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

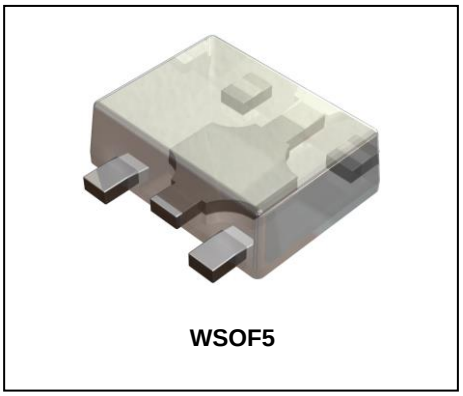
Mobile Phone, LCD TV, Note PC, Portable Game Machine, Digital Camera, LCD Display, etc.

Key Specifications

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

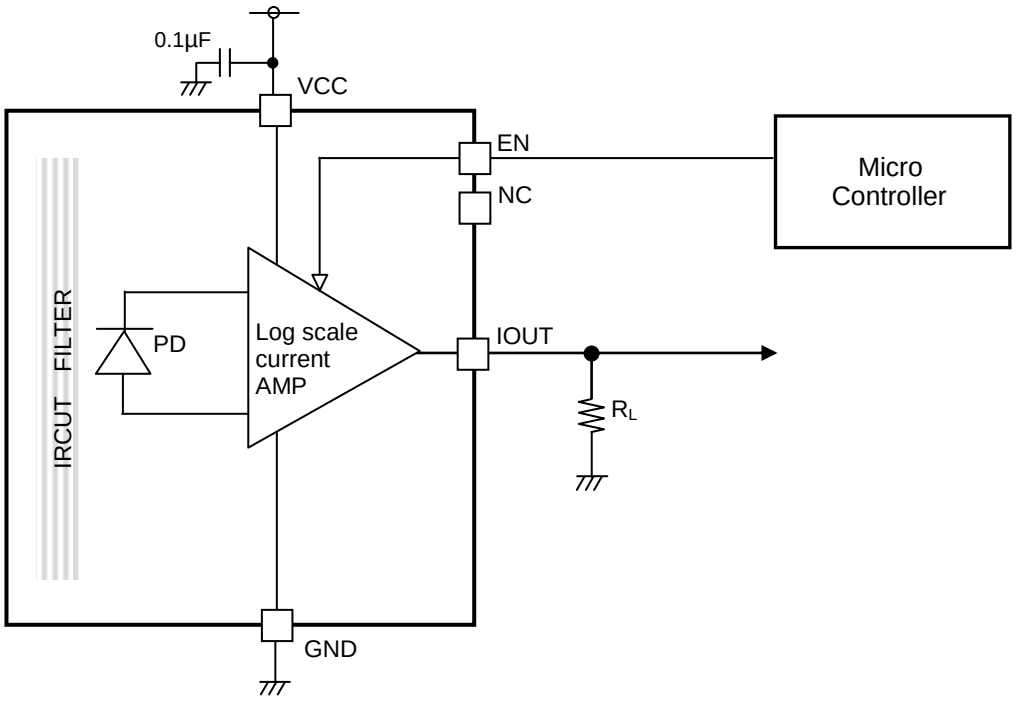
Package

Package	W(Typ) x D(Typ) x H(Max)
WSOF5	1.60mm x 1.60mm x 0.60mm



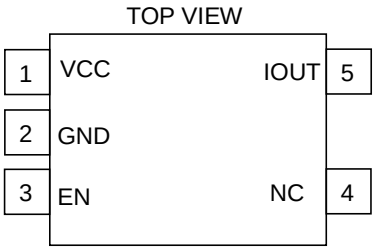
WSOF5

Typical Application Circuits



○Product structure：Silicon monolithic integrated circuit.
○This product has no designed protection against radioactive rays.
○This product does not include laser transmitter.
○This product does not include optical load.
○This product includes Photo detector, (Photo Diode) inside of it.

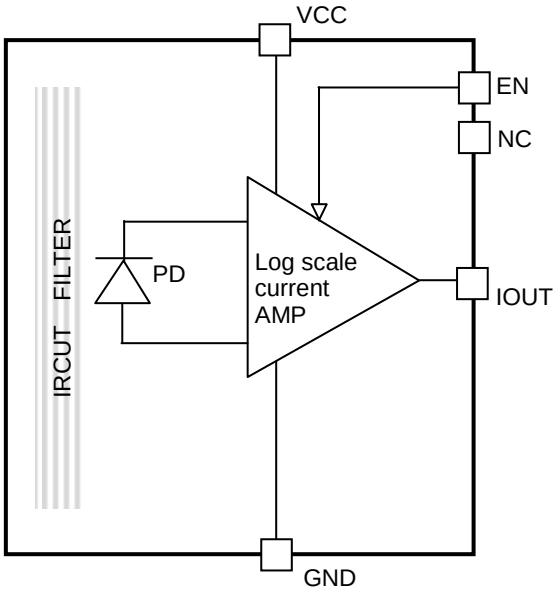
Pin Configuration



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	IOUT	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_{CCMR}	7	V
Input Voltage	V_{INMR}	-0.3 to (VCC+0.3) or +7 whichever is less	V
Operating Temperature Range	Topr	-40 to +85	°C
Storage Temperature Range	Tstg	-40 to +100	°C
Maximum Junction Temperature	Tjmax	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*(Note 1)*

Parameter	Symbol	Thermal Resistance (Typ)		Unit
		1s*(Note 3)*	2s2p*(Note 4)*	
WSOF5				
Junction to Ambient	θ_{JA}	466.9	131.0	°C/W
Junction to Top Characterization Parameter*(Note 2)*	Ψ_{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 1.57mmt

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 1.6mmt

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_{CC}	2.3	3.0	5.5	V
Input Voltage	V_{IN}	0	-	5.5	V

Electrical Characteristics (Unless otherwise specified VCC=3.0V, Ta=25°C, EN=VCC)*(Note)*

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Supply Current1	I_{CC1}	-	75	105	μA	Ev=1000lx
Supply Current2	I_{CC2}	-	28	42	μA	Ev=0lx
Supply Current3	I_{CC3}	-	0.1	0.4	μA	EN=0V, No Input Light
IOUT Output Current1	I_{OUT1}	-	-	0.5	μA	Ev=0lx
IOUT Output Current2	I_{OUT2}	17	20	23	μA	Ev=100lx
Saturated Output Voltage	V_{OMAX}	2.6	2.9	3.0	V	Ev=100lx, R_L=220kΩ
EN Input 'L' Voltage	V_{IL}	-	-	0.4	V	
EN Input 'H' Voltage 1	V_{IH1}	1.4	-	-	V	2.3V ≤ VCC ≤ 3.6V
EN Input 'H' Voltage 2	V_{IH2}	2.0	-	-	V	3.6V < VCC ≤ 5.5V
Wake-up Time	t_{WU}	-	65	130	μs	Shutdown to Operating mode Ev=100lx

(Note) White LED is used as optical source.

Typical Performance Curves

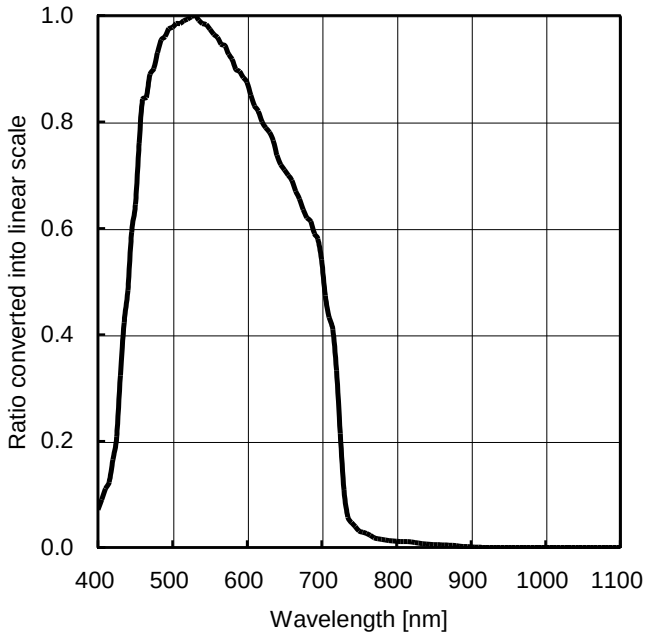


Figure 1. Ratio converted into linear scale vs Wavelength (Spectral Response)

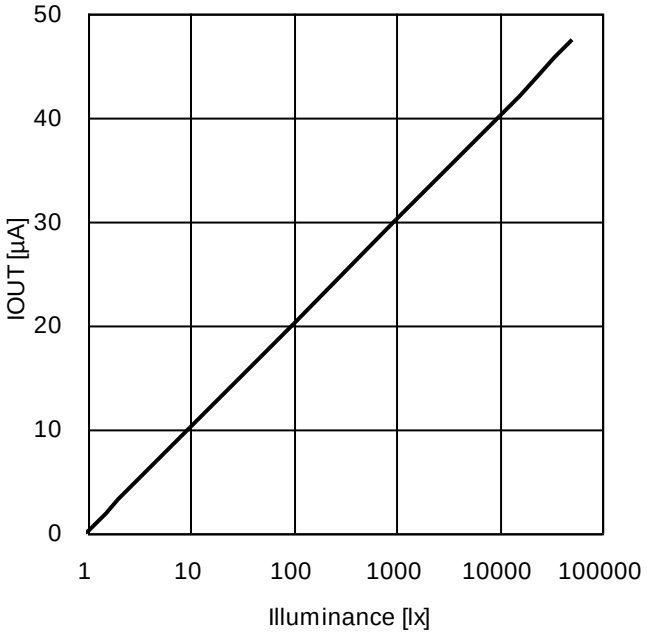


Figure 2. IOUT vs Illuminance

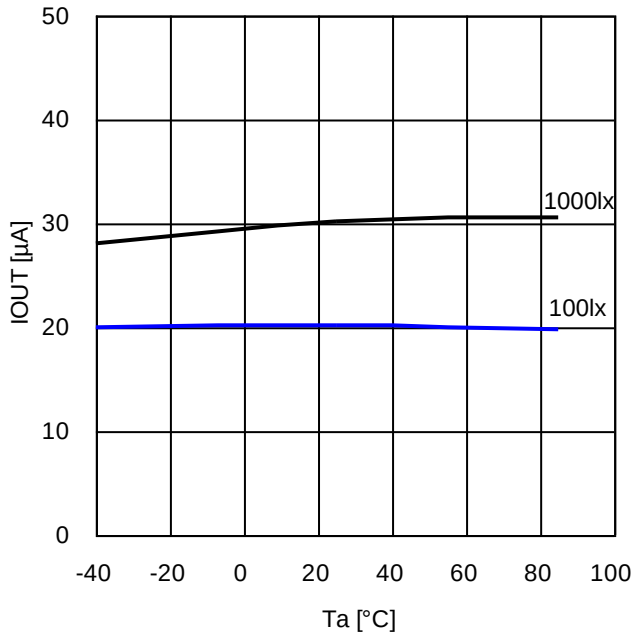


Figure 3. IOUT vs Ta

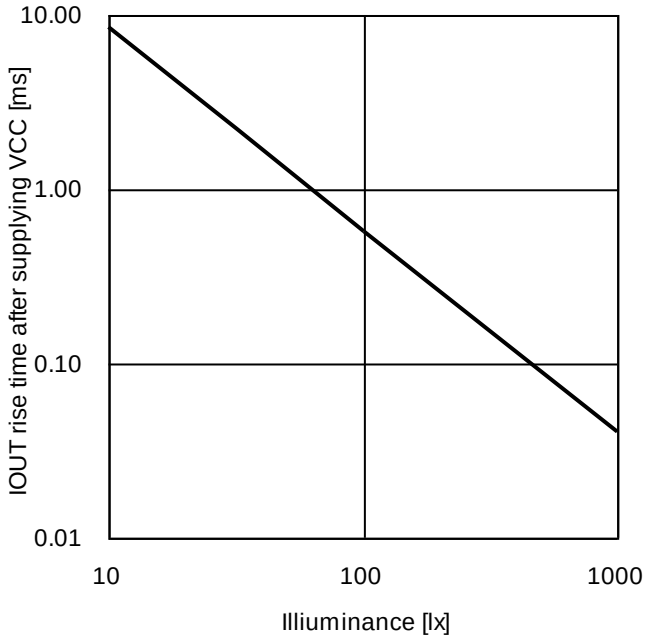
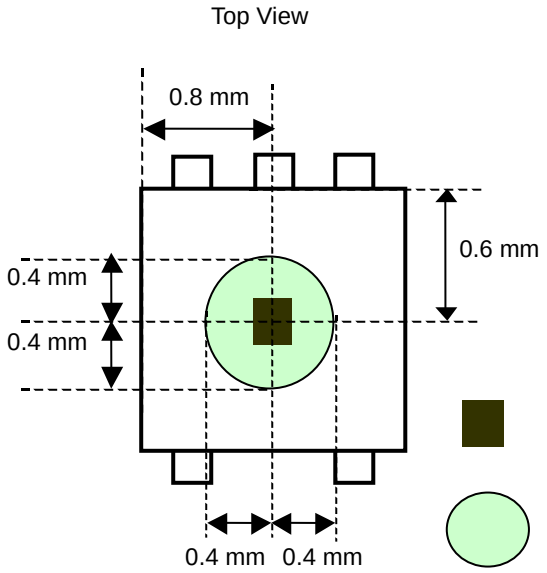


Figure 4. IOUT rise time after supplying VCC vs Illuminance

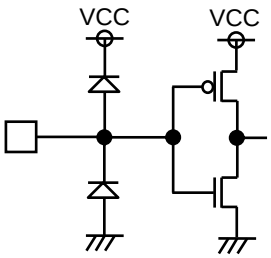
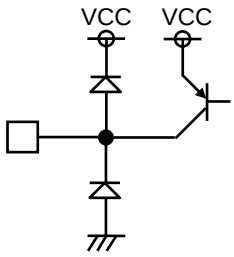
Optical design for the device



PD area: 0.25mm x 0.3mm

Please design the optical window so that light can cover at least this area.
Regarding optical design, need to be done with sufficient evaluation.

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.

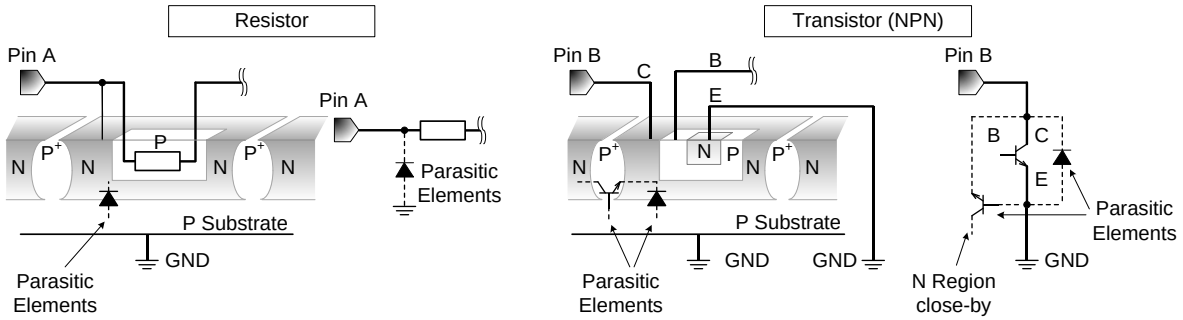


Figure. Example of monolithic IC structure

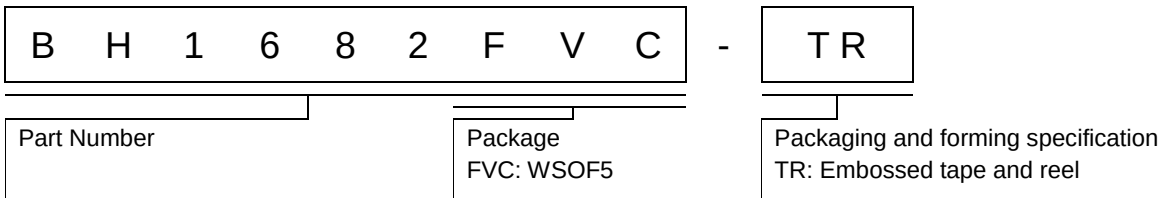
13. **Ceramic Capacitor**

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.

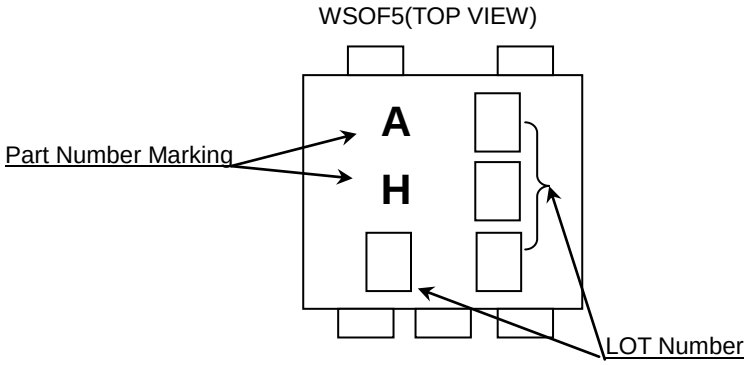
14. **Area of Safe Operation (ASO)**

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

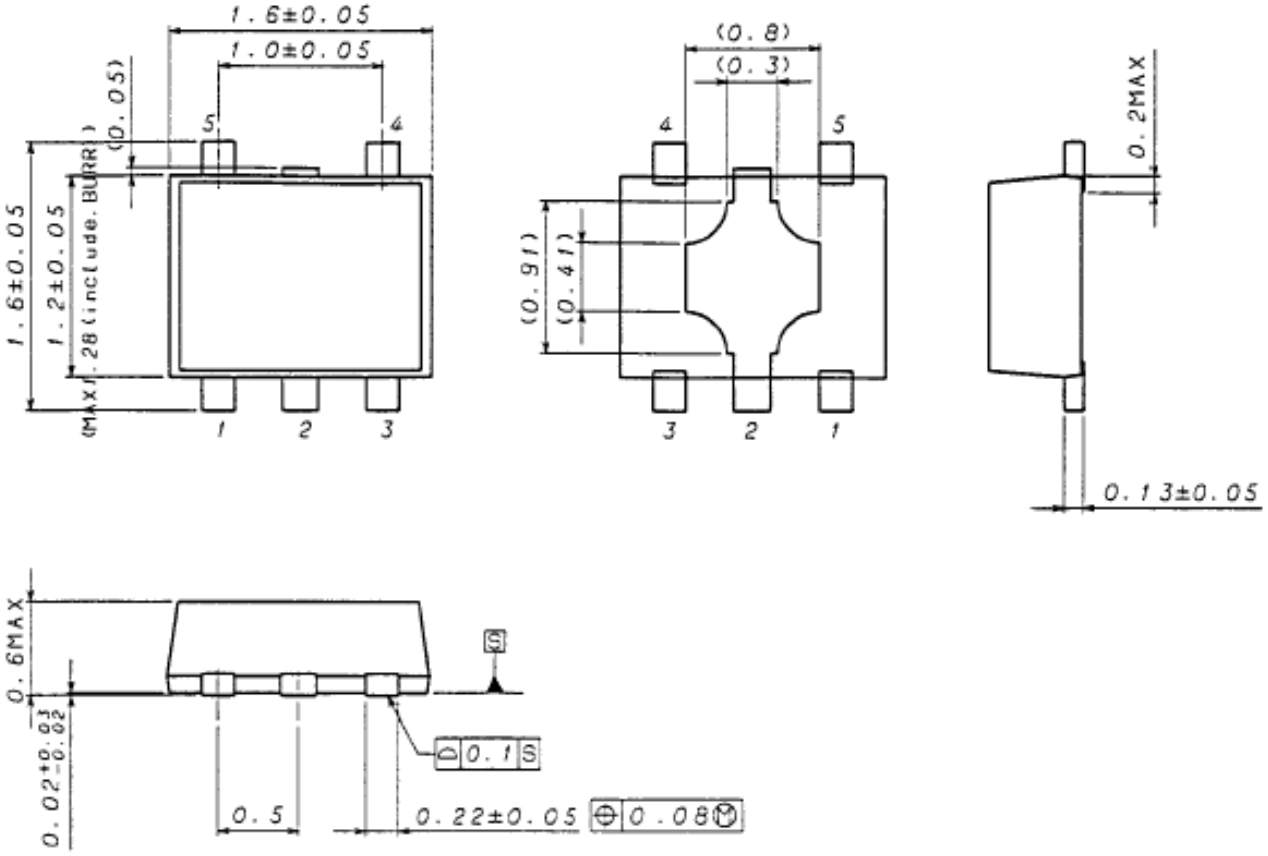


Marking Diagram



Physical Dimension, Tape and Reel Information

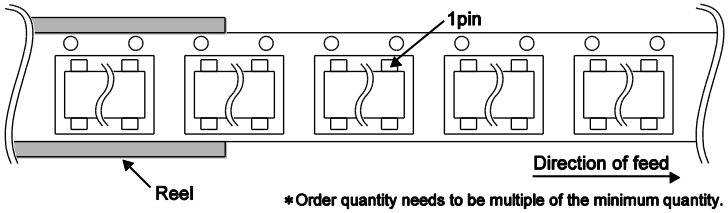
Package Name	WSOF5



(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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JAPAN	USA	EU	CHINA
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CLASSⅣ		CLASSⅢ	

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   [f] Sealing or coating our Products with resin or other coating materials
   [g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
   [h] Use of the Products in places subject to dew condensation

4. The Products are not subject to radiation-proof design.

5. Please verify and confirm characteristics of the final or mounted products in using the Products.

6. In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse. is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.

7. De-rate Power Dissipation depending on ambient temperature. When used in sealed area, confirm that it is the use in the range that does not exceed the maximum junction temperature.

8. Confirm that operation temperature is within the specified range described in the product specification.

9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

Precaution for Mounting / Circuit board design

1. When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.

2. In principle, the reflow soldering method must be used on a surface-mount products, the flow soldering method must be used on a through hole mount products. If the flow soldering method is preferred on a surface-mount products, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

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Precaution for Electrostatic

This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

Precaution for Storage / Transportation

1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
   [a] the Products are exposed to sea winds or corrosive gases, including Cl2, H2S, NH3, SO2, and NO2
   [b] the temperature or humidity exceeds those recommended by ROHM
   [c] the Products are exposed to direct sunshine or condensation
   [d] the Products are exposed to high Electrostatic

2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.

3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

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