1.25G SFP transceiver module with DDM function

GSFP-LX-10-D

Features:

- 1310nm Fabry-Perot laser transmitter
- Up to 1.25Gbps data rate
- Duplex LC receptacle optical interface compliant
- Single +3.3V power supply
- DDM function implemented
- Hot-pluggable
- Low power consumption< 1 .0W
- Receiver Loss of Signal Output
- International Class 1 laser safety certified
- Transmitter disable input
- Operating temperature range: 0°C ~+70°C
- RoHS Compliant
- 10km on 9/125um SMF

Applications:

- Gigabit Ethernet
- Gigabit Fiber Channel
- Switch to switch interface
- Switched backplane applications

Standard:

- Compliant with SFP MSA (INF-8074i)
- Compliant with SFF-8472 v9.5
- Compliant with IEEE802.3z Gigabit Ethernet
- Compliant with FC-PI v2.0

Absolute Maximum Ratings

Parameter	Symbol	Unit	Min	Max
Storage Temperature Range	Ts	°C	-40	+85
Relative Humidity	RH	%	5	95
Power supply Voltage	Vcc	V	-0.5	4

Recommended Operating Conditions

Parameter	Symbol	Unit	Min	Typ	Max
Case Operating Temperature Range	T_c	°C	0		70
Power Supply Voltage	V_{cc}	V	3.135	3.3	3.465
Data Rate	-	Gb/s	-	1.25	-

Specifications (tested under recommended operating conditions, unless otherwise noted)

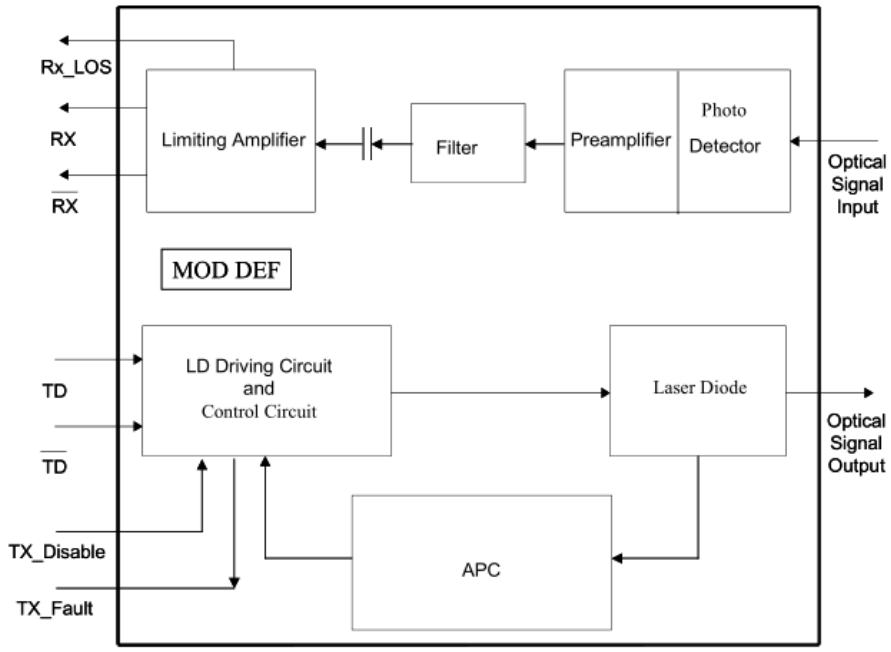
Parameter		Symbol	Unit	Min	Typ	Max	Notes
Electrical Characteristics							
Supply Current	Tx Section	I_{cc}	mA	-	-	300	1
	Rx Section						
Single Ended Data Input Swing		-	mV	-	-	1100	
Single Ended Data Output Swing		-	mV	300	-	600	
Optical transmitter Characteristics							
Launch Optical Power		P_o	dBm	-9		-3	
Center Wavelength Range		λ c	nm	1260	1310	1360	
Extinction Ratio		EX	dB	9			
Spectral Width(RMS)		Δλ	nm			4	
Eye Diagram		Complies with IEEE802.3z eye masks when filtered					
Optical Rise/Fall Time		T_{rise}/T_{fall}	ps			260	2
Pout of OFF transmitter		P_{off}	dBm	-	-	-45	
LD turn-on Time		T_{on}	ms			1	
LD turn-off Time		T_{off}	us			10	
Optical receiver Characteristics							
Center Wavelength Range		λ c	nm	1260		1360	
Receiver Sensitivity		S	dBm			-25	3
Overload Input Optical Power		P_{in}	dBm	-3			3
LOS	Optical De-assert	LOS_D	dBm			-26	
	Optical Assert	LOS_A	dBm	-35			

Notes 1: The supply current includes SFP module’s supply current and test board working current.

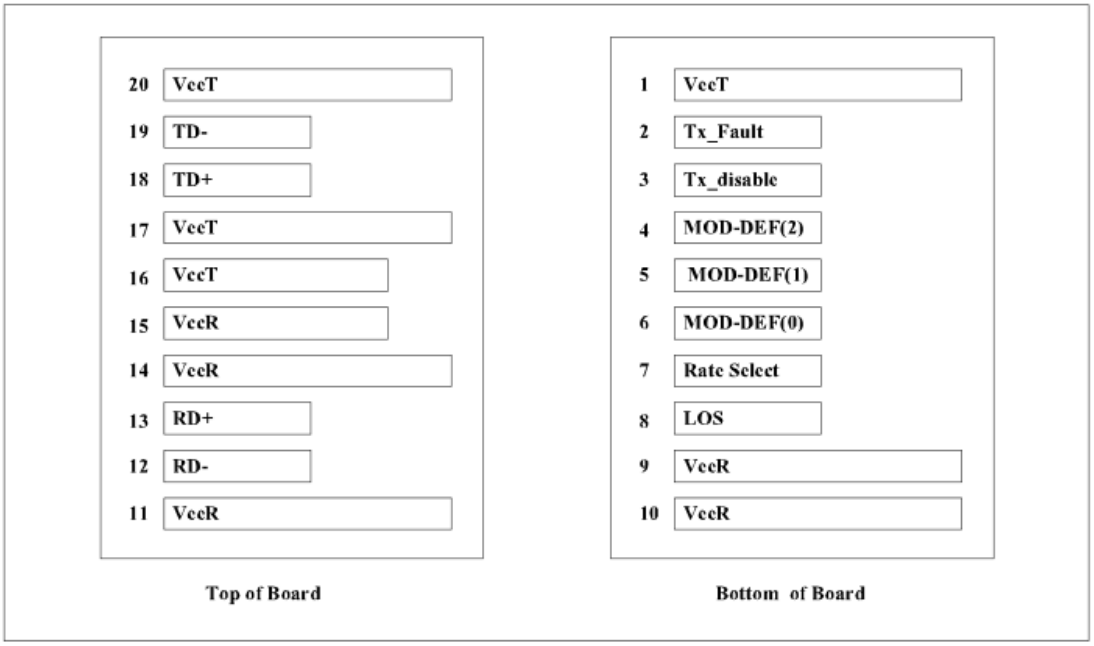
Notes 2: Optical transition time is the time interval required for the rising or falling edge of an optical pulse to transition between the 20% and 80% amplitudes relative to the logical 1 and 0 levels

Notes 3: Measured with a PRBS 2^{23}-1 test pattern, @1.25Gb/s, EX=10dB, BER<10^{-12}.

Principle Diagram



Electric Ports Definition



As Viewed Through Top of Board

Pin Connections

Pin	Name	Function/Description	Engagement order	Notes
1	VeeT	Transmitter Ground	1	
2	TX Fault	Transmitter Fault Indication	3	1

3	TX Disable	Transmitter Disable-Module disables on high or open	3	2
4	MOD_DEF2	Module Definition 2-Two wire serial ID interface	3	3
5	MOD_DEF1	Module Definition 1-Two wire serial ID interface	3	3
6	MOD_DEF0	Module Definition 0-Two wire serial ID interface	3	3
7	Rate Select	Not Connected	3	
8	LOS	Loss of Signal	3	4
9	VeeR	Receiver Ground	1	
10	VeeR	Receiver Ground	1	
11	VeeR	Receiver Ground	1	
12	RD-	Inverse Received Data out	3	5
13	RD+	Received Data out	3	5
14	VeeR	Receiver Ground	1	
15	VccR	Receiver Power —— +3.3V±5%	2	6
16	VccT	Transmitter Power —— +3.3 V±5%	2	6
17	VeeT	Transmitter Ground	1	
18	TD+	Transmitter Data In	3	7
19	TD-	Inverse Transmitter Data In	3	7
20	VeeT	Transmitter Ground	1	

Notes 1: TX Fault is open collector/drain output which should be pulled up externally with a 4.7K-10KΩresistor on the host board to supply <VccT+0.3V or VccR+0.3V. When high, this output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to <0.8V.

Notes 2: TX Disable input is used to shut down the laser output per the state table below. It is pulled up within the module with a 4.7-10K resistor.

Low (0-0.8V): Transmitter on

Between (0.8V and 2V): Undefined

High (2.0-VccT): Transmitter Disabled

Open : Transmitter Disabled

Notes 3:. Mod-Def 0, 1, 2. These are the module definition pins. They should be pulled up with a 4.7 – 10K resistor on the host board to supply less than VccT+0.3V or VccR+0.3V.

Mod-Def 0 is grounded by the module to indicate that the module is present.

Mod-Def 1 is clock line of two wire serial interface for optional serial ID.

Mod-Def 2 is data line of two wire serial interface for optional serial ID.

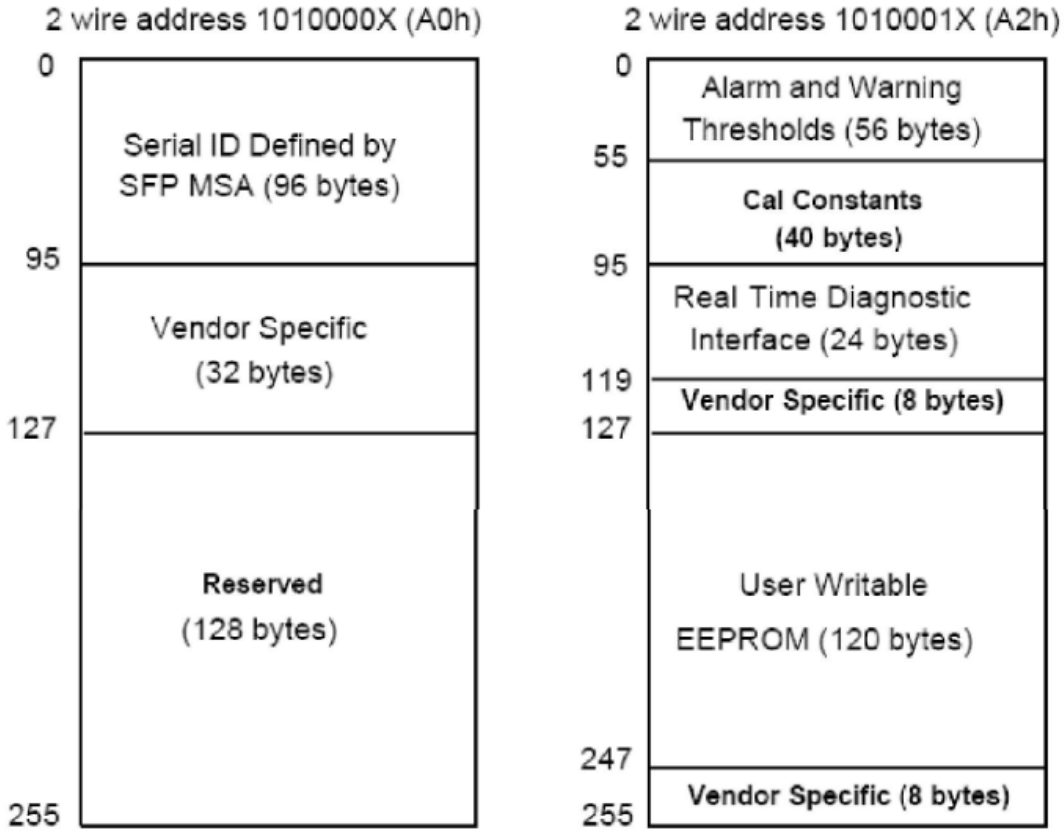
Notes 4: LOS (Loss of signal) is an open collector/drain output which should be pulled up externally with a 4.7-10K resistor on the host board to supply <VccT+0.3V or VccR+0.3V. When high, this output indicates the received optical power is below the worst case receiver sensitivity (as defined by the standard in use). Low indicates normal operation. In the low state, the output will be pulled to <0.8V.

Notes 5: RD-/+: These are the differential receiver outputs. They are AC coupled 100Ω differential lines which should be terminated with 100Ω differential at the user SERDES. The AC coupling is done inside the module and thus not required on the host board.

Notes 6: VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V±5% at the SFP connector pin. The in-rush current will typically be no more than 30Ma above steady state supply current after 500ns.

Notes 7: TD-/+: These are the differential transmitter inputs. They are AC coupled differential lines with 100Ω differential termination inside the module. The AC coupling is done inside the module and is thus not required on host board.

Software Command



EEPROM Serial ID Memory Contents

Accessing Serial ID Memory uses the 2 wire address 1010000X(A0). Memory Contents of Serial ID are shown in Table 2

Table 2 Serial ID Memory Contents

Data Address	Size (Bytes)	Name of Field	Contents(Hex)	Description
BASE ID FIELDS				
0	1	Identifier	03	SFP

1	1	Ext. Identifier	04	SFP function is defined by serial ID only
2	1	Connector	07	LC Connector
3~10	8	Transceiver	XX XX XX XX XX XX XX XX	Transceiver Codes
11	1	Encoding	01	NRZ
12	1	BR, Nominal	0D	1.25Gbit/s
13	1	Reserved	00	
14	1	Length (9μm) km	0A	Transceiver transmit distance 10km
15	1	Length (9μm) 100m	64	
16	1	Length (50μm) 10m	00	
17	1	Length(62.5μm)10m	00	
18	1	Length (Copper)	00	
19	1	Reserved	00	
20~35	16	Vendor name		
36	1	Reserved	00	
37~39	3	Vendor OUI	XX XX XX	
40~55	16	Vendor PN		
56~59	4	Vendor rev	20 20 20 20	
60~61	2	Wavelength	05 1E	1310nm
62	1	Reserved	00	
63	1	CC_BASE	XX	Check code for Base ID Fields
EXTENDED ID FIELDS				
64~65	2	Options	00 1A	TX_DISABLE, TX_FAULT and Loss of Signal implemented.
66	1	BR,max	00	
67	1	BR,min	00	
68~83	16	Vendor SN	XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX XX	Serial Number of transceiver (ASCII)
84~91	8	Date code	XX XX XX XX XX XX 20 20	Year(2)Month(2)Day(2) (ASCII)
92	1	Diagnostic Monitoring Type	58	Digital diagnostic monitoring implemented, “externally calibrated” is implemented, RX measurement type is “Average Power”.
93	1	Enhanced Options	B0	Optional Alarm/Warning flags implemented for all monitored quantities, Optional Soft TX_FAULT monitoring implemented, Optional Soft RX_LOS monitoring implemented.

94	1	SFF_8472 Compliance	02	Includes functionality described in Rev9.5 SFF-8472.
95	1	CC_EXT	XX	Check sum for Extended ID Field
VENDOR SPECIFIC ID FIELDS				
96~127	32	Vendor Specific		Depends on customer information
128~255	128	Reserved		

Diagnostic Monitor Functions

Diagnostic Monitor Functions interface uses the 2 wire address 1010001X (A2). Memory contents of Diagnostic Monitor Functions are shown in Table 3

Table 3 Memory contents of Diagnostic Monitor Function

Data Address	Field Size (bytes)	Name	Contents and Description
Alarm and Warning Thresholds			
00-01	2	Temperature High Alarm	Set to 85℃
02-03	2	Temperature Low Alarm	Set to -5℃
04-05	2	Temperature High Warning	Set to 75℃
06-07	2	Temperature Low Warning	Set to 0℃
08-09	2	Vcc High Alarm	Set to 3.6 V
10-11	2	Vcc Low Alarm	Set to 3.0 V
12-13	2	Vcc High Warning	Set to 3.5 V
14-15	2	Vcc Low Warning	Set to 3.1 V
16-17	2	Bias High Alarm	60mA
18-19	2	Bias Low Alarm	0mA
20-21	2	Bias High Warning	50mA
22-23	2	Bias Low Warning	0mA
24-25	2	TX Power High Alarm	Manufacture measurement plus 2dB
26-27	2	TX Power Low Alarm	Manufacture measurement minus 2dB
28-29	2	TX Power High Warning	Manufacture measurement plus 1dB
30-31	2	TX Power Low Warning	Manufacture measurement minus 1dB
32-33	2	RX Power High Alarm	Maximum input optical power
34-35	2	RX Power Low Alarm	Minimum input optical power
36-37	2	RX Power High Warning	Maximum input power minus 3dB
38-39	2	RX Power Low Warning	Manufacture measurement plus 3dB
40-55	16	Reserved	
Calibration Constants			
56-59	4	RX Power Calibration Data4	Single precision floating-point numbers (various values at each device)
60-63	4	RX Power Calibration Data3	
64-67	4	RX Power Calibration Data2	Single precision floating-point numbers (various values at each device)
68-71	4	RX Power Calibration Data1	

72-75	4	RX Power Calibration Data0	
76-77	2	Bias Calibration Data1	00 01 (fixed)
78-79	2	Bias Calibration Data0	00 00 (fixed)
80-81	2	TX Power Calibration Data1	00 01 (fixed)
82-83	2	TX Power Calibration Data0	00 00 (fixed)
84-85	2	Temperature Calibration Data1	00 01 (fixed)
86-87	2	Temperature Calibration Data0	00 00 (fixed)
88-89	2	Vcc Calibration Data1	00 01 (fixed)
90-91	2	Vcc Calibration Data0	00 00 (fixed)
92-94	3	Reserved	00 00 00 (fixed)
95	1	Check Sum	Checksum of bytes 0-94
Real Time Diagnostic Monitor Interface			
96-97	2	Measured Temperature	Yield to a 16-bit A/D value (see Table 3.1)
98-99	2	Measured Vcc	Yield a 16-bit A/D value (see Table 3.1)
100-101	2	Measured Bias	Yield a 16-bit A/D value (see Table 3.1)
102-103	2	Measured TX Power	Yield a 16-bit A/D value (see Table 3.1)
104-105	2	Measured RX Power	Yield a 16-bit A/D value (see Table 3.1)
106-109	4	Reserved	
110	1	Logic Status	See Table 3.2
111	1	AD Conversion Updates	See Table 3.2
112-129	8	Alarm and Warning Flags	See Table 3.3
Vendor Specific			
120-127	8	Vendor Specific	Don't Access
128-247	120	User writable EEPROM	
245-255	8	Vendor Specific	Don't Access

The measured values located at bytes 96-105(in the 2 wire address 0Xa2) are raw A/D values (16-bit integers) of transceiver temperature, supply voltage, laser bias current, laser optical output power and received power. All the measured values are "Externally Calibrated", and then it is necessary to convert raw A/D values to real world units by the manner as shown in Table 3.1

Table 3.1 Real Time Diagnostic Monitor Values

Byte	Name	Description
96	Temperature MSB	Internally measured transceiver temperature. Comply with External Calibration of SFF-8472.
97	Temperature LSB	
98	Vcc MSB	Internally measured supply voltage. Comply with External Calibration of SFF-8472
99	Vcc LSB	
100	Laser Bias MSB	Measured Laser bias current. Comply with External Calibration of SFF-8472
101	Laser Bias LSB	
102	Tx Power MSB	Measured Tx power. Comply with External Calibration of SFF-8472.
103	Tx Power LSB	

104	Rx Power MSB	Measured Tx power. Comply with External Calibration of SFF-8472
105	Rx Power LSB	

This transceiver implements two optional status bytes, “Logic States” at byte 110(0Xa2)” and “A/D Updated” at byte 111(0Xa2) as shown in Table 3.2. “A/D Updated” status bits allow the user to verify if an update from the analog-digital conversion has occurred of the measured values, temperature, Vcc, laser bias, Tx power and Rx power. The user writes the byte to 0x00. Once a conversion is completed for a given value, its bit will change to ‘1’.

Table 3.2 Logic Status and AD Conversion Updates

Byte	Bit	Name	Description
110	7	Tx Disable State	Optional digital State of the Tx Disable input pin.
110	6	Soft Tx Disable Control	Not supported (set to 0).
110	5	Reserved	Set to 0.
110	4	Rx Rate Select State	Not supported (set to 1).
110	3	Soft Rate Select Control	Not supported (set to 0).
110	2	Tx Fault	Optional digital state of the Tx Fault output pin
110	1	LOS	Optional digital state of the LOS output pin
110	0	Power on Logic	Bit will be 0 when the analog monitoring is active
111	7	Temp A/D Valid	Indicates A/D value in Bytes 96/97 is valid.
111	6	Vcc A/D Valid	Indicates A/D value in Bytes 98/99 is valid.
111	5	Laser Bias A/D Valid	Indicates A/D value in Bytes 100/101 is valid.
111	4	Tx Power A/D Valid	Indicates A/D value in Bytes 102/103 is valid.
111	3	Rx Power A/D Valid	Indicates A/D value in Bytes 104/105 is valid.
111	2	Reserved	Set to 0
111	1	Reserved	Set to 0
111	0	Reserved	Set to 0

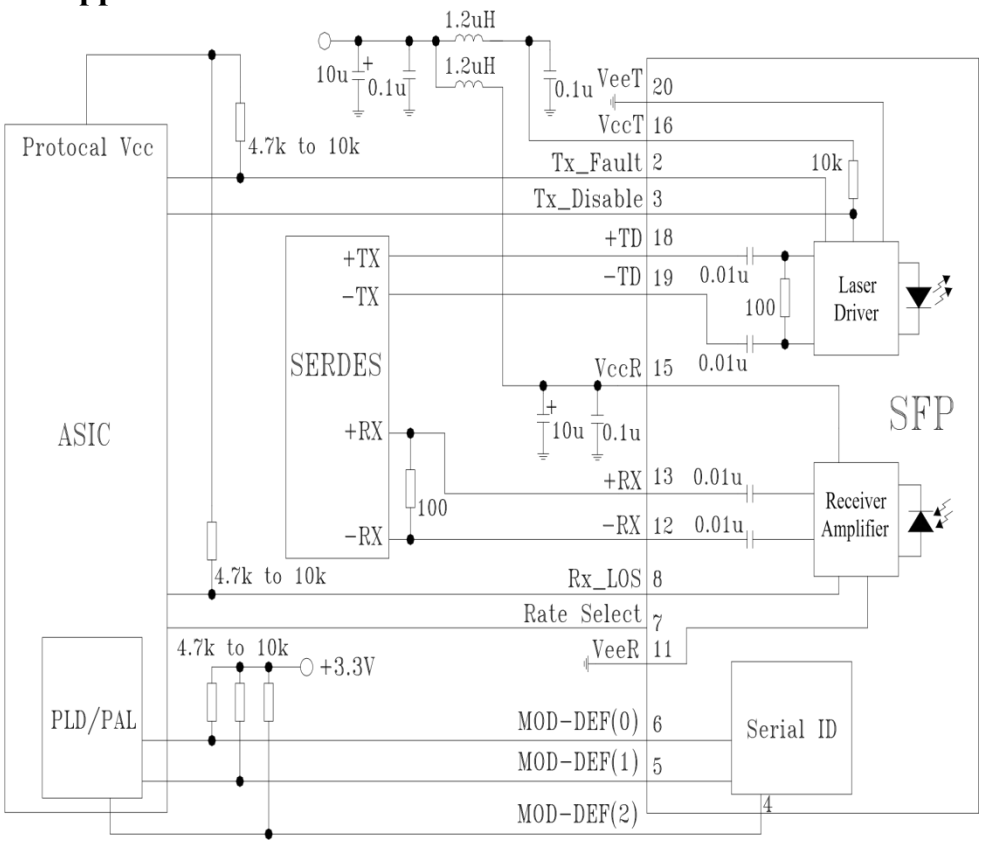
Each of the measured values has a corresponding high alarm, low alarm, high warning and low warning threshold level at location 00-39(x0A2) written as the data format of a corresponding valued shown in Table 3.3.Alarm and warning flags at bytes 112-119(0Xa2) are defined as follows. Alarm flags indicate conditions likely to result (or have resulted) in link failure and cause for immediate action. Warning flags indicate conditions outside the guaranteed operating specification of transceiver but not necessarily causes of immediate link failures

Table 3.3 Alarm and Warning Flags

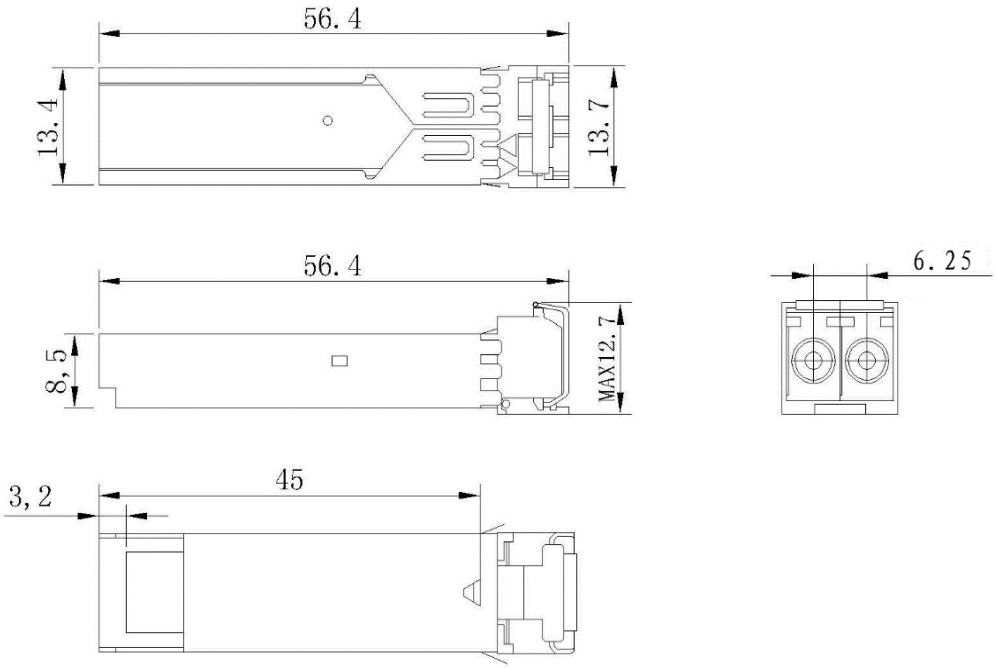
Byte	Bit	Name	Description
112	7	Temperature High Alarm	Set when temperature monitor value exceeds high alarm level.
112	6	Temperature Low Alarm	Set when temperature monitor value exceeds low alarm level
112	5	Vcc High Alarm	Set when Vcc monitor value exceeds high alarm level.
112	4	Vcc Low Alarm	Set when Vcc monitor value exceeds Low alarm level
112	3	Laser Bias High Alarm	Set when laser bias monitor value exceeds high alarm level.
112	2	Laser Bias Low Alarm	Set when laser bias monitor value exceeds low alarm level.
112	1	Tx Power High Alarm	Set when Tx power monitor value exceeds high alarm level

112	0	Tx Power Low Alarm	Set when Tx power monitor value exceeds low alarm level.
113	7	Rx Power High Alarm	Set when Rx power monitor value exceeds high alarm level
113	6	Rx Power Low Alarm	Set when Rx power monitor value exceeds low alarm level
113	5-0	Reserved	All bits set to 0
114	7-0	Reserved	All bits set to 0
115	7-0	Reserved	All bits set to 0
116	7	Temperature High warning	Set when temperature monitor value exceeds high warning level.
116	6	Temperature Low warning	Set when temperature monitor value exceeds low warning level
116	5	Vcc High warning	Set when Vcc monitor value exceeds high warning level.
116	4	Vcc Low warning	Set when Vcc monitor value exceeds Low warning level.
116	3	Laser Bias High warning	Set when laser bias monitor value exceeds high warning level.
116	2	Laser Bias Low warning	Set when laser bias monitor value exceeds low warning level.
116	1	Tx Power High warning	Set when Tx power monitor value exceeds high warning level
116	0	Tx Power Low warning	Set when Tx power monitor value exceeds low warning level.
117	7	Rx Power High warning	Set when Rx power monitor value exceeds high warning level
117	6	Rx Power Low warning	Set when Rx power monitor value exceeds low warning level
117	5-0	Reserved	All bits set to 0.
118	7-0	Reserved	All bits set to 0.
119	7-0	Reserved	All bits set to 0.

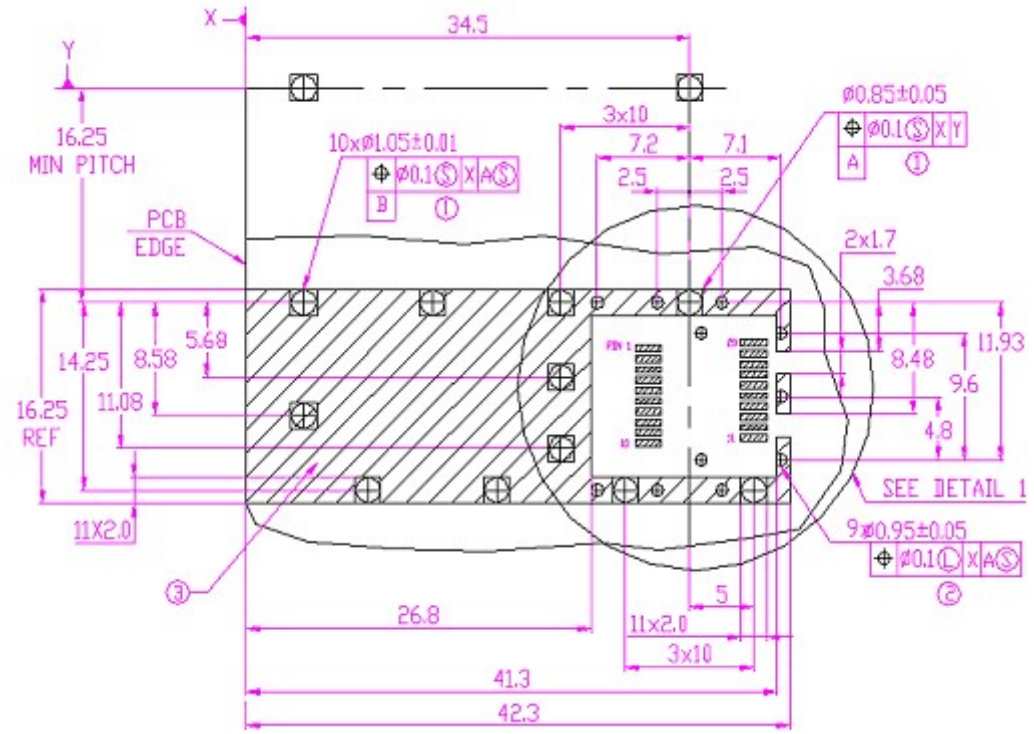
Typical Application Circuit

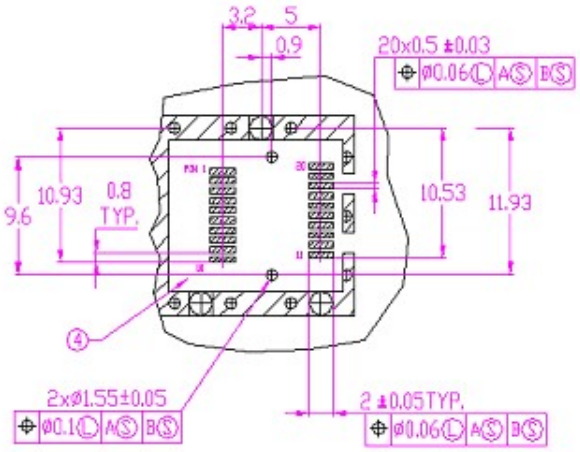


Package Outline



PCB Layout Recommendation





DETAIL 1

NOTES:

1.PADS AND VIAS ARE CHASSIS GROUND.

2.THROUGH HOLES,PLATING OPTIONAL.

3.HATCHED AREA DENOTES COMPONENT AND TRACE KEEPOUT (EXCEPT CHASSIS GROUND).

4.AREA DENOTES COMPONENT KEEPOUT (TRACES ALLOWED).

DIMENSIONS IN MILLIMETERS

Ordering Information

Ordering P/Ns	Description
GSFP-LX-10-D	20km,1.25Gbps, Tx 1310nm, Rx 1310nm, SFP form-factor, Duplex LC/UPC receptacle connector, 0~70°C Commercial temperature

For More Information

For more information about the GSFP-LX-10-D, please contact your local BDCOM account representative.

Shanghai Baud Data Communication Co., LTD.

No.123, Juli Road,

Pudong Zhangjiang High-Tech Park,

Shanghai 201203, P.R.China

www.bdcom.cn

Tel: +86-21-50800666