

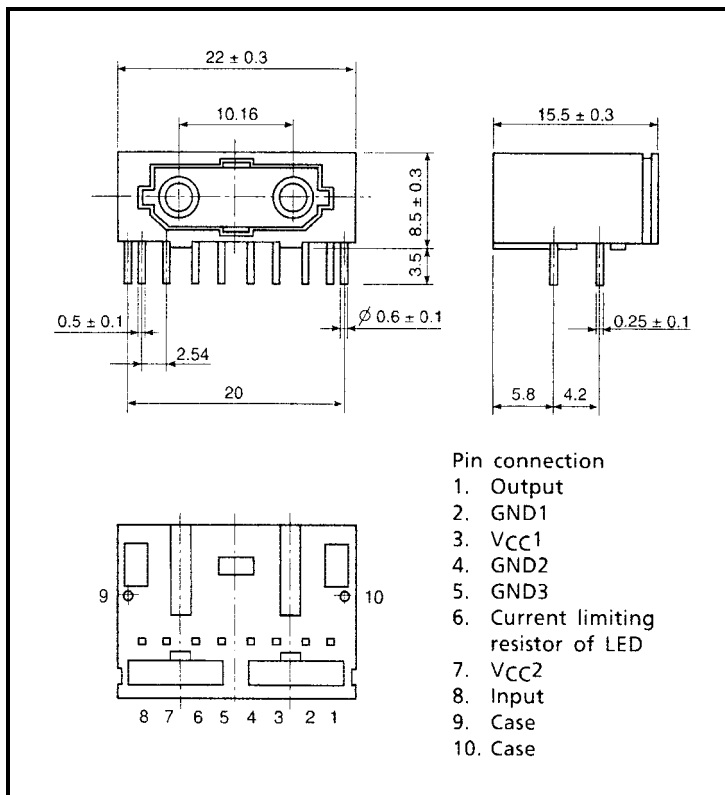
FIBER OPTIC TRANSCEIVING MODULE

# TODX294

## FIBER OPTIC TRANSCEIVING MODULE FOR DUPLEX DIGITAL SIGNAL COMMUNICATION

Unit: mm

- Data rate: DC to 10 Mb / s (NRZ code)
- Transmission distance: Up to 1000 m
- TTL interface
- LED is driven by Differential circuit.
- ATC (Automatic Threshold Control) circuit is used for stabilized output at wide range of optical power level.



### 1. Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Storage Temperature	T <sub>stg</sub>	-40 to 85	°C
Operating Temperature	T <sub>opr</sub>	-40 to 85	°C
Supply Voltage	V <sub>CC</sub>	-0.5 to 7	V
Input Voltage	V <sub>IN</sub>	-0.5 to V <sub>CC</sub> + 0.5	V
Low Level Output Current	I <sub>OL</sub>	20	mA
High Level Output Current	I <sub>OH</sub>	-1	mA
Soldering Temperature	T <sub>sol</sub>	260 (Note 1)	°C

Note 1: Soldering time ≤ 3 s (More than 1 mm apart from the package).

Handling precaution: The LEDs used in this product contain GaAs (Gallium Arsenide).

Care must be taken to protect the safety of people and the environment when scrapping or terminal processing.

## 2. Recommended Operating Conditions

Characteristics	Symbol	Min	Typ.	Max	Unit
Supply Voltage	$V_{CC}$	4.75	5.0	5.25	V
High Level Input Voltage	$V_{IH}$	2.0	—	$V_{CC}$	V
Low Level Input Voltage	$V_{IL}$	0	—	0.8	V
High Level Output Current	$I_{OH}$	—	—	-150	$\mu A$
Low Level Output Current	$I_{OL}$	—	—	1.6	mA

## 3. Electrical and Optical Characteristics (Ta = 25°C, V<sub>CC</sub> = 5 V)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Data Rate		NRZ Code (Note 2)	DC	—	8	Mb / s
Transmission Distance		Using PCF (Note 3), TODX294	0.2	—	1000	m
		Using PCF (Note 4), TODX294	0.2	—	700	m
Pulse Width Distortion (Note 5)	$\Delta tw$	Using TODX294 Pulse width 100 ns Pulse cycle 200 ns, $C_L = 10$ pF	-30	—	30	ns
Fiber Output Power	$P_f$	$R = 1.2$ k $\Omega$ (Note 6)	-20	—	-14	dBm
Peak Emission Wavelength	$\lambda_p$		—	800	—	nm
Maximum Receivable Power (Note 7)	$P_{MAX}$	DC to 10 Mb/s, Using PCF	-18	—	—	dBm
Minimum Receivable Power (Note 7)	$P_{MIN}$	DC to 10 Mb/s, Using PCF	—	—	-29	dBm
Current Consumption	$I_{CC}$	$R = 1.2$ k $\Omega$	—	60	95	mA
High Level Input Voltage	$V_{IH}$		2.0	—	—	V
Low Level Input Voltage	$V_{IL}$		—	—	0.8	V
High Level Input Current	$I_{IH}$		—	—	20	$\mu A$
Low Level Input Current	$I_{IL}$		—	—	-0.4	mA
High Level Output Voltage	$V_{OH}$		2.7	—	—	V
Low Level Output Voltage	$V_{OL}$		—	—	0.4	V

Note 2: LED is on when input signal is high level, it is off when low level.

High level output when optical flux is received. Low level output when it is not received.

Note 3: TOCP200Q-□□B, TOCP200X-□□B

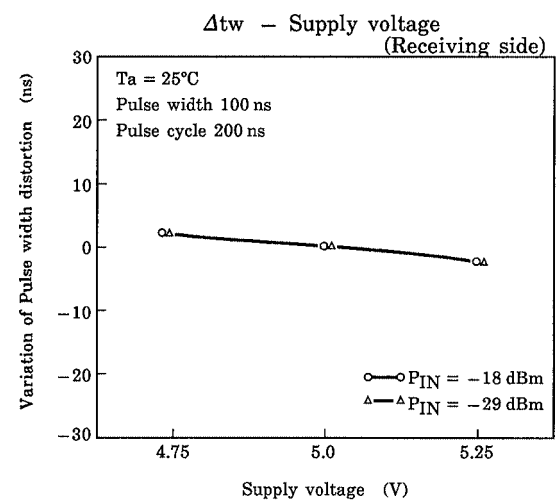
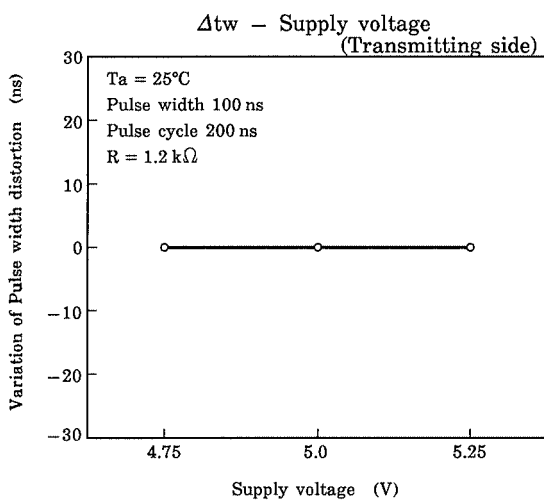
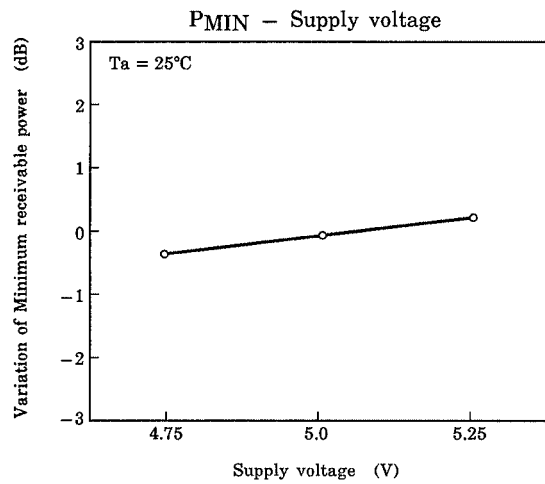
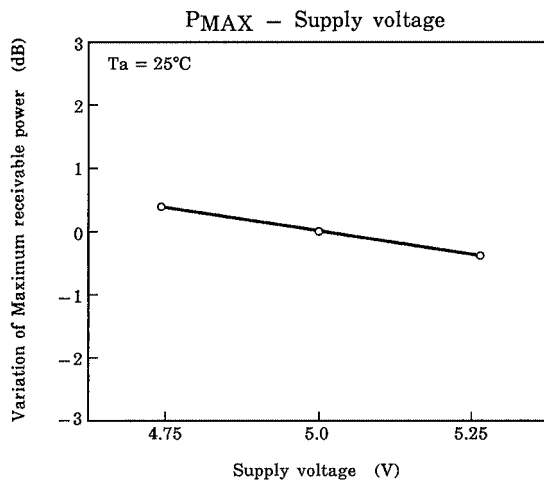
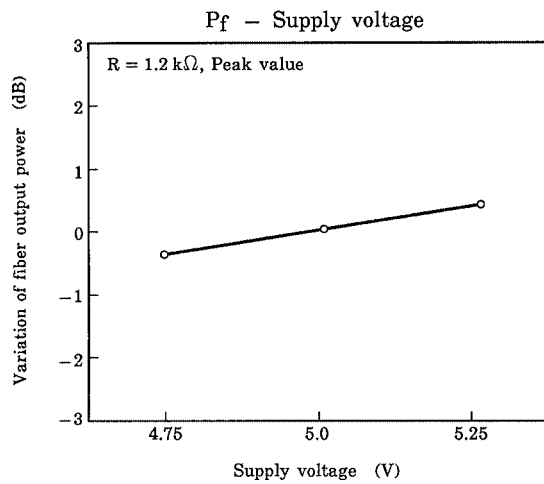
Note 4: CF-2071 series

Note 5: Between input of TODX294 and output of TODX294.

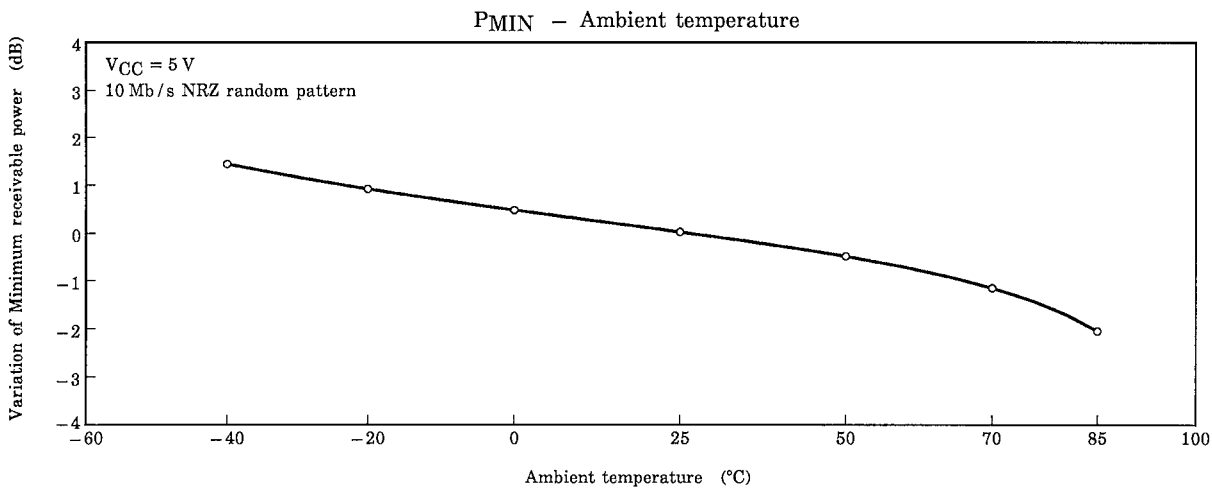
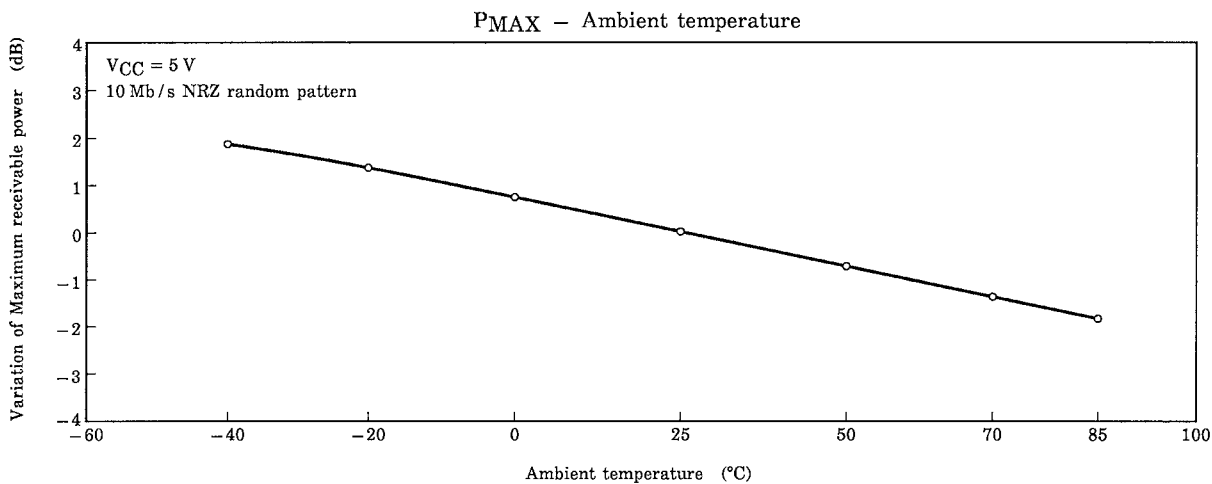
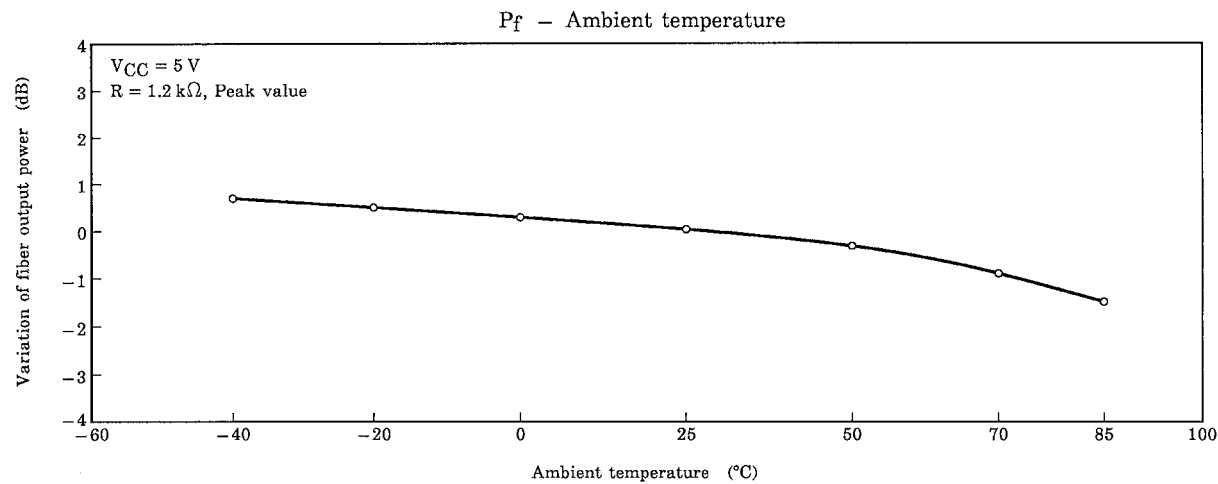
Note 6: Measure with a standard optical fiber with fiber optic connectors. Valued by peak.

Note 7:  $BER \leq 10^{-9}$ , Valued by peak.

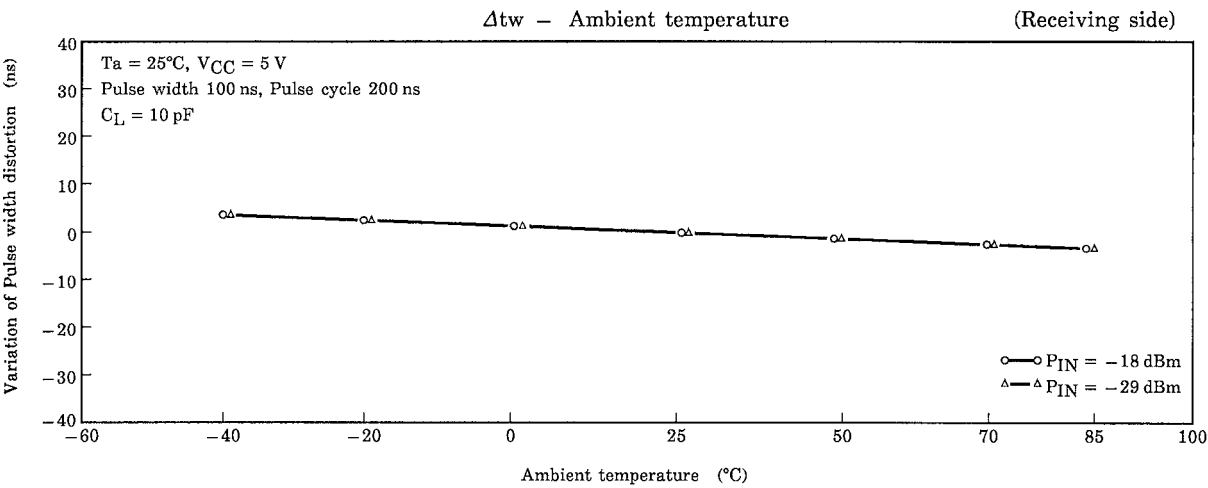
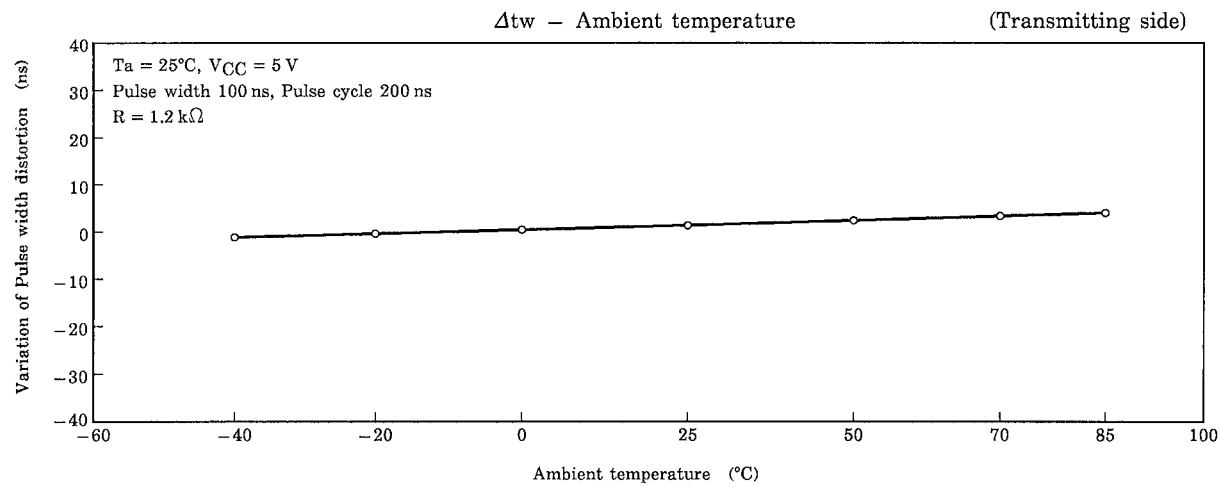
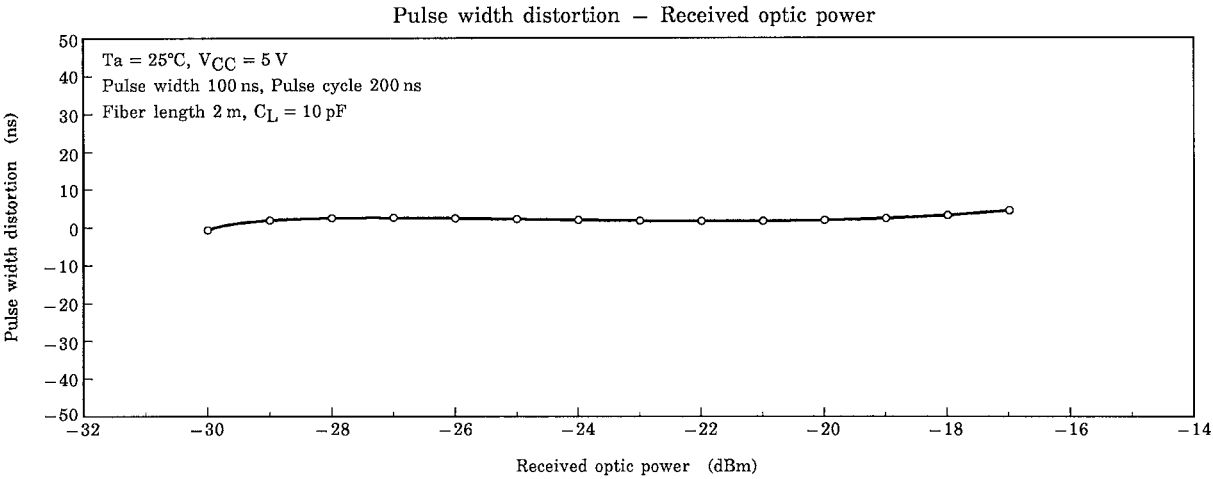
## 4. Example of Typical Characteristics (Note 8)



Note 8: There give characteristic examples, and its values are not guaranteed.

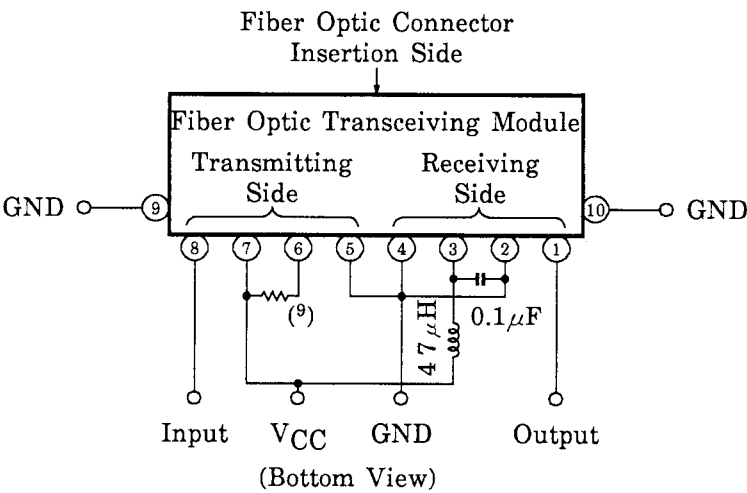


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5. Application Circuit



Note 9: Select a resistor value as follows:

Fiber Optic Connector Type Name	Transmission Distance (m)	Resistor (Ω)
TOCP200Q-□□B TOCP200X-□□B	0.2 to 300	8.2 k
	300 to 600	3.9 k
	600 to 1000	1.2 k
CF-2071 series	0.2 to 150	8.2 k
	150 to 350	5.1 k
	350 to 500	2.7 k
	500 to 700	1.2 k

6. Applicable Optical Fiber with Fiber Optic Connectors

TOCP200Q-□□B, TOCP200X-□□B  
CF-2071 series

## 7. Precaution on Use

(1) Maximum rating

The maximum ratings are the limit values which must not be exceeded during operation of device. None of these rating value must not be exceeded. If the maximum rating value is exceeded, the characteristics of devices may never be restored properly. In extreme cases, the device may be permanently damages.

(2) Lifetime of light emitters

If an optical module is used for a long period of time, degeneration in the characteristics will mostly be due to a lowering of the fiber output power (Pf). This is caused by the degradation of the optical output of the LEDs used as the light source. The cause of degradation of the optical output of the LEDs may be defects in wafer crystallization or mold resin stress. The detailed causes are, however, not clear.

The lifetime of light emitters is greatly influenced by the operating conditions and the environment in which it is used as well as by the lifetime characteristics unique to the device type. Thus, when a light emitting device and its operating conditions determined, Toshiba recommend that lifetime characteristics be checked.

Depending on the environment conditions, Toshiba recommend that maintenance such as regular checks of the amount of optical output in accordance with the condition of operating environment.

(3) Soldering

Optical modules are comprised of internal semiconductor devices. However, in principle, optical modules are optical components. During soldering, ensure that flux does not contact with the emitting surface or the detecting surface. Also ensure that proper flux removal is conducted after soldering. Some optical modules come with a protective cap. The protective cap is used to avoid malfunction when the optical module is not in use. Note that it is not dust or waterproof.

As mentioned before, optical modules are optical components. Thus, in principle, soldering where there may be flux residue and flux removal after soldering is not recommended. Toshiba recommend that soldering be performed without the optical module mounted on the board. Then, after the board has been cleaned, the optical module should be soldered on to the board manually.

If the optical module cannot be soldered manually, use non-halogen (chlorine-free) flux and make sure, without cleaning, there is no residue such as chlorine. This is one of the ways to eliminate the effects of flux. In such a cases, be sure to check the devices' reliability.

(4) Noise resistance

It is believed that the use of optical transfer devices improve noise resistance. In theory, optical fiber is not affected by noise at all. However, receiving modules which handle signals whose level is extremely small, are susceptible to noise.

TOSLINK improve noise resistance to use a conductive case. However, the current signal output by the optical receiving modules' photodiode is extremely small. Thus, in some environments, shielding the case may not achieve sufficient noise resistance.

First systems which incorporate TOSLINK, Toshiba recommend testing using the actual device to check its noise resistance.

Use a simple noise filter on TOSLINK fiber optic transceiving module's power line. If the ripple in the power supply used is significant, reinforce the filter.

The optical module is to be used in an area which is susceptible to radiated noise, increase the shielding by covering the optical module and the power line filter with a metallic cover.

(5) Vibration and shock

This module is plastic sealed and has its wire fixed by resin. This structure is relatively resistant to vibration and shock. In actual equipment, there are sometime cases in which vibration, shock, or stress is applied to soldered parts or connected parts, resulting in lines cut. A care must be taken in the design of equipment which will be subject to high levels of vibration.

(6) Fixing fiber optical transceiving module

Solder the fixed pin (pins 9 and 10) of fiber optic transceiving module TODX294 to the printed circuit board to fix the module to the board.

(7) Shielding and wiring pattern of fiber optic transceiving modules

To shield, connect the fixed pins (pins 9 and 10) of fiber optic transceiving module TODX294 to the GND.

Where the fiber optic transceiving module uses conductive resin, be careful that the case does not touch wiring (including land).

To improve noise resistance, shield the optical module and the power line filter using a metallic cover.

- (8) Solvent  
When using solvent for flux removal, do not use a high acid or high alkali solvent. Be careful not to pour solvent in to the optical connector ports. If solvent is inadvertently poured in to them, clean it off using cotton tips.
- (9) Protective cap  
When the TODX294 is not in use, attach the protective cap.
- (10) Supply voltage  
Use the supply voltage within the recommended operating condition ( $V_{CC} = 5 \pm 0.25 \text{ V}$ ). Make sure that supply voltage does not exceed the maximum rating value of 7 V, even for an instant.
- (11) Input voltage  
If a voltage exceeding the maximum rating value ( $V_{CC} + 0.5 \text{ V}$ ) is applied to the transmitter input, the internal IC may suffer damage. If there is a possibility that excessive voltage due to surges may be added to the input terminal, insert a protective circuit.
- (12) Output  
If the receiver output is at low and is connected to the power supply, or if the output is high and is connected to GND, the internal IC may be destroyed.
- (13) Soldering condition  
Solder at 260°C or less for no more than three seconds.
- (14) Precautions when disposing of devices and packing materials.  
When disposing devices and packing materials, follow the procedures stipulated by local regulations in order to protect the environment against contamination.  
Compound semiconductors such as GaAs are used as LED materials in this module. When devices are disposed of, worker safety and protection of the environment must be taken into account.
- (15) Precautions during use  
Toshiba is continually working to improve the quality and the reliability of their products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and their vulnerability to physical stress. It is the responsibility of the buyer, when utilizing Toshiba products, to observe standards of safety, and to avoid situations in which the malfunction or failure of a Toshiba product could cause loss of human life, bodily injury or damage to property.  
When developing equipment, please ensure that Toshiba products are used within the specified operating ranges set forth in the most recent product specifications. Also, please keep in mind the precautions and conditions set forth in the Toshiba Semiconductor Reliability Handbook.

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