

## Highly Accurate, Ultra Small, Low Power Consumption Voltage Detector

### ■ GENERAL DESCRIPTION

The XC61J series is highly precise, low power consumption voltage detectors, manufactured using CMOS and laser trimming technologies. With low power consumption and high accuracy, the series is suitable for precision mobile equipment. The XC61J in ultra small package is ideally suited for high-density mounting. The XC61J is available in both CMOS and N-channel open drain output configurations.

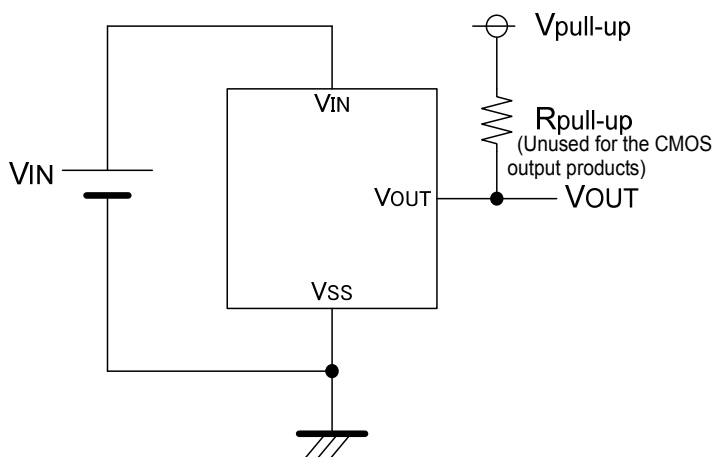
### ■ APPLICATIONS

- Microprocessor reset circuitry
- Memory battery back-up circuits
- Power-on reset circuits
- Power failure detection
- System battery life and charge voltage monitors

### ■ FEATURES

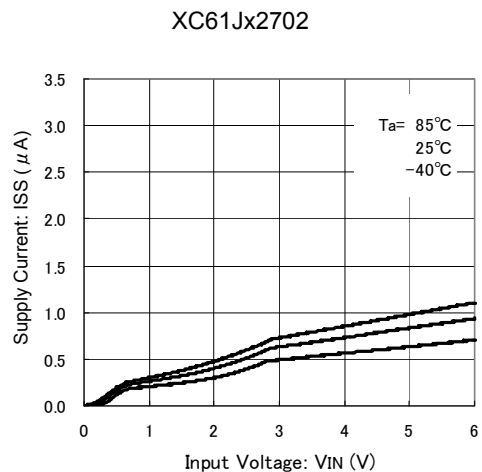
<b>Highly Accurate</b>	: $\pm 2\%$ ( $V_{DF} \geq 1.5V$ ) : $\pm 30mV$ ( $V_{DF} < 1.5V$ )
<b>Low Power Consumption</b>	: $0.6 \mu A$ [ $V_{DF}=2.7V, V_{IN}=2.97V$ ]
<b>Detect Voltage Range</b>	: $1.0V \sim 5.0V$ (0.1V increments)
<b>Operating Voltage Range</b>	: $0.7V \sim 6.0V$
<b>Temperature Characteristics</b>	: $\pm 100ppm/^{\circ}C$ (TYP.)
<b>Output Configuration</b>	: CMOS (XC61JC) : N-channel open drain (XC61JN)
<b>Operating Temperature Range</b>	: $-40^{\circ}C \sim +85^{\circ}C$
<b>Package</b>	: SOT-25-03
<b>Environmentally Friendly</b>	: EU RoHS Compliant, Pb Free

### ■ TYPICAL APPLICATION CIRCUIT



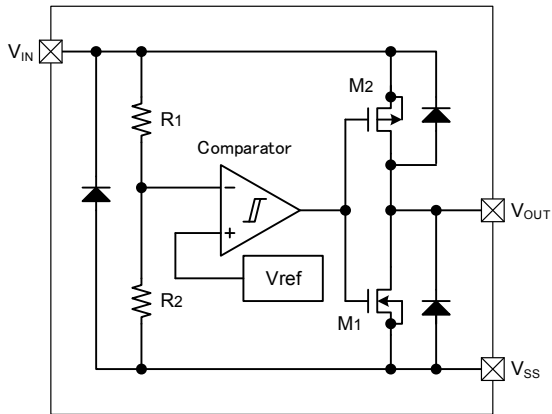
### ■ TYPICAL PERFORMANCE CHARACTERISTICS

- Supply Current vs. Input Voltage

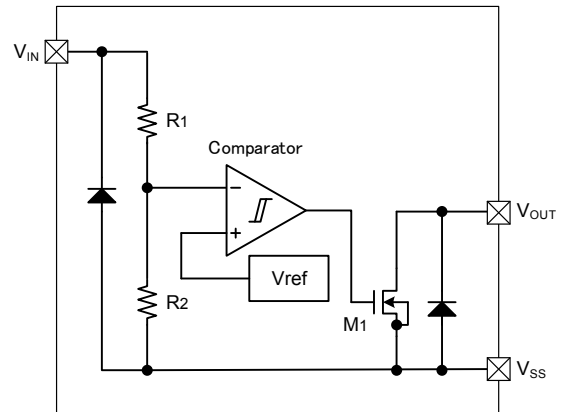


## ■ BLOCK DIAGRAMS

(1) XC61JC



(2) XC61JN



\* Diodes inside the circuits are ESD protection diodes and parasitic diodes.

## ■ PRODUCT CLASSIFICATION

### ● Ordering Information

XC61J①②③④⑤⑥⑦-⑧<sup>(\*)</sup>

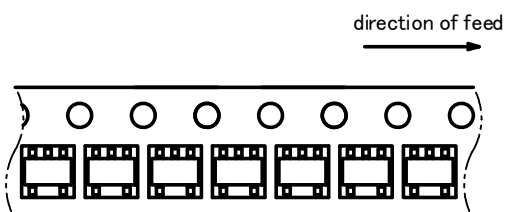
DESIGNATOR	ITEM	SYMBOL	DESCRIPTION
①	Output Configuration	C	CMOS output
		N	N-ch open drain output
②③	Detect Voltage	10~50	e.g. 1.0V → ②=1, ③=0
④⑤	Detect Accuracy	02	±2% ( $1.5V \leq V_{DF} \leq 5.0V$ ) ±30mV ( $1.0V \leq V_{DF} < 1.5V$ )
⑥⑦-⑧	Package (Order Unit) Taping Specification <sup>(**)</sup>	ML-G	SOT-25-03 (3,000/Reel) Reverse feed

<sup>(\*)</sup> The "-G" suffix denotes Halogen and Antimony free as well as being fully EU RoHS compliant.

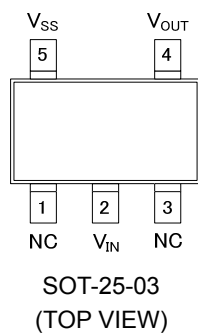
<sup>(\*\*)</sup> Refer to the Taping Specification.

### ● Taping Specification

- ML-G



## PIN CONFIGURATION



## PIN ASSIGNMENT

PIN NUMBER	PIN NAME	FUNCTION
SOT-25-03		
1	NC	No Connection
2	V <sub>IN</sub>	Power Input
3	NC	No Connection
4	V <sub>OUT</sub>	Signal Output (Active Low)
5	V <sub>SS</sub>	Ground

■ **ABSOLUTE MAXIMUM RATINGS**

Ta=25°C

PARAMETER		SYMBOL	RATING	UNITS
Input Voltage		V <sub>IN</sub>	-0.3~+7.0	V
Output Current		I <sub>OUT</sub>	10	mA
Output Voltage	XC61JC <sup>(*1)</sup>	V <sub>OUT</sub>	-0.3~V <sub>IN</sub> +0.3 or +7.0 <sup>(*3)</sup>	V
	XC61JN <sup>(*2)</sup>		-0.3~+7.0	
Power Dissipation	SOT-25-03	P <sub>d</sub>	250	mW
Operating Temperature Range		T <sub>opr</sub>	-40~+85	°C
Storage Temperature Range		T <sub>stg</sub>	-55~+125	°C

<sup>(\*1)</sup> CMOS Output

<sup>(\*2)</sup> N-ch Open Drain Output

<sup>(\*3)</sup> The maximum value should be either V<sub>IN</sub>+0.3 or +7.0 in the lowest

## ELECTRICAL CHARACTERISTICS

XC61J Series

Ta=25°C

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNITS	CIRCUIT			
Operating Voltage	V <sub>IN</sub>	V <sub>DF(T)</sub> =1.0~5.0V (*1)	0.7	-	6.0	V	-			
Detect Voltage	V <sub>DF</sub>	V <sub>DF(T)</sub> =1.0V~5.0V	E-1			V	①			
Hysteresis Width	V <sub>HYS</sub>	V <sub>DF(T)</sub> =1.0V~5.0V	V <sub>DF</sub> × 0.03	V <sub>DF</sub> × 0.05	V <sub>DF</sub> × 0.07	V	①			
Quiescent Current 1	I <sub>SS1</sub>	V <sub>IN</sub> =V <sub>DF(T)</sub> × 1.1	E-2			μA	②			
Quiescent Current 2	I <sub>SS2</sub>	V <sub>IN</sub> = V <sub>DF(T)</sub> × 0.9	E-3			μA	②			
Output Current	I <sub>OUTN</sub>	V <sub>IN</sub> =0.7V	V <sub>OUT</sub> =0.5V	0.09	0.57	-	mA	③		
			V <sub>OUT</sub> =0.3V	0.08	0.56	-				
			V <sub>OUT</sub> =0.1V	0.05	0.30	-				
		V <sub>IN</sub> =1.0V	V <sub>OUT</sub> =0.1V, V <sub>DF(T)</sub> >1.0V	0.46	0.71	-				
		V <sub>IN</sub> =2.0V	V <sub>OUT</sub> =0.1V, V <sub>DF(T)</sub> >2.0V	1.15	1.41	-				
		V <sub>IN</sub> =3.0V	V <sub>OUT</sub> =0.1V, V <sub>DF(T)</sub> >3.0V	1.44	1.77	-				
	V <sub>IN</sub> =4.0V	V <sub>OUT</sub> =0.1V, V <sub>DF(T)</sub> >4.0V	1.61	1.96	-					
	I <sub>OUTP</sub> (*2)	V <sub>IN</sub> =6.0V	V <sub>OUT</sub> =5.5V	-	-0.95	-0.60	mA	③		
Leakage Current	CMOS Output	I <sub>LEAK</sub>	V <sub>IN</sub> =V <sub>DF</sub> × 0.9V, V <sub>OUT</sub> =0V			-	-0.001	-	μA	③
	N-ch Open Drain Output		V <sub>IN</sub> =6.0V, V <sub>OUT</sub> =6.0V			-	0.001	0.10		
Temperature Characteristics	ΔV <sub>DF</sub> / (ΔT <sub>opr</sub> · V <sub>DF</sub> )	-40 °C ≤ T <sub>opr</sub> ≤ 85 °C	-	± 100	-	ppm/°C	①			
Detect Delay Time (*3)	t <sub>DF</sub>	V <sub>IN</sub> =6.0V→0.7V V <sub>IN</sub> =V <sub>DF</sub> to V <sub>OUT</sub> =0.5V	-	30	100	μs	④			
Release Delay Time (*5)	t <sub>DR</sub>	V <sub>IN</sub> =0.7V→6.0V V <sub>IN</sub> =V <sub>DR</sub> to V <sub>OUT</sub> =V <sub>DR</sub> (*4)	-	20	100	μs	④			

\*1: V<sub>DF (T)</sub>: Nominal detect voltage

\*2: For XC61JC only.

\*3: A time taking from the time at V<sub>IN</sub> = V<sub>DF</sub> to the time at V<sub>OUT</sub>=0.5V when V<sub>IN</sub> falls from 6.0V to 0.7V.

\*4: V<sub>DR</sub>: Release voltage (V<sub>DR</sub> = V<sub>DF</sub> + V<sub>HYS</sub>)

\*5: A time taking from the time at V<sub>IN</sub> = V<sub>DR</sub> to the time at V<sub>OUT</sub> = V<sub>DR</sub> when V<sub>IN</sub> rise from 0.7V to 6.0V.

### ●XC61JN recommended pull-up resistance

Input Voltage Range	Pull-up Resistance
0.7V~6.0V	≥ 220kΩ
0.8V~6.0V	≥ 100kΩ
1.0V~6.0V	≥ 33kΩ

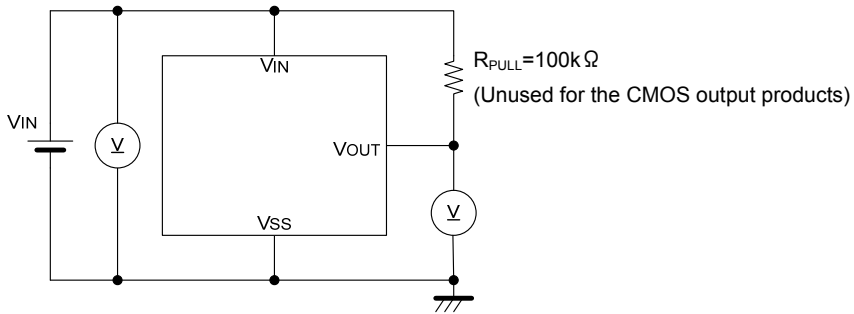
## ■ ELECTRICAL CHARACTERISTICS (Continued)

### ● DETECT VOLTAGE ACCURACY AND QUIESCENT CURRENT SPECIFICATIONS

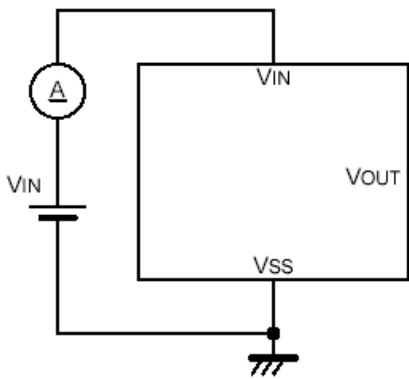
SYMBOL	E-1		E-2		E-3	
PARAMETER	DETECT VOLTAGE		QUIESCENT CURRENT1		QUIESCENT CURRENT2	
NOMINAL DETECT VOLTAGE	$V_{DF} (V)^1$		$I_{SS1} (\mu A)$		$I_{SS2} (\mu A)$	
$V_{DF(T)}$	MIN.	MAX.	TYP.	MAX.	TYP.	MAX.
1.0	0.970	1.030	0.5	1.4	0.4	1.35
1.1	1.070	1.130				
1.2	1.170	1.230				
1.3	1.270	1.330				
1.4	1.370	1.430				
1.5	1.470	1.530				
1.6	1.568	1.632				
1.7	1.666	1.734				
1.8	1.764	1.836				
1.9	1.862	1.938				
2.0	1.960	2.040	0.6	1.7	0.5	1.60
2.1	2.058	2.142				
2.2	2.156	2.244				
2.3	2.254	2.346				
2.4	2.352	2.448				
2.5	2.450	2.550				
2.6	2.548	2.652				
2.7	2.646	2.754				
2.8	2.744	2.856	0.7	1.9	0.6	1.80
2.9	2.842	2.958				
3.0	2.940	3.060				
3.1	3.038	3.162				
3.2	3.136	3.264				
3.3	3.234	3.366				
3.4	3.332	3.468				
3.5	3.430	3.570				
3.6	3.528	3.672				
3.7	3.626	3.774				
3.8	3.724	3.876				
3.9	3.822	3.978				
4.0	3.920	4.080				
4.1	4.018	4.182				
4.2	4.116	4.284				
4.3	4.214	4.386				
4.4	4.312	4.488				
4.5	4.410	4.590				
4.6	4.508	4.692				
4.7	4.606	4.794				
4.8	4.704	4.896				
4.9	4.802	4.998				
5.0	4.900	5.100				

## TEST CIRCUITS

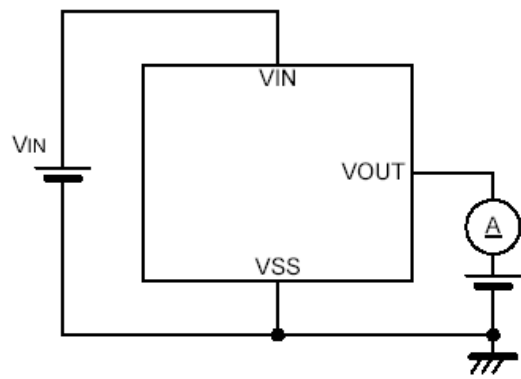
Circuit 1



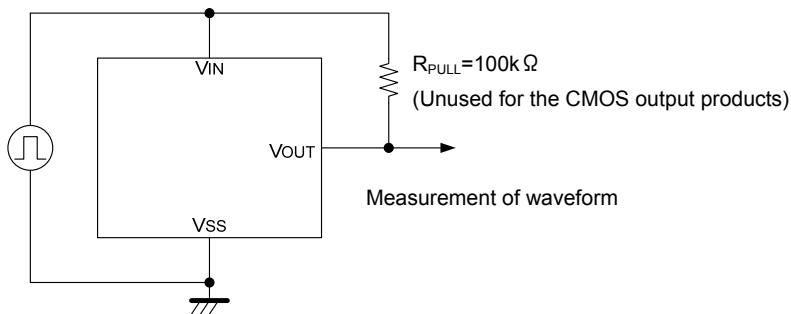
Circuit 2



Circuit 3



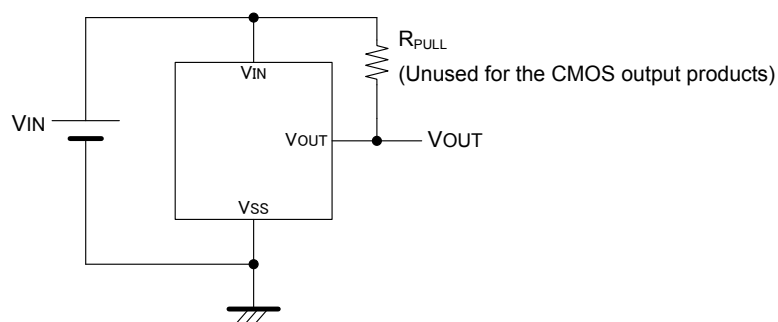
Circuit 4



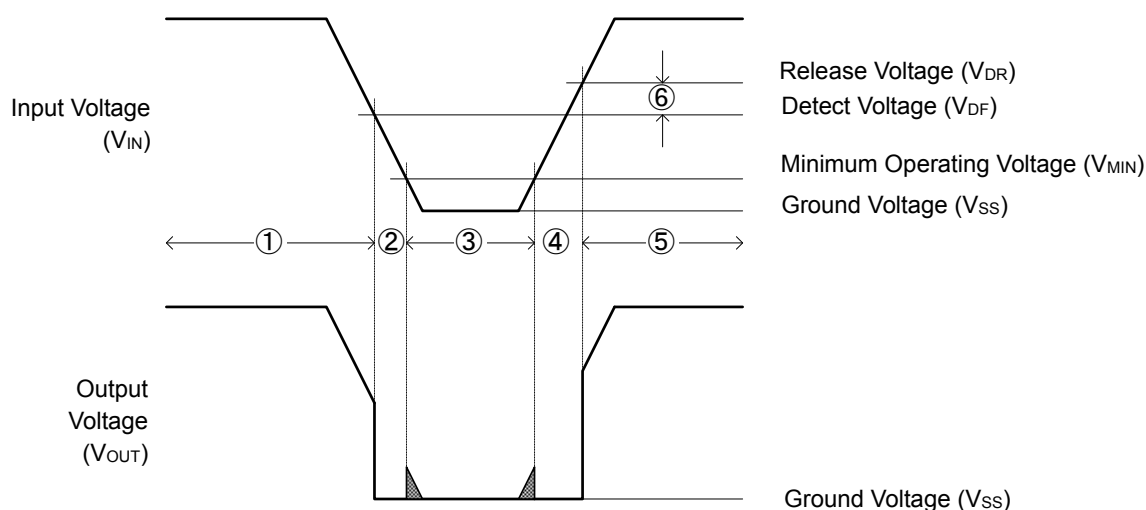


## OPERATIONAL EXPLANATION

### ● Typical Application Circuit



### ● Timing Chart



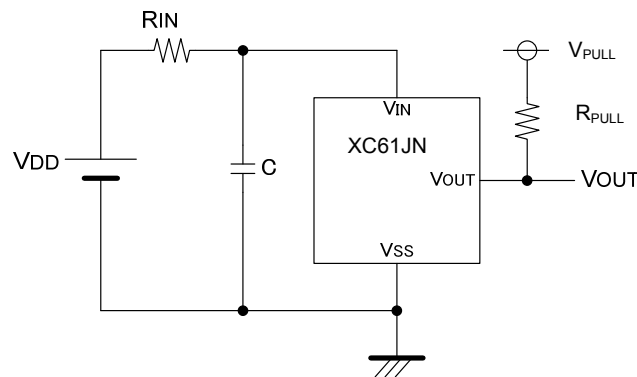
Note: The above timing chart omits the  $t_{DF}$  and  $t_{DR}$ .

The following explains the operation of the typical application circuit along number symbols shown in the timing chart.

- ① When input voltage ( $V_{IN}$ ) is higher than detect voltage ( $V_{DF}$ ), output voltage ( $V_{OUT}$ ) will be equal to input voltage ( $V_{IN}$ ). (A condition of high impedance exists with N-ch open drain output configurations.)
- ② When input voltage ( $V_{IN}$ ) falls below detect voltage ( $V_{DF}$ ), output voltage ( $V_{OUT}$ ) will be equal to the ground voltage ( $V_{SS}$ ) level.
- ③ When input voltage ( $V_{IN}$ ) falls to a level below that of the minimum operating voltage ( $V_{MIN}$ ), output will become unstable. If in this condition,  $V_{IN}$  will equal the pulled-up output (should output be pulled-up.) (Input voltage,  $V_{IN}$ , in the typical application circuit.)
- ④ When input voltage ( $V_{IN}$ ) rises above the minimum operating voltage ( $V_{MIN}$ ) level until it achieves a release voltage ( $V_{DR}$ ), output keeps the ground voltage level ( $V_{SS}$ ).
- ⑤ When the input voltage ( $V_{IN}$ ) rises above the release voltage ( $V_{DR}$ ), output voltage ( $V_{OUT}$ ) will be equal to input voltage ( $V_{IN}$ ). (A condition of high impedance exists with N-ch open drain output configurations.)
- ⑥ The difference between  $V_{DR}$  and  $V_{DF}$  represents the hysteresis width.

## NOTE ON USE

1. Please use this IC within the stated maximum ratings. For temporary, transitional voltage drop or voltage rising phenomenon, the IC is liable to malfunction should the ratings be exceeded.
2. In order to stabilize the IC's operations, please ensure that  $V_{IN}$  pin's input frequency's rise and fall times are more than several  $\mu s / V$ .
3. With a resistor connected between the  $V_{IN}$  pin and the power supply  $V_{DD}$  some errors may be observed from the input voltage at the detect and release voltage. Those errors are not constant because of the fluctuation of the supply current.
4. When a resistor is connected between the  $V_{IN}$  pin and the power supply  $V_{DD}$ , oscillation may occur as a result of through current and voltage drop at the  $R_{IN}$  at the time of voltage release. (refer to the Oscillation Description (1) below ) Especially in the CMOS output configurations, oscillation may occur regardless of detect/release operation if load current ( $I_{OUT}$ ) exists. (refer to the Oscillation Description (2) below)
5. Please use N-ch open drains configuration, when a resistor  $R_{IN}$  is connected between the  $V_{IN}$  pin and the power supply  $V_{DD}$  power source. In such cases, please ensure that  $R_{IN}$  is less than  $10k\Omega$  and that  $C$  is more than  $0.1 \mu F$ .
6. Torex places an importance on improving our products and its reliability. However, by any possibility, we would request user fail-safe design and post-aging treatment on system or equipment.



[Figure 1: Circuit connected with the input resistor]

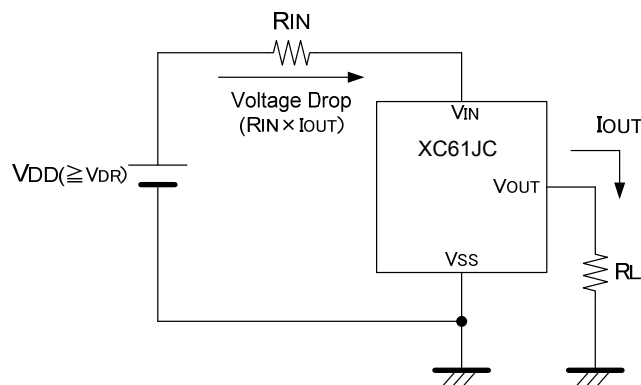
### ● Oscillation Description

#### (1) Oscillation as a result of through current

Since the XC61J series are CMOS ICs, transient through current will flow when the IC's internal circuit switching operates regardless of output configuration. Consequently, oscillation is liable to occur as a result of the similar operations as in (1) above. This oscillation does not occur during the detect operation.

#### (2) Output current oscillation with the CMOS output configuration

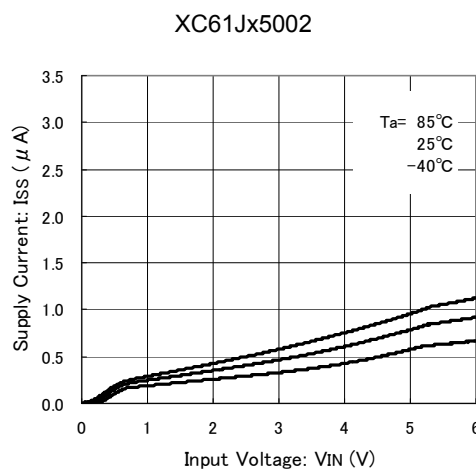
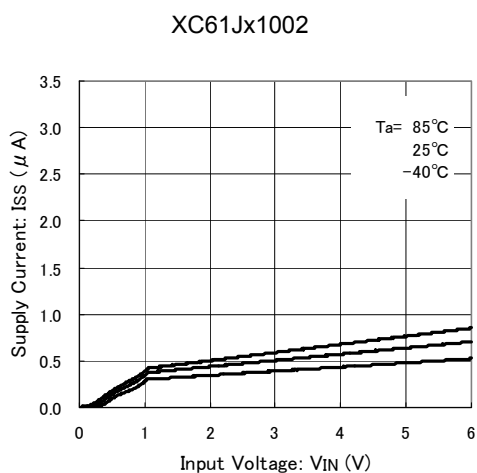
As shown in figure 2, when the voltage applied at the power supply ( $V_{DD}$ ) rises from below detect voltage to above release voltage, the IC commence release operations and the internal P-ch driver transistor will be on. The output current ( $I_{OUT}$ ) flows the input resistor ( $R_{IN}$ ) via the P-ch driver transistor. Because of the input resistor ( $R_{IN}$ ) and the output current ( $I_{OUT}$ ), an input pin voltage drops  $R_{IN} \times I_{OUT}$ . If the voltage drop level is larger than the IC's hysteresis width ( $V_{HYS}$ ), the input pin voltage will fall below the  $V_{DF}$  and detect operations will commence so that the internal P-ch driver transistor will be off. The voltage drop will stop because the output current ( $I_{OUT}$ ) which was flowing the P-ch driver transistor will run down. The input pin voltage will become the same voltage level as the input voltage ( $V_{IN}$ ). For this, the input pin voltage will rise above the release voltage ( $V_{DR}$ ), therefore, the release operations will begin over again. Oscillation may occur with this repetition. Further, this condition will also appear via means of a similar mechanism during detect operations.



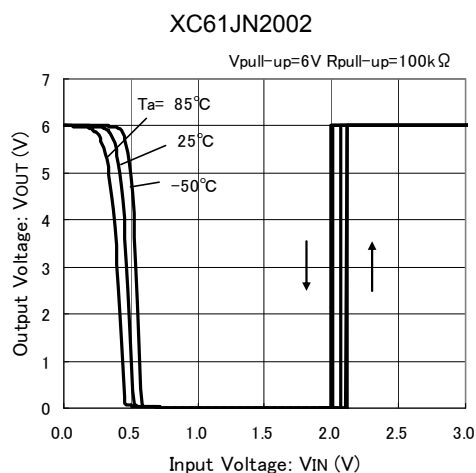
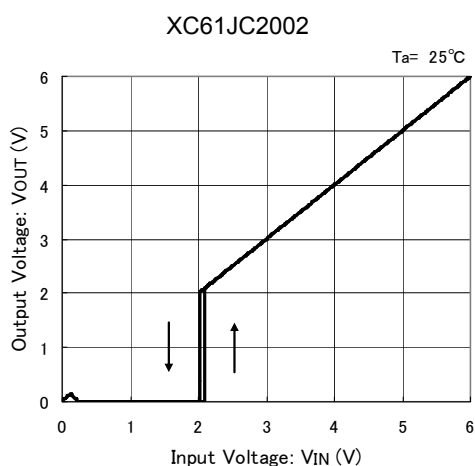
[Figure 2: Oscillation caused by the input resistor of the CMOS output product and the output current]

## ■ TYPICAL PERFORMANCE CHARACTERISTICS

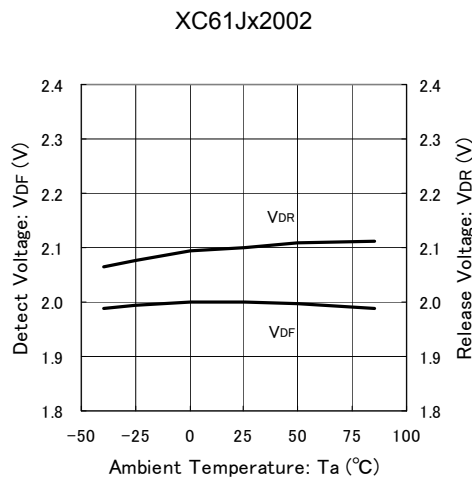
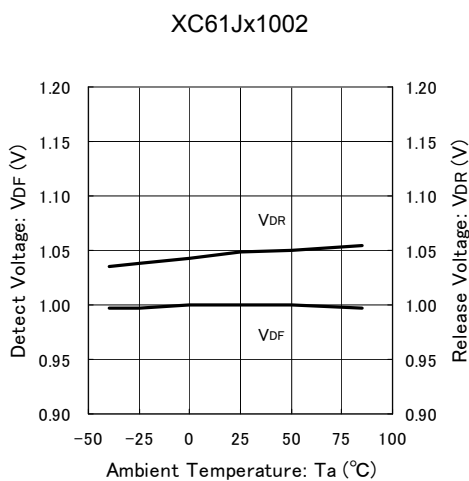
### (1) Supply Current vs. Input Voltage



### (2) Output Voltage vs. Input Voltage

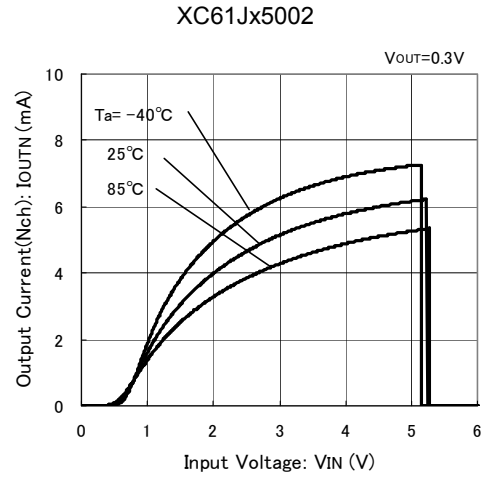
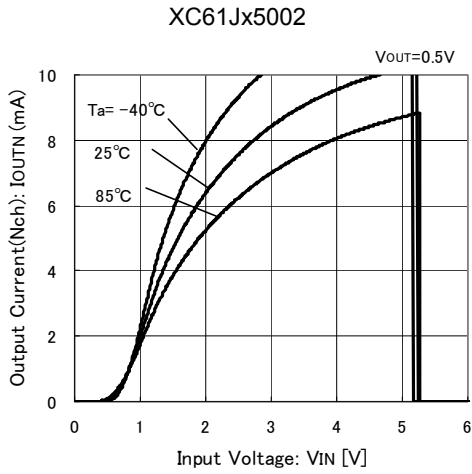


### (3) Detect Voltage, Release Voltage vs. Ambient Temperature

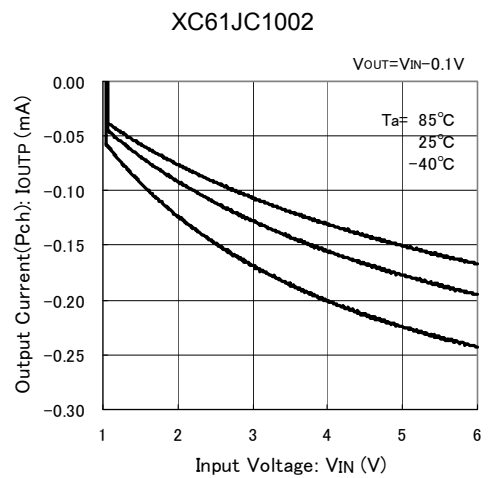
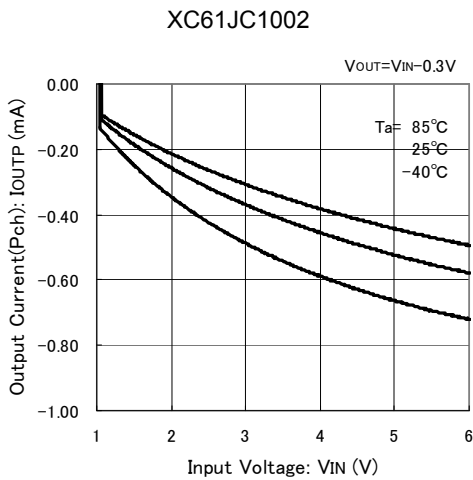
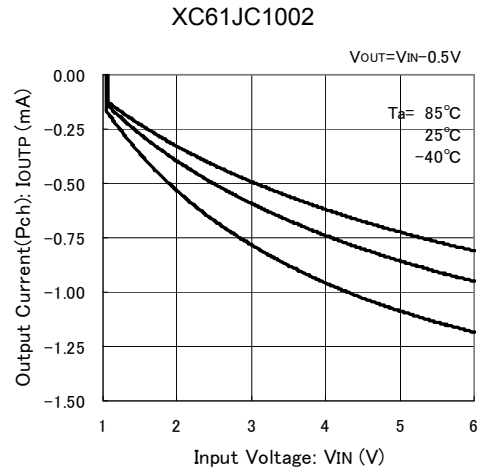
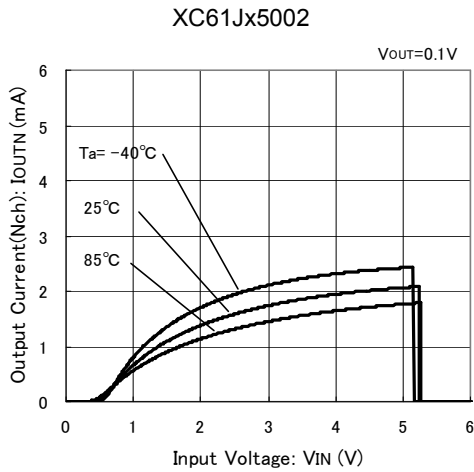


## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(4) Output Current (Nch Driver) vs. Input Voltage

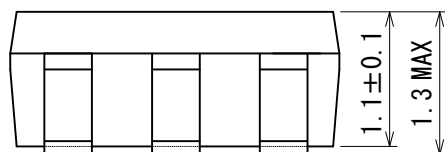
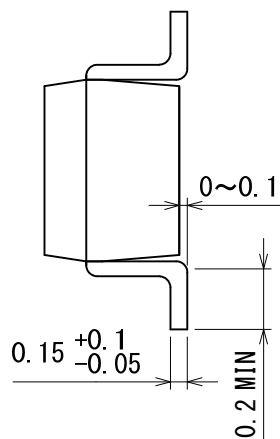
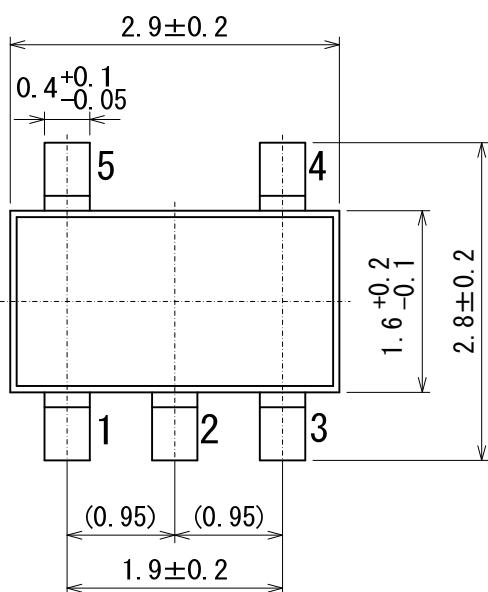


(5) Output Current (Pch Driver) vs. Input Voltage



■ **PACKAGING INFORMATION**

● SOT-25-03 (unit: mm)



## MARKING RULE

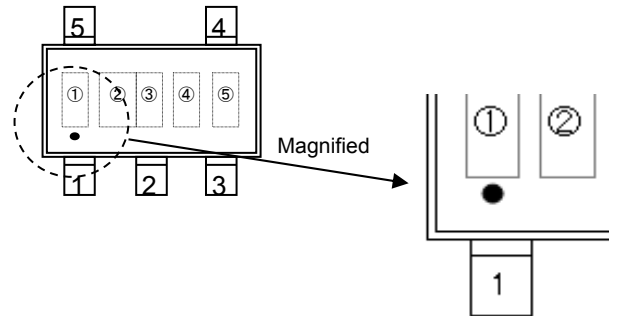
### ● SOT-25-03

① represents product series

MARK	PRODUCT SERIES
H	XC61J*****-G

\* SOT-25-03 with the under-dot marking is used.

SOT-25-03 (Under dot)



② represents output configuration

MARK	DESCRIPTION	DETECT VOLTAGE RANGE (V)	PRODUCT SERIES
C	CMOS output	1.0~3.9	XC61JC*****-G
D		4.0~5.0	
N	N-ch open drain output	1.0~3.9	XC61JN*****-G
P		4.0~5.0	

③ represents detect voltage

MARK	VOLTAGE (V)	MARK	VOLTAGE (V)	MARK	VOLTAGE (V)	MARK	VOLTAGE (V)
0	1.0	A	2.0	N	3.0	0	4.0
1	1.1	B	2.1	P	3.1	1	4.1
2	1.2	C	2.2	R	3.2	2	4.2
3	1.3	D	2.3	S	3.3	3	4.3
4	1.4	E	2.4	T	3.4	4	4.4
5	1.5	F	2.5	U	3.5	5	4.5
6	1.6	H	2.6	V	3.6	6	4.6
7	1.7	N	2.7	X	3.7	7	4.7
8	1.8	L	2.8	Y	3.8	8	4.8
9	1.9	M	2.9	Z	3.9	9	4.9
						A	5.0

④⑤ represents production lot number. 01~09, 0A~0Z, 11~9Z, A1~A9, AA~AZ, B1~ZZ repeated.

(G, I, J, O, Q, W excluded.)

\* No character inversion used.

1. The product and product specifications contained herein are subject to change without notice to improve performance characteristics. Consult us, or our representatives before use, to confirm that the information in this datasheet is up to date.
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