

System Reset IC

■FEATURES

- Suitable for replacement from MB3771
- Detection voltage $V_{SA}=4.2V\pm1.0\%$
- Adjustable detection voltage $V_{SB}=1.23V\pm1.0\%$
- Possible to detect over voltage $V_{SC}=1.245V\pm1.0\%$
- V_{SA} and V_{SB} have hysteresis characteristics at reset release
- Operating temperature $T_a=-40$ to $125^{\circ}C$
- Low quiescent current $280\mu A$ typ.
- Reference voltage can be taken out $0.8V$ typ.
- Package EMP8

■GENERAL DESCRIPTION

The NJU2103B 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.

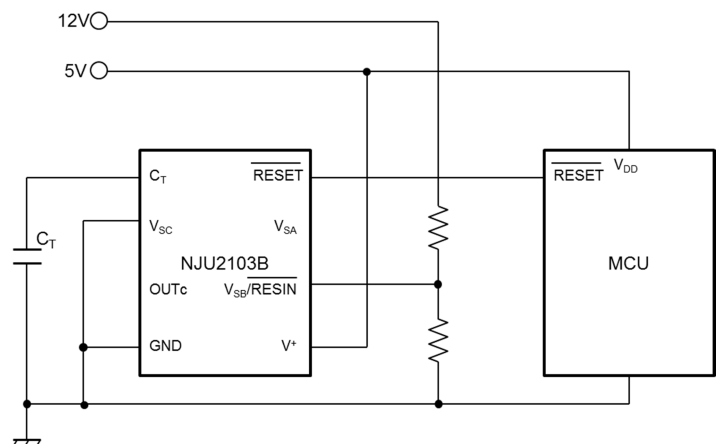
Since V_{SB} Detecting Voltage, V_{SC} Detecting Voltage and $\overline{RESET}$ Output Pulse Width are adjusted from NJU2103A, it is more suitable for replacement from MB3771.

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

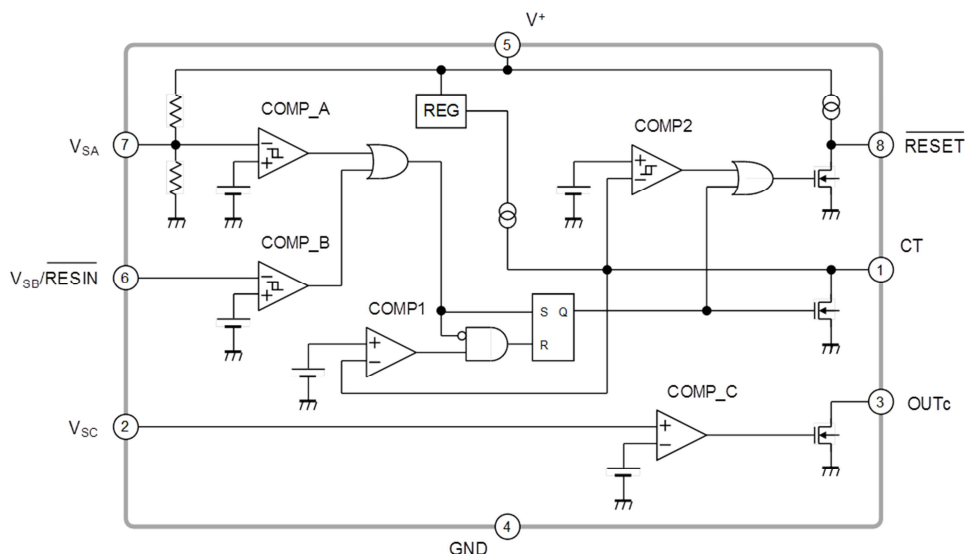
■APPLICATION

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

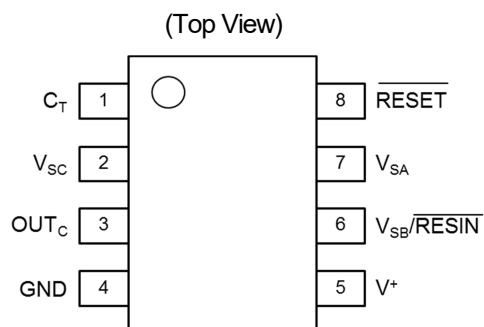
■TYPICAL APPLICATION



■BLOCK DIAGRAM



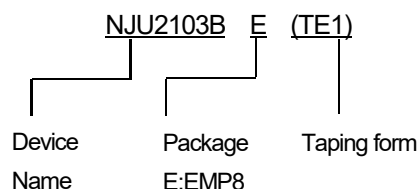
■PIN CONFIGURATION



EMP8

PIN No.	PIN NAME	FUNCTION
1	C_T	Connects Capacitor pin for setting RESET Output Pulse Width
2	V_{SC}	Comparator C input pin
3	OUT_C	Comparator C output pin
4	GND	GND pin
5	V^+	Power Supply pin
6	$V_{SB}/\overline{RESIN}$	Comparator B input pin
7	V_{SA}	Comparator A input pin
8	$\overline{RESET}$	RESET output pin (Active Low)

■PRODUCT NAME INFORMATION



■ORDERING INFORMATION

PRODUCT NAME	PACKAGE OUTLINE	RoHS	Halogen-Free	TERMINAL FINISH	MARKING	WEIGHT (mg)	MOQ (pcs)
NJU2103BE(TE1)	EMP8	yes	yes	Sn-2Bi	2103B	76	2000

■ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V^+	-0.3 to 20	V
Input Voltage	V_{SA}	-0.3 to $V^+ + 0.3$ (<20)	V
	V_{SB}	-0.3 to 20	V
	V_{SC}	-0.3 to 20	V
C_T Pin Voltage	V_{CT}	-0.3 to $V^+ + 0.3$ (<20)	V
$\overline{RESET}$ Output Voltage	V_{RESET}	-0.3 to $V^+ + 0.3$ (<20)	V
OUT_C Output Voltage	V_{OUTC}	-0.3 to 20	V
Power Dissipation($T_a=25^\circ\text{C}$) EMP8	P_D	(2-layer / 4-layer) 700 ⁽¹⁾ / 1000 ⁽²⁾	mW
Junction Temperature	T_J	-40 to +150	$^\circ\text{C}$
Operating Temperature	T_{opr}	-40 to +125	$^\circ\text{C}$
Storage Temperature	T_{stg}	-50 to +150	$^\circ\text{C}$

(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^+	2.5 to 18	V
Input Voltage	V_{SA}	0 to V^+	V
	V_{SB}	0 to 18	V
	V_{SC}	0 to 18	V
Output Current	I_{RESET}	0 to 20	mA
	I_{OUTC}	0 to 6	mA
$\overline{RESET}$ Output Pulse Width	t_{PO}	0.10 to 1000	ms
C_T Capacitor	C_T	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	μA
Operating Current 2	I_{CC2}		-	300	410	μA
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	1.218	1.230	1.242	V
		V_{SB} sweep down, $T_a=-40^\circ C$ to $125^\circ C$	1.200	-	1.260	
V_{SB} Detecting Supply Voltage Fluctuation	ΔV_{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}	$I_{RESE\overline{T}}=-5\mu A$, $V_{SB}=5V$	4.5	4.9	-	V
RESET Output Saturation Voltage 1	V_{OLR1}	$I_{RESE\overline{T}}=3mA$	-	0.05	0.40	V
RESET Output Saturation Voltage 2	V_{OLR2}	$I_{RESE\overline{T}}=10mA$	-	0.15	0.50	V
RESET Output Sink Current	$I_{RESE\overline{T}}$	$V_{OLR}=1V$	20	60	-	mA
C_T Charge Current	I_{CT}	$V_{SB}=5V$, $V_{CT}=0.5V$	9	12	16	μA
V_{SC} Input Current1	I_{IHC}	$V_{SC}=5V$	-	0	500	nA
V_{SC} Input Current 2	I_{ILC}		-	0	500	nA
V_{SC} Detecting Voltage	V_{SC}		1.233	1.245	1.257	V
		$T_a=-40^\circ C$ to $125^\circ C$	1.205	-	1.285	
V_{SC} Detecting Supply Voltage Fluctuation	ΔV_{SC}	$V^+=2.5$ to $18V$	-	3	10	mV
OUT_C Output Leak Current	I_{OHC}	$V_{OHC}=18V$	-	0	1	μA
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^+	$V_{OLR}=0.4V$, $I_{RESE\overline{T}}=200\mu A$	-	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	-	-	μs
V_{SB} Input Pulse Width	t_{PIB}		5	-	-	μs
RESET Output Pulse Width	t_{PO}	$V_{SB}=V^+$	0.5	1.0	1.5	ms
RESET Rise Time	t_r	$V_{SB}=V^+$, $R_L=2.2k\Omega$, $C_L=100pF$ RESET=10% to 90%	-	1.0	1.5	μs
RESET Fall Time	t_f	$V_{SB}=V^+$, $R_L=2.2k\Omega$, $C_L=100pF$ RESET=90% to 10%	-	0.1	0.5	μs
Output Delay Time	t_{PD}	V_{SB} sweep down	-	2	10	μs
	t_{PHL}	V_{SC} sweep up, $R_L=2.2k\Omega$, $C_L=100pF$	-	0.5	-	μs
	t_{PLH}	V_{SC} sweep down, $R_L=2.2k\Omega$, $C_L=100pF$	-	1.0	-	μs

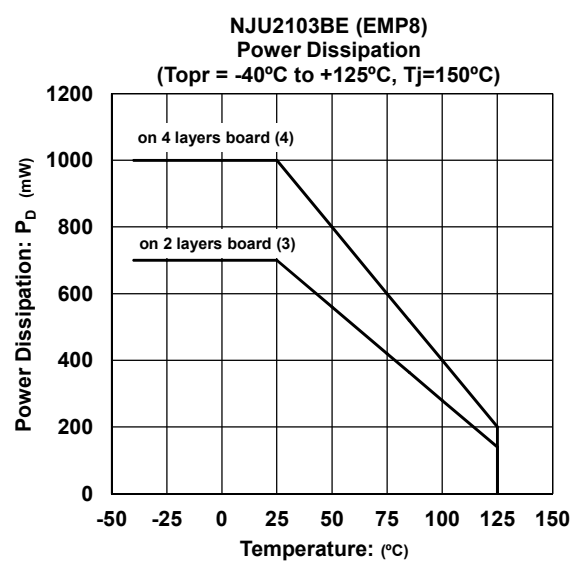
■ THERMAL CHARACTERISTICS

PARAMETER	SYMBOL	VALUE		UNIT
Junction-to-ambient thermal resistance	θ_{ja}	EMP8	178 ⁽³⁾ 121 ⁽⁴⁾	°C/W
Junction-to-Top of package characterization parameter	ψ_{jt}	EMP8	31 ⁽³⁾ 27 ⁽⁴⁾	°C/W

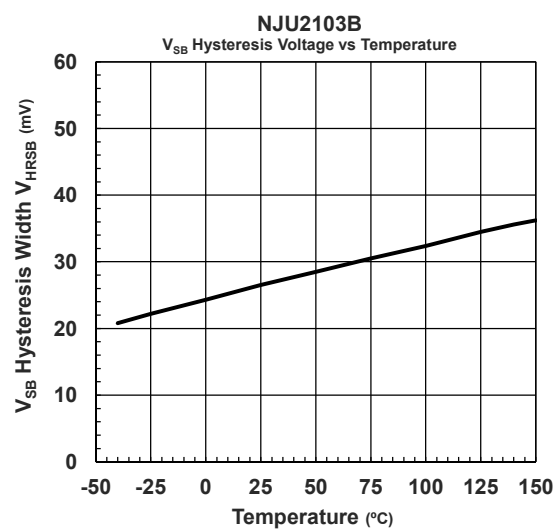
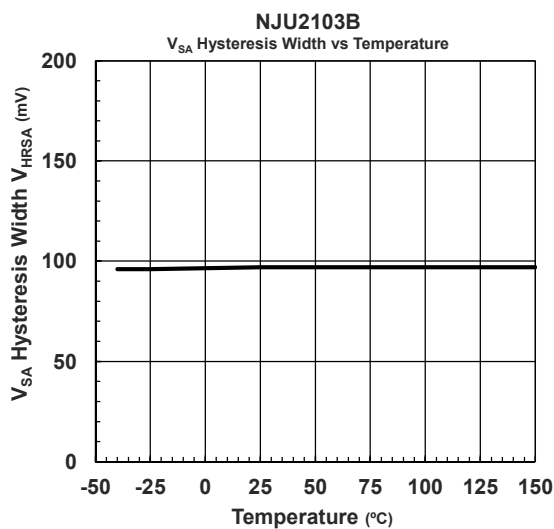
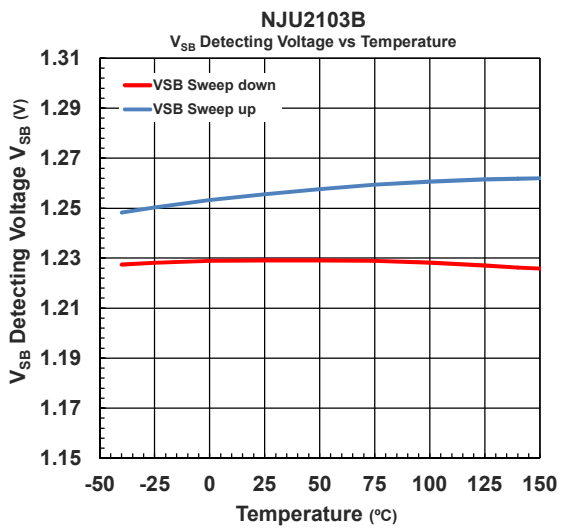
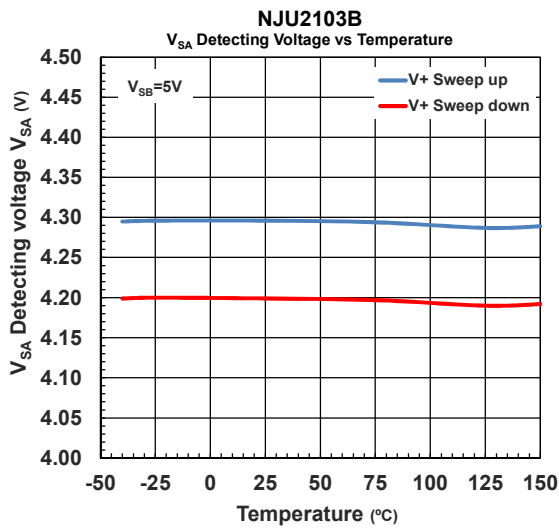
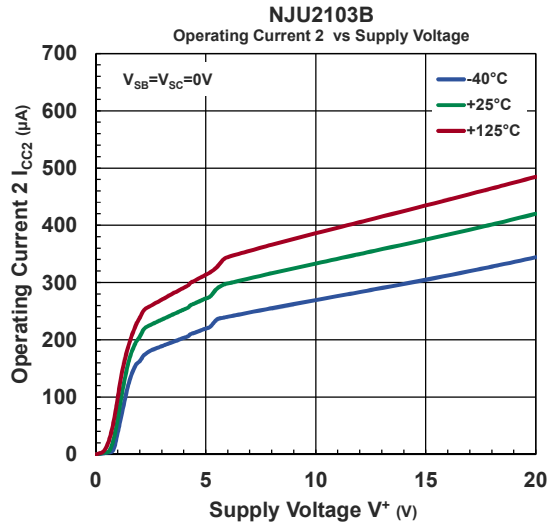
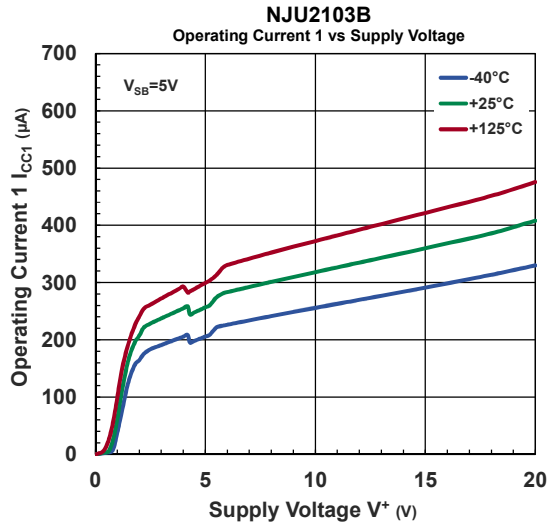
(3): Mounted on glass epoxy board.(76.2 x 114.3 x 1.6 :based on EIA/JEDEC standard, 2 Layers)

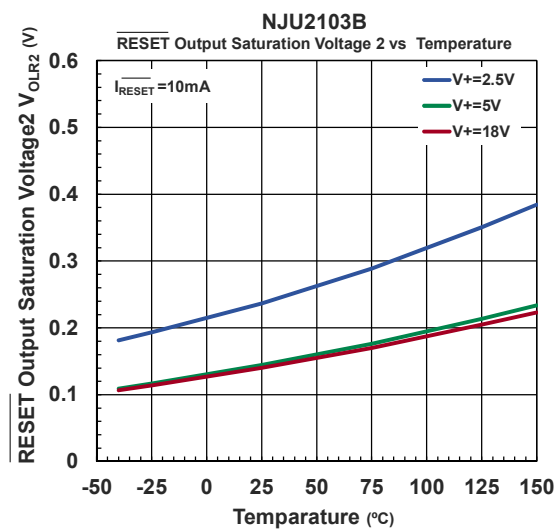
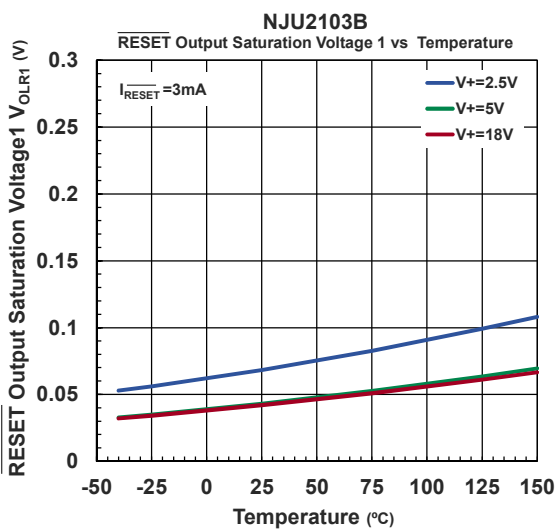
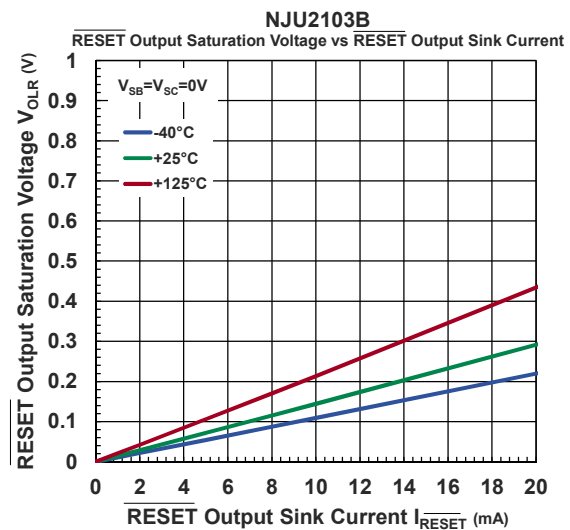
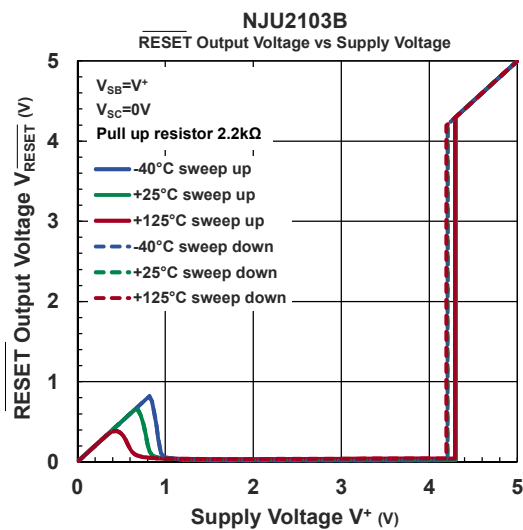
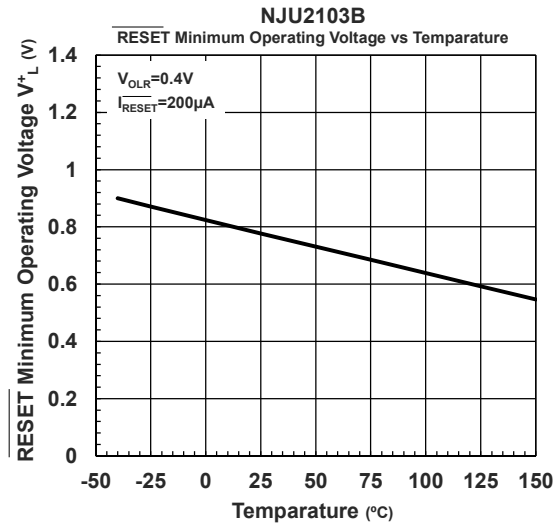
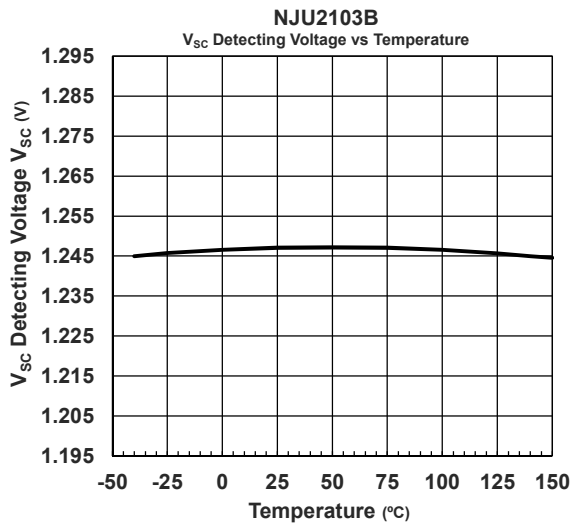
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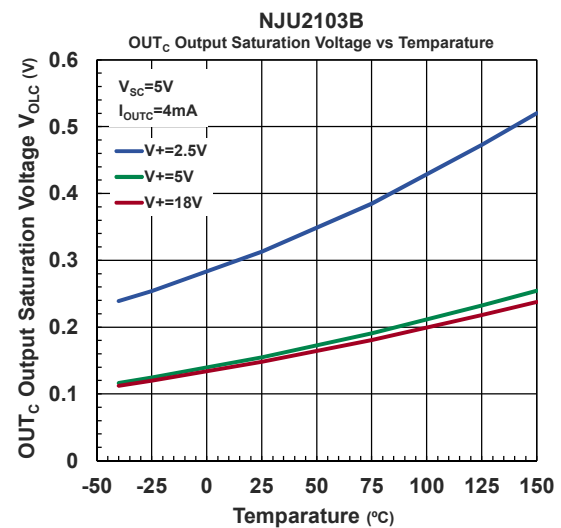
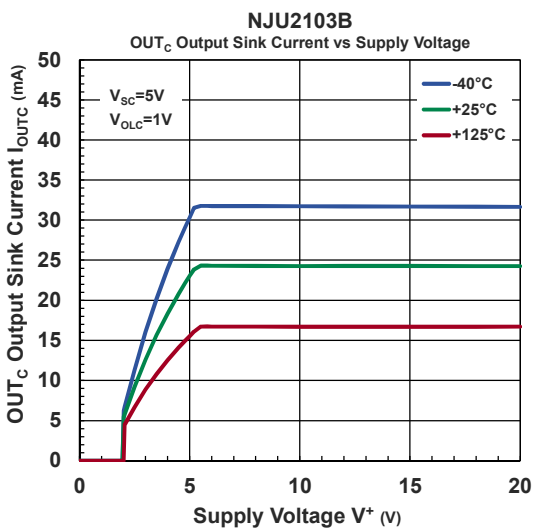
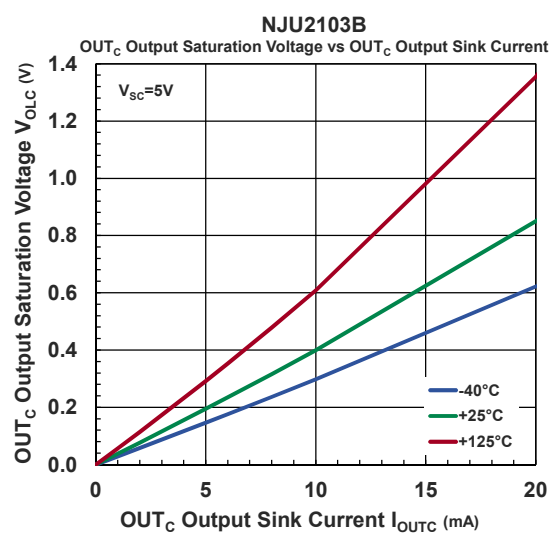
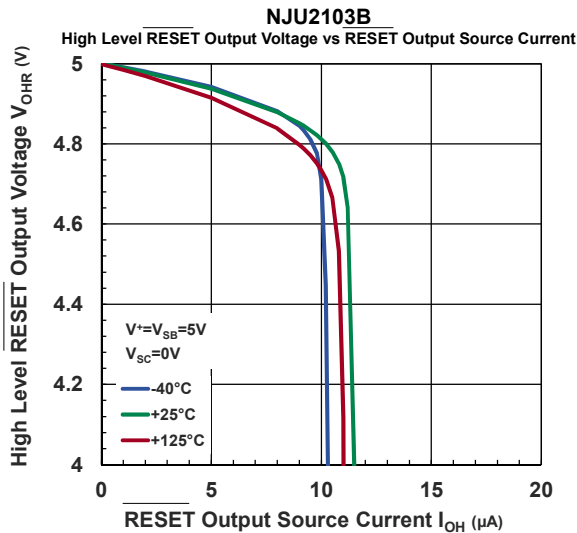
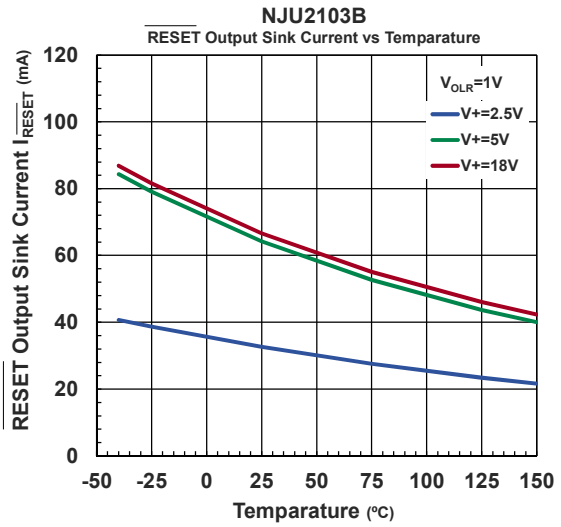
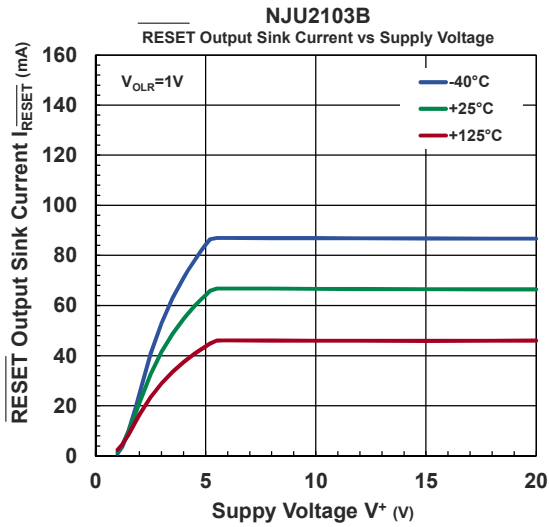
■ POWER DISSIPATION vs. AMBIENT TEMPERATURE

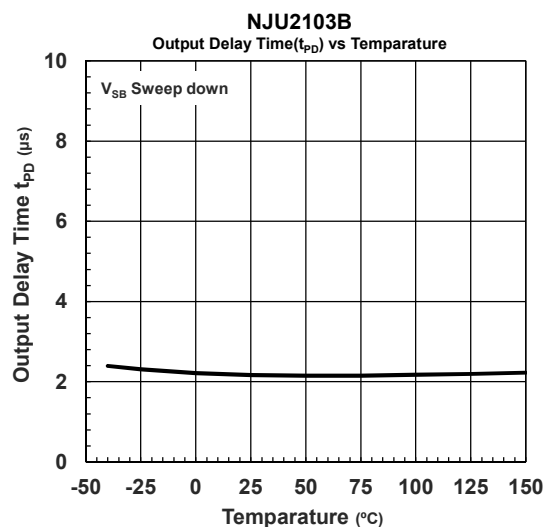
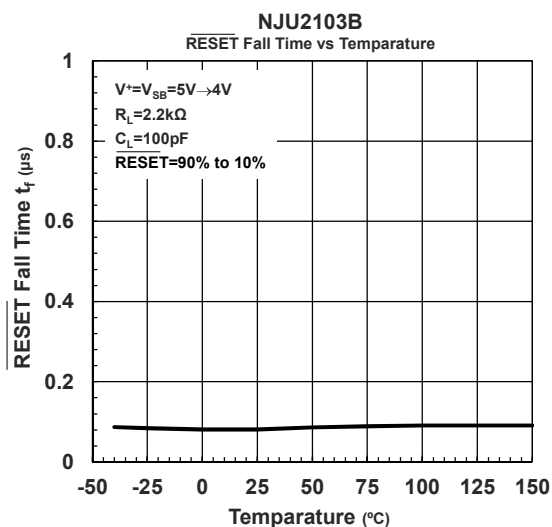
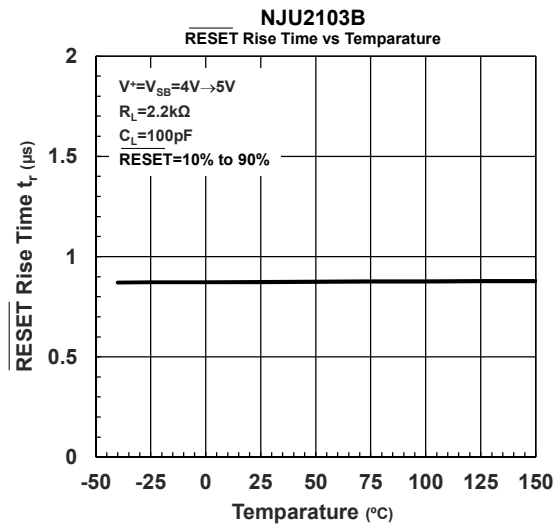
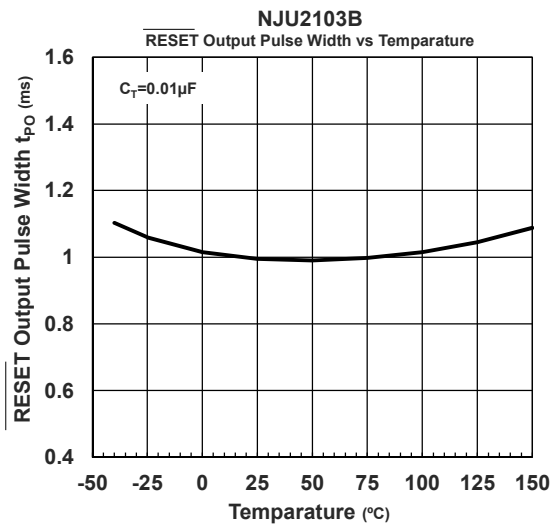
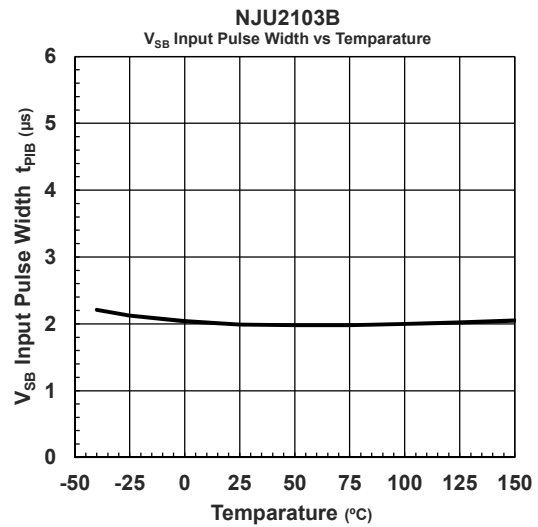
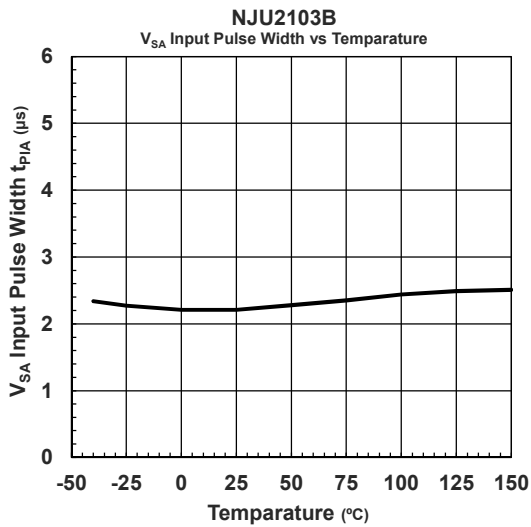


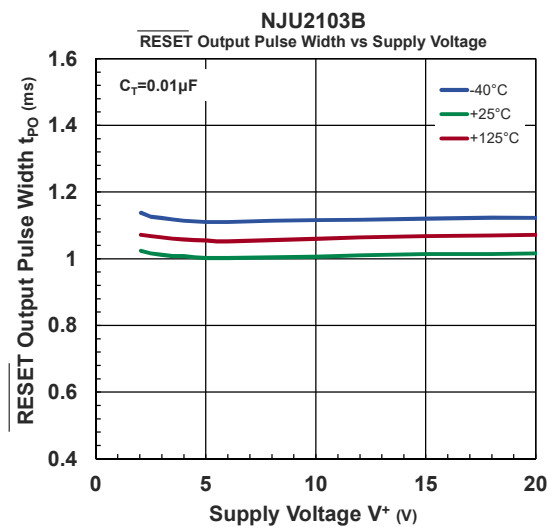
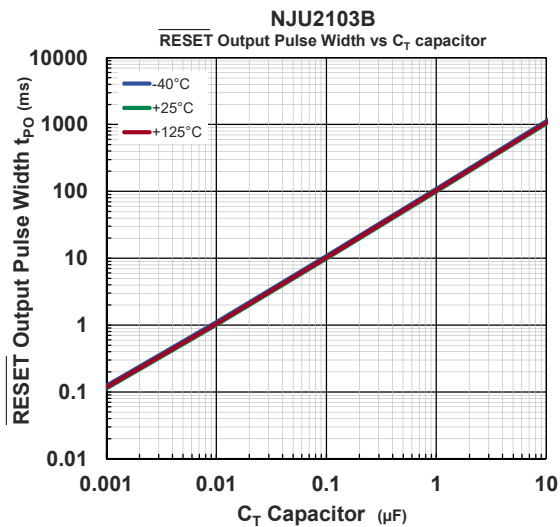
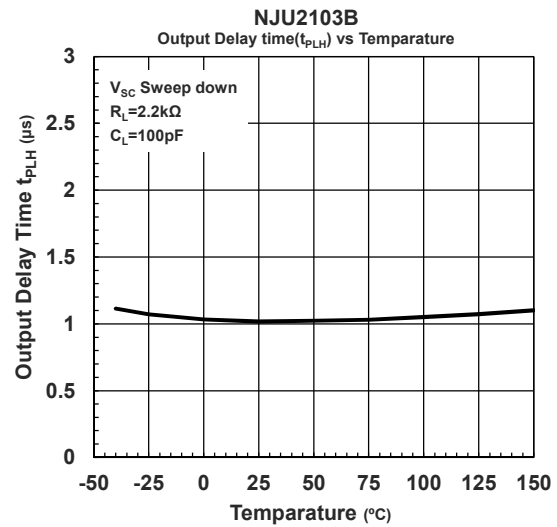
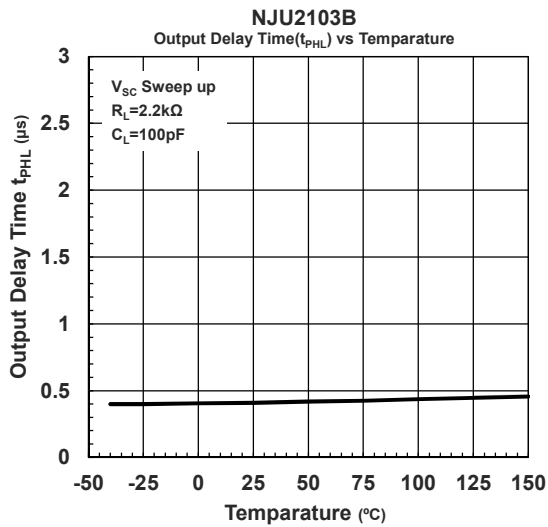
■ TYPICAL CHARACTERISTICS









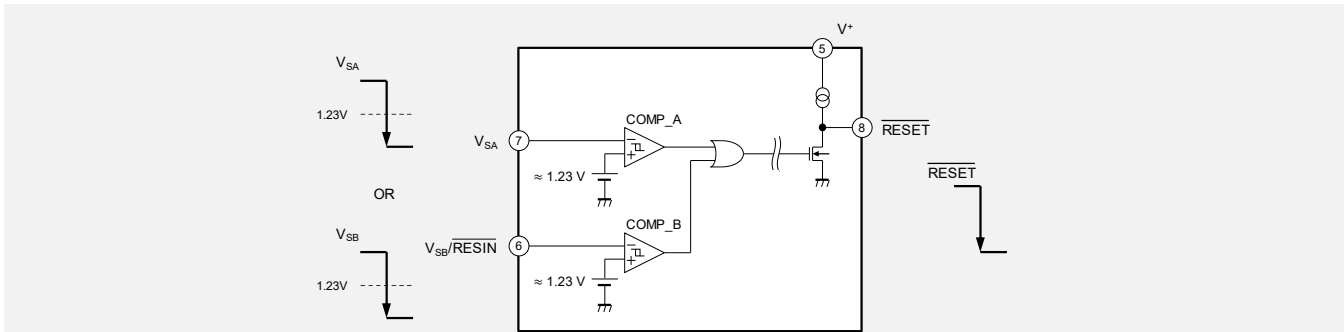


FUNCTION EXPLANATION

Technical Information

COMP_A and COMP_B are comparator with hysteresis in detection voltage.

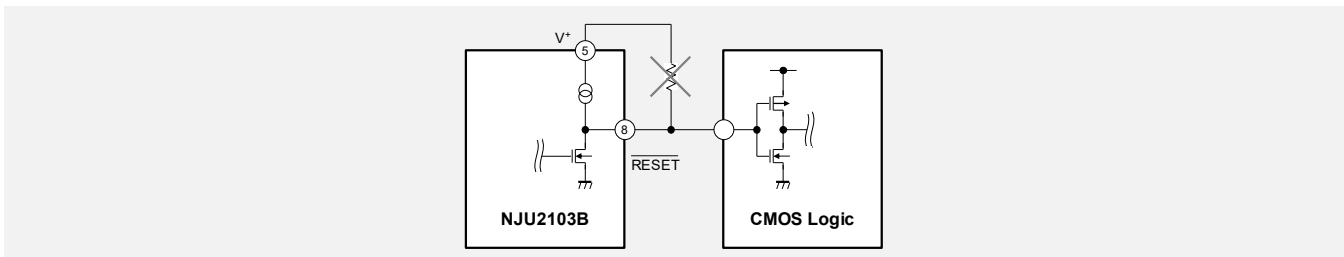
When either V_{SA} or V_{SB} pin voltage becomes about 1.23 V or less, the $\overline{RESET}$ output becomes "Low".



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)

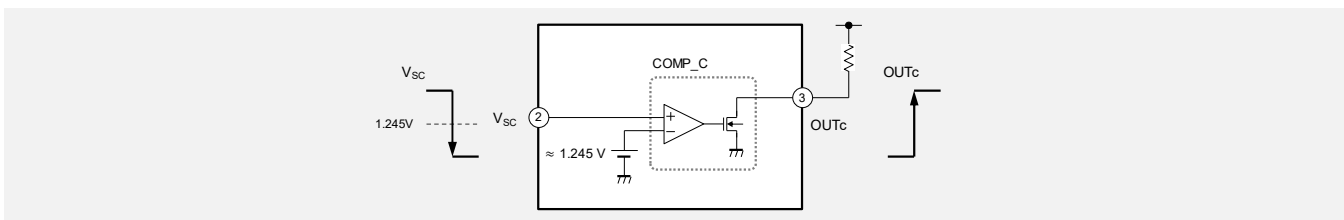
The NJU2103B can detect the instantaneous interruption and the instantaneous drop of the power line with a time of about 2 μ s width. If this level of instantaneous interruption or drop is not a problem, it can have a delayed trigger function by connecting capacitor to the V_{SA} and V_{SB} pins (refer 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)

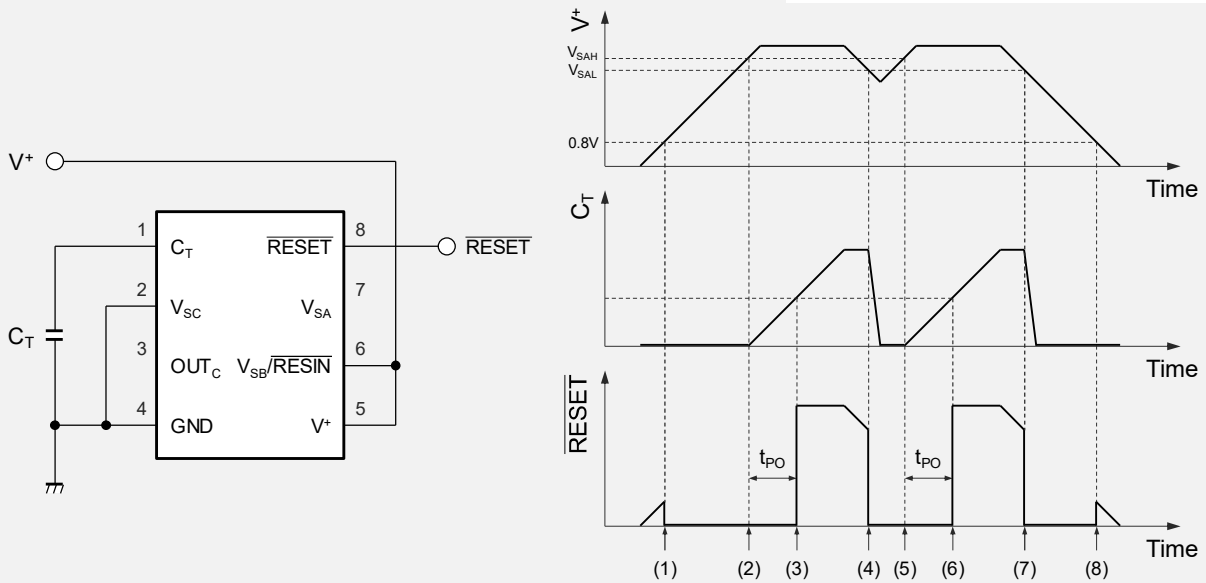


Unused Pin should be treated as shown in the table below.

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

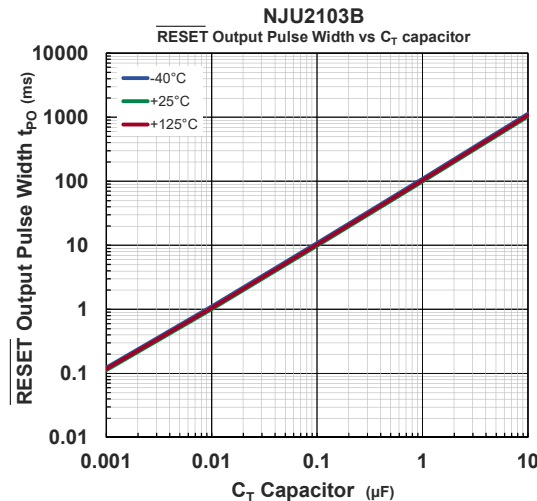
Technical Information



- (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.

$$\overline{\text{RESET}} \text{ Output Pulse Width } t_{PO} [\text{ms}] \approx 100 \times C_T [\mu\text{F}]$$



- (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.

APPLICATION EXAMPLE

Technical Information

1. 5V Power supply monitor

Monitor the 5V power supply with $V_{SA}(\text{COMP_A})$. The detection voltage at falling is the V_{SA} detection voltage 1 V_{SAL} (4.2 V typ.), and the detection voltage at rising is the V_{SA} detection voltage 2 V_{SAH} (4.3Vtyp.).

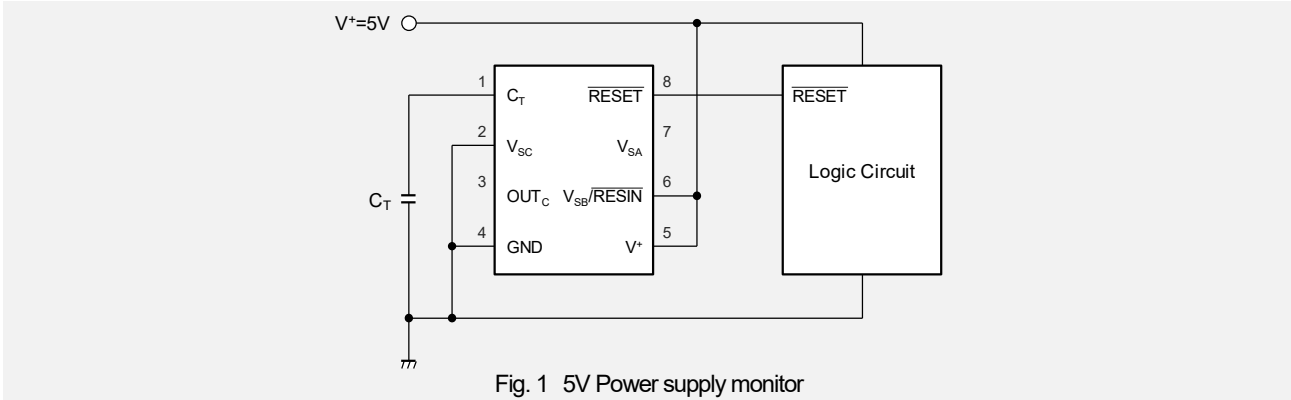


Fig. 1 5V Power supply monitor

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

V_{SA} detection voltage1 can be adjusted with an external resistor.

- By selecting the external voltage-dividing resistors R_1 and R_2 to a sufficiently smaller value than internal voltage-dividing resistors R' , R'' (99 k Ω , 41 k Ω), the detection voltage can be set by the resistance ratio of R_1 and R_2 .

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

Detection voltage calculate formula ($R_1 \ll 100\text{k}\Omega$, $R_2 \ll 41\text{k}\Omega$)

$$\text{Detection Voltage(falling)} = \frac{(R_1 \parallel R') + (R_2 \parallel R'')}{R_2 \parallel R''} \times \frac{R''}{R' + R''} \times V_{SAL} \approx \frac{R_1 + R_2}{R_2} \times 1.2300 \text{ [V]}$$

$$\text{Detection Voltage(rising)} = \frac{(R_1 \parallel R') + (R_2 \parallel R'')}{R_2 \parallel R''} \times \frac{R''}{R' + R''} \times V_{SAH} \approx \frac{R_1 + R_2}{R_2} \times 1.2593 \text{ [V]}$$

Tab. 1 Setting example

External resistor R_1 [k Ω]	External resistor R_2 [k Ω]	Detection Voltage(falling) [V]	Detection Voltage(rising) [V]
10	3.9	4.37	4.47
9.1	3.9	4.11	4.20

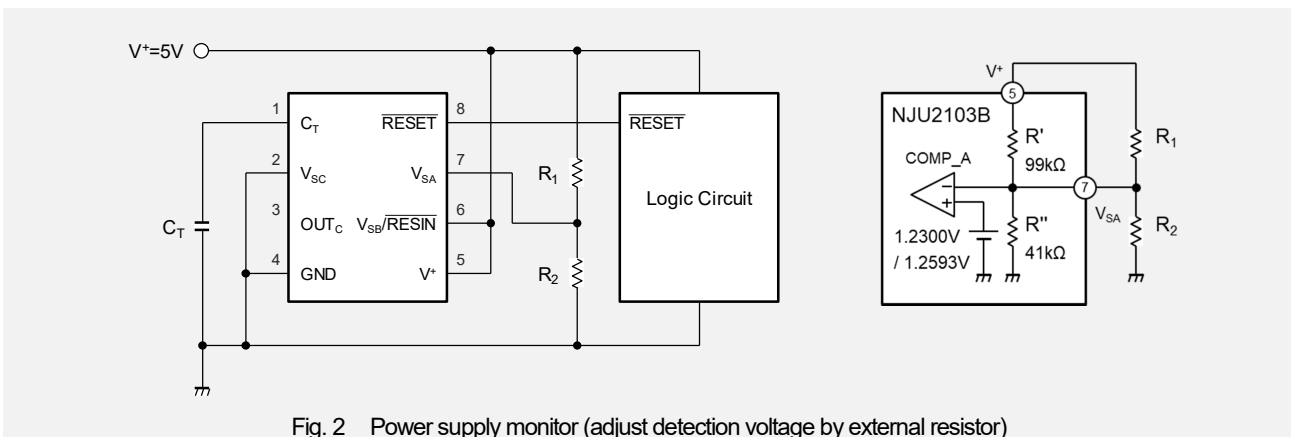


Fig. 2 Power supply monitor (adjust detection voltage by external resistor)

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

Technical Information

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.

$$\begin{aligned} \text{Detection Voltage(falling)} &= \frac{R_1 + R_2}{R_2} \times V_{SBL} \approx \frac{R_1 + R_2}{R_2} \times 1.230 \text{ [V]} \\ \text{Detection Voltage(rising)} &= \frac{R_1 + R_2}{R_2} \times (V_{SBL} + V_{HRSB}) \approx \frac{R_1 + R_2}{R_2} \times 1.258 \text{ [V]} \end{aligned}$$

- 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: $17.2 \times V^+ [\mu A]$)

Tab. 2 setting example

External resistor R_1 [kΩ]	External resistor R_2 [kΩ]	Detection Voltage(falling) [V]	Detection Voltage(rising) [V]
20	7.5	4.51	4.61
39	27	3.01	3.08

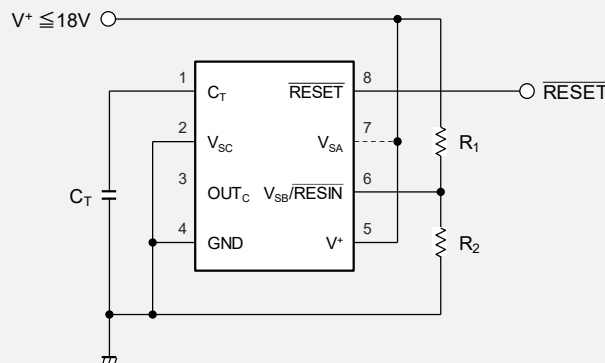


Fig. 3 Arbitrary power supply monitor (monitoring $V^+ \leq 18V$)

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

$$\text{Detection Voltage}(V^+ \text{ falling}) = \frac{R_1 + R_2}{R_2} \times V_{SBL} \approx \frac{R_1 + R_2}{R_1} \times 1.230 \text{ [V]}$$

$$\text{Detection Voltage}(V^+ \text{ rising}) = \frac{R_1 + R_2}{R_2} \times (V_{SBL} + V_{HRSB}) \approx \frac{R_1 + R_2}{R_2} \times 1.258 \text{ [V]}$$

- 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.

$$\text{Constant Voltage } V_{OUT} = \frac{R_4 + R_5}{R_5} \times V_{SC} \approx \frac{R_4 + R_5}{R_5} \times 1.245 \text{ [V]}$$

- 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.

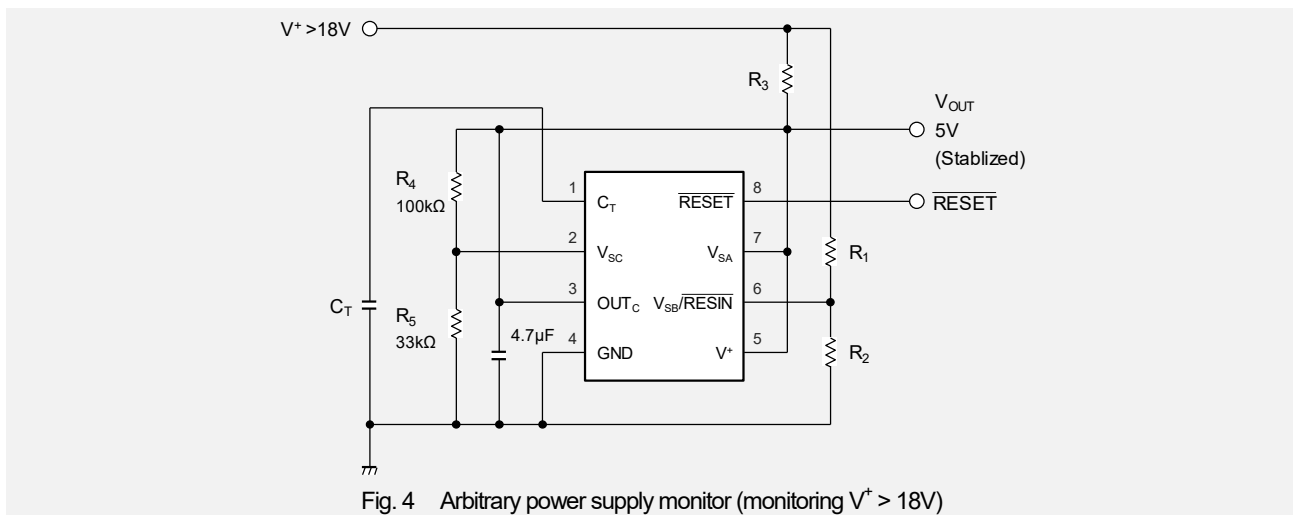


Fig. 4 Arbitrary power supply monitor (monitoring $V^+ > 18V$)

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

$$\text{Detection Voltage}(V_2^+ \text{ falling}) = \frac{R_1 + R_2}{R_2} \times V_{SBL} \approx \frac{R_1 + R_2}{R_2} \times 1.230 \text{ [V]}$$

$$\text{Detection Voltage}(V_2^+ \text{ rising}) = \frac{R_1 + R_2}{R_2} \times (V_{SBL} + V_{HRSB}) \approx \frac{R_1 + R_2}{R_2} \times 1.258 \text{ [V]}$$

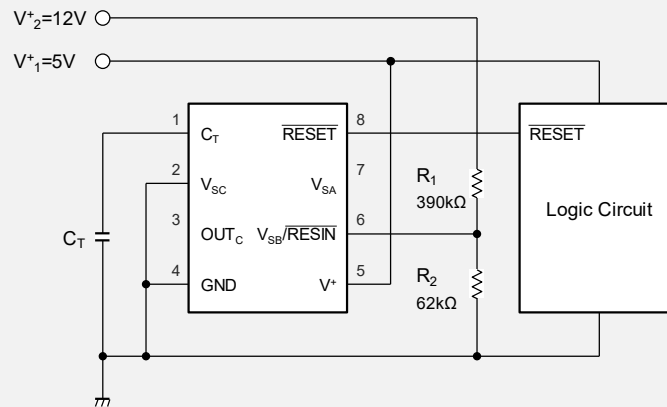


Fig. 5 5V, 12V power supply monitor (dual power supply monitor : $V_1^+ = 5V$, $V_2^+ = 12V$)

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 $\overline{RESET}$.

In addition, monitor the V_2 (12V) power supply with $V_{SC}(\text{COMP}_C)$ 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

V₂ detection voltage and hysteresis width at rising calculate formula

$$\text{Detection Voltage}(V_2^+ \text{falling}) = \frac{R_1 + R_2 + R_3}{R_2 + R_3} \times V_{sc} \approx \frac{R_1 + R_2 + R_3}{R_2 + R_3} \times 1.245 \text{ [V]}$$

$$\text{Hysteresis width at rising} = \frac{R_1(R_3 - R_3 \parallel R_4)}{(R_2 + R_3)(R_2 + R_3 \parallel R_4)} \times V_{SC} \approx \frac{R_1(R_3 - R_3 \parallel R_4)}{(R_2 + R_3)(R_2 + R_3 \parallel R_4)} \times 1.245 \text{ [V]}$$

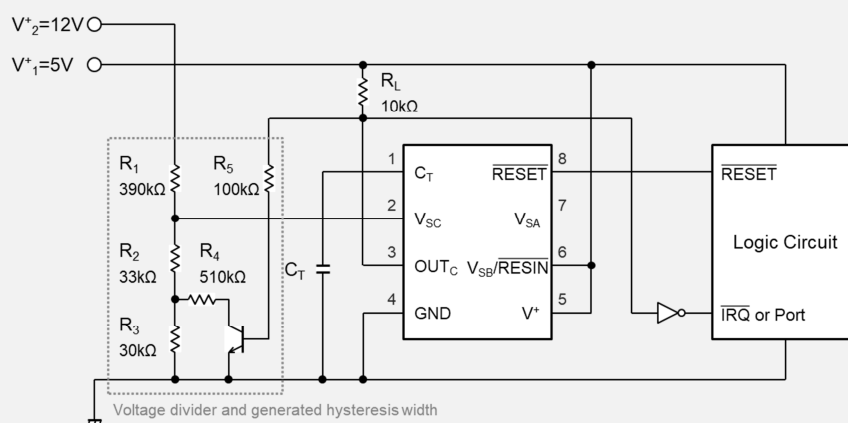


Fig. 6 5V, 12V power supply monitor ($V_1^+ = 5V$, $V_2^+ = 12V$, $\overline{\text{RESET}}$ output is only V_1^+ detection result)

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

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

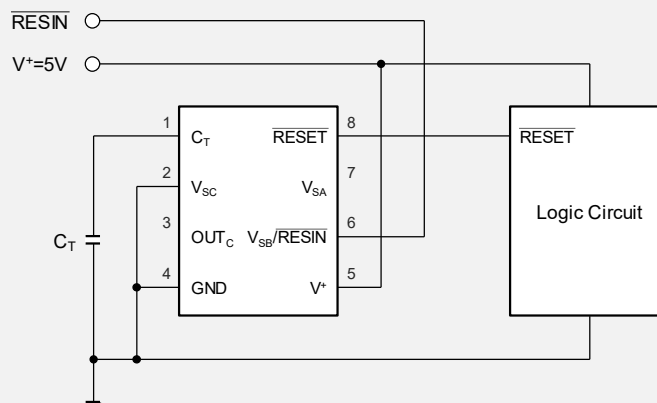


Fig. 7 Manual Reset function ($V^+ = 5V$)

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_C . Since OUT_C is an open drain output, It is required the pull-up resistor.(shown as R_L in Fig.8)

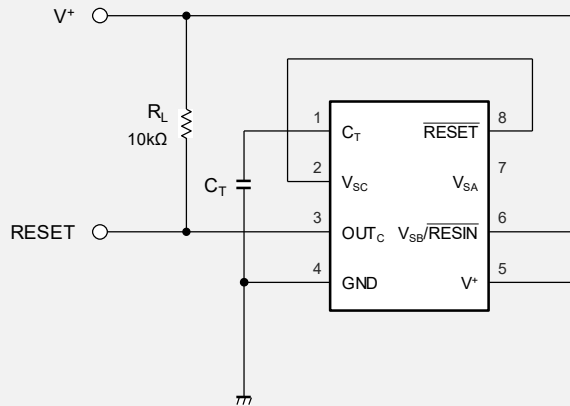


Fig. 8 Non-inverting reset output

9. Power supply voltage monitoring by delayed trigger

An arbitrary delay is added to the COMP_A operation by connecting capacitor C_1 between V_{SA} and GND.

When C_1 is connected minimum input pulse width becomes longer. e.g. $t_{PI} = 40\mu s$ ($C_1 = 1000pF$)

Minimum input pulse width t_{PI} is calculated as following formula.

Minimum input pulse width calculate formula

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

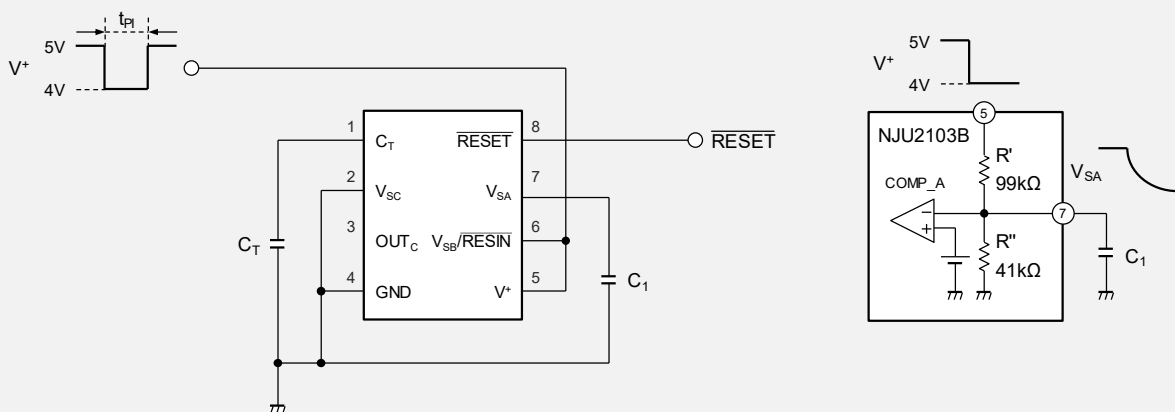


Fig. 9 Power supply voltage monitoring by delayed trigger

Technical Information

10. Positive and negative dual power supply monitoring (e.g. $V^+ = 5V$, V^- =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 -4.4V and the detection voltage (rising) is about -4.5V.

V^- detection voltage calculate formula

$$\text{Detection voltage } (V^- \text{ falling}) = \frac{R_3 + R_4}{R_3} \times V_{SC} - \frac{2R_4}{R_3} \times V_{SBL} \approx \frac{R_3 - R_4}{R_3} \times 1.230 \text{ [V]}$$

$$\text{Detection voltage } (V^- \text{ rising}) = \frac{R_3 + R_4}{R_3} \times V_{SC} - \frac{2R_4}{R_3} \times (V_{SBL} + V_{HRSB}) \approx \frac{R_3 - R_4}{R_3} \times 1.258 \text{ [V]}$$

- 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.

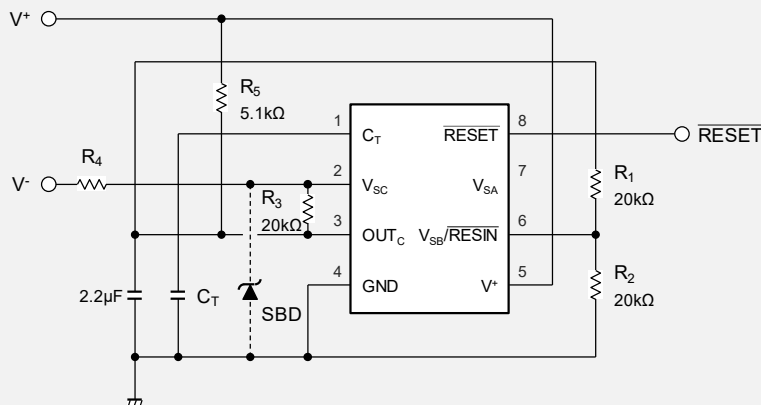


Fig. 10 Positive and negative dual power supply monitoring ($V^+ = 5V$, V^- =negative voltage)

Technical Information

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

Monitor the V^+ (5V) power supply with $V_{SA}(COMP_A)$.

9V Reference voltage V_{OUT} is generated by $V_{SC}(COMP_C)$, feedback resistors R_3 , R_4 and NPN transistor, and its 9V is monitored by $V_{SB}(COMP_B)$ and voltage-dividing resistors R_1 and R_2 .

- V^+ detection voltage (falling) is 4.2V and detection voltage (rising) is 4.3V.
- The reference voltage V_{OUT} and its detection voltage are calculated as the following formula. In case of resistor value In Fig.11, the reference voltage V_{OUT} is about 9.0V, the detection voltage (V_{OUT} falling) is about 7.2V and the detection voltage (V_{OUT} rising) is about 7.3V

Reference Voltage and detection voltage calculate formula

$$\text{Reference voltage } V_{OUT} = \frac{R_3 + R_4}{R_4} \times V_{SC} \approx \frac{R_3 + R_4}{R_4} \times 1.245 \text{ [V]}$$

$$\text{Detection Voltage}(V_{OUT} \text{ falling}) = \frac{R_1 + R_2}{R_2} \times V_{SBL} \approx \frac{R_1 + R_2}{R_2} \times 1.230 \text{ [V]}$$

$$\text{Detection Voltage}(V_{OUT} \text{ rising}) = \frac{R_1 + R_2}{R_2} \times (V_{SBL} + V_{HRSB}) \approx \frac{R_1 + R_2}{R_2} \times 1.258 \text{ [V]}$$

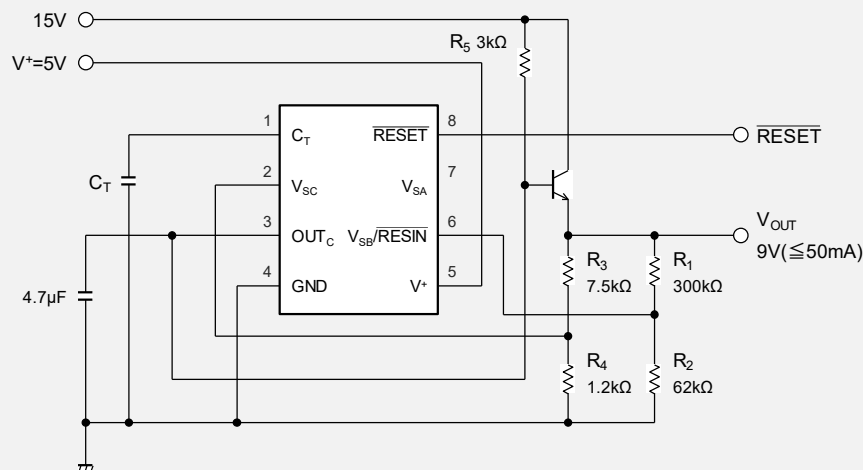


Fig. 11 Reference voltage output and voltage drop monitoring (e.g. 9V reference output, 5V, 9V monitoring)

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 $V_{SC}(\text{COMP_C})$, feedback resistors R_3 , R_4 , NPN transistor and drive resistor R_5 , and its 5V is monitored by $V_{SA}(\text{COMP_A})$.

- 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

$$\text{Reference voltage } V_{OUT} = \frac{R_3 + R_4}{R_3} \times V_{SC} \approx \frac{R_3 + R_4}{R_3} \times 1.245 \text{ [V]}$$

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

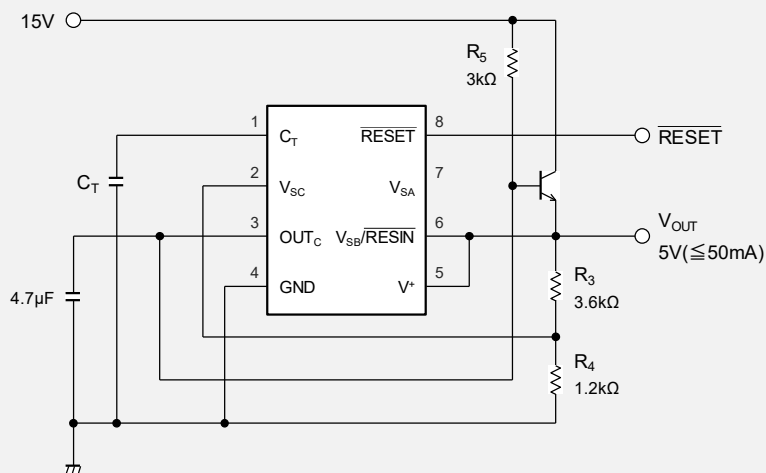


Fig. 12-1 Reference Voltage output and Voltage drop monitoring (e.g. 5V output, 5V monitoring)

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

$$\text{Reference voltage } V_{OUT} = \frac{R_2 + R_3}{R_3} \times V_{SC} \approx \frac{R_2 + R_3}{R_3} \times 1.245 \text{ [V]}$$

- The detection voltage (falling) is 4.2V and detection voltage (rising) is 4.3V.
- R_1 value should be calculated from current consumption of NJU2103B, the current flowing through R_2 and R_3 , and 5V output current.

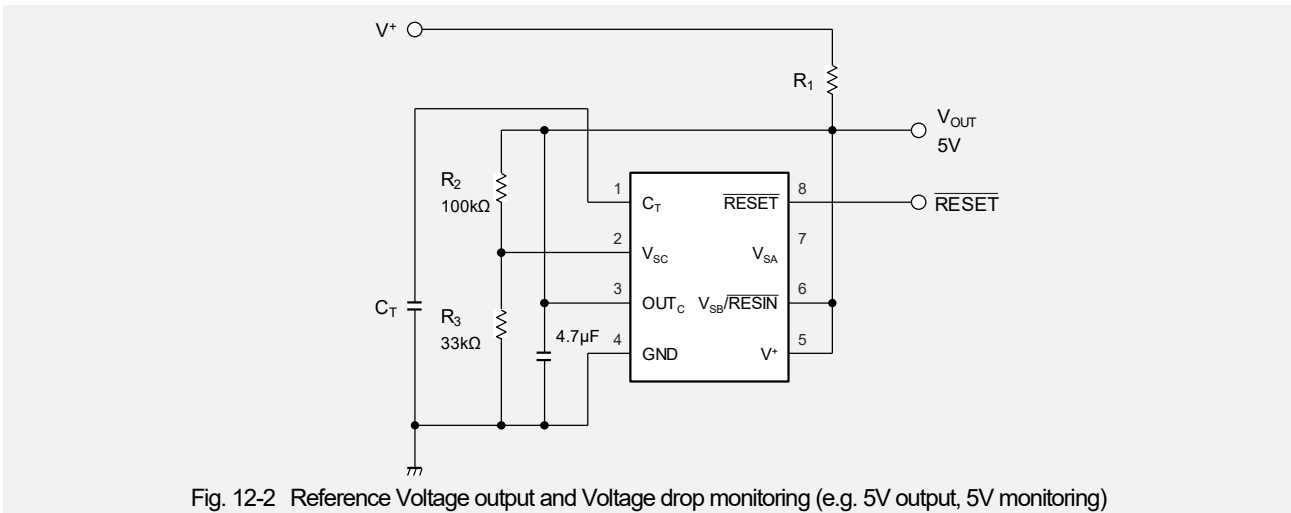


Fig. 12-2 Reference Voltage output and Voltage drop monitoring (e.g. 5V output, 5V monitoring)

13. Reference Voltage output and Voltage drop monitoring (e.g. 1.245V 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

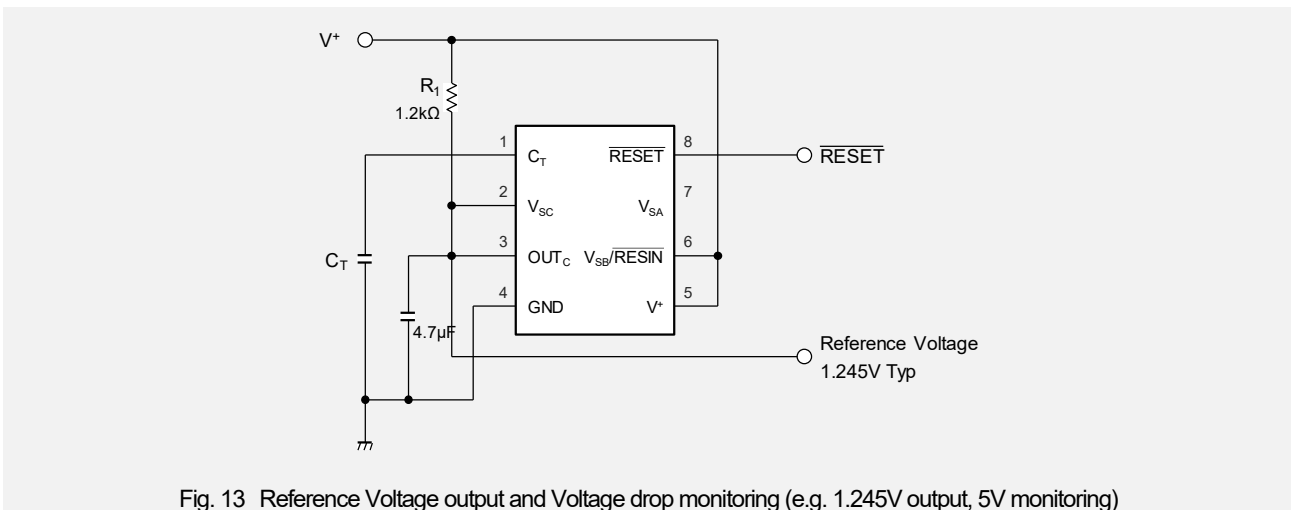


Fig. 13 Reference Voltage output and Voltage drop monitoring (e.g. 1.245V output, 5V monitoring)

Technical Information

14. Low voltage and over voltage detection ($V^+ = 5V$)

V_{SB} (COMP_B) for low voltage detection and V_{SC} (COMP_C) for overvoltage detection.

Logically synthesizes low voltage and over voltage detection by connecting OUT_C to V_{SA} , and output from $\overline{RESET}$.

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

$$\text{Low voltage detection (falling)} V_{SL1} = \frac{R_1 + R_2}{R_2} \times V_{SBL} \approx \frac{R_1 + R_2}{R_2} \times 1.230 \text{ [V]}$$

$$\text{Low voltage detection (rising)} V_{SL2} = \frac{R_1 + R_2}{R_2} \times (V_{SBL} + V_{HRSB}) \approx \frac{R_1 + R_2}{R_2} \times 1.258 \text{ [V]}$$

$$\text{Over voltage detection } V_{SH} = \frac{R_3 + R_4}{R_4} \times V_{SC} \approx \frac{R_3 + R_4}{R_4} \times 1.245 \text{ [V]}$$

- There is no hysteresis characteristic for over voltage detection.
- "RESET Output Pulse Width t_{PO} " is valid even when overvoltage is detected

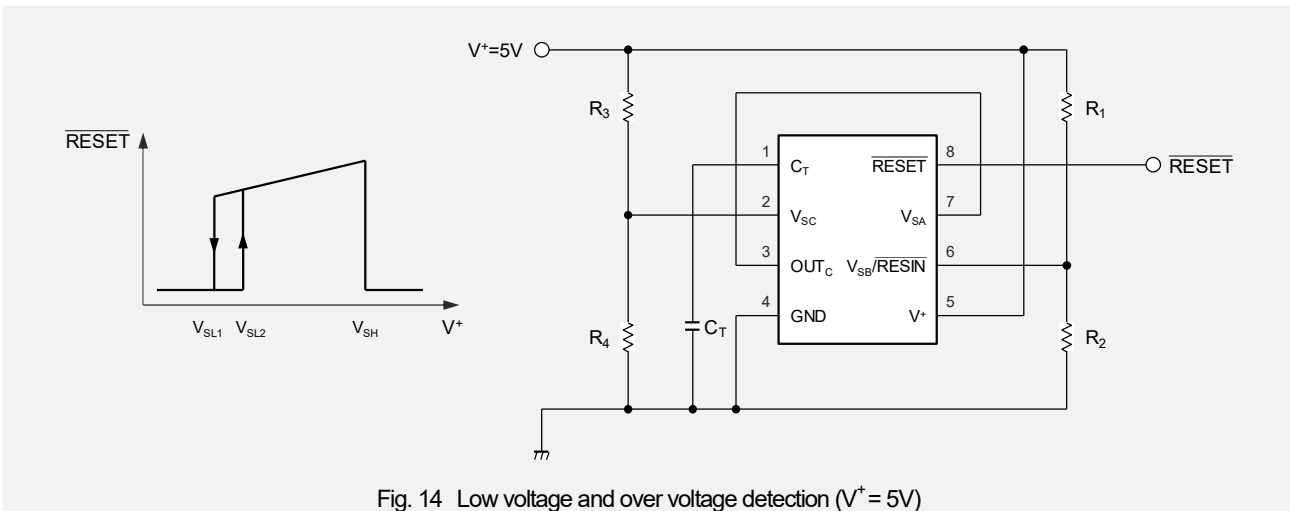
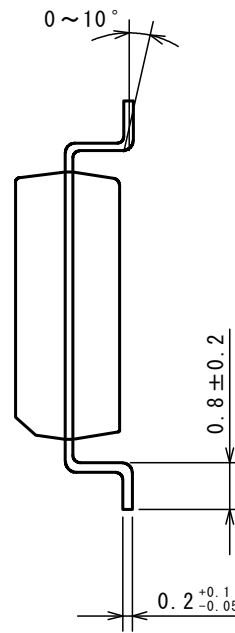
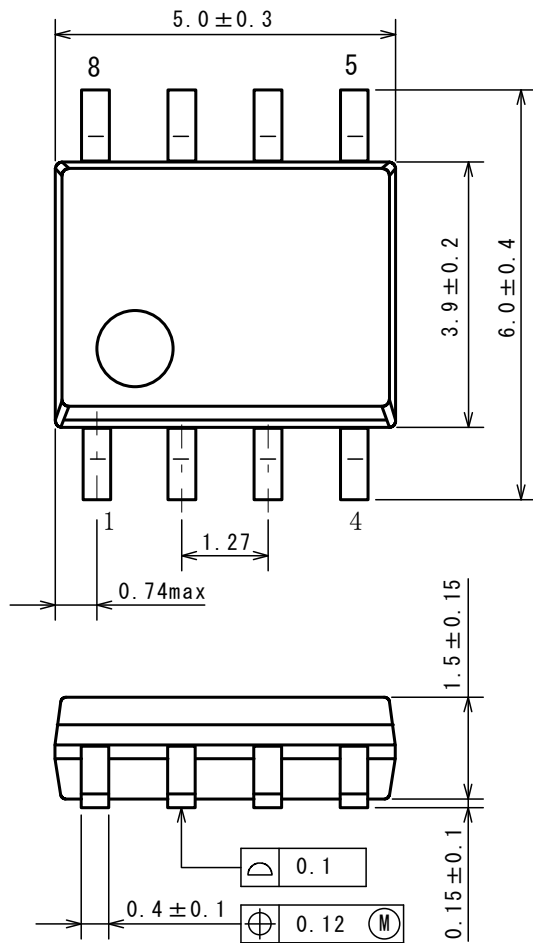


Fig. 14 Low voltage and over voltage detection ($V^+ = 5V$)

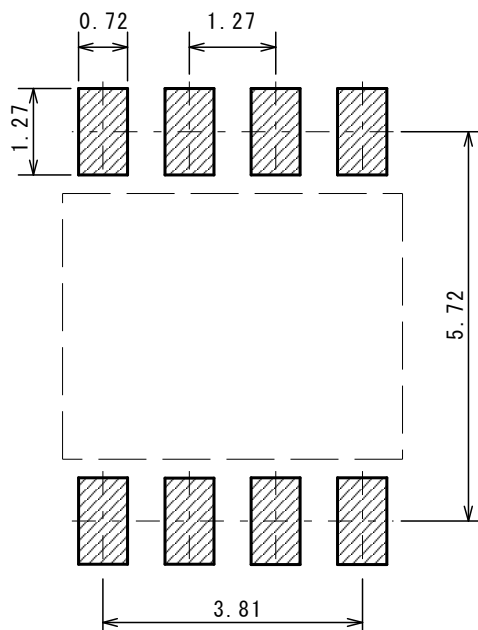
■PACKAGE DIMENSIONS

EMP8(SOP8 JEDEC 150mil)

Unit: mm



■EXAMPLE OF SOLDER PADS DIMENSION

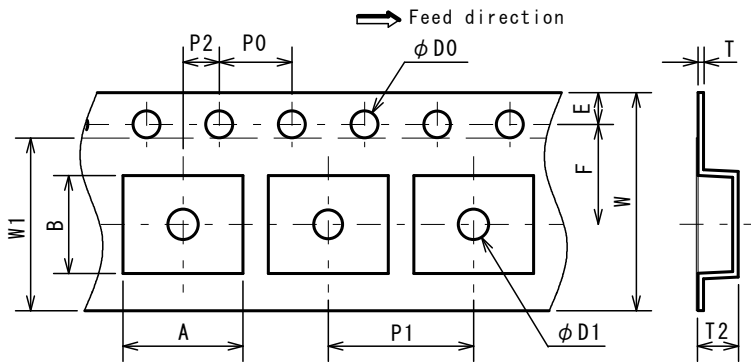


EMP8(SOP8 JEDEC 150mil)

PACKING SPEC

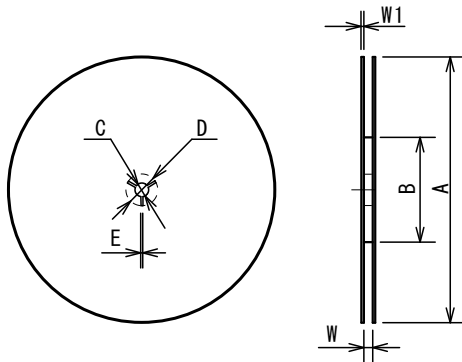
TAPING DIMENSIONS

Unit: mm



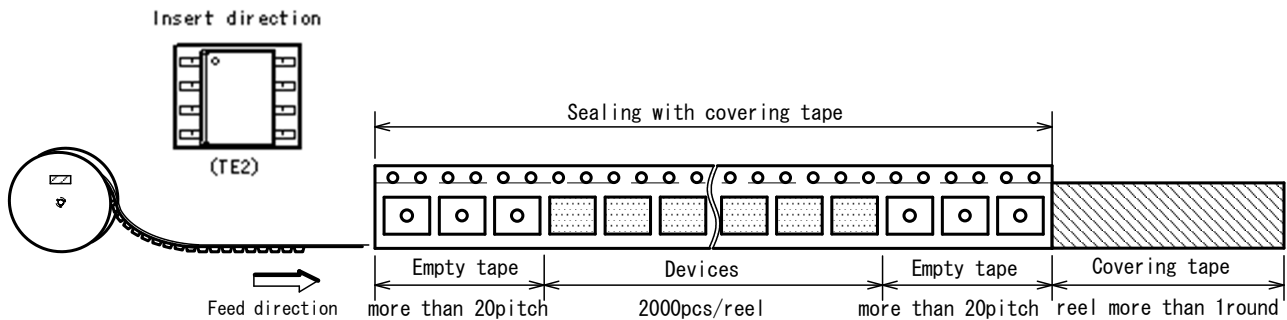
SYMBOL	DIMENSION	REMARKS
A	6.6	BOTTOM DIMENSION
B	5.4	BOTTOM DIMENSION
D0	1.5 ^{+0.1} ₀	
D1	1.7±0.1	
E	1.75±0.1	
F	5.5±0.05	
P0	4.0±0.1	
P1	8.0±0.1	
P2	2.0±0.05	
T	0.30±0.05	
T2	2.2	
W	12.0±0.3	
W1	9.5	THICKNESS 0.1max

REEL DIMENSIONS

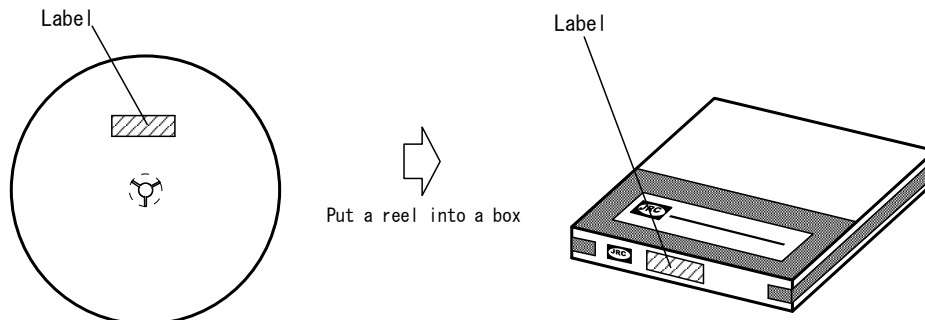


SYMBOL	DIMENSION
A	φ330±2
B	φ80±1
C	φ13±0.2
D	φ21±0.8
E	2±0.5
W	13.5±0.5
W1	2.0±0.2

TAPING STATE

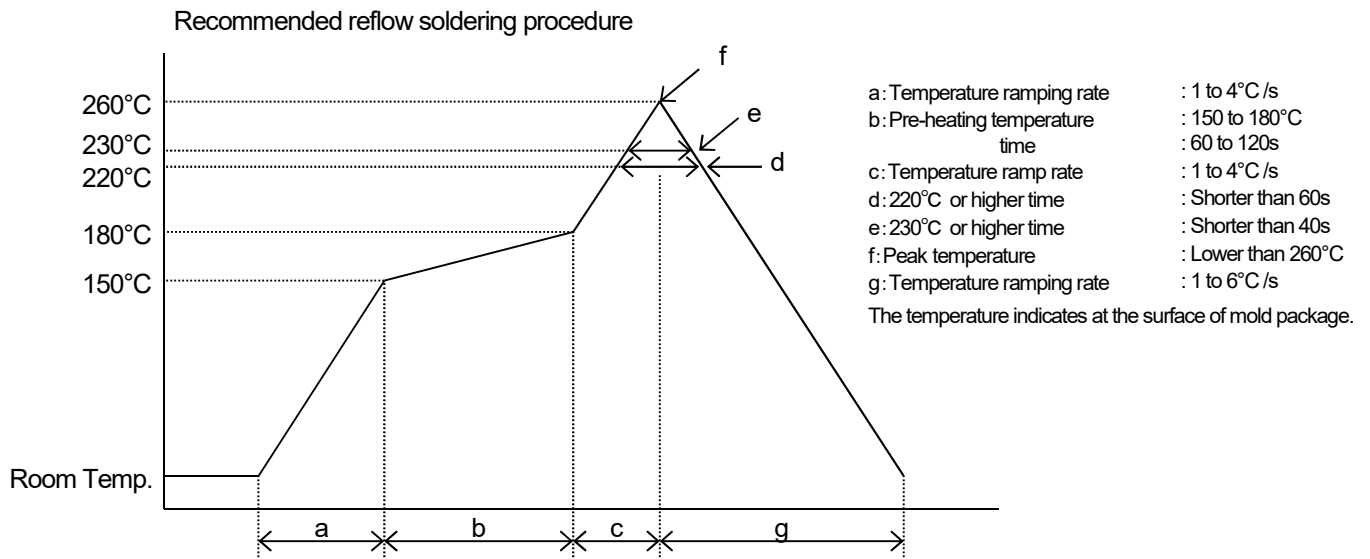


PACKING STATE



■RECOMMENDED MOUNTING METHOD

INFRARED REFLOW SOLDERING METHOD



■REVISION HISTORY

Date	Revision	Changes
12.Nov.2018.	1.0	New Release
07.Feb.2019	1.1	Correction of error

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