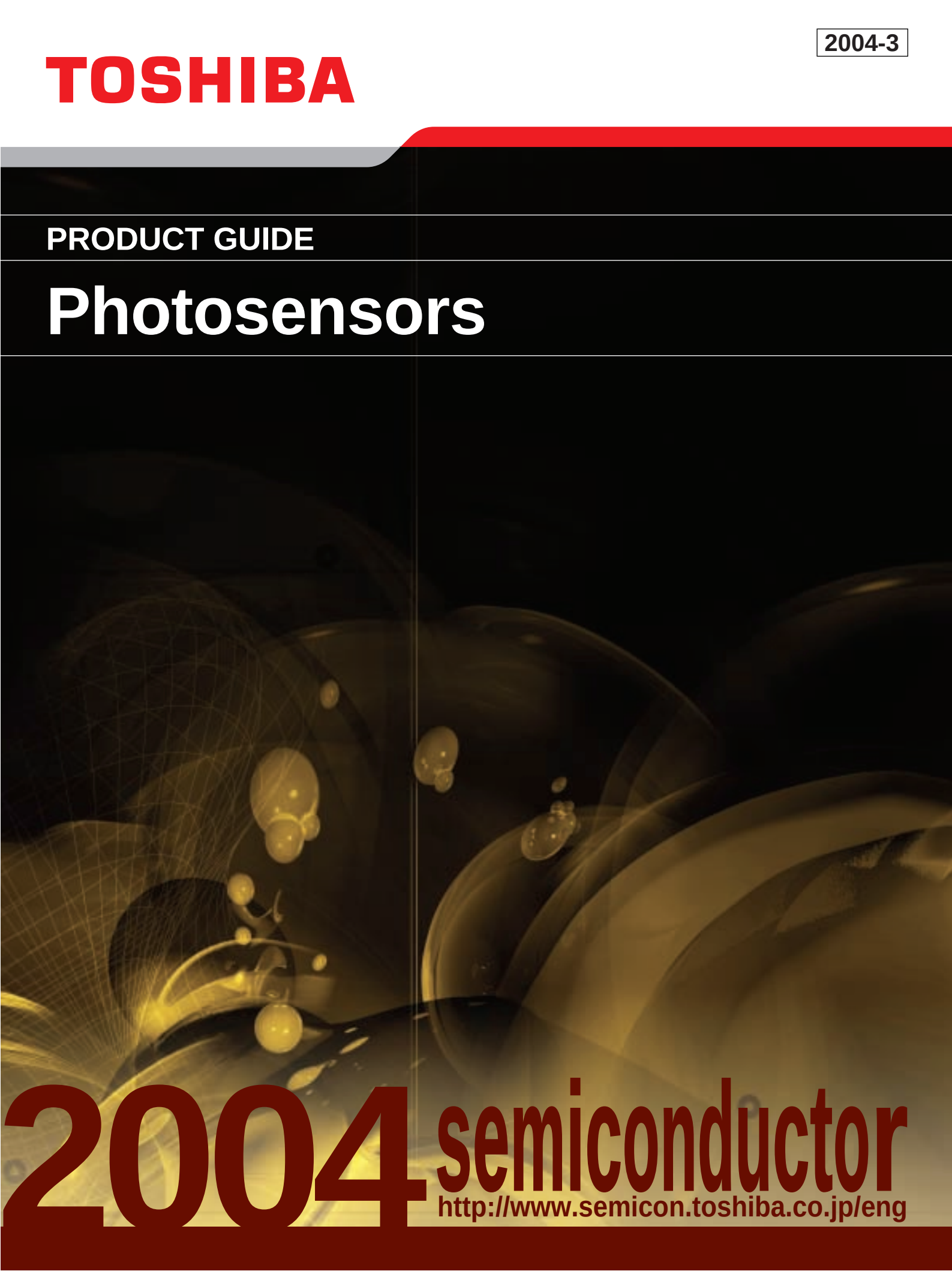


TOSHIBA

2004-3

PRODUCT GUIDE

Photosensors



2004 semiconductor
<http://www.semicon.toshiba.co.jp/eng>

CONTENTS

1. New Product Digest	3
2. Classification of Photosensors	4
3. Services Provided by Photosensors	4
4. Features of Photosensors	5
5. Selection Guide by Package	6
6. Product List	10
6.1 Infrared LEDs and Visible LEDs	10
6.2 Phototransistors and Photodarlington Transistors	12
6.3 Photodiodes	13
6.4 Photo-ICs (digital-output)	13
6.5 Photo-ICs (analog-output)	13
6.6 Photointerrupters (phototransistor output and photodarlington transistor output)	15
6.7 Photointerrupters (photo-IC outputs)	18
6.8 Photointerrupters (with connectors)	19
6.9 Photoreflective Sensors	20
7. List of Connectors Used in Toshiba Photo-interrupters	21
8. Photosensor Application Examples	22
8.1 Applications in Optical Remote Controls	22
8.2 Applications in Fax Machines	22
8.3 Applications in Impact Printers	22
8.4 Applications in Inkjet Printers	22
8.5 Applications in Page Printers	23
8.6 Applications in Copiers	23
8.7 Applications in Floppy Disk Drives	23
8.8 Applications in VHS VCRs	24
8.9 Applications in 8-mm VCRs	24
8.10 Applications in Image Scanners	24
8.11 Applications in Cameras	25
8.12 Applications in Office Networks	25
8.13 Applications in Audiovisual hi-fi Component Systems	26
8.14 Applications in Wireless Keyboards and Wireless Mice	26
8.15 Others	27
9. List of Final-Phase Production Products	29
10. Related Documents on Websites	30
12. Part Number Index	31

1 New Product Digest

High-Brightness LED for AF Auxiliary Light TLOH9203



The TLOH9203 is a high-brightness LED for auto-focus (AF) auxiliary light in digital still cameras. This newly developed product achieved 1.25 times higher brightness than the conventional TLOH9202.

- High luminous intensity (on-axis):
 $I_v = 15 \text{ cd (typ.) @ } I_f = 20 \text{ mA, } T_a = 25^\circ\text{C}$
- Low forward voltage:
 $V_f = 2 \text{ V (typ.) @ } I_f = 20 \text{ mA, } T_a = 25^\circ\text{C}$
- Narrow radiation pattern:
 $2\theta_{1/2} = 8^\circ \text{ (typ.)}$
- High optical axis accuracy:
 Optical axis deviation $\leq 3^\circ$

Surface-Mount Photo-IC for Illuminance Detection: TPS852



The TPS852 is a photo-IC which incorporates a photodiode, a current amplifier, and a luminous-efficiency correction function in a single chip. The device has high sensitivity and excellent output linearity relative to change in the ambient brightness of the operating environment. This also features little variation in output sensitivity among light source. When used as the luminous control for displays in various equipment and the power-saving control for automatic equipment, this device enables low power consumption to be achieved.

- Extremely small thin surface-mount package:
 $1.6 \text{ mm} \times 1.6 \text{ mm}$ (thickness = 0.55 mm)
- Current linear output type:
 incorporating a photodiode and a current amplifier in a single chip
- High sensitivity:
 $\text{Light current (} I_L \text{)} = 27 \text{ to } 54 \mu\text{A @ } E_v = 100 \text{ lx using fluorescent light}$
- Little variation in output sensitivity among light source
 $(I_L @ \text{ incandescent light} / I_L @ \text{ florescent light})$: Light source ratio = 1.2 x (typ.)
- Low supply voltage: $V_{cc} = 2.7 \text{ to } 5.5 \text{ V}$
- Silicon is used as the chip material. This can be used in place of CdS cell.
- Lead-free leadframe package

Through-Hole Photo IC for Illuminance Detection TPS855(F)



The TPS855(F) is a photo-IC which incorporates a photodiode, a current amplifier, and a luminous-efficiency correction function in a single chip. The device has high sensitivity and excellent output linearity relative to change in the ambient brightness of the operating environment. This also features little variation in output sensitivity among light source. When used as the luminous control for displays in various equipment and the power-saving control for automatic equipment, this device enables low power consumption to be achieved.

- Current linear output type: incorporating a photodiode and a current amplifier in a single chip
- High sensitivity:
 $\text{Light current (} I_L \text{)} = 210 \text{ to } 350 \mu\text{A @ } E_v = 100 \text{ lx using fluorescent light}$
- Little variation in output sensitivity among light source
 $(I_L @ \text{ incandescent light} / I_L @ \text{ florescent light})$: Light source ratio = 1.3 x (typ.)
- Low supply voltage: $V_{cc} = 2.7 \text{ to } 5.5 \text{ V}$
- Silicon is used as the chip material. This can be used in place of CdS cell.

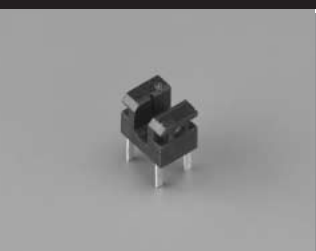
Small and General-Purpose Photointerrupter TLP841



The TLP841 is a photointerrupter which consists of GaAs infrared LED optically coupled to a phototransistor and directly mounted on a board. This is housed in a compact yet wide gap and high-back type package; therefore, it is ideal for machine design in small equipment.

- Package dimensions: $7.5 \text{ mm} \times 2.6 \text{ mm} \times 6.3 \text{ mm}$
- Gap: 5 mm (typ.)
- Slot depth: 3.8 mm
 $\text{*Length between the center of sensor and the bottom of the slot}$
- Slit width: 0.5 mm (typ.)
- Current transfer ratio: $I_c / I_f \geq 2.5\%$
 $\text{@ } V_{CE} = 2 \text{ V, } I_f = 10 \text{ mA, } T_a = 25^\circ\text{C}$
- Low dark current: $I_d \leq 0.05 \mu\text{A}$
 $\text{@ } V_{CE} = 24 \text{ V, } I_f = 0, T_a = 25^\circ\text{C}$
- Lead-free leadframe package

Extremely small and High Current Transfer Ratio Photointerrupter TLP846



The TLP842 is an extremely small and high-resolution photointerrupter which consists of GaAs infrared LED optically coupled to a phototransistor. This is housed in an extremely compact yet wide gap package and also features high current transfer ratio; therefore, it is ideal for lens position detection in cameras which requires a high-density mounting, fast speed and high resolution photointerrupter.

- Package dimensions: $3.5 \text{ mm} \times 2.6 \text{ mm} \times 2.9 \text{ mm}$
- Gap width: 1.2 mm (typ.)
- Slit width: 0.15 mm (typ.)
- Current transfer ratio: $I_c / I_f = 3 \text{ to } 24\%$
 $\text{@ } V_{CE} = 2 \text{ V, } I_f = 5 \text{ mA, } T_a = 25^\circ\text{C}$
- Lead-free leadframe package

Next-Generation Small Photointerrupter with Connector for OA Equipment TLP1243(C8)/TLP1255(C8)



TLP1243(C8)



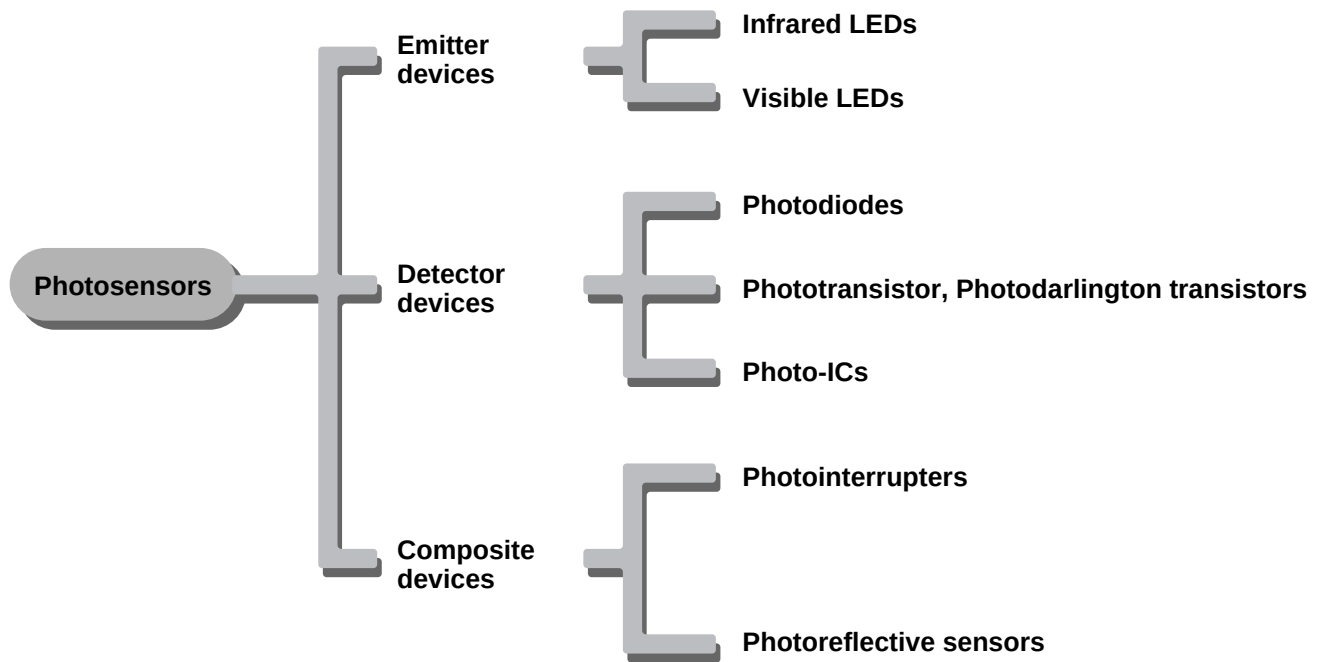
TLP1255(C8)

The TLP1243 (C8) / TLP1255 (C8) are the industry's first small photointerrupters which combine connectors, the Mini CT connector manufactured by Tyco Electronics AMP K.K. These are ideal for use in OA equipment, improving set's size in small and operating temperature higher.

- Combining a 1.5-mm pitch Mini CT connector manufactured by Tyco Electronics AMP K.K.
- Gap: 5 mm (typ.)
- Output device: phototransistorTLP1243 (C8)
 Photo-IC.....TLP1255(C8)
- High operating temperature: $T_{opr} \leq 95^\circ\text{C}$
- Supply Voltage: $V_{cc} = 2.97 \text{ to } 5.5 \text{ V}$ TLP1225(C8)
- Lead-free leadframe package

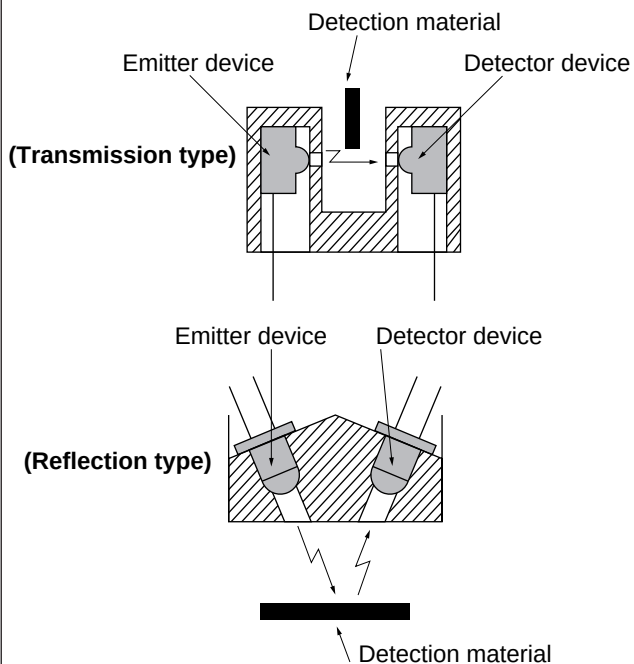
2 Classification of Photosensors

Photosensors are classified as follows:

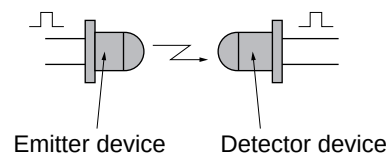


3 Services Provided by Photosensors

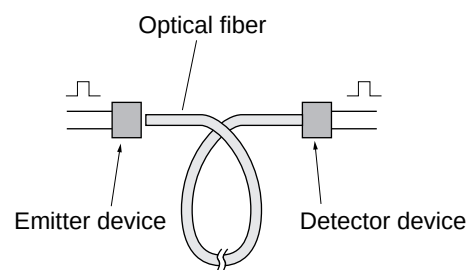
Position detection



Optical communication (fiberless transmission)



Optical fiber communication



4 Features of Photosensors

● Infrared LEDs

- **TLN100 Series**..... Infrared LEDs of λ_p (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**..... Infrared LEDs of λ_p = 870 nm to 880 nm. The radiant power is greater than that of the TLN100 Series.

● Visible LEDs

- **TLRA270**..... Visible LED for AF Auxiliary Light
- **TLOH9202, TLOH9203** ... λ_p = 695 nm Visible LED for AF auxiliary light in digital still cameras

● Photodiodes

- **TPS700 Series**..... High-speed response detector devices which are suitable for optical remote controls and optical fiber communications

● Phototransistors and photodarlington transistors

- **TPS600 Series**..... Highly sensitive detectors devices which are suitable for optoelectronic switches

● Photo-IC

- **TPS800 Series**..... Detector devices with amps
Digital output type: high-speed response and suitable for optoelectronic switches
Linear output type: suitable for illuminance detection, optoelectronic switches

● Photointerrupters

- **TLP800 Series**..... Photointerrupters generating phototransistor output and photodarlington transistor output
- **TLN1000 Series**..... Photointerrupters for photo-IC output which can be directly connected to a logic IC.
- **TLN1200 Series**..... Photointerrupters with connectors. Phototransistor output type and photo-IC output type are available.

● Photoreflective Sensors

- **TPS900 Series**..... Photoreflective sensors generating phototransistor output

■ Emitter devices, Detector devices

Type		With TO-18CAN Lens	φ3 Resin	φ5 Resin		
External Appearance						
Emitter	Infrared LED	TLN108(F) TLN201(F)	TLN119(F) TLN238(F)	TLN105B(F) TLN110(F) TLN115A(F) TLN231(F) TLN233(F)	TLN225(F) TLN226(F)	TLN227(F)
	Visible LED					
Detector	Photo-transistor	TPS601A(F)	TPS615(F) TPS616(F)	TPS610(F) TPS611(F)		
	Photo-darlington transistor					
	Photo-diode					
	Photo-IC					

■ Emitter devices, Detector devices

Type		Side View							
External Appearance									
Emitter	Infrared LED	TLN117(F)		TLN210(F) TLN212(F) TLN217(F)					
	Visible LED								
Detector	Photo-transistor	TPS622(F)							
	Photo-darlington transistor								
	Photo-diode				TPS703(F) TPS704(F)	TPS705(F) TPS706(F)			
	Photo-IC		TPS820(F) TPS841(F) TPS842A(F) TPS843(F) TPS844(F)				TPS830(F) TPS831(F)	TPS816(F)	TPS855(F)

Type		Surface-Mount			
External Appearance					
Emitter	Infrared LED				
	Visible LED				TLOH9202 TLOH9203
Detector	Photo-transistor				
	Photo-darlington transistor				
	Photo-diode				
	Photo-IC	TPS850	TPS851	TPS852	

5 Selection Guide by Package

Photointerrupter Case type

Type		Double-sided Screw-mount			Single-sided Screw-mount		
External Appearance (mm)							
Gap (mm)		3	3	5	3	5	5
Slit Width (mm)		0.5	1	1	0.5	0.5	1
Output Mode	Photo-transistor		TLP800A(F)	TLP803(F)	TLP825(F)	TLP822(F)	
	Photo-darlington transistor			TLP853(F)	TLP865(F)	TLP862(F)	
	Photo-IC	TLP1006A(F) TLP1007A(F) TLP1016(F) TLP1017(F)	TLP1000A(F) TLP1001A(F)		TLP1024(F) TLP1034(F)		TLP1002A(F) TLP1003A(F)

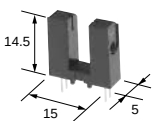
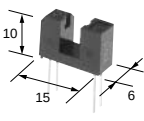
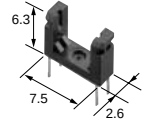
Type		PWB Direct Mounting Type					
External Appearance (mm)							
Gap (mm)		1.2	2	2	1.2	2.2	3
Slit Width (mm)		0.15	0.15	0.15*	0.15	0.2**	0.5
Output Mode	Photo-transistor	TLP846	TLP830(F)		TLP844	TLP813(F)	
	Photo-darlington transistor			TLP869(F)		TLP863(F)	TLP871(F)
	Photo-IC					TLP1020(F)	

*The LED slit width is 0.5mm **Horizontal slit

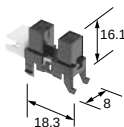
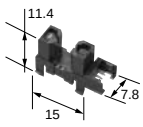
Type		PWB Direct Mounting Type					
External Appearance (mm)							
Gap (mm)		3	3	4.2	5	5	5
Slit Width (mm)		0.5	1	0.5**	—	0.5	0.5
Output Mode	Photo-transistor	TLP824(F)	TLP801A(F)	TLP831(F)	TLP828(F)	TLP818(F)	TLP832(F)
	Photo-darlington transistor	TLP864(F)					TLP866(F)
	Photo-IC	TLP1004A(F) TLP1005A(F) TLP1014(F) TLP1015(F)				TLP1023(F)	TLP1018(F) TLP1033A(F)

**Horizontal slit

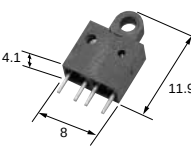
■ Photointerrupter

Type		PWB Direct Mounting Type		
External Appearance (mm)				
	Gap (mm)	5	5	5
	Slit Width (mm)	0.5	0.5**	0.5
Output Mode	Photo-transistor	TLP833(F)	TLP827(F)	TLP841
	Photo-darlington transistor		TLP867(F)	
	Photo-IC			

With Connector

Type		Snap-in Mount Type	
External Appearance (mm)			
	Gap (mm)	5	5
	Slit Width (mm)	0.5	0.7
Output Mode	Photo-transistor	TLP1241(C5,F) TLP1242(C6,F)	TLP1243(C8)
	Photo-IC	TLP1251(C5,F) TLP1252(C6,F) TLP1253(C6,F) TLP1254(C6,F)	TLP1255(C8)

■ Photoreflective Sensor

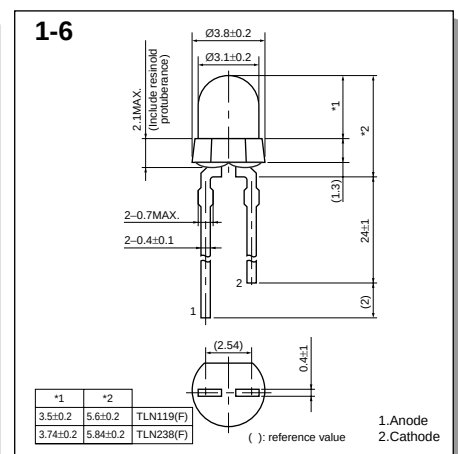
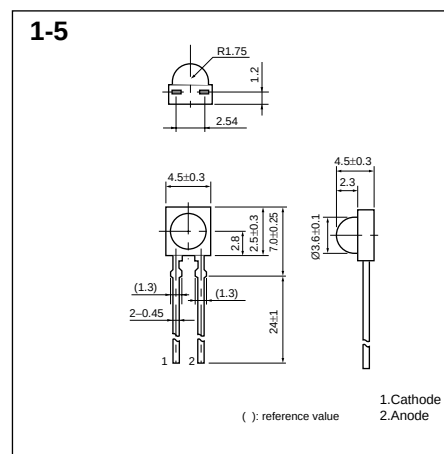
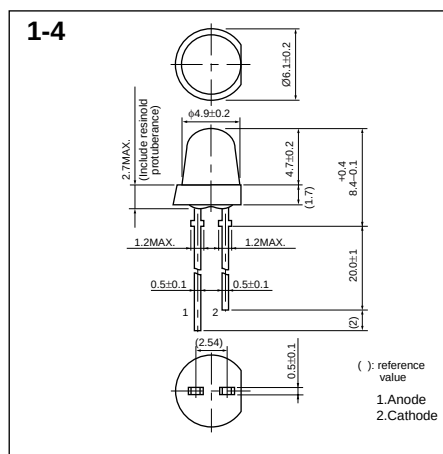
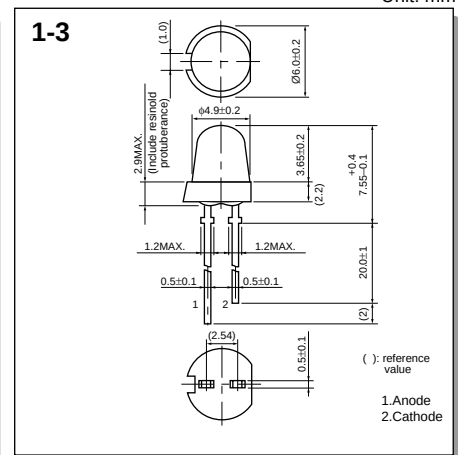
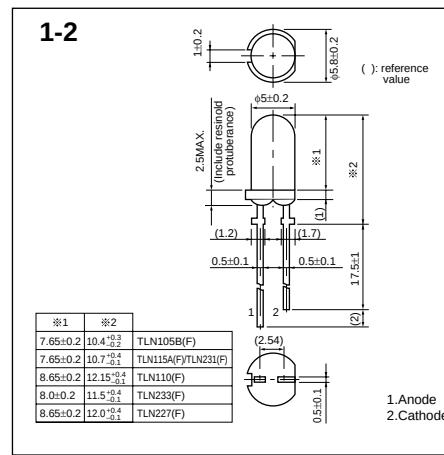
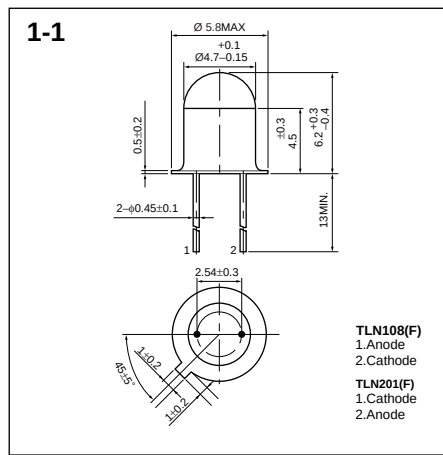
Type		Single-sided Screw-mount
External Appearance (mm)		
	Output Mode	Photo-transistor Photo-darlington transistor
		TLP921(F)

6.1 Infrared LEDs and Visible LEDs

Part Number	Package Type	Electrical and Optical Characteristics (Ta = 25°C)									Package No.	Applications	
		Part number with rank	Radiant intensity (mW/sr)			Radiant power (mW)			Peak-emission wavelength (nm)	Half-angle value (°)			
TLN108(F)	TO-18CAN(lens, can)	—	10	—	50	—	—	—	940	±8	1-1	Optoelectronic switches	
TLN201(F)		—	20	—	50	—	—	—	880	±7			
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	1-2	Remote controls	
TLN115A(B,F)		19	—										
TLN227(F)	φ5	—	—	—	—	14	—	50	870	±5	1-3	Fiberless optical transmissions Opto-electronic switches	
TLN231(F)	φ5	—	35	—	50	—	—	—	870	±16			
TLN233(F)	φ5	—	46	—	50	—	—	—	870	±13			
TLN225(F)	φ4.9	—	—	—	—	14	—	50	870	±21			
TLN226(F)	φ4.9	—	—	—	—	14	—	50	870	±13	1-4		
TLN210(F)	φ3.6 Side view	—	—	—	—	7	—	300*3	875	±32	1-5	Used only for cameras (for light projection)	
TLN212(F)	φ3.6 Side view	—	—	—	—	8	—	300*3	870	±35			
TLN217(F)	φ3.6 Side view	—	—	—	—	12	—	300*3	870	±32.5			
* TLN238(F)	φ3	—	40	—	50	—	—	—	870	±18	1-6	Optoelectronic switches	
TLN119(F)	φ3	—	2.5	10	20	—	—	—	945	±30			
		TLN119(B,F)	4.2	10									
TLN117(F)	Small side view	—	2	—	20	—	—	—	940	±15	1-7	Optoelectronic switches	
		TLN117(B,F)	2	7.5									
		TLN117(C,F)	5	18.7									
TLOH9202*2	φ3.1 SOP	—	Iv=13cd(Typ.)			20	—	—	—	612	±4	1-8	Used only for cameras (for auxiliary lighting)
* TLOH9203*2			Iv=15cd(Typ.)										

*1 red color LED *2 orange color LED *3 t=10ms ON, Note: If = forward current Iv: luminous intensity (on-axis) *: New product **: Plan to be marked "final phase"

Unit: mm





Reliability

The infrared LED (GaAlAs), of which Al in a crystal is oxidized to form light absorbing layer on the surface of the LED when power is applied, used in TLRA series or other series of products may result in low light output. This is likely to happen when products are used in high temperature and humid environment; hence, using these products in such environment, note that you evaluate them fully before actually use.

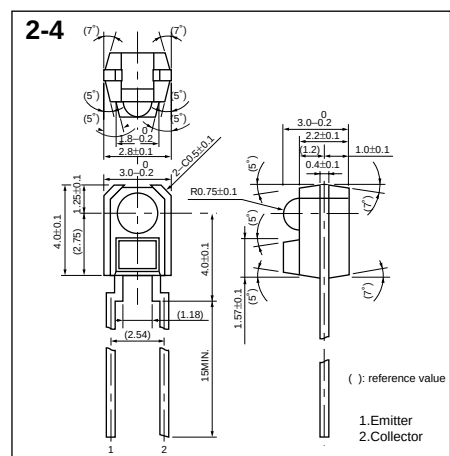
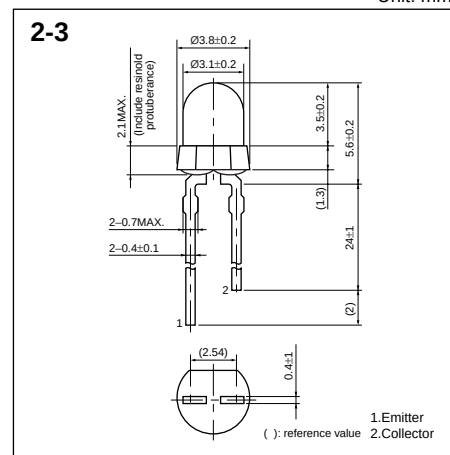
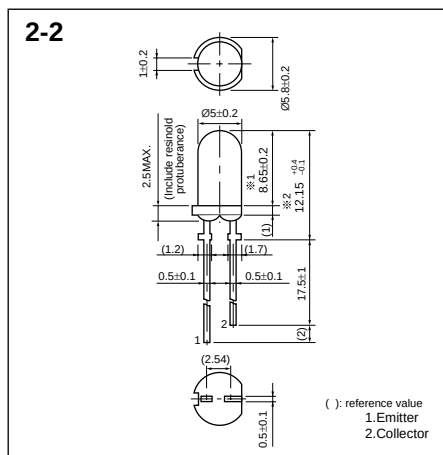
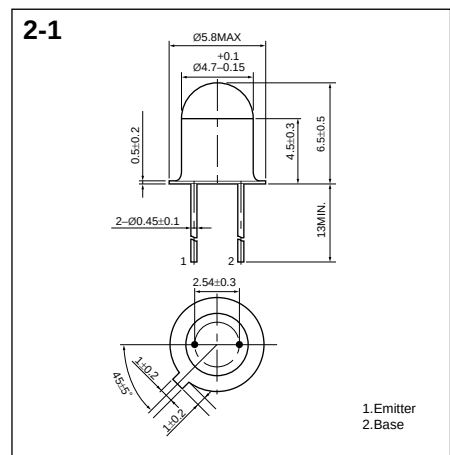
Product List

6.2 Phototransistors and Photodarlington Transistors

[illegible]

Note: E = radiant incident; V_{CE} = collector-emitter voltage

Unit: mm



6.3 Photodiodes

Part Number	Package Type	Electrical and Optical Characteristics (Ta = 25°C)							Package No.	Applications
		Short-circuit current (μA)		Dark current (nA)		Peak-sensitivity wavelength (nm)	Half-angle value (°)	Impermeable to visible light		
		min	E (mW/cm ²)	max	V _R (V)					
TPS703(F)	Side view	0.9	0.1	30	10	960	±65	○	3-1	Remote controls
TPS704(F)		0.5	0.1	30	10	1000	±65	○		
TPS705(F)	TO-92	0.5	0.1	30	10	970	±65	○	3-2	
TPS706(F)		1.0	0.1	30	10	970	±65	○		

Note: E = radiant incident; V_R = reverse voltage

6.4 Photo-ICs (digital-output)

Part Number	Package Type and Features	Electrical and Optical Characteristics (Ta = 25°C)								Package No.	Applications
		Output format		Threshold radiant incidence (mW/cm ²)		Peak-sensitivity wavelength (nm)	Half-angle value (°)	Impermeable to visible light			
		With resistor	Open-collector	L→H max	H→L max				V _{CC} (V)		
TPS841(F)	Small side view	—	○	0.3	—	2.7-15	900	±15	○	4-1	Opto-electronic switches
TPS842A(F)		—	○	—	0.3	2.7-15	900	±15	○		
TPS843(F)		○	—	0.3	—	2.7-15	900	±15	○		
TPS844(F)		○	—	—	0.3	2.7-15	900	±15	○		
TPS816(F)	Side view optical modulation	○	—	0.08	0.1	5	900	±65	○	4-2	High-speed optical remote controller (fo = 455 kHz)
TPS830(F)	Side view Oval lens	○	—	L = 3 m(min)		5	900	±63/±30	○	4-3	
TPS831(F)		○	—			5	940	±63/±30	○		

Note: V_{CC} = supply voltage; I_L = light current; E = radiant incident; E_v = illuminance; L = Transmission range; fo = Carrier frequency

6.5 Photo-ICs (analog-output)

Part Number	Package Type and Features	Electrical and Optical Characteristics (Ta = 25°C)										Package No.	Applications
		Part Number with rank	Light current (μA)				Dark current (nA)		Peak-sensitivity wavelength (nm)	Half-angle value (°)	Impermeable to visible light		
			min	max	EV(lx)	VCC(V)	max	VCC(V)					
TPS820(F)	Side view	—	**	**	E = 0.1 mW/cm ²	5	0.5	5	870	±15	○	5-1	Opto-electronic switches
* TPS855(F)		—	210	350	100	5	0.5	5.5	640	±65	—	5-2	
TPS850	Chip type	—	180	300	100	3	0.5	3.3	640	±40	—	5-3	Illuminance sensors
TPS851		—	37	74	100	3	0.17	3.3	600	±55	—	5-4	
		TPS851(A)	37	62									
		TPS851(B)	44	74									
* TPS852		—	27	54	100	3	0.1	3.3	600	±55	—	5-5	
		TPS852(A)	30	50									

Note: V_{CC} = supply voltage E = radiant incident; E_v = illuminance

*: New product

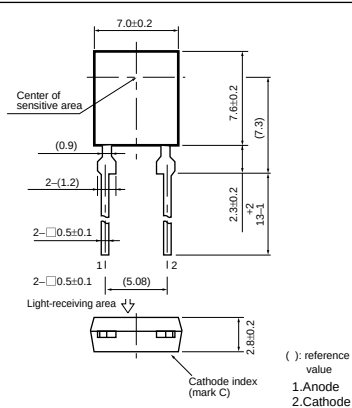
**: For details, please ask the nearest Toshiba sales office.

6

Product List

Unit: mm

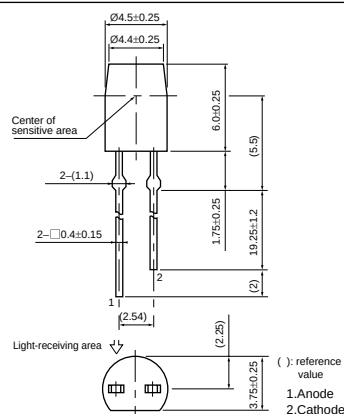
3-1



(): reference value

1. Anode
2. Cathode

3-2

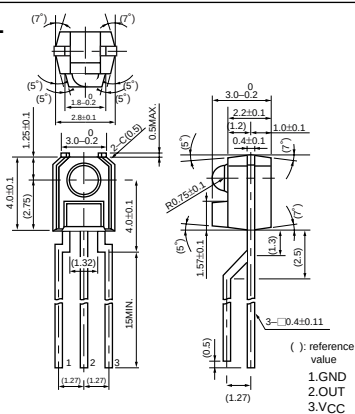


(): reference value

1. Anode

2. Cathode

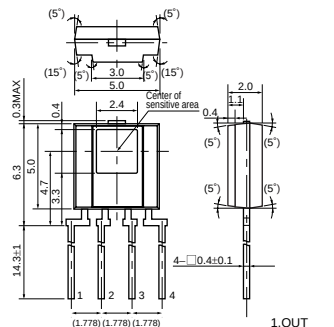
4-1



(): reference value

- 1.GND
- 2.OUT
- 3.VCC

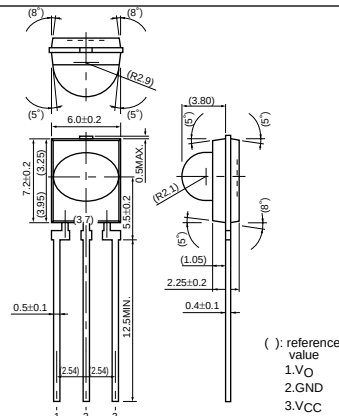
4-2



(): reference value
Tolerance unless
otherwise specified: ± 0.2

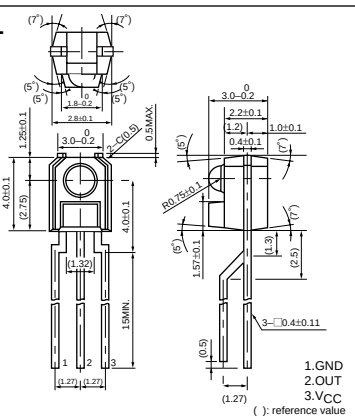
1.OUT
2.GND
3.LEDOUT
4.VCC

4-3



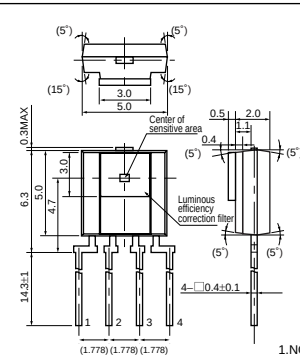
(): reference value
1.V_O
2.GND
3.V_{CC}

5-1



1.GND
2.OUT
3.V_{CC}
(): reference value

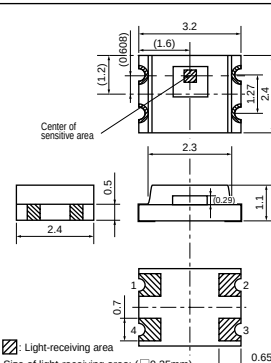
5-2



(): reference value
Tolerance unless otherwise specified: ± 0.2

1.NC
2.GND
3.OUT
4.V_{CC}

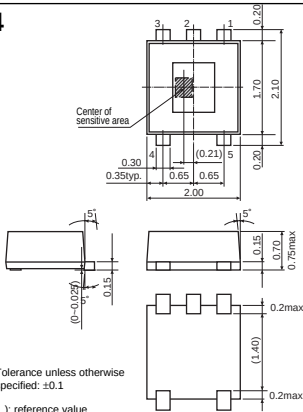
5-3



: Light-receiving area
 Size of light-receiving area: (□0.35mm) —
 Tolerance unless otherwise specified: ± 0.2
 (): reference value

1.GND
2.GND
3.V_{CC}
4.OUT

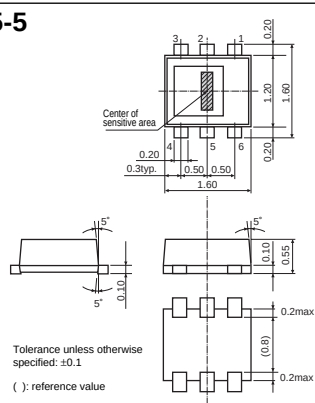
5-4



Tolerance unless otherwise specified: ± 0.1

1.VCC
2.GND
3.NC
4.NC
5.OUT

5-5



Tolerance unless otherwise specified: ± 0.1

1.VCC
2.GND
3.GND
4.GND
5.GND
6.OUT

6.6 Photointerrupters (phototransistor output and photodarlington transistor output)

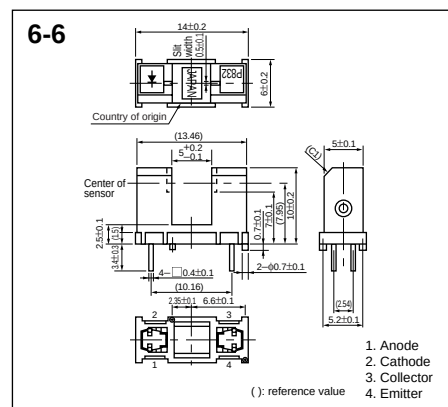
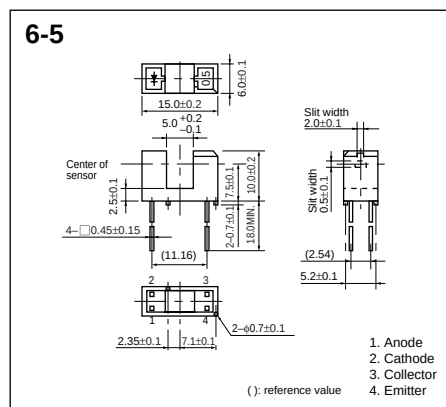
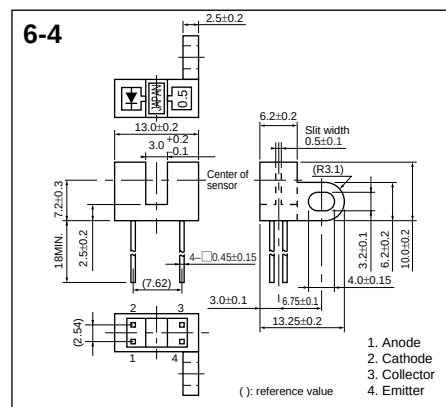
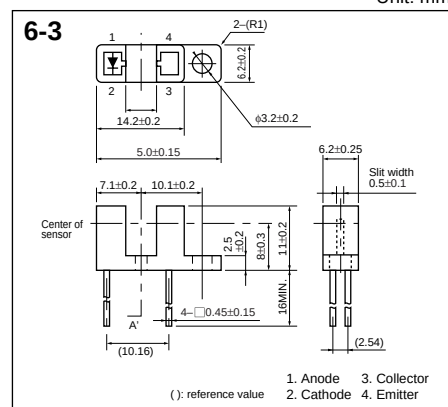
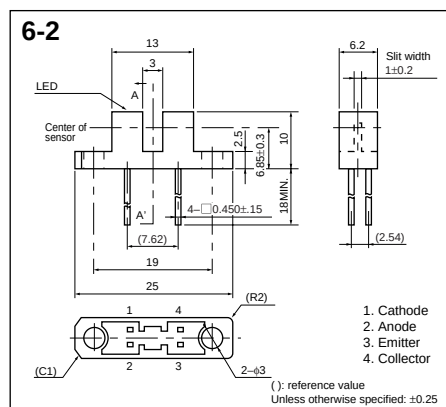
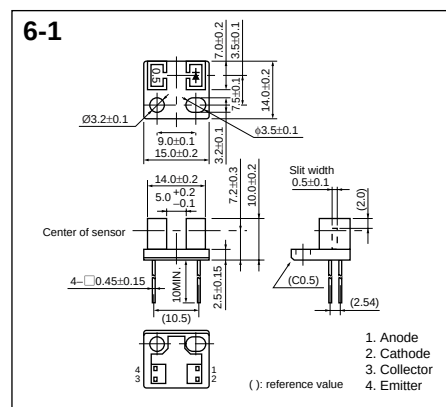
Part Number	Package Type	Gap (mm)	Slit Width (mm)	Electrical Characteristics (Ta = 25°C)				Maximum Rating★	Output Format		Package No.	Applications	
				Current transfer ratio (%)				Collector-emitter voltage (V)	S	D			
				min	max	I _F (mA)	V _{CE} (V)						
TLP803(F)	Double-sided screw mount type	5	0.5	2.5	60	20	5	35	○		6-1		
TLP853(F)		5	0.5	20	—	10	2	30		○			
TLP800A(F)		3	1	10	165	20	5	30	○				6-2
TLP822(F)	Single-sided screw mount type	5	0.5	5	75	10	2	35	○		6-3		
TLP862(F)		5	0.5	30	1200	1	2	30		○			
TLP825(F)		3	0.5	6	90	10	2	35	○				6-4
TLP865(F)		3	0.5	50	2000	1	2	30		○			
TLP827(F)		PCB direct-mount type with positioning pin	5	0.5**	5	75	10	2	35	○		6-5	
TLP867(F)	5		0.5**	30	1200	1	2	30		○			
TLP832(F)	5		0.5	5	100	10	2	35	○		6-6	Printers Fax machines Copiers Image scanners VCRs Optical mice Vending machines Tape readers	
TLP866(F)	5		0.5	30	1200	1	2	30		○	6-9		
TLP833(F)	5		0.5	5	100	10	2	35	○		6-7		
* TLP841	5		0.5	2.5	50	10	2	35	○		6-8		
TLP831(F)	4.2		0.5**	5	100	10	2	35	○		6-10		
TLP801A(F)	3		1	10	165	20	5	30	○		6-11		
TLP824(F)	3		0.5	6	90	10	2	35	○		6-12		Optical mice
TLP864(F)	3		0.5	50	2000	1	2	30		○			
TLP871(F)	3		0.5	50	2000	1	2	30		○	6-13		Vending machines
TLP813(F)	2.2		0.2**	2.5	50	20	5	35	○		6-14		Tape readers
TLP863(F)	2.2		0.2**	25	1000	1	2	30		○			
TLP830(F)	2		0.15	3	20	10	2	35	○		6-15		
TLP869(F)	2		0.15*	30	1200	1	2	30		○	6-16		
TLP846(F)	PCB direct-mount type, ultra-compact	1.2	0.15	3	24	5	2	35	○		6-17		
* TLP846(R,F)		1.2	0.15	4	20	5	2	35	○				
* TLP818(F)	PCB direct-mount type with dust cover	5	0.5	2.5	32	20	5	35	○		6-18		
TLP828(F)	PCB direct-mount type, dust-proof type	5	—	7.5	150	10	2	35	○		6-19		
* TLP844	PCB direct-mount type, ultra-compact	2	0.3	3.5	35	5	2	35	○		6-20		

★: $T_a = 25^\circ\text{C}$, *: Width of slit on LED side is 0.5 mm **: Horizontal slit; ***: Width of slit on LED side is 0.15 mm.

S = phototransistor output; D = photodarlington transistor output; PCB = printed circuit board; I_F = forward current; V_{CE} = collector-emitter voltage

*: New product

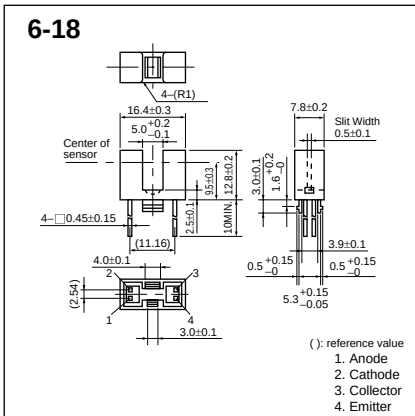
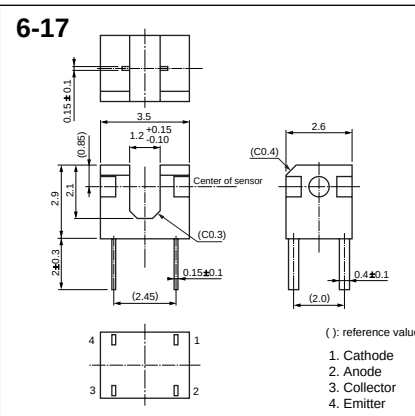
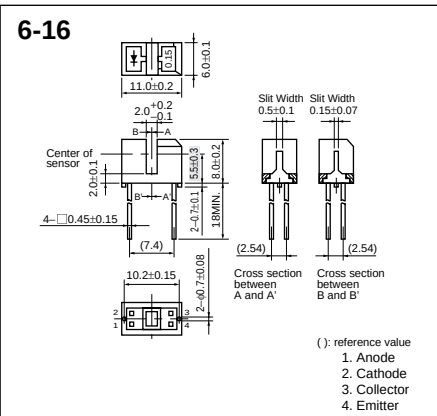
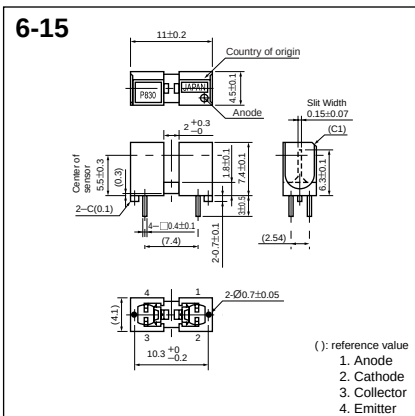
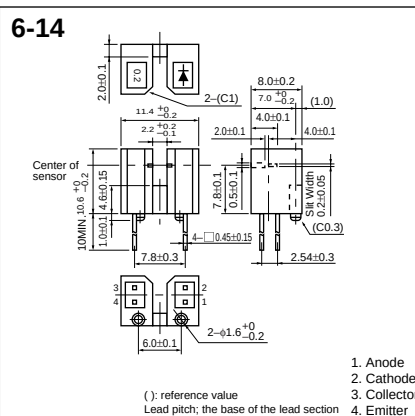
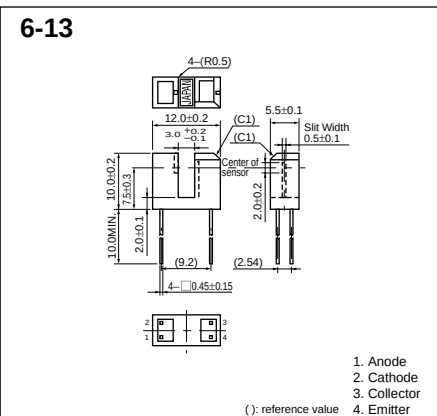
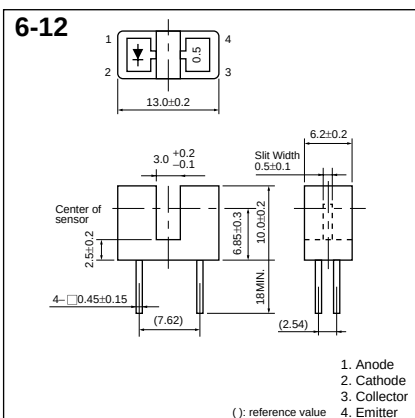
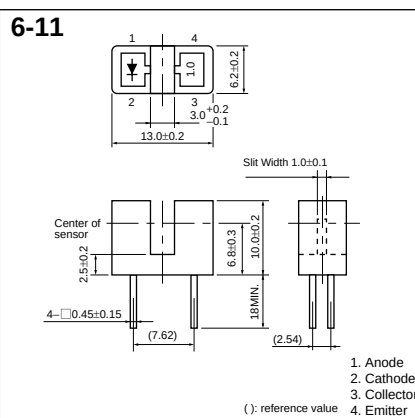
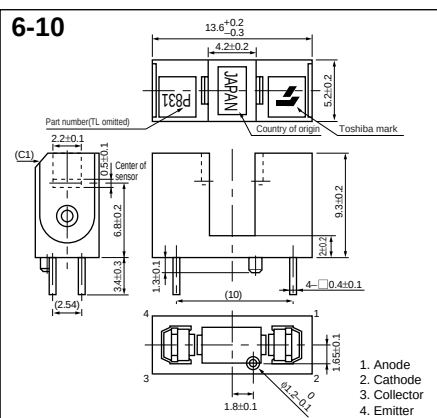
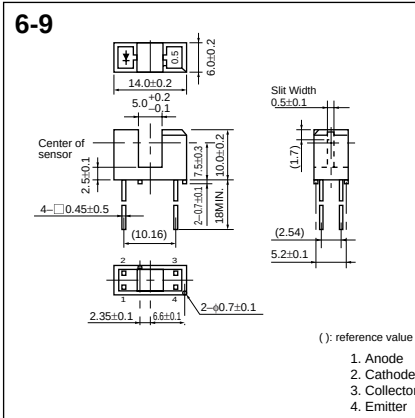
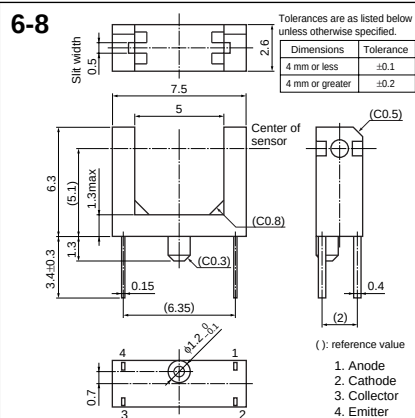
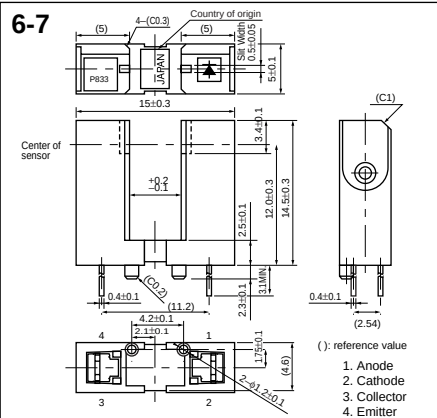
Unit: mm



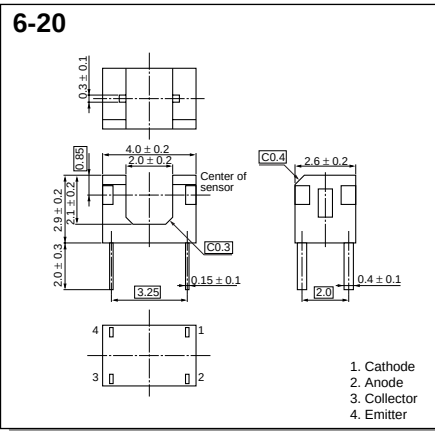
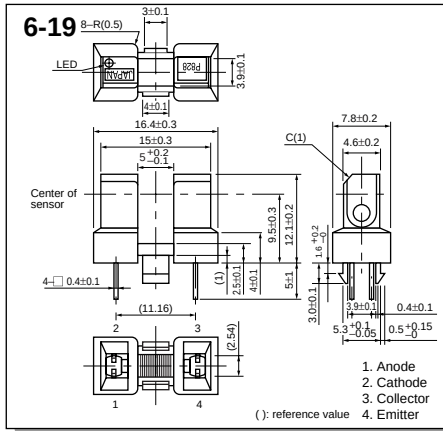
6

6

Unit: mm



Unit: mm



Column

Recommended Matched Pairs of LEDs and Detectors

Applications	LEDs	Detectors
Optical remote controls	TLN105B(F), TLN115A(F)	TPS703(F), TPS704(F), TPS705(F), TPS706(F) TPS830(F), TPS831(F)
Optoelectronic switches	TLN108(F), TLN201(F)	TPS601A(F)
	TLN119(F), TLN238(F)	TPS615(F), TPS616(F)
	TLN110(F), TLN231(F), TLN233(F)	TPS610(F), TPS611(F)
	TLN117(F)	TPS816(F)
Photointerrupters	TLN117(F)	TPS622(F), TPS820(F), TPS841(F), TPS842A(F), TPS843(F), TPS844(F)
AF cameras	TLN210(F), TLN212(F), TLN217(F)	—
	TLOH9202, TLOH9203	—
Fiberless optical transmissions	TLN231(F), TLN233(F), TLN225(F), TLN226(F), TLN227(F)	TPS703(F), TPS704(F), TPS705(F), TPS706(F)

6.7 Photointerrupters (photo-IC outputs)

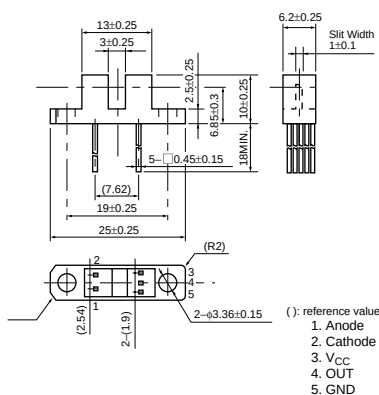
Part Number	Package Type	Gap (mm)	Slit width (mm)	Electrical Characteristics (Ta = 25°C)					Package No.	Applications
				Output format		Threshold input current (mA)				
				With resistor	Open-collector	L→H min	H→L max	Vcc (V)		
TLP1000A(F)	Double-sided screw mount type	3	1	○		2.5	—	5	7-1	Printers Fax machines Copiers Image scanners VCRs Optical mice Vending machines Tape readers
TLP1001A(F)		3	1	○		—	2.5	5		
TLP1006A(F)		3	0.5	○		4	—	5	7-2	
TLP1007A(F)		3	0.5	○		—	4	5		
TLP1016(F)		3	0.5		○	4	—	5		
TLP1017(F)		3	0.5		○	—	4	5		
TLP1002A(F)	Single-sided screw mount type	5	1	○		3	—	5	7-3	
TLP1003A(F)		5	1	○		—	3	5		
TLP1024(F)		3	0.5		○	4	—	5	7-4	
TLP1034(F)		3	0.5	○		4	—	5		
TLP1018(F)	PCB direct-mount type	5	0.5		○	6	—	5	7-5	
TLP1033A(F)		5	0.5		○	—	3	2.7-15	7-6	
TLP1004A(F)		3	0.5	○		4	—	5	7-7	
TLP1005A(F)		3	0.5	○		—	4	5		
TLP1014(F)		3	0.5		○	4	—	5		
TLP1015(F)		3	0.5		○	—	4	5		
TLP1020(F)		2.2	0.2*		○	10	—	5	7-8	
TLP1023(F)	PCB direct-mount type with dust cover	5	0.5		○	—	7	5	7-9	

* : Horizontal slit;

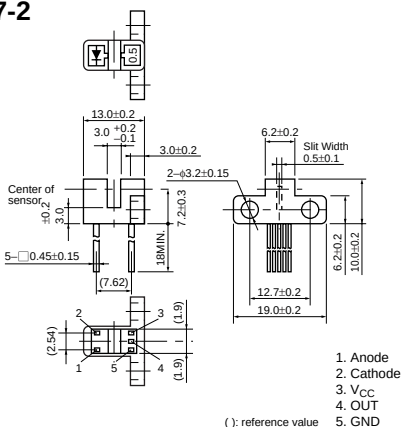
PCB = printed circuit board; V_{CC} = power supply voltage

Unit: mm

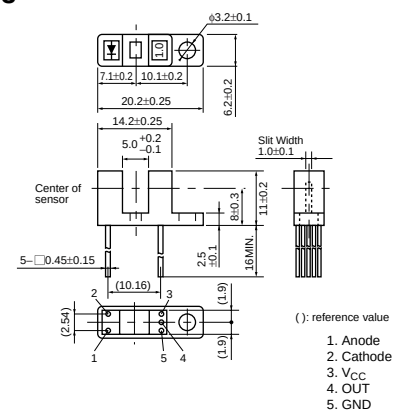
7-1



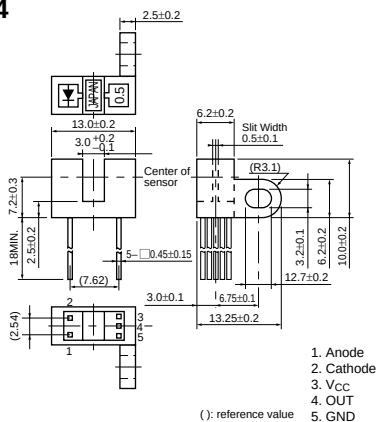
7-2



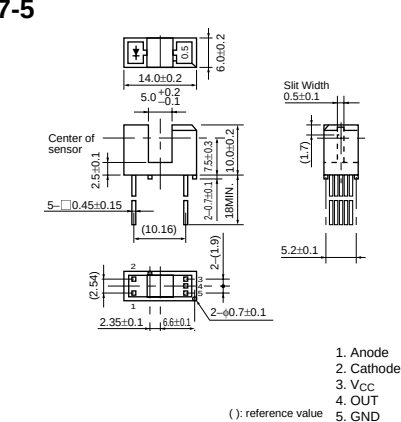
7-3



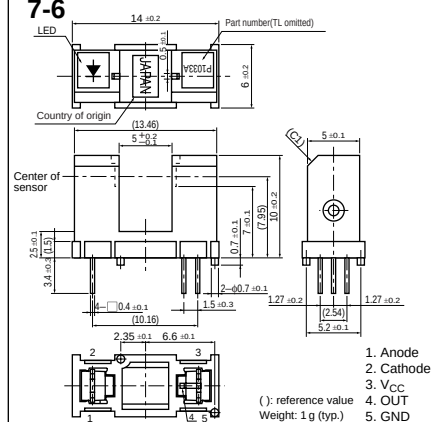
7-4



7-5



7-6

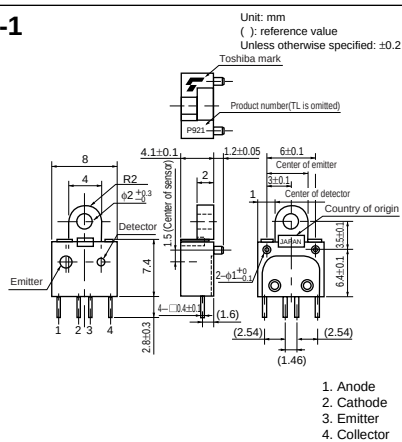


6.9 Photoreflective sensors

Part Number	Package Type	Electrical Characteristics (Ta = 25°C)								Output Format		Package No.	Applications
		Detection distance (mm)	Part Number with rank	Collector current (μA)				Dark current (μA)		S	D		
				Min	Max	I _F (mA)	V _{CE} (V)	Max	V _{CE} (V)				
TLP921(F)	Single-sided screw mount	8	—	580	2600	20	5	0.1	24	○	—	9-1	Equipment that senses the levels of various liquids (rectangular prism used)

Note: I_F = forward current; V_{CE} = collector-emitter voltage;
S = phototransistor output; D = photodarlington transistor output

9-1



EI Series Connectors (MT receptacle type) Manufactured by Tyco Electronics AMP K.K.

Housing-terminal en Block Type	Natural Color	Terminal Material	AWG size	External diameter of insulation coating	Matched Toshiba Part No.
	173977-3	Phosphor bronze	AWG26~AWG28	0.85 mm~1.05 mm	TLP1241 (C5,F) TLP1242 (C6,F) TLP1251 (C5,F) TLP1252 (C6,F) TLP1253 (C6,F) TLP1254 (C6,F)

CT Connectors (crimp Type II) Manufactured by Tyco Electronics AMP K.K.

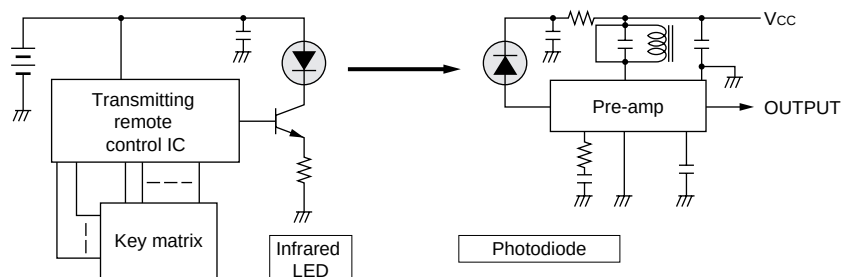
Housing Type No.	Natural Color	Blue	Yellow	Black	Matched Toshiba Part No.
	179228-3	2-179228-3	4-179228-3	6-179228-3	
Terminal	Model no.	Product type	Material	AWG size	External diameter of insulation coating
	179227-1	Plugged together	Phosphor bronze	AWG22~AWG26	0.93 mm~1.5 mm
	179518-1	Loose			
					TLP1242 (C6,F) TLP1252 (C6,F) TLP1253 (C6,F) TLP1254 (C6,F)

Tyco Electronics AMP K.K. Mini CT Connector (mass termination / crimp type)

Connector with housing terminal	Model no.	Connector type	Terminal material	AWG Size	External diameter of insulation coating	Matched Toshiba Part No.
	353293-3	Mass termination	Phosphor bronze	AWG26~28	0.85~0.95 mm	TLP1243(C8)
	353908-3	Crimp				TLP1255(C8)

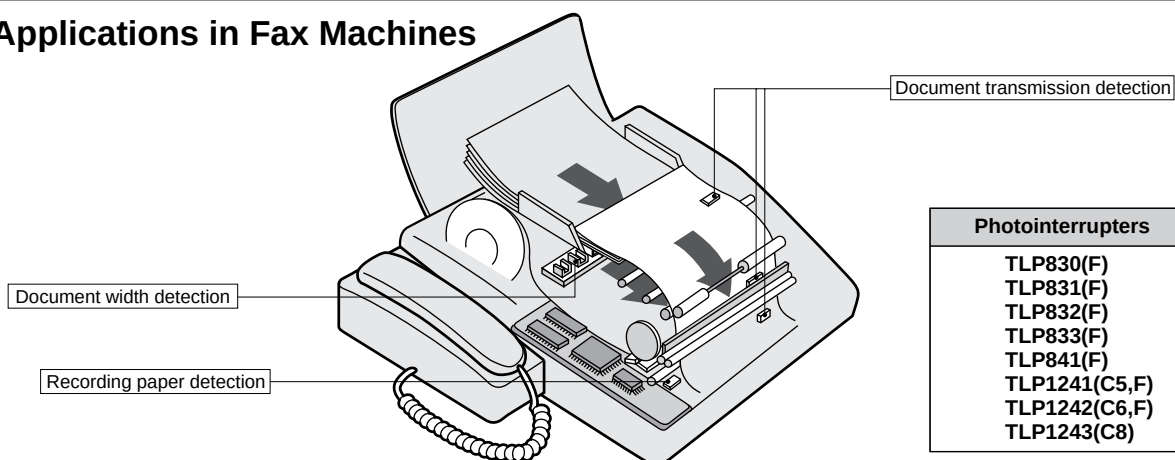
8 Photosensor Application Examples

8.1 Applications in Optical Remote Controls



Infrared LED	Photodiode
TLN105B(F) TLN115A(F)	TPS703(F) TPS704(F) TPS705(F) TPS706(F)

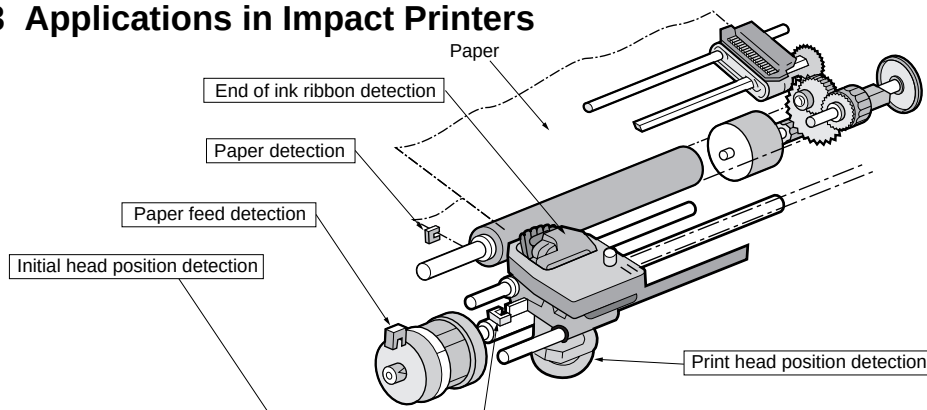
8.2 Applications in Fax Machines



Photointerrupters

TLP830(F)
TLP831(F)
TLP832(F)
TLP833(F)
TLP841(F)
TLP1241(C5,F)
TLP1242(C6,F)
TLP1243(C8)

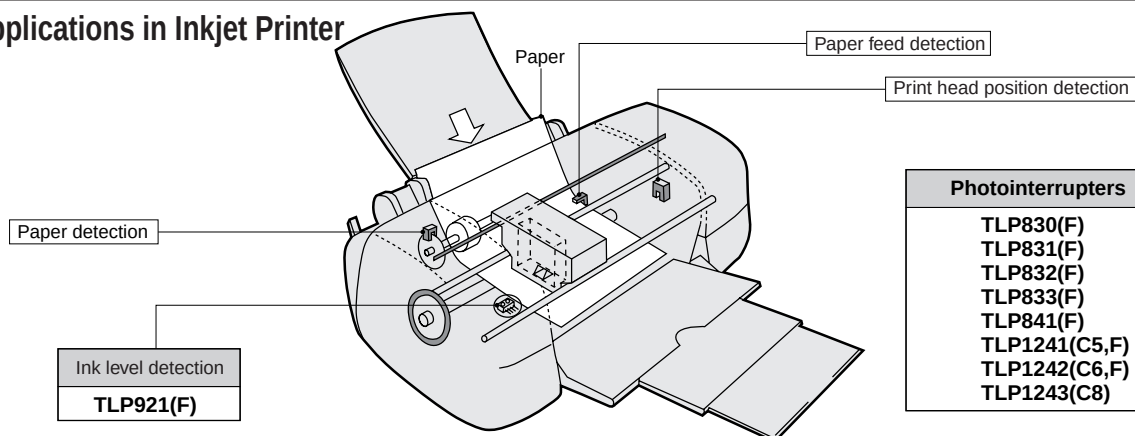
8.3 Applications in Impact Printers



Photointerrupters

TLP830(F)
TLP831(F)
TLP832(F)
TLP833(F)
TLP841(F)
TLP1241(C5,F)
TLP1242(C6,F)
TLP1243(C8)

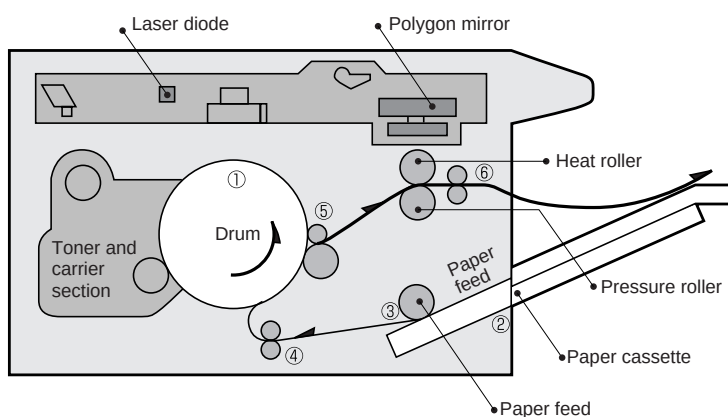
8.4 Applications in Inkjet Printer



Photointerrupters

TLP830(F)
TLP831(F)
TLP832(F)
TLP833(F)
TLP841(F)
TLP1241(C5,F)
TLP1242(C6,F)
TLP1243(C8)

8.5 Applications in Page Printers



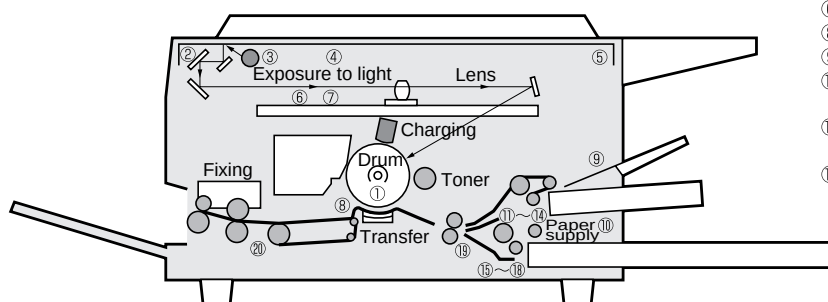
Application examples

- ① Drum revolution detection
- ② Paper presence detection
- ③, ④ Paper transport detection
- ⑤ Paper separation detection
- ⑥ Paper ejection detection

Photointerrupters

TLP832(F)
TLP833(F)
TLP841
TLP1033A(F)
TLP1241(C5,F)
TLP1242(C6,F)
TLP1243(C8)

8.6 Applications in Copiers



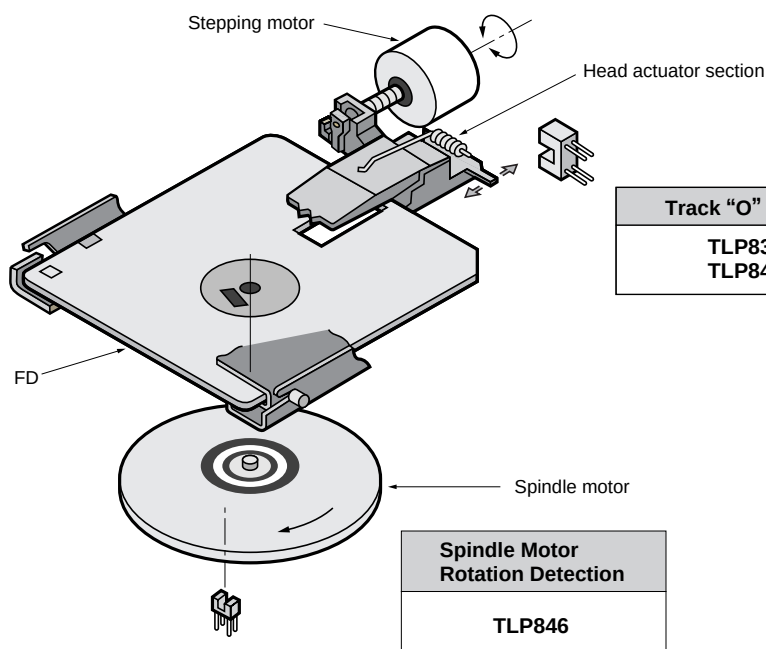
Application examples

- ① Drum position detection
- ②~⑤ Optics block position detection
- ⑥, ⑦ Lens position detection
- ⑧ Paper separation detection
- ⑨, ⑩ Paper presence detector
- ⑪~⑭ Upper cassette paper transport detection
- ⑮~⑰ Lower cassette paper transport detection
- ⑱, ⑲ Paper ejection and transport detection

Photointerrupters

TLP1000 Series
TLP1200 Series

8.7 Applications in Floppy Disk Drives



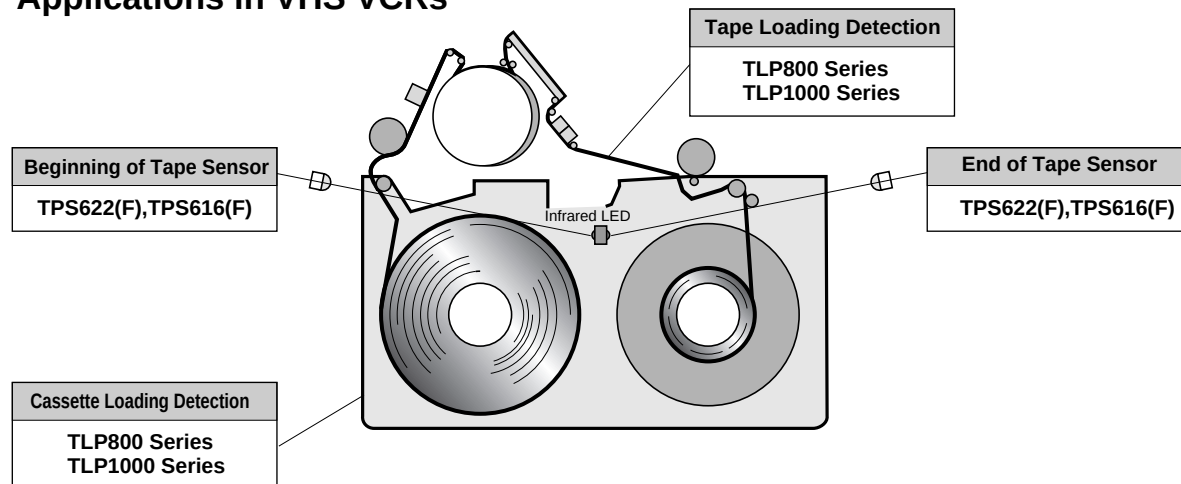
Track "O" Sensor

TLP830(F)
TLP846

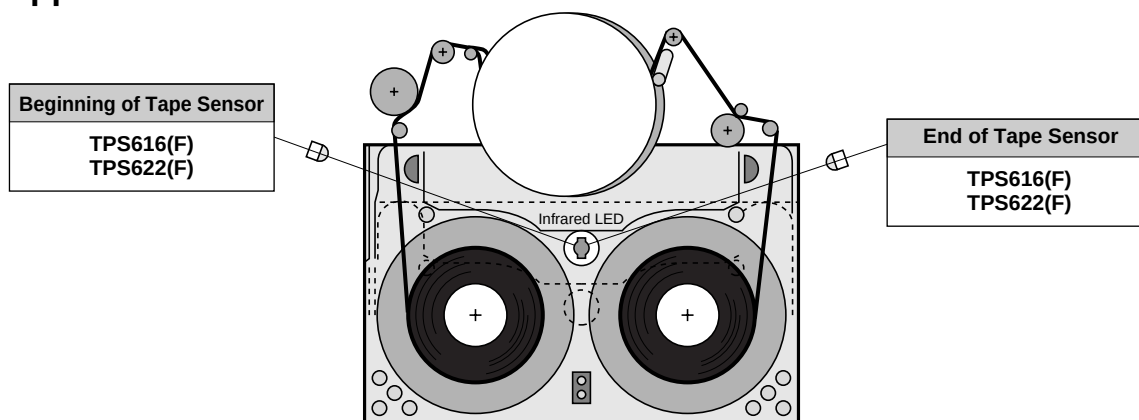
Spindle Motor Rotation Detection

TLP846

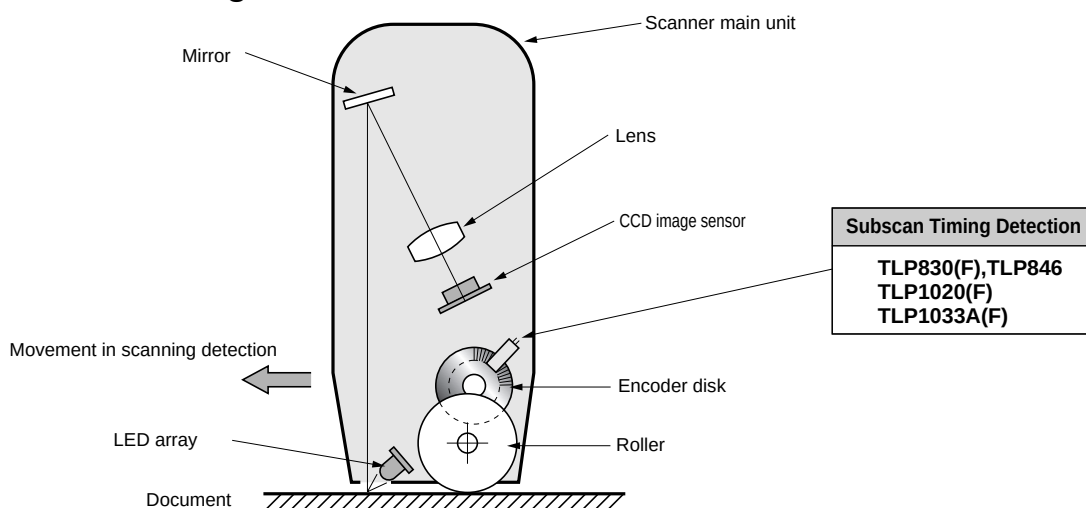
8.8 Applications in VHS VCRs



8.9 Applications in 8-mm VCRs

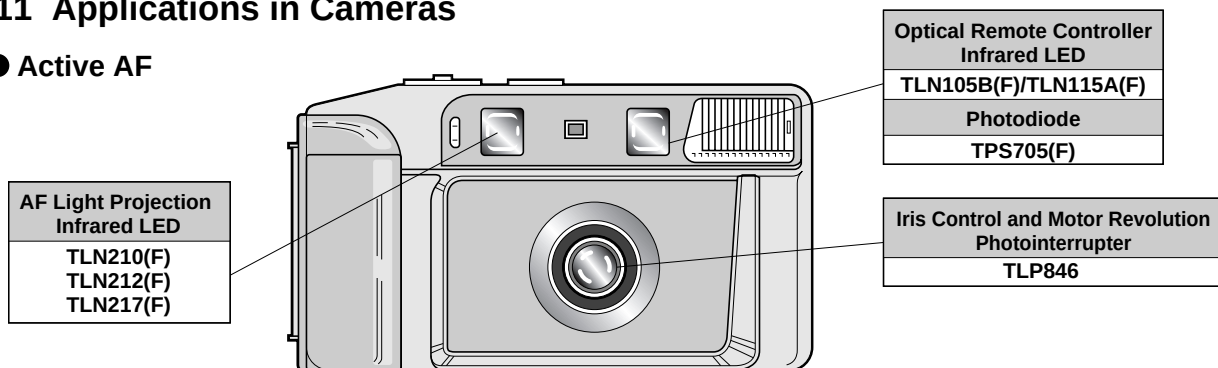


8.10 Applications in Image Scanners

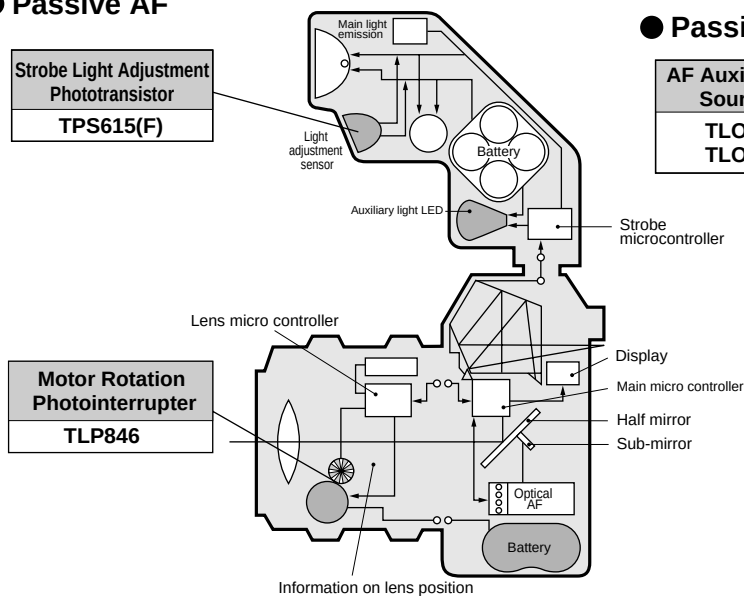


8.11 Applications in Cameras

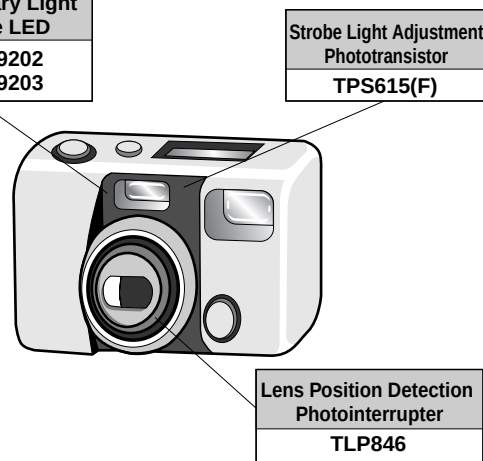
● Active AF



● Passive AF

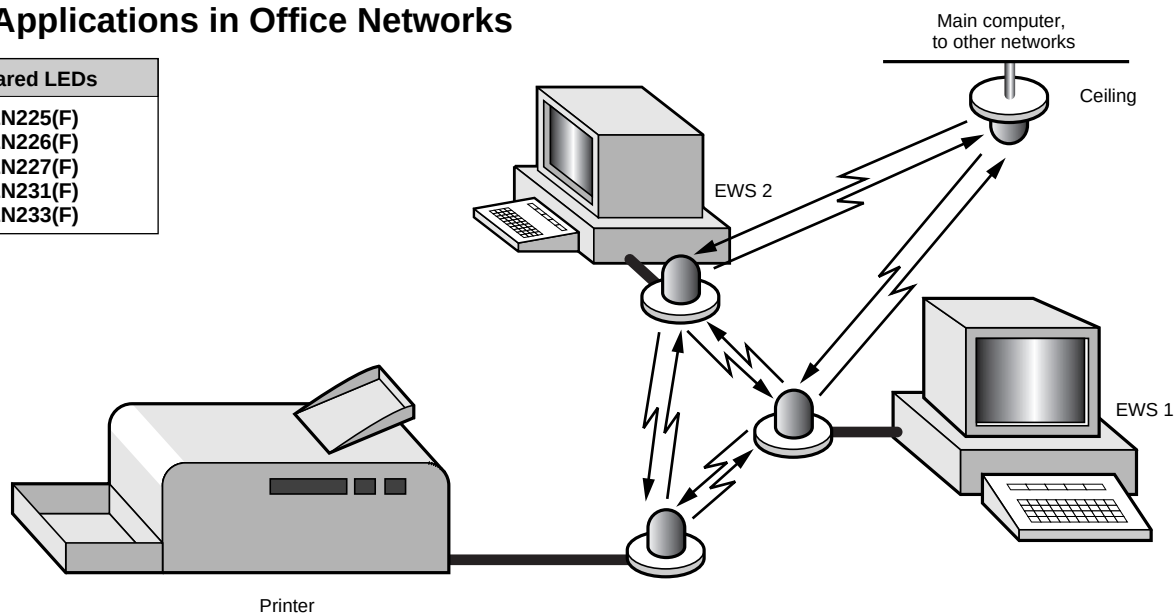


● Passive AF



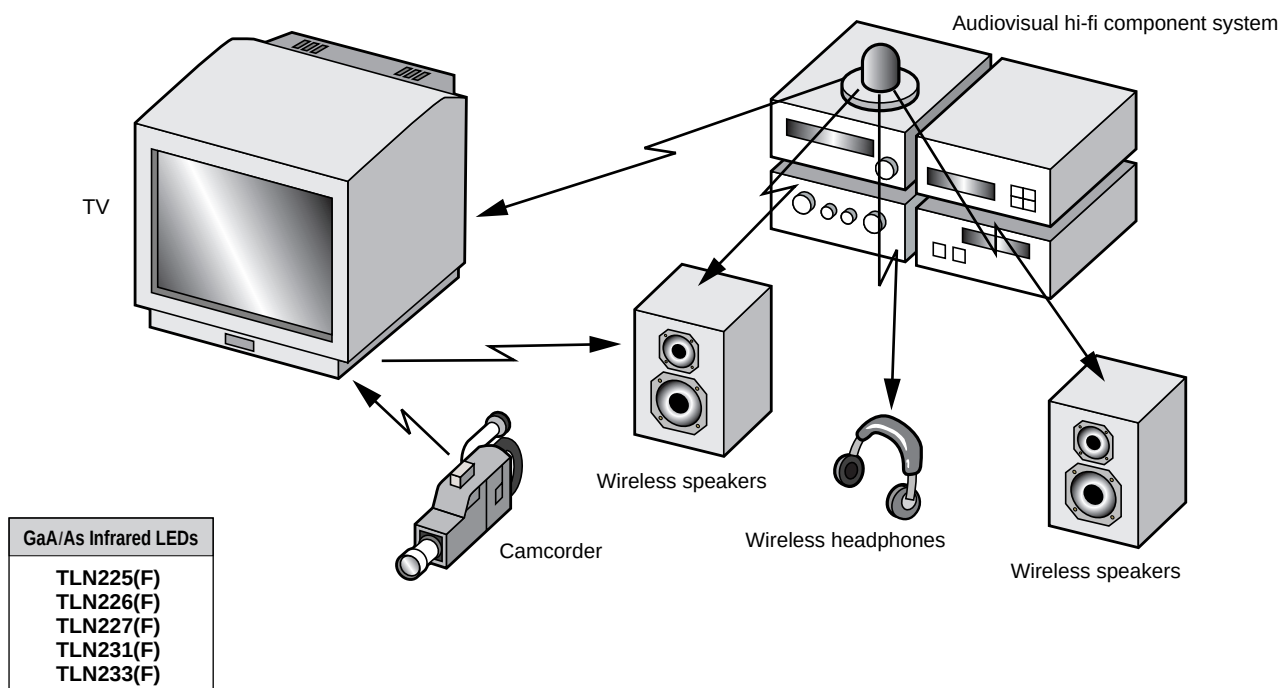
8.12 Applications in Office Networks

Infrared LEDs
TLN225(F)
TLN226(F)
TLN227(F)
TLN231(F)
TLN233(F)

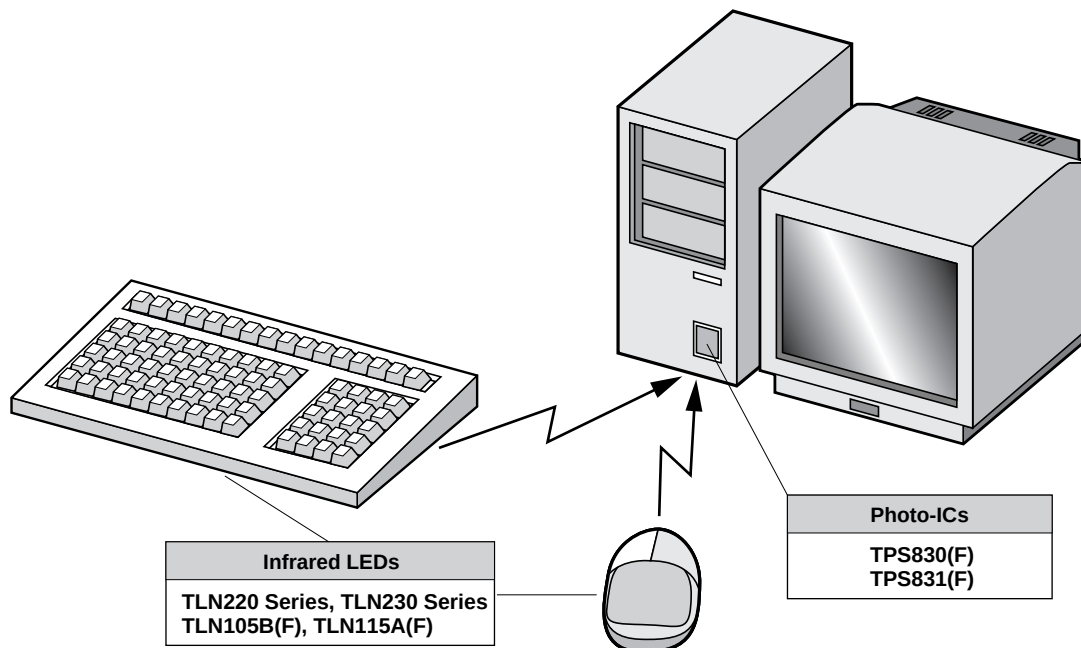


8 Photosensor Application Examples

8.13 Applications in Audiovisual hi-fi Component Systems



8.14 Applications in Wireless Keyboards and Wireless Mice



8.15 Others

Category	Appliance	Applications	Recommended Devices
AV equipment	TVs	Luminosity adjustment of TV screen	TPS850, TSP851, TPS855
	VCRs	Luminosity adjustment of monitor screen	TPS851, TPS852
	Digital still cameras		
	CD players	Pick-up head home position detection	TLP800 Series
Household electrical goods and domestic electrical appliances	Refrigerators	Ice-maker internal position detection	TLP800 Series
		Ambient-light detection	TPS850, TPS851, TPS855
	Microwave ovens	Detection of height and number of cooked objects	TLN108(F) → TPS601A(F)
	Electric pots	Ambient-light detection	TPS850, TPS851, TPS855
	Air-conditioners	Remote controls	TLN105B(F) TLN115A(F) } → { TPS704(F) TPS705(F)
		Ambient-light detection	TPS850, TPS851, TPS855
		Louver direction detection	TLP1000 Series
	Automatic blinkers	Ambient-light detection	TPS850, TPS851, TPS855
	Washing machines	Detection of degree of rinsing	TLN115A(F) → TPS611(F)
	Health equipment	Internal mechanism position detection	Any photointerrupter
	Sewing machines	Detection of needle up/down and cloth feeding	Any photointerrupter
Control and measurement	Opto-electronic switches	Emitter and detector sources	TLN201(F) TLN117(F) → TPS816(F)
	Rotary encoders	Rotation detection	TPS601A(F)
	Various measurement devices	Distance detection	TLN201(F) → TPS708(F)
	Automatic production machines	Internal mechanism position detection	TLP1200 Series
	Industrial robots	Object detection	TLN108(F) → TPS601A(F)

Category	Appliance	Applications	Recommended Devices
Office equipment automatic vending machines and office equipment	Copiers	Paper size detection, toner quantity detection and toner density detection	TLN117(F) → TPS820(F)
	Printers	Paper size detection, toner quantity detection and toner density detection	TLN117(F) → TPS820(F)
		Ink level detection	TLP921(F)
	Automatic vending machines	Coin detection and product feed detection	TLN108(F) → TPS601A(F)
		Ambient-light detection	TPS850, TPS851, TPS855
	Ticketing machines	Coin detection, ticket feed detection	TLN108 → TPS601A
	Portable information devices	Luminosity adjustment of monitor screens	TPS850, TPS851, TPS852
	Handy terminals	Optical communications	TPS843(F) TLN231(F) TLN233(F) TLN225(F) TLN226(F) TLN227(F)
	Notebook PCs	Luminosity adjustment of screens	TPS850, TPS851, TPS852
Communications devices	PC monitors	Luminosity adjustment of screens	TPS850, TPS851, TPS855
	Telephones	Hook sensors	TLP831(F)
	Portable phones	Luminosity adjustment of monitor screens	TPS851, TPS852
	Photo telephones	Information transmission	TLN115A(F) → { TPS704(F) TPS705(F) TPS830(F) TPS831(F) }
	Optical communications	Space transmission	TLN115A(F) → TPS830(F) TPS831(F) TLN225(F) } TLN226(F) } TLN227(F) } TLN231(F) } TLN233(F) }
Others	Gaming equipment (pachinko, computer games etc.)	Coin detection and detection of position of internal mechanism	TLN108(F) → TPS601A(F) TLP1200 Series
	Toys (rifle games) (remote controls, robots) (game controls)	Remote controls	TLN115A(F) → { TPS704(F) TPS705(F) TPS830(F) TPS831(F) } TLN231(F) TLN233(F)
	Garage doors	Remote controls	TLN115A(F) → { TPS704(F) TPS705(F) }

9

List of Final-Phase Production Products

Note that the following products are superseded and final-phase products and not recommended for new design.

Part Number	Final-Phase	Recommended Alternative product	Compatibility
TLN101A	○	TLN108(F)	I
TLN102	○	—	—
TLN103	○	TLN119(F)	III
TLN104	○	—	—
TLN104(LB)	○	—	—
TLN107A	○	TLN117(F)	III
TLN113	○	TLN119(F)	III
TLN203	○	TLN238(F)	III
TLN205	○	TLN231(F)	II
TLN208	○	—	—
TLN221	○	TLN231(F)	II
TLN223	○	TLN233(F)	II
TLR215A	○	—	—
TLRA270	○	—	—
TLRH9202	○	—	—
TLRH9100	○	—	—
TLOH9200	○	TLOH9202, TLOH9203	III
TPS603A	○	TPS615(F)	III
TPS604	○	—	—
TPS605	○	—	—
TPS605(LB)	○	—	—
TPS606	○	—	—
TPS606(LB)	○	—	—
TPS607A	○	—	—
TPS608A	○	—	—
TPS612	○	TPS616(F)	III
TPS613	○	TPS615(F)	III
TPS614	○	—	—
TPS617	○	—	—
TPS618	○	TPS622(F)	III
TPS621	○	—	—
TPS625	○	—	—
TPS626	○	—	—
TPS708	○	—	—
TPS721A	○	—	—
TPS723A	○	—	—
TPS805	○	TPS841(F)	III
TPS806	○	TPS842A(F)	III
TPS807	○	TPS843(F)	III
TPS808	○	TPS844(F)	III
TPS811	○	TPS841(F)	II
TPS812	○	TPS842A(F)	II
TPS813	○	TPS843(F)	II
TPS814	○	TPS844(F)	II
TPS842	○	TPS842A(F)	III
TPS818	○	TPS855(F)	III
TPS819	○	TPS850	II
TPS823	○	—	—

Part Number	Final-Phase	Recommended Alternative product	Compatibility
TPS825	○	—	—
TPS826	○	—	—
TLP507A	○	TLP864(F)	III
TLP810	○	TLP846	II
TLP812	○	TLP846	II
TLP814	○	TLP844	II
TLP815	○	TLP825(F)	III
TLP836	○	TLP846	II
TLP838	○	TLP832(F)	III
TLP903	○	—	—
TLP904	○	—	—
TLP907	○	—	—
TLP907(LB)	○	—	—
TLP908	○	—	—
TLP908(LB)	○	—	—
TLP909	○	—	—
TLP910	○	—	—
TLP1019	○	TLP1033A(F)	III
TLP1025	○	—	—
TLP1029	○	TLP1033A(F)	III
TLP1031	○	TLP1033A(F)	III
TLP1031A	○	TLP1033A(F)	III
TLP1033	○	TLP1033A(F)	III
TLP1037	○	—	—
TLP1037A	○	—	—
TLP1039	○	TLP1033A(F)	III
TLP1039A	○	TLP1033A(F)	III
TLP1201A	○	—	—
TLP1201A(C1)	○	—	—
TLP1201A(C2)	○	—	—
TLP1204(C1)	○	—	—
TLP1204(C3)	○	—	—
TLP1205	○	—	—
TLP1208(C3)	○	—	—
TLP1209(C7)	○	—	—
TLP1211	○	—	—
TLP1215(C1)	○	TLP1253(C6,F)	III
TLP1215(C7)	○	TLP1253(C6,F)	III
TLP1217(C2)	○	TLP1252(C6,F)	III
TLP1221(C7)	○	—	—
TLP1224	○	—	—
TLP1224(C1)	○	—	—
TLP1230(C4)	○	TLP1241(C5,F) TLP1242(C6,F)	III
TLP1231(C5)	○	TLP1241(C5,F) TLP1242(C6,F)	III

Description of the compatibility

I : Electrically equivalent or enhanced. The lead-free product does not require any changes to surrounding circuitry. II: Electrically equivalent or enhanced. Part of the surrounding circuitry should be modified.
III: Electrically equivalent or enhanced. Surrounding circuitry should be modified since the pin configuration and package type of the lead-free product are different from those of the lead-containing product.

10 Related Documents on Websites

The related documents on this catalog are also published on the website shown.

As of March 2004

<http://www.semicon.toshiba.co.jp/eng/prd/opt/index.html>



Part Number	Page	Part Number	Page	Part Number	Page
TLN105B(F)	10	TLP818(F)	15	TLP1252(C6,F)	19
TLN108(F)	10	TLP822(F)	15	TLP1253(C6,F)	19
TLN110(F)	10	TLP824(F)	15	TLP1254(C6,F)	19
TLN115A(F)	10	TLP825(F)	15	TLP1255(C8)	19
TLN117(F)	10	TLP827(F)	15	TLP921(F)	20
TLN119(F)	10	TLP828(F)	15		
TLN201(F)	10	TLP830(F)	15		
TLN210(F)	10	TLP831(F)	15		
TLN212(F)	10	TLP832(F)	15		
TLN217(F)	10	TLP833(F)	15		
TLN225(F)	10	TLP841	15		
TLN226(F)	10	TLP844	15		
TLN227(F)	10	TLP846	15		
TLN231(F)	10	TLP853(F)	15		
TLN233(F)	10	TLP862(F)	15		
TLN238(F)	10	TLP863(F)	15		
TLOH9202	10	TLP864(F)	15		
TLOH9203	10	TLP865(F)	15		
TPS601A(F)	12	TLP866(F)	15		
TPS610(F)	12	TLP867(F)	15		
TPS611(F)	12	TLP869(F)	15		
TPS615(F)	12	TLP871(F)	15		
TPS616(F)	12	TLP1000A(F)	18		
TPS622(F)	12	TLP1001A(F)	18		
TPS703(F)	13	TLP1002A(F)	18		
TPS704(F)	13	TLP1003A(F)	18		
TPS705(F)	13	TLP1004A(F)	18		
TPS706(F)	13	TLP1005A(F)	18		
TPS816(F)	13	TLP1006A(F)	18		
TPS820(F)	13	TLP1007A(F)	18		
TPS830(F)	13	TLP1014(F)	18		
TPS831(F)	13	TLP1015(F)	18		
TPS841(F)	13	TLP1016(F)	18		
TPS842A(F)	13	TLP1017(F)	18		
TPS843(F)	13	TLP1018(F)	18		
TPS844(F)	13	TLP1020(F)	18		
TPS850	13	TLP1023(F)	18		
TPS851	13	TLP1024(F)	18		
TPS852	13	TLP1033A(F)	18		
TPS855(F)	13	TLP1034(F)	18		
TLP800A(F)	15	TLP1241(C5,F)	19		
TLP801A(F)	15	TLP1242(C6,F)	19		
TLP803(F)	15	TLP1243(C8)	19		
TLP813(F)	15	TLP1251(C5,F)	19		

**Toshiba America
Electronic Components, Inc.**

Headquarters-Irvine, CA
9775 Toleda Way, Irvine, CA 92618, U.S.A.
Tel: (949)455-2000 Fax: (949)859-3963

Boulder, CO (Denver)
3100 Arapahoe #500,
Boulder, CO 80303, U.S.A.
Tel: (303)442-3801 Fax: (303)442-7216

Deerfield, IL (Chicago)
One Pkwy., North, #500, Deerfield,
IL 60015-2547, U.S.A.
Tel: (847)945-1500 Fax: (847)945-1044

Duluth, GA (Atlanta)
3700 Crestwood Pkwy, #160,
Duluth, GA 30096, U.S.A.
Tel: (770)931-3363 Fax: (770)931-7602

Beaverton/Portland, OR
8323 SW Cirrus Drive, Beaverton,
OR 97008, U.S.A.
Tel: (503)466-3721 Fax: (503)629-0827

Raleigh, NC
3120 Highwoods Blvd., #108, Raleigh,
NC 27604, U.S.A.
Tel: (919)859-2800 Fax: (919)859-2898

Richardson, TX (Dallas)
777 East Campbell Rd., #650, Richardson,
TX 75081, U.S.A.
Tel: (972)480-0470 Fax: (972)235-4114

San Jose Engineering Center, CA
1060 Rincon Circle, San Jose, CA 95131, U.S.A.
Tel: (408)526-2400 Fax: (408)526-8910

Wakefield, MA (Boston)
401 Edgewater Place, #360, Wakefield,
MA 01880-6229, U.S.A.
Tel: (781)224-0074 Fax: (781)224-1095

Toshiba do Brasil, S.A.

Electronics Component Div.
Rua Afonso Celso, 55213 ardar,
Vila Mariana CEP 04119-002, São Paulo, Brasil
Tel: (011)5576-6619 Fax: (011)5576-6607

Toshiba India Private Ltd.
6F DR. Gopal Das Bhawan 28,
Barakhamba Road, New Delhi, 110001, India
Tel: (011)2371-4601 Fax: (011)2371-4603

Toshiba Electronics Europe GmbH

Düsseldorf Head Office
Hansaallee 181, D-40549 Düsseldorf,
Germany
Tel: (0211)5296-0 Fax: (0211)5296-400

München Office
Büro München Hofmannstrasse 52,
D-81379, München, Germany
Tel: (089)748595-0 Fax: (089)748595-42

France Branch
Les Jardins du Golf 6 rue de Rome 93561,
Rosny-Sous-Bois, Cedex, France
Tel: (1)48-12-48-12 Fax: (1)48-94-51-15

Italy Branch
Centro Direzionale Colleoni,
Palazzo Perseo 3,
I-20041 Agrate Brianza, (Milan), Italy
Tel: (039)68701 Fax: (039)6870205

Spain Branch
Parque Empresarial, San Fernando, Edificio Europa,
1^a Planta, E-28831 Madrid, Spain
Tel: (91)660-6798 Fax: (91)660-6799

U.K. Branch
Riverside Way, Camberley Surrey,
GU15 3YA, U.K.
Tel: (01276)69-4600 Fax: (01276)69-4800

Sweden Branch
Gustavslundsvägen 18, 5th Floor,
S-167 15 Bromma, Sweden
Tel: (08)704-0900 Fax: (08)80-8459

**Toshiba Electronics Asia
(Singapore) Pte. Ltd.**

Singapore Head Office
438B Alexandra Road, #06-08/12 Alexandra
Technopark, Singapore 119968
Tel: (6278)5252 Fax: (6271)5155

**Toshiba Electronics Service
(Thailand) Co., Ltd.**
135 Moo 5, Bangkadi Industrial Park, Tivanon Road,
Pathumthani, 12000, Thailand
Tel: (02)501-1635 Fax: (02)501-1638

**Toshiba Electronics Trading
(Malaysia) Sdn. Bhd.**

Kuala Lumpur Head Office
Suite W1203, Wisma Consplant, No.2,
Jalan SS 16/4, Subang Jaya, 47500 Petaling Jaya,
Selangor Darul Ehsan, Malaysia
Tel: (03)5631-6311 Fax: (03)5631-6307

Penang Office
Suite 13-1, 13th Floor, Menara Penang Garden,
42-A, Jalan Sultan Ahmad Shah,
10050 Penang, Malaysia
Tel: (04)226-8523 Fax: (04)226-8515

Toshiba Electronics Philippines, Inc.
26th Floor, Citibank Tower, Valero Street, Makati,
Manila, Philippines
Tel: (02)750-5510 Fax: (02)750-5511

Toshiba Electronics Asia, Ltd.

Hong Kong Head Office
Level 11, Tower 2, Grand Century
Place, No.193, Prince Edward Road West,
Mongkok, Kowloon, Hong Kong
Tel: 2375-6111 Fax: 2375-0969

Beijing Office
Room 714, Beijing Fortune Building,
No.5 Dong San Huan Bei-Lu, Chao Yang District,
Beijing, 100004, China
Tel: (010)6590-8796 Fax: (010)6590-8791

Chengdu Office
Suite 403A, Holiday Inn Crown Plaza 31, Zongfu Street,
Chengdu, 610016, Sichuan, China
Tel: (028)675-1773 Fax: (028)675-1065

Qingdao Office
Room B707, Full Hope Plaza,
12 Hong Kong Central Road, Qingdao,
Shandong, 266071, China
Tel: (0532)502-8105 Fax: (0532)502-8109

Toshiba Electronics Shenzhen Co., Ltd.
Room 2601-2609, 2616, Office Tower Shun Hing Square,
Di Wang Commercial Center, 5002 Shennan Road East,
Shenzhen, 518008, China
Tel: (0755)2583-0827 Fax: (0755)8246-1581

Toshiba Electronics Korea Corporation

Seoul Head Office
891, Sejong Securities Bldg. 20F, Daechi-dong,
Gangnam-gu, Seoul, 135-738, Korea
Tel: (02)3484-4334 Fax: (02)3484-4302

Gumi Office
6F, Goodmorning Securities Building,
56 Songjung-dong, Gumi-shi,
Kyeongbuk, 730-090, Korea
Tel: (054)456-7613 Fax: (054)456-7617

Toshiba Electronics (Shanghai) Co., Ltd.
11F, HSBC Tower, 101
Yin Cheng East Road, Pudong New Area, Shanghai,
200120, China
Tel: (021)6841-0666 Fax: (021)6841-5002

Hangzhou Office
9F Zhejiang San Rui Bldg. No. 36 QingChun Road,
Hangzhou 310004, China
Tel: (0571)8704-0255 Fax: (0571)8704-0200

Tsurong Xiamen Xiangyu Trading Co., Ltd.
14G, International Bank BLDG., No.8 Lujiang Road,
Xiamen, 361001, China
Tel: (0592)226-1398 Fax: (0592)226-1399

Toshiba Electronics Taiwan Corporation

Taipei Head Office
17F, Union Enterprise Plaza Building, 109
Min Sheng East Road, Section 3, Taipei,
105, Taiwan
Tel: (02)2514-9988 Fax: (02)2514-7892

Kaohsiung Office
16F-A, Chung-Cheng Building, 2, Chung-Cheng 3Road,
Kaohsiung, 800, Taiwan
Tel: (07)237-0826 Fax: (07)236-0046

The information contained herein is subject to change without notice. 021023_D

The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA for any infringements of patents or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of TOSHIBA or others. 021023_C

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. 021023_A

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. 021023_B

The products described in this document may include products subject to the foreign exchange and foreign trade laws. 021023_F

GaAs(Gallium Arsenide) is used in some of the products. The dust or vapor is harmful to the human body. Do not break, cut, crush or dissolve chemically. 021023_J

TOSHIBA

TOSHIBA CORPORATION
Semiconductor Company

Website: <http://www.semicon.toshiba.co.jp/eng>

© 2004 TOSHIBA CORPORATION

Previous edition: 3612C-0209

2004-03(1.0k)PC-O

Printed in Japan



100% recycled paper