

TOSHIBA Photocoupler Photorelay

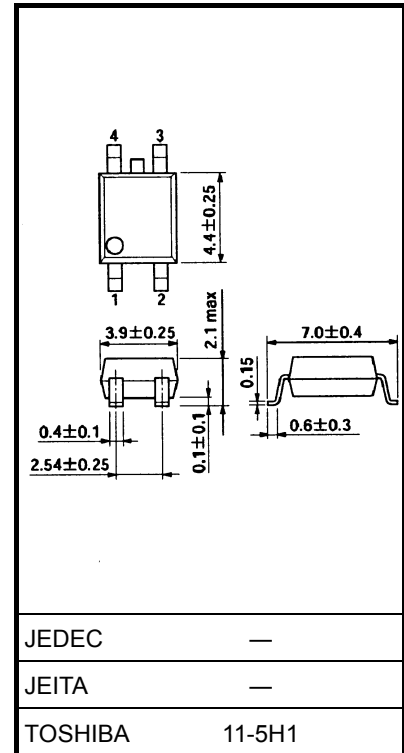
## TLP170J

Modem·Fax Cards, Modems in PC  
Telecommunications  
PBX  
Security Equipment  
Measurement Equipment

The Toshiba TLP170J consists of a gallium arsenide infrared emitting diode optically coupled to a photo-MOSFET in a 4-pin SOP package. This photorelay requires 1 mA of LED current to turn it on. It is suitable for applications that need electrical power savings.

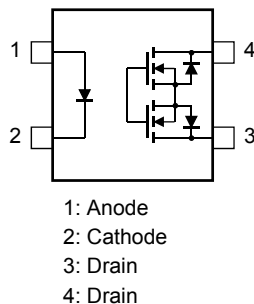
- 4-pin SOP (2.54SOP4): Height = 2.1 mm, Pitch = 2.54 mm
- 1-Form-A
- Peak OFF-state voltage: 600 V (min)
- Trigger LED current: 1 mA (max)
- ON-state current: 90 mA (max)
- ON-state resistance: 40  $\Omega$  (max,  $t < 1$  s)
- ON-state resistance: 60  $\Omega$  (max, continuous)
- Isolation voltage: 1500 Vrms (min)
- UL recognized: UL1577, File No.E67349
- c-UL recognized  
CSA Component Acceptance Service No. 5A File No.E67349

Unit: mm

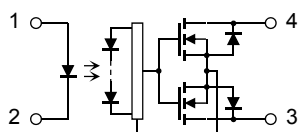


Weight: 0.1 g (typ.)

### Pin Configuration (top view)



### Internal Circuit



Start of commercial production  
2009/06

**Absolute Maximum Rating (Ta = 25°C)**

| Characteristics                                       |                                               | Symbol                         | Rating  | Unit  |
|-------------------------------------------------------|-----------------------------------------------|--------------------------------|---------|-------|
| LED                                                   | Forward current                               | $I_F$                          | 50      | mA    |
|                                                       | Forward current derating (Ta ≥ 25°C)          | $\Delta I_F/^\circ\text{C}$    | -0.5    | mA/°C |
|                                                       | Pulse forward current (100 μs pulse, 100 pps) | $I_{FP}$                       | 1       | A     |
|                                                       | Reverse voltage                               | $V_R$                          | 5       | V     |
|                                                       | Junction temperature                          | $T_j$                          | 125     | °C    |
| Detector                                              | OFF-state output terminal voltage             | $V_{OFF}$                      | 600     | V     |
|                                                       | ON-state current                              | $I_{ON}$                       | 90      | mA    |
|                                                       | ON-state current derating (Ta ≥ 25°C)         | $\Delta I_{ON}/^\circ\text{C}$ | -0.9    | mA/°C |
|                                                       | Junction temperature                          | $T_j$                          | 125     | °C    |
| Storage temperature range                             |                                               | $T_{stg}$                      | -55~125 | °C    |
| Operating temperature range                           |                                               | $T_{opr}$                      | -40~85  | °C    |
| Lead soldering temperature (10 s)                     |                                               | $T_{sol}$                      | 260     | °C    |
| Isolation voltage (AC, 1 minute, R.H. ≤ 60%) (Note 1) |                                               | $BV_S$                         | 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: Device considered a two-terminal device: LED side pins shorted together, and detector side pins shorted together.

**Recommended Operating Conditions**

| Characteristics       | Symbol    | Min | Typ. | Max | Unit |
|-----------------------|-----------|-----|------|-----|------|
| Supply voltage        | $V_{DD}$  | —   | —    | 480 | V    |
| Forward current       | $I_F$     | —   | 2    | 25  | mA   |
| ON-state current      | $I_{ON}$  | —   | —    | 70  | mA   |
| Operating temperature | $T_{opr}$ | -20 | —    | 65  | °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.

**Electrical Characteristics (Ta = 25°C)**

| Characteristics |                   | Symbol    | Test Condition             | Min | Typ. | Max  | Unit |
|-----------------|-------------------|-----------|----------------------------|-----|------|------|------|
| LED             | Forward voltage   | $V_F$     | $I_F = 10 \text{ mA}$      | 1.0 | 1.15 | 1.3  | V    |
|                 | Reverse current   | $I_R$     | $V_R = 5 \text{ V}$        | —   | —    | 10   | μA   |
|                 | Capacitance       | $C_T$     | $V = 0, f = 1 \text{ MHz}$ | —   | 30   | —    | pF   |
| Detector        | OFF-state current | $I_{OFF}$ | $V_{OFF} = 600 \text{ V}$  | —   | 1    | 1000 | nA   |
|                 | Capacitance       | $C_{OFF}$ | $V = 0, f = 1 \text{ MHz}$ | —   | 75   | —    | pF   |

## Coupled Electrical Characteristics (Ta = 25°C)

| Characteristics     | Symbol   | Test Condition                                                      | Min | Typ. | Max | Unit     |
|---------------------|----------|---------------------------------------------------------------------|-----|------|-----|----------|
| Trigger LED current | $I_{FT}$ | $I_{ON} = 90 \text{ mA}$                                            | —   | 0.4  | 1   | mA       |
| Return LED current  | $I_{FC}$ | $I_{OFF} = 100 \mu\text{A}$                                         | 0.1 | —    | —   | mA       |
| ON-state resistance | $R_{ON}$ | $I_{ON} = 90 \text{ mA}$ , $I_F = 2 \text{ mA}$ , $t < 1 \text{ s}$ | —   | —    | 40  | $\Omega$ |
|                     |          | $I_{ON} = 90 \text{ mA}$ , $I_F = 2 \text{ mA}$ , continuous        | —   | 45   | 60  |          |

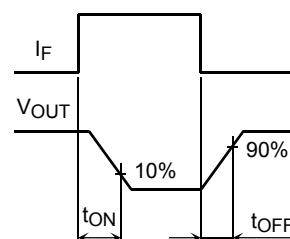
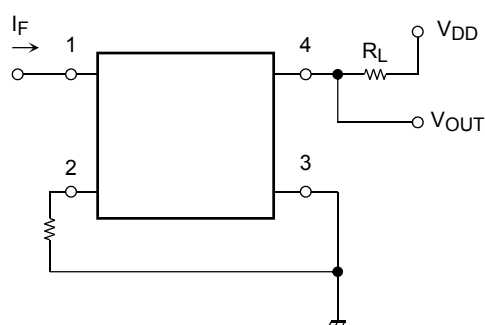
## Isolation Characteristics (Ta = 25°C)

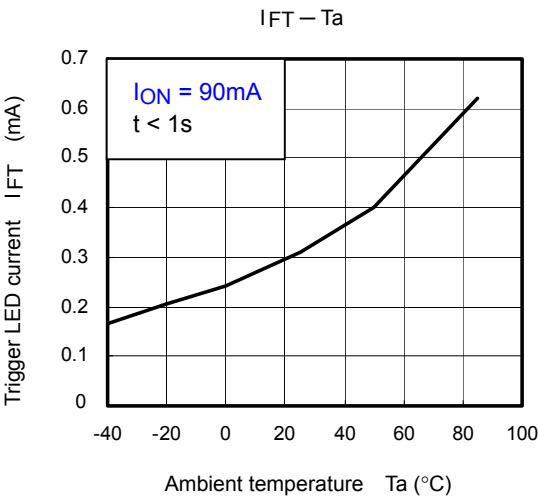
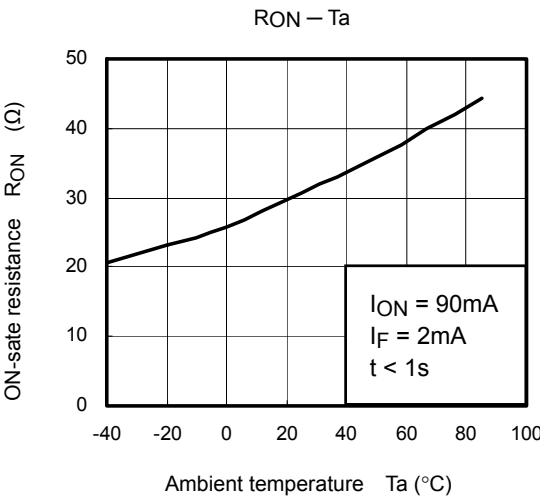
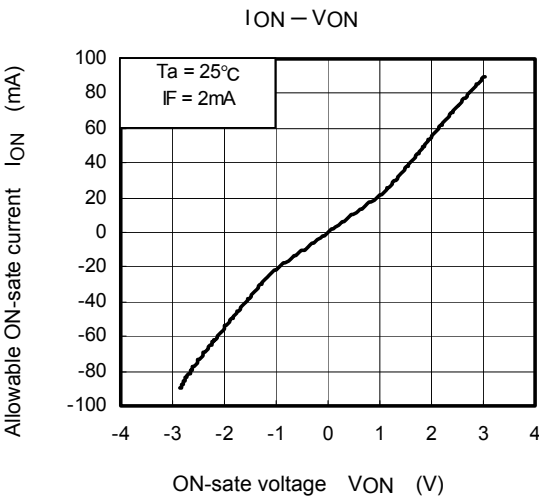
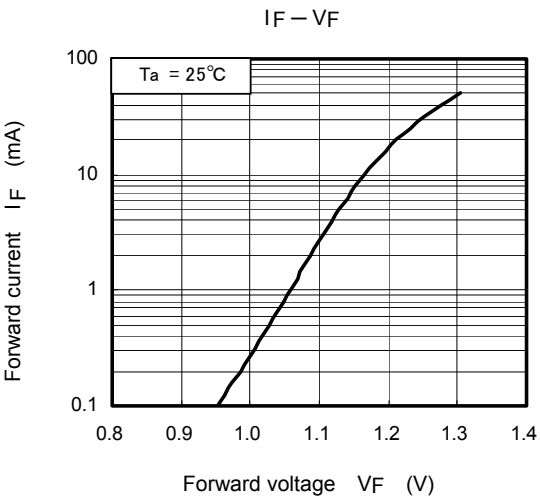
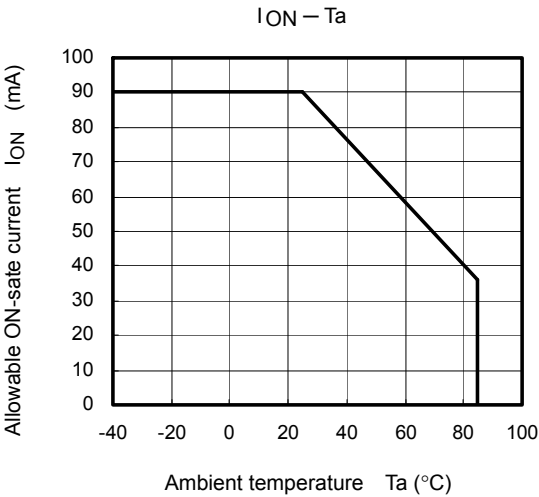
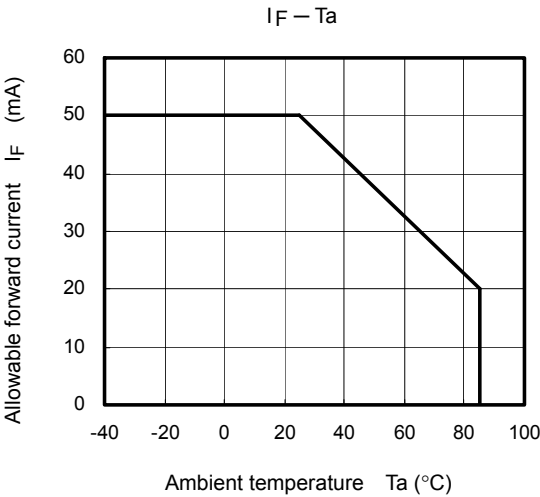
| Characteristics             | Symbol | Test Condition                            | Min                | Typ.      | Max | Unit     |
|-----------------------------|--------|-------------------------------------------|--------------------|-----------|-----|----------|
| Capacitance input to output | $C_S$  | $V_S = 0 \text{ V}$ , $f = 1 \text{ MHz}$ | —                  | 0.8       | —   | pF       |
| Isolation resistance        | $R_S$  | $V_S = 500 \text{ V}$ , R.H. $\leq 60\%$  | $5 \times 10^{10}$ | $10^{14}$ | —   | $\Omega$ |
| Isolation voltage           | $BV_S$ | AC, 1 minute                              | 1500               | —         | —   | Vrms     |
|                             |        | AC, 1 second, in oil                      | —                  | 3000      | —   |          |
|                             |        | DC, 1 minute, in oil                      | —                  | 3000      | —   | Vdc      |

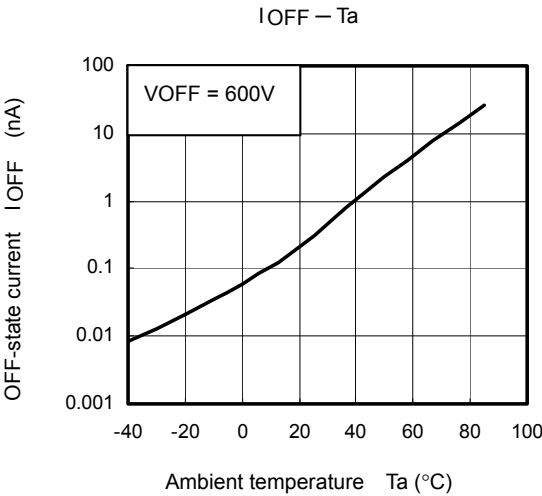
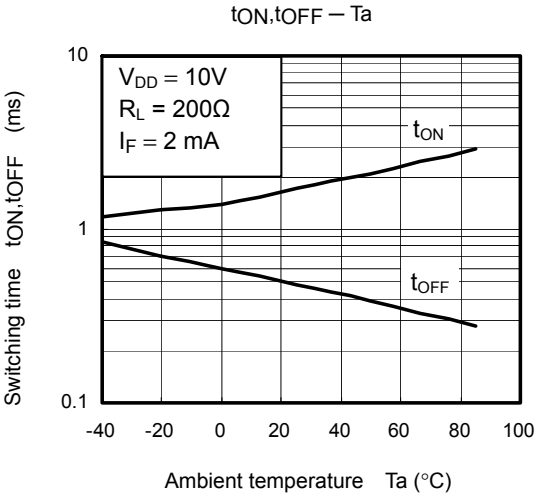
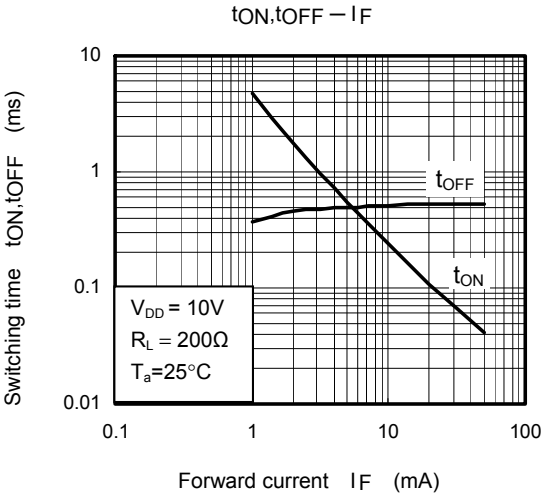
## Switching Characteristics (Ta = 25°C)

| Characteristics | Symbol    | Test Condition                                                                | Min | Typ. | Max | Unit |
|-----------------|-----------|-------------------------------------------------------------------------------|-----|------|-----|------|
| Turn-on time    | $t_{ON}$  | $R_L = 200 \Omega$<br>$V_{DD} = 10 \text{ V}$ , $I_F = 2 \text{ mA}$ (Note 2) | —   | 2.0  | 8.0 | ms   |
| Turn-on time    | $t_{ON}$  | $R_L = 200 \Omega$<br>$V_{DD} = 10 \text{ V}$ , $I_F = 5 \text{ mA}$ (Note 2) | —   | —    | 5.0 |      |
| Turn-off time   | $t_{OFF}$ | $R_L = 200 \Omega$<br>$V_{DD} = 10 \text{ V}$ , $I_F = 2 \text{ mA}$ (Note 2) | —   | 0.5  | 3.0 |      |

Note 2: Switching time test circuit







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