Bipolar Voltage detector IC

BD47××G series

BD47××G is a series of Voltage detector ICs developed to prevent system error at transient state when the power of CPU and logic circuit switches ON/OFF or shutdown. These ICs consist of Power, GND, and reset output to detect power supply voltage of various systems and to output reset signal. These ICs are more practical for portable products because of their ultra-small package and low current consumption.

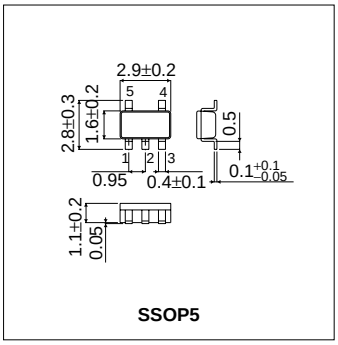
●Applications

Portable products, Equipments with CPU and logic circuit

●Features

1) Detection voltage : 0.1V step line up 1.9~4.6V(Typ.)
2) High-accuracy voltage detection ±2% guaranteed (Ability ±1%)
3) Low current consumption
4) "L" reset output of open collector
5) Small SSOP5 package

●External dimensions (Units : mm)



SSOP5

●Series characteristics

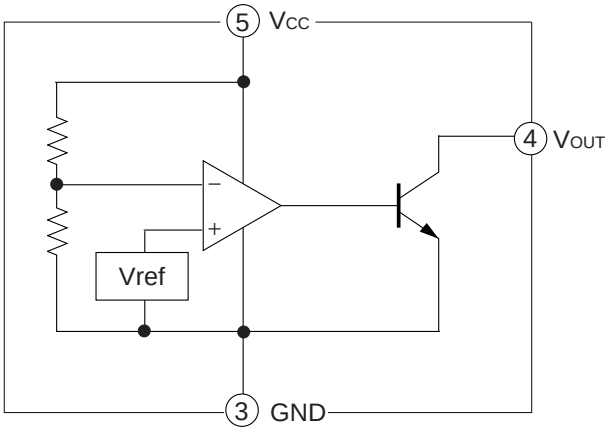
Part No.	Detection voltage V_S(V)			Consumption current (μA Typ.)		Hysteresis voltage (mV)	Operating output current (mA)	Package
	Min.	Typ.	Max.	I_{CCL}	I_{CCH}			
BD4746G	4.508	4.600	4.692	1.5	1.6	50	15	SSOP5
BD4745G	4.410	4.500	4.590	1.5	1.6	50	15	SSOP5
BD4744G	4.312	4.400	4.488	1.5	1.6	50	15	SSOP5
BD4743G	4.214	4.300	4.386	1.5	1.6	50	15	SSOP5
BD4742G	4.116	4.200	4.284	1.5	1.6	50	15	SSOP5
BD4741G	4.018	4.100	4.182	1.5	1.6	50	15	SSOP5
BD4740G	3.920	4.000	4.080	1.5	1.6	50	15	SSOP5
BD4739G	3.822	3.900	3.978	1.5	1.6	50	15	SSOP5
BD4738G	3.724	3.800	3.876	1.5	1.6	50	15	SSOP5
BD4737G	3.626	3.700	3.774	1.5	1.6	50	15	SSOP5
BD4736G	3.528	3.600	3.672	1.5	1.6	50	15	SSOP5
BD4735G	3.430	3.500	3.570	1.5	1.6	50	15	SSOP5
BD4734G	3.332	3.400	3.468	1.5	1.6	50	15	SSOP5
BD4733G	3.234	3.300	3.366	1.5	1.6	50	15	SSOP5
BD4732G	3.136	3.200	3.264	1.5	1.6	50	15	SSOP5
BD4731G	3.038	3.100	3.162	1.5	1.6	50	15	SSOP5
BD4730G	2.940	3.000	3.060	1.5	1.6	50	15	SSOP5
BD4729G	2.842	2.900	2.958	1.5	1.6	50	15	SSOP5
BD4728G	2.744	2.800	2.856	1.5	1.6	50	15	SSOP5
BD4727G	2.646	2.700	2.754	1.5	1.6	50	15	SSOP5
BD4726G	2.548	2.600	2.652	1.5	1.6	50	15	SSOP5
BD4725G	2.450	2.500	2.550	1.5	1.6	50	15	SSOP5
BD4724G	2.352	2.400	2.448	1.5	1.6	50	15	SSOP5
BD4723G	2.254	2.300	2.346	1.5	1.6	50	15	SSOP5
BD4722G	2.156	2.200	2.244	1.5	1.6	50	15	SSOP5
BD4721G	2.058	2.100	2.142	1.5	1.6	50	15	SSOP5
BD4720G	1.960	2.000	2.040	1.5	1.6	50	15	SSOP5
BD4719G	1.862	1.900	1.938	1.5	1.6	50	15	SSOP5

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

Parameter	Symbol	Limits	Unit
Power supply voltage	V_{CC}	−0.3~+10	V
Output voltage	P_O	−0.3~+10	V
Power dissipation	Pd	150 *	mW
Operating temperature range	Topr	−20~+75	°C
Storage temperature range	Tstg	−40~+125	°C

Note) The ratings shown above indicate breakdown limit of the pin and should not be regarded as the values that guarantee the operation.
* Derating : 1.5mW/°C for operation above Ta=25°C.

●**Block diagram**



●**Pin descriptions**

Pin No. SMP5	Pin name	Function
1	NC	
2	SUB	Substrate Pin (GND)
3	GND	Ground Pin
4	V_{OUT}	Output Pin
5	V_{CC}	Input Pin

●**Electrical characteristics** (Unless otherwise noted; Ta=25°C)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions		Measurement circuit
Detection	Vs	4.508	4.600	4.692	V	RL=4.7kΩ, VCC=H to L	BD4746G	Fig2
		4.410	4.500	4.590	V		BD4745G	Fig2
		4.312	4.400	4.488	V		BD4744G	Fig2
		4.214	4.300	4.386	V		BD4743G	Fig2
		4.116	4.200	4.284	V		BD4742G	Fig2
		4.018	4.100	4.182	V		BD4741G	Fig2
		3.920	4.000	4.080	V		BD4740G	Fig2
		3.822	3.900	3.978	V		BD4739G	Fig2
		3.724	3.800	3.876	V		BD4738G	Fig2
		3.626	3.700	3.774	V		BD4737G	Fig2
		3.528	3.600	3.672	V		BD4736G	Fig2
		3.430	3.500	3.570	V		BD4735G	Fig2
		3.332	3.400	3.468	V		BD4734G	Fig2
		3.234	3.300	3.366	V		BD4733G	Fig2
		3.136	3.200	3.264	V		BD4732G	Fig2
		3.038	3.100	3.162	V		BD4731G	Fig2
		2.940	3.000	3.060	V		BD4730G	Fig2
		2.842	2.900	2.958	V		BD4729G	Fig2
		2.744	2.800	2.856	V		BD4728G	Fig2
		2.646	2.700	2.754	V		BD4727G	Fig2
		2.548	2.600	2.652	V		BD4726G	Fig2
		2.450	2.500	2.550	V		BD4725G	Fig2
		2.352	2.400	2.448	V		BD4724G	Fig2
		2.254	2.300	2.346	V		BD4723G	Fig2
		2.156	2.200	2.244	V		BD4722G	Fig2
		2.058	2.100	2.142	V		BD4721G	Fig2
		1.960	2.000	2.040	V		BD4720G	Fig2
		1.862	1.900	1.938	V		BD4719G	Fig2
Temperature Coefficient of Derection voltage	Vs/ΔT	–	±0.01	–	%/°C	RL=4.7kΩ, Ta=–20 to +75°C		Fig2
Detection Hysteresis voltage	ΔVs	30	50	100	mV	RL=4.7kΩ, VCC=L to H to L		Fig2
Transfer Delay time "H"	TPLH	–	20	50	µs	CL=100pF, RL=4.7kΩ *1		Fig5
Transfer Delay time "L"	TPHL	–	60	120	µs	CL=100pF, RL=4.7kΩ *2		Fig5
Reset Output voltage "L"	VOL	–	0.1	0.4	V	VCC=VsMin.–0.05V, RL=4.7kΩ		Fig2
Circuit current ON	ICC1	–	1.5	3.0	µA	VCC=VsMin.–0.05V, RL=∞		Fig4
Circuit curent OFF	ICC2	–	1.6	3.2	µA	VCC=VsTyp./0.85V, RL=∞		Fig4
Threshold Operating voltage	VOPL	–	0.65	0.85	V	RL=4.7kΩ, VOL≧0.4V		Fig2
Output leak current	IL	–	–	0.1	µA	VCC=VOUT=10V		Fig3
Reset Output current "L"	IOL	3.0	15.0	–	mA	VO=0.4V, VCC=VsMin.–0.05V		Fig6

*1 TPLH : VCC=(Vs Typ.–0.4V) to (Vs Typ.+0.4V)
*2 TPHL : VCC=(Vs Typ.+0.4V) to (Vs Typ.–0.4V)

●**Timing waveform**

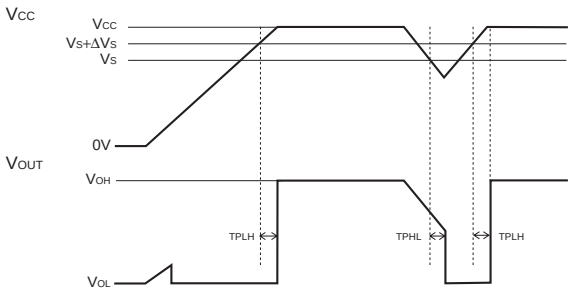


Fig.1 Timing waveform

Note:

The detection voltage varies because the circuit current causes voltage drop when resistance exists supply voltage line. Please have attention for using it.

A capacitor should be connected between Vcc and GND when impedance exists on supply voltage line.

●**Measurement circuits**

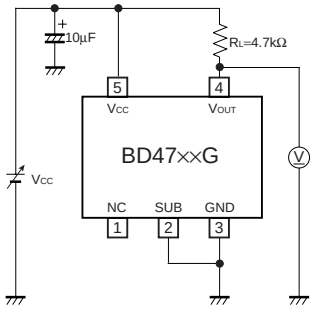


Fig.2 Detection voltage, Detection Hysteresis voltage, Reset Output voltage"L" , Threshold Voltage

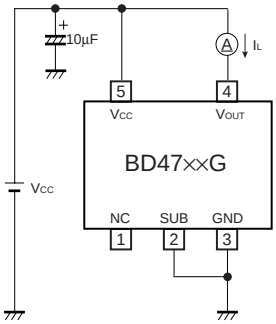


Fig.3 Output leak current

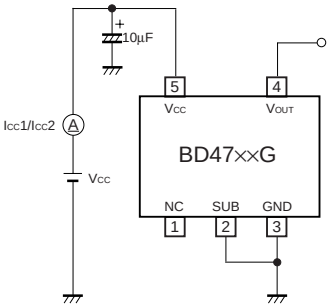


Fig.4 Circuit Current ON,Circuit Current OFF

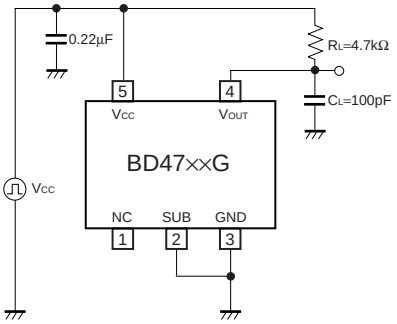


Fig.5 Transfer delay time

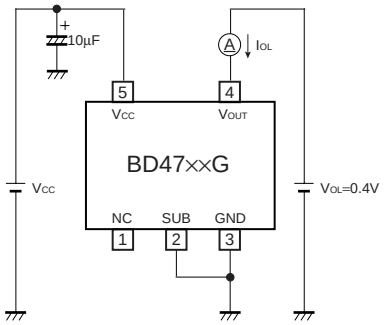


Fig.6 Reset output current "L"

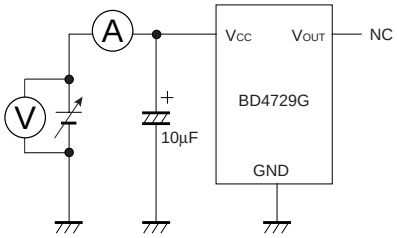


Fig.7 Current consumption

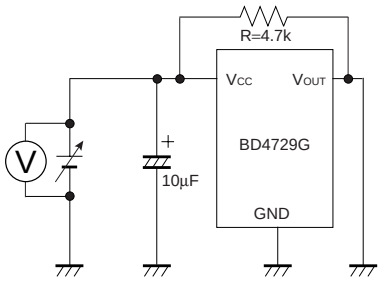


Fig.8 I/O characteristic

● **Operating explanation**

For both BD47xxG series detection voltage and release voltage is threshold voltage. When voltage applied to input reaches each threshold voltage, output goes "H"→"L" or "L"→"H".

Some hysteresis is given such a way that the release voltage is the detection voltage +50mV(Typ), and as toprevent fluctuation in output . When input is equal to or more than the release voltage, output is in "H" mode.

When input is gradually decreased from this mode, output turns "L" in the detection voltage.

When input is equal to or less than the detection voltage, output is in "L" mode. When input is gradually increased from this mode, output turns "H" in the release voltage.

Input of 0.85V and more is necessary to operate circuit completely , the output becomes inconsistent if the input is equal to or lower than the operating limit voltage.

Setting of the RESET signal delay time

Delay time can be set by capacitor CL and resistance RL connected to the output pin as shown below.

CL is charged by RL when Vcc is rising. The delay time caused by charging is determined by the time constant of CL, RL and the threshold voltage of RESET pin. Voltage detector IC discharges CL forcedly when Vcc is falling. The delay time of RESET single is determined by adding the delay time of sing le Voltage detector IC to each time.

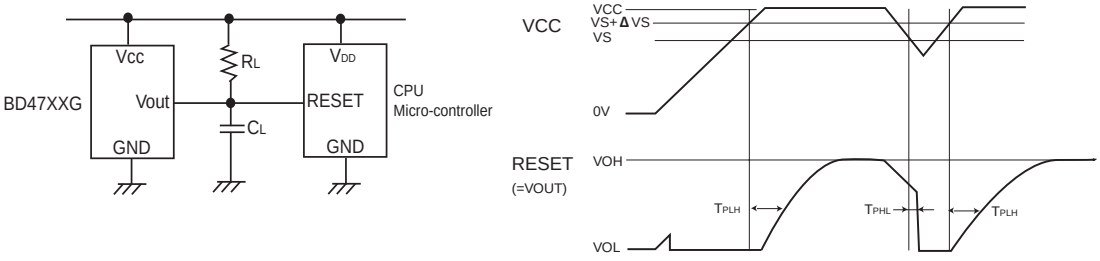


Fig.9

●**Application circuit**

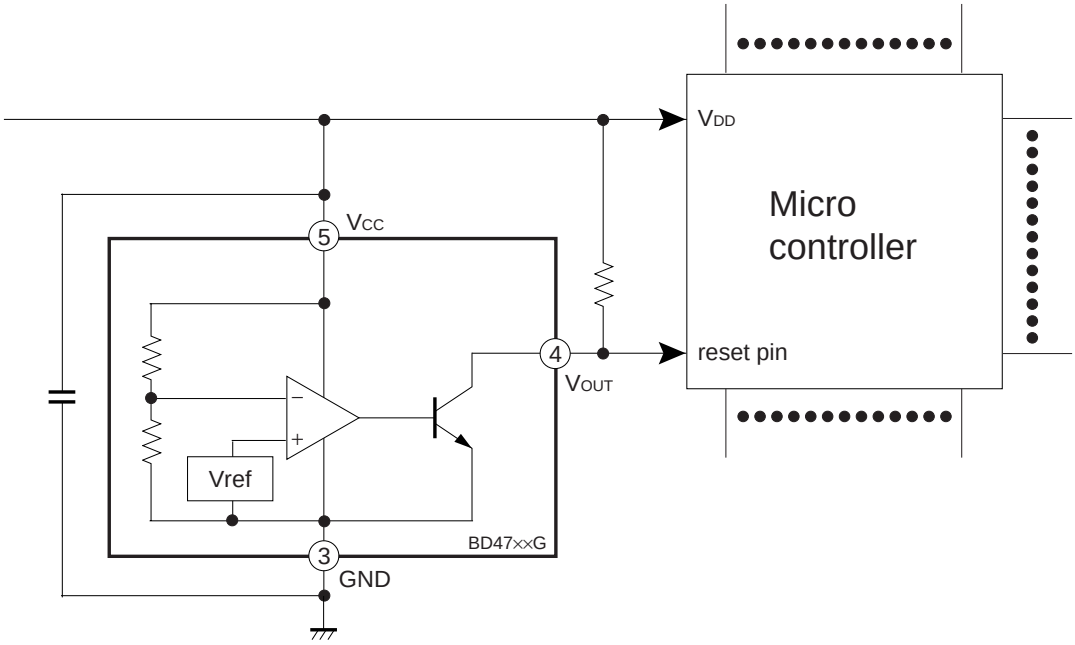


Fig.10

BD47xxG/FVE series need pull-up resistor in output pin. For resistance ,please confirm the level of supply voltage pulled-up and output current capacity sufficiently, and use it to any applications.
When the capacitor for noise filtering and for delay time setting is connected to output pin, confirm the pull-up resistance, output current capacity, capacitance of capacitor considering of the wave rounding of the rise and decay of output.
Please be careful when the by-pass capacitor is connected between input and GND because the transient response speed can be delayed if the extreme big capacitor is used.

● **NOTES FOR USE**

(1)Operation supply voltage range

Funtional circuit operation is guaranteed within operation ambient temperature, as long as it is within operation supply voltage range. The electrical characteristics standard value can not be guaranteed. However, there is no drastic variation in these values, as long as it is within operation supply voltage range.

(2)Grounding

For the grounding shown in the application circuit, wire every ground to GND terminal(3pin) in a short pattern arrangement to avoid electrical disturbance.

(3)Miscellaneous

This product are produced with struct quality control, but might be destroyed in using beyond absolute maximum ratings. Open IC destroyed a failure mode cannot be defined (like short mode, or open mode).Therefore physical security countermeasure, like fuse, is to be given when a specified mode to be beyond absolute maximum ratings is considered.

(4)Mal-function may happen when the device is used in the strong electromagnetic field.

(5)Bypass capacitor for noise rejection

Please put into capacitor to reject noise between supply voltage pin and GND. It recommends degree of 10 µ F capacitance capacitor. If extremely big capacitor is used, transient response might be late. Please confirm sufficiently for the point.

(6)This IC is a bipolar IC which (as shown in Figure 5) has P+ isolation in the P substrate and between the various pins. A P-N junction is formed from this P layer and the N layer of each pin. For example the relation between each potentials is as follows,

(When GND > PinB and GND > PinA, the P-N junction operates as a parasitic diode.)

(When PinB > GND > PinA, the P-N junction operates as a parasitic transistor.)

Parasitic diodes can occur inevitably in the structure of the IC. The operation of parasitic diodes can result in mutual interference among circuits as well as operation faults and physical damage.

Accordingly, you must not use methods by which parasitic diodes operate,such as applying a voltage that is lower than the GND (P substrate) voltage to an input pin.

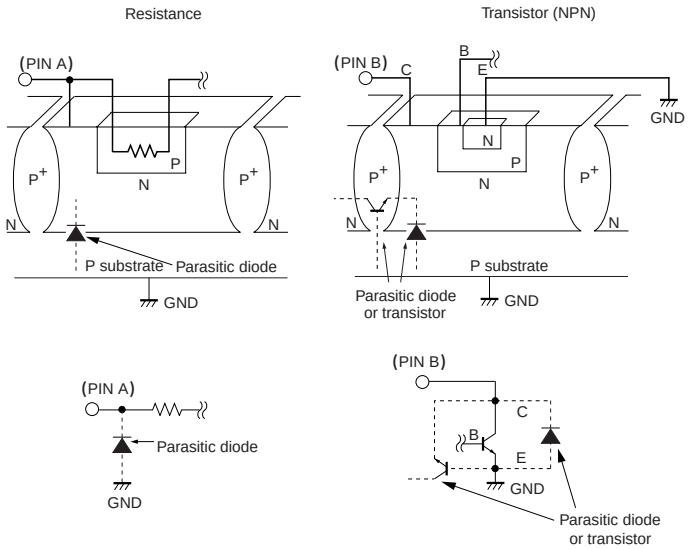
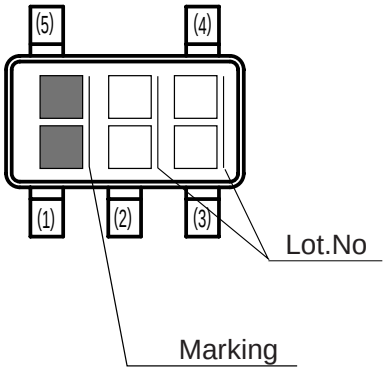


Fig.11 Simplified structure of bipolar IC

●**Part number and marking of samples**



Marking	Voltage	Part No.	Marking	Voltage	Part No.	Marking	Voltage	Part No.
BA	1.9V	BD4719	BK	2.9V	BD4729	BU	3.9V	BD4739
BB	2.0V	BD4720	BL	3.0V	BD4730	BV	4.0V	BD4740
BC	2.1V	BD4721	BM	3.1V	BD4731	BW	4.1V	BD4741
BD	2.2V	BD4722	BN	3.2V	BD4732	BX	4.2V	BD4742
BE	2.3V	BD4723	B4	3.3V	BD4733	BY	4.3V	BD4743
BF	2.4V	BD4724	BP	3.4V	BD4734	BZ	4.4V	BD4744
BG	2.5V	BD4725	BQ	3.5V	BD4735	B1	4.5V	BD4745
BH	2.6V	BD4726	BR	3.6V	BD4736	B2	4.6V	BD4746
B3	2.7V	BD4727	BS	3.7V	BD4737			
BJ	2.8V	BD4728	BT	3.8V	BD4738			

●**Characteristic diagram and Measurement circuit (When BD4729G is measured.)**

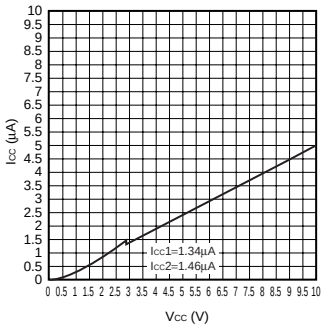


Fig.12 Current consumption

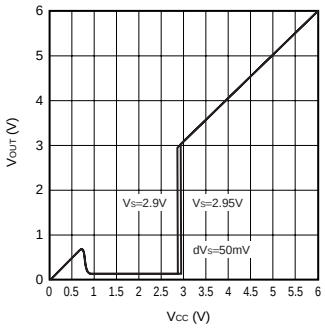


Fig.13 I/O characteristic

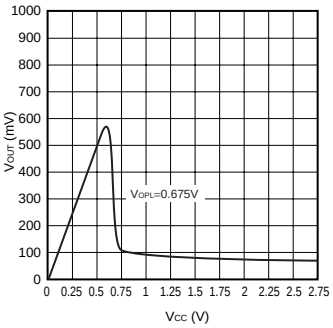


Fig.14 Operating limit voltage

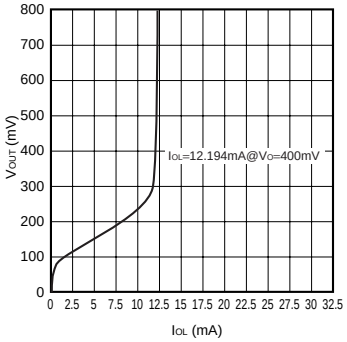


Fig.15 "L" output current