Photocouplers Photorelay

TLP3109

1. Applications

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

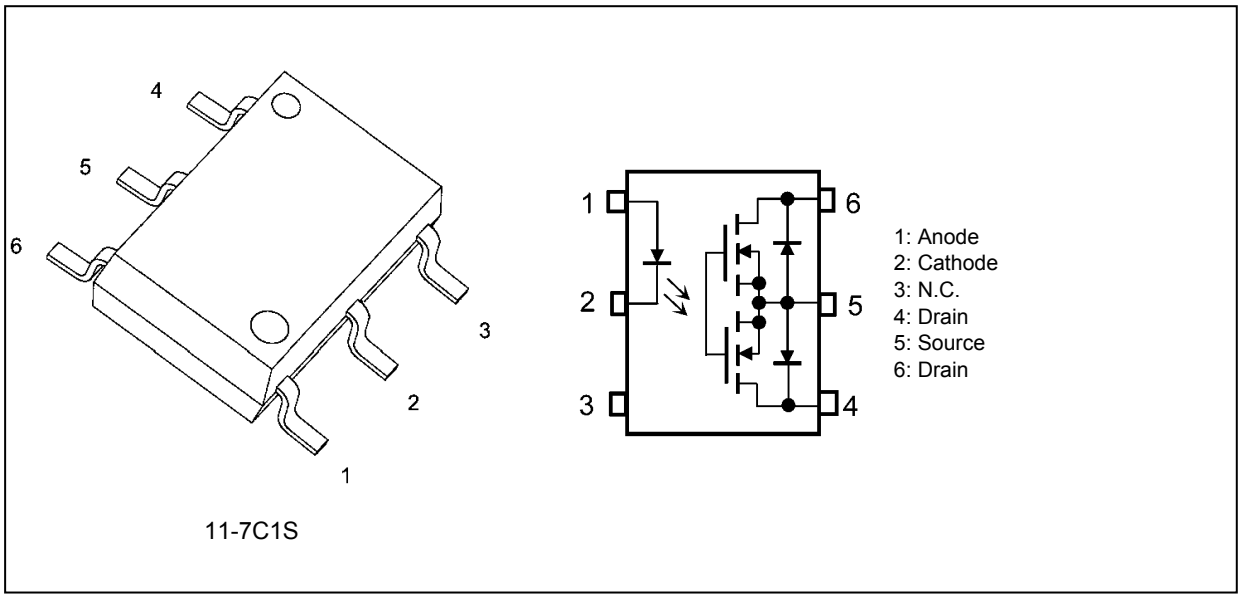
2. General

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

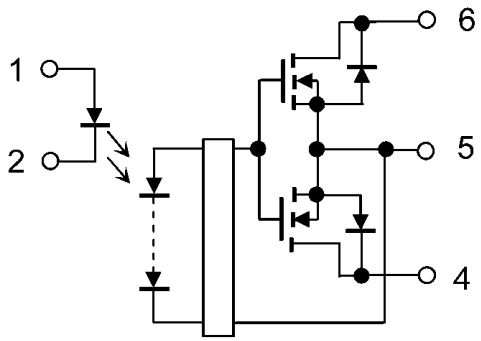
(1) Normally opened (1-Form-A)
(2) OFF-state output terminal voltage: 100 V (min)
(3) Trigger LED current: 3 mA (max)
(4) ON-state current: 2.0 A (max) (A connection)
(5) ON-state resistance: 70 mΩ (max) (A connection)
(6) Isolation voltage: 1500 Vrms (min)
(7) Safety standards
UL-approved: UL1577, File 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 °C)

	Characteristics		Symbol	Note	Rating	Unit
LED	Input forward current		I_F		30	mA
	Input forward current derating	($T_a \geq 25$ °C)	$\Delta I_F/\Delta T_a$		-0.3	mA/°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	($T_a \geq 25$ °C)	$\Delta P_D/\Delta T_a$		-0.5	mW/°C
	Junction temperature		T_j		125	°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	
	ON-state current (C connection)		I_{ON}	(Note 1)	4.0	
	ON-state current derating (A connection)	($T_a \geq 25$ °C)	$\Delta I_{ON}/\Delta T_a$	(Note 1)	-20	mA/°C
	ON-state current derating (B connection)	($T_a \geq 25$ °C)	$\Delta I_{ON}/\Delta T_a$	(Note 1)	-20	
	ON-state current derating (C connection)	($T_a \geq 25$ °C)	$\Delta I_{ON}/\Delta T_a$	(Note 1)	-40	
	ON-state current (pulsed)	(t = 100 ms, Duty = 1/10)	I_{ONP}		6	A
	Output power dissipation		P_O		400	mW
	Output power dissipation derating	($T_a \geq 25$ °C)	$\Delta P_O/\Delta T_a$		-4.0	mW/°C
	Junction temperature		T_j		125	°C
Common	Storage temperature		T_{stg}		-55 to 125	
	Operating temperature		T_{opr}		-40 to 85	
	Lead soldering temperature	(10 s)	T_{sol}		260	
	Isolation voltage	AC, 60 s, R.H. ≤ 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 °C)

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

9. Coupled Electrical Characteristics (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Trigger LED current	I_{FT}		I_{ON} = 100 mA	—	0.4	3	mA
Return LED current	I_{FC}		I_{OFF} = 10 μA	0.1	—	—	
ON-state resistance (A connection)	R_{ON}	(Note 1)	I_{ON} = 2.0 A, I_F = 5 mA, t < 1 s	—	45	70	mΩ
ON-state resistance (B connection)				—	22	35	
ON-state resistance (C connection)			I_{ON} = 4.0 A, I_F = 5 mA, t < 1 s	—	11	18	

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

10. Isolation Characteristics (Unless otherwise specified, 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	—	0.8	—	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	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 °C)

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Turn-on time	t_{ON}		See Fig. 11.1. R_L = 200 Ω, V_{DD} = 20 V, I_F = 5 mA	—	1.1	5.0	ms
			See Fig. 11.1. R_L = 200 Ω, V_{DD} = 20 V, I_F = 10 mA	—	0.6	3.0	
Turn-off time	t_{OFF}		See Fig. 11.1. R_L = 200 Ω, V_{DD} = 20 V, I_F = 5 mA	—	0.1	1.0	
			See Fig. 11.1. R_L = 200 Ω, V_{DD} = 20 V, I_F = 10 mA	—	0.1	1.0	

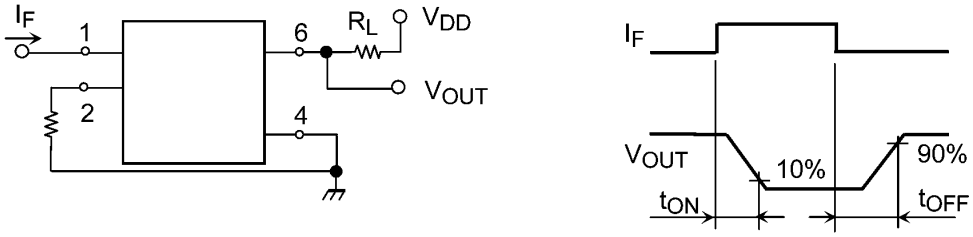


Fig. 11.1 Switching Time Test Circuit and Waveform

12. Characteristics Curves and Circuit Connections

12.1. Characteristics Curves (Note)

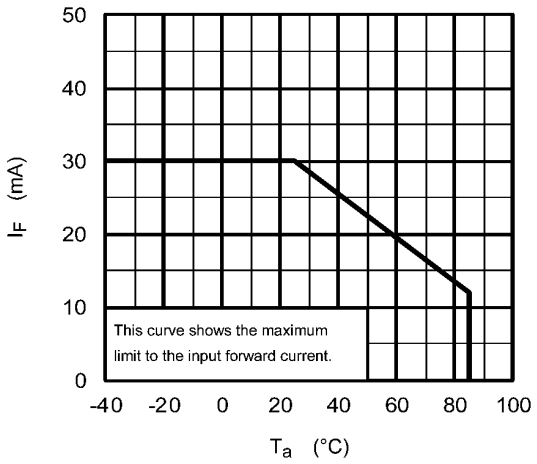


Fig. 12.1.1 I_F - T_a

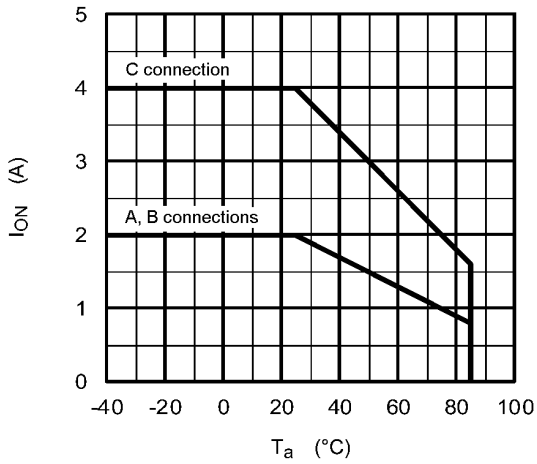


Fig. 12.1.2 I_{ON} - T_a

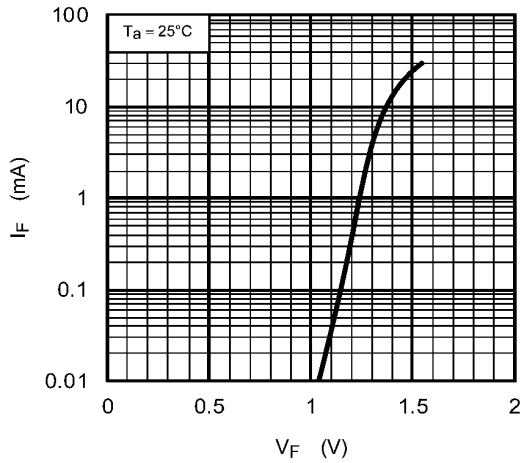


Fig. 12.1.3 I_F - V_F

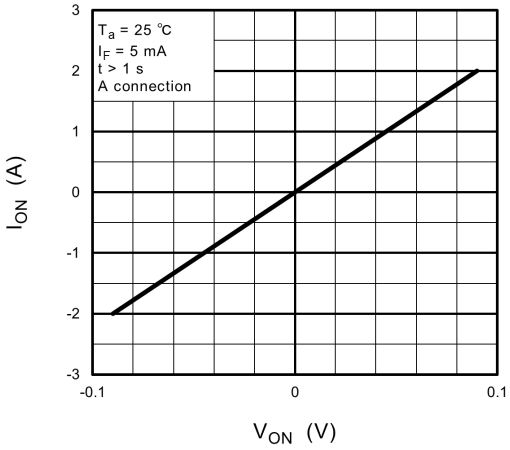


Fig. 12.1.4 I_{ON} - V_{ON}

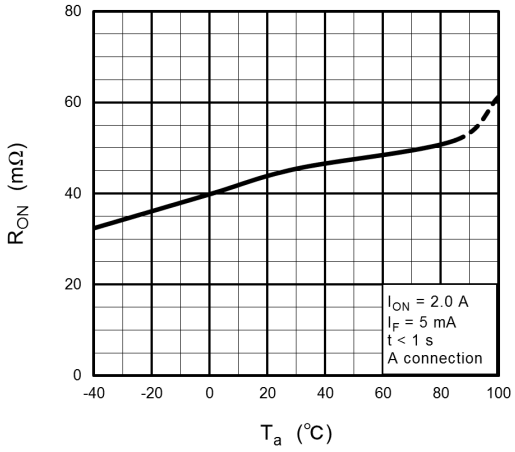


Fig. 12.1.5 R_{ON} - T_a

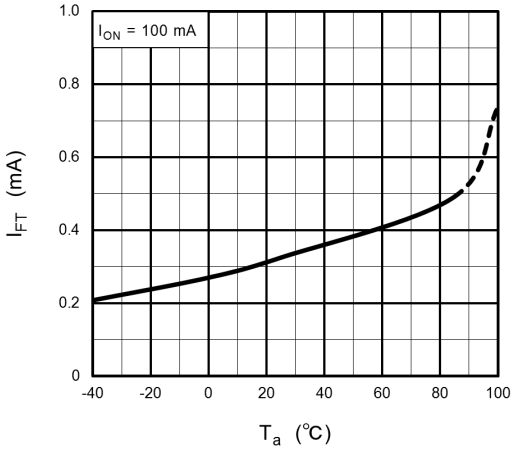


Fig. 12.1.6 I_{FT} - T_a

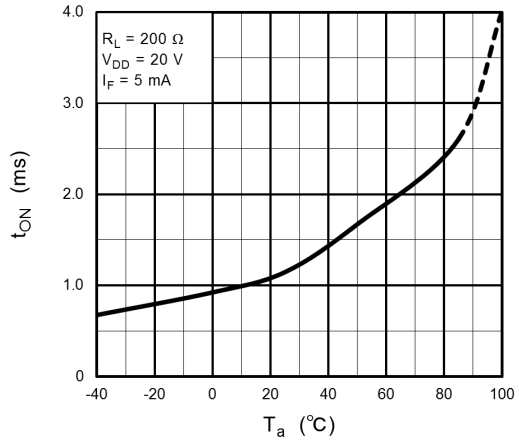


Fig. 12.1.7 t_{ON} - T_a

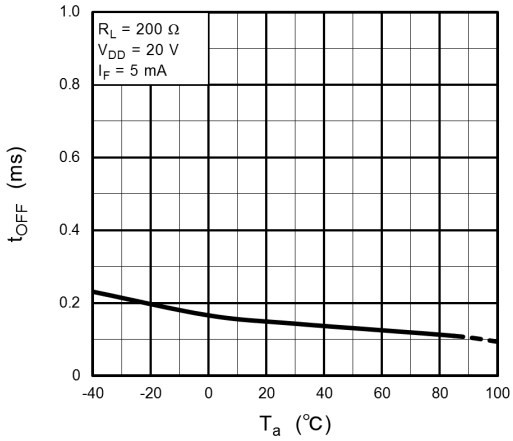


Fig. 12.1.8 t_{OFF} - T_a

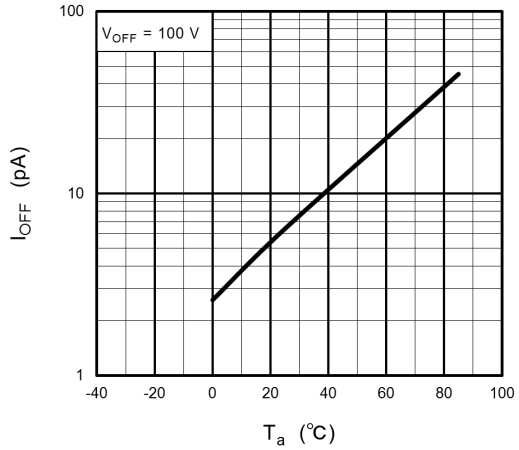


Fig. 12.1.9 I_{OFF} - T_a

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

12.2. Circuit Connections

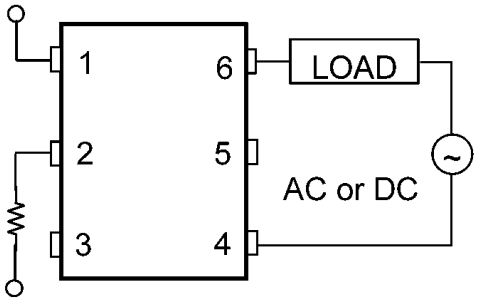


Fig. 12.2.1 A Connection

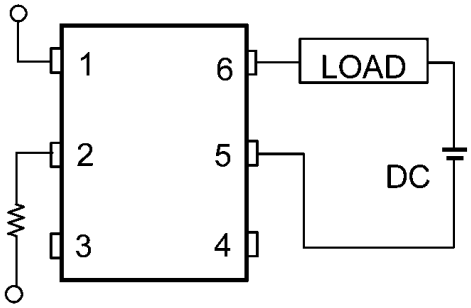


Fig. 12.2.2 B Connection

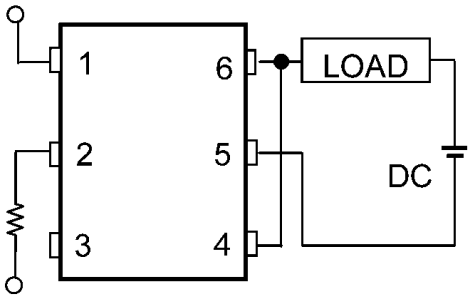
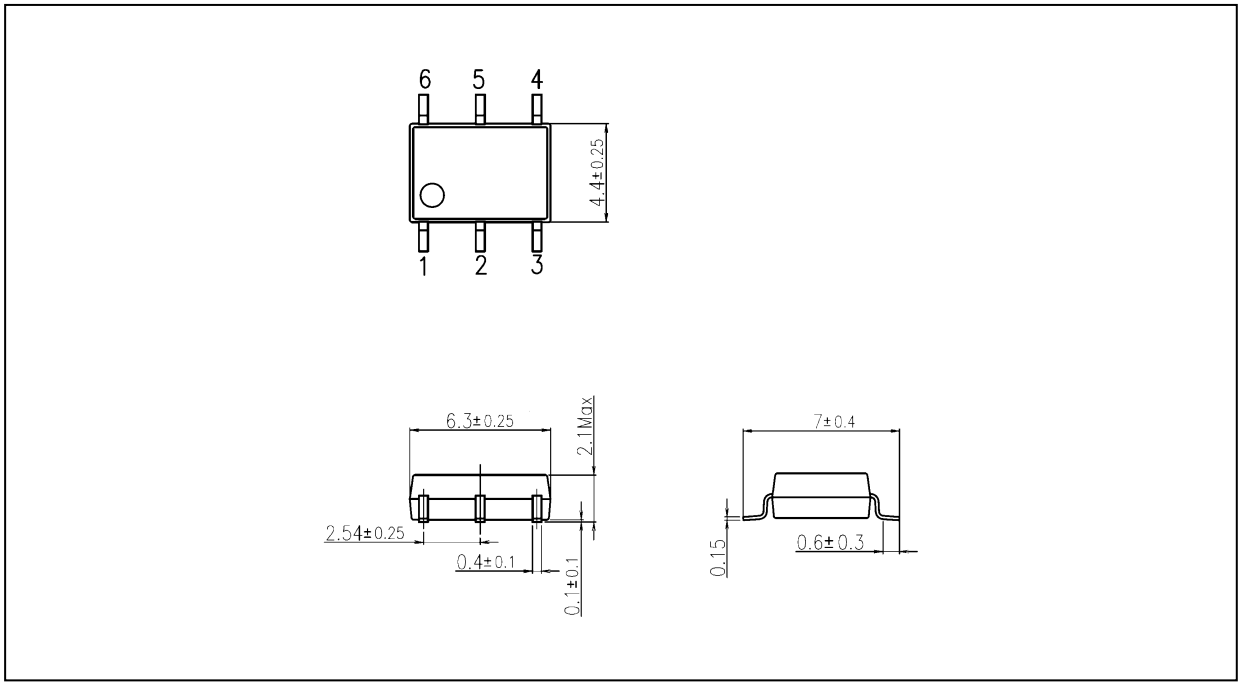


Fig. 12.2.3 C Connection

Package Dimensions

Unit: mm



Weight: 0.13 g (typ.)

Package Name(s)
TOSHIBA: 11-7C1S

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