GLC-LH-SM-OEM

1.25GBd SFP (Small Form Pluggable) Long Wavelength (1310nm) Transceiver

- Up to 1.25 GBd bi-directional data links
- Compliant with IEEE 802.3z Gigabit Ethernet and 1000BASE-LX and SFP MSA
- Hot-pluggable SFP footprint
- 1310nm Fabry-Perot laser transmitter
- Duplex LC connector
- Built-in digital diagnostic functions
- Up to 10km on 9/125um SMF
- Single power supply 3.3V
- RoHS Compliance
- Class 1 laser product complies with EN 60825-1
- Operating temperature range: 0°C to 70°C.

Product Overview

GLC-LH-SM-OEM SFP 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 Sourcing Agreement (MSA) and SFF-8472.

Product Protocols

- 1.25 GBd Gigabit Ethernet, 1.063 GBd Fiber Channel

Ordering Information

Part Number	Description
GLC-LH-SM-OEM	GE/FC SFP 1310nm LC Connectors 10km on SMF.

Contact

General Specifications

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Data Rate	*DR*		1.25		GBd	IEEE 802.3
			1.062			FC-PI-2 Rev 5
Bit Error Rate	*BER*			10^{-12}		
Operating Temperature	T_{OP}	0		70	°C	Case temperature
Storage Temperature	T_{STO}	-40		85	°C	Ambient Temperature
Supply Current	I_S		175	300	mA	For electrical power interface
Input Voltage	V_{CC}	3	3.3	3.6	V	
Maximum Voltage	V_{MAX}	-0.5		4	V	For electrical power interface

Optical Characteristic – Transmitter

V_{CC} = 3V to 3.6V, T_C = 0°C to 70°C

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Output Optical Power	P_{TX}	-9.5		-3	dBm	Class 1 Product
Optical Center Wavelength	*λC*	1270		1360	nm	
Optical Modulation Amplitude	*OMA*	174			uW	Equivalent extinction ratio specification for FC
Extinction Ratio	*ER*	9			dB	
Spectral Width (RMS)	*Δλ*			3	nm	
Optical Rise/Fall Time (20% - 80%)	T_{RF_IN}		150	260	ps	
Relative Intensity Noise	*RIN*			-120	dB/Hz	
Deterministic Jitter Contribution	*TX_ ΔDJ*		20	60	ps	
Total Jitter Contribution	*TX_ ΔTJ*		50	120	ps	

Optical Characteristics – Receiver

V_{CC} =3V to 3.6V, T_C = 0°C to 70°C

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Optical Receiver Power	P_{RX}			0	dBm	Average
Optical Center Wavelength	*λC*	1265		1600	nm	
Receiver Sensitivity @ 1.063GBd	R_{X_SEN1}			- 22	dBm	FC-PI-2 Rev.5
Receiver Sensitivity @ 1.25GBd	R_{X_SEN2}			- 22	dBm	IEEE 802.3
Stressed Rx Sens @ 1.25GBd				-14.5	dBm	IEEE 802.3

Optical Return Loss	*ORL*	12			dB
Receiver Electrical 3dB Upper cutoff frequency				1500	MHz
Loss of Signal-Asserted	P_{LOS_A}	- 30			dBm
Loss of Signal-Deasserted	P_{LOS_D}			- 22	dBm
Loss of Signal-Hysteresis		0.5			dB

Electrical Characteristics – Transmitter

V_{CC} = 3V to 3.6V, T_C = 0°C to 70°C

Parameter	Symbol	Min	Typ	Max	Unit	Remarks
Input differential impedance	R_{IN}		100		Ω	Non condensing
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		

Electrical Characteristics – Receiver

V_{CC} = 3V to 3.6V, T_C = 0°C to 70°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			300	ps	
LOS Fault	V_{LOS_Fault}	V_{CC} –0.5		V_{CC_HOST}	V	
LOS Normal	V_{LOS_normal}	V_{EE}		V_{EE} +0.5	V	

Digital Diagnostic Functions

GLC-LH-SM-OEM support the 2-wire serial communication protocol as defined in the SFP MSA. Digital diagnostic information are accessible over the 2-wire interface at the address 0xA2. Digital Diagnostics for GLC-LH-SM-OEM are internally calibrated by default. A microcontroller 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 ±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 µVolt, 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 µA, yielding a total range of 0 to 131mA. Accuracy is better than ±10% over

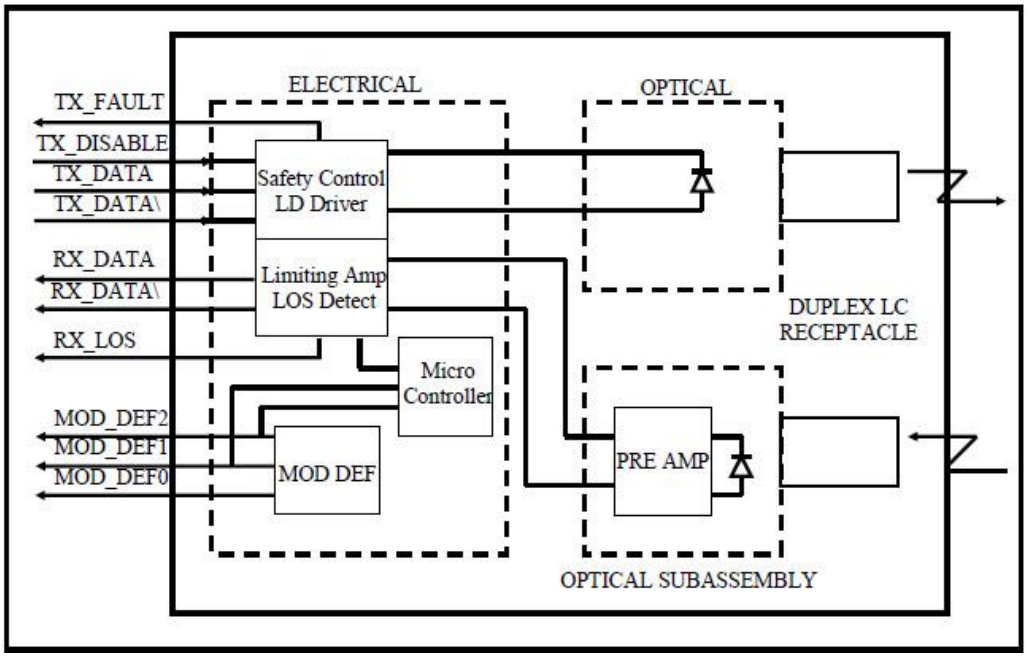
specified operating temperature and voltage.

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 µW. Data is assumed to be based on measurement of laser monitor photodiode current. Accuracy is better than ±3dB 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 µW. Accuracy is better than ±3dB over specified temperature and voltage.

Parameter	Symbol	Accuracy	Units	Report Range		Unit	Remarks
			Internal Calibration				
Temperature	T_{MON}	±3	°C	-40	95	°C	
Voltage	V_{MON}	±0.1	V	2.7	3.9	V	
Bias Current	I_{MON}	±10	%	1	80	mA	
Tx Power	P_{MON}	±3	dB	-12	0	dBm	
Rx Power	P_{MON}	±3	dB	-30	0	dBm	

Block Diagram of Transceiver



Transmitter Section
The FP 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. 1310 nm FP 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").

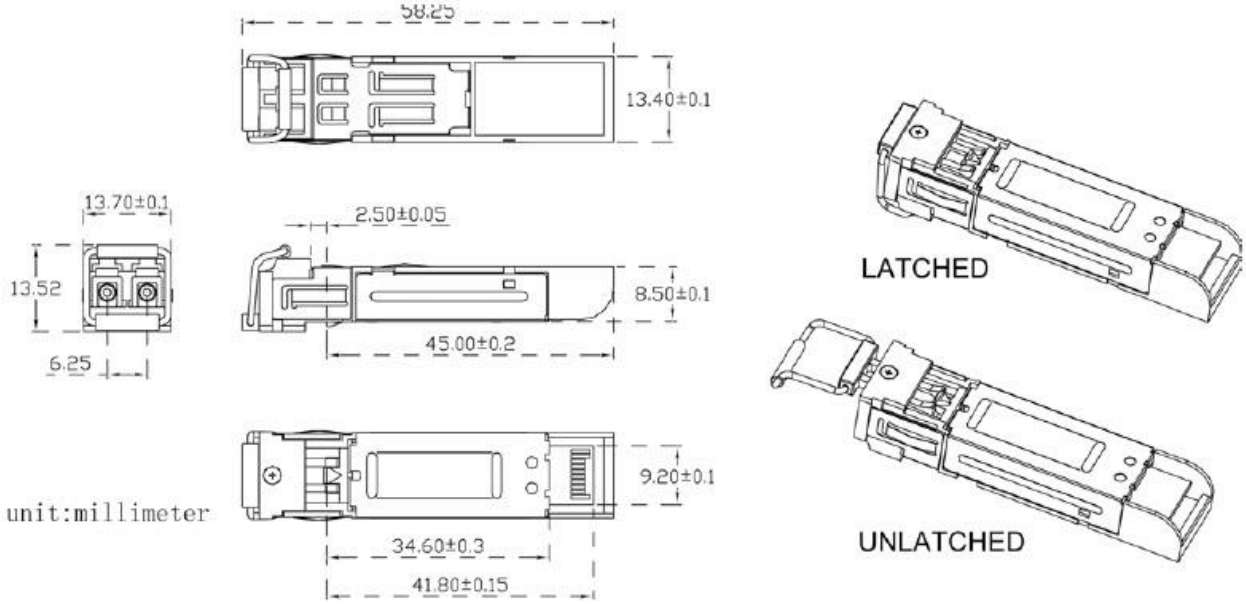
TX_FAULT
When the TX_FAULT signal is high, output indicates a laser fault of some kind. Low indicates normal operation.

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 Loss (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.

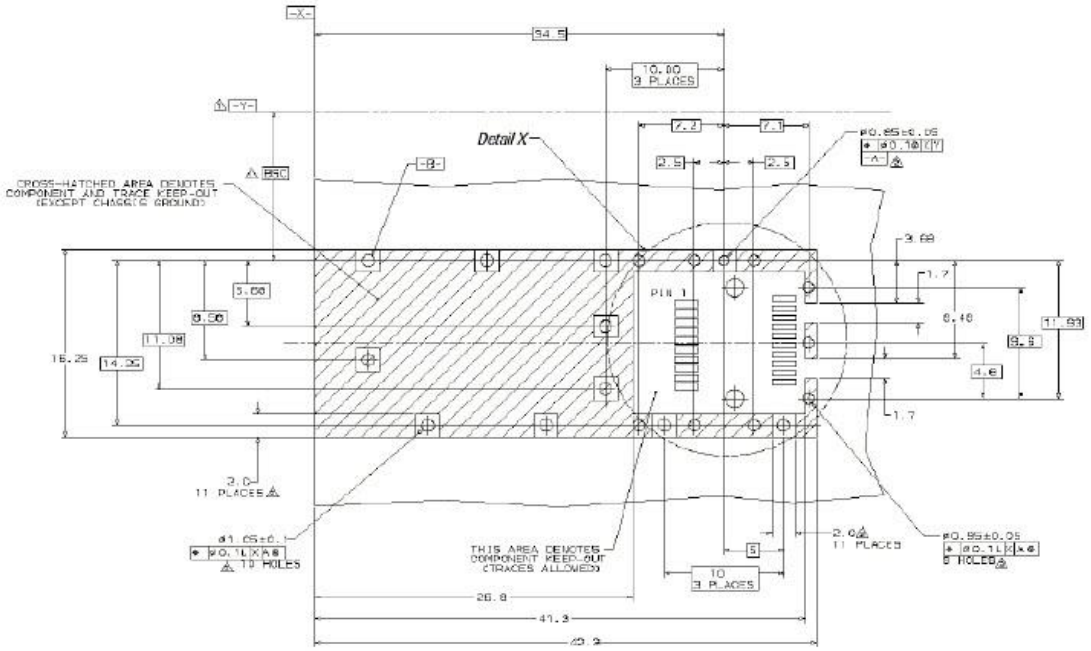
Controller Section
The micro controller unit monitors the operation information of LD driver and Limiting Amplifier. And report these status to the customer.

Dimensions

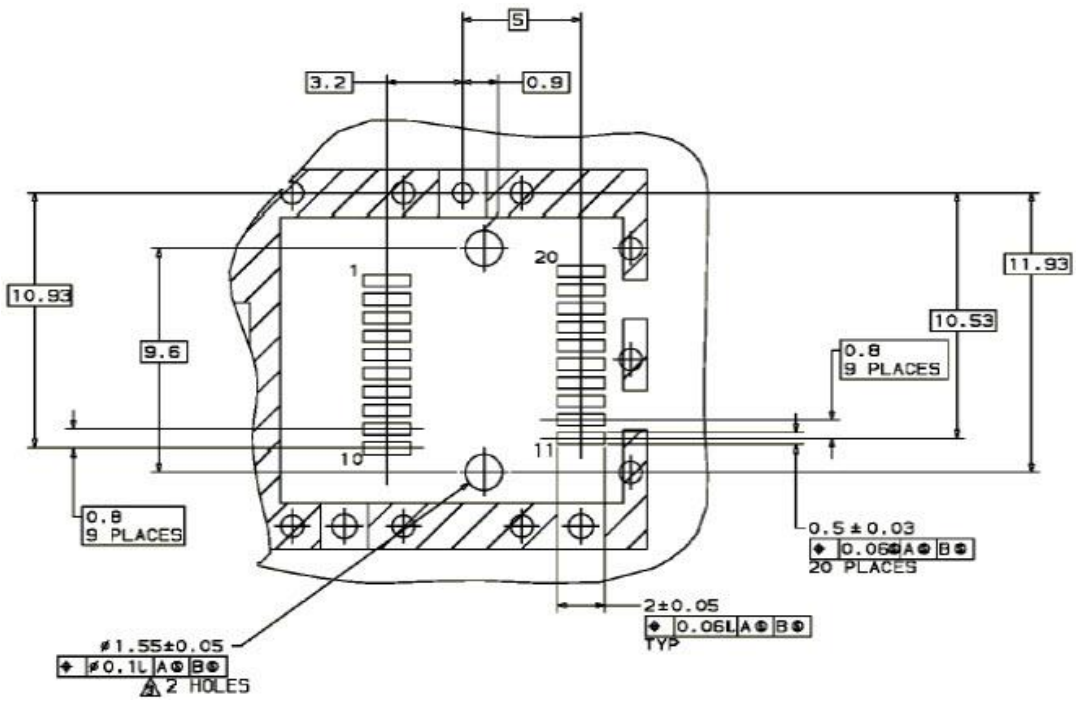


ALL DIMENSIONS ARE ±0.2mm UNLESS OTHERWISE SPECIFIED UNIT: mm

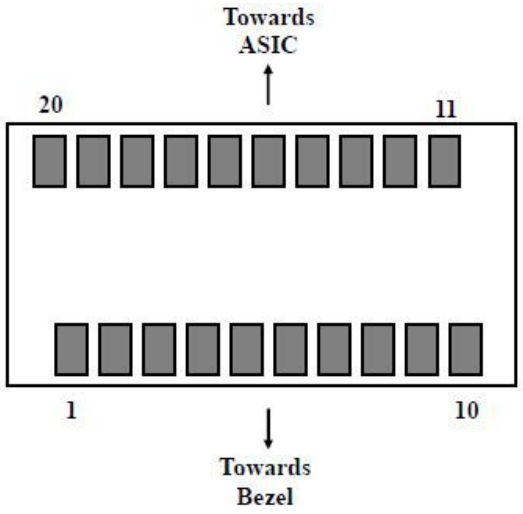
PCB Layout Recommendation

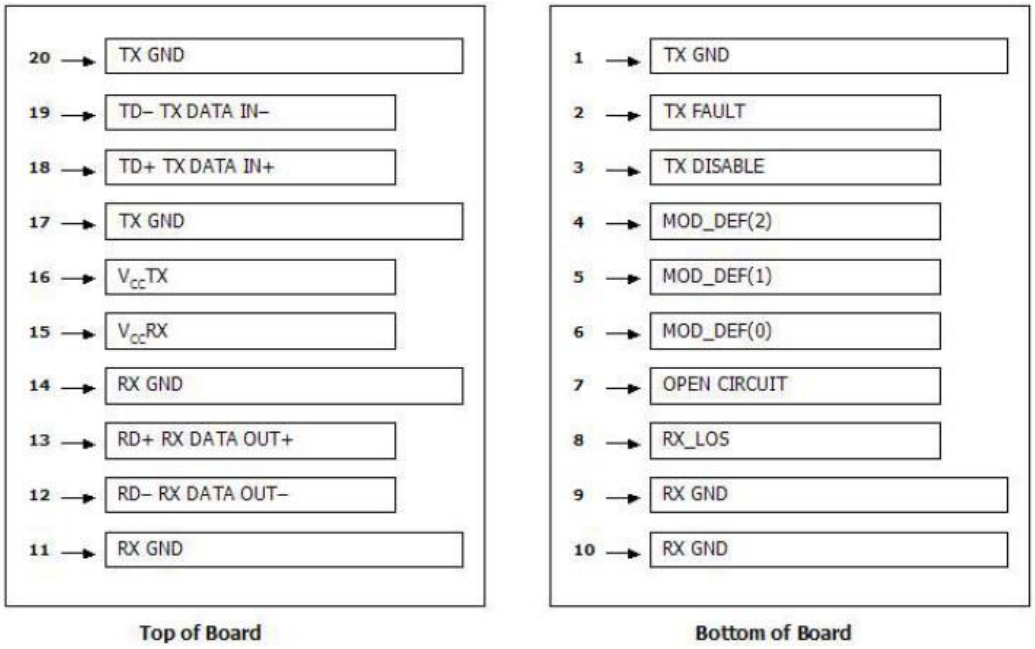


1. Datum and Basic Dimension Established by Customer
2. Pads and Vias are Chassis Ground, 11 Places
3. Through Holes are Unplated



Electrical Pad Layout





Pin Assignment

PIN #	Symbol	Description	Remarks
1	V_{EET}	Transmitter ground (common with receiver ground)	Circuit ground is isolated from chassis ground
2	T_{FAULT}	Transmitter Fault. Not supported	
3	T_{DIS}	Transmitter Disable. Laser output disable on high or open	Disabled: T_{DIS} >2V or open
			Enabled: T_{DIS} <0.8V
4	MOD_DEF (2)	Module Definition 2. Data line for serial ID	Should Be pulled up with 4.7k – 10k ohm on host board to a voltage between 2V and 3.6V
5	MOD_DEF (1)	Module Definition 1. Clock line for serial ID	
6	MOD_DEF (0)	Module Definition 0. Grounded within the module	
7	Rate Select	No connection required	
8	LOS	Loss of Signal indication. Logic 0 indicates normal operation	LOS is open collector output
9	V_{EER}	Receiver ground (common with transmitter ground)	Circuit ground is isolated from chassis ground
10	V_{EER}	Receiver ground (common with transmitter ground)	
11	V_{EER}	Receiver ground (common with transmitter ground)	
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)	Circuit ground is isolated from chassis ground
15	V_{CCR}	Receiver power supply	
16	V_{CCT}	Transmitter power supply	
17	V_{EET}	Transmitter ground (common with receiver ground)	Circuit ground is connected to chassis ground
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)	Circuit ground is connected to chassis ground

References

1. IEEE standard 802.3. IEEE Standard Department, 2002.
2. Small Form Factor Pluggable (SFP) Transceiver Multi-Source Agreement (MSA), September 2000.
3. Fiber Channel Draft Physical Interface Specification (FC-PI-2 Rev.5).
4. Digital Diagnostics Monitoring Interface for Optical Transceivers – SFF-8472.
5. Fiber Channel Physical and Signaling Interface (FC-PH/PH2/PH3).