Voltage Detector IC Series

# Counter Timer Built-in CMOS Voltage Detector IC

## BD45xxx series　BD46xxx series

### ●General Description

ROHM's BD45xxx and BD46xxx series are highly accurate, low current consumption Voltage Detector ICs. Because the counter timer delay circuit is built into these series, an external capacitor for the delay time setting is unnecessary. The lineup was established with low output types (Nch open drain and CMOS output) and detection voltages range from 2.3V to 4.8V in increments of 0.1V, so that the series may be selected according the application at hand.

### ●Features

- Counter Timer Built-in
- No delay time setting external capacitor required
- Ultra-low current consumption
- Two output types (Nch open drain and CMOS output)
- Package SSOP5 is similar to SOT-23-5 (JEDEC)

### ●Key Specifications

- Detection voltage: 2.3V to 4.8V (Typ.) 0.1V steps
- High accuracy detection voltage: ±1.0%
- Ultra-low current consumption: 0.85µA (Typ.)
- Operating temperature range: -40°C to +105°C
- Three internal, fixed delay time: 50ms 100ms 200ms

### ●Package

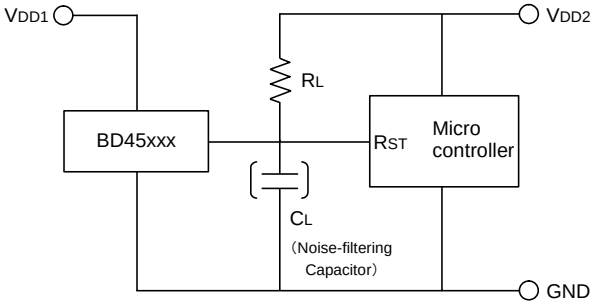
SSOP5

2.90mm x 2.80mm x 1.25mm

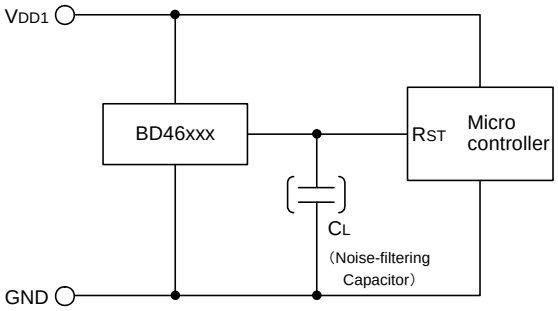
### ●Applications

Circuits using microcontrollers or logic circuits that require a reset.

### ●Typical Application Circuit



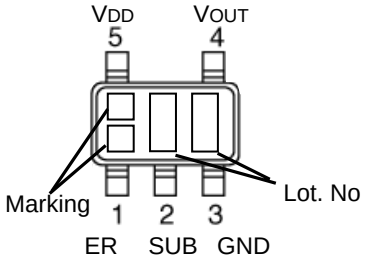

(Open Drain Output Type)
BD45xxx series




(CMOS Output Type)
BD46xxx series

### ●Connection Diagram

**SSOP5**




### ●Pin Descriptions

| PIN No. | Symbol | Function |
|---|---|---|
| 1 | ER | Manual Reset |
| 2 | SUB | Substrate * |
| 3 | GND | GND |
| 4 | VOUT | Reset Output |
| 5 | VDD | Power Supply Voltage |

*Connect the substrate to GND.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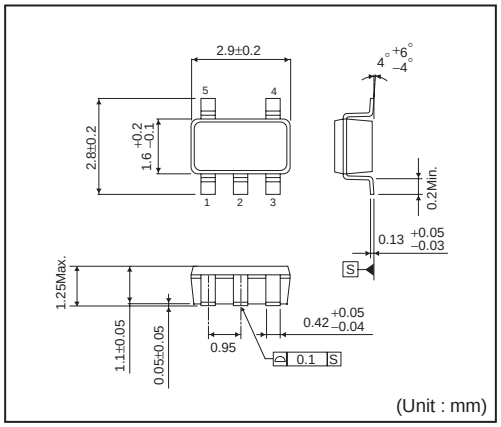
**●Ordering Information**

| B | D | x | x | x | x | x | x | – | T | R |
|---|---|---|---|---|---|---|---|---|---|---|

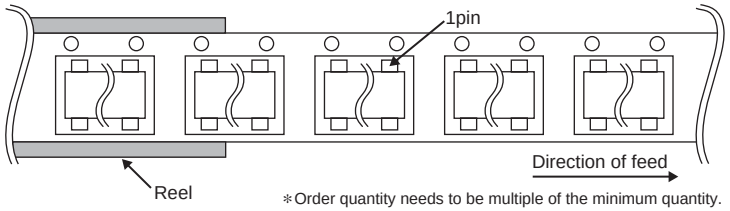
| Part Number | Output Type<br>45 : Open Drain<br>46 : CMOS | Reset Voltage Value<br>23 : 2.3V<br>⇩ 0.1V step<br>48 : 4.8V | Counter Timer Delay Time Settings<br>5 : 50ms<br>1 : 100ms<br>2 : 200ms | Package<br>G : SSOP5 | Packaging and forming specification<br>TR : Embossed tape and reel |
|---|---|---|---|---|---|

**SSOP5**




<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 ) |




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

**●Lineup**

Table 1. Open Drain Output Type

| Detection Voltage | Counter Timer Delay Time Settings: 50ms Marking | 50ms Part Number | 100ms Marking | 100ms Part Number | 200ms Marking | 200ms Part Number |
|---|---|---|---|---|---|---|
| 4.8V | T0 | BD45485 | TS | BD45481 | UJ | BD45482 |
| 4.7V | T1 | BD45475 | TT | BD45471 | UK | BD45472 |
| 4.6V | T2 | BD45465 | TU | BD45461 | UL | BD45462 |
| 4.5V | T3 | BD45455 | TV | BD45451 | UM | BD45452 |
| 4.4V | T4 | BD45445 | TW | BD45441 | UN | BD45442 |
| 4.3V | T5 | BD45435 | TX | BD45431 | UP | BD45432 |
| 4.2V | T6 | BD45425 | TY | BD45421 | UQ | BD45422 |
| 4.1V | T7 | BD45415 | TZ | BD45411 | UR | BD45412 |
| 4.0V | T8 | BD45405 | U0 | BD45401 | US | BD45402 |
| 3.9V | T9 | BD45395 | U1 | BD45391 | UT | BD45392 |
| 3.8V | TA | BD45385 | U2 | BD45381 | UU | BD45382 |
| 3.7V | TB | BD45375 | U3 | BD45371 | UV | BD45372 |
| 3.6V | TC | BD45365 | U4 | BD45361 | UW | BD45362 |
| 3.5V | TD | BD45355 | U5 | BD45351 | UX | BD45352 |
| 3.4V | TE | BD45345 | U6 | BD45341 | UY | BD45342 |
| 3.3V | TF | BD45335 | U7 | BD45331 | UZ | BD45332 |
| 3.2V | TG | BD45325 | U8 | BD45321 | V0 | BD45322 |
| 3.1V | TH | BD45315 | U9 | BD45311 | V1 | BD45312 |
| 3.0V | TJ | BD45305 | UA | BD45301 | V2 | BD45302 |
| 2.9V | TK | BD45295 | UB | BD45291 | V3 | BD45292 |
| 2.8V | TL | BD45285 | UC | BD45281 | V4 | BD45282 |
| 2.7V | TM | BD45275 | UD | BD45271 | V5 | BD45272 |
| 2.6V | TN | BD45265 | UE | BD45261 | V6 | BD45262 |
| 2.5V | TP | BD45255 | UF | BD45251 | V7 | BD45252 |
| 2.4V | TQ | BD45245 | UG | BD45241 | V8 | BD45242 |
| 2.3V | TR | BD45235 | UH | BD45231 | V9 | BD45232 |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●**Lineup - continued**

Table 2. CMOS Output Type

| Detection Voltage | Counter Timer Delay Time Settings | | | | | |
|---|---|---|---|---|---|---|
| | 50ms | | 100ms | | 200ms | |
| | Marking | Part Number | Marking | Part Number | Marking | Part Number |
| 4.8V | VA | BD46485 | W2 | BD46481 | WU | BD46482 |
| 4.7V | VB | BD46475 | W3 | BD46471 | WV | BD46472 |
| 4.6V | VC | BD46465 | W4 | BD46461 | WW | BD46462 |
| 4.5V | VD | BD46455 | W5 | BD46451 | WX | BD46452 |
| 4.4V | VE | BD46445 | W6 | BD46441 | WY | BD46442 |
| 4.3V | VF | BD46435 | W7 | BD46431 | WZ | BD46432 |
| 4.2V | VG | BD46425 | W8 | BD46421 | X0 | BD46422 |
| 4.1V | VH | BD46415 | W9 | BD46411 | X1 | BD46412 |
| 4.0V | VJ | BD46405 | WA | BD46401 | X2 | BD46402 |
| 3.9V | VK | BD46395 | WB | BD46391 | X3 | BD46392 |
| 3.8V | VL | BD46385 | WC | BD46381 | X4 | BD46382 |
| 3.7V | VM | BD46375 | WD | BD46371 | X5 | BD46372 |
| 3.6V | VN | BD46365 | WE | BD46361 | X6 | BD46362 |
| 3.5V | VP | BD46355 | WF | BD46351 | X7 | BD46352 |
| 3.4V | VQ | BD46345 | WG | BD46341 | X8 | BD46342 |
| 3.3V | VR | BD46335 | WH | BD46331 | X9 | BD46332 |
| 3.2V | VS | BD46325 | WJ | BD46321 | XA | BD46322 |
| 3.1V | VT | BD46315 | WK | BD46311 | XB | BD46312 |
| 3.0V | VU | BD46305 | WL | BD46301 | XC | BD46302 |
| 2.9V | VV | BD46295 | WM | BD46291 | XD | BD46292 |
| 2.8V | VW | BD46285 | WN | BD46281 | XE | BD46282 |
| 2.7V | VX | BD46275 | WP | BD46271 | XF | BD46272 |
| 4.8V | VY | BD46265 | WQ | BD46261 | XG | BD46262 |
| 4.7V | VZ | BD46255 | WR | BD46251 | XH | BD46252 |
| 4.6V | W0 | BD46245 | WS | BD46241 | XJ | BD46242 |
| 4.5V | W1 | BD46235 | WT | BD46231 | XK | BD46232 |


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● **Absolute maximum ratings**

| Parameter | | Symbol | Limits | Unit |
|---|---|---|---|---|
| Power Supply Voltage | | $V_{DD}$-GND | -0.3 to +10 | V |
| Output Voltage | Nch Open Drain Output | VOUT | GND-0.3 to +10 | V |
| | CMOS Output | | GND-0.3 to $V_{DD}$+0.3 | |
| Output Current | | IO | 60 | mA |
| ER pin Voltage | | VCT | GND-0.3 to $V_{DD}$+0.3 | V |
| Power Dissipation *1 *2 | | Pd | 540 | mW |
| Operating Temperature | | Topr | -40 to +105 | °C |
| Ambient Storage Temperature | | Tstg | -55 to +125 | °C |

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

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

| Parameter | Symbol | Condition | | Limit Min. | Limit Typ. | Limit Max. | Unit |
|---|---|---|---|---|---|---|---|
| Detection Voltage | VDET | VDD=H→L, RL=470kΩ *1 | | VDET(T) ×0.99 | VDET(T) | VDET(T) ×1.01 | V |
| | | VDET=2.5V | Ta=+25°C | 2.475 | 2.5 | 2.525 | |
| | | | Ta=-40°C to 85°C | 2.417 | - | 2.580 | |
| | | | Ta=85°C to 105°C | 2.422 | - | 2.598 | |
| | | VDET=3.0V | Ta=+25°C | 2.970 | 3.0 | 3.030 | |
| | | | Ta=-40°C to 85°C | 2.901 | - | 3.095 | |
| | | | Ta=85°C to 105°C | 2.906 | - | 3.117 | |
| | | VDET=3.3V | Ta=+25°C | 3.267 | 3.3 | 3.333 | |
| | | | Ta=-40°C to 85°C | 3.191 | - | 3.405 | |
| | | | Ta=85°C to 105°C | 3.196 | - | 3.429 | |
| | | VDET=4.2V | Ta=+25°C | 4.158 | 4.2 | 4.242 | |
| | | | Ta=-40°C to 85°C | 4.061 | - | 4.334 | |
| | | | Ta=85°C to 105°C | 4.068 | - | 4.364 | |
| | | VDET=4.8V | Ta=+25°C | 4.752 | 4.8 | 4.848 | |
| | | | Ta=-40°C to 85°C | 4.641 | - | 4.953 | |
| | | | Ta=85°C to 105°C | 4.649 | - | 4.988 | |
| Detection Voltage Temperature coefficient | VDET/ ΔT | -40°C to +105°C | | - | ±100 | ±360 | ppm/°C |
| Hysteresis Voltage | ΔVDET | VDD=L→H→L, RL=470kΩ | | VDET(T) ×0.03 | VDET(T) ×0.05 | VDET(T) ×0.08 | V |
| 'High' Output Delay time | tPLH | CL=100pF, RL=100kΩ *1, *2, *3 | BD45xx5, BD46xx5 | 45 | 50 | 55 | ms |
| | | | BD45xx1, BD46xx1 | 90 | 100 | 110 | |
| | | | BD45xx2, BD46xx2 | 180 | 200 | 220 | |
| Circuit Current when ON | IDD1 | VDD=VDET-0.2V, VER=0V VDET=2.3V to 3.1V *1 | | - | 0.70 | 2.10 | μA |
| | | VDD=VDET-0.2V, VER=0V VDET=2.3V to 3.1V | | - | 0.70 | 2.85 | |
| | | VDD=VDET-0.2V, VER=0V VDET=3.2V to 4.2V *1 | | - | 0.75 | 2.25 | |
| | | VDD=VDET-0.2V, VER=0V VDET=3.2V to 4.2V | | - | 0.75 | 3.00 | |
| | | VDD=VDET-0.2V, VER=0V VDET=4.3V to 4.8V *1 | | - | 0.80 | 2.40 | |
| | | VDD=VDET-0.2V, VER=0V VDET=4.3V to 4.8V | | - | 0.80 | 3.15 | |
| Circuit Current when OFF | IDD2 | VDD=VDET+0.2V, VER=0V VDET=2.3V to 3.1V *1 | | - | 0.75 | 2.25 | μA |
| | | VDD=VDET+0.2V, VER=0V VDET=2.3V to 3.1V | | - | 0.75 | 4.28 | |
| | | VDD=VDET+0.2V, VER=0V VDET=3.2V to 4.2V *1 | | - | 0.80 | 2.40 | |
| | | VDD=VDET+0.2V, VER=0V VDET=3.2V to 4.2V | | - | 0.80 | 4.50 | |
| | | VDD=VDET+0.2V, VER=0V VDET=4.3V to 4.8V *1 | | - | 0.85 | 2.55 | |
| | | VDD=VDET+0.2V, VER=0V VDET=4.3V to 4.8V | | - | 0.85 | 4.73 | |

VDET(T):Standard Detection Voltage (2.3V to 4.8V, 0.1V step)
RL :Pull-up resistor to be connected between VOUT and power supply.
CL :Capacitor to be connected between VOUT and GND.
*1 Guarantee is Ta=25°C.
*2 tPLH:VDD=(VDET(T)-0.5V)→(VDET(T)+0.5V)
*3 tPLH:VDD=Please set the rise up time between VDD=0→VDET to more than 100μs.
Attention: Please connect the GND when you don't use 'ER'


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

| Parameter | Symbol | Condition | Limit | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| Operating Voltage Range | $V_{OPL}$ | $V_{OL}$≤0.4V, $R_L$=470kΩ, Ta=25 to 105°C | 0.95 | - | - | V |
| | | $V_{OL}$≤0.4V, $R_L$=470kΩ, Ta=-40 to 25°C | 1.20 | - | - | |
| 'High' Output Voltage (Pch) | $V_{OH}$ | $V_{DD}$=4.8V, $I_{SOURCE}$= 1.0 mA, $V_{DET}$(2.3V to 4.2V) | VDD-0.5 | - | - | V |
| | | $V_{DD}$=6.0V, $I_{SOURCE}$= 1.2 mA, $V_{DET}$(4.3V to 4.8V) | VDD-0.5 | - | - | |
| 'Low'Output Voltage (Nch) | $V_{OL}$ | $V_{DD}$=1.2V, $I_{SINK}$ = 0.45 mA | - | - | 0.3 | V |
| | | $V_{DD}$=2.4V, $I_{SINK}$ = 1.3 mA, $V_{DET}$(2.7V to 4.8V) | - | - | 0.3 | |
| Leak Current when OFF | $I_{leak}$ | $V_{DD}$=$V_{DS}$=10V *1 | - | - | 0.1 | μA |
| ER Pin 'H' Voltage | $V_{EH}$ | *1 | 2.0 | - | - | V |
| ER Pin 'L' Voltage | $V_{EL}$ | *1 | - | - | 0.8 | V |
| ER Pin Input Current | $I_{EL}$ | | - | 1 | 10 | μA |

$V_{DET}$(T):Standard Detection Voltage (2.3V to 4.8V, 0.1V step)
$R_L$ :Pull-up resistor to be connected between $V_{OUT}$ and power supply.
$C_L$ :Capacitor to be connected between $V_{OUT}$ and GND.
*1 Guarantee is Ta=25°C.
Attention: Please connect the GND when you don't use 'ER'


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●**Block Diagrams**

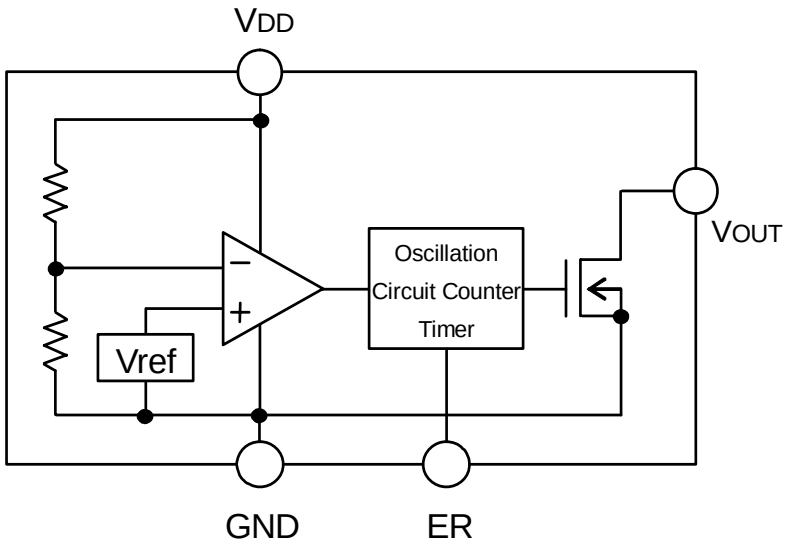


Fig.1 BD45xxx Series

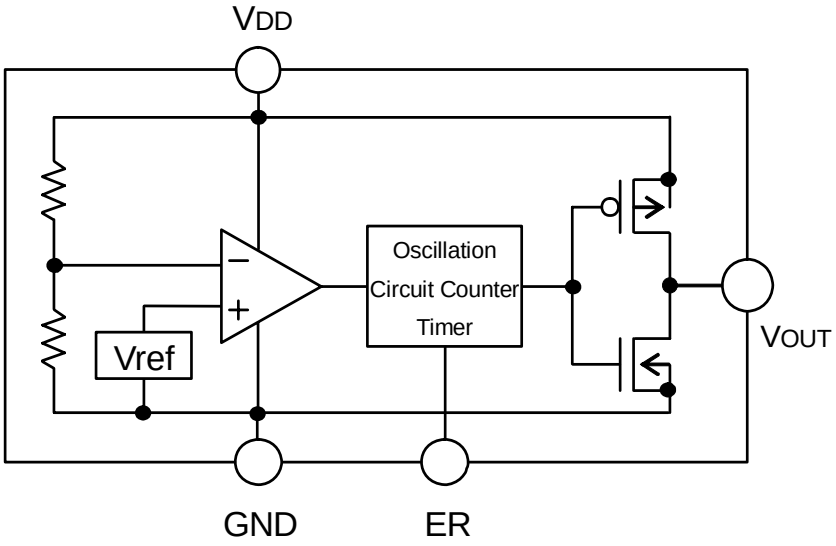


Fig.2 BD46xxx Series


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●**Typical Performance Curves**

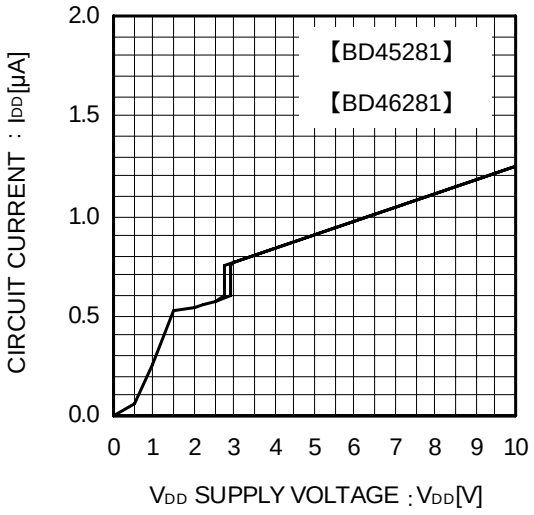


Fig.3 Circuit Current

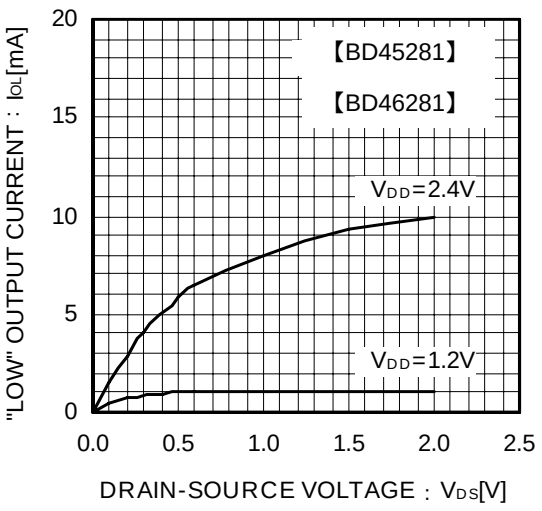


Fig.4 “Low” Output Current

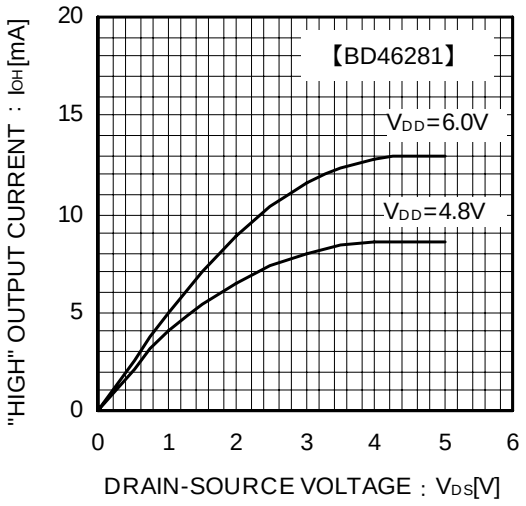


Fig.5 “High” Output Current

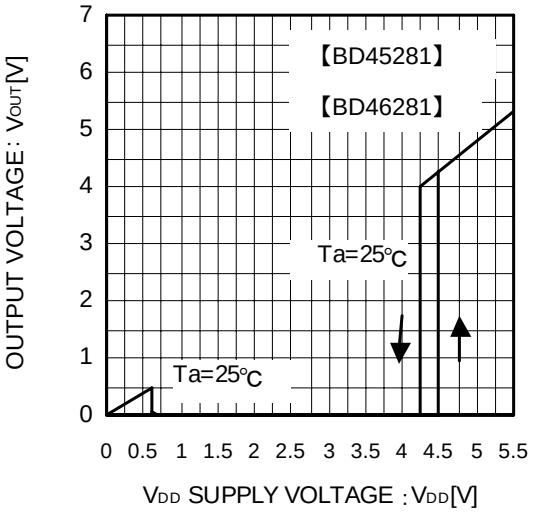


Fig.6 I/O Characteristics


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●**Typical Performance Curves – continued**

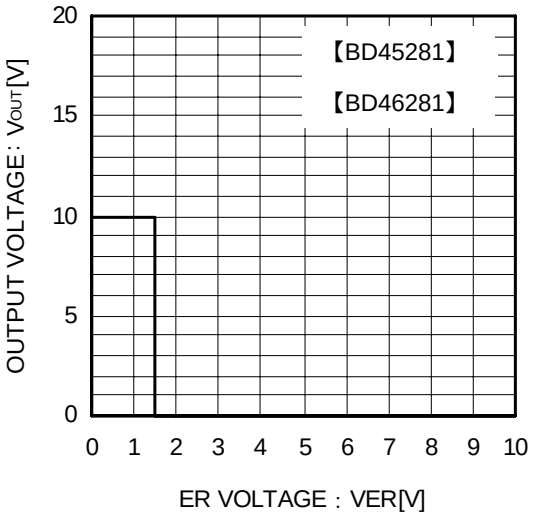


Fig.7 ER Terminal Threshold Voltage

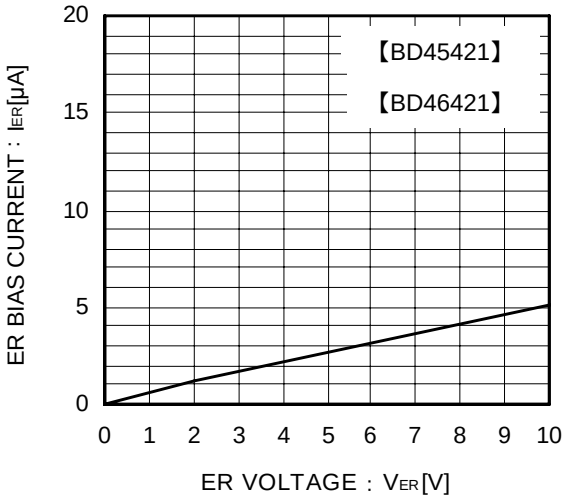


Fig.8 ER Terminal Input Current

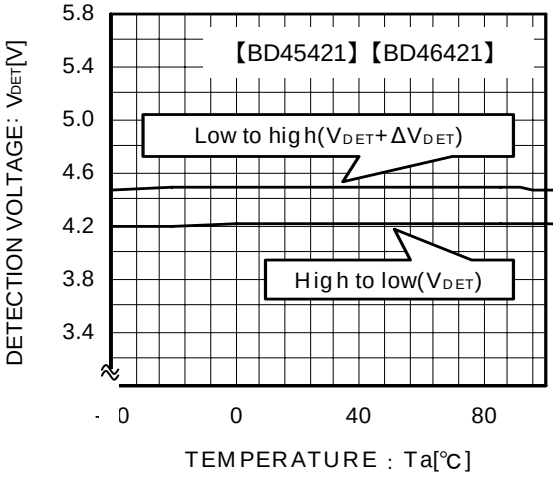


Fig.9 Detection Voltage
Release Voltage

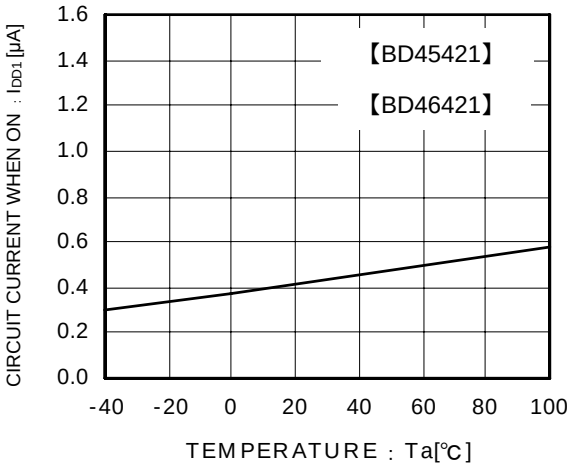


Fig.10 Circuit Current when ON
(VDET-0.2V)


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●**Typical Performance Curves – continued**

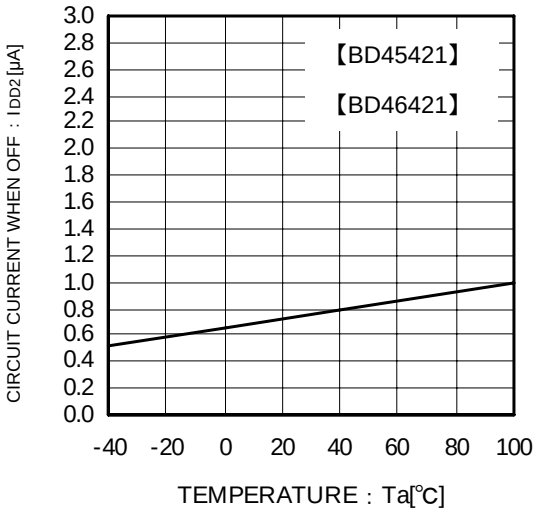


Fig.11 Circuit Current when OFF

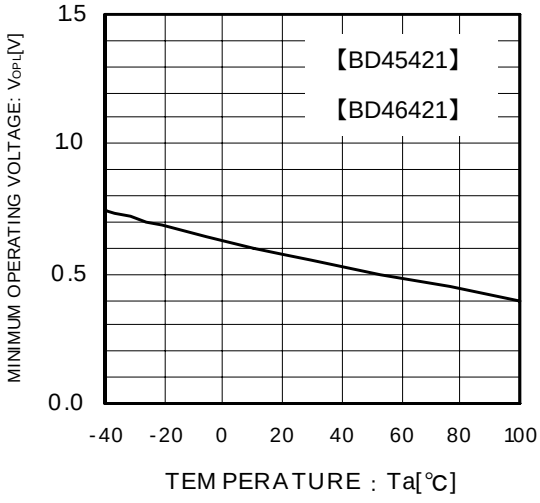


Fig.12 Operating Limit Voltage

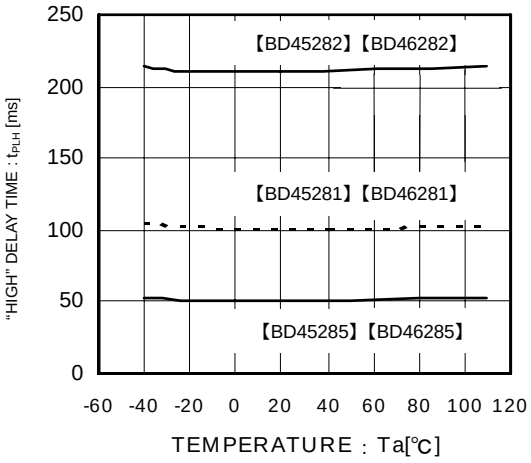


Fig.13 Output Delay Time
"Low"→"High"

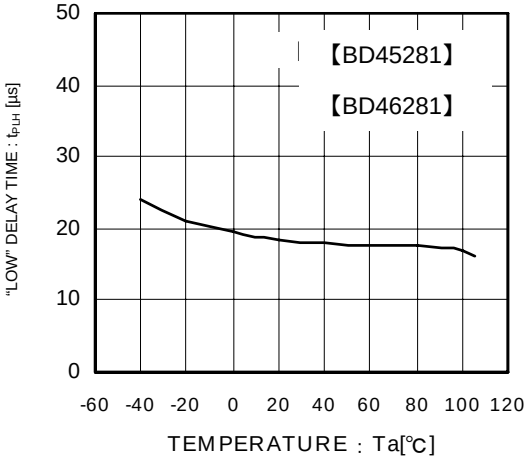


Fig.14 Output Delay Time
"High"→"Low"


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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 $V_{DD}$ pins reaches the applicable threshold voltage, the $V_{OUT}$ terminal voltage switches from either “High” to “Low” or from “Low” to “High”. Because the BD45xxx series uses an open drain output type, it is necessary to connect either a pull-up resistor to $V_{DD}$ or another power supply if needed [The output “High” voltage ($V_{OUT}$) in this case becomes $V_{DD}$ or the voltage of the other power supply].

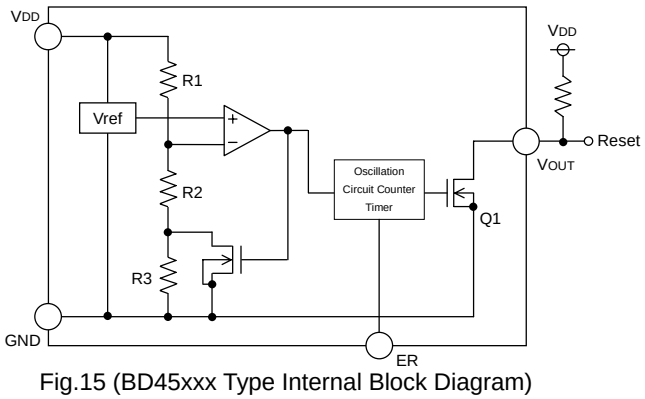


Fig.15 (BD45xxx Type Internal Block Diagram)

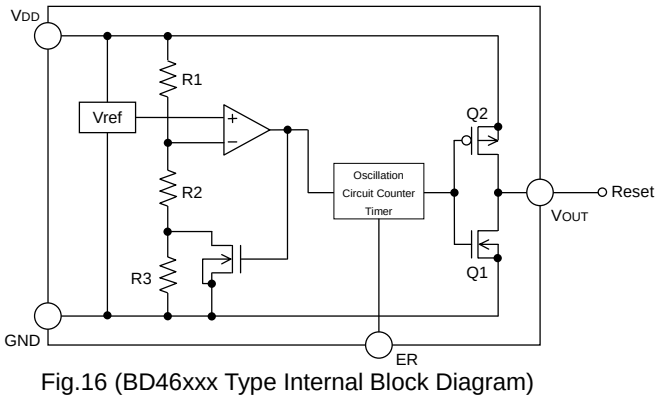


Fig.16 (BD46xxx Type Internal Block Diagram)

### Reference Data

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

| Part Number | $t_{PLH}$[ms] | $t_{PHL}$[µs] |
|---|---|---|
| BD45275G | 50 | 18 |
| BD46275G | 50 | 18 |
| | $V_{DD}$=2.2V→3.2V | $V_{DD}$=3.2V→2.2V |

*This data is for reference only.

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

### Timing Waveform

Example: The following shows the relationship between the input voltages $V_{DD}$, the output voltage $V_{OUT}$ and ER terminal 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).

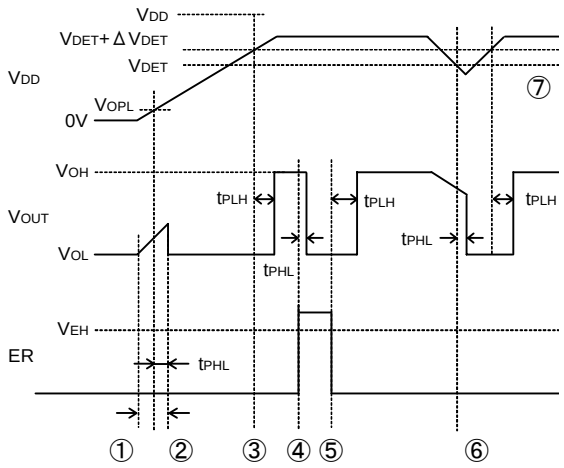


Fig.17 Timing Waveform

① When the power supply is turned on, the output is unstable from after over the operating limit voltage ($V_{OPL}$) until $t_{PHL}$. Therefore it is possible that the reset signal is not outputted when the rise time of $V_{DD}$ is faster than $t_{PHL}$.

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

③ If $V_{DD}$ exceeds the reset release voltage ($V_{DET} + \Delta V_{DET}$), the counter timer start and $V_{OUT}$ switches from L to H.

④ When more than the high level voltage is supplied to the ER terminal, $V_{OUT}$ comes to “L” after $t_{PLH}$ delay time. Therefore, a time when ER terminal is “H” is necessary for 100µsec or more.

⑤ When the ER terminal switches to Low, the counter timer starts to operate, a delay of $t_{PLH}$ occurs, and $V_{OUT}$ switches from “L” to “H”.

⑥ If $V_{DD}$ drops below the detection voltage ($V_{DET}$) when the power supply is powered down or when there is a power supply fluctuation, $V_{OUT}$ switches to L (with a delay of $t_{PHL}$).

⑦ The potential difference between the detection voltage and the release voltage is known as the hysteresis width ($\Delta V_{DET}$). The system is designed such that the output does not toggle with power supply fluctuations within this hysteresis width, preventing malfunctions due to noise.

These time changes by the application and use it, please verify and confirm using practical applications.


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●**Circuit Applications**

1) Examples of common power supply detection reset circuits.

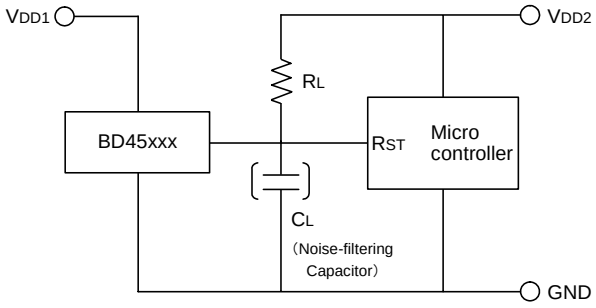


Fig.18 Open Drain Output Type

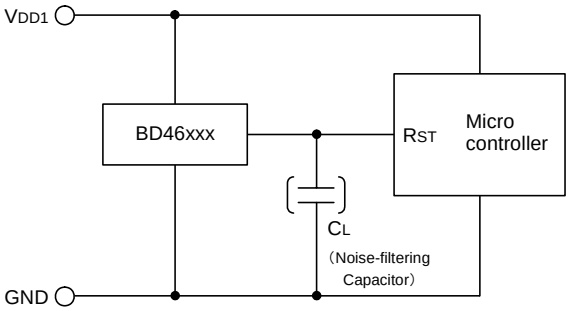


Fig.19 CMOS Output Type

Application examples of BD45xxx series (Open Drain output type) and BD46xxx series (CMOS output type) are shown below.

CASE1: Power supply of the microcontroller ($V_{DD2}$) differs from the power supply of the reset detection ($V_{DD1}$).
Use an open drain output type (BD45xxx) with a load resistance $R_L$ as shown Fig.18.

CASE2: Power supply of the microcontroller ($V_{DD1}$) is same as the power supply of the reset detection ($V_{DD1}$).
Use a CMOS output type (BD46xxx) device or an open drain output type (BD45xxx) device with a pull up resistor between the output and $V_{DD1}$.

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

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

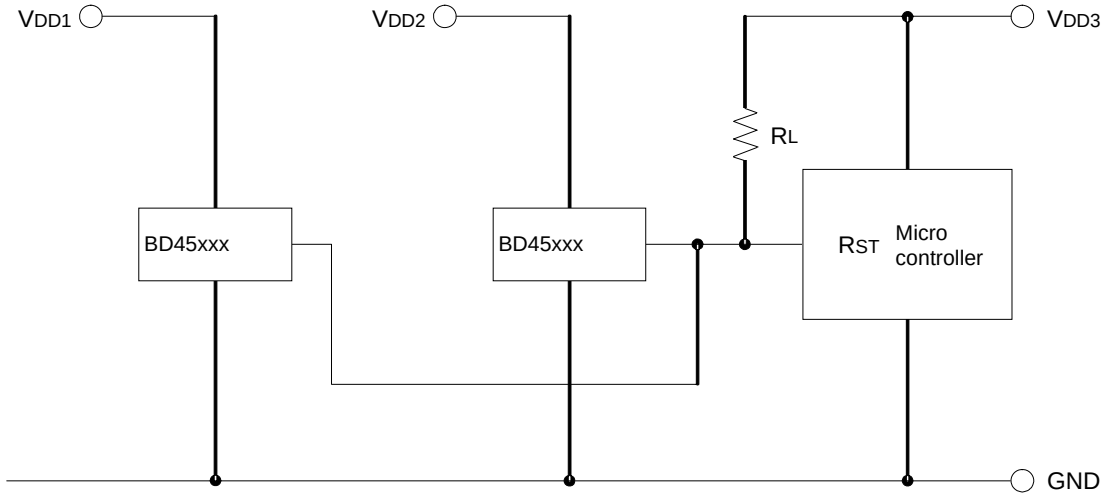


Fig. 20

To reset the microcontroller when many independent power supplies are used in the system, OR connect an open drain output type (BD45xxx 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 wherein the power supply voltage of an IC comes from a resistor divider circuit, an in-rush current will flow into the circuit when the output level switches from “High” to “Low” or vice versa. In-rush current is a sudden surge of current that flows from the power supply (VDD) to ground (GND) as the output logic changes its state. This current flow may cause malfunction in the systems operation such as output oscillations, etc.

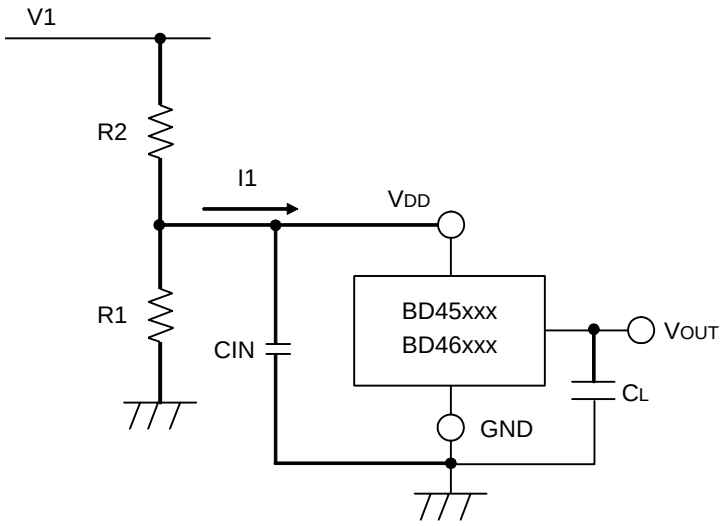


Fig. 21

When an in-rush current (I1) flows into the circuit (Refer to Fig. 21) at the time when output switches from “Low” to “High”, a voltage drop of I1×R2 (input resistor) will occur in the circuit causing the VDD supply voltage to decrease. When the VDD voltage drops below the detection voltage, the output will switch from “High” to “Low”. While the output voltage is at “Low” condition, in-rush current will stop flowing and the voltage drop will be reduced. As a result, the output voltage will switches again from “Low” to “High” which causes an in-rush current and a voltage drop. This operation repeats and will result to oscillation.

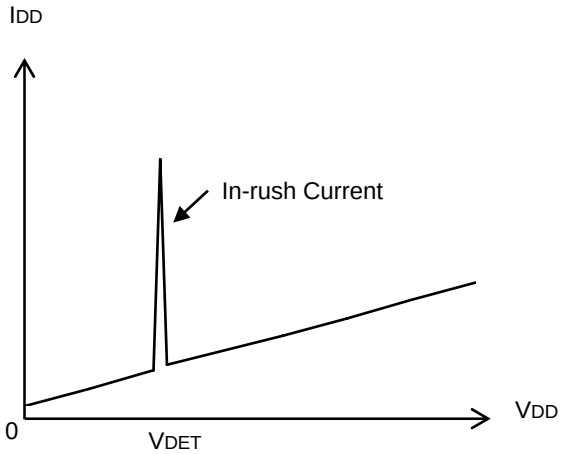


Fig. 22 Current Consumption vs. Power Supply Voltage


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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) This IC has extremely high impedance terminals. Small leak current due to the uncleanness of PCB surface might cause unexpected operations. Application values in these conditions should be selected carefully. If the leakage of about 1MΩ is assumed between the ER terminal and the GND terminal, 100kΩ connection between the ER terminal and the $V_{DD}$ terminal would be recommended. If the leakage is assumed between the $V_{OUT}$ terminal and the GND terminal, the pull-up resistor should be less than 1/10 of the assumed leak resistance.

11) External parameters
The recommended parameter range for $R_L$ is 50kΩ to 1MΩ. There are many factors (board layout, etc) that can affect characteristics. Please verify and confirm using practical applications.

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

13) 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.

14) 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.


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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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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

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   [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.

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