

Product Specification

100G Ethernet 10km CFP Optical Transceiver Module

FTLC1181RDNx

PRODUCT FEATURES

- Hot-pluggable CFP form factor
- Supports 103.1Gb/s aggregate bit rate
- Power dissipation < 24W
- 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)
- Temperature-stabilized 4x25Gb/s LAN-WDM transmitter
- CAUI electrical interface
- Duplex SC or LC receptacles
- MDIO management interface



APPLICATIONS

- 100GBASE-LR4 100G Ethernet

Finisar's FTLC1181RDNx 100GE CFP transceiver modules are designed for use in 100 Gigabit Ethernet links over single mode fiber. They are compliant with the CFP MSA¹ and IEEE 802.3ba 100GBASE-LR4². Digital diagnostics functions are available via an 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 2002/95/EC³, and Finisar Application Note AN-2038⁴.

PRODUCT SELECTION

FTLC1181RDNx

- R: 100G Ethernet maximum bit rate (103.1Gb/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 DescriptionsPer CFP MSA¹, 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			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
37	MOD LOPWR	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			3.3V Module Supply Voltage Return Ground, internally connected to Signal Ground
56	3.3V GND			

PIN #	Name	I/O	Logic	Description
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	V _{cc}	-0.5		4.0	V	
Storage Temperature	T _S	-40		85	°C	
Case Operating Temperature	T _{OP}	-5		75	°C	
Relative Humidity	RH	15		85	%	1
Receiver Damage Threshold, per Lane	P _{Rdmg}	5.5			dBm	

Notes:

1. 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	V _{cc}	3.2		3.4	V	
Supply Current	I _{cc}			7	A	
Module total power	P			24	W	1
Transmitter						
Signaling rate per lane				10.3125	Gb/s	2
Input differential impedance	R _{in}		100		Ω	3
Differential data input swing per lane	V _{in,pp}			760	mV	4
Data input rise time tolerance	t _r			24	ps	5
Data input fall time tolerance	t _f			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				10.3125	Gb/s	2
Differential data output swing per lane	V _{out,pp}			760	mV	
Data output rise time	t _r			24	ps	5
Data output fall time	t _f			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 _{rip}			See Note 5 below		6

Notes:

1. Maximum total power value is specified across the full temperature and voltage range.
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.

FTLC1181RDNx Clocking Signals

Clock Name	Status	I/O	Value
REFCLK	Required	I	1/64 of host lane rate (161.1 MHz)
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_{OP} = 0 to 70°C, V_{CC} = 3.2 to 3.4 Volts)

Parameter	Symbol	Min	Typ	Max	Unit	Ref.
Transmitter						
Signaling Speed per Lane				25.78125	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}				
Receiver						
Signaling Speed per Lane				25.78125	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 25Gb/s each.
2. Minimum value is informative.
3. Receiver consists of 4 photodetectors operating at 25Gb/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	Gb/s	1
Bit Error Ratio	BER			10 ⁻¹²		2
Maximum Supported Distances						
Fiber Type						
SMF	Lmax1			10	km	
MMF	Lmax2			n/a		

Notes:

- Supports 100GBASE-LR4 per IEEE 802.3ba. Contact Finisar for higher data-rate support.
- Tested with a 2³¹ – 1 PRBS

VI. Environmental Specifications

Finisar FTLC1181 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 FTLC1181 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: 1994+A11:1996+A2:2001 IEC 60825-1: 1993+A1:1997+A2:2001 IEC 60825-2: 2000, Edition 2	R 72102454
Electrical Safety	TÜV	EN 60950	R 72102454
Electrical Safety	UL/CSA	CLASS 3862.07 CLASS 3862.87	TBD

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

VIII. Digital Diagnostics Functions

FTLC1181 CFP transceivers support the MDIO-based diagnostics interface specified in the CFP MSA¹. See 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 FTLC1181 CFP transceivers are compatible with the CFP MSA specification for 100G pluggable form factor modules.

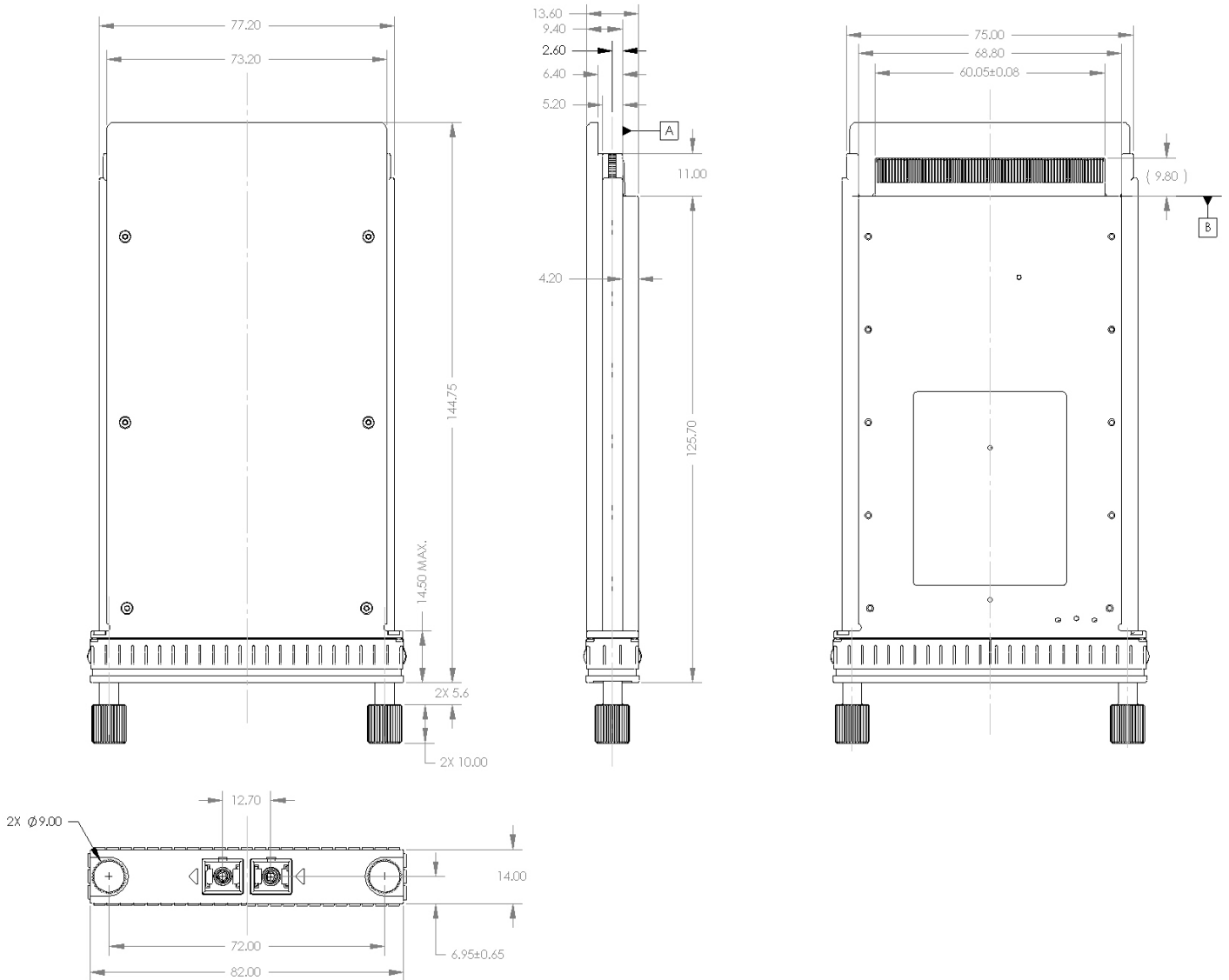


Figure 1. FTLC1181RDNx Mechanical Dimensions.

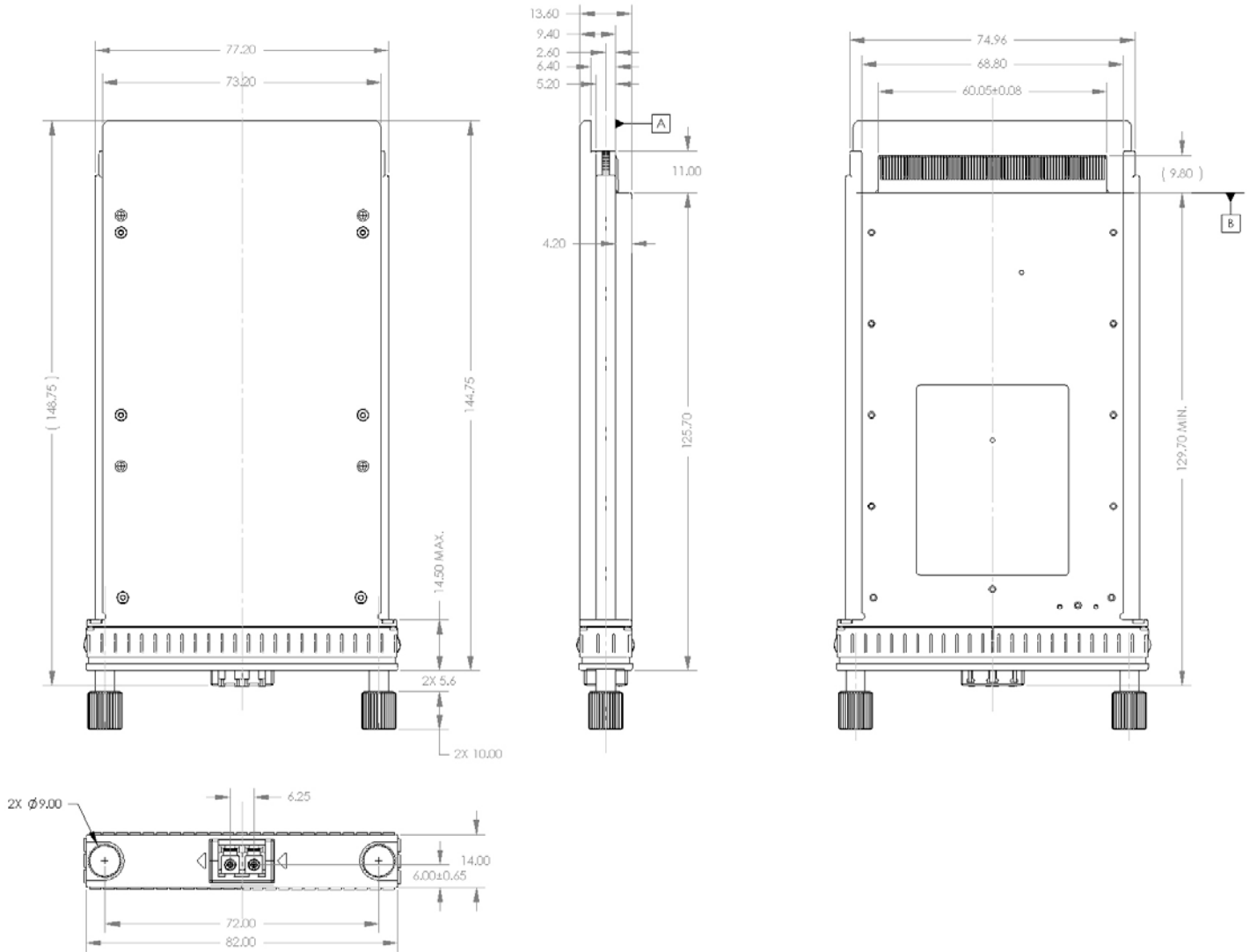


Figure 2. FTLC1181RDNL Mechanical Dimensions.

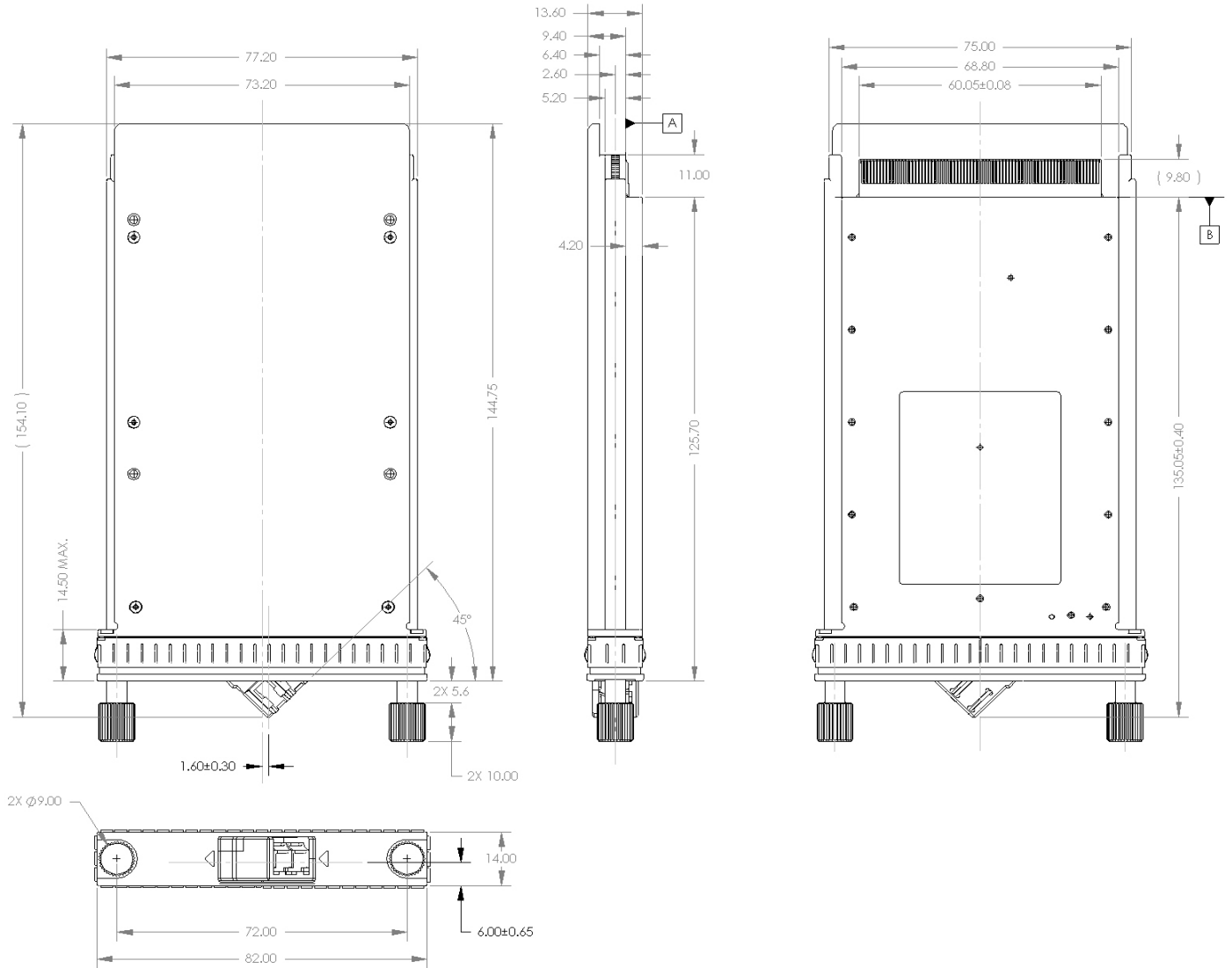


Figure 3. FTLC1181RDNx Mechanical Dimensions

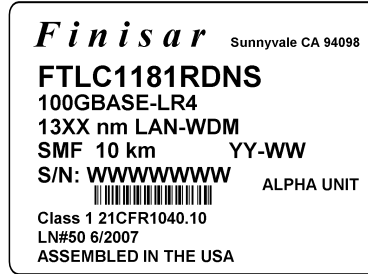


Figure 4. Standard Product Label

XII. References

1. CFP MSA Hardware Specification, Rev 1.4 and Management Interface Specifications, Rev 1.4., www.cfp-msa.org
2. IEEE 802.3ba, PMD Type 100GBASE-LR4.
3. Directive 2002/95/EC of the European Council Parliament and of the Council, “on the restriction of the use of certain hazardous substances in electrical and electronic equipment”. January 27, 2003.
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.

XIII. Revision History

Revision	Date	Description
A0	6/23/2009	<ul style="list-style-type: none">• Preliminary document created.
A1	6/30/2009	<ul style="list-style-type: none">• Operating case temperature range updated.
A2	11/4/2009	<ul style="list-style-type: none">• Photo updated.
A3	6/1/2010	<ul style="list-style-type: none">• Updated Vcc tolerance.
A4	10/22/2010	<ul style="list-style-type: none">• Added CAUI spec, mechanical drawing, pin-out tables, application note references.
B	11/15/2010	<ul style="list-style-type: none">• First non-Preliminary release. Updated mechanical drawings.

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