TOSHIBA Photointerrupter Infrared LED + Photo IC

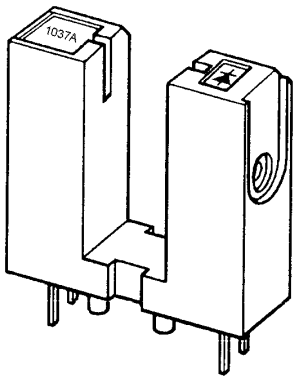
TLP1037A

Domestic electrical appliances such as VTRs and CD players

Office equipment such as photocopiers, printers and fax machines

Vending machines, bank ATMs and automatic ticket machines

Position detectors



TOSHIBA	—

Weight: 1 g (typ.)

The TLP1037A is a high-withstanding-voltage photo-interrupter for digital output. The device combines a high-optical-output GaAs infrared LED with a high-sensitivity, high-gain Si photo-IC. The photo-IC, which supports a wide range of systems (3.3 V to 12 V), enables the device to consume less power than conventional devices. The device also features a narrow slit width and high resolution.

The device is housed in a deep-slot package.

- Deep-slot package (detection slot depth: 12 mm)
- Designed for direct mounting on printed circuit boards (positioning pins included)
- Gap: 5 mm
- Resolution: slit width 0.5 mm
- Digital output (open-collector, high-level output when no light is present)
- Direct connection to logic IC
- Power supply voltage: V_{CC} = 2.7 V~15 V
- Switching time: t_{pLH} = 15 μs (max)
- Detector impermeable to visible light
- Package material: Polybutylene-terephthalate (UL94V-0, black)

Maximum Ratings (Ta = 25°C)

Characteristics			Symbol	Rating	Unit
LED	Forward current		I_F	50	mA
	Forward current derating	(Ta > 25°C)	ΔI_F/°C	−0.33	mA/°C
		(Ta > 85°C)		−2	
	Reverse voltage		V_R	5	V
Detector	Supply voltage		V_{CC}	15	V
	Output voltage		V_O	15	V
	Low-level output current (Ta = T_{opr})		I_{OL}	16	mA
Operating temperature			T_{opr}	−30~95	°C
Storage temperature			T_{stg}	−40~100	°C
Soldering temperature (5 s)		(Note 1)	T_{sol}	260	°C

Note 1: Soldering is performed 1.5 mm from the bottom of the package.

Recommended Operating Conditions

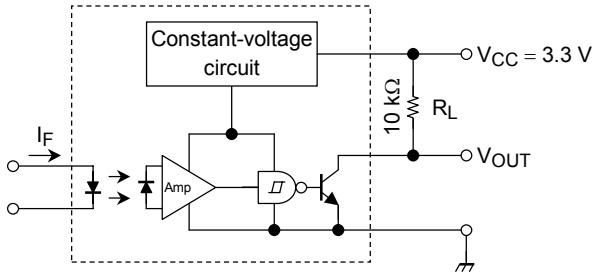
Characteristics	Symbol	Min	Typ.	Max	Unit
LED forward current	I_F	8 (Note 2)	—	20	mA
Supply voltage	V_{CC}	2.7	3.3	13.2	V
Output voltage	V_O	—	—	13.2	V
Low-level output current	I_{OL}	—	—	16	mA
Operating temperature	T_{opr}	−25	—	95	°C

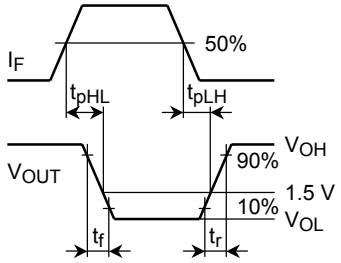
Note 2: The value 8 mA takes account of 50% LED optical fluctuation. The initial value of the threshold input current is 4 mA or less.

Electrical and Optical Characteristics
(unless otherwise specified: Ta = −30~95°C, V_{CC} = 2.7~15 V)

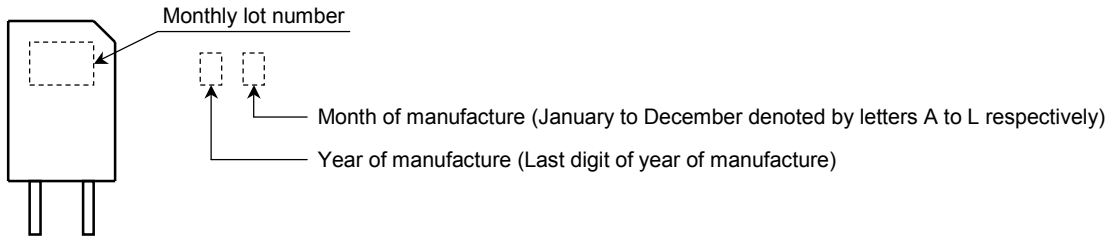
Characteristics		Symbol	Test Conditions	Min	Typ.	Max	Unit
LED	Forward voltage	V_F	I_F = 10 mA, Ta = 25°C	1.00	1.15	1.30	V
	Reverse current	I_R	V_R = 5 V, Ta = 25°C	—	—	10	μA
	Peak emission wavelength	λ_P	I_F = 15 mA, Ta = 25°C	—	940	—	nm
Detector	operating supply voltage	V_{CC}	—	2.7	—	15	V
	Low-level supply current	I_{CCL}	I_F = 15 mA, Ta = 25°C	—	—	1.6	mA
			I_F = 15 mA	—	—	2.0	
	High-level supply current	I_{CCH}	I_F = 0	—	—	1.2	mA
	Low-level output voltage	V_{OL}	I_{OL} = 16 mA, I_F = 15 mA, Ta = 25°C	—	0.05	0.3	V
			I_{OL} = 16 mA, I_F = 15 mA	—	—	0.4	
	High-level output current	I_{OH}	I_F = 0, V_O = 15 V	—	—	6.3	μA
	Peak sensitivity wavelength	λ_P	Ta = 25°C	—	900	—	nm
Propagation characteristics	H → L threshold input current	I_{FHL}	Ta = 25°C	—	—	3	mA
				—	—	4	
	Hysteresis	I_{FHL}/I_{FLH}	—	—	1.5	—	—
	Propagation delay time (L → H)	t_{pLH}	V_{CC} = 3.3 V, I_F = 15 mA, R_L = 10 kΩ, Ta = 25°C (Note 3)	—	—	15	μs
	Propagation delay time (H → L)	t_{pHL}		—	—	9	
	Rise time	t_r		—	0.8	—	
	Fall time	t_f		—	0.02	—	

Note 3: The switching time measurement circuit and waveform are as follows:





Markings



Precautions

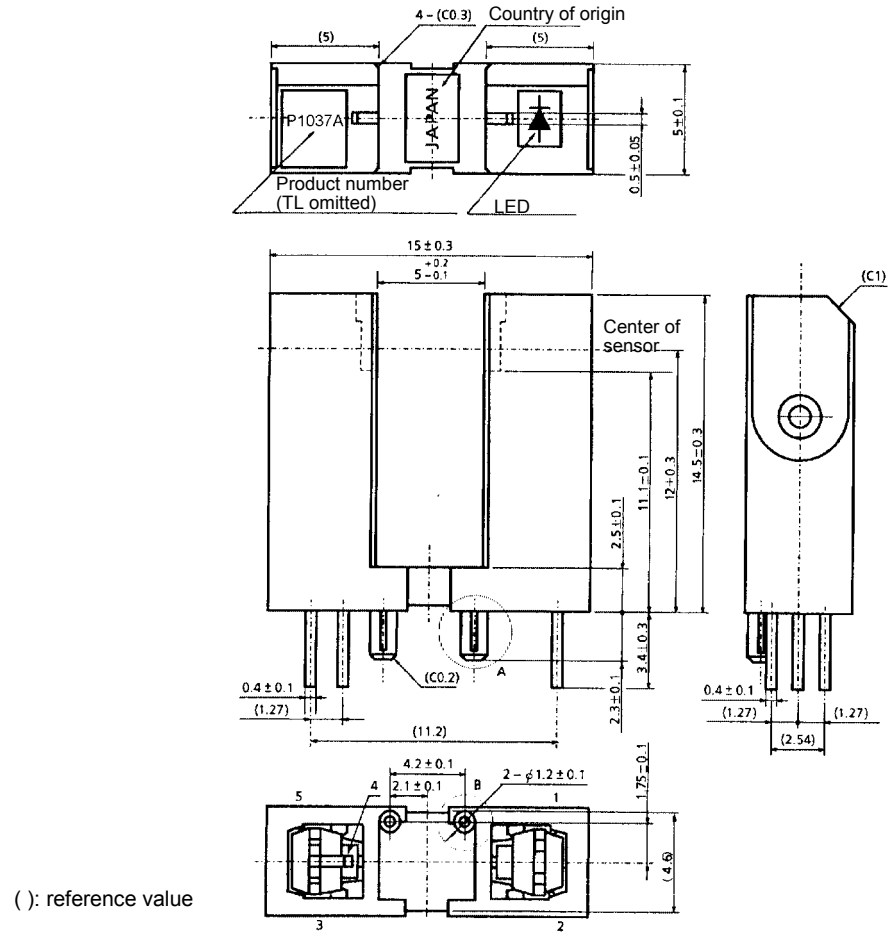
- When removing flux with chemicals after soldering, clean only the soldered part of the leads. Do not immerse the entire package in the cleaning solvent. Chemical residue on the LED emitter or the photodetector inside the photo-IC case may adversely affect the optical characteristics of the device and may drastically reduce the threshold input current.
- The case is made of polybutylene-terephthalate. Oil or chemicals may cause the package to melt or crack. Care must be taken in relation to the environment in which the device is to be installed.
- Mount the device on a level surface.
- Output fluctuates for 100 μs after power-on while the internal circuit stabilizes.
- To stabilize the power line, insert a bypass capacitor of up to 0.01 μF between V_{CC} and GND, close to the device.
- The threshold input current increases over time due to current flowing in the infrared LED. The design of circuits which incorporate the device must take into account the change in threshold input current over time. The change in threshold input current is equal to the reciprocal of the change in LED infrared optical output.

$$\frac{I_{FHL}(t)}{I_{FHL}(0)} = \left(\frac{P_O(t)}{P_O(0)} \right)^{-1}$$

- Choose a high-quality shutter material which is impermeable to light. If the material is of inferior quality, light from the LED may pass through the shutter, causing the device to malfunction.

Package Dimensions

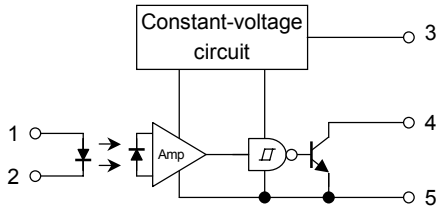
Unit: mm



( ): reference value

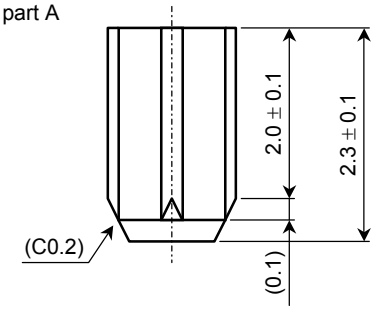
Weight: 1 g (typ.)

Pin Connection

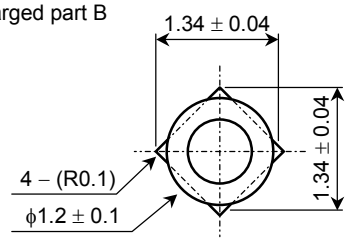


1: Anode
2: Cathode
3: V_{CC}
4: OUT
5: GND

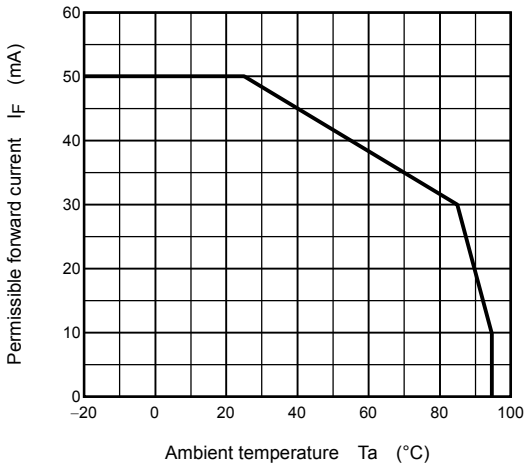
Enlarged part A



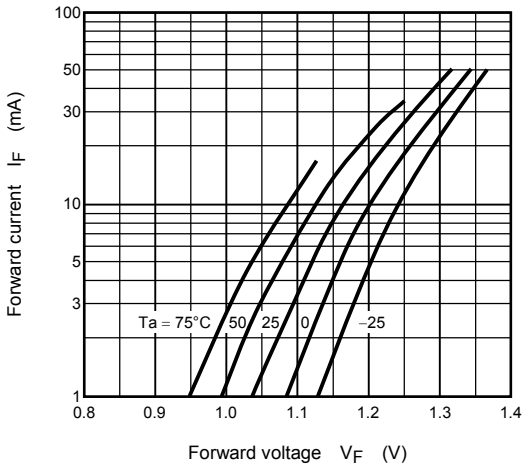
Enlarged part B



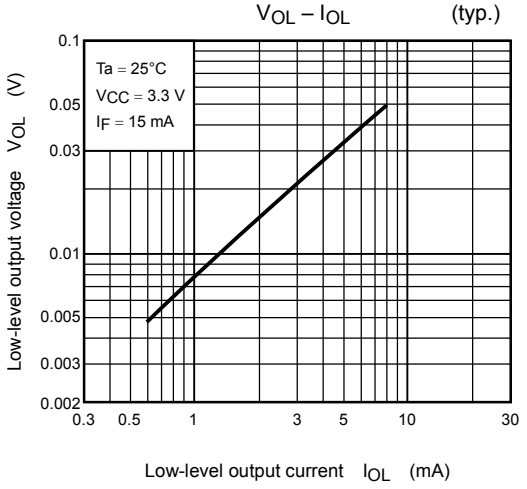
I_F – Ta



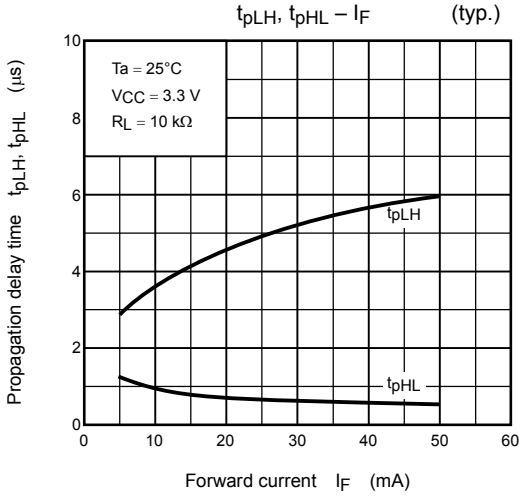
I_F – V_F (typ.)



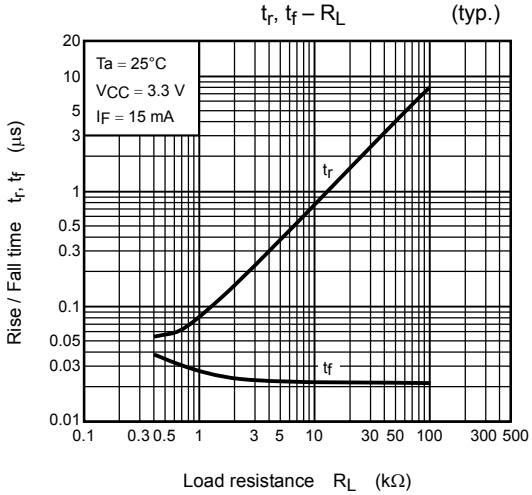
V_{OL} – I_{OL} (typ.)



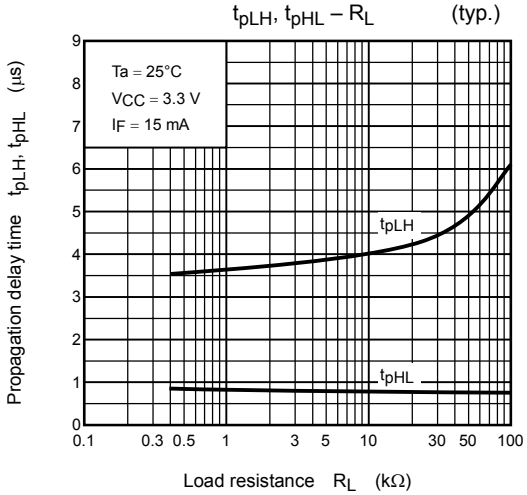
t_{pLH}, t_{pHL} – I_F (typ.)

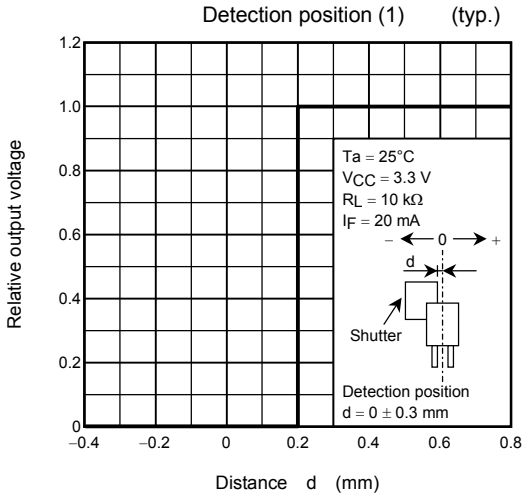


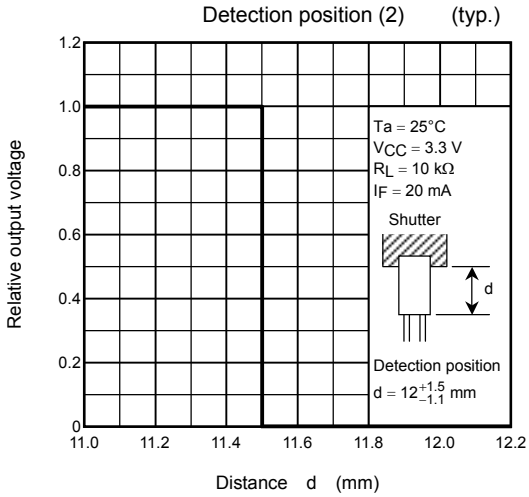
t_r, t_f – R_L (typ.)



t_{pLH}, t_{pHL} – R_L (typ.)

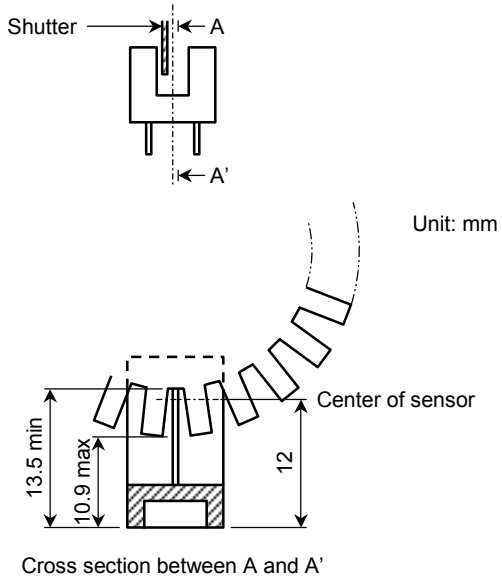






Relative Positioning of Shutter and Device

For normal operation, position the shutter and the device as shown in the figure below. By considering the device's detection direction characteristic and switching time, determine the shutter slit width and pitch.



Cross section between A and A'

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