

# Cleerline 1.25 Gbps Bi-Directional SFPs

1310/1550nm, 20km Reach, w/DDM



Bi-directional (BiDi) SFP transceivers are high performance, cost effective modules supporting dual data-rates of 1.25Gbps/1.0625Gbps and 20km transmission distance with SMF. These SFPs use Wavelength Division (WDM) technology, mixing two wavelengths simultaneously.

These modules each accept 1 LC connector.

In order to function correctly, these SFPs must be used as a pair: SSF-SFP-SM1GBDA matched with SSF-SFP-SM1GBDB.

The SSF-SFP-SM1GBDA consists of three sections: a FP laser transmitter, a PIN photodiode integrated with a trans-impedance preamplifier (TIA) and MCU control unit.

The SSF-SFP-SM1GBDB transceiver consists of three sections: a DFB laser transmitter, a PIN photodiode integrated with a trans-impedance preamplifier (TIA) and MCU control unit.

All modules satisfy class I laser safety requirements.

The transceivers are compatible with SFP Multi-Source Agreement (MSA) and SFF-8472. For further information, please refer to SFP MSA.



## Features

- Dual data-rate of 1.25Gbps/1.063Gbps operation
- SSF-SFP-SM1GBDA: 1310nm FP laser and PIN photo-detector for 20km transmission
- SSF-SFP-SM1GBDB: 1550nm DFB laser and PIN photo-detector for 20km transmission
- Compliant with SFP MSA and SFF-8472 with simplex LC receptacle
- Digital Diagnostic Monitoring:
- Internal Calibration or External Calibration
- Compatible with SONET OC-24-LR-1
- Compatible with RoHS
- +3.3V single power supply
- Operating case temperature:
- Standard : 0 to +70°C

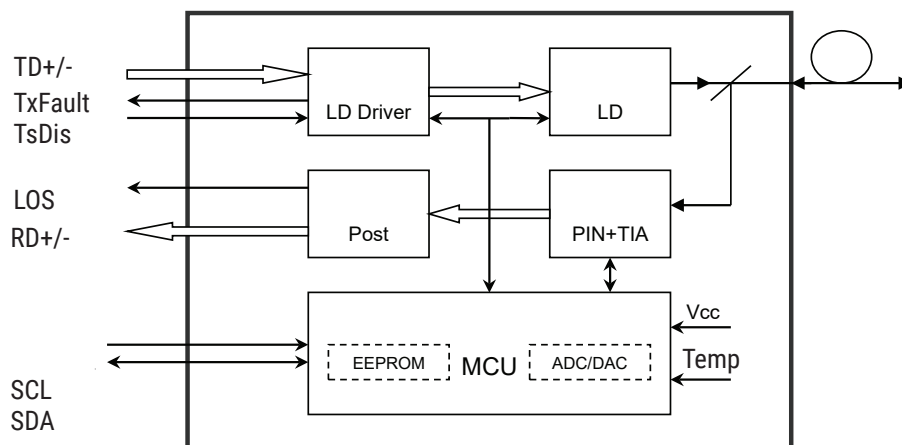
## Applications

- Gigabit Ethernet
- Fiber Channel
- Switch to Switch interface
- Switched backplane applications
- Router/Server interface
- Other optical transmission system

PART NUMBER	DESCRIPTION
SSF-SFP-SM1GBDA	1.25G SFP transceiver BiDi T:1310/R:1550nm, 20Km max reach, w/DDM
SSF-SFP-SM1GBDB	1.25G SFP transceiver BiDi T:1550/R:1310nm, 20Km max reach, w/DDM

## General Specifications

	SSF-SFP-SM1GBDA	SSF-SFP-SM1GBDB
Form factor	SFP	SFP
Optical connector	Single LC	Single LC
Operating distance	20Km	20Km
Compliance	MSA SFF-8431, RoHS	MSA SFF-8431, RoHS
Operating mode	Bi-Directional	Bi-Directional
Fiber type	Single-mode 9/125um, single strand	Single-mode 9/125um, single strand
Wavelength	Tx:1310nm/Rx:1550nm	Tx:1550nm/Rx:1310nm
Digital Diagnostic	Yes (SFF-8472 compliant)	Yes (SFF-8472 compliant)
Min Output (dBm)	-8	-8
Sensitivity (dBm)	-23	-23
Power Budget (dB)	15	15



## Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN	MAX	UNIT
Supply Voltage	Vcc	-0.5	4.5	V
Storage Temperature	Ts	-40	+85	°C
Operating Humidity	-	5	85	%

## Recommended Operating Conditions

PARAMETER	SYMBOL	MIN	TYPICAL	MAX	UNIT
Operating Case Temperature	Tc	0		+70	°C
Power Supply Voltage	Vcc	3.13	3.3	3.47	V
Power Supply Current	Icc			300	mA
Data Rate			1.25		Mbps
			1.063		Gbps

## Optical and Electrical Characteristics

### SSF-SFP-SM1GBDA: (FP and PIN, 1310nm, 20km Reach)

**Table 3 - Optical and Electrical Characteristics**

PARAMETER	SYMBOL	MIN	TYPICAL	MAX	UNIT	NOTES
<b>TRANSMITTER</b>						
Centre Wavelength	$\lambda_c$	1260	1310	1360	nm	
Spectral Width (RMS)	$\Delta\lambda$			4	nm	
Average Output Power	P <sub>out</sub>	-9		-3	dBm	1
Extinction Ratio	ER	9			dB	
Optical Rise/Fall Time (20%~80%)	tr/tf			0.26	ns	
Data Input Swing Differential	V <sub>IN</sub>	400		1800	mV	2
Input Differential Impedance	Z <sub>IN</sub>	90	100	110	$\Omega$	
TX Disable	Disable	2.0		V <sub>cc</sub>	V	
	Enable	0		0.8	V	
TX Fault	Fault	2.0		V <sub>cc</sub>	V	
	Normal	0		0.8	V	
<b>RECEIVER</b>						
Centre Wavelength	$\lambda_c$	1480		1580	nm	
Receiver Sensitivity				-23	dBm	3
Receiver Overload		-3			dBm	3
LOS De-Assert	LOS <sub>D</sub>			-24	dBm	
LOS Assert	LOS <sub>A</sub>	-35			dBm	
LOS Hysteresis		1		4	dB	
Data Output Swing Differential	V <sub>out</sub>	400		1800	mV	4
LOS	High	2.0		V <sub>cc</sub>	V	
	Low			0.8	V	

**Notes:**

1. The optical power is launched into SMF.
2. PECL input, internally AC-coupled and terminated.
3. Measured with a PRBS 2<sup>7</sup>-1 test pattern @1250Mbps, BER  $\leq 1 \times 10^{-12}$ .
4. Internally AC-coupled.

## Optical and Electrical Characteristics

### SSF-SFP-SM1GBDB: (DFP and PIN, 20km Reach)

Table 3A - Optical and Electrical Characteristics

PARAMETER	SYMBOL	MIN	TYPICAL	MAX	UNIT	NOTES
<b>TRANSMITTER</b>						
Centre Wavelength	$\lambda_c$	1530	1550	1570	nm	
Spectral Width (-20dB)	$\Delta\lambda$			1	nm	
Side Mode Suppression Ratio	SMSR	30			dB	
Average Output Power	P <sub>out</sub>	-9		-3	dBm	1
Extinction Ratio	ER	9			dB	
Optical Rise/Fall Time (20%~80%)	tr/tf			0.26	ns	
Data Input Swing Differential	V <sub>IN</sub>	400		1800	mV	2
Input Differential Impedance	Z <sub>IN</sub>	90	100	110	$\Omega$	
TX Disable	Disable		2.0	V <sub>cc</sub>	V	
	Enable		0	0.8	V	
TX Fault	Fault		2.0	V <sub>cc</sub>	V	
	Normal		0	0.8	V	
<b>RECEIVER</b>						
Centre Wavelength	$\lambda_c$	1260		1360	nm	
Receiver Sensitivity				-23	dBm	3
Receiver Overload		-3			dBm	3
LOS De-Assert	LOS <sub>D</sub>			-24	dBm	
LOS Assert	LOS <sub>A</sub>	-35			dBm	
LOS Hysteresis		1		4	dB	
Data Output Swing Differential	V <sub>out</sub>	400		1800	mV	4
LOS	High	2.0		V <sub>cc</sub>	V	
	Low			0.8	V	

**Notes:**

1. The optical power is launched into SMF.
2. PECL input, internally AC-coupled and terminated.
3. Measured with a PRBS 2<sup>7</sup>-1 test pattern @1250Mbps, BER  $\leq 1 \times 10^{-12}$ .
4. Internally AC-coupled.

## Timing and Electrical

**Table 4 - Timing and Electrical**

PARAMETER	SYMBOL	MIN	TYPICAL	MAX	UNIT
Tx Disable Negate Time	t_on			1	ms
Tx Disable Assert Time	t_off			10	µs
Time To Initialize, including Reset of Tx Fault	t_init			300	ms
Tx Fault Assert Time	t_fault			100	µs
Tx Disable To Reset	t_reset	10			µs
LOS Assert Time	t_loss_on			100	µs
LOS De-assert Time	t_loss_off			100	µs
Serial ID Clock Rate	f_serial_clock			400	KHz
MOD_DEF (0:2)-High	V <sub>H</sub>	2		V <sub>cc</sub>	V
MOD_DEF (0:2)-Low	V <sub>L</sub>			0.8	V

## Diagnostics

**Table 5 – Diagnostics Specification**

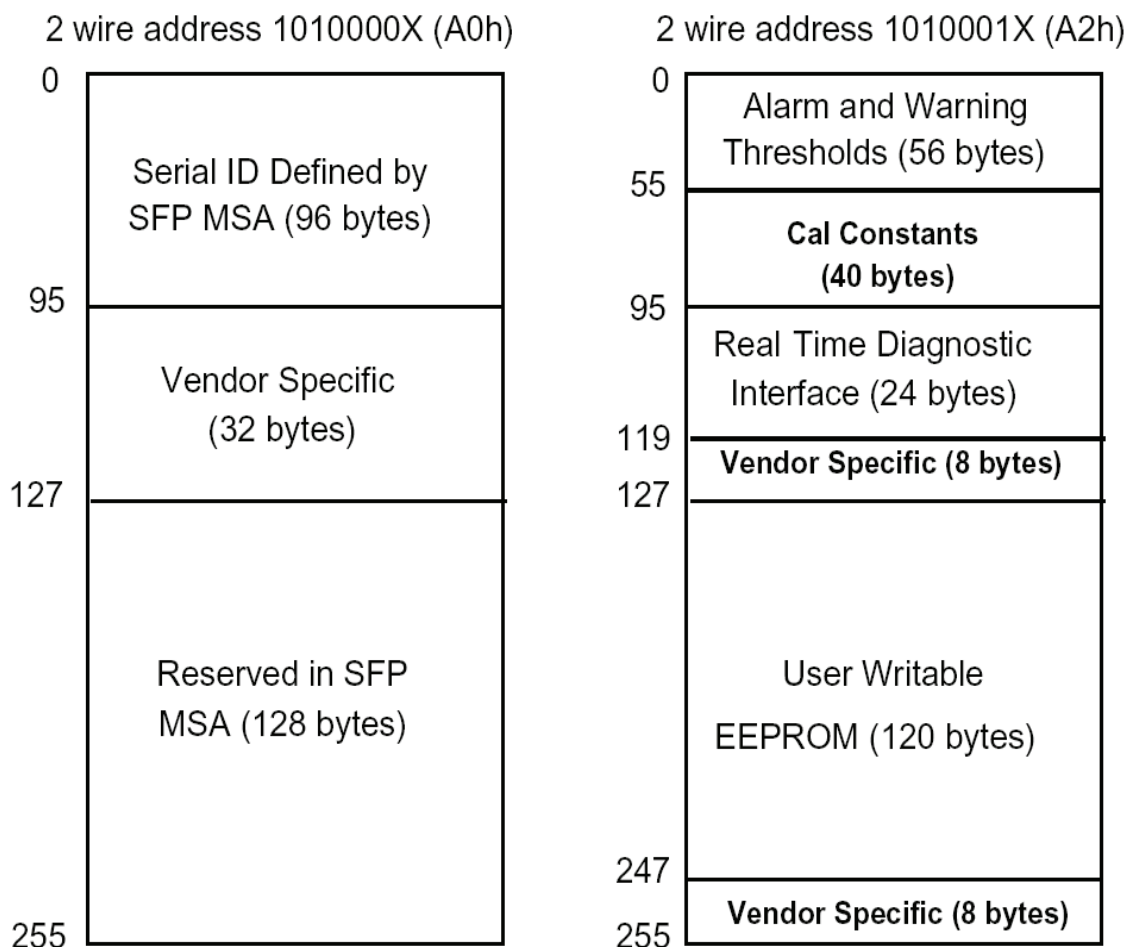
PARAMETER	RANGE	UNIT	ACCURACY	CALIBRATION
Temperature	0 to +70	°C	±3°C	Internal / External
Voltage	3.0 to 3.6	V	±3%	Internal / External
Bias Current	0 to 100	mA	±10%	Internal / External
TX Power	-9 to -3	dBm	±3dB	Internal / External
RX Power	-23 to -3	dBm	±3dB	Internal / External

## Digital Diagnostic Memory Map

The transceivers provide serial ID memory contents and diagnostic information about the present operating conditions by the 2-wire serial interface (SCL, SDA).

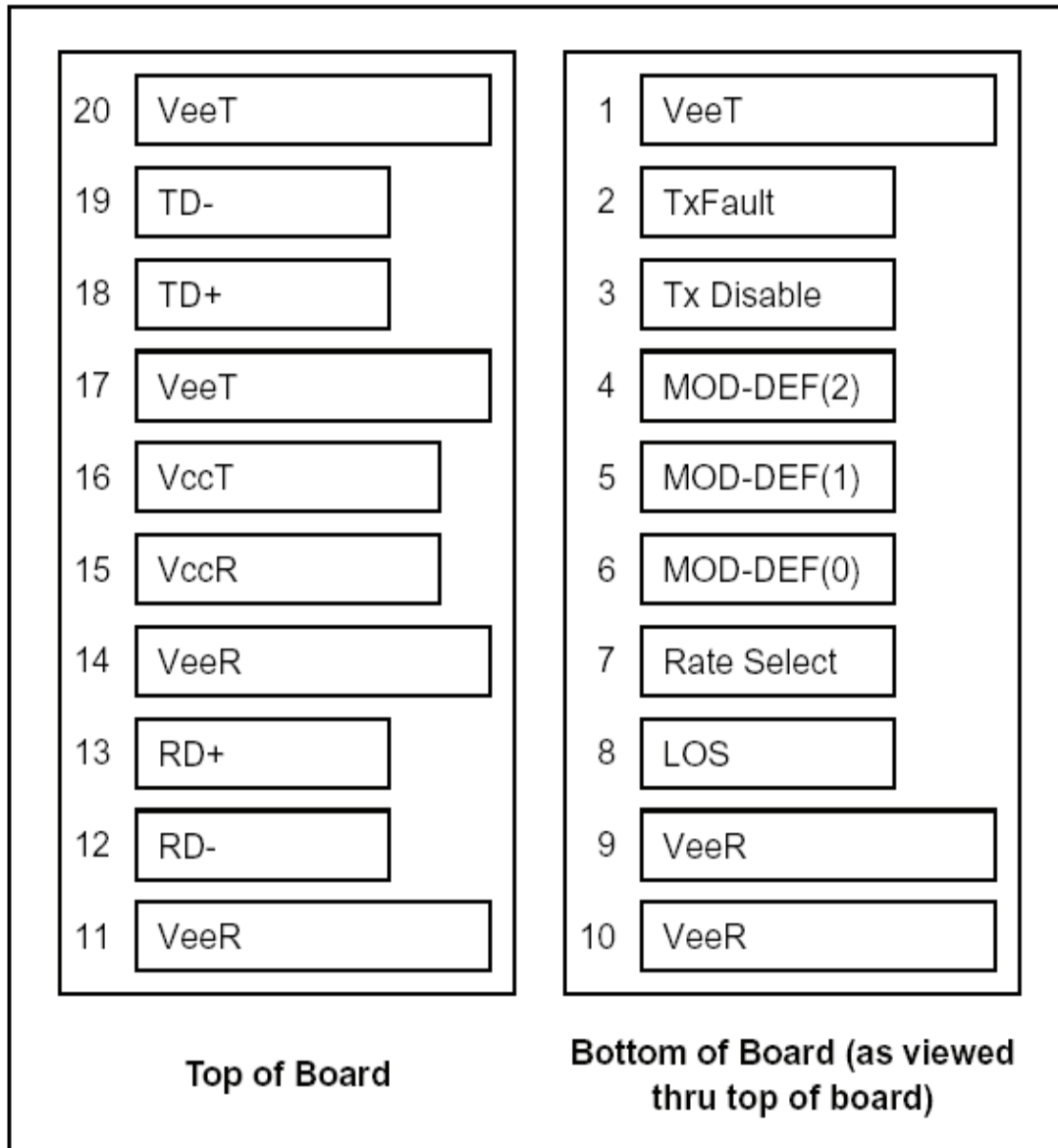
The diagnostic information with internal calibration or external calibration all are implemented, including received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring.

The digital diagnostic memory map specific data field defines as following.



## Pin Definitions

### Pin Diagram



## Pin Descriptions

PIN	SIGNAL NAME	DESCRIPTION	PLUG SEQ.	NOTES
1	V <sub>EET</sub>	Transmitter Ground	1	
2	TX FAULT	Transmitter Fault Indication	3	Note 1
3	TX DISABLE	Transmitter Disable	3	Note 2
4	MOD_DEF(2)	SDA Serial Data Signal	3	Note 3
5	MOD_DEF(1)	SCL Serial Clock Signal	3	Note 3
6	MOD_DEF(0)	TTL Low	3	Note 3
7	Rate Select	Not Connected	3	
8	LOS	Loss of Signal	3	Note 4
9	V <sub>EER</sub>	Receiver ground	1	
10	V <sub>EER</sub>	Receiver ground	1	
11	V <sub>EER</sub>	Receiver ground	1	
12	RD-	Inv. Received Data Out	3	Note 5
13	RD+	Received Data Out	3	Note 5
14	V <sub>EER</sub>	Receiver ground	1	
15	V <sub>CCR</sub>	Receiver Power Supply	2	
16	V <sub>CCT</sub>	Transmitter Power Supply	2	
17	V <sub>EET</sub>	Transmitter Ground	1	
18	TD+	Transmit Data In	3	Note 6
19	TD-	Inv. Transmit Data In	3	Note 6
20	V <sub>EET</sub>	Transmitter Ground	1	

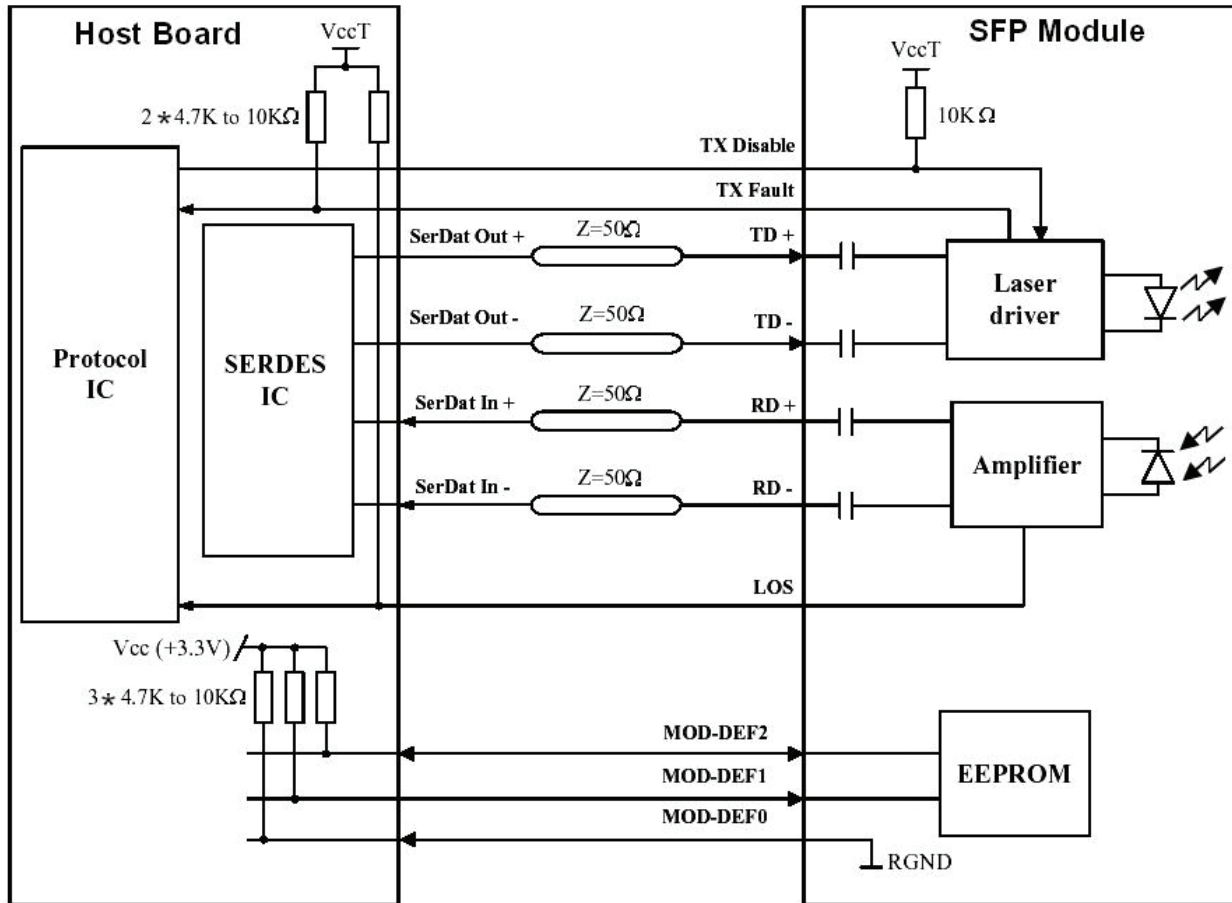
### Notes:

Plug Seq.: Pin engagement sequence during hot plugging.

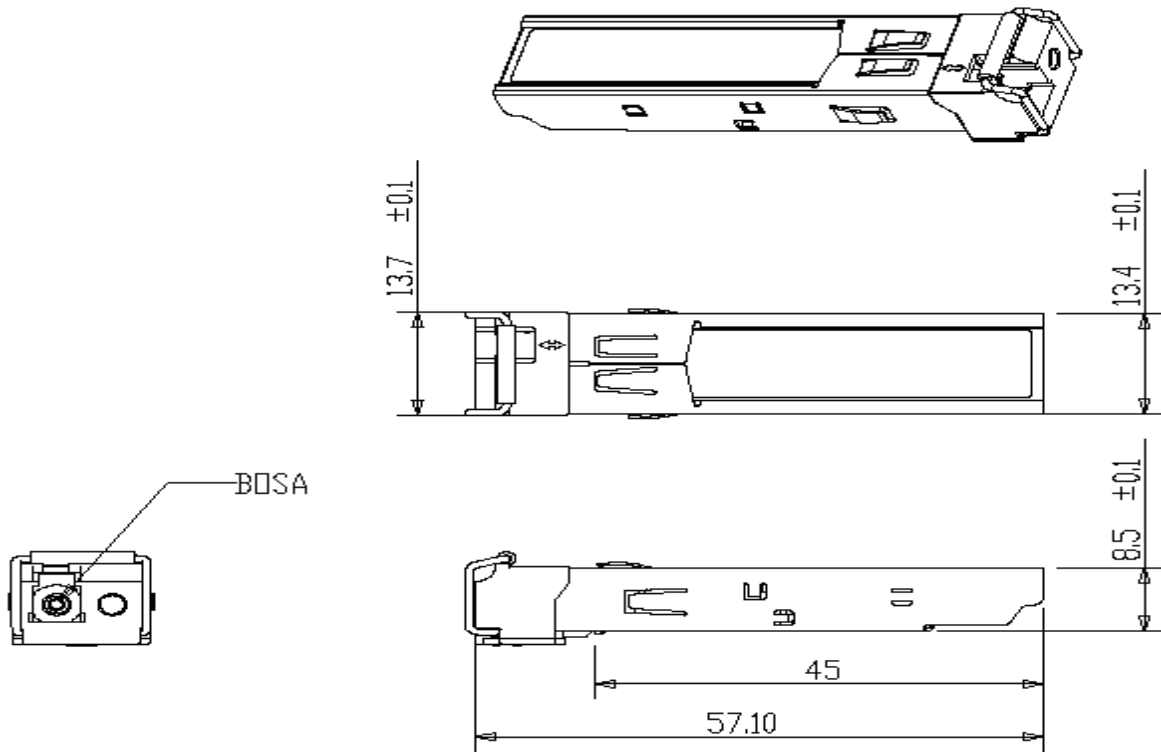
- TX Fault is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor on the host board to a voltage between 2.0V and Vcc+0.3V. Logic 0 indicates normal operation; Logic 1 indicates a laser fault of some kind. In the low state, the output will be pulled to less than 0.8V.
- TX Disable 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 to 0.8V): Transmitter on  
 (>0.8V, < 2.0V): Undefined  
 High (2.0 to 3.465V): Transmitter Disabled  
 Open: Transmitter Disabled
- Mod-Def 0,1,2. These 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
- LOS is an open collector output, which should be pulled up with a 4.7k~10kΩ resistor. Pull up voltage between 2.0V and Vcc+0.3V. Logic 1 indicates loss of signal; Logic 0 indicates normal operation. In the low state, the output will be pulled to less than 0.8V.
- RD-/+ : These are the differential receiver outputs. They are internally AC-coupled 100 differential lines which should be terminated with 100Ω (differential) at the user SERDES.
- TD-/+ : These are the differential transmitter inputs. They are internally AC-coupled, differential lines with 100Ω differential termination inside the module.



## Recommended Interface Circuit



## Mechanical Dimensions



## Ordering information

PART NUMBER	PRODUCT DESCRIPTION
SSF-SFP-SM1GBDA	1.25G SFP transceiver BiDi T:1310/R:1550nm, 20Km max reach, w/DDM
SSF-SFP-SM1GBDB	1.25G SFP transceiver BiDi T:1550/R:1310nm, 20Km max reach, w/DDM