

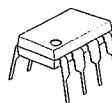
SWITCHING OPERATIONAL AMPLIFIER

■ GENERAL DESCRIPTION

The NJM 2120 is a dual operational amplifier of 2-INPUT and 1-OUTPUT with analog switch. The NJM2120 can be used as analog switch under the condition of  $G_v=0$  dB, as Switch+Amp in order that each gain (A or B) can be adjusted independently. Each amplifier of the NJM2120 has the same electrical characteristics as the NJM4558.

The NJM2120 is suitable for Audio, Video, Electrical musical instrument...etc.

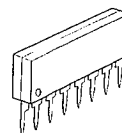
■ PACKAGE OUTLINE



NJM2120D



NJM2120M

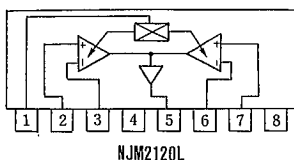
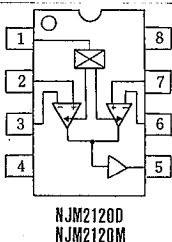


NJM2120L

■ FEATURES

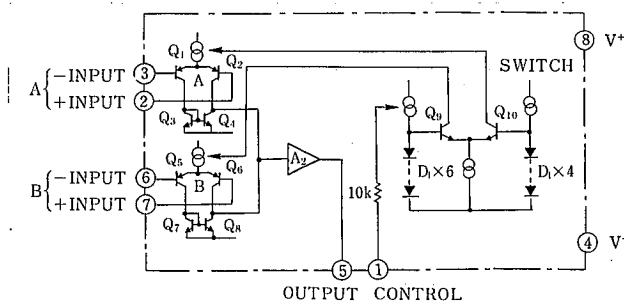
- Analog Switch Function
- Operating Voltage ( $\pm 2.5V \sim \pm 18V$ )
- Slew Rate ( $2.2V/\mu s$  typ.)
- Wide Unity Gain Bandwidth ( $7MHz$  typ.)
- Package Outline DIP8, DMP8, SIP8
- Bipolar Technology

■ PIN CONFIGURATION



- PIN FUNCTION
1. SW. CONTROL
  2. A +INPUT
  3. A -INPUT
  4. V-
  5. OUTPUT
  6. B -INPUT
  7. B +INPUT
  8. V+

■ EQUIVALENT CIRCUIT



## ■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V <sup>+</sup> /V <sup>-</sup>	±18	V
Differential Input Voltage	V <sub>ID</sub>	±30	V
Input Voltage	V <sub>IC</sub>	±15 (note)	V
Output Current	I <sub>O</sub>	±50	mA
Power Dissipation	P <sub>D</sub>	(DIP8) 500	mW
		(DMP8) 300	mW
		(SIP8) 800	mW
Operating Temperature Range	T <sub>opr</sub>	-40 ~ +85	°C
Storage Temperature Range	T <sub>stg</sub>	-40 ~ +125	°C

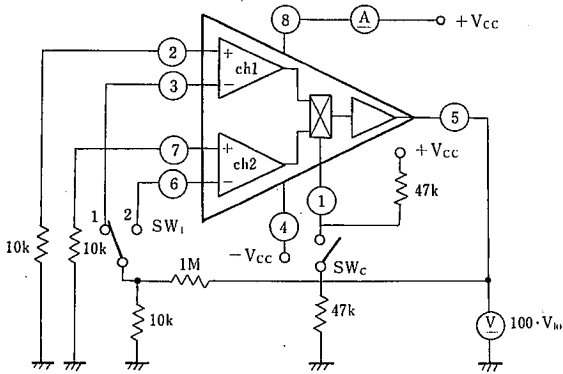
## ■ ELECTRICAL CHARACTERISTICS

(V<sup>+</sup>/V<sup>-</sup> = ±15V, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current	I <sub>CC</sub>	V <sub>in</sub> SW ON	—	2.3	6.0	mA
		SW OFF	—	2.1	6.0	mA
Input Offset Voltage	V <sub>IO</sub>	R <sub>S</sub> = 10kΩ	—	0.8	6.0	mV
Input Bias Current	I <sub>B</sub>		—	80	500	nA
Large Signal Voltage Gain	A <sub>V</sub>	R <sub>L</sub> = 2kΩ	—	100	—	dB
Maximum Output Voltage Swing	V <sub>OM</sub>	R <sub>L</sub> = 10kΩ	±12	±14	—	V
Total Harmonic Distortion	THD	f=1kHz, V <sub>O</sub> =5V <sub>rms</sub> , G <sub>V</sub> =20dB	—	0.002	—	%
Supply Voltage Rejection Ratio	SVR		—	20	150	μV/V
Channel Separation	CS	f=1kHz	—	82	—	dB
Unity Gain Bandwidth	f <sub>T</sub>	G <sub>V</sub> = 0dB	—	7	—	MHz
Slew Rate	SR	G <sub>V</sub> = 0dB, R <sub>L</sub> = 2kΩ/100pF	—	2.2	—	V/μs
Equivalent Input Noise Voltage	V <sub>NI</sub>	R <sub>S</sub> = 1kΩ, BW = 10Hz~30kHz, Flat	—	2.0	—	μV <sub>rms</sub>

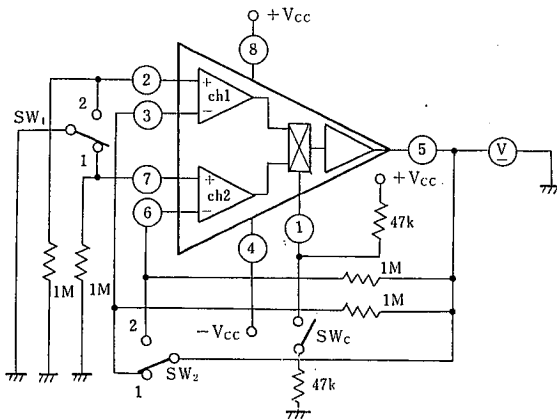
## TEST CIRCUIT

(1)  $I_{cc}$ ,  $V_{io}$ , SVR



	SW <sub>c</sub>	SW <sub>1</sub>	Select ch
$I_{cc1}$ , $V_{io1}$ , SVR <sub>1</sub>	OFF	1	ch 1
$I_{cc2}$ , $V_{io2}$ , SVR <sub>2</sub>	ON	2	ch 2

(2)  $I_b$ ,  $I_o$



Unit Resistance:  $\Omega$   
Capacity: F

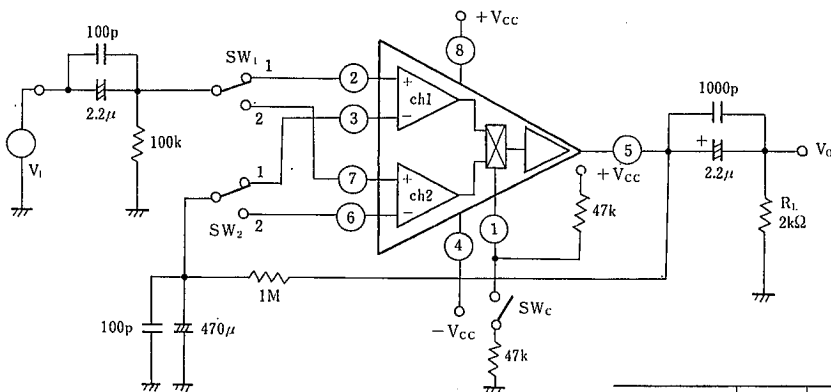
$$I_b^+ = V_o^+ / 1M\Omega$$

$$I_b^- = V_o^- / 1M\Omega$$

$$I_{io} = |I_b^+ - I_b^-|$$

	SW <sub>c</sub>	SW <sub>1</sub>	SW <sub>2</sub>	Select ch
$V_{o1}$	OFF	1	1	ch 1
$V_{o1}$	OFF	2	2	ch 1
$V_{o2}$	ON	2	2	ch 2
$V_{o2}$	ON	1	1	ch 2

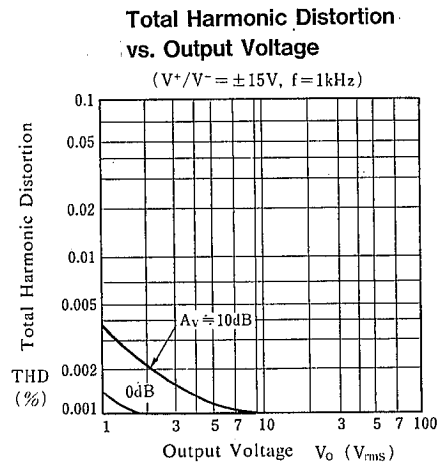
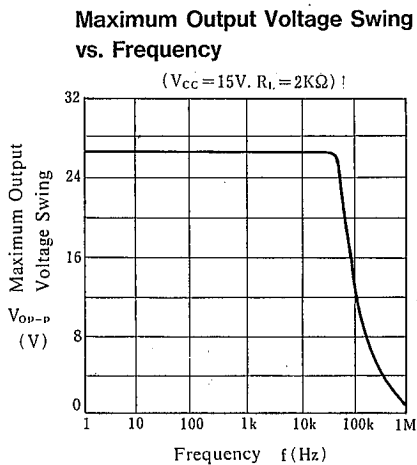
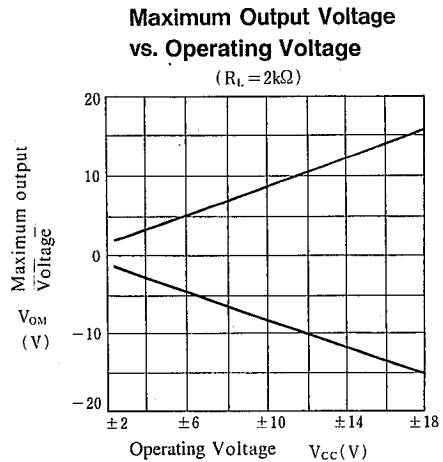
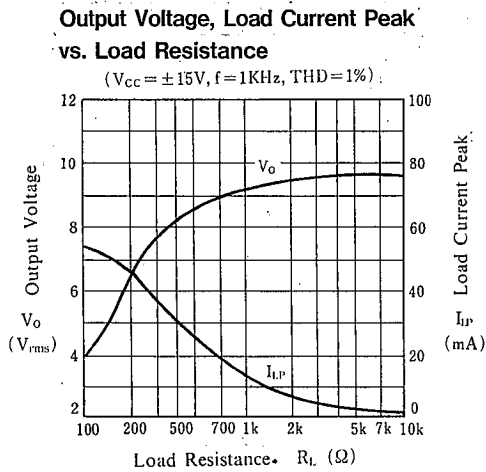
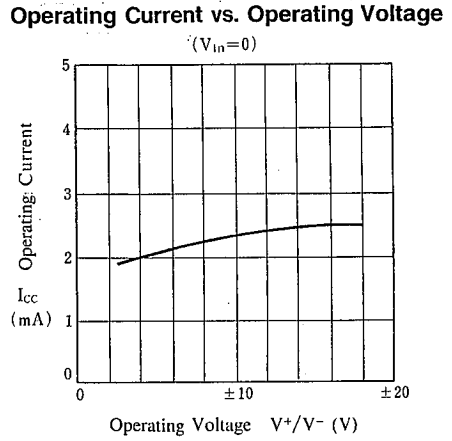
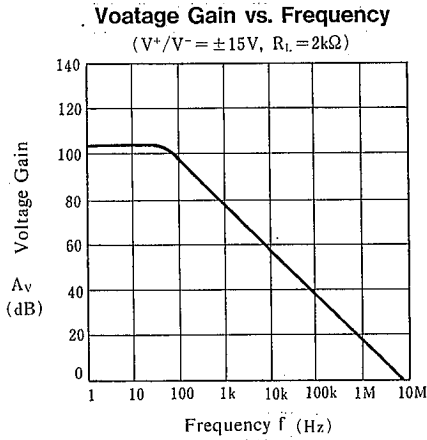
(3)  $f_t$ ,  $A_v$



Unit Resistance:  $\Omega$   
Capacity: F

	SW <sub>c</sub>	SW <sub>1</sub>	SW <sub>2</sub>	Selection
$f_{t1}$ , $A_{v1}$	OFF	1	1	ch 1
$f_{t2}$ , $A_{v2}$	ON	2	2	ch 2

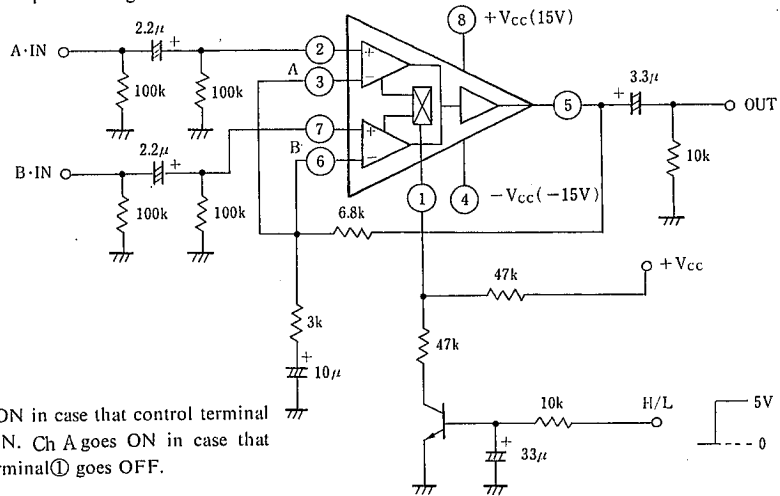
■ TYPICAL CHARACTERISTICS



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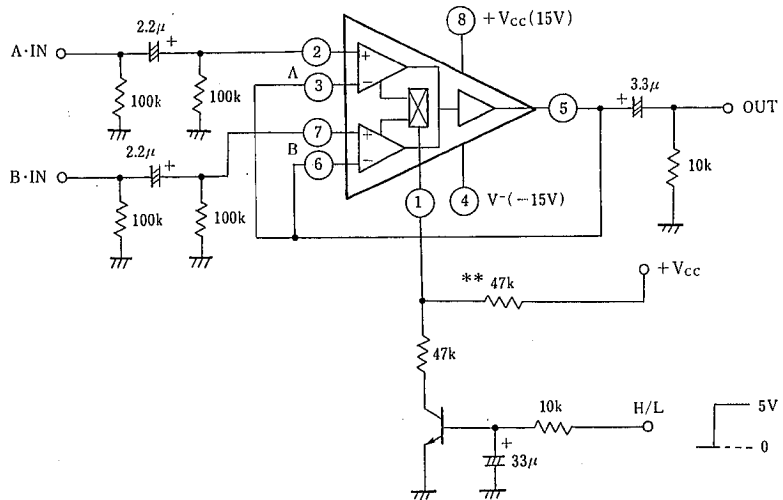
## APPLICATION CIRCUIT

(1)  $G_V \approx 10\text{dB}$  FLAT Amp + Analog Switch Circuit



\*Ch B goes ON in case that control terminal ① goes ON. Ch A goes ON in case that control terminal ① goes OFF.

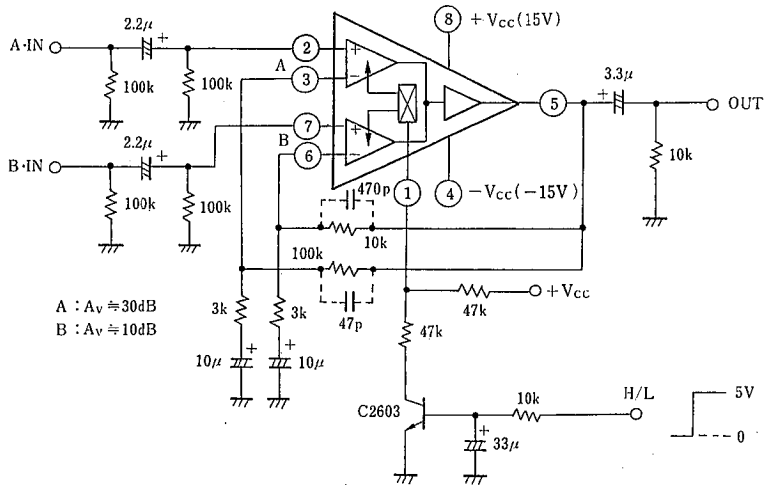
(2) Analog Switch Circuit ( $G_V=0\text{dB}$  Voltage Follower Amp)



\*:\*\*Resistanc(\*\*) is Pull-up-resistance for prevent from switching terminal ① going ON by leakage of external circuit (TR...etc).

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■ TYPICAL APPLICATION CIRCUIT



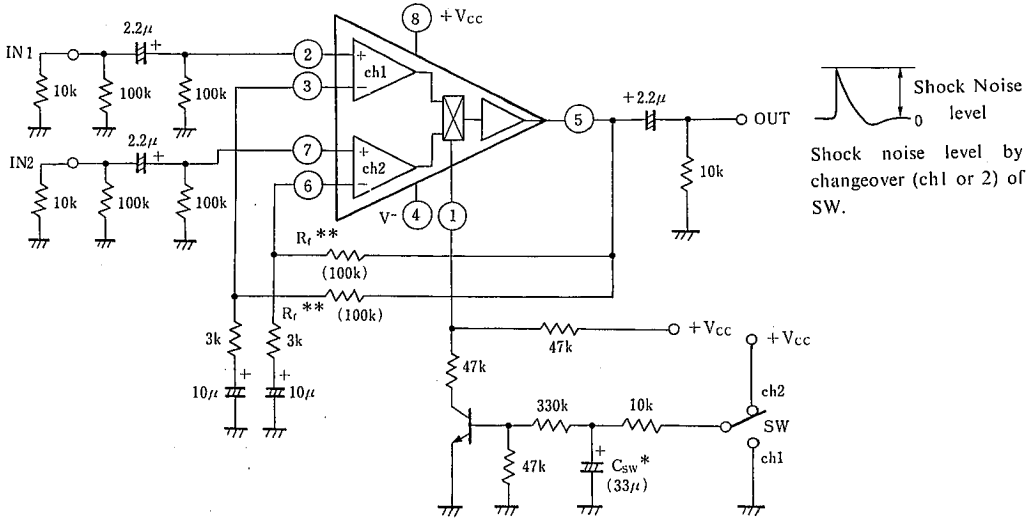
\* Ch B goes ON in case that control terminal  
 ① goes ON. Ch A goes ON in case that  
 control terminal ① goes OFF.

Unit Resistance: Ω  
 Capacity : F

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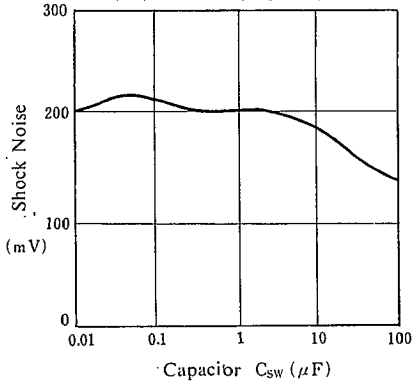
## SHOCK NOISE TEST

Test Circuit



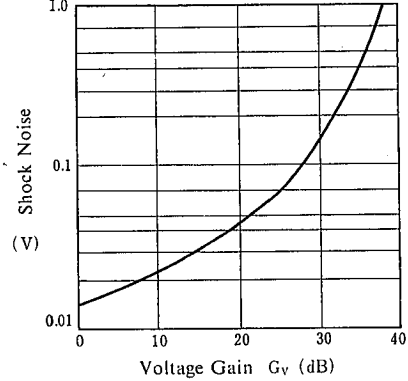
Shock Noise vs. Capacitor  $C_{sw}$

( $V^+/V^- = \pm 15V$ ,  $C_{sw} = 33\mu F$ )

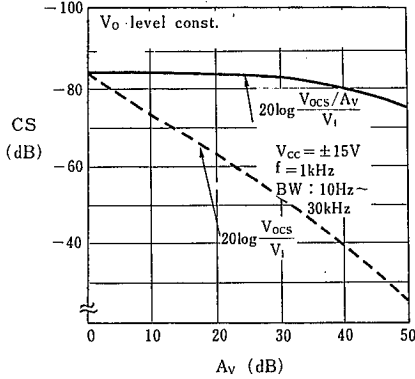


Shock Noise vs. Voltage Gain

( $V^+/V^- = \pm 15V$ ,  $A_v \approx 30dB$ )



■ CHANNEL SEPARATION

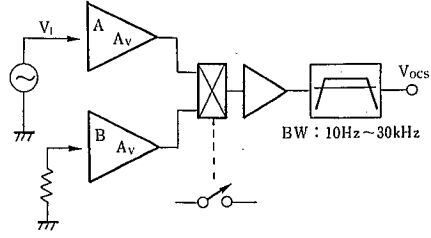


C·S is defined on ratio of reakege signal which occur on input side and input signal.

$$(20 \log \frac{V_{ocs}}{V_i} / A_v)$$

But, C·S seem to be inferior apparently in case that Gain(Av) is left out of consideration.

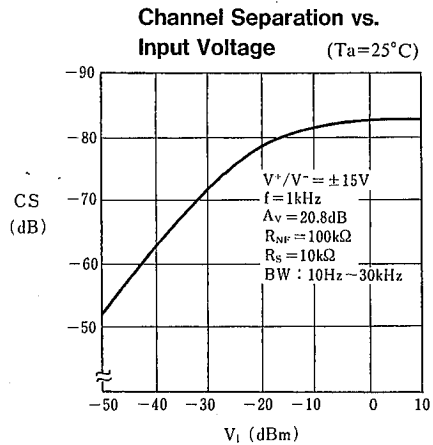
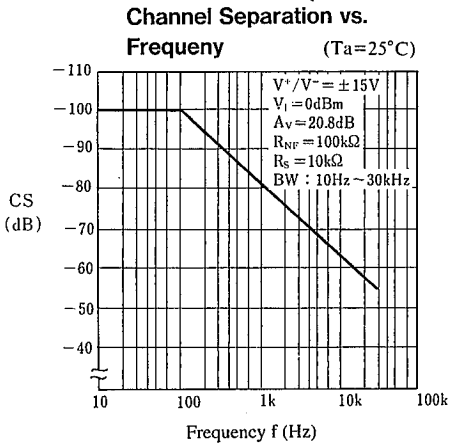
[In case of A:OFF/B:ON]



$$CS = 20 \log \left[ \frac{\text{Input Reakege Level}}{\text{Signal Level}} \right] \text{ (dB)}$$

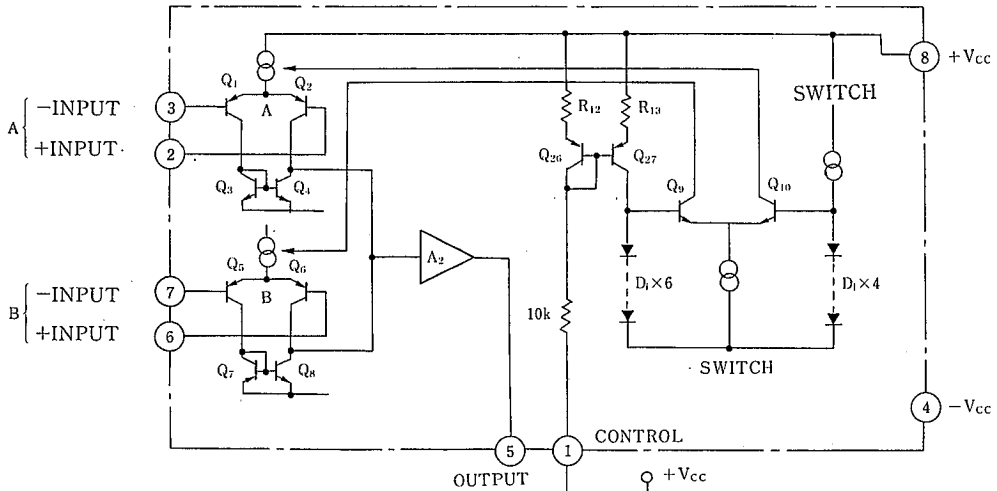
$$= 20 \log \frac{V_{ocs}/A_v}{V_i} \text{ (dB)}$$

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## SWITCHING MECHANISM

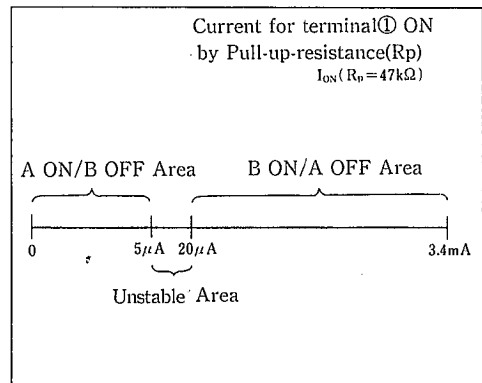
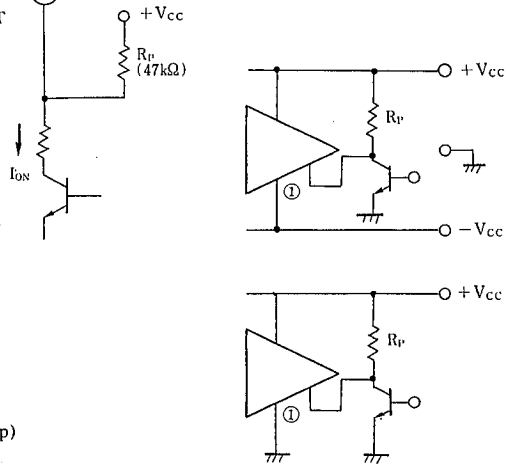


Switching mechanism of NJM2120 is as follows.

Switch signal is communicated in case that  $V_F$  of Q26 goes ON: on current mirror which is composed with Q26 and Q27. Q10 goes ON by 4 diodes of Q10 in case that terminal ① goes OFF and Amp(ch A) goes active. Q9 goes ON by 6 diodes of Q9 in case that terminal ① goes ON and Amp(ch B) goes active. So, NJM2120 have merit that drive system is controlled freely. Because drive system is not related to supply voltage system (Single supply type/Two supply type) in order that switch change by current ON/OFF.

But this switch goes ON by very little current because of signal communicate system which depend on ON of  $V_F$

So, please use NJM2120 under the condition of lowering sensitivity for current ON/OFF by external Pull-up-resistance( $R_p$ )



## MEMO

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