

XC31B

Series

CMOS Temperature Sensor



- ◆Low Power Consumption : $7\mu\text{A}$
- ◆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.

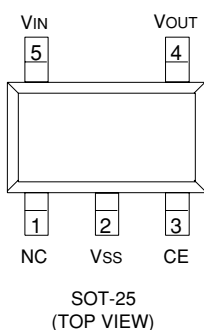
The operating temperature range of the series is from -30°C to +80°C. The XC31B comes in a mini molded SOT-25 package with a quiescent current of only $7\mu\text{A}$ (2.0V) and as such, is suitable for use with various portable devices.

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 : $\pm 3\%$
- Detectable Temperature Range : -30°C ~ +80°C
- Output Voltage Temp. Coefficient: TYP -3900ppm/°C
- Low Power Consumption : $7\mu\text{A}$ (2.0V)

Pin Configuration



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

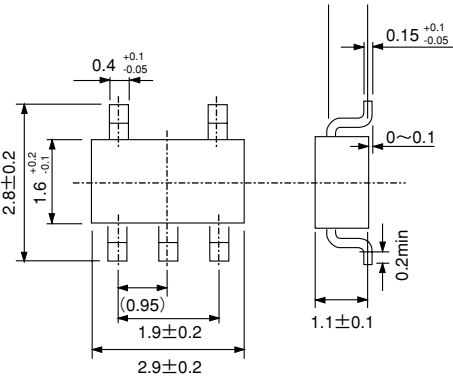
●Ordering Information

XC31Bxxxxxx
↑↑↑↑↑
a b c d e f

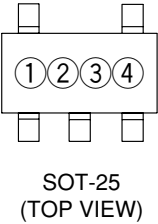
DESIGNATOR	DESCRIPTION	DESIGNATOR	DESCRIPTION
a	Polarity of Output Voltage P: + (Positive)	e	Package Type M=SOT-25
b	Temperature Coefficient N: - (Negative)		
c	Output Voltage (25°C) 20 = 2.0V 30 = 3.0V	f	Device Orientation R = Embossed Tape (Standard Feed) L = Embossed Tape (Reverse Feed)
d	Revision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

■Packaging Information

●SOT-25



■ **Marking**



- ①Based on internal standards
- ②Represents the integer of the Output Voltage

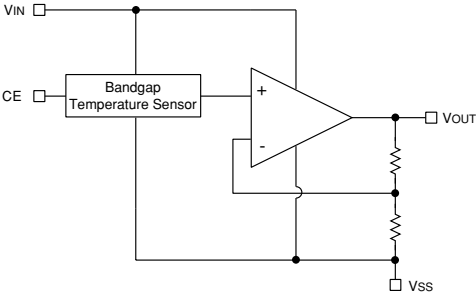
SYMBOL	VOLTAGE (V)
2	2.③
3	3.③
4	4.③
5	5.③
6	6.③

- 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	°C
Storage Temperature	Tstg	-40 ~ +125	°C

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}	$I_{OUT}=100\mu A^2$, $V_{IN}=4.0V$, $T_a=25^\circ C$	1.94	2.0	2.06	V
Detectable Temperature Range			-30		+80	$^\circ C$
Output Voltage Temperature Coefficient	$T_D^3)$	$I_{OUT}=100\mu A$, $V_{IN}=4.0V$ $-30^\circ C \leq T_a \leq 80^\circ C$	-3400	-3900	-4400	ppm/ $^\circ C$
Temperature Sensitivity	T_{SE}	$-30^\circ C \leq T_a \leq 80^\circ C$	-6.8	-7.8	-8.8	mV/ $^\circ C$
Linearity Margin Error	$T_L^4)$	$-30^\circ C \leq T_a \leq 80^\circ C$		1	3.5	%
Load Stability	ΔV_{OUT}	$V_{IN}=4.0V$ $1\mu A \leq I_{OUT} \leq 100\mu A$		2.0		mV
Supply Current 1	I_{SS1}	$V_{IN}=V_{CE}=4.0V$, $T_a=25^\circ C$		7	17	μA
Supply Current 2	I_{SS2}	$V_{IN}=4.0V$, $V_{CE}=V_{SS}$, $T_a=25^\circ C$			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}	$I_{OUT}=100\mu A^2$, $V_{IN}=6.0V$, $T_a=25^\circ C$	3.88	2.0	4.12	V
Detectable Temperature Range			-30		+80	$^\circ C$
Output Voltage Temperature Coefficient	$T_D^3)$	$I_{OUT}=100\mu A$, $V_{IN}=6.0V$ $-30^\circ C \leq T_a \leq 80^\circ C$	-3400	-3900	-4400	ppm/ $^\circ C$
Temperature Sensitivity	T_{SE}	$-30^\circ C \leq T_a \leq 80^\circ C$	-13.6	-15.6	-17.6	mV/ $^\circ C$
Linearity Margin Error	$T_L^4)$	$-30^\circ C \leq T_a \leq 80^\circ C$		1	3.5	%
Load Stability	ΔV_{OUT}	$V_{IN}=6.0V$ $1\mu A \leq I_{OUT} \leq 100\mu A$		3.0		mV
Supply Current 1	I_{SS1}	$V_{IN}=V_{CE}=6.0V$, $T_a=25^\circ C$		8	18	μA
Supply Current 2	I_{SS2}	$V_{IN}=6.0V$, $V_{CE}=V_{SS}$, $T_a=25^\circ C$			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 $25^\circ C$.
- 2) Should output current exceed $100\mu A$, 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

$$T_D = \frac{\Delta V_{OUT}}{\Delta T_a \cdot V_{OUT}}$$

- 4) Linearity margin error is calculated as follows,

$$T_L = \frac{e_{max}}{T_{se} \cdot \Delta T_a}$$

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.

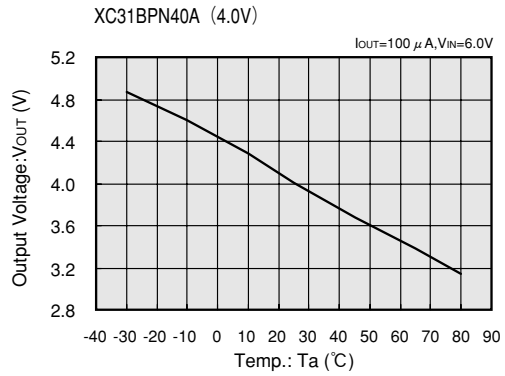
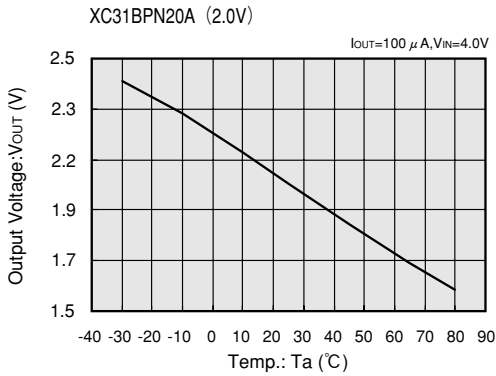
Directions for use

Notes on Use

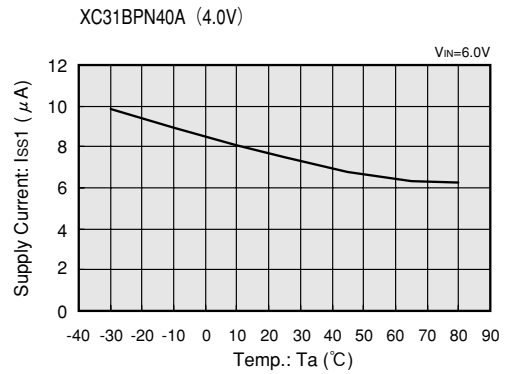
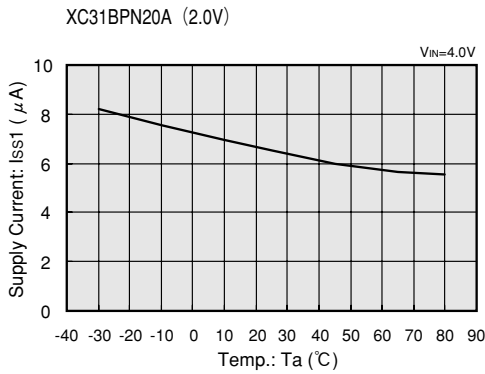
1. When the load capacitance C_L is too large, oscillation may occur on the output signal.
2. Output signal overshoot will occur when the power (V_{IN}) is switched on or when the power drastically fluctuates. The chip enable (CE) function is effective for helping to avoid overshoot and also in saving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

■ Typical Performance Characteristics

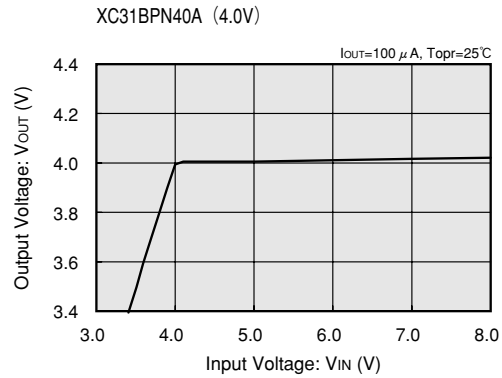
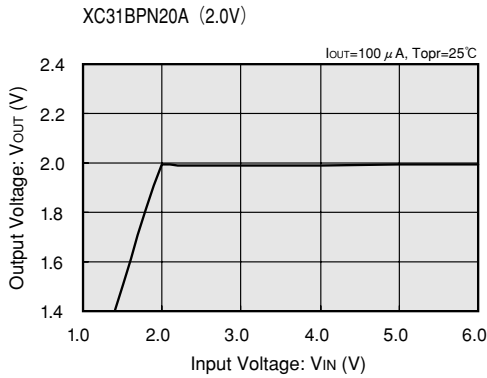
(1) OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE



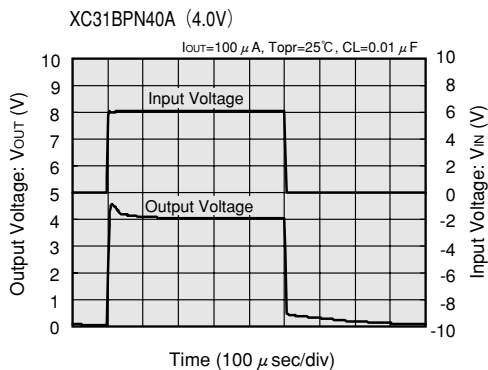
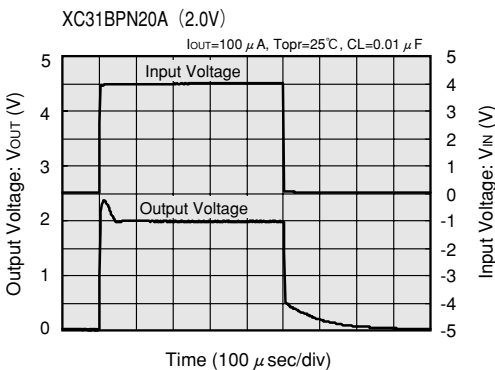
(2) SUPPLY CURRENT vs. AMBIENT TEMPERATURE



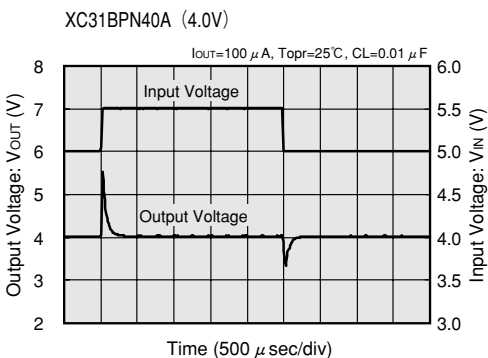
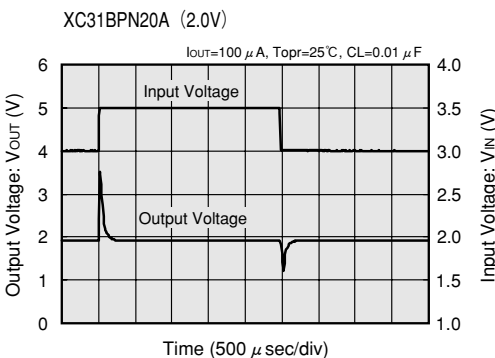
(3) OUTPUT VOLTAGE vs. INPUT VOLTAGE



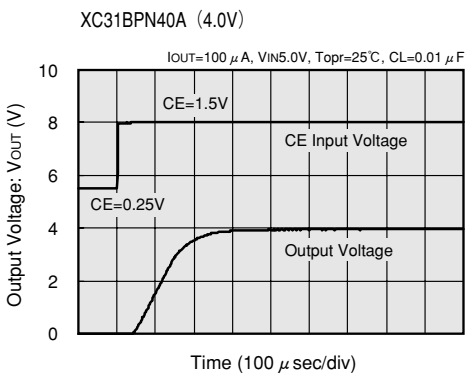
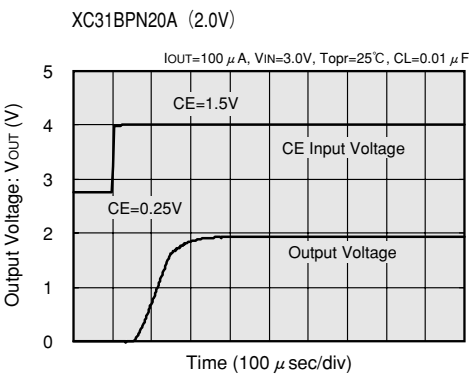
(4) INPUT TRANSIENT RESPONSE 1



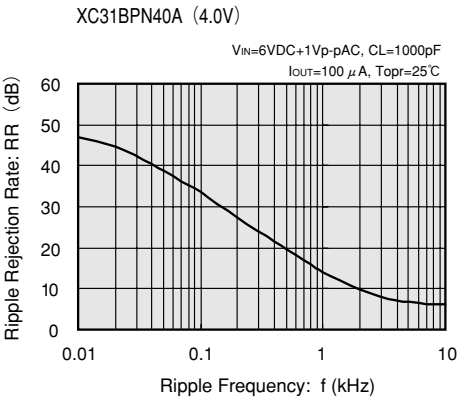
(5) INPUT TRANSIENT RESPONSE 2



(6) CE PIN TRANSIENT RESPONSE



(7) RIPPLE REJECTION RATE



■ Typical Application Circuit

