Speaker/headphone switch power amplifier

BA5210FS

The BA5210FS is a power amplifier with a built-in monaural speaker/stereo headphone switch. The speaker drive is BTL for large output, and when the headphones are connected, the "center-amp" design means that coupling is not required. This significantly reduces the number of external components required, and makes this IC ideal for compact sets that have high component density. Mute and standby functions are provided, and direct microprocessor control is possible.

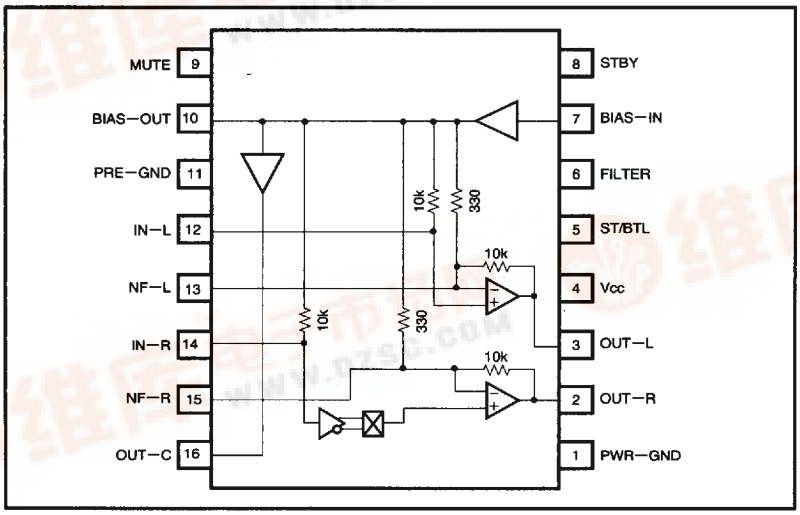
●Applications

Notebook computers, electronic books, portable CD players, video cameras with built-in monitors, LCD TVs, radios, and electronic instruments

●Features

1) Built-in BTL/stereo switch circuit.
2) Mute function.
3) Standby function.
4) Few external components required.
5) Low current consumption and good sound quality.

●Block diagram



●Absolute maximum ratings (Ta = 25℃)

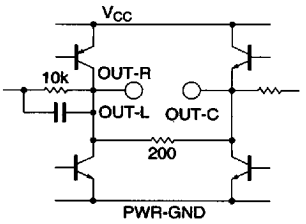
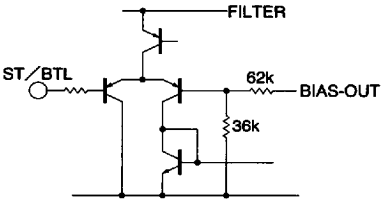
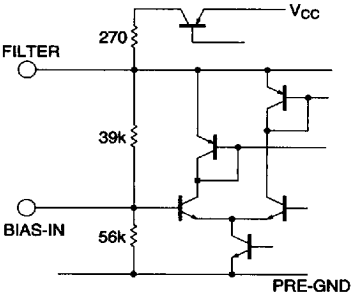
Parameter	Symbol	Limits	Unit
Supply voltage	Vcc	6	V
Power dissipation	Pd	650*	mW
Operating temperature	Topr	−10~60	℃
Storage temperature	Tstg	−55~125	℃

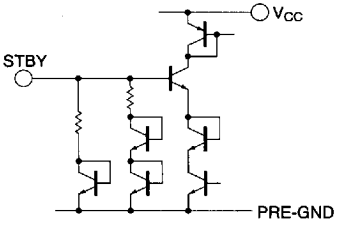
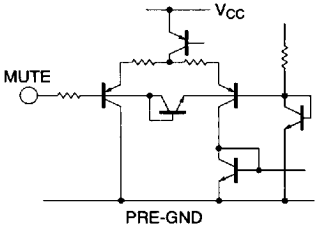
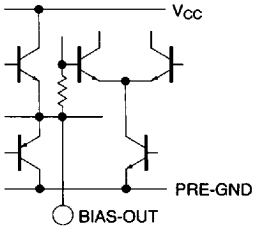
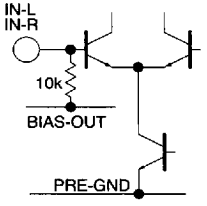
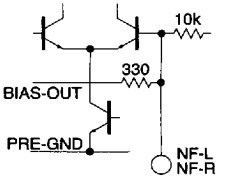
* When mounted on a 90mm x 50mm x 1.6mm glass-epoxy PCB, reduced by 6.5mW for each increase in Ta of 1°C over 25°C.

●Recommended operating conditions (Ta = 25℃)

Parameter	Symbol	Limits	Unit
Supply voltage	Vcc	2.5~6.0	V

●Pin descriptions

Pin No.	Name	Function / No-signal DC voltage (V)	Equivalent circuit
1	PWR—GND	Power amplifier system ground 0	
2	OUT—R	Power amplifier and system amplifier output terminal This has low output impedance during operation, so if it is shorted to Vcc or GND the IC will probably be destroyed. 1.8	
3	OUT—L		
16	OUT—C		
4	Vcc	Power supply terminal 3.3	
5	ST/BTL	Stereo/BTL switch terminal The threshold voltage is approximately 0.2 x Vcc. BTL mode when high, and stereo mode when low. 0.9 (BTL) 0 (stereo)	
6	FILTER	Ripple filter During operation a voltage close to the supply voltage is generated. The output impedance is low, so if it is shorted to GND or low impedance power sources, a large current will flow and destroy the IC. 3.0	
7	BIAS—IN	Bias amplifier input This terminal sets the DC operating point for all amplifiers on the IC. 1.8	

Pin No.	Name	Function / o-signal DC voltage (V)	Equivalent circuit
8	STBY	Standby control terminal The more slowly that the voltage rises on this terminal, the lower the noise that occurs when standby is released. 2.6 (E1=3.3V)	
9	MUTE	Mute control terminal The more slowly that the voltage rises and falls on this terminal, the lower the noise that occurs when mute is turned on and off. 1.6 (E2=3.3V) 0 (E2=0V)	
10	BIAS—OUT	Bias amplifier output This is the impedance conversion point for the operating point voltage set by BIAS-IN for supply to the other amplifiers. The output impedance is low, so if it is shorted to Vcc or GND a large current will flow, and the IC will probably be destroyed. 1.8	
11	PRE—GND	Small signal GND 0	
12	IN—L	Input terminal	
14	IN—R	1.8	
13	NF—L	Feedback terminal	
15	NF—R	1.8	

●Electrical characteristics (unless otherwise specified Ta = 25℃, V_{CC} = 3.3V R_L = 8Ω, f= 1kHz and RG = 600Ω)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Circuit current 1	Icc1	2	8	14	mA	V_{IN}=0Vrms, R_L=∞
Circuit current 2	Icc2	2	11	22	mA	V_{IN}=0Vrms, R_L=8Ω
Voltage gain 1	Gv1	32	35	38	dB	
Voltage gain 2	Gv2	9	12	15	dB	Stereo operation, R_L = 100 + 16Ω, measured at end of 16Ω
Rated output power 1	P_{OUT}1	350	450	—	mW	THD=10%
Rated output power 2	P_{OUT}2	1.2	1.7	—	mW	Measured at end of 16Ω; Stereo operation, R_L = 100 + 16Ω, THD = 10%
Maximum output voltage	V_{OM}	0.9	1.2	—	Vrms	Measured between L/R output terminal and center amplifier output; Stereo operation, R_L = 100 + 16Ω, THD = 10%
Total harmonic distortion 1	THD1	—	0.5	1.0	%	Po=50mW
Total harmonic distortion 2	THD2	—	0.2	0.6	%	Stereo operation, R_L = 100 + 16Ω, measured between L/R output terminal and center amplifier output Vo=0.5Vrms
Output noise voltage	V_{NO}	—	50	100	μVrms	Stereo operation, R_L = 100 + 16Ω, Rg = 0Ω, measured between L/R output terminal and center amplifier output
Ripple rejection ratio	RR	58	65	—	dB	Stereo operation, R_L = 100 + 16Ω, V_{RR} = -20dBm, f_{RR} = 1kHz, Rg = 0Ω, measured at end of 16Ω
Channel separation	CS	55	65	—	dB	Stereo operation, R_L = 100 + 16Ω, Vo = 0dBm, at end of 100 + 16Ω
Input resistance	R_{IN}	8	10	12	kΩ	
Standby release threshold	VthSA	—	1.5	2.0	V	Stereo operation, R_L = 100 + 16Ω, measured at end of 16Ω, GV2 > 6dB
Standby threshold	VthSB	0.2	0.6	—	V	V_{IN} = 0Vrms, R_L = 8Ω, Icc2 < 10μA
Mute on threshold	VthMA	—	0.8	2.0	V	Stereo operation, R_L = 100 + 16Ω, V_{IN} = -25dBm, Vo < -80dB (end of 16Ω)
Mute off threshold	VthMB	0.2	0.7	—	V	Stereo operation, R_L = 100 + 16Ω, measured at end of 16Ω, GV2 > 6dB
Standby terminal source current	I_{SS}S	—	30	100	μA	
Mute terminal source current	I_{SS}M	—	20	100	μA	

●Measurement circuit

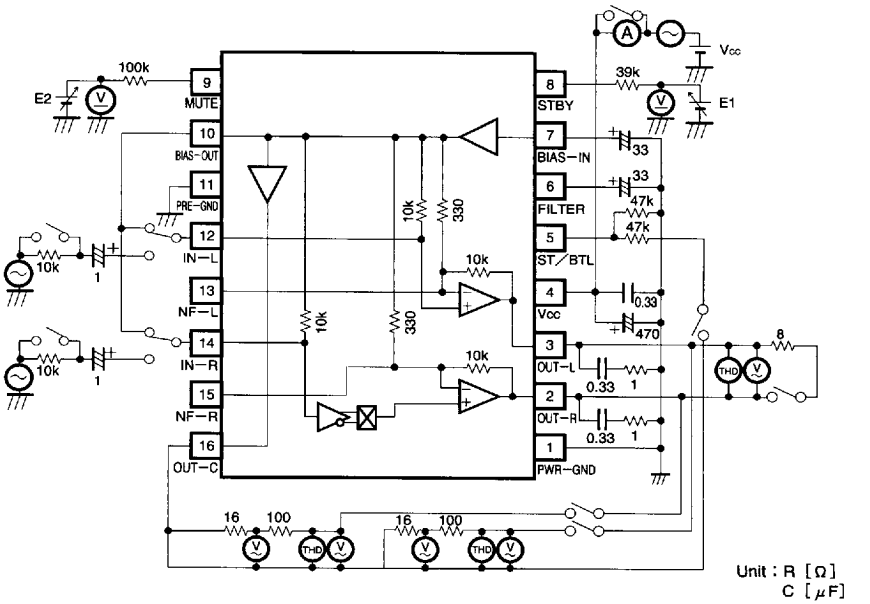
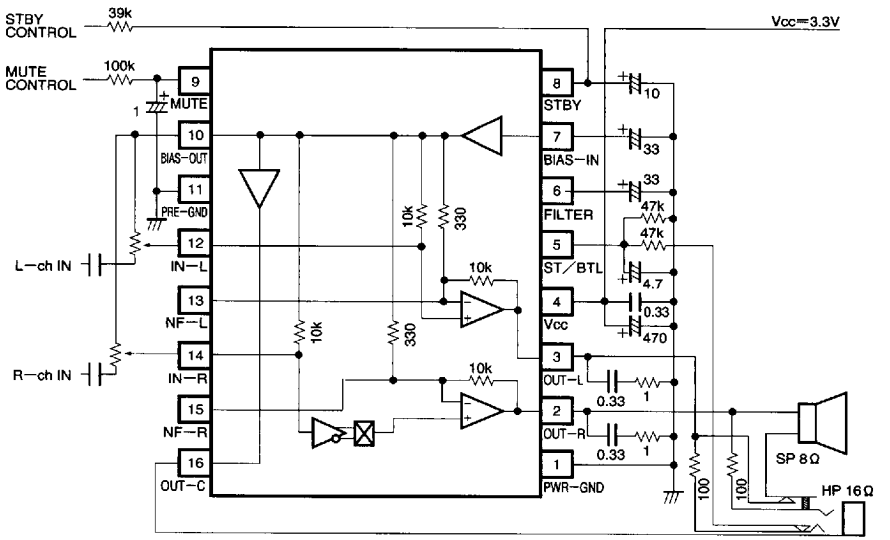


Fig. 1

●Application example



Unit : R [Ω]
C [μF]

STBY: operating when H, standby when L
MUTE: mute on when H, off when L

Fig. 2

●Operation notes

A characteristic of this IC is that if it is used with a supply voltage that is less than the recommended value (2.5V), the OUT-R offset increases. When using the IC with a BTL 8Ω load, if the voltage drops, the supply current will increase accompanied by an increase in power supply impedance, which can lead to low-frequency blocking oscillation. For this reason, we recommend that you use a low-voltage detection circuit that puts the IC in the standby state when the voltage drops below 2.5V.

●Electrical characteristics curves

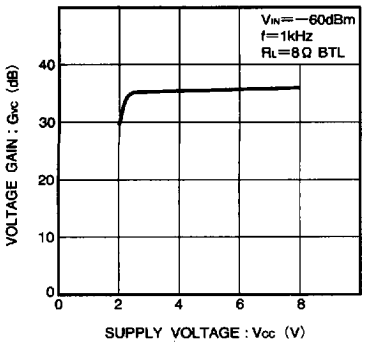


Fig. 3 Voltage gain vs. supply voltage

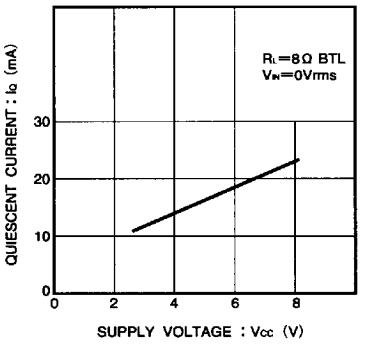


Fig. 4 Quiescent current vs. supply voltage

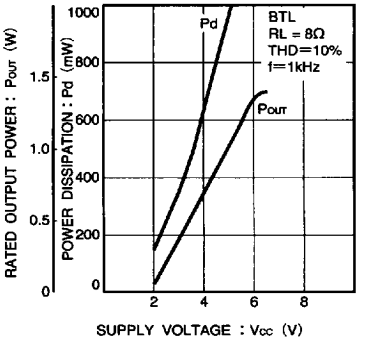


Fig. 5 Power dissipation and rated output power vs. supply voltage

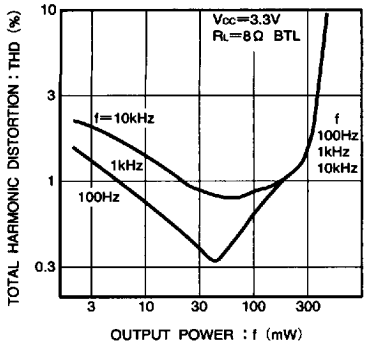


Fig. 6 Distortion vs. output

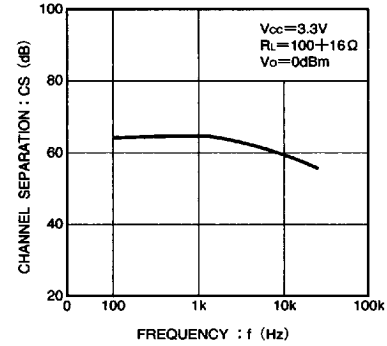


Fig. 7 Channel separation vs. frequency

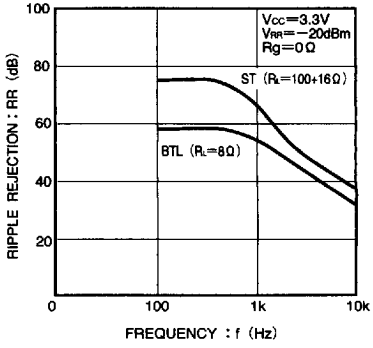
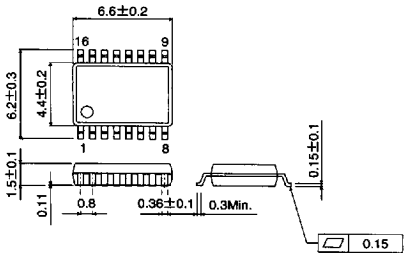


Fig. 8 Ripple rejection vs. frequency

●External dimensions (Unit: mm)



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