

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.

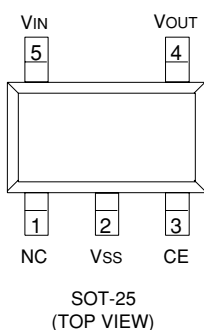
The operating temperature range of the series is from -30°C to +80°C. The XC31B comes in a mini molded SOT-25 package with a quiescent current of only $7\mu\text{A}$ (2.0V) and as such, is suitable for use with various portable devices.

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

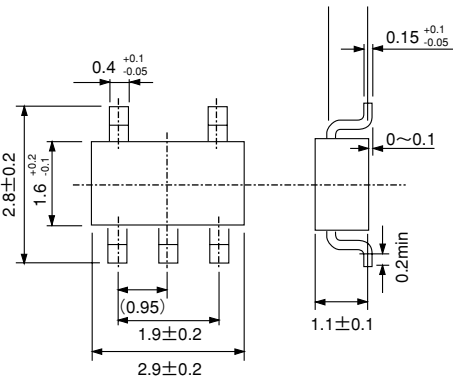
Ordering Information

XC31Bxxxxx
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 ↑↑ ↑ ↑↑↑
 a b c d e f

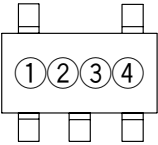
DESIGNATOR	DESCRIPTION	DESIGNATOR	DESCRIPTION
a	Polarity of Output Voltage P: + (Positive)	e	Package Type M=SOT-25
b	Temperature Coefficient N: - (Negative)		
c	Output Voltage (25°C) 20 = 2.0V 30 = 3.0V	f	Device Orientation R = Embossed Tape (Standard Feed) L = Embossed Tape (Reverse Feed)
d	Revision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

Packaging Information

SOT-25



■Marking



SOT-25
(TOP VIEW)

①Based on internal standards

②Represents the integer of the Output Voltage

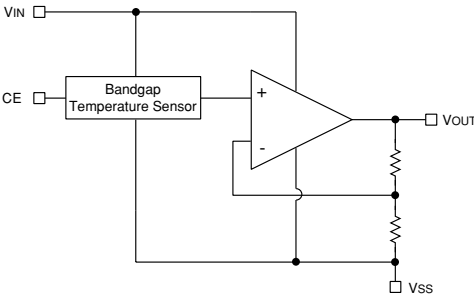
SYMBOL	VOLTAGE (V)
2	2.③
3	3.③
4	4.③
5	5.③
6	6.③

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	°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:

- $V_{OUT}(T)$ =Specified Output Voltage at $25^\circ C$.
- 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.
- Output voltage temperature coefficient T_D is defined as

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

- 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.

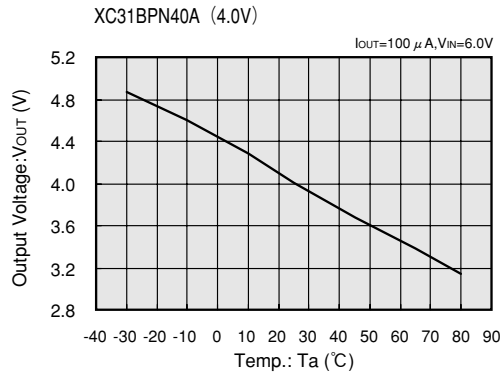
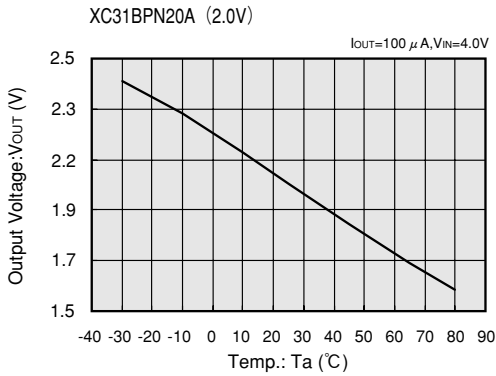
Directions for use

Notes on Use

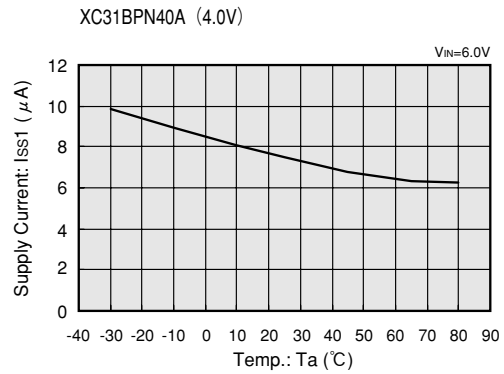
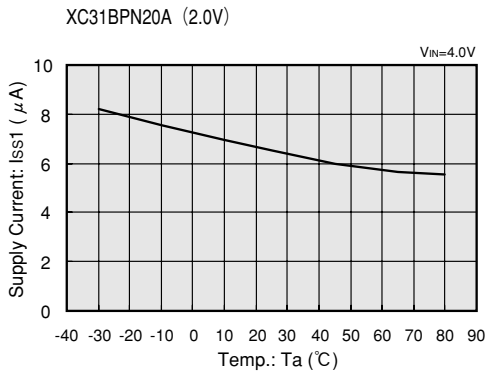
- When the load capacitance C_L is too large, oscillation may occur on the output signal.
- Output signal overshoot will occur when the power (V_{IN}) is switched on or when the power drastically fluctuates. The chip enable (CE) function is effective for helping to avoid overshoot and also in saving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

■ **Typical Performance Characteristics**

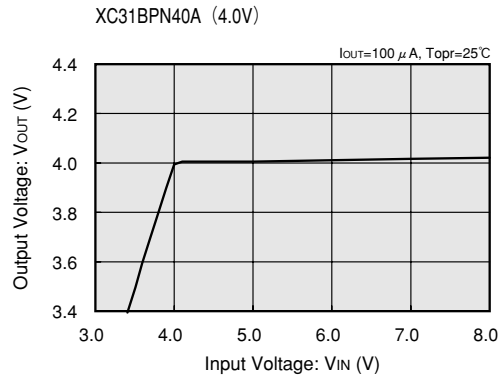
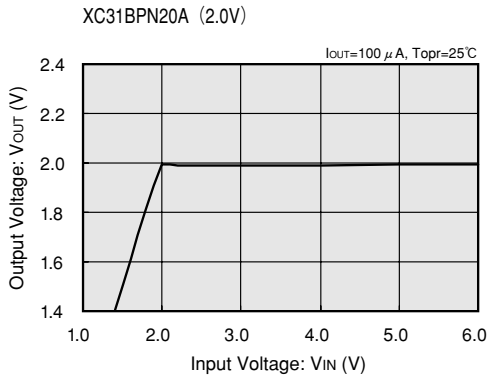
(1) OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE



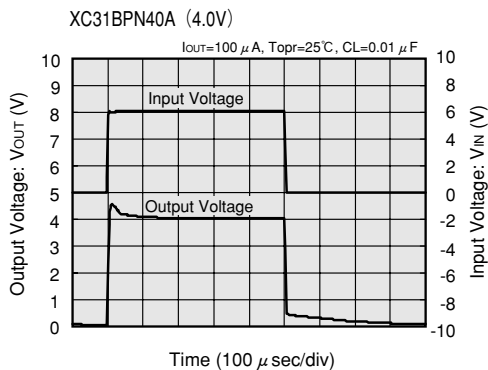
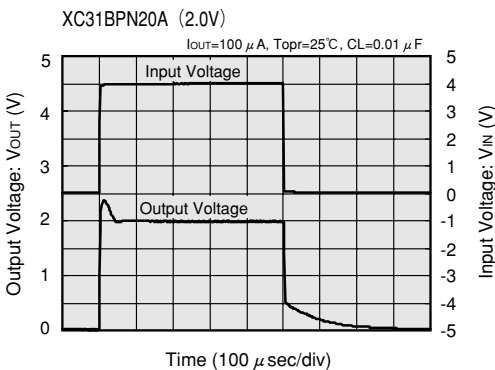
(2) SUPPLY CURRENT vs. AMBIENT TEMPERATURE



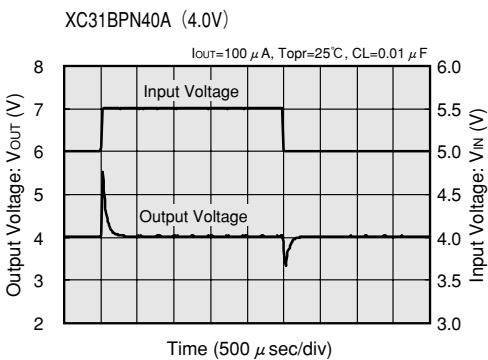
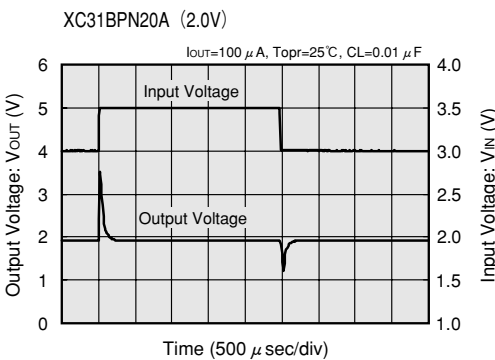
(3) OUTPUT VOLTAGE vs. INPUT VOLTAGE



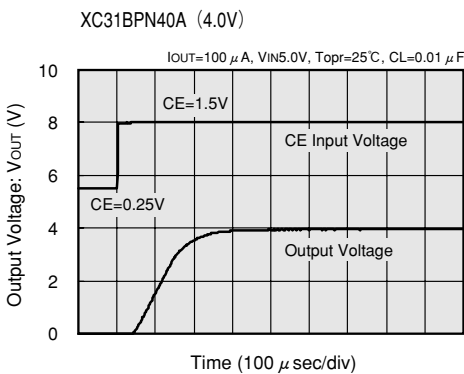
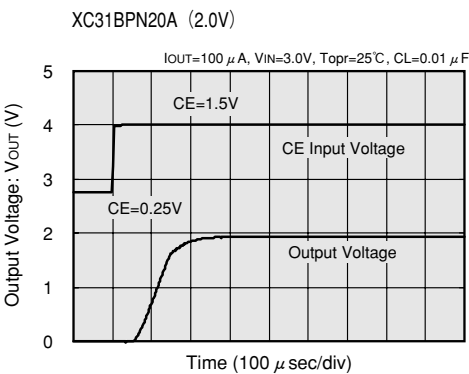
(4) INPUT TRANSIENT RESPONSE 1



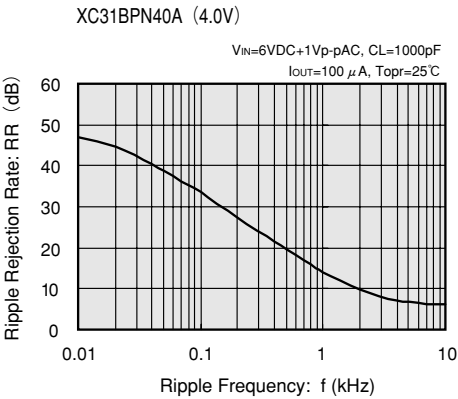
(5) INPUT TRANSIENT RESPONSE 2



(6) CE PIN TRANSIENT RESPONSE



(7) RIPPLE REJECTION RATE



■ Typical Application Circuit

