



## LV0111CF — Monolithic Linear IC For Ultra-small Ambient Light Sensor Photo IC

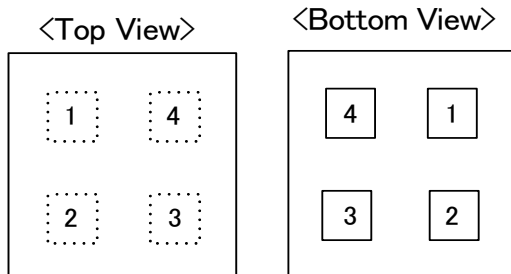
### Overview

The LV0111CF 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, tablet PC, digital still camera, security camera and camcorder.

### Features

- Logarithmic current output
- Smallest ODCSP package in the world (1.08mmX1.08mm, thickness:0.6mm)
- Integrated sleep mode (Max current 0.1uA)
- Low power consumption (75uA at 1,000Lux)
- Less sensibility in infrared area
- Low output temperature variation
- Halogen free compliant

### Pin Assignment

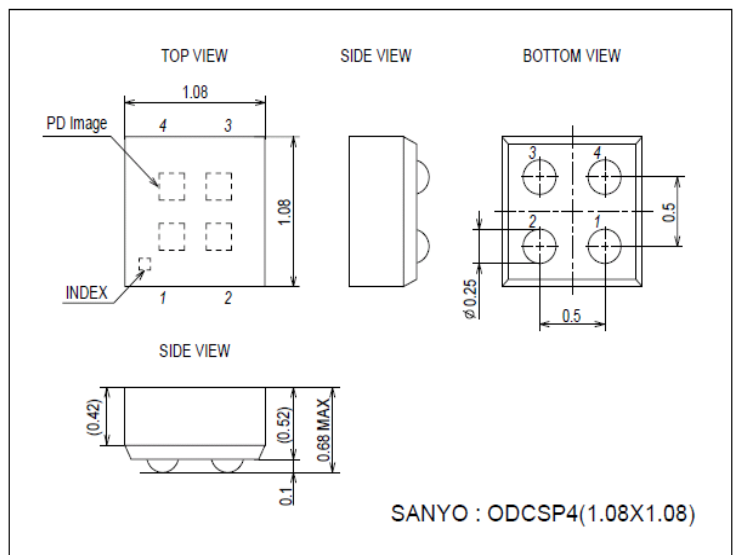


No.	Name	Function
1	VCC	Power supply
2	EN	Enable
3	GND	Ground
4	OUT	Output

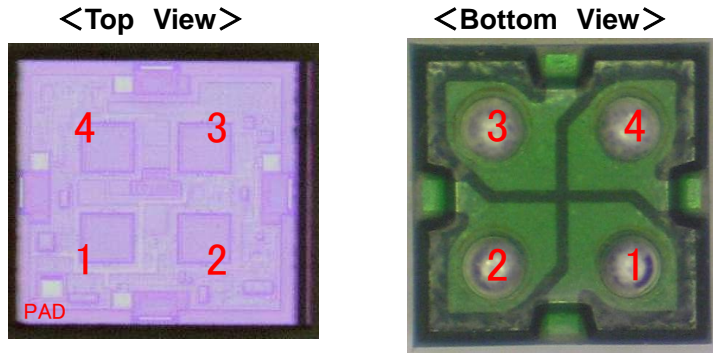
Ball Pitch : 0.5mm , Ball Size : 0.25mm <sup>□</sup>

### Package Dimensions

unit : mm (typ)  
3350A

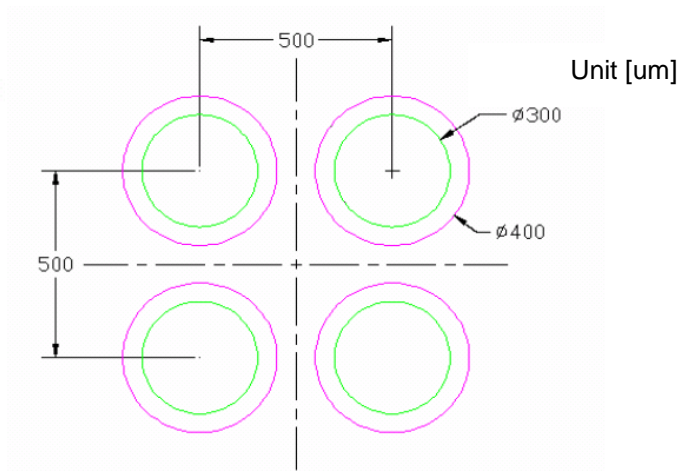


Pad Layout (Photos)



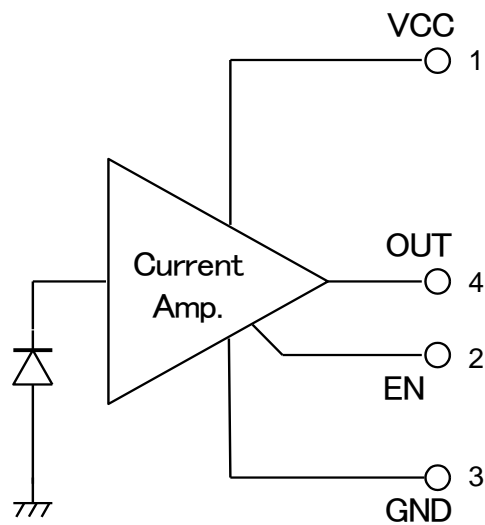
\* The position with PAD becomes pin 1.

Recommended Land Pattern

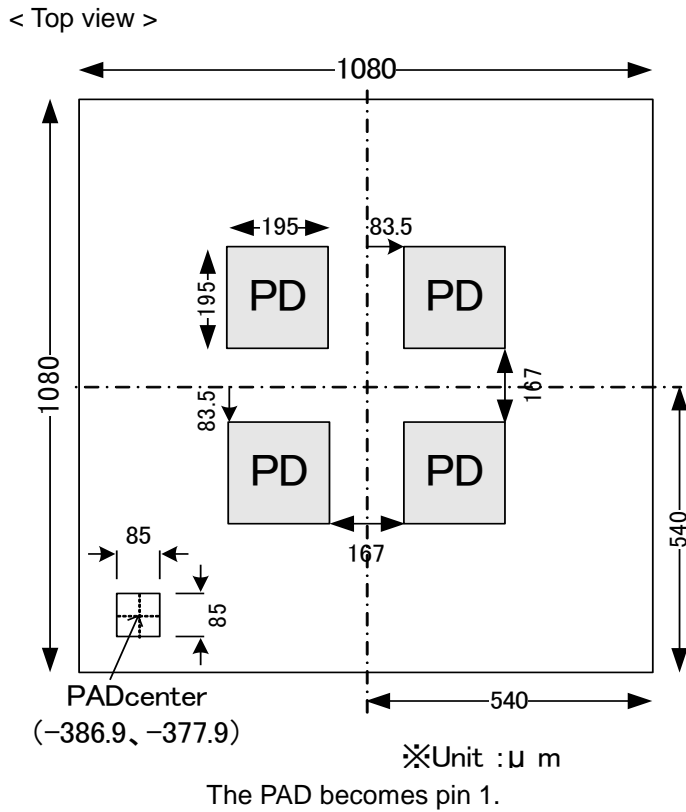


Land ( pink ) : 300um  $\phi$   
 Solder resist opening (green) : 400um  $\phi$

Block Diagram



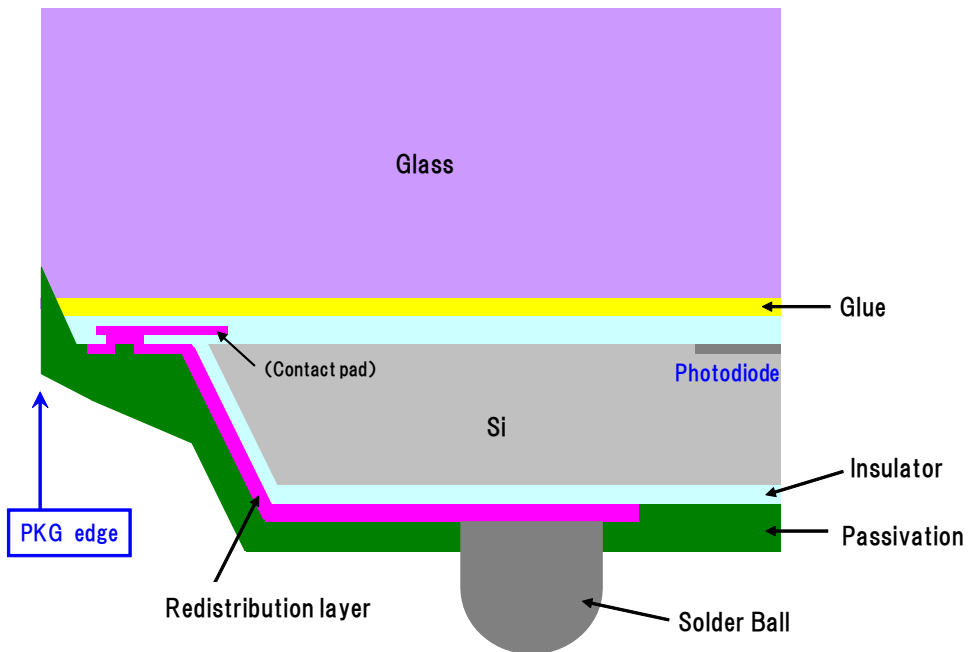
Chip Pattern and Photo-receiving Pattern Diagrams



ODCSP Cross Section Structure

Optical Device Chip Size Package

SANYO original wafer level package for optical device.



# LV0111CF

## Specifications

**Absolute Maximum Ratings** at  $T_a=25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	VCC		6	V
Operating temperature	Topr		-30 to 85	$^\circ\text{C}$
Storage temperature	Tstg		-40 to 100	$^\circ\text{C}$

**Recommended operating conditions and operating voltage range** at  $T_a=25^\circ\text{C}$

Parameter	Symbol	Conditions	min	typ	max	Unit
Recommended supply voltage	VCC		2.3	3.3	5.5	V
EN pin low voltage	VI	Sleep mode	0		0.4	V
EN pin high voltage	Vh	Normal operation mode	1.5		VCC	V

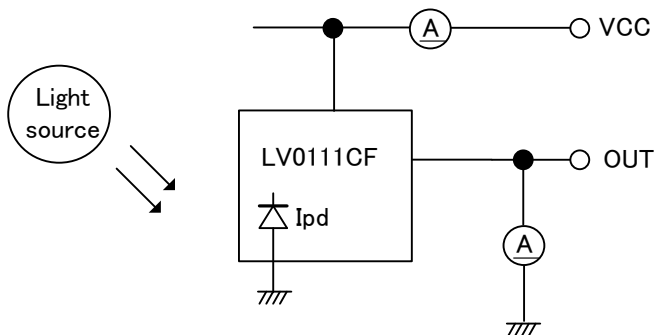
**Electrical and optical characteristics** at  $V_{CC}=3.3\text{V}$ ,  $T_a=25^\circ\text{C}$

Parameter	Symbol	Conditions	min	typ	max	Unit
Current dissipation *1, *3	ICC	$E_v=1000\text{ lux}$ , $R_L=27\text{k}\Omega$	50	75	100	$\mu\text{A}$
Sleep current *3	Isl	$E_v=0\text{ lux}$		0.01	0.1	$\mu\text{A}$
Output current (1) *1, *3	IO1	$E_v=100\text{ lux}$	18	21	24	$\mu\text{A}$
Output current (2) *1, *3	IO2	$E_v=1000\text{ lux}$	27	31	35	$\mu\text{A}$
Dark current *3	Ileak	$E_v=0\text{ lux}$		0.35	0.5	$\mu\text{A}$
Temperature coefficient *2	Itc	$E_v=100\text{ lx}$		0.1		$\% / ^\circ\text{C}$
Rise time *4	Tr1	$E_v=1000\text{ lux}$ , $R_L=27\text{k}\Omega$		40	100	$\mu\text{s}$
Fall time *4	Tf1	$E_v=1000\text{ lux}$ , $R_L=27\text{k}\Omega$		2	5	ms
Peak sensitivity wave length *2	$\lambda_p$			550		nm

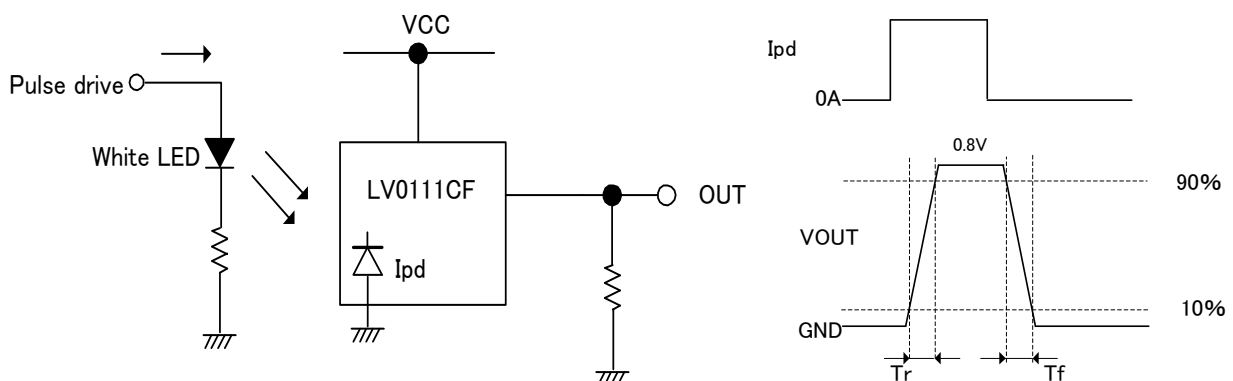
\*1. Measured with the standard light source A. White LED is used instead in the mass production line.

\*2. Design guaranteed item

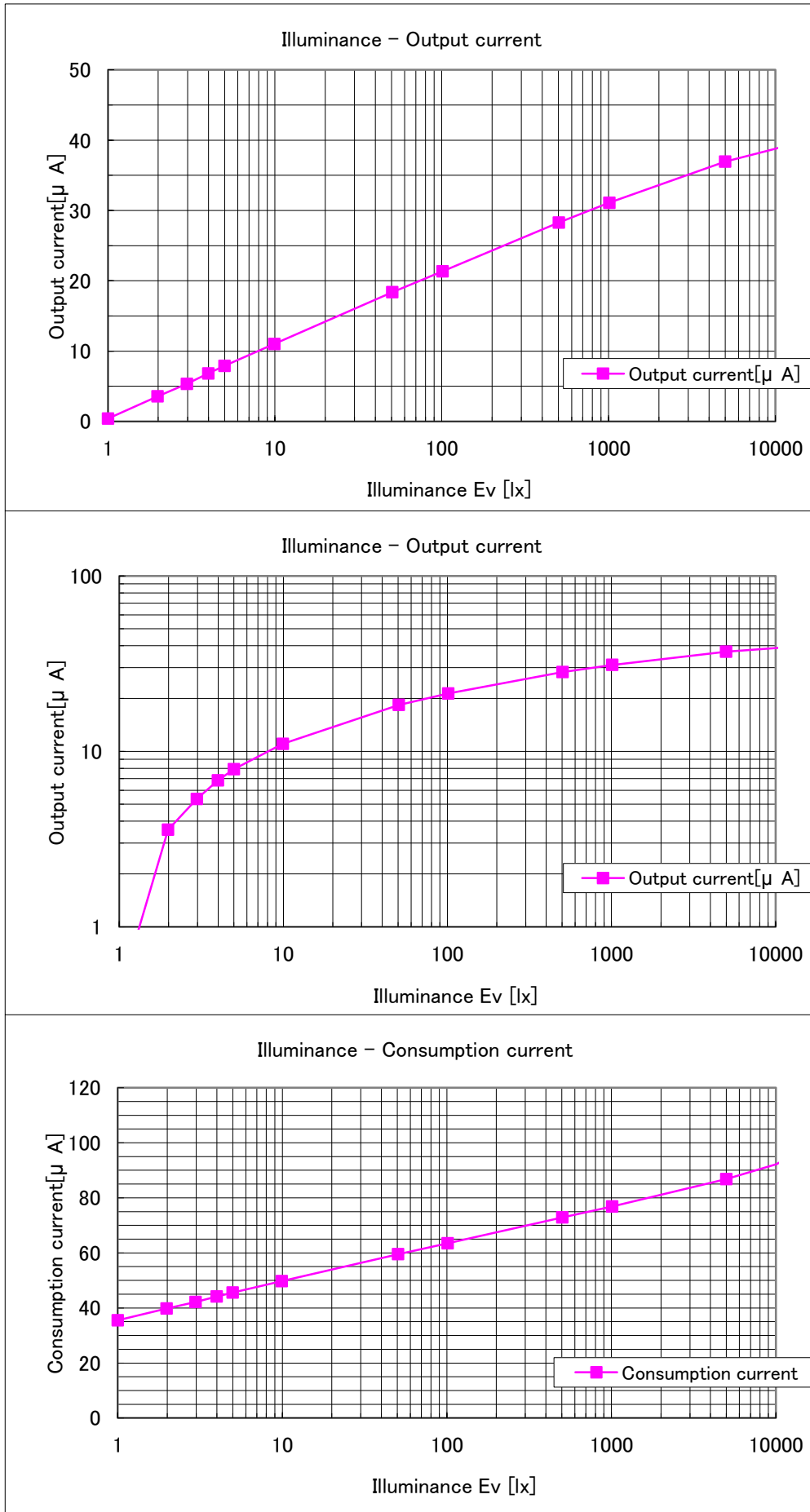
\*3. Test circuit for measuring current dissipation and output current

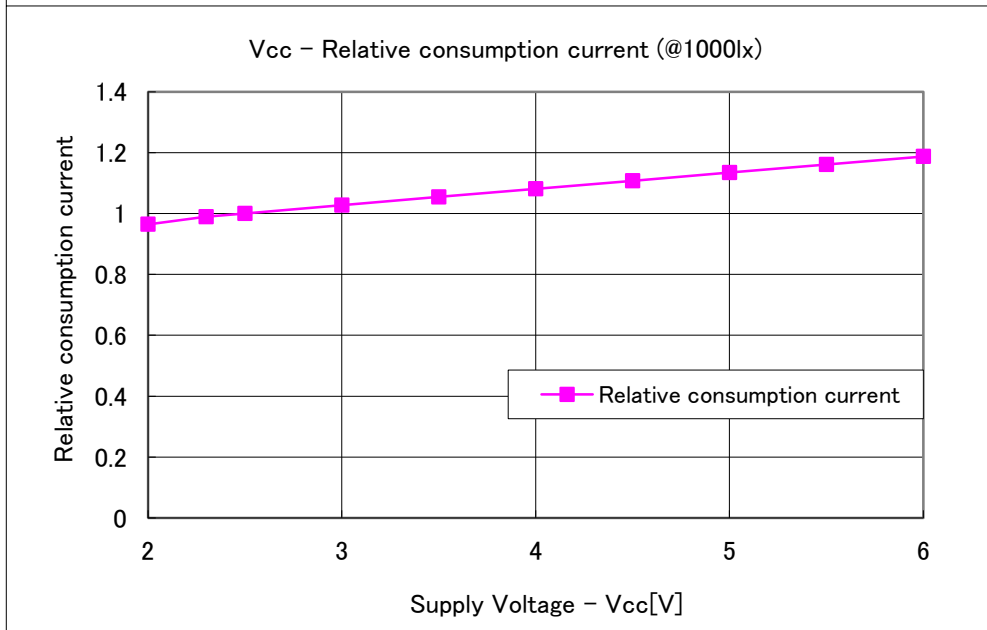
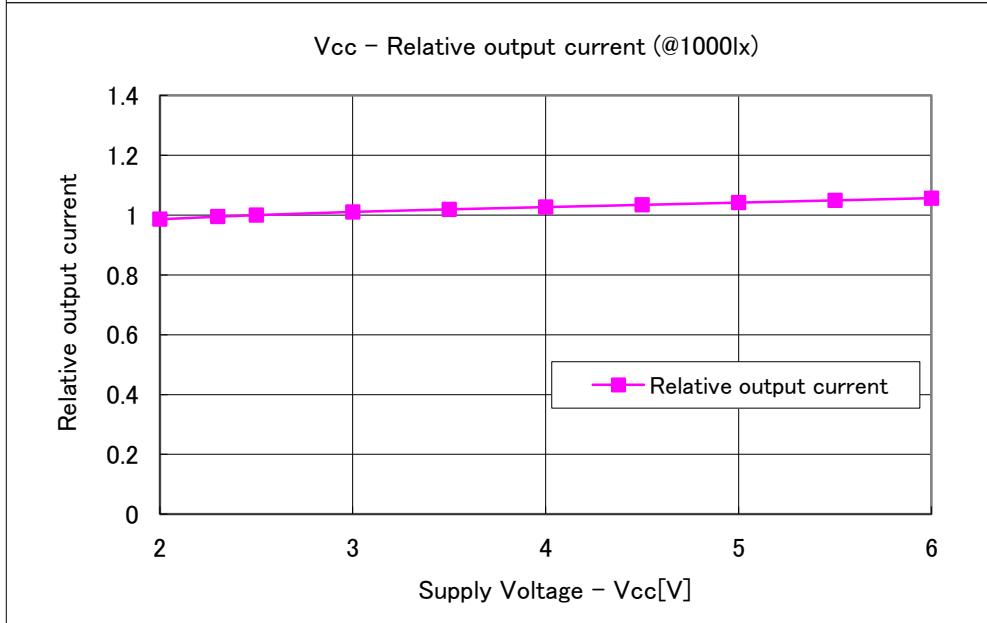
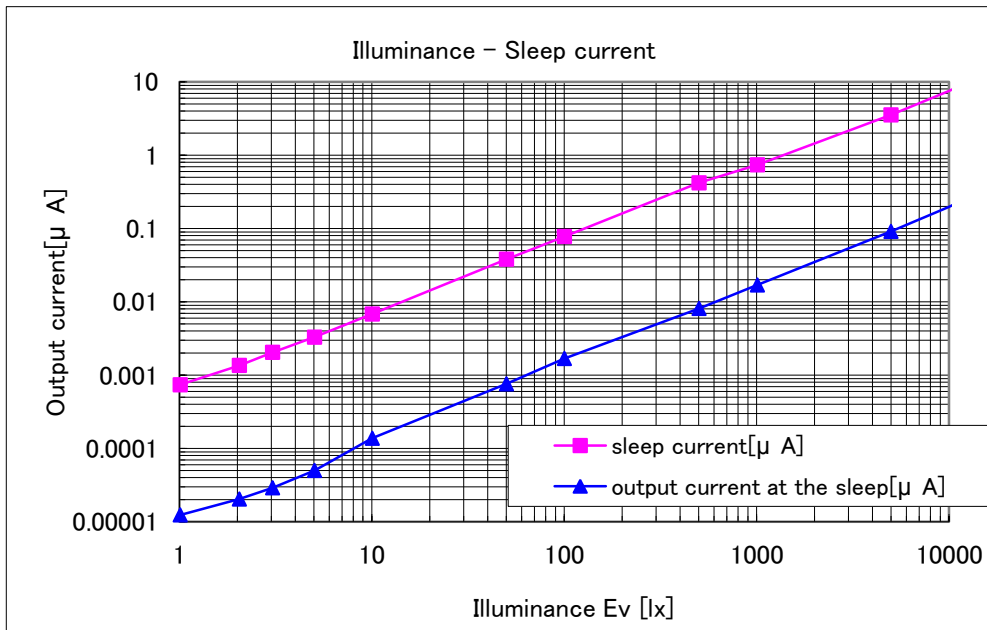


\*4. Measuring method of rise time ( $T_r$ ) and fall time ( $T_f$ )

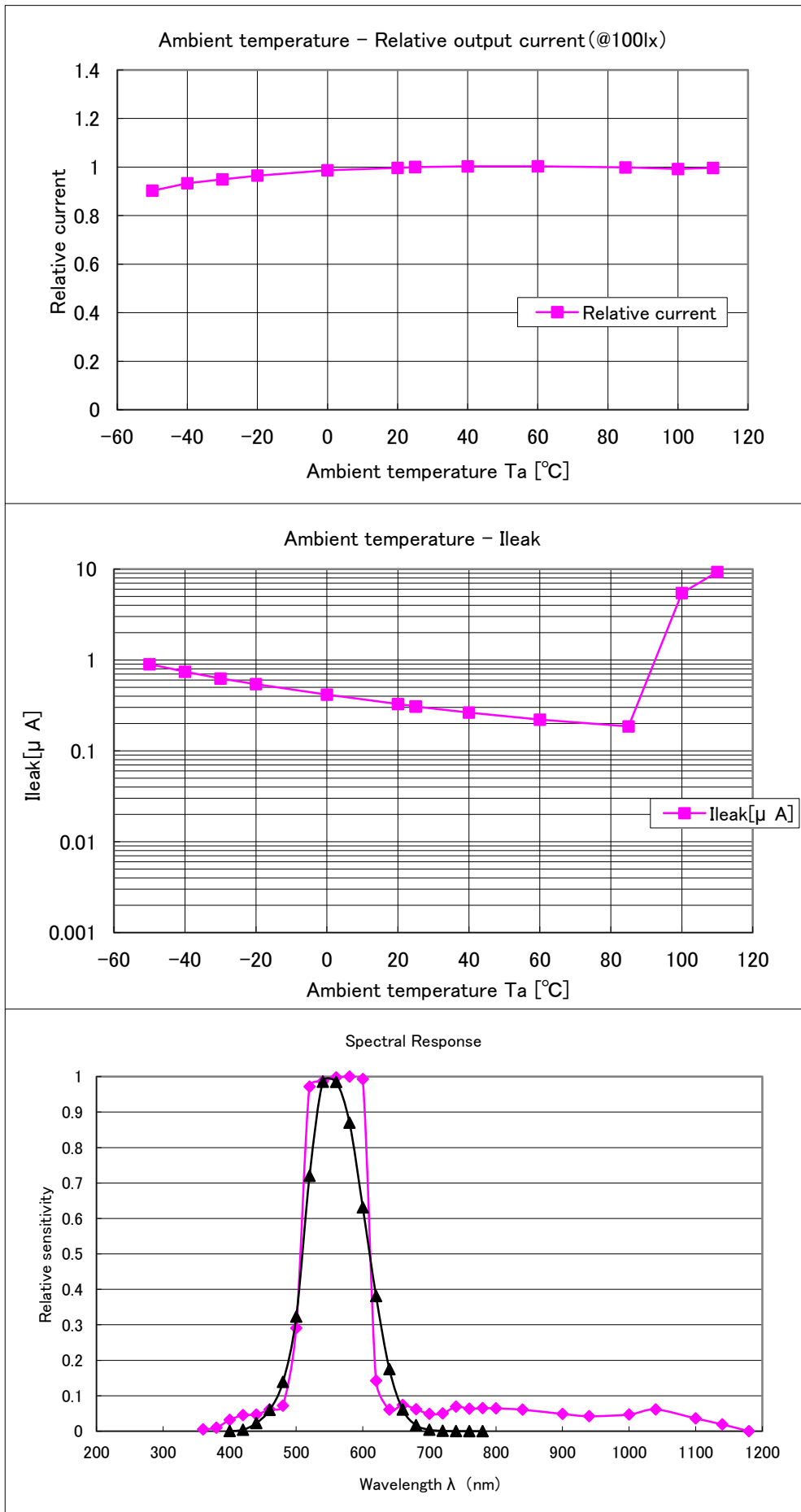


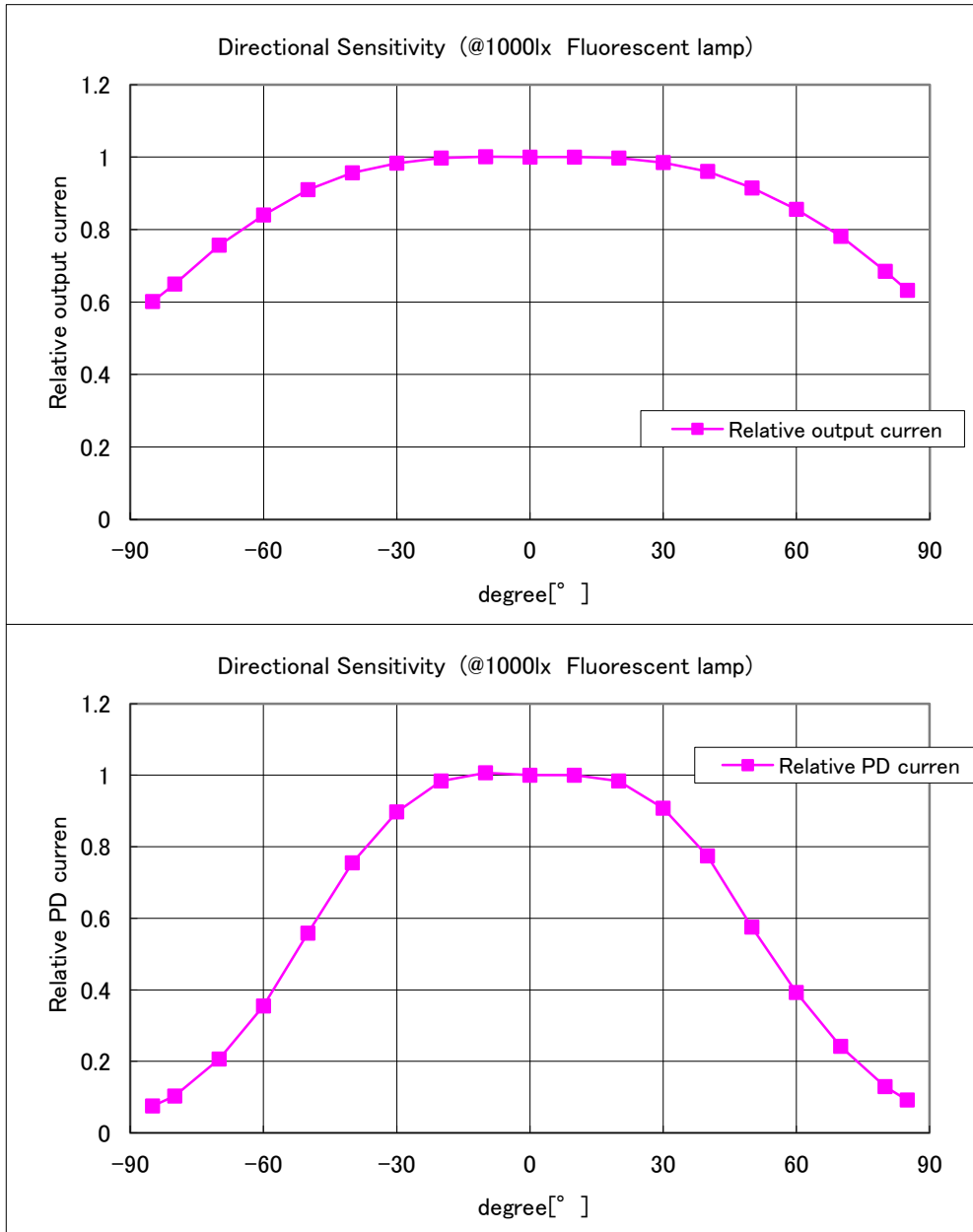
Typical Performance Characteristics





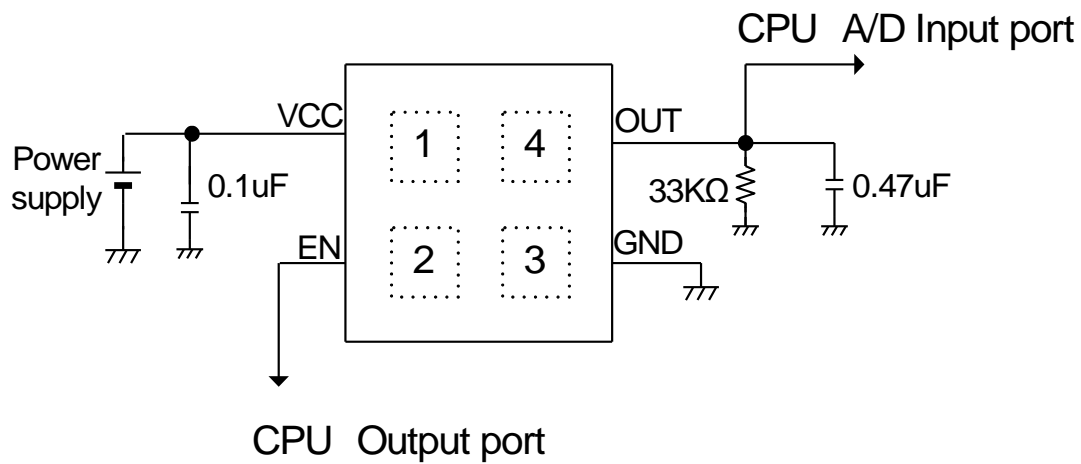
# LV0111CF







## 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.

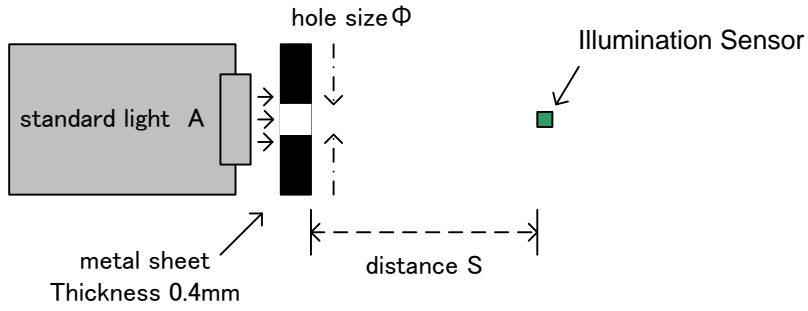
# LV0111CF

## Pin Functions

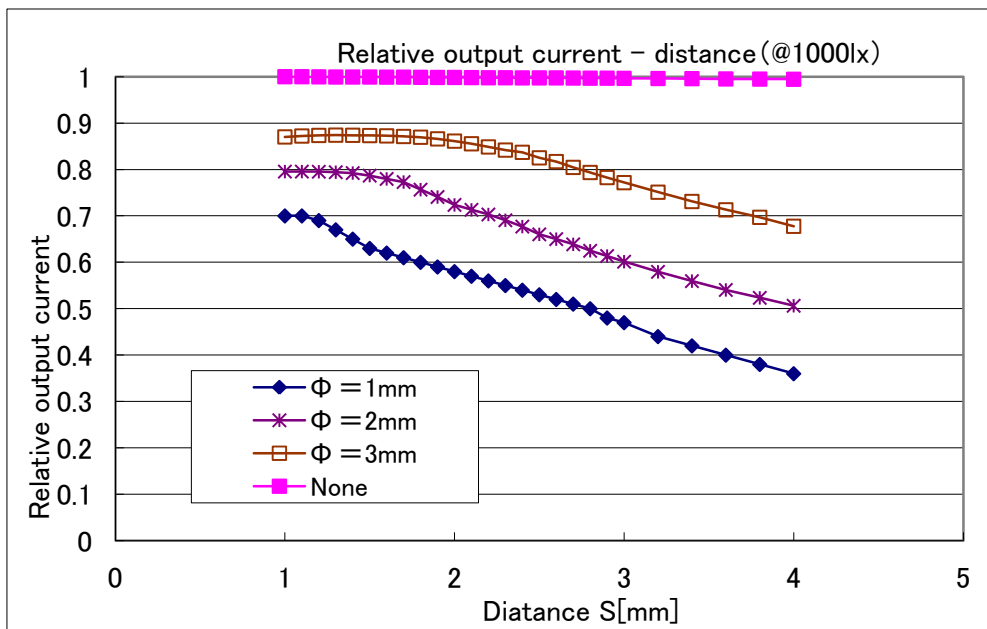
Pin No.	Pin Name	Pin function	Equivalent Circuit
1	VCC	Power supply terminal. Insert a capacitor between this pin and ground to prevent the influence of noise, etc.	
2	EN	Enable terminal. This pin is used to control the IC operational state. When this pin is low, "sleep" state. When this pin is high,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

Relative Output Current vs Distance

• Measuring method



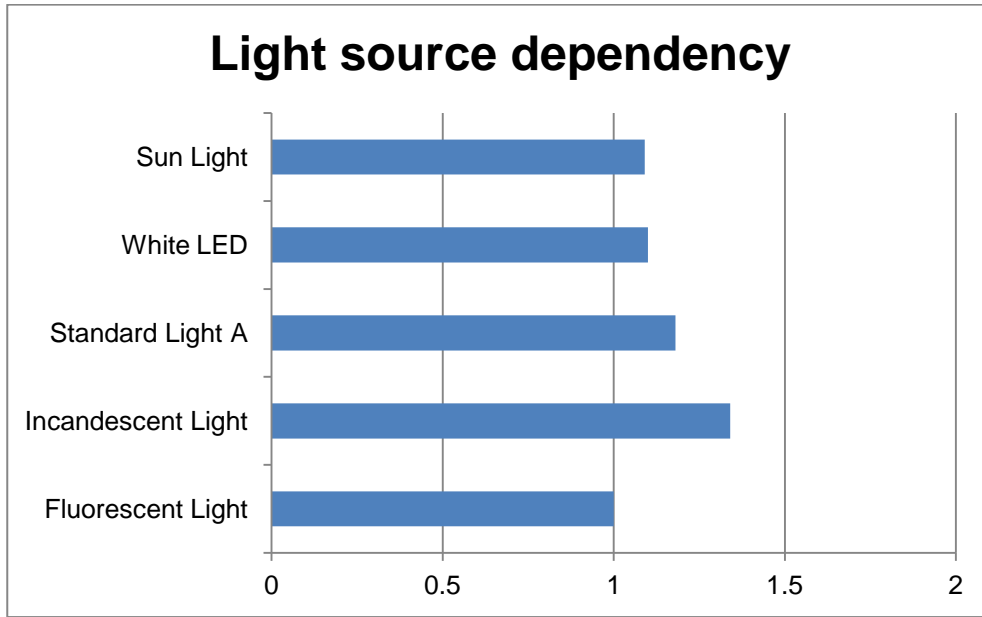
• Evaluation result



• Recommended condition

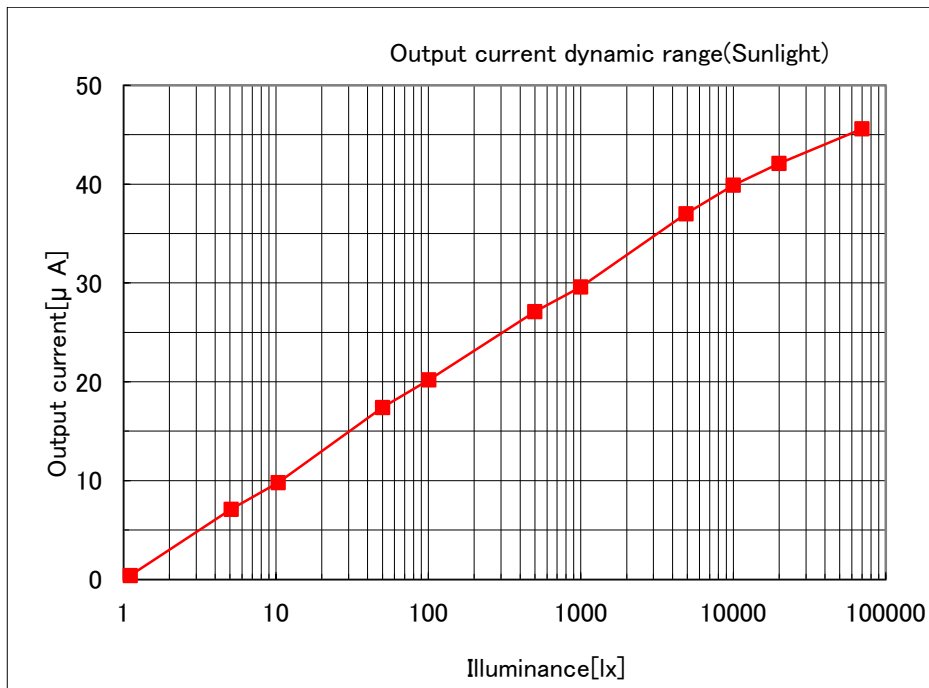
- Hole size  $\phi$  (optical window) = more than 2mm.
- Distance from sensor to optical window = less than 2mm.

Light Source Dependency



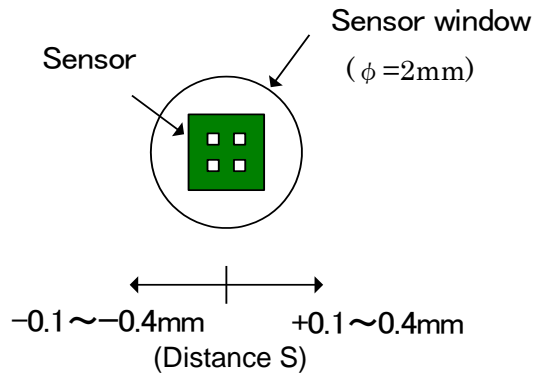
\*Fluorescent light is set to "1"

Dynamic Current Range

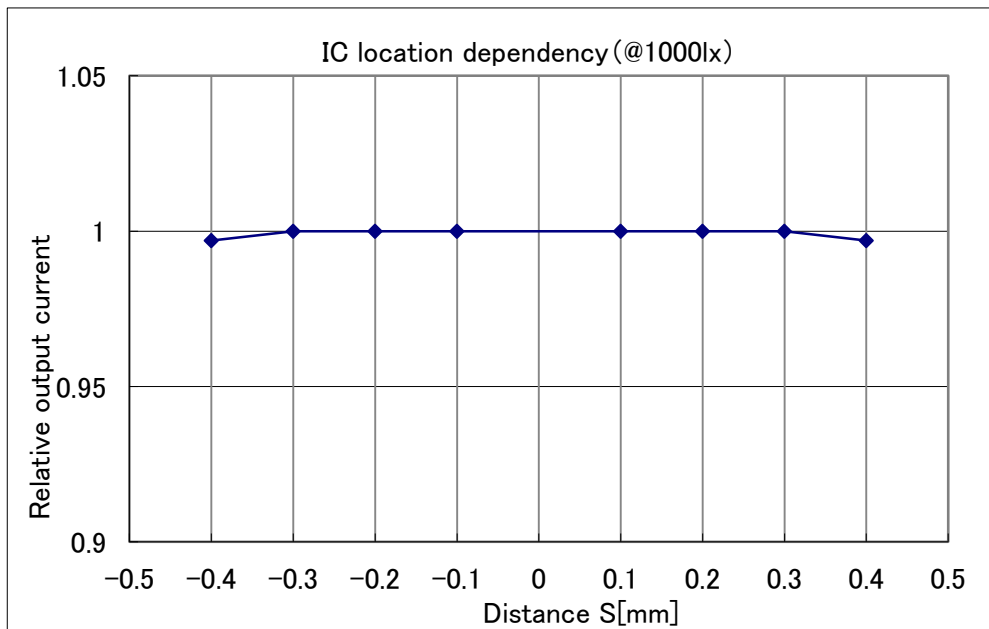
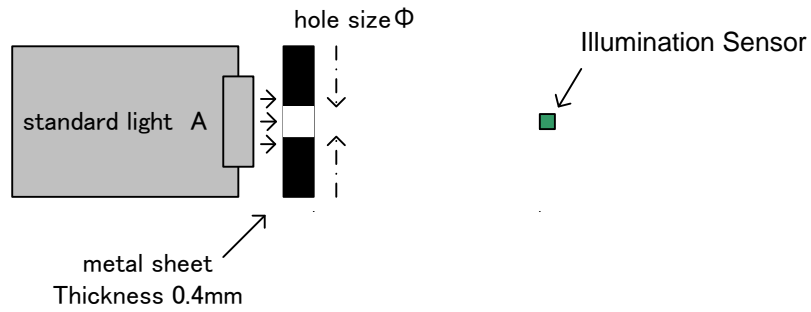


Differential Light Sensibility by IC Location

<Top view>



<Side view>



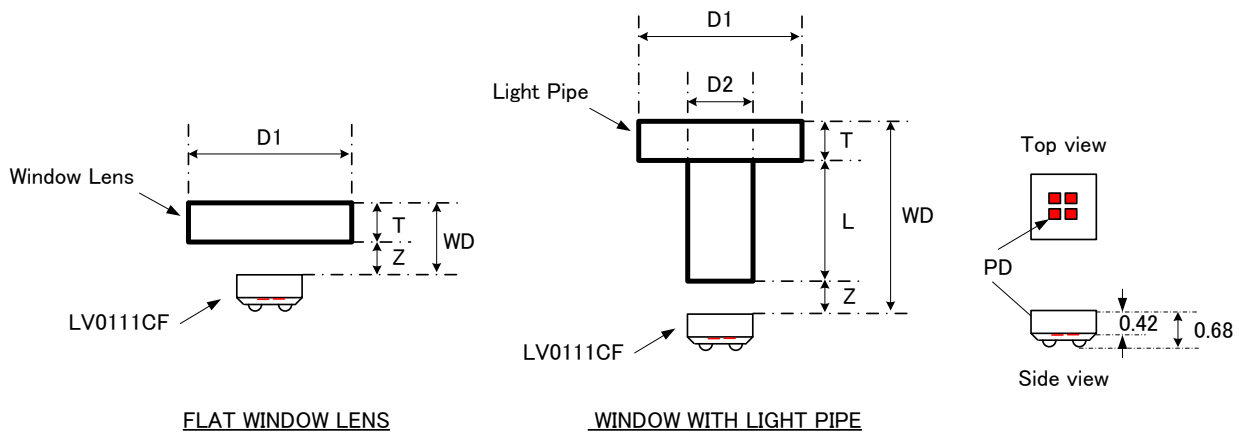
**Window design guide**

**Flat window lens design**

A window lens will surely limit the viewing angle of the LV0111CF. The window lens should be placed directly on top of the LV0111CF. 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  $T = 1 \text{ mm}$  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 LV0111CF, a cylindrical piece of transparent plastic is needed to trap the light and then focus and guide the light on to the LV0111CF. Hence the name light guide or also known as light pipe. The pipe should be placed directly on top of the LV0111CF with a distance of  $Z = 0.5\text{mm}$  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.



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.

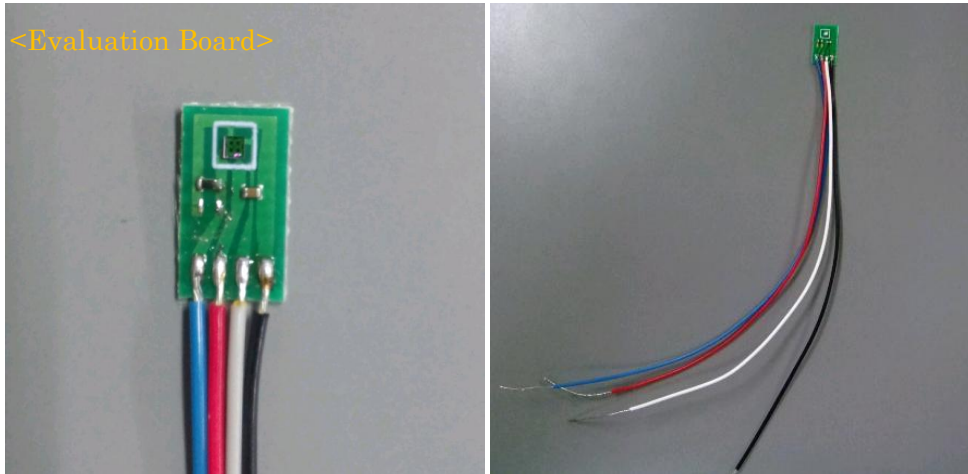
\*These dimensions are based on a window lens thickness of 1.0mm and a refractive index of 1.59.

**WD:** Distance between window front panel and LV0111CF

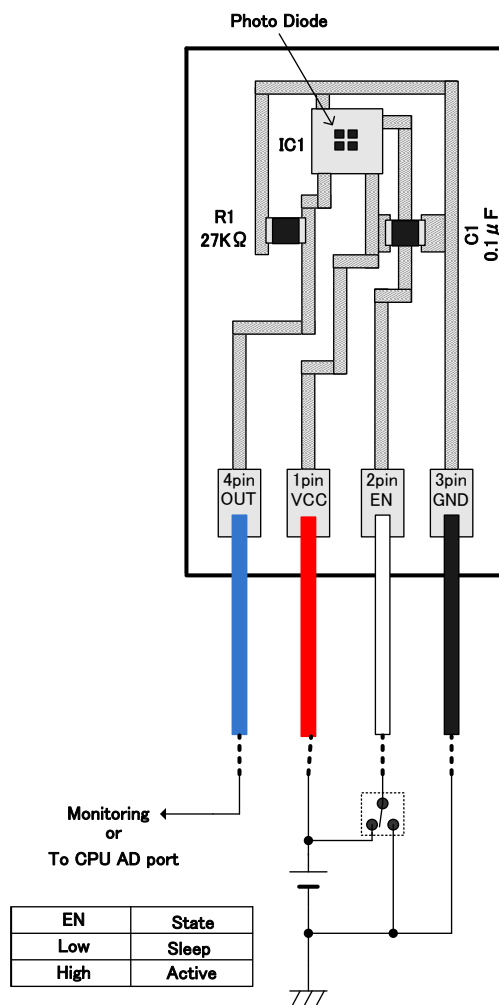
**D1:** Window diameter, **T:** Thickness, **L:** Length of light pipe

**D2:** Light pipe diameter, **Z:** Distance between window rear panel and LV0111CF

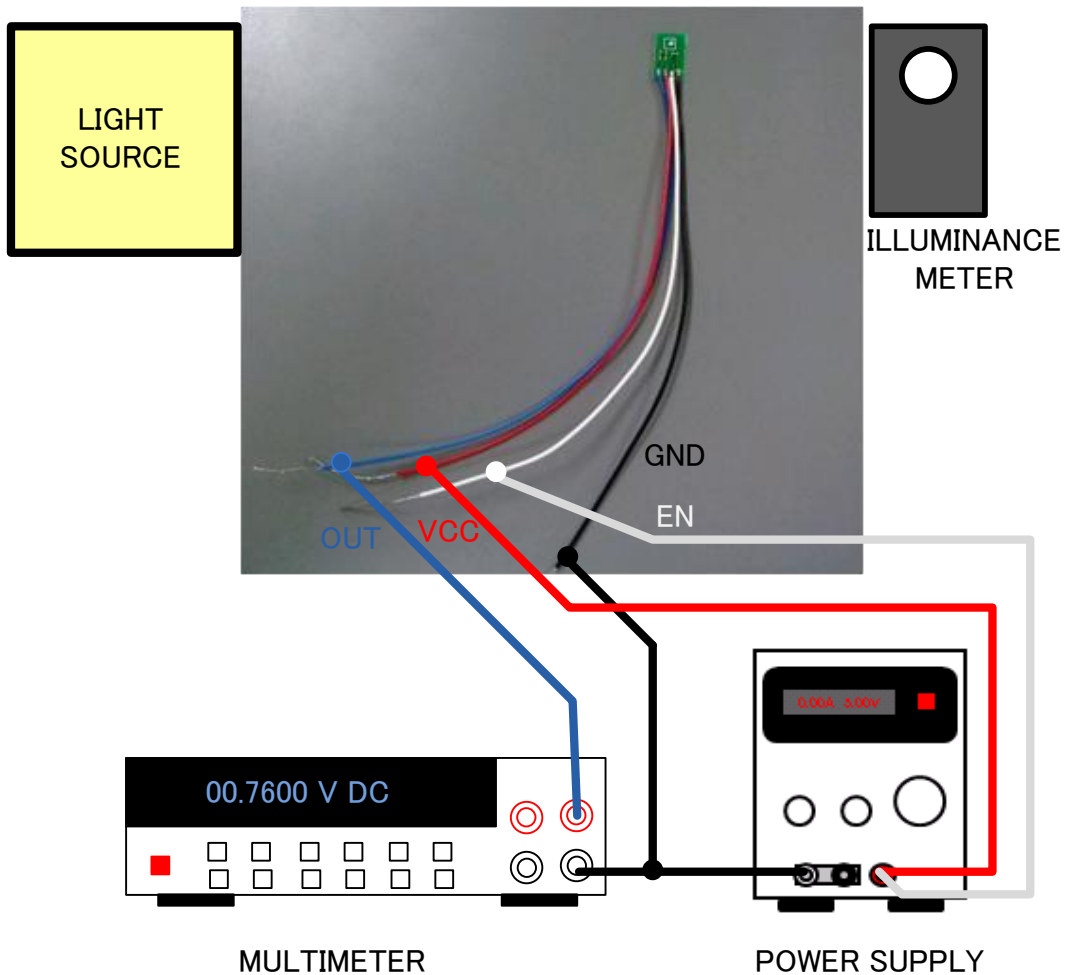
Evaluation Board Manual



Evaluation Board



## LV0111CF



### Test Procedure:

1. Connect the test setup as shown above.
2. Connect IC power supply (2.3V 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 LV0111CF is outputted roughly 28uA. Therefore, multimeter is showed roughly 0.76V. ( $0.76V = 28\mu A \times 27k\Omega$ )

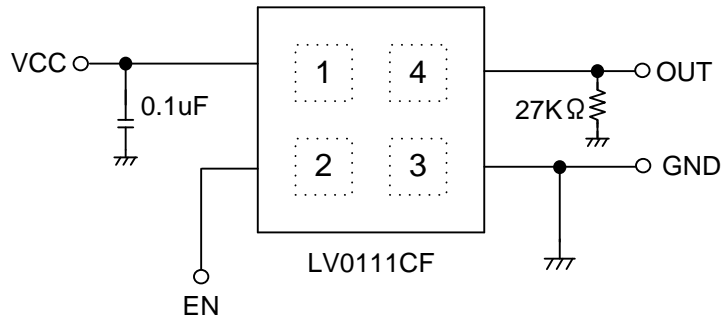
### LV0111CF features:

- Logarithmic current output
- Low current consumption (typ 75uA at 1000lux)



# LV0111CF

## Evaluation Board Circuit Diagram



## Bill of Materials for LV0111CF Evaluation Board

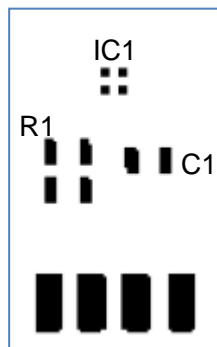
Designator	Quantity	Description	Value	Tolerance	Footprint	Manufacturer	Manufacturer Part Number	Substitution Allowed	Lead Free
IC1	1	Ambient Light Sensor	-	-	ODCSP4 (0.5mm ,pitch)	SANYO	LV0111CF	No	yes
R1	1	OUT (to GND)	27k (0.063W)	±5%	1005 (0402Inch)	ROHM	MCR01MZPJ273	yes	yes
C1	1	VCC Bypass Capacitor	0.1uF /16V	±10%	1005 (0402Inch)	MURATA	GRM155B11C104KA	yes	yes

## Evaluation Board PCB Design

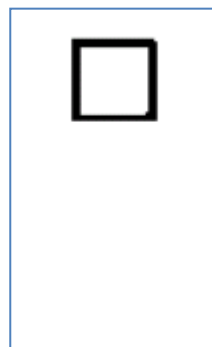
(Top View )



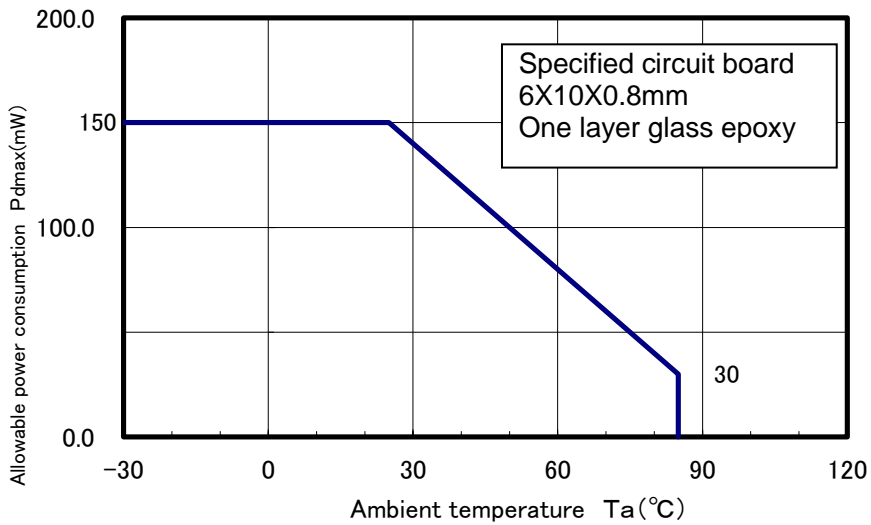
( Pattern )



( Resist )



( Silk )

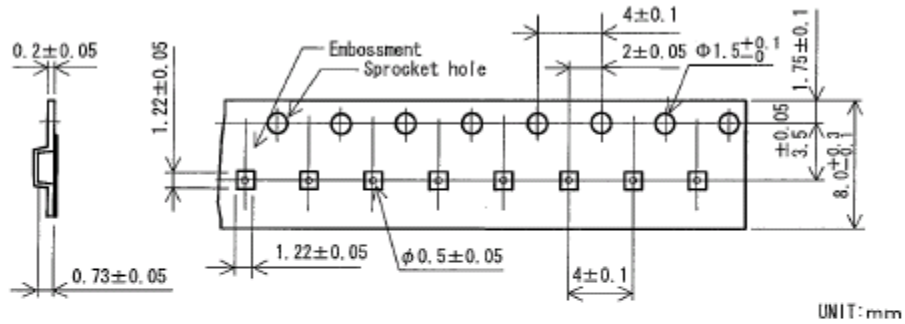


Pdmax - Ta

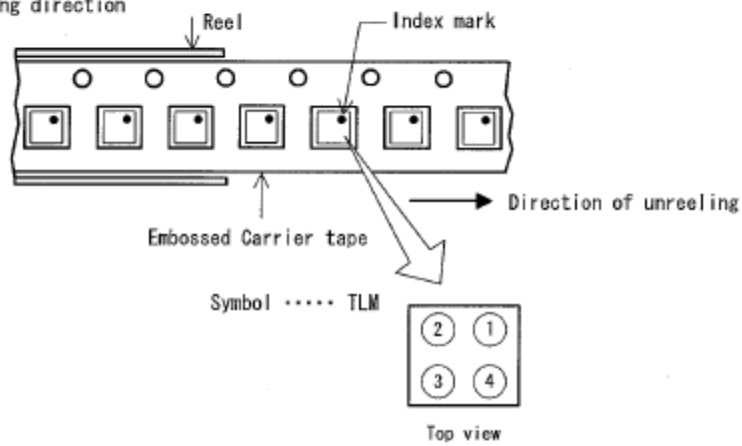
Packing Specification of Embossed Carrier Taping

1. EMOSS CARRIER TAPING

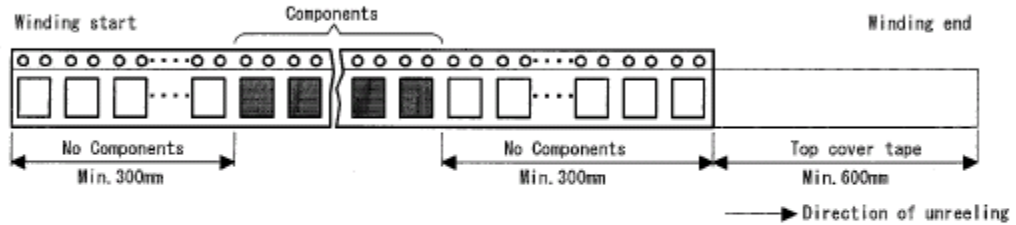
1-1. Emboss carrier tape dimensions



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

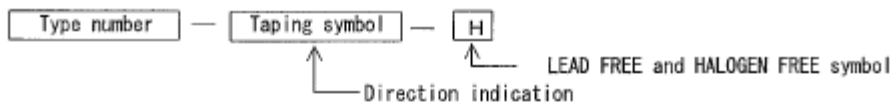
2-2. Peel strength of the top cover tape

(a) Peel angle :  $165^\circ$  to  $180^\circ$  relative to the tape adhesive surface

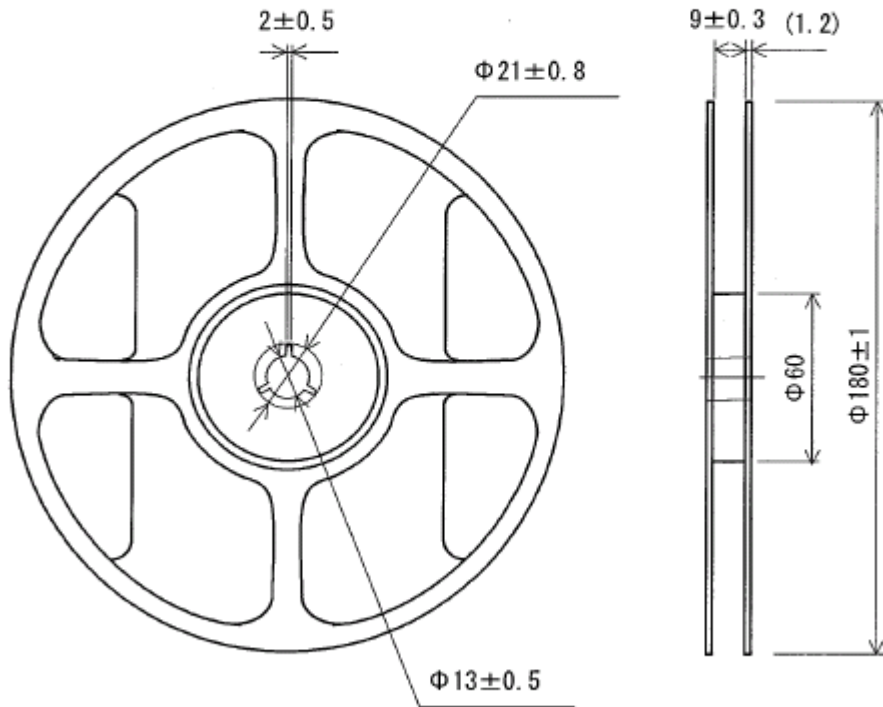
(b) Peel rate : 300mm / minute

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

3. PARTS No. ON BAR CODE LABEL



4. REEL DIMENSIONS



Model : EIAJ-RRM08B  
Unit : mm

# LV0111CF

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)
GARR (BD0115X0115)	ODCSP4/J (1.08X1.08)	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

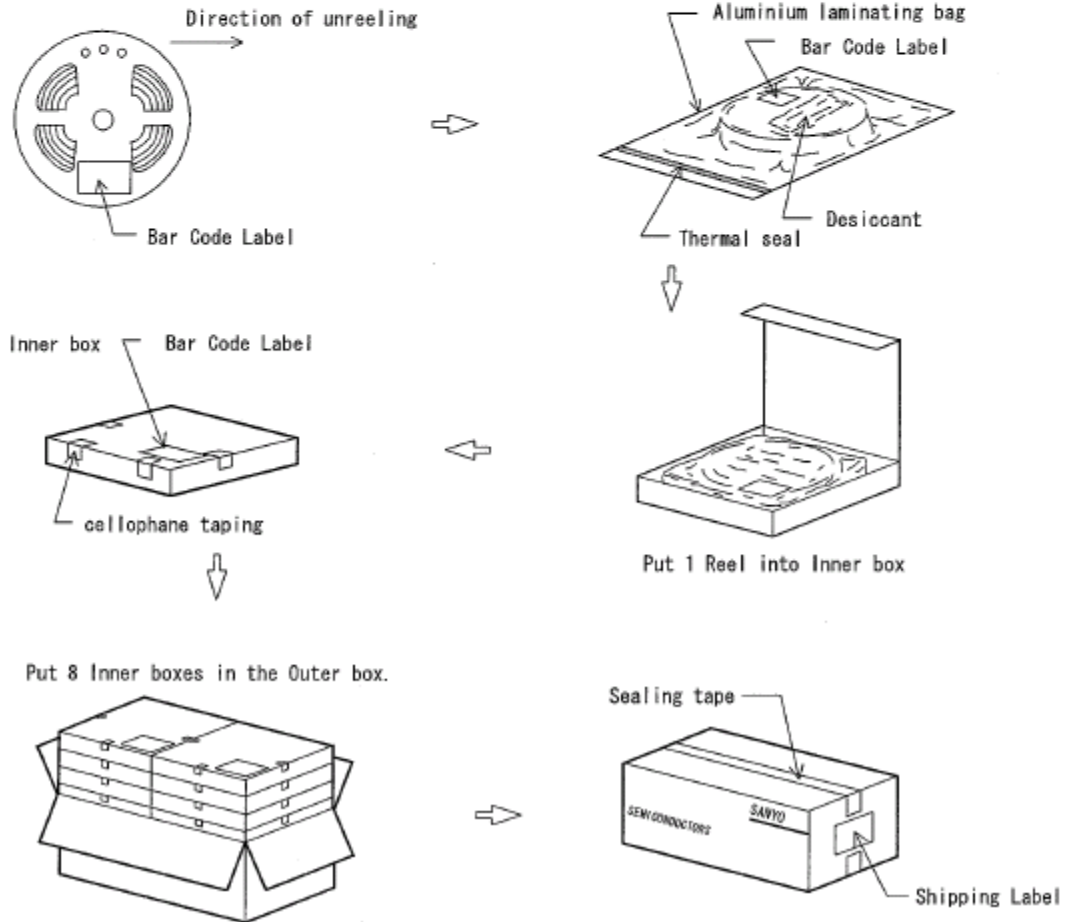


## Shipping Label

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



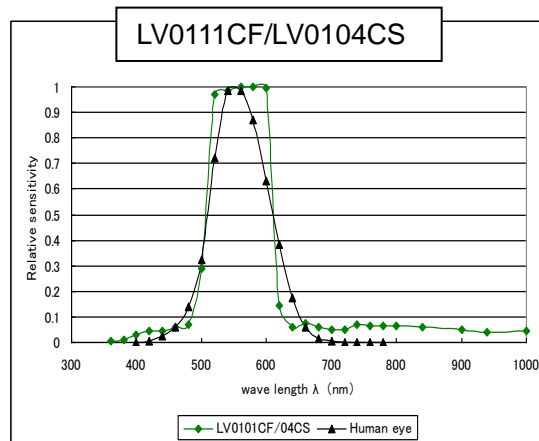
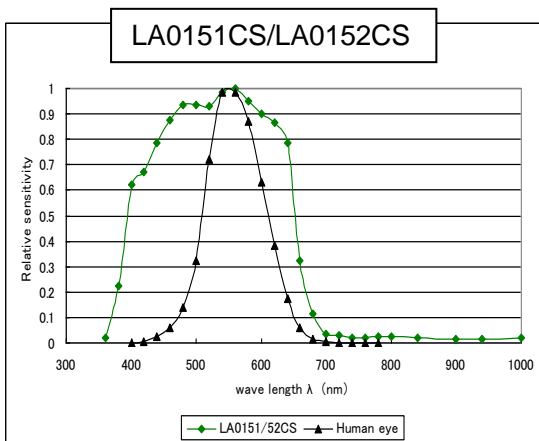
## Packing Method



# LV0111CF

## Lineup of Ambient Light Sensor by SANYO

Product name	LA0151CS	LA0152CS	LV0111CF	LV0104CS
Output type	Linear current	Linear current	Logarithmic 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	0.125~65k 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.