFF}$			-30	dBm	
Output Eye Mask	Compatible with IEEE 802.3ae					
<b>Receiver</b>						
Input Optical Wavelength	$\lambda_{IN}$	1260		1600	nm	SFP10G-LR
Rx Sensitivity	$R_{SENS1}$			-14.4	dBm	Note (1)
Rx Sensitivity(OMA)	$R_{SENS2}$			-10.3	dBm	Note (2)
Input Saturation Power (Overload)	$P_{SAT}$	-3			dBm	
Loss of Signal Assert	$P_A$	-30			dBm	
Loss of Signal De-assert	$P_D$			-15.4	dBm	
LOS Hysteresis	$P_D - P_A$	0.5		6	dB	

Note (1): With worst-case extinction ratio. Measured with a PRBS 2<sup>31</sup>-1 test pattern, @10.3125Gb/s, BER<10<sup>-12</sup>.

Note (2): Valid between 1260 and 1355 nm. Per IEEE 802.3ae.

## VI. Digital Diagnostic Memory Map



## VII. Digital Diagnostic Monitoring Information

Parameter	Unit	Accuracy
Case Temperature	°C	±3
Supply Voltage	V	±3%
Tx Bias Current	mA	±10%
Tx Optical Power	dB	±3
Rx Optical Power	dB	±3

## VIII. Electrical Interface Characteristics

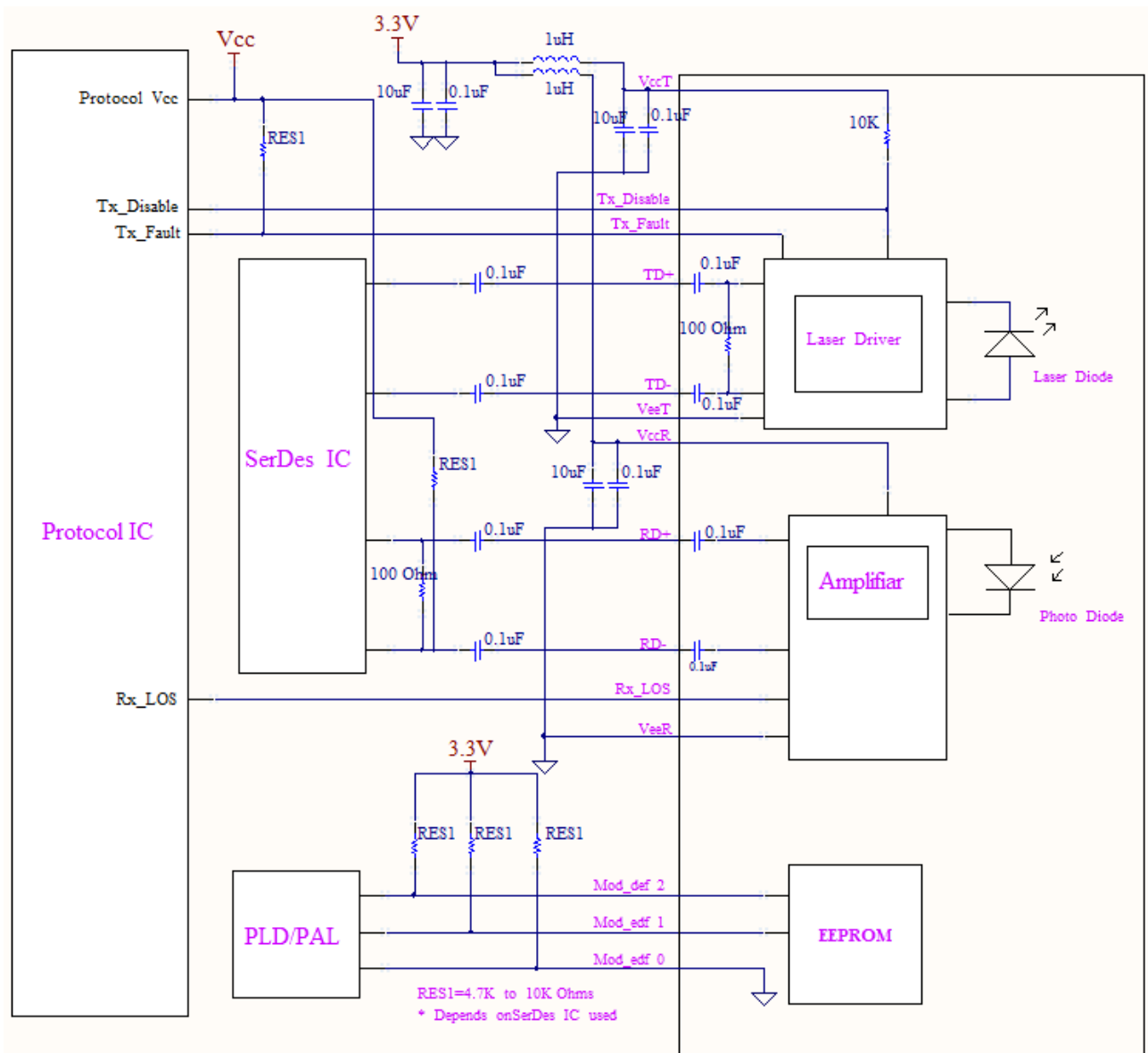
Parameter	Symbol	Min.	Typ.	Max.	Unit	Ref.
Supply Voltage	V <sub>CC</sub>	3.13	3.30	3.47	V	
Supply Current	I <sub>CC</sub>		200	285	mA	
<b>Transmitter</b>						
Input different impedance	R <sub>in</sub>	90	100	110	Ω	Note (1)
Single ended data input swing	V <sub>in,pp</sub>	180		700	mV	
Transmitter Disable Voltage	V <sub>DIS</sub>	2		V <sub>CC</sub>	V	
Transmitter Enable Voltage	V <sub>EN</sub>	0		0.8	V	
<b>Receiver</b>						
Output different impedance	R <sub>out</sub>	90	100	110	Ω	Note (1)
Single ended data output swing	V <sub>out,pp</sub>	300		850	mV	Note (2)
LOSAsserted	V <sub>LOSA</sub>	2		V <sub>CCHOST</sub>	V	Note (3)
LOSDe-asserted	V <sub>LOSD</sub>	0		0.8	V	Note (3)

Note (1): Connected directly to TX data input pins. AC coupled thereafter.

Note (2): Into 100Ω differential termination.

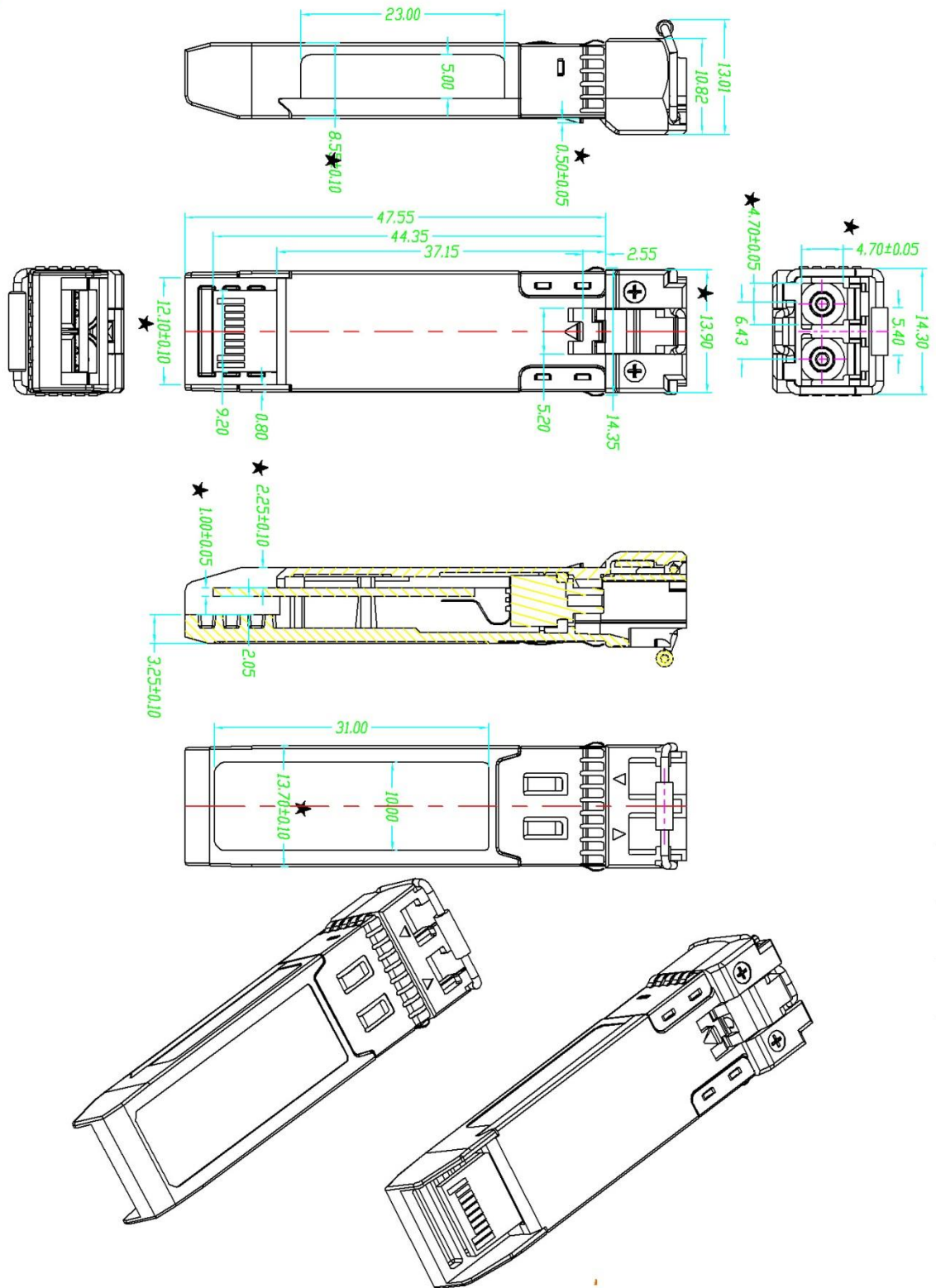
Note(3): LossOf Signal is LVTTTL. Logic “0” indicates normal operation; logic “1” indicates no signal detected.

## IX. Recommend Circuit Schematic





## X. Mechanical Specifications (Unit: mm)



**SFP10G-LR**

## XI. Regulatory Compliance

Feature	Reference	Performance
EMC	EN61000-3	Compatible with standards
Electrostatic Discharge (ESD)	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 ,EC/EN 60825-2	Class 1 laser product
Component Recognition	IEC/EN 60950 ,L 60950	Compatible with standards
ROHS	2002/95/EC	Compatible with standards

## Revision History

Version No.	Date	Description
1.0	June 24, 2019	Preliminary datasheet