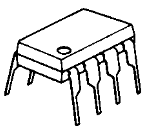
VOLTAGE DETECTOR

■ GENERAL DESCRIPTION

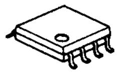
The **NJM2078** is a dual comparator including precise reference circuit. Output stages are open collector and can be used on wired OR. The NJM2078 has hysterisis terminals.

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

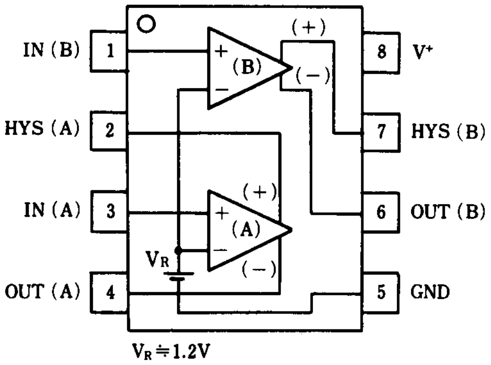


NJM2078M

■ FEATURES

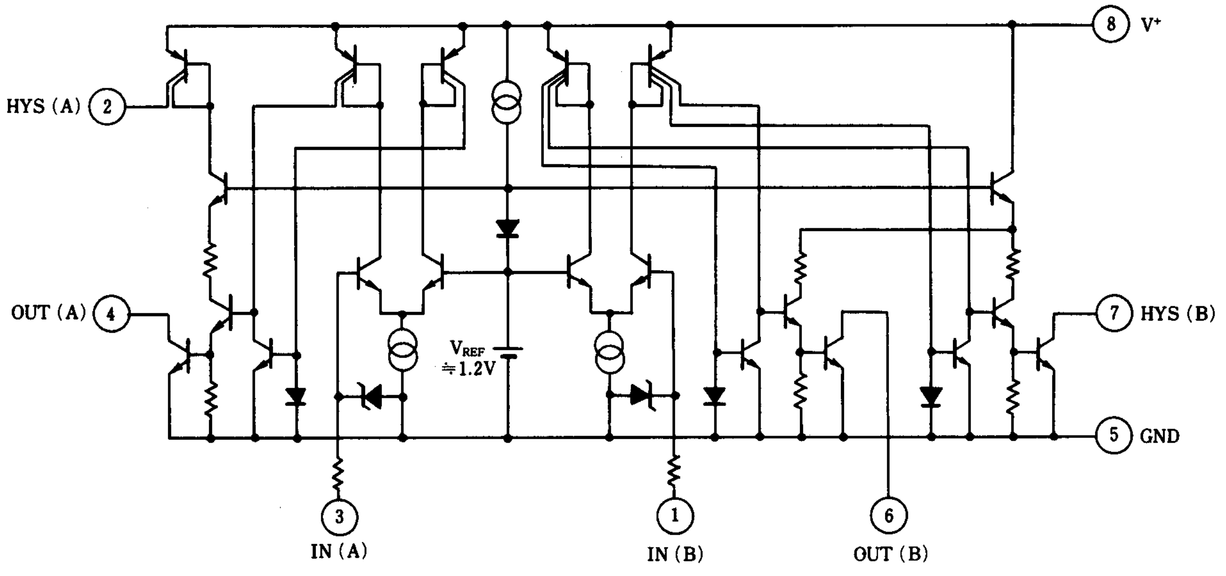
● Low Operating Current	(250µA typ.)
● Stabled Internal Reference Voltage	(1.20V typ.)
● Hysterisis Function with Resistors	
● Package Outline	DIP8, DMP8
● Bipolar Technology	

■ PIN CONFIGURATION



NJM2078D
NJM2078M

■ EQUIVALENT CIRCUIT



■ ABSOLUTE MAXIMUM RATINGS

(T_a=25°C)

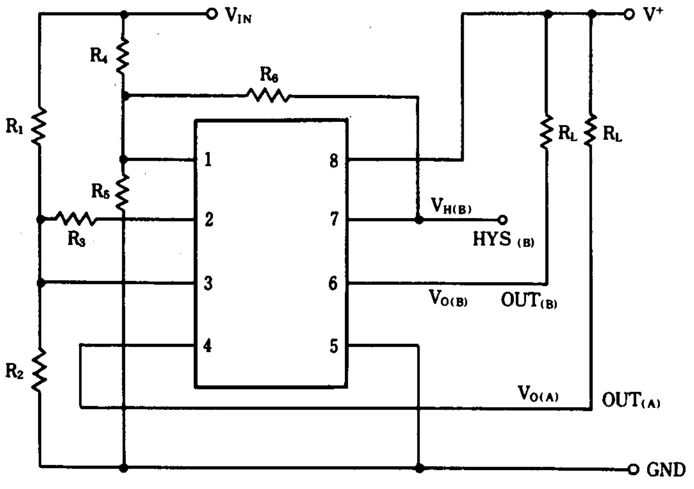
PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V^+	21	V
Output Voltage	V_O	21	V
Output Current	I_O	50	mA
Input Voltage	V_{IN}	-0.3 to +6.5	Vdc
Power Dissipation	P_D	(DIP8) 500 (DMP8) 300	mW mW
Operating Temperature Range	T_{opr}	-40 to +85	°C
Storage Temperature Range	T_{stg}	-40 to +125	°C

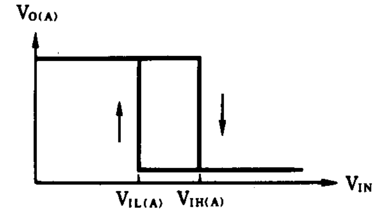
■ ELECTRICAL CHARACTERISTICS

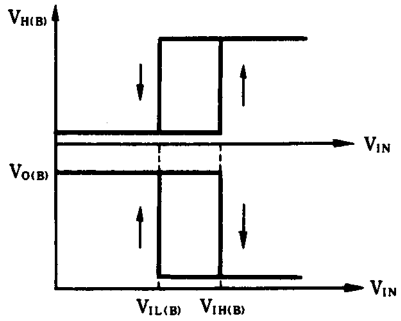
(V^+=5V, T_a=25°C)

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≤T_a≤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
Hysterisys 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

$$V_{IH(A)} = \left(1 + \frac{R_1}{R_2}\right) V_R \qquad V_{IH(B)} = \left(1 + \frac{R_4}{R_5 /\!/ R_6}\right) V_R$$

$$V_{IL(A)} = \left(1 + \frac{R_1}{R_2 /\!/ R_3}\right) V_R - \frac{R_1}{R_3} V^+ \qquad V_{IL(B)} = \left(1 + \frac{R_4}{R_5}\right) V_R$$

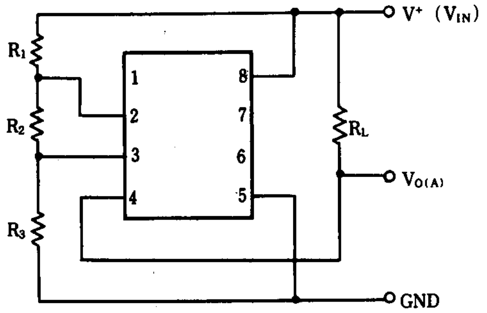
(note)$V_R \fallingdotseq V_H (\fallingdotseq 1.20V)$

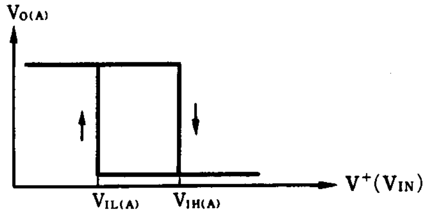
$$R_2 /\!/ R_3 = \frac{R_2 R_3}{R_2 + R_3}$$

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

■ TYPICAL APPLICATION

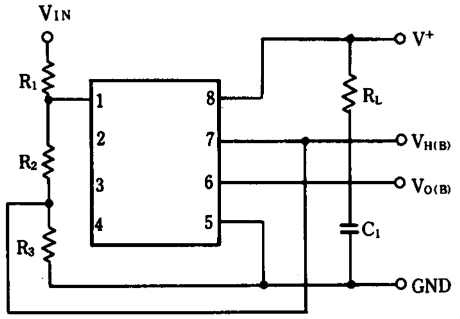
1. Hysterisis

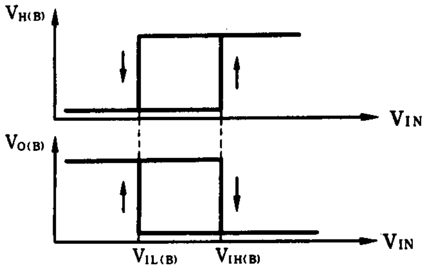




$$V_{IN(A)} \fallingdotseq \left(1+\frac{R_1+R_2}{R_3}\right)V_R$$

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



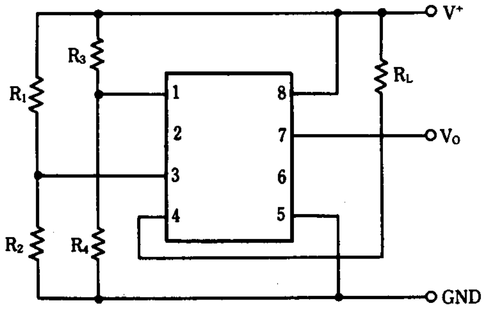


Each equation is calculated without considering the saturation voltage. It is necessary to compensate by the saturation voltage fit to lead conditions, precisely.

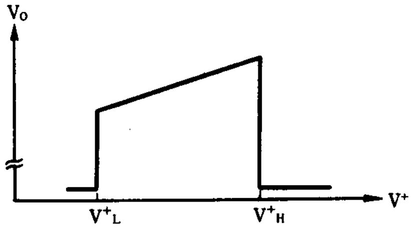
$$V_{IN(B)} \fallingdotseq \left(1+\frac{R_1}{R_2}\right)V_R$$

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

2. Detection of Abnormal Supply Voltage



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

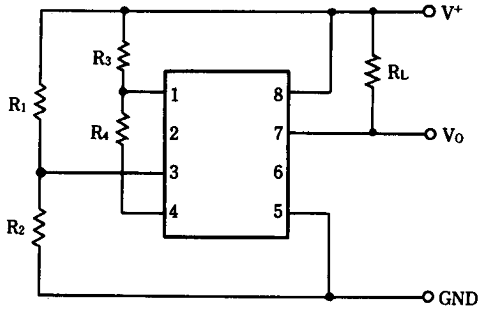


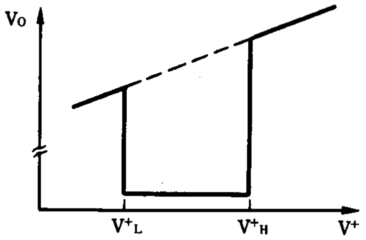
$$V^{+}_{H} = \left(1+\frac{R_1}{R_2}\right)V_R$$

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

Note : $V^{+} \geq 2.5V$

3. Detection of Abnormal Operating Voltage



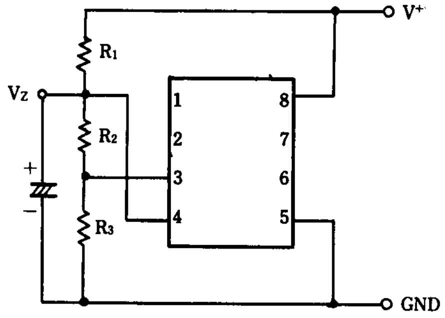


$$V^{+}{}_{H} = \left(1+\frac{R_3}{R_4}\right)V_R$$

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

Note : $V^{+}{}_{L} \geq 2.5V$

4. Programmable Zener

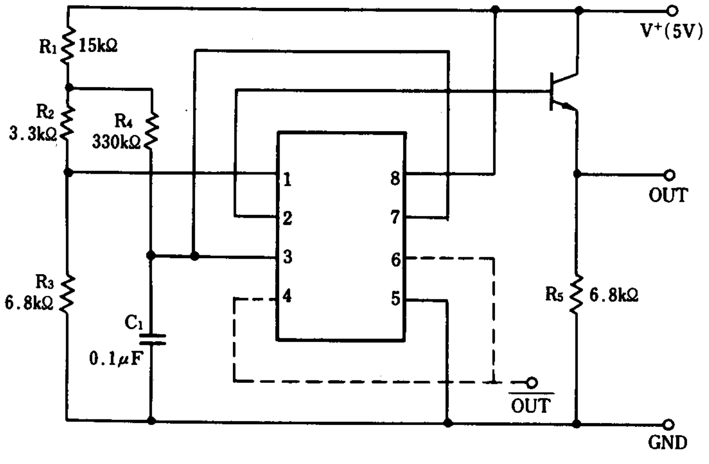


$$V_Z \doteqdot \left(1+\frac{R_2}{R_3}\right)V_R$$

$$\frac{V_z}{R_2+R_3} \leq V\frac{V^{+}-V_z}{R_1} \leq 6mA$$

Can use channel B independently.

5. Reset Circuit for Decreased Operating Voltage



Comparate Voltage and hysterisis width can be adjustabel by R_1 to R_4. Roughly.

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

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

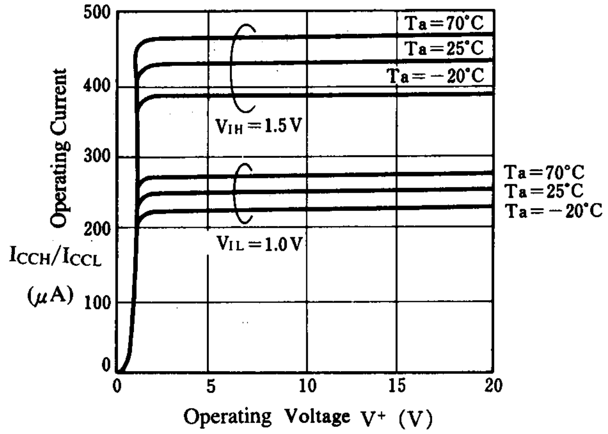
- Power-on reset time t_{RST} (roughly)

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

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

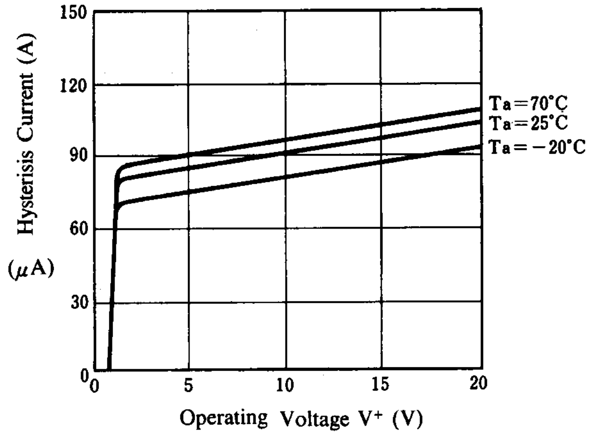
■ TYPICAL CHARACTERISTICS

Operating Current



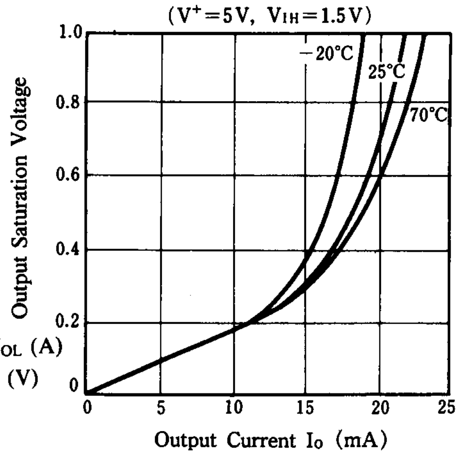
Hysterisis Current (A)

(V_{IH}=1.5V)



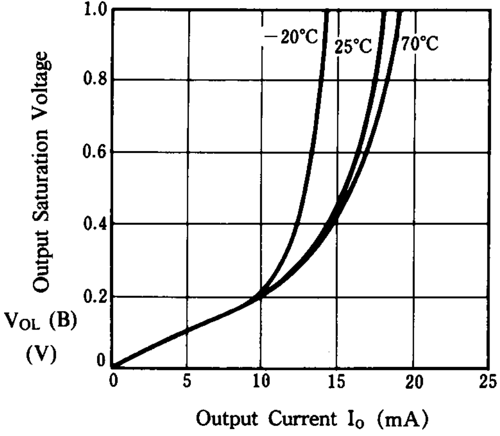
Output Saturation Voltage (A)

(V^+=5V, V_{IH}=1.5V)



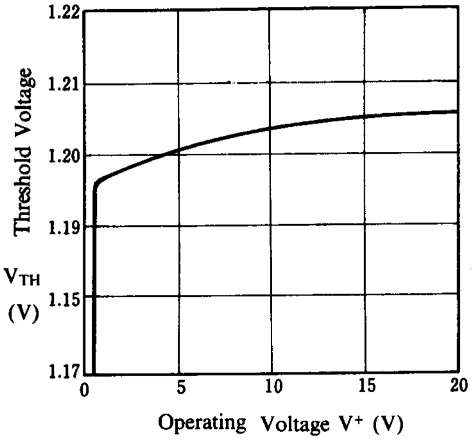
Output Saturation Voltage (B)

(V^+=5V, V_{IH}=1.5V)



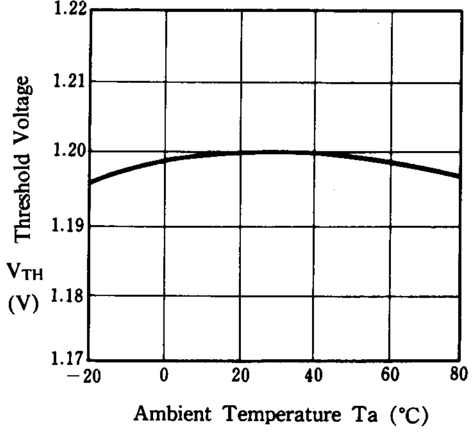
Threshold Voltage

(Ta=25°C)



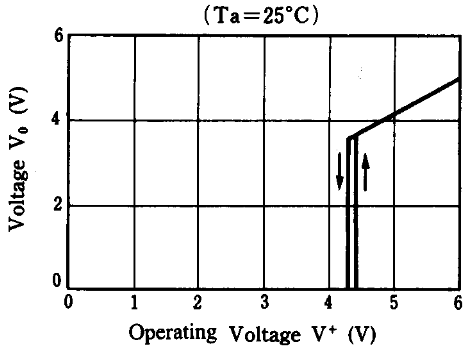
Threshold Voltage

(V^+=5V)



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

DC Characteristics



Pulse Response