2.5 Gbps BiDi 10 km DDM SFP Transceiver

SFP Series

- **Data rate up to 2.5 Gbps**
- **1310 nm and 1550 nm operating wavelength**
- **PIN-TIA receiver**
- **20 km with 9/125 µm SMF**
- **Single 3.3V power supply**
- **Hot-pluggable SFP footprint**
- **LC connector interface**
- **Power dissipation < 1.0 W**
- **Compliant with SFF-8472**
- **Compliant with MSA SFP specification**
- **Class 1 FDA and IEC60825-1 laser safety compliant**

ASCENT 2.5G 10 km BiDi Small Form Factor Pluggable (SFP) transceiver modules are compatible with the Small Form Factor Pluggable Multi-Sourcing Agreement (MSA).

The transceiver consists of five sections: the LD driver, the limiting amplifier, the digital diagnostic monitor, the 1550nm or 1310nm DFB laser and the PIN photo-detector. The module data link up to 20KM in 9/125um single mode fiber. There are two versions to work together as a pair, 1550nm TX/1310nm-RX and 1310nm TX/1550nm-RX.

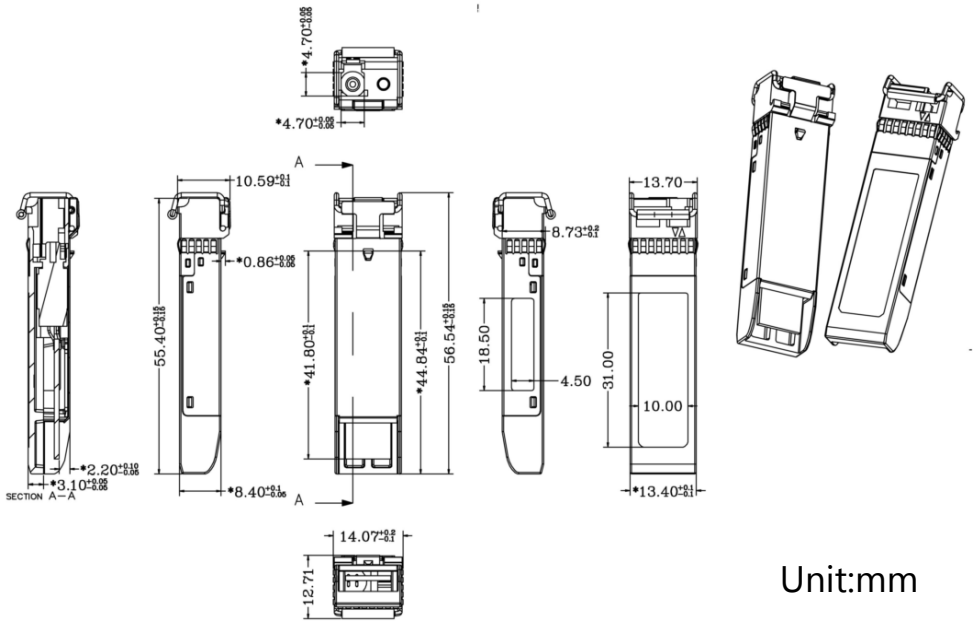
The optical output can be disabled by a TTL logic high-level input of Tx Disable, and the system also can disable the module via I2C. Tx Fault is provided to indicate that degradation of the laser. Loss of signal (LOS) output is provided to indicate the loss of an input optical signal of receiver or the link status with partner.

The transceiver system can also get the LOS (or Link)/Disable/Fault information via I2C register access.

Key Features

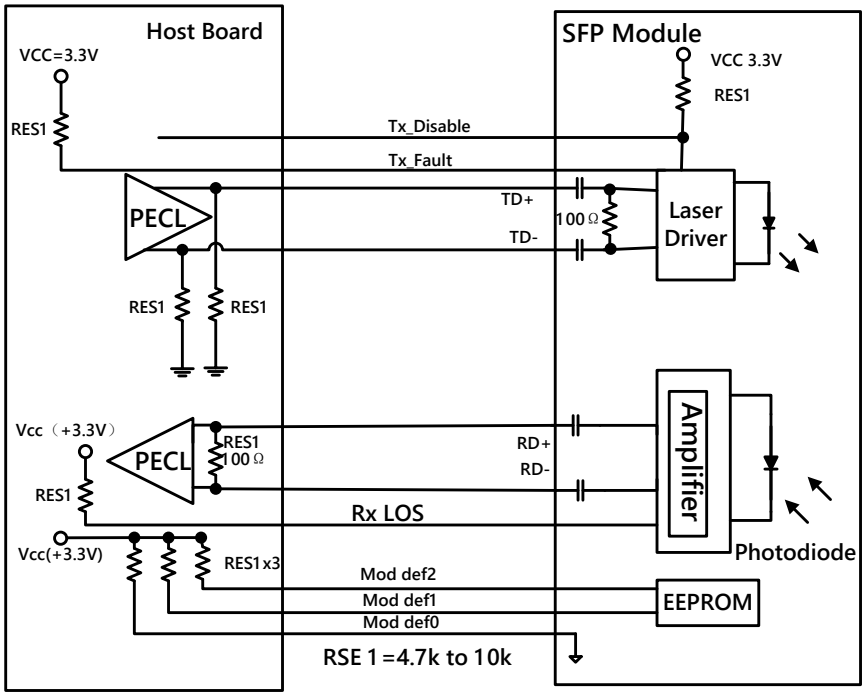
- Operating data rate up to 2.5 Gbps
- 1310 nm and 1550 nm operating wavelength
- PIN-TIA receiver
- 20 km with 9/125 µm SMF
- Single 3.3V power supply
- Hot-pluggable SFP footprint
- LC connector interface
- Power dissipation < 1.0 W
- Operating temperature: 0 °C to +70 °C
- Compliant with SFF-8472
- Compliant with MSA SFP specification
- Class 1 FDA and IEC60825-1 laser safety compliant

Mechanical Specifications

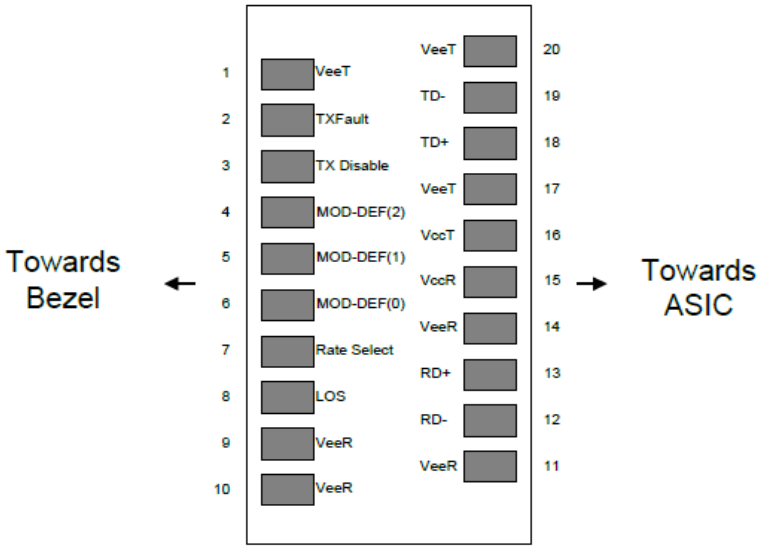


Unit:mm

Recommended Circuit Schematic



Pin Description



Pin	Name	Function	Plug Seq.	Notes
1	VeeT	Transmitter Ground	1	5)
2	TX Fault	Transmitter Fault Indication	3	1)

3	TX Disable	Transmitter Disable	3	2) Module disables on high or open
4	MOD-DEF2	Module Definition 2	3	3) 2-wire serial ID interface.
5	MOD-DEF1	Module Definition 1	3	3) 2-wire serial ID interface.
6	MOD-DEF0	Module Definition 0	3	3) Grounded within the module.
7	Rate Select	Not Connect	3	Function not available
8	LOS	Loss of Signal	3	4)
9	VeeR	Receiver Ground	1	5)
10	VeeR	Receiver Ground	1	5)
11	VeeR	Receiver Ground	1	5)
12	RD-	Inv. Received Data Out	3	6)
13	RD+	Received Data Out	3	7)
14	VeeR	Receiver Ground	1	5)
15	VccR	Receiver Power	2	7) 3.3 ± 5%
16	VccT	Transmitter Power	2	7) 3.3 ± 5%
17	VeeT	Transmitter Ground	1	5)
18	TD+	Transmit Data In	3	8)
19	TD-	Inv. Transmit Data In	3	8)
20	VeeT	Transmitter Ground	1	5)

Notes:

1) TX Fault is an open collector/drain output, which should be pulled up with a 4.7 kΩ to 10 kΩ resistor on the host board. Pull up voltage between 2.0 V and VccT/R + 0.3 V. When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to <0.8 V.

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 4.7 kΩ to 10 kΩ resistor. Its states are:

Low (0 – 0.8V): Transmitter on

(>0.8, < 2.0V): Undefined

High (2.0 – 3.465V): Transmitter Disabled

Open: Transmitter Disabled

3) Mod-Def 0, 1, 2. These are the module definition pins. They should be pulled up with a 4.7 kΩ to 10 kΩ 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 (Loss of Signal) is an open collector/drain output, which should be pulled up with a 4.7 kΩ to 10 kΩ resistor. Pull up voltage between 2.0 V and VccT/R + 0.3 V. 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 <0.8 V.

5) VeeR and VeeT may be internally connected within the SFP module.

6) RD-/+: These are the differential receiver outputs. They are AC coupled 100 Ω differential Lines which should be terminated with 100 Ω (differential) at the user SERDES. The AC coupling is done inside the

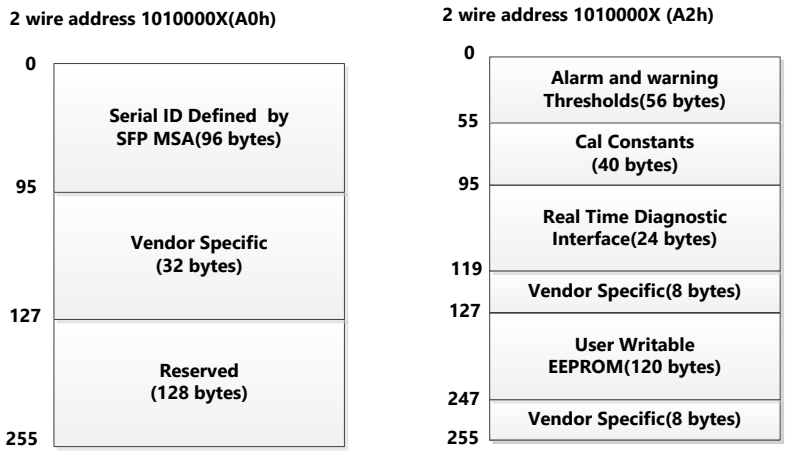
module and is thus not required on the host board. The voltage swing on these lines will be between 400 mV and 2000 mV differential (200 mV to 1000 mV single ended) when properly terminated.

7) VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3 V ± 5 % at the SFP connector pin. Maximum supply current is 300 mA. Recommended host board power supply filtering is shown below. Inductors with DC resistance of less than 1 Ω should be used in order to maintain the required voltage at the SFP input pin with 3.3 V supply voltage When the recommended supply-filtering network is used, hot plugging of the SFP transceiver module will result in an in rush current of no more than 30 mA greater than the steady state value. VccR and VccT may be internally connected within the SFP transceiver module.

8) TD-/+: These are the differential transmitter inputs. They are AC-coupled, differential lines with 100 differential terminations inside the module. The AC coupling is done inside the module and is thus not required on the host board. The inputs will accept differential swings of 400 mV to 2000 mV (200 mV to 1000 mV single-ended).

EEPROM

The serial interface uses the 2-wire serial CMOS EEPROM protocol defined. When the serial protocol is activated, the host generates the serial clock signal (SCL). The positive edge clocks data into those segments of the EEPROM that are not write protected within the SFP transceiver. The negative edge clocks data from the SFP transceiver. The serial data signal (SDA) is Bi-directional for serial data transfer. The host uses SDA in conjunction with SCL to mark the start and end of serial protocol activation. The memories are organized as a series of 8-bit data words that can be addressed individually or sequentially. The Module provides diagnostic information about the present operating conditions. The transceiver generates this diagnostic data by digitization of internal analog signals. Calibration and alarm/warning threshold data is written during device manufacture. Received power monitoring, transmitted power monitoring, bias current monitoring, supply voltage monitoring and temperature monitoring all are implemented. If the module is defined as external calibrated, the diagnostic data are raw A/D values and must be converted to real world units using calibration constants stored in EEPROM locations 56 – 95 at wire serial bus address A2h. The digital diagnostic memory map specific data field define as following. For detail EEPROM information please refer to the related document of SFF8472 Rev 10.2.



Specifications

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Storage Temperature	Ts	-40	+85	°C
Maximum Supply Voltage	Vcc	-0.5	3.6	V
Operating Relative Humidity	RH	5	85	%

Note: Exceeding any one of these values may destroy the device immediately.

Recommended Operating Conditions

Parameter		Symbol	Min.	Typ.	Max.	Unit
Operating Case Temperature		Tc	0		70	°C
Power Supply Voltage		Vcc	3.15	3.3	3.47	V
Power Supply Current		Icc			300	mA
Data Rate	FC			1.063		Gbps
	2XFC			2.125		
	OC-48/STM-16			2.5		

Optical Characteristics

Parameter		Symbol	Min.	Typ.	Max.	Unit
9 µm Core Diameter MMF		L		20		km
Data Rate				2.488		Gbps
Transmitter						
Center Wavelength	SFP-2G-3155-10	λ_C	1290	1310	1330	nm
	SFP-2G-5531-10	λ_C	1530	1550	1570	nm
Spectral Width (-20 dB)		Δλ			1	nm
Side Mode Suppression Ratio		SMSR	30			dB
Average Output Power[1]		Pout	-5		0	dBm
Extinction Ratio		ER	8.2			dB
Rise/Fall Time (20 % to 80 %)		tr/tf			0.16	ns
Output Optical Eye[2]		Compliant with IEEE 802.3				
Pout@TX Disable Asserted		Pout			-45	dBm
Receiver						
Center Wavelength	SFP-2G-3155-10	λ_C	1530	1550	1570	nm
	SFP-2G-5531-10	λ_C	1290	1310	1330	nm
Receiver Sensitivity*(Note3)		Pmin			-18	dBm
Receiver Overload		Pmax	-3			dBm
LOS De-Assert		LOSD			-19	dBm
LOS Assert		LOSA	-30			dBm
LOS Hysteresis			0.5			dB

Notes:

1. Output is coupled into a 9/125 µm SMF.
2. Filtered, measured with a PRBS 2^{23} - 1 test pattern @ 2.5 Gbps.
3. Minimum average optical power, measured at BER less than 1E-12, with 2^{23}-1 PRBS and ER = 8.2 dB.

Electrical Characteristics

Parameter		Symbol	Min.	Typ.	Max.	Unit	Notes
Transmitter							
LVPECL Inputs (Differential)		Vin	400		2000	mVpp	AC Coupled Inputs[1]
Input Impedance (Differential)		Zin	85	100	115	Ω	Rin > 100 kΩ @ DC
TX_Dis	Disable		2		Vcc+0.3	V	
	Enable		0		0.8		
TX_FAULT	Fault		2		Vcc+0.3	V	
	Normal		0		0.8		
Receiver							
LVPECL Outputs (Differential)		Vout	400		2000	mVpp	AC Coupled Outputs[1]
Output Impedance (Differential)		Zout	85	100	115	Ω	
TX_Disable Assert Time		t_off			10	µs	
RX_LOS	LOS		2		Vcc+0.3	V	
	Normal		0		0.8		
MOD_DEF (0.2)		VoH	2.5		Vcc+0.3	V	With Serial ID
		VoL	0		0.5		

Notes:

1. LVPECL logic, internally AC coupled.

Digital Diagnostic Functions

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	10 to 80	mA	±10 %	Internal / External
TX Power	-5 to 0	dBm	±3 dB	Internal / External
RX Power	-18 to -3	dBm	±3 dB	Internal / External

Note: 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.

Ordering Information

Product Name	Product Description
SFP-2G-3155-10	SFP Plug-in, 2.5 Gbps, 10 km, TX=1310/RX=1550, on one single-mode fiber, LC/PC Blue
SFP-2G-5531-10	SFP Plug-in, 2.5 Gbps, 10 km, TX=1550/RX=1310, on one single-mode fiber, LC/PC Blue

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Ver. ACT_SFP-2G-3155-10_Datasheet_V1b_Jun_2022