

1.8 V Supply voltage, Low current consumption, high sensitivity CMOS Hall IC Operates for Alternating magnetic field directions

FEATURES

- High sensitivity (8 mT max) due to offset cancel circuit and a new sample and hold circuit.
- Small current by using intermittent action.
(average supply current : 56 μ A typ. sampling cycle : 670 μ s typ at $V_{CC} = 3.0$ V)
- Power supply voltage : 2.5 to 5.25 V
- Operating ambient temperature : -25 to $+75$ °C
- CMOS inverter output. (no pull-up resistance)
- Wheel keys / Track ball applications.
- Magnetic fields polarity change from S to N or from N to S can be detected.
- Contactless switch in various moving devices to involve reliabilities and dusty circumstances.
- 5 pin Plastic Small Surface Mount Package. (SMINI Type)

APPLICATIONS

- Magneto-electric conversion switch.
- Rotation detection contactless switch.

DESCRIPTION

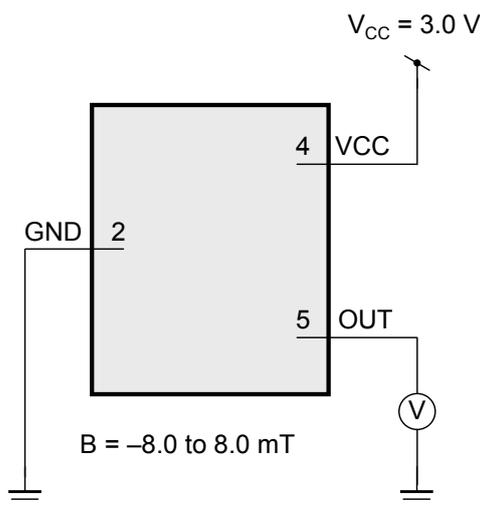
AN48841B is a Hall IC (a magnetic sensor) for 3.0 V supply voltage by using Bi-CMOS technology.

In this Hall IC, a Hall element, a offset cancel circuit, an amplifier circuit, a sample and hold circuit, a Schmidt circuit, and output stage FET are integrated on a single chip housed in a small package by LSI technique.

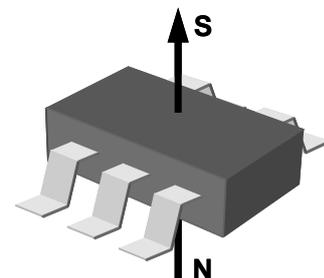
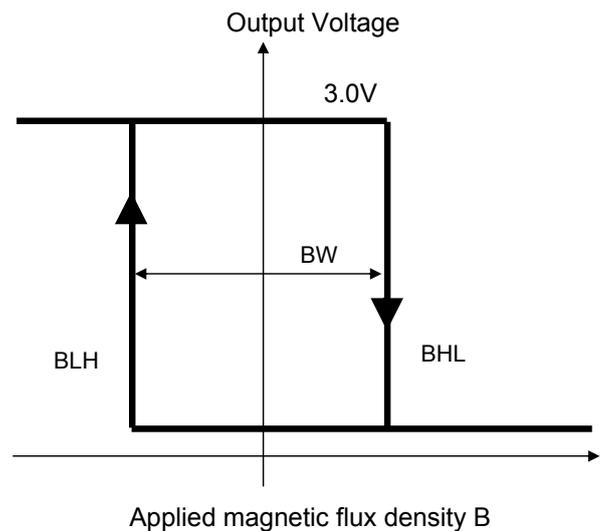
High sensitivity due to offset cancel circuit and a new sample and hold circuit gives you the benefits by use of low cost magnet.

Small current by using intermittent action gives you the benefits by low power consumption.

SIMPLIFIED APPLICATION



Operating magnetic flux density



Notes) This application circuit is an example. The operation of mass production set is not guaranteed. You should perform enough evaluation and verification on the design of mass production set. You are fully responsible for the incorporation of the above application circuit and information in the design of your equipment.

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Unit	Note
Supply voltage	V_{CC}	5.4	V	*1
Supply Current	I_{CC}	5.0	mA	*1
Output Voltage Range	V_O	-0.3 to ($V_{CC} + 0.3$)	V	*1
Operating ambient temperature	T_{opr}	-40 to +75	°C	*2
Operating junction temperature	T_j	-40 to +125	°C	*2
Storage temperature	T_{stg}	-55 to +125	°C	*2

Notes). This product may sustain permanent damage if subjected to conditions higher than the above stated absolute maximum rating. This rating is the maximum rating and device operating at this range is not guaranteeable as it is higher than our stated recommended operating range.

When subjected under the absolute maximum rating for a long time, the reliability of the product may be affected.

*1:The values under the condition not exceeding the above absolute maximum ratings and the power dissipation.

*2:Except for the power dissipation, operating ambient temperature, and storage temperature, all ratings are for $T_a = 25^{\circ}\text{C}$.

POWER DISSIPATION RATING

PACKAGE	θ_{JA}	PD ($T_a=25^{\circ}\text{C}$)	PD ($T_a=75^{\circ}\text{C}$)
SMINI-5DE	833.3	120mW	60mW

Note). For the actual usage, please refer to the PD-Ta characteristics diagram in the package specification, supply voltage, load and ambient temperature conditions to ensure that there is enough margin follow the power and the thermal design does not exceed the allowable value.



CAUTION

Although this has limited built-in ESD protection circuit, but permanent damage may occur on it. Therefore, proper ESD precautions are recommended to avoid electrostatic damage to the MOS gates

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Supply voltage range	V_{CC}	2.5	3.0	5.25	V	*1
Output Voltage Range	V_{OUT}	-0.3	—	$V_{CC}+0.3$	V	—
Output Current Range	I_{OUT}	-2	—	2	mA	—
Operating ambient temperature	T_{aopr}	-25	—	75	°C	—

Note)*1: The values under the condition not exceeding the above absolute maximum ratings and the power dissipation.

ELECTRICAL CHARACTERISTICS

T_a = 25 °C±2 °C unless otherwise noted.

Parameter	Symbol	Condition	Limits			Unit	Note
			Min	Typ	Max		
Operating magnetic flux density (1)	BHL	V _{CC} = 3 V, 5 V	0.5	—	8	mT	*1
Operating magnetic flux density (2)	BLH	V _{CC} = 3 V, 5 V	-8	—	-0.5	mT	*1
Output voltage Low(1)	V _{OL1}	V _{CC} = 3 V, I _O = 2 mA B = 8.0 mT	—	0.1	0.3	V	—
Output voltage Low(2)	V _{OL2}	V _{CC} = 5 V, I _O = 2 mA B = 8.0 mT	—	0.1	0.3	V	—
Output voltage High(1)	V _{OH1}	V _{CC} = 3 V, I _O = -2 mA B = -8.0 mT	2.7	2.9	—	V	—
Output voltage High(2)	V _{OH2}	V _{CC} = 5 V, I _O = -2 mA B = -8.0 mT	4.7	4.9	—	V	—
Supply current (1)	I _{CC} (AVE)	V _{CC} = 3 V	—	56.0	70.0	μA	*2
Supply current (2)	I _{CC2} (AVE)	V _{CC} = 5 V	—	100	300	μA	*2
Intermittent operation time (1)	Tsam	V _{CC} = 3 V	490	670	850	μs	—
Intermittent operation time (2)	Tsam2	V _{CC} = 5 V	456	623	790	μs	—

Notes) *1:Symbol BHL shows the operating magnetic flux density at which output level is changed from high to low, and
Symbol BLH shows the operating magnetic flux density at which output level is changed from low to high.

*2:I_{CC}(AVE) = {I_{CC}(ON) × t(ON) + I_{CC}(OFF) × t(OFF)} / {t(ON) + t(OFF)}.

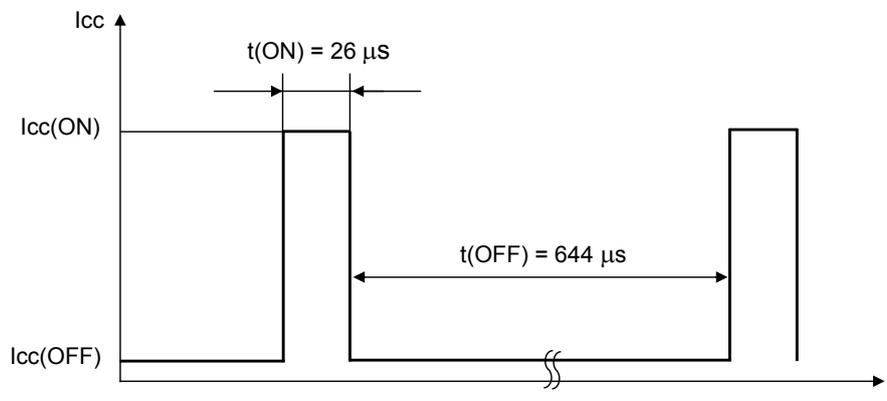
ELECTRICAL CHARACTERISTICS (continued) (Reference values for design)

$T_a = 25^\circ\text{C} \pm 2^\circ\text{C}$ unless otherwise noted.

Parameter	Symbol	Condition	Limits			Unit	Note
			Min	Typ	Max		
Hysteresis width	BW	$V_{CC} = 3\text{ V}, 5\text{ V}$	—	7	—	mT	—
Supply current (3)	$I_{CC}(\text{ON})$	$V_{CC} = 3\text{ V}$	—	1.4	2.1	mA	*3
Supply current (4)	$I_{CC}(\text{OFF})$	$V_{CC} = 3\text{ V}$	—	2.5	—	μA	*3
Supply current (5)	$I_{CC2}(\text{ON})$	$V_{CC} = 5\text{ V}$	—	2.4	3.5	mA	*3
Supply current (6)	$I_{CC2}(\text{OFF})$	$V_{CC} = 5\text{ V}$	—	3.7	—	μA	*3
Operation time	t (ON)	$T_a = -25^\circ\text{C}$ to 75°C , $V_{CC} = 3\text{ V}$	10	26	42	μs	*3
Stop time	t (OFF)	$T_a = -25^\circ\text{C}$ to 75°C , $V_{CC} = 3\text{ V}$	258	644	1 030	μs	*3
Operation time 2	t2 (ON)	$T_a = -25^\circ\text{C}$ to 75°C , $V_{CC} = 5\text{ V}$	9	23	37	μs	*3
Stop time 1	t2 (OFF)	$T_a = -25^\circ\text{C}$ to 75°C , $V_{CC} = 5\text{ V}$	329	600	939	μs	*3

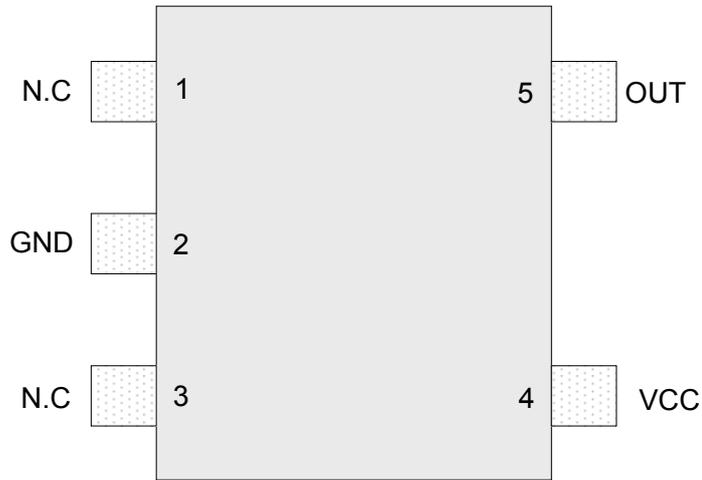
Note)*3: Power Supply Timing Chart

Normal operation starts approx. 670 ms after power supply is turned on.



PIN CONFIGURATION

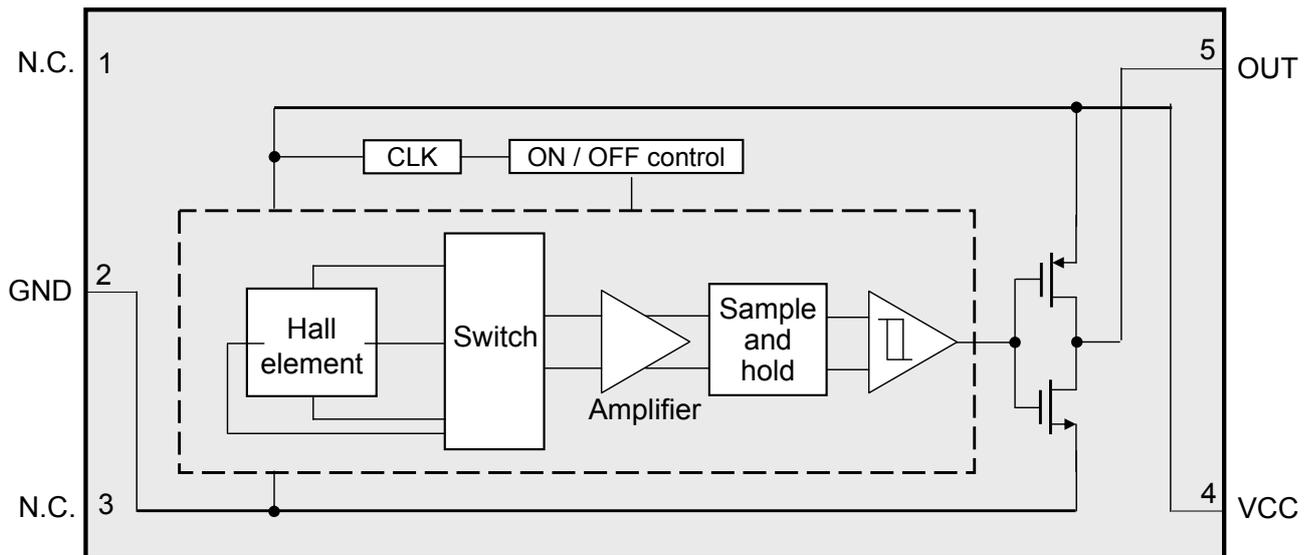
Top View



PIN FUNCTIONS

Pin No.	Pin name	Type	Description
1,3	N.C.	—	
2	GND	GND	Ground pin
4	VCC	VCC	Voltage supply pin
5	OUT	O	Output pin

FUNCTIONAL BLOCK DIAGRAM



Notes) · This block diagram is for explaining functions. Part of the block diagram may be omitted, or it may be simplified.

APPLICATIONS INFORMATION

1. Caution on Use of Hall ICs

As the Hall-IC often detects movement, the position of the Hall-IC may be changed, and there is the risk of a change in detection level, if exposed to shock or vibration over a long period. Secure the LSI by applying adhesive to the package or placing in a dedicated case.

1) When using an adhesive

Some kinds of adhesive generate gas (such as chlorine gas) during curing. This corrosive gas corrodes the aluminum on the surface of the Hall-IC, and may cause a functional defect of disconnection.

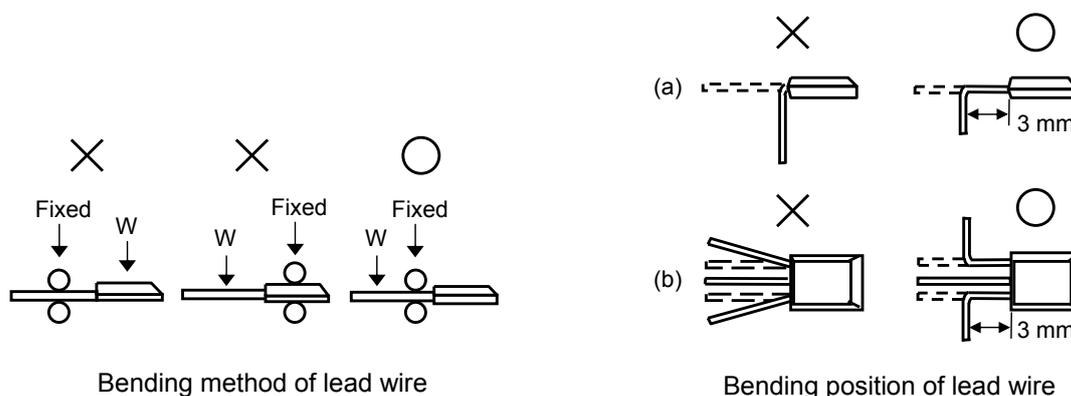
If Hall-IC is to be sealed after installation, attention should be given to the adhesive used for Hall-IC installation, as well as for the adhesive or resin used for peripherals and substrate cleaner.

Please confirm the above matter to those manufacturers before using.

We could not select the specified adhesive, for we find it difficult to guarantee the ingredient of each adhesive.

2) When bending lead wire

Bend the lead wire without stressing the package.



Bending method of lead wire

Bending position of lead wire

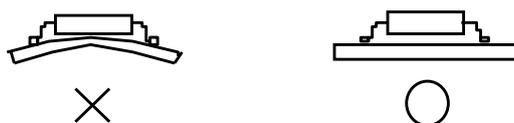
3) Power supply line/ Power transmission line

If a power supply line/power transmission line becomes longer, noise and/or oscillation may be found on the line. In this case, set the capacitor of 0.1 μ F to 10 μ F near the Hall IC to prevent it.

If a voltage of 5.4 V or more is thought to be applied to the power supply line (reverse electromotive force from coil or the ignition pulse, etc.), protect it with external components (capacitor, resistor, zener diode, diode, surge absorbing elements, etc.).

4) Mounting the surface mount type (MINI-3D and SMINI-5D packages)

When mounted on printed circuit board, the Hall-IC may be highly stressed by the warpage that may occur from the soldering. This may also cause a change in the operating magnetic flux density and a deterioration of its resistance to moisture.



Observe the recommended conditions since electrical characteristics can easily change due to stress when mounting. Avoid soldering by using soldering iron or solder flow (dip) method.

APPLICATIONS INFORMATION (continued)

1. Caution on Use of Hall ICs (continued)

5) Mounting the insertion type (SE-3S package)

If the insertion type Hall-IC is inserted to the bottom of its lead into the printed circuit board, it will be stressed so that reliability can not be maintained. Set a space of at least 2.0 mm between the package and printed circuit board.

6) V_{CC} and GND

Do not connect VCC and GND pins reversely. Otherwise, the LSI will be damaged. If the voltage of GND pin is set higher than that of the other pins, which is the same configuration as diode forward connection, it is set to ON at current may flow, resulting in damage to the LSI. (This is common to monolithic IC.)

7) Cautions of Hall IC at Power-On

When a Hall IC is turned on, the position of the magnet or looseness may cause the output of a Hall IC to be changed, and a pulse may be generated.

Therefore, care should be exercised whenever the output state of a Hall IC is critical when the supply power is ON.

8) When Hall-IC is fixed with holder

When a Hall-IC is mounted on the printed circuit board with a holder and the coefficient of expansion of the holder is large, the lead wire of the Hall-IC will be stretched and it may give a stress to the Hall IC.

If the lead wire is stressed intensely due to the distortion of holder or substrate, the adhesiveness between the package and the lead wire may be weakened and cause a minute gap resulting in the deterioration of its resistance to moisture.

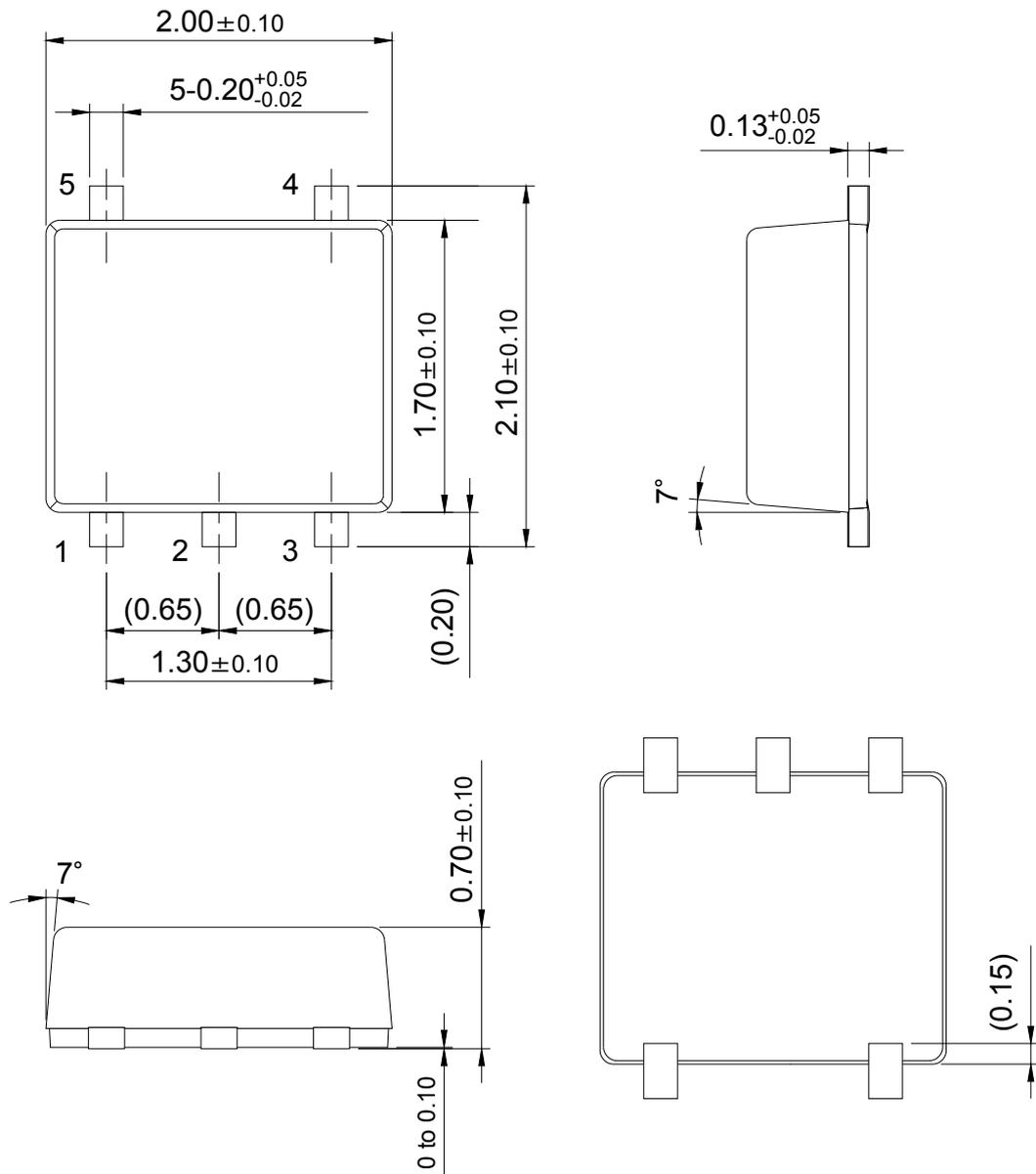
9) On using flux in soldering

Choose a flux which does not include ingredients from the chloric group. The ingredients of chloric group may enter through the joint of the lead frame and package resin, causing corrosion and disconnection of the aluminum wiring on the surface of LSI chip.

PACKAGE INFORMATION (Reference Data)

Package Code:SMINI-5DE

Unit:mm



Body Material	: Br / Sb Free Epoxy Resin
Lead Material	: Cu Alloy
Lead Finish Method	: SnBi Plating

IMPORTANT NOTICE

1. The products and product specifications described in this book are subject to change without notice for modification and/or improvement. At the final stage of your design, purchasing, or use of the products, therefore, ask for the most up-to-date Product Standards in advance to make sure that the latest specifications satisfy your requirements.
2. When using the LSI for new models, verify the safety including the long-term reliability for each product.
3. When the application system is designed by using this LSI, be sure to confirm notes in this book.
Be sure to read the notes to descriptions and the usage notes in the book.
4. The technical information described in this book is intended only to show the main characteristics and application circuit examples of the products. No license is granted in and to any intellectual property right or other right owned by Panasonic Corporation or any other company. Therefore, no responsibility is assumed by our company as to the infringement upon any such right owned by any other company which may arise as a result of the use of technical information de-scribed in this book.
5. This book may be not reprinted or reproduced whether wholly or partially, without the prior written permission of our company.
6. This LSI is intended to be used for general electronic equipment.
Consult our sales staff in advance for information on the following applications: Special applications in which exceptional quality and reliability are required, or if the failure or malfunction of this LSI may directly jeopardize life or harm the human body.
Any applications other than the standard applications intended.
 - (1) Space appliance (such as artificial satellite, and rocket)
 - (2) Traffic control equipment (such as for automobile, airplane, train, and ship)
 - (3) Medical equipment for life support
 - (4) Submarine transponder
 - (5) Control equipment for power plant
 - (6) Disaster prevention and security device
 - (7) Weapon
 - (8) Others : Applications of which reliability equivalent to (1) to (7) is requiredIt is to be understood that our company shall not be held responsible for any damage incurred as a result of or in connection with your using the LSI described in this book for any special application, unless our company agrees to your using the LSI in this book for any special application.
7. This LSI is neither designed nor intended for use in automotive applications or environments unless the specific product is designated by our company as compliant with the ISO/TS 16949 requirements.
Our company shall not be held responsible for any damage incurred by you or any third party as a result of or in connection with your using the LSI in automotive application, unless our company agrees to your using the LSI in this book for such application.
8. If any of the products or technical information described in this book is to be exported or provided to non-residents, the laws and regulations of the exporting country, especially, those with regard to security export control, must be observed.
9. Please use this product in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Our company shall not be held responsible for any damage incurred as a result of your using the LSI not complying with the applicable laws and regulations.

USAGE NOTES

1. When designing your equipment, comply with the range of absolute maximum rating and the guaranteed operating conditions (operating power supply voltage and operating environment etc.). Especially, please be careful not to exceed the range of absolute maximum rating on the transient state, such as power-on, power-off and mode-switching. Otherwise, we will not be liable for any defect which may arise later in your equipment.

Even when the products are used within the guaranteed values, take into the consideration of incidence of break down and failure mode, possible to occur to semiconductor products. Measures on the systems such as redundant design, arresting the spread of fire or preventing glitch are recommended in order to prevent physical injury, fire, social damages, for example, by using the products.
2. Comply with the instructions for use in order to prevent breakdown and characteristics change due to external factors (ESD, EOS, thermal stress and mechanical stress) at the time of handling, mounting or at customer's process. When using products for which damp-proof packing is required, satisfy the conditions, such as shelf life and the elapsed time since first opening the packages.
3. Pay attention to the direction of LSI. When mounting it in the wrong direction onto the PCB (printed-circuit-board), it might smoke or ignite.
4. Pay attention in the PCB (printed-circuit-board) pattern layout in order to prevent damage due to short circuit between pins. In addition, refer to the Pin Description for the pin configuration.
5. Perform a visual inspection on the PCB before applying power, otherwise damage might happen due to problems such as a solder-bridge between the pins of the semiconductor device. Also, perform a full technical verification on the assembly quality, because the same damage possibly can happen due to conductive substances, such as solder ball, that adhere to the LSI during transportation.
6. Take notice in the use of this product that it might break or occasionally smoke when an abnormal state occurs such as output pin-VCC short (Power supply fault), output pin-GND short (Ground fault), or output-to-output-pin short (load short) .

And, safety measures such as an installation of fuses are recommended because the extent of the above-mentioned damage and smoke emission will depend on the current capability of the power supply.

Request for your special attention and precautions in using the technical information and semiconductors described in this book

- (1) If any of the products or technical information described in this book is to be exported or provided to non-residents, the laws and regulations of the exporting country, especially, those with regard to security export control, must be observed.
- (2) The technical information described in this book is intended only to show the main characteristics and application circuit examples of the products. No license is granted in and to any intellectual property right or other right owned by Panasonic Corporation or any other company. Therefore, no responsibility is assumed by our company as to the infringement upon any such right owned by any other company which may arise as a result of the use of technical information described in this book.
- (3) The products described in this book are intended to be used for general applications (such as office equipment, communications equipment, measuring instruments and household appliances), or for specific applications as expressly stated in this book.
Consult our sales staff in advance for information on the following applications:
 - Special applications (such as for airplanes, aerospace, automotive equipment, traffic signaling equipment, combustion equipment, life support systems and safety devices) in which exceptional quality and reliability are required, or if the failure or malfunction of the products may directly jeopardize life or harm the human body.It is to be understood that our company shall not be held responsible for any damage incurred as a result of or in connection with your using the products described in this book for any special application, unless our company agrees to your using the products in this book for any special application.
- (4) The products and product specifications described in this book are subject to change without notice for modification and/or improvement. At the final stage of your design, purchasing, or use of the products, therefore, ask for the most up-to-date Product Standards in advance to make sure that the latest specifications satisfy your requirements.
- (5) When designing your equipment, comply with the range of absolute maximum rating and the guaranteed operating conditions (operating power supply voltage and operating environment etc.). Especially, please be careful not to exceed the range of absolute maximum rating on the transient state, such as power-on, power-off and mode-switching. Otherwise, we will not be liable for any defect which may arise later in your equipment.
Even when the products are used within the guaranteed values, take into the consideration of incidence of break down and failure mode, possible to occur to semiconductor products. Measures on the systems such as redundant design, arresting the spread of fire or preventing glitch are recommended in order to prevent physical injury, fire, social damages, for example, by using the products.
- (6) Comply with the instructions for use in order to prevent breakdown and characteristics change due to external factors (ESD, EOS, thermal stress and mechanical stress) at the time of handling, mounting or at customer's process. When using products for which damp-proof packing is required, satisfy the conditions, such as shelf life and the elapsed time since first opening the packages.
- (7) This book may be not reprinted or reproduced whether wholly or partially, without the prior written permission of our company.