

# TPS816(F)

Lead(Pb)-Free

Photo-electric Switches

Office Equipment such as Photocopiers, Printers and Fax Machines

The TPS816(F) is an Si photo-IC for digital output. It incorporates a photodiode, amp, waveform shaper, LED driver and sync detector in a single chip.

Use of sync optical modulation makes the IC ideal for applications in external light.

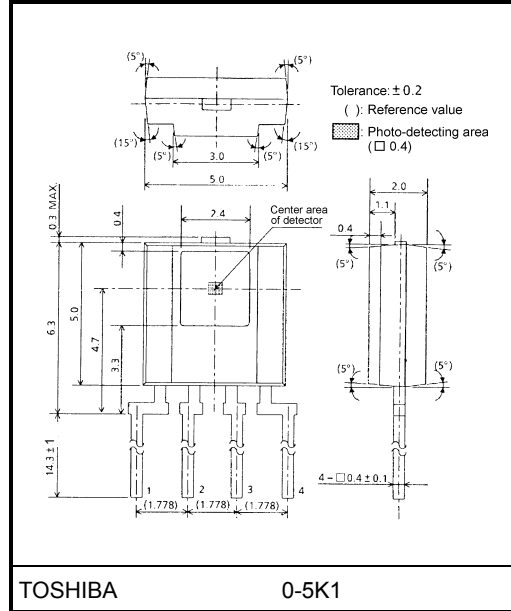
- Housed in compact side-view epoxy resin package
- High resistance to external light due to sync optical modulation:  $E_X = 3000 \text{ lx (min)}$
- High-sensitivity:  $EHL = 1 \mu\text{W/mm}^2 \text{ (max)}$
- Wide operating temperature range:  $T_{opr} = -30^\circ\text{C to } 85^\circ\text{C}$
- High LED output current and low-level output current:

$$I_{LED} = 70 \text{ mA (Ta = T}_{opr}\text{)}$$

$$I_{OL} = 16 \text{ mA (Ta = T}_{opr}\text{)}$$

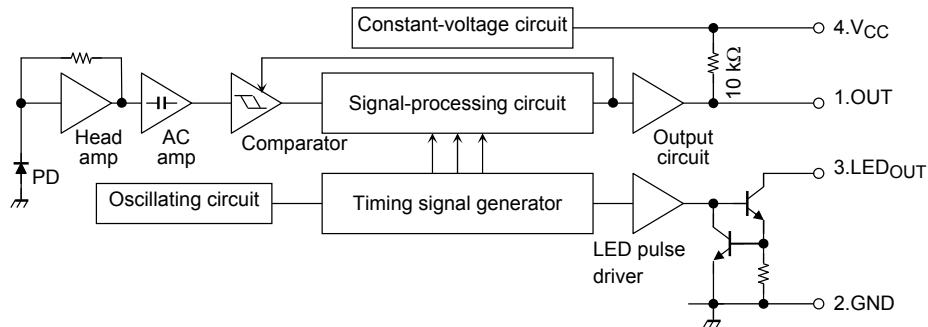
- Digital output (pull-up resistor included) : Low-level output for light input
- TPS816(F) package resin impermeable to visible light

Unit: mm



Weight: 0.3g (typ.)

## Block Diagram



## Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	7	V
Output voltage	V <sub>OUT</sub>	≦ V <sub>CC</sub>	V
Output current (Ta = Topr)	I <sub>OUT</sub>	16	mA
LED output voltage	V <sub>LED</sub>	≦ V <sub>CC</sub>	V
LED pulse forward current (Ta = Topr)	I <sub>LED</sub>	70	mA
Operating temperature	T <sub>opr</sub>	-30~85	°C
Storage temperature	T <sub>stg</sub>	-40~100	°C
Soldering temperature (5s) (Note 1)	T <sub>sol</sub>	260	°C

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 and the operating ranges.

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).

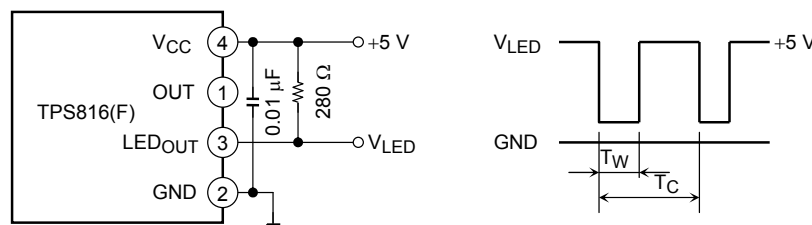
Note 1: Solder under the lead stopper.

## Electrical and Optical Characteristics (V<sub>CC</sub> = 5 V, Ta = 25°C)

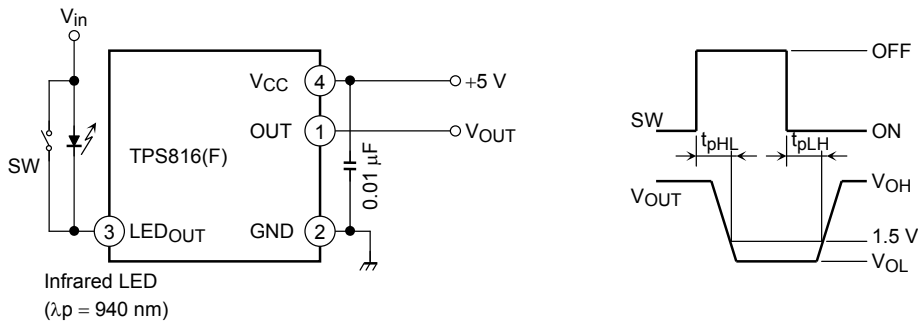
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Supply voltage		V <sub>CC</sub>	—	4.5	5	5.5	V
Supply current		I <sub>CC</sub>	V <sub>OUT</sub> , V <sub>LED</sub> left open	—	4	7	mA
Output	High-level output voltage	V <sub>OH</sub>	E = 0	4.9	5	—	V
	Low-level output voltage	V <sub>OL</sub>	I <sub>OL</sub> = 16 mA, E = 2 μW/nm <sup>2</sup> (Note 2)	—	0.15	0.4	V
LED output	Low-level output voltage	V <sub>LED</sub>	I <sub>LED</sub> = 70 mA (peak)	1.05	1.35	1.65	V
	Pulse cycle	T <sub>C</sub>	(Note 3)	64	130	220	μs
	Pulse width	T <sub>W</sub>	(Note 3)	4	8	13.7	μs
	Duty ratio	T <sub>W</sub> /T <sub>C</sub>	—	—	6	10	%
Peak sensitivity wavelength		λ <sub>p</sub>	—	—	900	—	nm
Propagation characteristics	H → L threshold radiant incidence	E <sub>HL</sub>	No visible light (Note 2)	—	0.6	1.0	μW/mm <sup>2</sup>
	L → H threshold radiant incidence	E <sub>LH</sub>		—	0.4	0.8	
	Hysteresis	E <sub>LH</sub> /E <sub>HL</sub>	—	0.45	0.65	0.8	—
	Propagation delay time (L → H)	t <sub>pLH</sub>	(Note 4)	—	400	670	μs
	Propagation delay time (H → L)	t <sub>pHL</sub>		—	400	670	
Permissible luminosity		E <sub>X</sub>	E = 2 μW/nm <sup>2</sup> (Note 2, 5)	3000	—	—	lx

Note 2: The signal light source is an infrared LED with λ<sub>p</sub> = 940 nm.

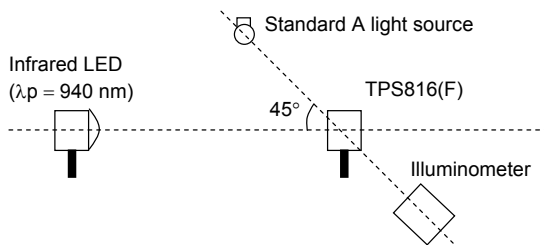
Note 3: The LED output waveform measurement circuit and waveform are as follows:



Note 4: The switching time measurement circuit and waveform are as follows:



Note 5: Measurement of permissible external luminance

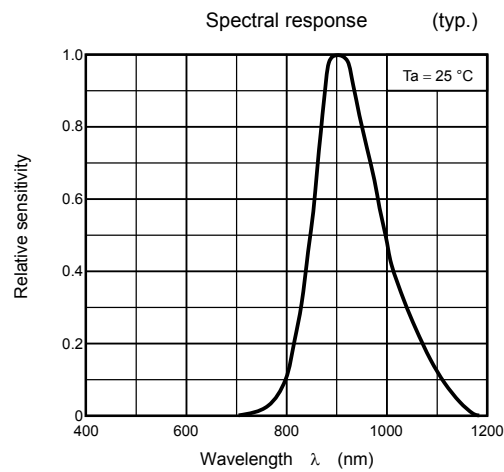
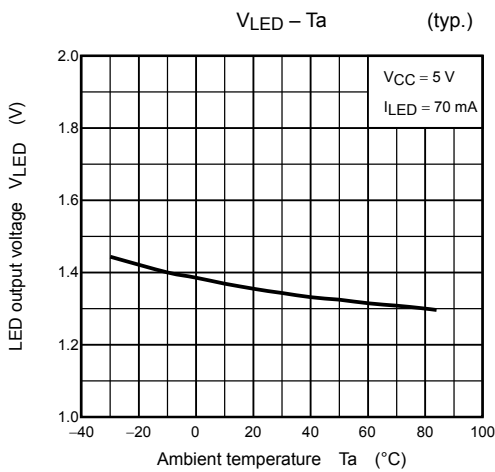
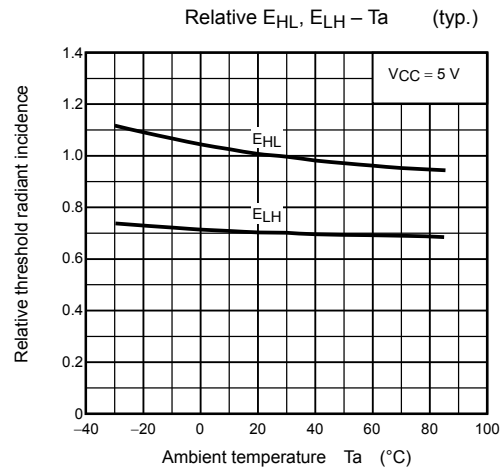
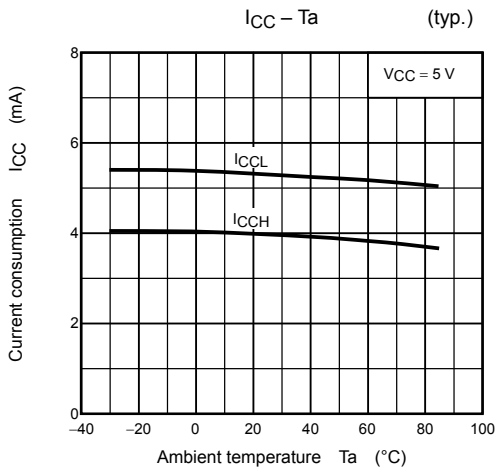
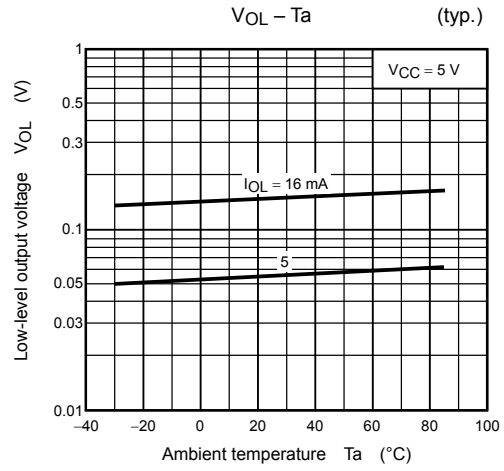
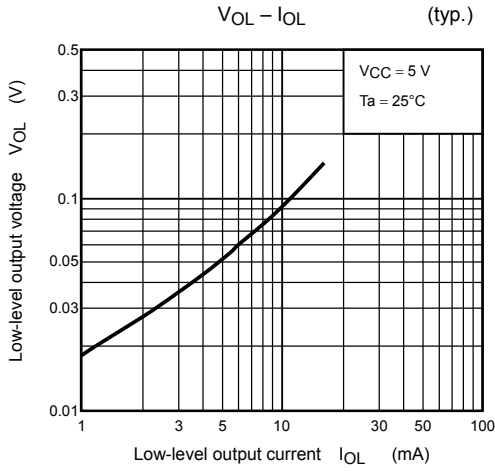


Measure the luminance limit at which the device operates normally.

The light used is a CIE Standard A light source (a standard tungsten bulb with a color temperature of 2856°K).

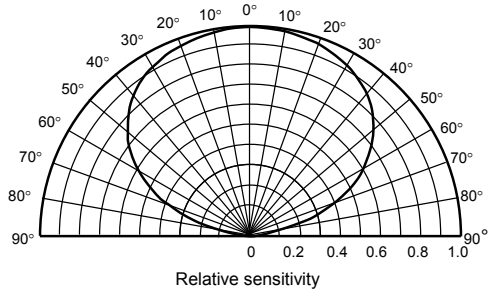
### Handling Precautions

- When using the device with an LED, use an infrared LED. Note that light with a wavelength of 800 nm or less cannot be detected.
- Do not use the device in an environment where the external light is 3000 lx or more, as this may prevent the device from working properly.
- At power-on the internal circuit takes about 100  $\mu\text{s}$  to stabilize. During this period the output signal is unstable and may change. Design the circuit so that no signal is output during this period.
- The photo-IC has a highly sensitive amp built in. To stabilize the power line, insert a bypass capacitor of up to 0.01  $\mu\text{F}$  between VCC and GND, close to the device.
- If the LED is directly connected to the LEDOUT pin, excessive current will flow in the LED, severely degrading the optical output. Be sure to insert a limiting resistor to prevent excessive current flow in the LED.
- When forming the leads, bend each lead under the lead stopper. Soldering must be performed after the leads have been formed.
- Soldering must be performed under the stopper.



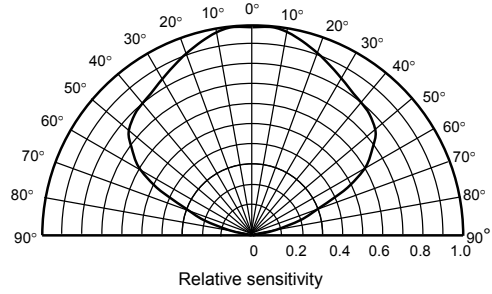
Radiation pattern - vertical direction (typ.)

Ta = 25°C

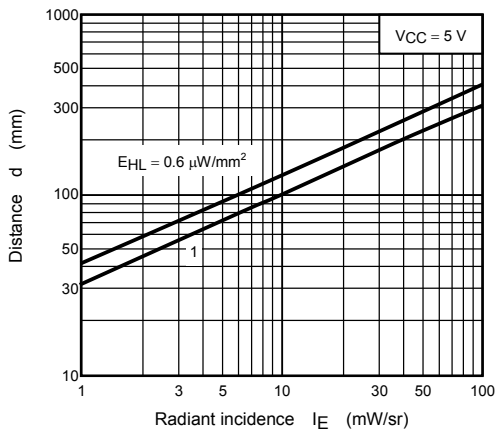


Radiation pattern - horizontal direction (typ.)

Ta = 25°C



I<sub>E</sub> - d (typ.)



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20070701-EN GENERAL

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