TOSHIBA Photocoupler GaAℓAs IRED LED + Photo IC

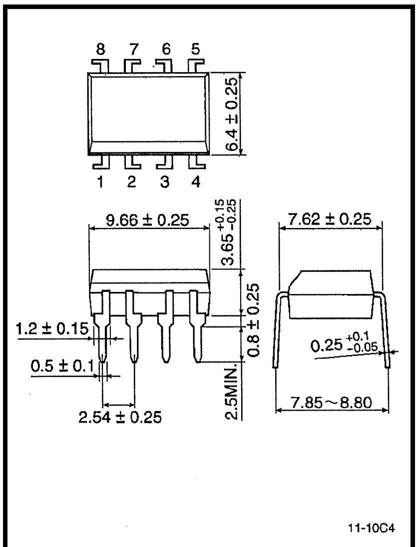
TLP358,TLP358F

Industrial Inverter
MOS FET / IGBT Gate Driver
IH(Induction Heating)

The TOSHIBA TLP358 consists of a GaAℓAs light-emitting diode and an integrated photodetector. This unit is an 8-lead DIP package.
The TLP358 is suitable for gate driving IGBTs or power MOSFETs.
The TLP358F is of a long creepage distance and clearance type.

- Peak output current : I_{OP} = ± 6.0A (max)
- Guaranteed performance over temperature : −40 to 100°C
- Supply current : I_{CC} = 2 mA (max)
- Power supply voltage : 15 to 30 V
- Input current: I_{FLH} = 5mA (max)
- Switching time (t_{pLH} / t_{pHL}) : 500 ns (max)
- Common-mode transient immunity : ±15 kV / μs (min)
- Isolation voltage : 3750 Vrms (min)
- UL under application : UL1577, File No.E67349
- c-UL under application: CSA Component Acceptance Service No. 5A, File No.E67349
- Option (D4)
  VDE / TÜV under application: EN 60747-5-2

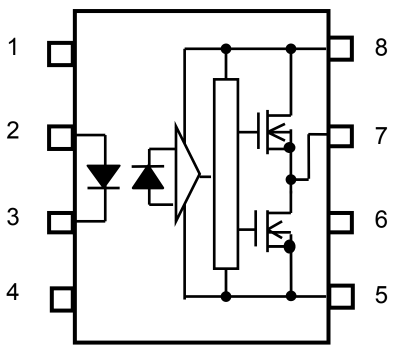
TLP358 Unit: mm



TOSHIBA 11−10C4

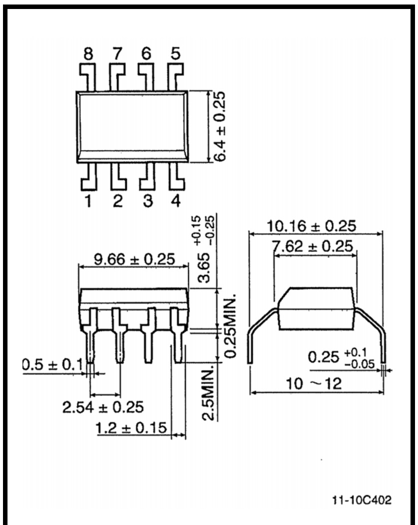
Weight: 0.54 g (typ.)

Pin Configuration (top view)



1: N.C
2: Anode
3: Cathode
4: N.C
5: GND
6: N.C
7: VO (output)
8: VCC

TLP358F Unit: mm



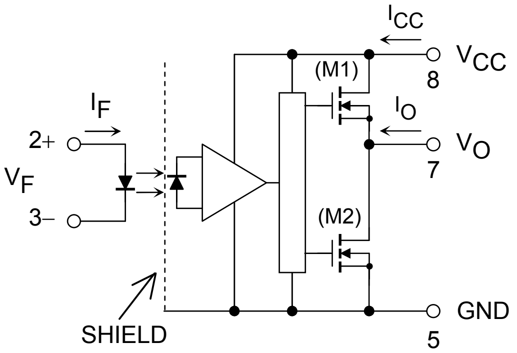
TOSHIBA 11−10C402

Weight: 0.54 g (typ.)

Construction Mechanical Rating

	7.62 mm Pitch TLP358 Type	10.16 mm Pitch TLP358F Type
Creepage distance	6.4 mm (min)	8.0 mm (min)
Clearance	6.4 mm (min)	8.0 mm (min)
Insulation thickness	0.4 mm (min)	0.4 mm (min)

Schematic



Truth Table

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

1.0 μF bypass capacitor must be connected between pins 8 and 5. (Note 5)

Absolute Maximum Ratings (Ta = 25°C)

	Characteristic		Symbol	Rating	Unit
LED	Forward current		I_F	20	mA
	Forward current derating (Ta ≥ 85°C)		$\Delta I_F/\Delta Ta$	−0.54	mA/°C
	Peak transient forward current (Note 1)		I_{FP}	1	A
	Reverse voltage		V_R	5	V
Detector	"H" peak output current	Ta = −40 to 100°C (Note 2)	I_{OPH}	-6.0	A
	"L" peak output current		I_{OPL}	6.0	A
	Supply voltage		V_{CC}	35	V
Operating temperature range			T_{opr}	−40 to 100	°C
Storage temperature range			T_{stg}	−55 to 125	°C
Lead soldering temperature (10 s) (Note 3)			T_{sol}	260	°C
Isolation voltage (AC, 1 minute, R.H. ≤ 60%) (Note 4)			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: Pulse width P_W ≤ 1 μs, 300 pps

Note 2: Exponential waveform pulse width P_W ≤ 0.3μs, f ≤ 15kHz

Note 3: At 2 mm or more from the lead root.

Note 4: 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.

Note 5: A ceramic capacitor(1.0 μF) should be connected from pin 8 to pin 5 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.

Recommended Operating Conditions

Characteristic	Symbol	Min	Typ.	Max	Unit
Input current, ON (Note 6)	$I_{F\ (ON)}$	7.5	—	10	mA
Input voltage, OFF	$V_{F\ (OFF)}$	0	—	0.8	V
Supply voltage*	V_{CC}	15	—	30	V
Peak output current	I_{OPH}/I_{OPL}	—	—	± 5.5	A
Operating frequency (Note 7)	f	—	—	50	kHz
Operating temperature	T_{opr}	−40	—	100	°C

*This item denotes operating ranges, 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 6: Input signal rise time (fall time) $<$ 0.5 μs.

Note 7: Exponential waveform I_{OPH} ≥ -4.0 A (≤ 0.3 μs), I_{OPL} ≤ 4.0 A (≤ 0.3 μs)

Electrical Characteristics (Ta = −40 to 100°C, unless otherwise specified)

Characteristic		Symbol	Test Circuit	Test Conditions		Min	Typ.*	Max	Unit
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 reverse current		I_R	—	V_R = 5 V, Ta = 25 °C		—	—	10	μA
Input capacitance		C_T	—	V = 0 , f = 1 MHz, Ta = 25 °C		—	100	—	pF
Output current (Note 8)	"H" Level	I_{OPH}	1	V_{CC} = 30 V, I_F = 5 mA , $V_{8\text{-}7}$ = -3.5 V		—	-4.0	-2.0	A
				V_{CC} = 15 V, I_F = 5 mA , $V_{8\text{-}7}$ = -5.5 V		—	—	-5.0	
	"L" Level	I_{OPL}	2	V_{CC} = 30 V, I_F = 0 mA, $V_{7\text{-}5}$ = 2.5 V		2.0	4.0	—	
				V_{CC} = 15 V, I_F = 0 mA, $V_{7\text{-}5}$ = 5.5 V		5.0	—	—	
Output voltage	"H" Level	V_{OH}	3	$V_{CC\ 1}$= +15 V $V_{EE\ 1}$= -15 V R_L = 100 Ω	I_F = 5 mA	11	13.7	—	V
	"L" Level	V_{OL}	4		V_F = 0.8 V	—	-14.9	-12.5	
Supply current	"H" Level	I_{CCH}	5	V_{CC} = 30 V V_O open	I_F = 5 mA	—	1.3	2.0	mA
	"L" Level	I_{CCL}	6		I_F = 0 mA	—	1.3	2.0	
Threshold input current	L → H	I_{FLH}	—	V_{CC} = 15 V , V_O > 1 V , I_O = 0 mA		—	1.8	5	mA
Threshold input voltage	H → L	V_{FHL}	—	V_{CC} = 15 V , V_O < 1 V , I_O = 0 mA		0.8	—	—	V
Supply voltage		V_{CC}	—	—		15	—	30	V
UVLO threshold		V_{UVLO+}	—	V_O > 2.5 V , I_F = 5 mA		11.0	12.5	13.5	V
		V_{UVLO-}	—			9.5	11.0	12.0	V
UVLO hysteresis		$UVLO_{HYS}$	—	—		—	1.5	—	V

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

Note 8: Duration of I_O : ≤ 50 μs (1 PULSE)

Note 9: This product is more sensitive to static electricity (ESD) than the conventional product because of its minimal power consumption design.
General static electricity precautions are necessary for handling this component.

Isolation Characteristics (Ta = 25°C)

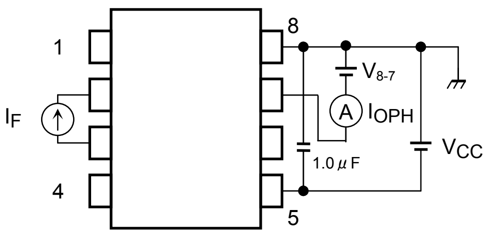
Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Capacitance input to output	C_S	V = 0, f = 1MHz (Note4)	—	1.0	—	pF
Isolation resistance	R_S	V_S = 500 V, R.H. ≤ 60% (Note4)	1×10^{12}	10^{14}	—	Ω
Isolation voltage	BV_S	AC,1 minute	3750	—	—	V_{rms}
		AC,1 second, in oil	—	10000	—	V_{rms}
		DC,1 minute, in oil	—	10000	—	Vdc

Switching Characteristics (Ta = −40 to 100°C, unless otherwise specified)

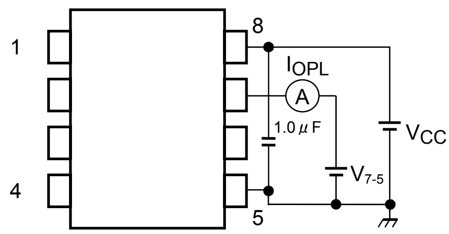
Characteristic		Symbol	Test Circuit	Test Conditions		Min	Typ.*	Max	Unit
Propagation delay time	L → H	t_{pLH}	7	V_{CC} = 30 V, R_g = 10 Ω, C_g = 10 nF	I_F = 0 → 5 mA	50	230	500	ns
	H → L	t_{pHL}	7		I_F = 5 → 0 mA	50	230	500	ns
Switching Time Dispersion between ON and OFF		$\lvert t_{pHL}-t_{pLH}\rvert$	7	V_{CC} = 30 V, R_g = 10 Ω, C_g = 10 nF		—	—	250	ns
Output rise time (10-90%)		t_r	7	V_{CC} = 30 V, R_g = 10 Ω, C_g = 10 nF	I_F = 0 → 5 mA	—	17	—	ns
Output fall time (90-10%)		t_f	7		I_F = 5 → 0 mA	—	17	—	ns
Common mode transient immunity at high level output		CM_H	8	V_{CM} = 1000 Vp-p, Ta = 25 °C, V_{CC} = 30 V	I_F = 5 mA, $V_{O\,(min)}$ =26V	- 15000	—	—	V/µs
Common mode transient immunity at low level output		CM_L	8		I_F = 0 mA, $V_{O\,(max)}$ =1V	15000	—	—	V/µs

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

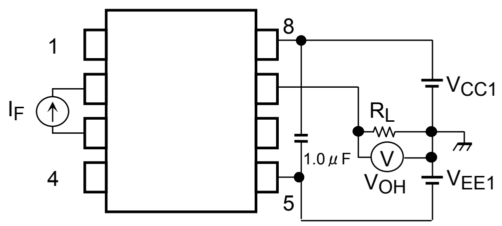
Test Circuit 1: I_{OPH}



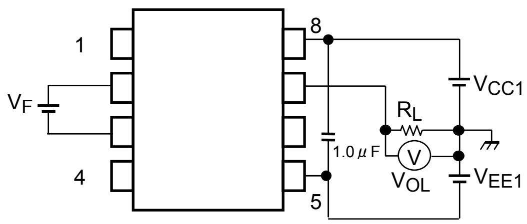
Test Circuit 2: I_{OPL}



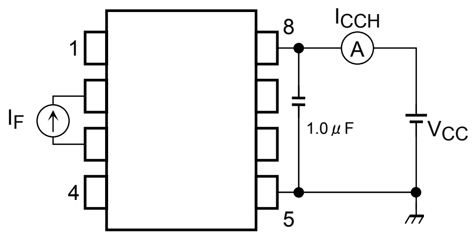
Test Circuit 3: V_{OH}



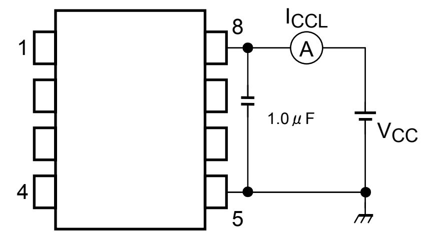
Test Circuit 4: V_{OL}



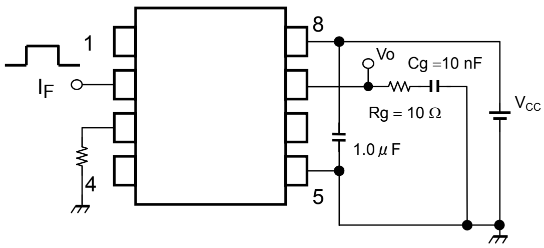
Test Circuit 5: I_{CCH}

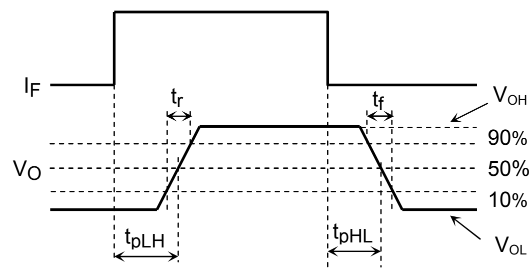


Test Circuit 6: I_{CCL}

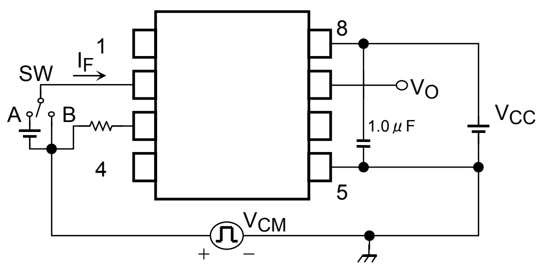


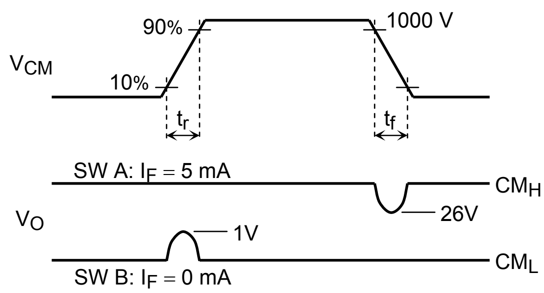
Test Circuit 7: t_{pLH}, t_{pHL}, t_r, t_f





Test Circuit 8: CM_H, CM_L





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

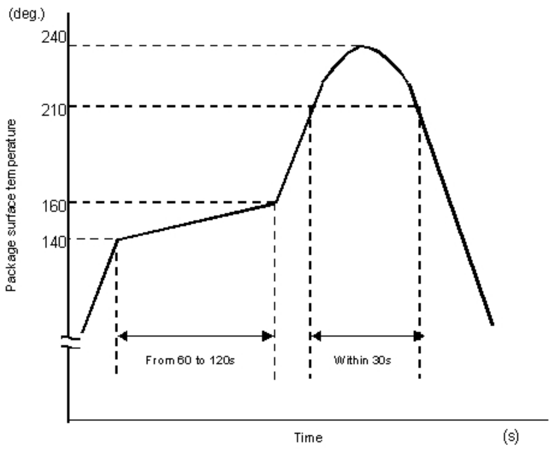
CM_L (CM_H) is the maximum rate of rise (fall) of the common mode voltage that can be sustained with the output voltage in the low (high) state.

Soldering and Storage

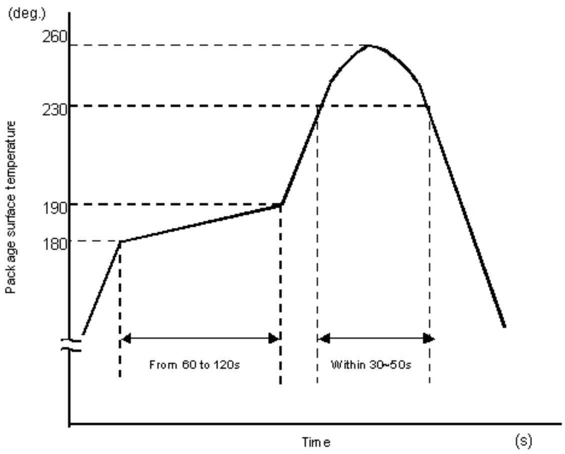
(1) Precautions for Soldering

1) When Using Soldering Reflow

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



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



- 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.

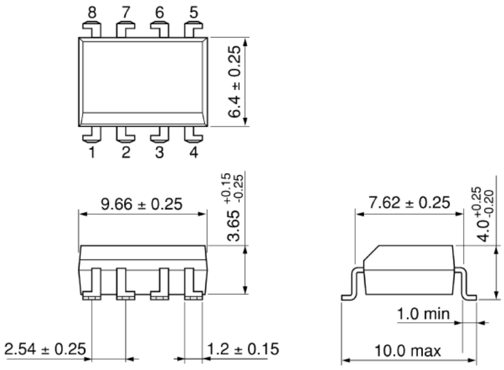
6) When repacking devices, use anti-static containers.

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.

DIP8 Package Dimensions

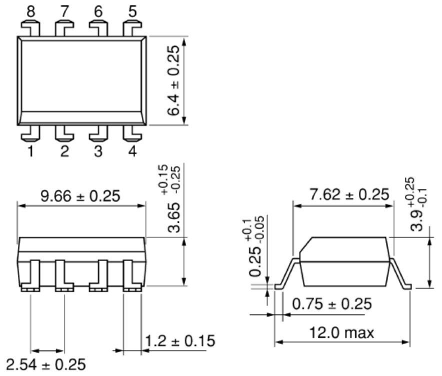
DIP8（LF1）/（TP1） Unit: mm



TOSHIBA 11−10C401

Weight: 0.54 g (typ.)

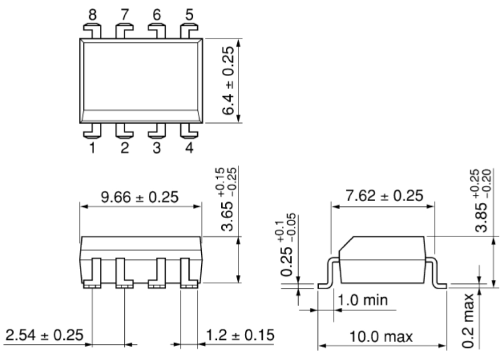
DIP8（LF4）/（TP4） Unit: mm



TOSHIBA 11−10C404

Weight: 0.54 g (typ.)

DIP8（LF5）/（TP5） Unit: mm



TOSHIBA 11−10C405

Weight: 0.54 g (typ.)

Specifications for Embossed-Tape Packing for DIP8 Type Photocoupler : (TP1), (TP4), (TP5)

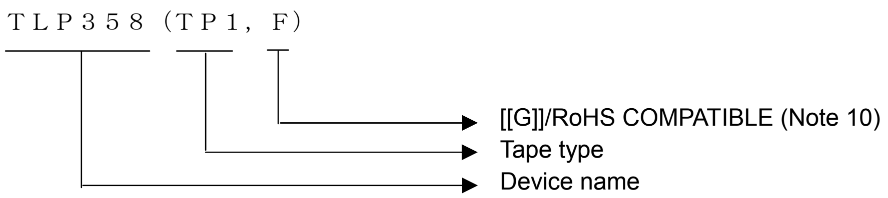
1. Applicable Package

Package Name	Product Type
DIP8LF1 / DIP8LF5	TLP358
DIP8LF4	TLP358F

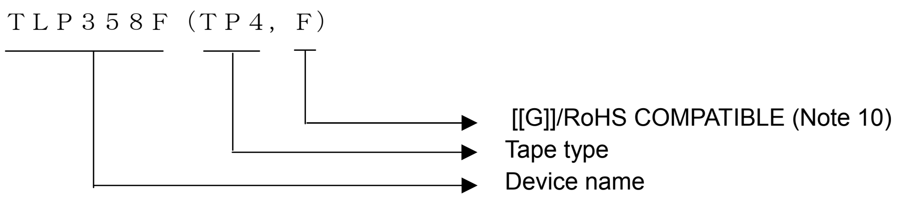
2. Product Naming System

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

(Example 1)



(Example 2)



3. Tape Dimensions

3.1 Orientation of Devices in Relation to Direction of Tape Movement

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

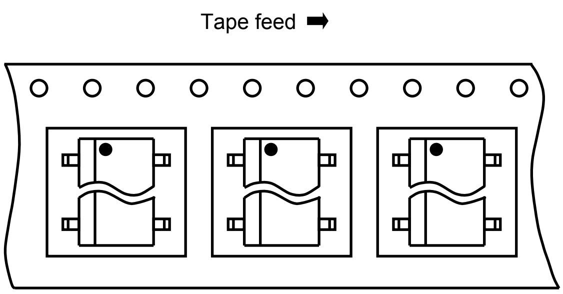


Figure 1 Device Orientation

3.2 Tape Packing Quantity

DIP8LF1 / DIP8LF5 : 1,500 devices per reel
DIP8LF4 : 1,000 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 30 or more empty holes. The end of the tape has 30 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.

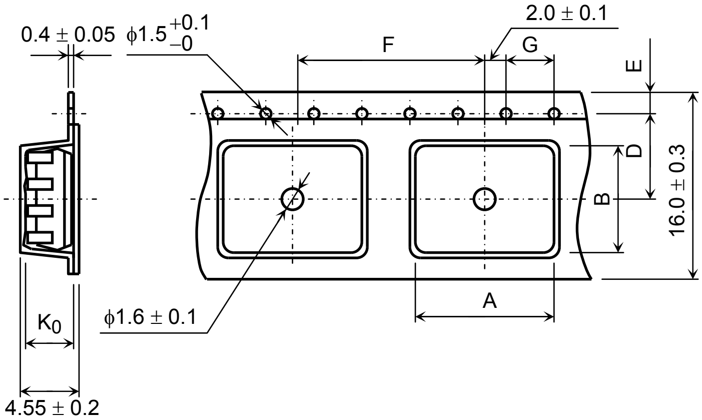


Figure 2 Tape Forms

Table 2 Tape Dimension

Unit: mm
Unless otherwise specified: ±0.1

Symbol	Dimensions		Remark
	(TP1), (TP5)	(TP4)	
A	10.4	12.3	—
B	10.1	10.1	—
D	7.5	7.5	Center line of indented square hole and sprocket hole
E	1.75	1.75	Distance between tape edge and hole center
F	16.0	16.0	Cumulative error $^{+0.1}_{-0.3}$ (max) per 10 feed holes
G	4.0	4.0	Cumulative error $^{+0.1}_{-0.3}$ (max) per 10 feed holes
K_0	4.1	4.1	Internal space

3.6 Reel

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

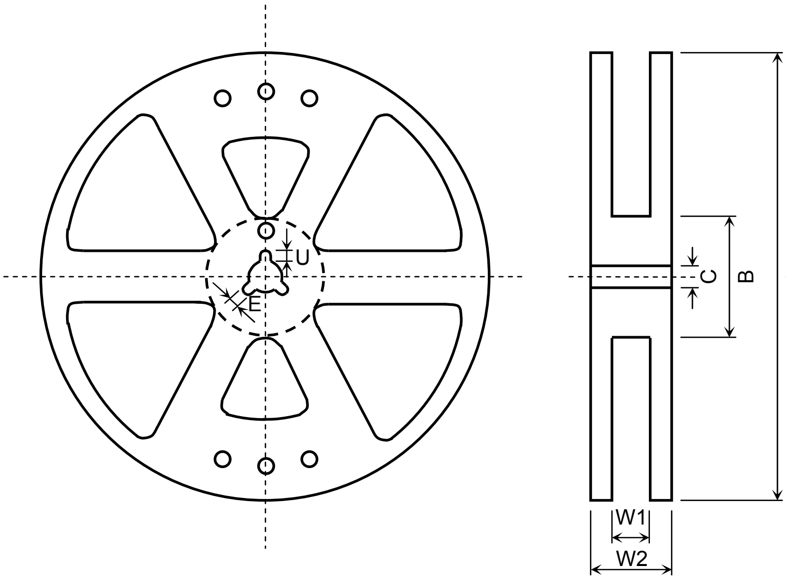


Figure 3 Reel Forms

Table 3 Reel Dimension

Unit: mm

Symbol	Dimensions
A	ϕ380 ± 2
B	ϕ80 ± 1
C	ϕ13 ± 0.5
E	2.0 ± 0.5
U	4.0 ± 0.5
W1	17.5 ± 0.5
W2	21.5 ± 1.0

4. Packing

Either one reel or five reels of photocouplers 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 1)

ＴＬＰ３５８（ＴＰ１，Ｆ）１５００pcs

Quantity (must be a multiple of 1500)
[[G]]/RoHS COMPATIBLE (Note 10)
Tape type
Device name

(Example 2)

ＴＬＰ３５８Ｆ（ＴＰ４，Ｆ）２０００pcs

Quantity (must be a multiple of 1000)
[[G]]/RoHS COMPATIBLE(Note 10)
Tape type
Device name

Note 10 : Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product.
RoHS is the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronics equipment.

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