

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.

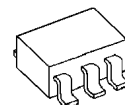
The delay function achieves set wait time when supply voltage is unstable. Moreover, the delay function can make a sequence that other devices in application work and stabilize before microcomputer or DSP works.

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

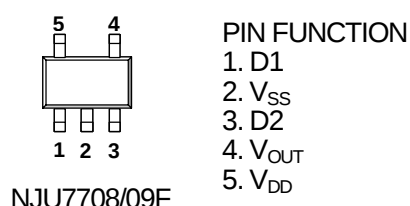


NJU7708/09F

■ 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

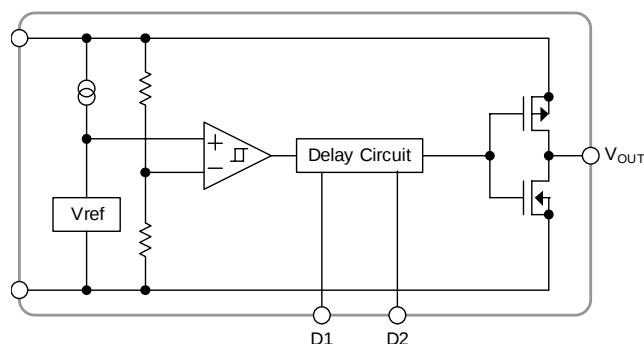
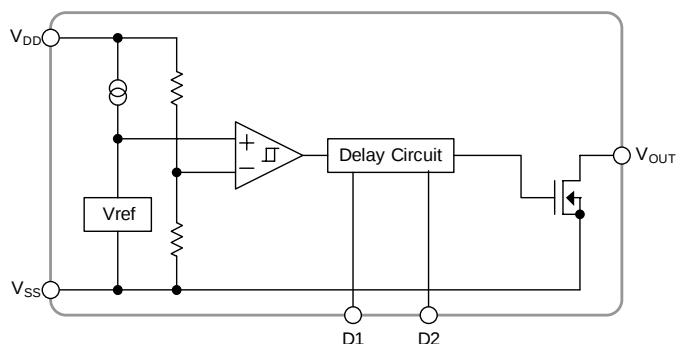
■ PIN CONFIGURATION



PIN FUNCTION

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

■ EQUIVALENT CIRCUIT



■ DETECTION VOLTAGERANK LIST

Device Name	V _{DET}
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 _{DD}	+10	V
Output Voltage	V _{OUT}	V _{SS} -0.3 ~ +10	V
Output Current	I _{OUT}	50	mA
Power Dissipation	P _D	SOT-23-5 350(*1) 200(*2)	mW
Operating Temperature	T _{opr}	-40 ~ +85	°C
Storage Temperature	T _{stg}	-40 ~ +125	°C

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

(*2) : Device itself

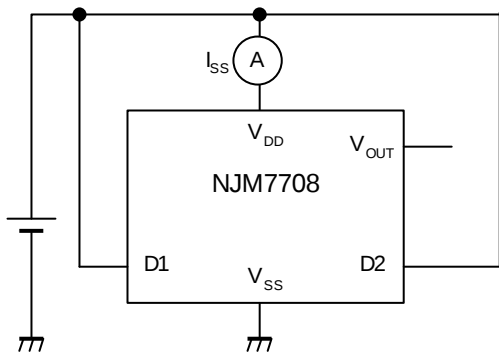
■ ELECTRICAL CHARACTERISTICS (Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Detection Voltage	V _{DET}		-1.0%	—	+1.0%	V
Hysteresis Voltage	V _{HYS}		70	90	130	V
Quiescent Current	I _{SS}	V _{DD} =V _{DET} +1V				
		V _{DET} =1.5V ~ 2.5V Version	—	1.0	1.7	μA
		V _{DET} =2.6V ~ 6.0V Version	—	1.3	2.2	μA
Output Current	I _{OUT}	Nch, V _{DS} =0.5V				
		V _{DD} =1.2V	0.75	2.0	—	mA
		V _{DD} =2.4V (≥2.7V Version)	4.5	7.0	—	mA
Output Leak Current	I _{LEAK}	V _{DD} =V _{OUT} =9V	—	—	0.1	μA
Detection Voltage Temperature Coefficient	ΔV _{DET} /ΔTa	Ta=0 ~ +85°C	—	±100	—	ppm/°C
Delay Time	t _d	V _{DD} =V _{DET} +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	V _{D1 H} / V _{D2 H}		1.5	—	V _{DD}	V
Terminal Input Voltage	V _{D1 L} / V _{D2 L}		0	—	0.3	V
Operating Voltage(*3)	V _{DD}	R _L =100kΩ	0.7	—	9	V

(*3): The minimum operating voltage(V_{OPL}) indicates the same value of the input voltage(V_{DD}) on condition that V_{OUT} becomes 10% or less of the input voltage(V_{DD}).

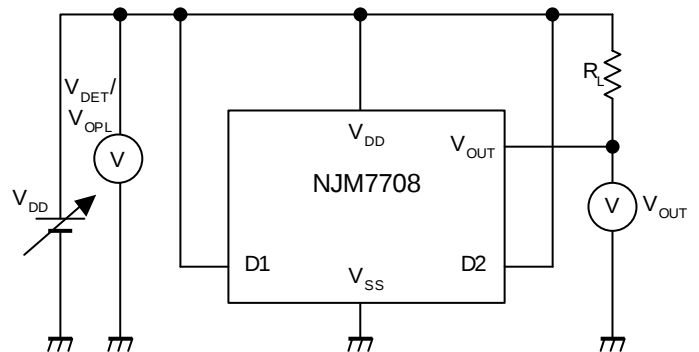
■ TEST CIRCUIT

● Quiescent Current TEST CIRCUIT

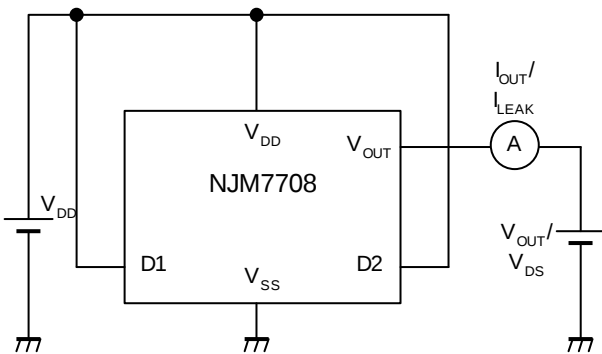


● Detection Voltage

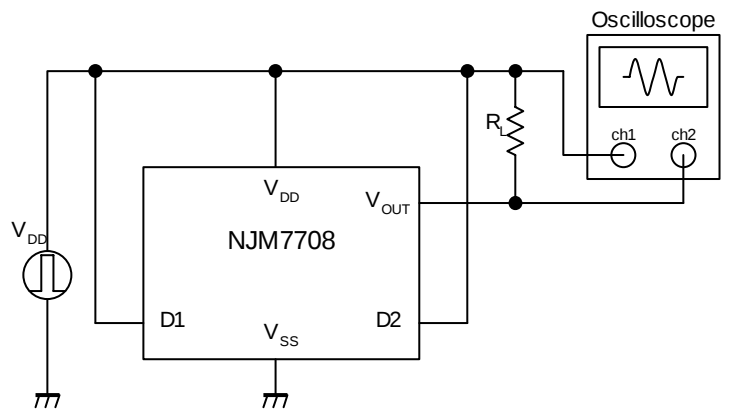
/Minimum Operating Voltage TEST CIRCUIT



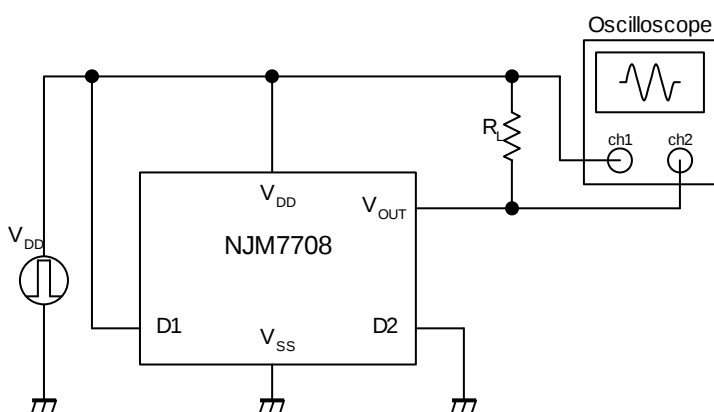
● Leak Current/Output Current TEST CIRCUIT



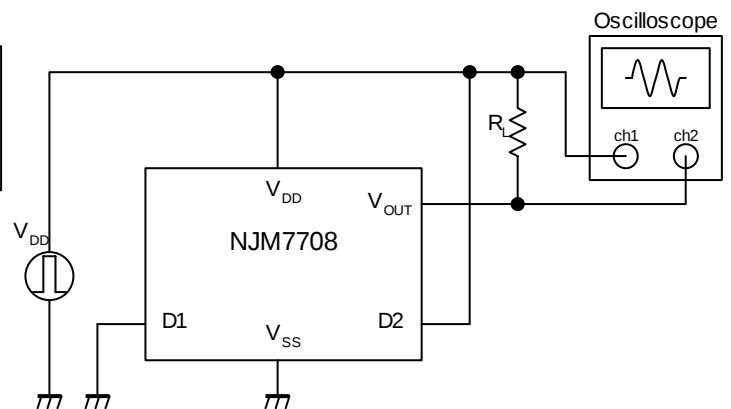
● Delay Time=0mS TEST CIRCUIT



● Delay Time=50mS TEST CIRCUIT

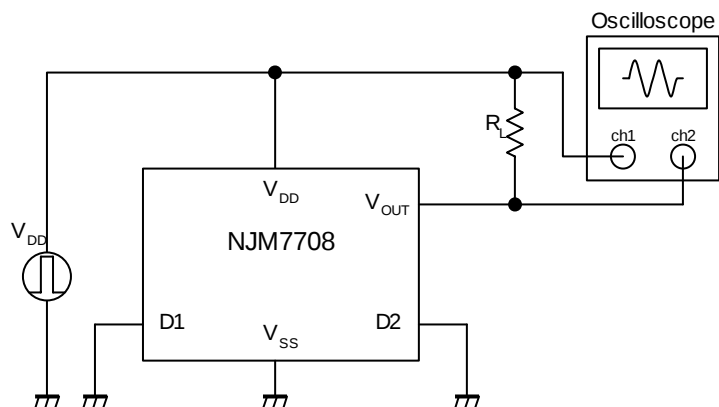


● Delay Time=100mS TEST CIRCUIT



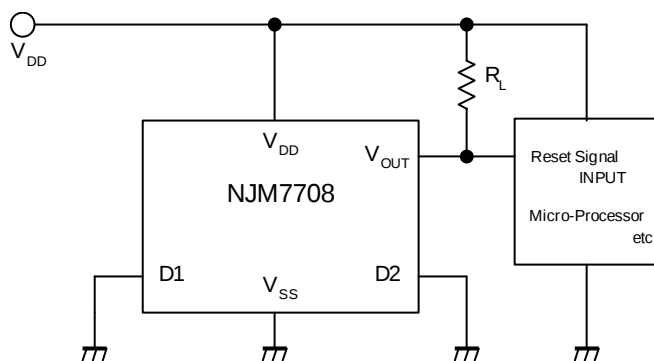
■ TEST CIRCUIT

● Delay Time=200mS TEST CIRCUIT

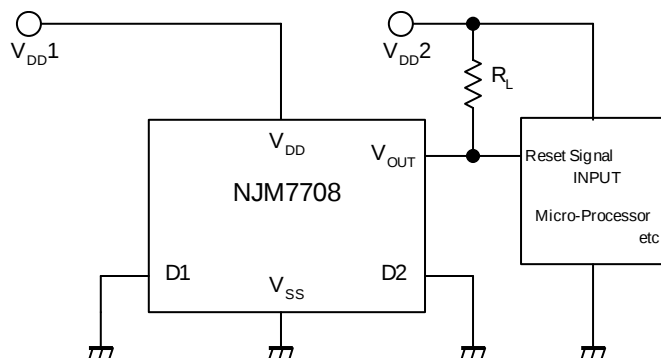


■ TYPICAL APPLICATION

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 _{DD}	+10	V
Output Voltage	V _{OUT}	V _{SS} -0.3 ~ V _{DD} +0.3	V
Output Current	I _{OUT}	50	mA
Power Dissipation	P _D	SOT-23-5 350(*4) 200(*5)	mW
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

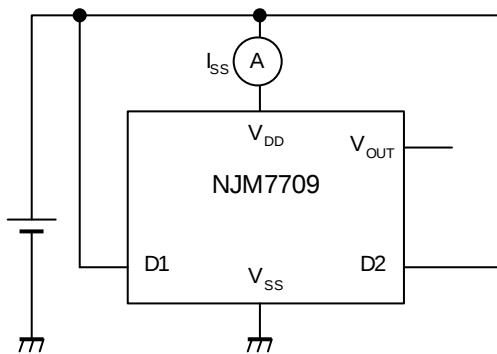
(Ta=25°C)

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

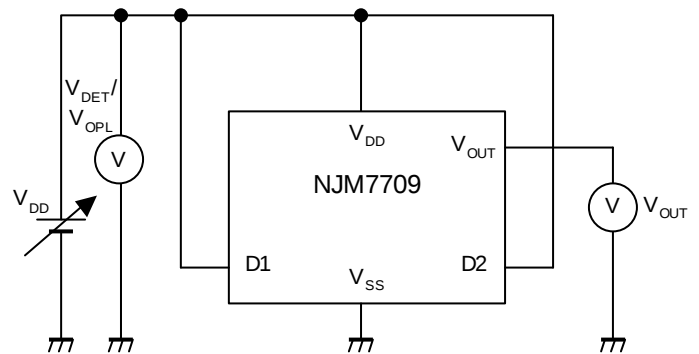
(*6): The minimum Operating Voltage(V_{OPL}) indicates the same value of the output voltage(V_{OUT}) on condition that V_{OUT} becomes 10% or less of the input voltage(V_{DD}).

■ TEST CIRCUIT

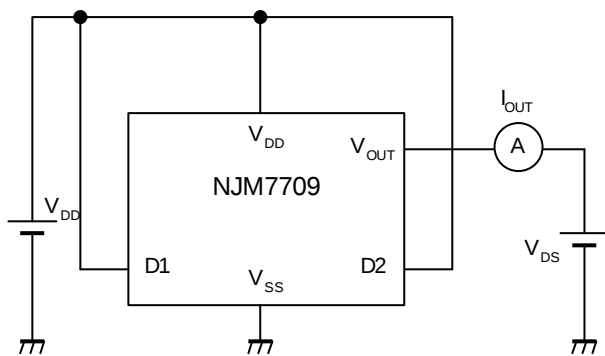
● Quiescent Current TEST CIRCUIT



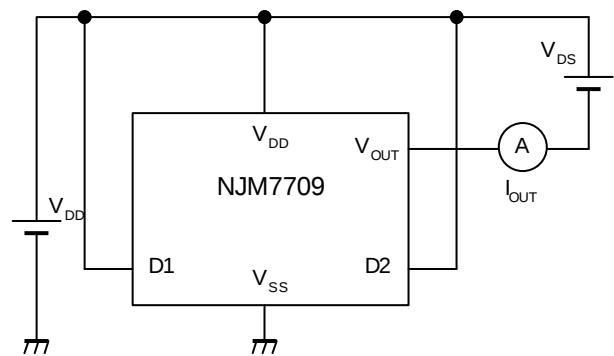
● Detection Voltage TEST CIRCUIT



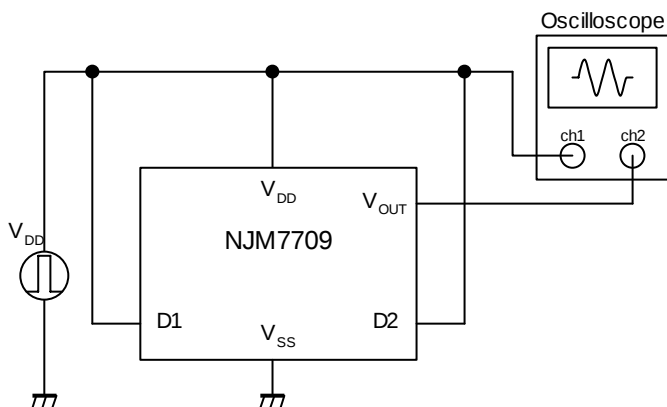
● Nch Output Current TEST CIRCUIT



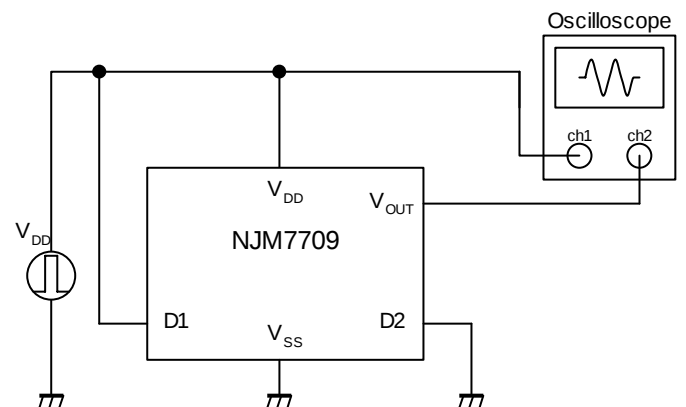
● Pch Output Current TEST CIRCUIT



● Delay Time=0mS TEST CIRCUIT

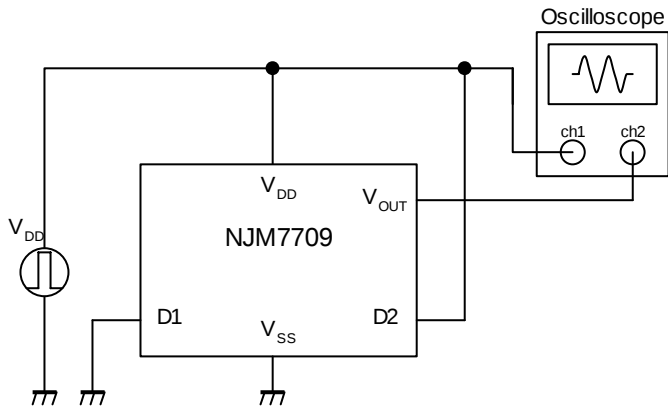


● Delay Time=50mS TEST CIRCUIT

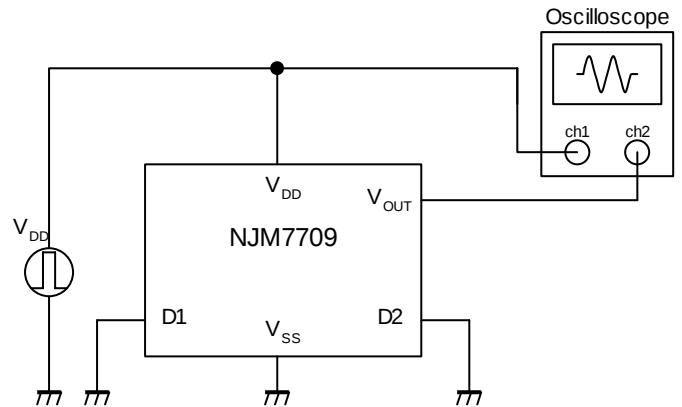


■ TEST CIRCUIT

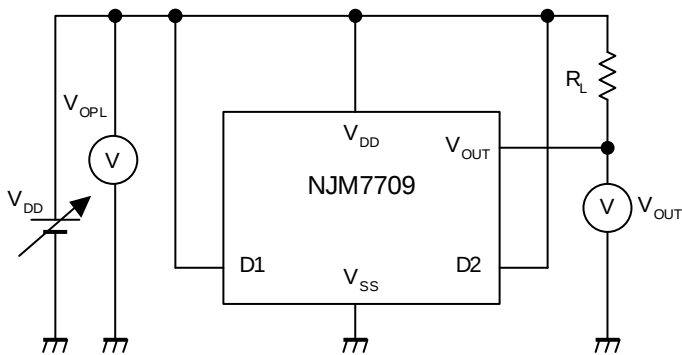
● Delay Time=100mS TEST CIRCUIT



● Delay Time=200mS TEST CIRCUIT

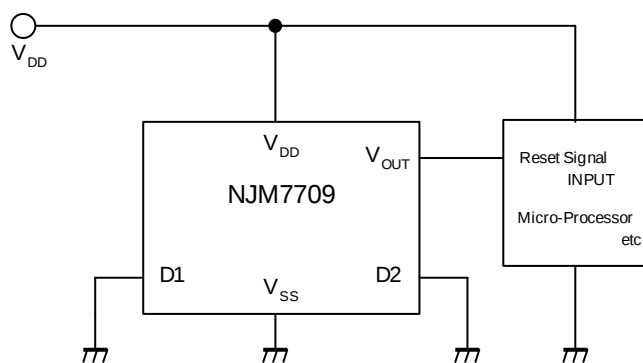


● Minimum Operating Voltage TEST CIRCUIT



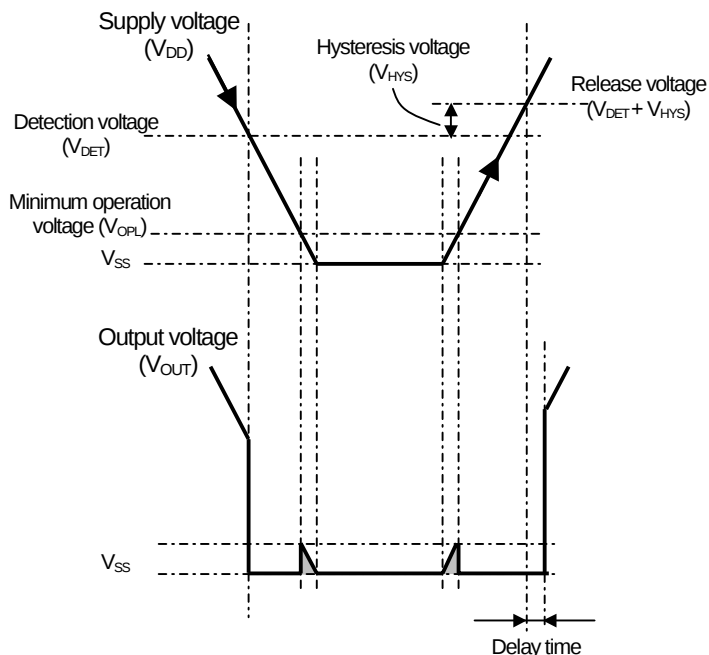
■ TYPICAL APPLICATION

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_{OP} , 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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