

TLP3109

1. Applications

- Mechanical relay replacements
- Security Systems
- Measuring Instruments
- Factory Automation (FA)
- Amusement Equipment

2. General

The TLP3109 photorelay consists of a photo MOSFET optically coupled to an infrared light emitting diode. It is housed in a 2.54SOP6 package. The low ON-state resistance and the high permissible ON-state current of the TLP3109 make it suitable for power line control applications.

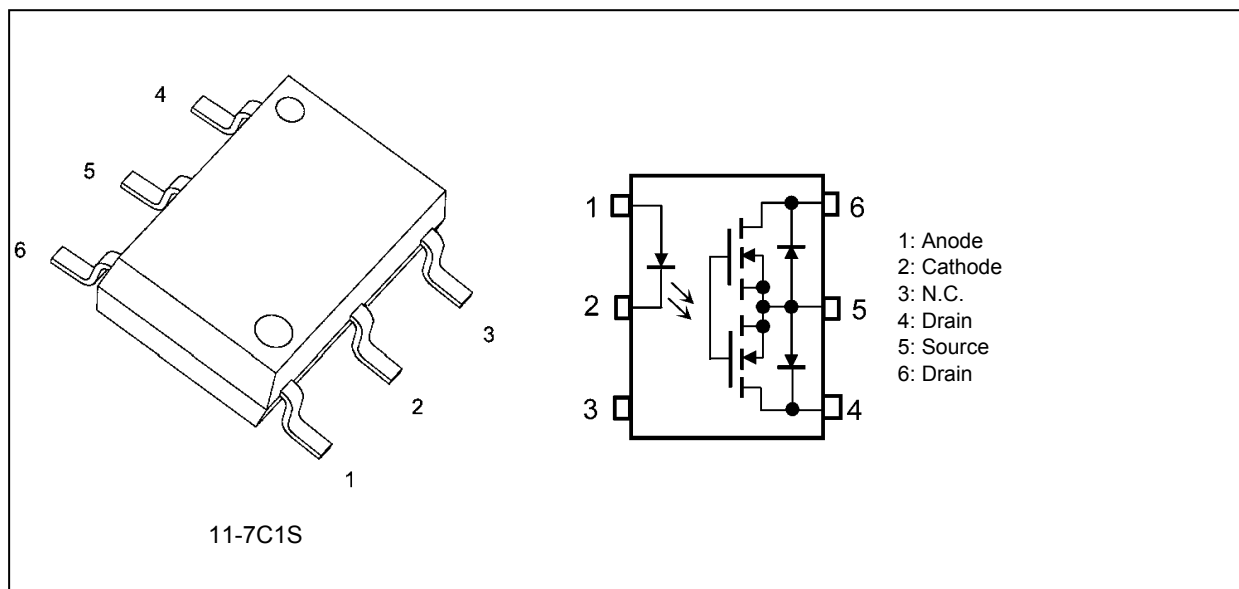
3. Features

- (1) Normally opened (1-Form-A)
- (2) OFF-state output terminal voltage: 100 V (min)
- (3) Trigger LED current: 3 mA (max)
- (4) ON-state current: 2.0 A (max) (A connection)
- (5) ON-state resistance: 70 mΩ (max) (A connection)
- (6) Isolation voltage: 1500 Vrms (min)
- (7) Safety standards

UL-approved: UL1577, File No.E67349

cUL-approved: CSA Component Acceptance Service No.5A File No.E67349

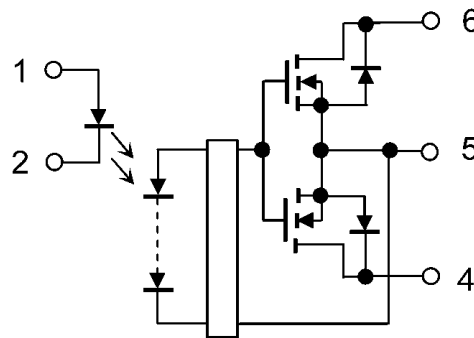
4. Packaging and Pin Assignment



Start of commercial production

2015-05

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 μs 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}		100	V
	ON-state current (A connection)	I_{ON}	(Note 1)	2.0	A
	ON-state current (B connection)	I_{ON}	(Note 1)	2.0	A
	ON-state current (C connection)	I_{ON}	(Note 1)	4.0	A
	ON-state current derating (A connection) ($T_a \geq 25\text{ }^\circ\text{C}$)	$\Delta I_{ON} / \Delta T_a$	(Note 1)	-20	mA/ $^\circ\text{C}$
	ON-state current derating (B connection) ($T_a \geq 25\text{ }^\circ\text{C}$)	$\Delta I_{ON} / \Delta T_a$	(Note 1)	-20	mA/ $^\circ\text{C}$
	ON-state current derating (C connection) ($T_a \geq 25\text{ }^\circ\text{C}$)	$\Delta I_{ON} / \Delta T_a$	(Note 1)	-40	mA/ $^\circ\text{C}$
	ON-state current (pulsed) ($t = 100\text{ ms}$, Duty = 1/10)	I_{ONP}		6	A
	Output power dissipation	P_O		400	mW
	Output power dissipation derating ($T_a \geq 25\text{ }^\circ\text{C}$)	$\Delta P_O / \Delta T_a$		-4.0	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 2)	1500	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: For an application circuit example, see Chapter 12.2.

Note 2: This device is considered as a two-terminal device: Pins 1, 2 and 3 are shorted together, and pins 4, 5 and 6 are shorted together.

7. Recommended Operating Conditions (Note)

Characteristics	Symbol	Note	Min	Typ.	Max	Unit
Supply voltage	V_{DD}		—	—	80	V
Input forward current	I_F		5	10	25	mA
ON-state current (A connection)	I_{ON}		—	—	2.0	A
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 (Unless otherwise specified, $T_a = 25\text{ °C}$)

	Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
LED	Input forward voltage	V_F		$I_F = 10\text{ mA}$	1.18	1.33	1.48	V
	Input reverse current	I_R		$V_R = 5\text{ V}$	—	—	10	μA
	Input capacitance	C_t		$V = 0\text{ V}, f = 1\text{ MHz}$	—	70	—	pF
Detector	OFF-state current	I_{OFF}		$V_{OFF} = 100\text{ V}$	—	—	1	μA
				$V_{OFF} = 80\text{ V}$	—	—	20	nA
	Output capacitance	C_{OFF}		$V = 0\text{ V}, f = 1\text{ MHz}$	—	500	—	pF

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

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Trigger LED current	I_{FT}		$I_{ON} = 100\text{ mA}$	—	0.4	3	mA
Return LED current	I_{FC}		$I_{OFF} = 10\text{ }\mu\text{A}$	0.1	—	—	
ON-state resistance (A connection)	R_{ON}	(Note 1)	$I_{ON} = 2.0\text{ A}, I_F = 5\text{ mA}, t < 1\text{ s}$	—	45	70	m Ω
ON-state resistance (B connection)				—	22	35	
ON-state resistance (C connection)				—	11	18	

Note 1: For an application circuit example, see Chapter 12.2.

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

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)	$V_S = 500\text{ V}, R.H. \leq 60\%$	5×10^{10}	10^{14}	—	Ω
Isolation voltage	BV_S	(Note 1)	AC, 60 s	1500	—	—	Vrms
			AC, 1 s in oil	—	3000	—	
			DC, 60 s, in oil	—	3000	—	Vdc

Note 1: This device is considered as a two-terminal device: Pins 1, 2 and 3 are shorted together, and pins 4, 5 and 6 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. $R_L = 200\ \Omega$, $V_{DD} = 20\ \text{V}$, $I_F = 5\ \text{mA}$	—	1.1	5.0	ms
			See Fig. 11.1. $R_L = 200\ \Omega$, $V_{DD} = 20\ \text{V}$, $I_F = 10\ \text{mA}$	—	0.6	3.0	
Turn-off time	t_{OFF}		See Fig. 11.1. $R_L = 200\ \Omega$, $V_{DD} = 20\ \text{V}$, $I_F = 5\ \text{mA}$	—	0.1	1.0	
			See Fig. 11.1. $R_L = 200\ \Omega$, $V_{DD} = 20\ \text{V}$, $I_F = 10\ \text{mA}$	—	0.1	1.0	

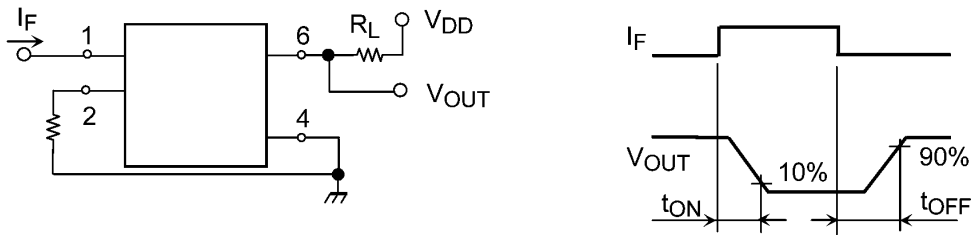


Fig. 11.1 Switching Time Test Circuit and Waveform

12. Characteristics Curves and Circuit Connections

12.1. Characteristics Curves (Note)

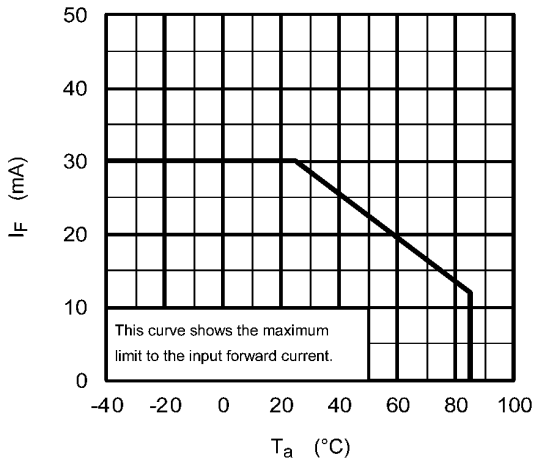


Fig. 12.1.1 $I_F - T_a$

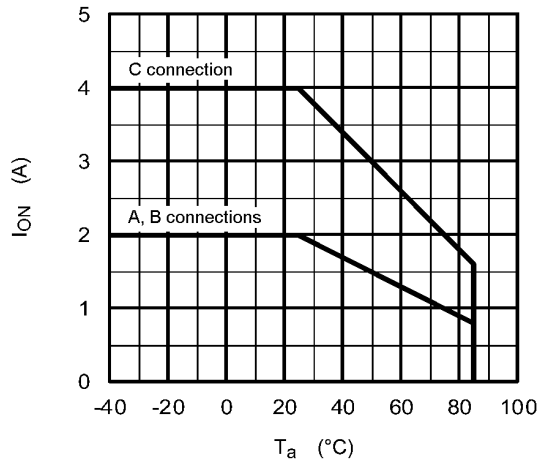


Fig. 12.1.2 $I_{ON} - T_a$

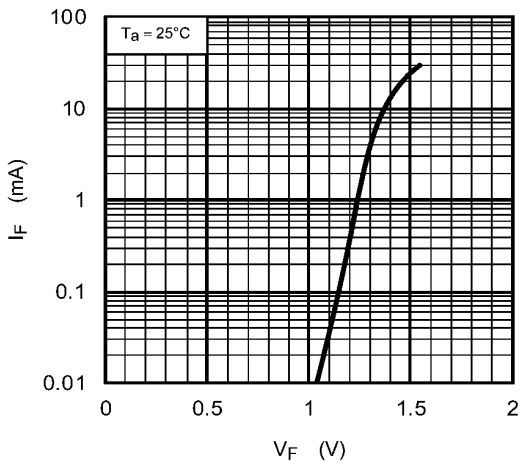


Fig. 12.1.3 $I_F - V_F$

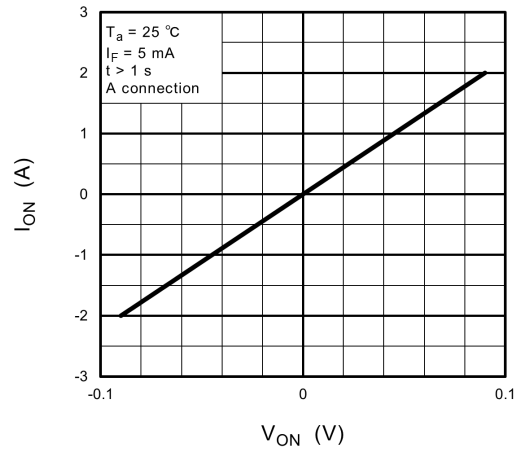


Fig. 12.1.4 $I_{ON} - V_{ON}$

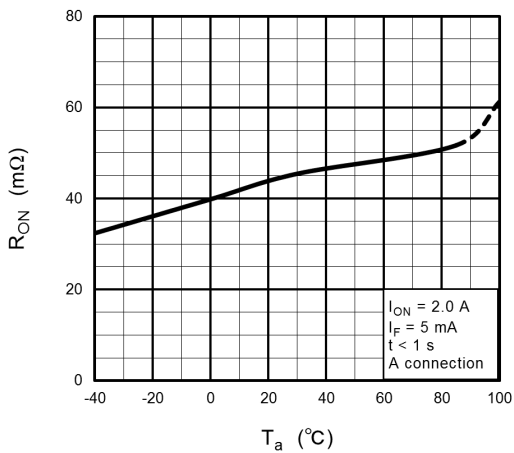


Fig. 12.1.5 $R_{ON} - T_a$

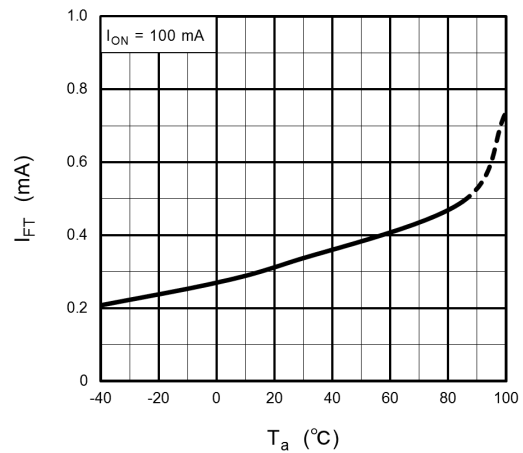


Fig. 12.1.6 $I_{FT} - T_a$

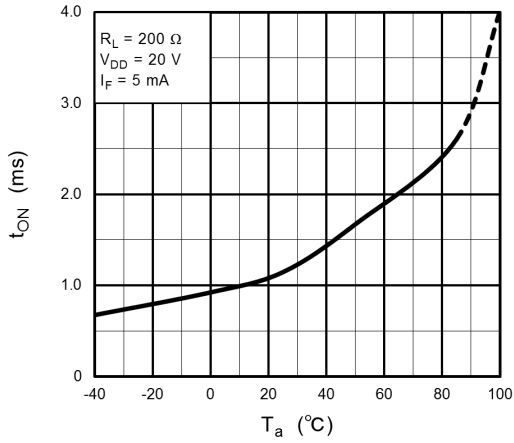


Fig. 12.1.7 $t_{ON} - T_a$

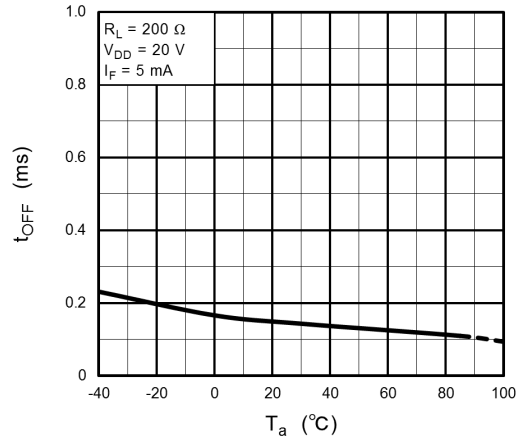


Fig. 12.1.8 $t_{OFF} - T_a$

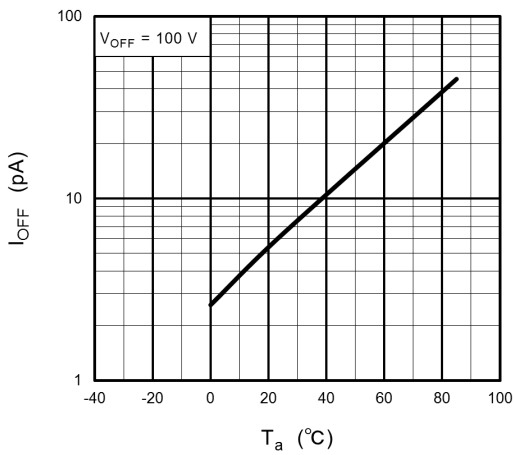


Fig. 12.1.9 $I_{OFF} - T_a$

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

12.2. Circuit Connections

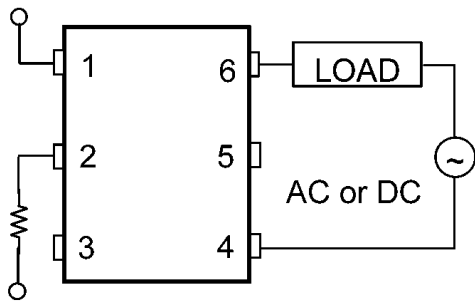


Fig. 12.2.1 A Connection

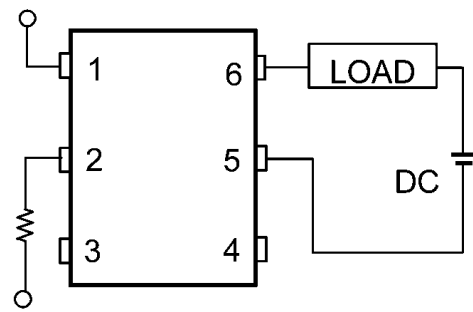


Fig. 12.2.2 B Connection

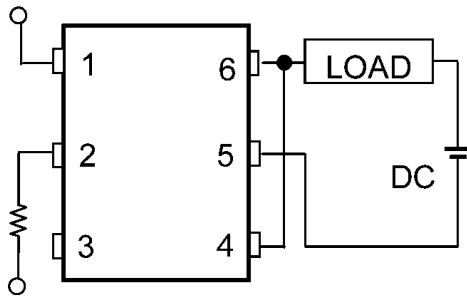
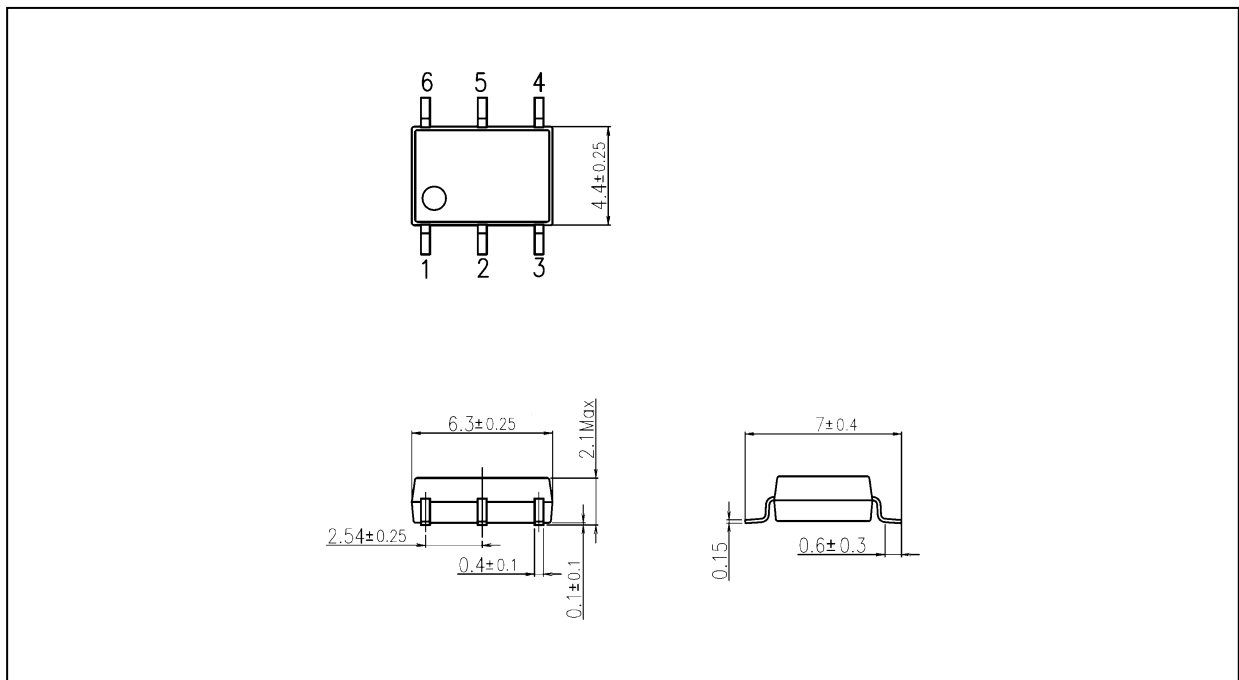


Fig. 12.2.3 C Connection

Package Dimensions

Unit: mm



Weight: 0.13 g (typ.)

Package Name(s)
TOSHIBA: 11-7C1S

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