

FTLC1183SDNX

10km Multi-rate 100G CFP Optical Transceiver Module

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 MSA¹, IEEE 802.3ba 100GBASE-LR4² 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-2080⁵. The transceiver is RoHS-6 compliant and lead-free per Directive 2011/65/EU³, and Finisar Application Note AN-2038⁴.



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

Product Selection

FTLC1183SDNx

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

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

I. Pin Descriptions

Per CFPMSA¹, Table5-6and5-7.

	TopRow		BottomRow			TopRow		BottomRow
148	GND	1	3.3V_GND		111	GND	38	MOD_ABS
147	REFCLKn	2	3.3V_GND		110	N.C.	39	MOD_RSTn
146	REFCLKp	3	3.3V_GND		109	N.C.	40	RX_LOS
145	GND	4	3.3V_GND		108	GND	41	GLB_ALRMn
144	N.C.	5	3.3V_GND		107	RX9n	42	PRTADR4
143	N.C.	6	3.3V		106	RX9p	43	PRTADR3
142	GND	7	3.3V		105	GND	44	PRTADR2
141	TX9n	8	3.3V		104	RX8n	45	PRTADR1
140	TX9p	9	3.3V		103	RX8p	46	PRTADR0
139	GND	10	3.3V		102	GND	47	MDIO
138	TX8n	11	3.3V		101	RX7n	48	MDC
137	TX8p	12	3.3V		100	RX7p	49	GND
136	GND	13	3.3V		99	GND	50	VND_IO_F
135	TX7n	14	3.3V		98	RX6n	51	VND_IO_G
134	TX7p	15	3.3V		97	RX6p	52	GND
133	GND	16	3.3V_GND		96	GND	53	VND_IO_H
132	TX6n	17	3.3V_GND		95	RX5n	54	VND_IO_J
131	TX6p	18	3.3V_GND		94	RX5p	55	3.3V_GND
130	GND	19	3.3V_GND		93	GND	56	3.3V_GND
129	TX5n	20	3.3V_GND		92	RX4n	57	3.3V_GND
128	TX5p	21	VND_IO_A		91	RX4p	58	3.3V_GND
127	GND	22	VND_IO_B		90	GND	59	3.3V_GND
126	TX4n	23	GND		89	RX3n	60	3.3V
125	TX4p	24	TX_MCLKn		88	RX3p	61	3.3V
124	GND	25	TX_MCLKp		87	GND	62	3.3V
123	TX3n	26	GND		86	RX2n	63	3.3V
122	TX3p	27	VND_IO_C		85	RX2p	64	3.3V
121	GND	28	VND_IO_D		84	GND	65	3.3V
120	TX2n	29	VND_IO_E		83	RX1n	66	3.3V
119	TX2p	30	PRG_CNTL1		82	RX1p	67	3.3V
118	GND	31	PRG_CNTL2		81	GND	68	3.3V
117	TX1n	32	PRG_CNTL3		80	RX0n	69	3.3V
116	TX1p	33	PRG_ALARM1		79	RX0p	70	3.3V_GND
115	GND	34	PRG_ALARM2		78	GND	71	3.3V_GND
114	TX0n	35	PRG_ALARM3		77	RX_MCLKn	72	3.3V_GND
113	TX0p	36	TX_DIS		76	RX_MCLKp	73	3.3V_GND
112	GND	37	MOD_LOPWR		75	GND	74	3.3V_GND

Bottom Row Pin Descriptions

PIN#	Name	I/O	Logic	Description
1	3.3V_GND			3.3V Module Supply Voltage Return Ground, internally connected to Signal Ground
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			3.3V Module Supply Voltage Return Ground, internally connected to Signal Ground
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_ALRM1	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_ALRM2	O	LVC MOS	Programmable Alarm 2 set over MDIO, Default: MOD_READY, "1": Ready; "0": not Ready.
35	PRG_ALRM3	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

PIN#	Name	I/O	Logic	Description
37	MOD_LOP-WR	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_AL-RMn	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			3.3V Module Supply Voltage Return Ground, internally connected to Signal Ground
56	3.3V_GND			
57	3.3V_GND			
58	3.3V_GND			
59	3.3V_GND			
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	Vcc	-0.5		4.0	V	
Storage Temperature	TS	-40		85	°C	
Case Operating Temperature	TOP	0		70	°C	
Relative Humidity	RH	15		85	%	1
Receiver Damage Threshold, per Lane	PRdmg	5.5			dBm	

Notes:
Non-condensing.

III. Electrical Characteristics (EOL, $T_{OP}=0$ to 70°C , $V_{CC}=3.2$ to 3.4 Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Supply Voltage	Vcc	3.2		3.4	V	
Supply Current	Icc			5	A	1
Module total power	P			16	W	1
Transmitter						
Signaling rate per lane				11.2	Gb/s	2
Input differential impedance	Rin		100		Ω	3
Differential data input swing per lane	Vin,pp			760	mV	4
Data input rise time tolerance	tr	24			ps	5
Data input rise time tolerance	tf	24			ps	5
Electrical input eye mask definition	{X1,X2} {Y1,Y2}		{0.31,0.5} {42.5,425}		UI mV	
Receiver						
Signaling rate per lane				11.2	Gb/s	2
Differential data output swing per lane	Vout,pp			760	mV	
Data output rise time	tr	24			ps	5
Data output fall time	tf	24			ps	5
Electrical output eye mask definition	{X1,X2} {Y1,Y2}		{0.2,0.5} {136,380}		UI mV	
Power Supply Noise Tolerance	Vrip		SeeNote5below			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 Specification1.

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, TOP = 0 to 70°C, VCC = 3.2 to 3.4 Volts)

OTU4 4I1-9D1F Operation

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Transmitter						
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_{OUT}			10.0	dBm	
Average Launch Power per Channel	TXP_x	-0.6		4.0	dBm	
Optical Channel Extinction Ratio	ER	4.0		6.5	dB	
Channel Power Difference	ΔP_{OUT}			5	dB	
Optical Return Loss	ORL			20	dB	
Receiver						
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_x	-6.9		4.0	dBm	
Optical Path Penalty	OPP			1.5	dB	
Equivalent Sensitivity per Channel	R_{xsens}			-8.4	dBm	3
Total Average Input Power	PIN			10.0	dBm	
Channel Power Difference	ΔP_{IN}			5.5	dB	
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 27.95Gb/s each.
2. Receiver consists of 4 photodetectors operating at 27.95Gb/s each.
3. Specified at a BER of 10⁻⁶ (pre-FEC), per ITU-T G.sup39.

100GBASE-LR4Operation

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Transmitter						
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	RIN			-130	dB/Hz	
Relative Intensity Noise				20	dB	
Optical Return Loss Tolerance				-12	dB	
Transmitter eye mask definition {X1, X2, X3, Y1, Y2, Y3}		{0.25,0.4,0.45,0.25,0.28,0.4}				
Receiver						
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			10-12		2
Bit Error Ratio @27.95Gb/s	BER2			10-6		3
Maximum Supported Distances						
Fiber Type						
SMF per G.652	Lmax1			10	km	

Notes:

1. Supports OTU4 4I1-9D1F per ITU-T G.959.1 and 100GBASE-LR4 per IEEE 802.3ba.
2. Tested with a 231 – 1 PRBS.
3. Tested with a 231 – 1 PRBS. Per ITU-T G.959.1 and G.sup39, the BER of 10-12 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 10-6. The values for receiver sensitivity and optical path penalty measured at the receiver output at a BER of 10-6 will normally be conservative estimates of the values for receiver sensitivity and path penalty at the BER of 10-12 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_{op}	0		70	°C	
Storage Temperature	T_{sto}	-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	EN60825-1:2007 IEC60825-2:2004+A1+A2	R 72130387
Electrical Safety	TÜV	EN60950	R 72130387
Electrical Safety	UL/CSA	CLASS3862.07 CLASS3862.87	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 2.21. See also Finisar Application Note AN-2080.

IX. Memory Contents

Per the CFP MSA¹. See Finisar Application Note AN-2080.

X. Host PCB Layout and Bezel Recommendations

Per CFP MSA Hardware Specification, Rev 1.41.

XI. Mechanical Specifications

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

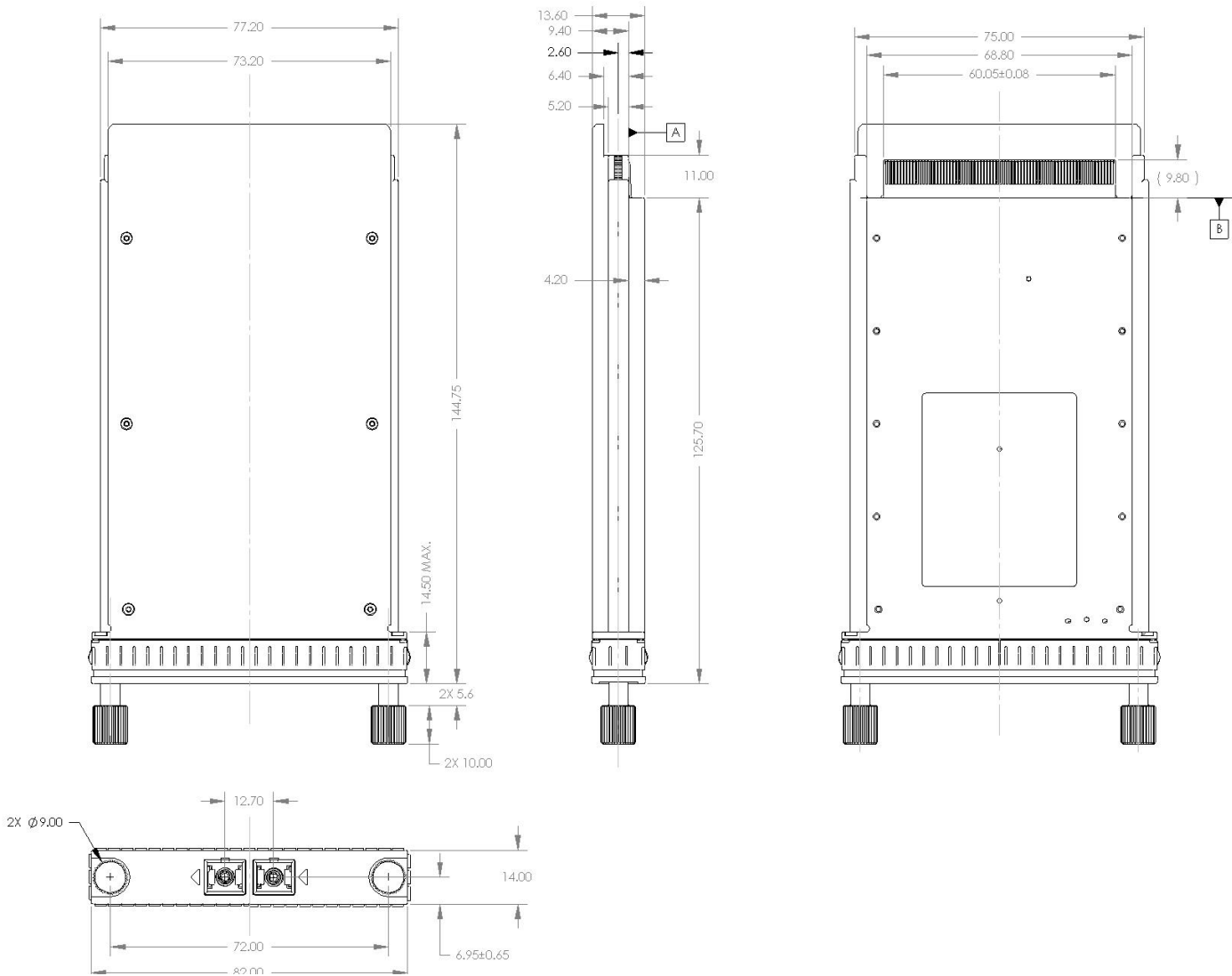


Figure 1. FTLC1183SDNS Mechanical Dimensions.

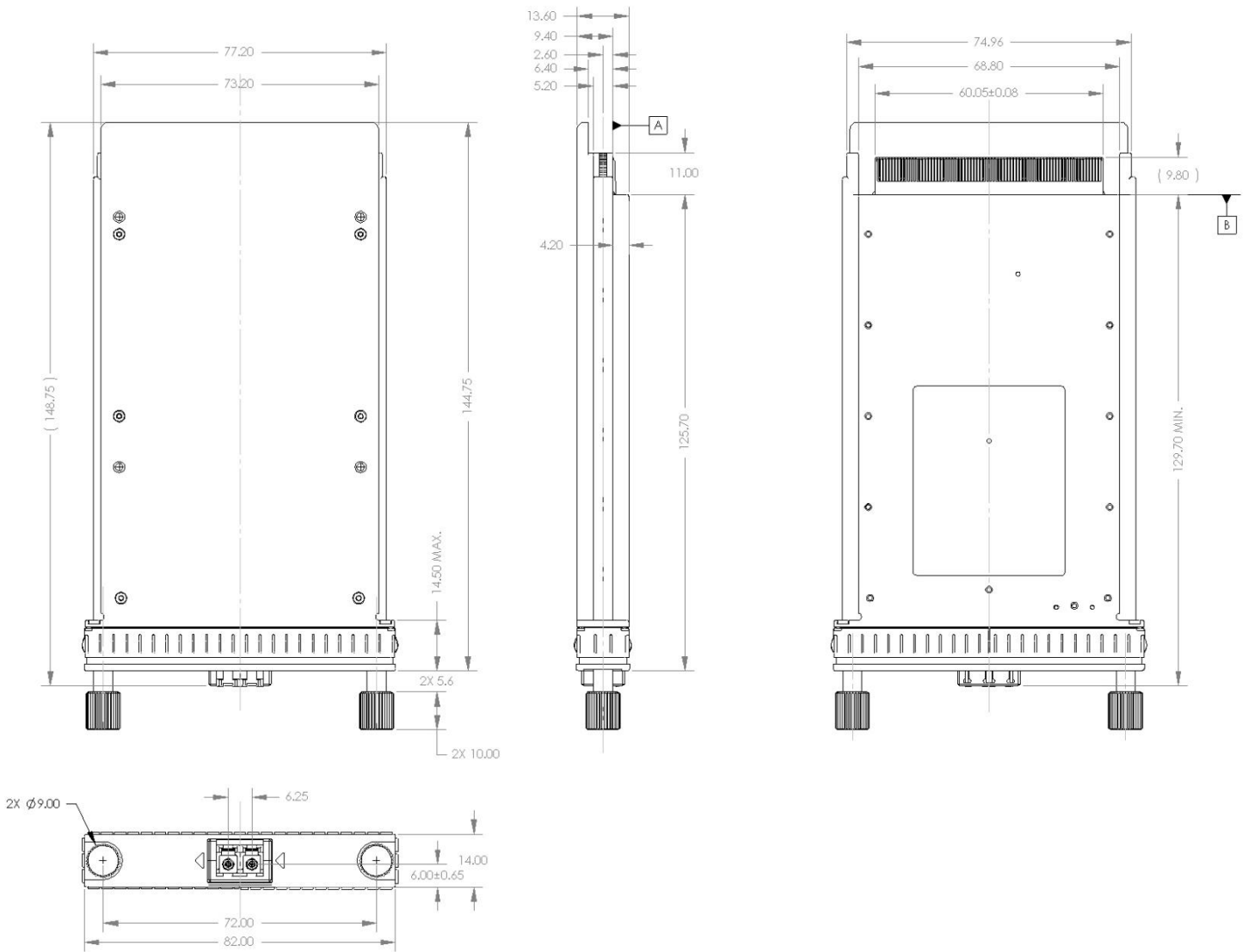


Figure 2. FTLC1183SDNL Mechanical Dimensions.

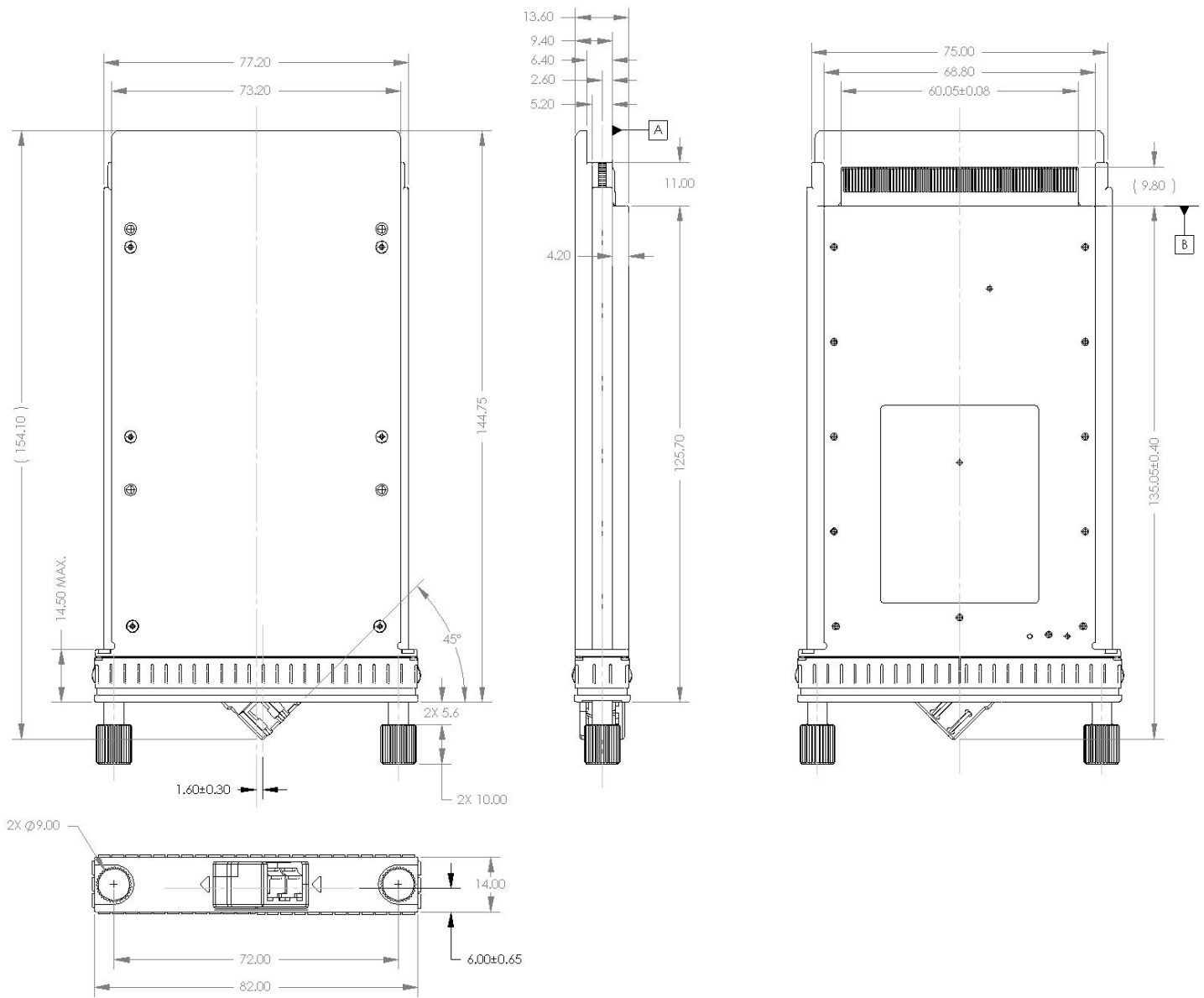


Figure 3. FTLC1183SDNA Mechanical Dimensions

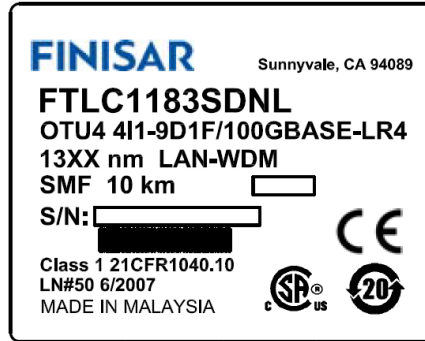


Figure 4. Standard Product Label

XII. References

1. CFP MSA Hardware Specification, Rev 1.4 and Management Interface Specifications, Rev 2.2, www.cfp-msa.org
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.