

TOSHIBA Photocoupler Photorelay

TLX9150M

1. Description

Toshiba TLX9150M consists of an infrared emitting diode optically coupled to a photo-MOSFET in a SO12L-T package.

This coupler uses high voltage MOSFET between output terminals, making it suitable for battery-related control applications.

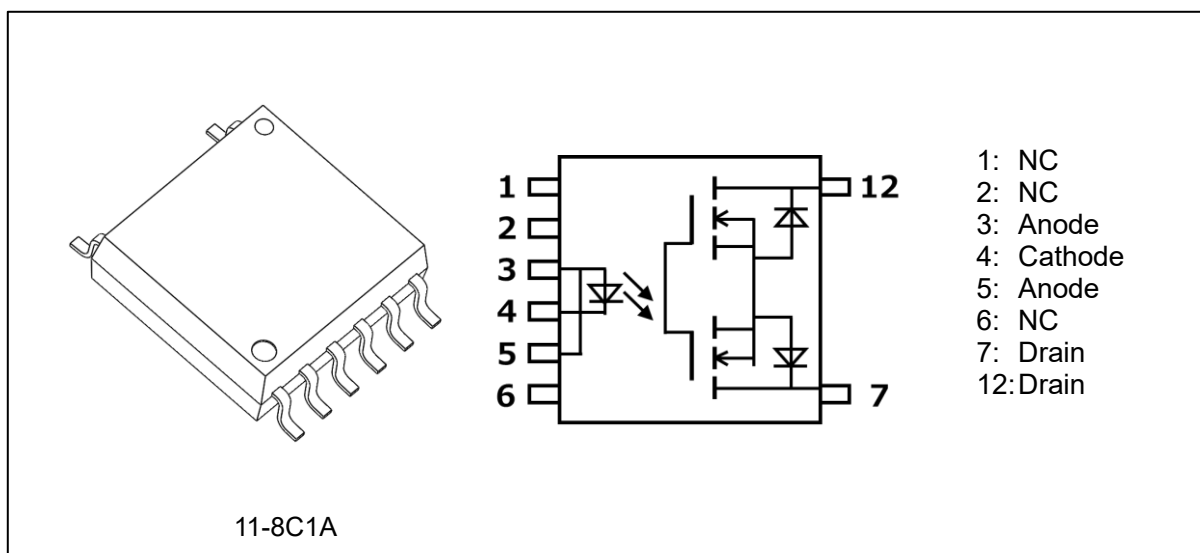
2. Applications

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

3. Features

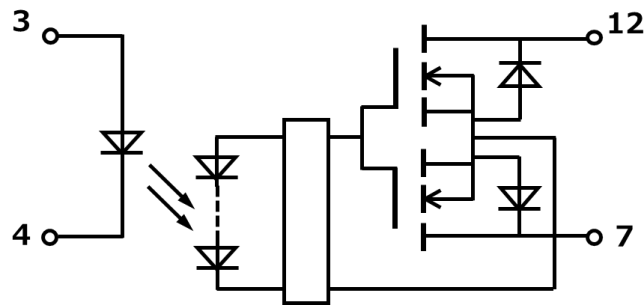
- Normally open (1-Form-A) device
- Peak off-state voltage: 900 V (min)
- Trigger LED current: 3 mA (max)
- On-state current: 50 mA (max)
- On-state resistance: 250Ω (max)(@t < 1s)
- Isolation voltage: 5000 Vrms (min)
- Clearance distance: 8 mm (min)
- Creepage distance: 8 mm (min)
- Insulation thickness: 0.4 mm (min)
- Outer resin: CTI > 600
- AEC-Q101 qualified

4. Packing and Pin Assignments



Start of commercial production
2024-09

5. Internal Circuit



6. Absolute Maximum Ratings (Note) (Unless otherwise specified, $T_a = 25^\circ\text{C}$)

	Characteristics	Symbol	Note	Rating	Unit	
LED	Forward current	I_F		30	mA	
	Forward current derating ($T_a \geq 100^\circ\text{C}$)	$\Delta I_F/^\circ\text{C}$		-0.8	mA/ $^\circ\text{C}$	
	Reverse voltage	V_R		5	V	
	Input Power Dissipation	P_D		50	mW	
	Input Power Dissipation Derating ($T_a \geq 100^\circ\text{C}$)	$\Delta P_D/^\circ\text{C}$		-1.3	mW/ $^\circ\text{C}$	
	Junction temperature	T_j		135	$^\circ\text{C}$	
Detector	On-state current	I_{ON}		$T_a = 25^\circ\text{C}$	50	mA
				$T_a = 105^\circ\text{C}$	20	mA
				$T_a = 125^\circ\text{C}$	10	mA
	On-state current derating	$\Delta I_{ON}/^\circ\text{C}$			-0.5	mA/ $^\circ\text{C}$
	On-state current (Peak)	I_{ONpk}	(Note 1)	$T_a = 25^\circ\text{C}$	150	mA
				$T_a = 105^\circ\text{C}$	60	mA
				$T_a = 125^\circ\text{C}$	30	mA
	Avalanche current	I_{AV}	(Note 2)		0.6	mA
	Output power dissipation	P_O			600	mW
	Output power dissipation derating ($T_a \geq 47^\circ\text{C}$)	$\Delta P_O/^\circ\text{C}$			-7	mW/ $^\circ\text{C}$
Junction temperature	T_j			135	$^\circ\text{C}$	
Common	Storage temperature	T_{stg}		-55 to 150	$^\circ\text{C}$	
	Operating temperature	T_{opr}		-40 to 125	$^\circ\text{C}$	
	Lead soldering temperature (10s)	T_{sol}		260	$^\circ\text{C}$	
	Isolation voltage (AC, 60 s, R.H. $\leq 60\%$)	BV_s	(Note 3)		5000	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: This product is more sensitive than conventional products to electrostatic discharge (ESD). It is therefore all the more necessary to observe general precautions regarding ESD when handling this component.

Note 1: Exponential curve, pulse width $< 1\text{ms}$, $f \leq 150\text{Hz}$

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

Note 3: LED pins are shorted together. Detector pins are also shorted together.

7. Recommended Operating Conditions (Note)

Characteristics	Symbol	Min	Typ.	Max	Unit
Supply voltage	V_{DD}	—	—	720	V
Forward current	I_F	5	10	20	mA
On-state current	I_{ON}	—	—	50	mA
Operating temperature	T_{opr}	-40	—	125	°C

Note: Recommended operating conditions are given as a design guideline to obtain expected performance of the device. Additionally, each item is an independent guideline respectively. In developing designs using this product, please confirm specified characteristics shown in this document.

8. Electrical Characteristics (Unless otherwise specified, $T_a = 25^\circ\text{C}$)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
LED	Forward voltage	V_F	$I_F = 10 \text{ mA}$	1.5	1.65	1.8	V
			$I_F = 10 \text{ mA}, T_a = -40 \text{ to } 125^\circ\text{C}$	1.4	—	1.95	
	Reverse current	I_R	$V_R = 5 \text{ V}$	—	—	10	μA
	Capacitance	C_T	$V = 0 \text{ V}, f = 1 \text{ MHz}$	—	45	—	pF
Detector	Output withstand voltage	V_{OFF}	$I_{OFF} = 10 \mu\text{A}, T_a = 25^\circ\text{C}$	900	—	—	V
	Off-state current	I_{OFF}	$V_{OFF} = 900 \text{ V}, T_a = 25^\circ\text{C}$	—	—	100	nA
			$V_{OFF} = 900 \text{ V}, T_a = -40 \text{ to } 105^\circ\text{C}$	—	—	1000	
			$V_{OFF} = 900 \text{ V}, T_a = -40 \text{ to } 125^\circ\text{C}$	—	—	5000	
Capacitance	C_{OFF}	$V = 0 \text{ V}, f = 1 \text{ MHz}$	—	60	—	pF	

9. Coupled Electrical Characteristics

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Trigger LED current	I_{FT}	$I_{ON} = 50 \text{ mA}, T_a = 25^\circ\text{C}, t = 10 \text{ ms}$	—	—	3	mA
		$I_{ON} = 20 \text{ mA}, T_a = -40 \text{ to } 105^\circ\text{C}, t = 10 \text{ ms}$	—	—	3	
		$I_{ON} = 10 \text{ mA}, T_a = -40 \text{ to } 125^\circ\text{C}, t = 10 \text{ ms}$	—	—	3	
Return LED current	I_{FC}	$I_{OFF} = 100 \mu\text{A}, T_a = -40 \text{ to } 125^\circ\text{C}, t = 40 \text{ ms}$	0.05	—	—	mA
On-state resistance	R_{ON}	$I_{ON} = 50 \text{ mA}, I_F = 10 \text{ mA}, T_a = 25^\circ\text{C}, t < 1 \text{ s}$	—	—	250	Ω
		$I_{ON} = 20 \text{ mA}, I_F = 10 \text{ mA}, T_a = -40 \text{ to } 105^\circ\text{C}, t < 1 \text{ s}$	—	—	350	
		$I_{ON} = 10 \text{ mA}, I_F = 10 \text{ mA}, T_a = -40 \text{ to } 125^\circ\text{C}, t < 1 \text{ s}$	—	—	400	

10. Isolation Characteristics ($T_a = 25^\circ\text{C}$)

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Capacitance input to output	C_s	(Note1)	$V_s = 0\text{ V}$, $f = 1\text{ MHz}$	—	0.9	—	pF
Isolation resistance	R_s	(Note1)	$V_s = 1000\text{V}$, R.H. $\leq 60\%$	5×10^{10}	10^{14}	—	Ω
Isolation voltage	BVs	(Note1)	AC, 60 s	5000	—	—	Vrms

Note1: Device considered a two-terminal device: Pins 1 to 6 shorted together, and 7 and 12 shorted together.

11. Switching Characteristics

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Turn on time	t_{ON}		$I_F = 10\text{ mA}$ $R_L = 20\text{ k}\Omega$ $V_{DD} = 40\text{ V}$	—	—	1	ms
Turn off time	t_{OFF}						
Turn on time	t_{ON}		$T_a = -40\text{ to }125^\circ\text{C}$	—	—	1	ms
Turn off time	t_{OFF}						

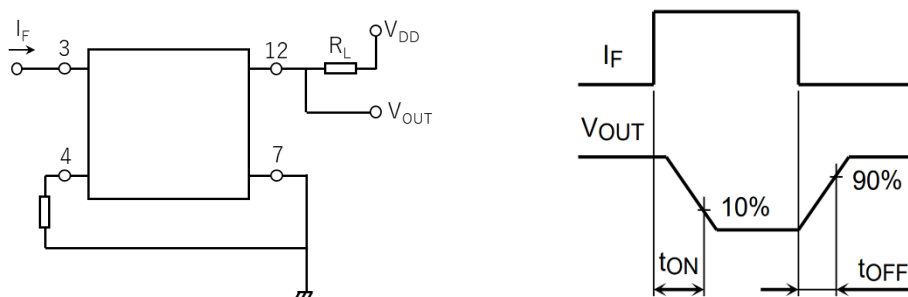


Fig. 11.1 Switching Time Test Circuit and Waveform

12. Characteristics Curves (Note)

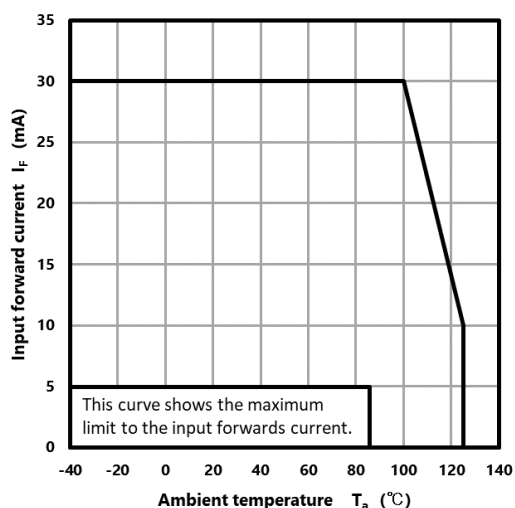


Fig. 12.1 $I_F - T_a$

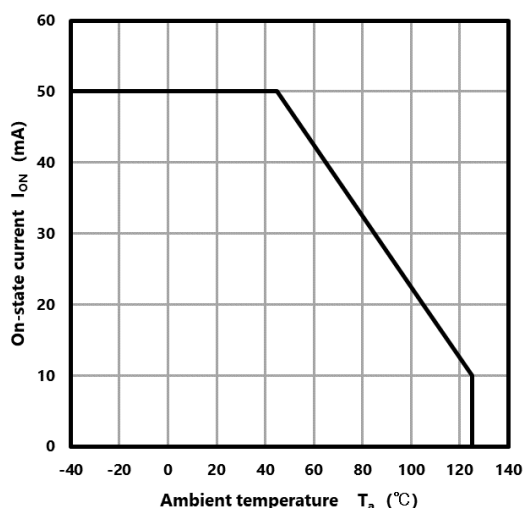


Fig. 12.2 $I_{ON} - T_a$

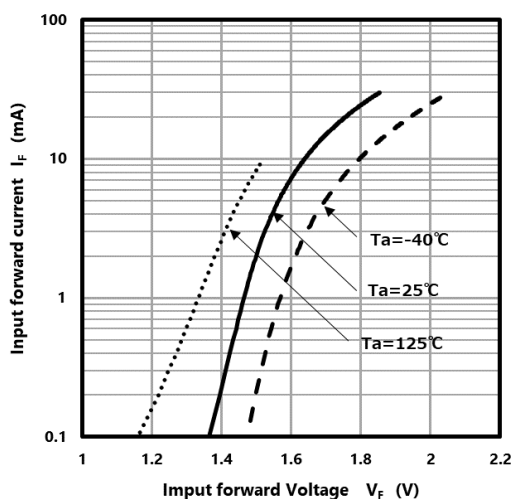


Fig. 12.3 $I_F - V_F$

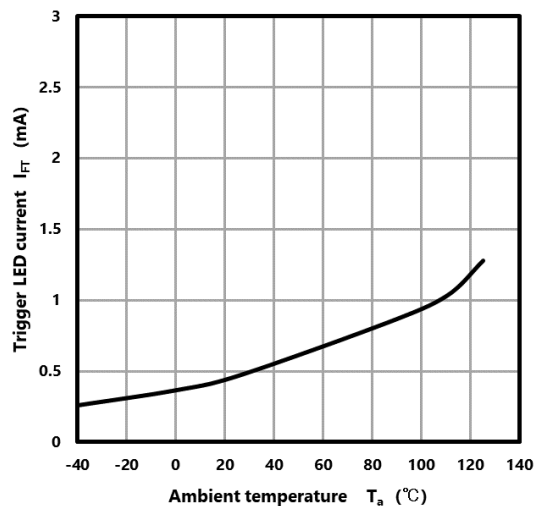


Fig. 12.4 $I_{FT} - T_a$

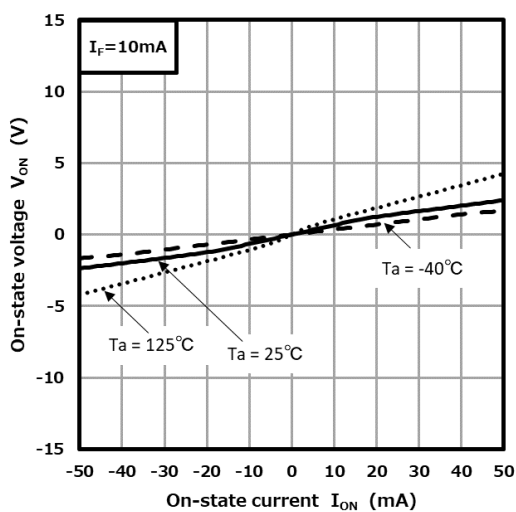


Fig. 12.5 $V_{ON} - I_{ON}$

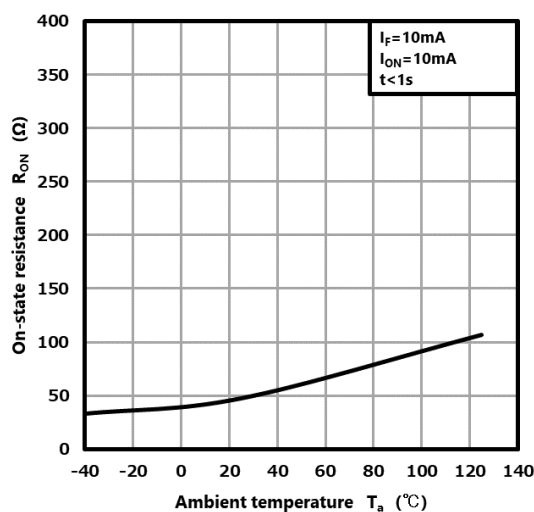


Fig. 12.6 $R_{ON} - T_a$

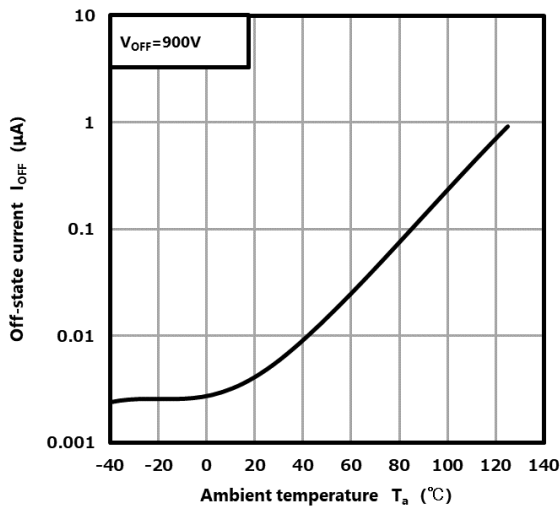


Fig. 12.7 $I_{OFF} - T_a$

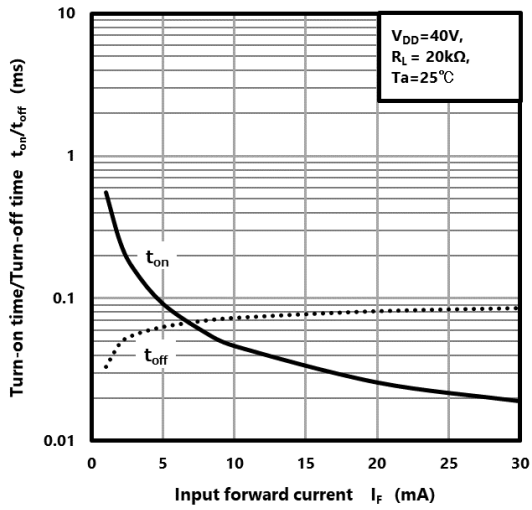


Fig. 12.8 $t_{ON}/t_{OFF} - I_F$

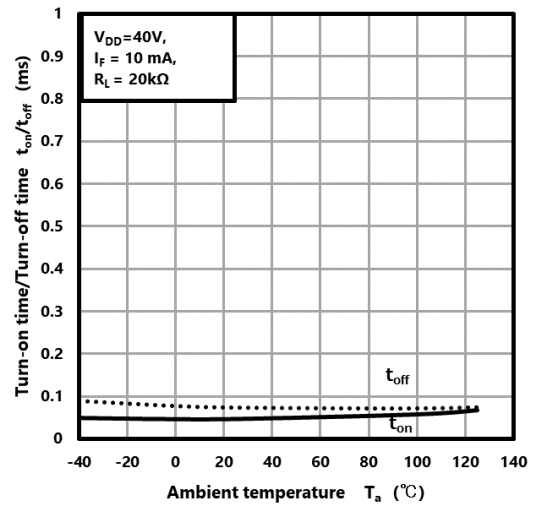
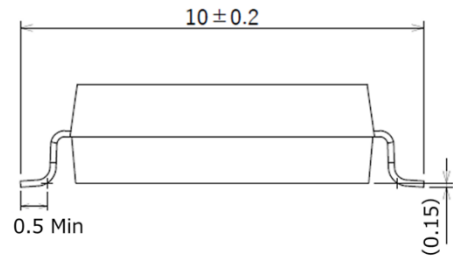
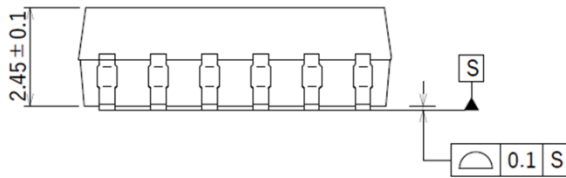
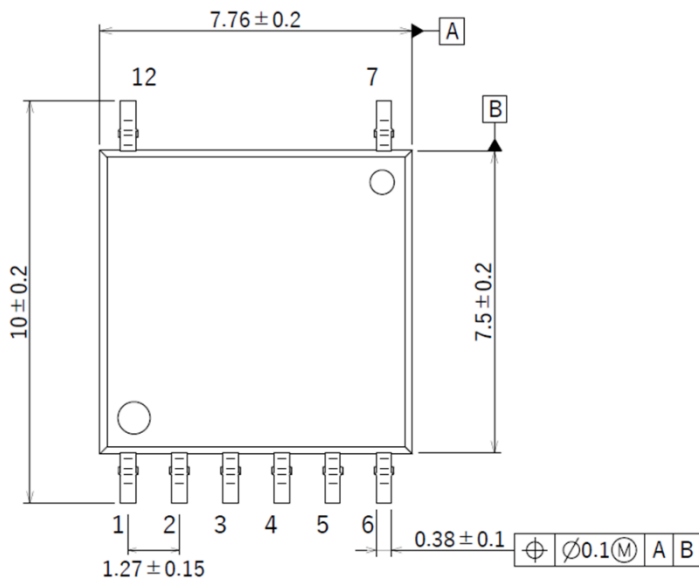


Fig. 12.9 $t_{ON}/t_{OFF} - T_a$

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

13. Package Dimensions

Unit: mm



Weight: 0.31 g (typ.)

Package Name(s)
TOSHIBA: 11-8C1A

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