

## DATA SHEET

### MODULETEK – XFP-10GB-LR40-C10 10 Gigabit 1310nm XFP Extended Distance Optical Transceiver

#### XFP-10GB-LR40-C10 Overview

ModuleTek's XFP-10GB-LR40-C10 10 Gb/s XFP extended distance optical transceivers are designed for the IEEE 802.3ae 10GBASE-LR, 10GBASE-LW and 10GFC 1200-SM-LL-L interconnects. The XFP-10GB-LR40-C10 are compliant with the XFP Multi-Source Agreement (MSA) Specification. The digital diagnostics functions are available via the 2-wire serial interface, as specified in the XFP MSA. The maximum transmission distance is up to 40km.

#### Product Features

- Up to 11.3 Gb/s bit rates.
- Compliant with IEEE 802.3ae, 10GBASE-LR/LW, 10GFC application.
- Compliant with XFP MSA.
- Uncooled 1310nm DFB laser.
- 30 pin XFP compatible connector.
- Standard bail mechanism for consistent installation and removal
- Built-in digital diagnostic functions.
- Hot Pluggable XFP footprint.
- Duplex LC Connectors.
- Up to 40km on SMF
- RoHS Compliant
- Operating temperature range: 0°C to 70°C.

#### Applications

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

#### Ordering Information

Part Number	Description
XFP-10GB-LR40-C10	10 Gigabit XFP Transceiver, LC Connectors, 1310nm, Single Mode Fiber, up to 40km

#### For More Information:

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## Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Storage Ambient Temperature	T <sub>S</sub>	- 40		85	°C	
Supply Voltage 3.3V	V <sub>CC_3</sub>	- 0.5		4	V	

## General Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Data Rate	DR	9.95	10.3125	11.3	Gb/s	1
Bit Error Rate	BER			10 <sup>-12</sup>		
Total Power Consumption	P			2	W	
Supply Voltage – 3.3V	V <sub>CC_3</sub>	3.14	3.3	3.46	V	2
Supply Current –V <sub>CC_3</sub> supply	I <sub>CC_3</sub>			550	mA	
Case Operating Temperature	T <sub>C</sub>	0		70	°C	

### Notes:

- 10GBASE-LR/LW 1200-SM-LL-L
- Operating Environment

## Link Distances

Parameter	Fiber Type	Distance Range (km)
9.95 – 11.3 Gb/s	9/125um SMF	40

## Optical Characteristics - Transmitter

V<sub>CC\_3</sub>=3.14V to 3.46V, T<sub>C</sub>=0°C to 70°C

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Optical Wavelength	λ	1260		1350	nm	
Optical Output Power	P <sub>OUT</sub>	2		5	dBm	1
Launch Power of OFF Transmitter	P <sub>OUT_OFF</sub>			- 30	dBm	1
Side Mode Suppression Ratio	SMSR	30			dB	
Optical Extinction Ratio	ER	3.5			dB	
Relative Intensity Noise	RIN			- 130	dB/Hz	
Transmitter Dispersion Penalty	TDP			3.2	dB	
Transmitter Jitter		According to IEEE 802.3ae requirement				

### Notes:

1. Average

## Optical Characteristics - Receiver

V<sub>CC\_3</sub>=3.14V to 3.46V, T<sub>C</sub>=0°C to 70°C

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Center Wavelength Range	$\lambda_C$	1260		1600	nm	
Maximum Input Power	P <sub>IN</sub>	0.5			dBm	
Receiver Sensitivity@ 10.3Gb/s	P <sub>SENS1</sub>			- 14.4	dBm	1
Receiver Reflectance	TR <sub>RX</sub>			- 27	dB	
LOS De-Assert	LOS_D			- 16	dBm	
LOS Assert	LOS_A	- 30			dBm	
LOS Hysteresis	LOS_H	0.5			dB	

### Notes:

1. Measured with worst ER: BER<10<sup>-12</sup> 2<sup>31</sup>-1 PRBS

## Electrical Characteristics – Transmitter

V<sub>CC\_3</sub>=3.14V to 3.46V, T<sub>C</sub>=0°C to 70°C

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Input differential impedance	R <sub>in</sub>		100		Ω	1
Differential data input swing	V <sub>IN_PP</sub>	120		820	mV	
Transmit Disable Voltage	V <sub>D</sub>	2		V <sub>CC</sub>	V	2
Transmit Enable Voltage	V <sub>EN</sub>	GND		GND+0.8	V	
Transmit Disable Assert Time				10	us	

### Notes:

1. After internal AC coupling
2. Or open circuit

## Electrical Characteristics – Receiver

V<sub>CC\_3</sub>=3.14V to 3.46V, T<sub>C</sub>=0°C to 70°C

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Differential data output swing	V <sub>OUT_PP</sub>	340	650	850	mV	
Data output rise time	T <sub>R</sub>			38	ps	1
Data output fall time	T <sub>F</sub>			38	ps	1
LOS Fault	V <sub>LOS_F</sub>	V <sub>CC</sub> -0.5		V <sub>CC_HOST</sub>	V	
LOS Normal	V <sub>LOS_N</sub>	GND		GND+0.5	V	

### Notes:

1. 20%-80%

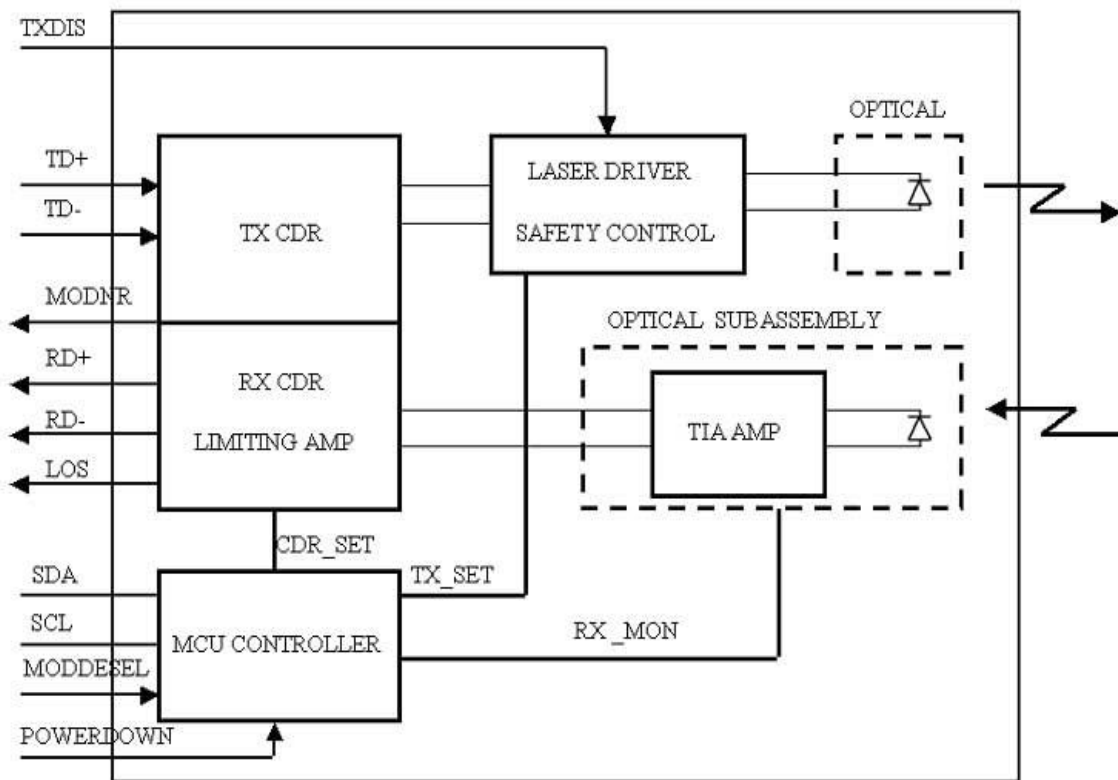
## Digital Diagnostic

ModuleTek's XFP-10GB-LR40-C10 incorporates a XFP compliant 2-wire management interface which is used for serial ID, digital diagnostics, and certain control functions. It is modeled on the SFF-8472 Rev 9.3 specification modified to accommodate a single 2-wire interface address. In addition to the basic I<sup>2</sup>C read/write functionality the modules support packet error checking that,

when enabled, allows the host system to confirm the validity of any read data. Details of the protocol and interface are explicitly described in the MSA. And the digital diagnostic functions via a 2-wire serial interface can provide real-time access to following operating parameters:

- a. Transceiver Temperature
- b. Laser Bias Current
- c. Transmitted Optical Power
- d. Received Optical Power
- e. Transceiver Supply Voltage

## Block Diagram



### Transmitter Section:

The Laser Driver accept differential input data and provide bias and modulation currents for driving a laser. An automatic power control (APC) feedback loop is incorporated to maintain a constant average optical power. Laser in an eye safe optical subassembly (OSA) mates to the fiber cable. TX CDR is used to overcomes host board and connector signal degradations by reshaping, regenerating, and attenuating jitter.

### TXDIS:

TX\_DIS is an input pin. When TX\_DIS is asserted High, the XFP module transmitter output must be turned off.

### Receiver Section:

The Receiver utilizes a PIN detector integrated with a trans-impedance preamplifier in an OSA. The OSA is connected to a limiting Amplifier which providing post-amplification quantization, and optical signal detection. The limiting amplifier is AC coupled to the Trans-impedance amplifier, with internal 100ohm differential termination. RX CDR is used to overcomes host board degradations

by reshaping, regenerating, and attenuating jitter.

**LOS:**

The LOS of an output pin, when LOS is high, it indicates insufficient optical power for reliable signal reception.

**MODNR:**

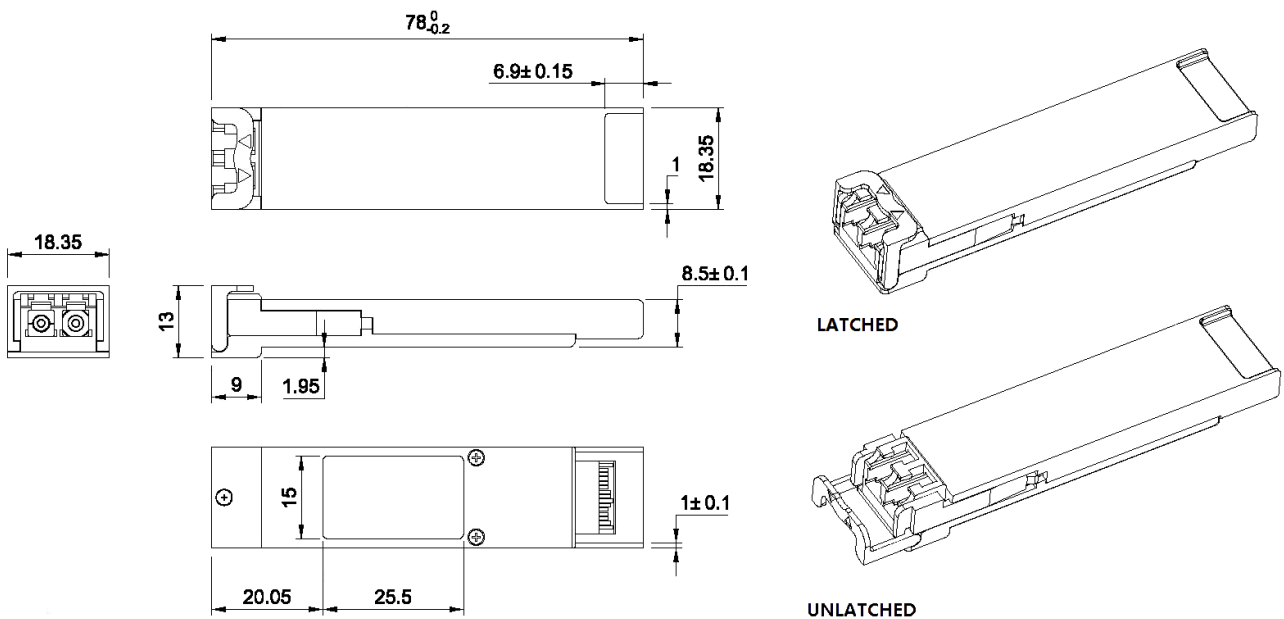
The MODNR is an output pin that when High, indicates that the module has detected a condition that renders transmitter and or receiver data invalid, shall consist of logical OR of the following signals:

- f. Transmit Signal Conditioner Loss of Lock
- g. Transmitter Laser Fault
- h. Receiver Signal Conditioner Loss of Lock

**Controller Section**

The micro controller unit initializes the control register of laser driver, limiting amplifier and CDR. And monitors the running information from the laser driver, limiting amplifier and CDR. Then report these information to the customer.

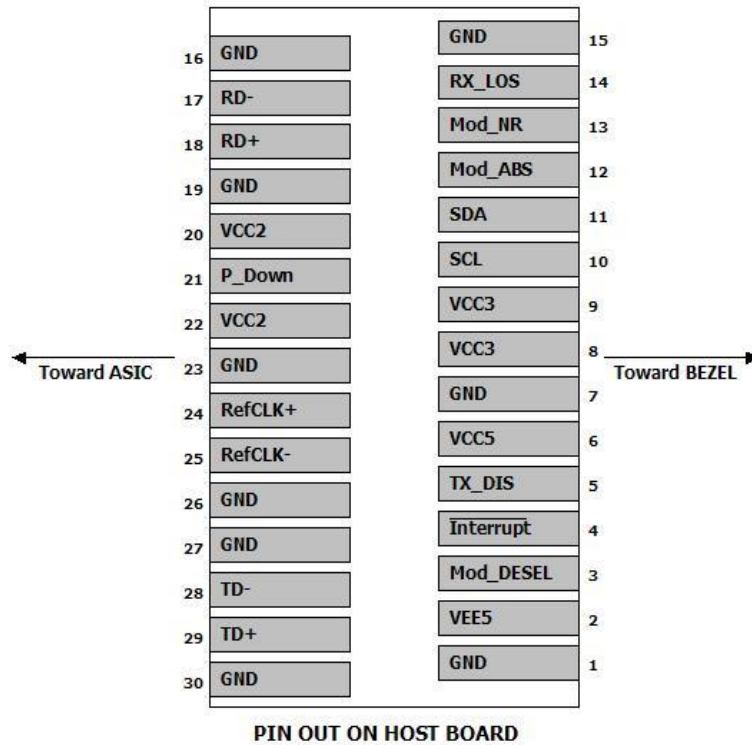
**Dimensions**



**ALL DIMENSIONS ARE  $\pm 0.2$ mm UNLESS OTHERWISE SPECIFIED**

**UNIT: mm**

## Electrical Pad Layout



### Pin Assignment – Pin 1 to Pin 23

PIN #	Symbol	Logic	Description	Remarks
1	GND		Module Ground	1
2	VEE5		Optional – 5.2 Power Supply (Not required)	2
3	Mod-Desel	LVTTTL-I	Module De-select; When held low allows the module to respond to 2-wire serial interface commands	
4	Interrupt	LVTTTL-O	Indicates presence of an important condition which can be read over the serial 2-wire interface	3
5	TX_DIS	LVTTTL-I	Transmitter Disable; Transmitter laser source turned off	
6	VCC5		+5V Power Supply	2
7	GND		Module Ground	4
8	VCC3		+3.3V Power Supply	
9	VCC3		+3.3V Power Supply	
10	SCL	LVTTTL-I	Serial 2-wire interface clock	5
11	SDA	LVTTTL-I/O	Serial 2-wire interface data line	5
12	Mod_Abs	LVTTTL-O	Module Absent; Indicates module is not present. Grounded in the module	5
13	Mod_NR	LVTTTL-O	Module Not Ready; Indicates module operating fault	5
14	RX_LOS	LVTTTL-O	Receiver Loss of Signal indicator	5

15	GND		Module Ground	4
16	GND		Module Ground	4
17	RD-	CML-O	Receiver inverted data output	
18	RD+	CML-O	Receiver non-inverted data output	
19	GND		Module Ground	4
20	VCC2		+1.8V Power Supply	2
21	P_Down/RST	LVTTTL-I	Power Down; When high, places the module in the low power stand-by mode and on the falling edge of P_Down initiates a module rest Reset; The falling edge initiates a complete reset of the module including the 2-wire serial interface, equivalent to a power cycle	
22	VCC2		+1.8V Power Supply	2
23	GND		Module Ground	4

**Notes:**

1. Module ground pins (GND) are isolated from the module case and chassis ground within the module
2. Not required
3. Open collector, should be pulled up with 4.7kΩ-10kΩ on host board to a voltage between 3.15V and 3.6V
4. Same as Pin# 1
5. Same as Pin# 4

**Pin Assignment – Pin 24 to Pin 30**

PIN #	Symbol	Logic	Description	Remarks
24	RefCLK+	PECL-I	Reference Clock non-inverted input, AC coupled on the host board	1
25	RefCLK-	PECL-I	Reference Clock inverted input, AC coupled on the host board	1
26	GND		Module Ground	2
27	GND		Module Ground	2
28	TD-	CML-I	Transmitter inverted data input	
29	TD+	CML-I	Transmitter non-inverted data input	
30	GND		Module Ground	2

**Notes:**

1. Not required
2. Same as Pin# 1

**References**

1. 10 Gigabit Small Form Factor Pluggable Module (XFP) Multi-Source Agreement (MSA), Rev 4.5 – August 2005.