TOSHIBA Photocoupler Photorelay

TLX9152M

1. Description

Toshiba TLX9152M consists of an infrared emitting diode optically coupled to a photo-MOSFET in a SO16L-T package.
This coupler uses high voltage MOSFET between output terminals, making it suitable for battery-related control applications.

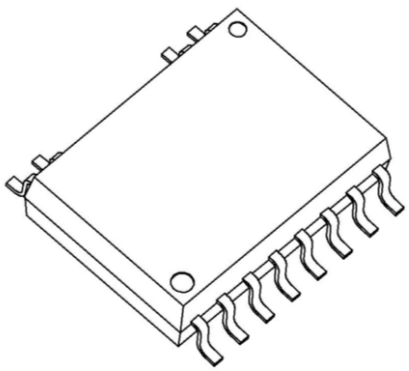
2. Applications

- 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: 250 Ω (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



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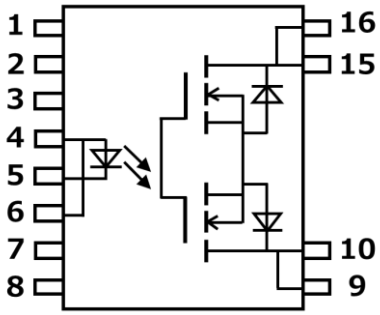
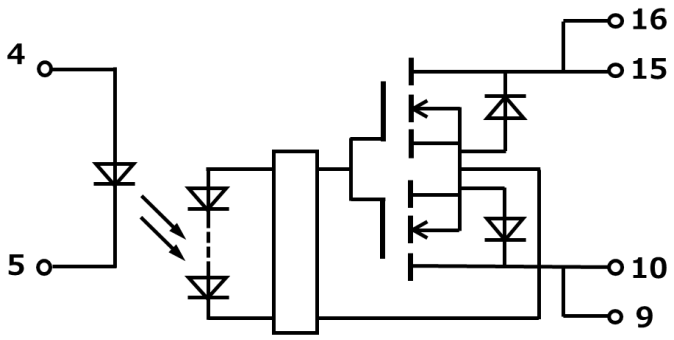


1: NC
2: NC
3: NC
4: Anode
5: Cathode
6: Anode
7: NC
8: NC
9: Drain
10: Drain
15: Drain
16: Drain

Start of commercial production
2024-06

5. Internal Circuit



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

	Characteristics		Symbol	Note	Rating	Unit
LED	Forward current		I_F		30	mA
	Forward current derating (T_a ≥ 100 ℃)		ΔI_F/℃		-0.8	mA/℃
	Reverse voltage		V_R		5	V
	Input Power Dissipation		P_D		50	mW
	Input Power Dissipation Derating (T_a ≥ 100℃)		ΔP_D/℃		-1.3	mW/℃
	Junction temperature		T_j		135	℃
Detector	On-state current	T_a = 25 ℃	I_{ON}		50	mA
		T_a = 105 ℃			20	mA
		T_a = 125 ℃			10	mA
	On-state current derating	T_a ≥ 45 ℃	ΔI_{ON}/℃		-0.5	mA/℃
	On-state current (Peak)	T_a = 25 ℃	I_{ONpk}	(Note 1)	150	mA
		T_a = 105 ℃			60	mA
		T_a = 125 ℃			30	mA
	Avalanche current		IAV	(Note 2)	0.6	mA
	Output power dissipation		P_O		600	mW
	Output power dissipation derating (T_a ≥ 47 ℃)		ΔP_O/℃		-7	mW/℃
	Junction temperature		T_j		135	℃
Common	Storage temperature		T_{stg}		-55 to 150	℃
	Operating temperature		T_{opr}		-40 to 125	℃
	Lead soldering temperature (10 s)		T_{sol}		260	℃
	Isolation voltage (AC, 60 s, R.H. ≤ 60 %)		BVs	(Note 3)	5000	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: 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 ms, f ≤150 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	℃

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℃)

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

9. Coupled Electrical Characteristics

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

10. Isolation Characteristics (T_a = 25℃)

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Capacitance input to output	C_S	(Note1)	Vs = 0 V, f = 1MHz	—	0.9	—	pF
Isolation resistance	R_S	(Note1)	Vs = 1000 V, R.H. ≤ 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 8 shorted together, and 9, 10, 15 and 16 shorted together.

11. Switching Characteristics

Characteristics	Symbol	Note	Test Condition		Min	Typ.	Max	Unit
Turn on time	t_{ON}		I_F = 10 mA R_L = 20 kΩ V_{DD} = 40 V	T_a = 25 ℃	—	—	1	ms
Turn off time	t_{OFF}				—	—	1	
Turn on time	t_{ON}			T_a = -40 to 125℃	—	—	1	ms
Turn off time	t_{OFF}				—	—	1	

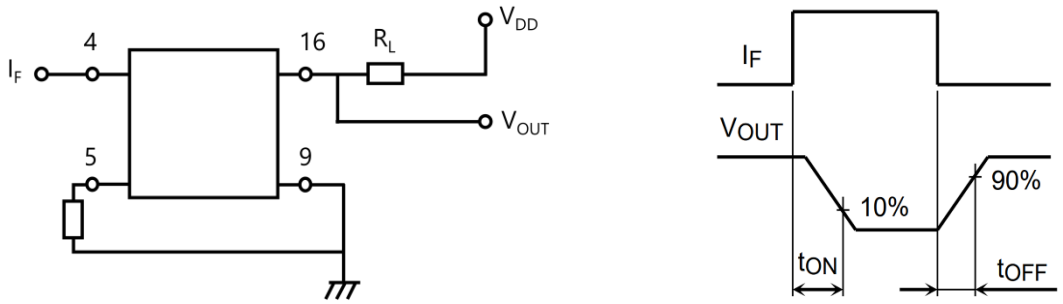


Fig. 11.1 Switching Time Test Circuit and Waveform

12. Characteristics Curves (Note)

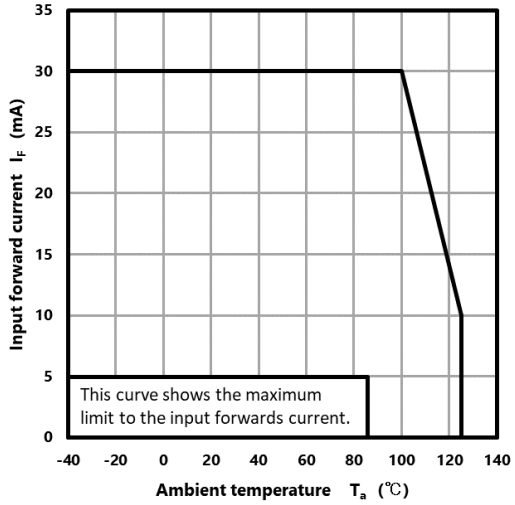


Fig. 12.1 I_F - T_a

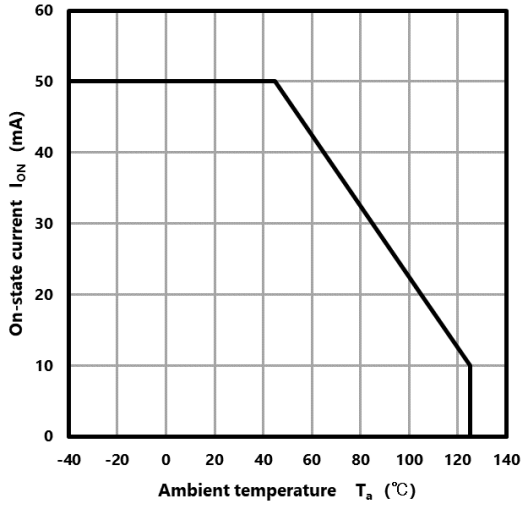


Fig. 12.2 I_{ON} - T_a

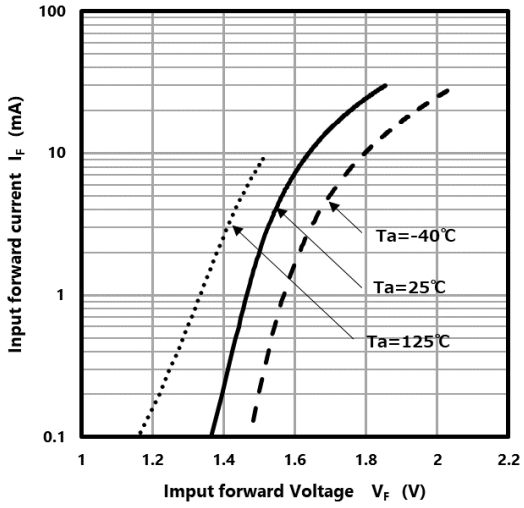


Fig. 12.3 I_F - V_F

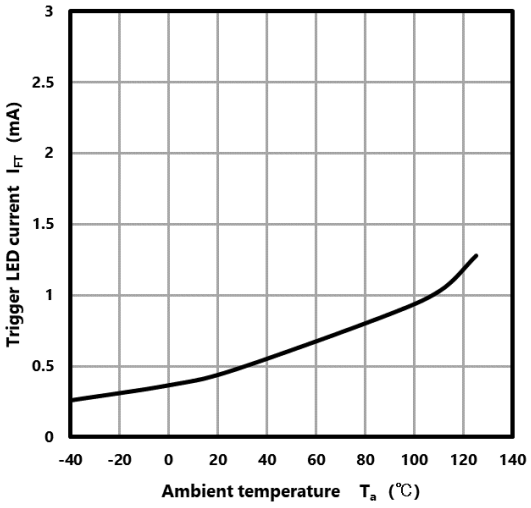


Fig. 12.4 I_{FT} - T_a

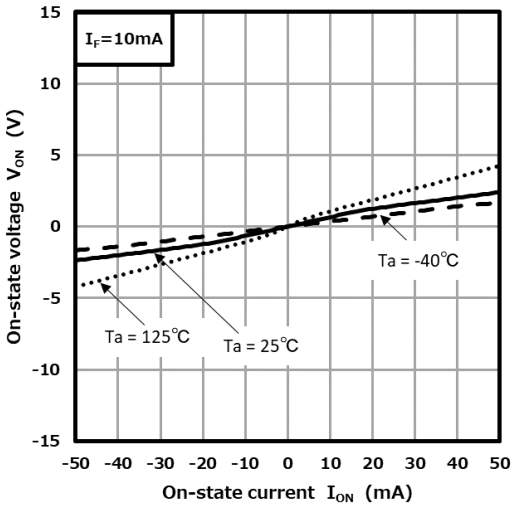


Fig. 12.5 V_{ON} - I_{ON}

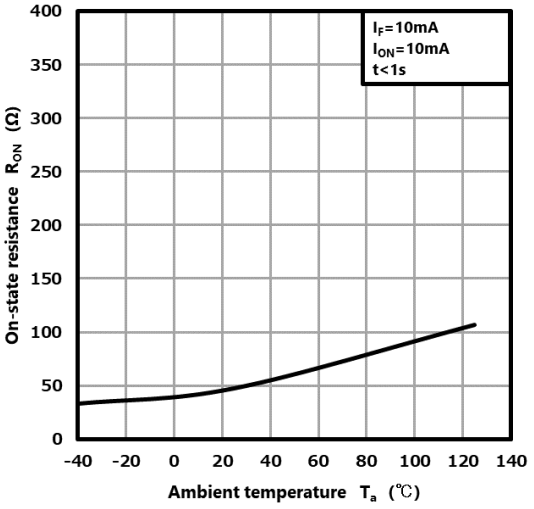


Fig. 12.6 R_{ON} - T_a

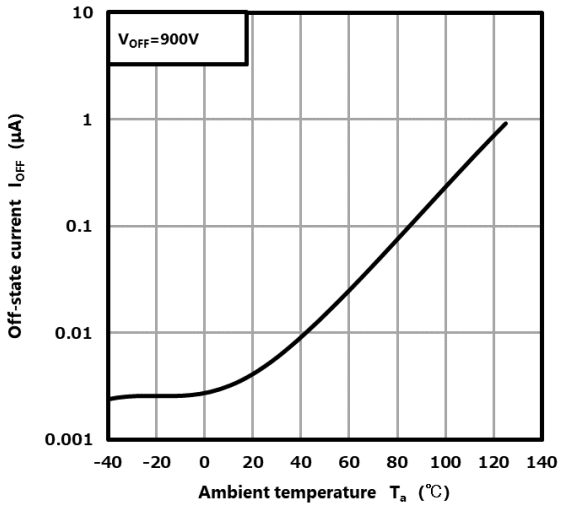


Fig. 12.7 I_{OFF} - T_a

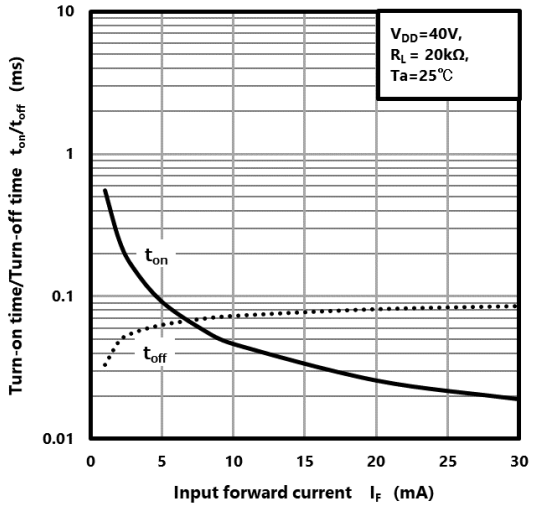


Fig. 12.8 t_{ON} /t_{OFF} - I_F

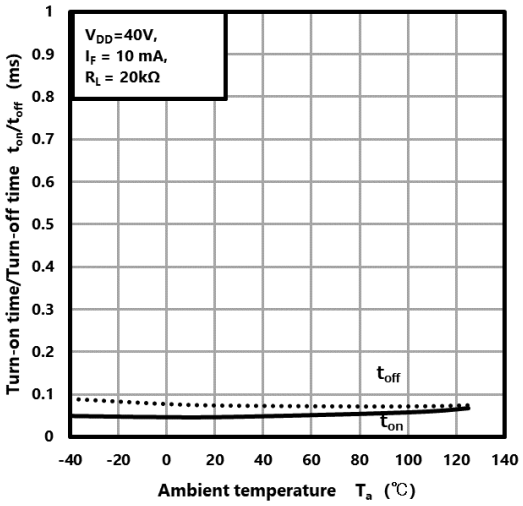
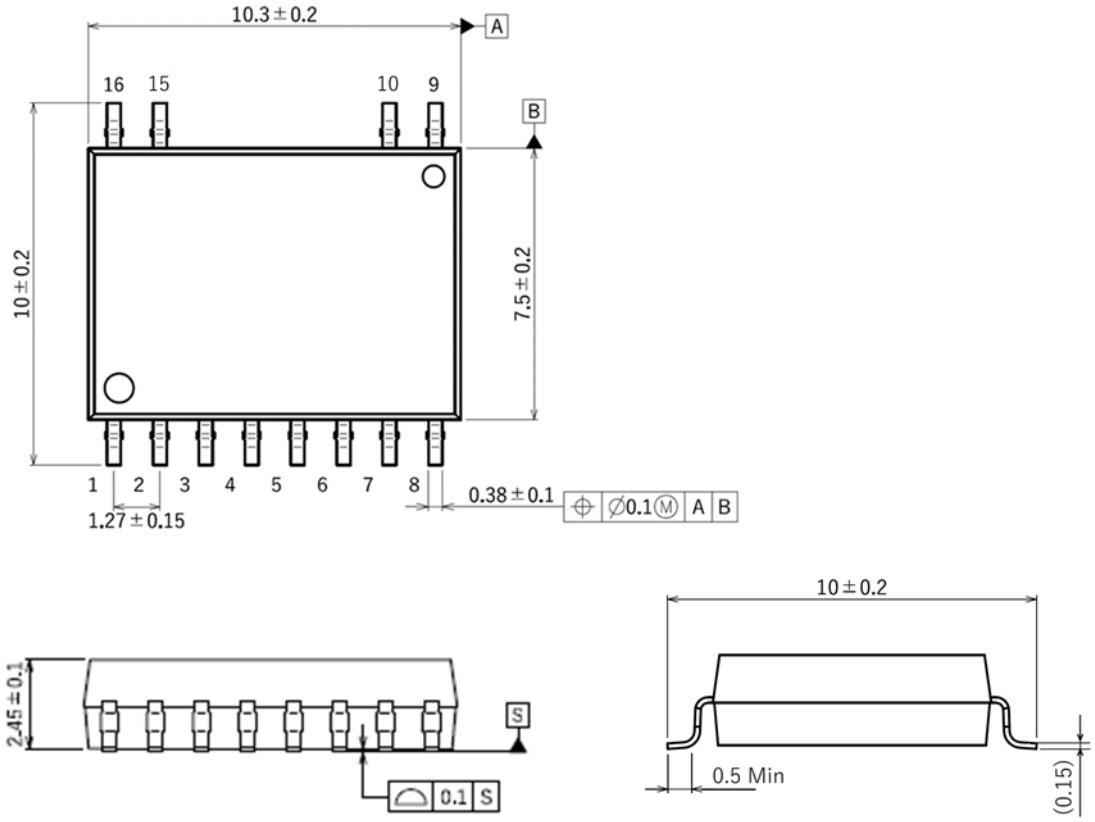


Fig. 12.9 t_{ON} /t_{OFF} - T_a

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: 0.42g (typ.)

Package Name(s)
TOSHIBA: 11-10N1A

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