TOSHIBA PHOTOCOUPLER　IRED & PHOTO-IC

TLP2095

Programmable controllers

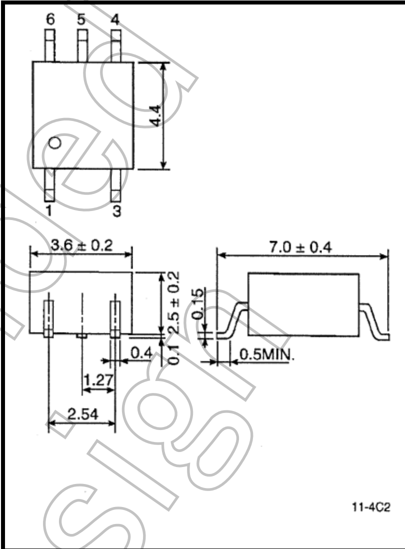
Microprocessor system interfaces

The Toshiba TLP2095 consists of two infrared emitting diodes optically coupled to a high-gain, high-speed photodetector.
The TLP2095 is housed in a 6-pin MFSOP.
With a totem-pole output, the TLP2095 is capable of both sinking and sourcing current.
The TLP2095 has an internal Faraday shield, which provides a guaranteed common-mode transient immunity of ±10 kV/μs.
The TLP2095 has a noninverting output. An inverting-output version, the TLP2098, is also available.

- Buffer logic type (totem-pole output)
- Guaranteed Performance Over Temperature: -40 to 100°C
- Power Supply Voltage: 3.0 to 20 V
- Input Threshold Current: I_{FLH} =±3 mA (max)
- Switching Time (t_{pLH}/t_{pHL}): 250 ns (max)
- Common mode transient immunity: ±15 kV/μs
- Isolation Voltage: 3750 Vrms
- UL-recognized: UL 1577, File No.E67349
- cUL-recognized: CSA Component Acceptance Service No.5A
  File No.E67349
- VDE-approved : EN 60747-5-5　(Note 1)

Note 1: When a VDE approved type is needed,
please designate the **Option(V4)**.

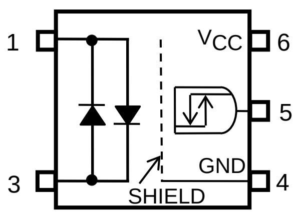
Unit: mm



JEDEC	―
JEITA	―
TOSHIBA	11-4C2

Weight: 0.09 g (typ.)

Pin Configuration (top view)

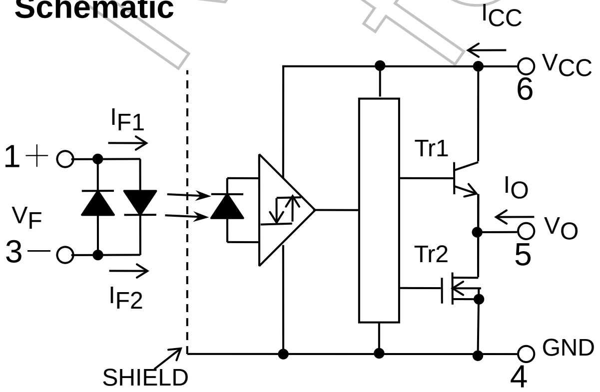


1 : Anode
　Cathode
3 : Cathode
　Anode
4 : GND
5 : Output
6 : V_{CC}

Truth Table

Input	LED	Tr1	Tr2	Output
H	ON	ON	OFF	H
L	OFF	OFF	ON	L

Schematic



0.1 μF bypass capacitor must be connected between pin 6 and 4

Start of commercial production
2009-05

Recommended Operating Conditions

CHARACTERISTIC	SYMBOL	MIN	TYP.	MAX	UNIT
Input Current, ON	$I_{F(ON)}$	5	—	15	mA
Input Voltage, OFF	$V_{F(OFF)}$	0	—	0.8	V
Supply Voltage*	V_{CC}	3.0	—	20	V
Operating Temperature	T_{opr}	-40	—	100	°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.

Absolute Maximum Ratings (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
LED	Forward Current	I_F	±20	mA
	Forward Current Derating (Ta ≥ 83 °C)	$\Delta I_F/\Delta Ta$	-0.48	mA/°C
	Peak Transient Forward Current (Note 1)	I_{FPT}	±1	A
	Input Power Dissipation	P_D	40	mW
	Input power dissipation derating (Ta ≥ 83 °C)	$\Delta P_D/\Delta Ta$	-0.96	mW/°C
DETECTOR	Output Current 1 (Ta ≤ 25 °C)	I_{O1}	25/-15	mA
	Output Current 2 (Ta ≤ 100 °C)	I_{O2}	5/-5	mA
	Output Voltage	V_O	-0.5 to 20	V
	Supply Voltage	V_{CC}	-0.5 to 20	V
	Output Power Dissipation	P_O	75	mW
	Output Power Dissipation Derating (Ta ≥ 25°C)	$\Delta P_O/\Delta Ta$	-0.75	mW/°C
Operating Temperature Range		T_{opr}	-40 to 100	°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 2)		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 ≤ 1 μs, 300 pps.

Note 2: Device considered a two terminal device: pins 1 and 3 shorted together and pins 4, 5 and 6 shorted together.

Electrical Characteristics
(Unless otherwise specified, Ta = -40 to 100°C, V_{CC} = 3.0 to 20 V)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	CONDITION		MIN	TYP.	MAX	UNIT
Input Forward Voltage	V_F	—	I_F = 10 mA , Ta = 25 °C		1.45	1.57	1.75	V
Temperature Coefficient of Forward Voltage	$\Delta V_F/\Delta Ta$	—	I_F = 10 mA		—	-2.0	—	mV/°C
Input Capacitance	C_T	—	V = 0 V, f = 1 MHz , Ta = 25 °C		—	190	-	pF
Logic Low Output Voltage	V_{OL}	1	I_{OL} = 0.02 mA, V_F = 0.8 V		—	0.2	0.6	V
Logic High Output Voltage	V_{OH}	2	I_{OH} = -0.02 mA I_F = 5 mA	V_{CC} = 3.0 V	2.0	2.5	—	V
				V_{CC} = 20 V	17.4	19.5	—	
Logic Low Supply Current	I_{CCL}	3	V_F = 0 V		—	—	3.0	mA
Logic High Supply Current	I_{CCH}	4	I_F = 5 mA		—	—	3.0	mA
Logic Low Short Circuit Output Current (Note 3)	I_{OSL}	5	V_F = 0 V	V_{CC} = V_O = 4.5 V	15	80	—	mA
				V_{CC} = V_O = 20 V	20	90	—	
Logic High Short Circuit Output Current (Note 3)	I_{OSH}	6	I_F = 5 mA V_O = GND	V_{CC} = 4.5 V	-5	-12	—	mA
				V_{CC} = 20 V	-10	-20	—	
Input Current Logic High Output	I_{FLH}	—	I_O = -0.02 mA, V_O> 2.4 V		—	1.0	3.0	mA
Input Voltage Logic Low Output	V_{FHL}	—	I_O = 0.02 mA, V_O< 0.6 V		0.8	—	—	V
Input Current Hysteresis	I_{HYS}	—	V_{CC} = 5 V		—	0.05	—	mA

*All typical values are at V_{CC} = 5 V, Ta = 25 °C

Note 3: Duration of output short circuit time should not exceed 10 ms.

Isolation Characteristics (Ta = 25°C)

Characteristic	Symbol	Test Condition	MIN	TYP.	MAX	Unit
Capacitance input to output	C_S	V_S = 0 V, f = 1 MHz (Note 2)	—	0.8	—	pF
Isolation resistance	R_S	R.H. ≤ 60 %,V_S = 500 V (Note 2)	1×10^{12}	10^{14}	—	Ω
Isolation voltage	BV_S	AC, 60 s (Note 2)	3750	—	—	V_{rms}

Switching Characteristics

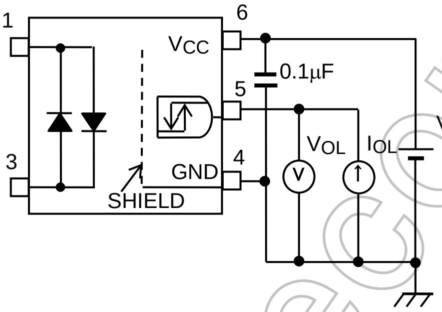
(Unless otherwise specified, Ta = -40 to 100°C, VCC = 3.0 to 20 V)

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	CONDITION	MIN	TYP.	MAX	UNIT
Propagation Delay Time to Logic High output	t_{pLH}	7, 8 (Note 4)	I_F = 0→5 mA	30	150	250	ns
Propagation Delay Time to Logic Low output	t_{pHL}		I_F = 5→0 mA	30	150	250	ns
Switching Time Dispersion between ON and OFF	$\lvert t_{pHL}-t_{pLH}\rvert$		—	—	—	220	ns
Rise Time (10 – 90 %)	t_r		I_F = 0→5 mA, V_{CC} = 5 V	—	30	75	ns
Fall Time (90 – 10 %)	t_f		I_F = 5→0 mA, V_{CC} = 5 V	—	30	75	ns
Common Mode transient Immunity at High Level Output	CM_H	9	V_{CM} = 1000 V_{p-p}, I_F = 5 mA, V_{CC} = 20 V, Ta = 25 °C	-15	—	—	kV/μs
Common Mode transient Immunity at Low Level Output	CM_L		V_{CM} = 1000 V_{p-p}, I_F = 0 mA, V_{CC} = 20 V, Ta = 25 °C	15	—	—	kV/μs

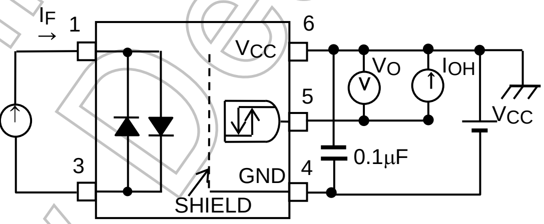
*All typical values are at Ta = 25 °C

Note 4: V_{CC} = 4.5 to 20 V at test circuit 7.

TEST CIRCUIT 1: V_{OL}

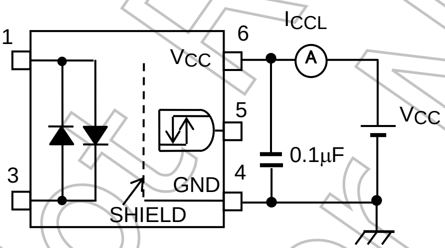


TEST CIRCUIT 2: V_{OH}

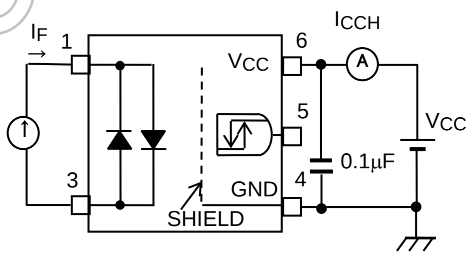


*V_{OH}= V_{CC}-V_O

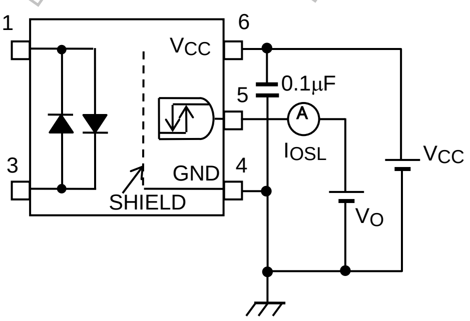
TEST CIRCUIT 3: I_{CCL}



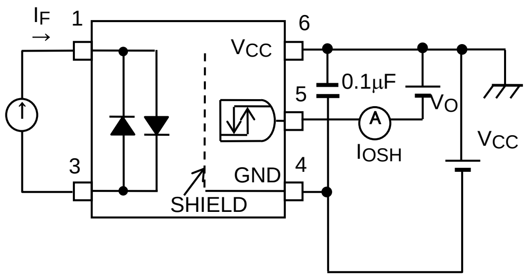
TEST CIRCUIT 4: I_{CCH}



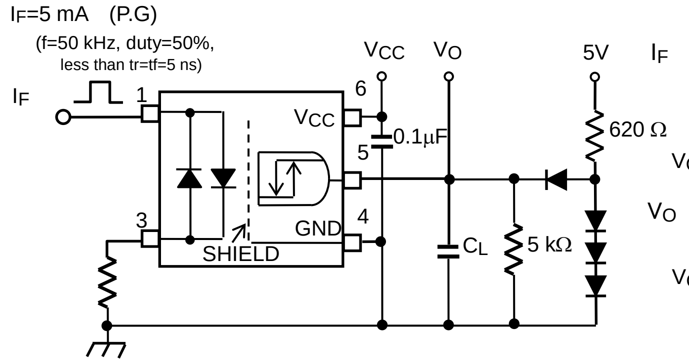
TEST CIRCUIT 5: I_{OSL}

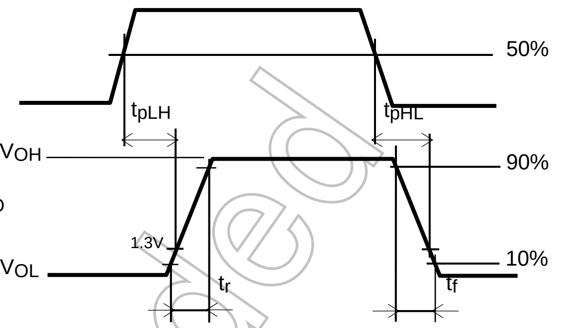


TEST CIRCUIT 6: I_{OSH}



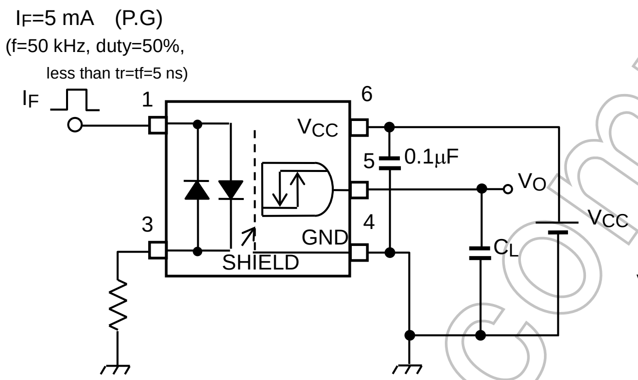
TEST CIRCUIT 7: Switching Time Test Circuit

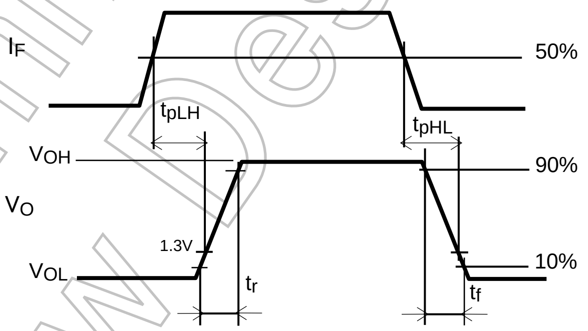




C_L is approximately 15 pF which includes probe and stray capacitance.
P.G.: Pulse generator

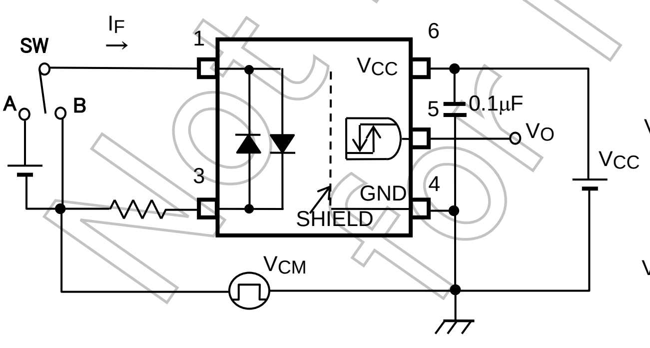
TEST CIRCUIT 8: Switching Time Test Circuit

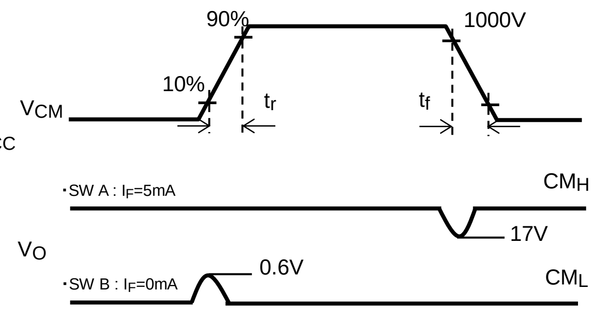




C_L is approximately 15 pF which includes probe and stray capacitance.
P.G.: Pulse generator

TEST CIRCUIT 9: Common Mode Transient Immunity Test Circuit





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

Soldering and Storage

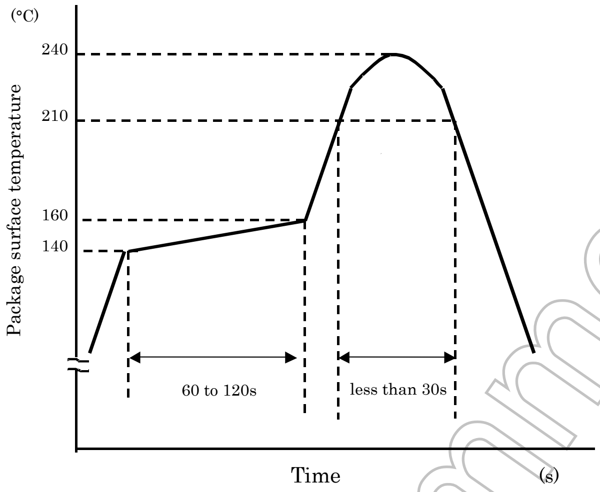
1. Soldering

1.1 Soldering

When using a soldering iron or medium infrared ray/hot air reflow, avoid a rise in device temperature as much as possible by observing the following conditions.

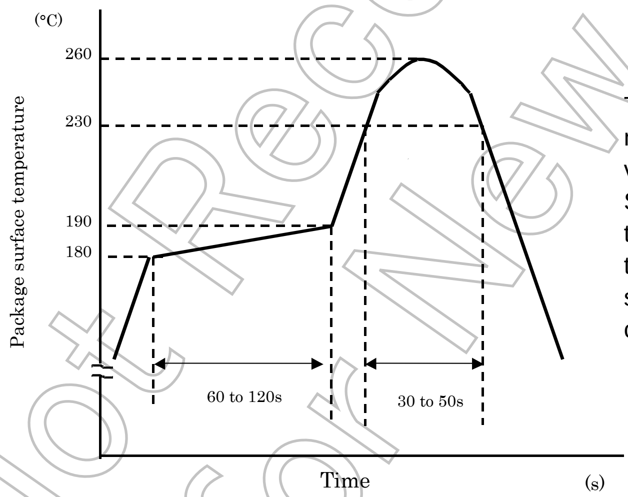
1) Using solder reflow

·Temperature profile example of lead (Pb) solder



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.

·Temperature profile example of using lead (Pb)-free solder



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) Using solder flow (for lead (Pb) solder, or lead (Pb)-free solder)

・Please preheat it at 150°C between 60 and 120 seconds.

・Complete soldering within 10 seconds below 260°C. Each pin may be heated at most once.

3) Using a soldering iron

Complete soldering within 10 seconds below 260°C, or within 3 seconds at 350°C. Each pin may be heated at most once.

2. Storage

1) Avoid storage locations where devices may be exposed to moisture or direct sunlight.
2) Follow the precautions printed on the packing label of the device for transportation and storage.
3) Keep the storage location temperature and humidity within a range of 5°C to 35°C and 45% to 75% respectively.
4) Do not store the products in locations with poisonous gases (especially corrosive gases) or in dusty conditions.
5) 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.
6) When restoring devices after removal from their packing, use anti-static containers.
7) Do not allow loads to be applied directly to devices while they are in storage.
8) If devices have been stored for more than two years under normal storage conditions, it is recommended that you check the leads for ease of soldering prior to use.

Specification for Embossed–Tape Packing (TPL)(TPR) for Mini-flat Coupler

1. Applicable Package

Package	Product Type
MFSOP	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) TLP2095 (TPL, F)

- F → [[G]]/RoHS COMPATIBLE (Note 5)
- TPL → Tape type
- TLP2095 → Device name

3. Tape Dimensions

3.1 Specification Classification are as shown in Table 1

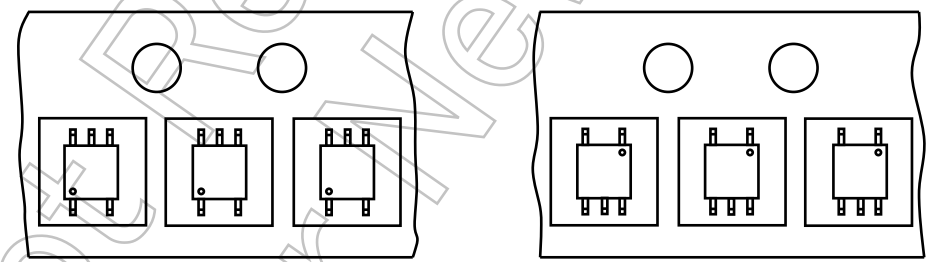
Table 1 Tape Type Classification

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.

Direction of Tape ➡



L direction R direction

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.

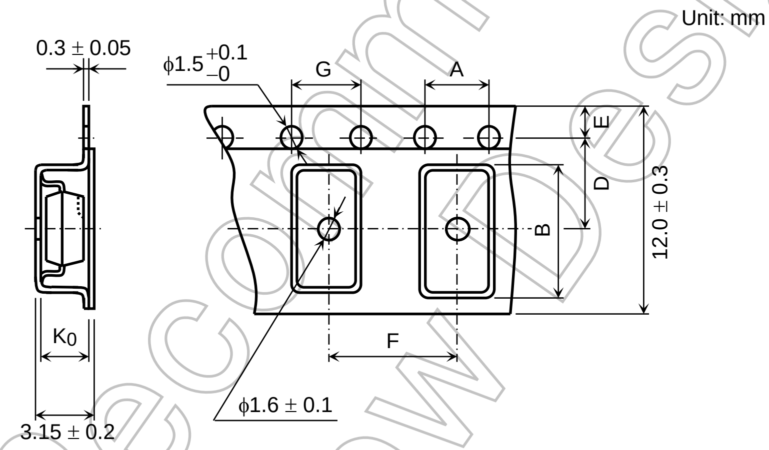


Figure 2 Tape Forms

Table 3 Tape Dimensions

Unit: mm
Unless otherwise specified: ±0.1

Symbol	Dimension	Remark
A	4.2	—
B	7.6	—
D	5.5	Centre 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	2.8	Internal space

3.6 Reel

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

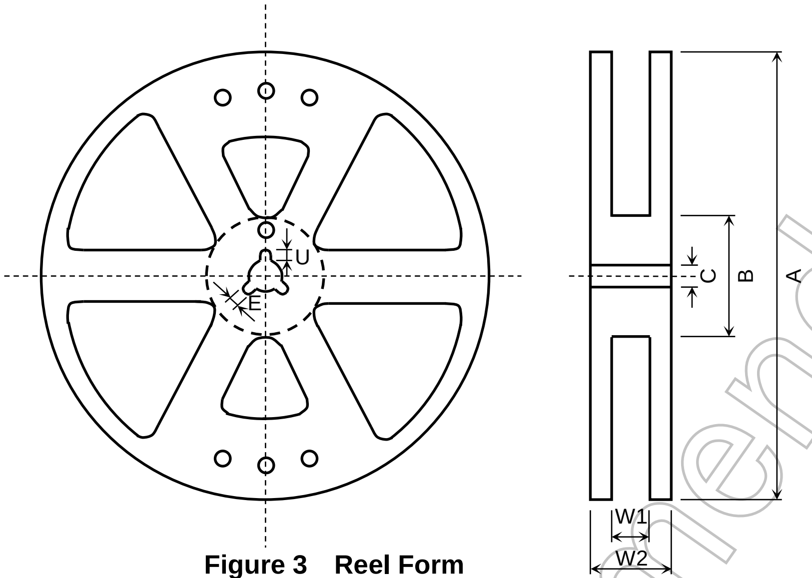


Figure 3 Reel Form

Table 4 Reel Dimensions

Unit: mm

Symbol	Dimension
A	Φ330±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

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)

(Example) TLP2095 (TPL, F) 3000 pcs

- Quantity (must be a multiple of 3000)
- [[G]]/RoHS COMPATIBLE (Note 5)
- Tape type
- Device name

Note 5 : Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product.
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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