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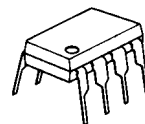
VOLTAGE DETECTOR

■ 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 hysteresis 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

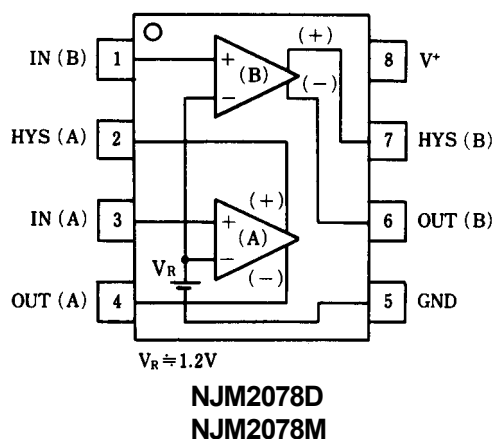


NJM2078M

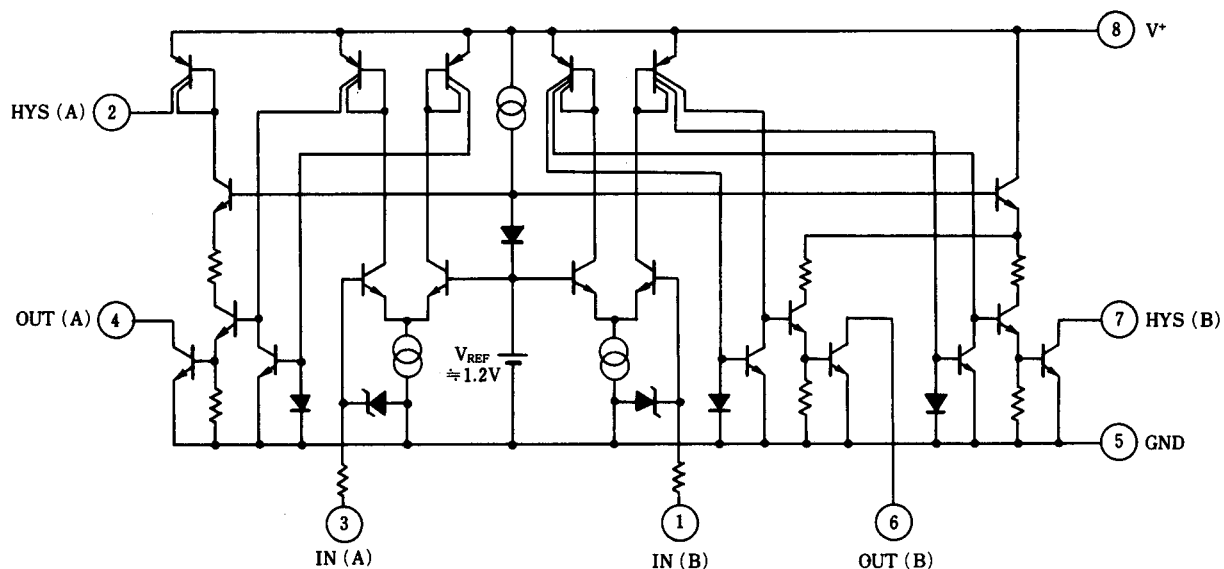
■ FEATURES

- Low Operating Current (250 μ A typ.)
- Stabled Internal Reference Voltage (1.20V typ.)
- Hysteresis Function with Resistors
- Package Outline DIP8, DMP8
- Bipolar Technology

■ PIN CONFIGURATION



■ EQUIVALENT CIRCUIT



NJM2078

■ ABSOLUTE MAXIMUM RATINGS

(T_a=25°C)

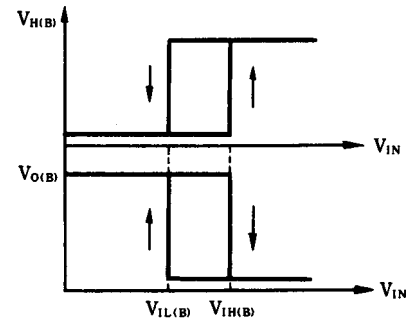
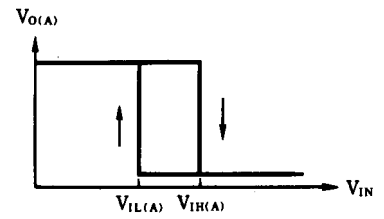
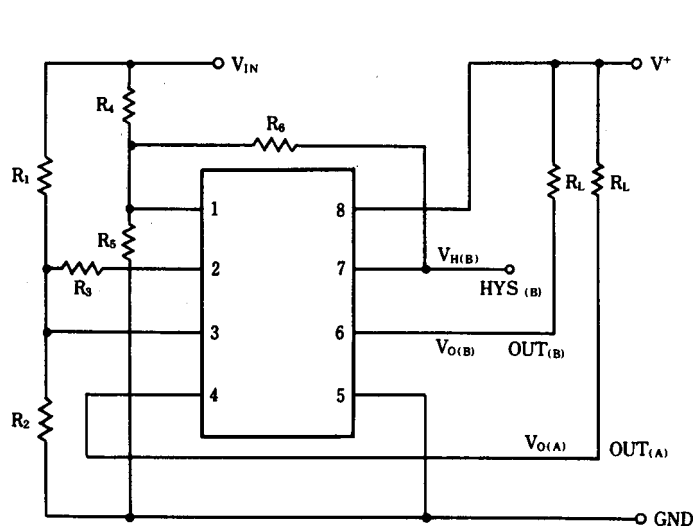
PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V ⁺	21	V
Output Voltage	V _O	21	V
Output Current	I _O	50	mA
Input Voltage	V _{IN}	-0.3 to +6.5	Vdc
Power Dissipation	P _D	(DIP8) 500	mW
		(DMP8) 300	mW
Operating Temperature Range	T _{opr}	-40 to +85	°C
Storage Temperature Range	T _{stg}	-40 to +125	°C

■ ELECTRICAL CHARACTERISTICS

($V^+=5V$, $T_a=25^\circ C$)

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current	I_{OCL}	$V^+=20V$, $V_{IL}=1.0V$	-	250	400	μA
	I_{OCH}	$V^+=20V$, $V_{IH}=1.5V$	-	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}	$2.5V \leq V^+ \leq 5.5V$	-	3	12	mV
	ΔV_{TH2}	$4.5V \leq V^+ \leq 20V$	-	10	40	mV
Offset Voltage Between Normal Output and Hysteresis Output		$I_O(A)=4.5mA$, $V_O(A)=2V$, $I_H(A)=20\mu A$, $V_H(A)=3V$	-	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		$-20^\circ C \leq T_a \leq 70^\circ C$	-	± 0.05	-	mV / $^\circ C$
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
Hysteresis Output Leak Current	$I_{HIL}(A)$	$V^+=20V$, $V_H(A)=0V$, $V_{IL}=1.0V$	-	-	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
Hysteresis Current	$I_{HH}(A)$	$V_H=0V$, $V_{IH}=1.5V$	40	80	-	μA
	$I_{HIL}(B)$	$V_H=1.0V$, $V_{IL}=1.0V$	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
Hysteresis Output Saturation Voltage	$V_{HH}(A)$	$I_H=20\mu A$, $V_{IH}=1.5V$	-	50	200	mV
	$V_{HL}(B)$	$I_H=3.0mA$, $V_{IL}=1.0V$	-	120	400	mV
Delay Time	t_{PHL}	$R_L=5k\Omega$	-	2	-	μs
	t_{PLH}	$R_L=5k\Omega$	-	3	-	μs

■ OPERATION PRINCIPLE



Equation

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

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

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

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

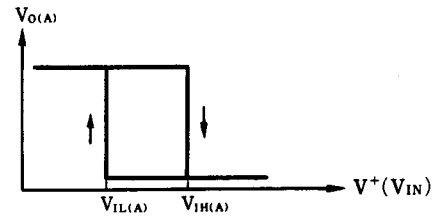
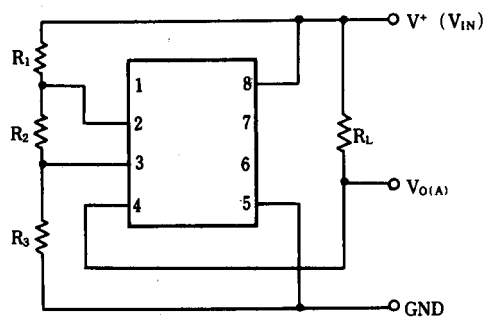
(note) $V_R \doteq V_H (\doteq 1.20V)$

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

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

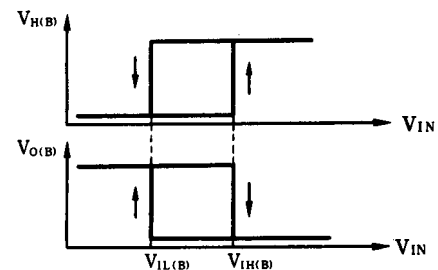
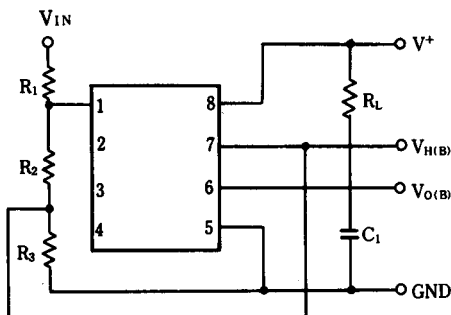
■ TYPICAL APPLICATION

1. Hysteresis



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

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

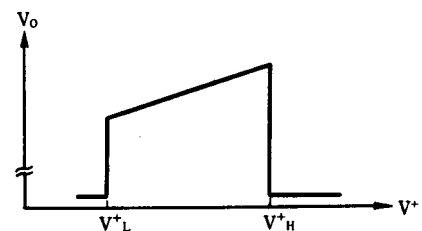
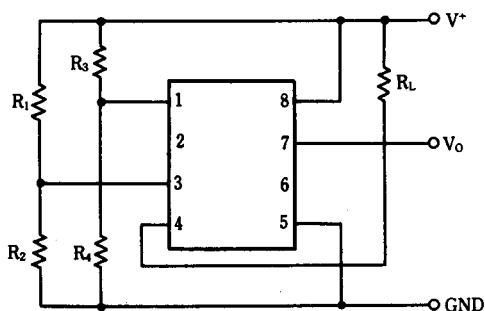


$$V_{IN(B)} = \left(1 + \frac{R_1}{R_2}\right) V_R$$

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

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

2. Detection of Abnormal Supply Voltage



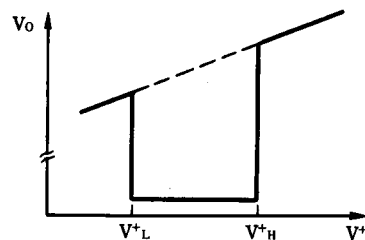
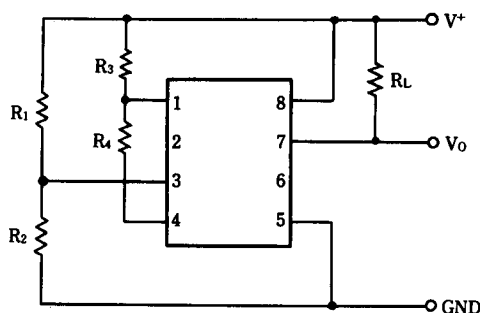
$$V^+_H = \left(1 + \frac{R_1}{R_2}\right) V_R$$

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

Note : $V^+ \geq 2.5V$

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

3. Detection of Abnormal Operating Voltage

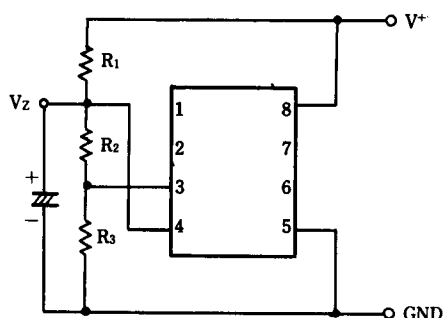


$$V^+_{H} = \left(1 + \frac{R_3}{R_4}\right) V_R$$

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

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

4. Programmable Zener

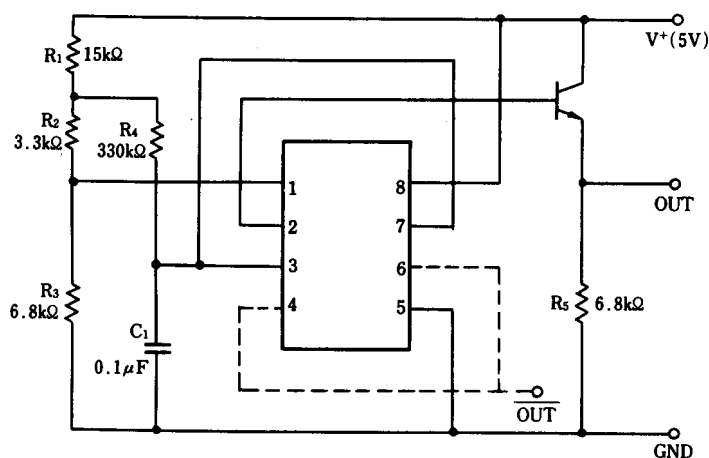


$$V_Z \approx \left(1 + \frac{R_2}{R_3}\right) V_R$$

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

Can use channel B independently.

5. Reset Circuit for Decreased Operating Voltage



Compare Voltage and hysteresis width can be adjustable by R_1 to R_4 . Roughly.

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

$$V^+_{(H)} = V^+_{(L)} \frac{R_1(R_2 + R_3)}{R_3 R_4} V_{TH}$$

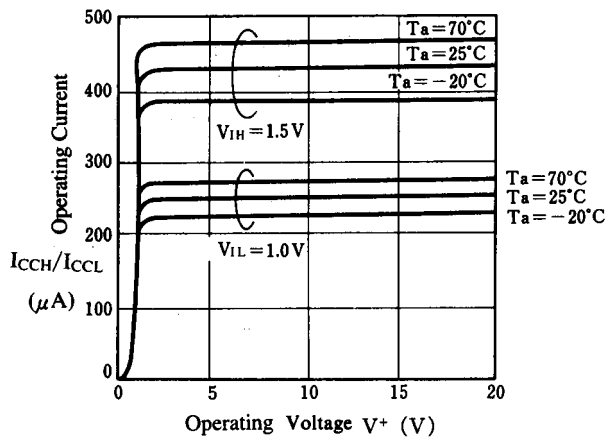
• Power-on reset time t_{RST} (roughly)

$$t_{RST} = -C_1 R_4 \ln \left\{ 1 - \frac{V_{TH}}{V^+} \left(1 + \frac{R_1}{R_2 + R_3} \right) \right\}$$

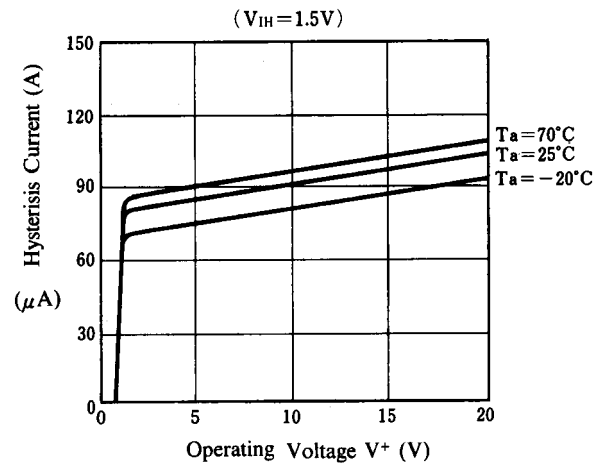
- Transistor ; Recommended $h_{FE} = 50$ to 200
- Rapid Signal Off ; Be care to remained charge of C_1 . It affects to t_{RST}
- Reverse polarity output $\overline{OUT}$: Open collector.

■ TYPICAL CHARACTERISTICS

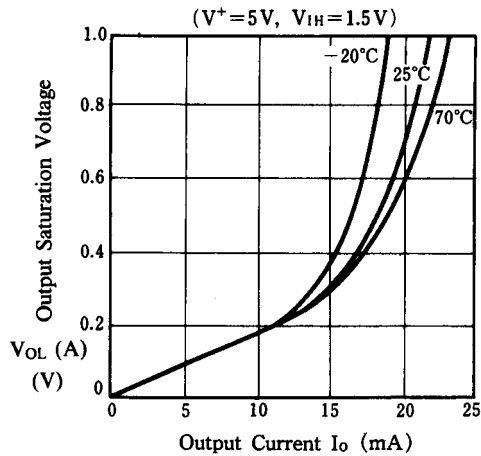
Operating Current



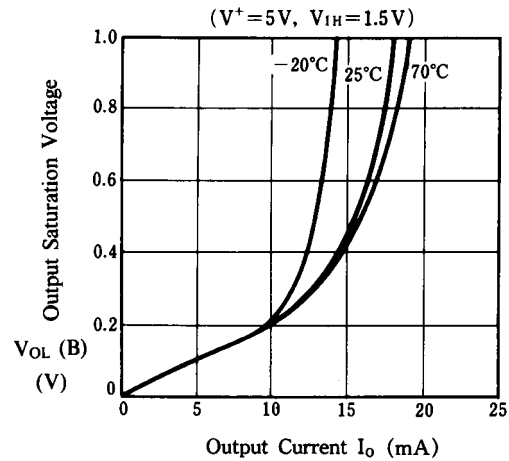
Hysteresis Current (A)



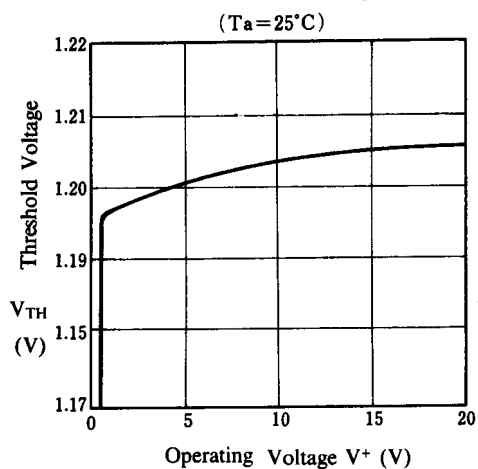
Output Saturation Voltage (A)



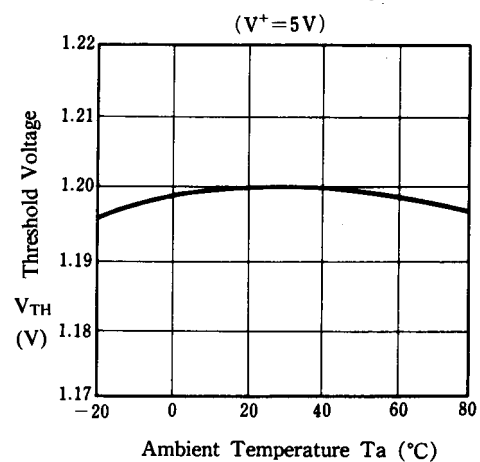
Output Saturation Voltage (B)



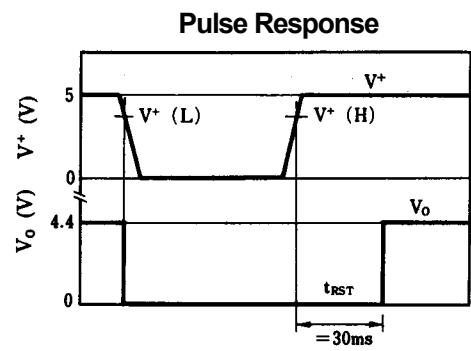
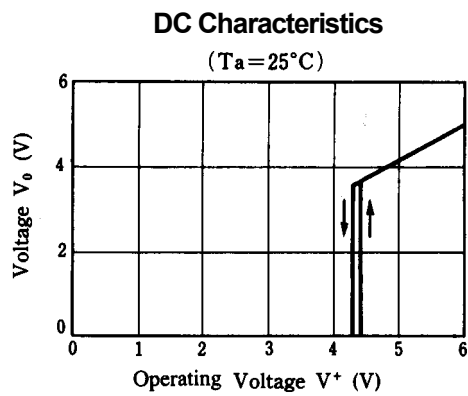
Threshold Voltage



Threshold Voltage



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



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