

VSC* system processor IC

BA1701

The BA1701 is a monolithic audio-compression system controller IC that uses VSC*. When used in combination with an analog delay circuit and low-pass filter, it can replay recorded audio at 1 to 2.5 times the recording speed, without altering the pitch.

●Applications

Audio compression systems for tape-based answering machines and learning aids

●Features

- 1) Wide operating voltage range (4.5V to 14V).
- 2) Built-in two-phase sweep oscillator that can directly drive BBD.
- 3) Built-in motor controller is synchronized with the audio compression ratio.
- 4) Built-in voltage regulator.

●Absolute maximum ratings (Ta = 25°C)

| Parameter | Symbol | Limits | Unit |
|-----------------------|------------------|----------|------|
| Power supply voltage | V _{CC} | 14 | V |
| Power dissipation | P _d | 640* | mW |
| Operating temperature | T _{opr} | 0~+55 | °C |
| Storage temperature | T _{stg} | -55~+125 | °C |

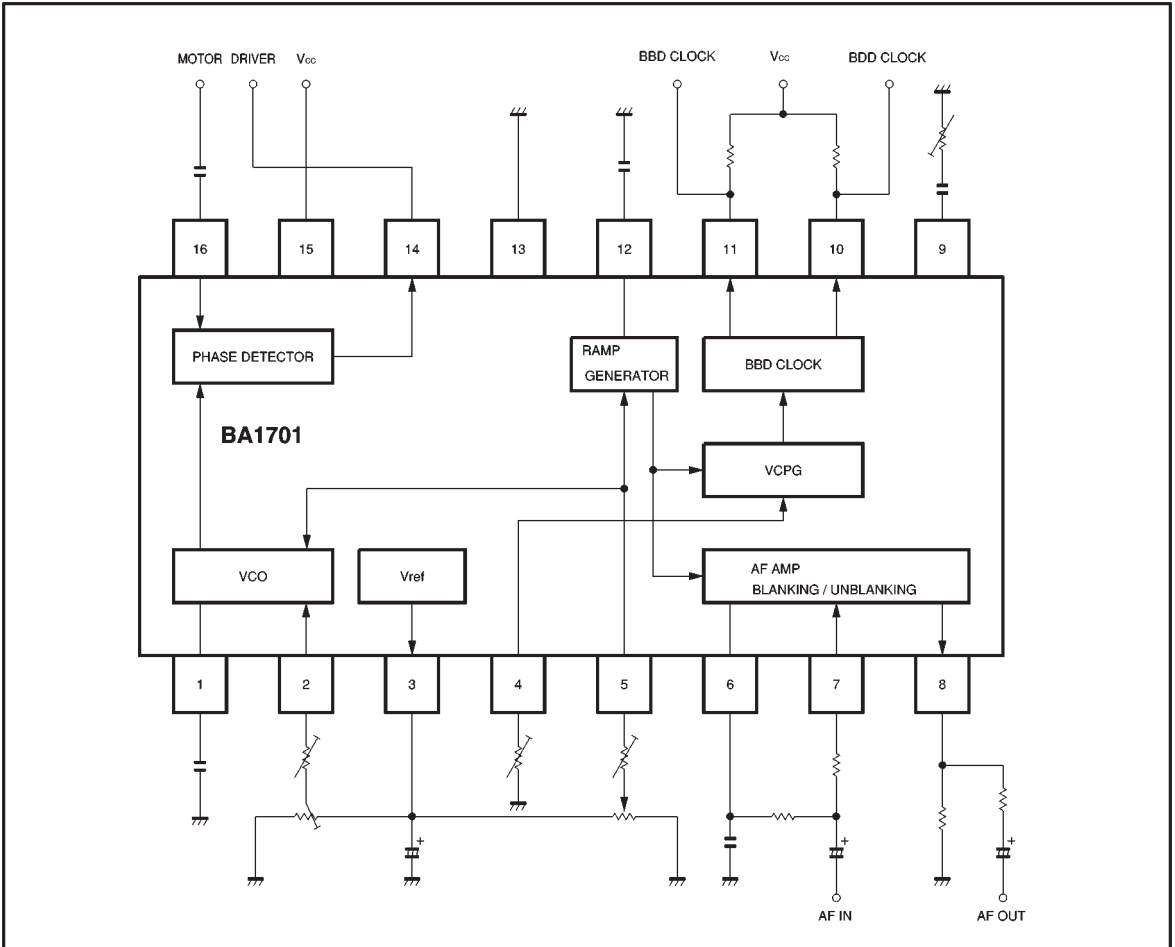
* Reduced by 6.4mW for each increase in Ta of 1°C over 25°C.

●Recommended operating conditions (Ta = 25°C)

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|----------------------|-----------------|------|------|------|------|
| Power supply voltage | V _{CC} | 4.5 | 6 | 14 | V |



● Block diagram



● Electrical characteristics (unless otherwise noted, $T_a = 25^\circ\text{C}$, $V_{CC} = 6\text{V}$, $f = 1\text{kHz}$, and $V_{IN} = 1.5\text{V}_{P-P}$)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|---|-----------|------|------|------|------------------|---|
| Quiescent current | I_Q | 6 | 11 | 17 | mA | RATE=1X |
| Internal reference power supply voltage | V_{REF} | 2.1 | 2.5 | 2.8 | V | $I_{OUT}=3\text{mA}$ |
| Buffer amplifier gain | G_V | -1 | 0 | 1 | dB | $V_{IN}=1.5\text{V}_{P-P}$, $f_{IN}=1\text{kHz}$ |
| Buffer amplifier distortion | T_{HD} | - | 0.2 | 1 | % | $V_{IN}=1.5\text{V}_{P-P}$, $f_{IN}=1\text{kHz}$ |
| Maximum allowable, input level | V_{Max} | 2 | - | - | V _{P-P} | $T_{HD}=1\%$, $f_{IN}=1\text{kHz}$ |
| Blanking period | T_B | 1 | 2.5 | 4 | ms | RATE=2.5X |
| Pin 14 high level voltage | V_H | 1.7 | 2.0 | 2.25 | V | - |
| Pin 14 medium level voltage | V_M | 0.9 | 1.25 | 1.4 | V | - |
| Pin 14 low level voltage | V_L | - | 0.2 | 0.5 | V | - |

● Measurement circuit

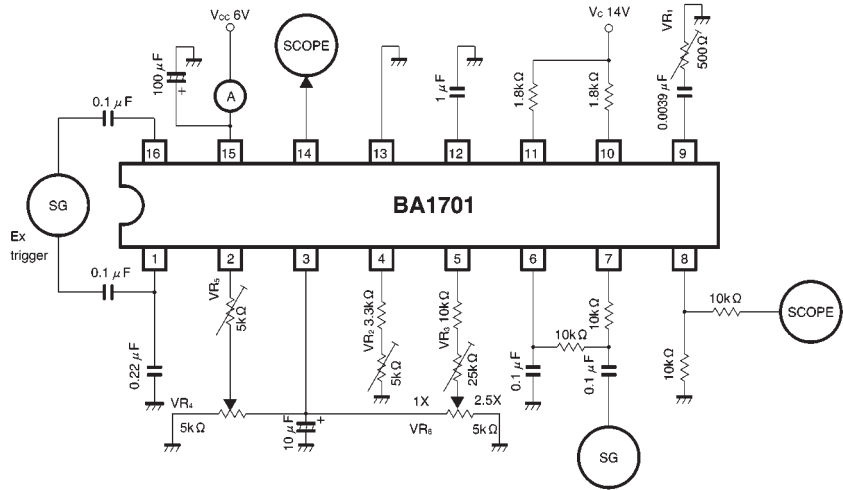


Fig. 1

● Application example

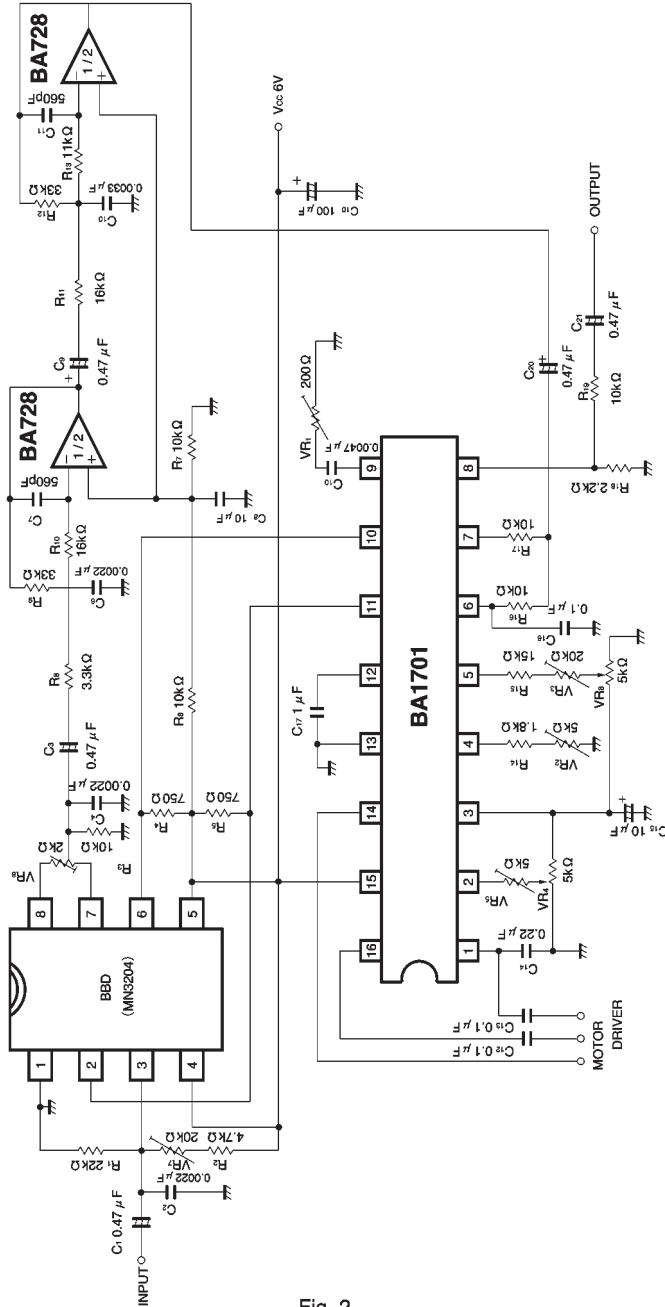


Fig. 2

● Circuit operation

(1) System construction

The BA1701 is a monolithic audio-compression system controller IC that uses VSC. When used in combination with an analog delay circuit, low-pass filter, and tape speed controller, it can replay recorded audio at 1 to 2.5 times the recording speed, without altering the pitch (see

Fig. 3).

The BA1701 has a built-in motor driver control circuit that is synchronized with the pitch control that allows the system to be built with just one pitch control potentiometer (see Fig. 4).

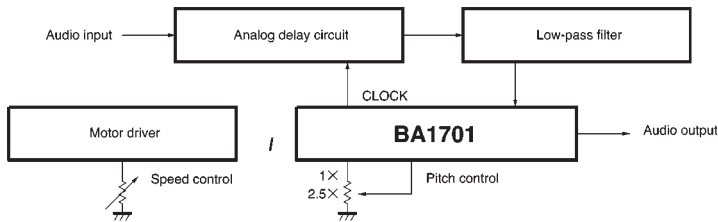


Fig. 3

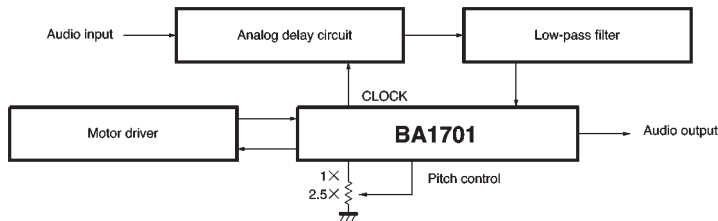


Fig. 4

(2) Principles of audio compression (see Fig. 5)

When recorded audio (A) is replayed at high speed, the pitch of the audio increases in proportion to the playback speed (B). By expanding this using an analog delay circuit, a compressed audio signal with the same pitch as

the original recorded signal is obtained (C). Partial audio dropout occurs when the audio is expanded, but due to the diffuse nature of speech, the expanded audio does not sound unnatural to the human ear.

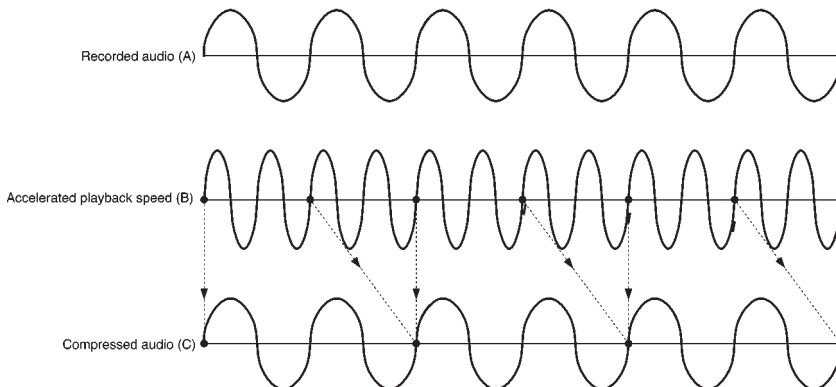


Fig. 5

● Application board patterns (solder side)

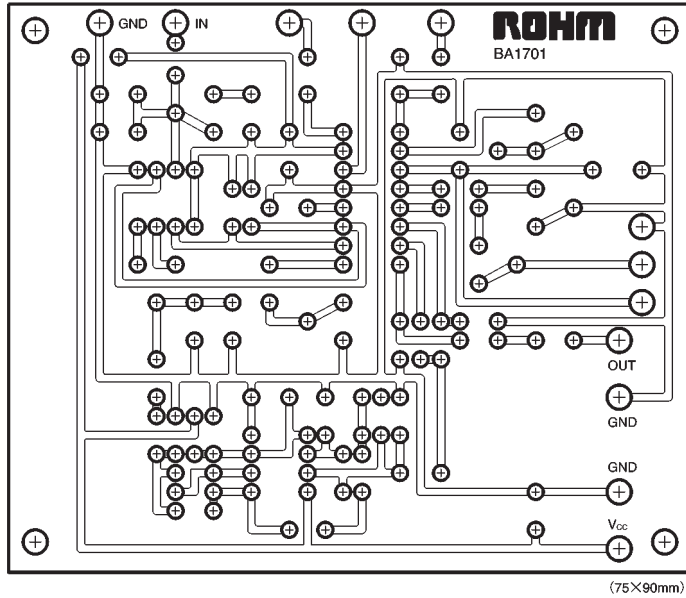


Fig. 6

● Application board component layout (solder side)

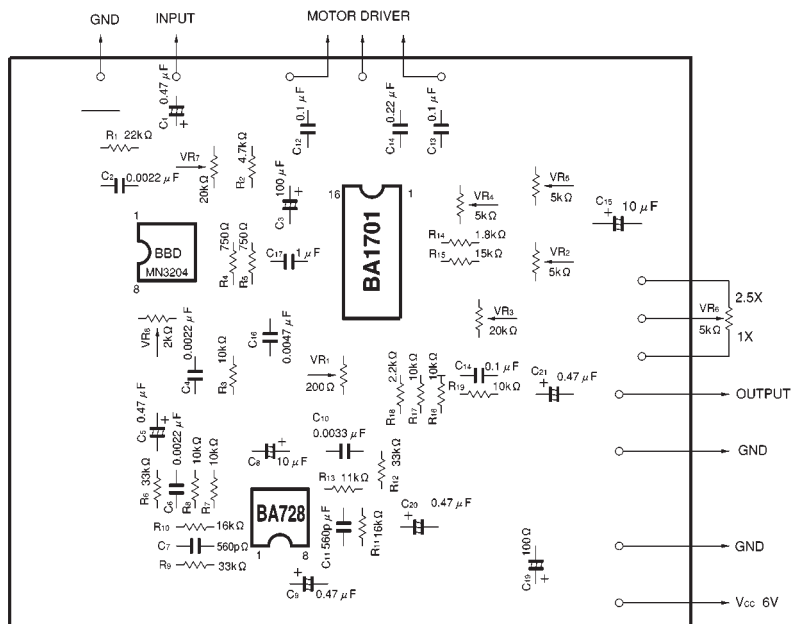


Fig.7

● Adjustment procedure

- (1) With Rate = 2.5X ($V_{R6} = \text{GND}$), apply DC270mV to pin 12, and adjust V_{R1} so that the frequency of the waveform on pin 11 is 300kHz.
- (2) With Rate = 2.5X, apply DC2.462mV to pin 12, and adjust V_{R2} so that the frequency of the waveform on pin 11 is 12kHz.
- (3) Repeat adjustments (1) and (2).
- (4) With Rate = 2.5X, adjust V_{R3} so that the period of the waveform on pin 12 is 19ms.
- (5) With Rate = 1X ($V_{R6} = V_{\text{ref}}$), adjust V_{R4} so that the frequency at pin 1 is 300Hz.
- (6) With Rate = 2.5X, adjust V_{R5} so that the frequency at pin 1 is 750Hz.
- (7) With Rate = 1X, input $V_{\text{IN}} = 500\text{mV}$ and $f_{\text{IN}} = 2.5\text{kHz}$, and adjust V_{R7} and V_{R8} so that the output distortion is minimized.

* If you are not using the motor drive control circuit, adjustments (5) and (6) are not necessary.

● Operation notes

- (1) Use accurate film capacitors for the VCO time constant capacitor C_{14} ($0.22\mu\text{F}$), the RAMP time constant capacitor C_{17} ($1\mu\text{F}$), and the BBD clock time constant capacitor ($0.0047\mu\text{F}$).
- (2) If the AF output pin (pin 8) has a capacitive load, you must take precautions to ensure that the BA1701 AF amplifier does not oscillate. We recommend that you insert R_{19} (about $10\text{k}\Omega$) in the signal output line.
- (3) To prevent oscillation, position the earth point of the BBD clock time constant pin (pin 9) close to the GND pin (pin 13) (see Fig. 6).

● Electrical characteristic curves

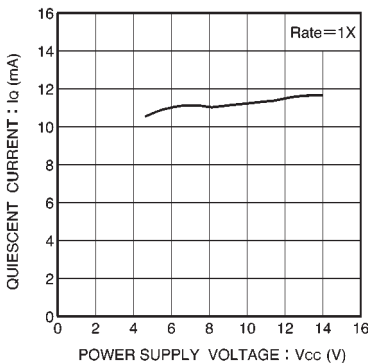


Fig. 8 Quiescent current vs. power supply voltage

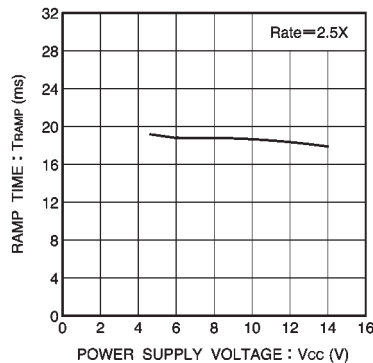


Fig. 9 RAMP period vs. power supply voltage

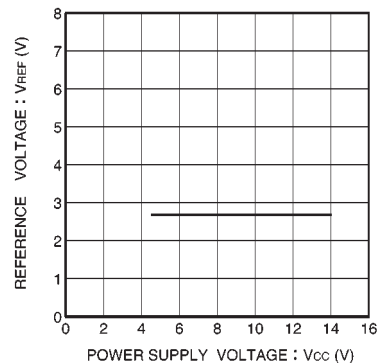


Fig. 10 Reference voltage vs. power supply voltage

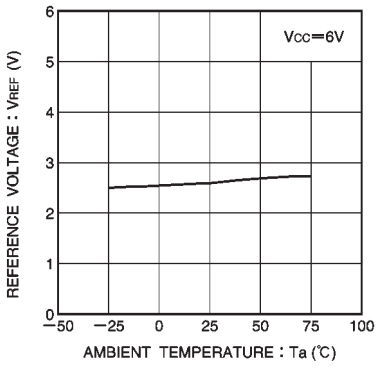


Fig. 11 Reference voltage vs. ambient temperature

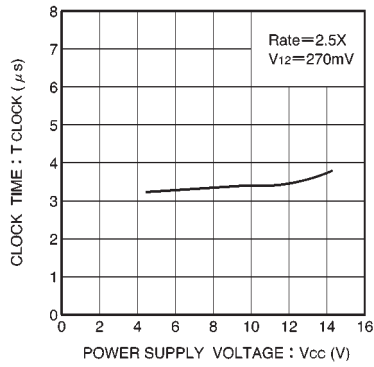


Fig. 12 Clock period vs. power supply voltage (I)

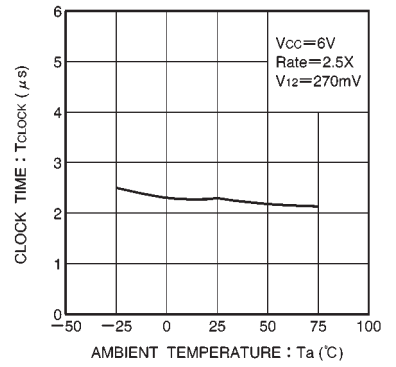


Fig. 13 Clock period vs. ambient temperature (I)

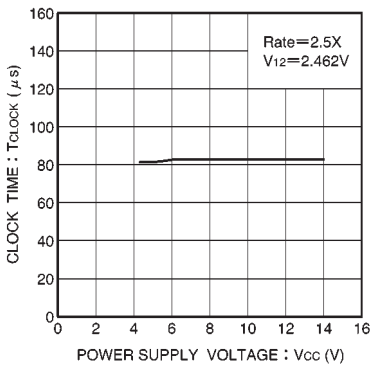


Fig. 14 Clock period vs. power supply voltage (II)

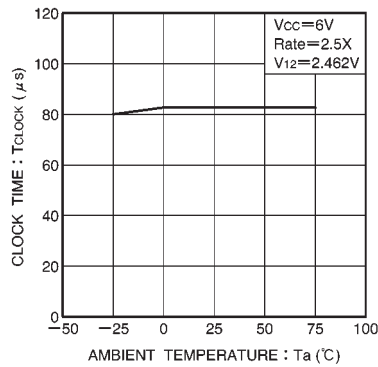


Fig. 15 Clock period vs. ambient temperature (II)

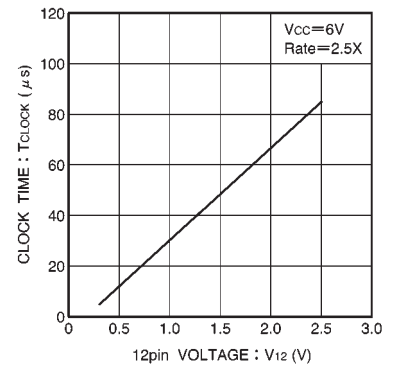


Fig. 16 Clock period vs. pin 12 voltage

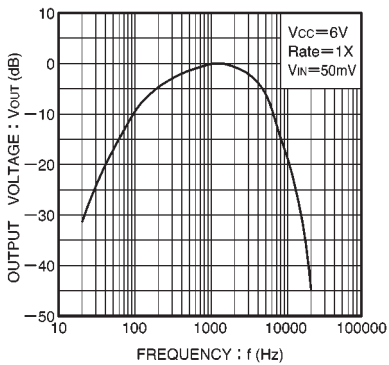


Fig. 17 Output voltage vs. signal frequency

● External dimensions (Units: mm)

