

## VOLTAGE DETECTOR

### ■ GENERAL DESCRIPTION

The NJU7704/05 is a low quiescent current voltage detector featuring high precision detection voltage.

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

The NJU7704/05 are useful for preventing malfunction of microcomputer or DSP etc. through detect a drop in voltage of battery or power supply.

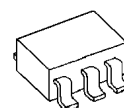
The delay function achieves set wait time when supply voltage is unstable. Moreover, the delay function can make a sequence that other devices in application work and stabilize before microcomputer or DSP works.

Delay time can be set by an external capacitor. Manual reset function can output reset signal irrespective of detection voltage.

NJU7704 is Nch. Open Drain and NJU7705 is a C-MOS output type.

Small packaging makes NJU7704 and NJU7705 suitable for space conscious applications.

### ■ PACKAGE OUTLINE



NJU7704/05F

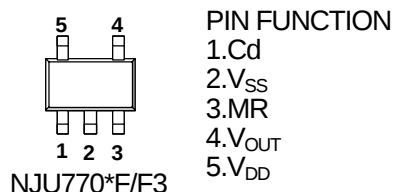


NJU7704/05F3

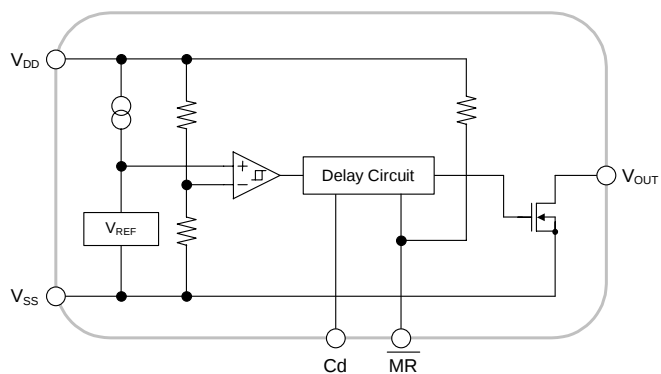
### ■ FEATURES

- High Precision Detection Voltage  $\pm 1.0\%$
- Low Quiescent Current  $0.9\mu\text{A typ.}$
- Detection Voltage Range  $1.5\sim 6.0\text{V}(0.1\text{V Step})$
- Adjustable delay time with external capacitor
- Manual Reset  
Active "L" : NJU770\*\*\*\*A  
Active "H" : NJU770\*\*\*\*B
- Output Configuration  
NJU7704: Nch. Open Drain type  
NJU7705: C-MOS Output type
- Package Outline  
SOT-23-5: NJU770\*F  
SC88A : NJU770\*F3

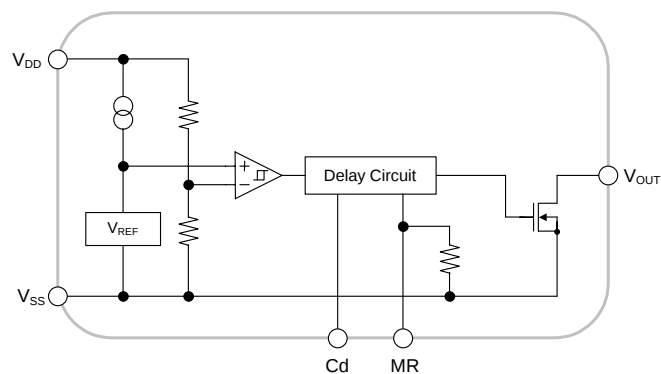
### ■ PIN CONFIGURATION



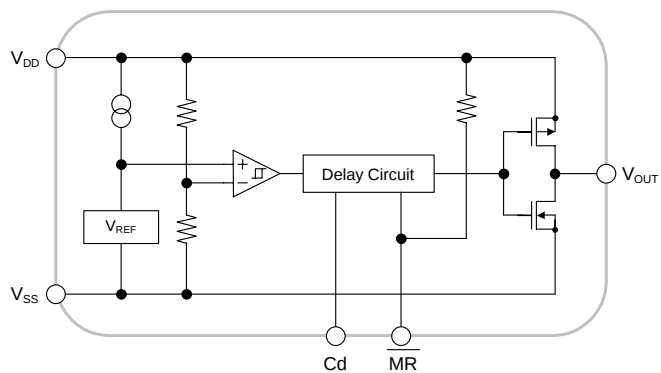
## ■ EQUIVALENT CIRCUIT



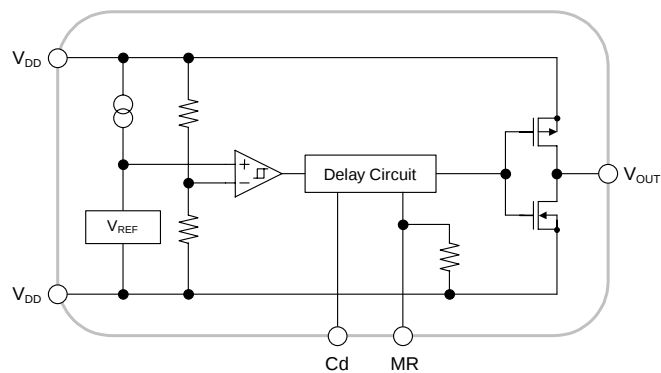
NJU7704\*\*\*A



NJU7704F\*\*B



NJU7705\*\*\*A



NJU7705\*\*\*B

## ■ DETECTION VOLTAGE RANK LIST

| Device Name     | V <sub>DET</sub> | MR Logic   |
|-----------------|------------------|------------|
| NJU770*F3-/F15A | 1.5V             | Active "L" |
| NJU770*F3-/F19A | 1.9V             |            |
| NJU770*F3-/F02A | 2.0V             |            |
| NJU770*F3-/F21A | 2.1V             |            |
| NJU770*F3-/F22A | 2.2V             |            |
| NJU770*F3-/F23A | 2.3V             |            |
| NJU770*F3-/F25A | 2.5V             |            |
| NJU770*F3-/F27A | 2.7V             |            |
| NJU770*F3-/F28A | 2.8V             |            |
| NJU770*F3-/F29A | 2.9V             |            |
| NJU770*F3-/F03A | 3.0V             |            |
| NJU770*F3-/F32A | 3.2V             |            |
| NJU770*F3-/F39A | 3.9V             |            |
| NJU770*F3-/F42A | 4.2V             |            |
| NJU770*F3-/F43A | 4.3V             |            |
| NJU770*F3-/F44A | 4.4V             |            |
| NJU770*F3-/F45A | 4.5V             |            |
| NJU770*F3-/F48A | 4.8V             |            |
| NJU770*F3-/F06A | 6.0V             |            |
| NJU770*F3-/F19B | 1.9V             | Active "H" |
| NJU770*F3-/F27B | 2.7V             |            |
| NJU770*F3-/F28B | 2.8V             |            |
| NJU770*F3-/F03B | 3.0V             |            |
| NJU770*F3-/F42B | 4.2V             |            |

## ■ NJU7704

### ■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

| PARAMETER               | SYMBOL    | RATINGS                      | UNIT    |
|-------------------------|-----------|------------------------------|---------|
| Input Voltage           | $V_{DD}$  | +10                          | V       |
| Output Voltage          | $V_{OUT}$ | $V_{SS}-0.3 \sim +10$        | V       |
| Input Voltage of Cd pin | $V_{Cd}$  | $V_{SS}-0.3 \sim V_{DD}+0.3$ | V       |
| Input Voltage of MR pin | $V_{MR}$  | $V_{SS}-0.3 \sim V_{DD}+0.3$ | V       |
| Output Current          | $I_{OUT}$ | 50                           | mA      |
| Power Dissipation       | $P_D$     | SOT-23-5                     | 350(*1) |
|                         |           |                              | 200(*2) |
|                         |           | SC88A                        | 250(*1) |
| 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

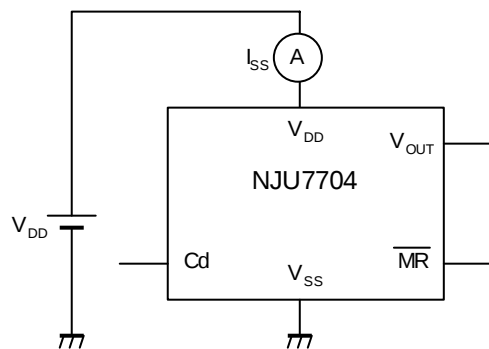
(Ta=25°C)

| PARAMETER                                 | SYMBOL                        | TEST CONDITION                 | MIN.                                 | TYP.      | MAX.         | UNIT       |
|-------------------------------------------|-------------------------------|--------------------------------|--------------------------------------|-----------|--------------|------------|
| Detection Voltage                         | $V_{DET}$                     |                                | -1.0%                                | -         | +1.0%        | V          |
| Hysteresis Voltage                        | $V_{HYS}$                     |                                | 70                                   | 90        | 130          | mV         |
| Quiescent Current                         | $I_{SS}$                      | $V_{DD}=V_{DET}+1V$            | $V_{DET}=1.5V \sim 1.9V$ Version     | 0.7       | 1.5          | $\mu A$    |
|                                           |                               |                                | $V_{DET}=2.0V \sim 6.0V$ Version     | 0.9       | 2.0          |            |
| Output Current                            | $I_{OUT}$                     | $N_{ch}, V_{DS}=0.5V$          | $V_{DD}=1.2V$                        | 0.75      | 2.0          | mA         |
|                                           |                               |                                | $V_{DD}=2.4V$ ( $\geq 2.7V$ Version) | 4.5       | 7.0          |            |
| Output Leak Current                       | $I_{LEAK}$                    | $V_{DD}=V_{OUT}=9V$            | -                                    | -         | 0.1          | $\mu A$    |
| Detection Voltage Temperature Coefficient | $\Delta V_{DET} / \Delta T_a$ | $T_a=0 \sim +85^\circ C$       | -                                    | $\pm 100$ | -            | ppm/°C     |
| Delay Time                                | $t_d$                         | $V_{DD}=V_{DET}+1V, C_d=4.7nF$ | 8                                    | 10        | 12           | ms         |
| Input Voltage of MR pin (Active "L")      | $V_{MR\_H}$                   |                                | 1.5                                  | -         | $V_{DD}$     | V          |
|                                           | $V_{MR\_L}$                   |                                | 0                                    | -         | 0.3          |            |
| Input Voltage of MR pin (Active "H")      | $V_{MR\_H}$                   |                                | $V_{DD}-0.3$                         | -         | $V_{DD}$     | V          |
|                                           | $V_{MR\_L}$                   |                                | 0                                    | -         | $V_{DD}-1.5$ |            |
| Impedance of MR pin                       | $R_{MR}$                      |                                | 1.0                                  | 2.0       | 3.0          | M $\Omega$ |
| Operating Voltage (*3)                    | $V_{DD}$                      | $R_L=100k\Omega$               | 0.8                                  | -         | 9            | V          |

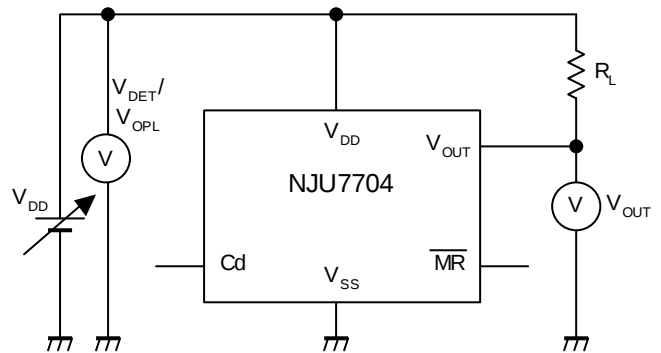
(\*3): The minimum operating voltage( $V_{OPL}$ ) indicates the same value of the input voltage( $V_{DD}$ ) on condition that  $V_{OUT}$  becomes 10% or less of the input voltage( $V_{DD}$ ).

## ■ TEST CIRCUIT

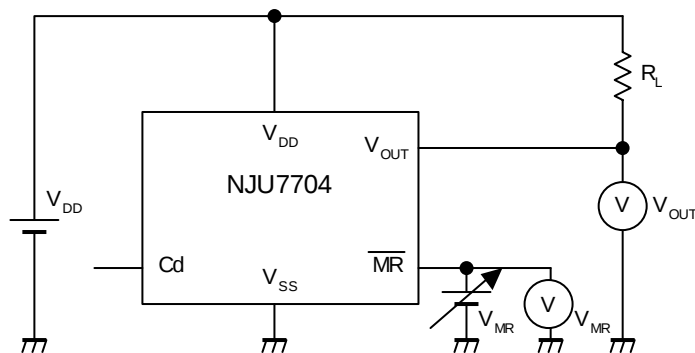
### ● Circuit Operating Current TEST CIRCUIT



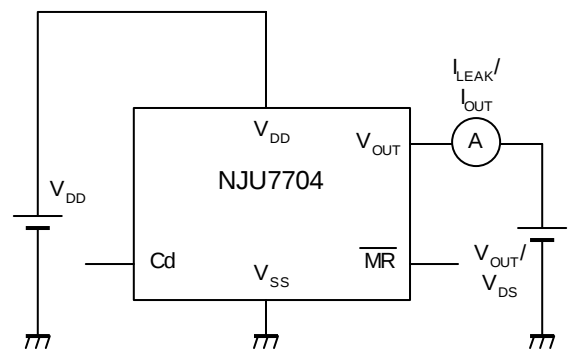
### ● Detection voltage/Minimum operating voltage



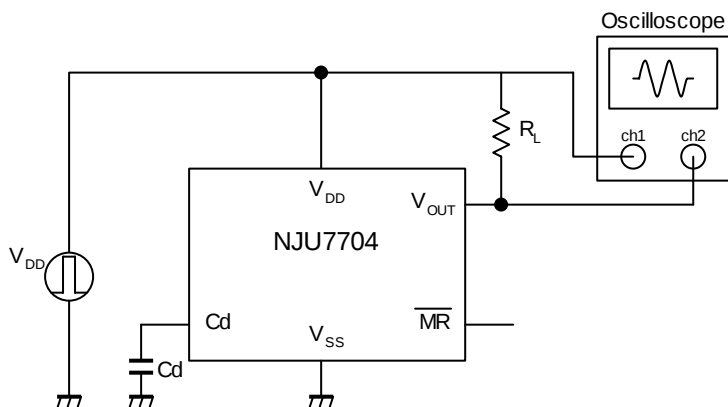
### ● MR pin Input voltage TEST CIRCUIT



### ● Leak current / Output current TEST CIRCUIT

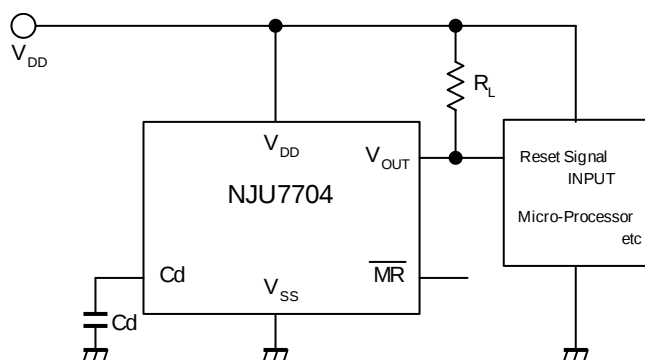


### ● Delay time TEST CIRCUIT

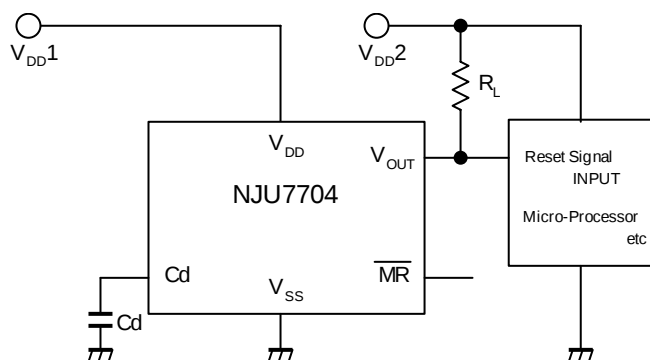


## ■ TYPICAL APPLICATION

### ① Power Supply Monitor Circuit ( $V_{DD}$ line COMMON)



### ② Power Supply Monitor Circuit ( $V_{DD}$ line SEPARATE)



■ NJU7705

■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

| PARAMETER               | SYMBOL    | RATINGS                      | UNIT    |
|-------------------------|-----------|------------------------------|---------|
| Input Voltage           | $V_{DD}$  | +10                          | V       |
| Output Voltage          | $V_{OUT}$ | $V_{SS}-0.3 \sim +10$        | V       |
| Input Voltage of Cd pin | $V_{Cd}$  | $V_{SS}-0.3 \sim V_{DD}+0.3$ | V       |
| Input Voltage of MR pin | $V_{MR}$  | $V_{SS}-0.3 \sim V_{DD}+0.3$ | V       |
| Output Current          | $I_{OUT}$ | 50                           | mA      |
| Power Dissipation       | $P_D$     | SOT-23-5                     | 350(*4) |
|                         |           |                              | 200(*5) |
|                         |           | SC88A                        | 250(*4) |
| Operating Temperature   | $T_{opr}$ | -40~+85                      | °C      |
| Storage Temperature     | $T_{stg}$ | -40~+125                     | °C      |

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

(\*5) : Device itself

■ ELECTRICAL CHARACTERISTICS

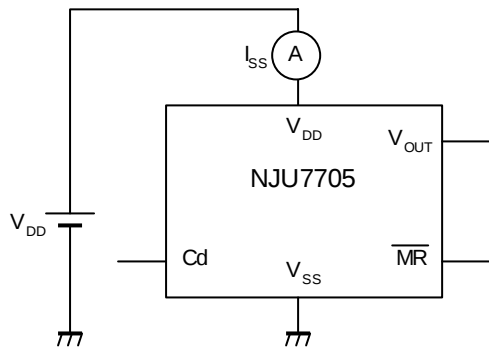
(Ta=25°C)

| PARAMETER                                 | SYMBOL                       | TEST CONDITION                | MIN.                                 | TYP.      | MAX.         | UNIT   |
|-------------------------------------------|------------------------------|-------------------------------|--------------------------------------|-----------|--------------|--------|
| Detection Voltage                         | $V_{DET}$                    |                               | -1.0%                                | -         | +1.0%        | V      |
| Hysteresis Voltage                        | $V_{HYS}$                    |                               | 70                                   | 90        | 130          | mV     |
| Quiescent Current                         | $I_{SS}$                     | $V_{DD}=V_{DET}+1V$           | $V_{DET}=1.5V \sim 2.9V$ Version     | -         | 0.7          | 1.5    |
|                                           |                              |                               | $V_{DET}=2.6V \sim 6.0V$ Version     | -         | 0.9          | 2.0    |
| Output Current                            | $I_{OUT}$                    | $Nch, V_{DS}=0.5V$            | $V_{DD}=1.2V$                        | 0.75      | 2.0          | -      |
|                                           |                              |                               | $V_{DD}=2.4V$ ( $\geq 2.7V$ Version) | 4.5       | 7.0          | -      |
|                                           |                              | $Pch, V_{DS}=0.5V$            | $V_{DD}=4.8V$ ( $\leq 3.9V$ Version) | 2.0       | 3.5          | -      |
|                                           |                              |                               | $V_{DD}=6.0V$ (4.0~5.6V Version)     | 2.5       | 4.0          | -      |
|                                           |                              |                               | $V_{DD}=8.4V$ ( $\geq 5.7V$ Version) | 3.0       | 5.0          | -      |
| Detection Voltage Temperature Coefficient | $\Delta V_{DET} / \Delta Ta$ | $Ta=0 \sim +85^\circ C$       | -                                    | $\pm 100$ | -            | ppm/°C |
| Delay Time                                | $t_d$                        | $V_{DD}=V_{DET}+1V, Cd=4.7nF$ | 8                                    | 10        | 12           | ms     |
| Input Voltage of MR pin (Active "L")      | $V_{MR\_H}$                  |                               | 1.5                                  | -         | $V_{DD}$     | V      |
|                                           | $V_{MR\_L}$                  |                               | 0                                    | -         | 0.3          | V      |
| Input Voltage of MR pin (Active "H")      | $V_{MR\_H}$                  |                               | $V_{DD}-0.3$                         | -         | $V_{DD}$     | V      |
|                                           | $V_{MR\_L}$                  |                               | 0                                    | -         | $V_{DD}-1.5$ | V      |
| Impedance of MR pin                       | $R_{MR}$                     |                               | 1.0                                  | 2.0       | 3.0          | MΩ     |
| Operating Voltage (*6)                    | $V_{DD}$                     | $R_L=100k\Omega$              | 0.8                                  | -         | 9            | V      |

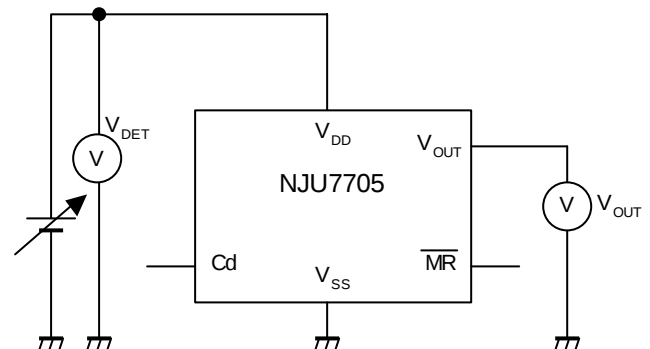
(\*6): The minimum operating voltage( $V_{OPL}$ ) indicates the same value of the input voltage( $V_{DD}$ ) on condition that  $V_{OUT}$  becomes 10% or less of the input voltage( $V_{DD}$ ).

## ■ TEST CIRCUIT

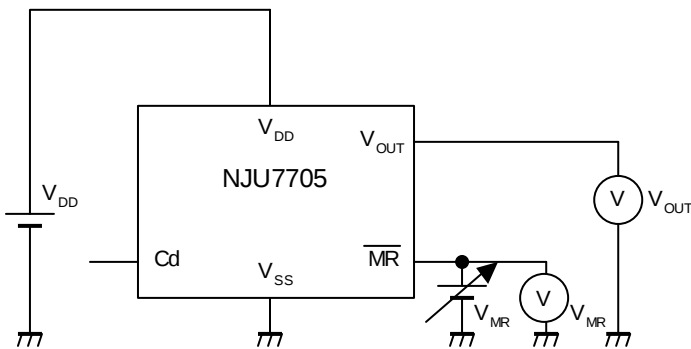
### ● Circuit Operating Current TEST CIRCUIT



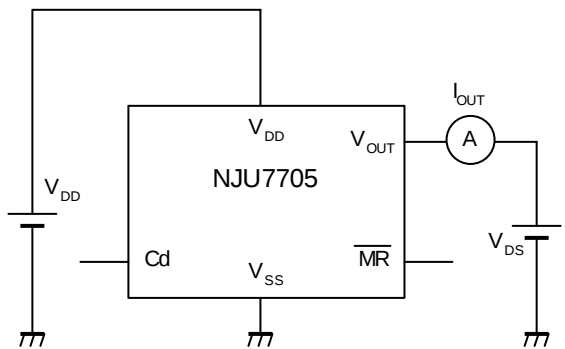
### ● Detection voltage TEST CIRCUIT



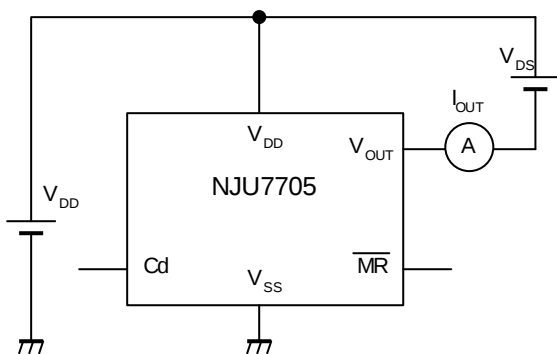
### ● MR pin Input voltage TEST CIRCUIT



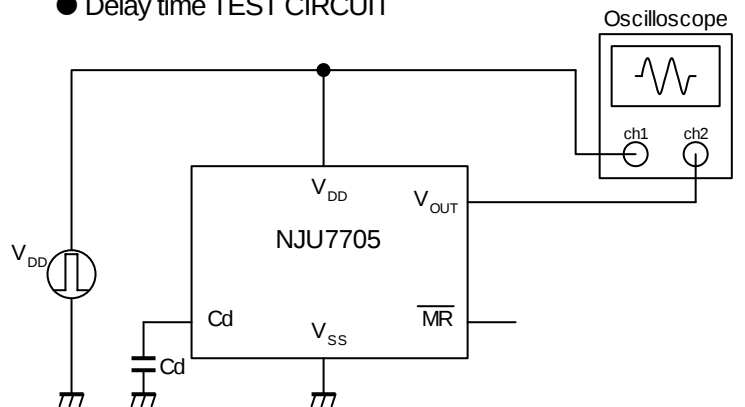
### ● Nch Output current TEST CIRCUIT



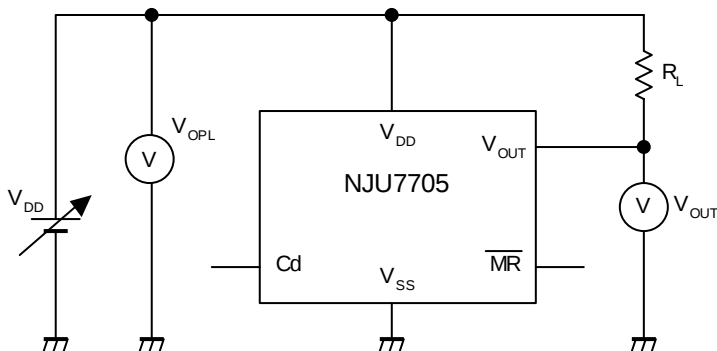
### ● Pch Output current TEST CIRCUIT



### ● Delay time TEST CIRCUIT

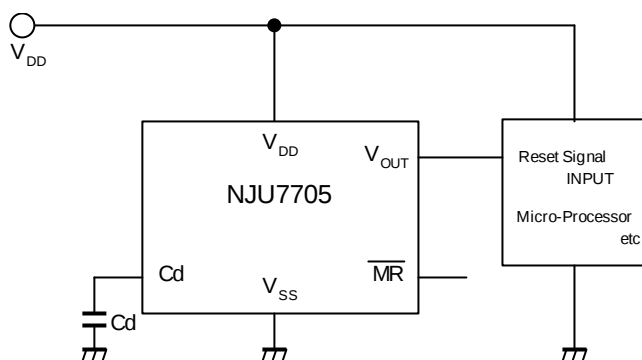


### ● Minimum operating voltage TEST CIRCUIT



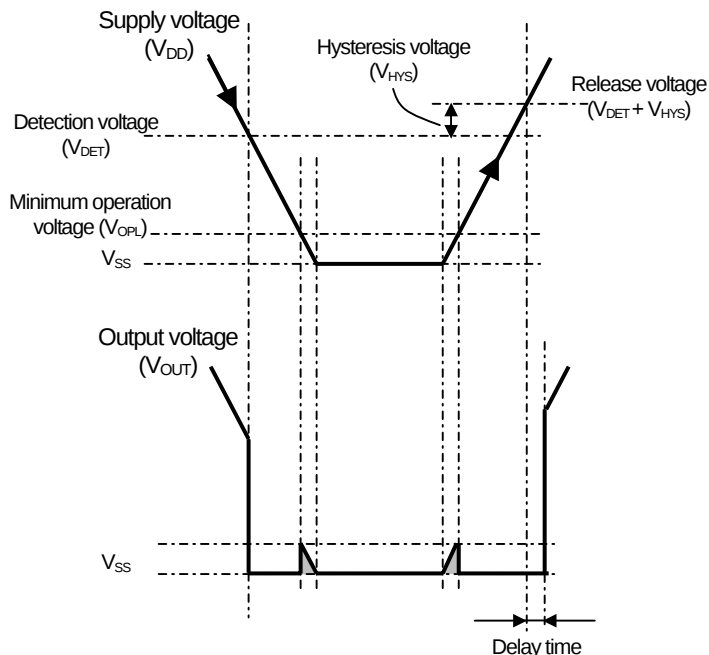
## ■ TYPICAL APPLICATION

### ① Power Supply Monitor Circuit ( $V_{DD}$ line COMMON)



## 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 set by the external capacitors is past, then  $V_{OUT}$  changes from "L" to "H" to resume normal state.

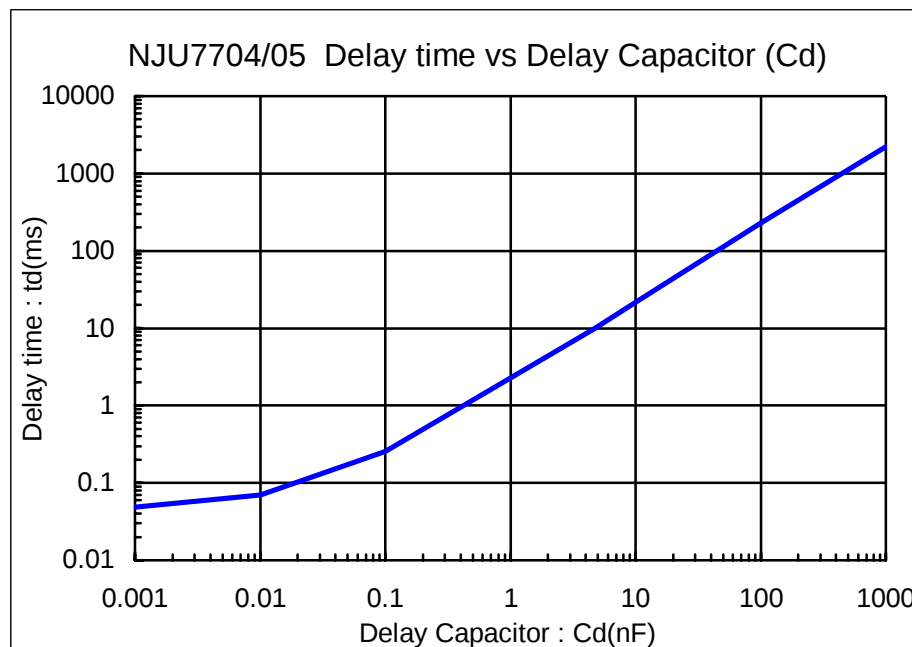
(\*7)  $V_{HYS}$  is to avoid unstable  $V_{OUT}$  state caused by rapid voltage change at nearby  $V_{DET}$ .

(\*8): C-MOS output product (NJU7705) : 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 the external capacitor. The delay time is given by the following:

$$\text{External delay capacitor (nF)} = \text{Required delay time : } t_d(\text{ms}) / 10(\text{ms}) \times 4.7(\text{nF})$$



## (3) Description of Manual Reset

Reset signal can output independently with MR.

| Logic of MR | Operation                                    |
|-------------|----------------------------------------------|
| Active "L"  | $V_{MR} = "L" \Rightarrow \text{Reset "ON"}$ |
| Active "H"  | $V_{MR} = "H" \Rightarrow \text{Reset "ON"}$ |

If Manual Reset is not required, please connect MR terminal as following.

| Logic of MR | Connection                              |
|-------------|-----------------------------------------|
| Active "L"  | Connect MR terminal to $V_{DD}$ or open |
| Active "H"  | Connect MR terminal to GND or open      |

### [CAUTION]

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[NJU7705F3-15A-TE1](#) [NJU7704F27B-TE1](#) [NJU7704F3-25A-TE1](#) [NJU7704F3-06A-TE1](#) [NJU7705F28A-TE1](#)  
[NJU7705F3-45A-TE1](#) [NJU7705F3-28A-TE1](#) [NJU7704F3-27B-TE1](#) [NJU7704F43A-TE1](#) [NJU7704F23A-TE1](#)  
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[43A-TE1](#) [NJU7704F3-28B-TE1](#) [NJU7704F02A-TE1](#) [NJU7705F3-21A-TE1](#) [NJU7705F3-25A-TE1](#) [NJU7705F3-19A-](#)  
[TE1](#) [NJU7704F28B-TE1](#) [NJU7705F3-06A-TE1](#) [NJU7704F22A-TE1](#) [NJU7705F06A-TE1](#)