LA0152CS — Monolithic Linear IC For Ultra-small Ambient Light Sensor Photo IC

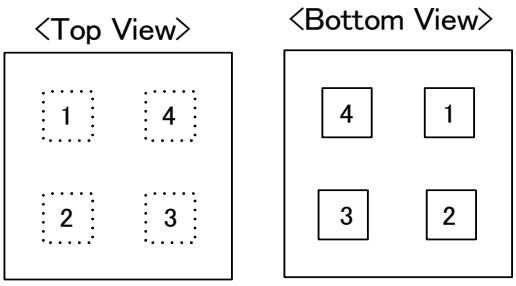
Overview

The LA0152CS is a photo IC for micro-sized ambient light sensor. It enables to be mounted on a very small limited space such as on the cell phones which is becoming small and thinner and on other mobile applications. It is suitable for application like mobile phone, laptop computer, PDA, DSC and camcorder.

Features

- Smallest ODCSP package in the world (1.01mmX1.01mm, thickness:0.6mm)
- Integrated sleep mode (Max current 0.1uA)
- Low power consumption (150uA at 1,000Lux)
- Low dark current (Max current 0.1uA)
- No sensibility in infrared area
- Less difference in sensibility depending on the type of light source (Fluorescent/Incandescent:1.0/1.1)
- Linear current output
- Wide dynamic range (1~100,000Lux)
- Halogen free compliant

Pin Assignment



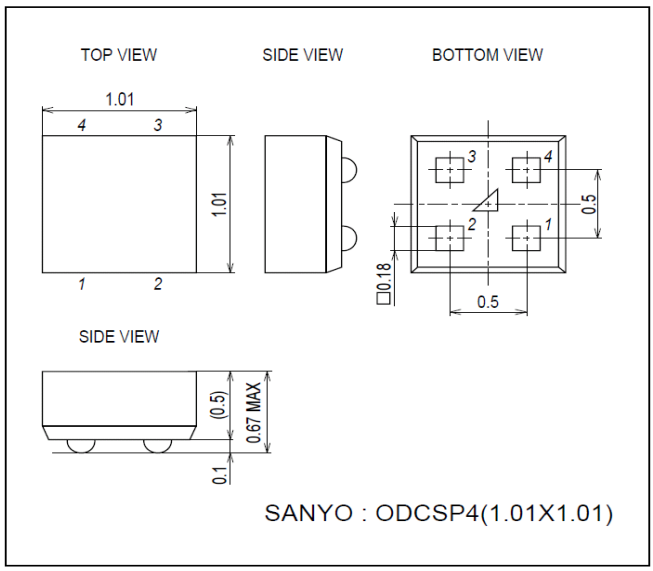
No.	Name	Function
1	V_{CC}	Power supply
2	EN	Enable
3	GND	Ground
4	OUT	Output

Ball Pitch : 0.5mm , Ball Size : 0.18mm □

Package Dimensions

unit : mm (typ)

3350A



Pad Layout (Photos)

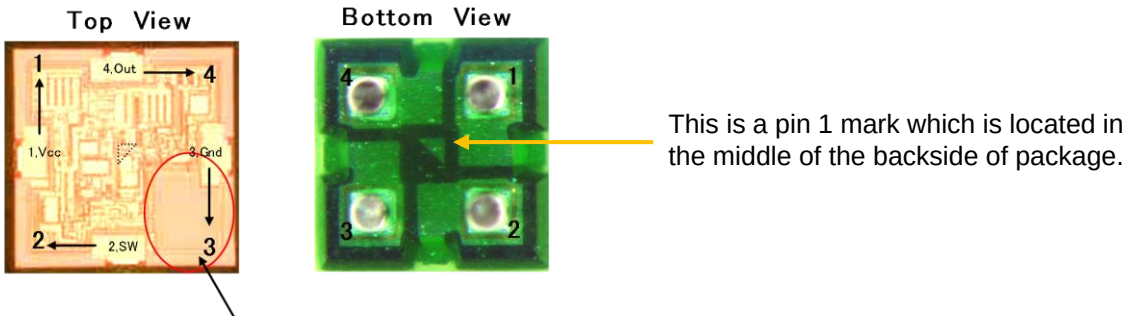
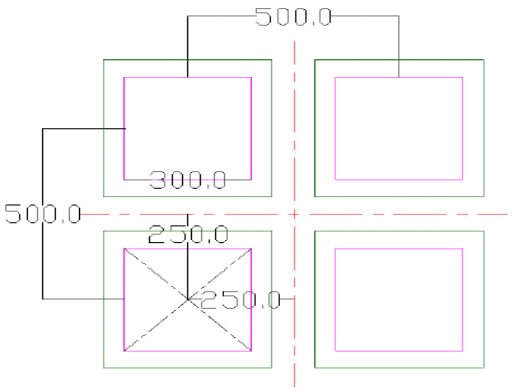


Photo diode: Only this part looks dark.

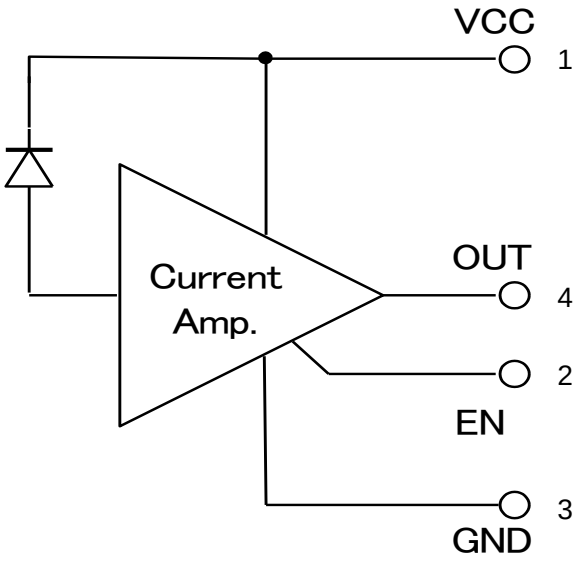
Recommended Land Pattern

Unit [um]



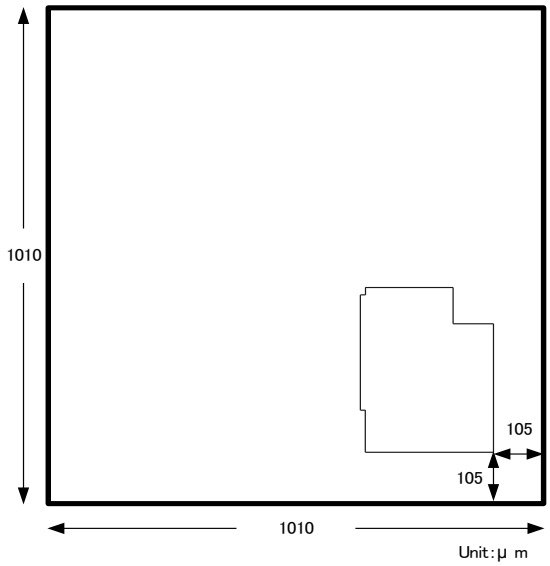
Land (pink) : 300um square
Solder resist opening (green) : 400um square

Block Diagram



Chip Pattern and Photo-receiving Pattern Diagrams

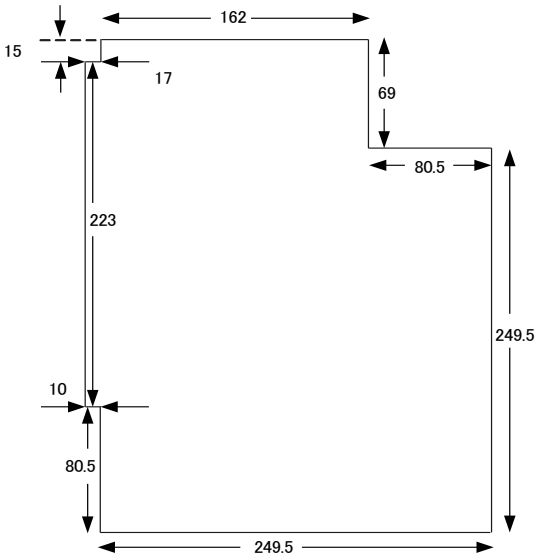
Chip Pattern diagram (Top View)



Unit: μ m

＊Pin 1 is on the upper left.

Photo-receiving Pattern Enlarged Diagram (effective area)

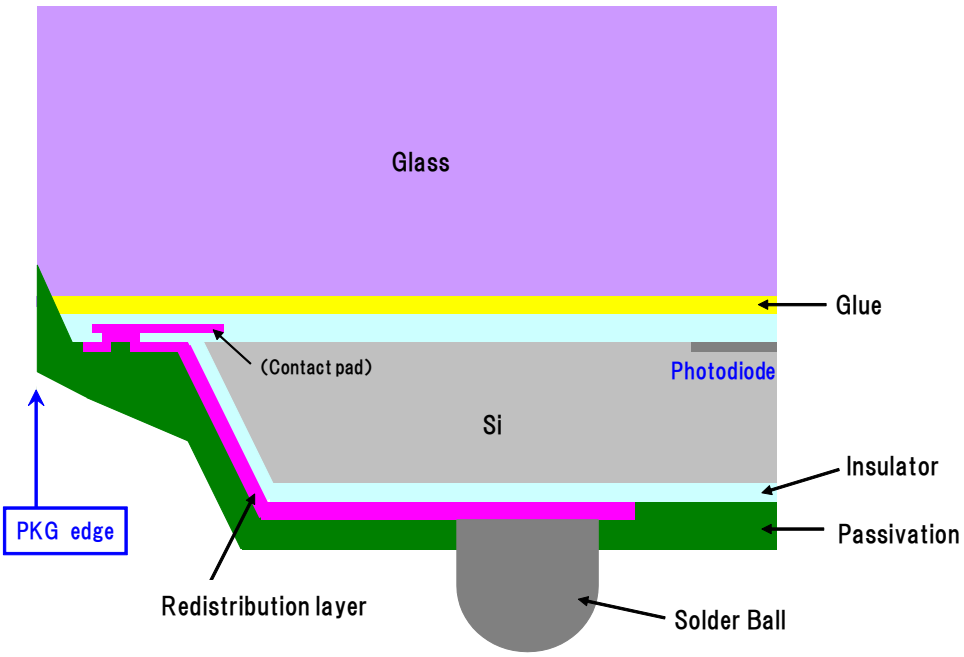


Unit: μ m

ODCSP Cross Section Structure

Optical Device Chip Size Package

SANYO original wafer level package for optical device.



Specifications

Absolute Maximum Ratings at Ta=25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC}		6	V
Operating temperature	Topr		-30 to 85	°C
Storage temperature	Tstg		-40 to 100	°C

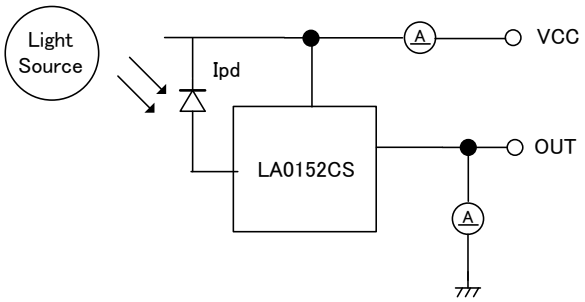
Recommended operating conditions and operating voltage range atTa=25□C

Parameter	Symbol	Conditions	min	typ	max	Unit
Recommended supply voltage	V_{CC}		2.2	3.3	5.5	V
EN pin low voltage	Vl	Sleep mode	0		0.4	V
EN pin high voltage	Vh	Normal operation mode	1.4		V_{CC}	V

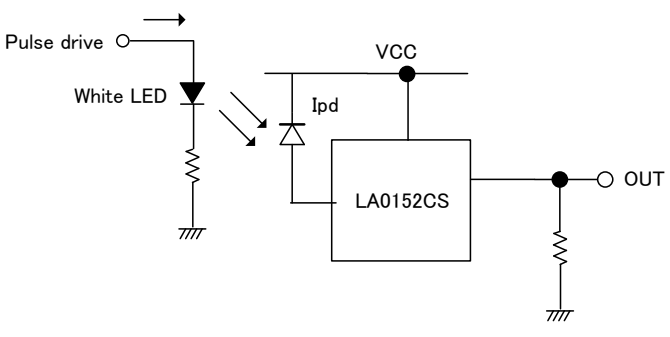
Electrical and optical characteristics at V_{CC}=3.3V, Ta=25□C

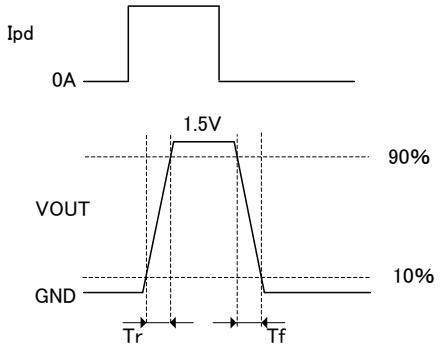
Parameter	Symbol	Conditions	min	typ	max	Unit
Current dissipation *1, *3	I_{CC}	Ev=1000 lux, RL=5k□	90	150	210	μA
Sleep current (1) *3	Isl1	Ev=0 lux			0.1	μA
Sleep current (2) *3	Isl2	Ev=1000 lux			0.3	μA
Output current (1) *1, *3	I_O1	Ev=100 lux	6	8	10	μA
Output current (2) *1, *3	I_O2	Ev=1000 lux	60	80	100	μA
Dark current *3	Ileak	Ev=0 lux			0.1	μA
Temperature coefficient *2	Itc	Ev=100 lx, Ta=-20 to 60□C		0.34		% / °C
Rice time (1) *4	Tr1	Ev=1000 lux, RL=5k□		15	40	μs
Fall time (1) *4	Tf1	Ev=1000 lux, RL=5k□		150	500	μs
Peak sensitivity wave length *2	λp			550		nm
Saturation output voltage *1, *3	V_O	R_L=150K, Ev=1000 lx	3.0	3.2		V

*1. Measured with the standard light source A. White LED is used instead in the mass production line.
*2. Design guaranteed item
*3. Test circuit for measuring current dissipation and output current

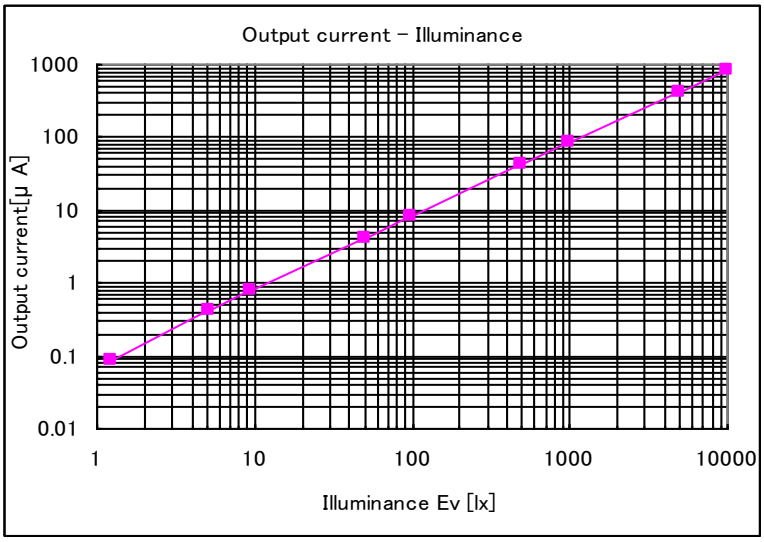


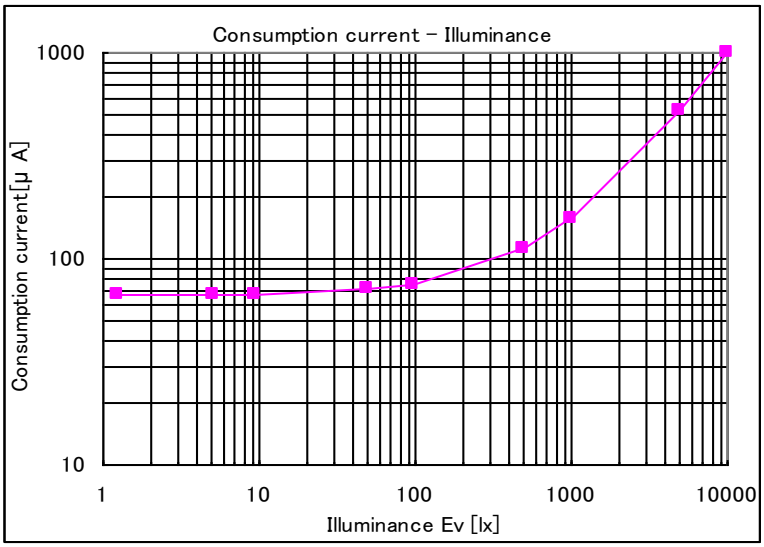
*4. Measuring method of rise time (Tr) and fall time (Tf)

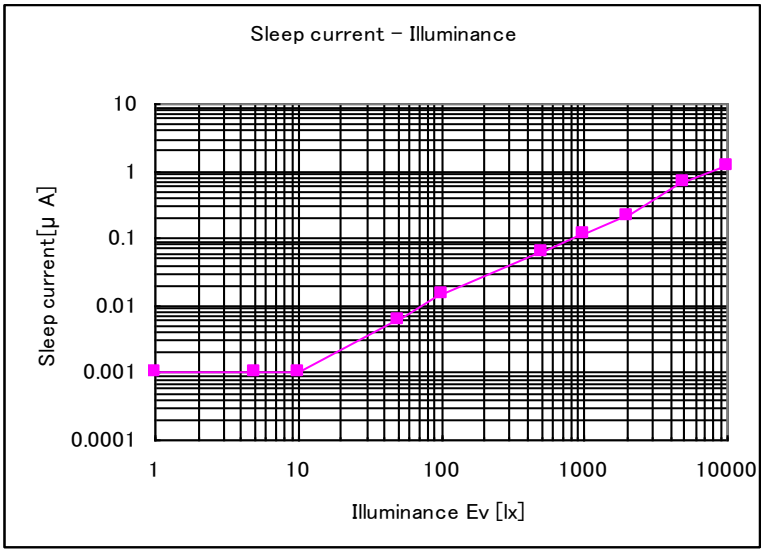


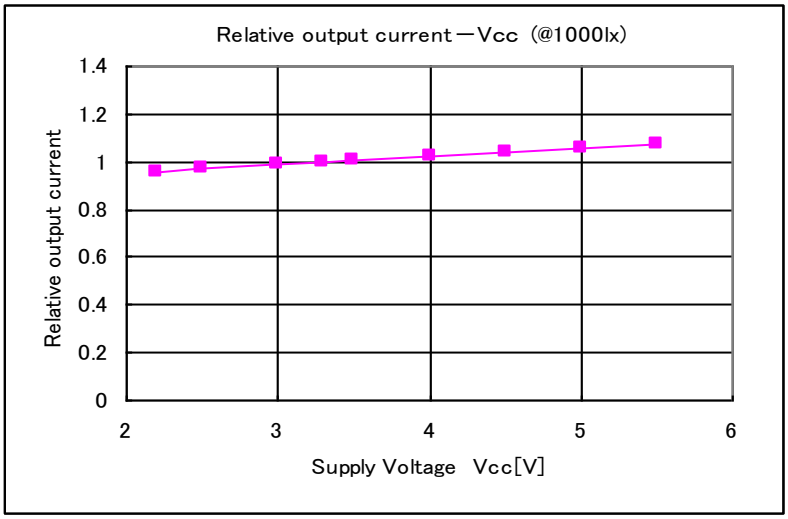


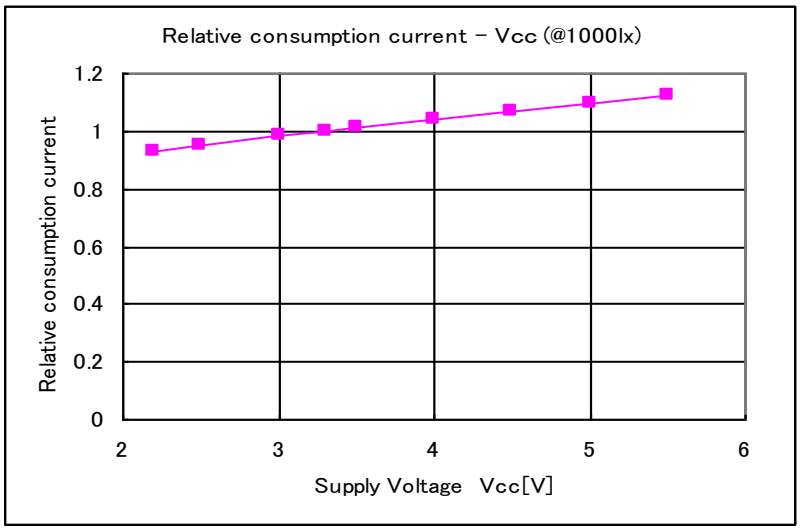
Typical Performance Characteristics

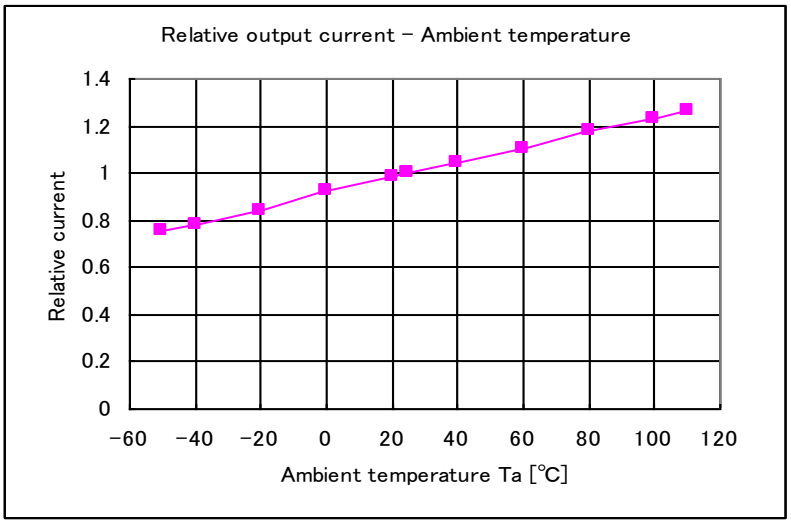


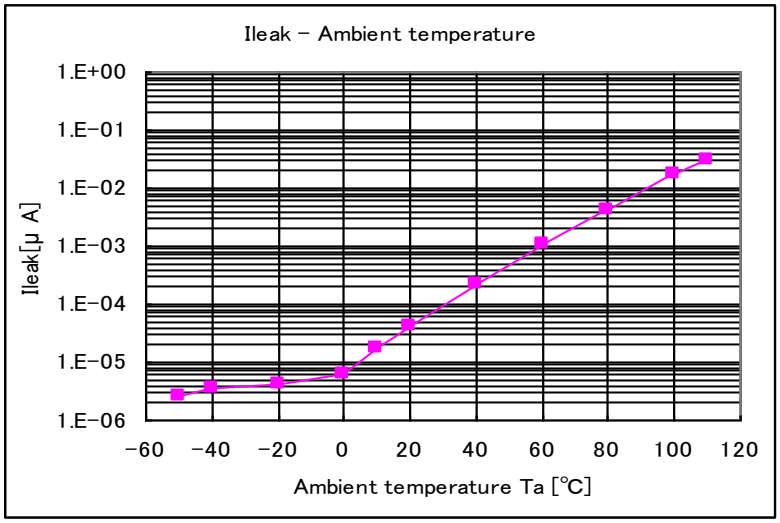


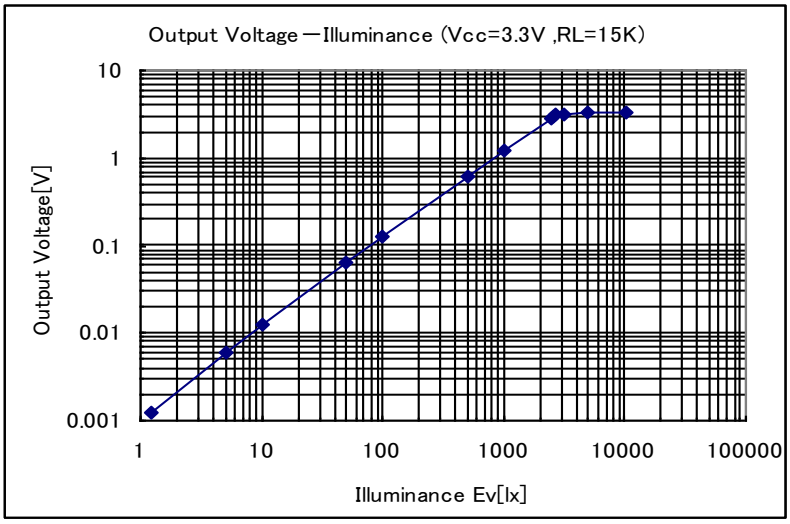


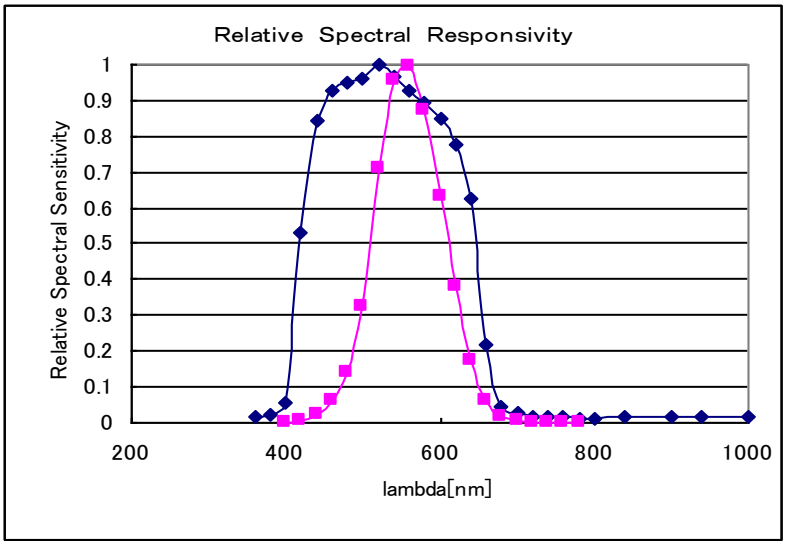

Relative output current－Vcc (@1000lx)
Relative output current
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2
3
4
5
6
Supply Voltage Vcc[V]

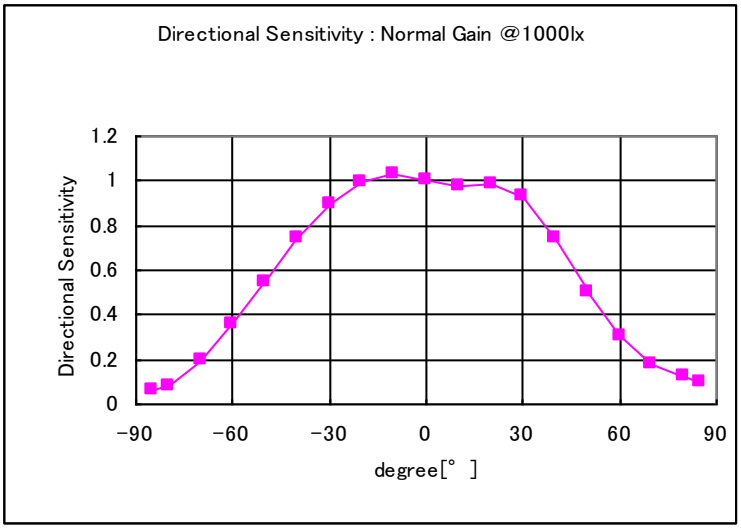

Relative consumption current – Vcc (@1000lx)
Relative consumption current
1.2
1
0.8
0.6
0.4
0.2
0
2
3
4
5
6
Supply Voltage Vcc[V]

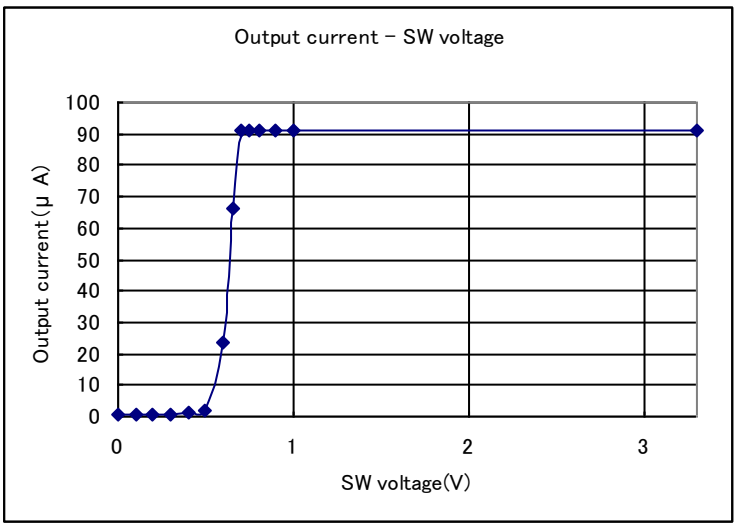

Relative output current – Ambient temperature
Relative current
1.4
1.2
1
0.8
0.6
0.4
0.2
0
−60
−40
−20
0
20
40
60
80
100
120
Ambient temperature Ta [℃]

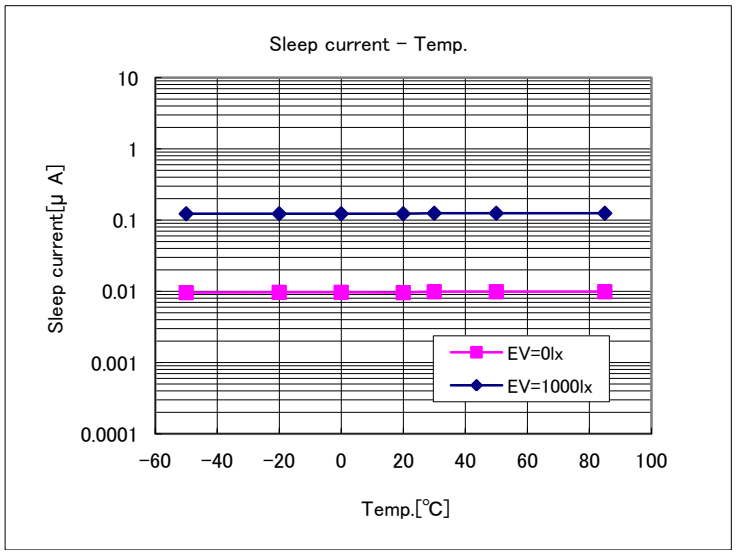

Ileak − Ambient temperature
1.E+00
1.E−01
1.E−02
1.E−03
1.E−04
1.E−05
1.E−06
Ileak[μ A]
−60 −40 −20 0 20 40 60 80 100 120
Ambient temperature Ta [℃]


Output Voltage－Illuminance (Vcc=3.3V ,RL=15K)
10
1
0.1
0.01
0.001
Output Voltage[V]
1 10 100 1000 10000 100000
Illuminance Ev[lx]

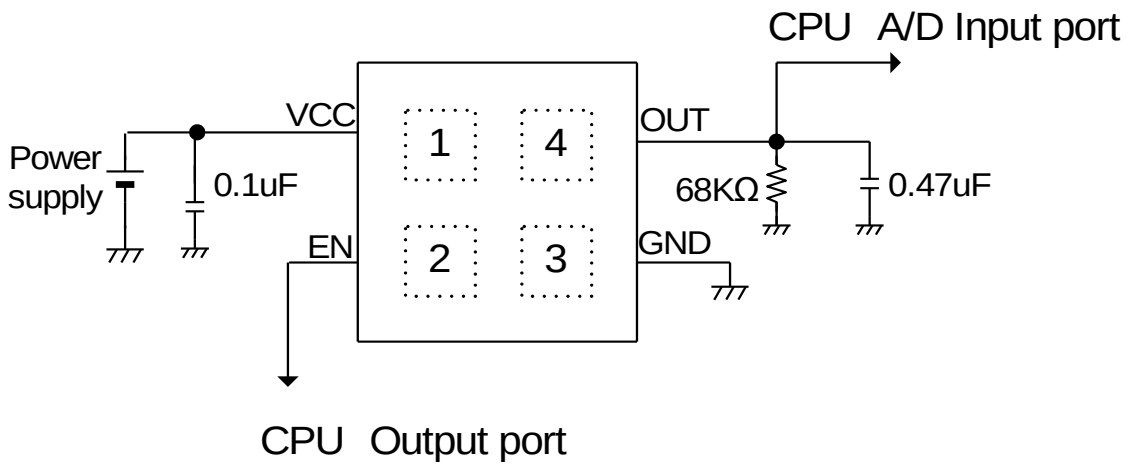

Relative Spectral Responsivity
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Relative Spectral Sensitivity
200 400 600 800 1000
lambda[nm]


Directional Sensitivity : Normal Gain @1000lx
Directional Sensitivity
1.2
1
0.8
0.6
0.4
0.2
0
-90
-60
-30
0
30
60
90
degree[°]


Output current - SW voltage
Output current(μ A)
100
90
80
70
60
50
40
30
20
10
0
0
1
2
3
SW voltage(V)

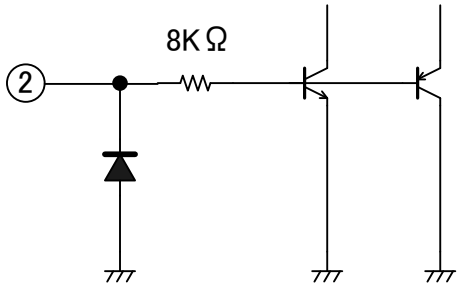
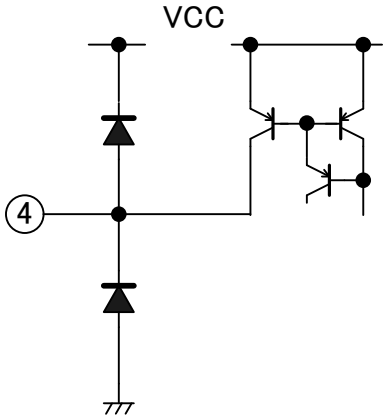

Sleep current - Temp.
Sleep current[μ A]
10
1
0.1
0.01
0.001
0.0001
-60
-40
-20
0
20
40
60
80
100
Temp.[℃]
EV=0lx
EV=1000lx

Sample Application Circuit



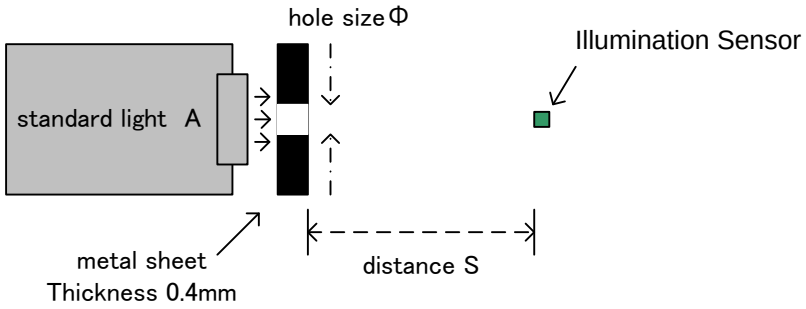
*The receiving photoresponse changes depending on the distance from the diameter , the material, and the case to IC of the sensor window etc.
Therefore, the optimum setting is necessary for resistance and the capacity value between 4 pin(OUT) and 3 pin(GND) according to the application.

Pin Functions

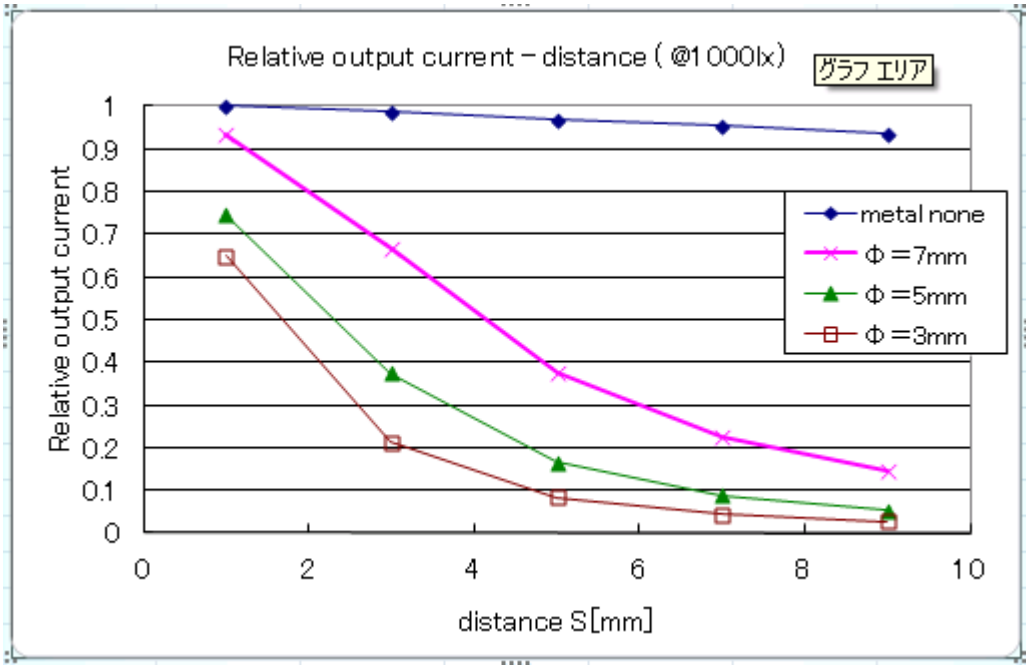
Pin No.	Pin Name	Pin function	Equivalent Circuit
1	V_{CC}	Power supply terminal. Insert a capacitor between this pin and ground to prevent the influence of noise, etc.	
2	EN	Enable terminal. This pin is used to control the IC operational state. When this pin is low, "sleep" state. When this pin is high, "active" state.	
3	GND	Ground terminal.	
4	OUT	Output terminal. This pin is outputted the linear current depending on ambient light.	

Relative Output Current vs Distance

・Measuring method



・Evaluation result

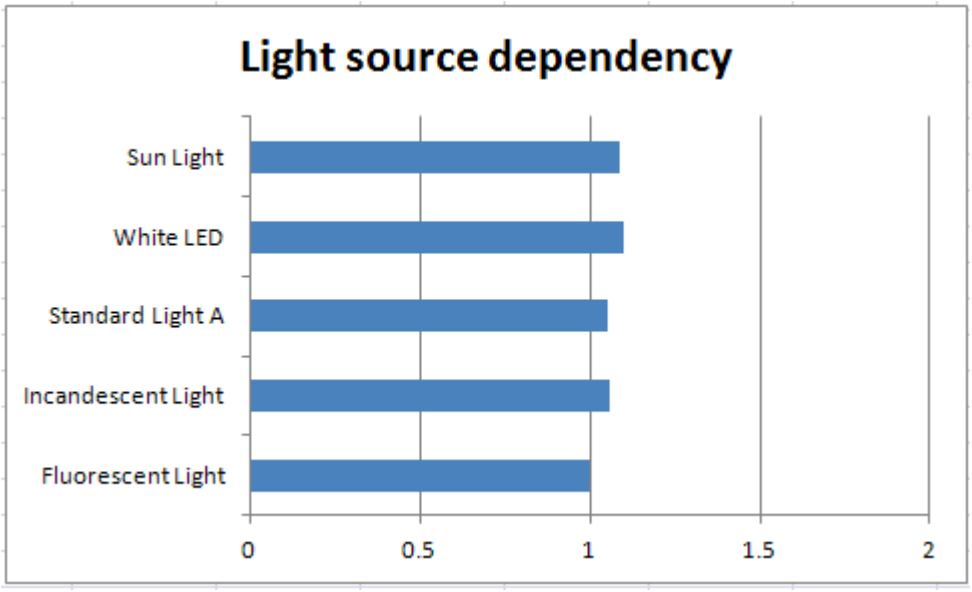


・Recommended condition

Hole size φ (optical window) = more than 2mm.

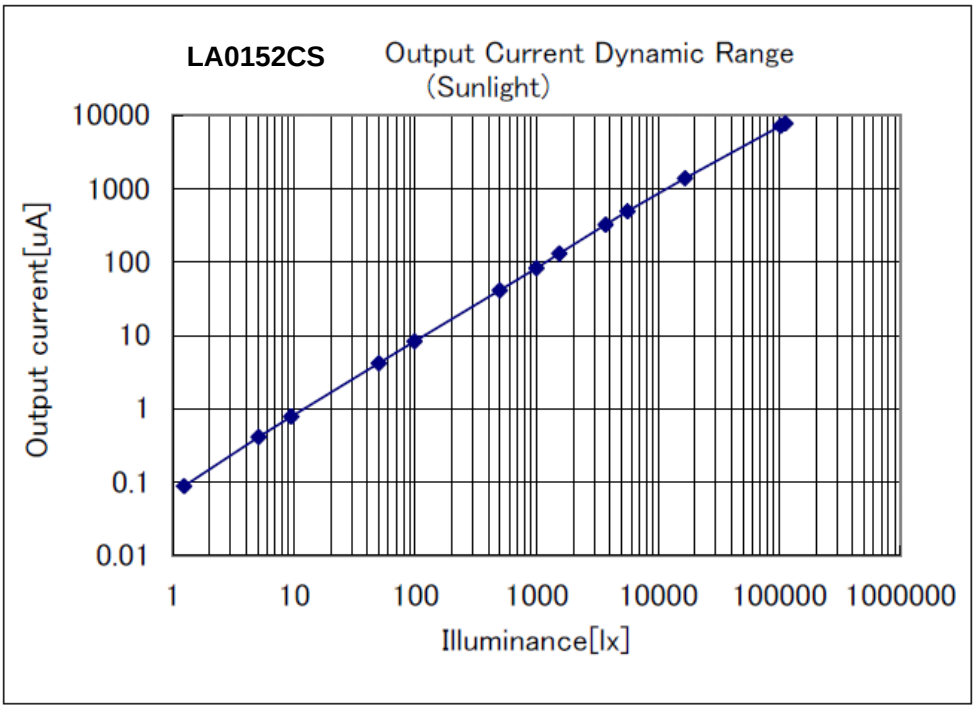
Distance from sensor to optical window = less than 2mm.

Light Source Dependency

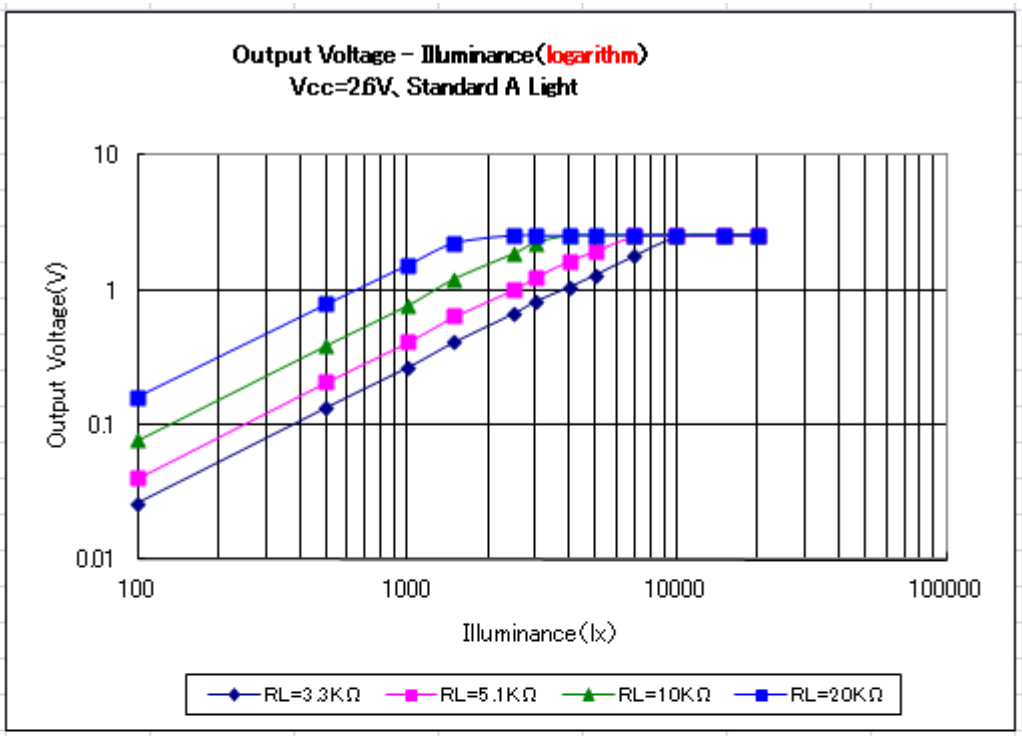


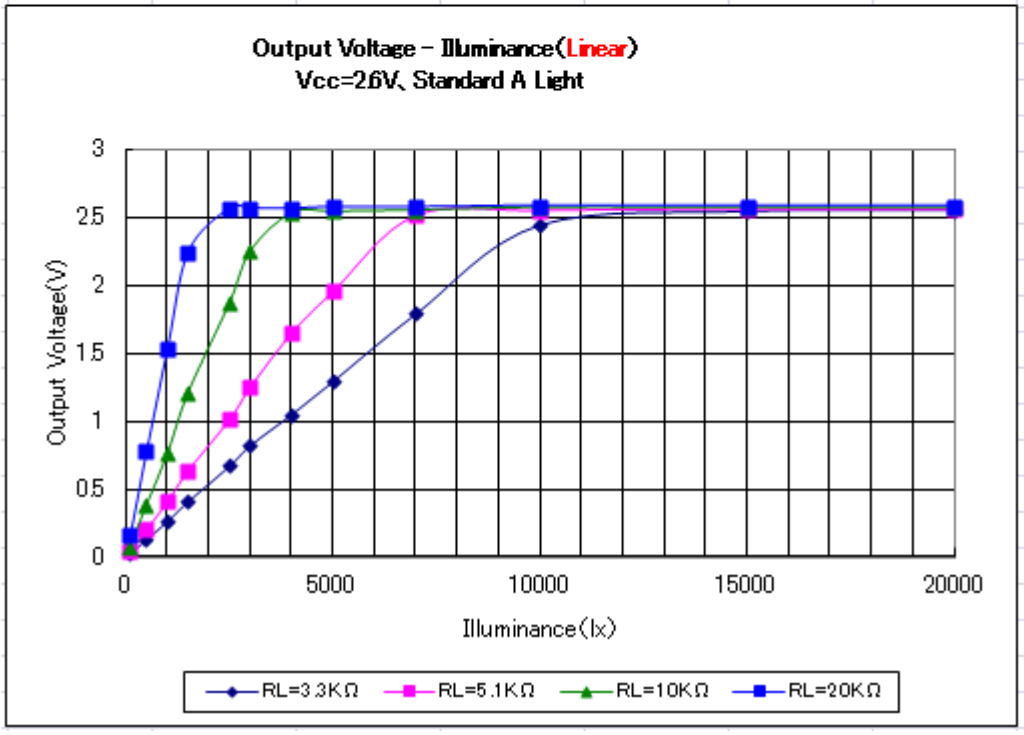
*Fluorescent light is set to “1”

Dynamic Current Range



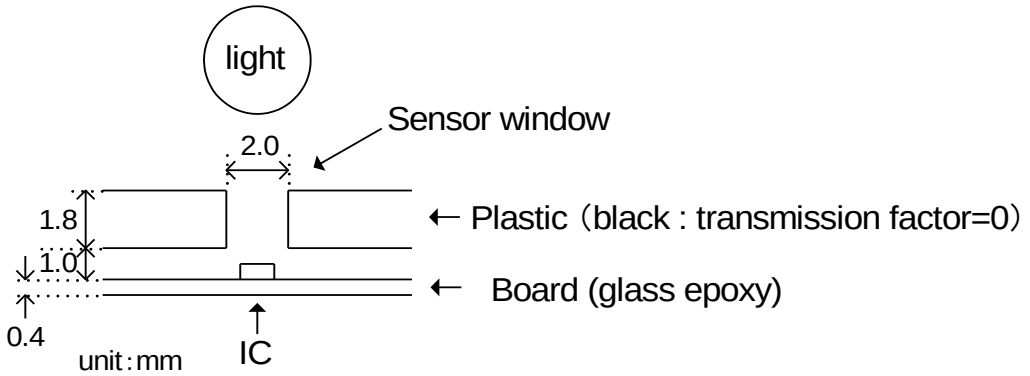
Dynamic Voltage Range



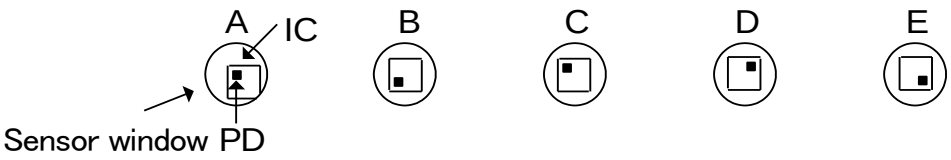


Differential Light Sensibility by PD Location

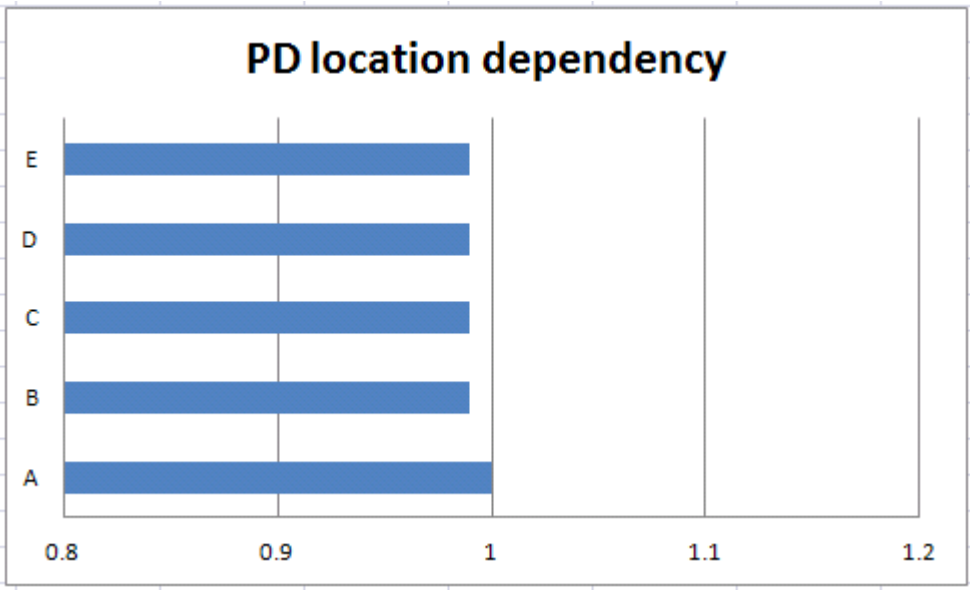
＜Side view＞



＜Top view＞



A：PD is arranged at the center of the sensor window.
B～E：The position of PD was rotated.



PD location A is set to “1”

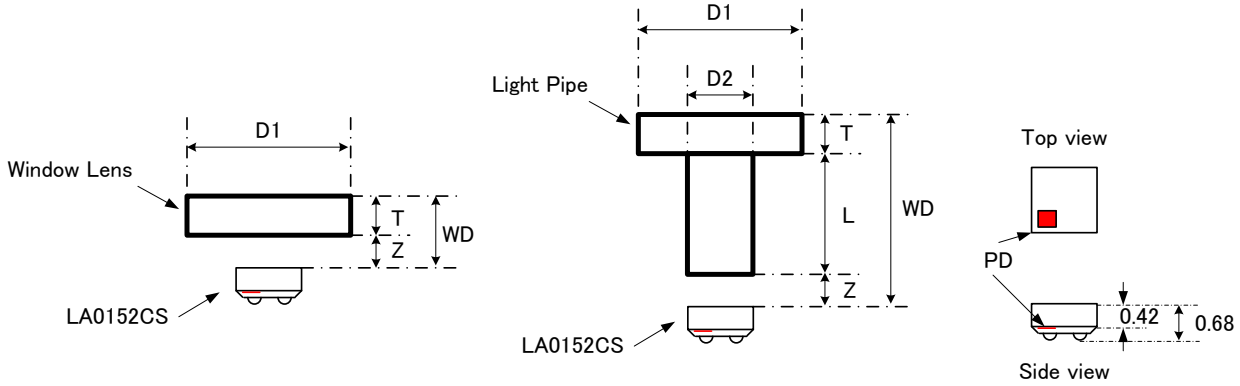
Window design guide

Flat window lens design

A window lens will surely limit the viewing angle of the LA0152CS. The window lens should be placed directly on top of the LA0152CS. The thickness of the lens should be kept at minimum to minimize loss of power due to reflection and also to minimize loss of loss due to absorption of energy in the plastic material. A thickness of T = 1 mm is recommended for a window lens design.

Window with light pipe design

If a smaller window is desired while maintaining a wide effective viewing angle of the LA0152CS, a cylindrical piece of transparent plastic is needed to trap the light and then focus and guide the light on to the LA0152CS. Hence the name light guide or also known as light pipe. The pipe should be placed directly on top of the LA0152CS with a distance of Z = 0.5mm to achieve peak performance. The light pipe should have minimum of 1.5mm in diameter to ensure that whole area of the sensor will be exposed.



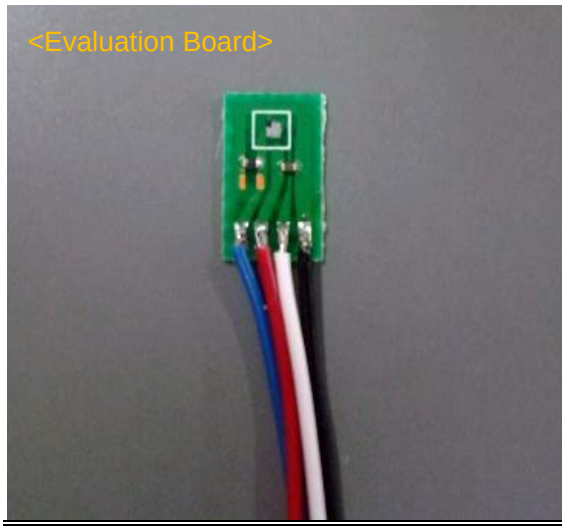
FLAT WINDOW LENS WINDOW WITH LIGHT PIPE

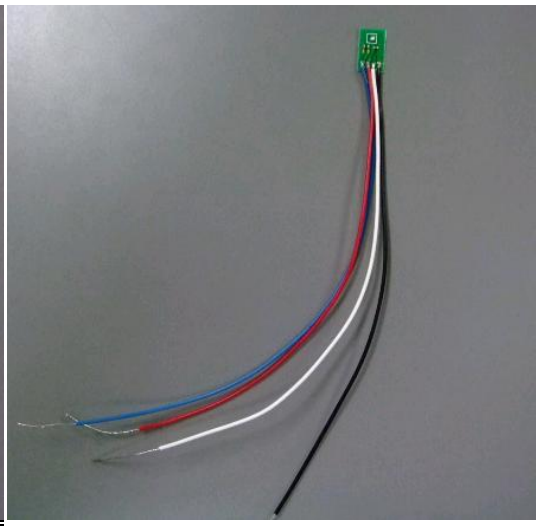
WD (T+L+Z)	FLAT WINDOW LENS (L=0.0)		WINDOW WITH LIGHT PIPE (D2=1.5, Z=0.5)	
	Z	D1	D1	L
1.5	0.5	2.0	-	-
2.0	1.0	3.0	-	-
2.5	1.5	4.0	-	-
3.0	2	5.0	2.5	1.5

*All dimensions are in mm.
*These dimensions are based on a window lens thickness of 1.0mm and a refractive index of 1.59.

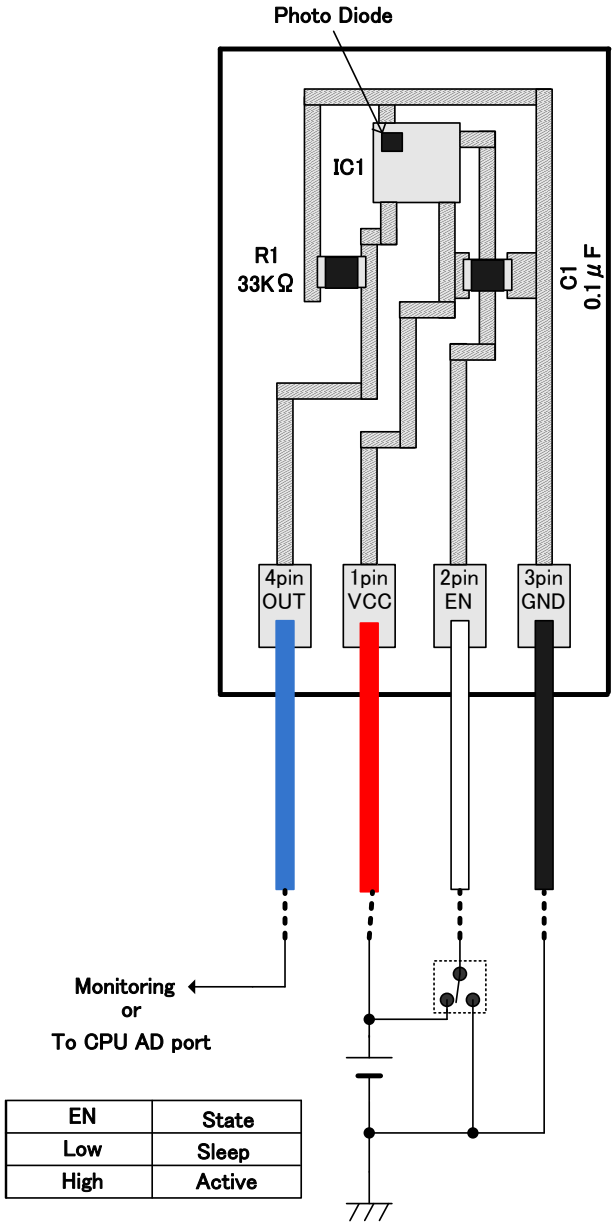
WD: Distance between window front panel and LA0152CS
D1: Window diameter, **T**: Thickness, **L**: Length of light pipe
D2: Light pipe diameter, **Z**: Distance between window rear panel and LA0152CS

Evaluation Board Manual

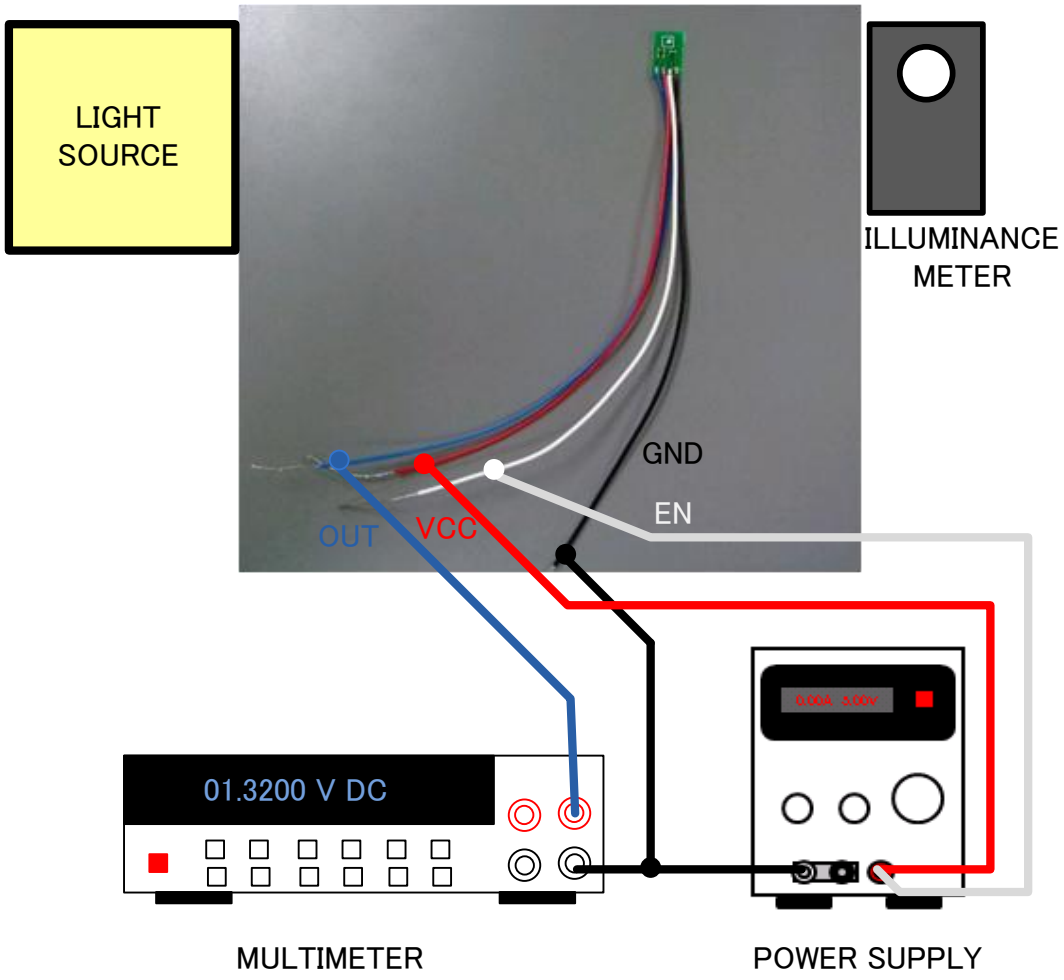




Evaluation Board



EN	State
Low	Sleep
High	Active



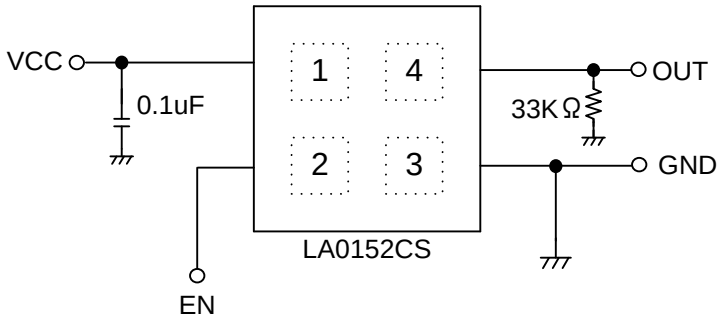
Test Procedure:

1. Connect the test setup as shown above.
2. Connect IC power supply (2.2V to 5.5V) between VCC and GND.
3. Connect multimeter between OUT and GND.
4. Irradiate a light, and put on the illuminance meter near the IC.
5. Control the light source and to be adjusted 500 lux.
6. Then , OUT terminal of LA0152CS is outputted roughly 40uA. Therefore, multimeter is showed roughly 1.32V. (1.32V = 40uA×33kΩ)

LA0152CS features:

- No sensibility in infrared area.
- Less difference in sensibility depending on the type of light source.
  (Please see to page 12 “Light Source Dependency”.)

Evaluation Board Circuit Diagram

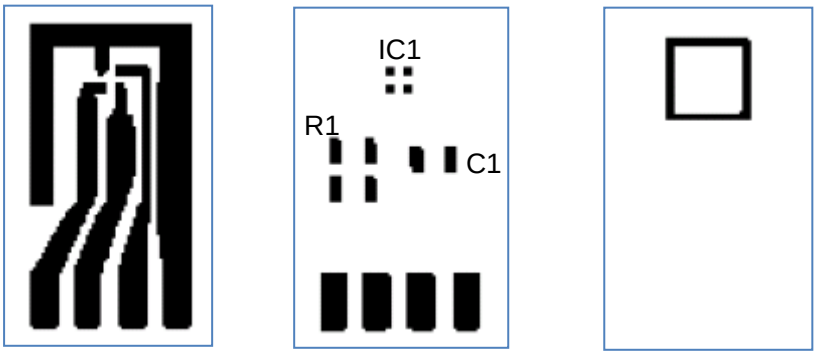


Bill of Materials for LA0152CS Evaluation Board

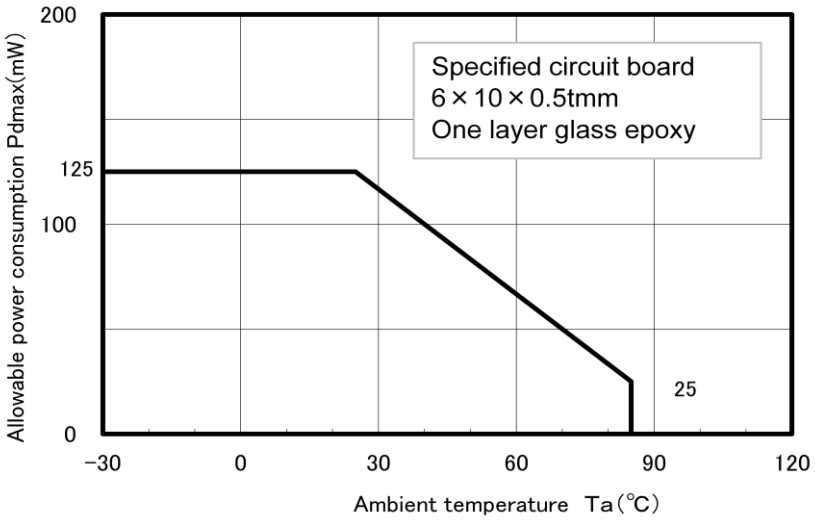
Designator	Quantity	Description	Value	Tolerance	Footprint	Manufacturer	Manufacturer Part Number	Substitution Allowed	Lead Free
IC1	1	Ambient Light Sensor	-	-	ODCSP4 (0.5mm ,pitch)	SANYO	LA0152CS	No	yes
R1	1	OUT (to GND)	33k (0.063W)	±5%	1005 (0402Inch)	ROHM	MCR01MZPJ333	yes	yes
C1	1	VCC Bypass Capacitor	0.1uF /16V	±10%	1005 (0402Inch)	MURATA	GRM155B11C104KA	yes	yes

Evaluation Board PCB Design

(Top View)



(Pattern) (Resist) (Silk)

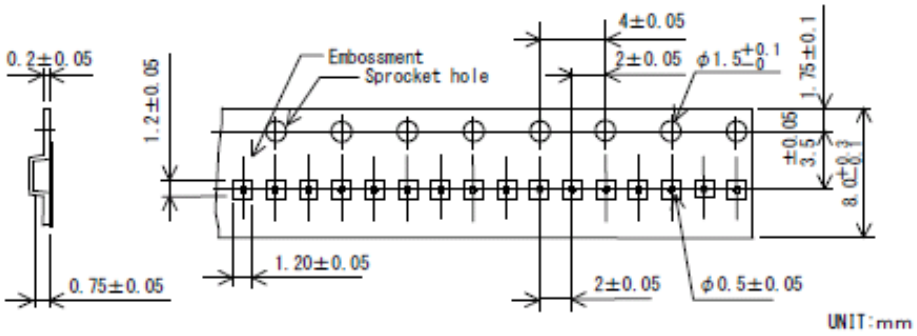


Pdmax - Ta

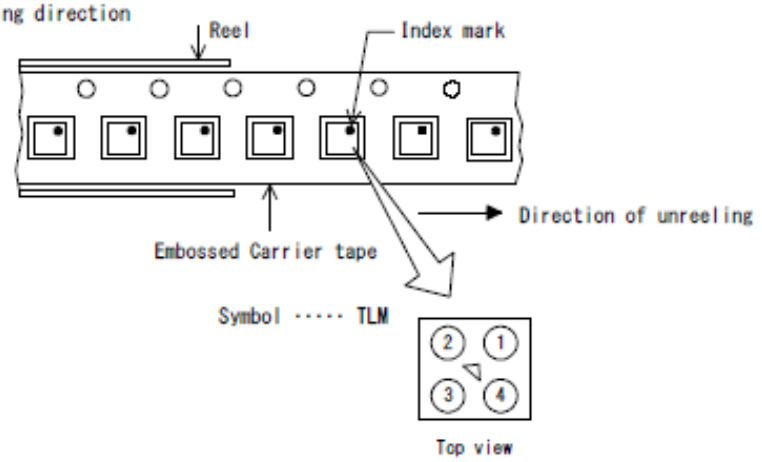
Packing Specification of Embossed Carrier Taping

1. EMBOSS CARRIER TAPING

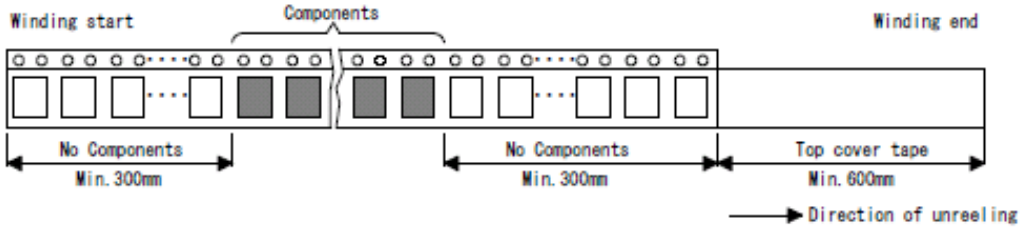
1-1. Emboss carrier tape dimensions



1-2. Tape mounting direction



1-3. Reel winding start and reel winding end



2. TAPE STRENGTH

2-1. Tensile strength of the carrier tape : Min. 10N

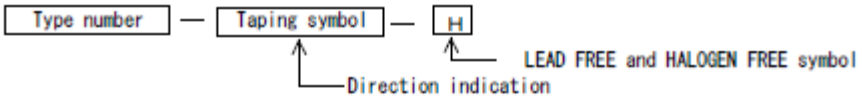
2-2. Peel strength of the top cover tape

(a) Peel angle: 165° to 180° relative to the tape adhesive surface

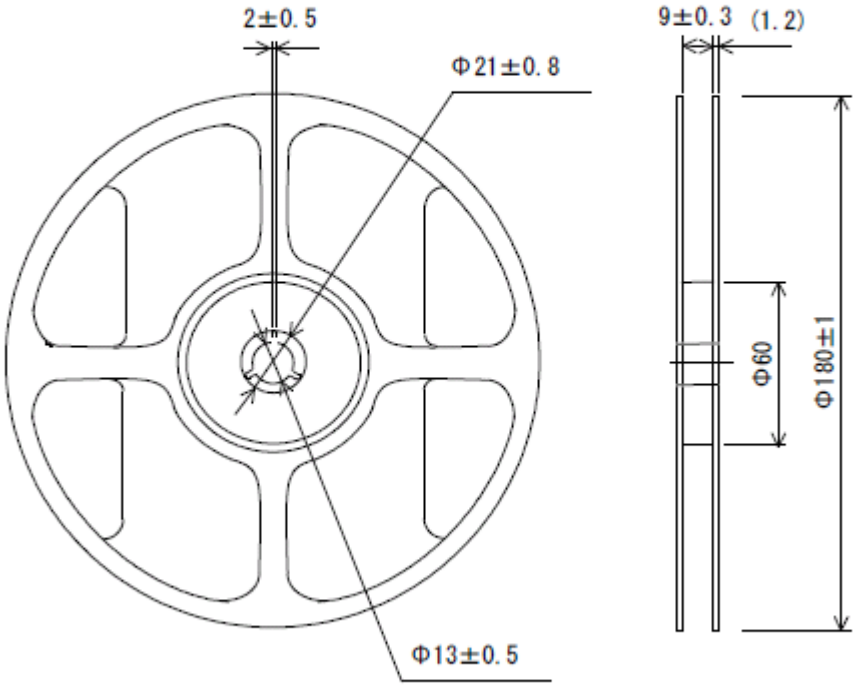
(b) Peel rate: 300mm / minute

(c) Peel of strength : 0.1N to 1.0N

3. PARTS No. ON BAR CODE LABEL



4. REEL DIMENSIONS



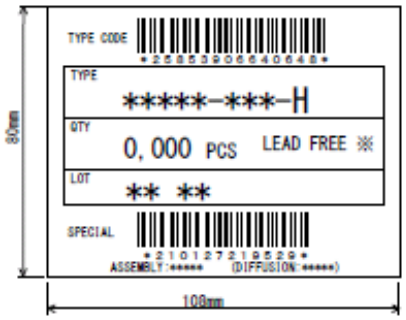
Model : EIAJ-RRM08B
Unit : mm

Carrier tape type number	SANYO Package code	Maximum number of ICs contained (pcs.)			Packing form	
		Reel	Inner box	Outer box	Inner box. BOX(TE-1208)	Outer box. L-BOX(TE-1208)
CARR(WLP1X1X750)	ODCSP4 (1.01X1.01)	5,000	5,000	40,000	1 Reels contained Dimensions:mm 190×37×190	8 Inner boxes contained Dimensions:mm 222×175×402

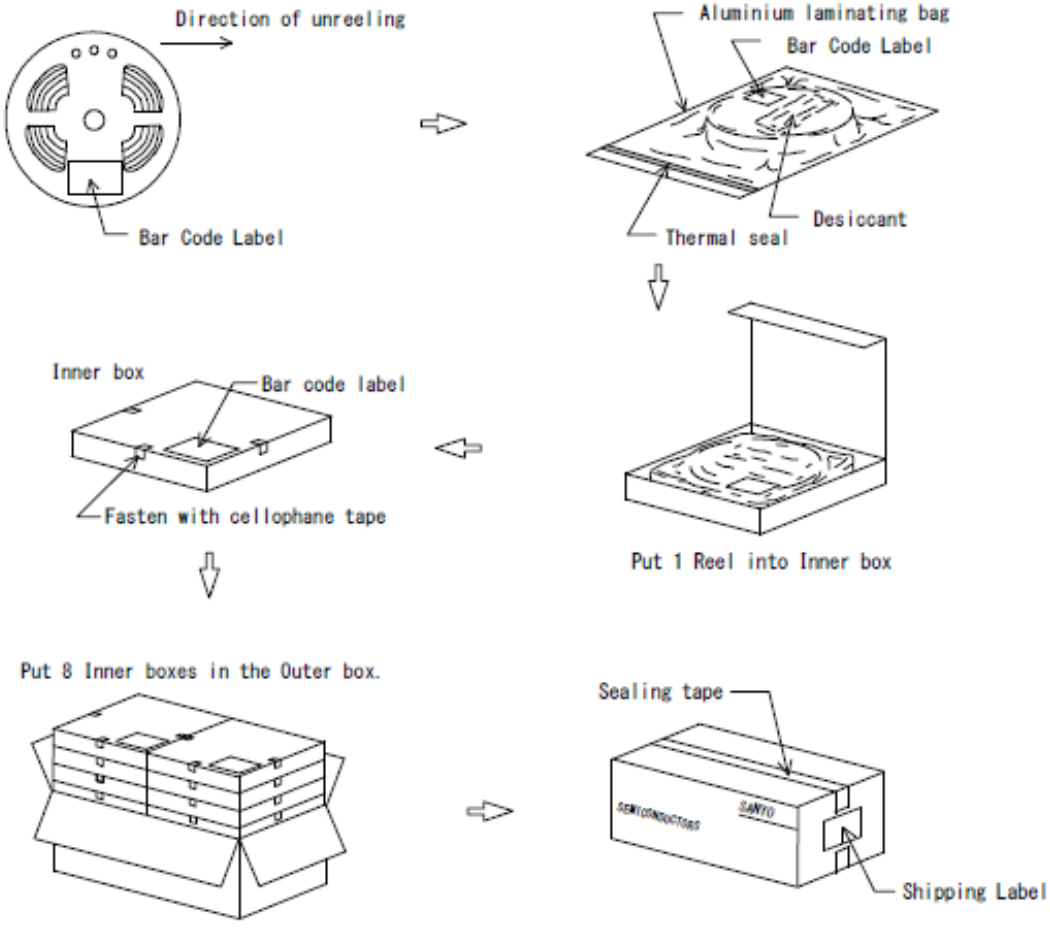
Bar Code Label

Shipping Label

It is a label at the time of factory shipments.
The form of a label may change in physical distribution process.

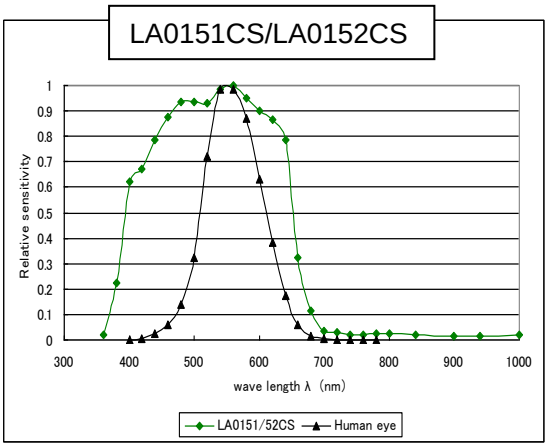


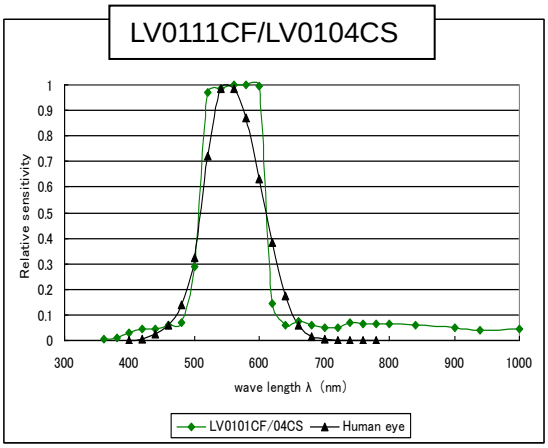
Packing Method



Lineup of Ambient Light Sensor by SANYO

Product name	LA0151CS	LA0152CS	LV0111CF	LV0104CS
Output type	Linear current	Linear current	Logarithm current	16bitAD digital
Overall size(mm)	1.01*1.01*0.6	1.01*1.01*0.6	1.08*1.08*0.6	1.08*1.08*0.6
Spectral characteristics	Normal	Normal	Closer to visibility	Closer to visibility
Gain switching	○	—	—	○
Standby function	—	○	○	○
Operating voltage (V)	2.2～5.5	2.2～5.5	2.3～5.5	2.3～3.6
Operating temperature range (°C)	-30～85	-30～85	-30～85	-30～85
Consumption current 1000 lx	150uA	150uA	75uA	70uA
Output current 100 lx	8uA	8uA	20uA	100 counts
Output current 1000 lx	80uA	80uA	30uA	1000 counts
Peak sensitivity (nm)	550	550	550	550
D range	1～100k lx	1～100k lx	1～100k lx	1～65k lx
Pb free	○	○	○	○
Halogen free	-	○	○	○
Status	Mass production	Mass production	Mass production	Sep.2012 MP





This catalog provides information as of February, 2012. Specifications and information herein are subject to change without notice.