Product Specification

Part NO.	Specifications									Application
	Package	Rate	Tx(nm)	Pout(dBm)	Rx	S(dBm)	Top	Reach	Others	
GCS1L0C85	SFP	1.25G	850	-9.5~-3	VCSEL	≤-18	-10~70°C	550m	DDM, RoHS	SDH L-1.1
GCS3L0C31	SFP	1.25G	1310 FP	-9~-3	PIN	≤-23	-10~70°C	10km	DDM, RoHS	SDH L-1.1
GCS4L0C31	SFP	1.25G	1310 FP	-9~-3	PIN	≤-23	-10~70°C	20km	DDM, RoHS	SDH L-1.1
GCS5L0C31	SFP	1.25G	1310 FP	-5～0	PIN	<-23	-10~70°C	40km	DDM, RoHS	SDH L-1.1
GCS5L0C55	SFP	1.25G	1550 DFB	-4 ~-1	PIN	<-23	-10~70°C	40km	DDM, RoHS	SDH L-1.1
GCS7L0C55	SFP	1.25G	1550 DFB	-2~+3	PIN	<-23	-10~70°C	80km	DDM, RoHS	SDH L-1.1
GCS9L0C55	SFP	1.25G	1550 DFB	0~+3	APD	<-31	-10~70°C	120km	DDM, RoHS	SDH L-1.1

Features

- UP to 1.25Gbps data rate
- Duplex LC receptacle optical
- interface compliant
- single +3.3V power supply
- DDM function implemented
- External calibration
- HOT-Pluggable
- Receiver loss of Signal O utput
- AC coupling of PECL signals
- Serial ID module on MOD(0-2)
- International Class 1 laser safety certified
- Transmitter disable input
- Operating temperature range -10℃～+70℃
- CWDM module Operating temperature range:0℃～+70℃
- RoHS Compliance

Application

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

Standards

- Compliant with SFP MSA (INF-8074i)
- Compliant with SFF-8472 v9.3
- Compliant with IEEE802.3z Gigabit Ethernet
- Compliant with ITU-T G.695
- Compliant with FC-PI v2.0

Absolute Maximum Ratings

Parameter	Symbol	Unit	Min	Max
Storage Temperature Range	Ts	℃	-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	Tc	oC	-10		70
Power Supply Voltage	Vcc	V	3.135	3.3	3.465
Data rate		Gb/s	-	1.25/1.0625	-

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

Parameter		Symbol	Unit	Min	Typ	Max	Notes	
Electrical Characteristics								
Supply Current	Tx Section	Icc	mA	-	-	300		1
	Rx Section							
Single Ended Data Input Swing			mV	150	-	1100		
Single Ended Data Output Swing			mV	300	-	600		
TX_fault /LOS output (TTL)		VOH	V	2.0	-	Vcc		
		VOL		0	-	0.8		
TX_disable input (TTL)		VOH	V	2.0	-	Vcc		
		VOL		0	-	0.8		
Optical transmitter Characteristics								
Launch Optical Power		Po	dBm	-9.5	-6	-3	550m 850nm VCSEL-LD	
				-9	-5	-3	10km 1310nm FP-LD	
				-9	-5	-3	20km 1310nm FP-LD	
				-5	-3	0	40km 1310nm FP-LD	
				-4	-1	+1	40km 1550nm DFB-LD	
				-2	0	+3	80km 1550nm DFB-LD	
				0	+1	+3	120km 1550nm DFB-LD	
Center Wavelength Range		λc	nm	830	850	860	VCSEL LD	
				1270	1310	1350	FP-LD	
				1290	1310	1330	DFB-LD	
				1530	1550	1570	DFB-LD	
				λ-6.5		λ+6.5	CWDM	2
Extinction Ratio		EX	dB	9				
Spectral Width		Δλ	nm			0.85	VCSEL LD	
						4	FP-LD	
						1	DFB-LD	
Side Mode Suppression Ratio		SMSR	dB	30			DFB-LD	
Contributed Total Jitter added at TP2		TJ	UI			0.284	3	
Relative Intensity Noise		RIN	dB/Hz			-120	4	
Eye Diagram		Complies with IEEE802.3z eye masks when filtered						
Dispersion Penalty			dB			1		

					2	CWDM	
Optical Rise/Fall Time	Trise/Tfall	ps			260	5	
Optical receiver Characteristics							
Receiver Sensitivity	S	dBm			-18	550m	6
					-23	1310nm 10km	
						1550nm 40km	
					-23	1310nm 40km	
						1550nm 80km	
					-24	CWDM 80km	
					-29	1550nm 120km	SUPER TIA
					-31	CWDM 120km	
Overload Input Optical Power	Pin	dBm	0			550m	
			-3			15km ~80km	
			-3			120km SUPER TIA	
LOS Optical Dessert				S			
LOS Optical Assert		-35				15km ~80km PIN	
		-45				120km APD	
LOS Hysteresis	dB	0.5	3	5		7	

Note:

1.The supply current includes SFP module's supply current and test board working current.

2.The CWDM transmitter center wavelengths "ë"are: 1471, 1491, 1511, 1531, 1551, 1571, 1591, 1611nm

3.TP refers to the compliance point specified in IEEE802.3z, section 38.2.1.

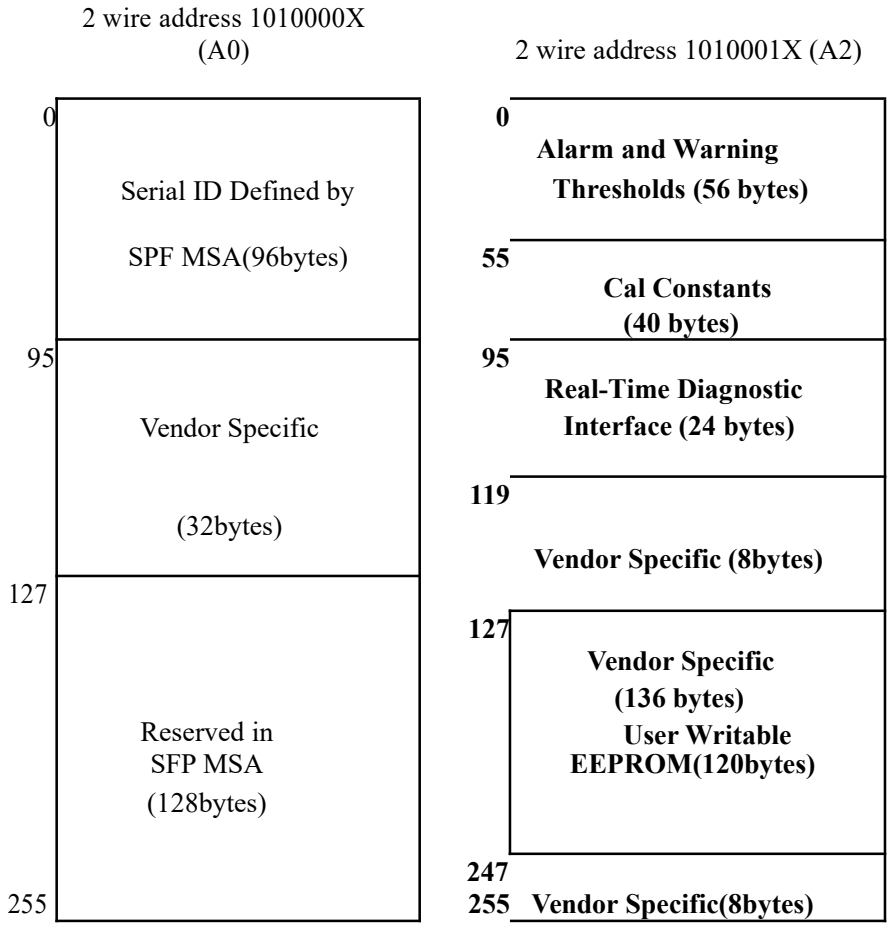
4. RIN is the laser noise, integrated over a specified bandwidth, measured relative to average optical power with 12dB return loss. For multimode application, the RIN is better than -117dB/Hz.

5.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

6.Measured with a PRBS 223-1 test pattern, @1.25Gb/s, EX=10dB, BER<10-12.

7.The LOS Hysteresis to minimize "chatter" on the output line. In principle, Hysteresis alone does not guarantee chatter-free operation

Digital Diagnostic Memory Map



EEPROM Serial ID Memory Contents

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

Data Address	Size(Bytes)	Name of Field	Contents(Hex)	Description
Base in Fields				
0	1	Identifiler	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		Transceiver Codes
11	1	Encoding	03	NRZ
12	1	BR , Nominal	0C	1.25Gbit/s
13	1	Reserved	00	
14	1	Length (9 μm) Km		Transceiver transmit distance
15	1	Length (9 μm) 100m		
16	1	Length (50μm) 10m		
17	1	Length (62.5μm) 10m		

18	1	Length (Copper)	00	Not compliant
19	1	Reserved	00	
20-35	16	Vendor name	4F 45 4D 20 20 20 20 20 20 20 20 20 20 20 20 20	“OEM”(ASCII)
36	1	Reserved	00	
37-39	3	Vendor OUI	02 1B AS	
40-55	16	Vendor PN		Transceiver part number
56-59	4	Vebdor rev	20 20 20 20	
60-61	2	Wavelength		Transceiver wavelength
62	1	Wavelength		Transceiver wavelength
63	1	CC_BASE	Check Sum (Variable)	Check code for Base ID Fields
Extended 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	42 30 30 39 38 32 32 20 20 20 20 20 20 20 20 20	serial Number of transceiver(ASCII) .Forexample “B009822”.
84-91	8	Date code	30 32 31 30 30 35 20 20	Manufactory date code.For example”021005”.
92	1	Diagnostic Monitoring Type	58	Digital diagnostic monitoring implemented, “externally calibrated” is implemented, RX
93	1	Enhanced Options	B0	Optional Alarm/Warning flags implemented for all monitored quantities,Optional Sof TX_FAULT monitoring implemented, Optional Soft RX_LOS monitoring implemented.
94	1	SFF_8472 Compliance	01	Includes functionality described in rev9.3 SFF_8472
95	1	CC_EXT	Check Sum (Variable)	Check sum for Extended ID Field .
Vendor Specific ID Fields				
96-127	32	Vendor Specific	Read only	Depends on customer information
128-255	128	Reserved	Read only	Filled by zero

Diagnostic Monitor Functions

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

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	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	2×IBias(25℃)+20
18-19	2	Bias Low Alarm	25％×IBias(25℃)
20-21	2	Bias High Warning	2×IBias(25℃)+10
22-23	2	Bias Low Warning	50％×IBias(25℃)
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	Maximum input optical power
36-37	2	RX Power High Warning	Maximum input 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 mprecision floating-point numbers(various values at each device)
60-63	4	RX Power Calibration Data3	
64-67	4	RX Power Calibration Data2	Single mprecision floating-point numbers(various values at each device) Data0
68-71	4	RX Power Calibration Data1	
72-75	4	RX Power Calibration	
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 Data 0	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 a 16-bit A/D value (see Table 3.1)
98-99	2	Measured Vcc	
100-101	2	Measured Bias	
102-103	2	Measured TX Power	
104-105	2	Measured RX Power	
106-109	4	Reserved	
110	1	Logic Status	

111	1	AD Conversion Updates	See Table 3.2
112-119	8	Alarn and Warning Updates	See Table 3.3
Vendor Specific			
120-127	8	Vendor Specific	Don't Access
128-247	120	User writable EEPROM	
248-255	8	Vendor Specific	Don't Access

The measured values located at byes 96-105(in the 2wire address 0×A2)are A/D values(16-bit integers)of transceiver temperature,supply voltage,laser bias current,laseroptical output power and received power.

All the measured values are "Externally Calibrated,andthen it is necessary to convert raw A/D values to real world units by the manner as shown in following

Real Time Diagnostic Monitor Values

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

This transceiver implements two optional status bytes, "Logic States" at bute 110(0×A2)"and "A/D Updated"at byte 111(0×A2) as shown in Table 3.2 "A/D Updated" status bits allow the user to verify if an update form 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 0×00.Once a conversion is completed for a give value,its bit will change to '1'

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	Rwserved	et to 0
110	4	Rx Rate Select State	Not supported (set to 1).
110	3	Soft Rate Select Contorl	Not supported (set to 0).
110	2	Tx Fault	Optional digital State of the TX Fualt 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 ib Bytes 96/97 is valid
111	6	Vcc A/D Valid	Indicates A/D value ib Bytes 98/99 is valid
111	5	Laser Bias A/D Valid	Indicates A/D value ib Bytes 100/101 is valid.

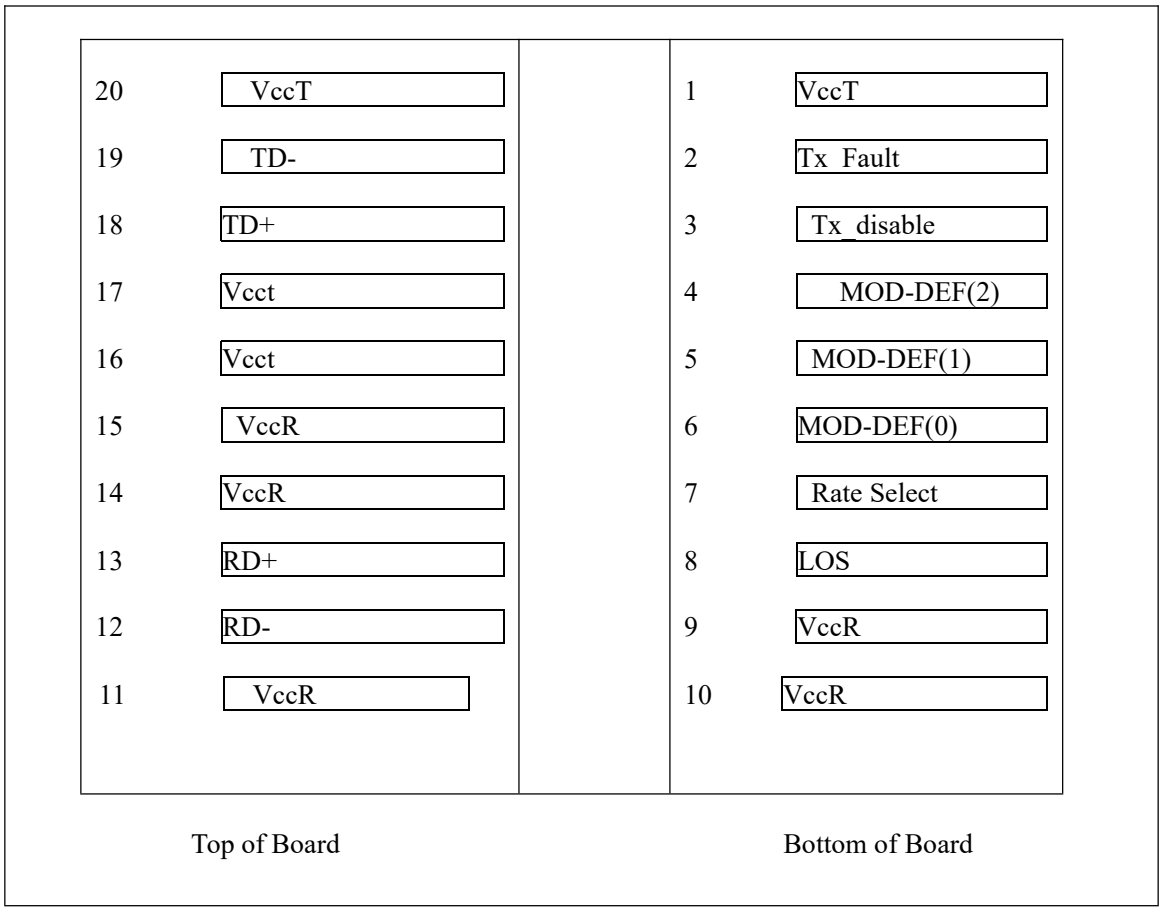
111	4	Tx Power A/D Valid	Indicates A/D value ib Bytes 102/103 is valid.
111	3	Rx Power A/D Valid	Indicates A/D value ib Bytes 104/105 is valid.
111	2	Reserved	Set to 0.
111	1	Reserved	Set to 0.
111	0	Reserved	Set to 0.

Each of the measure values has a corresponding high alarm,low alarm,high warning and low warning threshold levl at location 00-39(×0A2)writte as the dada format of a corresponding valued shown in Table 3.3.Alarm and warning flags at buyes 112-119(0×A2) 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 condition outside the guarateed operating specification of transceiver but not necessarily causes of immediate link failured.

A LARM AND Warning Flags

Byte	Bit(s)	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 A larm	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.

Pin Description



As Viewed Through Top of Board

Pin	Name	Function/Description	Engagement order notes
1	VeeT	Transmitter Ground	1
2	Tx Fault	Transmitter Fault Indication	3
3	Tx Disable	Transmitter Disable-Module disables on high or open	3
4	MOD-DEF2	Module Definition 2-Two wire serial ID interface	3
5	MOD-DEF1	Module Definition 1- Two wire serial ID interface	3
6	MOD-DEF0	Module Definition 0- Two wire serial ID interface	3
7	Rate Select	Not Connected	3
8	LOS	loss of Signal	3
9	VeeR	Receiver Ground	1
10	VeeR	Receiver Ground	1
11	Veer	Receiver Ground	1
12	RD-	Inverse Received Date out	3
13	RD+	Received Data out	3
14	VeeR	Receiver Ground	1
15	VccR	Receiver Power--+3.3V±5%	2
16	VccT	Transmitter Power---+3.3V±5%	2

17	VeeT	Transmitter Ground	1
18	TD+	Trabsmitter Data In	3
19	TD-	Inverse Transmitter Data In	3
20	VeeT	Transmitter Ground	

Note:

1. TX Fault is open collector/drain output which should be pulled up externally with a 4.7K – 10K Ωresistor on the host board to supply <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.

2. TX Disable input is used to shut down the laser output per the state 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

3. Mod-Def 0, 1, 2. These are the module definition pins. They should be pilled 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.

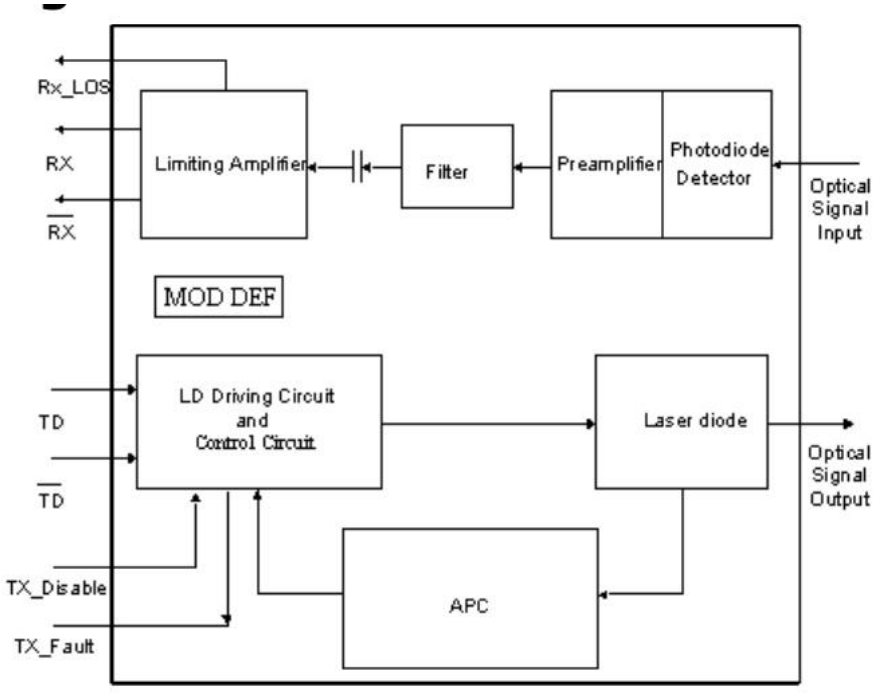
4. LOS (Loss of signal) is an open collector/drain output which should be pulled up externally with a 4.7-10K resistor on the host board to supply <VccT+0.3V or VccR+0.3V. When high, this output indicates the received optical power is below the worst case receiver sensitivity (as defined by the standard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

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

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.

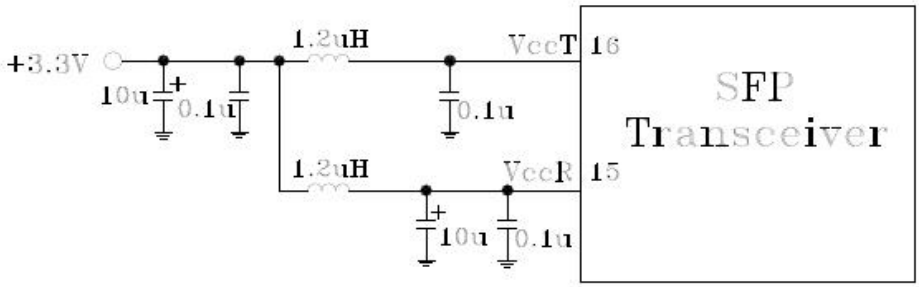
7. TD-/+: These are the differential transmitter inputs. They are AC coupled differential lines with 100Ω differential termination inside the module. The AC coupling is done inside the module and thus not required on host bpard.

Block Diagram

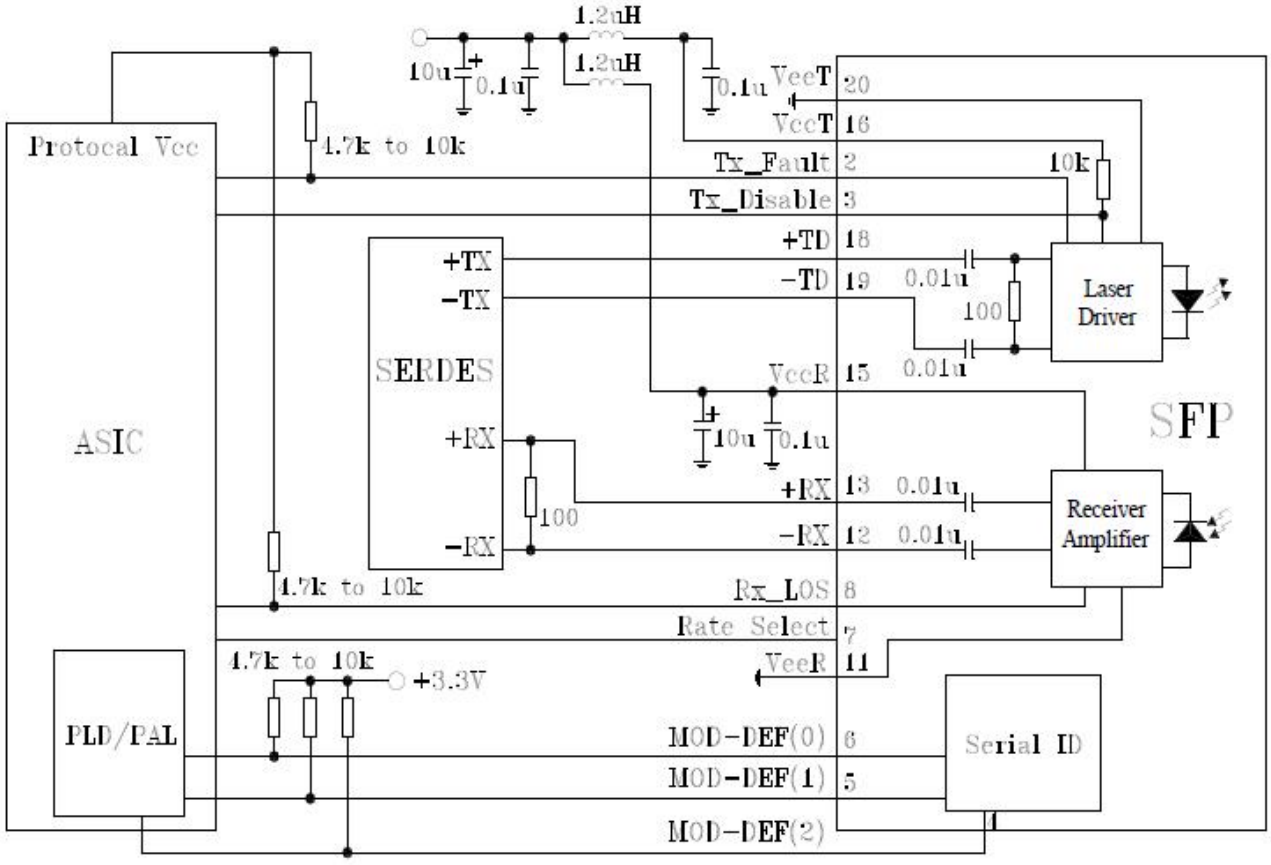


Required Host Board Components

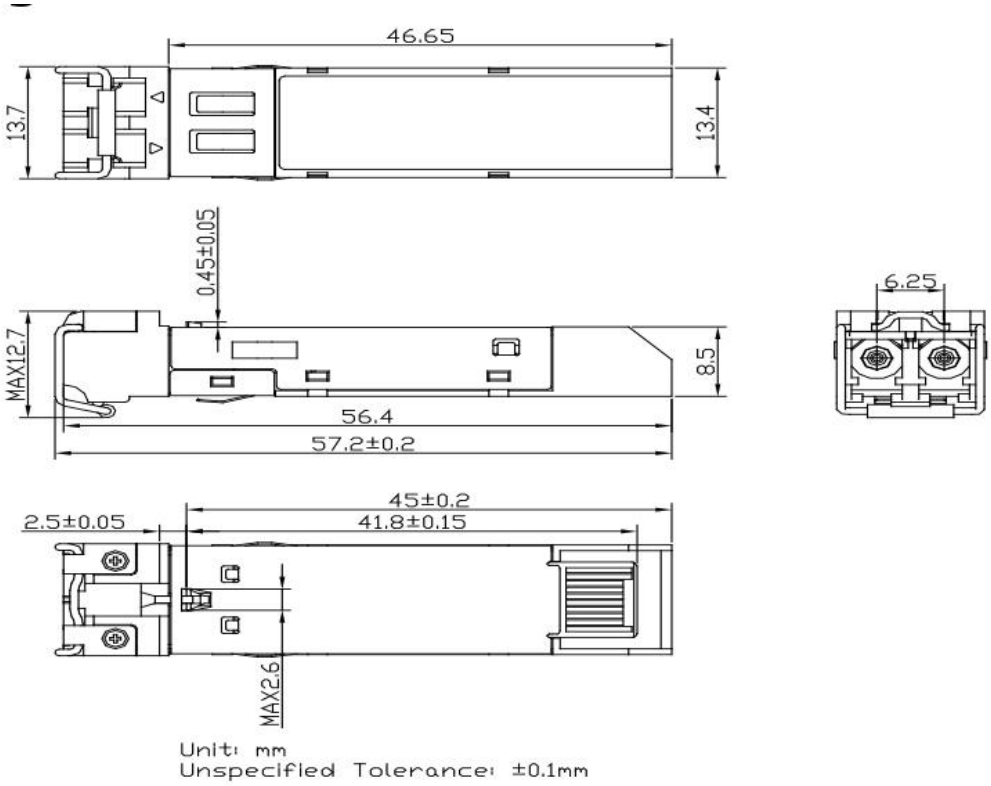
The MSA power supply noise rejection filter is required on the host PCB to meet data sheet performance.The MSA filter incorporates an inductor which should be rated 400mADC and 1 Ω serial resistance or better.It should not be replaced with a ferrite.The required filter is illustrated in Figure 3.The MSA also specifies that 4.7K to 10K Ω pull-up resistors for TX_FAULT,LOS,and MOD_DEF0,1,2 are requited on zhe host PCB.Figure is the suggested transcelver/host interface



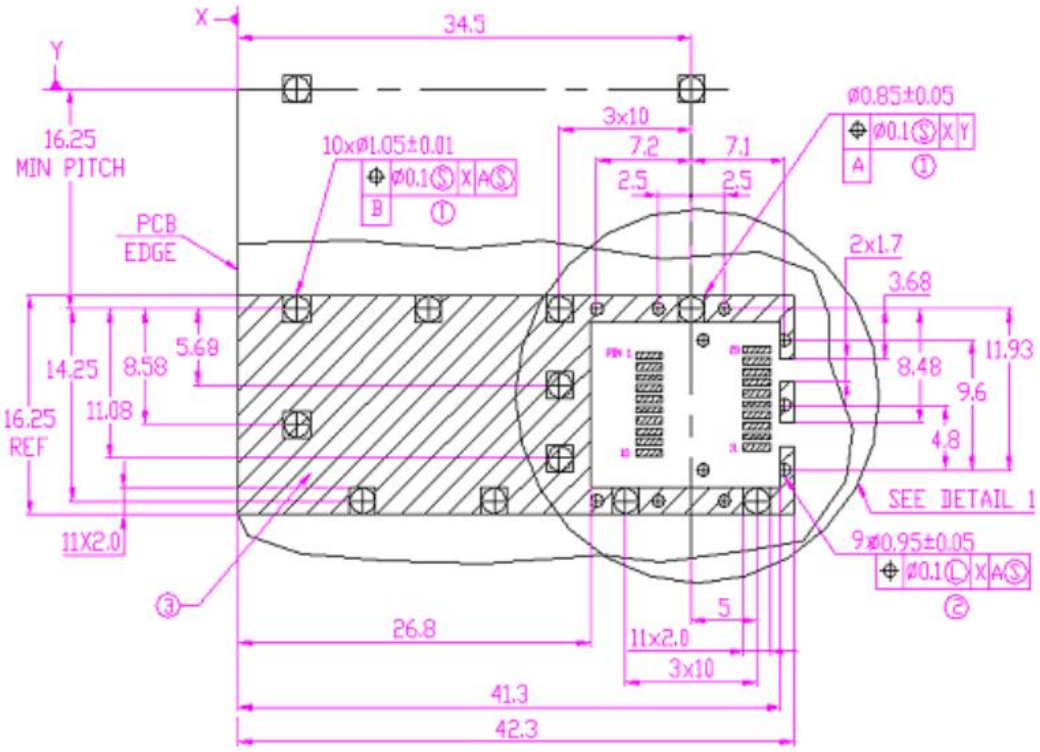
Typical Application Circuit

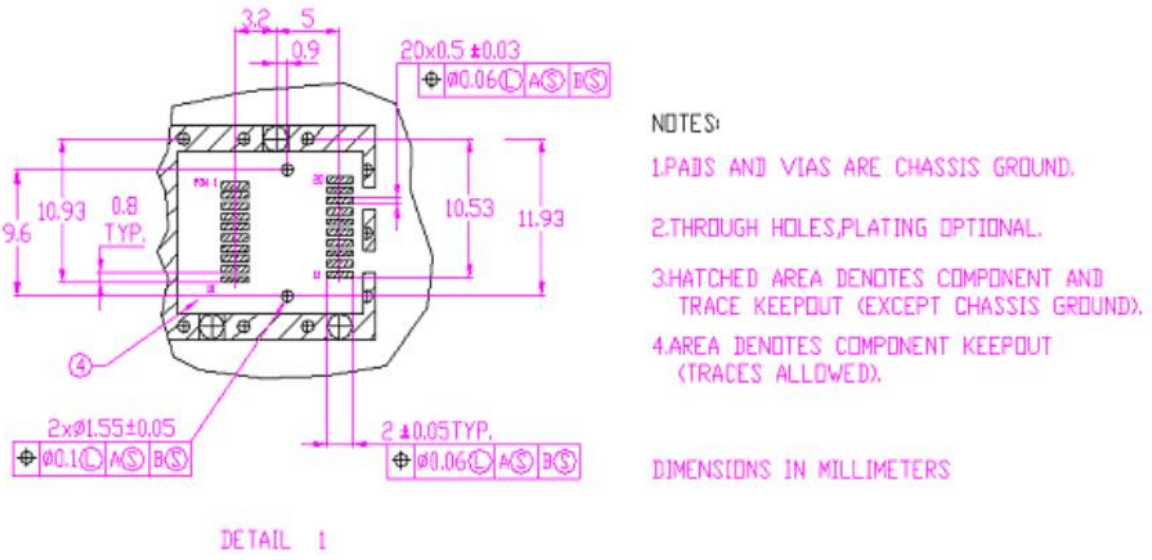


Package Outline



PCB Laout Recommendation





Regulatory Compliance

Feature	Test Method	Performance
Electrostatic Discharge(ESD) to the Electrical Pins	MIL-STD-883E Method 3015.7	Class1(>1.5kV) - Human Body Model
Electrostatic Discharge (ESD) Immunity	IEC61000-4-2	Class2(>4.0kV)
Electromagnetic Interference(EMI)	CISPT22 ITE Class B FCC Class B CENELEC EN55022 VCCI Class1	Compliant with standard
Immunity	IEC61000-4-3 Class 2	Typically show no measutable effect from a 3V/m field swept from 80 to 1000MHz applied to the transceiver without a chassis enclosure
Safety		FDA 0322110-00 CDRH 21-CFR 1040 Class 1
		UL E239070
		TUV-GS B0501 54481 001
		CE E8 0501 54481 004