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Voltage Detector (Reset) IC Series for Automotive Application

Supervisory IC

BD70Hxx-xC Series BD73Hxx-2C Series

General Description

ROHM's Supervisory ICs are highly accurate, with ultra-low current consumption feature that uses CMOS process. The lineup includes N-channel open drain output (BD70Hxx-xC) and CMOS output (BD73Hxx-2C) so that the users can select depending on the application. Because there is no hysteresis, the Release Voltage is set to same value of Detection Voltage.

Features

- AEC-Q100 Qualified *(Note 1)*
- No Hysteresis
- Two Output Types
  (Nch Open Drain and CMOS Output)
- Nano Energy
- Very Small, Lightweight and Thin Package
- Package SSOP5 is similar to SOT-23-5 (JEDEC)

(Note 1) Grade 1

Key Specifications

- Release Voltage:
  3.76 V, 3.66 V, 3.56 V, 3.46 V, 3.06 V, 1.20V
- Ultra-Low Current Consumption: 270 nA (Typ)
- Operation Temperature Range: -40 °C to +125 °C

Special Characteristics

- Release Voltage Accuracy:
  ±50 mV (-40 °C to +125 °C)

Package

W (Typ) x D (Typ) x H (Max)

SSOP5: 2.90 mm x 2.80 mm x 1.25 mm



Application

All automotive devices that requires voltage detection

Typical Application Circuits

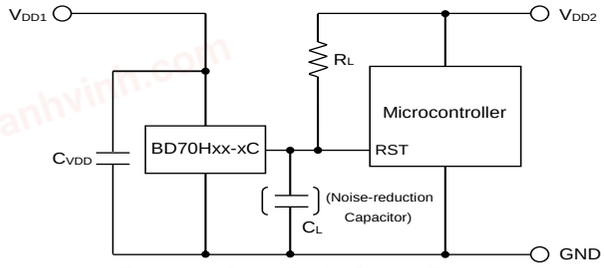


Figure 1. Open Drain Output Type
BD70Hxx-xC Series

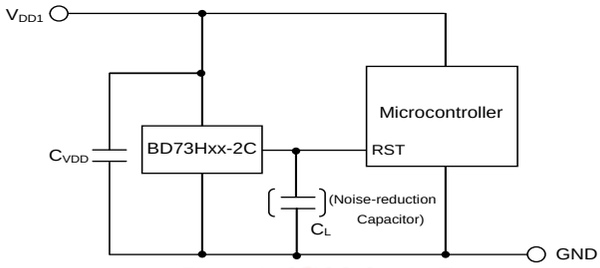
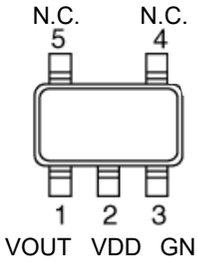


Figure 2. CMOS Output Type
BD73Hxx-2C Series

Pin Configuration

SSOP5

TOP VIEW



Pin Description

SSOP5		
PIN No.	PIN NAME	Function
1	VOUT	Output pin
2	VDD	Power supply voltage
3	GND	GND
4	N.C.	No connection pin
5	N.C.	No connection pin

The no connection pin is electrically open and can be connected to either VDD or GND.

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Block Diagrams

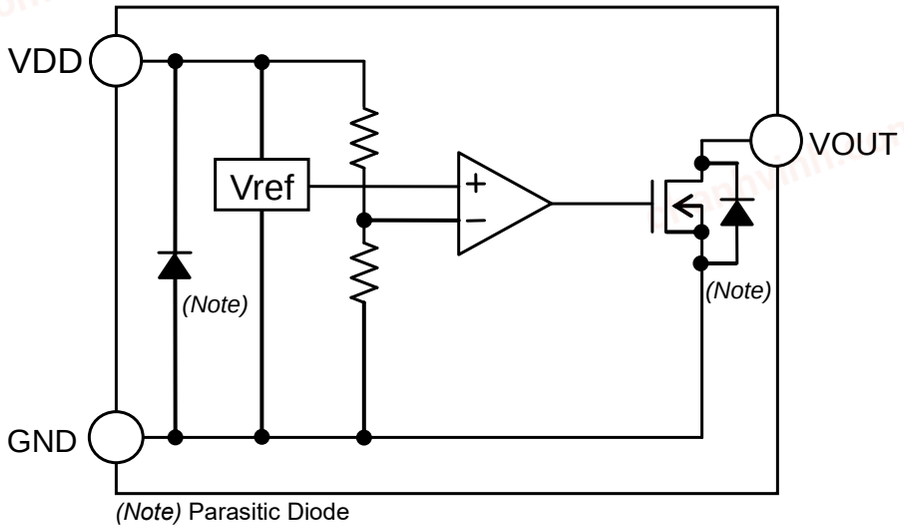


Figure 3. BD70Hxx-xC Series

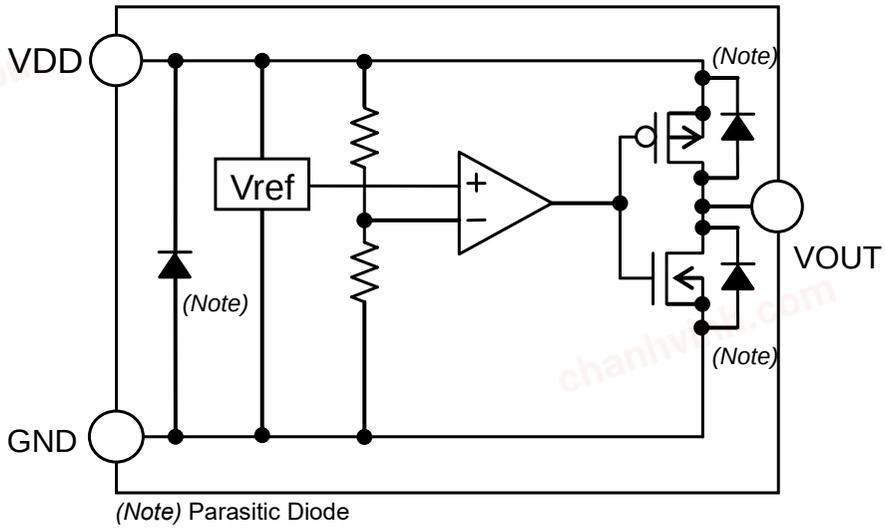
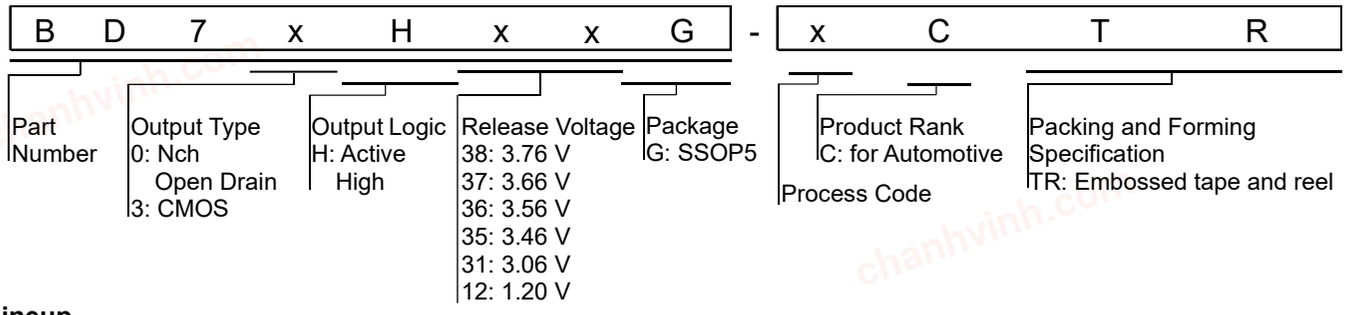


Figure 4. BD73Hxx-2C Series

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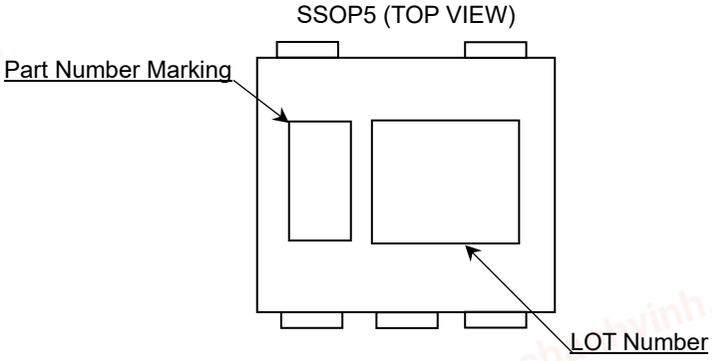
Ordering Information



Lineup

Output Type	Open Drain		CMOS	
Release Voltage	Marking	Part Number	Marking	Part Number
3.76 V	9E	BD70H38G-2CTR	5P	BD73H38G-2CTR
3.66 V	9F	BD70H37G-2CTR	5Q	BD73H37G-2CTR
3.56 V	5M	BD70H36G-2CTR	5R	BD73H36G-2CTR
3.46 V	5N	BD70H35G-2CTR	5S	BD73H35G-2CTR
3.06 V	9N	BD70H31G-CTR	-	-
1.20 V	dh	BD70H12G-2CTR	-	-

Marking Diagram



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Absolute Maximum Ratings (Ta = 25 °C)

Parameter		Symbol	Limit	Unit
Power Supply Voltage		V_{DD} - GND	-0.3 to +7	V
Output Voltage	Nch Open Drain Output	V_{OUT}	GND - 0.3 to +7	V
	CMOS Output		GND - 0.3 to VDD + 0.3	
Output Current		I_O	70	mA
Maximum Junction Temperature		Tjmax	+150	°C
Storage Temperature Range		Tstg	-55 to +150	°C

Caution 1: *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 and the internal circuitry. 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.*

Caution 2: *Should by any chance the maximum junction temperature rating be exceeded the rise in temperature of the chip may result in deterioration of the properties of the chip. In case of exceeding this absolute maximum rating, design a PCB with thermal resistance taken into consideration by increasing board size and copper area so as not to exceed the maximum junction temperature rating.*

Thermal Resistance *(Note 1)*

Parameter	Symbol	Thermal Resistance (Typ)		Unit
		1s *(Note 3)*	2s2p *(Note 4)*	
SSOP5				
Junction to Ambient	θ_{JA}	376.5	185.4	°C/W
Junction to Top Characterization Parameter *(Note 2)*	Ψ_{JT}	40	30	°C/W

(Note 1) Based on JESD51-2A (Still-Air).
(Note 2) The thermal characterization parameter to report the difference between junction temperature and the temperature at the top center of the outside surface of the component package.
(Note 3) Using a PCB board based on JESD51-3.
(Note 4) Using a PCB board based on JESD51-7.

Layer Number of Measurement Board	Material	Board Size
Single	FR-4	114.3 mm x 76.2 mm x 1.57 mmt

Top	
Copper Pattern	Thickness
Footprints and Traces	70 µm

Layer Number of Measurement Board	Material	Board Size
4 Layers	FR-4	114.3 mm x 76.2 mm x 1.6 mmt

Top		2 Internal Layers		Bottom	
Copper Pattern	Thickness	Copper Pattern	Thickness	Copper Pattern	Thickness
Footprints and Traces	70 µm	74.2 mm x 74.2 mm	35 µm	74.2 mm x 74.2 mm	70 µm

Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
Operating Temperature	Topr	-40	+25	+125	°C

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Electrical Characteristics (Unless otherwise specified Ta = -40 °C to +125 °C, V_{DD} = 0.8 V to 6.0 V)

Parameter	Symbol	Condition		Limit			Unit
				Min	Typ	Max	
Release Voltage	V_R	BD70H38G-2C, BD73H38G-2C	Ta = -30 to +70 °C	3.72	3.76	3.80	V
			Ta = -40 to +125 °C	3.71		3.81	
		BD70H37G-2C, BD73H37G-2C	Ta = -30 to +70 °C	3.62	3.66	3.70	
			Ta = -40 to +125 °C	3.61		3.71	
		BD70H36G-2C, BD73H36G-2C	Ta = -30 to +70 °C	3.52	3.56	3.60	
			Ta = -40 to +125 °C	3.51		3.61	
		BD70H35G-2C, BD73H35G-2C	Ta = -30 to +70 °C	3.42	3.46	3.50	
			Ta = -40 to +125 °C	3.41		3.51	
		BD70H31G-C	Ta = -30 to +70 °C	3.02	3.06	3.10	
			Ta = -40 to +125 °C	3.01		3.11	
		BD70H12G-2C	Ta = -30 to +70 °C	1.16	1.20	1.24	
			Ta = -40 to +125 °C	1.15		1.25	
Circuit Current when ON	I_{DD1}	V_{DD} = V_R - 0.2 V		-	0.27	1.50	µA
Circuit Current when OFF	I_{DD2}	V_{DD} = V_R + 0.5 V		-	0.30	1.60	µA
Minimum Operating Voltage	V_{OPL}	V_{OL} ≤ 0.4 V, R_L = 100 kΩ *(Note 1)*		0.80	-	-	V
"High" Output Voltage (Pch)	V_{OH}	V_{DD} = 4.0 V, I_{SOURCE} = 4.0 mA		V_{DD} - 0.4	-	-	V
		V_{DD} = 6.0 V, I_{SOURCE} = 2.5 mA		V_{DD} - 0.4	-	-	
"Low" Output Voltage (Nch)	V_{OL}	V_{DD} = 0.8 V, I_{SINK} = 0.17 mA, V_R = 1.2V		-	-	0.4	V
		V_{DD} = 1.2 V, I_{SINK} = 1.0 mA, V_R = 3.06V to 3.76V		-	-	0.4	
		V_{DD} = 2.4 V, I_{SINK} = 2.0 mA, V_R = 3.06V to 3.76V		-	-	0.4	
Output Leak Curent (BD70Hxx-xC)	I_{LEAK}	V_{DD} = V_{DS} = 6 V		-	-	1.0	µA
Delay Time (H → L)	t_{PHL}	V_{OUT} = V_{DD} → 50 %, R_L = 100 kΩ *(Note 1) (Note 2)*		20	50	200	µs
Delay Time (L → H)	t_{PLH}	V_{OUT} = GND → 50 %, R_L = 100 kΩ *(Note 1) (Note 2)*		15	40	100	µs

(Note 1) R_L: Pull-up resistor connected between V_{OUT} and power supply.

(Note 2) t_{PLH}: V_{DD} = (V_R - 0.5 V) → (V_R + 0.5 V)

t_{PHL}: V_{DD} = (V_R + 0.5 V) → (V_R - 0.5 V)

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Typical Performance Curves

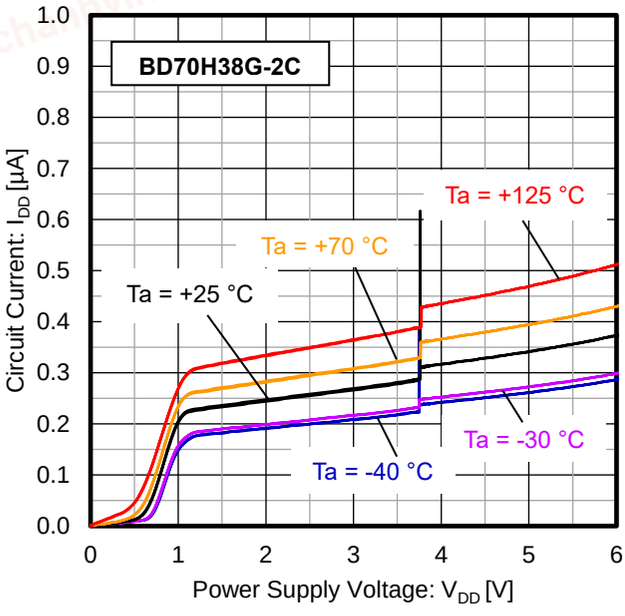


Figure 5. Circuit Current vs Power Supply Voltage

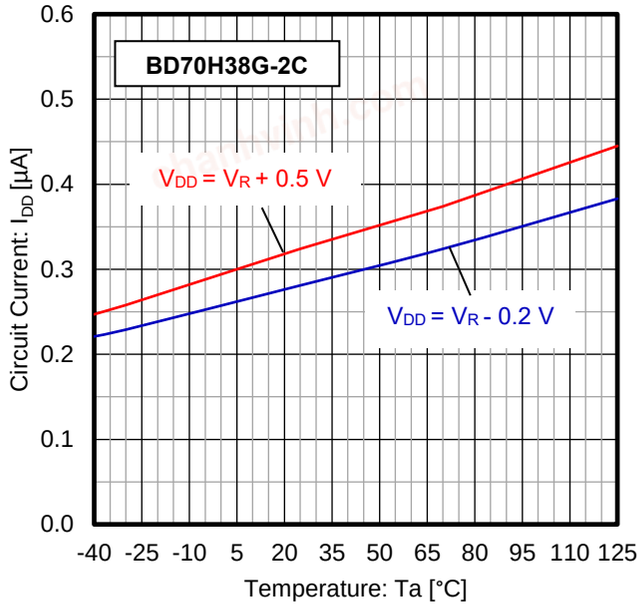


Figure 6. Circuit Current vs Temperature

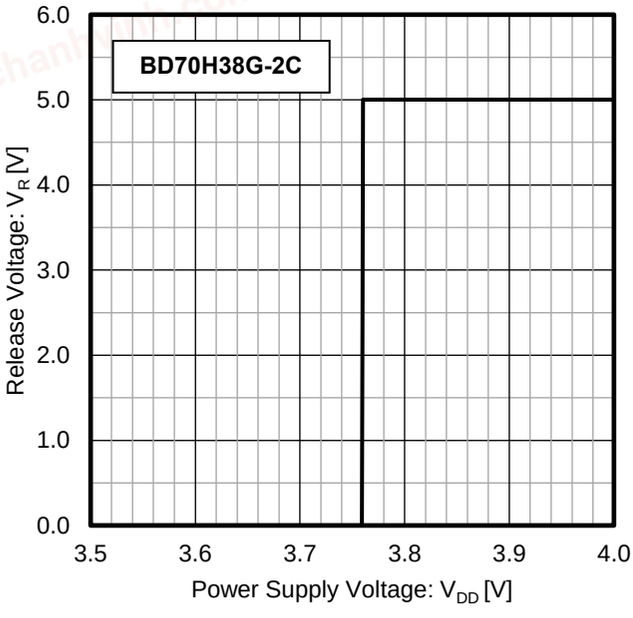


Figure 7. Release Voltage vs Power Supply Voltage

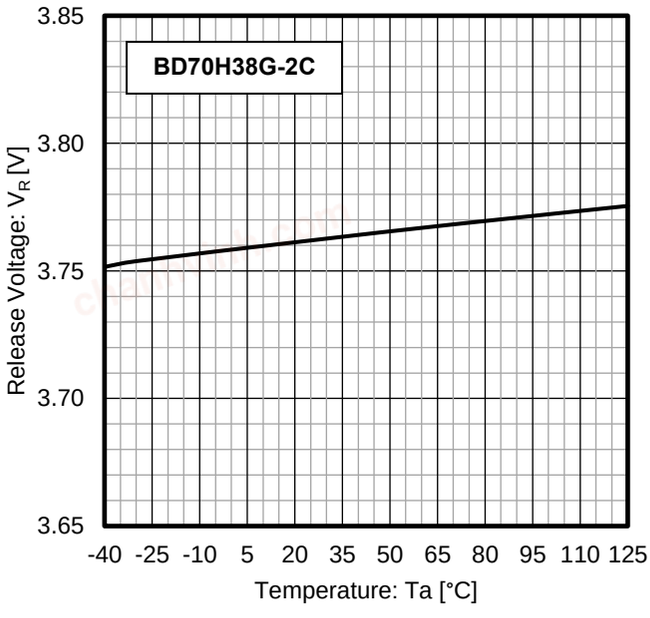


Figure 8. Release Voltage vs Temperature

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Typical Performance Curves - continued

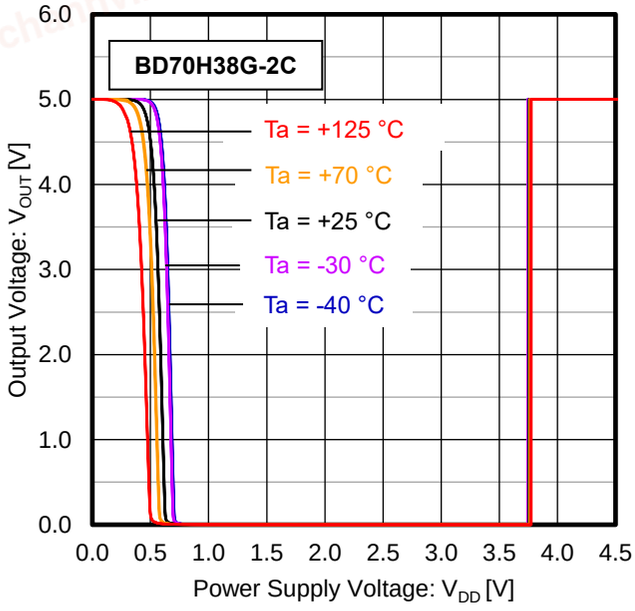


Figure 9. I/O Characteristics
(VOUT Pull-up to 5 V, R_L = 100 kΩ)

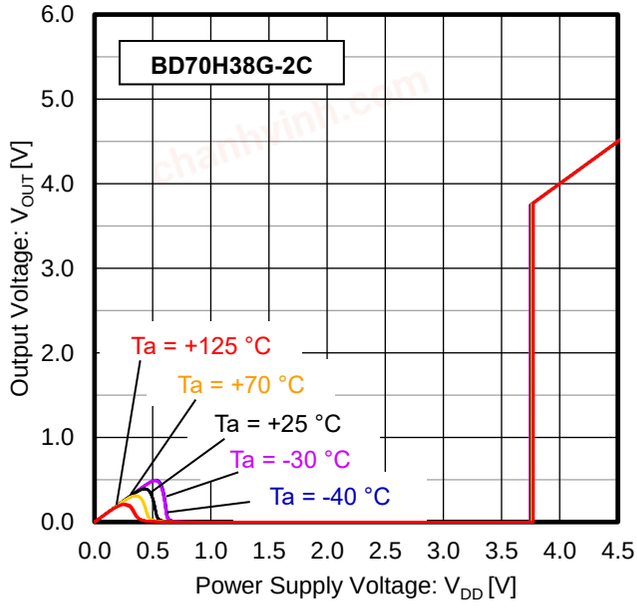


Figure 10. I/O Characteristics
(VOUT Pull-up to V_{DD}, R_L = 100 kΩ)

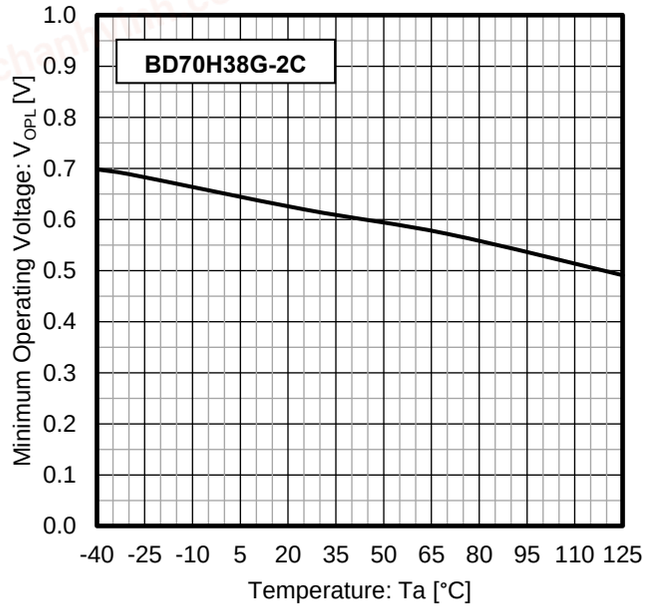


Figure 11. Minimum Operating Voltage vs Temperature
(VOUT Pull-up to 5 V, R_L = 100 kΩ)

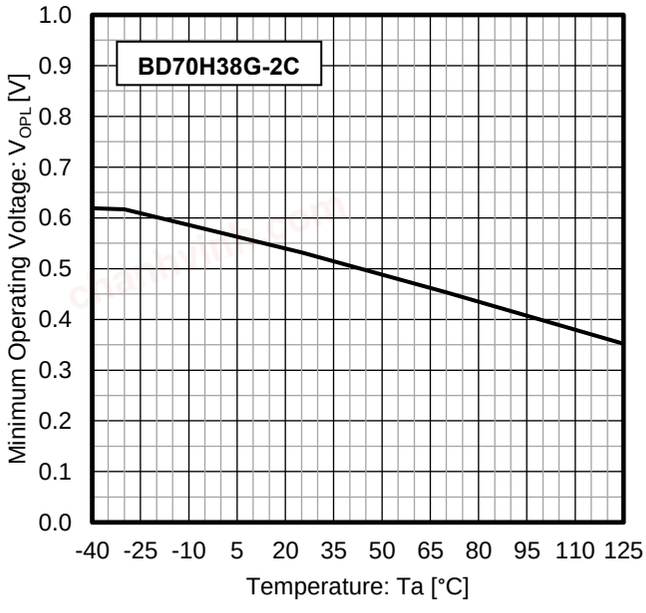


Figure 12. Minimum Operating Voltage vs Temperature
(VOUT Pull-up to V_{DD}, R_L = 100 kΩ)

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Typical Performance Curves - continued

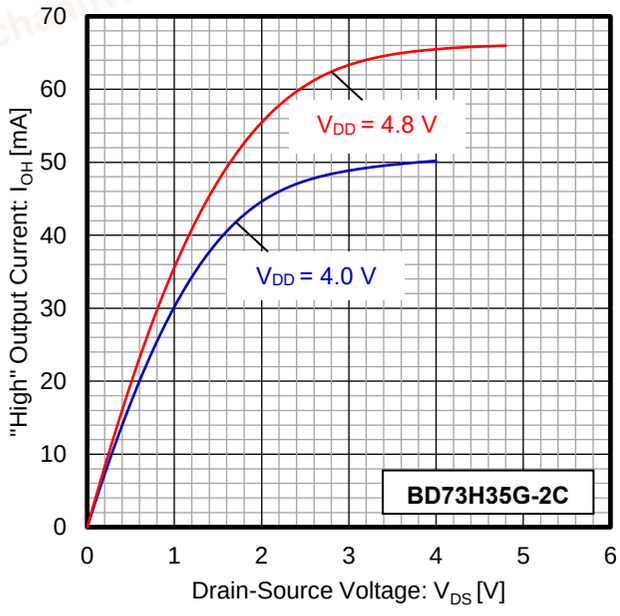


Figure 13. “High” Output Current vs Drain-Source Voltage

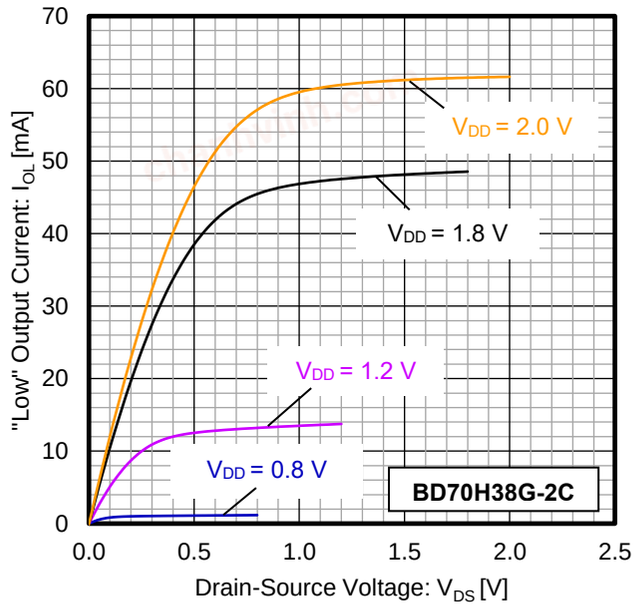


Figure 14. “Low” Output Current vs Drain-Source Voltage

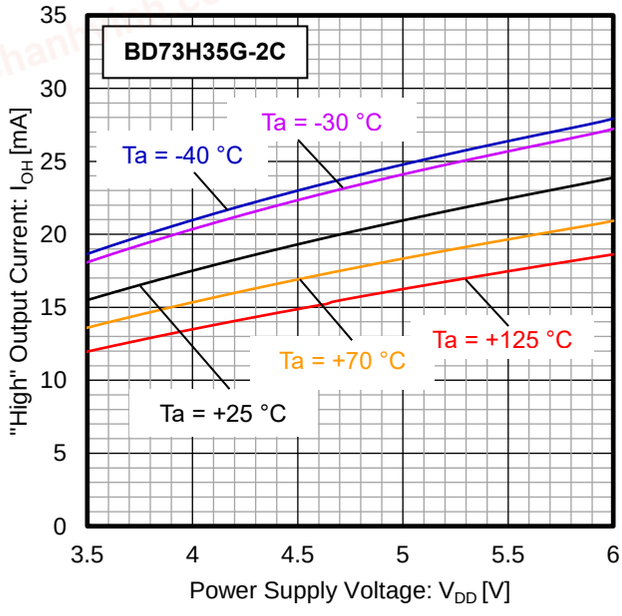


Figure 15. “High” Output Current vs Power Supply Voltage (V_{DS} = 0.5 V)

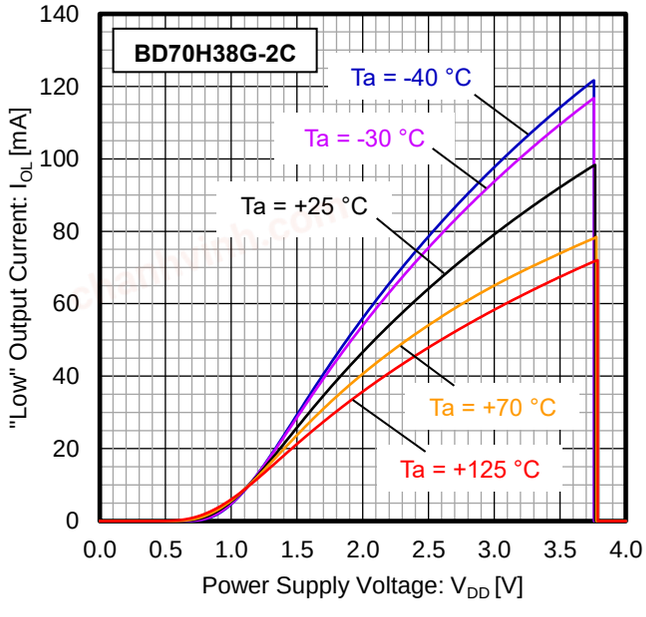


Figure 16. “Low” Output Current vs Power Supply Voltage (V_{DS} = 0.5 V)

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Typical Performance Curves - continued

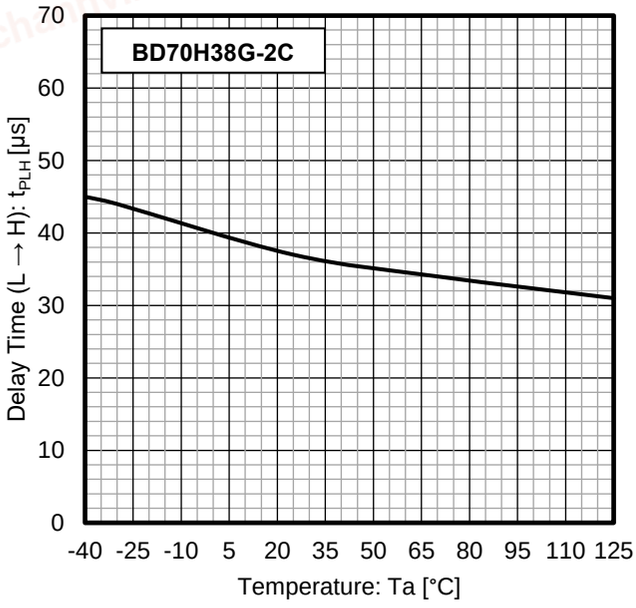


Figure 17. Output Delay Time (L → H) vs Temperature

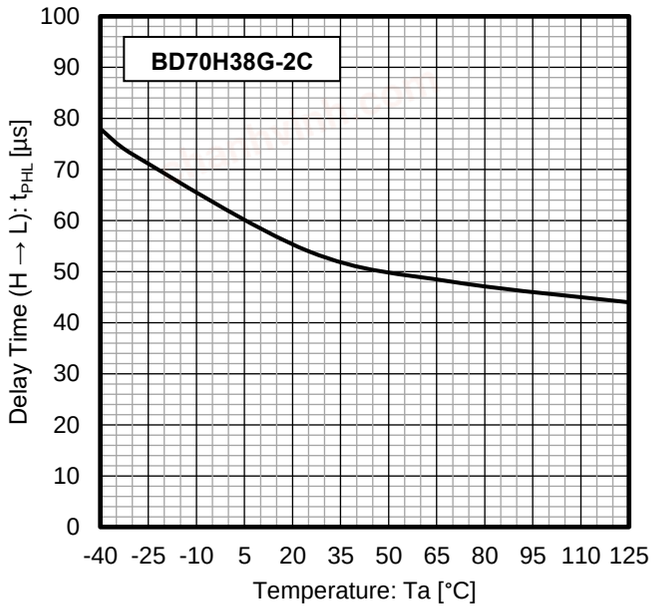


Figure 18. Output Delay Time (H → L) vs Temperature

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Application Information

Operation Description

Consider the release voltage is same as the threshold voltage. When the voltage applied to V_{DD} reaches the respective threshold voltage, V_{OUT} level will change from "H" to "L" and from “L" to "H". Since the output pattern in BD70Hxx-xC is an open-drain system, a pull-up resistor has to be connected to V_{DD} or other power supply.
(The output (V_{OUT}) “H” voltage in this case becomes V_{DD} or other power supply voltage.)

Timing Waveform

The following shows the relationship between the input voltage V_{DD} and the output voltage V_{OUT} when the power supply voltage V_{DD} is swept up and swept down.

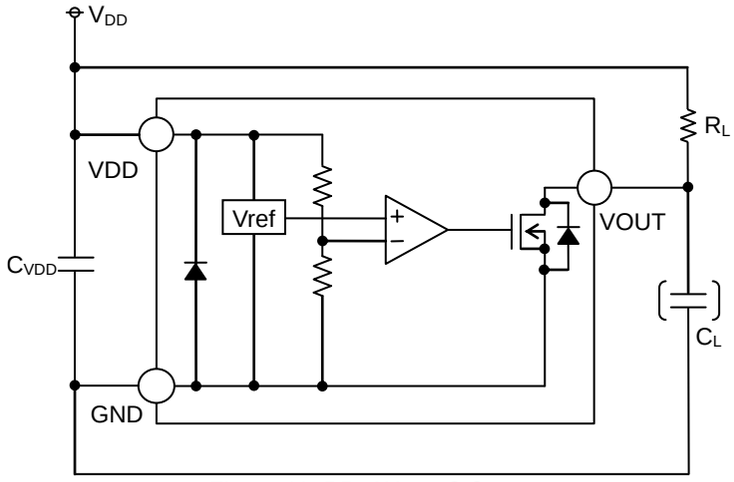


Figure 19. BD70Hxx-xC Set-up

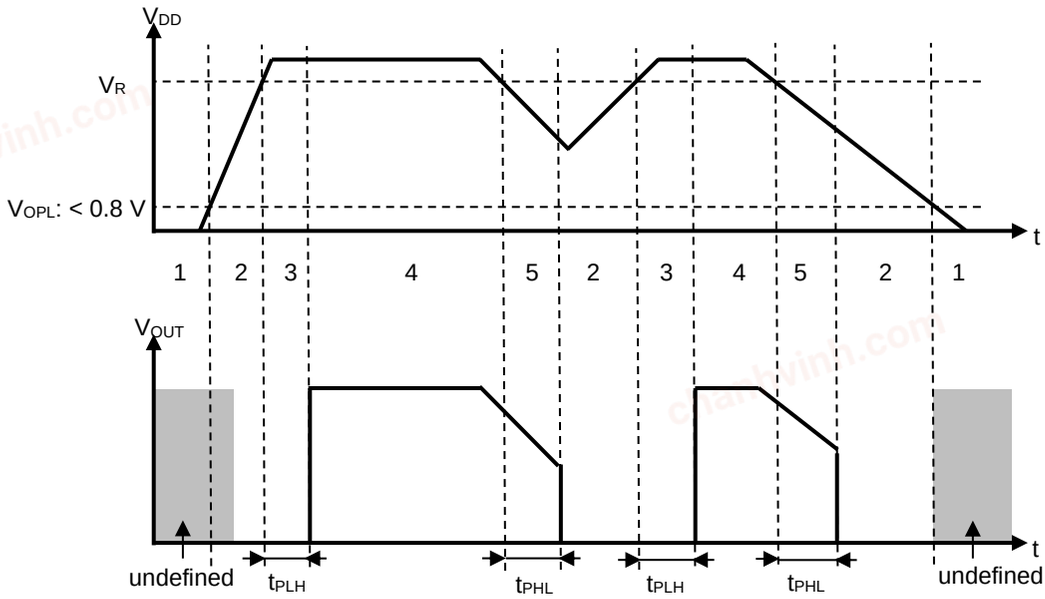


Figure 20. Timing Diagram

Operating Conditions Explanation

1. When the power supply turns on, the Output Voltage (V_{OUT}) becomes unstable until V_{DD} exceeds the Minimum Operating Voltage (V_{OPL}).
2. V_{OUT} changes to “L”. However, this change depends on the V_{OUT} rise time when the power supply starts up, so thorough confirmation is required.
3. When V_{DD} exceeds the Release Voltage (V_R), delay time (t_{PLH}) happens, then V_{OUT} switches from “L” to “H”.
4. V_{OUT} keeps “H”.
5. When V_{DD} drops below Release Voltage (V_R), delay time (t_{PHL}) happens, then V_{OUT} switches from “H” to “L”.

Since this IC does not have hysteresis width, when V_{DD} fluctuates near V_R, V_{OUT} switches repeatedly with “H” → “L” → “H” → “L”. As a counter measure, it is recommended to use capacitor (C_{VDD}). Perform sufficient evaluation before deciding the capacitor value since the capacitance needs to be adjusted according to the amount of power supply voltage fluctuation.

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Application Information – continued

Bypass Capacitor for Noise Rejection

For the stable operation of the IC, put capacitor between the VDD and GND pin and connect it closer to the pin as possible. When using extremely big capacitors, the transient response speed becomes slow so please thoroughly check.

External Parameters

The recommended value of pull-up resistance value is 50 kΩ to 1 MΩ. Since the changes are brought by many factors (circuit configuration, board layout, etc.) when using, ensure that confirmation of the real function was carried out.
In addition, this IC has high impedance design. So depending on the condition of use, this may be affected by small leak current due to the uncleanness of PCB surface. For example, if a 10 MΩ leakage is assumed between the VOUT and GND pin, it is recommended to set the value of pull up resistor less than or equal to 1/10 of the impedance of assumed leakage route.

Behavior at less than the Operating Voltage Limit

When V_{DD} falls less than the minimum operating voltage, output will be undefined. When output is connected to pull-up voltage, output will be equivalent to pull-up voltage.

Precautions when Steep Power Supply Rise

In case of a steep power supply rise, the output may toggle to “High” once like as shown in Figure 21. This is due to the undefined output when the supply is less than the minimum operating voltage of the IC. When this waveform affects the application, make the rise time slower by attaching capacitor to V_{DD} (C_{VDD}). As a reference value, the recommended V_{DD} Rise Time is 200 µs or more.

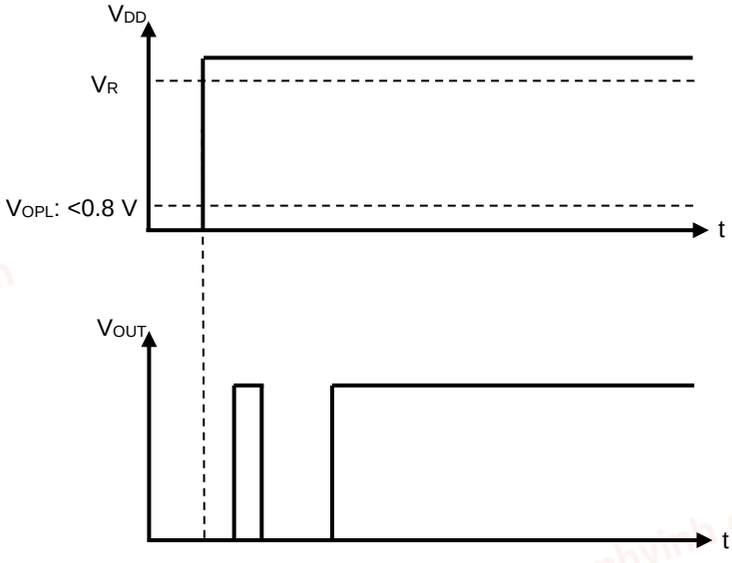


Figure 21. Steep Power Supply Rise Response

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Application Examples

(1) Examples of common application circuits

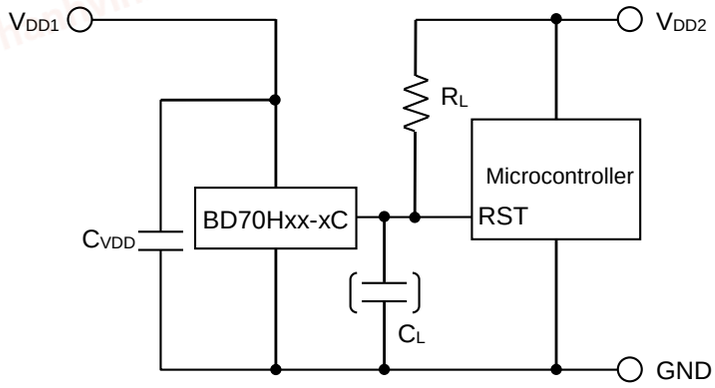


Figure 22. Open Drain Output Type

Application examples of BD70Hxx-xC series (Open drain output type) and BD73Hxx-2C series (CMOS output type) are shown below.

CASE1: If the power supply of the microcontroller (V_{DD2}) differs from the power supply of the detection (V_{DD1}), use the load resistance R_L connected to V_{DD2} in the output of open drain output type (BD70Hxx-xC series) as shown in Figure 22.

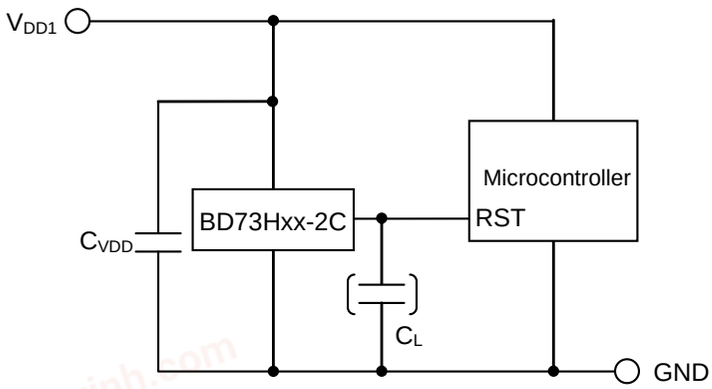


Figure 23. CMOS Output Type

CASE2: If the power supply of the microcontroller is the same as the power supply of the detection (V_{DD1}), use it in CMOS output type (BD73Hxx-2C series) as shown in Figure 23.

Otherwise, use the R_L connected to V_{DD1} in open drain output type (BD70Hxx-xC series).

When connecting a capacitor C_L for noise elimination and for setting the output delay time to the VOUT pin (reset signal input pin of microcontroller), the waveform is dull during rising and falling of the output so use after confirmation that there is no problem.

(2) The following is an example of an OR connection between two types of detection voltage resets the microcontroller.

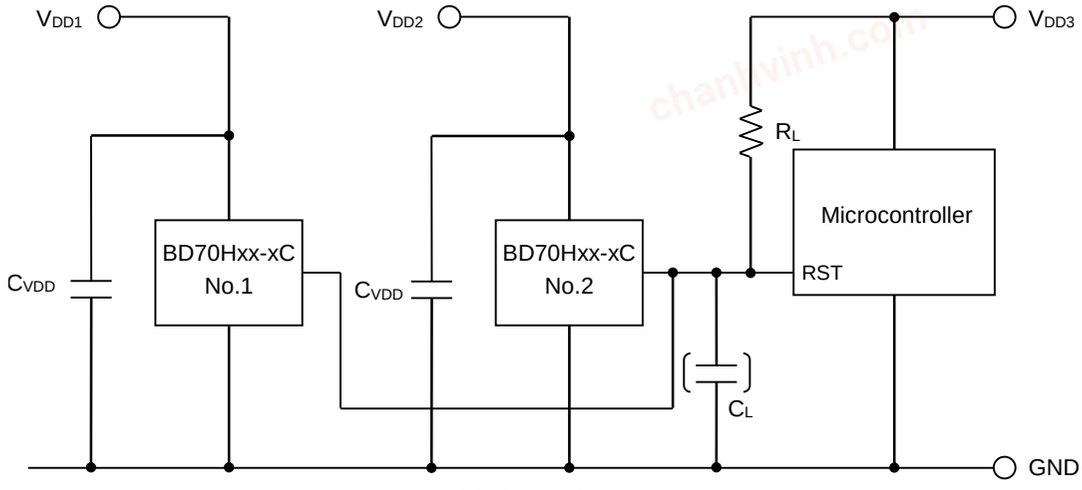


Figure 24. OR Circuit Connection Application

There are multiple power supply in the system, and in case monitoring for each independent power supply V_{DD1} and V_{DD2} and reset of micro-controller is required, an application where output “H” voltage is aligned to the microcontroller power supply V_{DD3} is possible by connecting OR application and pull-up at random voltage (V_{DD3}) such as shown in Figure 24.

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Application Examples – continued

(3) Examples of the power supply with resistor dividers

In some applications, the power supply voltage of an IC comes from a resistor divider circuit. An inrush current will flow into the circuit when the output level switches from “Low” to “High” or vice versa. Inrush current is a sudden surge of current that flows from the power supply (V_{DD}) 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.

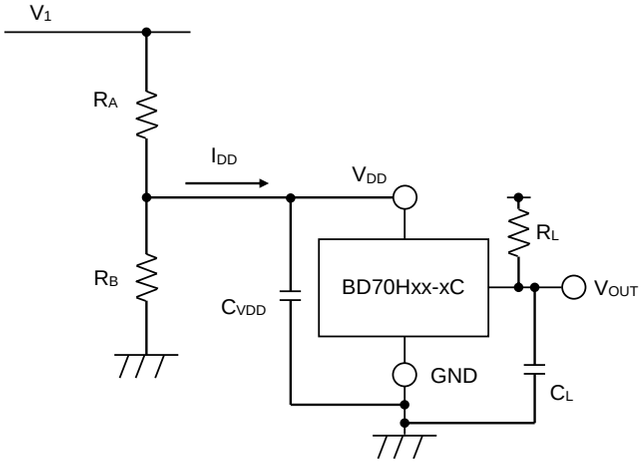


Figure 25. Resistor Divider Connection Application

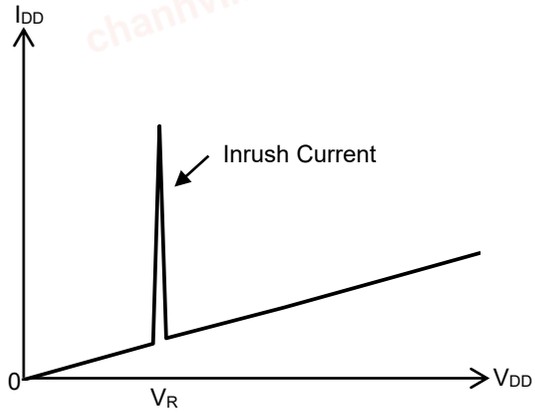


Figure 26. Current Consumption vs V_{DD} Voltage

A voltage drop [Inrush current (I_{DD})] x [input resistor (R_A)] is caused by the inrush current when the output switches from "L"→"H", and causes the input voltage to drop. When the input voltage drops and falls below the release voltage, the output will switch from "H"→"L". At this time, the inrush current stops flowing through at output “L”, and the voltage drop disappears. As a result, the output switches from "L"→"H", which again causes the inrush current to flow and the voltage to drop. This operation repeats and leads to oscillation.
In case resistor divider is not use and only use R_A, same response will happen.

(Attention)
Since there is no hysteresis width, it is not advisable to use it in circuit that connects the resistance to the input side. When using it, set the circuit configuration and constants in the actual application after a thorough evaluation is carried out.

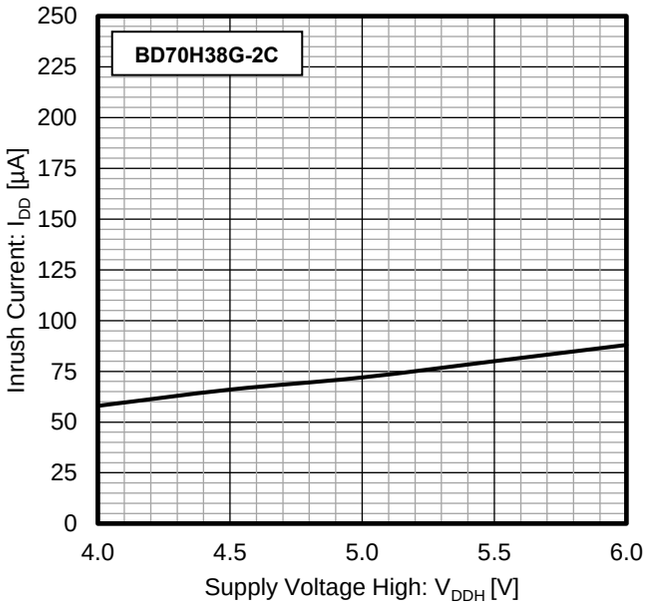


Figure 27. Open Drain Output Inrush Current
(VOUT Pull-up to V_{DD}, R_L = 100 kΩ, V_{DD} = 1 V → V_{DDH}, Ta = 25 °C)

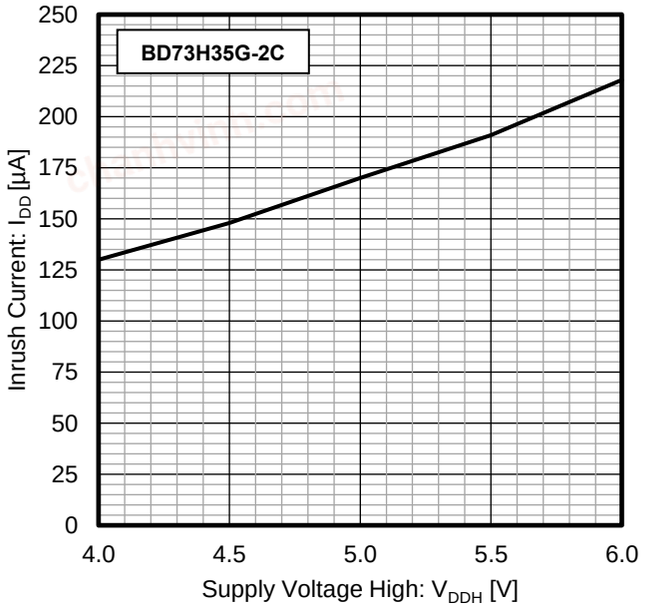


Figure 28. CMOS Output Inrush Current
(V_{DD} = 1 V → V_{DDH}, Ta = 25 °C)

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Considerations on Input and Output Capacitor

It is suggested to use input and output capacitors which is positioned as near as possible to the pins. The capacitor between the input pin and GND is effective when the power supply impedance increases or when the wiring is long. A large capacitor at the output improves stability and output load characteristics. Before implementation, check the state of mounting. In addition, the ceramic capacitor deviates in general and has temperature characteristics and AC bias characteristics. Furthermore, depending on the usage, the capacitance value decreases over time. It is recommended that ceramic capacitor to use is decided after gathering detailed data information by consulting brand manufacturers.

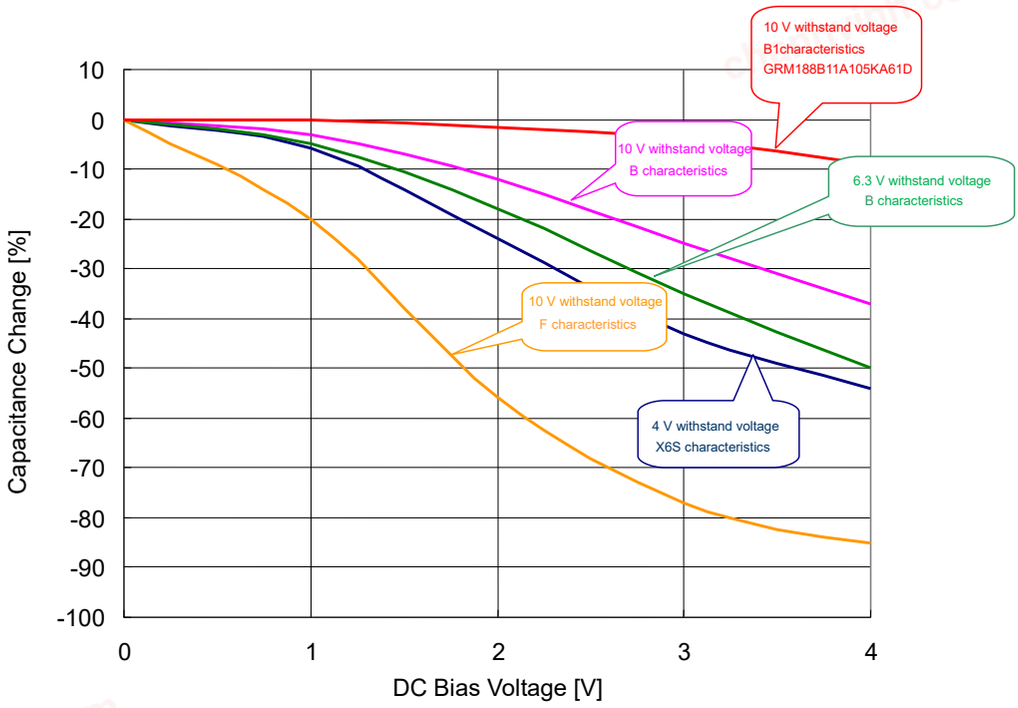


Figure 29. Ceramic Capacitance Change - DC Bias Properties (Characteristic example)

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Operational Notes

1. **Reverse Connection of Power Supply**
   Connecting the power supply in reverse polarity can damage the IC. Take precautions against reverse polarity when connecting the power supply, such as mounting an external diode between the power supply and the IC's power supply pins.

2. **Power Supply Lines**
   Design the PCB layout pattern to provide low impedance supply lines. Furthermore, connect a capacitor to ground at all power supply pins. Consider the effect of temperature and aging on the capacitance value when using electrolytic capacitors.

3. **Ground Voltage**
   Ensure that no pins are at a voltage below that of the ground pin at any time, even during transient condition.

4. **Ground Wiring Pattern**
   When using both small-signal and large-current ground traces, the two ground traces should be routed separately but connected to a single ground at the reference point of the application board to avoid fluctuations in the small-signal ground caused by large currents. Also ensure that the ground traces of external components do not cause variations on the ground voltage. The ground lines must be as short and thick as possible to reduce line impedance.

5. **Recommended Operating Conditions**
   The function and operation of the IC are guaranteed within the range specified by the recommended operating conditions. The characteristic values are guaranteed only under the conditions of each item specified by the electrical characteristics.

6. **Inrush Current**
   When power is first supplied to the IC, it is possible that the internal logic may be unstable and inrush current may flow instantaneously due to the internal powering sequence and delays, especially if the IC has more than one power supply. Therefore, give special consideration to power coupling capacitance, power wiring, width of ground wiring, and routing of connections.

7. **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.

8. **Inter-pin Short and Mounting Errors**
   Ensure that the direction and position are correct when mounting the IC on the PCB. Incorrect mounting may result in damaging the IC. Avoid nearby pins being shorted to each other especially to ground, power supply and output pin. Inter-pin shorts could be due to many reasons such as metal particles, water droplets (in very humid environment) and unintentional solder bridge deposited in between pins during assembly to name a few.

9. **Unused Input Pins**
   Input pins of an IC are often connected to the gate of a MOS transistor. The gate has extremely high impedance and extremely low capacitance. If left unconnected, the electric field from the outside can easily charge it. The small charge acquired in this way is enough to produce a significant effect on the conduction through the transistor and cause unexpected operation of the IC. So unless otherwise specified, unused input pins should be connected to the power supply or ground line.

10. **Regarding the Input Pin of the IC**
    In the construction of this IC, P-N junctions are inevitably formed creating parasitic diodes or transistors. The operation of these parasitic elements can result in mutual interference among circuits, operational faults, or physical damage. Therefore, conditions which cause these parasitic elements to operate, such as applying a voltage to an input pin lower than the ground voltage should be avoided. Furthermore, do not apply a voltage to the input pins when no power supply voltage is applied to the IC. Even if the power supply voltage is applied, make sure that the input pins have voltages within the values specified in the electrical characteristics of this IC.

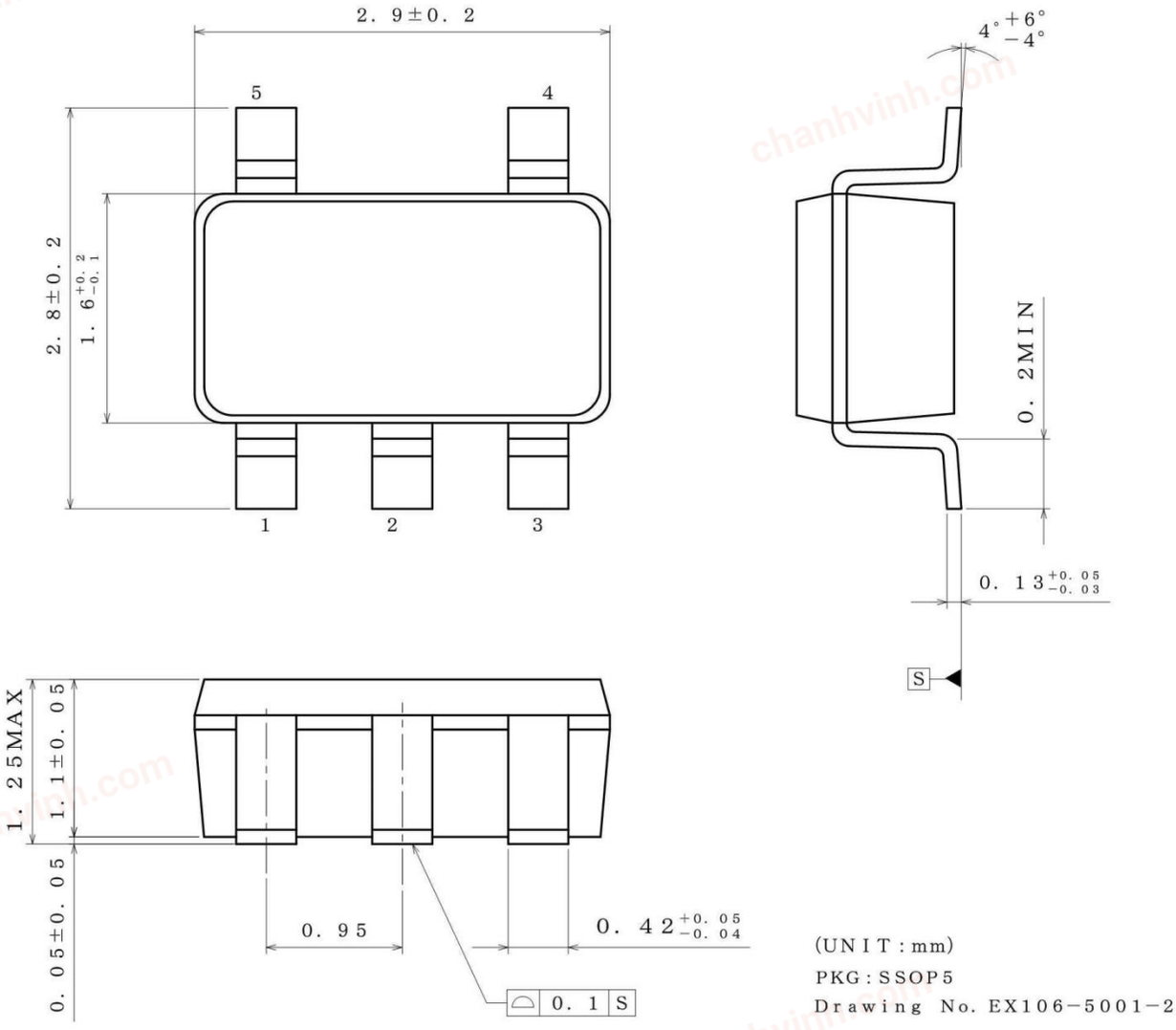
11. **Ceramic Capacitor**
    When using a ceramic capacitor, determine a capacitance value considering the change of capacitance with temperature and the decrease in nominal capacitance due to DC bias and others.

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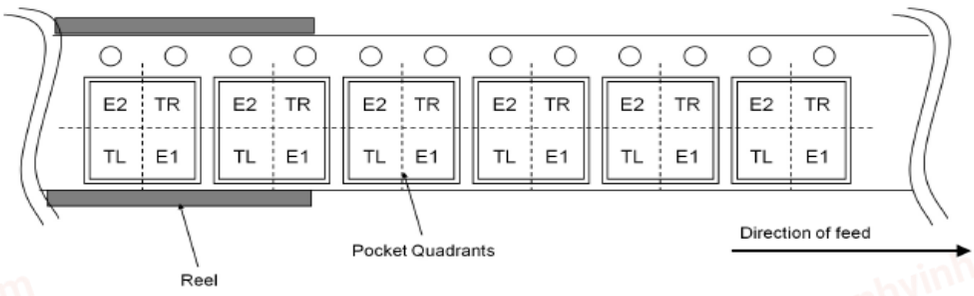
Physical Dimension and Packing Information

Package Name	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)



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Revision History

Date	Revision	Changes
2017/10/12	001	New Release
2018/04/03	002	Format change
2019/11/05	003	Format change, added notation of “Nano Energy”, added BD70H31G-C in the lineup
2021/06/28	004	Added BD70H12G-2C in the lineup

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(Note1) Medical Equipment Classification of the Specific Applications

JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		CLASSⅢ	

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   [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

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   [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 (Exclude cases where no-clean type fluxes is used. However, recommend sufficiently about the residue.); 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 depending on ambient temperature. When used in sealed area, confirm that it is the use in the range that does not exceed the maximum junction 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 on a surface-mount products, the flow soldering method must be used on a through hole mount products. If the flow soldering method is preferred on a surface-mount products, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

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Precautions Regarding Application Examples and External Circuits

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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 Cl_2, H_2S, NH_3, SO_2, and NO_2
   - [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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A two-dimensional barcode 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.

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