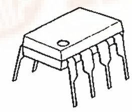
VOLTAGE DETECTOR

■ GENERAL DESCRIPTION

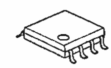
The NJM2078 is a dual comparator including precise reference circuit. Output stages are open collector and can be used on wired OR. The NJM 2078 has hysterisis terminals.

As it is less operating current, the NJM2078 is suitable for voltage detection of decreased power supply in memory stack and abnormal voltage.

■ PACKAGE OUTLINE



NJM2078D

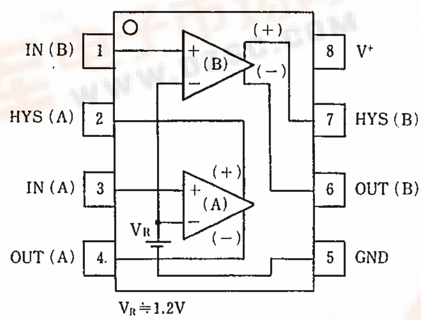


NJM2078M

■ FEATURES

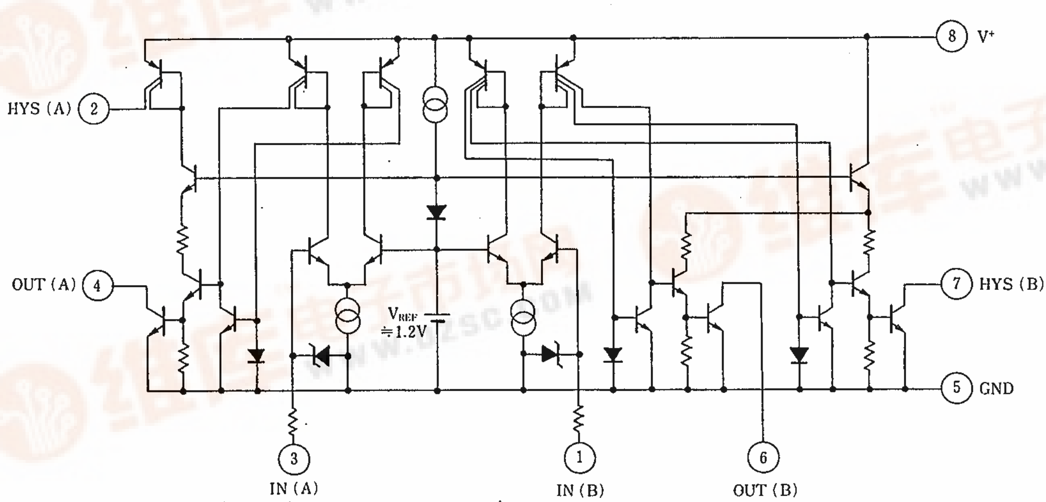
- Low Operating Current (250 μA typ.)
- Stable Internal Reference Voltage (1.20V typ.)
- Hysterisis Function with Resistors
- Package Outline DIP8, DMP8
- Bipolar Technology

■ PIN CONFIGURATION



NJM2078D
NJM2078M

■ EQUIVALENT CIRCUIT



■ ABSOLUTE MAXIMUM RATINGS

(Ta=25℃)

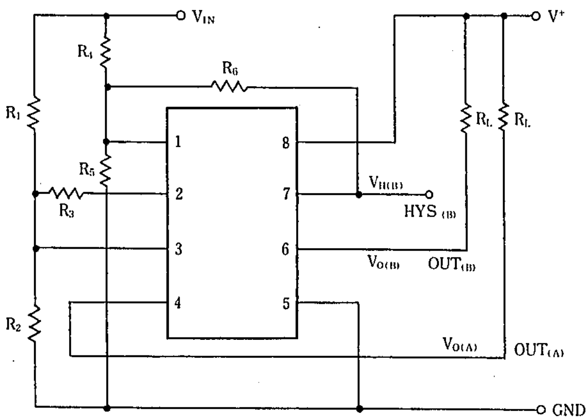
PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V^+	21	V
Output Voltage	V_O	21	V
Output Current	I_O	50	mA
Input Voltage	V_{IN}	−0.3～+6.5	Vdc
Power Dissipation	P_D	(DIP8) 500	mW
		(DMP8) 300	mW
Operating Temperature Range	T_{opr}	−40～+85	℃
Storage Temperature Range	T_{stg}	−40～+125	℃

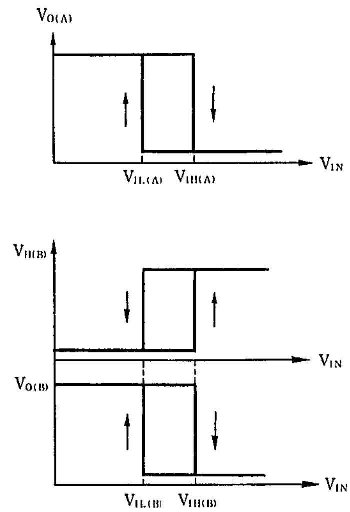
■ ELECTRICAL CHARACTERISTICS

(V^{+}=5V, Ta=25℃)

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current	I_{CCL}	V^{+}=20V, V_{IL}=1.0V	—	250	400	μA
	I_{CCH}	V^{+}=20V, V_{IH}=1.5V	—	400	600	μA
Threshold Voltage	V_{TH}	I_O=2mA, V_O=1V	1.15	1.20	1.25	V
Threshold Voltage Deviation vs. Operating Voltage	ΔV_{TH1}	2.5V≦V^{+}≦5.5V	—	3	12	mV
	ΔV_{TH2}	4.5V≦V^{+}≦20V	—	10	40	mV
Offset Voltage Between Normal Output and Hysterisis Output		I_O(A)=4.5mA, V_O(A)=2V, I_H(A)=20μA, V_H(A)=3V	—	2.0	—	mV
		I_O(B)=3mA, V_O(B)=2V, I_H(B)=3mA, V_H(B)=2V	—	2.0	—	mV
Threshold Voltage Temperature Coefficient		−20°C≦Ta≦70°C	—	±0.05	—	mV/°C
Threshold Voltage Difference Between Channels			−10	—	10	mV
Input Current	I_{IL}	I_{IL}=1.0V	—	5	—	nA
	I_{IH}	I_{IH}=1.5V	—	100	500	nA
Output Leak Current	I_{OH}	V_O=20V, V_{IL}=1.0V	—	—	1	μA
Hysterisis Output Leak Current	I_{HL}(A)	V^{+}=20V, V_H(A)=0V, V_{IL}=1.0V	—	—	0.1	μA
	I_{HH}(B)	V_H(B)=20V, V_{IH}=1.5V	—	—	1	μA
Output Sink Current	I_{OL}(A)	V_O=1.0V, V_{IH}=1.5V	6	12	—	mA
	I_{OL}(B)	V_O=1.0V, V_{IH}=1.5V	4	10	—	mA
Hysterisis Current	I_{HH}(A)	V_H=0V, V_{IH}=1.5V	40	80	—	μA
	I_{HL}(B)	V_H=1.0V, V_{IL}=1.0V	4	10	—	mA
Output Saturation Voltage	V_{OL}(A)	I_O=4.5mA, V_{IH}=1.5V	—	120	400	mV
	V_{OL}(B)	I_O=3.0mA, V_{IH}=1.5V	—	120	400	mV
Hysterisis Output Saturation Voltage	V_{HH}(A)	I_H=20μA, V_{IH}=1.5V	—	50	200	mV
	V_{HL}(B)	I_H=3.0mA, V_{IL}=1.0V	—	120	400	mV
Delay Time	t_{PHL}	R_L=5kΩ	—	2	—	μs
	t_{PLH}	R_L=5kΩ	—	3	—	μs

■ OPERATION PRINCIPLE





Equation :

$$V_{IH(A)} = \left(1 + \frac{R_1}{R_2}\right) V_R$$

$$V_{IL(A)} = \left(1 + \frac{R_1}{R_2 /\!/ R_3}\right) V_R - \frac{R_1}{R_3} V^+$$

$$V_{IH(B)} = \left(1 + \frac{R_4}{R_5 /\!/ R_6}\right) V_R$$

$$V_{IL(B)} = \left(1 + \frac{R_4}{R_5}\right) V_R$$

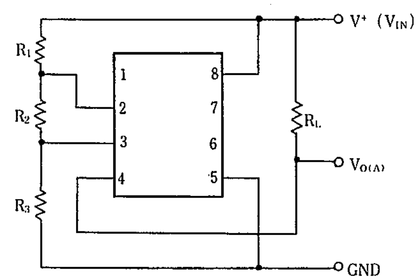
(note) $V_R \doteqdot V_{TH}$ ($\doteqdot 1.20V$)

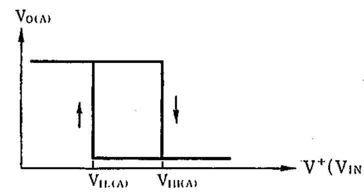
$$R_2 /\!/ R_3 = \frac{R_2 R_3}{R_2 + R_3}$$

$$R_5 /\!/ R_6 = \frac{R_5 R_6}{R_5 + R_6}$$

■ TYPICAL APPLICATION

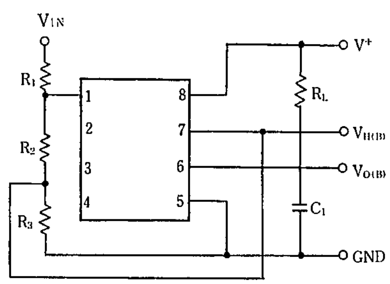
1. Hysterisis

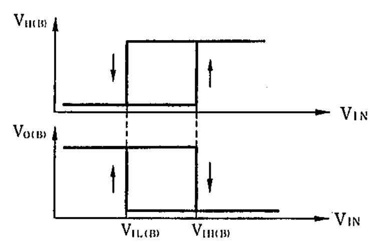




$$V_{IH(A)} \fallingdotseq \left(1+\frac{R_1+R_2}{R_3}\right)V_R$$

$$V_{IL(A)} \fallingdotseq \left(1+\frac{R_2}{R_3}\right)V_R$$



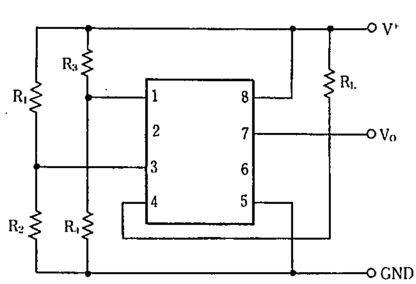


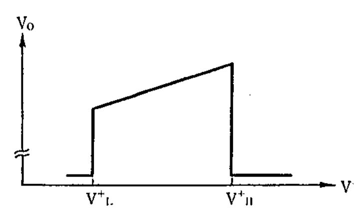
Each equation is calculated without considering the saturation voltage. It is necessary to compensate by the saturation voltage fit to lead conditions, precisely.

$$V_{IH(B)} \fallingdotseq \left(1+\frac{R_1}{R_2}\right)V_R$$

$$V_{IL(B)} \fallingdotseq \left(1+\frac{R_1}{R_2+R_3}\right)V_R$$

2. Detection of Abnormal Supply Voltage





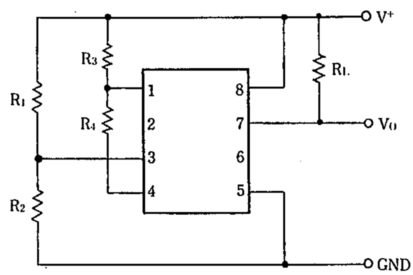
$$V^+_H = \left(1+\frac{R_1}{R_2}\right)V_R$$

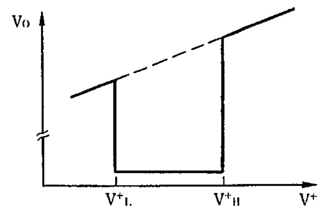
$$V^+_L = \left(1+\frac{R_3}{R_4}\right)V_R$$

Note: $V^+ \geqq 2.5V$

Hysterisis; Positive feedback from pin 2 or pin 7 (ref. 1).

3. Detection of Abnormal Operating Voltage



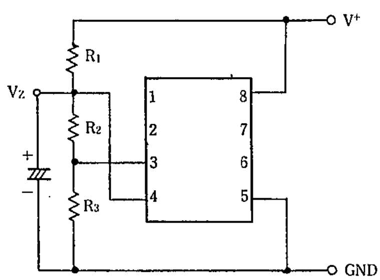


$$V^+_H = \left(1+\frac{R_3}{R_4}\right)V_R$$

$$V^+_L = \left(1+\frac{R_1}{R_2}\right)V_R$$

Note: $V^+_L \geqq 2.5V$

4. Programmable Zener

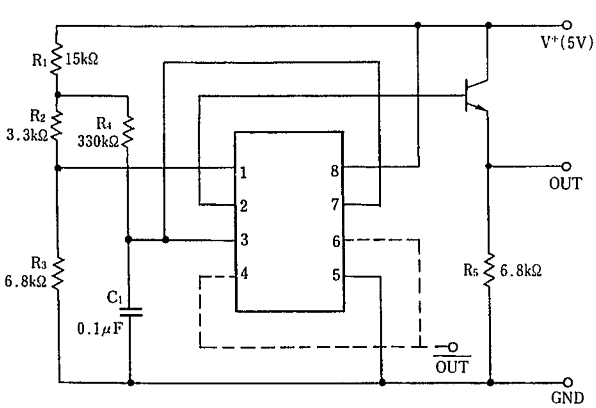


$$V_Z \fallingdotseq \left(1+\frac{R_2}{R_3}\right)V_R$$

$$\frac{V_Z}{R_2+R_3} \leqq \frac{V^+ - V_Z}{R_1} \leqq 6\,mA$$

Can use channel B independently.

5. Reset Circuit for Decreased Operating Voltage



Comparate Voltage and hysterisis width can be adjustable by $R_1 \sim R_4$. Roughly.

$$V^+_{(L)} = \frac{R_1+R_2+R_3}{R_3} V_{TH}$$

$$V^+_{(H)} = V^+_{(L)} \frac{R_1(R_2+R_3)}{R_3R_4} V_{TH}$$

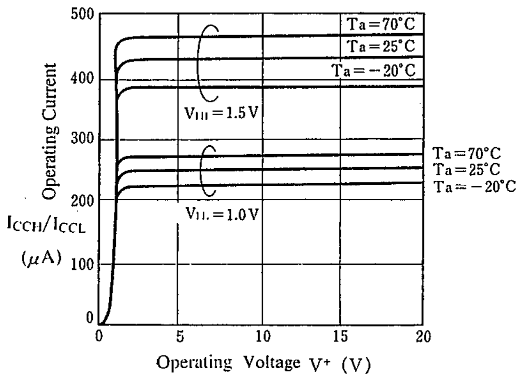
- Power-on reset time t_{RST} (roughly)

$$t_{RST} = -C_1R_4\ \ln\left\{1-\frac{V_{TH}}{V^+}\left(1+\frac{R_1}{R_2+R_3}\right)\right\}$$

- Transistor; Recommended $h_{FE}=50 \sim 200$
- Rapid Signal Off; Be care to remained charge of C_1. It affects to t_{RST}.
- Reverse polarity output $\overline{OUT}$: Open collector.

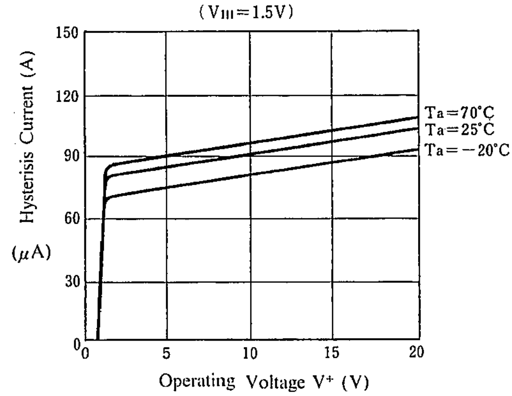
■ TYPICAL CHARACTERISTICS

Operating Current



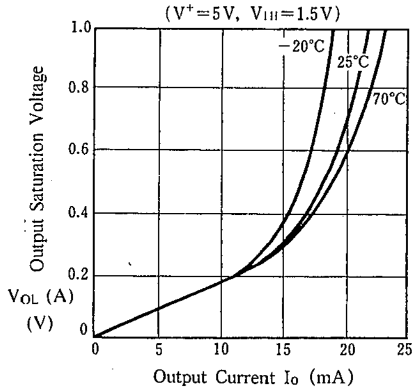
Hysterisis Current(A)

(V_IH=1.5V)



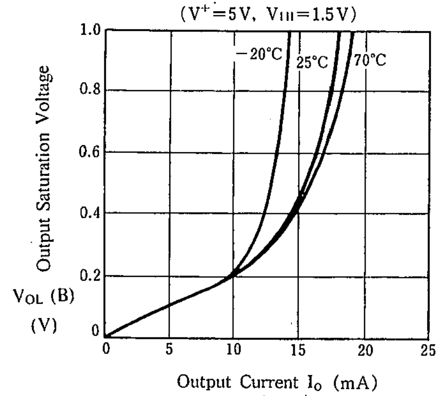
Output Saturation Voltage (A)

(V+=5V, V_IH=1.5V)



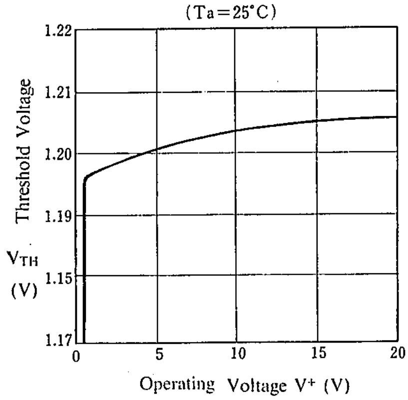
Output Saturation Voltage (B)

(V+=5V, V_IH=1.5V)



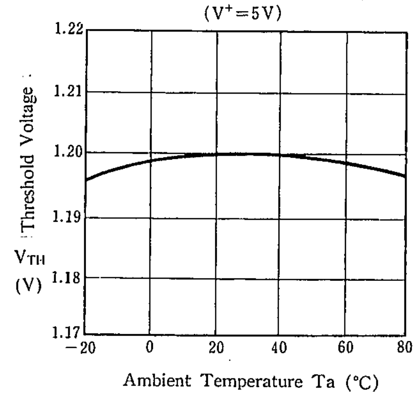
Threshold Voltage

(Ta=25°C)



Threshold Voltage

(V+=5V)



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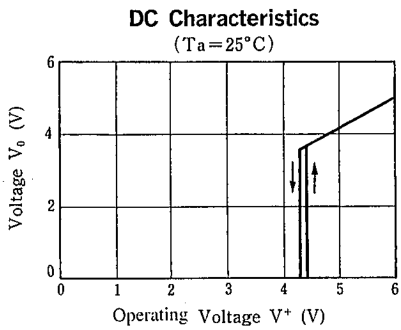
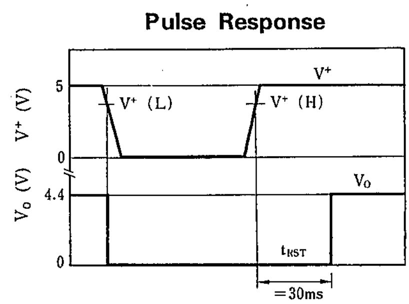
■ TYPICAL CHARACTERISTICS (Refer to Application 5 of Reset Circuit for Decreased Supply Voltage)





MEMO