Voltage Detector IC Series

Standard CMOS Voltage Detector IC

Pb Free — ROHM Electronic Components

RoHS Directive Compliance

BD48☐☐G, BD48☐☐FVE, BD49☐☐G, BD49☐☐FVE series

No.09006EAT04

● **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   VSOF5: 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

No.	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:VSOF5

● **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

● Absolute maximum ratings (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 *1*3	Pd	540	mW
	VSOF5 *2*3		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 Otherwise Specified Ta=-40 to 105°C)

Parameter	Symbol	Condition		Limit			Unit
				Min.	Typ.	Max.	
Detection Voltage	Vs	R_L=470kΩ, VDD=H→L *1		Vs(T) ×0.99	Vs(T)	Vs(T) ×1.01	V
Output Delay Time "L→H"	tPLH	C_L=100pF R_L=100kΩ Vout=GND→50% *2		-	-	100	μs
Circuit Current when ON	Icc1	VDD=Vs-0.2V *1	Vs=2.3-3.1V	-	0.51	1.53	μA
			Vs=3.2-4.2V	-	0.56	1.68	
			Vs=4.3-5.2V	-	0.60	1.80	
			Vs=5.3-6.0V	-	0.66	1.98	
Circuit Current when OFF	Icc2	VDD=Vs+2.0V *1	Vs=2.3-3.1V	-	0.75	2.25	μA
			Vs=3.2-4.2V	-	0.80	2.40	
			Vs=4.3-5.2V	-	0.85	2.55	
			Vs=5.3-6.0V	-	0.90	2.70	
Minimum Operating Voltage	VOPL	VOL≤0.4V, Ta=25~105°C, R_L=470kΩ		0.95	-	-	V
		VOL≤0.4V, Ta=-40~25°C, R_L=470kΩ		1.20	-	-	
'Low'Output Current (Nch)	IOL	VDS=0.5V, VDD=1.5V, Vs=2.3-6.0V		0.4	1.0	-	mA
		VDS=0.5V, VDD=2.4V, Vs=2.7-6.0V		2.0	4.0	-	
'High'Output Current (Pch) (BD49□□G/FVE)	IOH	VDS=0.5V, VDD=4.8V, Vs=2.3-4.2V		0.7	1.4	-	mA
		VDS=0.5V, VDD=6.0V, Vs=4.3-5.2V		0.9	1.8	-	
		VDS=0.5V, VDD=8.0V, Vs=5.3-6.0V		1.1	2.2	-	
Leak Current when OFF (BD48□□G/FVE)	Ileak	VDD=VDS=10V *1		-	-	0.1	μA
Detection Voltage Temperature coefficient	Vs/ΔT	Ta=-40°C to 105°C (Designed Guarantee)		-	±100	±360	ppm/°C
Hysteresis Voltage	ΔVs	VDD=L→H→L		Vs×0.03	Vs×0.05	Vs×0.08	V

V_s(T) :　Standard Detection Voltage(2.3V to 6.0V, 0.1V step)
R_L:　Pull-up resistor to be connected between VOUT and power supply.
C_L:　Capacitor to be connected between VOUT and GND.
Designed Guarantee. (Outgoing inspection is not done on all products.)
*1　Guarantee is Ta=25°C.
*2　tPLH:VDD=(Vs typ.-0.5V)→(Vs typ.+0.5V)
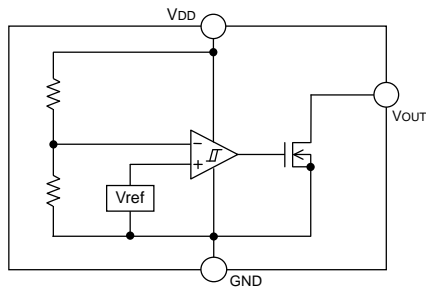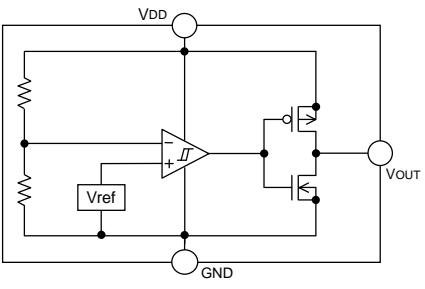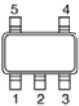
● **Block Diagrams**

BD48□□G/FVE

VDD

VOUT

Vref

GND

Fig.1

TOP VIEW

5   4

1   2   3

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

VDD

VOUT

Vref

GND

Fig.2

TOP VIEW

5 4

1 2 3
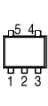
VSOF5

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)**
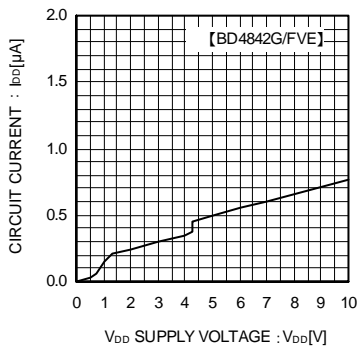
Fig.3 Circuit Current
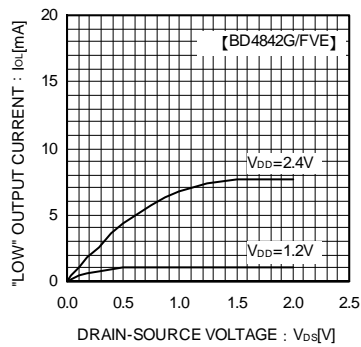
Fig.4 "Low" Output Current
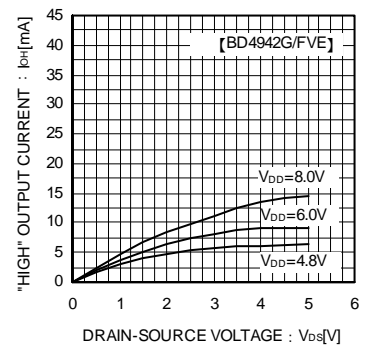
Fig.5 "High" Output Current
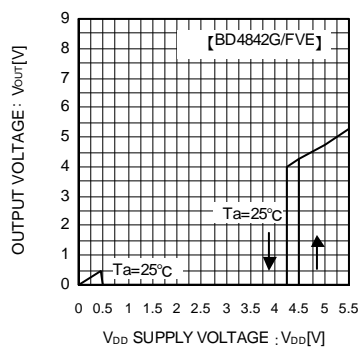
Fig.6 I/O Characteristics
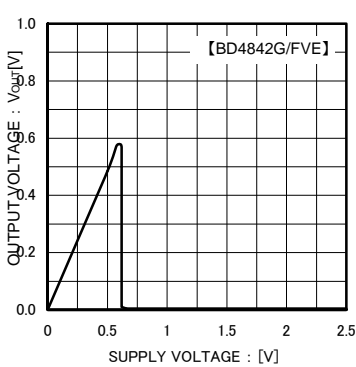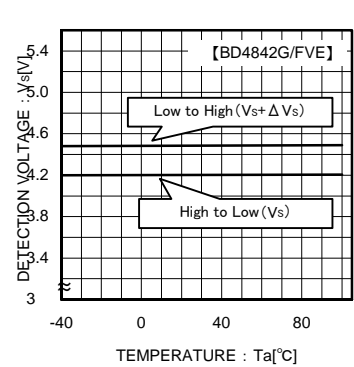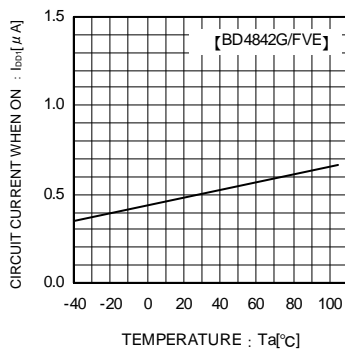
Fig.7 Operating Limit Voltage

Fig.8 Detection Voltage
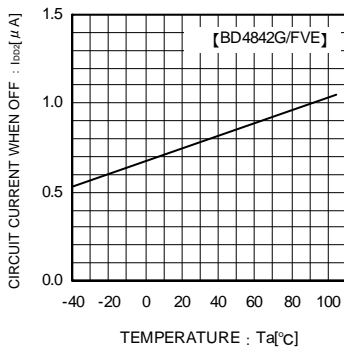Release Voltage

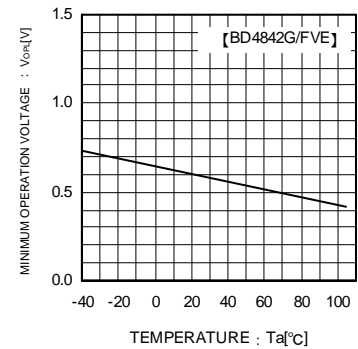Fig.9 Circuit Current when ON

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].
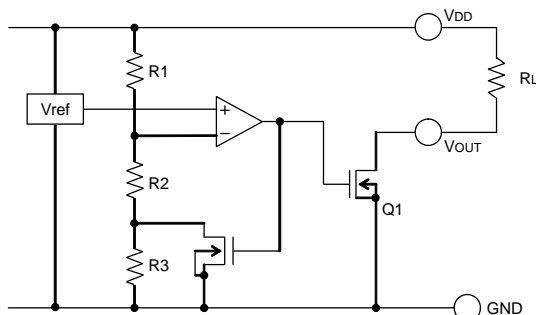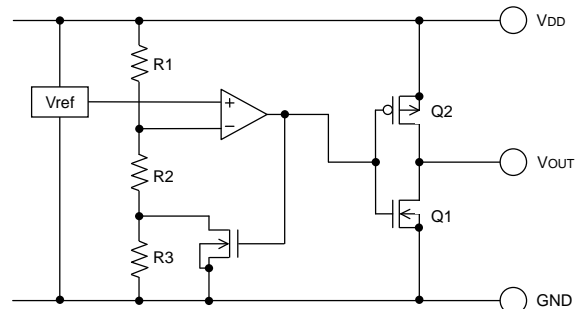

Fig.12 (BD48□□ Type Internal Block Diagram)   Fig.13 (BD49□□ Type Internal Block Diagram)

● **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).
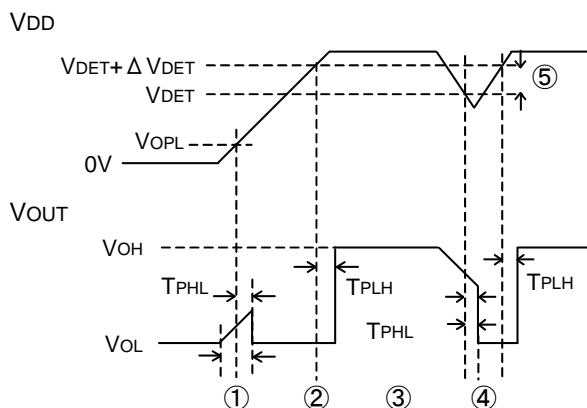

Fig.14

① When the power supply is turned on, the output is unsettled from after over the operating limit voltage (VOPL) until TPHL. There fore it is possible that the reset signal is not outputted when the rise time of VDD is faster than TPHL.

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 TPHL).

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**

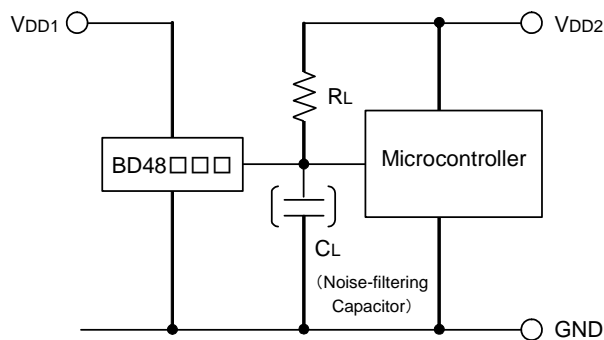1) Examples of a common power supply detection reset circuit.

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 Fig.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 Fig.16)
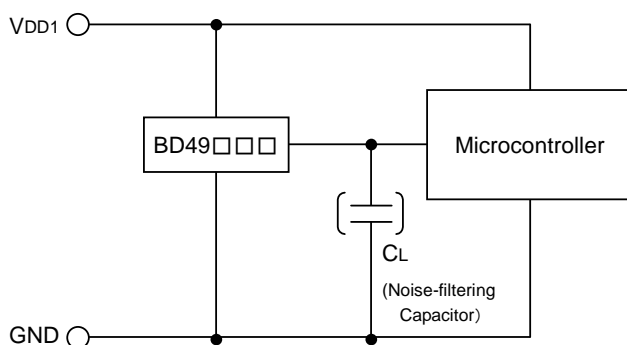
When a capacitance CL for noise filtering is connected to the VOUT pin (the reset signal input terminal of the microcontroller), please take into account the waveform of the rise and fall of the output voltage (VOUT).

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.
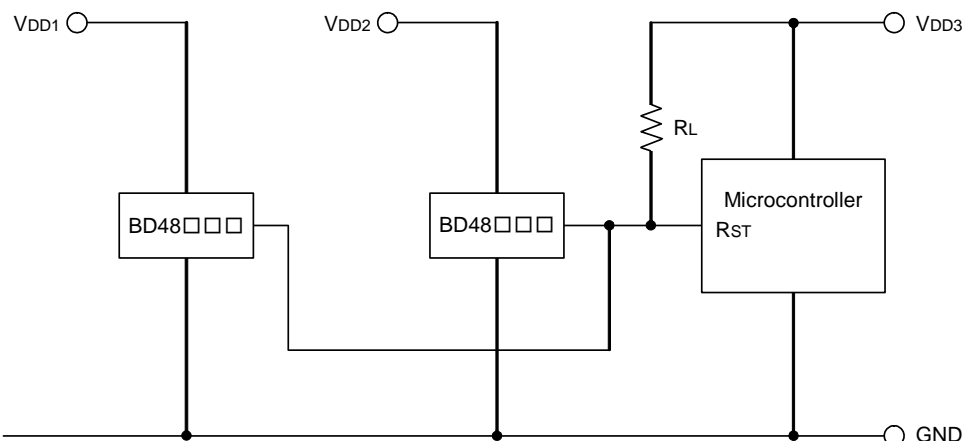

Fig.17

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.)
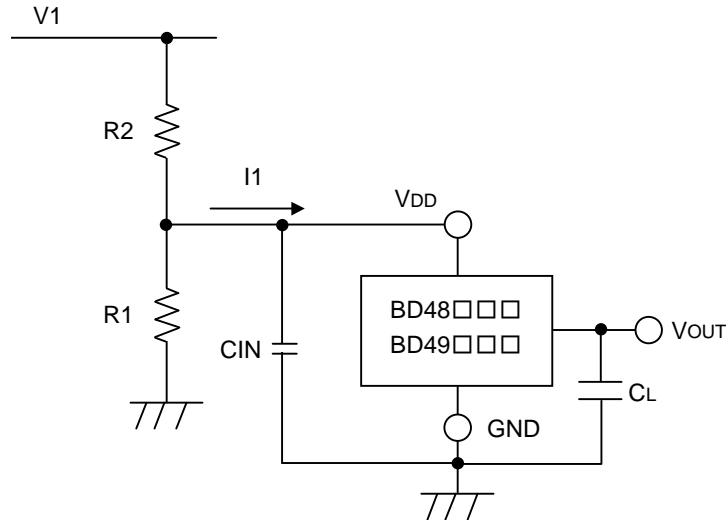
Fig.18

A voltage drop of [the through-current (I1)] × [input resistor (R2)] 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.
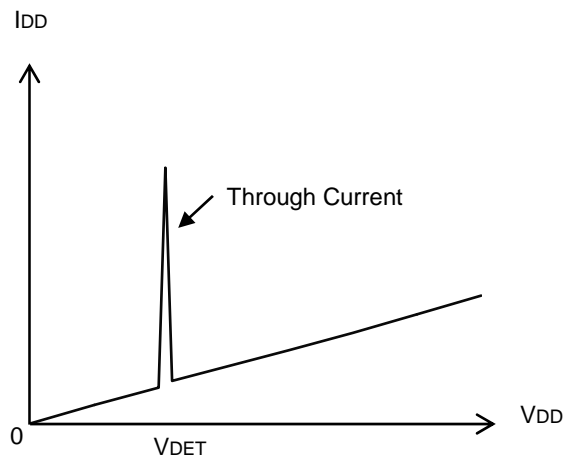
Fig.19 Current Consumption vs. Power Supply Voltage

● **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 inpedance might cause oscillation because of the detection current.

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

9 . Lower than the mininum input voltage makes the V_{OUT} high impedance, and it must be V_{DD} in pull up (V_{DD}) 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 handing, 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**

| B | D | 4 | 8 | | 2 | 3 | | G | – | T | R |

Standard CMOS Reset IC

BD48: Open Drain Type

BD49: CMOS Output Type

Reset Voltage Value

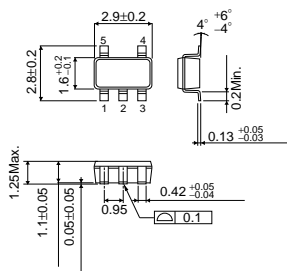23: 2.3V to (0.1V step)

60: 6.0V

Package

G: SSOP5

FVE: VSOF5

Taping Specifications

Embossed Taping

SSOP5

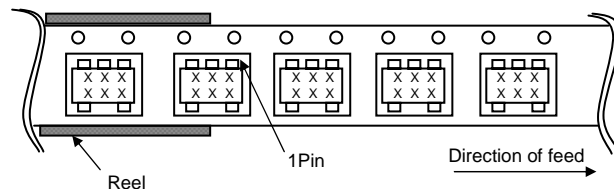| <Dimension>	(Unit：mm)

2.9±0.2
2.8±0.2
1.6 +0.2 −0.1
4° +6° −4°
0.2Min.
0.13 +0.05 −0.03
1.25Max.
1.1±0.05
0.05±0.05
0.95
0.42 +0.05 −0.04
0.1

<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)

1Pin

Reel

Direction of feed

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

VSOF5

<Dimension>	(Unit：mm)

1.0±0.05
1.6±0.05
1.6±0.05
1.2±0.05
0.2Max.
0.13±0.05
0.6Max.
0.5
0.22±0.05
0.08

<Tape and Reel information> VSOF5

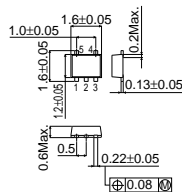| Tape	Embossed carrier tape
Quantity	3000pcs
Direction of feed	TR (The direction is the 1pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand)

1Pin

Reel

Direction of feed

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

N o t e s

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