

Free Delay Time Setting CMOS Voltage Detector IC

BD4142HFV

●General Description

BD4142HFV is 1ch voltage detector IC for monitoring an input voltage line. The default detected voltage is 0.5V and is adjustable via external resistors. When monitoring an input voltage supply, the IC outputs a HIGH signal via a PGOOD pin when the supply rises above the threshold and is LOW when below.

●Features

- Open Drain Output
- Built in Under Voltage LockOut (UVLO) Circuit
- Delay Time Controlled by External Capacitor
- Very small and low height package
- PGOOD HIGH Output

●Applications

Laptop PC, Desktop PC, LCD-TV, Printer, STB, Digital Appliances, and more.

●Key Specifications

- Input voltage range: 3.0V to 5.5V
- Detected voltage: 500mV(Typ)
- PGOOD output ON resistance: 100Ω(Typ)
- Bias current: 7.5μA (Typ)
- Operating temperature range (Ta): -10°C to +100°C

●Package

HVSO5F5

1.60mm x 1.60mm x 0.60mm



HVSO5F5

●Typical Application Circuit

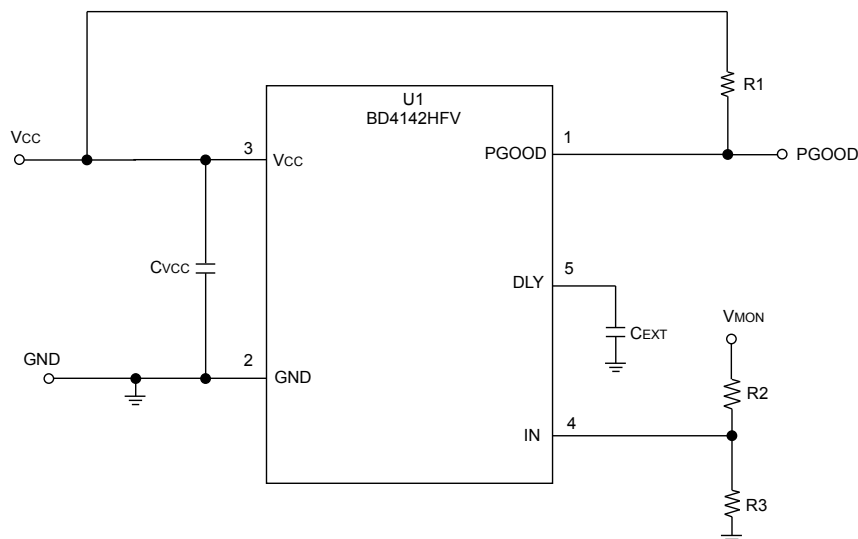


Figure 1. Typical Application Circuit

●Pin Configuration

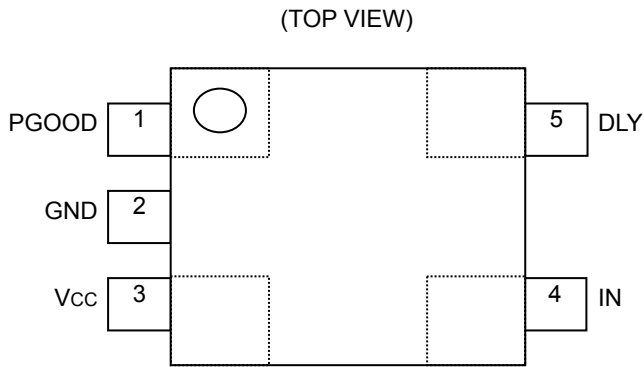


Figure 2. Pin configuration

●Pin Description

Pin No.	Symbol	Function
1	PGOOD	Reset Output Pin (Power Good Signal)
2	GND	Ground Pin
3	Vcc	Power Supply Input Pin
4	IN	Monitoring Voltage Input Pin
5	DLY	Capacitor Connected Pin for Setting Delay Time
Bottom	E-Pad	Substrate. Connect the substrate to GND.

●Block Diagram

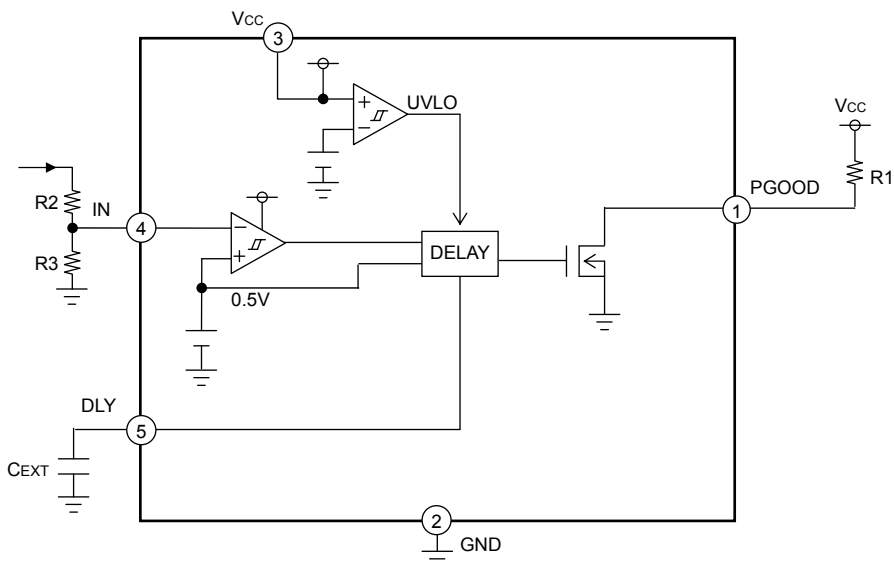


Figure 3. Block Diagram

● Absolute Maximum Ratings (Ta=25°C)

Parameter	Symbol	Limits	Unit
Terminal voltage	V _{CC} , V _{IN} , V _{DLY} , V _{PGOOD}	6 *1	V
Power Dissipation	P _d	0.67 *2	W
PGOOD Capacity Current	I _{PGOOD}	5	mA
Operating temperature range	T _{opr}	-10 to +100	°C
Storage temperature range	T _{stg}	-55 to +150	°C
Junction Temperature	T _{jmax}	+150	°C

*1 No need to exceed P_d.

*2 Reduced by $\theta_{ja} = 186.6^{\circ}\text{C}/\text{W}$ when used over 25°C.

(when mounted on a board 70.0mm × 70mm × 1.6mm Glass-epoxy PCB which has 1 layer. (copper foil density :2%))

● Recommended Operating Ratings (Ta=25°C)

Parameter	Symbol	Limits		Unit
		Min	Max	
Terminal voltage	V _{CC}	3.0	5.5	V
	V _{IN}	-0.3	V _{CC} - 2	V
	V _{PGOOD}	-0.3	5.5	V
	V _{DLY}	-0.3	V _{CC}	V

● Electrical Characteristics (Unless otherwise noted, Ta=25°C, V_{CC}=5V)

Parameter	Symbol	Limits			Unit	Conditions
		Min	Typ	Max		
Bias Current	I _{CC}	-	7.5	20	μA	
Detected Voltage	V _{DET}	491	500	509	mV	IN sweep up
Hysteresis Voltage	V _{HYS}	-	10	-	mV	IN sweep down
Delay Current	I _{DLY}	150	250	350	nA	IN=0.6V
PGOOD Output ON Resistance	R _{OUT}	-	100	200	Ω	IN=0V
PGOOD Output Leak Current	I _{OUT}	-	0	5	μA	IN=0.6V

● Typical Performance Curves (Unless otherwise noted, Ta=25°C, Vcc=5V)

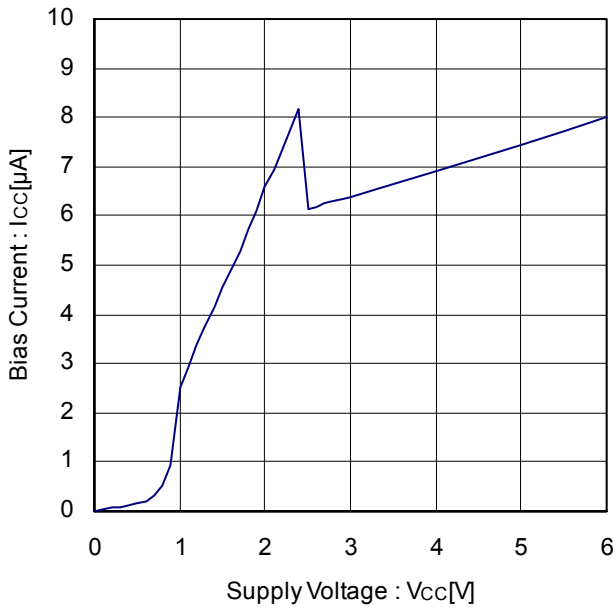


Figure 4. Supply Voltage - Bias Current

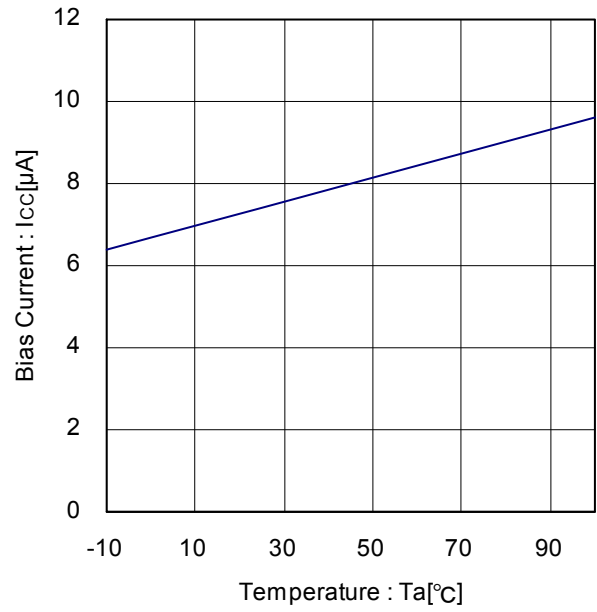


Figure 5. Temperature - Bias Current

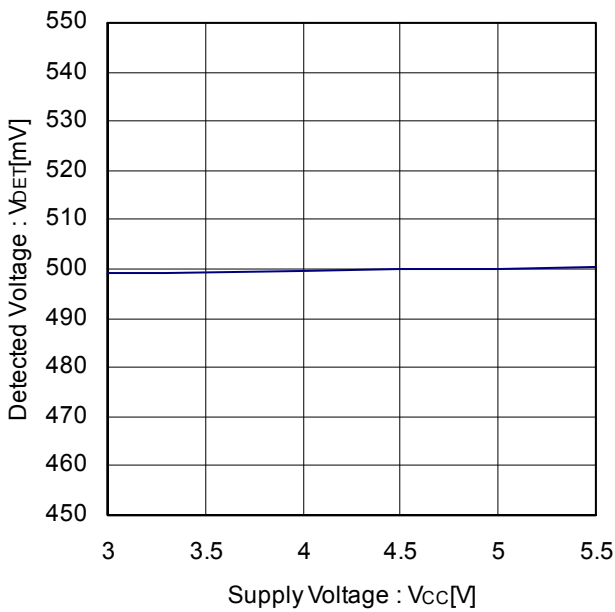


Figure 6. Supply Voltage - Detected Voltage

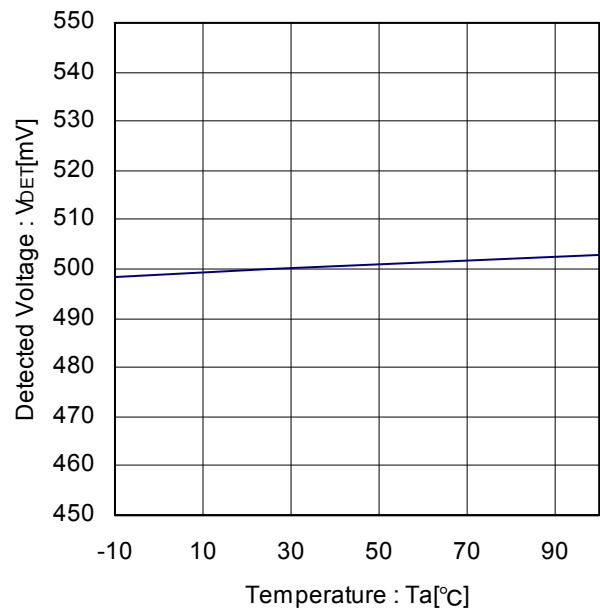


Figure 7. Temperature - Detected Voltage

● Typical Performance Curves (Unless otherwise noted, Ta=25°C, Vcc=5V) - continued

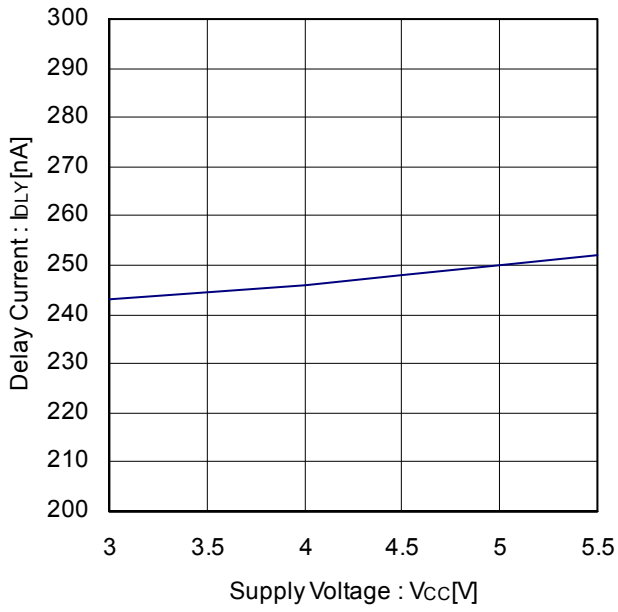


Figure 8. Supply Voltage - Delay Current

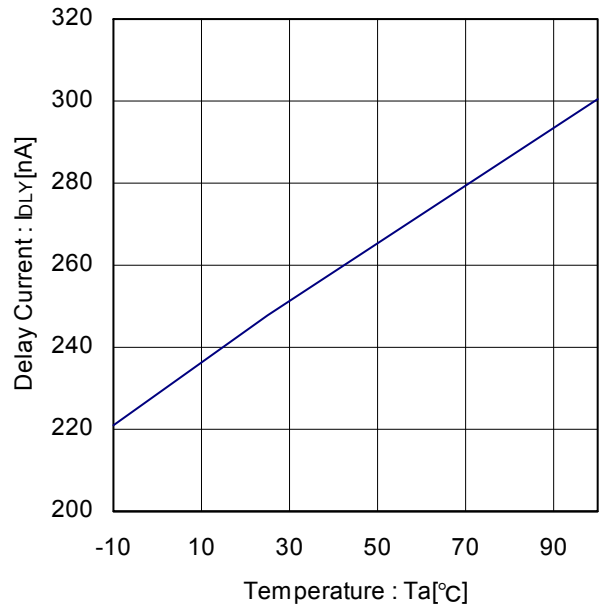


Figure 9. Temperature - Delay Current

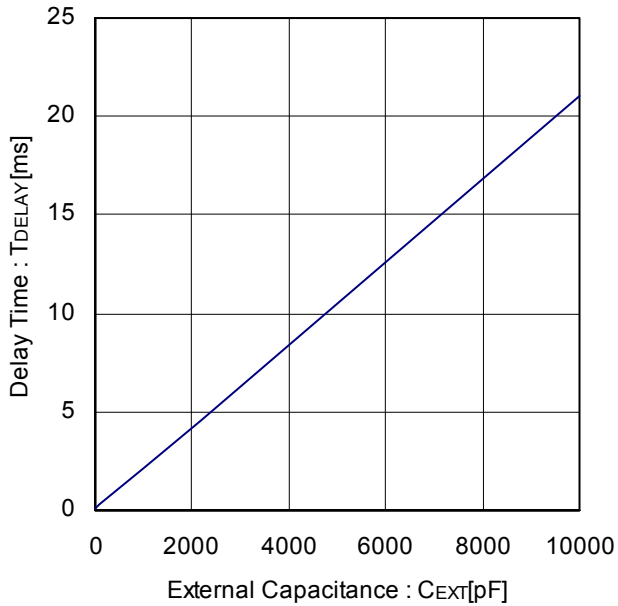


Figure 10. External Capacitance - Delay Time

●Basic Operation

BD4142HFV is a 1ch voltage detector IC with an independent supply voltage (Vcc). Vcc voltage must be supplied before inputting the monitoring voltage (IN).

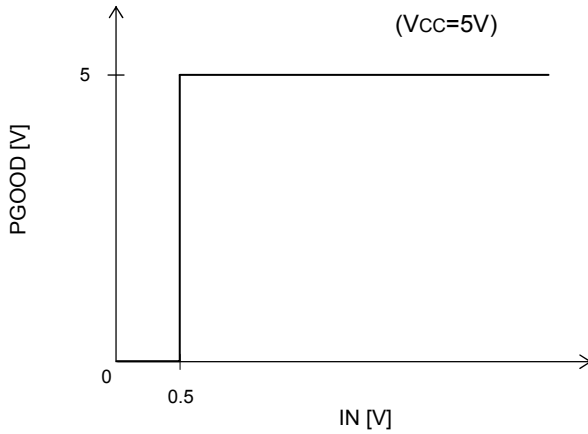


Figure 11. Input-Output Voltage Characteristic

●Timing Chart

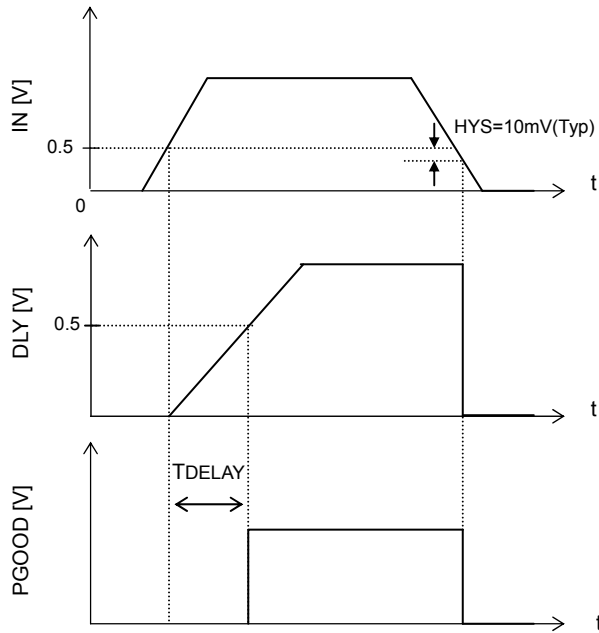


Figure 12. Timing Chart

Detected Delay Time (TDELAY) Setting

TDELAY is calculated as below.

$$T_{DELAY} [s] = \frac{C_{EXT} [F] \times 500 [mV]}{250 [nA]}$$

$$= C_{EXT} [F] \times 2 \times 10^6$$

$$C_{EXT} [F] = T_{DELAY} [s] / (2 \times 10^6)$$

(Example) When using a 4700pF capacitor,

$$T_{DELAY} = 4700 [pF] \times 2 \times 10^6$$

$$= 9400 \times 10^{-6} = 9.4 [ms]$$

(Example) When setting a 2ms delay,

$$C_{EXT} = 2 [ms] / (2 \times 10^6)$$

$$= \frac{2 \times 10^{-3}}{2 \times 10^6}$$

$$= 1 \times 10^{-9}$$

$$= 1000 [pF]$$

● **Limit of Detected Delay Time Operation ($T_a=25^\circ\text{C}$, $V_{CC}=5\text{V}$, $C_{EXT}=4700\text{pF}$)**

When the input pulse width (IN) is shorter than $50\mu\text{s}$ (Typ) ($20\mu\text{s}$ (Min)), PGOOD goes LOW and come back to HIGH without any delay time setup by capacitor of DLY terminal.

The behavior depends on the V_{CC} voltage and the C_{EXT} capacitance.

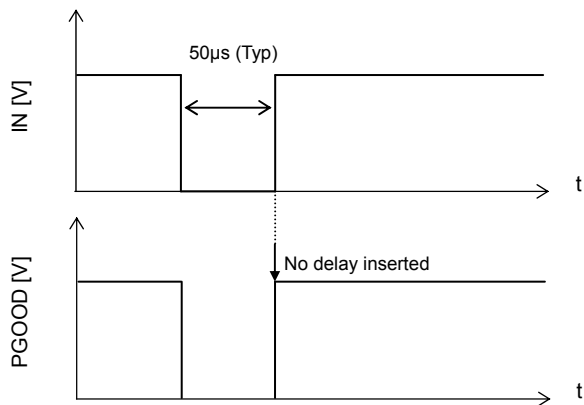


Figure 13. Input low pulse is shorter than $50\mu\text{s}$ (Typ)
($T_a=25^\circ\text{C}$, $V_{CC}=5\text{V}$, $C_{EXT}=4700\text{pF}$)

● **Limit of Reaction Time**

If the input pulse (IN) is shorter than $1\mu\text{s}$ (Typ), PGOOD does not react (PGOOD keeps HIGH).

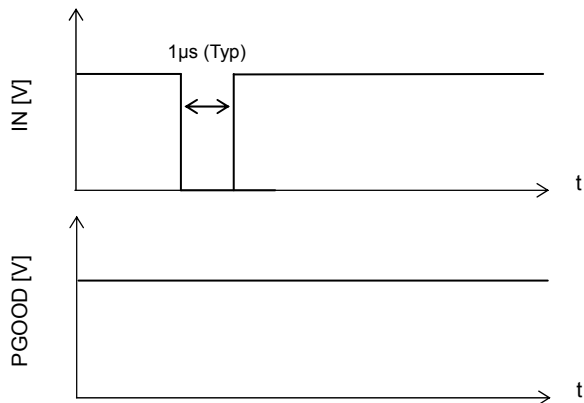


Figure 14. Input low pulse is shorter than $1\mu\text{s}$

●Vcc Operation

- ① When Vcc is below the minimum operation voltage, PGOOD pin will become HIGH.
(The meaning of the minimum operation voltage is : When the starting of Vcc, PGOOD output voltage become within 10% of Vcc voltage, and the value will be around 0.8V (Typ). Note that this value is reference.)
- ② When Vcc value exceeds the minimum operation voltage, PGOOD output become LOW until the Vcc reached UVLO released voltage (2.5V (Typ)).
- ③ When Vcc exceeds UVLO released voltage, PGOOD pin will become HIGH if the input voltage of IN pin is over the detected voltage (0.5V (Typ)), and PGOOD pin will become LOW if the input voltage of IN pin is below the detected voltage.

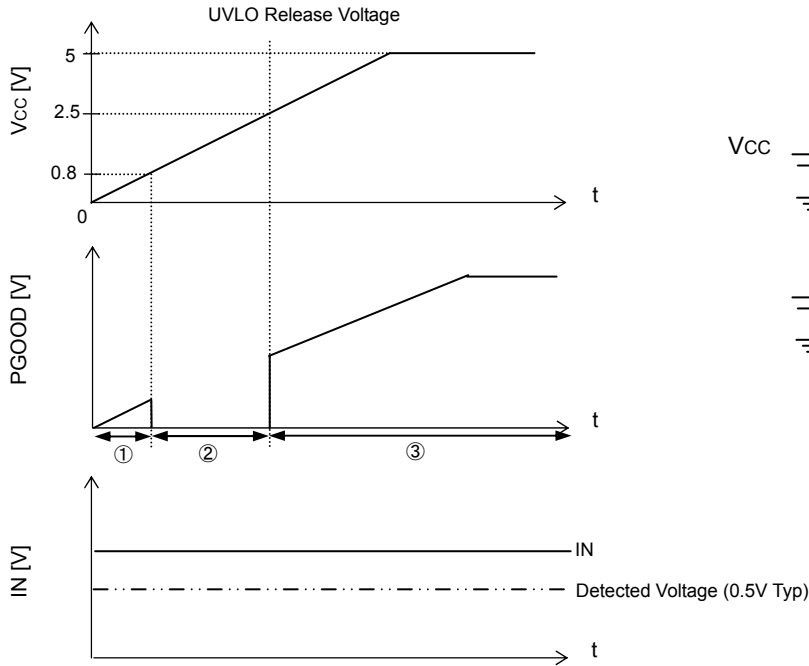


Figure 15. IN > Detected Voltage

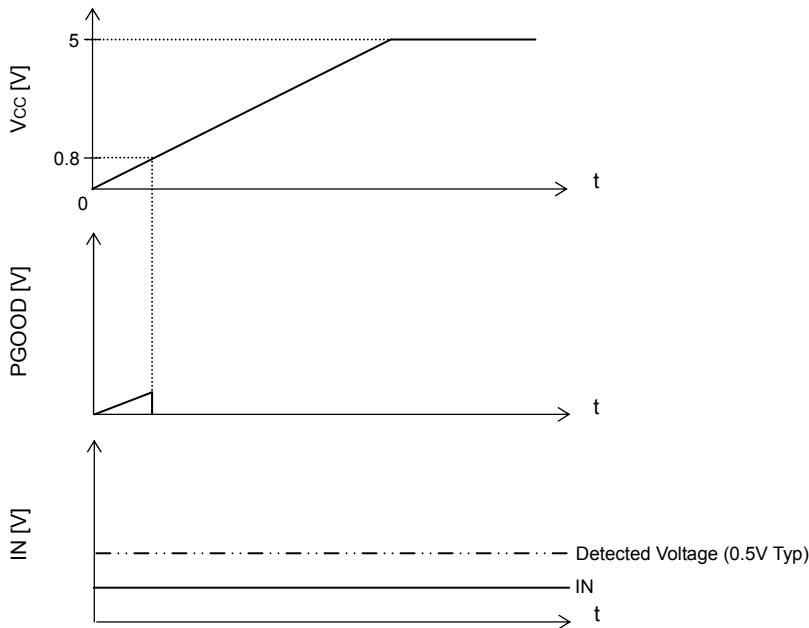


Figure 17. IN < Detected Voltage

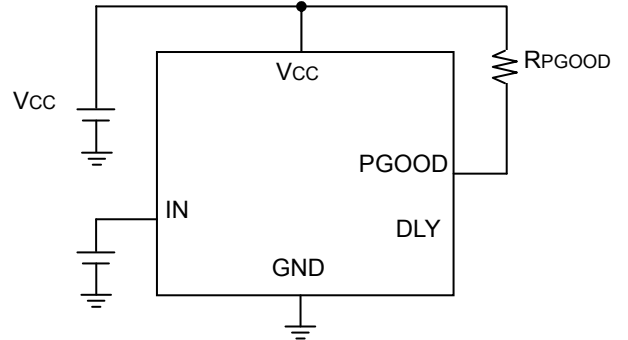


Figure 16. Vcc Operation

● Application Example

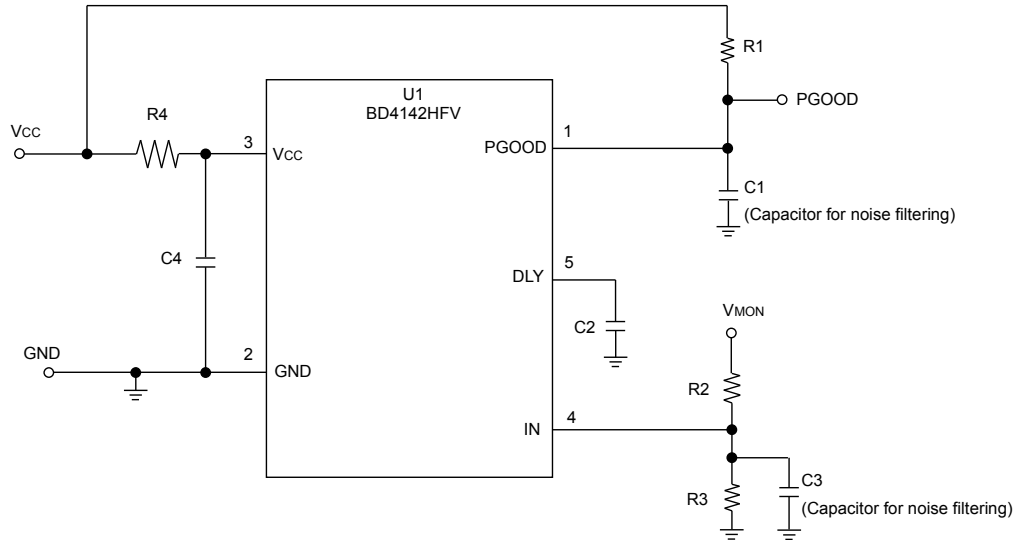


Figure 18. Application Circuit

Table 1. Recommended Component Values

Ref Des	Value	Description	Type	Manufacturer
U1	-	BD4142HFV	-	ROHM
C1	-	-	-	-
C2	4700pF	GRM18 series, 50V, 1608	Ceramic Capacitor	MURATA
C3	-	-	-	-
C4	0.01 μ F	GRM18 series, 50V, 1608	Ceramic Capacitor	MURATA
R1	100k Ω	MCR03 series, 1608	Chip Resistor	ROHM
R2	Short	-	-	-
R3	-	-	-	-
R4	Short	-	-	-

• R1 (Pull-up Resistor)

R1 should be set not to be affected by output leak current (5 μ A (Max)) and capacity current (5mA).

• R2, R3

The detected voltage is adjustable via external resistors (R2, R3).

The recommended total resistance value for R2 and R3 is within total 300k Ω .

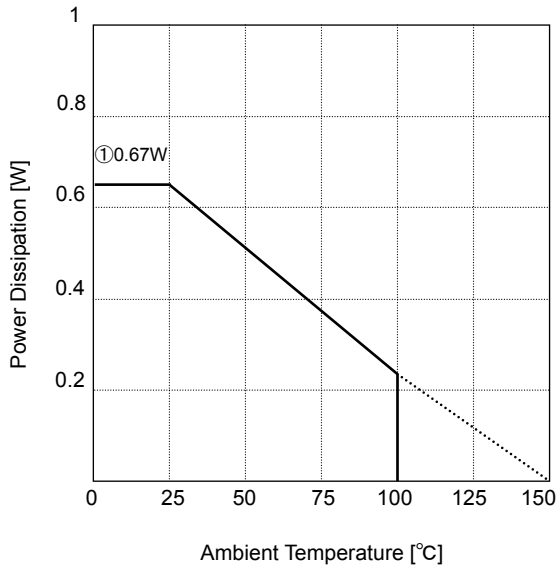
• C2 (Capacitor for Detected Delay Time Setting)

Please set C2 value with double of minimum delay time for application.

Please refer to Page. 6 regarding Detected Delay Time Setting. The maximum value of C2 is 4.7 μ F.

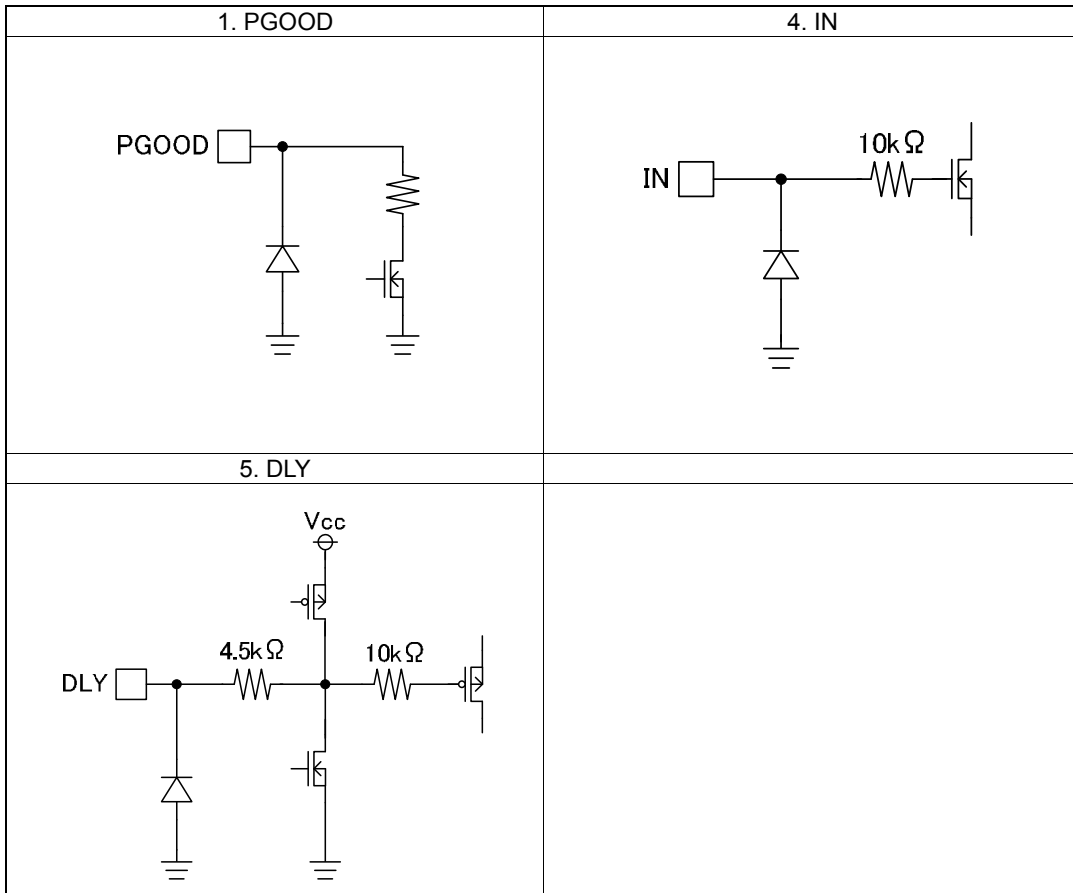
●Power Dissipation

©HVSOF5



PCB size : 70mm × 70mm × 1.6mm
 ①board : 1 layer board (copper foil density : 2%)

●I/O Equivalence Circuit



●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 power dissipation 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 Pd 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.

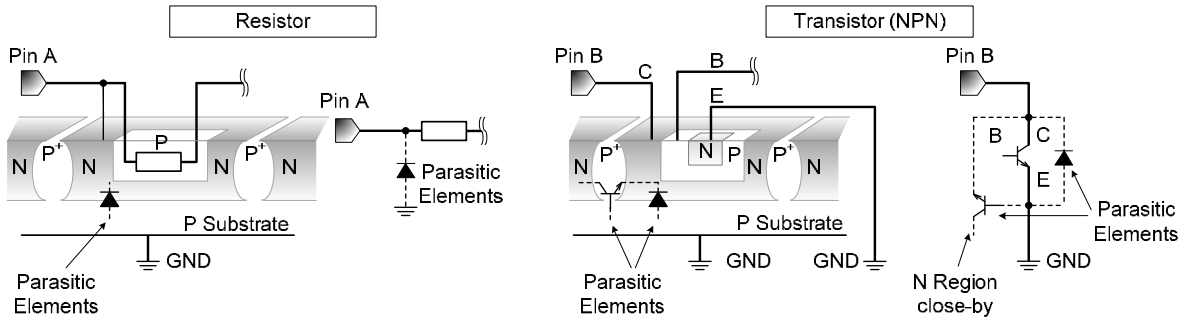
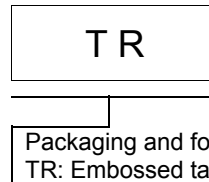
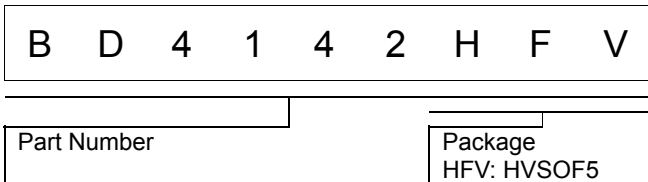


Figure 19. Example of monolithic IC structure

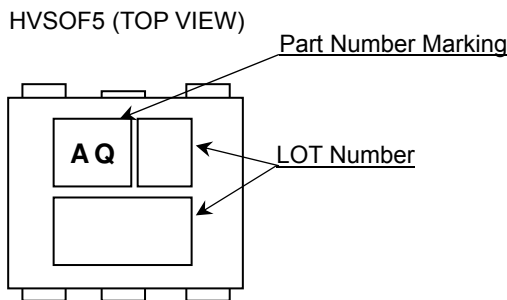
13. Ceramic Capacitor

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.

●Ordering Information

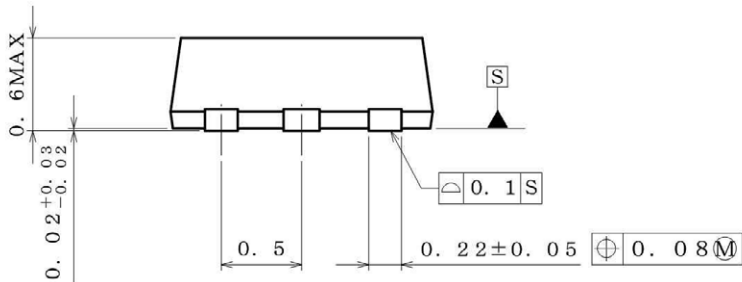
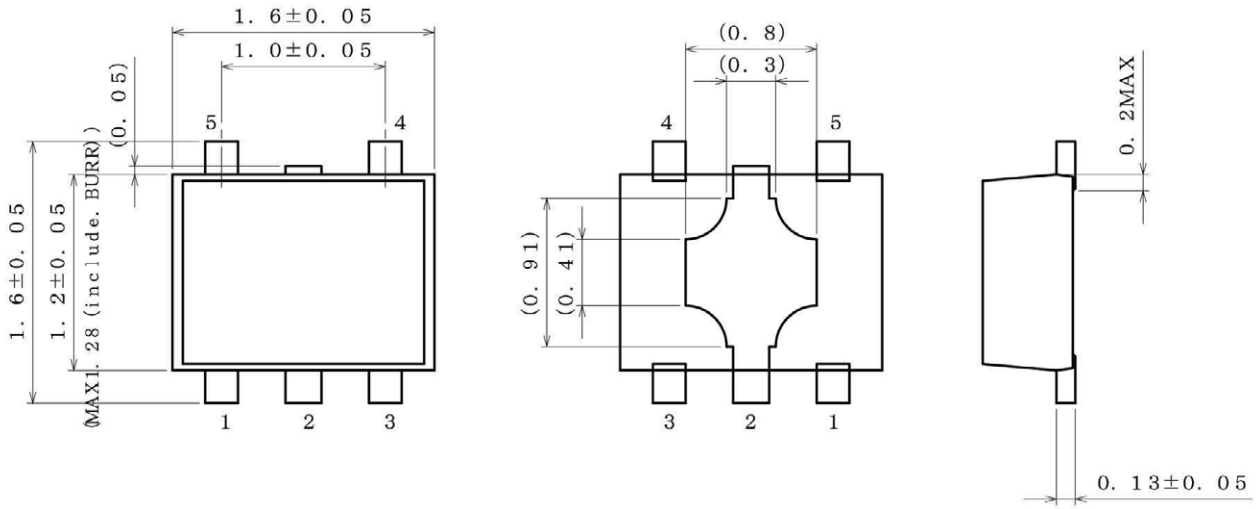


●Marking Diagram



●Physical Dimension, Tape and Reel Information

Package Name	HVSOF5
--------------	--------



(UNIT : mm)
 PKG : HVSO5
 Drawing No. EX108-5002

<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
29. Jan. 2013.	001	New Release
21. Aug. 2015	002	Add Application Example

Notice

Precaution on using ROHM Products

- Our Products are designed and manufactured for application in ordinary electronic equipments (such as AV equipment, OA equipment, telecommunication equipment, home electronic appliances, amusement equipment, etc.). If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment ^(Note 1), transport equipment, traffic equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, 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 any ROHM's Products for Specific Applications.

(Note1) Medical Equipment Classification of the Specific Applications

JAPAN	USA	EU	CHINA
CLASS III	CLASS III	CLASS II b	CLASS III
CLASS IV		CLASS III	

- ROHM designs and manufactures its Products subject to strict quality control system. However, semiconductor products can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against the physical injury, damage to any property, which a failure or malfunction of our Products may cause. The following are examples of safety measures:
 - Installation of protection circuits or other protective devices to improve system safety
 - Installation of redundant circuits to reduce the impact of single or multiple circuit failure
- Our Products are designed and manufactured for use under standard conditions and not under any special or extraordinary environments or conditions, as exemplified below. Accordingly, ROHM shall not be in any way responsible or liable for any damages, expenses or losses arising from the use of any ROHM's Products under any special or extraordinary environments or conditions. If you intend to use our Products under any special or extraordinary environments or conditions (as exemplified below), your independent verification and confirmation of product performance, reliability, etc. prior to use, must be necessary:
 - Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
 - Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
 - Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl₂, H₂S, NH₃, SO₂, and NO₂
 - Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
 - Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
 - Sealing or coating our Products with resin or other coating materials
 - 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
 - Use of the Products in places subject to dew condensation
- The Products are not subject to radiation-proof design.
- Please verify and confirm characteristics of the final or mounted products in using the Products.
- 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.
- De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta). When used in sealed area, confirm the actual ambient temperature.
- Confirm that operation temperature is within the specified range described in the product specification.
- 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

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

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.

Precaution for Foreign Exchange and Foreign Trade act

Since concerned goods might be fallen under listed items of export control prescribed by Foreign exchange and Foreign trade act, please consult with ROHM in case of export.

Precaution Regarding Intellectual Property Rights

1. All information and data including but not limited to application example contained in this document is for reference only. ROHM does not warrant that foregoing information or data will not infringe any intellectual property rights or any other rights of any third party regarding such information or data.
2. ROHM shall not have any obligations where the claims, actions or demands arising from the combination of the Products with other articles such as components, circuits, systems or external equipment (including software).
3. No license, expressly or implied, is granted hereby under any intellectual property rights or other rights of ROHM or any third parties with respect to the Products or the information contained in this document. Provided, however, that ROHM will not assert its intellectual property rights or other rights against you or your customers to the extent necessary to manufacture or sell products containing the Products, subject to the terms and conditions herein.

Other Precaution

1. This document may not be reprinted or reproduced, in whole or in part, without prior written consent of ROHM.
2. The Products may not be disassembled, converted, modified, reproduced or otherwise changed without prior written consent of ROHM.
3. In no event shall you use in any way whatsoever the Products and the related technical information contained in the Products or this document for any military purposes, including but not limited to, the development of mass-destruction weapons.
4. The proper names of companies or products described in this document are trademarks or registered trademarks of ROHM, its affiliated companies or third parties.

General Precaution

1. Before you use our Products, you are requested to carefully read this document and fully understand its contents. ROHM shall not be in any way responsible or liable for failure, malfunction or accident arising from the use of any ROHM's Products against warning, caution or note contained in this document.
2. All information contained in this document is current as of the issuing date and subject to change without any prior notice. Before purchasing or using ROHM's Products, please confirm the latest information with a ROHM sales representative.
3. The information contained in this document is provided on an "as is" basis and ROHM does not warrant that all information contained in this document is accurate and/or error-free. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties resulting from inaccuracy or errors of or concerning such information.