

## Product Specification

### 10km Multi-rate 100G CFP Optical Transceiver Module FTLC1183SDNx

#### PRODUCT FEATURES

- Hot-pluggable CFP form factor
- Supports 103.1Gb/s and 112Gb/s aggregate bit rates
- Power dissipation < 16W
- RoHS-6 compliant (lead-free)
- Commercial case temperature range of 0°C to 70°C
- Single 3.3V power supply
- Maximum link length of 10km on Single Mode Fiber (SMF)
- 4x28Gb/s DFB-based LAN-WDM transmitter
- 10x10G MLD electrical interface
- Duplex SC or LC receptacles

- MDIO management interface



#### APPLICATIONS

- OTN OTU4 4I1-9D1F & OTUC1(FOIC1.4)
- 100GBASE-LR4 100G Ethernet

Finisar's FTLC1183SDNx second-generation 100GE CFP transceiver modules are designed for use in 100 Gigabit Ethernet links and 4x28G OTN client interfaces over single mode fiber. They are compliant with the CFP MSA<sup>1</sup>, IEEE 802.3ba 100GBASE-LR4<sup>2</sup> and OTU4 4I1-9D1F requirements specified in ITU-T Recommendations G.959.1/G.709 and Supplement 39 (G.sup39). Digital diagnostics functions are available via the MDIO interface, as specified by the CFP MSA and Finisar Application Note AN-2080<sup>5</sup>. The transceiver is RoHS-6 compliant and lead-free per Directive 2011/65/EU<sup>3</sup>, and Finisar Application Note AN-2038<sup>4</sup>.

#### PRODUCT SELECTION

### FTLC1183SDNx

- S: OTU4 maximum bit rate (112 Gb/s)
- D: 4x25G LAN-WDM optical architecture
- N: Flat top module (no heat sink)

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x: S: SC straight receptacles  
L: LC straight receptacles  
A: LC angled receptacles

## I. Pin Descriptions

Per CFP MSA<sup>1</sup>, Table 5-6 and 5-7.

	Top Row		Bottom Row
148	GND	1	3.3V_GND
147	REFCLKn	2	3.3V_GND
146	REFCLKp	3	3.3V_GND
145	GND	4	3.3V_GND
144	N.C.	5	3.3V_GND
143	N.C.	6	3.3V
142	GND	7	3.3V
141	TX9n	8	3.3V
140	TX9p	9	3.3V
139	GND	10	3.3V
138	TX8n	11	3.3V
137	TX8p	12	3.3V
136	GND	13	3.3V
135	TX7n	14	3.3V
134	TX7p	15	3.3V
133	GND	16	3.3V_GND
132	TX6n	17	3.3V_GND
131	TX6p	18	3.3V_GND
130	GND	19	3.3V_GND
129	TX5n	20	3.3V_GND
128	TX5p	21	VND_IO_A
127	GND	22	VND_IO_B
126	TX4n	23	GND
125	TX4p	24	TX_MCLKn
124	GND	25	TX_MCLKp
123	TX3n	26	GND
122	TX3p	27	VND_IO_C
121	GND	28	VND_IO_D
120	TX2n	29	VND_IO_E
119	TX2p	30	PRG_CNTL1
118	GND	31	PRG_CNTL2
117	TX1n	32	PRG_CNTL3
116	TX1p	33	PRG_ALARM1
115	GND	34	PRG_ALARM2
114	TX0n	35	PRG_ALARM3
113	TX0p	36	TX_DIS
112	GND	37	MOD_LOPWR

	Top Row		Bottom Row
111	GND	38	MOD_ABS
110	N.C.	39	MOD_RSTn
109	N.C.	40	RX_LOS
108	GND	41	GLB_ALRMn
107	RX9n	42	PRTADR4
106	RX9p	43	PRTADR3
105	GND	44	PRTADR2
104	RX8n	45	PRTADR1
103	RX8p	46	PRTADR0
102	GND	47	MDIO
101	RX7n	48	MDC
100	RX7p	49	GND
99	GND	50	VND_IO_F
98	RX6n	51	VND_IO_G
97	RX6p	52	GND
96	GND	53	VND_IO_H
95	RX5n	54	VND_IO_J
94	RX5p	55	3.3V_GND
93	GND	56	3.3V_GND
92	RX4n	57	3.3V_GND
91	RX4p	58	3.3V_GND
90	GND	59	3.3V_GND
89	RX3n	60	3.3V
88	RX3p	61	3.3V
87	GND	62	3.3V
86	RX2n	63	3.3V
85	RX2p	64	3.3V
84	GND	65	3.3V
83	RX1n	66	3.3V
82	RX1p	67	3.3V
81	GND	68	3.3V
80	RX0n	69	3.3V
79	RX0p	70	3.3V_GND
78	GND	71	3.3V_GND
77	RX_MCLKn	72	3.3V_GND
76	RX_MCLKp	73	3.3V_GND
75	GND	74	3.3V_GND

### Bottom Row Pin Descriptions

PIN #	Name	I/O	Logic	Description
1	3.3V_GND			<b>3.3V Module Supply Voltage Return Ground, internally connected to Signal Ground</b>
2	3.3V_GND			
3	3.3V_GND			
4	3.3V_GND			
5	3.3V_GND			
6	3.3V			3.3V Module Supply Voltage
7	3.3V			
8	3.3V			
9	3.3V			
10	3.3V			
11	3.3V			
12	3.3V			
13	3.3V			
14	3.3V			
15	3.3V			
16	3.3V_GND			<b>3.3V Module Supply Voltage Return Ground, internally connected to Signal Ground</b>
17	3.3V_GND			
18	3.3V_GND			
19	3.3V_GND			
20	3.3V_GND			
21	VND_IO_A	I/O		Module Vendor I/O A. Do Not Connect!
22	VND_IO_B	I/O		Module Vendor I/O B. Do Not Connect!
23	GND			
24	TX_MCLKn	O		Freq = Optical rate/32. Utilized for optical waveform testing. Not for normal use.
25	TX_MCLKp	O		Freq = Optical rate/32. Utilized for optical waveform testing. Not for normal use.
26	GND			
27	VND_IO_C	I/O		Module Vendor I/O C. Do Not Connect!
28	VND_IO_D	I/O		Module Vendor I/O D. Do Not Connect!
29	VND_IO_E	I/O		Module Vendor I/O E. Do Not Connect!
30	PRG_CNTL1	I	LVC MOS w/ PUR	Programmable Control 1 set over MDIO, Default: TRXIC_RSTn, TX & RX ICs reset, "0": reset; "1" or NC: enabled (i.e., not used).
31	PRG_CNTL2	I	LVC MOS w/ PUR	Programmable Control 2 set over MDIO, Default: Hardware Interlock LSB, "00": ≤8W; "01": ≤16W; "10": ≤24W; "11" or NC: ≤32W (i.e., not used).
32	PRG_CNTL3	I	LVC MOS w/ PUR	Programmable Control 3 set over MDIO, Default: Hardware Interlock MSB, "00": ≤8W; "01": ≤16W; "10": ≤24W; "11" or NC: ≤32W (i.e., not used).
33	PRG_ALARM1	O	LVC MOS	Programmable Alarm 1 set over MDIO, Default: HIPWR_ON, "1": module power up completed; "0": module not high powered up.
34	PRG_ALARM2	O	LVC MOS	Programmable Alarm 2 set over MDIO, Default: MOD_READY, "1": Ready; "0": not Ready.
35	PRG_ALARM3	O	LVC MOS	Programmable Alarm 3 set over MDIO, Default: MOD_FAULT, fault detected, "1": Fault; "0": No Fault.
36	TX_DIS	I	LVC MOS w/ PUR	Transmitter Disable for all lanes, "1" or NC = transmitter disabled, "0" = transmitter enabled
37	MOD_LOPWPR	I	LVC MOS w/ PUR	Module Low Power Mode. "1" or NC: module in low power (safe) mode, "0": power-on enabled
38	MOD_ABS	O	GND	Module Absent. "1" or NC: module absent, "0": module present, Pull Up Resistor on Host
39	MOD_RSTn	I	LVC MOS w/ PDR	Module Reset. "0" resets the module, "1" or NC = module enabled, Pull Down Resistor in Module
40	RX_LOS	O	LVC MOS	Receiver Loss of Optical Signal, "1": low optical signal, "0": normal condition
41	GLB_ALRMn	O	LVC MOS	Global Alarm. "0": alarm condition in any MDIO Alarm register, "1": no alarm condition, Open Drain, Pull Up Resistor on Host
42	PRTADR4	I	1.2V CMOS	MDIO Physical Port address bit 4
43	PRTADR3	I	1.2V CMOS	MDIO Physical Port address bit 3
44	PRTADR2	I	1.2V CMOS	MDIO Physical Port address bit 2
45	PRTADR1	I	1.2V CMOS	MDIO Physical Port address bit 1
46	PRTADR0	I	1.2V CMOS	MDIO Physical Port address bit 0
47	MDIO	I/O	1.2V CMOS	Management Data I/O bi-directional data (electrical specs as per 802.3ae and ba)
48	MDC	I	1.2V CMOS	Management Data Clock (electrical specs as per 802.3ae and ba)
49	GND			
50	VND_IO_F	I/O		Module Vendor I/O F. Do Not Connect!
51	VND_IO_G	I/O		Module Vendor I/O G. Do Not Connect!
52	GND			
53	VND_IO_H	I/O		Module Vendor I/O H. Do Not Connect!
54	VND_IO_J	I/O		Module Vendor I/O J. Do Not Connect!
55	3.3V_GND			<b>3.3V Module Supply Voltage Return Ground, internally connected to Signal Ground</b>
56	3.3V_GND			
57	3.3V_GND			
58	3.3V_GND			
59	3.3V_GND			

PIN #	Name	I/O	Logic	Description
60	3.3V			3.3V Module Supply Voltage
61	3.3V			
62	3.3V			
63	3.3V			
64	3.3V			
65	3.3V			
66	3.3V			
67	3.3V			
68	3.3V			
69	3.3V			
70	3.3V_GND			3.3V Module Supply Voltage Return Ground, internally connected to Signal Ground
71	3.3V_GND			
72	3.3V_GND			
73	3.3V_GND			
74	3.3V_GND			

## II. Absolute Maximum Ratings

Module performance is not guaranteed beyond the operating range (see Section VI). Exceeding the limits below may damage the transceiver module permanently.

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Maximum Supply Voltage	V <sub>CC</sub>	-0.5		4.0	V	
Storage Temperature	T <sub>S</sub>	-40		85	°C	
Case Operating Temperature	T <sub>OP</sub>	0		70	°C	
Relative Humidity	RH	15		85	%	1
Receiver Damage Threshold, per Lane	P <sub>Rdmg</sub>	5.5			dBm	

### Notes:

1. Non-condensing.

**III. Electrical Characteristics (EOL, T<sub>OP</sub> = 0 to 70 °C, V<sub>CC</sub> = 3.2 to 3.4 Volts)**

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Supply Voltage	V <sub>cc</sub>	3.2		3.4	V	
Supply Current	I <sub>cc</sub>			5	A	1
Module total power	P			16	W	1
<b>Transmitter</b>						
Signaling rate per lane				11.2	Gb/s	2
Input differential impedance	R <sub>in</sub>		100		Ω	3
Differential data input swing per lane	V <sub>in,pp</sub>			760	mV	4
Data input rise time tolerance	t <sub>r</sub>	24			ps	5
Data input rise time tolerance	t <sub>f</sub>	24			ps	5
Electrical input eye mask definition	{X1, X2} {Y1, Y2}		{0.31, 0.5} {42.5, 425}		UI mV	
<b>Receiver</b>						
Signaling rate per lane				11.2	Gb/s	2
Differential data output swing per lane	V <sub>out,pp</sub>			760	mV	
Data output rise time	t <sub>r</sub>	24			ps	5
Data output fall time	t <sub>f</sub>	24			ps	5
Electrical output eye mask definition	{X1, X2} {Y1, Y2}		{0.2, 0.5} {136, 380}		UI mV	
Power Supply Noise Tolerance	V <sub>rip</sub>		See Note 5 below			6

**Notes:**

1. Maximum supply current and total power values are specified across the full temperature and voltage range. The module will meet the maximum total power specification at EOL under any supply voltage.
2. +/- 100ppm
3. After internal AC coupling.
4. Host is expected to be compliant with IEEE 802.3ba, clause 83A.
5. 20% to 80%
6. Per Table 4-1 in the CFP MSA Specification<sup>1</sup>.

**FTLC1183SDNx Clocking Signals**

Clock Name	Status	I/O	Value
REFCLK	Required	I	1/64 of host lane rate (174.7 MHz for OTU4; 161.1 MHz for 100GE-LR4)
TX_MCLK	Supported	O	1/32 of optical lane rate
RX_MCLK	Supported	O	1/64 and 1/16 of host or network lane rate

**IV. Optical Characteristics (EOL, T<sub>OP</sub> = 0 to 70°C, V<sub>CC</sub> = 3.2 to 3.4 Volts)****OTU4 4I1-9D1F Operation**

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
<b>Transmitter</b>						
Signaling Speed per Channel		27.95		27.95	Gb/s	1
Channel center wavelengths (range)		1294.53 – 1296.59 1299.02 – 1301.09 1303.54 – 1305.63 1308.09 – 1310.19			nm	
Total Average Launch Power	P <sub>OUT</sub>			10.0	dBm	
Average Launch Power per Channel	TXP <sub>x</sub>	-0.6		4.0	dBm	
Optical Channel Extinction Ratio	ER	4.0		6.5	dB	
Channel Power Difference	ΔP <sub>OUT</sub>			5	dB	
Optical Return Loss	ORL			20	dB	
<b>Receiver</b>						
Signaling Speed per Channel		27.95		27.95	GBd	2
Channel center wavelengths (range)		1294.53 – 1296.59 1299.02 – 1301.09 1303.54 – 1305.63 1308.09 – 1310.19			nm	
Average Input Power per Channel	RXP <sub>x</sub>	-6.9		4.0	dBm	
Optical Path Penalty	OPP			1.5	dB	
Equivalent Sensitivity per Channel	Rxsens			-8.4	dBm	3
Total Average Input Power	P <sub>IN</sub>			10.0	dBm	
Channel Power Difference	ΔP <sub>IN</sub>			5.5	dB	
LOS De-Assert	LOS <sub>D</sub>			-11.6	dBm	
LOS Assert	LOS <sub>A</sub>			-13.6	dBm	
LOS Hysteresis			1		dBm	

**Notes:**

1. Transmitter consists of 4 lasers operating at 27.95Gb/s each.
2. Receiver consists of 4 photodetectors operating at 27.95Gb/s each.
3. Specified at a BER of 10<sup>-6</sup> (pre-FEC), per ITU-T G.sup39.

**100GBASE-LR4 Operation**

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
<b>Transmitter</b>						
Signaling Speed per Lane		25.78		25.78	Gb/s	1
Lane center wavelengths (range)		1294.53 – 1296.59 1299.02 – 1301.09 1303.54 – 1305.63 1308.09 – 1310.19			nm	
Total Average Launch Power	$P_{OUT}$			10.5	dBm	
Transmit OMA per Lane	$TxOMA$	-1.3		4.5	dBm	
Average Launch Power per Lane	$TXP_x$	-4.3		4.5	dBm	2
Optical Extinction Ratio	ER	4			dB	
Sidemode Suppression ratio	$SSR_{min}$	30			dB	
Average launch power of OFF transmitter, per lane				-30	dBm	
Relative Intensity Noise	RIN			-130	dB/Hz	
Optical Return Loss Tolerance				20	dB	
Transmitter Reflectance				-12	dB	
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}		{0.25, 0.4, 0.45, 0.25, 0.28, 0.4}				
<b>Receiver</b>						
Signaling Speed per Lane		25.78		25.78	GBd	3
Lane center wavelengths (range)		1294.53 – 1296.59 1299.02 – 1301.09 1303.54 – 1305.63 1308.09 – 1310.19			nm	
Receive Power (OMA) per Lane	$RxOMA$			4.5	dBm	
Average Receive Power per Lane	$RXP_x$	-10.6		4.5	dBm	4
Receiver Sensitivity (OMA) per Lane	$Rxsens$			-8.6	dBm	
Stressed Receiver Sensitivity (OMA) per Lane	SRS			-6.8	dBm	
Return Loss	RL	-26			dB	
Vertical eye closure penalty, per lane				1.8	dB	
Receive electrical 3 dB upper cutoff frequency, per lane				31	GHz	
LOS De-Assert	$LOS_D$			-11.6	dBm	
LOS Assert	$LOS_A$			-13.6	dBm	
LOS Hysteresis			1		dBm	

**Notes:**

1. Transmitter consists of 4 lasers operating at 25.78Gb/s each.
2. Minimum value is informative.
3. Receiver consists of 4 photodetectors operating at 25.78Gb/s each.
4. Minimum value is informative, equals min TxOMA with infinite ER and max channel insertion loss.



## V. General Specifications

Parameter	Symbol	Min	Typ	Max	Units	Ref.
Bit Rate (all wavelengths combined)	BR	103.1		112.0	Gb/s	1
Bit Error Ratio @25.78Gb/s	BER1			10 <sup>-12</sup>		2
Bit Error Ratio @27.95Gb/s	BER2			10 <sup>-6</sup>		3
<b>Maximum Supported Distances</b>						
Fiber Type						
SMF per G.652	Lmax1			10	km	

### Notes:

- Supports OTU4 4I1-9D1F per ITU-T G.959.1 and 100GBASE-LR4 per IEEE 802.3ba.
- Tested with a 2<sup>31</sup> – 1 PRBS.
- Tested with a 2<sup>31</sup> – 1 PRBS. Per ITU-T G.959.1 and G.sup39, the BER of 10<sup>-12</sup> for the OTU4 (112 Gb/s) application code is required to be met only after forward error correction has been applied. ITU-T G.sup39 defines the pre-FEC BER to be met as 10<sup>-6</sup>. The values for receiver sensitivity and optical path penalty measured at the receiver output at a BER of 10<sup>-6</sup> will normally be conservative estimates of the values for receiver sensitivity and path penalty at the BER of 10<sup>-12</sup> after the FEC decoder.

## VI. Environmental Specifications

Finisar FTLC1183 CFP transceivers have a commercial operating case temperature range of 0°C to +70°C.

Parameter	Symbol	Min	Typ	Max	Units	Ref.
Case Operating Temperature	T <sub>op</sub>	0		70	°C	
Storage Temperature	T <sub>sto</sub>	-40		85	°C	

## VII. Regulatory Compliance

Finisar FTLC1183 CFP transceivers are Class 1 Laser Products. They are certified per the following standards:

Feature	Agency	Standard	Certificate Number
Laser Eye Safety	FDA/CDRH	CDRH 21 CFR 1040 and Laser Notice 50	9210176
Laser Eye Safety	TÜV	EN 60825-1: 2007 IEC 60825-2: 2004+A1+A2	R 72130387
Electrical Safety	TÜV	EN 60950	R 72130387
Electrical Safety	UL/CSA	CLASS 3862.07 CLASS 3862.87	2375840

**CAUTION** – Use of Controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure

Copies of the referenced certificates are available at Finisar Corporation upon request.

**VIII. Digital Diagnostics Functions**

FTLC1183 CFP transceivers support the MDIO-based diagnostics interface specified in the CFP MSA Management Interface Specification, Rev 2.2<sup>1</sup>. See also Finisar Application Note AN-2080.

**IX. Memory Contents**

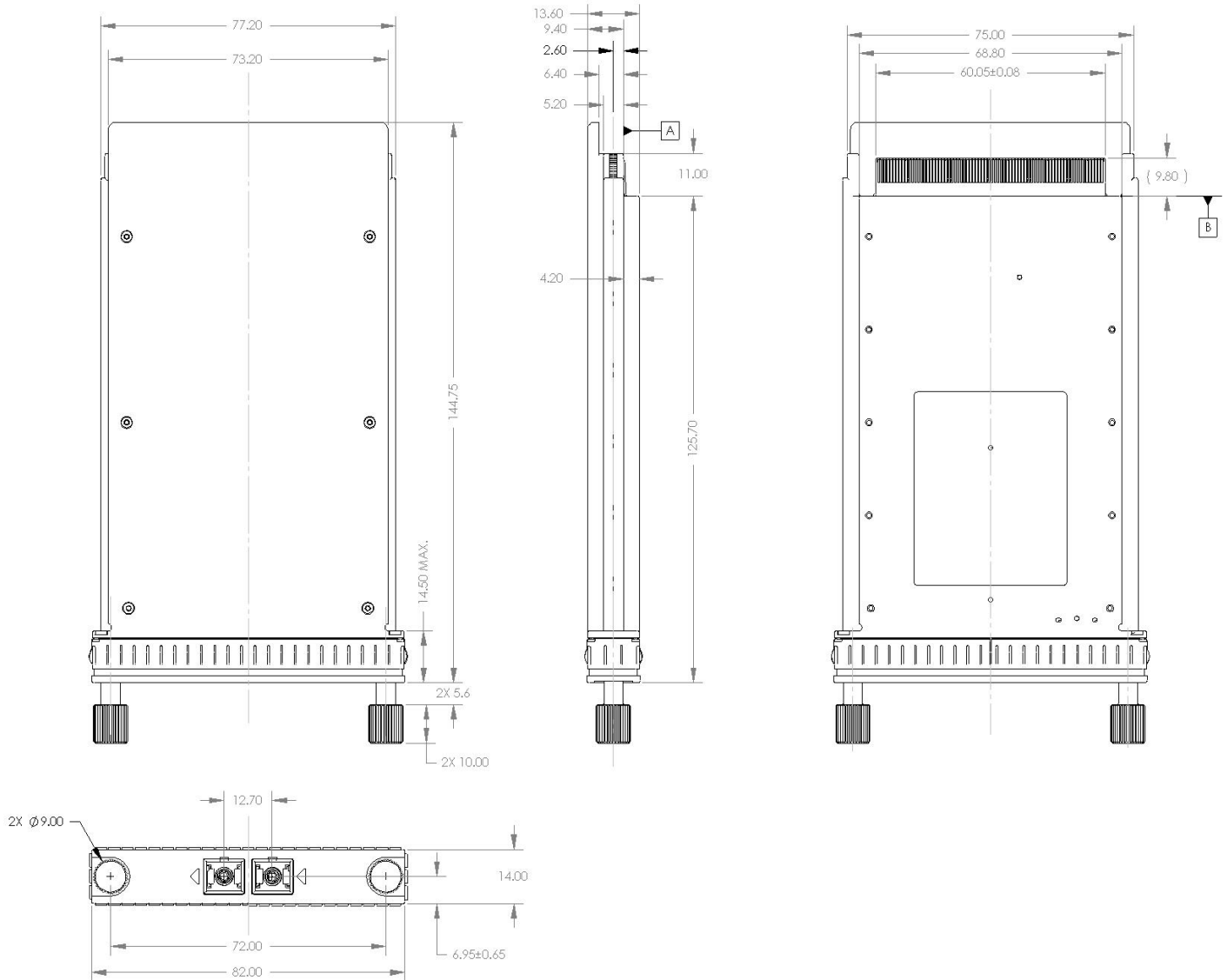
Per the CFP MSA<sup>1</sup>. See Finisar Application Note AN-2080.

**X. Host PCB Layout and Bezel Recommendations**

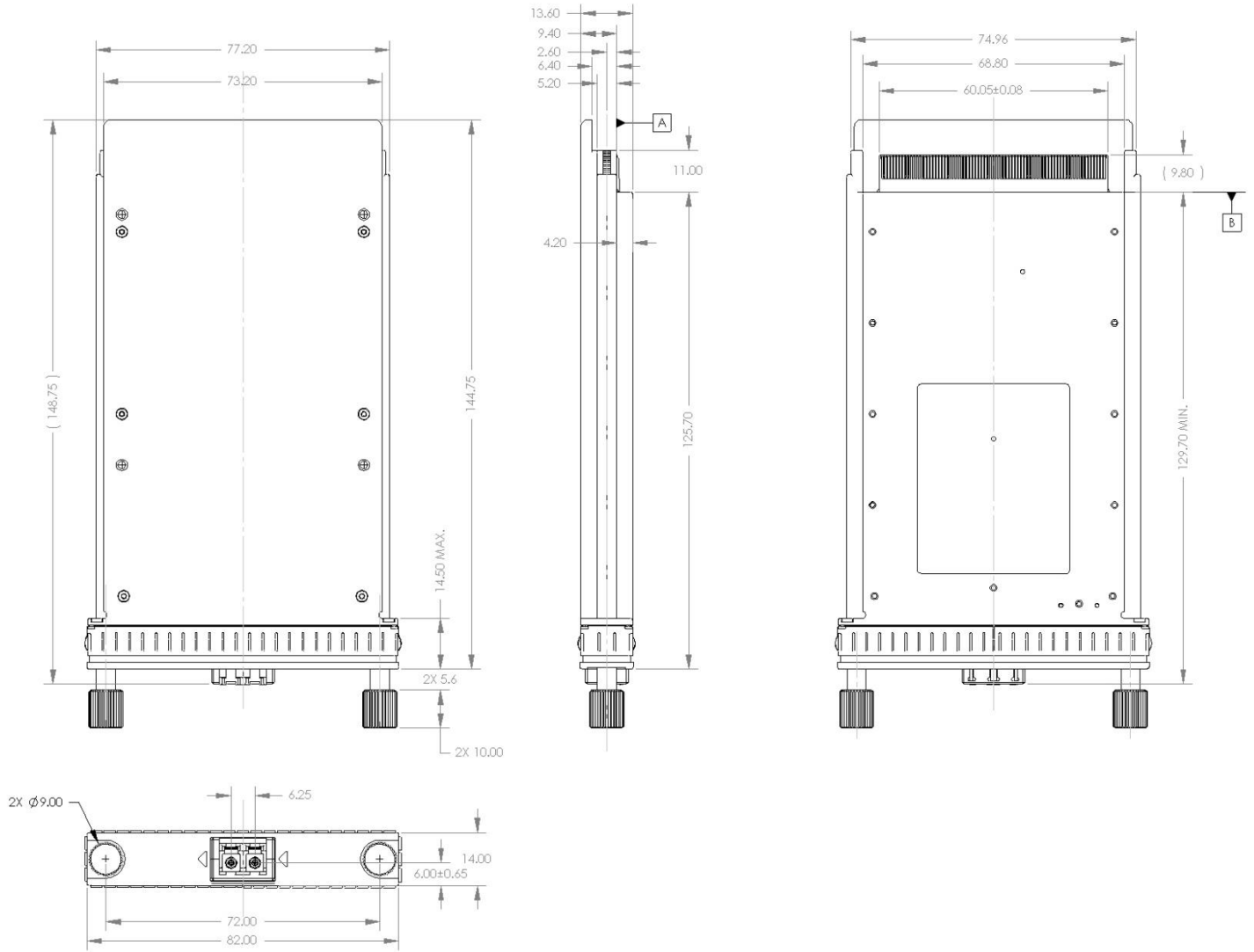
Per CFP MSA Hardware Specification, Rev 1.4<sup>1</sup>.

**XI. Mechanical Specifications**

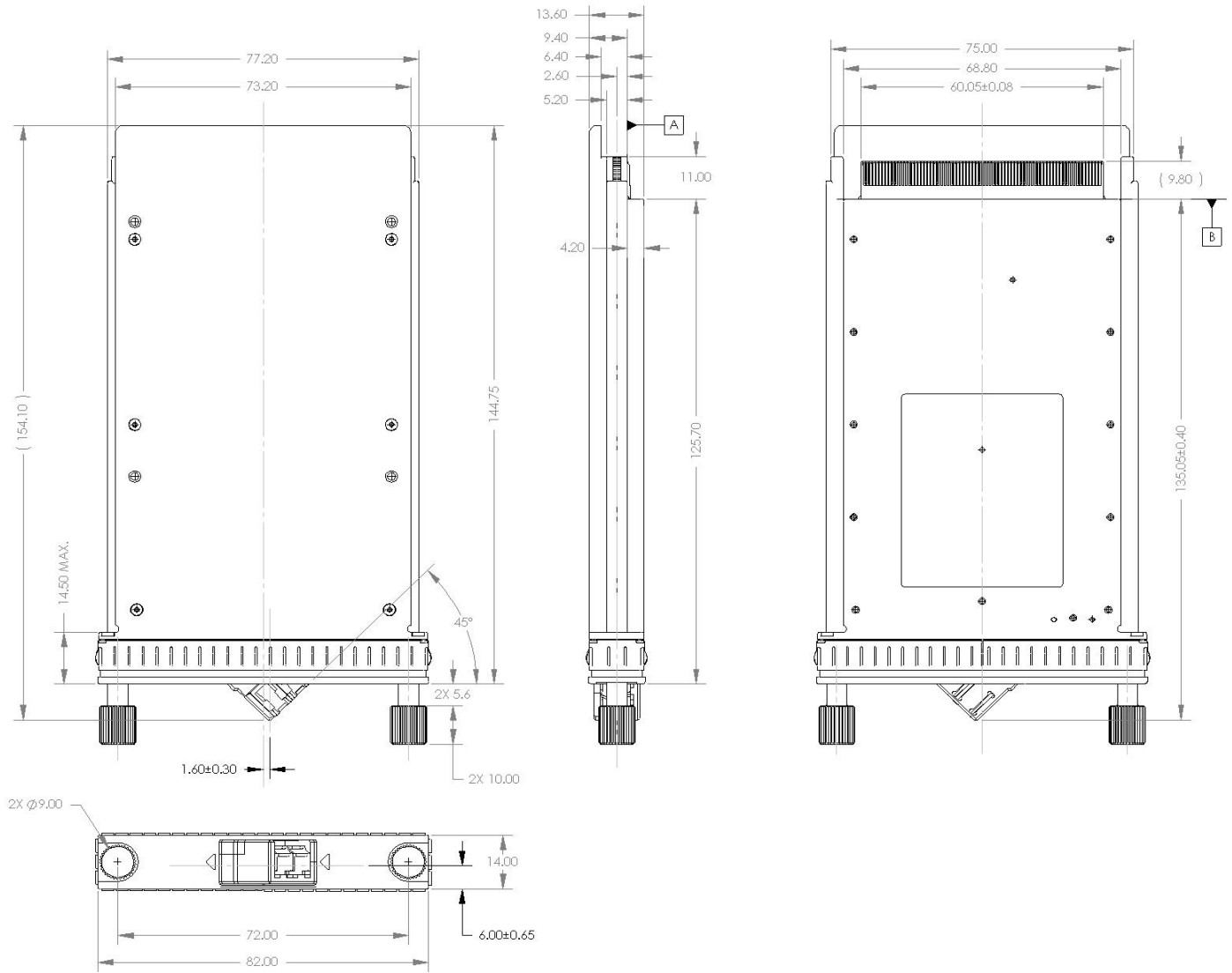
Finisar FTLC1183 CFP transceivers are compatible with the CFP MSA specification for 100G pluggable form factor modules.



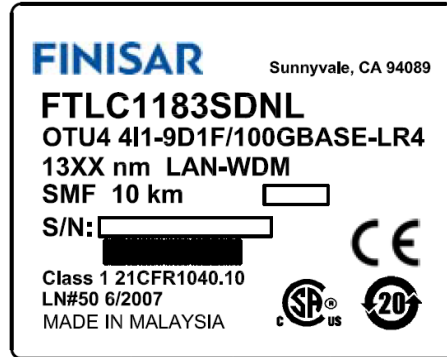
**Figure 1. FTLC1183SDNS Mechanical Dimensions.**



**Figure 2. FTLC1183SDNL Mechanical Dimensions.**



**Figure 3. FTLC1183SDNA Mechanical Dimensions**



**Figure 4. Standard Product Label**

## **XII. References**

1. CFP MSA Hardware Specification, Rev 1.4 and Management Interface Specifications, Rev 2.2, [www.cfp-msa.org](http://www.cfp-msa.org)
2. IEEE 802.3ba, PMD Type 100GBASE-LR4.
3. Directive 2011/65/EU of the European Council Parliament and of the Council, “on the restriction of the use of certain hazardous substances in electrical and electronic equipment,” June 8, 2011.
4. “Application Note AN-2038: Finisar Implementation Of RoHS Compliant Transceivers”, Finisar Corporation, January 21, 2005.
5. “Application Note AN-2080: NVR1 and NVR2, 100GBASE-LR4 CFP Transceiver Module (FTLC1181xxxx)”, Finisar Corporation, September 16, 2010.

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