Introduction to Android Light Sensors

CS 436 Software Development on Mobile

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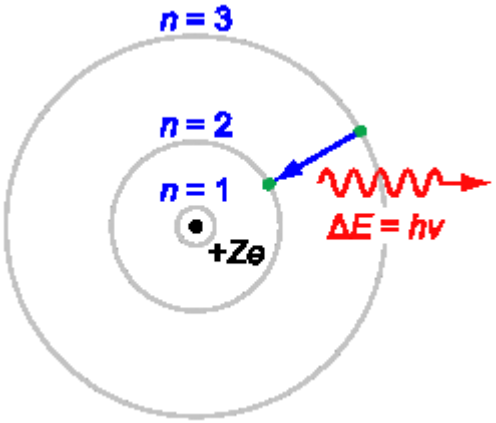
Light sensor

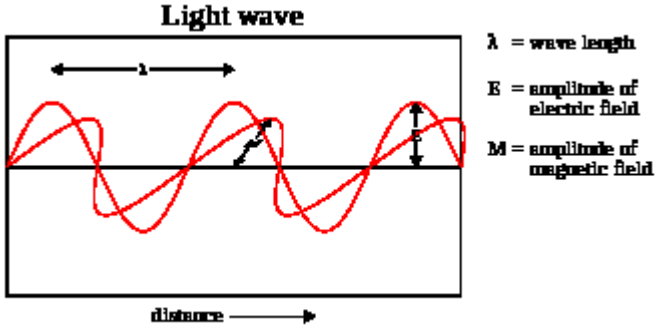
-What is light
-How we measure light
-How light sensor works
-Application example

What is light

-Electromagnetic radiation that is visible to the human eye

-Can be wave or particle





How we measure light

Primary properties of light

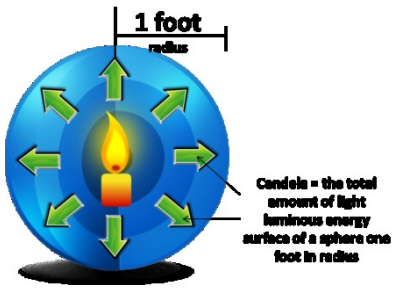
-Intensity
-Frequency
-Polarization
-Speed

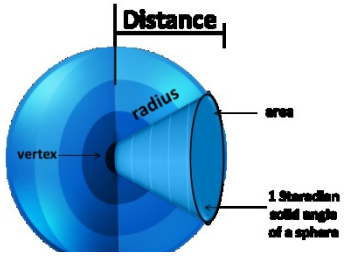
Light intensity

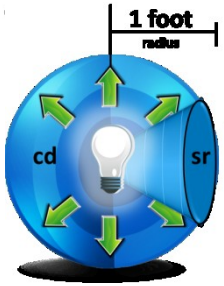
-Watt
-Candela
-Lumen
-Lux
??????????

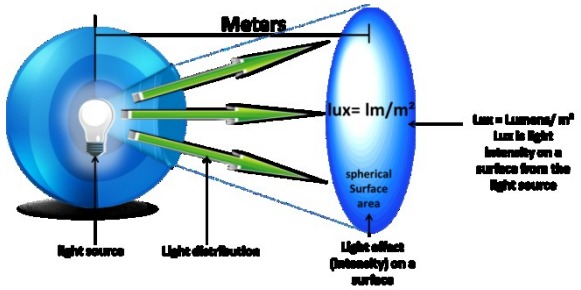
Light intensity

Measurements	Symbolized	Formula	Definitions
Candela	cd	radiation emitted by 1/60 of a single square centimetre of platinum when it is at its melting point.	A common candle emits light with roughly 1 cd luminous intensity.
Steradian	sr	$1\ sr = r^2 \times 4\pi$	Is a standard unit of measurement used to define a solid angle which
Lumens	lm	$lm = cd \times sr$	The total amount of light that is produced by a light source in all directions.
Foot-candle	ft	$ft = 1\ lm \times foot^2$	Non-standard measure of illuminance
Lux	lux	$lux = lm \times meter^2$	Lux is a scale used to measure light intensity or the illumination that is produces by a light source at a distance.
Watts	w	w= volts x amps	Total power to operate
Lumens per watt	lm/w	Lumens ÷ watts	A light engineering term for the measurement of the rate at which a lamp is able to convert electrical power (watts) to light (lumens)









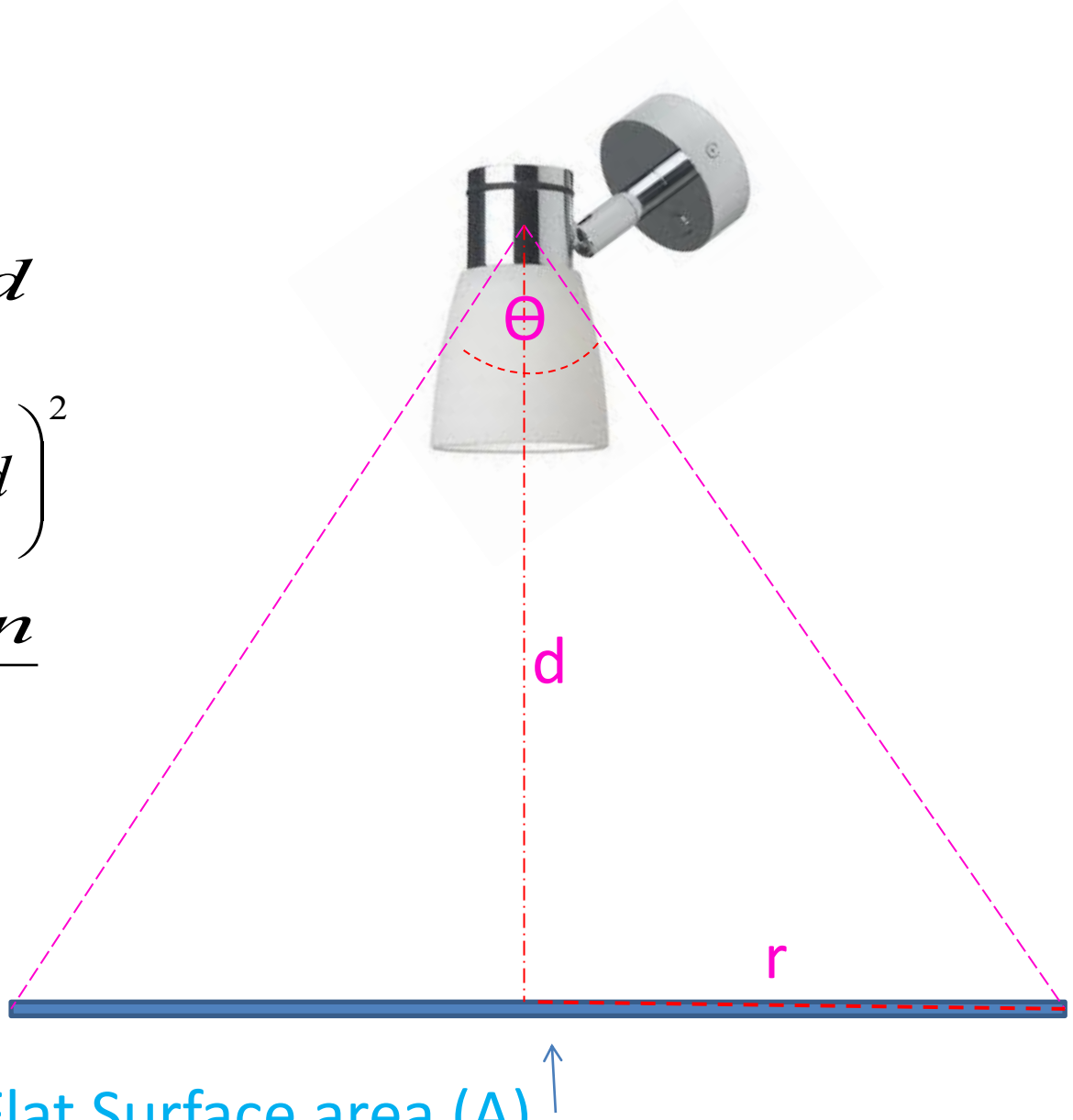
http://www.solarlightaustralia.com.au/2013/02/01/lumens-lux-and-watts/

Light intensity

$$r = \tan\left(\frac{\theta}{2}\right)d$$

$$A = \pi r^2 = \left(\tan\left(\frac{\theta}{2}\right)d\right)^2$$

$$Lux = \frac{Lumen}{A}$$



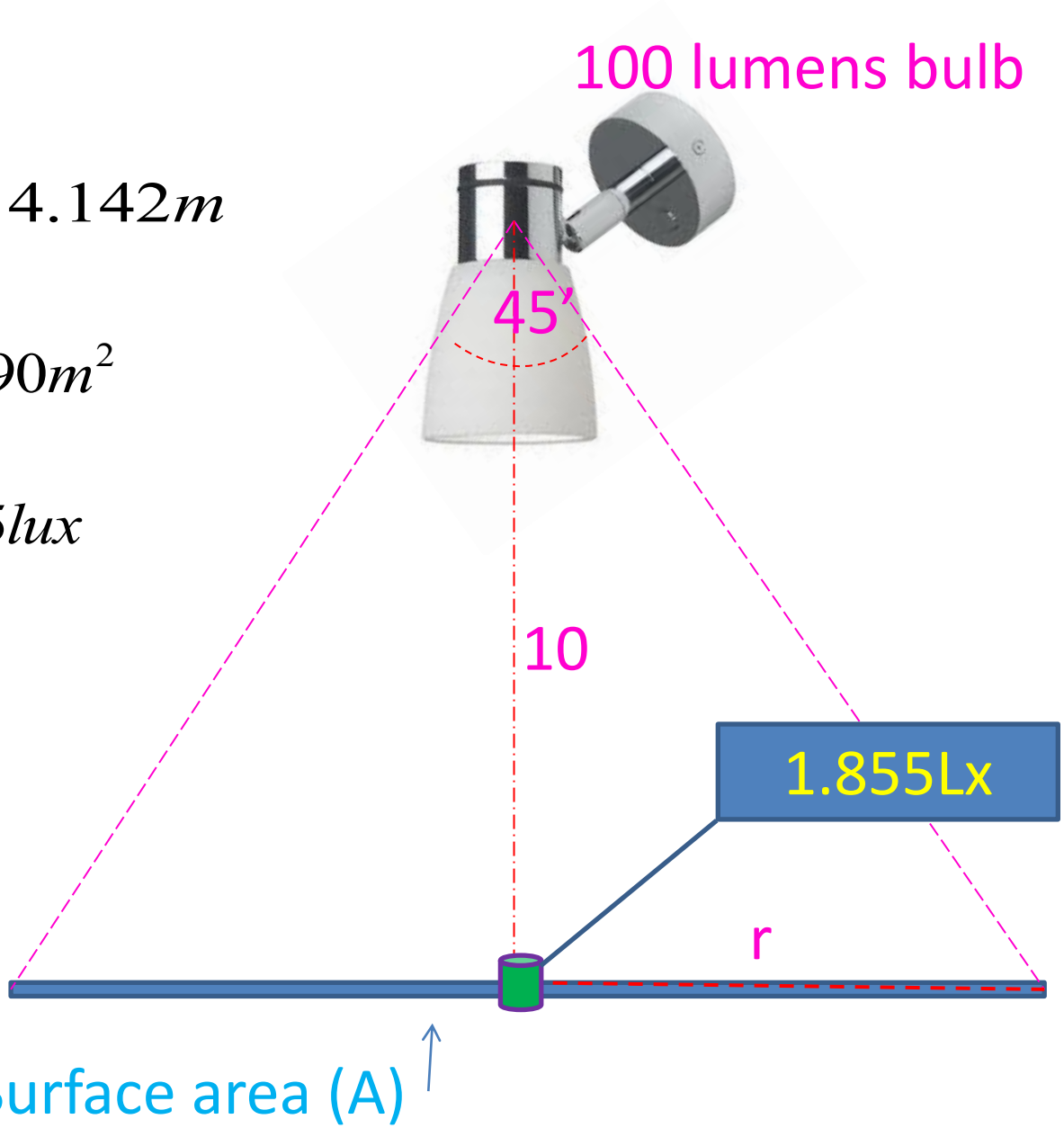
Light intensity

Example

$$r = \tan\left(\frac{45}{2}\right) \times 10 = 4.142m$$

$$A = 4.142^2 \times \pi = 53.890m^2$$

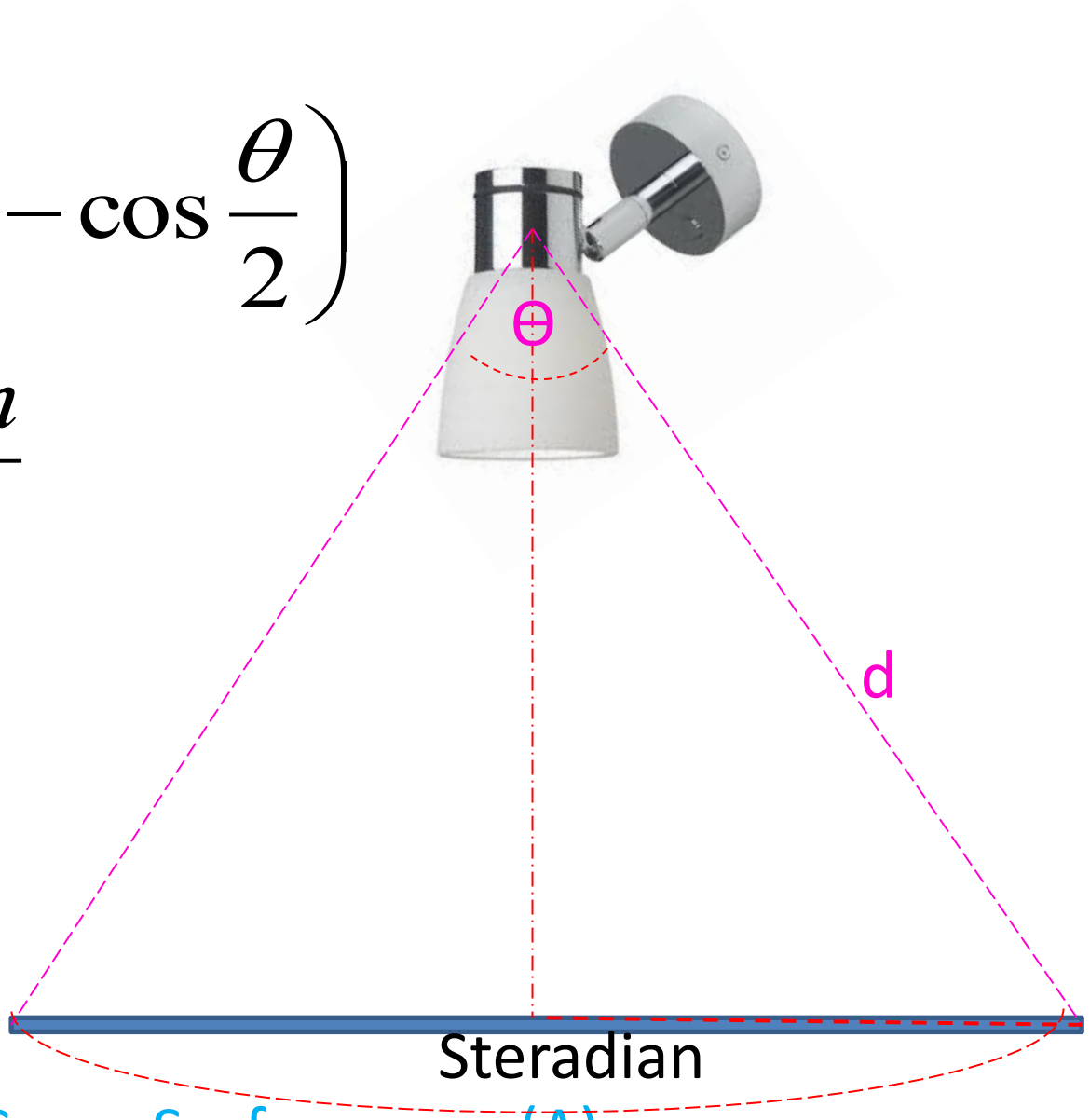
$$Lux = \frac{100}{53.890} = 1.855lux$$



Light intensity

$$A = 2\pi d^2 \times \left(1 - \cos\frac{\theta}{2}\right)$$

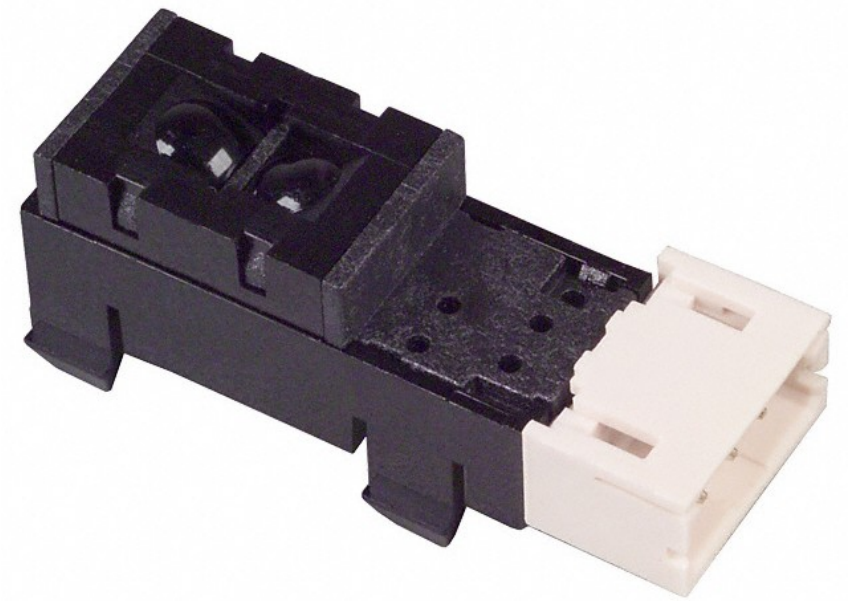
$$Lux = \frac{Lumen}{A}$$



Curve Surface area (A)

Light intensity Sensor

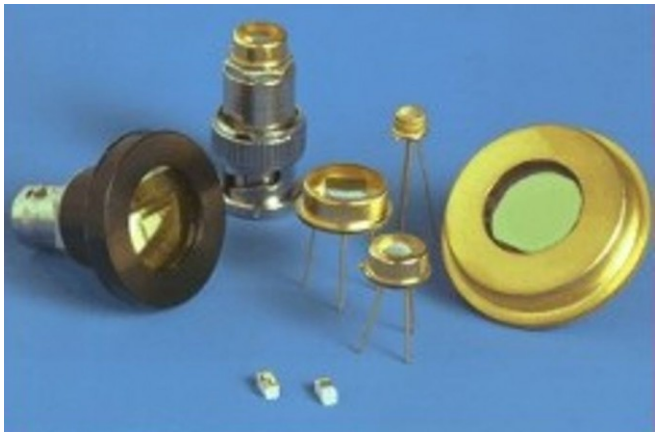
-Detect light using photo-diode
-Convert voltage to digital
-Report output in Lux

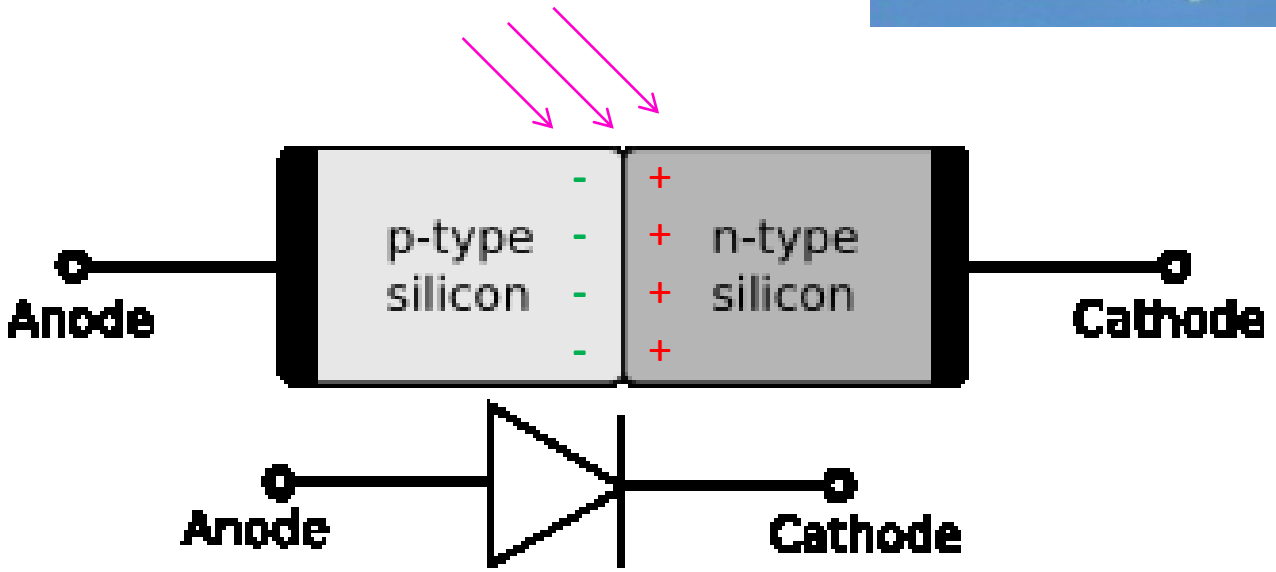


Light intensity Sensor

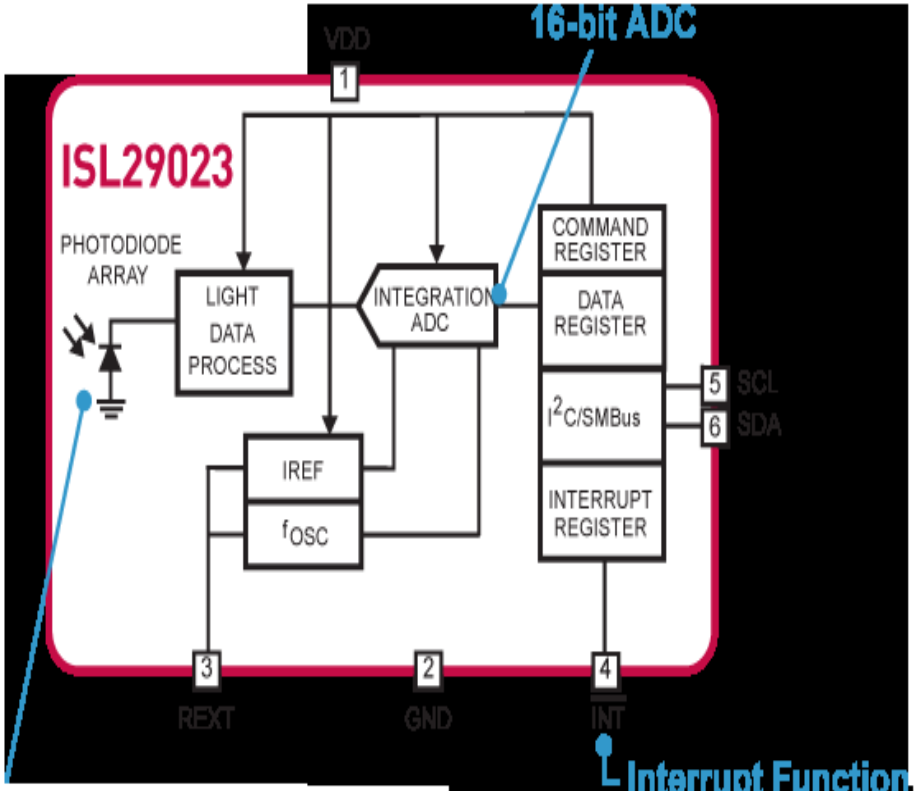
Photo-diode

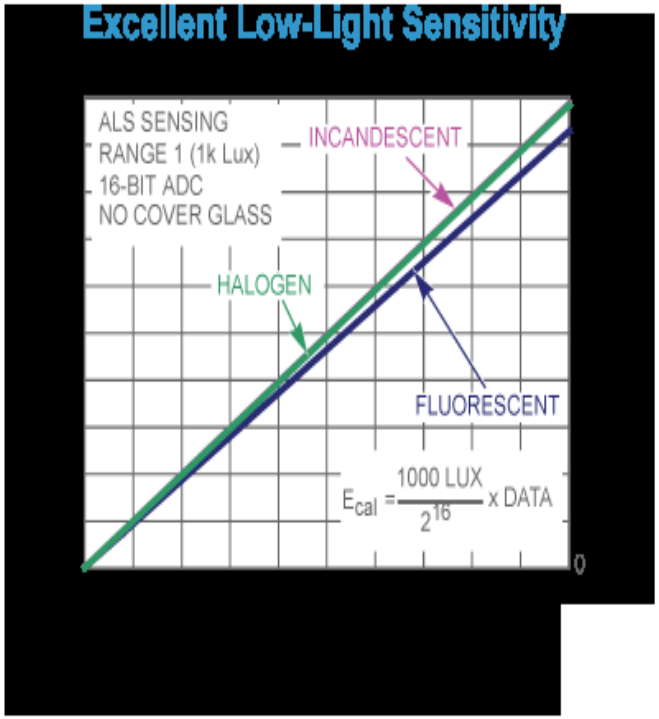
-Current flow in one direction
-Operating in reverse bias mode





Light intensity Sensor





Integrated Photodiode

ISL29023 digital output is more immune to noise than an analog output solution.

Interrupt Function

Interrupt pin serves as an alarm or monitoring function to determine whether the ambient light level exceeds a pre-select upper or lower threshold.

Light intensity Sensor

The Application

- Automatic adjust display's backlight
- Power savings

Programming Light intensity Sensor

Get the sensor

```
SensorManager mSensorManager;
Sensor mLight;
mLight = mSensorManager.getDefaultSensor(Sensor.TYPE_LIGHT);
```

Get the sensor data

```
@Override
        public void onSensorChanged(SensorEvent event) {
                if(event.sensor.getType()==Sensor.TYPE_LIGHT){
                  edittext1.setText(sensorinfo+ "\nLight Sensor Reading:"
                   + String.valueOf(event.values[0]) + " Luxes");
                }
        }
```

Programming Light intensity Sensor

Illuminance evaluator

Programming Light intensity Sensor

Activity	**Illumination (lux, lumen/m^2)**
Public areas with dark surroundings	20 - 50
Simple orientation for short visits	50 - 100
Working areas where visual tasks are only occasionally performed	100 - 150
Warehouses, Homes, Theaters, Archives	150
Easy Office Work, Classes	250
Normal Office Work, PC Work, Study Library, Groceries, Show Rooms, Laboratories	500
Supermarkets, Mechanical Workshops, Office Landscapes	750
Normal Drawing Work, Detailed Mechanical Workshops, Operation Theatres	1,000
Detailed Drawing Work, Very Detailed Mechanical Works	1500 - 2000
Performance of visual tasks of low contrast and very small size for prolonged periods of time	2000 - 5000
Performance of very prolonged and exacting visual tasks	5000 - 10000
Performance of very special visual tasks of extremely low contrast and small size	10000 - 20000

Thank you ☺