

TOSHIBA Photocoupler GaAlAs IRED LED + Photo IC

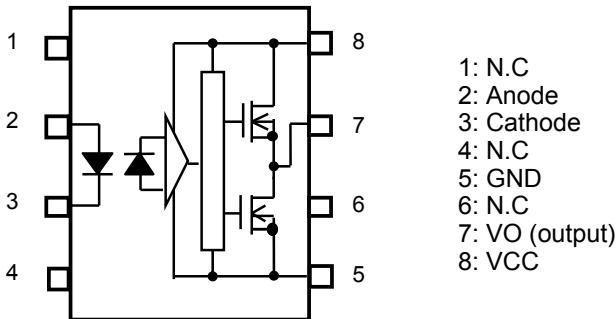
# TLP358, TLP358F

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 :  $I_{OP} = \pm 6.0A$  (max)
- Guaranteed performance over temperature :  $-40$  to  $100^{\circ}C$
- 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 :  $\pm 15$  kV /  $\mu s$  (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

### Pin Configuration (top view)

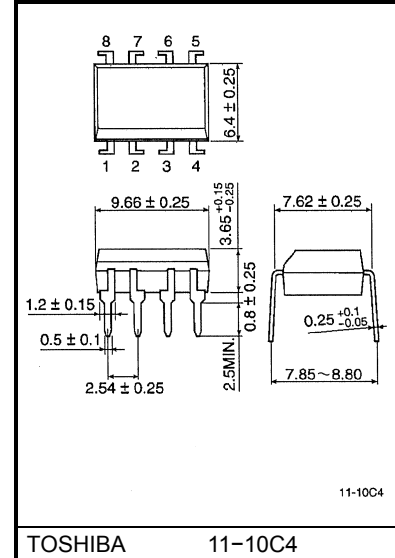


### Construction Mechanical Rating

	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)

### TLP358

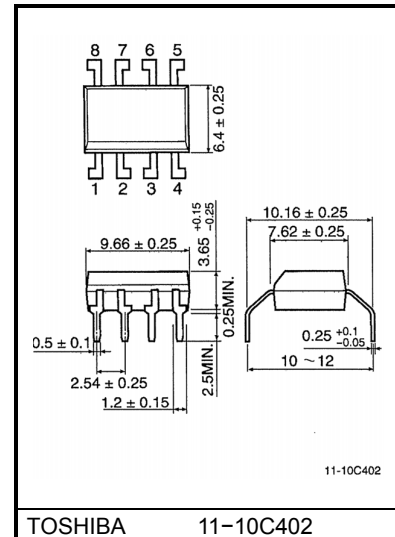
Unit: mm



Weight: 0.54 g (typ.)

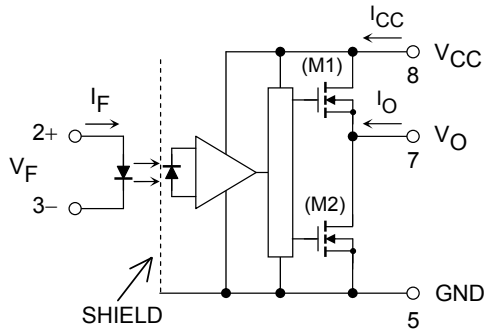
### TLP358F

Unit: mm



Weight: 0.54 g (typ.)

## Schematic



## Truth Table

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

1.0  $\mu$ F 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 $\geq$ 85°C)	$\Delta I_F / \Delta T_a$	-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. $\leq$ 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  $P_W \leq 1 \mu$ s, 300 pps

Note 2: Exponential waveform pulse width  $P_W \leq 0.3 \mu$ s,  $f \leq 15$ kHz

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  $\mu$ F) 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	$I_{OPH}/I_{OPL}$	—	—	$\pm 5.5$	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  $\mu$ s.

Note 7: Exponential waveform  $I_{OPH} \geq -4.0$  A ( $\leq 0.3$   $\mu$ s),  $I_{OPL} \leq 4.0$  A ( $\leq 0.3$   $\mu$ s)

## 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, $T_a = 25$ °C	1.45	1.57	1.75	V	
Temperature coefficient of forward voltage		$\Delta V_F / \Delta T_a$	—	$I_F = 10$ mA	—	-2.0	—	mV/°C	
Input reverse current		$I_R$	—	$V_R = 5$ V, $T_a = 25$ °C	—	—	10	$\mu$ A	
Input capacitance		$C_T$	—	$V = 0$ , $f = 1$ MHz, $T_a = 25$ °C	—	100	—	pF	
Output current (Note 8)	"H" Level	$I_{OPH}$	1	$V_{CC} = 30$ V, $I_F = 5$ mA, $V_{8-7} = -3.5$ V	—	-4.0	-2.0	A	
				$V_{CC} = 15$ V, $I_F = 5$ mA, $V_{8-7} = -5.5$ V	—	—	-5.0		
	"L" Level	$I_{OPL}$	2	$V_{CC} = 30$ V, $I_F = 0$ mA, $V_{7-5} = 2.5$ V	2.0	4.0	—		
				$V_{CC} = 15$ V, $I_F = 0$ mA, $V_{7-5} = 5.5$ V	5.0	—	—		
Output voltage	"H" Level	$V_{OH}$	3	$V_{CC} = +15$ V $V_{EE} = -15$ V $R_L = 100$ $\Omega$	$I_F = 5$ 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	$I_F = 5$ mA	—	1.3	2.0	mA
	"L" Level	$I_{CCL}$	6	$V_O$ open	$I_F = 0$ mA	—	1.3	2.0	
Threshold input current		L $\rightarrow$ H	$I_{FLH}$	—	$V_{CC} = 15$ V, $V_O > 1$ V, $I_O = 0$ mA	—	1.8	5	mA
Threshold input voltage		H $\rightarrow$ 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		$V_{UVLOHYS}$	—	—	—	1.5	—	V	

\*: All typical values are at  $T_a = 25$ °C

Note 8: Duration of  $I_O \leq 50$   $\mu$ s (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)

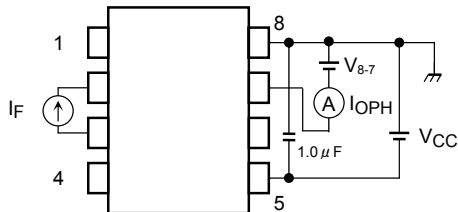
Characteristic	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Capacitance input to output	C <sub>S</sub>	V = 0, f = 1MHz (Note4)	—	1.0	—	pF
Isolation resistance	R <sub>S</sub>	V <sub>S</sub> = 500 V, R.H. ≤ 60% (Note4)	1×10 <sup>12</sup>	10 <sup>14</sup>	—	Ω
Isolation voltage	BV <sub>S</sub>	AC, 1 minute	3750	—	—	V <sub>rms</sub>
		AC, 1 second, in oil	—	10000	—	
		DC, 1 minute, in oil	—	10000	—	V <sub>dc</sub>

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

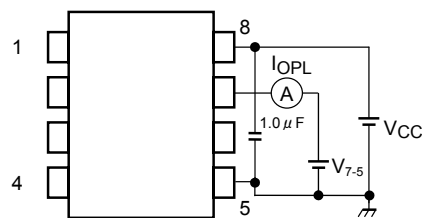
Characteristic	Symbol	Test Circuit	Test Conditions	Min	Typ.*	Max	Unit	
Propagation delay time	L → H	t <sub>pLH</sub>	V <sub>CC</sub> = 30 V, R <sub>g</sub> = 10 Ω, C <sub>g</sub> = 10 nF	I <sub>F</sub> = 0 → 5 mA	50	230	500	ns
	H → L	t <sub>pHL</sub>		I <sub>F</sub> = 5 → 0 mA	50	230	500	
Switching Time Dispersion between ON and OFF	t <sub>pHL</sub> -t <sub>pLH</sub>	7	V <sub>CC</sub> = 30 V, R <sub>g</sub> = 10 Ω, C <sub>g</sub> = 10 nF	—	—	250		
Output rise time (10-90%)	t <sub>r</sub>	8	V <sub>CC</sub> = 30 V, R <sub>g</sub> = 10 Ω, C <sub>g</sub> = 10 nF	I <sub>F</sub> = 0 → 5 mA	—	17	—	
Output fall time (90-10%)	t <sub>f</sub>			I <sub>F</sub> = 5 → 0 mA	—	17	—	
Common mode transient immunity at high level output	CM <sub>H</sub>	8	V <sub>CM</sub> = 1000 V <sub>p-p</sub> Ta = 25 °C, V <sub>CC</sub> = 30 V	I <sub>F</sub> = 5 mA, V <sub>O</sub> (min) = 26V	- 15000	—	—	
Common mode transient immunity at low level output	CM <sub>L</sub>			I <sub>F</sub> = 0 mA, V <sub>O</sub> (max) = 1V	15000	—	—	

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

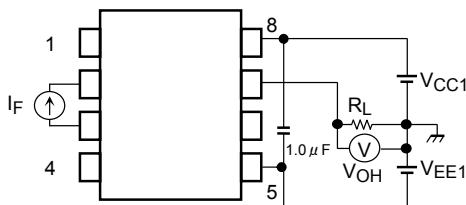
**Test Circuit 1: I<sub>OPH</sub>**



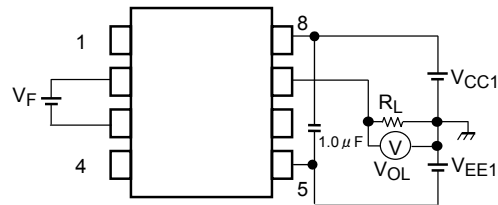
**Test Circuit 2: I<sub>OPL</sub>**



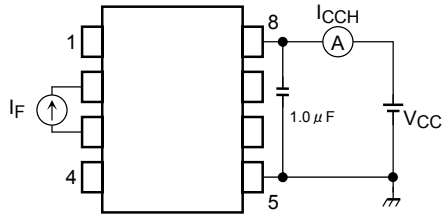
**Test Circuit 3: V<sub>OH</sub>**



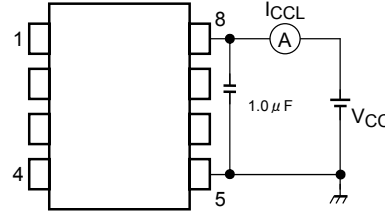
**Test Circuit 4: V<sub>OL</sub>**



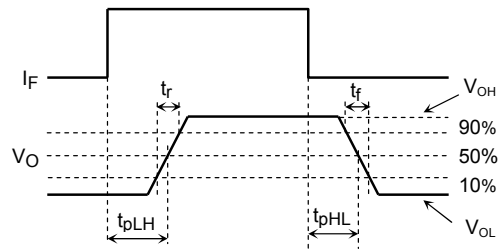
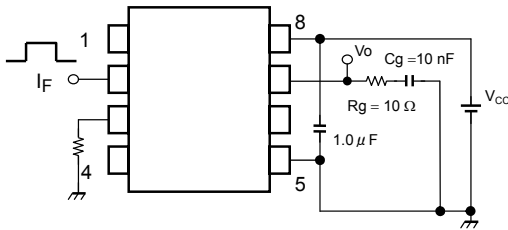
**Test Circuit 5:  $I_{CCH}$**



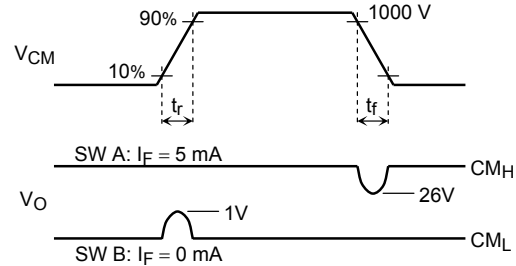
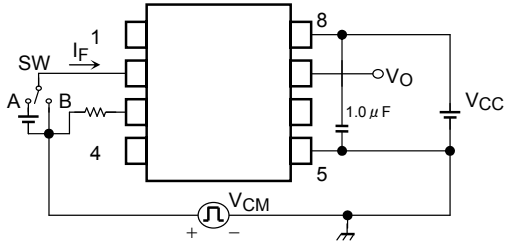
**Test Circuit 6:  $I_{CCL}$**



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



**Test Circuit 8:  $CM_H$ ,  $CM_L$**



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

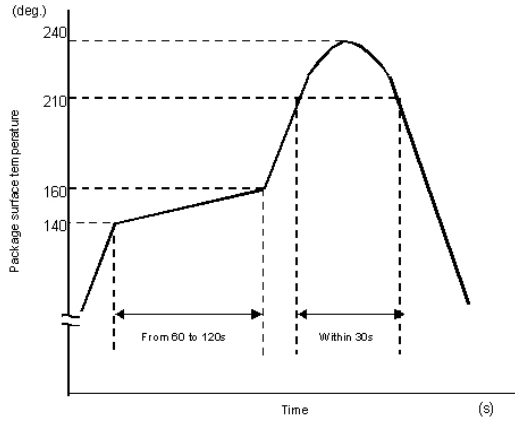
$CM_L$  ( $CM_H$ ) is the maximum rate of rise (fall) of the common mode voltage that can be sustained with the output voltage in the low (high) state.

**Soldering and Storage**

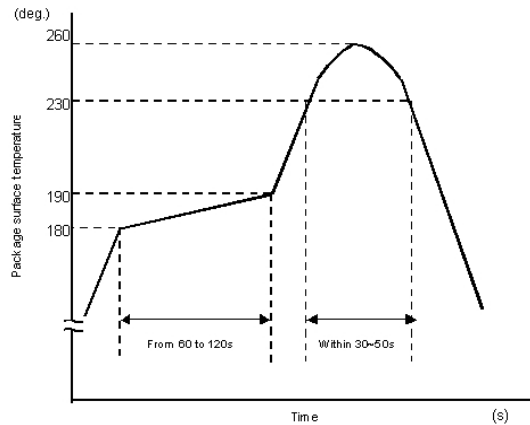
**(1) Precautions for Soldering**

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

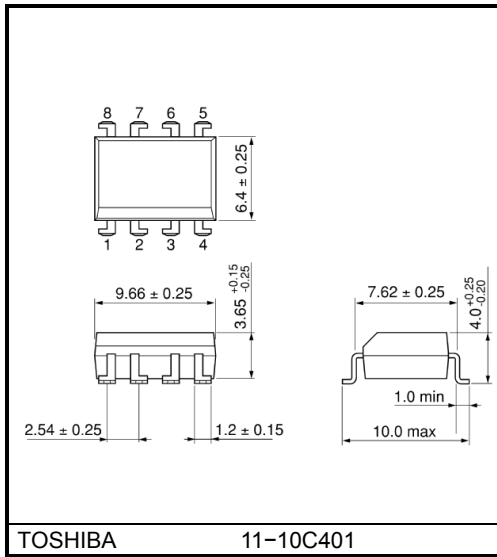
**(2) Precautions for General Storage**

- 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)**

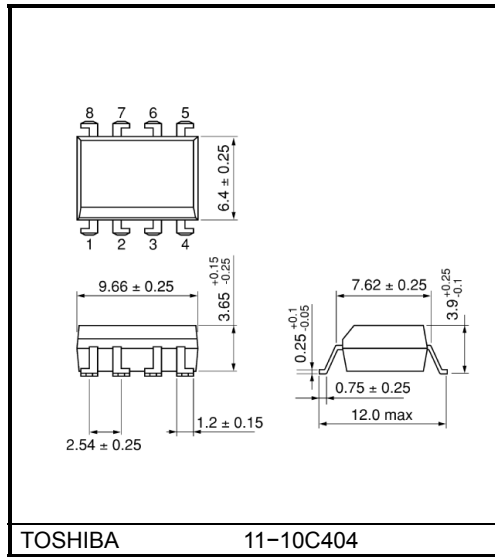
Unit: mm



Weight: 0.54 g (typ.)

**DIP8 (LF4) / (TP4)**

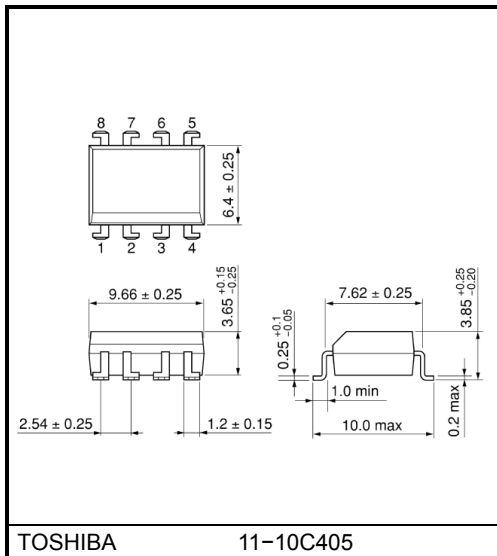
Unit: mm



Weight: 0.54 g (typ.)

**DIP8 (LF5) / (TP5)**

Unit: mm



Weight: 0.54 g (typ.)



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

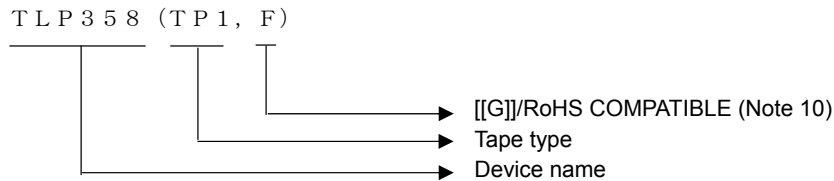
### 1. Applicable Package

Package Name	Product Type
DIP8LF1 / DIP8LF5	TLP358
DIP8LF4	TLP358F

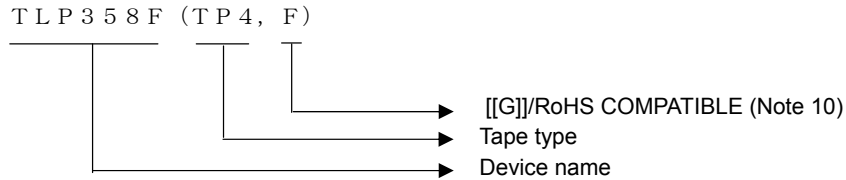
### 2. Product Naming System

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)



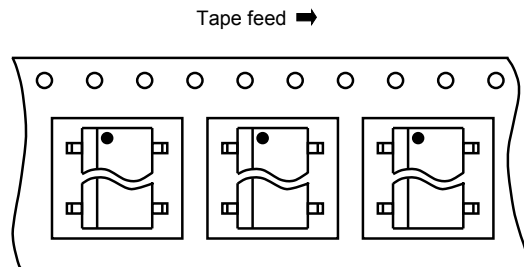
(Example 2)



### 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**

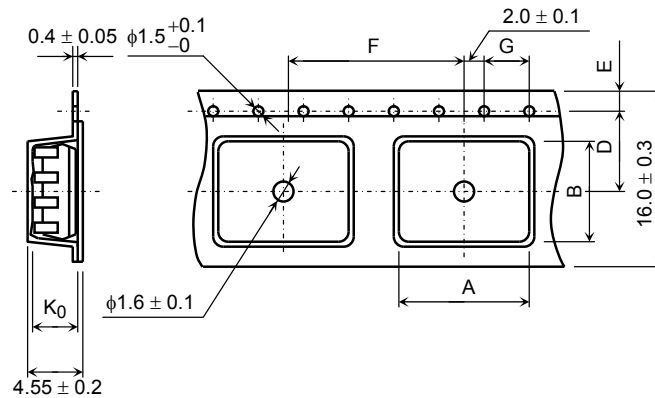
	Standard	Remarks
Occurrences of 2 or more successive empty device recesses	0	Within any given 40-mm section of tape, not including leader and trailer
Single empty device recesses	6 devices (max) per reel	Not including leader and trailer

**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**

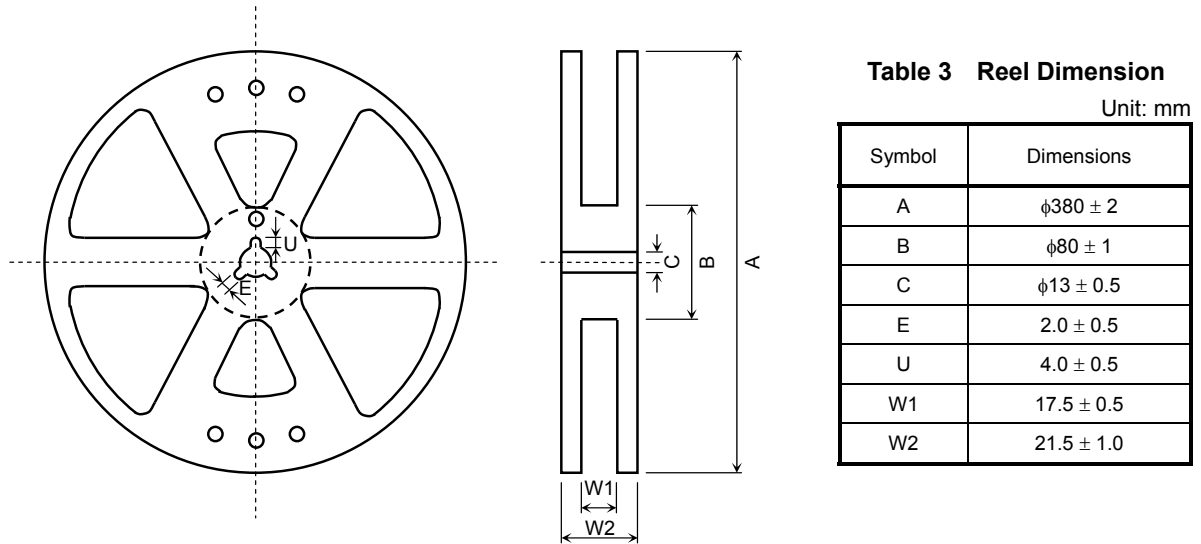
**Table 2 Tape Dimension**

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 $\begin{matrix} +0.1 \\ -0.3 \end{matrix}$ (max) per 10 feed holes
G	4.0	4.0	Cumulative error $\begin{matrix} +0.1 \\ -0.3 \end{matrix}$ (max) per 10 feed holes
K <sub>0</sub>	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**

**4. Packing**

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

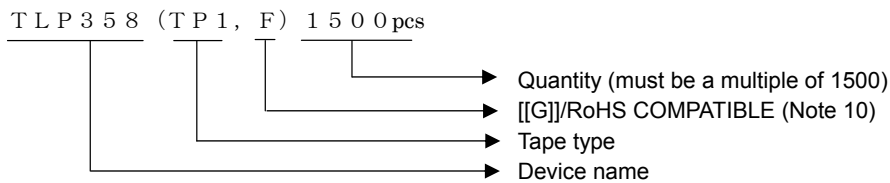
**5. Label Indication**

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.

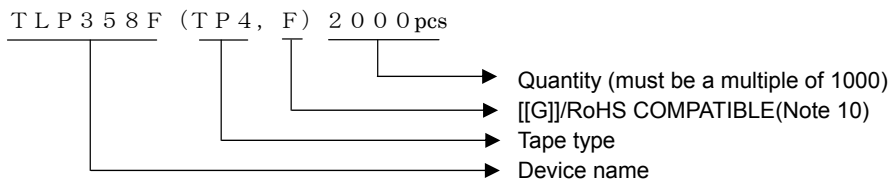
**6. Ordering Method**

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

(Example 1)



(Example 2)



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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