



RoHS Compliant
1550 nm Single-mode Transceiver
Small Form Pluggable (SFP+), with Diagnostic Monitoring
10G BASE-EW/ER Ethernet



Features

- Compliant with SFF8472 diagnostic monitoring interface Duplex LC connector
- Single power supply 3.3V
- Hot Pluggable
- Up to 40km transmission on SMF
- 1550nm EML laser and PIN receiver
- Class 1 laser product complies with EN 60825-1
- Support CPRI line bit rate option 7: 9830.4 Mbit/s

Ordering Information

PART NUMBER	VOLTAGE	TEMPERATURE	Distance
LE48-H3L-TC-N	3.3V	0°C to 70 °C	40km
LE48-H3L-TI-N	3.3V	-40°C to 85 °C	40km

Diagnostics

Parameter	Range	Accuracy	Unit	Calibration
Internal Transceiver Temperature	-40 to 85	± 3	°C	Internal
Internal Transceiver Voltage	3.14 to 3.46	± 0.1	V	
Bias Current	0 to 120	± 10%	mA	
TX Power	-4.7 to +4.7	± 3	dB	
RX average Power	-1 to -16	± 3	dB	



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Absolute Maximum Ratings

PARAMETER	SYMBOL	MIN	MAX	UNITS	NOTE
Storage Temperature	T_s	-40	85	°C	
Operating Relative Humidity	RH	0	85	%	
Supply Voltage	V_{cc}	0	3.6	V	
Input Voltage	V_{in}	0	V_{cc}	V	

Recommended Operating Conditions

PARAMETER	SYMBOL	MIN	MAX	UNITS	NOTE
Case operating Temperature	T_C	0	70	°C	LE48-H3L-TC-N
		-40	85		LE48-H3L-TI-N
Supply Voltage	V_{cc}	3.14	3.46	V	
Supply Current	$I_{TX} + I_{RX}$		450	mA	
Power Consumption	P		1.5	W	



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Transmitter Electro-optical Characteristics

$V_{CC} = 3.14\text{ V to } 3.46\text{ V}$, $TC = 0\text{ }^{\circ}\text{C to } 70\text{ }^{\circ}\text{C}$, $TI = -40\text{ }^{\circ}\text{C to } 85\text{ }^{\circ}\text{C}$

PARAMETER	SYMBOL	MIN	TYP.	MAX	UNITS	NOTE
Data Rate	B		10.3125		Gbps	
Output Optical Power(Average)	P_{out}	-4.7	---	+4.0	dBm	
Output Optical Power(OMA)	P_{out}	-1.7	---	---	dBm	
Extinction Ratio	ER	6			dB	
Center Wavelength	λ_c	1530	---	1565	nm	
Spectrum Width	$\Delta \lambda$			1	nm	
Side mode Suppression ratio	SSR_{min}	30			dB	
Transmitter and Dispersion Penalty	TDP			2	dB	
Relative Intensity Noise	RIN	---	---	-128	dB/Hz	
Optical Return Loss	ORL	21	---	---	dB	
Output Eye			Compliant with IEEE802.3ae			
Differential Input Impedance	Z_d		100		Ω	
Differential Input Voltage Swing	V_{DIFF}	300		1000	mVpp	
Transmit Fault Output-Low	TX_FAULT_L	0.0	---	0.5	V	
Transmit Fault Output-High	TX_FAULT_H	2.4	---	V_{CC}	V	
TX_DISABLE Assert Time	t_{off}	---	---	100	μs	
TX_DISABLE Negate Time	t_{on}	---	---	2	ms	
Tx_Fault assert for cooled module	t_{fault}	---	---	50	ms	
TX_DISABLE time to start reset	t_{reset}	10	---	---	μs	



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Receiver Electro-optical Characteristics

$V_{CC} = 3.14 \text{ V to } 3.46 \text{ V}$, $TC = 0^\circ \text{C to } 70^\circ \text{C}$, $TI = -40^\circ \text{C to } 85^\circ \text{C}$

PARAMETER	SYMBOL	MIN	TYP.	MAX	UNITS	NOTE
	L					
Data Rate	B		10.3125		Gbps	
Optical Input Power-maximum	P_{IN}	-1.0	---	---	dBm	BER < 10^{-12}
Receiver Sensitivity@10.3125Gbps	P_{IN}	---	---	-15.8	dBm	BER < 10^{-12}
Receiver Sensitivity(OMA)	P_{IN}	---	---	-14.1	dBm	BER < 10^{-12}
Stressed Receiver Sensitivity(OMA)	P_{IN}	---	---	-11.3	dBm	BER < 10^{-12}
Receiver Reflectance	Ref	---	---	-26	dB	
Operating Center Wavelength	λ_C	1530	---	1565	nm	
Loss of Signal-Asserted	P_A	-30	---	---	dBm	
Loss of Signal-Deasserted	P_D	---	---	-18	dBm	
Differential Output Impedance	Z_d	---	100	---	Ω	
Differential Output Voltage	V_{DIFF}	300	---	800	mVpp	
Receiver Loss of Signal Output Voltage-Low	RX_LO S_L	0	---	0.5	V	
Receiver Loss of Signal Output Voltage-High	RX_LO S_H	2.4	---	V_{CC}	V	
Receiver Loss of Signal Assert Time (off to on)	t_{A,RX_LOS}	---	---	100	μs	
Receiver Loss of Signal Assert Time (on to off)	t_{D,RX_LOS}	---	---	100	μs	

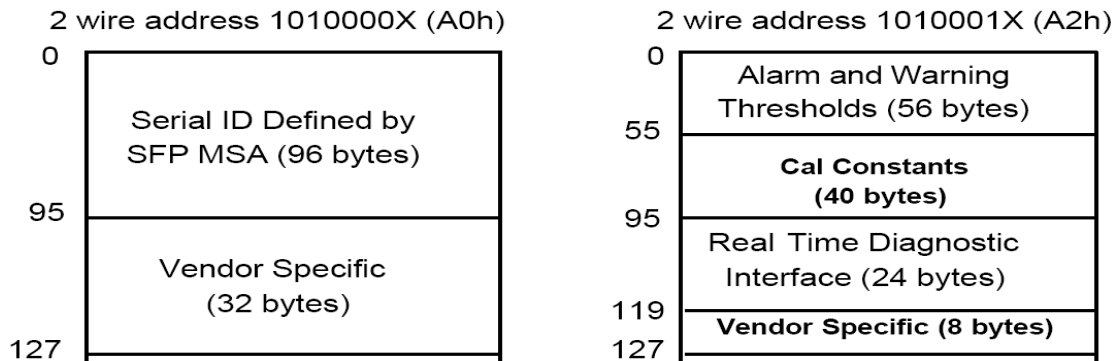
Timing Parameters

PARAMETER	SYMBOL	MIN	TYP.	MAX	UNITS	NOTE
Time to initialize	t_{start_up}			10	s	



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Digital Diagnostic Memory Map



EEPROM Serial ID Memory contents(A0h)

Address	Hex	Fields	Result
0	03(H)	identifier	SFP or SFP+ or SFP28
1	04(H)	Ext.Identifier	GBIC/SFP function is defined by two-wire interface ID only
2	07(H)	Connector	LC
3	20(H)	Transceiver	10G Base-ER;
4	00(H)	Unallocated	
5	00(H)		
6	00(H)		
7	00(H)		
8	00(H)		
9	00(H)		
10	00(H)		
11	06(H)	Encoding	64B/66B
12	67(H)	BR(Nominal)	10300Mbps
13	00(H)	Rate Identifier	Unspecified
14	0A(H)	Length(SMFm)-km	40(units of km)
15	64(H)	Length(SMF)	255(units of 100m)
16	00(H)	Length(50µm)	N/A
17	00(H)	Length(62.5µm)	N/A
18	00(H)	Length(cable)	N/A
19	00(H)	Length(OM3)	N/A
20	4D(H)	Vendor name	A
21	4F(H)	Vendor name	P
22	58(H)	Vendor name	A
23	41(H)	Vendor name	C
24	20(H)	Vendor name	



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25	20(H)	Vendor name	O
26	20(H)	Vendor name	p
27	20(H)	Vendor name	t
28	20(H)	Vendor name	o
29	20(H)	Vendor name	
30	20(H)	Vendor name	
31	20(H)	Vendor name	
32	20(H)	Vendor name	
33	20(H)	Vendor name	
34	20(H)	Vendor name	
35	20(H)	Vendor name	
36	00(H)	Transceiver	Unallocated
37	00(H)	Vendor OUI	00
38	00(H)	Vendor OUI	0F
39	00(H)	Vendor OUI	99
40	53(H)	Vendor PN	L
41	46(H)	Vendor PN	E
42	50(H)	Vendor PN	4
43	2D(H)	Vendor PN	8
44	31(H)	Vendor PN	-
45	30(H)	Vendor PN	H
46	47(H)	Vendor PN	3
47	4C(H)	Vendor PN	L
48	52(H)	Vendor PN	-
49	4C(H)	Vendor PN	T
50	43(H)	Vendor PN	C
51	2D(H)	Vendor PN	-
52	54(H)	Vendor PN	N
53	20(H)	Vendor PN	
54	20(H)	Vendor PN	
55	20(H)	Vendor PN	
56	30(H)	Vendor rev	0
57	30(H)	Vendor rev	0
58	30(H)	Vendor rev	0
59	30(H)	Vendor rev	0
60	05(H)	Wavelength	1550nm
61	1E(H)	Wavelength	
62	00(H)	Unallocated	Unallocated
63		CC_BASE	E5
64	00(H)	Options	Cooled Transceiver Declaration
65	1A(H)	Options	Loss of Signal;Tx_Fault;Tx_Disable;
66	00(H)	BR	Max
67	00(H)	BR	Min
68		Vendor SN	0



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69			1
70			2
71			3
72			4
73			5
74			6
75			7
76			8
77			9
78			A
79			B
80			C
81			D
82			E
83			F
84			0
85			7
86			0
87		Date code	1
88			0
89			1
90			
91			
92	68(H)	Diagnostic Monitoring Type	Received Average Power Measurement Type;Internally Calibrated;Digital diagnostic monitoring implemented;
93	B0(H)	Enhanced Options	Rx_Loss Monitoring;Tx_Fault Monitoring;Tx_Disable Control;Alarm/warning Flags;
94	03(H)	SFF-8472 Compliance	includes functionality described in Rev 11.0 of SFF-8472
95		CC_EXT	86
96	4D(H)	Vendor Specific	E
97	6F(H)	Vendor Specific	X
98	78(H)	Vendor Specific	T
99	61(H)	Vendor Specific	R
100	6E(H)	Vendor Specific	E
101	65(H)	Vendor Specific	M
102	74(H)	Vendor Specific	E
103	20(H)	Vendor Specific	L



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104	53(H)	Vendor Specific	Y
105	46(H)	Vendor Specific	
106	50(H)	Vendor Specific	C
107	2D(H)	Vendor Specific	O
108	31(H)	Vendor Specific	M
109	30(H)	Vendor Specific	P
110	47(H)	Vendor Specific	A
111	4C(H)	Vendor Specific	T
112	52(H)	Vendor Specific	I
113	4C(H)	Vendor Specific	B
114	43(H)	Vendor Specific	L
115	2D(H)	Vendor Specific	E
116	54(H)	Vendor Specific	E
117	00(H)	Vendor Specific	X
118	00(H)	Vendor Specific	T
119	00(H)	Vendor Specific	R
120	00(H)	Vendor Specific	E
121	00(H)	Vendor Specific	M
122	00(H)	Vendor Specific	E
123	00(H)	Vendor Specific	
124	00(H)	Vendor Specific	
125	00(H)	Vendor Specific	
126	00(H)	Vendor Specific	
127	00(H)	Vendor Specific	

EEPROM Serial ID Memory contents (A2h)

For $T_C = -40^{\circ}C$ to $85^{\circ}C$

Address(A2h)	Description	Value
00-01	Temp High Alarm	80 Degree C
02-03	Temp Low Alarm	-10 Degree C
04-05	Temp High Warning	75 Degree C
06-07	Temp Low Warning	-5 Degree C
08-09	Voltage High Alarm	3.6 V
10-11	Voltage Low Alarm	3.0 V



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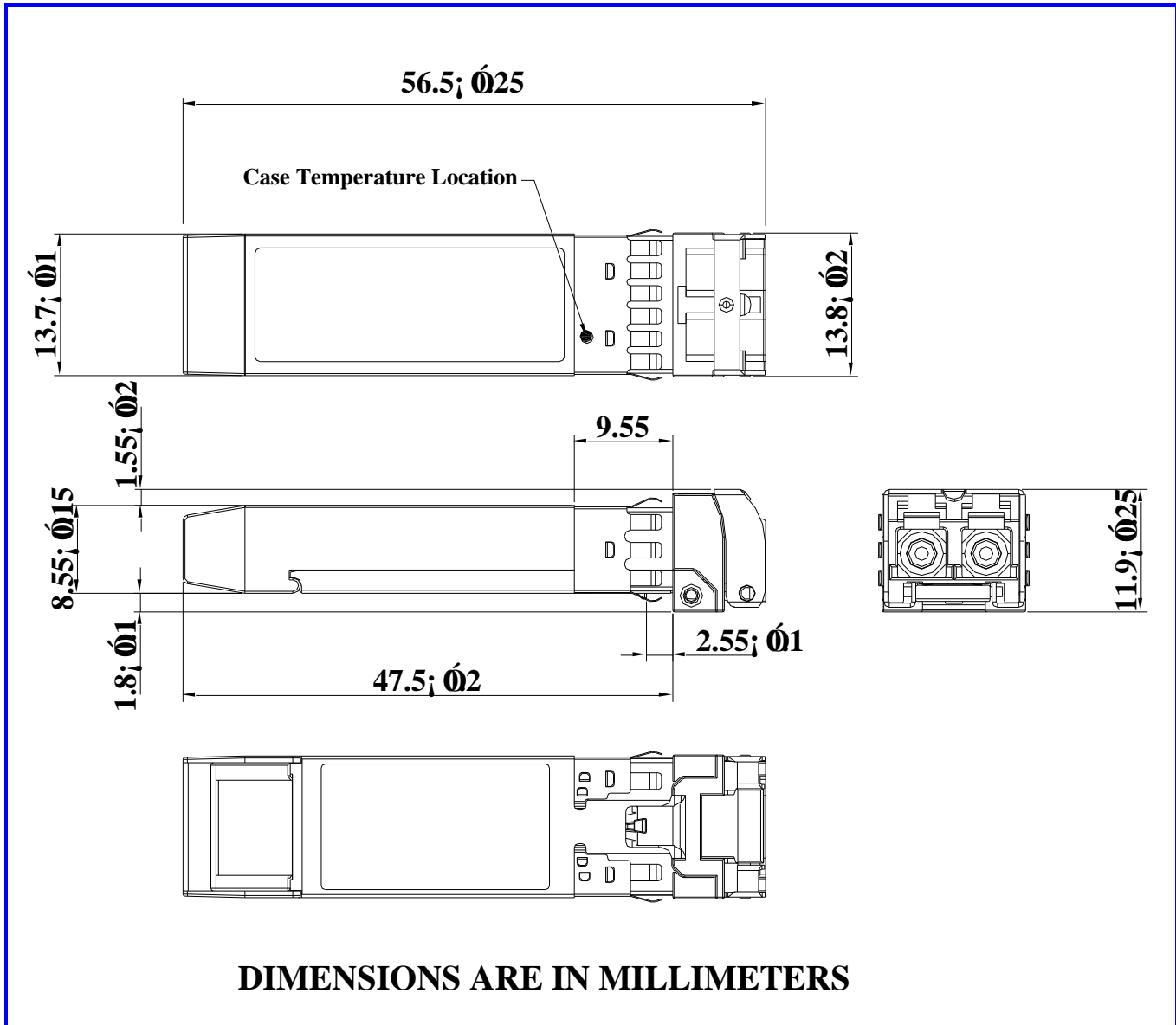
12-13	Voltage High Warning	3.5 V
14-15	Voltage Low Warning	3.1 V
16-17	Bias High Alarm	100 mA
18-19	Bias Low Alarm	30 mA
20-21	Bias High Warning	90 mA
22-23	Bias Low Warning	40 mA
24-25	TX Power High Alarm	+3 dBm
26-27	TX Power Low Alarm	-2 dBm
28-29	TX Power High Warning	+2 dBm
30-31	TX Power Low Warning	-1 dBm
32-33	RX Power High Alarm	0 dBm
34-35	RX Power Low Alarm	-17 dBm
36-37	RX Power High Warning	-1 dBm
38-39	RX Power Low Warning	-16 dBm
40-55	Reserved Reserved for future monitored quantities	
56-91	External calibration constant	
92-94	Reserved	
95	Check sum	
96-97	Real Time temperature	
98-99	Real Time supply voltage	
100-101	Real Time TX bias current	
102-103	Real Time TX optical power	
104-105	Real Time RX received power	
106-109	Reserved	
110(bit7)	NA	
110(bit6)	NA	
110(bit5)	Reserved	
110(bit4)	NA	
110(bit3)	NA	
110(bit2)	Digital state of TX fault output pin	
110(bit1)	Digital state of LOS output pin	
110(bit0)	NA	
111	Reserved	
112(bit7)	Set when internal temperature exceeds high alarm level	
112(bit6)	Set when internal temperature exceeds is below alarm level	
112(bit5)	Set when internal supply voltage exceeds high alarm level	
112(bit4)	Set when internal supply voltage is below alarm level	
112(bit3)	Set when TX bias exceeds high alarm level	
112(bit2)	Set when TX bias voltage is below alarm level	
112(bit1)	Set when TX output power exceeds high alarm level	
112(bit0)	Set when TX output power voltage is below alarm level	
113(bit7)	Set when RX received power exceeds high alarm level	
113(bit6)	Set when RX received power is below alarm level	
113(bit5-0)	Reserved	



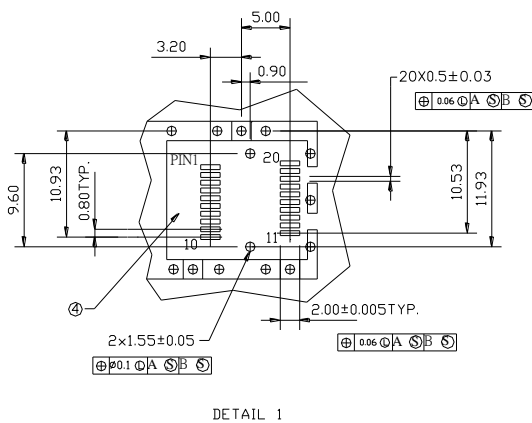
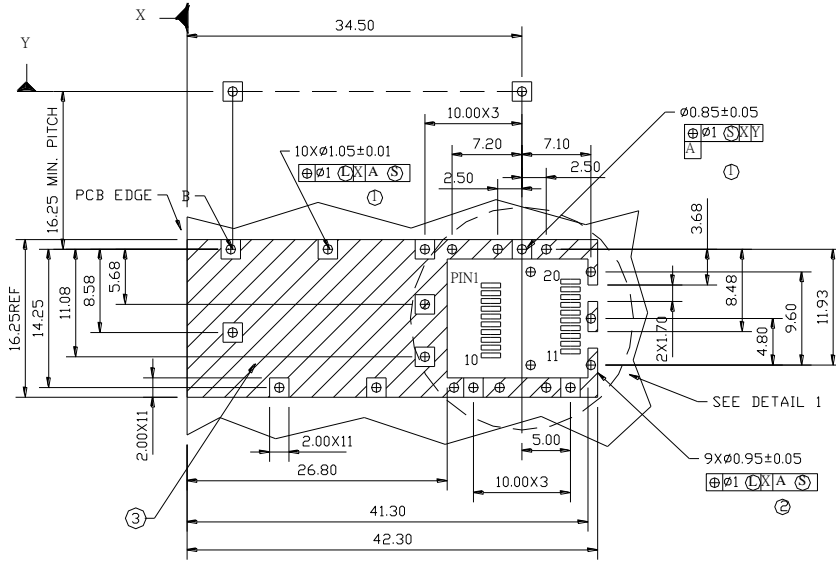
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114-115	Reserved	
116(bit7)	Set when internal temperature exceeds high warning level	
116(bit6)	Set when internal temperature exceeds is below warning level	
116(bit5)	Set when internal supply voltage exceeds high warning level	
116(bit4)	Set when internal supply voltage is below warning level	
116(bit3)	Set when TX bias exceeds high warning level	
116(bit2)	Set when TX bias voltage is below warning level	
116(bit1)	Set when TX output power exceeds high warning level	
116(bit0)	Set when TX output power voltage is below warning level	
117(bit7)	Set when RX received power exceeds high warning level	
117(bit6)	Set when RX received power is below warning level	
117(bit5-0)	Reserved	
118-119	Reserved	
120-127	Reserved	

Dimensions



SFP host board mechanical layout



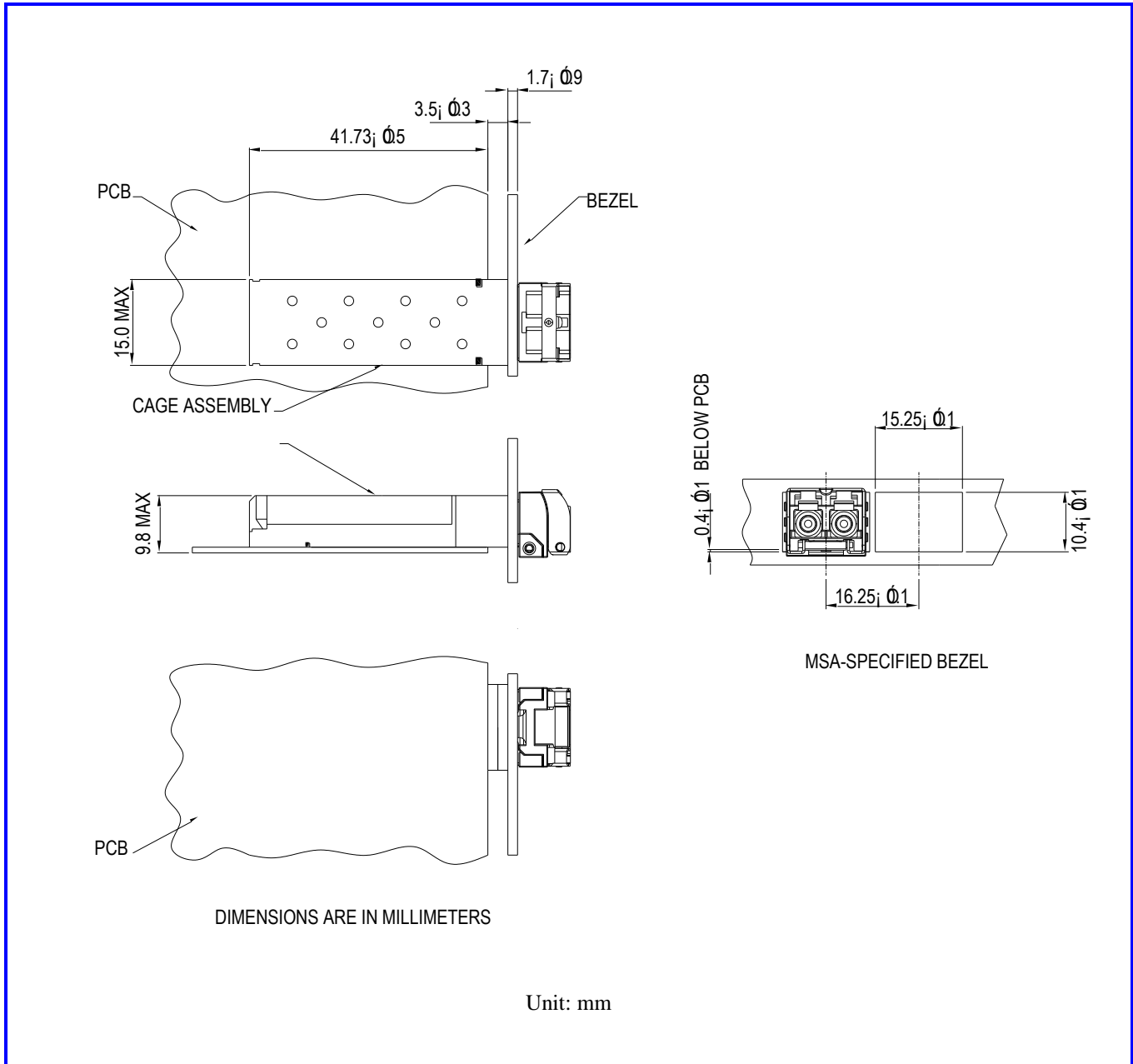
LEGEND

- 1.PADS AND VIAS ARE CHASSIS GROUND
- 2.THROUGH HOLES, PLATING OPTIONAL
- 3.HATCHED AREA DENOTES COMPONENT AND TRACE KEEPOUT(EXCEPT CHASSIS GROUND)
- 4.AREA DENOTES COMPONENT KEEPOUT (TRACES ALLOWED)

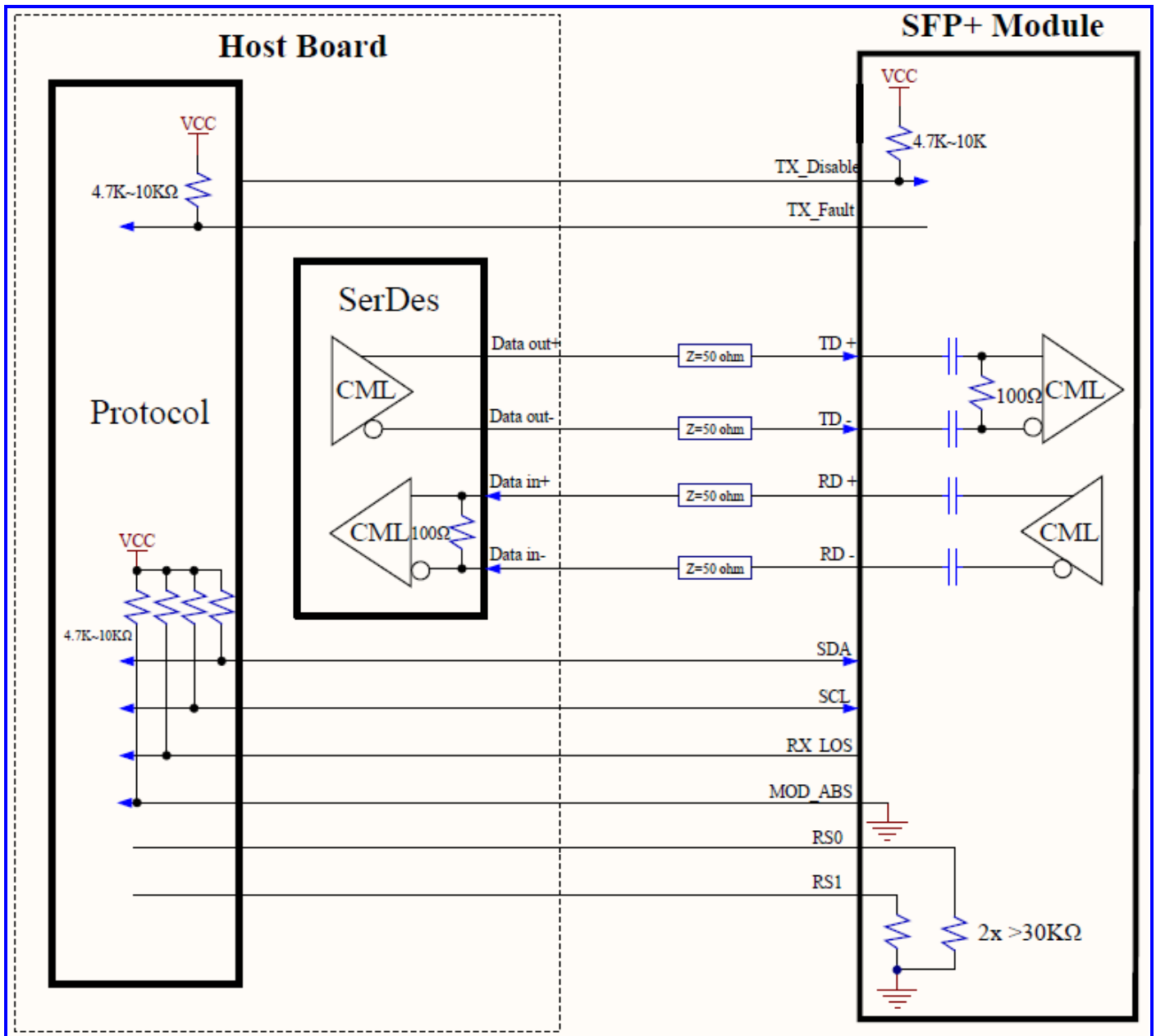
DIMENSIONS ARE IN MILLIMETERS

Unit: mm

Assembly Drawing

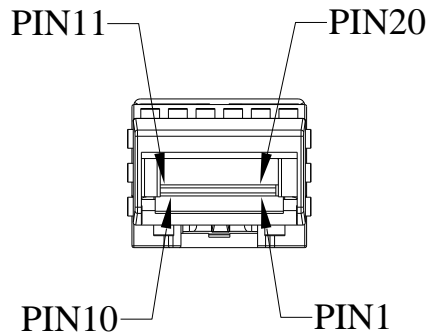


Recommended Interface Circuit



Pin Assignment

Pin-Out



Pin	Signal Name	Description
1	T_{GND}	Transmit Ground
2	TX_FAULT	Transmit Fault
3	$TX_DISABLE$	Transmit Disable
4	$MOD_DEF (2)$	SDA Serial Data Signal
5	$MOD_DEF (1)$	SCL Serial Clock Signal
6	$MOD_DEF (0)$	TTL Low
7	$RS0$	RX Rate Select, No function implemented
8	RX_LOS	Receiver Loss of Signal, TTL High, open collector
9	$RS1$	TX Rate Select, No function implemented
10	R_{GND}	Receiver Ground
11	R_{GND}	Receiver Ground
12	$RX-$	Receive Data out Bar, ac coupled
13	$RX+$	Receive Data out, ac coupled
14	R_{GND}	Receiver Ground
15	V_{CCR}	Receiver Power Supply
16	V_{CCT}	Transmitter Power Supply
17	T_{GND}	Transmitter Ground
18	$TX+$	Transmit Data in, ac coupled
19	$TX-$	Transmit Data in Bar, ac coupled
20	T_{GND}	Transmitter Ground

Note : All information contained in this document is subject to change without notice.