Photocouplers GaAℓAs Infrared LED & Photo IC

TLP2403

1. Applications

2. General

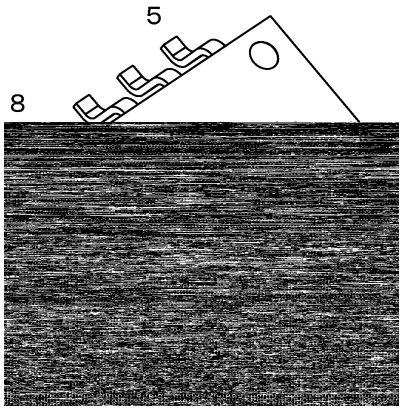
3. Features

℃

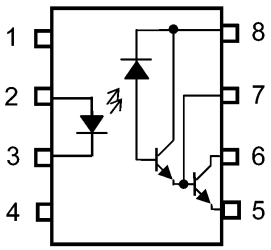
μ μ Ω

Note: When an EN60747-5-2 approved type is needed, please designate the **Option (V4)**.

4. Packaging and Pin Configuration



SO8



1: NC
2: Anode
3: Cathode
4: NC
5: GND (Emitter)
6: Output (Collector)
7: Base
8: V_{CC}

5. Internal Circuit

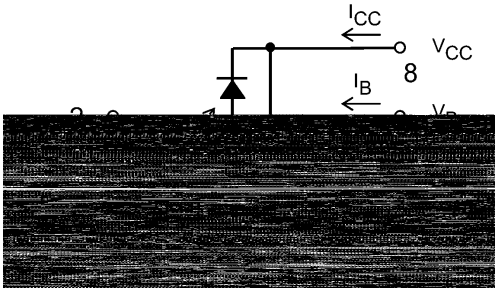


Fig. 5.1 Internal Circuit

6. Principle of Operation

6.1. Mechanical Parameters

Characteristics	Min	Unit
Creepage distances	4.0	mm
Clearance	4.0	
Internal isolation thickness	—	

7. Absolute Maximum Ratings (Note)

℃

	Characteristics		Symbol	Note	Rating	Unit
LED	Forward current		I_F		20	mA
	Forward current derating	($T_a \geq 85$℃)	ΔI_F/℃		-0.67	mA/℃
	Pulse forward current		I_{FP}	(Note 1)	40	mA
	Pulse forward current derating	($T_a \geq 85$℃)	ΔI_{FP}/℃		-1.0	mA/℃
	Transient pulse forward current		I_{FPT}	(Note 2)	1	A
	Transient pulse forward current derating	($T_a \geq 85$℃)	ΔI_{FPT}/℃		-25	mA/℃
	Reverse voltage		V_R		5	V
	Power dissipation		P_D		40	mW
	Power dissipation derating	($T_a \geq 85$℃)	ΔP_D/℃		-1.0	mW/℃
Detector	Output current		I_O		60	mA
	Output current derating	($T_a \geq 25$℃)	ΔI_O/℃		-0.6	mA/℃
	Output voltage		V_O		-0.5 to 18	V
	Supply voltage		V_{CC}		-0.5 to 18	
	Emitter-base reverse voltage		V_{EB}		0.5	
	Output power dissipation		P_O		100	mW
	Output power dissipation derating	($T_a \geq 25$℃)	ΔP_O/℃		-1.0	mW/℃
Common	Operating temperature		T_{opr}		-40 to 100	℃
	Storage temperature		T_{stg}		-55 to 125	
	Lead soldering temperature	(10 s)	T_{sol}		260	
	Isolation voltage	AC, 1 min, R.H. ≤ 60%	BV_S	(Note 3)	3750	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: Pulse width (PW) ≤ 1 ms, duty = 50%

Note 2: Pulse width (PW) ≤ 1 μs, 300 pps

Note 3: This device is considered as a two-terminal device: Pins 1, 2, 3 and 4 are shorted together, and pins 5, 6, 7 and 8 are shorted together.

8. Recommended Operating Conditions (Note)

Characteristics	Symbol	Note	Min	Typ.	Max	Unit
Forward current	I_F		0.5	—	15	mA
Output current	I_O		—	—	30	
Supply voltage	V_{CC}		—	—	16	
Operating temperature	T_{opr}	(Note 1)	-40	—	100	

9. Electrical Characteristics (Note)

℃

Characteristics	Symbol	Note	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Input forward voltage	V_F			I_F = 1.6 mA, T_a = 25℃	1.30	1.45	1.70	V
Input temperature coefficient of forward voltage	$\Delta V_F/\Delta T_a$			I_F = 1.6 mA	—	-1.8	—	mV/℃
Input reverse current	I_R			V_R = 5 V, T_a = 25℃	—	—	10	μA
Input capacitance	C_t			V = 0 V, f = 1 MHz, T_a = 25℃	—	60	—	pF
High-level output current	I_{OH}			V_F = 0.8 V, V_{CC} = V_O = 18 V	—	0.1	100	μA
High-level supply current	I_{CCH}			I_F = 0 mA, V_{CC} = 5 V, V_O = Open	—	0.01	10	μA
Low-level supply current	I_{CCL}			I_F = 1.6 mA, V_{CC} = 5 V, V_O = Open	0.1	1	1.5	mA
Current transfer ratio	I_O/I_F			I_F = 0.5 mA, V_{CC} = 4.5 V, V_O = 0.4 V	400	1000	—	%
				I_F = 1.6 mA, V_{CC} = 4.5 V, V_O = 0.4 V	500	900	—	
Low-level output voltage	V_{OL}			I_F = 1.6 mA, V_{CC} = 4.5 V, I_{OL} = 6.4 mA	—	0.1	0.4	V
				I_F = 5 mA, V_{CC} = 4.5 V, I_{OL} = 15 mA	—	0.1	0.4	
				I_F = 12 mA, V_{CC} = 4.5 V, V_O = 24 mA	—	0.15	0.4	

Note: All typical values are at T_a = 25℃.

10. Isolation Characteristics

℃

Characteristics	Symbol	Note	Test Conditions	Min	Typ.	Max	Unit
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%	1×10^{12}	10^{14}	—	Ω
Isolation voltage	BV_S		AC, 1 min	3750	—	—	Vrms
			AC, 1 s in oil	—	10000	—	
			DC, 1 min in oil	—	10000	—	Vdc

Note 1: This device is considered as a two-terminal device: Pins 1, 2, 3 and 4 are shorted together, and pins 5, 6, 7 and 8 are shorted together.

11. Switching Characteristics

°C

Characteristics	Symbol	Note	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Propagation delay time (H/L)	t_{pHL}		Fig. 12.1.1	I_F = 0.5 mA, R_L = 4.7 kΩ, T_a = 25°C	—	2	25	μs
				I_F = 0.5 mA, R_L = 4.7 kΩ	—	2	30	
				I_F = 12 mA, R_L = 270 Ω, T_a = 25°C	—	0.3	1	
				I_F = 12 mA, R_L = 270 Ω	—	0.3	2	
				I_F = 1.6 mA, R_L = 2.2 kΩ, T_a = 25°C	—	0.5	10	
				I_F = 1.6 mA, R_L = 2.2 kΩ	—	0.5	15	
Propagation delay time (L/H)	t_{pLH}		Fig. 12.1.1	I_F = 0.5 mA, R_L = 4.7 kΩ, T_a = 25°C	—	4	60	μs
				I_F = 0.5 mA, R_L = 4.7 kΩ	—	4	90	
				I_F = 12 mA, R_L = 270 Ω, T_a = 25°C	—	1	7	
				I_F = 12 mA, R_L = 270 Ω	—	1	10	
				I_F = 1.6 mA, R_L = 2.2 kΩ, T_a = 25°C	—	4.5	35	
				I_F = 1.6 mA, R_L = 2.2 kΩ	—	4.5	50	
Common-mode transient immunity at output high	CM_H	(Note 1)	Fig. 12.1.2	I_F = 0 mA, R_L = 2.2 kΩ, V_{CM} = 10 V, $V_{O(min)}$ = 2 V	—	500	—	V/μs
Common-mode transient immunity at output low	CM_L	(Note 2)		I_F = 1.6 mA, R_L = 2.2 kΩ, V_{CM} = 10 V, $V_{O(max)}$ = 0.8 V	—	-500	—	

12. Test Circuits and Characteristics Curves

12.1. Test Circuits

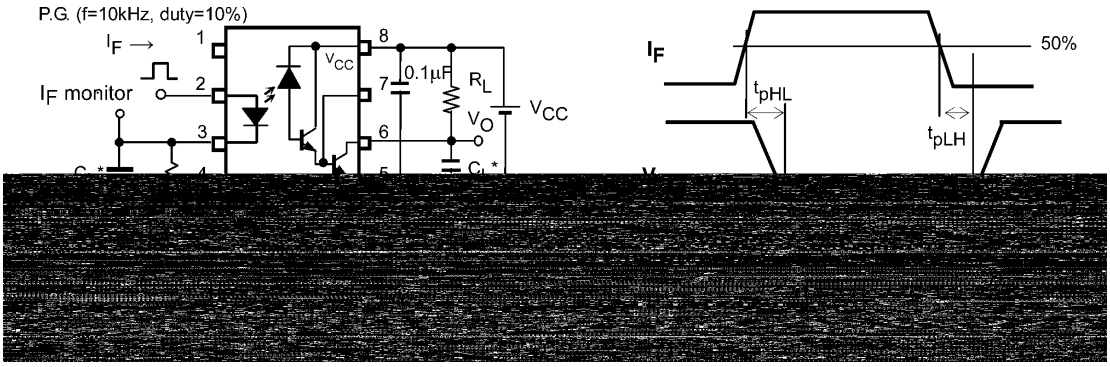


Fig. 12.1.1 Switching Time Test Circuit

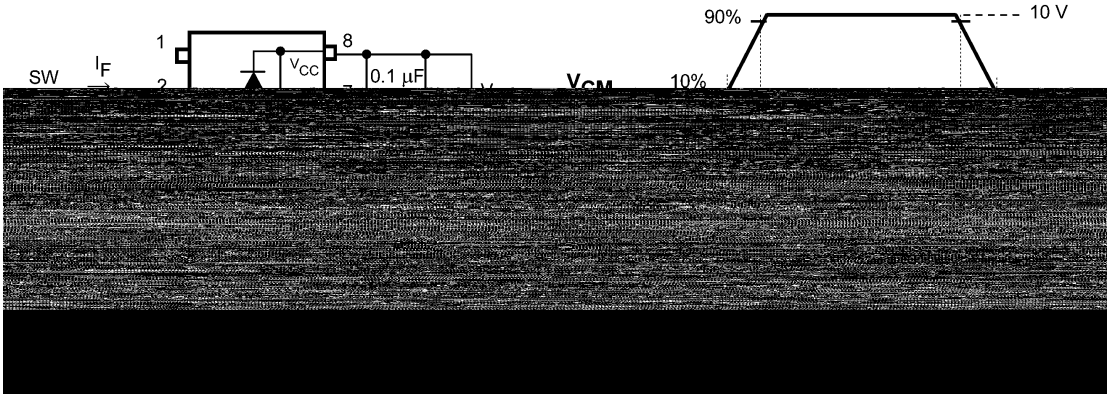


Fig. 12.1.2 Common-Mode Transient Immunity

13. Soldering and Storage

13.1. Precautions for Soldering

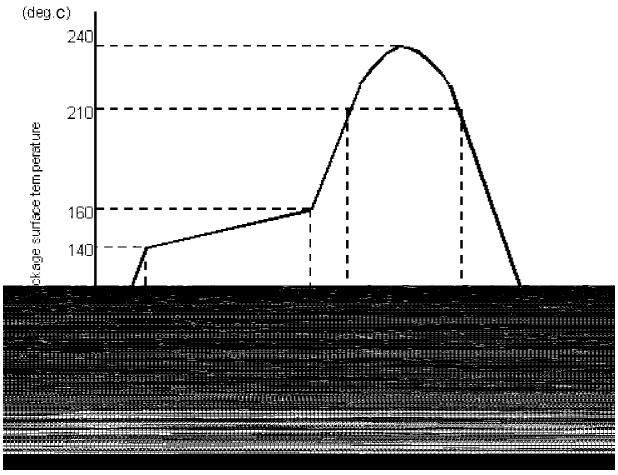


Fig. 13.1.1 An example of a temperature profile when Sn-Pb eutectic solder is used

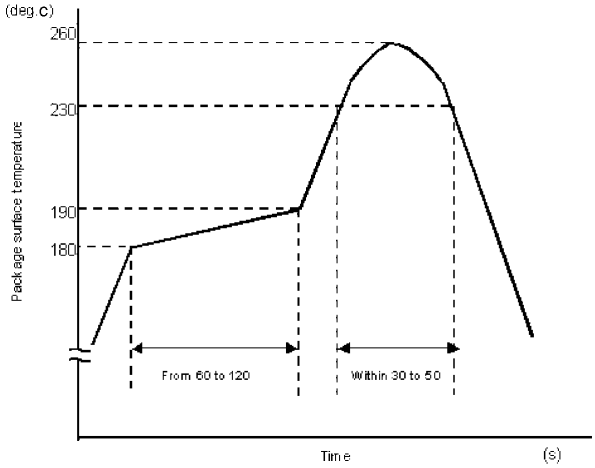


Fig. 13.1.2 An example of a temperature profile when lead(Pb)-free solder is used

℃

℃

℃

℃

13.2. Precautions for General Storage

℃ ℃

14. Land Pattern Dimensions for Reference Only

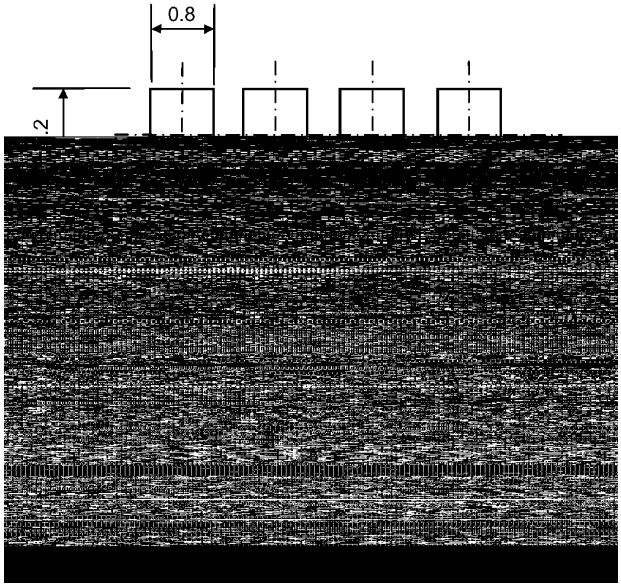


Fig. 14.1 Land Pattern Dimensions for Reference Only (unit: mm)

15. Marking

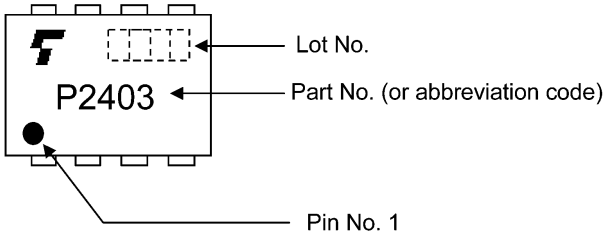
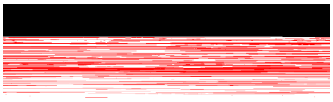


Fig. 15.1 Marking



2010-09-06
Rev.1.0

Minimum creepage distance	Cr	4.0mm
Minimum clearance	Cl	4.0mm
[illegible]	[illegible]	[illegible]

Fig. 16.2 Insulation Related Specifications (Note)

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 3.5 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.

Marking on product for EN60747 : V

Marking on packing for EN60747 : VDE

Marking Example : TLP2403

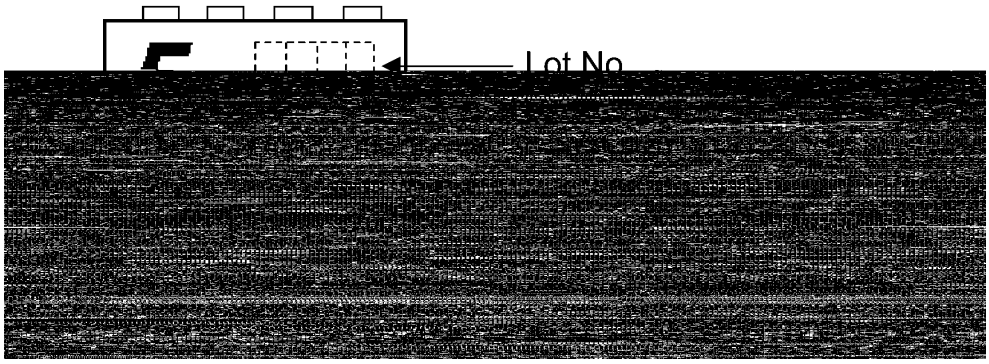
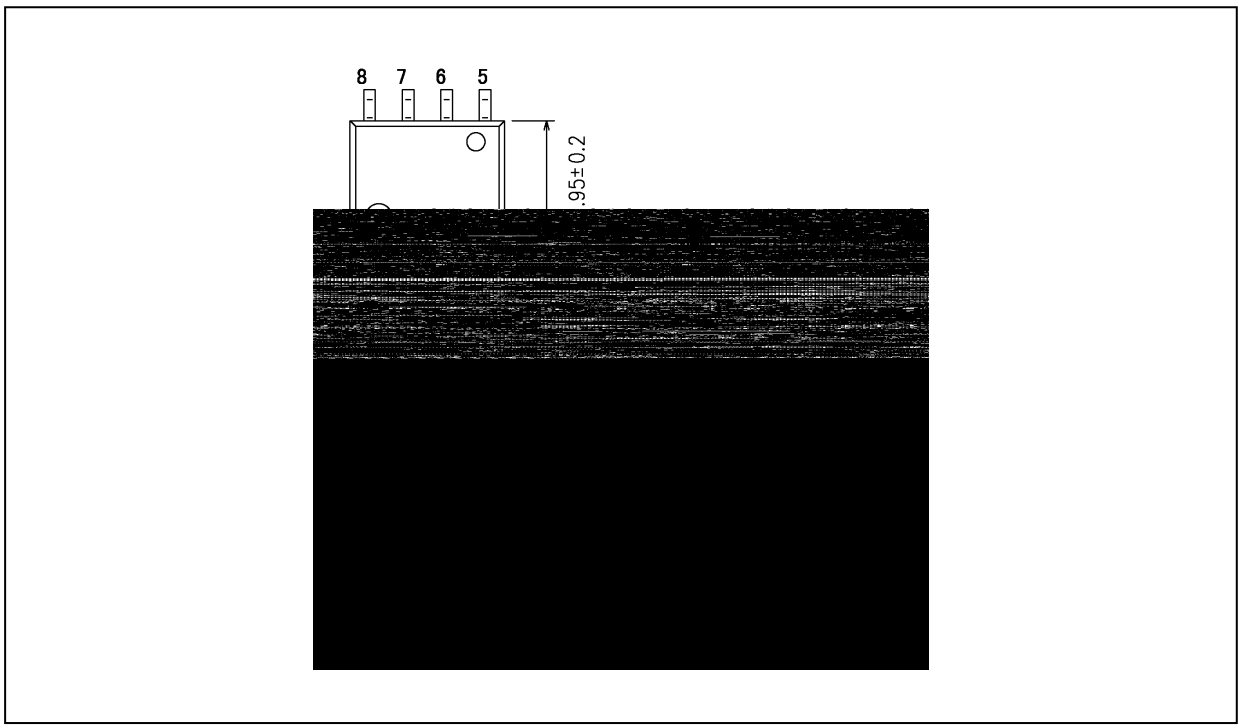


Fig. 16.3 Marking Example (Note)

Note: The above marking is applied to the photocouplers that have been qualified according to option (V4) of EN60747.

Package Dimensions

Unit: mm



Weight: 0.11 g (typ.)

Package Name(s)
TOSHIBA: 11-5K1S
Nickname: SO8

RESTRICTIONS ON PRODUCT USE

- Toshiba Corporation, and its subsidiaries and affiliates (collectively "TOSHIBA"), reserve the right to make changes to the information in this document, and related hardware, software and systems (collectively "Product") without notice.
- This document and any information herein may not be reproduced without prior written permission from TOSHIBA. Even with TOSHIBA's written permission, reproduction is permissible only if reproduction is without alteration/omission.
- Though TOSHIBA works continually to improve Product's quality and reliability, Product can malfunction or fail. Customers are responsible for complying with safety standards and for providing adequate designs and safeguards for their hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of Product could cause loss of human life, bodily injury or damage to property, including data loss or corruption. Before customers use the Product, create designs including the Product, or incorporate the Product into their own applications, customers must also refer to and comply with (a) the latest versions of all relevant TOSHIBA information, including without limitation, this document, the specifications, the data sheets and application notes for Product and the precautions and conditions set forth in the "TOSHIBA Semiconductor Reliability Handbook" and (b) the instructions for the application with which the Product will be used with or for. Customers are solely responsible for all aspects of their own product design or applications, including but not limited to (a) determining the appropriateness of the use of this Product in such design or applications; (b) evaluating and determining the applicability of any information contained in this document, or in charts, diagrams, programs, algorithms, sample