Datasheet

Voltage Detector IC Series

Standard CMOS Voltage Detector IC

BD48Exxx-M series BD49Exxx-M series (for Automotive Accessories)

●General Description
ROHM's BD48Exxx-M and BD49Exxx-M series are highly accurate, low current consumption Voltage Detector 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.

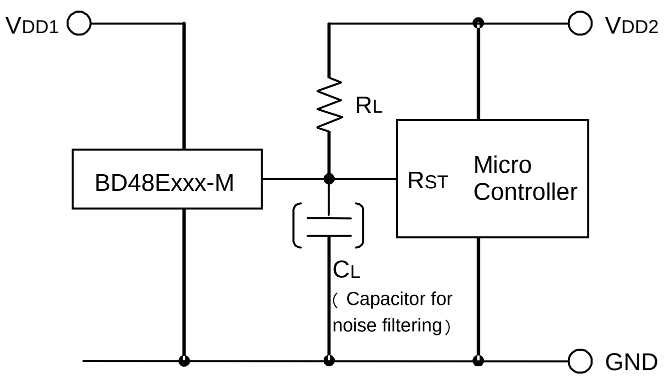
●Features
- High accuracy detection
- Ultra-low current consumption
- Two output types (N-ch open drain and CMOS output)
- Wide Operating temperature range
- Very small and low height package
- Package SSOP5 is similar to SOT-23-5(JEDEC)

●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

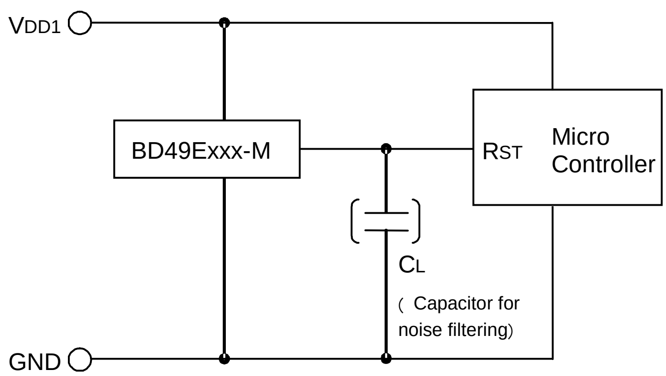
●Package
SSOP5:  2.90mm x 2.80mm x 1.25mm

●Applications
Circuits using microcontrollers or logic circuits that require a reset.

●Typical Application Circuit



(Open Drain Output type)
BD48Exxx-M series

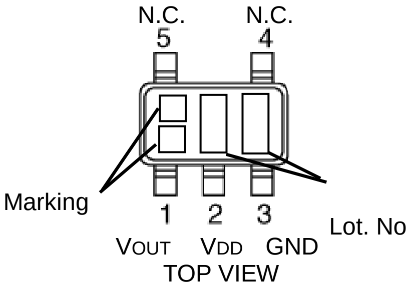


(CMOS Output type)
BD49Exxx-M series

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

●Connection Diagram

SSOP5



●Pin Descriptions

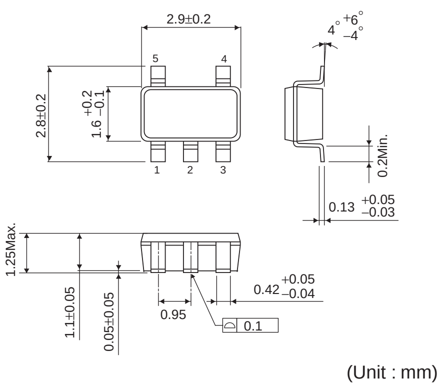
SSOP5		
PIN No.	Symbol	Function
1	VOUT	Reset Output
2	VDD	Power Supply Voltage
3	GND	GND
4	N.C.	Unconnected Terminal
5	N.C.	Unconnected Terminal

● Ordering Information

B D x x E x x x － M T R

Part Number	Output Type	Reset Voltage Value	Package	Automotive Accessories	Packaging and forming specification
BD	48 : Open Drain 49 : CMOS	23 : 2.3V ⇩ 0.1V step 60 : 6.0V	G : SSOP5	M	TR : Embossed tape and reel

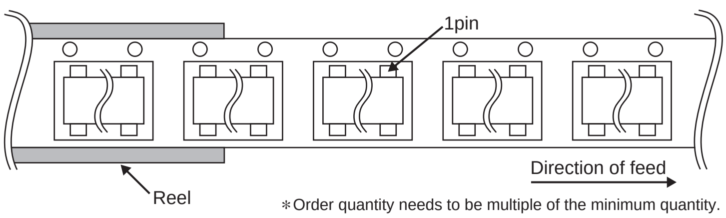
SSOP5



(Unit : mm)

<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.

●**Lineup**

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

●Absolute Maximum Ratings

Parameter		Symbol	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	
Output Current		Io	70	mA
Power Dissipation	SSOP5 *1*2	Pd	540	mW
Operating Temperature		Topr	-40 to +105	°C
Ambient Storage Temperature		Tstg	-55 to +125	°C

*1 Reduced by 5.4mW/°C when used over 25°C.
*2 When mounted on ROHM standard circuit board (70mm×70mm×1.6mm, glass epoxy board).

●Electrical Characteristics (Unless Otherwise Specified Ta=-40°C to 105°C)

Parameter	Symbol	Condition		Limit Min.	Limit Typ.	Limit Max.	Unit
Detection Voltage	V_{DET}	RL=470kΩ, VDD=H→L *1		V_{DET}(T) ×0.99	V_{DET}(T)	V_{DET}(T) ×1.01	V
		VDET=2.5V	Ta=+25°C	2.475	2.5	2.525	
			Ta=-40°C to 85°C	2.418	-	2.584	
			Ta=85°C to 105°C	2.404	-	2.597	
		VDET=3.0V	Ta=+25°C	2.970	3.0	3.030	
			Ta=-40°C to 85°C	2.901	-	3.100	
			Ta=85°C to 105°C	2.885	-	3.117	
		VDET=3.3V	Ta=+25°C	3.267	3.3	3.333	
			Ta=-40°C to 85°C	3.191	-	3.410	
			Ta=85°C to 105°C	3.173	-	3.428	
		VDET=4.2V	Ta=+25°C	4.158	4.2	4.242	
			Ta=-40°C to 85°C	4.061	-	4.341	
			Ta=85°C to 105°C	4.039	-	4.364	
		VDET=4.8V	Ta=+25°C	4.752	4.8	4.848	
			Ta=-40°C to 85°C	4.641	-	4.961	
			Ta=85°C to 105°C	4.616	-	4.987	
Output Delay Time "L→H"	tPLH	CL=100pF RL=100kΩ Vout=GND→50% *2		-	-	100	µs
Circuit Current when ON	ICC1	VDD=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	VDD=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	-	-	

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.
Design Guarantee. (Outgoing inspection is not done on all products.)
*1 Guarantee is Ta=25°C.
*2 tPLH:VDD=(V_{DET} typ.-0.5V)→(V_{DET} typ.+0.5V)

●Electrical Characteristics (Unless Otherwise Specified Ta=-40°C to 105°C) - continued

Parameter	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
'Low'Output Voltage (Nch)	V_{OL}	V_{DD}=1.5V, I_{SINK} = 0.4 mA, V_{DET}=2.3-6.0V	-	-	0.5	V
		V_{DD}=2.4V, I_{SINK} = 2.0 mA, V_{DET}=2.7-6.0V	-	-	0.5	
'High'Output Voltage (Pch) (BD49Exxx-M Series)	V_{OH}	V_{DD}=4.8V, I_{SOURCE}=0.7 mA, V_{DET}(2.3V to 4.2V)	VDD-0.5	-	-	V
		V_{DD}=6.0V, I_{SOURCE}=0.9 mA, V_{DET}(4.3V to 5.2V)	VDD-0.5	-	-	
		V_{DD}=8.0V, I_{SOURCE}=1.1 mA, V_{DET}(5.3V to 6.0V)	VDD-0.5	-	-	
Leak Current when OFF (BD48Exxx-M Series)	I_{leak}	V_{DD}=V_{DS}=10V *1	-	-	0.1	µA
Detection Voltage Temperature coefficient	$V_{DET}/\Delta T$	Ta=-40°C to 105°C (Designed Guarantee)	-	±100	±360	ppm/°C
Hysteresis Voltage	ΔV_{DET}	V_{DD}=L→H→L, R_L=470kΩ	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.
Design Guarantee. (Outgoing inspection is not done on all products.)
*1 Guarantee is Ta=25°C.

●Block Diagrams

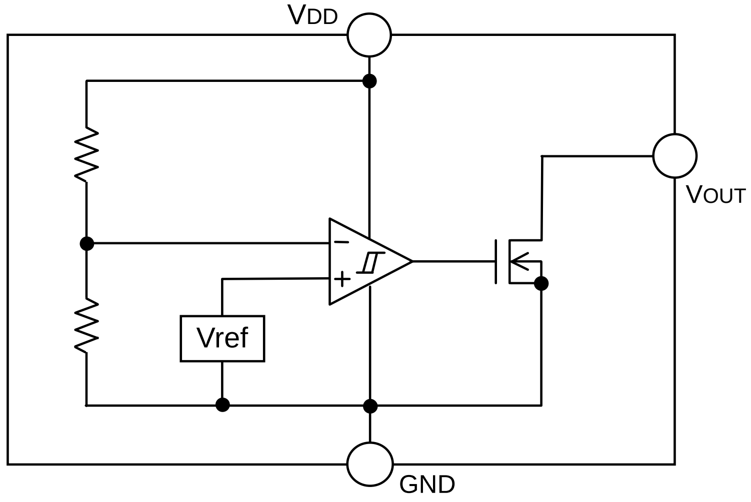


Fig.1 BD48Exxx-M series

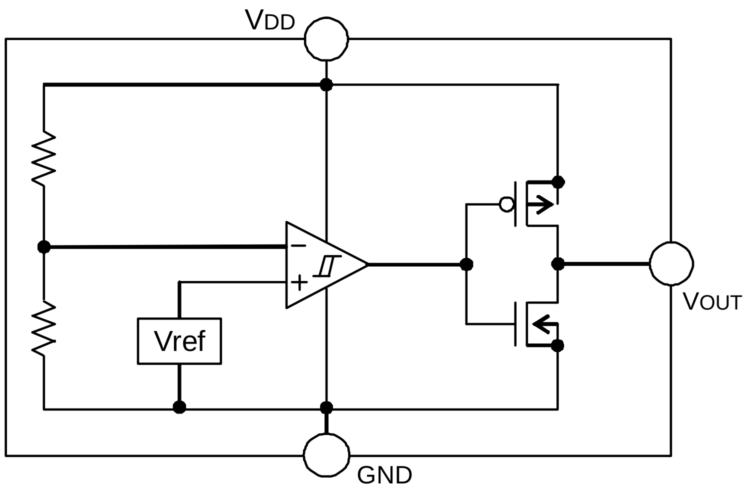


Fig.2 BD49Exxx-M series

●**Typical Performance Curves**

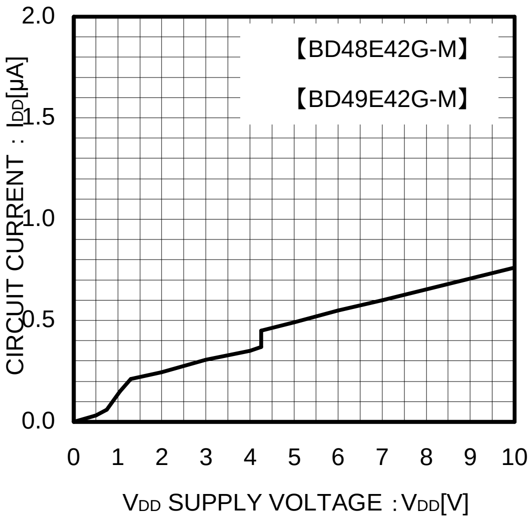


Fig.3 Circuit Current

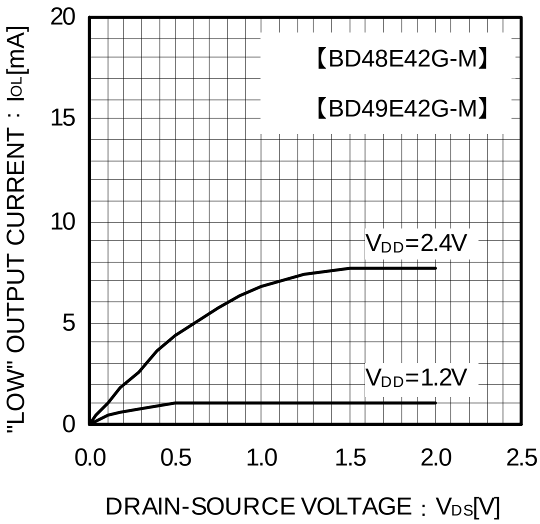


Fig.4 “Low” Output Current

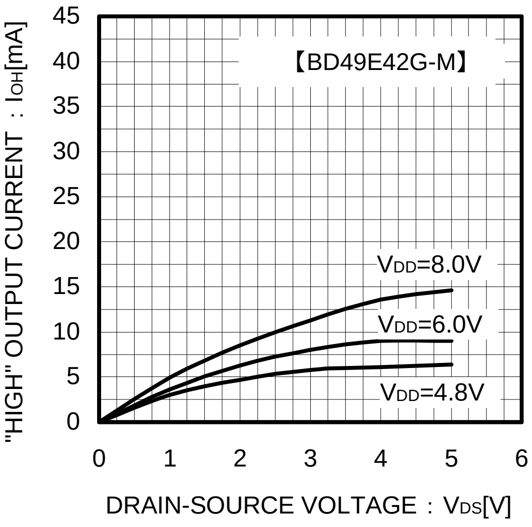


Fig.5 “High” Output Current

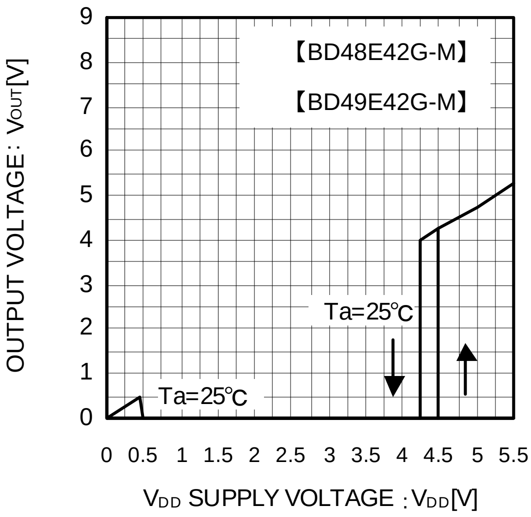


Fig.6 I/O Characteristics

●**Typical Performance Curves – continued**

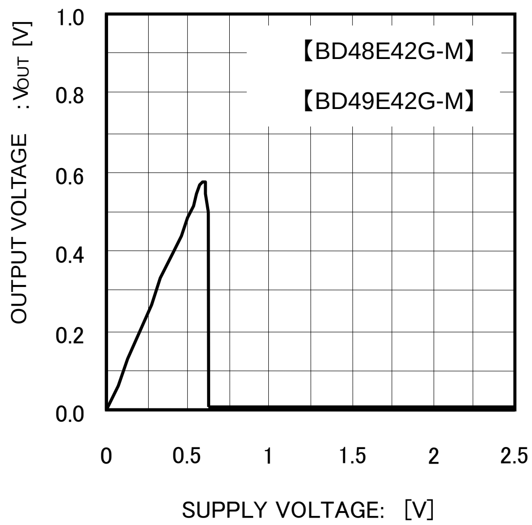


Fig.7 Operating Limit Voltage

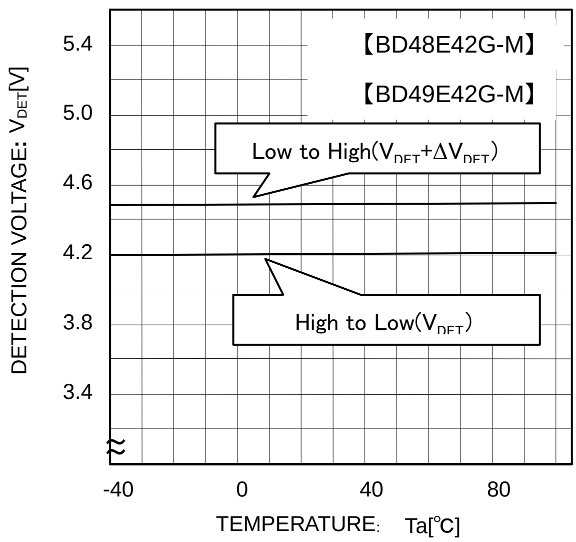


Fig.8 Detection Voltage
Release Voltage

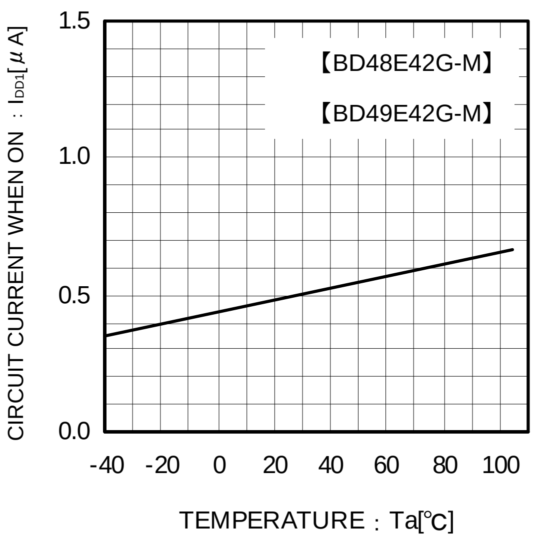


Fig.9 Circuit Current when ON

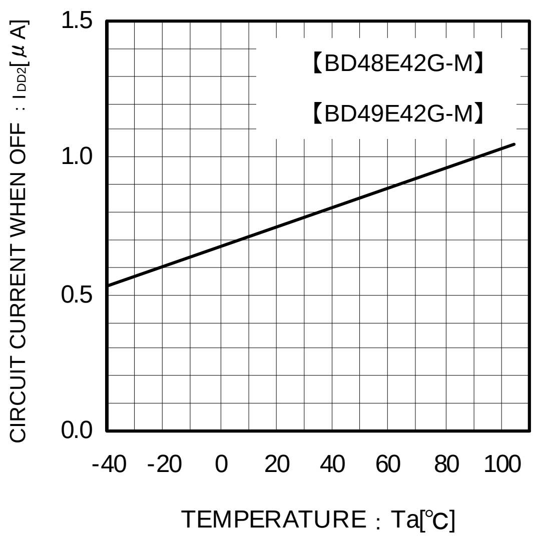


Fig.10 Circuit Current when OFF

●**Typical Performance Curves – continued**

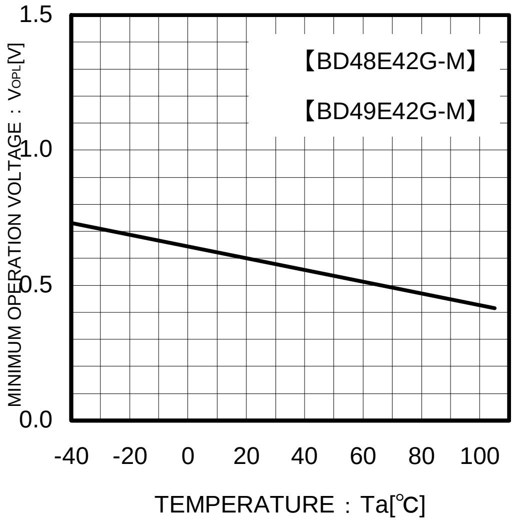


Fig.11 Operating Limit Voltage

●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 BD48Exxx-M series uses an open drain output type, it is necessary to connect a pull-up resistor to V_{DD} or another power supply if needed [The output "High" voltage (V_{OUT}) in this case becomes V_{DD} or the voltage of the other power supply].

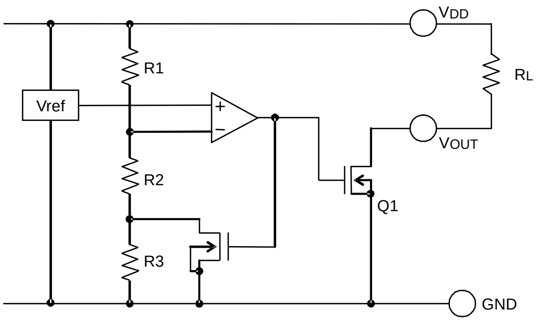


Fig.12 (BD48Exxx-M series Internal Block Diagram)

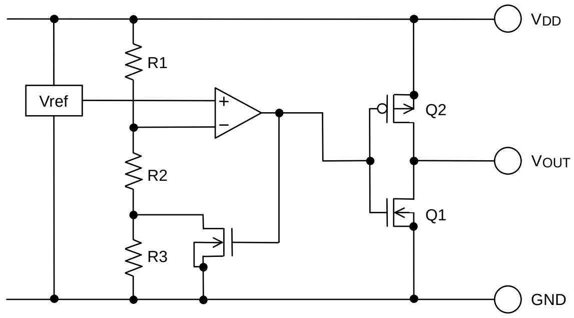


Fig.13 (BD49Exxx-M series Internal Block Diagram)

Reference Data

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

Part Number	t_{PLH} (µs)	t_{PHL} (µs)
BD48E45G-M	39.5	87.8
BD49E45G-M	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).

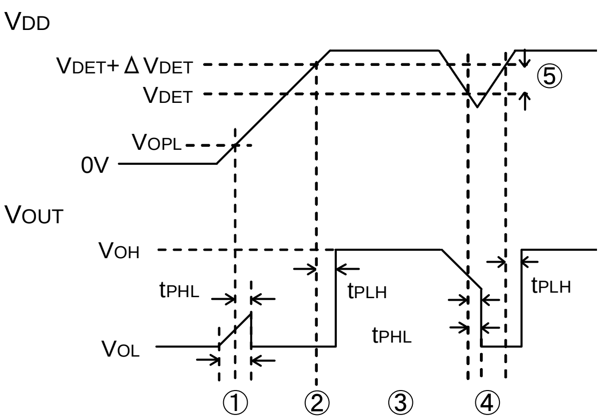


Fig.14 Timing Waveform

① When the power supply is turned on, the output is unstable 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} + ΔV_{DET}), the output voltages will switch to Low.

③ If V_{DD} exceeds the reset release voltage (V_{DET} + ΔV_{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 toggle with power supply fluctuations within this hysteresis width, preventing the
malfunctions due to noise.

●Circuit Applications

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

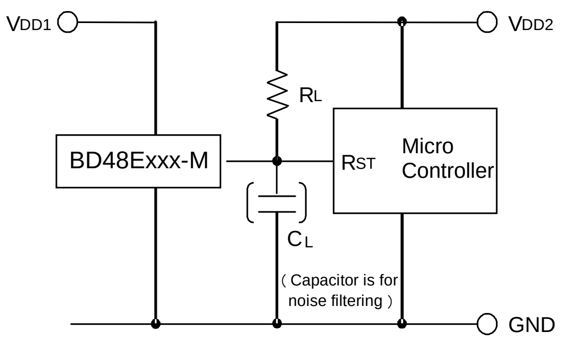


Fig.15 Open Drain Output Type

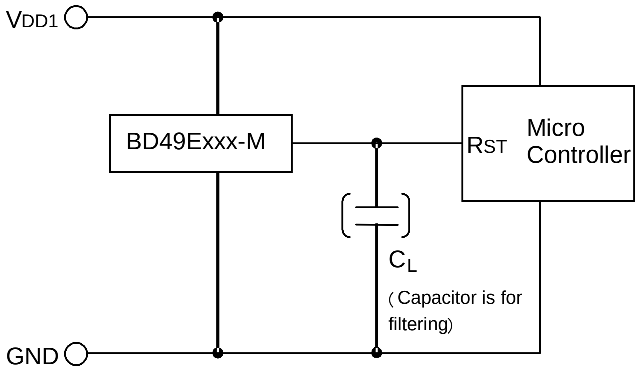


Fig.16 CMOS Output Type

Application examples of BD48Exxx-M series (Open Drain output type) and BD49Exxx-M series (CMOS output type) are shown on the left.

CASE1: 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-M) device with a load resistance R_L attached as shown in figure 15.

CASE2: 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-M) 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.

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

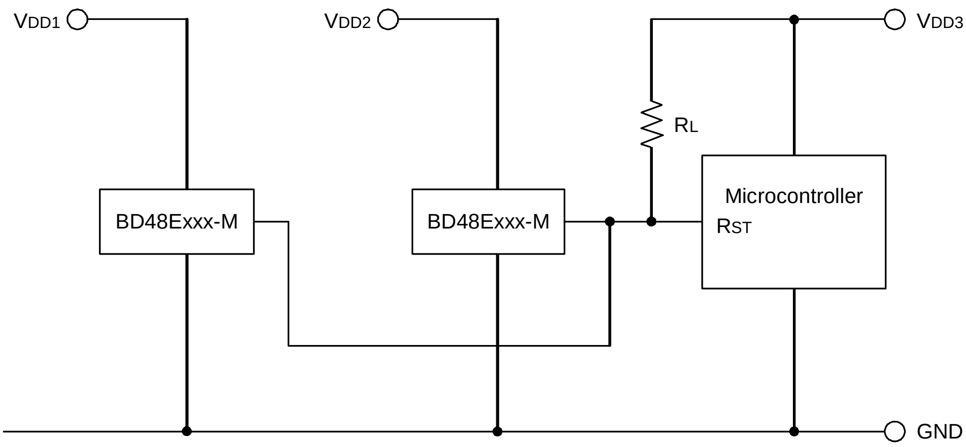


Fig.17

To reset the microcontroller when many independent power supplies are used in the system, OR connect an open drain output type (BD48Exxx-M series) to the microcontroller's input with pull-up resistor to the supply voltage of the microcontroller (V_{DD3}) as shown in Fig. 17. By pulling-up to V_{DD3}, output "High" voltage of micro-controller power supply is possible.

3) Examples of the power supply with resistor dividers

In applications wherein the power supply voltage of an IC comes from a resistor divider circuit, an in-rush current will flow into the circuit when the output level switches from “High” to “Low” or vice versa. In-rush current is a sudden surge of current that flows from the power supply (VDD) to ground (GND) as the output logic changes its state. This current flow may cause malfunction in the systems operation such as output oscillations, etc.

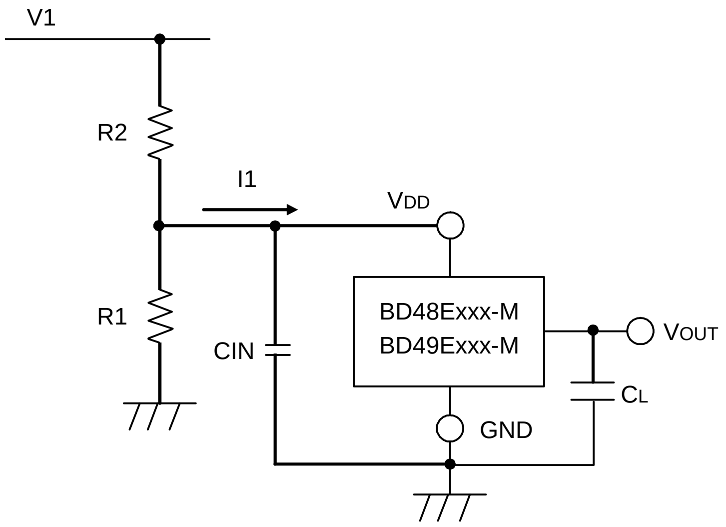


Fig.18

When an in-rush current (I1) flows into the circuit (Refer to Fig. 18) at the time when output switches from “Low” to “High”, a voltage drop of I1×R2 (input resistor) will occur in the circuit causing the VDD supply voltage to decrease. When the VDD voltage drops below the detection voltage, the output will switch from “High” to “Low”. While the output voltage is at “Low” condition, in-rush current will stop flowing and the voltage drop will be reduced. As a result, the output voltage will switches again from “Low” to “High” which causes an in-rush current and a voltage drop. This operation repeats and will result to oscillation.

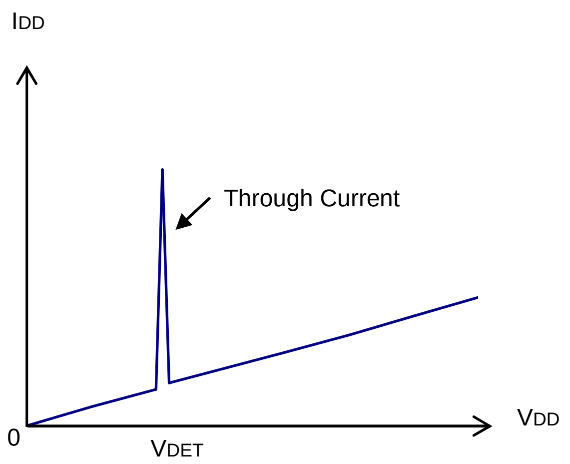


Fig.19 Current Consumption vs. Power Supply Voltage

●Operational Notes

1) Absolute maximum ratings
Operating the IC over the absolute maximum ratings may damage the IC. The damage can either be a short circuit between pins or an open circuit between pins. Therefore, it is important to consider circuit protection measures, such as adding a fuse, in case the IC is operated over the absolute maximum ratings.

2) Ground Voltage
The voltage of the ground pin must be the lowest voltage of all pins of the IC at all operating conditions. Ensure that no pins are at a voltage below the ground pin at any time, even during transient condition.

3) Recommended operating conditions
These conditions represent a range within which the expected characteristics of the IC can be approximately obtained. The electrical characteristics are guaranteed under the conditions of each parameter.

4) Bypass Capacitor for Noise Rejection
To help reject noise, put a 1µF capacitor between V_{DD} pin and GND and 1000pF capacitor between V_{OUT} pin and GND. Be careful when using extremely big capacitor as transient response will be affected.

5) Short between pins and mounting errors
Be careful when mounting the IC on printed circuit boards. The IC may be damaged if it is mounted in a wrong orientation or if pins are shorted together. Short circuit may be caused by conductive particles caught between the pins.

6) Operation under strong electromagnetic field
Operating the IC in the presence of a strong electromagnetic field may cause the IC to malfunction.

7) The V_{DD} line impedance might cause oscillation because of the detection current.

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

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

10) 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.

11) Power on reset operation
Please note that the power on reset output varies with the V_{DD} rise time. Please verify the behavior in the actual operation.

12) Testing on application boards
When testing the IC on an application board, connecting a capacitor directly to a low-impedance output pin may subject the IC to stress. Always discharge capacitors completely after each process or step. The IC's power supply should always be turned off completely before connecting or removing it from the test setup during the inspection process. To prevent damage from static discharge, ground the IC during assembly and use similar precautions during transport and storage.

13) Rush current
When power is first supplied to the IC, rush current may flow instantaneously. It is possible that the charge current to the parasitic capacitance of internal photo diode or the internal logic may be unstable. Therefore, give special consideration to power coupling capacitance, power wiring, width of GND wiring, and routing of connections.

14) 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 10MΩ leakage is assumed between the C_T terminal and the GND terminal, 1MΩ connection between the CT terminal and the V_{DD} terminal would be recommended. Also, 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.

● **Revision History**

Date	Revision	Changes
30.Mar.2012	001	New Release
14.Dec.2012	002	Updated General Description, Features, Applications, Absolute maximum ratings, Explanation of Operation, Timing Waveform, Circuit Applications, and Operational Notes. Changed Lineup table format. Add Io in Absolute Maximum Rating table Add limits for VDET specifically at VDET=2.5V,3.0V,3.3V,4.2V,4.8V Change parameter in electrical characteristics from IOL to VOL and IOH to VOH Add circuits application numbers 2 and 3 Added Revision History.
22.May.2013	003	Change limits for VDET at VDET=2.5V,3.0V,3.3V,4.2V,4.8V

Notice

General Precaution

1. Before you use our Products, you are requested to carefully read this document and fully understand its contents. ROHM shall not be in any way responsible or liable for failure, malfunction or accident arising from the use of any ROHM's Products against warning, caution or note contained in this document.

2. All information contained in this document is current as of the issuing date and subject to change without any prior notice. Before purchasing or using ROHM's Products, please confirm the latest information with a ROHM sales representative.

Precaution on using ROHM Products

1. If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment, aircraft/spacecraft, nuclear power controllers, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, 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 any ROHM's Products for Specific Applications.

2. ROHM designs and manufactures its Products subject to strict quality control system. However, semiconductor products can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against the physical injury, damage to any property, which a failure or malfunction of our Products may cause. The following are examples of safety measures:
   [a] Installation of protection circuits or other protective devices to improve system safety
   [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

3. Our Products are not designed under any special or extraordinary environments or conditions, as exemplified below. Accordingly, ROHM shall not be in any way responsible or liable for any damages, expenses or losses arising from the use of any ROHM's Products under any special or extraordinary environments or conditions. If you intend to use our Products under any special or extraordinary environments or conditions (as exemplified below), your independent verification and confirmation of product performance, reliability, etc, prior to use, must be necessary:
   [a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
   [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.

Precaution for Electrostatic

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).

Precaution for Storage / Transportation

1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
   - [a] the Products are exposed to sea winds or corrosive gases, including Cl2, H2S, NH3, SO2, and NO2
   - [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.

Precaution for Product Label

QR code printed on ROHM Products label is for ROHM's internal use only.

Precaution for Disposition

When disposing Products please dispose them properly using an authorized industry waste company.

Precaution for Foreign Exchange and Foreign Trade act

Since our Products might fall under controlled goods prescribed by the applicable foreign exchange and foreign trade act, please consult with ROHM representative in case of export.

Precaution Regarding Intellectual Property Rights

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