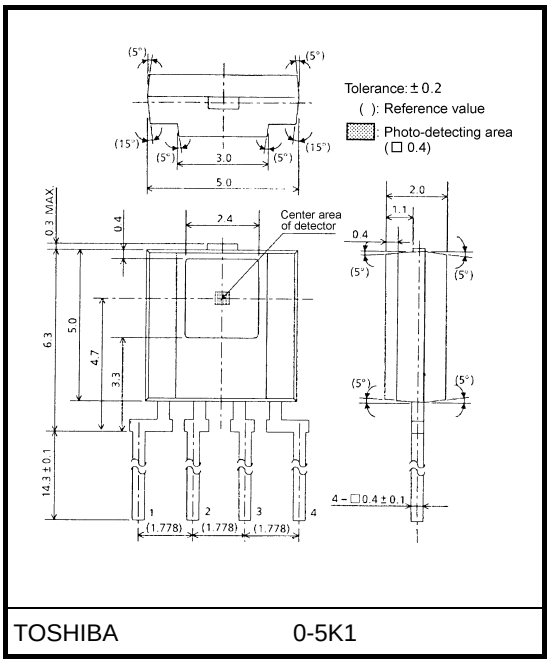
TOSHIBA Photo-IC Silicon Epitaxial Planar

TPS816(F)

Photo-electric Switches

Office Equipment such as Photocopiers, Printers and Fax Machines

Unit: mm



TOSHIBA	0-5K1

Weight: 0.3g (typ.)

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.

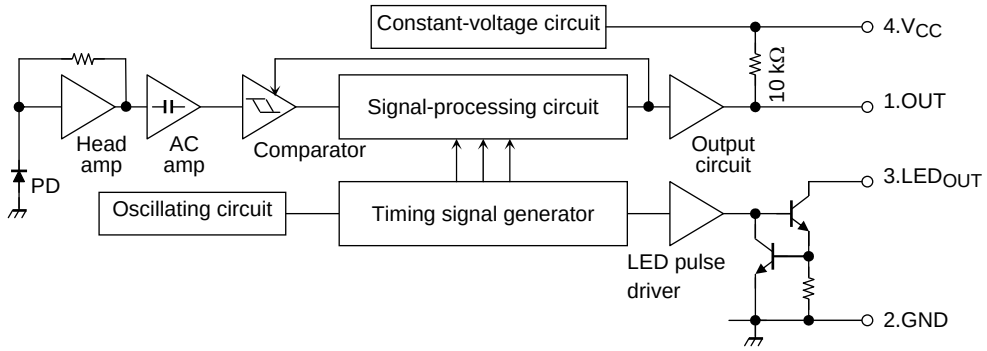
Use of sync optical modulation makes the IC ideal for applications in external light.

- Housed in compact side-view epoxy resin package
- High resistance to external light due to sync optical modulation: E_X = 3000 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(F) package resin impermeable to visible light

Block Diagram



Absolute 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: 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).

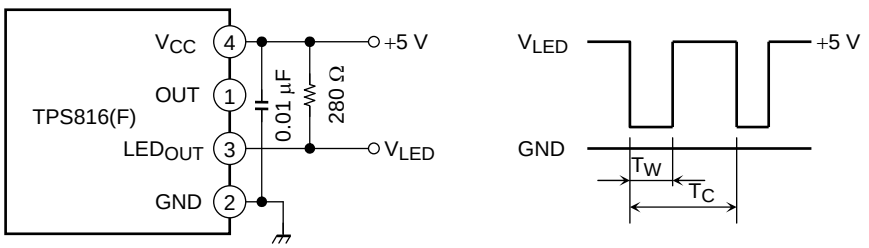
Note 1: Solder under the lead stopper.

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

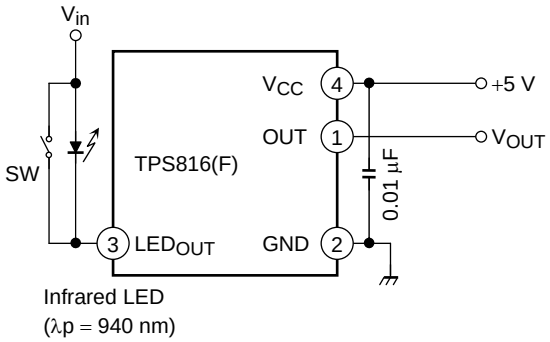
Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Supply voltage		V_{CC}	—	4.5	5	5.5	V
Supply current		I_{CC}	V_{OUT}, V_{LED} left open	—	4	7	mA
Output	High-level output voltage	V_{OH}	E = 0	4.9	5	—	V
	Low-level output voltage	V_{OL}	I_{OL} = 16 mA, E = 2 μW/nm^2 (Note 2)	—	0.15	0.4	V
LED output	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

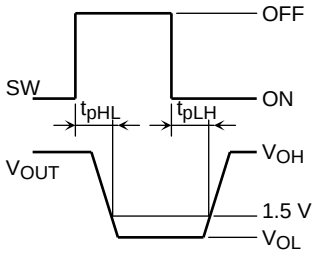
Note 2: The signal light source is an infrared LED with λp = 940 mm.

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

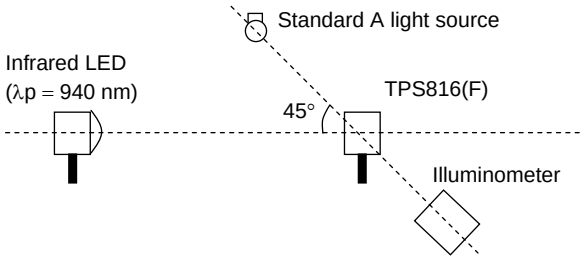


Note 4: The switching time measurement circuit and waveform are as follows:





Note 5: Measurement of permissible external luminance



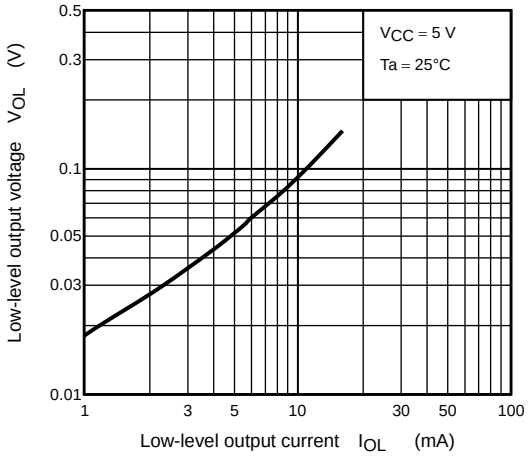
Measure the luminance limit at which the device operates normally.

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

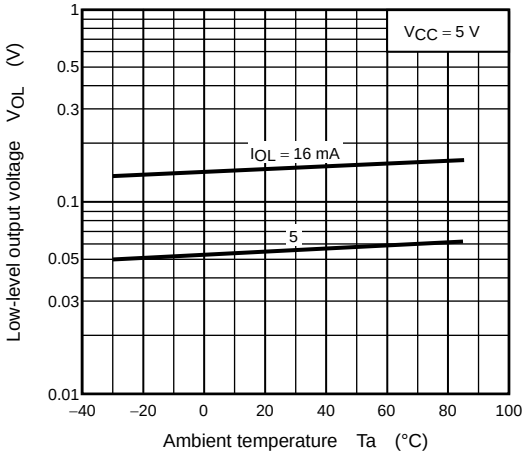
Handling Precautions

- 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.

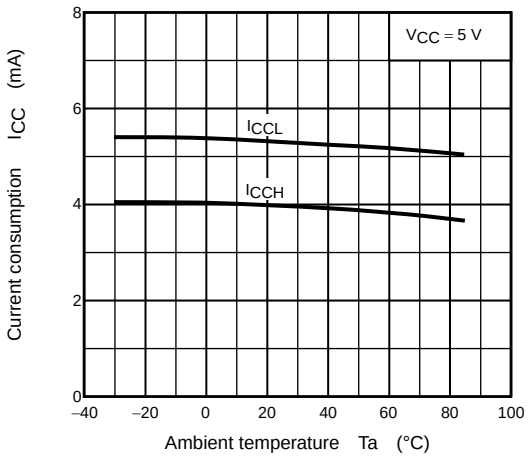
V_{OL} – I_{OL} (typ.)



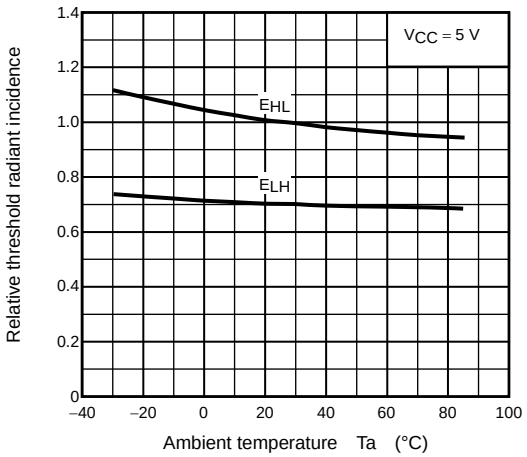
V_{OL} – Ta (typ.)



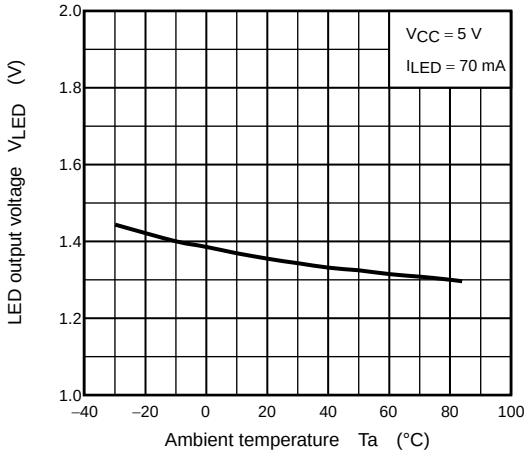
I_{CC} – Ta (typ.)



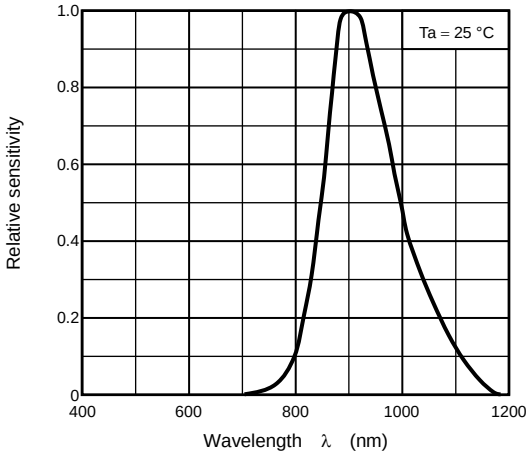
Relative E_{HL}, E_{LH} – Ta (typ.)



V_{LED} – Ta (typ.)

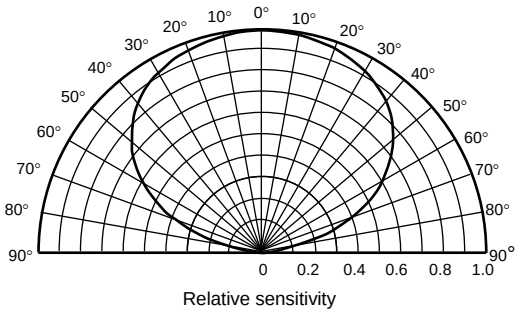


Spectral response (typ.)



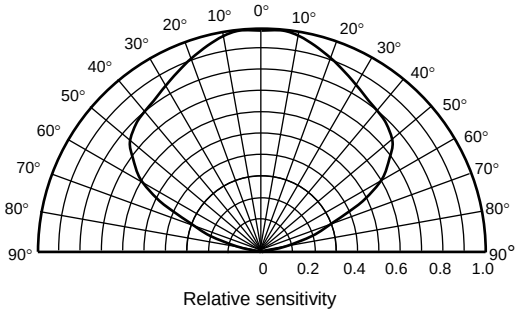
Radiation pattern - vertical direction (typ.)

Ta = 25°C

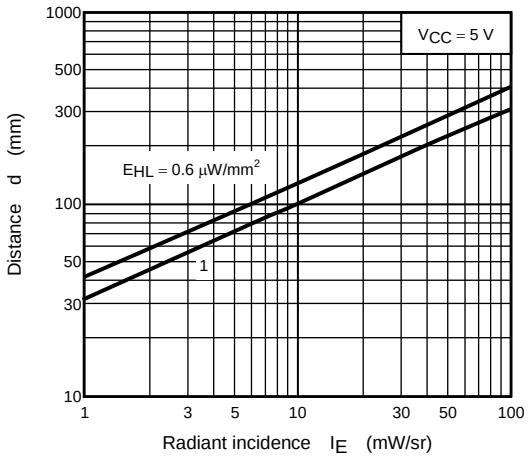


Radiation pattern - horizontal direction (typ.)

Ta = 25°C



I_E – d (typ.)



RESTRICTIONS ON PRODUCT USE

- Toshiba Corporation, and its subsidiaries and affiliates (collectively “TOSHIBA”), reserve the right to make changes to the information in this document, and related hardware, software and systems (collectively “Product”) without notice.
- This document and any information herein may not be reproduced without prior written permission from TOSHIBA. Even with TOSHIBA’s written permission, reproduction is permissible only if reproduction is without alteration/omission.
- Though TOSHIBA works continually to improve Product’s quality and reliability, Product can malfunction or fail. Customers are responsible for complying with safety standards and for providing adequate designs and safeguards for their hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of Product could cause loss of human life, bodily injury or damage to property, including data loss or corruption. Before creating and producing designs and using, customers must also refer to and comply with (a) the latest versions of all relevant TOSHIBA information, including without limitation, this document, the specifications, the data sheets and application notes for Product and the precautions and conditions set forth in the “TOSHIBA Semiconductor Reliability Handbook” and (b) the instructions for the application that Product will be used with or for. Customers are solely responsible for all aspects of their own product design or applications, including but not limited to (a) determining the appropriateness of the use of this Product in such design or applications; (b) evaluating and determining the applicability of any information contained in this document, or in charts, diagrams, programs, algorithms, sample application circuits, or any other referenced documents; and (c) validating all operating parameters for such designs and applications. **TOSHIBA ASSUMES NO LIABILITY FOR CUSTOMERS’ PRODUCT DESIGN OR APPLICATIONS.**
- Product is intended for use in general electronics applications (e.g., computers, personal equipment, office equipment, measuring equipment, industrial robots and home electronics appliances) or for specific applications as expressly stated in this document. Product is neither intended nor warranted for use in equipment or systems that require extraordinarily high levels of quality and/or reliability and/or a malfunction or failure of which may cause loss of human life, bodily injury, serious property damage or serious public impact (“Unintended Use”). Unintended Use includes, without limitation, equipment used in nuclear facilities, equipment used in the aerospace industry, medical equipment, equipment used for automobiles, trains, ships and other transportation, traffic signaling equipment, equipment used to control combustions or explosions, safety devices, elevators and escalators, devices related to electric power, and equipment used in finance-related fields. Do not use Product for Unintended Use unless specifically permitted in this document.
- Do not disassemble, analyze, reverse-engineer, alter, modify, translate or copy Product, whether in whole or in part.
- Product shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable laws or regulations.
- The information contained herein is presented only as guidance for Product use. No responsibility is assumed by TOSHIBA for any infringement of patents or any other intellectual property rights of third parties that may result from the use of Product. No license to any intellectual property right is granted by this document, whether express or implied, by estoppel or otherwise.
- **ABSENT A WRITTEN SIGNED AGREEMENT, EXCEPT AS PROVIDED IN THE RELEVANT TERMS AND CONDITIONS OF SALE FOR PRODUCT, AND TO THE MAXIMUM EXTENT ALLOWABLE BY LAW, TOSHIBA (1) ASSUMES NO LIABILITY WHATSOEVER, INCLUDING WITHOUT LIMITATION, INDIRECT, CONSEQUENTIAL, SPECIAL, OR INCIDENTAL DAMAGES OR LOSS, INCLUDING WITHOUT LIMITATION, LOSS OF PROFITS, LOSS OF OPPORTUNITIES, BUSINESS INTERRUPTION AND LOSS OF DATA, AND (2) DISCLAIMS ANY AND ALL EXPRESS OR IMPLIED WARRANTIES AND CONDITIONS RELATED TO SALE, USE OF PRODUCT, OR INFORMATION, INCLUDING WARRANTIES OR CONDITIONS OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, ACCURACY OF INFORMATION, OR NONINFRINGEMENT.**
- Do not use or otherwise make available Product or related software or technology for any military purposes, including without limitation, for the design, development, use, stockpiling or manufacturing of nuclear, chemical, or biological weapons or missile technology products (mass destruction weapons). Product and related software and technology may be controlled under the Japanese Foreign Exchange and Foreign Trade Law and the U.S. Export Administration Regulations. Export and re-export of Product or related software or technology are strictly prohibited except in compliance with all applicable export laws and regulations.
- Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. Please use Product in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. TOSHIBA assumes no liability for damages or losses occurring as a result of noncompliance with applicable laws and regulations.