

Free Delay Time Setting CMOS Voltage Detector IC

BD4142HFV

●General Description

BD4142HFV is 1ch voltage detector IC for monitoring an input voltage line. The default detected voltage is 0.5V and is adjustable via external resistors. When monitoring an input voltage supply, the IC outputs a HIGH signal via a PGOOD pin when the supply rises above the threshold and is LOW when below.

●Features

- Open Drain Output
- Built in Under Voltage LockOut (UVLO) Circuit
- Delay Time Controlled by External Capacitor
- Very small and low height package
- PGOOD HIGH Output

●Applications

Laptop PC, Desktop PC, LCD-TV, Printer, STB, Digital Appliances, and more.

●Key Specifications

- Input voltage range: 3.0V to 5.5V
- Detected voltage: 500mV(Typ)
- PGOOD output ON resistance: 100Ω(Typ)
- Bias current: 7.5μA (Typ)
- Operating temperature range (Ta): -10°C to +100°C

●Package

HVSO5F5

1.60mm x 1.60mm x 0.60mm



●Typical Application Circuit

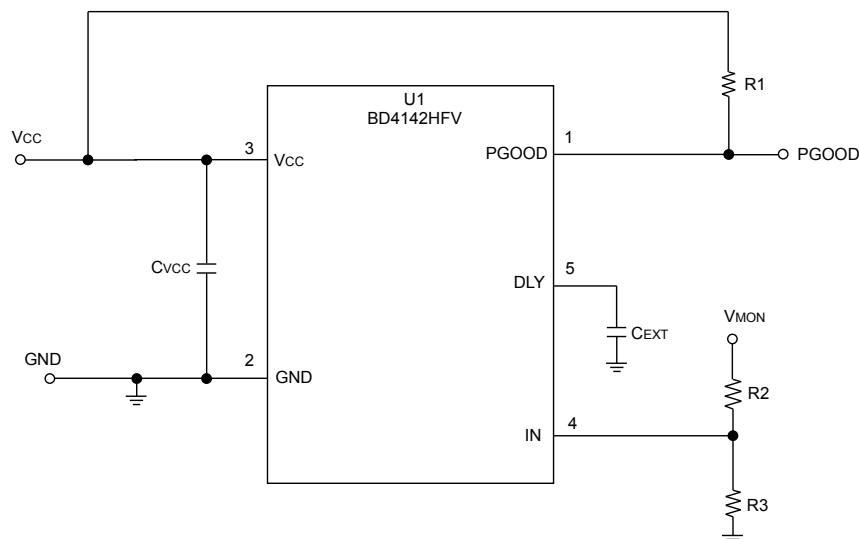


Figure 1. Typical Application Circuit

●Pin Configuration

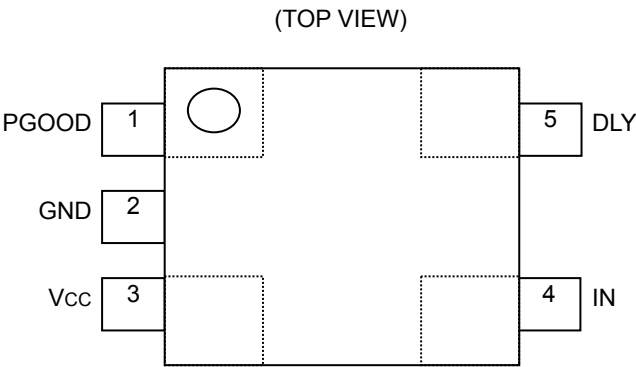


Figure 2. Pin configuration

●Pin Description

Pin No.	Symbol	Function
1	PGOOD	Reset Output Pin (Power Good Signal)
2	GND	Ground Pin
3	Vcc	Power Supply Input Pin
4	IN	Monitoring Voltage Input Pin
5	DLY	Capacitor Connected Pin for Setting Delay Time
Bottom	E-Pad	Substrate. Connect the substrate to GND.

●Block Diagram

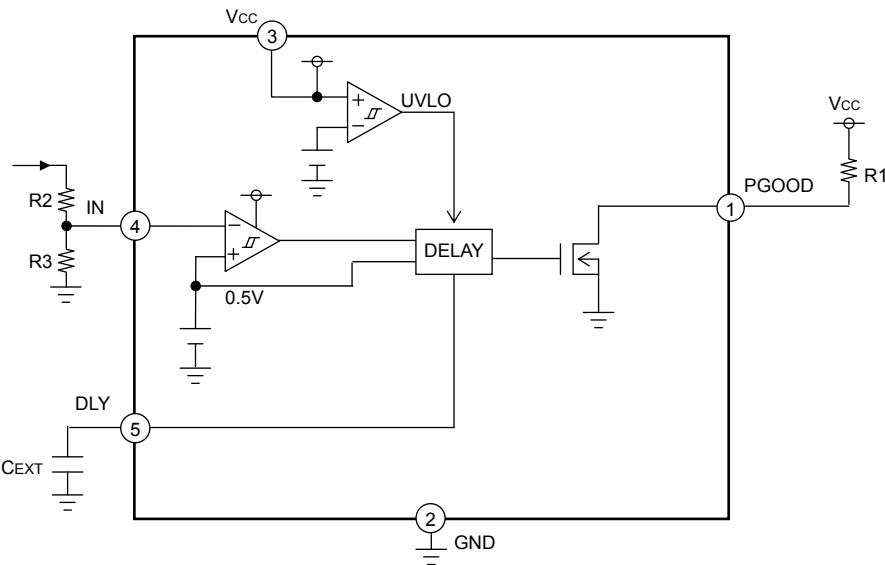


Figure 3. Block Diagram

●Absolute Maximum Ratings (Ta=25°C)

Parameter	Symbol	Limits	Unit
Terminal voltage	V _{CC} , V _{IN} , V _{DLY} , V _{PGOOD}	6 *1	V
Power Dissipation	P _d	0.67 *2	W
PGOOD Capacity Current	I _{PGOOD}	5	mA
Operating temperature range	T _{opr}	-10 to +100	°C
Storage temperature range	T _{stg}	-55 to +150	°C
Junction Temperature	T _{jmax}	+150	°C

*1 No need to exceed P_d.

*2 Reduced by $\theta_{ja} = 186.6^{\circ}\text{C/W}$ when used over 25°C.

(when mounted on a board 70.0mm × 70mm × 1.6mm Glass-epoxy PCB which has 1 layer. (copper foil density :2%))

●Recommended Operating Ratings (Ta=25°C)

Parameter	Symbol	Limits		Unit
		Min	Max	
Terminal voltage	V _{CC}	3.0	5.5	V
	V _{IN}	-0.3	V _{CC} - 2	V
	V _{PGOOD}	-0.3	5.5	V
	V _{DLY}	-0.3	V _{CC}	V

●Electrical Characteristics (Unless otherwise noted, Ta=25°C, V_{CC}=5V)

Parameter	Symbol	Limits			Unit	Conditions
		Min	Typ	Max		
Bias Current	I _{CC}	-	7.5	20	μA	
Detected Voltage	V _{DET}	491	500	509	mV	IN sweep up
Hysteresis Voltage	V _{HYS}	-	10	-	mV	IN sweep down
Delay Current	I _{DLY}	150	250	350	nA	IN=0.6V
PGOOD Output ON Resistance	R _{OUT}	-	100	200	Ω	IN=0V
PGOOD Output Leak Current	I _{OUT}	-	0	5	μA	IN=0.6V

● Typical Performance Curves (Unless otherwise noted, $T_a=25^\circ\text{C}$, $V_{CC}=5\text{V}$)

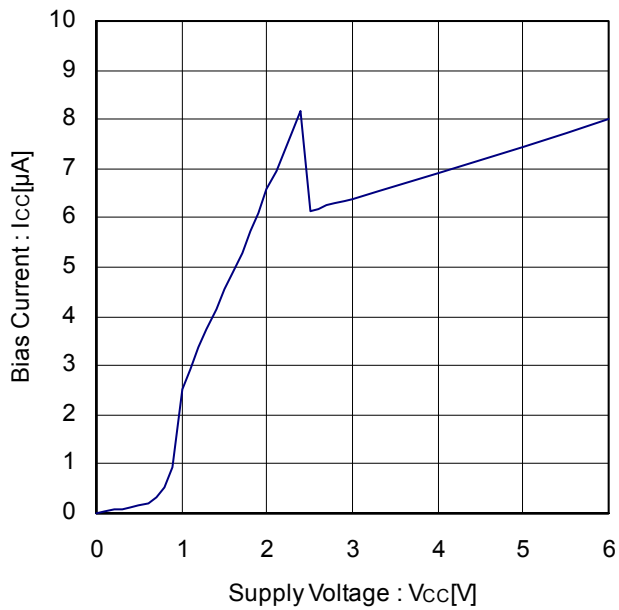


Figure 4. Supply Voltage - Bias Current

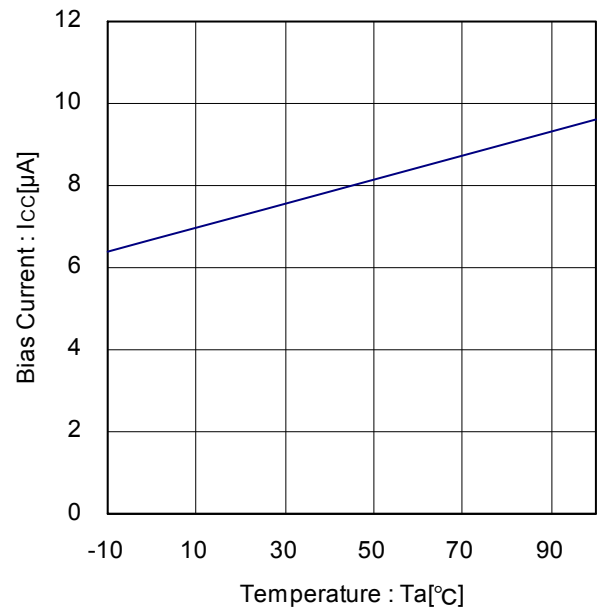


Figure 5. Temperature - Bias Current

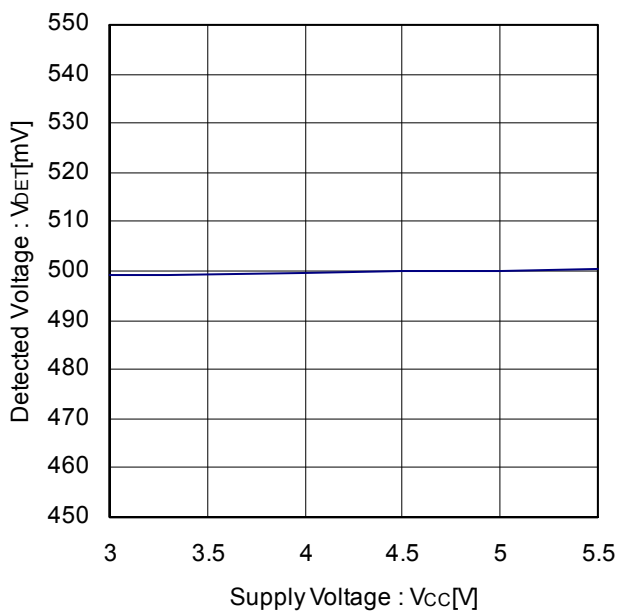


Figure 6. Supply Voltage - Detected Voltage

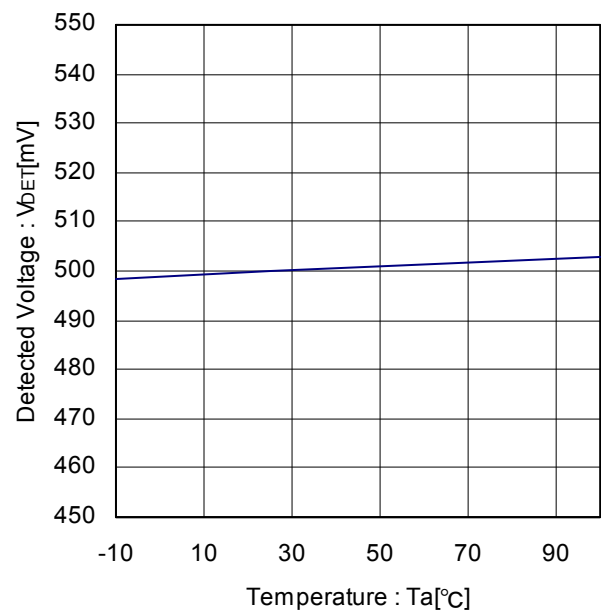


Figure 7. Temperature - Detected Voltage

●Typical Performance Curves (Unless otherwise noted, Ta=25°C, Vcc=5V) - continued

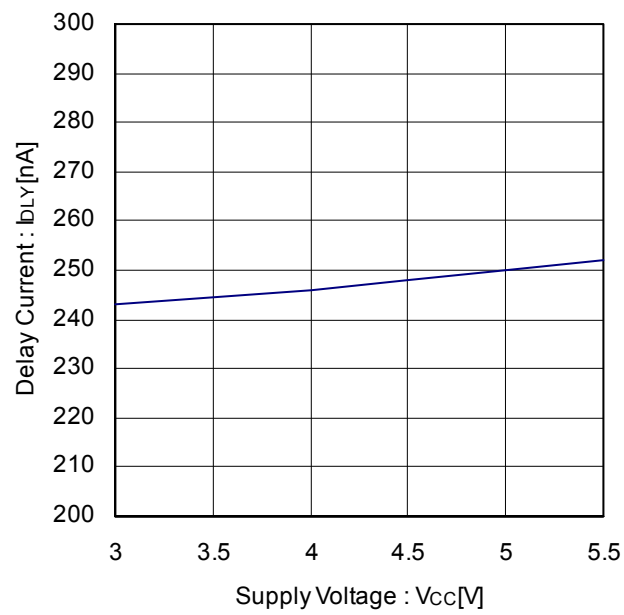


Figure 8. Supply Voltage - Delay Current

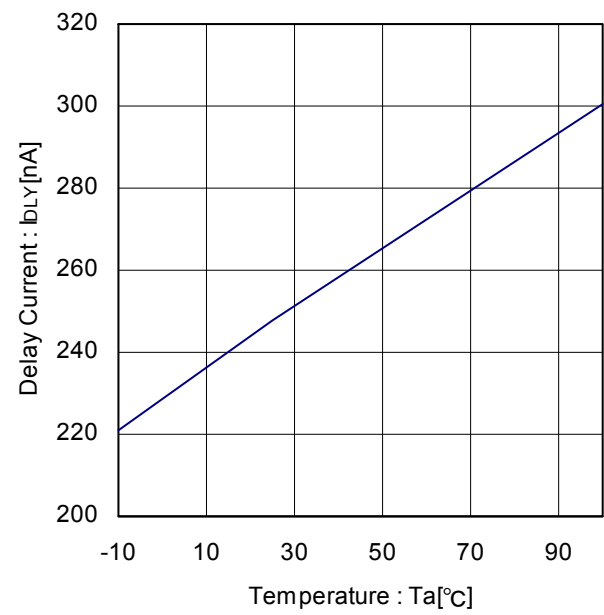


Figure 9. Temperature - Delay Current

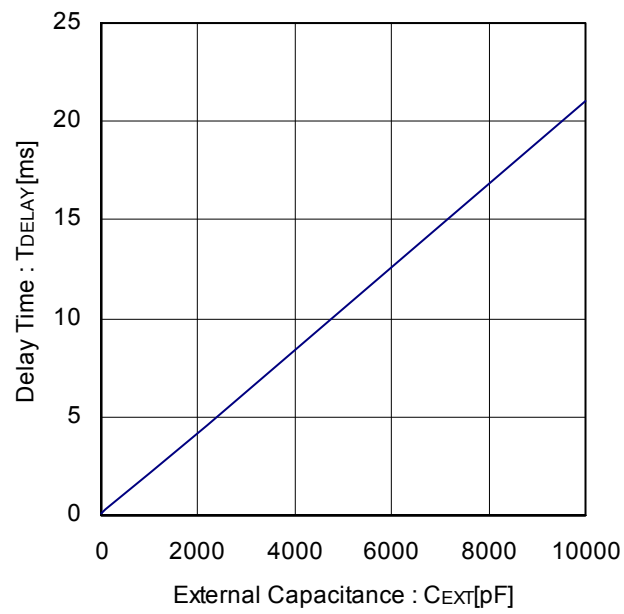


Figure 10. External Capacitance - Delay Time

●Basic Operation

BD4142HFV is a 1ch voltage detector IC with an independent supply voltage (V_{CC}).
 V_{CC} voltage must be supplied before inputting the monitoring voltage (IN).

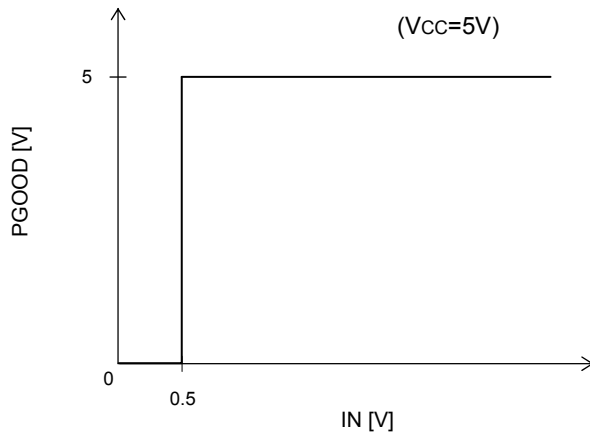


Figure 11. Input-Output Voltage Characteristic

●Timing Chart

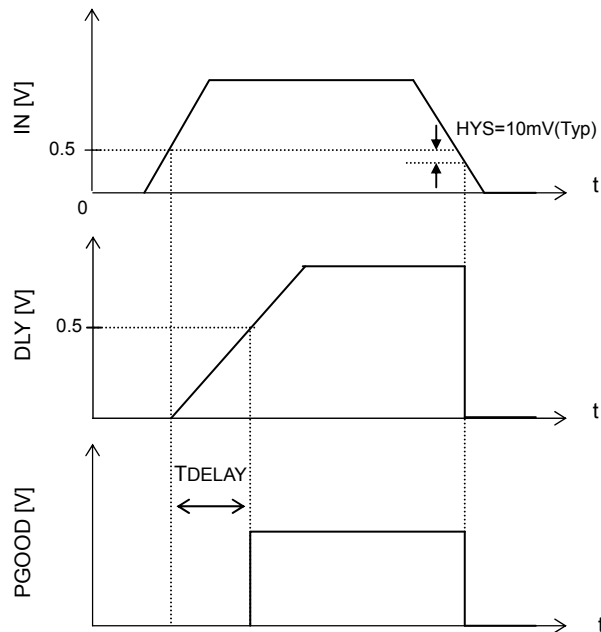


Figure 12. Timing Chart

Detected Delay Time (T_{DELAY}) Setting

T_{DELAY} is calculated as below.

$$\begin{aligned} T_{DELAY} [s] &= \frac{C_{EXT} [F] \times 500 [mV]}{250 [nA]} \\ &= C_{EXT} [F] \times 2 \times 10^6 \\ C_{EXT} [F] &= T_{DELAY} [s] / (2 \times 10^6) \end{aligned}$$

(Example) When using a 4700pF capacitor,

$$\begin{aligned} T_{DELAY} &= 4700 [pF] \times 2 \times 10^6 \\ &= 9400 \times 10^{-6} = 9.4 [ms] \end{aligned}$$

(Example) When setting a 2ms delay,

$$\begin{aligned} C_{EXT} &= 2 [ms] / (2 \times 10^6) \\ &= \frac{2 \times 10^{-3}}{2 \times 10^6} \\ &= 1 \times 10^{-9} \\ &= 1000 [pF] \end{aligned}$$

● **Limit of Detected Delay Time Operation ($T_a=25^\circ\text{C}$, $V_{CC}=5\text{V}$, $C_{EXT}=4700\text{pF}$)**

When the input pulse width (IN) is shorter than $50\mu\text{s}$ (Typ) ($20\mu\text{s}$ (Min)), PGOOD goes LOW and come back to HIGH without any delay time setup by capacitor of DLY terminal.

The behavior depends on the V_{CC} voltage and the C_{EXT} capacitance.

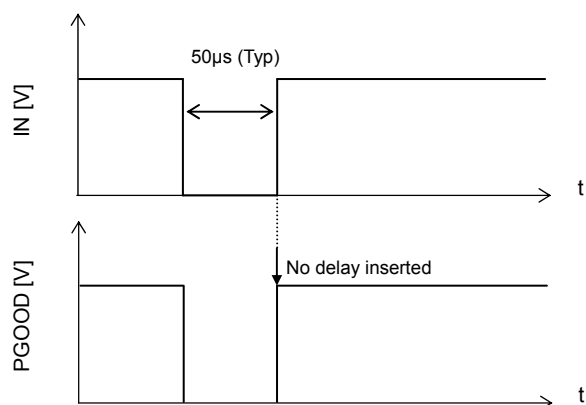


Figure 13. Input low pulse is shorter than $50\mu\text{s}$ (Typ)
($T_a=25^\circ\text{C}$, $V_{CC}=5\text{V}$, $C_{EXT}=4700\text{pF}$)

● **Limit of Reaction Time**

If the input pulse (IN) is shorter than $1\mu\text{s}$ (Typ), PGOOD does not react (PGOOD keeps HIGH).

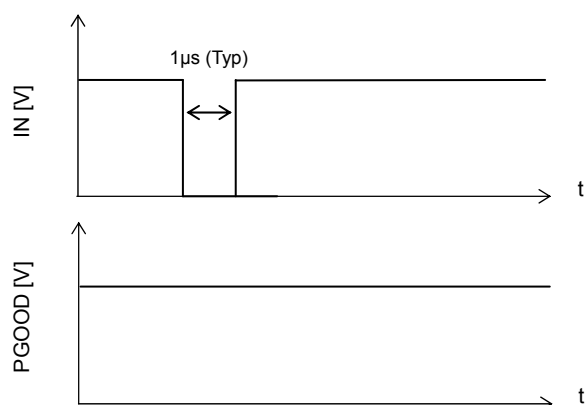


Figure 14. Input low pulse is shorter than $1\mu\text{s}$

●Vcc Operation

- ① When Vcc is below the minimum operation voltage, PGOOD pin will become HIGH.
(The meaning of the minimum operation voltage is : When the starting of Vcc, PGOOD output voltage become within 10% of Vcc voltage, and the value will be around 0.8V (Typ). Note that this value is reference.)
- ② When Vcc value exceeds the minimum operation voltage, PGOOD output become LOW until the Vcc reached UVLO released voltage (2.5V (Typ)).
- ③ When Vcc exceeds UVLO released voltage, PGOOD pin will become HIGH if the input voltage of IN pin is over the detected voltage (0.5V (Typ)), and PGOOD pin will become LOW if the input voltage of IN pin is below the detected voltage.

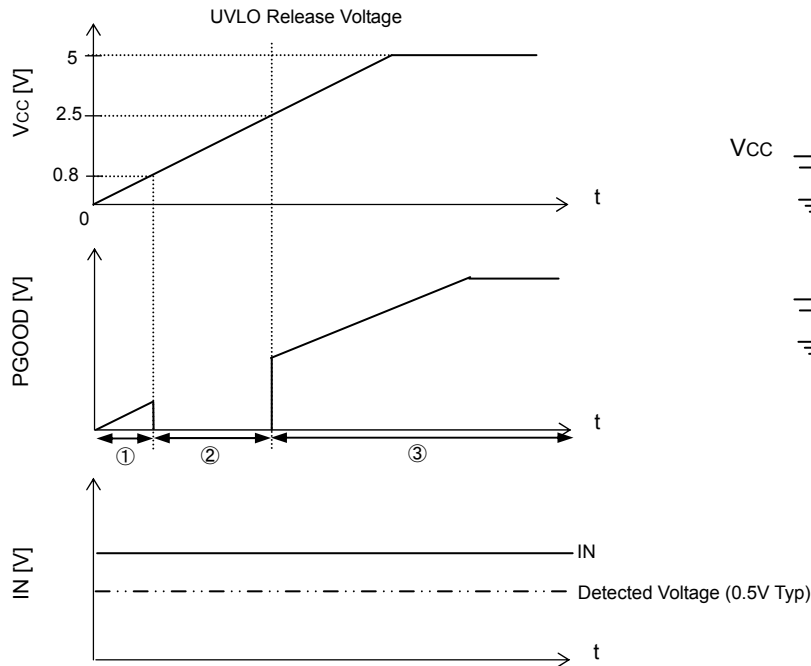


Figure 15. IN > Detected Voltage

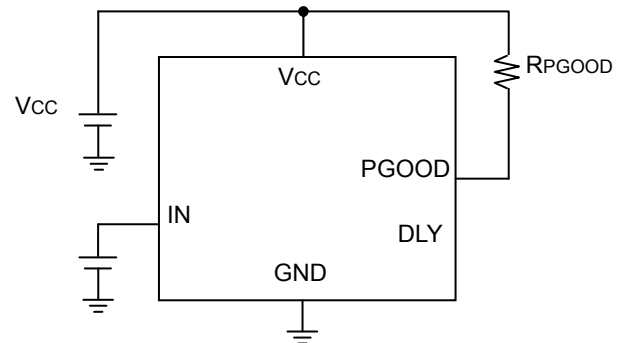


Figure 16. Vcc Operation

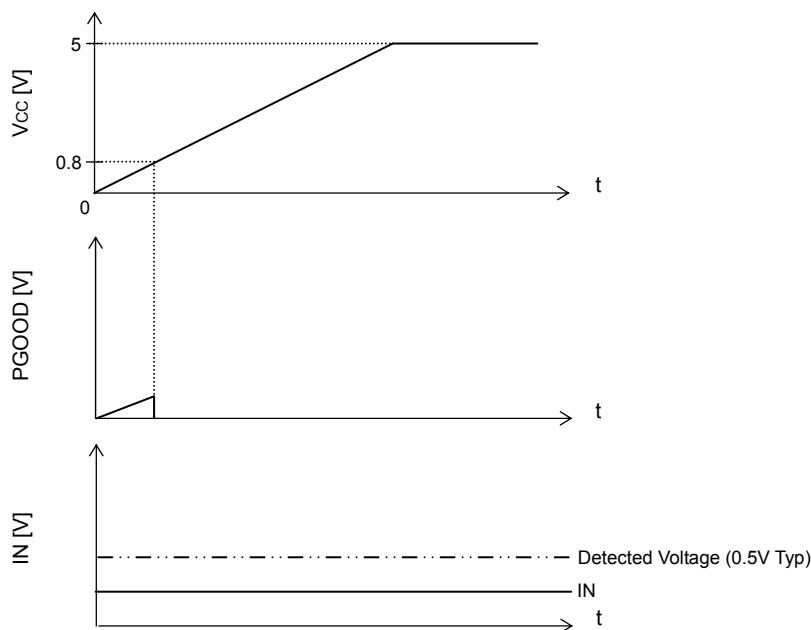


Figure 17. IN < Detected Voltage

●Application Example

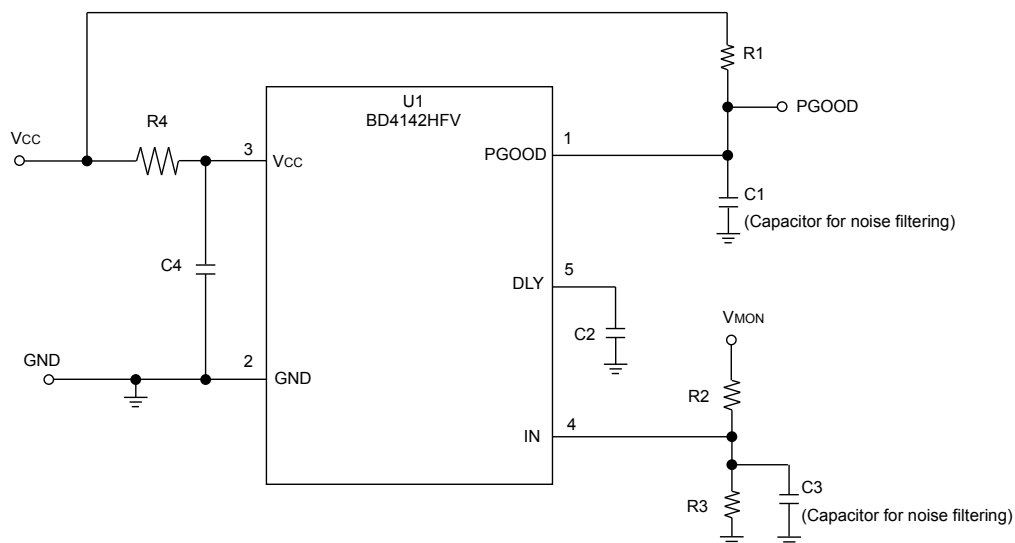


Figure 18. Application Circuit

Table 1. Recommended Component Values

Ref Des	Value	Description	Type	Manufacturer
U1	-	BD4142HFV	-	ROHM
C1	-	-	-	-
C2	4700pF	GRM18 series, 50V, 1608	Ceramic Capacitor	MURATA
C3	-	-	-	-
C4	0.01μF	GRM18 series, 50V, 1608	Ceramic Capacitor	MURATA
R1	100kΩ	MCR03 series, 1608	Chip Resistor	ROHM
R2	Short	-	-	-
R3	-	-	-	-
R4	Short	-	-	-

• R1 (Pull-up Resistor)

R1 should be set not to be affected by output leak current (5μA (Max)) and capacity current (5mA).

• R2, R3

The detected voltage is adjustable via external resistors (R2, R3).

The recommended total resistance value for R2 and R3 is within total 300kΩ.

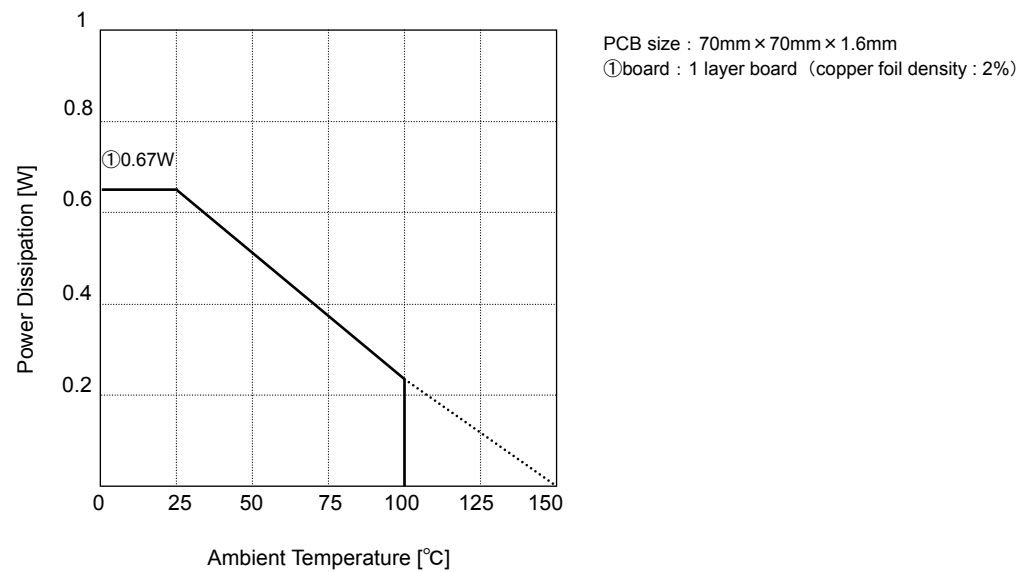
• C2 (Capacitor for Detected Delay Time Setting)

Please set C2 value with double of minimum delay time for application.

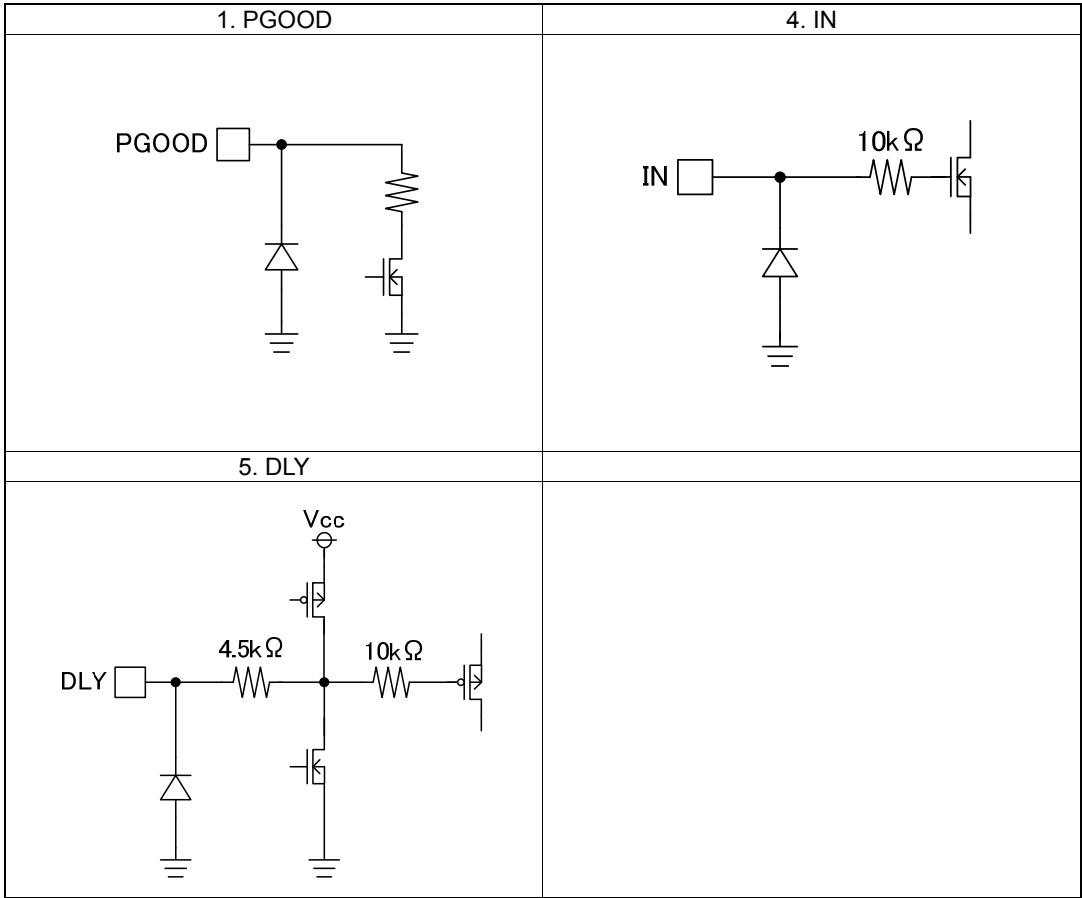
Please refer to Page. 6 regarding Detected Delay Time Setting. The maximum value of C2 is 4.7μF.

●Power Dissipation

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●I/O Equivalence Circuit



●Operational Notes**1. Reverse Connection of Power Supply**

Connecting the power supply in reverse polarity can damage the IC. Take precautions against reverse polarity when connecting the power supply, such as mounting an external diode between the power supply and the IC's power supply pins.

2. Power Supply Lines

Design the PCB layout pattern to provide low impedance supply lines. Furthermore, connect a capacitor to ground at all power supply pins. Consider the effect of temperature and aging on the capacitance value when using electrolytic capacitors.

3. Ground Voltage

Ensure that no pins are at a voltage below that of the ground pin at any time, even during transient condition.

4. Ground Wiring Pattern

When using both small-signal and large-current ground traces, the two ground traces should be routed separately but connected to a single ground at the reference point of the application board to avoid fluctuations in the small-signal ground caused by large currents. Also ensure that the ground traces of external components do not cause variations on the ground voltage. The ground lines must be as short and thick as possible to reduce line impedance.

5. Thermal Consideration

Should by any chance the power dissipation rating be exceeded the rise in temperature of the chip may result in deterioration of the properties of the chip. In case of exceeding this absolute maximum rating, increase the board size and copper area to prevent exceeding the Pd rating.

6. 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.

7. Inrush Current

When power is first supplied to the IC, it is possible that the internal logic may be unstable and inrush current may flow instantaneously due to the internal powering sequence and delays, especially if the IC has more than one power supply. Therefore, give special consideration to power coupling capacitance, power wiring, width of ground wiring, and routing of connections.

8. Operation Under Strong Electromagnetic Field

Operating the IC in the presence of a strong electromagnetic field may cause the IC to malfunction.

9. 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.

10. Inter-pin Short and Mounting Errors

Ensure that the direction and position are correct when mounting the IC on the PCB. Incorrect mounting may result in damaging the IC. Avoid nearby pins being shorted to each other especially to ground, power supply and output pin. Inter-pin shorts could be due to many reasons such as metal particles, water droplets (in very humid environment) and unintentional solder bridge deposited in between pins during assembly to name a few.

11. Unused Input Pins

Input pins of an IC are often connected to the gate of a MOS transistor. The gate has extremely high impedance and extremely low capacitance. If left unconnected, the electric field from the outside can easily charge it. The small charge acquired in this way is enough to produce a significant effect on the conduction through the transistor and cause unexpected operation of the IC. So unless otherwise specified, unused input pins should be connected to the power supply or ground line.

●Operational Notes – continued

12. Regarding the Input Pin of the IC

This monolithic IC contains P⁺ isolation and P substrate layers between adjacent elements in order to keep them isolated. P-N junctions are formed at the intersection of the P layers with the N layers of other elements, creating a parasitic diode or transistor. For example (refer to figure below):

When GND > Pin A and GND > Pin B, the P-N junction operates as a parasitic diode.

When GND > Pin B, the P-N junction operates as a parasitic transistor.

Parasitic diodes inevitably occur in the structure of the IC. The operation of parasitic diodes can result in mutual interference among circuits, operational faults, or physical damage. Therefore, conditions that cause these diodes to operate, such as applying a voltage lower than the GND voltage to an input pin (and thus to the P substrate) should be avoided.

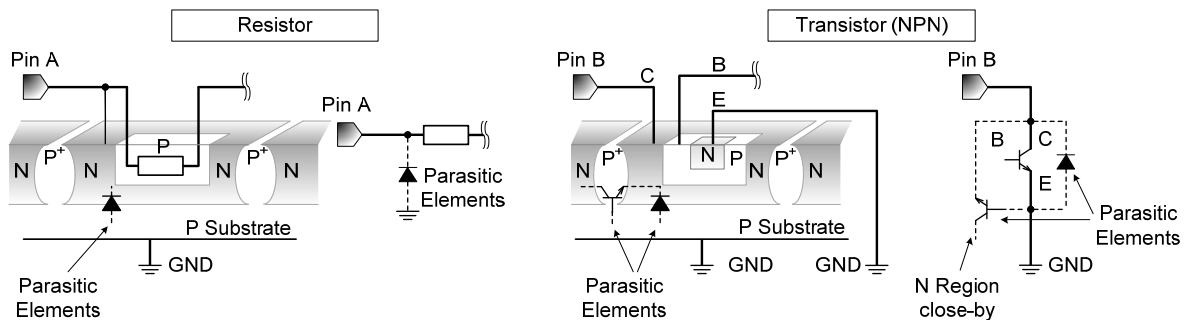


Figure 19. Example of monolithic IC structure

13. Ceramic Capacitor

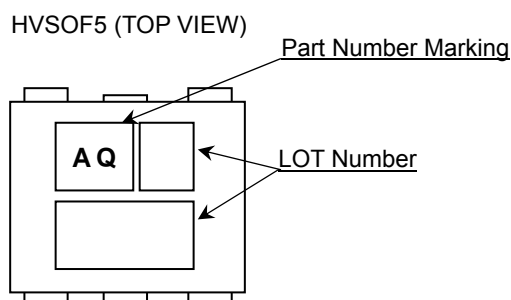
When using a ceramic capacitor, determine the dielectric constant considering the change of capacitance with temperature and the decrease in nominal capacitance due to DC bias and others.

●Ordering Information

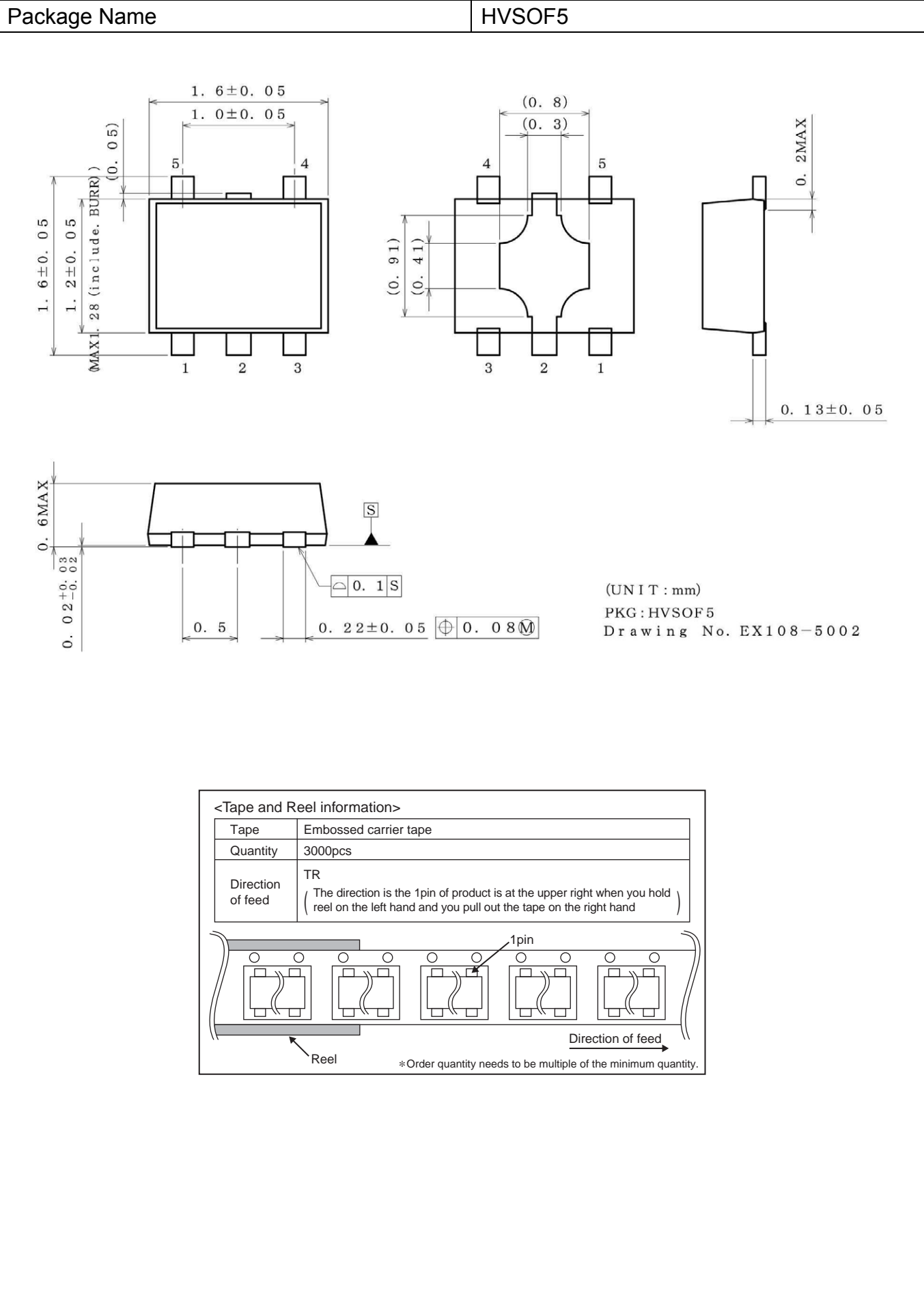
B	D	4	1	4	2	H	F	V
Part Number						Package HFV: HVSO5		

T	R
Packaging and forming specification TR: Embossed tape and reel	

●Marking Diagram



●Physical Dimension, Tape and Reel Information



Revision History

Date	Revision	Changes
29. Jan. 2013.	001	New Release
21. Aug. 2015	002	Add Application Example

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CLASS IV		CLASS III	

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 - Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
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