

TLP1033A

Domestic electrical appliances such as VTRs and CD players

Office equipment such as photocopiers, printers and fax machines

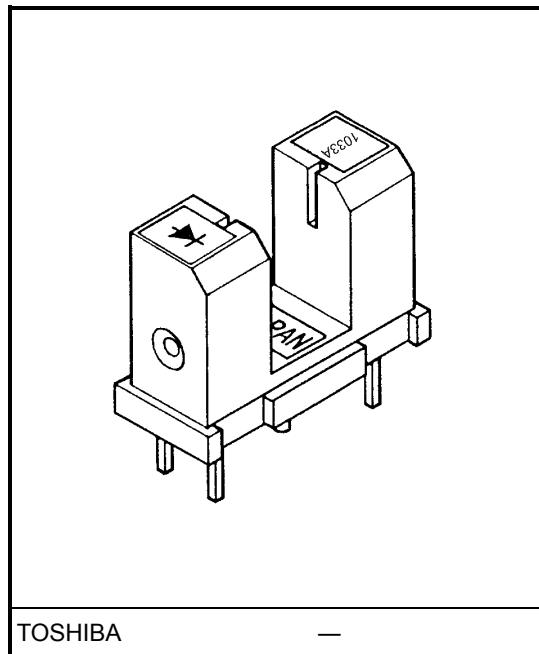
Vending machines, bank ATMs and automatic ticket machines

Position detectors

The TLP1033A 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 short lead package allows automatic mounting.

- Designed for direct mounting on printed circuit boards (positioning pins included)
- The short lead package allows automatic mounting
: Lead length 3.4 ± 0.3 mm
- Permissible board thickness: 1.6 mm or less
- 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: $V_{CC} = 2.7 \text{ V} \sim 15 \text{ V}$
- Switching time: $t_{PLH} = 15 \mu\text{s}$ (max)
- Detector impermeable to visible light
- Package material: Polybutylene-terephthalate (UL94V-0, black)



Weight: 0.6 g (typ.)

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

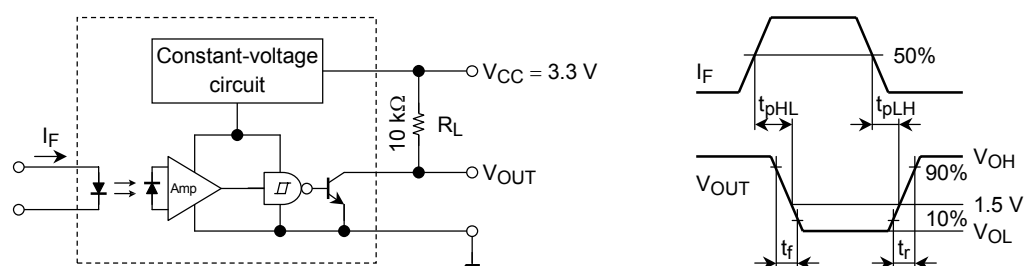
Note 2: The value 8 mA takes account of 50% LED optical fluctuation. The initial value of the threshold input current is 4 mA or less.

Electrical and Optical Characteristics

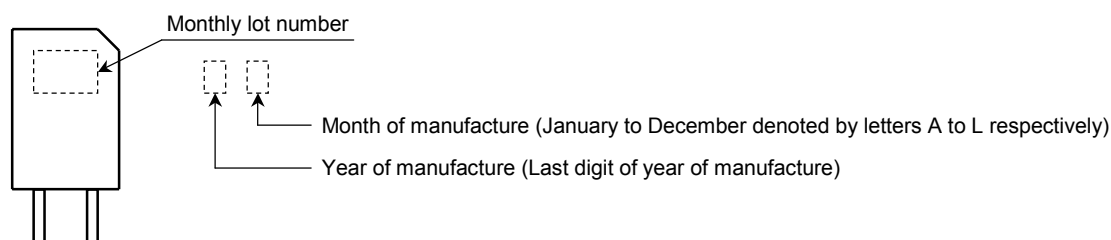
(unless otherwise specified: $T_a = -30 \sim 95^\circ\text{C}$, $V_{CC} = 2.7 \sim 15\text{ V}$)

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	μA
	Peak emission wavelength	λ_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	μA
Propagation characteristics	Peak sensitivity wavelength	λ_P	$T_a = 25^\circ\text{C}$	—	900	—	nm
	H $\rightarrow$ L threshold input current	I_{FHL}	$T_a = 25^\circ\text{C}$	—	—	3	mA
				—	—	4	
	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	μs
	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

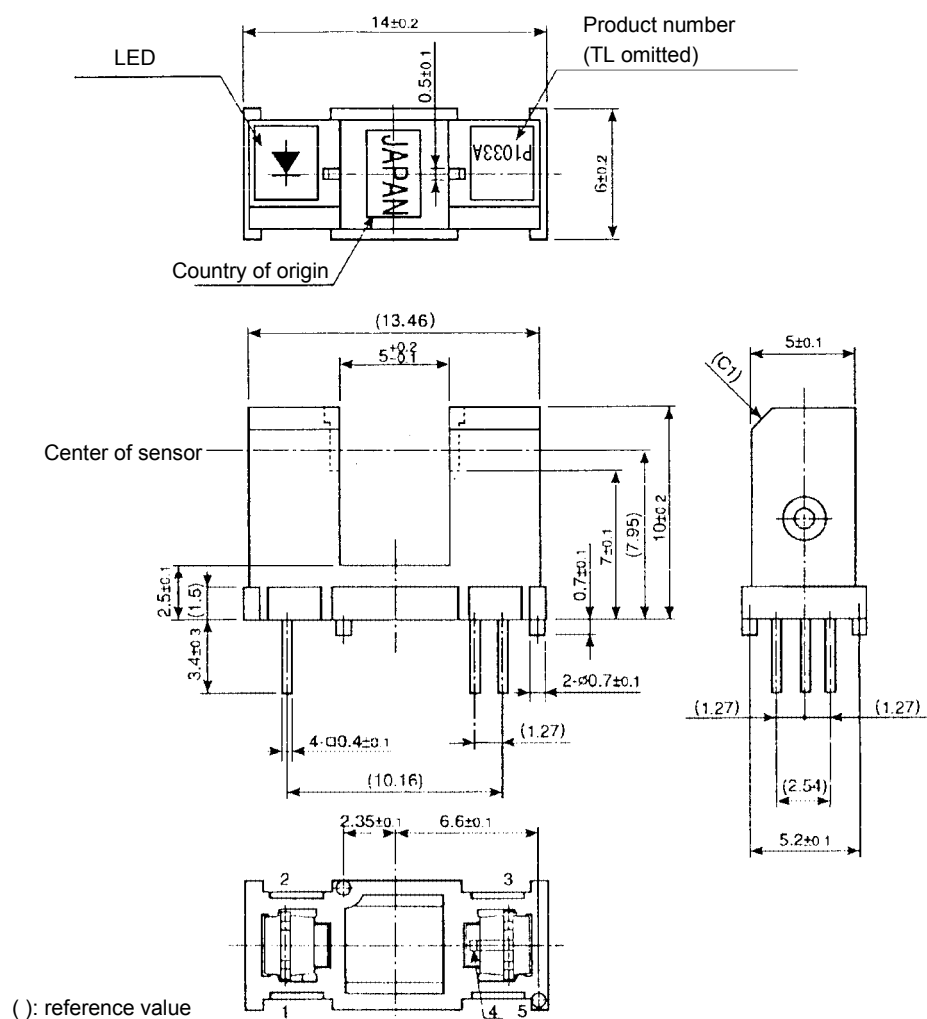
- When removing flux with chemicals after soldering, clean only the soldered part of the leads. Do not immerse the entire package in the cleaning solvent. Chemical residue on the LED emitter or the photodetector inside the photo-IC case may adversely affect the optical characteristics of the device and 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 μ s after power-on while the internal circuit stabilizes.
- To stabilize the power line, insert a bypass capacitor of up to 0.01 μ 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.

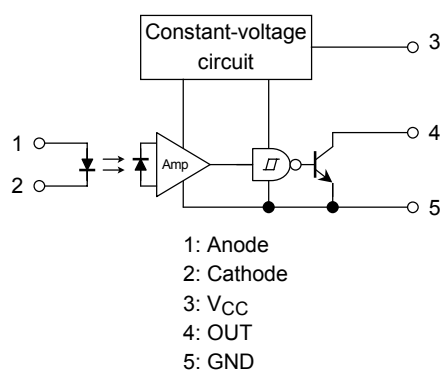
Package Dimensions

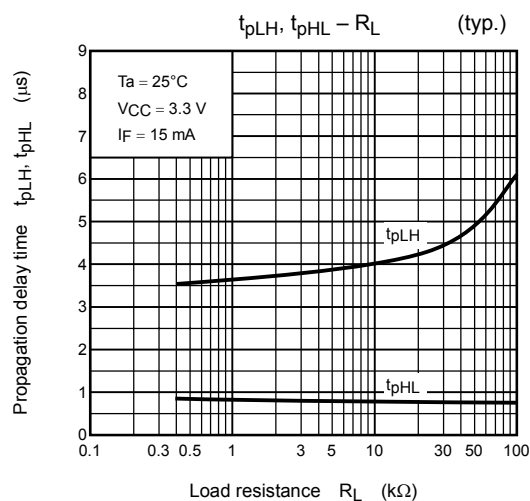
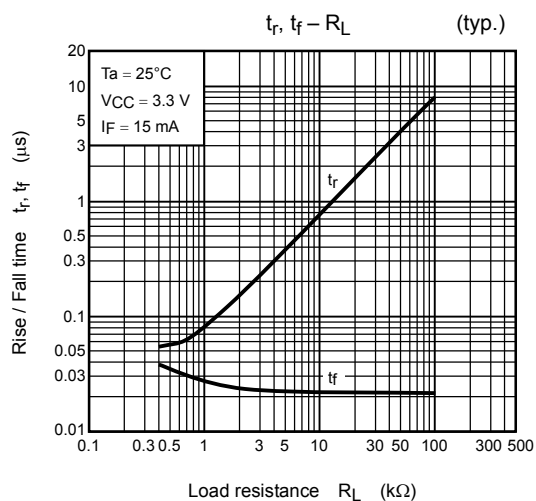
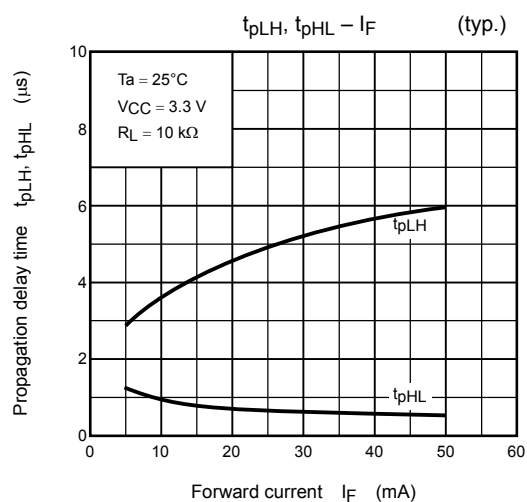
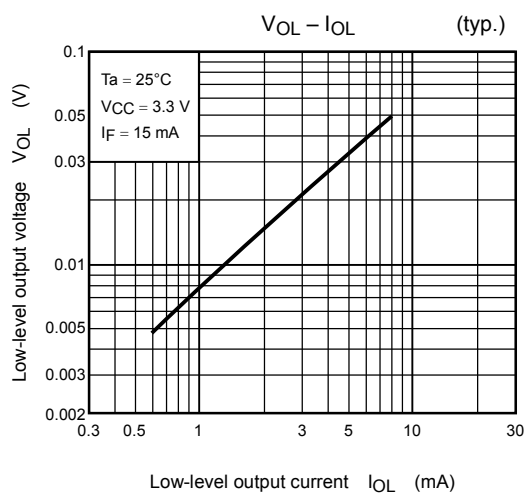
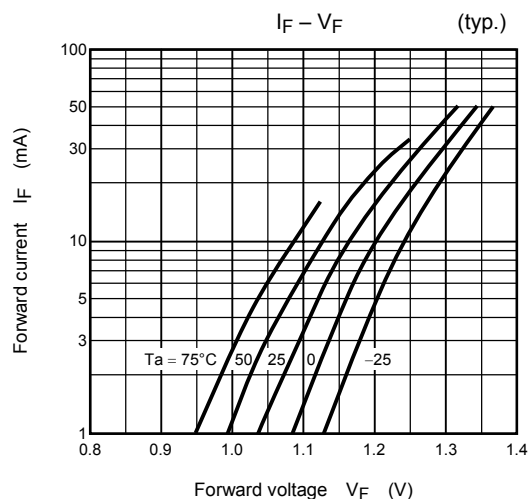
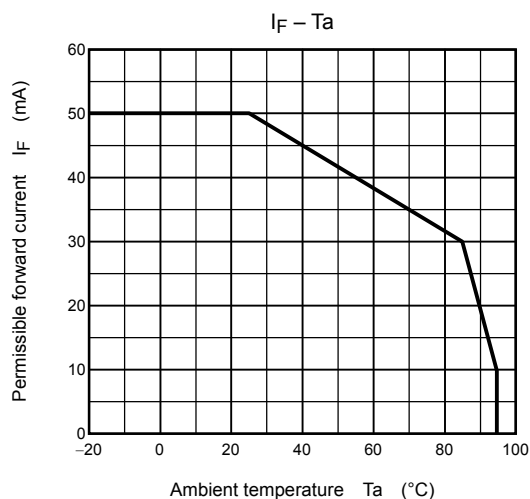
Unit: mm

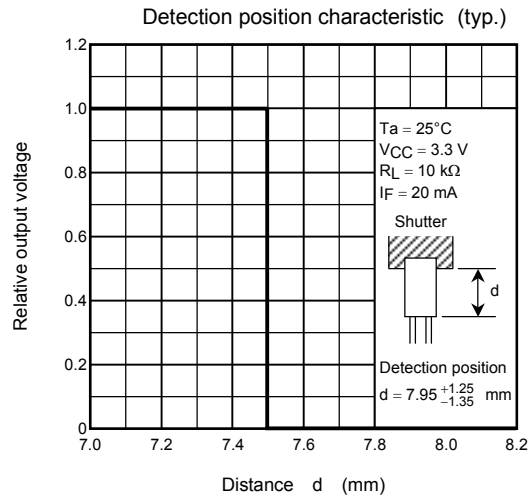
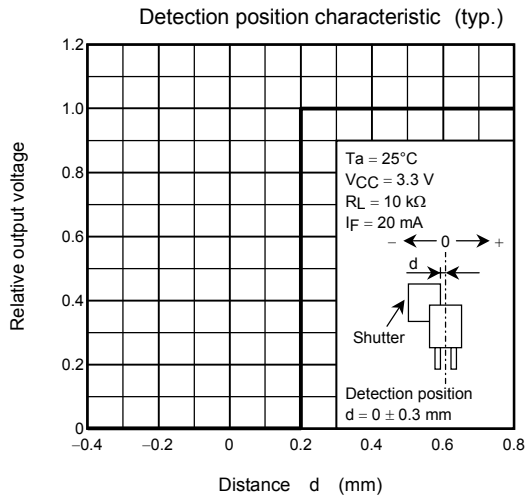


Weight: 0.6 g (typ.)

Pin Connection

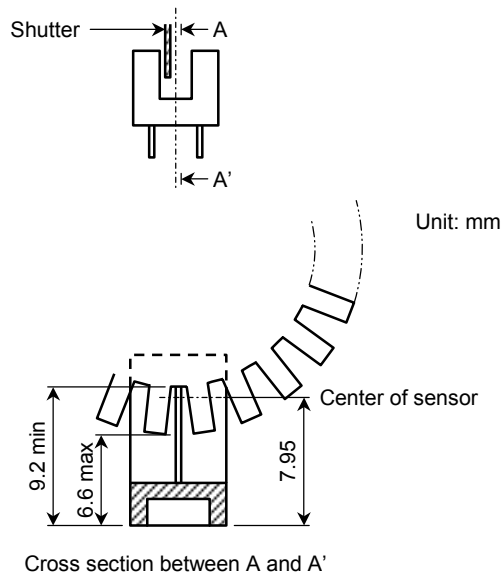






Relative Positioning of Shutter and Device

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.



RESTRICTIONS ON PRODUCT USE

020704EBC

- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.
In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc..
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk.
- Gallium (GaAs) Arsenide is a substance used in the products described in this document. GaAs dust or vapor is harmful to the human body. Do not break, cut, crush or dissolve chemically.
- The products described in this document are subject to the foreign exchange and foreign trade laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.