

## VOLTAGE DETECTOR with Delay Function

### ■ GENERAL DESCRIPTION

The NJU7708/09 is a low quiescent current voltage detector with delay function featuring high precision detection voltage.

The detection voltage is internally fixed with an accuracy of 1.0%.

The NJU7708/09 are useful for preventing malfunction of microcomputer or DSP etc. through detect a drop in voltage of battery or power supply.

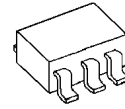
The delay function achieves set wait time when supply voltage is unstable. Moreover, the delay function can make a sequence that other devices in application work and stabilize before microcomputer or DSP works.

Delay time can be set by logical combination from 4-delay time.

NJU7708 is Nch. Open Drain and NJU7709 is a C-MOS output type.

Small packaging makes NJU7708 and NJU7709 suitable for space conscious applications.

### ■ PACKAGE OUTLINE

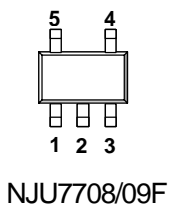


NJU7708/09F

### ■ FEATURES

- High Precision detection Voltage       $\pm 1.0\%$
- Low Quiescent Current                     $1.3\mu\text{A}$
- Detection Voltage Range                 $1.3 \sim 6.0\text{V}$  (0.1V step)
- Delay Time (Built-in Fixed Type)      0ms/50ms/100ms/200ms: Logical selectable 4-delay time
- Output Configuration  
     NJU7708: Nch. Open Drain Type  
     NJU7709: C-MOS Output Type
- CMOS Technology
- Package Outline                            SOT-23-5

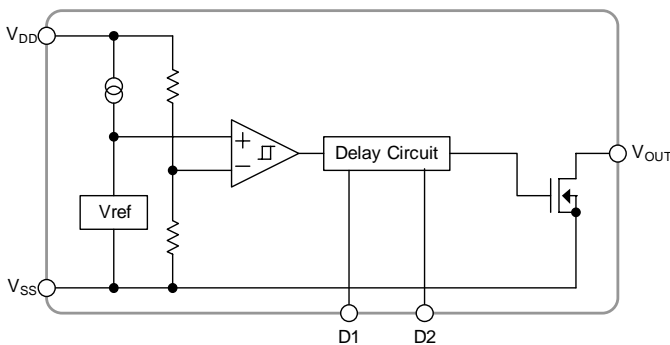
### ■ PIN CONFIGURATION



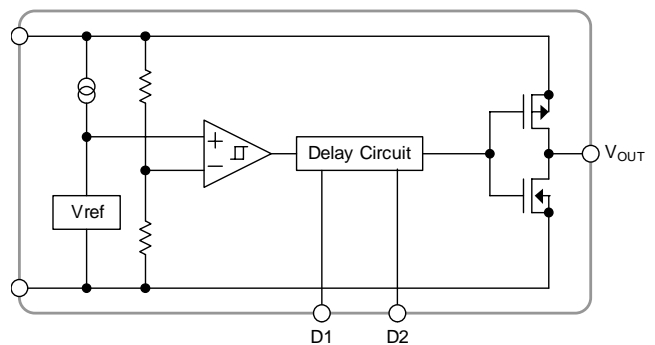
#### PIN FUNCTION

1. D1
2.  $V_{SS}$
3. D2
4.  $V_{OUT}$
5.  $V_{DD}$

### ■ EQUIVALENT CIRCUIT



NJU7708



NJU7709

# NJU7708/09

## ■ DETECTION VOLTAGERANK LIST

Device Name	V <sub>DET</sub>
NJU7708/09F15	1.5V
NJU7708/09F27	2.7V
NJU7708/09F42	4.2V
NJU7708/09F06	6.0V

## ■ LOGICAL TABLE OF DELAY TIME

D1	D2	DELAY
H	H	0ms
H	L	50ms
L	H	100ms
L	L	200ms

## ■ NJU7708

### ■ ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Input Voltage	V <sub>DD</sub>	+10	V
Output Voltage	V <sub>OUT</sub>	V <sub>SS</sub> -0.3 ~ +10	V
Output Current	I <sub>OUT</sub>	50	mA
Power Dissipation	P <sub>D</sub>	SOT-23-5 350(*1) 200(*2)	mW
Operating Temperature	Topr	-40 ~ +85	°C
Storage Temperature	Tstg	-40 ~ +125	°C

(\*1) : Mounted on glass epoxy board based on EIA/JEDEC. (114.3x76.2x1.6mm: 2Layers)

(\*2) : Device itself

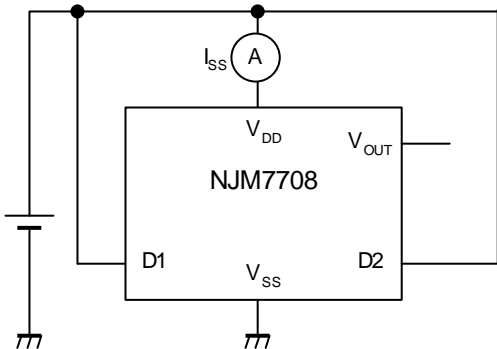
## ■ ELECTRICAL CHARACTERISTICS (Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Detection Voltage	V <sub>DET</sub>		-1.0%	-	+1.0%	V	
Hysteresis Voltage	V <sub>HYS</sub>		70	90	130	V	
Quiescent Current	I <sub>SS</sub>	V <sub>DD</sub> =V <sub>DET</sub> +1V	V <sub>DET</sub> =1.5V ~ 2.5V Version	-	1.0	1.7	μA
			V <sub>DET</sub> =2.6V ~ 6.0V Version	-	1.3	2.2	μA
Output Current	I <sub>OUT</sub>	Nch, V <sub>DS</sub> =0.5V	V <sub>DD</sub> =1.2V	0.75	2.0	-	mA
			V <sub>DD</sub> =2.4V (≥2.7V Version)	4.5	7.0	-	mA
Output Leak Current	I <sub>LEAK</sub>	V <sub>DD</sub> =V <sub>OUT</sub> =9V	-	-	0.1	μA	
Detection Voltage Temperature Coefficient	ΔV <sub>DET</sub> /ΔTa	Ta=0 ~ +85°C	-	±100	-	ppm/°C	
Delay Time	td	V <sub>DD</sub> =V <sub>DET</sub> +1V	D1=H, D2=H	25	100	300	μs
			D1=H, D2=L	42.5	50	57.5	ms
			D1=L, D2=H	85	100	115	ms
			D1=L, D2=L	170	200	230	ms
Delay Time Change Terminal Input Voltage	V <sub>D1_H</sub> /V <sub>D2_H</sub>		1.5	-	V <sub>DD</sub>	V	
	V <sub>D1_L</sub> /V <sub>D2_L</sub>		0	-	0.3	V	
Operating Voltage(*3)	V <sub>DD</sub>	R <sub>L</sub> =100kΩ	0.7	-	9	V	

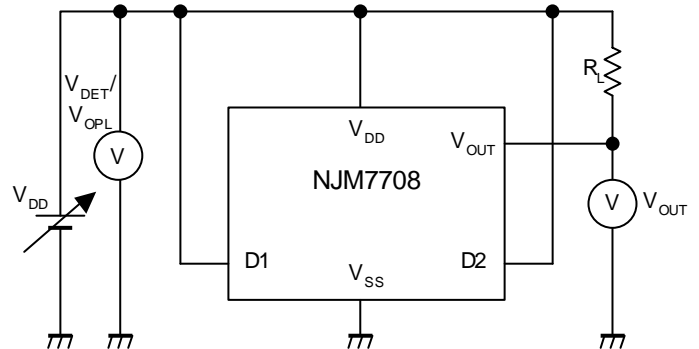
(\*3): The minimum operating voltage(V<sub>OPL</sub>) indicates the same value of the input voltage(V<sub>DD</sub>) on condition that V<sub>OUT</sub> becomes 10% or less of the input voltage(V<sub>DD</sub>).

## ■ TEST CIRCUIT

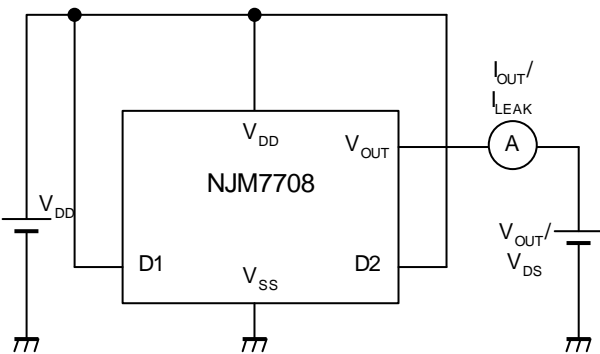
### ● Quiescent Current TEST CIRCUIT



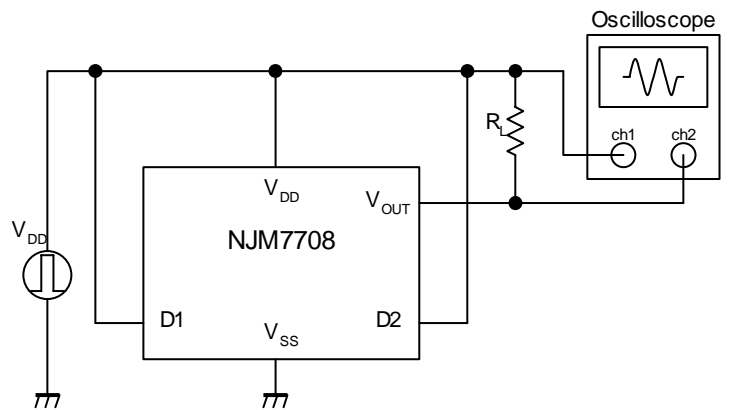
### ● Detection Voltage / Minimum Operating Voltage TEST CIRCUIT



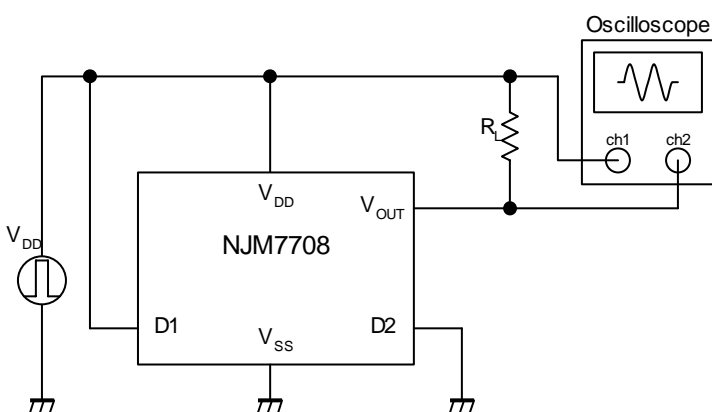
### ● Leak Current/Output Current TEST CIRCUIT



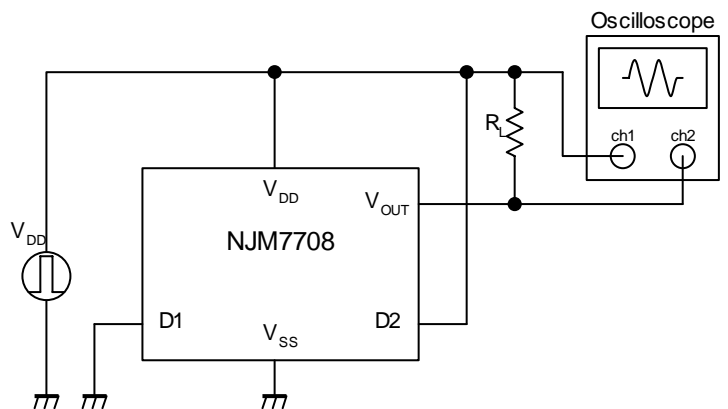
### ● Delay Time=0mS TEST CIRCUIT



### ● Delay Time=50mS TEST CIRCUIT



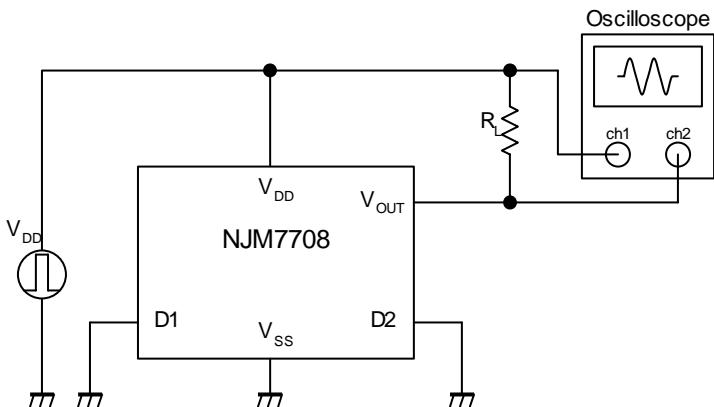
### ● Delay Time=100mS TEST CIRCUIT



# NJU7708/09

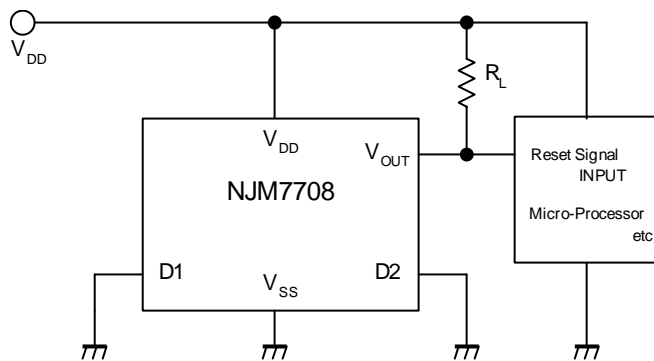
## ■ TEST CIRCUIT

● Delay Time=200mS TEST CIRCUIT

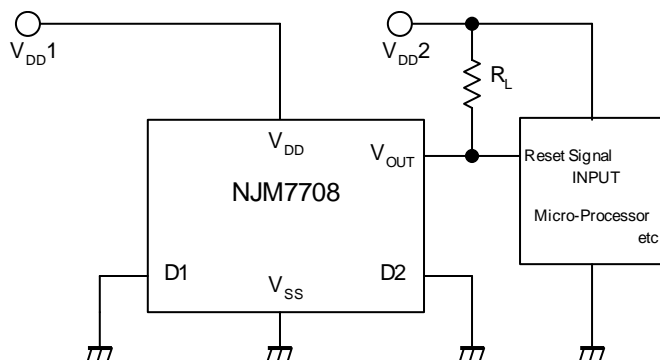


## ■ TYPICAL APPLICATION

① Power Supply Voltage Supervisory Circuit



② Power Supply Voltage Supervisory Circuit (Another Power Supply to Micro-Processor)



■ NJU7709

■ ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT	
Input Voltage	V <sub>DD</sub>	+10	V	
Output Voltage	V <sub>OUT</sub>	V <sub>SS</sub> -0.3 ~ V <sub>DD</sub> +0.3	V	
Output Current	I <sub>OUT</sub>	50	mA	
Power Dissipation	P <sub>D</sub>	SOT-23-5	350(*4)	mW
			200(*5)	
Operating Temperature	Topr	-40 ~ +85	°C	
Storage Temperature	Tstg	-40 ~ +125	°C	

(\*4) : Mounted on glass epoxy board based on EIA/JEDEC. (114.3x76.2x1.6mm: 2Layers)

(\*5) : Device itself

■ ELECTRICAL CHARACTERISTICS (Ta=25°C)

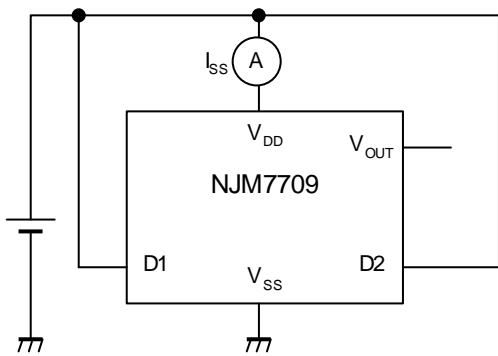
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Detection Voltage	V <sub>DET</sub>		-1.0%	-	+1.0%	V	
Hysteresis Voltage	V <sub>HYS</sub>		70	90	130	V	
Quiescent Current	I <sub>SS</sub>	V <sub>DD</sub> =V <sub>DET</sub> +1V	V <sub>DET</sub> =1.5V ~ 1.9V Version	-	1.0	1.7	μA
			V <sub>DET</sub> =2.0V ~ 6.0V Version	-	1.3	2.2	μA
Output Current	I <sub>OUT</sub>	Nch, V <sub>DS</sub> =0.5V	V <sub>DD</sub> =1.2V	0.75	2.0	-	mA
			V <sub>DD</sub> =2.4V(≥2.7V Version)	4.5	7.0	-	mA
		Pch, V <sub>DS</sub> =0.5V	V <sub>DD</sub> =4.8V(≤3.9V Version)	2.0	3.5	-	mA
			V <sub>DD</sub> =6.0V(4.0V~5.6V Version)	2.5	4.0	-	mA
		V <sub>DD</sub> =8.4V (≥5.7V Version)	3.0	5.0	-	mA	
Detection Voltage Temperature Coefficient	ΔV <sub>DET</sub> /ΔTa	Ta=0 ~ +85°C	-	±100	-	ppm/°C	
Delay Time	td	V <sub>DD</sub> =V <sub>DET</sub> +1V,	D1=H, D2=H	25	100	300	μs
			D1=H, D2=L	42.5	50	57.5	ms
			D1=L, D2=H	85	100	115	ms
			D1=L, D2=L	170	200	230	ms
Delay Time Change Terminal Input Voltage	V <sub>D1_H</sub> /V <sub>D2_H</sub>		1.5	-	V <sub>DD</sub>	V	
	V <sub>D1_L</sub> /V <sub>D2_L</sub>		0	-	0.3	V	
Operating Voltage (*6)	V <sub>DD</sub>	R <sub>L</sub> =100kΩ	0.8	-	9	V	

(\*6): The minimum Operating Voltage(V<sub>OPL</sub>) indicates the same value of the output voltage(V<sub>OUT</sub>) on condition that V<sub>OUT</sub> becomes 10% or less of the input voltage(V<sub>DD</sub>).

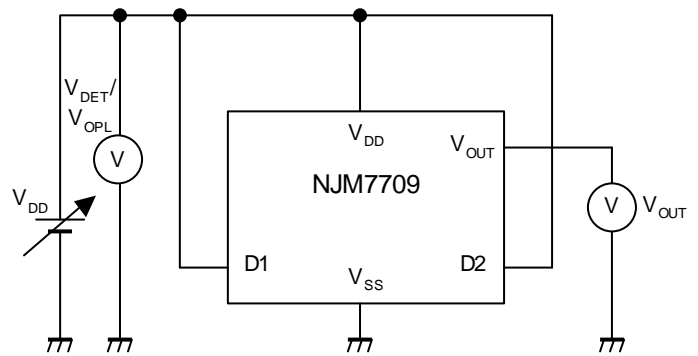
# NJU7708/09

## ■ TEST CIRCUIT

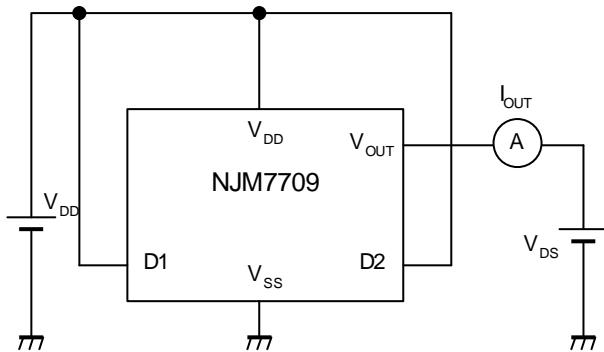
● Quiescent Current TEST CIRCUIT



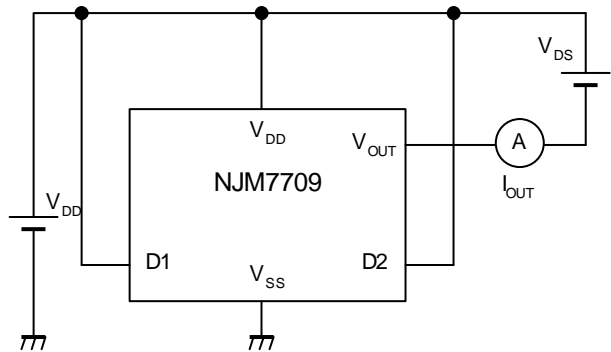
● Detection Voltage TEST CIRCUIT



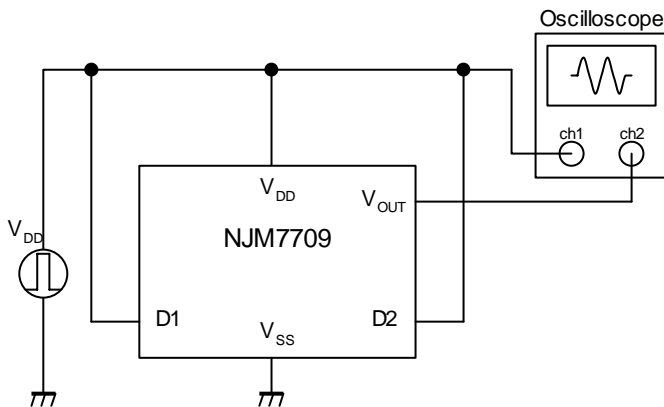
● Nch Output Current TEST CIRCUIT



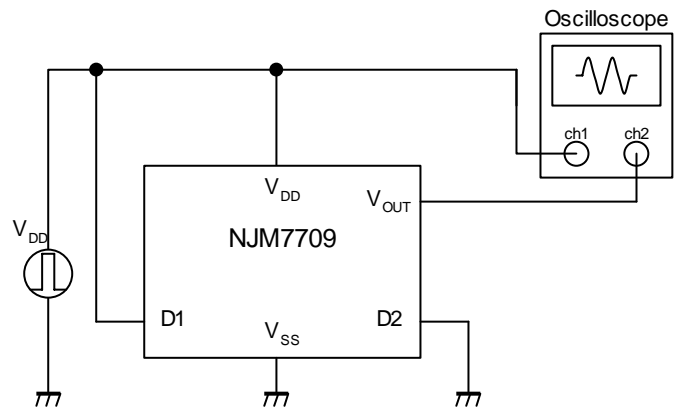
● Pch Output Current TEST CIRCUIT



● Delay Time=0mS TEST CIRCUIT

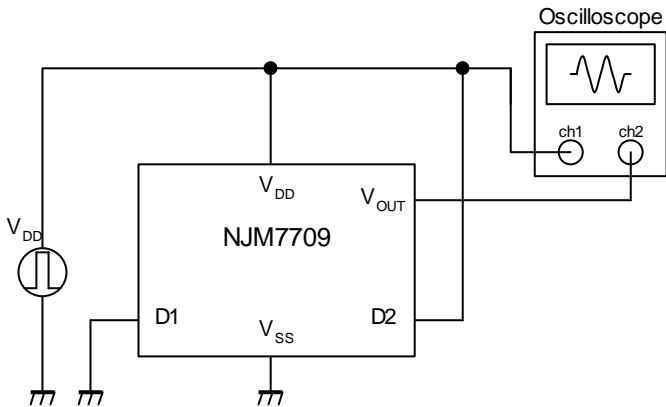


● Delay Time=50mS TEST CIRCUIT

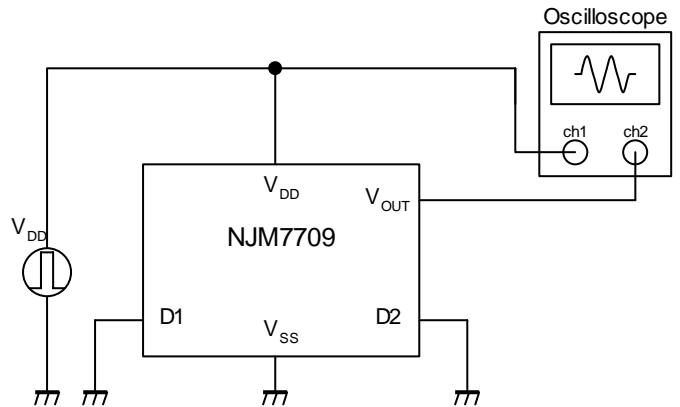


## ■ TEST CIRCUIT

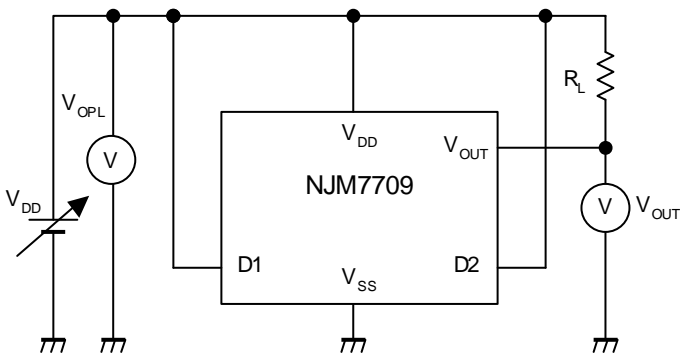
### ● Delay Time=100mS TEST CIRCUIT



### ● Delay Time=200mS TEST CIRCUIT

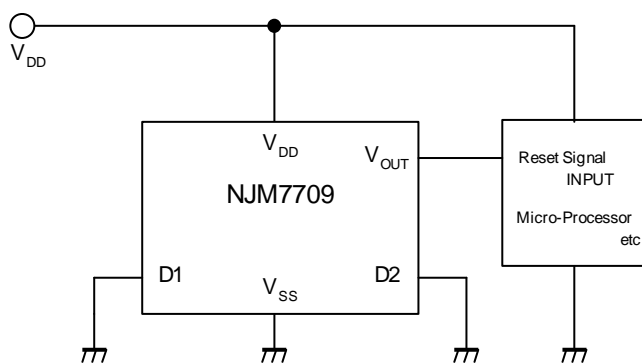


### ● Minimum Operating Voltage TEST CIRCUIT



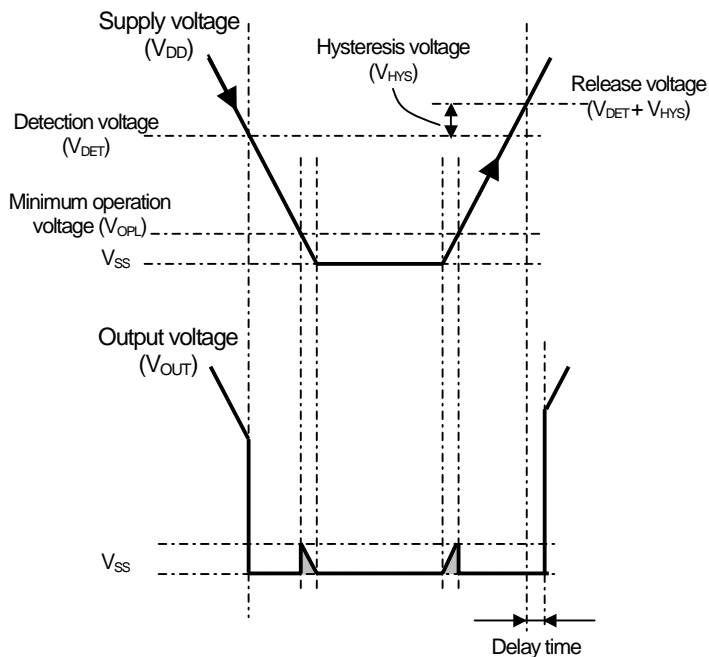
## ■ TYPICAL APPLICATION

### ① Power Supply Voltage Supervisory Circuit



## FUNCTIONAL DESCRIPTION

### (1) Basic Operation



- (1) When supply voltage ( $V_{DD}$ ) drops below detection voltage ( $V_{DET}$ ), Output voltage ( $V_{OUT}$ ) changes "H" to "L" to alert reset state.
- (2) The reset state is kept while  $V_{DD}$  is lower than release voltage. The release voltage is a sum of  $V_{DET}$  and Hysteresis voltage ( $V_{HYS}$ ). Please refer to the (\*7) below.
- (3) When  $V_{DD}$  becomes higher than the release voltage and reset release delay time fixed by logical select is past, then  $V_{OUT}$  changes from "L" to "H" to resume normal state.

(\*7)  $V_{HYS}$  is to avoid unstable  $V_{OUT}$  state caused by rapid voltage change at nearby  $V_{DET}$ .

(\*8): C-MOS output product (NJU7709) : When  $V_{DD}$  less than  $V_{OPL}$ ,  $V_{OUT}$  is free of the shaded region.

### (2) Description of Delay Time

Delay time can be set by logical combination of D1 and D2 (see " LOGICAL TABLE OF DELAY TIME " on page2).

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