Ambient Light Sensor ICs

Analog Current Output Type Ambient Light Sensor IC

BH1603FVC

No.12046EDT05

●Descriptions

BH1603FVC is an analog current output ambient light sensor. BH1603FVC is the most suitable to obtain the ambient light data for adjusting LCD and Keypad backlight of Mobile phone for power saving and better visibility

●Features

1) Compact surface mount package 3.0 × 1.6 mm
2) Spectral sensitivity close to human eyes sensitivity.
3) Output current in proportion to brightness.
4) Minimum supply voltage 2.4V
5) Built-in shutdown function
6) 3 steps controllable output current gain.
7) 1.8V logic input interface
8) Low sensitivity variation (+/-15%)

●Applications

Mobile phone, LCD TV, PDP TV, Laptop PC, Portable game console, Digital camera, Digital video camera, PDA, LCD display

●Absolute Maximum Ratings

Parameter	Symbol	Limits	Units
Supply Voltage	Vmax	7	V
Operating Temperature	Topr	-40～85	℃
Storage Temperature	Tstg	-40～100	℃
Iout Current	Ioutmax	7.5	mA
Power Dissipation	Pd	260※	mW

※ 70mm × 70mm × 1.6mm glass epoxy board. Derating at 3.47mW/℃ for operating above Ta=25℃.

●Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Units
VccVoltage V_{CC}	V_{CC}	2.4	3.0	5.5	V

●Electrical Characteristics (VCC = 3.0V, Ta = 25℃, unless otherwise noted)

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Supply Current1 (Operate)	Icc1	51	74	97	uA	Ev=100 lx (H-Gain Mode) ※
Supply Current2 (0 lx)	Icc2	4.5	9	13.5	uA	Ev=0 lx (H-Gain Mode)
Supply Current3(Shutdown)	Icc3sd	-	0.2	0.4	uA	V_{GC1}=V_{GC2}=0 No Input Light
IOUT Output Current1 (Dark Current)	Iout1	-	-	0.2	uA	Ev=0 lx
IOUT Output Current2	Iout2	51	60	69	uA	Ev=100 lx (H-Gain Mode) ※
Peak Wave Length	λp	-	560	-	nm	
Incandescent/Fluorescent Light Current Ratio	rIF	-	1.0	-	times	Ev=100 lx
Saturated Output Voltage	V_{OMAX}	2.6	2.9	3.0	V	Ev=100 lx, RL=220kΩ(H-Gain Mode)※
GC1, GC2 Input 'L' Voltage	V_{IL}	0	-	0.4	V	
GC1,GC2 Input 'H' Voltage1	V_{IH1}	1.4	-	Vcc	V	2.4V ≦ V_{CC} ≦ 3.6V
GC1,GC2 Input 'H' Voltage2	V_{IH2}	2.0	-	Vcc	V	3.6V ＜ V_{CC} ≦ 5.5V
Wake-up Time	twu	-	45	128	us	Shutdown→H-Gain Mode ,Ev=100lx※
Gain Ratio H-Gain Mode/M-Gain Mode	rHM	9.5	10	10.5	times	Ev=100lx ※
Gain Ratio M-Gain Mode/L-Gain Mode	rML	9.5	10	10.5	times	Ev=100lx ※

※ White LED is used as optical source

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●Reference Data

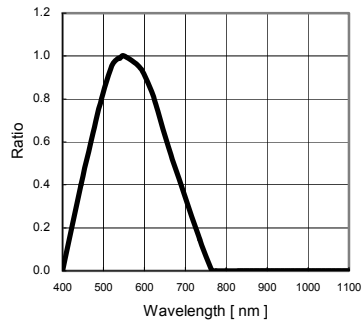


Fig.1 Spectral Response

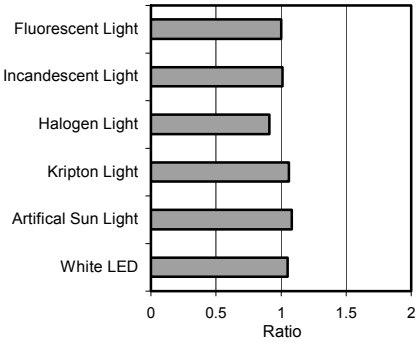


Fig.2 Light Source Dependency
(Fluorescent Light is set to '1')

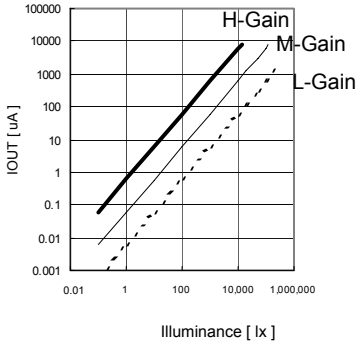


Fig.3 Illuminance – IOUT Characteristics

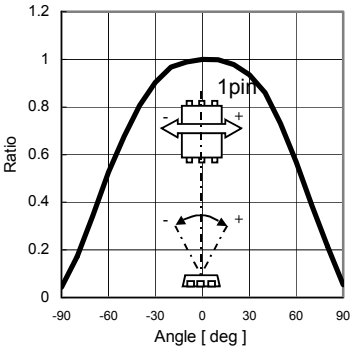


Fig.4 Directional Characteristics 1

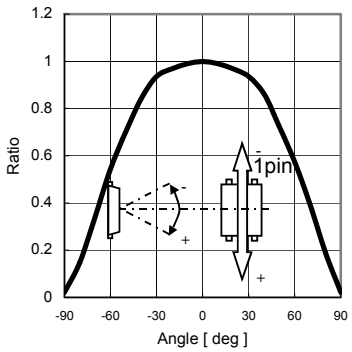


Fig.5 Directional Characteristics 2

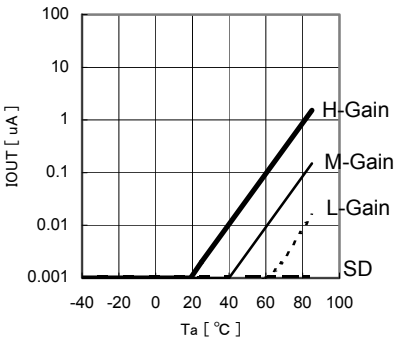


Fig.6 Ta – IOUT (0 lx)

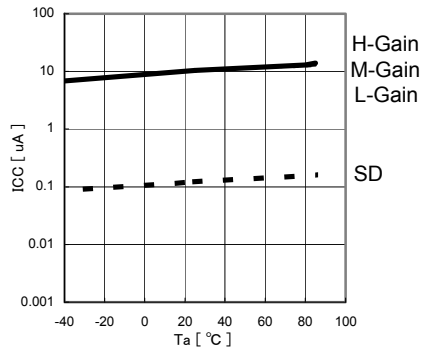


Fig.7 Ta – ICC (0 lx)

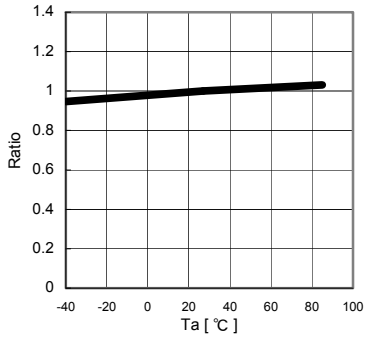


Fig.8 IOUT Temperature dependency
(100 lx)

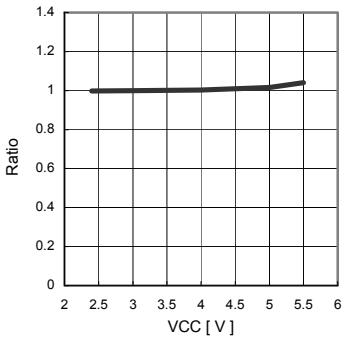


Fig.9 IOUT VCC dependency

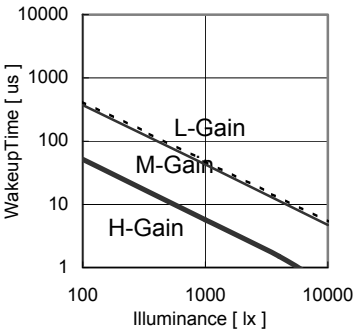
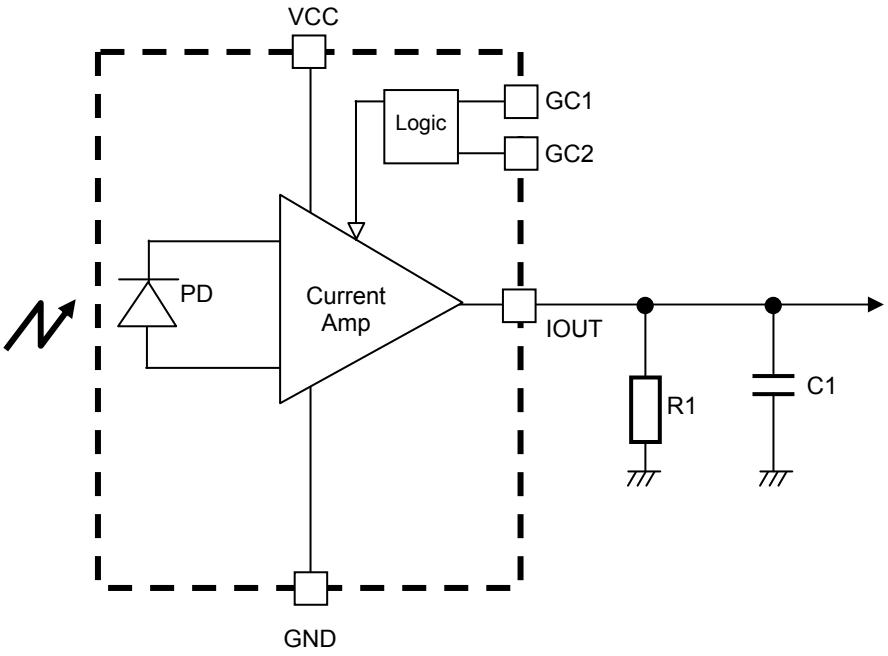


Fig.10 Illuminance – Wake up Time

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●Block Diagram



●Block Diagram Descriptions

●PD

Photo diode close to human eyes sensitivity.

●Current AMP

To amplify Photo diode current (H-Gain / M-Gain / L-Gain)

Gain controllable in 3 steps by input voltage from GC1 and GC2.

●Logic

Logic block for mode setting by input voltage from GC1 and GC2

●Mode Setting

GC2	GC1	Mode
0	0	Shutdown
0	1	H-Gain Mode
1	0	M-Gain Mode
1	1	L-Gain Mode

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●External parts Setting

1) Gain setting of BH1603FVC

Please select the best gain controlled by 5 and 6pin based on the required illuminance range.
The reference is as follows.

Illuminance detection range [lx]	Gain Mode
~1,000	H-Gain Mode
~10,000	M-Gain Mode
~100,000	L-Gain Mode

This device will be mounted under the optical window in actual designing. Therefore, there is a possibility that the illuminace to ALS(Ambient Light Sensor) will be less than the illuminance on the final product surface.
Please consider the attenuation of light through the optical window.
Please set output resistance value(R1) within the range of 1 kΩ ~1MΩ which needs to be smaller than the input impedance of the next circuit.

2) Approximate formula of IOUT output voltage in each Gain Mode

(1) H-Gain mode

The output voltage is calculated as below.

Viout= 0.6 x 10^{-6} x Ev x R1

Viout is IOUT output voltage [V]. Ev is an illuminance of the ALS surface [lx].
R1 is IOUT output resistor[Ω].

(For example) In case you want to convert the illuminance value up to 500 lx by ADC.
If the maximum voltage of ADC input is 2V, output resistor value will be as below.

R1 = Viout/(0.6 x 10^{-6} x Ev)
= 2 /(0.6 x 10^{-6} x 500) = 6667[Ω]
⇒6.8[kΩ]

(2) M-Gain mode

The output voltage is calculated as follows.

Viout= 0.06 x 10^{-6} x Ev x R1

(3) L-Gain mode

The output voltage is calculated as follows.

Viout= 0.006 x 10^{-6} x Ev x R1

3) C1

(1) To reject the flicker light..

In case IOUT output is R1 only and an ALS receives the artificial lights such as fluorescent lamps and incandescent lamps synchronized with 50/60 Hz of AC power supplies, the output current has a ripple. If you want to reject this ripple, please add C1 to R1 in parallel. Please set it to C1 x R1 = about 0.1 as a time constant.

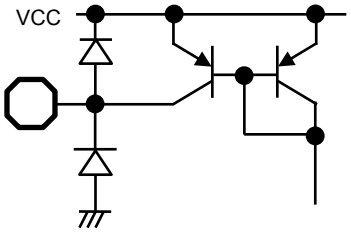
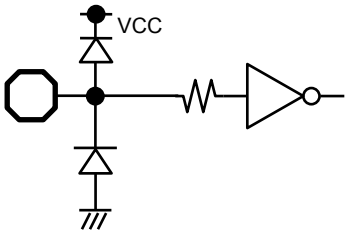
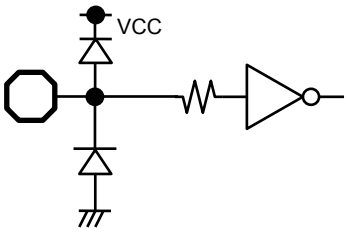
(2) To control backlight smoothly by using illuminance value.

C1 is effective to control backlight smoothly for a rapid changing of the illuminance. In this case, please set it to C1 x R1 = about 1 ~ 10 as a time constant. It is not necessary if you average illuminance value with software to change backlight smoothly.

Please note that the rise time becomes slow at power-on and recovery from shutdown mode to operation mode.

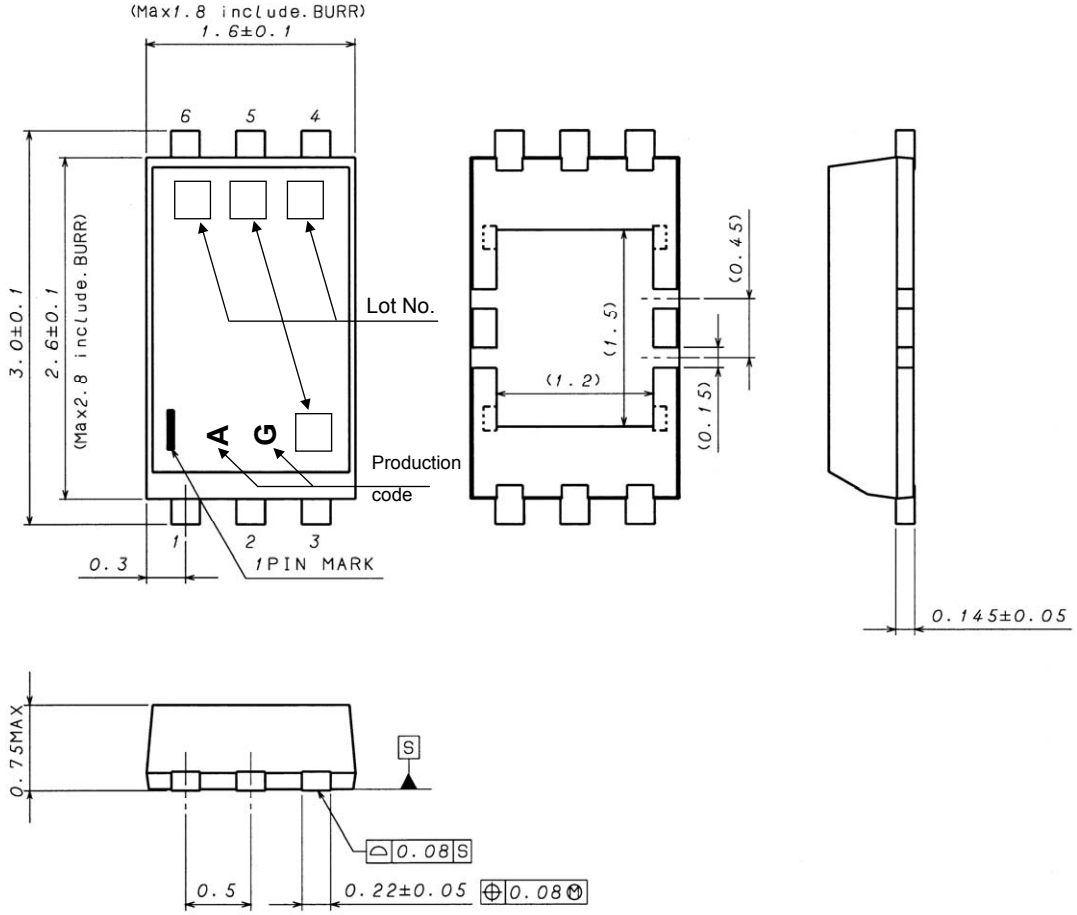
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●**Terminal Descriptions**

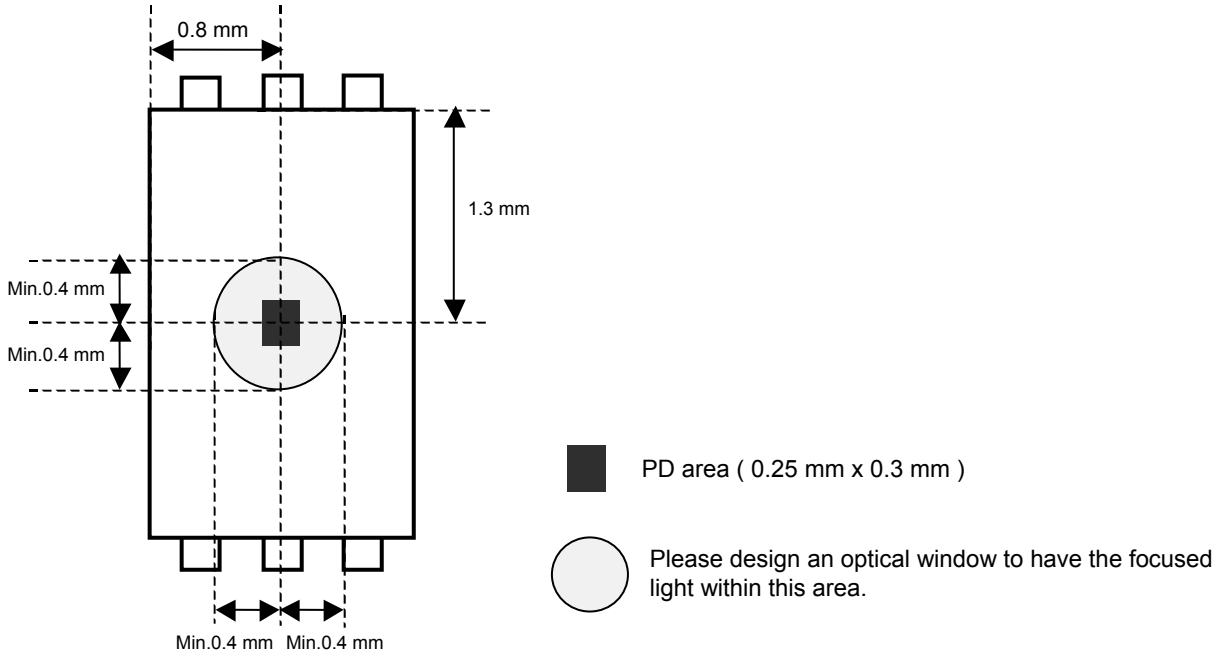
Pin No.	Pin Name	Equivalent Circuit	Function
1	IOUT		This terminal outputs current depending on illuminance level. Use this pin by putting resistor between GND.
2	GND		GND Terminal
3	VCC		Power Supply Terminal
4	NC		NC(Non connection)Terminal Open or short to GND
5	GC1		Mode Setting Terminal 1
6	GC2		Mode Setting Terminal 2

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●Package Outlines



●Optical design for the device



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●Notes for use

1) Absolute Maximum Ratings
An excess in the absolute maximum ratings, such as supply voltage (Vmax), temperature range of operating conditions (Topr), etc., can break down devices, thus making impossible to identify breaking mode such as a short circuit or an open circuit. If any special mode exceeding the absolute maximum ratings is assumed, consideration should be given to take physical safety measures including the use of fuses, etc.

2) GND voltage
Make setting of the potential of the GND terminal so that it will be maintained at the minimum in any operating state. Furthermore, check to be sure no terminals are at a potential lower than the GND voltage including an actual electric transient.

3) Short circuit between terminals and erroneous mounting
In order to mount ICs on a set PCB, pay thorough attention to the direction and offset of the ICs. Erroneous mounting can break down the ICs. Furthermore, if a short circuit occurs due to foreign matters entering between terminals or between the terminal and the power supply or the GND terminal, the ICs can break down.

4) Operation in strong electromagnetic field
Be noted that using ICs in the strong electromagnetic field can malfunction them.

5) Inspection with set PCB
On the inspection with the set PCB, if a capacitor is connected to a low-impedance IC terminal, the IC can suffer stress. Therefore, be sure to discharge from the set PCB by each process. Furthermore, in order to mount or dismount the set PCB to/from the jig for the inspection process, be sure to turn OFF the power supply and then mount the set PCB to the jig. After the completion of the inspection, be sure to turn OFF the power supply and then dismount it from the jig. In addition, for protection against static electricity, establish a ground for the assembly process and pay thorough attention to the transportation and the storage of the set PCB.

6) Input terminals
In terms of the construction of IC, parasitic elements are inevitably formed in relation to potential. The operation of the parasitic element can cause interference with circuit operation, thus resulting in a malfunction and then breakdown of the input terminal. Therefore, pay thorough attention not to handle the input terminals; such as to apply to the input terminals a voltage lower than the GND respectively, so that any parasitic element will operate. Furthermore, do not apply a voltage to the input terminals when no power supply voltage is applied to the IC. In addition, even if the power supply voltage is applied, apply to the input terminals a voltage lower than the power supply voltage or within the guaranteed value of electrical characteristics.

7) Thermal design
Perform thermal design in which there are adequate margins by taking into account the permissible dissipation (pd) in actual states of use.

8) Treatment of package
Dusts or scratch on the photo detector may affect the optical characteristics. Please handle it with care.

9) Rush current
When power is first supplied to this IC, rush current may flow instantaneously. Because it is possible that the charge current to the parasitic capacitance of internal photo diode or the internal logic may be unstable.
Therefore, give special consideration to power coupling capacitance, power wiring, width of GND wiring, and routing of connections.

10) The exposed central pad on the back side of the package
There is an exposed central pad on the back side of the package. But please do it non connection.
(Don't solder, and don't do electrical connection)
Please mount by Footprint dimensions described in the Jisso Information for WSOF6.
This pad is GND level, therefore there is a possibility that LSI malfunctions and heavy-current is generated.

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●Ordering part number

B	H	1	6	0	3	F	V	C	-	T	R

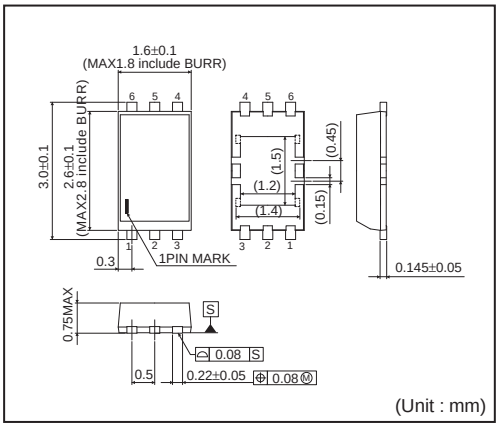
Part No.

Part No.
1603

Package
FVC: WSOF6

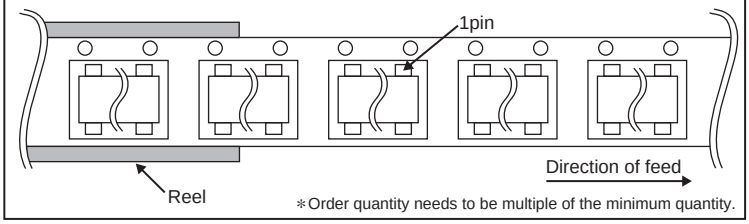
Packaging and forming specification
TR: Embossed tape and reel
(WSOF6)

WSOF6



<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.

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(Note1) Medical Equipment Classification of the Specific Applications

JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		CLASSⅢ	

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   [a] Installation of protection circuits or other protective devices to improve system safety
   [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

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   [a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
   [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
   [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
   [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
   [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
   [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 (Pd) depending on Ambient temperature (Ta). When used in sealed area, confirm the actual ambient 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; if flow soldering method is preferred, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

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Precautions Regarding Application Examples and External Circuits

1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.

2. You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

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.

Precaution for Product Label

QR code printed on ROHM Products label is for ROHM's internal use only.

Precaution for Disposition

When disposing Products please dispose them properly using an authorized industry waste company.

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BH1603FVC - Web Page

Buy

Distribution Inventory

Part Number	BH1603FVC
Package	WSOF6
Unit Quantity	3000
Minimum Package Quantity	3000
Packing Type	Taping
Constitution Materials List	inquiry
RoHS	Yes