STRUCTURE Silicon Monolithic Integrated Circuit

PRODUCT SERIES 16bit serial output digital Ambient Light Sensor IC

TYPE **BH1750FVI**

FUNCTION
1. Correspond to I²C bus interface (f/s Mode Support)
2. Spectral responsibility is approximates human eyes response
3. Illuminance to digital converter
4. Correspond to wide range of light intensity (1 – 65535 lx range)
5. Low Current by power down function
6. Rejecting 50Hz/60Hz light noise enables a more stable sensing
7. Correspond to 1.8V logic interface
8. No need any external parts
9. Low measurement variation (+/– 20%)
10. The influence of infrared is very small.

●Absolute Maximum Ratings (Ta = 25℃)

Parameter	Symbol	Limits	Units
Supply Voltage	Vmax	4.5	V
Operating Temperature	Topr	−40～85	℃
Storage Temperature	Tstg	−40～100	℃
SDA Sink Current	Imax	7	mA
Power Dissipation	Pd	260※	mW

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

●Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Units
VCC Voltage	Vcc	2.4	3.0	3.6	V
I²C Reference Voltage	VDVI	1.65	–	VCC	V

NOTE: This product is not designed for 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.

・Status of this document
The Japanese version of this document is the formal specification. A customer may use this translation version only for a reference to help reading the formal version. If there are any differences in translation version of this document, formal version takes priority.

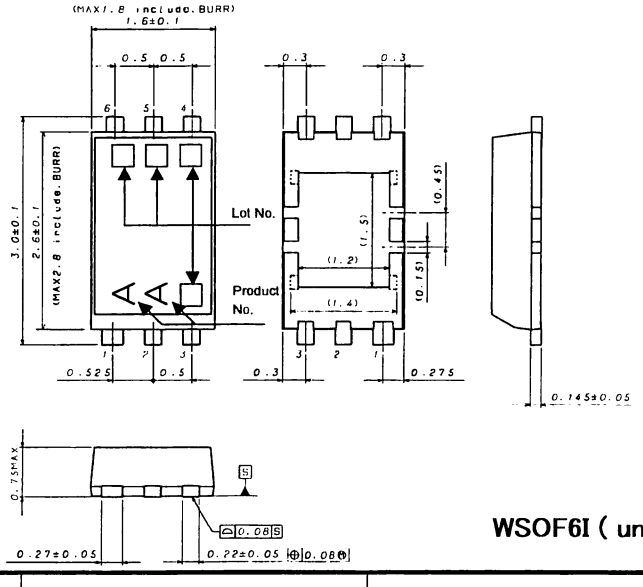
Application example
・ROHM cannot provide adequate confirmation of patents.
・The product described in this specification is designed to be used with ordinary electronic equipment or devices (such as audio-visual equipment, office-automation equipment, communications devices, electrical appliances, and electronic toys).
Should you intend to use this product with equipment or devices which require an extremely high level of reliability and the malfunction of which would directly endanger human life (such as medical instruments, transportation equipment, aerospace machinery, nuclear-reactor controllers, fuel controllers and other safety devices), please be sure to consult with our sales representative in advance.
・ROHM assumes no responsibility for use of any circuits described herein, conveys no license under any patent or other right, and makes no representations that the circuits are free from patent infringement.

● Electrical Characteristics (VCC = 3.0V, DVI = 3.0V, Ta = 25°C, unless otherwise noted.)

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Supply Current	Icc1	—	120	190	uA	Ev=100 lx ※1
Powerdown Current	Icc2	—	0.01	1.0	uA	No Input Light
Measurement Accuracy	S/A	0.96	1.2	1.44	Times	Sensor out / Actual lx Ev=1000 lx ※1, ※2
Dark (0 lx) Sensor out	S0	0	0	3	count	H-Resolution Mode ※3
H-Res Mode Measure Time	tHR	—	120	180	ms	
L-Res Mode Measure Time	tLR	—	16	24	ms	
ADDR input 'H' Voltage	VAH	0.7*VCC	—	—	V	
ADDR input 'L' Voltage	VAL	—	—	0.3*VCC	V	
DVI input 'L' Voltage	VDVL	—	—	0.4	V	
SCL SDA input 'H' Voltage 1	VIH1	0.7*DVI	—	—	V	DVI ≧ 1.8V
SCL SDA input 'H' Voltage 2	VIH2	1.26	—	—	V	1.65V ≦ DVI < 1.8V
SCL SDA input 'L' Voltage 1	VIL1	—	—	0.3*DVI	V	DVI ≧ 1.8V
SCL SDA input 'L' Voltage 2	VIL2	—	—	DVI-1.26	V	1.65V ≦ DVI < 1.8V
SCL SDA ADDR input 'H' Current	IIH	—	—	10	uA	
SCL SDA ADDR input 'L' Current	IIL	—	—	10	uA	
I^2C SDA Output 'L' Voltage	VOL	0	—	0.4	V	IOL=3 mA
I^2C SCL Clock Frequency	fSCL	—	—	400	kHz	
I^2C Hold Time (Repeated) START Condition	tHDSTA	0.6	—	—	us	
I^2C 'L' Period of the SCL Clock	tLOW	1.3	—	—	us	
I^2C 'H' Period of the SCL Clock	tHIGH	0.6	—	—	us	
I^2C Set up time for a Repeated START Condition	tSUSTA	0.6	—	—	us	
I^2C Data Hold Time	tHDDAT	0	—	0.9	us	
I^2C Data Setup Time	tSUDAT	100	—	—	ns	
I^2C Set up Time for STOP Condition	tSUSTO	0.6	—	—	us	
I^2C Bus Free Time between a STOP and START Condition	tBUF	1.3	—	—	us	

※1 White LED is used as optical source.
※2 Measurement Accuracy typical value is possible to change '1' by "Measurement result adjustment function".
※3 Use H-Resolution Mode if dark data (less than 10 lx) is need.

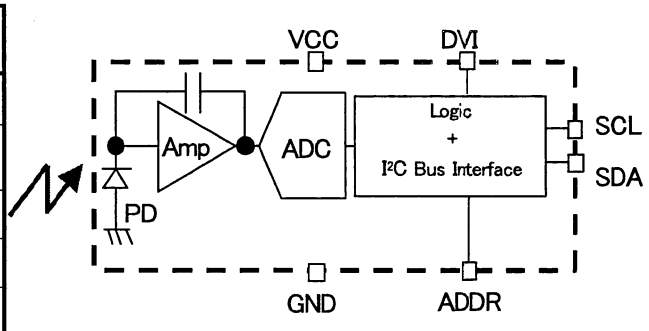
● Package Outlines



WSOF6I (unit : mm)

●Block Diagram and Pin Description

Pin No.	Pin Name	Function
1	VCC	Power Supply Voltage Pin
2	ADDR	Pin to Appoint Slave Address of I²C Bus Interface
3	GND	GND Pin
4	SDA	I²C Bus SDA Pin
5	DVI	I²C Bus Reference Voltage and initial reset Pin ('L' reset) ※
6	SCL	I²C Bus SCL Pin



※ Initial reset is necessary on power supply sequence.
(More than 1us)

●Slave Address Setting by ADDR Terminal

ADDR	Slave Address
'H' (ADDR ≧ VCC * 0.7)	1011100
'L' (ADDR ≦ VCC * 0.3)	0100011

●I²C Bus Access

Write Format (Instruction of measurement beginning etc.)

ST	Slave Address	R/W 0	Ack	Opecode	Ack	SP

Read Format (Reading of Illuminance Data)

ST	Slave Address	R/W 1	Ack	High Byte [15:8] 2^{15} 2^{14} 2^{13} 2^{12} 2^{11} 2^{10} 2^{9} 2^{8}	Ack

Low Byte [7:0] 2^{7} 2^{6} 2^{5} 2^{4} 2^{3} 2^{2} 2^{1} 2^{0}	$\overline{Ack}$	SP

from Master to Slave

from Slave to Master

Ex) When High Byte = 1000_0011
Low Byte = 1001_0000
calculate illuminance by following expression.
$(2^{15} + 2^{9} + 2^{8} + 2^{7} + 2^{4}) / 1.2 \fallingdotseq 28067$ [lx]

※ I2CBUS is trademark of Phillips Semiconductors. Please refer formality specification

Instruction Set Architecture (Opecode of Write Format)

Instruction	Opecode	Instruction	Opecode
POWER DOWN	0000_0000	Continuously Measurement L-Resolution Mode	0001_0011
POWER ON	0000_0001	One Time Measurement H-Resolution Mode	0010_0000
Reset	0000_0111	One Time Measurement L-Resolution Mode	0010_0011
Continuously Measurement H-Resolution Mode	0001_0000		

●Cautions on 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 power 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) When power is first supplied to the CMOS IC, it is possible that the internal logic may be unstable and rush current may flow instantaneously. 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 WSOF6I. This pad is GND level, therefore there is a possibility that LSI malfunctions and heavy-current is generated.