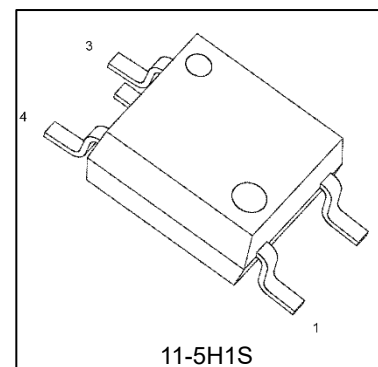


TLP176GA

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.



Weight: 0.1 g (typ.)

2. Applications

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

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

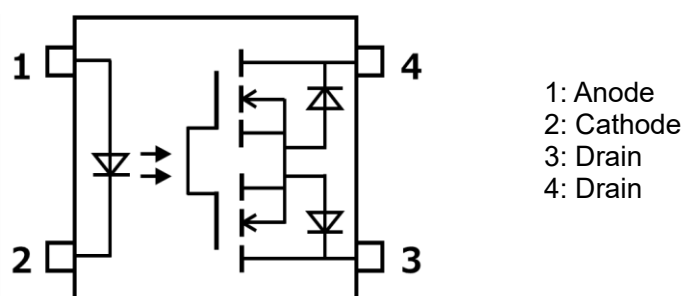


Figure 4.1 Pin Assignment

5. Internal Circuit

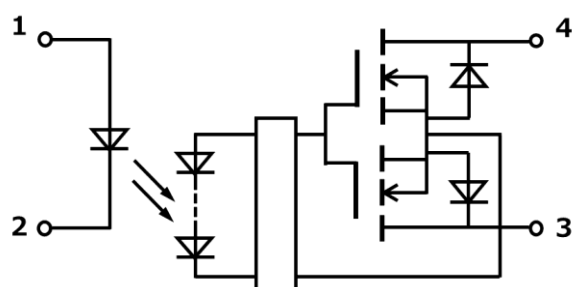


Figure 5.1 Internal Circuit

6. Absolute Maximum Ratings (Note)

($T_a = 25^\circ\text{C}$ 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 μs 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}		400	V
	ON-state current	I_{ON}		120	mA
	ON-state current derating ($T_a \geq 25^\circ\text{C}$)	$\Delta I_{ON} / \Delta T_a$		-1.2	mA/ $^\circ\text{C}$
	Output power dissipation	P_O		350	mW
	Output power dissipation derating ($T_a \geq 25^\circ\text{C}$)	$\Delta P_O / \Delta T_a$		-3.5	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}		—	—	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	$^\circ\text{C}$

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	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	

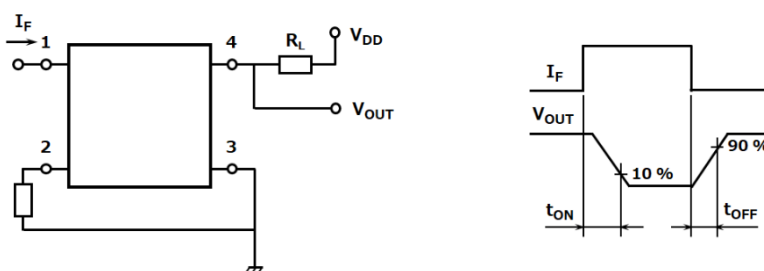


Figure 11.1 Switching Time Test Circuit and Waveform

12. Characteristics Curves and Circuit Connections (Note)

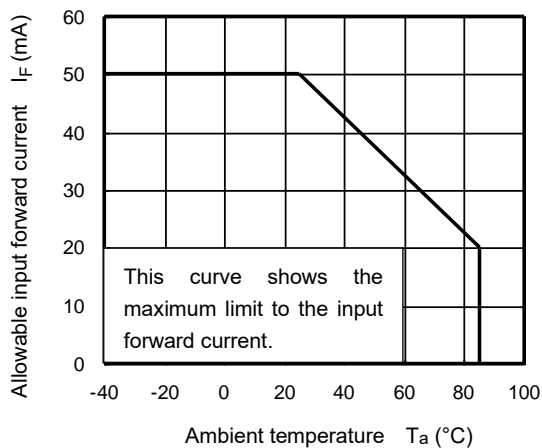


Fig.12.1 $I_F - T_a$

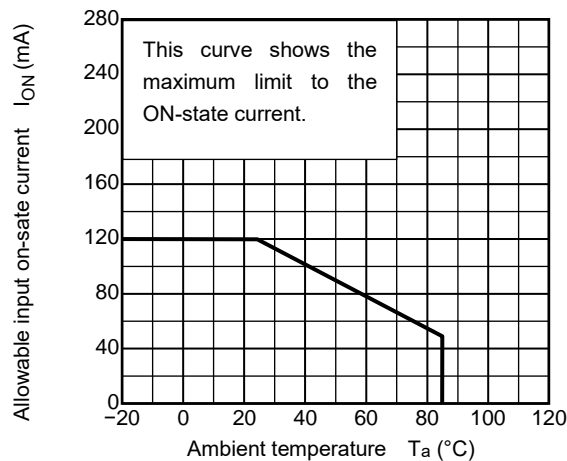


Fig.12.2 $I_{ON} - T_a$

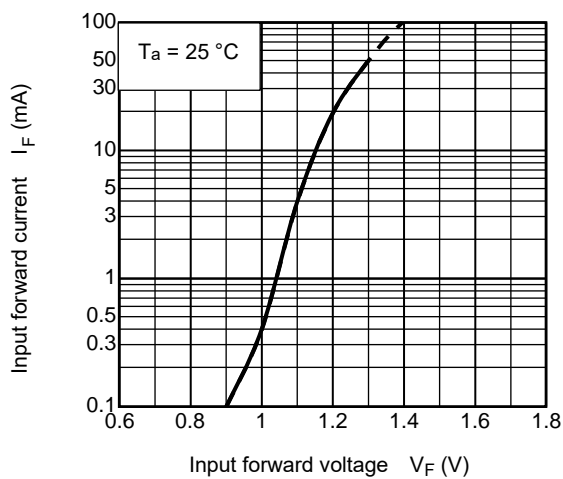


Fig.12.3 $I_F - V_F$

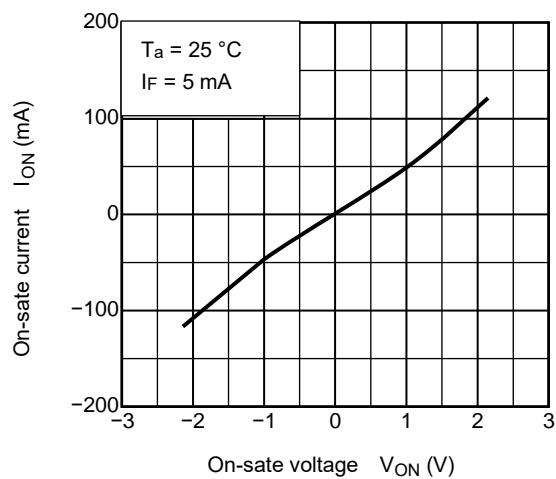


Fig.12.4 $I_{ON} - V_{ON}$

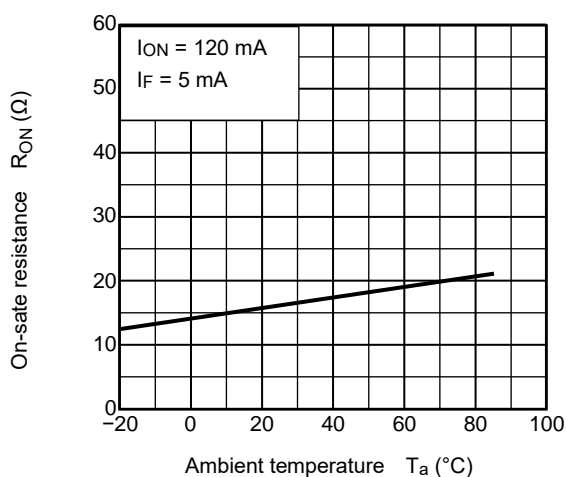


Fig.12.5 $R_{ON} - T_a$

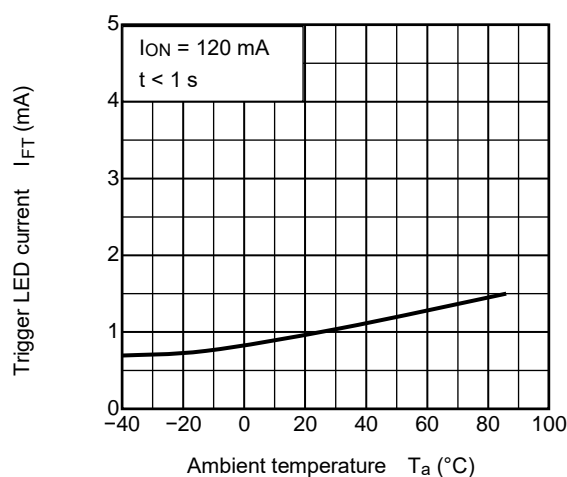


Fig.12.6 $I_{FT} - T_a$

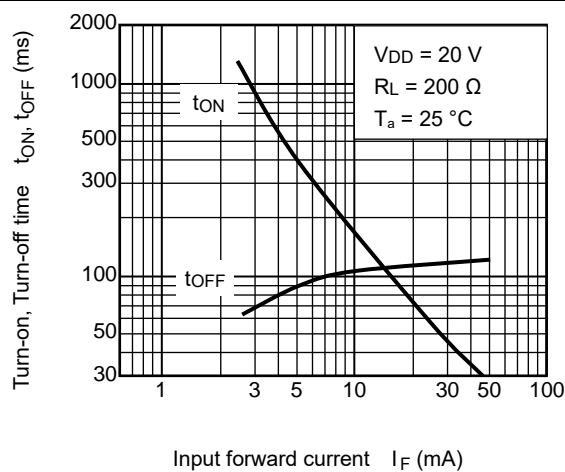


Fig.12.7 t_{ON} , $t_{OFF} - I_F$

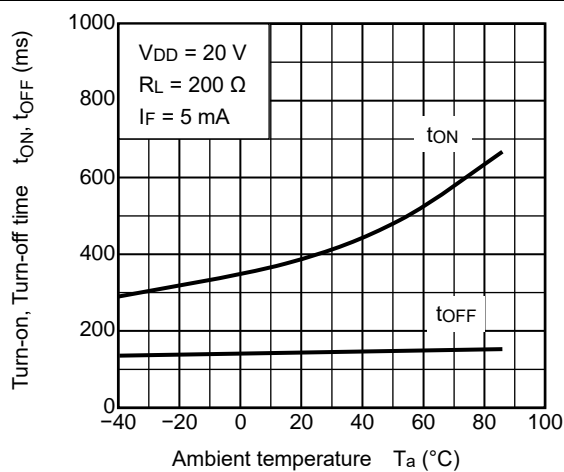


Fig.12.8 t_{ON} , $t_{OFF} - T_a$

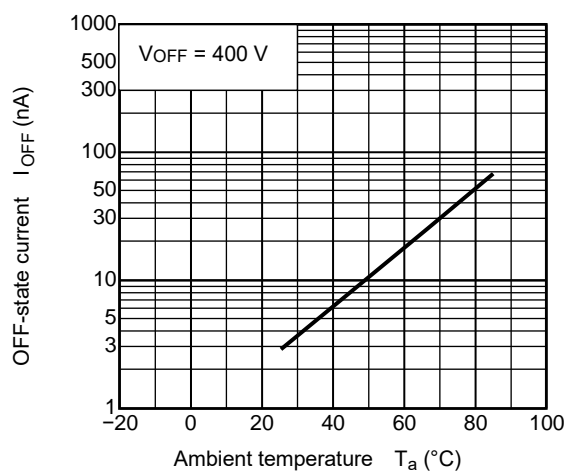


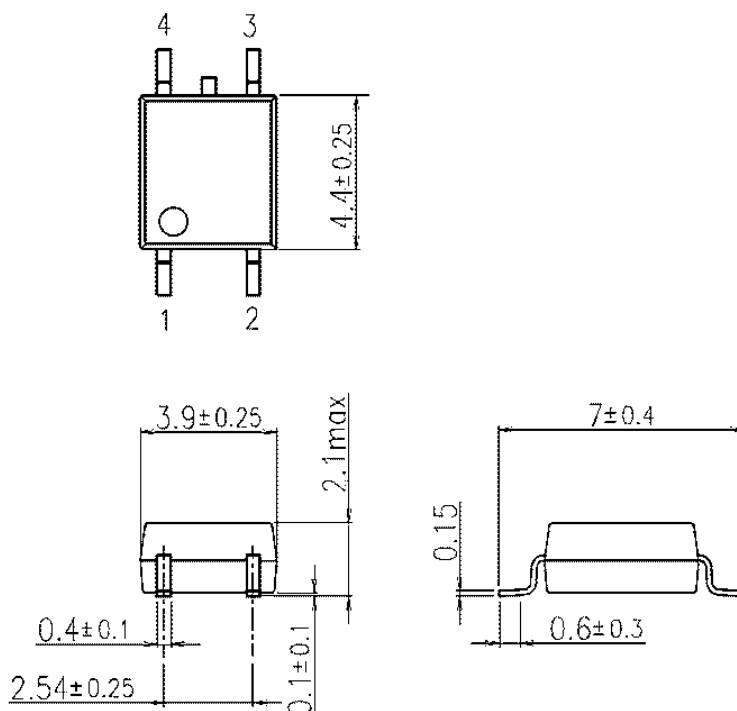
Fig.12.9 $I_{OFF} - T_a$

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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