Voltage Detector IC Series

Low Voltage Standard CMOS Voltage Detector ICs

BU48xx series　BU49xx series

●General Description

ROHM standard CMOS reset IC series is a high-accuracy, low current consumption reset IC series. The lineup was established with two output types (Nch open drain and CMOS output) and detection voltage range from 0.9V to 4.8V in increments of 0.1V, so that the series may be selected according to the application at hand.

●Features

- Ultra-low current consumption
- High accuracy detection, Ultra-low voltage detection
- Two output types (Nch open drain and CMOS output)
- Wide operating temperature range
- Very small and low height package
- Package SSOP5 and SOP4 is similar to SOT-23-5 and SC-82 respectively (JEDEC)

●Key Specifications

- Detection voltage: 0.9V to 4.8V 0.1V steps
- High accuracy detection voltage: ±1.0%
- Ultra-low current consumption: 0.55μA (Typ.)
- Operating temperature range: -40°C to +125°C

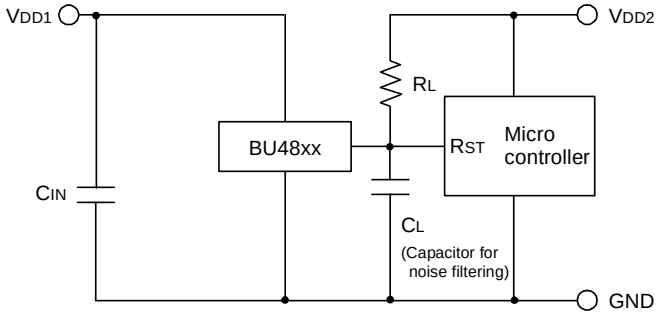
●Package

SSOP5	2.90mm x 2.80mm x 1.25mm
SOP4	2.00mm x 2.10mm x 0.95mm
VSOF5	1.60mm x 1.60mm x 0.60mm
SOT89-3F	4.50mm x 4.15mm x 1.50mm

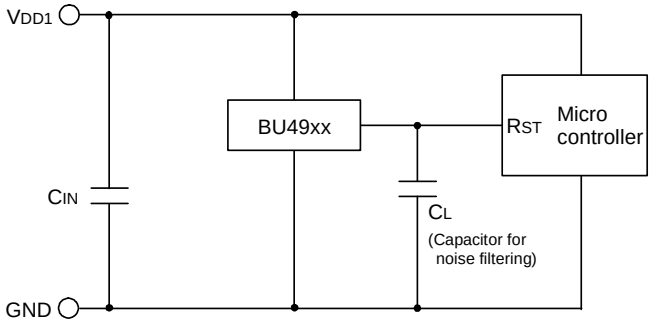
●Applications

All electronic devices that use micro controllers and logic circuits

●Typical Application Circuit



（Open Drain Output type）
BU48xx series



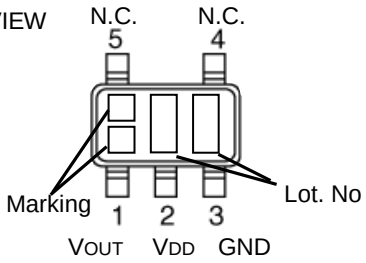
（CMOS Output type）
BU49xx series

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●Connection Diagram & Pin Descriptions

SSOP5

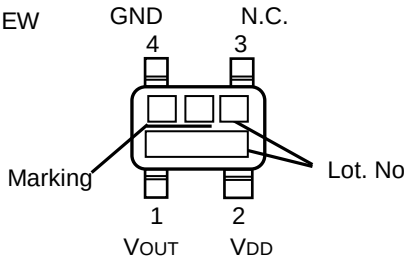
TOP VIEW



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

SOP4

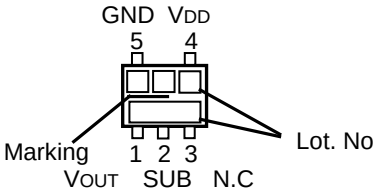
TOP VIEW



PIN No.	Symbol	Function
1	VOUT	Reset output
2	VDD	Power supply voltage
3	N.C.	Unconnected terminal
4	GND	GND

VSOF5

TOP VIEW

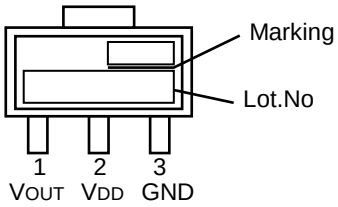


PIN No.	Symbol	Function
1	VOUT	Reset output
2	SUB	Substrate*
3	N.C.	Unconnected terminal
4	VDD	Power supply voltage
5	GND	GND

*Connect the substrate to VDD

SOT89-3F

TOP VIEW



PIN No.	Symbol	Function
1	VOUT	Reset output
2	VDD	Power supply voltage
3	GND	GND

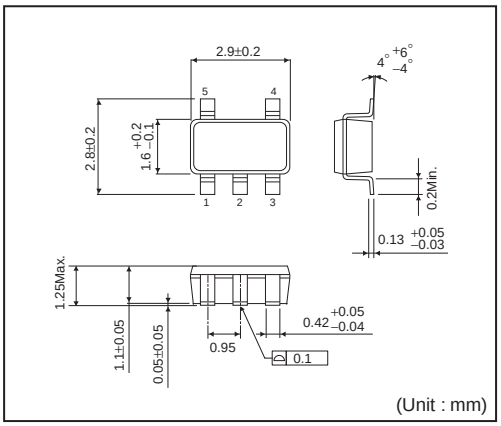
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●**Ordering Information**

B	U	x	x	x	x	x	–	T	R

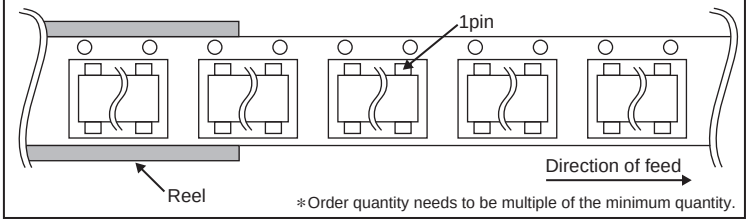
Part Number	Output Type 48 : Open Drain 49 : CMOS	Reset Voltage Value 09 : 0.9V ⇩ 0.1V step 48 : 4.8V	Package G : SSOP5 F : SOP4 FVE : VSOF5 FP3 : SOT89-3F	Packaging and forming specification TR : Embossed tape and reel

SSOP5



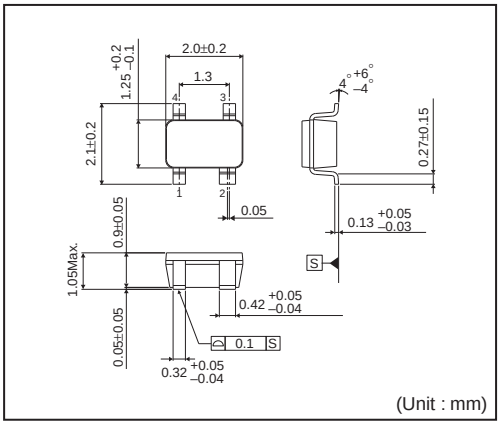
<Tape and Reel information>

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)

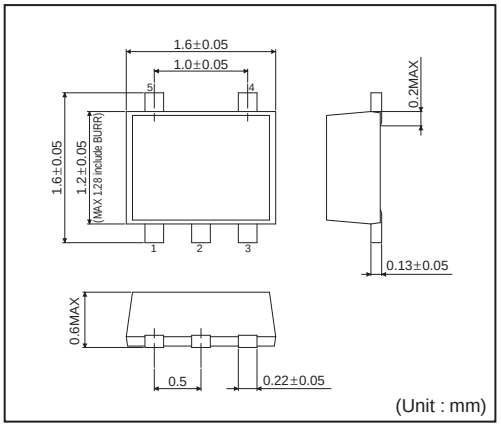


∗Order quantity needs to be multiple of the minimum quantity.

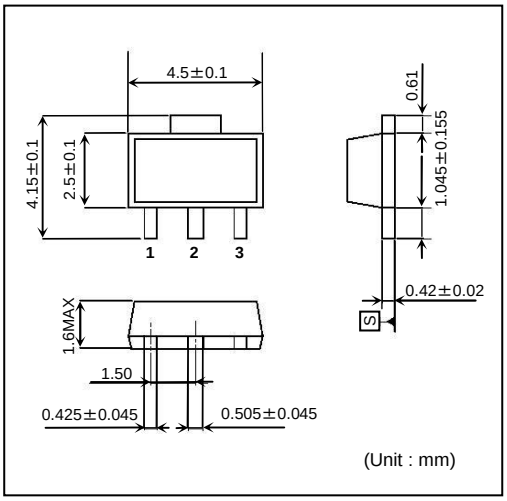
SOP4



VSOF5

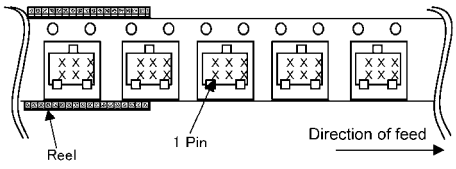


SOT89-3F



< Tape and Reel Information >

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



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●**Lineup**

Output Type	Open Drain		CMOS	
Detection Voltage	Marking	Part Number	Marking	Part Number
4.8V	JR	BU4848	LH	BU4948
4.7V	JQ	BU4847	LG	BU4947
4.6V	JP	BU4846	LF	BU4946
4.5V	JN	BU4845	LE	BU4945
4.4V	JM	BU4844	LD	BU4944
4.3V	JL	BU4843	LC	BU4943
4.2V	JK	BU4842	LB	BU4942
4.1V	JJ	BU4841	LA	BU4941
4.0V	JH	BU4840	KZ	BU4940
3.9V	JG	BU4839	KY	BU4939
3.8V	JF	BU4838	KX	BU4938
3.7V	JE	BU4837	KW	BU4937
3.6V	JD	BU4836	KV	BU4936
3.5V	JC	BU4835	KU	BU4935
3.4V	JB	BU4834	KT	BU4934
3.3V	JA	BU4833	KS	BU4933
3.2V	HZ	BU4832	KR	BU4932
3.1V	HY	BU4831	KQ	BU4931
3.0V	HX	BU4830	KP	BU4930
2.9V	HW	BU4829	KN	BU4929
2.8V	HV	BU4828	KM	BU4928
2.7V	HU	BU4827	KL	BU4927
2.6V	HT	BU4826	KK	BU4926
2.5V	HS	BU4825	KJ	BU4925
2.4V	HR	BU4824	KH	BU4924
2.3V	HQ	BU4823	KG	BU4923
2.2V	HP	BU4822	KF	BU4922
2.1V	HN	BU4821	KE	BU4921
2.0V	HM	BU4820	KD	BU4920
1.9V	HL	BU4819	KC	BU4919
1.8V	HK	BU4818	KB	BU4918
1.7V	HJ	BU4817	KA	BU4917
1.6V	HH	BU4816	JZ	BU4916
1.5V	HG	BU4815	JY	BU4915
1.4V	HF	BU4814	JX	BU4914
1.3V	HE	BU4813	JW	BU4913
1.2V	HD	BU4812	JV	BU4912
1.1V	HC	BU4811	JU	BU4911
1.0V	HB	BU4810	JT	BU4910
0.9V	HA	BU4809	JS	BU4909

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●Absolute Maximum Ratings

Parameter		Symbol	Limits	Unit
Power Supply Voltage		V_{DD}	-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 V_{DD}+0.3	
Output Current		Io	70	mA
Power Dissipation	SSOP5 *1*4	Pd	540	mW
	SOP4 *2*4		400	
	VSOF5 *3*4		210	
Operation Temperature Range		T_{opt}	-40 to +125	°C
Ambient Storage Temperature		Tstg	-55 to +125	℃

*1 When used at temperatures higher than Ta=25℃, the power is reduced by 5.4mW per 1℃ above 25℃.
*2 When used at temperatures higher than Ta=25℃, the power is reduced by 4.0mW per 1℃ above 25℃.
*3 When used at temperatures higher than Ta=25℃, the power is reduced by 2.1mW per 1℃ above 25℃.
*4 When a ROHM standard circuit board (70mm×70mm×1.6mm, glass epoxy board)is mounted.

●Electrical Characteristics

Parameter	Symbol	Condition		Limits Min.	Limits Typ.	Limits Max.	Unit
Detection Voltage	V_{DET}	V_{DD}=H→L , Ta=25℃, R_L=470kΩ		V_{DET}(T) ×0.99	V_{DET}(T)	V_{DET}(T) ×1.01	V
		VDET=1.8V	Ta=+25°C	1.782	1.8	1.818	
			Ta=-40°C to 85°C	1.741	-	1.860	
			Ta=85°C to 125°C	1.731	-	1.870	
		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 125°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 125°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 125°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 125°C	4.039	-	4.364	
Detection Voltage Temperature Coefficient	$V_{DET}/\Delta T$	Ta=-40℃ to 125℃ *1		-	±30	-	ppm/℃
Hysteresis Voltage	ΔV_{DET}	V_{DD}=L→H→L Ta=-40℃ to 125℃ R_L=470kΩ	V_{DET}≤1.0V	V_{DET} ×0.03	V_{DET} ×0.05	V_{DET} ×0.08	V
			V_{DET}≥1.1V	V_{DET} ×0.03	V_{DET} ×0.05	V_{DET} ×0.07	

*1 Guaranteed by design.(Outgoing inspection is not done on all products.)
V_{DET}(T) : Standard Detection Voltage (0.9V to 4.8V, 0.1V step)
R_L: Pull-up resistor to be connected between V_{OUT} and power supply.

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Unless Otherwise Specified Ta=-25 to 125℃

Parameter	Symbol	Condition		Limit			Unit
				Min.	Typ.	Max.	
Circuit Current when ON	$I_{DD}1$	$V_{DD}=V_{DET}-0.2V$	V_{DET}=0.9-1.3V	-	0.15	0.88	µA
			V_{DET}=1.4-2.1V	-	0.20	1.05	
			V_{DET}=2.2-2.7V	-	0.25	1.23	
			V_{DET}=2.8-3.3V	-	0.30	1.40	
			V_{DET}=3.4-4.2V	-	0.35	1.58	
			V_{DET}=4.3-4.8V	-	0.40	1.75	
Circuit Current when OFF	$I_{DD}2$	$V_{DD}=V_{DET}+2.0V$	V_{DET}=0.9-1.3V	-	0.30	1.40	µA
			V_{DET}=1.4-2.1V	-	0.35	1.58	
			V_{DET}=2.2-2.7V	-	0.40	1.75	
			V_{DET}=2.8-3.3V	-	0.45	1.93	
			V_{DET}=3.4-4.2V	-	0.50	2.10	
			V_{DET}=4.3-4.8V	-	0.55	2.28	
Operating Voltage Range	V_{OPL}	V_{OL}≤0.4V, Ta=25 to 125℃, R_L=470kΩ		0.70	-	-	V
		V_{OL}≤0.4V, Ta=-40 to 25℃, R_L=470kΩ		0.90	-	-	
‘Low’ Output Voltage (Nch)	V_{OL}	V_{DD}=0.85V, I_{SINK} = 20 µA		-	-	0.05	V
		V_{DD}=1.5V, I_{SINK} = 1 mA, V_{DET}=1.7-4.8V		-	-	0.5	V
		V_{DD}=2.4V, I_{SINK} = 4 mA, V_{DET}=2.7-4.8V		-	-	0.5	
‘High’ Output Voltage (Pch) (only BU49xx)	V_{OH}	VDD=4.8V,I_{SOURCE}=1.7mA, V_{DET}=0.9V to 3.9V		VDD-0.5	-	-	V
		VDD=6.0V,I_{SOURCE}=2.0mA, V_{DET}=4.0V to 4.8V		VDD-0.5	-	-	
Output Leak Current when OFF (only BU48xx)	I_{leak}	$V_{DD}=V_{DS}$=7V Ta=-40℃ to 85℃		-	0	0.1	µA
		$V_{DD}=V_{DS}$=7V Ta=85℃ to 125℃		-	0	1	

* This product is not designed for protection against radioactive rays.
V_{DET}(T) : Standard Detection Voltage (0.9V to 4.8V, 0.1V step)
R_L: Pull-up resistor to be connected between V_{OUT} and power supply.

●Block Diagrams

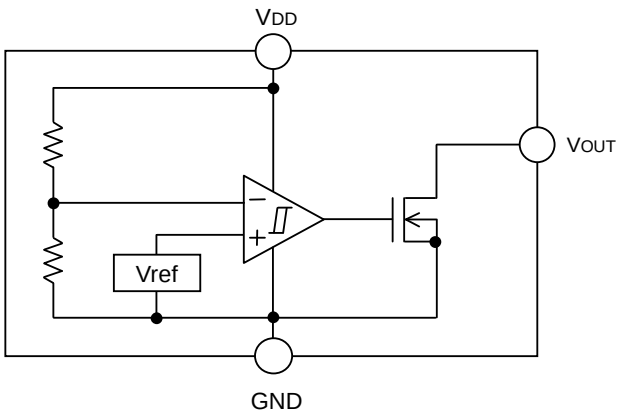


Fig.1 BU48xx Series

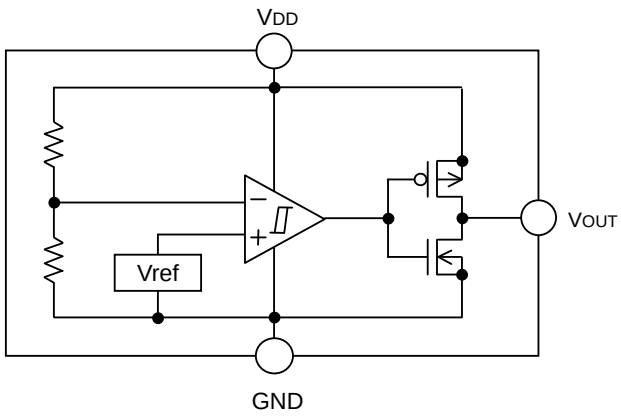


Fig.2 BU49xx Series

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●**Typical Performance Curves**

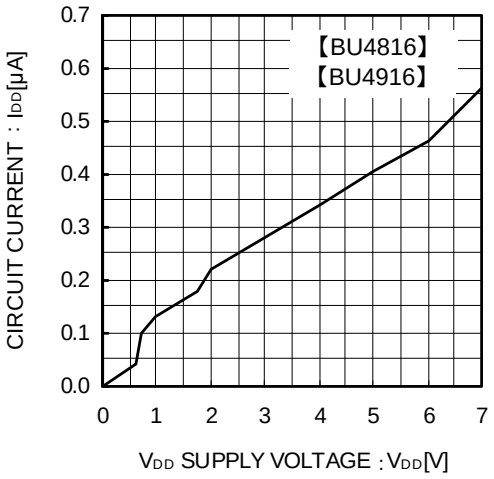


Fig.3 Circuit Current

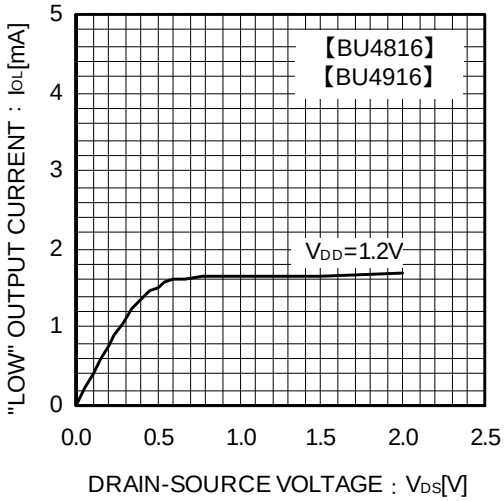


Fig.4 “LOW” Output Current

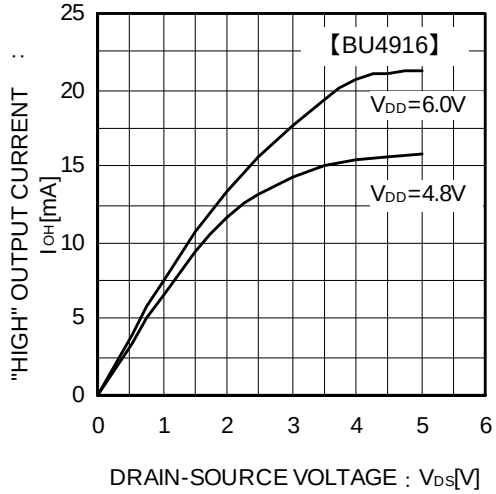


Fig.5 “High” Output Current

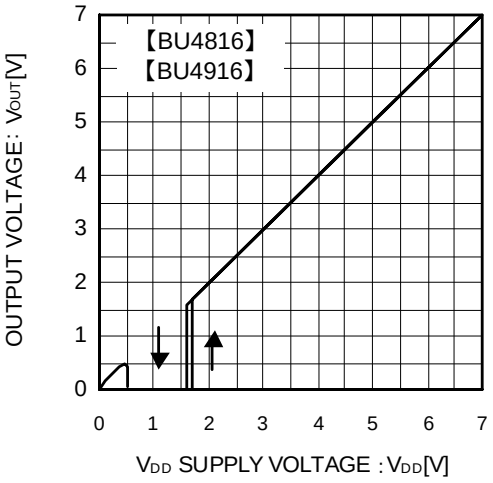


Fig.6 I/O Characteristics

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●**Typical Performance Curves – continued**

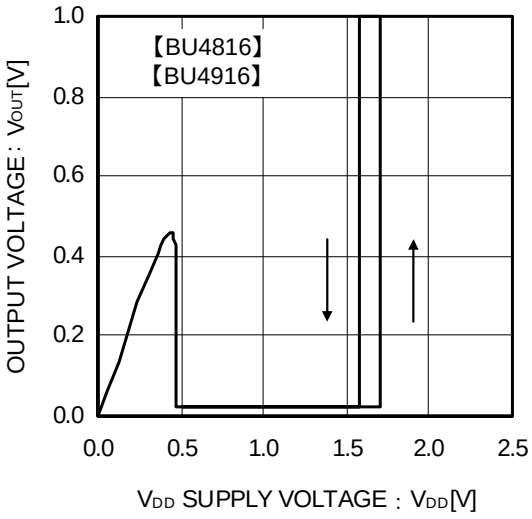


Fig.7 Operating Limit Voltage

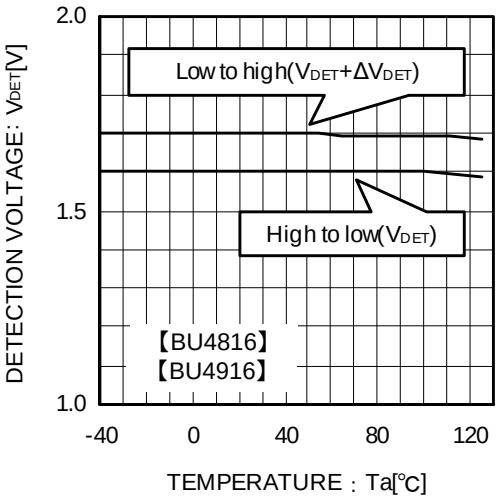


Fig.8 Detecting Voltage
Release Voltage

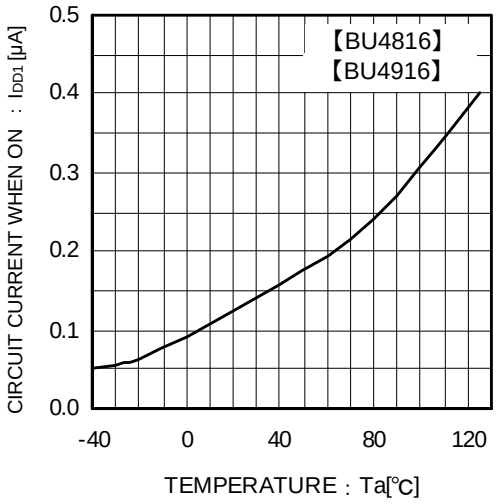


Fig.9 Circuit Current when ON

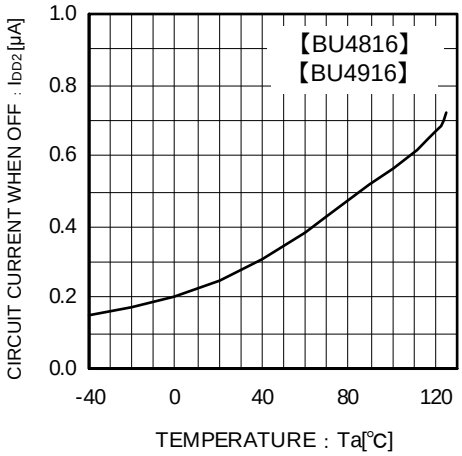


Fig.10 Circuit Current when OFF

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●**Typical Performance Curves – continued**

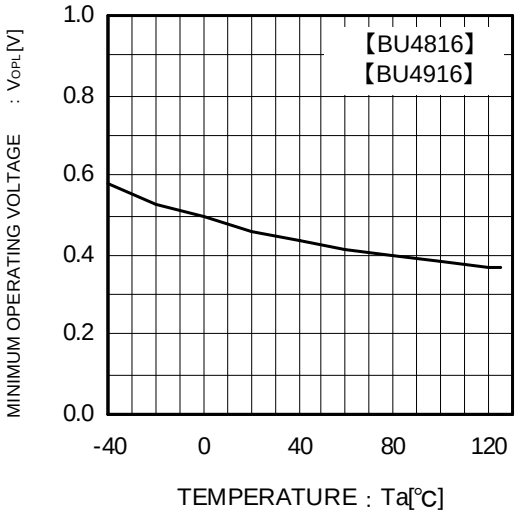


Fig.11 Operating Limit Voltage

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●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”. Because the BU48xx 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].

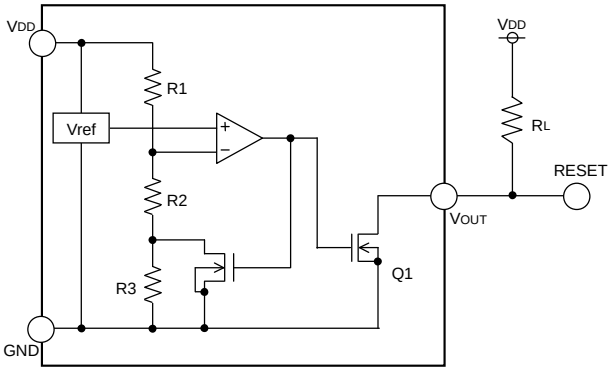


Fig.12 (BU48xx type internal block diagram)

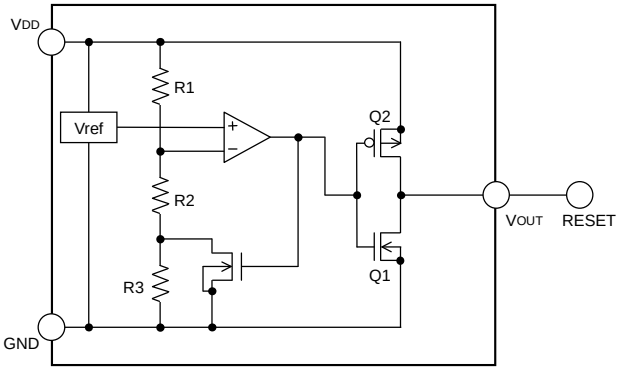


Fig.13 (BU49xx type internal block diagram)

Reference Data

Examples of Output rising value(t_{PLH})and Output falling value(t_{PHL})

Part Number	t_{PLH}[µs]	t_{PHL}[µs]
BU4845	23.3	275.9
BU4945	3.5	354.3
	V_{DD}=4.3V→5.1V	V_{DD}=5.1V→4.3V

* This data is for reference only.

This figure will vary with the application, so please confirm actual operation conditions before use.

Timing Waveforms

Example:The following shows the relationship between the input voltage V_{DD}, the C_T Terminal Voltage V_{CT} 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).

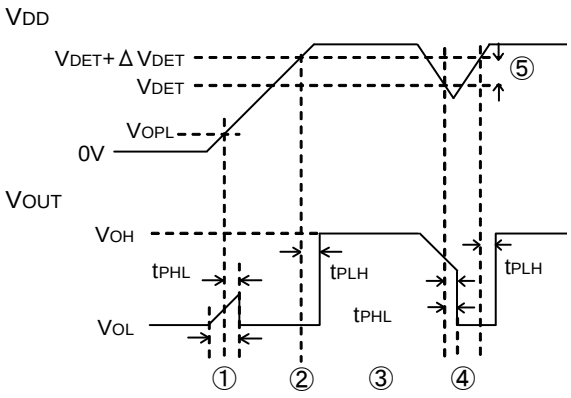


Fig.14 Timing Waveforms

①When 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 outputted when the rise time of V_{DD} is faster than t_{PHL}.

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

③If V_{DD} exceeds the reset release voltage (V_{DET} + V_{DET}), then V_{OUT} switches from L to H (with a delay of t_{PLH}).

④If 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}).

⑤The potential deference between the detection voltage and the release voltage is known as the hysteresis width (V_{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.

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●**Circuit Applications**

1) Examples of a common power supply detection reset circuit

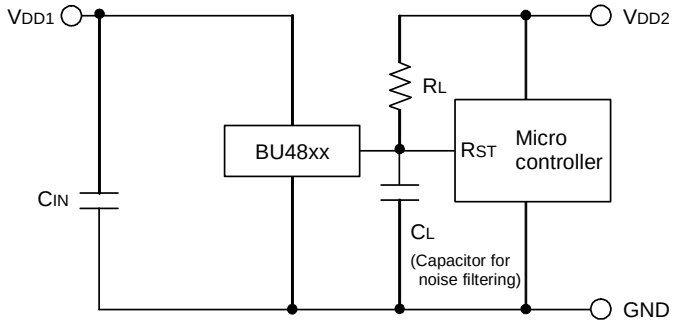


Fig.15 Open Drain Output type

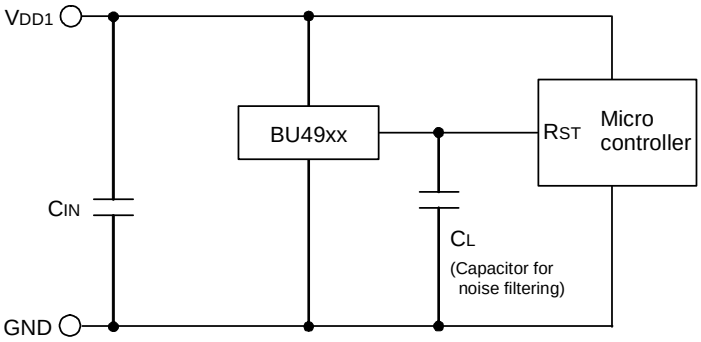


Fig.16 CMOS Output type

Application examples of BU48xx series (Open Drain output type) and BU49xx series (CMOS output type) are shown below.

CASE1:The power supply of the microcontroller ($V_{DD}2$) differs from the power supply of the reset detection ($V_{DD}1$). Use the Open Drain Output Type (BU48xx series). Attach a load resistance (R_L) between the output and $V_{DD}2$. (As shown Fig.15)

CASE2:The power supply of the microcontroller ($V_{DD}1$) is same as the power supply of the reset detection ($V_{DD}1$). Use CMOS output type (BU43xx series) or Open Drain Output Type (BU48xx series). Attach a load resistance (R_L) between the output and $V_{DD}1$. (As shown Fig.16)

When a capacitance C_L for noise filtering for setting the output delay time 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}).

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

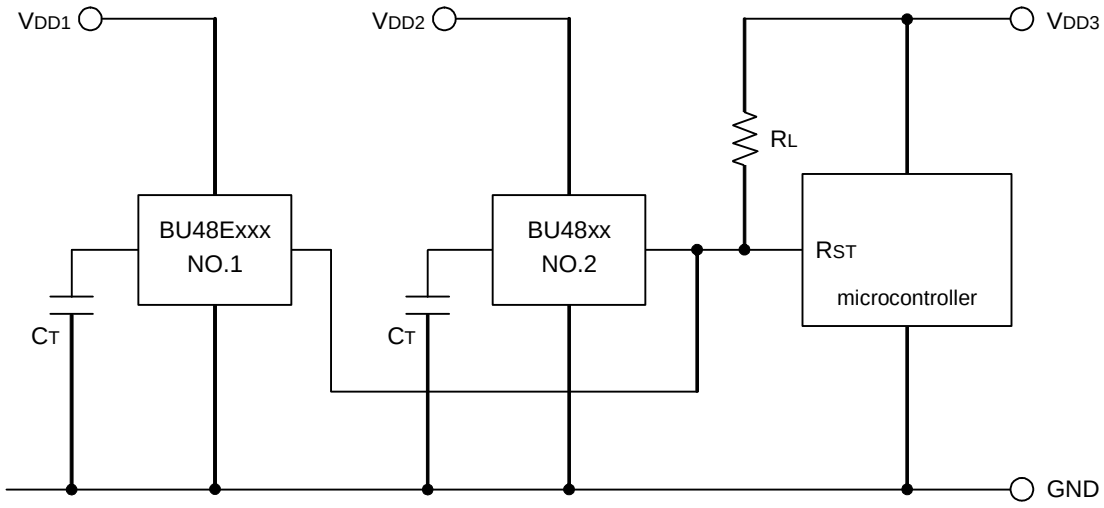


Fig.17

To reset the microcontroller when many independent power supplies are used in the system, OR connect an open drain output type (BU48xx series) to the microcontroller's input with pull-up resistor to the supply voltage of the microcontroller (V_{DD3}) as shown in Fig. 20. By pulling-up to V_{DD3}, output "High" voltage of micro-controller power supply is possible.

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3) Examples of the power supply with resistor dividers

In applications where the power supply input terminal (VDD) of an IC is connected through resistor dividers, it is possible that a through current will momentarily flow into the circuit when the output logic switches, resulting in malfunctions (such as output oscillatory state).
(Through-current is a current that momentarily flows from the power supply (VDD) to ground (GND) when the output level switches from “High” to “Low” or vice versa.)

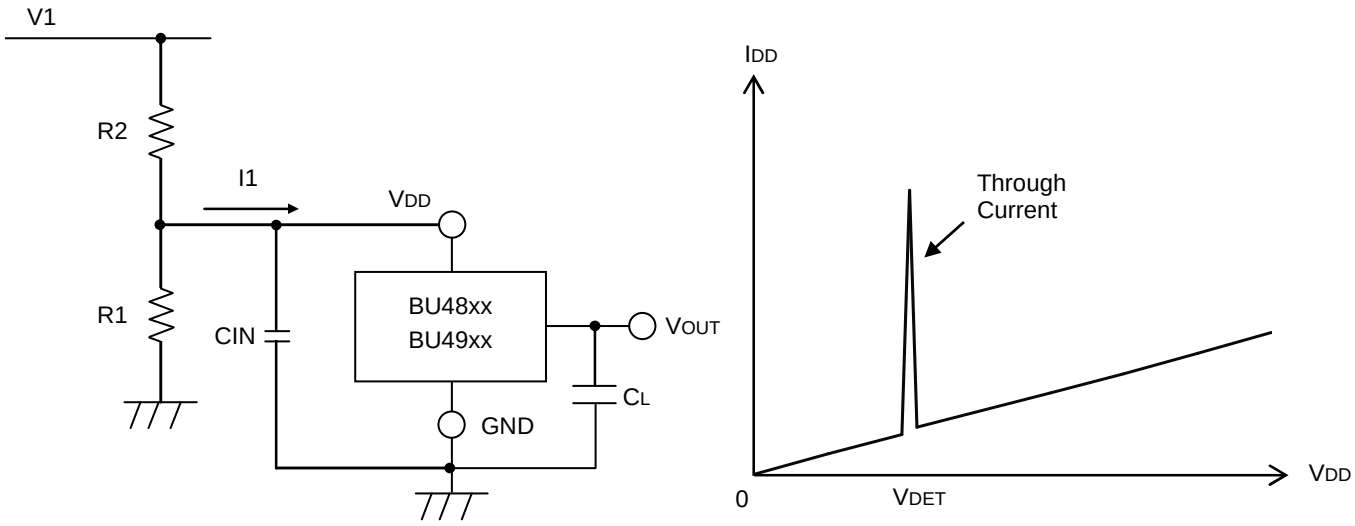


Fig.18

A voltage drop of [the through-current (I1)] × [input resistor (R2)] is caused by the through current, and the input voltage to descends, when the output switches from “Low” to “High”. When the input voltage decreases and falls below the detection voltage, the output voltage switches from “High” to “Low”. At this time, the through-current stops flowing through output “Low”, and the voltage drop is eliminated. As a result, the output switches from “Low” to “High”, which again causes the through current to flow and the voltage drop. This process is repeated, resulting in oscillation.

Consider the use of BU48xx when the power supply input it with resistor dividers.

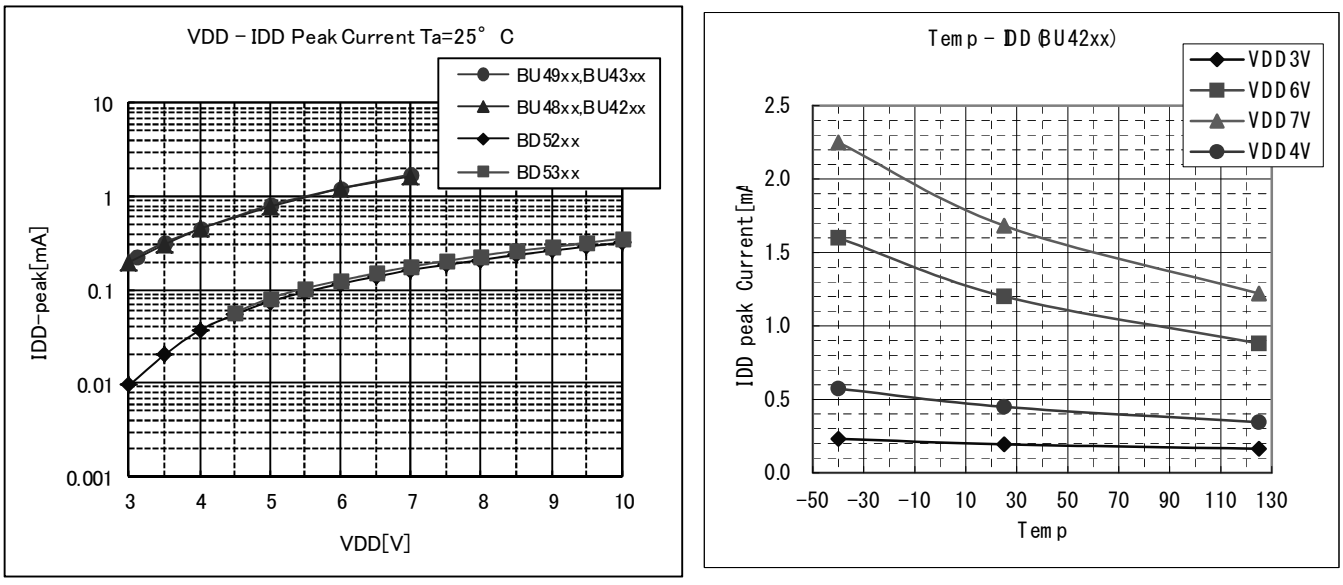


Fig.19 Current Consumption vs. Power Supply Voltage

* This data is for reference only.
The figures will vary with the application, so please confirm actual operating conditions before use.

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●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 case of needless “Delay Time”, recommended to insert more 470kΩ resister between V_{DD} and C_T. The recommended value of R_L Resistor is over 10kΩ to 1MΩ for V_{DET}=1.5V to 4.8V, and over 100kΩ to 1MΩ for V_{DET}=0.9V to 1.4V. The recommended value of C_T Capacitor is over 100pF to 0.1µF. 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) C_T pin discharge
Due to the capabilities of the C_T pin discharge transistor, the C_T pin may not completely discharge when a short input pulse is applied, and in this case the delay time may not be controlled. Please verify the actual operation.

15) 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. The value of Rct depends on the external resistor that is connected to C_T terminal, so please consider the delay time that is decided by $t \times R_{CT} \times C_{CT}$ changes.

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   [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.

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●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).

●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.

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