

TLP3109

1. Applications

- Mechanical relay replacements
- Security Systems
- Measuring Instruments
- Factory Automation (FA)
- Amusement Equipment

2. General

The TLP3109 photorelay consists of a photo MOSFET optically coupled to an infrared LED. It is housed in a 2.54SOP6 package. The low ON-state resistance and the high permissible ON-state current of the TLP3109 make it suitable for power line control applications.

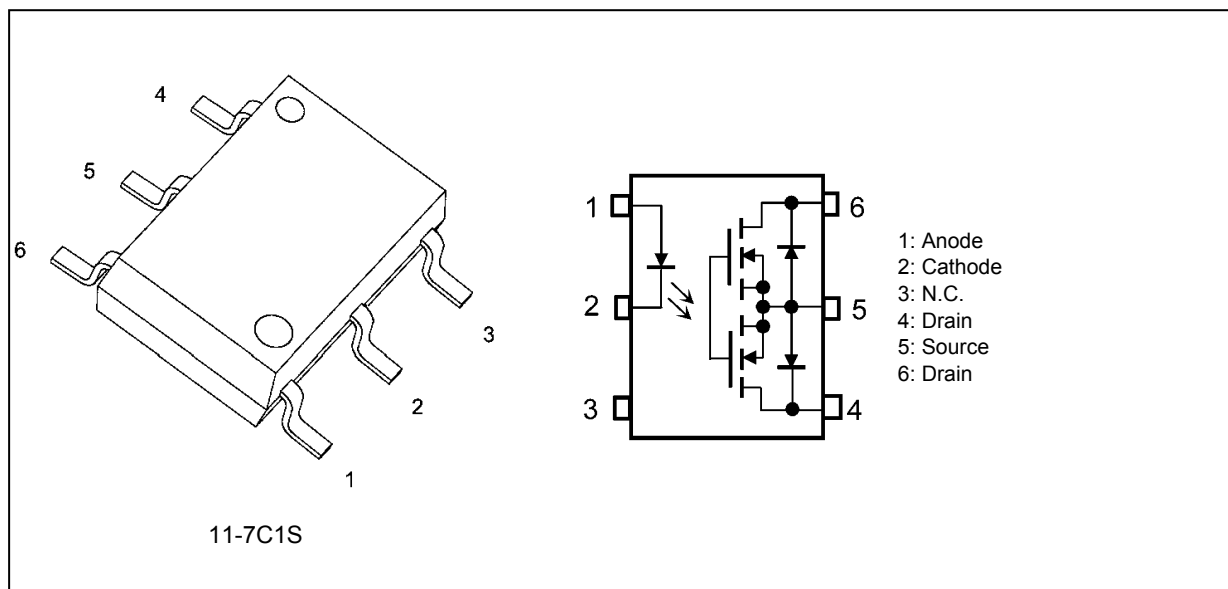
3. Features

- (1) Normally opened (1-Form-A)
- (2) OFF-state output terminal voltage: 100 V (min)
- (3) Trigger LED current: 3 mA (max)
- (4) ON-state current: 2.0 A (max) (A connection)
- (5) ON-state resistance: 70 mΩ (max) (A connection)
- (6) Isolation voltage: 1500 Vrms (min)
- (7) Safety standards

UL-recognized: UL 1577, File No.E67349

cUL-recognized: CSA Component Acceptance Service No.5A File No.E67349

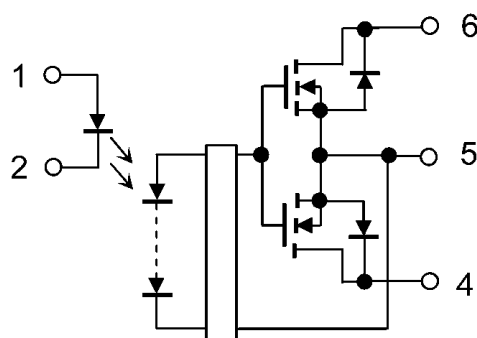
4. Packaging and Pin Assignment



Start of commercial production

2015-05

5. Internal Circuit



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

| | Characteristics | Symbol | Note | Rating | Unit |
|----------|--|------------------------------|----------|------------|------------------------|
| LED | Input forward current | I_F | | 30 | mA |
| | Input forward current derating ($T_a \geq 25\text{ }^{\circ}\text{C}$) | $\Delta I_F / \Delta T_a$ | | -0.3 | mA/ $^{\circ}\text{C}$ |
| | Input forward current (pulsed) (100 μs pulse, 100 pps) | I_{FP} | | 1 | A |
| | Input reverse voltage | V_R | | 5 | V |
| | Input power dissipation | P_D | | 50 | mW |
| | Input power dissipation derating ($T_a \geq 25\text{ }^{\circ}\text{C}$) | $\Delta P_D / \Delta T_a$ | | -0.5 | mW/ $^{\circ}\text{C}$ |
| | Junction temperature | T_j | | 125 | $^{\circ}\text{C}$ |
| Detector | OFF-state output terminal voltage | V_{OFF} | | 100 | V |
| | ON-state current (A connection) | I_{ON} | (Note 1) | 2.0 | A |
| | ON-state current (B connection) | I_{ON} | (Note 1) | 2.0 | |
| | ON-state current (C connection) | I_{ON} | (Note 1) | 4.0 | |
| | ON-state current derating (A connection) ($T_a \geq 25\text{ }^{\circ}\text{C}$) | $\Delta I_{ON} / \Delta T_a$ | (Note 1) | -20 | mA/ $^{\circ}\text{C}$ |
| | ON-state current derating (B connection) ($T_a \geq 25\text{ }^{\circ}\text{C}$) | $\Delta I_{ON} / \Delta T_a$ | (Note 1) | -20 | |
| | ON-state current derating (C connection) ($T_a \geq 25\text{ }^{\circ}\text{C}$) | $\Delta I_{ON} / \Delta T_a$ | (Note 1) | -40 | |
| | ON-state current (pulsed) ($t = 100\text{ ms}$, Duty = 1/10) | I_{ONP} | | 6 | A |
| | Output power dissipation | P_O | | 400 | mW |
| | Output power dissipation derating ($T_a \geq 25\text{ }^{\circ}\text{C}$) | $\Delta P_O / \Delta T_a$ | | -4.0 | mW/ $^{\circ}\text{C}$ |
| | Junction temperature | T_j | | 125 | $^{\circ}\text{C}$ |
| Common | Storage temperature | T_{stg} | | -55 to 125 | $^{\circ}\text{C}$ |
| | Operating temperature | T_{opr} | | -40 to 85 | |
| | Lead soldering temperature (10 s) | T_{sol} | | 260 | |
| | Isolation voltage AC, 60 s, R.H. $\leq 60\%$ | BV_S | (Note 2) | 1500 | 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 1: For an application circuit example, see Chapter 12.2.

Note 2: This device is considered as a two-terminal device: Pins 1, 2 and 3 are shorted together, and pins 4, 5 and 6 are shorted together.

7. Recommended Operating Conditions (Note)

| Characteristics | Symbol | Note | Min | Typ. | Max | Unit |
|---------------------------------|-----------|------|-----|------|-----|------|
| Supply voltage | V_{DD} | | — | — | 80 | V |
| Input forward current | I_F | | 5 | 10 | 25 | mA |
| ON-state current (A connection) | I_{ON} | | — | — | 2.0 | A |
| Operating temperature | T_{opr} | | -20 | — | 65 | °C |

Note: The recommended operating conditions are given as a design guide necessary to obtain the intended performance of the device. Each parameter is an independent value. When creating a system design using this device, the electrical characteristics specified in this data sheet should also be considered.

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

| | Characteristics | Symbol | Note | Test Condition | Min | Typ. | Max | Unit |
|----------|-----------------------|-----------|------|------------------------------------|------|------|------|---------------|
| LED | Input forward voltage | V_F | | $I_F = 10\text{ mA}$ | 1.18 | 1.33 | 1.48 | V |
| | Input reverse current | I_R | | $V_R = 5\text{ V}$ | — | — | 10 | μA |
| | Input capacitance | C_t | | $V = 0\text{ V}, f = 1\text{ MHz}$ | — | 70 | — | pF |
| Detector | OFF-state current | I_{OFF} | | $V_{OFF} = 100\text{ V}$ | — | — | 1 | μA |
| | | | | $V_{OFF} = 80\text{ V}$ | — | — | 20 | nA |
| | Output capacitance | C_{OFF} | | $V = 0\text{ V}, f = 1\text{ MHz}$ | — | 500 | — | pF |

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

| Characteristics | Symbol | Note | Test Condition | Min | Typ. | Max | Unit |
|------------------------------------|----------|----------|--|-----|------|-----|------------|
| Trigger LED current | I_{FT} | | $I_{ON} = 100\text{ mA}$ | — | 0.4 | 3 | mA |
| Return LED current | I_{FC} | | $I_{OFF} = 10\text{ }\mu\text{A}$ | 0.1 | — | — | |
| ON-state resistance (A connection) | R_{ON} | (Note 1) | $I_{ON} = 2.0\text{ A}, I_F = 5\text{ mA}, t < 1\text{ s}$ | — | 45 | 70 | m Ω |
| ON-state resistance (B connection) | | | | — | 22 | 35 | |
| ON-state resistance (C connection) | | | $I_{ON} = 4.0\text{ A}, I_F = 5\text{ mA}, t < 1\text{ s}$ | — | 11 | 18 | |

Note 1: For an application circuit example, see Chapter 12.2.

10. Isolation Characteristics (Unless otherwise specified, $T_a = 25^\circ\text{C}$)

| Characteristics | Symbol | Note | Test Condition | Min | Typ. | Max | Unit |
|-------------------------------------|--------|----------|---|--------------------|-----------|-----|----------|
| Total capacitance (input to output) | C_S | (Note 1) | $V_S = 0\text{ V}, f = 1\text{ MHz}$ | — | 0.8 | — | pF |
| Isolation resistance | R_S | (Note 1) | $V_S = 500\text{ V}, \text{R.H.} \leq 60\%$ | 5×10^{10} | 10^{14} | — | Ω |
| Isolation voltage | BV_S | (Note 1) | AC, 60 s | 1500 | — | — | Vrms |

Note 1: This device is considered as a two-terminal device: Pins 1, 2 and 3 are shorted together, and pins 4, 5 and 6 are shorted together.

11. Switching Characteristics (Unless otherwise specified, $T_a = 25\text{ }^{\circ}\text{C}$)

| Characteristics | Symbol | Note | Test Condition | Min | Typ. | Max | Unit |
|-----------------|-----------|------|---|-----|------|-----|------|
| Turn-on time | t_{ON} | | See Fig. 11.1. $R_L = 200\text{ }\Omega$, $V_{DD} = 20\text{ V}$, $I_F = 5\text{ mA}$ | — | 1.1 | 5.0 | ms |
| | | | See Fig. 11.1. $R_L = 200\text{ }\Omega$, $V_{DD} = 20\text{ V}$, $I_F = 10\text{ mA}$ | — | 0.6 | 3.0 | |
| Turn-off time | t_{OFF} | | See Fig. 11.1. $R_L = 200\text{ }\Omega$, $V_{DD} = 20\text{ V}$, $I_F = 5\text{ mA}$ | — | 0.1 | 1.0 | |
| | | | See Fig. 11.1. $R_L = 200\text{ }\Omega$, $V_{DD} = 20\text{ V}$, $I_F = 10\text{ mA}$ | — | 0.1 | 1.0 | |

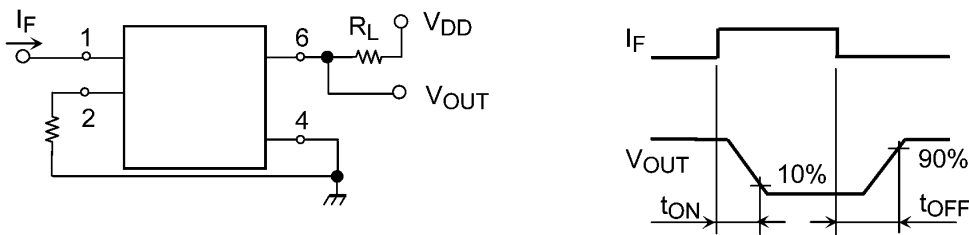


Fig. 11.1 Switching Time Test Circuit and Waveform

12. Characteristics Curves and Circuit Connections

12.1. Characteristics Curves (Note)

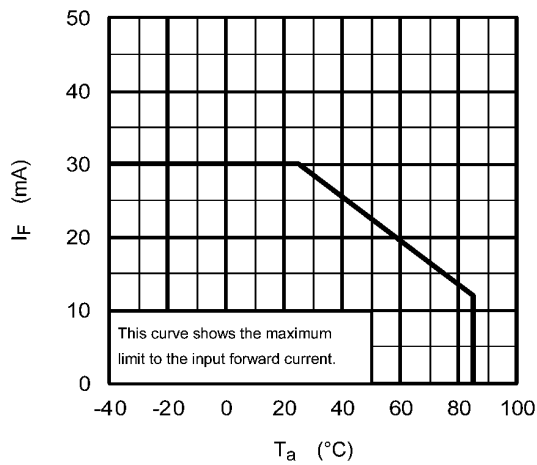


Fig. 12.1.1 $I_F - T_a$

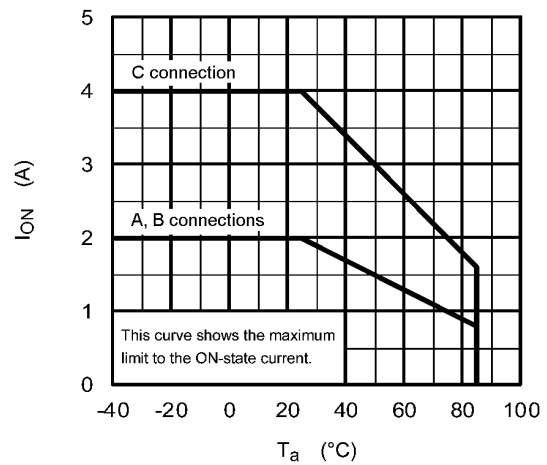


Fig. 12.1.2 $I_{ON} - T_a$

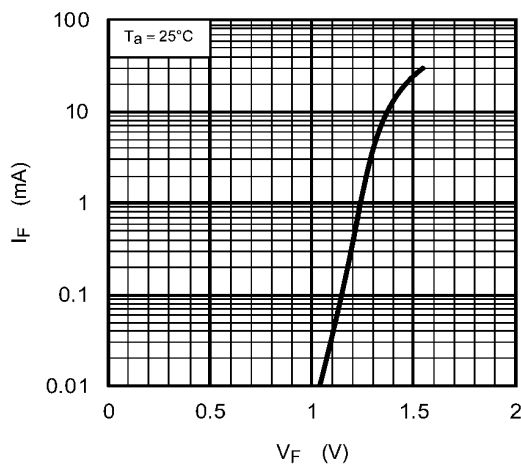


Fig. 12.1.3 $I_F - V_F$

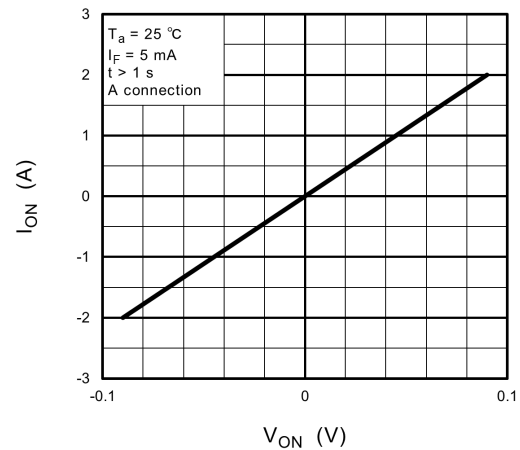


Fig. 12.1.4 $I_{ON} - V_{ON}$

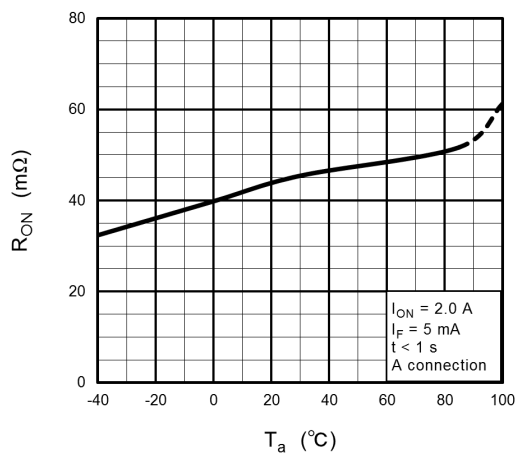


Fig. 12.1.5 $R_{ON} - T_a$

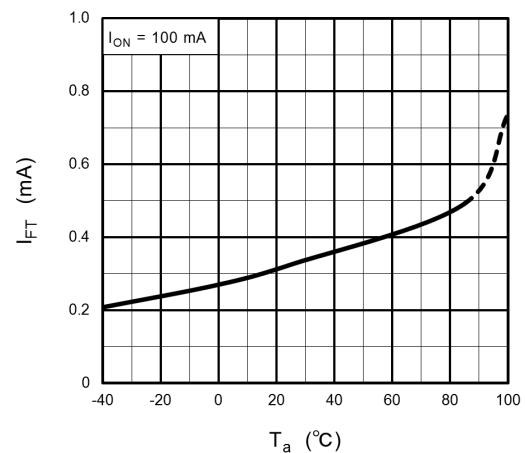


Fig. 12.1.6 $I_{FT} - T_a$

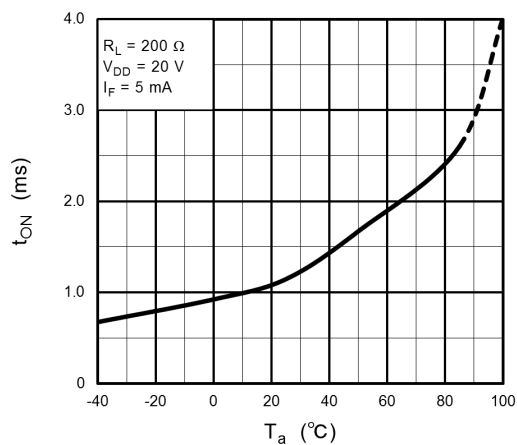


Fig. 12.1.7 $t_{ON} - T_a$

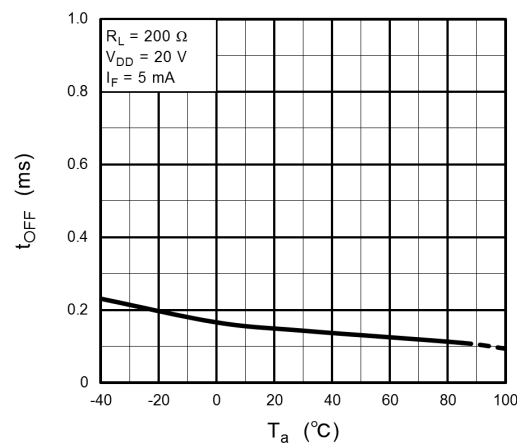


Fig. 12.1.8 $t_{OFF} - T_a$

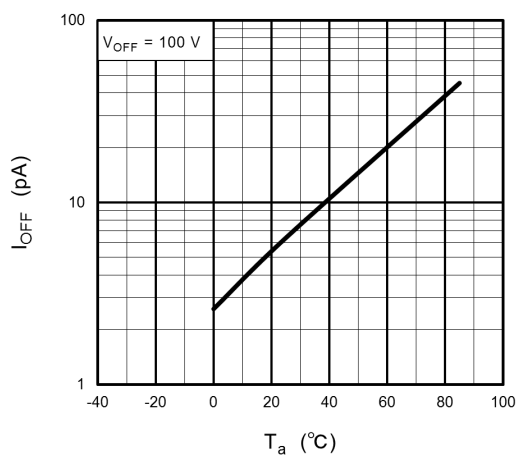


Fig. 12.1.9 $I_{OFF} - T_a$

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

12.2. Circuit Connections

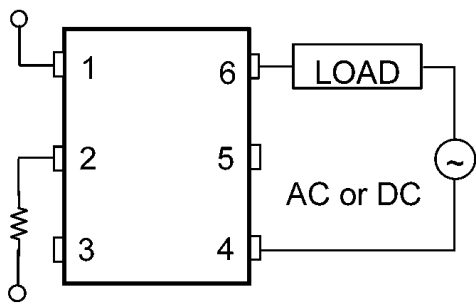


Fig. 12.2.1 A Connection

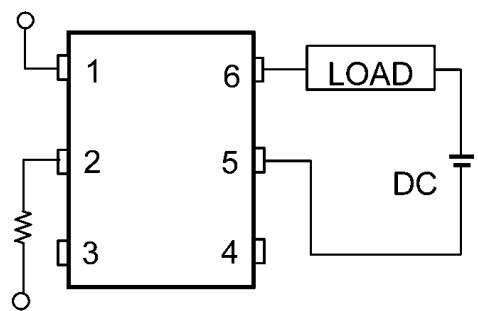


Fig. 12.2.2 B Connection

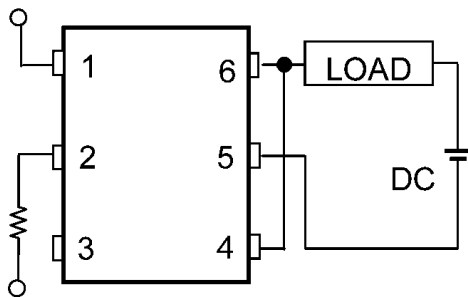
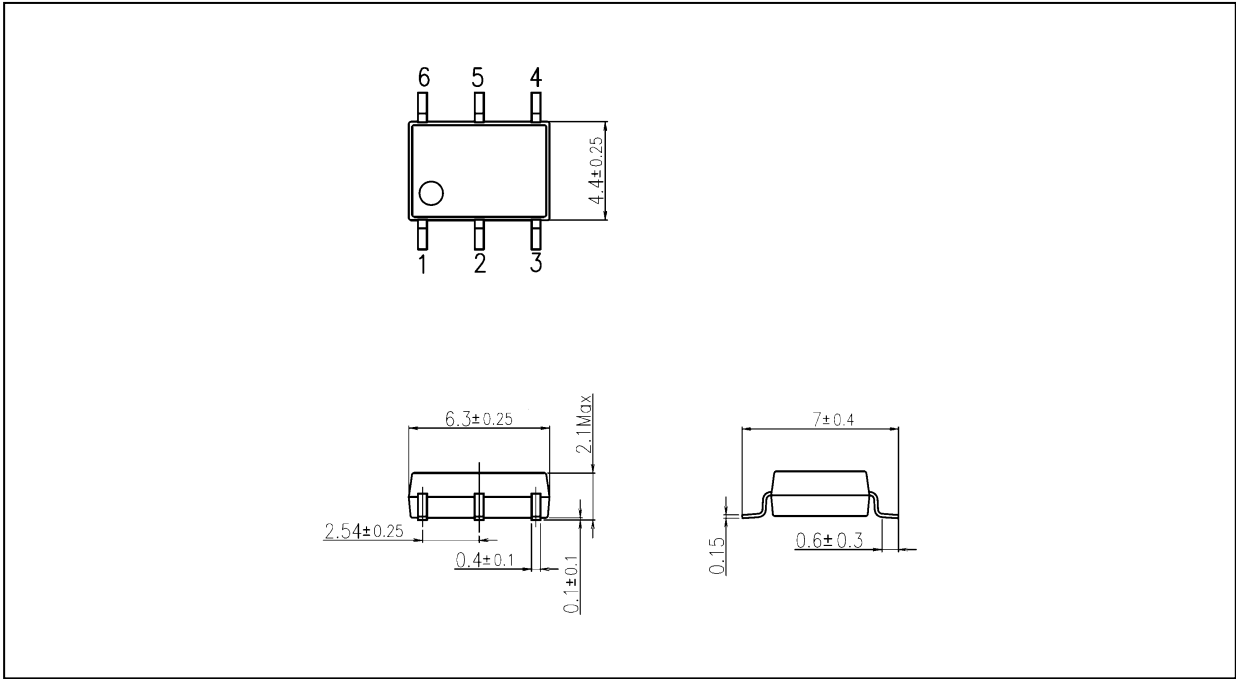


Fig. 12.2.3 C Connection

Package Dimensions

Unit: mm



Weight: 0.13 g (typ.)

| Package Name(s) |
|------------------|
| TOSHIBA: 11-7C1S |

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