155M Spring-Latch SFP BiDi Transceiver

With DDM Function

(For 80～120km transmission)

- Compatible with IEEE 802.3z
- Compatible with ANSI specifications for Fibre Channel
- Compatible with Telcordia GR-468-CORE
- Compatible with FCC 47 CFR Part 15, Class B
- Compatible with FDA 21 CFR 1040.10 and 1040.11, Class I
- RoHS compliance (Optional)

Features

- Dual data-rate of 125Mbps/155Mbps operation
- 1490/1550nm DFB laser and 1550/1490nm PIN photo detector
- 80 km~120 km transmission with SMF
- Monitoring Interface Compliant with SFF-8472
- Standard serial ID information compatible with SFP MSA
- SFP MSA package with BiDi LC connector
- With Spring-Latch for high density application
- Very low EMI and excellent ESD protection
- +3.3V single power supply
- Operating case temperature:
  Standard:0 to +70°C
  Industrial: -40 to +85°C

Applications

- Router/Server interface
- Switch to Switch interface
- Switched backplane applications
- Other optical transmission systems

Standard

- Compatible with SFP MSA

Description

The SFP transceiver is high performance, cost effective module supporting dual data-rate of 125Mbps/155Mbps and from 80 km to 120 km transmission distance with SMF.

The transceiver consists of two sections: The transmitter section incorporates a 1490nm DFB laser or 1550nm DFB laser. And the receiver section consists of a PIN photodiode integrated with a TIA. All modules satisfy class I laser safety requirements.

The optical output can be disabled by a TTL logic high-level input of Tx Disable. Tx Fault is provided to indicate that degradation of the laser. Loss of signal(LOS) output is provided to indicate the loss of an input optical signal of receiver.

The standard serial ID information compatible with SFP MSA describes the transceiver's capabilities,standard interfaces, manufacturer and other information. The host equipment can access this information via the 2-wire serial CMOS EEPROM protocol. For further information, please refer to SFP MSA.

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Absolute Maximum Ratings

Table 1 - Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Storage Temperature	Tstg	-50	+105	ºC
Relative Humidity -Storage	RHS	0	95	%
Relative Humidity -Operating	RHO	0	85	%
DC Supply Voltage	VCC	0	3.6	V
Tx DATA	Vin	0	VCC + 0.5	V
Optical and Electrical Signal Absolute Maximum Ratings				
Signal / Data Input Voltage (Tx_DATA)	VIN PK-PK	-	2.4	V
Rx Optical Input Power	PIN-MAX		3	dBm
Logic State Absolute Maximum Ratings				
Tx_DISABLE Logic HIGH State	Tx_DIS	-	VCC+0.5	V
Tx_FAULT Logic HIGH State	Tx_FAULT	-	VCC+0.5	V
Rx_LOS Logic HIGH State	Rx_LOS	-	VCC+0.5	V

Note:Exceeding these ratings may cause irreversible damage to the device.

Recommended Operating Conditions

Table 2- Recommended Operating Conditions

Parameter		Symbol	Min.	Typical	Max.	Unit
Operating Temperature	Standard	TC	0		+70	°C
	Industrial		-40		+85	
Power Supply Voltage		VCC	3.13		3.47	V
Power Supply Current		Icc		200	300	mA
Date Rate	SONET/SDH			155		Mbps
	Fast Ethernet			125		

Digital Diagnostic Monitor Characteristics

Parameter	Min.	Unit
Tx Output Power Accuracy	±3.0	dBm
Rx Input Power Accuracy	±3.0	dBm
Laser Bias Current Accuracy	±1 0	%
Transceiver Internal Temperature Accuracy	±3.0	°C
Transceiver Internal Supply Voltage Accuracy	±0.1	V

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(1490nm DFB Tx/1550nm Rx and 1550nm DFB Tx/1490nm Rx PIN, 80~120km)

Table 3 - Optical and Electrical Characteristics

Parameter		Symbol	Min.	Typical	Max.	Unit	Notes
Transmitter							
Centre Wavelength		λc	1470	1490	1510	nm	
			1530	1550	1570		
Average Output Power	80km	Po(1490 DFBTx)	-8		-3	dBm	1
		Po(1550 DFBTx)	-8		-3		
	100km	Po(1490 DFBTx)	-5		0		
		Po(1550 DFBTx)	-5		0		
	120km	Po(1490 DFBTx)	-2		+3		
		Po(1550 DFBTx)	-2		+3		
POut@TX Disable Asserted		POut			-45	dBm	1
Spectral Width	σ	DFB@-20dB FWHM			1	nm	
Extinction Ratio		EX	9			dB	
Rise/Fall Time (20%～80%)		tr/tf		1	3	ns	2
Total Jitter	155M	TJ			2	UI	3
Output Optical Eye		IEEE 802.3z and ANSI Fibre Channel Compatible					4
Data Input Swing Differential		VIN	500		2400	mV	5
Input Differential Impedance		ZIN	90	100	110	Ω	
TX Disable	Disable		2.0		Vcc	V	
	Enable		0		0.8	V	
TX Fault	Fault		2.0		Vcc+0.3	V	
	Normal		0		0.8	V	
Receiver							
Centre Wavelength		λc	1530	1550	1570	nm	
			1470	1490	1510		
Receiver Sensitivity	80/100km	Sen			-34	dBm	6
	120km				-36		
Receiver Overload			-3			dBm	6
Return Loss			12			dB	
LOS De-Assert		LOSD			Sen	dBm	
LOS Assert		LOSA	-45			dBm	
LOS Hysteresis			0.5		5	dB	
DataOutput Swing Differential		VOUT	370		2000	mV	5
LOS	High		2.0		Vcc+0.3	V	
	Low		0		0.8	V	

Notes:

1. The optical power is launched into SMF.
2. Unfiltered, measured with a PRBS 2^7-1 test pattern @155Mbps
3. Meet the specified maximum output jitter requirements if the specified maximum input jitter is present.

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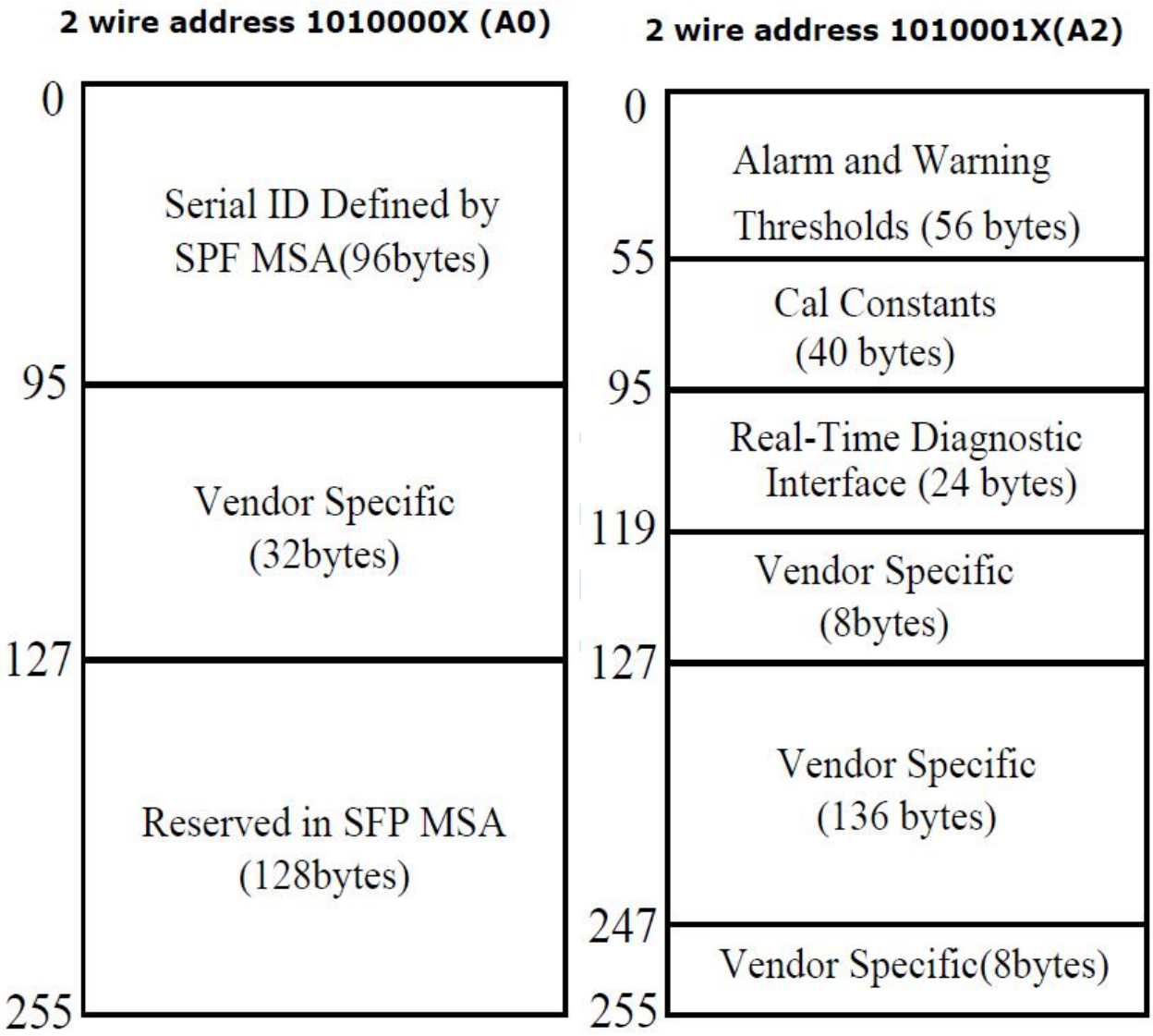
4. Measured with a PRBS 2^7-1 test pattern @155Mbps/125Mbps.
5. LVPECL logic, internally AC coupled.
6. Measured with a PRBS 2^7-1 test pattern @155Mbps, worst-case extinction ratio, BER ≤1×10^(-12).

Digital Diagnostic Memory Map



EEPROM Information

The SFP SMA defines a 256-byte memory map in EEPROM describing the transceiver's capabilities, standard interfaces, manufacturer, and other information, which is accessible over a 2 wire serial interface at the 8-bit address 1010000X (A0h). The memory contents refer to Table 6

Table 6 - EEPROM Serial ID Memory Contents (A0h)

Addr.	Field Size (Bytes)	Name of Field	Hex	Description
0	1	Identifier	03	SFP
1	1	Ext. Identifier	04	MOD4
2	1	Connector	07	LC
3—10	8	Transceiver	00 00 00 02 12 00 01 01	Transmitter Code
11	1	Encoding	01	8B10B
12	1	BR, nominal	02	155Mbps
13	1	Reserved	00	
14	1	Length (9um)-km	50 /64/78	80/100/120km
15	1	Length (9um)	FF	80/100/120km
16	1	Length (50um)	00	
17	1	Length (62.5um)	00	
18	1	Length (copper)	00	
19	1	Reserved	00	
20—35	16	Vendor name	4E 4F 41 48 20 20 20 20 20 20 20 20 20 20 20 20	“NOAH “(ASCⅡ)
36	1	Reserved	00	
37—39	3	Vendor OUI	00 00 00	
40—55	16	Vendor PN	4E 53 37 33 32 33 38 37 2D 44 86 20 20 20 20 20	“NS732387-DV ” (ASCⅡ)
56—59	4	Vendor rev	xx xx xx xx	ASCⅡ(“31 30 20 20” means 1.0 revision)
60-61	2	Wavelength	06 0E	1550nm
62	1	Reserved	00	
63	1	CC BASE	xx	Check sum of bytes 0 - 62
64—65	2	Options	00 1A	LOS, TX_FAULT and TX_DISABLE
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	ASCⅡ
84—91	8	Vendor date code	xx xx xx xx xx xx 20 20	Year(2 bytes), Month(2 bytes), Day (2 bytes)
92	1	Digital 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		SFF_8472 Compliance		
95		CC_EXT		
96-127		Vendor specifi		
128-255		Reserved		

Note: The “xx” byte should be filled in according to practical case. For more information, please refer to the related document of SFP Multi-Source Agreement (MSA).

Diagnostic Monitor Functions

Diagnostic Monitor Functions interface uses the 2 wire address 1010001X(A2). Memory contents of Diagnostic Monitor Functions are shown in Table 7

Table 7 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 -10 ℃
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	Minimum input optical power
36-37	2	RX Power High Warning	Maximum input power minus 3dB

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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
60-63	4	RX Power Calibration Data3	(various values at each device)
64-67	4	RX Power Calibration Data2	Single precision floating-point (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 a 16-bit A/D value (see Table 8)
98-99	2	Measured Vcc	Yield a 16-bit A/D value (see Table 8)
100-101	2	Measured Bias	Yield a 16-bit A/D value (see Table 8)
102-103	2	Measured TX Power	Yield a 16-bit A/D value (see Table 8)
104-105	2	Measured RX Power	Yield a 16-bit A/D value (see Table 8)
106-109	4	Reserved	
110	1	Logic Status	See Table9
111	1	AD Conversion Updates	See Table 9
112-119	8	Alarm and Warning Flags	See Table 10
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 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 8.

Table 8 Real Time Diagnostic Monitor Values

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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. Compliant with External Calibration of SFF-8472.
99	Vcc LSB	
100	Laser Bias MSB	Measured Laser bias current. Compliant with External Calibration of SFF-8472.
101	Laser Bias LSB	
102	Tx Power MSB	Measured Tx power. Compliant with External Calibration of SFF-8472.
103	Tx Power LSB	
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 byte 110(0xA2)” and “A/D Updated” at byte 111(0xA2) as shown in Table 9. “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 9 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 Table10.Alarm and warning flags at bytes 112-119(0xA2) are defined as follows.

(1) Alarm flags indicate conditions likely to result (or have resulted) in link failure and cause for

immediate action.

(2) Warning flags indicate conditions outside the guaranteed operating specification of transceiver but not necessarily causes of immediate link failures.

Table 10 Alarm 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 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.

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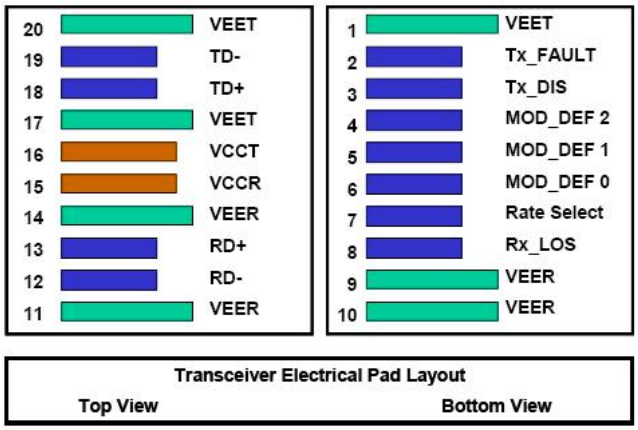
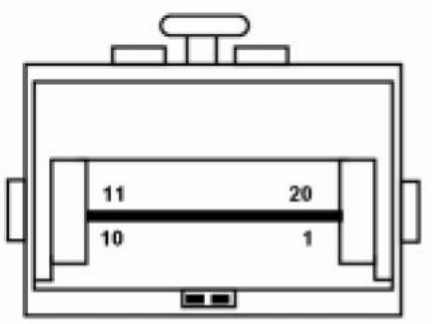
117	7	Rx Power High warning	Set when Rx power monitor value exceeds high warning level
117	6	Rx Power Low warning	Set when Rx power monitor value exceeds low warning level
117	5-0	Reserved	All bits set to 0.
118	7-0	Reserved	All bits set to 0.
119	7-0	Reserved	All bits set to 0.

Pin Description



Transceiver Electrical Pad Layout



Transceiver Pin Locations

Pin	Name	Function/Description	Plug Seq.	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	

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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 an open collector output, which should be pulled up with a 4.7k~10kΩ resistor on the host board to a voltage between 2.0V and Vcc+0.3V. Logic 0 indicates normal operation; logic 1 indicates a laser fault of some kind. In the low state, the output will be pulled to less than 0.8V.
2. TX Disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7k~10kΩ resistor. Its states are:
   Low (0~0.8V): Transmitter on
   (>0.8V, <2.0V): Undefined
   High (2.0~3.465V): Transmitter Disabled
   Open: Transmitter Disabled
3. MOD-DEF 0,1,2 are the module definition pins. They should be pulled up with a 4.7k~10kΩ resistor on the host board. The pull-up voltage shall be VccT or VccR.
   MOD-DEF 0 is grounded by the module to indicate that the module is present
   MOD-DEF 1 is the clock line of two wire serial interface for serial ID
   MOD-DEF 2 is the data line of two wire serial interface for serial ID
4. LOS is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor on the host board to a voltage between 2.0V and Vcc+0.3V. Logic 0 indicates normal operation; logic 1 indicates loss of signal.In the low state, the output will be pulled to less than 0.8V.
5. These are the differential receiver output. They are internally AC-coupled 100Ω differential lines which should be terminated with 100Ω (differential) at the user SERDES.
6. These are the differential transmitter inputs. They are AC-coupled, differential lines with 100Ω differential termination inside the module.

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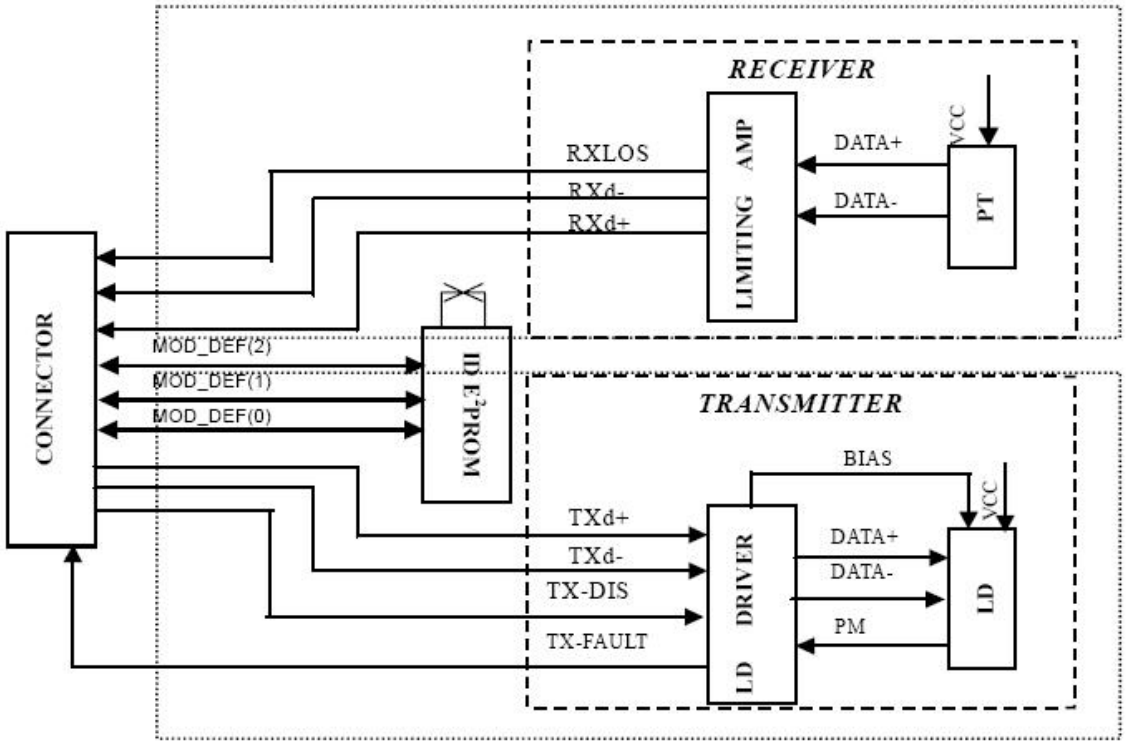
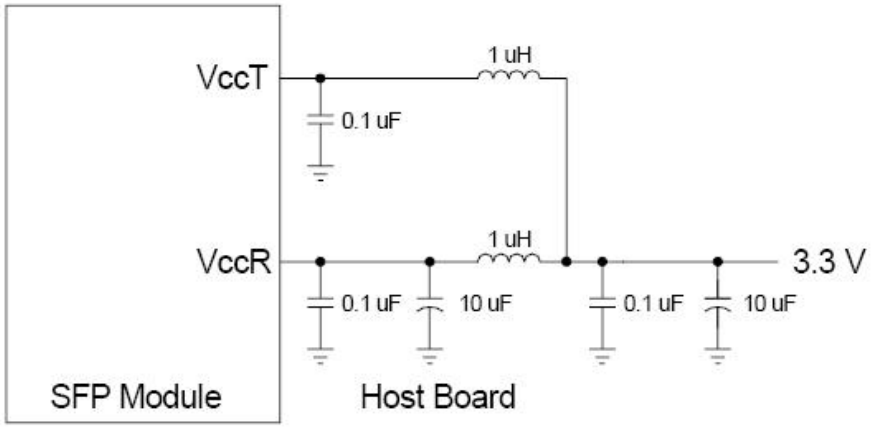
Block Diagram



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 1Ωserial 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 10KΩ pull-up resistors for TX_FAULT, LOS, and MOD_DEF0,1,2 are required on the host PCB. Figure is the suggested transceiver/host interface.



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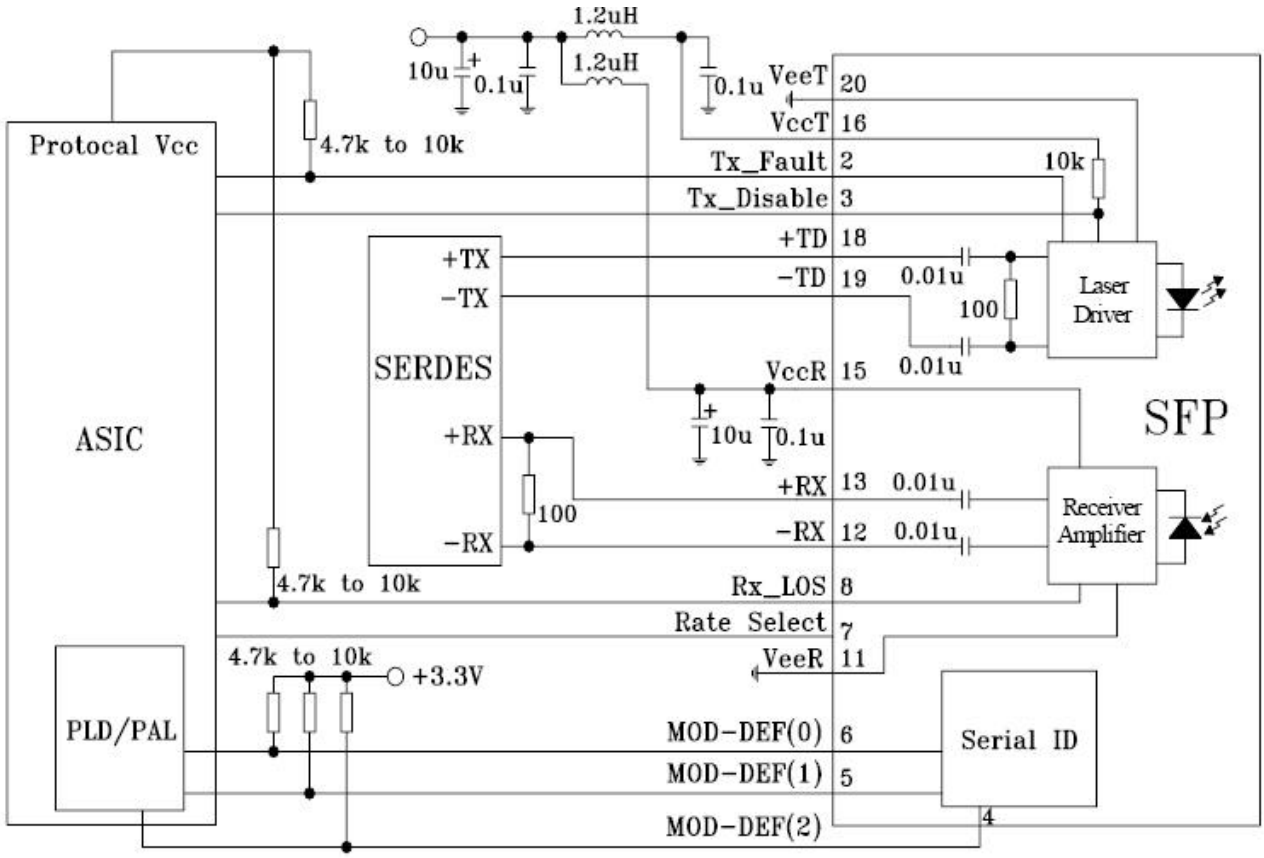
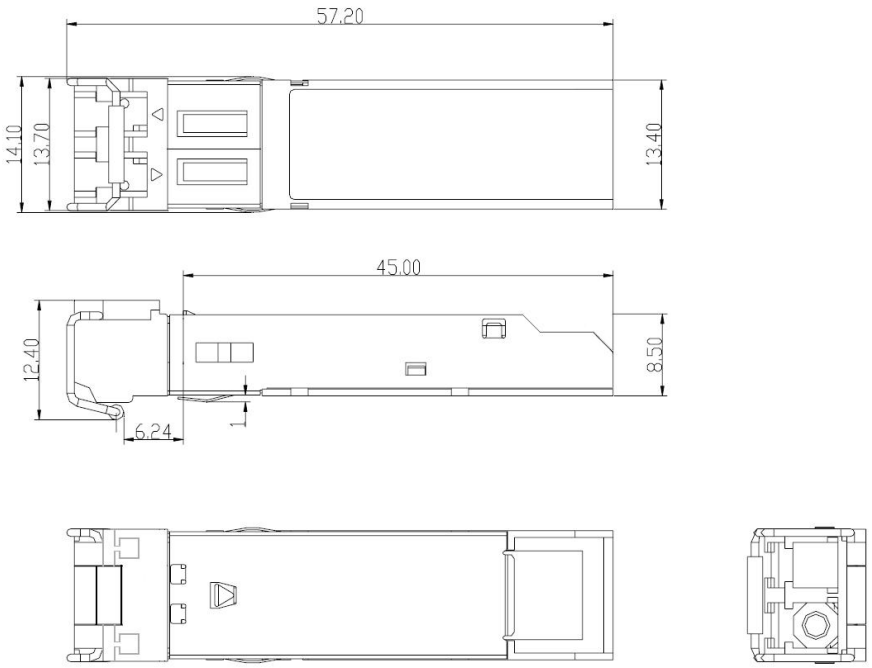
Typical Application Circuit



Dimensions

Dimensions are in millimeters. All dimensions are ±0.1mm unless otherwise specified. (unit:mm).



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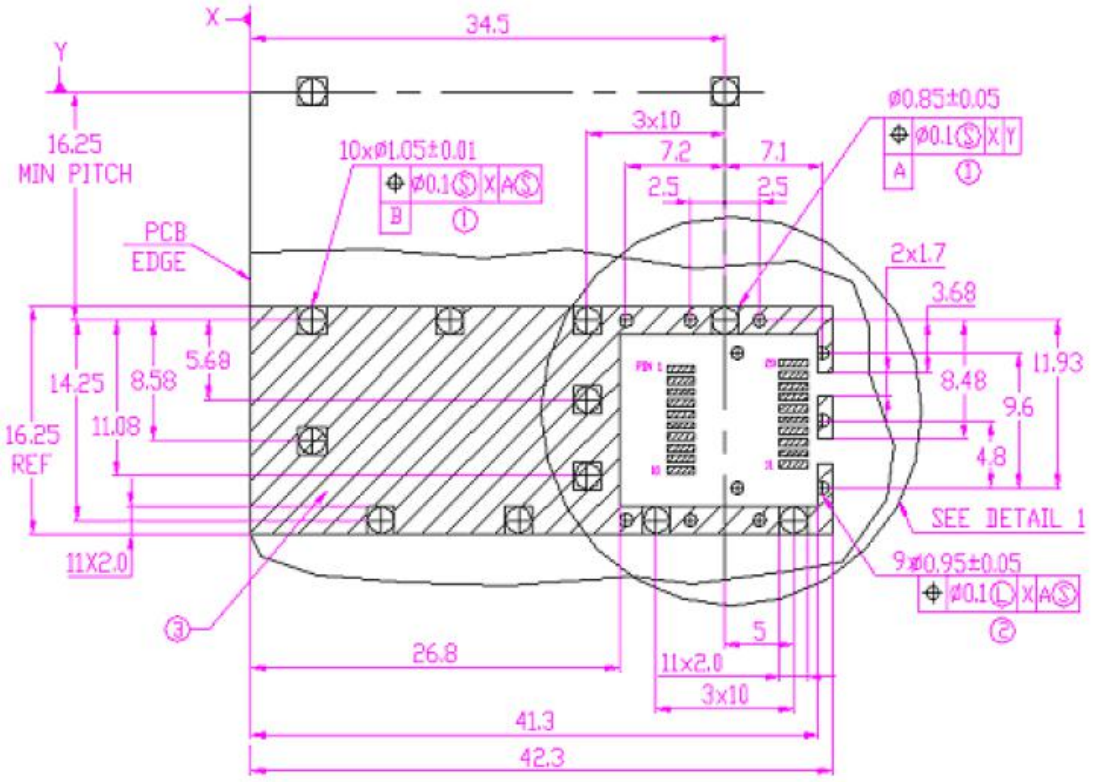
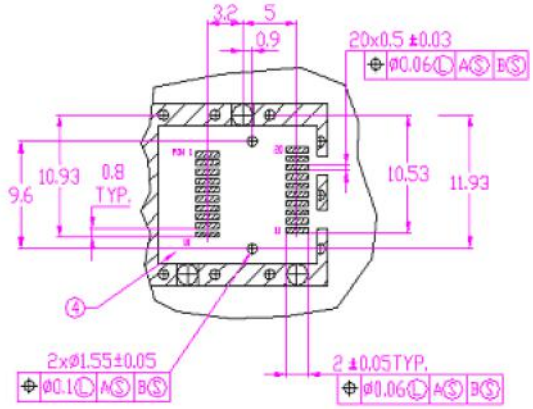
PCB layout Recommendation





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

Corporate Headquarters

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Ordering Information

Part No.	Tx Wavelength（nm）	TX Power (dBm)	RX Sens(Max.) (dBm)	Distance
NS(R)732387-DS	Tx 1490 DFB/Rx 1550	-8~-3	-34	80km
NS(R)732387-DV	Tx1550 DFB/RX 1310	-8~-3	-34	80km
NS(R)732397-DS	Tx 1490 DFB/Rx 1550	-5~0	-34	100km
NS(R)732397-DV	Tx1550 DFB/RX 1310	-5~-3	-34	100km
NS(R)7323A7-DS	Tx 1490 DFB/Rx 1550	-2~+3	-36	120km
NS(R)7323A7-DV	Tx1550 DFB/RX 1310	-2~+3	-36	120km

NOTICE:This document contains preliminary information on product but not yet fully characterized. Wuhan Noah Science & Tech Co., Ltd. reserves the right to change the specification in any manner without notice.

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