

## NJU2103A

### System Reset IC

#### FEATURES

- Full compatible with NJM2103
- Detection Voltage  $V_{SA}=4.2V\pm 1.0\%$
- Adjustable Detection Voltage  $V_{SB}=1.22V\pm 1.0\%$
- $V_{SA}$  and  $V_{SB}$  have Hysteresis Characteristics at Reset release
- Possible to detect Over Voltage  $V_{SC}=1.235V\pm 1.0\%$
- Operating Temperature  $T_a=-40$  to  $125^\circ\text{C}$
- Low Quiescent Current  $280\mu\text{A typ.}$
- Reference Voltage can be taken out
- Low reset operation voltage  $0.8V$  typ.
- Package DMP8, DIP8, TVSP8

#### GENERAL DESCRIPTION

The NJU2103A is a power supply voltage monitoring IC that instantaneously detects abnormality such as power supply voltage cutoff or drop and generates reset signal.

It can monitor 2 systems of 5 V power supply and arbitrarily set voltage.

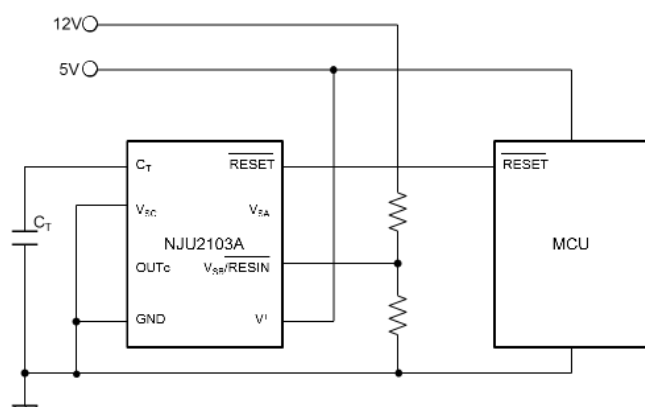
It is possible to direct replacement from NJM2103 and the small TVSP8 package is added.

Furthermore, it improves usability by extending operating temperature, standardizing AC characteristics, and making each parameter highly accurate.

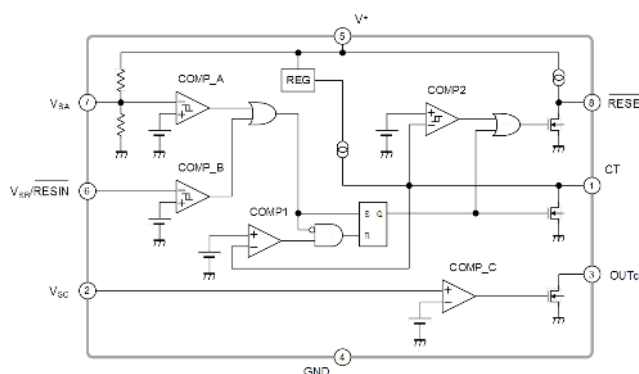
#### APPLICATIONS

- Industrial equipment
- Housing and facility equipment
- OA equipment
- Amusement equipment

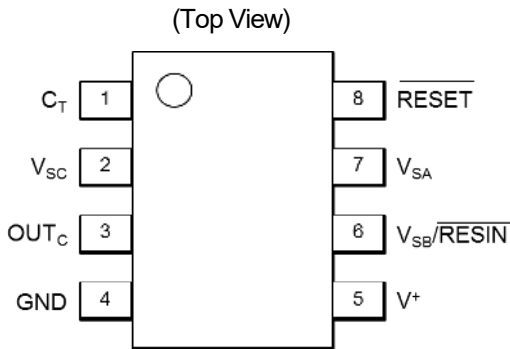
#### TYPICAL APPLICATION



#### BLOCK DIAGRAM



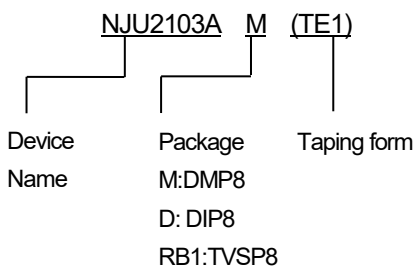
■PIN CONFIGURATION



DMP8/DIP8/TVSP8

PIN No.	PIN NAME	FUNCTION
1	C <sub>T</sub>	Connects Capacitor pin for setting RESET Output Pulse Width
2	V <sub>sc</sub>	Comparator C input pin
3	OUT <sub>c</sub>	Comparator C output pin
4	GND	GND pin
5	V <sup>+</sup>	Power Supply pin
6	V <sub>sb</sub> /RESIN	Comparator B input pin
7	V <sub>sa</sub>	Comparator A input pin
8	RESET	RESET output pin (Active Low)

■PRODUCT NAME INFORMATION



■ORDERING INFORMATION

PRODUCT NAME	PACKAGE OUTLINE	RoHS	Halogen-Free	TERMINAL FINISH	MARKING	WEIGHT (mg)	MOQ (pcs)
NJU2103AM(TE1)	DMP8	○	○	Sn-2Bi	2103A	95	2000
NJU2103AD	DIP8	○	-	Sn-2Bi	2103AD	510	2000
NJU2103ARB1(TE1)	TVSP8	○	○	Sn-2Bi	2103A	18	2000

■ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V <sup>+</sup>	-0.3 to 20	V
Input Voltage	V <sub>SA</sub>	-0.3 to V <sup>+</sup> +0.3 (<20)	V
	V <sub>SB</sub>	-0.3 to 20	V
	V <sub>SC</sub>	-0.3 to 20	V
C <sub>T</sub> Pin Voltage	V <sub>CT</sub>	-0.3 to V <sup>+</sup> +0.3 (<20)	V
RESET Output Voltage	V <sub>RESET</sub>	-0.3 to V <sup>+</sup> +0.3 (<20)	V
OUT <sub>C</sub> Output Voltage	V <sub>OUTC</sub>	-0.3 to 20	V
Power Dissipation(Ta=25°C)	P <sub>D</sub>	(2-layer / 4-layer)	mW
DMP8		470 <sup>(1)</sup> / 600 <sup>(2)</sup>	
DIP8		910 <sup>(1)</sup> / 1300 <sup>(2)</sup>	
TVSP8		510 <sup>(1)</sup> / 680 <sup>(2)</sup>	
Junction Temperature	T <sub>J</sub>	-40 to +150	°C
Operating Temperature	T <sub>opr</sub>	-40 to +125	°C
Storage Temperature	T <sub>stg</sub>	-50 to +150	°C

(1): Mounted on glass epoxy board.(76.2 x 114.3 x 1.6 :based on EIA/JEDEC standard, 2 Layers)

(2): Mounted on glass epoxy board.(76.2 x 114.3 x 1.6 :based on EIA/JEDEC standard, 4 Layers) internal Cu area: 74.2 x 74.2mm

■RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V <sup>+</sup>	2.5 to 18	V
Input Voltage	V <sub>SA</sub>	0 to V <sup>+</sup>	V
	V <sub>SB</sub>	0 to 18	V
	V <sub>SC</sub>	0 to 18	V
Output Current	I <sub>RESET</sub>	0 to 20	mA
	I <sub>OUTC</sub>	0 to 6	mA
RESET Output Pulse Width	t <sub>PO</sub>	0.15 to 1500	ms
C <sub>T</sub> Capacitor	C <sub>T</sub>	0.001 to 10	μF

## ■ ELECTRICAL CHARACTERISTICS

## (DC Characteristics)

Unless other noted,  $V^+=5V$ ,  $V_{SB}=0V$ ,  $V_{SC}=0V$ ,  $C_T=0.01\mu F$ ,  $T_a=25^\circ C$ 

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current 1	$I_{CC1}$	$V_{SB}=5V$	-	280	390	$\mu A$
Operating Current 2	$I_{CC2}$		-	300	410	$\mu A$
$V_{SA}$ Detecting Voltage 1	$V_{SAL}$	$V^+$ sweep down, $V_{SB}=V^+$	4.158	4.200	4.242	V
		$V^+$ sweep down, $V_{SB}=V^+$ , $T_a=-40^\circ C$ to $125^\circ C$	4.050	-	4.350	
$V_{SA}$ Detecting Voltage 2	$V_{SAH}$	$V^+$ sweep up, $V_{SB}=V^+$	4.210	4.300	4.390	V
		$V^+$ sweep up, $V_{SB}=V^+$ , $T_a=-40^\circ C$ to $125^\circ C$	4.150	-	4.450	
$V_{SA}$ Hysteresis Width	$V_{HRS A}$		50	100	150	mV
$V_{SB}$ Detecting Voltage	$V_{SBL}$	$V_{SB}$ sweep down	1.208	1.220	1.232	V
		$V_{SB}$ sweep down, $T_a=-40^\circ C$ to $125^\circ C$	1.190	-	1.250	
$V_{SB}$ Detecting Supply Voltage Fluctuation	$\Delta V_{SBL}$	$V^+=2.5$ to $18V$	-	3	10	mV
$V_{SB}$ Hysteresis Width	$V_{HRS B}$		14	28	42	mV
$V_{SB}$ Input Current 1	$I_{IHB}$	$V_{SB}=5V$	-	0	250	nA
$V_{SB}$ Input Current 2	$I_{ILB}$		-	0	250	nA
High Level RESET Output Voltage	$V_{OHR}$	$\overline{I_{RESET}}=-5\mu A$ , $V_{SB}=5V$	4.5	4.9	-	V
RESET Output Saturation Voltage 1	$V_{OLR1}$	$\overline{I_{RESET}}=3mA$	-	0.05	0.40	V
RESET Output Saturation Voltage 2	$V_{OLR2}$	$\overline{I_{RESET}}=10mA$	-	0.15	0.50	V
RESET Output Sink Current	$\overline{I_{RESET}}$	$V_{OLR}=1V$	20	60	-	mA
$C_T$ Charge Current	$I_{CT}$	$V_{SB}=5V$ , $V_{CT}=0.5V$	6	9	13	$\mu A$
$V_{SC}$ Input Current 1	$I_{IHC}$	$V_{SC}=5V$	-	0	500	nA
$V_{SC}$ Input Current 2	$I_{ILC}$		-	0	500	nA
$V_{SC}$ Detecting Voltage	$V_{SC}$		1.223	1.235	1.247	V
		$T_a=-40^\circ C$ to $125^\circ C$	1.195	-	1.275	
$V_{SC}$ Detecting Supply Voltage Fluctuation	$\Delta V_{SC}$	$V^+=2.5$ to $18V$	-	3	10	mV
$OUT_C$ Output Leak Current	$I_{OHC}$	$V_{OHC}=18V$	-	0	1	$\mu A$
$OUT_C$ Output Saturation Voltage	$V_{OLC}$	$I_{OUTC}=4mA$ , $V_{SC}=5V$	-	0.15	0.40	V
$OUT_C$ Output Sink Current	$I_{OUTC}$	$V_{OLC}=1V$ , $V_{SC}=5V$	6	20	-	mA
RESET Minimum Operating Voltage	$V^*_L$	$V_{OLR}=0.4V$ , $\overline{I_{RESET}}=200\mu A$	-	0.8	1.2	V

■ELECTRICAL CHARACTERISTICS

(AC Characteristics)

Unless other noted,  $V^+=5V$ ,  $V_{SB}=5V$ ,  $V_{SC}=0V$ ,  $C_T=0.01\mu F$ ,  $T_a=25^\circ C$

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
$V_{SA}$ Input Pulse Width	$t_{PIA}$		5	-	-	$\mu s$
$V_{SB}$ Input Pulse Width	$t_{PIB}$		5	-	-	$\mu s$
$\overline{RESET}$ Output Pulse Width	$t_{PO}$	$V_{SB}=V^+$	1.0	1.5	2.0	ms
$\overline{RESET}$ Rise Time	$t_r$	$V_{SB}=V^+$ , $R_L=2.2k\Omega$ , $C_L=100pF$ $\overline{RESET}=10\%$ to $90\%$	-	1.0	1.5	$\mu s$
$\overline{RESET}$ Fall Time	$t_f$	$V_{SB}=V^+$ , $R_L=2.2k\Omega$ , $C_L=100pF$ $\overline{RESET}=90\%$ to $10\%$	-	0.1	0.5	$\mu s$
Output Delay Time	$t_{PD}$	$V_{SB}$ sweep down	-	2	10	$\mu s$
	$t_{PHL}$	$V_{SC}$ sweep up, $R_L=2.2k\Omega$ , $C_L=100pF$	-	0.5	-	$\mu s$
	$t_{PLH}$	$V_{SC}$ sweep down, $R_L=2.2k\Omega$ , $C_L=100pF$	-	1.0	-	$\mu s$

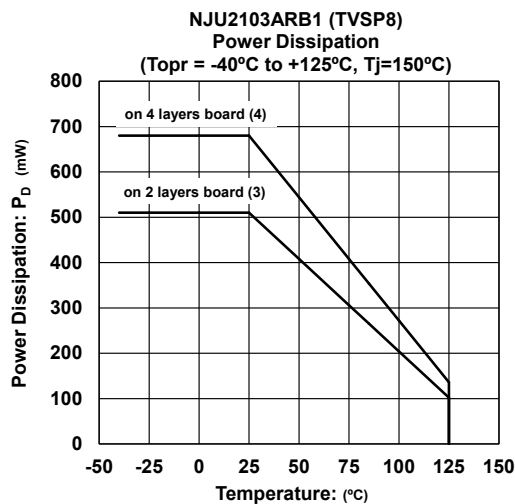
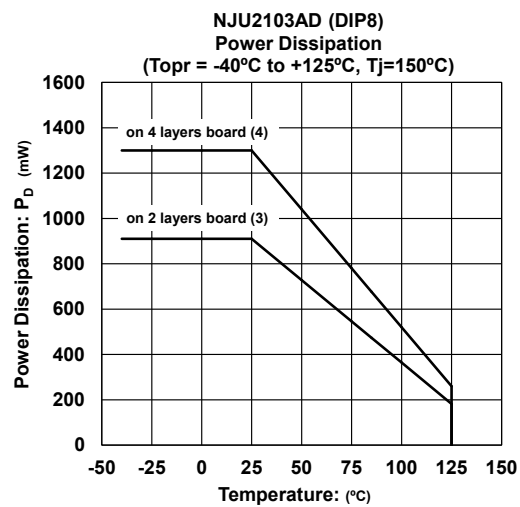
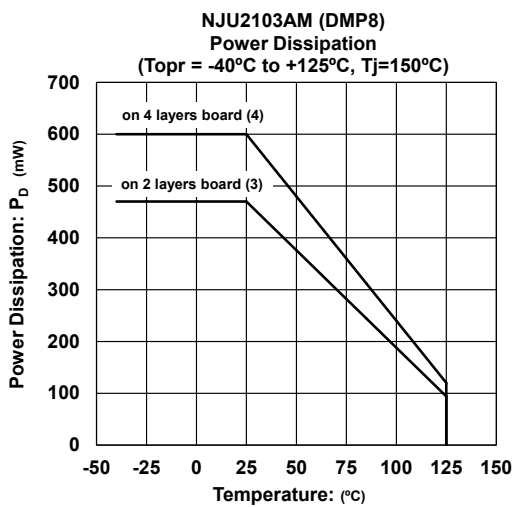
■ THERMAL CHARACTERISTICS

PARAMETER	SYMBOL	VALUE		UNIT
Junction-to-ambient thermal resistance	$\theta_{ja}$	DMP8	262 <sup>(3)</sup> 206 <sup>(4)</sup>	°CW
		DIP8	138 <sup>(3)</sup> 98 <sup>(4)</sup>	
		TVSP8	244 <sup>(3)</sup> 185 <sup>(4)</sup>	
Junction-to-Top of package characterization parameter	$\psi_{jt}$	DMP8	72 <sup>(3)</sup> 65 <sup>(4)</sup>	°CW
		DIP8	57 <sup>(3)</sup> 54 <sup>(4)</sup>	
		TVSP8	51 <sup>(3)</sup> 45 <sup>(4)</sup>	

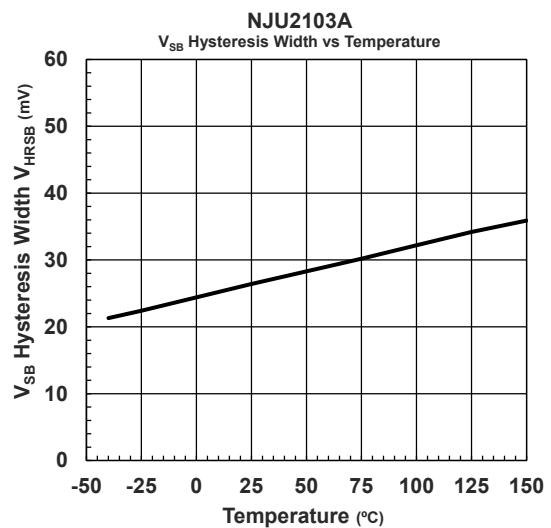
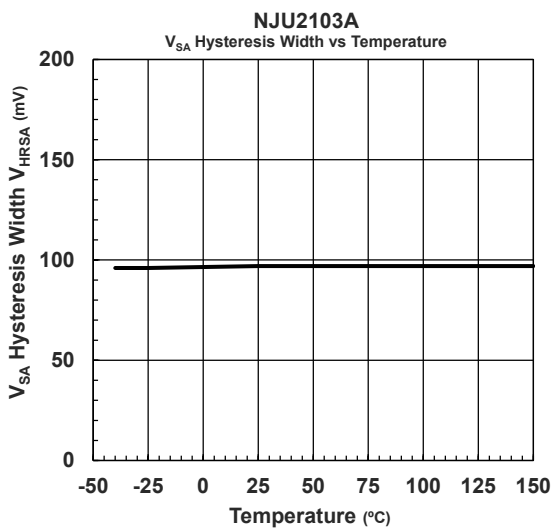
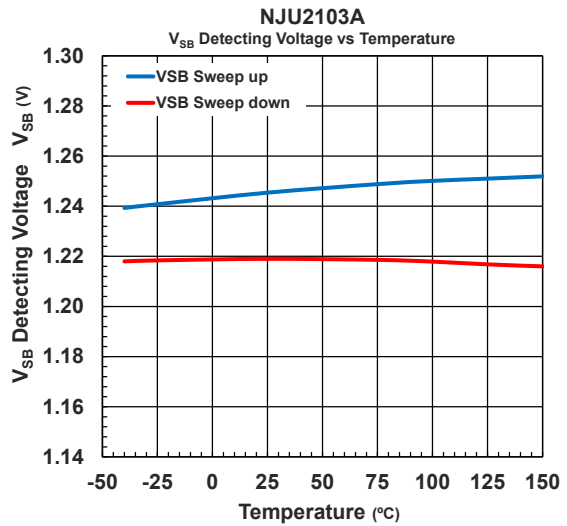
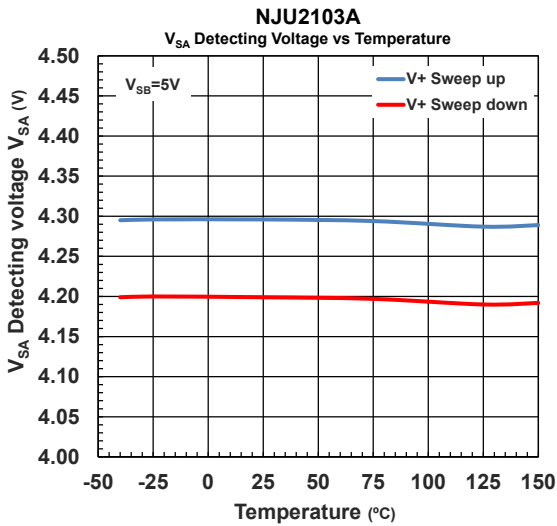
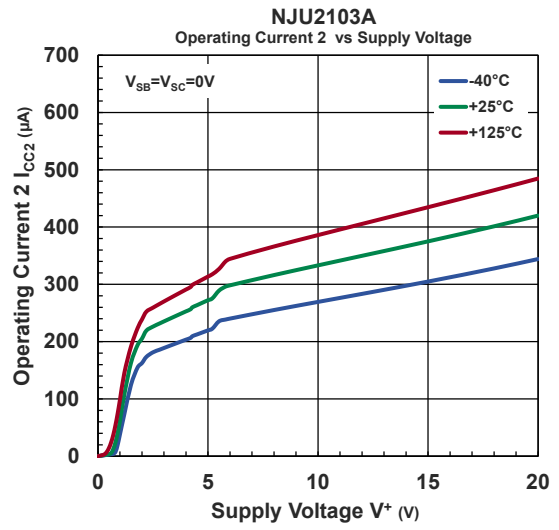
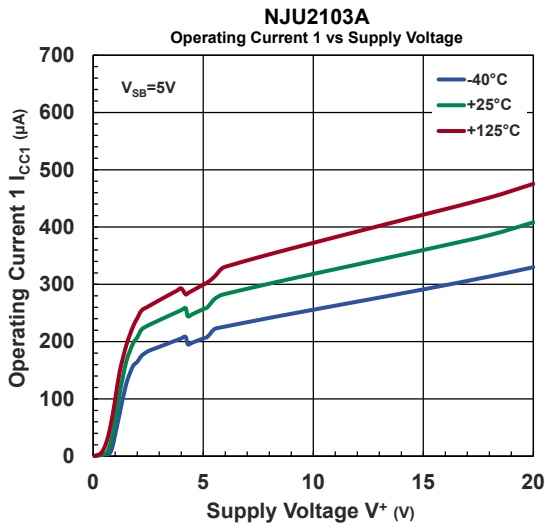
(3): Mounted on glass epoxy board.(76.2 x 114.3 x 1.6 :based on EIA/JEDEC standard, 2 Layers)

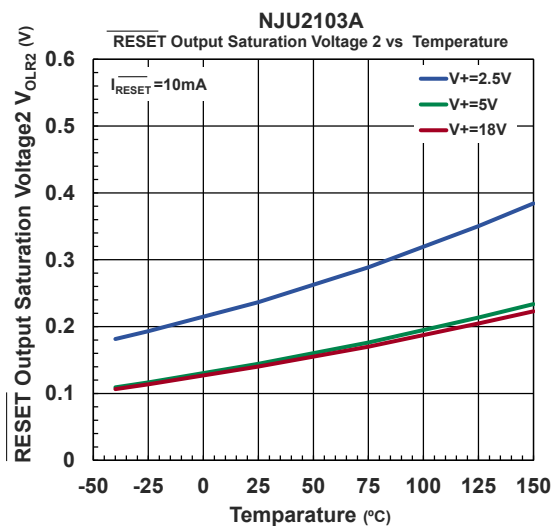
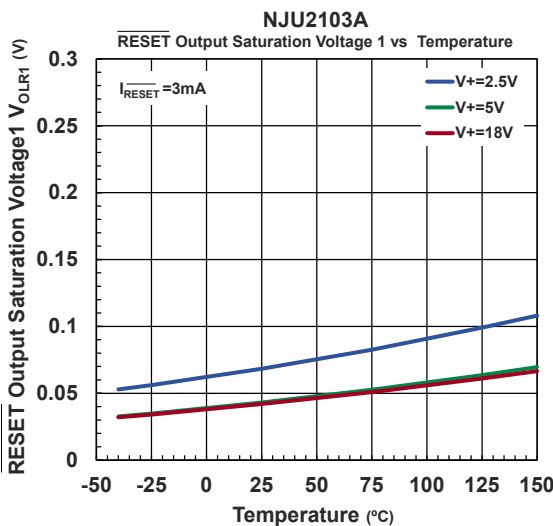
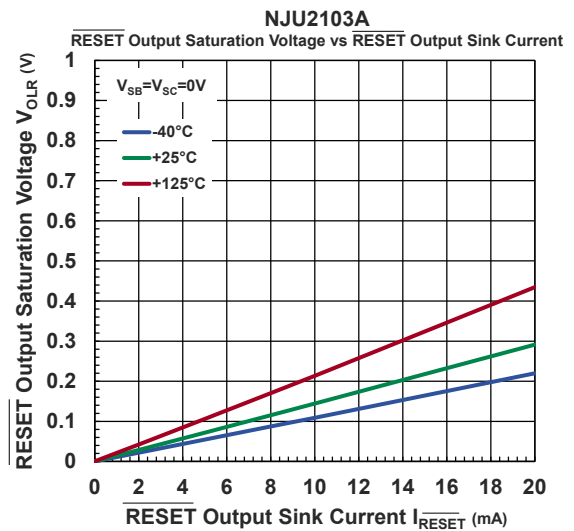
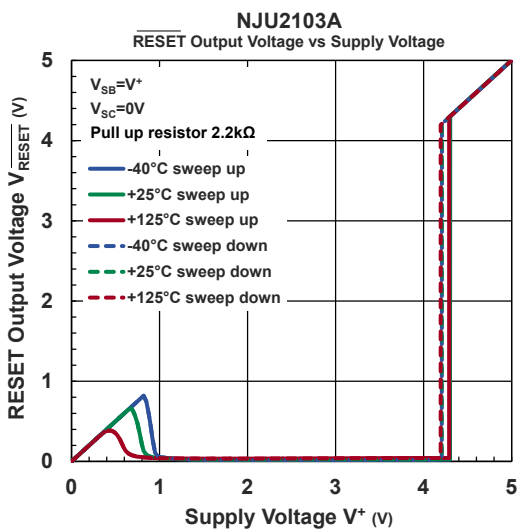
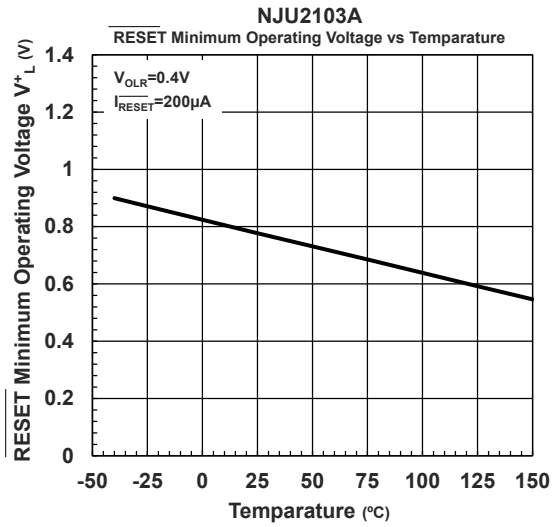
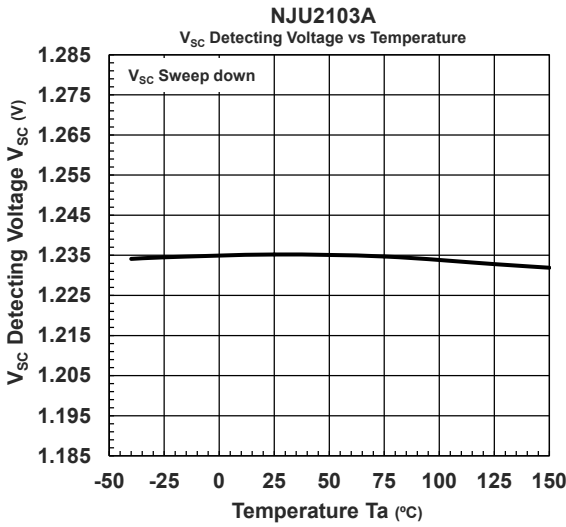
(4): Mounted on glass epoxy board.(76.2 x 114.3 x 1.6 :based on EIA/JEDEC standard, 4 Layers) internal Cu area: 74.2 x 74.2mm

■ POWER DISSIPATION vs. AMBIENT TEMPERATURE

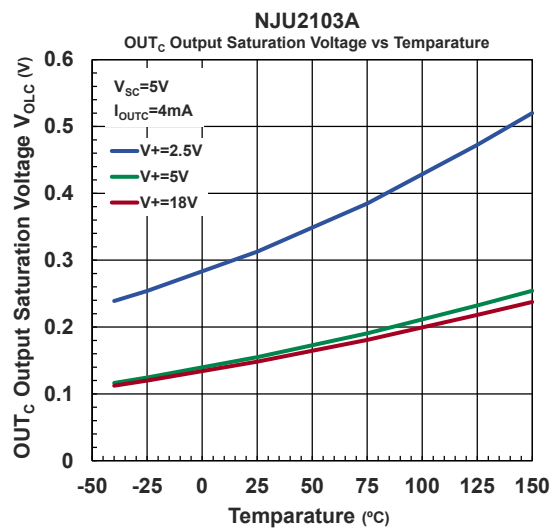
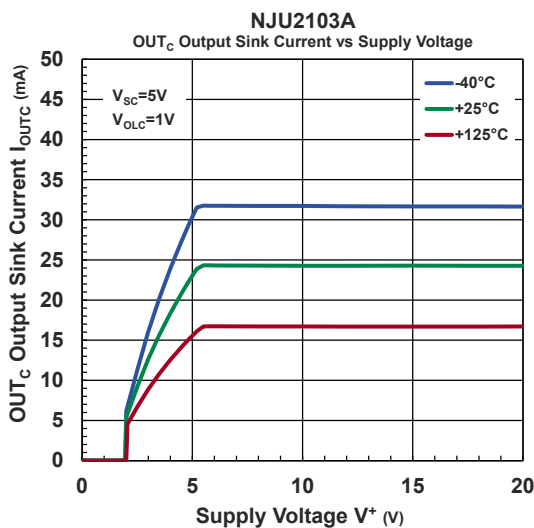
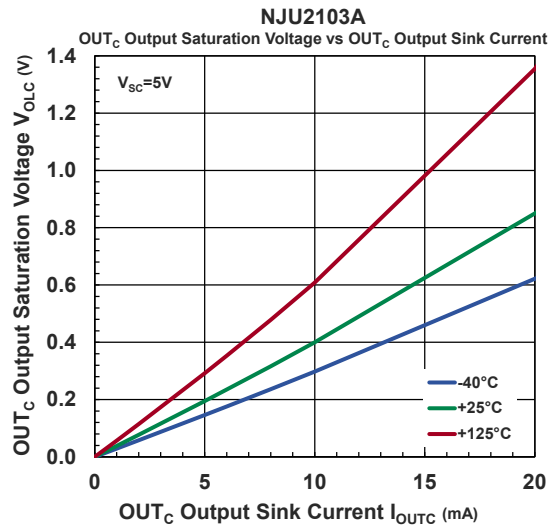
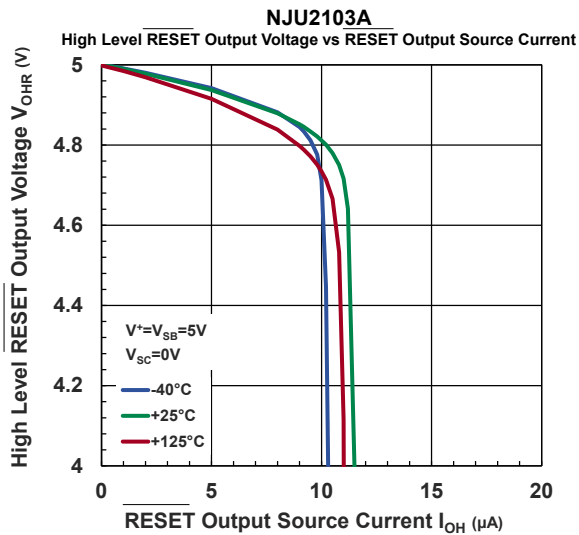
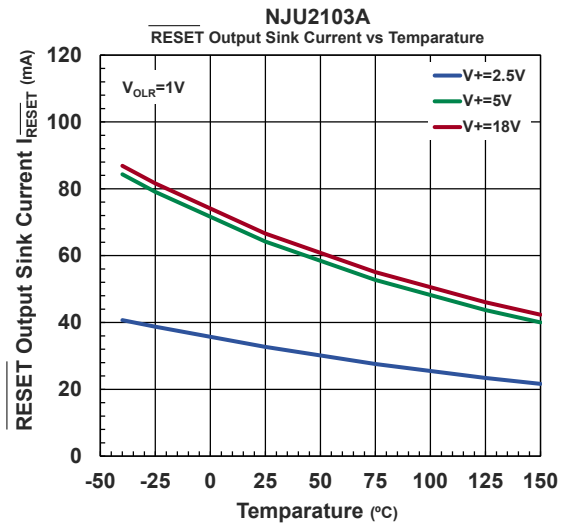
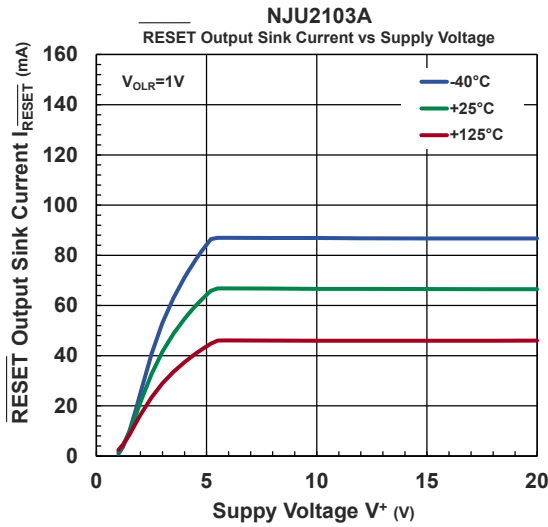


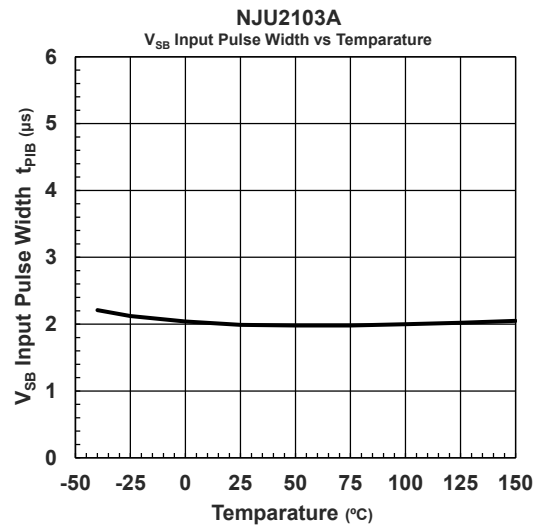
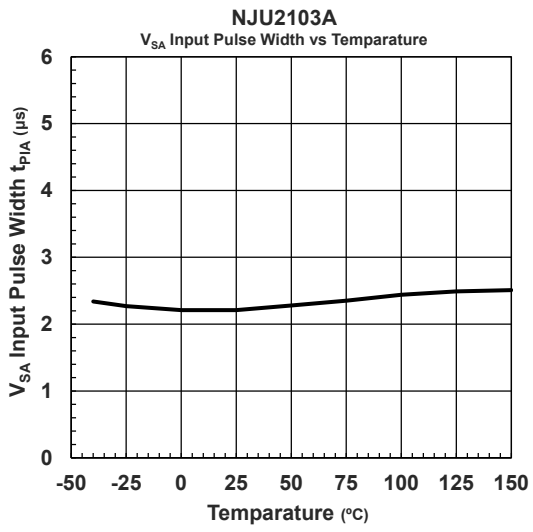
■ TYPICAL CHARACTERISTICS

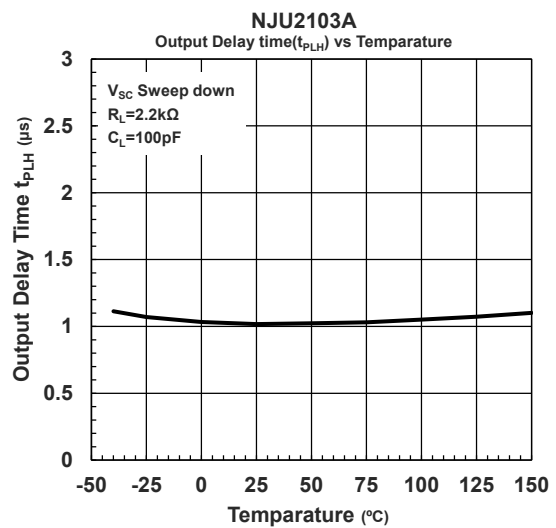
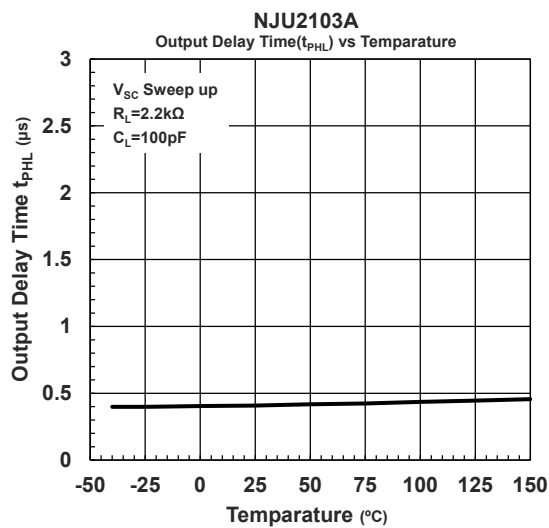
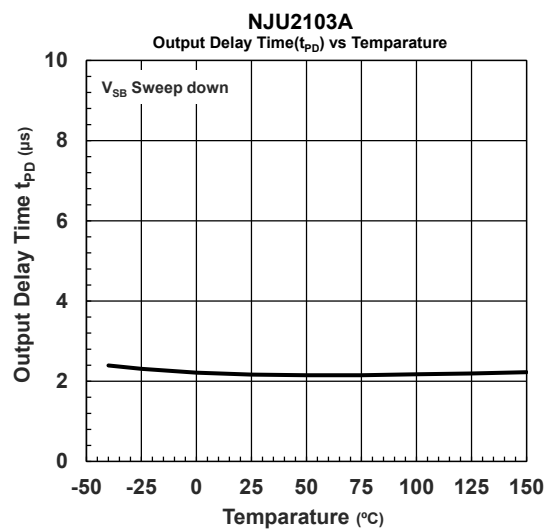
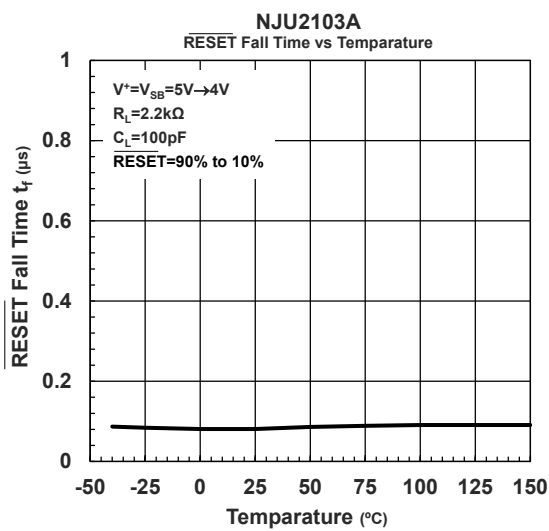
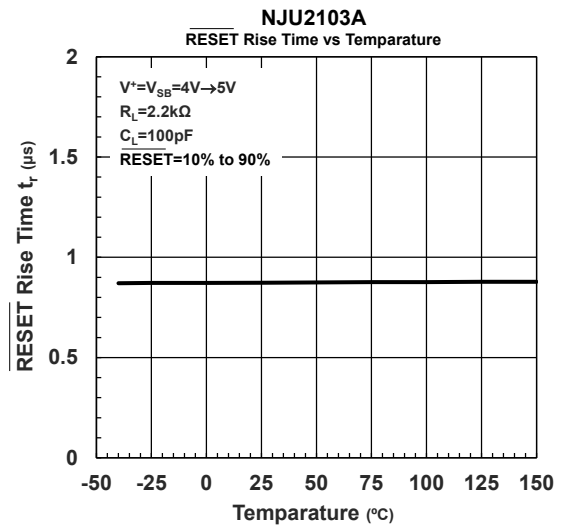
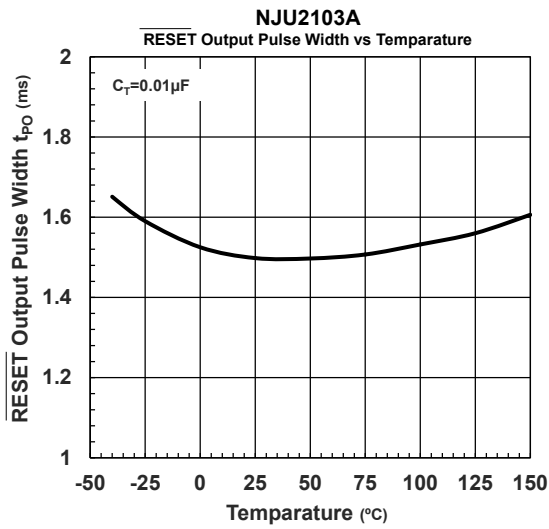


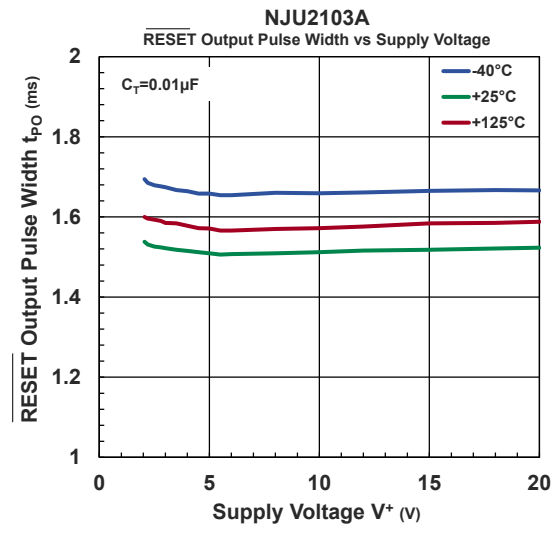
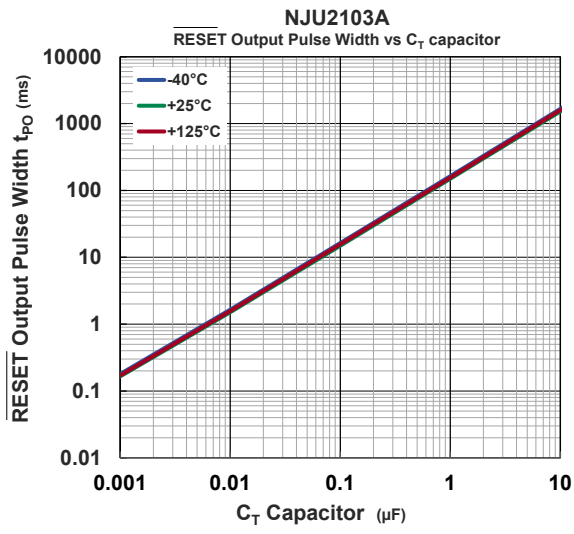










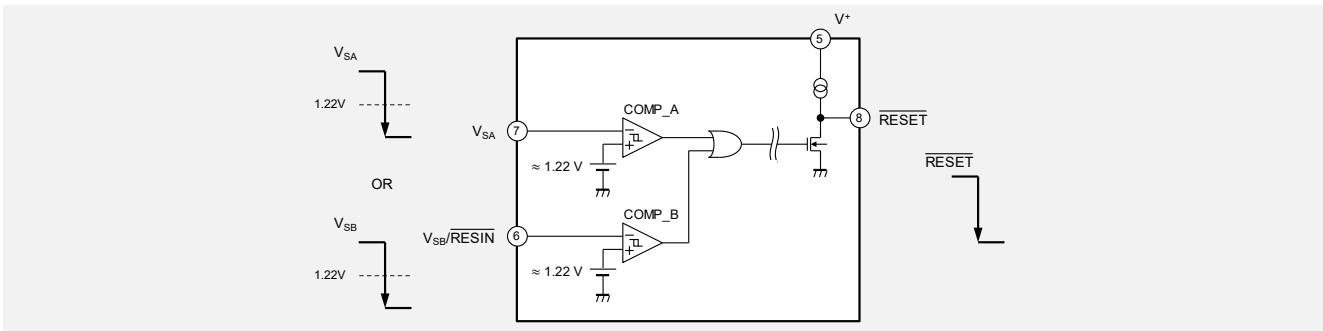


Technical Information

FUNCTION EXPLANATION

COMP\_A and COMP\_B are comparator with hysteresis in detection voltage.

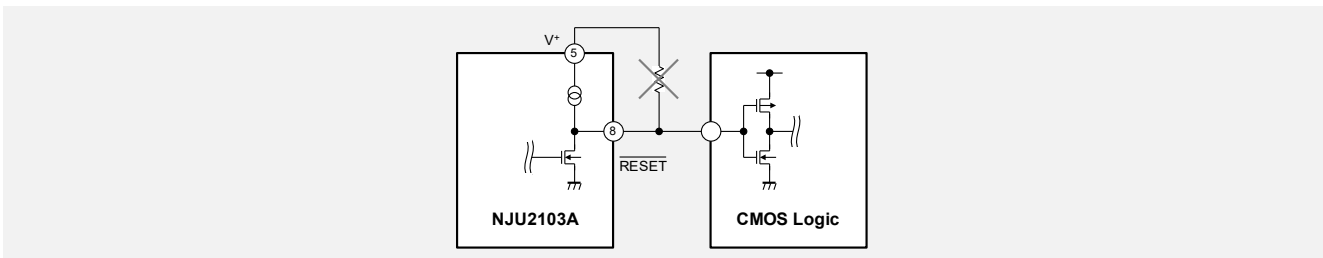
When either  $V_{SA}$  or  $V_{SB}$  pin voltage becomes about 1.22 V or less, the  $\overline{RESET}$  output becomes " Low ".



COMP\_B can be used for arbitrary voltage detection (refer to Fig.3 or Fig.4) and also can be used as a manual reset function with reset hold time by TTL signal input. (refer to Fig.7)

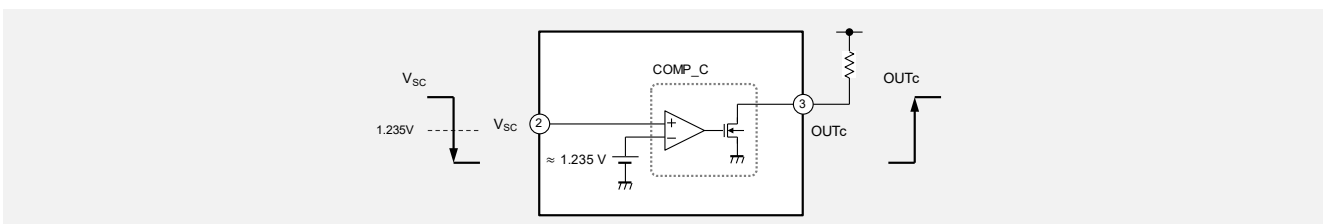
The NJU2103A can detect the instantaneous interruption and the instantaneous drop of the power line with a time of about 2  $\mu$ s width. If this level of instantaneous interruption or drop is not a problem, it can have a delayed trigger function by connecting capacitor to the  $V_{SA}$  and  $V_{SB}$  pins (refer to Fig.9).

Since the  $\overline{RESET}$  pin is internally pulled up to  $V^+$ , an external pull-up resistor isn't required in case of high impedance load like a CMOS logic IC.



COMP\_C is an open-drain output comparator without hysteresis which has anti-polarity input and output.

Therefore, it can be used for overvoltage detection (refer to Fig.14), positive logic reset output (refer to Fig.8) and generating a reference voltage source.(refer to Fig.11 to 13)

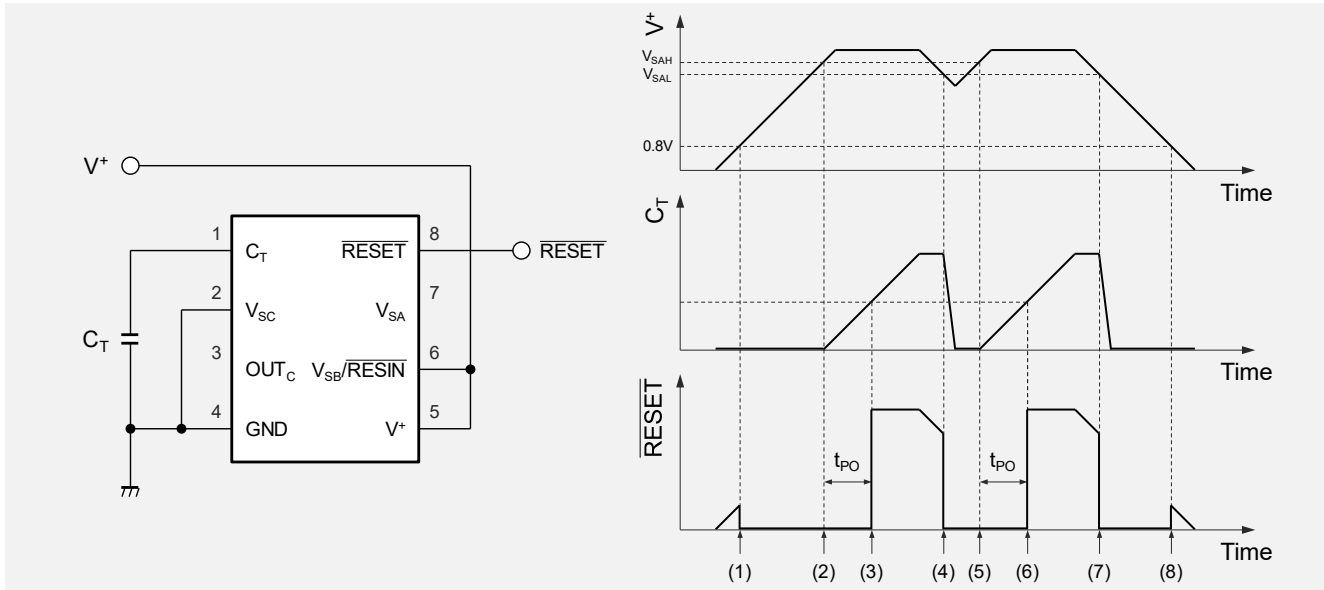


Unused Pin should be treated as shown in the table below.

Pin. No.	Pin Name	Treatment method of unused Pin
2	$V_{SC}$	Connect to GND
3	$OUT_c$	OPEN
6	$V_{SB}/\overline{RESIN}$	Connect to $V^+$
7	$V_{SA}$	OPEN
8	$\overline{RESET}$	OPEN

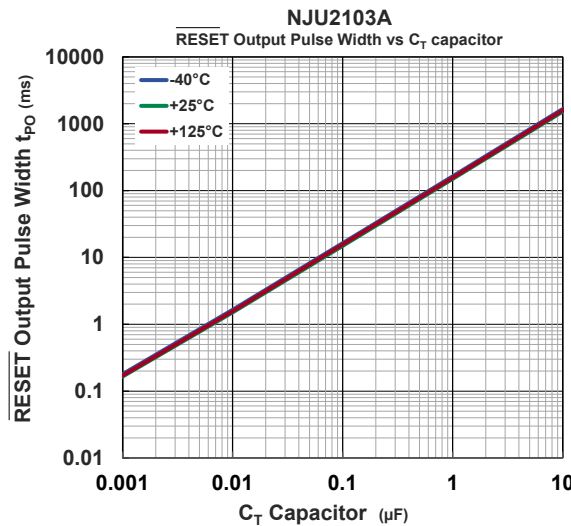
OPERATION EXPLANATION

Technical Information



- (1) When  $V^+$  increases to about 0.8V,  $\overline{\text{RESET}}$  becomes Low
- (2) When  $V^+$  increases to  $V_{SAH}$ , charging to capacitor  $C_T$  starts. At this time,  $\overline{\text{RESET}}$  holds Low.
- (3)  $\overline{\text{RESET}}$  switches from Low to High after the  $\overline{\text{RESET}}$  Output Pulse Width  $t_{PO}$ .  
Refer to "Output Pulse Width vs  $C_T$  capacitor " in TYPICAL CHARACTERISTICS and  $t_{PO}$  can be calculated as following formula.

$$\overline{\text{RESET}} \text{ Output Pulse Width } t_{PO} \text{ [ms]} \approx 150 \times C_T \text{ [\mu F]}$$



- (4) After  $\overline{\text{RESET}}$  becomes High, When  $V^+$  decreases below  $V_{SAL}$ ,  $\overline{\text{RESET}}$  goes Low and discharges  $C_T$ .
- (5) After  $V^+$  decreases below  $V_{SAL}$ , it starts charging  $C_T$  when  $V^+$  increase to  $V_{SAH}$ .  
In case of instantaneous  $V^+$  drop, if the time from  $V^+$  decreases below  $V_{SAL}$  to increase to  $V_{SAH}$  is more than  $V_{SA}$  Input Pulse Width  $t_{PIA}$ , charging will start after discharging  $C_T$ .
- (6)  $V^+$  increase to  $V_{SAH}$  and  $\overline{\text{RESET}}$  switches from Low to High after  $\overline{\text{RESET}}$  Output Pulse Width  $t_{PO}$
- (7) When  $V^+$  becomes less than  $V_{SAL}$ , repeat steps (4) – (6).
- (8) When  $V^+$  decreases to 0 V,  $\overline{\text{RESET}}$  holds Low until  $V^+$  reaches about 0.8 V.

Technical Information

APPLICATION EXAMPLE

1. 5V Power supply monitor

Monitor the 5V power supply with V<sub>SA</sub>(COMP\_A). The detection voltage at falling is the V<sub>SA</sub> detection voltage 1 V<sub>SAL</sub> (4.2 V typ.), and the detection voltage at rising is the V<sub>SA</sub> detection voltage 2 V<sub>SAH</sub> (4.3Vtyp.).

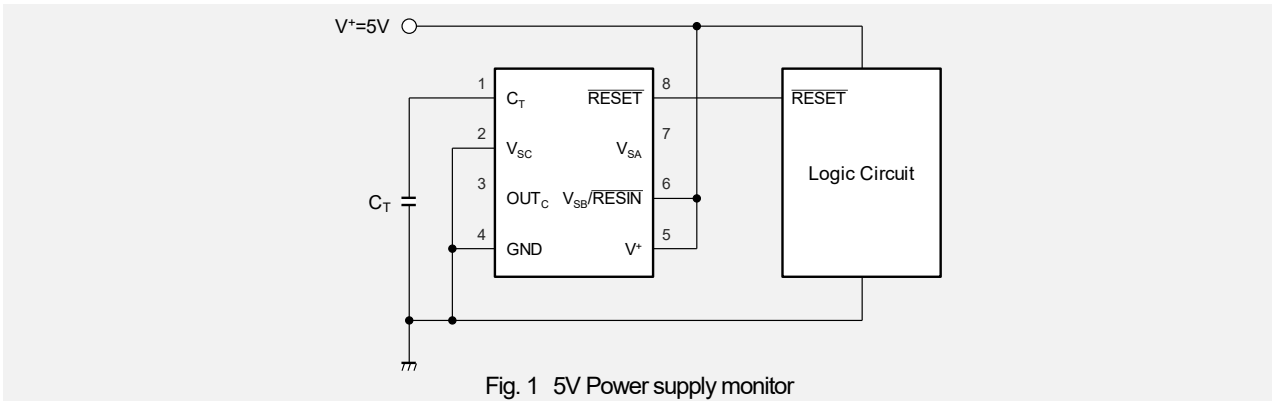


Fig. 1 5V Power supply monitor

2. Power supply monitor (adjust detection voltage by external resistor)

V<sub>SA</sub> detection voltage1 can be adjusted with an external resistor.

- By selecting the external voltage-dividing resistors R<sub>1</sub> and R<sub>2</sub> to a sufficiently smaller value than internal voltage-dividing resistors R', R'' (100 kΩ, 41 kΩ), the detection voltage can be set by the resistance ratio of R<sub>1</sub> and R<sub>2</sub>.

The formula for calculating detection voltage is as follows and refer to Tab.1 for setting example.

**Detection voltage calculate formula (R<sub>1</sub> << 100kΩ, R<sub>2</sub> << 41kΩ )**

$$Detection\ Voltage(falling) = \frac{(R_1 \parallel R') + (R_2 \parallel R'')}{R_2 \parallel R''} \times \frac{R''}{R' + R''} \times V_{SAL} \approx \frac{R_1 + R_2}{R_2} \times 1.2213 \text{ [V]}$$

$$Detection\ Voltage(rising) = \frac{(R_1 \parallel R') + (R_2 \parallel R'')}{R_2 \parallel R''} \times \frac{R''}{R' + R''} \times V_{SAH} \approx \frac{R_1 + R_2}{R_2} \times 1.2504 \text{ [V]}$$

Tab. 1 Setting example

External resistor R <sub>1</sub> [kΩ]	External resistor R <sub>2</sub> [kΩ]	Detection Voltage(falling) [V]	Detection Voltage(rising) [V]
6.2	2.4	4.37	4.47
12	5.1	4.11	4.20

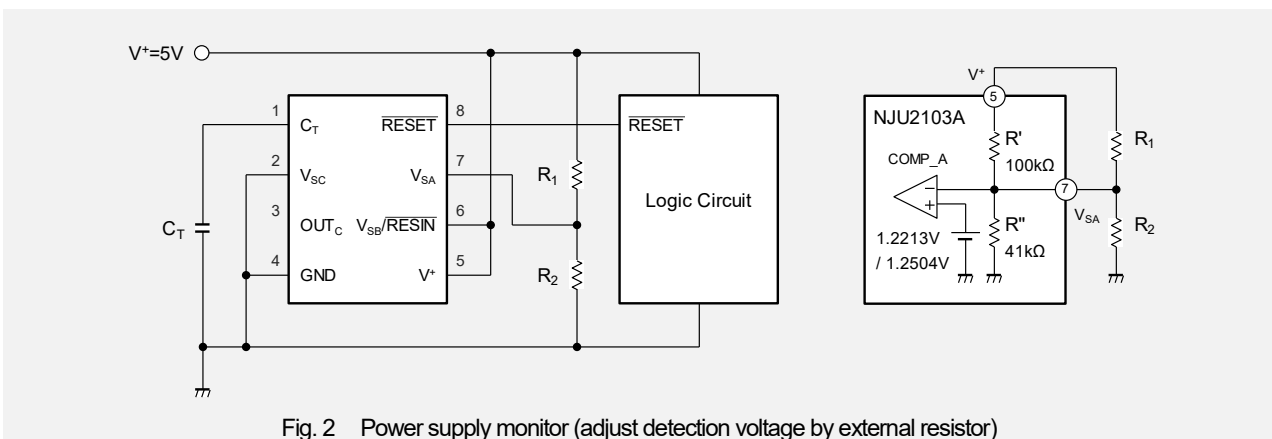


Fig. 2 Power supply monitor (adjust detection voltage by external resistor)

Technical Information

3. Arbitrary power supply monitor (monitoring  $V^+ \leq 18V$ )

Monitor the power supply of  $V^+ \leq 18V$  with  $V_{SB}$  (COMP\_B) and voltage-dividing resistors  $R_1$  and  $R_2$ .

- The detection voltage can be set by resistors  $R_1$  and  $R_2$ .

The formula for calculating  $R_1$  and  $R_2$  is as follows and refer to Tab.2.

**Detection voltage calculate formula**

$$Detection\ Voltage(falling) = \frac{R_1 + R_2}{R_2} \times V_{SBL} \approx \frac{R_1 + R_2}{R_2} \times 1.220\ [V]$$

$$Detection\ Voltage(rising) = \frac{R_1 + R_2}{R_2} \times (V_{SBL} + V_{HRSB}) \approx \frac{R_1 + R_2}{R_2} \times 1.248\ [V]$$

- When  $V^+$  is 4.45V or less, connects  $V_{SA}$  (pin 7) to  $V^+$  to disable COMP\_A
- When  $V^+$  is greater than 4.45 V,  $V_{SA}$  (pin 7) should be opened. And in this case, current consumption decreases. (decrease value:  $17.3 \times V^+ [\mu A]$ )

Tab.2 setting example

External resistor $R_1$ [kΩ]	External resistor $R_2$ [kΩ]	Detection Voltage(falling) [V]	Detection Voltage(rising) [V]
43	16	4.50	4.60
22	15	3.01	3.08

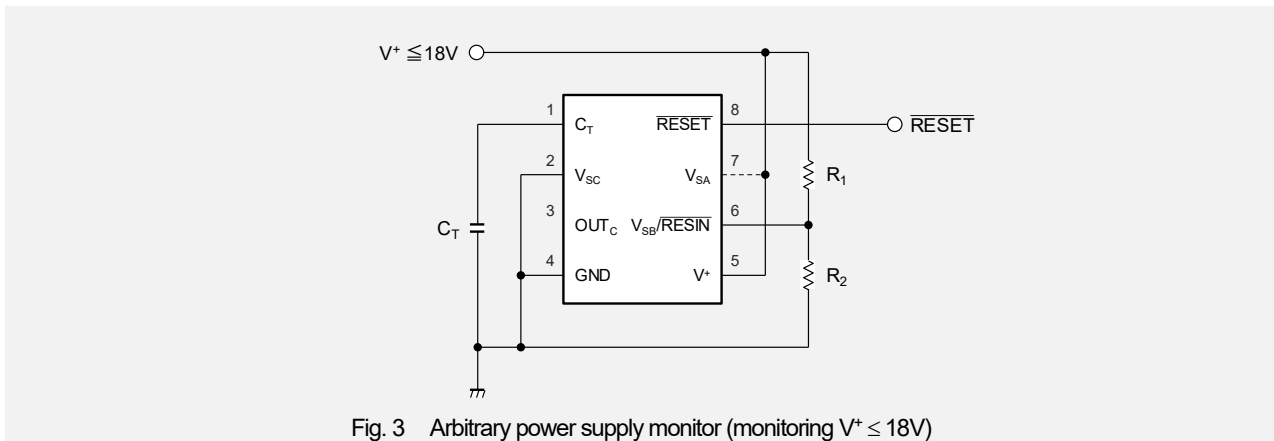


Fig. 3 Arbitrary power supply monitor (monitoring  $V^+ \leq 18V$ )



## Technical Information

### 4. Arbitrary power supply monitor (monitoring $V^+ > 18V$ )

Monitor the power supply of  $V^+ > 18V$  with  $V_{SB}$  (COMP\_B) and voltage-dividing resistors  $R_1$  and  $R_2$ .

The power supply of this IC (about 5V) is generated with  $V_{SC}$  (COMP\_C) and feedback resistors  $R_4$  and  $R_5$ .

- Set the detection voltage with resistors  $R_1$  and  $R_2$  according to the following formula.

#### Detection voltage calculate formula

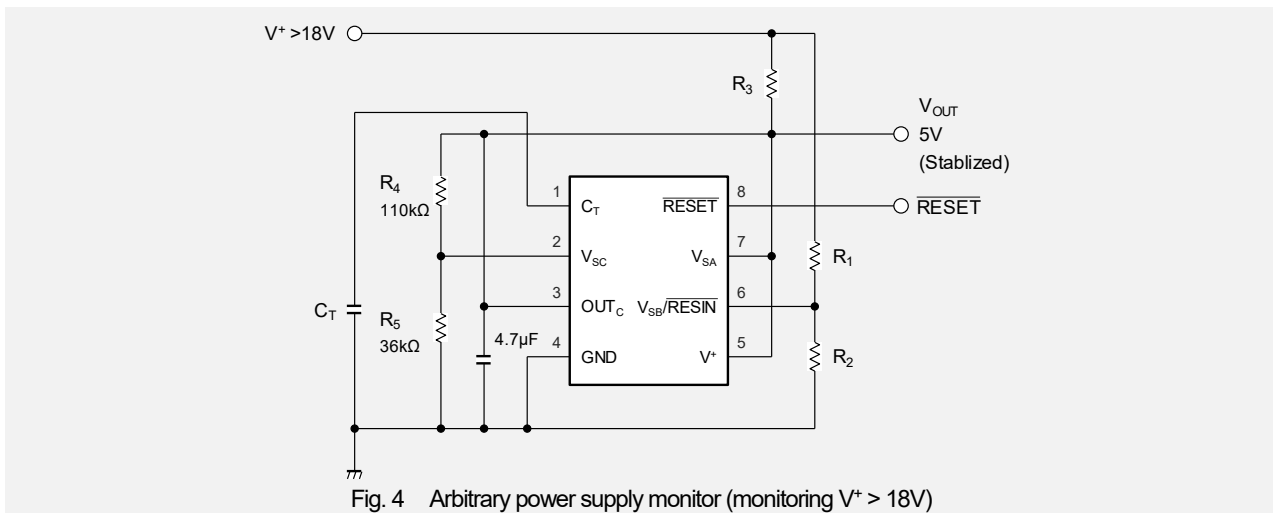
$$\text{Detection Voltage}(V^+ \text{ falling}) = \frac{R_1 + R_2}{R_2} \times V_{SBL} \approx \frac{R_1 + R_2}{R_1} \times 1.220 \text{ [V]}$$

$$\text{Detection Voltage}(V^+ \text{ rising}) = \frac{R_1 + R_2}{R_2} \times (V_{SBL} + V_{HRSB}) \approx \frac{R_1 + R_2}{R_2} \times 1.248 \text{ [V]}$$

- The  $\overline{\text{RESET}}$  output is  $\approx 0V$  (low level) and  $\approx 5V$  (high level). Not outputs  $V^+$  voltage.  
 $\overline{\text{RESET}}$  should not be pulled up to  $V^+$
- If the resistor ratio of  $R_4$  and  $R_5$  is adjusted, high level  $\overline{\text{RESET}}$  voltage is changed according to constant voltage set by resistor ratio of  $R_4$  and  $R_5$ . Constant voltage  $V_{OUT}$  is calculated as the following formula. However, shouldn't be exceed 18V.

$$\text{Constant Voltage } V_{OUT} = \frac{R_4 + R_5}{R_5} \times V_{SC} \approx \frac{R_4 + R_5}{R_5} \times 1.235 \text{ [V]}$$

- The constant voltage (5V output) can be used as the power supply for the small current consumption circuit.
- When deciding the value of  $R_3$ , it is necessary to be careful about power consumption.



Technical Information

5. 5V, 12V power supply monitor ( dual power supply monitor e.g.  $V^+_1 = 5V$ ,  $V^+_2 = 12V$ )

Monitor the  $V^+_1$ (5V) power supply with  $V_{SA}$ (COMP\_A) and monitor the  $V^+_2$ (12V) power supply with  $V_{SB}$  (COMP\_B) and voltage-dividing resistors  $R_1$  and  $R_2$ .

- $V^+_1$  detection voltage (falling) is 4.2V and detection voltage (rising) is 4.3V.
- $V^+_2$  detection voltage (falling, rising) is set by  $R_1$  and  $R_2$  according to following formula. In case of resistor value in Fig.5, the detection voltage (falling) is about 9.0 V and the detection voltage (rising) is about 9.2 V.

**$V^+_2$  detection voltage calculate formula**

$$\text{Detection Voltage}(V^+_2 \text{ falling}) = \frac{R_1 + R_2}{R_2} \times V_{SBL} \approx \frac{R_1 + R_2}{R_2} \times 1.220 \text{ [V]}$$

$$\text{Detection Voltage}(V^+_2 \text{ rising}) = \frac{R_1 + R_2}{R_2} \times (V_{SBL} + V_{HRSB}) \approx \frac{R_1 + R_2}{R_2} \times 1.248 \text{ [V]}$$

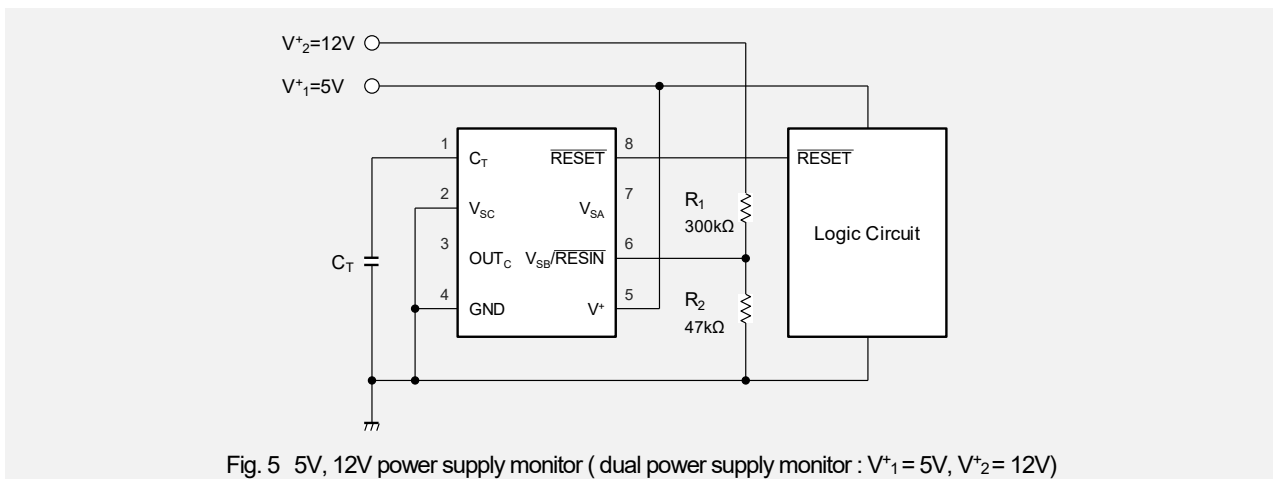


Fig. 5 5V, 12V power supply monitor ( dual power supply monitor :  $V^+_1 = 5V$ ,  $V^+_2 = 12V$ )

Technical Information

6. 5V, 12V power supply monitor (e.g.  $V^+_1 = 5V$ ,  $V^+_2 = 12V$ ,  $\overline{\text{RESET}}$  output is only  $V^+_1$  detection result)

Monitor the  $V^+_1(5V)$  power supply with  $V_{SA}(COMP\_A)$  and output signal from  $\overline{\text{RESET}}$ .

In addition, monitor the  $V^+_2(12V)$  power supply with  $V_{SC}(COMP\_C)$  and voltage-dividing resistors  $R_1, R_2, R_3, R_4$ , NPN transistor, base current limiting resistor  $R_5$ , and output signal from  $OUT_C$ .

- $V^+_1$  detection voltage (falling) is 4.2V and detection voltage (rising) is 4.3V.
- $V^+_2$  detection voltage (falling) and hysteresis width at rising are calculated as following formula. In case of resistor value in Fig.6, the detection voltage (falling) is about 9.0 V and the hysteresis width at rising is about 0.2 V

**$V^+_2$  detection voltage and hysteresis width at rising calculate formula**

$$\text{Detection Voltage}(V^+_2 \text{ falling}) = \frac{R_1 + R_2 + R_3}{R_2 + R_3} \times V_{SC} \approx \frac{R_1 + R_2 + R_3}{R_2 + R_3} \times 1.235 \text{ [V]}$$

$$\text{Hysteresis width at rising} = \frac{R_1(R_3 - R_3 \parallel R_4)}{(R_2 + R_3)(R_2 + R_3 \parallel R_4)} \times V_{SC} \approx \frac{R_1(R_3 - R_3 \parallel R_4)}{(R_2 + R_3)(R_2 + R_3 \parallel R_4)} \times 1.235 \text{ [V]}$$

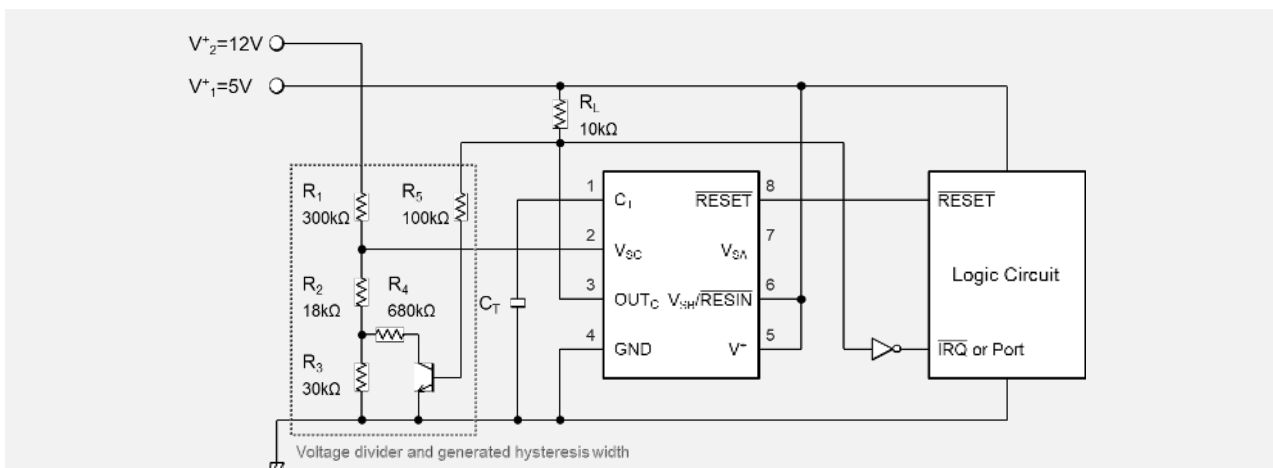


Fig. 6 5V, 12V power supply monitor ( $V^+_1 = 5V$ ,  $V^+_2 = 12V$ ,  $\overline{\text{RESET}}$  output is only  $V^+_1$  detection result)

7. Manual Reset function ( $V^+ = 5V$ )

By inputting the TTL signal to  $V_{SB}/\overline{\text{RESIN}}$ , it realizes manual reset output signal regardless of the state of  $V^+$ .

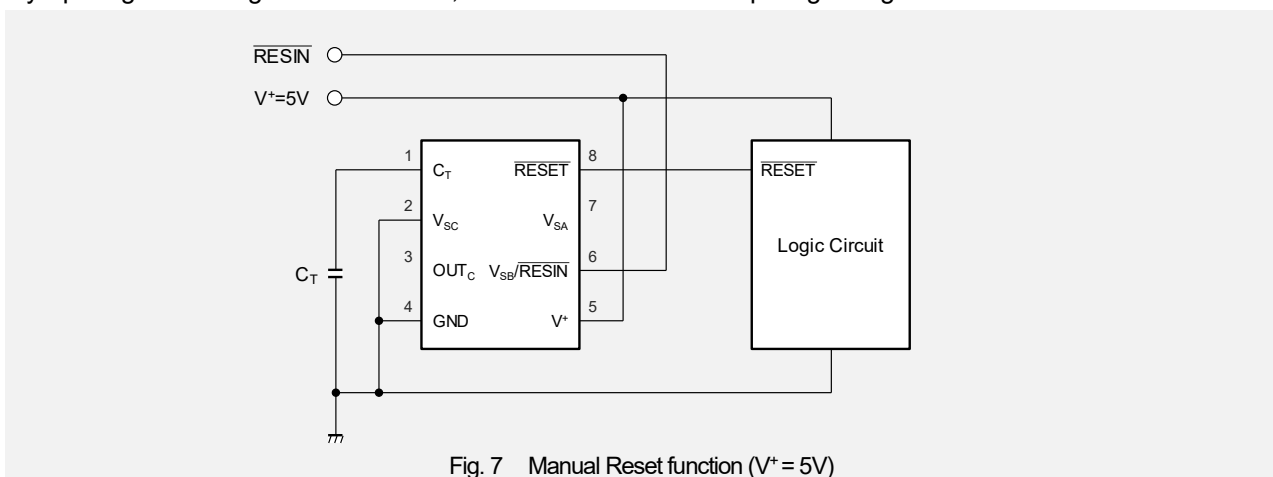
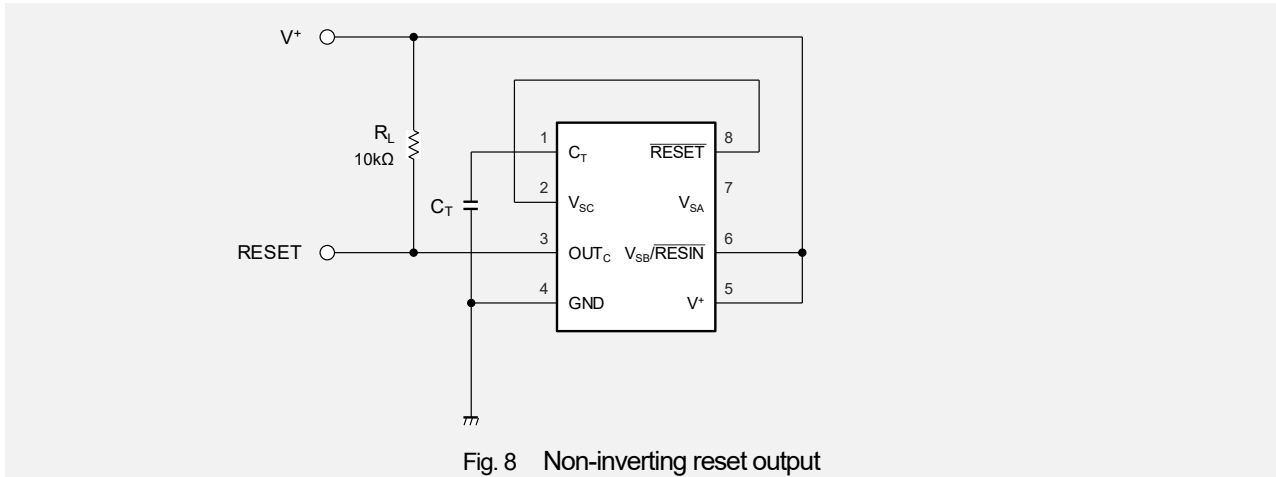


Fig. 7 Manual Reset function ( $V^+ = 5V$ )

Technical Information

8. Non-inverting reset output

If a positive output is required for reset signal, invert the  $\overline{\text{RESET}}$  output with COMP\_C and output from OUT<sub>c</sub>. Since OUT<sub>c</sub> is an open drain output, It is required the pull-up resistor.(shown as R<sub>L</sub> in Fig.8)



9. Power supply voltage monitoring by delayed trigger

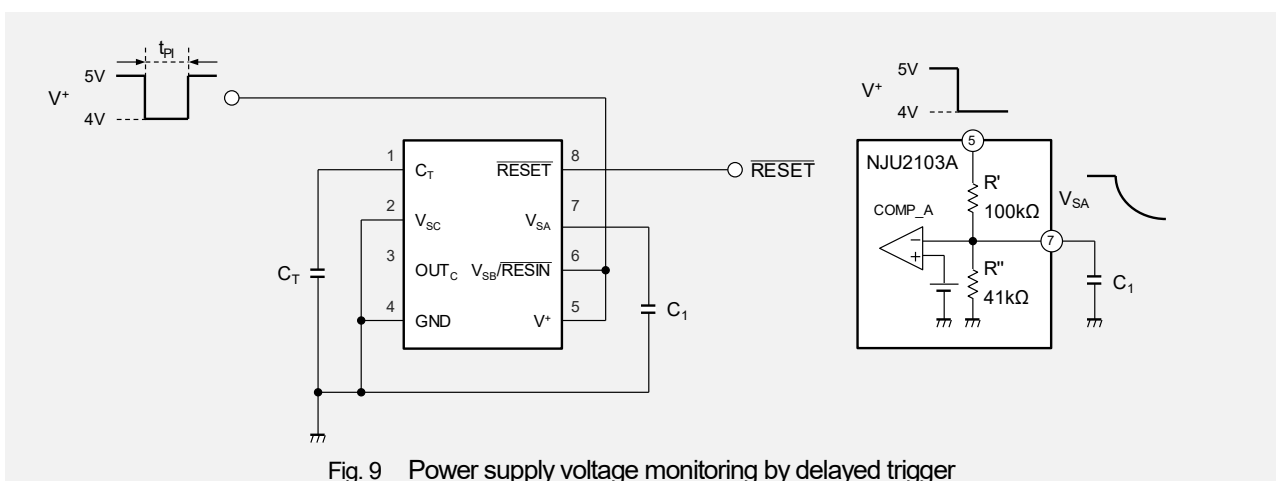
An arbitrary delay is added to the COMP\_A operation by connecting capacitor C<sub>1</sub> between V<sub>SA</sub> and GND.

When C<sub>1</sub> is connected minimum input pulse width becomes longer. E.g. t<sub>PI</sub> = 40μs (C<sub>1</sub>=1000pF)

Minimum input pulse width t<sub>PI</sub> is calculated as following formula.

**Minimum input pulse width calculate formula**

$$t_{PI} [\mu s] \approx (R' \parallel R'') \times \ln \left( \frac{5 - 4}{V_{SAL} - 4} \right) \times 10^{-6} \times C_1 [\text{pF}] \approx 4.7 \times 10^{-2} \times C_1 [\text{pF}]$$



Technical Information

10. Positive and negative dual power supply monitoring (e.g.  $V^+ = 5V$ ,  $V^- = \text{negative voltage}$ )

Monitor the positive power supply with  $V_{SA}$  (COMP\_A) and monitor the negative voltage with  $V_{SB}$  (COMP\_B)  
 $V_{SC}$  (COMP\_C) is used to shift negative voltage to positive voltage.

- $R_1$ ,  $R_2$ ,  $R_3$  should have the same resistance value
- $V^+$  detection voltage (falling) is 4.2V and detection voltage (rising) is 4.3V.
- $V^-$  detection voltage is calculated as following formula. In case of resistor value in Fig.10, the detection voltage (falling) is about -4.3V and the detection voltage (rising) is about -4.4V.

**$V^-$  detection voltage calculate formula**

$$\text{Detection voltage } (V^- \text{ falling}) = \frac{R_3 + R_4}{R_3} \times V_{SC} - \frac{2R_4}{R_3} \times V_{SBL} \approx \frac{R_3 - R_4}{R_3} \times 1.220 \text{ [V]}$$

$$\text{Detection voltage } (V^- \text{ rising}) = \frac{R_3 + R_4}{R_3} \times V_{SC} - \frac{2R_4}{R_3} \times (V_{SBL} + V_{HR SB}) \approx \frac{R_3 - R_4}{R_3} \times 1.248 \text{ [V]}$$

- When using a power supply that outputs  $V^-$  without  $V^+$  output, it is necessary to connect a Schottky barrier diode (SBD) between the  $V_{SC}$  and GND to prevent being applied negative voltage to this IC.

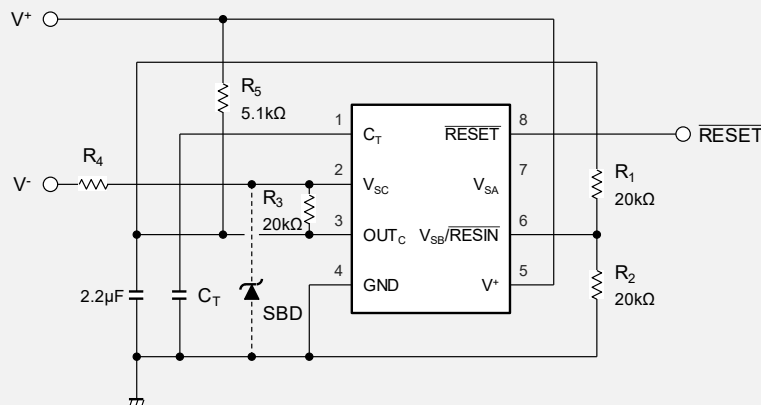


Fig. 10 Positive and negative dual power supply monitoring ( $V^+ = 5V$ ,  $V^- = \text{negative voltage}$ )

Technical Information

11. Reference voltage output and voltage drop monitoring (e.g. 9V reference output, 5V, 9V monitoring)

Monitor the V<sup>+</sup>(5V) power supply with V<sub>SA</sub>(COMP\_A).

9V Reference voltage V<sub>OUT</sub> is generated by V<sub>SC</sub>(COMP\_C), feedback resistors R<sub>3</sub>, R<sub>4</sub> and NPN transistor, and its 9V is monitored by V<sub>SB</sub>(COMP\_B) and voltage-dividing resistors R<sub>1</sub> and R<sub>2</sub>.

- V<sup>+</sup> detection voltage (falling) is 4.2V and detection voltage (rising) is 4.3V.
- The reference voltage V<sub>OUT</sub> and its detection voltage are calculated as the following formula. In case of resistor value in Fig.11, the reference voltage V<sub>OUT</sub> is about 9.0V, the detection voltage (V<sub>OUT</sub> falling) is about 7.1V and the detection voltage (V<sub>OUT</sub> rising) is about 7.3V

Reference Voltage and detection voltage calculate formula

$$\text{Reference voltage } V_{OUT} = \frac{R_3 + R_4}{R_4} \times V_{SC} \approx \frac{R_3 + R_4}{R_4} \times 1.235 \text{ [V]}$$

$$\text{Detection Voltage}(V_{OUT} \text{ falling}) = \frac{R_1 + R_2}{R_2} \times V_{SBL} \approx \frac{R_1 + R_2}{R_2} \times 1.220 \text{ [V]}$$

$$\text{Detection Voltage}(V_{OUT} \text{ rising}) = \frac{R_1 + R_2}{R_2} \times (V_{SBL} + V_{HRSB}) \approx \frac{R_1 + R_2}{R_2} \times 1.248 \text{ [V]}$$

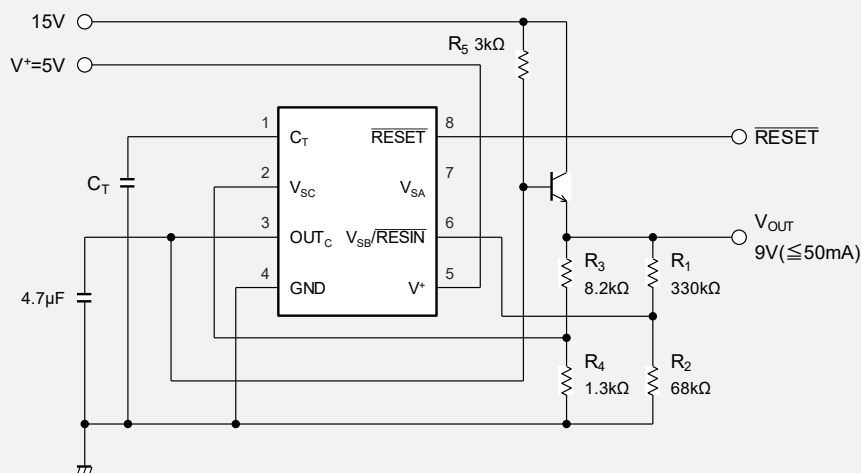


Fig. 11 Reference voltage output and voltage drop monitoring (e.g. 9V reference output, 5V, 9V monitoring)

Technical Information

12-1. Reference Voltage output and Voltage drop monitoring (e.g. 5V output, 5V monitoring)

5V Reference voltage  $V_{OUT}$  is generated by  $V_{SC}(COMP\_C)$ , feedback resistors  $R_3, R_4$ , NPN transistor and drive resistor  $R_5$ , and its 5V is monitored by  $V_{SA}(COMP\_A)$ .

- The reference voltage  $V_{OUT}$  is calculated as following formula. In case of resistor value In Fig.12-1, the reference voltage  $V_{OUT}$  is about 5.0V

**Reference Voltage calculate formula**

$$\text{Reference voltage } V_{OUT} = \frac{R_3 + R_4}{R_3} \times V_{SC} \approx \frac{R_3 + R_4}{R_3} \times 1.235 \text{ [V]}$$

- The detection voltage (falling) is 4.2V and detection voltage (rising) is 4.3V.

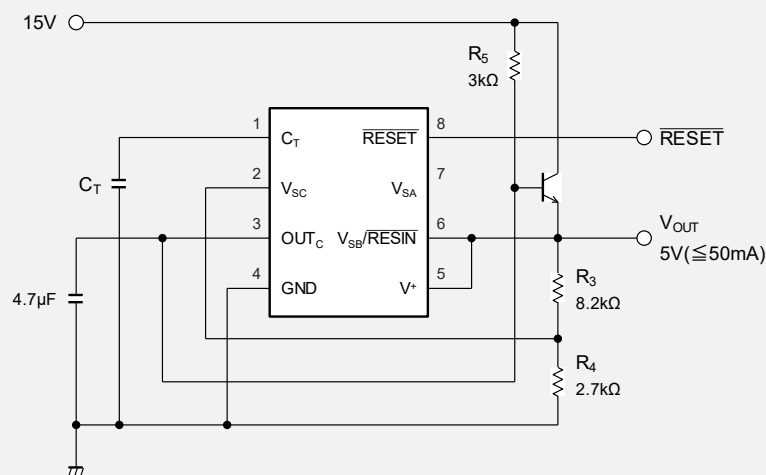


Fig. 12-1 Reference Voltage output and Voltage drop monitoring (e.g. 5V output, 5V monitoring)

Technical Information

12.2. Reference Voltage output and Voltage drop monitoring (e.g. 5V output, 5V monitoring)

5V Reference voltage  $V_{OUT}$  is generated by  $V_{SC}(COMP\_C)$  and feedback resistors  $R_2$ ,  $R_3$ , and its 5V is monitored by  $V_{SA}(COMP\_A)$ . Unlike Fig.12-1, 5V output cannot supply large current.

- The reference voltage  $V_{OUT}$  is calculated as following formula.

In case of resistor value In Fig.12-2, the reference voltage  $V_{OUT}$  is about 5.0V

$$\text{Reference voltage } V_{OUT} = \frac{R_2 + R_3}{R_3} \times V_{SC} \approx \frac{R_2 + R_3}{R_3} \times 1.235 \text{ [V]}$$

- The detection voltage (falling) is 4.2V and detection voltage (rising) is 4.3V.
- $R_1$  value should be calculated from current consumption of NJU2103A, the current flowing through  $R_2$  and  $R_3$ , and 5V output current. .

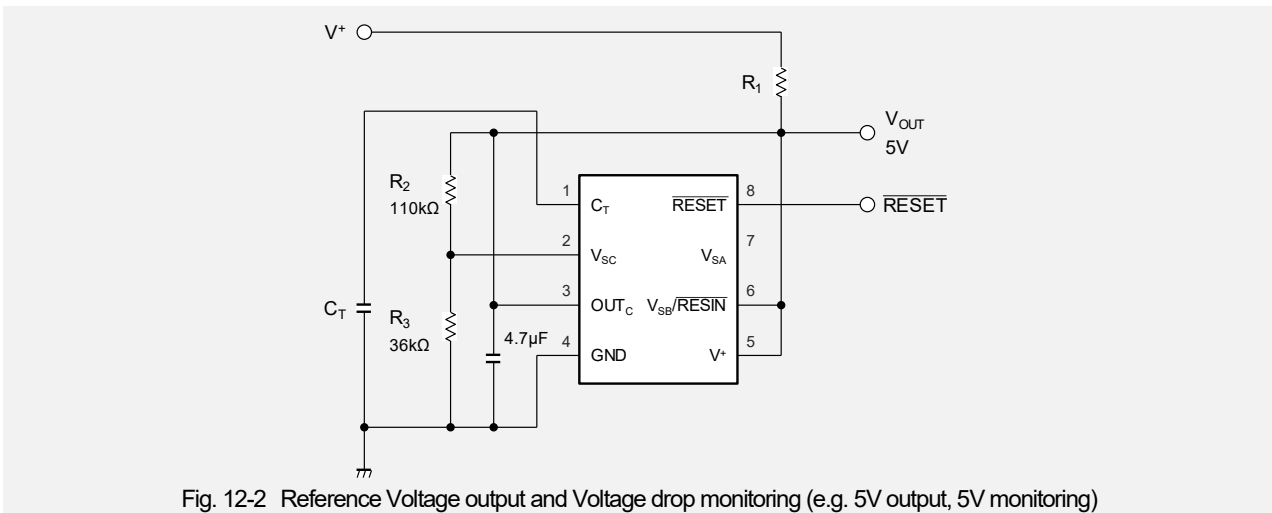


Fig. 12-2 Reference Voltage output and Voltage drop monitoring (e.g. 5V output, 5V monitoring)

13. Reference Voltage output and Voltage drop monitoring (e.g. 1.235V output, 5V monitoring)

Buffer-connect the  $V_{SC}(COMP\_C)$  and output the reference voltage of  $COMP\_C$ .

The output current of the reference voltage output is limited by  $R_1$ . If  $R_1$  is 1.2 kΩ, it can output about 2 mA

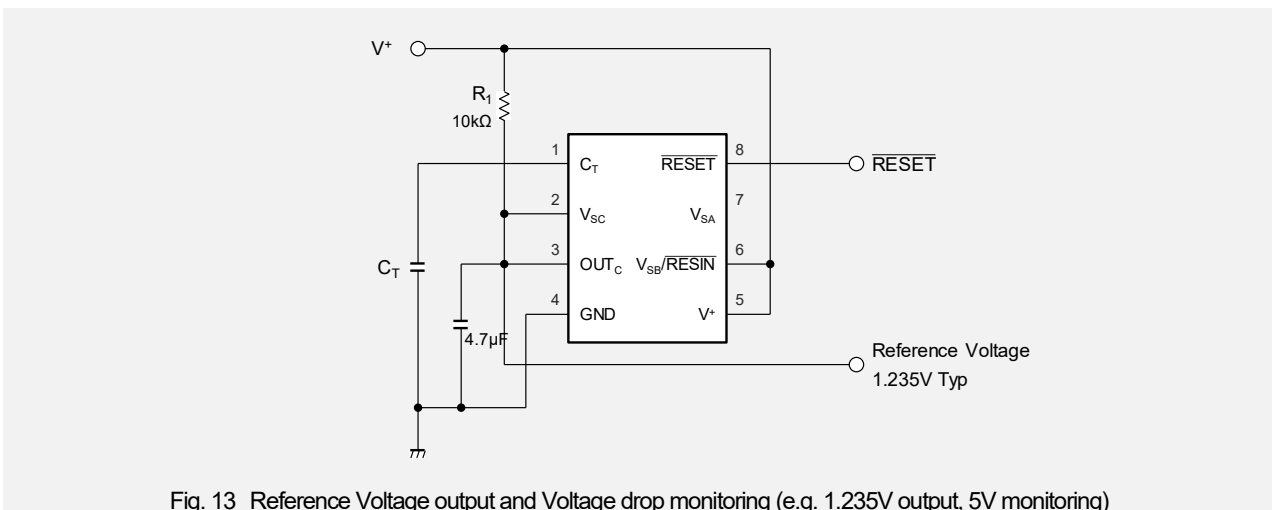


Fig. 13 Reference Voltage output and Voltage drop monitoring (e.g. 1.235V output, 5V monitoring)



Technical Information

14. Low voltage and over voltage detection (V<sup>+</sup> = 5V)

V<sub>SB</sub> (COMP\_B) for low voltage detection and V<sub>SC</sub> (COMP\_C) for overvoltage detection.

Logically synthesizes low voltage and over voltage detection by connecting OUT<sub>C</sub> to V<sub>SA</sub>, and output from  $\overline{\text{RESET}}$ .

- Low voltage detection and over voltage detection are calculated as following formula.

$$\text{Low voltage detection (falling)} \quad V_{SL1} = \frac{R_1 + R_2}{R_2} \times V_{SBL} \approx \frac{R_1 + R_2}{R_2} \times 1.220 \text{ [V]}$$

$$\text{Low voltage detection (rising)} \quad V_{SL2} = \frac{R_1 + R_2}{R_2} \times (V_{SBL} + V_{HRSB}) \approx \frac{R_1 + R_2}{R_2} \times 1.248 \text{ [V]}$$

$$\text{Over voltage detection} \quad V_{SH} = \frac{R_3 + R_4}{R_4} \times V_{SC} \approx \frac{R_3 + R_4}{R_4} \times 1.235 \text{ [V]}$$

- There is no hysteresis characteristics for over voltage detection.
- “ $\overline{\text{RESET}}$  Output Pulse Width t<sub>PO</sub>” is valid even when overvoltage is detected

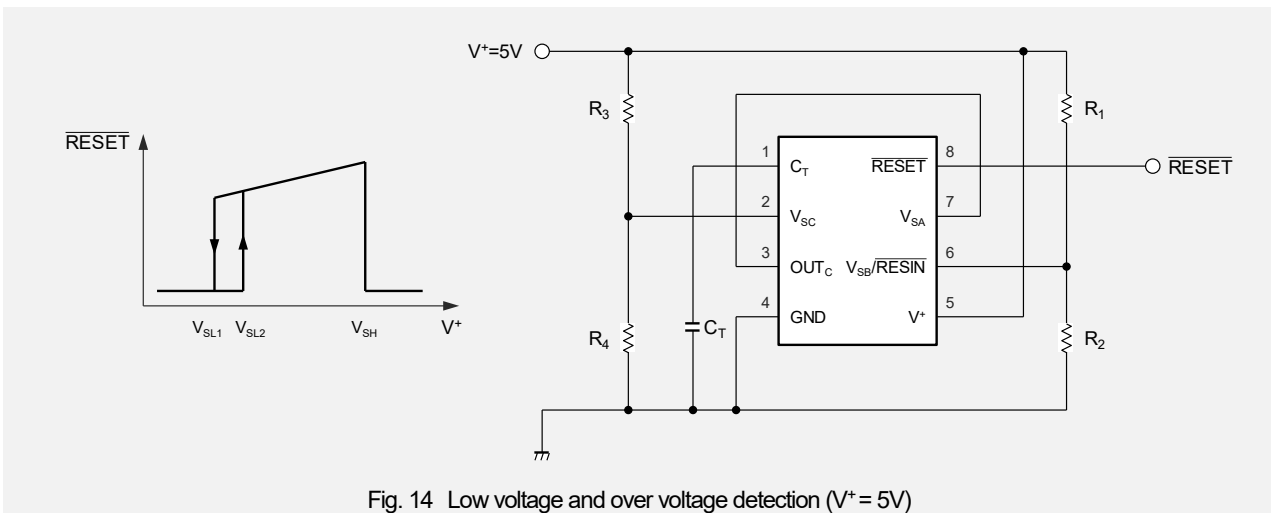
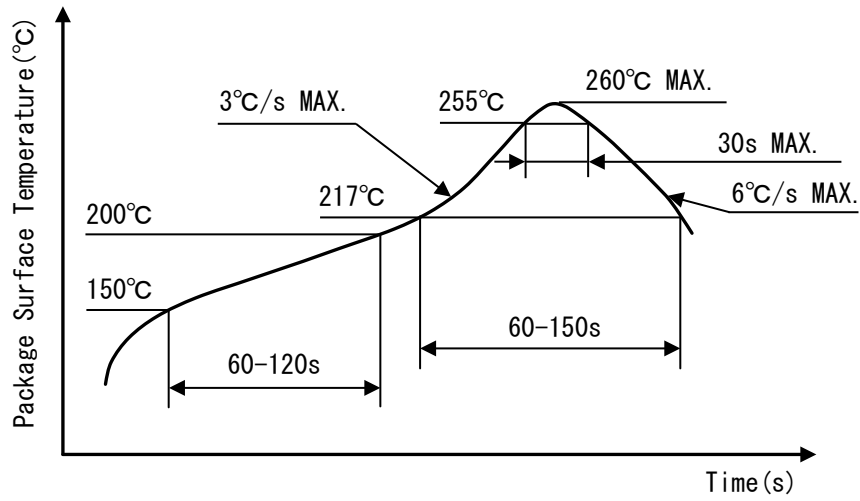


Fig. 14 Low voltage and over voltage detection (V<sup>+</sup> = 5V)

■REVISION HISTORY

Date	Revision	Changes
January.11.2018.	1.0	New Release
August.22. 2018	1.1	Add the Technical Information. (FUNCTION EXPLAMATION, OPERATION EXPLAMATION, APPLICATION EXAMPLE)
Feburary.07. 2019	1.2	Correction of error
January.08.2019	1.3	Change of company name and design form.

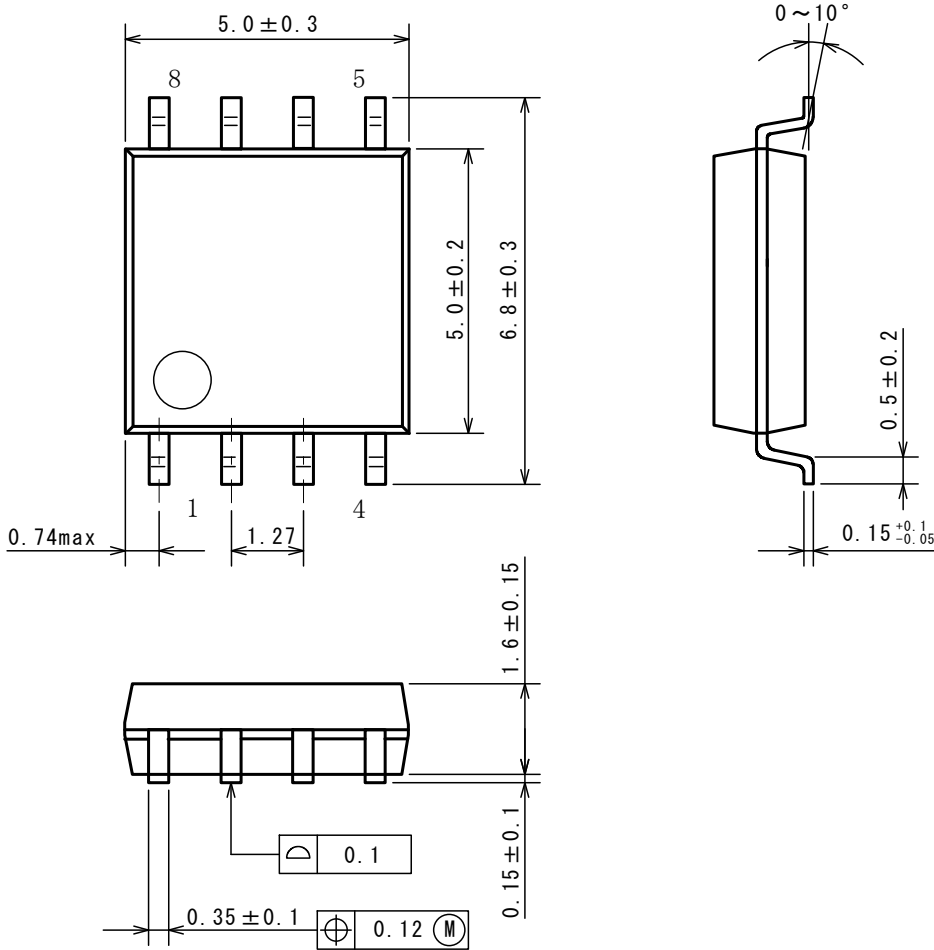
■ HEAT-RESISTANCE PROFILES



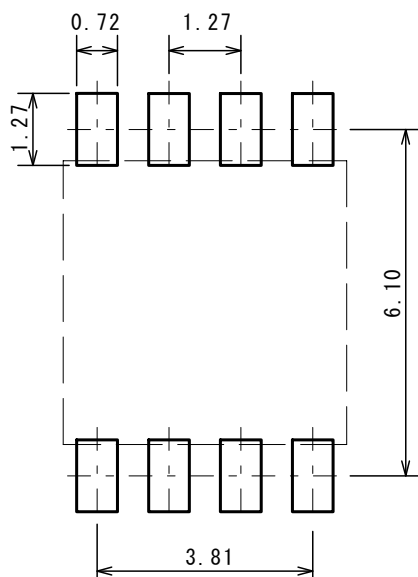
Reflow profile

■ PACKAGE DIMENSIONS

UNIT: mm



■ EXAMPLE OF SOLDER PADS DIMENSIONS



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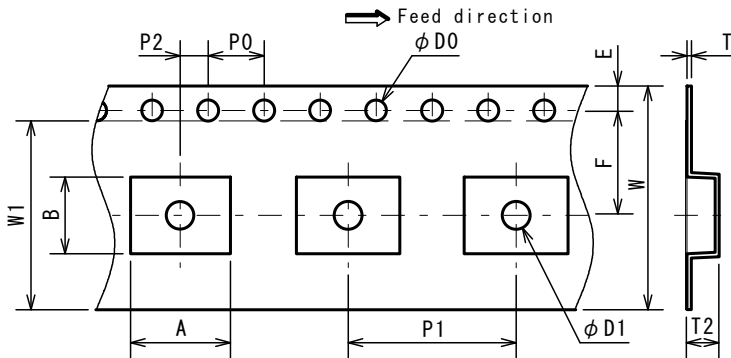
DMP8

PI-DMP8-E-B

■ PACKING SPEC

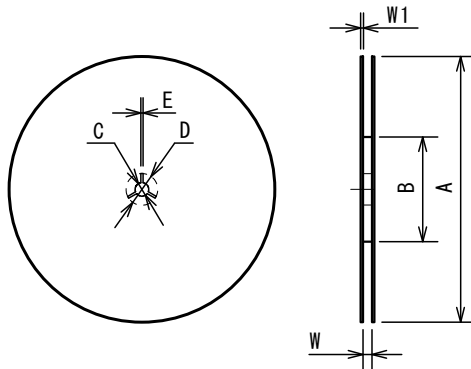
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TAPING DIMENSIONS



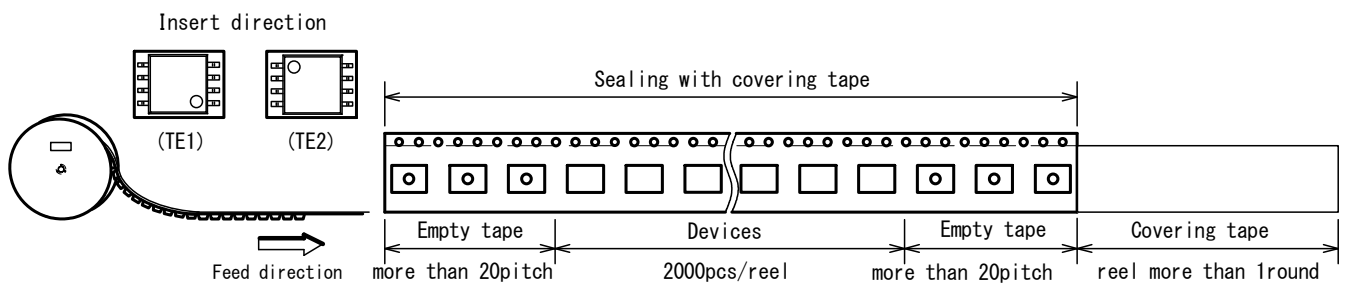
SYMBOL	DIMENSION	REMARKS
A	7.1	BOTTOM DIMENSION
B	5.4	BOTTOM DIMENSION
D0	1.55±0.05	
D1	2.05±0.1	
E	1.75±0.1	
F	7.5±0.1	
P0	4.0±0.1	
P1	12.0±0.1	
P2	2.0±0.1	
T	0.3±0.05	
T2	2.3	
W	16.0±0.3	
W1	13.5	THICKNESS 0.1max

REEL DIMENSIONS

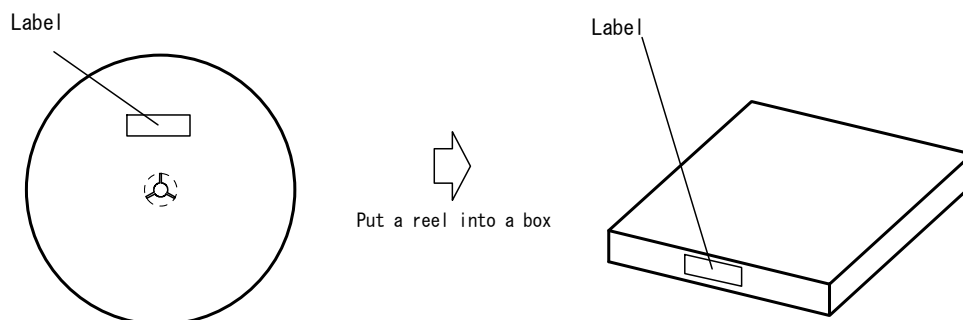


SYMBOL	DIMENSION
A	φ 330±2
B	φ 80±1
C	φ 13±0.2
D	φ 21±0.8
E	2±0.5
W	17.5±0.5
W1	2±0.2

TAPING STATE



PACKING STATE



# Nisshinbo Micro Devices Inc.

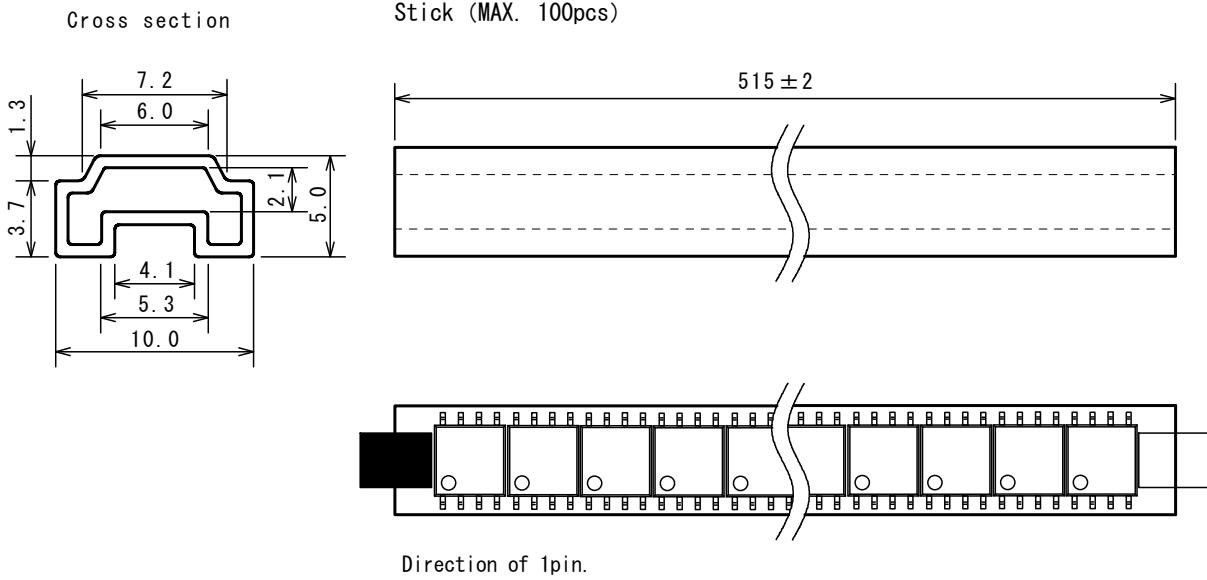
DMP8

PI-DMP8-E-B

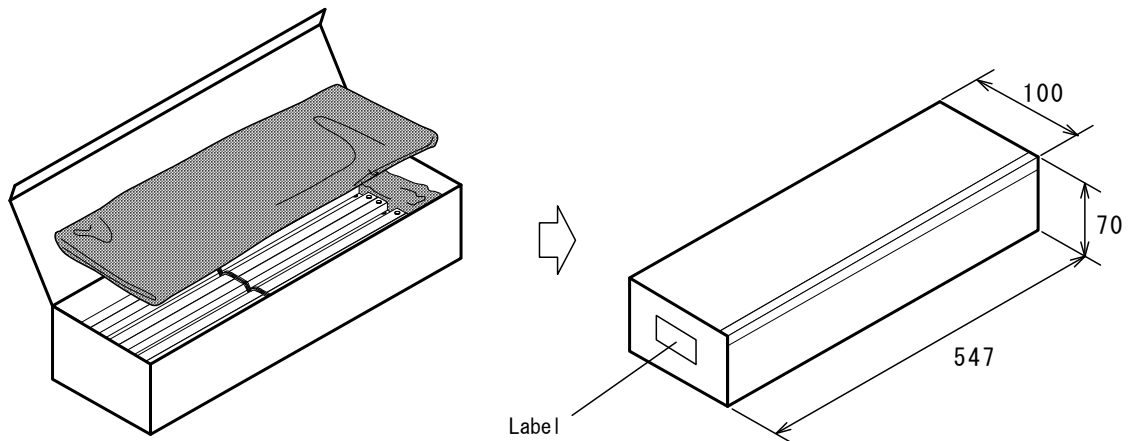
■ PACKING SPEC

UNIT: mm

STICK DIMENSIONS



PACKING STATE



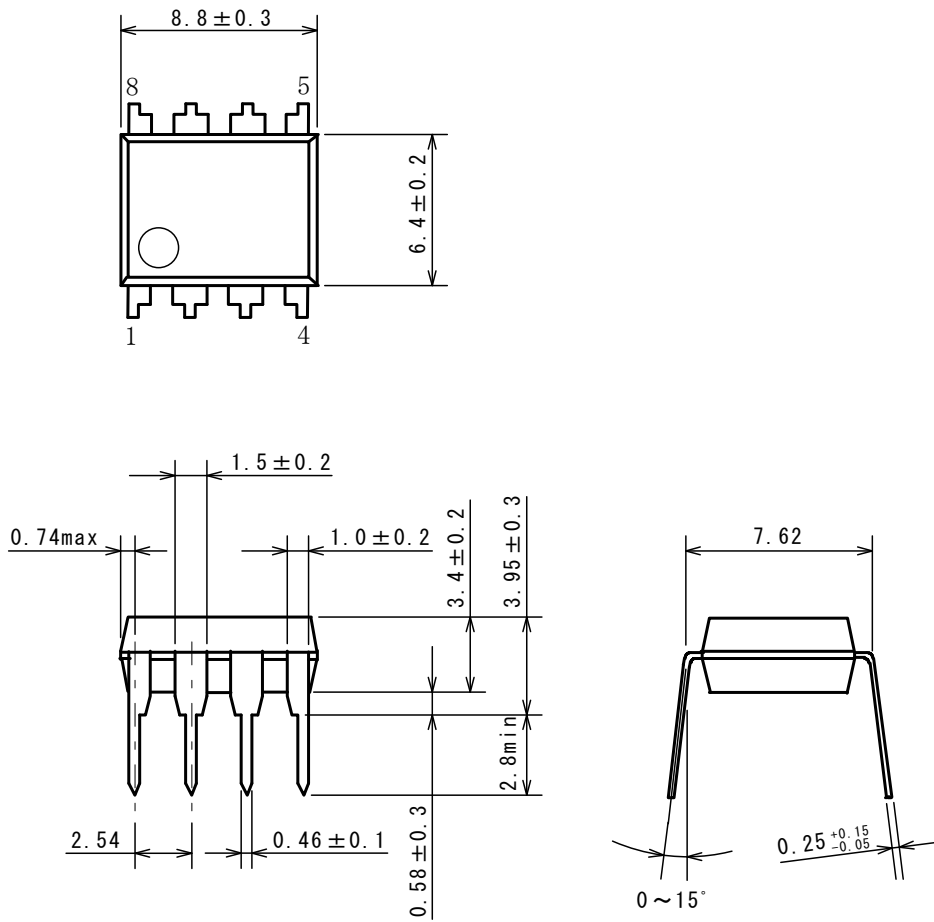
# Nisshinbo Micro Devices Inc.

DIP8

PI-DIP8-E-A

■ PACKAGE DIMENSIONS

UNIT: mm



Nisshinbo Micro Devices Inc.

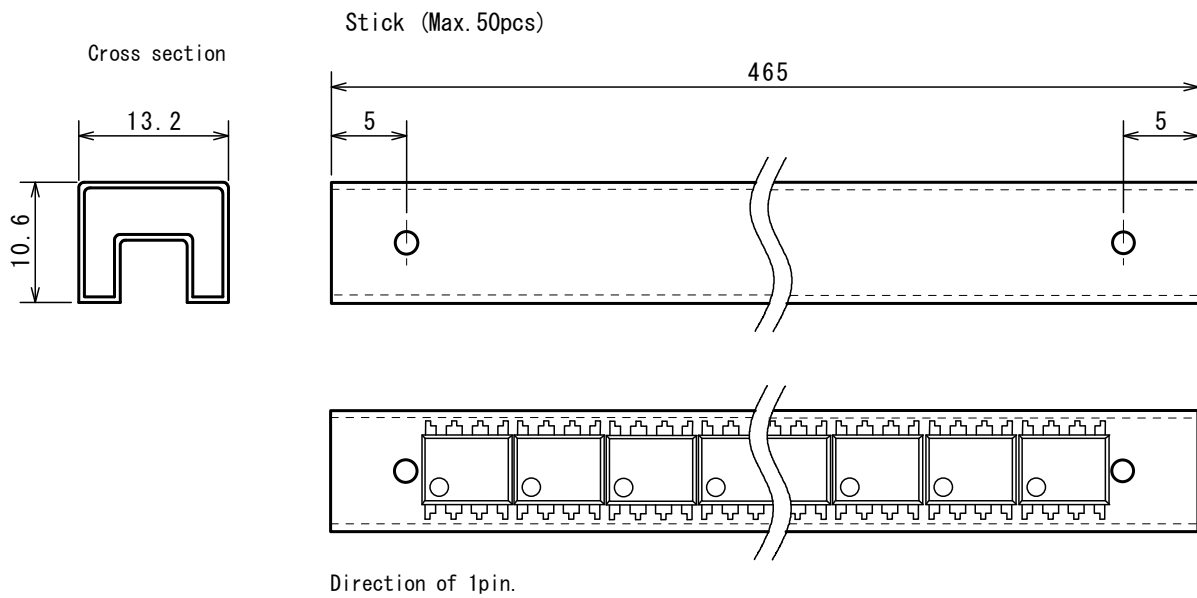
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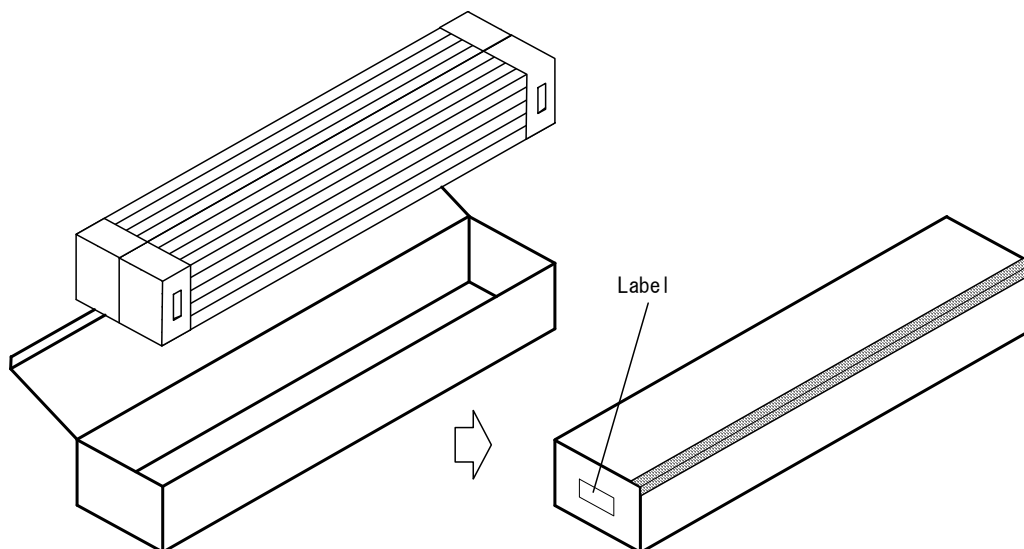
■ PACKING SPEC

UNIT: mm

STICK STATE



PACKING STATE





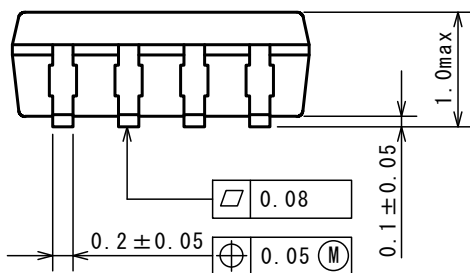
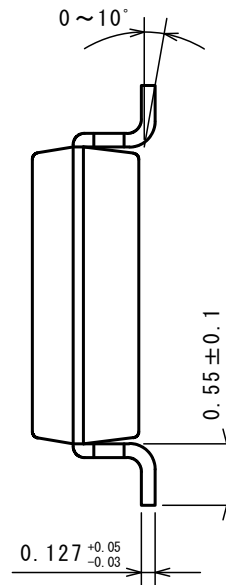
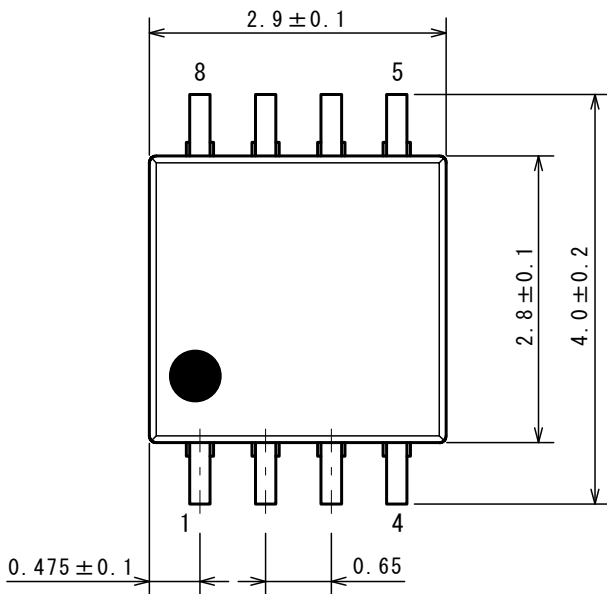
Nisshinbo Micro Devices Inc.

MSOP8 MEET JEDEC MO-187-DA / THIN TYPE (TVSP8)

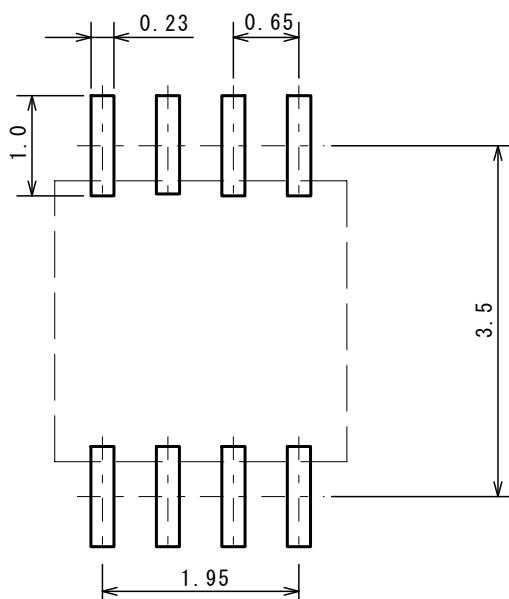
PI-MSOP8 / THIN TYPE-E-A

■ PACKAGE DIMENSIONS

UNIT: mm



■ EXAMPLE OF SOLDER PADS DIMENSIONS



# Nisshinbo Micro Devices Inc.

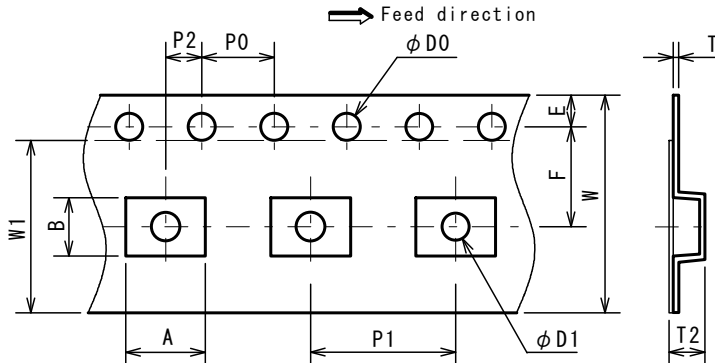
## MSOP8 MEET JEDEC MO-187-DA / THIN TYPE (TVSP8)

PI-MSOP8 / THIN TYPE-E-A

### PACKING SPEC

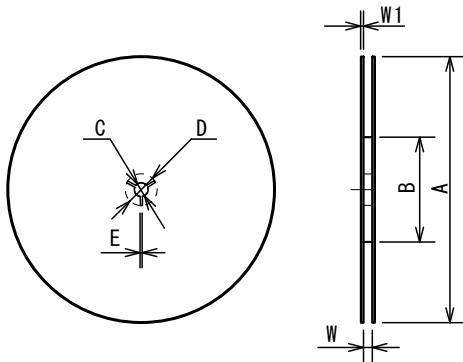
UNIT: mm

#### TAPING DIMENSIONS



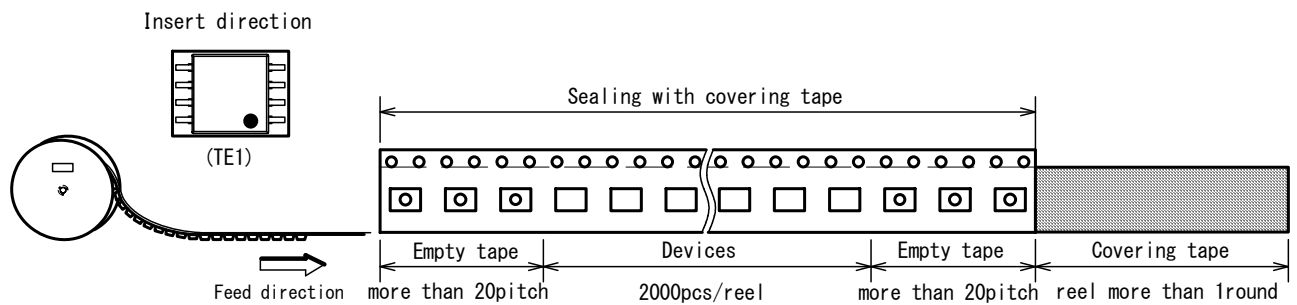
SYMBOL	DIMENSION	REMARKS
A	4.4	BOTTOM DIMENSION
B	3.2	BOTTOM DIMENSION
D0	1.5 <sup>+0.1</sup> <sub>0</sub>	
D1	1.5 <sup>+0.1</sup> <sub>0</sub>	
E	1.75±0.1	
F	5.5±0.05	
P0	4.0±0.1	
P1	8.0±0.1	
P2	2.0±0.05	
T	0.30±0.05	
T2	1.75 (MAX.)	
W	12.0±0.3	
W1	9.5	THICKNESS 0.1max

#### REEL DIMENSIONS

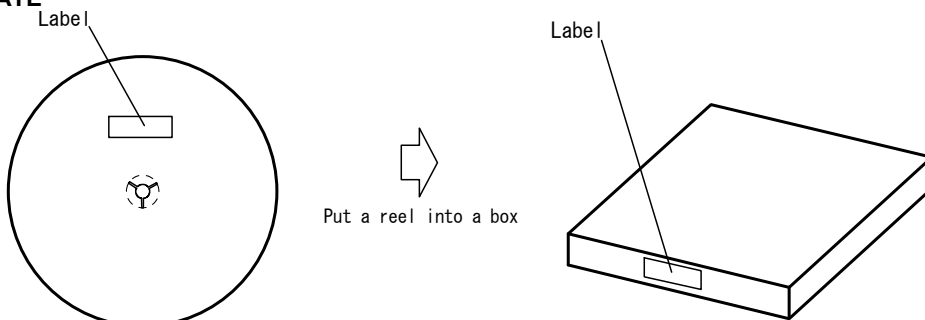


SYMBOL	DIMENSION
A	φ 254±2
B	φ 100±1
C	φ 13±0.2
D	φ 21±0.8
E	2±0.5
W	13.5±0.5
W1	2.0±0.2

#### TAPING STATE



#### PACKING STATE



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  - Power Generator Control Equipment (nuclear, steam, hydraulic, etc.)
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  - Fire Alarms / Intruder Detectors
  - Vehicle Control Equipment (automotive, airplane, railroad, ship, etc.)
  - Various Safety Devices
  - Traffic control system
  - Combustion equipment

In case your company desires to use this product for any applications other than general electronic equipment mentioned above, make sure to contact our company in advance. Note that the important requirements mentioned in this section are not applicable to cases where operation requirements such as application conditions are confirmed by our company in writing after consultation with your company.

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7. The products have been designed and tested to function within controlled environmental conditions. Do not use products under conditions that deviate from methods or applications specified in this datasheet. Failure to employ the products in the proper applications can lead to deterioration, destruction or failure of the products. We shall not be responsible for any bodily injury, fires or accident, property damage or any consequential damages resulting from misuse or misapplication of the products.
8. **Quality Warranty**
  - 8-1. **Quality Warranty Period**

In the case of a product purchased through an authorized distributor or directly from us, the warranty period for this product shall be one (1) year after delivery to your company. For defective products that occurred during this period, we will take the quality warranty measures described in section 8-2. However, if there is an agreement on the warranty period in the basic transaction agreement, quality assurance agreement, delivery specifications, etc., it shall be followed.
  - 8-2. **Quality Warranty Remedies**

When it has been proved defective due to manufacturing factors as a result of defect analysis by us, we will either deliver a substitute for the defective product or refund the purchase price of the defective product.

Note that such delivery or refund is sole and exclusive remedies to your company for the defective product.
  - 8-3. **Remedies after Quality Warranty Period**

With respect to any defect of this product found after the quality warranty period, the defect will be analyzed by us. On the basis of the defect analysis results, the scope and amounts of damage shall be determined by mutual agreement of both parties. Then we will deal with upper limit in Section 8-2. This provision is not intended to limit any legal rights of your company.
9. Anti-radiation design is not implemented in the products described in this document.
10. The X-ray exposure can influence functions and characteristics of the products. Confirm the product functions and characteristics in the evaluation stage.
11. WLCSP products should be used in light shielded environments. The light exposure can influence functions and characteristics of the products under operation or storage.
12. Warning for handling Gallium and Arsenic (GaAs) products (Applying to GaAs MMIC, Photo Reflector). These products use Gallium (Ga) and Arsenic (As) which are specified as poisonous chemicals by law. For the prevention of a hazard, do not burn, destroy, or process chemically to make them as gas or power. When the product is disposed of, please follow the related regulation and do not mix this with general industrial waste or household waste.
13. Please contact our sales representatives should you have any questions or comments concerning the products or the technical information.



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