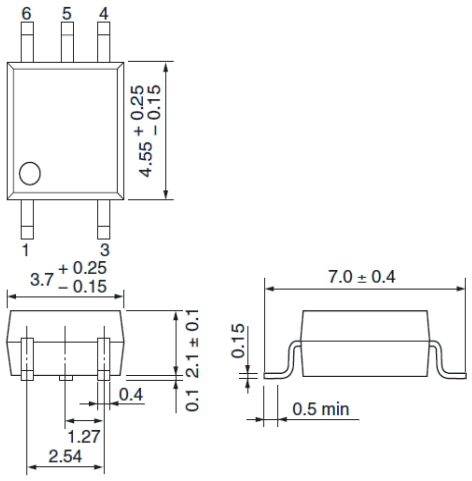
TOSHIBA Photocoupler GaAℓAs Ired & Photo-IC

TLP109

Programmable Controllers
Industrial Inverters
Switching Power Supplies

Unit: mm



JEDEC	—
JEITA	—
TOSHIBA	11-4L1

Weight: 0.08 g (typ.)

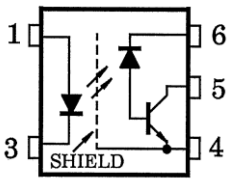
The Toshiba TLP109 mini-flat coupler is a small-outline coupler suitable for surface-mount assembly. The TLP109 consists of a high-output-power GaAℓAs light emitting diode optically coupled to a high-speed photodiode-transistor chip. The TLP109 is housed in the SO6 package and guarantees a creepage distance of ≥ 5.0 mm, a clearance of ≥ 5.0 mm and an insulation thickness of ≥ 0.4 mm. Therefore, the TLP109 meets the reinforced insulation class requirements of international safety standards.

- Isolation voltage: 3750 Vrms (min)
- Switching speed: t_{pHL} = 0.8 μs, t_{pLH} = 0.8 μs (max)
  @R_L = 1.9 kΩ
- TTL-compatible
- UL approved : UL1577, File No.E67349
- c-UL approved : CSA Component Acceptance Service No. 5A, File No.E67349
- VDE-approved: EN60747-5-5, EN60065 or EN60950-1 (Note 1)
- CQC-approved: GB4943.1, GB8898 Thailand Factory

仅适用于海拔 2000m 以下地区安全使用

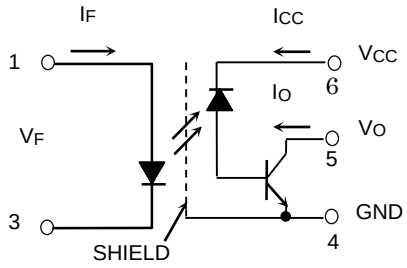
Note 1 : When a EN60747-5-5 approved type is needed, Please designate "Option(V4)"

Pin Configuration (Top View)



1: ANODE
3: CATHODE
4: EMITTER (GND)
5: COLLECTOR (OUTPUT)
6: V_{CC}

Schematic



Construction Mechanical Ratings

Creepage distance:	5.0 mm (min)
Clearance:	5.0 mm (min)
Insulation thickness:	0.4 mm (min)

Start of commercial production
2008-07

Absolute Maximum Ratings (Ta = 25°C)

Characteristic			Symbol	Rating	Unit
LED	Forward current		I_F	20	mA
	Forward Current Derating (Ta ≥ 95 °C)		ΔIF/°C	-0.36	mA/°C
	Pulse forward current	(Note 1)	I_{FP}	40	mA
	Peak transient forward current	(Note 2)	I_{FPT}	1	A
	Reverse voltage		V_R	5	V
	Power dissipation	(Note 3)	P_D	40	mW
Detector	Output current		I_O	8	mA
	Output Current Derating (Ta ≥ 95 °C)		ΔIO/°C	-0.3	mA/°C
	Peak output current		I_{OP}	16	mA
	Supply voltage		V_{CC}	−0.5 to 30	V
	Output voltage		V_O	−0.5 to 20	V
	Output power dissipation	(Note 4)	P_O	100	mW
Operating temperature range			T_{opr}	−55 to 125	°C
Storage temperature range			T_{stg}	−55 to 125	°C
Lead solder temperature (10 s)			T_{sol}	260	°C
Isolation Voltage (AC, 60 s, R.H. ≤ 60%)		(Note 5)	BV_S	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: 50% duty cycle, 1 ms pulse width. Derate 0.72 mA / °C above 95°C.

Note 2: Pulse width ≤ 1 μs, 300 pps.

Note 3: Derate 0.72 mW / °C above 95°C.

Note 4: Derate 1.8 mW / °C above 95°C.

Note 5: Device considered a two−terminal device: Pins 1 and 3 shorted together, and pins 4, 5 and 6 shorted together.

Electrical Characteristics (Ta = 25°C)

Characteristic		Symbol	Test Condition	Min	Typ.	Max	Unit
LED	Forward voltage	V_F	I_F = 16 mA	1.50	1.64	1.85	V
	Forward voltage temperature coefficient	$\Delta V_F / \Delta Ta$	I_F = 16 mA	—	−1.6	—	mV /°C
	Reverse current	I_R	V_R = 3 V	—	—	10	μA
	Capacitance between terminals	C_T	V_F = 0 V, f = 1 MHz	—	60	—	pF
Detector	High level output current	$I_{OH\ (1)}$	I_F = 0 mA, V_{CC} = V_O = 5.5 V	—	3	500	nA
		$I_{OH\ (2)}$	I_F = 0 mA, V_{CC} = 30 V, V_O = 20 V	—	—	5	μA
		I_{OH}	I_F = 0 mA, V_{CC} = 30 V, V_O = 20 V, Ta = 100°C	—	—	50	
	High level supply current	I_{CCH}	I_F = 0 mA, V_{CC} = 30 V	—	0.01	1	μA
Current transfer ratio		I_O / I_F	I_F = 16 mA, V_{CC} = 4.5 V, V_O = 0.4 V	20	—	—	%
Low level output voltage		V_{OL}	I_F = 16 mA, V_{CC} = 4.5 V, I_O = 2.4 mA	—	—	0.4	V

Isolation Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Conditions	Min	Typ.	Max	Unit
Capacitance input to output	C_S	V = 0 V, f = 1 MHz (Note 6)	—	0.8	—	pF
Isolation resistance	R_S	R.H. ≤ 60%, V_S = 500 V (Note 6)	1×10^{12}	10^{14}	—	Ω
Isolation voltage	BV_S	AC, 60 s	3750	—	—	V_{rms}
		AC, 1 s, in oil	—	10000	—	
		DC, 60 s, in oil	—	10000	—	Vdc

Note 6: Maximum electrostatic discharge voltage for any pins: 100 V (C = 200 pF, R=0 Ω)

Switching Characteristics (Ta = 25°C, V_{CC} = 5 V)

Characteristic	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Propagation delay time (H→ L)	t_{pHL}	Figure 1	I_F = 0→ 16 mA, R_L = 1.9 kΩ	—	—	0.8	μs
Propagation delay time (L→ H)	t_{pLH}	Figure 1	I_F = 16→ 0 mA, R_L = 1.9 kΩ	—	—	0.8	μs
Common mode transient immunity at high output level (Note 7)	CM_H	Figure 2	I_F = 0 mA, V_{CM} = 400 V_{p-p}, R_L = 4.1 kΩ	5000	10000	—	V / μs
Common mode transient Immunity at low output level (Note 7)	CM_L	Figure 2	I_F = 16 mA, V_{CM} = 400 V_{p-p}, R_L = 4.1 kΩ	−5000	−10000	—	V / μs

Note 7: CM_L is the maximum rate of fall of the common mode voltage that can be sustained with the output voltage in the logic low state (V_O < 0.8 V).
CM_H is the maximum rate of rise of the common mode voltage that can be sustained with the output voltage in the logic high state (V_O > 2.0 V)

Figure 1: Switching Time Test Circuit and Waveform

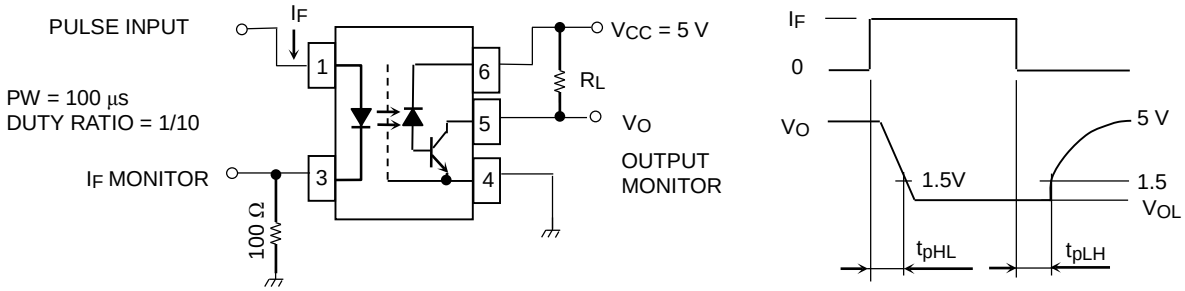
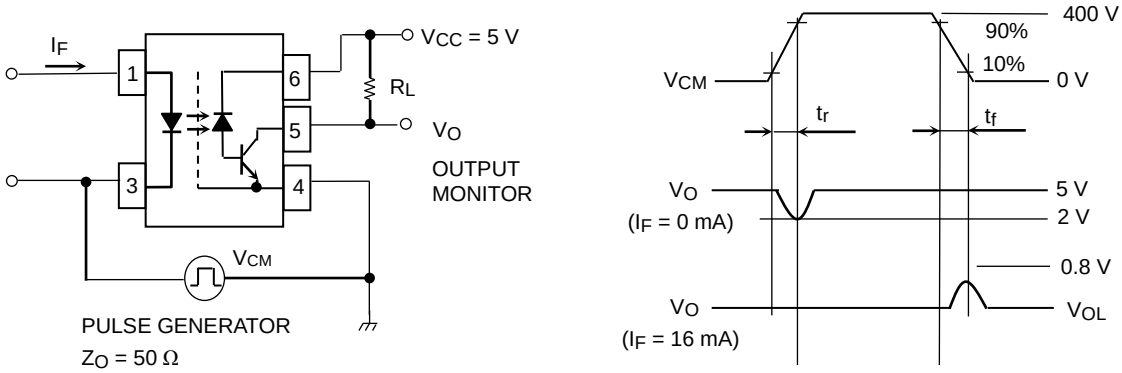
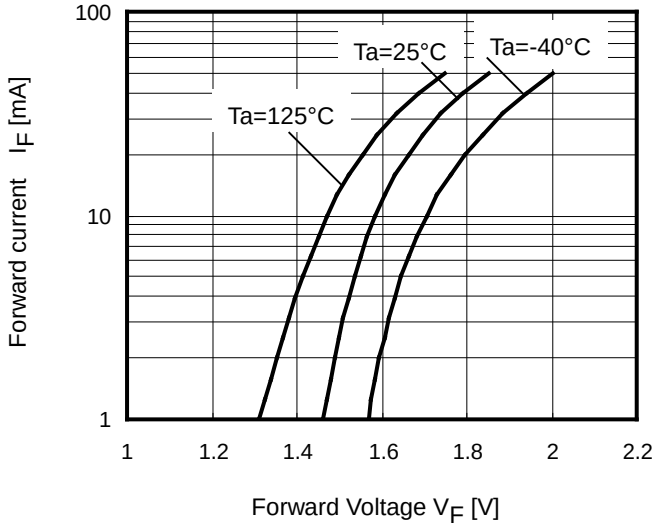


Figure 2: Common Mode Transient Immunity Test Circuit and Waveform

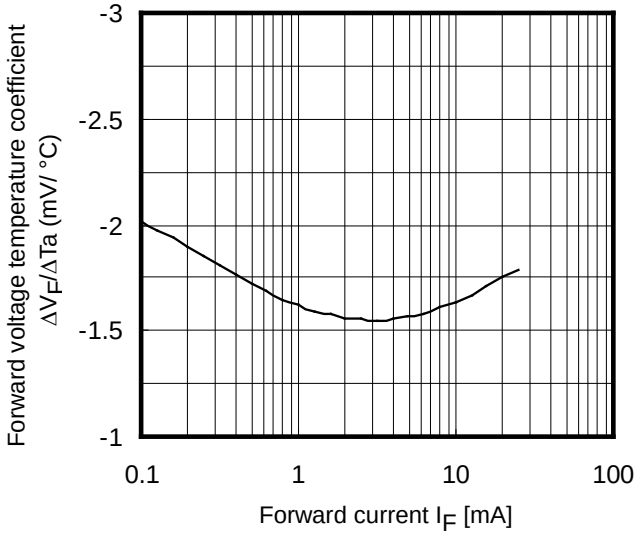


$$CM_H = \frac{320(V)}{t_r(\mu s)}, \quad CM_L = \frac{320(V)}{t_r(\mu s)}$$

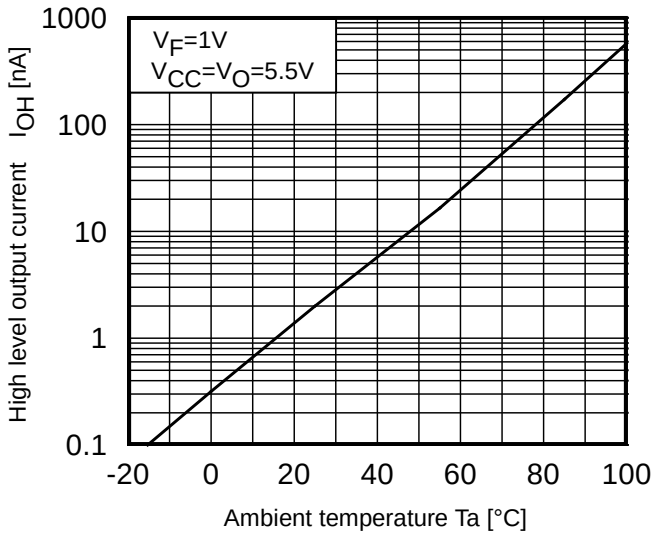
$I_F - V_F$



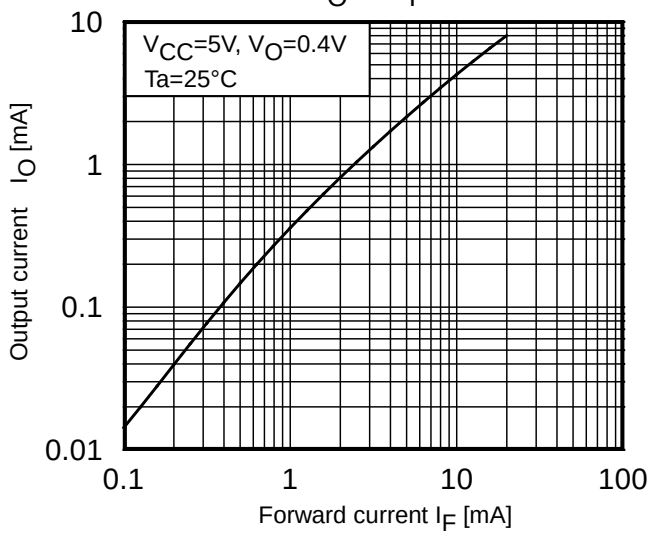
$\Delta V_F/\Delta Ta - I_F$



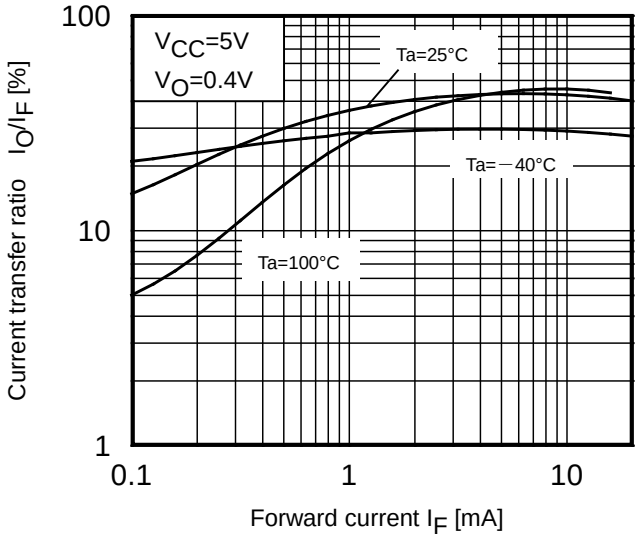
$I_{OH} - Ta$



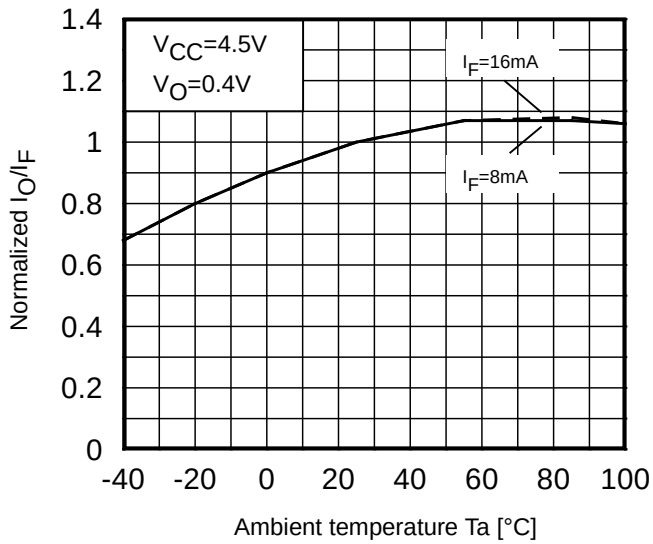
$I_O - I_F$



$I_O/I_F - I_F$

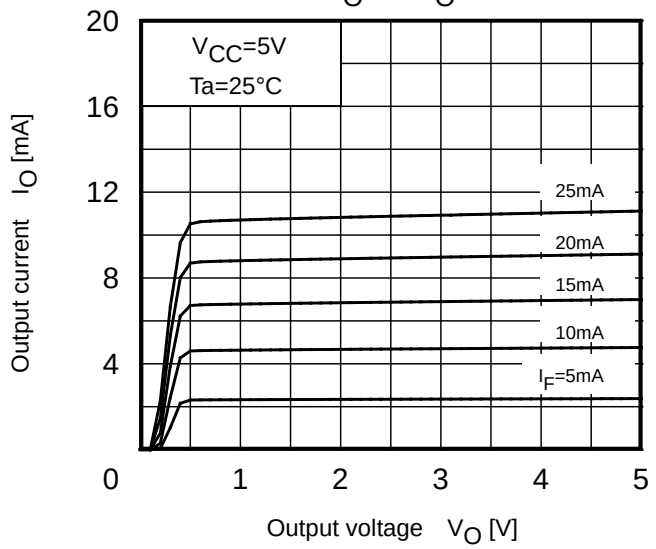


$I_O/I_F - Ta$

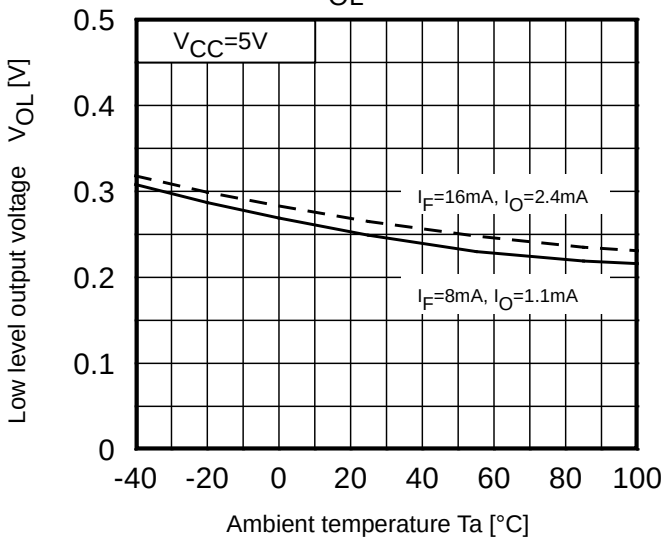


* The above graphs show typical characteristics.

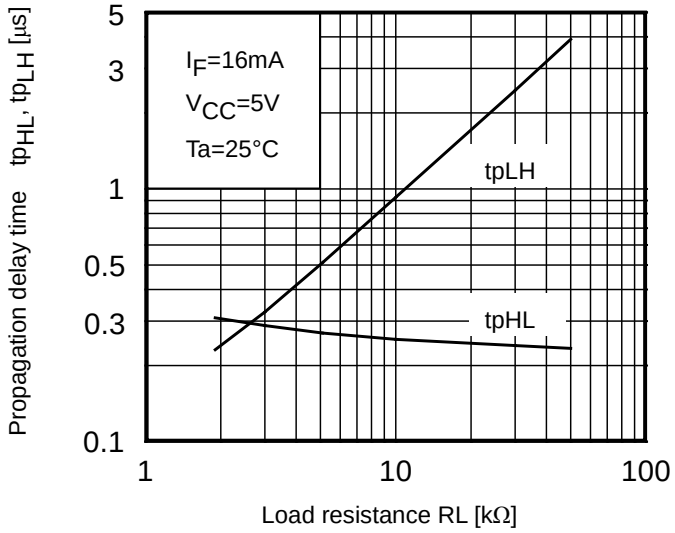
I_O – V_O



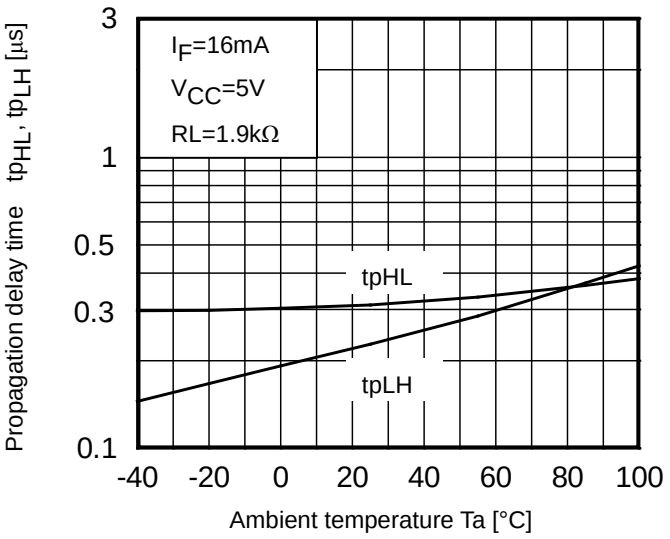
V_{OL} – Ta



tpHL, tpLH – RL



tpHL, tpLH – Ta



* The above graphs show typical characteristics.

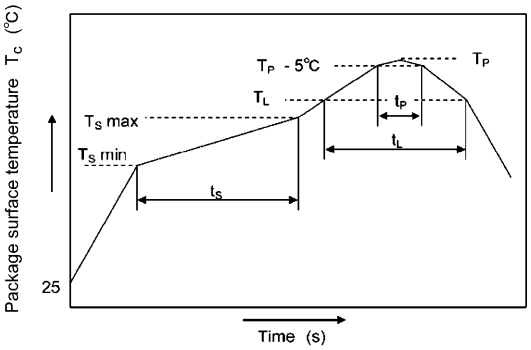
PRECAUTIONS OF SURFACE MOUNTING TYPE PHOTOCOUPLER SOLDERING & GENERAL STORAGE

(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.

1) When Using Soldering Reflow

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



	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

- 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..

2) 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.

3) 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 only once per 1 lead

Specification for Embossed–Tape Packing (TPL)(TPR) for SO6 Coupler

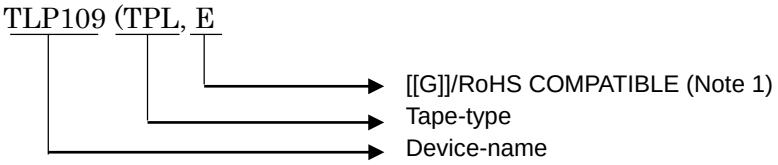
1. Applicable Package

Package	Product Type
SO6	Mini-flat coupler

2. Product Naming System

Type of package used for shipment is denoted by a symbol suffix after a product number. The method of classification is as below.

(Example)



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 electronics equipment.

3. Tape Dimensions

3.1 Specification Classification Are as Shown in Table 1

Table 1 Tape Type Classification

Tape type	Classification	Quantity (pcs / reel)
TPL	L direction	3000
TPR	R direction	3000

3.2 Orientation of Device in Relation to Direction of Tape Movement

Device orientation in the recesses is as shown in Figure 1.

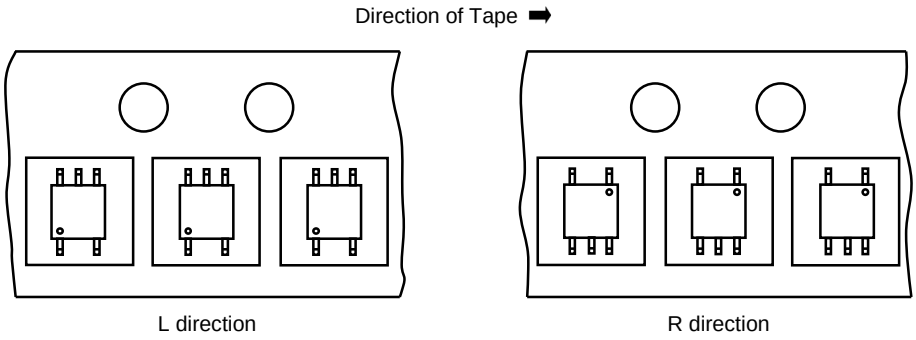


Figure 1 Device Orientation

3.3 Empty Device Recesses Are as Shown in Table 2.

Table 2 Empty Device Recesses

	Standard	Remarks
Occurrences of 2 or more successive empty device recesses	0	Within any given 40-mm section of tape, not including leader and trailer
Single empty device recesses	6 devices (max) per reel	Not including leader and trailer

3.4 Start and End of Tape

The start of the tape has 50 or more empty holes. The end of tape has 50 or more empty holes and two empty turns only for a cover tape.

3.5 Tape Specification

(1) Tape material: Plastic (protection against electrostatics)
(2) Dimensions: The tape dimensions are as shown in Figure 2 and Table 3.

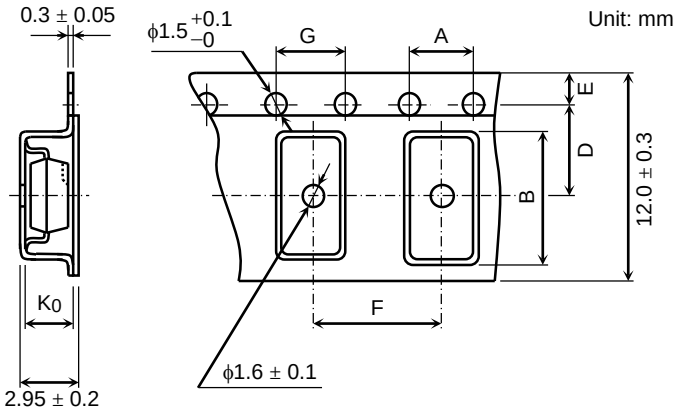


Figure 2 Tape Forms

Table 3 Tape Dimensions

Unit: mm
Unless otherwise specified: ±0.1

Symbol	Dimension	Remark
A	4.0	—
B	7.6	—
D	5.5	Center line of indented square hole and sprocket hole
E	1.75	Distance between tape edge and hole center
F	8.0	Cumulative error $^{+0.1}_{-0.3}$ (max) per 10 feed holes
G	4.0	Cumulative error $^{+0.1}_{-0.3}$ (max) per 10 feed holes
K_0	2.6	Internal space

3.6 Reel

(1) Material: Plastic

(2) Dimensions: The reel dimensions are as shown in Figure 3 and Table 4.

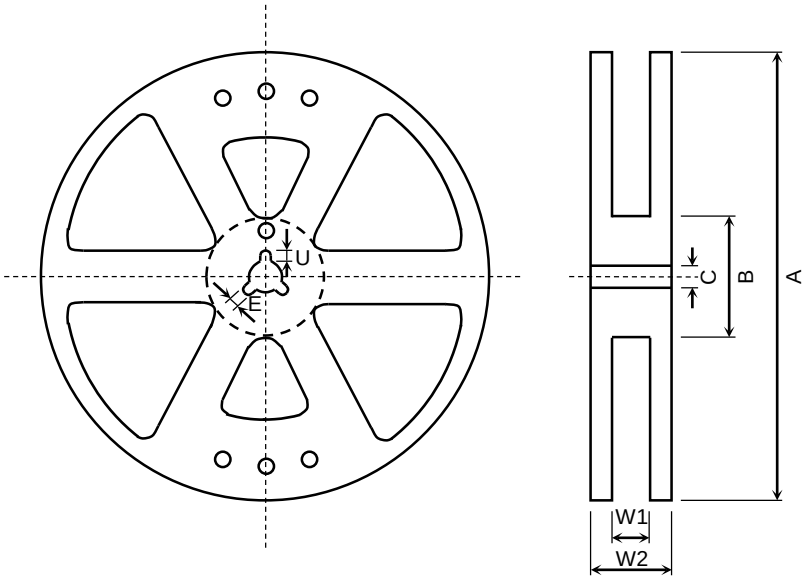


Figure 3 Reel Form

Table 4 Reel Dimensions

Unit: mm

Symbol	Dimension
A	Φ380 ±2
B	Φ80 ±1
C	Φ13 ±0.5
E	2.0 ±0.5
U	4.0 ±0.5
W1	13.5 ±0.5
W2	17.5 ±1.0

4. Packing

Either one reel or five reels of photocoupler are packed in a shipping carton.

5. Label Indication

The carton bears a label indicating the product number, the symbol representing classification of standard, the quantity, the lot number and the Toshiba company name.

6. Ordering Method

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

(Example)

TLP109 (TPL) 3000 pcs

- Quantity (must be a multiple of 3000)
- Tape type
- Device name

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