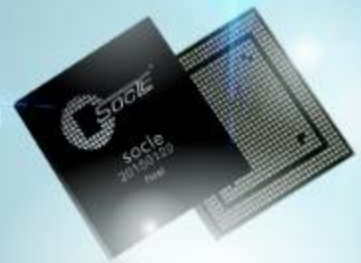
Sharp Proximity Sensors

Product Introduction



虹晶股份有限公司 Socle Technology Corp.

July 2018

Sharp Proximity Sensors

- Proximity sensors are small, low-cost sensors designed for smartphones
- Used for object detection but generally do not return absolute distance
- Primary application is user detection (e.g. 10 cm)
- Potential for off-label use such as touchless switch, robot cleaners
- Current Models (I2C Output):
  - GP2AP070S00F - Proximity Sensor (high accuracy)
  - GP2AP007A00F - Proximity + ALS (Ambient Light Sensing)
  - GP2AP054A00F - Proximity + Gesture + ALS
- New Models under Development:
  - GP2AP080C00F - Proximity + RGB - for AMOLED display, camera adjustment
  - GP2AP090S00F - Laser Diode (IR-VCSEL) Proximity Sensor
- Under Planning:
  - Proximity function using 1D-TOF sensor (can return absolute distance)

GP2AP054A00F

Proximity Sensor and Ambient Light Sensor Basics

■ Proximity Sensor (PS)

- Cell Phone Touch-Screen Auto Disable/ Auto Enable.
- Mechanical Switch Replacement.

Auto disable mode.

Auto enable mode.

Used for Cell phone.

■ Ambient Light Sensor (ALS)

The Ambient Light Sensor (ALS) has a wide range of performance allowing accurate ALS measurements in lighting environments ranging from low-light to bright sunlight.

This Sensor is particularly useful for display management dimming or brightness control with the purpose of reducing power consumption, extending battery life, and providing the optimum viewing in diverse lighting conditions.

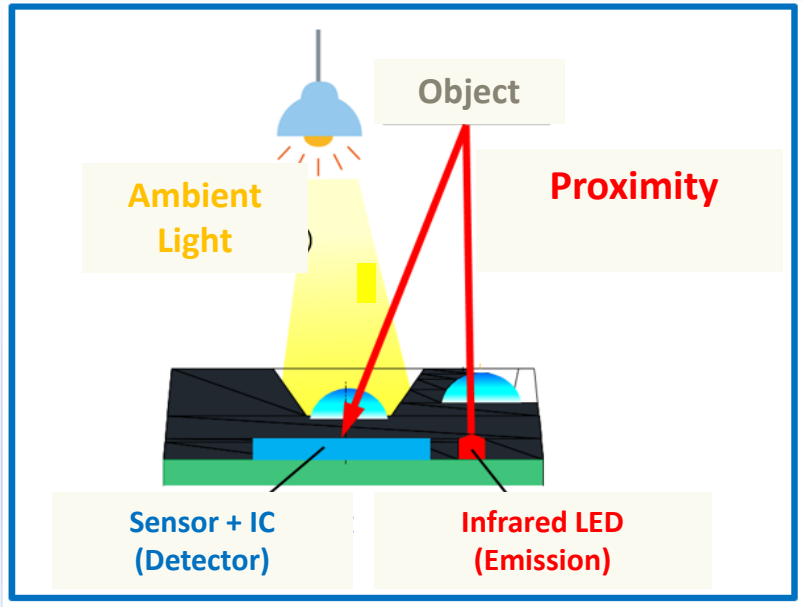
■ Principle of operation and configuration

Illuminate the infrared LED, digitally output the amount of light reflected from the object and convert it into distance.

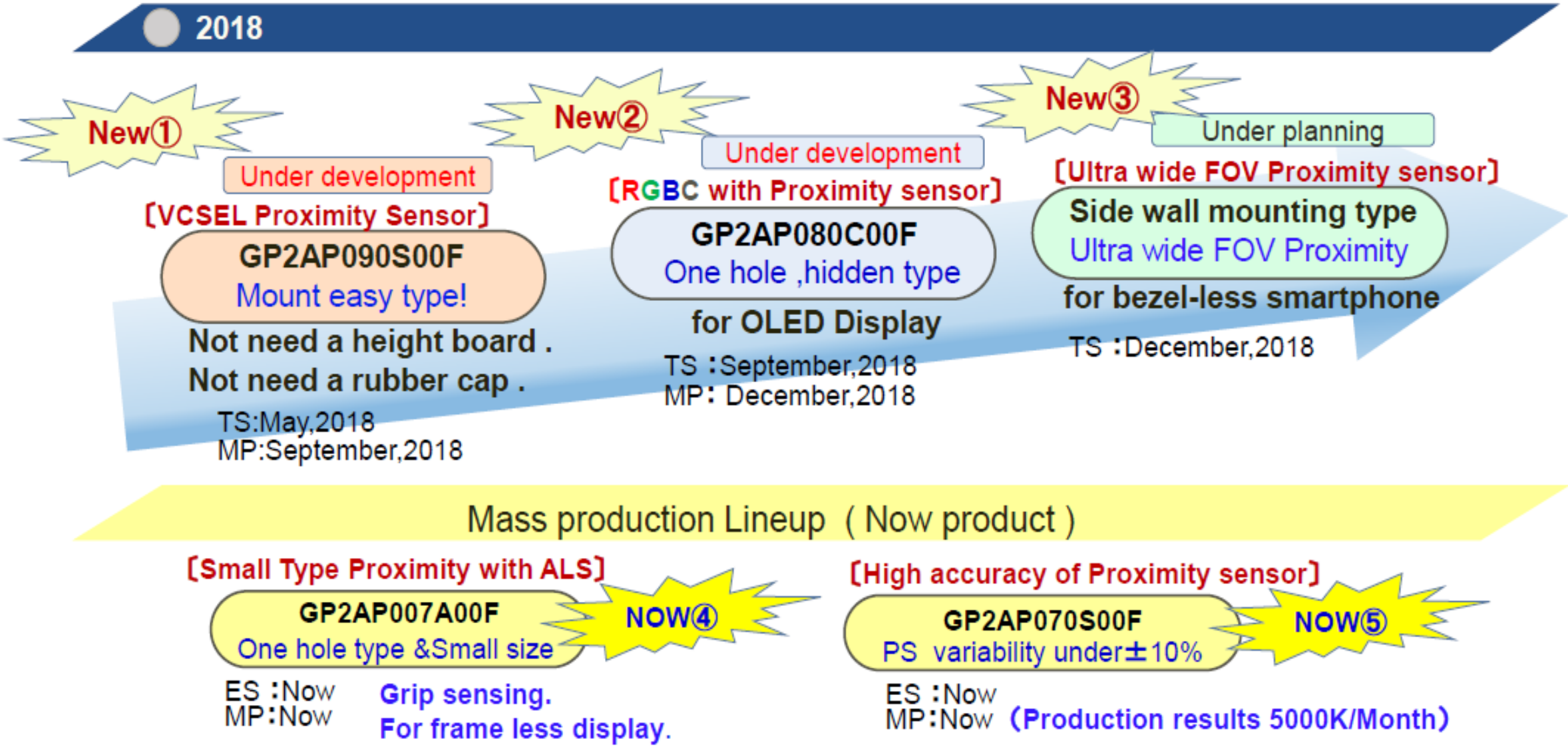
Various malfunction prevention algorithms are realized with hardware and software.

By our proprietary packaging technology, the proximity sensor and the illuminance sensor interfere
It is formed without integral formation.

Head-mounted



Sharp Proximity Sensors Roadmap



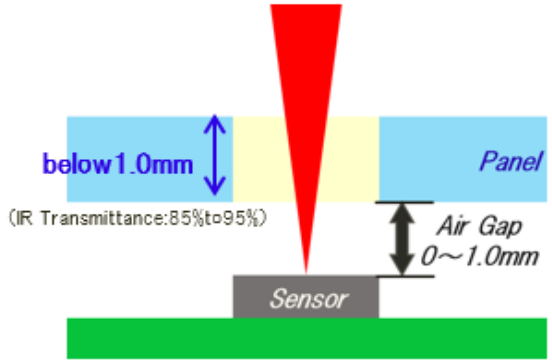
Compare Proximity Sensors with DMS and TOF Sensors - Panel Mounting

Please select sensor by panel mounting condition.

Distance Measuring Sensor

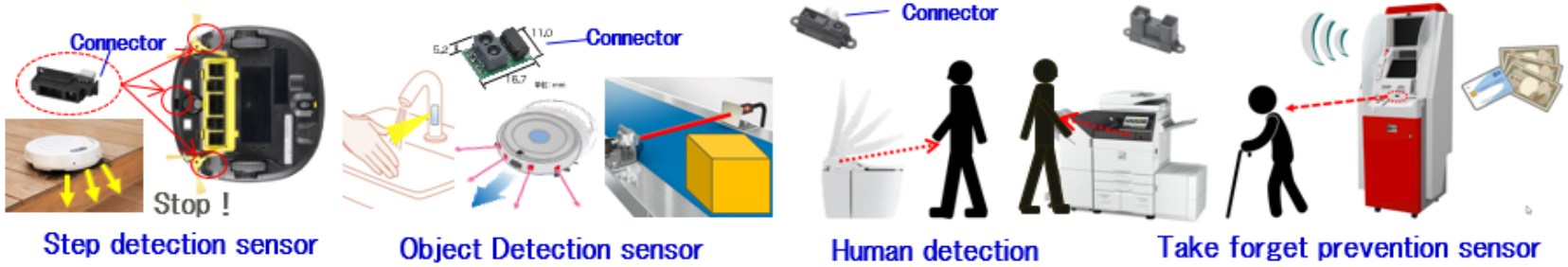
〔Panel mount condition〕

Air Gap: 0 ～1.0mm



■Detection distance range

2～15cm	4～50cm	10～80cm	20～150cm
Model:GP2Y0A51SK0F	Model:GP2Y0E03	Model:GP2Y0A21YK0F	Model:GP2Y0A02YK0F



Step detection sensor | Object Detection sensor | Human detection | Take forget prevention sensor

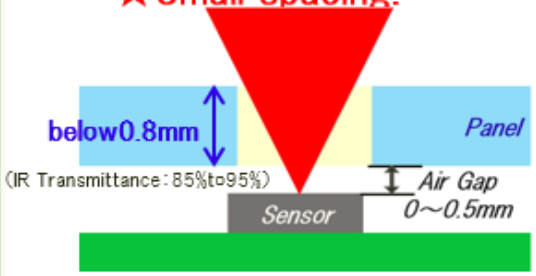
Easy mounting. With Connector and screw holes.

TOF Sensor/Proximity Sensor

〔Panel mount condition〕

Air Gap:Must 0～0.5mm

★Small spacing.



■Proximity Sensor ■TOF Sensor

0～10cm	4～120cm	4～500cm
Low Price	*Middle range*	*Long range*
Model:GP2AP008/070S Distance accuracy:10cm±10mm	Model:GP2AP01VT10F Distance accuracy:120cm±5cm	Next Model TS:03/2018

Under planning: *Multi Long range*

Proximity sensor/Grip Sensor | AF Camera of smartphone

Safety sensor | AR/VR/Robotics

Proximity Sensor - GP2AP070S00F

TS : NOW, MP:NOW

Features

Type:GP2AP070S00F

【Overview】

- All in one（ Photo-diode detector, LED emitter ）
- Two hole window type
- Package Size： 4.0mm×2.0mm×1.1mm
- Operation voltage : 2.2V to 3.6V
- Low Power consumption :
  0.18µm process technology with 1.8V,I2C bus interface
- Design :
  Hidden design by black Regine Integrated IR LED and Synchronous LED Driver

【Proximity function】

High accuracy of Proximity Sensor,
Factory calibrated PS detection.

- Cancellation of cross-talk : offset adjustment registers
- Full Scale : Up to 14-Bits

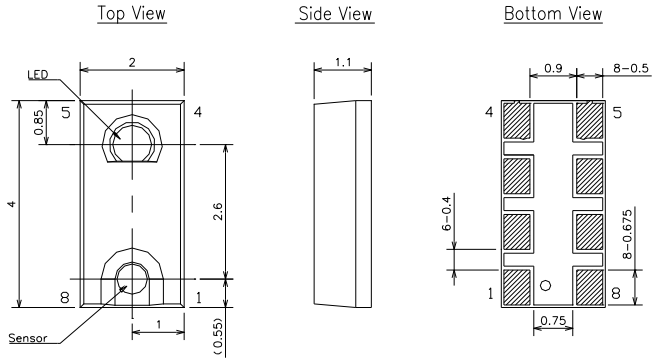
【I2C Interface compatible】

- Clock frequency : Up to 400kHz
- Dedicated Interrupt Pin

Specification

Parameter	Symbol	Characteristics	Condition
Operation voltage	Vcc	2.2 to 3.6 V	
Consumption current	Icc	Typ 170 µA	At non-detecting
LED peak current	I_{LED}	82 mA	
LED peak wavelength	λ_{ps}	Typ.940 nm	
Detecting distance	Lon	90～110 mm	
Operation temperature	Topr	-30 to +85 ℃	

Outline dimensions



Pin	Pin name	Symbol
1	Supply Voltage	VCC
2	Non Connect	NC
3	Ground	GND
4	LED Cathode	LEDK
5	LED Anode	LEDA
6	I2C Clock	SCL
7	Interrupt	INT
8	I2C Data Bus	SDA

Proximity Sensor with ALS - GP2AP007A00F

TS : NOW, MP:NOW

For frame less display : Type : GP2AP007A00F

"Proximity Sensing" or "Grip Sensing"

(1) "Grip only". Display power on.
(2) "Grip" and "Telephone call" . Display power off.
(3) "Grip only". Screen does not rotate.

Flame less display

Proximity Sensor with ALS
(Proximity with Ambient Light Sensor)

Left Side
(Proximity Sensor)

Grip Right Side
(Proximity Sensor)

Recommended model
"One hole type".
・GP2AP007A00F

Hard case type.

No problem. Many kind case type.

Note book type.

Soft case type.

SHARP

Proximity Sensor with ALS - GP2AP007A00F

TS : NOW, MP:NOW

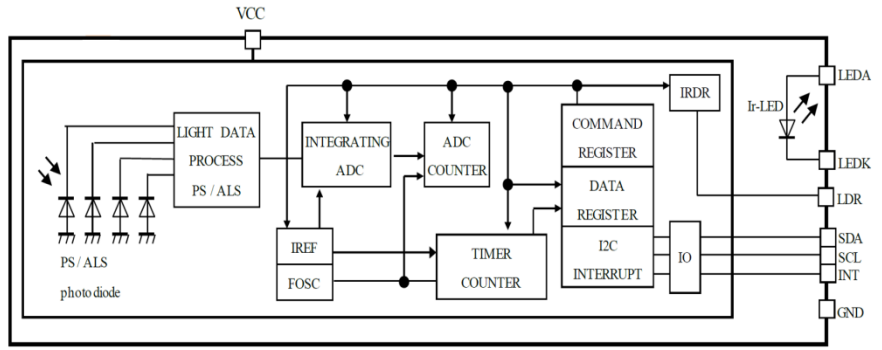
Features

Type:GP2AP007A00F

- Small Window and Small Size Package Proximity with ALS.
  Panel window size : Min : 1.2mm×1.75mm～
- Detecting distance [*1] : Typ. 0～100mm
- Small package : 2.5×2.0×1.0 mm
- Single package with receiving light and LED parts easy to design
- Even the low illumination (0.02 lx) can be detected.

[*1] Kodak Gray Card(white side [r=0.9])

Block diagram

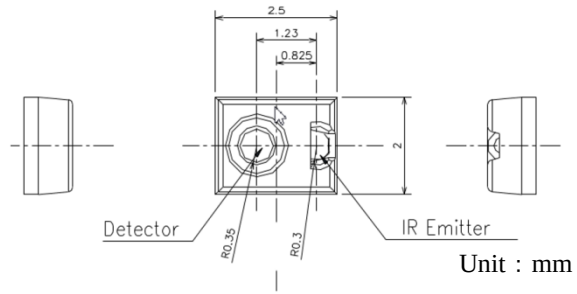


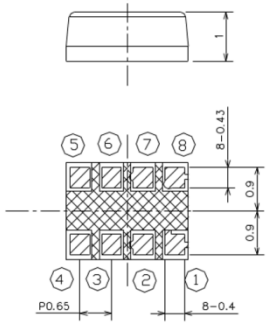
Specification

	Parameter	Symbol	Characteristics	Condition
Common part	Operation voltage	Vcc	2.2～5.5V	
	I2C voltage	VI2C	1.7～Vcc	
	Consumption current (proximity)	Icc_PS	Typ.170uA	Ta=25℃、Vcc=VI2C=3.0V
	Consumption current (ALS)	Icc_ALS	Typ.100uA	Ta=25℃、Vcc=VI2C=3.0V
	Consumption current (shut own)	Icc_s	Max.5uA	Ta=25℃、Vcc=VI2C=3.0V
	Operation temperature	Topr	-30～+85℃	Vcc=VI2C=3.0V
PS part	LED current 1	I_{LED1}	Typ.19mA	IS[1:0]=00
	LED current 2	I_{LED2}	Typ.38mA	IS[1:0]=01
	LED current 3	I_{LED3}	Typ.75mA	IS[1:0]=10
	LED current 4	I_{LED4}	Typ.150mA	IS[1:0]=11
	Peak wavelength	λLED	940nm	
	Detecting distance	Lon	Typ. 100mm	ILED=130mA [*1]
ALS part	Adccode_ALS1	Data_1	1000±200lx	Vcc=3.0V,RES_A[2:0]=100 , RANGE_A[2:0]=011,Ev=1000 lx , White color LED 5200K
		–	–	

[*1] ILED=140mA / without panel / the detection object : Gray Card(white side / r=0.9) , 100x20mm

Outline dimensions





Pin	Pin name	Symbol
①	LED Cathode	LEDK
②	LED driver	LDR
③	Interrupt	INT
④	I2C Data Bus	SDA
⑤	Supply Voltage	VCC
⑥	I2C Clock	SCL
⑦	Ground	GND
⑧	LED Anode	LEDA

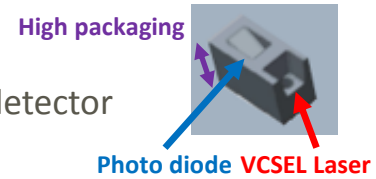
Proximity Sensor (Laser Diode/VCSEL Type) - GP2AP090S00F

TS: May 2018 MP: Sep 2018

Features

New①

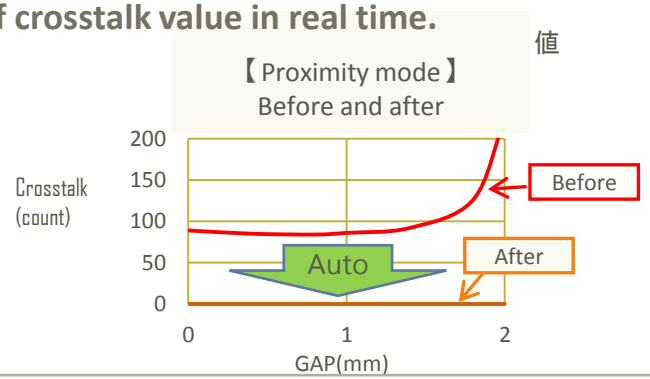
Type:GP2AP090S00F



- All in one
  Laser Diode（IR-VCSEL）emitter, Photo-diode detector
- **One Hole window type.**
  Low crosstalk and low power consumption.
- Crosstalk reduction function.
  Dynamic calibration and Auto calibration.
- High packaging structure. Easy mounting.
  Package height is 2.5 times higher than Standard type.
  No need rubber cap . No need height adjustment board.
- Package Size （2.0×3.65× Height： 2.5mm）

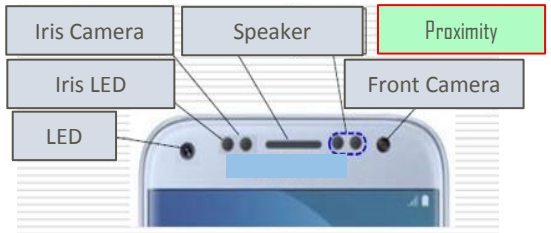
Low crosstalk

- **Dynamic calibration**
  Automatic correction of crosstalk initial value.
- **Auto calibration**
  Automatic correction of crosstalk value in real time.



Simple Design

New devices increased. The hole also increased.

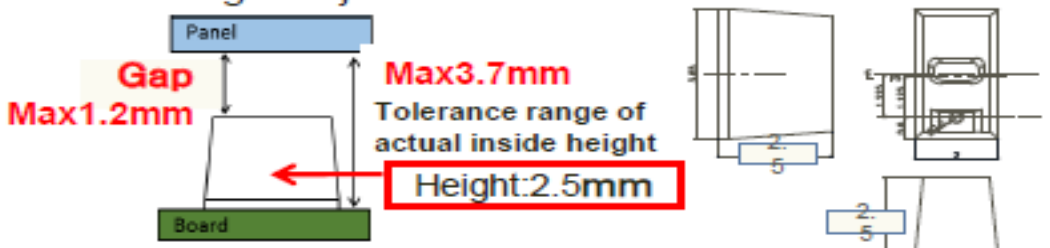


One Hole window type Simple Design.

Easy mounting

High packaging structure. Easy mounting.

- No need rubber cap.
- No need height adjustment board.



- **Tolerance range of Gap :*Max1.2mm***
- **Tolerance range of actual inside height :*Max3.7mm***

SHARP

Proximity Sensor with RGB - GP2A080C00F

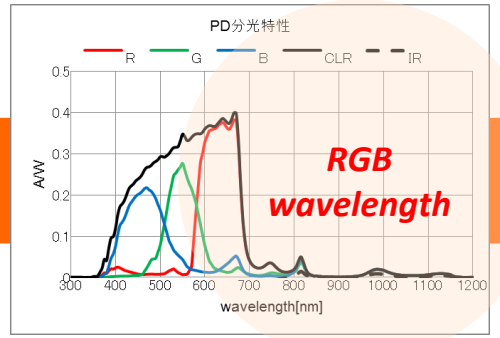
New②

TS：Sep 2018 MP: Dec 2018

For OLED display ：Type ：GP2A080C00F

【Definition】Sensor for sensing the 3 primary colors of light. Measure the color temperature (CCT) of light. So it is able to control color conditions for the OLED. Other applications include: camera white balance, exposure and flash light adjustment, panel display color tone and brightness adjustment.

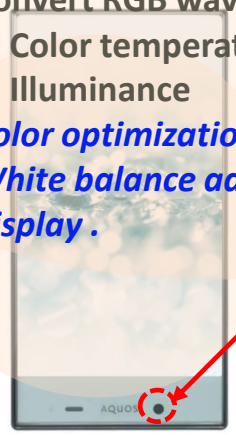
[Spectral Characteristics]



Convert RGB wavelength.

- Color temperature
- Illuminance

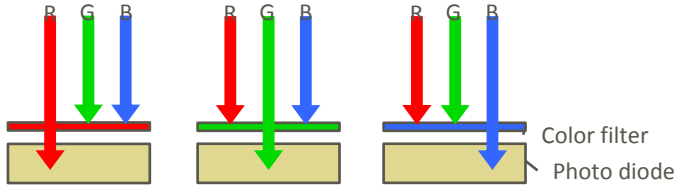
Color optimization ,
White balance adjustment of display .



One-hole type
・Φ2.3mm~
One Package Type
・4.0 x 2.0 x 1.0mm

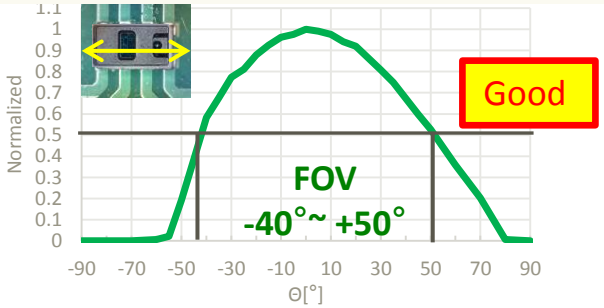
[Photo diode pattern]

● For measure CCT ,
Sensor use photo diode & color filter



● Wide FOV

SHARP（GP2AP080C00F）



SHARP

Proximity Sensor with RGB - GP2A080C00F

New②

TS: Sep 2018 MP: Dec 2018

Features

Type:GP2AP080C00F

- Simple design model. One-Hole type RGB sensor.

Two-Hole type → NEW → One-Hole type

Hole size
Φ2.3mm～
Simple Design !

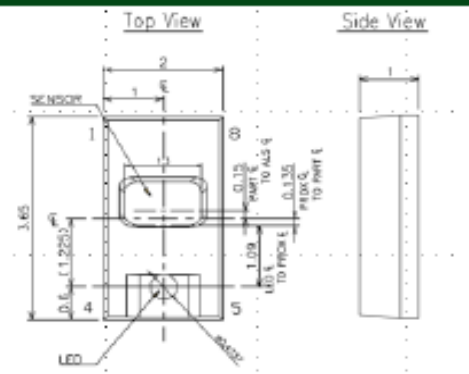
- Black lens Type

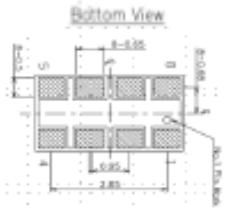
NEW

Cost reduction !
No need panel paint.
No look sensor.

- Proximity Detecting distance [*1] : Typ. 100mm
- All in one : 3.65×2.0×1.0 mm

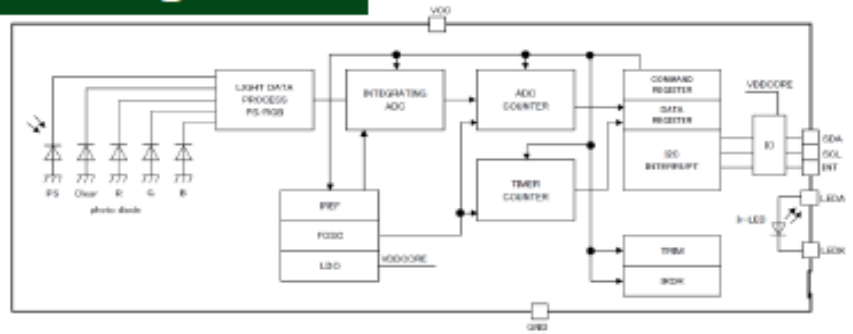
Outline dimensions





Pin	Pin name	Symbol
1	Supply Voltage	VCC
2	I2C Data Bus	SDA
3	I2C Clock	SCL
4	LED Anode	LEDA
5	LED Cathode	LEDK
6	Ground	GND
7	Interrupt	INT
8	Ground	GND

Block diagram



Specification

Ta=25℃(unless otherwise specified)

Parameter	Symbol	Operating condition	Unit	Remarks
Power supply voltage	VCC	1.7 to 3.6	V	
LED voltage	VLED	3.0 to 3.6	V	
I2C voltage	VI2C	1.7 to Vcc	V	
Operating temperature	Topr	-30 to 85	℃	
SCL, SDA input low level	VIL	-0.3 to 0.54	V	
SCL, SDA input high level	VIH	1.26 to Vcc+0.2	V	

Electrical and Optical Characteristics

Ta=25℃, VCC=VLED=VI2C=3.0V
(unless otherwise specified. The external circuit constants follow the recommended external circuit of page 3.)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
ADCCODE_ALS1	Data_A1	800	1000	1200	Lux	RES_A[1:0]=01, RANGE_A[3:0]=0110, at 1000 lx, White color LED 5200K *1
ADCCODE_ALS2	Data_A2	800	1000	1200	Lux	RES_A[1:0]=01, RANGE_A[3:0]=0110, at 1000 lx, Fluorescent lamp 6900K *1
ADCCODE_ALS3	Data_A3	800	1000	1200	Lux	RES_A[1:0]=01, RANGE_A[3:0]=0110, at 1000 lx, Halogen lamp 2770K *1
ADCCODE_ALS4	Data_A4	400	500	600	Lux	RES_A[1:0]=01, RANGE_A[3:0]=0110, at 500 lx, Incandescence lamp 2700K *1
Correlated Color Temperature	Data_CCT1	—	5200	—	K	RES_A[1:0]=01, RANGE_A[3:0]=0110, LED 5200K
	Data_CCT2	—	2770	—	K	RES_A[1:0]=01, RANGE_A[3:0]=0110, LED 2770K
ADCCODE_RGB	Data_RGB	-20	0	+20	%	RES_A[1:0]=01, RANGE_A[3:0]=0110

SHARP

Ultra wide FOV Proximity Sensor for bezel-less smartphone

TS: Dec 2018

New③

Ultra wide angle Proximity Sensor

Under planning

◆Proximity sensor mounting position

To mount on the front of the display.
It is not suitable for narrow frame panel design.

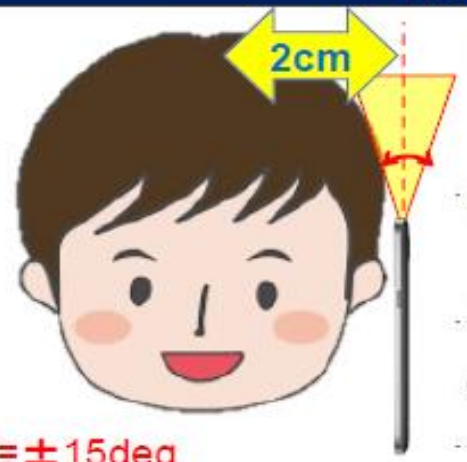
Plan

◆New mounting position

Ultra wide angle proximity sensor mounted on the "side wall".

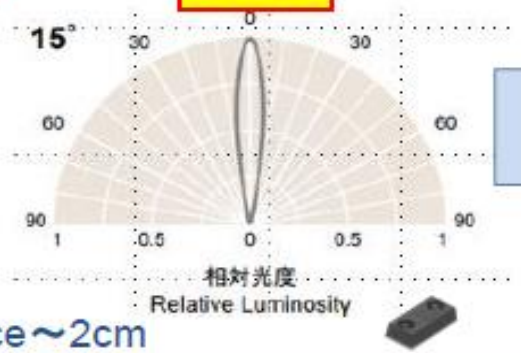
An example of mounting to
the side wall.

Now



The sensor FOV specification
can not detect objects.

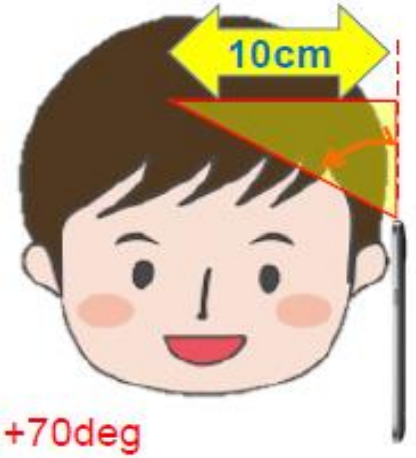
Bad



FOV=±15deg
※horizontal direction distance～2cm

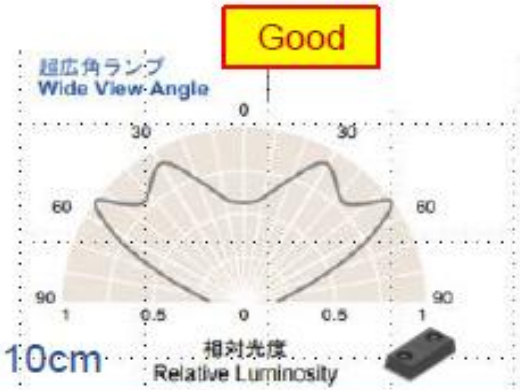
idea

New sensor (Ultra wide angle Proximity Sensor)



Ultra wide angle specification
can detect objects.

Good



FOV= +70deg
※horizontal direction distance～10cm

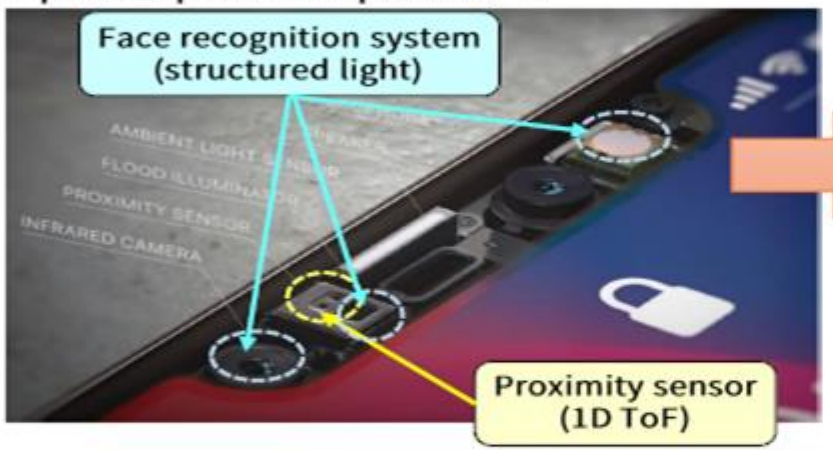
SHARP

Proximity-TOF sensor - Under Planning

Proximity ToF for wake up Face-ID system

Proposal for Face-ID system

Exploded picture of product "X"



How does Proximity sensor work for 3D app?

3D camera system consumes such high power that the face recognition (or 3D apps) cannot always work. Addition of proximity ToF sensor to such a system can greatly help wake up the 3D camera system triggered by some proximity detection.

1D-ToF type proximity sensor

Features

- Small package: 3.6×2.2×1.0 mm
- Active power consumption ~10mW
- All in one(SPAD detector, IR-VCSEL emitter)
- Detecting distance : Typ. 70cm @18% Grey
- Considering S/N improvement;
  ①High accuracy ~3%
  ②Robust cross talk (Panel reflection)
  ~ Gap = 0.5mm
  ③Tolerant of sunlight noise

※ Specs., sample providing schedule and so forth are subjects to change.

Proximity-TOF sensor - Under Planning

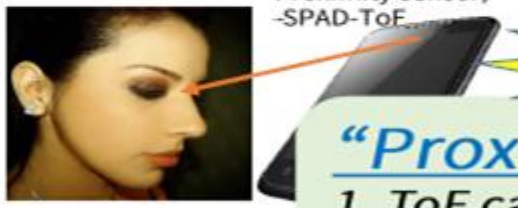
Proximity ToF for wake up Face-ID system

Small package 1D-ToF for face recognition

Issue

3D image sensor is higher power consumption
- Depth sensor, power consumption ~3.0 W
- Impossible to keep it power ON

How to start 3D sensor to reduce power consumption?
- Press a hard switch of a smartphone? → Not Smart.
- Recognize handling by human with motion sensor? → Complicated



Solution

"Proximity function by absolute distance"

1. ToF can detect the access of a human face in the range of 40cm~50cm.
2. Then starts 3D image sensor for face recognition.
Smart and easy system with low power consumption ~ 10 mW

Small package with original optical design and effective circuit design
- High accuracy of distance output ~3%
- Robust over cross talk from a panel

SHARP

About Socle Technology Corp.

- Founded in 2001, Socle Technology Corp is a leading semiconductor design firm headquarted in Taiwan
- Socle provides SoC (System-on-Chip) design services for IoT, server, automotive, multimedia, and peripheral market segments
- 100% owned by Foxconn Technology Group (Hon Hai Precision Industry Co., Ltd.)
- Sales and marketing for Sharp Optoelectronics components and sensors in North America and China since 2017
- Parts are still designed and manufactured by Sharp, no change in production or packaging or branding
- Authorized distributors: WPG Americas, Future Electronics, Mouser, Digi-Key, WPI Group

For more information, contact: Socle_Sales_NA@socle-tech.com

http://www.socle-tech.com/