Voltage Detector with Separated Sense Pin & Delay Capacitor Pin

■GENERAL DESCRIPTION

The XC6118 series is a low power consumption voltage detector with high accuracy detection, manufactured using CMOS process and laser trimming technologies.

Since the sense pin is separated from the power supply pin, it allows the IC to monitor the other power supply. The XC6118 can maintain the state of detection even when voltage of the monitored power supply drops to 0V. Moreover, a release delay time can be adjusted by the external capacitor connected to the Cd pin. The V_{OUT} pin is available in both CMOS and N-channel open drain output configurations.

■ APPLICATIONS

Microprocessor reset circuitry

- Charge voltage monitors
- Memory battery back-up switch circuits
- Power failure detection circuits

■FEATURES

High Accuracy

Low Power Consumption

Detect Voltage Range Operating Voltage Range Temperature Characteristics Output Configuration Pin Function

Operating Ambient Temperature: -40°C ~ 85°CPackages: USP-4, SOT-Environmentally Friendly: EU RoHS Cor

:±2% (Detect Voltage ≥ 1.5V) ±30mV(Detect Voltage < 1.5V) : 0.4 μ A TYP. (Detect, V_{IN}=1.0V) 0.8 μ A TYP. (Release, V_{IN}=1.0V) : 0.8V ~ 5.0V (0.1V increments) : 1.0V ~ 6.0V : ±100ppm/°C TYP. : CMOS, N-channel open drain : Power supply separation Release delay time adjustable : -40°C ~ 85°C : USP-4, SOT-25 : EU RoHS Compliant, Pb Free

TYPICAL APPLICATION CIRCUIT



Output Voltage vs. Sense Voltage



XC6118C25AGR



■ PIN CONFIGURATION





* In the XC6118xxxA/B series, the dissipation pad should not be short-circuited with other pins.

* In the XC6118xxxC/D series, when the dissipation pad is short-circuited with other pins, connect it to the NC pin (No.2) pin before use.

■ PIN ASSIGNMENT

PIN NU	JMBER	PIN NAME	FUNCTION
USP-4	SOT-25		FUNCTION
1	1	Vout	Output (Detect "L")
2	5	Cd	Delay Capacitance (*1)
2	5	NC	No Connection
3	4	VSEN	Sense
4	3	VIN	Input
5	2	Vss	Ground (*2)

NOTE:

*1: With the VSS pin of the USP-4 package, a tab on the backside is used as the pin No.5.

*2: In the case of selecting no built-in delay capacitance pin type, the delay capacitance (Cd) pin will be used as the NC.

■PRODUCT CLASSIFICATION

Ordering Information

XC6118123456-7^(*1)

DESIGNATOR	ITEM	SYMBOL	DESCRIPTION
1	Output Configuration	С	CMOS output
U		Ν	N-ch open drain output
23	Detect Voltage	08 ~ 50	e.g. 18 → 1.8V
		А	Built-in delay capacitance pin, hysteresis 5% (TYP.) (Standard*)
		В	Built-in delay capacitance pin, hysteresis less than 1%(Standard*)
4	Options	С	No built-in delay capacitance pin, hysteresis 5% (TYP.) (Semi-custom)
			No built-in delay capacitance pin, hysteresis less than 1% (Semi-custom)
56-7	Packages	GR-G	USP-4 (3,000pcs/Reel)
	(Order Unit)	MR-G	SOT-25 (3,000pcs/Reel)

*When delay function isn't used, open the delay capacitance pin before use.

(*1) The "-G" suffix denotes Halogen and Antimony free as well as being fully EU RoHS compliant.

■ BLOCK DIAGRAMS

(1) XC6118CxxA



(2) XC6118CxxB



(3) XC6118NxxA



(4) XC6118NxxB



*The delay capacitance pin (Cd) is not connected to the circuit in the block diagram of XC6118CxxC (semi-custom).

*The delay capacitance pin (Cd) is not connected to the circuit in the block diagram of XC6118CxxD (semi-custom).

*The delay capacitance pin (Cd) is not connected to the circuit in the block diagram of XC6118NxxC (semi-custom).

*The delay capacitance pin (Cd) is not connected to the circuit in the block diagram of XC6118NxxD (semi-custom).

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

■ABSOLUTE MAXIMUM RATINGS

●XC6118xxxA/B

●XC6118xxxA/B				Ta=25°C
PARAM	IETER	SYMBOL	RATINGS	UNITS
Input Vo	oltage	V _{IN}	V _{SS} -0.3 ~ 7.0	V
Output C	Current	Іоит	10	mA
Output Voltage	XC6118C (*1)	Vout	V_{SS} -0.3 ~ V_{IN} +0.3	V
Output voltage	XC6118N (*2)	VOUT	Vss-0.3 ~ 7.0	v
Sense Pir	n Voltage	Vsen	Vss-0.3 ~ 7.0	V
Delay Capacitar	nce Pin Voltage	V _{CD}	V_{SS} -0.3 ~ V_{IN} +0.3	V
Delay Capacitar	nce Pin Current	I _{CD}	5.0	mA
Power Dissipation	USP-4	Pd	120	mW
Power Dissipation	SOT-25		250	1117.
Operating Ambie	nt Temperature	Та	-40 ~ 85	°C
Storage Ter	nperature	Tstg	-55 ~ 125	О°

●XC6118xxxC/D

Ta=25°C

TER	SYMBOL	RATINGS	UNITS
age	VIN	Vss-0.3 ~ 7.0	V
rrent	Іоит	10	mA
XC6118C (*1)	Varm	V _{SS} -0.3 ~ V _{IN} +0.3	V
XC6118N (*2)	V001	Vss-0.3 ~ 7.0	v
Voltage	VSEN	Vss-0.3 ~ 7.0	V
USP-4	Dd	120	mW
SOT-25	Fu	250	IIIVV
Temperature	Та	-40 ~ 85	°C
perature	Tstg	-55 ~ 125	٥C
	age rrent XC6118C (*1) XC6118N (*2) /oltage USP-4 SOT-25 Temperature	age V _{IN} rrent IouT XC6118C (*1) XC6118N (*2) Vout Voltage V _{SEN} USP-4 SOT-25 Temperature Ta	age V_{IN} V_{SS} -0.3 ~ 7.0 rrent Iour 10 XC6118C (*1) V_{OUT} V_{SS} -0.3 ~ V_{IN} +0.3 XC6118N (*2) V_{OUT} V_{SS} -0.3 ~ 7.0 /oltage V_{SEN} V_{SS} -0.3 ~ 7.0 USP-4 Pd 120 SOT-25 Ta -40 ~ 85

NOTE:

*1: CMOS output

*2: N-ch open drain output

■ ELECTRICAL CHARACTERISTICS

●XC6118xxxA

PAF	RAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUITS
Opera	ating Voltage	V _{IN}	V _{DF(T)} =0.8 ~ 5.0V ^(*1)	1.0		6.0	V	-
Dete	ect Voltage	V _{DF}	V _{IN} =1.0 ~ 6.0V		E-1		V	1
	eresis Width	V _{HYS}	V _{IN} =1.0 ~ 6.0V		E-2		V	1
	ect Voltage	ΔV _{DF} /						
Line	Regulation	$(\Delta V_{IN} \cdot V_{DF})$	V _{IN} =1.0 ~ 6.0V		±0.1		%/V	1
			$V_{SEN} = V_{DF} \times 0.9$					
Supply	Current 1 (*2)	I _{SS1}	V _{IN} =1.0V		0.4	1.0	μA	2
			V _{IN} =6.0V		0.4	1.0		
			$V_{SEN}=V_{DF} \times 1.1$					
Supply	Current 2 ^(*2)	I _{SS2}	V _{IN} =1.0V		0.8	1.6	μA	2
			V _{IN} =6.0V		0.9	1.8		
			V_{SEN} =0V, V_{DS} =0.5V(Nch)					
			V _{IN} =1.0V	0.1	0.7			
			V _{IN} =2.0V	0.8	1.6			
		I _{OUT1}	V _{IN} =3.0V	1.2	2.0		mA	3
			V _{IN} =4.0V	1.6	2.3			
Outpu	ut Current (*3)		V _{IN} =5.0V	1.8	2.4			
			V _{IN} =6.0V	1.9	2.5			
			V _{SEN} =6.0V,					
			V _{DS} =0.5V(Pch)		0.00	0.00		
		I _{OUT2}	V _{IN} =1.0V		-0.30	-0.08	mA	4
			V _{IN} =6.0V		-1.00	-0.70		
	CMOS Output		V _{IN} =6.0V, V _{SEN} =0V,					
Leakage	(P-ch)		V _{OUT} =0V, Cd: Open		-0.20			
Current	. ,	I _{LEAK}					μA	3
Current	N-ch Open Drain		V _{IN} =6.0V, V _{SEN} =6.0V,		0.20	0.40		
	Output		V _{OUT} =6.0V, Cd: Open					
		ΔV_{DF}						
Temperatu	re Characteristics	(∆T _{opr} •	-40 °C≦T _{opr} ≦85 °C		±100		ppm/ºC	1
		V _{DF})						
Sense	Resistance (*4)	R _{SEN}	V _{SEN} =5.0V, V _{IN} =0V		E-4		MΩ	5
			V _{SEN} =6.0V, V _{IN} =5.0V					
Delay Resistance (*5)		R _{DELAY}	Cd=0V	1.6	2.0	2.4	MΩ	6
Delay capacitance pin								-
Sink Current		I _{CD}	Cd=0.5V, V _{IN} =1.0V		200		μA	6
Delay Capacitance Pin Threshold			V _{SEN} =6.0V, V _{IN} =1.0V	0.4	0.5	0.6	ĺ	_
Voltage		V _{TCD}	V _{SEN} =6.0V, V _{IN} =6.0V	2.9	3.0	3.1	V	\bigcirc
Undefined Operation (*6)		V _{UNS}	$V_{IN} = V_{SEN} = 0 \sim 1.0V$		0.3	0.4	V	8
	•	V UN5	$V_{IN}=6.0V, V_{SEN}=6.0V \rightarrow 0V$		0.0	0.7	v	
Detect	Delay Time ^(*7)	t _{DF0}	Cd: Open		30	230	μs	9
Detect Delay Time (*7)					+		<u> </u>	
	Release Delay Time (*8)		V _{IN} =6.0V, V _{SEN} =0V→6.0V					

NOTE:

*1: V_{DF (T)}: Nominal detect voltage

*2: Current to the sense resistor is not included.

*3: IOUT2 is applied only to the XC6118C series (CMOS output).

*4: It is calculated from the voltage value and the current value of the $V_{\mbox{\scriptsize SEN}}$

*5: It is calculated from the voltage value of the $V_{\mbox{\scriptsize IN}}$ and the current value of the Cd.

*6: Maximum V_{OUT} voltage when V_{IN} is changed from 0V to 1.0V under connecting the V_{IN} pin to the V_{SEN} pin. This value is effective only to the XC6118C series (CMOS output).

*7: Delay time from the time of V_{SEN}=V_{DF} to the time of V_{OUT}= 0.6V when the V_{SEN} falls.

*8: Delay time from the time of V_{IN} = V_{DF} + V_{HYS} to the time of V_{OUT} = 5.4V when the V_{SEN} rises.

■ ELECTRICAL CHARACTERISTICS (Continued)

PARAMETER		SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Opera	ting Voltage	V _{IN}	$V_{\text{DF(T)}}$ =0.8 ~ 5.0V (*1)	1.0		6.0	V	-
Dete	ect Voltage	V _{DF}	V _{IN} =1.0 ~ 6.0V		E-1		V	1
Hyste	eresis Width	V _{HYS}	V _{IN} =1.0 ~ 6.0V		E-3		V	1
Dete	ect Voltage	ΔV_{DF}					0/ 0/	
Line	Regulation	$(\Delta V_{IN} \cdot V_{DF})$	V _{IN} =1.0~ 6.0V		±0.1		%/V	1
			$V_{SEN} = V_{DF} \times 0.9$					
Supply	Current 1 (*2)	I _{SS1}	V _{IN} =1.0V		0.4	1.0	μA	2
			V _{IN} =6.0V		0.4	1.0		
			$V_{SEN}=V_{DF} \times 1.1$					
Supply	Current 2 ^(*2)	I _{SS2}	V _{IN} =1.0V		0.8	1.6	μA	2
			V _{IN} =6.0V		0.9	1.8		
			V _{SEN} =0V V _{DS} =0.5V(Nch)					
			V _{IN} =1.0V	0.1	0.7			
			V _{IN} =2.0V	0.8	1.6			_
		I _{OUT1}	V _{IN} =3.0V	1.2	2.0		mA	3
Outpu	t Current (*3)		V _{IN} =4.0V	1.6	2.3			
•			V _{IN} =5.0V	1.8	2.4			
			V _{IN} =6.0V	1.9	2.5			
			V_{SEN} =6.0V V_{DS} =0.5V(Pch)					~
		I _{OUT2}	V _{IN} =1.0V		-0.30	-0.08	mA	4
			V _{IN} =6.0V		-1.00	-0.70		
	CMOS Output		V _{IN} =6.0V, V _{SEN} =0V,		-0.20			
Leakage	(P-ch)	I _{LEAK}	V _{OUT} =0V, Cd: Open				μA	3
Current	N-ch Open		V _{IN} =6.0V, V _{SEN} =6.0V,		0.20	0.40		
	Drain Output		V _{OUT} =6.0V, Cd: Open					
		ΔV_{DF}						
Temperatu	e Characteristics	(ΔT_{opr} ·	-40 °C≦T _{opr} ≦85 °C		±100		ppm/°C	1
		V _{DF})						
Sense I	Resistance (*4)	R _{SEN}	V _{SEN} =5.0V, V _{IN} =0V		E-4		MΩ	5
Delay Resistance (*5)		R _{DELAY}	V _{SEN} =6.0V, V _{IN} =5.0V Cd=0V	1.6	2.0	2.4	MΩ	6
Delay capacitance pin								
Sink Current		I _{CD}	Cd=0.5V, V _{IN} =1.0V		200		μA	6
Delay Capacitance Pin		N	V _{SEN} =6.0V, V _{IN} =1.0V	0.4	0.5	0.6		
Threshold Voltage		V _{TCD}	V _{SEN} =6.0V, V _{IN} =6.0V	2.9	3.0	3.1	V	$\overline{\mathcal{O}}$
Undefined Operation (*6)		V _{UNS}	V _{IN} =V _{SEN} =0~1.0V		0.3	0.4	V	8
Detect I	Delay Time (*7)	t _{DF0}	V _{IN} =6.0V, V _{SEN} =6.0V→0V Cd: Open		30	230	μs	9
Release Delay Time ^(*8)			V _{IN} =6.0V, V _{SEN} =0V→6.0V					

NOTE:

*1: V_{DF (T)}: Nominal detect voltage

*2: Current to the sense resistor is not included.

*3: I_{OUT2} is applied only to the XC6118C series (CMOS output).

*4: It is calculated from the voltage value and the current value of the $V_{\mbox{\scriptsize SEN}}$

*5: It is calculated from the voltage value of the $V_{\mbox{\scriptsize IN}}$ and the current value of the Cd.

*6: Maximum V_{OUT} voltage when V_{IN} is changed from 0V to 1.0V under connecting the V_{IN} pin to the V_{SEN} pin. This value is effective only to the XC6118C series (CMOS output).

*7: Delay time from the time of $V_{\text{SEN}}\text{=}V_{\text{DF}}$ to the time of $V_{\text{OUT}}\text{=}$ 0.6V when the V_{SEN} falls.

*8: Delay time from the time of V_{IN} = V_{DF} + V_{HYS} to the time of V_{OUT} = 5.4V when the V_{SEN} rises.

■ ELECTRICAL CHARACTERISTICS (Continued)

●XC6118xxxC

Ta=25°C

PAF	RAMETER	PARAMETER SYMBOL CONDITIONS		MIN.	TYP.	MAX.	UNITS	CIRCUITS
Opera	Operating Voltage		V _{DF(T)} =0.8 ~ 5.0V ^(*1)	1.0		6.0	V	-
Dete	ect Voltage	V _{DF}	V _{IN} =1.0 ~ 6.0V		E-1		V	1
Hyste	eresis Width	V _{HYS}	V _{IN} =1.0 ~ 6.0V		E-2		V	1
	ect Voltage Regulation	ΔV _{DF} / (ΔV _{IN} • V _{DF})	V _{IN} =1.0 ~ 6.0V		±0.1		%/V	1
Supply	/ Current 1 (*2)	I _{SS1}	V _{SEN} =V _{DF} × 0.9 V _{IN} =1.0V V _{IN} =6.0V		0.4 0.4	1.0 1.0	μA	2
Supply	y Current 2 (*2)	I _{SS2}	V _{SEN} =V _{DF} × 1.1 V _{IN} =1.0V V _{IN} =6.0V		0.8 0.9	1.6 1.8	μA	2
Output Current (*3)		I _{OUT1}	$V_{SEN}=0V, V_{DS}=0.5V(Nch) \\ V_{IN}=1.0V \\ V_{IN}=2.0V \\ V_{IN}=3.0V \\ V_{IN}=4.0V \\ V_{IN}=5.0V \\ V_{IN}=6.0V$	0.1 0.8 1.2 1.6 1.8 1.9	0.7 1.6 2.0 2.3 2.4 2.5		mA	3
		I _{OUT2}	V _{SEN} =6.0V, V _{DS} =0.5V(Pch) V _{IN} =1.0V V _{IN} =6.0V		-0.30 -1.00	-0.08 -0.70	mA	4
Leakage Current	CMOS Output (P-ch) Nch Open Drain	I _{LEAK}	V _{IN} =6.0V, V _{SEN} =0V, V _{OUT} =0V V _{IN} =6.0V, V _{SEN} =6.0V,		-0.20		μA	3
	Output		V _{OUT} =6.0V		0.20	0.40		
Temperature Characteristics		ΔV _{DF} / (ΔT _{opr} ・ V _{DF})	-40 °C \leq T _{opr} \leq 85 °C		±100		ppm/ºC	1
Sense	Resistance (*4)	R _{SEN}	V _{SEN} =5.0V V _{IN} =0V		E-4		MΩ	5
Undefine	ed Operation (*5)	V _{UNS}	V _{IN} =V _{SEN} =0~1.0V		0.3	0.4	V	\bigcirc
Detect	Delay Time ^(*6)	t _{DF0}	V _{IN} =6.0V, V _{SEN} =6.0→0V		30	230	μs	9
Release	e Delay Time ^(*7)	t _{DR0}	V _{IN} =6.0V, V _{SEN} =0→6.0V		30	200	μs	9

NOTE:

*1: V_{DF (T)}: Nominal detect voltage

*2: Current to the sense resistor is not included.

*3: I_{OUT2} is applied only to the XC6118C series (CMOS output).

*4: It is calculated from the voltage value and the current value of the $V_{\mbox{\scriptsize SEN}}$

*5: Maximum V_{OUT} voltage when V_{IN} is changed from 0V to 1.0V under connecting the V_{IN} pin to the V_{SEN} pin. This value is effective only to the XC6118C series (CMOS output).

*6: Delay time from the time of $V_{SEN}=V_{DF}$ to the time of $V_{OUT}=0.6V$ when the V_{SEN} falls.

*7: Delay time from the time of V_{IN} = V_{DF} + V_{HYS} to the time of V_{OUT} = 5.4V when the V_{SEN} rises.

■ ELECTRICAL CHARACTERISTICS (Continued)

●XC6118xxxD

Ta=25℃

PA	RAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUITS
Opera	Operating Voltage V _{IN}		$V_{\text{DF(T)}}$ =0.8 ~ 5.0V ^(*1)	1.0		6.0	V	-
Det	ect Voltage	V _{DF}	V _{IN} =1.0 ~ 6.0V		E-1		V	1
Hyst	eresis Width	V _{HYS}	V _{IN} =1.0 ~ 6.0V		E-3		V	1
	ect Voltage Regulation	ΔV _{DF} / (ΔV _{IN} ・ V _{DF})	V _{IN} =1.0~6.0V		±0.1		%/V	1
Supply	y Current 1 ^(*2)	I _{SS1}	V _{SEN} =V _{DF} × 0.9 V _{IN} =1.0V V _{IN} =6.0V		0.4 0.4	1.0 1.0	μA	2
Supply	y Current 2 ^(*2)	I _{SS2}	V _{SEN} =V _{DF} × 1.1 V _{IN} =1.0V V _{IN} =6.0V		0.8 0.9	1.6 1.8	μA	2
Output Current (*3)		I _{OUT1}	$V_{SEN}=0V V_{DS}=0.5V(Nch) \\ V_{IN}=1.0V \\ V_{IN}=2.0V \\ V_{IN}=3.0V \\ V_{IN}=4.0V \\ V_{IN}=5.0V \\ V_{IN}=6.0V \\ \end{array}$	0.1 0.8 1.2 1.6 1.8 1.9	0.7 1.6 2.0 2.3 2.4 2.5		mA	3
		I _{OUT2}	V _{SEN} =6.0V, V _{DS} =0.5V(Pch) V _{IN} =1.0V V _{IN} =6.0V		-0.30 -1.00	-0.08 -0.70	mA	4
Leakage Current	CMOS Output (P-ch) Nch Open	I _{LEAK}	V _{IN} =6.0V, V _{SEN} =0V, V _{OUT} =0V V _{IN} =6.0V, V _{SEN} =6.0V,		-0.20 0.20	0.40	μA	3
Temperature Characteristics		ΔV _{DF} / (ΔT _{opr} ・ V _{DF})	V _{OUT} =6.0V -40 °C≦T _{opr} ≦85 °C		±100		ppm/ºC	1
Sense	Resistance (*4)	R _{SEN}	V _{SEN} =5.0V, V _{IN} =0V		E-4		MΩ	5
Undefin	ed Operation (*5)	V _{UNS}	V _{IN} =V _{SEN} =0~1.0V		0.3	0.4	V	$\overline{\mathcal{O}}$
Detect	Delay Time ^(*6)	t _{DF0}	V _{IN} =6.0V V _{SEN} =6.0→0V		30	230	μs	9
Release	e Delay Time ^(*7)	t _{DR0}	V _{IN} =6.0V V _{SEN} =0→6.0V		30	200	μs	9

NOTE:

- *1: V_{DF (T)}: Nominal detect voltage
- *2: Current to the sense resistor is not included.
- *3: IOUT2 is applied only to the XC6118C series (CMOS output).
- *4: It is calculated from the voltage value and the current value of the V_{SEN} .
- *5: Maximum V_{OUT} voltage when V_{IN} is changed from 0V to 1.0V under connecting the V_{IN} pin to the V_{SEN} pin. This value is effective only to the XC6118C series (CMOS output).
- *6: Delay time from the time of $V_{\text{SEN}}\text{=}V_{\text{DF}}$ to the time of $V_{\text{OUT}}\text{=}$ 0.6V when the V_{SEN} falls.
- *7: Delay time from the time of V_{IN} = V_{DF} + V_{HYS} to the time of V_{OUT} = 5.4V when the V_{SEN} rises.

■VOLTAGE CHART

SYMBOL	E	-1	E	-2	E	-3	E	-4
PARAMETER NOMINAL VOLTAGE	DETECT V((\			SIS RANGE V)		SIS RANGE V)		SISTANCE 1Ω)
VDEN KOL	V)F	V	HYS	V	HYS	R	EN
(V)	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	TYP.
0.8	0.770	0.830	0.015	0.066		0.008		
0.9	0.870	0.930	0.017	0.074		0.009		
1.0	0.970	1.030	0.019	0.082		0.010		
1.1	1.070	1.130	0.021	0.090		0.011		
1.2	1.170	1.230	0.023	0.098		0.012		
1.3	1.270	1.330	0.025	0.106		0.013	10	20
1.4	1.370	1.430	0.027	0.114		0.014	10	20
1.5	1.470	1.530	0.029	0.122		0.015		
1.6	1.568	1.632	0.031	0.131		0.016		
1.7	1.666	1.734	0.033	0.085		0.017		
1.8	1.764	1.836	0.035	0.147		0.018		
1.9	1.862	1.938	0.037	0.155		0.019		
2.0	1.960	2.040	0.039	0.163		0.020		
2.1	2.058	2.142	0.041	0.171		0.021		
2.2	2.156	2.244	0.043	0.180		0.022		
2.3	2.254	2.346	0.045	0.188		0.023		
2.4	2.352	2.448	0.047	0.196		0.024		
2.5	2.450	2.550	0.049	0.204		0.026		
2.6	2.548	2.652	0.051	0.212		0.027		
2.7	2.646	2.754	0.053	0.220		0.028		
2.8	2.744	2.856	0.055	0.228		0.029	-	
2.9	2.842	2.958	0.057	0.237	0	0.030	13	24
3.0	2.940	3.060	0.059	0.245	-	0.031	10	27
3.1	3.038	3.162	0.061	0.253	-	0.032		
3.2	3.136	3.264	0.063	0.261	-	0.033		
3.3	3.234	3.366	0.065	0.269		0.034	-	
3.4	3.332	3.468	0.067	0.277	-	0.035		
3.5	3.430	3.570	0.069	0.286	-	0.036		
3.6	3.528	3.672	0.071	0.294		0.037		
3.7	3.626	3.774	0.073	0.302		0.038	4	
3.8	3.724	3.876	0.074	0.310		0.039	4	
3.9	3.822	3.978	0.076	0.318	-	0.040		
4.0	3.920	4.080	0.078	0.326	-	0.041	-	
4.1	4.018	4.182	0.080	0.335	-	0.042	-	
4.2	4.116	4.284	0.082	0.343	-	0.043	-	
4.3	4.214	4.386	0.084	0.351	-	0.044	-	
4.4	4.312	4.488	0.086	0.359	-	0.045		
4.5	4.410	4.590	0.088	0.367	-	0.046	15	28
4.6	4.508	4.692	0.090	0.375	-	0.047		
4.7	4.606	4.794	0.092	0.384	-	0.048		
4.8	4.704	4.896	0.094	0.392	-	0.049	-	
4.9	4.802	4.998	0.096	0.400	-	0.050	4	
5.0	4.900	5.100	0.098	0.408		0.051		

NOTE:

*1: When VDF(T) \leq 1.4V, the detection accuracy is ±30mV. When VDF(T) \geq 1.5V, the detection accuracy is ±2%.

TEST CIRCUITS

Circuit 1



Circuit 3



Circuit 5



Circuit 7



CMOS output products)







Circuit 2



Circuit 8



Circuit 9



■ OPERATIONAL EXPLANATION

A typical circuit example is shown in Figure 1, and the timing chart of Figure 1 is shown in Figure 2.



Figure 1: Typical application circuit example



Figure 2: The timing chart of Figure 1

- As an early state, the sense pin is applied sufficiently high voltage (6.0V MAX.) and the delay capacitance (Cd) is charged to the power supply input voltage, (VIN: 1.0V MIN., 6.0V MAX.). While the sense pin voltage (VSEN) starts dropping to reach the detect voltage (VDF) (VSEN>VDF), the output voltage (VOUT) keeps the "High" level (=VIN).
 * If a pull-up resistor of the XC6118N series (N-ch open drain) is connected to added power supply different from the input voltage pin, the "High" level will be a voltage value where the pull-up resistor is connected.
- 2 When the sense pin voltage keeps dropping and becomes equal to the detect voltage (VSEN =VDF), an N-ch transistor (M1) for the delay capacitance (Cd) discharge is turned ON, and starts to discharge the delay capacitance (Cd). An inverter (Inv.1) operates as a comparator of the reference voltage VIN, and the output voltage changes into the "Low" level (=VSS). The detect delay time [t_{DF}] is defined as time which ranges from VSEN=VDF to the VOUT of "Low" level (especially, when the Cd pin is not connected: t_{DFO}).
- ③ While the sense pin voltage keeps below the detect voltage, the delay capacitance (Cd) is discharged to the ground voltage (=Vss) level. Then, the output voltage maintains the "Low" level while the sense pin voltage increases again to reach the release voltage (Vsen< VDF +VHYs).</p>

■ OPERATIONAL EXPLANATION (Continued)

- ④ When the sense pin voltage continues to increase up to the release voltage level (VDF+VHYS), the N-ch transistor (M1) for the delay capacitance (Cd) discharge will be turned OFF, and the delay capacitance (Cd) will start discharging via a delay resistor (R_{DELAY}). The inverter (Inv.1) will operate as a comparator (Rise Logic Threshold: VTLH=VTCD, Fall Logic Threshold: VTHL=VSS) while the sense pin voltage keeps higher than the detect voltage (VSEN > VDF).
- (5) While the delay capacitance pin voltage (VCD) rises to reach the delay capacitance pin threshold voltage (VTCD) with the sense pin voltage equal to the release voltage or higher, the sense pin will be charged by the time constant of the RC series circuit. Assuming the time to the release delay time (t_{DR}), it can be given by the formula (1).

$$t_{DR}$$
=- $R_{DELAY} \times Cd \times In(1-V_{TCD}/V_{IN}) \cdots (1)$

The release delay time can also be briefly calculated with the formula (2) because the delay resistance is $2.0M\Omega(TYP.)$ and the delay capacitance pin threshold voltage is VIN /2 (TYP.)

$$t_{DR}=R_{DELAY} \times Cd \times 0.69 \quad \cdots (2)$$

* : R_{DELAY} is 2.0M Ω (TYP.)

As an example, presuming that the delay capacitance is $0.68 \,\mu$ F, t_{DR} is :

2.0 × 10⁶ × 0.68 × 10⁻⁶ × 0.69=938(ms)

- * Note that the release delay time may remarkably be short when the delay capacitance (Cd) is not discharged to the ground (=VSS) level because time described in ③ is short.
- ⑥ When the delay capacitance pin voltage reaches to the delay capacitance pin threshold voltage (VcD=VTcD), the inverter (Inv.1) will be inverted. As a result, the output voltage changes into the "High" (=VIN) level. t_{DR0} is defined as time which ranges from VsEN=VDF+VHYS to the Vout of "High" level without connecting to the Cd.
- ⑦ While the sense voltage is higher than the detect voltage (VSEN > VDF), the delay capacitance pin is charged until the delay capacitance pin voltage becomes the input voltage level. Therefore, the output voltage maintains the "High"(=VIN) level.

Function Chart

Veru	Cd	TRANSITIC	ON OF VOUT CONDITION *1		
Vsen	Cu	1		2	
	L				
	Н	L			
	L	Ц	~		
	Н	п			
	L		⇒	L	
	Н	L	⇒		
	L	Ц	1	Н	
	Н		7		

●Example

ex. 1) VOUT ranges from 'L' to 'H' in case of VSEN = 'H' (VDR≧VSEN), Cd='H' (VTCD≧Cd) while VOUT is 'L'.

ex. 2) Vout maintains 'H' when Cd ranges from 'H' to 'L', VSEN='H' and Cd='L' when Vout becomes 'H' in ex.1.

●Release Delay Time Chart

DELAY	DELAY RELEASE DELAY TIME [tbr] RELEASE DELAY TIME [tbr] *2		
CAPACITANCE [Cd]	(TYP.)	(MIN. ~ MAX.)	
(<i>μ</i> F)	(ms)	(ms)	
0.010	13.8	11.0 ~ 16.6	
0.022	30.4	24.3 ~ 36.4	
0.047	64.9	51.9 ~ 77.8	
0.100	138	110 ~ 166	
0.220	304	243 ~ 364	
0.470	649	519 ~ 778	
1.000	1380	1100 ~ 1660	

* The release delay time values above are calculated by using the formula (2).

*2: The release delay time (t_{DR}) is influenced by the delay capacitance Cd.

■NOTES 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. The power supply input pin voltage drops by the resistance between power supply and the VIN pin, and by through current at operation of the IC. At this time, the operation may be wrong if the power supply input pin voltage falls below the minimum operating voltage range. In CMOS output, for output current, drops in the power supply input pin voltage similarly occur. Moreover, in CMOS output, when the VIN pin and the sense pin are short-circuited and used, oscillation of the circuit may occur if the drops in voltage, which caused by through current at operation of the IC, exceed the hysteresis voltage. Note it especially when you use the IC with the VIN pin connected to a resistor.
- 3. When the setting voltage is less than 1.0V, be sure to separate the VIN pin and the sense pin, and to apply the voltage over 1.0V to the VIN pin.
- 4. Note that a rapid and high fluctuation of the power supply input pin voltage may cause a wrong operation.
- 5. Power supply noise may cause operational function errors, Care must be taken to put the capacitor between V_{IN}-GND and test on the board carefully.
- 6. If the V_{IN} pin voltage drops sharply (example: 6.0V to 0V) during the release operation with a Cd (delay capacitance) connected to the Cd pin, an overcurrent will flow through the diode between the Cd and V_{IN} pin. If the fluctuation range of the V_{IN} pin during the release operation is less than 1.0V, no special measures are required, but if the Cd is 0.1µF or more and the power supply voltage fluctuation is 0.01V/µs or more, please take either one of the following measures.
 - To place a Schottky diode between the V_{IN} pin and the Cd pin. (See Figure 3)
 - To place a resistance (RCd) of 500Ω to 1kΩ between the Cd and Cd pin. (See Figure 4)
 - * Please note if the RCd is connected between the Cd and Cd pin, the Cd discharge time will be longer. When connecting the RCd, please confirm in advance that there is no problem in actual operation.



Figure 3: Circuit example with a Schottky diode connected to the Cd pin



Figure 4: Circuit example with a resistor connected to the Cd pin

NOTES ON USE

7. In N-channel open drain output, V_{OUT} voltage at detect and release is determined by resistance of a pull up resistor connected at the V_{OUT} pin. Please choose proper resistance values with refer to Figure 5;

During detection: V_{OUT} = V_{PULL} / (1+R_{PULL} / R_{ON})

V_{PULL}: Pull up voltage

R_{ON}(%1) : On resistance of N channel driver M3 can be calculated as V_{DS} / I_{OUT1} from electrical characteristics,

For example, when (≥ 2) R_{ON} = 0.5 / 0.8×10⁻³ = 625 Ω (MAX.)at V_{IN}=2.0V, V_{PULL} = 3.0V and V_{OUT} $\le 0.1V$ at detect, R_{PULL} = (V_{PULL} /V_{OUT}-1)×R_{ON}= (3 / 0.1-1)×625=18k Ω

In this case, R_{PULL} should be selected higher or equal to $18k\Omega$ in order to keep the output voltage less than 0.1V during detection.

(%1) R_{ON} is bigger when V_{IN} is smaller, be noted.

(%2) For calculation, Minimum V_{IN} should be chosen among the input voltage range.

During releasing : $V_{OUT} = V_{PULL} / (1 + R_{PULL} / R_{OFF})$

V_{PULL} : Pull up voltage

 R_{OFF} : On resistance of N channel driver M3 is 15M Ω (MIN.) when the driver is off (as to V_{OUT} / I_{LEAK}) For example : when V_{PULL} = 6.0V and V_{OUT} \geq 5.99V,

 $R_{PULL} = (V_{PULL} / V_{OUT}-1) \times R_{OFF} = (6/5.99-1) \times 15 \times 10^6 \approx 25 \text{ k}\Omega$

In this case, R_{PULL} should be selected smaller or equal to 25 k Ω in order to obtain output voltage higher than 5.99V during releasing.



Figure 5: Circuit example of XC6118N

8. Torex places an importance on improving our products and their reliability.

We request that users incorporate fail-safe designs and post-aging protection treatment when using Torex products in their systems.

■ TYPICAL PERFORMANCE CHARACTERISTICS

(1) Supply Current vs. Sense Voltage



(2) Supply Current vs. Input Voltage









(4) Detect Voltage vs. Input Voltage

XC6118C25Ax

Input Voltage: VIN (V)



TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(5) Hysteresis Voltage vs. Ambient Temperature



(7) Output Voltage vs. Sense Voltage



(9) Output Current vs. Input Voltage



(6) CD Pin Sink Current vs. Input Voltage



(8) Output Voltage vs. Input Voltage



XC6118C25Ax VDS(Pch)=0.5V 0.0 Output Current: lout (mA) Ta=85℃ -0.5 -1.0 25°C -1.5 -40°C -2.0 0 2 1 3 4 5 6 Input Voltage : VIN (V)

XC6118N25Ax

■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

(10) Delay Resistance vs. Ambient Temperature



(12) Detect Delay Time vs. Delay Capacitance



(14) Leakage Current vs. Supply Voltage



(11) Release Delay Time vs. Delay Capacitance



(13) Leakage Current vs. Ambient Temperature



XC6118N25Ax

■PACKAGING INFORMATION

For the latest package information go to, www.torexsemi.com/technical-support/packages

PACKAGE	OUTLINE / LAND PATTERN	THERMAL CHARACTERISTICS
USP-4	USP-4 PKG	USP-4 Power Dissipation
SOT-25	SOT-25 PKG	SOT-25 Power Dissipation

■MARKING RULE

●SOT-25

1 represents output configuration and integer number of detect voltage

Ċ.		
С	MOS Output (XC6118C Series)	
	MARK	VOLTAGE (V)
	L	0.X
	М	1.X
	Ν	2.X
	Р	3.X
	R	4.X
	S	5.X

 N-ch Open Drain Output (XC6118N Series)

 MARK
 VOLTAGE (V)

 T
 0.X

 U
 1.X

 V
 2.X

 X
 3.X

 Y
 4.X

 Z
 5.X



2 represents decimal number of detect voltage

(ex.)

MARK	VOLTAGE (V)	PRODUCT SERIES
3	X.3	XC6118**3***
0	X.0	XC6118**0***

③ represents options

MARK	OPTIONS	PRODUCT SERIES
А	Built-in delay capacitance pin with hysteresis 5% (TYP.) (Standard)	XC6118***A**
В	Built-in delay capacitance pin with hysteresis less than 1% (Standard)	XC6118***B**
С	No built-in delay capacitance pin with hysteresis 5% (TYP.) (Semi-custom)	XC6118***C**
D	No built-in delay capacitance pin with hysteresis less than 1% (Semi-custom)	XC6118***D**

(4)5 represents production lot number

0 to 9 A to Z, or inverted characters of 0 to 9, A to Z repeated.

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

*No character inversion used.

■MARKING RULE (Continued)

●USP-4

1 represents output configuration and integer number of detect voltage

С	CMOS Output (XC6118C Series	
	MARK	VOLTAGE (V)
	L	0.X
	М	1.X
	Ν	2.X
	Р	3.X
	R	4.X
	S	5.X

N-ch Open Drain Output (XC6118N Series)

MARK	VOLTAGE (V)
Т	0.X
U	1.X
V	2.X
Х	3.X
Y	4.X
Z	5.X



(TOP VIEW)

② represents decimal number of detect voltage

(ex.)

MARK	VOLTAGE (V)	PRODUCT SERIES
3	X.3	XC6118**3***
0	X.0	XC6118**0***

③ represents options

MARK	OPTIONS	PRODUCT SERIES
А	Built-in delay capacitance pin with hysteresis 5% (TYP.) (Standard)	XC6118***A**
В	Built-in delay capacitance pin with hysteresis less than 1% (Standard)	XC6118***B**
С	No built-in delay capacitance pin with hysteresis 5% (TYP.) (Semi-custom)	XC6118***C**
D	No built-in delay capacitance pin with hysteresis less than 1% (Semi-custom)	XC6118***D**

45 represents production lot number

0 to 9, A to Z or inverted characters of 0 to 9, A to Z repeated.

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

*No character inversion used.

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