

Low Voltage Detectors ($V_{DF} = 0.8V \sim 1.5V$)
 Standard Voltage Detectors ($V_{DF} 1.6V \sim 6.0V$)

■ GENERAL DESCRIPTION

The XC61G series are highly precise, low power consumption voltage detectors, manufactured using CMOS and laser trimming technologies.

Detect voltage is extremely accurate with minimal temperature drift.

Both CMOS and N-ch open drain output configurations are available.

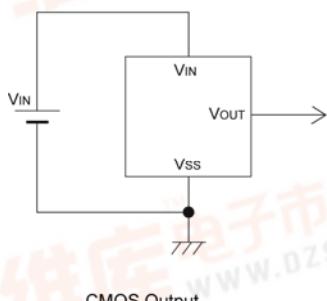
■ APPLICATIONS

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

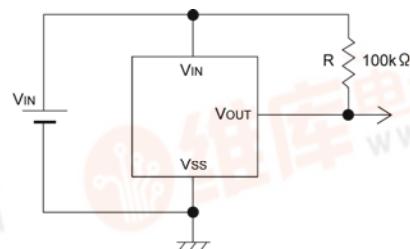
■ FEATURES

- Highly Accurate** : $\pm 2\%$
- Low Power Consumption** : $0.7 \mu A$ [$V_{IN}=1.5V$] (TYP.)
- Detect Voltage Range** : $0.8V \sim 1.5V$ in 0.1V increments (Low Voltage)
 $1.6V \sim 6.0V$ in 0.1V increments (Standard Voltage)
- Operating Voltage Range** : $0.7V \sim 6.0V$ (Low Voltage)
 $0.7V \sim 10.0V$ (Standard Voltage)
- Detect Voltage Temperature characteristics** : $\pm 100ppm/{^\circ}C$ (TYP.)
- Output Configuration** : N-ch open drain output or CMOS
- CMOS**
- Package** : USP-3
- Environmentally Friendly**: EU RoHS Compliant, Pb Free

■ TYPICAL APPLICATION CIRCUITS

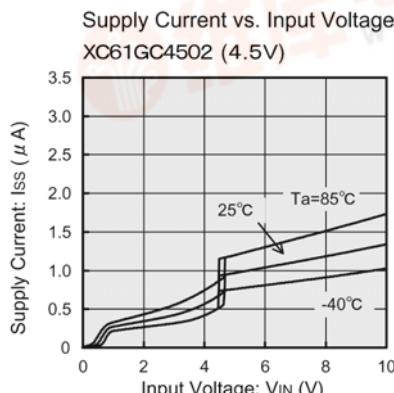
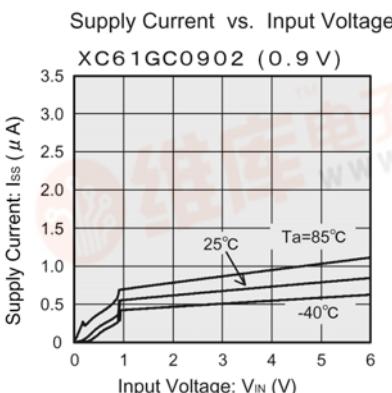


CMOS Output

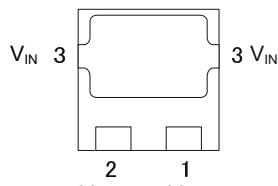


N-ch Open Drain Output

■ TYPICAL PERFORMANCE CHARACTERISTICS



■PIN CONFIGURATION



(BOTTOM VIEW)

■PIN ASSIGNMENT

PIN NUMBER	PIN NAME	FUNCTION
USP-3		
3	VIN	Supply Voltage
1	Vss	Ground
2	VOUT	Output

■PRODUCT CLASSIFICATION

● Ordering Information

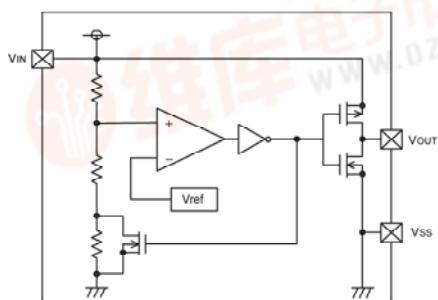
XC61G ①②③④⑤⑥⑦-⑧^(*)

DESIGNATOR	ITEM	SYMBOL	DESCRIPTION
①	Output Configuration	C	CMOS output
		N	N-ch open drain output
②③	Detect Voltage	08 ~ 60	e.g. 0.8V → ②0, ③8
			e.g. 1.5V → ②1, ③5
④	Output Delay	0	No delay
⑤	Detect Accuracy	2	Within $\pm 2\%$
⑥⑦-⑧	Packages (Order Unit)	HR	USP-3 (3,000/Reel)
		HR-G	USP-3 (3,000/Reel)

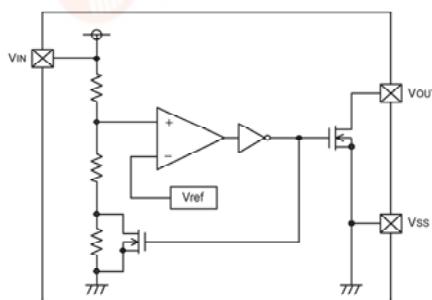
(*) The "-G" suffix indicates that the products are Halogen and Antimony free as well as being fully RoHS compliant.

■BLOCK DIAGRAMS

(1) CMOS Output



(2) N-ch Open Drain Output



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■ ABSOLUTE MAXIMUM RATINGS

Ta = 25°C

PARAMETER		SYMBOL	RATINGS		UNITS		
Input Voltage		VIN	V _{SS} -0.3 ~ 9.0		V		
			V _{SS} -0.3 ~ 12.0				
Output Current		I _{OUT}	50		mA		
			50				
Output Voltage	CMOS	V _{OUT}	V _{SS} -0.3 ~ V _{IN} +0.3		V		
	N-ch Open Drain Output *1		V _{SS} -0.3 ~ 9.0				
	N-ch Open Drain Output *2		V _{SS} -0.3 ~ 12.0				
Power Dissipation	USP-3	P _d	120		mW		
Operating Temperature Range		T _{OPR}	-40~+85		°C		
Storage Temperature Range		T _{STG}	-40~+125		°C		

■ ELECTRICAL CHARACTERISTICS

V_{DF}(T) = 0.8 to 6.0V ± 2%

Ta=25°C

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUITS	
Detect Voltage	V _{DF}		V _{DF} x 0.98	V _{DF}	V _{DF} x 1.02	V	1	
Hysteresis Range	V _{HYS}		V _{DF} x 0.02	V _{DF} x 0.05	V _{DF} x 0.08	V	1	
Supply Current	I _{SS}	V _{IN} = 1.5V	-	0.7	2.3	μA	2	
		V _{IN} = 2.0V	-	0.8	2.7			
		V _{IN} = 3.0V	-	0.9	3.0			
		V _{IN} = 4.0V	-	1.0	3.2			
		V _{IN} = 5.0V	-	1.1	3.6			
Operating Voltage	V _{IN}	V _{DF} (T) = 0.8V to 1.5V	0.7	-	6.0	V	1	
		V _{DF} (T) = 1.6V to 6.0V	0.7	-	10.0			
Output Current (Low Voltage)	I _{OUT}	N-ch, V _{DS} = 0.5V V _{IN} = 0.7V	0.10	0.80	-	mA	3	
		V _{IN} = 1.0V	0.85	2.70	-			
Output Current (Standard Voltage)		CMOS, P-ch, V _{DS} =2.1V V _{IN} = 6.0V	-	-7.5	-1.5		4	
		V _{IN} = 1.0V	1.0	2.2	-			
		V _{IN} = 2.0V	3.0	7.7	-			
		N-ch, V _{DS} = 0.5V V _{IN} = 3.0V	5.0	10.1	-		3	
		V _{IN} = 4.0V	6.0	11.5	-			
		V _{IN} = 5.0V	7.0	13.0	-			
		CMOS, P-ch, V _{DS} =2.1V V _{IN} = 8.0V	-	-10.0	-2.0		4	
Leakage Current	CMOS	I _{LEAK}	V _{IN} =6.0V, V _{OUT} =6.0V ^{*1} V _{IN} =10.0V, V _{OUT} =10.0V ^{*2}	-	10	-	nA	3
	N-ch Open Drain			-	10	100		
Temperature Characteristics	ΔV _{DF} / (ΔT _{OPR} ·V _{DF})	-40°C ≤ T _{OPR} ≤ 85°C	-	±100	-	ppm/ °C	1	
Delay Time (V _{DR} → V _{OUT} inversion)	t _{DLY}	V _{DR} →V _{OUT} inversion	-	0.03	0.2	ms	5	

NOTE:

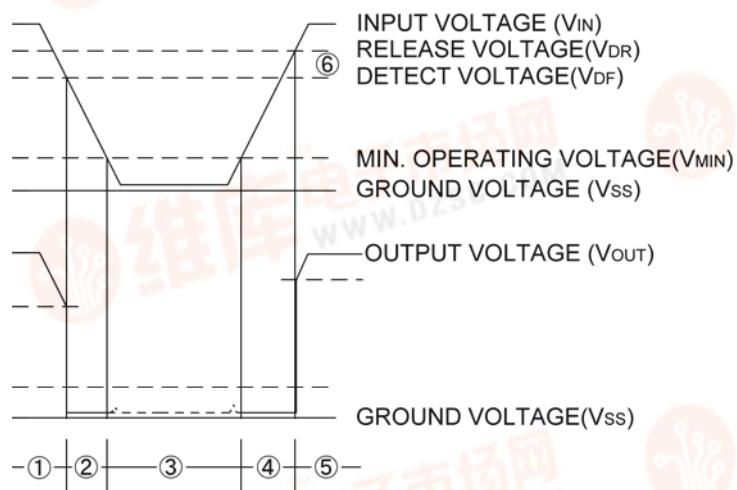
V_{DF}(T): Nominal detect voltageRelease Voltage: V_{DR} = V_{DF} + V_{HYS}

■ OPERATIONAL EXPLANATION

● CMOS output

- ① When input voltage (V_{IN}) rises above detect voltage (V_{DF}), output voltage (V_{OUT}) will be equal to 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. (As for the N-ch open drain product of XC61CN, the pull-up voltage goes out at the output voltage.)
- ④ When input voltage (V_{IN}) rises above the ground voltage (V_{SS}) level, output will be unstable at levels below the minimum operating voltage (V_{MIN}). Between the V_{MIN} and detect release voltage (V_{DR}) levels, the ground voltage (V_{SS}) level will be maintained.
- ⑤ When input voltage (V_{IN}) rises above detect release voltage (V_{DR}), output voltage (V_{OUT}) will be equal to 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 range.

● Timing Chart



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■ NOTES ON USE

1. Please use this IC within the stated absolute maximum ratings. For temporary, transitional voltage drop or voltage rising phenomenon, the IC is liable to malfunction should the ratings be exceeded.
2. When a resistor is connected between the V_{IN} pin and the power supply with CMOS output configurations, oscillation may occur as a result of voltage drops at R_{IN} if load current (I_{OUT}) exists. (refer to the Oscillation Description (1) below)
3. When a resistor is connected between the V_{IN} pin and the power supply with CMOS output configurations, irrespective of N-ch open-drain output configurations, oscillation may occur as a result of through current at the time of voltage release even if load current (I_{OUT}) does not exist. (refer to the Oscillation Description (2) below)
4. Please use N-ch open drain output configuration, when a resistor R_{IN} is connected between the V_{IN} pin and power source. In such cases, please ensure that R_{IN} is less than $10k\Omega$ and that C is more than $0.1\mu F$, please test with the actual device. (refer to the Oscillation Description (1) below)
5. With a resistor R_{IN} connected between the V_{IN} pin and the power supply, the V_{IN} pin voltage will be getting lower than the power supply voltage as a result of the IC's supply current flowing through the V_{IN} pin.
6. In order to stabilize the IC's operations, please ensure that V_{IN} pin input frequency's rise and fall times are more than $2\mu s/V$.
7. 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.

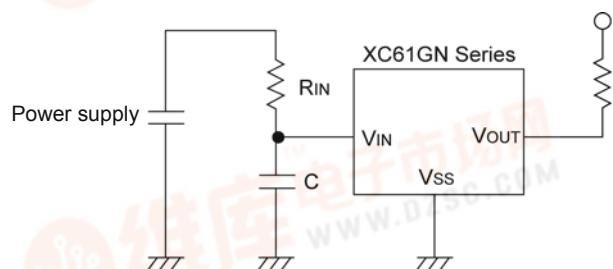


Figure 1: Circuit using an input resistor

● Oscillation Description

(1) Load current oscillation with the CMOS output configuration

When the voltage applied at power supply, release operations commence and the detector's output voltage increases. Load current (I_{OUT}) will flow at R_L . Because a voltage drop ($R_{IN} \times I_{OUT}$) is produced at the R_{IN} resistor, located between the power supply and the V_{IN} pin, the load current will flow via the IC's V_{IN} pin. The voltage drop will also lead to a fall in the voltage level at the V_{IN} pin. When the V_{IN} pin voltage level falls below the detect voltage level, detect operations will commence. Following detect operations, load current flow will cease and since voltage drop at R_{IN} will disappear, the voltage level at the V_{IN} pin will rise and release operations will begin over again.

Oscillation may occur with this "release - detect - release" repetition.

Further, this condition will also appear via means of a similar mechanism during detect operations.

(2) Oscillation as a result of through current

Since the XC61G series are CMOS IC's, through current will flow when the IC's internal circuit switching operates (during release and detect operations). Consequently, oscillation is liable to occur as a result of drops in voltage at the through current's resistor (R_{IN}) during release voltage operations. (refer to Figure 3)

Since hysteresis exists during detect operations, oscillation is unlikely to occur.

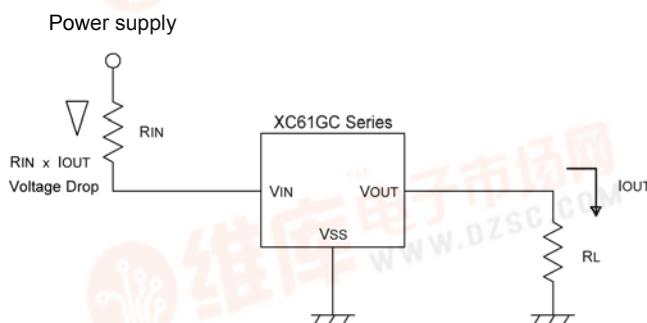


Figure 2: Oscillation in relation to output current

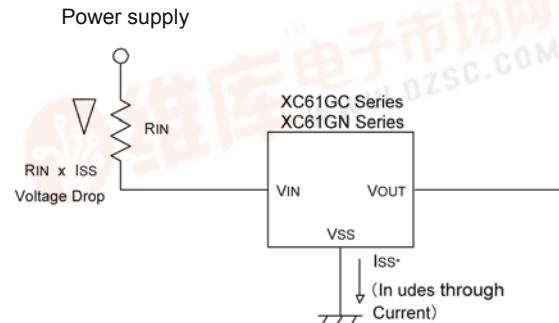
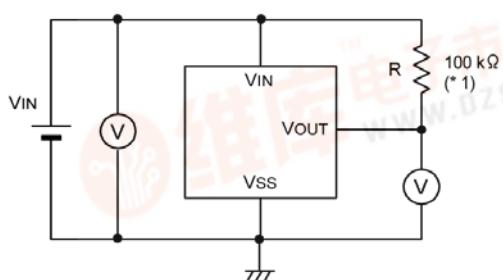


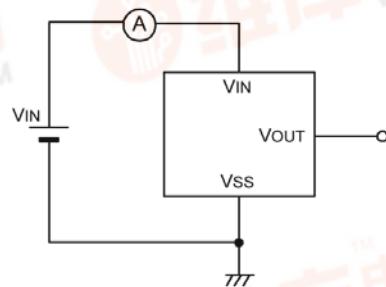
Figure 3: Oscillation in relation to through current

■ TEST CIRCUITS

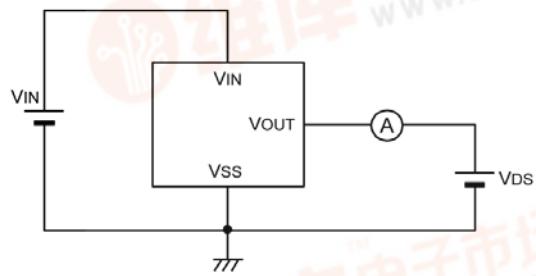
Circuit 1



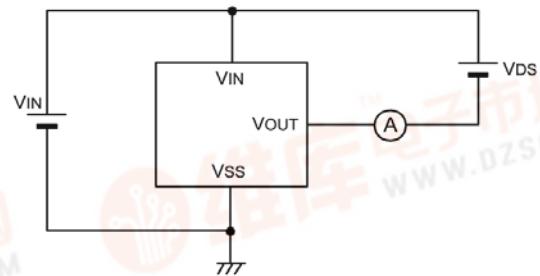
Circuit 2



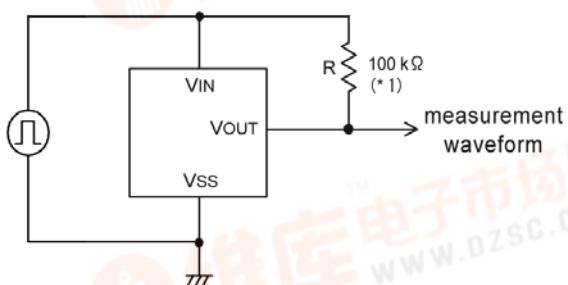
Circuit 3



Circuit 4



Circuit 5



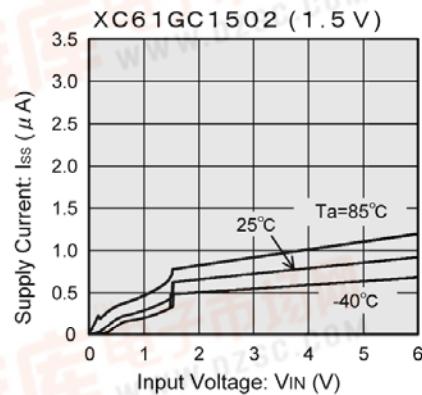
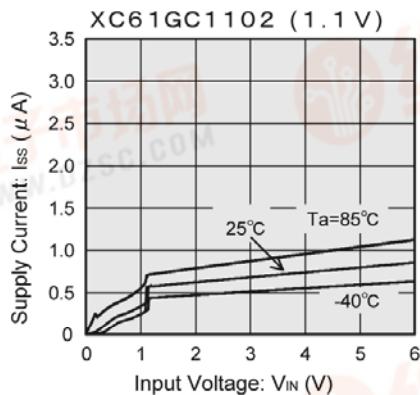
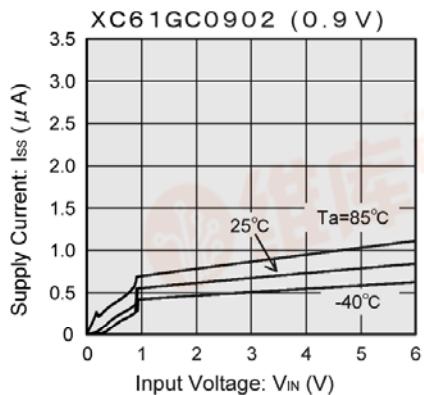
* 1 : The resistor is not necessary with CMOS output products.

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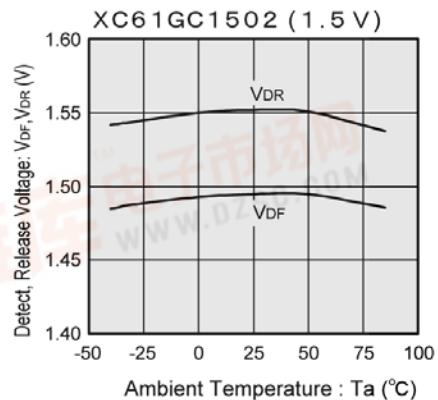
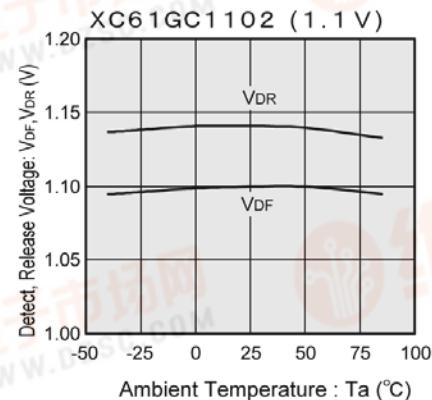
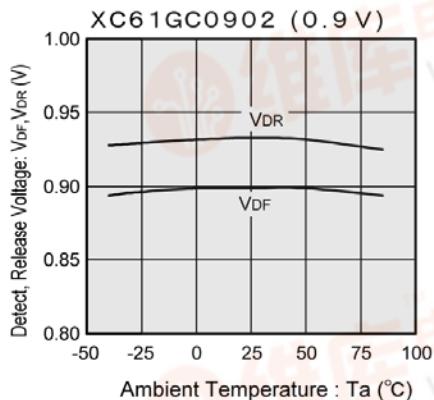
■ TYPICAL PERFORMANCE CHARACTERISTICS

● Low Voltage

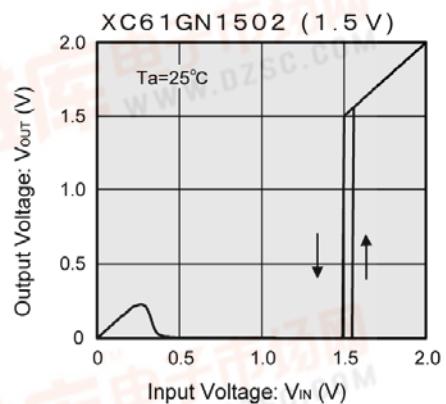
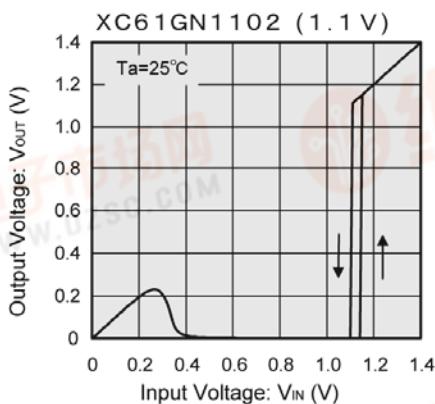
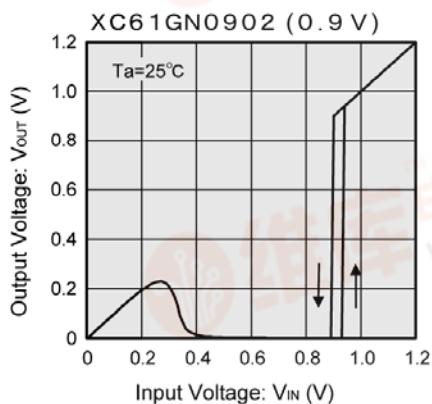
(1) Supply Current vs. Input Voltage



(2) Detect, Release Voltage vs. Ambient Temperature



(3) Output Voltage vs. Input Voltage

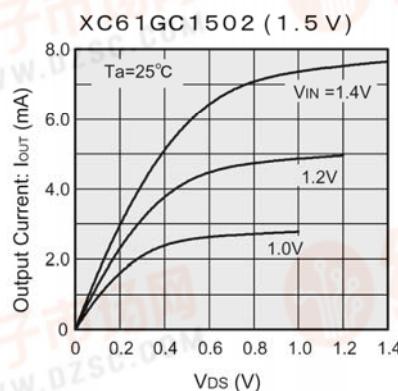
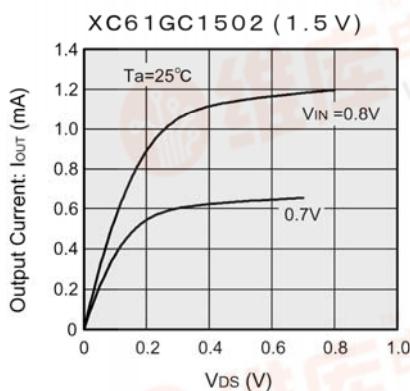
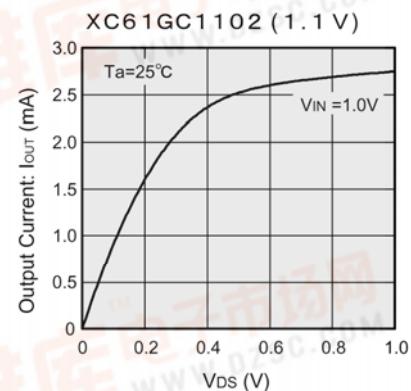
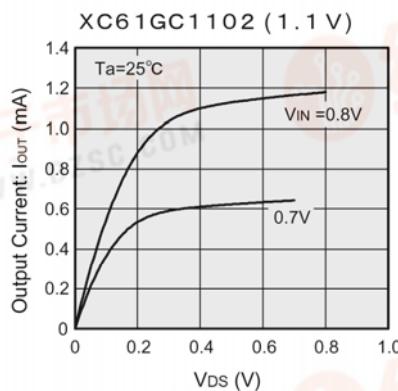
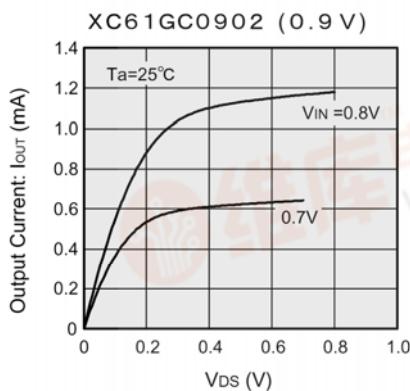


Note: Unless otherwise stated, the N-ch open drain pull-up resistance value is 100k Ω .

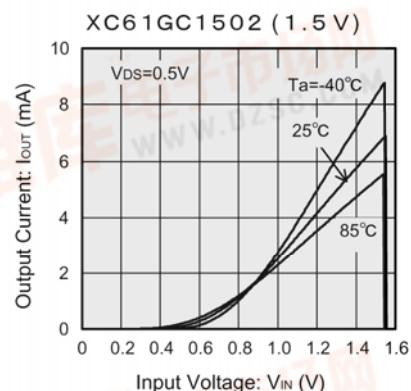
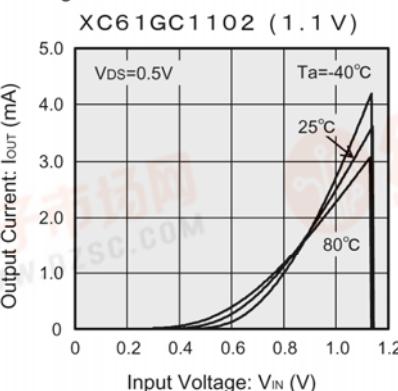
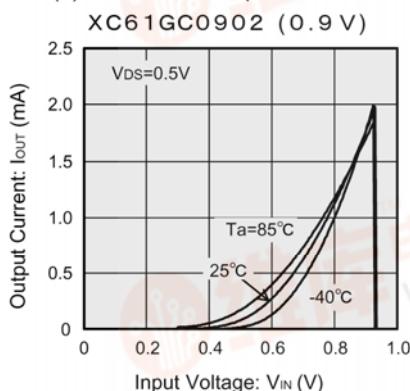
■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

● Low Voltage (Continued)

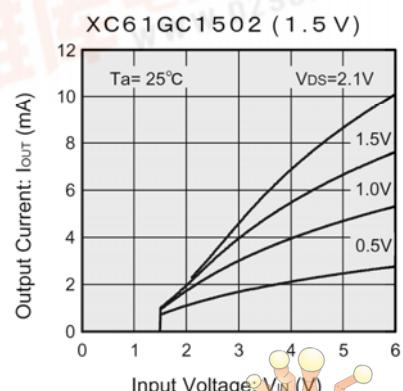
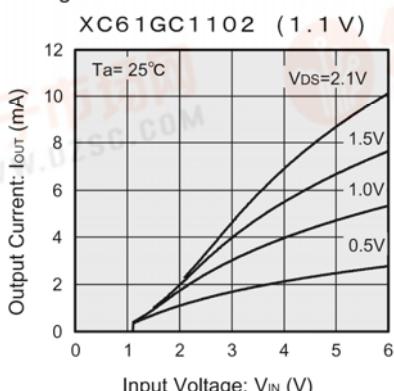
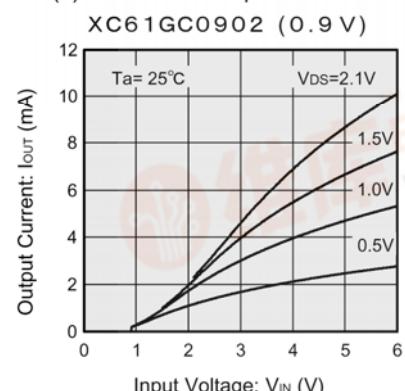
(4) N-ch Driver Output Current vs. V_{DS}



(5) N-ch Driver Output Current vs. Input Voltage



(6) P-ch Driver Output Current vs. Input Voltage

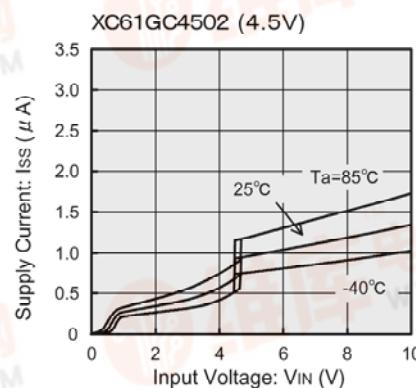
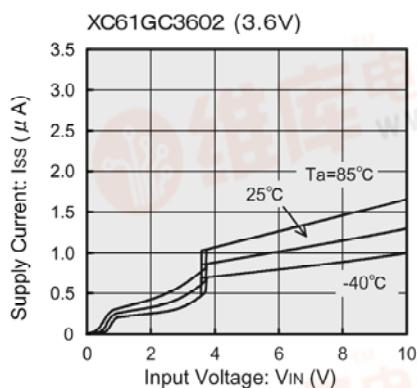
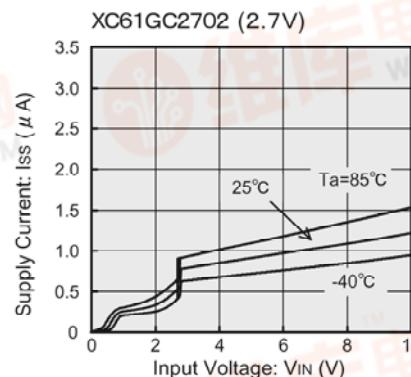
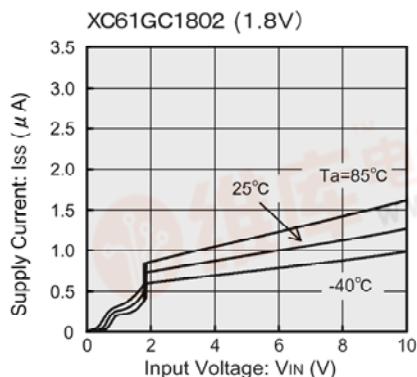


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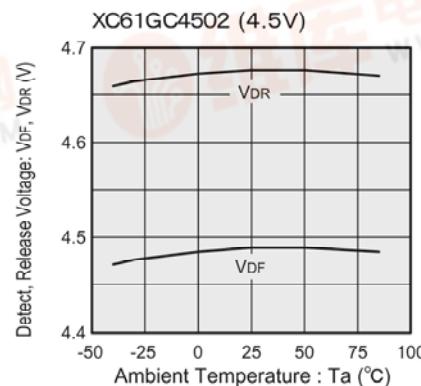
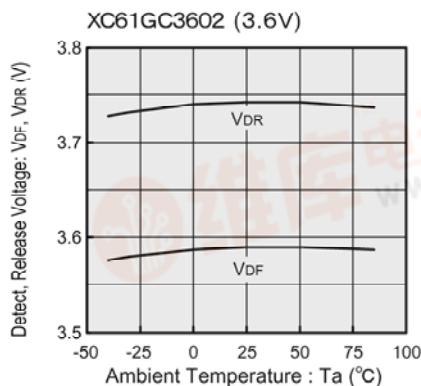
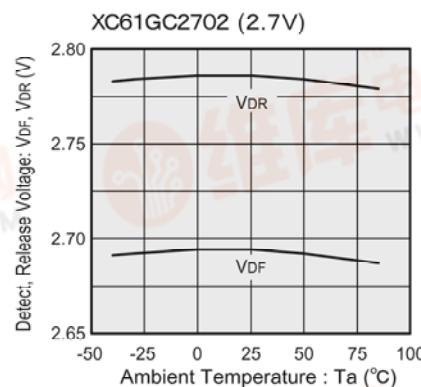
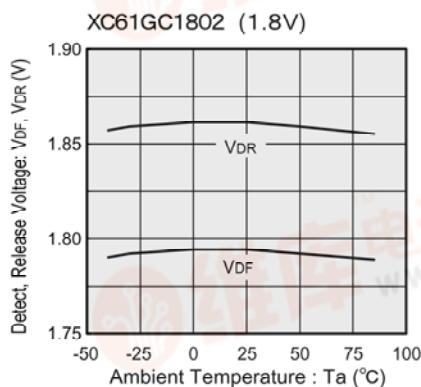
■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

● Standard Voltage

(1) Supply Current vs. Input Voltage



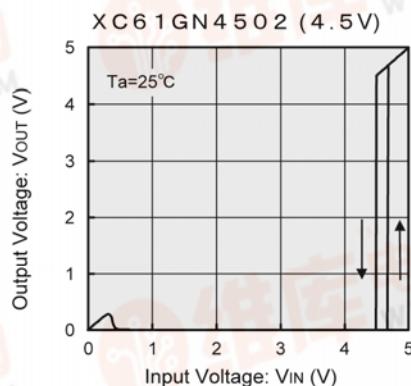
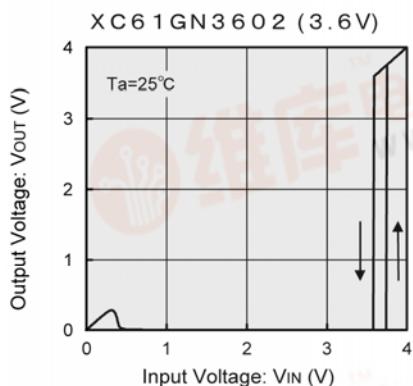
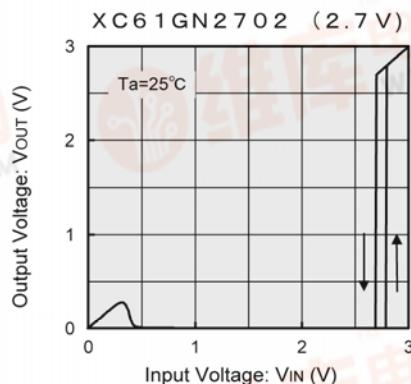
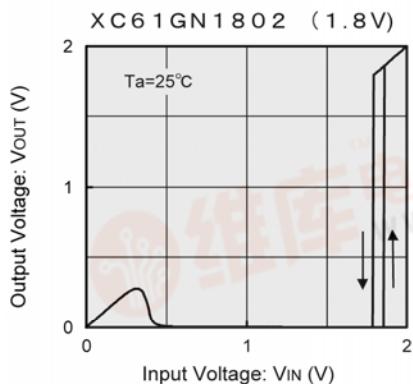
(2) Detect, Release Voltage vs. Ambient Temperature



■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

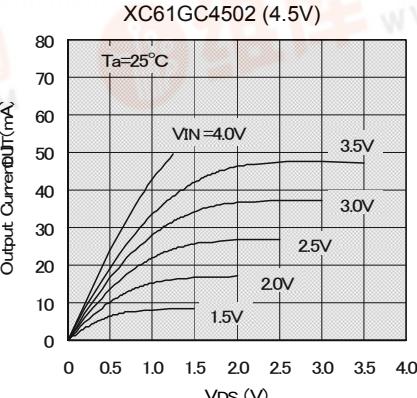
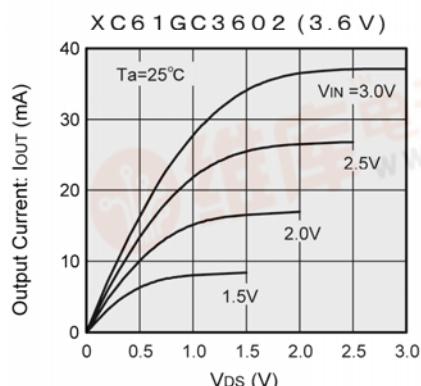
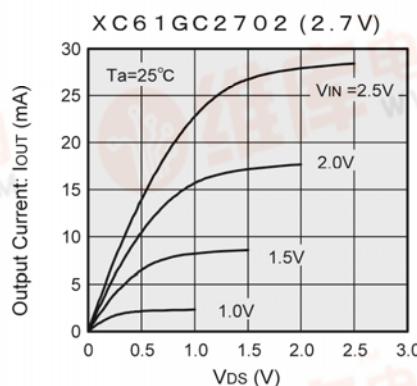
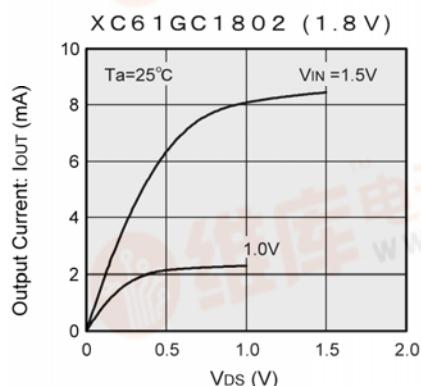
● Standard Voltage (Continued)

(3) Output Voltage vs. Input Voltage



Note: Unless otherwise stated, the N-ch open drain pull-up resistance value is 100kΩ.

(4) N-ch Driver Output Current vs. V_{DS}

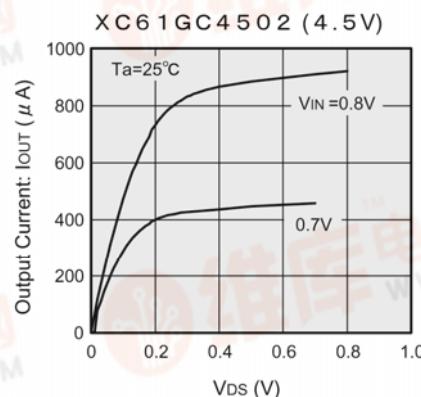
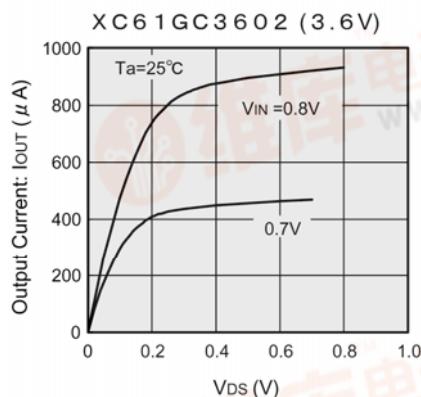
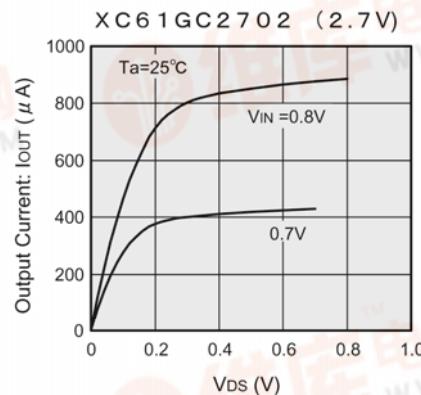
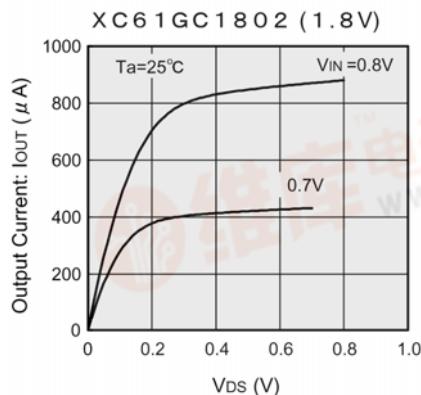


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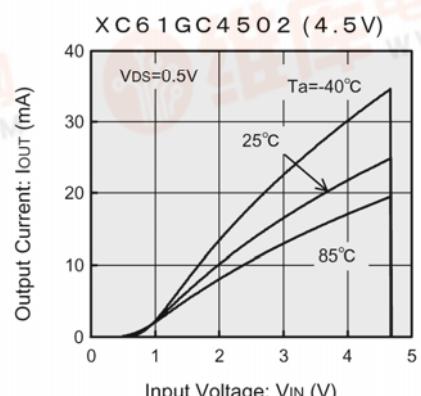
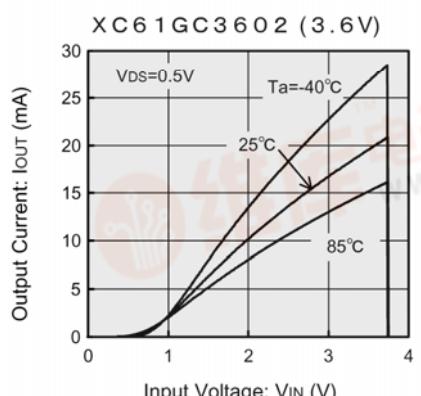
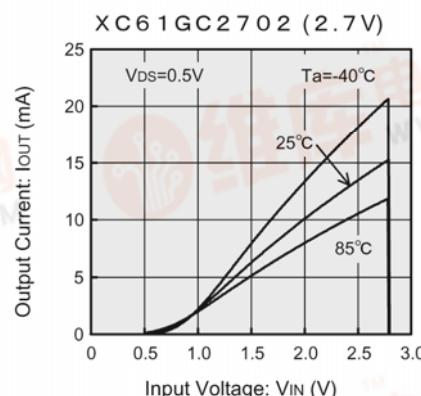
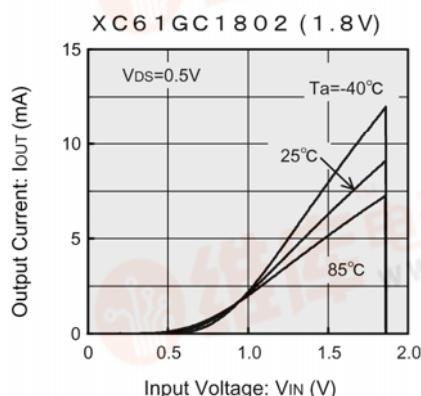
■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

● Standard Voltage (Continued)

(4) N-ch Driver Output Current vs. V_{DS}



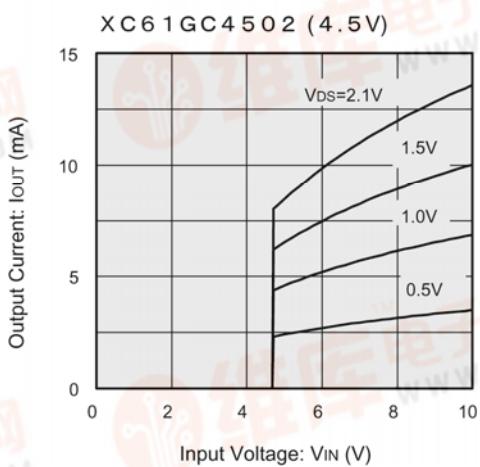
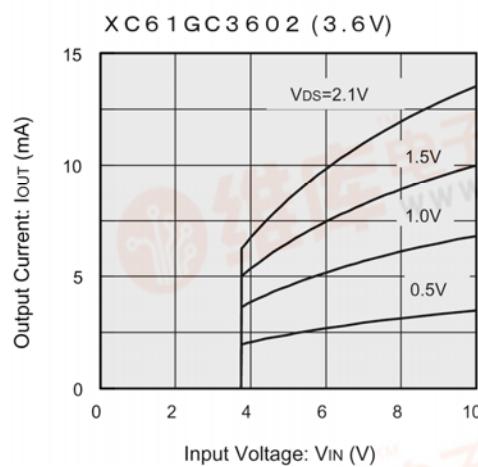
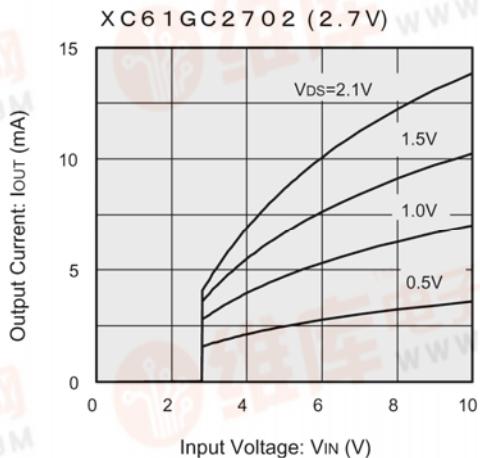
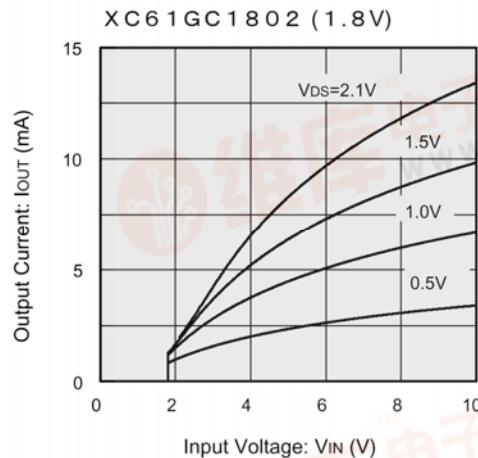
(5) N-ch Driver Output Current vs. Input Voltage



■ TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

● Standard Voltage (Continued)

(6) P-ch Driver Output Current vs. Input Voltage

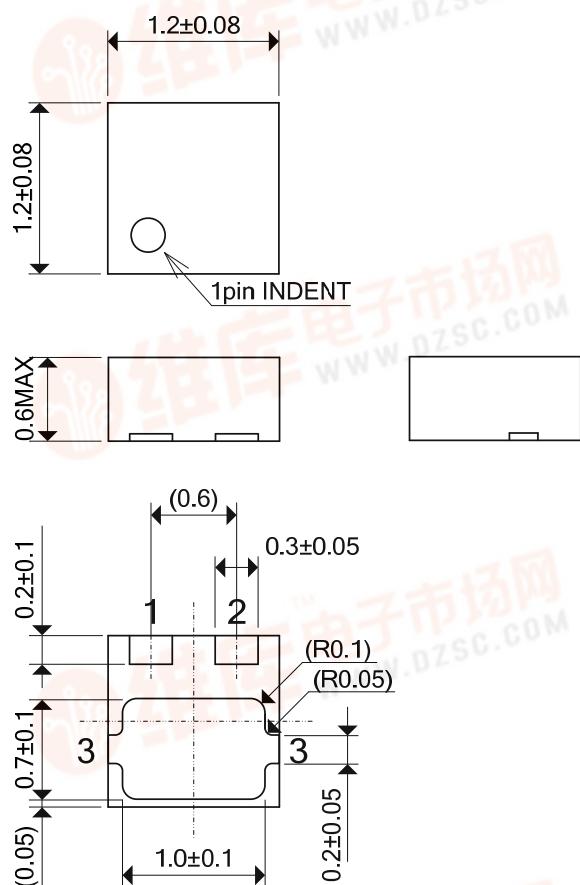


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■PACKAGING INFORMATION

●USP-3

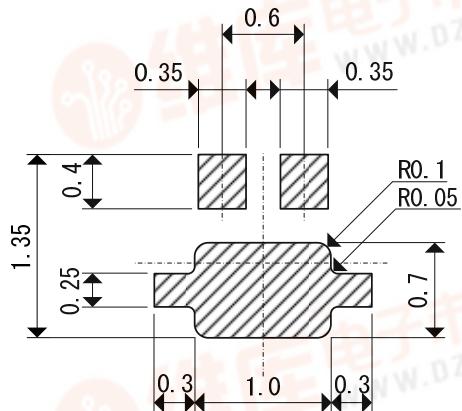
(unit : mm)



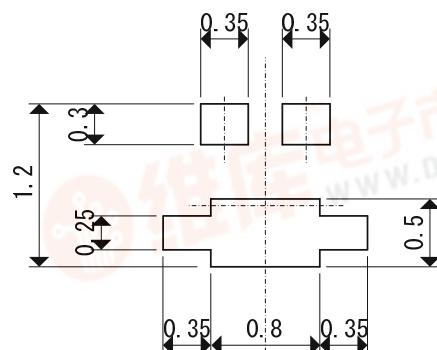
■PACKAGING INFORMATION (Continued)

● USP-3

Reference Pattern Layout Dimension



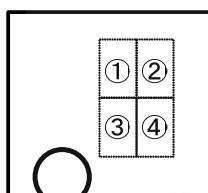
Reference metal mask design



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■ MARKING RULE

● USP-3

USP-3
(TOP VIEW)

① represents integer of output voltage and detect voltage
CMOS Output (XC61GC series)

MARK	CONFIGURATION	VOLTAGE (V)
A	CMOS	0.x
B	CMOS	1.x
C	CMOS	2.x
D	CMOS	3.x
E	CMOS	4.x
F	CMOS	5.x
G	CMOS	6.x

N-ch Open Drain Output (XC61GN series)

MARK	CONFIGURATION	VOLTAGE (V)
K	N-ch	0.x
L	N-ch	1.x
M	N-ch	2.x
N	N-ch	3.x
P	N-ch	5.x
R	N-ch	6.x
S	N-ch	7.x

② represents decimal number of detect voltage

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

③ based on internal standards

MARK
3

④ represents production lot number

0 to 9, A to Z repeated (G, I, J, O, Q, W excluded)

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