Compact High Accuracy Temperature Sensor ICs

# Thermostat Output Temperature ICs with Variable Detection Temperature

## BDE□□□0G Series

No.10047JBT03

### ●Description

Low quiescent current (16μA), high accuracy thermostat (temperature switch) ICs. Built in temperature sensor, reference voltage regulator, D/A converter, and comparator. Detecting temperature by itself, OS terminal state is changed at logically. Open Drain Output (Active L ) is available in BDE□□□0G series.

### ●Features

1) Detection Temperature Range +55～+125℃ by 7 products.
2) ±5℃ Step Selectable Detection Temperature with CTRL.
3) Hysteresis Temperature (typically 10℃)
4) High Accuracy Analog Output (typically ±3.5℃@Ta=30℃)
5) Analog Output Temperature Sensitivity (typically -10.8mV/℃)
6) Low Supply Current (typically 16μA)
7) Small Package (typically 2.90mm×2.80mm×1.25mm)
8) ESD Rating 8kV (HBM)
9) Excellent Ripple Rejection Characteristic

### ●Applications

Thermal Protection for Electrical Equipment (Notebook PC, Cell phone, FPD-TV, etc.) FAN Control for Thermal Management

### ●Products Line up

BDE □□□ 0 G

- □□□: Detection Temperature (Center Temperature)
  - 120:120℃
  - 110:110℃
  - 100:100℃
  - 090: 90℃
  - 080: 80℃
  - 070: 70℃
  - 060: 60℃
- 0: Output Format (Open Drain, Active Low)
- G: Package (SSOP5)

Temperature / Output Format Table
CTRL status description ( L : Low, O : Open, H : High )

| Product Name | Detection Temperature (℃) CTRL | | | OS Output Format | | Marking |
|---|---|---|---|---|---|---|
| | L | H | O | | | |
| BDE1200G | 115 | 120 | 125 | Open Drain | Active L | eA |
| BDE1100G | 105 | 110 | 115 | Open Drain | Active L | eB |
| BDE1000G | 95 | 100 | 105 | Open Drain | Active L | eC |
| BDE0900G | 85 | 90 | 95 | Open Drain | Active L | eD |
| BDE0800G | 75 | 80 | 85 | Open Drain | Active L | eE |
| BDE0700G | 65 | 70 | 75 | Open Drain | Active L | eF |
| BDE0600G | 55 | 60 | 65 | Open Drain | Active L | eG |

●**Absolute Maximum Ratings** ( Ta = 25℃ )

| Parameters | Symbol | Limit | Unit |
|---|---|---|---|
| Power Supply Voltage | $V_{DD}$ | -0.3 to 7.0[*1] | V |
| Input Voltage ( CTRL ) | $V_{IN}$ | -0.3 to $V_{DD}$+0.3 | V |
| Input Current ( CTRL ) | $I_{IN}$ | -1.0, +0.1 | mA |
| OS terminal Voltage | $V_{OS}$ | -0.3 to 7.0 | V |
| OS terminal Current | $I_{OS}$ | 5.0 | mA |
| Power dissipation | Pd | 540[*2] | mW |
| Storage Temperature Range | $T_{stg}$ | -55 to 150 | ℃ |

*1. Not to exceed Pd
*2. Reduced by 5.40mW for each increase in Ta of 1℃ over 25℃( mounted on 70mm×70mm×1.6mm Glass-epoxy PCB )

●**Recommended Operating Condition**

| Parameters | Symbol | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Power Supply Voltage | VDD | 2.9 | 3.0 | 5.5 | V |
| Operating Temperature Range | Topr | -30 | - | 130 | ℃ |

●**Temperature Accuracy** ( Unless otherwise specified, $V_{DD}$ = 3.0V )

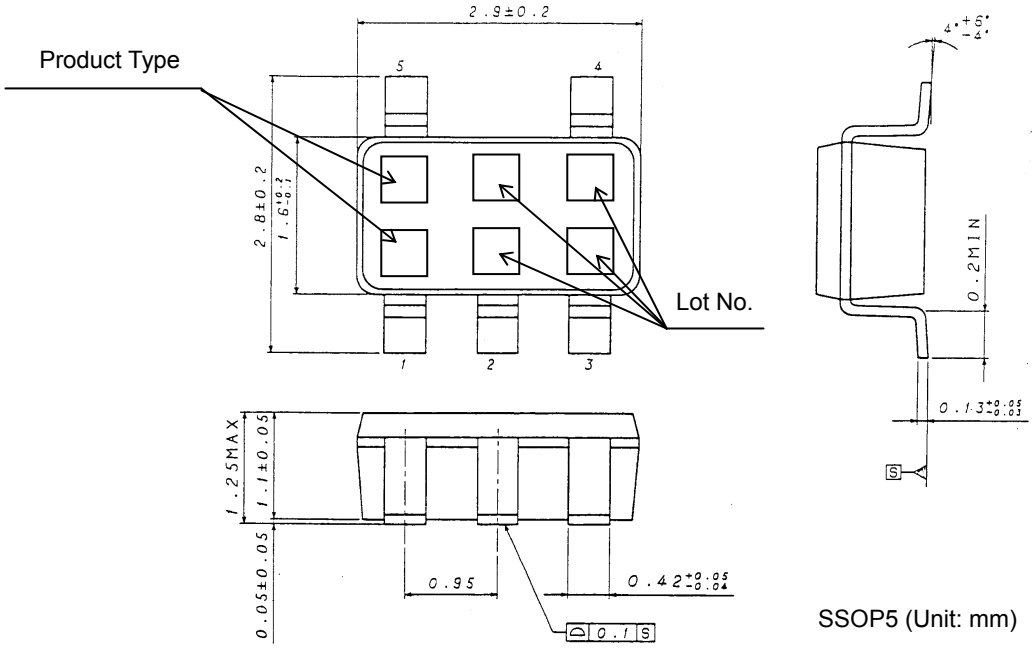
| Parameters | | Symbol | Limit | | | Unit | Conditions |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Thermostat ( Temperature Switch ) | | | | | | | |
| | Detection TemperatureAccuracy | Tacc | - | 0 | ±4.0<br>±5.0 | ℃ | Ta = -20℃～115℃<br>Ta = ～125℃ |
| | Detection Temperature Hysteresis | Thys | 7.5 | 10.0 | 12.5 | ℃ | |
| Analog Output | | | | | | | |
| | VTemp Temperature Accuracy | TTemp | - | - | ±3.5 | ℃ | Ta = 30℃ |

●**Electrical Characteristics** ( Unless otherwise specified, $V_{DD}$ = 3.0V, Ta = 25℃ )

| Parameter | | Symbol | Limits | | | Unit | Conditions |
|---|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | | |
| Supply Current | | IDD | - | 16.0 | 20.0 | μA | CTRL = 3.0V |
| Analog Output | | | | | | | |
| | VTemp Output Voltage | VTemp | 1.716 | 1.753 | 1.790 | V | Ta = 30℃ |
| | VTemp Temperature Sensitivity | VSE | -10.28 | -10.68 | -11.08 | mV/℃ | Ta = -30 to 100℃ |
| | VTemp Load Regulation | ⊿VTempRL | - | - | 1 | mV | difference of IOUT : 0μA / 2μA |
| OS Output Open Drain | | | | | | | |
| | OS Leakage Current | IL | - | - | 1.0 | μA | OS : 5.0V |
| | OS Output Voltage | VOL | - | - | 0.4 | V | IinOS = 1.2mA |
| CTRL | | | | | | | |
| | Input L Voltage | VIL | GND | - | 0.6 | V | |
| | Input H Voltage | VIH | 2.4 | - | VDD | V | |

*Radiation hardiness is not designed.

●Package Outline

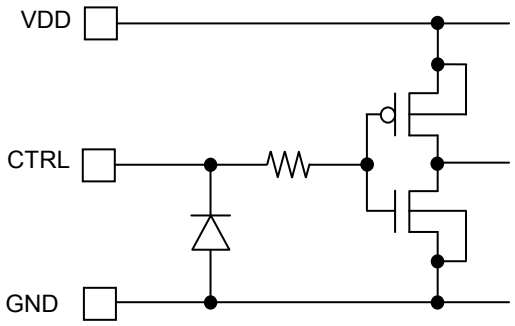



●Pin Description

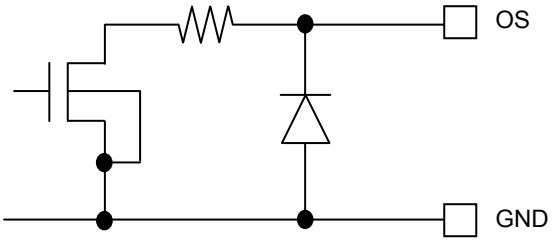
| Pin No. | Pin Name | Function | Comment |
|---|---|---|---|
| 1 | CTRL | Detection temperature setting | Refer to 2/7 page for the temperature set.<br>( Temperature / Output Format Table ) |
| 2 | GND | GROUND | - |
| 3 | Vtemp | Output voltage in inverse proportion to the temperature( TYP. -10.68mV/°C) | Set the OPEN state or<br>Connect high impedance input node. |
| 4 | VDD | POWER SUPPLY | - |
| 5 | OS | Digital thermostat output | Open Drain type<br>Use the pull-up resistor over 10kΩ. |

●Equivalence Circuit

CTRL

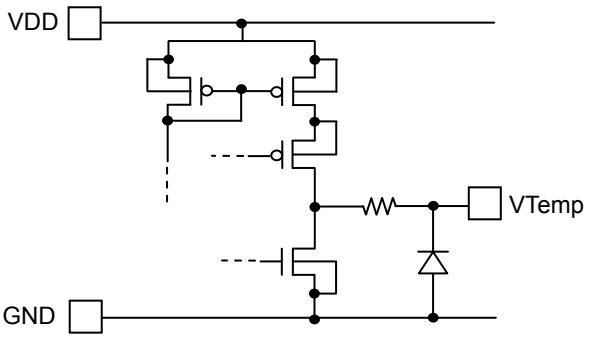



OS



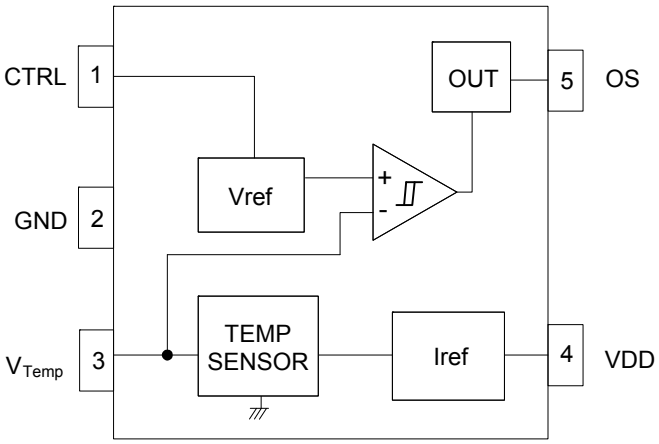

Please connect the pull-up resistor over 10kΩ.

VTemp

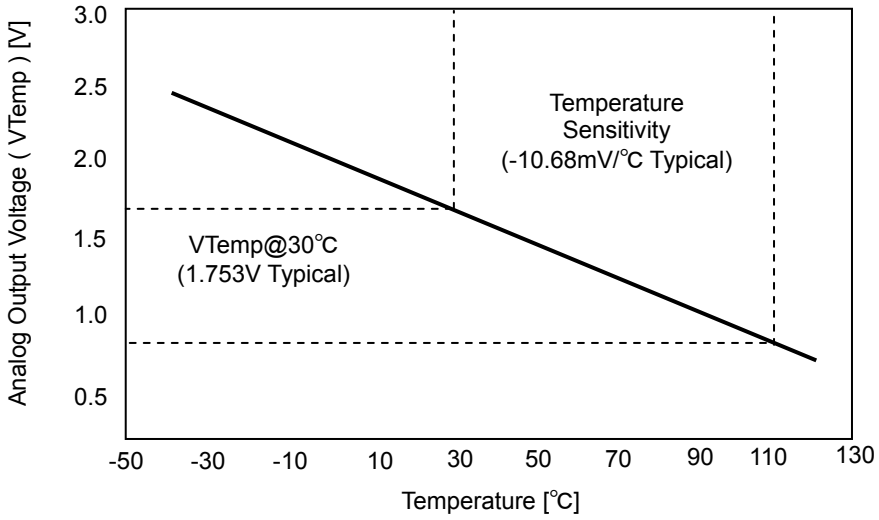


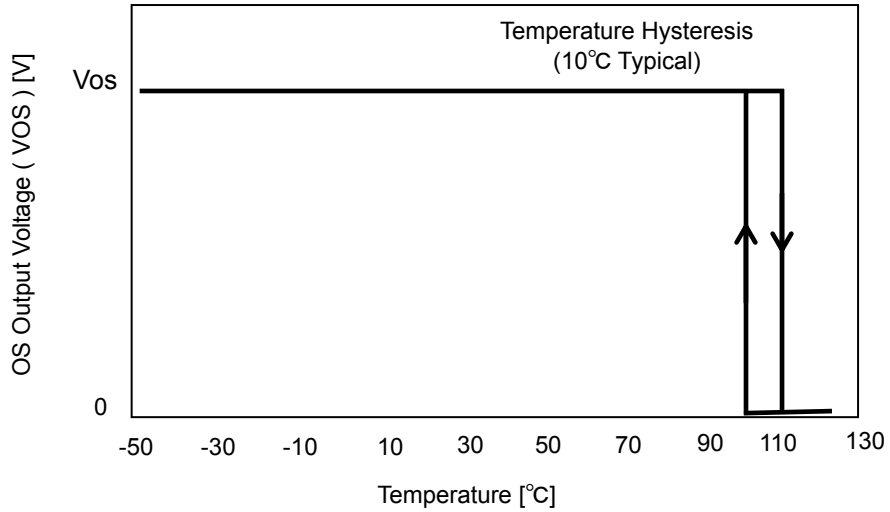

Please don't connect the pull-down resistor

●Block Diagram



●**Functional Diagram** ( ex. Detection Temperature 110℃ )



●Reference Data

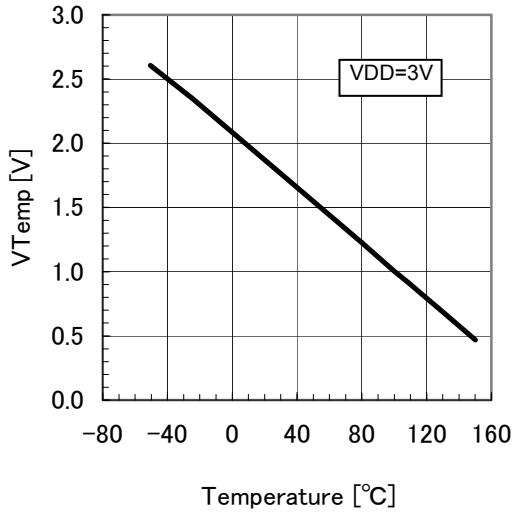



Fig1. VTemp Voltage vs. Temperature
(Temperature Sensitivity)

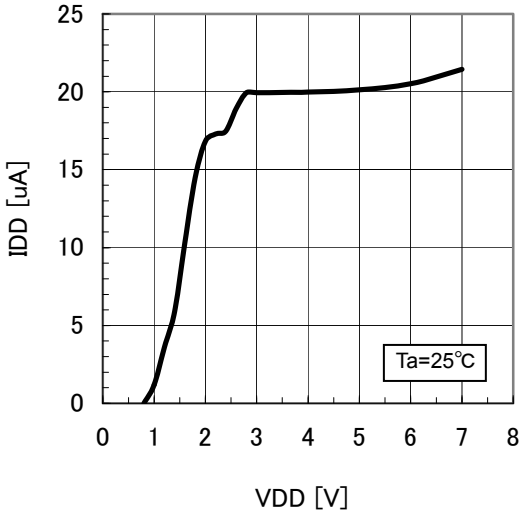



Fig2. Supply Current vs. Supply Voltage

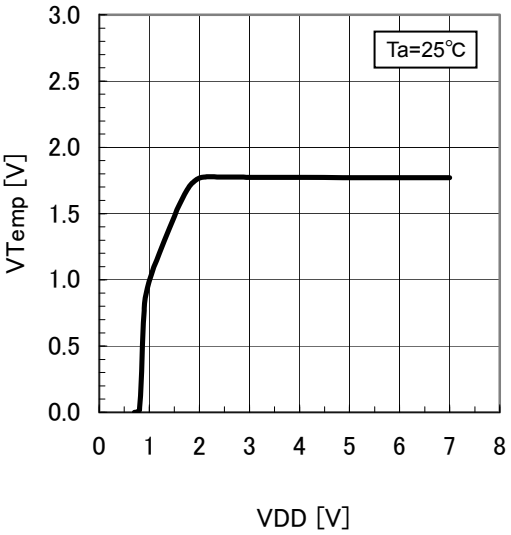



Fig3. VTemp Voltage vs. Supply Voltage

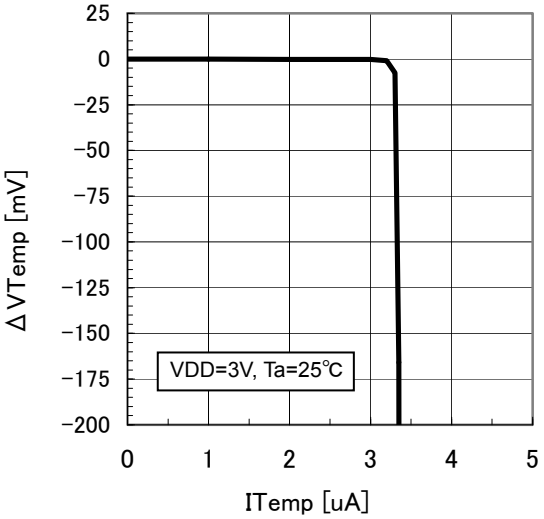



Fig4. VTemp Voltage vs. Output Current

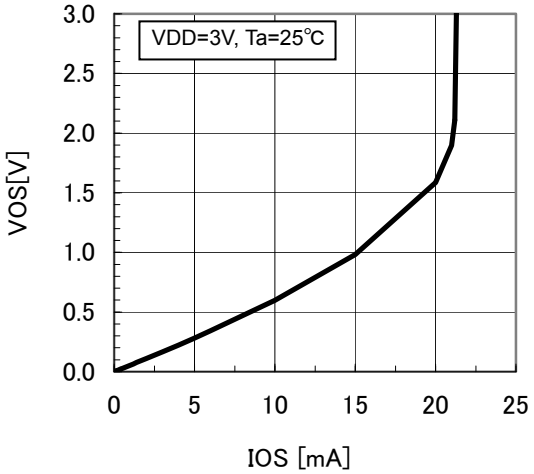



Fig5. OS Output Voltage vs. Load Current

## ●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 | E | 0 | 6 | 0 | 0 | G | - | T | R |
|---|---|---|---|---|---|---|---|---|---|---|

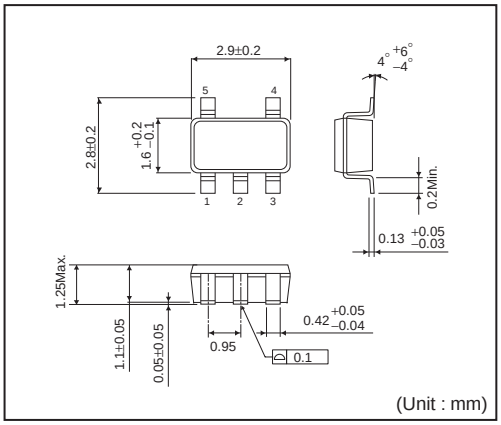
Part No.

Part No.
0600 0700 0800
0900 1000 1100
1200

Package
G: SSOP5

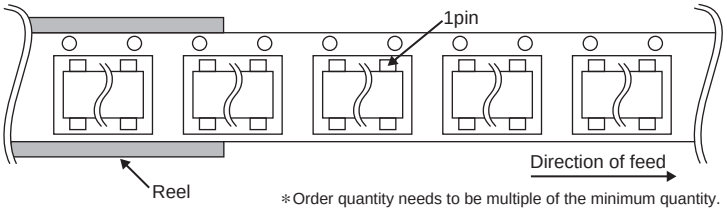
Packaging and forming specification
TR: Embossed tape and reel
(SSOP5)

**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.

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