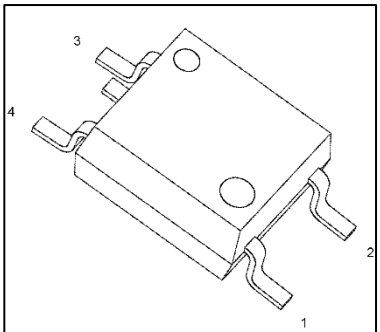
Photocouplers Photorelay

TLP170A

1. Description

The Toshiba TLP170A 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.



11-5H1S

Weight: 0.1 g (typ.)

2. Applications

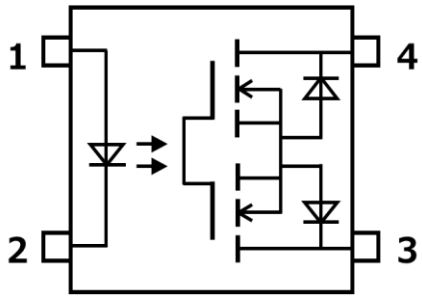
Mechanical relay replacements
Security Equipment
Measuring Instruments
Factory Automation (FA)
Private Branch Exchanges (PBXs)

3. Features

- Package : SOP (2.54SOP4) (Height 2.1 mm, pitch 2.54 mm)
- Normally opened (1-Form-A)
- OFF-state output terminal voltage: 60 V (min)
- Trigger LED current: 1 mA (max)
- ON-state current: 400 mA (max)
- ON-state resistance: 2 Ω (max)
- Isolation voltage: 1500 V_{rms} (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



1: Anode
2: Cathode
3: Drain
4: Drain

Figure 4.1 Pin Assignment

5. Internal Circuit

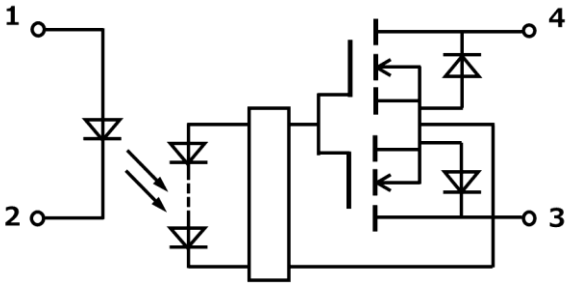


Figure 5.1 Internal Circuit

6. Absolute Maximum Ratings (Note)

(T_a = 25°C unless otherwise specified)

	Characteristics	Symbol	Note	Rating	Unit
LED	Input forward current	I_F		50	mA
	Input forward current derating ($T_a \geq 25$ °C)	$\Delta I_F/\Delta T_a$		−0.5	mA/°C
	Input reverse voltage	V_R		5	V
	Pulse forward current (100 μs pulse, 100 pps)	I_{FP}		1	A
	Input power dissipation	P_D		50	mW
	Input power dissipation derating ($T_a \geq 25$ °C)	$\Delta P_D/\Delta T_a$		−0.5	mW/°C
	Junction temperature	T_j		125	°C
Detector	OFF-state output terminal voltage	V_{OFF}		60	V
	ON-state current	I_{ON}		400	mA
	ON-state current derating ($T_a \geq 25$ °C)	$\Delta I_{ON}/\Delta T_a$		−4.0	mA/°C
	Output power dissipation	P_O		300	mW
	Output power dissipation derating ($T_a \geq 25$ °C)	$\Delta P_O/\Delta T_a$		−3.0	mW/°C
	Junction temperature	T_j		125	°C
Common	Storage temperature	T_{stg}		−55 to 125	°C
	Operating temperature	T_{opr}		−40 to 85	°C
	Lead soldering temperature (10 s)	T_{sol}		260	°C
	Isolation voltage (AC, 60 s, R.H. ≤ 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}		—	—	48	V
Input forward current	I_F		—	2	25	mA
ON-state current	I_{ON}		—	—	320	mA
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

(T_a = 25°C unless otherwise specified)

	Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
LED	Input forward voltage	V_F		I_F = 10 mA	1.0	1.15	1.3	V
	Input reverse current	I_R		V_R = 5 V	—	—	10	μA
	Input capacitance	C_t		V = 0 V, f =1 MHz	—	30	—	pF
Detector	OFF-state current	I_{OFF}		V_{OFF} = 60 V	—	1	1000	nA
	Output capacitance	C_{OFF}		V = 0 V, f =1 MHz	—	130	—	pF

9. Coupled Electrical Characteristics

(T_a = 25°C unless otherwise specified)

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Trigger LED current	I_{FT}		I_{ON} = 400 mA	—	0.4	1	mA
Return LED current	I_{FC}		I_{OFF} = 100 μA	0.1	—	—	mA
ON-state resistance	R_{ON}		I_{ON} = 400 mA, I_F = 2 mA	—	1	2	Ω

10. Isolation Characteristics

(T_a = 25°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 V, f = 1 MHz	—	0.8	—	pF
Isolation resistance	R_S	(Note 1)	V_S = 500 V, R.H. ≤ 60 %	5×10^{10}	10^{14}	—	Ω
Isolation voltage	BV_S	(Note 1)	AC, 60 s	1500	—	—	V_{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°C unless otherwise specified)

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Turn-on time	t_{ON}		See Figure 11.1 R_L = 200 Ω, V_{DD} = 20 V, I_F = 2 mA	—	3.0	8.0	ms
Turn-on time	t_{ON}		See Figure 11.1 R_L = 200 Ω, V_{DD} = 20 V, I_F = 5 mA	—	—	5.0	
Turn-off time	t_{OFF}		See Figure 11.1 R_L = 200 Ω, V_{DD} = 20 V, I_F = 2 mA	—	1.0	3.0	

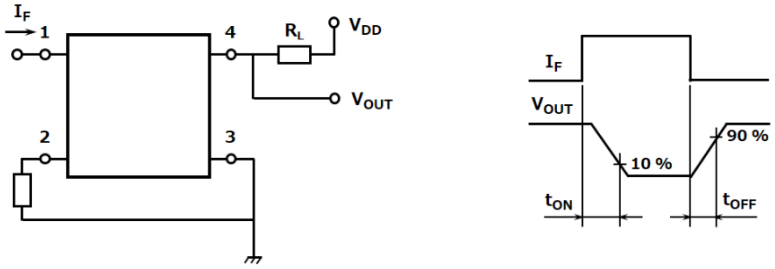


Figure 11.1 Switching Time Test Circuit and Waveform

12. Characteristics Curves and Circuit Connections (Note)

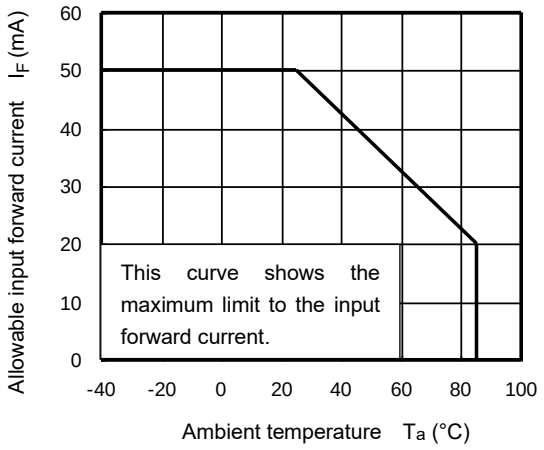


Fig.12.1 I_F – T_a

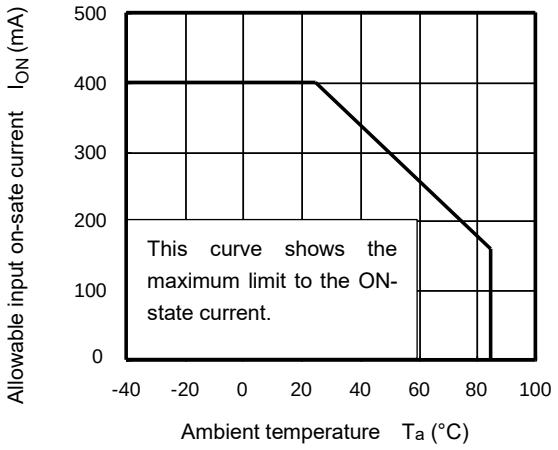


Fig.12.2 I_{ON} – T_a

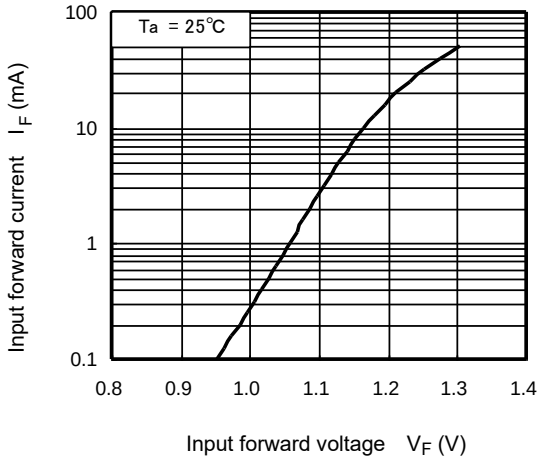


Fig.12.3 I_F – V_F

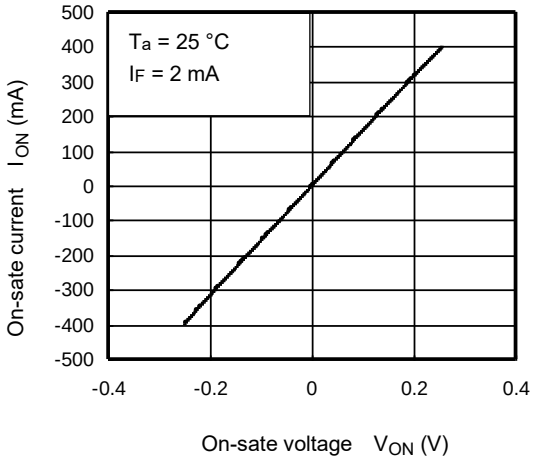


Fig.12.4 I_{ON} – V_{ON}

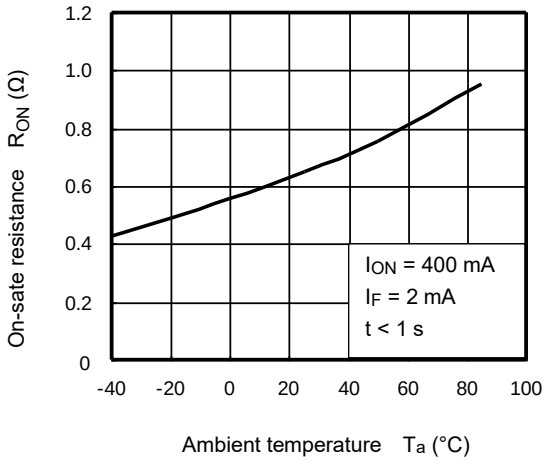


Fig.12.5 R_{ON} – T_a

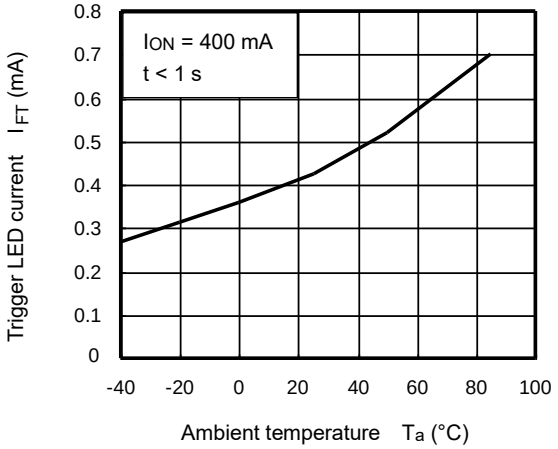


Fig.12.6 I_{FT} – T_a

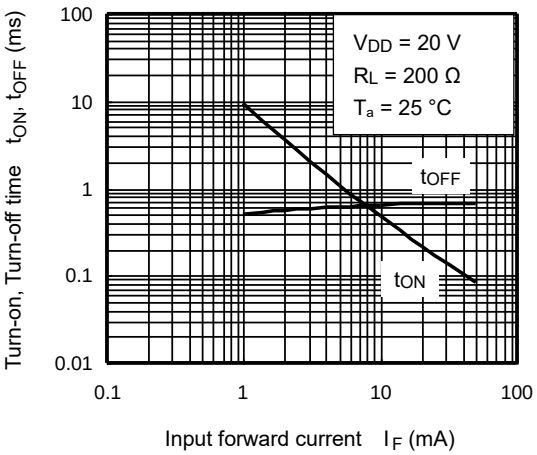


Fig.12.7 t_{ON}, t_{OFF} – I_F

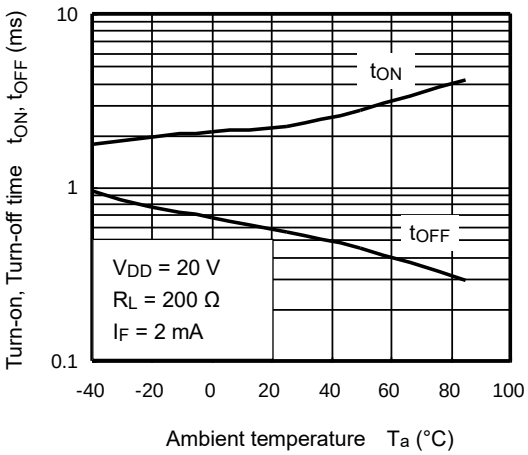


Fig.12.8 t_{ON}, t_{OFF} – T_a

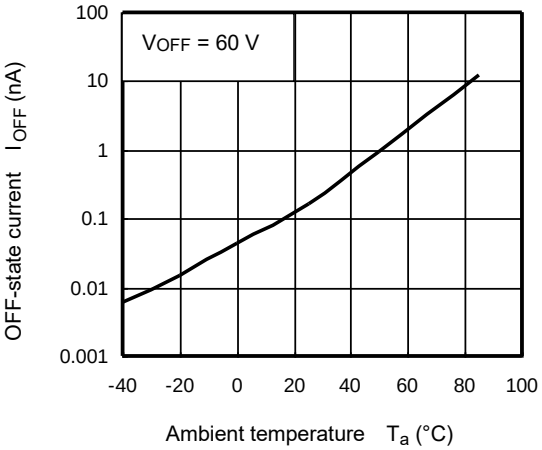


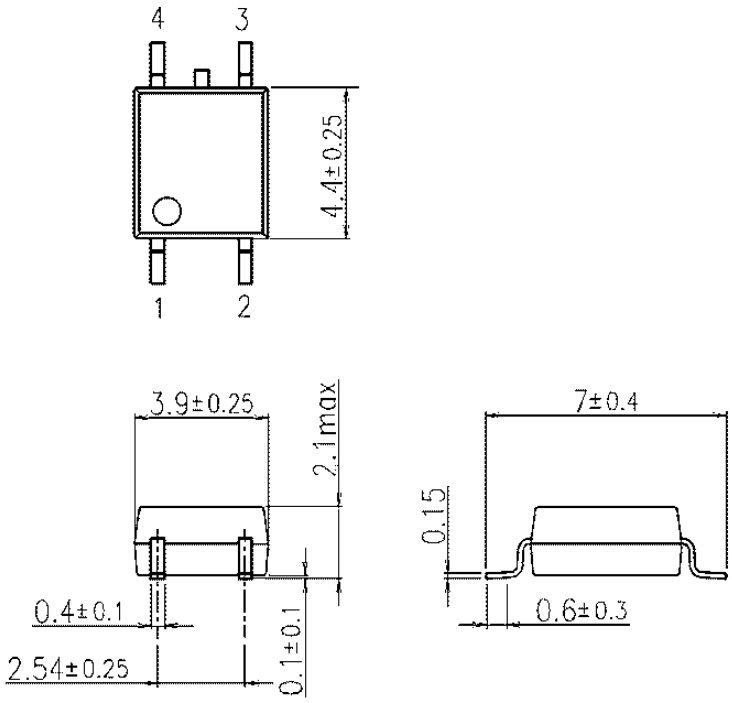
Fig.12.9 I_{OFF} – T_a

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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