Voltage Detector IC Series

Free Delay Time Setting CMOS Voltage Detector IC Series

BD52xx series BD53xx series

●General Description

Rohm's BD52xx and BD53xx series are highly accurate, low current consumption reset ICs with a capacitor controlled time delay. The line up includes BD52xx devices with N channel open drain output and BD53xx 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

- Free delay time setting by external capacitor
- Two output types (Nch open drain and CMOS output)
- Ultra-low current consumption
- 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: 0.95μA (Typ.)

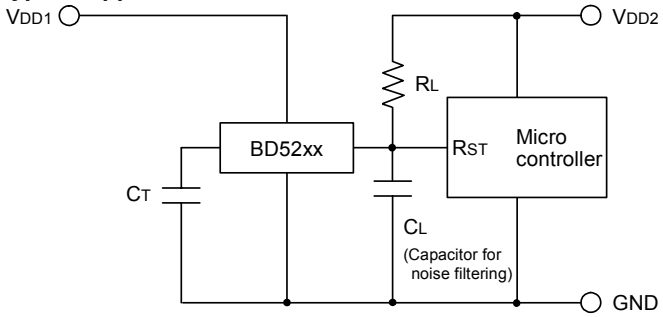
●Package

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

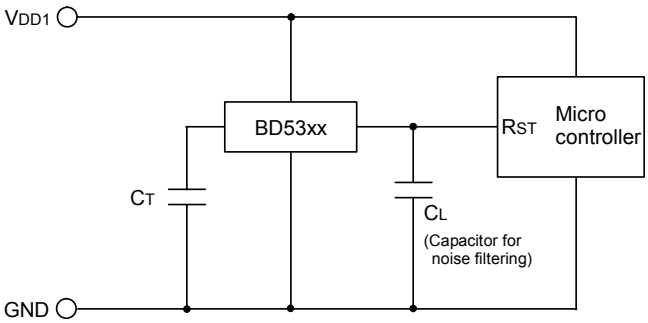
●Applications

Circuits using microcontrollers or logic circuits that require a reset or Power Good signal.

●Typical Application Circuit



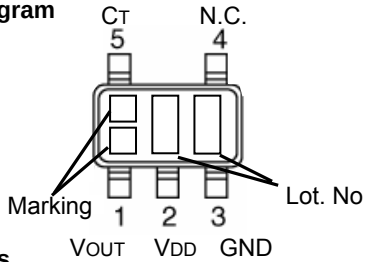
Open Drain Output type
BD52xx Series



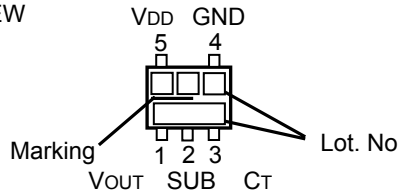
CMOS Output type
BD53xx Series

●Connection Diagram

SSOP5
TOP VIEW



VSOF5
TOP VIEW



●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	CT	Capacitor connection terminal for output delay time

VSOF5		
PIN No.	Symbol	Function
1	VOUT	Reset Output
2	SUB	Substrate*
3	CT	Capacitor connection terminal for output delay time
4	GND	GND
5	VDD	Power Supply Voltage

*Connect the substrate to GND.

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

●Ordering Information

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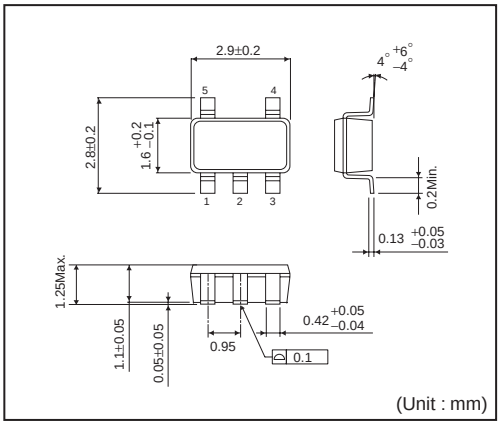
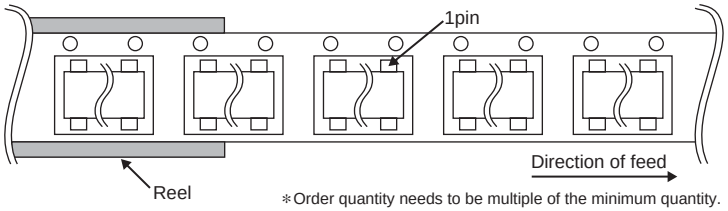
Part Number	Output Type 52 : Open Drain 53 : CMOS	Reset Voltage Value 23 : 2.3V ⇩ 0.1V step 60 : 6.0V	Package G : SSOP5 FVE : VSOF5	Packageing and forming specification TR : Embossed tape and reel

SSOP5



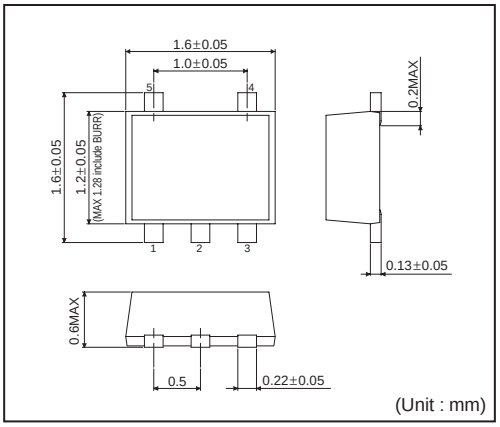
<Tape and Reel information>

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



●Lineup

Marking	Detection Voltage	Part Number	Marking	Detection Voltage	Part Number	Marking	Detection Voltage	Part Number	Marking	Detection Voltage	Part Number
PW	6.0V	BD5260	PB	4.1V	BD5241	RW	6.0V	BD5360	RB	4.1V	BD5341
PV	5.9V	BD5259	PA	4.0V	BD5240	RV	5.9V	BD5359	RA	4.0V	BD5340
PU	5.8V	BD5258	MV	3.9V	BD5239	RU	5.8V	BD5358	QV	3.9V	BD5339
PT	5.7V	BD5257	MU	3.8V	BD5238	RT	5.7V	BD5357	QU	3.8V	BD5338
PS	5.6V	BD5256	MT	3.7V	BD5237	RS	5.6V	BD5356	QT	3.7V	BD5337
PR	5.5V	BD5255	MS	3.6V	BD5236	RR	5.5V	BD5355	QS	3.6V	BD5336
PQ	5.4V	BD5254	MR	3.5V	BD5235	RQ	5.4V	BD5354	QR	3.5V	BD5335
PP	5.3V	BD5253	MQ	3.4V	BD5234	RP	5.3V	BD5353	QQ	3.4V	BD5334
PN	5.2V	BD5252	MP	3.3V	BD5233	RN	5.2V	BD5352	QP	3.3V	BD5333
PM	5.1V	BD5251	MN	3.2V	BD5232	RM	5.1V	BD5351	QN	3.2V	BD5332
PL	5.0V	BD5250	MM	3.1V	BD5231	RL	5.0V	BD5350	QM	3.1V	BD5331
PK	4.9V	BD5249	ML	3.0V	BD5230	RK	4.9V	BD5349	QL	3.0V	BD5330
PJ	4.8V	BD5248	MK	2.9V	BD5229	RJ	4.8V	BD5348	QK	2.9V	BD5329
PH	4.7V	BD5247	MJ	2.8V	BD5228	RH	4.7V	BD5347	QJ	2.8V	BD5328
PG	4.6V	BD5246	MH	2.7V	BD5227	RG	4.6V	BD5346	QH	2.7V	BD5327
PF	4.5V	BD5245	MG	2.6V	BD5226	RF	4.5V	BD5345	QG	2.6V	BD5326
PE	4.4V	BD5244	MF	2.5V	BD5225	RE	4.4V	BD5344	QF	2.5V	BD5325
PD	4.3V	BD5243	ME	2.4V	BD5224	RD	4.3V	BD5343	QE	2.4V	BD5324
PC	4.2V	BD5242	MD	2.3V	BD5223	RC	4.2V	BD5342	QD	2.3V	BD5323

●Absolute maximum ratings (Ta=25°C)

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	
Power Dissipation	SSOP5 *1*3	Pd	540	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	Symbol	Condition		Limit Min.	Limit Typ.	Limit Max.	Unit
Detection Voltage	V_{DET}	V_{DD}=H→L, R_L=470kΩ *1		V_{DET}(T) ×0.99	V_{DET}(T)	V_{DET}(T) ×1.01	V
Circuit Current when ON	I_{DD1}	V_{DD}=V_{DET}-0.2V	V_{DET} =2.3-3.1V	-	0.80	2.40	μA
			V_{DET} =3.2-4.2V	-	0.85	2.55	
			V_{DET} =4.3-5.2V	-	0.90	2.70	
			V_{DET} =5.3-6.0V	-	0.95	2.85	
Circuit Current when OFF	I_{DD2}	V_{DD}=V_{DET}+2.0V	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	V_{OPL}	V_{OL}≤0.4V, Ta=25 to 105°C, R_L=470kΩ		0.95	-	-	V
		V_{OL}≤0.4V, Ta=-40 to 25°C, R_L=470kΩ		1.20	-	-	
'Low' Output Current (Nch)	I_{OL}	V_{DS}=0.5V V_{DD}=1.2V		0.4	1.2	-	mA
		V_{DS}=0.5V V_{DD}=2.4V		2.0	5.0	-	
'High' Output Current (Pch)	I_{OH}	V_{DS}=0.5V V_{DD}=4.8V V_{DET}=2.3-4.2V		0.7	1.4	-	mA
		V_{DS}=0.5V V_{DD}=6.0V V_{DET}=4.3-5.2V		0.9	1.8	-	
		V_{DS}=0.5V V_{DD}=8.0V V_{DET}=5.3-6.0V		1.1	2.2	-	
Leak Current when OFF	I_{leak}	V_{DD}=V_{DS}=10V *1		-	-	0.1	μA
C_T pin Threshold Voltage	V_{CTH}	V_{DD}=V_{DET}×1.1, V_{DET}=2.3-2.6V, R_L=470kΩ		V_{DD} ×0.30	V_{DD} ×0.40	V_{DD} ×0.60	V
		V_{DD}=V_{DET}×1.1, V_{DET}=2.7-4.2V, R_L=470kΩ		V_{DD} ×0.30	V_{DD} ×0.45	V_{DD} ×0.60	
		V_{DD}=V_{DET}×1.1, V_{DET}=4.3-5.2V, R_L=470kΩ		V_{DD} ×0.35	V_{DD} ×0.50	V_{DD} ×0.60	
		V_{DD}=V_{DET}×1.1, V_{DET}=5.3-6.0V, R_L=470kΩ		V_{DD} ×0.40	V_{DD} ×0.50	V_{DD} ×0.60	
Output Delay Resistance	R_{CT}	V_{DD}=V_{DET}×1.1 V_{CT}=0.5V *1		5.5	9	12.5	MΩ
C_T pin Output Current	I_{CT}	V_{CT}=0.1V V_{DD}=0.95V *1		15	40	-	μA
		V_{CT}=0.5V V_{DD}=1.5V		150	240	-	
Detection Voltage Temperature coefficient	$V_{DET}/\Delta T$	Ta=-40°C to 105°C		-	±100	±360	ppm/°C
Hysteresis Voltage	Δ V_{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 V_{OUT} and power supply.
Designed Guarantee. (Outgoing inspection is not done on all products.)
*1 Guarantee is Ta=25°C.

●**Block Diagrams**

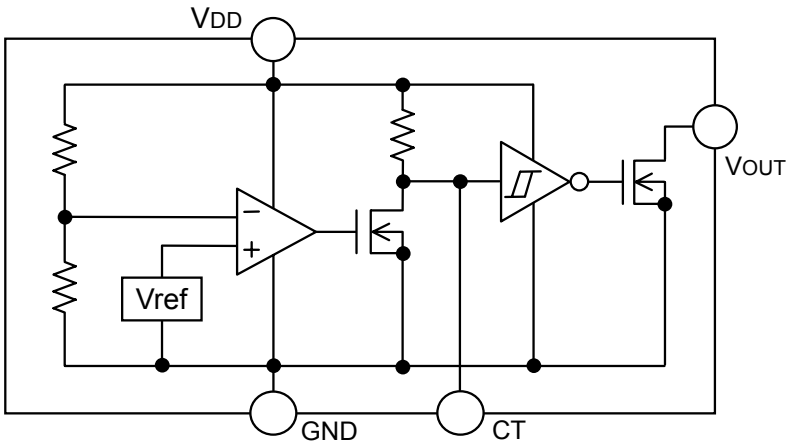


Fig.1 BD52xx Series

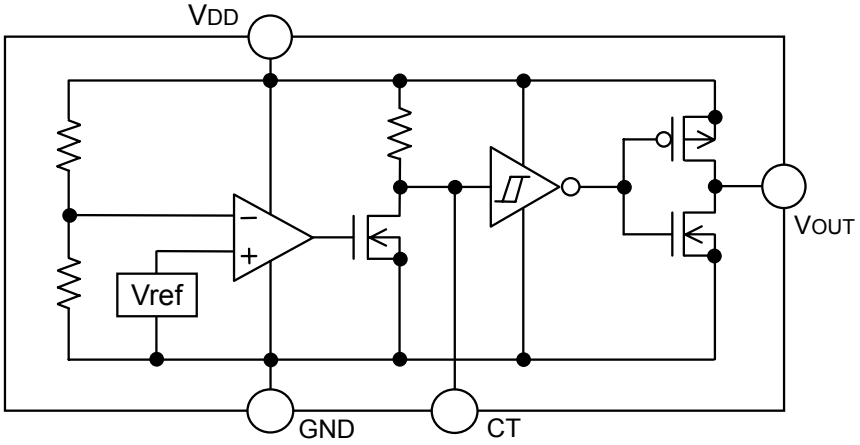


Fig.2 BD53xx Series

●**Typical Performance Curves**

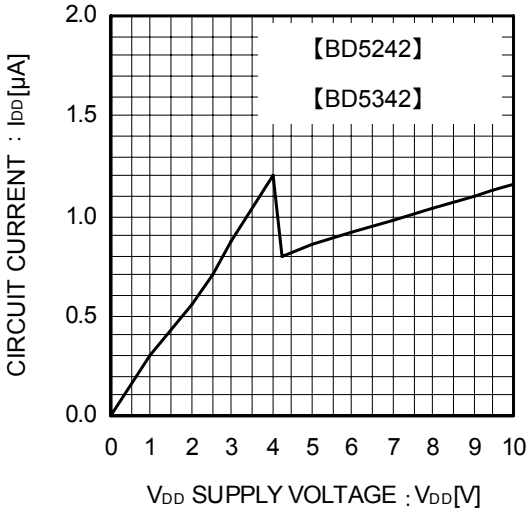


Fig.3 Circuit Current

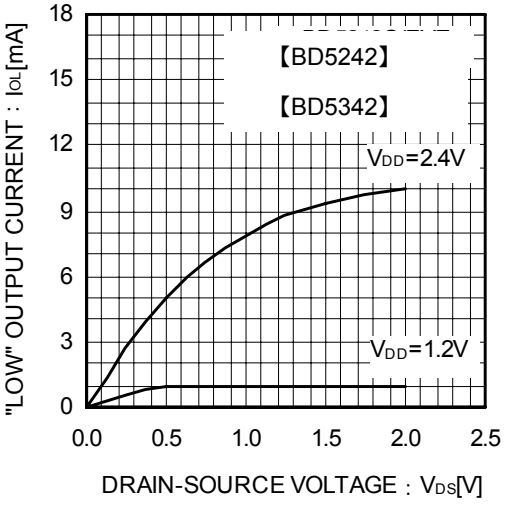


Fig.4 “Low” Output Current

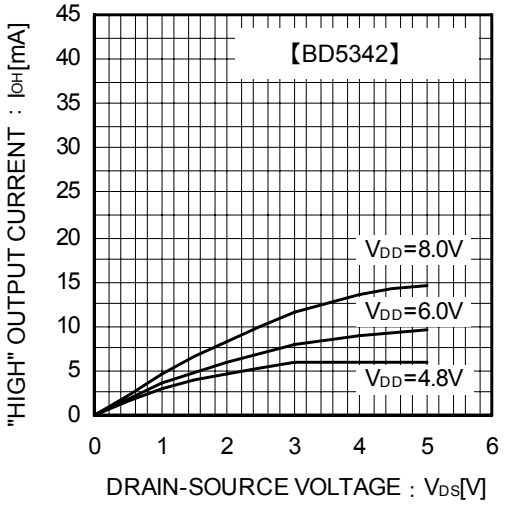


Fig.5 “High” Output Current

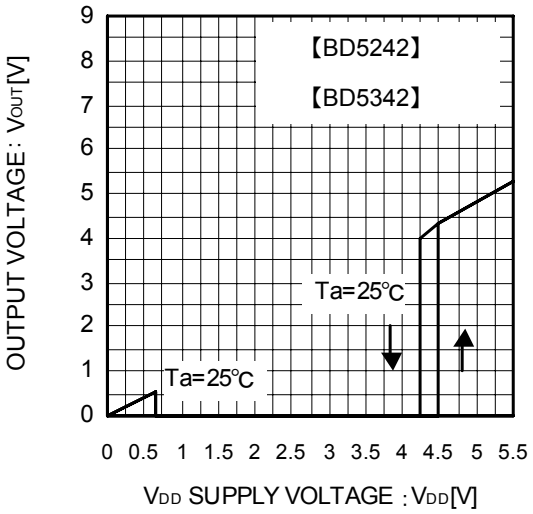


Fig.6 I/O Characteristics

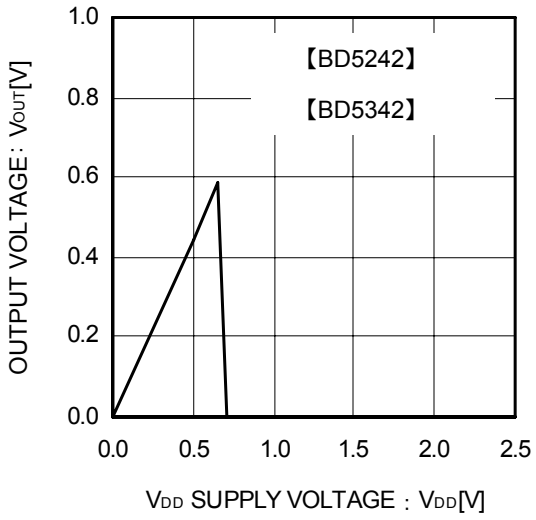


Fig.7 Operating Limit Voltage

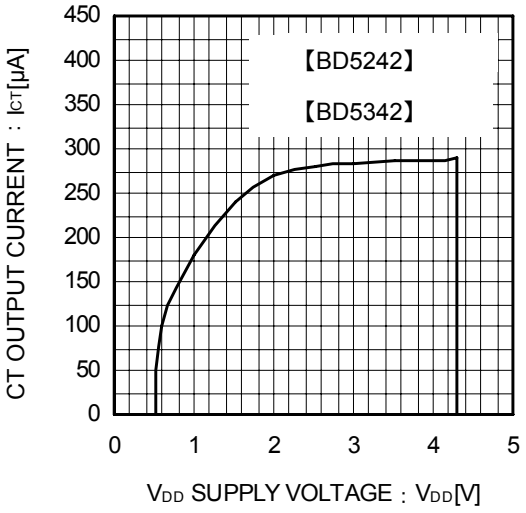


Fig.8 CT Terminal Current

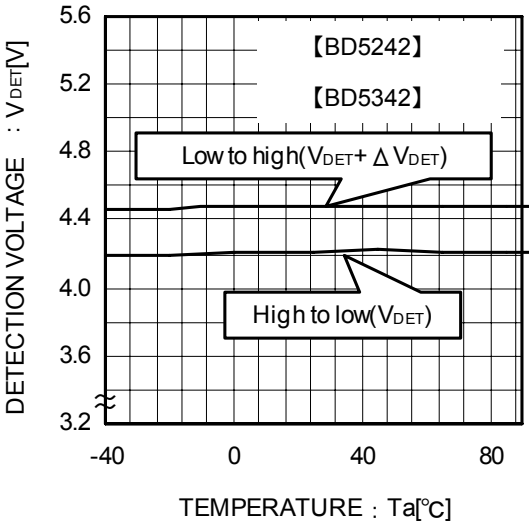


Fig.9 Detection Voltage
Release Voltage

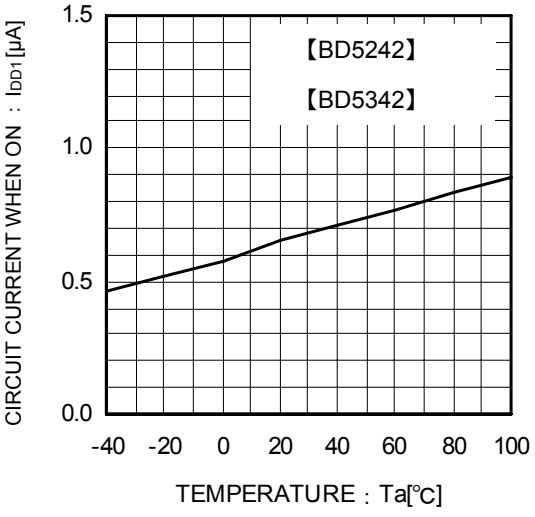


Fig.10 Circuit Current when ON

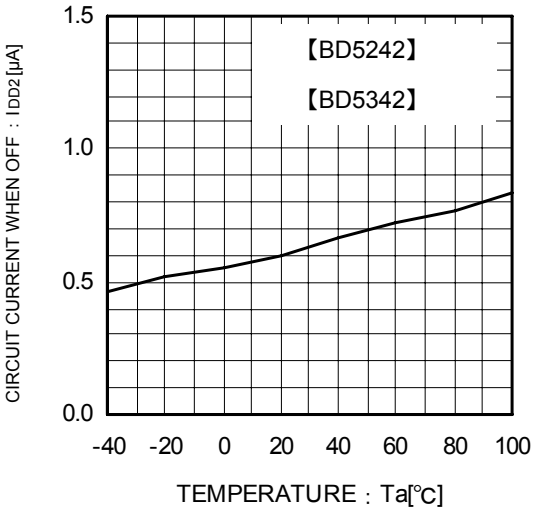


Fig.11 Circuit Current when OFF

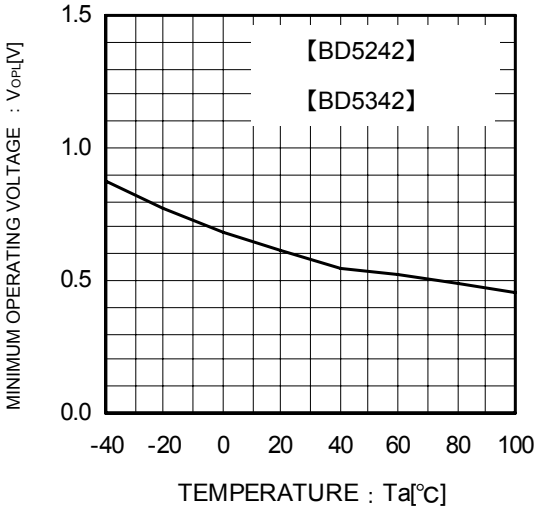


Fig.12 Operating Limit Voltage

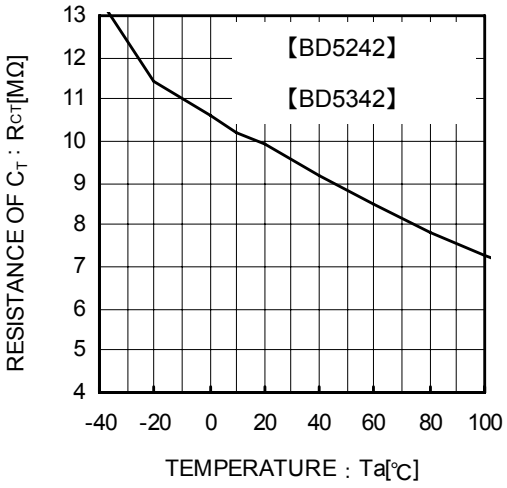


Fig.13 C_T Terminal Circuit Resistance

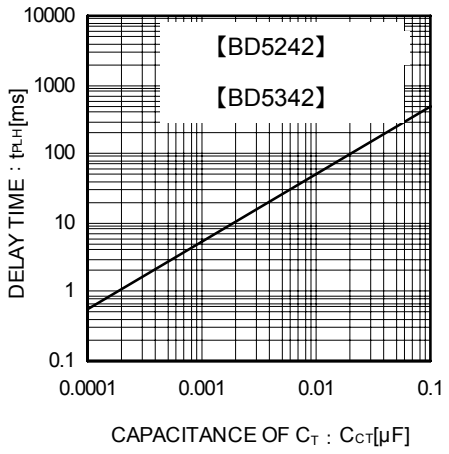


Fig.14 Delay Time (t_{PLH}) and
C_T Terminal External Capacitance

●Application Information

Explanation of Operation

For both the open drain type (Fig.15) and the CMOS output type (Fig.16), 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 BD52xx 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].

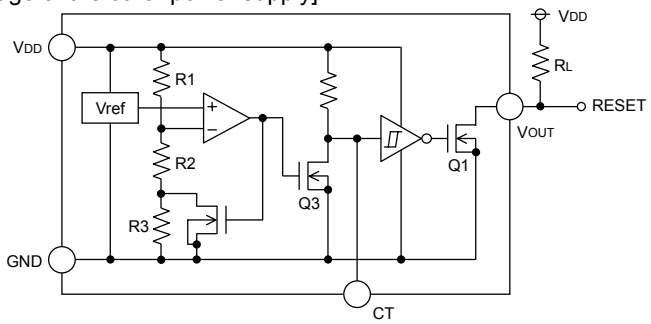


Fig.15 (BD52xxType Internal Block Diagram)

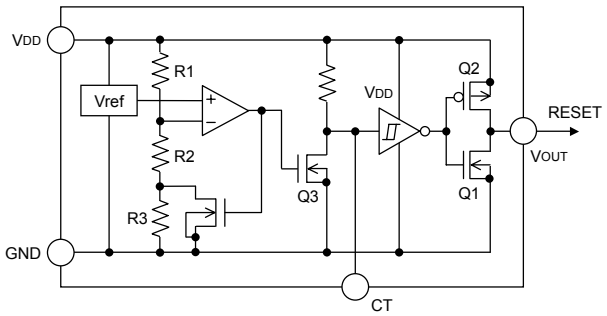


Fig.16 (BD53xxType Internal Block Diagram)

Setting of Detector Delay Time

It is possible to set the delay time at the rise of VDD using a capacitor connected to the Ct terminal.

Delay time at the rise of V_{DD} t_{PLH}:Time until when Vout rise to 1/2 of V_{DD} after V_{DD} rise up and beyond the release voltage($V_{DET}+\Delta V_{DET}$)

$$t_{PLH} = -C_{CT} \times R_{CT} \times \ln\left(\frac{V_{DD}-V_{CTH}}{V_{DD}}\right)$$

C_{CT}: C_T pin Externally Attached Capacitance

R_{CT}: C_T pin Internal Impedance（Please refer to Electrical Characteristics.）

V_{CTH}: C_T pin Threshold Voltage（Please refer to Electrical Characteristics.）

ln : Natural Logarithm

Reference Data of Falling Time (t_{PHL}) Output

Examples of Falling Time (t_{PHL}) Output

Part Number	t_{PHL}[μs] -40°C	t_{PHL}[μs] ,+25°C	t_{PHL}[μs],+105°C
BD5227	30.8	30	28.8
BD5327	26.8	26	24.8

*This data is for reference only.

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

Timing Waveforms

Example: the following shows the relationship between the input voltage VDD, the C_T Terminal Voltage VCT 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.15 and 16).

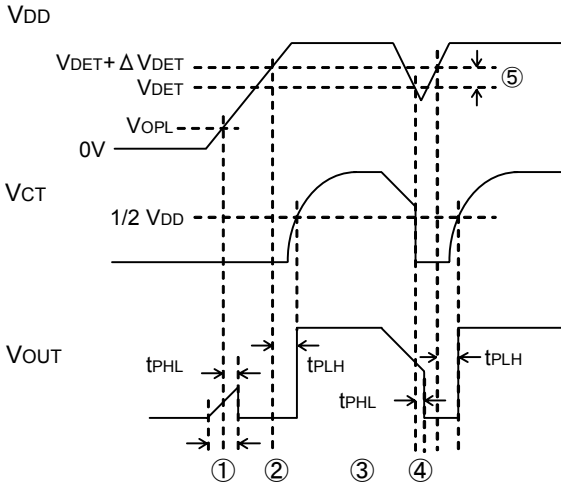


Fig.17 Timing Waveform

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 V_{DD} is faster than tPHL.

② When VDD is greater than VOPL but less than the reset release voltage ($V_{DET}+\Delta V_{DET}$), the C_T terminal (VCT) and output (VOUT) voltages will switch to L.

③ If VDD exceeds the reset release voltage ($V_{DET}+\Delta V_{DET}$), then VOUT switches from L to H (with a delay due to the C_T terminal).

④ If VDD drops below the detection voltage (VDET) 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 (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

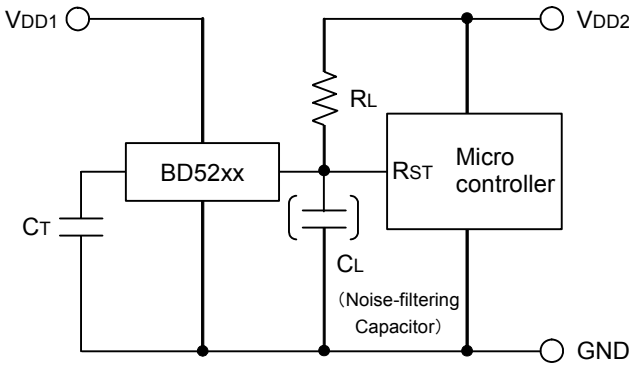


Fig.18 Open Drain Output Type

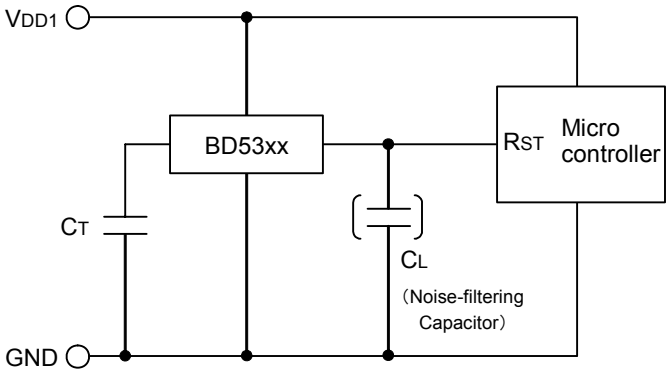


Fig.19 CMOS Output Type

Application examples of BD52xx series (Open Drain output type) and BD53xx 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 the open drain output type (BD52xx) attached a load resistance (R_L) between the output and V_{DD2}. (As shown Fig.15)

CASE2: the power supply of the microcontroller (V_{DD1}) is same as the power supply of the reset detection (V_{DD1}). Use CMOS output type (BD53xx) or open drain output type (BD52xx) attached a load resistance (R_L) between the output and V_{DD1}. (As shown Fig.16)

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}).

Please refer to Operational Notes for recommendations on resistor and capacitor values.

●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. If 10MΩ leakage is assumed between the C_T terminal and the GND terminal, 1MΩ connection between the C_T terminal and the V_{DD} terminal would be recommended. The value of R_{CT} depends on the external resistor that is connected to C_T terminal, so please consider the delay time that is decided by $\tau \times R_{CT} \times C_{CT}$ changes.

11. External parameters

The recommended parameter range for C_T is 100pF to 0.1μF and RL is 50kΩ 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

●General Precaution

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   [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 designed and manufactured for use under standard conditions and not 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.

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