

## SFP-10GB-DW-C-E-N-AO

Alcatel-Lucent Nokia® Compatible TAA 10GBase-DWDM 100GHz SFP+ Transceiver (SMF, Tunable, 80km, LC, DOM, -20 to 85C)

### Features

- Small Form Factor Pluggable WDM Optical Transceiver from 191.3 to 196.3THz with 100GHz Spacing
- 10G Electrical Interface (SFF-8418)
- Self-Tuning Function Enables Automatic Link-Up
- Loss of Signal (LOS) Function
- Operating Data Rate: 9.83 to 10.31Gbps
- Up to 80km Over SMF (ITU-T G.652)
- Single Voltage 3.3V Power Supply
- LC Connector Interface
- Operating Temperature: -20 to 85 Celsius, -40C Cold Start
- Hot-Pluggable Electrical Interface
- RoHS Compliant and Lead-Free



### Applications

- 10GBase Ethernet

### Product Description

This Alcatel-Lucent Nokia® SFP+ transceiver provides 10GBase-DWDM throughput up to 80km over single-mode fiber (SMF) using a tunable wavelength via an LC connector. It is guaranteed to be 100% compatible with the equivalent Alcatel-Lucent Nokia® transceiver. This easy to install, hot swappable transceiver has been programmed, uniquely serialized and data-traffic and application tested to ensure that it will initialize and perform identically. Digital optical monitoring (DOM) support is also present to allow access to real-time operating parameters. This transceiver is Trade Agreements Act (TAA) compliant. We stand behind the quality of our products and proudly offer a limited lifetime warranty.

AddOn's transceivers are RoHS compliant and lead-free.

TAA refers to the Trade Agreements Act (19 U.S.C. & 2501-2581), which is intended to foster fair and open international trade. TAA requires that the U.S. Government may acquire only "U.S. – made or designated country end products."



## ITU Channel Wavelength Guide

ITU Channel	Frequency (THz)	Center Wavelength (nm)	ITU Channel	Frequency (THz)	Center Wavelength (nm)
13	191.30	1567.13	39	193.90	1546.12
14	191.40	1566.31	40	194.00	1545.32
15	191.50	1565.50	41	194.10	1544.53
16	191.60	1564.68	42	194.20	1543.73
17	191.70	1563.86	43	194.30	1542.94
18	191.80	1563.05	44	194.40	1542.14
19	191.90	1562.23	45	194.50	1541.35
20	192.00	1561.42	46	194.60	1540.56
21	192.10	1560.61	47	194.70	1539.77
22	192.20	1559.79	48	194.80	1538.98
23	192.30	1558.98	49	194.90	1538.19
24	192.40	1558.17	50	195.00	1537.40
25	192.50	1557.36	51	195.10	1536.61
26	192.60	1556.56	52	195.20	1535.82
27	192.70	1555.75	53	195.30	1535.04
28	192.80	1554.94	54	195.40	1534.25
29	192.90	1554.13	55	195.50	1533.47
30	193.00	1553.33	56	195.60	1532.68
31	193.10	1552.52	57	195.70	1531.90
32	193.20	1551.72	58	195.80	1531.12
33	193.30	1550.92	59	195.90	1530.33
34	193.40	1550.12	60	196.00	1529.55
35	193.50	1549.32	61	196.10	1528.77
36	193.60	1548.52	62	196.20	1527.99
37	193.70	1547.72	63	196.30	1527.22
38	193.80	1546.92			

## Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Relative Humidity (Non-Condensing)		5		85	%	
Operating Case Temperature	T <sub>c</sub>	-20		85	°C	1
Storage Temperature	T <sub>stg</sub>	-40		85	°C	
Supply Voltage	V	-0.3		3.6		
Data Rate	Gbps	9.8304		10.3125		± 100ppm
Ambient Humidity (Non-Condensing)	%	5		85		
Modulation Type		8B/10B, 64B/66B (NRZ)				2
Transmission Cable		SMF (ITU-T G.6520) 80km				

### Notes:

1. Cold start temperature: -40°C.
2. 9.83, 10.31Gbps.

## Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Voltage on LVTTTL Input		-0.3		V <sub>cc</sub> +0.3	V	
Tx Input Data Signal Levels (AC Coupled)				1.2	V <sub>ppd</sub>	
Static Discharge Voltage HBM Per JEDEC JESD22-A224-B		-1000		1000	V	
		-2000		2000		
Peak Optical Input Power				-6	dBm	
Power Supply Voltage		3.14	3.3	3.46	V <sub>cc</sub>	
Power Consumption				2.5	W	
<b>Low-Speed Electrical Interface</b>						
Tx_Fault, Rx_LOS	VOL	-0.3		0.4	V	1
	IOH	-50		37.5	uA	
Tx_Disable, RS0, RS1	VIL	-0.3		0.8	V	
	VIH	2.0		V <sub>cc</sub> T+0.3	V	

### Notes:

1. Positive values indicate current flowing into the module. At 0.7mA.

## Optical Characteristics

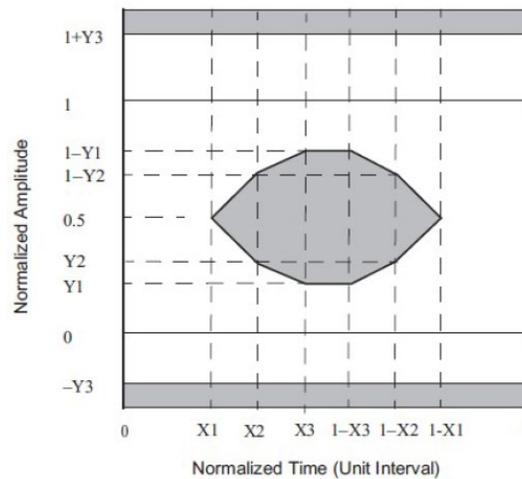
Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
<b>Transmitter</b>						
Center Frequency Range	FR	191.3		196.3	THz	
Central Frequency Accuracy (EOL)		-12.5		12.5	GHz	
Frequency Spacing			100		GHz	
Side-Mode Suppression Ratio	SMSR	30			dB	
Spectral Width (-20dB)	$\Delta\lambda$			1	nm	
Average Optical Power	P <sub>avg</sub>	-1		3	dBm	
Extinction Ratio	ER	8.2			dB	
Average Launch Power of Tx_Disable				-30	dBm	
Optical Return Loss Tolerance	ORL			20	dB	
Transmitter Reflectance	TR			-12	dB	
Transmitter Eye Mask		Transmitter Eye Mask				1
<b>Receiver</b>						
Center Frequency Range	FR	191.3		196.3	THz	
Rx Sensitivity in Average	Pr_Avg			-24	dBm	2
				-21	dBm	3
Rx Overload in Average	OL	-7			dBm	2

Receiver Reflectance	RR			-27	dB	
LOS Assert Level	LOSA	-32			dBm	
LOS De-Assert Level	LOSD			-25	dB	
LOS Hysteresis	LOSH	0.5			dB	

**Notes:**

1. 9.8304Gbps to 10.3125Gbps, PRBS31 NRZ, 10GBase-LR mask and filter, at least 500 waveforms, and Hit Ratio meets the standard of  $1E^{-12}$  under margin.
2. 10.3125Gbps, PRBS31 NRZ, ER>8.2dB, and BER= $1E^{-12}$ , back-to-back.
3. 10.3125Gbps, PRBS31 NRZ, ER>8.2dB, BER= $1E^{-12}$ , CD=1400ps/nm, and OSNR>35dB.

**Transmitter Eye Mask**



$$\{X1, X2, X3, Y1, Y2, Y3\} = \{0.25, 0.40, 0.45, 0.25, 0.28, 0.40\}$$

**Timing Specifications**

Parameter	Symbol	Min.	Max.	Unit	Notes
Tx_Disable Assert Time	T_off		100	us	1
Tx_Disable Negate Time	T_on		2	ms	2
Time to Initialize Cooled Module & Time to Power-Up a Cooled Module to Power Level II	T_start_up_cooled		90	s	3
Tx_Fault Assert for Cooled Module	Tx_fault_on_cooled		50	ms	4
Tx_Fault Reset	T_reset	10		us	5
RS0, RS1: Rate Select Timing for Low Input	T_RS0_L, T_RS1_L		N/A		6
RS0, RS1: Rate Select Timing for High Input	T_RS0_H, T_RS1_H		N/A		6
Rx_LOS Assert Delay	T_los_on		100		7
Rx_LOS Negate Delay	T_los_off		20		8
Wavelength Tuning Time	T_wave_change	3	10		9

**Notes:**

1. Rising edge of Tx\_Disable to fall of output signal below 10% of normal.
2. Falling edge of Tx\_Disable to rise of output signal above 90% of nominal. This only applies in normal operation, not during start-up or fault recovery.
3. From power on or hot plug, or Tx\_Disable negated during power-up or Tx\_Fault recovery, until cooled Power Level I part (or cooled Power Level II part during fault recovery) is fully operational. Also, from stop bit low-to-high SDA transition enabling Power Level II until cooled module is fully operational.
4. From occurrence of fault to assertion of Tx\_Fault.
5. Time Tx\_Disable must be held “high” to reset Tx\_Fault.
6. From assertion until stable output.
7. From occurrence of loss of signal to assertion of Rx\_LOS.
8. From occurrence of presence of signal to negation of Rx\_LOS.
9. From writing of wavelength set command to completion of the wavelength tuning and output signal above 90%.

**Two-Wire I/O**

Parameter	Symbol	Min.	Max.	Unit	Notes
Clock Frequency	fSCL	0.1	400	KHz	1
Clock Pulse Width - Low	tLOW	1.3		us	
Clock Pulse Width - High	tHIGH	0.6		us	
START Hold Time	tHD:STA	0.6		us	
START Set-Up Time	tSU:STA	0.6		us	
Data In Hold Time	tHD:DAT	0		ns	
Data In Set-Up Time	tSU:DAT	100		ns	
Input Rise Time (100KHz) from (VIL, Max.-0.15) to (VIH, Min.+0.15)	Tr,100		1000	ns	
Input Rise Time (400KHz) from (VIL, Max.-0.15) to (VIH, Min.+0.15)	Tr,400		300	ns	
Input Fall Time (100KHz) from (VIH, Min.+0.15) to (VIL, Max.-0.15)	Tf,100		300	ns	
Input Fall Time (400KHz) from (VIH, Min.+0.15) to (VIL, Max.-0.15)	Tf,400		300	ns	
STOP Set-Up Time	tSU:STO	0.6		us	
Time Bus is Free Before a New Transmission Can Start	tBUF	20		us	
Time to Initialize	T_init		300	ms	
Clock Stretching	T_clock_hold		500	us	
Complete Single or Sequential Write Up to 4 Byte	tWR		40	ms	
Complete Sequential Write of 5-8 Bytes	tWR		80	ms	
Endurance of User Writable EEPROM (Write Cycles)		10k		cycle	

**Notes:**

1. The module shall operate with fSCL up to 100kHz without requiring clock stretching. The module may clock stretch with fSCL greater than 100kHz and up to 400kHz.

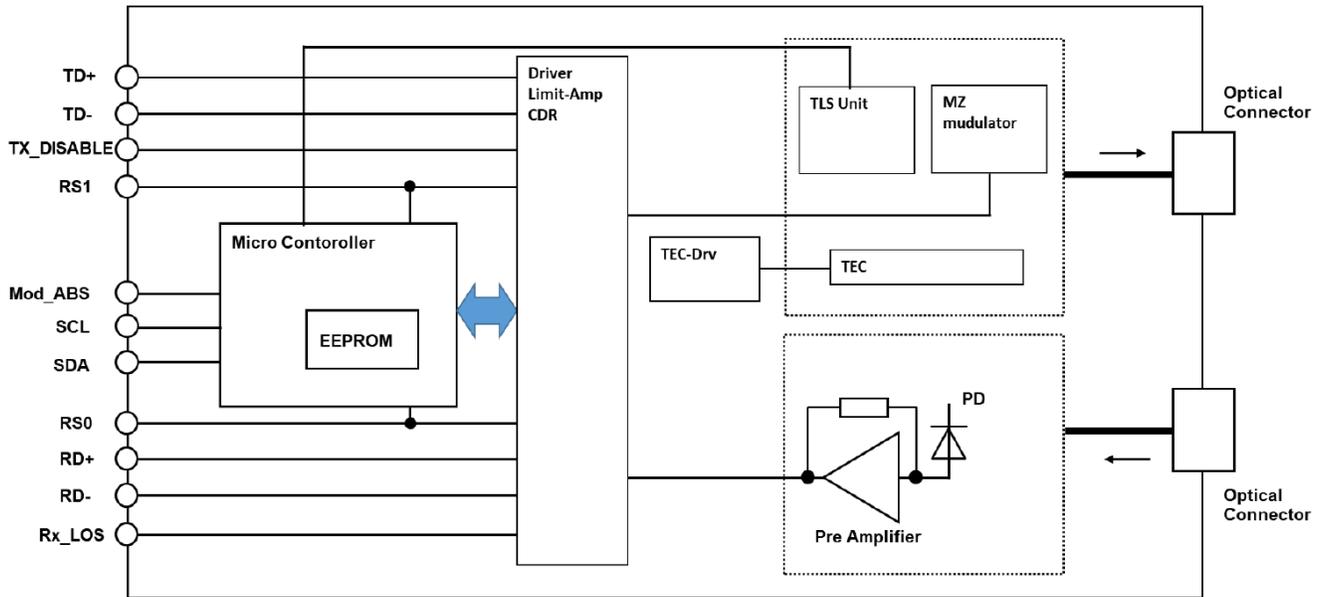
## Pin Descriptions

Pin	Symbol	Name/Description	Plug Seq.	Notes
1	VeeT	Transmitter Ground.	1	
2	Tx_Fault	Transmitter Fault Indication.	3	
3	Tx_Disable	Transmitter Disable.	3	
4	SDA	2-Wire Serial Interface Data.	3	
5	SCL	2-Wire Serial Interface Clock.	3	
6	MOD_ABS	Module Absent.	3	
7	RS0	Rate Select 0. Optionally controls.	3	
8	Rx_LOS	Receiver Loss of Signal Indication.	3	
9	RS1	Rate Select 1. Optionally controls.	3	
10	VeeR	Receiver Ground.	1	
11	VeeR	Receiver Ground.	1	
12	RD-	Receiver Inverted Data Output.	3	
13	RD+	Receiver Non-Inverted Data Output.	3	
14	VeeR	Receiver Ground.	1	
15	VccR	Receiver 3.3V Supply.	2	
16	VccT	Transmitter 3.3V Supply.	2	
17	VeeT	Transmitter Ground.	1	
18	TD+	Transmitter Non-Inverted Data Input.	3	
19	TD-	Transmitter Inverted Data Input.	3	
20	VeeT	Transmitter Ground.	1	

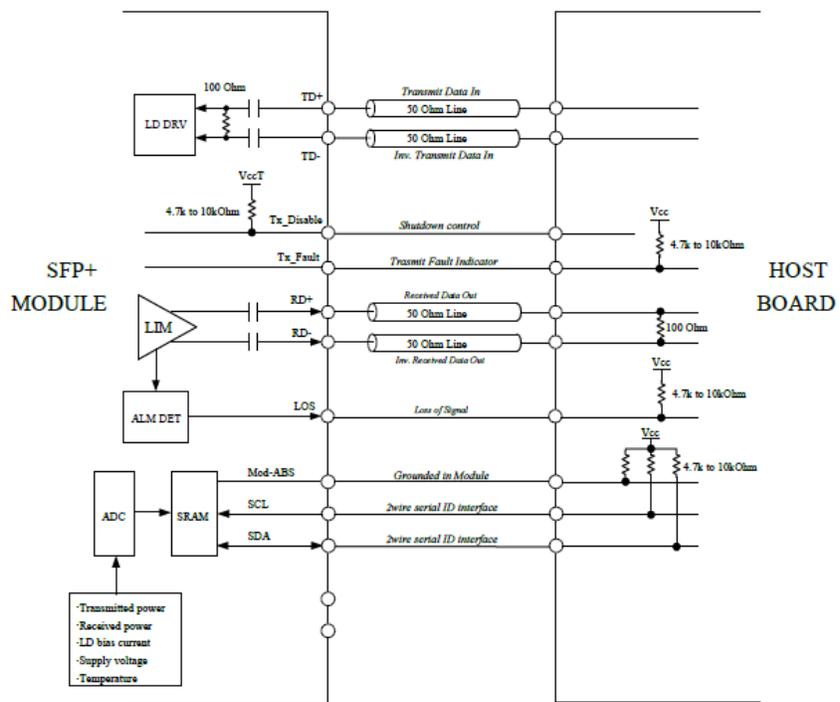
### Notes:

- The case makes electrical contact to the cage before any of the board edge contacts are made.
- The module signal ground contacts, VeeR and VeeT, should be isolated from the module case.
- SCL, SDA, and MOD\_ABS should be pulled up with a 4.7k $\Omega$  to 10k $\Omega$  resistor on the host board.  
The pull-up voltage shall be VccT or VccR.  
SCL is the clock line of the 2-wire serial interface for serial ID.  
SDA is the data line of the 2-wire serial interface for serial ID.  
MOD\_ABS is grounded by the module to indicate that the module is present.
- VccR and VccT are the receiver and transmitter power supplies. They are defined as 3.3V $\pm$ 5% at the SFP+ connector pin. Recommended host board power supply filtering is shown below.
- TD- and TD+ are the differential transmitter inputs. They are AC coupled, differential lines with 100 $\Omega$  differential termination inside the module.
- RD- and RD+ are the differential receiver outputs. They are AC coupled, 100 $\Omega$  differential lines which should be terminated with 100 $\Omega$  (differential) at the host.

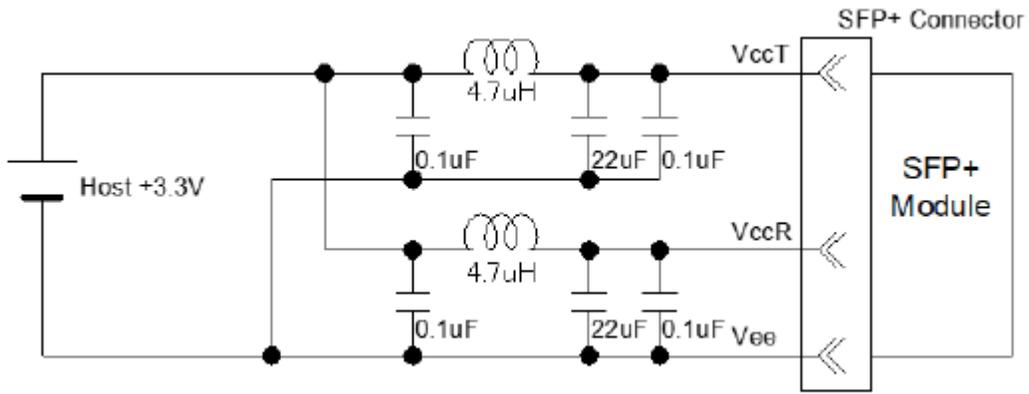
## Block Diagram of the Transceiver



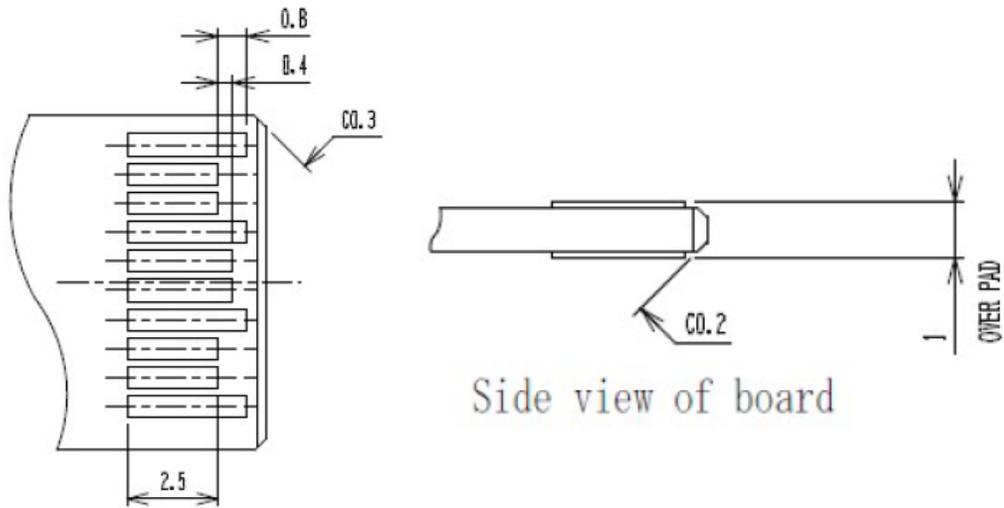
## Recommended Interface Circuit



### Power Supply Filter

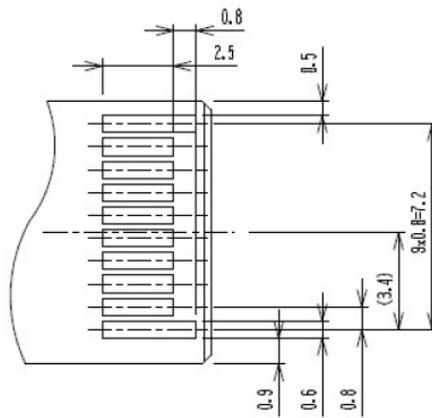


### Circuit Board Connector Layout



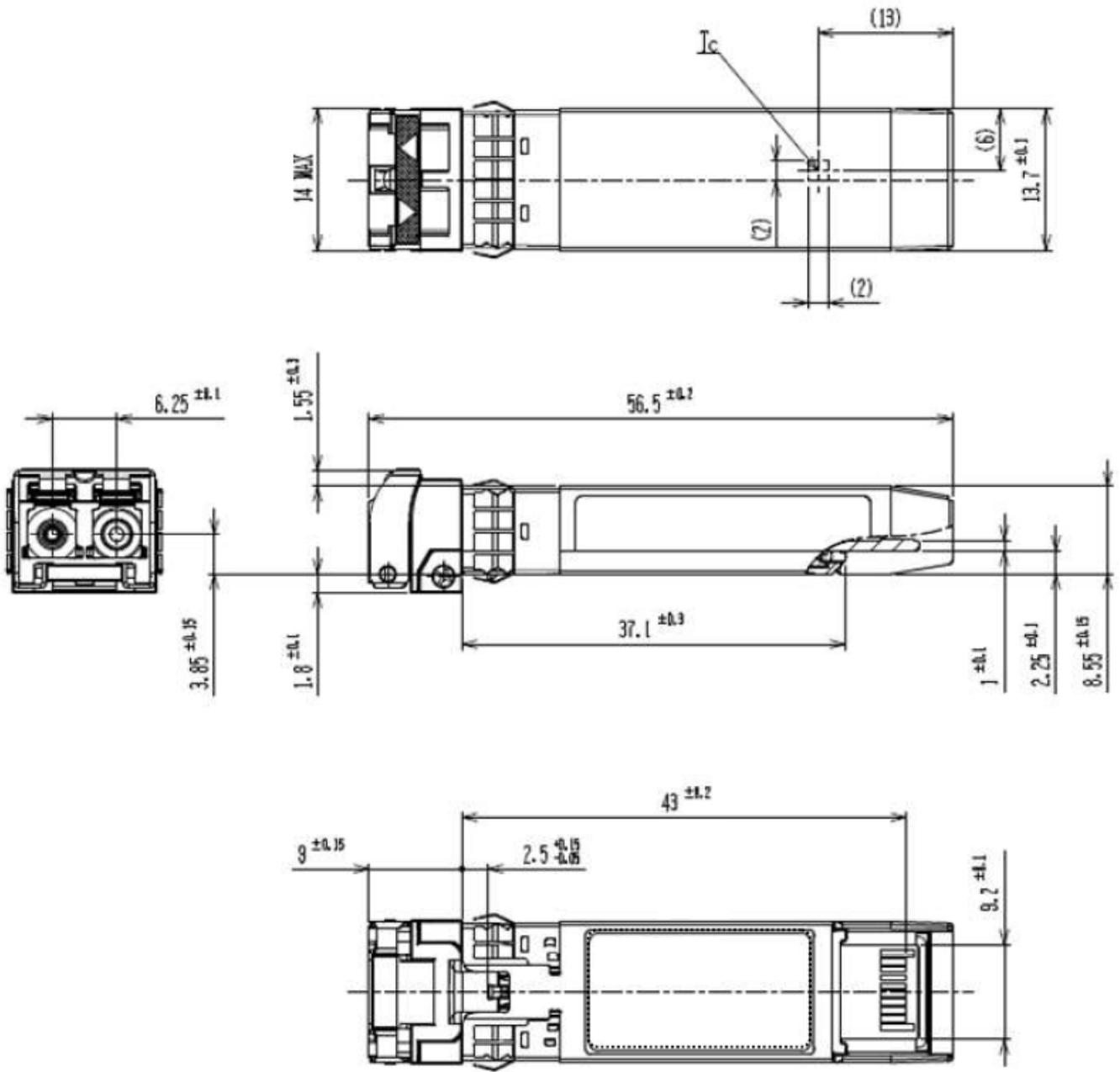
Top view of board

Side view of board



Bottom view of board

# Mechanical Specifications



## About AddOn Networks

In 1999, AddOn Networks entered the market with a single product. Our founders fulfilled a severe shortage for compatible, cost-effective optical transceivers that compete at the same performance levels as leading OEM manufacturers. Adhering to the idea of redefining service and product quality not previously had in the fiber optic networking industry, AddOn invested resources in solution design, production, fulfillment, and global support.

Combining one of the most extensive and stringent testing processes in the industry, an exceptional free tech support center, and a consistent roll-out of innovative technologies, AddOn has continually set industry standards of quality and reliability throughout its history.

Reliability is the cornerstone of any optical fiber network and is engrained in AddOn's DNA. It has played a key role in nurturing the long-term relationships developed over the years with customers. AddOn remains committed to exceeding industry standards with certifications from ranging from NEBS Level 3 to ISO 9001:2005 with every new development while maintaining the signature reliability of its products.



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