

OPERATIONAL AMPLIFIER WITH SWITCH

■ GENERAL DESCRIPTION

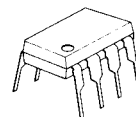
The NJM2120 is a dual operational amplifier of 2-INPUT and 1-OUTPUT with analog switch. The NJM2120 can be used as analog switch under the condition of $G_v=0\text{dB}$, as Switch + Amp in order that each gain (A or B) can be adjusted independently. Each amplifier of the NJM2120 has the same electrical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

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

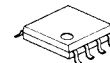
■ FEATURES

- 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 (7MHz typ.)
- Package Outline DIP8, DMP8, SIP8
- Bipolar Technology

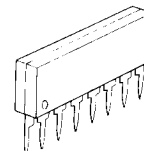
■ PACKAGE OUTLINE



NJM2120D

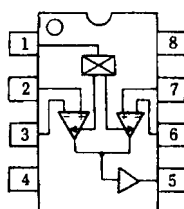


NJM2120M

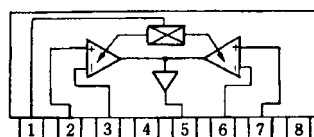


NJM2120L

■ PIN CONFIGURATION



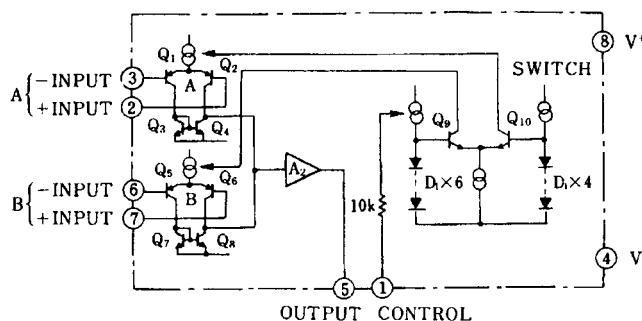
NJM2120D
NJM2120M



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 (DMP8) 300 (SIP8) 800	mW
Operating Temperature Range	T_{opr}	-40~+85	°C
Storage Temperature Range	T_{stg}	-40~+125	°C

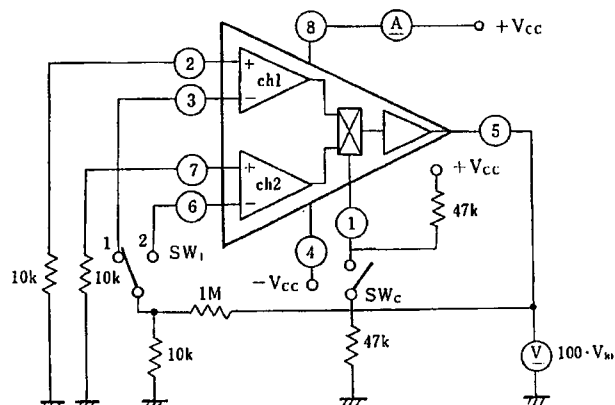
■ ELECTRICAL CHARACTERISTICS

($V^+ / V^- = \pm 15V$, Ta=25°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/ μs
Equivalent Input Noise Voltage	V_{NI}	$R_S = 1k\Omega, BW = 10Hz \sim 30kHz, Flat$	-	2.0	-	μV_{rms}

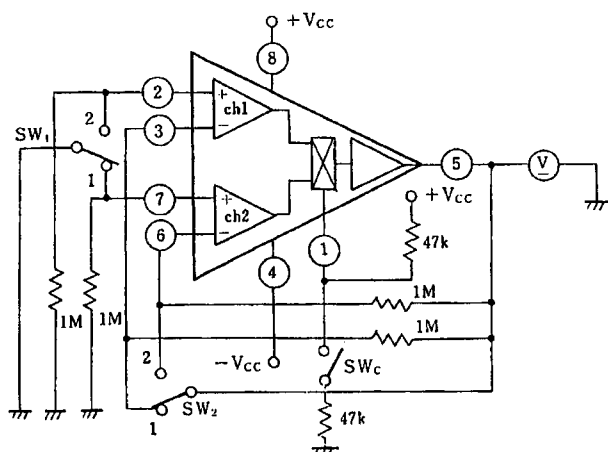
■ TEST CIRCUIT

(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

(2) I_b , I_{IO}



Unit Resistance: Ω
Capacity : F

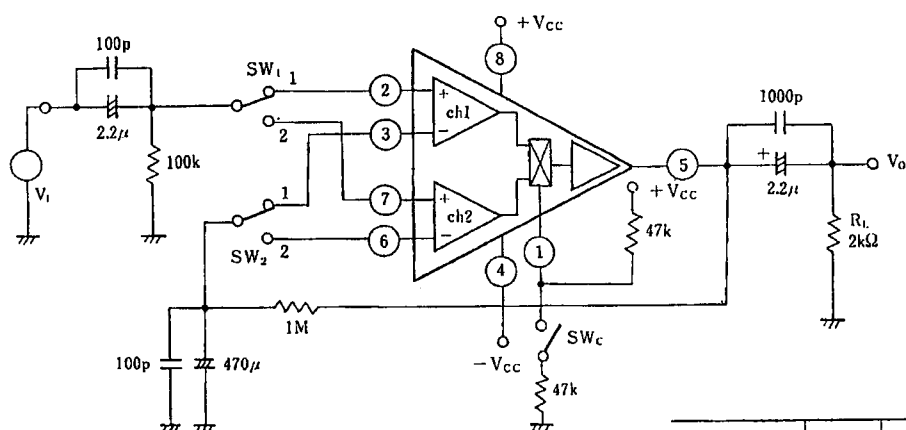
$$I_b^+ = V_o^+ / 1M\Omega$$

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

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

	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

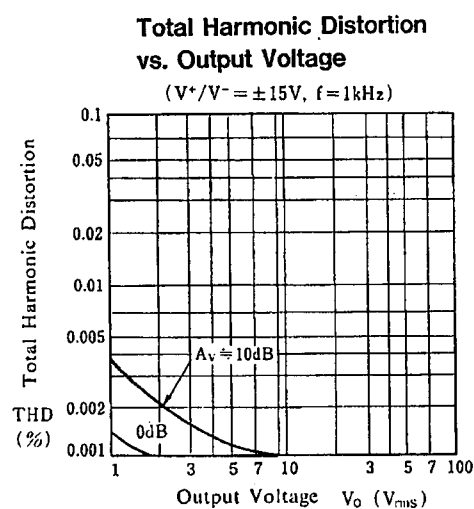
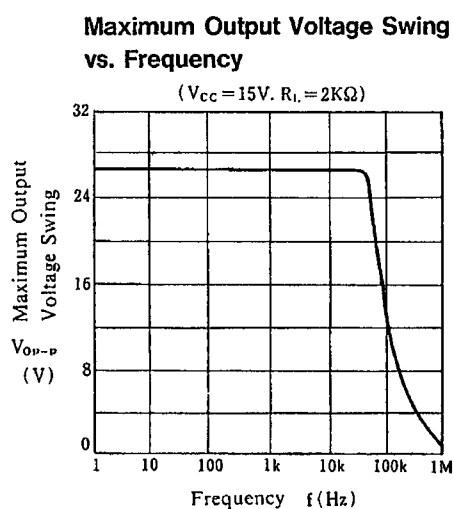
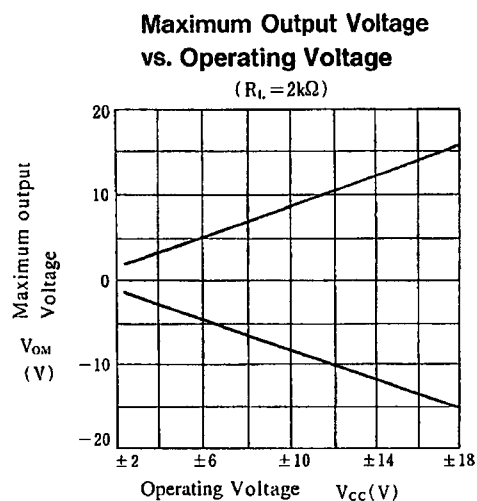
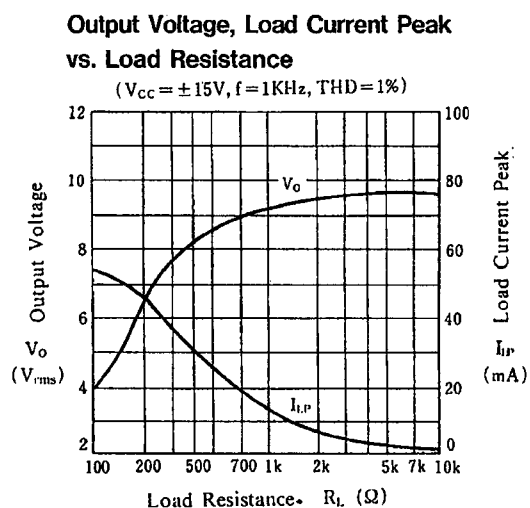
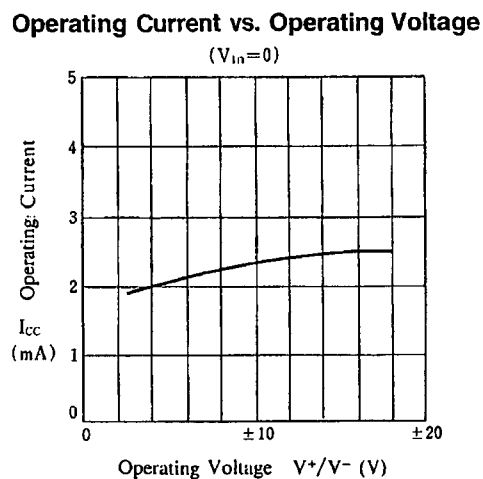
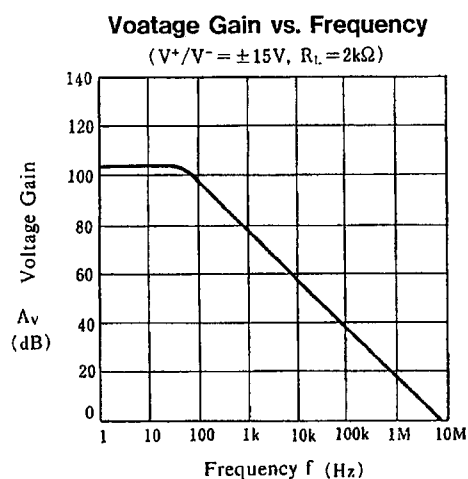
(3) f_t , A_v



Unit Resistance: Ω
Capacity : F

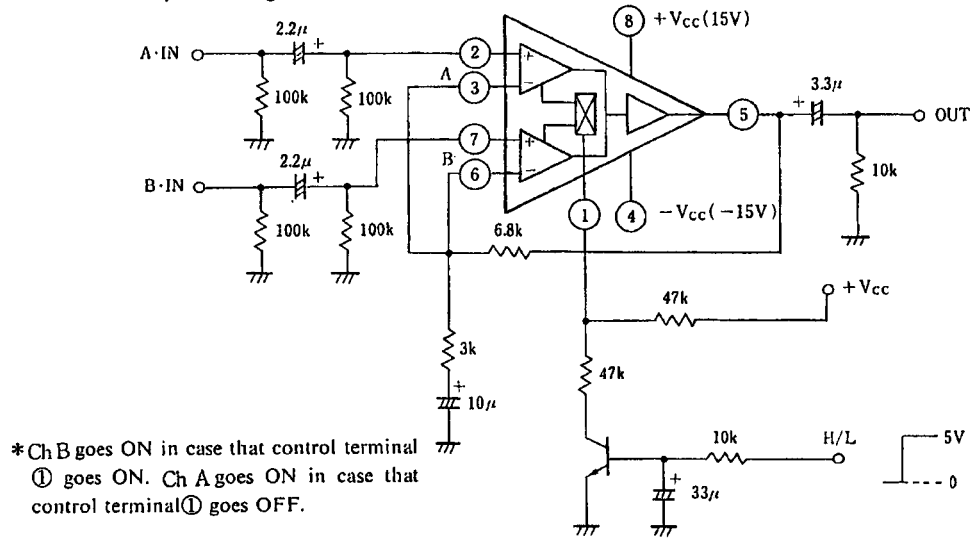
	SW _c	SW ₁	SW ₂	Selection
f_{t1} , A_{v1}	OFF	1	1	ch 1
f_{t2} , A_{v2}	ON	2	2	ch 2

■ TYPICAL CHARACTERISTICS

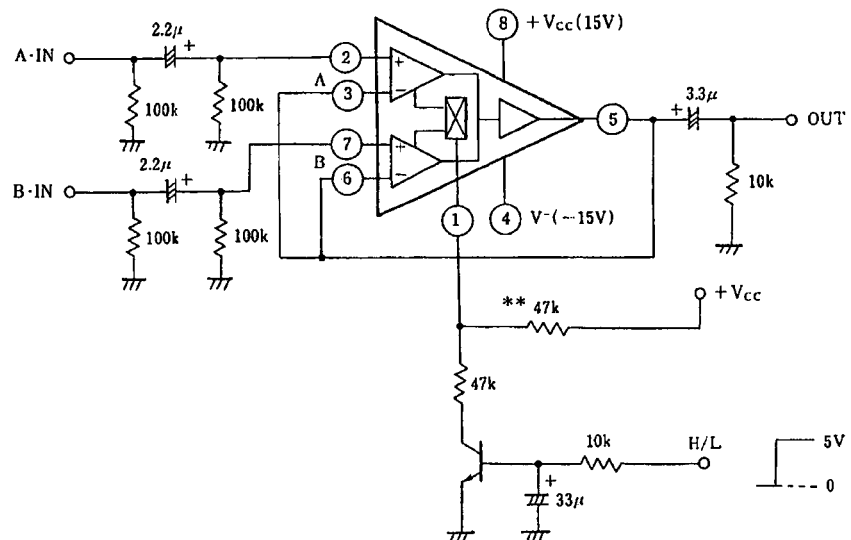


■ APPLICATION CIRCUIT

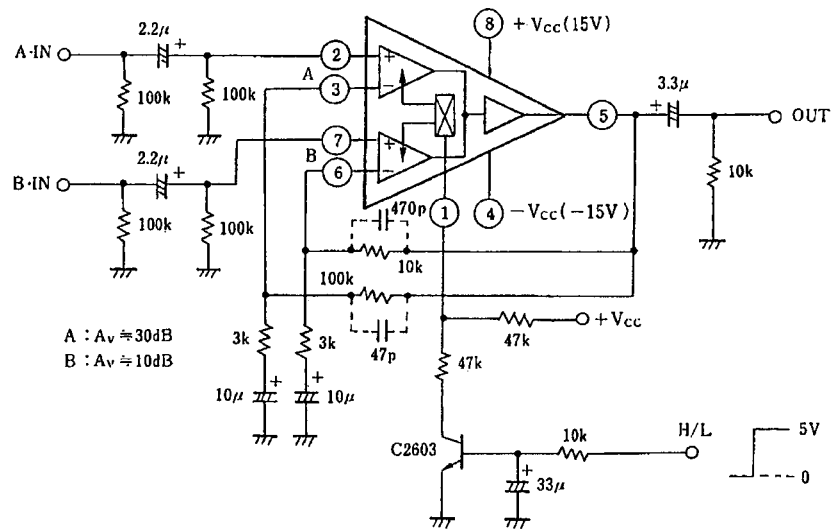
(1) $G_V \approx 10\text{dB}$ FLAT Amp + Analog Switch Circuit



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



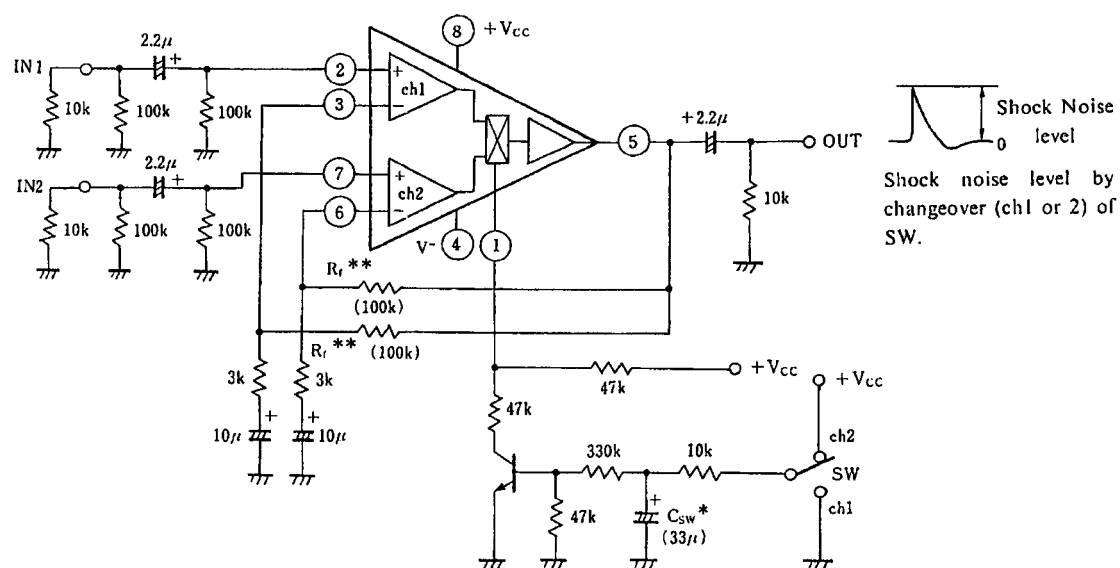
■ TYPICAL APPLICATION CIRCUIT



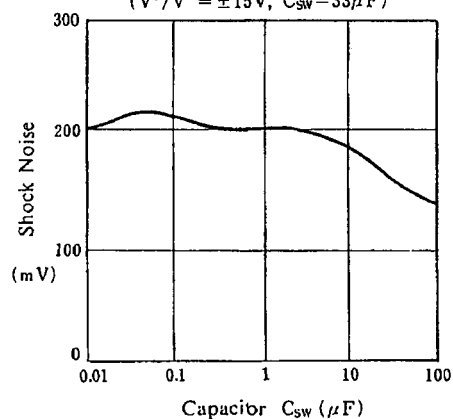
*Ch B goes ON in case that control terminal ① goes ON. Ch A goes ON in case that control terminal ① goes OFF.

■ SHOCK NOISE TEST

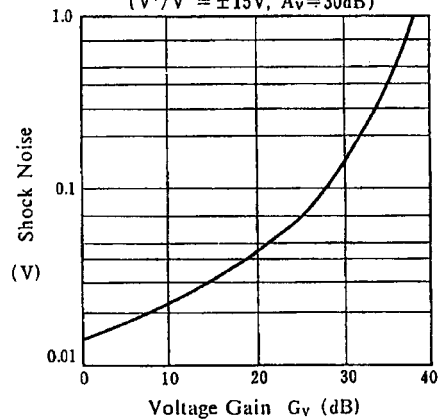
Test Circuit



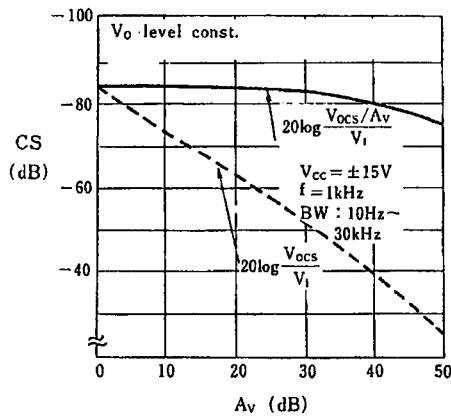
Shock Noise vs. Capacitor Csw

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

Shock Noise vs. Voltage Gain

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

■ CHANNEL SEPARATION

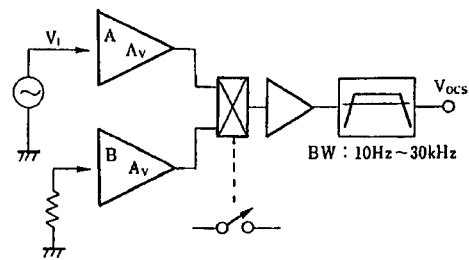


C·S is defined on ratio of reakege signal which occur on input side and input signal.

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

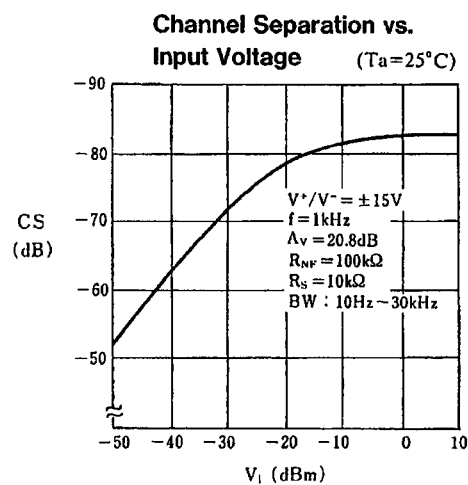
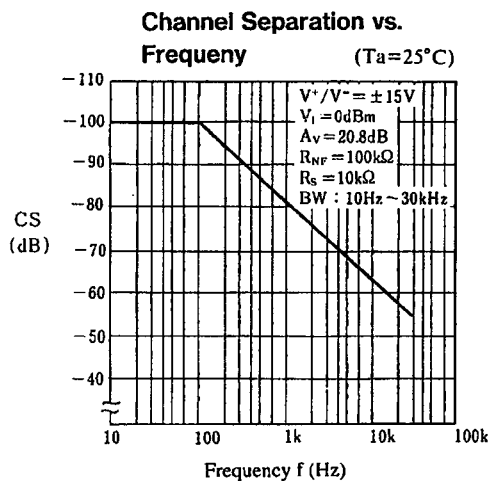
But, C·S seem to be inferior apparently in case that Gain(A_v) is left out of consideration.

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

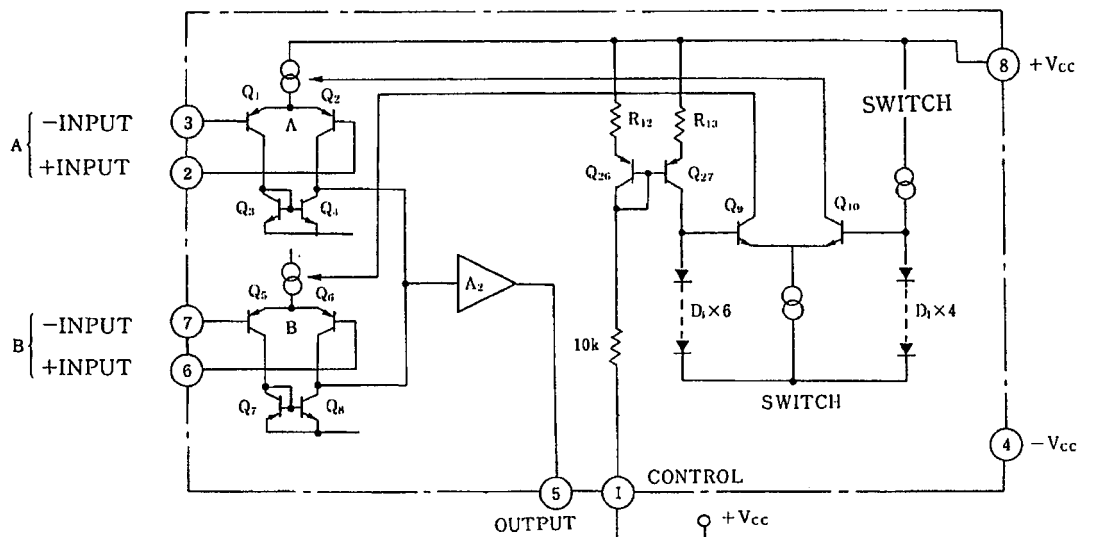


$$CS = 20 \log \left[\frac{\text{Input Reakege Level}}{\text{Signal Level}} \right] \text{ (dB)}$$

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



■ SWITCHING MECHANISM

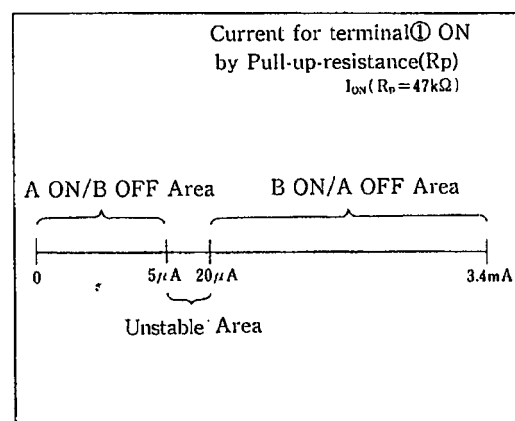
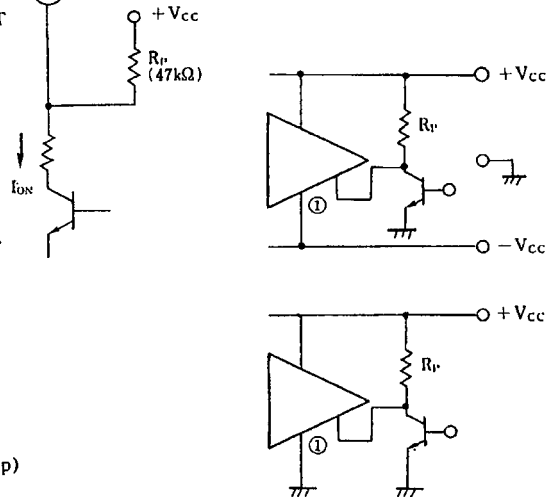


Switching mechanism of NJM2120 is as follows.

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]

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