![INTEC advanced fiber optic]

25G LC BIDI SFP28 ER Lite Transceiver

[IBP-25xxyyB-C30I]

✚ Key Features

- **SFP28 Transceivers for 30km Transmission**
- **Single +3.3V Power Supply**
- **LC BIDI Connector**

◆ Features

- **Uncooled DFB Laser transmitter**
- **High sensitive APD Receiver**
- **LC BIDI optical receptacle**
- **SFF-8472 compliant digital diagnostic monitoring function implemented**
- **Operating case temperature range from 0℃ to 70℃(-40℃ to +85℃:Option)**
- **Low power consumption: Max. 1.8W**
- **Hot-pluggable to 20-pin electrical interface**
- **2-wire management interface**
- **Class 1 Laser safety**
- **RoHS 6/6 compliant**

◆ Applications

- **Local area networks**
- **Wide area networks**
- **Digital Wireless Repeater**
- **Storage area networks**

1. Functional Description

The transceiver is the SFP28 optical transceiver module which is a hot pluggable form factor designed for high speed optical networking application. The transceiver is designed for 25Gigabit Ethernet application, 2-wire management interface. The transceiver converts 25Gb/s electrical data streams to 25Gb/s optical output signal and 25Gb/s optical input signal 25Gb/s electrical data streams.

The high performance DFB-LD transmitter and high sensitivity APD receiver provide superior performance for 25Gigabit Ethernet applications up to 30km links.

The transceiver is designed to used in a single power supply (+3.3V) and an operating temperature range of 0℃ to +70℃(-40℃ to +85℃:Option).

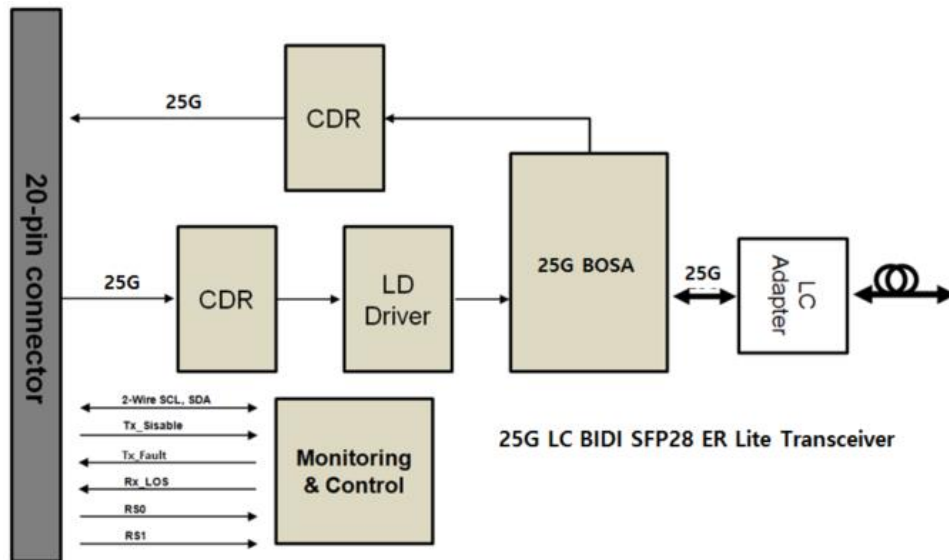**Figure 1. Transceiver block diagram**

1.1 Low Speed Description

1.1.1 Low Speed Pin Descriptions

The transceiver has several low-speed interface connectors including a 2-wire serial interface (SCL and SDA). These connections include: Tx_Fault, Tx_Disable, RS0/RS1, Mod_ABS, Rx_LOS.

[Tx_Fault]

Tx_Fault is a module output that when high, indicates that the module transmitter has detected a fault condition related to laser operation or safety. If Tx_Fault is not implemented, the Tx_Fault contact signal shall be held low by the module and may be connected to Vee within the module. The Tx_Fault output is an open drain/collector and shall be pulled up to the Vcc_Host in the host with a resistor in the range 4.7 kOhms to 10 kOhms.

[Tx_Disable]

When Tx_Disable is asserted high or left open, the SFP+ module transmitter output shall be turned off unless the module is a passive cable assembly (see Appendix E in SFF-8419) in which case this signal may be ignored. This contact shall be pulled up to VccT with a 4.7 kOhms to 10 kOhms resistor in modules and cable assemblies.
Tx_Disable is a module input contact. When Tx_Disable is asserted low or grounded the module transmitter is operating normally.

[RS0/RS1]

RS0 and RS1 are module inputs and are pulled low to VeeT with >30 kOhms resistors in the module. RS0 optionally selects the optical receive signaling rate coverage. RS1 optionally selects the optical transmit signaling rate coverage. For logical definitions of RS0/RS1 see Section 4.2. These contacts can also be used for AS0 and AS1 if implementing SFF-8079. See SFF- 8079 for details.
RS1 is commonly connected to VeeT or VeeR in the classic SFP modules. The host needs to ensure that it will not be damaged if this contact is connected to VeeT or VeeR in the module.

[Mod_ABS]

Mod_ABS is connected to VeeT or VeeR in the SFP+ module. The host may pull this contact up to Vcc_Host with a resistor in the range 4.7 kOhms to 10 kOhms. Mod_ABS is asserted 'High' when the SFP+ module is physically absent from a host slot. In the SFP MSA (INF-8074i) this contact has the same function but is called MOD_DEF0.

[Rx_LOS]

Rx_LOS when high indicates an optical signal level below that specified in the relevant standard.

Rx_LOS is an open drain/collector output, but may also be used as an input by supervisory circuitry in the module. For a nominally 3.3 V Vcc_Host using a resistive pull up to Vcc_Host the resistor value shall be in the range 4.7kOhms to 10 kOhms. For a nominally 2.5 V Vcc_Host using a resistive pull up to Vcc_Host the resistor value shall be in the range 4.7 kOhms to 7.2 kOhms. The Rx_LOS signal is intended as a preliminary indication to the host in which the module is installed that the received signal strength is below the specified range. Such an indication typically points to non-installed cables, broken cables, or a disabled, failing or a powered off transmitter at the far end of the cable.

Additional indications are provided by the host in which the module is installed to verify that the information being transmitted is valid, correctly encoded, and in the correct format. Such additional indications are outside the scope of the module specification.

Rx_LOS may be an optional function depending on the supported standard. If the Rx_LOS function is not implemented, or is reported via the two-wire interface only, the Rx_LOS contact shall be held low by the module and may be connected to Vee within the module.

Rx_LOS assert min and de-assert max are defined in the relevant standard. To avoid spurious transition of Rx_LOS a minimum hysteresis of 0.5 dBo is recommended.

1.1.1 Low Speed Pin Electrical Specifications

[Low Speed Signaling]

Low speed signaling other than SCL and SDA is based on Low Voltage TTL (LVTTL) operating at Vcc. Vcc refers to the generic supply voltages of VccTx, VccRx, Vcc_host or Vcc1.

Hosts shall use a pull-up resistor connected to Vcc_host on each of the 2-wire interface SCL (clock), SDA (data), and all low speed status outputs.

The SCL and SDA is a hot plug interface that may support a bus topology. During module insertion or removal, the module may implement a pre-charge circuit which prevents corrupting data transfers from other modules that are already using the bus.

Table 1. Low Speed Pin Electrical Specifications

Parameter	Symbol	Min	Max	Unit	Condition
Host 2-wire Vcc	Vcc_Host_2w	3.14	3.46	V	
SCL and SDA	VOL	0.0	0.4	V	Rp2w 2 pulled to Vcc_Host_2w
	VOH	Vcc_Host_2w -0.5	Vcc_Host_2w +0.3	V	Rp2w 2 pulled to Vcc_Host_2w
SCL and SDA	VIL	-0.3	VccT*0.3	V	
	VIH	VccT*0.7	VccT+0.5	V	
Capacitance for SCL and SDA I/O	Ci		14	pF	

Pin					
Total bus capacitive load for SCL and SDA	Cb		100	pF	3.0KΩ Pull-up resistor, Max
			200	pF	1.6KΩ Pull-up resistor, Max
LPMode, Reset and ModSelL	VIL	-0.3	0.8	V	│Iin│<=125uA for 0V<Vin, Vcc
	VIH	2	Vcc+0.3	V	
ModPrsL and IntL	VOL	0	0.4	V	IOL=2.0mA
	VOH	Vcc-0.5	Vcc+0.3	V	

[2-wire Timing Daigram]

The transceiver 2-wire bus timing is shown in Fig 2. and the detail of clock stretching is shown in Figure 3. The transceiver 2-wire timing specifications are given in Table 2.
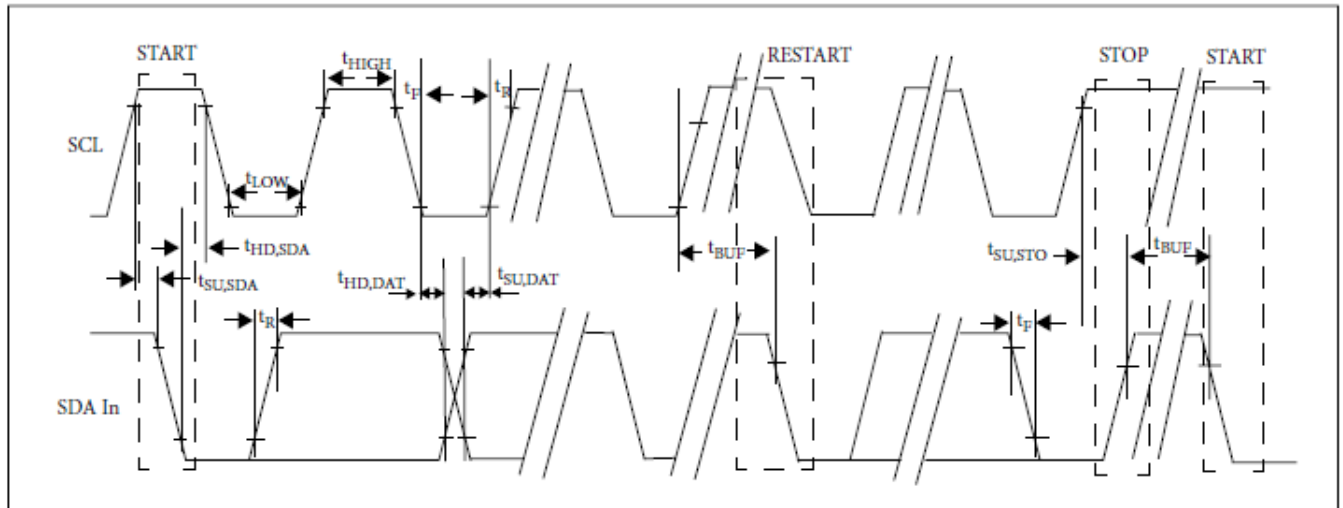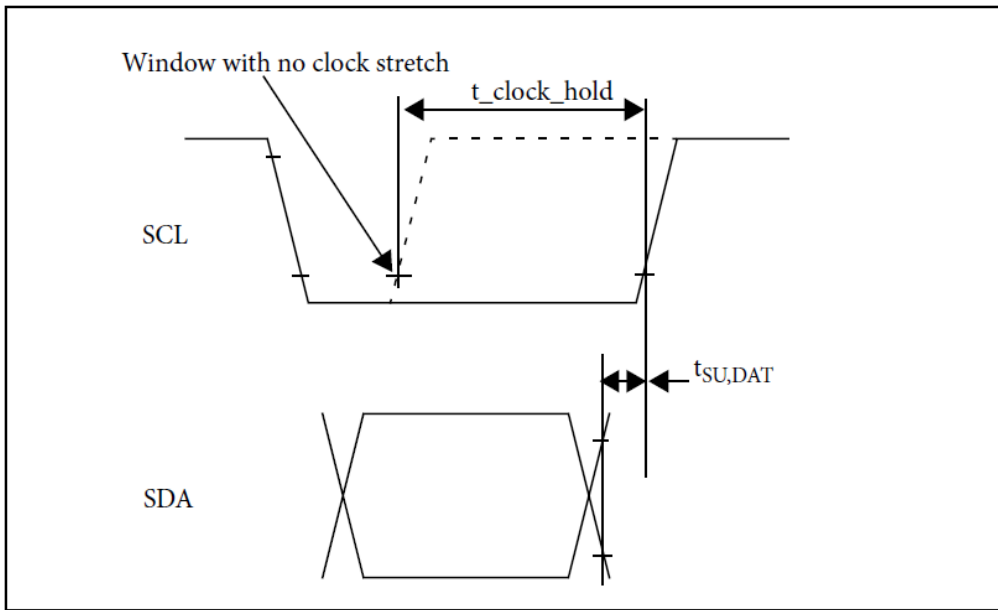

Fig 2. Two wire interface timing diagram

Fig 3. Detail of Clock Stretching

Table 2. MANAGEMENT INTERFACE TIMING PARAMETERS

Parameter	Symbol	Min	Max	Unit	Conditions
Clock Frequency	fSCL	0	400	kHz	Module shall operate with fSCL up to 100 kHz without requiring clock stretching. The module may clock stretch with fSCL greater than 100 kHz and up to 400 kHz.
Clock Pulse Width Low	tLOW	1.3		us	
Clock Pulse Width High	tHIGH	0.6		us	
Time bus free before new transmission can start	tBUF	20		us	Between STOP and START and between ACK and ReSTART
START Hold Time	tHD.STA	0.6		us	
START Set-up Time	tSU.STA	0.6		us	
Data In Hold Time	tHD.DAT	0		us	
Data in Set-up Time	tSU.DAT	0.1		us	
Input Rise Time (100 kHz)	tR,100		1000	ns	From (VIL,MAX-0.15) to (VIH, MIN +0.15)
Input Rise Time (400 kHz)	tR.400		300	ns	From (VIL,MAX-0.15) to (VIH, MIN +0.15)
Input Fall Time (400 kHz)	tF.400		300	ns	From (VIH,MIN +0.15) to (VIL,MAX - 0.15)
STOP Set-up Time	tSU.STO	0.6		us	
Serial Interface Clock Holdoff (ClockStretching)	T_cLock_hold		500	us	Maximum time the slave may hold the SCL line low before continuing with a read or write operation

2. Application

Recommended MSA connections to the transceiver are shown in Figure 4 below.

Power supply filtering is recommended for the transceiver.

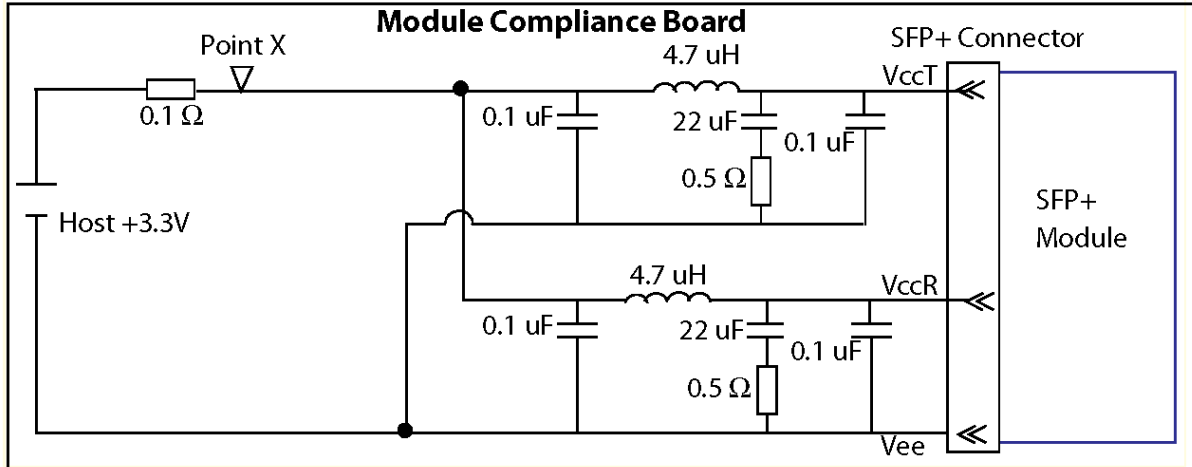**Fig 4. MODULE COMPLIANCE BOARD POWER SUPPLY FILTERS**

3. PIN description

Figure 5 shows the signal symbols and contact numbering for the module edge connector. The diagram shows the module PCB edge as a top and bottom view. There are 20 contacts intended for high speed signals, low speed signals, power and ground connections.
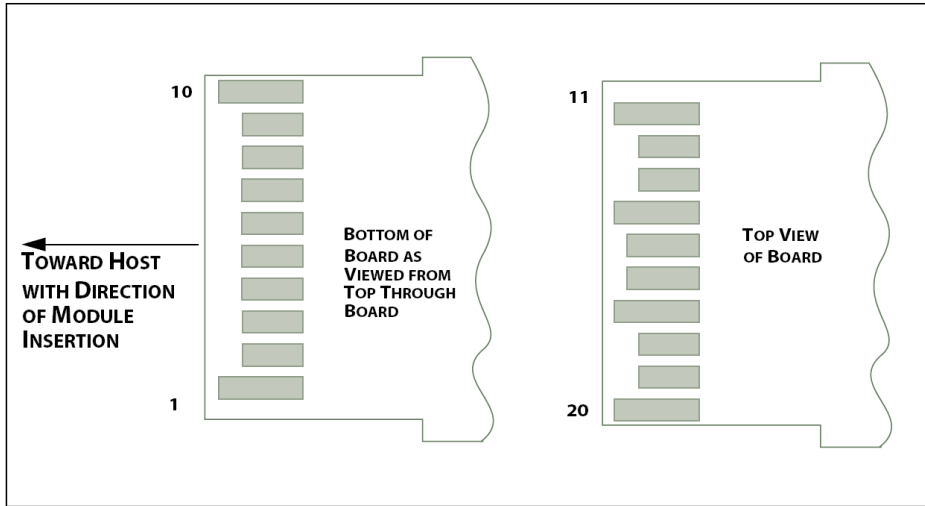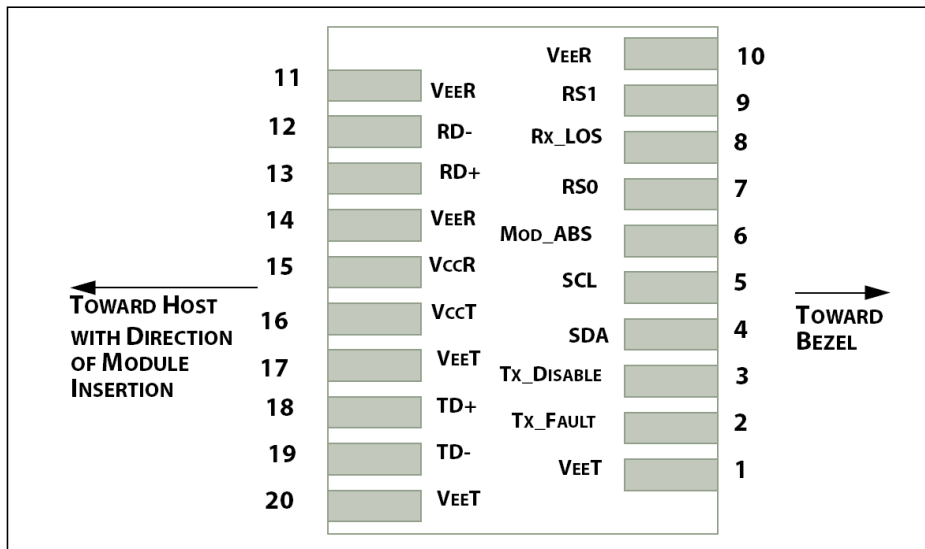

Fig 5. MODULE PAD LAYOUT

Fig 6. HOST PCB SFP+ PAD ASSIGNMENT TOP VIEW

4. Electrical Pin Descriptions

Table 3. Pin Assignment

Pin	Logic	Symbol	Description	Plug Sequence
1		VeeT	Module Transmitter Ground	1
2	LVTTL-O	Tx_Fault	Module Transmitter Fault	3
3	LVTTL-I	Tx_Disable	Transmitter Disable; Turns off transmitter laser output	3
4	LVTTL-I/O	SDA	2-wire Serial Interface Data Line (Same as MOD-DEF2 in INF-8074i)	3
5	LVTTL-I/O	SCL	2-wire Serial Interface Clock (Same as MOD-DEF1 in INF-8074i)	3
6		Mod_ABS	Module Absent, connected to VeeT or VeeR in the module	3
7	LVTTL-I	RS0	Rate Select 0, optionally controls SFP+ module receiver.	3
8	LVTTL-O	Rx_LOS	Receiver Loss of Signal Indication (In FC designated as Rx_LOS and in Ethernet designated as Signal Detect)	3
9	LVTTL-I	RS1	Rate Select 1, optionally controls SFP+ module transmitter	3
10		VeeR	Module Receiver Ground	1
11		VeeR	Module Receiver Ground	1
12	CML-O	RD-	Receiver Inverted Data Output	3
13	CML-O	RD+	Receiver Non-Inverted Data Output	3
14		VeeR	Module Receiver Ground	1
15		VccR	Module Receiver 3.3V Supply	2
16		VccT	Module Transmitter 3.3V Supply	2
17		VeeT	Module Transmitter Ground	1
18	CML-I	TD+	Transmitter Non-Inverted Data Input	3
19	CML-I	TD-	Transmitter Inverted Data Input	3
20		VeeT	Module Transmitter Ground	1

5. Dimensions

Dimensions are in millimeters.
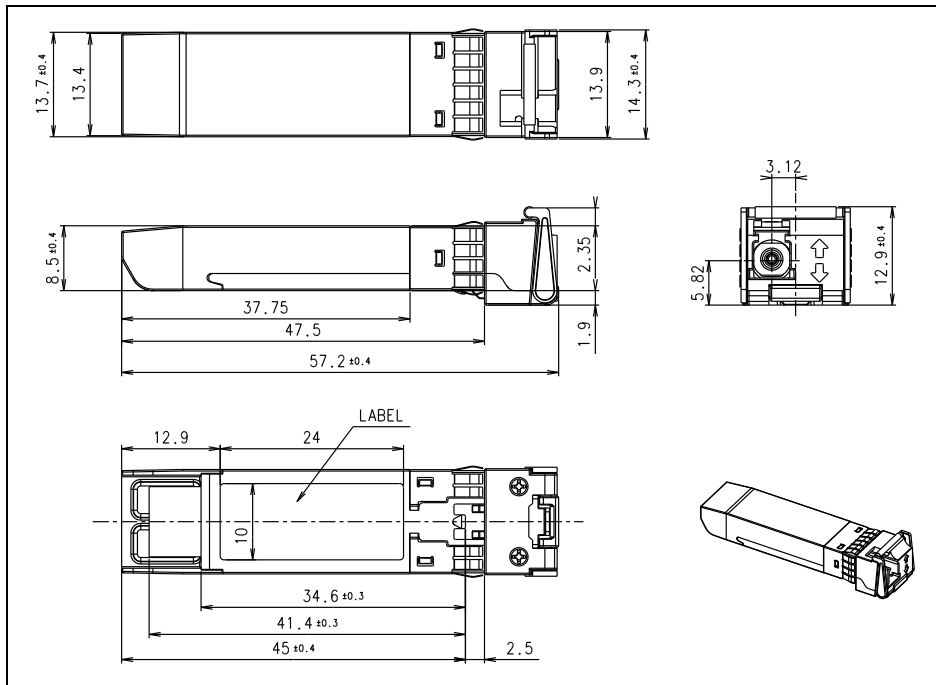
Tolerances are ±0.2mm, unless otherwise specified.

Fig 7. BIDI SFP 28 Dimensions

6. SFP+ Host Board Mechanical Layout [unit: mm]

A typical host board mechanical layout for attaching the SFP+ connector and cage system is shown in Figure 8 and Figure 9.
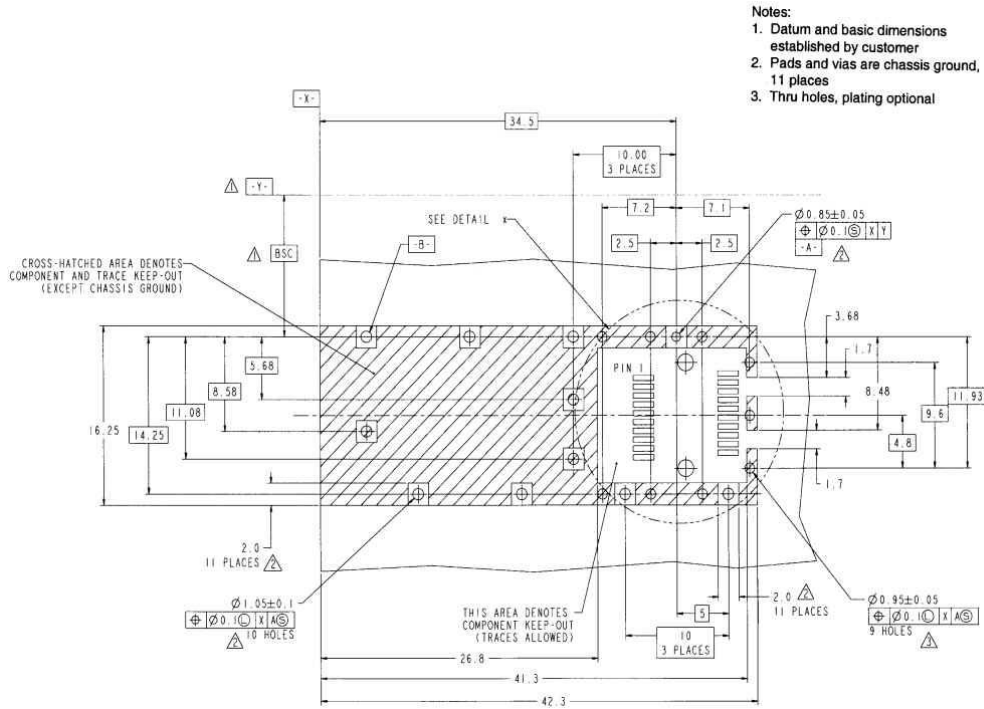
Fig 8. Host board mechanical layout(mm)
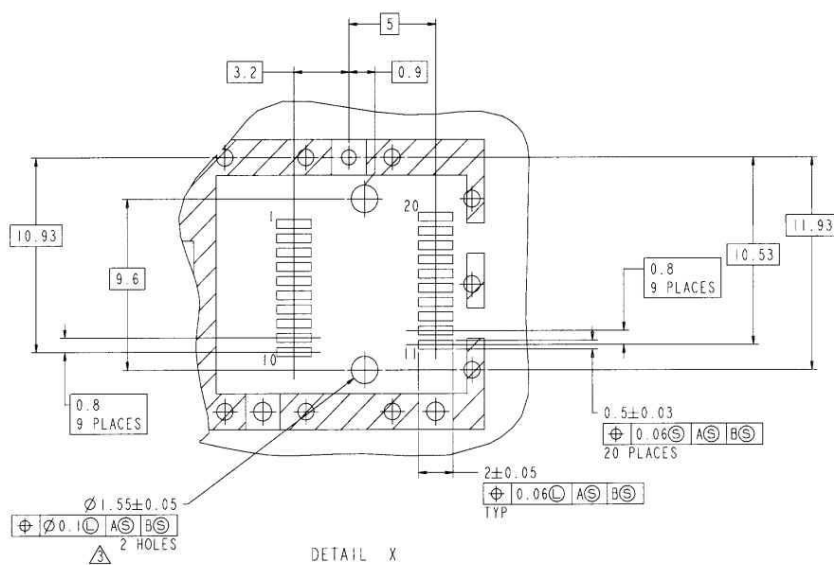
Fig 9. Detailed host board mechanical layout(mm)

7. Two-wire interface Protocol and Management Interface

7.1. Memory Map

2-Wire Serial Address 1010000x	
Lower Page 00h	
0	Identifier
1 - 2	Status
3 - 21	Interrupt Flags
22 - 33	Module Monitors
34 - 81	Channel Monitors
82 - 85	Reserved
86 - 98	Control
99	Reserved
100 - 106	Free Side Device and Channel Mask
107	Reserved
108 - 112	Free Side Device Properties
113 - 118	Reserved
119 - 122	Password Change Entry Area (Optional)
123 - 126	Password Entry Area(Optional)
127	Page Select Byte

Upper Page 00h	
128	Identifier
129 - 191	Base ID Fields
192 - 223	Extended ID
224 - 255	Vendor Specific ID

Optional	
Page 01h	
128	CC_APPS
129	AST Table Length (TL)
130 - 131	Application Code Entry 0
132 - 133	Application Code Entry 1
134 - 253	Other entries
254 - 255	Application Code Entry TL

Optional	
Page 02h	
128 - 255	User EEPROM Data

Optional	
Page 03h(Cable Assemblies)	
128 - 175	Free Side Device Thresholds
176 - 223	Channel Threshold
224 - 225	Reserved
226 - 227	Vendor
238 - 241	Channel Controls
242 - 253	Channel Monitor Masks
254 - 255	Reserved

Fig 10. Memory map

7.2. Two-wire interface ID (A0 Address)

Address	Hex	Name of fields	description	Note
0	03	Identifier	SFP+/SFP28	
1	04	Ext. Identifier	GBIC/SFP Function is defined by serial ID only	
2	07	Connector	LC	
3~8	00	Transceiver		
9	00	Fiber channel transmission media		
10	00	Fiber Channel speed		
11	03	Encoding	NRZ	
12	FF	Nominal bit rate, units of 100MBits/sec	25.78125 Gbps	
13	00	Reserved		
14	1E	Length(9u)[km]	30km	
15	00	Length(9u)[100m]	-	
16	00	Length(50u,OM2)[m]	Not support	
17	00	Length(62.5u,OM1)[m]	Not support	
18	00	Length(Copper)	Not support	
19	00	Length(50u,OM3)[m]	Not support	
20	49	Vendor Name	I	Intec E&C(ASCII)
21	6E		n	
22	74		t	
23	65		e	
24	63		c	
25	20		SPACE	
26	45		E	
27	26		&	
28	43		C	
29	20		SPACE	
30	20		SPACE	
31	20		SPACE	
32	20		SPACE	

33	20		SPACE	
34	20		SPACE	
35	20		SPACE	
36	00	Reserved		
37~39	00	Vendor OUI		
40			I	
41			B	
42			P	
43			-	
44			2	(ASCII)
45			5	
46			X	xx : Tx Wavelength
47			X	1270nm : 27
48		Vendor PN	Y	1330nm : 33
49			Y	yy : Rx Wavelength
50			B	1270nm : 27
51			-	1330nm : 33
52			C	
53			3	
54			0	
55			I	
56	31		1	
57	2E	Vendor Rev.	.	1.0(ASCII)
58	30		0	
59	20			
60 ~ 61	04F7 0533	Wavelength[nm]	xxxx	xxxx : Tx Wavelength 1271nm : 04F7 1331nm : 0533
62	00	Reserved		
63	Varies	CC_BASE	Check Sum byte for Bytes 0 to 62	
64	00	Reserved		
65	3A	Options	TX_Disable, TX_Fault, Los	
66	65	Bit Rate MAX[%]		
67	63	Bit Rate MIN[%]		

68		Vendor S/N	I	xx : Tx Wavelength
69			B	1270nm : 27
70			P	1330nm : 33
71			x	
72			x	
73			y	yy : Rx Wavelength
74			y	1270nm : 27
75			-	1330nm : 33
76			1(Year)	
77			5(Year)	
78			1~C(Month)	
79			0	
80			0	
81			0	
82			0	
83			1	
84		Date Code	1	170717(ASCII)
85			7	
86			0	
87			7	
88			0	
89			3	
90	20		SPACE	
91	20		SPACE	
92	68	Diagnostic Monitoring type	Digital diagnostic, Internally Calibrated, Average Power	
93	F0	Enhanced Options		
94	06	SFF-8472 Compliance	Rev. 12.0 of SFF-8472	

8. Specification

8.1. Absolute Maximum Ratings

Parameter	Symbol	Min	Typ	Max	Unit
Storage Temperature	T_{ST}	-40		+85	℃
Power Supply Voltage	V_{CC}	0		3.6	V
Operating Humidity	H_{OP}			85	% RH

8.2. Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
Operating Case Temperature	T_c	0 (-40)		+70 (+85)	℃
Supply Voltage	V_{CC}	3.14	3.3	3.46	V
Power Consumption	P_W			1.8(TBD)	W

8.3. Transmitter Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Signaling rate	B		25.78125 ± 100 ppm		GBd
Wavelength	λ_c		1270 /1330		nm
Side-mode suppression ratio(SMSR)		30			dB
Average launch power		+2.0		+5.5	dBm
Transmitter and dispersion penalty				1.5	dB
Average launch power of OFF transmitter				-30	dBm
Extinction ratio		4.3			dB
RIN OMA				-130	dB/Hz
Optical return loss tolerance				20	dB
Transmitter reflectance				-12	dB

8.4. Receiver Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Signaling rate	B	25.78125 ± 100 ppm			GBd
Wavelength	λ_c		1270 /1330		nm
Damage threshold			-7.0		dBm
Receiver reflectance				-26	dB
Receiver sensitivity(OMA)				-16.0	dBm

Note) Receiver sensitivity is -16.0dBm at 25.78125GBd[NRZ, PRBS-2^31-1, ER=4.3].

9. ESD(Electrostatic Discharge)

The module speed signal contacts shall withstand 1000 V electrostatic discharge based on Human Body Model per JEDEC JESD22-A114-B.

10, Laser Safety

The transceivers use a semiconductor laser that is classified as Class 1 laser products per the laser safety requirements of FDA/CDRH, 21 CFR1040.10 and 1040.11. These products have also been tested and certified as Class 1 laser products per IEC60825-1:2007 and IEC60825-1:2001 International standards.

11. Ordering Information

For more information on this or other products and their availability, please contact e-mail at sales@intecec.com.

| ① | ② | - | ③ | ④ | ⑤ | ⑥ | - | ⑦ | ⑧ | ⑨ |

No.	ITEM	Code	Description
①	Company	I	INTEC E&C
②	Form Factor	BP	BIDI SFP28
③	Data-rate	25	25Gbps
④	Tx wavelength	xx	1270nm/1330nm
⑤	Rx wavelength	yy	1270nm/1330nm
⑥	Optical interface	B	LC-UPC receptacle
⑦	Temperature range	C	0℃ ~ 70℃(Case temp.)
		[I]	[-40℃ to +85℃(Case temp):Option]
⑧	Distance	30	30Km
⑨	customer	I	-

12. Revision History

1. Version 0.1(dated 2017-07-25)

   : Initial Release

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