

This 1310 nm DFB 10 Gbps SFP+ transceiver enables long-range transmission up to 20 km over single-mode fiber using LC connectors. It operates at a 10.3125 Gbps line rate with a Distributed Feedback (DFB) laser transmitter.

The transceiver's electrical interface follows SFI specifications, featuring 100 Ohm differential impedance with internally AC-coupled data lines, ensuring quality signal termination and reduced EMI. It supports up to 200 mm of enhanced FR4 or 150 mm of standard FR4 with a connector.

On the transmission side, it converts a 10.3125 Gbps electrical signal from the host to an optical signal. It includes a Transmit Disable (TX\_Dis) input for laser control and a Transmit Fault (TX\_Fault) output for detecting laser issues. The internal APC loop stabilizes the optical output.

The receiver converts 10 Gbps optical signals to serial PECL/CML electrical signals and includes a Loss of Signal (Rx\_LOS) output for detecting weak signals. Power supply filtering is recommended for both transmitter and receiver.

The module also supports a two-wire I<sup>2</sup>C interface for serial ID, digital diagnostics, and real-time monitoring of key parameters like received optical power, laser bias current, and optical output power.

## FEATURES AND BENEFITS

- Optical interface compliant to IEEE 802.3ae 10GBASE-LR
- Compliance: MSA SFF-8431, RoHS
- Hot Pluggable
- 1310nm DFB transmitter, PIN photo-detector
- Applicable for 20km SMF connection
- Operating case temperature: 0 to 70°C
- Low power consumption
- All-metal housing for superior EMI performance
- Advanced firmware allow customer system encryption information to be stored in transceiver



## APPLICATIONS

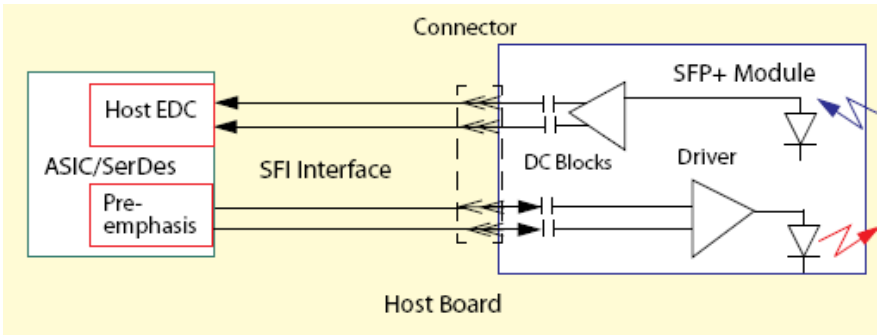
- 10GBASE-LR at 10.3125Gbps
- 10GBASE-LW at 9.953Gbps
- Other optical links

## GENERAL SPECIFICATIONS

ITEM	DETAIL
Speed	9.95 to 10.3Gb/s
Optical connector	Dual LC
Operating distance	20Km
Power	Single 3.3V
Fiber type	Single-mode 9/125um, two strands
Wavelength	1310nm
Compliance	MSA SFF-8431, RoHS
Digital Diagnostic	Yes (SFF-8472 compliant)

PART NUMBER	DESCRIPTION
SSF-SFP-SM10G	10G SFP+ transceiver SM 10GBase-LR, 1310nm, 20Km max reach

INTERFACE TO HOST



PIN DEFINITION

The SFP+ modules are hot-pluggable. Hot pluggable refers to plugging in or unplugging a module while the host board is powered. The SFP+ host connector is a 0.8 mm pitch 20 position right angle improved connector specified by SFF-8083, or stacked connector with equivalent with equivalent electrical performance. Host PCB contact assignment is shown in Figure 2 and contact definitions are given in Table 2. SFP+ module contacts mates with the host in the order of ground, power, followed by signal as illustrated by Figure 3 and the contact sequence order listed in Table 2.

Figure 2: Interface to Host PCB

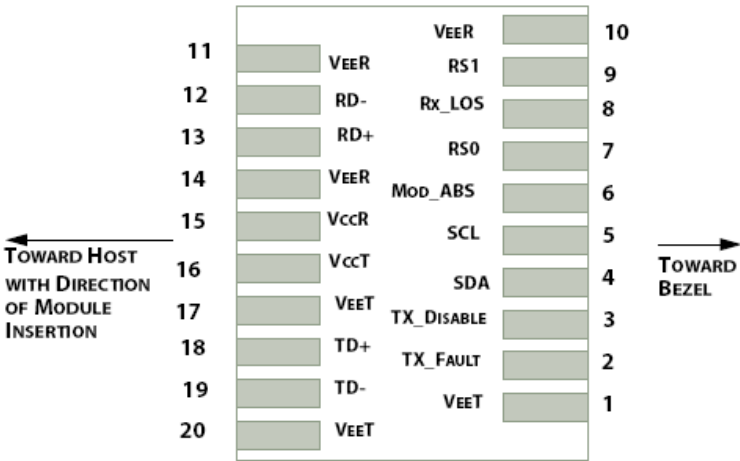
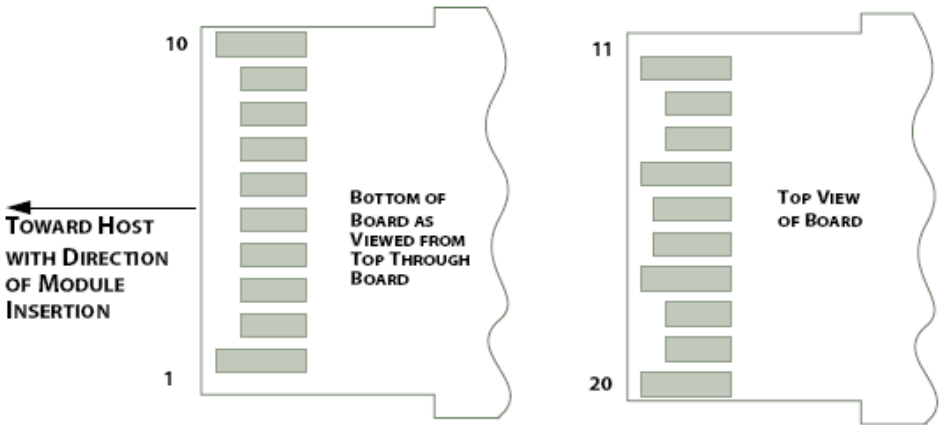


Figure 3: Module Contact Assignment



## PIN DEFINITION

CONTACTS	LOGIC	SYMBOL	POWER SEQUENCE ORDER	DESCRIPTION
1		VeeT	1st	Module Transmitter Ground
2	LVTTL-O	TX_Fault	3rd	Module Transmitter Fault
3	LVTTL-I	TX_Disable	3rd	Transmitter Disable; Turns off transmitter laser output
4	LVTTL-I/O	SDA	3rd	2-wire Serial Interface Data Line (Same as MOD-DEF2 in the INF-8074i)
5	LVTTL-I/O	SCL	3rd	2-wire Serial Interface Clock (Same as MOD-DEF1 in the INF-8074i)
6		Mod_ABS	3rd	Module Absent, connected to VeeT or VeeR in the module
7	LVTTL-I	RS0	3rd	Rate Select 0, optionally controls SFP+ module receiver. When high input signaling rate > 4.25 GBd and when low input signaling rate ≤ 4.25 GBd
8	LVTTL-O	Rx_LOS	3rd	Receiver Loss of Signal Indications (In FC designated as RX_LOS and in Ethernet designated as Signal Detect)
9	LVTTL-I	RS1	3rd	Rate Select 1, optionally controls SFP+ transmitter . When high input signaling rate > 4.25 GBd and when low input signaling rate ≤ 4.25 GBd
10		VeeR	1st	Module Receiver Ground
11		VeeR	1st	Module Receiver Ground
12	CML-O	RD-	3rd	Receiver Inverted Data Output
13	CML-O	RD+	3rd	Receiver Non-Inverted Data Output
14		VeeR	1st	Module Receiver Ground
15		VccR	2nd	Module Receiver 3.3 V Supply
16		VccT	2nd	Module Transmitter 3.3 V Supply
17		VeeT	1st	Module Transmitter Ground
18	CML-I	TD+	3rd	Transmitter Non-Inverted Data Input
19	CML-I	TD-	3rd	Transmitter Inverted Data Input
20		VeeT	1st	Module Transmitter Ground

## ABSOLUTE MAXIMUM RATINGS

These values represent the damage threshold of the module. Stress in excess of any of the individual Absolute Maximum Ratings can cause immediate catastrophic damage to the module even if all other parameters are within Recommended Operating Conditions.

**Table 1 - Absolute Maximum Ratings**

PARAMETERS	SYMBOL	MIN.	MAX.	UNIT
Power Supply Voltage	VCC	0	+3.6	V
Storage Temperature	T <sub>c</sub>	-40	+85	°C
Operating Case Temperature	T <sub>c</sub>	0	+70	°C
Relative Humidity	RH	5	95	%
RX Input Average Power	P <sub>max</sub>	-	0	dBm

## RECOMMENDED OPERATING CONDITIONS

Recommended Operating Environment specifies parameters for which the electrical and optical characteristics hold unless otherwise noted.

**Table 2 - Recommended Operating Conditions**

PARAMETER	SYMBOL	MIN	TYPICAL	MAX	UNIT
Power Supply Voltage	VCC	3.135	3.300	3.465	V
Operating Case Temperature	T <sub>c</sub>	0	25	70	°C

## OPTICAL CHARACTERISTICS

The following optical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

PARAMETER	UNIT	VALUES
Operating Reach	Km	20
<b>TRANSMITTER</b>		
Center wavelength (range)	nm	1260 -1355
Side Mode Suppression Ratio (min)	dB	30
Launched power		
– Maximum	dBm	+0.5
– Minimum	dBm	-5.2 Notes1
- OMA	dBm	-4.2
- OMA-TDP (min)	dBm	-4.7
Transmitter and dispersion penalty	dB	3.2 Notes4
Average launch power of OFF transmitter (max)	dBm	-30
Extinction ratio (min)	dB	3.5 Notes2
RIN12 OMA (max)	dB/Hz	-128
Optical Return Loss Tolerance (min)	dB	12
<b>RECEIVER</b>		
Center wavelength (range)	nm	1260-1355
Receive overload (max) in average power <sup>1</sup>	dBm	0.5
Receive sensitivity (min) in average power <sup>1</sup>	dBm	-14.4 Notes3
Receiver sensitivity (max) in OMA (footnote 2)	dBm	-12.6 Notes3
Receiver Reflectance (max)	dB	-12
Stressed receiver sensitivity (max) in OMA <sup>2</sup>	dBm	-10.3
Vertical eye closure penalty (min) <sup>3</sup>	dB	2.2
Stressed eye jitter (min) <sup>2</sup>	Ulp-p	0.7
Receive electrical 3dB upper cutoff frequency (max)	GHz	12.3
Receiver power (damage, Max)	dBm	1.5

**Notes:**

1. The optical power is launched into SMF
2. Measured with a PRBS 231-1 test pattern@10.3125Gbps
3. Measured with a PRBS 231-1 test pattern@10.3125Gbps BER≤10<sup>-12</sup>
4. In G.652 and G.655(NDSF)

## ELECTRICAL CHARACTERISTICS

The following electrical characteristics are defined over the Recommended Operating Environment unless otherwise specified.

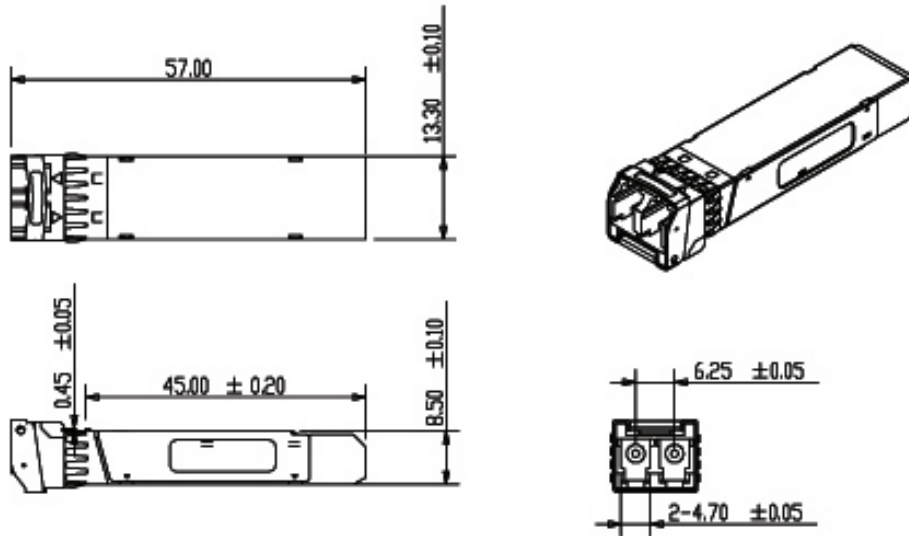
PARAMETER	SYMBOL	MIN	TYPICAL	MAX	UNIT	NOTES
Data Rate		-	10.3125	-	Gbps	
Power Consumption		-	1200	1500	mW	
<b>TRANSMITTER</b>						
Single Ended Output Voltage Tolerance		-0.3	-	4.0	V	
C common mode voltage tolerance		15	-	-	mV	
Tx Input Diff Voltage	VI	400		1600	mV	
Tx Fault	VoL	-0.3		0.4	V	At 0.7mA
Data Dependent Input Jitter	DDJ			0.10	UI	
Data Input Total Jitter	TJ			0.28	UI	
<b>RECEIVER</b>						
Single Ended Output Voltage Tolerance		-0.3	-	4.0	V	
Rx Output Diff Voltage	Vo	300		850	mV	
Rx Output Rise and Fall Time	Tr/Tf	30			ps	20% to 80%
Total Jitter	TJ			0.70	UI	
Deterministic Jitter	DJ			0.42	UI	

## CONTROL AND STATUS I/O TIMING CHARACTERISTICS

Timing characteristics of control and status I/O are included below (Table 8), which is also defined in SFF-8431.

PARAMETER	SYMBOL	MIN	MAX	UNIT	CONDITIONS
TX_Disable assert time	t <sub>of</sub>		100	μs	Rising edge of TX_Disable to fall of output signal below 10% of nominal
TX_Disable negate time	t <sub>on</sub>		2	ms	Falling edge of TX_Disable to rise of output signal above 90% of nominal. This only applies in normal operation, not during start up or fault recovery
Time To Initialize 2-wire interface	t <sub>2w_start_up</sub>		300	ms	From power on or hot plug after the supply meeting Table 8
Time to initialize	t <sub>start_up</sub>		300	ms	From power supplies meeting Table 8 or hot plug or TX disable negated during power up, or TX_Fault recovery, until non-cooled power level I part (or non-cooled power level II part already enabled at power level II for TX_Fault recovery) is fully operational.
Time to initialize cooled module	t <sub>start_up_cooled</sub>		90	s	From power supplies meeting Table 8 or hot plug, or TX disable negated during power up, or TX_Fault recovery, until cooled power level I part (or cooled power level II part during fault recovery) is fully operational.
Time to Power Up to Level II	t <sub>power_level2</sub>		300	ms	From falling edge of stop bit enabling power level II until non-cooled module is fully operational
Time to Power Down from Level II	t <sub>power_down</sub>		300	ms	From falling edge of stop bit disabling power level II until module is within power level I requirements
TX_Fault assert	TX_Fault_on		1	ms	From occurrence of fault to assertion of TX_Fault
TX_Fault assert for cooled module	TX_Fault_on_cooled		50	ms	From occurrence of fault to assertion of TX_Fault
TX_Fault Reset	t <sub>reset</sub>	10		μs	Time TX_Disable must be held high to reset TX_Fault
RS0, RS1 rate select timing for FC	t <sub>RS0_FC, RS1_FC</sub>		500	μs	From assertion till stable output
RS0, RS1 rate select timing non FC	t <sub>RS0, t_RS1</sub>		10	ms	From assertion till stable output
Rx_LOS assert delay	t <sub>los_on</sub>		100	μs	From occurrence of loss of signal to assertion of Rx_LOS
Rx_LOS negate delay	t <sub>los_off</sub>		100	μs	From occurrence of presence of signal to negation of Rx_LOS

## MECHANICAL DIMENSIONS



## ESD

This transceiver is specified as ESD threshold 1kV for high speed pins and 2kV for all other electrical input pins, tested per MIL-STD-883, Method 3015.4 / JESD22-A114-A (HBM). However, normal ESD precautions are still required during the handling of this module. This transceiver is shipped in ESD protective packaging. It should be removed from the packaging and handled only in an ESD protected environment.

## LASER SAFETY

This is a Class 1 Laser Product according to IEC 60825-1:1993+A1:1997+A2:2001. This product complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated (July 26, 2001)