Photocouplers GaAℓAs Infrared LED & Photo Diode

TLP3930

1. Applications

- MOSFET Gate Drivers
- Factory Automation (FA)
- Programmable Logic Controllers (PLCs)
- Measuring Instruments

2. General

The TLP3930 is a photocoupler in the SO6L package that consists of an infrared light emitting diode optically coupled to a photodiode array. This photocoupler built in a control circuit on the photodiode array side, so there is no need to connect a discharge resistor. It features a high open-voltage that remains stable across varying ambient temperatures, making it suitable for driving SiC MOSFET gates.

3. Features

(1) SO6L package
(2) Open voltage: 17 V (min)
(3) Short current: 12 μA (min)
(4) Isolation voltage: 5000 Vrms (min)
(5) Halogen-free
For details, see "Devices in Halogen-Free Resin Packages" at the end of this datasheet.
(6) Safety standards
UL-recognized: UL 1577, File No.E67349
cUL-recognized: CSA Component Acceptance Service No.5A File No.E67349
VDE-approved: EN IEC 60747-5-5 **(Note 1)**

Note 1: When a VDE approved type is needed, please designate the **Option (D4)**.

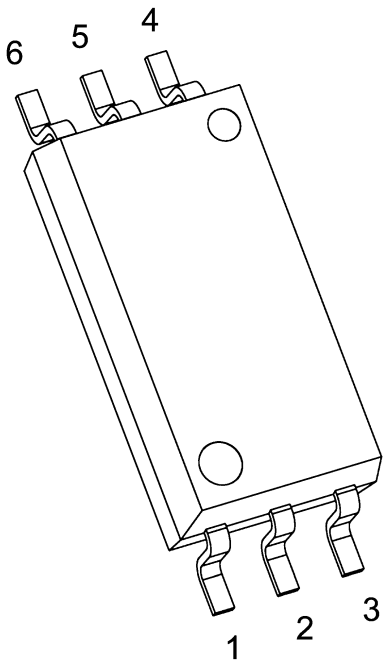
Table 3.1 Mechanical Parameters

Characteristics	Min	Unit
Creepage distances	8.0	mm
Clearance	8.0	
Internal isolation thickness	0.4	

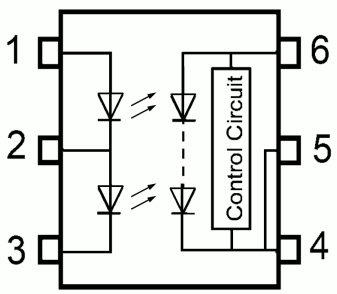
Start of commercial production
2026-11

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4. Packaging and Pin Assignment



11-4N1A



1: Anode (Input)
2: N.C. (Note)
3: Cathode (Input)
4: Cathode (Output)
5: Cathode (Output)
6: Anode (Output)

Note: Input side is considerd 2 LEDs serial connection.(i.e. Foward mean pin 1 to 3, Reverse mean pin 3 to 1.) Don't connect anything to pin 2.

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

	Characteristics		Symbol	Note	Rating	Unit
LED	Input forward current	(-40 ≤T_a ≤ 85 °C)	I_F	(Note 1)	30	mA
	Input forward current derating	(T_a ≥ 85 °C)	$\Delta I_F/\Delta T_a$	(Note 1)	-0.6	mA/°C
	Input forward current (pulsed)	(t = 1ms, Duty = 1/100)	I_{FP}	(Note 1)	220	mA
	Input power dissipation	(-40 ≤T_a ≤ 85 °C)	P_D	(Note 1)	121.4	mW
	Input power dissipation derating	(T_a ≥ 85 °C)	$\Delta P_D/\Delta T_a$	(Note 1)	-2.43	mW/°C
	Input reverse voltage		V_R	(Note 2)	10	V
	Junction temperature		T_j		135	°C
Detector	Output forward current		I_{FD}		60	μA
	Output reverse voltage		V_{RD}		20	V
	Output power dissipation	(-40 ≤T_a ≤ 125 °C)	P_O		1.5	mW
	Junction temperature		T_j		135	°C
Common	Operating temperature		T_{opr}		-40 to 125	°C
	Storage temperature		T_{stg}		-55 to 135	°C
	Lead soldering temperature	(10 s)	T_{sol}		260	°C
	Isolation voltage	AC, 60 s, R.H. ≤ 60 %	BV_S	(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 1: I_F and P_D pin connection: Pin 1 to 3.

Note 2: V_R pin connection: Pin 3 to 1.

Note 3: 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.

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

	Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
LED	Input forward voltage	V_F	(Note 1)	I_F = 10 mA	3	3.3	3.6	V
	Input reverse current	I_R	(Note 2)	V_R = 10 V	—	—	10	μA
	Input capacitance	C_t		V = 0 V, f = 1 MHz	—	23	—	pF

Note 1: V_F and I_F pin conection: Pin 1 to 3.(Pin 2 is N.C.)

Note 2: V_R and I_R pin conection: Pin 3 to 1.(Pin 2 is N.C.)

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

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Trigger LED current	I_{FT}	(Note 1)	V_{OC} ≥ 10 V	—	0.55	3	mA
Open voltage	V_{OC}	(Note 1)	I_F = 10 mA	17	19	21.5	V
		(Note 1)	I_F = 10 mA, T_a = 125 °C	—	17	—	
		(Note 1)	I_F = 10 mA, T_a = -40 °C	—	19.2	—	
Short-circuit current	I_{SC}	(Note 1)	I_F = 10 mA	12	19.5	40	μA
		(Note 1)	I_F = 10 mA, T_a = 125 °C	—	15.2	—	

Note 1: I_F and I_{FT} pin conection: Pin 1 to 3.(Pin 2 is N.C.)

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8. 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 %	10^{12}	10^{14}	—	Ω
Isolation voltage	BV_S	(Note 1)	AC, 60 s	5000	—	—	Vrms

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.

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

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Turn-on time	t_{on}		I_F = 10 mA, C_L = 1000 pF See Fig. 9.1.	—	0.85	1.5	ms
Turn-off time	t_{off}			—	0.15	0.5	
Turn-on time	t_{on}		I_F = 25 mA, C_L = 1000 pF See Fig. 9.1.	—	0.4	0.8	
Turn-off time	t_{off}			—	0.15	0.5	

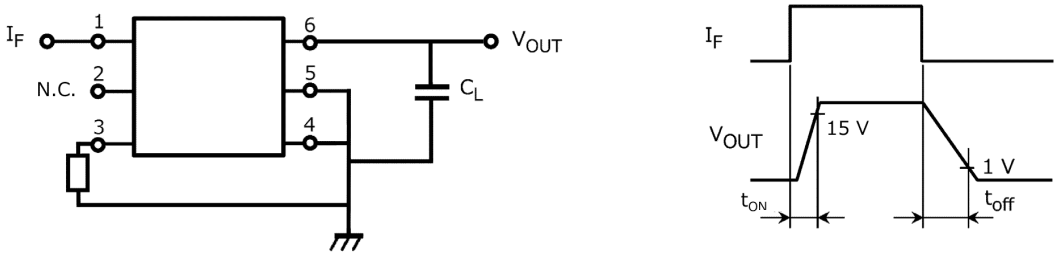


Fig. 9.1 Switching Time Test Circuit, Waveform

10. Characteristics Curves (Note)

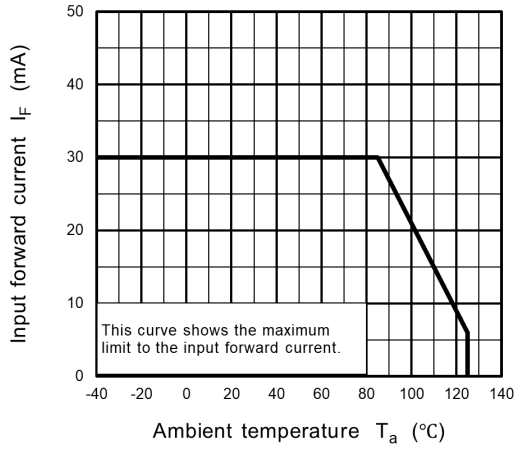


Fig. 10.1 I_F - T_a

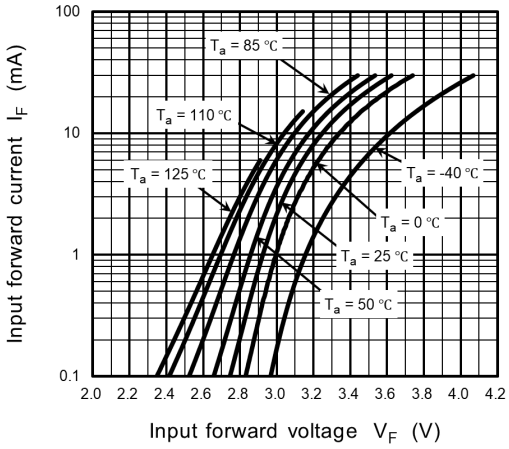


Fig. 10.2 I_F - V_F

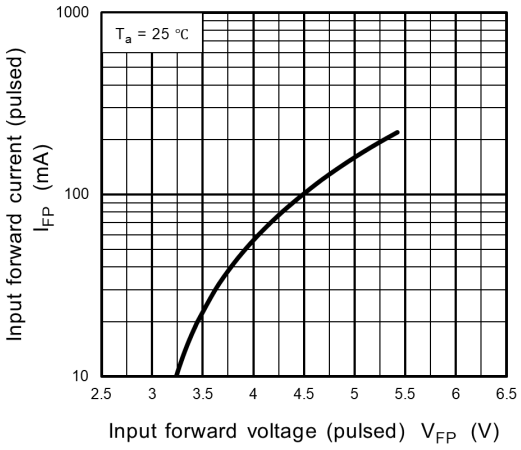


Fig. 10.3 I_{FP} - V_{FP}

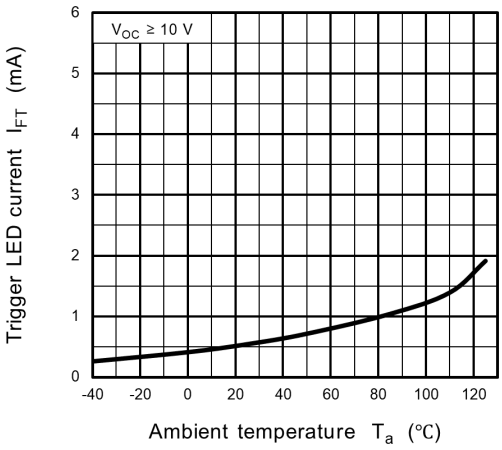


Fig. 10.4 I_{FT} - T_a

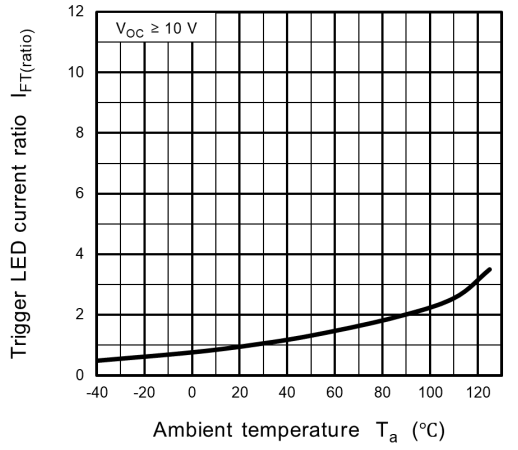


Fig. 10.5 $I_{FT(ratio)}$ - T_a

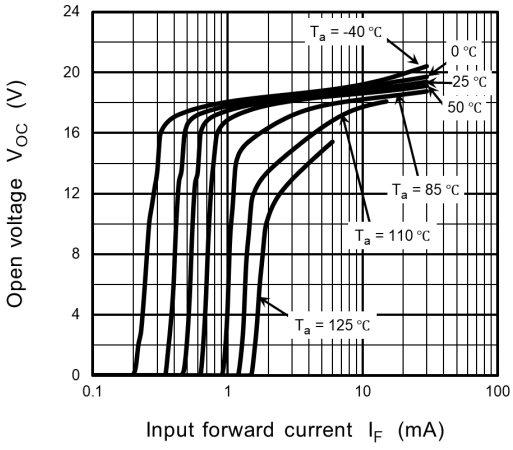


Fig. 10.6 V_{OC} - I_F

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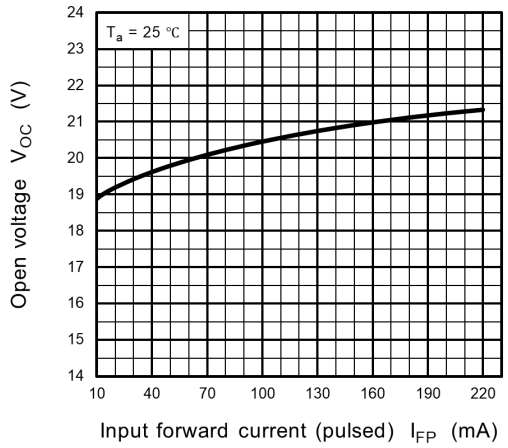


Fig. 10.7 V_{OC} - I_{FP}

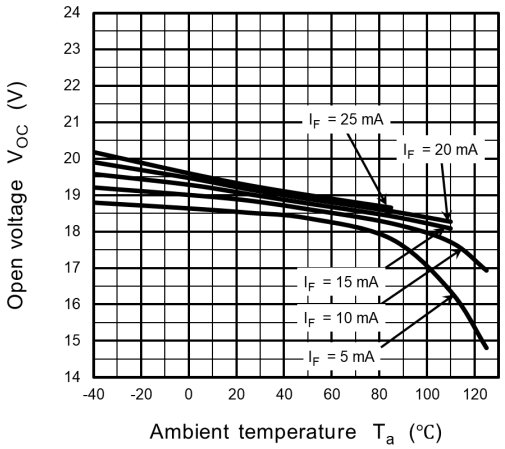


Fig. 10.8 V_{OC} - T_a

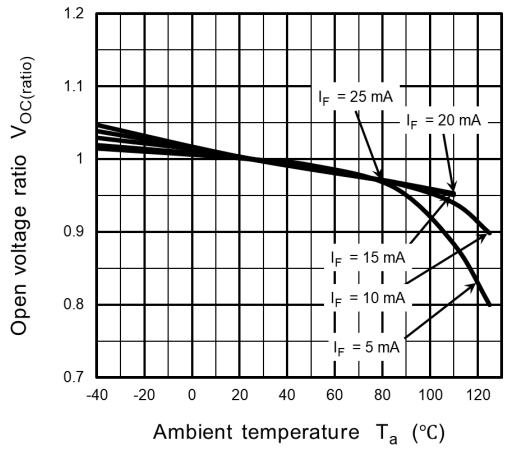


Fig. 10.9 $V_{OC(ratio)}$ - T_a

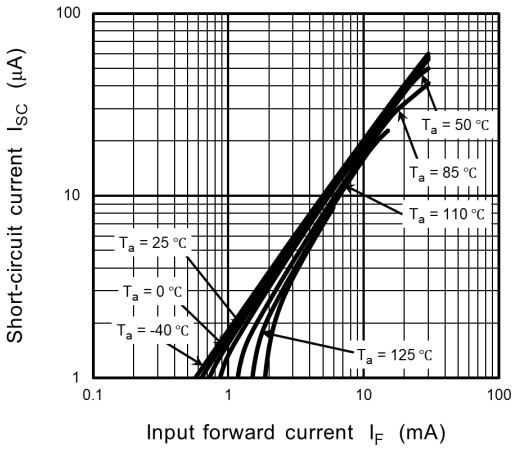


Fig. 10.10 I_{SC} - I_F

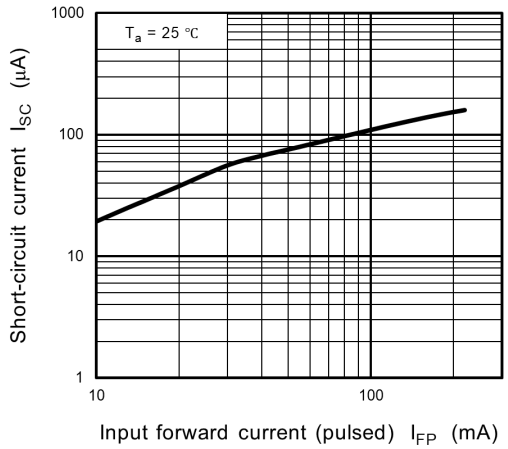


Fig. 10.11 I_{SC} - I_{FP}

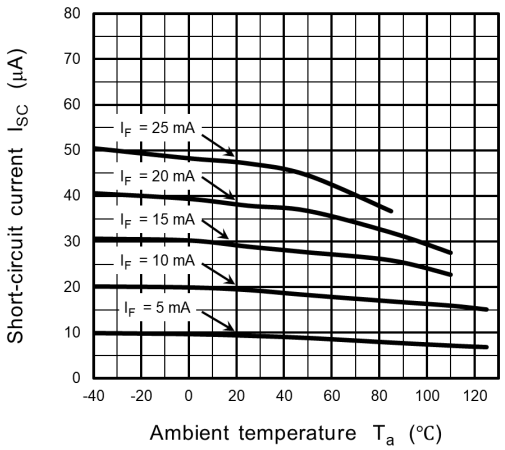


Fig. 10.12 I_{SC} - T_a

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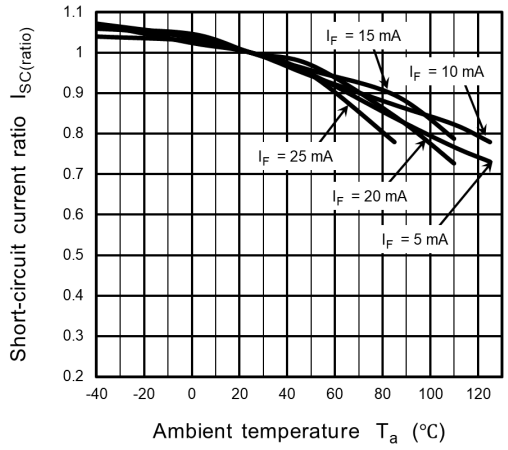


Fig. 10.13 $I_{SC(ratio)}$ - T_a

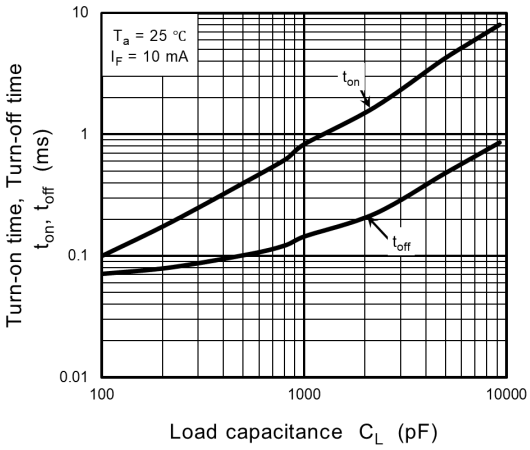


Fig. 10.14 t_{on}, t_{off} - C_L

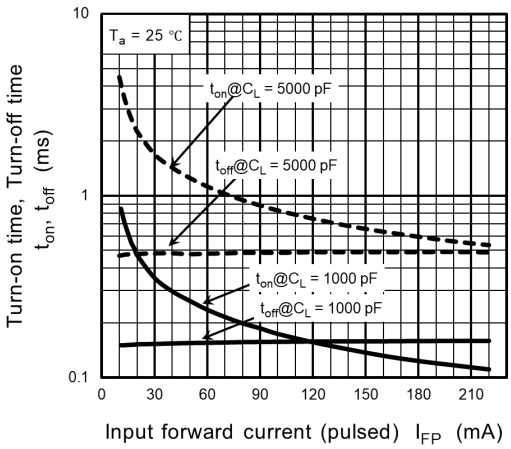


Fig. 10.15 t_{on}, t_{off} - I_{FP}

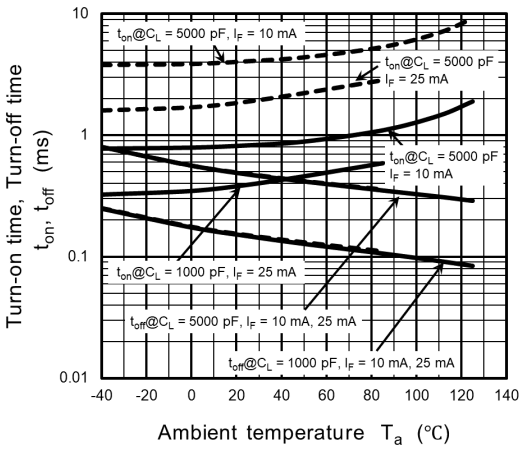


Fig. 10.16 t_{on}, t_{off} - T_a

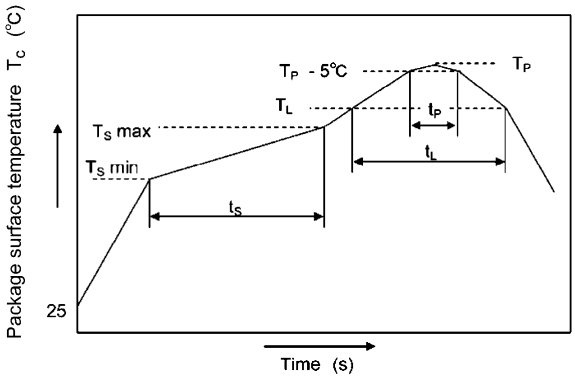
Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

11. Soldering and Storage

11.1. Precautions for Soldering

The soldering temperature should be controlled as closely as possible to the conditions shown below, irrespective of whether a soldering iron or a reflow soldering method is used.

- When using soldering reflow.
  The soldering temperature profile is based on the package surface temperature.
  (See the figure shown below, which is based on the package surface temperature.)
  Reflow soldering must be performed once or twice.
  The mounting should be completed with the interval from the first to the last mountings being 2 weeks.



	Symbol	Min	Max	Unit
Preheat temperature	T_S	150	200	°C
Preheat time	t_S	60	120	s
Ramp-up rate (T_L to T_P)			3	°C/s
Liquidus temperature	T_L	217		°C
Time above T_L	t_L	60	150	s
Peak temperature	T_P		260	°C
Time during which T_c is between (T_P – 5) and T_P	t_P		30	s
Ramp-down rate (T_P to T_L)			6	°C/s

Fig. 11.1.1 An example of a temperature profile when lead(Pb)-free solder is used

- When using soldering flow
  Preheat the device at a temperature of 150 °C (package surface temperature) for 60 to 120 seconds.
  Mounting condition of 260 °C within 10 seconds is recommended.
  Flow soldering must be performed once.
- When using soldering Iron
  Complete soldering within 10 seconds for lead temperature not exceeding 260 °C or within 3 seconds not exceeding 350 °C
  Heating by soldering iron must be done only once per lead.

11.2. Precautions for General Storage

- Avoid storage locations where devices may be exposed to moisture or direct sunlight
- Follow the precautions printed on the packing label of the device for transportation and storage.
- Keep the storage location temperature and humidity within a range of 5 °C to 35 °C and 45 % to 75 %, respectively.
- Do not store the products in locations with poisonous gases (especially corrosive gases) or in dusty conditions.
- Store the products in locations with minimal temperature fluctuations. Rapid temperature changes during storage can cause condensation, resulting in lead oxidation or corrosion, which will deteriorate the solderability of the leads.
- When restoring devices after removal from their packing, use anti-static containers.
- Do not allow loads to be applied directly to devices while they are in storage.

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12. Land Pattern Dimensions (for reference only)

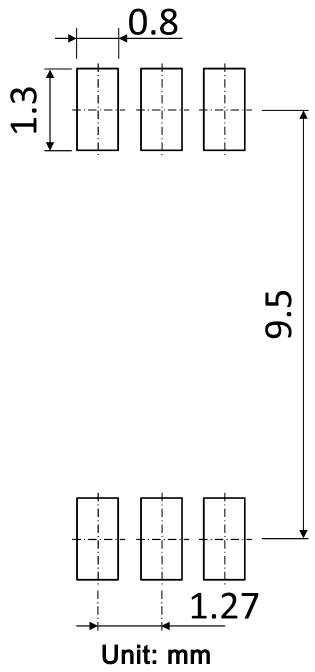


Fig. 12.1 Land Pattern Dimensions (for reference only)

13. Marking

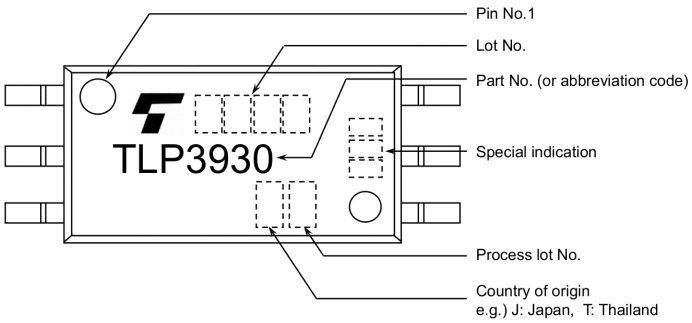
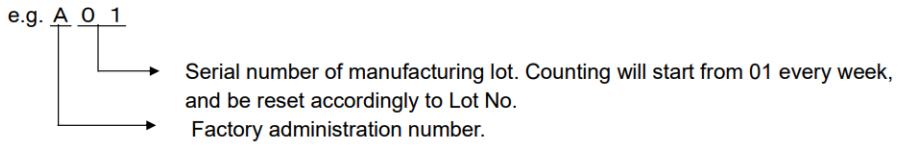
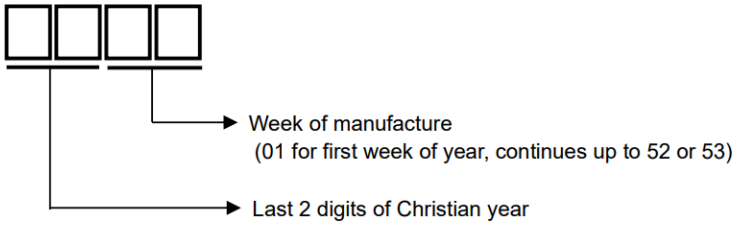


Fig. 13.1 Marking Example

・Information of special indication



・Information of Weekly 4 digits code table



For example, “1841” means that the lot is manufactured at the 41th week of **18 year.
(**18 year: A year that its last 2 digits are 18.)

14. EN IEC 60747-5-5 Option (D4) Specification

- Part number: TLP3930 **(Note 1)**
- The following part naming conventions are used for the devices that have been qualified according to option (D4) of EN IEC 60747.

  Example: TLP3930(D4-TP,E

  D4: EN IEC 60747 option
  TP: Tape type
  E: [[G]]/RoHS COMPATIBLE **(Note 2)**

Note 1: Use TOSHIBA standard type number for safety standard application.
e.g., TLP3930(D4-TP,E → TLP3930

Note 2: Please contact your Toshiba sales representative for details on environmental information such as the product's RoHS compatibility.
RoHS is the Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Description	Symbol	Rating	Unit
Application classification for rated mains voltage ≤ 600 Vrms for rated mains voltage ≤ 1000 Vrms		 I-IV I-III	—
Climatic classification		40 / 125 / 21	—
Pollution degree		2	—
Maximum operating insulation voltage	V_{IORM}	1230	Vpeak
Input to output test voltage, Method A V_{pr} = 1.6 × V_{IORM}, type and sample test t_p = 10 s, partial discharge < 5 pC	V_{pr}	1970	Vpeak
Input to output test voltage, Method B V_{pr} = 1.875 × V_{IORM}, 100 % production test t_p = 1 s, partial discharge < 5 pC	V_{pr}	2310	Vpeak
Highest permissible overvoltage (transient overvoltage, t_{pr} = 60 s)	V_{TR}	8000	Vpeak
Safety limiting values (max. permissible ratings in case of fault, also refer to thermal derating curve) current (input current I_F, P_{so} = 0) power (output or total power dissipation) temperature	 I_{si} P_{so} T_s	 300 700 150	 mA mW °C
Insulation resistance V_{IO} = 500 V, T_a = 25 °C V_{IO} = 500 V, T_a = 100 °C V_{IO} = 500 V, T_a = T_s	R_{si}	≥ 10^{12} ≥ 10^{11} ≥ 10^9	Ω

Fig. 14.1 EN IEC 60747 Insulation Characteristics

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Table Insulation Related Specifications (Note)

Insulation Related Parameters	Symbol	TLP3930
Minimum creepage distance	Cr	8.0 mm
Minimum clearance	Cl	8.0 mm
Minimum insulation thickness	ti	0.4 mm
Comparative tracking index	CTI	500

Note: If a printed circuit is incorporated, the creepage distance and clearance may be reduced below this value. (e.g., at a standard distance between soldering eye centers of 7.5 mm). If this is not permissible, the user shall take suitable measures.

Note: This photocoupler is suitable for **safe electrical isolation** only within the safety limit data. Maintenance of the safety data shall be ensured by means of protective circuits.

Fig. 14.2 Marking on packing

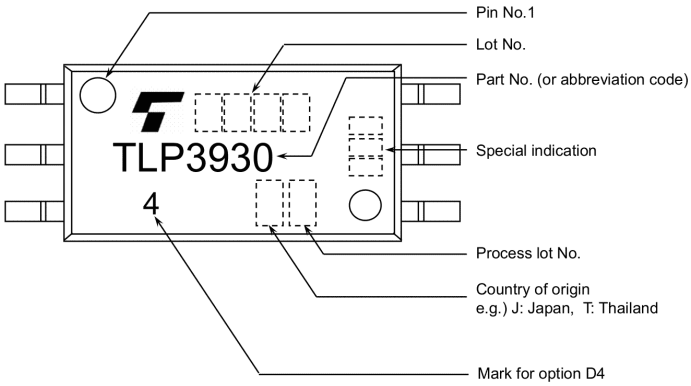


Fig. 14.3 Marking Example (Note)

Note: The above marking is applied to the photocouplers that have been qualified according to option (D4) of EN IEC 60747.

Figure 1 Partial discharge measurement procedure according to EN IEC 60747
Destructive test for qualification and sampling tests.

Method A

(for type and sampling tests, destructive tests)

t_1, t_2	= 1 to 10 s
t_3, t_4	= 1 s
t_p (Measuring time for partial discharge)	= 10 s
t_b	= 12 s
t_{ini}	= 60 s

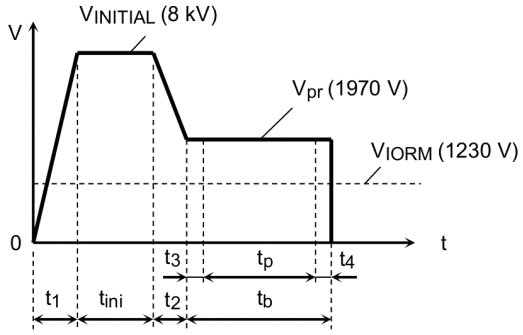


Figure 2 Partial discharge measurement procedure according to EN IEC 60747
Non-destructive test for 100 % inspection.

Method B

(for sample test, non-destructive test)

t_3, t_4	= 0.1 s
t_p (Measuring time for partial discharge)	= 1 s
t_b	= 1.2 s

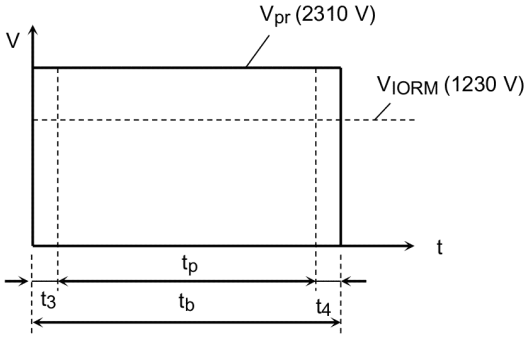


Figure 3 Dependency of maximum safety ratings on ambient temperature

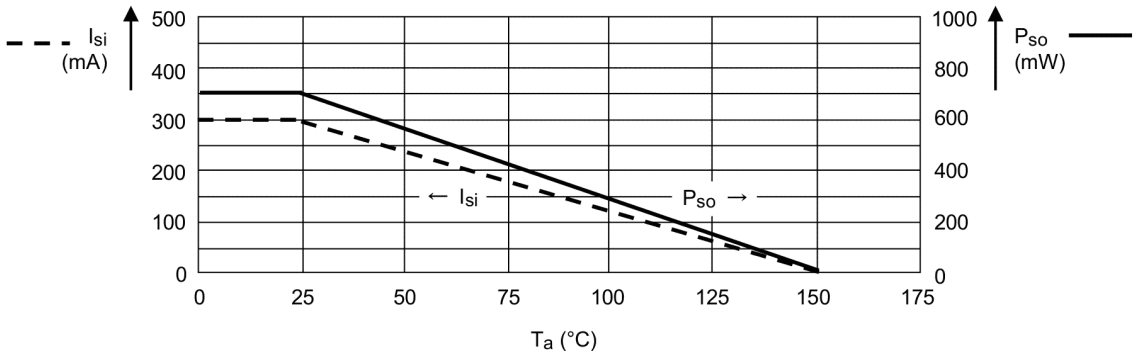


Fig. 14.4 Measurement Procedure

15. Devices in Halogen-Free Resin Packages

・This product is Halogen-Free

Toshiba Electronic Devices & Storage Corporation ("Toshiba") defines a "Halogen-Free resin semiconductor product" as a semiconductor product in which:

(1) the encapsulating resins do not contain any of the following elements: bromine (Br), chlorine (Cl) and antimony (Sb), respectively, in an amount exceeding 0.09 weight percent, and do not contain chlorine and bromine in an aggregate amount exceeding 0.15 weight percent of the encapsulating resins, and/or

(2) the resin portion(s) in printed circuit boards do not contain any of the following elements: bromine, chlorine and antimony, respectively, in an amount exceeding 0.09 weight percent, and do not contain chlorine and bromine in an aggregate amount exceeding 0.15 weight percent of the each resin portion(s) in printed circuit boards.

For avoidance of doubt, "Halogen-Free resin semiconductor product" does not mean, and Toshiba does not make any warranty of any kind, that said semiconductor product is entirely free of antimony or of any of the following elements of the halogen family: bromine, chlorine, iodine (I), fluorine (F) and astatine (At).

In addition, a Halogen-Free resin semiconductor product may contain antimony and/or any of the elements of the halogen family as mentioned in the above paragraph in one or more portion(s) of the semiconductor product other than the encapsulating resins and the resin portion(s) in printed circuit boards.

The information provided herein is accurate as of the date that it was provided, to the best of the knowledge and belief of the Toshiba Electronic Devices & Storage Corporation ("Toshiba"), Toshiba bases such knowledge and belief on information provided by third parties, and Toshiba makes no representation or warranty as to the accuracy of such third party information. Toshiba has taken and will continue to take, reasonable steps to provide accurate information to its customers, but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals.

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16. Ordering Information (Example of Item Name)

Item Name (Note 1)	Packaging (Note 2)	VDE Option	Packing (MOQ)
TLP3930(E(*	SMD		Magazine (125 pcs)
TLP3930(TP,E(*	SMD		Tape and reel (1500 pcs)
TLP3930(D4,E(*	SMD	EN IEC 60747	Magazine (125 pcs)
TLP3930(D4-TP,E(*	SMD	EN IEC 60747	Tape and reel (1500 pcs)

Note 1: (*: Factory production (O: Japan, (T: Thailand
Note 2: SMD: Surface Mount Device

17. Ordering Information

When placing an order, please specify the part number, tape type and quantity as shown in the following example.

Example: TLP3930(TP,E(* 1500 pcs

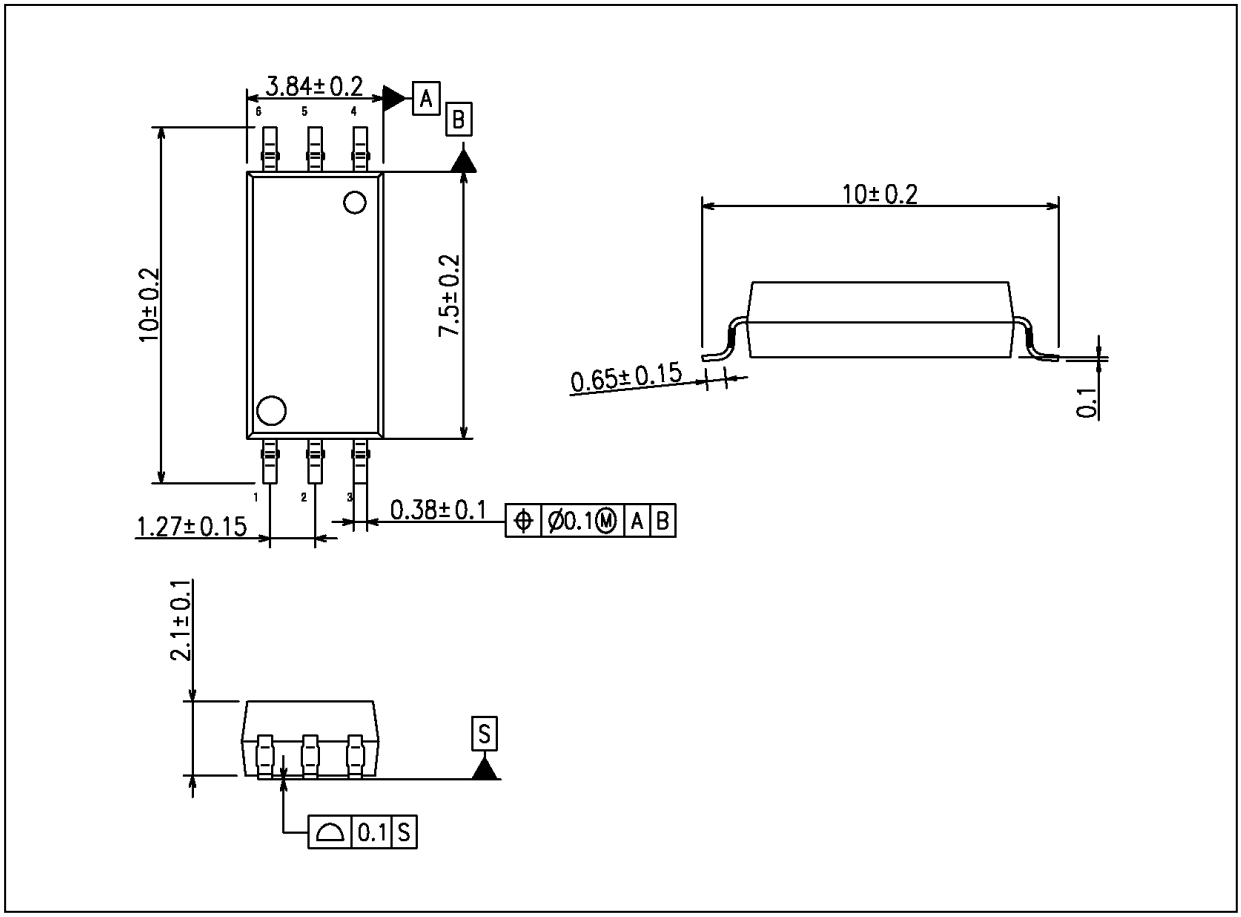
Part number: TLP3930
TPL: Tape type
E: [[G]]/RoHS COMPATIBLE (Note 1)
(*: Factory production (O: Japan (T: Thailand
Quantity (must be a multiple of 1500): 1500 pcs

Note 1: Please contact your Toshiba sales representative for details on environmental information such as the product's RoHS compatibility.
RoHS is the Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

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Package Dimensions

Unit: mm



Weight: 0.126 g (typ.)

Package Name(s)
TOSHIBA: 11-4N1A

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