Photocouplers Photorelay

TLX9176J

1. Applications

- Battery Control in Automotive Equipment
- Fuel Battery Control in Automotive Equipment
- Application for Electrical Vehicle

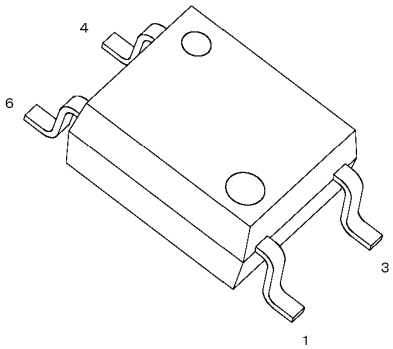
2. General

The Toshiba TLX9176J consists of an infrared LED optically coupled to a photo-MOSFET in a SO6 package.
This coupler uses high voltage MOSFET between output terminals.
It adequate for the applications of Battery Control Systems.
In addition, avalanche current is guaranteed under room temperature conditions, making the device suitable for automotive ground fault detection applications.
Compared to the TLX9175J, the ESD protection function has been improved by revising the device structure.

3. Features

(1) Normally opened (1-Form-A)
(2) Peak off-state voltage: 600 V (min)
(3) Trigger LED current: 3 mA (max)
(4) ON-state current: 15 mA (max)
(5) ON-state resistance: 400 Ω (max)(@t<1s)
(6) Isolation voltage: 3750 Vrms (min)
(7) AEC-Q101 qualified

4. Packaging and Pin Assignment



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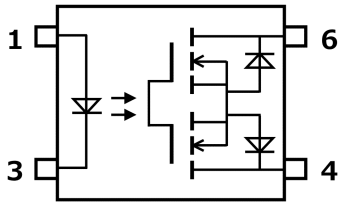
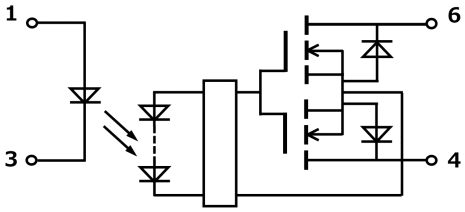


1: Anode
3: Cathode
4: Drain
6: Drain

Start of commercial production
2026-04

5. Internal Circuit



6. Absolute Maximum Ratings (Note) (Unless otherwise specified, T_a = 25 °C)

	Characteristics		Symbol	Note	Rating	Unit
LED	Input forward current		I_F		25	mA
	Input forward current derating	($T_a \geq$ 70 °C)	$\Delta I_F/\Delta T_a$		-0.18	mA/°C
	Input reverse voltage		V_R		5	V
	Input power dissipation		P_D		50	mW
	Input power dissipation derating	($T_a \geq$ 70 °C)	$\Delta P_D/\Delta T_a$		-0.61	mW/°C
	Junction temperature		T_j		125	°C
Detector	OFF-state output terminal voltage		V_{OFF}		600	V
	ON-state current	T_a = 25 °C	I_{ON}		15	mA
		T_a = 85 °C			11	
		T_a = 105 °C			7	
	ON-state current derating	$T_a \geq$ 60 °C	$\Delta I_{ON}/\Delta T_a$		-0.16	mA/°C
		$T_a \geq$ 85 °C			-0.2	
	ON-state current (Peak)	T_a = 25 °C	I_{ONpk}	(Note 1)	80	mA
		T_a = 85 °C			50	
		T_a = 105 °C			25	
	Avalanche current		I_{AV}	(Note 2)	0.6	mA
	Output power dissipation		P_O		90	mW
	Output power dissipation derating	($T_a \geq$ 70 °C)	$\Delta P_O/\Delta T_a$		-0.9	mW/°C
	Junction temperature		T_j		125	°C
Common	Storage temperature		T_{stg}		-55 to 125	
	Operating temperature		T_{opr}		-55 to 105	
	Lead soldering temperature	(10 s)	T_{sol}		260	
	Isolation voltage	(AC, 60 s, R.H. ≤ 60%)	BV_S	(Note 3)	3750	Vrms

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: Exponential curve, pulse width < 1 ms, f ≤ 150 Hz

Note 2: 1min (max continuous), Duty cycle=0.1 %, 5 time over lifetime.

Note 3: This device is considered as a two-terminal device: Pins 1 and 3 are shorted together, and pins 4 and 6 are shorted together.

7. Recommended Operating Conditions (Note)

Characteristics	Symbol	Min	Typ.	Max	Unit
Supply voltage	V_{DD}	—	—	450	V
Input forward current	I_F	10	12	20	mA
ON-state current	I_{ON}	—	—	10	mA
Operating temperature	T_{opr}	-40	—	85	°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 °C)

	Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
LED	Input forward voltage	V_F	I_F = 10 mA	1.5	1.65	1.8	V
			I_F = 10 mA, T_a = -40 to 105 °C	1.4	—	1.95	
	Input reverse current	I_R	V_R = 5 V,	—	—	10	μA
	Input capacitance	C_t	V = 0 V, f = 1 MHz	—	45	—	pF
Detector	OFF-state current	I_{OFF}	V_{OFF} = 600 V, T_a = 25 °C	—	10	50	nA
			V_{OFF} = 600 V, T_a = 85 °C	—	—	250	
			V_{OFF} = 600 V, T_a = 105 °C	—	—	400	
	Output capacitance	C_{OFF}	V = 0 V, f = 1 MHz	—	8.0	—	pF

9. Coupled Electrical Characteristics

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Trigger LED current	I_{FT}	I_{ON} = 15 mA, T_a = 25 °C, t = 10 ms	—	—	3	mA
		I_{ON} = 11 mA, T_a = -40 to 85 °C, t = 10 ms	—	—	5	
		I_{ON} = 7 mA, T_a = -40 to 105 °C, t = 10 ms	—	—	8	
Return LED current	I_{FC}	I_{OFF} = 100 μA, T_a = 25 °C, t = 40 ms	0.1	—	—	mA
		I_{OFF} = 100 μA, T_a = -40 to 85 °C, t = 40 ms	0.05	—	—	
		I_{OFF} = 100 μA, T_a = -40 to 105 °C, t = 40 ms	0.05	—	—	
ON-state resistance	R_{ON}	I_{ON} = 15 mA, I_F = 10mA, T_a = 25 °C, t < 1 s	200	—	400	Ω
		I_{ON} = 11 mA, I_F = 10mA, T_a = 85°C, t < 1 s	380	—	610	
		I_{ON} = 7 mA, I_F = 10mA, T_a = 105 °C, t < 1 s	440	—	710	
		I_{ON} = 15 mA, I_F = 10mA, T_a = 25°C, t > 60 s	—	360	—	

10. Coupled Electrical Characteristics (T_a = 25 °C)

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	—	0.5	—	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	3750	—	—	Vrms

Note 1: This device is considered as a two-terminal device: Pins 1 and 3 are shorted together, and pins 4 and 6 are shorted together.

11. Switching Characteristics

Characteristics	Symbol	Test Condition	Test Condition	Min	Typ.	Max	Unit
Turn-on time	t_{ON}	I_F = 10 mA, R_L = 4 kΩ, V_{DD} = 20 V	T_a = 25 °C	—	—	0.2	ms
Turn-off time	t_{OFF}			—	—	0.2	
Turn-on time	t_{ON}		T_a = -40 to 105 °C	—	—	0.35	
Turn-off time	t_{OFF}			—	—	0.35	

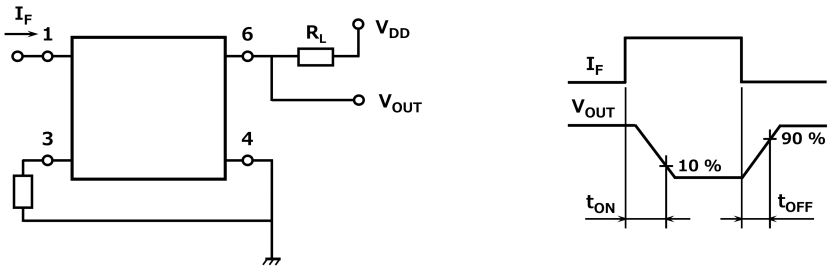


Fig. 11.1 Switching Time Test Circuit and Waveform

12. Characteristics Curves (Note)

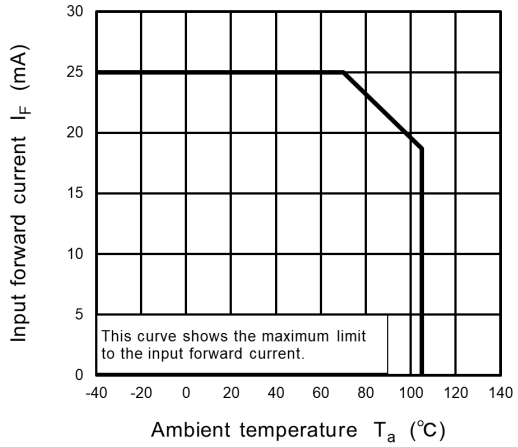


Fig. 12.1 I_F - T_a

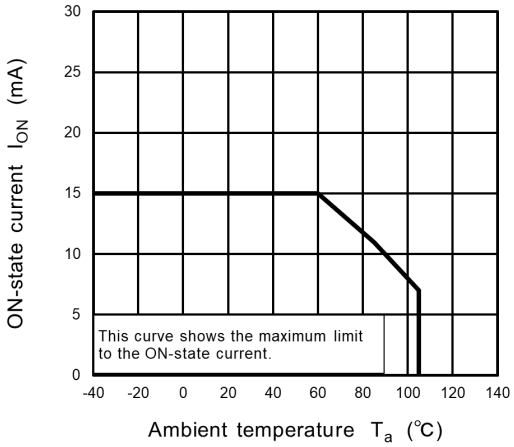


Fig. 12.2 I_{ON} - T_a

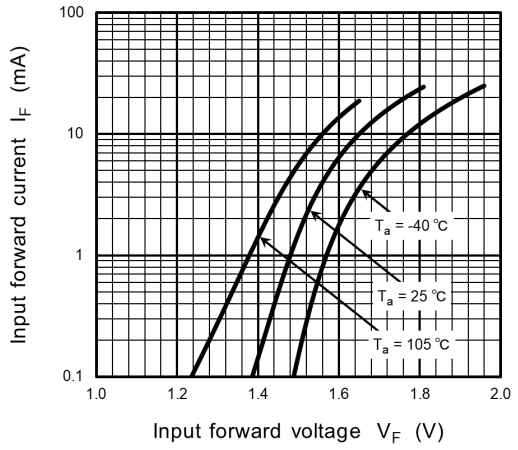


Fig. 12.3 I_F - V_F

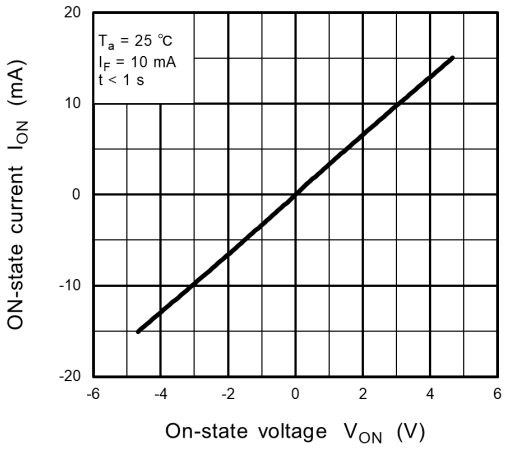


Fig. 12.4 V_{ON} - I_{ON}

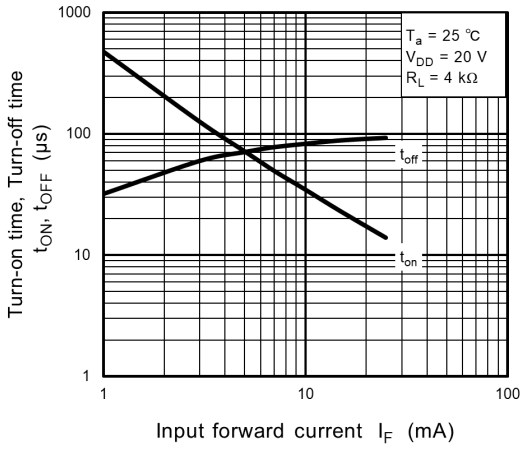


Fig. 12.5 t_{ON}, t_{OFF} - I_F

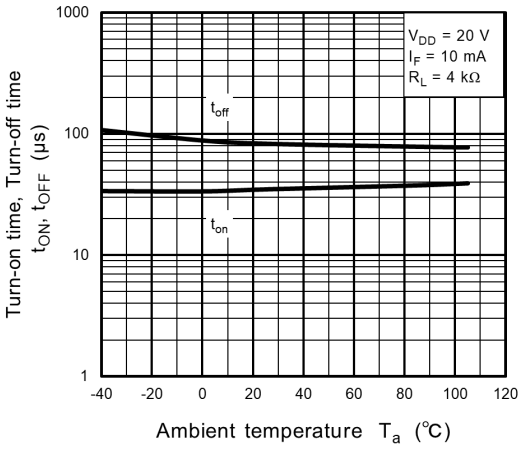


Fig. 12.6 t_{ON}, t_{OFF} - T_a

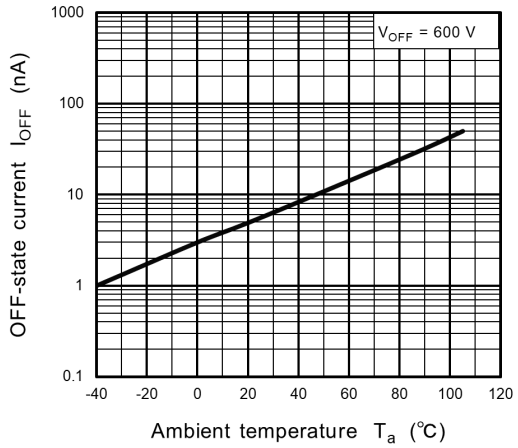
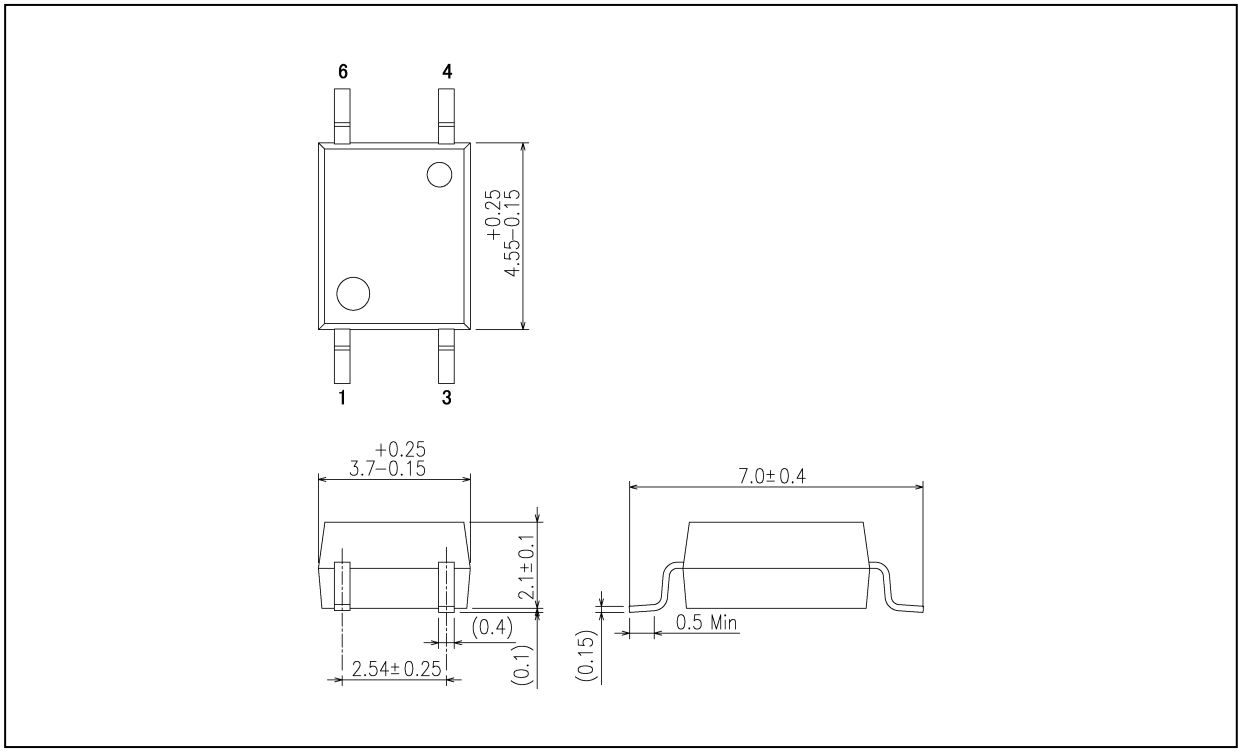


Fig. 12.7 I_{OFF} - T_a

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

Package Dimensions

Unit: mm



Weight: 0.08 g (typ.)

Package Name(s)
TOSHIBA: 11-4M1S

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