

TOSHIBA Photocoupler GaAlAs IRED + Photo IC

TLP2451

Industrial Inverter

MOSFET / IGBT Gate Driver

IH (Induction Heating)

Operate at high ambient temperatures up to 125°C

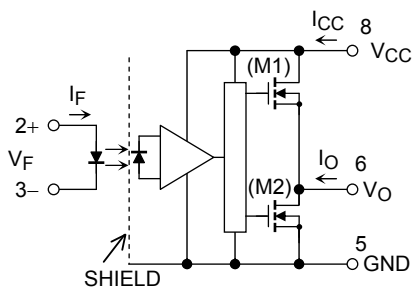
The Toshiba TLP2451 consists of GaAlAs infrared light emitting diodes and integrated high gain, high-speed photodetectors. The TLP2451 is housed in the SO8 package.

The photodetector has an internal Faraday shield that provides a guaranteed common-mode transient immunity of ±15 kV/μs. TLP2451 is suitable for direct gate driving circuit for IGBTs or power MOSFETs.

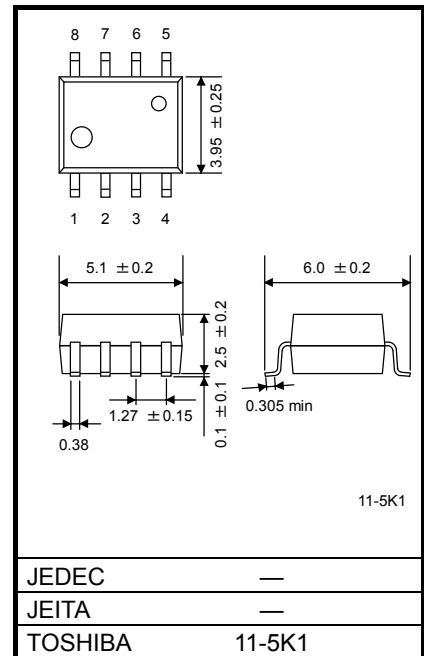
- Buffer logic type (Totem pole output)
- Package type: SO8
- Peak Output Current : $I_{OP} = \pm 0.6A$ (max)
- Guaranteed performance over temperature: -40 to 125°C
- Power supply voltage: 10 to 30 V
- Threshold Input Current: $I_{FLH} = 5.0$ mA (max)
- Propagation delay time: $t_{pLH}/t_{pHL} = 700$ ns (max)
- Common mode transient immunity: ±15kV/μs (min)
- Isolation voltage: 3750Vrms (min)
- UL under application: UL1577, File No.E67349
- c-UL under application: CSA Component Acceptance Service No. 5A, File No.E67349
- Option(V4) VDE under application : EN60747-5-2

(Note) When a EN60747-5-2 approved type is needed, Please designate the "option(V4)"

Schematic

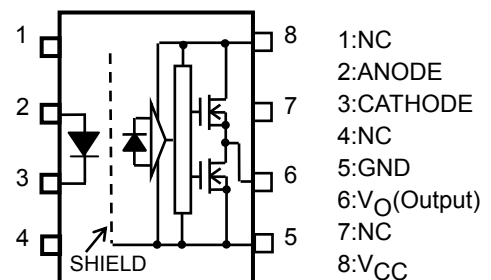


Unit: mm



weight: 0.11 g (typ)

Pin Configuration (Top View)



Truth Table

Input	LED	M1	M2	Output
H	ON	ON	OFF	H
L	OFF	OFF	ON	L

Absolute Maximum Ratings (Ta = 25 °C)

Characteristic		Symbol	Rating	Unit
LED	Forward Current	I_F	25	mA
	Forward Current Derating (Ta ≥ 110°C)	$\Delta I_F / ^\circ\text{C}$	-0.67	mA/°C
	Peak Transient Forward Current (Note 1)	I_{FPT}	50	mA
	Peak Transient Forward Current Derating (Ta ≥ 110°C)	$\Delta I_{FPT} / ^\circ\text{C}$	-1.34	mA/°C
	Reverse Voltage	V_R	5	V
Detector	"H" Peak Output Current (Note2)	I_{OPH}	-0.6	A
	"L" Peak Output Current (Note2)	I_{OPL}	0.6	A
	Output Voltage	V_O	35	V
	Supply Voltage	V_{CC}	35	V
	Output Power Dissipation	P_O	80	mW
	Output Power Dissipation Derating (Ta ≥ 110°C)	$\Delta P_O / ^\circ\text{C}$	-2.0	mW/°C
Operating Temperature Range		T_{opr}	-40 to 125	°C
Storage Temperature Range		T_{stg}	-55 to 150	°C
Lead Soldering Temperature (10 s)		T_{sol}	260	°C
Isolation Voltage (AC, 1 min., R.H. ≤ 60%) (Note 3)		BV_s	3750	V_{rms}

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 ≤ 1ms, duty=50%.

Note 2: Exponential waveform pulse width $P_W \leq 2 \mu\text{s}$, $f \leq 10 \text{ kHz}$

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

Recommended Operating Conditions

Characteristic	Symbol	Min	Typ.	Max	Unit
Input Current, High Level (Note 4)	I_{FLH}	7.5	-	15	mA
Input Voltage, Low Level	V_{FHL}	0	-	0.8	V
Supply Voltage*	V_{CC}	10	-	30	V
Peak output current	I_{OPH} / I_{OPL}	-	-	±0.2	A
Operating Temperature	T_{opr}	-40	-	125	°C

* This item denotes operating range, not meaning of recommended operating conditions.

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.

Note 4: Input signal rise time (fall time) < 0.5 μs.

Note 5: A steep rising slope of the V_{CC} may cause an unstable operation of the device. Therefore please design the V_{CC} rise slope under 3.0 V/μs.

Electrical Characteristics (Ta = -40 to 125 °C, unless otherwise specified)

Characteristics		Symbol	Test Circuit	Test Condition		Min	Typ.*	Max	Unit	
Forward voltage		V _F	—	I _F = 10 mA, Ta = 25 °C		1.40	1.57	1.80	V	
Temperature coefficient of forward voltage		ΔV _F /ΔTa	—	I _F = 10 mA		—	-1.8	—	mV/°C	
Input reverse current		I _R	—	V _R = 5 V, Ta = 25 °C		—	—	10	μA	
Input capacitance		C _T	—	V = 0 V, f = 1 MHz		—	60	—	pF	
Output current (Note 6)	"H" Level	I _{OPH1}	1	V _{CC} = 15 V I _F = 5 mA	V ₈₋₆ = 4 V	—	-0.4	-0.2	A	
		I _{OPH2}			V ₈₋₆ = 10 V	—	—	-0.4		
	"L" Level	I _{OPL1}	2	V _{CC} = 15 V I _F = 0 mA	V ₆₋₅ = 2 V	0.2	0.5	—		
		I _{OPL2}			V ₆₋₅ = 10 V	0.4	—	—		
Output voltage	"H" Level	V _{OH}	3	V _{CC} = 10 V	I _O = -100 mA, I _F = 5 mA	6.0	8.5	—	V	
	"L" Level	V _{OL}			4	I _O = 100 mA, V _F = 0.8 V	—	0.35		1.0
Supply current	"H" Level	I _{CCH}	5	V _{CC} = 10 to 30 V V _O = Open	I _F = 10 mA	—	1.1	2.0	mA	
	"L" Level	I _{CCL}			6	I _F = 0 mA	—	1.1		2.0
Threshold input current		L → H	I _{FLH}	—	V _{CC} = 15 V, V _O > 1 V		—	1.2	5	mA
Threshold input voltage		H → L	V _{FHL}	—	V _{CC} = 15 V, V _O < 1 V		0.8	—	—	V
Supply voltage		V _{CC}	—	—		10	—	30	V	

*All typical values are at Ta=25°C, V_{CC}=10 V unless otherwise specified

Note 6: Duration of I_O time ≤ 50 μs, 1 pulse

Note 7: This product is more sensitive than conventional products to electrostatic discharge (ESD) owing to its low power consumption design. It is therefore all the more necessary to observe general precautions regarding ESD when handling this component.

Isolation Characteristics (Ta = 25 °C)

Characteristic	Symbol	Test Condition		Min	Typ.	Max	Unit
Capacitance input to output	C _S	V _S = 0 V, f = 1MHz	(Note 3)	—	0.8	—	pF
Isolation resistance	R _S	R.H. ≤ 60 %, V _S = 500 V	(Note 3)	1×10 ¹²	10 ¹⁴	—	Ω
Isolation voltage	BV _S	AC, 1 minute		3750	—	—	V _{rms}
		AC, 1 second, in oil		—	10000	—	
		DC, 1 minute, in oil		—	10000	—	V _{dc}

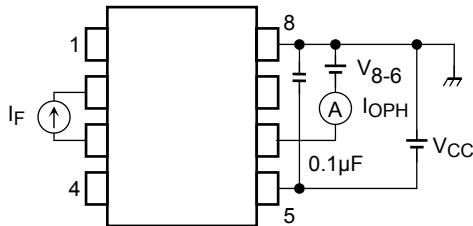
Switching Characteristics (Ta = -40 to 125 °C, unless otherwise specified)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.*	Max	Unit	
Propagation delay time	L → H	7	V _{CC} = 30 V R _g = 47 Ω C _g = 3 nF	I _F = 0 → 5 mA	100	—	700	ns
	H → L			t _{pHL}	I _F = 5 → 0 mA	100	—	
Output rise time (10–90 %)	t _r	7	V _{CC} = 30 V R _g = 47 Ω C _g = 3 nF	I _F = 0 → 5 mA	—	50	—	
Output fall time (90–10 %)	t _f			I _F = 5 → 0 mA	—	50	—	
Switching time dispersion between ON and OFF	t _{pHL} - t _{pLH}			I _F = 0, 5 mA	—	—	500	
Common mode transient immunity at HIGH level output	CM _H	8	V _{CM} = 1000 Vp-p V _{CC} = 30 V Ta = 25 °C	I _F = 5 mA V _O (min) = 26 V	-15	—	—	kV/μs
Common mode transient immunity at LOW level output	CM _L			I _F = 0 m V _O (max) = 1 V	15	—	—	

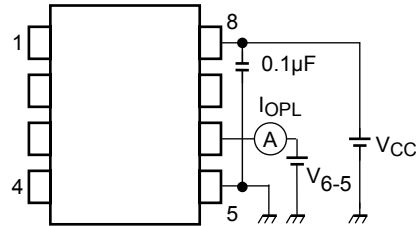
(*): All typical values are at Ta = 25 °C.

Note 8: A ceramic capacitor (0.1 μF) should be connected from pin 8 (V_{CC}) to pin 5 (GND) to stabilize the operation of the high gain linear amplifier. Failure to provide the bypass may impair the switching property. The total lead length between capacitor and coupler should not exceed 1 cm.

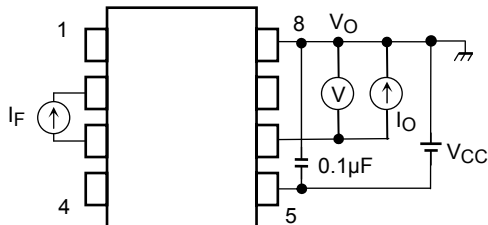
Test Circuit 1: I_{OPH}



Test Circuit 2: I_{OPL}

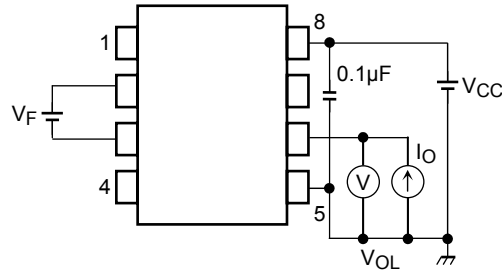


Test Circuit 3: V_{OH}

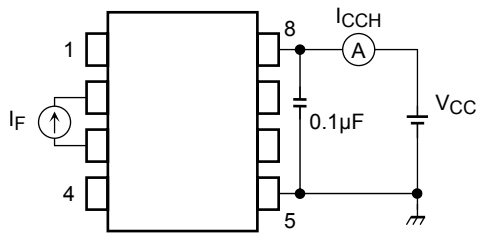


$$*V_{OH} = V_{CC} - V_O$$

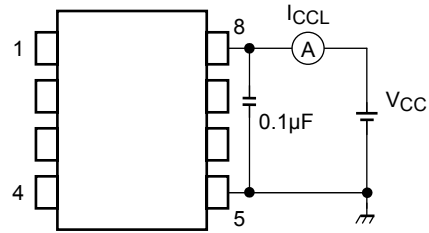
Test Circuit 4: V_{OL}



Test Circuit 5: I_{CCH}



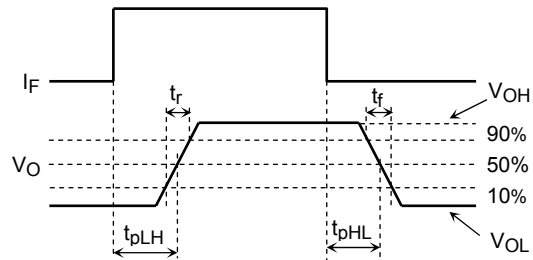
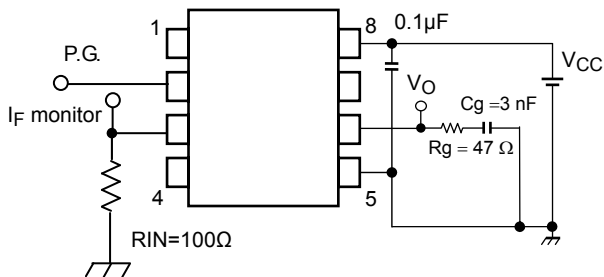
Test Circuit 6: I_{CCL}



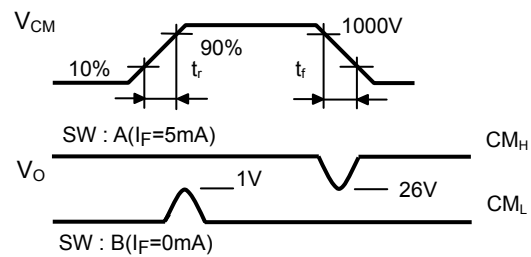
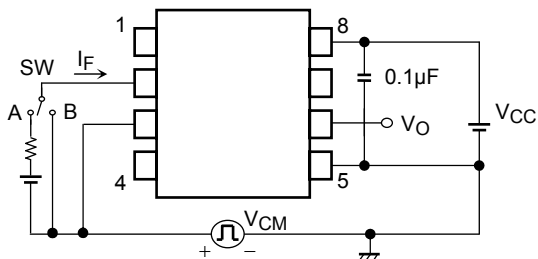
Test Circuit 7: t_{pLH} , t_{pHL} , t_r , t_f , $|t_{pLH}$, $|t_{pHL}|$

$I_F = 5\text{mA (P.G)}$

($f = 25\text{kHz}$, $\text{duty} = 50\%$, $t_r = t_f = \text{less than } 5\text{ns}$)



Test Circuit 8: CM_H , CM_L



$$CM_L = \frac{800(V)}{t_r(\mu s)} \quad CM_H = \frac{800(V)}{t_f(\mu s)}$$

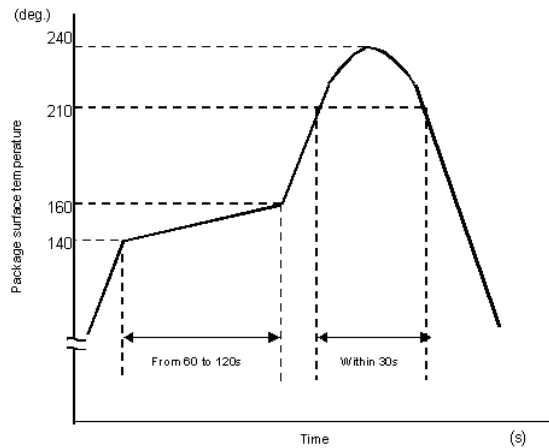
CM_L (CM_H) is the maximum rate of rise (fall) of the common mode voltage that can be sustained with the output voltage in the low (high) state.

PRECAUTIONS OF SURFACE MOUNTING TYPE PHOTOCOUPLER SOLDERING & GENERAL STORAGE

(1) Precautions for Soldering

1) When Using Soldering Reflow

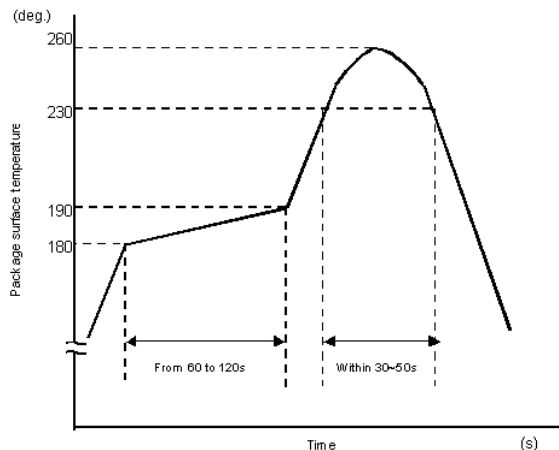
- An example of a temperature profile when Sn-Pb eutectic solder is used:



This profile is based on the device's maximum heat resistance guaranteed value.

Set the preheat temperature/heating temperature to the optimum temperature corresponding to the solder paste type used by the customer within the described profile.

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



This profile is based on the device's maximum heat resistance guaranteed value.

Set the preheat temperature/heating temperature to the optimum temperature corresponding to the solder paste type used by the customer within the described profile.

- 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 (Applicable to both eutectic solder and Lead(Pb)-Free solder)

- Apply preheating of 150 deg.C for 60 to 120 seconds.
- Mounting condition of 260 deg.C or less within 10 seconds is recommended.
- Flow soldering must be performed once

3) When using soldering Iron (Applicable to both eutectic solder and Lead(Pb)-Free solder)

- Complete soldering within 10 seconds for lead temperature not exceeding 260 deg.C or within 3 seconds not exceeding 350 deg.C.
- Heating by soldering iron must be only once per 1 lead

(2) Precautions for General Storage

- 1) Do not store devices at any place where they will be exposed to moisture or direct sunlight.
- 2) When transportation or storage of devices, follow the cautions indicated on the carton box.
- 3) The storage area temperature should be kept within a temperature range of 5 degree C to 35 degree C, and relative humidity should be maintained at between 45% and 75%.
- 4) Do not store devices in the presence of harmful (especially corrosive)gases, or in dusty conditions.
- 5) Use storage areas where there is minimal temperature fluctuation. Because rapid temperature changes can cause condensation to occur on stored devices, resulting in lead oxidation or corrosion, as a result, the solderability of the leads will be degraded.
- 6) When repacking devices, use anti-static containers.
- 7) Do not apply any external force or load directly to devices while they are in storage.
- 8) If devices have been stored for more than two years, even though the above conditions have been followed, it is recommended that solderability of them should be tested before they are used.

Specification for Embossed–Tape Packing (TP) for SO8 Coupler

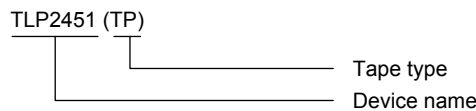
1. Applicable Package

Package	Product Type
SO8	Photocoupler

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)



3. Tape Dimensions

3.1 Orientation of Device in Relation to Direction of Tape Movement

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

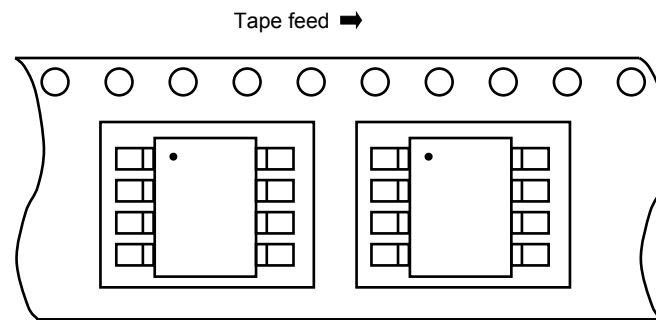


Figure 1 Device Orientation

3.2 Tape Packing Quantity: 2500 devices per reel

3.3 Empty Device Recesses Are as Shown in Table 1.

Table 1 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 2.

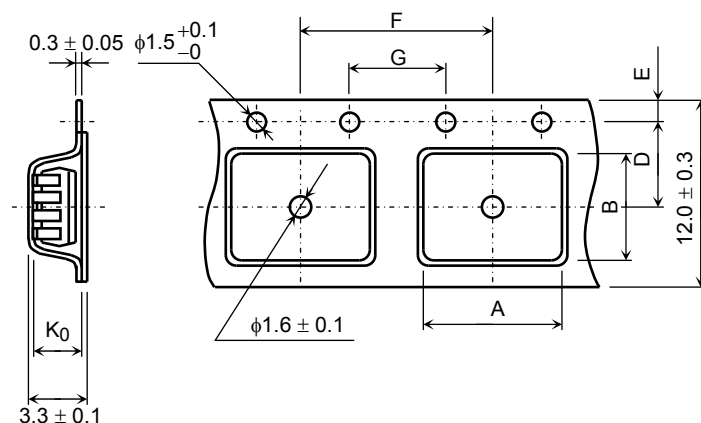


Figure 2 Tape Forms

Table 2 Tape Dimensions

Unit: mm
Unless otherwise specified: ±0.1

Symbol	Dimension	Remark
A	6.5	—
B	5.6	—
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
K ₀	3.1	Internal space

3.6 Reel

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

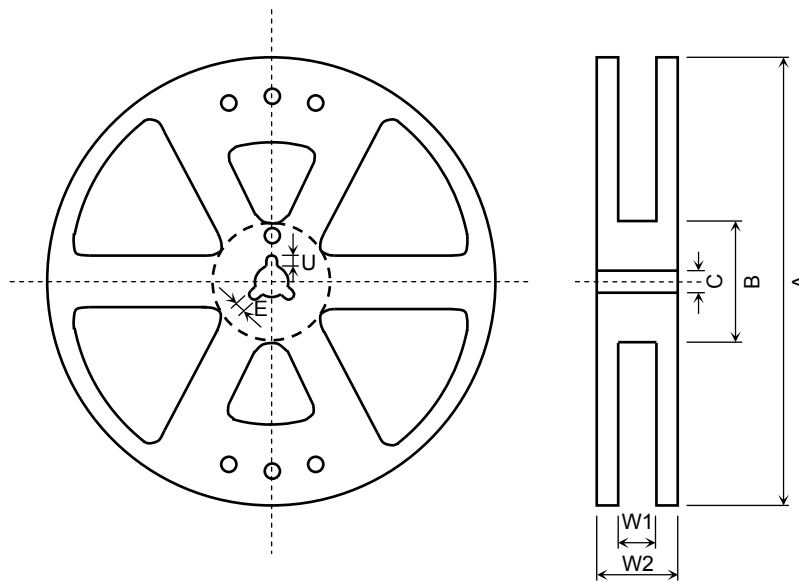


Figure 3 Reel Form

Table 3 Reel Dimensions

Unit: mm

Symbol	Dimension
A	$\Phi 330 \pm 2$
B	$\Phi 80 \pm 1$
C	$\Phi 13 \pm 0.5$
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.

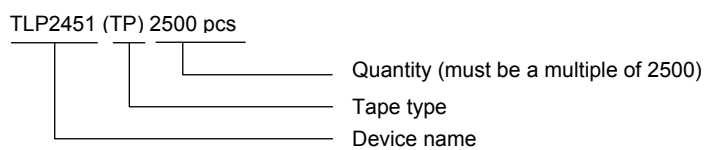
5. Label Indication

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)



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