

## DATA SHEET

### MODULETEK-SFP-GE-LX40-C10

1.25Gb/s SFP (Small Form Pluggable) Long Wavelength (1310nm) Transceiver

#### SFP-GE-LX40-C10 Overview

ModuleTek's SFP-GE-LX40-C10 optical transceivers are based on Gigabit Ethernet IEEE 802.3 standard and Fiber Channel FC-PI Rev.5.0 and provide a quick and reliable interface for the GE/FC application. The digital diagnostics functions are available via 2-wire serial bus specified in the SFP MSA. In addition, they comply with the Small Form Factor Pluggable Multi-Source Agreement (MSA) and SFF-8472.

#### Product Features

- Up to 1.25 Gb/s bi-directional data links
- Compliant with IEEE 802.3z Gigabit Ethernet
- Compliant with SFP MSA
- Hot-pluggable SFP footprint
- Uncooled 1310nm DFB laser transmitter
- Duplex LC connector
- Built-in digital diagnostic functions
- Up to 40km on 9/125um SMF
- Single power supply 3.3V
- RoHS Compliant
- Class 1 laser product complies with EN 60825-1
- Operating temperature range: 0°C to 70°C

#### Applications

- 1.25 Gb/s Gigabit Ethernet
- 1.063 Gb/s Fiber Channel

## Ordering Information

Part Number	Description	Color on Clasp
SFP-GE-LX40-C10	GE/FC SFP 1310nm LC Connectors 40km on SMF, with DOM function	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>		

## General Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Data Rate	DR		1.25		Gb/s	1
	DR		1.062		Gb/s	2
Bit Error Rate	BER			$10^{-12}$		
Operating Temperature	T <sub>OP</sub>	0		70	°C	3
Storage Temperature	T <sub>STO</sub>	-40		85	°C	4
Supply Current	I <sub>S</sub>		200	300	mA	5
Input Voltage	V <sub>CC</sub>	3.14	3.3	3.46	V	
Maximum Voltage	V <sub>MAX</sub>	-0.5		4	V	5

### Notes:

1. IEEE 802.3
2. FC-PI-2 Rev 5
3. Case temperature
4. Ambient temperature
5. For electrical power interface

## Optical-Characteristics-Transmitter

$V_{CC}=3.14V$  to  $3.46V$ ,  $T_C=0^{\circ}C$  to  $70^{\circ}C$

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Output Optical Power	$P_{TX}$	-9.5		-3	dBm	1
Optical Center Wavelength	$\lambda_C$	1270		1360	nm	
Optical Modulation Amplitude	OMA	174			uW	2
Extinction Ratio	ER	9			dB	
Side Mode Suppression Ratio	SMSR	30			dB	
Spectral Width (- 20 dB)	$\Delta\lambda$			1	nm	
Optical Rise/Fall Time(20%-80%)	$t_r/t_f$			180	ps	
Relative Intensity Noise	RIN			- 120	dB/Hz	
Deterministic Jitter Contribution	DJ			60	ps	
Total Jitter Contribution	TJ			130	ps	

### Notes:

1. Class 1 Product
2. Equivalent extinction ratio specification for FC

## Optical-Characteristics-Receiver

$V_{CC}=3.14V$  to  $3.46V$ ,  $T_C=0^{\circ}C$  to  $70^{\circ}C$

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Max Input Power	$P_{MAX}$			0	dBm	1
Optical Center Wavelength	$\lambda_C$	1270		1600	nm	
Receiver Sensitivity@1.062Gb/s	$R_{X\_SEN1}$			-19	dBm	2
Receiver Sensitivity @ 1.25Gb/s	$R_{X\_SEN2}$			-19	dBm	3
Stressed Receiver Sensitivity @ 1.25Gb/s			18	14.5	dBm	3
Optical Return Loss	ORL	12			dB	
Receiver Electrical 3dB Upper cutoff frequency				1500	MHz	
LOS Assert	$LOS_A$	-35			dBm	
LOS De-Assert	$LOS_D$			-23	dBm	
LOS Hysteresis	$LOS_H$	0.5			dB	

### Notes:

1. Average
2. FC-PI- Rev.5
3. IEEE 802.3

## Electrical - Characteristics - Transmitter

$V_{CC3}=3.14V$  to  $3.46V$ ,  $T_C=0^{\circ}C$  to  $70^{\circ}C$

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Input differential impedance	$R_{IN}$		100		$\Omega$	
Single ended data input swing	$V_{IN\_PP}$	250		1200	mV	
Transmit disable voltage	$V_D$	$V_{CC}-1.3$		$V_{CC}$	V	
Transmit enable voltage	$V_{EN}$	$V_{EE}$		$V_{EE}+0.8$	V	
Transmit disable assert time				10	us	

## Electrical - Characteristics - Receiver

$V_{CC3}=3.14V$  to  $3.46V$ ,  $T_C=0^{\circ}C$  to  $70^{\circ}C$

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Single ended data output swing	$V_{OUT\_PP}$	300	400	800	mV	
Data output rise/fall time (20%–80%)	$T_R/ T_F$		100	175	ps	
LOS Assert	$V_{LOS\_A}$	$V_{CC}-0.5$		$V_{CC\_HOST}$	V	
LOS De-Assert	$V_{LOS\_D}$	$V_{EE}$		$V_{EE}+0.5$	V	

## Digital Diagnostic Functions

SFP-GE-LX40-C10 supports the 2-wire serial communication protocol as defined in the SFP MSA. Digital diagnostic information is accessible over the 2-wire interface at the address 0xA2. Digital diagnostics for SFP-GE-LX40-C10 are internally calibrated by default. A micro controller unit inside the transceiver gathers the monitoring information and reports the status of transceiver.

**Transceiver Temperature**, internally measured, represented as a 16 bit signed twos complement value in increments of 1/256 degrees Celsius, Temperature accuracy is better than  $\pm 3$  degrees Celsius over specified operating temperature and voltage.

**Transceiver Supply Power**, internally measured, represented as a 16 bit unsigned integer with the voltage defined as the full 16 bit value (0 – 65535) with LSB equal to 100  $\mu$ Volt, yielding a total range of 0 to +6.55 Volts.

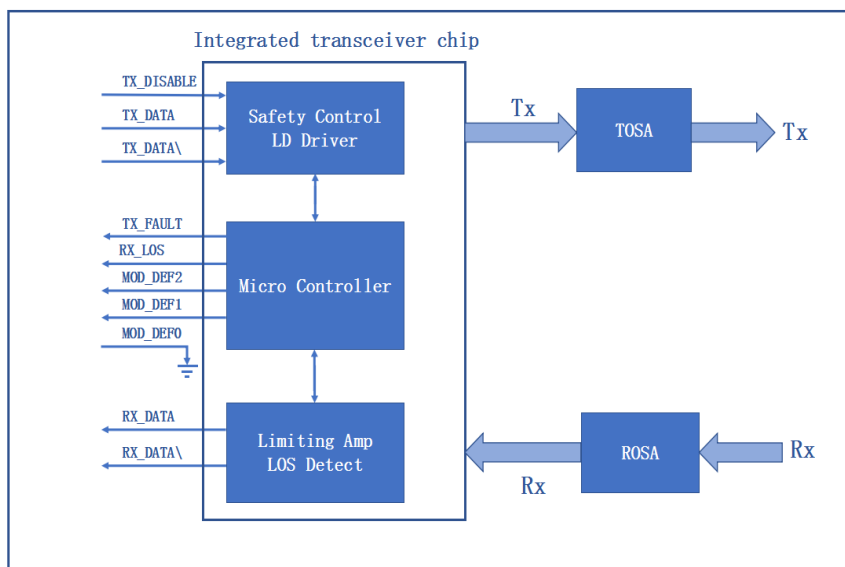
**Transceiver TX bias current**, internally measured, represented as a 16 bit unsigned integer with the current defined as the full 16 bit value (0 – 65535) with LSB equal to 2  $\mu$ A, yielding a total range of 0 to 131mA. Accuracy is better than  $\pm 10\%$  over specified operating temperature and voltage.

**Transceiver TX output power**, internally measured, represented as a 16 bit unsigned integer with the power defined as the full 16 bit value (0– 65535) with LSB equal to 0.1  $\mu$ W. Data is assumed to be based on measurement of laser monitor photodiode current. Accuracy is better than  $\pm 3$ dB over specified temperature and voltage. Data is not valid when the transmitter is disabled.

**Transceiver RX received optical power**, internally measured, represented as a 16 bit unsigned integer with the power defined as the full 16 bit 35 value (0 – 65535) with LSB equal to 0.1  $\mu$ W. Accuracy is better than  $\pm 3$ dB over specified temperature and voltage.

Parameter	Symbol	Accuracy	Units	Report Range		Unit	Remarks
Internal Calibration							
Temperature	T <sub>MON</sub>	$\pm 3$	$^{\circ}$ C	-40	95	$^{\circ}$ C	
Voltage	V <sub>MON</sub>	$\pm 0.1$	V	2.7	3.9	V	
Bias Current	I <sub>MON</sub>	$\pm 10$	%	1	80	mA	
Tx Power	P <sub>MON</sub>	$\pm 3$	dB	-5	5	dBm	
Rx Power	P <sub>MON</sub>	$\pm 3$	dB	-30	0	dBm	

## Block-Diagram-of-Transceiver



### Transmitter Section

The DFB driver accepts 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. 1310 nm DFB in an eye safe optical subassembly (OSA) mates to the fiber cable.

### TX\_DISABLE

The TX\_DISABLE signal is high (TTL logic "1") to turn off the laser output. The laser will turn on within 1ms when TX\_DISABLE is low (TTL logic"0").

### TX\_FAULT

When the TX\_FAULT signal is high, output indicates a laser fault of some kind. Low indicates normal operation.

### Receiver Section

The receiver utilizes a PIN detector integrated with a trans-impedance preamplifier in an OSA. This OSA is connected to a Limiting Amplifier which providing post-amplification quantization, and optical signal detection. The limiting Amplifier is AC-coupled to the transimpedance amplifier, with internal 100Ω differential termination.

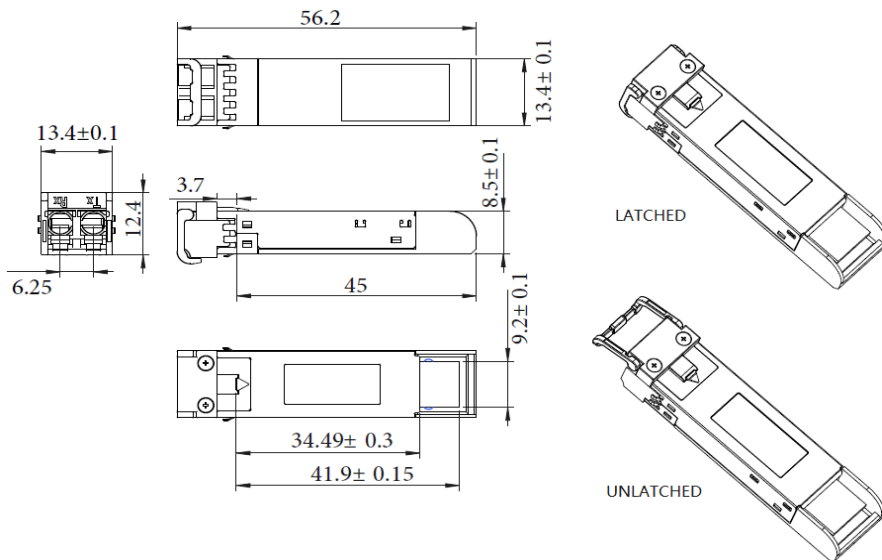
### Receive (RX\_LOS)

The RX\_LOS is high (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 TTL level.

## Controller Section

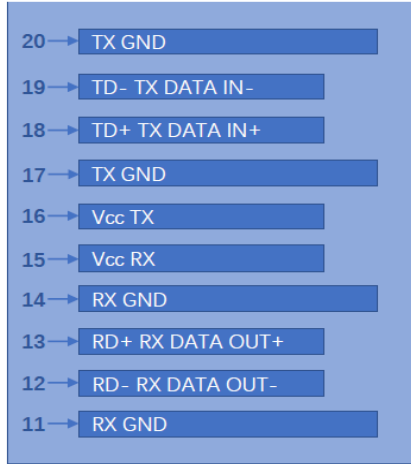
The micro controller unit monitors the operation information of LD driver and Limiting Amplifier. And report these status to the customer.

## Dimensions

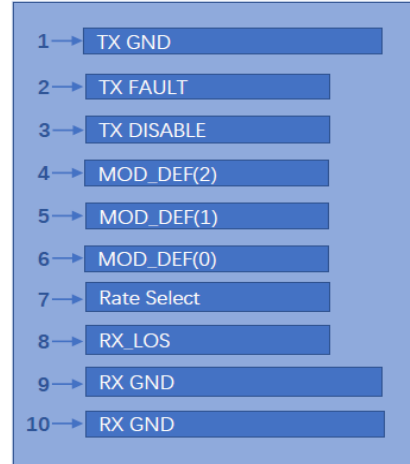


ALL DIMENSIONS ARE ±0.2mm UNLESS OTHERWISE SPECIFIED  
UNIT: mm

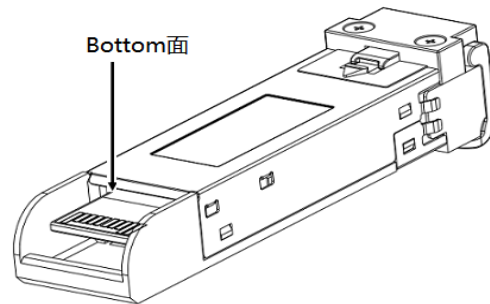
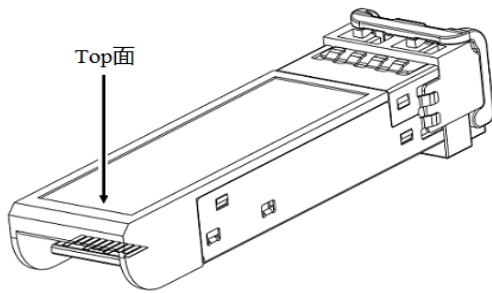
## Electrical Pad Layout



Top of Board



Bottom of Board





## Pin Assignment

PIN #	Symbol	Description	Remarks
1	V <sub>EET</sub>	Transmitter ground (common with receiver ground)	1
2	T_FAULT	Transmitter Fault. Not supported	
3	T_DIS	Transmitter Disable. Laser output disabled on high or open	2
4	MOD_DEF(2)	Module Definition 2. Data line for serial ID	3
5	MOD_DEF(1)	Module Definition 1. Clock line for serial ID	3
6	MOD_DEF(0)	Module Definition 0. Grounded within the module	3
7	Rate Select	No connection required	
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation	4
9	V <sub>EER</sub>	Receiver ground (common with transmitter ground)	1
10	V <sub>EER</sub>	Receiver ground (common with transmitter ground)	1
11	V <sub>EER</sub>	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 <sub>EER</sub>	Receiver ground (common with transmitter ground)	1
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)	1
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)	1

### Notes:

1. Circuit ground is isolated from chassis ground
2. Disabled: T<sub>DIS</sub>>2V or open, Enabled: T<sub>DIS</sub><0.8V
3. Should Be pulled up with 4.7k -10k ohm on host board to a voltage between 2V and 3.6V
4. LOS is open collector output

## References

1. IEEE standard 802.3. IEEE Standard Department, 2002.
2. Small Form Factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA), INT-8074i.
3. Fiber Channel Draft Physical Interface Specification (FC-P1-2 Rev.5).
4. Digital Diagnostics Monitoring Interface for Optical Transceivers –SFF-8472.
5. Fiber Channel Physical and Signaling Interface (FC-PH/PH2/PH3).