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 reset IC series. Because the counter timer delay circuit is built into those series, an external capacitor for the delay time setting is unnecessary. The lineup was established with tow 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
- None delay time setting capacitor
- Ultra-low current consumption
- Tow output types (Nch open drain and CMOS output)

●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

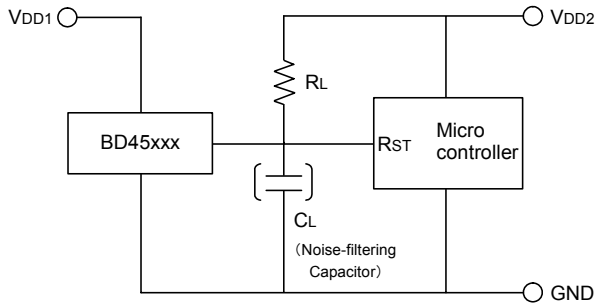
●Package

SSOP5 2.90mm x 2.80mm x 1.15mm

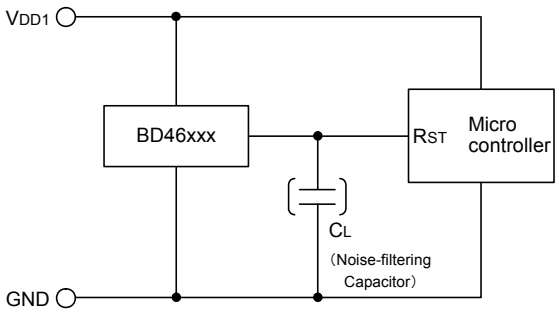
●Applications

All electronic devices that use microcontrollers and logic circuits

●Typical Application Circuit



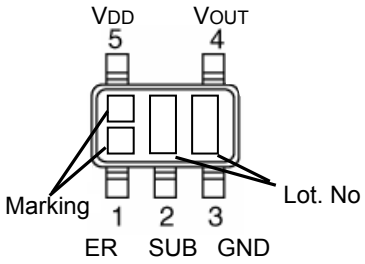
(Open Drain Output Type)
BD45xxx series



(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.

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

●Ordering Information

B	D	4	5	2	3	1	G	–	T R

BD45: Open Drain Type
CMOS Detector IC with
Built-In Counter Timer

BD46: CMOS Output Type
CMOS Detector IC with
Built-In Counter Timer

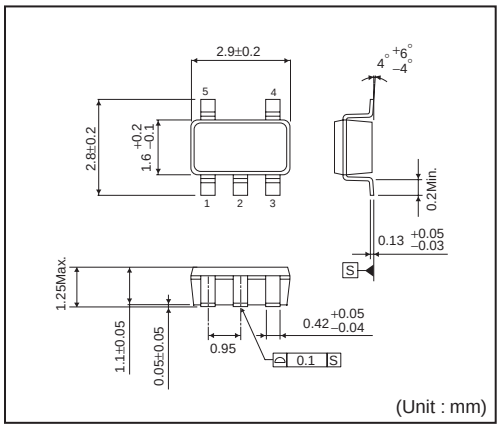
Reset Voltage Value
23: 2.3V
48: 4.8V

Counter Timer
Delay Time Settings
5: 50ms
1: 100ms
2: 200ms

Package
G: SSOP5

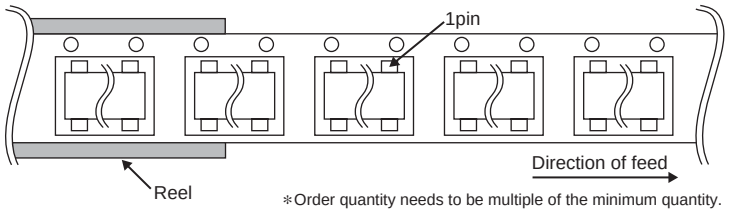
Packaging and forming specification
TR: Embossed tape and reel

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.

●Lineup

Detection Voltage	Marking	Part Number	Marking	Part Number	Marking	Part Number	Marking	Part Number	Marking	Part Number	Marking	Part Number
4.8V	T0	BD45485	TS	BD45481	UJ	BD45482	VA	BD46485	W2	BD46481	WU	BD46482
4.7V	T1	BD45475	TT	BD45471	UK	BD45472	VB	BD46475	W3	BD46471	WV	BD46472
4.6V	T2	BD45465	TU	BD45461	UL	BD45462	VC	BD46465	W4	BD46461	WW	BD46462
4.5V	T3	BD45455	TV	BD45451	UM	BD45452	VD	BD46455	W5	BD46451	WX	BD46452
4.4V	T4	BD45445	TW	BD45441	UN	BD45442	VE	BD46445	W6	BD46441	WY	BD46442
4.3V	T5	BD45435	TX	BD45431	UP	BD45432	VF	BD46435	W7	BD46431	WZ	BD46432
4.2V	T6	BD45425	TY	BD45421	UQ	BD45422	VG	BD46425	W8	BD46421	X0	BD46422
4.1V	T7	BD45415	TZ	BD45411	UR	BD45412	VH	BD46415	W9	BD46411	X1	BD46412
4.0V	T8	BD45405	U0	BD45401	US	BD45402	VJ	BD46405	WA	BD46401	X2	BD46402
3.9V	T9	BD45395	U1	BD45391	UT	BD45392	VK	BD46395	WB	BD46391	X3	BD46392
3.8V	TA	BD45385	U2	BD45381	UU	BD45382	VL	BD46385	WC	BD46381	X4	BD46382
3.7V	TB	BD45375	U3	BD45371	UV	BD45372	VM	BD46375	WD	BD46371	X5	BD46372
3.6V	TC	BD45365	U4	BD45361	UW	BD45362	VN	BD46365	WE	BD46361	X6	BD46362
3.5V	TD	BD45355	U5	BD45351	UX	BD45352	VP	BD46355	WF	BD46351	X7	BD46352
3.4V	TE	BD45345	U6	BD45341	UY	BD45342	VQ	BD46345	WG	BD46341	X8	BD46342
3.3V	TF	BD45335	U7	BD45331	UZ	BD45332	VR	BD46335	WH	BD46331	X9	BD46332
3.2V	TG	BD45325	U8	BD45321	V0	BD45322	VS	BD46325	WJ	BD46321	XA	BD46322
3.1V	TH	BD45315	U9	BD45311	V1	BD45312	VT	BD46315	WK	BD46311	XB	BD46312
3.0V	TJ	BD45305	UA	BD45301	V2	BD45302	VU	BD46305	WL	BD46301	XC	BD46302
2.9V	TK	BD45295	UB	BD45291	V3	BD45292	VV	BD46295	WM	BD46291	XD	BD46292
2.8V	TL	BD45285	UC	BD45281	V4	BD45282	VW	BD46285	WN	BD46281	XE	BD46282
2.7V	TM	BD45275	UD	BD45271	V5	BD45272	VX	BD46275	WP	BD46271	XF	BD46272
2.6V	TN	BD45265	UE	BD45261	V6	BD45262	VY	BD46265	WQ	BD46261	XG	BD46262
2.5V	TP	BD45255	UF	BD45251	V7	BD45252	VZ	BD46255	WR	BD46251	XH	BD46252
2.4V	TQ	BD45245	UG	BD45241	V8	BD45242	W0	BD46245	WS	BD46241	XJ	BD46242
2.3V	TR	BD45235	UH	BD45231	V9	BD45232	W1	BD46235	WT	BD46231	XK	BD46232

● **Absolute maximum ratings (Ta=25°C)**

Parameter		Symbol	Limits	Unit
Power Supply Voltage		V_{DD}-GND	-0.3 to +10	V
Output Voltage	Nch Open Drain Output	VOUT	GND-0.3 to +10	V
	CMOS Output		GND-0.3 to V_{DD}+0.3	
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 Use above Ta=25°C results in a 5.4mW loss per degree.
*2 When mounted on a 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
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	
Operating Voltage Range	VOPL	VOL≤0.4V, RL=470kΩ, Ta=25 to 105°C		0.95	-	-	V
		VOL≤0.4V, RL=470kΩ, Ta=-40 to 25°C		1.20	-	-	
'High' Output Current	IOH	VDS=0.5V,VDD=6.0V,VDET≥4.3V		1.2	2.7	-	mA
'Low'Output Current (Nch)	IOL	VDS=0.5V, VDD=1.2V		0.4	1.2	-	mA
		VDS=0.5V, VDD=2.4V VDET=2.7V to 4.8V		2.0	5.0	-	
Leak Current when OFF	I_{leak}	VDD=VDS=10V *1		-	-	0.1	μA
ER Pin 'H' Voltage	VEH	*1		2.0	-	-	V
ER Pin 'L' Voltage	VEL	*1		-	-	0.8	V
ER Pin Input Current	IEL			-	1	10	μA

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 up the rise up time between VDD=0→VDET more than 100μs.
Attention: Please connect the GND when you don't use 'ER'

●**Block Diagrams**

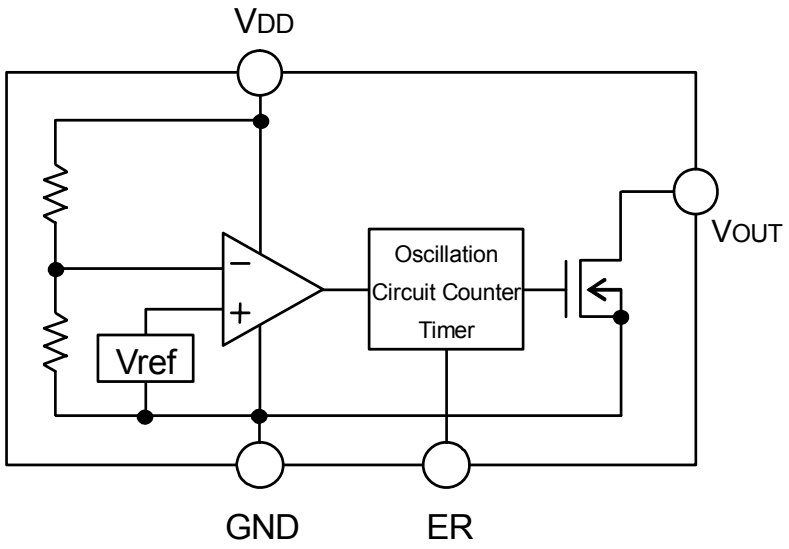


Fig.1 BD45xxx Series

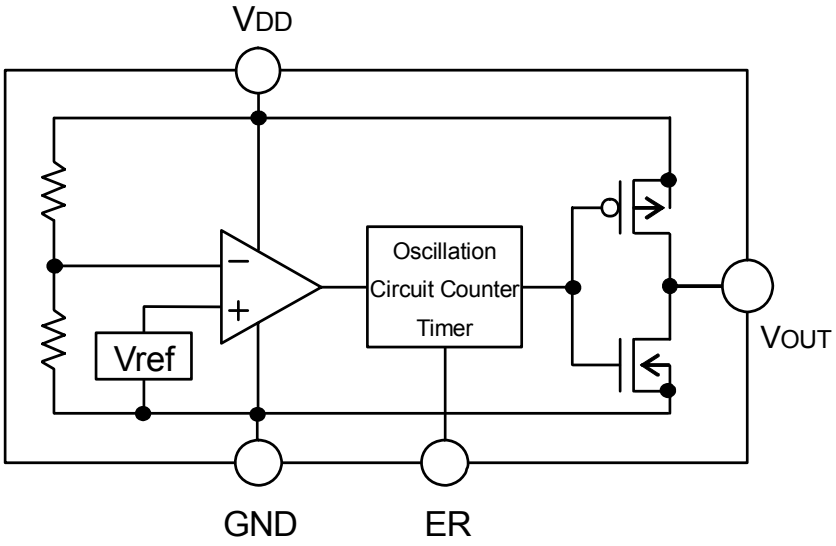


Fig.2 BD46xxx Series

●Typical Performance Curves

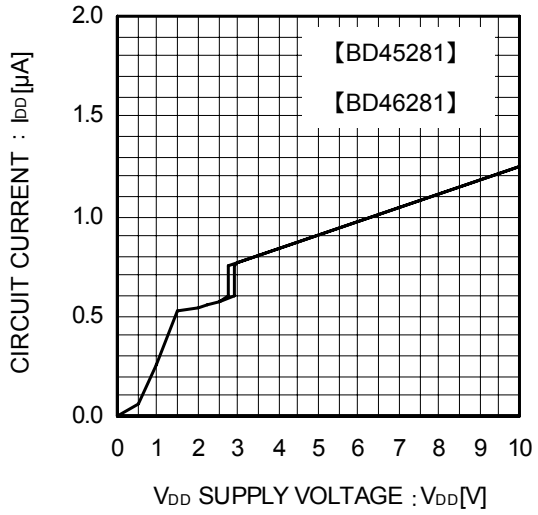


Fig.3 Circuit Current

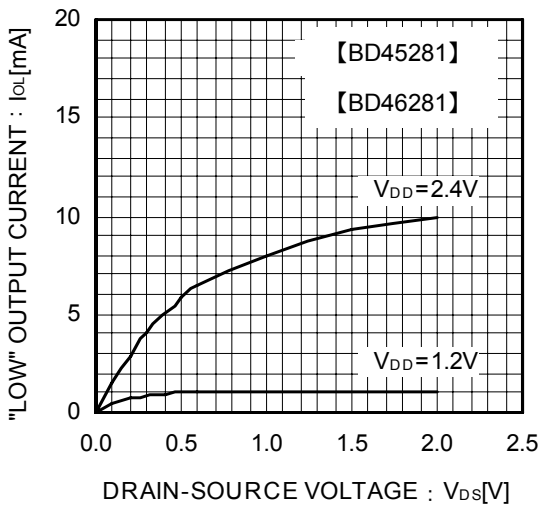


Fig.4 “Low” Output Current

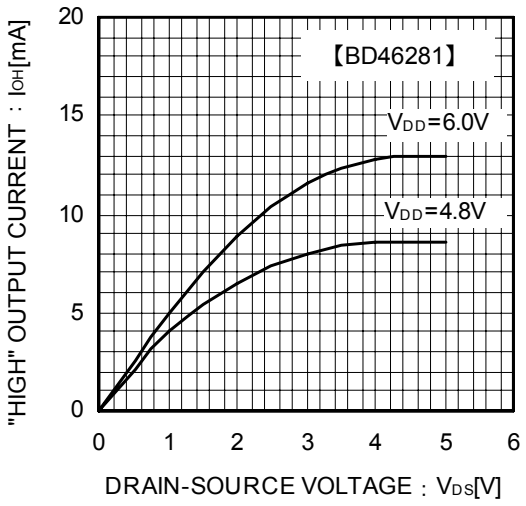


Fig.5 “High” Output Current

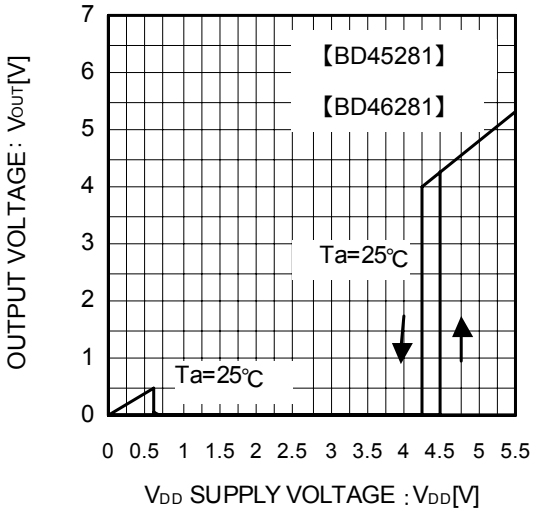


Fig.6 I/O Characteristics

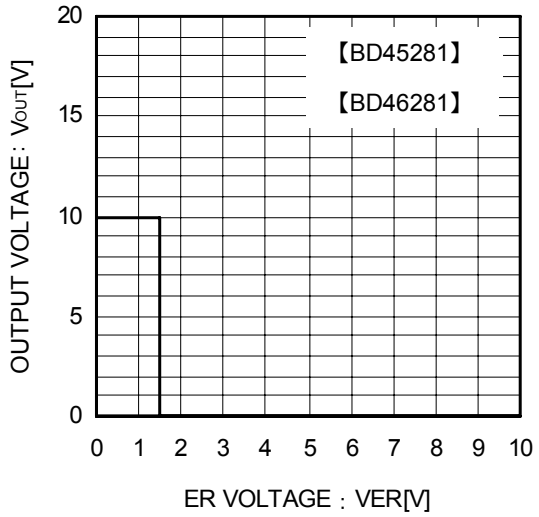


Fig.7 ER Terminal Threshold Voltage

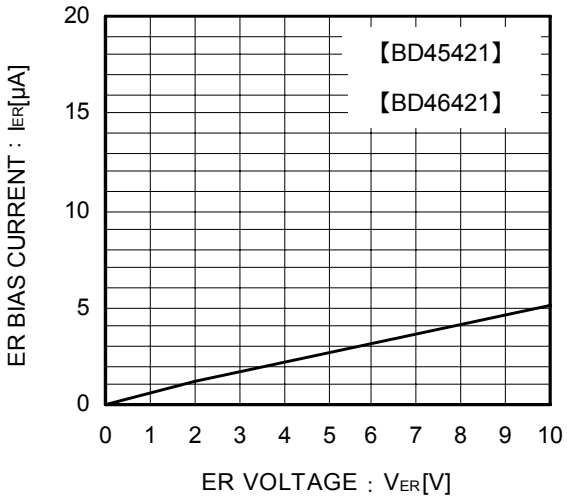


Fig.8 ER Terminal Input Current

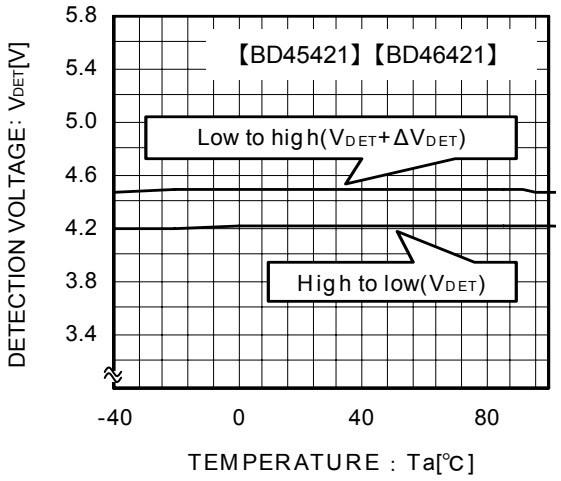


Fig.9 Detection Voltage
Release Voltage

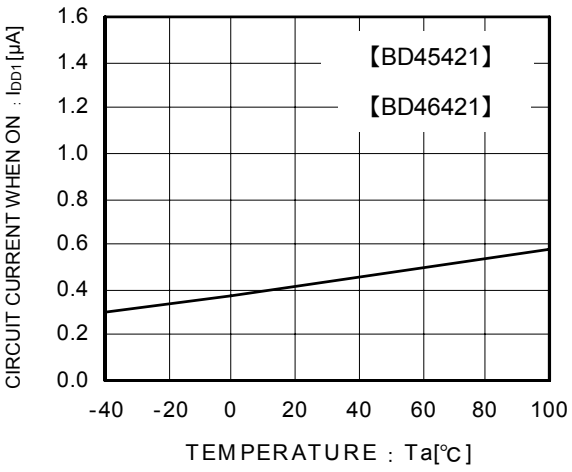


Fig.10 Circuit Current when ON
(VDET-0.2V)

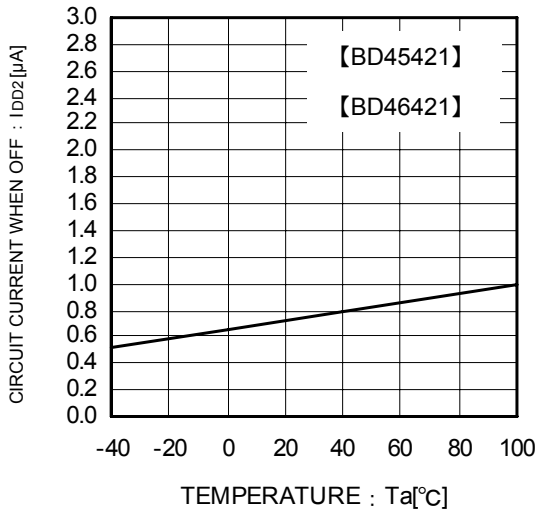


Fig.11 Circuit Current when OFF

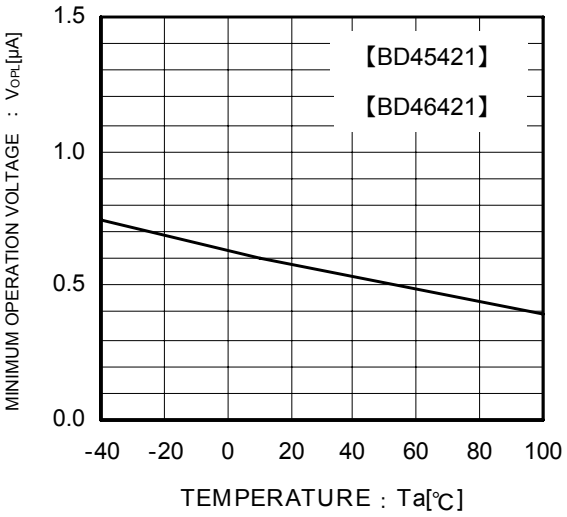


Fig.12 Operating Limit Voltage

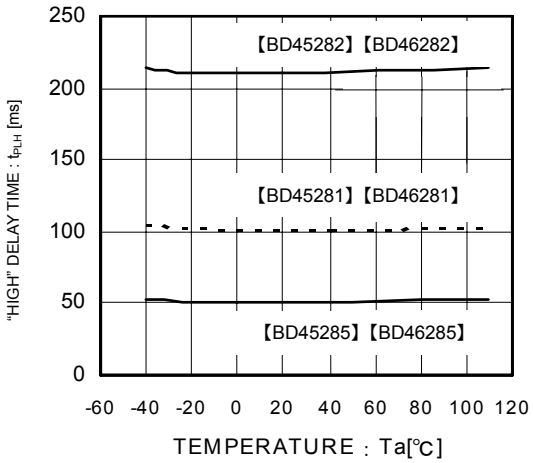


Fig.13 Output Delay Time
"Low"→"High"

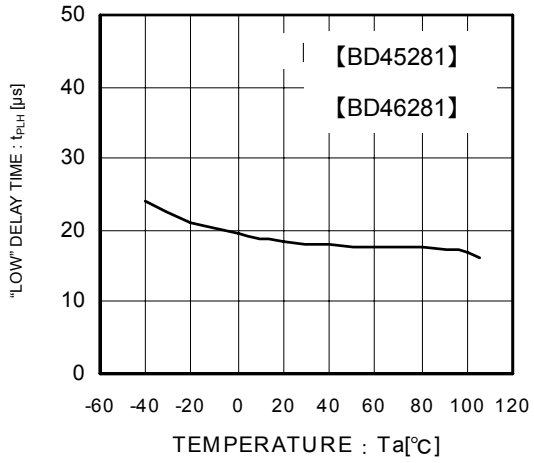


Fig.14 Output Delay Time
"High"→"Low"

●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 BD45xx series uses an open drain output type, it is possible to connect a pull-up resistor to V_{DD} or another power supply [The output “High” voltage (V_{OUT}) in this case becomes V_{DD} or the voltage of the other power supply].

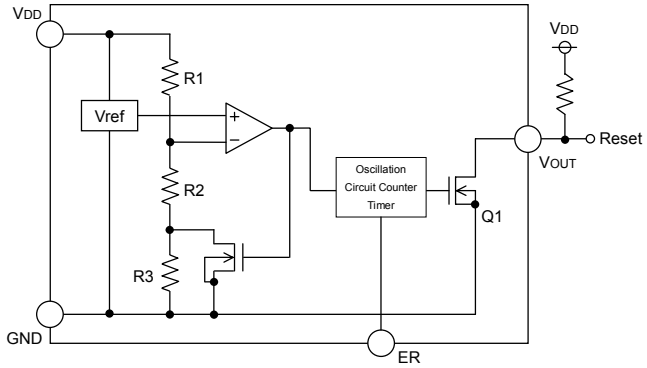


Fig.15 (BD45xx Type Internal Block Diagram)

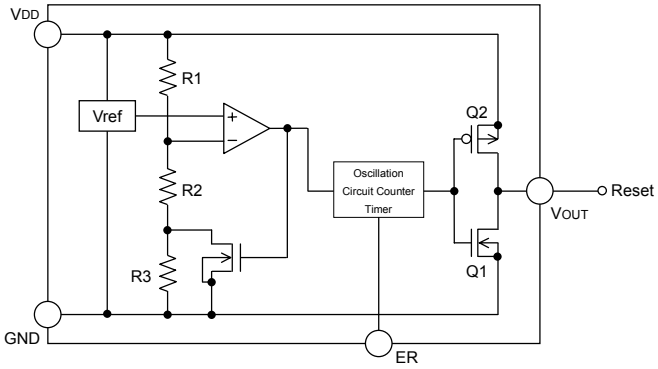


Fig.16 (BD46xx Type Internal Block Diagram)

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).

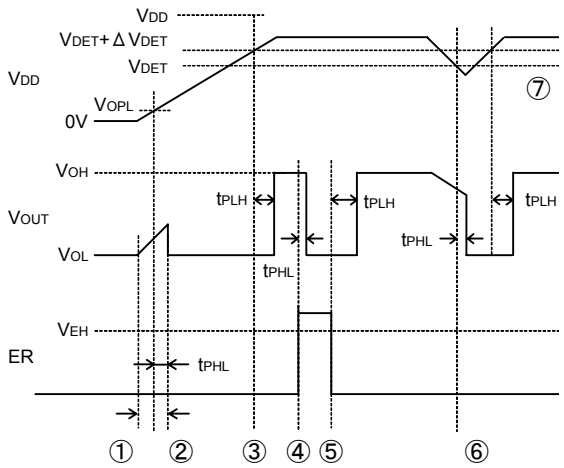


Fig.17 Timing Waveform

① When the power supply is turned on, the output is unsettled from after over the operating limit voltage (V_{OPL}) until t_{PHL}. There fore 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} + ΔV_{DET}), the output voltages will switch to Low.

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

④ When more than the high level voltage is supplied 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 (ΔV_{DET}). The system is designed such that the output does not flip-flop with power supply fluctuations within this hysteresis width, preventing malfunctions due to noise.

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

Circuit Applications

●Examples of a common power supply detection reset circuit.

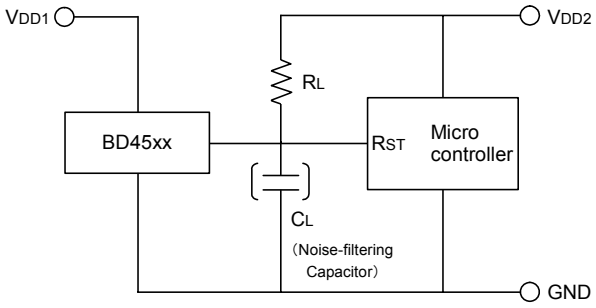


Fig.18 Open Drain Output Type

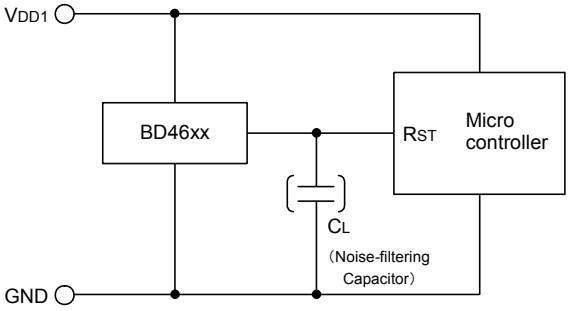


Fig.19 CMOS Output Type

Application examples of BD45xx series (Open Drain output type) and BD46xx series (CMOS output type) are shown below.

CASE1: the power supply of the microcontroller (V_{DD2}) differs from the power supply of the reset detection (V_{DD1}). Use the open drain output type (BD45xx) attached a load resistance (R_L) between the output and V_{DD2}. (As shown Fig.18)

CASE2: the power supply of the microcontroller (V_{DD1}) is same as the power supply of the reset detection (V_{DD1}).

Use CMOS output type (BD46xx) or open drain output type (BD45xx) attached a load resistance (R_L) between the output and V_{DD1}. (As shown Fig.19)

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}).

●Operational Notes

1) Absolute Maximum Range
Absolute Maximum Ratings are those values beyond which the life of a device may be destroyed. We cannot be defined the failure mode, such as short mode or open mode. Therefore a physical security countermeasure, like fuse, is to be given when a specific mode to be beyond absolute maximum ratings is considered.

2) GND Potential
GND terminal should be a lowest voltage potential every state.
Please make sure all pins, which are over ground even if, include transient feature.

3) Electrical Characteristics
Be sure to check the electrical characteristics that are one the tentative specification will be changed by temperature, Supply voltage, and external circuit.

4) Bypass Capacitor for Noise Rejection
Please put into the capacitor of 1μF or more between V_{DD} pin and GND, and the capacitor of about 1000pF between V_{OUT} pin and GND, to reject noise. If extremely big capacitor is used, transient response might be late. Please confirm sufficiently for the point.

5) Short Circuit between Terminal and Soldering
Don't short-circuit between Output pin and V_{DD} pin, Output pin and GND pin, or V_{DD} pin and GND pin. When soldering the IC on circuit board, please be unusually cautious about the orientation and the position of the IC. When the orientation is mistaken the IC may be destroyed.

6) Electromagnetic Field
Mal-function may happen when the device is used in the strong electromagnetic field.

7) The V_{DD} line inpedance might cause oscillation because of the detection current.

8) A V_{DD} -GND capacitor (as close connection as possible) should be used in high V_{DD} line impedance condition.

9) Lower than the mininum input voltage makes the V_{OUT} high impedance, and it must be V_{DD} in pull up (V_{DD}) condition.

10) This IC has extremely high impedance terminals. Small leak current due to the uncleanness of PCB surface might cause unexpected operations. Application values in these conditions should be selected carefully. If the leakage 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 RL is 50kΩ to 1MΩ. There are many factors (board layout, etc) that can affect characteristics. Please verify and confirm using practical applications.

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

13) Precautions for board inspection
Connecting low-impedance capacitors to run inspections with the board may produce stress on the IC. Therefore, be certain to use proper discharge procedure before each process of the test operation.
To prevent electrostatic accumulation and discharge in the assembly process, thoroughly ground yourself and any equipment that could sustain ESD damage, and continue observing ESD-prevention procedures in all handing, transfer and storage operations. Before attempting to connect components to the test setup, make certain that the power supply is OFF. Likewise, be sure the power supply is OFF before removing any component connected to the test setup.

14) When the power supply, is turned on because of in certain cases, momentary Rash-current flow into the IC at the logic unsettled, the couple capacitance, GND pattern of width and leading line must be considered.

Status of this document
The Japanese version of this document is formal specification. A customer may use this translation version only for a reference to help reading the formal version.
If there are any differences in translation version of this document formal version takes priority.

Notice

●Precaution for circuit design

1) The products are designed and produced for application in ordinary electronic equipment (AV equipment, OA equipment, telecommunication equipment, home appliances, amusement equipment, etc.). If the products are to be used in devices requiring extremely high reliability (medical equipment, transport equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or operational error may endanger human life and sufficient fail-safe measures, please consult with the ROHM sales staff in advance. If product malfunctions may result in serious damage, including that to human life, sufficient fail-safe measures must be taken, including the following:
   [a] Installation of protection circuits or other protective devices to improve system safety
   [b] Installation of redundant circuits in the case of single-circuit failure

2) The products are designed for use in a standard environment and not in any special environments. Application of the products in a special environment can deteriorate product performance. Accordingly, verification and confirmation of product performance, prior to use, is recommended if used under the following conditions:
   [a] Use in various types of liquid, including water, oils, chemicals, and organic solvents
   [b] Use outdoors where the products are exposed to direct sunlight, or in dusty places
   [c] Use in places where the products are exposed to sea winds or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
   [d] Use in places where the products are exposed to static electricity or electromagnetic waves
   [e] Use in proximity to heat-producing components, plastic cords, or other flammable items
   [f] Use involving sealing or coating the products with resin or other coating materials
   [g] Use involving unclean solder or use of water or water-soluble cleaning agents for cleaning after soldering
   [h] Use of the products in places subject to dew condensation

3) The products are not radiation resistant.

4) Verification and confirmation of performance characteristics of products, after on-board mounting, is advised.

5) 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.

6) De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta).
   When used in sealed area, confirm the actual ambient temperature.

7) Confirm that operation temperature is within the specified range described in product specification.

8) Failure induced under deviant condition from what defined in the product specification cannot be guaranteed.

●Precaution for Mounting / Circuit board design

1) When a highly active halogenous (chlorine, bromine, etc.) flux is used, the remainder 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 Company in advance.

Regarding Precaution for Mounting / Circuit board design, please specially refer to ROHM Mounting specification

●Precautions Regarding Application Examples and External Circuits

1) If change is made to the constant of an external circuit, allow a sufficient margin due to variations of the characteristics of the products and external components, including transient characteristics, as well as static characteristics.

2) The application examples, their constants, and other types of information contained herein are applicable only when the products are used in accordance with standard methods. Therefore, if mass production is intended, sufficient consideration to external conditions must be made.

●Precaution for Electrostatic

This product is Electrostatic sensitive product, which may be damaged due to Electrostatic discharge. Please take proper caution during manufacturing and storing so that voltage exceeding Product maximum rating won't 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 following places:
   [a] Where the products are exposed to sea winds or corrosive gases, including Cl2, H2S, NH3, SO2, and NO2
   [b] Where the temperature or humidity exceeds those recommended by the Company
   [c] Storage in direct sunshine or condensation
   [d] Storage in 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 recommended storage time period .

3) Store / transport cartons in the correct direction, which is indicated on a carton as 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 dry bag.

●Precaution for product label

QR code printed on ROHM product label is only for internal use, and please do not use at customer site. It might contain a internal part number that is inconsistent with an product part number.

●Precaution for disposition

When disposing products please dispose them properly with a industry waste company.

●Precaution for Foreign exchange and Foreign trade act

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

●Prohibitions Regarding Industrial Property

1) Information and data on products, including application examples, contained in these specifications are simply for reference; the Company does not guarantee any industrial property rights, intellectual property rights, or any other rights of a third party regarding this information or data. Accordingly, the Company does not bear any responsibility for:
   [a] infringement of the intellectual property rights of a third party
   [b] any problems incurred by the use of the products listed herein.

2) The Company prohibits the purchaser of its products to exercise or use the intellectual property rights, industrial property rights, or any other rights that either belong to or are controlled by the Company, other than the right to use, sell, or dispose of the products.