

## DATA SHEET

### MODULETEK: XFP-10GB-LR-I-C10

Industrial temperature 10 Gigabit 1310nm SingleMode XFP Optical Transceiver

#### XFP-10GB-LR-I-C10 Overview

ModuleTek's XFP-10GB-LR-I-C10 10Gb/s XFP optical transceivers are designed for the IEEE 802.3ae 10GBASE-LR, 10GBASE-LW and 10GFC 1200-SM-LL-L interconnects. The product implements digital diagnostics functions via a 2-wire serial interface, compliant with XFP Multi-Source Agreement (MSA) Specification.

#### 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.
- Standard bail mechanism for consistent installation and removal
- Built-in digital diagnostic functions.
- Hot Pluggable XFP footprint.
- Duplex LC Connectors.
- Up to 10km on SMF
- RoHS Compliant
- Case Industrial temperature range: -40°C to 85°C

#### Applications

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

## Ordering Information

Part Number	Description	Color on Clasp
XFP-10GB-LR-I-C10	10 Gigabit XFP Transceiver, LC Connectors, 1310nm, Single Mode Fiber 10km	blue
<b>For More Information:</b> ModuleTek Limited Web: <a href="http://www.moduletek.com">www.moduletek.com</a> Email: <a href="mailto:sales@moduletek.com">sales@moduletek.com</a>		

## Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Storage Ambient Temperature	T <sub>S</sub>	-40		85	°C	
Supply Voltage 5V	V <sub>CC5</sub>	-0.5		5.5	V	
Supply Voltage 3.3V	V <sub>CC3</sub>	-0.5		4	V	
Supply Voltage 1.8V	V <sub>CC1.8</sub>	-0.5		2	V	

## General Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Data Rate	DR	8.5		11.3	Gb/s	1
Bit Error Rate	BER			10 <sup>-12</sup>		
Total Power Consumption	P			2.5	W	
Supply Voltage-3.3V	V <sub>CC3</sub>	3.14		3.46	V	2
Supply Voltage-1.8V	V <sub>CC1.8</sub>	1.71		1.89	V	2
Supply Current-V <sub>CC3</sub> supply	I <sub>CC3</sub>			265	mA	
Supply Current-V <sub>CC1.8</sub> supply	I <sub>CC1.8</sub>			320	mA	
Case Operating Temperature	T <sub>C</sub>	-40		85	°C	3

### Notes:

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

## Link Distances

Data Rate	Fiber Type	Distance Range (km)
8.5 – 11.3 Gb/s	9/125umSMF	10

## Optical – Characteristics – Transmitter

$V_{CC5}=4.75V$  to  $5.25V$ ,  $V_{CC3}=3.14V$  to  $3.46V$ ,  $V_{CC1.8}=1.71V$  to  $1.89V$ ,  $T_C=-40^{\circ}C$  to  $85^{\circ}C$

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Optical Center Wavelength	$\lambda_C$	1260		1350	nm	
Output Optical Power	$P_{TX}$	-8		0.5	dBm	1
Launch Power in OMA	$P_{OUT\_OMA}$	-4.8		0	dBm	
Optical Extinction Ratio	ER	3.5			dB	
Side Mode Suppression Ratio	SMSR	30			dB	
Relative Intensity Noise	RIN			-130	dB/Hz	
Transmitter Dispersion Penalty	TDP			3.2	dB	
Launch Power of OFF Transmitter	$P_{OUT\_OFF}$			-30	dBm	1
Transmitter Jitter	According to IEEE 802.3ae requirement					

### Notes:

1. Average

## Optical – Characteristics – Receiver

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Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Center Wavelength Range	$\lambda_C$	1260		1600	nm	
Receiver Overload	$P_{OL}$	0.5			dBm	
Receiver Sensitivity @10.3Gb/s	$R_{X\_SEN1}$			-14.4	dBm	1
Receiver Reflectance	$TR_{RX}$			-12	dB	
LOS Assert	$LOS_A$	-35			dBm	
LOS De-Assert	$LOS_D$			-18	dBm	
LOS Hysteresis	$LOS_H$	0.5			dB	

### Notes:

1. Measured with worst ER:  $BER < 10^{-12}$ ;  $2^{31}$ -1 PRBS

## Electrical – Characteristics – Transmitter

$V_{CC5}=4.75V$  to  $5.25V$ ,  $V_{CC3}=3.14V$  to  $3.46V$ ,  $V_{CC1.8}=1.71V$  to  $1.89V$ ,  $T_C=-40^{\circ}C$  to  $85^{\circ}C$

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Input differential impedance	$R_{IN}$		100		$\Omega$	1
Differential data input swing	$V_{IN\_PP}$	120		820	mV	
Transmit Disable Voltage	$V_D$	2		$V_{CC}$	V	2
Transmit Enable Voltage	$V_{EN}$	GND		$GND+0.8$	V	
Transmit Disable Assert Time				10	us	

### Notes:

1. After internal AC coupling
2. Or open circuit

## Electrical – Characteristics – Receiver

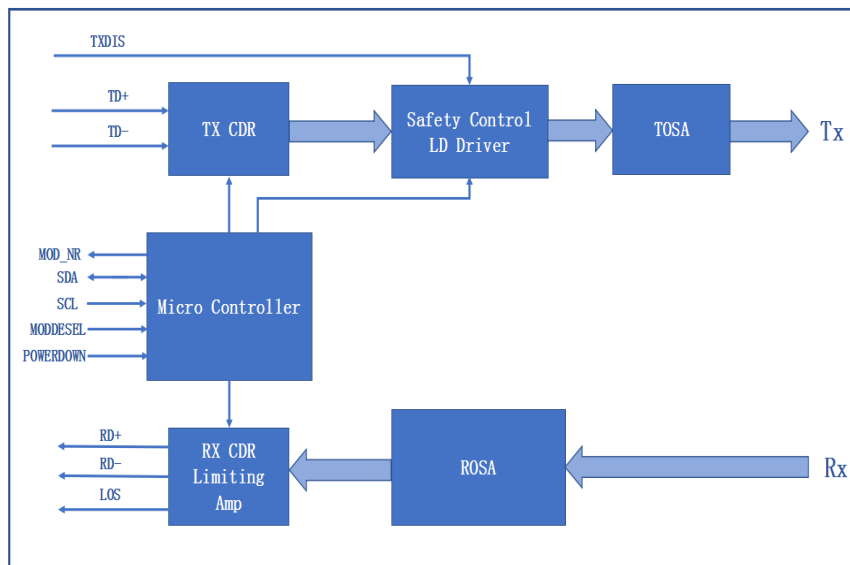
$V_{CC5}=4.75V$  to  $5.25V$ ,  $V_{CC3}=3.14V$  to  $3.46V$ ,  $V_{CC1.8}=1.71V$  to  $1.89V$ ,  $T_C=-40^{\circ}C$  to  $85^{\circ}C$

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Differential data output swing	$V_{OUT\_PP}$	340	650	850	mV	
Data output rise time/fall time (20%-80%)	$t_r/t_f$			38	ps	
LOS Fault	$V_{LOS\_A}$	$V_{CC}-0.5$		$V_{CC\_HOST}$	V	
LOS Normal	$V_{LOS\_D}$	GND		$GND+0.5$	V	

## Digital Diagnostic Functions

ModuleTek's XFP-10GB-LR-I-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 I2C 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. The digital diagnostics provides real-time access to operating parameters via a 2-wire serial interface, including operating temperature, laser bias current, transmitted optical power, received optical power, and operating voltage.

## Block-Diagram-of-Transceiver

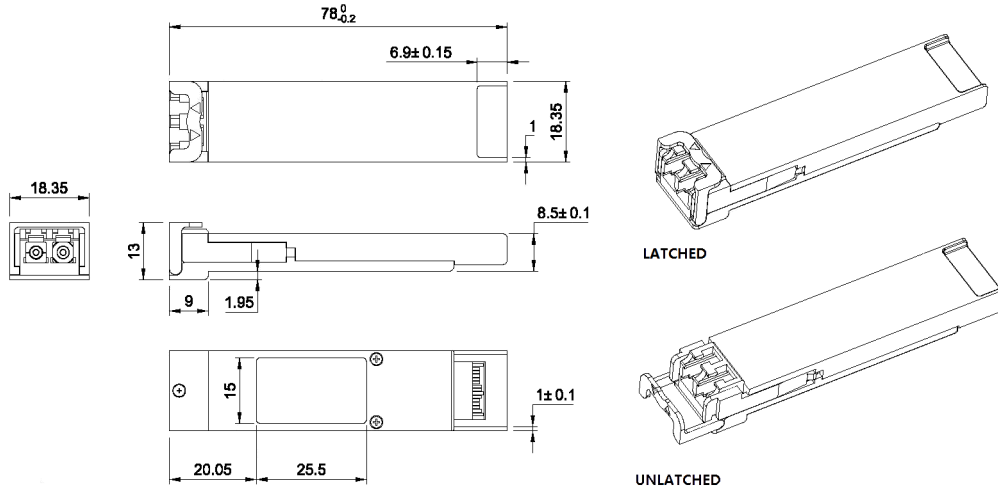


## Functions Description

The transmitter consists of a laser driver chip and a TOSA (light-emitting component). The TOSA includes a laser and a backlight photodetection chip, and the input signal is connected to the laser driver chip. The laser driver chip supplies the bias current and the modulation current to the laser. The laser driver chip simultaneously uses an automatic optical power control (APC) feedback loop to maintain a constant average optical power of the laser output. The purpose is to eliminate the change of the output optical signal due to temperature changes and aging of the light source device. Clock Data Recovery Module (CDR) overcomes board and connector degradation by reshaping, regenerating, and reducing jitter. TX\_DIS is an input pin. When TX\_DIS is asserted High, the XFP module transmitter output must be turned off.

The receiver consists of a ROSA (light-receiving component) and a limiting amplifier chip, ROSA includes a PIN photodetector and a transimpedance amplifier chip. The ROSA detects the incident optical signal, converts the optical signal into an electrical signal, and outputs the electrical signal to the limiting amplifier. The limiting amplifier further amplifies the input signal and outputs a fixed amplitude electrical signal. Clock Data Recovery Module (CDR) overcomes board and connector degradation by reshaping, regenerating, and reducing jitter. The RX\_LOS of an output pin, when LOS is high, it indicates insufficient optical power for reliable signal reception. MOD\_NR is an output pin. When it is high, it indicates that the module detects the condition that invalidates the transmitter/receiver data. The transmission signal regulator loses lock, the transmitter laser fails, and the receiver signal regulator loses lock. Etc. 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

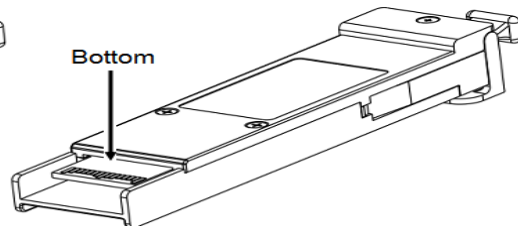
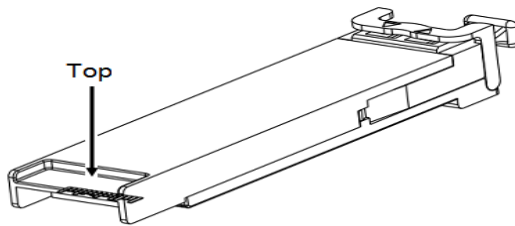
## Electrical Pad Layout

30	→	GND
29	→	TD+
28	→	TD-
27	→	GND
26	→	GND
25	→	REFCLK-
24	→	REFCLK+
23	→	GND
22	→	VCC2
21	→	P_DOWN/RST
20	→	VCC2
19	→	GND
18	→	RD+
17	→	RD-
16	→	GND

Top of Board

1	→	GND
2	→	VEE5
3	→	MOD_DESEL
4	→	INTERRUPT
5	→	TX_DIS
6	→	VCC5
7	→	GND
8	→	VCC3
9	→	VCC3
10	→	SCL
11	→	SDA
12	→	MOD_ABS
13	→	MOD_NR
14	→	RX_LOS
15	→	GND

Bottom of Board



## Pin Assignment - Pin1 to Pin30

PIN #	Symbol	Description	Remarks
1	GND	Module Ground	1
2	VEE5	Optional -5.2 Power Supply (Not required)	
3	Mod-Desel	Module De-select, when held low allows the module to respond to 2-wire serial interface commands	
4	$\overline{\text{Interrupt}}$	Indicates presence of an important condition which can be read over the serial 2-wire interface	2
5	TX_DISABLE	Transmitter Disable, Transmitter laser source turned off	
6	VCC5	+5V Power Supply	
7	GND	Module Ground	1
8	VCC3	+3.3V Power Supply	
9	VCC3	+3.3V Power Supply	
10	SCL	Serial 2-wire interface clock	2
11	SDA	Serial 2-wire interface data line	2
12	Mod_ABS	Module Absent; Indicates module is not present. Grounded in the module	2
13	Mod_NR	Module Not Ready; Indicates module operating fault	2
14	RX_LOS	Receiver Loss of Signal indicator	2
15	GND	Module Ground	1
16	GND	Module Ground	1
17	RD-	Receiver inverted data output	
18	RD+	Receiver non-inverted data output	
19	GND	Module Ground	1
20	VCC2	+1.8V Power Supply	
21	P_Down/RST	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	
23	GND	Module Ground	1
24	RefCLK+	Reference Clock non-inverted input, AC coupled on the host board	
25	RefCLK-	Reference Clock inverted input, AC coupled on the host board	
26	GND	Module Ground	1
27	GND	Module Ground	1



28	TD-	Transmitter inverted data input	
29	TD+	Transmitter non-inverted data input	
30	GND	Module Ground	1

**Notes:**

1. Module ground pins (GND) are isolated from the module case and chassis ground within the module
2. Open collector, should be pulled up with 4.7k $\Omega$ -10k $\Omega$  on host board to a voltage between 3.15V and 3.6V

**References**

1. 10 Gigabit Small Form Factor Pluggable Module(XFP)Multi-Source Agreement(MSA),Rev4.5 – August 2005.