SFP-10GB-HD1-XXU-20-AO

MSA and TAA Compliant 10GBase-CWDM HD1 SFP+ Transceiver (SMF, 1xx0nm LTx/HRx, 20km, LC, DOM)

Features

- Up to 10.3125GB/s Bi-directional Optical Transceivers
- LC/UPC Receptacle (9/125μm, SMF, customized)
- High-density SFP+ Transceivers
- Embedded Thermo-Electric Cooling System
- Customized CWDM wavelength Tx (DFB-LD) / Rx(PIN-PD)
- Compliant to SFP+ MSA (SFF-8431 for electrical interface and SFF-8432 for mechanical interface)
- Digital Diagnostic Monitoring Compliant
- Supports Serial ID functionality
- Class 1 Laser Safety Products
- Single +3.3V power supply with hot-pluggable interface
- RoHS compliant

Applications

- CPRI/OBSAI application
- 10G Ethernet application
- Fibre Channel application

Product Description

This MSA compliant SFP+ transceiver provides 10GBase-CWDM HD1 throughput up to 20km over single-mode fiber (SMF) at a bidirectional wavelength of 1xx0nm LTx/HRx using an LC connector. This CWDM HD transceiver allows for high-density transmission of data by utilizing common CWDM wavelengths as center wavelengths for bidirectional data transmission, doubling the data channels. It is built to MSA standards and is uniquely serialized and data-traffic and application tested to ensure that they will integrate into your network seamlessly. Digital optical monitoring (DOM) support is also present to allow access to real-time operating parameters. This transceiver is Trade Agreements Act (TAA) compliant. We stand behind the quality of our products and proudly offer a limited lifetime warranty.

AddOn's SFP+ transceivers are RoHS compliant and lead-free.

TAA refers to the Trade Agreements Act (19 U.S.C. & 2501-2581), which is intended to foster fair and open international trade. TAA requires that the U.S. Government may acquire only "U.S. – made or designated country end products."

Regulatory Compliance

- ESD to the Electrical PINs: compatible with MIL-STD-883E Method 3015.4
- ESD to the LC Receptacle: compatible with IEC 61000-4-3
- EMI/EMC compatible with FCC Part 15 Subpart B Rules, EN55022:2010
- Laser Eye Safety compatible with FDA 21CFR, EN60950-1& EN (IEC) 60825-1,2
- RoHS compliant with EU RoHS 2.0 directive 2015/863/EU

CWDM Available Wavelengths

Label Description	Bail Color
1271nm LTx/HRx 10Gb/s 20km	Purple
1271nm HTx/LRx 10Gb/s 20km	Purple
1291nm LTx/HRx 10Gb/s 20km	Blue
1291nm HTx/LRx 10Gb/s 20km	Blue
1311nm LTx/HRx 10Gb/s 20km	Yellow Green
1311nm HTx/LRx 10Gb/s 20km	Yellow Green
1331nm LTx/HRx 10Gb/s 20km	Yellow Ocher
1331nm HTx/LRx 10Gb/s 20km	Yellow Ocher

Absolute Maximum Ratings

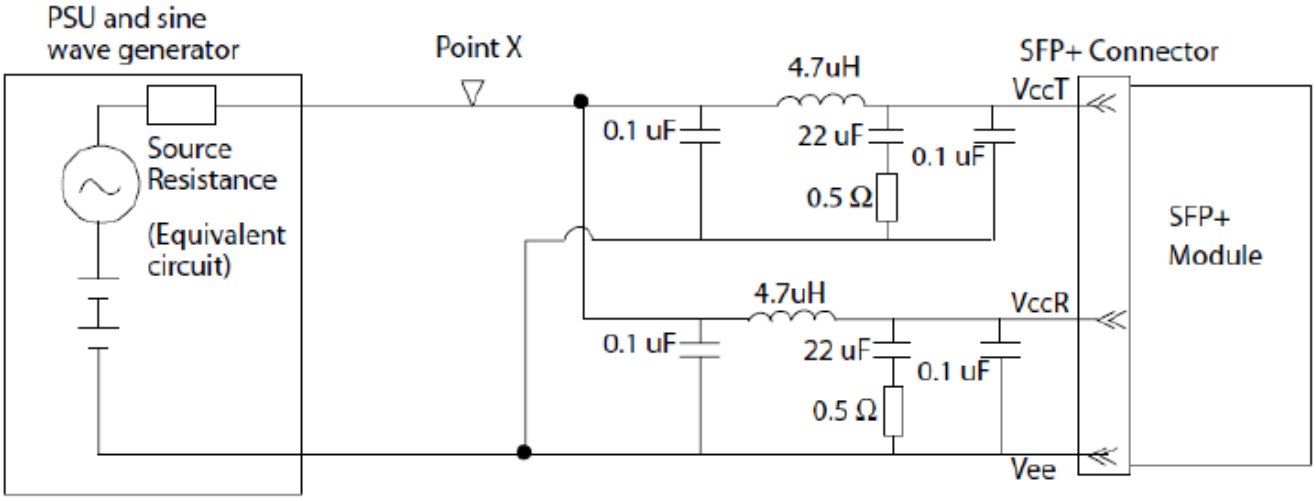
Parameter	Symbol	Min	Max	Units	Note
Storage Temperature	T_{st}	-40	100	°C	
Operating Case Temperature	T_{op}	0	70	°C	
Relative Humidity	RH	5	95	%	Non-condensation
Transmitter Single Ended Input Voltage	V_p	-0.3	Vcc+0.3	V	
Power Supply Voltage	VccT, VccR	-0.3	3.8	V	
Receiver Input Optical Power (Average)	P_{ave}		2	dBm	

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Case Operating Temperature	Top	-40	+85	°C	
Module Supply Voltage	VccT, VccR	+3.1354	+3.465	V	
Module Supply Current	Icc		455	mA	1
Power Dissipation	PDISS		1500	mW	2
Power Supply Noise Tolerance including Ripple (10Hz~10MHz)			66	mVp-p	3

Notes:

1. Measured with a 3.3v supply voltage.
2. Supply current includes both VccT and VccR connections.



Power Noise Tolerance Test Setup

Low Speed Signal Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Tx Fault, Rx LOS	V_{OL}	-0.3		0.4	V	At 0.7 mA
	I_{OH}	-50		37.5	µA	1
Tx Disable	V_{IL}	-0.3		0.8	V	2
	V_{IH}	2.0		VccT + 0.3	V	2

Notes:

1. Measured with a 4.7kΩ load pull up to Vcc_Host.
2. Tx Disable has an internal 4.7kΩ to 10kΩ pull up to VccT.

Low Speed Signals Timing Specifications

Parameter	Symbol	Min.	Max.	Unit	Notes
Tx Disable Assert Time	T_off		100	µs	1
Tx Disable Negate Time	T_on		2	ms	2
Time to Initialize. Cold and Warm Start Time	T_start_up		10	S	3
Rx LOS Assert Delay	T_los_on		100	µs	4
Rx LOS Negate Delay	T_los_off		100	µs	5
Tx Fault Assert	Tx_fault_on		1	ms	6
Tx Fault Reset	T_reset	10		µs	7

Notes:

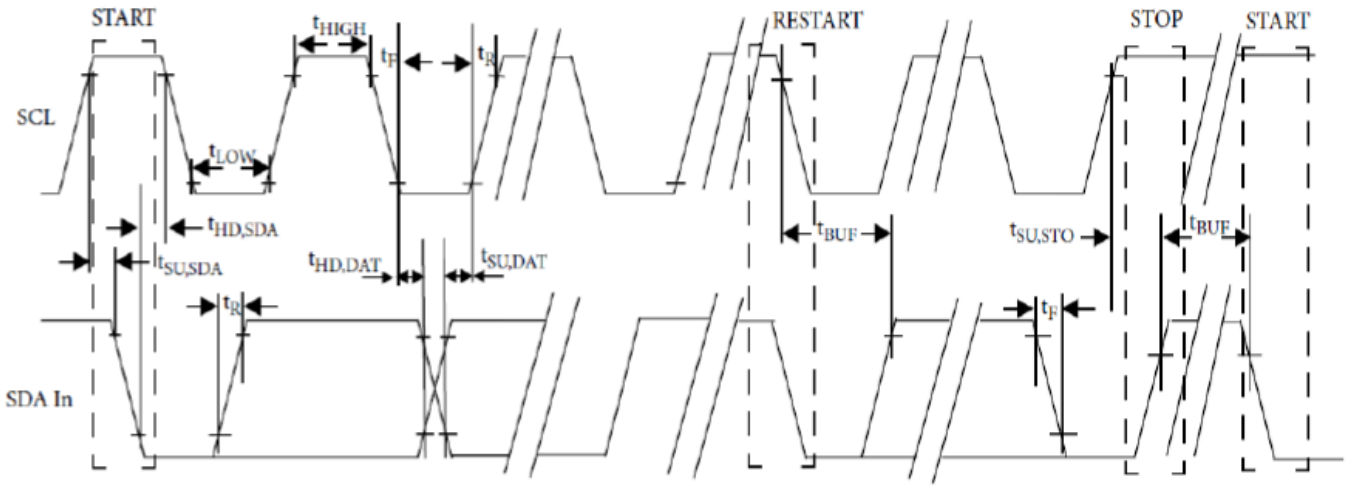
1. Rising edge of Tx_Disable to fall of output signal below 10% of nominal.
2. Falling edge of Tx_Disable to rise of output signal above 90% of nominal. This only applies in normal operation, not during start up or fault recovery.
3. Time from power on or falling edge of TX_DISABLE to when the modulated optical output rises above 90% of nominal and the Two-Wire Interface is available.
4. From occurrence of loss of signal to assertion of Rx_LOS
5. From occurrence of presence of signal to negation of Rx_LOS
6. From occurrence of fault to assertion of Tx_Fault
7. Time Tx_Disable must be held high to reset Tx_Fault

2-Wire Interface Electrical Specifications

Parameter	Symbol	Min.	Max.	Unit	Notes
Host 2-wire Vcc	Vcch	3.14	3.46	V	1
SCL and SDA	V_{OL}	0.0	0.40	V	R_p pulled up to VccT/R, 2
	V_{OH}	Vcch-0.5	Vcch+0.3	V	
SCL and SDA	V_{IL}	-0.3	VccT*0.3	V	3
	V_{IH}	VccT*0.7	VccT+0.5	V	
Input Current on the SCl and SDA Contacts	I_I	-10	10	µA	
Capacitance on SCL and SDA contacts	C_i		14	pF	
Total Bus Capacitance for SCL and SDA	C_b		100	pF	At 400kHz, 3.0kΩ Rp, max At 100kHz, 8.0kΩ Rp, max
			290	pF	At 400kHz, 1.1kΩ Rp, max At 100kHz, 2.75kΩ Rp, max

Notes:

1. The Host 2-wire Vcc is the voltage used for resistive pull up for the 2 wire interface
2. Rp is the pull up resistor. Active bus termination may be used by the host in place of a pull up resistor. Pull ups can be connected to any one of several power supplies, however the host board design shall ensure that no module contact has voltage exceeding module VccT/R + 0.5V nor requires the module to sink more than 3.0mA current.
3. These voltages are measured on the other side of the connector to the device under test.
4. C_i is the capacitance looking into the module SCl and SDA contacts.
5. C_b is the total bus capacitance on the SCl or SDA bus.



2-Sire Bus Timing Diagram

2-Wire Timing Specifications

Parameter	Symbol	Min.	Max.	Unit	Notes
Clock Frequency	f_{SCL}	0	400	kHz	1
Clock Pulse Width Low	t_{LOW}	1.3		µs	
Clock Pulse Width High	t_{HIGH}	0.6		µs	
Stop to Start Time	t_{BUF}	20		Ms	2
Start Hold Time	$t_{HD, STA}$	0.6		µs	
Start Set-up Time	$t_{SU, STA}$	0.6		µs	
Data In Hold Time	$t_{HD, DAT}$	0		µs	
Data In Set-up Time	$t_{SU, DAT}$	0.1		µs	
Input Rise Time (100kHz)	$t_{R, 100}$		1000	ns	3
Input Rise Time (400kHz)	$t_{R, 400}$		300	ns	3
Input Fall Time (100kHz)	$t_{F, 100}$		300	Ns	4
Input Fall Time (400kHz)	$t_{F, 400}$		300	ns	4
Stop Set-up Time	$t_{SU, STO}$	0.6		µs	
Serial Interface Clock Hold off "Clock Stretching"	T_clock_hold		500	µs	5

Notes:

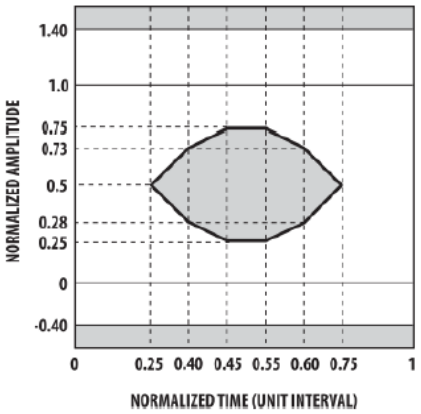
1. Module shall operate with f_{SCL} up to 100 kHz without requiring clock stretching. The module may clock stretch with f_{SCL} greater than 100 kHz and up to 400 kHz.
2. Between STOP and START and between ACK and Re-START.
3. From (VIL, MAX – 0.15) to (VIH, MIN + 0.15)
4. From (VIH, MIN + 0.15) to (VIL, MAX – 0.15)
5. Maximum time the SFP+ module may hold the SCL line low before continuing with a read or write description.

High Speed Signal Electrical Characteristics

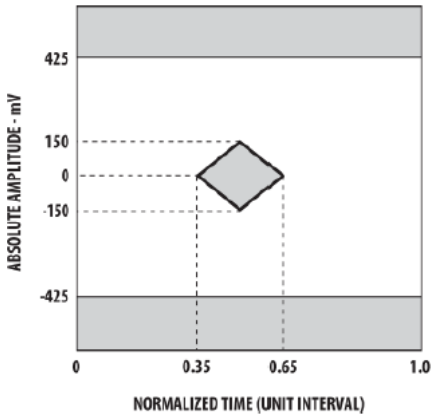
Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Tx Input Differential Swing Voltage	VI	190		700	mVp-p	
AC Common Mode Voltage Tolerance		15			mV	1
Differential Input S-parameter (Note 1)	SDD11			Note 2	dB	0.01 to 4.1 GHz
				Note 3	dB	4.1 to 11.1 GHz
Reflected Differential to Common Mode Conversion	SCD11			-10	dB	0.01 to 11.1 GHz
Rx Output Differential Swing Voltage	V_o	300		850	mVp-p	
Termination Mismatch at 1 MHz	ΔZM			5	%	
Output Ac Common Mode Voltage				7.5	mV	4
Differential Output S-parameter	SDD22			Note 5	dB	0.01 to 4.1 GHz
				Note 6	dB	4.1 to 11.1 GHz
Common Mode Output Reflection Coefficient	SCC2			Note 7	dB	0.01 to 2.5 GHz
				-3	dB	2.5 to 11.1 GHz
Rx Output Rise and Fall Time (20% to 80%)	Tr, Tf	28			Ps	
RX Output Total Jitter	T_J			0.70	Ulp-p	
Rx Output Deterministic Jitter	D_J			0.42	Ulp-p	
Receiver Output Eye Mask						Figure below

Notes:

1. Measured at B" with Host Compliance Board and Module Compliant Board pair.
2. Reflection Coefficient given by equation SDD11 (dB) < -12 + 2 x SQRT (f), with f in GHz.
3. Reflection Coefficient given by equation SDD11 (dB) < -6.3 + 13 x log10 (f/5.5), with f in GHz.
4. The RMS value is measured by calculating the standard deviation of the histogram for one UI of the common mode signal.
5. Reflection Coefficient given by equation SDD22 (dB) < -12 + 2 x SQRT (f), with f in GHz.
6. Reflection Coefficient given by equation SDD22 (dB) < -6.3 + 13 x log10 (f/5.5), with f in GHz.
7. Reflection Coefficient given by equation SCC22 (dB) < -7 + 1.6 x f, with f in GHz.



Transmitter Optical Eye Mask Definition



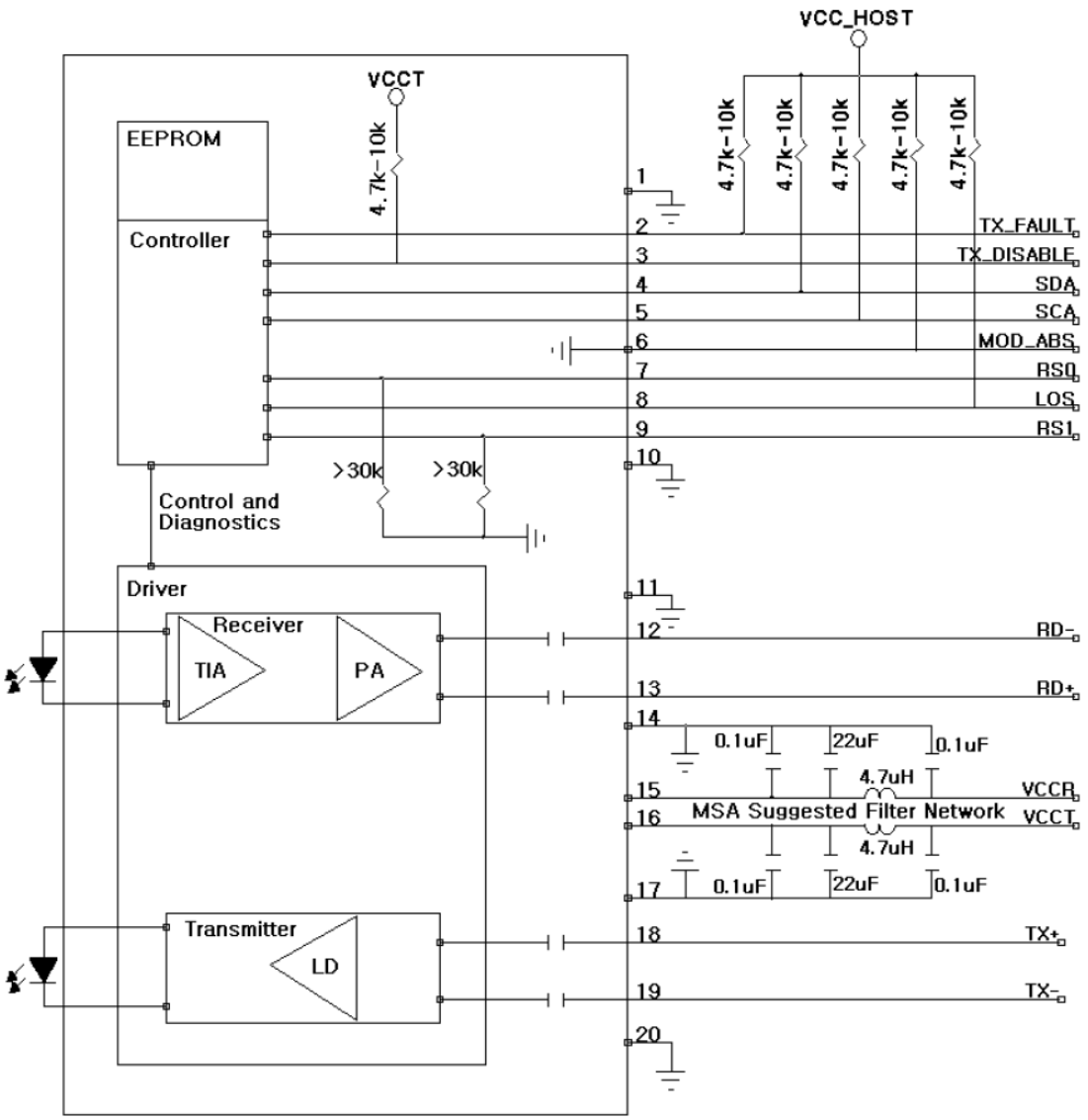
Receiver Electrical Optical Eye Mask Definition

Optical Characteristics

Parameter		Symbol	Min.	Typ.	Max.	Unit	Notes
Transmitter							
Peak Wavelength	HBDXG-SE2MW-IxL	λP	λc – 6.5 ~ λc – 1.5			Nm	CWDM, DFB-LD, 1
	HBDXG-SE2MW-IxH		λc + 2.0 ~ λc + 6.5				
Side Mode Suppression Ratio		SMSR	30			dB	2
Average Optical Power		P_{ave}	-2.0		+2.0	dBm	
Optical Modulation Amplitude		P_{OMA}	-2.6			dBm	
Spectral Width		Δ λ			1.0	Nm	@ -20db
Extinction Ratio		ER	4.0			dB	2
Transmitter and Dispersion Penalty		TDP			3.2	dB	2
Laser Off Power		P_{off}			-35.0	dBm	
Relative Intensity Noise		$RIN_{12}OMA$			-128.0	dB/Hz	2
Transmitter Output Eye Mask		IEEE 802.3-2008 Clause 52.9.7					5
Receiver							
Operating Wavelength	HBDXG-SE2MW-IxL	$λ_O$	λc + 2.0 ~ λc + 6.5			Nm	1
	HBDXG-SE2MW-IxH		λc – 6.5 ~ λc – 1.5				
Receiver Sensitivity (Average)		S			-13.5	dBm	3
Receiver Power (Pave) Overload		OL	+2.0			dBm	3
Sensitivity (OMA) at 10.3125 Gb/s		S_{OMA}			-14.1	dBm	3
Receiver Reflectance		RR			-27.0	dB	@ $λ_O$
Loss of Signal-Asserted		P_A	-30.0			dBm	4
Loss of Signal-De-asserted		P_D			-13.5	dBm	4
Loss of Signal Hysteresis		P_D-P_A	0.5	2.5	5.0	dB	

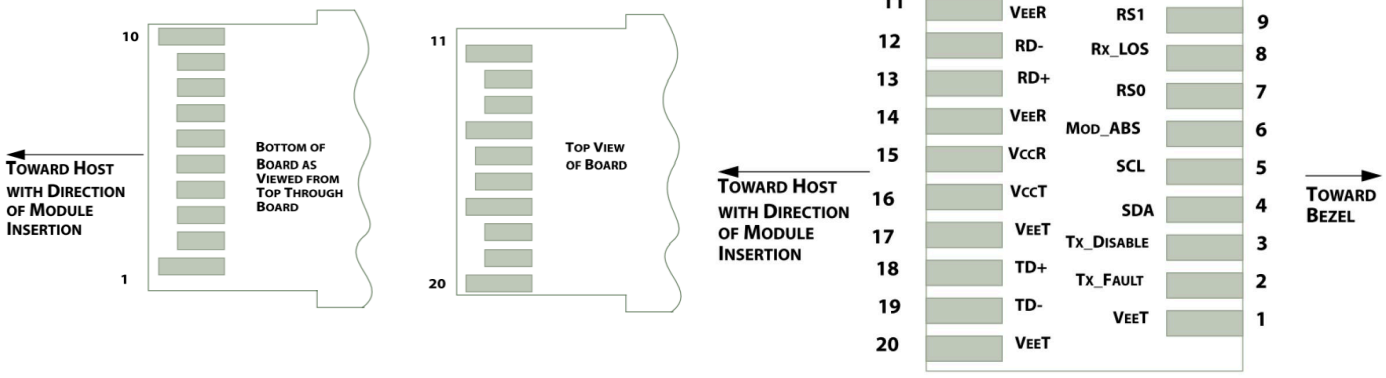
Notes:

1. λC = 1271, 1291, 1311, 1331nm
2. IEEE 802.3ae Clause 52 compliant
3. Measured with PRBS 2^{31}-1 at $1x10^{-12}$ BER and 4dB extinction ratio
4. Loss of Signal (LOS) detection responds only to OMA and the indicator will respond unpredictably with the application of un-modulated optical.



Notes:

1. Tx_Disable: Transmitter Disable, logic high, 4.7k to 10kohm pull up to Vcc on SFP.
2. Tx_Fault: Transmitter Fault, logic high, 4.7k to 10khohm pull up to Vcc on Host.
3. Rx_LOS: Receiver loss of signal, logic high, 4.7k to 10kohm pull up to Vcc on Host.



SFP+ Transceiver Electrical Pad Layout **Host PCB SFP Pinout**

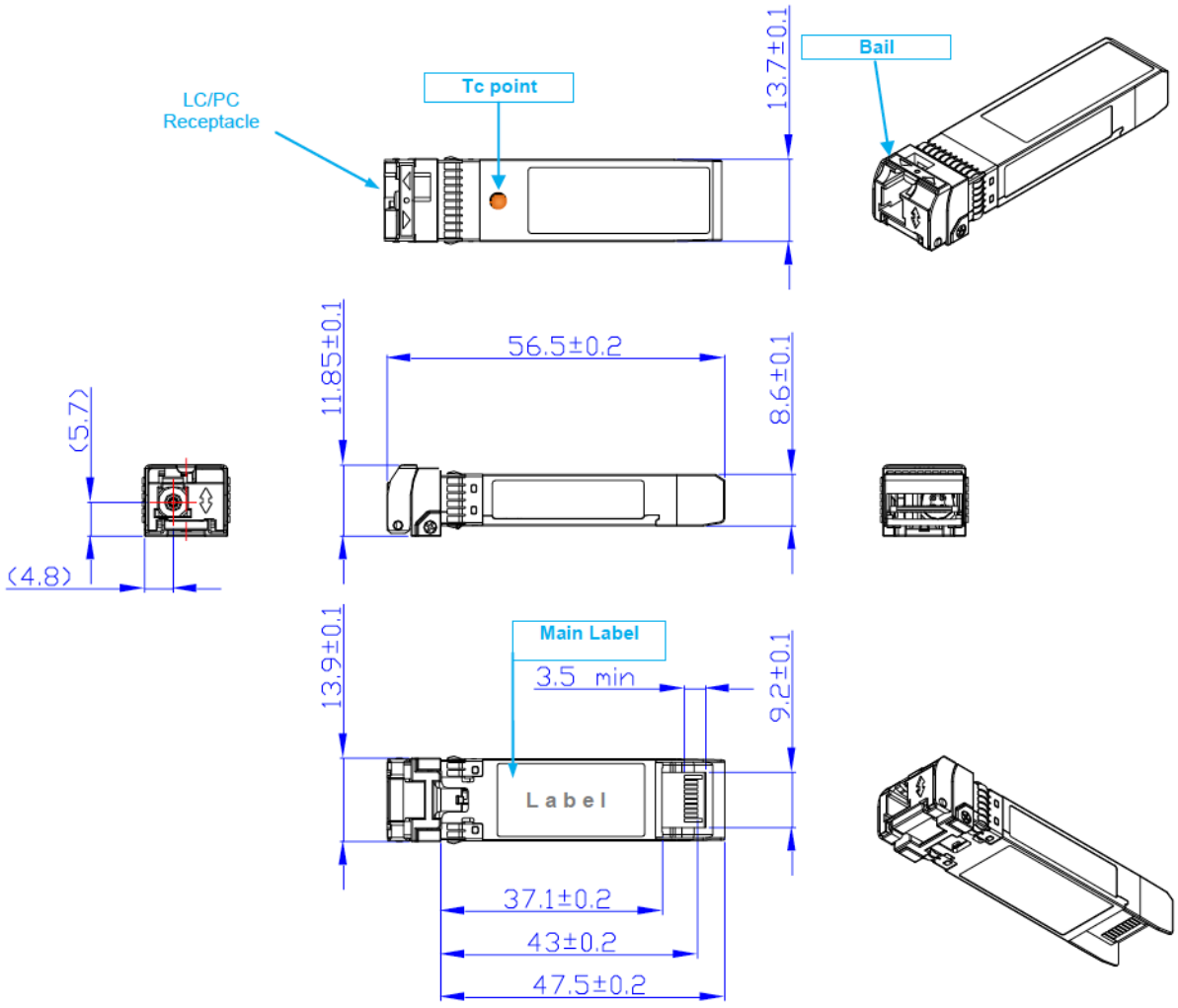
Pin Descriptions

Pin	Symbol	Name/Descriptions	Ref.
1	VeeT	Transmitter Signal Ground	1
2	Tx_Fault	Transmitter Fault (LVTTL-O) – High indicates a fault condition	2
3	Tx_Disable	Transmitter Disable (LVTTL-I) – High or open disables the transmitter	3
4	SDA	Two Wire Serial Interface Data Line (LVCMOS – I/O) (same as MOD-DEF2 in INF-8074)	4
5	SCL	Two Wire Serial Interface Clock Line (LVCMOS – I/O) (same as MOD-DEF1 in INF-8074)	4
6	MOD_DFF0	Module Absent (Output), connected to VeeT or VeeR in the module	5
7	RS0	Rate Select 0 – Not used, internally pull down	
8	RX_LOS	Receiver Loss of Signal (LVTTL-O)	2
9	RS1	Rate Select 1 – Not used, internally put down	
10	VeeR	Receiver Signal Ground	1
11	VeeR	Receiver Signal Ground	1
12	RD-	Receiver Data Out Inverted (CML-O)	
13	RD+	Receiver Data Out (CML-O)	
14	VeeR	Receiver Signal Ground	
15	VccR	Receiver Power +3.3V	
16	VccT	Transmitter Power +3.3V	
17	VeeT	Transmitter Signal Ground	1
18	TD+	Transmitter Data In (CML-I)	
19	TD-	Transmitter Data in Inverted (CML-I)	
20	VeeT	Transmitter Signal Ground	1

Notes:

4. The module signal grounds are isolated from the module case.
5. This is an open collector/drain output that on the host board requires a 4.7kΩ to 10kΩ pull-up resistor to Vcc_Host.
6. This input is internally biased high with a 4.7kΩ to 10kΩ pull-up resistor to VccT.
7. Two-Wire Serial Interface clock and data lines require an external pull-up resistor dependent on the capacitance load.
8. The signals Mod-Def 0, 1, 2 designate the two wire serial interface pins. They must be pulled up with a 4.7kΩ to 10kΩ resistor on the host board. Mod-Def 0 is grounded by the module to indicate the module is present.

Module Outline



Contact Information

Founded in 1999, AddOn Networks is North America's leading provider of transceivers and high speed cabling. With a reputation for high quality products as well as an extensive custom design portfolio, AddOn has the connectivity solution regardless of the requirement.

At AddOn, 100% of the products we ship every day are tested in the specific application for which they are intended–never batch or spec tested only. We run bandwidth, distance and IOS network tests. We have documented an impressive 0.03% failure rate over the last 10 years. To continue this rate of success we invest millions annually in our own on-site testing lab.

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