

Ambient Light Sensor IC Series

# Analog Current Output Type Ambient Light Sensor IC

## BH1682FVC

### General Description

BH1682FVC is an analog current output type ambient light sensor IC. The output is proportion to logarithm of illuminance. It has wide illuminance detection range and is suitable for the application of display brightness control.

### Features

- Built-in log scale current AMP
- Built-in Ircut filter
- Built-in shutdown function
- Correspond to 1.8V logic interface

### Applications

Mobile Phone, LCD TV, Note PC, Portable Game Machine, Digital Camera, LCD Display, etc.

### Key Specifications

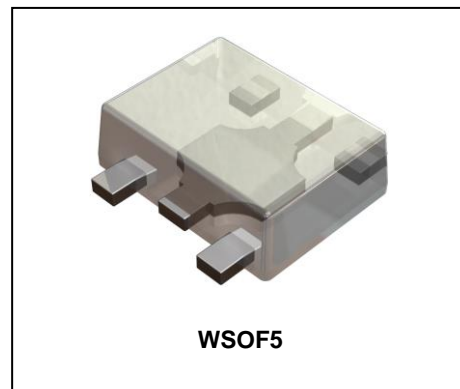
- VCC Voltage Range: 2.3V to 5.5V
- Detection Range: 55klx (Typ)
- IOU Output Current at 100lx: 20μA (Typ)
- Shutdown Current: 0.1μA (Typ)
- Operating Temperature Range: -40°C to +85°C

### Package

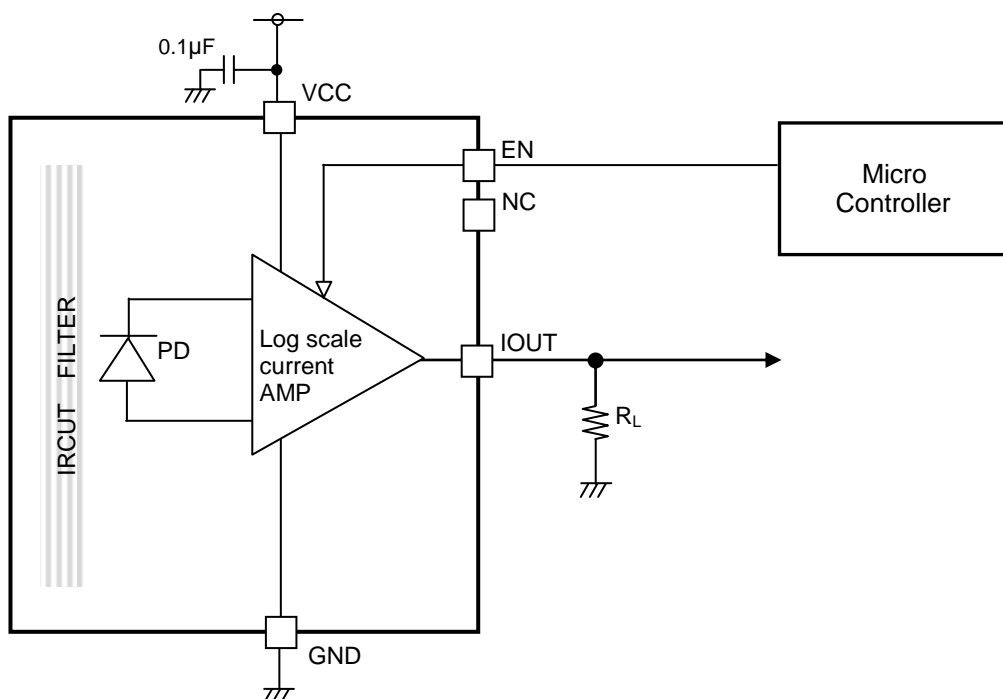
WSOF5

W(Typ) x D(Typ) x H(Max)

1.60mm x 1.60mm x 0.60mm



### Typical Application Circuits



○Product structure : Silicon monolithic integrated circuit.

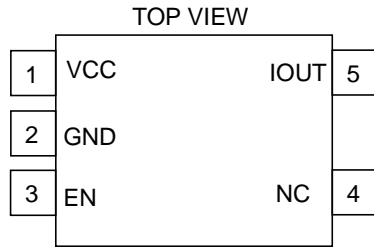
○This product does not include laser transmitter.

○This product includes Photo detector, ( Photo Diode ) inside of it.

○This product has no designed protection against radioactive rays.

○This product does not include optical load.

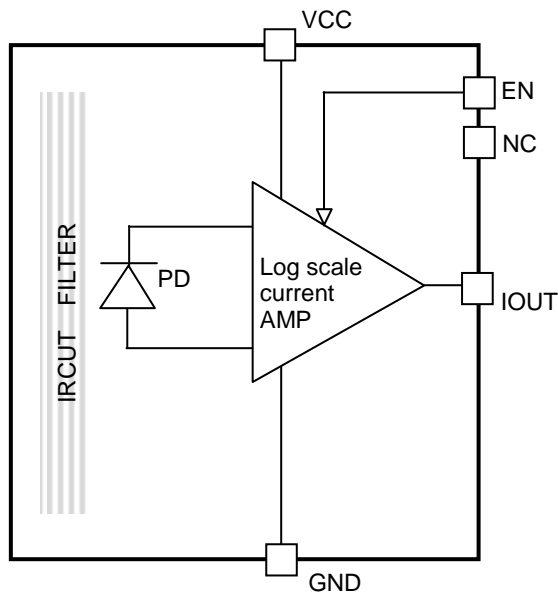
## Pin Configuration



## Pin Description

Pin No.	Pin Name	Function
1	VCC	Power supply
2	GND	Ground
3	EN	Mode select H: Operating mode, L: Shutdown mode
4	NC	Non connect
5	IOOUT	Current output pin It outputs current which depends on illuminance.

## Block Diagram



## Description of Blocks

- PD  
Photodiode
- Log scale current AMP  
Current amplifier. It amplifies PD current and perform logarithmic transform.

**Absolute Maximum Ratings (Ta = 25°C)**

Parameter	Symbol	Rating	Unit
Supply Voltage	V <sub>CCMR</sub>	7	V
Input Voltage	V <sub>INMR</sub>	-0.3 to (V <sub>CC</sub> +0.3) or +7 whichever is less	V
Operating Temperature Range	T <sub>opr</sub>	-40 to +85	°C
Storage Temperature Range	T <sub>stg</sub>	-40 to +100	°C
Maximum Junction Temperature	T <sub>Jmax</sub>	100	°C

**Caution:** Operating the IC over the absolute maximum ratings may damage the IC. The damage can either be a short circuit between pins or an open circuit between pins and the internal circuitry. Therefore, it is important to consider circuit protection measures, such as adding a fuse, in case the IC is operated over the absolute maximum ratings.

**Thermal Resistance** <sup>(Note 1)</sup>

Parameter	Symbol	Thermal Resistance (Typ)		Unit
		1s <sup>(Note 3)</sup>	2s2p <sup>(Note 4)</sup>	
WSOF5				
Junction to Ambient	$\theta_{JA}$	466.9	131.0	°C/W
Junction to Top Characterization Parameter <sup>(Note 2)</sup>	$\Psi_{JT}$	163	49	°C/W

(Note 1)Based on JESD51-2A(Still-Air)

(Note 2)The thermal characterization parameter to report the difference between junction temperature and the temperature at the top center of the outside surface of the component package.

(Note 3)Using a PCB board based on JESD51-3.

Layer Number of Measurement Board	Material	Board Size
Single	FR-4	114.3mm x 76.2mm x 1.57mm
Top		
Copper Pattern	Thickness	
Footprints and Traces	70μm	

(Note 4)Using a PCB board based on JESD51-7.

Layer Number of Measurement Board	Material	Board Size			
4 Layers	FR-4	114.3mm x 76.2mm x 1.6mm			
Top		2 Internal Layers		Bottom	
Copper Pattern	Thickness	Copper Pattern	Thickness	Copper Pattern	Thickness
Footprints and Traces	70μm	74.2mm x 74.2mm	35μm	74.2mm x 74.2mm	70μm

**Recommended Operating Conditions (Ta = -40°C to +85°C)**

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	V <sub>CC</sub>	2.3	3.0	5.5	V
Input Voltage	V <sub>IN</sub>	0	-	5.5	V

Electrical Characteristics (Unless otherwise specified VCC=3.0V, Ta=25°C, EN=VCC)<sup>(Note)</sup>

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Supply Current1	I <sub>CC1</sub>	-	75	105	μA	Ev=1000lx
Supply Current2	I <sub>CC2</sub>	-	28	42	μA	Ev=0lx
Supply Current3	I <sub>CC3</sub>	-	0.1	0.4	μA	EN=0V, No Input Light
IOUT Output Current1	I <sub>OUT1</sub>	-	-	0.5	μA	Ev=0lx
IOUT Output Current2	I <sub>OUT2</sub>	17	20	23	μA	Ev=100lx
Saturated Output Voltage	V <sub>OMAX</sub>	2.6	2.9	3.0	V	Ev=100lx, R <sub>L</sub> =220kΩ
EN Input 'L' Voltage	V <sub>IL</sub>	-	-	0.4	V	
EN Input 'H' Voltage 1	V <sub>IH1</sub>	1.4	-	-	V	2.3V ≤ VCC ≤ 3.6V
EN Input 'H' Voltage 2	V <sub>IH2</sub>	2.0	-	-	V	3.6V < VCC ≤ 5.5V
Wake-up Time	t <sub>WU</sub>	-	65	130	μs	Shutdown to Operating mode Ev=100lx

(Note) White LED is used as optical source.

Typical Performance Curves

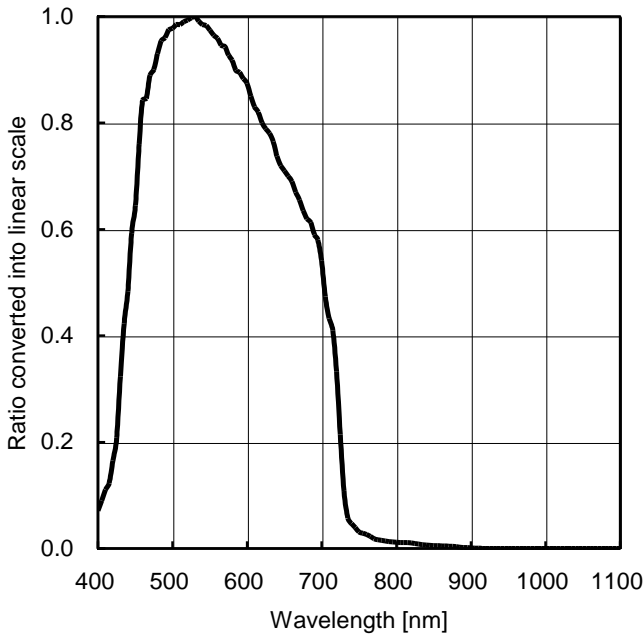


Figure 1. Ratio converted into linear scale vs Wavelength (Spectral Response)

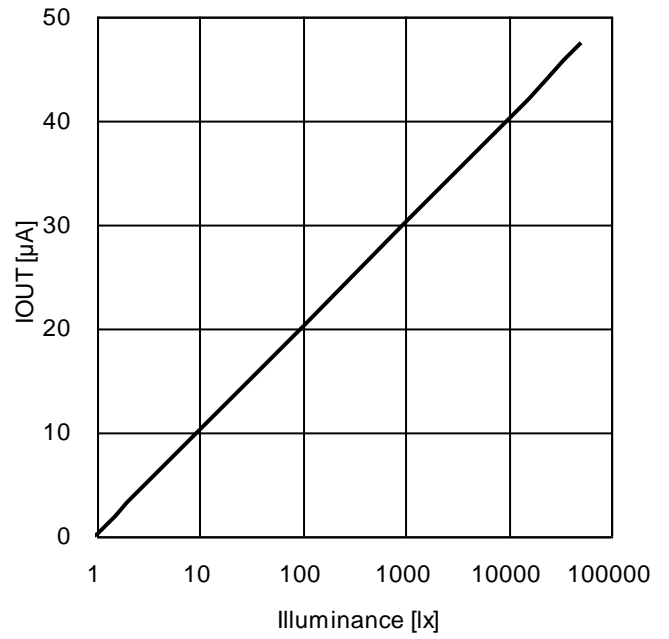


Figure 2. IOUT vs Illuminance

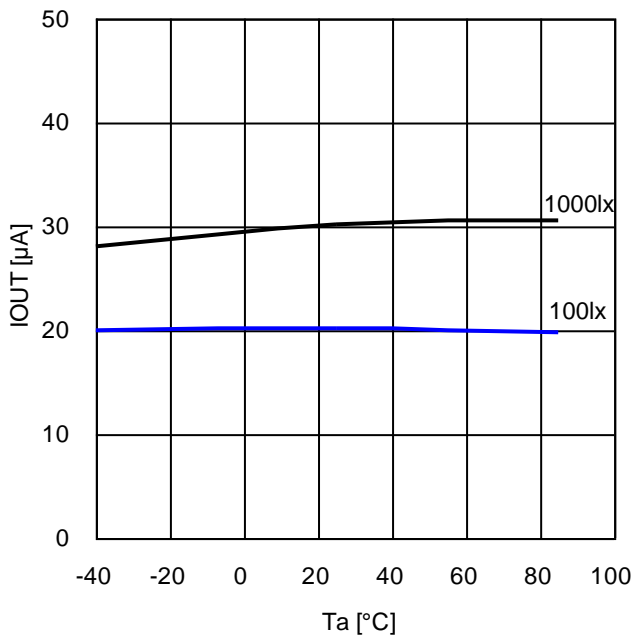


Figure 3. IOUT vs Ta

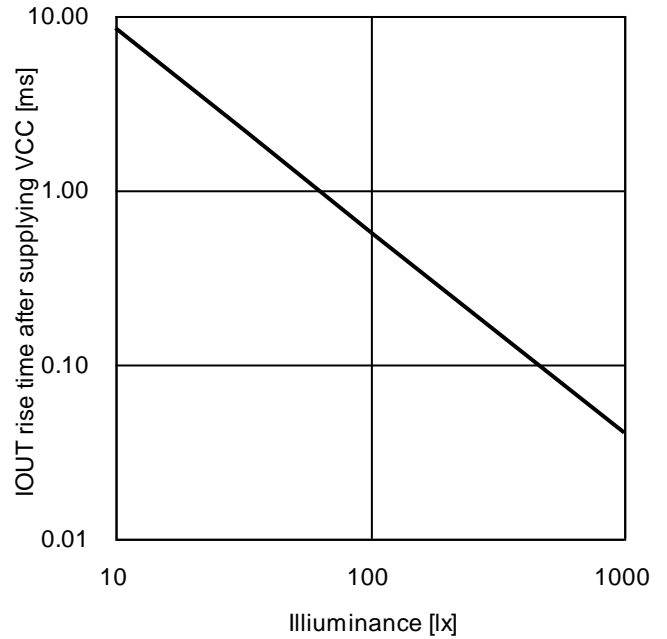
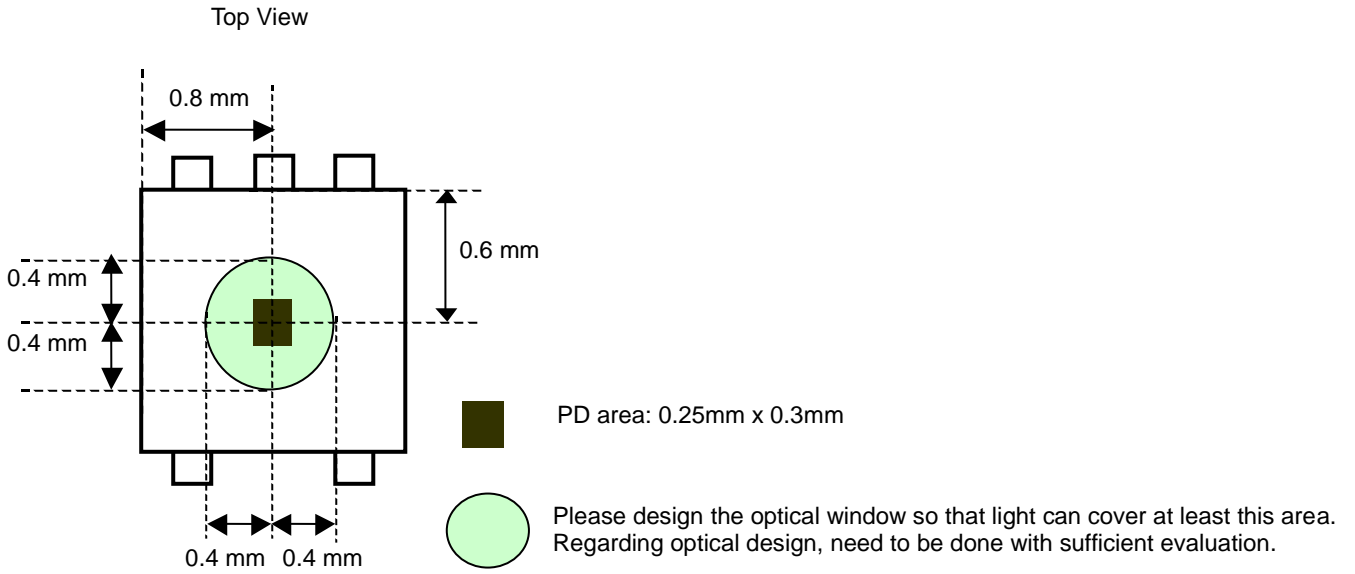


Figure 4. IOUT rise time after supplying VCC vs Illuminance

Optical design for the device



I/O Equivalent Circuit

Pin Name	Equivalent Circuit
EN	
IOUT	

## Operational Notes

### 1. Reverse Connection of Power Supply

Connecting the power supply in reverse polarity can damage the IC. Take precautions against reverse polarity when connecting the power supply, such as mounting an external diode between the power supply and the IC's power supply pins.

### 2. Power Supply Lines

Design the PCB layout pattern to provide low impedance supply lines. Furthermore, connect a capacitor to ground at all power supply pins. Consider the effect of temperature and aging on the capacitance value when using electrolytic capacitors.

### 3. Ground Voltage

Ensure that no pins are at a voltage below that of the ground pin at any time, even during transient condition.

### 4. Ground Wiring Pattern

When using both small-signal and large-current ground traces, the two ground traces should be routed separately but connected to a single ground at the reference point of the application board to avoid fluctuations in the small-signal ground caused by large currents. Also ensure that the ground traces of external components do not cause variations on the ground voltage. The ground lines must be as short and thick as possible to reduce line impedance.

### 5. Thermal Consideration

Should by any chance the maximum junction temperature rating be exceeded the rise in temperature of the chip may result in deterioration of the properties of the chip. In case of exceeding this absolute maximum rating, increase the board size and copper area to prevent exceeding the maximum junction temperature rating.

### 6. Recommended Operating Conditions

These conditions represent a range within which the expected characteristics of the IC can be approximately obtained. The electrical characteristics are guaranteed under the conditions of each parameter.

### 7. Inrush Current

When power is first supplied to the IC, it is possible that the internal logic may be unstable and inrush current may flow instantaneously due to the internal powering sequence and delays, especially if the IC has more than one power supply. Therefore, give special consideration to power coupling capacitance, power wiring, width of ground wiring, and routing of connections.

### 8. Operation Under Strong Electromagnetic Field

Operating the IC in the presence of a strong electromagnetic field may cause the IC to malfunction.

### 9. Testing on Application Boards

When testing the IC on an application board, connecting a capacitor directly to a low-impedance output pin may subject the IC to stress. Always discharge capacitors completely after each process or step. The IC's power supply should always be turned off completely before connecting or removing it from the test setup during the inspection process. To prevent damage from static discharge, ground the IC during assembly and use similar precautions during transport and storage.

### 10. Inter-pin Short and Mounting Errors

Ensure that the direction and position are correct when mounting the IC on the PCB. Incorrect mounting may result in damaging the IC. Avoid nearby pins being shorted to each other especially to ground, power supply and output pin. Inter-pin shorts could be due to many reasons such as metal particles, water droplets (in very humid environment) and unintentional solder bridge deposited in between pins during assembly to name a few.

### 11. Unused Input Pins

Input pins of an IC are often connected to the gate of a MOS transistor. The gate has extremely high impedance and extremely low capacitance. If left unconnected, the electric field from the outside can easily charge it. The small charge acquired in this way is enough to produce a significant effect on the conduction through the transistor and cause unexpected operation of the IC. So unless otherwise specified, unused input pins should be connected to the power supply or ground line.

## Operational Notes – continued

## 12. Regarding the Input Pin of the IC

This monolithic IC contains P+ isolation and P substrate layers between adjacent elements in order to keep them isolated. P-N junctions are formed at the intersection of the P layers with the N layers of other elements, creating a parasitic diode or transistor. For example (refer to figure below):

When  $GND > Pin A$  and  $GND > Pin B$ , the P-N junction operates as a parasitic diode.

When  $GND > Pin B$ , the P-N junction operates as a parasitic transistor.

Parasitic diodes inevitably occur in the structure of the IC. The operation of parasitic diodes can result in mutual interference among circuits, operational faults, or physical damage. Therefore, conditions that cause these diodes to operate, such as applying a voltage lower than the GND voltage to an input pin (and thus to the P substrate) should be avoided.

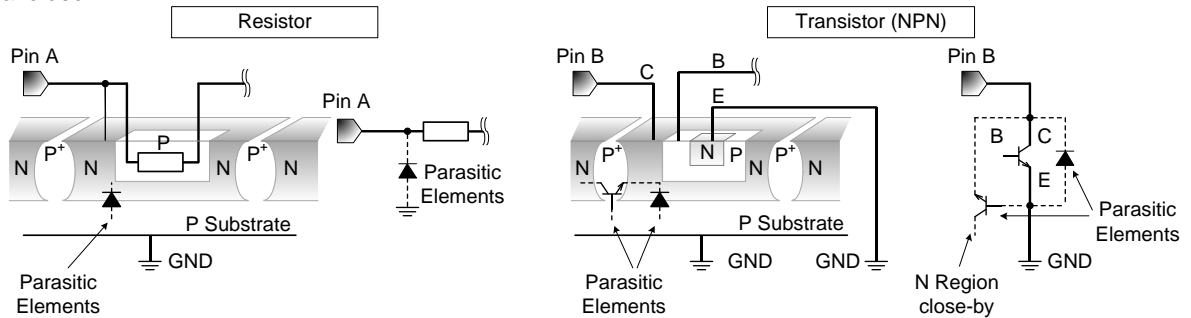


Figure. Example of monolithic IC structure

## 13. Ceramic Capacitor

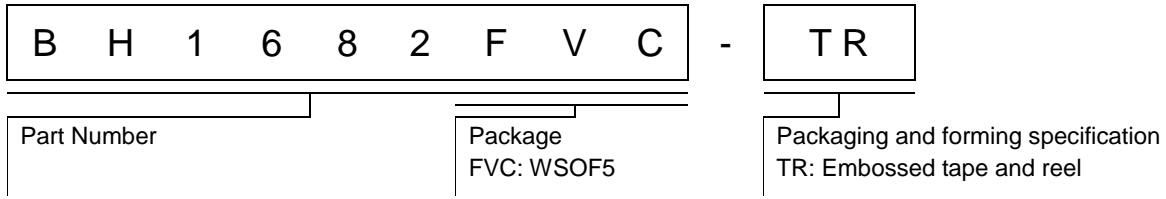
When using a ceramic capacitor, determine the dielectric constant considering the change of capacitance with temperature and the decrease in nominal capacitance due to DC bias and others.

## 14. Area of Safe Operation (ASO)

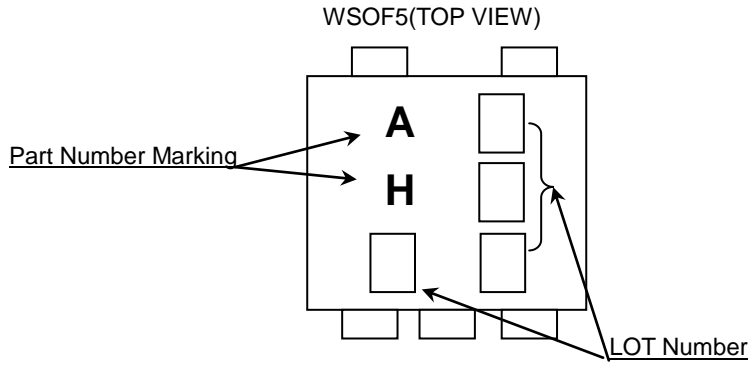
Operate the IC such that the output voltage, output current, and the maximum junction temperature rating are all within the Area of Safe Operation (ASO).



Ordering Information

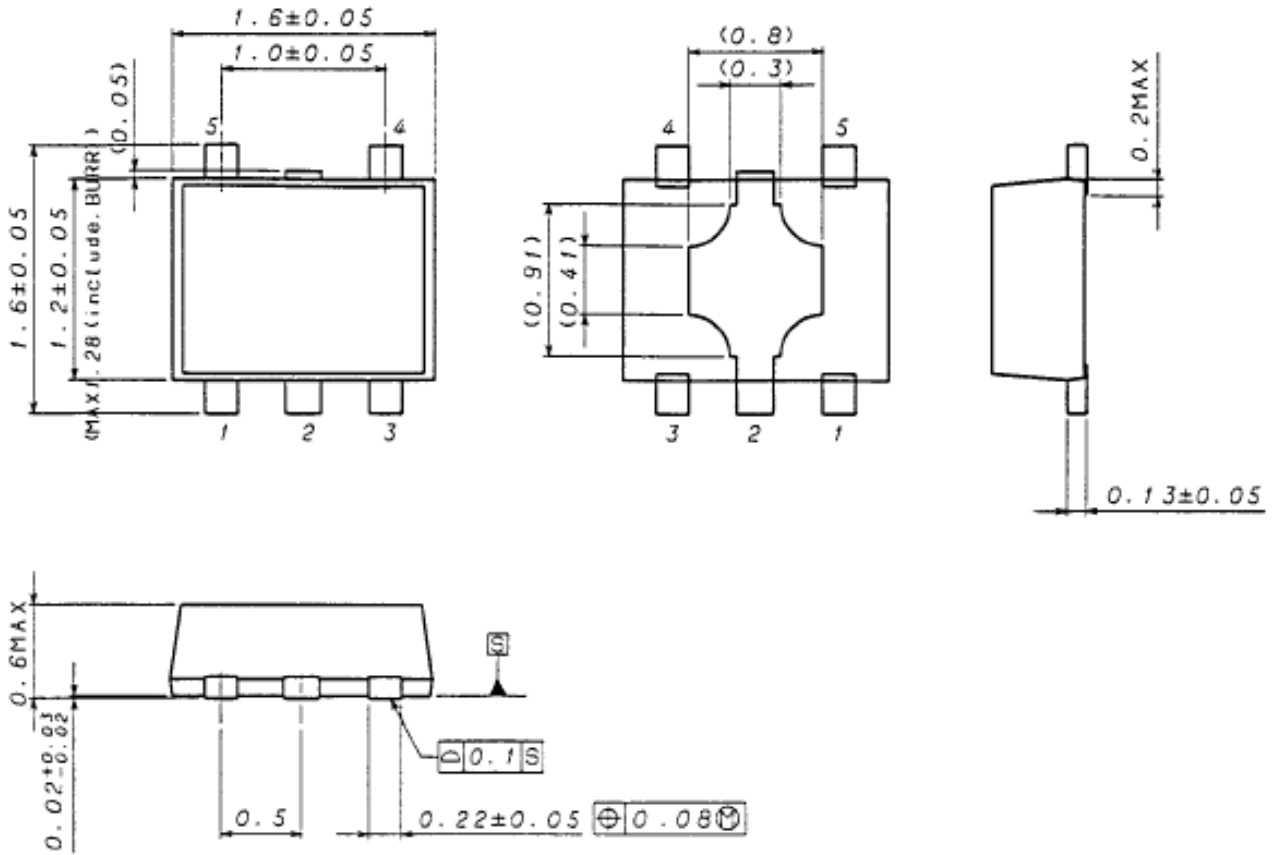


Marking Diagram



Physical Dimension, Tape and Reel Information

Package Name	WSOF5
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(UNIT : mm)

<Tape and Reel information>

Tape	Embossed carrier tape
Quantity	3000pcs
Direction of feed	TR (The direction is the 1pin of product is at the upper right when you hold reel on the left hand and you pull out the tape on the right hand)

\*Order quantity needs to be multiple of the minimum quantity.

## Revision History

Date	Revision	Changes
13.May.2016	001	New Release

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  - Use of the Products in places subject to dew condensation
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