DATA SHEET

MODULETEK: XFP-10GB-100KM-C10

10 Gigabit 1550nm Single Mode XFP Optical Transceiver

XFP-10GB-100KM-C10 Overview

ModuleTek's XFP-10GB-100KM-C10 10Gb/s XFP optical transceivers are designed for 10GFC and OC192 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 10GFC, OC192 application.
- Compliant with XFP MSA.
- Temperature-stabilized 1550nm EML laser and Receiver with APD
- Standard bail mechanism for consistent installation and removal
- Built-in digital diagnostic functions.
- Hot Pluggable XFP footprint.
- Duplex LC Connectors.
- Up to 100km on SMF
- Low power consumption (Module work consumption <2.5W)
- RoHS Compliant
- Operating temperature range: 0°C to 70°C

Applications

- 10G Ethernet
- 10G Fiber Channel
- OC192/STM -64

Ordering Information

Part Number	Description	Color on Clasp
XFP-10GB-100KM-C10	10 Gigabit XFP Transceiver, LC Connectors, 1550nm, Single Mode Fiber 100km	Cold gray
For More Information: ModuleTek Limited Web: www.moduletek.com Email: sales@moduletek.com		

Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Storage Ambient Temperature	T_S	-40		85	$^\circ$C	
Supply Voltage 5V	V_{CC5}	-0.5		5.5		
Supply Voltage 3.3V	V_{CC3}	-0.5		4	V	

General Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Data Rate	DR	9.95		11.3	Gb/s	
Bit Error Rate	BER			10^{-12}		
Total Power Consumption	P			2.5	W	
Supply Voltage -5V	V_{CC5}	4.75		5.25	V	1
Supply Voltage-3.3V	V_{CC3}	3.14		3.46	V	1
Supply Current-V_{CC5}	I_{CC5}			350		
Supply Current-V_{CC3}	I_{CC3}			500	mA	
Case Operating Temperature	T_C	0		70	$^\circ$C	2

Notes:
1. Operating Environment
2. Case temperature

Link Distances

Data Rate	Fiber Type	Distance Range (km)
9.95 −11.3 Gb/s	9/125um SMF	100

Optical – Characteristics – Transmitter

V_{CC5}=4.75V to 5.25V,V_{CC3}=3.14V to 3.46V,T_C=0°C to 70°C

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Output Optical Power	P_{TX}	2.5		4	dBm	1
Optical Center Wavelength	$λ_C$	1530		1570	nm	
Extinction Ratio	ER	9			dB	
Side Mode Suppression Ratio	SMSR	30			dB	
Relative Intensity Noise	RIN			-130	dB/Hz	
Transmitter Dispersion Penalty	TDP			3	dB	
Launch Power of OFF Transmitter	P_{OUT_OFF}			-30	dBm	1
Transmitter Jitter (Peak-to-Peak)	TJ			0.1	UI	

Notes:
1. Average

Optical – Characteristics – Receiver

V_{CC5}=4.75V to 5.25V,V_{CC3}=3.14V to 3.46V,T_C=0°C to 70°C

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Center Wavelength Range	$λ_C$	1260		1600	nm	
Receiver Overload	P_{OL}	-7			dBm	
Receiver Sensitivity @10.3Gb/s	R_{X_SEN}			-25	dBm	1
Receiver Reflectance	TR_{RX}			-27	dB	
LOS Assert	LOS_A	-35			dBm	
LOS De-Assert	LOS_D			-27	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,T_C=0°C to 70°C

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Input differential impedance	R_{IN}		100		Ω	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,T_C=0°C to 70°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-100KM-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.

| Digital Diagnostic Threshold Range					
Parameter	High Alarm	High Warning	Low Warning	Low Alarm	Remarks
Temperature (°C)	75	70	0	-5	
Voltage 5V (V)	5.5	5.25	4.75	4.5	
Voltage 3.3V (V)	3.63	3.46	3.13	2.97	
Voltage 1.8V (V)	1.98	1.89	1.71	1.62	
Bias Current (mA)	131	130	20	15	
Tx Power (uw)	3014.2	2511.8	1000	800	
Rx Power (uw)	251.7	188.8	2.9	1.9	

Block-Diagram-of-Transceiver
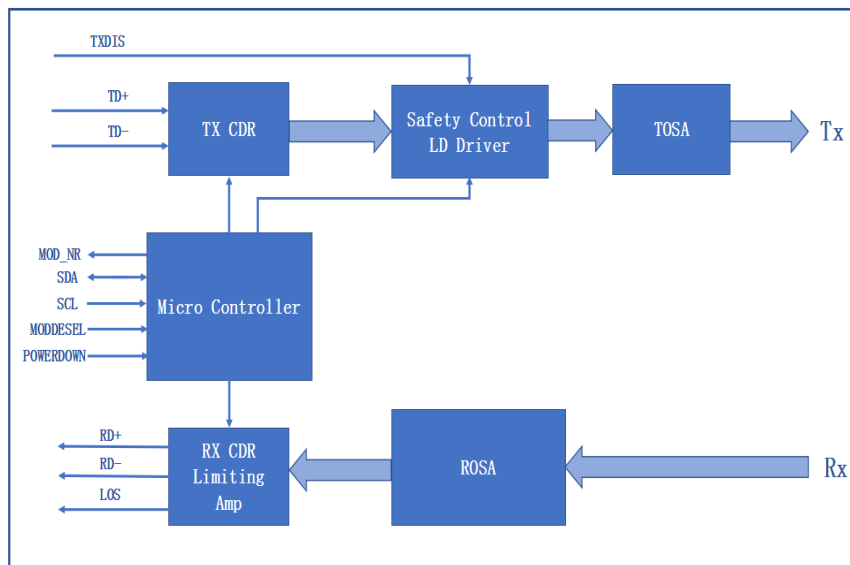
Functions Description

The transmitter consists of a laser driver chip and a TOSA (light-emitting component). The TOSA includes a laser, an electroabsorption modulator (EAM), a TEC, and a backlight diode. Unlike DML, EML TOSA uses external modulation. When the transmission rate of the system is high, the transmission distance is not only limited by the attenuation of the optical fiber, but also by the dispersion of the optical fiber, and the dispersion of the optical communication system is related to the modulation spectral width. The directly modulated laser has a large dispersion cost, and has spectral broadening, frequency chirp, and short transmission distance, so the external modulation method is adopted in the medium-long-distance transmission at a rate of 10 Gb/s.TEC (Thermo Electric Cooler) Controls the temperature of the laser tube.When a temperature is set, the TOSA temperature of the module will remain unchanged through the control of the TEC.The wavelength of the module laser tube is related to the temperature of the laser tube. The module wavelength can be set by setting the TOSA temperature.When stable, the module has excellent wavelength stability. The electrical signal enters the optical module from the serial electrical interface and is then input 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 a 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 APD 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, and then shapes and synchronizes the electrical signal to the host through the CDR.Clock Data
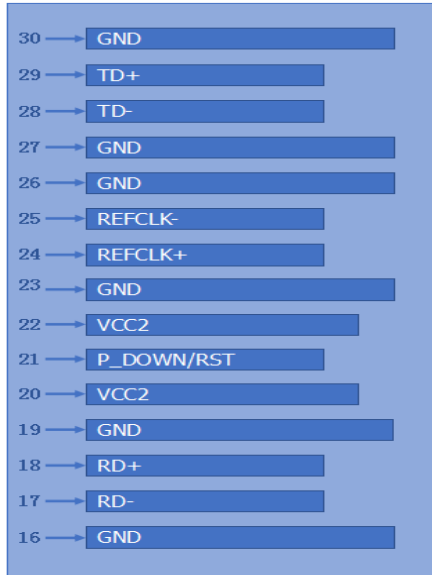
Recovery Module (CDR) overcomes board and connector degradation by reshaping, regenerating, and reducing jitter.The RX_LOS of an output pin, when LOS is high, it indicates insufficient optical power for reliable signal reception.MOD_NR is an output pin. When it is high, it indicates that the module detects 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.
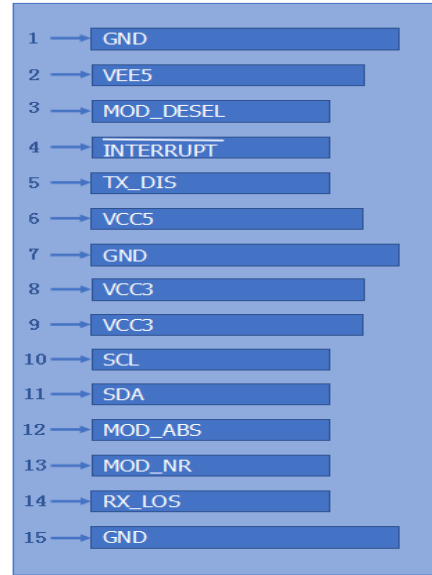
Dimensions
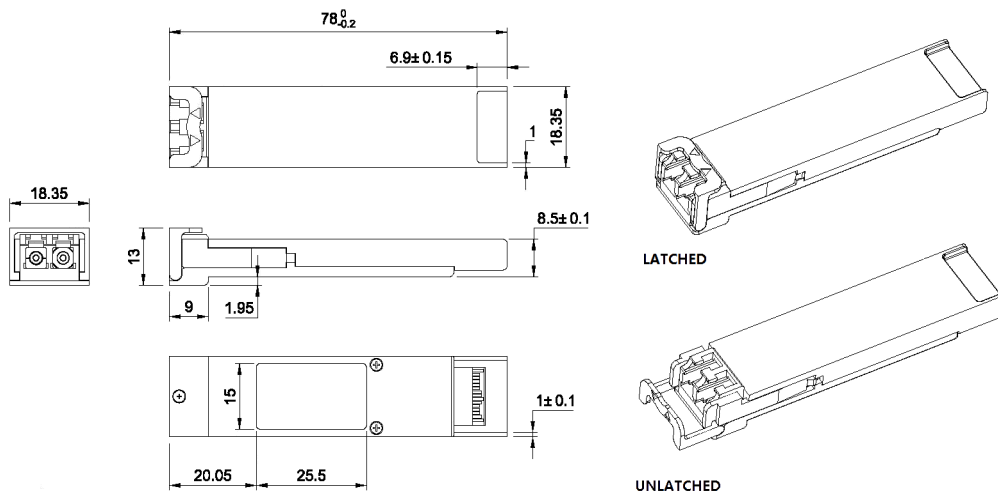
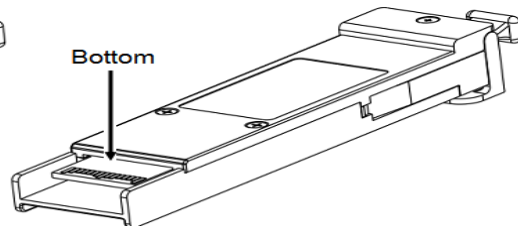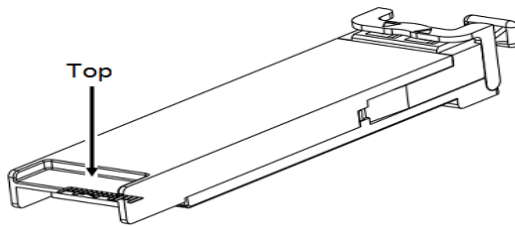ALL DIMENSIONS ARE ±0.2mm UNLESS OTHERWISE SPECIFIED
UNIT: mm

Electrical Pad Layout

Top of Board		Bottom of Board	
30 →	GND	1 →	GND
29 →	TD+	2 →	VEE5
28 →	TD-	3 →	MOD_DESEL
27 →	GND	4 →	INTERRUPT
26 →	GND	5 →	TX_DIS
25 →	REFCLK-	6 →	VCC5
24 →	REFCLK+	7 →	GND
23 →	GND	8 →	VCC3
22 →	VCC2	9 →	VCC3
21 →	P_DOWN/RST	10 →	SCL
20 →	VCC2	11 →	SDA
19 →	GND	12 →	MOD_ABS
18 →	RD+	13 →	MOD_NR
17 →	RD-	14 →	RX_LOS
16 →	GND	15 →	GND

Top of Board   **Bottom of Board**

Top   Bottom

ModuleTek

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	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 4.7kΩ-10kΩ 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.