

Photocouplers Photorelay

TLP176GA

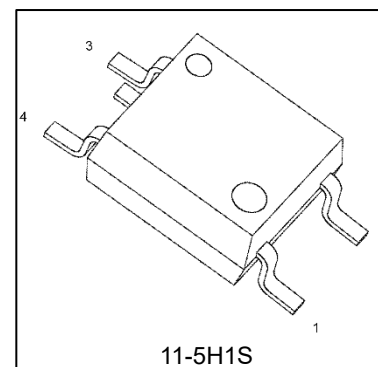
1. Description

The Toshiba TLP176GA consists of an infrared emitting diode optically coupled to a photo-MOSFET in a 4-pin SOP package.

This photorelay is suitable for replacement of mechanical relays in many applications which require space savings.

2. Applications

Mechanical relay replacements
Measuring Instruments
Data Acquisition Systems
Factory Automation (FA)



Weight: 0.1 g (typ.)

3. Features

- Package : SOP (2.54SOP4) (Height 2.1 mm, pitch 2.54 mm)
- Normally opened (1-Form-A)
- OFF-state output terminal voltage: 400 V (min)
- Trigger LED current: 3 mA (max)
- ON-state current: 120 mA (max)
- ON-state resistance: 35 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
2001-06

4. Pin Assignment

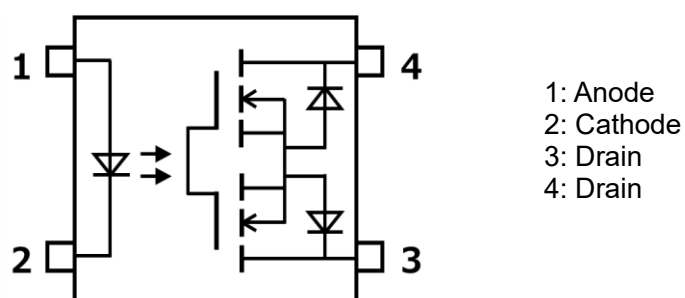


Figure 4.1 Pin Assignment

5. Internal Circuit

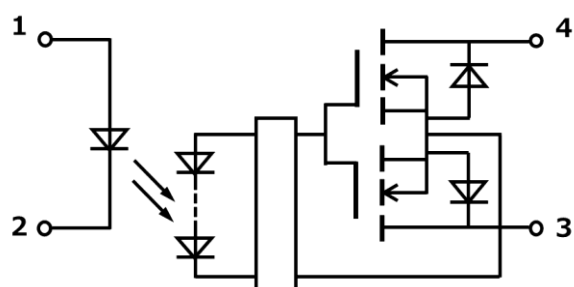


Figure 5.1 Internal Circuit

6. Absolute Maximum Ratings (Note)

(T_a = 25°C unless otherwise specified)

	Characteristics	Symbol	Note	Rating	Unit
LED	Input forward current	I _F		50	mA
	Input forward current derating (T _a ≥ 25 °C)	ΔI _F /ΔT _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 ≥ 25 °C)	ΔP _D /ΔT _a		-0.5	mW/°C
	Junction temperature	T _j		125	°C
Detector	OFF-state output terminal voltage	V _{OFF}		400	V
	ON-state current	I _{ON}		120	mA
	ON-state current derating (T _a ≥ 25 °C)	ΔI _{ON} /ΔT _a		-1.2	mA/°C
	Output power dissipation	P _O		350	mW
	Output power dissipation derating (T _a ≥ 25 °C)	ΔP _O /ΔT _a		-3.5	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}		—	—	320	V
Input forward current	I _F		5	7.5	25	mA
ON-state current	I _{ON}		—	—	120	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

($T_a = 25^\circ\text{C}$ 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	μA
	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	μA
	Output capacitance	C_{OFF}		$V = 0\text{ V}, f = 1\text{ MHz}$	—	70	—	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_{FT}		$I_{ON} = 120\text{ mA}$	—	1	3	mA
Return LED current	I_{FC}		$I_{OFF} = 100\text{ }\mu\text{A}$	0.1	—	—	mA
ON-state resistance	R_{ON}		$I_{ON} = 120\text{ mA}, I_F = 5\text{ mA}$	—	17	35	Ω

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)	$V_S = 500\text{ V}, \text{R.H.} \leq 60\%$	5×10^{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

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

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Turn-on time	t_{ON}		See Figure 11.1 $R_L = 200\text{ }\Omega, V_{DD} = 20\text{ V}, I_F = 5\text{ mA}$	—	0.3	1	ms
Turn-off time	t_{OFF}		See Figure 11.1 $R_L = 200\text{ }\Omega, V_{DD} = 20\text{ V}, I_F = 5\text{ mA}$	—	0.1	1	

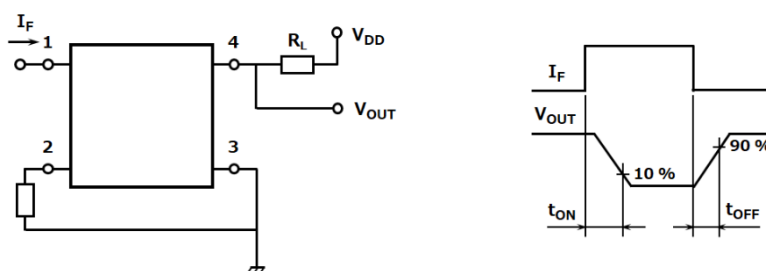


Figure 11.1 Switching Time Test Circuit and Waveform

12. Characteristics Curves and Circuit Connections (Note)

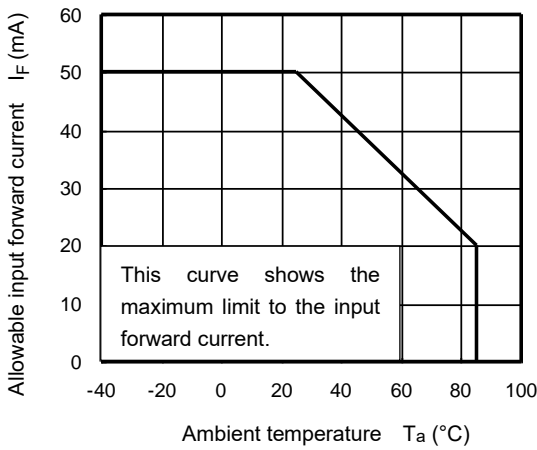


Fig.12.1 $I_F - T_a$

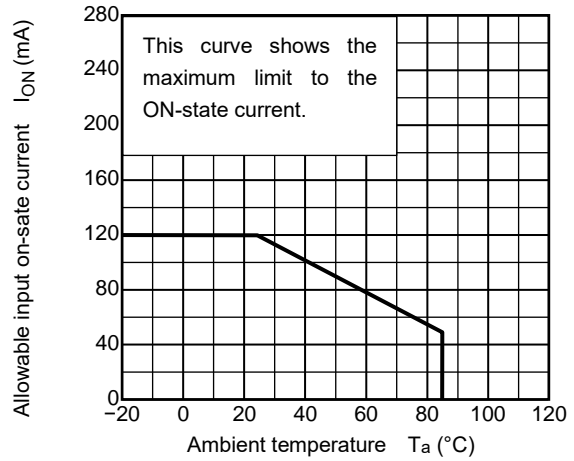


Fig.12.2 $I_{ON} - T_a$

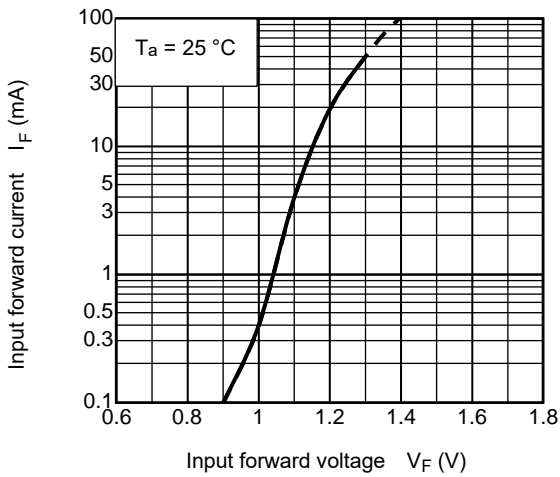


Fig.12.3 $I_F - V_F$

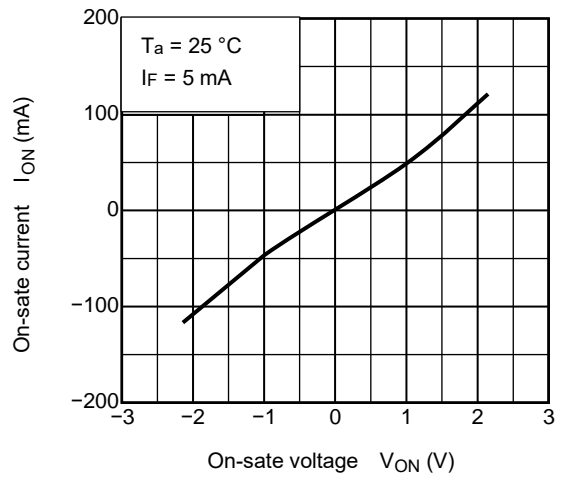


Fig.12.4 $I_{ON} - V_{ON}$

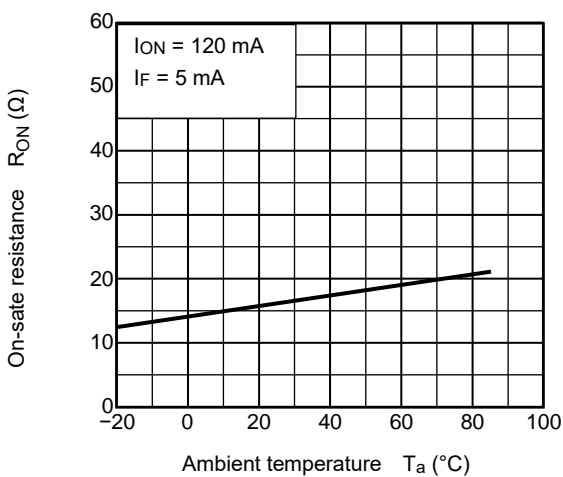


Fig.12.5 $R_{ON} - T_a$

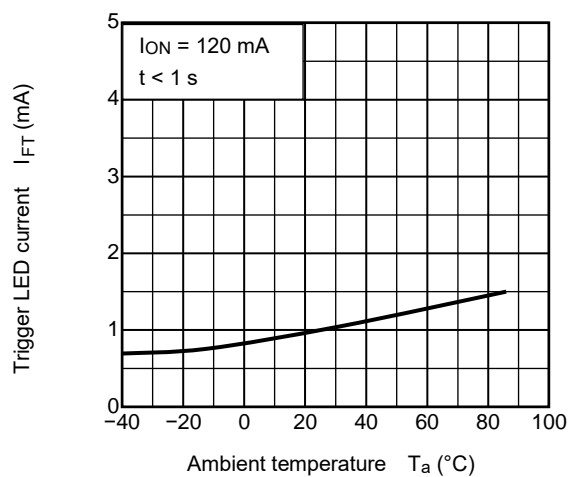


Fig.12.6 $I_{FT} - T_a$

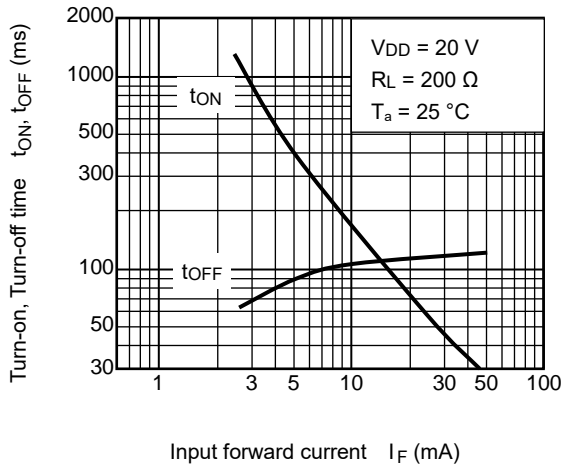


Fig.12.7 t_{ON} , $t_{OFF} - I_F$

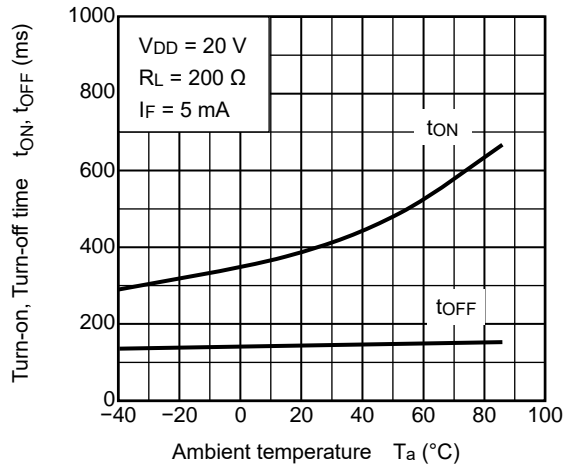


Fig.12.8 t_{ON} , $t_{OFF} - T_a$

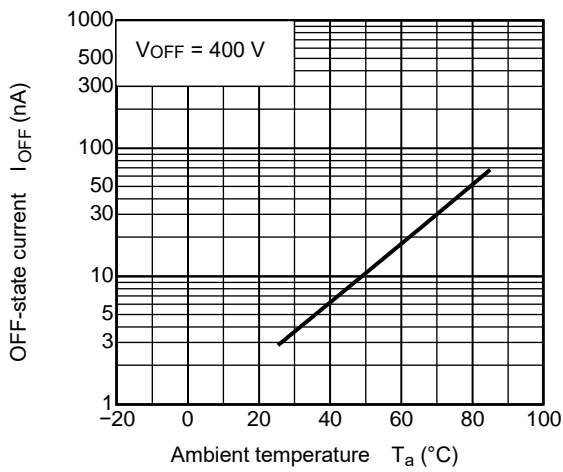


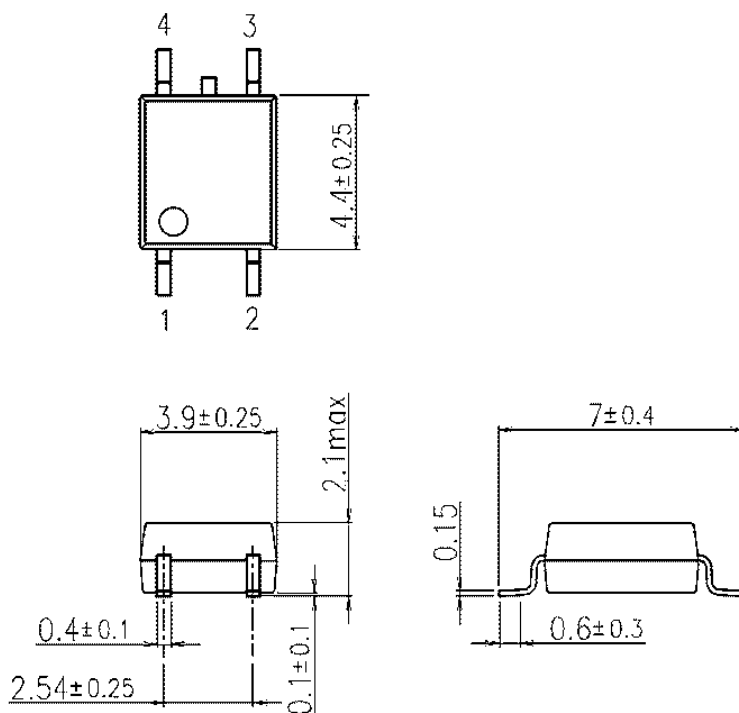
Fig.12.9 $I_{OFF} - T_a$

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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