

TOSHIBA Photocoupler Photorelay

# TLX9150M

## 1. Description

Toshiba TLX9150M consists of an infrared emitting diode optically coupled to a photo-MOSFET in a SO12L-T package.

This coupler uses high voltage MOSFET between output terminals, making it suitable for battery-related control applications.

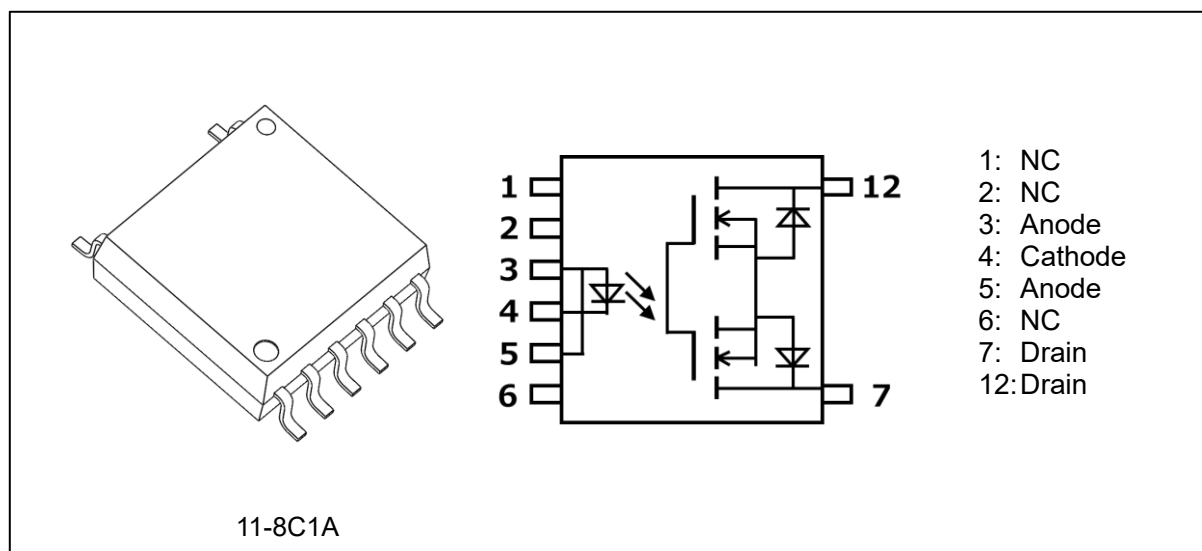
## 2. Applications

- Battery Control in Automotive Equipment
- Fuel Battery Control in Automotive Equipment
- Application for Electrical Vehicle

## 3. Features

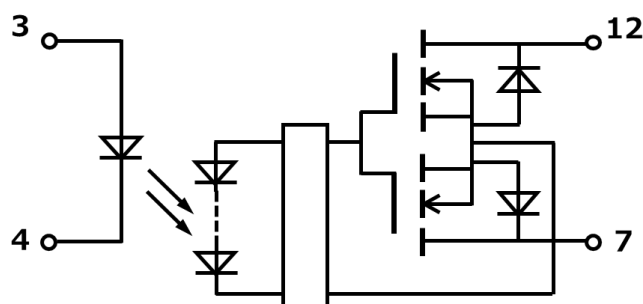
- Normally open (1-Form-A) device
- Peak off-state voltage: 900 V (min)
- Trigger LED current: 3 mA (max)
- On-state current: 50 mA (max)
- On-state resistance: 250Ω (max)(@t < 1s)
- Isolation voltage: 5000 Vrms (min)
- Clearance distance: 8 mm (min)
- Creepage distance: 8 mm (min)
- Insulation thickness: 0.4 mm (min)
- Outer resin: CTI > 600
- AEC-Q101 qualified

## 4. Packing and Pin Assignments



Start of commercial production  
2024-09

## 5. Internal Circuit



## 6. Absolute Maximum Ratings (Note) (Unless otherwise specified, $T_a = 25^\circ\text{C}$ )

|          | Characteristics   |                           | Symbol                         | Note     | Rating     | Unit                 |
|----------|---|---------------------------|--------------------------------|----------|------------|----------------------|
| LED      | Forward current   |                           | $I_F$                          |          | 30         | mA                   |
|          | Forward current derating ( $T_a \geq 100^\circ\text{C}$ )         |                           | $\Delta I_F/^\circ\text{C}$    |          | -0.8       | mA/ $^\circ\text{C}$ |
|          | Reverse voltage   |                           | $V_R$                          |          | 5          | V                    |
|          | Input Power Dissipation   |                           | $P_D$                          |          | 50         | mW                   |
|          | Input Power Dissipation Derating ( $T_a \geq 100^\circ\text{C}$ ) |                           | $\Delta P_D/^\circ\text{C}$    |          | -1.3       | mW/ $^\circ\text{C}$ |
|          | Junction temperature  |                           | $T_j$                          |          | 135        | $^\circ\text{C}$     |
| Detector | On-state current  | $T_a = 25^\circ\text{C}$  | $I_{ON}$                       |          | 50         | mA                   |
|          |   | $T_a = 105^\circ\text{C}$ |                                |          | 20         | mA                   |
|          |   | $T_a = 125^\circ\text{C}$ |                                |          | 10         | mA                   |
|          | On-state current derating   |                           | $\Delta I_{ON}/^\circ\text{C}$ |          | -0.5       | mA/ $^\circ\text{C}$ |
|          | On-state current (Peak)   | $T_a = 25^\circ\text{C}$  | $I_{ONpk}$                     | (Note 1) | 150        | mA                   |
|          |   | $T_a = 105^\circ\text{C}$ |                                |          | 60         | mA                   |
|          |   | $T_a = 125^\circ\text{C}$ |                                |          | 30         | mA                   |
|          | Avalanche current   |                           | $I_{AV}$                       | (Note 2) | 0.6        | mA                   |
|          | Output power dissipation  |                           | $P_O$                          |          | 600        | mW                   |
|          | Output power dissipation derating ( $T_a \geq 47^\circ\text{C}$ ) |                           | $\Delta P_O/^\circ\text{C}$    |          | -7         | mW/ $^\circ\text{C}$ |
|          | Junction temperature  |                           | $T_j$                          |          | 135        | $^\circ\text{C}$     |
| Common   | Storage temperature   |                           | $T_{stg}$                      |          | -55 to 150 | $^\circ\text{C}$     |
|          | Operating temperature   |                           | $T_{opr}$                      |          | -40 to 125 | $^\circ\text{C}$     |
|          | Lead soldering temperature (10s)                                  |                           | $T_{sol}$                      |          | 260        | $^\circ\text{C}$     |
|          | Isolation voltage (AC, 60 s, R.H. $\leq 60\%$ )                   |                           | BVs                            | (Note 3) | 5000       | Vrms                 |

Note: Using continuously under 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.).

Note: This product is more sensitive than conventional products to electrostatic discharge (ESD). It is therefore all the more necessary to observe general precautions regarding ESD when handling this component.

Note 1: Exponential curve, pulse width  $< 1\text{ms}$ ,  $f \leq 150\text{Hz}$

Note 2: 1min (max continuous), Duty cycle=0.1%, 5 time over lifetime.

Note 3: LED pins are shorted together. Detector pins are also shorted together.

## 7. Recommended Operating Conditions (Note)

| Characteristics       | Symbol    | Min | Typ. | Max | Unit |
|-----------------------|-----------|-----|------|-----|------|
| Supply voltage        | $V_{DD}$  | —   | —    | 720 | V    |
| Forward current       | $I_F$     | 5   | 10   | 20  | mA   |
| On-state current      | $I_{ON}$  | —   | —    | 50  | mA   |
| Operating temperature | $T_{opr}$ | -40 | —    | 125 | °C   |

Note: Recommended operating conditions are given as a design guideline to obtain expected performance of the device. Additionally, each item is an independent guideline respectively. In developing designs using this product, please confirm specified characteristics shown in this document.

## 8. Electrical Characteristics (Unless otherwise specified, $T_a = 25^\circ\text{C}$ )

| Characteristics |                          | Symbol    | Test Condition  | Min | Typ. | Max  | Unit          |
|-----------------|--------------------------|-----------|---|-----|------|------|---------------|
| LED             | Forward voltage          | $V_F$     | $I_F = 10\text{ mA}$  | 1.5 | 1.65 | 1.8  | V             |
|                 |                          |           | $I_F = 10\text{ mA}, T_a = -40\text{ to }125^\circ\text{C}$     | 1.4 | —    | 1.95 |               |
|                 | Reverse current          | $I_R$     | $V_R = 5\text{ V}$  | —   | —    | 10   | $\mu\text{A}$ |
|                 | Capacitance              | $C_T$     | $V = 0\text{ V}, f = 1\text{ MHz}$                              | —   | 45   | —    | pF            |
| Detector        | Output withstand voltage | $V_{OFF}$ | $I_{OFF} = 10\text{ }\mu\text{A}, T_a = 25^\circ\text{C}$       | 900 | —    | —    | V             |
|                 | Off-state current        | $I_{OFF}$ | $V_{OFF} = 900\text{ V}, T_a = 25^\circ\text{C}$                | —   | —    | 100  | nA            |
|                 |                          |           | $V_{OFF} = 900\text{ V}, T_a = -40\text{ to }105^\circ\text{C}$ | —   | —    | 1000 |               |
|                 |                          |           | $V_{OFF} = 900\text{ V}, T_a = -40\text{ to }125^\circ\text{C}$ | —   | —    | 5000 |               |
|                 | Capacitance              | $C_{OFF}$ | $V = 0\text{ V}, f = 1\text{ MHz}$                              | —   | 60   | —    | pF            |

## 9. Coupled Electrical Characteristics

| Characteristics     | Symbol   | Test Condition   | Min  | Typ. | Max | Unit     |
|---------------------|----------|--|------|------|-----|----------|
| Trigger LED current | $I_{FT}$ | $I_{ON} = 50\text{ mA}, T_a = 25^\circ\text{C}, t = 10\text{ ms}$                                  | —    | —    | 3   | mA       |
|                     |          | $I_{ON} = 20\text{ mA}, T_a = -40\text{ to }105^\circ\text{C}, t = 10\text{ ms}$                   | —    | —    | 3   |          |
|                     |          | $I_{ON} = 10\text{ mA}, T_a = -40\text{ to }125^\circ\text{C}, t = 10\text{ ms}$                   | —    | —    | 3   |          |
| Return LED current  | $I_{FC}$ | $I_{OFF} = 100\text{ }\mu\text{A}, T_a = -40\text{ to }125^\circ\text{C}, t = 40\text{ ms}$        | 0.05 | —    | —   | mA       |
| On-state resistance | $R_{ON}$ | $I_{ON} = 50\text{ mA}, I_F = 10\text{ mA}, T_a = 25^\circ\text{C}, t < 1\text{ s}$                | —    | —    | 250 | $\Omega$ |
|                     |          | $I_{ON} = 20\text{ mA}, I_F = 10\text{ mA}, T_a = -40\text{ to }105^\circ\text{C}, t < 1\text{ s}$ | —    | —    | 350 |          |
|                     |          | $I_{ON} = 10\text{ mA}, I_F = 10\text{ mA}, T_a = -40\text{ to }125^\circ\text{C}, t < 1\text{ s}$ | —    | —    | 400 |          |

10. Isolation Characteristics (Ta = 25°C)

| Characteristics             | Symbol | Note    | Test Condition          | Min                | Typ.             | Max | Unit |
|-----------------------------|--------|---------|-------------------------|--------------------|------------------|-----|------|
| Capacitance input to output | Cs     | (Note1) | Vs = 0 V, f = 1 MHz     | —                  | 0.9              | —   | pF   |
| Isolation resistance        | Rs     | (Note1) | Vs = 1000V, R.H. ≤ 60 % | 5×10 <sup>10</sup> | 10 <sup>14</sup> | —   | Ω    |
| Isolation voltage           | BVs    | (Note1) | AC, 60 s                | 5000               | —                | —   | Vrms |

Note1: Device considered a two-terminal device: Pins 1 to 6 shorted together, and 7 and 12 shorted together.

11. Switching Characteristics

| Characteristics | Symbol | Note | Test Condition                         | Min | Typ. | Max | Unit |
|-----------------|--------|------|--|-----|------|-----|------|
| Turn on time    | tON    |      | IF = 10 mA<br>RL = 20 kΩ<br>VDD = 40 V | —   | —    | 1   | ms   |
| Turn off time   | tOFF   |      |  |     |      | 1   |      |
| Turn on time    | tON    |      | Ta = -40 to 125°C                      | —   | —    | 1   | ms   |
| Turn off time   | tOFF   |      |  |     |      | 1   |      |

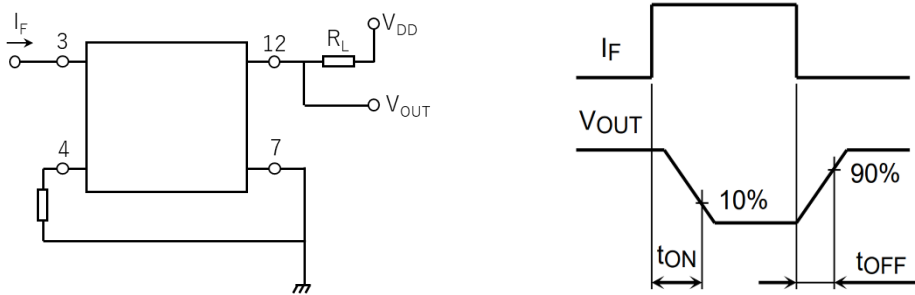


Fig. 11.1 Switching Time Test Circuit and Waveform

## 12. Characteristics Curves (Note)

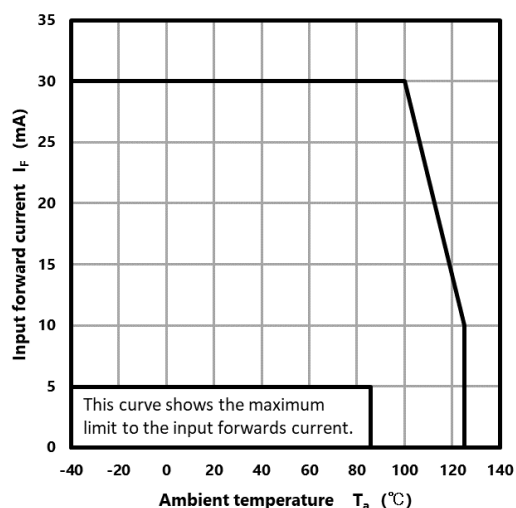


Fig. 12.1  $I_F - T_a$

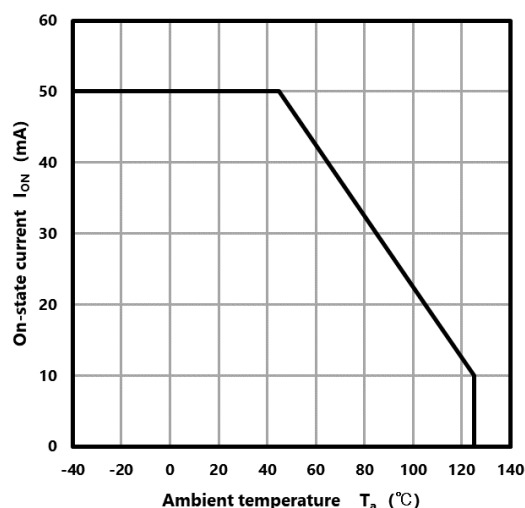


Fig. 12.2  $I_{ON} - T_a$

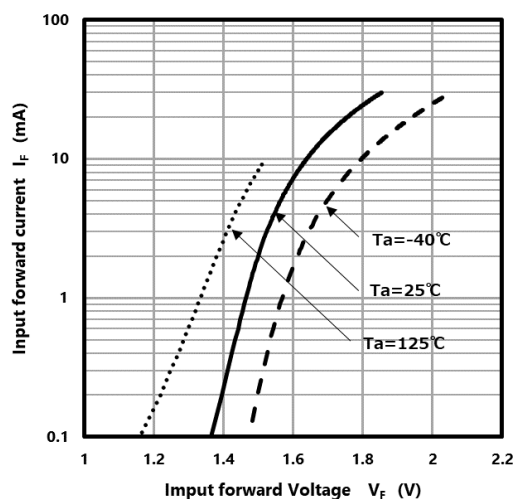


Fig. 12.3  $I_F - V_F$

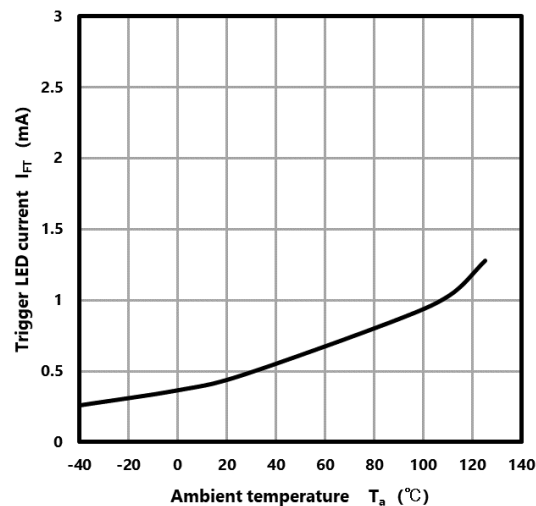


Fig. 12.4  $I_{FT} - T_a$

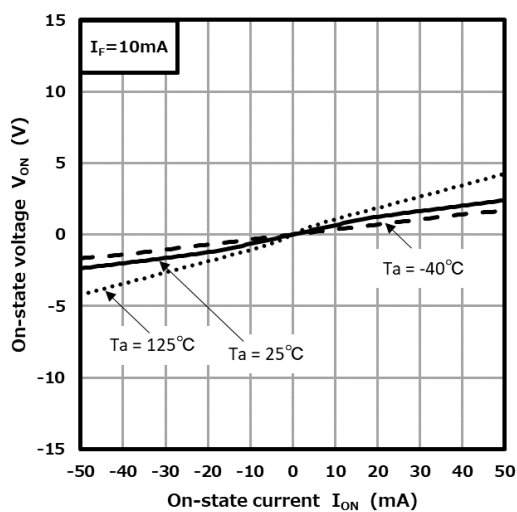


Fig. 12.5  $V_{ON} - I_{ON}$

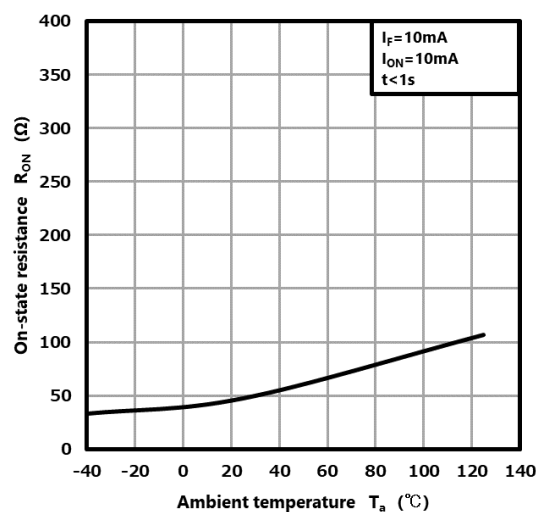


Fig. 12.6  $R_{ON} - T_a$

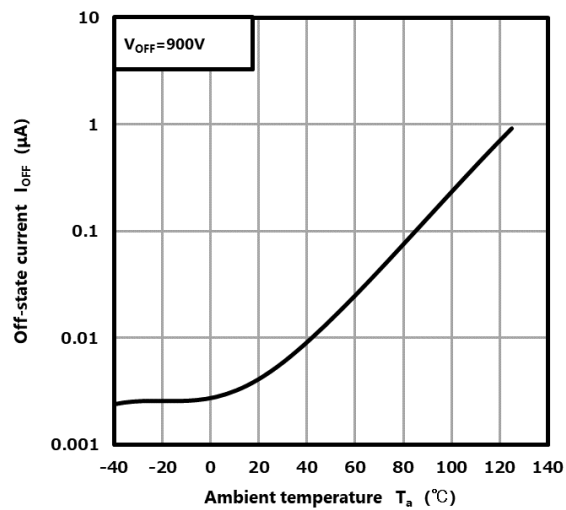


Fig. 12.7  $I_{OFF} - T_a$

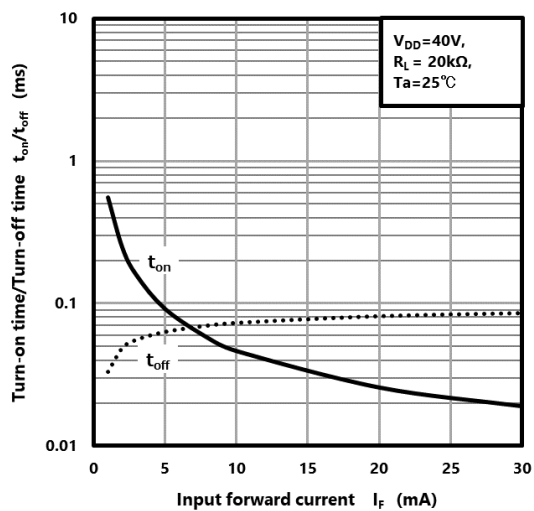


Fig. 12.8  $t_{ON}/t_{OFF} - I_F$

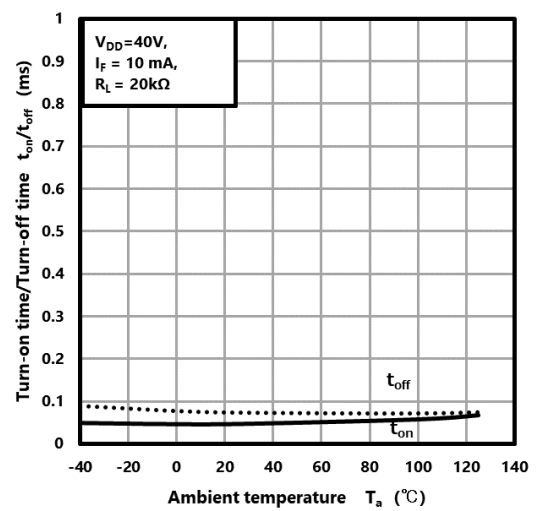
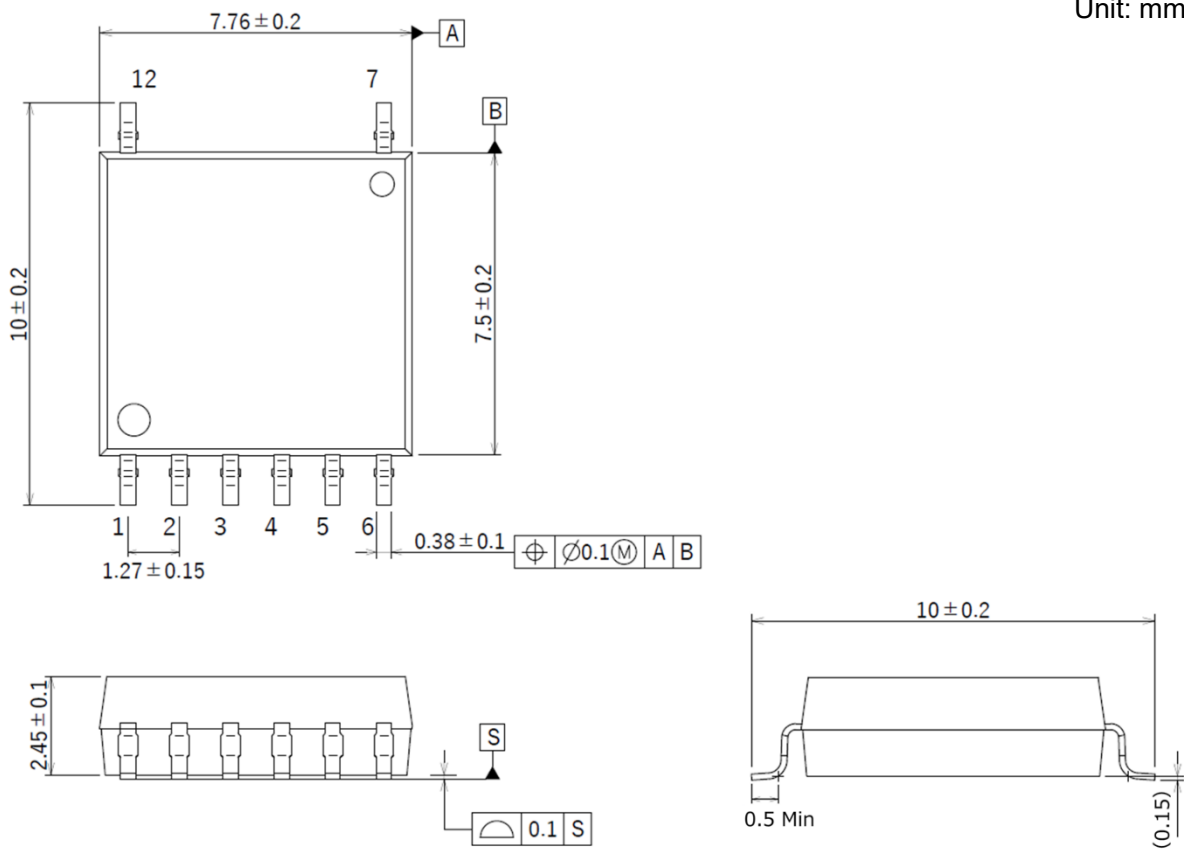


Fig. 12.9  $t_{ON}/t_{OFF} - T_a$

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

13. Package Dimensions

Unit: mm



Weight: 0.31 g (typ.)

| Package Name(s)  |
|------------------|
| TOSHIBA: 11-8C1A |



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