

Stereo microphone amplifier for camcorders

BA7781K

The BA7781K allows construction of a stereo-microphone amplifier for camcorder use with a minimum number of external components. The IC has a built-in wind-noise detection circuit, and wind-noise rejection filter. The filter circuit is controlled automatically. The IC can operate off a 3.0V power supply.

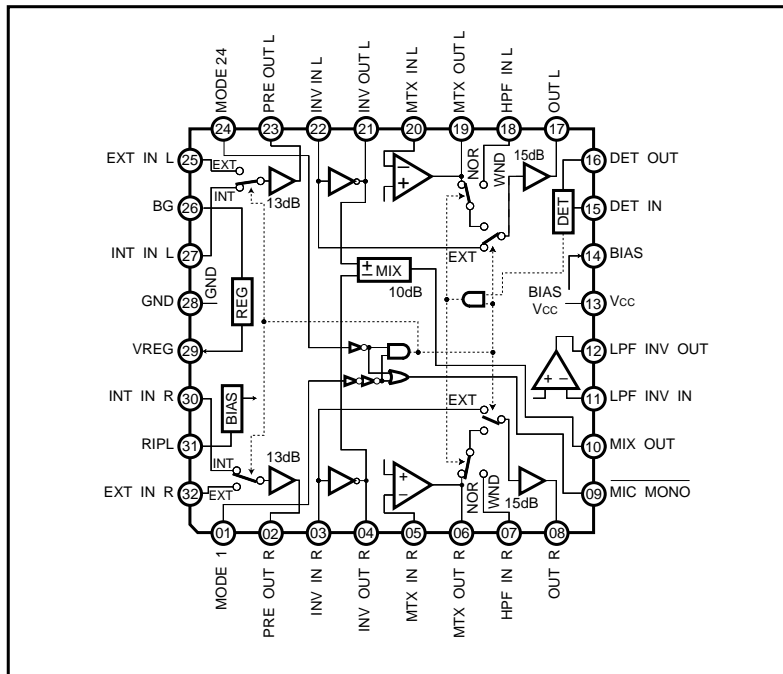
●Applications

Camcorders

●Features

- 1) Operates off a 3.0V to 5.25V power supply.
- 2) Automatic wind-noise rejection circuit.
- 3) Matrix circuit for stereo emphasis.
- 4) Automatic switching circuit for external microphones, built-in external monaural decision circuit, and input switch mode decision circuit.

●Block diagram



● Absolute maximum ratings (Ta = 25°C)

| Parameter | Symbol | Limits | Unit |
|-----------------------|------------------|------------|------|
| Power supply voltage | V _{CC} | 7.0 | V |
| Power dissipation | P _d | 400* | mW |
| Operating temperature | T _{opr} | -10 ~ +70 | °C |
| Storage temperature | T _{stg} | -55 ~ +125 | °C |

* Reduced by 4mW for each increase in Ta of 1°C over 25°C.

● Recommended operating conditions (Ta = 25°C)

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|----------------------|------------------|------|------|------|------|
| Power supply voltage | V _{CCS} | 3.0 | — | 5.25 | V |

● Electrical characteristics (unless otherwise noted, Ta = 25°C and V_{CC} = 3.3V)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|---|-------------------------------|------|------|-----------------|------------------|--|
| Current dissipation 1 | I _{INT} | — | 5.0 | 8.0 | mA | INT MIC IN, L / Rch No dissipation by mic |
| Current dissipation 2 | I _{EXT} | — | 4.8 | 8.0 | mA | EXT MIC IN, L / Rch No dissipation by mic |
| Preamplifier gain | V _{GPR} | 12 | 13 | 14 | dB | 30 / 32pin→2pin GAIN 27 / 25pin→23pin GAIN |
| Output amplifier gain | V _{GOA} | 14 | 15 | 16 | dB | 3 / 6 / 7pin→8pin GAIN 22 / 19 / 18pin→17pin GAIN |
| Distortion | THD | — | 0.05 | 0.3 | % | INT / EXT, V _o = 300mV _{rms} , L / Rch* ² |
| Maximum output voltage | V _{om} | 0.85 | 1.1 | — | V _{rms} | INT / EXT MIC IN, L / Rch f = 1kHz (distortion 1%* ²) |
| Output noise voltage | V _{NO} | — | -90 | -80 | dBV | INT / EXT, L / Rch, R _g = 1kΩ When gain is 28dB* ¹ |
| Input switch separation | CT _{L→E} | — | -88 | -70 | dB | INT→EXT MIC IN, R _g = 1kΩ, L / Rch (distortion 1%* ²), when gain is 28dB* ¹ |
| Interchannel separation | CT _{L←R} | — | -61 | -50 | dB | INT / EXT MIC, Lch→Rch, R _g = 1kΩ (distortion 1%* ²), when gain is 28dB* ¹ |
| Internal microphone power supply voltage | V _{REG} | 2.3 | 2.5 | 2.75 | V | Pin 27 output voltage for 30kΩ load |
| Input switch control voltage | V _{H_{SWH}} | 1.6 | — | V _{CC} | V | "H" level, 1 / 24 pin DC |
| | V _{H_{SWL}} | 0 | — | 0.6 | V | "L" level, 1 / 24 pin DC |
| High-pass filter switching attenuation characteristic | | | | | | Input 80Hz signal to pin 15, and measure gain at switch off side.* ¹ |
| | V _{G_{HON}} | — | — | -30 | dB | 15pin - 29.0dBV IN (80Hz) 6 / 19pin - 25.5dBV IN (1kHz) 6→8pin / 19→17pin GAIN |
| | V _{G_{HOFF}} | — | — | -30 | dB | 15pin - 45.0dBV IN (80Hz) 7 / 18pin - 25.5dBV IN (1kHz) 7→8pin / 18→17pin GAIN |
| High-pass filter control voltage | V _{H_{ON}} | 2.5 | — | V _{CC} | V | HPF on holding voltage (pin 16) |
| | V _{H_{OFF}} | 0 | — | 0.3 | V | HPF off holding voltage (pin 16) |

*1 JIS-A filter used.

*2 400Hz to 30kHz filter used.

●Pin descriptions

| Pin No. | Pin name | Function | Voltage (V) | Circuit |
|---------|-----------------|---|-------------|------------|
| 1 | MODE 1 | Mode control 1 input | — | 25kΩ |
| 2 | PRE OUT R | Preamplifier output | 1.65 | EF (P - P) |
| 3 | INV IN R | Inverter input | 1.65 | 100kΩ |
| 4 | INV OUT R | Inverter output | 1.65 | EF (P - P) |
| 5 | MTX IN R | Matrix amplifier input | 1.65 | B |
| 6 | MTX OUT R | Matrix amplifier output | 1.65 | EF (P - P) |
| 7 | HPF IN R | High-pass filter input | 1.65 | 100kΩ |
| 8 | OUT R | Signal output | 1.65 | C (P - P) |
| 9 | MIC MONO | External microphone monaural decision signal output | — | C |
| 10 | MIX OUT | Mix Output | 1.65 | EF (P - P) |
| 11 | LPF INV IN | Low-pass filter block inverter input | — | B |
| 12 | LPF INV OUT | Low-pass filter block inverter output | — | EF (P - P) |
| 13 | V _{CC} | V _{CC} | 3.3 | — |
| 14 | BIAS | Bias voltage | 1.65 | EF (P - P) |
| 15 | DET IN | Detector circuit input | 1.65 | 2kΩ |
| 16 | DET OUT | Detector circuit output | — | 22kΩ |
| 17 | OUT L | Signal output | 1.65 | C (P - P) |
| 18 | HPF IN L | High-pass filter input | 1.65 | 100kΩ |
| 19 | MTX OUT L | Matrix amplifier output | 1.65 | EF (P - P) |
| 20 | MTX IN L | Matrix amplifier input | 1.65 | B |
| 21 | INV OUT L | Inverter output | 1.65 | EF (P - P) |
| 22 | INV IN L | Inverter input | 1.65 | 100kΩ |
| 23 | PRE OUT L | Preamplifier output | 1.65 | EF (P - P) |
| 24 | MODE 24 | Mode control 24 input | — | 25kΩ |
| 25 | EXT IN L | External microphone input | 1.65 | 75kΩ |
| 26 | BG | For regulator ripple filter capacitor | 1.25 | 10kΩ |
| 27 | INT IN L | Internal microphone input | 1.65 | 75kΩ |
| 28 | GND | GND | — | — |
| 29 | VREG | Regulator output | 2.5 | C |
| 30 | INT IN R | Internal microphone input | 1.65 | 75kΩ |
| 31 | RIPL | For bias ripple filter capacitor | 1.65 | 50kΩ |
| 32 | EXT IN R | External microphone input | 1.65 | 75kΩ |

* EF: emitter follower, P-P: push pull, B: base, and C: collector.

All numerical values are standardized values.

● Measurement circuit

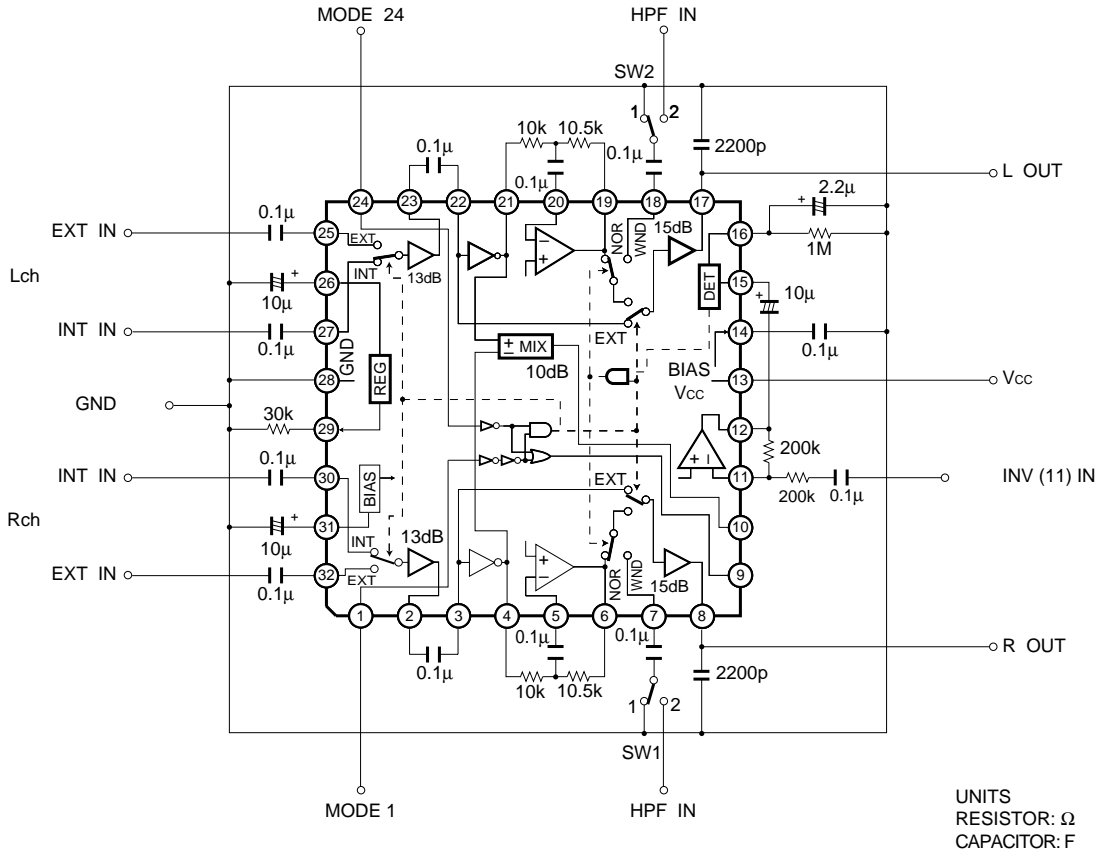
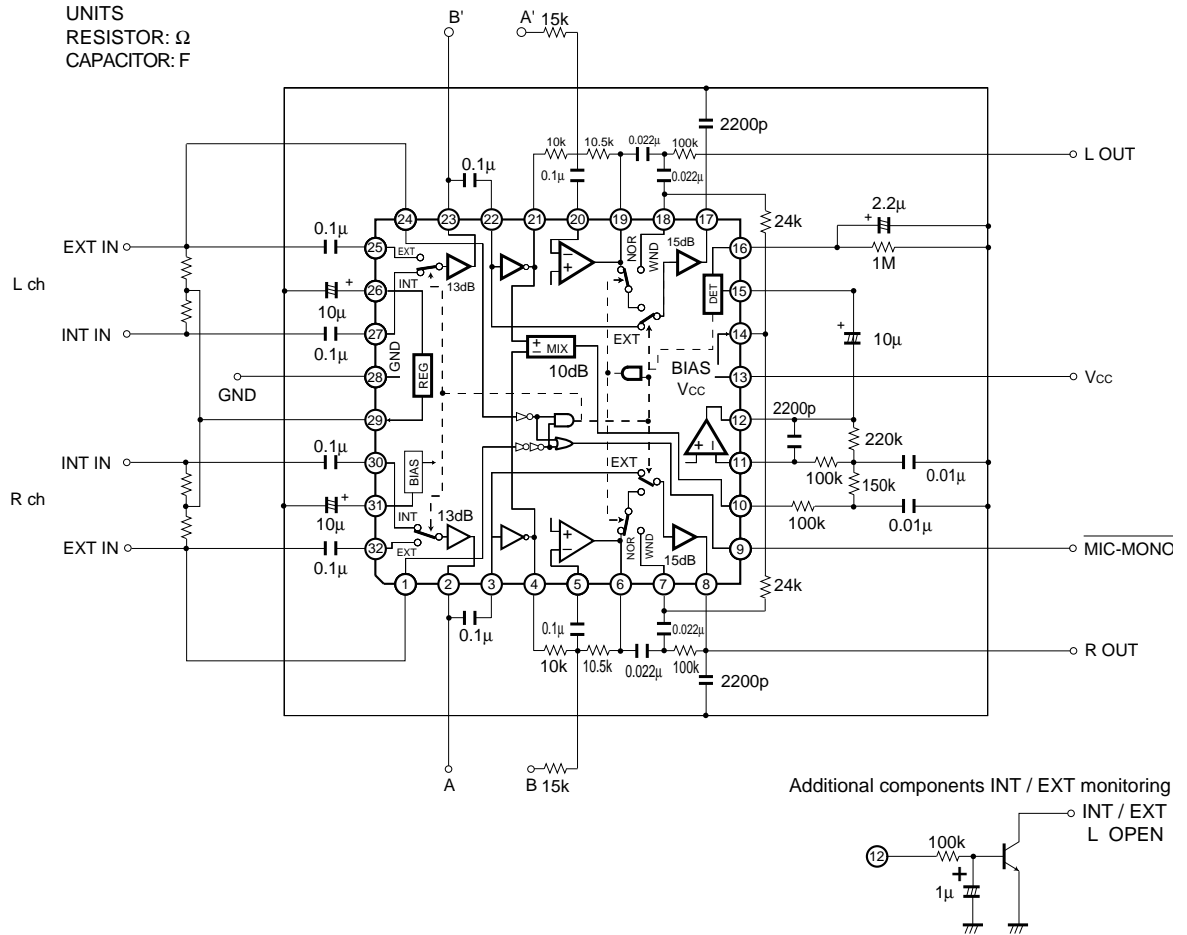


Fig. 1

●Application example



*1) When using the matrix circuit connect A-A' and B-B'.

*2) The pin 10 and 12 low-pass filter components are for $f_c = 150\text{Hz}$, Gain = 0dB, 18dB / oct.

Fig. 2

●Measurement circuit switch table (blank cells: no specification)

| Parameter | SW1 | SW2 | MODE1 | MODE24 | Signal input pin | |
|---|-----|-----|-----------------------------|--------|-------------------|-----|
| Current dissipation 1 | 1 | 1 | H | L | | |
| Current dissipation 2 | 1 | 1 | Conditions other than No. 1 | | | |
| Preamplifier gain | 1 | 1 | | | | |
| Output amplifier gain | 1 | 1 | | | | |
| Distortion | 1 | 1 | | | | |
| Maximum output | 1 | 1 | | | | |
| Output noise voltage | 1 | 1 | | | | |
| Input switch separation (INT→EXT) | 1 | 1 | L | L | INT | |
| Interchannel separation | INT | 1 | 1 | H | L | INT |
| | EXT | 1 | 1 | L | L | EXT |
| Internal microphone power supply voltage | 1 | 1 | | | | |
| Input switch control voltage | 1 | 1 | H | Vth | INT, EXT | |
| | 1 | 1 | Vth | L | INT, EXT | |
| High-pass filter switching attenuation characteristic | 2 | 2 | H | L | INV (11) , HPF | |
| | 1 | 1 | H | L | INV (11) , INT | |
| High-pass filter control voltage | 1 | 1 | H | L | INV, 16pin of Vth | |
| | 2 | 2 | H | L | HPF, 16pin of Vth | |

* H and L are Vcc and GND levels.

Measure the voltage range that maintains the mode for Vth.

●Operation notes

(1) Automatic wind-noise rejection circuit

The MAX OUT (pin 10) signal passes through the three-stage low-pass filter connected between pins 10 and 12, and the DC level of the low-frequency signal component is detected. This DC voltage (pin 16 DC voltage) automatically controls the on / off switching of the high-pass filter. The components connected to pins 11 and 12 set the gain of a multiple-feedback-type two-stage low-pass filter constructed around an inverting amplifier, and by changing the gain of the circuit you can adjust the detection sensitivity.

It is also possible to switch the high-pass filter manually by applying a DC voltage to pin 16 (see Fig 2).

(2) Additional components for INT / EXT monitor use

An internal circuit sets pin 12 to roughly the bias potential in INT mode, and to GND for EXT mode. This switches the external transistor on and off for INT and EXT modes respectively. This can be used to indicate whether the microphone amplifier is operating with the INT or EXT input. In the case of a camcorder, this can be used to display a message such as "EXT MIC ON" in the EVF.

●Electrical characteristic curves

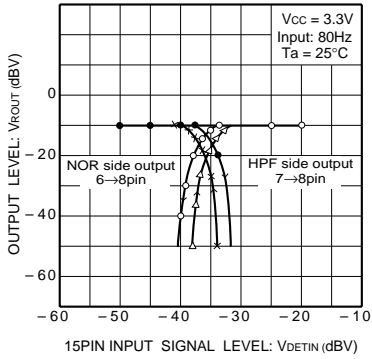


Fig. 3 HPF switching characteristics

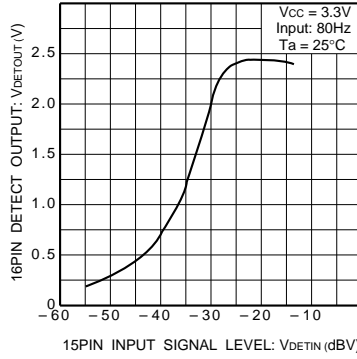


Fig. 4 Detector voltage characteristics

●External dimensions (Units: mm)

