

## FIBER OPTIC TRANSCEIVING MODULE

**TODX2901A(F)**

## ○ FIBER OPTIC TRANSCEIVING MODULE FOR HIGH SPEED

- For PN (JIS F07) type optical connector
- Data rate : 20Mb/s to 150 Mb/s (NRZ code)
- Transmission distance : Up to 20 m (APF)
- Transmitting IC and optical receiving IC built-in
- Compatible with 3.3 V PECL Level
- 660 nm LED

**1. Absolute 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>	-10 to 70	°C
Supply Voltage	V <sub>CC</sub>	-0.5 to 4.5	V
Output Current	I <sub>o</sub>	50	mA
Soldering Temperature	T <sub>sol</sub>	260 (Note 1)	°C

Note 1: Soldering time ≤10 s (More than 1 mm apart from the package)

Using continuously heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/ current/ voltage, etc.) are within the absolute maximum ratings.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/ "Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

**2. Operating Ranges**

Characteristics	Symbol	Min	Typ.	Max	Unit
Supply Voltage	V <sub>CC</sub>	3.0	3.3	3.6	V
Data Rate		20	—	150	Mb/s
Mark Ratio		—	50	—	%
Output Load	R <sub>L</sub>	—	50	—	Ω

Start of commercial production  
2015-05

### 3. Electrical and Optical Characteristics (Ta =25°C, Vcc=3.3V)

Characteristics	Symbol	Test condition	Min	Typ.	Max	Unit
Data Rate		NRZ Code (Note 2)	20	—	150	Mb / s
Transmission Distance		Using APF (Note 3), 150 Mb/s	0.1	—	20	m
Center Emission Wavelength	$\lambda_c$		—	660	—	nm
Fiber output Power (Note 4)	Pf(H)	APF 1 m	-12.0	—	-7.0	dBm
	Pf(L)	APF 1 m	—	—	-27.5	dBm
Maximum Receivable Power (Note 5)	P <sub>MAX</sub>	APF (Note 3), 150 Mb / s	-6.0	—	—	dBm
Minimum Receivable Power (Note 6)	P <sub>MIN</sub>	APF (Note 3), 150 Mb / s	—	—	-19.0	dBm
Current Consumption (T) (Note 7)	I <sub>CC(T)</sub>		—	40	50	mA
Current Consumption (R) (Note 8)	I <sub>CC(R)</sub>		—	45	60	mA
High Level Input Voltage	V <sub>IH</sub>		V <sub>CC</sub> -1.19	—	V <sub>CC</sub> -0.59	V
Low Level Input Voltage	V <sub>IL</sub>		V <sub>CC</sub> -2.09	—	V <sub>CC</sub> -1.49	V
High Level Output Voltage (Note 9)	V <sub>OH</sub>	R <sub>L</sub> = 50 Ω	V <sub>CC</sub> -1.15	—	V <sub>CC</sub> -0.90	V
Low Level Output Voltage (Note 9)	V <sub>OL</sub>	R <sub>L</sub> = 50 Ω	V <sub>CC</sub> -1.79	—	V <sub>CC</sub> -1.49	V
SD Assert Level (Note 10)	SDA	APF (Note 3), 150 Mb / s	—	—	-19.0	dBm
SD Deassert Level (Note 11)	SDD	APF (Note 3), 150 Mb / s	—	—	-20.0	dBm
High Level SD Output Voltage	V <sub>OSDH</sub>		V <sub>CC</sub> ×0.8	—	—	V
Low Level SD Output Voltage	V <sub>OSDL</sub>		—	—	V <sub>CC</sub> ×0.2	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.  
 The duty factor must be kept 25 to 75%.

Note. 3 : All Plastic Fiber (980 μm core / 1000 μm cladding, NA=0.5, ). Polished surface.

Note. 4 : 1 Mb/s duty 50%. Measured by standard optical fiber. Averaged Value.

Note. 5 : 2<sup>7</sup>-1 pattern. BER ≤ 10<sup>-9</sup>. Measured by standard optical module. Averaged Value.

Note. 6 : 2<sup>7</sup>-1 pattern. BER ≤ 10<sup>-9</sup>. Measured by eye center. Measured by standard optical module. Averaged Value.

Note. 7 : Without output load current.

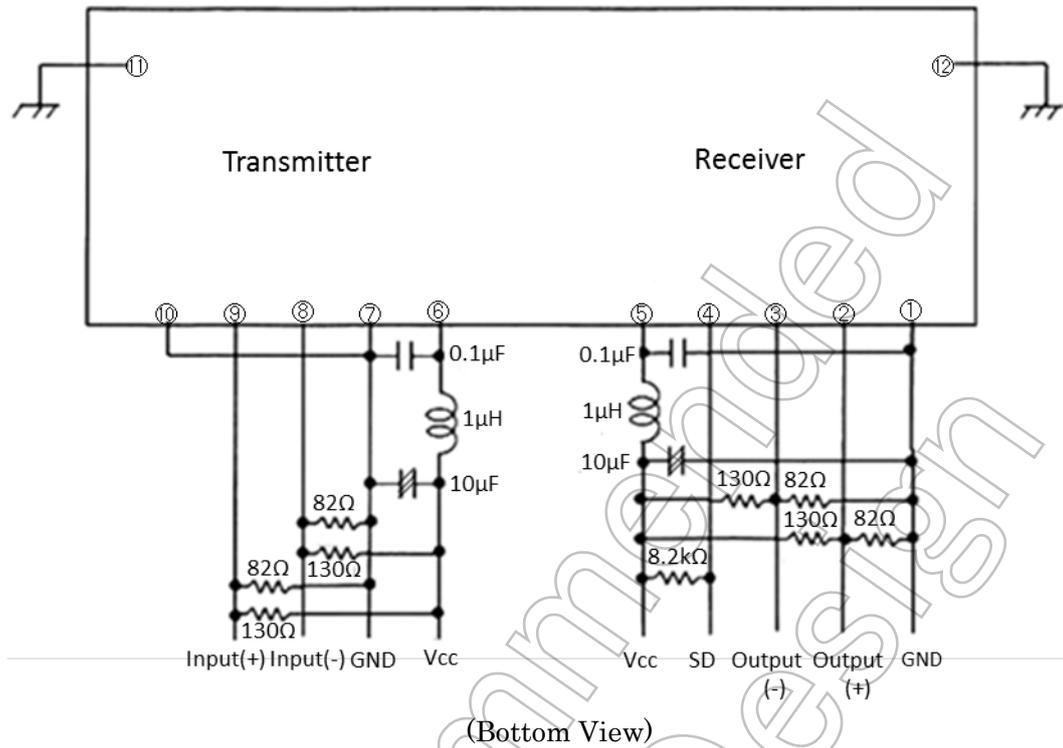
Note. 8 : Without output current.

Note. 9 : When High level input, optical output is on. Low level input, output is off.

Note. 10 : The value when SD output changes from L level to H level.

Note. 11 : The value when SD output changes from H level to L level.

## 4. Application Circuit



Note.12 : Place termination resistors near physical layer device data input pin.  
 Make differential signal paths short and the same length.  
 Use ground plane(or multi-layer)printed circuit board for best high frequency performance.  
 Signal trace should be 50 Ω transmission lines(micro strip or strip line).  
 Use high-frequency monolithic ceramic bypass capacitors and low DC resistance inductors.  
 Do not directly connect optical transceiver's outputs to the GND without proper current limiting impedance.

## 5. Applicable Optical Fiber with Fiber Optic Connectors

All Plastic Fiber (980 μm core / 1000 μm cladding ) with PN (F07) type optical connector. Polished surface.

## 6. Precautions during use

### (1) Absolute maximum rating

The absolute 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 absolute maximum rating value is exceeded, the characteristics of devices may never be recovered properly. In extreme cases, the device may be permanently damages.

### (2) Operating Range

The operating range is the range of conditions necessary for the device to operate as specified in individual technical datasheets and data books. Care must be exercised in the design of the equipment. If a device is used under conditions that do not exceed absolute maximum ratings but exceed the operating range, the specifications related to device operation and electrical characteristics may not be met, resulting in a decrease in reliability.

If greater reliability is required, derate the device's operating ranges for voltage, current, power and temperature before use.

### (3) 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.

### (4) Noise resistance

It is believed that the use of optical transfer device 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 transeiving 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) Soldering

Optical modules are comprised of internal semiconductor devices. However, in principle, optical modules are optical components. During soldering, ensure that flux dose not contact with the emitting surface or detecting surface. Also ensure that proper flux removal is conducted after soldering.

Some optical modules come with protective cap. The protective cap is used to avoid malfunction when the optical module is not in use. Not that it is not dust or waterproof.

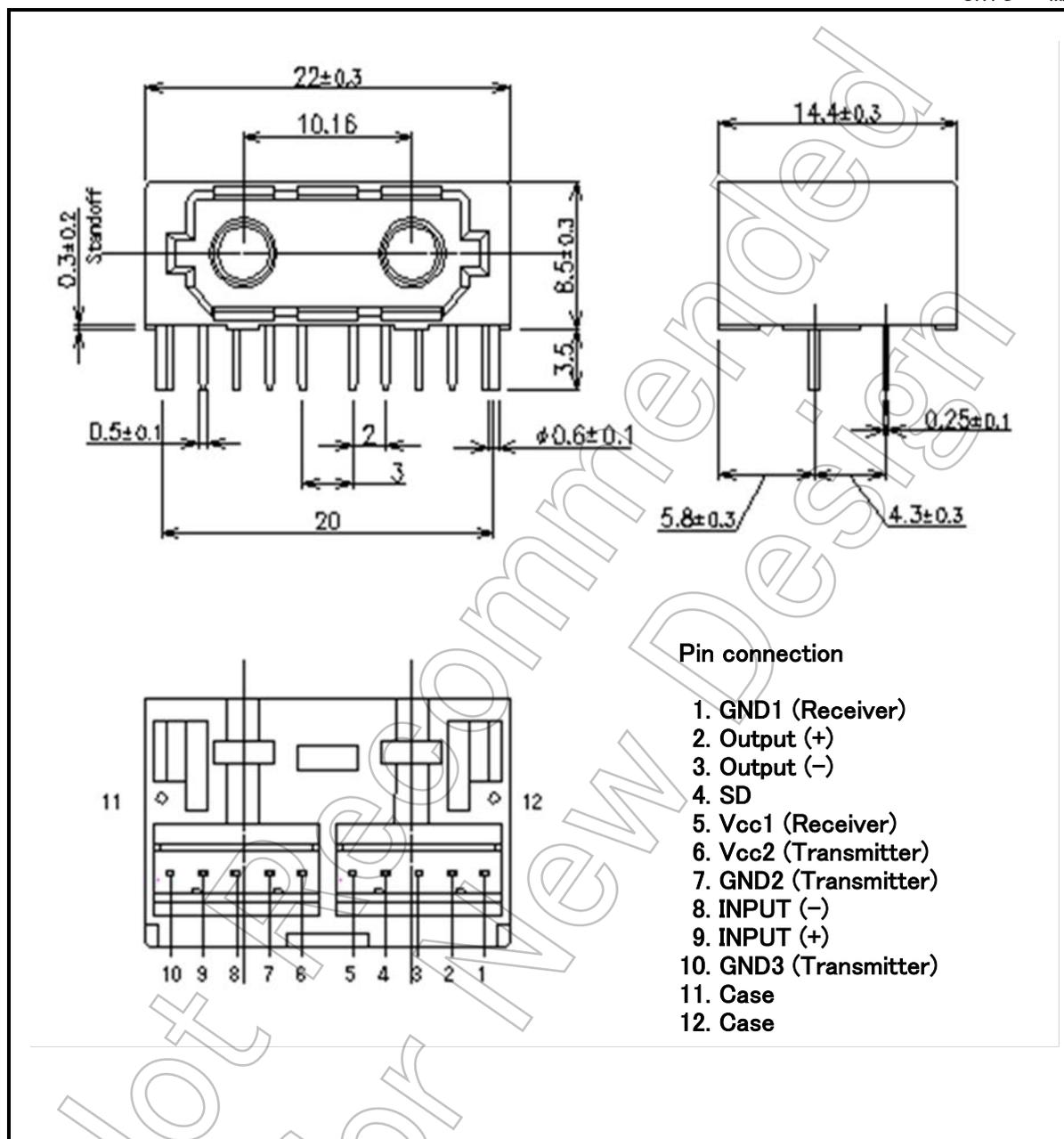
As mentioned before, optical modules are optical component. Thus, in principle, soldering where there may be flux residue or flux removal after soldering is not recommended. Toshiba recommends that soldering be performed without the optical module mounted on the board. Then, after the board is cleaned, solder the optical module manually. Do not perform any further cleaning.

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 case, check the reliability.

- (6) 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.
- (7) Shielding and wiring pattern of fiber optic transceiving module  
To shield, connect the fixed pins (pins 11 and 12) of fiber optic transceiving module TODX2901A(F) 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) Fixing fiber optical transceiving module  
Solder the fixed pin (pins 11 and 12) of fiber optic transceiving module TODX2901A(F) to the printed circuit board to fix the module to the board.
- (9) Solvent  
When using solvent for flux removal, do not use a high acid or high alkali solvent. Be careful not to pour solvent in the optical connector ports. If solvent is inadvertently poured there, clean with cotton tips.
- (10) Protective cap  
When the fiber optic transceiving module TODX2901A(F) is not in use, attach the protective cap.
- (11) Incidence of a photo flash  
If strong light such as a photo flash is incident on an optical module, a transmission error may occur. Be careful to avoid such situations.
- (12) Supply voltage  
Use the supply voltage within the operating ranges ( $V_{CC} = 3.3 \pm 0.3$  V). Make sure that supply voltage does not exceed the absolute maximum rating value of 4.5 V, even for an instant.
- (13) Soldering condition  
Solder at 260°C or less for no more than ten seconds.
- (14) Precautions when disposing of devices and packing materials.  
When disposing devices and packing materials, follow procedures stipulated by local regulations in order to protect the environment against contamination.

## 7. Package Outline drawing

Unit : mm



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