

# TLP1031A

Domestic electrical appliances such as VTRs and CD players

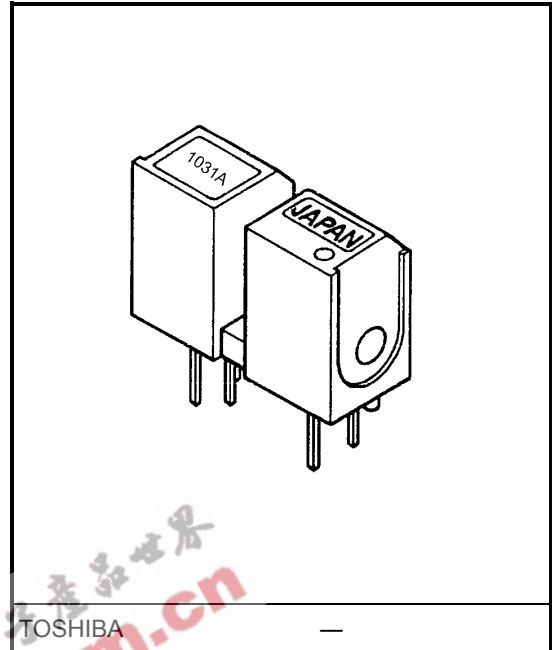
Office equipment such as photocopiers, printers and fax machines

Trackballs

Position detectors

The TLP1031A 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.

- Compact package:  
Package height: 7.4 mm  
Depth: 4.5 mm
- Designed for direct mounting on printed circuit boards (positioning pins included)
- Gap: 2 mm
- High resolution: Slit width of 0.15 mm
- Digital output (open-collector, high-level output when no light is present)
- Direct connection to logic IC
- Power supply voltage:  $V_{CC} = 2.7\text{ V} \sim 15\text{ V}$
- Switching time:  $t_{pLH} = 15\ \mu\text{s}$  (max)
- Detector impermeable to visible light
- Package material: Polybutylene-terephthalate (UL94V-0, black)



Weight: 0.4 g (typ.)

## Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
LED	Forward current	$I_F$	50	mA
	Forward current derating	$\Delta I_F / ^\circ\text{C}$	(Ta > 25°C)	-0.33
			(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 = Topr)	$I_{OL}$	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

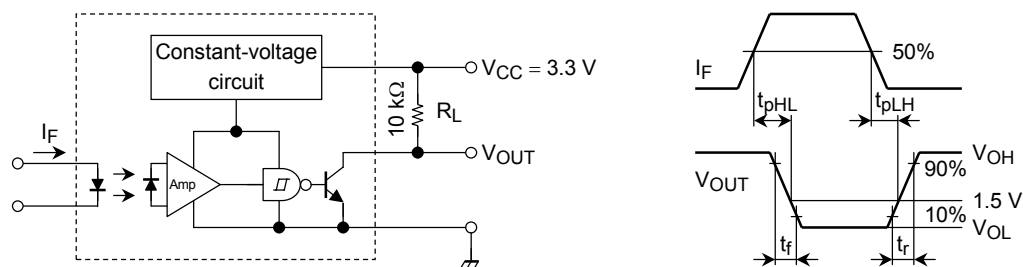
Characteristics	Symbol	Min	Typ.	Max	Unit
LED forward current	$I_F$	13.4 (Note 2)	—	20	mA
Supply voltage	$V_{CC}$	2.7	3.3	13.2	V
Output voltage	$V_O$	—	—	13.2	V
Low-level output current	$I_{OL}$	—	—	16	mA
Operating temperature	$T_{opr}$	-25	—	85	°C

Note 2: The value 13.4 mA takes account of 50% LED optical fluctuation. The initial value of the threshold input current is 6.7 mA or less.

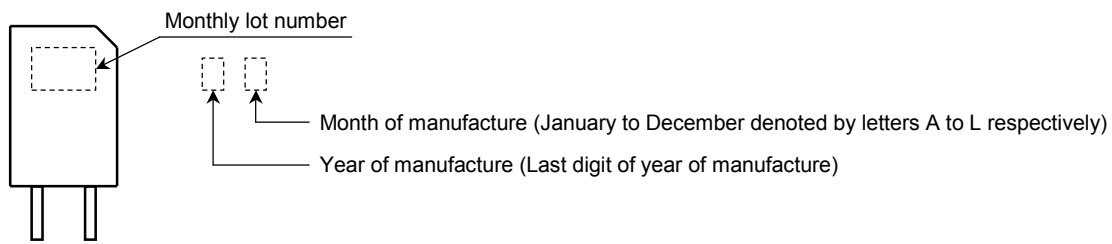
## Electrical and Optical Characteristics (unless otherwise specified: $T_a = -30\sim 95^\circ\text{C}$ , $V_{CC} = 2.7\sim 15\text{ V}$ )

Characteristics		Symbol	Test Conditions	Min	Typ.	Max	Unit
LED	Forward voltage	$V_F$	$I_F = 10\text{ mA}$ , $T_a = 25^\circ\text{C}$	1.00	1.15	1.30	V
	Reverse current	$I_R$	$V_R = 5\text{ V}$ , $T_a = 25^\circ\text{C}$	—	—	10	$\mu\text{A}$
	Peak emission wavelength	$\lambda_p$	$I_F = 15\text{ mA}$ , $T_a = 25^\circ\text{C}$	—	940	—	nm
Detector	operating supply voltage	$V_{CC}$	—	2.7	—	15	V
	Low-level supply current	$I_{CCL}$	$I_F = 15\text{ mA}$ , $T_a = 25^\circ\text{C}$	—	—	1.6	mA
			$I_F = 15\text{ mA}$	—	—	2.0	
	High-level supply current	$I_{CCH}$	$I_F = 0$	—	—	1.2	mA
	Low-level output voltage	$V_{OL}$	$I_{OL} = 16\text{ mA}$ , $I_F = 15\text{ mA}$ , $T_a = 25^\circ\text{C}$	—	0.05	0.3	V
			$I_{OL} = 16\text{ mA}$ , $I_F = 15\text{ mA}$	—	—	0.4	
	High-level output current	$I_{OH}$	$I_F = 0$ , $V_O = 15\text{ V}$	—	—	6.3	$\mu\text{A}$
Peak sensitivity wavelength	$\lambda_p$	$T_a = 25^\circ\text{C}$	—	900	—	nm	
Propagation characteristics	H $\rightarrow$ L threshold input current	$I_{FHL}$	$T_a = 25^\circ\text{C}$	—	—	4	mA
				—	—	6.7	
	Hysteresis	$I_{FHL}/I_{FLH}$	—	—	1.5	—	
	Propagation delay time (L $\rightarrow$ H)	$t_{pLH}$	$V_{CC} = 3.3\text{ V}$ , $I_F = 15\text{ mA}$ , $R_L = 10\text{ k}\Omega$ , $T_a = 25^\circ\text{C}$ (Note 3)	—	—	15	$\mu\text{s}$
	Propagation delay time (H $\rightarrow$ 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



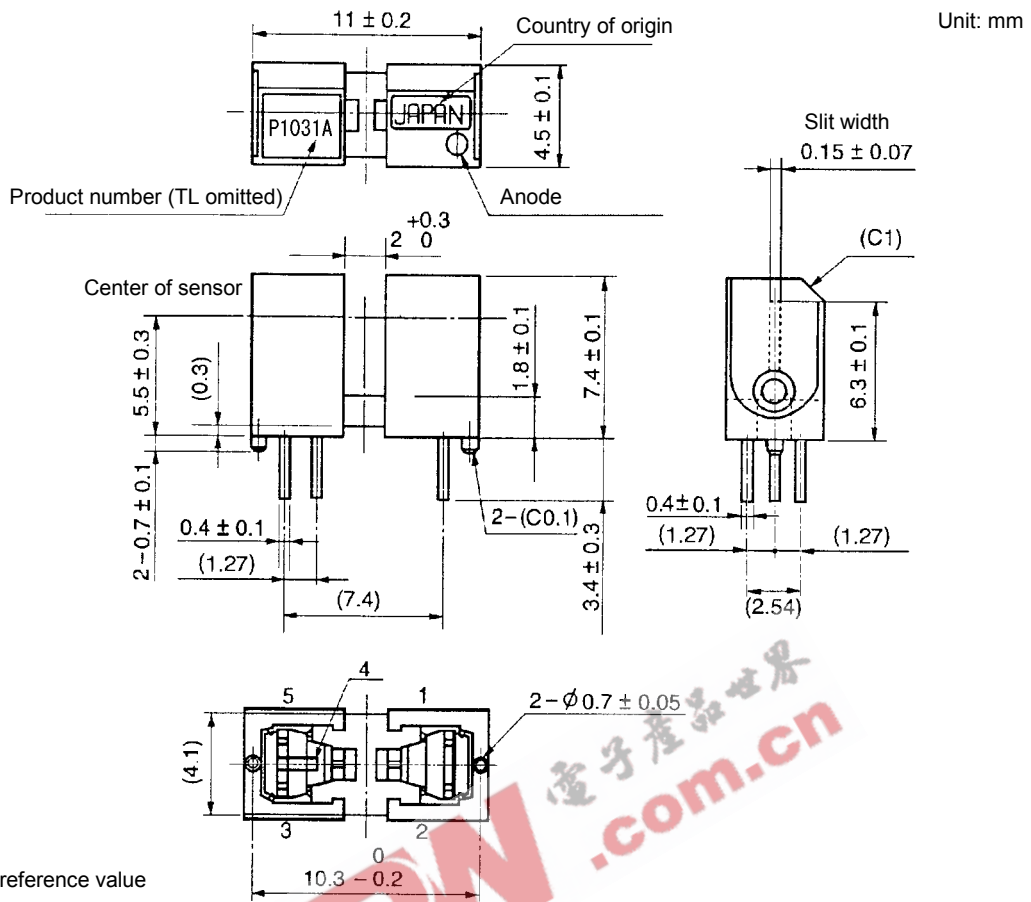
## Precautions

- 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  $\mu$ s after power-on while the internal circuit stabilizes.
- To stabilize the power line, insert a bypass capacitor of up to 0.01  $\mu$ F between VCC 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.

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

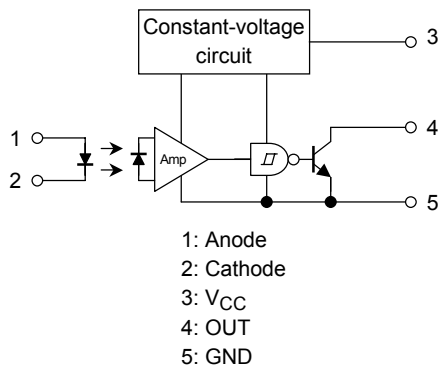
- Choose a high-quality shutter material which is impermeable to light. If the material is of inferior quality, light from the LED may pass through the shutter, causing the device to malfunction.

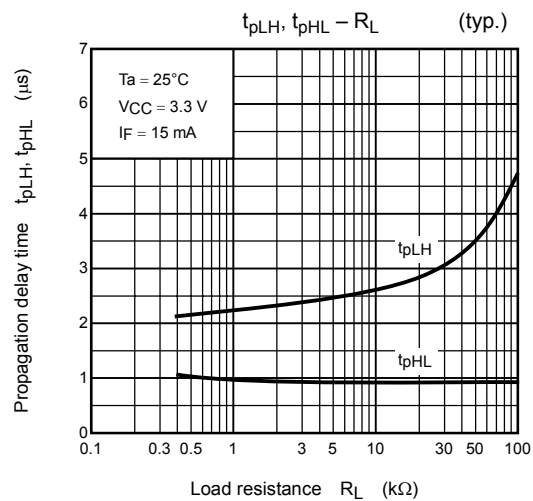
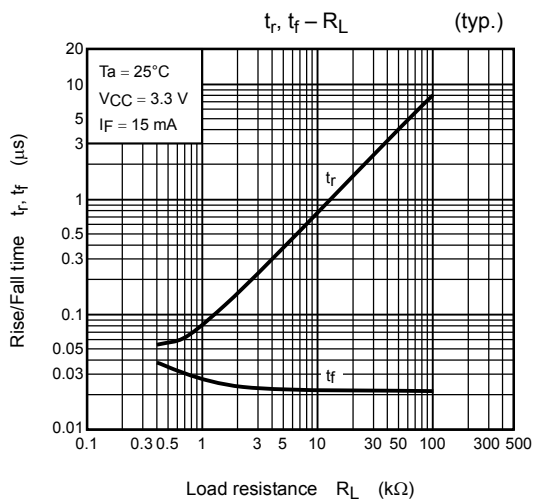
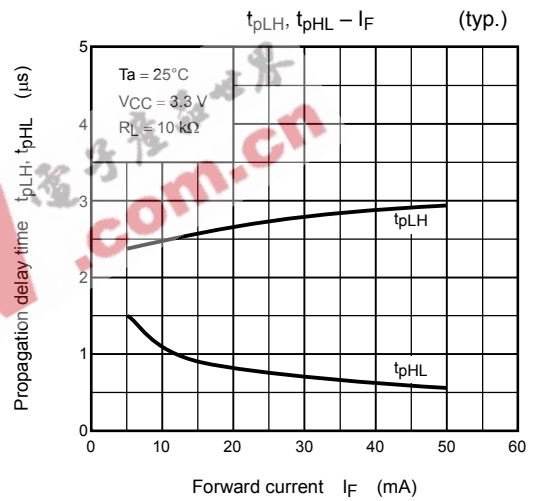
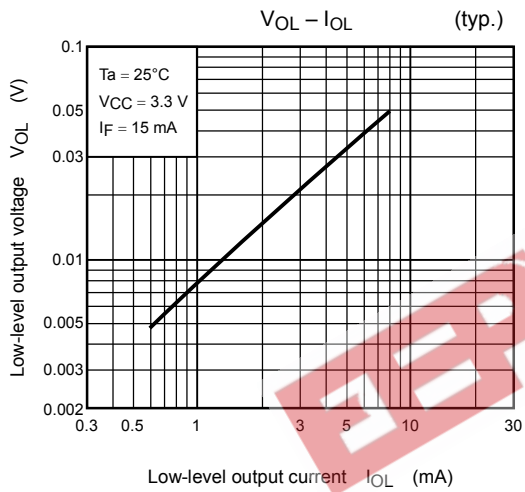
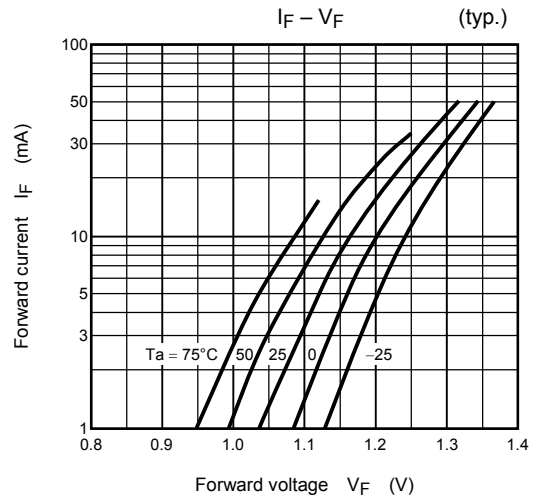
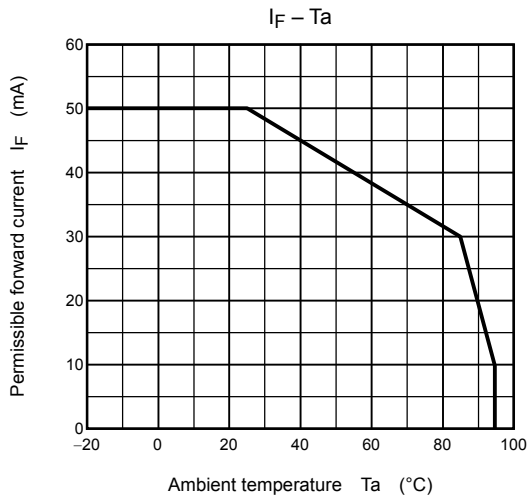
## Package Dimensions

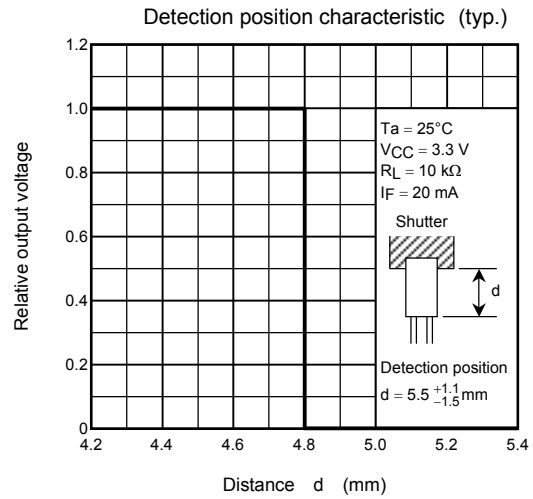
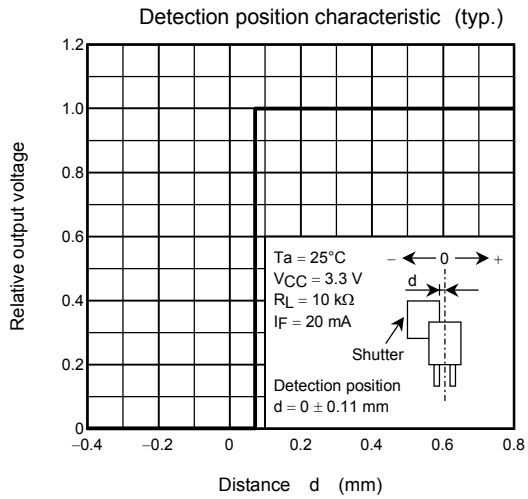


Weight: 0.4 g (typ.)

## Pin Connection

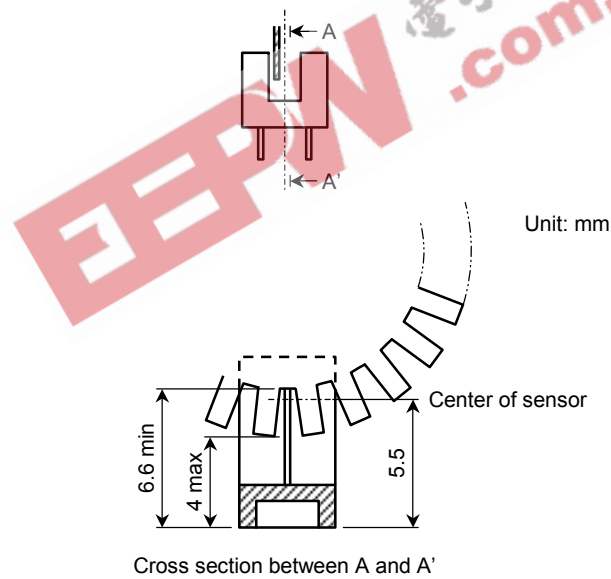






### Relative Positioning of Shutter and Device

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.



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