

# AN7531SA

## Headphone amplifier IC for portable equipment

### ■ Overview

AN7531SA is an audio signal processing IC in which bass boost amplifiers, ALC circuit and beep circuit are built in the headphone amplifiers for use in portable equipment. Its headphone output block is using the center amplifier method which eliminates the need for coupling capacitor so that the circuit is most suitable for rationalization of audio circuit.

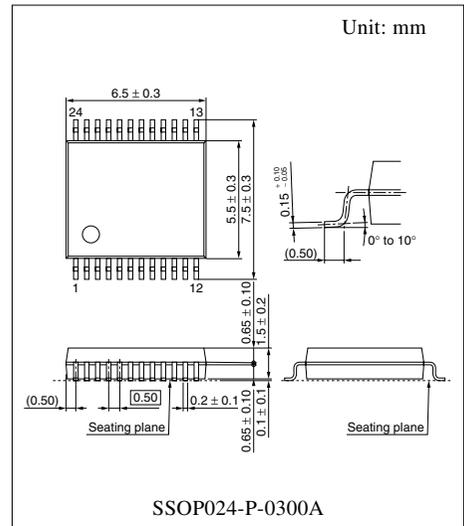
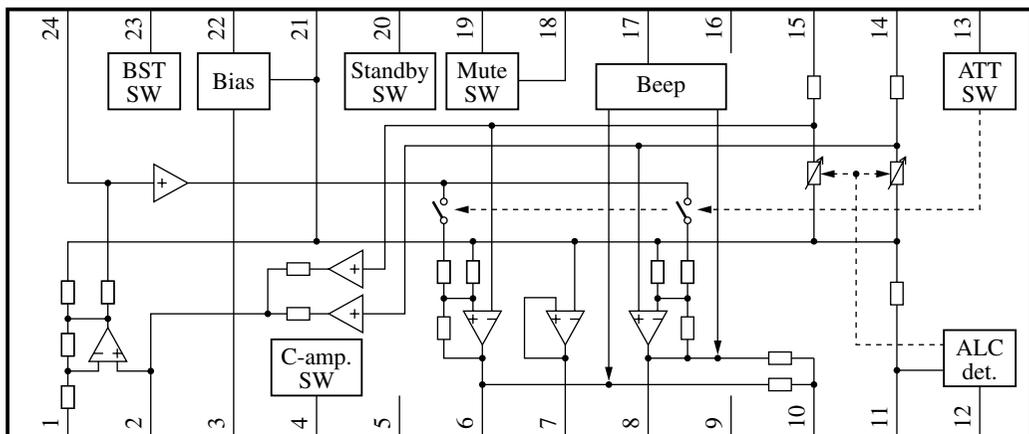
### ■ Features

- Output coupling capacitor is not required (Center amplifier method)
- Built-in bass boost amplifiers
- ALC circuit
- Built-in mute circuit
- Built-in beep circuit
- With mixed output pin of power amplifier

### ■ Applications

- Portable CD and MD players, etc.

### ■ Block Diagram



### ■ Pin Descriptions

Pin No.	Description	Pin No.	Description
1	Bass boost amplifier NF	13	Attenuation SW
2	ch.1 and ch.2-mixed output pin	14	ch.1 input pin
3	Ripple filter	15	ch.2 input pin
4	Center amplifier output control SW	16	GND (input)
5	Supply pin	17	Beep sound input pin
6	ch.2 output pin	18	Mute time-constant pin
7	Center amplifier output pin	19	Mute control pin
8	ch.1 output pin	20	Standby control pin
9	GND (output)	21	Bias output pin
10	Mixed output pin of power amplifier	22	Bias input pin
11	ALC input pin	23	Bass boost control pin
12	ALC detection pin	24	Bass boost amplifier output pin

### ■ Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage *2	$V_{CC}$	4.6	V
Supply current	$I_{CC}$	200	mA
Power dissipation *3	$P_D$	370	mW
Operating ambient temperature *1	$T_{opr}$	-25 to +75	°C
Storage temperature *1	$T_{stg}$	-55 to +125	°C

Note) \*1: Except for the operating ambient temperature and storage temperature, all ratings are for  $T_a = 25^\circ\text{C}$ .

\*2: Without signal.

\*3:  $T_a = 75^\circ\text{C}$ , mounted on standard board (Refer to the Application Notes).

### ■ Recommended Operating Range

Parameter	Symbol	Range	Unit
Supply voltage	$V_{CC}$	1.8 to 4.5	V

### ■ Electrical Characteristics at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Standby current	$I_{\text{STB}}$	$V_{\text{IN}} = 0 \text{ mV}$ , STB: On	—	0.1	5	$\mu\text{A}$
Quiescent current 1	$I_{\text{CQ1}}$	$V_{\text{IN}} = 0 \text{ mV}$ , C-CUP: On	—	1.5	3.0	mA
Quiescent current 2	$I_{\text{CQ2}}$	$V_{\text{IN}} = 0 \text{ mV}$ , C-CUP: Off	—	2.0	4.0	mA
Voltage gain 1	$G_{\text{V1}}$	$V_{\text{OUT}} = -22 \text{ dBV}$ , ATT: On	5.5	8.3	10.5	dB
Voltage gain 2	$G_{\text{V2}}$	$V_{\text{OUT}} = -22 \text{ dBV}$ , ATT: Off	14	15.9	18	dB
Channel balance	CB	$V_{\text{OUT}} = -22 \text{ dBV}$	-1.0	0	1.0	dB
Maximum output power	$P_{\text{O}}$	THD = 10%, $V_{\text{CC}} = 2 \text{ V}$	5.0	9.0	—	mW
Total harmonic distortion	THD	$V_{\text{OUT}} = -12.2 \text{ dBV}$	—	0.1	0.5	%
Output noise voltage	$V_{\text{NO}}$	$R_{\text{g}} = 600 \Omega$	—	-94.5	-88	dBV
Channel cross-talk	CT	$V_{\text{OUT}} = -12.2 \text{ dBV}$	30	50	—	dB
Ripple rejection	RR	$V_{\text{CC}} = 1.8 \text{ V}$ , $f_r = 100 \text{ Hz}$ , $V_r = -20 \text{ dBV}$	64	72	—	dB
Mute attenuation	MT	$V_{\text{OUT}} = -12.2 \text{ dBV}$	68	78	—	dB
Beep sound output voltage	$V_{\text{BEEP}}$	$V_{\text{BEEP-IN}} = 0 \text{ dBV}$	-56	-51	-46	dBV
Boosting amount	$B_{\text{ST}}$	$V_{\text{OUT}} = -30 \text{ dBV}$ , $f = 100 \text{ Hz}$	9.7	11.7	13.7	dB
ALC detection level	$V_{\text{ALC}}$	$V_{\text{IN}} = -20 \text{ dBV}$	-41.5	-39.5	-37.5	dBV

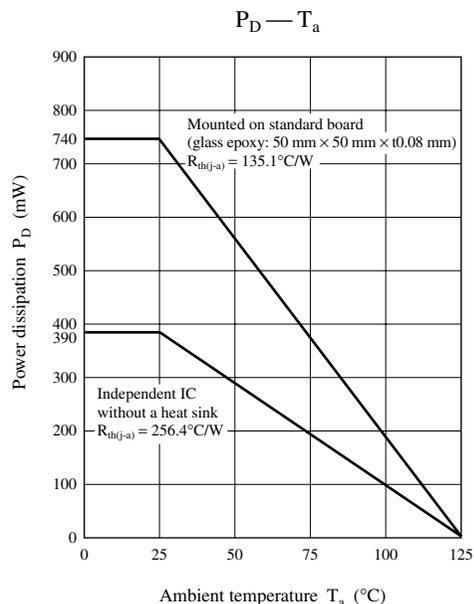
Note) Condition:  $V_{\text{CC}} = 2.4 \text{ V}$ ,  $R_{\text{L}} = 16 \Omega$ ,  $f = 1 \text{ kHz}$ ,  $R_{\text{g}} = 10 \text{ k}\Omega$ , STB: On, Mute: Off, C-CUP: Off, ATT: Off, ALC: Off, BST: Off

\*1: Measurement using A curve filter

\*2: Measurement using 30 kHz LPF

### ■ Application Notes

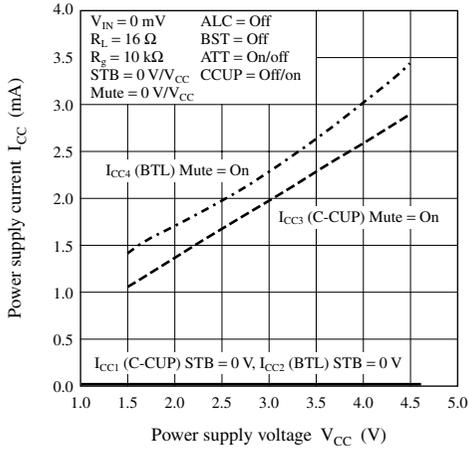
#### 1. $P_{\text{D}} - T_a$ curves of SSOP024-P-0300A



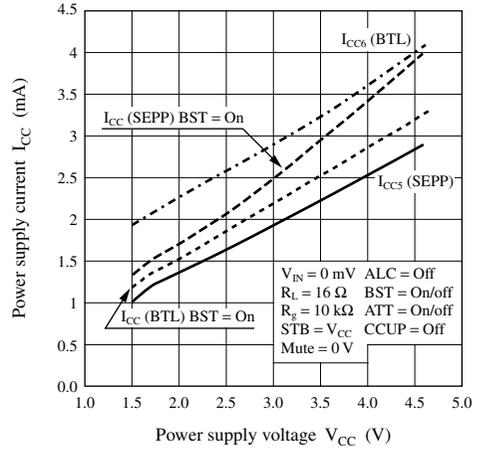
■ Application Notes (continued)

2. Main characteristics

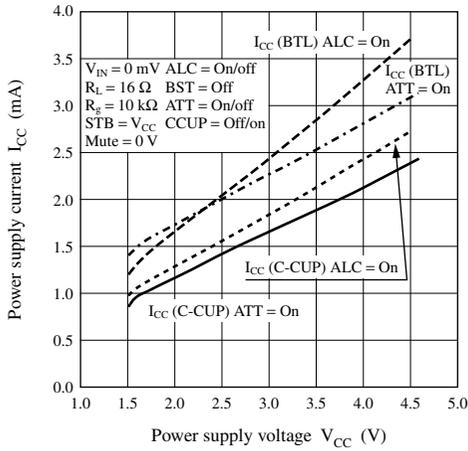
$I_{CC} - V_{CC}$  (STB: 0 V, Mute: On)



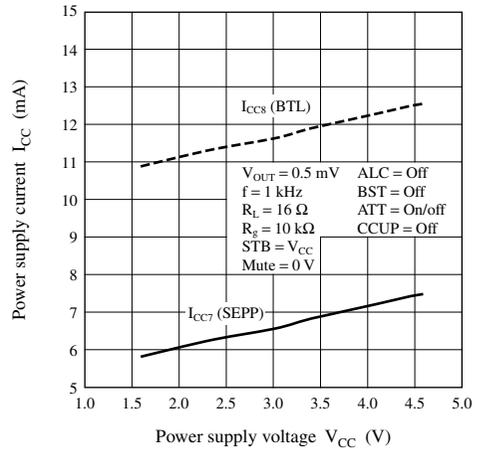
$I_{CC} - V_{CC}$



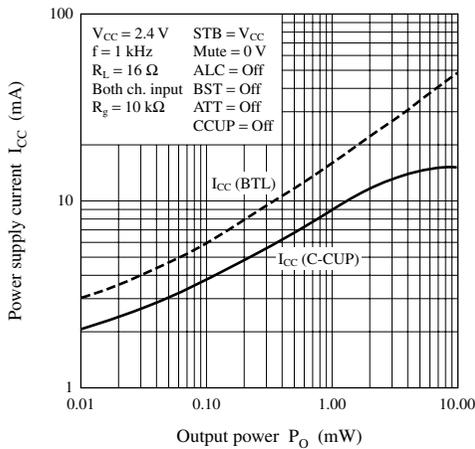
$I_{CC} - V_{CC}$  (ALC: On, ATT: On)



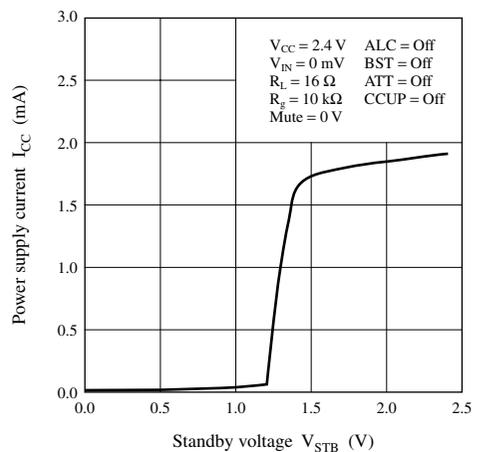
$I_{CC7,8} - V_{CC}$



$I_{CC} - P_O$



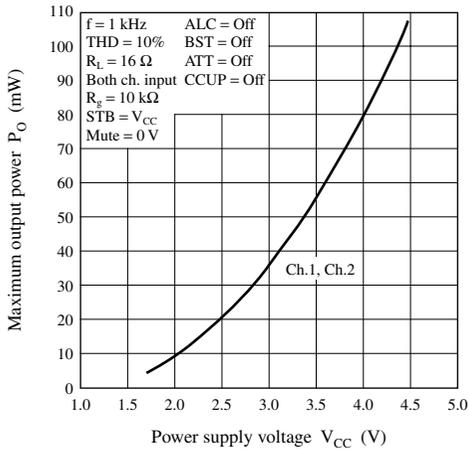
$I_{CQ} - V_{STB}$



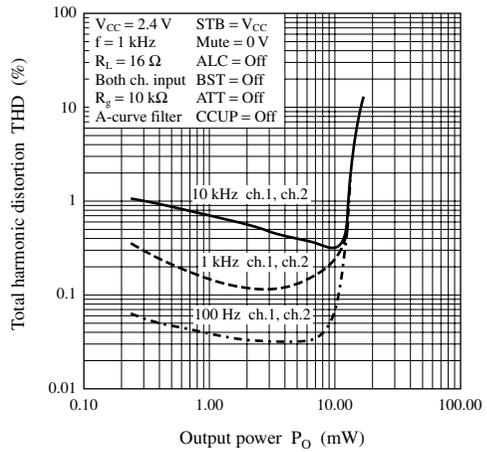
■ Application Notes (continued)

2. Main characteristics (continued)

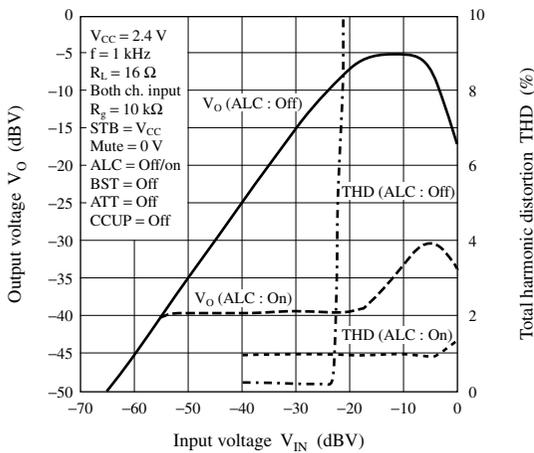
$P_O - V_{CC}$



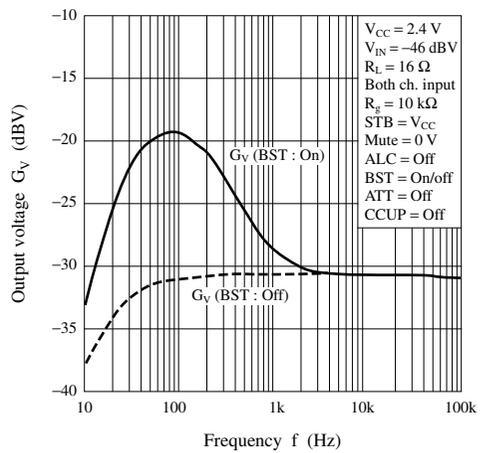
THD —  $P_O$



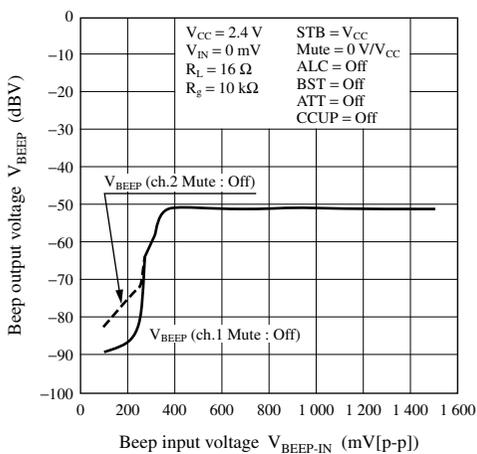
$P_O, THD - V_{IN}$  (ALC: On)



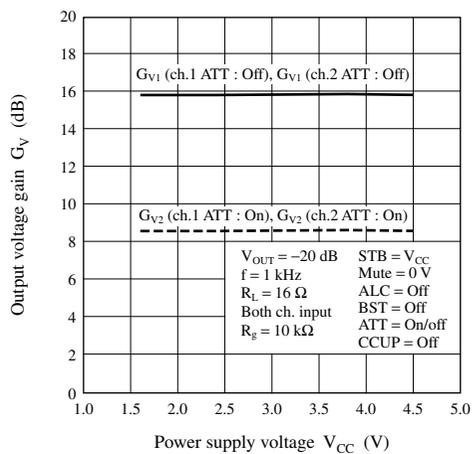
$G_V - \text{frequency}$



Beep —  $V_{IN}$



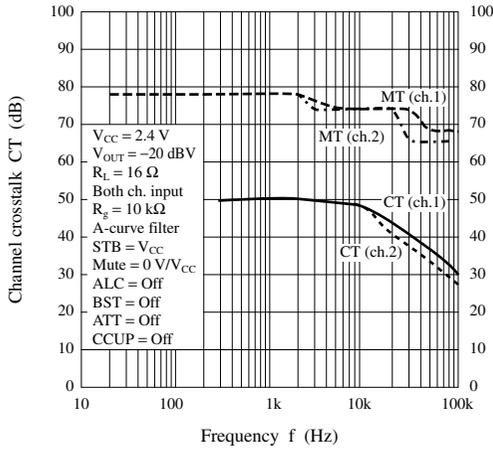
$G_V - V_{CC}$



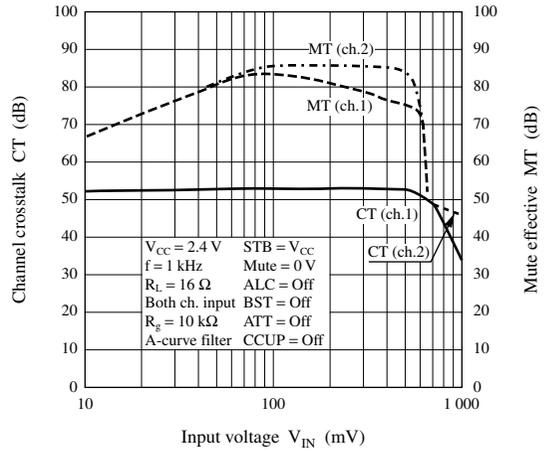
■ Application Notes (continued)

2. Main characteristics (continued)

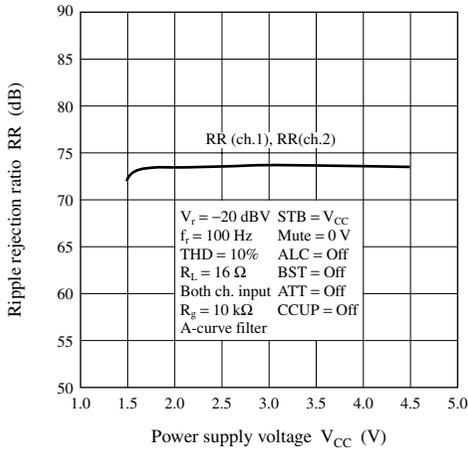
CT, MT — frequency



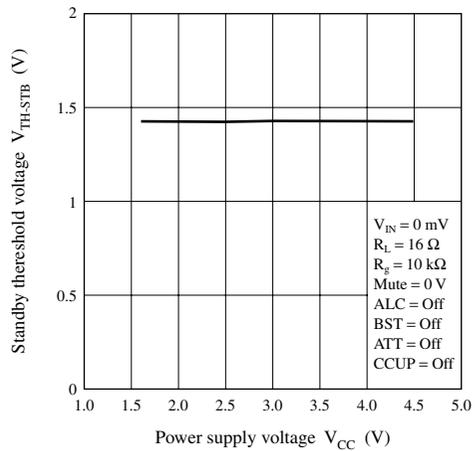
CT, MT —  $V_{IN}$



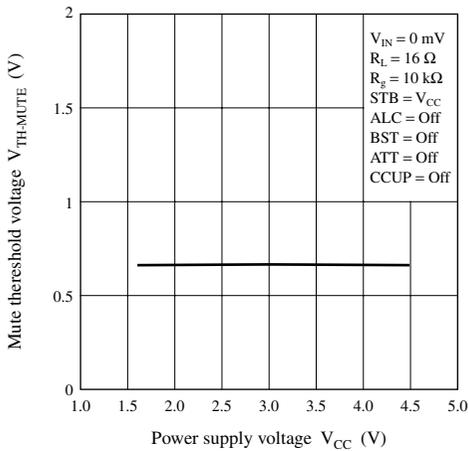
RR —  $V_{CC}$



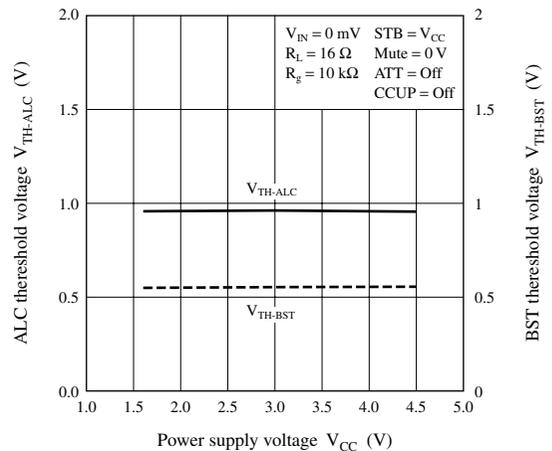
$V_{TH-STB}$  —  $V_{CC}$



$V_{TH-MUTE}$  —  $V_{CC}$

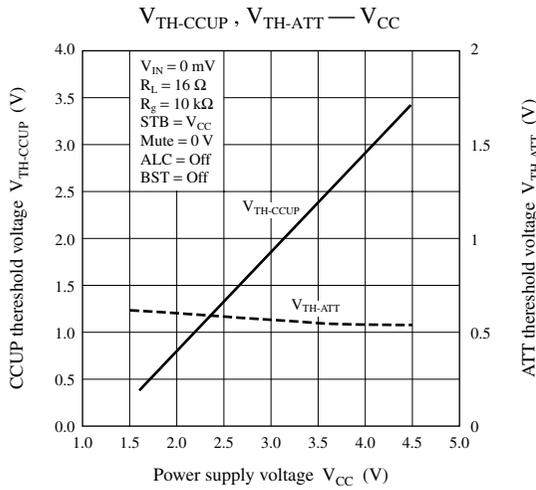


$V_{TH-ALC}$ ,  $V_{TH-BST}$  —  $V_{CC}$



■ Application Notes (continued)

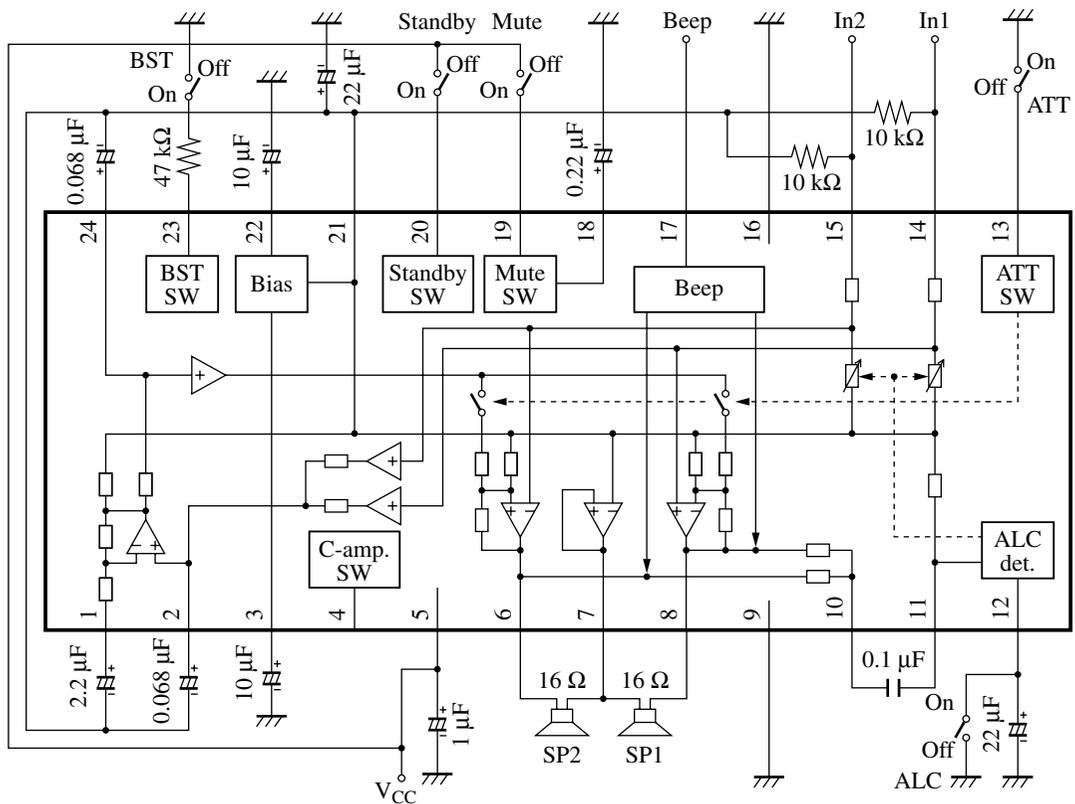
2. Main characteristics (continued)



■ Application Circuit Examples

1. Center output method (without output capacitor)

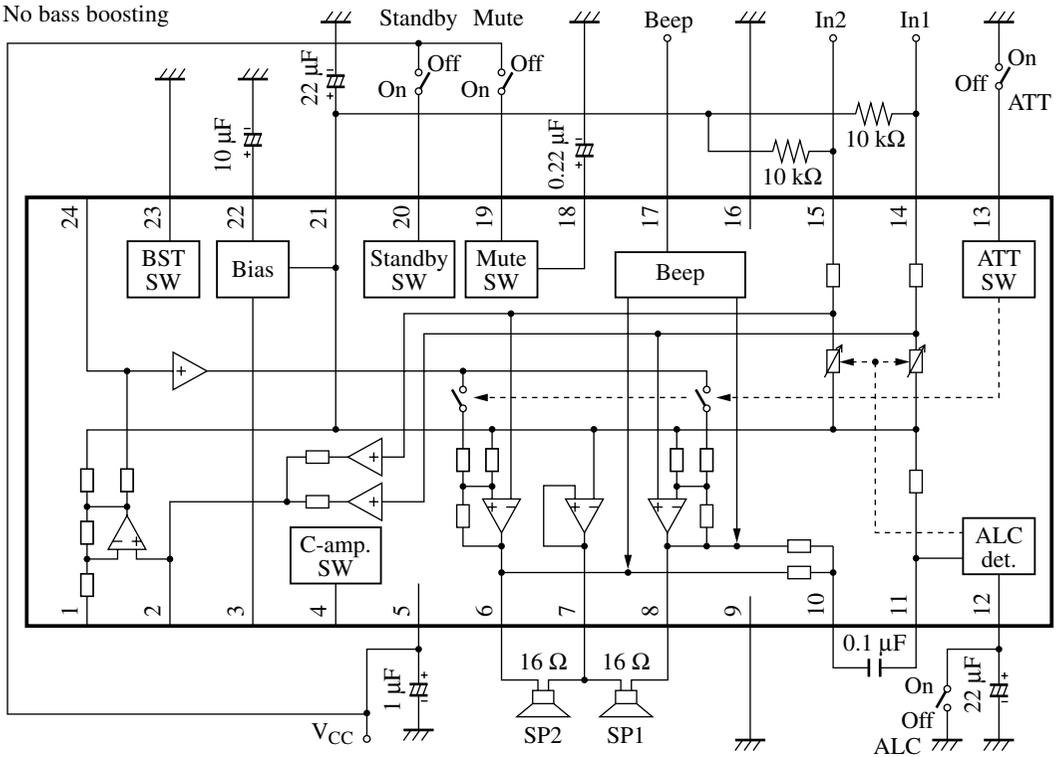
1) At bass boosting



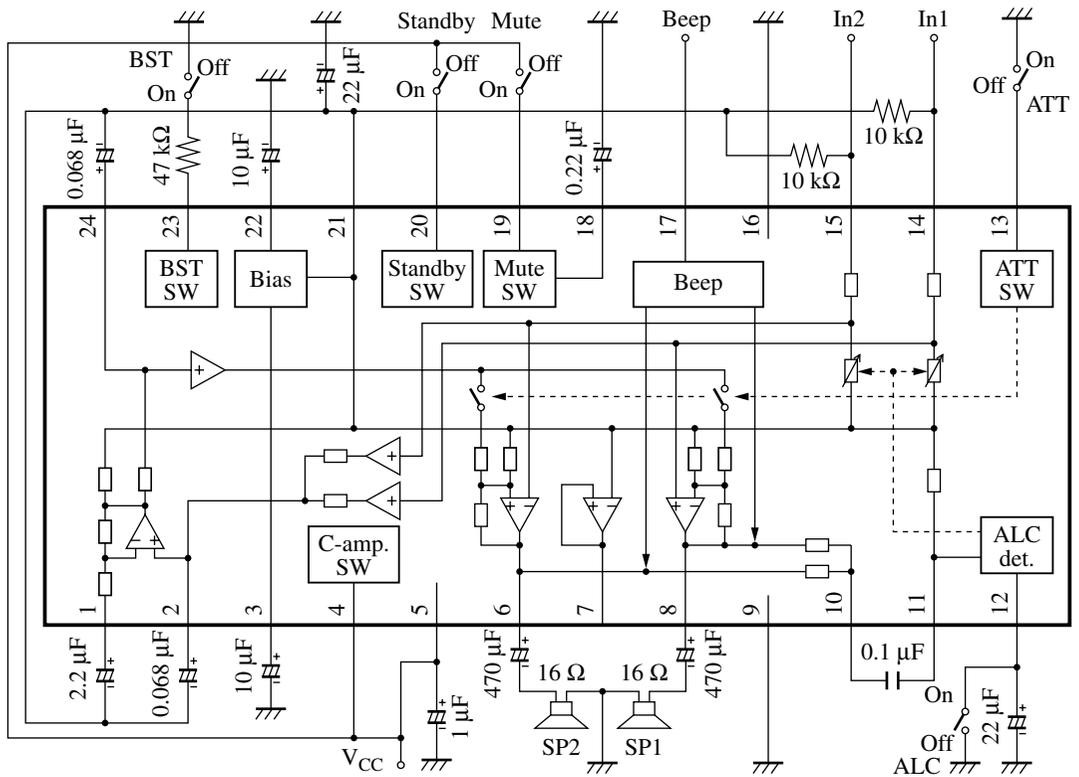
■ Application Circuit Examples (continued)

1. Center output method (without output capacitor) (continued)

2) No bass boosting



2. Output transformer less (OTL) (Output capacitors are necessary)



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