M5201AL/P/FP

GENERAL PURPOSE SWITCHING OPERATIONAL AMPLIFIER (DUAL INPUT, SINGLE OUTPUT TYPE)

DESCRIPTION

The M5201A is a semiconductor integrated circuit designed for an operational amplifier with analog switching,dual A and B input,and a single output.The device comes in an 8-pin SIP,DIP or FP and contains input differential A and B circuits,single output circuit and operational amplifier switching circuit, and can be used as a convertional operational amplifier,activating on A or B input by externally setting the control pin level high or low.For a voltage follower condition where Gv=0dB,the device functoins merely as an analog switch, but, for switching amplifier functoin, gain can be set independently for A and B input.The M5201A operational amplifier has basic characteristics similar to those of the M5218/M5R4558P and can be used in audio,video and musical instrument equipment.

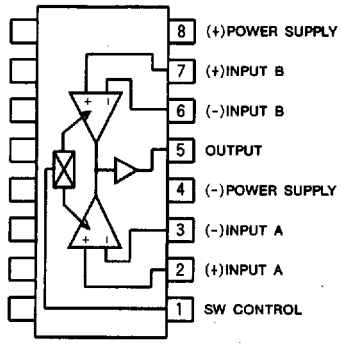
FEATURES

- Operational amplifier A and B input and gain can be set independently
- Applicable to both single and dual power supplies
- High gain, low distortion
  .....G_{VO} =100dB, THD = 0.002% (typ.)
- High slew rate, high f_T.....SR =2.2V/μs, f_T = 7MNz(typ.)
- Low noise(Rs=1KΩ)FLAT.....V_{NI} = 2μVrms(typ.)
- Low switching shock noise
- High load current, high power dissipation
  ..... I_{LP} = $\pm$50mA, Pd = 800mW(SIP)
  Pd = 625mW(DIP)
  Pd = 440mW(FP)

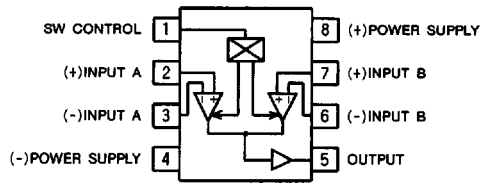
APPLICATION

Component audio equipment, VCR, Tape recorder unit, etc.

PIN CONFIGURATION (TOP VIEW)



Outline 8P5(AL)

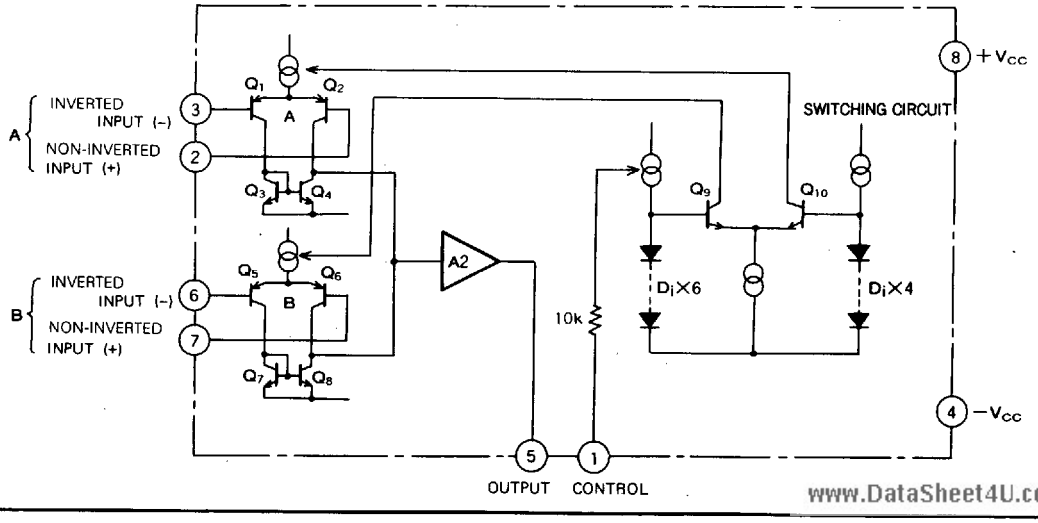


Outline 8P4 (AP)
8P2S-A(AFP)

RECOMMENDED OPERATING CONDITION

Supply voltage range.....$\pm$2.5~$\pm$16V
Rated supply voltage.....$\pm$15V

EQUIVALENT CIRCUIT



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ABSOLUTE MAXIMUM RATINGS

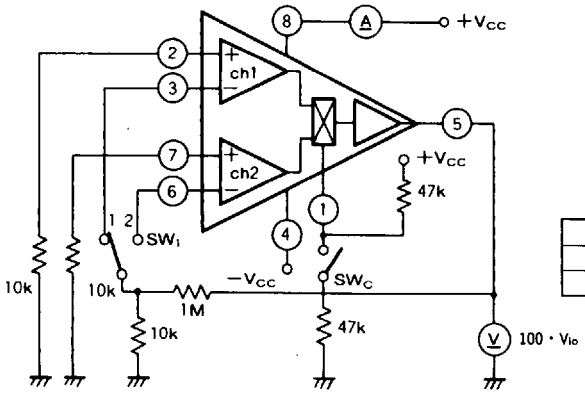
Symbol	Parameter	Ratings	Unit
V_{CC}	Supply voltage	±18 (36)	V
V_{id}	Differential input voltage	±30	V
V_{ic}	Common phase input voltage	±15	V
I_{LP}	Load current	±50	mA
Pd	Power dissipation	800 (SIP)/625 (DIP)/440 (FP)	mW
Topr	Operating temperature	−20~75	℃
Tstg	Storage temperature	−55~125	℃

ELECTRICAL CHARACTERISTICS (Ta=25℃, V_{CC}=±15V, unless otherwise noted)

Symbol	Parameter	Test conditions		Limits			Unit
				Min.	Typ.	Max.	
I_{CC}	Circuit current	Vin	SW ON		2.3	6.0	mA
			SW OFF		2.1	6.0	
V_{IO}	Input offset voltage	R_S=10kΩ			0.8	6.0	mV
I_B	Input bias current				80	500	nA
G_{VO}	Open loop voltage gain	R_L=2kΩ			100		dB
V_{OM}	Maximum output voltage	R_L≧10kΩ		±12	±14		V
THD	Total harmonic distortion	f=1kHz, Vo=5Vrms, Gv=20dB			0.002		%
SVR	Supply voltage rejection ratio				20	150	μV/V
C·S	Channel separation	f=1kHz			82		dB
f_T	Gain bandwidth product	Gv=0dB			7		MHz
SR	Slew rate	Gv=0dB, R_L=2kΩ//100pF			2.2		V/μs
V_{NI}	Input refferred noise voltage	R_S=1kΩ, BW=10Hz~30kHz, Flat			2.0		μVrms

TEST CIRCUIT

(1) I_{CC}, V_{IO}, SVR



	SW_C	SW_I	Select ch
I_{CC1}, V_{IO1}, SVR_1	OFF	1	ch1
I_{CC2}, V_{IO2}, SVR_2	ON	2	ch2

Unit Resistance : Ω
capacitance : F

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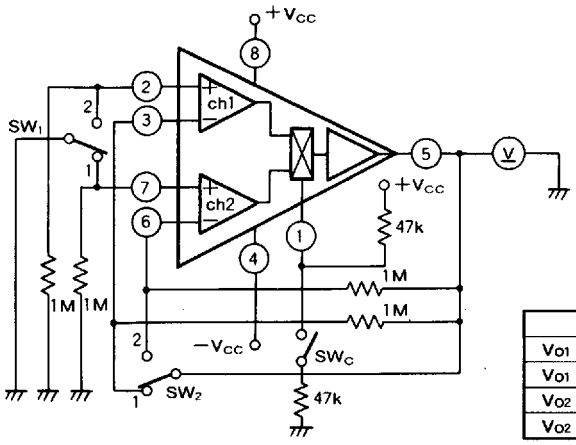
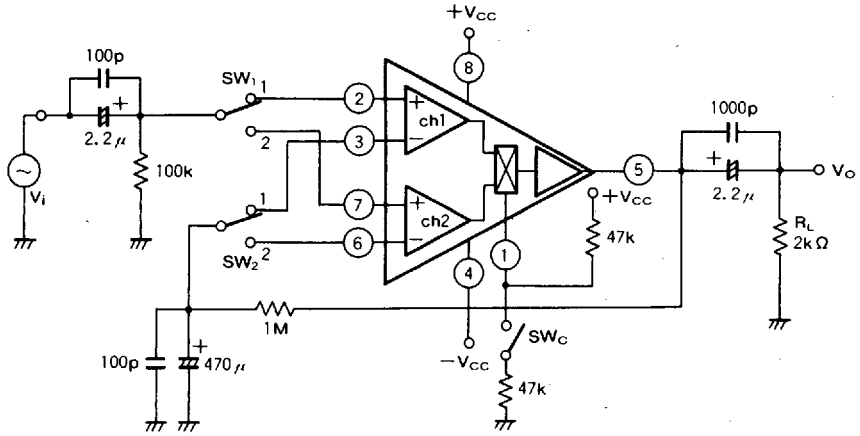
(2) I_b, I_{io}



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

	SWc	SW1	SW2	Select ch
V_{O1}	OFF	1	1	ch1
V_{O1}	OFF	2	2	ch1
V_{O2}	ON	2	2	ch2
V_{O2}	ON	1	1	ch2

(3) f_t, Gv



	SWc	SW1	SW2	Select ch
f_{t1}, G_{V1}	OFF	1	1	ch1
f_{t2}, G_{V2}	ON	2	2	ch2

Unit Resistance : Ω
Capacitance : F

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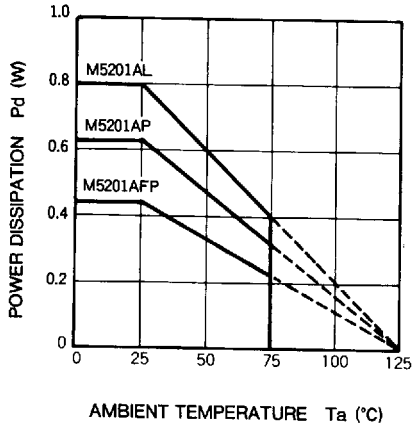
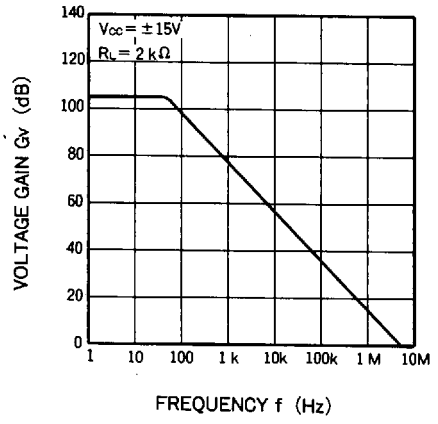
GENERAL PURPOSE SWITCHING OPERATIONAL AMPLIFIER (DUAL INPUT, SINGLE OUTPUT TYPE)

TYPICAL CHARACTERISTICS

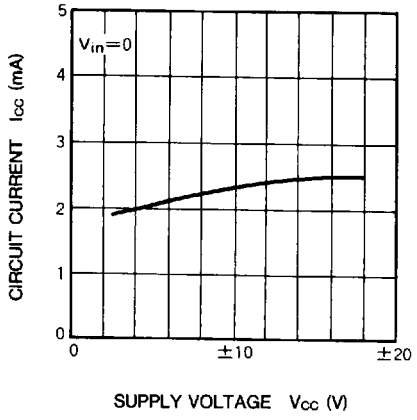
THERMAL DERATING (MAXIMUM RATING)



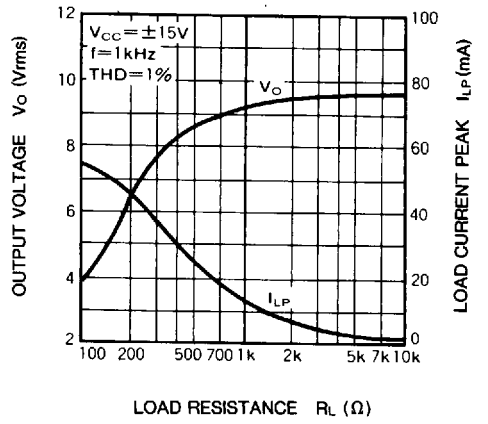
VOLTAGE GAIN VS. FREQUENCY RESPONSE



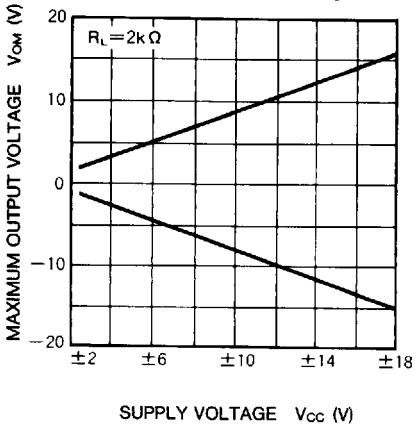
CIRCUIT CURRENT VS. SUPPLY VOLTAGE



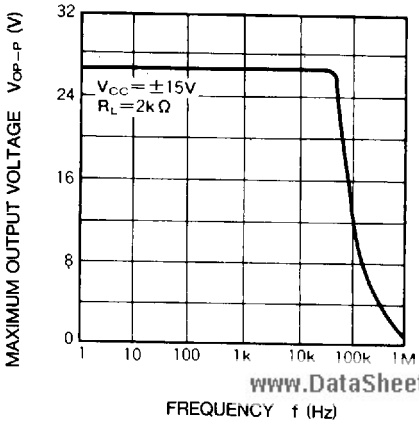
OUTPUT VOLTAGE/LOAD CURRENT PEAK VS. LOAD RESISTANCE



MAXIMUM OUTPUT VOLTAGE VS. SUPPLY VOLTAGE



MAXIMUM OUTPUT VOLTAGE VS. FREQUENCY RESPONSE



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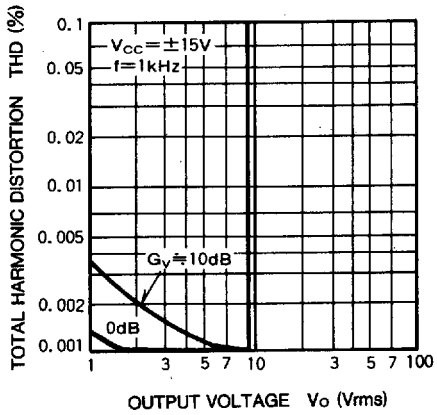
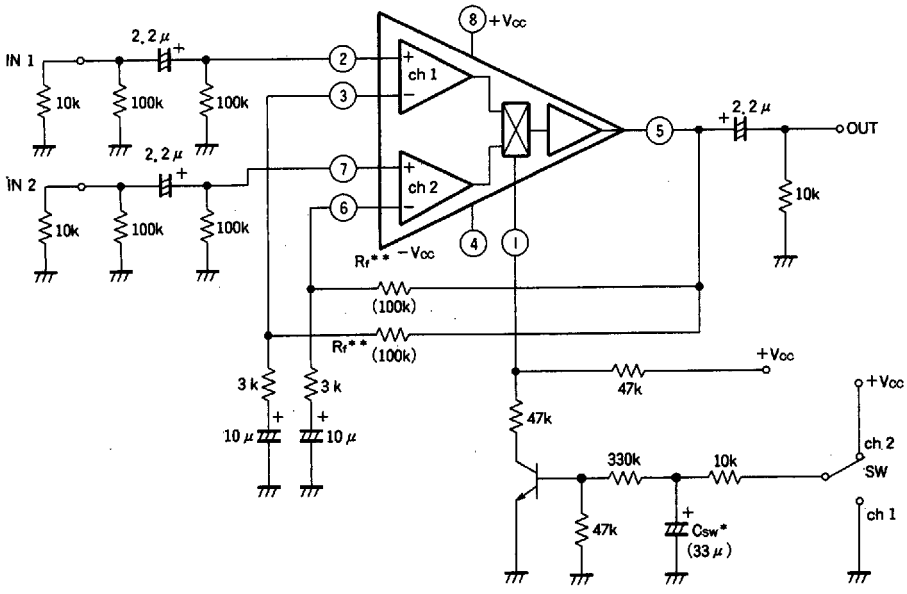
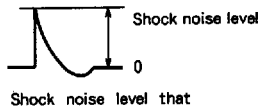
TOTAL HARMONIC DISTORTION VS. OUTPUT VOLTAGE



SHOCK NOISE MEASUREMENT

TEST CIRCUIT





Shock noise level that results when ch① and ch② are switched by SW

Unit: Resistance : Ω
Capacitance : F

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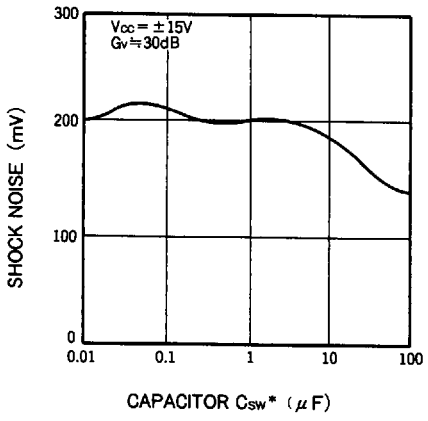
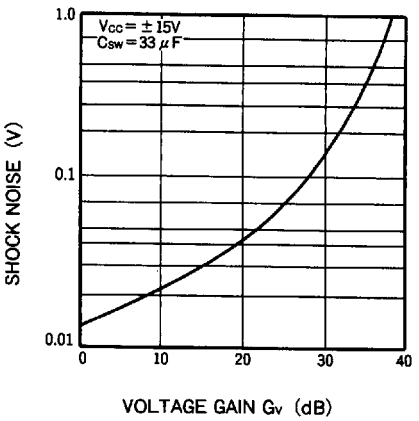
GENERAL PURPOSE SWITCHING OPERATIONAL AMPLIFIER (DUAL INPUT, SINGLE OUTPUT TYPE)

SHOCK NOISE VS. CAPACITOR Csw



* Characteristics of shock noise with respect to change of Csw

SHOCK NOISE VS. VOLTAGE GAIN



* * Characteristics of shock noise with respect to voltage gain varied by R1.

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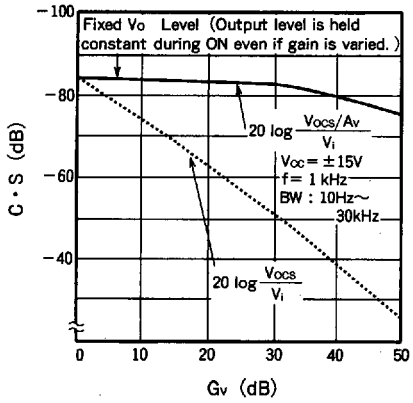
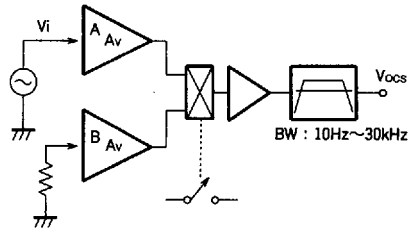
GENERAL PURPOSE SWITCHING OPERATIONAL AMPLIFIER (DUAL INPUT, SINGLE OUTPUT TYPE)

CHANNEL SEPARATION CHARACTERISTICS



(A : OFF/B : IN ON MODE)



$$C \cdot S = 20 \log \left[\frac{\text{INPUT LEAK LEVEL}}{\text{SIGNAL LEVEL}} \right] \text{(dB)}$$

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

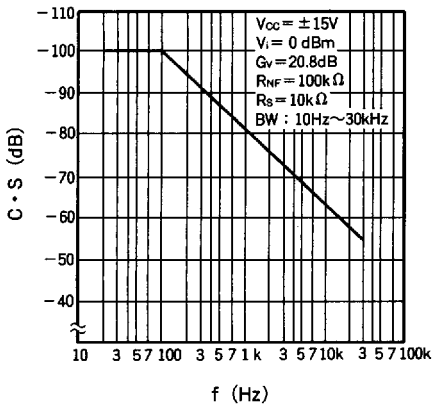
Channel separation is defined as ratio of leak signal (scaled on assumption it is present in input) to input signal.

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

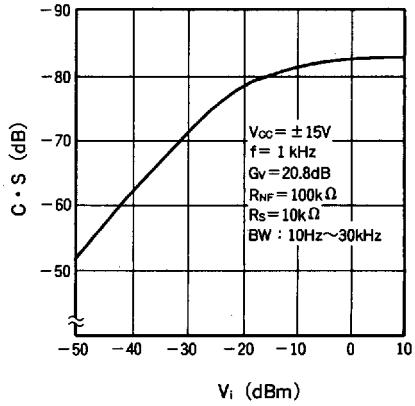
However, as indicated by above dashed line, if gain (Av) is not scaled channel separation appears to deteriorate as much as amplified amount.

$$\left(20 \log \frac{Vocs}{Vi}\right)$$

CHANNEL SEPARATION CHARACTERISTICS



CHANNEL SEPARATION CHARACTERISTICS



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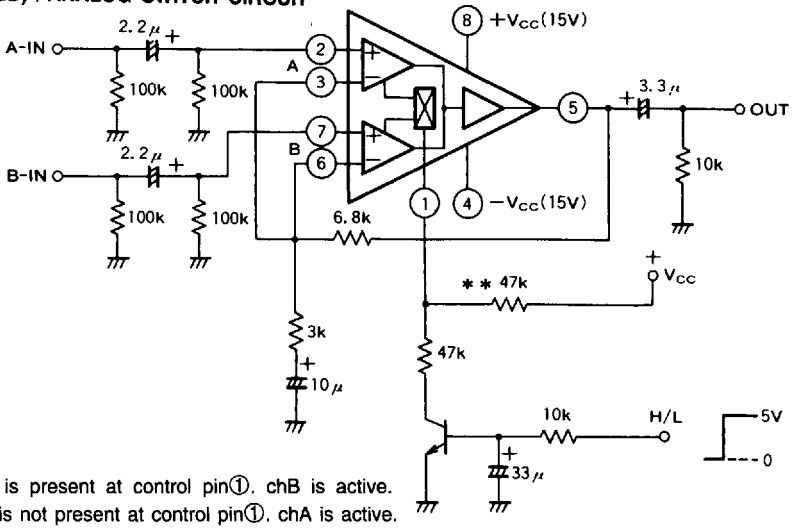
APPLICATION EXAMPLE

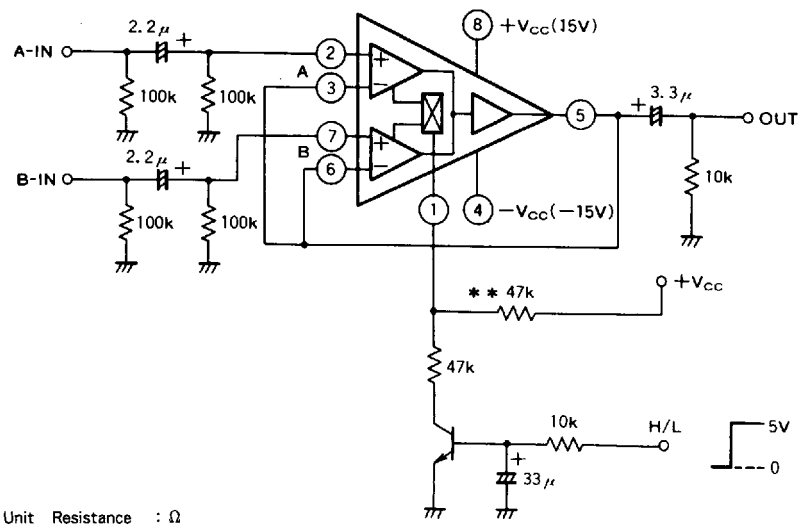
(1)FLAT AMPLIFIER (Gv≒10dB)+ANALOG SWITCH CIRCUIT



*When current is present at control pin①. chB is active.
When current is not present at control pin①. chA is active.

Unit Resistance : Ω
Capacitance : F

(2)ANALOG SWITCH CIRCUIT(Gv=0dB, VOLTAGE FOLLOWER AMPLIFIER)



Unit Resistance : Ω
Capacitance : F

Resistor indicated by ** is a pull-up resistor to prevent switching pin ① from being activated by leak current from an external circuit.(i.e.TR).

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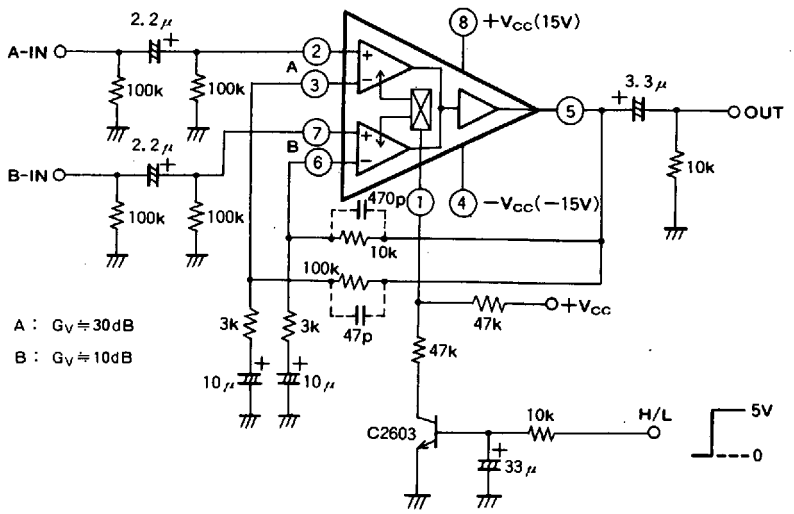

*When current is present at control pin①. chB is active.
When current is not present at control pin①. chA is active.

Unit Resistance : Ω
Capacitance : F

DESCRIPTION OF PIN

Pin No.	Name	Function
①	SW control	A/B channel select pin. By pulling current out from this pin, switching action is available.
②	(+) input A	Channel A op-amp (+) input pin
③	(−) input A	Channel A op-amp (−) input pin
④	(−) power supply	Negative power supply pin
⑤	Output	Output pin
⑥	(−) input B	Channel B op-amp (−) input pin
⑦	(+) input B	Channel B op-amp (+) input pin
⑧	(+) power supply	Positive power supply pin

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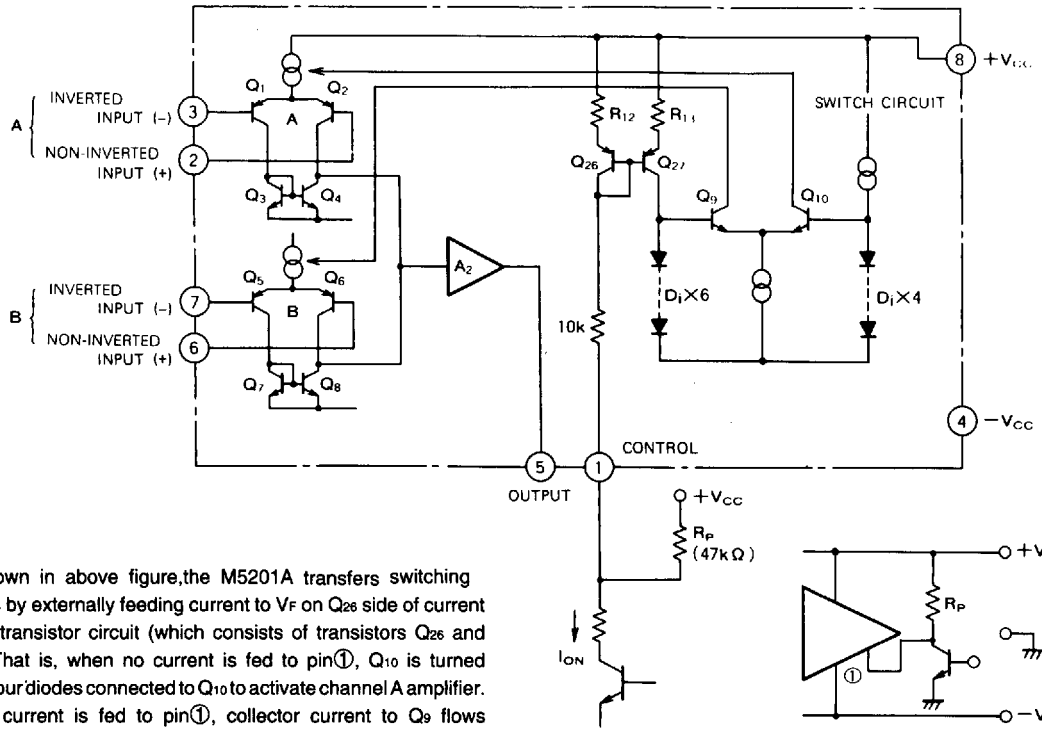
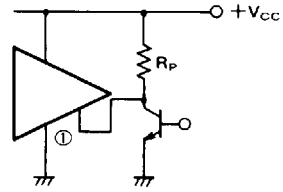
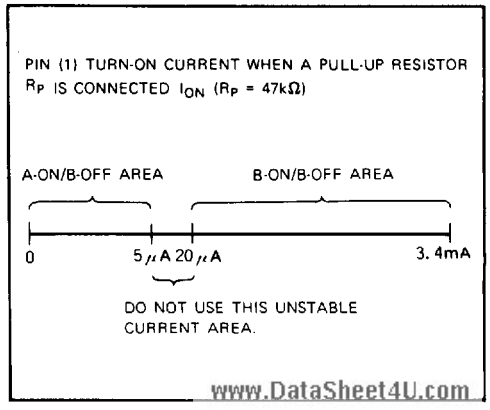
SWITCHING MECHANISM



As shown in above figure,the M5201A transfers switching signals by externally feeding current to V_F on Q_{26} side of current mirror transistor circuit (which consists of transistors Q_{26} and Q_{27}). That is, when no current is fed to pin①, Q_{10} is turned on by four diodes connected to Q_{10} to activate channel A amplifier. When current is fed to pin①, collector current to Q_9 flows to turn on six diodes connected to Q_9 and channel B is activated. Thus, applying or removing current to/from pin① switches an active channel. Therefore, M5203A can arbitrarily control drive method regardless of power supply type (single or dual). It is recommended that a pull-up resistor Rp be connected to pin① to reduce current sensitivity of transistor Q_{26} since very little current can turn on V_F.





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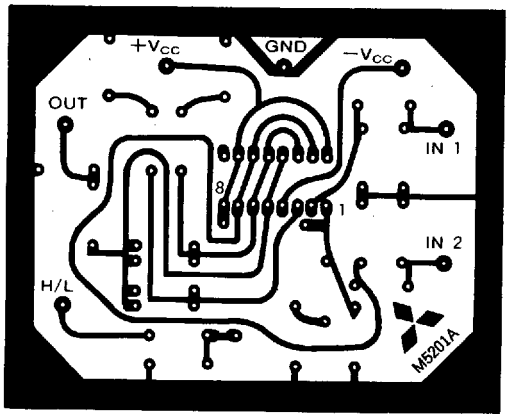
PCB FOR CIRCUIT TESTING

WIRING ON THE PCB



(PARTS INSERTION SIDE)