

## TLP109

Programmable Controllers  
Industrial Inverters  
Switching Power Supplies

The Toshiba TLP109 mini-flat coupler is a small-outline coupler suitable for surface-mount assembly. The TLP109 consists of a high-output-power infrared 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  $\geq 5.0$  mm, a clearance of  $\geq 5.0$  mm and an insulation thickness of  $\geq 0.4$  mm. Therefore, the TLP109 meets the reinforced insulation class requirements of international safety standards.

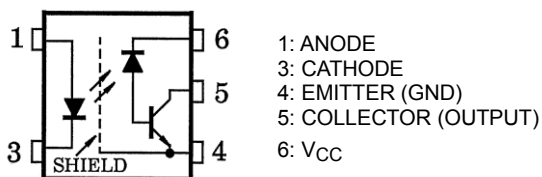
- Isolation voltage: 3750 Vrms (min)
- Switching speed:  $t_{pHL} = 0.8 \mu s$ ,  $t_{pLH} = 0.8 \mu s$  (max)  
@ $R_L = 1.9 k\Omega$
- TTL-compatible
- UL-recognized : UL 1577, File No.E67349
- cUL-recognized : CSA Component Acceptance Service No.5A  
File No.E67349
- VDE-approved: EN 60747-5-5, 62368-1 (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 VDE approved type is needed, please designate the **Option(V4)**.

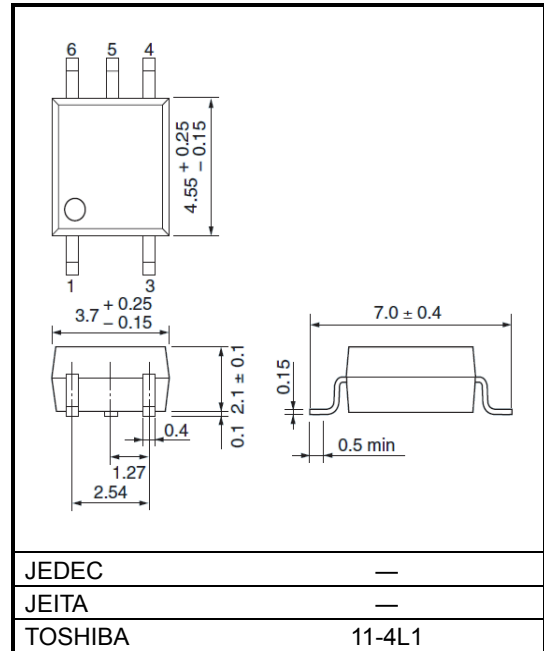
### Pin Configuration (Top View)



### Construction Mechanical Ratings

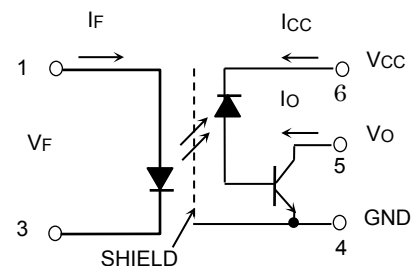
Creepage distance:	5.0 mm (min)
Clearance:	5.0 mm (min)
Insulation thickness:	0.4 mm (min)

Unit: mm



Weight: 0.08 g (typ.)

### Schematic



Start of commercial production  
2008-07

## Absolute Maximum Ratings (Ta = 25°C)

Characteristic		Symbol	Rating	Unit
LED	Forward current	I <sub>F</sub>	20	mA
	Forward Current Derating (Ta ≥ 95 °C)	ΔI <sub>F</sub> /°C	-0.36	mA/°C
	Pulse forward current (Note 1)	I <sub>FP</sub>	40	mA
	Peak transient forward current (Note 2)	I <sub>FPT</sub>	1	A
	Reverse voltage	V <sub>R</sub>	5	V
	Power dissipation (Note 3)	P <sub>D</sub>	40	mW
Detector	Output current	I <sub>O</sub>	8	mA
	Output Current Derating (Ta ≥ 95 °C)	ΔI <sub>O</sub> /°C	-0.3	mA/°C
	Peak output current	I <sub>OP</sub>	16	mA
	Supply voltage	V <sub>CC</sub>	-0.5 to 30	V
	Output voltage	V <sub>O</sub>	-0.5 to 20	V
	Output power dissipation (Note 4)	P <sub>O</sub>	100	mW
Operating temperature range		T <sub>opr</sub>	-55 to 125	°C
Storage temperature range		T <sub>stg</sub>	-55 to 125	°C
Lead solder temperature (10 s)		T <sub>sol</sub>	260	°C
Isolation Voltage (AC, 60 s, R.H. ≤ 60 %) (Note 5)		BVs	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	$V_F$	$I_F = 16 \text{ mA}$	1.50	1.64	1.85	V
	Forward voltage temperature coefficient	$\Delta V_F / \Delta T_a$	$I_F = 16 \text{ mA}$	—	-1.6	—	mV / °C
	Reverse current	$I_R$	$V_R = 3 \text{ V}$	—	—	10	$\mu\text{A}$
	Capacitance between terminals	$C_T$	$V_F = 0 \text{ V}, f = 1 \text{ MHz}$	—	60	—	pF
Detector	High level output current	$I_{OH(1)}$	$I_F = 0 \text{ mA}, V_{CC} = V_O = 5.5 \text{ V}$	—	3	500	nA
		$I_{OH(2)}$	$I_F = 0 \text{ mA}, V_{CC} = 30 \text{ V}$ $V_O = 20 \text{ V}$	—	—	5	$\mu\text{A}$
		$I_{OH}$	$I_F = 0 \text{ mA}, V_{CC} = 30 \text{ V}$ $V_O = 20 \text{ V}, T_a = 100 \text{ }^\circ\text{C}$	—	—	50	
	High level supply current	$I_{CCH}$	$I_F = 0 \text{ mA}, V_{CC} = 30 \text{ V}$	—	0.01	1	$\mu\text{A}$
Current transfer ratio	$I_O / I_F$	$I_F = 16 \text{ mA}, V_{CC} = 4.5 \text{ V}$ $V_O = 0.4 \text{ V}$	20	—	—	%	
Low level output voltage	$V_{OL}$	$I_F = 16 \text{ mA}, V_{CC} = 4.5 \text{ V}$ $I_O = 2.4 \text{ mA}$	—	—	0.4	V	

## Isolation Characteristics (Ta = 25°C)

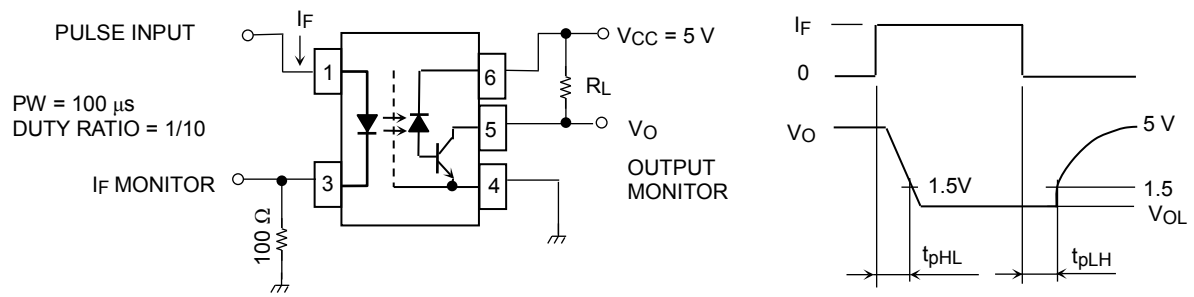
Characteristic	Symbol	Test Conditions	Min	Typ.	Max	Unit
Capacitance input to output	$C_S$	$V = 0 \text{ V}, f = 1 \text{ MHz}$ (Note 6)	—	0.8	—	pF
Isolation resistance	$R_S$	R.H. $\leq 60 \%$ , $V_S = 500 \text{ V}$ (Note 6)	$1 \times 10^{12}$	$10^{14}$	—	$\Omega$
Isolation voltage	$BV_S$	AC, 60 s	3750	—	—	$V_{rms}$

## Switching Characteristics (Ta = 25°C, Vcc = 5 V)

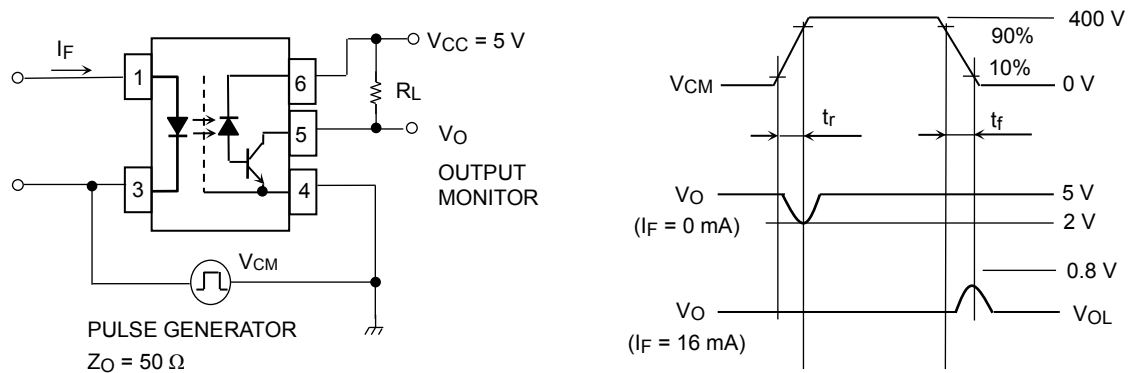
Characteristic	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Propagation delay time (H → L)	$t_{pHL}$	Figure 1	$I_F = 0 \rightarrow 16 \text{ mA}$ $R_L = 1.9 \text{ k}\Omega$	—	—	0.8	$\mu\text{s}$
Propagation delay time (L → H)	$t_{pLH}$	Figure 1	$I_F = 16 \rightarrow 0 \text{ mA}$ $R_L = 1.9 \text{ k}\Omega$	—	—	0.8	$\mu\text{s}$
Common mode transient immunity at high output level (Note 6)	$CM_H$	Figure 2	$I_F = 0 \text{ mA}, V_{CM} = 400 \text{ V}_{p-p}$ $R_L = 4.1 \text{ k}\Omega$	5000	10000	—	V / $\mu\text{s}$
Common mode transient immunity at low output level (Note 6)	$CM_L$	Figure 2	$I_F = 16 \text{ mA}, V_{CM} = 400 \text{ V}_{p-p}$ $R_L = 4.1 \text{ k}\Omega$	-5000	-10000	—	V / $\mu\text{s}$

Note 6:  $CM_L$  is the maximum rate of fall of the common mode voltage that can be sustained with the output voltage in the logic low state ( $V_O < 0.8 \text{ V}$ ).  
 $CM_H$  is the maximum rate of rise of the common mode voltage that can be sustained with the output voltage in the logic high state ( $V_O > 2.0 \text{ V}$ )

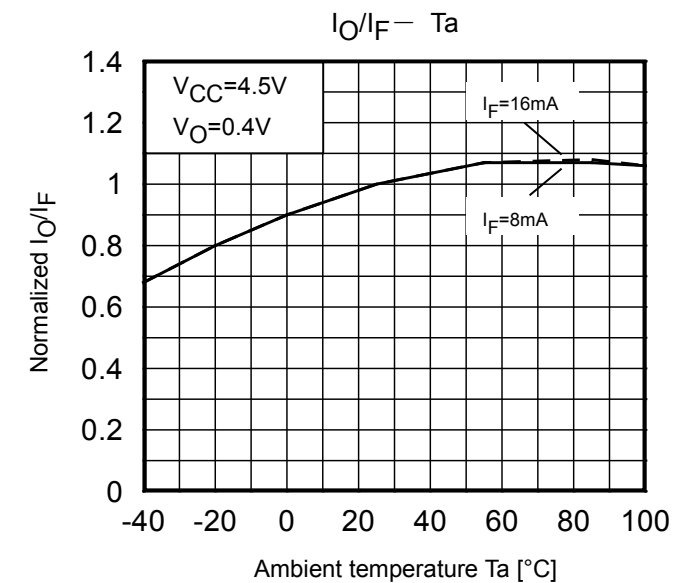
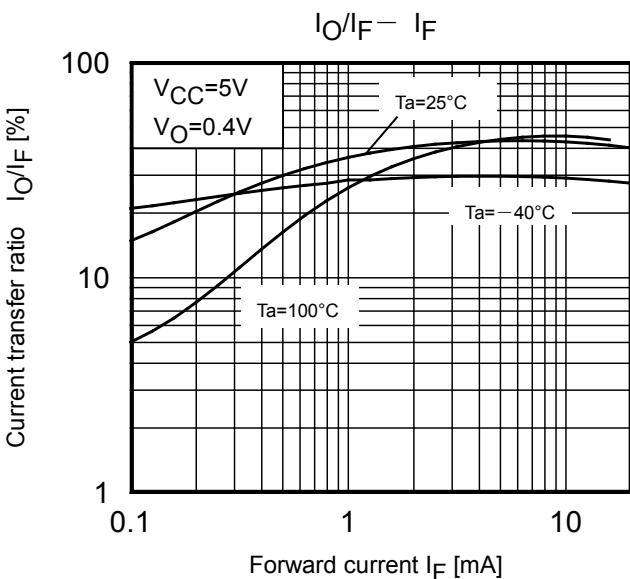
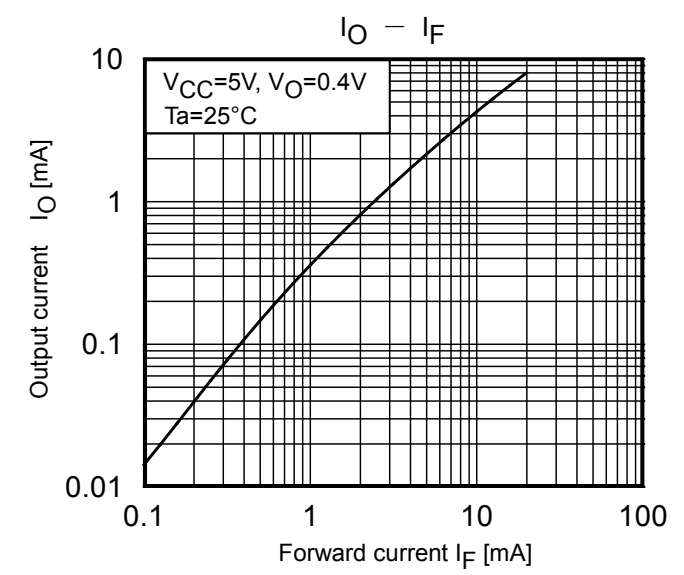
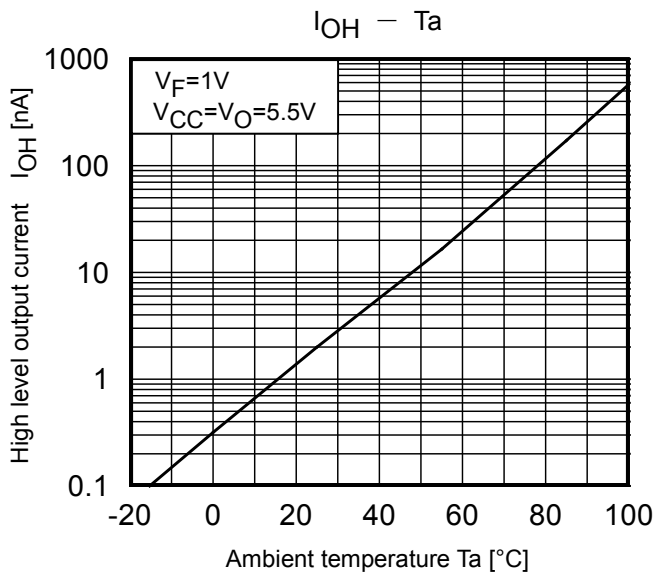
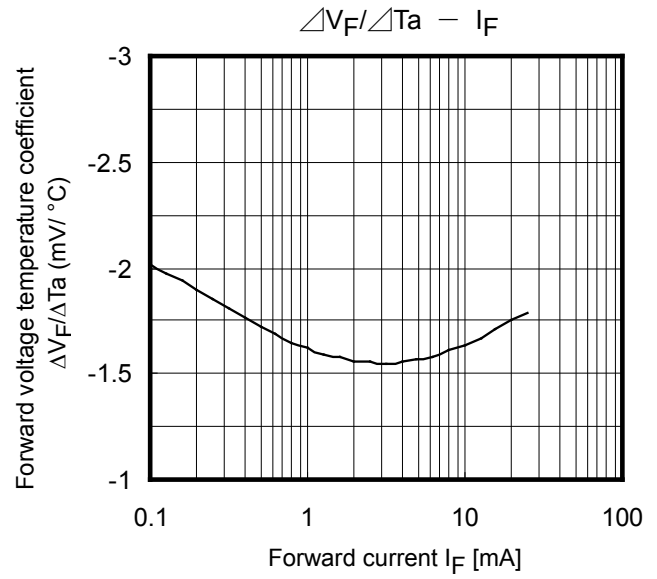
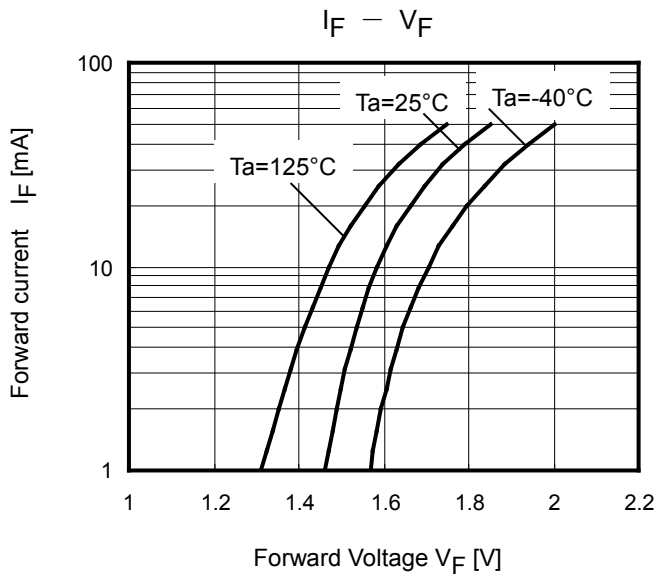
**Figure 1: Switching Time Test Circuit and Waveform**



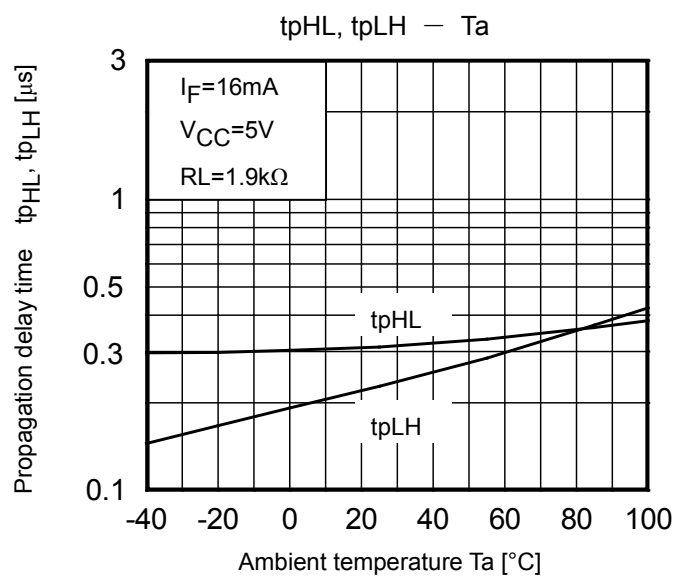
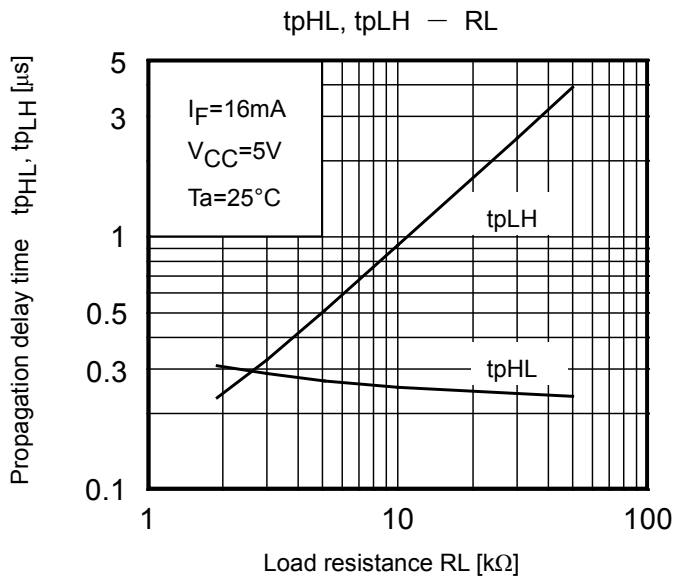
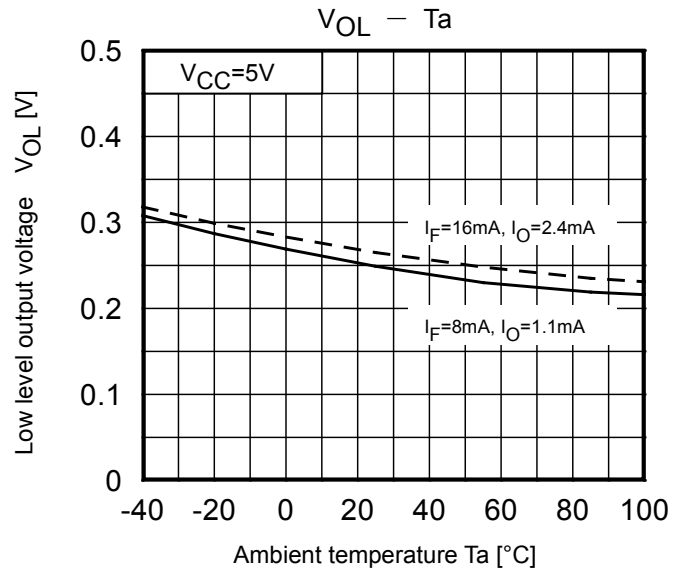
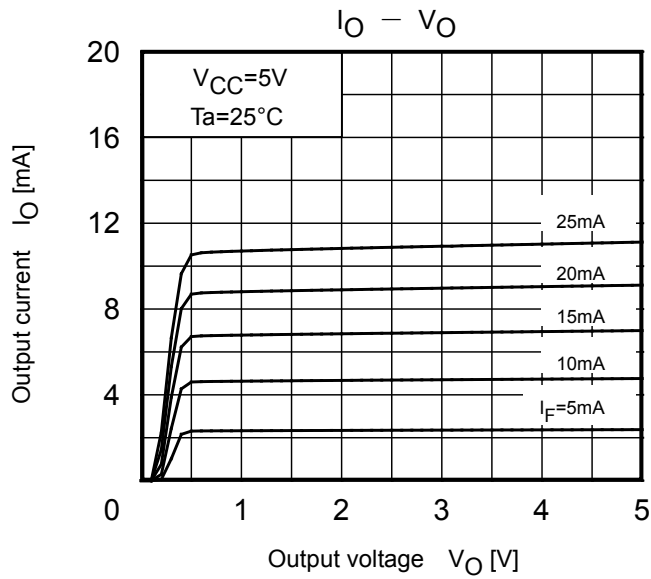
**Figure 2: Common Mode Transient Immunity Test Circuit and Waveform**



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



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



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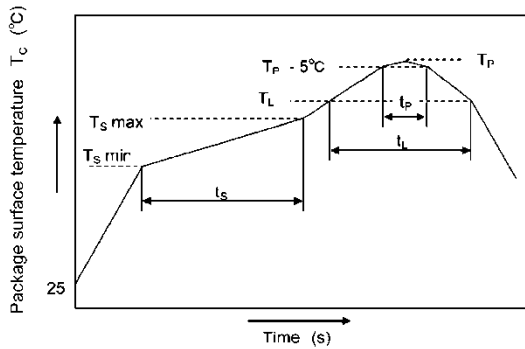
## PRECAUTIONS OF SURFACE MOUNTING TYPE PHOTOCOUPLER SOLDERING & GENERAL STORAGE

### (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

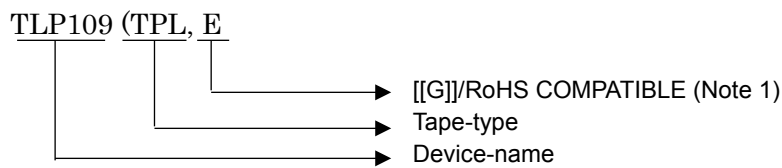
### 1. Applicable Package

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.

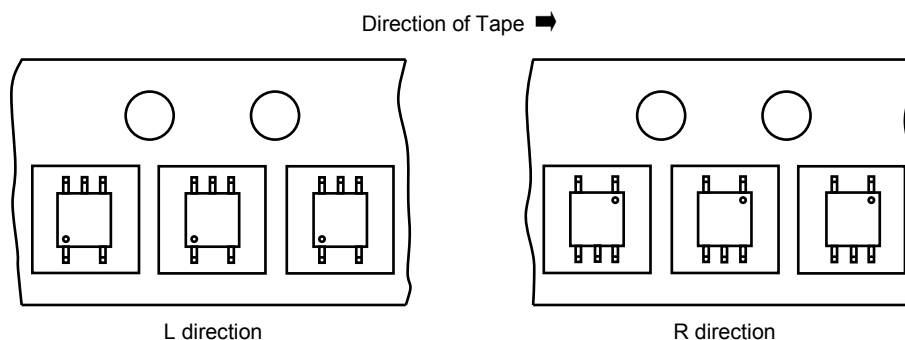


Figure 1 Device Orientation



**3.3 Empty Device Recesses Are as Shown in Table 2.**

**Table 2 Empty Device Recesses**

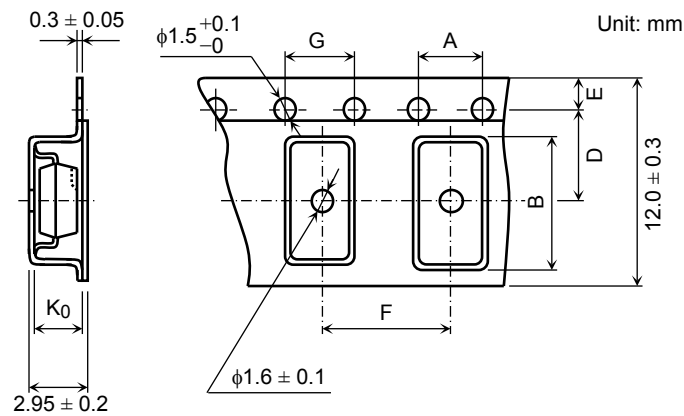
	Standard	Remarks
Occurrences of 2 or more successive empty device recesses	0 device	Within any given 40-mm section of tape, not including leader and trailer
Single empty device recesses	6 devices (max) per reel	Not including leader and trailer

**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 $\begin{matrix} +0.1 \\ -0.3 \end{matrix}$ (max) per 10 feed holes
G	4.0	Cumulative error $\begin{matrix} +0.1 \\ -0.3 \end{matrix}$ (max) per 10 feed holes
K0	2.6	Internal space

3.6 Reel

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

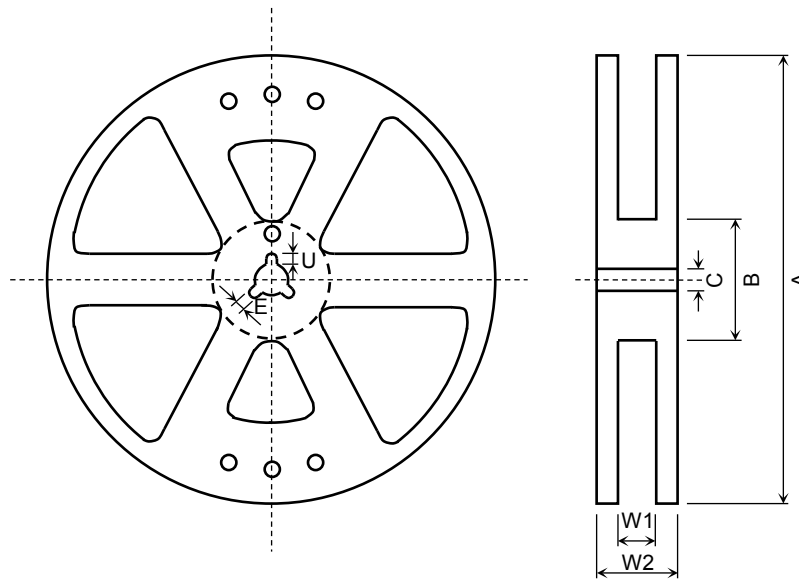


Figure 3 Reel Form

Table 4 Reel Dimensions

Unit: mm

Symbol	Dimension
A	$\Phi 380 \pm 2$
B	$\Phi 80 \pm 1$
C	$\Phi 13 \pm 0.5$
E	$2.0 \pm 0.5$
U	$4.0 \pm 0.5$
W1	$13.5 \pm 0.5$
W2	$17.5 \pm 1.0$

4. Packing

Packed in a shipping carton.

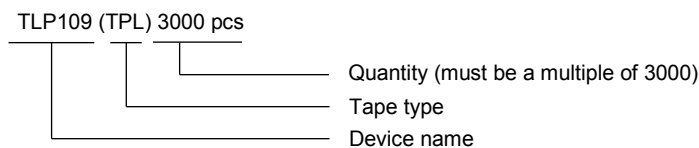
5. Label Indication

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)



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