TOSHIBA
Leading Innovation

2011-9

PRODUCT GUIDE

Photosensors

• SEMICONDUCTOR •

http://www.semicon.toshiba.co.jp/eng

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2 New Product Digest

Small Surface Mount Type High-power Infrared LED

New TLN1108

The TLN1108 is a small, high-power infrared LED that has been realized by combining a newly developed high-power infrared chip with a highly reliable surface mount package. Available for use with a wide range of products, including consumer equipment and on-vehicle components, this LED can contribute to the production of smaller, thinner applications that consume less power.

Features

- Small surface mount package
  TLN1108: PLCC-4 type, which offers good radiation performance 3.5(L) x 2.9(W) x 1.9(H) mm
- High radiant intensity has been realized owing to the adoption of a newly developed high-power infrared chip
- High heat resistance type with a wide range of operating temperatures
  Operating temperature: –40 to 100°C; Storage temperature: –40 to 110°C

Applications

Free-space optical communications; auxiliary light sources for security and automotive cameras; light sources for optoelectronic switches, etc.

Absolute maximum rating (Ta = 25°C)

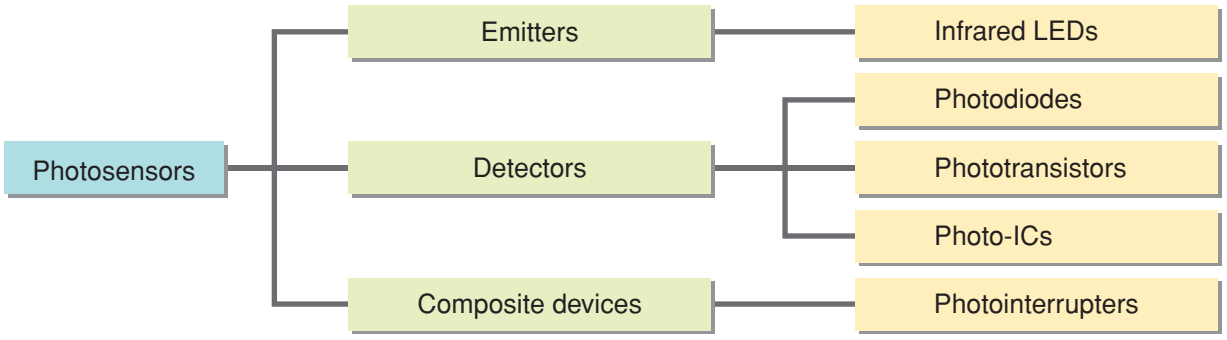
Characteristic	Rating	Unit
Direct forward current	100	mA
Direct reverse current	5	V
Operating temperature	–40 to 100	°C
Storage temperature	–40 to 110	°C

Electrical and optical characteristics (IF = 100 mA, Ta = 25°C) *Standard characteristics

Part number	Radiant intensity (mW/sr)	Forward voltage (V)	Peak emission wavelength (nm)	Angle of beam spread (°)
TLN1108	18	2.5	870	120

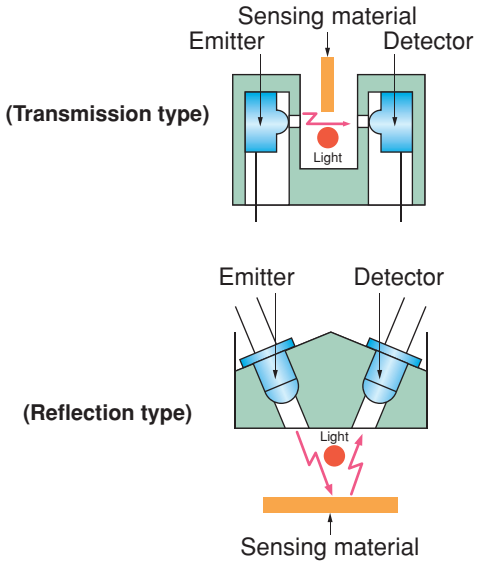
3 Classification of Photosensors

Photosensors are classified as follows:

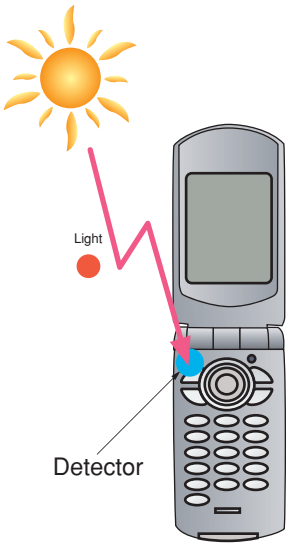


4 Applications of Photosensors

Position detection



Ambient light sensors



5 Features of Photosensors

Infrared LEDs, and visible LEDs for sensor light sources

- TLN100 Series ..... Infrared LEDs of λp (peak-emission wavelength) = 940 nm to 950 nm
  The light output is greater than that of visible LEDs and is most suitable for light sources for optoelectronic switches.
- TLN200 Series, TLN1000 Series..... Infrared LEDs of λp = 850 nm to 870 nm. The radiant power is greater than that of the TLN100 Series.

Phototransistors

- TPS600 Series ..... Photodetectors with higher sensitivity than photodiodes. Suitable for optoelectronic switch applications.

Photodiodes

- TPS700 Series ..... High-speed response detectors best suited for optical remote controls and various analog detection

Photo-ICs

- TPS800 series..... Detectors incorporate a photodiode and various circuits in a single chip.
  Linear output type: Suitable for ambient light sensors, optoelectronic switches and analog displacement detection

Photointerrupters

- TLP800 Series..... Phototransistor output

6 Selection Guide by Package

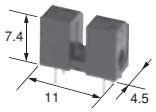
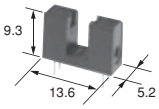
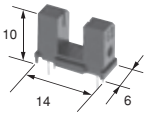
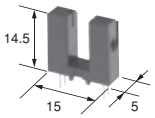
Emitters and Detectors

Package	External Appearance	Emitter	Detector		
		Infrared LED	Phototransistor	Photodiode	Photo-IC
TO-18CAN		**TLN108(F)**	**TPS601A(F)**		
ϕ3		**TLN119(F)** **TLN238(F)**	**TPS615(F)** **TPS616(F)**		
ϕ5		**TLN105B(F)** **TLN110(F)** **TLN115A(F)** **TLN231(F)** **TLN233(F)**	**TPS610(F)** **TPS611(F)**		
Side-View Package		**TLN117(F)**	**TPS622(F)**		
					**TPS820(B, F)**
				**TPS703(F)** **TPS704(F)**	
Surface-Mount Package					**TPS851(E*** **TPS853(E***
					**TPS852(T)/TPS852(K)*** **TPS856(T)/TPS856(K)*** **TPS859(T)/TPS859(K)***
		NEW **TLN1108**			

*: Manufactured by Toshiba Semiconductor (Thailand) Co., Ltd.

6 Selection Guide by Package

Photointerrupters

Package	External Appearance (mm)	Gap (mm)	Slit Width (mm)	Output Type
				Photo transistor
PWB Direct Mounting (General-Purpose)		2	0.15	**TLP830(F)**
		4.2	0.5*	**TLP831(F)**
		5	0.5	**TLP832(F)**
		5	0.5	**TLP833(F)**

*: Horizontal slit

7 Product Lineup

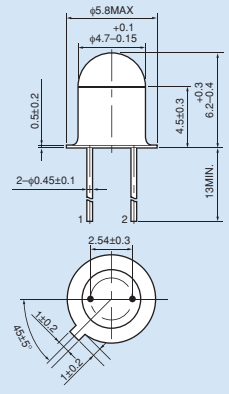
7.1 Infrared LEDs, and Visible LEDs for Sensor Light Sources

Part No.	Package	Electrical and Optical Characteristics (Ta = 25˚C)									Package No.	Applications
		Radiant intensity (mW/sr)				Radiant power (mW)			Peak-emission wavelength (nm)	Half-intensity angle (°)		
		Part number with rank	Min	Max	I_F(mA)	Min	Max	I_F(mA)				
TLN108(F)	TO-18 CAN	–	10	–	50	–	–	–	940	±8	1-1	Optoelectronic switches
TLN105B(F)	ϕ5	–	12	–	50	–	–	–	950	±23.5	1-2	Remote controls
TLN110(F)	ϕ5	–	15	–	50	–	–	–	940	±8		Optoelectronic switches
TLN115A(F)	ϕ5	–	15	–	50	–	–	–	950	±21		Remote controls
		TLN115A(B, F)	19	–								
TLN231(F)	ϕ5	–	35	–	50	–	–	–	870	±16		Fiberless optical transmissions Optoelectronic switches
TLN233(F)	ϕ5	–	46	–	50	–	–	–	870	±13		
TLN238(F)	ϕ3	–	40	–	50	–	–	–	870	±18	1-3	
TLN119(F)	ϕ3	–	2.5	10	20	–	–	–	945	±30		Optoelectronic switches
		TLN119(B, F)	4.2	10								
TLN117(F)	Small side-view package	–	2	–	20	–	–	–	940	±15	1-4	
		TLN117(C, F)	5	18.7								
NEW **TLN1108**	PLCC	–	10	35	100	70(Typ.)		100	870	±60	1-5	Infrared lighting Fiberless optical transmissions

Note: I_F = forward current

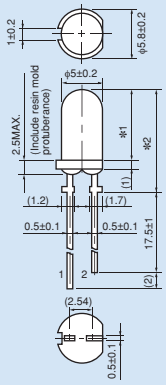
Unit: mm

1-1



1.Anode
2.Cathode

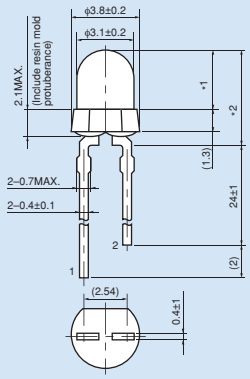
1-2



( ): Typical value
1.Anode
2.Cathode

*1	*2	
7.65±0.2	10.4 +0.3 −0.2	TLN105B(F)
7.65±0.2	10.7 +0.4 −0.1	TLN115A(F)/ TLN231(F)
8.65±0.2	12.15 +0.4 −0.1	TLN110(F)
8.0±0.2	11.5 +0.4 −0.1	TLN233(F)

1-3



( ): Typical value
1.Anode
2.Cathode

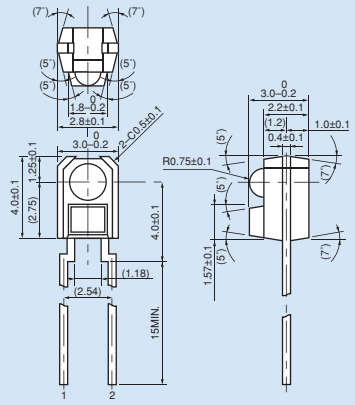
*1	*2	
3.5±0.2	5.6±0.2	TLN119(F)
3.74±0.2	5.84±0.2	TLN238(F)

7 Product Lineup

7.1 Infrared LEDs, and Visible LEDs for Sensor Light Sources

Unit: mm

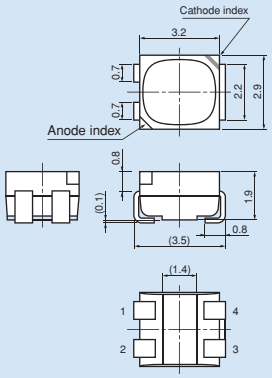
1-4



( ): Typical value

1.Cathode
2.Anode

1-5



( ): Typical value
Tolerance: ±0.2

1.Anode
2.Cathode
3.Cathode
4.Cathode

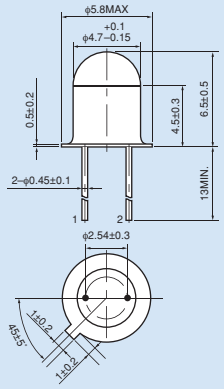
7.2 Phototransistors

Part No.	Package	Electrical and Optical Characteristics (Ta = 25 ˚C)									Package No.	Applications
		Light current (μA)				Dark current (μA)		Peak-sensitivity wavelength (nm)	Half-intensity angle (°)	Impermeable to visible light		
		Part number with rank	Min	Max	E(mW/cm²)	Max	VCE(V)					
TPS601A(F)	TO-18 CAN	–	100	–	0.1	0.2	30	800	±10	–	2-1	Optoelectronic switches
		TPS601A(A, F)	100	300								
		TPS601A(B, F)	200	600								
		TPS601A(C, F)	400	1200								
TPS610(F)	φ5	–	100	–	0.1	0.1	24	800	±8	–	2-2	
TPS611(F)	φ5	–	30	–	0.1	0.1	24	900	±8	Y		
TPS615(F)	φ3	–	20	150	0.1	0.1	24	800	±30	–	2-3	
		TPS615(B, F)	34	85								
		TPS615(C, F)	60	150								
		TPS615(BC, F)	34	150								
TPS616(F)	φ3	–	10	75	0.1	0.1	24	900	±30	Y		
		TPS616(B, F)	17	42.5								
		TPS616(C, F)	30	75								
		TPS616(BC, F)	17	75								
TPS622(F)	Small side-view	–	27	–	0.1	0.1	24	870	±15	Y	2-4	
		TPS622(A, F)	27	80								
		TPS622(B, F)	55	165								

Note: E = radiant incident, VCE = collector-emitter voltage

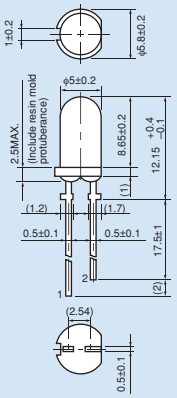
Unit: mm

2-1



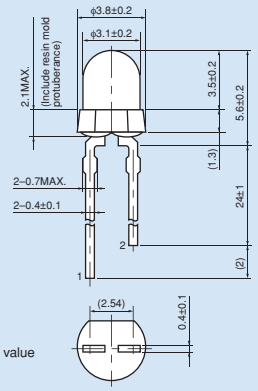
1.Emitter
2.Collector

2-2



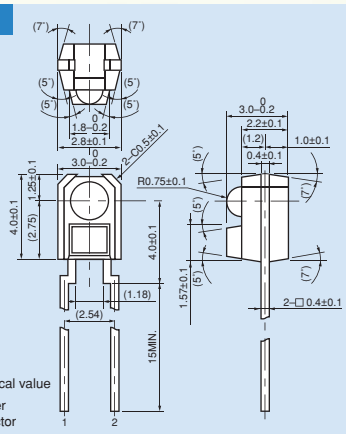
( ): Typical value
1.Emitter
2.Collector

2-3



( ): Typical value
1.Emitter
2.Collector

2-4



( ): Typical value
1.Emitter
2.Collector

7 Product Lineup

7.3 Photodiodes

Part No.	Package	Electrical and Optical Characteristics (Ta = 25°C)							Package No.	Applications
		Short-circuit current (μA)		Dark current (nA)		Peak-sensitivity wavelength (nm)	Half-intensity angle (°)	Impermeable to visible light		
		Min	E(mW/cm²)	Max	V_R(V)					
TPS703(F)	Side-view	0.9	0.1	30	10	960	±65	Y	3-1	Remote controls
TPS704(F)		0.5	0.1	30	10	1000	±65	Y		

Note: E = radiant incident, V_R = reverse voltage

7.4 Photo-ICs

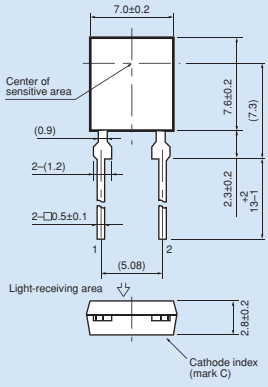
Part No.	Package	Electrical and Optical Characteristics (Ta = 25°C)										Package No.	Applications
		Part number with rank	Light current (μA) Min	Max	Ev (lx)	Vcc (V)	Dark current (μA) Max	Vcc(V)	Peak-sensitivity wavelength (nm)	Half-intensity angle (°)	Impermeable to visible light		
TPS820(B, F)	Side-view Package	–	1500	6000	E = 0.1 mW/cm²	5	0.5	5	870	±15	Y	4-1	Optoelectronic switches
TPS851(E*	Chip type	–	37	74	100	3	0.17	3.3	600	±55	–	4-2	Ambient light sensors
		TPS851(E, A	37	62									
TPS852(T)*/ TPS852(K)*		–	27	54	100	3	0.1	3.3	600	±55	–	4-3	
		TPS852(A,T)/TPS852(A,K)	30	50									
TPS853(E*		–	37	74	100	3	0.1	3.3	600	±55	–	4-2	
		TPS853(E, A	39	65									
TPS856(T)*/ TPS856(K)*		–	40	80	100	3	0.1	3	550	±55	–	4-3	
		TPS856(A,T)/TPS856(A,K)	44.1	73.7									
TPS859(T)*/ TPS859(K)*		–	160	320	100	3	0.2	3	550	±55	–	4-3	
		TPS859(A,T)/TPS859(A,K)	180	300									

Note1: Vcc = supply voltage, Ev = illuminance, E = radiant incident

*: The parts with the (E, (T) and (K) suffixes are manufactured by Toshiba Semiconductor (Thailand) Co., Ltd.
Those with the (K) suffix are the part numbers used for ordering in Japan. Those with the (E suffix are also available in Japan.
For details, ask your local Toshiba sales representative.

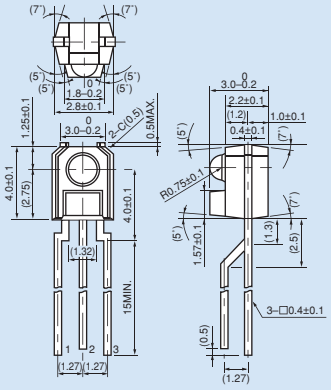
Unit: mm

3-1



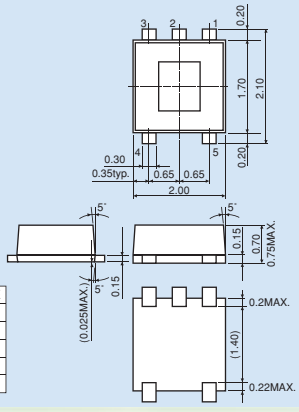
( ): Typical value
1.Anode
2.Cathode

4-1



( ): Typical value
1.GND
2.OUT
3.Vcc

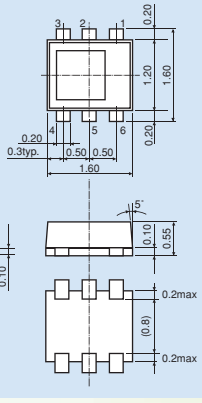
4-2



( ): Typical value
Tolerance: ±0.1

	TPS851(E	TPS853(E
1	Vcc	Vcc
2	GND	GND
3	NC	NC
4	NC	Vstb
5	OUT	OUT

4-3



( ): Typical value
Tolerance: ±0.1

	TPS852(T)/852(K) TPS852(T)/859(K)	TPS856(T)/ TPS856(K)
1	Vcc	Vcc
2	GND	GND
3	GND	GND
4	GND	GND
5	GND	GND
6	OUT	OUT(Vstb)

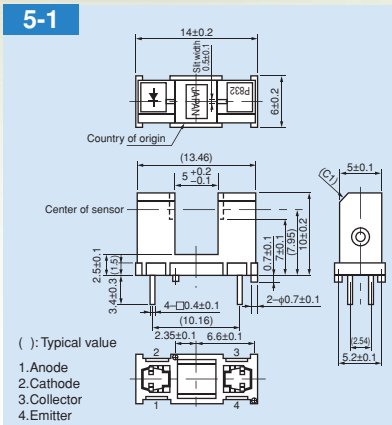
7.5 Photointerrupters

Part No.	Package	Gap (mm)	Slit Width (mm)	Electrical Characteristics (Ta = 25°C)				Absolute Maximum Rating★	Package No.	Applications
				Current transfer ratio (%)				Collector-emitter voltage (V)		
				Min	Max	IF(mA)	VCE(V)			
TLP832(F)	PWB direct mounting	5	0.5	5	100	10	2	35	5-1	Printers, Fax machines Copiers, Image scanners Vending machines Tape readers, Cameras
TLP833(F)		5	0.5	5	100	10	2	35	5-2	
TLP831(F)		4.2	0.5*	5	100	10	2	35	5-3	
TLP830(F)		2	0.15	3	20	10	2	35	5-4	

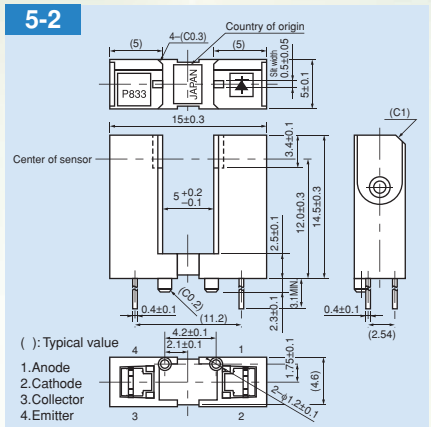
★: Ta = 25°C ✻: Horizontal slit Note: IF: forward current, VCE: collector-emitter voltage, PWB: Printed wired board

Unit: mm

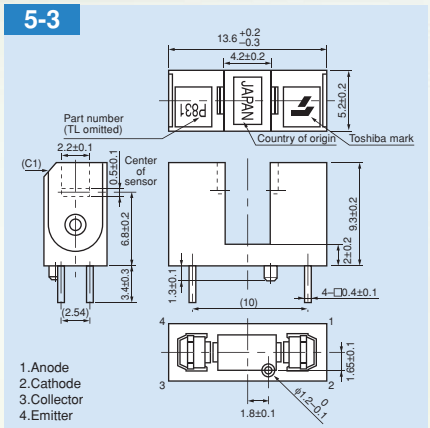
5-1



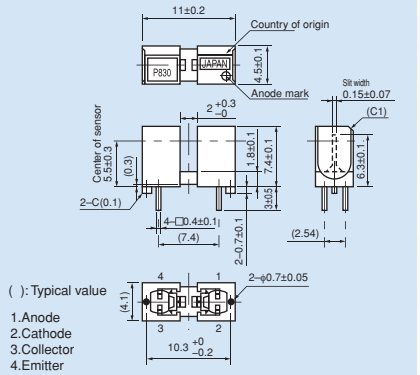
5-2



5-3

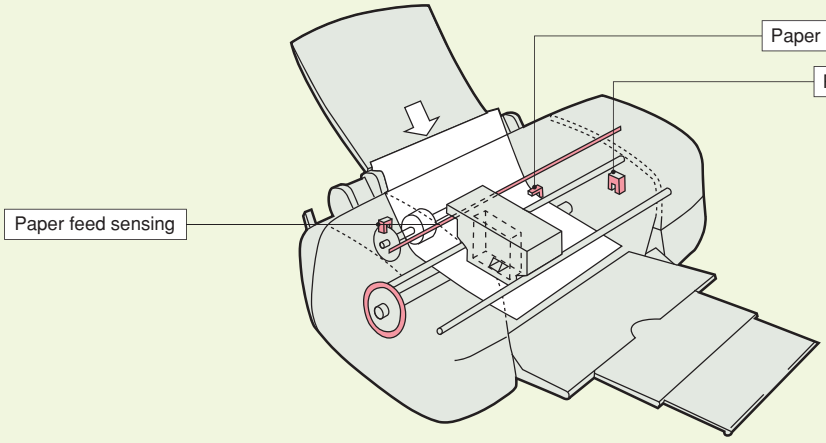


5-4



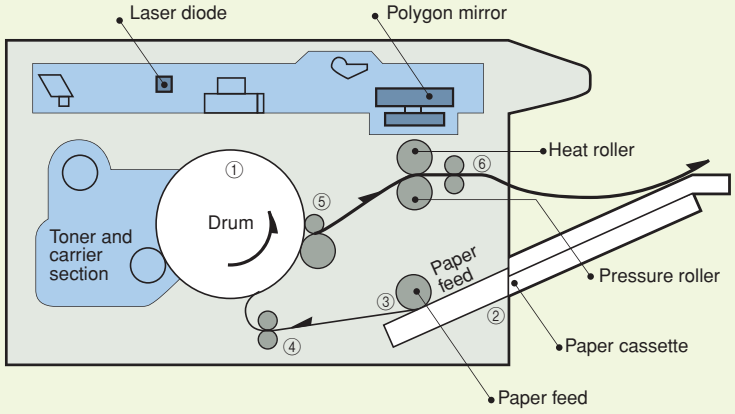
8 Application Examples

8.1 Inkjet Printers



Photointerrupters
TLP830(F)
TLP831(F)
TLP832(F)
TLP833(F)

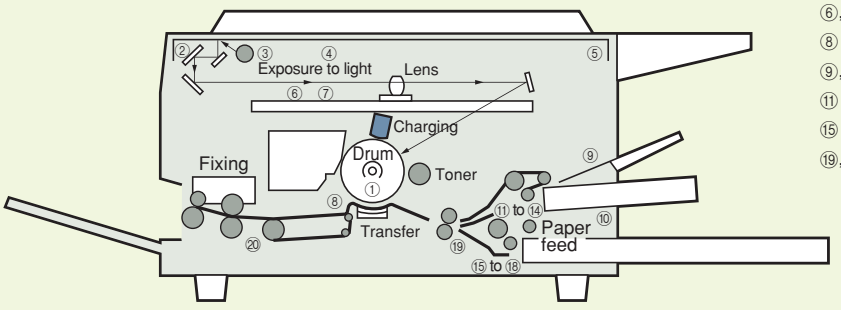
8.2 Page Printers



[Application examples]
① Drum revolution sensing
② Paper presence sensing
③, ④ Paper transport sensing
⑤ Paper separation sensing
⑥ Paper ejection sensing

Photointerrupters
TLP832(F)
TLP833(F)

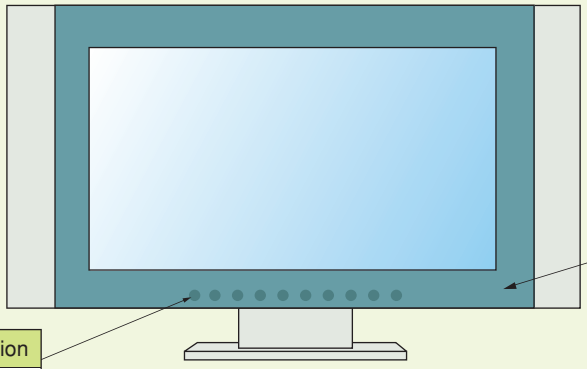
8.3 Copiers



[Application examples]
① Drum position sensing
② to ⑤ Optics block position sensing
⑥, ⑦ Lens position sensing
⑧ Paper separation sensing
⑨, ⑩ Paper presence sensing
⑪ to ⑭ Upper cassette paper transport sensing
⑮ to ⑱ Lower cassette paper transport sensing
⑲, ⑳ Paper ejection and transport sensing

Photointerrupters
TLP832(F)
TLP833(F)

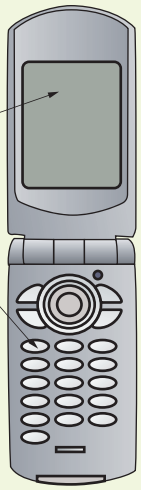
8.4 TV Monitors



Luminous adjustment for screens
TPS851(E, TPS853(E TPS859(T)/TPS859(K)

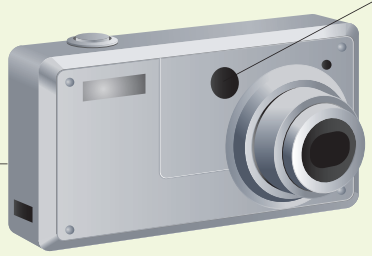
3D timing signal transmission
TLN1108

8.5 Cell Phones



Ambient light sensors for LCDs Brightness control for key backlighting
TPS851(E, TPS852(T)/TPS852(K) TPS853(E, TPS856(T)/TPS856(K)

8.6 Digital Still Cameras

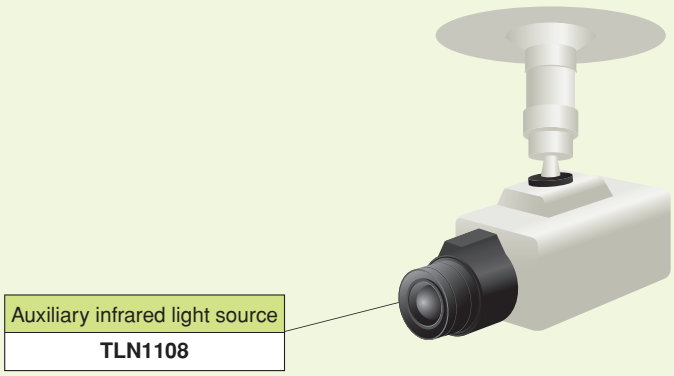


Phototransistor for strobe light sensors
TPS615(F)

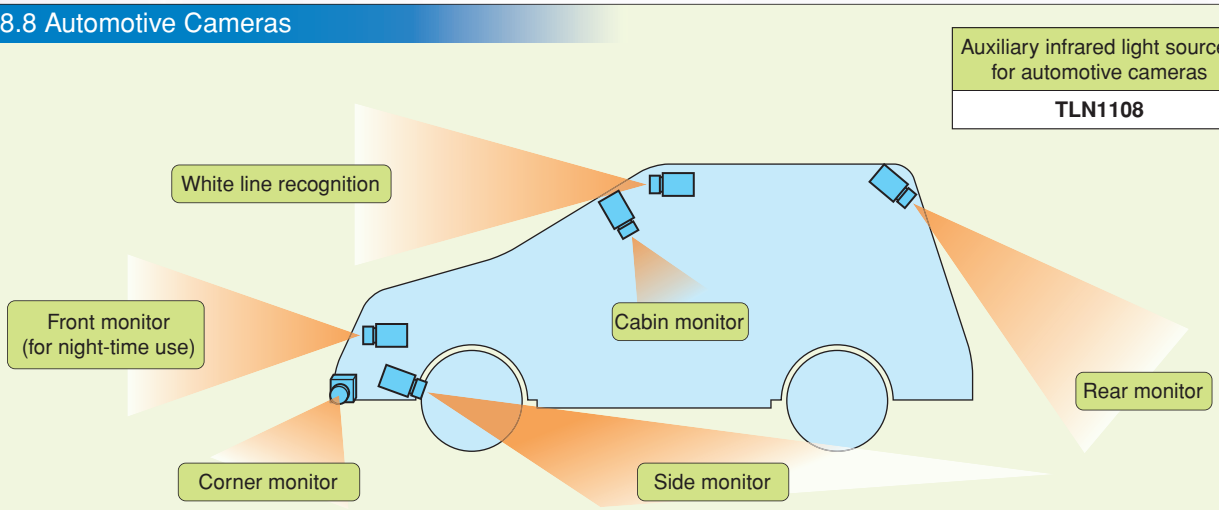
Ambient light sensors for LCDs
TPS851(E, TPS852(T)/TPS852(K) TPS853(E, TPS856(T)/TPS856(K)

8 Application Examples

8.7 Security Cameras



8.8 Automotive Cameras



8.7 Others

Category	Appliances	Applications	Recommended Devices
AV equipment	Camcorders	Ambient light sensors for monitor screens	**TPS85x** Series
	Digital still cameras		
Household appliances	Refrigerators	Icemaker internal position sensing	**TLP800** Series
		Ambient light sensors	**TPS85x** Series
	Microwave ovens	Sensing of height and number of cooked objects	**TLN108(F)** → **TPS601A(F)**
	Electric pots	Ambient light sensors	**TPS85x** Series
	Air conditioners	Remote controls	**TLN105B(F)**, **TLN115A(F)** → **TPS703(F)**
		Ambient light sensors	**TPS85x** Series
		Louver direction sensing	**TLP800** Series
	Automatic blinkers	Ambient light sensors	**TPS85x** Series
	Washing machines	Sensing of degree of rinsing	**TLN115A(F)** → **TPS611(F)**
	Health equipment	Internal mechanism position sensing	Any photointerrupters
	Sewing machines	Needle up/down and cloth-feed sensing	Any photointerrupters
Control and Measurement	Optoelectronic switches	Emitters and detectors	**TLN108(F)** → **TPS601A(F)** **TLN117(F)** → **TPS622(F)**
	Automatic production machines	Internal mechanism position sensing	**TLP830** Series
	Industrial robots	Object sensing	**TLN108(F)** → **TPS601A(F)**
Information devices, Automatic vending machines and Office equipment	Copiers	Paper size sensing, toner quantity sensing and toner density sensing	**TLN117(F)** → **TPS820(B,F)**
	Printers	Paper size sensing, toner quantity sensing and toner density sensing	**TLN117(F)** → **TPS820(B,F)**
	Automatic vending machines	Coin sensing and product feed sensing	**TLN108(F)** → **TPS601A(F)**
		Ambient light sensors	**TPS85x** Series
	PDAs	Ambient light sensors for monitor screens	
	Notebook PCs	Ambient light sensors for screens	
	PC monitors	Ambient light sensors for screens	
Communications Devices	Telephones	Hook sensors	**TLP831(F)**
	Optical telephones	Information transmission	**TLN115A(F)** → **TPS704(F)**
	Optical communications	Space transmission	**TLN231(F)** **TLN233(F)** **TLN238(F)** **TLN1108**
Others	Gaming equipment (pachinko, computer games, etc.)	Coin sensing and internal mechanism position sensing	**TLN108(F)** → **TPS601A(F)**
	Toys (rifle games, remote controls, robots and game controls)	Remote controls	**TLN115A(F)** **TLN231(F)** **TLN233(F)** → **TPS704(F)**

9 Usage Considerations

LEDs for Optical Sensor Applications

Toshiba photosensors are available with two types of LEDs, and a projection of the operating life has been made for each LED. The table below shows the types of LED used in photosensors and the figures on pages 17 and 18 show projections of long-term light output performance and operating life. Note that these operating life data are estimates extrapolated from long-term light output degradation over a single wafer lot and are shown as reference only.

	Projected Operating Life (Ta = 40°C, I_F = 20 mA, failure criteria: degradation rate ΔPo<–50%)		Photosensors
	F50% operating life	F0.1% operating life	
① GaAs LED	1,300,000 h	260,000 h	Photointerrupters, Infrared LEDs
② GaAℓAs LED	1,000,000 h	200,000 h	Infrared LEDs

F50% (cumulative failure rate 50%) operating life: Time period until the projected long-term light output degradation curve of the average light output change ($\overline{X}$) shown on pages 17 to 18 reaches the failure criteria.

F0.1% (cumulative failure rate 0.1%) operating life: Time period until the projected long-term light output degradation curve of $\overline{X} - 3\sigma$ shown on pages 17 to 18 reaches the failure criteria.

The relationship between LED light output degradation and optical coupling characteristics is shown below.

The relationship between the current transfer ratio (I_C/I_F) or LED radiant intensity (I_E) degradation and the LED light output degradation is 1:1.

$$\frac{I_C/I_F\ (t)}{I_C/I_F\ (o)} = \frac{Po\ (t)}{Po\ (o)} \quad \text{or} \quad \frac{I_E\ (t)}{I_E\ (o)} = \frac{Po\ (t)}{Po\ (o)}$$

■ Reading a projected operating life from a graph

As an example, let's read the operating life of an LED from the *GaAs LED Projected Operating Life Data (Failure criteria: light output degradation ΔP_O < -50%).*

Assume that the ambient temperature is 25°C.

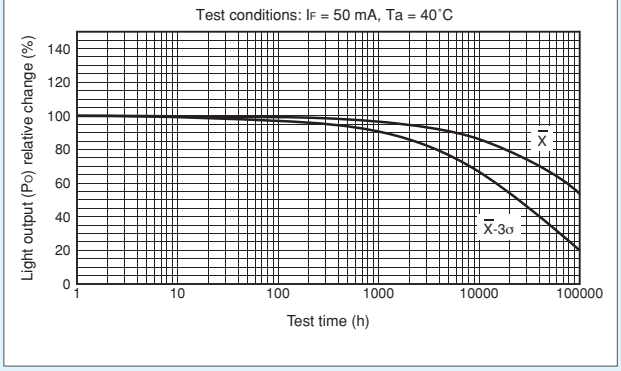
1. Convert the ambient temperature into Kelvin. 25°C + 273 = 298 (K)
2. Calculate the reciprocal of the Kelvin temperature. $1/298 = 3.36 \times 10^{-3}$
3. Read the projected operating life from the graph.
   Ta = 25°C, I_F = 50 mA (Failure criteria: light output degradation ΔP_O < -50%)
   F50% (cumulative failure rate: 50%) operating life: Approx. 200,000 hours (for reference only)
   F0.1% (cumulative failure rate: 0.1%) operating life: Approx. 40,000 hours (for reference only)

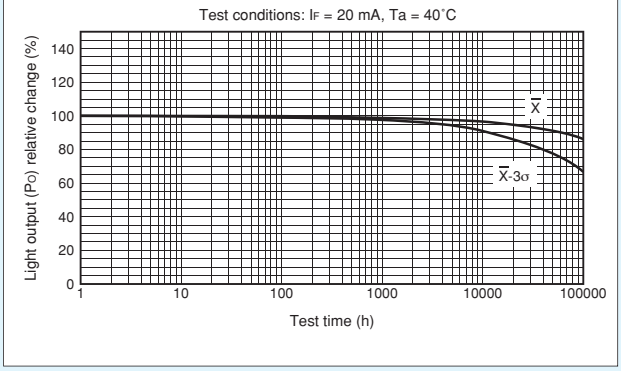
LEDs Used in Photosensors

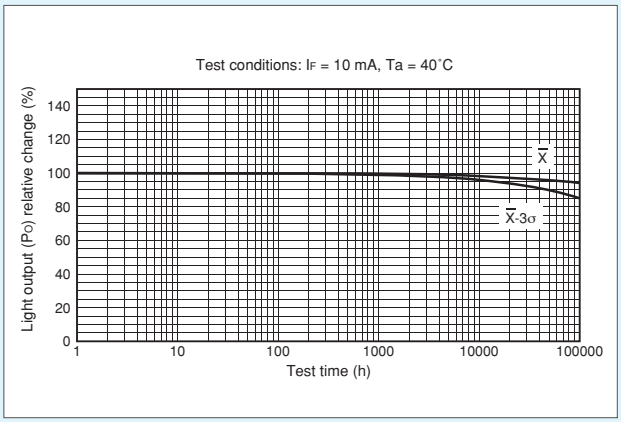
Photosensors	LED	Photosensors	LED
TLN105B(F)	①	TLN233(F)	②
TLN108(F)	①	TLN238(F)	②
TLN110(F)	①	TLP830(F)	①
TLN115A(F)	①	TLP831(F)	①
TLN117(F)	①	TLP832(F)	①
TLN119(F)	①	TLP833(F)	①
TLN231(F)	②		

①: GaAs Infrared LEDs ②: GaAℓAs Infrared LEDs

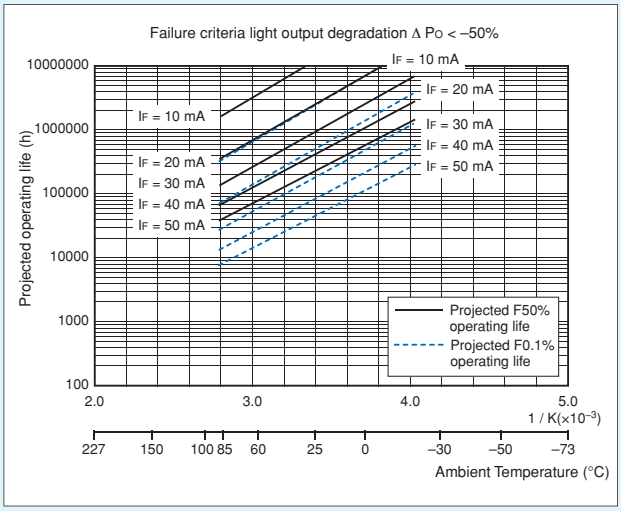
① GaAs LED Projected Light Output Degradation Data

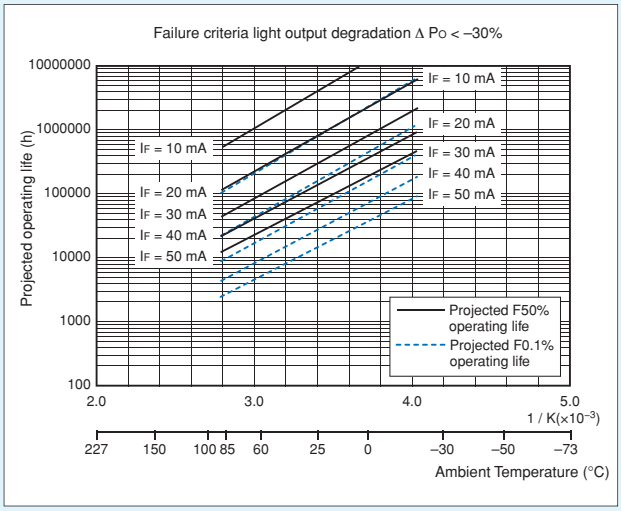






① GaAs LED Projected Operating Life Data

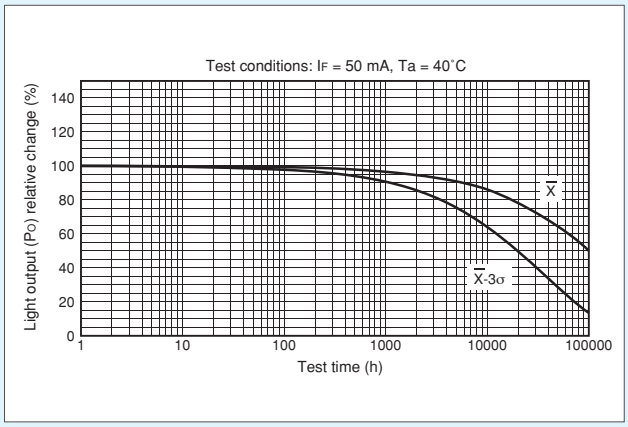


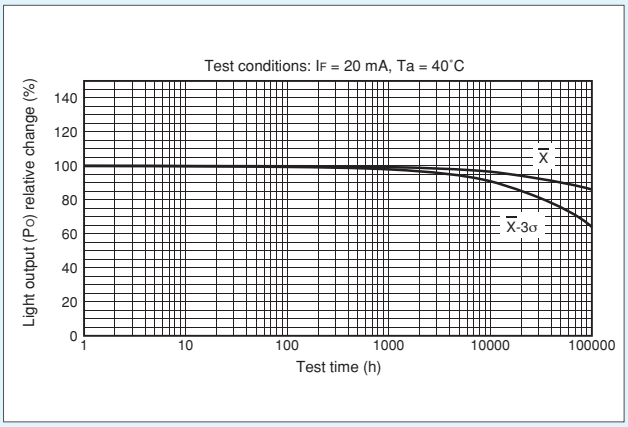


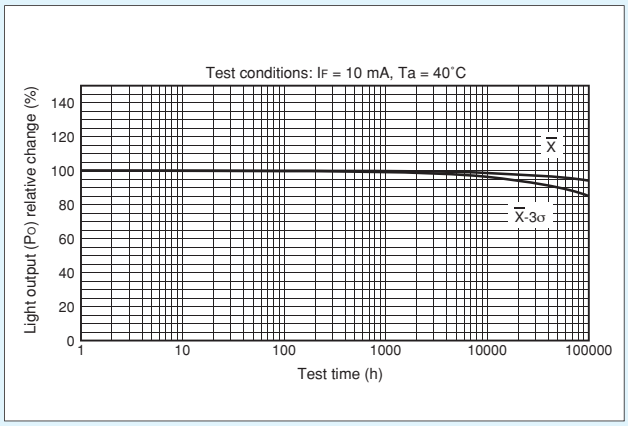
The above operating life data are estimates extrapolated from long-term light output degradation over a single wafer lot and are shown as reference only. Operating conditions exceeding the maximum ratings are not guaranteed.

9 Usage Considerations

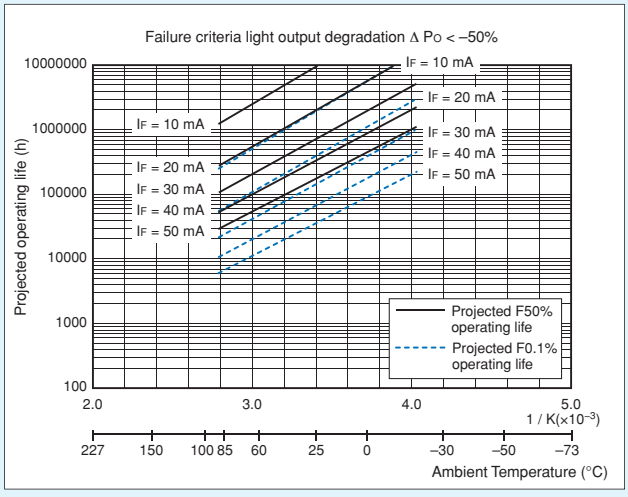
② GaAℓAs LED Projected Light Output Degradation Data

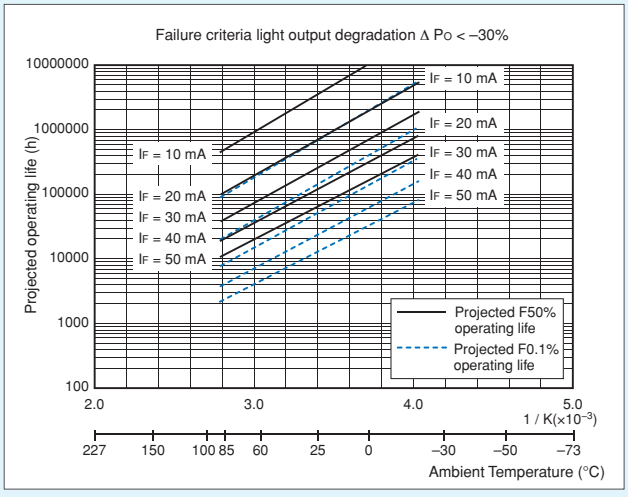






② GaAℓAs LED Projected Operating Life Data





The above operating life data are estimates extrapolated from long-term light output degradation over a single wafer lot and are shown as reference only. Operating conditions exceeding the maximum ratings are not guaranteed.

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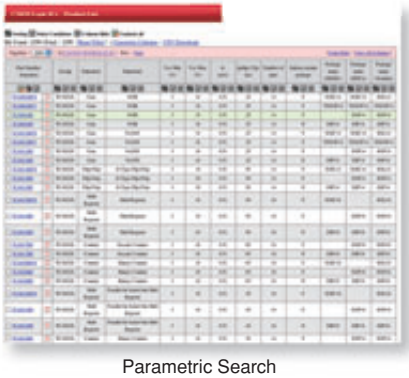

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