Voltage Detector IC Series

Standard CMOS Voltage Detector IC

BD48xxx series BD49xxx series

●General Description

ROHM's BD48xxx and BD49xxx series are highly accurate, low current consumption reset IC series. The line up includes BD48xxx devices with N channel open drain output and BD49xxx devices with CMOS output. The devices are available for specific detection voltages ranging from 2.3V to 6.0V in increments of 0.1V.

●Features

- High accuracy detection
- Ultra-low current consumption
- Two output types (Nch open drain and CMOS output)
- Wide Operating temperature range
- Very small and low height package
- Package SSOP5 is similar to SOT-23-5 (JEDEC)
- Package SSOP3 is similar to SOT-23-3 (JEDEC)

●Key Specifications

- Detection voltage: 2.3V to 6.0V (Typ.), 0.1V steps
- High accuracy detection voltage: ± 1.0%
- Ultra-low current consumption: 0.9μA (Typ.)
- Operating temperature range: -40°C to +105°C

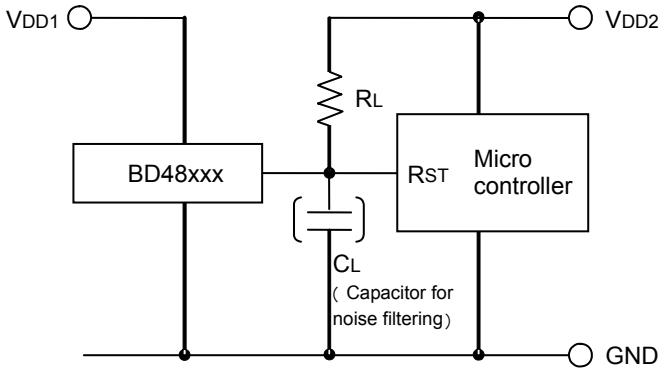
●Package

SSOP5: 2.90mm x 2.80mm x 1.15mm
SSOP3: 2.90mm x 2.80mm x 1.15mm
VSOF5: 1.60mm x 1.60mm x 0.60mm

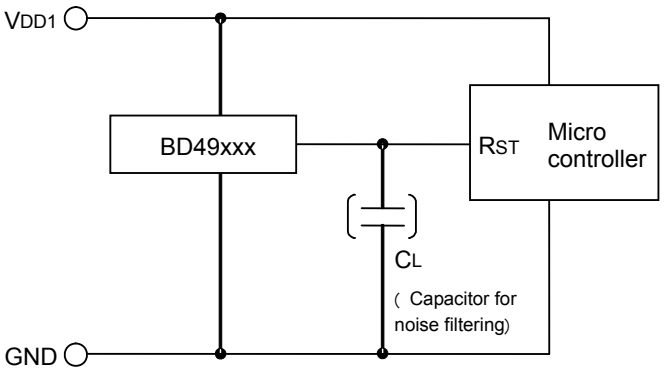
●Applications

Circuits using microcontrollers or logic circuits that require a reset.

●Typical Application Circuit



(Open Drain Output type)
BD48xxx series

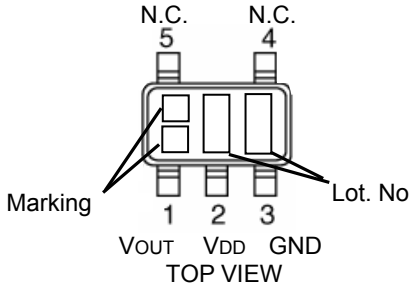


(CMOS Output type)
BD49xxx series

○Product structure:Silicon monolithic integrated circuit ○This product is not designed protection against radioactive rays.

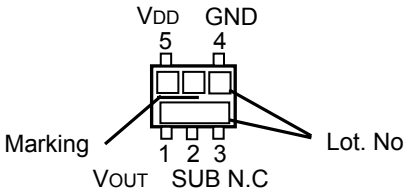
●Connection Diagram

SSOP5



TOP VIEW

VSOF5



TOP VIEW

●Pin Descriptions

SSOP5

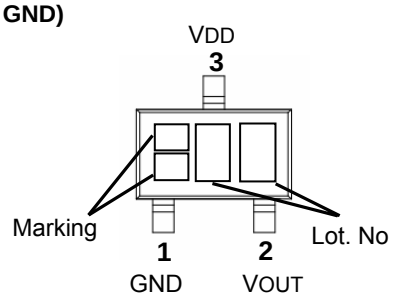
PIN No.	Symbol	Function
1 V	OUT Reset	Output
2 V	DD Po	wer Supply Voltage
3 GND		GND
4 N.C.		Unconnected Terminal
5 N.C.		Unconnected Terminal

VSOF5

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

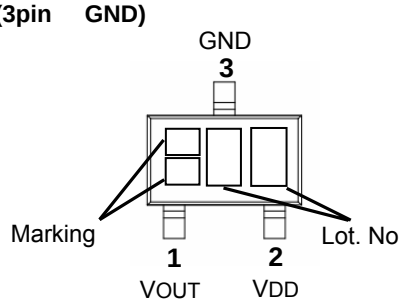
*Connect the substrate to GND.

SSOP3(1pin GND)



TOP VIEW

SSOP3(3pin GND)



TOP VIEW

●Pin Descriptions

SSOP3-1

PIN No.	Symbol	Function
1	GND	GND
2	VOUT Reset	Output
3	VDD	Power Supply Voltage

SSOP3-2

PIN No.	Symbol	Function
1	VOUT Reset	Output
2	VDD Po	wer Supply Voltage
3	GND	GND

● Ordering Information

BD x x x x x x – T R

Part Number

Output Type
48 : Open Drain
49 : CMOS

Package1

Reset Voltage Value
23 : 2.3V
⇩ 0.1V step
60 : 6.0V

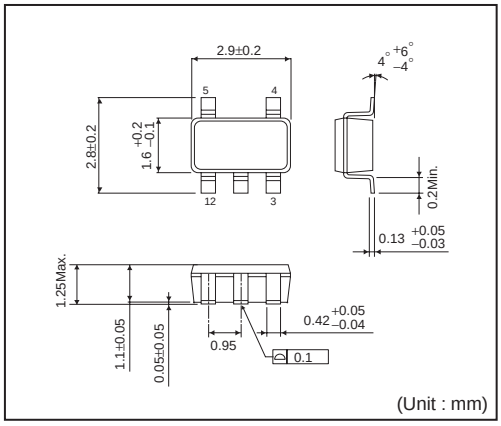
Package2

Packageing and forming specification
Embossed tape and reel
TR :The pin number 1is the upper right
:SSOP5
:VSOF5
TL :The pin number 1is the upper left
:SSOP3-1
:SSOP3-2

Package1	Package2	Package name
E	G	SSOP5
K	G	SSOP3(1pin GND)
L	G	SSOP3(3pin GND)
Blank	FVE	VSOF5
Blank	G	SSOP5

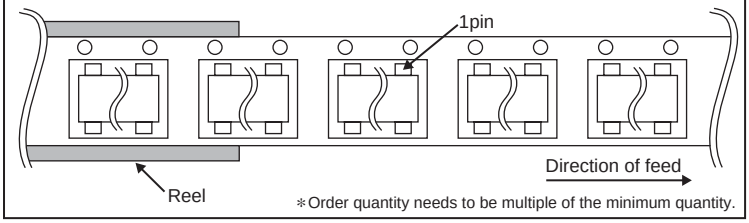
note) Please be new and, in hope of SSOP5, choose the package 1 by "E" and package 2" G."

SSOP5



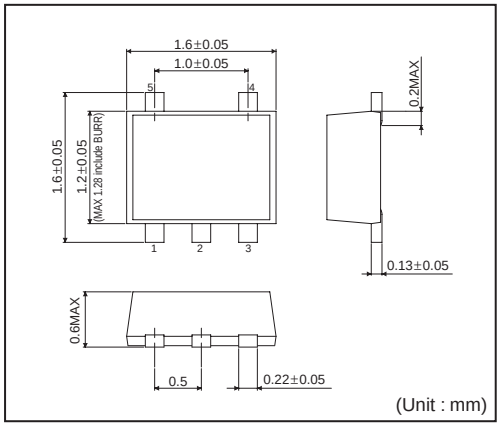
<Tape and Reel information>

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

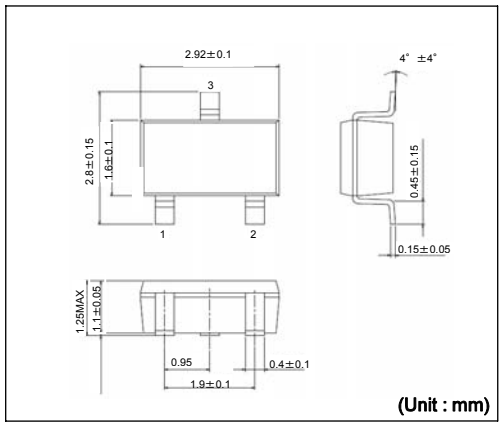


∗Order quantity needs to be multiple of the minimum quantity.

VSOF5

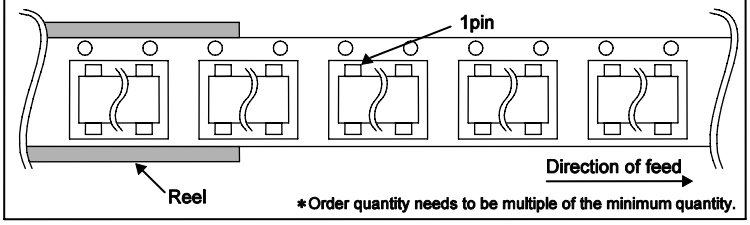


SSOP3



<Tape and Reel information>

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



∗Order quantity needs to be multiple of the minimum quantity.

●**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	BD4938
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

Marking	Detection Voltage	Part Number	Marking	Detection Voltage	Part Number	Marking	Detection Voltage	Part Number	Marking	Detection Voltage	Part Number
Cm	6.0V	BD48E60	Be	4.1V	BD48E41	Ff	6.0V	BD49E60	Ea	4.1V	BD49E41
Ck	5.9V	BD48E59	Bd	4.0V	BD48E40	Fe	5.9V	BD49E59	Dy	4.0V	BD49E40
Ch	5.8V	BD48E58	Bc	3.9V	BD48E39	Fd	5.8V	BD49E58	Dr	3.9V	BD49E39
Cg	5.7V	BD48E57	Bb	3.8V	BD48E38	Fc	5.7V	BD49E57	Dp	3.8V	BD49E38
Cf	5.6V	BD48E56	Ba	3.7V	BD48E37	Fb	5.6V	BD49E56	Dn	3.7V	BD49E37
Ce	5.5V	BD48E55	Ay	3.6V	BD48E36	Fa	5.5V	BD49E55	Dm	3.6V	BD49E36
Cd	5.4V	BD48E54	Ar	3.5V	BD48E35	Ey	5.4V	BD49E54	Dk	3.5V	BD49E35
Cc	5.3V	BD48E53	Ap	3.4V	BD48E34	Er	5.3V	BD49E53	Dh	3.4V	BD49E34
Cb	5.2V	BD48E52	An	3.3V	BD48E33	Ep	5.2V	BD49E52	Dg	3.3V	BD49E33
Ca	5.1V	BD48E51	Am	3.2V	BD48E32	En	5.1V	BD49E51	Df	3.2V	BD49E32
By	5.0V	BD48E50	Ak	3.1V	BD48E31	Em	5.0V	BD49E50	De	3.1V	BD49E31
Br	4.9V	BD48E49	Ah	3.0V	BD48E30	Ek	4.9V	BD49E49	Dd	3.0V	BD49E30
Bp	4.8V	BD48E48	Ag	2.9V	BD48E29	Eh	4.8V	BD49E48	Dc	2.9V	BD49E29
Bn	4.7V	BD48E47	Af	2.8V	BD48E28	Eg	4.7V	BD49E47	Db	2.8V	BD49E28
Bm	4.6V	BD48E46	Ae	2.7V	BD48E27	Ef	4.6V	BD49E46	Da	2.7V	BD49E27
Bk	4.5V	BD48E45	Ad	2.6V	BD48E26	Ee	4.5V	BD49E45	Cy	2.6V	BD49E26
Bh	4.4V	BD48E44	Ac	2.5V	BD48E25	Ed	4.4V	BD49E44	Cr	2.5V	BD49E25
Bg	4.3V	BD48E43	Ab	2.4V	BD48E24	Ec	4.3V	BD49E43	Cp	2.4V	BD49E24
Bf	4.2V	BD48E42	Aa	2.3V	BD48E23	Eb	4.2V	BD49E42	Cn	2.3V	BD49E23

Marking	Detection Voltage	Part Number	Marking	Detection Voltage	Part Number	Marking	Detection Voltage	Part Number	Marking	Detection Voltage	Part Number
Cm	6.0V BD	48K60	Be	4.1V BD	48K41	Ff	6.0V BD	49K60	Ea	4.1V	BD49K41
Ck	5.9V BD	48K59	Bd	4.0V BD	48K40	Fe	5.9V BD	49K59	Dy	4.0V	BD49K40
Ch	5.8V BD	48K58	Bc	3.9V BD	48K39	Fd	5.8V BD	49K58	Dr	3.9V	BD49K39
Cg	5.7V BD	48K57	Bb	3.8V BD	48K38	Fc	5.7V BD	49K57	Dp	3.8V	BD49K38
Cf	5.6V BD	48K56	Ba	3.7V BD	48K37	Fb	5.6V BD	49K56	Dn	3.7V	BD49K37
Ce	5.5V BD	48K55	Ay	3.6V BD	48K36	Fa	5.5V BD	49K55	Dm	3.6V	BD49K36
Cd	5.4V BD	48K54	Ar	3.5V BD	48K35	Ey	5.4V BD	49K54	Dk	3.5V	BD49K35
Cc	5.3V BD	48K53	Ap	3.4V BD	48K34	Er	5.3V BD	49K53	Dh	3.4V	BD49K34
Cb	5.2V BD	48K52	An	3.3V BD	48K33	Ep	5.2V BD	49K52	Dg	3.3V	BD49K33
Ca	5.1V BD	48K51	Am	3.2V BD	48K32	En	5.1V BD	49K51	Df	3.2V	BD49K32
By	5.0V BD	48K50	Ak	3.1V BD	48K31	Em	5.0V BD	49K50	De	3.1V	BD49K31
Br	4.9V BD	48K49	Ah	3.0V BD	48K30	Ek	4.9V BD	49K49	Dd	3.0V	BD49K30
Bp	4.8V BD	48K48	Ag	2.9V BD	48K29	Eh	4.8V BD	49K48	Dc	2.9V	BD49K29
Bn	4.7V BD	48K47	Af	2.8V BD	48K28	Eg	4.7V BD	49K47	Db	2.8V	BD49K28
Bm	4.6V BD	48K46	Ae	2.7V BD	48K27	Ef	4.6V BD	49K46	Da	2.7V	BD49K27
Bk	4.5V BD	48K45	Ad	2.6V BD	48K26	Ee	4.5V BD	49K45	Cy	2.6V	BD49K26
Bh	4.4V BD	48K44	Ac	2.5V BD	48K25	Ed	4.4V BD	49K44	Cr	2.5V	BD49K25
Bg	4.3V BD	48K43	Ab	2.4V BD	48K24	Ec	4.3V BD	49K43	Cp	2.4V	BD49K24
Bf	4.2V BD	48K42	Aa	2.3V BD	48K23	Eb	4.2V BD	49K42	Cn	2.3V	BD49K23

Marking	Detection Voltage	Part Number	Marking	Detection Voltage	Part Number	Marking	Detection Voltage	Part Number	Marking	Detection Voltage	Part Number
Kb	6.0V BD	48L60	Gn	4.1V BD	48L41	Np	6.0V BD	49L60	Mg	4.1V	BD49L41
Ka	5.9V BD	48L59	Gm	4.0V BD	48L40	Nn	5.9V BD	49L59	Mf	4.0V	BD49L40
Hy	5.8V BD	48L58	Gk	3.9V BD	48L39	Nm	5.8V BD	49L58	Me	3.9V	BD49L39
Hr	5.7V BD	48L57	Gh	3.8V BD	48L38	Nk	5.7V BD	49L57	Md	3.8V	BD49L38
Hp	5.6V BD	48L56	Gg	3.7V BD	48L37	Nh	5.6V BD	49L56	Mc	3.7V	BD49L37
Hn	5.5V BD	48L55	Gf	3.6V BD	48L36	Ng	5.5V BD	49L55	Mb	3.6V	BD49L36
Hm	5.4V BD	48L54	Ge	3.5V BD	48L35	Nf	5.4V BD	49L54	Ma	3.5V	BD49L35
Hk	5.3V BD	48L53	Gd	3.4V BD	48L34	Ne	5.3V BD	49L53	Ky	3.4V	BD49L34
Hh	5.2V BD	48L52	Gc	3.3V BD	48L33	Nd	5.2V BD	49L52	Kr	3.3V	BD49L33
Hg	5.1V BD	48L51	Gb	3.2V BD	48L32	Nc	5.1V BD	49L51	Kp	3.2V	BD49L32
Hf	5.0V BD	48L50	Ga	3.1V BD	48L31	Nb	5.0V BD	49L50	Kn	3.1V	BD49L31
He	4.9V BD	48L49	Fy	3.0V BD	48L30	Na	4.9V BD	49L49	Km	3.0V	BD49L30
Hd	4.8V BD	48L48	Fr	2.9V BD	48L29	My	4.8V BD	49L48	Kk	2.9V	BD49L29
Hc	4.7V BD	48L47	Fp	2.8V BD	48L28	Mr	4.7V BD	49L47	Kh	2.8V	BD49L28
Hb	4.6V BD	48L46	Fn	2.7V BD	48L27	Mp	4.6V BD	49L46	Kg	2.7V	BD49L27
Ha	4.5V BD	48L45	Fm	2.6V BD	48L26	Mn	4.5V BD	49L45	Kf	2.6V	BD49L26
Gy	4.4V BD	48L44	Fk	2.5V BD	48L25	Mm	4.4V BD	49L44	Ke	2.5V	BD49L25
Gr	4.3V BD	48L43	Fh	2.4V BD	48L24	Mk	4.3V BD	49L43	Kd	2.4V	BD49L24
Gp	4.2V BD	48L42	Fg	2.3V BD	48L23	Mh	4.2V BD	49L42	Kc	2.3V	BD49L23

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

Parameter S		ymbol	Limits	Unit
Power Supply Voltage		V_{DD}-GND	-0.3 to +10	V
Output Voltage	Nch Open Drain Output	V_{OUT}	GND-0.3 to +10	V
	CMOS Output		GND-0.3 to V_{DD}+0.3	
Power Dissipation	SSOP5 *1*3	540 Pd		mW
	VSOF5 *2*3		210	
Operating Temperature		Topr	-40 to +105	°C
Ambient Storage Temperature		Tstg	-55 to +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 S	ymbol	Condition		Limit Min. T	Limit yp.	Limit Max.	Unit
Detection Voltage	V_{DET} R	L=470kΩ, VDD=H→L *1		V_{DET}(T) ×0.99	V_{DET}(T)	V_{DET}(T) ×1.01	V
Output Delay Time "L→H" t	PLH	CL=100pF R L =100kΩ Vout=GND→50% *2		- -		100	μs
Circuit Current when ON	ICC1 V	DD=V_{DET}-0.2V *1	V_{DET}=2.3-3.1V -		0.51	1.53	μA
			V_{DET}=3.2-4.2V -		0.56	1.68	
			V_{DET}=4.3-5.2V -		0.60	1.80	
			V_{DET}=5.3-6.0V -		0.66	1.98	
Circuit Current when OFF	ICC2 V	DD=V_{DET}+2.0V *1	V_{DET}=2.3-3.1V -		0.75	2.25	μA
			V_{DET}=3.2-4.2V -		0.80	2.40	
			V_{DET}=4.3-5.2V -		0.85	2.55	
			V_{DET}=5.3-6.0V -		0.90	2.70	
Operating Voltage Range	VOPL	VOL≤0.4V, Ta=25 to 105°C, RL=470kΩ 0.95			-	-	V
		VOL≤0.4V, Ta=-40 to 25°C, RL=470kΩ 1.20			-	-	
'Low'Output Current (Nch)	IOL	VDS=0.5V, VDD=1.5V, V_{DET}=2.3-6.0V 0.4			1.0	-	mA
		VDS=0.5V, VDD=2.4V, V_{DET}=2.7-6.0V 2.0			4.0	-	
'High'Output Current (Pch) (BD49xxx Series)	IOH	VDS=0.5V, VDD=4.8V, V_{DET}=2.3-4.2V		0.7	1.4	-	mA
		VDS=0.5V, VDD=6.0V, V_{DET}=4.3-5.2V		0.9	1.8	-	
		VDS=0.5V, VDD=8.0V, V_{DET}=5.3-6.0V		1.1	2.2	-	
Leak Current when OFF (BD48xxx Series)	I_{leak} V	DD=VDS=10V *1		- -		0.1	μA
Detection Voltage Temperature coefficient	$V_{DET}/\Delta T$	Ta=-40°C to 105°C (Designed Guarantee)		- ±10	0	±360	ppm/°C
Hysteresis Voltage	ΔV_{DET} V	DD=L→H→L V		DET×0.03	V DET×0.05	V DET×0.08	V

V_{DET}(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 Guar antee is Ta=25°C.
*2 tPLH:VDD=(V_{DET} typ.-0.5V)→(V_{DET} typ.+0.5V)

●**Block Diagrams**

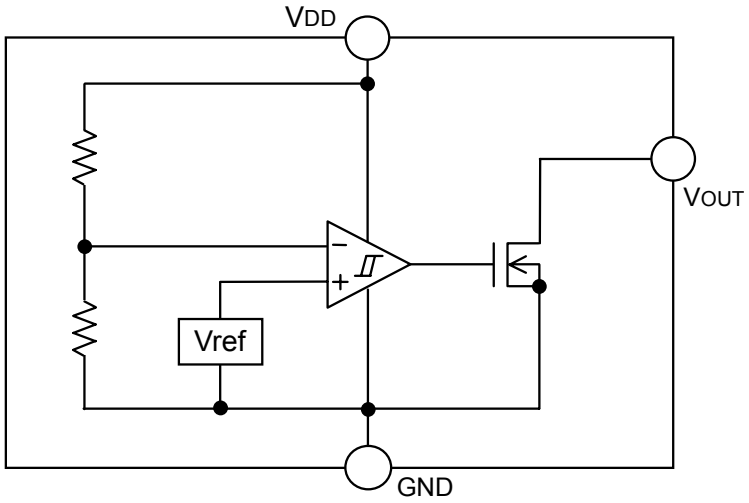


Fig.1 BD48xxx series

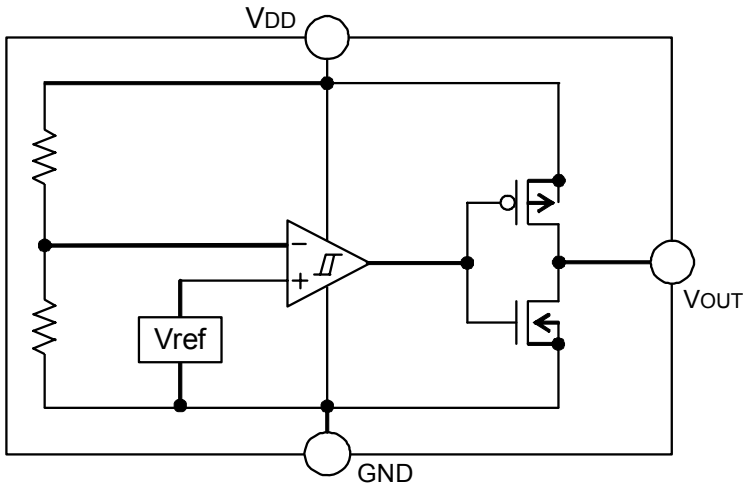


Fig.2 BD49xxx series

●**Typical Performance Curves**

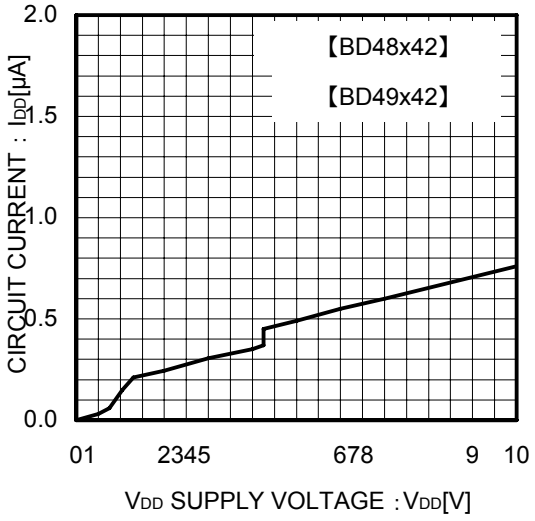


Fig.3 Circuit Current

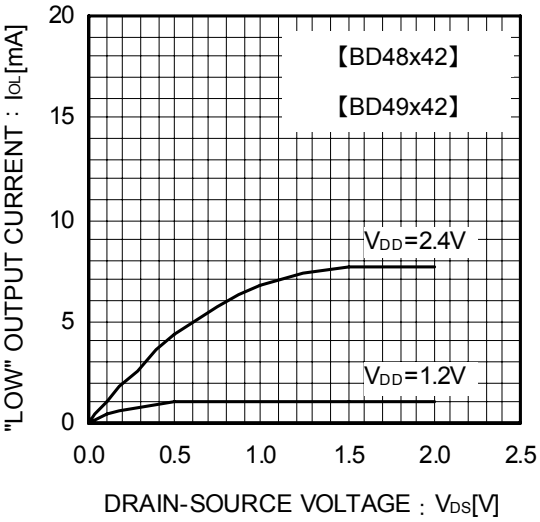


Fig.4 “Low” Output Current

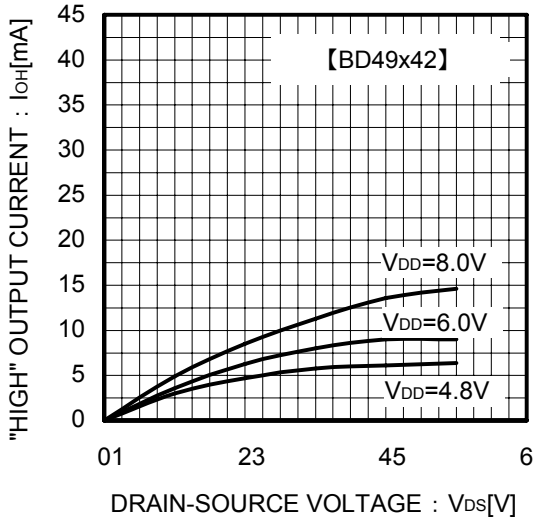


Fig.5 “High” Output Current

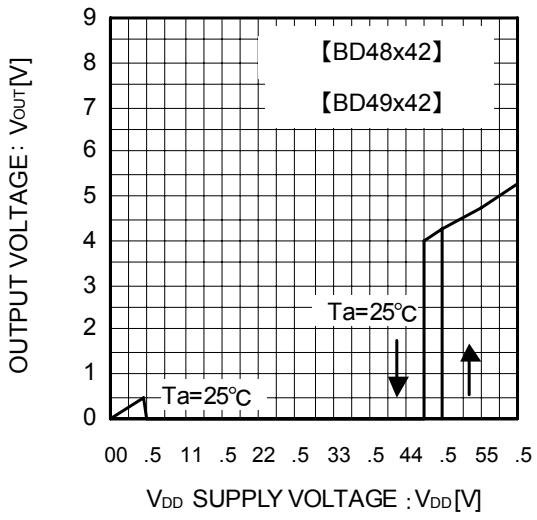


Fig.6 I/O Characteristics

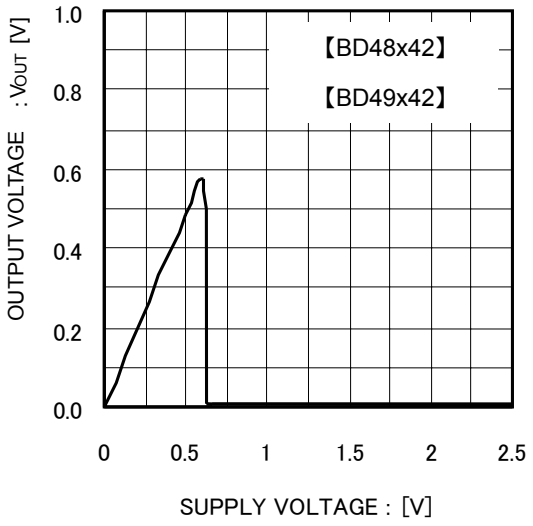


Fig.7 Operating Limit Voltage

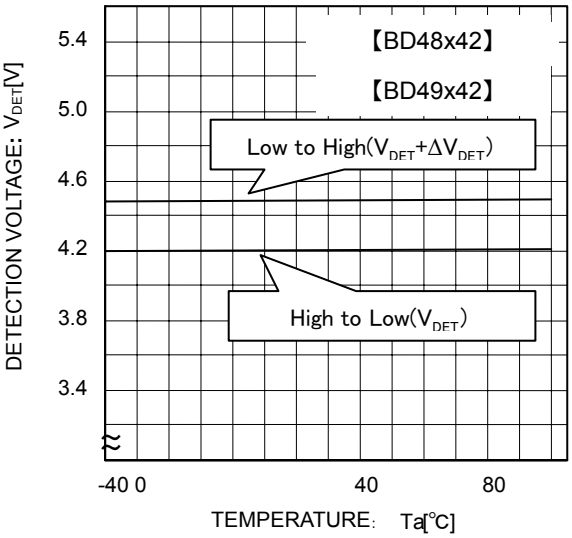


Fig.8 Detection Voltage
Release Voltage

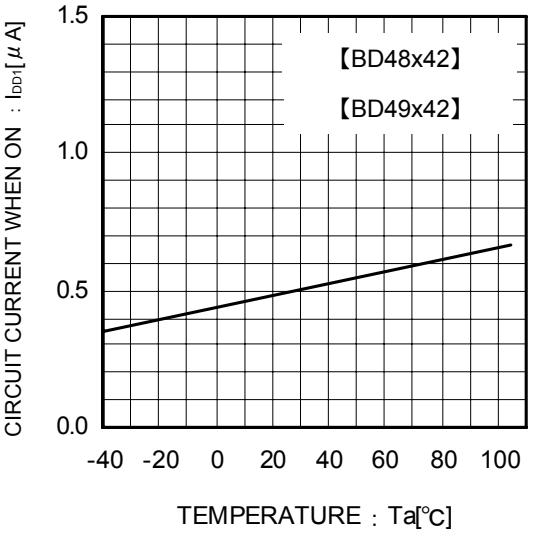


Fig.9 Circuit Current when ON

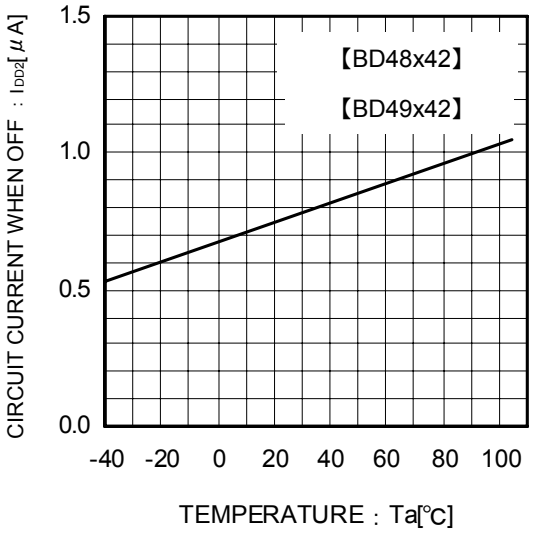


Fig.10 Circuit Current when OFF

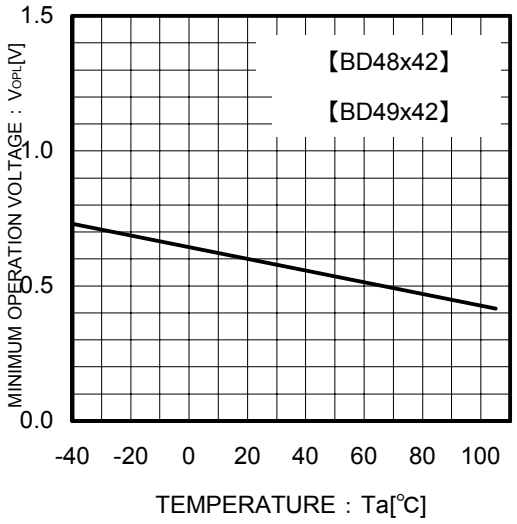


Fig.11 Operating Limit Voltage

●Application Information

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 V_{DD} pins reaches the applicable threshold voltage, the V_{OUT} terminal voltage switches from either "High" to "Low" or from "Low" to "High". Please refer to the Timing Waveform and Electrical Characteristics for information on hysteresis.

Because the BD48xxx series uses an open drain output type, it is possible to connect a pull-up resistor to V_{DD} or another power supply [The output "High" voltage (V_{OUT}) in this case becomes V_{DD} or the voltage of the other power supply].

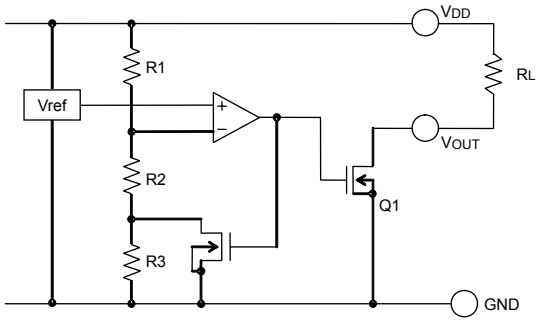


Fig.12 (BD48xxx series Internal Block Diagram)

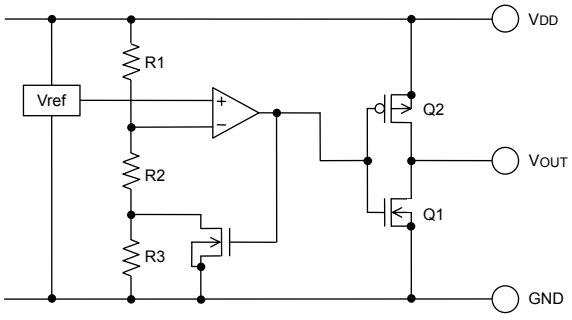


Fig.13 (BD49xxx series Internal Block Diagram)

Reference Data

Examples of Leading (t_{PLH}) and Falling (t_{PHL}) Output

Part Number	t_{PLH} (µs) t	$_{PHL}$ (µs)
BD48x45	39.5	87.8
BD49x45	32.4	52.4
	V_{DD}=4.3V→5.1V	V_{DD}=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.

Timing Waveform

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

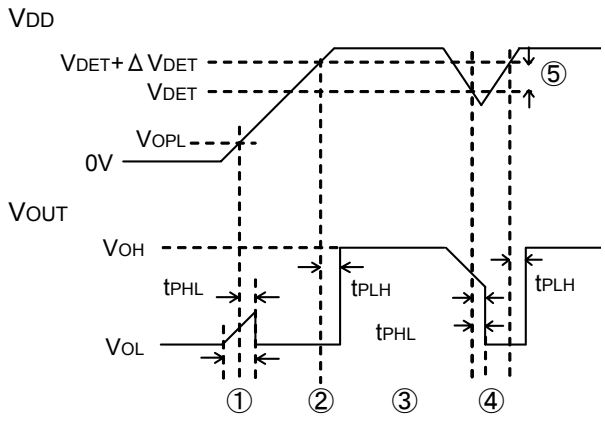


Fig.14 Timing Waveform

① When the power supply is turned on, the output is unsettled from after over the operating limit voltage (V_{OPL}) until t_{PHL}. Therefore it is possible that the reset signal is not valid when the rise time of V_{DD} is faster than t_{PHL}.

② When V_{DD} is greater than V_{OPL} but less than the reset release voltage ($V_{DET} + \Delta V_{DET}$), the output voltages will switch to Low.

③ If V_{DD} exceeds the reset release voltage ($V_{DET} + \Delta V_{DET}$), then V_{OUT} switches from L to H.

④ If V_{DD} drops below the detection voltage (V_{DET}) when the power supply is powered down or when there is a power supply fluctuation, V_{OUT} switches to L (with a delay of t_{PHL}).

⑤ The potential difference between the detection voltage and the release voltage is known as the hysteresis width (ΔV_{DET}). 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**

Examples of a common power supply detection reset circuit.

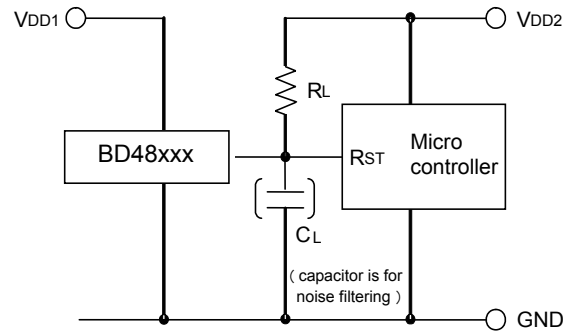


Fig.15 Open Drain Output Type

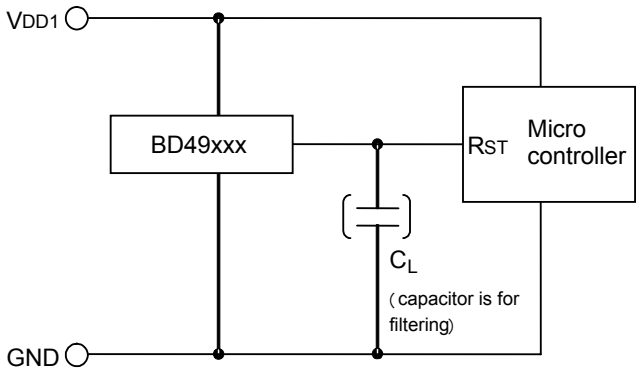


Fig.16 CMOS Output Type

Application examples of BD48xxx series (Open Drain output type) and BD49xxx series (CMOS output type) are shown below.

CASE1: the power supply of the microcontroller (V_{DD2}) differs from the power supply of the reset detection (V_{DD1}). Use an open drain output type (BD48xxx) device with a load resistance R_L attached as shown in figure 15.

CASE2: the power supply of the microcontroller (V_{DD1}) is same as the power supply of the reset detection (V_{DD1}). Use a CMOS output type (BD49xxx) device or an open drain device with a pull up resistor between output and VDD1.

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

The Electrical characteristics were measured using R_L= 470kΩ and C_L = 100pF.

●**Operational 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 V_{DD} pin and GND, and the capacitor of about 1000pF between V_{OUT} 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 V_{DD} pin, Output pin and GND pin, or V_{DD} 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 V_{DD} line inpedance might cause oscillation because of the detection current.

8. A V_{DD} -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 V_{OUT} terminal and the GND terminal, the pull-up resistor should be less than 1/10 of the assumed leakage resistance.

11. External parameters
The recommended parameter range for R_L is 10kΩ to 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 V_{DD} 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.

Status of this document
The Japanese version of this document is formal specification. A customer may use this translation version only for a reference to help reading the formal version.
If there are any differences in translation version of this document formal version takes priority.

Notice

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   [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
   [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
   [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
   [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
   [f] Sealing or coating our Products with resin or other coating materials
   [g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
   [h] Use of the Products in places subject to dew condensation

4) The Products are not subject to radiation-proof design.

5) Please verify and confirm characteristics of the final or mounted products in using the Products.

6) In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse) is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.

7) De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta). When used in sealed area, confirm the actual ambient temperature.

8) Confirm that operation temperature is within the specified range described in the product specification.

9) ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

●Precaution for Mounting / Circuit board design

1) When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.

2) In principle, the reflow soldering method must be used; if flow soldering method is preferred, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

●Precautions Regarding Application Examples and External Circuits

1) If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.

2) You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

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This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

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1) Product performance and soldered connections may deteriorate if the Products are stored in the places where:
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   [b] the temperature or humidity exceeds those recommended by ROHM
   [c] the Products are exposed to direct sunshine or condensation
   [d] the Products are exposed to high Electrostatic

2) Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.

3) Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

4) Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

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