

# Video signal switcher

## BA7609 / BA7609F

The BA7609 and BA7609F are switching ICs developed for use in VCRs. Each contains three two-channel analog multiplexers. As one of the switches has sync-tip clamp inputs and the other two have non-clamped inputs these ICs are ideal for switching audio, video and chroma signals.

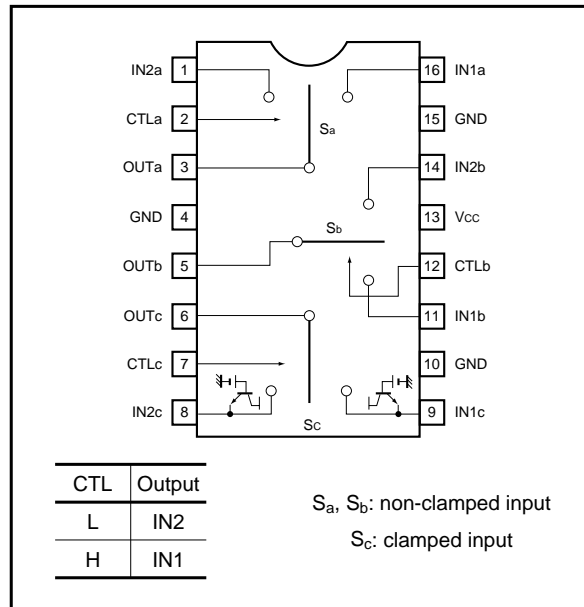
●Applications

Video cassette recorders and televisions

●Features

- 1) Three 2-input / 1-output switches (one with sync-clamped inputs, the other two non-clamped).
- 2) 5V power supply.
- 3) Low power consumption (62.5mW Typ.).
- 4) Excellent frequency characteristics (10MHz, 0dB Typ.).
- 5) Wide dynamic range (clamped input: 2.9V<sub>P-P</sub> Typ., non-clamped input: 3.0V<sub>P-P</sub> Typ.).
- 6) Fast switching speed (50ns Typ.).

●Block diagram



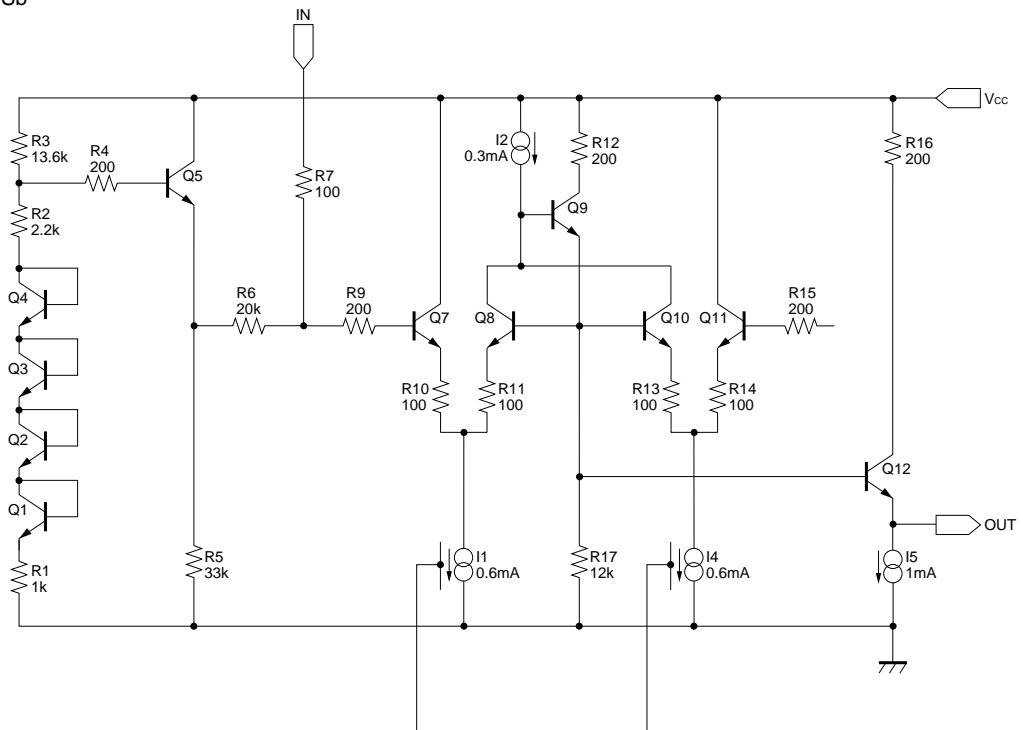
● Absolute maximum ratings (Ta = 25°C)

| Parameter             | Symbol | Limits       | Unit |
|-----------------------|--------|--------------|------|
| Power supply voltage  | Vcc    | 9            | V    |
| Power dissipation     | Pd     | 500*         | mW   |
| Operating temperature | Topr   | - 40 ~ + 85  | °C   |
| Storage temperature   | Tstg   | - 55 ~ + 125 | °C   |

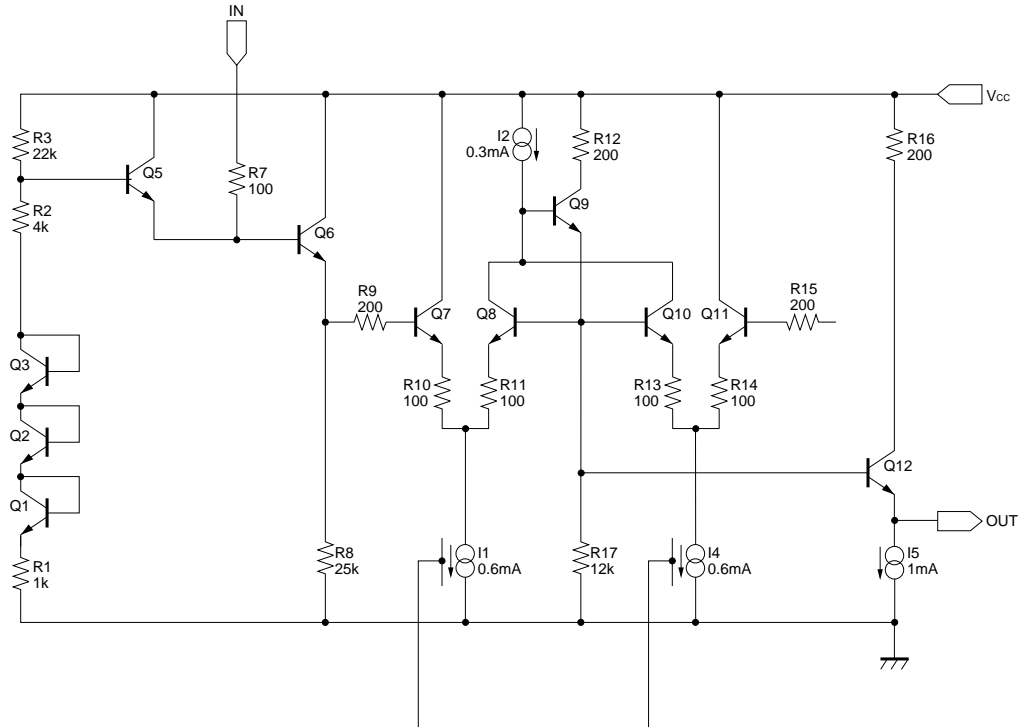
\* Reduced by 5.0mW for each increase in Ta of 1°C over 25°C.

● Equivalent circuits

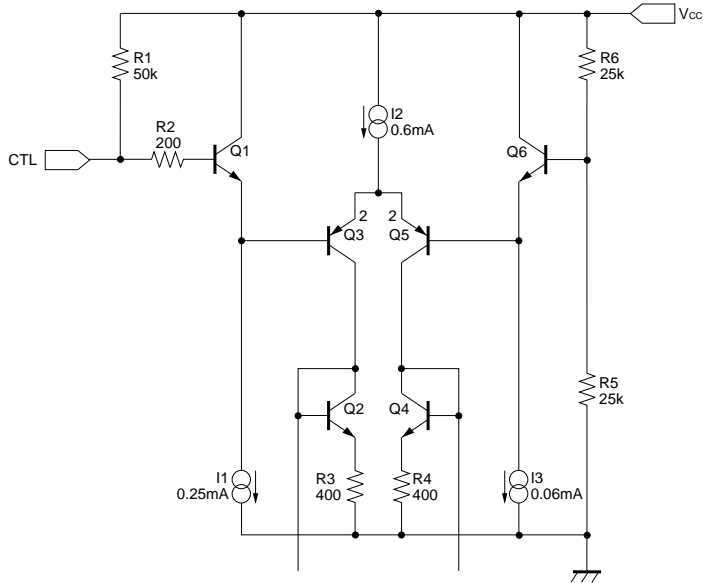
Sa, Sb



Sc



CTL



Units  
: R = Ω

●Electrical characteristics (unless otherwise noted, Ta = 25°C and V<sub>CC</sub> = 5V)

| Parameter                 | Symbol          | Min. | Typ.  | Max. | Unit             | Conditions  |
|---------------------------|-----------------|------|-------|------|------------------|---|
| Operating voltage         | V <sub>CC</sub> | 4.5  | 5.0   | 5.5  | V                | —   |
| Supply current            | I <sub>CC</sub> | —    | 12.5  | 20.0 | mA               | —   |
| Maximum output level 1    | V <sub>om</sub> | 2.6  | 2.9   | —    | V <sub>P-P</sub> | f = 1kHz, THD = 0.5% clamped input                |
| Maximum output level 2    | V <sub>om</sub> | 2.7  | 3.0   | —    | V <sub>P-P</sub> | f = 1kHz, THD = 0.5% non-clamped input            |
| Voltage gain              | G <sub>V</sub>  | -0.5 | 0     | 0.5  | dB               | f = 1MHz, V <sub>IN</sub> = 1V <sub>P-P</sub>     |
| Interchannel crosstalk    | C <sub>T</sub>  | —    | -65   | —    | dB               | f = 4.43MHz, V <sub>IN</sub> = 1V <sub>P-P</sub>  |
| Frequency characteristic  | G <sub>f</sub>  | -3   | 0     | 1    | dB               | 10MHz / 1MHz, V <sub>IN</sub> = 1V <sub>P-P</sub> |
| Input impedance           | Z <sub>IN</sub> | 14   | 20    | 26   | kΩ               | non-clamped input                                 |
| Total-harmonic distortion | THD             | —    | 0.007 | —    | %                | f = 1kHz, 1V <sub>P-P</sub> non-clamped input     |
| CTL pin switch level      | V <sub>TH</sub> | 2.0  | 2.5   | 3.0  | V                | —   |

Note: Refer to the measurement circuit given in Fig. 1.

## ●Reference data

Pin DC voltages (reference values)

Units: Vdc

| Pin No. | DC voltage | Pin No. | DC voltage |
|---------|------------|---------|------------|
| 1       | 2.48       | 9       | 2.05       |
| 2       | 4.91       | 10      | 0          |
| 3       | 1.76       | 11      | 2.48       |
| 4       | 0          | 12      | 4.91       |
| 5       | 1.76       | 13      | 5.00       |
| 6       | 0.65       | 14      | 2.48       |
| 7       | 4.91       | 15      | 0          |
| 8       | 2.05       | 16      | 2.48       |

## Electrical characteristics

| Parameter                    | Min. | Typ. | Max. | Unit |
|------------------------------|------|------|------|------|
| Sync tip clamp level         | 0.49 | 0.65 | 0.80 | Vdc  |
| Input impedance (no clamp)   | —    | 20k  | —    | Ω    |
| Input impedance (with clamp) | —    | 1.7M | —    | Ω    |
| Output impedance             | —    | 30   | —    | Ω    |

The input coupling capacitor values should be 0.1μF to 1μF.

● Measurement circuit

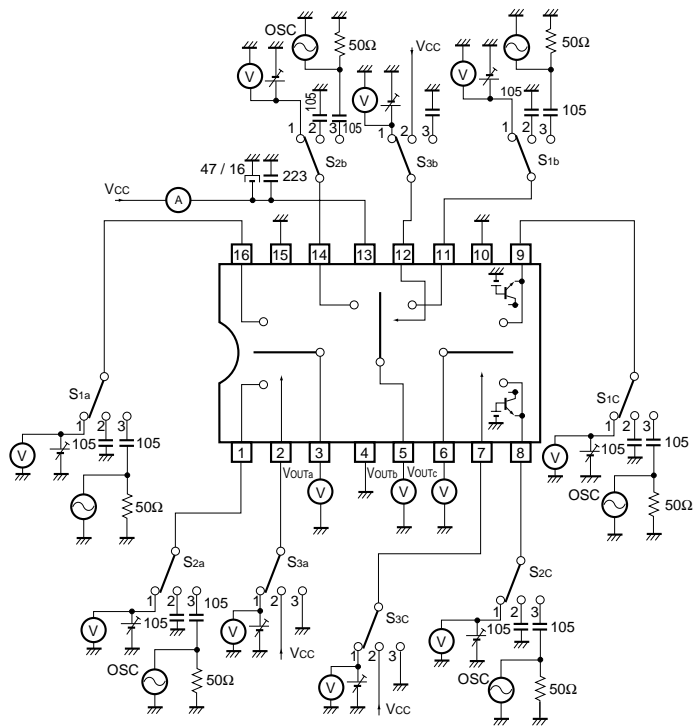


Fig.1

## ● Measurement conditions

| Parameter                 |      | Symbol          | Switch settings |                 |                 |                 |                 |                 |                 |                 |                 | Measurement method                                       |
|---------------------------|------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|--|
|                           |      |                 | S <sub>1a</sub> | S <sub>2a</sub> | S <sub>3a</sub> | S <sub>1b</sub> | S <sub>2b</sub> | S <sub>3b</sub> | S <sub>1c</sub> | S <sub>2c</sub> | S <sub>3c</sub> |  |
| Current dissipation       |      | I <sub>CC</sub> | 2               | 2               | 2               | 2               | 2               | 2               | 2               | 2               | 2               | Ammeter  |
| Maximum output level      | IN1a | V <sub>om</sub> | 3               | 2               | 2               | 2               | 2               | 2               | 2               | 2               | 2               | f = 1kHz<br>THD = 0.5%<br>Note 1                         |
|                           | IN2a | V <sub>om</sub> | 2               | 3               | 3               | 2               | 2               | 2               | 2               | 2               | 2               |  |
|                           | IN1b | V <sub>om</sub> | 2               | 2               | 2               | 3               | 2               | 2               | 2               | 2               | 2               |  |
|                           | IN2b | V <sub>om</sub> | 2               | 2               | 2               | 2               | 3               | 3               | 2               | 2               | 2               |  |
|                           | IN1c | V <sub>om</sub> | 2               | 2               | 2               | 2               | 2               | 2               | 3               | 2               | 2               |  |
|                           | IN2c | V <sub>om</sub> | 2               | 2               | 2               | 2               | 2               | 2               | 2               | 3               | 3               |  |
| Voltage gain              | IN1a | G <sub>V</sub>  | 3               | 2               | 2               | 2               | 2               | 2               | 2               | 2               | 2               | f = 1MHz<br>V = 1V <sub>P-P</sub><br>Note 2              |
|                           | IN2a | G <sub>V</sub>  | 2               | 3               | 3               | 2               | 2               | 2               | 2               | 2               | 2               |  |
|                           | IN1b | G <sub>V</sub>  | 2               | 2               | 2               | 3               | 2               | 2               | 2               | 2               | 2               |  |
|                           | IN2b | G <sub>V</sub>  | 2               | 2               | 2               | 2               | 3               | 3               | 2               | 2               | 2               |  |
|                           | IN1c | G <sub>V</sub>  | 2               | 2               | 2               | 2               | 2               | 2               | 3               | 2               | 2               |  |
|                           | IN2c | G <sub>V</sub>  | 2               | 2               | 2               | 2               | 2               | 2               | 2               | 3               | 3               |  |
| Interchannel crosstalk    | IN1a | C <sub>T</sub>  | 2               | 3               | 2               | 2               | 2               | 2               | 2               | 2               | 2               | f = 4.43MHz<br>V = 1V <sub>P-P</sub><br>Note 3           |
|                           | IN2a | C <sub>T</sub>  | 3               | 2               | 3               | 2               | 2               | 2               | 2               | 2               | 2               |  |
|                           | IN1b | C <sub>T</sub>  | 2               | 2               | 2               | 2               | 3               | 2               | 2               | 2               | 2               |  |
|                           | IN2b | C <sub>T</sub>  | 2               | 2               | 2               | 3               | 2               | 3               | 2               | 2               | 2               |  |
|                           | IN1c | C <sub>T</sub>  | 2               | 2               | 2               | 2               | 2               | 2               | 2               | 3               | 2               |  |
|                           | IN2c | C <sub>T</sub>  | 2               | 2               | 2               | 2               | 2               | 2               | 3               | 2               | 3               |  |
| Frequency characteristic  | IN1a | G <sub>f</sub>  | 3               | 2               | 2               | 2               | 2               | 2               | 2               | 2               | 2               | f = 10MHz<br>f = 1MHz<br>V = 1V <sub>P-P</sub><br>Note 4 |
|                           | IN2a | G <sub>f</sub>  | 2               | 3               | 3               | 2               | 2               | 2               | 2               | 2               | 2               |  |
|                           | IN1b | G <sub>f</sub>  | 2               | 2               | 2               | 3               | 2               | 2               | 2               | 2               | 2               |  |
|                           | IN2b | G <sub>f</sub>  | 2               | 2               | 2               | 2               | 3               | 3               | 2               | 2               | 2               |  |
|                           | IN1c | G <sub>f</sub>  | 2               | 2               | 2               | 2               | 2               | 2               | 3               | 2               | 2               |  |
|                           | IN2c | G <sub>f</sub>  | 2               | 2               | 2               | 2               | 2               | 2               | 2               | 3               | 3               |  |
| CTL pin switching level   | CTLa | V <sub>TH</sub> | 3               | 2               | 1               | 2               | 2               | 2               | 2               | 2               | 2               | Note 5   |
|                           | CTLb | V <sub>TH</sub> | 2               | 2               | 2               | 3               | 2               | 1               | 2               | 2               | 2               |  |
|                           | CTLc | V <sub>TH</sub> | 2               | 2               | 2               | 2               | 2               | 2               | 3               | 2               | 1               |  |
| Input impedance           | IN1a | Z <sub>IN</sub> | 1               | 2               | 2               | 2               | 2               | 2               | 2               | 2               | 2               | Note 6   |
|                           | IN2a | Z <sub>IN</sub> | 2               | 1               | 3               | 2               | 2               | 2               | 2               | 2               | 2               |  |
|                           | IN1b | Z <sub>IN</sub> | 2               | 2               | 2               | 1               | 2               | 2               | 2               | 2               | 2               |  |
|                           | IN2b | Z <sub>IN</sub> | 2               | 2               | 2               | 2               | 1               | 3               | 2               | 2               | 2               |  |
| Total-harmonic distortion | IN1a | THD             | 3               | 2               | 2               | 2               | 2               | 2               | 2               | 2               | 2               | Note 7   |
|                           | IN2a | THD             | 2               | 3               | 3               | 2               | 2               | 2               | 2               | 2               | 2               |  |
|                           | IN1b | THD             | 2               | 2               | 2               | 3               | 2               | 2               | 2               | 2               | 2               |  |
|                           | IN2b | THD             | 2               | 2               | 2               | 2               | 3               | 3               | 2               | 2               | 2               |  |

Note 1: Connect a distortion meter to the output, and input a f = 1kHz sine wave. Adjust the input level until the output distortion is 0.5%.

This output voltage at this time is the maximum output level V<sub>om</sub> (V<sub>P-P</sub>).

Note 2: Input a 1V<sub>P-P</sub>, 1MHz sine wave. The voltage gain is given by  $G_V = 20 \log (V_{OUT} / V_{IN})$ .

Note 3: Input a 1V<sub>P-P</sub>, 4.43MHz sine wave. The interchannel crosstalk is given by  $C_T = 20 \log (V_{OUT} / V_{IN})$ .

Note 4: Input 1V<sub>P-P</sub>, 1MHz and 10MHz sine waves. The frequency characteristic is given by  $G_f = 20 \log (V_{OUT}(f = 10\text{MHz}) / V_{OUT}(f = 1\text{MHz}))$ .

Note 5: Input a 1V<sub>P-P</sub>, 1MHz sine wave. Reduce the CTL pin voltage from V<sub>CC</sub>.

The CTL pin switching level (V<sub>TH</sub>) is the CTL pin voltage at which the V<sub>out</sub> level drops below 20mV<sub>P-P</sub>.

Note 6: Measure the input pin voltage V<sub>IN50</sub> when a current of DC50μA is flowing into the input pin. Measure the input pin open-circuit voltage.

The input impedance is given by  $Z = (V_{IN50} - V_{IN0}) / 50 \times 10^{-6} [\Omega]$ .

Note 7: Input a 1V<sub>P-P</sub>, 1kHz sine wave and measure the total-harmonic distortion of the output using a total-harmonic distortion meter.

●External dimensions (Units: mm)

