FIBER OPTIC TRANSCEIVING MODULE

TODX2701A(F)

○ FIBER OPTIC TRANSCEIVING MODULE FOR HIGH SPEED

- For PN (JIS F07) type fiber optic connector
- Data rate:20 Mb/s to 125 Mb/s
- Tansmission distance:Up to 20 m (125 Mb/s, APF)
  Up to 100 m (125 Mb/s, GI-PCF)
- Transmitting IC and optical receiving IC built-in
- Compatible with 3.3 V PECL Level
- 650 nm LED
- Resin molded type

1. Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Storage Temperature	T_{stg}	−40 to 85	°C
Operating Temperature	T_{opr}	−10 to 70	°C
Supply Voltage	V_{CC}	-0.5 to 4.5	V
Output Current	I_O	50	mA
Soldering Temperature	T_{sol}	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_{CC}	3.0	3.3	3.6	V
Data Rate		20	-	125	Mb/s
Mark Ratio		-	50	-	%
Output Load	R_L	-	50	-	Ω

Start of commercial production
2015-06

3. Electrical and Optical Characteristics (Ta = 25°C, V_{CC} = 3.3 V)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Data Rate		NRZ code (Note.2)	20	-	125	Mb/s
Transmission Distance		APF(Note.3), 125 Mb/s Using TODX2701A(F)	0.1	-	20	m
		GI-PCF(Note.4), 125 Mb/s Using TODX2701A(F)	0.1	-	100	m
Center Emission Wavelength	λ_C		-	650	-	nm
Fiber Output Power (Note 5)	Pf(H)	APF 1 m	-12.0	-	- 8.0	dBm
	Pf(L)	APF 1 m	-	-	-27.5	dBm
	Pf(H)	GI-PCF 1 m	-18.0	-	-11.5	dBm
	Pf(L)	GI-PCF 1 m	-	-	-32.5	dBm
Maximum Receivable Power (Note 6)	P_{MAX}	APF(Note.3), 125 Mb/s Using TODX2701A(F)	- 8.0	-	-	dBm
		GI-PCF(Note.4), 125 Mb/s Using TODX2701A(F)	-11.5	-	-	dBm
Minimum Receivable Power (Note 7)	P_{MIN}	APF(Note.3), 125 Mb/s Using TODX2701A(F)	-	-	-19.0	dBm
		GI-PCF(Note.4), 125 Mb/s Using TODX2701A(F)	-	-	-23.0	dBm
Current Consumption (T) (Note 8)	I_{CC}(T)		-	40	50	mA
Current Consumption (R) (Note 9)	I_{CC}(R)		-	45	60	mA
High Level Input Voltage	V_{IH}		V_{CC}-1.19	-	V_{CC}-0.59	V
Low Level Input Voltage	V_{IL}		V_{CC}-2.09	-	V_{CC}-1.49	V
High Level Output Voltage (Note 10)	V_{OH}	R_L=50 Ω	V_{CC}-1.15	-	V_{CC}-0.90	V
Low Level Output Voltage (Note 10)	V_{OL}	R_L=50 Ω	V_{CC}-1.79	-	V_{CC}-1.49	V
SD Assert Level (Note 11)	SDA	APF (Note.3), 125 Mb/s	-	-	-19.0	dBm
		GI-PCF (Note.4), 125 Mb/s	-	-	-23.0	dBm
SD Deassert Level (Note 12)	SDD	APF (Note.3), 125 Mb/s	-	-	-20.0	dBm
		GI-PCF (Note.4), 125 Mb/s	-	-	-24.0	dBm
High Level SD Output Voltage	VoSDH		Vcc×0.8	-	-	V
Low Level SD Output Voltage	VoSDL		-	-	Vcc×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: GI-PCF (200 μm core / 230 μm cladding, NA=0.4). polished surface.

Note.5: 1 Mb/s duty 50%. Measured by standard optical fiber. Averaged value.

Note.6: 2^7-1 pattern. BER≤10^{-9}. Measured by standard optical module. Averaged Value.

Note.7: 2^7-1 pattern. BER≤10^{-9}. Measured by eye center. Measured by standard optical module. Averaged Value.

Note.8: Without output load current.

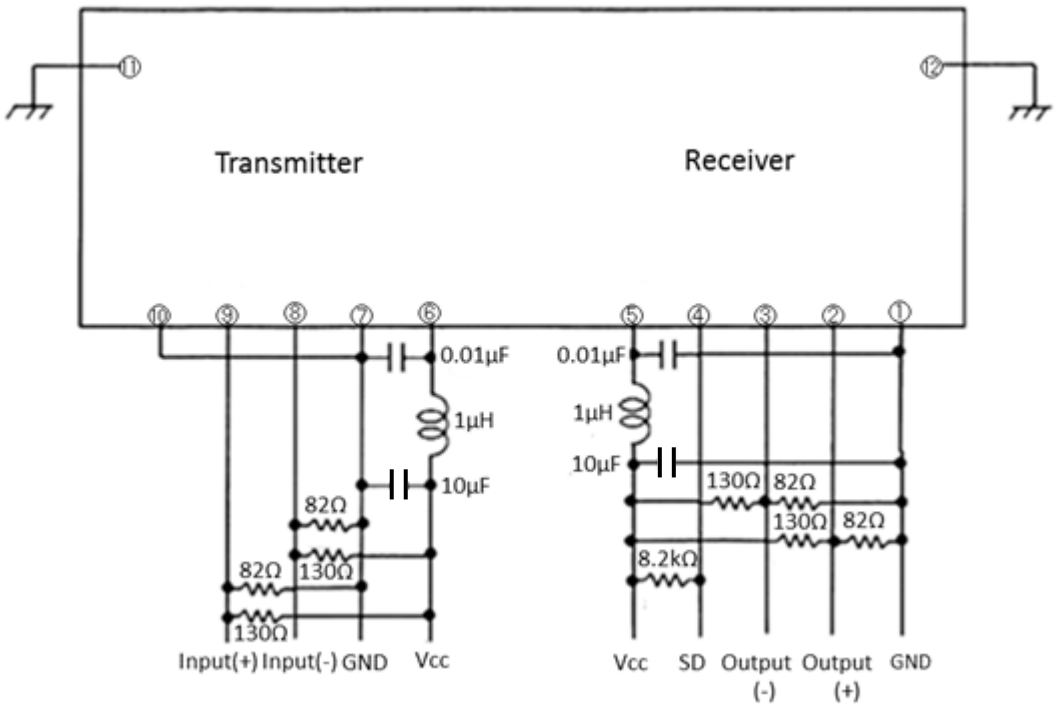
Note.9: Without output load current.

Note.10: High level output when high level optical flux is received, Low level output when low level optical flux is received.

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

Note.12: The value when SD output changes from H level to L level.

4. Application Circuit



(Bottom View)

Note.13: 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, NA=0.5) with PN (F07) type connector. Polished surface.

GI-PCF (200 μm core / 230 μm cladding, NA=0.4) with PN (F07) 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 restored 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 databooks. 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 imrove 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) 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.

(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 TODX2701A(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 TODX2701A (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 to the optical connector ports. If solvent is inadvertently poured in to them, clean it off using cotton tips.

(10) Protective cap
When the fiber optic transceiving module TODX2701A(F) is not in use, attach the protective cap..

(11) An influence of flash or strong light
Do not emit a flash or a strong light to the optical module directly they may cause an error in data transmission.

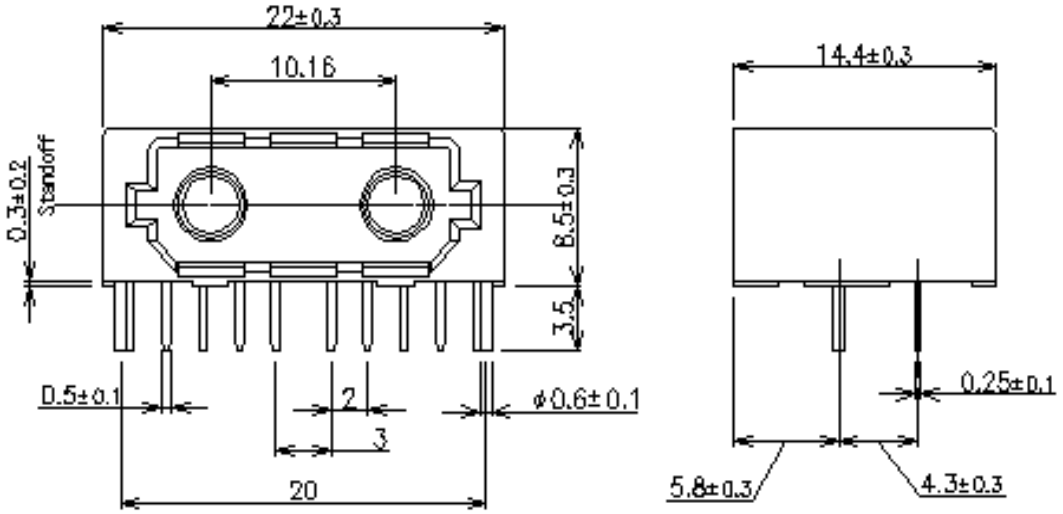
(12) Supply Voltage
Use the supply voltage within the recommended operating condition (V_{CC}=3.3±0.3 V). Make sure that Supply voltage does not exceed the maximum rating value of 4.5 V, even for an instant.

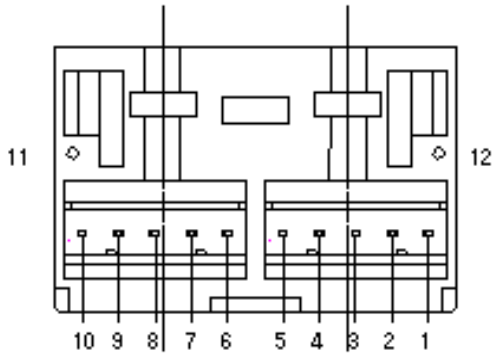
(13) Solderling condition
Solder at 260°C or less for no more than ten seconds.

(14) Precautions when disposing of devices and packing materials.
When disposing devices and packing materials, follow the procedures stipulated by local regulations in order to protect the environment against contamination.

7. Package Outline drawing

Unit: mm





Pin connection

1. GND1 (Receiver)
2. OUTPUT (+)
3. OUTPUT (-)
4. SD
5. Vcc1 (Receiver)
6. Vcc2 (Transmitter)
7. GND2 (Transmitter)
8. INPUT (-)
9. INPUT (+)
10. GND3 (Transmitter)
11. Case
12. Case

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