

FIBER OPTIC TRANSMITTING MODULE

TOTX1960A(F)

GENERAL PURPOSE OPTICAL TRANSMITTING MODULE

- For JIS F05 type optical connector
- CMOS level interface
- +5V single power supply
- LED is driven by differential circuit.
- 770 nm LED

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

| Characteristics | Symbol | Rating | Unit |
|-----------------------|------------------|-------------------------------|------|
| Storage Temperature | T _{stg} | -40 to 95 | °C |
| Operating Temperature | T _{opr} | -40 to 85 | °C |
| Supply Voltage | V _{CC} | -0.5 to 6 | V |
| Input Voltage | V _{IN} | -0.5 to V _{CC} + 0.5 | V |
| Soldering Temperature | T _{sol} | 260 (Note 1) | °C |

Note 1: Soldering time ≤ 10 seconds (At a distance of 1 mm 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} | 4.75 | 5.0 | 5.25 | V |
| High Level Input Voltage | V _{IH} | 3.5 | - | V _{CC} | V |
| Low Level Input Voltage | V _{IL} | 0 | - | 1.5 | V |

Start of commercial production
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3. Electrical and Optical Characteristics (Ta = 25°C, Vcc = 5 V)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit | |
|---------------------------------|-------------|--|----------------|------|------|---------|---|
| Data Rate | - | NRZ Code (Note 2) | DC | - | 10 | Mb/s | |
| Transmission Distance | - | DC to 10 Mb/s, Using TORX1950A(F) | H-PCF (Note 3) | 0.2 | - | 1000 | m |
| | | | H-PCF (Note 4) | 0.2 | - | 700 | m |
| | | DC to 6 Mb/s, Using TORX1950A(F) | H-PCF (Note 3) | 0.2 | - | 1000 | m |
| | | | H-PCF (Note 4) | 0.2 | - | 800 | m |
| Pulse Width Distortion (Note 5) | Δtw | Using H-PCF (Note 3) and TORX1950A(F) Pulse width 100 ns Pulse cycle 200 ns, $C_L = 10$ pF | -30 | - | 30 | ns | |
| | | Using H-PCF (Note 3) and TORX1950A(F) Pulse width 165 ns Pulse cycle 330 ns, $C_L = 10$ pF | -55 | - | 55 | ns | |
| Fiber Output Power (Note 6) | P_f | $R = 3.3k\Omega$ | -20 | - | -14 | dBm | |
| Center Emission Wavelength | λ_C | - | - | 770 | - | nm | |
| Current Consumption | I_{CC} | $R = 3.3k\Omega$ | - | 17 | 30 | mA | |
| High Level Input Voltage | V_{IH} | - | 3.5 | - | - | V | |
| Low Level Input Voltage | V_{IL} | - | - | - | 1.5 | V | |
| High Level Input Current | I_{IH} | $V_{CC} = 5.25V, V_I = 2.7V$ | - | - | 20 | μA | |
| Low Level Input Current | I_{IL} | $V_{CC} = 5.25V, V_I = 0.4V$ | - | - | -0.4 | mA | |

Note 2: LED is on when input signal is high level, it is off when low level.
The duty factor must be kept 25 to 75%.

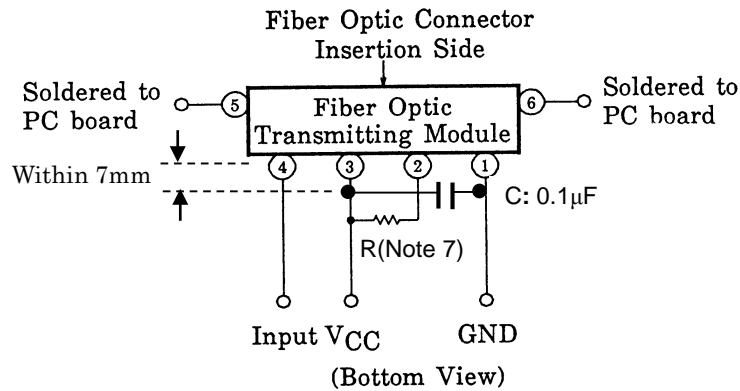
Note 3: H-PCF (200 μ m core / 230 μ m cladding). F05 type optical connector with polished surface.

Note 4: H-PCF (200 μ m core / 230 μ m cladding). F05 type optical connector with non-polished surface (cut by fiber cutter).

Note 5: Between input of TOTX1960A(F) and output of TORX1950A(F).

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

4. Application Circuit



Note 7: Select a resistor value as follows:

(1) DC to 10 Mb/s (with TORX1950A(F))

| Fiber Optic Connector Type Name | Transmission Distance (m) | Resistor (kΩ) |
|--|---------------------------|---------------|
| F05 type Optical Connector with H-PCF (200 / 230 μm) polished surface. | 0.2 to 1000 | 3.3 |
| F05 type Optical onnector with H-PCF (200 /230 μm) non-polished surface. (cut by fiber cutter) | 0.2 to 700 | 3.3 |

(2) DC to 6 Mb/s (with TORX1950A(F))

| Fiber Optic Connector Type Name | Transmission Distance (m) | Resistor (kΩ) |
|--|---------------------------|---------------|
| F05 type Optical Connector with H-PCF (200 / 230 μm) polished surface. | 0.2 to 1000 | 3.3 |
| F05 type Optical onnector with H-PCF (200 /230 μm) non-polished surface. (cut by fiber cutter) | 0.2 to 800 | 3.3 |

5. Applicable Optical Fiber with Fiber Optic Connectors

Plastic Cladding Silica Fiber (200μm core / 230μm cladding),
 F05 type Optical Connector with Polished Surface, or Non-polished surface (cut by fiber cutter)

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) **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 cases, be sure to check the devices' reliability.
- (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 sometimes 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) **Attaching the fiber optic transmitting module**

Solder the fixed pin (pins 5 and 6) of the fiber optic transmitting module TOTX1960A(F) to the printed circuit board in order to fix it to the board.
- (7) **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.

- (8) Protective cap
When the TOTX1960A(F) is not in use, attach the protective cap.

- (9) 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.

- (10) Supply voltage
Use the supply voltage within the operating ranges ($V_{CC} = 5 \pm 0.25$ V). Make sure that supply voltage does not exceed the absolute maximum rating value of 6 V, even for an instant.

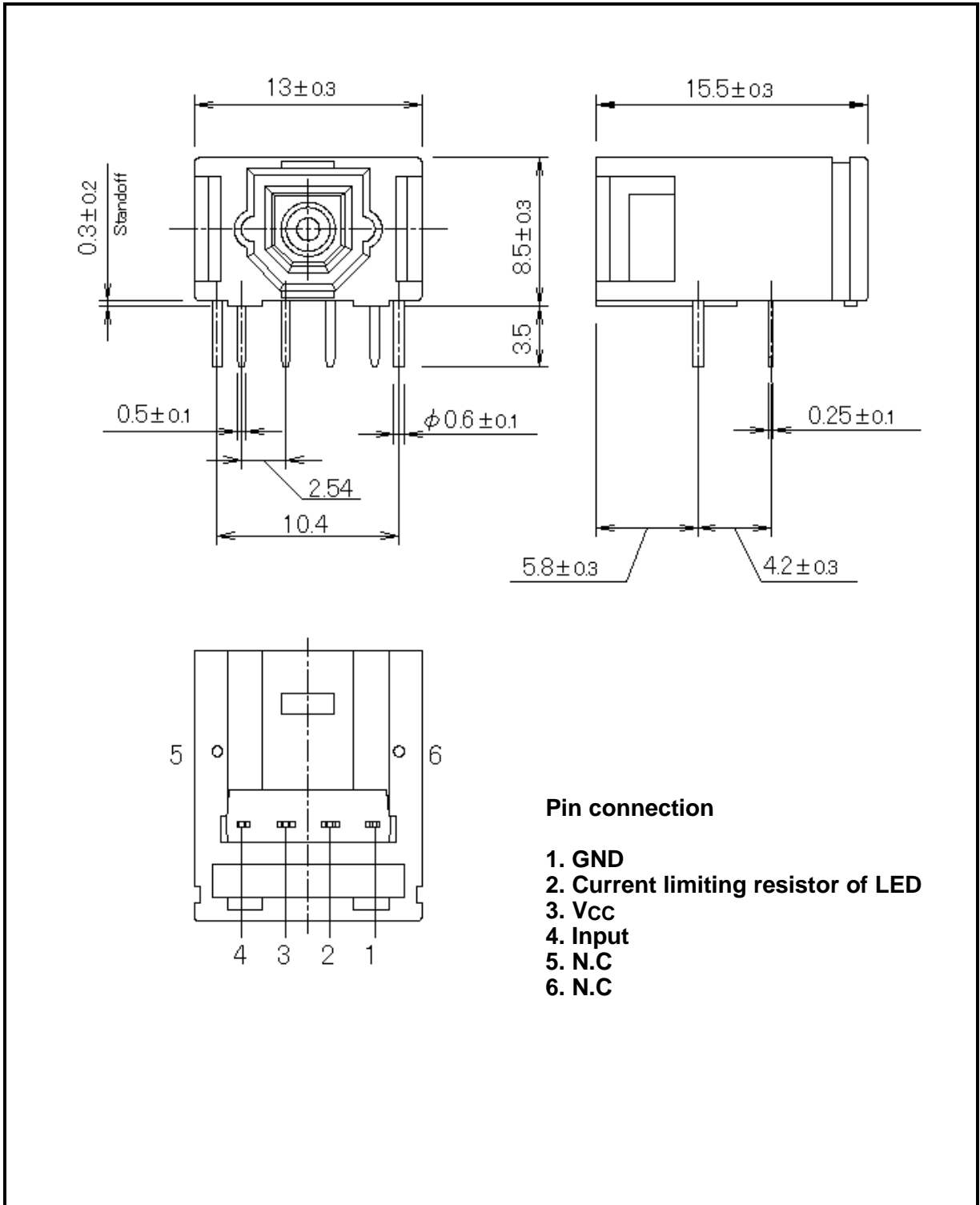
- (11) Input voltage
If a voltage exceeding the absolute maximum rating value ($V_{CC} + 0.5$ V) is applied to the transmitters' input, the internal IC may suffer damage. If there is possibility that excessive voltage due to surges may be added to the input terminal, insert a protective circuit.

- (12) Soldering condition
Solder at 260°C or less for no more than ten seconds.

- (13) 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



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