

## OPERATIONAL AMPLIFIER WITH SWITCH

### ■ GENERAL DESCRIPTION

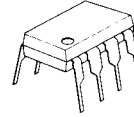
The NJM2120 is a dual operational amplifier of 2-INPUT and 1-OUTPUT with analog switch. The NJM2120 can be used as analog switch under the condition of  $G_v=0\text{dB}$ , as Switch + Amp in order that each gain (A or B) can be adjusted independently. Each amplifier of the NJM2120 has the same electrical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

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

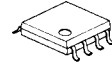
### ■ FEATURES

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

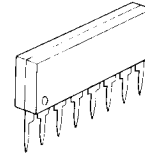
### ■ PACKAGE OUTLINE



NJM2120D

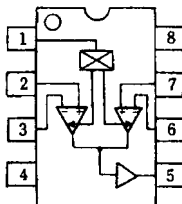


NJM2120M

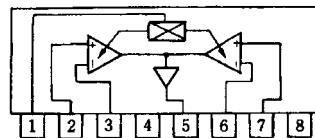


NJM2120L

### ■ PIN CONFIGURATION



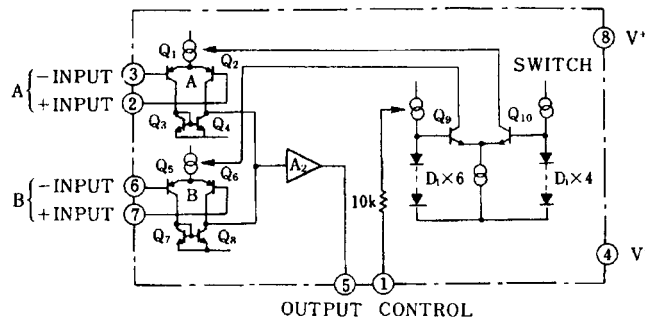
NJM2120D  
NJM2120M



NJM2120L

- 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



# NJM2120

## ■ ABSOLUTE MAXIMUM RATINGS

( Ta=25°C )

| PARAMETER                   | SYMBOL      | RATINGS                                      | UNIT |
|-----------------------------|-------------|--|------|
| Supply Voltage              | $V^+ / V^-$ | ± 18   | V    |
| Differential Input Voltage  | $V_{ID}$    | ± 30   | V    |
| Input Voltage               | $V_{IC}$    | ± 15   | V    |
| Output Current              | $I_O$       | ± 50   | mA   |
| Power Dissipation           | $P_D$       | ( DIP8 ) 500<br>( DMP8 ) 300<br>( SIP8 ) 800 | mW   |
| Operating Temperature Range | $T_{opr}$   | -40~+85                                      | °C   |
| Storage Temperature Range   | $T_{stg}$   | -40~+125                                     | °C   |

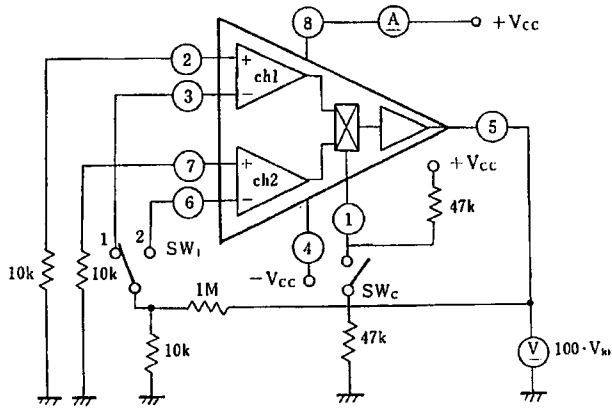
## ■ ELECTRICAL CHARACTERISTICS

(  $V^+ / V^- = \pm 15V, Ta = 25^\circ C$  )

| PARAMETER                      | SYMBOL   | TEST CONDITION                               | MIN. | TYP.  | MAX. | UNIT          |
|--------------------------------|----------|--|------|-------|------|---------------|
| Operating Current              | $I_{CC}$ | $V_{IN}$ SW ON                               | -    | 2.3   | 6.0  | mA            |
|                                |          | SW OFF                                       | -    | 2.1   | 6.0  | mA            |
| Input Offset Voltage           | $V_{IO}$ | $R_S = 10k\Omega$                            | -    | 0.8   | 6.0  | mV            |
| Input Bias Current             | $I_B$    |  | -    | 80    | 500  | nA            |
| Large Signal Voltage Gain      | $A_V$    | $R_L = 2k\Omega$                             | -    | 100   | -    | dB            |
| Maximum Output Voltage Swing   | $V_{OM}$ | $R_L = 10k\Omega$                            | ± 12 | ± 14  | -    | V             |
| Total Harmonic Distortion      | THD      | $f = 1kHz, V_O = 5V_{rms}, G_V = 20dB$       | -    | 0.002 | -    | %             |
| Supply Voltage Rejection Ratio | SVR      |  | -    | 20    | 150  | $\mu V/V$     |
| Channel Separation             | CS       | $f = 1kHz$                                   | -    | 82    | -    | dB            |
| Unity Gain Bandwidth           | $f_T$    | $G_V = 0dB$                                  | -    | 7     | -    | MHz           |
| Slew Rate                      | SR       | $G_V = 0dB, R_L = 2k\Omega / 100pF$          | -    | 2.2   | -    | $V/\mu s$     |
| Equivalent Input Noise Voltage | $V_{NI}$ | $R_S = 1k\Omega, BW = 10Hz \sim 30kHz, Flat$ | -    | 2.0   | -    | $\mu V_{rms}$ |

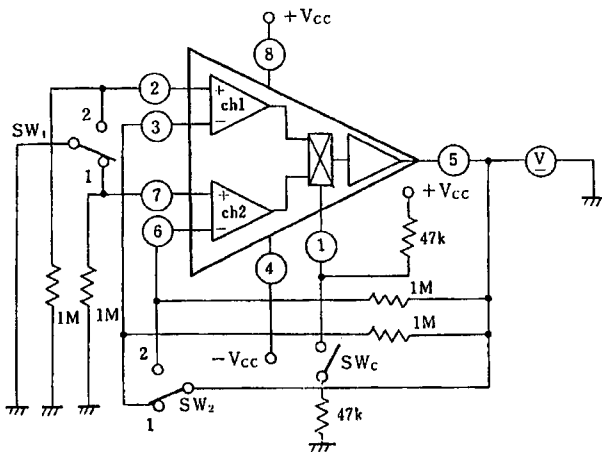
## ■ TEST CIRCUIT

(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)  $I_b$ ,  $I_{io}$



Unit Resistance:  $\Omega$   
Capacity : F

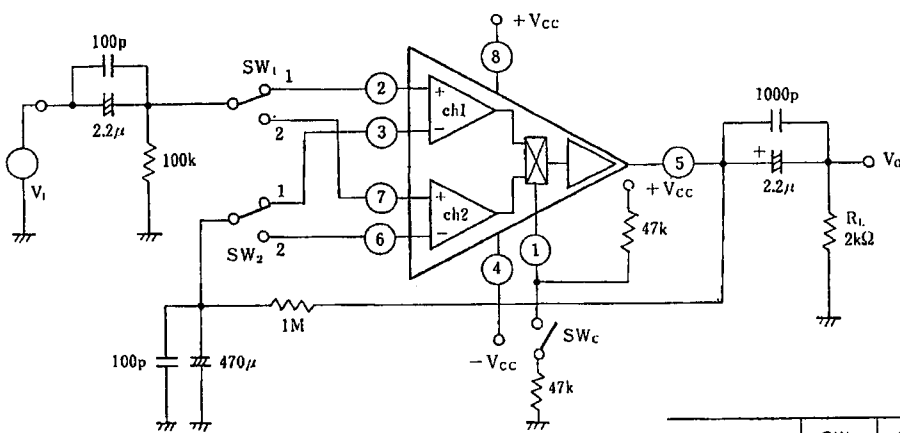
$$I_b^+ = V_o^+ / 1M\Omega$$

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

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

|          | 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      |

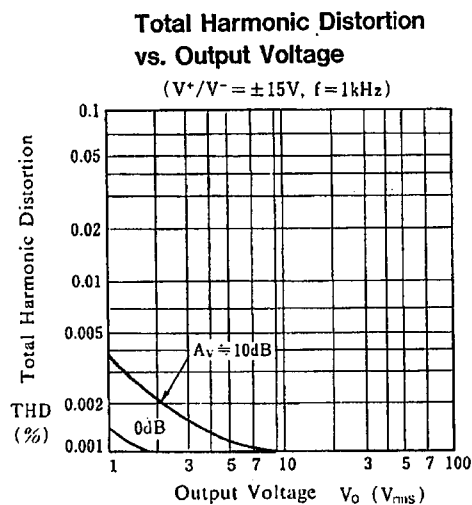
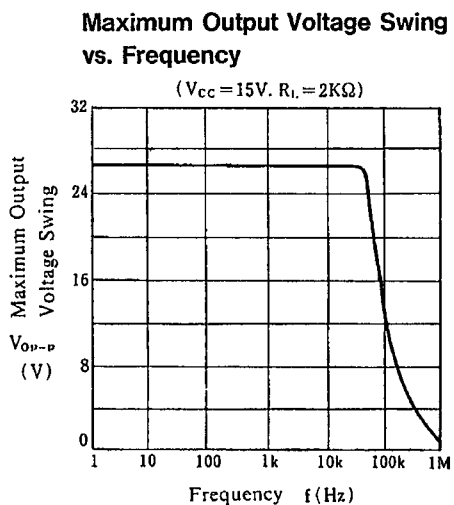
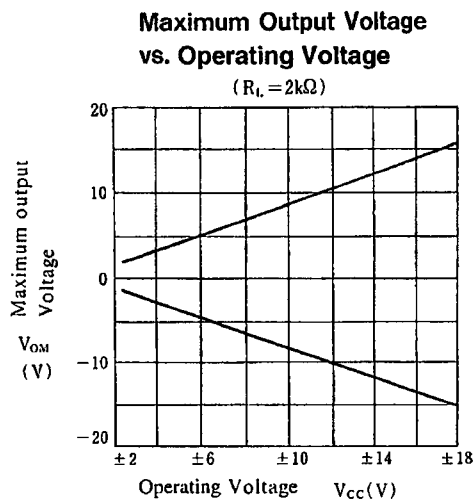
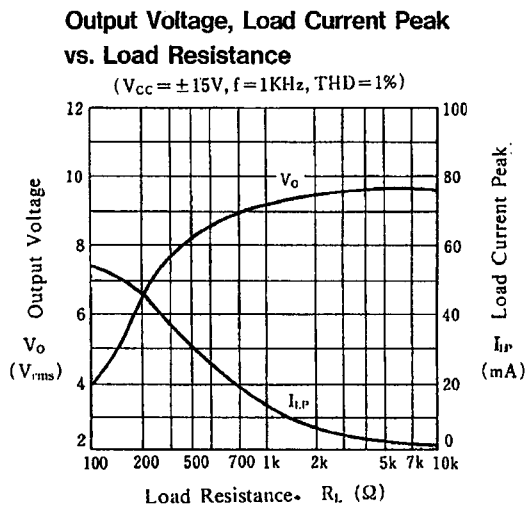
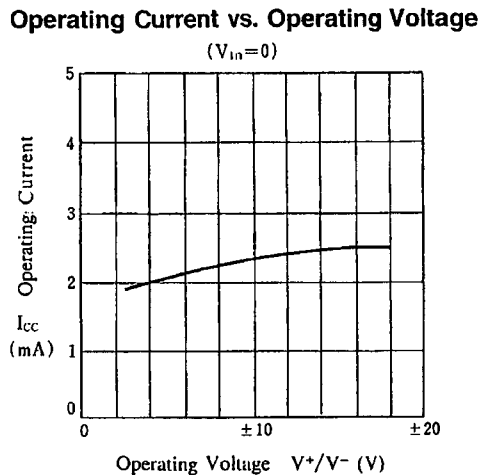
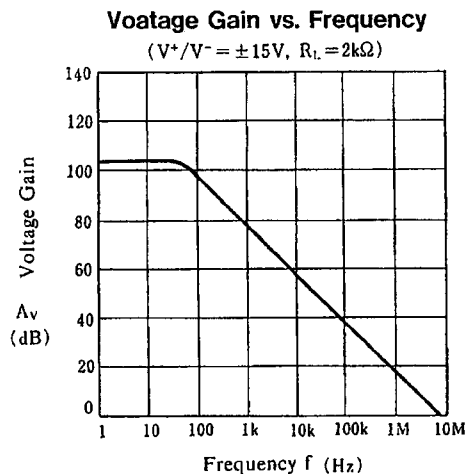
(3)  $f_t$ ,  $A_v$



Unit Resistance:  $\Omega$   
Capacity : F

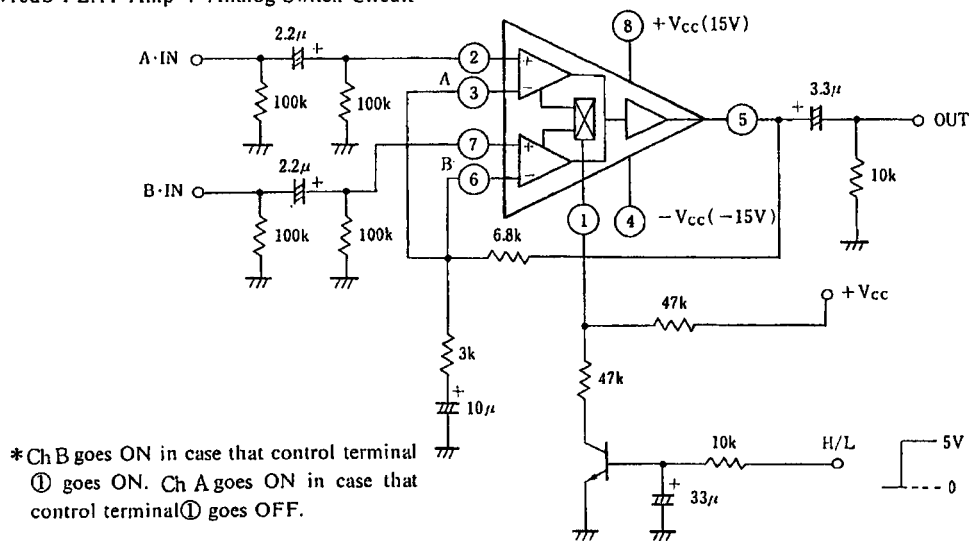
|                     | SW <sub>c</sub> | SW <sub>1</sub> | SW <sub>2</sub> | Selection |
|---------------------|-----------------|-----------------|-----------------|-----------|
| $f_{t1}$ , $A_{v1}$ | OFF             | 1               | 1               | ch 1      |
| $f_{t2}$ , $A_{v2}$ | ON    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

## ■ TYPICAL CHARACTERISTICS

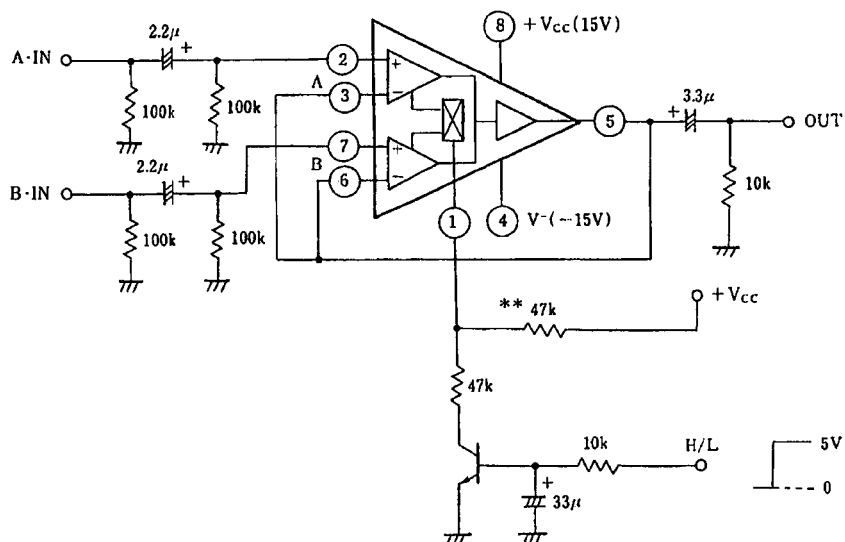


## APPLICATION CIRCUIT

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



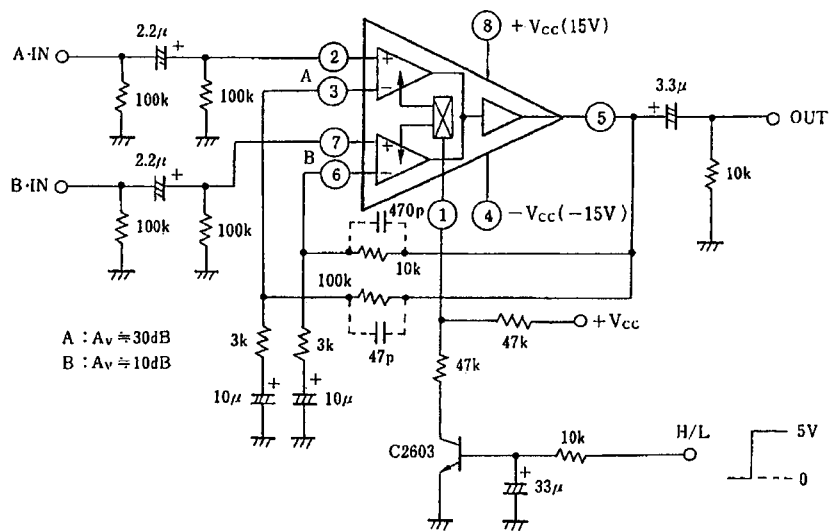
(2) Analog Switch Circuit ( $G_v=0\text{dB}$  Voltage Follower Amp)



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

# NJM2120

## ■ TYPICAL APPLICATION CIRCUIT

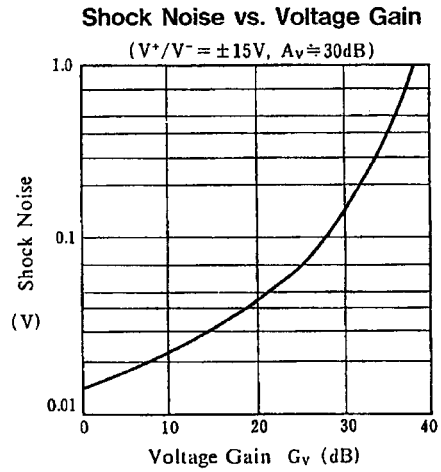
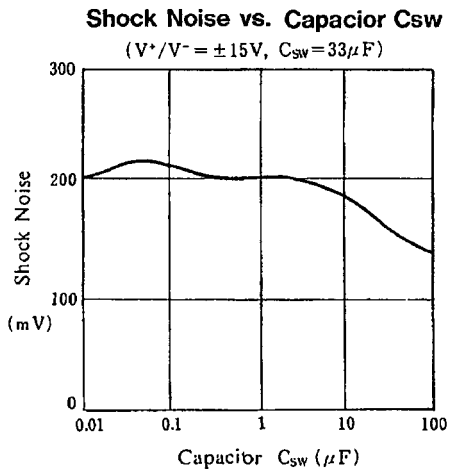
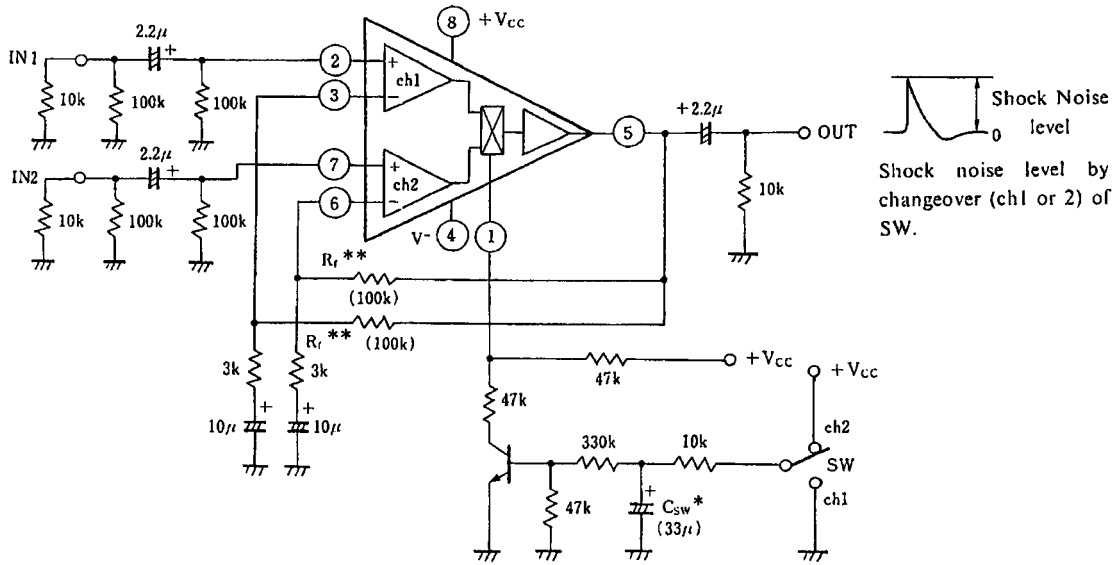


\*Ch B goes ON in case that control terminal ① goes ON. Ch A goes ON in case that control terminal ① goes OFF.

Unit Resistance:  $\Omega$   
Capacity : F

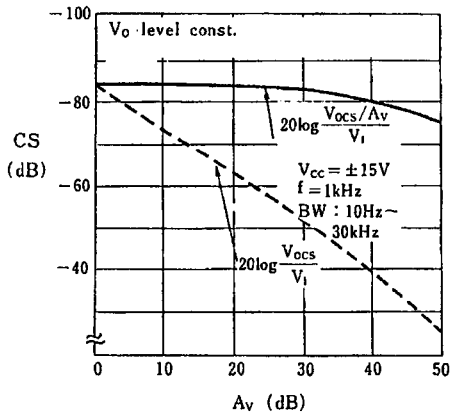
## SHOCK NOISE TEST

Test Circuit

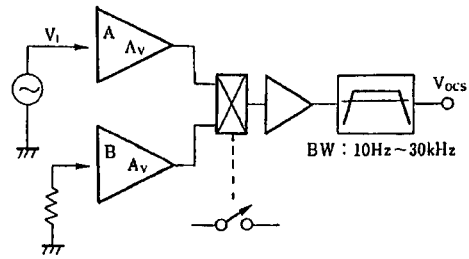


# NJM2120

## CHANNEL SEPARATION



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



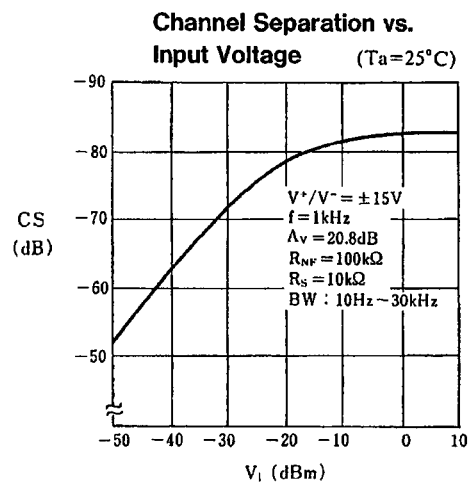
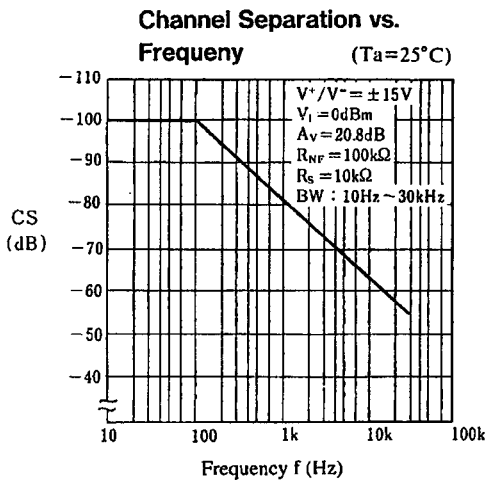
$$CS = 20\log \left[ \frac{\text{Input Reakage Level}}{\text{Signal Level}} \right] \text{ (dB)}$$

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

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

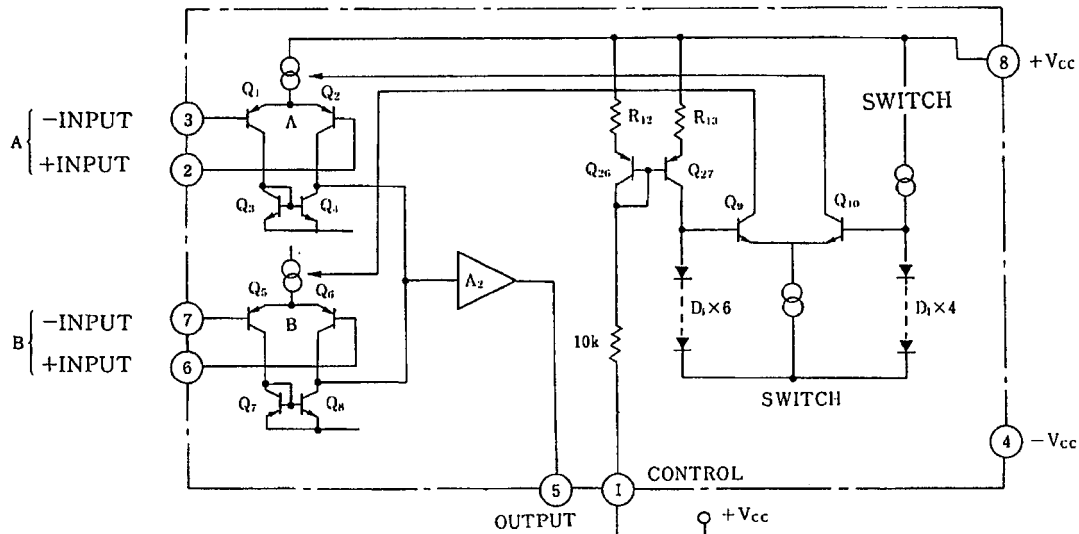
$$\left( 20\log \frac{V_{ocs}}{V_i} \right)$$

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





## ■ SWITCHING MECHANISM

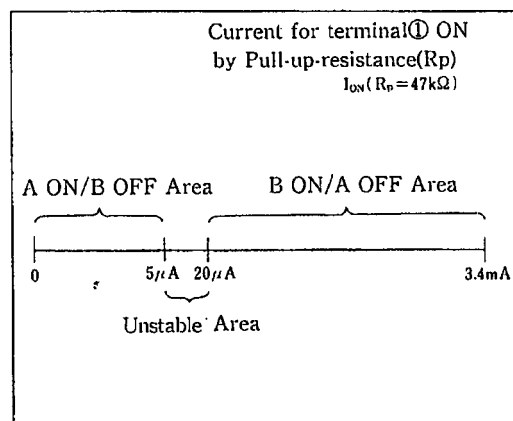
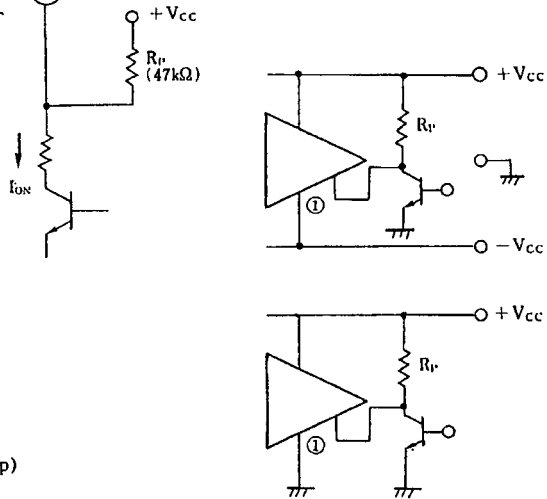


Switching mechanism of NJM2120 is as follows.

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( $R_p$ )



**[CAUTION]**

The specifications on this databook are only given for information, without any guarantee as regards either mistakes or omissions. The application circuits in this databook are described only to show representative usages of the product and not intended for the guarantee or permission of any right including the industrial rights.