System Reset IC

■FEATURES

- ･Suitable for replacement from MB3771
- ･Detection voltage V_{SA}=4.2V±1.0%
- ･Adjustable detection voltage V_{SB}=1.23V±1.0%
- ･Possible to detect over voltage V_{SC}=1.245V±1.0%
- ･V_{SA} and V_{SB} have hysteresis characteristics at reset release
- ･Operating temperature Ta=-40 to 125°C
- ･Low quiescent current 280µA typ.
- ･Reference voltage can be taken out
- ･Low reset operation voltage 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.

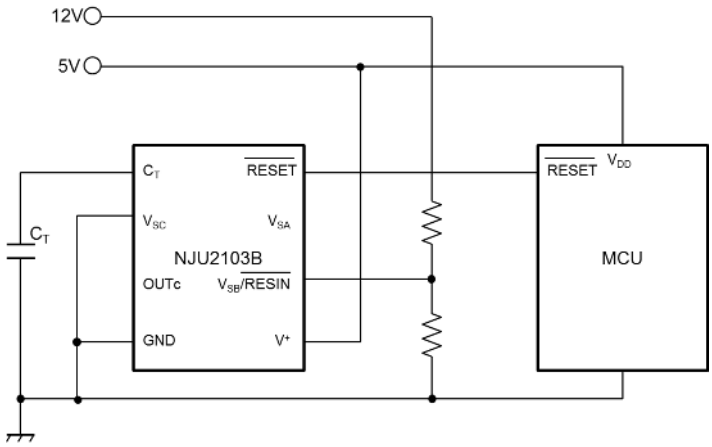
Since V_{SB} Detecting Voltage, V_{SC} Detecting Voltage and $\overline{\text{RESET}}$ Output Pulse Width are adjusted from NJU2103A, it is more suitable for replacement from MB3771.

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

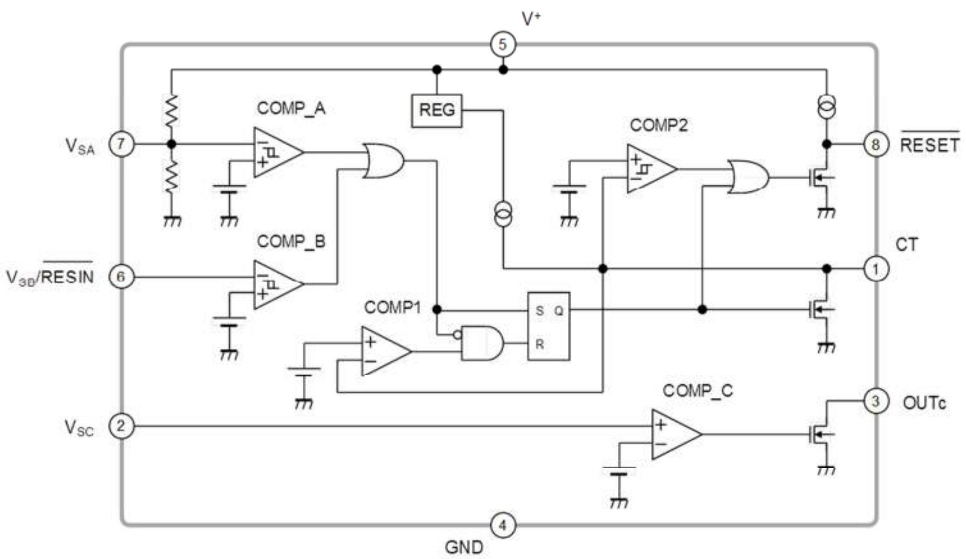
■APPLICATION

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

■TYPICAL APPLICATION

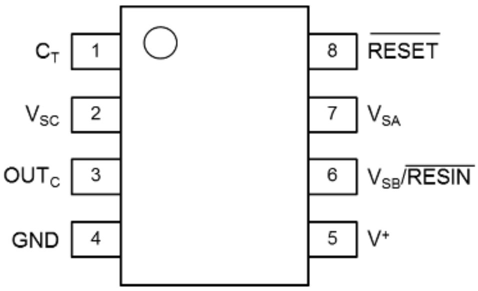


■BLOCK DIAGRAM



■PIN CONFIGURATION

(Top View)



EMP8

PIN No.	PIN NAME	FUNCTION
1	C_T	Connects Capacitor pin for setting $\overline{RESET}$ 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

NJU2103B E (TE1)

- NJU2103B: Device Name
- E: Package E:EMP8
- (TE1): Taping form

■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	$V_{\overline{RESET}}$	-0.3 to V^++0.3 (<20)	V
OUT_C Output Voltage	V_{OUTC}	-0.3 to 20	V
Power Dissipation(Ta=25°C) EMP8	P_D	(2-layer / 4-layer) 700(1)/ 1000(2)	mW
Junction Temperature	T_J	-40 to +150	°C
Operating Temperature	T_{opr}	-40 to +125	°C
Storage Temperature	T_{stg}	-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^+	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	$I_{\overline{RESET}}$	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=0.01µF, T_a=25°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, $V_{SB}=V^+$, Ta=-40 °C to 125°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, $V_{SB}=V^+$, Ta=-40 °C to 125°C	4.150	-	4.450	
V_{SA} Hysteresis Width	V_{HRSA}		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, Ta=-40 °C to 125°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_{HRSB}		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 $\overline{RESET}$ Output Voltage	V_{OHR}	$I_{\overline{RESET}}$ =-5µA, V_{SB}=5V	4.5	4.9	-	V
$\overline{RESET}$ Output Saturation Voltage 1	V_{OLR1}	$I_{\overline{RESET}}$ =3mA	-	0.05	0.40	V
$\overline{RESET}$ Output Saturation Voltage 2	V_{OLR2}	$I_{\overline{RESET}}$ =10mA	-	0.15	0.50	V
$\overline{RESET}$ Output Sink Current	$I_{\overline{RESET}}$	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
		Ta=-40 °C to 125°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
$\overline{RESET}$ Minimum Operating Voltage	V^+_L	V_{OLR}=0.4V, $I_{\overline{RESET}}$ =200µA	-	0.8	1.2	V

■ELECTRICAL CHARACTERISTICS

(AC Characteristics) Unless other noted, V^+=5V, V_{SB}=5V, V_{SC}=0V, C_T=0.01µF, T_a=25°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
$\overline{RESET}$ Output Pulse Width	t_{PO}	V_{SB}=V^+	0.5	1.0	1.5	ms
$\overline{RESET}$ Rise Time	t_r	V_{SB}=V^+, R_L=2.2kΩ, C_L=100pF $\overline{RESET}$=10% to 90%	-	1.0	1.5	µs
$\overline{RESET}$ Fall Time	t_f	V_{SB}=V^+, R_L=2.2kΩ, C_L=100pF $\overline{RESET}$=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=2.2kΩ, C_L=100pF	-	0.5	-	µs
	t_{PLH}	V_{SC} sweep down, R_L=2.2kΩ, C_L=100pF	-	1.0	-	µs

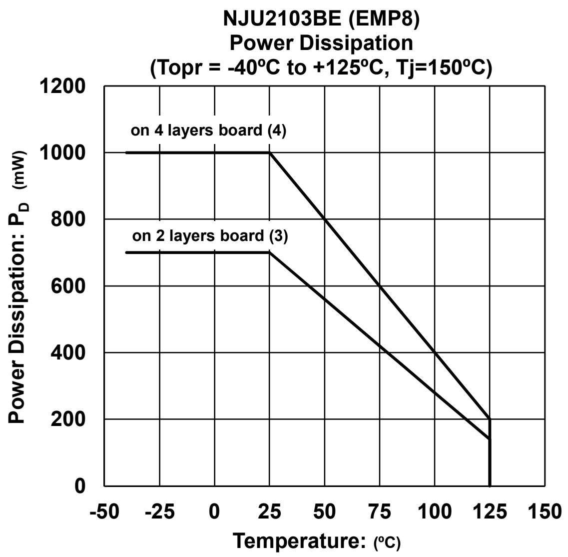
■THERMAL CHARACTERISTICS

PARAMETER	SYMBOL	VALUE		UNIT
Junction-to-ambient thermal resistance	θja	EMP8	178(3) 121(4)	°C/W
Junction-to-Top of package characterization parameter	ψjt	EMP8	31(3) 27(4)	°C/W

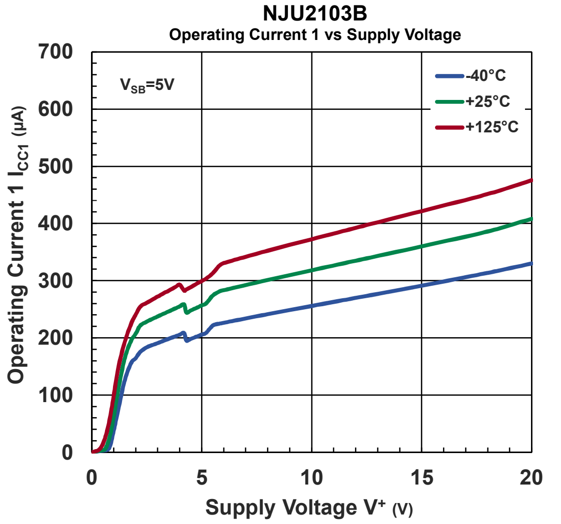
(3): Mounted on glass epoxy board.(76.2 x 114.3 x 1.6 :based on EIA/JEDEC standard, 2 Layers)

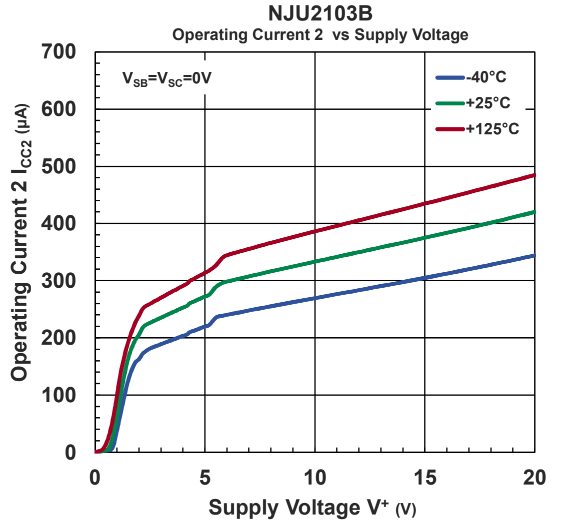
(4): Mounted on glass epoxy board.(76.2 x 114.3 x 1.6 :based on EIA/JEDEC standard, 4 Layers) internal Cu area: 74.2 x 74.2mm

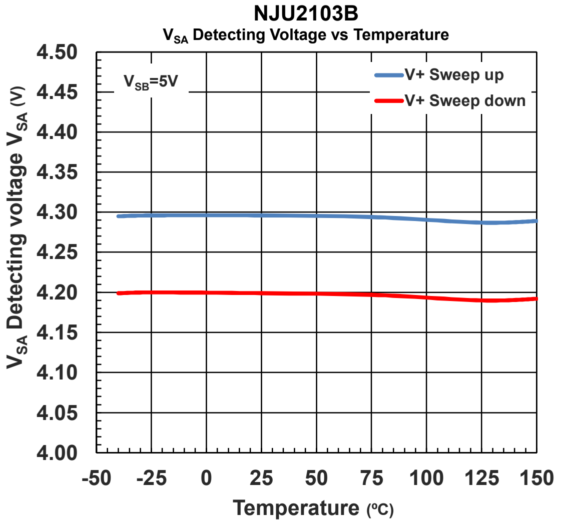
■POWER DISSIPATION vs. AMBIENT TEMPERATURE

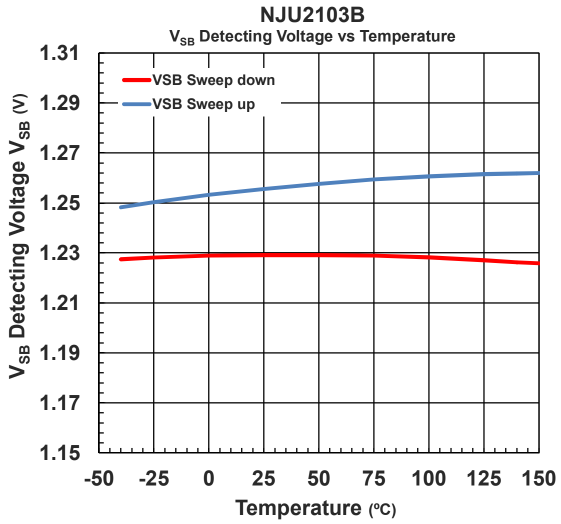


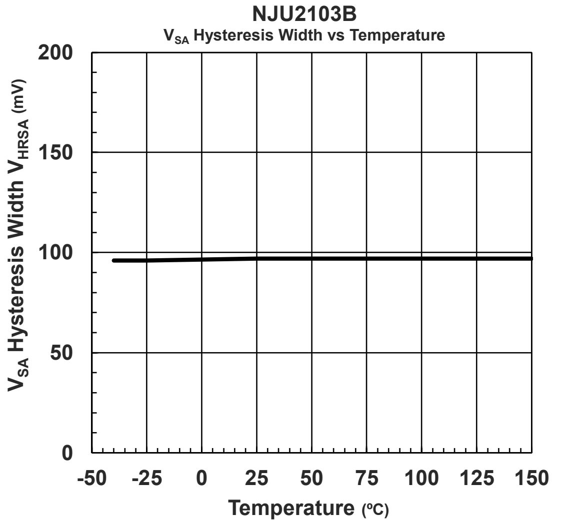
■TYPICAL CHARACTERISTICS

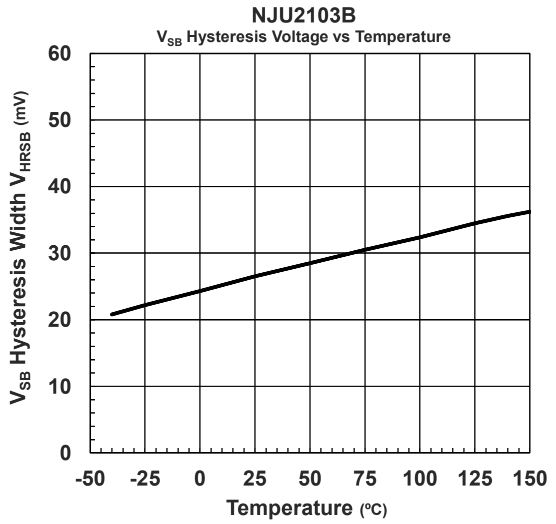


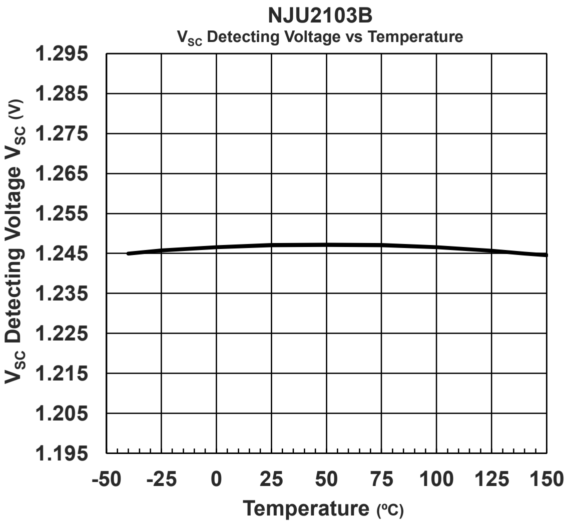


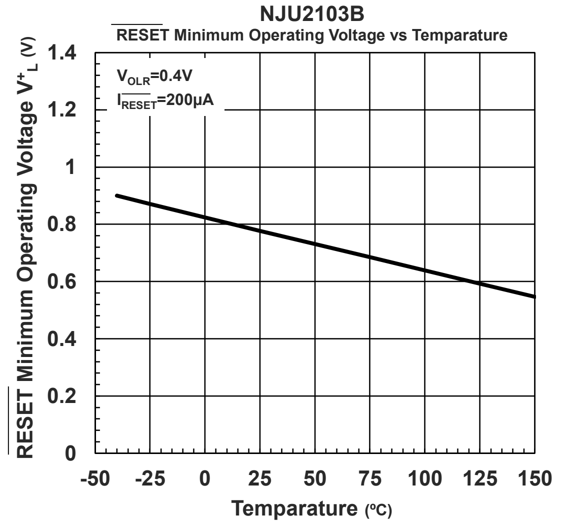


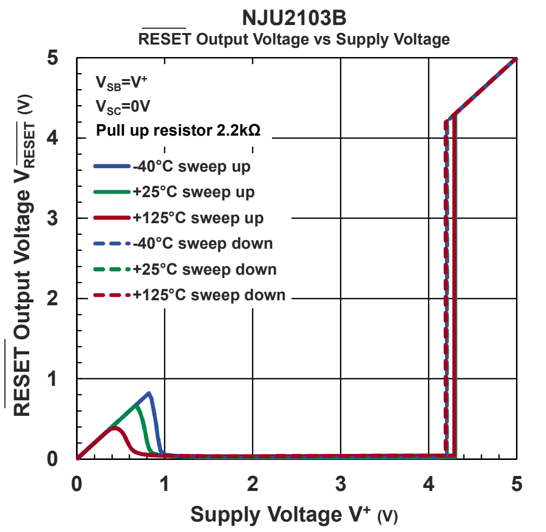


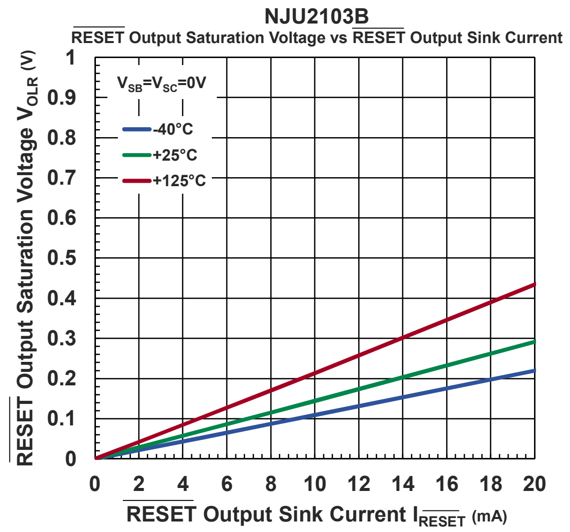


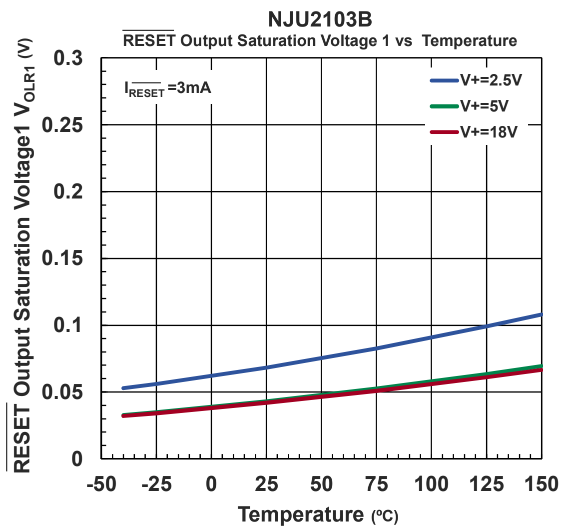


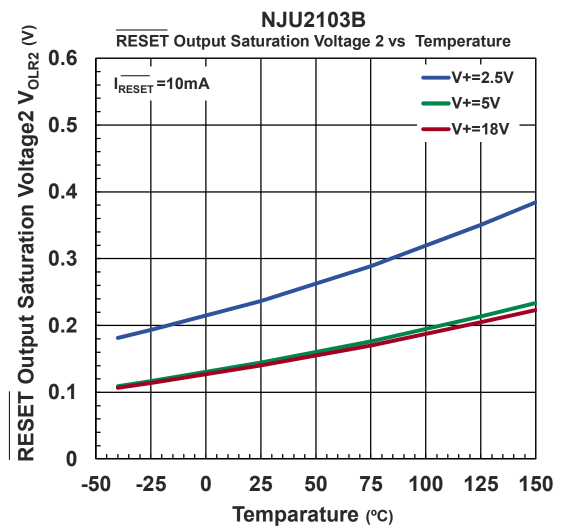

NJU2103B
VSC Detecting Voltage vs Temperature
VSC Detecting Voltage VSC (V)
1.295
1.285
1.275
1.265
1.255
1.245
1.235
1.225
1.215
1.205
1.195
-50 -25 0 25 50 75 100 125 150
Temperature (ºC)

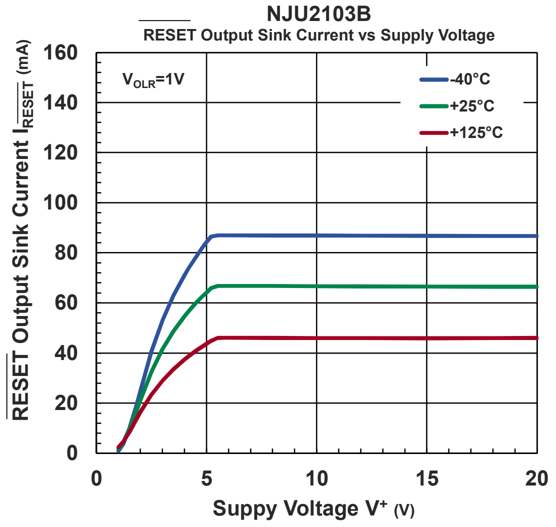

NJU2103B
RESET Minimum Operating Voltage vs Temparature
VOLR=0.4V
IRESET=200μA
RESET Minimum Operating Voltage V+L (V)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-50 -25 0 25 50 75 100 125 150
Temparature (ºC)

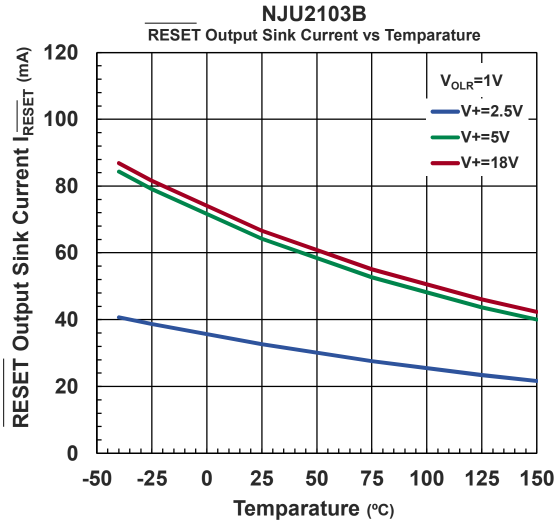

NJU2103B
RESET Output Voltage vs Supply Voltage
VSB=V+
VSC=0V
Pull up resistor 2.2kΩ
-40°C sweep up
+25°C sweep up
+125°C sweep up
-40°C sweep down
+25°C sweep down
+125°C sweep down
RESET Output Voltage VRESET (V)
5
4
3
2
1
0
0 1 2 3 4 5
Supply Voltage V+ (V)

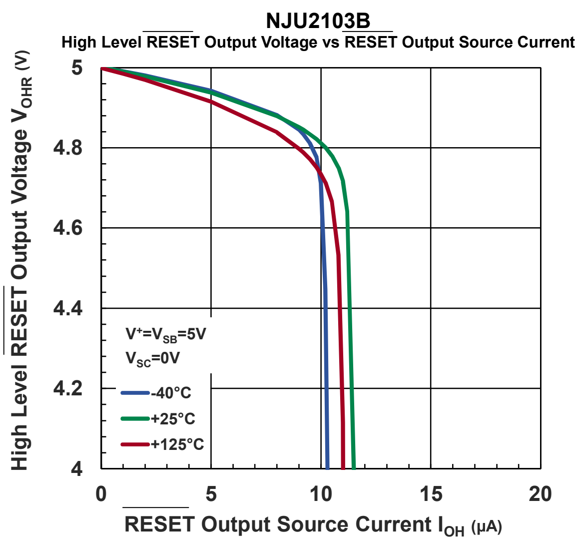

NJU2103B
RESET Output Saturation Voltage vs RESET Output Sink Current
VSB=VSC=0V
-40°C
+25°C
+125°C
RESET Output Saturation Voltage VOLR (V)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0 2 4 6 8 10 12 14 16 18 20
RESET Output Sink Current IRESET (mA)

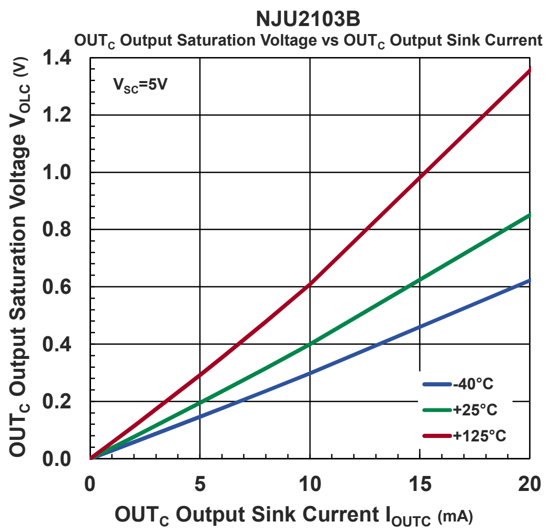

NJU2103B
RESET Output Saturation Voltage 1 vs Temperature
IRESET =3mA
V+=2.5V
V+=5V
V+=18V
RESET Output Saturation Voltage1 VOLR1 (V)
0.3
0.25
0.2
0.15
0.1
0.05
0
-50 -25 0 25 50 75 100 125 150
Temperature (ºC)

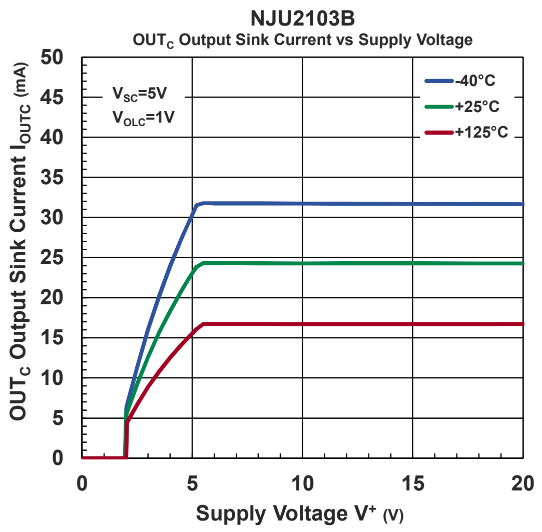

NJU2103B
RESET Output Saturation Voltage 2 vs Temperature
IRESET =10mA
V+=2.5V
V+=5V
V+=18V
RESET Output Saturation Voltage2 VOLR2 (V)
0.6
0.5
0.4
0.3
0.2
0.1
0
-50 -25 0 25 50 75 100 125 150
Temparature (ºC)

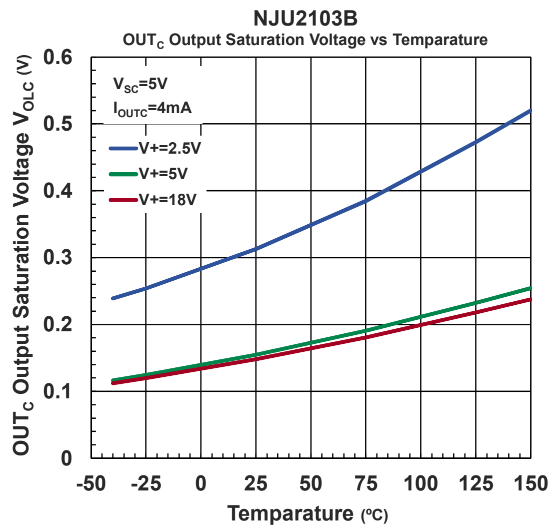

NJU2103B
RESET Output Sink Current vs Supply Voltage
V_OLR=1V
-40°C
+25°C
+125°C
RESET Output Sink Current I_RESET (mA)
Suppy Voltage V+ (V)

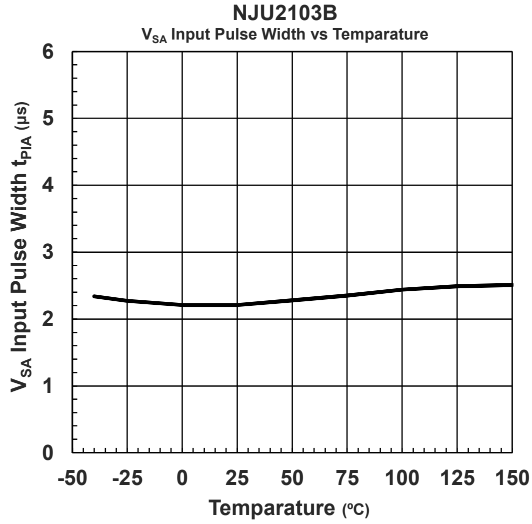

NJU2103B
RESET Output Sink Current vs Temparature
V_OLR=1V
V+=2.5V
V+=5V
V+=18V
RESET Output Sink Current I_RESET (mA)
Temparature (ºC)

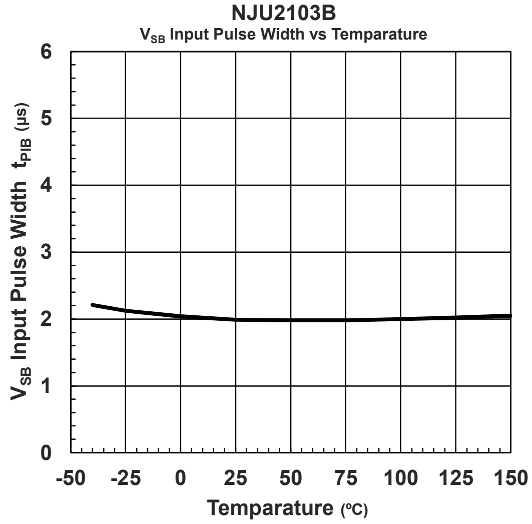

NJU2103B
High Level RESET Output Voltage vs RESET Output Source Current
V+=V_SB=5V
V_SC=0V
-40°C
+25°C
+125°C
High Level RESET Output Voltage V_OHR (V)
RESET Output Source Current I_OH (µA)

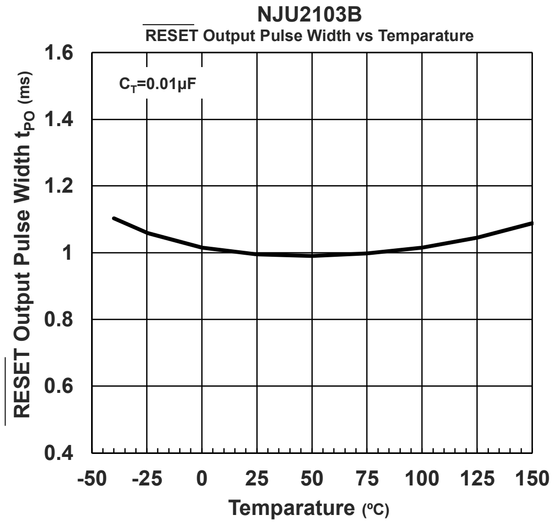

NJU2103B
OUT_C Output Saturation Voltage vs OUT_C Output Sink Current
V_SC=5V
-40°C
+25°C
+125°C
OUT_C Output Saturation Voltage V_OLC (V)
OUT_C Output Sink Current I_OUTC (mA)

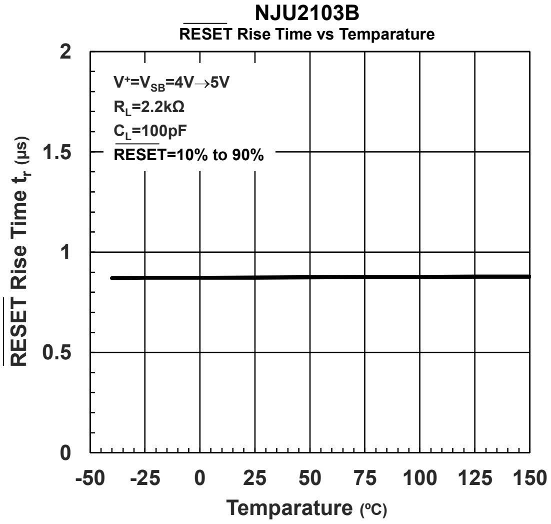

NJU2103B
OUT_C Output Sink Current vs Supply Voltage
V_SC=5V
V_OLC=1V
-40°C
+25°C
+125°C
OUT_C Output Sink Current I_OUTC (mA)
Supply Voltage V+ (V)

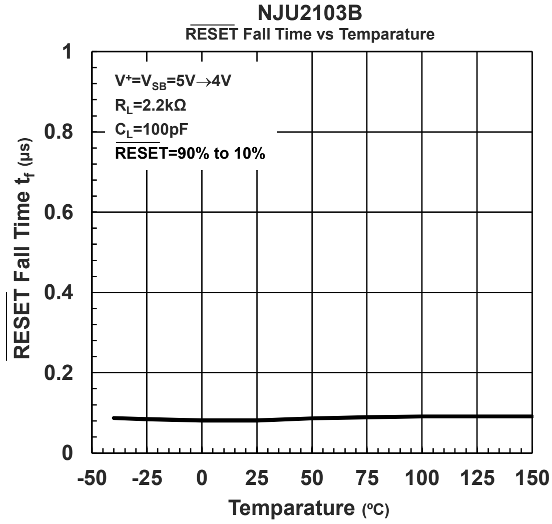

NJU2103B
OUT_C Output Saturation Voltage vs Temparature
V_SC=5V
I_OUTC=4mA
V+=2.5V
V+=5V
V+=18V
OUT_C Output Saturation Voltage V_OLC (V)
Temparature (ºC)

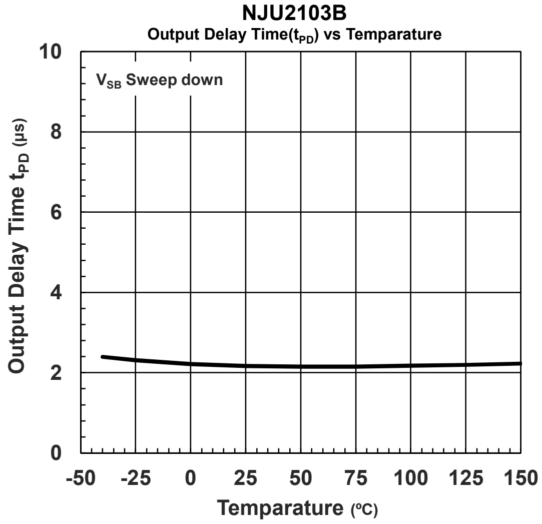

NJU2103B
VSA Input Pulse Width vs Temparature
VSA Input Pulse Width tPIA (µs)
Temparature (ºC)

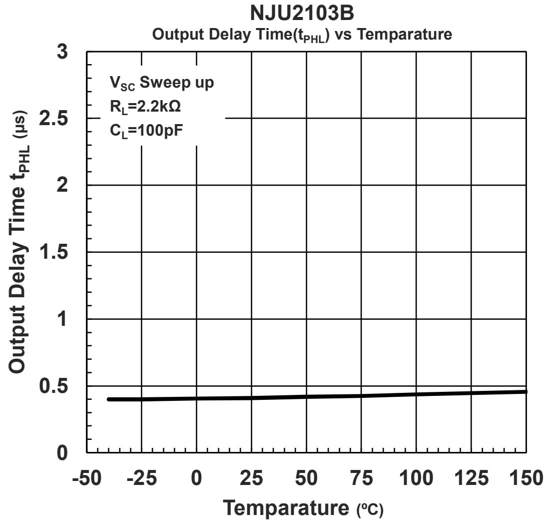

NJU2103B
VSB Input Pulse Width vs Temparature
VSB Input Pulse Width tPIB (µs)
Temparature (ºC)

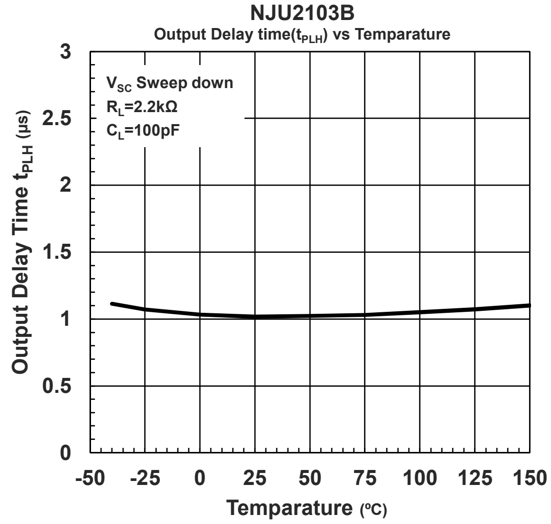

NJU2103B
RESET Output Pulse Width vs Temparature
CT=0.01µF
RESET Output Pulse Width tPO (ms)
Temparature (ºC)

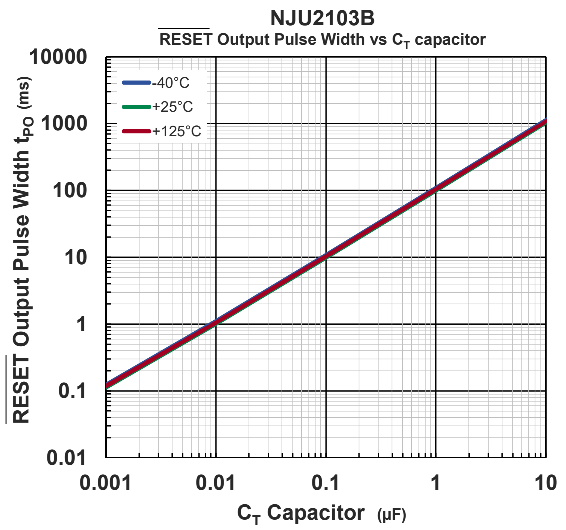

NJU2103B
RESET Rise Time vs Temparature
V+=VSB=4V→5V
RL=2.2kΩ
CL=100pF
RESET=10% to 90%
RESET Rise Time tr (µs)
Temparature (ºC)

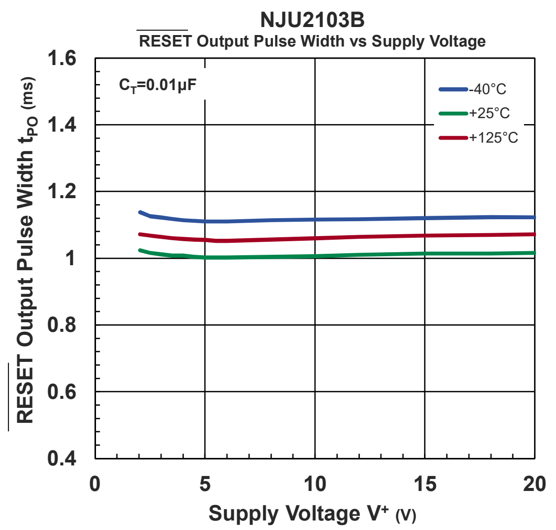

NJU2103B
RESET Fall Time vs Temparature
V+=VSB=5V→4V
RL=2.2kΩ
CL=100pF
RESET=90% to 10%
RESET Fall Time tf (µs)
Temparature (ºC)


NJU2103B
Output Delay Time(tPD) vs Temparature
VSB Sweep down
Output Delay Time tPD (µs)
Temparature (ºC)


NJU2103B
Output Delay Time(t_{PHL}) vs Temparature
V_{SC} Sweep up
R_L=2.2kΩ
C_L=100pF
Output Delay Time t_{PHL} (µs)
Temparature (ºC)


NJU2103B
Output Delay time(t_{PLH}) vs Temparature
V_{SC} Sweep down
R_L=2.2kΩ
C_L=100pF
Output Delay Time t_{PLH} (µs)
Temparature (ºC)

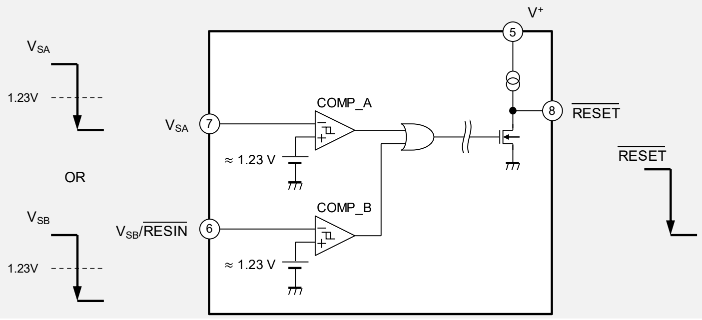

NJU2103B
$\overline{RESET}$ Output Pulse Width vs C_T capacitor
-40°C
+25°C
+125°C
$\overline{RESET}$ Output Pulse Width t_{PO} (ms)
C_T Capacitor (µF)


NJU2103B
$\overline{RESET}$ Output Pulse Width vs Supply Voltage
C_T=0.01µF
-40°C
+25°C
+125°C
$\overline{RESET}$ Output Pulse Width t_{PO} (ms)
Supply Voltage V⁺ (V)

■FUNCTION EXPLAMATION

COMP_A and COMP_B are comparator with hysteresis in detection voltage.

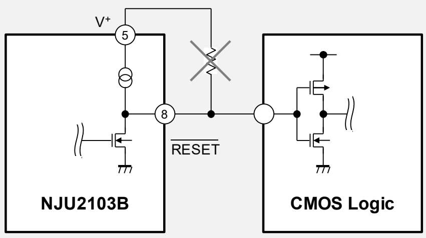
When either V_{SA} or V_{SB} pin voltage becomes about 1.23 V or less, the $\overline{RESET}$ output becomes " Low ".



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)

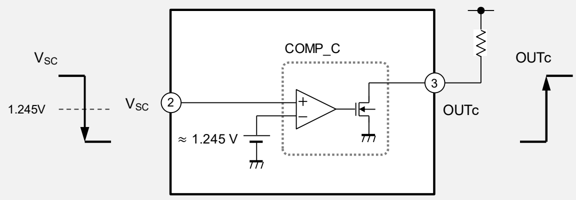
The NJU2103B can detect the instantaneous interruption and the instantaneous drop of the power line with a time of about 2 μs width. If this level of instantaneous interruption or drop is not a problem, it can have a delayed trigger function by connecting capacitor to the V_{SA} and V_{SB} pins (refer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

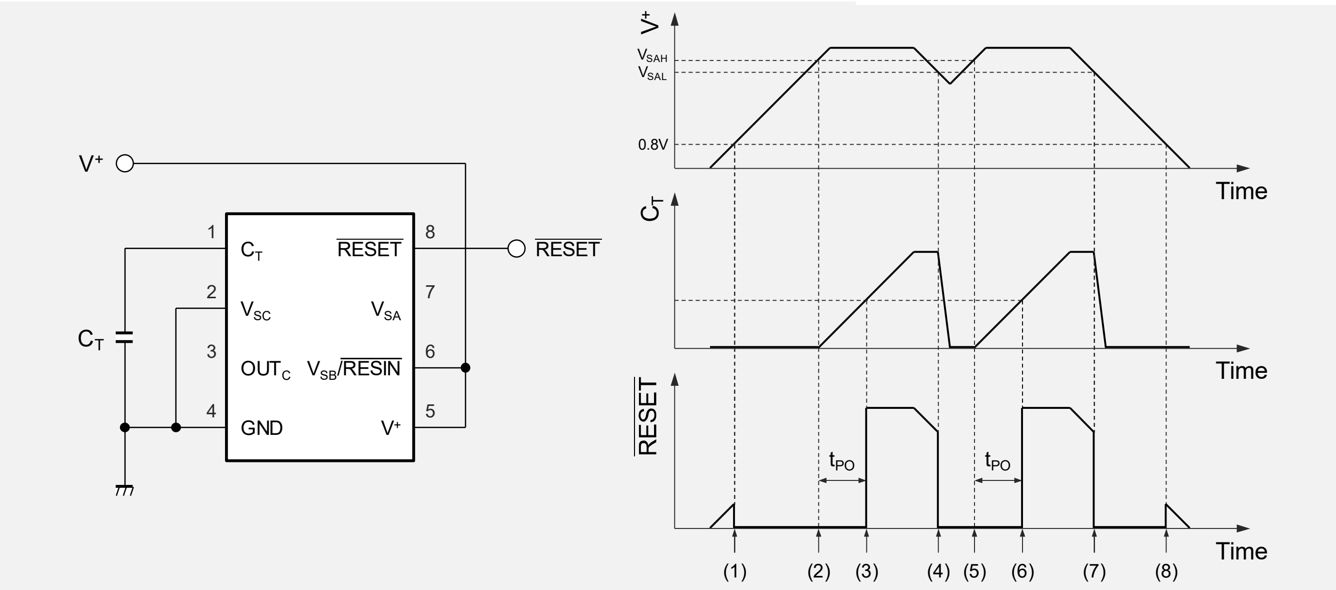
Therefore, it can be used for overvoltage detection (refer to Fig.14), positive logic reset output (refer to Fig.8) and generating a reference voltage source.(refer to Fig.11 to 13)



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 EXPLAMATION

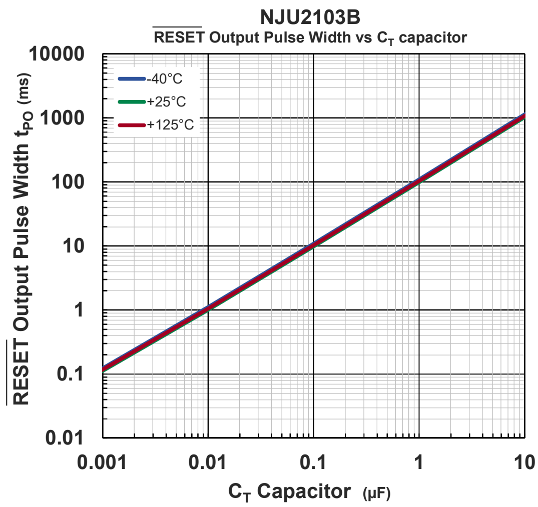


(1) When V^+ increases to about 0.8V, $\overline{\text{RESET}}$ becomes "Low"

(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.

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



(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.

Technical Information

■APPLICATION EXAMPLE

1. 5V Power supply monitor

Monitor the 5V power supply with V_{SA}(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.).

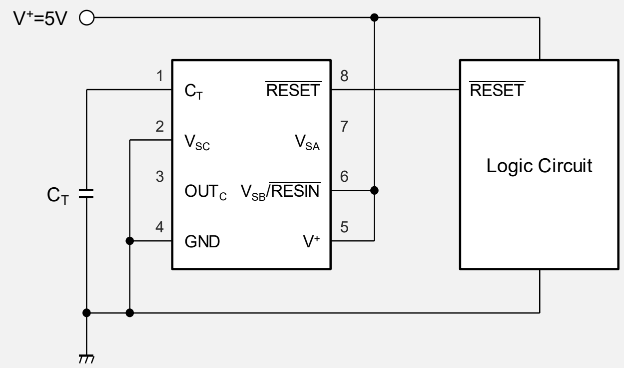


Fig. 1 5V Power supply monitor

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 kΩ, 41 kΩ), 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 << 100kΩ, R_2 << 41kΩ)

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

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

Tab. 1 Setting example

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

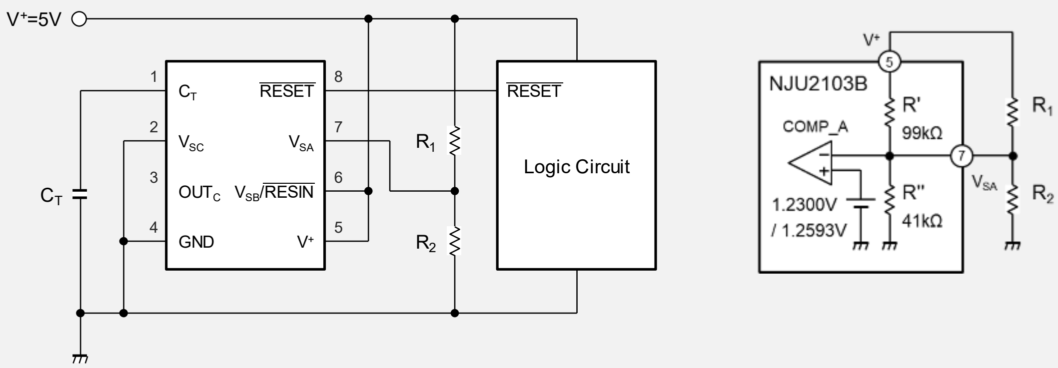


Fig. 2 Power supply monitor (adjust detection voltage by external resistor)

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

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.

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

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

- 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: 17.2 × V^+ [μA])

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

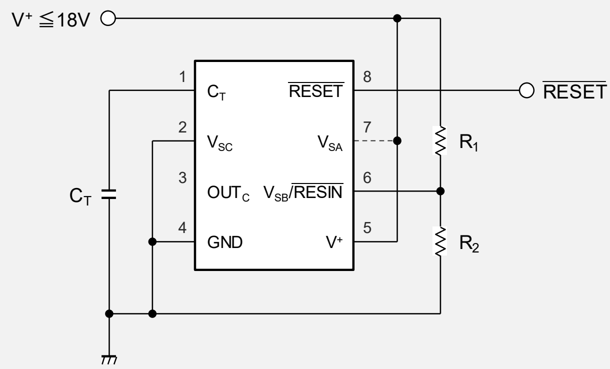


Fig. 3 Arbitrary power supply monitor (monitoring $V^+ \leq 18V$)

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

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

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

- The $\overline{\text{RESET}}$ output is ≈ 0V (low level) and ≈ 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.

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

- 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.

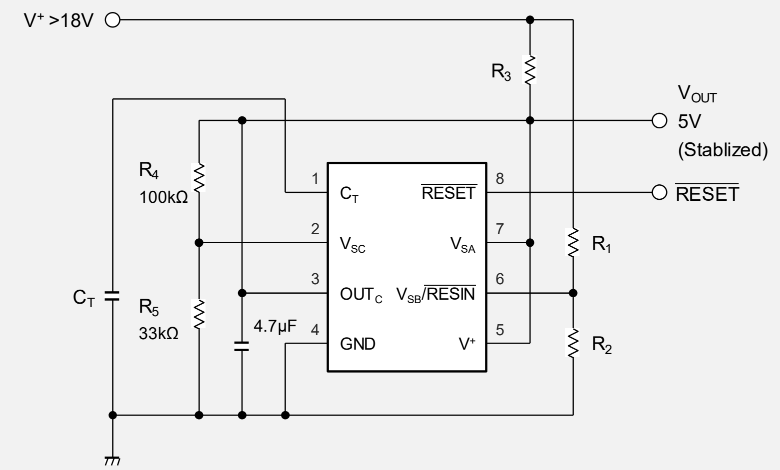


Fig. 4 Arbitrary power supply monitor (monitoring V^+ > 18V)

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

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

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

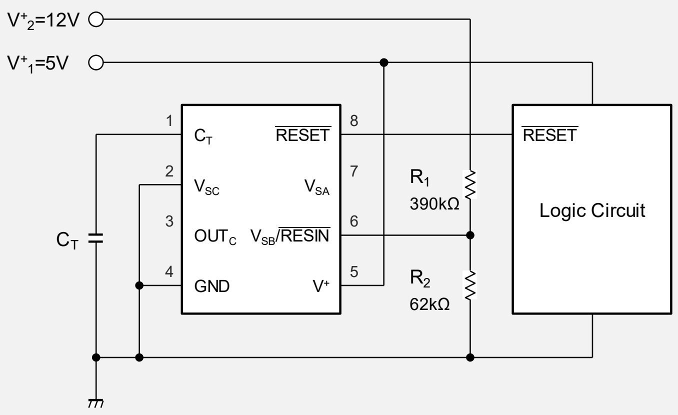


Fig. 5 5V, 12V power supply monitor (dual power supply monitor : V^+_1 = 5V, V^+_2 = 12V)

Technical Information

6. 5V, 12V power supply monitor (e.g. V^+_1 = 5V, V^+_2 = 12V, $\overline{RESET}$ 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}(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

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

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

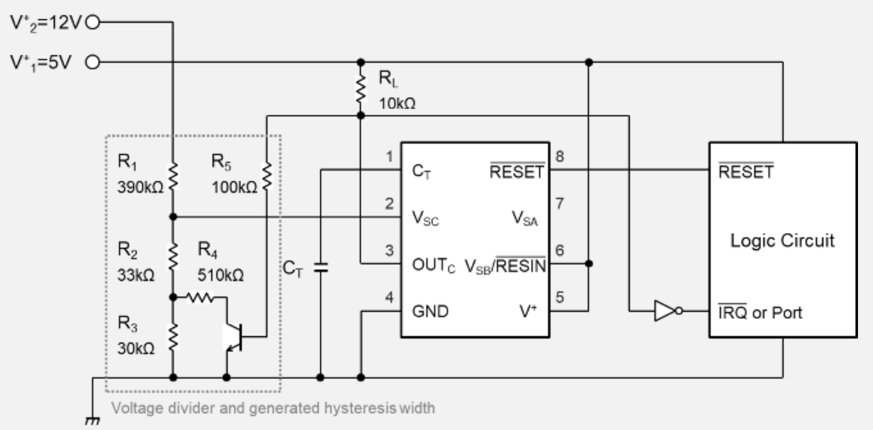


Fig. 6 5V, 12V power supply monitor (V^+_1 = 5V, V^+_2 = 12V, $\overline{RESET}$ output is only V^+_1 detection result)

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

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

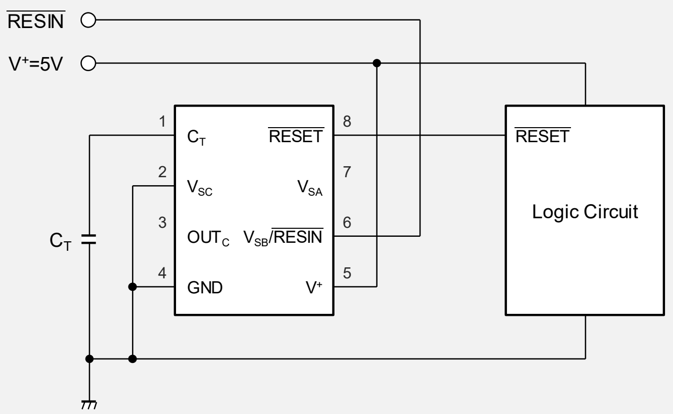


Fig. 7 Manual Reset function (V^+ = 5V)

8. Non-inverting reset output

If a positive output is required for reset signal, invert the $\overline{RESET}$ 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)

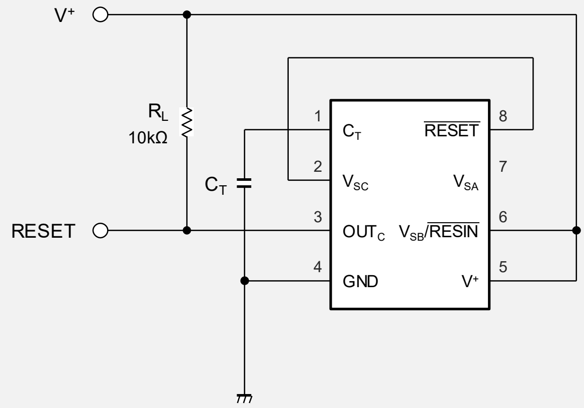


Fig. 8 Non-inverting reset output

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} = 40μs (C1=1000pF)

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

Minimum input pulse width calculate formula

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

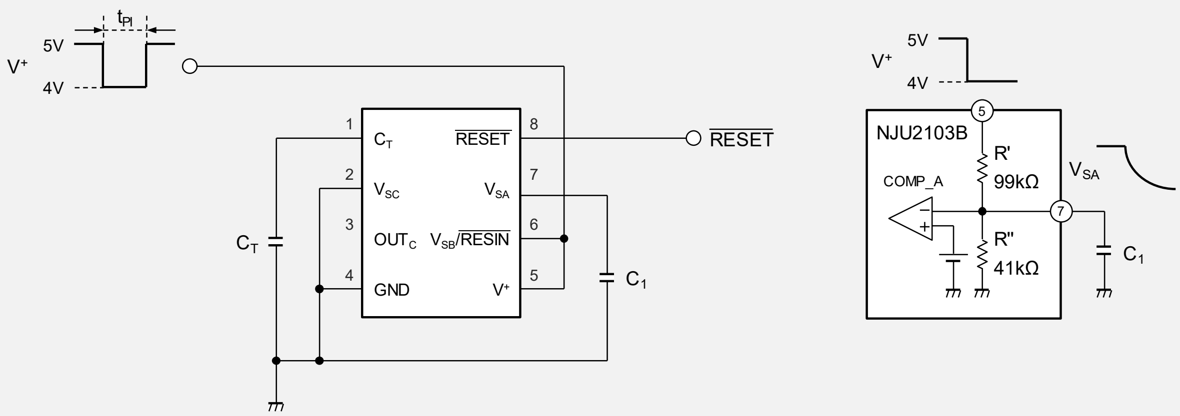


Fig. 9 Power supply voltage monitoring by delayed trigger

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

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

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

- 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.

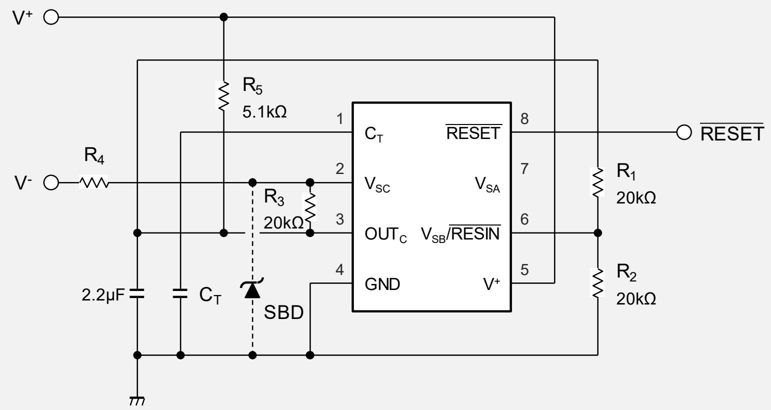


Fig. 10 Positive and negative dual power supply monitoring (V^+ = 5V、V^-=negative voltage)

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

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

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

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

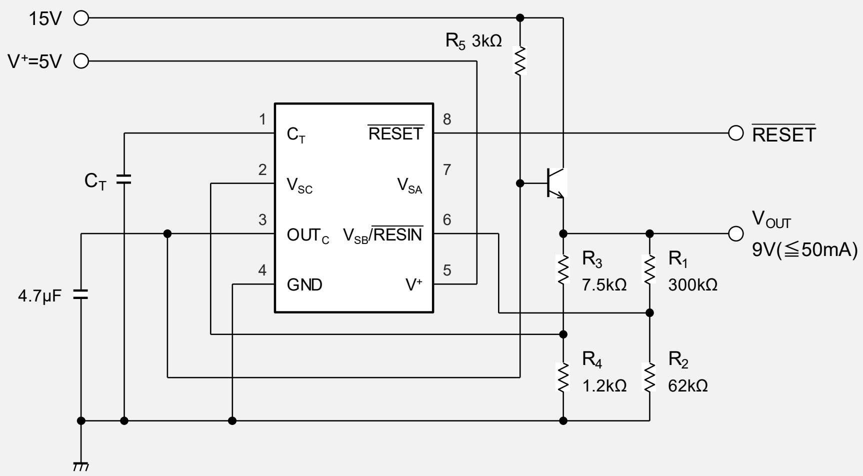


Fig. 11 Reference voltage output and voltage drop monitoring (e.g. 9V reference output, 5V, 9V monitoring)

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

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

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

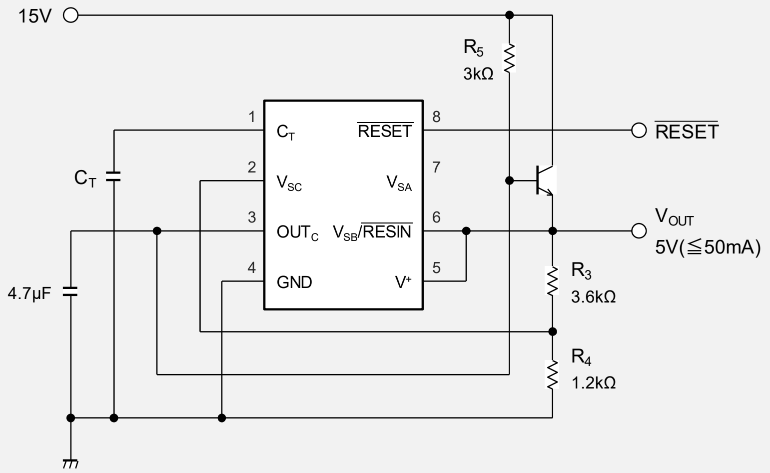


Fig. 12-1 Reference Voltage output and Voltage drop monitoring (e.g. 5V output, 5V monitoring)

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

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

- 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. .

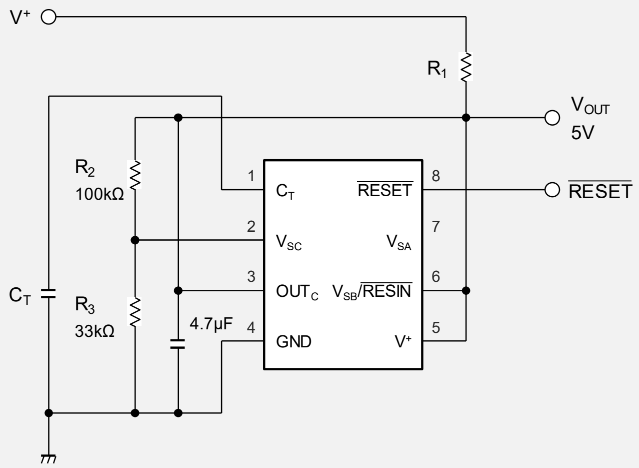


Fig. 12-2 Reference Voltage output and Voltage drop monitoring (e.g. 5V output, 5V monitoring)

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

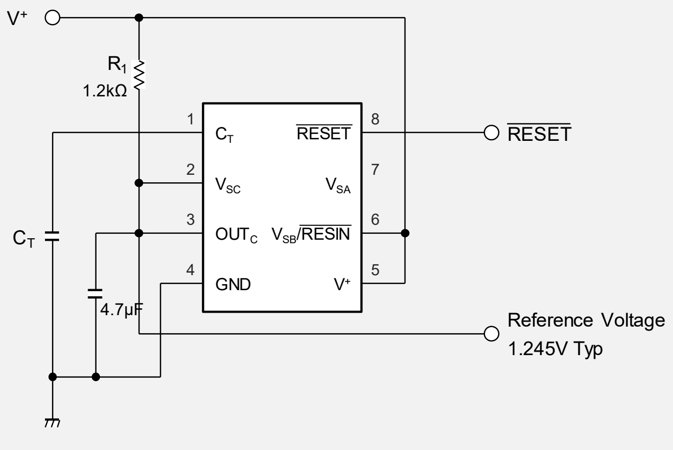


Fig. 13 Reference Voltage output and Voltage drop monitoring (e.g. 1.245V output, 5V monitoring)

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.
- "$\overline{RESET}$Output Pulse Width t_{PO}" is valid even when overvoltage is detected

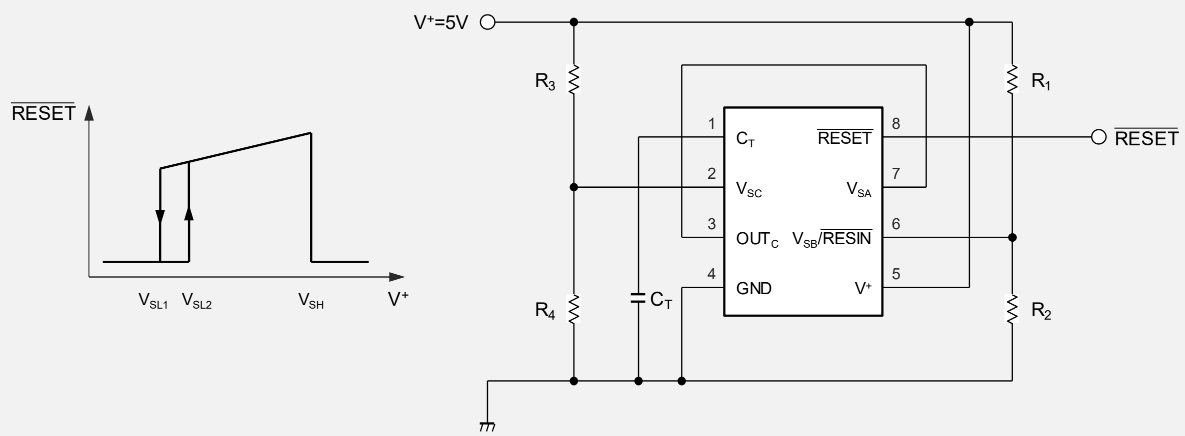
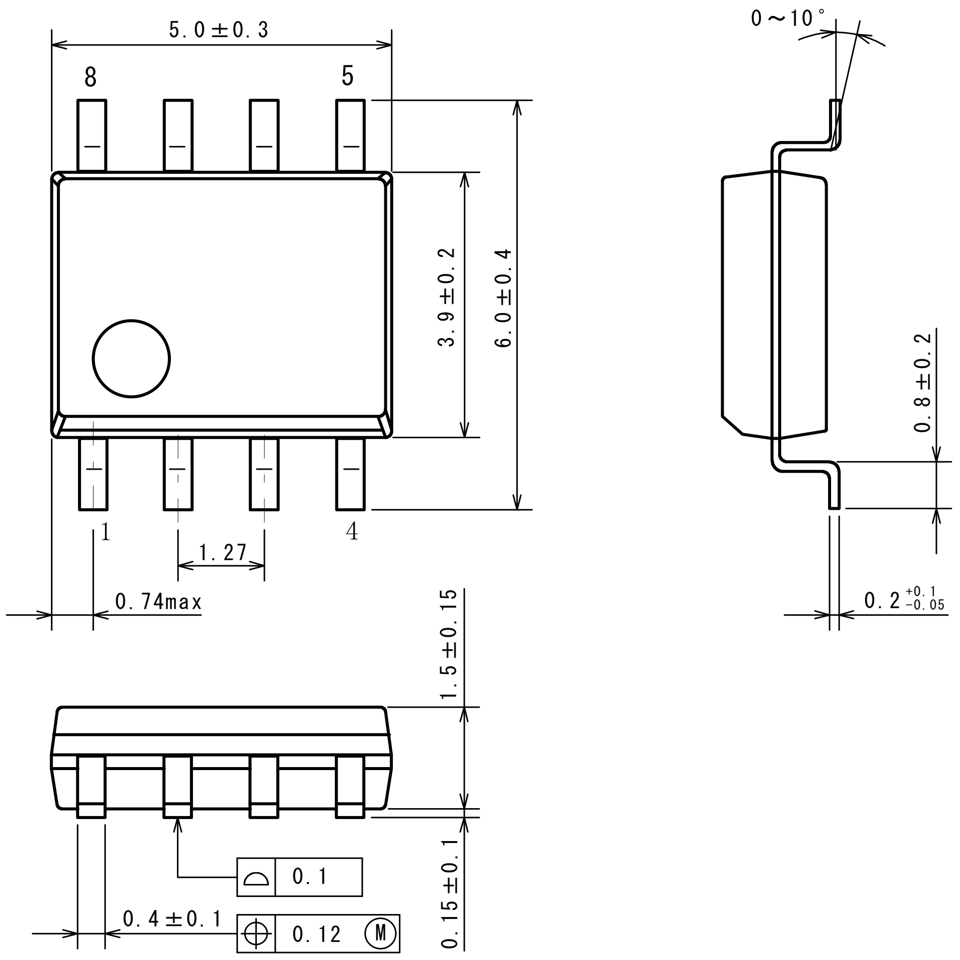


Fig. 14 Low voltage and over voltage detection ($V^+ = 5V$)

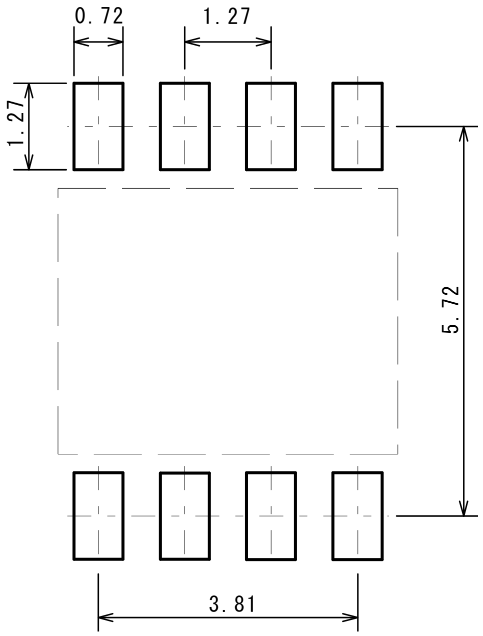
EMP8(SOP8 JEDEC 150mil)

■PACKAGE DIMENSIONS

Unit: mm



■EXAMPLE OF SOLDER PADS DIMENSION

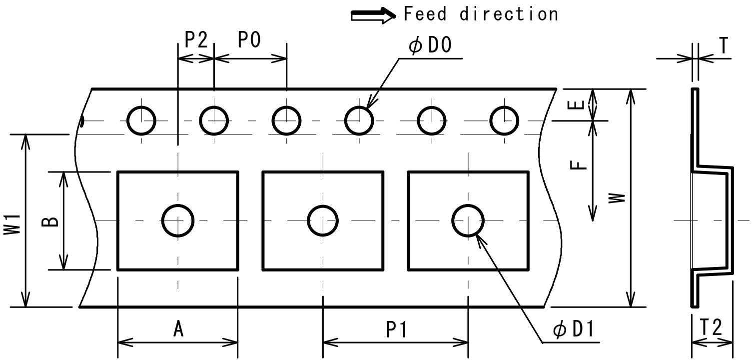


EMP8(SOP8 JEDEC 150mil)

■PACKING SPEC

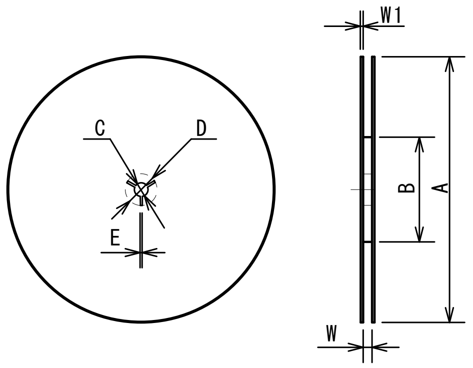
Unit: mm

TAPING DIMENSIONS



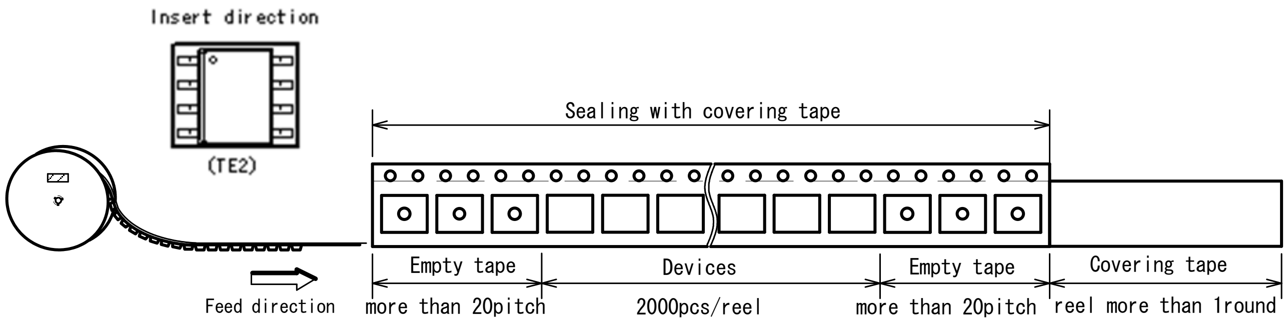
SYMBOL	DIMENSION	REMARKS
A	6.6	BOTTOM DIMENSION
B	5.4	BOTTOM DIMENSION
D0	1.5 $^{+0.1}_{0}$	
D1	1.7±0.1	
E	1.75±0.1	
F	5.5±0.05	
P0	4.0±0.1	
P1	8.0±0.1	
P2	2.0±0.05	
T	0.30±0.05	
T2	2.2	
W	12.0±0.3	
W1	9.5	THICKNESS 0.1max

REEL DIMENSIONS

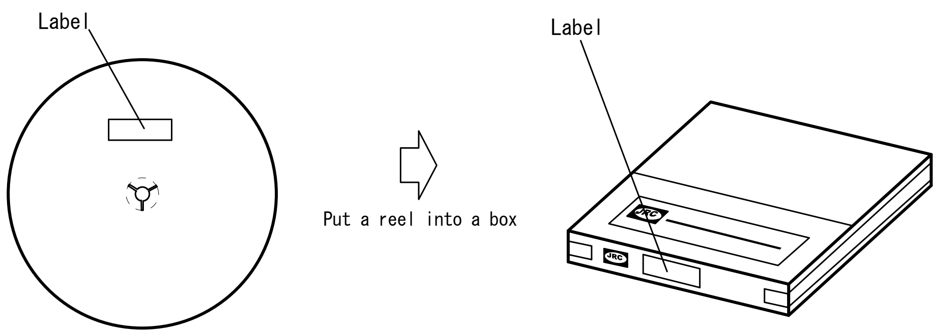


SYMBOL	DIMENSION
A	φ330±2
B	φ 80±1
C	φ 13±0.2
D	φ 21±0.8
E	2±0.5
W	13.5±0.5
W1	2.0±0.2

TAPING STATE



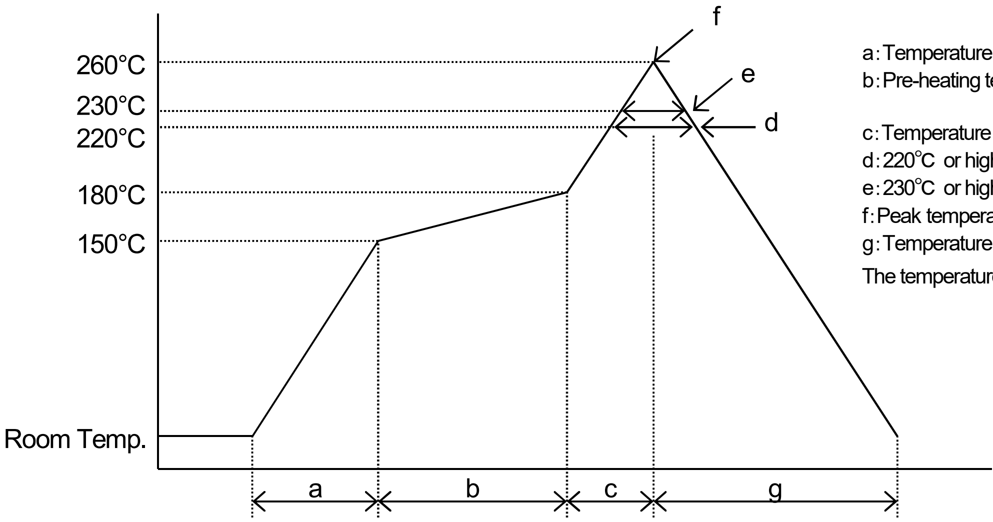
PACKING STATE



■RECOMMENDED MOUNTING METHOD

INFRARED REFLOW SOLDERING METHOD

Recommended reflow soldering procedure



a: Temperature ramping rate	: 1 to 4°C /s
b: Pre-heating temperature	: 150 to 180°C
time	: 60 to 120s
c: Temperature ramp rate	: 1 to 4°C /s
d: 220℃ or higher time	: Shorter than 60s
e: 230℃ or higher time	: Shorter than 40s
f: Peak temperature	: Lower than 260°C
g: Temperature ramping rate	: 1 to 6°C /s

The temperature indicates at the surface of mold package.

■REVISION HISTORY

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

[CAUTION]

1. NJR strives to produce reliable and high quality semiconductors. NJR's semiconductors are intended for specific applications and require proper maintenance and handling. To enhance the performance and service of NJR's semiconductors, the devices, machinery or equipment into which they are integrated should undergo preventative maintenance and inspection at regularly scheduled intervals. Failure to properly maintain equipment and machinery incorporating these products can result in catastrophic system failures

2. The specifications on this datasheet are only given for information without any guarantee as regards either mistakes or omissions. The application circuits in this datasheet are described only to show representative usages of the product and not intended for the guarantee or permission of any right including the industrial property rights.
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 The introduction of external contaminants (e.g. dust, oil or cosmetics) can result in failures of semiconductor products.

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   - Aerospace Equipment
   - Equipment Used in the Deep Sea
   - Power Generator Control Equipment (Nuclear, steam, hydraulic, etc.)
   - Life Maintenance Medical Equipment
   - Fire Alarms / Intruder Detectors
   - Vehicle Control Equipment (Airplane, railroad, ship, etc.)
   - Various Safety Devices

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9. The product specifications and descriptions listed in this datasheet are subject to change at any time, without notice.