Mute detector IC for 3V sets players
BA3708F

The BA3708F is a mute detector IC for 3V tape players. When the signal is higher than the input decision level V_{IN} and longer than the song detect time, a pulse of width T_W is output after the pulse delay time T_D which begins when the input signal ends. The output is an open collector which enables direct drive of the plunger. A mute function is included which makes it possible to stop detection.

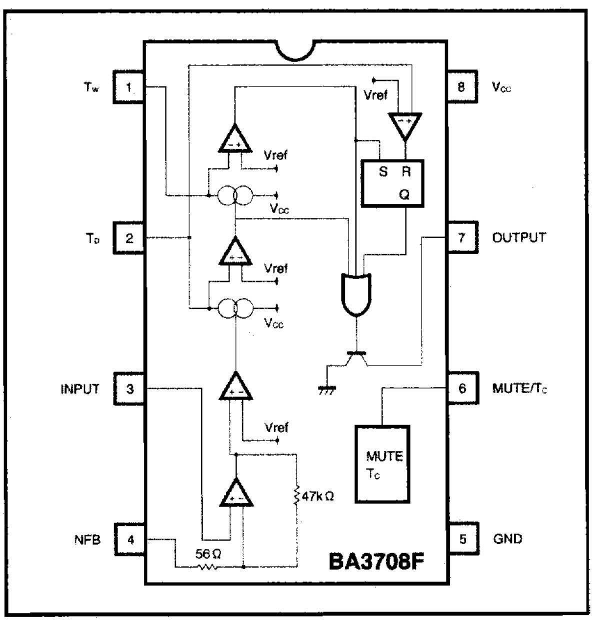
●Applications

3V tape players

●Features

1) Low supply voltage (can be operated at 1.8V; recommended voltage is 2.0 to 5.0V).
2) Uses the song detection method to minimize incorrect detection caused by) noise between songs.
3) The pulse delay time T_D, pulse width T_W, and song detect time T_C can be set using external RC time constants.
4) Includes a mute circuit which makes it possible to stop song selection.
5) Built-in output transistor enables direct drive of the plunger.

●Block diagram



● Absolute maximum ratings (Ta = 25℃)

Parameter	Symbol	Limits	Unit
Supply voltage	V_{CC}	6.0	V
Power dissipation	Pd	550*1	mW
Operating temperature	Topr	−25~75	℃
Storage temperature	Tstg	−55~125	℃
Maximum output current	$I_{O\,Max.}$	100*2	mA

*1 When used above Ta = 25℃, decreases 5.5 mW per degree.
*2 Tw=200ms On duty cycle=30%

● Recommended operating conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	V_{CC}	1.8	3.0	5.0	V

● Electrical characteristics (unless otherwise indicated, Ta = 25℃ and V_{CC} = 3V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions	Measurement Circuit
Quiescent current	I_Q	3.5	7	10.5	mA	MUTE OFF	Fig.1
Input decision level	V_{IN}	−67	−64	−61	dBV	f=10kHz, C_{NF}=0.47 μF	Fig.1
Mute detect timing	T_D	44	63	82	ms	R_D=390kΩ, C_D=0.1 μF	Fig.1
Output pulse width	T_W	42	60	78	ms	R_W=390kΩ, C_D=0.1 μF	Fig.1
Song detection time	T_C	150	250	350	ms	C_C=2.2 μF	Fig.1
Output saturation voltage	V_{OL}	−	0.25	0.5	V	I_{OUT}=50mA	Fig.1
Pin 6 threshold voltage 1	V_{6TH-1}	15	45	85	mV	MUTE OFF→MUTE ON	Fig.1
Pin 6 threshold voltage 2	V_{6TH-2}	−	1.5	−	V	During song detection	Fig.1

● Measurement circuit schematic

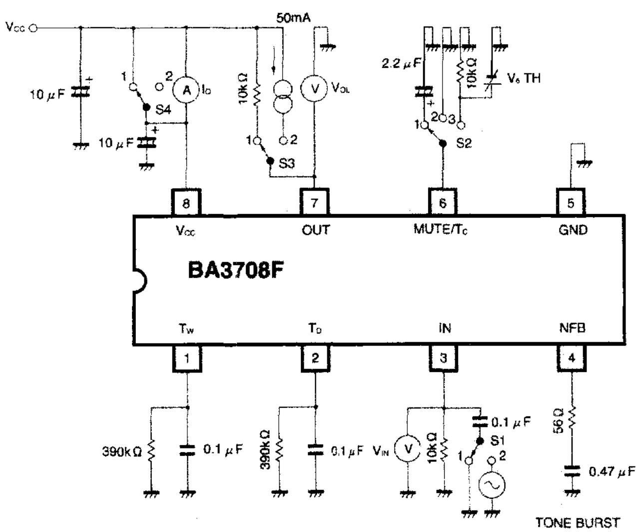


Fig. 1

Switch operations

	S_1	S_2	S_3	S_4
I_Q	1	1	1	2
V_{IN}	2	1	1	1
T_D	2	1	1	1
T_W	2	1	1	1
T_C	2	1	1	1
V_{OL}	1	1	2	1
$V_{6\,TH}$	1	3	1	1

●Application example

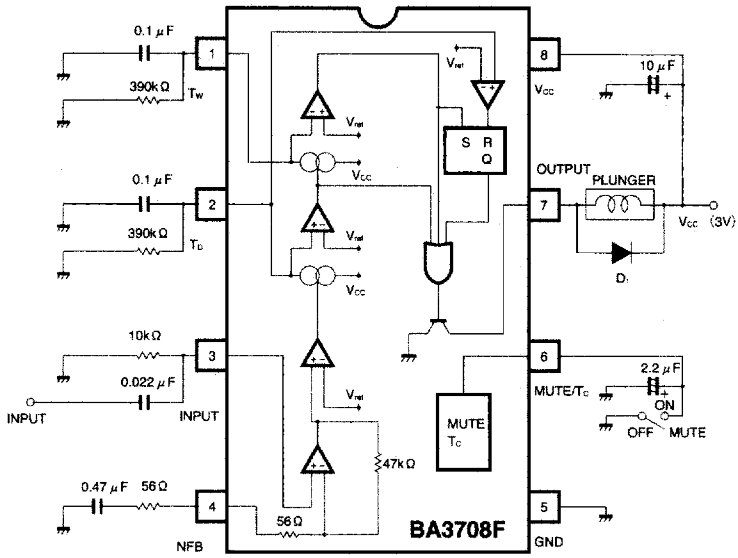


Fig. 2

●Circuit operation

(1) Input amplifier

The input amplifier is a PNP differential amplifier, and the input pin (Pin 3) must be directly connected to ground through a 10kΩ or less bias resistor (R_{IN}). If R_{IN} is too large, an input offset may occur and operation will become unstable. The gain and frequency characteristics of the amplifier are determined by C_{IN} and R_{IN} connected to the input pin (Pin 3), and C_{NF} and R_{NF} connected to the N_{FB} pin (Pin 4). (Figure 3)

(2) Timing

An output pulse of width T_W is generated from the output pin (Pin 7) after the pulse delay time T_D which begins when the input signal ends. The values of T_D and T_W are determined by the RC time constants of Pin 2 and Pin 1.

$$T_D\ (ms) \fallingdotseq 1.7 \times C_D\ (\mu F) \times R_D\ (k\Omega)$$

$$T_W\ (ms) \fallingdotseq 1.6 \times C_W\ (\mu F) \times R_W\ (k\Omega)$$

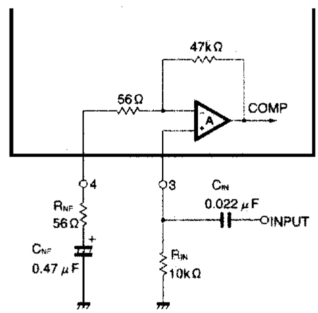


Fig. 3

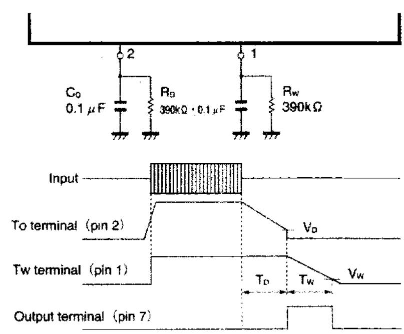


Fig. 4

(3) Song detect time Tc and mute circuit

To prevent incorrect detection due to noise between songs, a song detect function has been included. With this function, the plunger activate pulse is only output when the input signal is longer than the song detect time Tc, and therefore a song. A pulse is not output for noise signals shorter than Tc. The length of TC is set by the value of the capacitor Cc connected to Pin 6. (See Fig. 18 for the relation between Cc and Tc.)

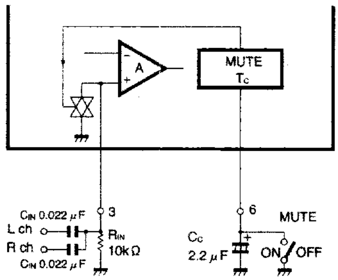


Fig. 5

If Pin 6 is connected to ground, the mute circuit will operate and song detection will stop. In this case, the value of the input resistor connected to Pin 3 will be smaller (approximately 1kΩ), and this will prevent the increase of crosstalk between the left and right channels.

(4) Output circuit

The output circuit is an open collector which is suitable for mechanical systems where the plunger is on during song selection. The pulse width Tw is 200 ms and the duty cycle is 30%, and drive is possible up to an output current IOUT = 100mA. The output is OFF (high) while the mute function operates. A discharge diode must be added in parallel with the plunger solenoid.

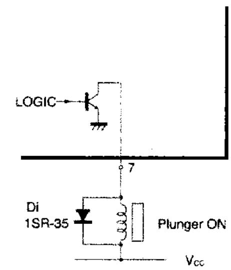


Fig. 6

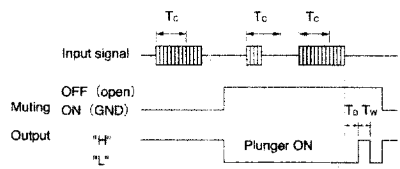


Fig. 7

●Electrical characteristic curves

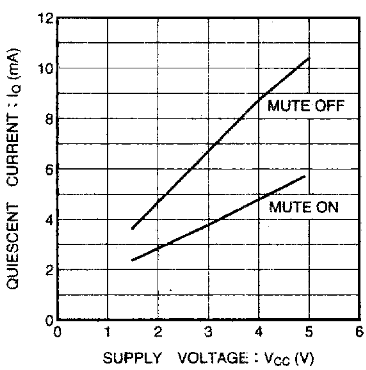


Fig. 8 Quiescent current vs. supply voltage

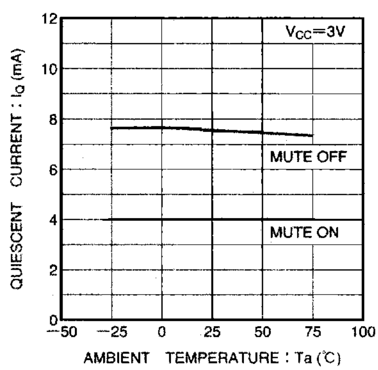


Fig. 9 Quiescent current vs. ambient temperature

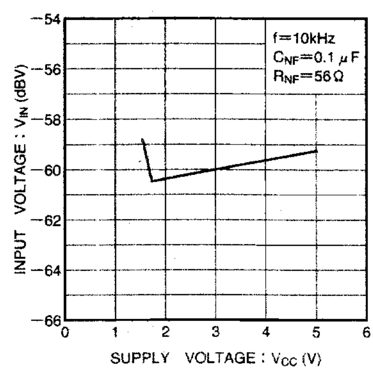


Fig.10 Input decision level vs. supply voltage

●Electrical characteristic curves

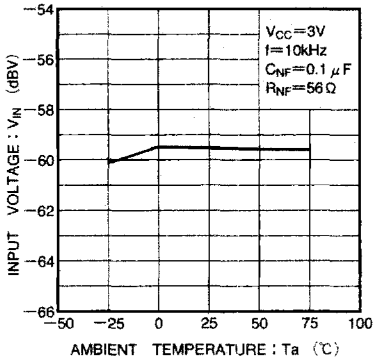


Fig.11 Input decision level vs. ambient temperature

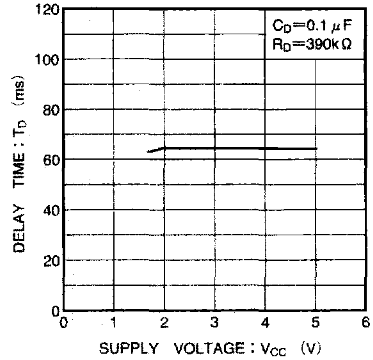


Fig. 12 Mute detection time vs. supply voltage

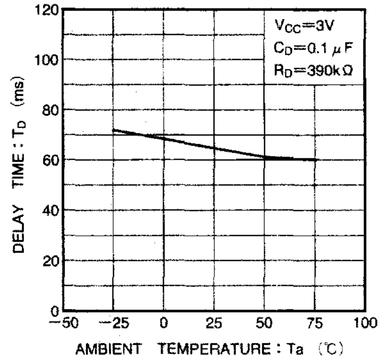


Fig. 13 Mute detection time vs. ambient temperature

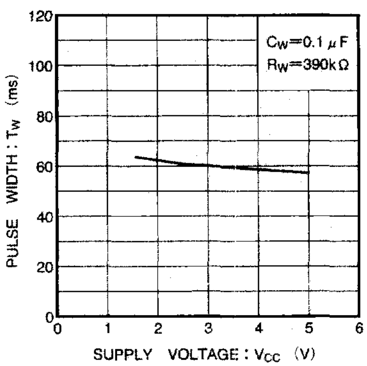


Fig. 14 Output pulse width vs. supply voltage

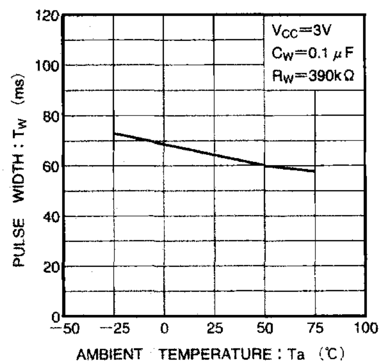


Fig. 15 Output pulse width vs. ambient temperature

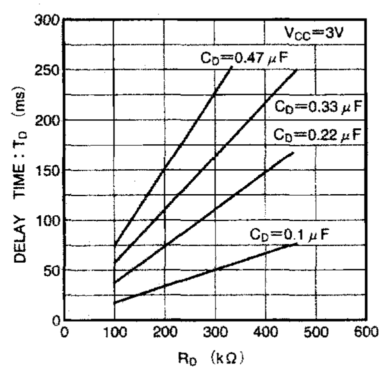


Fig. 16 Mute detection time vs. resitance R_D

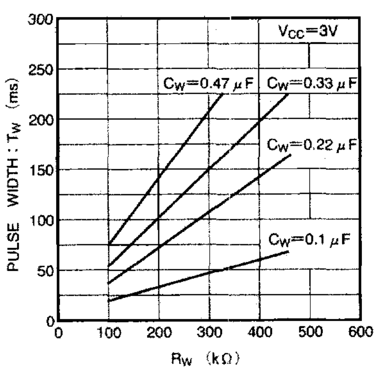


Fig. 17 Output pulse width vs. resistance R_W

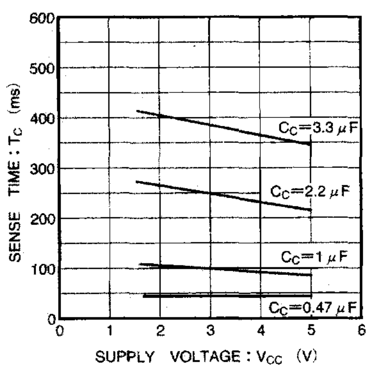


Fig. 18 Song detection time vs. supply voltage

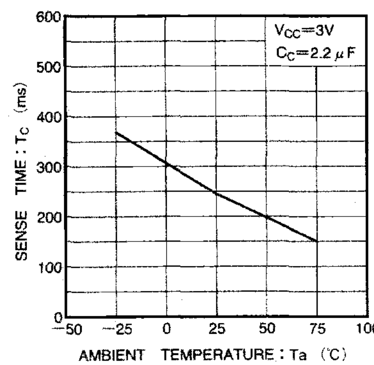


Fig. 19 Song detection time vs. ambient temperatue

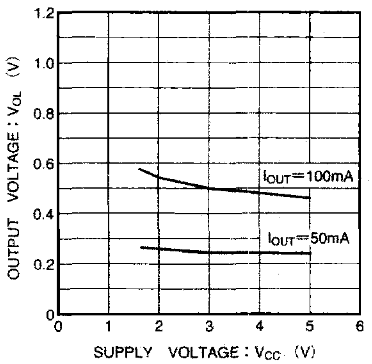


Fig. 20 Output voltage vs. supply voltage

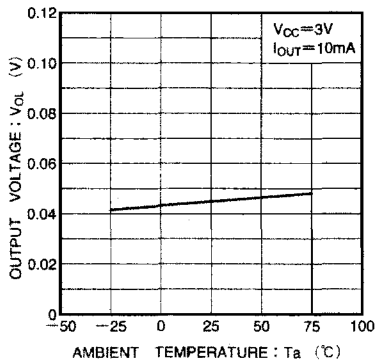


Fig. 21 Output voltage vs. ambient temperature

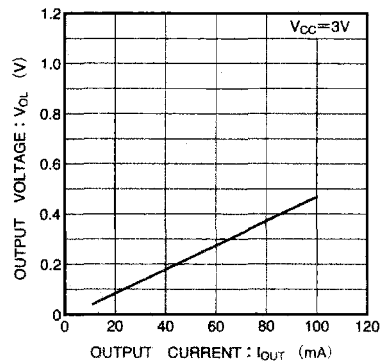


Fig. 22 Output voltage vs. output current

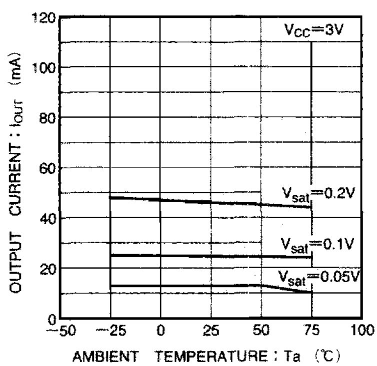


Fig. 23 Output current vs. ambient temperature

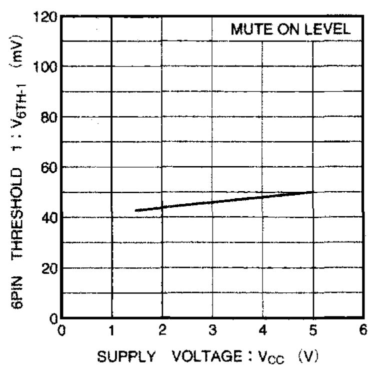


Fig. 24 6pin threshold voltage 1 vs. supply voltage

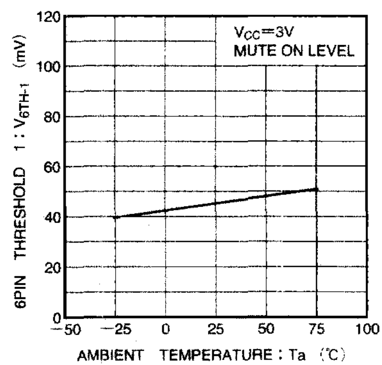


Fig. 25 6pin threshold voltage1 vs. ambient temperature

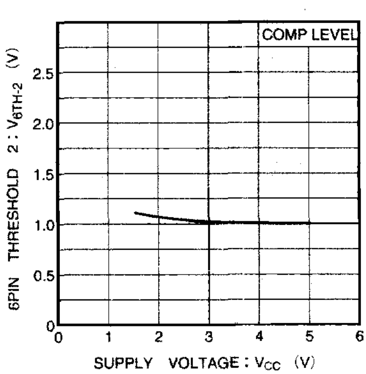


Fig. 26 6pin threshold voltage 2 vs. supply voltage

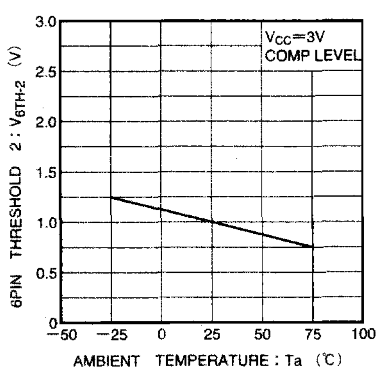
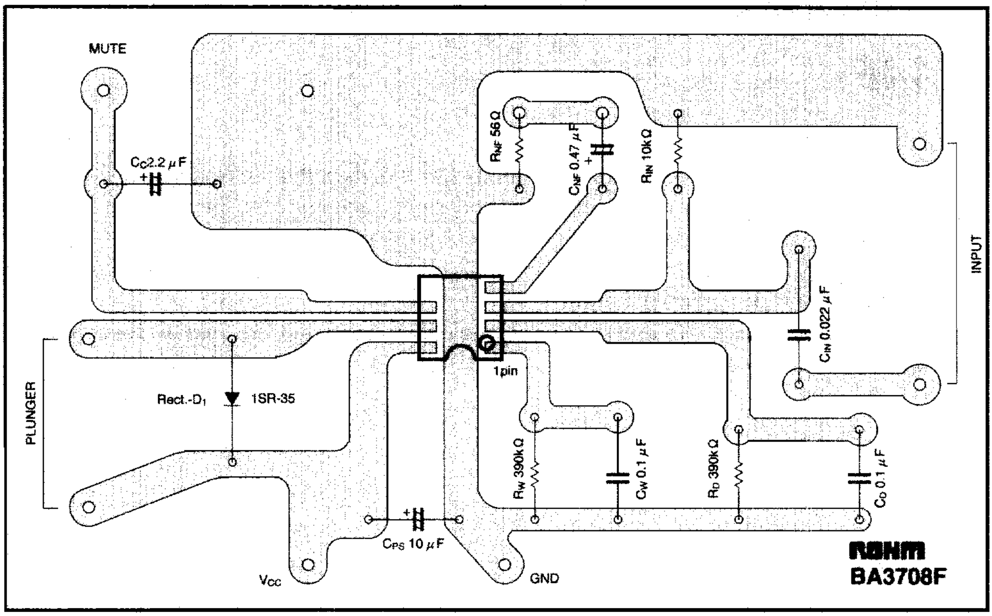


Fig. 27 6pin threshold voltage2 vs. ambient temperature

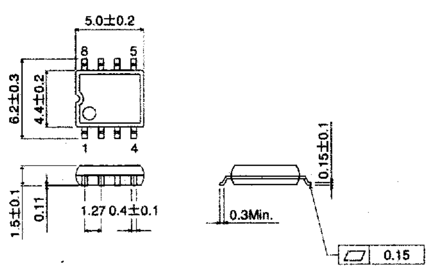
● Example of application board pattern and component layout



(Copper plating surface)

Fig. 28

● External dimensions (Unit: mm)



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