Voltage Detector IC Series

# Low Voltage Free Delay Time Setting CMOS Voltage Detector IC Series

## BU42xx series BU43xx series

### ●General Description

ROHM's BU42xx and BU43xx series are CMOS Voltage Detector ICs with adjustable output delay. It is a high-accuracy, low current consumption Voltage Detector IC series with a built-in delay circuit. The lineup was established with two output types (Nch open drain and CMOS output) and detection voltages range from 0.9V to 4.8V in increments of 0.1V, so that the series may be selected according to application.

### ●Features

- Delay Time Controlled by external Capacitor
- Two output types (Nch open drain and CMOS output)
- Ultra-low current consumption
- 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 (Typ.) 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

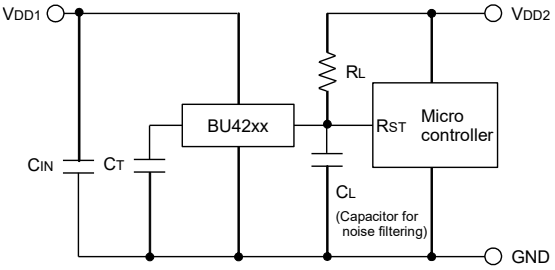
SOP4:  2.00mm x 2.10mm x 0.95mm

VSOF5:  1.60mm x 1.60mm x 0.60mm

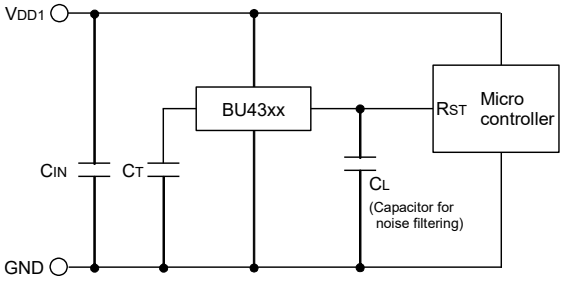
### ●Applications

Circuits using microcontrollers or logic circuits that require a reset.

### ●Typical Application Circuit




Open Drain Output type
BU42xx series

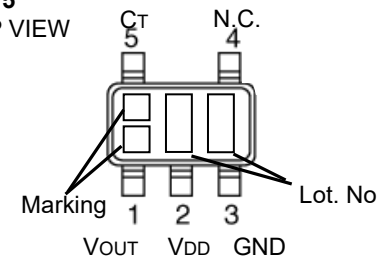



CMOS Output type
BU43xx series

### ●Connection Diagram & Pin Descriptions

**SSOP5**

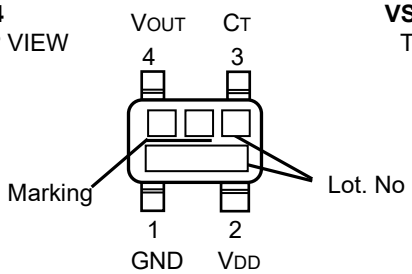
TOP VIEW




| PIN No. | Symbol | Function |
|---|---|---|
| 1 | VOUT | Reset output |
| 2 | VDD | Power supply voltage |
| 3 | GND | GND |
| 4 | N.C. | Unconnected terminal |
| 5 | CT | Capacitor connection terminal for output delay time |

**SOP4**

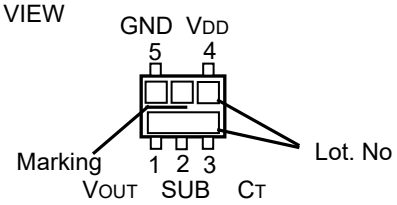
TOP VIEW




| PIN No. | Symbol | Function |
|---|---|---|
| 1 | GND | GND |
| 2 | VDD | Power supply voltage |
| 3 | CT | Capacitor connection terminal for output delay time |
| 4 | VOUT | Reset output |

**VSOF5**

TOP VIEW




| PIN No. | Symbol | Function |
|---|---|---|
| 1 | VOUT | Reset output |
| 2 | SUB | Substrate* |
| 3 | CT | Capacitor connection terminal for output delay time |
| 4 | VDD | Power supply voltage |
| 5 | GND | GND |

*Connect the substrate to VDD

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


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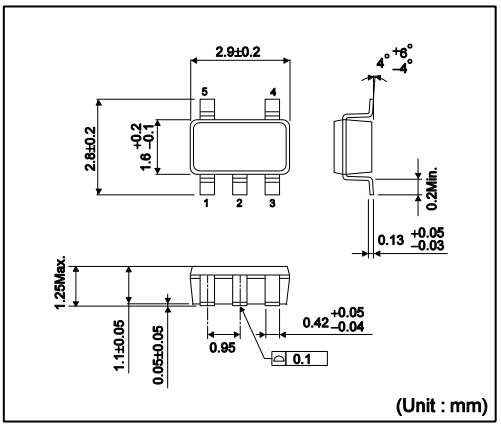

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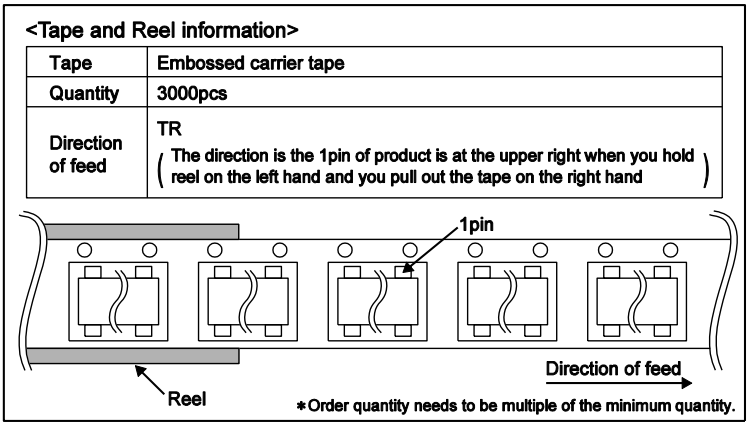
●Ordering Information

| B | U | x | x | x | x | x | - | T | R |
|---|---|---|---|---|---|---|---|---|---|

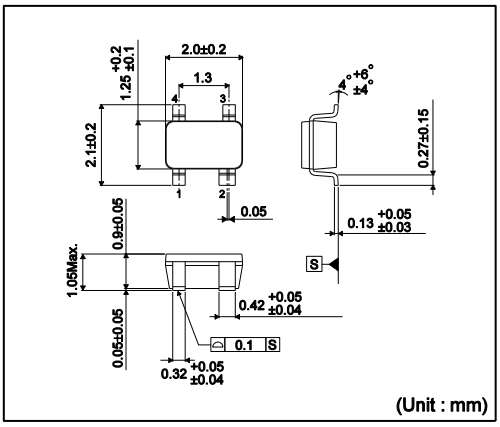
| Part Number | Output Type | Reset Voltage Value | Package | Packaging and forming specification |
|---|---|---|---|---|
| | 42 : Open Drain<br>43 : CMOS | 09 : 0.9V<br>⇩ 0.1V step<br>48 : 4.8V | G : SSOP5<br>F : SOP4<br>FVE : VSOF5 | TR : Embossed tape and reel |

**SSOP5**

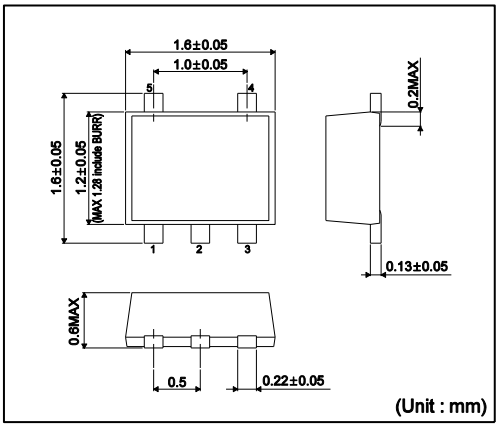



**SOP4**




**VSOF5**





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●**Lineup**

Table 1. Lineup for SSOP5 Package

| Package Type | SSOP5 | | | |
|---|---|---|---|---|
| Output Type | Open Drain | | CMOS | |
| Detection Voltage | Marking | Part Number | Marking | Part Number |
| 4.8V | ZR | BU4248 | 1H | BU4348 |
| 4.7V | ZQ | BU4247 | 1G | BU4347 |
| 4.6V | ZP | BU4246 | 1F | BU4346 |
| 4.5V | ZN | BU4245 | 1E | BU4345 |
| 4.4V | ZM | BU4244 | 1D | BU4344 |
| 4.3V | ZL | BU4243 | 1C | BU4343 |
| 4.2V | ZK | BU4242 | 1B | BU4342 |
| 4.1V | ZJ | BU4241 | 1A | BU4341 |
| 4.0V | ZH | BU4240 | 0Z | BU4340 |
| 3.9V | ZG | BU4239 | 0Y | BU4339 |
| 3.8V | ZF | BU4238 | 0X | BU4338 |
| 3.7V | ZE | BU4237 | 0W | BU4337 |
| 3.6V | ZD | BU4236 | 0V | BU4336 |
| 3.5V | ZC | BU4235 | 0U | BU4335 |
| 3.4V | ZB | BU4234 | 0T | BU4334 |
| 3.3V | ZA | BU4233 | 0S | BU4333 |
| 3.2V | YZ | BU4232 | 0R | BU4332 |
| 3.1V | YY | BU4231 | 0Q | BU4331 |
| 3.0V | YX | BU4230 | 0P | BU4330 |
| 2.9V | YW | BU4229 | 0N | BU4329 |
| 2.8V | YV | BU4228 | 0M | BU4328 |
| 2.7V | YU | BU4227 | 0L | BU4327 |
| 2.6V | YT | BU4226 | 0K | BU4326 |
| 2.5V | YS | BU4225 | 0J | BU4325 |
| 2.4V | YR | BU4224 | 0H | BU4324 |
| 2.3V | YQ | BU4223 | 0G | BU4323 |
| 2.2V | YP | BU4222 | 0F | BU4322 |
| 2.1V | YN | BU4221 | 0E | BU4321 |
| 2.0V | YM | BU4220 | 0D | BU4320 |
| 1.9V | YL | BU4219 | 0C | BU4319 |
| 1.8V | YK | BU4218 | 0B | BU4318 |
| 1.7V | YJ | BU4217 | 0A | BU4317 |
| 1.6V | YH | BU4216 | ZZ | BU4316 |
| 1.5V | YG | BU4215 | ZY | BU4315 |
| 1.4V | YF | BU4214 | ZX | BU4314 |
| 1.3V | YE | BU4213 | ZW | BU4313 |
| 1.2V | YD | BU4212 | ZV | BU4312 |
| 1.1V | YC | BU4211 | ZU | BU4311 |
| 1.0V | YB | BU4210 | ZT | BU4310 |
| 0.9V | YA | BU4209 | ZS | BU4309 |


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●**Lineup – continued**

Table 2. Lineup for SOP4 Package

| Package Type | SOP4 | | | |
|---|---|---|---|---|
| Output Type | Open Drain | | CMOS | |
| Detection Voltage | Marking | Part Number | Marking | Part Number |
| 4.8V | ZR | BU4248 | 1H | BU4348 |
| 4.7V | ZQ | BU4247 | 1G | BU4347 |
| 4.6V | ZP | BU4246 | 1F | BU4346 |
| 4.5V | ZN | BU4245 | 1E | BU4345 |
| 4.4V | ZM | BU4244 | 1D | BU4344 |
| 4.3V | ZL | BU4243 | 1C | BU4343 |
| 4.2V | ZK | BU4242 | 1B | BU4342 |
| 4.1V | ZJ | BU4241 | 1A | BU4341 |
| 4.0V | ZH | BU4240 | 0Z | BU4340 |
| 3.9V | ZG | BU4239 | 0Y | BU4339 |
| 3.8V | ZF | BU4238 | 0X | BU4338 |
| 3.7V | ZE | BU4237 | 0W | BU4337 |
| 3.6V | ZD | BU4236 | 0V | BU4336 |
| 3.5V | ZC | BU4235 | 0U | BU4335 |
| 3.4V | ZB | BU4234 | 0T | BU4334 |
| 3.3V | ZA | BU4233 | 0S | BU4333 |
| 3.2V | YZ | BU4232 | 0R | BU4332 |
| 3.1V | YY | BU4231 | 0Q | BU4331 |
| 3.0V | YX | BU4230 | 0P | BU4330 |
| 2.9V | YW | BU4229 | 0N | BU4329 |
| 2.8V | YV | BU4228 | 0M | BU4328 |
| 2.7V | YU | BU4227 | 0L | BU4327 |
| 2.6V | YT | BU4226 | 0K | BU4326 |
| 2.5V | YS | BU4225 | 0J | BU4325 |
| 2.4V | YR | BU4224 | 0H | BU4324 |
| 2.3V | YQ | BU4223 | 0G | BU4323 |
| 2.2V | YP | BU4222 | 0F | BU4322 |
| 2.1V | YN | BU4221 | 0E | BU4321 |
| 2.0V | YM | BU4220 | 0D | BU4320 |
| 1.9V | YL | BU4219 | 0C | BU4319 |
| 1.8V | YK | BU4218 | 0B | BU4318 |
| 1.7V | YJ | BU4217 | 0A | BU4317 |
| 1.6V | YH | BU4216 | ZZ | BU4316 |
| 1.5V | YG | BU4215 | ZY | BU4315 |
| 1.4V | YF | BU4214 | ZX | BU4314 |
| 1.3V | YE | BU4213 | ZW | BU4313 |
| 1.2V | YD | BU4212 | ZV | BU4312 |
| 1.1V | YC | BU4211 | ZU | BU4311 |
| 1.0V | YB | BU4210 | ZT | BU4310 |
| 0.9V | YA | BU4209 | ZS | BU4309 |


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●**Lineup – continued**

Table 3. Lineup for VSOF5 Package

| Package Type | VSOF5 | | | |
|---|---|---|---|---|
| Output Type | Open Drain | | CMOS | |
| Detection Voltage | Marking | Part Number | Marking | Part Number |
| 4.8V | ZR | BU4248 | 1H | BU4348 |
| 4.7V | ZQ | BU4247 | 1G | BU4347 |
| 4.6V | ZP | BU4246 | 1F | BU4346 |
| 4.5V | ZN | BU4245 | 1E | BU4345 |
| 4.4V | ZM | BU4244 | 1D | BU4344 |
| 4.3V | ZL | BU4243 | 1C | BU4343 |
| 4.2V | ZK | BU4242 | 1B | BU4342 |
| 4.1V | ZJ | BU4241 | 1A | BU4341 |
| 4.0V | ZH | BU4240 | 0Z | BU4340 |
| 3.9V | ZG | BU4239 | 0Y | BU4339 |
| 3.8V | ZF | BU4238 | 0X | BU4338 |
| 3.7V | ZE | BU4237 | 0W | BU4337 |
| 3.6V | ZD | BU4236 | 0V | BU4336 |
| 3.5V | ZC | BU4235 | 0U | BU4335 |
| 3.4V | ZB | BU4234 | 0T | BU4334 |
| 3.3V | ZA | BU4233 | 0S | BU4333 |
| 3.2V | YZ | BU4232 | 0R | BU4332 |
| 3.1V | YY | BU4231 | 0Q | BU4331 |
| 3.0V | YX | BU4230 | 0P | BU4330 |
| 2.9V | YW | BU4229 | 0N | BU4329 |
| 2.8V | YV | BU4228 | 0M | BU4328 |
| 2.7V | YU | BU4227 | 0L | BU4327 |
| 2.6V | YT | BU4226 | 0K | BU4326 |
| 2.5V | YS | BU4225 | 0J | BU4325 |
| 2.4V | YR | BU4224 | 0H | BU4324 |
| 2.3V | YQ | BU4223 | 0G | BU4323 |
| 2.2V | YP | BU4222 | 0F | BU4322 |
| 2.1V | YN | BU4221 | 0E | BU4321 |
| 2.0V | YM | BU4220 | 0D | BU4320 |
| 1.9V | YL | BU4219 | 0C | BU4319 |
| 1.8V | YK | BU4218 | 0B | BU4318 |
| 1.7V | YJ | BU4217 | 0A | BU4317 |
| 1.6V | YH | BU4216 | ZZ | BU4316 |
| 1.5V | YG | BU4215 | ZY | BU4315 |
| 1.4V | YF | BU4214 | ZX | BU4314 |
| 1.3V | YE | BU4213 | ZW | BU4313 |
| 1.2V | YD | BU4212 | ZV | BU4312 |
| 1.1V | YC | BU4211 | ZU | BU4311 |
| 1.0V | YB | BU4210 | ZT | BU4310 |
| 0.9V | YA | BU4209 | ZS | BU4309 |

The part number shown in red letters are “Not Recommended for New Designs”.


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## ●Absolute Maximum Ratings

| Parameter | | Symbol | Limit | 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(SOT-23-5) *1*4 | Pd | 540 | mW |
| | SOP4(SC-82) *2*4 | | 400 | |
| | VSOF5 *3*4 | | 210 | |
| Operation Temperature Range | | Topt | -40 to +125 | °C |
| Ambient Storage Temperature | | Tstg | -55 to +125 | °C |

*1 Reduced by 5.4mW/°C when used over 25°C.
*2 Reduced by 4.0mW/°C when used over 25°C.
*3 Reduced by 2.1mW/°C when used over 25°C.
*4 When mounted on ROHM standard circuit board (70mm×70mm×1.6mm, glass epoxy board).

## ●Electrical Characteristics (Unless Otherwise Specified Ta=-25 to 125°C)

| Parameter | Symbol | Condition | | Limit Min. | Limit Typ. | Limit Max. | Unit |
|---|---|---|---|---|---|---|---|
| Detection Voltage | $V_{DET}$ | $V_{DD}$=H→L, Ta=25°C, $R_L$=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 | 1.718 | - | 1.883 | |
| | | 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 | 2.386 | - | 2.615 | |
| | | 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 | 2.864 | - | 3.139 | |
| | | 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 | 3.150 | - | 3.452 | |
| | | 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 | 4.009 | - | 4.394 | |
| Circuit Current when ON | $I_{DD}1$ | $V_{DD}$=$V_{DET}$-0.2V | $V_{DET}$ =0.9 to 1.3V | - | 0.15 | 0.88 | μA |
| | | | $V_{DET}$ =1.4 TO 2.1V | - | 0.20 | 1.05 | |
| | | | $V_{DET}$ =2.2 TO 2.7V | - | 0.25 | 1.23 | |
| | | | $V_{DET}$ =2.8 to 3.3V | - | 0.30 | 1.40 | |
| | | | $V_{DET}$ =3.4 to 4.2V | - | 0.35 | 1.58 | |
| | | | $V_{DET}$ =4.3 to 4.8V | - | 0.40 | 1.75 | |
| Circuit Current when OFF | $I_{DD}2$ | $V_{DD}$=$V_{DET}$+2.0V | $V_{DET}$ =0.9 TO 1.3V | - | 0.30 | 1.40 | μA |
| | | | $V_{DET}$ =1.4 TO 2.1V | - | 0.35 | 1.58 | |
| | | | $V_{DET}$ =2.2 to 2.7V | - | 0.40 | 1.75 | |
| | | | $V_{DET}$ =2.8 to 3.3V | - | 0.45 | 1.93 | |
| | | | $V_{DET}$ =3.4 to 4.2V | - | 0.50 | 2.10 | |
| | | | $V_{DET}$ =4.3 to 4.8V | - | 0.55 | 2.28 | |
| Operating Voltage Range | $V_{OPL}$ | $V_{OL}$≤0.4V, Ta=25 to 125°C, $R_L$=470kΩ | | 0.70 | - | - | V |
| | | $V_{OL}$≤0.4V, Ta=-40 to 25°C, $R_L$=470kΩ | | 0.90 | - | - | |
| 'High' Output Voltage (Pch) | $V_{OH}$ | $V_{DD}$=4.8V, $I_{SOURCE}$=1.7 mA,$V_{DET}$=0.9V to 3.9V | | VDD-0.5 | - | - | V |
| | | $V_{DD}$=6.0V, $I_{SOURCE}$=2.0 mA,$V_{DET}$=4.0V to 4.8V | | VDD-0.5 | - | - | V |
| '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 to 4.8V | | - | - | 0.5 | V |
| | | $V_{DD}$=2.4V, $I_{SINK}$ = 3.6 mA, $V_{DET}$=2.7 to 4.8V | | - | - | 0.5 | |

*1: Design Guarantee. (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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●**Electrical Characteristics (Unless Otherwise Specified Ta=-25 to 125°C) - continued**

| Parameter | Symbol | Condition | | Limit | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Leak Current when OFF | $I_{leak}$ | $V_{DD}$=$V_{DS}$=7V Ta=-40 to 85°C | | - | 0 | 0.1 | μA |
| | | $V_{DD}$=$V_{DS}$=7V Ta=85 to 125°C | | - | 0 | 1 | |
| CT pin Threshold Voltage | $V_{CTH}$ | $V_{DD}$=$V_{DET}$×1.1, $V_{DET}$=0.9 to 2.5V Ta=25°C $R_L$=470kΩ | | $V_{DD}$ ×0.35 | $V_{DD}$ ×0.45 | $V_{DD}$ ×0.55 | V |
| | | $V_{DD}$=$V_{DET}$×1.1, $V_{DET}$=2.6 to 4.8V Ta=25°C $R_L$=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 Ta=25°C *1 | | 9 | 10 | 11 | MΩ |
| CT pin Output Current | $I_{CT}$ | $V_{CT}$=0.1V $V_{DD}$=0.85V | | 5 | 40 | - | μA |
| | | $V_{CT}$=0.5V $V_{DD}$=1.5V $V_{DET}$=1.7 to 4.8V | | 200 | 400 | - | |
| Detection Voltage Temperature coefficient | $V_{DET}/\Delta T$ | Ta=-40°C to 125°C | | - | ±30 | - | ppm/°C |
| Hysteresis Voltage | $\Delta V_{DET}$ | $V_{DD}$=L→H→L Ta=-40 to 125°C $R_L$=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: Design Guarantee. (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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●**Block Diagrams**

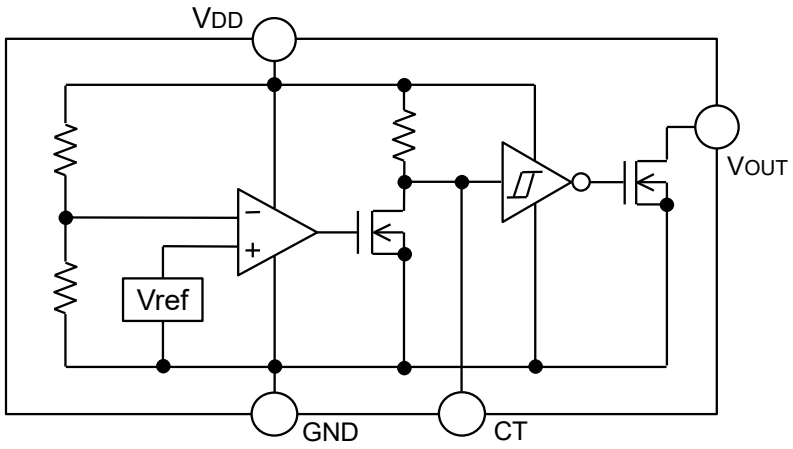



Fig.1 BU42xx Series

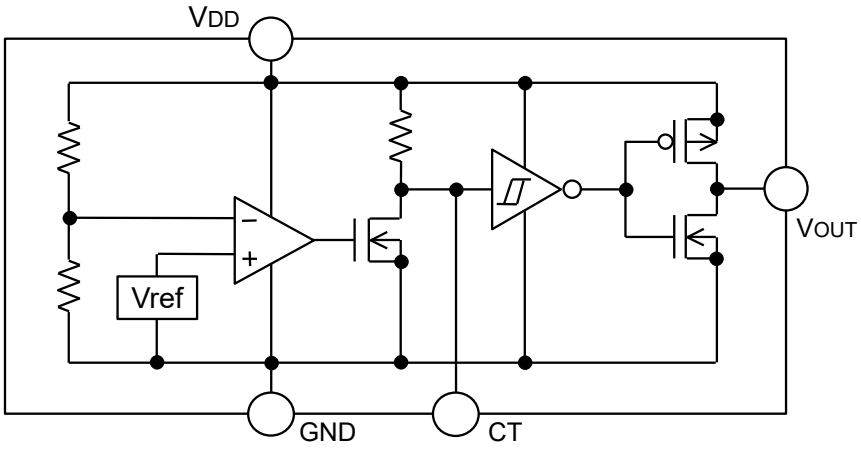



Fig.2 BU43xx Series


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●**Typical Performance Curves**

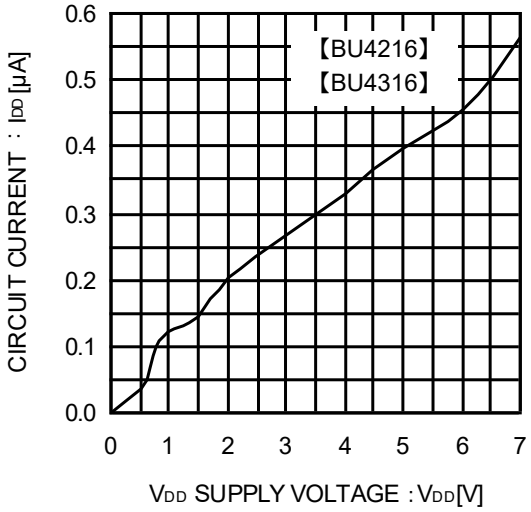



Fig.3 Circuit Current

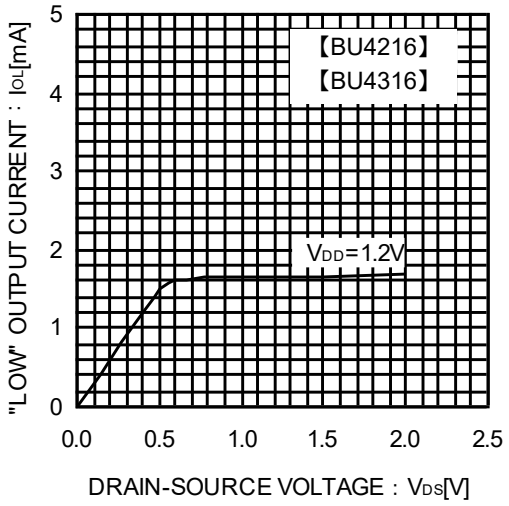



Fig.4 “LOW” Output Current

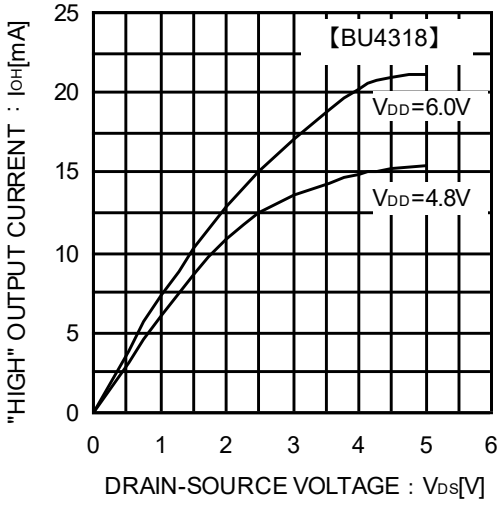



Fig.5 “High” Output Current

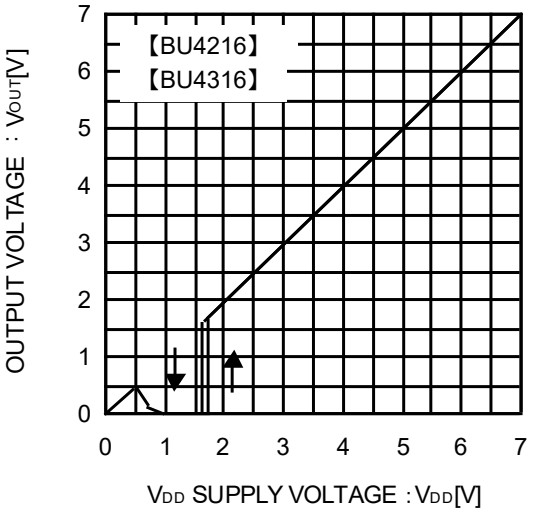



Fig.6 I/O Characteristics


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●**Typical Performance Curves – continued**

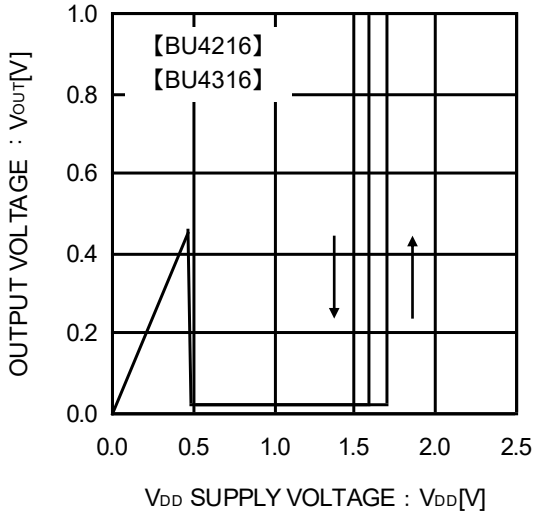



Fig.7 Operating Limit Voltage

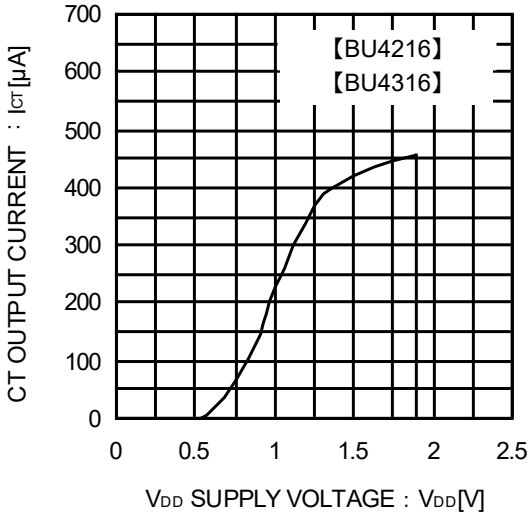



Fig.8 CT Terminal Current

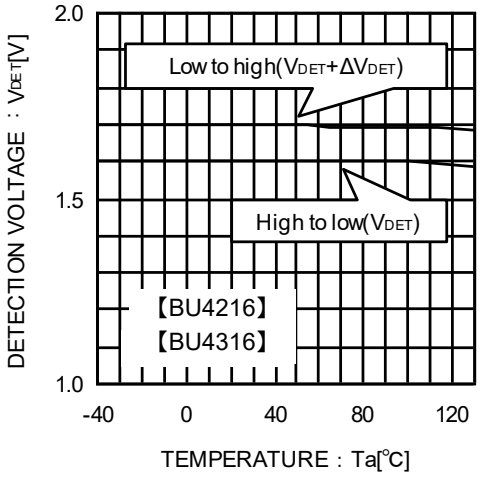



Fig.9 Detecting Voltage
Release Voltage

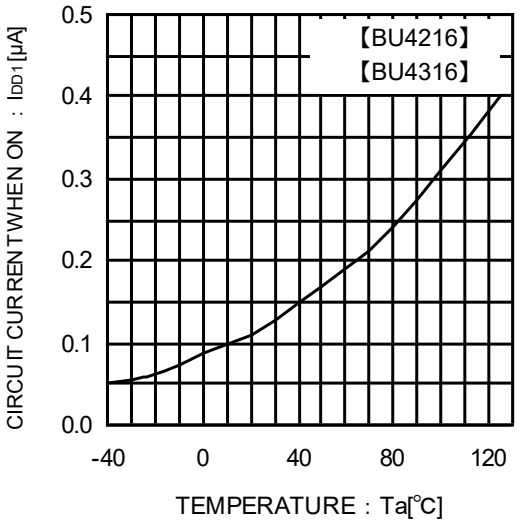



Fig.10 Circuit Current when ON


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●**Typical Performance Curves – continued**

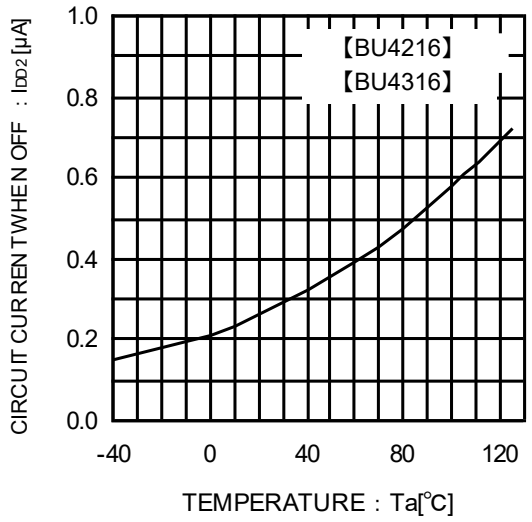



Fig.11 Circuit Current when OFF

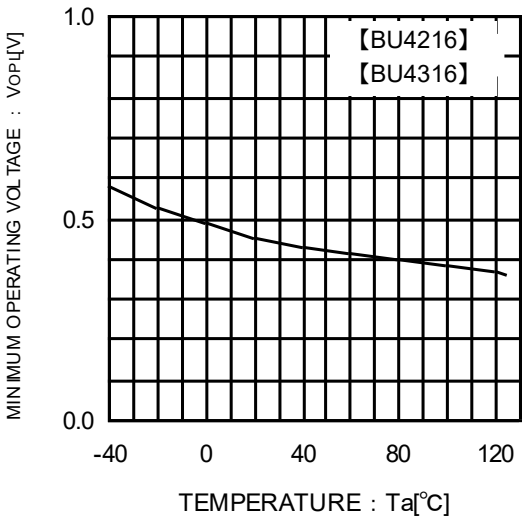



Fig.12 Operating Limit Voltage

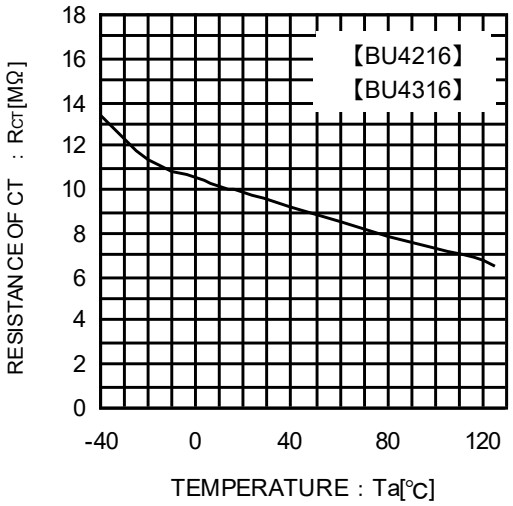



Fig.13 $C_T$ Terminal Circuit Resistance

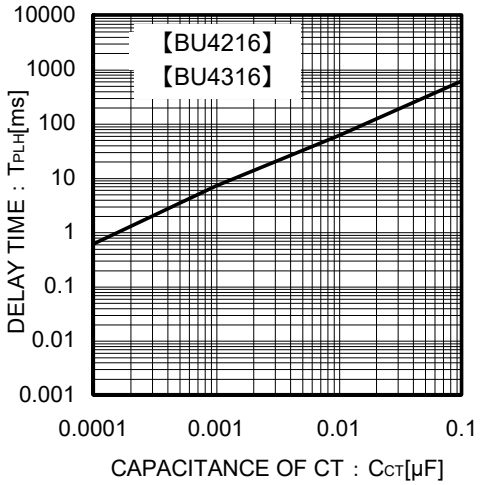



Fig.14 Delay Time ($t_{PLH}$) and $C_T$ Terminal External Capacitance


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## ●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 VDD pins reaches the applicable threshold voltage, the VOUT terminal voltage switches from either “High” to “Low” or from “Low” to “High”. BU42xx and BU43xx series have delay time function which set tPLH (Output “Low”→”High”) using an external capacitor (CCT). Because the BU42xx series uses an open drain output type, it is necessary to connect a pull-up resistor to VDD or another power supply if needed [The output “High” voltage (VOUT) in this case becomes VDD or the voltage of the other power supply].

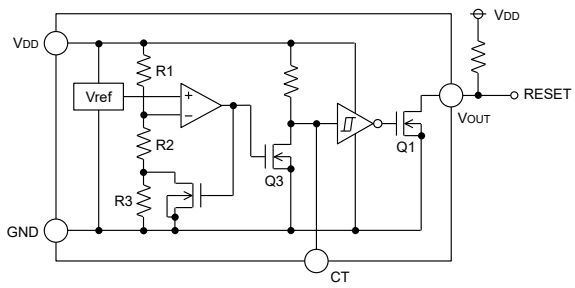



Fig.15 (BU42xx series Internal Block Diagram)

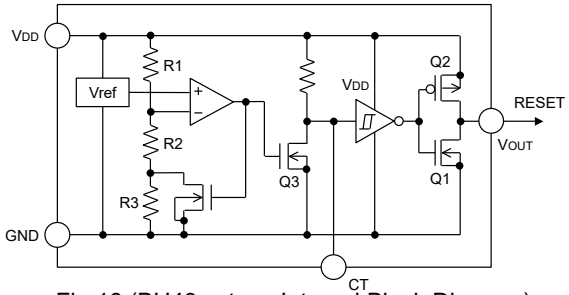



Fig.16 (BU43xx type Internal Block Diagram)

### Setting of Detector Delay Time

The delay time of this detector IC can be set at the rise of VDD by the capacitor connected to CT terminal.

Delay time at the rise of VDD tPLH:Time until when VOUT rises to 1/2 of VDD after VDD rises up and beyond the release voltage($V_{DET}+\Delta V_{DET}$)

$$T_{PLH}=-1\times C_{CT}\times R_{CT}\times \ln\left(\frac{V_{DD}-V_{CTH}}{V_{DD}}\right)$$

| | | | |
|---|---|---|---|
| CCT: | CT pin Externally Attached Capacitance | VCTH: | CT pin Threshold Voltage(P.3 VCTH refer.) |
| RCT: | CT pin Internal Impedance(P.3 RCT refer.) | In: | Natural Logarithm |

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

Examples of Falling Time ($t_{PHL}$) Output

| Part Number | $t_{PHL}$ [μs] |
|---|---|
| BU4245 | 275.7 |
| BU4345 | 359.3 |

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

### Timing Waveforms

Example: The following shows the relationship between the input voltage VDD, the CT 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 shown in Fig.15 and 16).

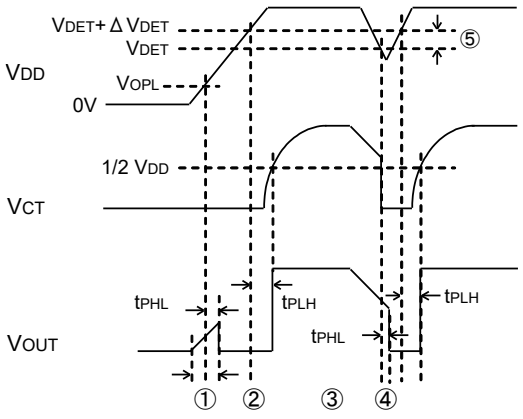



Fig.17 Timing Waveforms

① When the power supply is turned on, the output is unstable from after over the operating limit voltage (VOPL) until tPHL. Therefore, it is possible that the reset signal is not outputted when the rise time of VDD is faster than tPHL.

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

③ If VDD exceeds the reset release voltage ($V_{DET}+V_{DET}$), then VOUT switches from L to H (with a delay to the CT 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 (VDET). The system is designed such that the output does not toggle with power supply fluctuations within this hysteresis width, preventing malfunctions due to noise.


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## ●Circuit Applications

1) Examples of common power supply detection reset circuits

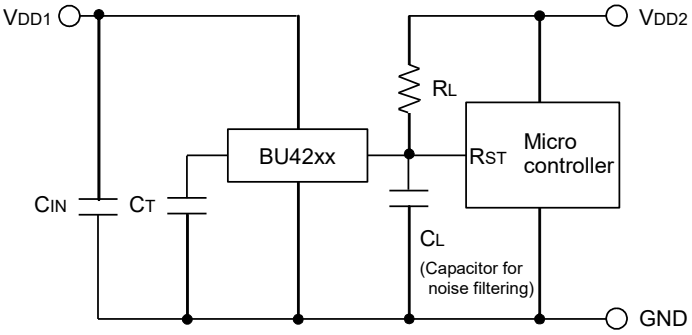



Fig.18 Open Drain Output type

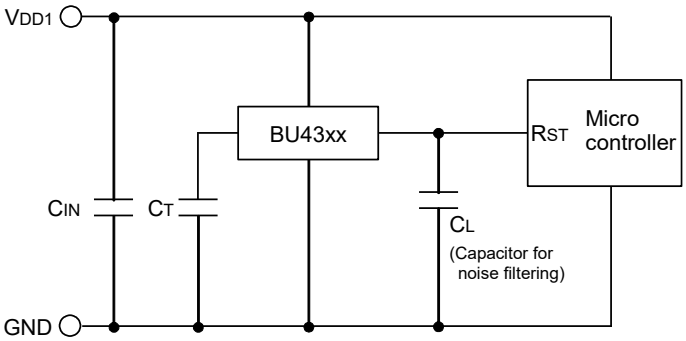



Fig.19 CMOS Output type

Application examples of BU42xx series (Open Drain output type) and BU43xx series (CMOS output type) are shown below.

CASE1: Power supply of microcontroller ($V_{DD}2$) differs from the power supply of the reset detection ($V_{DD}1$). Use an open drain output Type (BU42xx series) device with a load resistance $R_L$ as shown Fig.18.

CASE2: Power supply of microcontroller ($V_{DD}1$) is the same as the power supply of the reset detection ($V_{DD}1$). Use a CMOS output type (BU43xx series) device or an open drain output type (BU42xx series) device with a pull up resistor between the output and $V_{DD}1$.

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

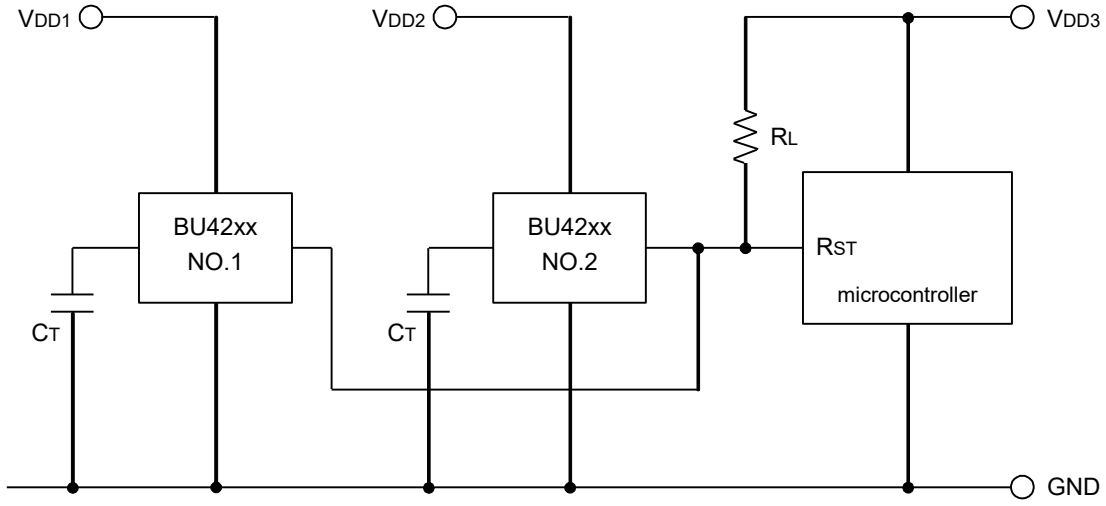



Fig.20

To reset the microcontroller when many independent power supplies are used in the system, OR connect an open drain output type (BU42xx series) to the microcontroller's input with pull-up resistor to the supply voltage of the microcontroller ($V_{DD}3$) as shown in Fig. 20. By pulling-up to $V_{DD}3$, 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 wherein the power supply input terminal (VDD) of an IC has resistor dividers, it is possible that an in-rush current will momentarily flow into the circuit when the output logic switches, resulting in malfunctions (such as output oscillations).

(In-rush 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.)

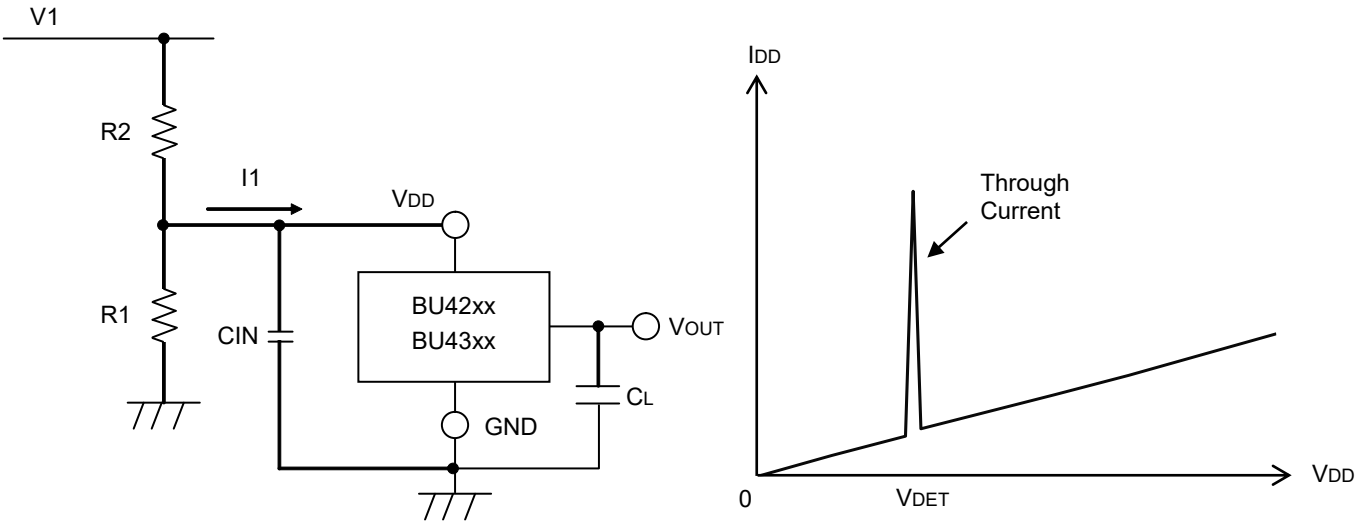



Fig.21

A voltage drop [in-rush current (I1)] × [input resistor (R2)] is caused by the in-rush current, and causes the input voltage to drop 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 in-rush current stops flowing through output “Low”, and the voltage drop is reduced. As a result, the output switches from “Low” to “High”, which again causes the in-rush current to flow and the voltage to drop. This operation repeats and will result to oscillation.

Consider the use of BD52xx when the power supply input has resistor dividers.

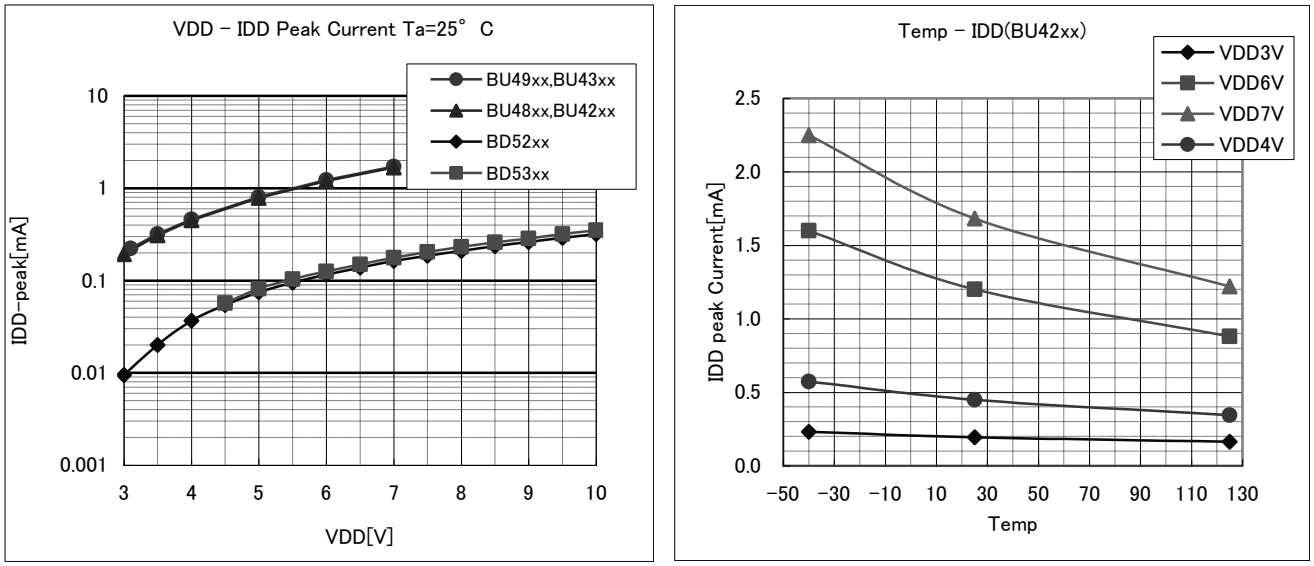



Fig.22 Current Consumption vs. Power Supply Voltage

* This data is for reference only.
The figures will vary with the application, so please confirm the 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 50kΩ 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.

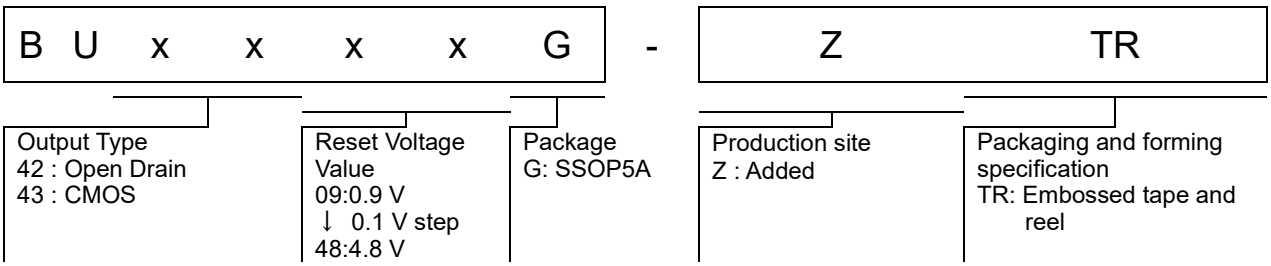
14) $C_T$ pin discharge
Due to the capabilities of the $C_T$ pin discharge transistor, the $C_T$ pin may not completely discharge when a short input pulse is applied, and in this case the delay time may not be controlled. Please verify the actual operation.

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.

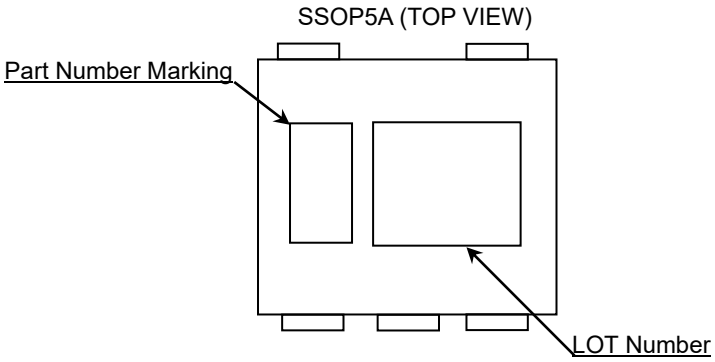

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## Ordering Information




## Marking Diagram




| Output Type | Open Drain | | CMOS | |
|---|---|---|---|---|
| Detection Voltage | Marking | Part Number | Marking | Part Number |
| 4.8V | ZR | BU4248 | 1H | BU4348 |
| 4.7V | ZQ | BU4247 | 1G | BU4347 |
| 4.6V | ZP | BU4246 | 1F | BU4346 |
| 4.5V | ZN | BU4245 | 1E | BU4345 |
| 4.4V | ZM | BU4244 | 1D | BU4344 |
| 4.3V | ZL | BU4243 | 1C | BU4343 |
| 4.2V | ZK | BU4242 | 1B | BU4342 |
| 4.1V | ZJ | BU4241 | 1A | BU4341 |
| 4.0V | ZH | BU4240 | 0Z | BU4340 |
| 3.9V | ZG | BU4239 | 0Y | BU4339 |
| 3.8V | ZF | BU4238 | 0X | BU4338 |
| 3.7V | ZE | BU4237 | 0W | BU4337 |
| 3.6V | ZD | BU4236 | 0V | BU4336 |
| 3.5V | ZC | BU4235 | 0U | BU4335 |
| 3.4V | ZB | BU4234 | 0T | BU4334 |
| 3.3V | ZA | BU4233 | 0S | BU4333 |
| 3.2V | YZ | BU4232 | 0R | BU4332 |
| 3.1V | YY | BU4231 | 0Q | BU4331 |
| 3.0V | YX | BU4230 | 0P | BU4330 |


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**Marking Diagram - continued**

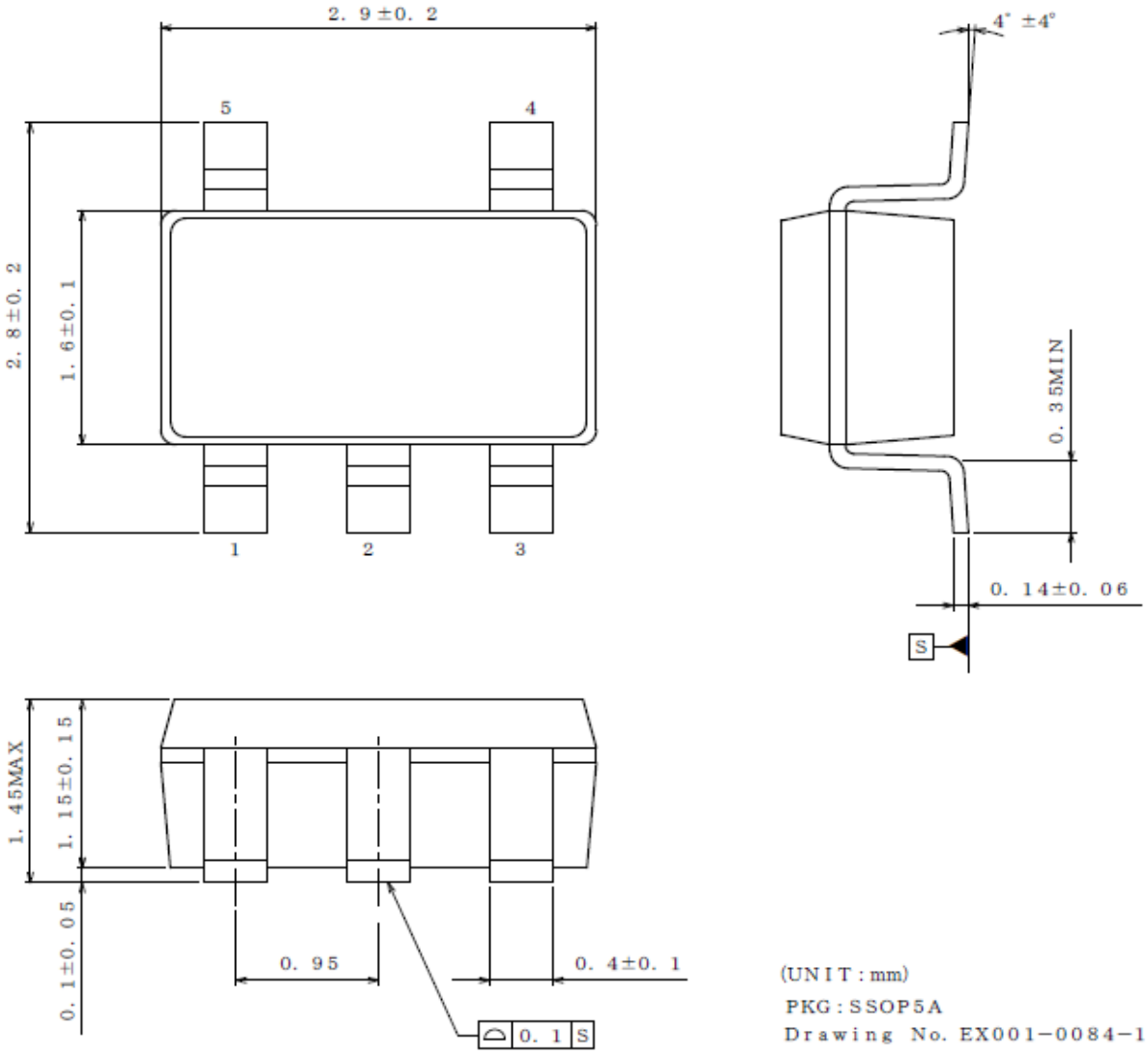
| Output Type | Open Drain | | CMOS | |
|---|---|---|---|---|
| Detection Voltage | Marking | Part Number | Marking | Part Number |
| 2.9V | YW | BU4229 | 0N | BU4329 |
| 2.8V | YV | BU4228 | 0M | BU4328 |
| 2.7V | YU | BU4227 | 0L | BU4327 |
| 2.6V | YT | BU4226 | 0K | BU4326 |
| 2.5V | YS | BU4225 | 0J | BU4325 |
| 2.4V | YR | BU4224 | 0H | BU4324 |
| 2.3V | YQ | BU4223 | 0G | BU4323 |
| 2.2V | YP | BU4222 | 0F | BU4322 |
| 2.1V | YN | BU4221 | 0E | BU4321 |
| 2.0V | YM | BU4220 | 0D | BU4320 |
| 1.9V | YL | BU4219 | 0C | BU4319 |
| 1.8V | YK | BU4218 | 0B | BU4318 |
| 1.7V | YJ | BU4217 | 0A | BU4317 |
| 1.6V | YH | BU4216 | ZZ | BU4316 |
| 1.5V | YG | BU4215 | ZY | BU4315 |
| 1.4V | YF | BU4214 | ZX | BU4314 |
| 1.3V | YE | BU4213 | ZW | BU4313 |
| 1.2V | YD | BU4212 | ZV | BU4312 |
| 1.1V | YC | BU4211 | ZU | BU4311 |
| 1.0V | YB | BU4210 | ZT | BU4310 |
| 0.9V | YA | BU4209 | ZS | BU4309 |


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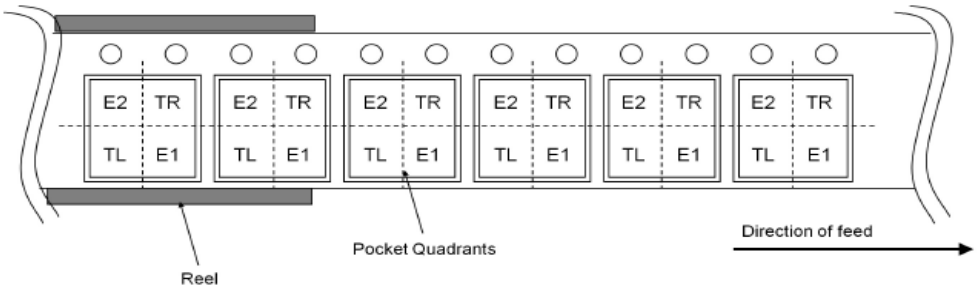
**Physical Dimension and Packing Information**

| Package Name | SSOP5A |
|---|---|




< Tape and Reel Information >

| | |
|---|---|
| Tape | Embossed carrier tape |
| Quantity | 3000pcs |
| Direction of feed | TR<br>( 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 |
|---|---|---|
| 11.Oct.2021 | 010 | Added “Revision History”.<br>Added words for Not Recommended New Designs category product. |


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# Notice

## Precaution on using ROHM Products

1. Our Products are designed and manufactured for application in ordinary electronic equipment (such as AV equipment, OA equipment, telecommunication equipment, home electronic appliances, amusement equipment, etc.). If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment (Note 1), transport equipment, traffic equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of any ROHM's Products for Specific Applications.

(Note1) Medical Equipment Classification of the Specific Applications

| JAPAN | USA | EU | CHINA |
|---|---|---|---|
| CLASSⅢ | CLASSⅢ | CLASSⅡb | CLASSⅢ |
| CLASSⅣ | | CLASSⅢ | |

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

3. Our Products are 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 (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

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 $Cl_2$, $H_2S$, $NH_3$, $SO_2$, 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.

## Precaution for Product Label

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.

## Precaution for Foreign Exchange and Foreign Trade act

Since concerned goods might be fallen under listed items of export control prescribed by Foreign exchange and Foreign trade act, please consult with ROHM in case of export.

## Precaution Regarding Intellectual Property Rights

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