

TOSHIBA Photo-IC Silicon Epitaxial Planar

# TPS851

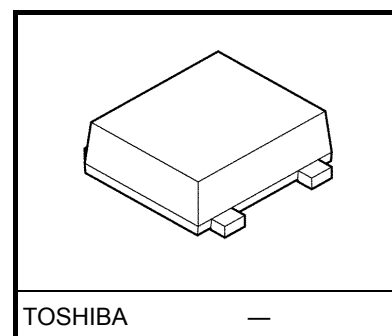
Mobile Phones, PHS  
 Notebook PCs, PDAs  
 Video cameras, Digital Still Cameras  
 Other Equipment Requiring Luminosity Adjustment

The TPS851 is an ultra-compact surface-mount photo-IC for illuminance sensors which incorporates a photodiode and current amp circuit in a single chip.

The sensitivity is superior to that of a phototransistor, and exhibits little variation.

It has spectral sensitivity closer to luminous efficiency and excellent output linearity.

With its ultra-compact surface-mount package, this photo-IC can be used as the power-saving control for domestic appliances or for backlighting for displays in cellular phones, this device enables low power consumption to be achieved.



Weight: 0.0054 g (typ.)

- Ultra-compact and light surface-mount package:  $2.0 \times 2.1 \times 0.7$  mm
- Excellent output linearity of illuminance
- Little fluctuation in light current and high level of sensitivity
  - :  $I_L = 37 \mu\text{A}$  to  $74 \mu\text{A}$  @  $E_V = 100$  lx using fluorescent light
  - : Light current variation width:  $\times 1.67$  (when light current classification is specified.)
  - : Little temperature fluctuation
- Built-in luminous-efficiency correction function, reduced sensitivity variations due to various light sources
  - :  $I_L$  (using incandescent light) /  $I_L$  (using fluorescent light) = 1.2 (typ.)
- Low supply voltage, making device suitable for battery-powered equipment:  $V_{CC} = 2.7$  V to 5.5 V
- Lead(Pb)-Free

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

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	-0.5 to 7	V
Output voltage	$V_{OUT}$	$\leq V_{CC}$	V
Light current	$I_L$	5	mA
Permissible power dissipation	P	35	mW
Operating temperature range	$T_{opr}$	-30 to 85	°C
Storage temperature range	$T_{stg}$	-40 to 100	°C
Soldering temperature range (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: The reflow time and the recommended temperature profile are shown in the section entitled Handling Precautions.

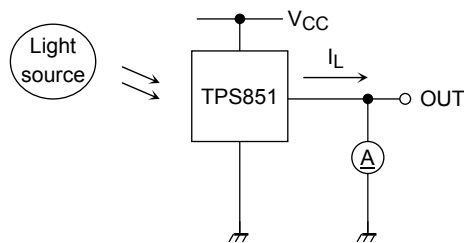
## Electrical and Optical Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Supply voltage		V <sub>CC</sub>	—	2.7	—	5.5	V
Supply current		I <sub>CC</sub>	V <sub>CC</sub> = 3 V, E <sub>V</sub> = 1000 lx R <sub>L</sub> = 1 kΩ (Note 2)	—	620	—	μA
Light current (1)		I <sub>L</sub> (1)	V <sub>CC</sub> = 3 V, E <sub>V</sub> = 100 lx (Note 2), (Note 4)	—	62	—	μA
Light current (2)		I <sub>L</sub> (2)	V <sub>CC</sub> = 3 V, E <sub>V</sub> = 10 lx (Note 3), (Note 4)	3.7	—	7.4	μA
Light current (3)		I <sub>L</sub> (3)	V <sub>CC</sub> = 3 V, E <sub>V</sub> = 100 lx (Note 3), (Note 4)	37	—	74	μA
Light current ratio		$\frac{I_L (1)}{I_L (3)}$	—	—	1.2	1.7	
Dark current		I <sub>LEAK</sub>	V <sub>CC</sub> = 3.3 V, E <sub>V</sub> = 0	—	—	0.17	μA
Saturation output voltage		V <sub>O</sub>	V <sub>CC</sub> = 3 V, R <sub>L</sub> = 150 kΩ, E <sub>V</sub> = 100 lx (Note 3)	2.2	2.35	—	V
Peak sensitivity wavelength		λ <sub>p</sub>	—	—	600	—	nm
Switching time	Rise time	t <sub>r</sub>	V <sub>CC</sub> = 3 V, R <sub>L</sub> = 5 kΩ (Note 5)	—	0.07	1	ms
	Fall time	t <sub>f</sub>		—	0.4	2	

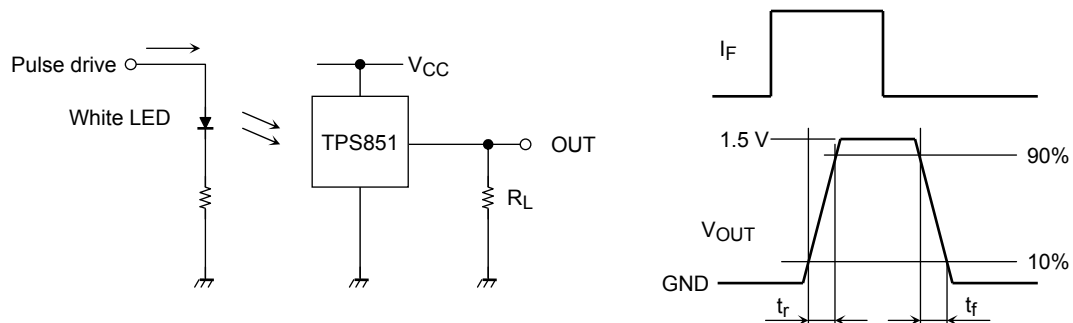
Note 2: CIE standard A light source is used (color temperature = 2856K, approximated incandescence light).

Note 3: Fluorescence light is used as light source. However, white LED is substituted in a mass-production process.  
I<sub>L</sub> (3) classification I<sub>L</sub> A: 37 μA to 62 μA

Note 4: Light current measurement circuit

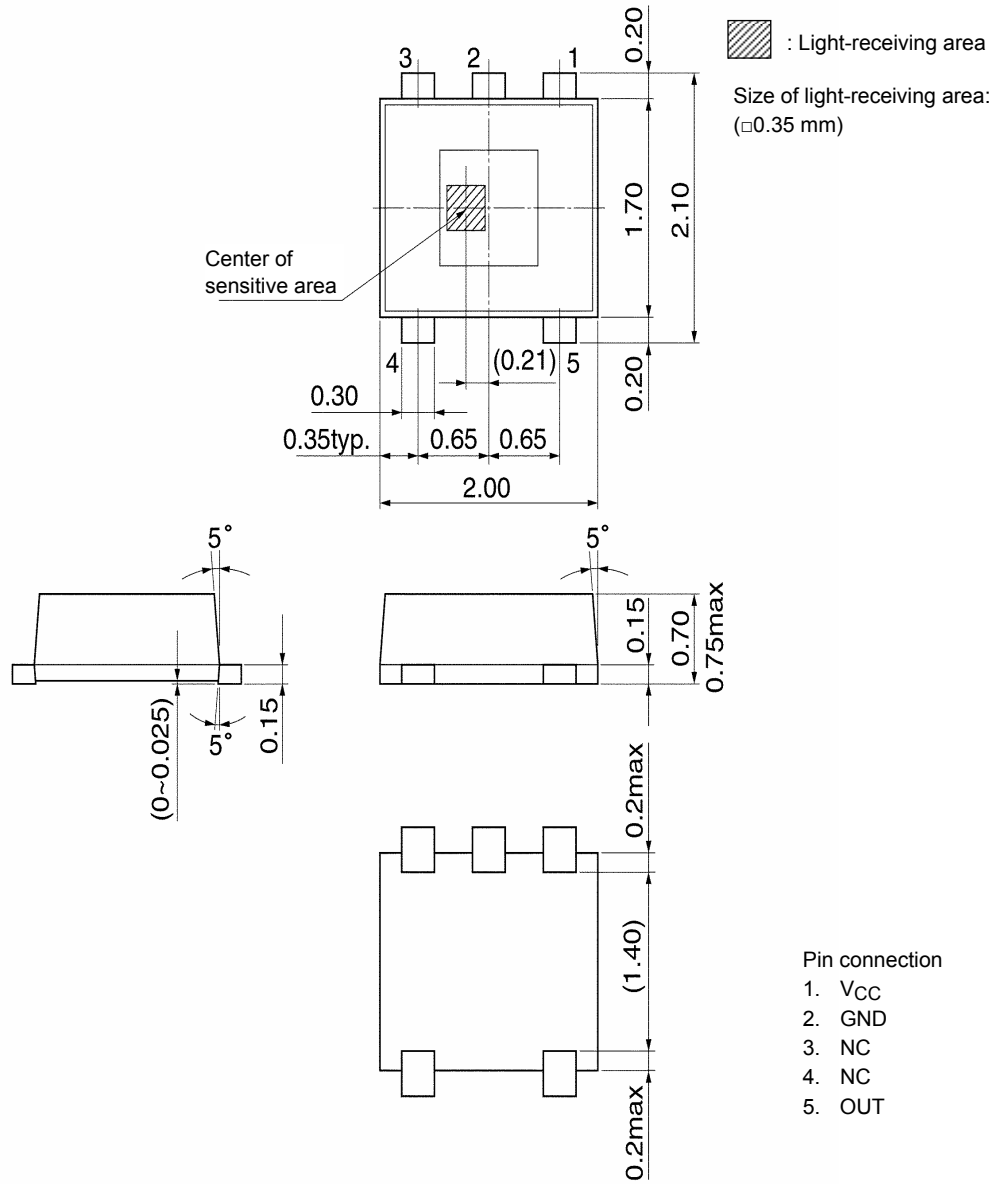


Note 5: Rise time/fall time time measurement method



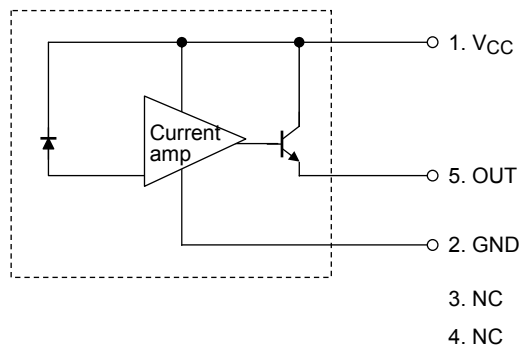
## Package Dimensions

Unit: mm  
 Tolerance:  $\pm 0.1$   
 ( ): Reference value



Weight: 0.0054 g (typ.)

## Block Diagram



## Handling Precautions

At power-on in darkness, the internal circuit takes about 100  $\mu$ s to stabilize. During this period the output signal is unstable and may change. Please take this into account.

### Moisture-Proof Packing

- (1) To avoid moisture absorption by the resin, the product is packed in an aluminum envelope with silica gel.
- (2) Since the optical characteristics of the device can be affected during soldering by vaporization resulting from prior absorption of moisture and they should therefore be stored under the following conditions:

Temperature: 5°C to 30°C, Relative humidity: 60% (max), Time: 168 h (max)

- (3) Baking is required if the devices have been store unopened for more than six months or if the aluminum envelope has been opened for more than 168 h.

These devices are packed on tapes; hence, please avoid baking at high temperature.

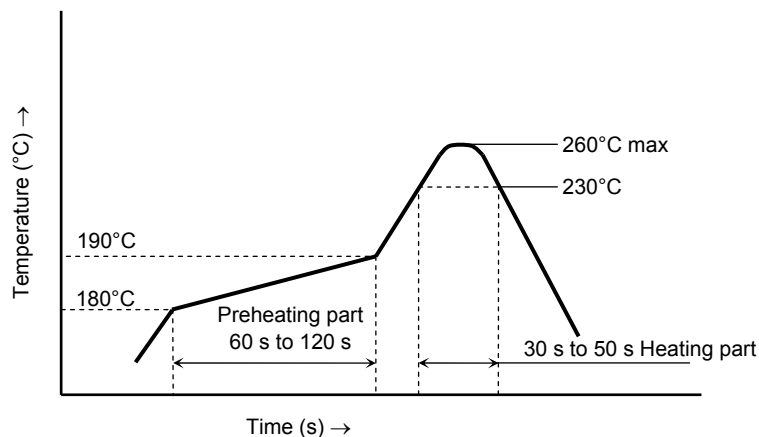
Recommended baking conditions: 60°C for 12 h or longer

### Mounting Precautions

- (1) Do not apply stress to the resin at high temperature.
- (2) The resin part is easily scratched, so avoid friction with hard materials.
- (3) When installing the assembly board in equipment, ensure that this product does not come into contact with other components.

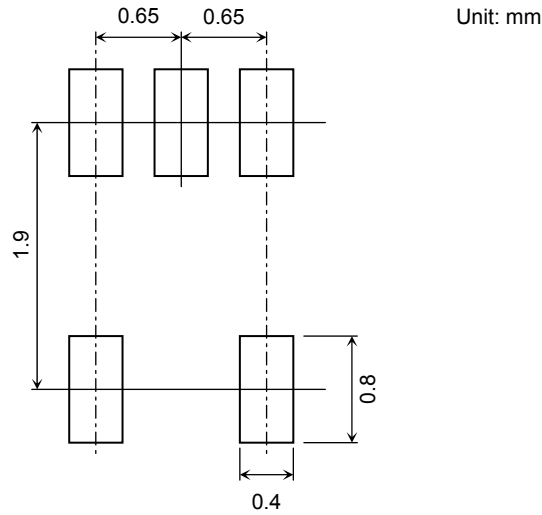
### Mounting Methods

- (1) Reflow soldering
  - Package surface temperature: 260°C (max)
  - Please perform reflow soldering using the following reference temperature profile. Perform reflow soldering no more than twice.



- Please perform the first reflow soldering within 168 h after opening the package with reference to the above temperature profile.
- Second reflow soldering
  - In case of second reflow soldering, it should be performed within 168 h after first reflow under the above conditions.
  - Storage conditions before second reflow soldering: 30°C, 60% RH or lower
- Do not perform flow soldering.
- Make any necessary soldering correction manually.
  - (do not do this more than once for any given pin.)
  - Temperature: no more than 350°C (25 W for soldering iron)
  - Time: within 5 s

(2) Recommended soldering pattern



(3) Cleaning conditions

When cleaning is required after soldering

Chemicals: AK225 alcohol

Temperature and time: 50°C × 30 s or 30°C × 3 minutes

Ultrasonic cleaning: 300 W or less

**Packing Specification**

(1) Packing quantity

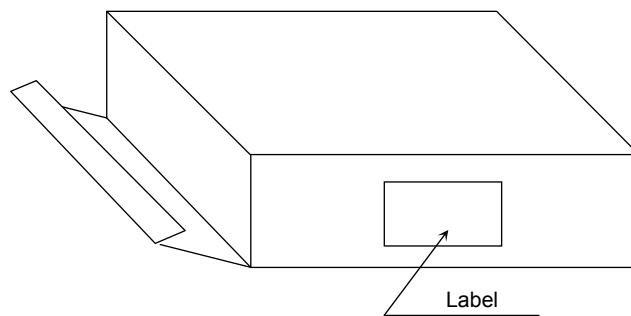
Reel (minimum packing quantity)	3,000 devices
Carton	5 reels (15,000 devices)

(2) Packing format

An aluminum envelope containing silica gel and reels is deaerated and sealed.

Pack shock-absorbent materials around the aluminum envelopes in the cartons to cushion them.

- Carton specification



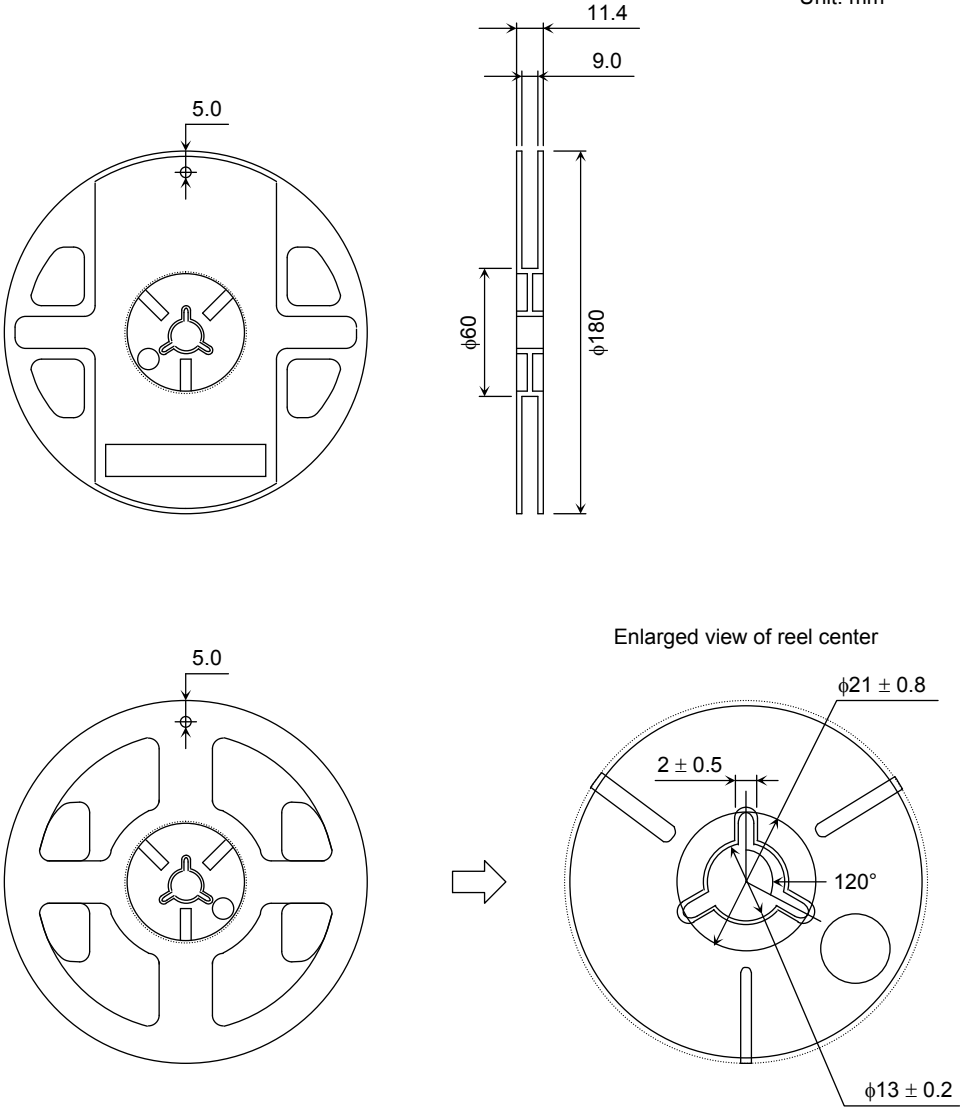
Carton dimensions

(W) 81 mm × (L) 280 mm × (H) 280 mm

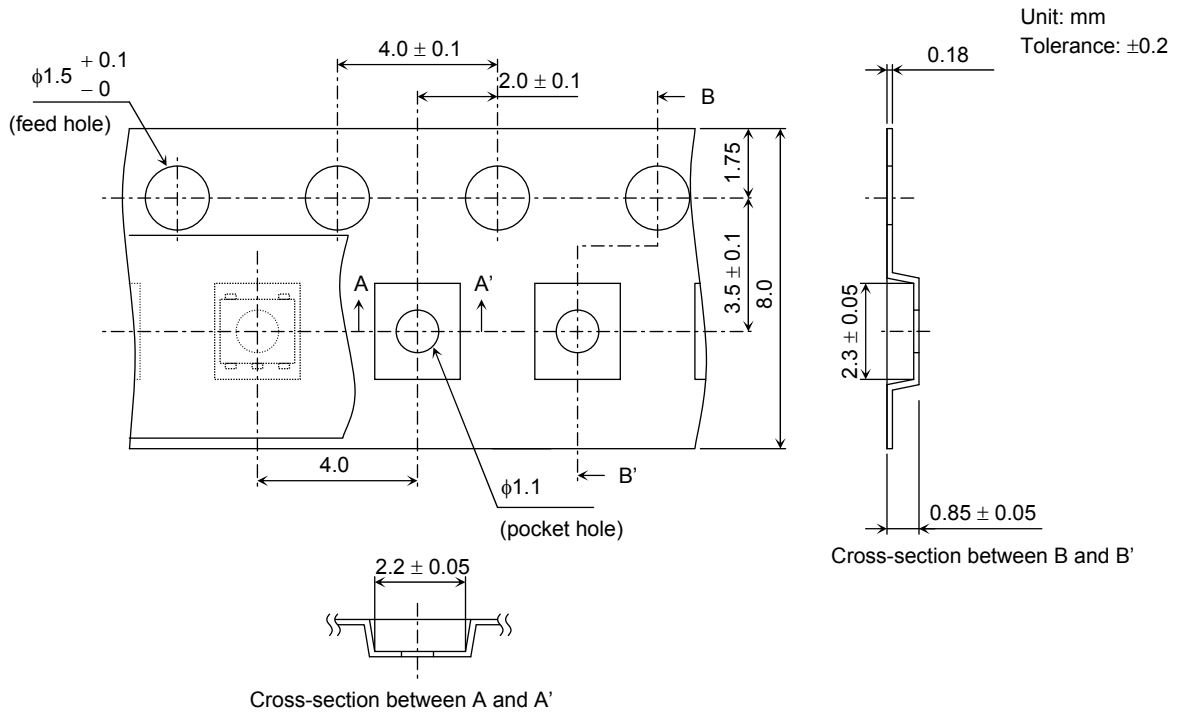
**Tape Packing Specifications**

- (1) Reel dimensions  
Reel material: Plastic

Unit: mm



- (2) Tape dimensions  
Tape material: Plastic (anti-electrostatic)

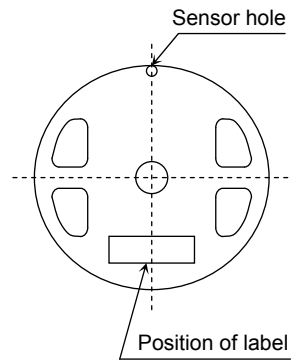


**Reel Label**

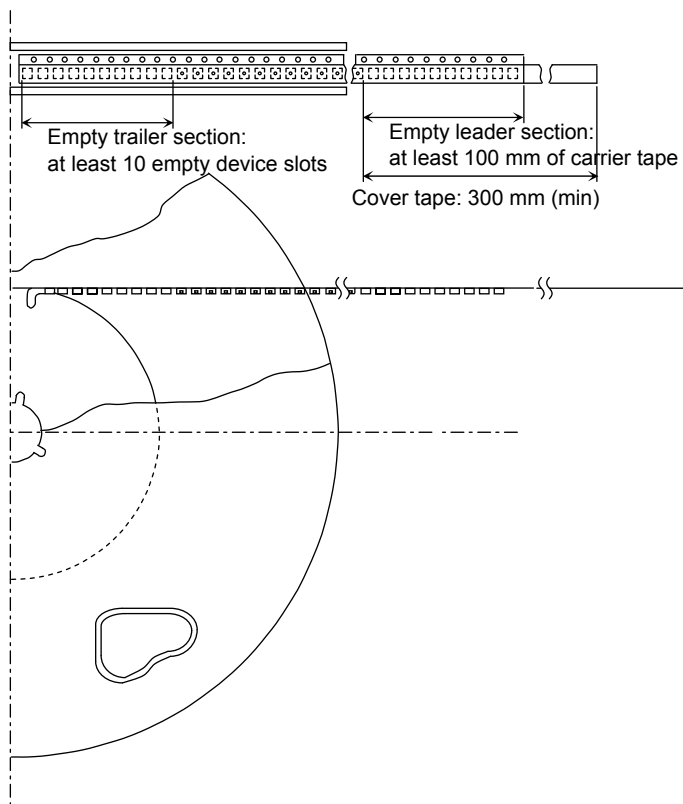
The label markings may include product number, tape type and quantity.

P/N

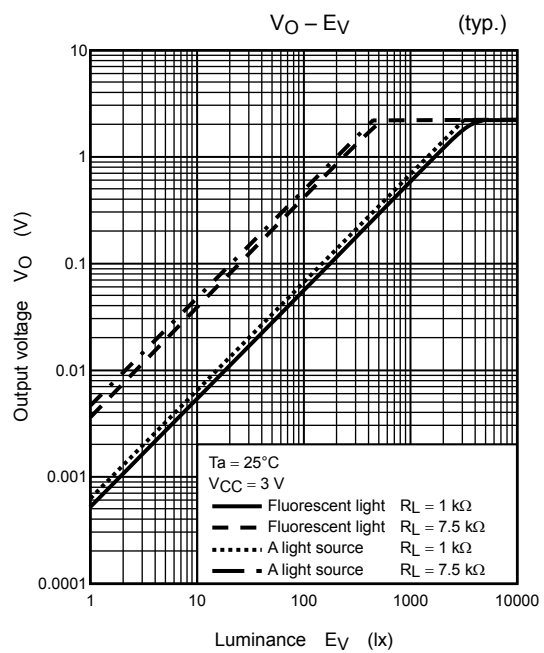
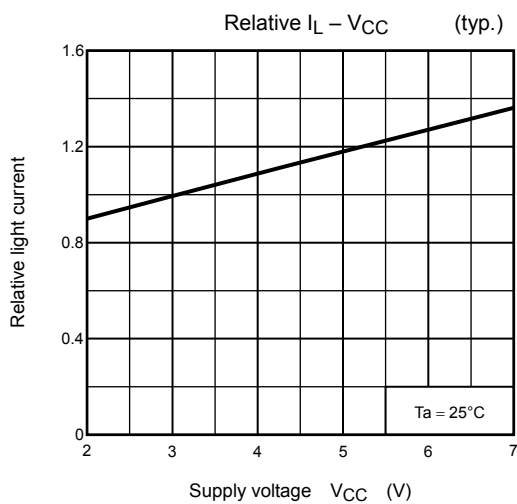
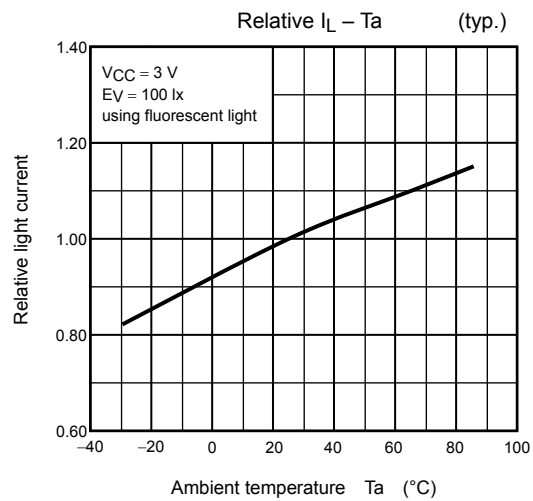
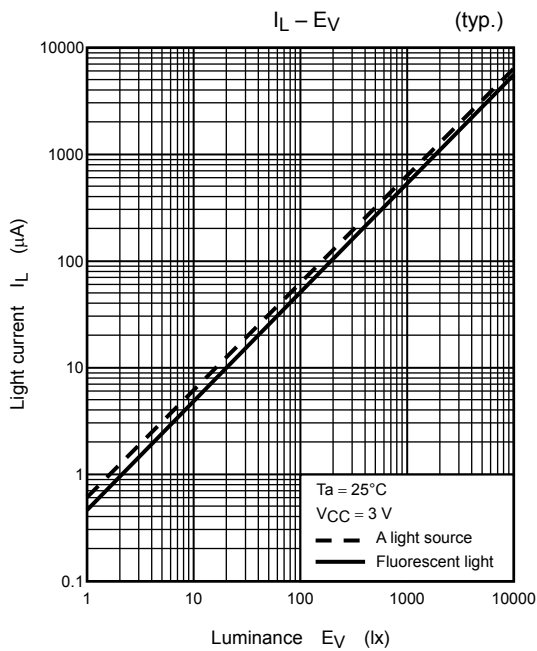
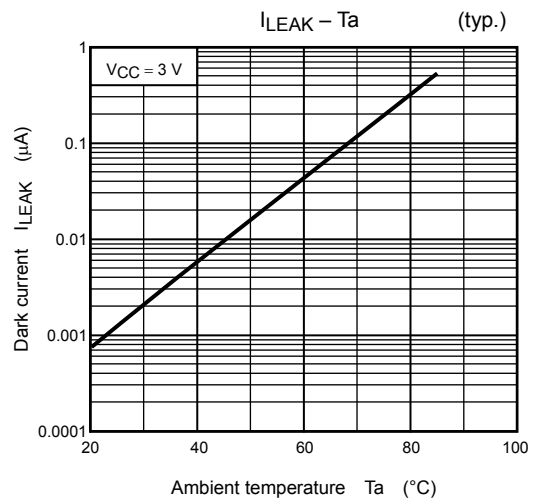
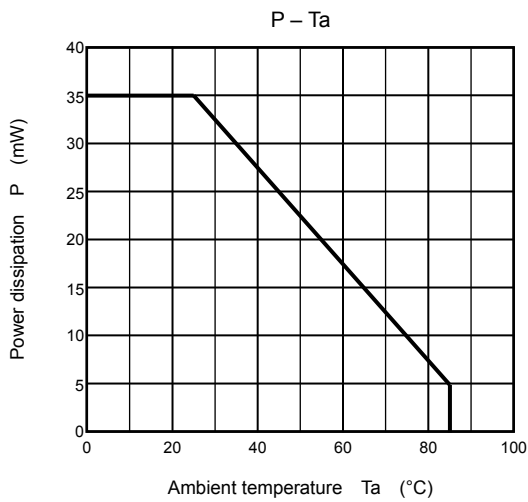
TYPE	TPS851		
ADDC		Q'TY	3,000 pcs.
NOTE			

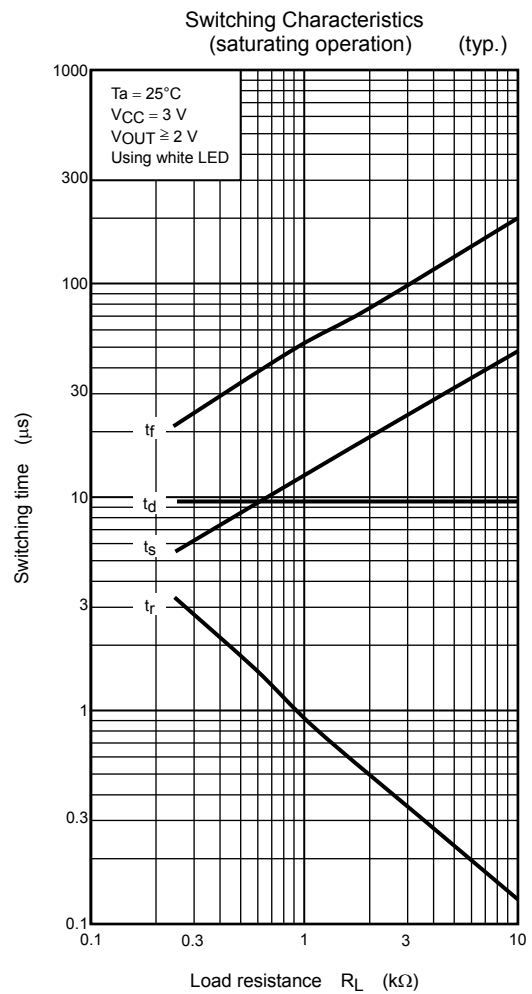
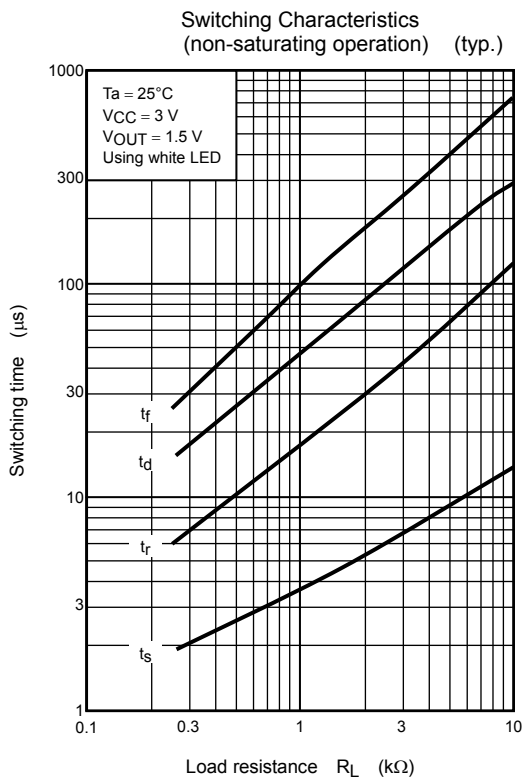
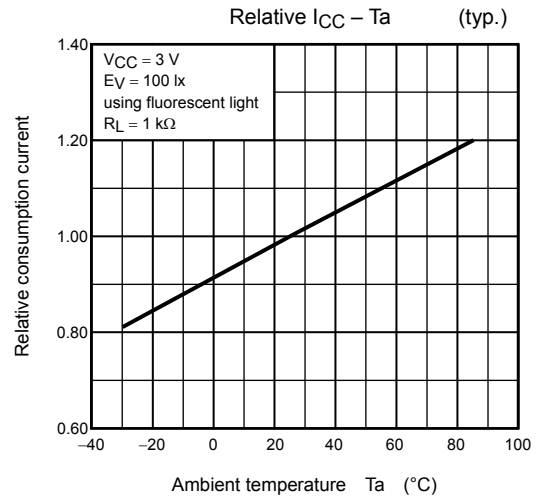
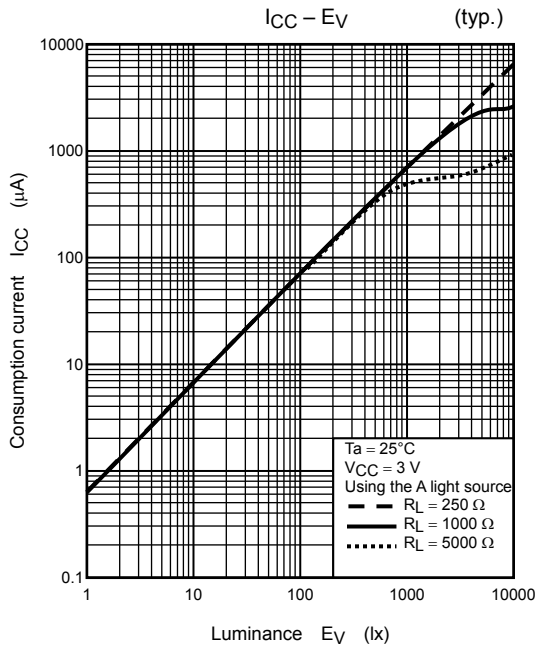


**Leader and Trailer Sections of Tape**

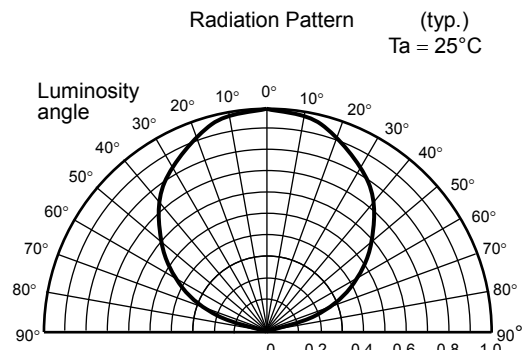
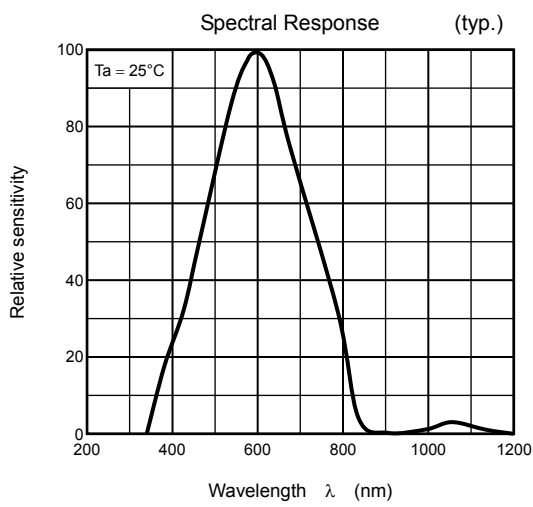
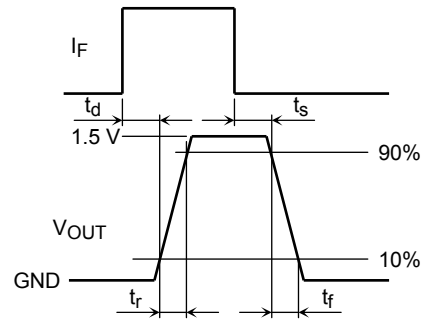
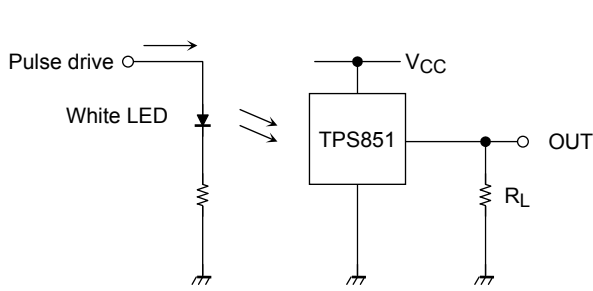








**Switching Time Measurement Circuit and Waveforms**



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20070701-EN GENERAL

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