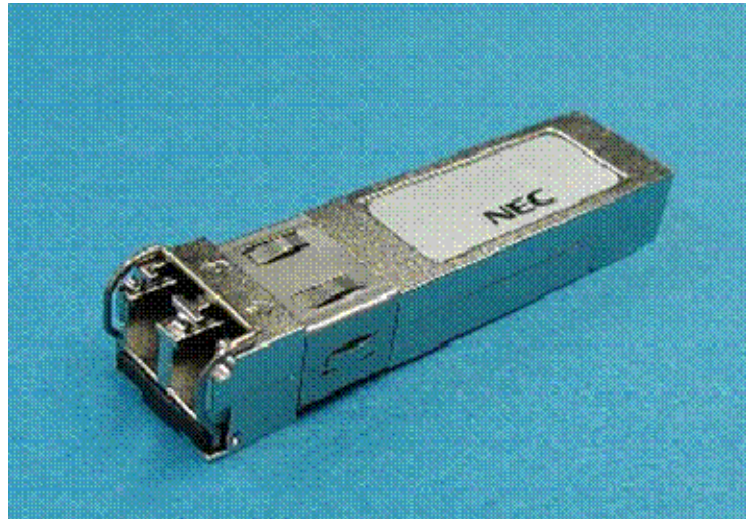


2.5Gbps Optical Transceiver  
**OD-J8833-5Cxx**

2.5Gbps SFP Optical Transceiver for C-WDM System



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**1. Description**

The OD-J8833-5Cxx is "Small Form Factor Pluggable" optical transceiver modules designed for 2.5Gbps C-WDM system.

**2. Feature**

- Designed for C-WDM System
- Small Form Factor Pluggable (SFP)
- Single +3.3V Power Supply
- Long Distance Transmission
- LC Optical Duplex Receptacle
- Digital Diagnostic Monitoring Function

**3. Ordering Information**

Product Number	Specification	Optical Connector	Operating Case Temperature Range
OD-J8833-5Cxx	CWDM for 80km application	LC Duplex	0 to +70deg.C

Wavelength information

5Cxx	Center wavelength	5Cxx	Center wavelength
5C47	1471nm	5C55	1551nm
5C49	1491nm	5C57	1571nm
5C51	1511nm	5C59	1591nm
5C53	1531nm	5C61	1611nm

These product numbers are NEC standard. If customization is required, e.g.) label, memory contents or so on, a special part number shall be provided.

**4. Specifications**

**4-1. Absolute Maximum Ratings**

Parameter	Unit	Specification		Note
		Min	Max	
Storage Temperature <sup>1</sup>	deg.C	-40	+85	
Supply Voltage (VccT, VccR)	V	-0.3	+4.0	
Input Data Signal Levels (AC coupled)	Vpp		+3.0	
Relative Humidity (non-condensing)	%		85	
Static Discharge Voltage (human body model)	V		500	
Peak Optical Input Power	dBm		-6	

<sup>1</sup> Temperature range for storage without device damage.

**4-2. Environmental Conditions**

Parameter	Unit	Specification	Note
Data Rate <sup>2</sup>	bps	2.48832G	
Data Format		Scrambled NRZ	Scrambler is not included.
Transmission Cable		SMF (ITU-T G.652)	
Nominal transmission distance	km	80	
Operating Case Temperature Range	deg.C	0 to +70	
Supply Voltage (Vcc)	V	+3.3 +/-5%	
Power Consumption	W	0.6W (Typ)	@+25 deg.C, +3.30V
	W	1.2W (Max)	@+70 deg.C, +3.47V

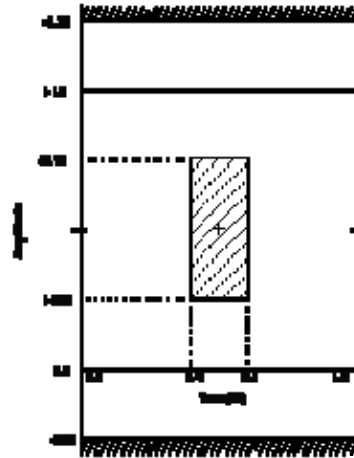
<sup>2</sup> All descriptions here are specified by STM-16/ SONET OC-48 (2.48832Gbps)

**4-3. Optical Signal Interface Specifications**

**Transmitter**

Parameter	Unit	Specification
Laser Diode Type	-	SLM-LD
Center Wavelength: $\lambda_n$	nm	$\lambda_1$ : 1471, $\lambda_2$ : 1491, $\lambda_3$ : 1511, $\lambda_4$ : 1531, $\lambda_5$ : 1551, $\lambda_6$ : 1571, $\lambda_7$ : 1591, $\lambda_8$ : 1611
Wavelength Stability	nm	$\lambda_n \pm 6.5\text{nm} @ T_c = 0 \text{ to } 70\text{degC}$
Maximum -20dB Width	nm	1
Minimum SMSR	dB	-30
Mean Launched Power	dBm	0 to +5
Extinction Ratio	dB	$\geq 8.2$
Optical Output Eye Diagram <sup>4</sup>	-	ITU-T G.957 compliant (Fig.1)
Optical Output Rise/Fall Time (20%-80%)	ps	<150
Output power with transmitter disabled	dBm	<-45
Optical Signal Polarity	-	Positive logic

<sup>4</sup> As per ITU-T G.957 at 2.48832Gbps



**Fig. 1** Optical output signal mask specifications of SONET/ITU standard specified by the waveform after passing through 4th order Bessel-filter which has cut-off frequency of 2.48832GHz ×0.75.

**Optical Path**

Parameter	Unit	Specification
Attenuation Range	dB	14 to 27
Residual Chromatic Dispersion	ps/nm	<1600 @1610nm
Optical Path Penalty	dB	<2
Discrete Reflectance Between S <sub>n</sub> and R <sub>n</sub> <sup>5</sup>	dB	<-27
Return Loss at Point S <sub>n</sub> <sup>5</sup> (including any connectors)	dB	>24

<sup>5</sup> S and R are the point at the transmitter and the point at the receiver following the definition of the ITU-T G.957.

**Receiver**

Parameter	Unit	Specification
Operating Wavelength Range	nm	1464 - 1617
Minimum sensitivity <sup>6</sup> (@BER=1E-10)	dBm	-29
Minimum overload <sup>6</sup> (@BER=1E-10)	dBm	-9
Optical pass penalty	dB	< 2
Reflectance of Receiver	dB	<-27
Optical Signal Polarity	-	Positive logic

<sup>6</sup> Back-to-back as per ITU-T G.957 under over all operating conditions at 2.48832 Gbit/s.

**4-4. Electrical Signal Interface Specifications**

**4-4-1. Transmitter**

Parameter		Unit	Specification			Note
			Min	Typ	Max	
Differential Input Signal Level		mVp-p	500		2400	
Differential Input Resistance		Ohm	85	100	115	
TX Fault <sup>8</sup>	Fault condition	V	O.C.			
	Normal condition		0		0.4	3mA Sink
TX Disable	Disable state	V	2		VccT	
	Enable state		0		0.8	

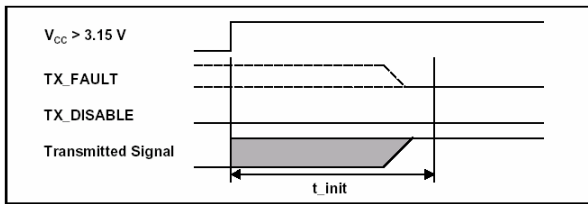
**4-4-2. Receiver**

Parameter		Unit	Specification			Note
			Min	Typ	Max	
Differential Output Voltage		mVp-p	370		1200	
LOS Output level <sup>8</sup>	Fault condition	V	O.C.			
	Normal condition		0		0.4	1.2mA Sink

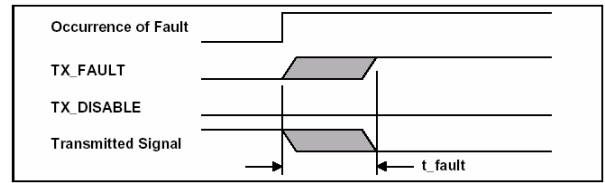
<sup>8</sup> Open collector output.

4-5. Timing Requirements of Control and Status I/O

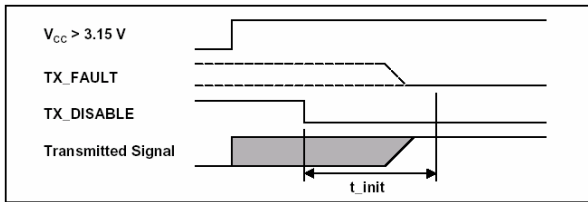
Parameter	Symbol	Unit	Min	Max	Note
TX Disable Assert Time	t_off	us		10	
TX Disable Negate Time	t_on	ms		1	
Time to initialize, including reset of TX Fault	t_init	ms		300	
TX Fault Assert Time	t_fault	us		100	
TX Disable to reset	t_reset	us	10		
LOS Assert Time	t_loss_on	us		100	
LOS Deassert Time	t_loss_off	us		100	
Serial ID Clock Rate	f_serial_clock	kHz		100	



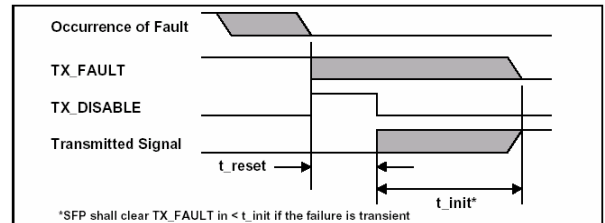
Power on initialization of SFP, Tx\_Disable negated.



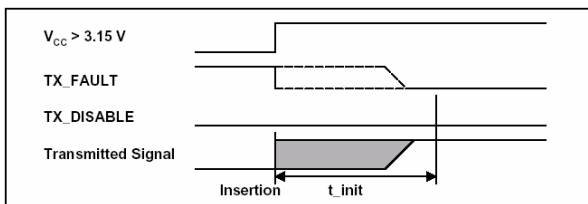
Detection of transmitter safety fault condition



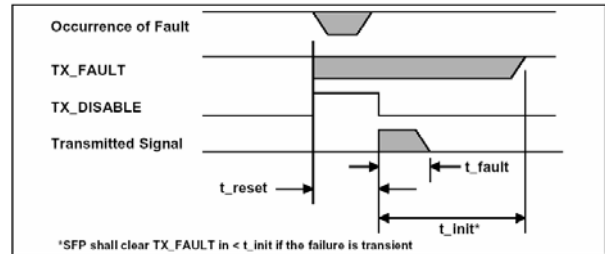
Power on initialization of SFP, Tx\_Disable asserted. Initialization during hot plugging of SFP.



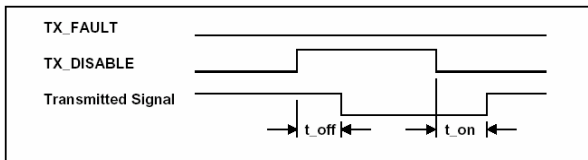
Successful recovery from transient safety fault condition



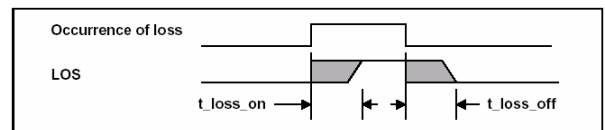
Example of initialization during hot plugging, Tx\_Disable negated.



Unsuccessful recovery from safety fault condition

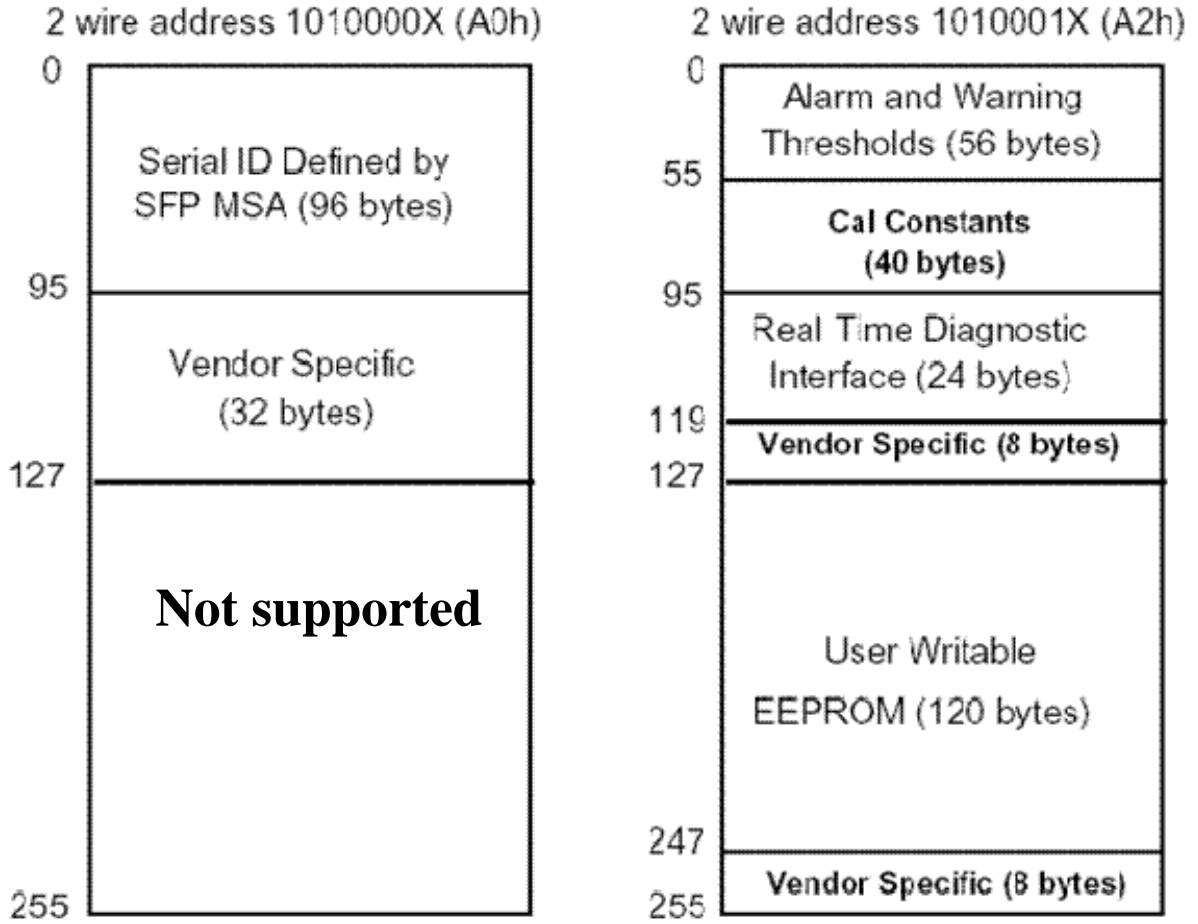


SFP Tx\_Disable timing during normal operation.



Timing of LOS detection

**5. Memory map**



Memory contents herein are for NEC standard products. Customizing is available.

**2 wire address 1010000x (A0h) memory**

Data Address	Name of Field	Value (Hex)	Description
<b>BASE ID FIELDS</b>			
0	Identifier	03	SFP
1	Ext.Identifier	04	by Serial ID
2	Connector	07	LC
3	Transceiver	00	
4	Transceiver	00	
5	Transceiver	00	
6	Transceiver	00	
7	Transceiver	00	
8	Transceiver	00	
9	Transceiver	00	
10	Transceiver	00	
11	Encoding	05	SONET Scrambled
12	BR, Nominal	19	2.5Gbps
13	Reserved	00	
14	Length(9um)-km	50	80km
		FF	>25500m
16	Length (50um)	00	
17	Length (62.5um)	00	
18	Length (Copper)	00	
19	Reserved	00	
20-35	Vendor name	4E 45 43 20 43 4F 52 50 4F 52 41 54 49 4F 4E 20	NEC_CORPORATION_
36	Reserved	00	
37-39	Vendor OUI	00 00 4C	NEC OUI code
		4F 44 2D 4A 38 38 33 33 2D 35 43 3n 3n 20 20 20	OD-J8833-5Cnn_
56-59	Vendor rev	30 30 30 31	0001
60-61	Wavelength	05 BE	1470 nm (OD-J8833-5C47)
		05 D2	1490 nm (OD-J8833-5C49)
		05 E6	1510 nm (OD-J8833-5C51)
		05 FA	1530 nm (OD-J8833-5C53)
		06 0E	1550 nm (OD-J8833-5C55)
		06 22	1570 nm (OD-J8833-5C57)
		06 36	1590 nm (OD-J8833-5C59)
		06 4A	1610 nm (OD-J8833-5C61)
62	Reserved	00	
63	CC_BASE		check sum of byte 0 to 62
<b>EXTENDED ID FIELDS</b>			
64	Options	00	Reserved
65	Options	1A	TX_DISABLE, TX_FAULT, LOS
66	BR, max	00	Unspecified
67	BR, min	00	Unspecified
68-83	Vendor SN		serial number
84-91	Date code		year, month
92	Diagnostic Type	58	External calibration
93	Enhanced Options	B0	Soft TX_FAULT, RX_LOS
94	SFF-8472	01	Compliance
95	CC_EXT		check sum of byte 64 to 94
<b>VENDOR SPECIFIC ID FIELDS</b>			
96-127	Vendor Specific	00 all	

## 2 wire address 1010001x (A2h) memory

### Alarm and Warning Threshold

Address	Bytes	Name	Description
00-01	2	Temp High Alarm	+85 deg. C
02-03	2	Temp Low Alarm	-40 deg. C
04-05	2	Temp High Warning	+70 deg. C
06-07	2	Temp Low Warning	0 deg. C
08-09	2	Vcc High Alarm	+ 4.0 V
10-11	2	Vcc Low Alarm	+ 3.13 V
12-13	2	Vcc High Warning	+ 3.47 V
14-15	2	Vcc Low Warning	+ 3.13 V
16-17	2	Bias High Alarm	100 mA
18-19	2	Bias Low Alarm	0 mA
20-21	2	Bias High Warning	100 mA
22-23	2	Bias Low Warning	0 mA
24-25	2	Tx Power High Alarm	+5dBm
26-27	2	Tx Power Low Alarm	0dBm
28-29	2	Tx Power High Warning	+5dBm
30-31	2	Tx Power Low Warning	0dBm
32-33	2	Rx Power High Alarm	-8dBm
34-35	2	Rx Power Low Alarm	-30dBm
36-37	2	Rx Power High Warning	-9dBm
38-39	2	Rx Power Low Warning	-29dBm
40-55	16	Reserved	Reserved

### Calibration data

Address	Bytes	Name	Description
56-59	4	Rx_PWR <sub>4</sub>	Single precision floating-point calibration data for receiving power. Bit 7 of byte 56 is MSB. Bit 0 of byte 59 is LSB.
60-63	4	Rx_PWR <sub>3</sub>	Single precision floating-point calibration data for receiving power. Bit 7 of byte 60 is MSB. Bit 0 of byte 63 is LSB.
64-67	4	Rx_PWR <sub>2</sub>	Single precision floating-point calibration data for receiving power. Bit 7 of byte 64 is MSB. Bit 0 of byte 67 is LSB.
68-71	4	Rx_PWR <sub>1</sub>	Single precision floating-point calibration data for receiving power. Bit 7 of byte 68 is MSB. Bit 0 of byte 71 is LSB.
72-75	4	Rx_PWR <sub>0</sub>	Single precision floating-point calibration data for receiving power. Bit 7 of byte 72 is MSB. Bit 0 of byte 75 is LSB.
76-77	2	Tx_I <sub>Slope</sub>	Fixed decimal (unsigned) calibration data for laser bias current. Bit 7 of byte 76 is MSB. Bit 0 of byte 77 is LSB.
78-79	2	Tx_I <sub>Offset</sub>	Fixed decimal (signed 2's complement) calibration data for laser bias current. Bit 7 of byte 78 is MSB. Bit 0 of byte 79 is LSB.
80-81	2	Tx_PWR <sub>Slope</sub>	Fixed decimal (unsigned) calibration data for optical output power. Bit 7 of byte 80 is MSB. Bit 0 of byte 81 is LSB.
82-83	2	Tx_PWR <sub>Offset</sub>	Fixed decimal (signed 2's complement) calibration data for optical output power. Bit 7 of byte 82 is MSB. Bit 0 of byte 83 is LSB.
84-85	2	T <sub>Slope</sub>	Fixed decimal (unsigned) calibration data for module temperature. Bit 7 of byte 84 is MSB. Bit 0 of byte 85 is LSB.
86-87	2	T <sub>Offset</sub>	Fixed decimal (signed 2's complement) calibration data for module temperature. Bit 7 of byte 86 is MSB. Bit 0 of byte 87 is LSB.
88-89	2	V <sub>Slope</sub>	Fixed decimal (unsigned) calibration data for module supply voltage. Bit 7 of byte 88 is MSB. Bit 0 of byte 89 is LSB.
90-91	2	V <sub>Offset</sub>	Fixed decimal (signed 2's complement) calibration data for module supply voltage. Bit 7 of byte 90 is MSB. Bit 0 of byte 91 is LSB.
92-94	3	Reserved	Reserved
95	1	Checksum	Low order 8 bits of the sum of bytes 0 to 94.

A/D monitor value

Address	Bytes	Name	Description
96	1	Temperature MSB	Internally measured module temperature
97	1	Temperature LSB	
98	1	Vcc MSB	Internally measured supply voltage in transceiver
99	1	Vcc LSB	
100	1	TX Bias MSB	Internally measured TX Bias Current
101	1	TX Bias LSB	
102	1	Tx Power MSB	Measured TX output power
103	1	Tx Power LSB	
104	1	Rx Power MSB	Measured RX input power
105	1	Rx Power LSB	
106	1	Reserved	Reserved
107	1	Reserved	
108	1	Reserved	
109	1	Reserved	Reserved

Status bit

Address	#Bit	Name	Description
110	7	TX Disable state	
	6	Soft TX Disable command	
	5	Reserved	
	4	RX rate select state	
	3	Soft RX rate select command	
	2	TX Fault state	Digital state of the TX Fault output pin.
	1	LOS state	Digital state of the LOS output pin.
	0	Data Ready Bar	
111	7-0	Reserved	

Real time diagnostic resistor

Address	#Bit	Name	Description
112	7	Temp High Alarm	Set when internal temperature exceeds high alarm level
	6	Temp Low Alarm	Set when internal temperature is below low alarm level
	5	Vcc High Alarm	Set when internal supply voltage exceeds high alarm level
	4	Vcc Low Alarm	Set when internal supply voltage is below low alarm level
	3	TX Bias High Alarm	Set when TX Bias current exceeds high alarm level
	2	TX Bias Low Alarm	Set when TX Bias current is below low alarm level
	1	TX Power High Alarm	Set when TX output power exceeds high alarm level
	0	TX Power Low Alarm	Set when TX output power is below low alarm level
113	7	RX Power High Alarm	Set when RX receiving power exceeds high alarm level
	6	RX Power Low Alarm	Set when RX receiving power is below low alarm level
	5-0	Reserved	
114	7-0	Reserved	
115	7-0	Reserved	
116	7	Temp High Warning	Set when internal temperature exceeds high warning level
	6	Temp Low Warning	Set when internal temperature is below low warning level
	5	Voltage High Warning	Set when internal supply voltage exceeds high warning level
	4	Voltage Low Warning	Set when internal supply voltage is below low warning level
	3	TX Bias High Warning	Set when TX Bias current exceeds high warning level
	2	TX Bias Low Warning	Set when TX Bias current is below low warning level
	1	TX PWR High Warning	Set when TX output power exceeds high warning level
	0	TX PWR Low Warning	Set when TX output power is below low warning level
117	7	RX PWR High Warning	Set when RX receiving power exceeds high warning level
	6	RX PWR Low Warning	Set when RX receiving power is below low warning level
	5-0	Reserved	

The others

Address	Bytes	Name	Description
118-119	2	Reserved	
120-127	8	Vender specific	00 all
128-247	120	User writable EEPROM	00 all
248-255	8	Vender specific	00 all

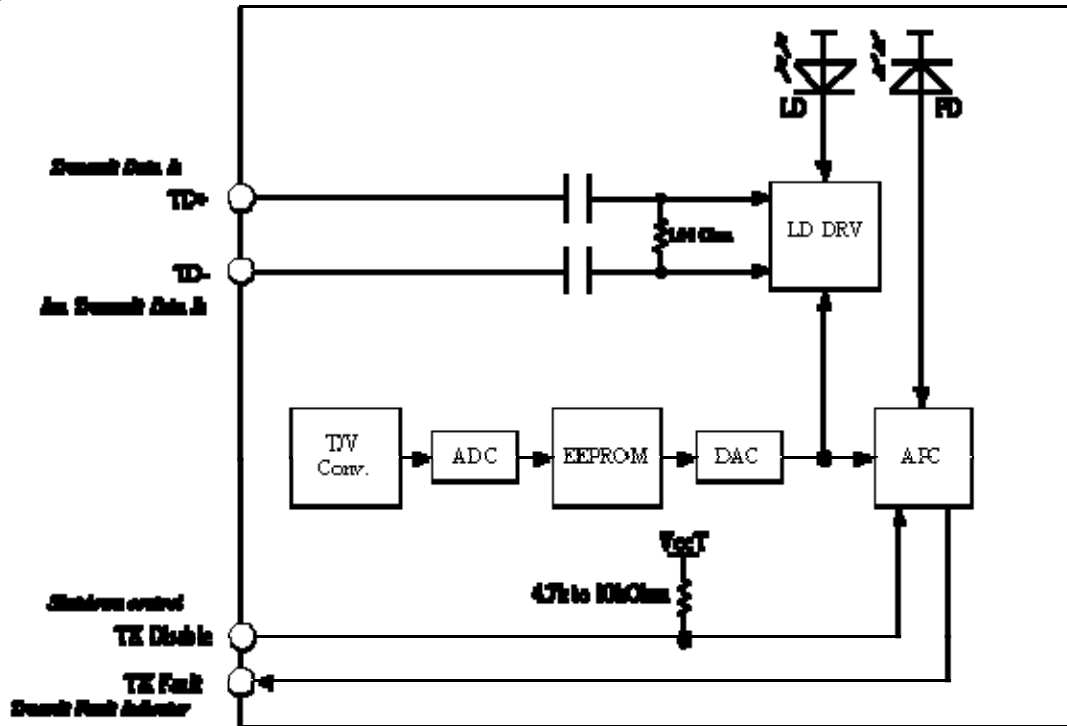
**6. Digital Diagnostic Monitor**

Parameter	Unit	Specification
Tx Optical Power	dB	+/- 3 ( @ 0 to +5 dBm)
Rx Optical Power	dB	+/- 3 ( @ -9 to -29 dBm)
Bias Current	%	+/- 10 ( @ 5 to 100 mA)
Power Supply Voltage	%	+/- 3 ( @ 3.13 to 3.47V)
Transceiver Case Temperature	deg. C	+/- 3 ( @ 0 to +70deg.C)

**7. Functional Block Diagram**

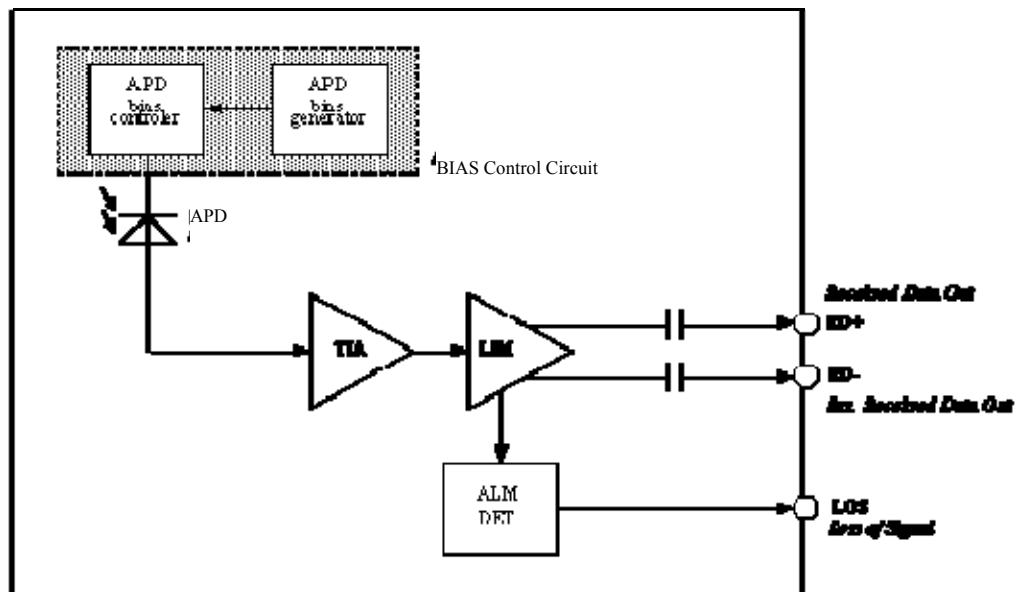
**7-1. Functional Block Diagram**

**a) Transmitter**



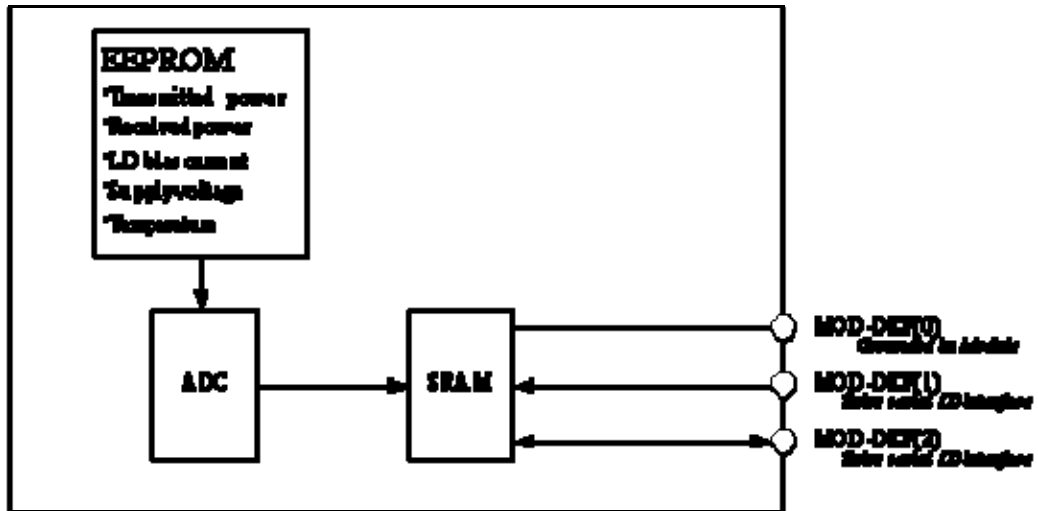
LD DRV: Laser diode driver, DAC: Digital to analogue converter, T/V Conv.: Temperature to voltage converter, APC: Automatic power control circuit, ADC: Analogue to digital converter, EEPROM: Electronic erasable ROM, PD: Photo Diode, LD: LASER Diode

**b) Receiver**



APD: Avalanche Photo Diode, TIA: Trans Impedance Amplifier, LIM: Limiting amplifier, ALM DET: alarm detector

C) Digital diagnostic monitor

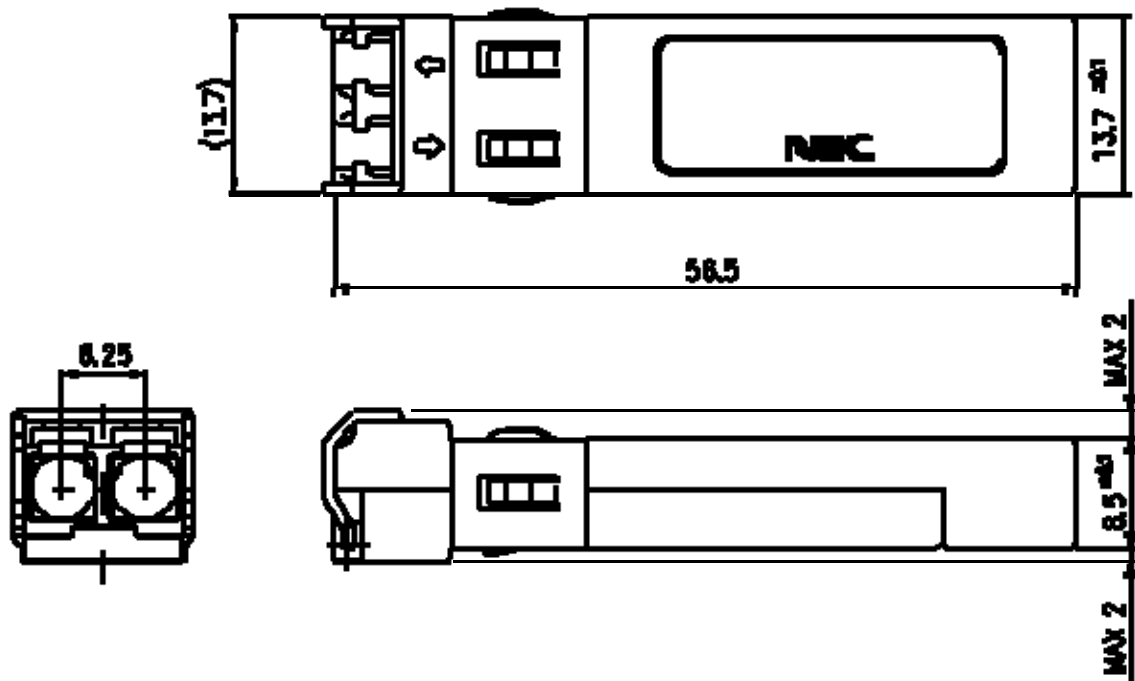


ADC: Analogue to digital converter

8. Package size, Pin Assignment

8-1. Outline

(Unit in mm)



8-2. Pin Description

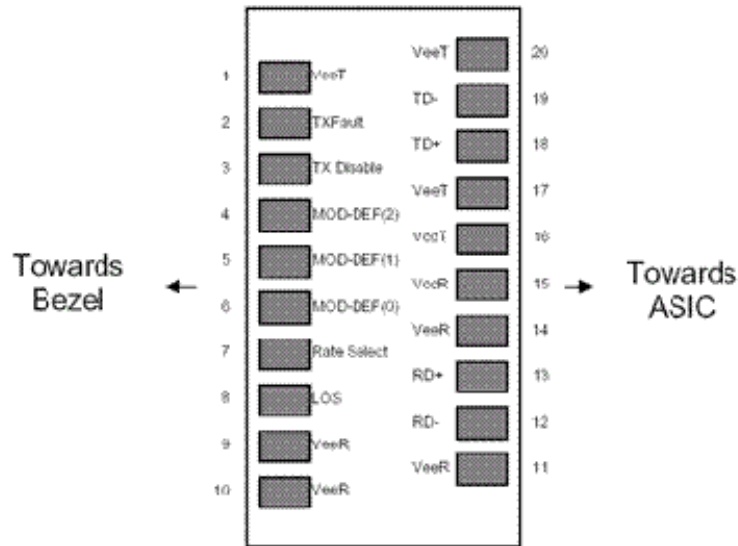


Fig. Diagram of Host Board Connector Block Pin Numbers and Names

Pin Num.	Name	Function	Plug Seq.	Note
1	VeeT	Transmitter Ground	1	
2	TX Fault	Transmitter Fault Indication	3	Note 1)
3	TX Disable	Transmitter Disable	3	Note 2) Module disables on high or open
4	MOD-DEF2	Module Definition 2	3	Note 3), 2wire serial ID interface
5	MOD-DEF1	Module Definition 1	3	Note 3), 2wire serial ID interface
6	MOD-DEF0	Module Definition 0	3	Note 3), Grounded in Module
7	NUC	NUC	3	
8	LOS	Loss of Signal	3	Note 4)
9	VeeR	Receiver Ground	1	
10	VeeR	Receiver Ground	1	
11	VeeR	Receiver Ground	1	
12	RD-	Inv. Received Data Out	3	Note 5)
13	RD+	Received Data Out	3	Note 5)
14	VeeR	Receiver Ground	1	
15	VccR	Receiver Power	2	3.3V±5%, Note 6)
16	VccT	Transmitter Power	2	3.3V±5%, Note 6)
17	VeeT	Transmitter Ground	1	
18	TD+	Transmit Data In	3	Note 7)
19	TD-	Inv. Transmit Data In	3	Note 7)
20	VeeT	Transmitter Ground	1	

Plug Seq: Pin engagement sequence during hot plugging.

- 1) TX Fault is an open collector output, which should be pulled up with a 4.7k-10k $\Omega$  resistor on the host board. Pull up voltage between 2.0V and VccT. When high, output indicates a laser fault of some kind. Low indicates normal operation. In the low state, the output will be pulled to <0.8V.
- 2) TX disable is an input that is used to shut down the transmitter optical output. It is pulled up within the module with a 4.7k-10k $\Omega$  resistor.
- 3) Mod-Def 0,1,2. These are the module definition pins. They should be pulled up with a 4.7k-10k $\Omega$  resistor on the host board. The pull-up voltage shall be VccT or VccR.  
Mod-Def 0 is grounded by the module to indicate that the module is present  
Mod-Def 1 is the clock line of two wire serial interface for serial ID  
Mod-Def 2 is the data line of two wire serial interface for serial ID
- 4) LOS(Loss of Signal) is an open collector output, which should be pulled up with a 4.7k-10k $\Omega$  resistor. Pull up voltage between 2.0V and VccR. Low indicates normal operation. In the low state, the output will be pulled to <0.8V.
- 5) RD-/+ : These are the differential receiver outputs. They are AC coupled 100 $\Omega$  differential lines which should be terminated with 100 $\Omega$ (differential) at the user SERDES. The AC coupling is done inside the module and is thus not required on the host board.
- 6) 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 Fig.7-2.
- 7) TD-/+ : These are the differential transmitter inputs. They are AC-coupled, differential lines with 100 $\Omega$  differential termination inside the module. The AC coupling is done inside the module and is thus not required on the host board.

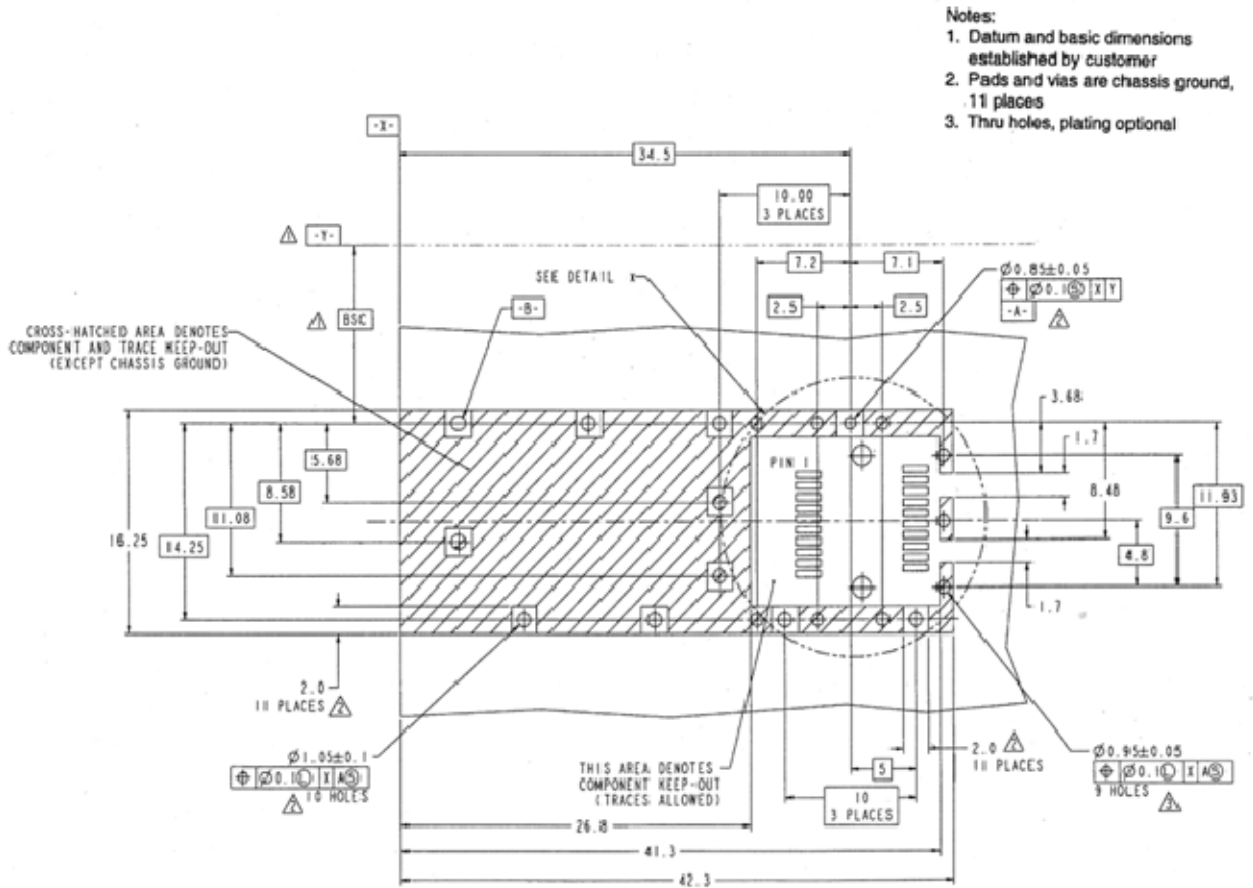


Fig. SFP Host Board Mechanical Layout

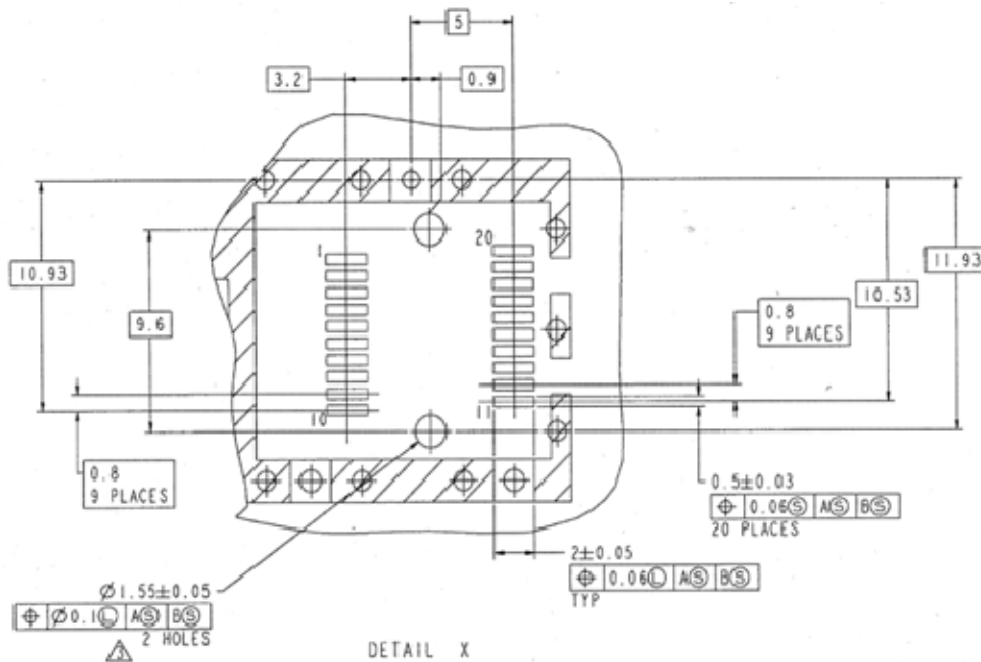
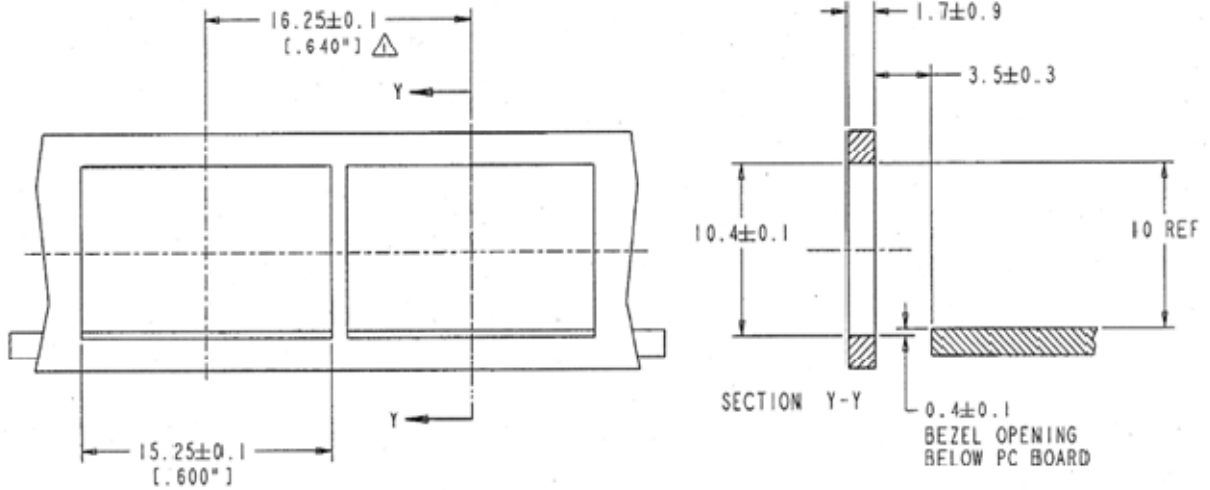


Fig. SFP Host Board Mechanical Layout (Cont.)



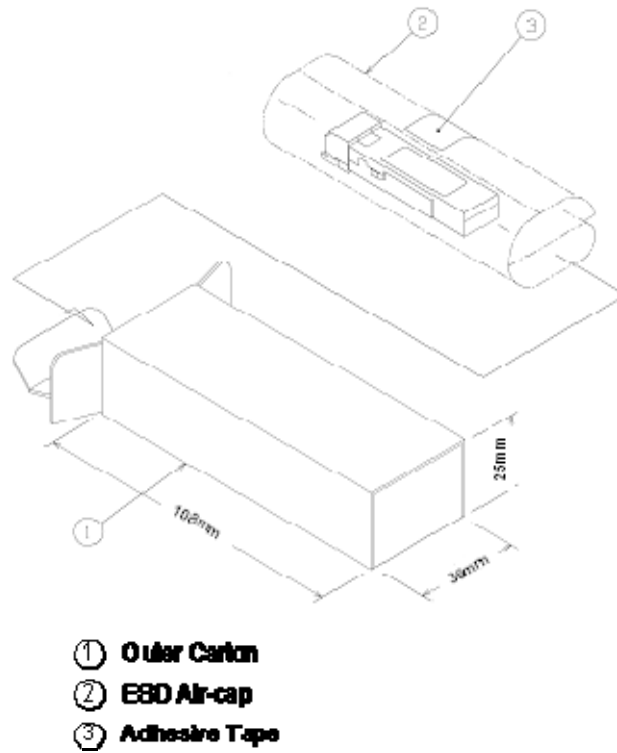
NOTES:

- 1.  $\triangle$  MINIMUM PITCH ILLUSTRATED. ENGLISH DIMENSIONS ARE FOR REFERENCE ONLY
- 2. NOT RECOMMENDED FOR PCI EXPANSION CARD APPLICATIONS

**Fig. Recommended Bezel Design**



**10. Shipment Packing**



**11. Reliability**

**11-1. FIT rate**

@ 45 deg. C

	Total FIT rate
OD-J8833-5Cxx	504 FIT

**11-2. Reliability test**

GR468-CORE

**12. Certifications**

**12-1. LASER Eye Safety**

IEC 60825-2 CLASS 1

**12-2. Flammability**

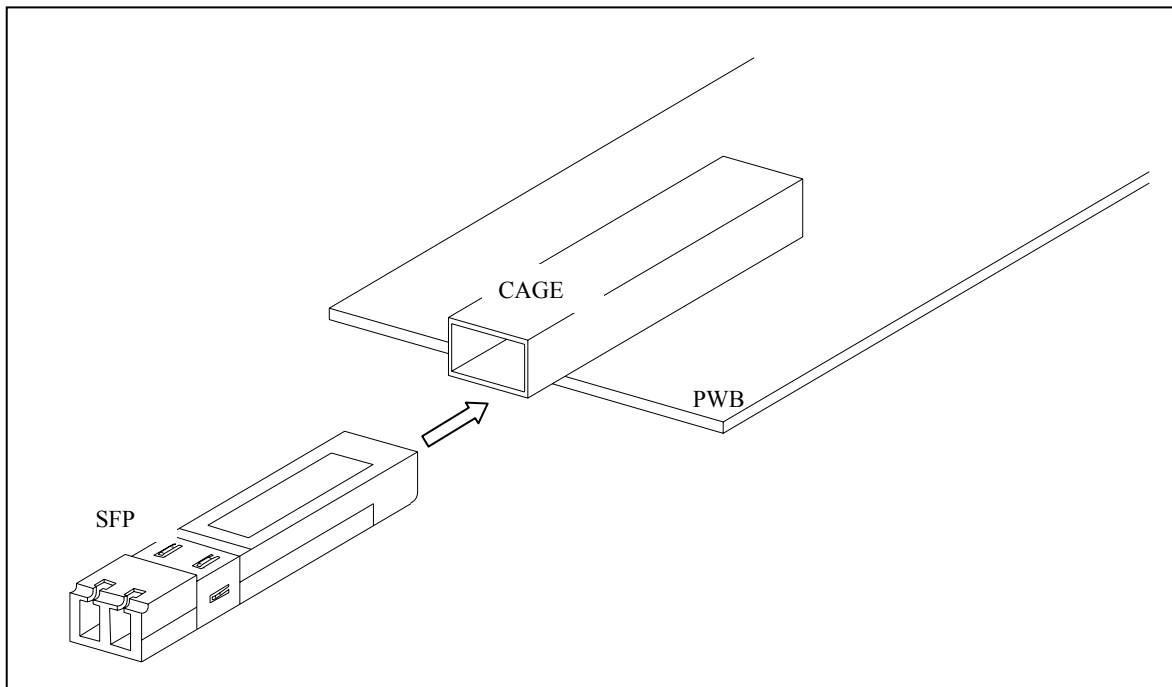
UL94V1 (qualified by each component)

**12-3. Electromagnetic compatibility**

FCC PART15 Class B

**13. Application Precautions**

- a) To prevent optical connector surface from crack or stain, please put the dust cap while this device is not in use.  
When the connector surface is stained, please wipe with a kind of lens paper.
- b) Optical components are mounted inside this device. Please handle with care. Mechanical shock due to falling could lead permanent damage.
- c) The device performance given in this manual is guaranteed for correct applications. Device performances are not guaranteed under incorrect use.
- d) Sudden heating or cooling by dryer or cooling spray could lead permanent damage to the device. The device may not work normally while sudden heating or cooling.
- e) This product should be handled as a CMOS product.
  
- f) Don't insert the module upside down. If the module is inserted into the cage on the host-board upside down, it may cause circuit to short out in the host-board. See Insert direction below.



**Fig.** Insert direction

**- Revision history -**

<b>Revision</b>	<b>Date</b>	<b>Contents</b>
01E	January 2006	First release
02E	March 2009	changed description for data rate range
03E	June, 2009	Changed contact information

**Areas of caution in the handling of laser diode products.**

- This product complies with IEC 60825-2.
- It corresponds to the category "Class 1 Laser Product" under IEC regulation.
- During operations, the laser diode discharges red beams and infrared beams invisible to the eye. Since it is very hazardous if these beams directly, or bypassing through a lens, get in one's eyes, please try to avoid this.
- Take proper Electrostatic-discharge (ESD) precautions while handling the device. The device is sensitive to ESD.
- May cause damage if dropped or subject to shock. This product includes optical parts.
- Caution-use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

**Areas of caution in handling GaAs.**

There are some products in our catalogue that use GaAs. Please strictly adhere to the caution items appearing below, in order to prevent dangerous situations.

- Do not put the product in your mouth.
- Do not turn the product into a vaporous or powdered form through burning, grinding or chemical processing.
- When disposing of the product, follow related laws, and your company's internal waste control regulations.

**Areas of caution in handling optical fiber products.**

- Be careful not to pierce your skins as the tips of optical fibers are extremely sharp. Especially you must pay attention in case of hazardous if they pierce one's eyes.
- Do not apply extreme stress to optical fiber, or it may cause deterioration of characteristics or disconnection. The force of pull should be less than 200gf, and, a radius for bending should be larger than R30 mm
- Do not hold only optical fiber or module package, because extreme stress is easy to apply to the optical fiber edge of the module

In general, failure occurs in electronic components with a certain probability. We at NEC work to improve the quality and reliability of industrial electronic components, but it is impossible to reduce such probability to zero. This being the case, users of NEC industrial electronic components are requested to provide redundant design, counterburning design, malfunction prevention design and other safety design to prevent failures that may cause possible accidents involving injuries of death, fire, social damages, etc.

NEC classifies the quality standard of its industrial electronic components into three categories, from the "Standard level" for lower quality upward to "Special level" and "specific level" for which customers are requested to designate their own quality assurance program. Respective quality levels are intended to be used for the following applications. In this connection, users considering to use NEC components for other than the "Standard level" application are always requested to contact an NEC sales representative in advance.

Standard level: For computers, O.A.(Office Automation) equipment, telecommunications equipment, measuring equipment, AV(Audio/Video) equipment, home electric appliances, machine tools, personal equipment and industrial robots.

Special level: Transportation machinery (automobiles, trains, ships, etc.), traffic signal equipment, disaster/crime prevention devices, various safety devices, and medical equipment not directly intended for life support.

Specific level: Aeronautical equipment, aerospace equipment, submarine relay equipment, nuclear control system, and medical equipment, devices or systems for life support.

NEC does not manufacture, as standard items, products recommendable to such "specific" applications as aerospace equipment, submarine relay equipment, nuclear control system and life-support medical equipment, which all require a very high level of reliability. Customers planning to use our products for the above-mentioned applications or those planning to use our products of "standard" or "special" quality level for other application than intended by us, are requested to contact in addition, please note that NEC industrial electronic components listed in catalogs, data sheets, data books and other materials published by NEC without the indication of their quality level are all of the standard quality level.

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