

# Compact High Accuracy Temperature Sensor ICs

## Low current Thermostat Output Temperature Sensor ICs



BDJ□□□1HFV Series

No.11047EDT01

### ●Description

BDJ□□□1HFV series is thermostat output temperature sensor IC with built-in temperature detection element, constant current circuit, high-accuracy reference voltage source in one chip. Temperature detection can be realized at  $\pm 2.5^{\circ}\text{C}$  accuracy without complicated design. It is the best temperature sensor IC for a portable equipment of micro and low current, the power down function, and the battery drive. It is possible to use it for a wide usage such as the heat detection and temperature monitors because it provides with the analog output in addition to the thermostat power output.

BDJ□□□1HFV series has 5 products at  $70^{\circ}\text{C}$ ,  $75^{\circ}\text{C}$ ,  $80^{\circ}\text{C}$ ,  $85^{\circ}\text{C}$ ,  $90^{\circ}\text{C}$  detection temperature.

### ●Features

- 1) Detection Temperature lineup at  $70^{\circ}\text{C}$ ,  $75^{\circ}\text{C}$ ,  $80^{\circ}\text{C}$ ,  $85^{\circ}\text{C}$ ,  $90^{\circ}\text{C}$  ( 5 products )
- 2) Power supply Voltage range 2.4~5.5V.
- 3) High Accuracy thermostat ( typ.  $\pm 1.0^{\circ}\text{C}$ , max.  $\pm 2.5^{\circ}\text{C}$  @ $T_a=70\sim 90^{\circ}\text{C}$  )
- 4) High Accuracy Analog Output ( typ.  $\pm 1.0^{\circ}\text{C}$ , max.  $\pm 2.5^{\circ}\text{C}$  @ $T_a=-30\sim 100^{\circ}\text{C}$  )
- 5) Analog Output Temperature Sensitivity ( typ.  $-8.2\text{mV}/^{\circ}\text{C}$  )
- 6) Low Supply Current ( typ.  $7.5\mu\text{A}$  )
- 7) Power down control function built in.(PD interface Voltage min 1.5V)
- 8) Small Package ( typ.  $1.60\text{mm} \times 1.60\text{mm} \times 0.60\text{mm}$  )
- 9) Low thermal resistance package ( typ.  $187^{\circ}\text{C}/\text{W}$  )
- 10) ESD Rating 8kV ( HBM )

### ●Applications

Cell phone, Digital Camera, Thermal Protection for Electrical Equipment (NoteBook PC, FPD-TV, etc.)

### ●Line up matrix

Product Name	Detect Temp. ( $^{\circ}\text{C}$ )	OS Output Format		Marking
		Open Drain	Active H	
BDJ0901HFV	90	Open Drain	Active H	gd
BDJ0851HFV	85	Open Drain	Active H	ge
BDJ0801HFV	80	Open Drain	Active H	gf

Product Name	Detect Temp. ( $^{\circ}\text{C}$ )	OS Output Format		Marking
		Open Drain	Active H	
BDJ0751HFV	75	Open Drain	Active H	gg
BDJ0701HFV	70	Open Drain	Active H	gh

## ● Absolute Maximum Ratings ( Ta = 25°C )

Parameter	Symbol	Ratings	Unit
Power Supply Voltage	V <sub>DD</sub>	-0.3 to 7.0 <sup>*1</sup>	V
Input Voltage ( PD )	V <sub>IN</sub>	-0.3 to V <sub>DD</sub> +0.3	V
OS terminal Voltage	V <sub>OS</sub>	-0.3 to 7.0 <sup>*1</sup>	V
OS terminal Current	I <sub>OS</sub>	5.0	mA
Power dissipation	P <sub>d</sub>	536 <sup>*2</sup>	mW
Storage Temperature Range	T <sub>stg</sub>	-55 to 150	°C

\*1. Not to exceed P<sub>d</sub>\*2. Reduced by 5.36mW for each increase in Ta of 1°C over 25°C  
( mounted on 70mm × 70mm × 1.6mm Glass-epoxy PCB )

## ● Recommended Operating Conditions

Parameter	Symbol	Ratings			Unit
		Min.	Typ.	Max.	
Power Supply Voltage	V <sub>DD</sub>	2.4	2.8	5.5	V
Operating Temperature Range	T <sub>opr</sub>	-30	-	100	°C

● Electrical Characteristics ( Unless otherwise specified, V<sub>DD</sub> = 2.8V, Ta = 25°C )

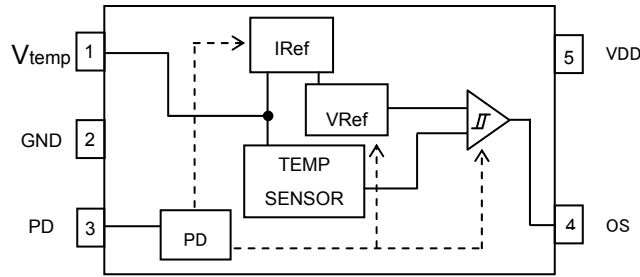
Parameter	Symbol	Limits			Unit	Conditions
		Min.	Typ.	Max.		
Supply Current						
Normal function mode	I <sub>DD</sub>	-	7.5	12.0	μA	PD="H"
Power Down mode	I <sub>DDPD</sub>	-	0.3	1.0	μA	PD="L"
PD						
Input L Voltage	V <sub>IL</sub>	GND	-	0.2	V	
Input H Voltage	V <sub>IH</sub>	1.5	-	V <sub>DD</sub>	V	
PD Leakage Current	I <sub>LPD</sub>	-	-	1.0	μA	PD=2.8V
Analog Output						
V <sub>Temp</sub> Output Voltage	V <sub>temp</sub>	1.279	1.300	1.321	V	Ta = 30°C
V <sub>Temp</sub> Temperature Sensitivity	V <sub>SE</sub>	-8.00	-8.20	-8.40	mV/°C	Ta = -30 to 100°C
V <sub>Temp</sub> Load Regulation	ΔV <sub>tempRL</sub>	-	-	1.0	mV	difference of I <sub>OUT</sub> : 0uA / 2uA
V <sub>temp</sub> V <sub>DD</sub> Regulation	ΔV <sub>tempVDD</sub>	-	-	4.0	mV	V <sub>DD</sub> =2.4~5.5V
OS Output Open Drain						
OS Leakage Current	I <sub>L</sub>	-	-	1.0	μA	V <sub>OS</sub> =5.0V
OS Output Voltage	V <sub>OL</sub>	-	-	0.4	V	I <sub>OS</sub> = 1.0mA

Radiation hardness is not designed.

● Temperature Accuracy ( Unless otherwise specified, V<sub>DD</sub> = 2.8V )

Parameter	Symbol	Limits			Unit	Conditions
		Min.	Typ.	Max.		
Thermostat						
Sensing Temperature Accuracy	T <sub>acc</sub>	-	±1.0	±2.5	°C	
Sensing Temperature Hysteresis	Thys	7.5	10.0	12.5	°C	
Analog Output						
V <sub>temp</sub> Temperature Accuracy	T <sub>temp</sub>	-	±1.0	±2.5	°C	V <sub>DD</sub> = 2.8V Ta = -30 to 100°C

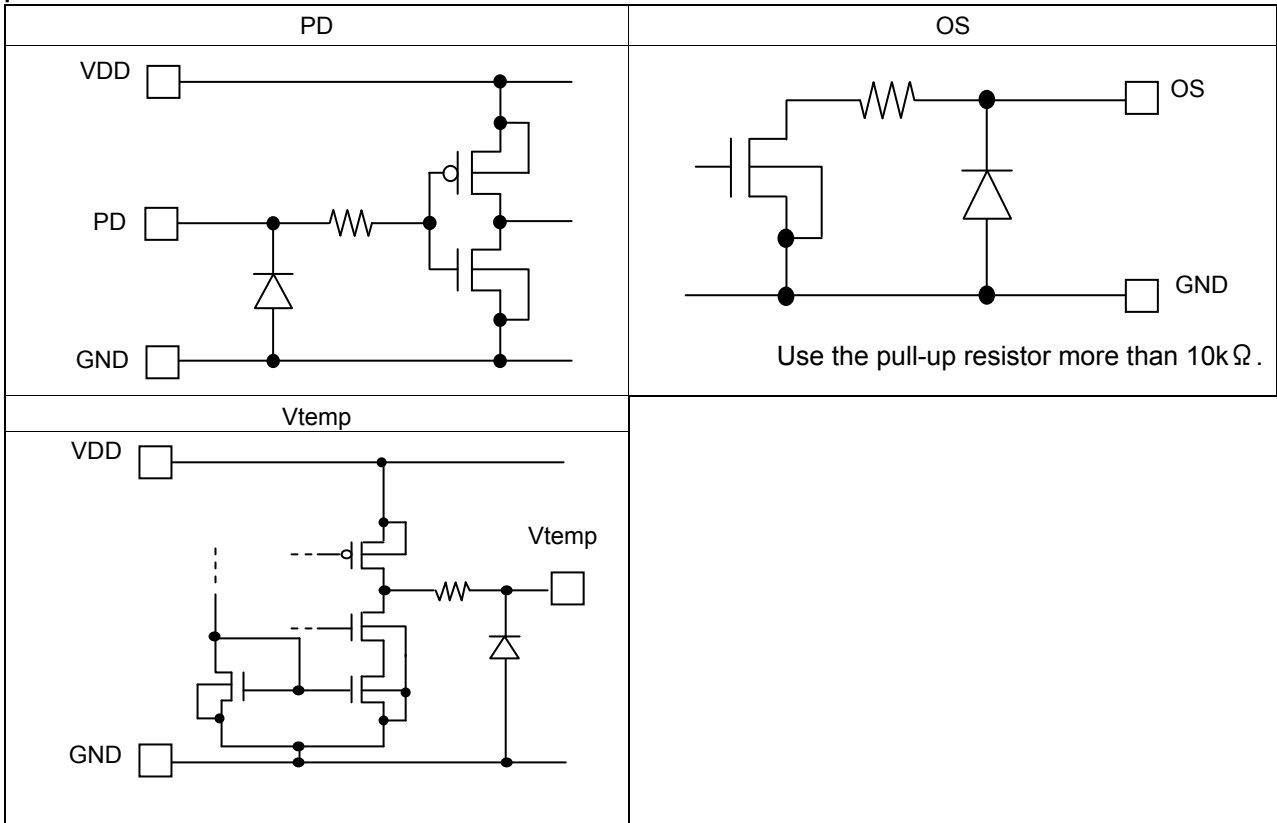
●Block Diagram



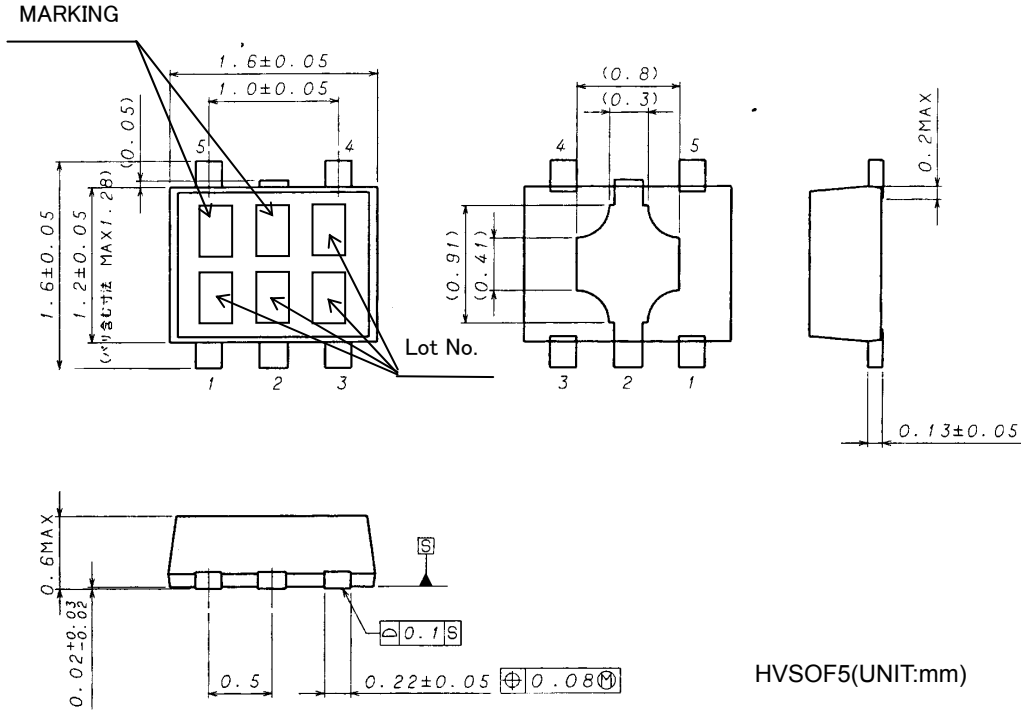
●Pin Description

Pin No.	Pin Name	Function	Comment
1	Vtemp	Output voltage in inverse proportion to the temperature ( TYP. -8.20mV/°C )	Set the OPEN state or connect high impedance input node.(over 10MΩ)
2	GND	GROUND	
3	PD	PD control H : Normal function mode L : Power Down mode	"H" Thermostat and Analog output operation. "L" Power Down state.
4	OS	Digital thermostat output	Open Drain Active H. Use the pull-up resistor more than 10kΩ.
5	VDD	POWER SUPPLY	

●Equivalent Circuit

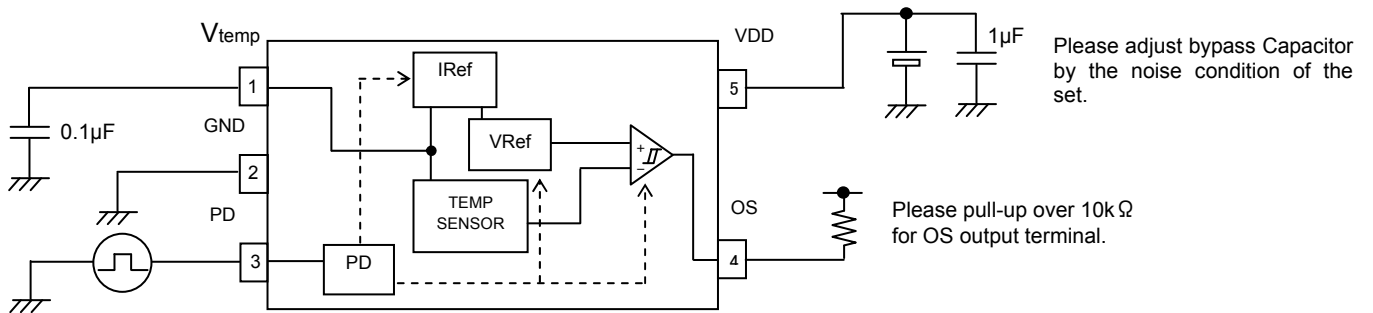


●Package Outlines ( HVSO5 )



●Block Diagram

Please adjust Capacitor by the noise condition of the set.



●Reference Data

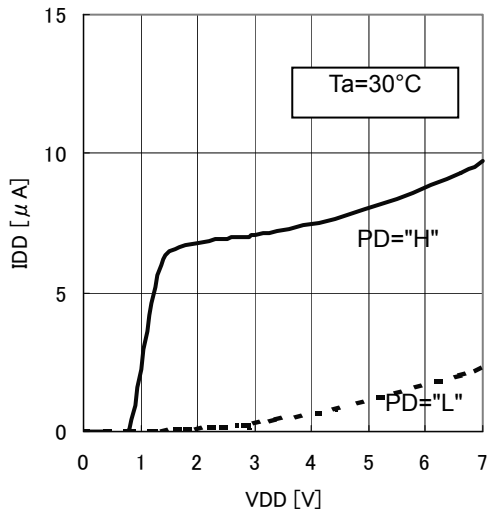


Fig1. Supply Current(IDD) vs. Supply Voltage

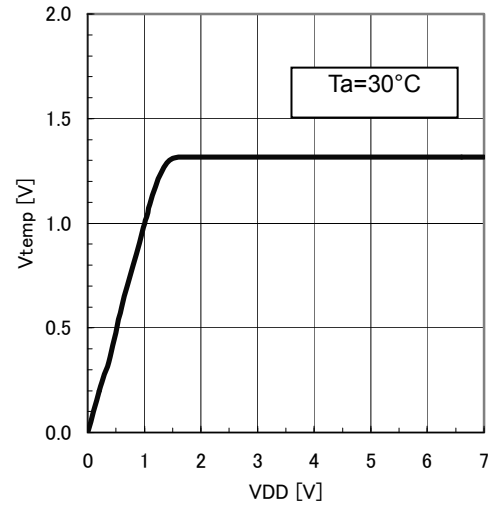


Fig2. Vtemp Voltage vs. Supply Voltage

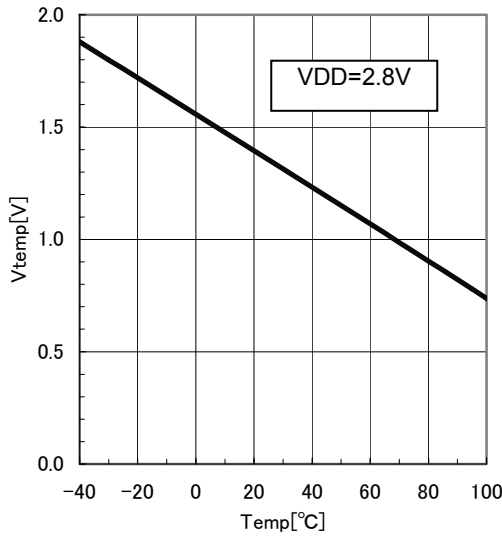


Fig3. Vtemp Voltage vs. Temperature

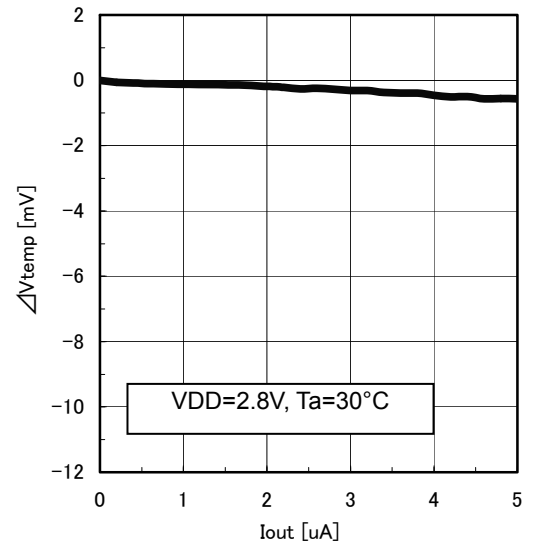


Fig4. Vtemp Voltage vs. Output Current

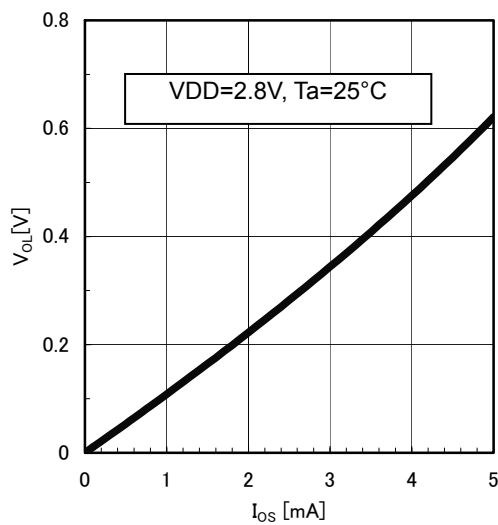
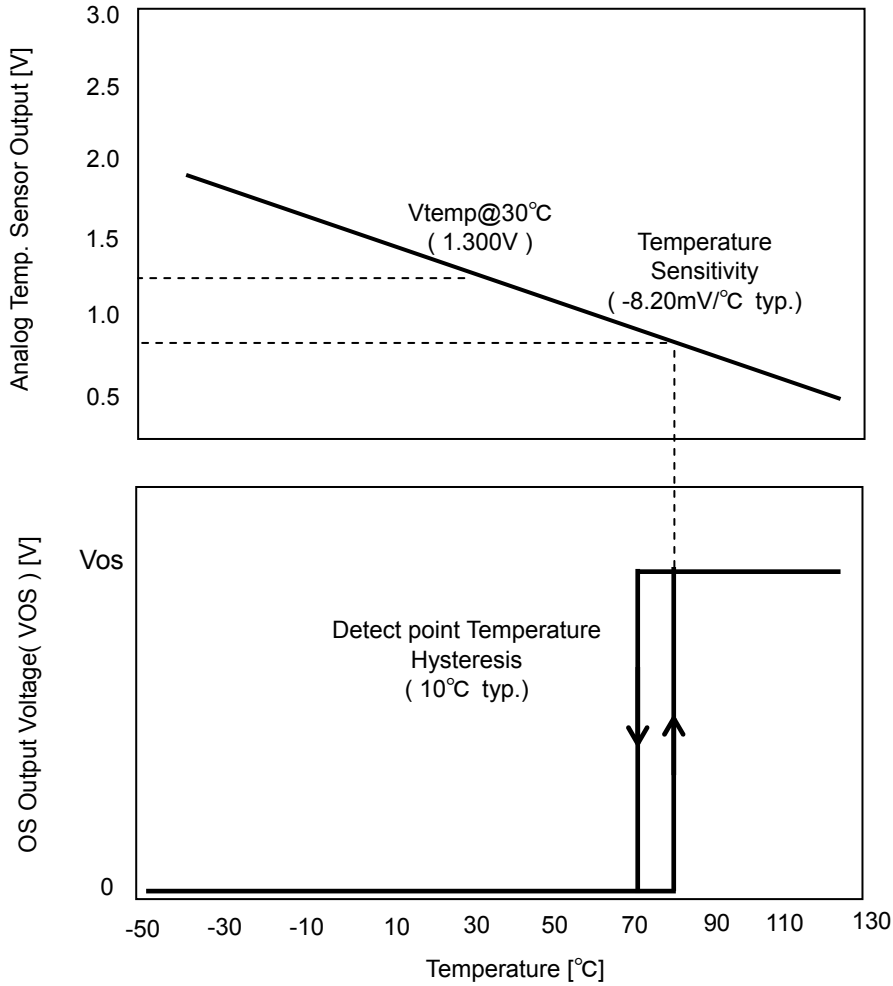


Fig5. OS Output Voltage vs. Load Current

●Function Diagram(ex. 80°C detect Active “H” type BDJ0801HFV)

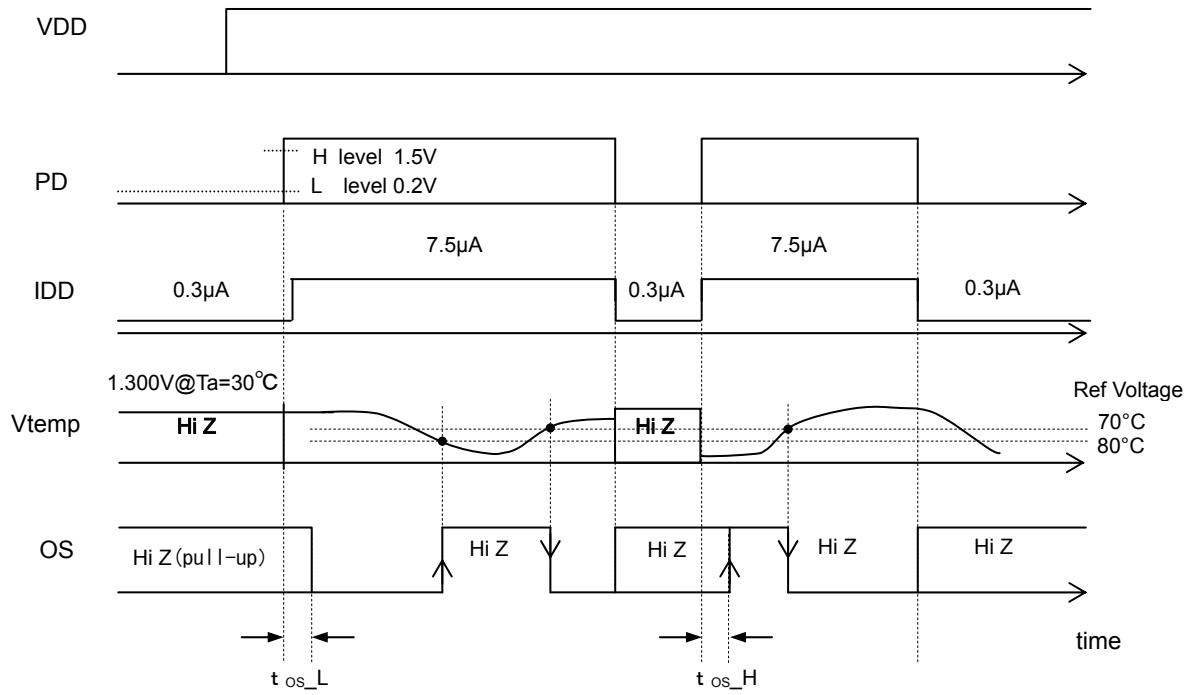
Temperature sensor internal IC sense temperature, Vtemp terminal output voltage convert temperature.  
 Vtemp value is 1.300[V] at Ta = 30[°C].  
 The value of Vtemp voltage reduce reversely proportional temperature at rate of -8.2mV/°C.



If the temperature over detect temperature,  
 internal comparator operate OS output “L” to “H”.(ex.active “H” Type)  
 In case of OS return to “L”,the temperature 10°C lower than detect temperature.

●Operation Sequence

(ex.80°C detect Active “H” type BDJ0801HFV)



BDJ0801HFV operate start after PD “H” Input.  
Please read OS terminal signal below wait time after PD "H" Input.

Ta	Symbol	Wait time
Under detect Temp.	t <sub>os_L</sub>	200µs
Over detect Temp.	t <sub>os_H</sub>	1000µs

**●Notes for use**

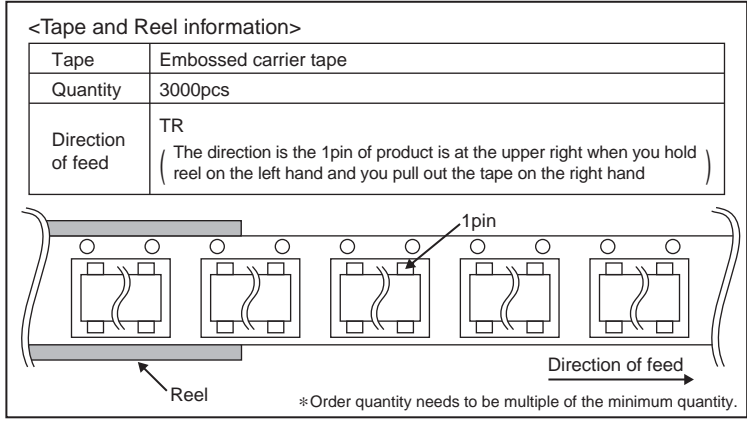
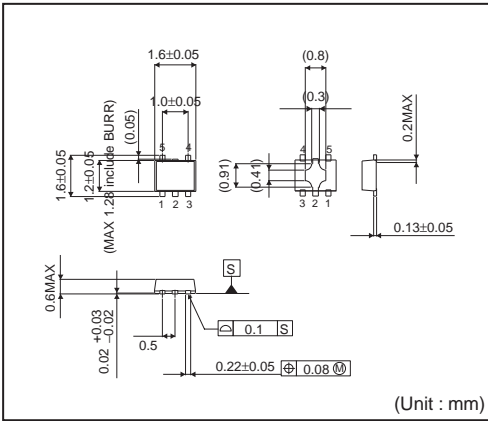
- 1) Absolute Maximum Ratings  
An excess in the absolute maximum ratings, such as supply voltage, temperature range of operating conditions, etc., can break down devices, thus making impossible to identify breaking mode such as a short circuit or an open circuit. If any special mode exceeding the absolute maximum ratings is assumed, consideration should be given to take physical safety measures including the use of fuses, etc.
- 2) GND voltage  
Make setting of the potential of the GND terminal so that it will be maintained at the minimum in any operating state.
- 3) Pin short and mistake fitting  
When mounting the IC on the PCB, pay attention to the orientation of the IC. If there is a placement mistake, the IC may be burned up.
- 4) Operation in strong electric field  
Be noted that using ICs in the strong electric field can malfunction them.
- 5) Mutual impedance  
Use short and wide wiring tracks for the power supply and ground to keep the mutual impedance as small as possible. Use a capacitor to keep ripple to a minimum.



●Ordering part number

B	D	J	0	8	0	1	H	F	V	-	T	R
Series Name			Detect Temp.		Output Format		Package			Packaging and forming specification		
			090: 90°C		0 : active L		HFV:HVSOF5			TR: Embossed tape and reel		
			085: 85°C		1 : active H							
			080: 80°C									
			075: 75°C									
			070: 70°C									

HVSOF5



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