

Voltage Detector IC Series

# Standard CMOS

# Voltage Detector IC

## BD48□□G/FVE, BD49□□G/FVE Series



### •General Description

ROHM's BD48□□G/FVE and BD49□□G/FVE series are highly accurate, low current consumption reset IC series. The lineup was established with tow output types (Nch open drain and CMOS output) and detection voltages range from 2.3V to 6.0V in increments of 0.1V, so that the series may be selected according the application at hand.

### •Features

- 1) Detection voltage: 2.3V to 6.0V (Typ.), 0.1V steps
- 2) High accuracy detection voltage: ±1.0%
- 3) Ultra-low current consumption: 0.8μA (Typ.)
- 4) Nch open drain output (BD48□□G/FVE), CMOS output (BD49□□G/FVE)
- 5) Compact packages VSOP5: BD48□□FVE, BD49□□FVE  
SSOP5: BD48□□G, BD49□□G

### •Applications

All electronic devices that use microcontrollers and logic circuits

### •Selection Guide

Part Number : BD4□□□□

①
②
③

Number	Specifications	Description
①	Output Circuit Format	8: Open Drain Output 9: CMOS Output
②	Detection Voltage	Example: Displays VS over a 2.3V to 6.0V range in 0.1V increments. (2.9V is marked as "29")
③	Package	G: SSOP5 / FVE: VSOP5

### •Lineup

Marking	Detection Voltage	Part Number	Marking	Detection Voltage	Part Number	Marking	Detection Voltage	Part Number	Marking	Detection Voltage	Part Number
EW	6.0V	BD4860	EB	4.1V	BD4841	GW	6.0V	BD4960	GB	4.1V	BD4941
EV	5.9V	BD4859	EA	4.0V	BD4840	GV	5.9V	BD4959	GA	4.0V	BD4940
EU	5.8V	BD4858	DV	3.9V	BD4839	GU	5.8V	BD4958	FV	3.9V	BD4939
ET	5.7V	BD4857	DU	3.8V	BD4838	GT	5.7V	BD4957	FU	3.8V	BD4998
ES	5.6V	BD4856	DT	3.7V	BD4837	GS	5.6V	BD4956	FT	3.7V	BD4937
ER	5.5V	BD4855	DS	3.6V	BD4836	GR	5.5V	BD4955	FS	3.6V	BD4936
EQ	5.4V	BD4854	DR	3.5V	BD4835	GQ	5.4V	BD4954	FR	3.5V	BD4935
EP	5.3V	BD4853	DQ	3.4V	BD4834	GP	5.3V	BD4953	FQ	3.4V	BD4934
EN	5.2V	BD4852	DP	3.3V	BD4833	GN	5.2V	BD4952	FP	3.3V	BD4933
EM	5.1V	BD4851	DN	3.2V	BD4832	GM	5.1V	BD4951	FN	3.2V	BD4932
EL	5.0V	BD4850	DM	3.1V	BD4831	GL	5.0V	BD4950	FM	3.1V	BD4931
EK	4.9V	BD4849	DL	3.0V	BD4830	GK	4.9V	BD4949	FL	3.0V	BD4930
EJ	4.8V	BD4848	DK	2.9V	BD4829	GJ	4.8V	BD4948	FK	2.9V	BD4929
EH	4.7V	BD4847	DJ	2.8V	BD4828	GH	4.7V	BD4947	FJ	2.8V	BD4928
EG	4.6V	BD4846	DH	2.7V	BD4827	GG	4.6V	BD4946	FH	2.7V	BD4927
EF	4.5V	BD4845	DG	2.6V	BD4826	GF	4.5V	BD4945	FG	2.6V	BD4926
EE	4.4V	BD4844	DF	2.5V	BD4825	GE	4.4V	BD4944	FF	2.5V	BD4925
ED	4.3V	BD4843	DE	2.4V	BD4824	GD	4.3V	BD4943	FE	2.4V	BD4924
EC	4.2V	BD4842	DD	2.3V	BD4823	GC	4.2V	BD4942	FD	2.3V	BD4923

2007.Apr.

● Absolute Maximum Rating (Ta=25°C)

Parameter		Symbol	Limits	Unit
Power Supply Voltage		VDD-GND	-0.3 ~ +10	V
Output Voltage	Nch Open Drain Output	VOUT	GND -0.3 ~ +10	V
	CMOS Output		GND -0.3 ~ VDD +0.3	
Power Dissipation	SSOP5 <sup>+1</sup> / <sub>+3</sub>	Pd	540	mW
	VSO5 <sup>+2</sup> / <sub>+3</sub>		210	
Operating Temperature		Topr	-40 ~ +105	°C
Ambient Storage Temperature		Tstg	-55 ~ +125	°C

- \*1 Use above Ta=25°C results in a 5.4mW loss per degree.
- \*2 Use above Ta=25°C results in a 2.1mW loss per degree.
- \*3 When a ROHM standard circuit board (70mm×70mm×1.6mm glass epoxy board) is mounted.

● Electrical Characteristics (Unless specified otherwise, Ta=-40°C~+105°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Detection Voltage	VS	VS(T)×0.99	VS(T)	VS(T)×1.01	V	VDD=H→L, RL=470kΩ
Detection Voltage Temperature Coefficient	VS/ΔT	—	±100	—	ppm/°C	Ta=-40 to +105°C (Designed Guarantee)
Hysteresis Voltage	ΔVS	VS×0.03	VS×0.05	VS×0.08	V	VS ≥ 1.1V, RL=470kΩ, VDD=L→H→L
Circuit Current at ON	IDD1	—	0.66	1.98	μA	VDD=VS-0.2V, VS=5.3~6.0V
Circuit Current at OFF	IDD2	—	0.9	2.7	μA	VDD=VS+2.0V, VS=5.3~6.0V
Operating Voltage Range	VOPL	0.95	—	—	V	VOL □ 0.4V
“Low” Output Current (Nch)	IOL	2	4	—	mA	VDS=0.5V, VDD=2.4V, VS=2.7V~6.0V
“High” Output Current (Pch)	IOH	1.1	2.2	—	mA	VDS=0.5V, VDD=8.0V, VS=5.3V~6.0V

\* Guarantee on Ta=25°C  
Designed Guarantee. (Outgoing inspection is not done on all products.)

● Block Diagrams

BD48□□G/FVE

Fig.1

TOP VIEW

SSOP5

PIN No.	Symbol	Function
1	VOUT	Reset Output
2	VDD	Power Supply Voltage
3	GND	GND
4	N.C.	Unconnected Terminal
5	N.C.	Unconnected Terminal

BD49□□G/FVE

Fig.2

TOP VIEW

VSO5

PIN No.	Symbol	Function
1	VOUT	Reset Output
2	SUB	Substrate*
3	N.C.	Unconnected Terminal
4	GND	GND
5	VDD	Power Supply Voltage

\* Connect the substrate to GND.

●Reference Data (Unless specified otherwise, Ta=25°C)

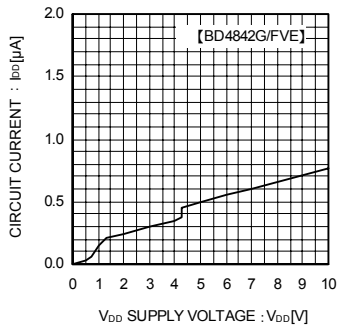


Fig.3 Circuit Current

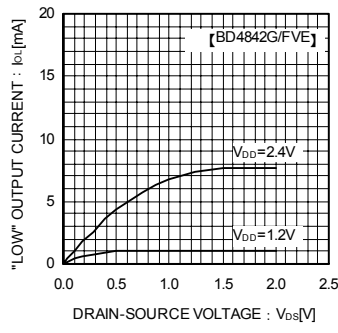


Fig.4 "Low" Output Current

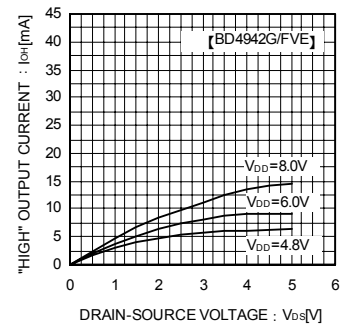


Fig.5 "High" Output Current

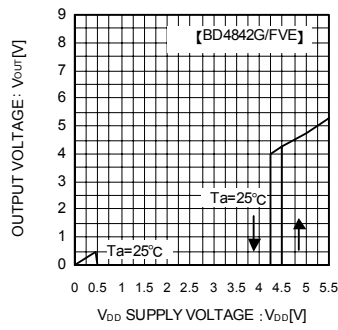


Fig.6 I/O Characteristics

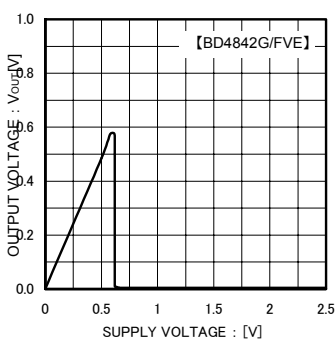


Fig.7 Operating Limit Voltage

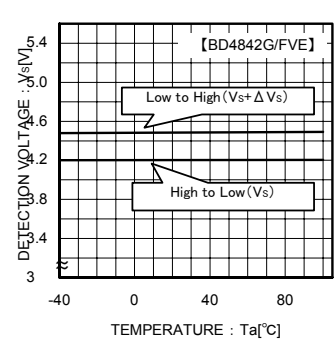


Fig.8 Detection Voltage Release Voltage

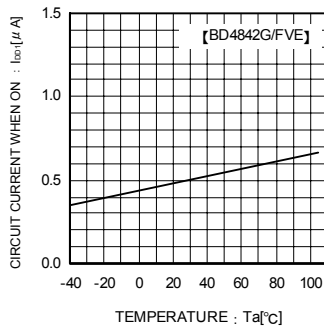


Fig.9 Circuit Current when ON

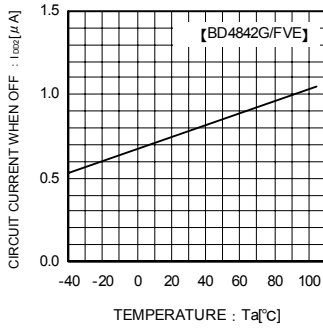


Fig.10 Circuit Current when OFF

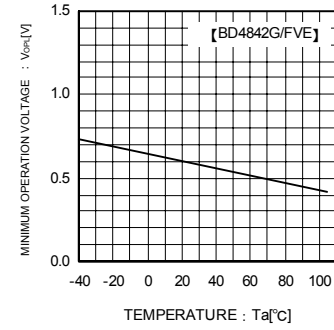


Fig.11 Operating Limit Voltage

●Reference Data

Examples of Leading (TPLH) and Falling (TPHL) Output

Part Number	TPLH (μs)	TPHL (μs)
BD4845G/FVE	39.5	87.8
BD4945G/FVE	32.4	52.4

VDD=4.3V→5.1V

VDD=5.1V→4.3V

\*This data is for reference only.

The figures will vary with the application, so please confirm actual operating conditions before use.

●Explanation of Operation

For both the open drain type (Fig. 12) and the CMOS output type (Fig. 13), the detection and release voltages are used as threshold voltages. When the voltage applied to the VDD pins reaches the applicable threshold voltage, the VOUT terminal voltage switches from either “High” to “Low” or from “Low” to “High”. Because the BD48□□G/FVE series uses an open drain output type, it is possible to connect a pull-up resistor to VDD or another power supply [The output “High” voltage (VOUT) in this case becomes VDD or the voltage of the other power supply].

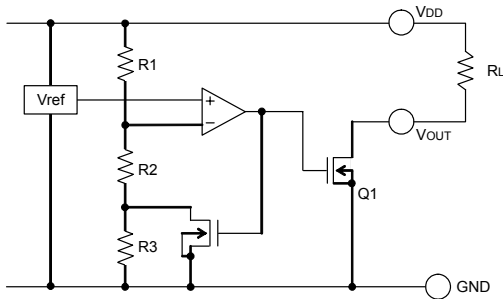


Fig. 12 (BD48□□ Type Internal Block Diagram)

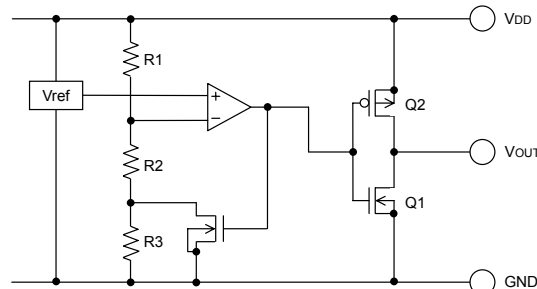


Fig. 13 (BD49□□ Type Internal Block Diagram)

●Timing Waveform

Example: the following shows the relationship between the input voltages VDD and the output voltage VOUT when the input power supply voltage VDD is made to sweep up and sweep down (the circuits are those in Fig. 12 and 13).

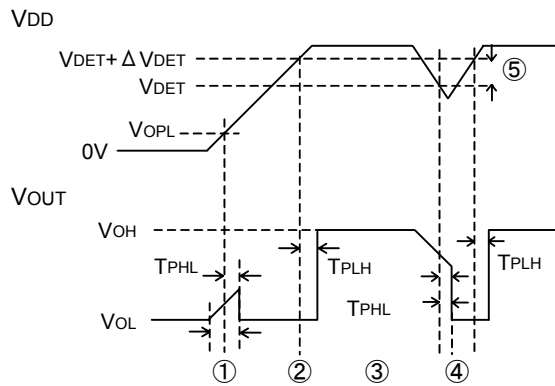


Fig. 14

- ① When the power supply is turned on, the output is unsettled from after over the operating limit voltage (VOPL) until TPLH. There fore it is possible that the reset signal is not outputted when the rise time of VDD is faster than TPLH.
- ② When VDD is greater than VOPL but less than the reset release voltage (VS + ΔVS), the output voltages will switch to Low.
- ③ If VDD exceeds the reset release voltage (VS + ΔVS), then VOUT switches from L to H.
- ④ If VDD drops below the detection voltage (VS) when the power supply is powered down or when there is a power supply fluctuation, VOUT switches to L (with a delay of TPLH).
- ⑤ The potential difference between the detection voltage and the release voltage is known as the hysteresis width (ΔVS). The system is designed such that the output does not flip-flop with power supply fluctuations within this hysteresis width, preventing malfunctions due to noise.

●Circuit Applications

1) Examples of a common power supply detection reset circuit.

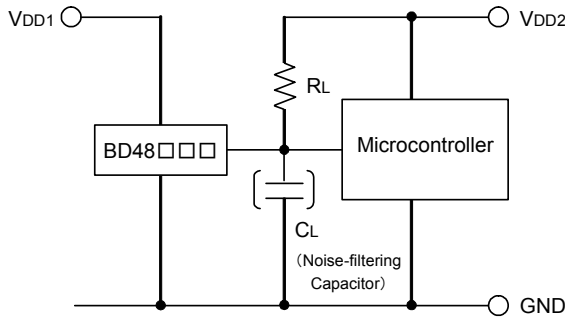


Fig.15 Open Collector Output Type

Application examples of BD48□□G/FVE series (Open Drain output type) and BD49□□G/FVE series (CMOS output type) are shown below.

CASE1: the power supply of the microcontroller (VDD2) differs from the power supply of the reset detection (VDD1). Use the open drain output type (BD48□□G/FVE) attached a load resistance (RL) between the output and VDD2. (As shown Figure 15)

CASE2: the power supply of the microcontroller (VDD1) is same as the power supply of the reset detection (VDD1). Use CMOS output type (BD49□□G/FVE) or open drain output type (BD48□□G/FVE) attached a load resistance (RL) between the output and VDD1. (As shown Figure 16)

When a capacitance CL for noise filtering is connected to the VOUT pin (the reset signal input terminal of the microcontroller), please take into account the waveform of the rise and fall of the output voltage (VOUT).

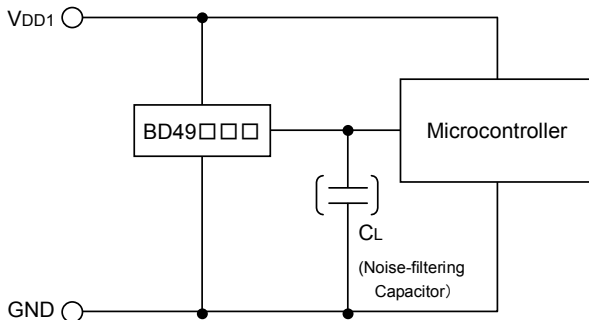


Fig.16 CMOS Output Type

2) The following is an example of a circuit application in which an OR connection between two types of detection voltages resets the microcontroller.

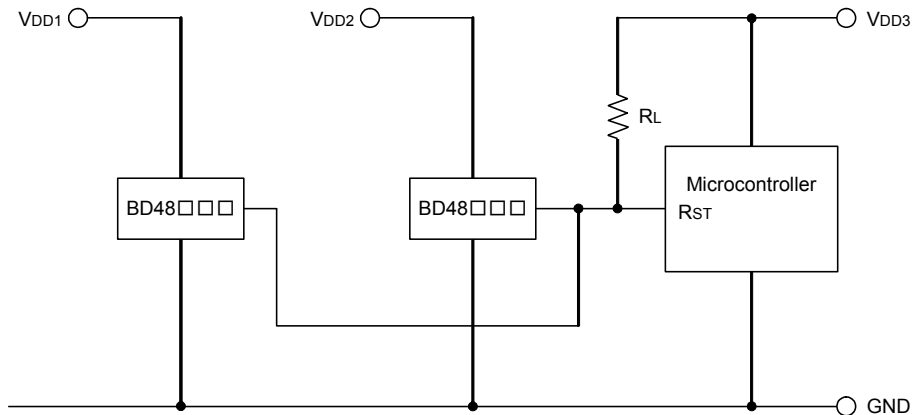


Fig.17

When there are many power supplies of the system, power supplies VDD1 and VDD2 are being monitored separately, and it is necessary to reset the microcomputer, it is possible to use an OR connection on the open drain output type BD48□□G/FVE series to pull-up to the desired voltage (VDD3) as shown in Fig. 17 and make the output "High" voltage matches the power supply voltage VDD3 of the microcontroller.

Examples of the power supply with resistor dividers

In applications where the power supply input terminal (VDD) of an IC with resistor dividers, it is possible that a through current will momentarily flow into the circuit when the output logic switches, resulting in malfunctions (such as output oscillatory state).

(Through-current is a current that momentarily flows from the power supply (VDD) to ground (GND) when the output level switches from "High" to "Low" or vice versa.)

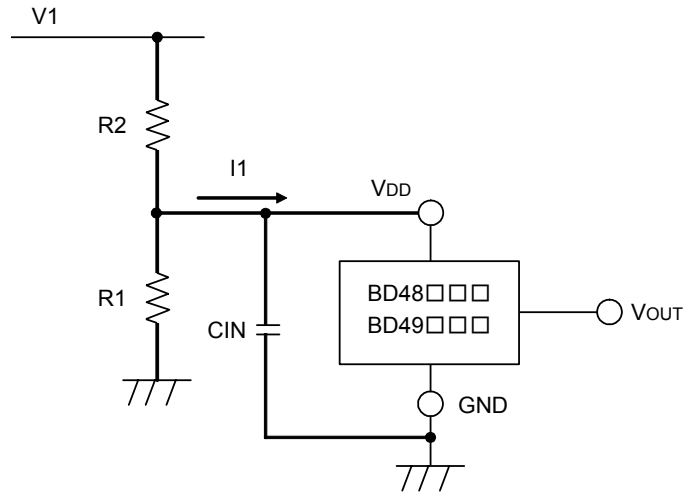


Fig.18

A voltage drop of [the through-current ( $I_1$ )]  $\times$  [input resistor ( $R_2$ )] is caused by the through current, and the input voltage to descends, when the output switches from "Low" to "High". When the input voltage decreases and falls below the detection voltage, the output voltage switches from "High" to "Low". At this time, the through-current stops flowing through output "Low", and the voltage drop is eliminated. As a result, the output switches from "Low" to "High", which again causes the through current to flow and the voltage drop. This process is repeated, resulting in oscillation.

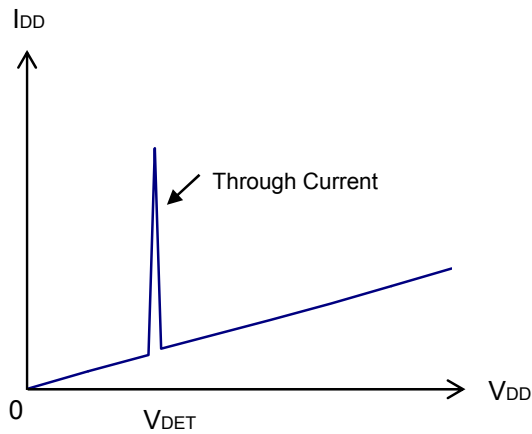


Fig.19 Current Consumption vs. Power Supply Voltage

● Operation Notes

1 . Absolute maximum range

Absolute Maximum Ratings are those values beyond which the life of a device may be destroyed. We cannot be defined the failure mode, such as short mode or open mode. Therefore a physical security countermeasure, like fuse, is to be given when a specific mode to be beyond absolute maximum ratings is considered.

2 . GND potential

GND terminal should be a lowest voltage potential every state.  
Please make sure all pins, which are over ground even if, include transient feature.

3 . Electrical Characteristics

Be sure to check the electrical characteristics that are one the tentative specification will be changed by temperature, supply voltage, and external circuit.

4 . Bypass Capacitor for Noise Rejection

Please put into the capacitor of 1μF or more between VDD pin and GND, and the capacitor of about 1000pF between VOUT pin and GND, to reject noise. If extremely big capacitor is used, transient response might be late. Please confirm sufficiently for the point.

5 . Short Circuit between Terminal and Soldering

Don't short-circuit between Output pin and VDD pin, Output pin and GND pin, or VDD pin and GND pin. When soldering the IC on circuit board, please be unusually cautious about the orientation and the position of the IC. When the orientation is mistaken the IC may be destroyed.

6 . Electromagnetic Field

Mal-function may happen when the device is used in the strong electromagnetic field.

7 . The VDD line impedance might cause oscillation because of the detection current.

8 . A VDD -GND capacitor (as close connection as possible) should be used in high VDD line impedance condition.

9 . Lower than the minimum input voltage makes the VOUT high impedance, and it must be VDD in pull up (VDD) condition.

10. This IC has extremely high impedance terminals. Small leak current due to the uncleanness of PCB surface might cause unexpected operations. Application values in these conditions should be selected carefully. If the leakage is assumed between the VOUT terminal and the GND terminal, the pull-up resistor should be less than 1/10 of the assumed leak resistance.

11. External parameters

The recommended parameter range for RL is 10kΩ~1MΩ. There are many factors (board layout, etc) that can affect characteristics. Please verify and confirm using practical applications.

12. Power on reset operation

Please note that the power on reset output varies with the VDD rise up time. Please verify the actual operation.

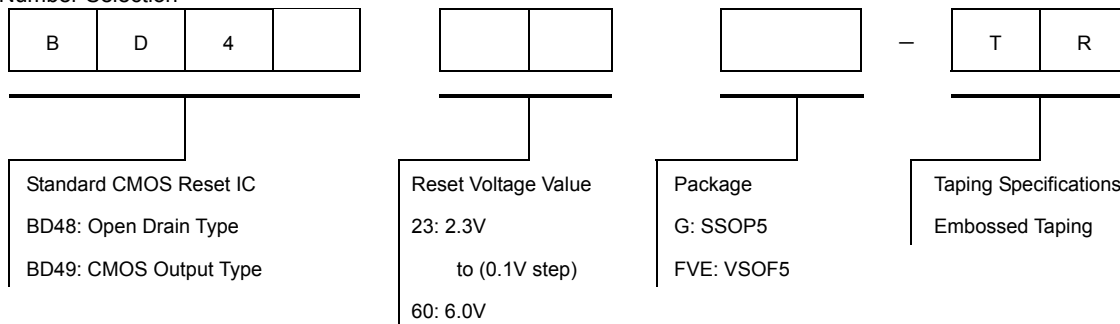
13. Precautions for board inspection

Connecting low-impedance capacitors to run inspections with the board may produce stress on the IC. Therefore, be certain to use proper discharge procedure before each process of the test operation.

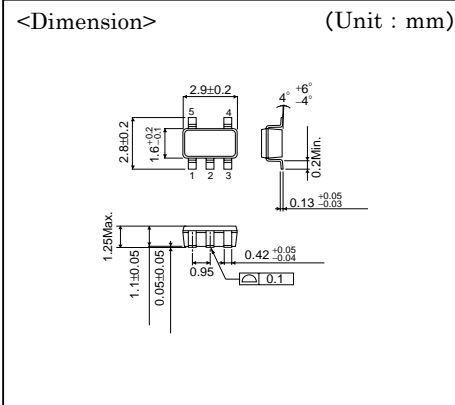
To prevent electrostatic accumulation and discharge in the assembly process, thoroughly ground yourself and any equipment that could sustain ESD damage, and continue observing ESD-prevention procedures in all handling, transfer and storage operations. Before attempting to connect components to the test setup, make certain that the power supply is OFF. Likewise, be sure the power supply is OFF before removing any component connected to the test setup.

14. When the power supply, is turned on because of in certain cases, momentary Rash-current flow into the IC at the logic unsettled, the couple capacitance, GND pattern of width and leading line must be considered.

●Part Number Selection

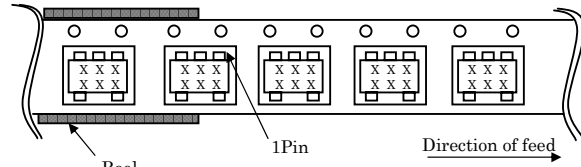


## SSOP5



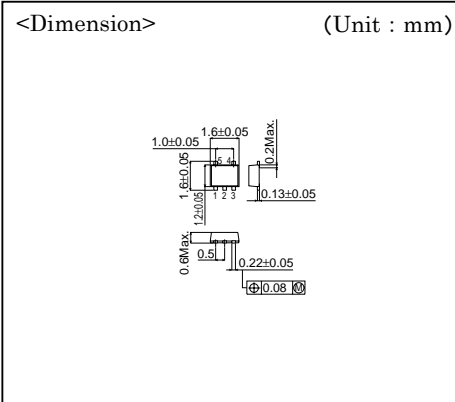
## <Tape and Reel information> SSOP5

Tape	Embossed carrier tape
Quantity	3000pcs
Direction of feed	TR (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)



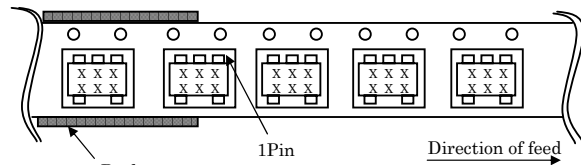
※When you order, please order in times the amount of package quantity.

## VSOF5



## <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 left when you hold reel on the left hand and you pull out the tape on the right hand)



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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.

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