

Photocouplers Photorelay

# TLP171GA

## 1. Applications

- Mechanical relay replacements
- Security Systems
- Private Branch Exchanges (PBXs)
- Set-Top Boxes (STBs)
- Measuring Instruments

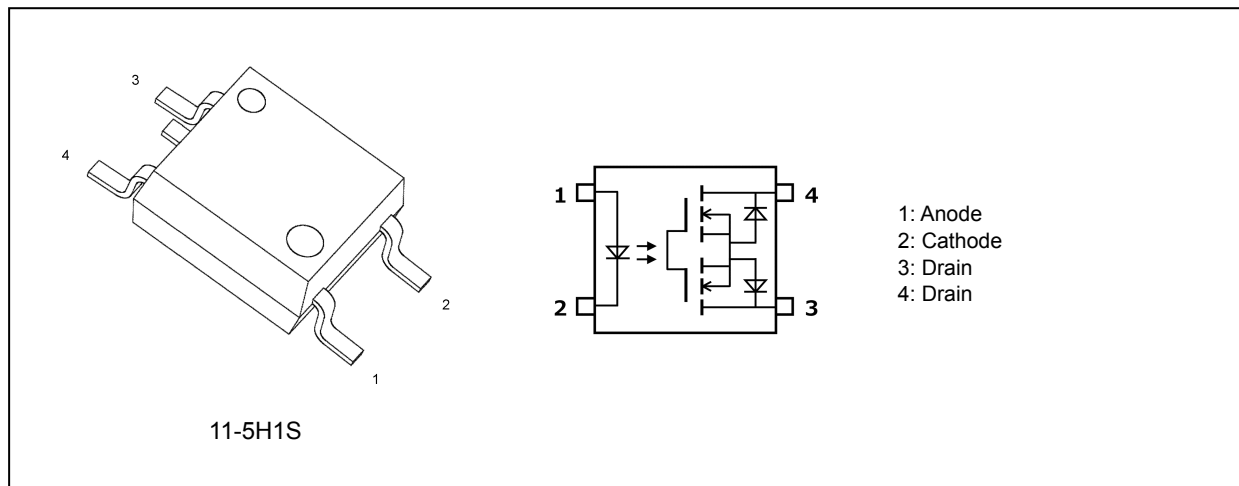
## 2. General

The TLP171GA photorelay consists of a photo MOSFET optically coupled to an infrared LED. It is housed in a 4-pin package with 2.54-mm lead pitch and 2.1-mm height. This photorelay requires 0.2 mA of LED current to turn it on. It is suitable for applications that need electrical power savings.

## 3. Features

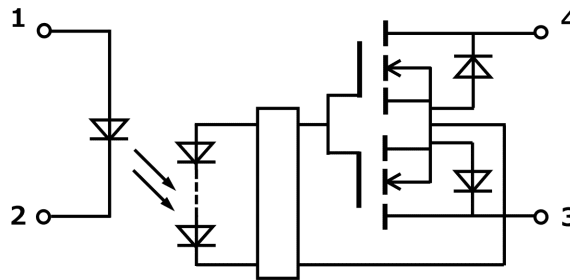
- (1) Package: SOP(2.54SOP4) (Height 2.1 mm, pitch 2.54 mm)
- (2) Normally opened (1-Form-A)
- (3) OFF-state output terminal voltage: 400 V (min)
- (4) Trigger LED current: 0.1 mA (max)( $t \leq 1s$ )  
0.2 mA (max)( $t > 1s$ )
- (5) ON-state current: 100 mA (max)
- (6) ON-state resistance: 35  $\Omega$  (max)
- (7) Isolation voltage: 1500 Vrms (min)

## 4. Packaging and Pin Assignment



Start of commercial production  
2012-10

## 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 $\mu\text{s}$ 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	$V_{OFF}$		400	V
	ON-state current	$I_{ON}$		100	mA
	ON-state current derating ( $T_a \geq 25\text{ }^\circ\text{C}$ )	$\Delta I_{ON}/\Delta T_a$		-1.0	mA/ $^\circ\text{C}$
	ON-state current (pulsed) ( $t = 100\text{ ms}$ )	$I_{ONP}$		300	mA
	Output power dissipation	$P_O$		300	mW
	Output power dissipation derating ( $T_a \geq 25\text{ }^\circ\text{C}$ )	$\Delta P_O/\Delta T_a$		-3.0	mW/ $^\circ\text{C}$
	Junction temperature	$T_j$		125	$^\circ\text{C}$
Common	Storage temperature	$T_{stg}$		-55 to 125	
	Operating temperature	$T_{opr}$		-40 to 85	
	Lead soldering temperature (10 s)	$T_{sol}$		260	$^\circ\text{C}$
	Isolation voltage AC, 60 s, R.H. $\leq 60\%$ , $T_a = 25\text{ }^\circ\text{C}$	$BV_S$	(Note 1)	1500	V <sub>rms</sub>

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	$V_{DD}$		—	—	320	V
Input forward current	$I_F$		—	0.5	25	mA
ON-state current	$I_{ON}$		—	—	80	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 (Unless otherwise specified, $T_a = 25\text{ }^\circ\text{C}$ )

	Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
LED	Input forward voltage	$V_F$		$I_F = 10\text{ mA}$	1.1	1.27	1.4	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	$I_{OFF}$		$V_{OFF} = 400\text{ V}$	—	1	1000	nA
	Output capacitance	$C_{OFF}$		$V = 0\text{ V}, f = 1\text{ MHz}$	—	70	—	pF

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

	Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Trigger LED current		$I_{FT}$		$I_{ON} = 100\text{ mA}, t \leq 1\text{ s}$	—	0.02	0.1	mA
				$I_{ON} = 100\text{ mA}, t > 1\text{ s}$	—	—	0.2	mA
Return LED current		$I_{FC}$		$I_{OFF} = 100\text{ }\mu\text{A}$	—	0.001	—	mA
ON-state resistance		$R_{ON}$		$I_{ON} = 100\text{ mA}, I_F = 0.5\text{ mA}, t < 1\text{ s}$	—	18	35	$\Omega$

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

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

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 (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. $R_L = 200\text{ }\Omega, V_{DD} = 20\text{ V}, I_F = 0.5\text{ mA}$	—	2	10	ms
				See Fig. 11.1. $R_L = 200\text{ }\Omega, V_{DD} = 20\text{ V}, I_F = 1.0\text{ mA}$	—	1	5	
Turn-off time		$t_{OFF}$		See Fig. 11.1. $R_L = 200\text{ }\Omega, V_{DD} = 20\text{ V}, I_F = 0.5\text{ mA}$	—	1	5	
				See Fig. 11.1. $R_L = 200\text{ }\Omega, V_{DD} = 20\text{ V}, I_F = 1.0\text{ mA}$	—	1	5	

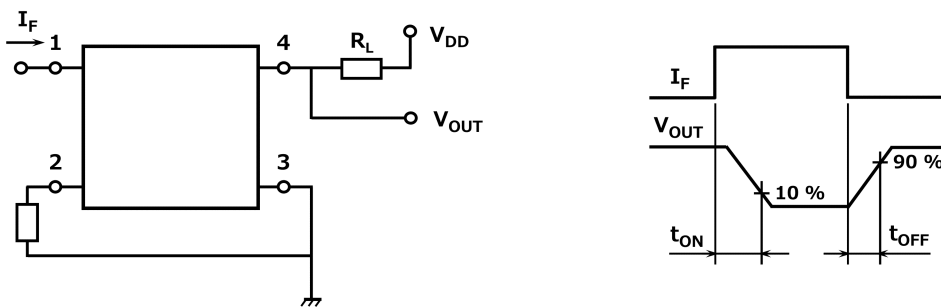


Fig. 11.1 Switching Time Test Circuit and Waveform

## 12. Characteristics Curves

### 12.1. Characteristics Curves (Note)

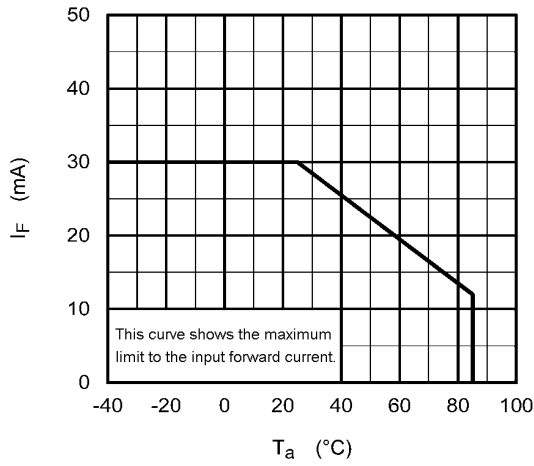


Fig. 12.1.1 I<sub>F</sub> - T<sub>a</sub>

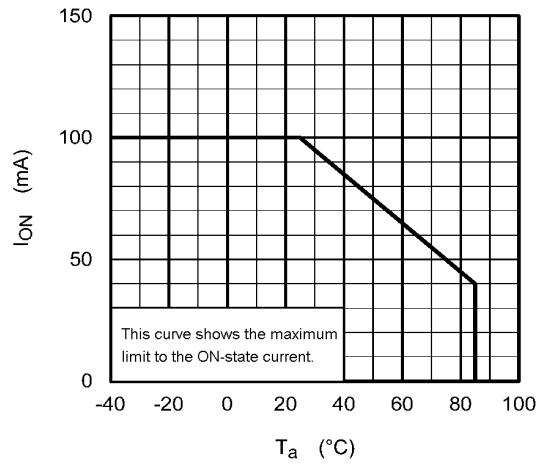


Fig. 12.1.2 I<sub>ON</sub> - T<sub>a</sub>

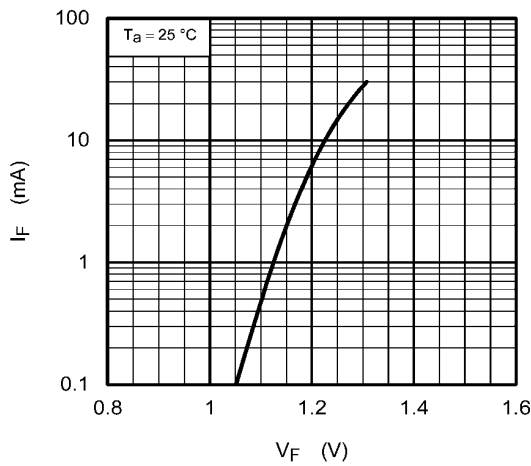


Fig. 12.1.3 I<sub>F</sub> - V<sub>F</sub>

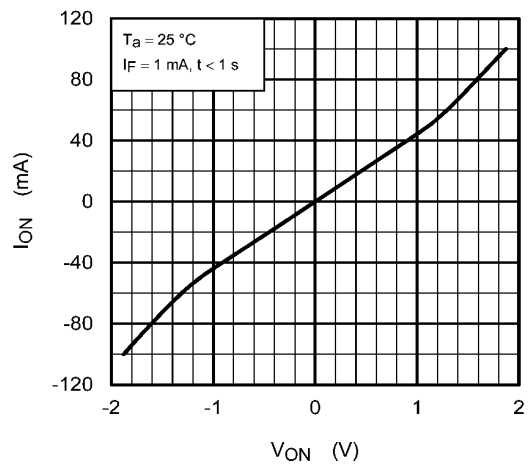


Fig. 12.1.4 I<sub>ON</sub> - V<sub>ON</sub>

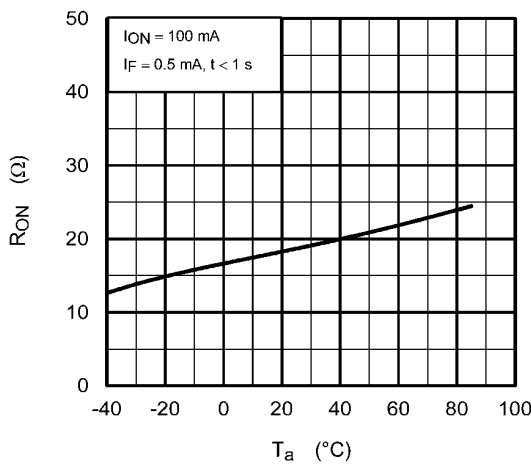


Fig. 12.1.5 R<sub>ON</sub> - T<sub>a</sub>

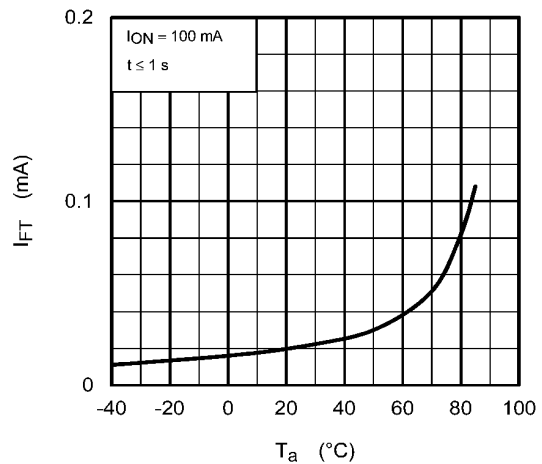


Fig. 12.1.6 I<sub>FT</sub> - T<sub>a</sub>

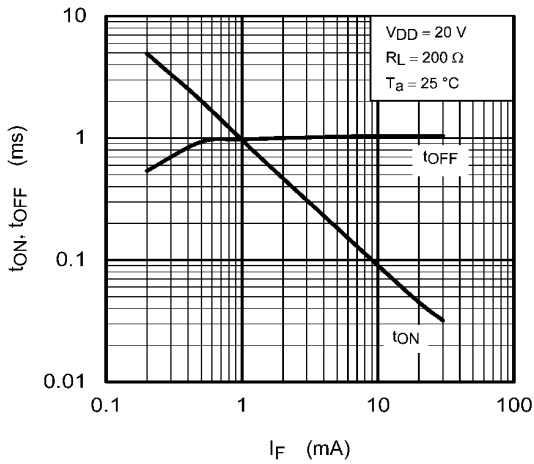


Fig. 12.1.7  $t_{ON}$ ,  $t_{OFF}$  -  $I_F$

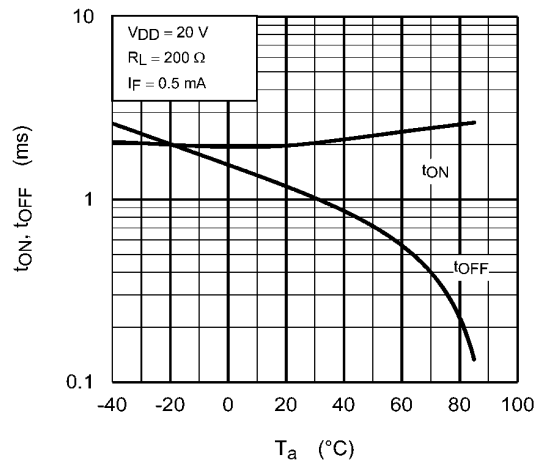


Fig. 12.1.8  $t_{ON}$ ,  $t_{OFF}$  -  $T_a$

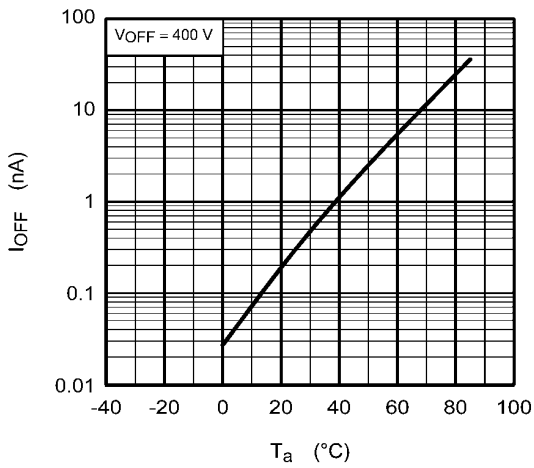


Fig. 12.1.9  $I_{OFF}$  -  $T_a$

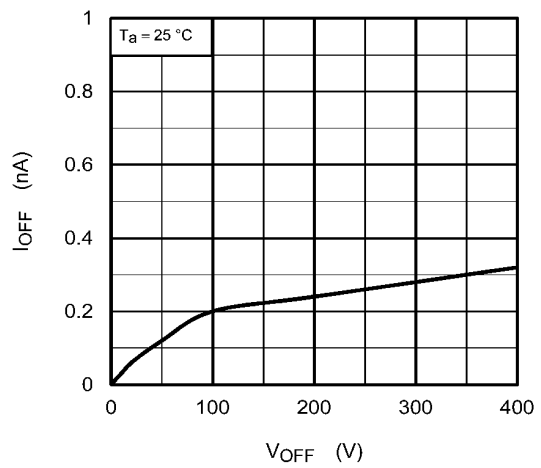
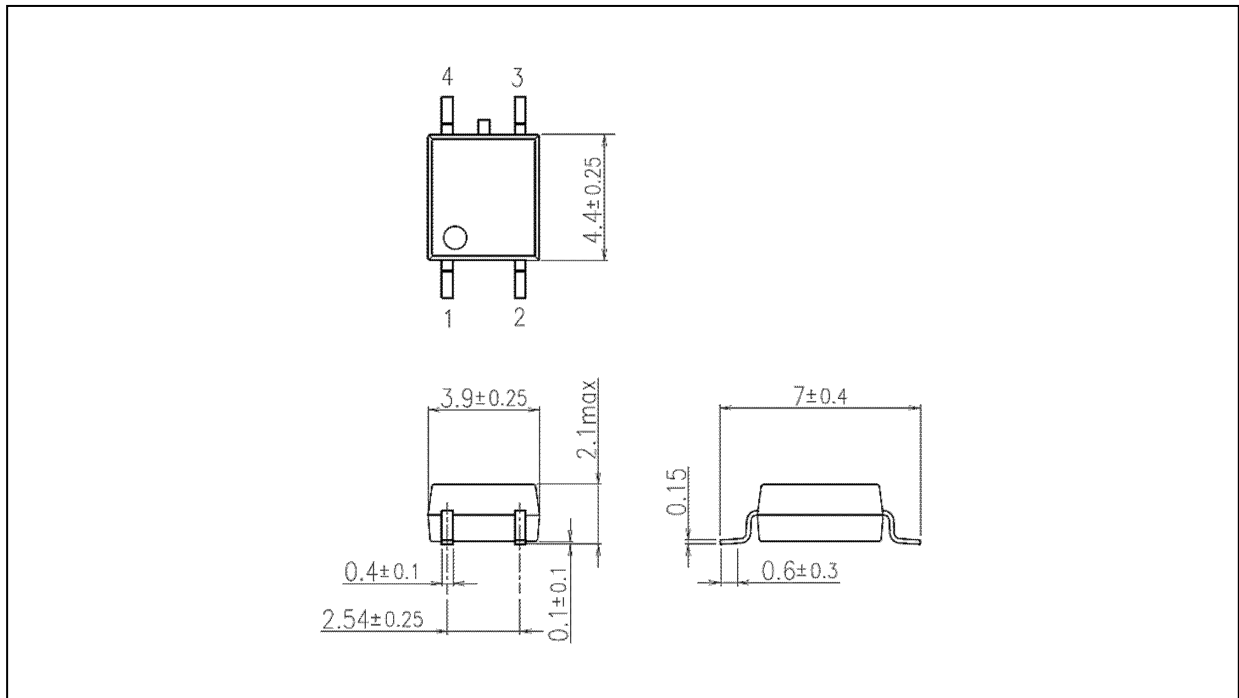


Fig. 12.1.10  $I_{OFF}$  -  $V_{OFF}$

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

## Package Dimensions

Unit: mm



Weight: 0.1 g (typ.)

Package Name(s)
TOSHIBA: 11-5H1S

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