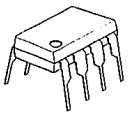
SWITCHING OPERATIONAL AMPLIFIER

■ 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 Gv=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.

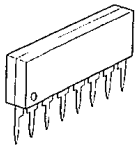
The NJM2120 is suitable for Audio, Video, Electrical musical instrument...etc.

■ PACKAGE OUTLINE



NJM2120D

NJM2120M

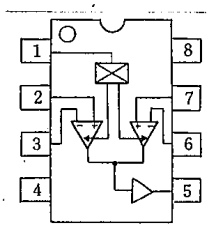


NJM2120L

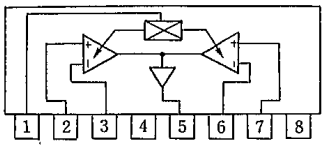
■ FEATURES

- Analog Switch Function
- Operating Voltage (±2.5V～±18V)
- Slew Rate (2.2V/ μs typ.)
- Wide Unity Gain Bandwidth (7MHz typ.)
- Package Outline DIP8, DMP8, SIP8
- Bipolar Technology

■ PIN CONFIGURATION



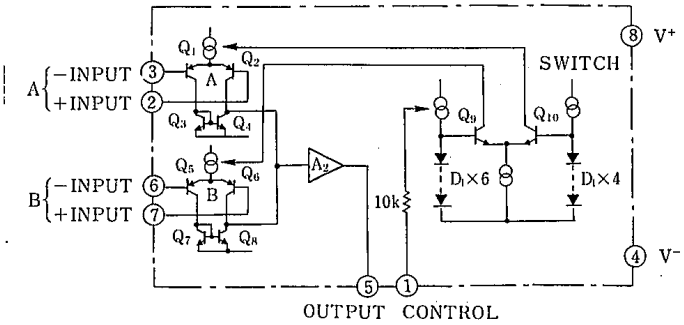
NJM2120D
NJM2120M



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



■ ABSOLUTE MAXIMUM RATINGS

(Ta=25℃)

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

■ ELECTRICAL CHARACTERISTICS

(V^+/V^-=±15V, Ta=25℃)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current	I_{CC}	Vin SW ON	—	2.3	6.0	mA
		SW OFF	—	2.1	6.0	mA
Input Offset Voltage	V_{IO}	R_S =10kΩ	—	0.8	6.0	mV
Input Bias Current	I_B		—	80	500	nA
Large Signal Voltage Gain	A_V	R_L =2kΩ	—	100	—	dB
Maximum Output Voltage Swing	V_{OM}	R_L =10kΩ	±12	±14	—	V
Total Harmonic Distortion	THD	f=1kHz, Vo=5Vrms, Gv=20dB	—	0.002	—	%
Supply Voltage Rejection Ratio	SVR		—	20	150	μV/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 =2kΩ/100pF	—	2.2	—	V/μs
Equivalent Input Noise Voltage	V_{NI}	Rs= 1kΩ, BW=10Hz～30kHz, Flat	—	2.0	—	μVrms

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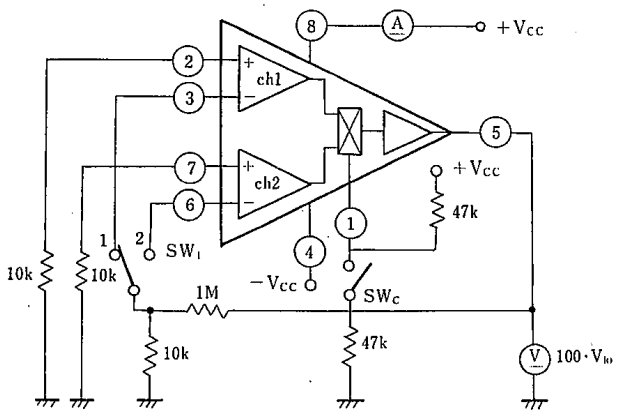
■ TEST CIRCUIT

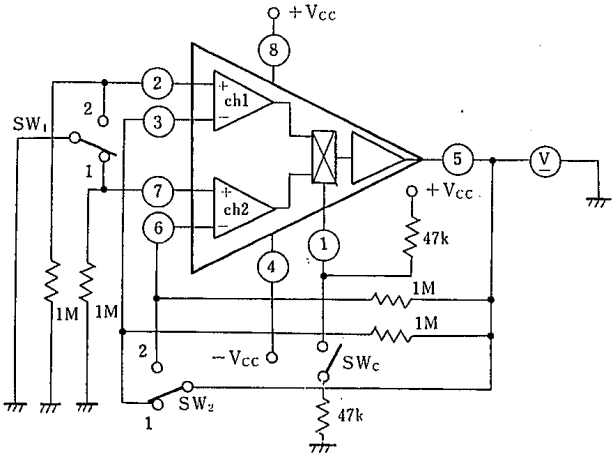
(1) I_{cc}, V_{Io}, SVR



	SW_C	SW_1	Select ch
I_{CC1}, V_{IO1}, SVR_1	OFF	1	ch 1
I_{CC2}, V_{IO2}, SVR_2	ON	2	ch 2

Unit Resistance: Ω
Capacity : F

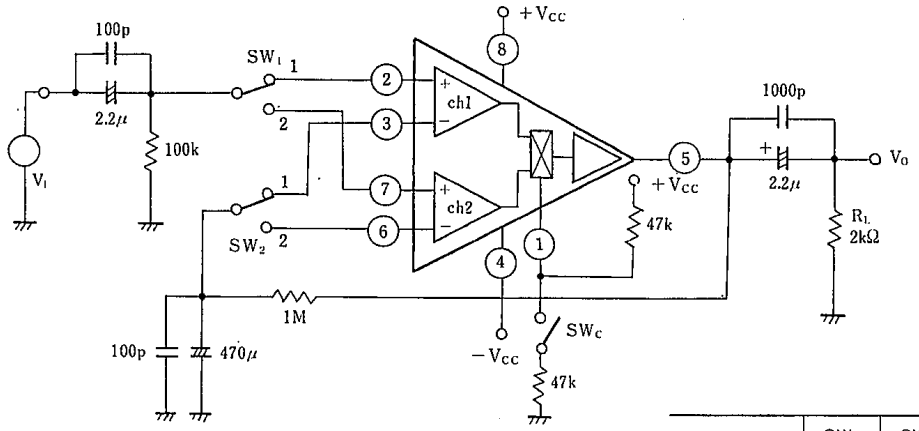
(2) I_b, I_{Io}



$I_b{}' = V_o{}^+/1M\Omega$
$I_b{}^- = V_o{}^-/1M\Omega$
$I_{IO} = |I_b{}^+ - I_b{}^-|$

	SW_C	SW_1	SW_2	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) ft, A_V



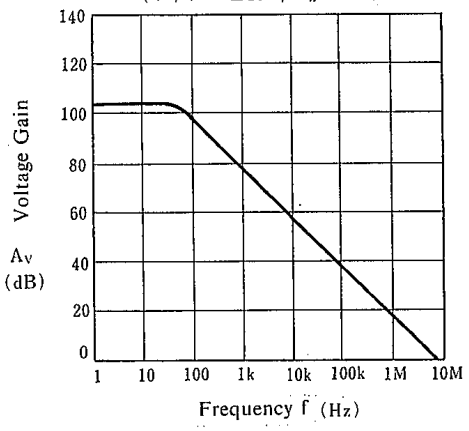
Unit Resistance: Ω
Capacity : F

	SW_C	SW_1	SW_2	Selection
f_{t1}, A_{V1}	OFF	1	1	ch 1
f_{t2}, A_{V2}	ON	2	2	ch 2

■ TYPICAL CHARACTERISTICS

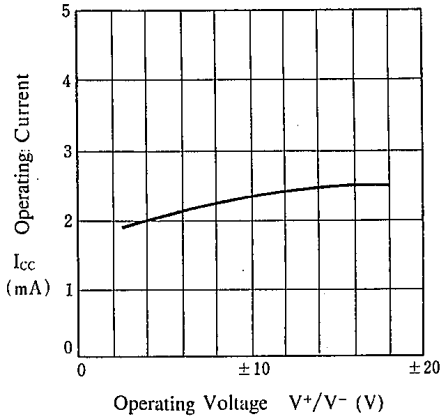
Voatage Gain vs. Frequency

($V^+/V^-=\pm15V$, $R_L=2k\Omega$)



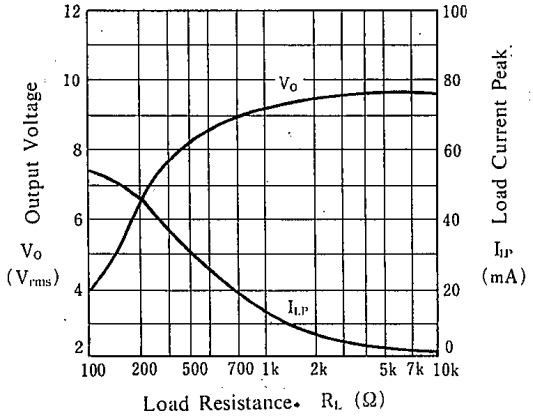
Operating Current vs. Operating Voltage

($V_{in}=0$)



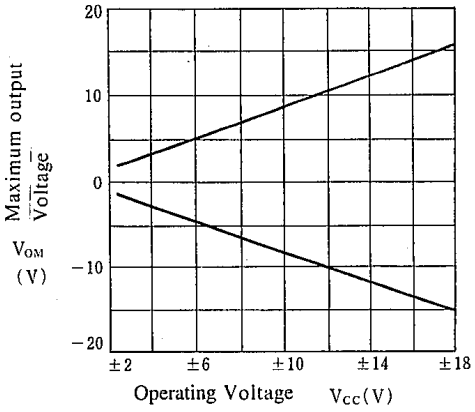
Output Voltage, Load Current Peak vs. Load Resistance

($V_{CC}=\pm15V$, f=1KHz, THD=1%)



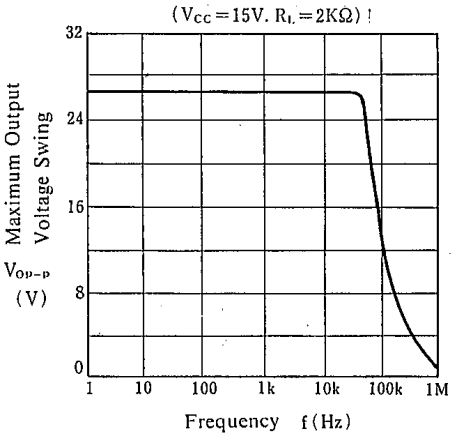
Maximum Output Voltage vs. Operating Voltage

($R_L=2k\Omega$)



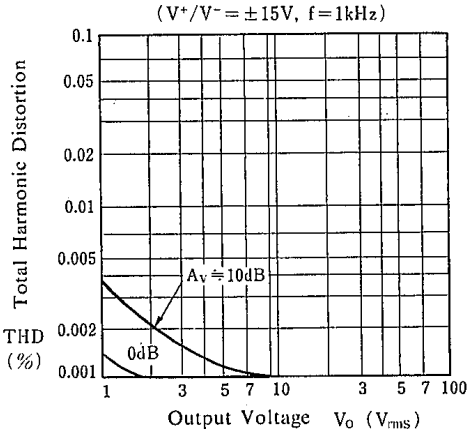
Maximum Output Voltage Swing vs. Frequency

($V_{CC}=15V$, $R_L=2K\Omega$)



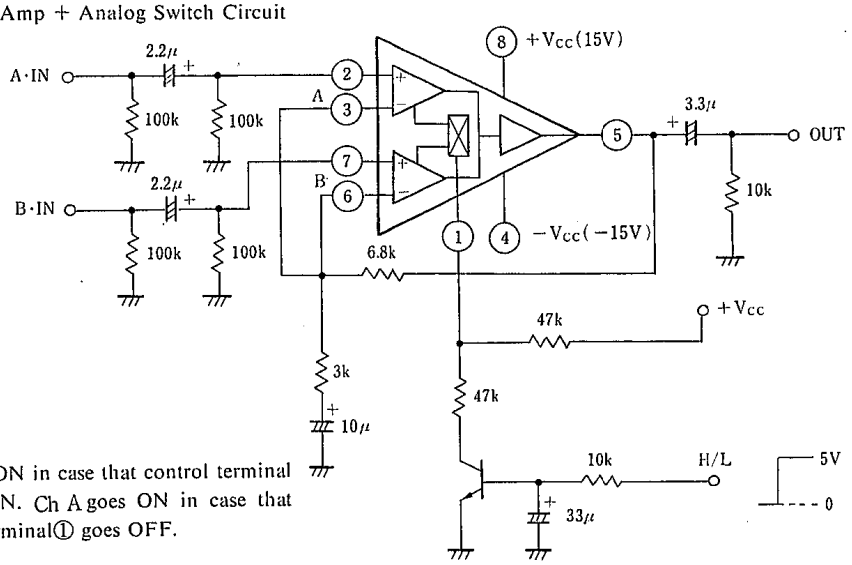
Total Harmonic Distortion vs. Output Voltage

($V^+/V^-=\pm15V$, f=1kHz)



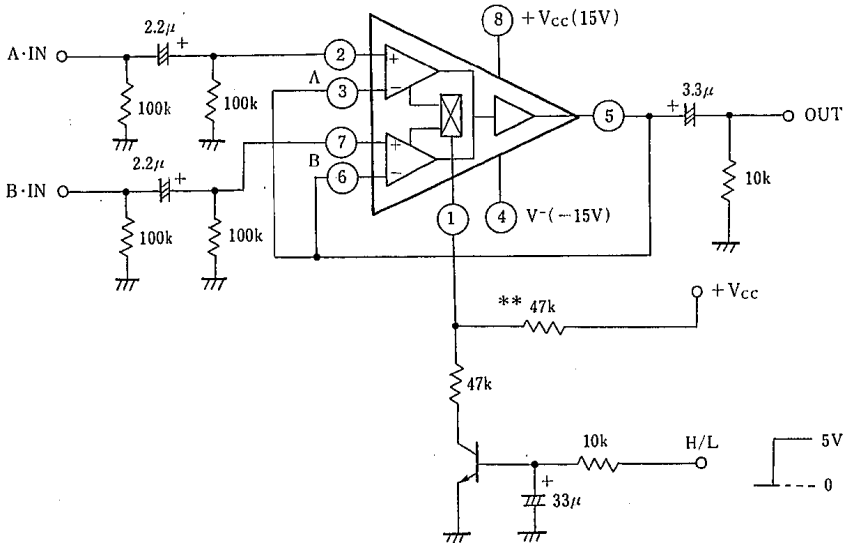
■ APPLICATION CIRCUIT

(1) $G_V \fallingdotseq 10$dB FLAT Amp + Analog Switch Circuit



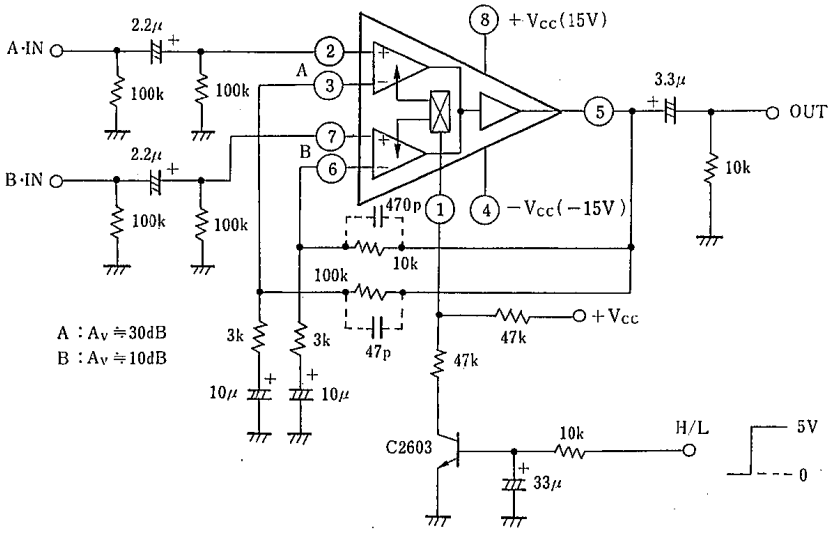
*Ch B goes ON in case that control terminal ① goes ON. Ch A goes ON in case that control terminal① goes OFF.

(2) Analog Switch Circuit (GV=0dB Voltage Follower Amp)



*:*Resistanc(**) is Pull-up-resistance for prevent from switching terminal① going ON by reakage of external circuit (TR...etc).

■ TYPICAL APPLICATION CIRCUIT



*Ch B goes ON in case that control terminal ① goes ON. Ch A goes ON in case that control terminal① goes OFF.

Unit Resistance: Ω
Capacity : F

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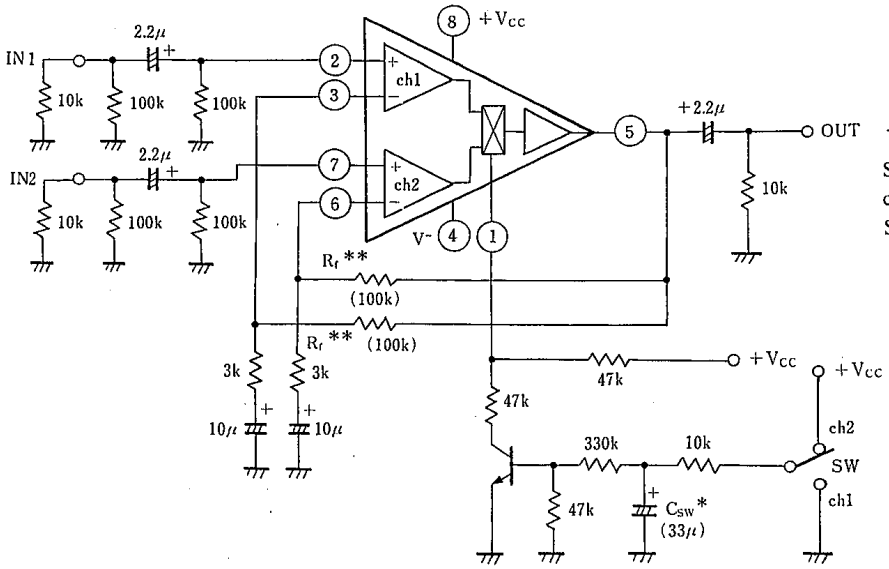
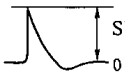
■ SHOCK NOISE TEST

Test Curcuit

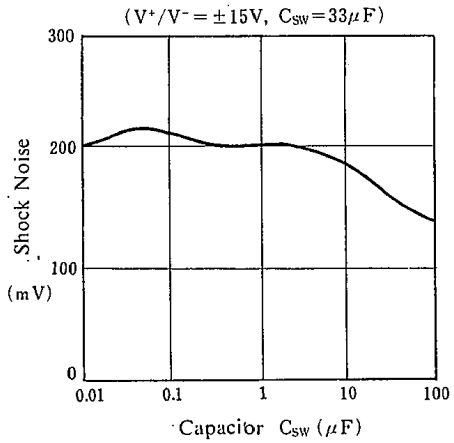




Shock noise level by changeover (ch1 or 2) of SW.

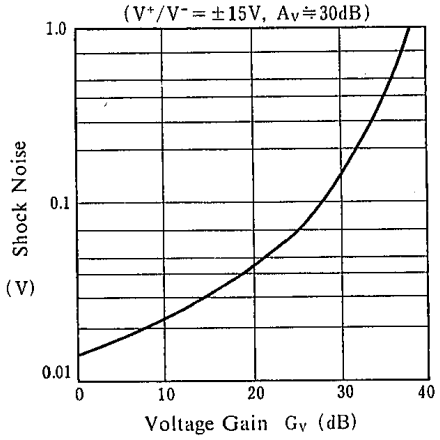
Shock Noise vs. Capacior Csw

($V^+/V^-=\pm15V$, $C_{SW}=33\mu F$)

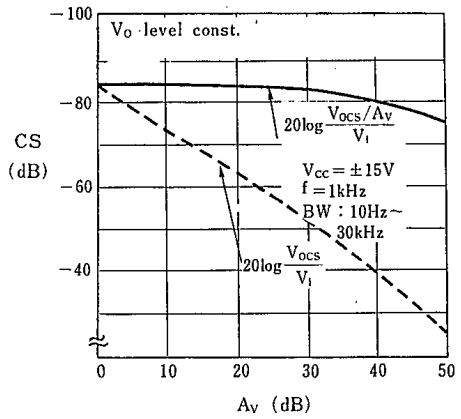


Shock Noise vs. Voltage Gain

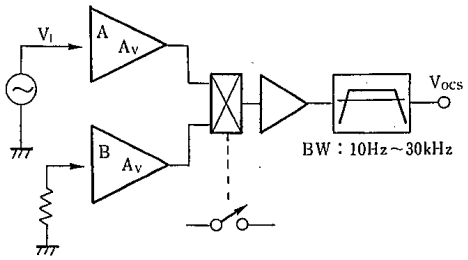
($V^+/V^-=\pm15V$, $A_V\fallingdotseq30dB$)



■ CHANNEL SEPARATION



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



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

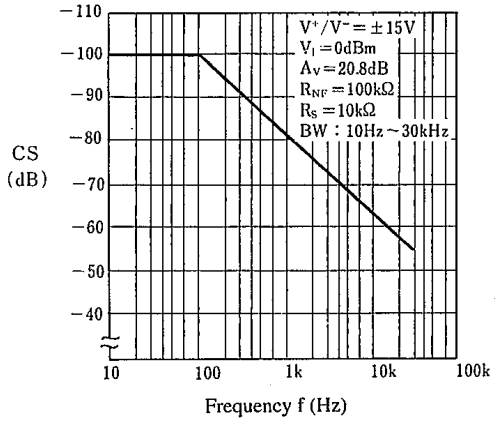
$$= 20\log\frac{Vocs/Av}{Vi} (dB)$$

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

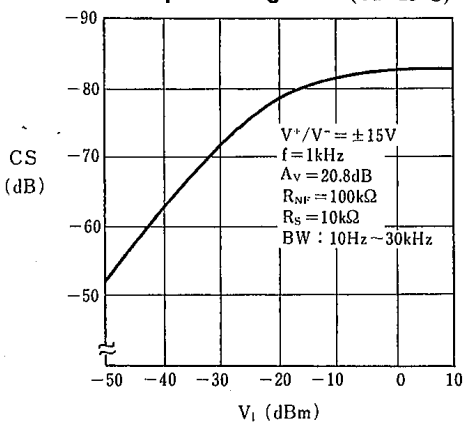
$(20\log\frac{Vocs\ /\ Av}{Vi})$

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

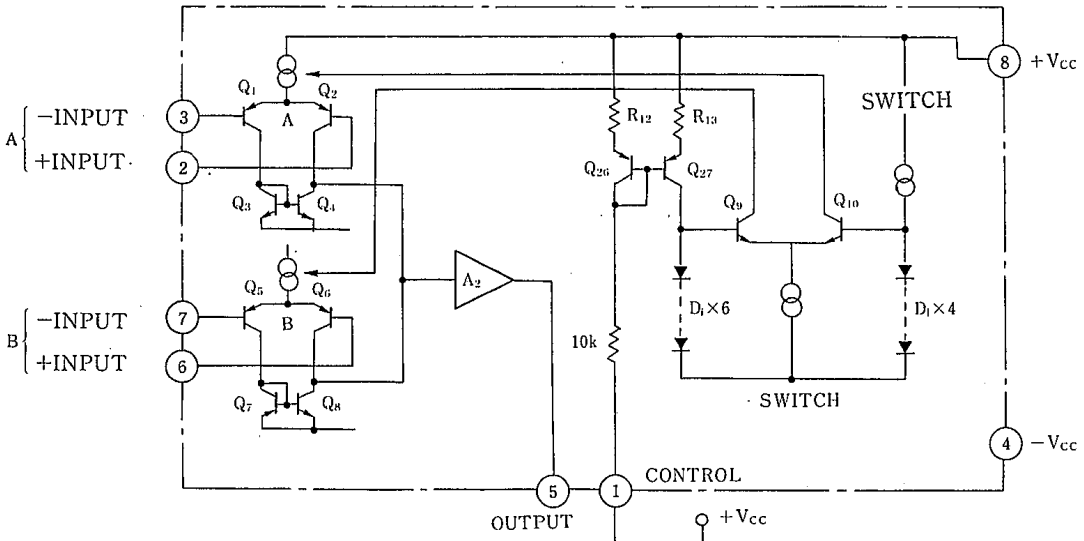
Channel Separation vs. Frequeny (Ta=25°C)

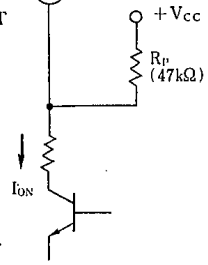


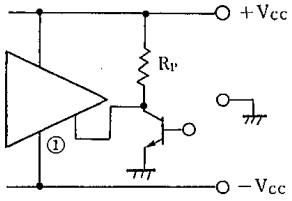
Channel Separation vs. Input Voltage (Ta=25°C)

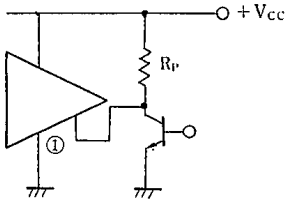


■ SWITCHING MECHANISM







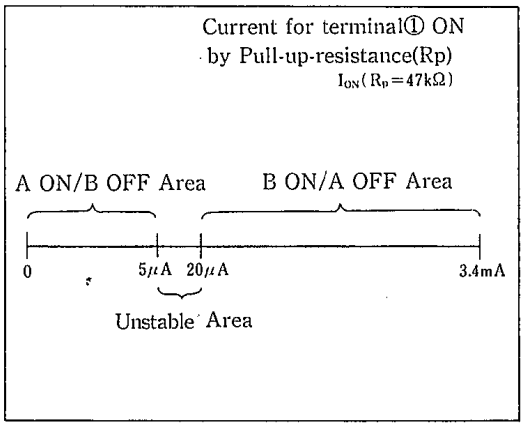


Switching mechanism of NJM2120 is as follows.

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 terminal① goes OFF and Amp(ch A) goes active. Q9 goes ON by 6 diodes of Q9 in case that terminal① 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 conditon of lowerring sensitivity for current ON/OFF by external Pull-up-resistance(Rp)



MEMO