# XC31B Series

## CMOS Temperature Sensor

◆**Low Power Consumption : 7μA**
◆**Operating Voltage Range : 3.0V ~ 10.0V**
◆**Output Voltage Temp. Coefficient : TYP -3900ppm/°C**
◆**SOT-25 Package**

## ■Applications

- ●Mobile phones
- ●Portable AV equipment
- ●Palm top computers, PDA
- ●Battery powered equipment

## ■General Description

The XC31B series are ultra small CMOS temperature sensor ICs. As a bandgap type temperature sensor is built-into the XC31B, linearity, in comparison to thermistor type temperature sensors, is much better.

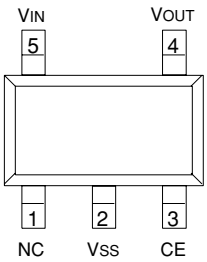
The operating temperature range of the series is from -30°C to +80°C.The XC31B comes in a mini molded SOT-25 package with a quiescent current of only 7μA(2.0V) and as such, is suitable for use with various portable devices.

Output voltage is selectable in 0.1V steps within a range of 2.0V to 6.0V (at 25°C).

## ■Features

| | |
|---|---|
| **Operating Voltage Range** | : 3.0V ~ 10.0V |
| **Output Voltage Range** | : 2.0V ~ 6.0V |
| **Output Voltage Accuracy** | : ±3% |
| **Detectable Temperature Range** | : -30°C ~ +80°C |
| **Output Voltage Temp. Coefficient** | : TYP -3900ppm/°C |
| **Low Power Consumption** | : 7 μA (2.0V) |

## ■Pin Configuration




SOT-25
(TOP VIEW)

## ■Pin Assignment

| PIN NUMBER | PIN NAME | FUNCTION |
|---|---|---|
| 1 | NC | No Connection |
| 2 | VSS | Ground |
| 3 | CE | Chip Enable |
| 4 | VOUT | Output |
| 5 | VIN | Power Supply |

## ■Product Classification

●Ordering Information

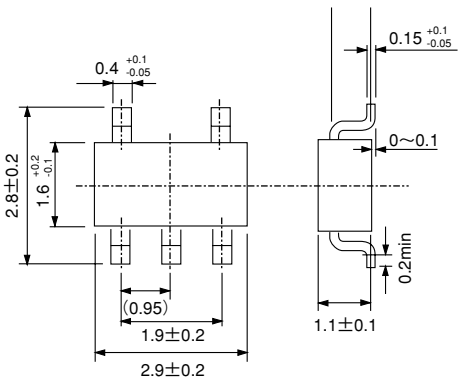
XC31Bxxxxxxx

a b c d e f

| DESIGNATOR | DESCRIPTION | DESIGNATOR | DESCRIPTION |
|---|---|---|---|
| a | Polarity of Output Voltage<br>P: + (Positive) | e | Package Type<br>M=SOT–25 |
| b | Temperature Coefficient<br>N: – (Negative) | f | Device Orientation<br>R = Embossed Tape (Standard Feed)<br>L = Embossed Tape (Reverse Feed) |
| c | Output Voltage (25°C)<br>20 = 2.0V<br>30 = 3.0V | | |
| d | Revision Character<br>A ～ | | |

## ■Packaging Information

●SOT-25

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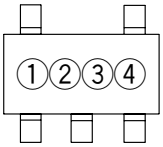
## ■Marking




SOT-25
(TOP VIEW)

①Based on internal standards

②Represents the integer of the Output Voltage

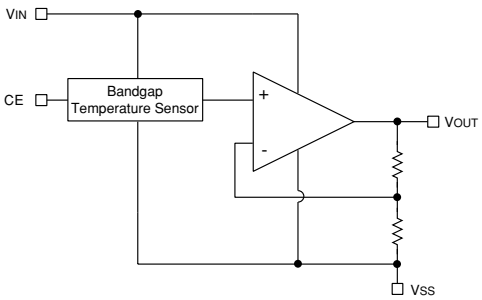
| SYMBOL | VOLTAGE (V) |
|---|---|
| 2 | 2.③ |
| 3 | 3.③ |
| 4 | 4.③ |
| 5 | 5.③ |
| 6 | 6.③ |

③Represents the decimal number point of the Output Voltage

| SYMBOL | VOLTAGE (V) |
|---|---|
| 0 | ②.0 |
| 1 | ②.1 |
| 2 | ②.2 |
| 3 | ②.3 |
| 4 | ②.4 |
| 5 | ②.5 |
| 6 | ②.6 |
| 7 | ②.7 |
| 8 | ②.8 |
| 9 | ②.9 |

④Represents the assembly lot no.

## ■Block Diagram




## ■Absolute Maximum Ratings

Ta = 25°C, VSS = 0V

| PARAMETER | SYMBOL | RATINGS | UNIT |
|---|---|---|---|
| Input Voltage | VIN | −0.3 ～ 12 | V |
| Output Voltage | VOUT | −0.3 ～ 12 | V |
| CE Pin Voltage | VCE | −0.3 ～ VIN+0.3 | V |
| Output Current | IOUT | 20 | mA |
| Power Dissipation | Pd | 150 | mW |
| Operating Ambient Temperature | Topr | −40 ～ +85 | ℃ |
| Storage Temperature | Tstg | −40 ～ +125 | ℃ |

## ■Electrical Characteristics

XC31BPN20A $V_{OUT}(T)^{1)}$=2.0V

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| Input Voltage | $V_{IN}$ | | | - | 10 | V |
| Output Voltage | $V_{OUT}$ | $I_{OUT}$=100 μA[2], $V_{IN}$=4.0V, Ta=25℃ | 1.94 | 2.0 | 2.06 | V |
| Detectable Temperature Range | | | -30 | | +80 | ℃ |
| Output Voltage Temperature Coefficient | $T_D$[3] | $I_{OUT}$=100μA, $V_{IN}$=4.0V<br>-30℃≤Ta≤80℃ | -3400 | -3900 | -4400 | ppm/℃ |
| Temperature Sensitivity | $T_{SE}$ | -30℃≤Ta≤80℃ | -6.8 | -7.8 | -8.8 | mV/℃ |
| Liniarity Margin Error | $T_L$[4] | -30℃≤Ta≤80℃ | | 1 | 3.5 | % |
| Load Stability | △$V_{OUT}$ | $V_{IN}$=4.0V<br>1μA≤IOUT≤100μA | | 2.0 | | mV |
| Supply Current 1 | $I_{SS}1$ | $V_{IN}$=$V_{CE}$=4.0V, Ta=25℃ | | 7 | 17 | μA |
| Supply Current 2 | $I_{SS}2$ | $V_{IN}$=4.0V, $V_{CE}$=VSS, Ta=25℃ | | | 0.1 | μA |
| CE "High" Level Voltage | $V_{CEH}$ | | 1.5 | | | V |
| CE "Low" Level Voltage | $V_{CEL}$ | | | | 0.3 | V |

XC31BPN40A $V_{OUT}(T)^{1)}$=4.0V

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|
| Input Voltage | $V_{IN}$ | | | - | 10 | V |
| Output Voltage | $V_{OUT}$ | $I_{OUT}$=100μA[2], $V_{IN}$=6.0V,Ta=25℃ | 3.88 | 2.0 | 4.12 | V |
| Detectable Temperature Range | | | -30 | | +80 | ℃ |
| Output Voltage Temperature Coefficient | $T_D$[3] | $I_{OUT}$=100μA, $V_{IN}$=6.0V<br>-30℃≤Ta≤80℃ | -3400 | -3900 | -4400 | ppm/℃ |
| Temperature Sensitivity | $T_{SE}$ | -30℃≤Ta≤80℃ | -13.6 | -15.6 | -17.6 | mV/℃ |
| Liniarity Margin Error | $T_L$[4] | -30℃≤Ta≤80℃ | | 1 | 3.5 | % |
| Load Stability | △$V_{OUT}$ | VIN=6.0V<br>1μA≤IOUT≤100μA | | 3.0 | | mV |
| Supply Current 1 | $I_{SS}1$ | $V_{IN}$=$V_{CE}$=6.0V, Ta=25℃ | | 8 | 18 | μA |
| Supply Current 2 | $I_{SS}2$ | $V_{IN}$=6.0V, $V_{CE}$=VSS, Ta=25℃ | | | 0.1 | μA |
| CE "High" Level Voltage | $V_{CEH}$ | | 1.5 | | | V |
| CE "Low" Level Voltage | $V_{CEL}$ | | | | 0.3 | V |

Note:

1) $V_{OUT}(T)$=Specified Output Voltage at 25°C.
2) Should output current exceed 100μA, output voltage drop will increase.
   If this IC is to be used in applications where such currents are required, please use a buffer on the output.
3) Output voltage temperature coefficient $T_D$ is defined as

$$T_D = \frac{\triangle V_{OUT}}{\triangle Ta \cdot V_{OUT}}$$

4) Liniarity margin error is calculated as follows,

$$T_L = \frac{e_{max}}{Tse \cdot \triangle Ta}$$

where $e_{max}$ = maximum error.
The maximum error is the maximum difference between the actual measured value and the value on an approximated straight line.

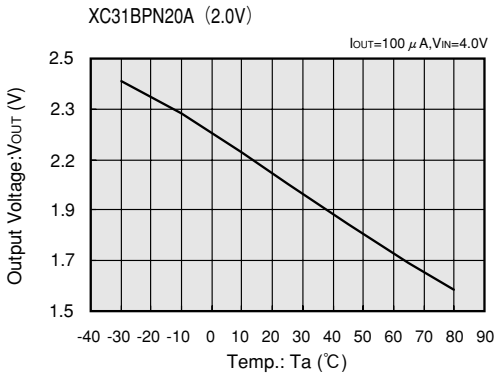
## ■Directions for use

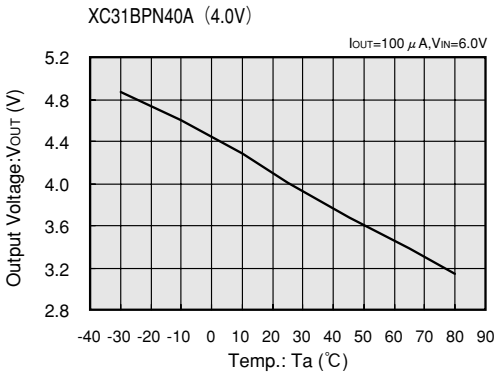
●Notes on Use

1. When the load capacitance CL is too large, oscillation may occur on the output signal.
2. Output signal overshoot will occur when the power ($V_{IN}$) is switched on or when the power drastically flucturates. The chip enable (CE) function is effective for helping to avoid overshoot and also in saving consumption current.

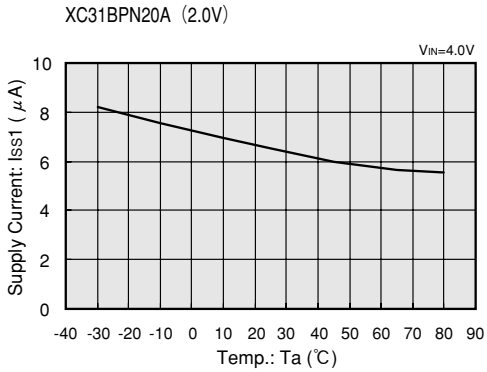
## ■Typical Performance Characteristics

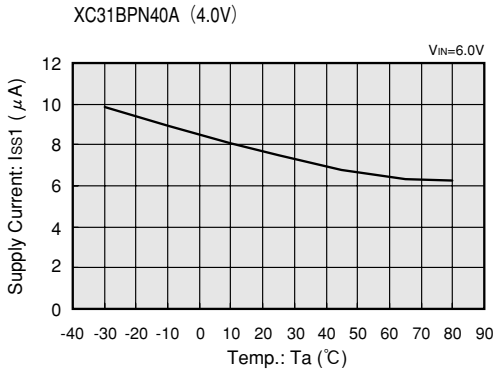
(1) OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE



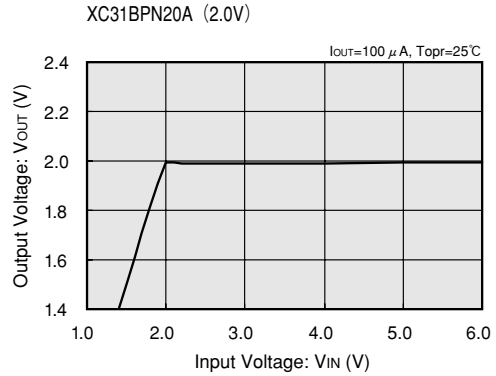



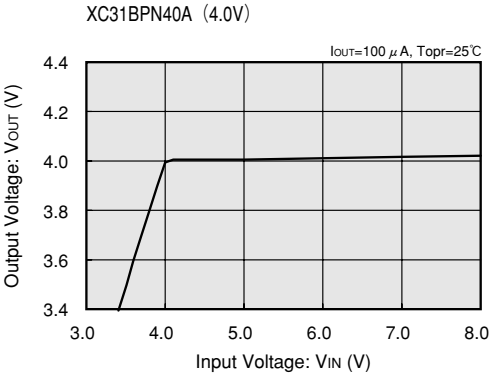

(2) SUPPLY CURRENT vs. AMBIENT TEMPERATURE




(3) OUTPUT VOLTAGE vs. INPUT VOLTAGE

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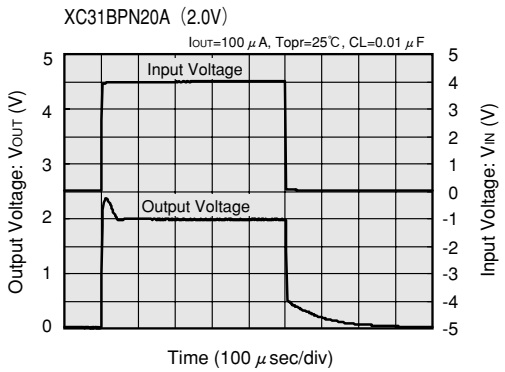
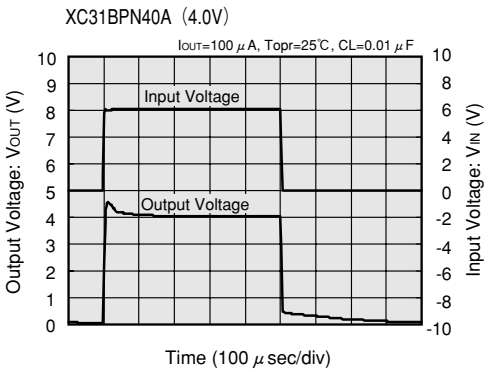
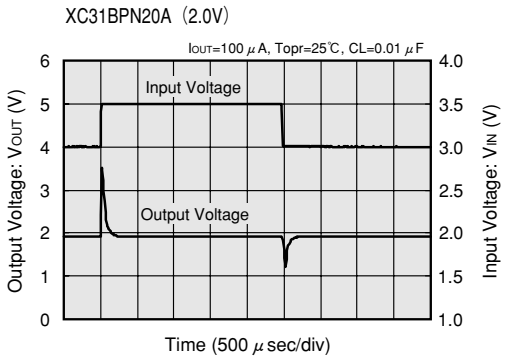
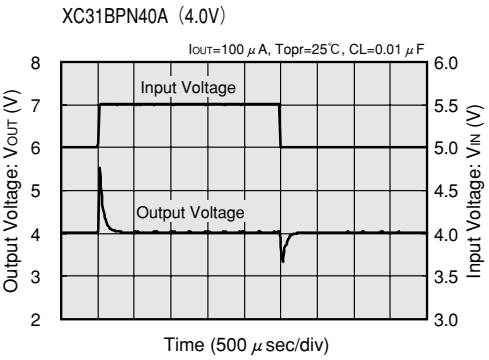
(4) INPUT TRANSIENT RESPONSE 1




(5) INPUT TRANSIENT RESPONSE 2

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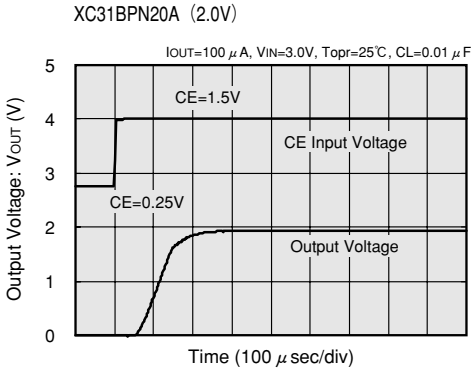
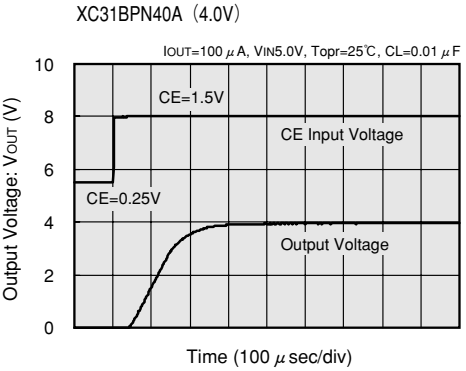
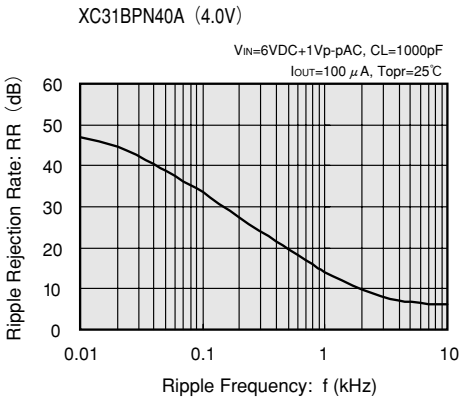
(6) CE PIN TRANSIENT RESPONSE

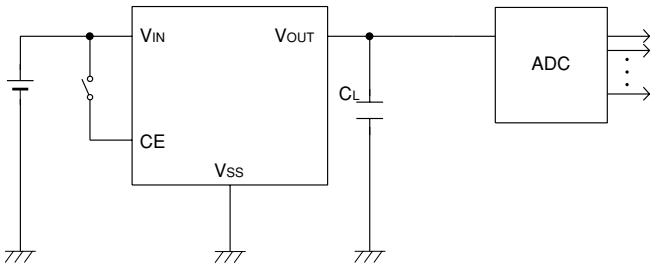


(7) RIPPLE REJECTION RATE




## ■Typical Application Circuit




CL：0.01 μF（ceramic capacitor）