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℃)

Parameter	Symbol	Limits	Unit
Supply voltage	V_{CC}	14	V
Power dissipation	Pd	640*	mW
Operating temperature	Topr	0~55	℃
Storage temperature	Tstg	−55~125	℃

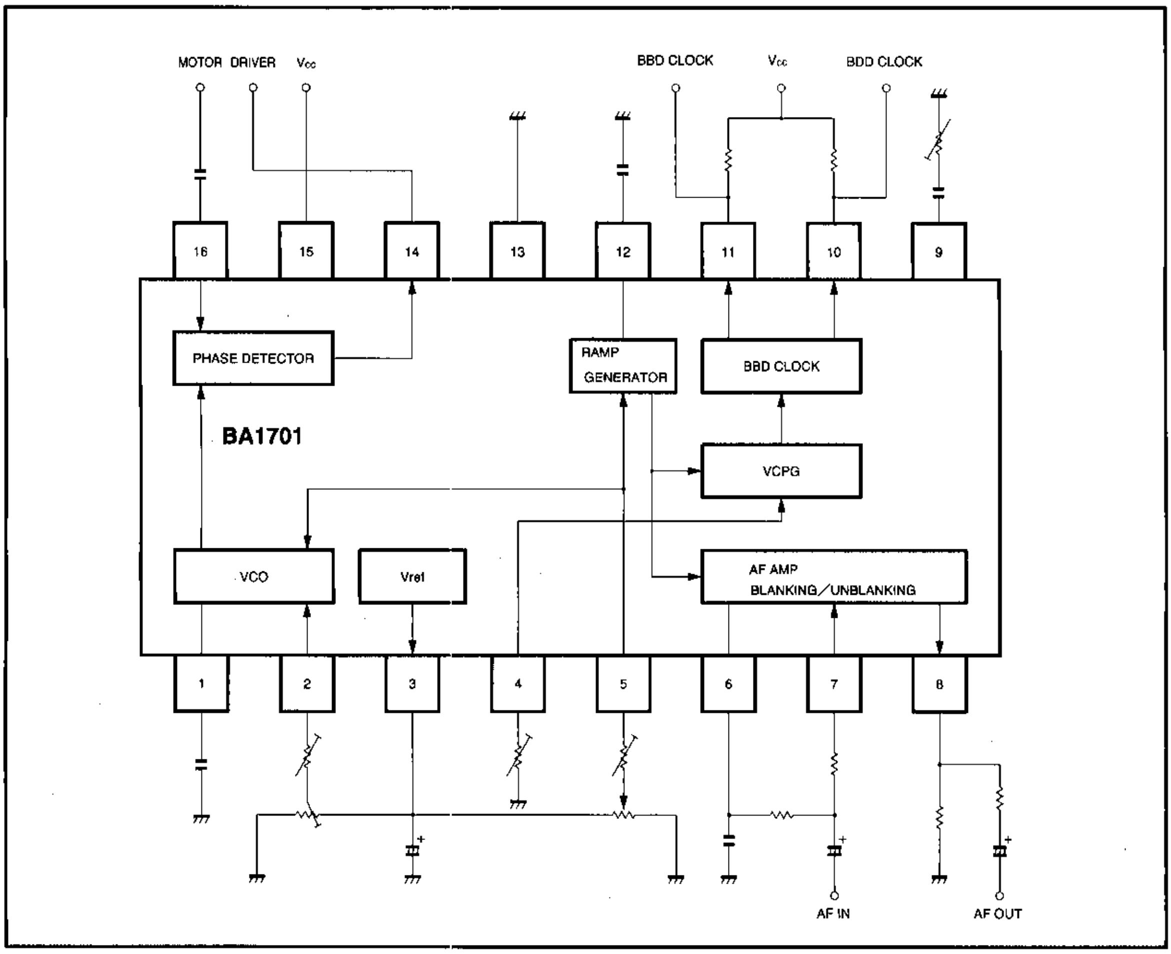
* Reduced by 6.4mW for each increase in Ta of 1°C over 25°C.

●Recommended operating conditions (Ta = 25℃)

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	V_{CC}	4.5	6	14	V

* VSC is a trademark of The Variable Speech Control Company. This product is manufactured under licence from VSC Ltd. for use in VSC systems.

●Block diagram



●Electrical characteristics (Unless otherwise specified, Ta = 25˚C and Vcc = 6V, f = 1kHz, and V_{IN} = 1.5V_{PP})

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

●Measurement circuit

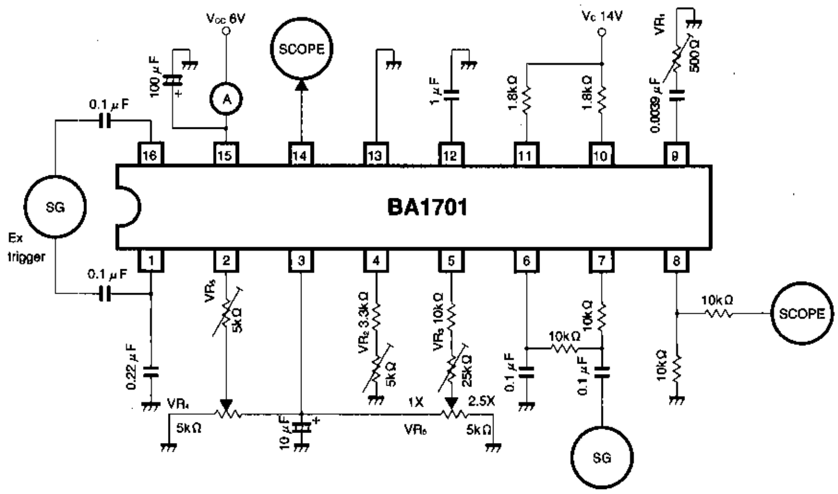


Fig. 1

●Application example

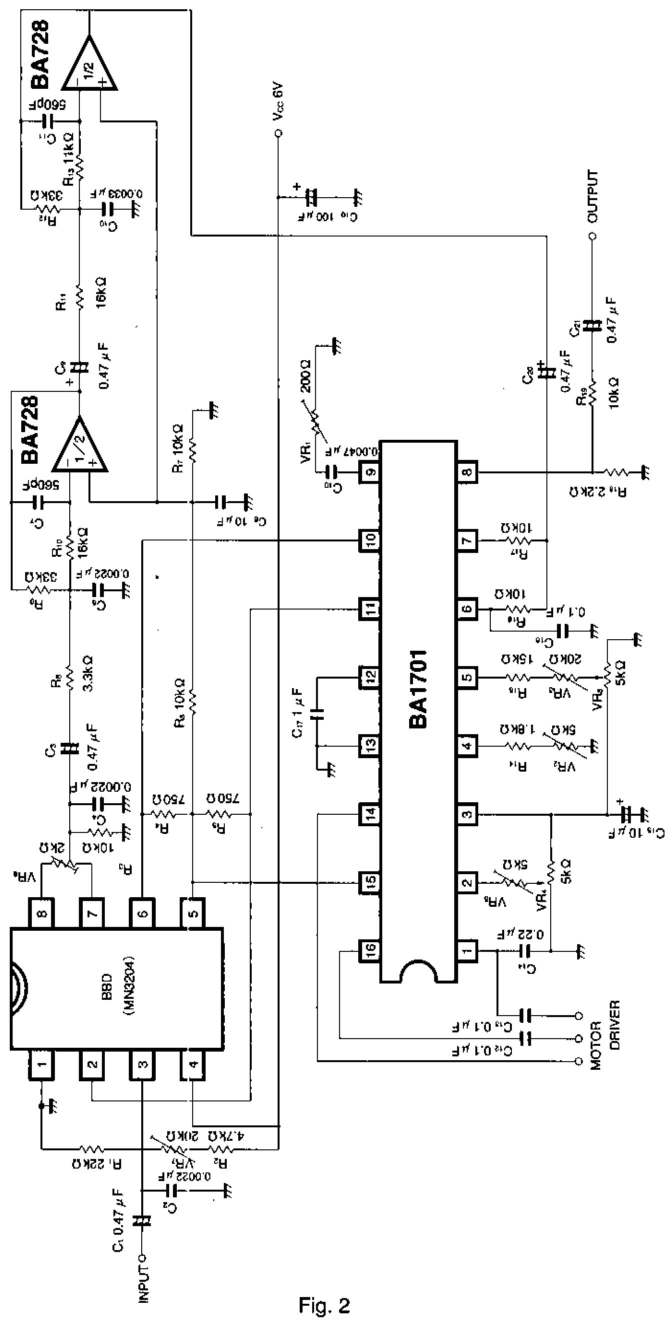


Fig. 2

●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).

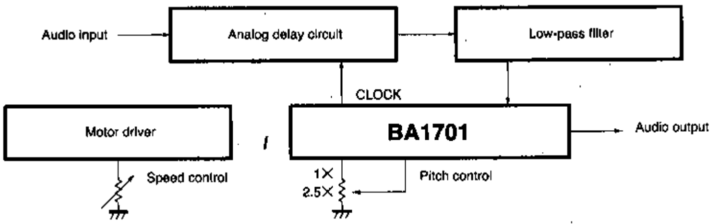


Fig. 3

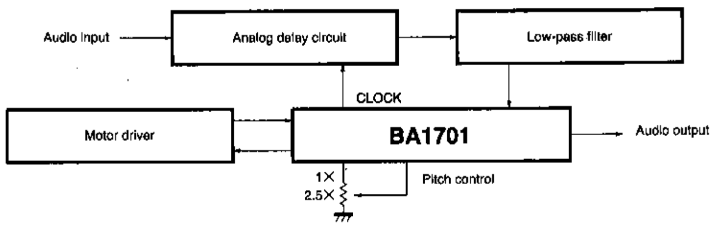


Fig. 4

(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.

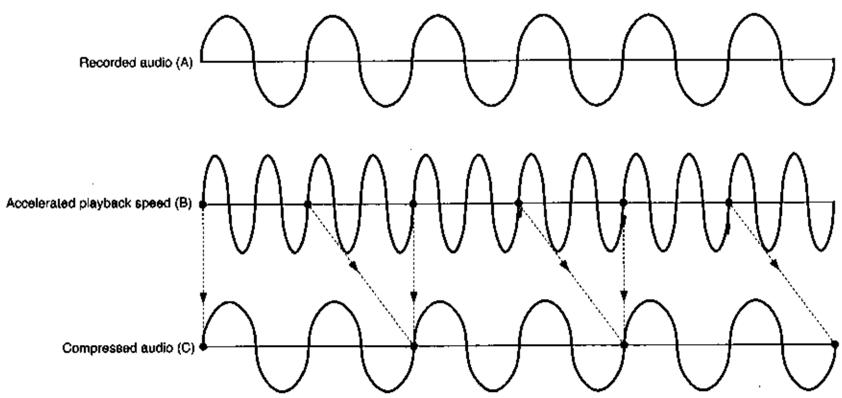
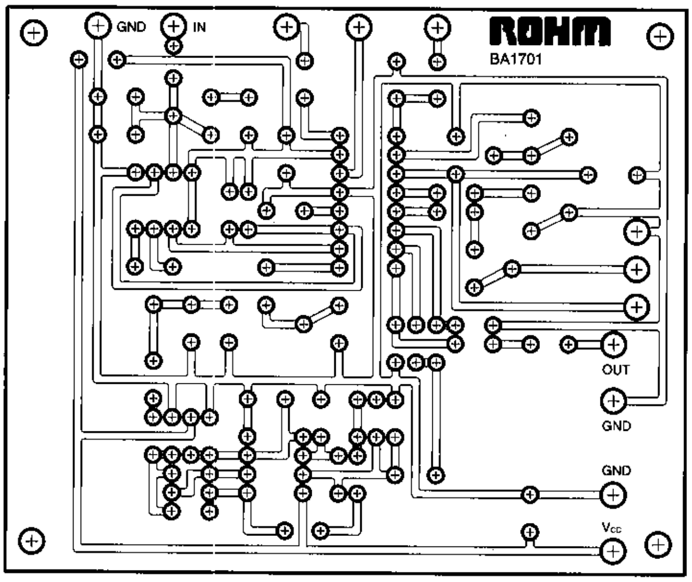


Fig. 5

●Application circuit PCB (solder sider)



(75X80mm)

Fig. 6 Application circuit PCB (solder sider)

●Application circuit component layout (solder sider)

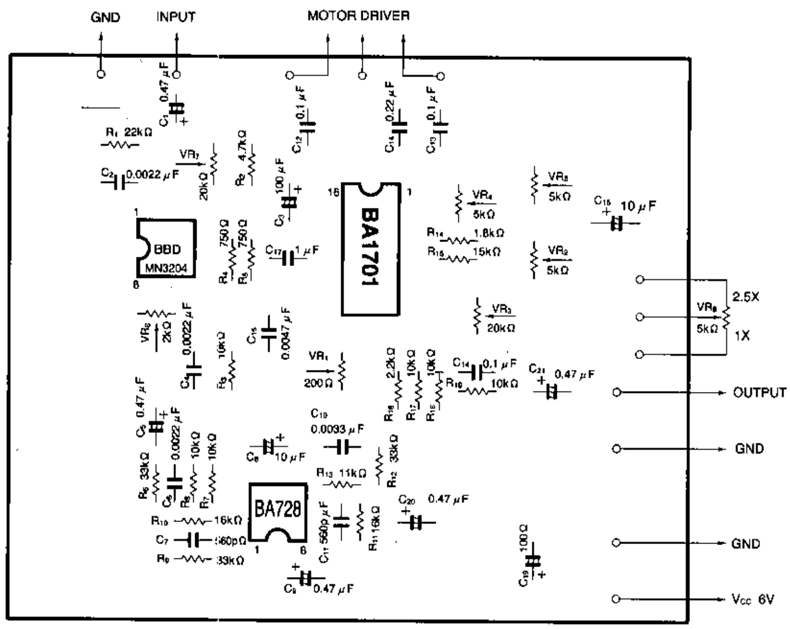


Fig. 7 Application circuit component layout (solder sider)

●Adjustment procedure

(1) With Rate = 2.5X (VR_6 = GND), apply DC12mV to pin 12, and adjust VR_1 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 VR_2 so that the frequency of the waveform on pin 11 is 12kHz.

(3) Repeat adjustments (1) and (2).

(4) With Rate = 2.5X, adjust VR_3 so that the period of the waveform on pin 12 is 19ms.

(5) With Rate = 1X, (VR_6 = Vref), adjust VR_4 so that the frequency at pin 1 is 300Hz.

(6) With Rate = 2.5X, (VR_6 = Vref), adjust VR_5 so that the frequency at pin 1 is 750Hz.

(7) With Rate = 1X, input V_{IN} = 500mV and f_{IN} = 2.5kHz, and adjust VR_7 and VR_8 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 μF), the RAMP time constant capacitor C_{17} (1 μF), and the BBD clock time constant capacitor (0.0047 μF).

(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 10kΩ) 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

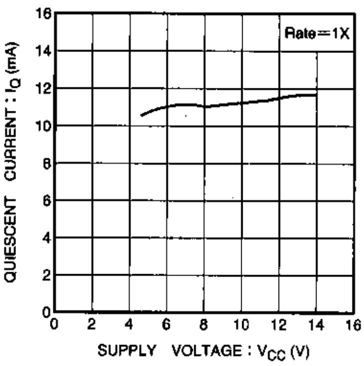


Fig. 8 Quiescent current vs. supply voltage

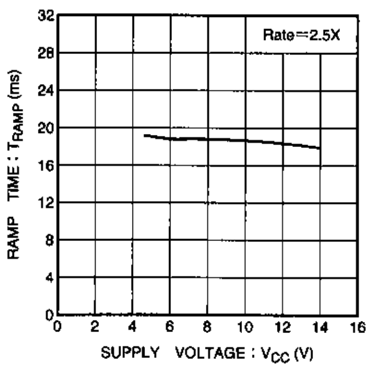


Fig. 9 RAMP period vs. supply voltage

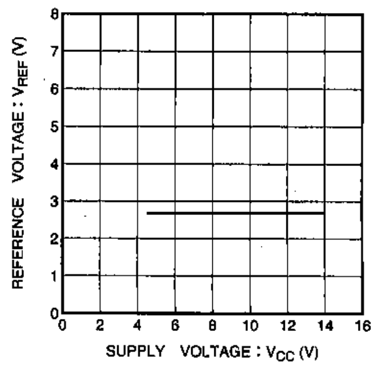


Fig. 10 Reference voltage vs. supply voltage

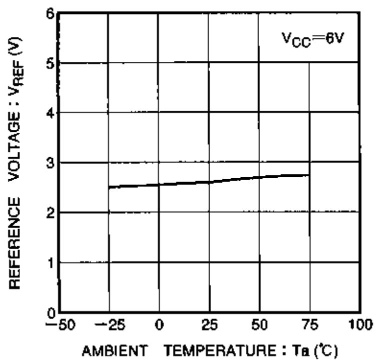


Fig. 11 Reference voltage vs. ambient temperature

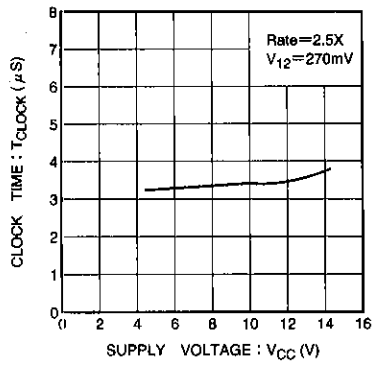


Fig. 12 Clock period vs. supply voltage (1)

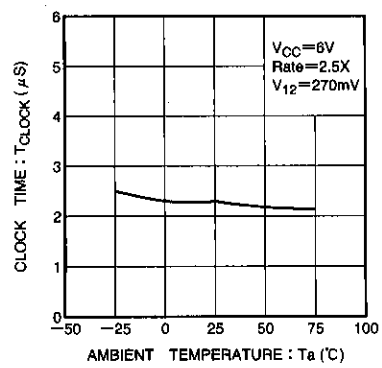


Fig. 13 Clock period vs. ambient temperature (1)

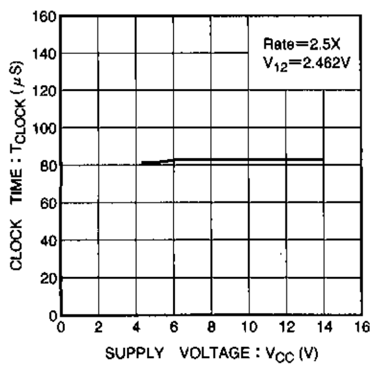


Fig. 14 Clock period vs. supply voltage (2)

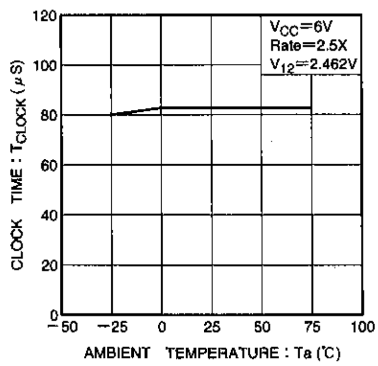


Fig. 15 Clock period vs. ambient temperature (2)

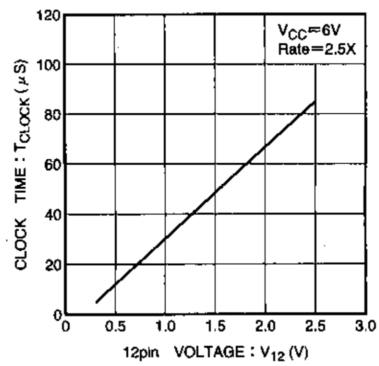


Fig. 16 Clock period vs. pin 12 voltage

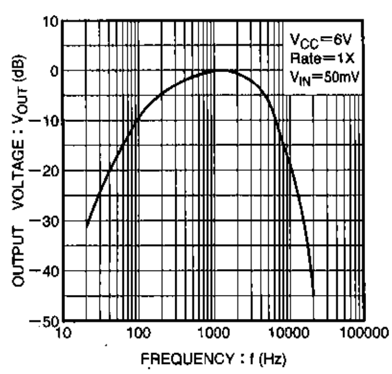
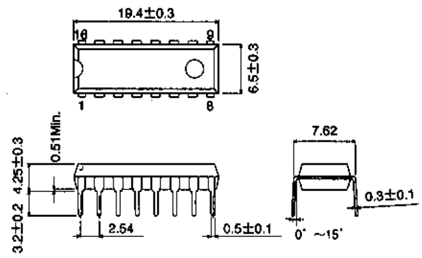


Fig. 17 Output voltage vs. signal frequency

●External dimensions (Unit: mm)



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