

STRUCTURE Silicon Monolithic Integrated Circuit

TYPE **BDE1204G**

PRODUCT Thermostat and Analog Temperature Sensor

- FEATURES
- 1) Highly accurate thermostat (  $\pm 4.0$  )
  - 2) Thermostat sensing temperature 115, 120, 125 with CTRL state
  - 3) Open drain output
  - 4) Hysteresis temperature ( TYP. 10 )
  - 5) Highly accurate analog output (  $\pm 3.5$  @Ta = 30 )
  - 6) Analog output temperature sensitivity ( -10.68 [ mV/ ] )
  - 7) Low supply current ( TYP. 16.0uA )
  - 8) Small package ( TYP. 2.90mm × 2.80mm × 1.25mm )

• ABSOLUTE MAXIMUM RATINGS ( Ta = 25 )

| PARAMETERS                | SYMBOL           | LIMIT                        | UNIT |
|---------------------------|------------------|------------------------------|------|
| Power Supply Voltage      | V <sub>DD</sub>  | -0.3 to 7.0 <sup>*1</sup>    | V    |
| Input Voltage ( CTRL )    | V <sub>IN</sub>  | -0.3 to V <sub>DD</sub> +0.3 | V    |
| Input Current ( CTRL )    | I <sub>IN</sub>  | -1.0, +0.1                   | mA   |
| OS terminal Voltage       | V <sub>OS</sub>  | -0.3 to 7.0                  | V    |
| OS terminal Current       | I <sub>OS</sub>  | 5.0                          | mA   |
| Power dissipation         | Pd               | 540 <sup>*2</sup>            | mW   |
| Storage Temperature Range | T <sub>stg</sub> | -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 )

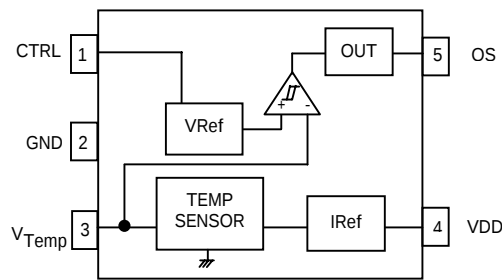
• RECOMMENDED OPERATING CONDITION

| PARAMETERS                  | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|-----------------------------|--------|------|------|------|------|
| Power Supply Voltage        | VDD    | 2.9  | 3.0  | 5.5  | V    |
| Operating Temperature Range | Topr   | -30  | -    | 130  |      |

• Status of this document

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

- BLOCK DIAGRAM



- PIN DESCRIPTION

| PIN NO. | PIN NAME          | FUNCTION                                                                         | COMMENT                                                                                            |
|---------|-------------------|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| 1       | CTRL              | Sensing temperature setting                                                      | Refer to page 3/4<br>( TEMPERATURE / OUTPUT FORMAT TABLE )<br>for the sensing temperature setting. |
| 2       | GND               | GROUND                                                                           |                                                                                                    |
| 3       | V <sub>temp</sub> | Output voltage in inverse proportion<br>to the temperature<br>( TYP. -10.68mV/ ) | Set the OPEN state or connect high impedance<br>input node.                                        |
| 4       | VDD               | POWER SUPPLY                                                                     |                                                                                                    |
| 5       | OS                | Digital thermostat output                                                        | Open Drain type ( Active L )<br>Use the pull-up resistor more than 10kΩ.                           |

- TEMPERATURE ACCURACY ( unless otherwise specified, V<sub>DD</sub> = 3.0V )

| PARAMETER     |                                        | SYMBOL            | LIMIT |      |       | UNIT | CONDITIONS         |
|---------------|----------------------------------------|-------------------|-------|------|-------|------|--------------------|
|               |                                        |                   | MIN.  | TYP. | MAX.  |      |                    |
| Thermostat    |                                        |                   |       |      |       |      |                    |
|               | Sensing Temperature Accuracy           | T <sub>acc</sub>  | -     | 0    | ± 4.0 |      | Ta = 115, 120, 125 |
|               | Sensing Temperature Hysteresis         | Thys              | 7.5   | 10.0 | 12.5  |      |                    |
| Analog Output |                                        |                   |       |      |       |      |                    |
|               | V <sub>Temp</sub> Temperature Accuracy | T <sub>Temp</sub> | -     | -    | ± 3.5 |      | Ta = 30            |

- ELECTRICAL CHARACTERISTICS ( unless otherwise specified, V<sub>DD</sub> = 3.0V, Ta = 25 )

| PARAMETER            |                                           | SYMBOL              | LIMIT  |        |                 | UNIT | CONDITIONS                                    |
|----------------------|-------------------------------------------|---------------------|--------|--------|-----------------|------|-----------------------------------------------|
|                      |                                           |                     | MIN.   | TYP.   | MAX.            |      |                                               |
| Supply Current       |                                           | I <sub>DD</sub>     | -      | 16.0   | 20.0            | μA   | CTRL = 3.0V                                   |
| Analog Output        |                                           |                     |        |        |                 |      |                                               |
|                      | V <sub>Temp</sub> Output Voltage          | V <sub>Temp</sub>   | 1.716  | 1.753  | 1.790           | V    | Ta = 30                                       |
|                      | V <sub>Temp</sub> Temperature Sensitivity | V <sub>SE</sub>     | -10.28 | -10.68 | -11.08          | mV/  | Ta = -30 to 100                               |
|                      | V <sub>Temp</sub> Load Regulation         | V <sub>TempRL</sub> | -      | -      | 1               | mV   | difference of<br>I <sub>OUT</sub> : 0μA / 2μA |
| OS Output Open Drain |                                           |                     |        |        |                 |      |                                               |
|                      | OS Leakage Current                        | I <sub>L</sub>      | -      | -      | 1.0             | μA   | OS : 5.0V                                     |
|                      | OS Output Voltage                         | V <sub>OL</sub>     | -      | -      | 0.4             | V    | I <sub>inos</sub> = 1.2mA                     |
| CTRL                 |                                           |                     |        |        |                 |      |                                               |
|                      | Input L Voltage                           | V <sub>IL</sub>     | GND    | -      | 0.6             | V    |                                               |
|                      | Input H Voltage                           | V <sub>IH</sub>     | 2.4    | -      | V <sub>DD</sub> | V    |                                               |

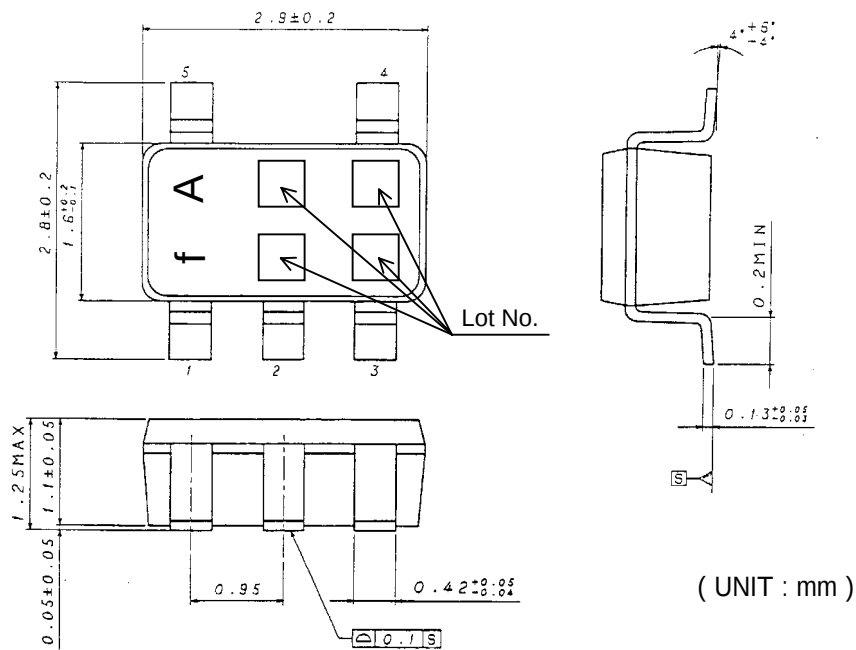
Radiation hardness is not designed.

● BDE12040G TEMPERATURE / OUTPUT FORMAT TABLE

CTRL INPUT    L : Low, O : Open, H : High

| TYPE     | SENSING<br>TEMPERATURE (    ) |     |     | OS Output<br>FORMAT |          | MARKING |
|----------|-------------------------------|-----|-----|---------------------|----------|---------|
|          | CTRL                          |     |     |                     |          |         |
|          | L                             | H   | O   |                     |          |         |
| BDE1204G | 120                           | 125 | 115 | Open Drain          | Active L | fA      |

● PACKAGE OUTLINES ( SSOP5 )



- CAUTIONS ON 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.