■ **Structure** Silicon Monolithic Integrated Circuit

■ **Product Name** For DSC handshake guard, signal processing and motor driving IC

■ **Model Name** **BH9992GU**

■ **Function**

- GYROAMP 2ch
- HALLAMP 2ch
- R-2R type 8bit D/A converter 5ch
- R-2R type 10bit D/A converter 2ch
- No dead zone system PWM Driver
- SAW wave oscillator
- Regulator
- Rail to Rail AMP

■ Absolute maximum ratings

Item	Symbol	Standard value	Unit
Power supply voltage	VC, VDD, PVCC	7.0	V
Power dissipation (*1)	PD	1400	mW
Operation temperature range	TOPR	−10～70	℃
Storage temperature range	TSTG	−40～125	℃
H Bridge output current1	IOUT1	300	mA
H Bridge output current2 (*2)	IOUT2	500	mA

*1 Mounting board specification (Rohm standard board) Material : The glass fabric base epoxy
Dimensions : 50[mm] × 58[mm] × 1.75[mm] (8 layers)
When using it at Ta=25℃ or more, 14 [mW] of 1[℃] decreases.

*2 Instantaneous current (1[us] or less)

■ Operating condition

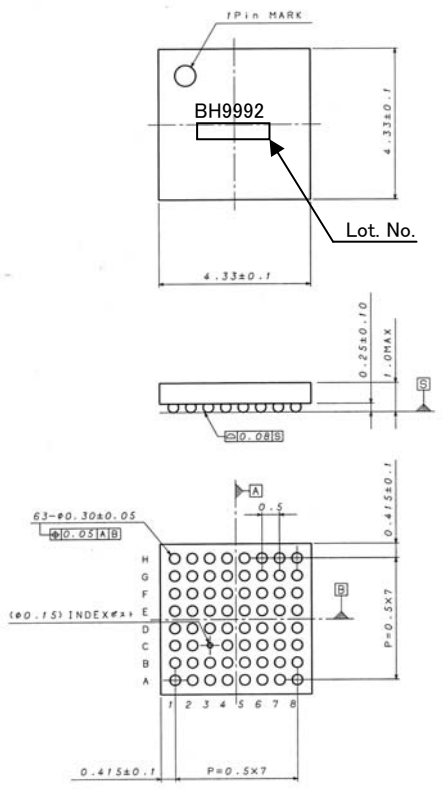
Item	Symbol	Min.	Typ.	Max.	Unit
VC power supply voltage	VC	3.0 (*3)	3.3	5.5	V
VDD power supply voltage (≦VC)	VDD	2.5	3.0	5.5	V
PVCC power supply voltage	PVCC	3.0	5.0	5.5	V
Serial clock frequency	FSCLK	—	1.0	4.0	MHz
DACOUT limit load capacity 1 (DAC0OUT,DAC3OUT,DAC4OUT)	CLA1	—	—	0.1	μF
Between VDDOUT and GND, load capacity	CLVDDOUT	1.0	—	30.0	μF

*3 When VDDOUT is used, the Min. operating condition of VC power supply voltage is 3.2[V].

・A radiation is not designed.

■ Physical Dimension

Package type nama : VCSP85H4



■ CHIP Backside PIN Arrangement

	1	2	3	4	5	6	7	8
H		AMP4 +IN	AMP4 −IN	AMP3 −IN	AMP3 +IN	AGND	AMP11 +IN	
G	AMP9 +IN	AMP2 OUT	AMP4 OUT	AMP3 OUT	VDD2	AMP11 OUT	AMP13 OUT	AMP13 −IN
F	GND1	AMP2 −IN	AMP7 OUT	AMP1 OUT	AMP1 −IN	AMP11 −IN	VDD1	AMP13 +IN
E	VDD OUT	VC1	AMP7 −IN	DAC4 OUT	DAC0 OUT	VREF1 IN	AMP14 OUT	AMP14 −IN
D	AMP9 −IN	AMP9 OUT	AMP8 −IN	AMP8 OUT	DAC3 OUT	AMP12 −IN	AMP12 OUT	AMP14 +IN
C	AMP10 −IN	AMP10 OUT		XSTBY	DAC6 OUT	DAC5 OUT	VC2	AMP12 +IN
B	AMP10 +IN	GND3	VC3	LD	DATA	CLK	GND2	PGND2
A		PGND1	OUT1F	OUT1R	PVCC	OUT2R	OUT2F	

Please keep open for ▯ the terminal, when you use.

Fig.1 Physical Dimension (Unit : mm)

■ PIN Description

PIN No.	Pin Name	Pin explanation
1-A	—	—
2-A	PGND1	Power block ground
3-A	OUT1F	CH1 forward output
4-A	OUT1R	CH1 reverse output
5-A	PVCC	Power block power supply
6-A	OUT2R	CH2 reverse output
7-A	OUT2F	CH2 forward output
8-A	—	—
1-B	AMP10+IN	AMP10+Input
2-B	GND3	GND
3-B	VC3	VC power supply
4-B	LD	Serial data loading input
5-B	DATA	Serial data input
6-B	CLK	Serial clock input
7-B	GND2	GND
8-B	PGND2	Power block ground
1-C	AMP10-IN	AMP10-input
2-C	AMP10OUT	AMP10 output
3-C	—	—
4-C	XSTBY	Standby control input
5-C	DAC6OUT	DAC6 output
6-C	DAC5OUT	DAC5 output
7-C	VC2	VC power supply
8-C	AMP12+IN	AMP12+input
1-D	AMP9-IN	AMP9-input
2-D	AMP9OUT	AMP9 output
3-D	AMP8-IN	AMP8-input
4-D	AMP8OUT	AMP8 output
5-D	DAC3OUT	DAC3 output
6-D	AMP12-IN	AMP12-input
7-D	AMP12OUT	AMP12 output
8-D	AMP14+IN	AMP14+input

PIN No.	Pin Name	Pin explanation
1-E	VDDOUT	VDD regulator output
2-E	VC1	VC power supply
3-E	AMP7-IN	AMP7-input
4-E	DAC4OUT	DAC4 output
5-E	DAC0OUT	DAC0 output
6-E	VREF1IN	AMP reference input
7-E	AMP14OUT	AMP14 output
8-E	AMP14-IN	AMP14-input
1-F	GND1	GND
2-F	AMP2-IN	AMP2-input
3-F	AMP7OUT	AMP7 output
4-F	AMP1OUT	AMP10 output
5-F	AMP1-IN	AMP1-input
6-F	AMP11-IN	AMP11-input
7-F	VDD1	VDD power supply
8-F	AMP13+IN	AMP13+input
1-G	AMP9+IN	AMP9+input
2-G	AMP2OUT	AMP2 output
3-G	AMP4OUT	AMP4 output
4-G	AMP3OUT	AMP3 output
5-G	VDD2	VDD power supply
6-G	AMP11OUT	AMP11 output
7-G	AMP13OUT	AMP13 output
8-G	AMP13-IN	AMP13-input
1-H	—	—
2-H	AMP4+IN	AMP4+input
3-H	AMP4-IN	AMP4- input
4-H	AMP3-IN	AMP3- input
5-H	AMP3+IN	AMP3+ input
6-H	AGND	Analog GND
7-H	AMP11+IN	AMP11+input
8-H	—	—

■ Whole Block Diagram

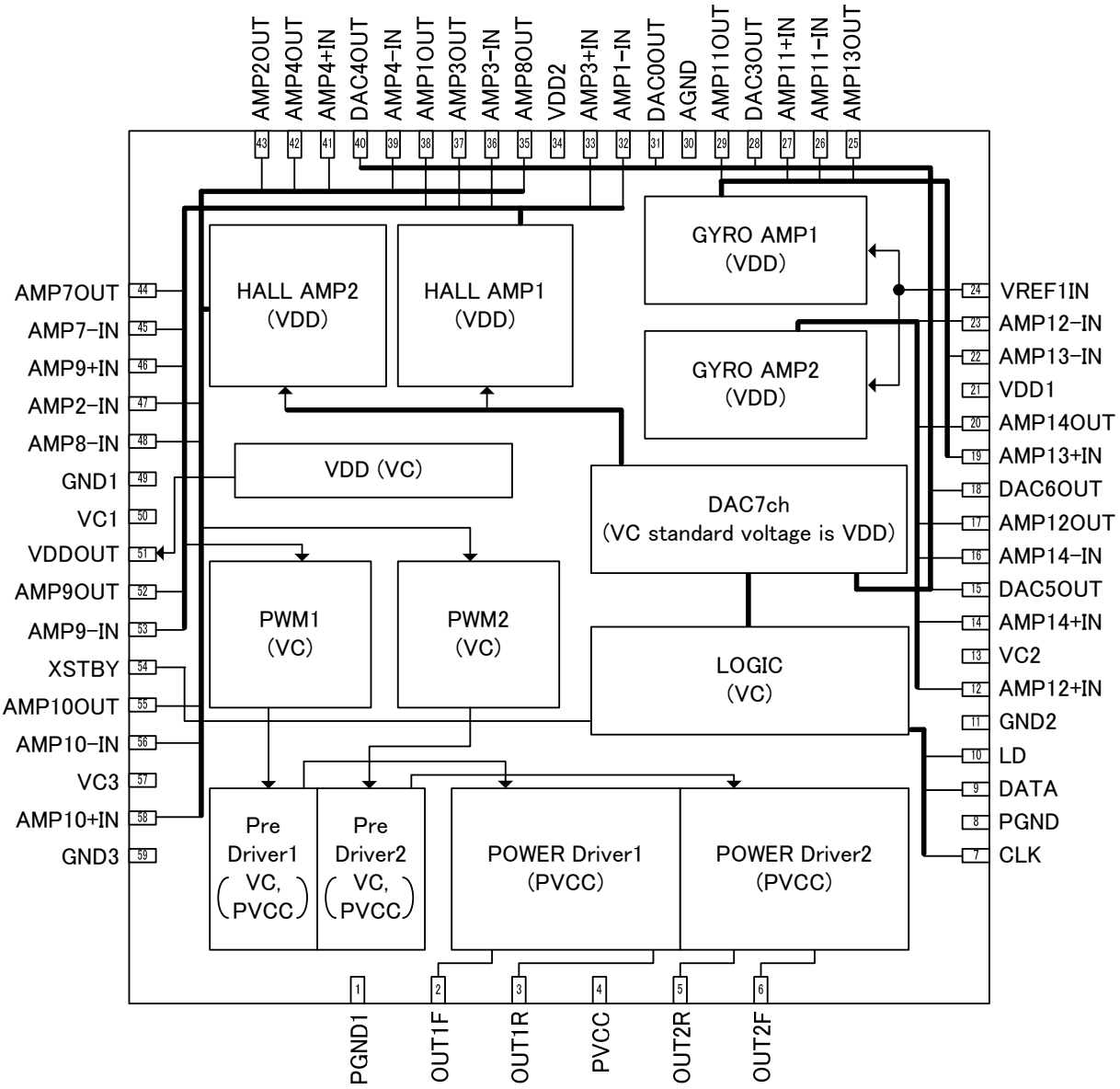


Fig.2 Whole Block Diagram

■ Electrical characteristic

◎Circuit current（VC=3.3[V], VDD=3.0[V], PVCC=5.0[V], DAC0OUT=VREF1IN, Ta=25[℃] except as otherwise noted.）

Item	Symbol	Standard value			Unit	Notes
		Min.	Typ.	Max.		
Current consumption 1 at standby (VC+VDD+PVCC)	ISTBY	—	1.5	10	μA	XSTBY, CLK, DI, LD=L
Current consumption1 when operating (VC+VDD)	ICC1	—	4.0	6.0	mA	DAC0=080H DAC1,2,3,4,5,6=000H
Current consumption2 when operating (VC+VDD)	ICC2	—	11.0	16.5	mA	DAC0=080H, DAC1,2,3,4,=0FFH DAC 5,6,=3FFH
Current consumption3 when operating (PVCC)	ICC3	—	25	50	μA	XSTBY=H, POWSTBY_N="0"

◎HALL Sensor input _AMP
(VC=3.3[V], VDD=3.0[V], PVCC=5.0[V], DAC0=080H, DAC0OUT=VREF1IN, Ta=25[℃] except as otherwise noted)

Item	Symbol	Standard value			Unit	Notes
		Min.	Typ.	Max.		
<HALL_AMP (A1,A2)>						
Output voltage	H1VOUT	2.50	—	—	V	DAC1, 2=0FFH External 500[Ω], 270[Ω]
Output voltage range (Hi) (Open loop)	H1VOH	2.40	—	—	V	DAC1, 2=0FFH Outflow current 5.0[mA],
Output voltage range (Low) (Open loop)	H1VOL	—	—	0.4	V	DAC1, 2=000H Inflow current 5.0[mA], VIN=250[mV]

◎HALL Sensor output _AMP
(VC=3.3[V], VDD=3.0[V], PVCC=5.0[V], DAC0, DAC3, DAC4=080H, DAC0OUT=VREF1IN, Ta=25[℃] except as otherwise noted)

Item	Symbol	Standard value			Unit	Notes
		Min.	Typ.	Max.		
<HALL_AMP (A3,A4,A9,A10)>						
Output voltage 1 (Open loop)	H2VOUT1	2.9	—	—	V	VINP=1.2[V], VINN=1.1[V]
Output voltage 2 (Open loop)	H2VOUT2	—	—	0.2	V	VINP=1.1[V], VINN=1.2[V]
Voltage gain	H2GVD	38.5	40.0	41.5	dB	VIN=10[mVpp] (Differential voltage input) f=100[Hz]
Cutoff frequency	H2fc	4.1	8.1	12.1	kHz	-3[dB], Capa 10[pF]
<HALL_AMP (A5-A7, A6-A8)>						
Output voltage 1	H3VOUT1	2.8	—	—	V	VINP Input=1.125, VINN Input=0.375 HALLSW1,3=ON, HALLSW2=OFF DAC0=0BFH, DAC3,4=040H
Output voltage 2	H3VOUT2	—	—	0.2	V	VINP Input=0.375, VINN Input=1.125 HALLSW1,3=ON, HALLSW2=OFF DAC0=040H, DAC3,4=0BFH
Output voltage 3	H3VOUT3	2.8	—	—	V	VINP Input=0.0[V], VINN Input=3.0[V] HALLSW2=ON, HALLSW1,3=OFF DAC3,4=0AAH
Output voltage 4	H3VOUT4	—	—	0.2	V	VINP Input=0.0[V], VINN Input=0.0[V] HALLSW2=ON, HALLSW1,3=OFF DAC3,4=055H
Voltage gain	H3GVD	-1.5	0	1.5	dB	VIN=10[mVpp] (Differential voltage input) f=100[Hz]
Cutoff frequency	H3fc	23.0	46.0	69.0	kHz	-3[dB], Capa 33[pF]

◎GYRO_AMP
(VC=3.3[V], VDD=3.0[V], PVCC=5.0[V], DAC0=080H, DAC0OUT=VREF1IN, Ta=25[℃] except as otherwise noted)

Item	Symbol	Standard value			Unit	Notes
		Min.	Typ.	Max.		
<GYRO_AMP (A11,A12)>						
Output voltage 1 (Open loop)	G1VOUT1	2.9	—	—	V	VINP =1.2[V], VINN =1.1[V]
Output voltage 2 (Open loop)	G1VOUT2	—	—	0.2	V	VINP =1.1[V], VINN =1.2[V]
Voltage gain	G1GVD	38.5	40.0	41.5	dB	VIN=10[mVpp] (Differential voltage input) f=100[Hz]
Cutoff frequency	G1fc	4.1	8.1	12.1	kHz	-3[dB], Capa 33[pF]
<GYRO_AMP (A13,A14)>						
Output voltage 1	G2VOUT1	1.30	1.50	1.70	V	GYROSW2=ON, GYROSW1, At GYROSW3=OFF, VINP=open
Output voltage 2	G2VOUT2	1.1	1.50	1.90	V	GYROSW1, GYROSW2=ON, At GYROSW3=OFF, VINP=open
Voltage gain	G2GVD	36.3	37.8	39.3	dB	GYROSW2=ON, At GYROSW3=OFF VIN=10[mVpp] (Differential voltage input) f=100[Hz]
Cutoff frequency	G2fc	1.1	2.1	3.1	kHz	GYROSW2=ON, At GYROSW3=OFF -3[dB], Capa 100[pF]
Voltage gain	G2GVD2	32.5	34.0	35.5	dB	GYROSW2=ON, At GYROSW3=ON VIN=10[mVpp] (Differential voltage input) f=100[Hz]
Cutoff frequency	G2fc2	1.7	3.3	4.9	kHz	GYROSW2=ON, At GYROSW3=ON -3[dB], Capa 100[pF]

■ Directions

1. Absolute maximum ratings

This IC might be destroyed when the absolute maximum ratings, such as impressed voltages (VC,PVCC,VDD) or the operating temperature range (TOPR) is exceeded, and whether the destruction is short circuit mode or open circuit mode cannot be specified. Please take into consideration the physical countermeasures for safety, such as fusing, if a particular mode that exceeds the absolute maximum rating is assumed.

2. Reverse polarity connection

Connecting the power line to the IC in reverse polarity (from that recommended) will damage the part. Please utilize the direction protection device as a diode in the supply line.

3. Power supply line

Due to switching and EMI noise generated by magnetic components (inductors and motors), using electrolytic and ceramic suppress filter capacitors close to the IC power input terminals (Vcc and GND) is recommended. Please note: the electrolytic capacitor value decreases at lower temperatures.

4. GND line

The ground line is where the lowest potential and transient voltages are connected to the IC.

5. Thermal design

Do not exceed the power dissipation (Pd) of the package specification rating under actual operation, and please design enough temperature margins. (Refer to page 10.)

6. Short circuit mode between terminals and wrong mounting

Do not mount the IC in the wrong direction and be careful about the reverse-connection of the power connector. Moreover, this IC might be destroyed when the dust short the terminals between them or GND.

7. Radiation

Strong electromagnetic radiation can cause operation failures.

8. ASO(Area of Safety Operation.)

Do not exceed the maximum ASO and the absolute maximum ratings of the output driver.

9. TSD(Thermal shut-down)

The TSD is activated when the junction temperature (Tj) reaches 175^0C(with +/-25^0C hysteresis), and the output terminal is switched to Hi-z. The TSD circuit aims to intercept IC from high temperature. The guarantee and protection of IC are not purpose. Therefore, please do not use this IC after TSD circuit operates, nor use it for assumption that operates the TSD circuit.

10. Capacitor between output and GND

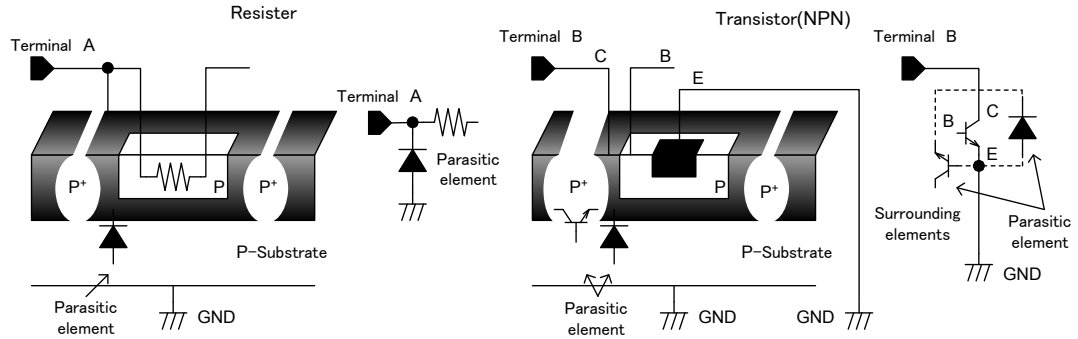
If a large capacitor is connected between the output and GND, this IC might be destroyed when Vcc becomes 0V or GND, because the electric charge accumulated in the capacitor flows to the output. Please set said capacitor to smaller than 0.1 μF.

11. Inspection by the set circuit board

The stress might hang to IC by connecting the capacitor to the terminal with low impedance. Then, please discharge electricity in each and all process. Moreover, in the inspection process, please turn off the power before mounting the IC, and turn on after mounting the IC. In addition, please take into consideration the countermeasures for electrostatic damage, such as giving the earth in assembly process, transportation or preservation.

12. Each input terminal

This IC is a monolithic IC, and has P^+ isolation and P substrate for the element separation. Therefore, a parasitic PN junction is firmed in this P-layer and N-layer of each element. For instance, the resistor or the transistor is connected to the terminal as shown in the figure below. When the GND voltage potential is greater than the voltage potential at Terminals A or B, the PN junction operates as a parasitic diode. In addition, the parasitic NPN transistor is formed in said parasitic diode and the N layer of surrounding elements close to said parasitic diode. These parasitic elements are formed in the IC because of the voltage relation. The parasitic element operating causes the wrong operation and destruction. Therefore, please be careful so as not to operate the parasitic elements by impressing to input terminals lower voltage than GND(P substrate). Please do not apply the voltage to the input terminal when the power-supply voltage is not impressed. Moreover, please impress each input terminal lower than the power-supply voltage or equal to the specified range in the guaranteed voltage when the power-supply voltage is impressing.



Simplified structure of IC

13. Earth wiring pattern

Use separate ground lines for control signals and high current power driver outputs. Because these high current outputs that flows to the wire impedance changes the GND voltage for control signal. Therefore, each ground terminal of IC must be connected at the one point on the set circuit board. As for GND of external parts, it is similar to the above-mentioned.

14. Reverse brake

When you do the reversal brake from the high-velocity revolution note the counter electromotive force. Moreover, confirm the output current enough and examine the rotational speed which uses the reversal brake.

15. About the capacitor between PVCC-PGND

The PVCC-PGND capacitor absorbs the change in a steep voltage and the current because of the PWM drive. As a result, there is a role to suppress the disorder of the PVCC voltage. However, the effect decreases by the influence of the wiring impedance etc. if the capacitor becomes far from IC. Arrange the PVCC-PGND capacitor near IC.

16. Bypass capacitor

Between the supply power supplies connect the bypass capacitor(0.1 μ F) near the pin of this IC.

Notes

No copying or reproduction of this document, in part or in whole, is permitted without the consent of ROHM Co.,Ltd.

The content specified herein is subject to change for improvement without notice.

The content specified herein is for the purpose of introducing ROHM's products (hereinafter "Products"). If you wish to use any such Product, please be sure to refer to the specifications, which can be obtained from ROHM upon request.

Examples of application circuits, circuit constants and any other information contained herein illustrate the standard usage and operations of the Products. The peripheral conditions must be taken into account when designing circuits for mass production.

Great care was taken in ensuring the accuracy of the information specified in this document. However, should you incur any damage arising from any inaccuracy or misprint of such information, ROHM shall bear no responsibility for such damage.

The technical information specified herein is intended only to show the typical functions of and examples of application circuits for the Products. ROHM does not grant you, explicitly or implicitly, any license to use or exercise intellectual property or other rights held by ROHM and other parties. ROHM shall bear no responsibility whatsoever for any dispute arising from the use of such technical information.

The Products specified in this document are intended to be used with general-use electronic equipment or devices (such as audio visual equipment, office-automation equipment, communication devices, electronic appliances and amusement devices).

The Products specified in this document are not designed to be radiation tolerant.

While ROHM always makes efforts to enhance the quality and reliability of its Products, a Product may fail or malfunction for a variety of reasons.

Please be sure to implement in your equipment using the Products safety measures to guard against the possibility of physical injury, fire or any other damage caused in the event of the failure of any Product, such as derating, redundancy, fire control and fail-safe designs. ROHM shall bear no responsibility whatsoever for your use of any Product outside of the prescribed scope or not in accordance with the instruction manual.

The Products are not designed or manufactured to be used with any equipment, device or system which requires an extremely high level of reliability the failure or malfunction of which may result in a direct threat to human life or create a risk of human injury (such as a medical instrument, transportation equipment, aerospace machinery, nuclear-reactor controller, fuel-controller or other safety device). ROHM shall bear no responsibility in any way for use of any of the Products for the above special purposes. If a Product is intended to be used for any such special purpose, please contact a ROHM sales representative before purchasing.

If you intend to export or ship overseas any Product or technology specified herein that may be controlled under the Foreign Exchange and the Foreign Trade Law, you will be required to obtain a license or permit under the Law.

ROHM SEMICONDUCTOR

Thank you for your accessing to ROHM product informations.
More detail product informations and catalogs are available, please contact us.

ROHM Customer Support System

http://www.rohm.com/contact/