XC31B Series

CMOS Temperature Sensor

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   to +80   . The XC31B comes in a mini molded SOT-25 and USP-6B packages with a supply current of only 7μ A

(@V_{OUT}=2.0V) and as such, is suitable for use with various portable devices.   Output voltage is selectable in 100mV increments within a range of 2.0V to 6.0V (at 25   ).
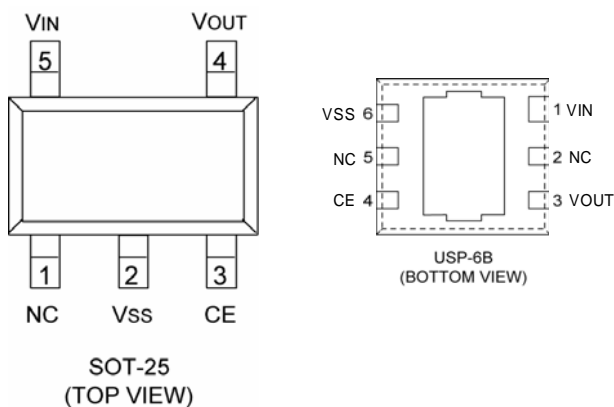
APPLICATIONS

Mobile phones
Portable AV equipment
Palm top computers, PDAS
Battery powered equipment

FEATURES

Operating Voltage Range	: 3.0V ~ 10.0V
Output Voltage Range	: 2.0V~ 6.0V
Output Voltage Accuracy	: ± 3%
Detectable Temperature Range	: -30 ~ +80
Output Voltage Temp. Coefficient	: -3900ppm/ (TYP.)
Low Power Consumption	: 7μ A (@V_{OUT}=2.0V)
Packages	: SOT-25, USP-6B

PIN CONFIGURATION

SOT-25
(TOP VIEW)

USP-6B
(BOTTOM VIEW)

*The dissipation pad for the USP-6B package should be solder-plated in recommended mount pattern and metal masking so as to enhance mounting strength and heat release.
If the pad needs to be connected to other pins, it should be connected to the V_{SS} pin.

PIN ASSIGNMENT

PIN NUMBER		PIN NAME	FUNCTION
SOT25	USP-6B		
1	2, 5	NC	No Connection
2	6	V_{SS}	Ground
3	4	CE	Chip Enable
4	3	V_{OUT}	Output
5	1	V_{IN}	Power Supply

PRODUCT CLASSIFICATION

Ordering Information

XC31B

DESIGNATOR	DESCRIPTION	SYMBOL	DESCRIPTION
	Polarity of Output Voltage	P	: + (Positive)
	Temperature Coefficient	N	: - (Negative)
	Output Voltage (25)	20~60	: e.g. 20=2.0V, 30=3.0V
	Revision Character	A ~	: -
	Package	M	: SOT-25 (SOT-23-5)
		D	: USP-6B
	Device Orientation	R	: Embossed tape, standard feed
		L	: Embossed tape, reverse feed

BLOCK DIAGRAM
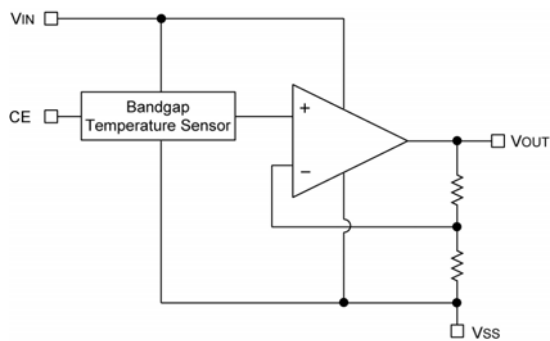
ABSOLUTE MAXIMUM RATINGS

Ta=25   Vss=0V

PARAMETER		SYMBOL	RATINGS		UNIT
Input Voltage		V_{IN}	0.3	12	V
Output Voltage		V_{OUT}	0.3	12	V
CE Pin Voltage		V_{CE}	0.3	V_{IN}+0.3	V
Output Current		I_{OUT}	20		mA
Power Dissipation	SOT-25	Pd	150		mW
	USP-6B		100		
Operating Temperature Range		Topr	40	+85	
Storage Temperature Range		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}=100μ A [*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}=100μ A, V_{IN}=4.0V -30 Ta 80	-3400	-3900	-4400	ppm/
Temperature Sensitivity	T_{SE}	-30 Ta 80	-6.8	-7.8	-8.8	mV/
Linearity Margin Error	T_L [*4]	-30 Ta 80		1	3.5	%
Load Regulation	$VOUT$	V_{IN}=4.0V 1μ A I_{OUT} 100μ A		2.0		mV
Supply Current 1	I_{SS1}	V_{IN}=V_{CE}=4.0V, Ta=25		7	17	μ A
Supply Current 2	I_{SS2}	V_{IN}=4.0V, V_{CE}=V_{SS}, Ta=25			0.1	μ A
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}=100μ A [*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}=100μ A, V_{IN}=6.0V -30 Ta 80	-3400	-3900	-4400	ppm/
Temperature Sensitivity	T_{SE}	-30 Ta 80	-13.6	-15.6	-17.6	mV/
Linearity Margin Error	T_L [*4]	-30 Ta 80		1	3.5	%
Load Regulation	$VOUT$	V_{IN}=6.0V 1μ A I_{OUT} 100μ A		3.0		mV
Supply Current 1	I_{SS1}	V_{IN}=V_{CE}=6.0V, Ta=25		8	18	μ A
Supply Current 2	I_{SS2}	V_{IN}=6.0V, V_{CE}=V_{SS}, Ta=25			0.1	μ A
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 .

*2: When output current exceed 100μ 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:
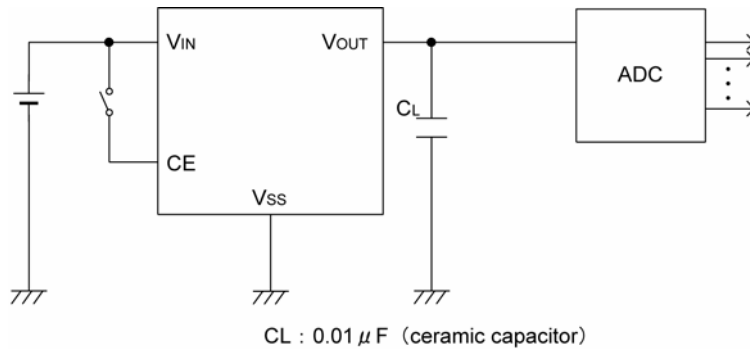
$$T_D = \frac{\Delta V_{OUT}}{Ta \cdot V_{OUT}}$$

*4: Linearity margin error (T_L) is calculated as follows:

$$T_L = \frac{emax}{Tse \cdot \Delta Ta}$$

where emax = maximum error.

The maximum error is the maximum difference between the actual measured value and the value on an approximated straight line.

TYPICAL APPLICATION CIRCUIT

CL : 0.01μF （ceramic capacitor）

NOTE 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.
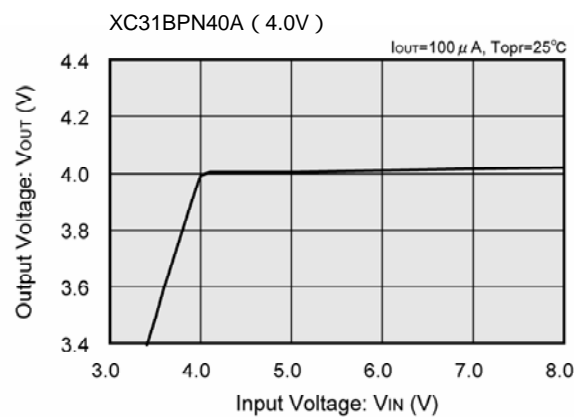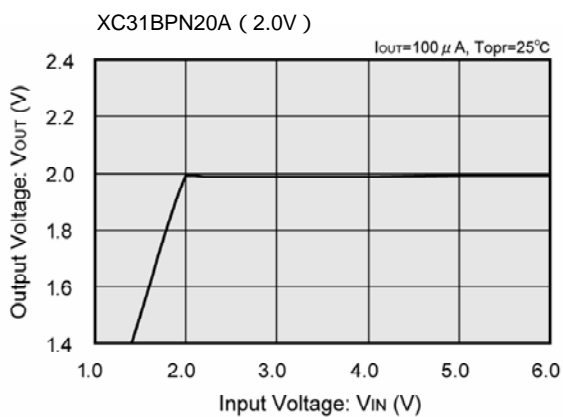
TYPICAL PERFORMANCE CHARACTERISTICS

(1) Output Voltage vs. Ambient Temperature

XC31BPN20A   2.0V

XC31BPN40A   4.0V
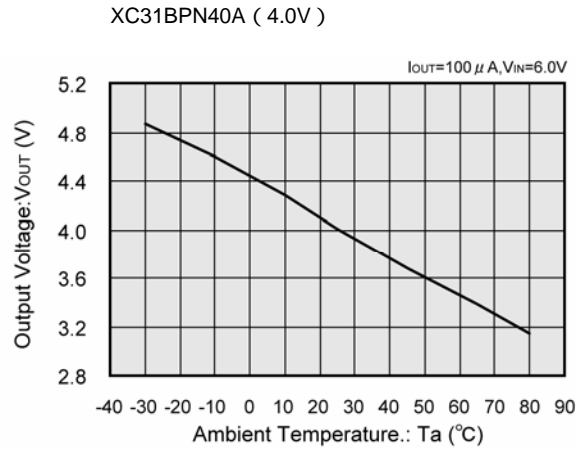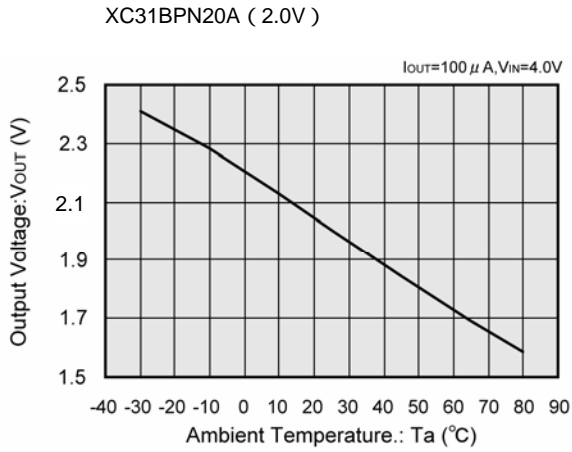
(2) Supply Current vs. Ambient Temperature

XC31BPN20A   2.0V

XC31BPN40A   4.0V
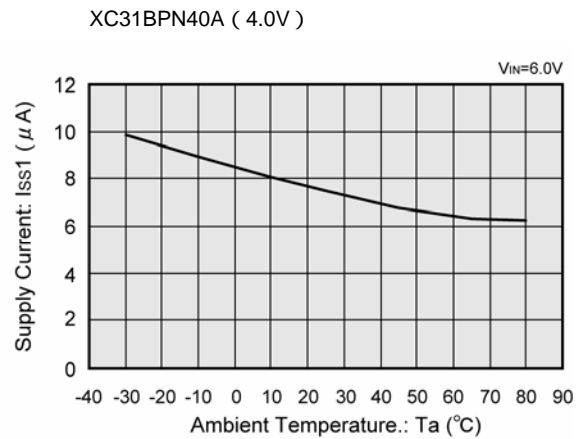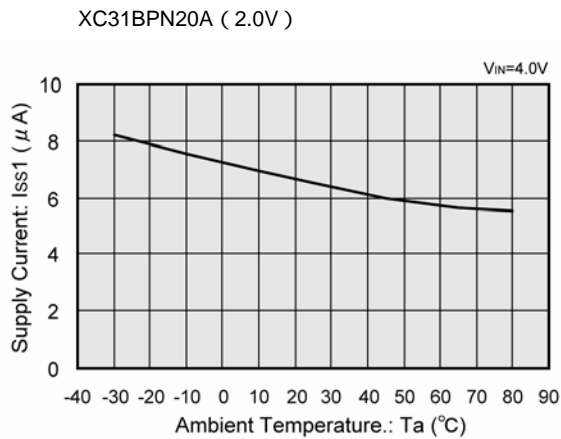
(3) Output Voltage vs. Input Voltage

XC31BPN20A   2.0V

XC31BPN40A   4.0V
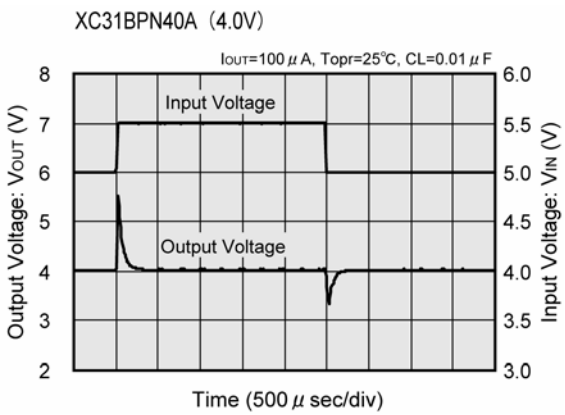
TYPICAL PERFORMANCE CHARACTERISTICS(Continued)

(4) Input Transient Response 1

XC31BPN20A (2.0V)

XC31BPN40A (4.0V)

(5) Input Transient Response 2

XC31BPN20A (2.0V)

XC31BPN40A (4.0V)
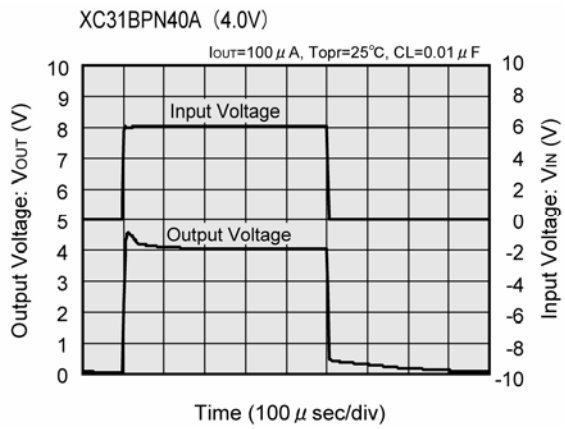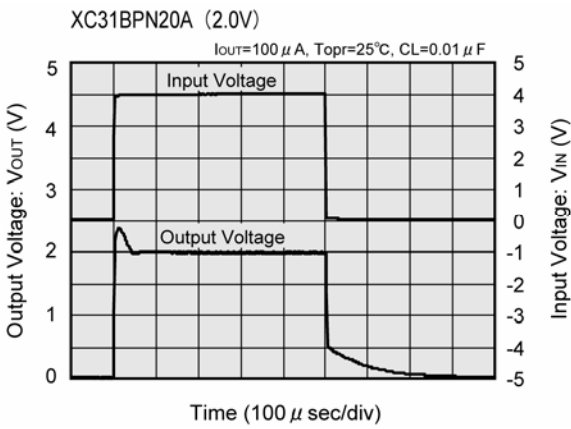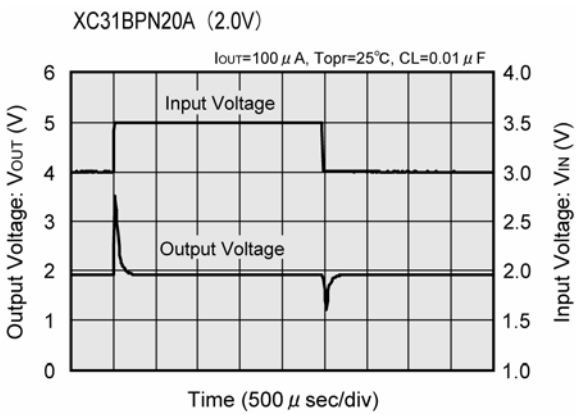
(6) CE Pin Transient Response

XC31BPN20A (2.0V)

XC31BPN40A (4.0V)
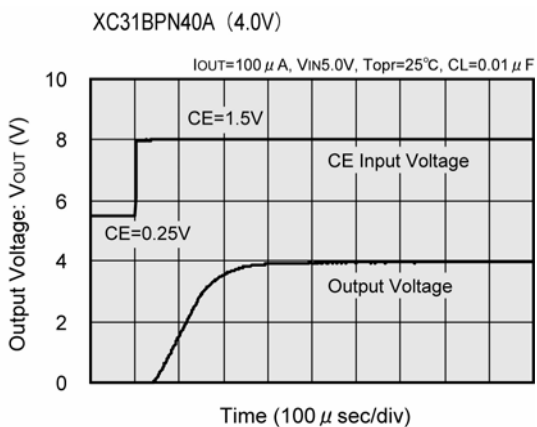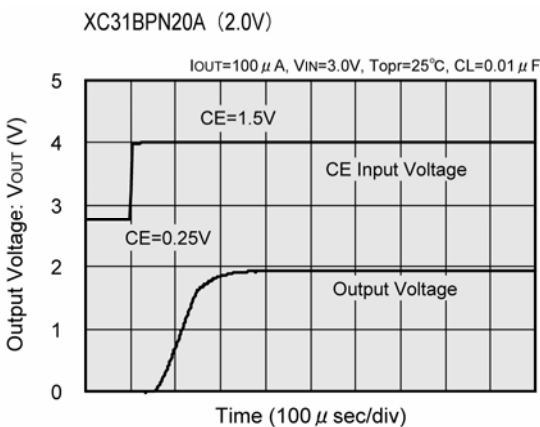
TYPICAL PERFORMANCE CHARACTERISTICS(Continued)

(7) Ripple Rejection Rate

XC31BPN40A（4.0V）

V_{IN}=6VDC+1Vp-pAC, CL=1000pF
I_{OUT}=100 μ A, Topr=25℃

Ripple Rejection Rate: RR （dB）

Ripple Frequency: f (kHz)
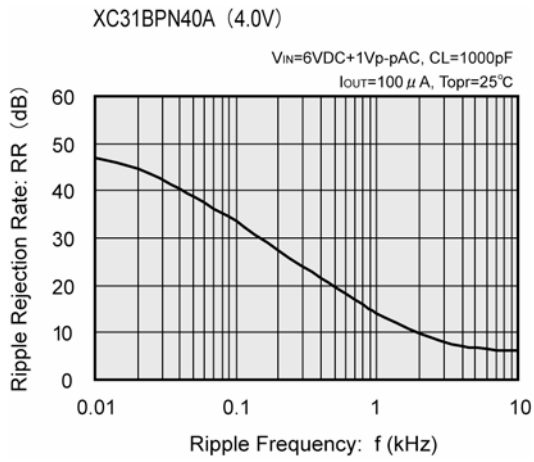
PACKAGING INFORMATION

SOT-25

USP-6B

Note : Pin 1 is larger than the other pins.

A-A' cross section
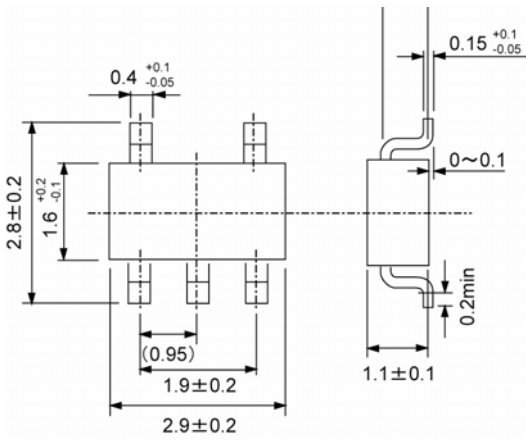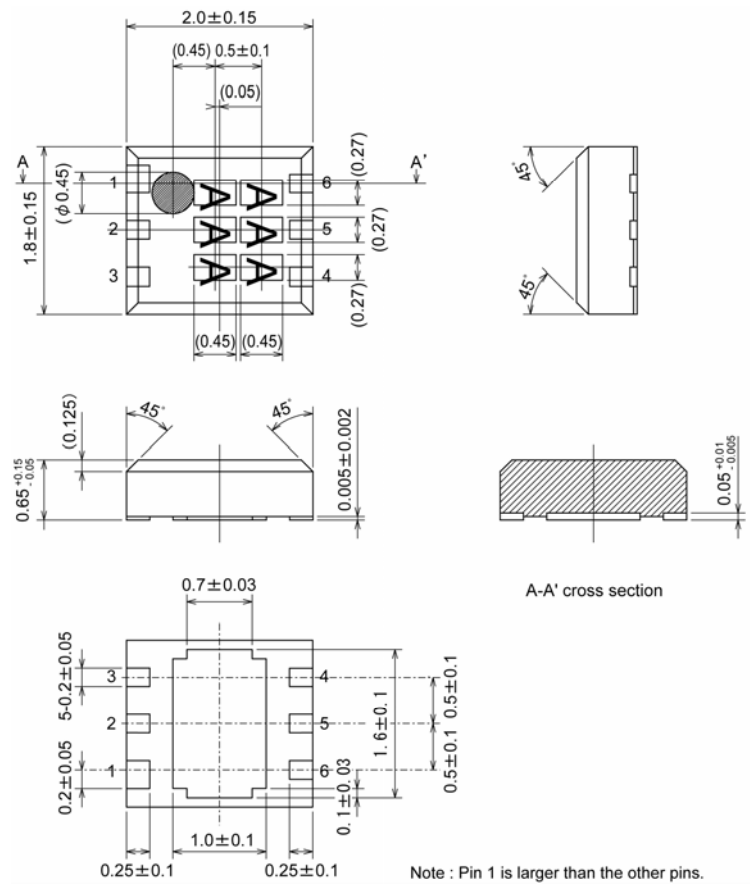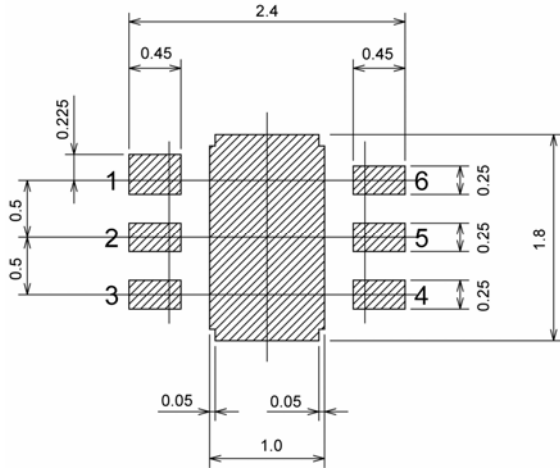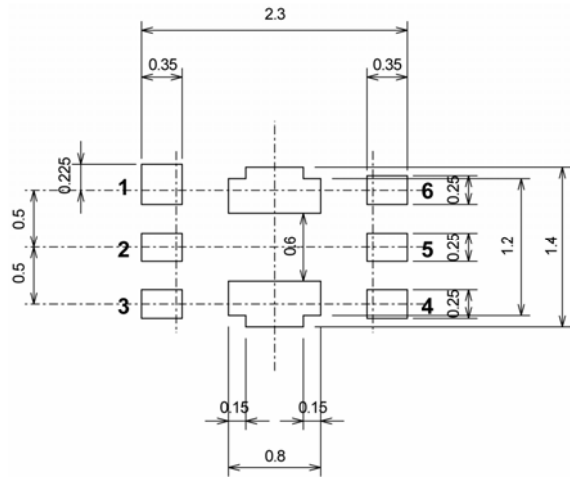
PACKAGING INFORMATION (Continued)
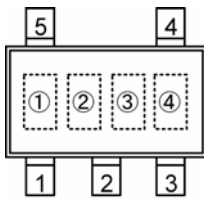
USP-6B Recommended Pattern Layout

USP-6B Recommended Metal Mask Design

MARKING RULE

SOT-25

SOT-25
(TOP VIEW)

Based on internal standards

Represents integer of output voltage

MARK	VOLTAGE (V)
2	2.x
3	3.x
4	4.x
5	5.x
6	6.x

Represents decimal number point of output voltage

MARK	VOLTAGE (V)
0	x.0
1	x.1
2	x.2
3	x.3
4	x.4
5	x.5
6	x.6
7	x.7
8	x.8
9	x.9

Represents assembly lot number
(Based on internal standards)

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