The S-8110ANP is a ultra-small packaged high-precision temperature sensor IC that outputs voltage with a temperature coefficient of -8.5mV/°C, and is able to operate at 2.4V. A temperature sensor, a constant current circuit and an operational amplifier are integrated on a single chip. The operating temperature ranges from -40°C to +100°C. The S-8110ANP is superior in linearity over conventional temperature sensors like thermistors. It can be applied to an ever expanding wide range of applications that call for high-precision thermal control.

### Features
- **Linear Output Voltage**: -8.5mV/°C
  - $T_a = -30°C$: 1.823 V typ.
  - $T_a = +30°C$: 1.326 V typ.
  - $T_a = +100°C$: 0.718 V typ.
- **Nonlinearity**: ± 0.5% typ. (-20°C to +80°C)
- **Vss standard output**
- **Low voltage operation**: Vdd min. = 2.4 V
- **Low current consumption**: Idd typ. = 4.5µA (+25°C)
- **Ultra-small plastic package**: (SC-82AB)

### Pin Assignment

```
SC-82AB

1  2  3  4

1. Vdd
2. Vss
3. N.C.
4. Vout

(Top view)
```
LOW VOLTAGE C-MOS TEMPERATURE SENSOR IC
S-8110ANP

- Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Ratings</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply voltage(Vss=0.0V)</td>
<td>Vdd</td>
<td>6.5</td>
<td>V</td>
</tr>
<tr>
<td>Output voltage</td>
<td>Vout</td>
<td>Vss to Vdd</td>
<td>V</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Topr</td>
<td>-40 to +100</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>Tstg</td>
<td>-55 to +125</td>
<td>°C</td>
</tr>
</tbody>
</table>

- Electrical characteristics

<table>
<thead>
<tr>
<th>Item</th>
<th>Symbol</th>
<th>Condition</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply voltage(Vss=0.0V)</td>
<td>Vdd</td>
<td>Ta = -30°C</td>
<td>1.779</td>
<td>1.823</td>
<td>1.863</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ta = +30°C</td>
<td>1.272</td>
<td>1.326</td>
<td>1.356</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ta = +100°C</td>
<td>0.665</td>
<td>0.718</td>
<td>0.749</td>
<td>V</td>
</tr>
<tr>
<td>Output voltage</td>
<td>Vout</td>
<td>-30 ≤ Ta ≤ +100°C</td>
<td>-8.84</td>
<td>-8.50</td>
<td>-8.18</td>
<td>mV/°C</td>
</tr>
<tr>
<td>Temperature sensitivity</td>
<td>Vse</td>
<td>-20 ≤ Ta ≤ +80°C</td>
<td>—</td>
<td>±0.5</td>
<td>—</td>
<td>%</td>
</tr>
<tr>
<td>Nonlinearity</td>
<td>△NL</td>
<td>-20 ≤ Ta ≤ +80°C</td>
<td>—</td>
<td>±0.5</td>
<td>—</td>
<td>%</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Topr</td>
<td>-40 ≤ Ta ≤ +100°C</td>
<td>—</td>
<td>—</td>
<td>+100</td>
<td>V</td>
</tr>
<tr>
<td>Current consumption</td>
<td>Idd</td>
<td>Ta = +25°C</td>
<td>—</td>
<td>4.5</td>
<td>10.0</td>
<td>μA</td>
</tr>
</tbody>
</table>
Definition of terms

1. Output voltage (Vout)

Output voltage Vout is defined as the voltage between measured pin-4 and Vss. Vout is linearly proportional to ambient temperature. S-8110ANP is tested for Vout at -30°C, +30°C and +100°C.

2. Temperature sensitivity (Vse)

Temperature sensitivity Vse is defined as the average slope of the Vout versus Ta curve using the following formula.

\[ V_{se} = \frac{(V_{out}(+100) - V_{out}(-30))}{130} \]

Vout(+100): Output voltage at Ta=+100°C
Vout(-30): Output voltage at Ta= -30°C

3. Nonlinearity (NL)

Nonlinearity \( \triangle NL \) is defined as the deviation of the Vout versus Ta curve from the best-fit straight line over the device’s rated temperature range.

\[ \triangle NL = \frac{a}{b} \times 100 \]

a: The maximum deviation of the Vout vs. Ta curve from the best-fit straight line between -20°C and +80°C.
b: The difference of the output voltage between -20°C and +80°C.
Load conditions

Load capacitance: \( C_L \leq 100\,\text{pF} \)
Load resistance: \( R_L \geq 500\,\text{k}\,\Omega \)

(Note: Do NOT connect a pull-up resistor to Vout pin.)
Typical performance characteristics

- Ambient temperature (Ta) - Output voltage (Vout)
- Heat response (TYP) from 28°C air into 100°C air.
- Power supply voltage (Vdd) - Current consumption (Idd)
- Accuracy - Temperature
- The best-fit straight line: $V_{out} = -8.5\text{mV/°C} \times Ta'°C + 1556\text{mV}$
- Approximate temperature $Ta' - Ta [°C]$ - Output voltage
- Current consumption (Idd) [µA]
- Power supply voltage (Vdd) - Output voltage (Vout) $Ta=30°C$ (TYP)
- Power supply voltage (Vdd) - Output voltage (Vout) $Ta=100°C$ (TYP)
Start up response

Ta=25°C, CL=100pF, RL=10MΩ

V dd
(= 6V)

V out

50 µ sec/div

Ta=25°C, CL=100pF, RL=10MΩ

V dd
(= 2.4V)

V out

50 µ sec/div
**SC-82AB**

- **Dimensions**

  Unit: mm

  ![Dimensions Diagram]

  No.: NP004-A-P-SD-1.0

- **Taping Specifications**

  1 reel holds 3000 ICs.

  ![Taping Specifications Diagram]

  No.: NP004-A-C-SD-1.0

- **Reel Specifications**

  ![Reel Specifications Diagram]

  No.: NP004-A-R-SD-1.0
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