

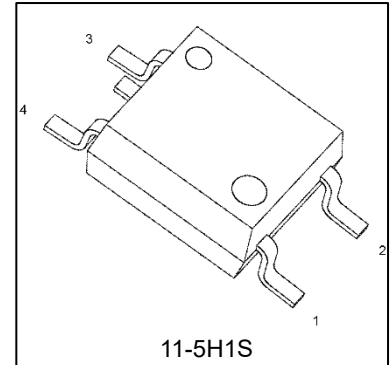
Photocouplers Photorelay

# TLP170D

## 1. Description

The Toshiba TLP170D consists of an 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.



Weight: 0.1 g (typ.)

## 2. Applications

Mechanical relay replacements  
Security Equipment  
Measuring Instruments  
Factory Automation (FA)  
Private Branch Exchanges (PBXs)

## 3. Features

- Package : SOP (2.54SOP4) (Height 2.1 mm, pitch 2.54 mm)
- Normally opened (1-Form-A)
- OFF-state output terminal voltage: 200 V (min)
- Trigger LED current: 1 mA (max)
- ON-state current: 200 mA (max)
- ON-state resistance: 8  $\Omega$  (max)
- Isolation voltage: 1500 V<sub>rms</sub> (min)
- Safety standards
  - UL-recognized: UL 1577, File No.E67349
  - cUL-recognized: CSA Component Acceptance Service No.5A File No.E67349

Start of commercial production  
2009-06

## 4. Pin Assignment

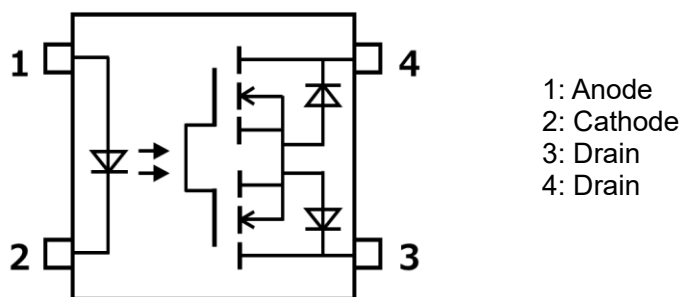


Figure 4.1 Pin Assignment

## 5. Internal Circuit

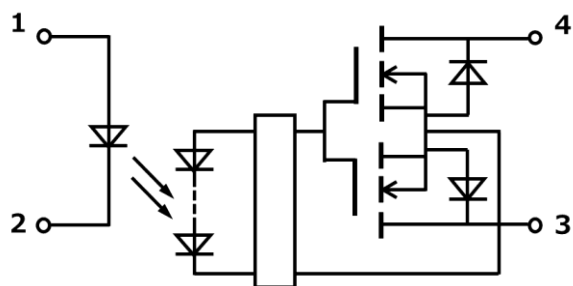


Figure 5.1 Internal Circuit

**6. Absolute Maximum Ratings (Note)**

( $T_a = 25^\circ\text{C}$  unless otherwise specified)

	Characteristics	Symbol	Note	Rating	Unit
LED	Input forward current	$I_F$		50	mA
	Input forward current derating ( $T_a \geq 25^\circ\text{C}$ )	$\Delta I_F/\Delta T_a$		-0.5	mA/ $^\circ\text{C}$
	Input reverse voltage	$V_R$		5	V
	Pulse forward current (100 $\mu\text{s}$ pulse, 100 pps)	$I_{FP}$		1	A
	Input power dissipation	$P_D$		50	mW
	Input power dissipation derating ( $T_a \geq 25^\circ\text{C}$ )	$\Delta P_D/\Delta T_a$		-0.5	mW/ $^\circ\text{C}$
	Junction temperature	$T_j$		125	$^\circ\text{C}$
Detector	OFF-state output terminal voltage	$V_{OFF}$		200	V
	ON-state current	$I_{ON}$		200	mA
	ON-state current derating ( $T_a \geq 25^\circ\text{C}$ )	$\Delta I_{ON}/\Delta T_a$		-2.0	mA/ $^\circ\text{C}$
	Output power dissipation	$P_O$		300	mW
	Output power dissipation derating ( $T_a \geq 25^\circ\text{C}$ )	$\Delta P_O/\Delta T_a$		-3.0	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	$^\circ\text{C}$
	Lead soldering temperature (10 s)	$T_{sol}$		260	$^\circ\text{C}$
	Isolation voltage (AC, 60 s, R.H. $\leq 60\%$ )	$BV_S$	(Note 1)	1500	$V_{rms}$

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

**7. Recommended Operating Conditions (Note)**

Characteristics	Symbol	Note	Min	Typ.	Max	Unit
Supply voltage	$V_{DD}$		—	—	160	V
Input forward current	$I_F$		—	2	25	mA
ON-state current	$I_{ON}$		—	—	160	mA
Operating temperature	$T_{opr}$		-20	—	65	$^\circ\text{C}$

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

( $T_a = 25^\circ\text{C}$  unless otherwise specified)

	Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
LED	Input forward voltage	$V_F$		$I_F = 10\text{ mA}$	1.0	1.15	1.3	V
	Input reverse current	$I_R$		$V_R = 5\text{ V}$	—	—	10	$\mu\text{A}$
	Input capacitance	$C_t$		$V = 0\text{ V}, f = 1\text{ MHz}$	—	30	—	pF
Detector	OFF-state current	$I_{\text{OFF}}$		$V_{\text{OFF}} = 200\text{ V}$	—	1	1000	nA
	Output capacitance	$C_{\text{OFF}}$		$V = 0\text{ V}, f = 1\text{ MHz}$	—	90	—	pF

## 9. Coupled Electrical Characteristics

( $T_a = 25^\circ\text{C}$  unless otherwise specified)

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Trigger LED current	$I_{\text{FT}}$		$I_{\text{ON}} = 200\text{ mA}$	—	0.4	1	mA
Return LED current	$I_{\text{FC}}$		$I_{\text{OFF}} = 100\text{ }\mu\text{A}$	0.1	—	—	mA
ON-state resistance	$R_{\text{ON}}$		$I_{\text{ON}} = 200\text{ mA}, I_F = 2\text{ mA}$	—	5	8	$\Omega$

## 10. Isolation Characteristics

( $T_a = 25^\circ\text{C}$  unless otherwise specified)

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)	$V_s = 500\text{ V}, \text{R.H.} \leq 60\%$	$5 \times 10^{10}$	$10^{14}$	—	$\Omega$
Isolation voltage	$BV_s$	(Note 1)	AC, 60 s	1500	—	—	$V_{\text{rms}}$

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

## 11. Switching Characteristics

( $T_a = 25^\circ\text{C}$  unless otherwise specified)

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Turn-on time	$t_{\text{ON}}$		See Figure 11.1 $R_L = 200\text{ }\Omega, V_{\text{DD}} = 20\text{ V}, I_F = 2\text{ mA}$	—	3.0	8.0	ms
Turn-on time	$t_{\text{ON}}$		See Figure 11.1 $R_L = 200\text{ }\Omega, V_{\text{DD}} = 20\text{ V}, I_F = 5\text{ mA}$	—	—	5.0	
Turn-off time	$t_{\text{OFF}}$		See Figure 11.1 $R_L = 200\text{ }\Omega, V_{\text{DD}} = 20\text{ V}, I_F = 2\text{ mA}$	—	0.6	3.0	

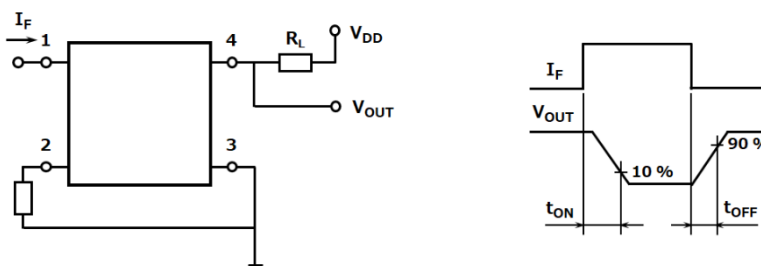
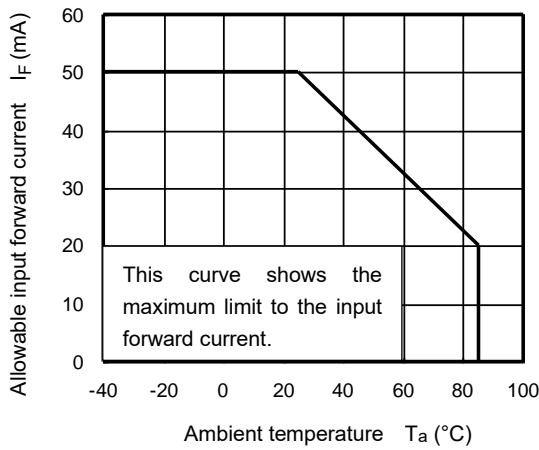
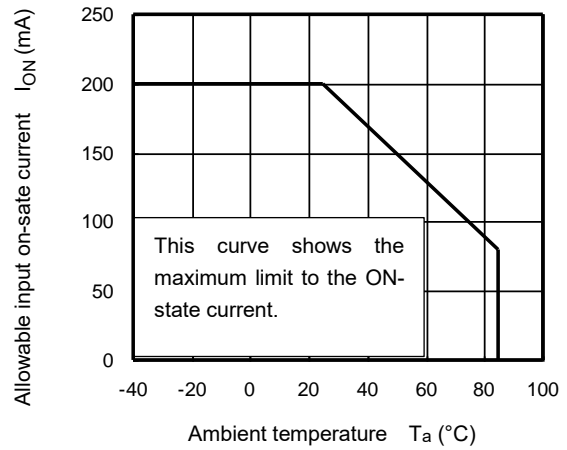


Figure 11.1 Switching Time Test Circuit and Waveform

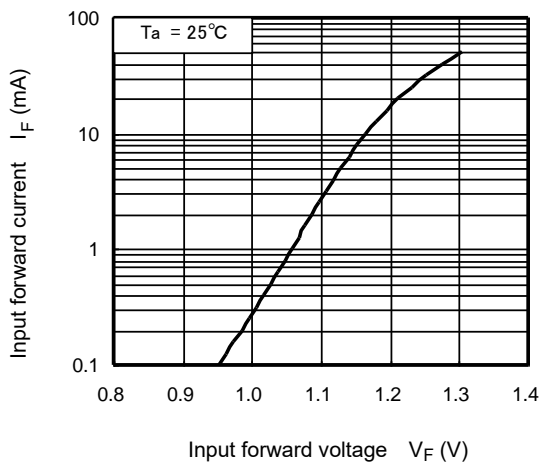
**12. Characteristics Curves and Circuit Connections (Note)**



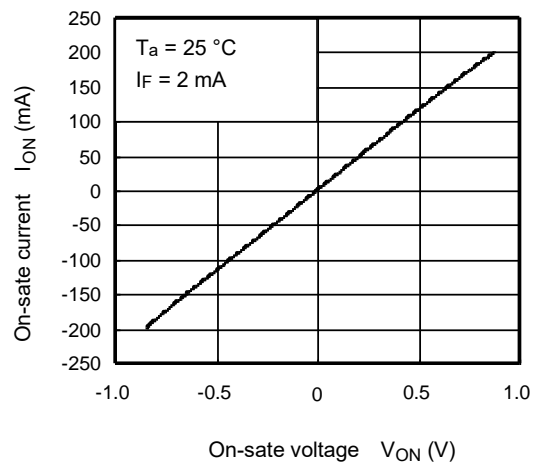
**Fig.12.1  $I_F - T_a$**



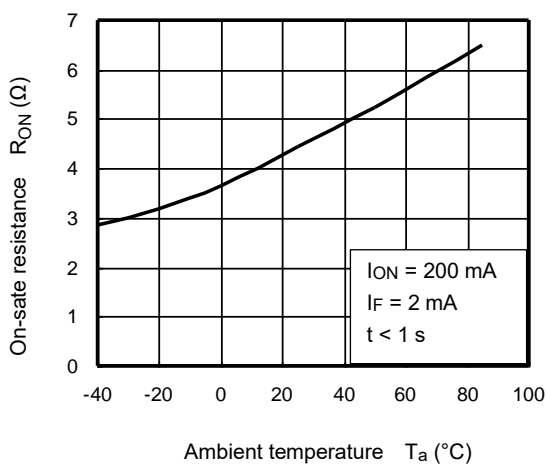
**Fig.12.2  $I_{ON} - T_a$**



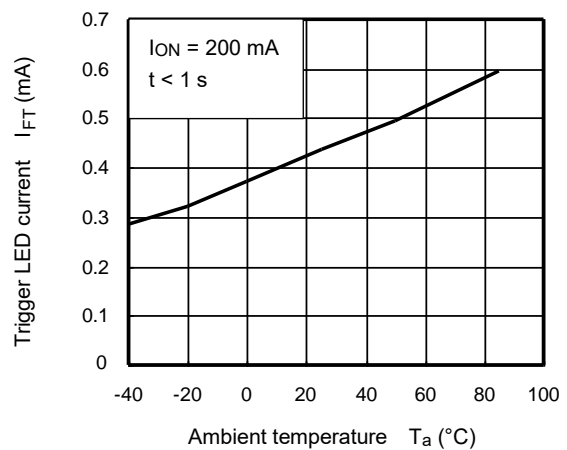
**Fig.12.3  $I_F - V_F$**



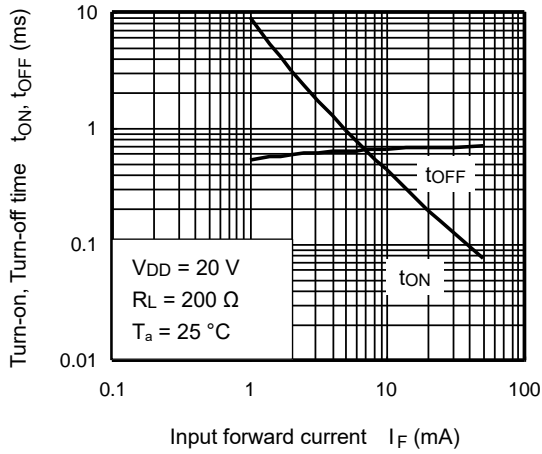
**Fig.12.4  $I_{ON} - V_{ON}$**



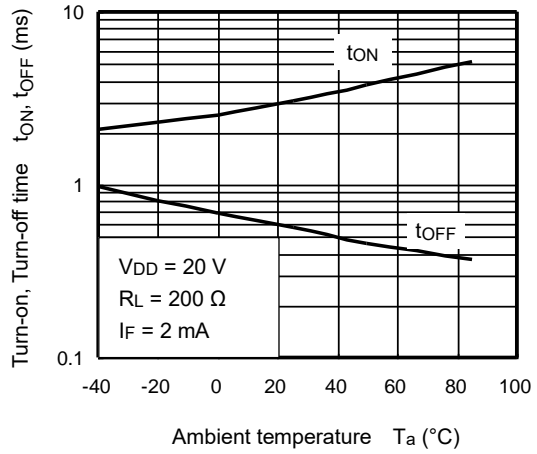
**Fig.12.5  $R_{ON} - T_a$**



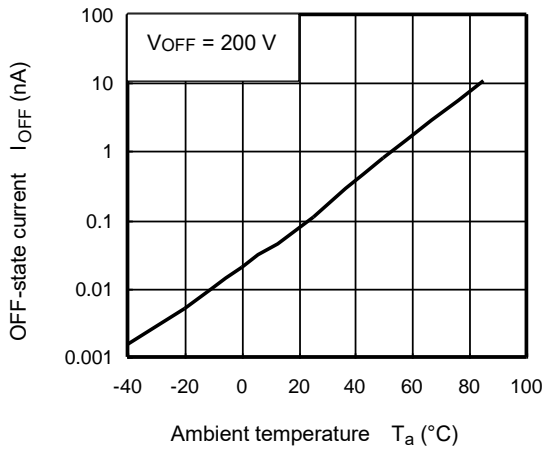
**Fig.12.6  $I_{FT} - T_a$**



**Fig.12.7  $t_{ON}$ ,  $t_{OFF} - I_F$**



**Fig.12.8  $t_{ON}$ ,  $t_{OFF} - T_a$**



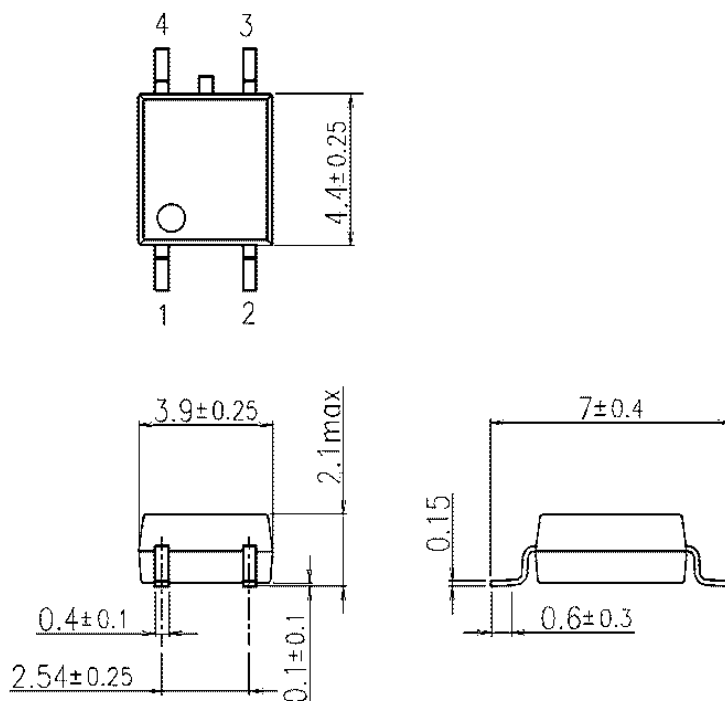
**Fig.12.9  $I_{OFF} - T_a$**

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

**13. Package Dimensions**

11-5H1S

Unit: mm



Weight: 0.1 g (typ.)

**Fig. 13.1 Package Dimensions**

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