

**M5201AL/P/FP****GENERAL PURPOSE SWITCHING OPERATIONAL AMPLIFIER  
(DUAL INPUT, SINGLE OUTPUT TYPE)****DESCRIPTION**

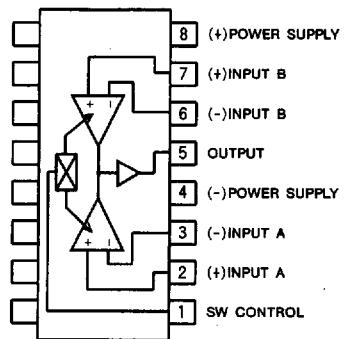
The M5201A is a semiconductor integrated circuit designed for an operational amplifier with analog switching, dual A and B input, and a single output. The device comes in an 8-pin SIP, DIP or FP and contains input differential A and B circuits, single output circuit and operational amplifier switching circuit, and can be used as a conventional operational amplifier, activating on A or B input by externally setting the control pin level high or low. For a voltage follower condition where  $G_v=0\text{dB}$ , the device functions merely as an analog switch, but, for switching amplifier function, 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**

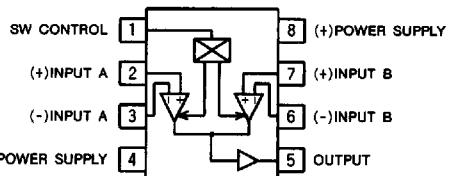
- Operational amplifier A and B input and gain can be set independently
- Applicable to both single and dual power supplies
- High gain, low distortion .....  $G_v = 100\text{dB}$ , THD = 0.002% (typ.)
- High slew rate, high  $f_t$  .....  $SR = 2.2\text{V}/\mu\text{s}$ ,  $f_t = 7\text{MHz}$  (typ.)
- Low noise ( $R_s=1\text{K}\Omega$ ) FLAT .....  $V_{NI} = 2\mu\text{Vrms}$  (typ.)
- Low switching shock noise
- High load current, high power dissipation .....  $I_{LP} = \pm 50\text{mA}$ ,  $P_d = 800\text{mW}$  (SIP)  
 $P_d = 625\text{mW}$  (DIP)  
 $P_d = 440\text{mW}$  (FP)

**APPLICATION**

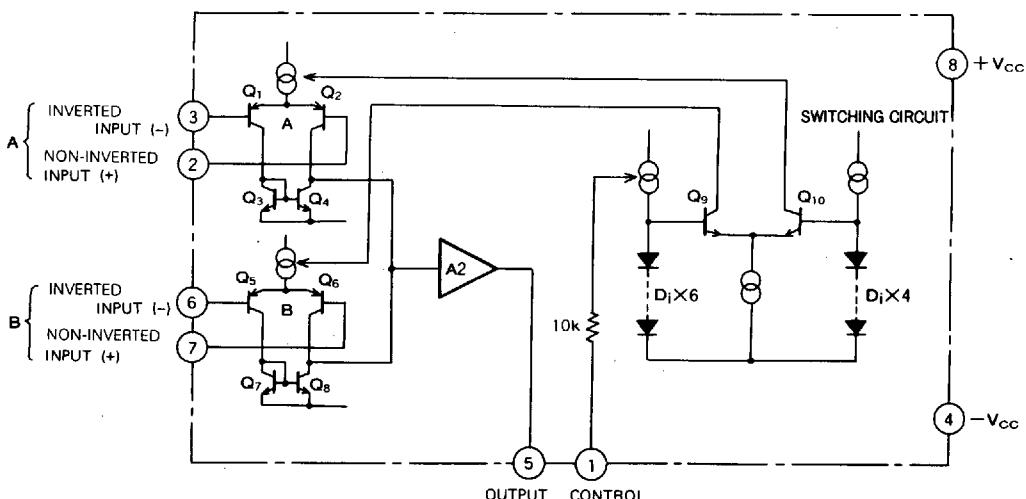
Component audio equipment, VCR, Tape recorder unit, etc.

**PIN CONFIGURATION (TOP VIEW)**

Outline 8P5(AL)

Outline 8P4 (AP)  
8P2S-A(AFP)**RECOMMENDED OPERATING CONDITION**

Supply voltage range .....  $\pm 2.5 \sim \pm 16\text{V}$   
 Rated supply voltage .....  $\pm 15\text{V}$

**EQUIVALENT CIRCUIT**

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

## **ABSOLUTE MAXIMUM RATINGS**

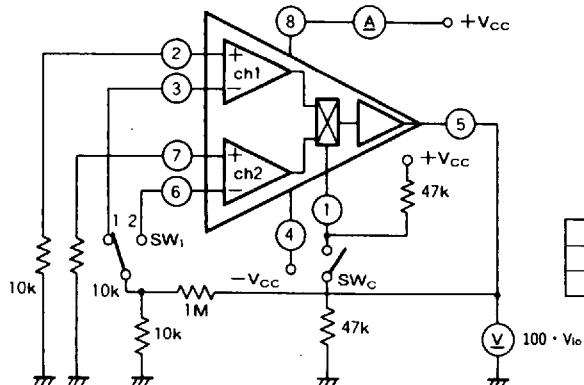
| Symbol           | Parameter                  | Ratings                      | Unit |
|------------------|----------------------------|------------------------------|------|
| Vcc              | Supply voltage             | ±18 (36)                     | V    |
| Vid              | Differential input voltage | ±30                          | V    |
| Vic              | Common phase input voltage | ±15                          | V    |
| I <sub>LP</sub>  | Load current               | ±50                          | mA   |
| Pd               | Power dissipation          | 800 (SIP)/625 (DIP)/440 (FP) | mW   |
| T <sub>opr</sub> | Operating temperature      | -20~75                       | °C   |
| T <sub>stg</sub> | Storage temperature        | -55~125                      | °C   |

#### **ELECTRICAL CHARACTERISTICS** ( $T_a=25^\circ\text{C}$ , $V_{cc}=\pm 15\text{V}$ , unless otherwise noted)

| Symbol          | Parameter                      | Test conditions                                     | Limits |       |      | Unit |
|-----------------|--------------------------------|---|--------|-------|------|------|
|                 |                                |   | Min.   | Typ.  | Max. |      |
| Icc             | Circuit current                | V <sub>in</sub>                                     | SW ON  | 2.3   | 6.0  | mA   |
|                 |                                |   | SW OFF | 2.1   | 6.0  |      |
| V <sub>io</sub> | Input offset voltage           | R <sub>s</sub> =10kΩ                                |        | 0.8   | 6.0  | mV   |
| I <sub>b</sub>  | Input bias current             |   |        | 80    | 500  |      |
| G <sub>vo</sub> | Open loop voltage gain         | R <sub>L</sub> =2kΩ                                 |        | 100   |      | dB   |
| V <sub>om</sub> | Maximum output voltage         | R <sub>L</sub> ≥10kΩ                                | ±12    | ±14   |      |      |
| THD             | Total harmonic distortion      | f=1kHz, V <sub>o</sub> =5Vrms, G <sub>v</sub> =20dB |        | 0.002 |      | %    |
| SVR             | Supply voltage rejection ratio |   |        | 20    | 150  |      |
| C·S             | Channel separation             | f=1kHz  |        | 82    |      | dB   |
| f <sub>r</sub>  | Gain bandwidth product         | G <sub>v</sub> =0dB                                 |        | 7     |      |      |
| SR              | Slew rate                      | G <sub>v</sub> =0dB, R <sub>L</sub> =2kΩ//100pF     |        | 2.2   |      | V/μs |
| V <sub>NI</sub> | Input referred noise voltage   | R <sub>s</sub> =1kΩ, BW=10Hz~30kHz, Flat            |        | 2.0   |      |      |

## TEST CIRCUIT

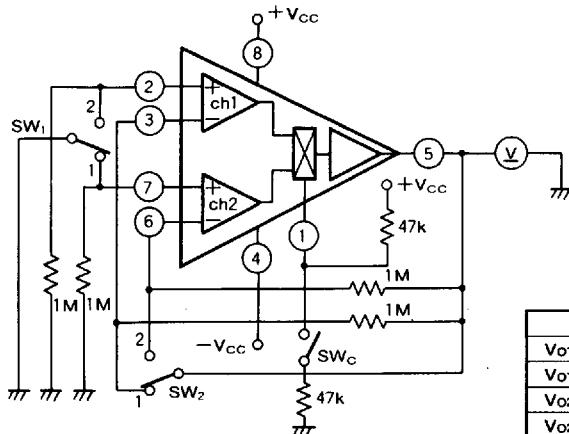
(1)  $I_{CC}$ ,  $V_{IO}$ , SVR



|                  | SWc | SWl | Select ch |
|------------------|-----|-----|-----------|
| Icc1, Vio1, SVR1 | OFF | 1   | ch1       |
| Icc2, Vio2, SVR2 | ON  | 2   | ch2       |

Unit      Resistance :  $\Omega$   
             capacitance : F

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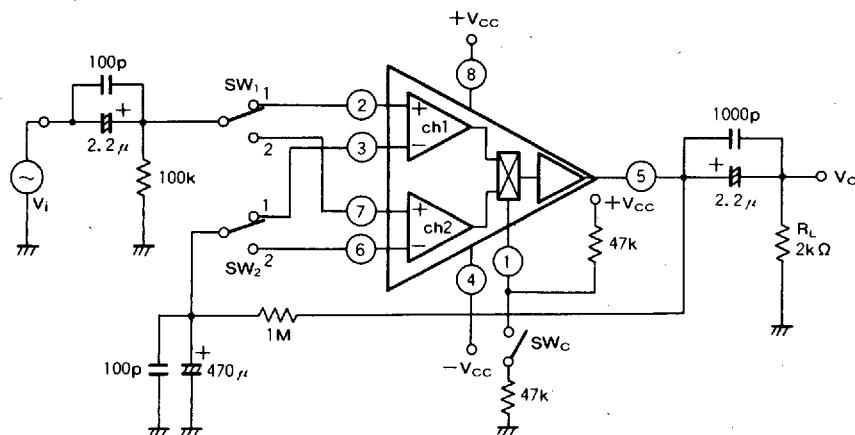
(2)  $I_b$ ,  $I_{lo}$ 

$$I_b^+ = V_o^+ / 1 \text{ M}\Omega$$

$$I_b^- = V_o^- / 1 \text{ M}\Omega$$

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

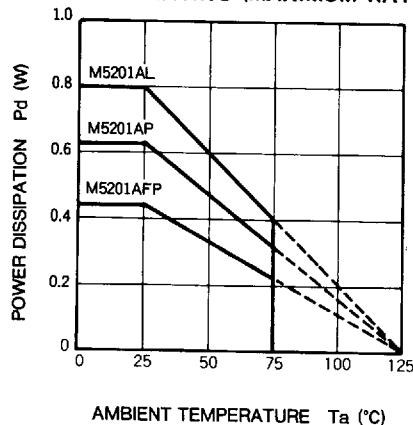
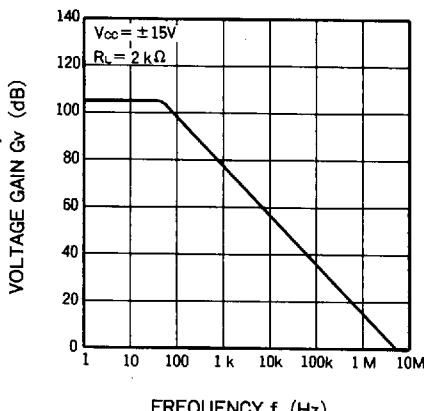
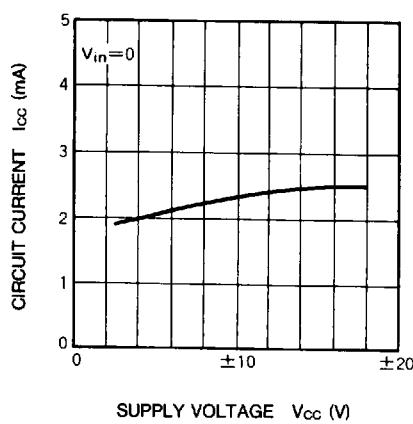
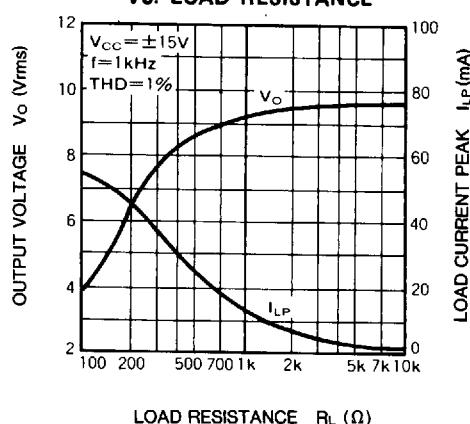
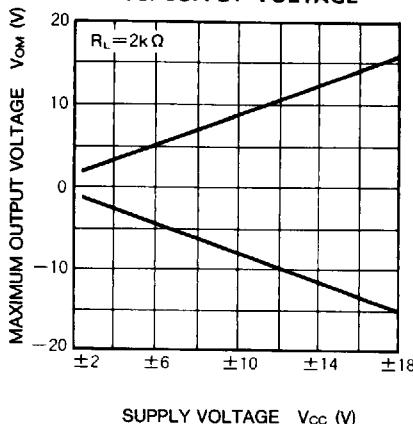
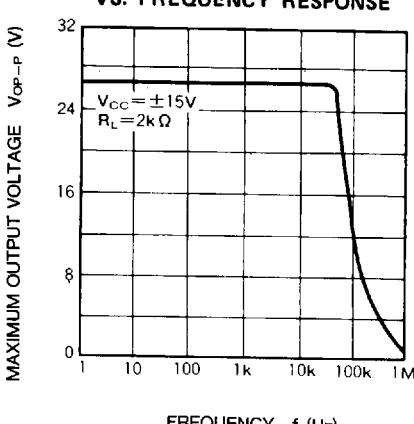
|                 | SW <sub>c</sub> | SW <sub>1</sub> | SW <sub>2</sub> | Select ch |
|-----------------|-----------------|-----------------|-----------------|-----------|
| V <sub>o1</sub> | OFF             | 1               | 1               | ch1       |
| V <sub>o1</sub> | OFF             | 2               | 2               | ch1       |
| V <sub>o2</sub> | ON              | 2               | 2               | ch2       |
| V <sub>o2</sub> | ON              | 1               | 1               | ch2       |

(3)  $f_t$ ,  $G_v$ 

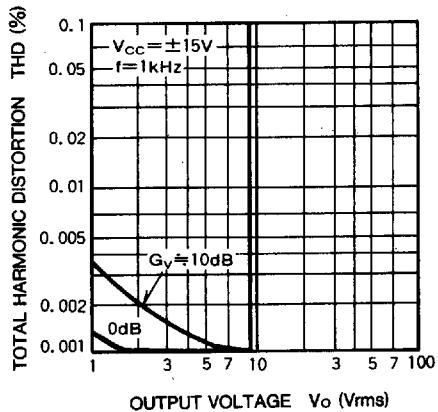
|                  | SW <sub>c</sub> | SW <sub>1</sub> | SW <sub>2</sub> | Select ch |
|------------------|-----------------|-----------------|-----------------|-----------|
| $f_{t1}, G_{v1}$ | OFF             | 1               | 1               | ch1       |
| $f_{t2}, G_{v2}$ | ON              | 2               | 2               | ch2       |

Unit Resistance : Ω  
Capacitance : F

**GENERAL PURPOSE SWITCHING OPERATIONAL AMPLIFIER  
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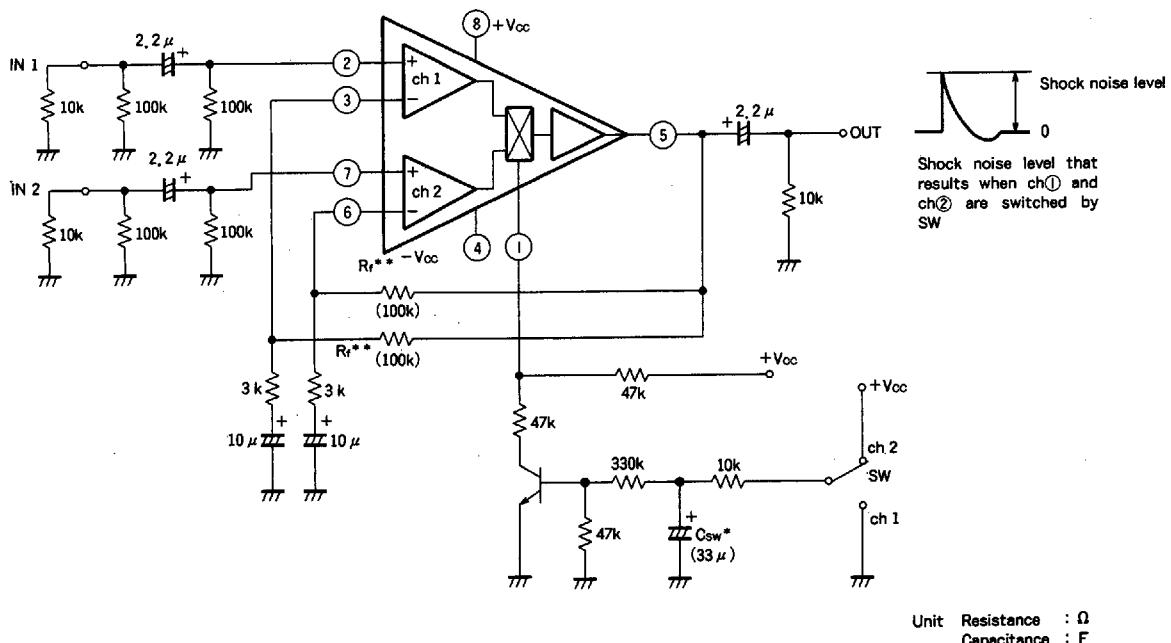
**TYPICAL CHARACTERISTICS****THERMAL DERATING (MAXIMUM RATING)****VOLTAGE GAIN VS.  
FREQUENCY RESPONSE****CIRCUIT CURRENT VS. SUPPLY VOLTAGE****OUTPUT VOLTAGE/LOAD CURRENT PEAK  
VS. LOAD RESISTANCE****MAXIMUM OUTPUT VOLTAGE  
VS. SUPPLY VOLTAGE****MAXIMUM OUTPUT VOLTAGE  
VS. FREQUENCY RESPONSE**

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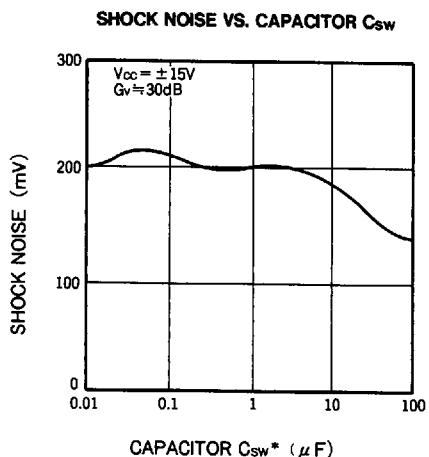
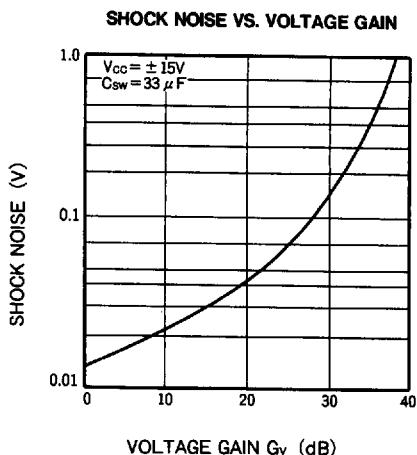
GENERAL PURPOSE SWITCHING OPERATIONAL AMPLIFIER  
(DUAL INPUT, SINGLE OUTPUT TYPE)TOTAL HARMONIC DISTORTION  
VS. OUTPUT VOLTAGE

## SHOCK NOISE MEASUREMENT

## TEST CIRCUIT



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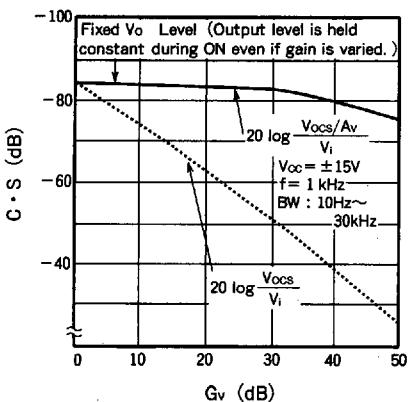
**GENERAL PURPOSE SWITCHING OPERATIONAL AMPLIFIER  
(DUAL INPUT, SINGLE OUTPUT TYPE)**\* Characteristics of shock noise with respect to change of  $C_{sw}$ 

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

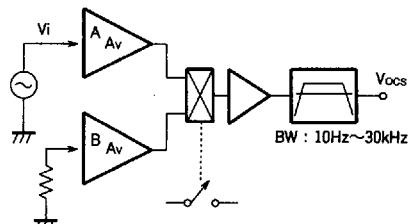
■ 6249826 0021520 819 ■

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

**CHANNEL SEPARATION CHARACTERISTICS**



(A : OFF/B : IN ON MODE)



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

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

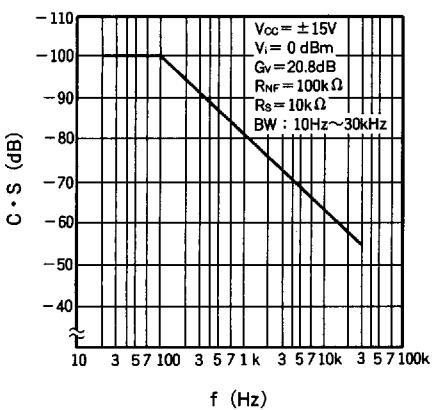
Channel separation is defined as ratio of leak signal (scaled on assumption it is present in input) to input signal.

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

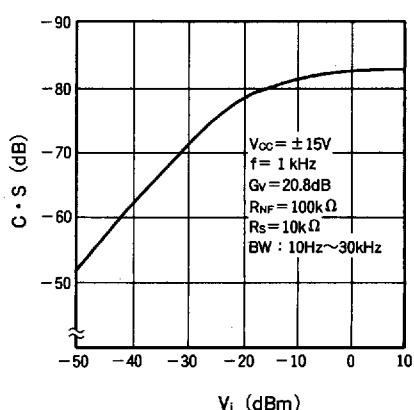
However, as indicated by above dashed line, if gain (Av) is not scaled channel separation appears to deteriorate as much as amplified amount.

$$(20 \log \frac{V_{oCS}}{V_i})$$

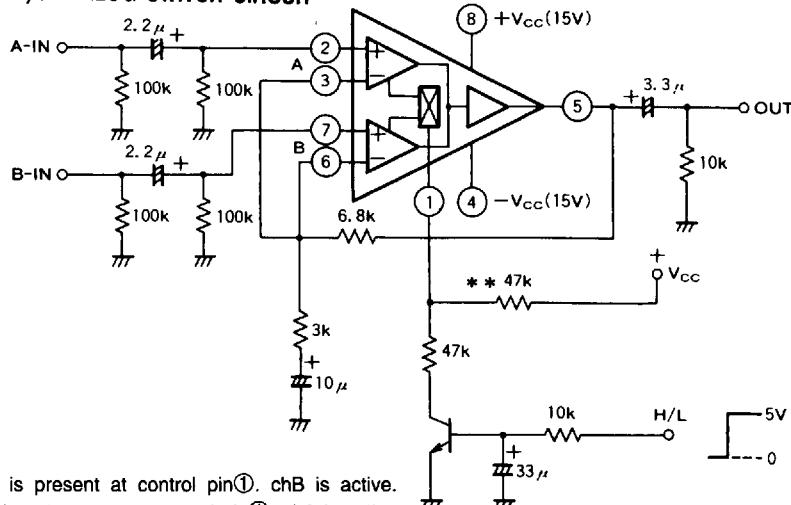
**CHANNEL SEPARATION CHARACTERISTICS**



**CHANNEL SEPARATION CHARACTERISTICS**

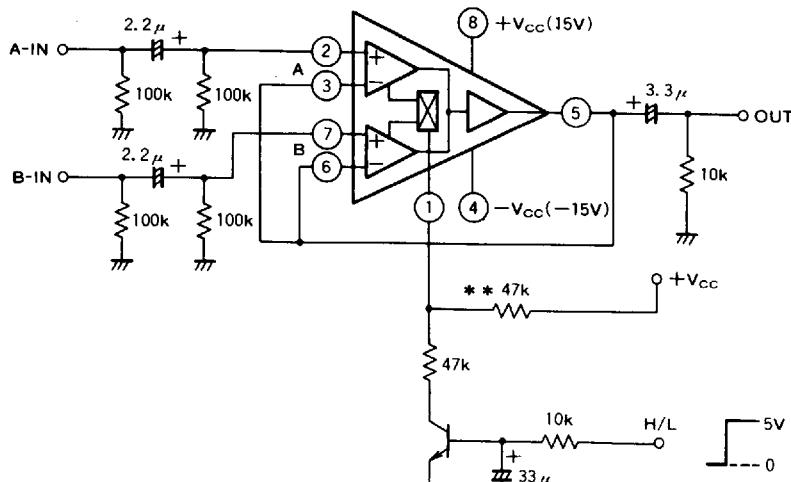


**GENERAL PURPOSE SWITCHING OPERATIONAL AMPLIFIER  
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**APPLICATION EXAMPLE****(1)FLAT AMPLIFIER ( $G_v \approx 10\text{dB}$ )+ANALOG SWITCH CIRCUIT**

\* 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

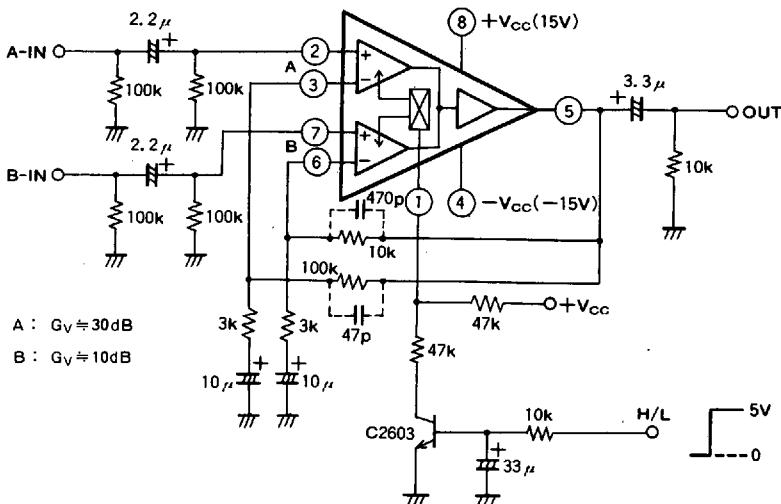
**(2)ANALOG SWITCH CIRCUIT( $G_v=0\text{dB}$ , VOLTAGE FOLLOWER AMPLIFIER)**

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



\*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

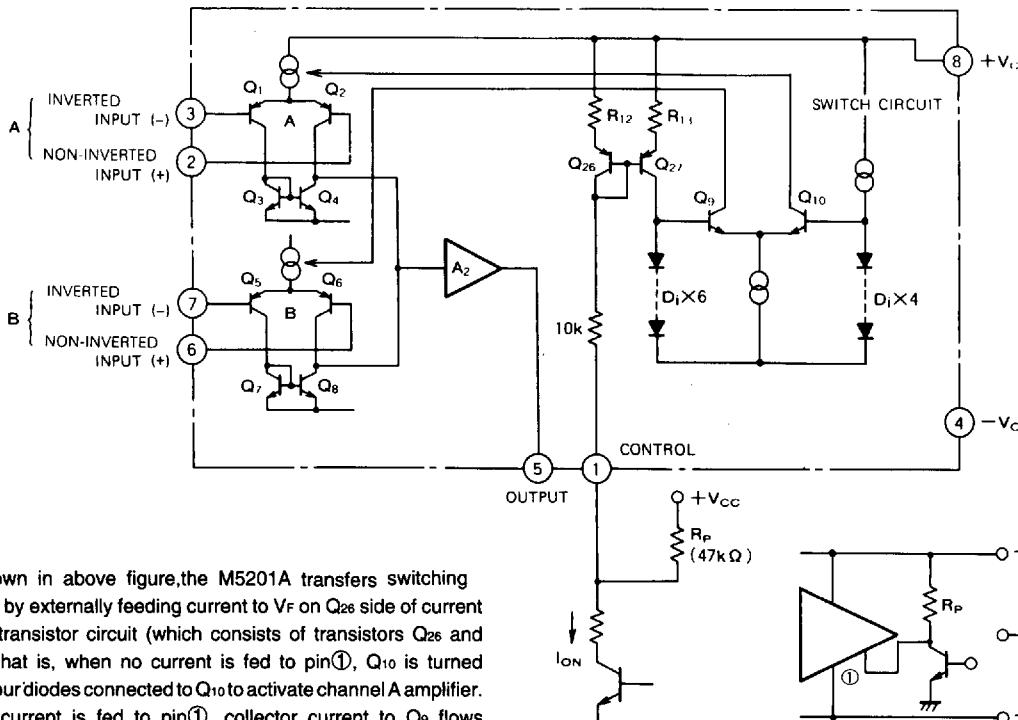
#### DESCRIPTION OF PIN

| 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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**GENERAL PURPOSE SWITCHING OPERATIONAL AMPLIFIER  
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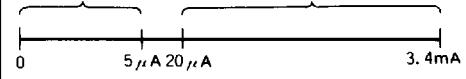
**SWITCHING MECHANISM**



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  $R_P$  be connected to pin① to reduce current sensitivity of transistor  $Q_{26}$  since very little current can turn on  $V_F$ .

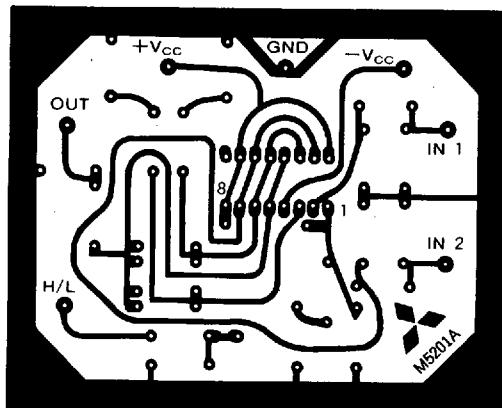
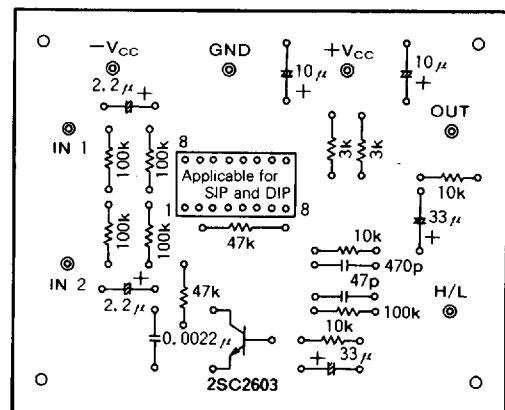
PIN (1) TURN-ON CURRENT WHEN A PULL-UP RESISTOR  $R_P$  IS CONNECTED  $I_{ON}$  ( $R_P = 47k\Omega$ )

A-ON/B-OFF AREA      B-ON/B-OFF AREA



DO NOT USE THIS UNSTABLE CURRENT AREA.

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

**PCB FOR CIRCUIT TESTING****WIRING ON THE PCB****(PARTS INSERTION SIDE)**

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