

## DACs for Electronic Adjustment

# High-precision 10bit 4ch/6ch D/A Converters



BU2508FV, BU2507FV

No.11052EBT02

**●Description**

BU2508FV and BU2507FV ICs are high performance 10bit R-2R-type DACs with 4ch and 6ch outputs, respectively. Each channel incorporates a full swing output-type buffer amplifier with high speed output response characteristics, resulting in a greatly shortened wait time. The ICs also utilize the TTL level input method.

**●Features**

- 1) High performance, multi-channels R-2R-type 10bit D/A converter built-in (BU2508FV: 4 channels, BU2507FV: 6 channels)
- 2) Full swing output type buffer amplifier incorporated at each output channel
- 3) The RESET terminal can keep the voltage of all channels within the lower reference voltage range
- 4) Digital input compatible with TTL levels
- 5) 14bit 3-line serial data + RESET signal input (address 4bit + data 10bit)
- 6) Compact package: 14 pins, 0.65mm pitch (SSOP-B14)

**●Applications**

DVDs, CD-Rs, CD-RWs, digital cameras

**●Lineup**

Parameter	BU2507FV	BU2508FV
Power source voltage range	4.5 to 5.5V	4.5 to 5.5V
Number of channels	6ch	4ch
Differential non linearity error	±1.0LSB	±1.0LSB
Integral non linearity error	±3.5LSB	±3.5LSB
Data transfer frequency	10MHz	10MHz
Package	SSOP-B14	SSOP-B14

**●Absolute Maximum Ratings (Ta=25°C)**

Parameter	Symbol	Ratings	Unit
Power source voltage	VCC	-0.3 to 6.0	V
D/A converter upper standard voltage	VDD	-0.3 to 6.0	V
Input voltage	VIN	-0.3 to 6.0	V
Output voltage	VOUT	-0.3 to 6.0	V
Storage temperature range	Tstg	-55 to 125	°C
Power dissipation	Pd	350 *	mW

\* Derated at 3.5mW/°C at Ta>25°C, mounted on a 70x70x1.6mm FR4 glass epoxy board (copper foil area less than 3%)  
Note: These products are not robust against radiation

**●Recommended Operating Conditions (Ta=25°C)**

Parameter	Symbol	Limits	Unit
Power supply voltage range	VCC	4.5 to 5.5	V
Operating temperature range	Topr	-30 to 85	°C

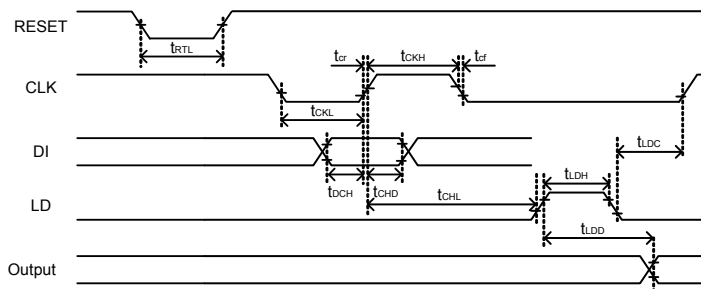
● **Electrical Characteristics** (Unless otherwise specified, VCC=5V, VrefH=5V, VrefL=0V, Ta=25°C)

Parameter		Symbol	Limits			Unit	Conditions
			MIN.	TYP.	MAX.		
<Digital unit>							
Power source current		ICC	-	0.85	2.8	mA	At CLK = 10MHz, IAO = 0uA
Input leak current		IILK	-5	-	5	μA	VIN=0 to VCC
Input voltage L		VIL	-	-	0.8	V	-
Input voltage H		VIH	2.0	-	-	V	-
Output voltage L		VOL	0	-	0.4	V	IOL=2.5mA
Output voltage H		VOH	4.6	-	5	V	IOH=-2.5mA
<Analog unit>							
Consumption current		IrefH	-	4.5	7.5	mA	Data condition : at maximum current
			-	2.0	3.4	mA <sup>(*)</sup>	
D/A converter upper standard voltage setting range		VrefH	3.0	-	5	V	Outputs does not necessarily take a value in standard voltage setting range. Value that output may take is in the buffer amplifier output voltage range (VO).
D/A converter lower standard voltage setting range		VrefL	0	-	1.5	V	
Buffer amplifier output voltage range		VO	0.1	-	4.9	V	IO=±100μA
			0.2	-	4.75		IO=±1.0mA
Buffer amplifier output drive range		IO	-2	-	2	mA	Upper side saturation voltage =0.35V (on full scale setting, current sourcing) Lower side saturation voltage =0.23V (on zero scale setting, current sinking)
Precision	Differential non-linearity error	DNL	-1.0	-	1.0	LSB	VrefH=4.796V VrefL=0.7V VCC=5.5V (4mV/LSB) No load (IO = +0mA)
	Integral non-linearity error	INL	-3.5	-	3.5		
	Zero point error	SZERO	-25	-	25	mV	
	Full scale error	SFULL	-25	-	25		
Buffer amplifier output impedance		RO	-	5	15	Ω	-
Pull-up I/O internal resistance value		Rup	12.5	25	37.5	kΩ	Input voltage 0V (Resistance value changes according to voltage to be impressed.)

\*1: Value in the case where CH1 ~ CH4 are set to maximum current (after reset)

● **Timing Characteristics** (Unless otherwise specified, VCC=5V, VrefH=5V, VrefL=0V, Ta=25°C)

Parameter	Symbol	Limits			Unit	Conditions
		MIN.	TYP.	MAX.		Judgment level is 80% / 20% of VCC.
Reset L pulse width	tRTL	50	-	-	nS	-
Clock L pulse width	tCKL	50	-	-		-
Clock H pulse width	tCKH	50	-	-		-
Clock rise time	tcr	-	-	50		-
Clock fall time	tcf	-	-	50		-
Data setup time	tDCH	20	-	-		-
Data hold time	tCHD	40	-	-		-
Load setup time	tCHL	50	-	-		-
Load hold time	tLDC	50	-	-		-
Load H pulse width	tLDH	50	-	-		-
DA output settling time	tLDD	-	7	20	μS	CL ≤ 100pF, VO:0.5V↔4.5V . Until output value deference from final value becomes 1/2LSB



(note) LD signal is level triggered. When LD input is on H level, internal shift-register state is loaded to DAC control latch. Clock transition during LD=H is inhibited.

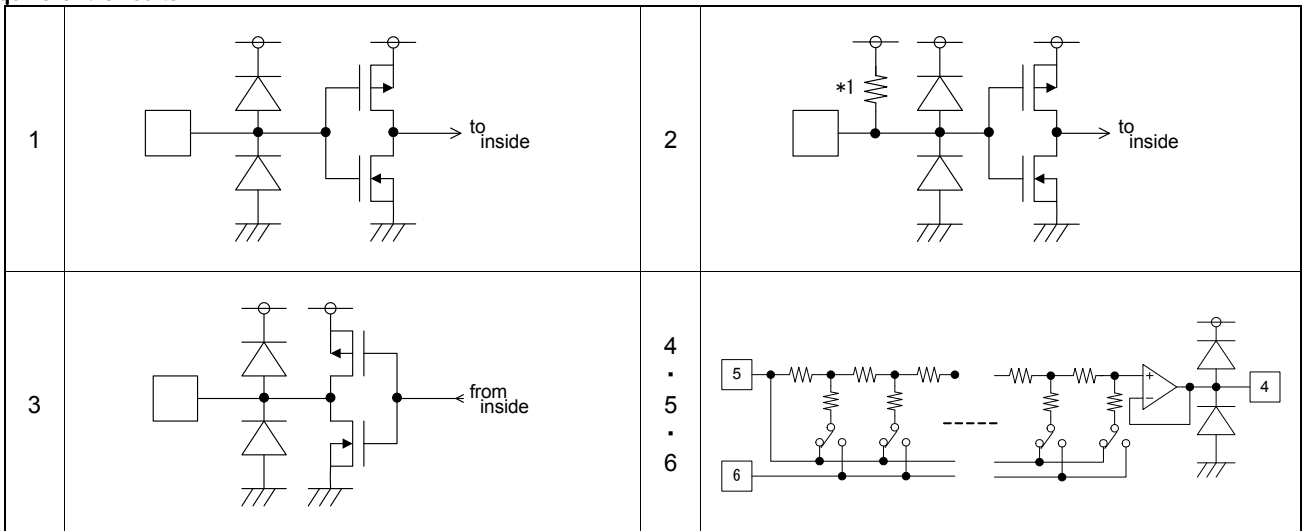


● Terminal Description

No	Terminal name	Analog / Digital	I/O	Description of terminal	Equivalent circuit
1	VSS	Analog	-	DA converter lower standard voltage (VrefL) input terminal	6
2	AO2	Analog	O	10bit D/A output (CH2)	4
3	AO3(TEST1)	Analog	O	10bit D/A output (CH3) (BU2508FV : test terminal)	4
4	Reset	Digital	I	All ch analog output L fixed	2
5	AO4(TEST2)	Digital	I	10bit D/A output (CH4) (BU2508FV : test terminal)	4
6	AO5 (AO3)	Analog	O	10bit D/A output (CH5) (BU2508FV : 10bit D/A output (CH3))	4
7	VDD	Analog	-	DA converter upper standard voltage (VrefH) input terminal	5
8	VCC	-	-	Power source terminal	-
9	AO6 (AO4)	Analog	O	10bit D/A output (CH6) (BU2508FV : 10bit D/A output (CH4))	4
10	LD	Digital	I	When High level is input to LD terminal, the value of 14bit shift register is loaded to decoder and D/A output register.	1
11	CLK	Digital	I	Shift clock input terminal. At rise of shift clock, the signal from DI terminal is input to 14bit shift register.	1
12	DI	Digital	I	Serial data input terminal. Serial data whose data length is 14bit (address 4bit + data 10bit) is input.	1
13	AO1	Analog	O	10bit D/A output (CH1)	4
14	GND	-	-	GND terminal	-

\*In the case of BU2508FV, be sure to open TEST1 and TEST2 terminals.

● Equivalent Circuits

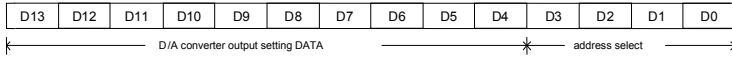


\*1: 25kΩ at Vcc = 5.0V (changes according to voltage supplied)

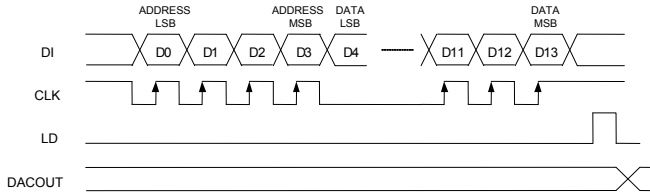
●Command Sending

1) In the case of BU2507FV

(1) Data format [data : LSB first]



(2) Data timing diagram

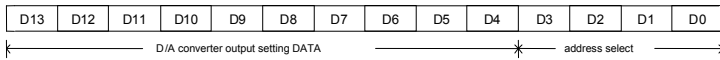


D3	D2	D1	D0	Address selection
0	0	0	0	Inconsequential
0	0	0	1	Inconsequential
0	0	1	0	AO1 selection
0	0	1	1	AO2 selection
0	1	0	0	Inconsequential
0	1	0	1	AO3 selection
0	1	1	0	AO4 selection
0	1	1	1	Inconsequential
1	0	0	0	AO5 selection
1	0	0	1	AO6 selection
1	0	1	0	Inconsequential
1	0	1	1	Inconsequential
1	1	0	0	Inconsequential
1	1	0	1	Inconsequential
1	1	1	0	Inconsequential
1	1	1	1	Inconsequential

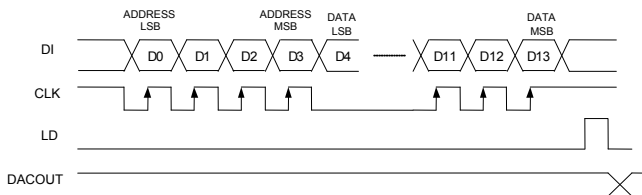
D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D/A output (VrefH=VDD, VrefL=VSS)
0	0	0	0	0	0	0	0	0	0	VrefL
0	0	0	0	0	0	0	0	0	1	$(VrefH-VrefL)/1024 \times 1 + VrefL$
0	0	0	0	0	0	0	0	1	0	$(VrefH-VrefL)/1024 \times 2 + VrefL$
0	0	0	0	0	0	0	0	1	1	$(VrefH-VrefL)/1024 \times 3 + VrefL$
:	:	:	:	:	:	:	:	:	:	:
1	1	1	1	1	1	1	1	1	0	$(VrefH-VrefL)/1024 \times 1022 + VrefL$
1	1	1	1	1	1	1	1	1	1	$(VrefH-VrefL)/1024 \times 1023 + VrefL$

2) In the case of BU2508FV

(1) Data format [Data : LSB first ]



(2) Data timing diagram



D3	D2	D1	D0	Address selection
0	0	0	0	Don't Care
0	0	0	1	Don't Care
0	0	1	0	AO1 selection
0	0	1	1	AO2 selection
0	1	0	0	Don't Care
0	1	0	1	Don't Care
0	1	1	0	Don't Care
0	1	1	1	Don't Care
1	0	0	0	AO3 selection
1	0	0	1	AO4 selection
1	0	1	0	Don't Care
1	0	1	1	Don't Care
1	1	0	0	Don't Care
1	1	0	1	Don't Care
1	1	1	0	Don't Care
1	1	1	1	Don't Care

D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D/A output (VrefH=VDD, VrefL=VSS)
0	0	0	0	0	0	0	0	0	0	VrefL
0	0	0	0	0	0	0	0	0	1	$(VrefH-VrefL)/1024 \times 1 + VrefL$
0	0	0	0	0	0	0	0	1	0	$(VrefH-VrefL)/1024 \times 2 + VrefL$
0	0	0	0	0	0	0	0	1	1	$(VrefH-VrefL)/1024 \times 3 + VrefL$
:	:	:	:	:	:	:	:	:	:	:
1	1	1	1	1	1	1	1	1	0	$(VrefH-VrefL)/1024 \times 1022 + VrefL$
1	1	1	1	1	1	1	1	1	1	$(VrefH-VrefL)/1024 \times 1023 + VrefL$

●Electrical Characteristics Curves

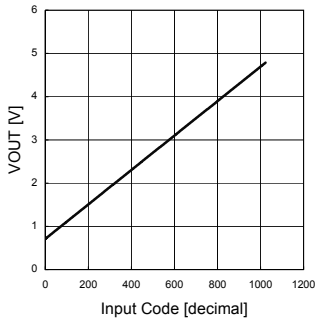


Fig.1 Output voltage linearity (-30°C)

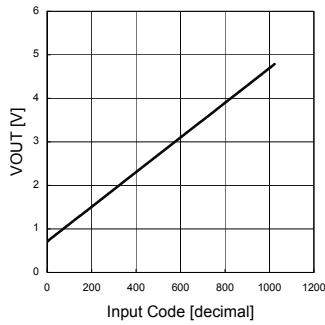


Fig.2 Output voltage linearity (25°C)

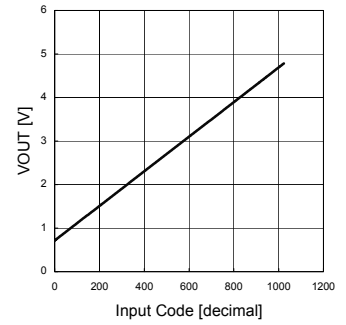


Fig.3 Output voltage linearity (85°C)

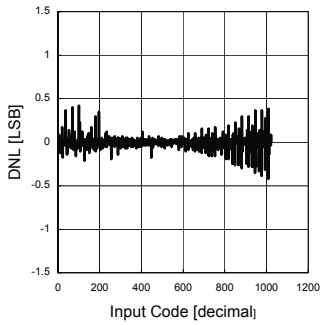


Fig.4 Differential linearity error (-30°C)

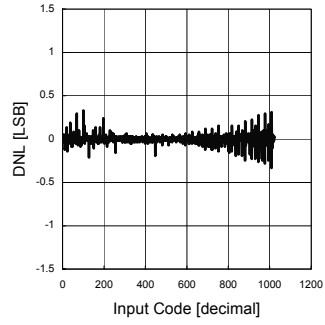


Fig.5 Differential linearity error (25°C)

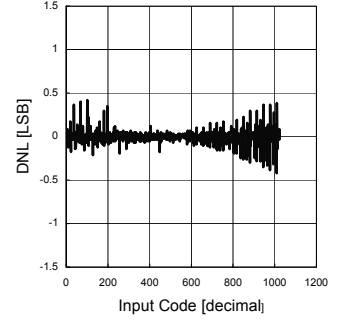


Fig.6 Differential linearity error (85°C)

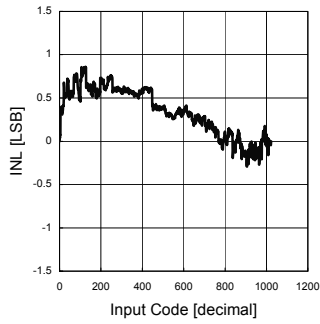


Fig.7 Integral linearity error (-30°C)

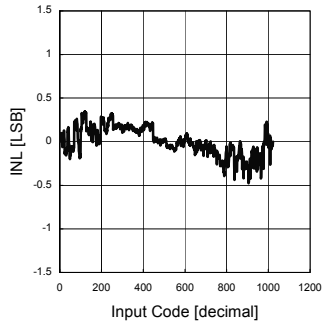


Fig.8 Integral linearity error (25°C)

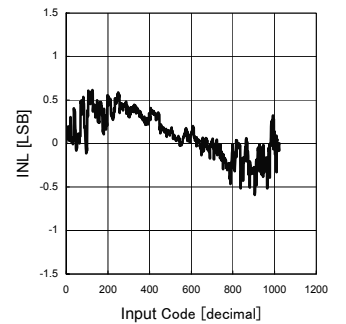


Fig.9 Integral linearity error (85°C)

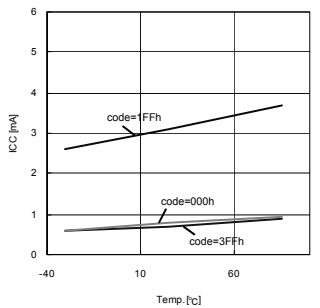


Fig.10 Circuit current temperature characteristic

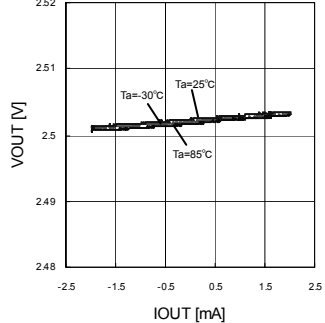


Fig.11 Output load fluctuation characteristic (input code : 1FFh)

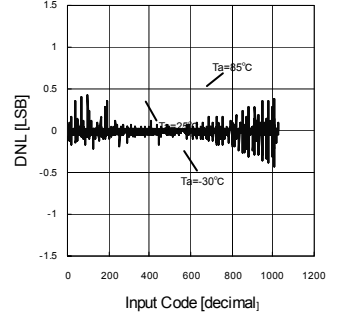
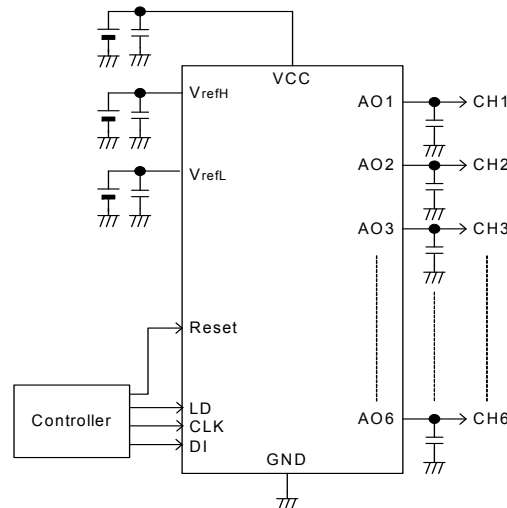


Fig.12 Pull-up built in resistance characteristic

### ● Standard Example Application Circuit



### ● Notes for use

- (1) The electrical characteristic and data on graphs for this datasheet, are typically evaluated value, and not guaranteed.
- (2) We suppose that application circuits are recommendable, but please make sufficient check for characteristics with the actual application. In case that value of external component for this IC is changed, please check characteristic, not only static but also transient.
- (3) About absolute maximum ratings  
If operation condition is over the absolute maximum ratings, supply voltage or other operation range, IC will be broken. Please don't apply any voltage or temperature over the absolute maximum ratings. If application have possibilities of become over the absolute maximum ratings, please take safety measures by using fuse and so on. Not to over absolute maximum ratings of IC.
- (4) GND voltage  
Please keep GND voltage lowest of any other terminal of this IC. Please confirm other terminal voltages is not lower than GND.
- (5) Thermal design  
Please making a thermal design that allows for a sufficient margin in light of the power dissipation in actual operating condition.
- (6) About terminals short and wrong mounting  
Please pay full attention to the IC direction and displacement when mounting IC on PCB. If you assemble them by mistake and electrify it, IC might be destroyed. And it is happen to short among IC terminals or terminals and power supply, by foreign substance.
- (7) About operation in strong electromagnetic field  
If you use it in strong electromagnetic field, please evaluate fully as there is a possibility of malfunction.
- (8) Place a bypass capacitor as close as possible between each power supply terminal and ground in order to prevent deterioration of the D/A conversion accuracy due to ripple and noise signals from power supply or GND.
- (9) A capacitor should be inserted between the analog output and ground in order to eliminate noise.  
A capacitance up to 100pF is recommended (including the capacitance of the wire).

●Ordering part number

B	U
---	---

Part No.

2	5	0	8
---	---	---	---

Part No.  
2507  
2508

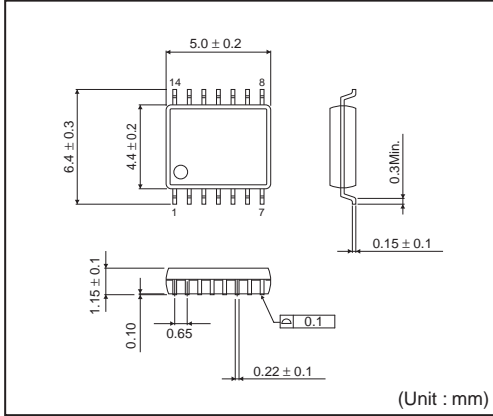
F	V
---	---

Package  
FV: SSOP-B14

E	2
---	---

Packaging and forming specification  
E2: Embossed tape and reel

SSOP-B14



<Tape and Reel information>

Tape	Embossed carrier tape
Quantity	2500pcs
Direction of feed	E2 ( The direction is the 1pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand )

Reel

1pin

Direction of feed

\*Order quantity needs to be multiple of the minimum quantity.



## 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.



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/>