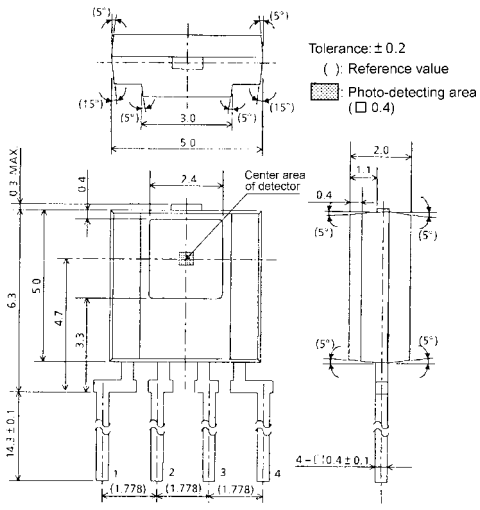
TOSHIBA Photo IC Silicon Epitaxial Planar

TPS816

Photo-electric Switches

Office Equipment such as Photocopiers, Printers and Fax Machines

Unit: mm



TOSHIBA	0-5K1

Weight: g (typ.)

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

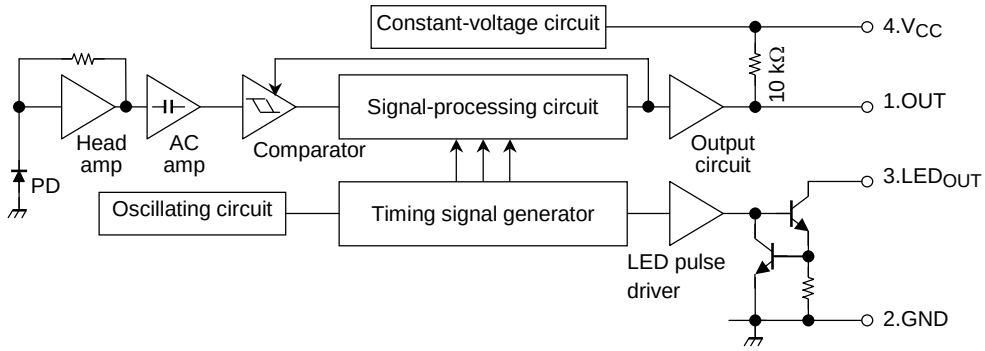
Use of sync optical modulation makes the IC ideal for applications in external light.

- Housed in compact side-view epoxy resin package
- High resistance to external light due to sync optical modulation: E_X = 3000 lx (min)
- High-sensitivity: E_{HL} = 1 μW/mm² (max)
- Wide operating temperature range: T_{opr} = −30°C to 85°C
- High LED output current and low-level output current:

  I_{LED} = 70 mA (Ta = T_{opr})

  I_{OL} = 16 mA (Ta = T_{opr})
- Digital output (pull-up resistor included) : Low-level output for light input
- TPS816 package resin impermeable to visible light

Block Diagram



Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	7	V
Output voltage	V_{OUT}	≦ V_{CC}	V
Output current (Ta = Topr)	I_{OUT}	16	mA
LED output voltage	V_{LED}	≦ V_{CC}	V
LED pulse forward current (Ta = Topr)	I_{LED}	70	mA
Operating temperature	T_{opr}	−30~85	°C
Storage temperature	T_{stg}	−40~100	°C
Soldering temperature (5s) (Note 1)	T_{sol}	260	°C

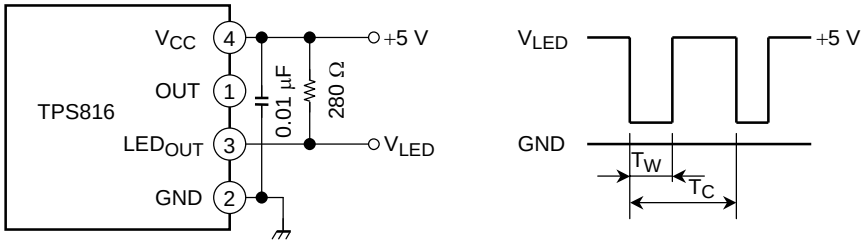
Note 1: Solder under the lead stopper.

Electrical and Optical Characteristics (V_{CC} = 5 V, Ta = 25°C)

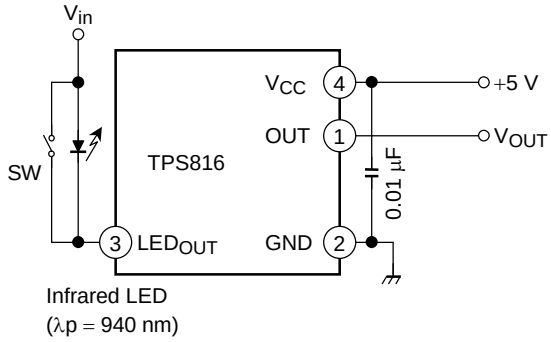
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Supply voltage		V_{CC}	—	4.5	5	5.5	V
Supply current		I_{CC}	V_{OUT}, V_{LED} left open	—	4	7	mA
Output	High-level output voltage	V_{OH}	E = 0	4.9	5	—	V
	Low-level output voltage	V_{OL}	I_{OL} = 16 mA, E = 2 μW/nm^2 (Note 2)	—	0.15	0.4	V
LED output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

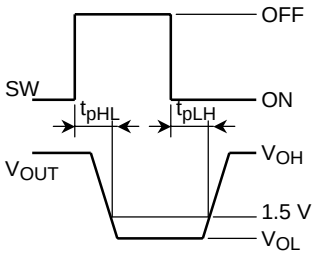
Note 2: The signal light source is an infrared LED with λp = 940 mm.

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

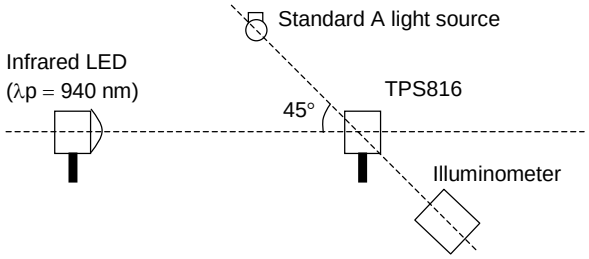


Note 4: The switching time measurement circuit and waveform are as follows:





Note 5: Measurement of permissible external luminance



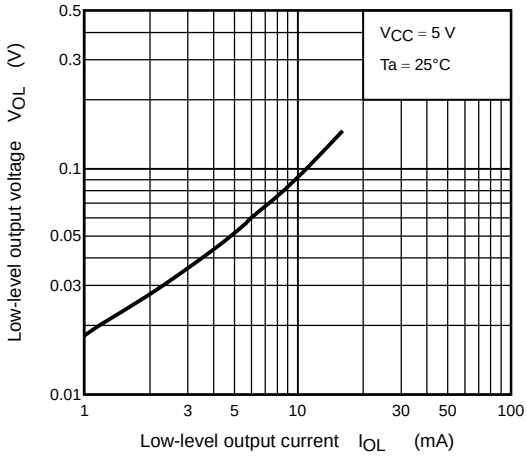
Measure the luminance limit at which the device operates normally.

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

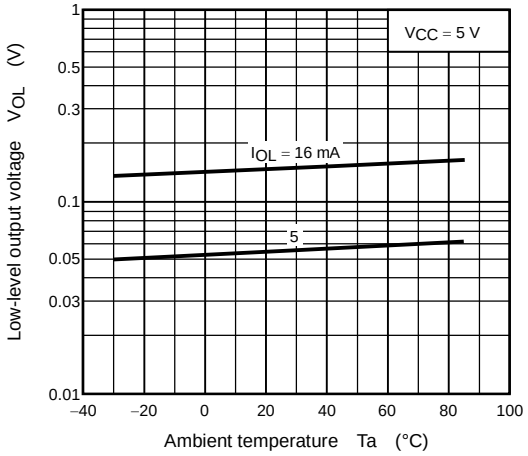
Handling Precautions

- 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 μs 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 μF between V_{CC} and GND, close to the device.
- If the LED is directly connected to the LED_{OUT} 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.

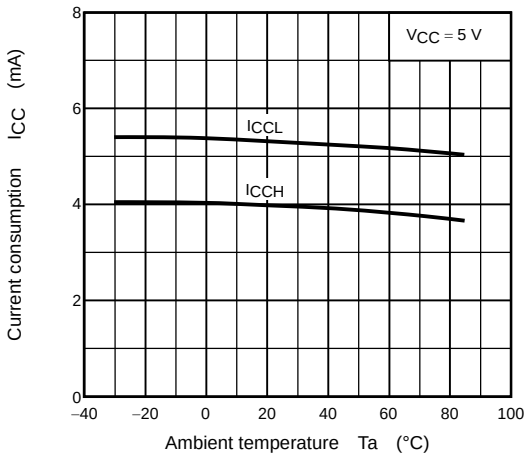
V_{OL} – I_{OL} (typ.)



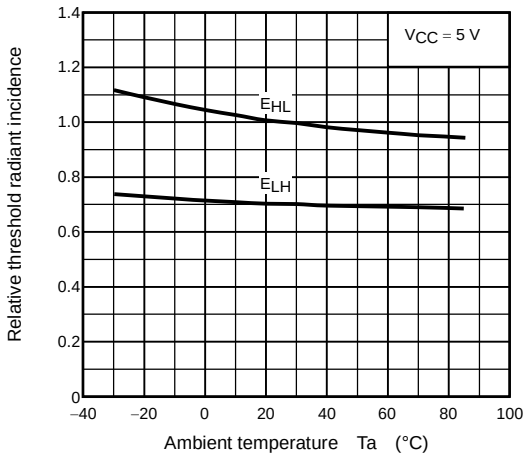
V_{OL} – Ta (typ.)



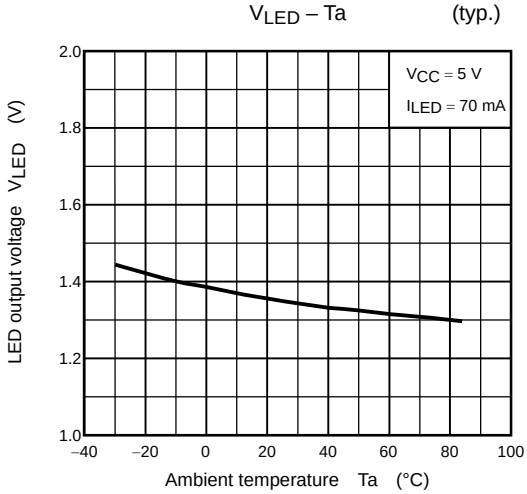
I_{CC} – Ta (typ.)



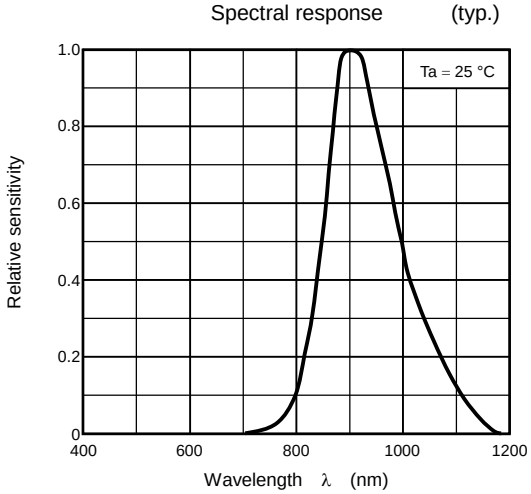
Relative E_{HL}, E_{LH} – Ta (typ.)



V_{LED} – Ta (typ.)

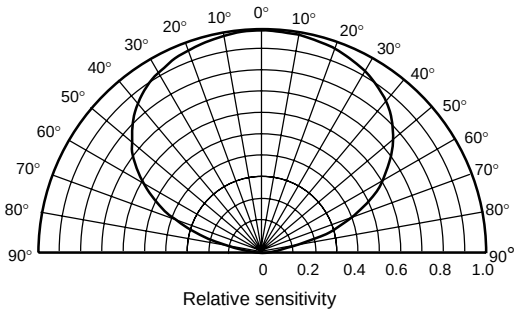


Spectral response (typ.)



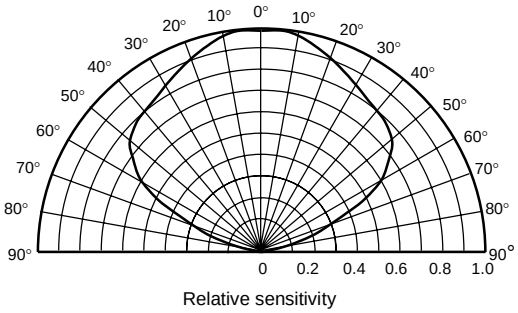
Radiation pattern - vertical direction (typ.)

Ta = 25°C

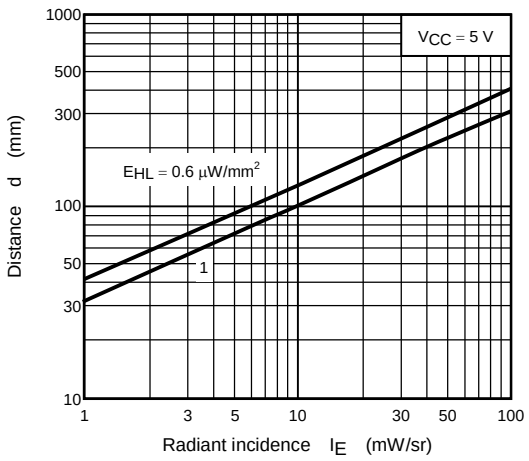


Radiation pattern - horizontal direction (typ.)

Ta = 25°C



I_E – d (typ.)



RESTRICTIONS ON PRODUCT USE

000707EAA

- 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.
- 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.