

Ambient Light Sensor IC Series

Digital 16bit Serial Output Type

Ambient Light Sensor IC

BH1715FVC



● Descriptions

BH1715FVC is an digital Ambient Light Sensor IC for I²C bus interface. This IC is the most suitable to obtain the ambient light data for adjusting LCD and Keypad backlight power of Mobile phone. It is possible to detect wide range at High resolution. (1 - 65535 lx).

● Features

- 1) I²C bus Interface (f / s Mode Support)
- 2) Spectral responsibility is approximately human eye response
- 3) Illuminance to Digital Converter
- 4) Wide range and High resolution. (1 – 65535 lx)
- 5) Low Current by power down function
- 6) 50Hz / 60Hz Light noise reject-function
- 7) 1.8V Logic input interface
- 8) No need any external parts
- 9) Light source dependency is little. (ex. Incandescent Lamp. Fluorescent Lamp. Halogen Lamp. White LED. Sun Light)
- 10) It is possible to select 2 type of I²C slave-address.
- 11) Adjustable measurement result for influence of optical window (It is possible to detect min. 0.33 lx, max. 100000 lx by using this function.)
- 12) Small measurement variation (+/- 15%)

● Applications

Mobile phone, LCD TV, NOTE PC, Portable game machine, Digital camera, Digital video camera, Car navigation, PDA, LCD display

● Absolute Maximum Ratings

Parameter	Symbol	Limits	Units
Supply Voltage	Vmax	4.5	V
Operating Temperature	Topr	-40~85	°C
Storage Temperature	Tstg	-40~100	°C
SDA Sink Current	I _{max}	7	mA
Power Dissipation	Pd	260 _※	mW

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

● Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Units
VCC Voltage	Vcc	2.4	3.0	3.6	V
I ² C Reference Voltage	VDVI	1.65	—	VCC	V

● 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
Peak Wave Length	λ p	—	560	—	nm	
Measurement Accuracy	S/A	1.02	1.2	1.38	times	Sensor out / Actual lx EV = 1000 lx ※1, ※2
Dark (0 lx) Sensor out	S0	0	0	2	count	H-Resolution Mode ※3
H-Resolution Mode Resolution	rHR	—	1	—	lx	
L-Resolution Mode Resolution	rLR	—	4	—	lx	
H-Resolution Mode Measurement Time	tHR	—	120	180	ms	
L-Resolution Mode Measurement Time	tLR	—	16	24	ms	
Incandescent / Fluorescent Sensor out ratio	rIF	—	1	—	times	EV = 1000 lx
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 ² C SCL Clock Frequency	fSCL	—	—	400	kHz	
I ² C Bus Free Time	tBUF	1.3	—	—	us	
I ² C Hold Time (repeated) START Condition	tHDSTA	0.6	—	—	us	
I ² C Set up time for a Repeated START Condition	tSUSTA	0.6	—	—	us	
I ² C Set up time for a Repeated STOP Condition	tSUSTD	0.6	—	—	us	
I ² C Data Hold Time	tHDDAT	0	—	0.9	us	
I ² C Data Setup Time	tSUDAT	100	—	—	ns	
I ² C 'L' Period of the SCL Clock	tLOW	1.3	—	—	us	
I ² C 'H' Period of the SCL Clock	tHIGH	0.6	—	—	us	
I ² C SDA Output 'L' Voltage	VOL	0	—	0.4	V	IOL = 3 mA

※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.

● Reference Data

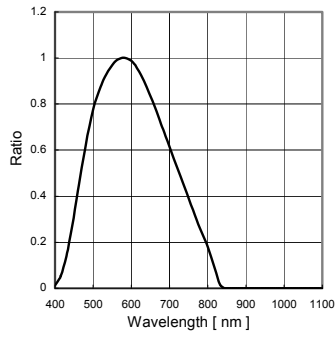


Fig.1 Spectral Response

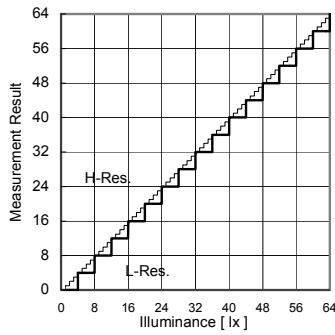


Fig.2 Illuminance – Measurement Result 1

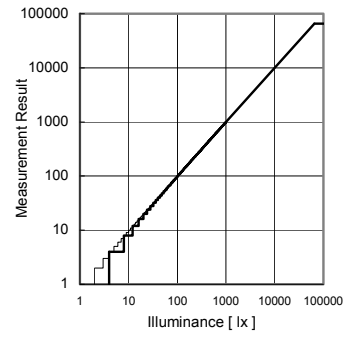


Fig.3 Illuminance – Measurement Result 2

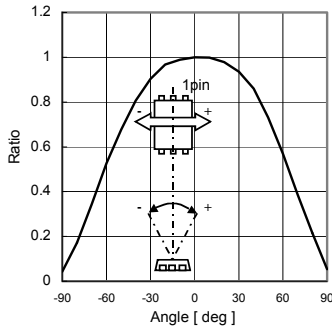


Fig.4 Directional Characteristics 1

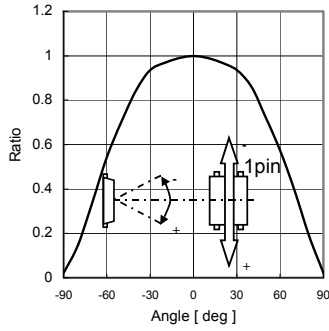


Fig.5 Directional Characteristics 2

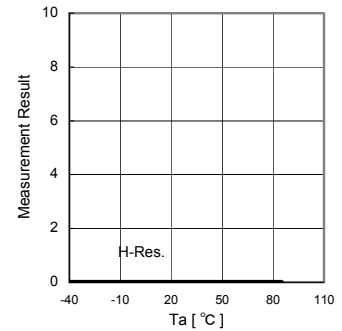


Fig.6 Dark Response

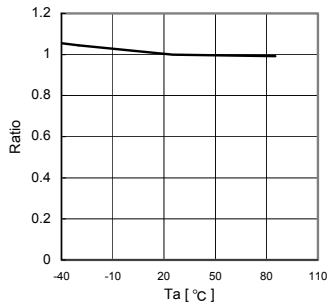


Fig.7 Measurement Result Temperature Dependency

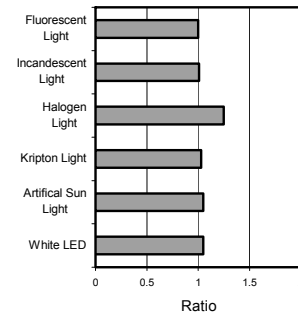


Fig.8 Light Source Dependency (Fluorescent Light is set to '1')

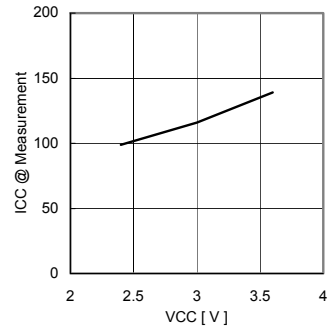


Fig.9 VCC – ICC (During measurement)

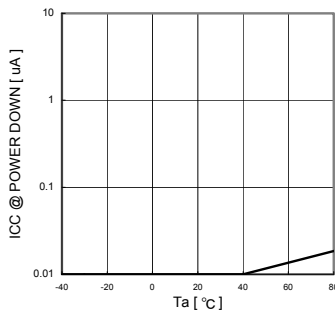


Fig.10 VCC – ICC@0 Lx (POWER DOWN)

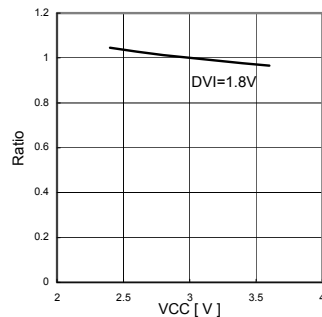


Fig.11 Measurement Result VCC Dependency

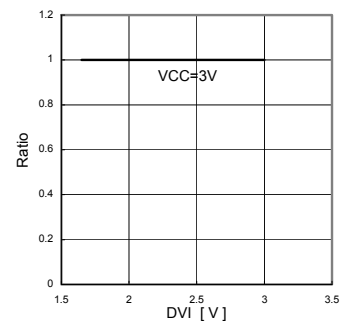
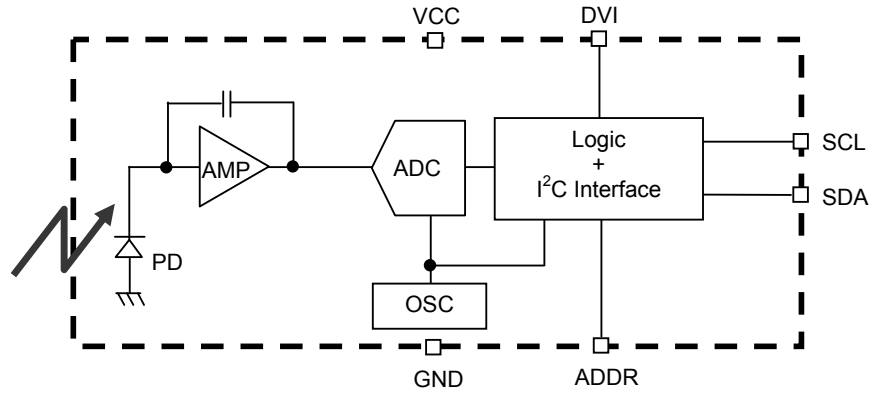


Fig.12 Measurement Result DVI Dependency

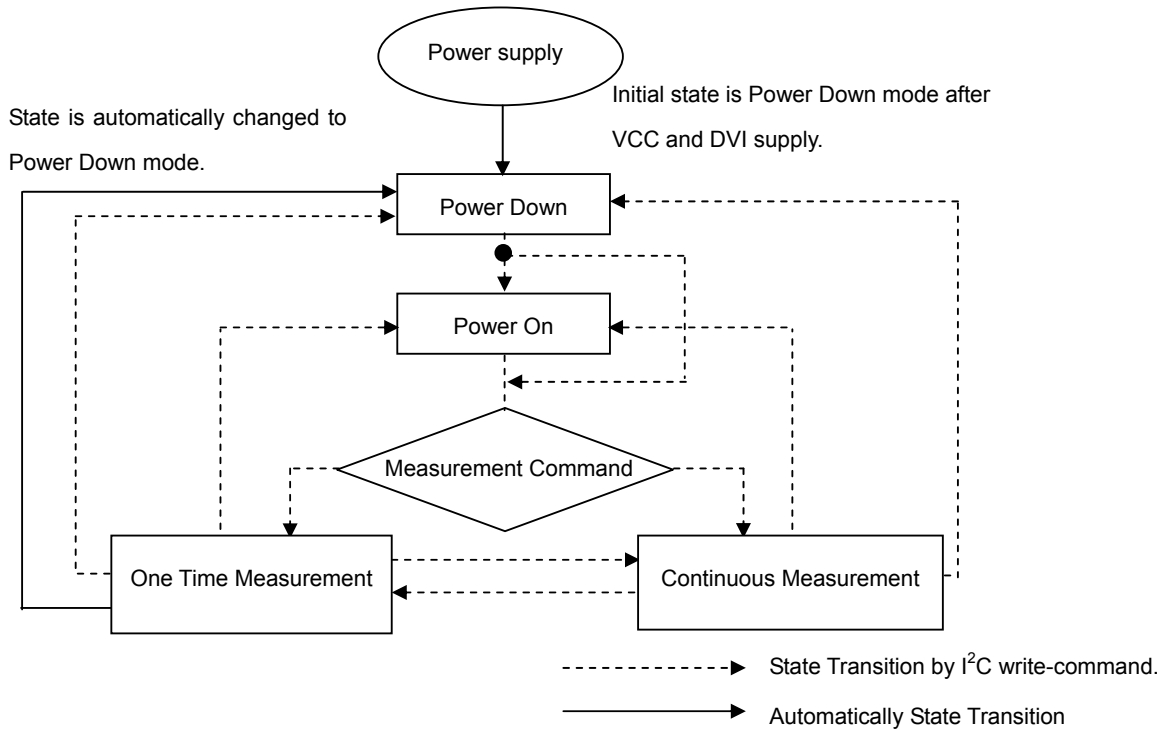
● Block Diagram



● Block Diagram Descriptions

- PD
Photo diode with approximately human eye response.
- AMP
Integration-OPAMP for converting from PD current to Voltage.
- ADC
AD converter for obtainment Digital 16bit data.
- Logic + I²C Interface
Ambient Light Calculation and I²C BUS Interface. It is including below register.
Data Register → This is for registration of Ambient Light Data. Initial Value is "0000_0000_0000_0000".
Measurement Time Register → This is for registration of measurement time. Initial Value is "0100_0101".
- OSC
Internal Oscillator (typ. 320kHz). It is CLK for internal logic.

● Measurement Procedure



* "Power On" Command is possible to omit.

● Instruction Set Architecture

Instruction	Opecode	Comments
Power Down	0000_0000	No active state.
Power On	0000_0001	Waiting for measurement command.
Reset	0000_0111	Reset Data register value. Reset command is not acceptable in Power Down mode.
Continuously H-Resolution Mode	0001_0000	Start measurement at 1lx resolution. Measurement Time is typically 120ms.
Continuously L-Resolution Mode	0001_0011	Start measurement at 4lx resolution. Measurement Time is typically 16ms.
One Time H-Resolution Mode	0010_0000	Start measurement at 1lx resolution. Measurement Time is typically 120ms. It is automatically set to Power Down mode after measurement.
One Time L-Resolution Mode	0010_0011	Start measurement at 4lx resolution. Measurement Time is typically 16ms. It is automatically set to Power Down mode after measurement.
Change Measurement time (High bit)	01000_MT[7,6,5]	Change measurement time. ※ Please refer "adjust measurement result for influence of optical window."
Change Measurement time (Low bit)	011_MT[4,3,2,1,0]	Change measurement time. ※ Please refer "adjust measurement result for influence of optical window."

※ Don't input the other opecode.

● Measurement mode explanation

Measurement Mode	Measurement Time.	Resolution
H-Resolution Mode	Typ. 120ms.	1 Lx.
L-Resolution Mode	Typ. 16ms.	4 Lx.

We recommend to use H-Resolution Mode.

Measurement time (integration time) of H-Resolution Mode is so long that some kind of noise(including in 50Hz / 60Hz noise) is rejected. And H-Resolution Mode is 1 lx resolution so that it is suitable for darkness (less than 10 lx)

● Explanation of Asynchronous reset and Reset command "0000_0111"

1) Asynchronous reset

All registers are reset. It is necessary on power supply sequence. Please refer "Timing chart for VCC and DVI power supply sequence" in this page. It is power down mode during DVI = 'L'.

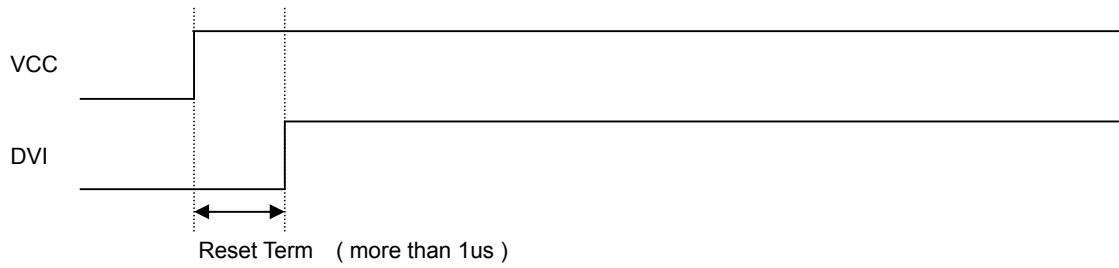
2) Reset command

Reset command is for only reset Illuminance data register. (reset value is '0') It is not necessary even power supply sequence. It is used for removing previous measurement result. This command is not working in power down mode, so that please set the power on mode before input this command.

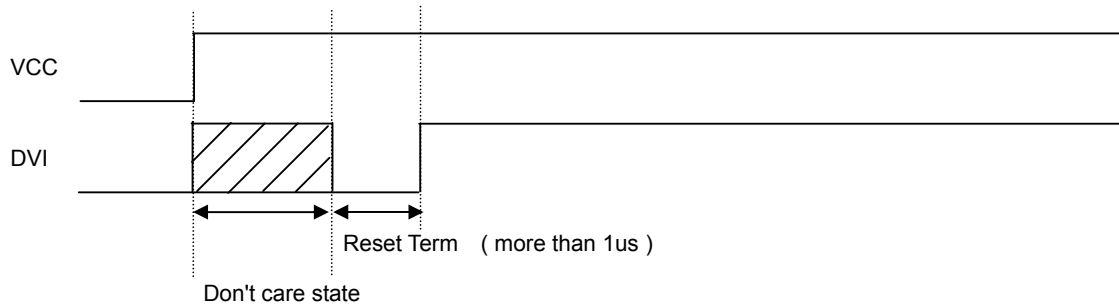
● Timing chart for VCC and DVI power supply sequence

DVI is I²C bus reference voltage terminal. And it is also asynchronous reset terminal. It is necessary to set to 'L' after VCC is supplied. In DVI 'L' term, internal state is set to Power Down mode.

1) Recommended Timing chart1 for VCC and DVI supply.



2) Timing chart2 for VCC and DVI supply.
(If DVI rises within 1us after VCC supply)



ADDR, SDA, SCL is not stable if DVI 'L' term (1us) is not given by systems.

In this case, please connect the resistors (approximately 100kOhm) to ADDR without directly connecting to VCC or GND,

● Measurement sequence example from "Write instruction" to "Read measurement result"

ex1) Continuously H-resolution mode (ADDR = 'L')



① Send "Continuously H-resolution mode " instruction

ST	0100011	0	Ack	00010000	Ack	SP
----	---------	---	-----	----------	-----	----

② Wait to complete 1st H-resolution mode measurement.(max. 180ms.)

③ Read measurement result.

ST	0100011	1	Ack	High Byte [15:8]	Ack	
				Low Byte [7:0]	Ack	SP

How to calculate when the data High Byte is "10000011" and Low Byte is "10010000"
 $(2^{15} + 2^9 + 2^8 + 2^7 + 2^4) / 1.2 \doteq 28067 [lx]$

The result of continuously measurement mode is updated.(120ms.typ at H-resolution mode, 16ms.typ at L-resolution mode)

ex2) One time L-resolution mode (ADDR = 'H')

① Send "One time L-resolution mode " instruction

ST	1011100	0	Ack	00100011	Ack	SP
----	---------	---	-----	----------	-----	----

② Wait to complete L-resolution mode measurement.(max. 24ms.)

③ Read measurement result

ST	1011100	1	Ack	High Byte [15:8]	Ack	
				Low Byte [7:0]	Ack	SP

How to calculate when the data High Byte is "00000001" and Low Byte is "00010000"
 $(2^8 + 2^4) / 1.2 \doteq 227 [lx]$

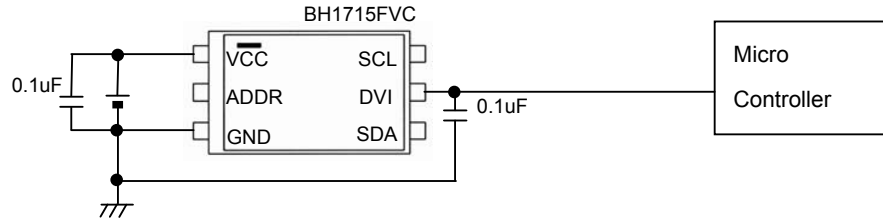
In one time measurement, Statement moves to power down mode after measurement completion. If updated result is need then please resend measurement instruction.

● Application circuit example of DVI terminal

The DVI terminal is an asynchronous reset terminal. Please note that there is a possibility that IC doesn't operate normally if the reset section is not installed after the start-up of VCC. (Please refer to the paragraph of "Timing chart for VCC and DVI power supply sequence")

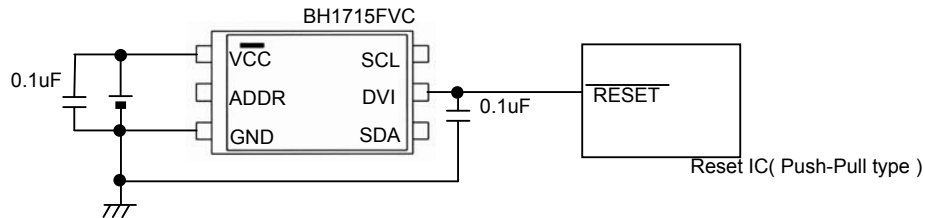
The description concerning SDA and the terminal SCL is omitted in this application circuit example. Please design the application the standard of the I2C bus as it finishes being satisfactory. Moreover, the description concerning the terminal ADDR is omitted. Please refer to the paragraph of "Timing chart for VCC and DVI power supply sequence" about the terminal ADDR design.

ex 1) The control signal line such as CPU is connected.

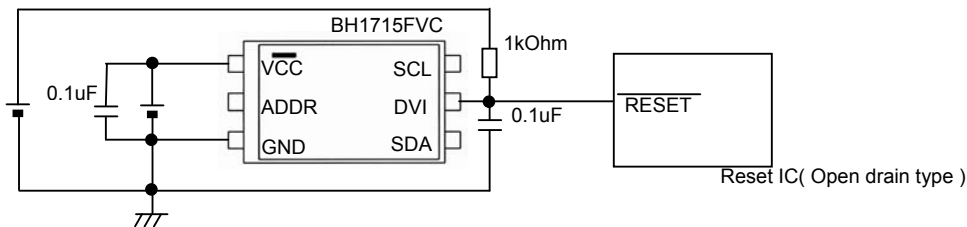


ex 2) Reset IC is used.

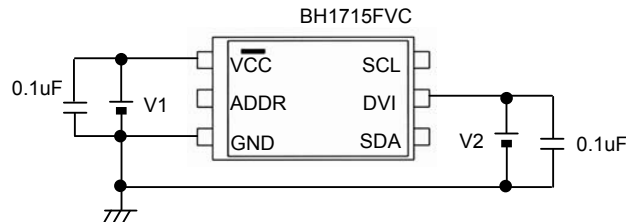
1, For Reset IC of the Push-Pull type



2, For Reset IC of the Open drain output



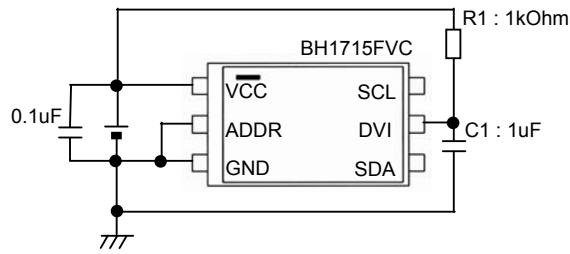
ex 3) A different power supply is used.



※ Power supply of DVI must stand up later than power supply of VCC stand up, because it is necessary to secure reset section (1us or more).

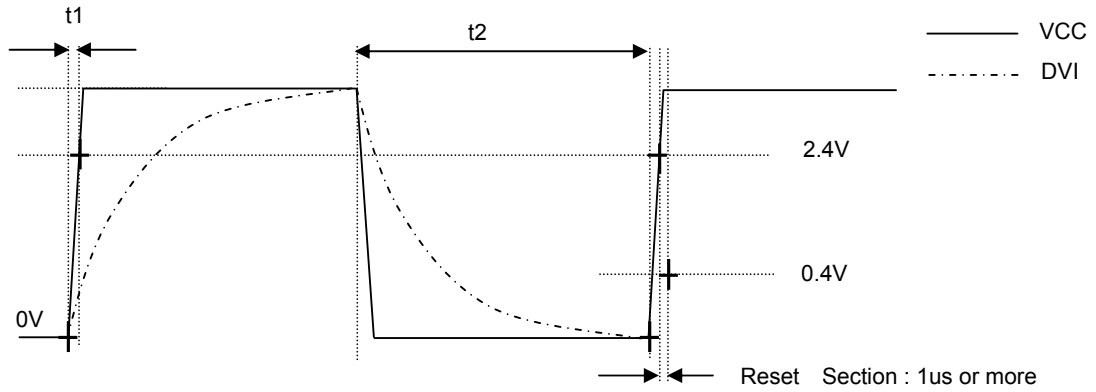
ex 4) LPF using CR is inserted between VCC and DVI.

This method has the possibility that the Reset section of turning on the power supply can not satisfied. cannot be satisfied.
Please design the set considering the characteristic of the power supply enough.



◆ Notes when CR is inserted between VCC and DVI

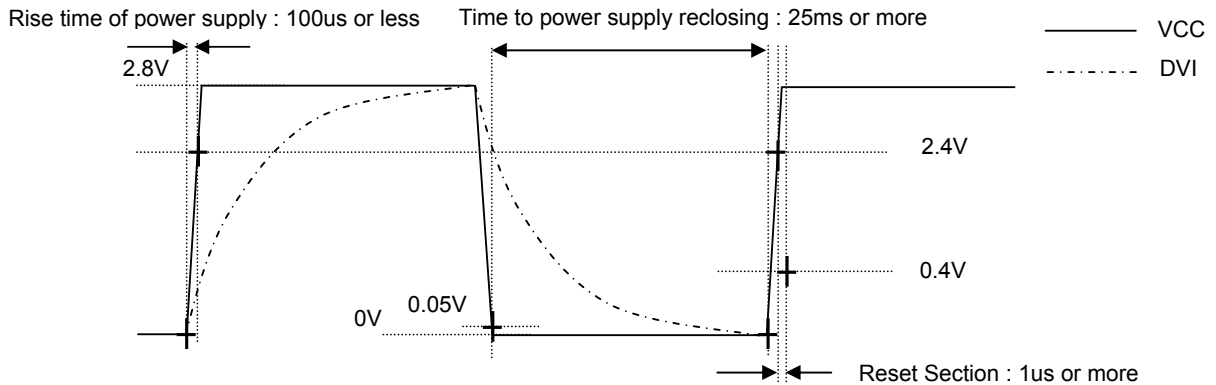
- ※ Please note that there is a possibility that reset section (1us) can not be satisfied because the power supply is turned on when the rise time of VCC is slow
- ※ When VCC is turned off, the DVI voltage becomes higher than VCC voltage but IC destruction is not occurred if recommended constant (R1 = 1kOhm, C1 = 1uF) is used.
- ※ Please note that there is a possibility that Reset section (1usec) cannot be satisfied if wait time is not enough long after turning off VCC.(It is necessary to consider DVI voltage level after turning off VCC.)



• Please do the application design to secure Reset section 1us or more after the reclosing of the power supply.

◆ Example of designing set when CR (C = 1uF, R = 1kΩ) is inserted between VCC and DVI with VCC=2.8V

- ① The rise time to 0→2.4V of VCC must use the power supply of 100us or less.
- ② Please wait 25ms or more after VCC turn off (VCC <= 0.05V), because it is necessary to secure reset section (1us or more).

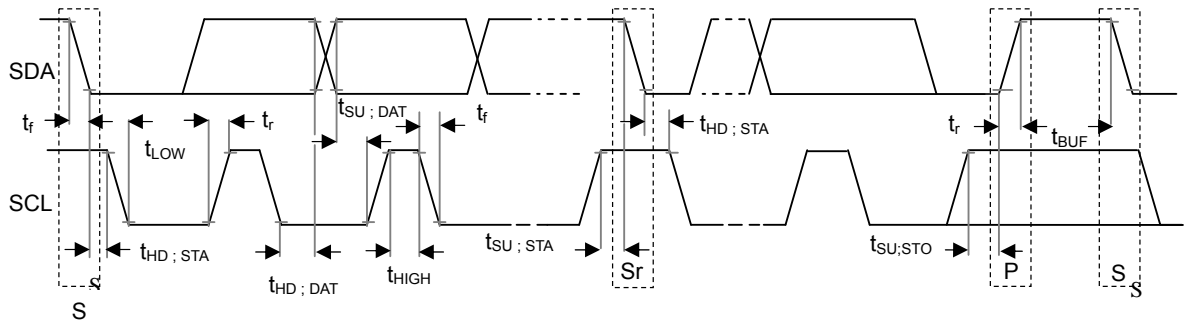


• Please do the application design to secure Reset section 1us or more after the reclosing of the power supply.

● I²C Bus Access

1) I²C Bus Interface Timing chart

Write measurement command and Read measurement result are done by I²C Bus interface. Please refer the formally specification of I²C Bus interface, and follow the formally timing chart.



2) Slave Address

Slave Address is 2 types, it is determined by ADDR Terminal

ADDR = 'H' (ADDR \geq 0.7VCC) \rightarrow "1011100"

ADDR = 'L' (ADDR \leq 0.3VCC) \rightarrow "0100011"

3) Write Format

BH1715FVC is not able to accept plural command without stop condition. Please insert SP every 1 Opcode.

ST	Slave Address	R/W 0	Ack	Opcode	Ack	SP
----	---------------	----------	-----	--------	-----	----

4) Read Format

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] $2^7 \ 2^6 \ 2^5 \ 2^4 \ 2^3 \ 2^2 \ 2^1 \ 2^0$	Ack	SP



from Master to Slave



from Slave to Master

ex)

High Byte = "1000_0011"

Low Byte = "1001_0000"

$$(2^{15} + 2^9 + 2^8 + 2^7 + 2^4) / 1.2 \doteq 28067 [lx] \quad \times 2$$

* I²C BUS is trademark of Phillips Semiconductors. Please refer formality specification.

- Adjust measurement result for influence of optical window.

BH1715FVC is including in adjust measurement result function for influence of optical window. Adjust is done by changing measurement time. For example, if transmission rate by optical window is 1 / N, then adjust is done by measurement time is set to "initial value * N".

Measurement time register (Mtreg) is 8bit register. Initial value is "0100_0101" (45xh). Please change this register value via to I²C Bus interface.

ex) Case of transmission rate is 50%.

Please change Mtreg value from "0100_0101" to "1000_1010".

1) Changing High bit of Mtreg

ST	Slave Address	R/W 0	Ack	01000_100	Ack	SP
----	---------------	----------	-----	-----------	-----	----

2) Changing Low bit of Mtreg

ST	Slave Address	R/W 0	Ack	011_01010	Ack	SP
----	---------------	----------	-----	-----------	-----	----

3) Input Measurement Command.

ST	Slave Address	R/W 0	Ack	0001_0000	Ack	SP
----	---------------	----------	-----	-----------	-----	----

※ This example is High Resolution mode, but it accepts the other measurement.

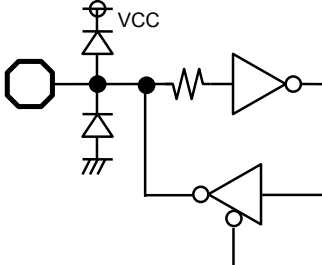
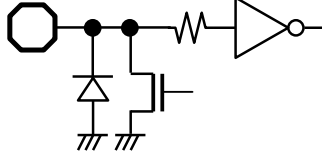
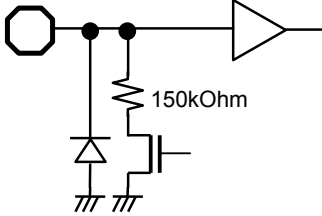
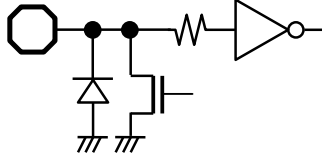
4) After about 240ms, measurement result is registered to Data Register. (High Resolution mode is typically 120ms, but measurement time is set twice.)

Supported Mtreg value is seeing below.

	Min.	Typ.	Max
Supported value (hex)	0010_1101 (transmission rate 153%)	0100_0101 (transmission rate 100%)	1111_1110 (transmission rate 27.2%)

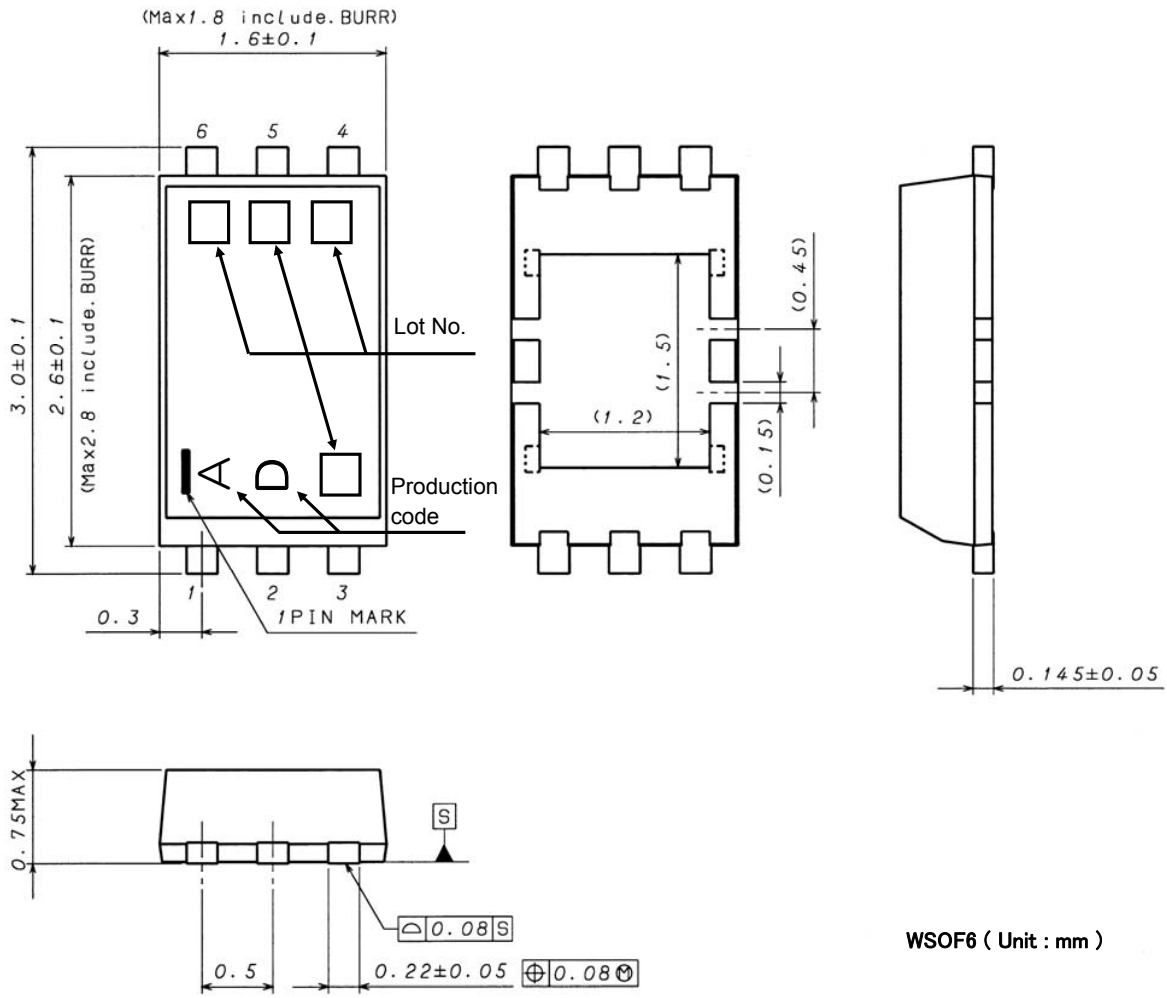
For example BH1715FVC is possible to detect min. 0.33 lx when Mtreg value is "1111_1110" at H-Resolution mode.

● Terminal Description

PIN No.	Terminal Name	Equivalent Circuit	Function
1	VCC		Power Supply Terminal
2	ADDR		<p>I^2C Slave-address Terminal</p> <p>ADDR = 'H' (ADDR \geq 0.7VCC) "1011100"</p> <p>ADDR = 'L' (ADDR \leq 0.3VCC) "0100011"</p> <p>ADDR Terminal is designed as 3 state buffer for internal test. So that please take care of VCC and DVI supply procedure. Please see P6.</p>
3	GND		GND Terminal
4	SDA		I^2C bus Interface SDA Terminal
5	DVI		<p>SDA, SCL Reference Voltage Terminal</p> <p>And DVI Terminal is also asynchronous Reset for internal registers. So that please set to 'L' (at least 1us, DVI \leq 0.4V) after VCC is supplied. BH1715FVC is pulled down by 150kOhm while DVI = 'L'.</p>
6	SCL		I^2C bus Interface SCL Terminal

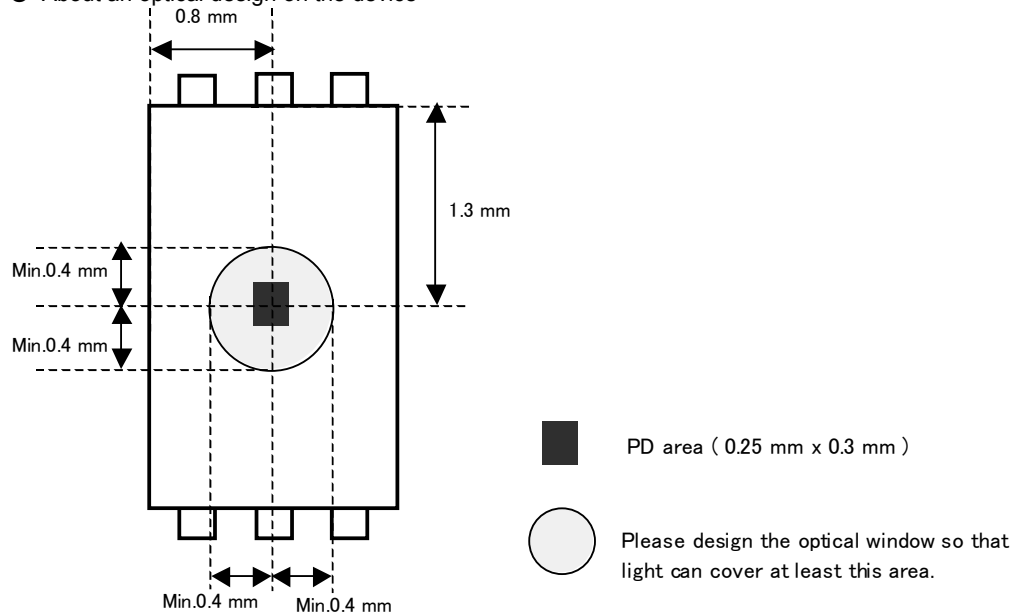
※ These values are design-value, not guaranteed.

● Package Outlines



WSOF6 (Unit : mm)

● About an optical design on the device



● Cautions on use

1) Absolute Maximum Ratings

An excess in the absolute maximum ratings, such as supply voltage (V_{max}), temperature range of operating conditions (T_{opr}), 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 (P_d) 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.

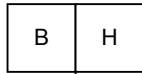
9) Rush current

When power is first supplied to 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.

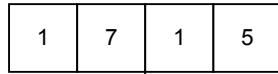
10) The exposed central pad on the back side of the package

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 WSO6. This pad is GND level, therefore there is a possibility that LSI malfunctions and heavy-current is generated.

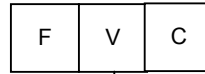
● Product Designations (Selecting a model name when ordering)



Rohm Model



Part number



Package type



TR = Reel-wound embossed taping

WSOF6

<Dimension>

(Unit:mm)

<Tape and Reel information>

Tape	Embossed carrier tape
Quantity	3000pcs
Direction of feed	TR (The direction is the 1 pin 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)

1Pin Direction of feed →

※When you order, please order in times the amount of package quantity.

- The contents described herein are correct as of June, 2008
- The contents described herein are subject to change without notice. For updates of the latest information, please contact and confirm with ROHM CO.,LTD.
- Any part of this application note must not be duplicated or copied without our permission.
- Application circuit diagrams and circuit constants contained herein are shown as examples of standard use and operation. Please pay careful attention to the peripheral conditions when designing circuits and deciding upon circuit constants in the set.
- Any data, including, but not limited to application circuit diagrams and information, described herein are intended only as illustrations of such devices and not as the specifications for such devices. ROHM CO.,LTD. disclaims any warranty that any use of such devices shall be free from infringement of any third party's intellectual property rights or other proprietary rights, and further, assumes no liability of whatsoever nature in the event of any such infringement, or arising from or connected with or related to the use of such devices.
- Upon the sale of any such devices, other than for buyer's right to use such devices itself, resell or otherwise dispose of the same, implied right or license to practice or commercially exploit any intellectual property rights or other proprietary rights owned or controlled by ROHM CO., LTD. is granted to any such buyer.
- The products described herein utilize silicon as the main material.
- The products described herein are not designed to be X ray proof.

The products listed in this catalog are 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 these products 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.

Contact us for further information about the products.

Excellence in Electronics

ROHM

ROHM CO., LTD.

21, Saiin Mizosaki-cho, Ukyo-ku, Kyoto
615-8585, Japan
TEL: +81-75-311-2121 FAX: +81-75-315-0172
URL: <http://www.rohm.com>

Published by
LSI Business Promotion Dept.

San Diego	TEL: +1-858-625-3630	FAX: +1-858-625-3670
Atlanta	TEL: +1-770-754-5972	FAX: +1-770-754-0691
Boston	TEL: +1-978-371-0382	FAX: +1-925-438-7164
Chicago	TEL: +1-847-368-1006	FAX: +1-847-368-1008
Dallas	TEL: +1-469-287-6366	FAX: +1-469-362-7973
Denver	TEL: +1-303-708-0908	FAX: +1-303-708-0858
Detroit	TEL: +1-248-348-9920	FAX: +1-248-348-9942
Nashville	TEL: +1-615-620-6700	FAX: +1-615-620-6702
Mexico	TEL: +52-33-3123-2001	FAX: +52-33-3123-2002
Düsseldorf	TEL: +49-2154-9210	FAX: +49-2154-921400
Munich	TEL: +49-8161-48310	FAX: +49-8161-483120
Stuttgart	TEL: +49-711-72723710	FAX: +49-711-72723720
France	TEL: +33-1-5697-3060	FAX: +33-1-5697-3080
United Kingdom	TEL: +44-1-908-306700	FAX: +44-1-908-235788
Denmark	TEL: +45-3694-4739	FAX: +45-3694-4789
Barcelona	TEL: +34-9375-24320	FAX: +34-9375-24410
Hungary	TEL: +36-1-4719338	FAX: +36-1-4719339
Poland	TEL: +48-22-5757213	FAX: +48-22-5757001
Russia	TEL: +7-95-980-6755	FAX: +7-95-937-8290
Seoul	TEL: +82-2-8182-700	FAX: +82-2-8182-715
Masan	TEL: +82-55-240-6234	FAX: +82-55-240-6236
Dalian	TEL: +86-411-8230-8549	FAX: +86-411-8230-8537
Beijing	TEL: +86-10-8525-2493	FAX: +86-10-8525-2489
Tianjin	TEL: +86-22-23029181	FAX: +86-22-23029183

Shanghai	TEL: +86-21-6279-2727	FAX: +86-21-6247-2066
Hangzhou	TEL: +86-571-87658072	FAX: +86-571-87658071
Nanjing	TEL: +86-25-8689-0015	FAX: +86-25-8689-0393
Ningbo	TEL: +86-574-87654201	FAX: +86-574-87654208
Qingdao	TEL: +86-532-5779-312	FAX: +86-532-5779-653
Suzhou	TEL: +86-512-6807-1300	FAX: +86-512-6807-2300
Wuxi	TEL: +86-510-82702693	FAX: +86-510-82702992
Shenzhen	TEL: +86-755-8307-3008	FAX: +86-755-8307-3003
Dongguan	TEL: +86-769-8393-3320	FAX: +86-769-8398-4140
Fuzhou	TEL: +86-591-8801-8698	FAX: +86-591-8801-8690
Guangzhou	TEL: +86-20-8364-9796	FAX: +86-20-8364-9707
Huizhou	TEL: +86-752-205-1054	FAX: +86-752-205-1059
Xiamen	TEL: +86-592-238-5705	FAX: +86-592-238-6380
Zhuhai	TEL: +86-756-3232-480	FAX: +86-756-3232-460
Hong Kong	TEL: +852-2-740-6262	FAX: +852-2-375-8971
Taipei	TEL: +886-2-2500-6956	FAX: +886-2-2503-2869
Kaohsiung	TEL: +886-7-237-0881	FAX: +886-7-238-7332
Singapore	TEL: +65-6332-2322	FAX: +65-6332-5662
Philippines	TEL: +63-2-807-6872	FAX: +63-2-809-1422
Thailand	TEL: +66-2-254-4890	FAX: +66-2-256-6334
Kuala Lumpur	TEL: +60-3-7958-8355	FAX: +60-3-7958-8377
Penang	TEL: +60-4-2286453	FAX: +60-4-2286452
Kyoto	TEL: +81-75-365-1218	FAX: +81-75-365-1228
Yokohama	TEL: +81-45-476-2290	FAX: +81-45-476-2295

Notes

- No technical content pages of this document may be reproduced in any form or transmitted by any means without prior permission of ROHM CO.,LTD.
- The contents described herein are subject to change without notice. The specifications for the product described in this document are for reference only. Upon actual use, therefore, please request that specifications to be separately delivered.
- Application circuit diagrams and circuit constants contained herein are shown as examples of standard use and operation. Please pay careful attention to the peripheral conditions when designing circuits and deciding upon circuit constants in the set.
- Any data, including, but not limited to application circuit diagrams information, described herein are intended only as illustrations of such devices and not as the specifications for such devices. ROHM CO.,LTD. disclaims any warranty that any use of such devices shall be free from infringement of any third party's intellectual property rights or other proprietary rights, and further, assumes no liability of whatsoever nature in the event of any such infringement, or arising from or connected with or related to the use of such devices.
- Upon the sale of any such devices, other than for buyer's right to use such devices itself, resell or otherwise dispose of the same, no express or implied right or license to practice or commercially exploit any intellectual property rights or other proprietary rights owned or controlled by
- ROHM CO., LTD. is granted to any such buyer.
- Products listed in this document are no antiradiation design.

The products listed in this document are 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 these products 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.

It is our top priority to supply products with the utmost quality and reliability. However, there is always a chance of failure due to unexpected factors. Therefore, please take into account the derating characteristics and allow for sufficient safety features, such as extra margin, anti-flammability, and fail-safe measures when designing in order to prevent possible accidents that may result in bodily harm or fire caused by component failure. ROHM cannot be held responsible for any damages arising from the use of the products under conditions out of the range of the specifications or due to non-compliance with the NOTES specified in this catalog.

Thank you for your accessing to ROHM product informations.

More detail product informations and catalogs are available, please contact your nearest sales office.

ROHM Customer Support System

THE AMERICAS / EUROPE / ASIA / JAPAN

www.rohm.com

Contact us : webmaster@rohm.co.jp