

# M51320P

ANALOG SWITCH

## DESCRIPTION

The M51320P is a semiconductor integrated circuit containing analog switches designed for use in a video system. It contains two audio switches and one video switch. One audio switch has two inputs and the other, three. The video switch has two inputs. Each switch can be independently controlled. In addition, the video switch contains an amplifier with a gain of about 6.7dB.

## FEATURES

- Video and stereo sound switches in one package
- Wide frequency range(video switch).....DC~10MHz
- High separation(video).....Crosstalk 55dB(typ.)@5MHz

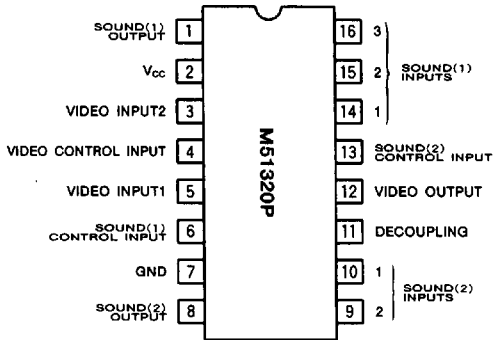
## APPLICATION

Video equipment.

## RECOMMENDED OPERATING CONDITION

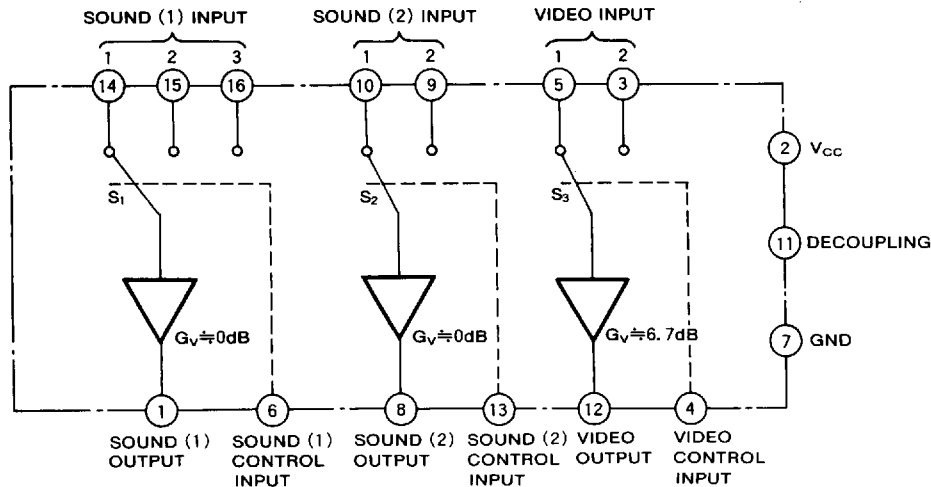
Supply voltage range.....5 ~ 14V

## PIN CONFIGURATION (TOP VIEW)



Outline 16P4

## BLOCK DIAGRAM



ANALOG SWITCH

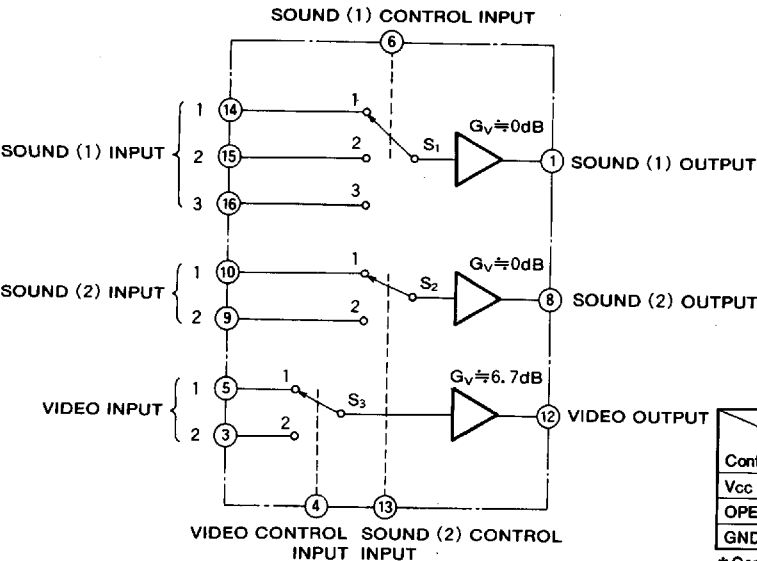
ABSOLUTE MAXIMUM RATINGS

| Symbol           | Parameter                 | Ratings         | Unit  |
|------------------|---------------------------|-----------------|-------|
| V <sub>CC</sub>  | Supply voltage            | 14              | V     |
| V <sub>IS</sub>  | Input signal voltage      | 6               | V     |
| V <sub>IC</sub>  | Input control voltage     | 6               | V     |
| P <sub>d</sub>   | Power dissipation         | V <sub>CC</sub> | W     |
| K <sub>θ</sub>   | Thermal derating          | 1.25            | mW/°C |
| T <sub>opr</sub> | Operating temperature     | 12.5            | °C    |
| T <sub>stg</sub> | Storage temperature range | -20~75          | °C    |
|                  |                           | -40~125         | °C    |

ELECTRICAL CHARACTERISTICS (T<sub>a</sub>=25°C, V<sub>CC</sub>=12V, unless otherwise noted)

| Symbol           | Parameter                     | Test conditions                       | Limits |      |      | Unit  |
|------------------|-------------------------------|---------------------------------------|--------|------|------|-------|
|                  |                               |                                       | Min.   | Typ. | Max. |       |
| I <sub>CC</sub>  | Circuit current               |                                       |        | 40   | 50   | mA    |
| V <sub>IDC</sub> | Input bias voltage            |                                       | 3.8    | 4.2  | 4.6  | V     |
| V <sub>ODC</sub> | Output bias voltage           | Video                                 | 5.0    | 5.6  | 6.2  | V     |
| V <sub>OP</sub>  | Output DC offset voltage      | Sound                                 | 3.0    | 3.6  | 4.2  | V     |
| V <sub>ICH</sub> | Control-pin threshold voltage | Sound (1) (pin⑥ 3-state input)        | 7.0    | 8.0  | 9.0  | mV    |
| V <sub>ICL</sub> |                               | Sound (1) (pin⑥ 3-state input)        | 3.0    | 4.0  | 5.0  | V     |
| V <sub>IC</sub>  |                               | Sound (2) and video (pin④, ⑬)         | 1.7    | 2.1  | 2.5  | V     |
| G <sub>V</sub>   | Voltage gain                  | Video, f=1MHz, V <sub>IN</sub> =1Vrms | 5.7    | 6.7  | 8.2  | dB    |
| THD              | Total harmonic distortion     | Sound, f=1kHz, V <sub>N</sub> =1Vrms  | -0.5   | -0.1 |      | %     |
| V <sub>N</sub>   | Output noise voltage          | Sound, R <sub>g</sub> =600Ω, BW=15kHz |        | 0.02 | 0.2  | μVrms |
|                  |                               | Video, R <sub>g</sub> =75Ω, BW=10MHz  |        | 0.5  | 1.0  | mVrms |
| CT               | Crosstalk                     | Sound, f=1kHz                         | 65     | 80   |      | dB    |
|                  |                               | Video, f=5MHz                         | 45     | 55   |      | dB    |

SWITCH MODE

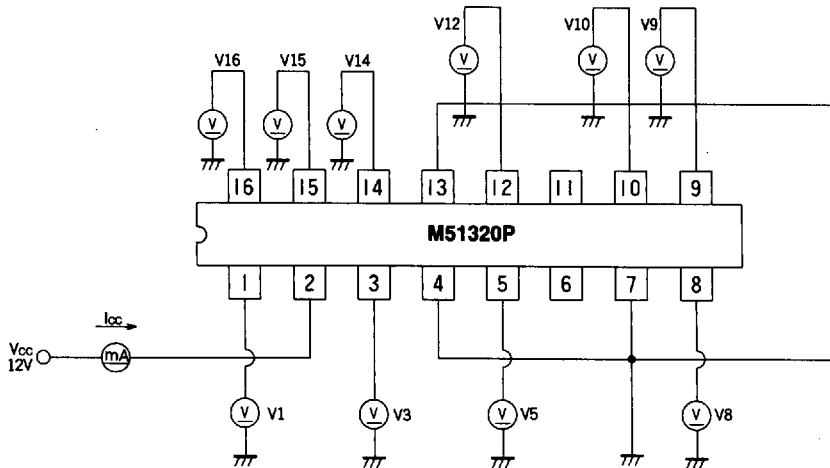


| Switch No.      | S <sub>1</sub> | S <sub>2</sub> | S <sub>3</sub> |
|-----------------|----------------|----------------|----------------|
| Control Input   |                |                |                |
| V <sub>CC</sub> | 1              | 1              | 1              |
| OPEN            | 2              | *              | *              |
| GND             | 3              | 2              | 2              |

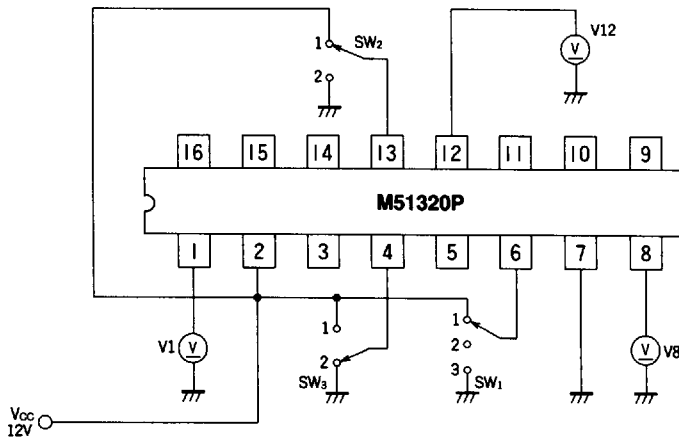
\* Connect to V<sub>CC</sub> or GND

**TEST CIRCUIT** ( $T_a=25^{\circ}\text{C}$ ,  $V_{CC}=12\text{V}$ , unless otherwise noted)

**CIRCUIT CURRENT  $I_{CC}$ , INPUT BIAS VOLTAGE  $V_{IDC}$ , OUTPUT BIAS VOLTAGE  $V_{OODC}$  TEST CIRCUIT**



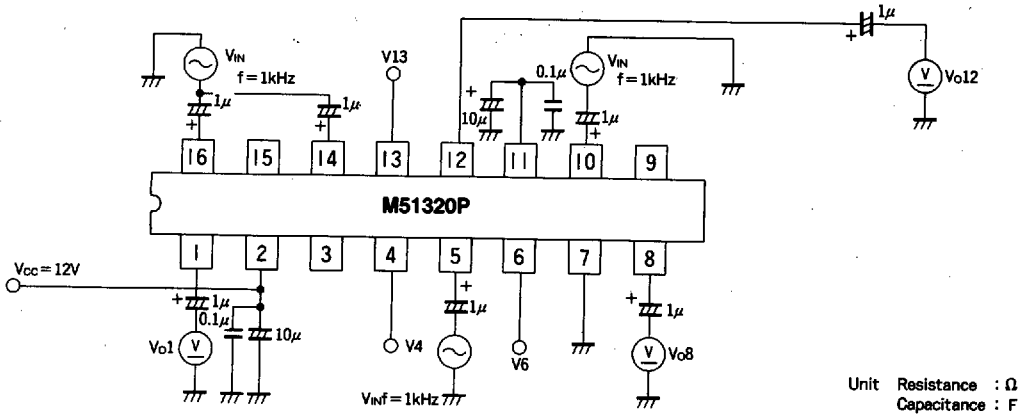
**OUTPUT DC OFFSET VOLTAGE TEST CIRCUIT**



$$\Delta V_{OODC} = V_{max} - V_{min}$$

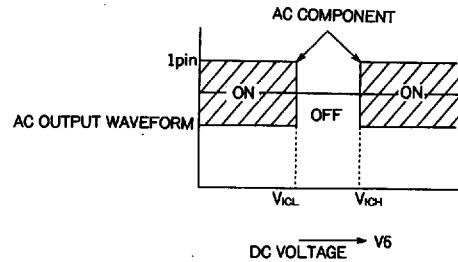
- Video : Measure each DC voltage of V12, when SW<sub>3</sub> is turned to 1 or 2, with SW<sub>1</sub> to 2 and SW<sub>2</sub> to 2.  
 Sound (1) : Measure each DC voltage of V1, when SW<sub>1</sub> is turned to 1, 2, or 3, with SW<sub>2</sub> to 2 and SW<sub>3</sub> to 2.  
 Sound (2) : Measure each DC voltage of V8, when SW<sub>2</sub> is turned to 1 or 2, with SW<sub>1</sub> to 2 and SW<sub>3</sub> to 2.

CONTROL PIN THRESHOLD VOLTAGE TEST CIRCUIT



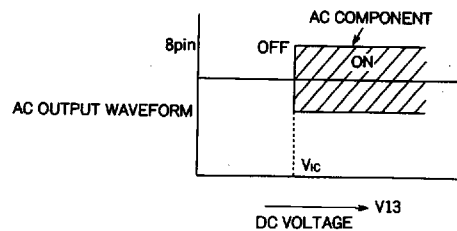
Sound (1) control pin threshold voltage test

V<sub>ICL</sub> shows the value of V<sub>6</sub> when AC component of ① pin waveform is switched OFF after initially raising DC voltage V<sub>6</sub> to 3-5 V.  
V<sub>ICH</sub> shows the value of V<sub>6</sub> when AC component is switched ON, after initially raising DC voltage V<sub>6</sub> to 7-9 V.



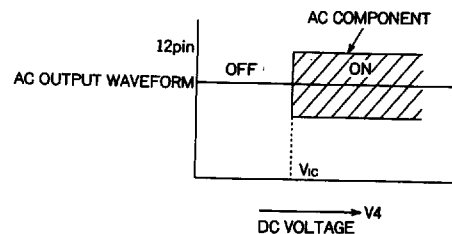
Sound (2) control pin threshold voltage test

V<sub>13</sub> shows the value of V<sub>IC</sub> when the AC component of ⑧ pin waveform is switched ON, after initially raising DC voltage V<sub>13</sub> to 1-3 V.

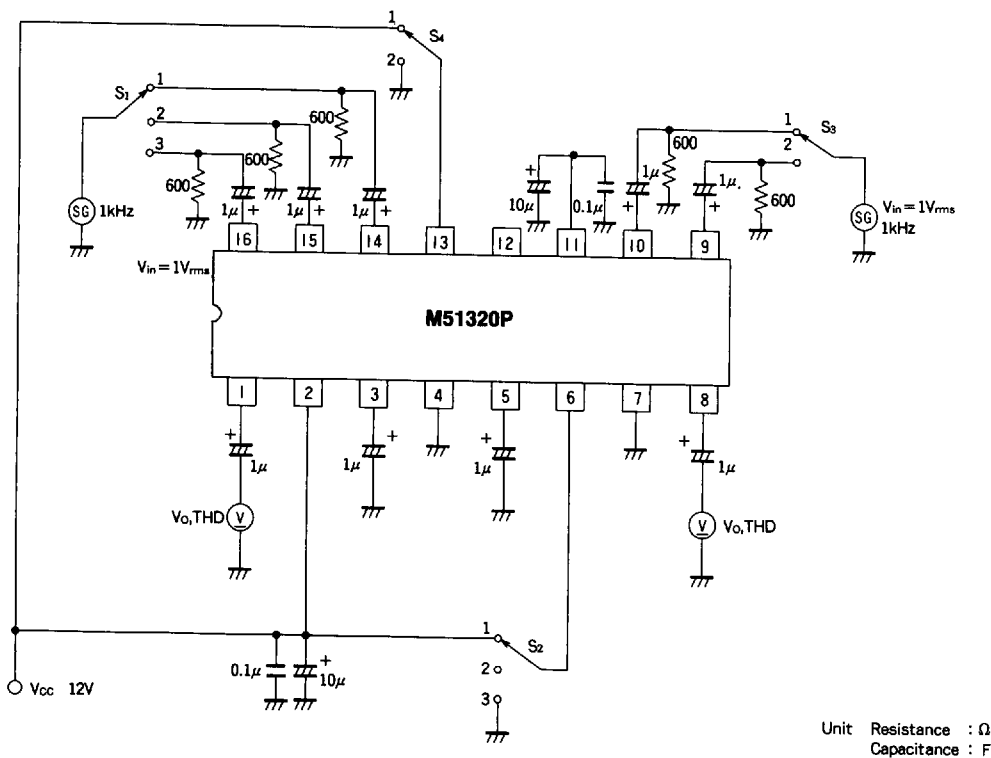


Video control pin threshold voltage test

V<sub>4</sub> shows the value of V<sub>IC</sub> when AC component of ⑫ pin waveform is switched ON, after initially raising the DC voltage V<sub>4</sub> to 1-3 V.



CROSSTALK AND TOTAL HARMONIC DISTORTION TEST CIRCUIT (SOUND SWITCH)



SWITCH MODE LIST

| S <sub>1</sub> | S <sub>2</sub> | OUTPUT(①pin)          |
|----------------|----------------|-----------------------|
| 1              | 1              | V <sub>os</sub> , THD |
|                | 2, 3           | V <sub>oc</sub>       |
| 2              | 2              | V <sub>os</sub> , THD |
|                | 1, 3           | V <sub>oc</sub>       |
| 3              | 3              | V <sub>os</sub> , THD |
|                | 1, 2           | V <sub>oc</sub>       |

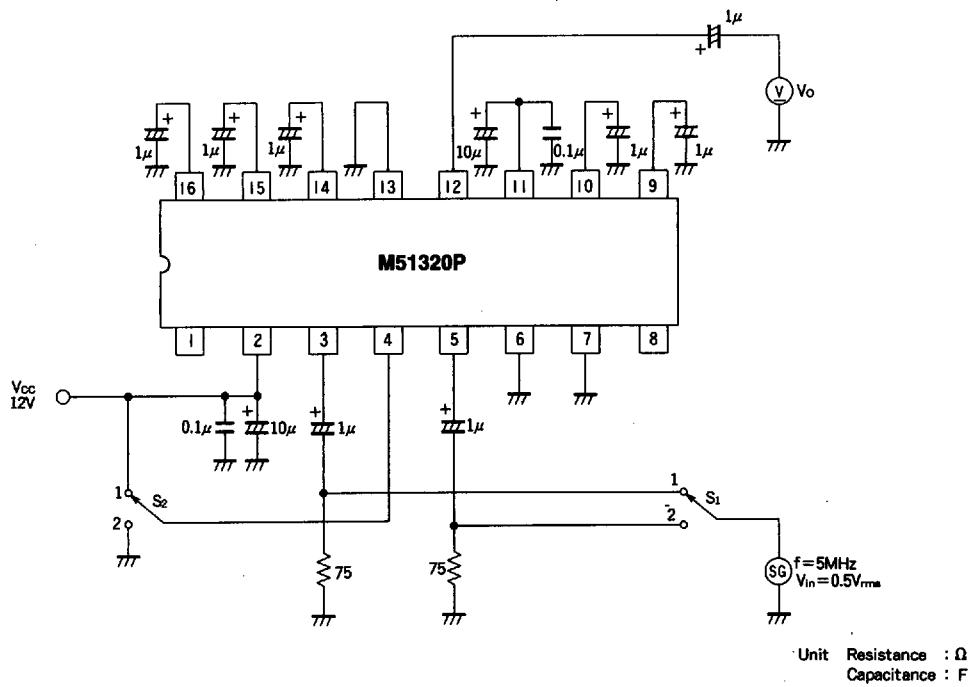
| S <sub>3</sub> | S <sub>4</sub> | OUTPUT(⑧pin)          |
|----------------|----------------|-----------------------|
| 1              | 1              | V <sub>os</sub> , THD |
|                | 2              | V <sub>oc</sub>       |
| 2              | 1              | V <sub>oc</sub>       |
|                | 2              | V <sub>os</sub> , THD |

Crosstalk  $CT = 20 \log \left( \frac{V_{os}}{V_{oc}} \right)$  dB

Voltage gain  $GV = 20 \log \left( \frac{V_{os}}{V_{in}} \right)$  dB

**ANALOG SWITCH**

**CROSSTALK, VOLTAGE GAIN (VIDEO SWITCH)**



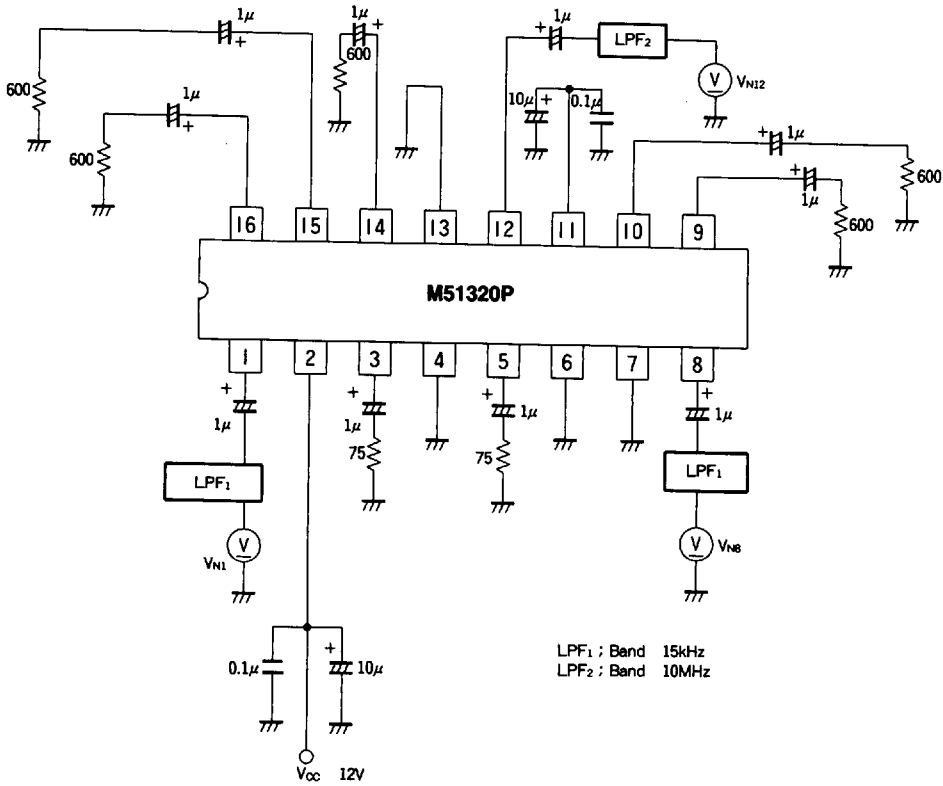
**SWITCH MODE LIST**

| S <sub>1</sub> | S <sub>2</sub> | OUTPUT(12pin)   |
|----------------|----------------|-----------------|
| 1              | 1              | V <sub>oc</sub> |
|                | 2              | V <sub>os</sub> |
| 2              | 1              | V <sub>os</sub> |
|                | 2              | V <sub>oc</sub> |

Crosstalk  $CT = 20 \log \left( \frac{V_{os}}{V_{oc}} \right)$  dB

Voltage gain  $GV = 20 \log \left( \frac{V_{os}}{V_{in}} \right)$  dB

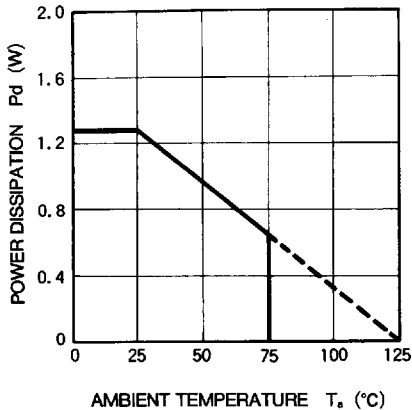
OUTPUT NOISE VOLTAGE



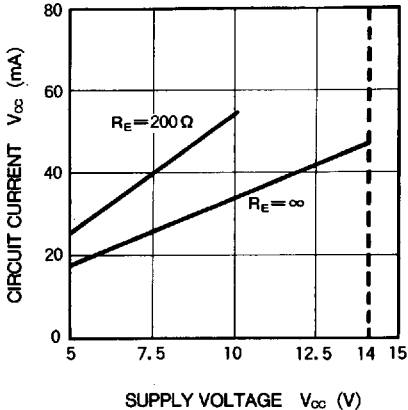
Unit Resistance : Ω  
Capacitance : F

TYPICAL CHARACTERISTICS (Ta=25°C, unless otherwise noted)

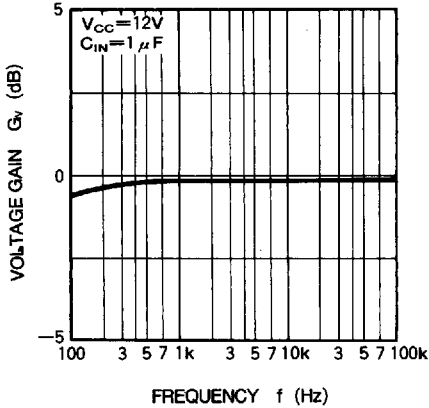
THERMAL DERATING (MAXIMUM RATING)



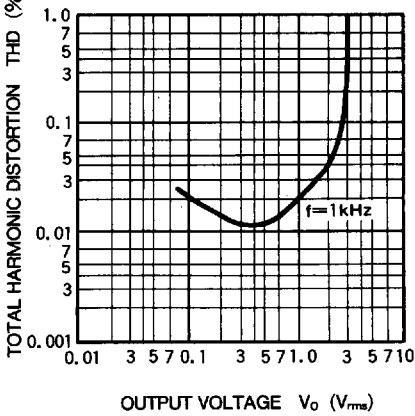
CIRCUIT CURRENT VS. SUPPLY VOLTAGE



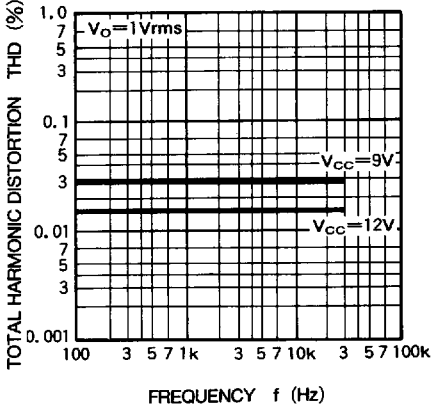
VOLTAGE GAIN VS. FREQUENCY (SOUND)



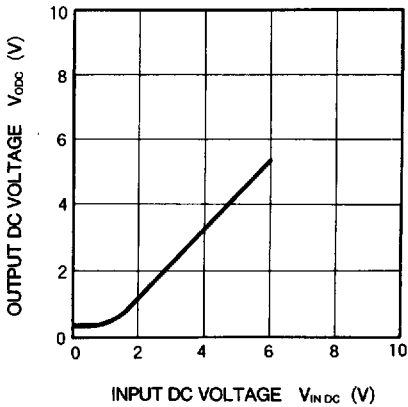
TOTAL HARMONIC DISTORTION VS. OUTPUT VOLTAGE (SOUND)



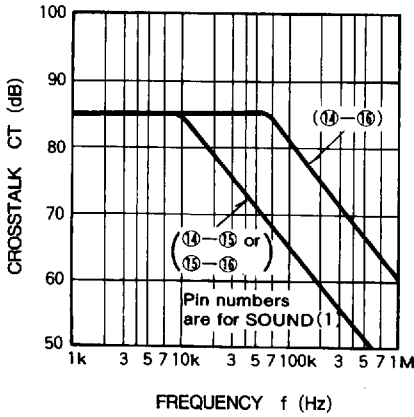
TOTAL HARMONIC DISTORTION VS. FREQUENCY (SOUND)



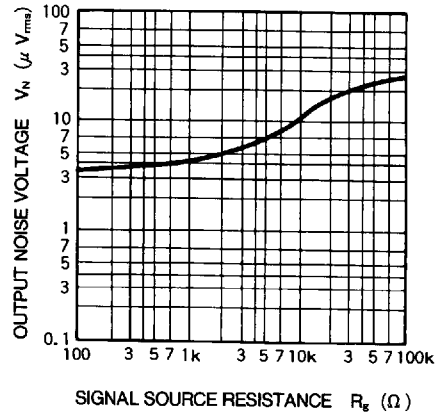
OUTPUT DC VOLTAGE VS. INPUT DC VOLTAGE (SOUND)



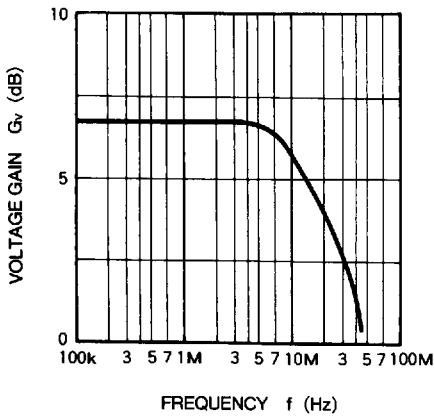
CROSSTALK, VS. FREQUENCY (SOUND)



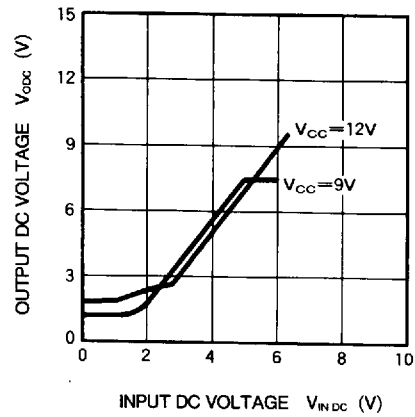
OUTPUT NOISE VOLTAGE VS. SIGNAL SOURCE RESISTANCE (SOUND)



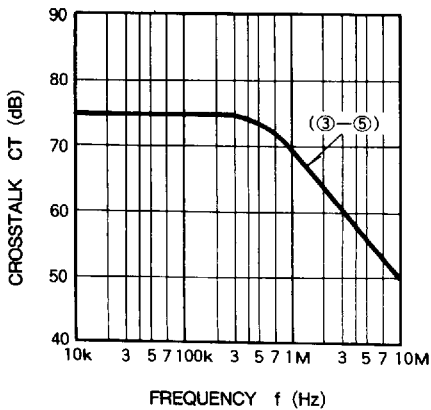
VOLTAGE GAIN VS. FREQUENCY (VIDEO)



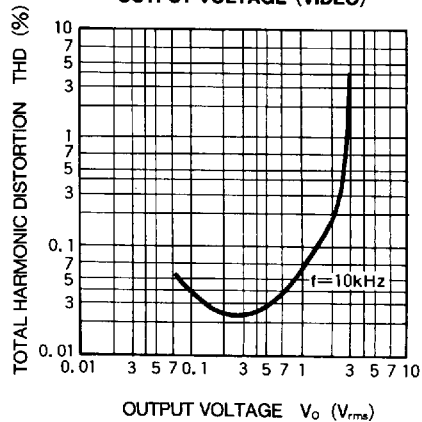
OUTPUT DC VOLTAGE VS. INPUT DC VOLTAGE (VIDEO)



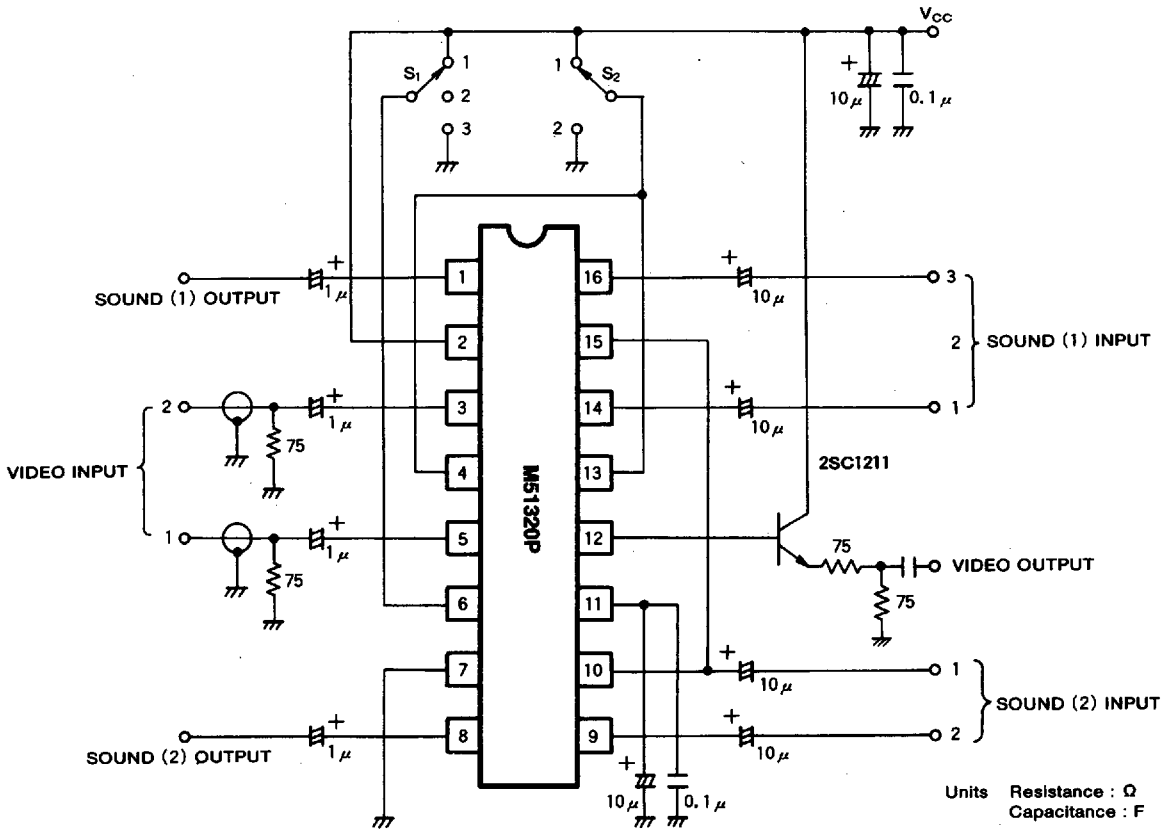
CROSSTALK VS. FREQUENCY (VIDEO)



TOTAL HARMONIC DISTORTION VS. OUTPUT VOLTAGE (VIDEO)



**APPLICATION EXAMPLE**



**PRECAUTIONS FOR APPLICATION**

When video output is sent through a  $75\Omega$  output and 12V supply is used, an external transistor buffer, such as the one shown in the above diagram, should be connected to maintain a balance with the power dissipation of the package. Should 9V be the sole supply voltage, a direct drive arrangement can be used as in the diagram at right by connecting resistor  $R_E$  between the output pin and ground. Since an emitter-follower output is used in video and sound outputs, when external wiring is long or a capacitive load is connected, a resistor with a value of several tens of ohms should be connected at a position near the output pin.

