

AN7523

3-W BTL audio power amplifier

■ Overview

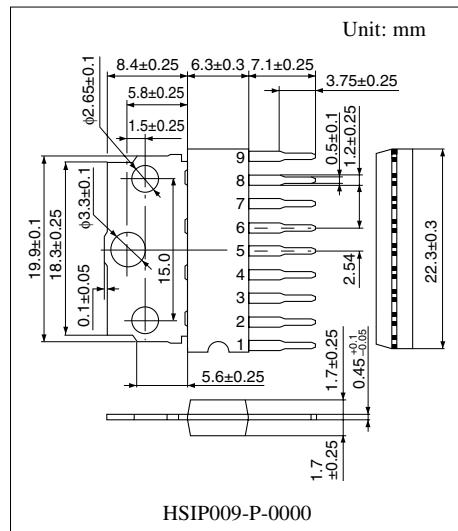
The AN7523 is an audio power amplifier IC of 1-ch. output. In the BTL (balanced transformerless) method, fewer external parts and easier design for applications are required.

■ Features

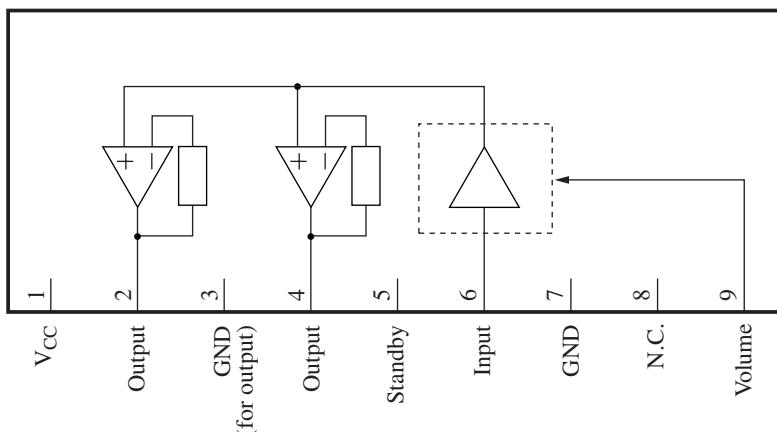
- 3-W output ($8\ \Omega$) with supply voltage of 8 V
- On-chip standby function
- On-chip volume function

■ Applications

- Televisions and audio equipment



■ Block Diagram



■ Pin Descriptions

Pin No.	Description
1	Supply voltage
2	Ch.1 + output
3	Ground (output ch.1)
4	Ch.1 – output
5	Standby (standby state if this pin is open.)
6	Ch.1 input
7	Ground
8	N.C.
9	Volume (max. volume if this pin is open.)

Note) Please do not apply voltage or current to the N.C. pin from outside.

■ Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage *2	V _{CC}	14	V
Supply current	I _{CC}	1.0	A
Power dissipation *3	P _D	1.22	W
Operating ambient temperature *1	T _{opr}	-25 to +70	°C
Storage temperature *1	T _{stg}	-55 to +150	°C

Note) *1: Except for the operating ambient temperature and storage temperature, all ratings are for T_a = 25°C.

*2: At no signal.

*3: The power dissipation shown is the value for T_a = 70°C.

■ Recommended Operating Range

Parameter	Symbol	Range	Unit
Supply voltage	V _{CC}	3.5 to 13.5	V

■ Electrical Characteristics at $V_{CC} = 8.0 \text{ V}$, $R_L = 8 \Omega$, $f = 1 \text{ kHz}$, $T_a = 25^\circ\text{C} \pm 2^\circ\text{C}$

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Quiescent circuit current	I_{CQ}	$V_{IN} = 0 \text{ mV}$, Vol. = 0 V	—	25	60	mA
Standby current	I_{STB}	$V_{IN} = 0 \text{ mV}$, Vol. = 0 V	—	1	10	μA
Output noise voltage *	V_{NO}	$R_g = 10 \text{ k}\Omega$, Vol. = 0 V	—	0.10	0.4	mV[mms]
Voltage gain	G_V	$P_O = 0.5 \text{ W}$, Vol. = 1.25 V	31	33	35	dB
Total harmonic distortion	THD	$P_O = 0.5 \text{ W}$, Vol. = 1.25 V	—	0.10	0.5	%
Maximum output power	P_{O1}	THD = 10%, Vol. = 1.25 V	2.4	3.0	—	W
Ripple rejection ratio *	RR	$R_g = 10 \text{ k}\Omega$, Vol. = 0 V, $V_R = 0.5 \text{ V[rms]}$, $f_R = 120 \text{ Hz}$	30	50	—	dB
Output offset voltage	V_{OFF}	$R_g = 10 \text{ k}\Omega$, Vol. = 0 V	-250	0	250	mV
Volume attenuation rate *	Att	$P_O = 0.5 \text{ W}$, Vol. = 0 V	70	85	—	dB
Intermediate voltage gain	G_{VM}	$P_O = 0.5 \text{ W}$, Vol. = 0.6 V	20.5	23.5	26.5	dB
Standby pin current	I_{STB2}	$V_{IN} = 0 \text{ mV}$, $V_{STB} = 3 \text{ V}$	—	—	25	μA
Volume pin current	I_{VOL}	$V_{IN} = 0 \text{ mV}$, Vol. = 0 V	-12	—	—	μA

Note) *: In measuring, the filter for the range of 15 Hz to 30 kHz (12 dB/OCT) is used.

■ Terminal Equivalent Circuits

Pin No.	Pin name	Equivalent circuit	Voltage
1	V_{CC}	—	5.0 V
2	Ch.1 + output pin		2.15 V
3	GND		0 V

■ Terminal Equivalent Circuits (continued)

Pin No.	Pin name	Equivalent circuit	Voltage
4	Ch.1 – output pin	<p>Detailed description: This diagram shows the terminal equivalent circuit for Pin 4. It consists of three stages. Stage 1 is a common-emitter stage with a base bias from $1/2 V_{CC}$ through a $800\ \Omega$ resistor. Stage 2 is a common-emitter stage with a gain of 20, driven by the output of Stage 1. Stage 3 is a common-emitter stage driving Pin 4, with a $200\ \Omega$ load. A $50\ \Omega$ resistor is connected between the collector of Stage 3 and Pin 4. A feedback path from Pin 4 to the base of Stage 2 is provided via a $50\ \Omega$ resistor. A ground connection is shown at the bottom right.</p>	2.15 V
5	Standby pin	<p>Detailed description: This diagram shows the terminal equivalent circuit for Pin 5. It includes a complex control network with several transistors and resistors. A $30\ k\Omega$ resistor connects Pin 5 to the base of a transistor. A $200\ \Omega$ resistor is connected between the collector of this transistor and the base of another. Other resistors in the network include $2\ k\Omega$, $50\ k\Omega$, $10\ k\Omega$, $12\ k\Omega$, and $33\ k\Omega$. The circuit also features a $5\ k\Omega$ resistor and a $10\ k\Omega$ resistor. Labels indicate connections to the shock sound prevention circuit and the constant current circuit.</p>	5 V
6	Ch.1 input pin	<p>Detailed description: This diagram shows the terminal equivalent circuit for Pin 6. It features a differential input stage with a $1\ k\Omega$ resistor from Pin 6 to ground. The non-inverting input is connected to V_{CC} through a $50\ \mu\text{A}$ current source. The inverting input is connected to V_{CC} through a $30\ k\Omega$ resistor. The output stage includes a $50\ \mu\text{A}$ current source and a $100\ \mu\text{A}$ current source. Feedback resistors of $1\ k\Omega$ and $500\ \Omega$ are connected between the output and the inverting input. A $500\ \Omega$ resistor is also connected between the output and ground.</p>	0 mV to 10 mV
7	GND	<p>Detailed description: This diagram shows the terminal equivalent circuit for Pin 7, which is a direct connection to ground.</p>	0 V
8	N.C.	Open	—

■ Terminal Equivalent Circuits (continued)

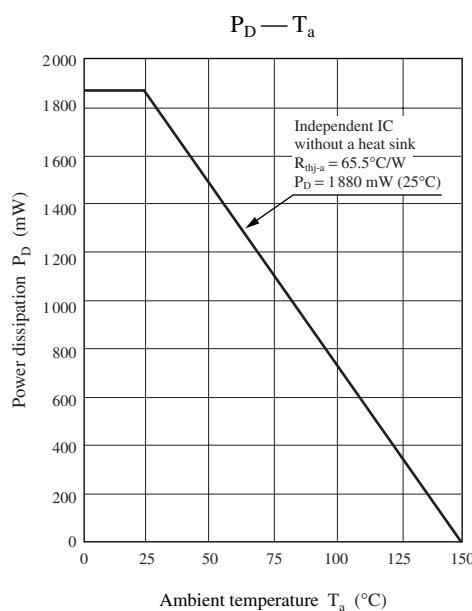
Pin No.	Pin name	Equivalent circuit	Voltage
9	Volume pin		—

■ Usage Notes

- Please avoid the short-circuits to V_{CC} , ground, or load short-circuit.
- Please connect the cooling fin with the GND potential.
- The thermal shutdown circuit operates at about $T_j = 150^\circ\text{C}$. However, the thermal shutdown circuit is reset automatically if the temperature drops.
- Please carefully design the heat radiation especially when you take out high power at high V_{CC} .
- Please connect only the ground of signal source with the signal GND of the amplifier in the previous stage.

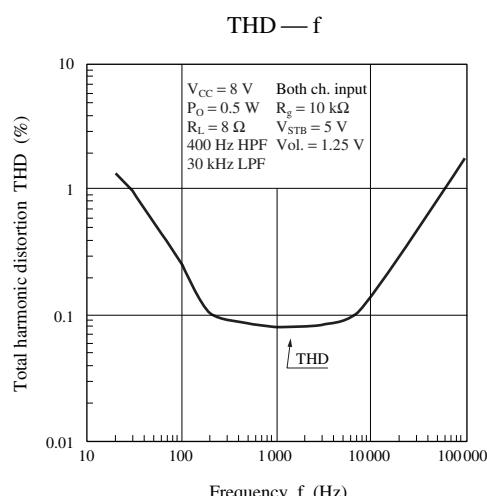
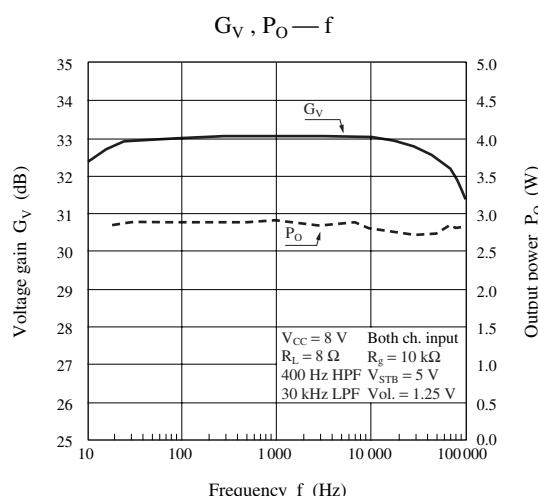
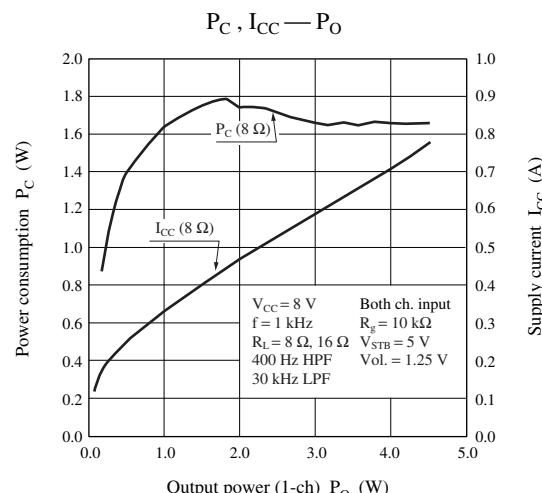
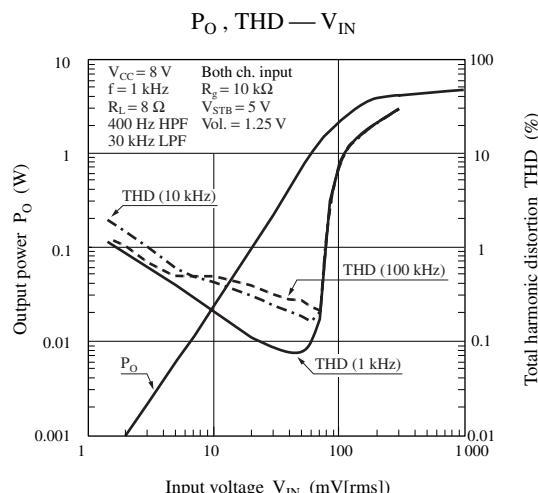
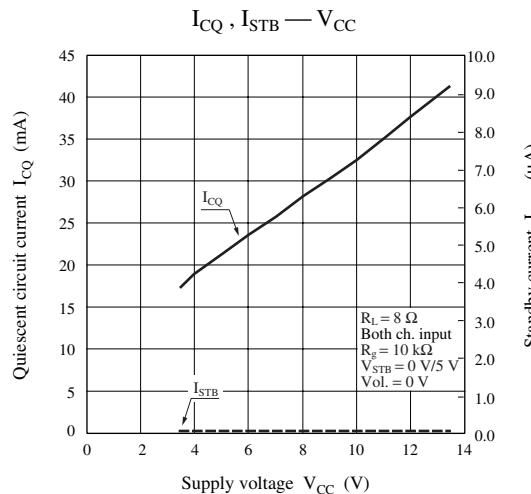
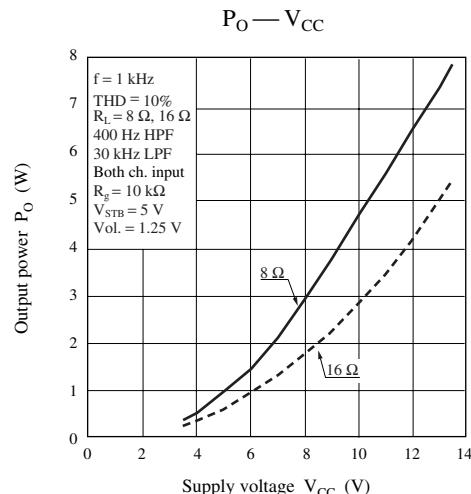
■ Technical Data

- $P_D - T_a$ curve of HSIP009-P-0000



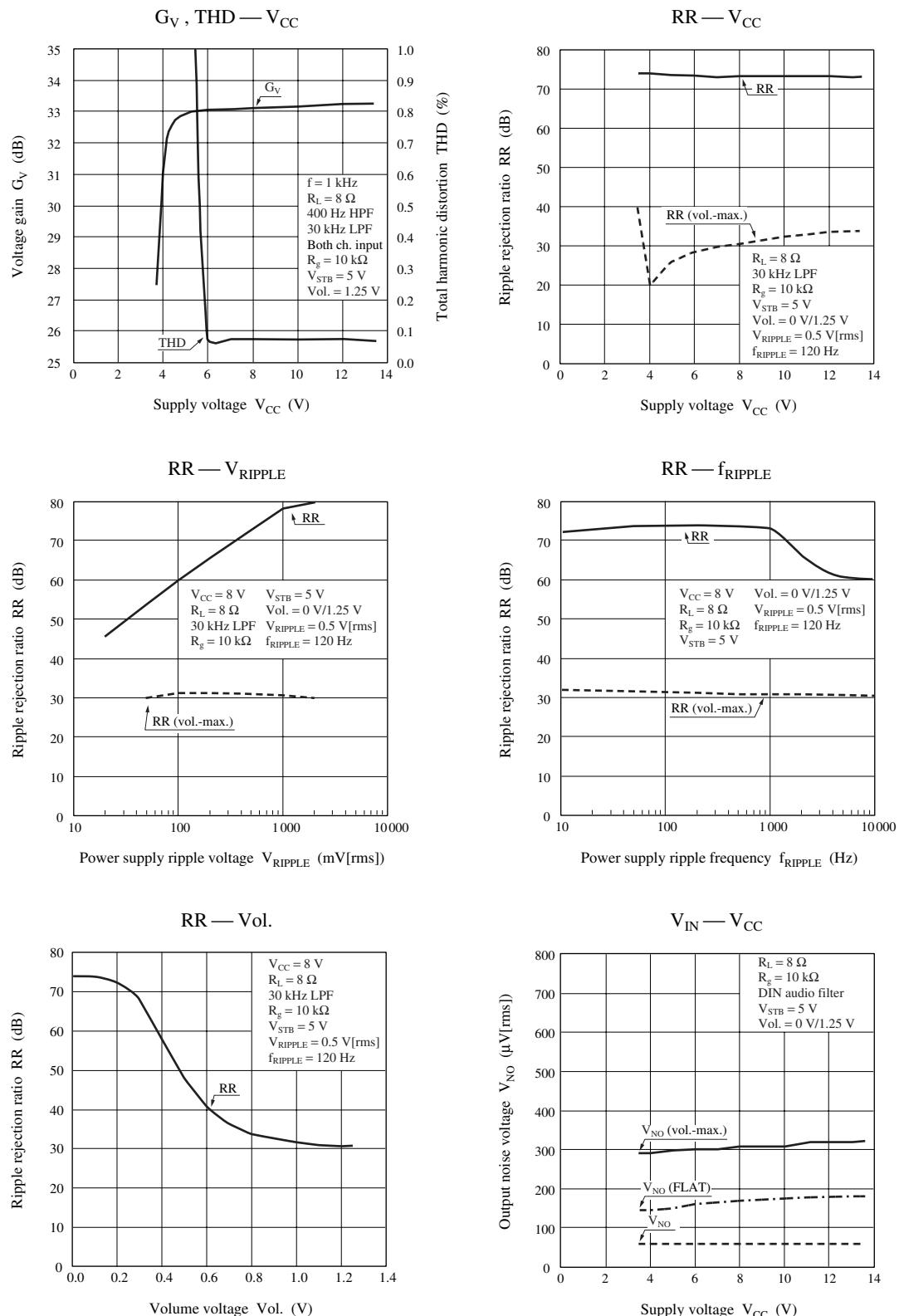
■ Technical Data (continued)

- Main characteristics



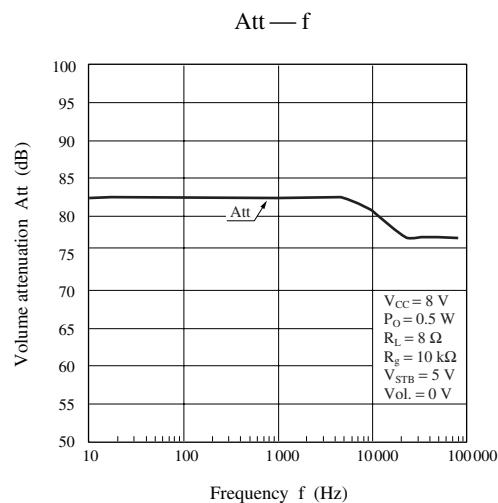
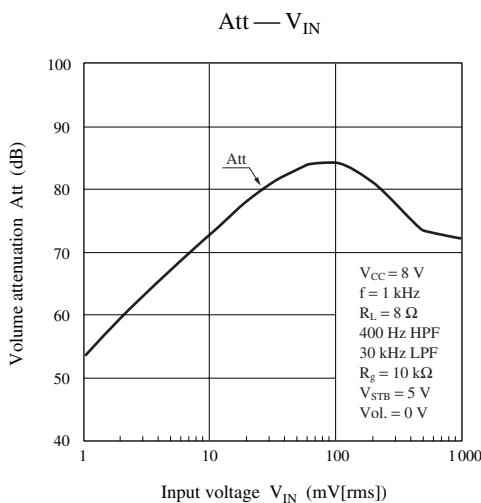
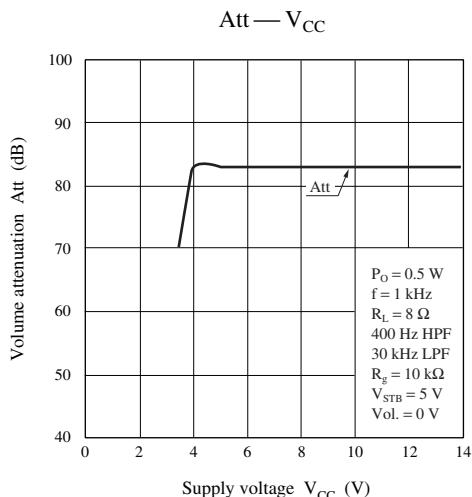
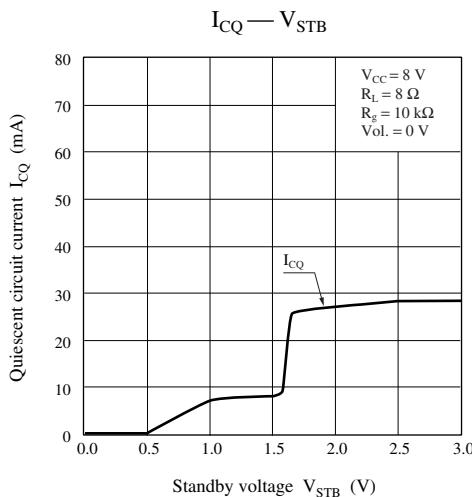
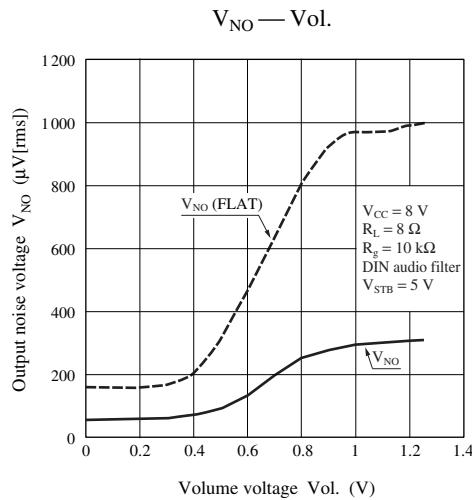
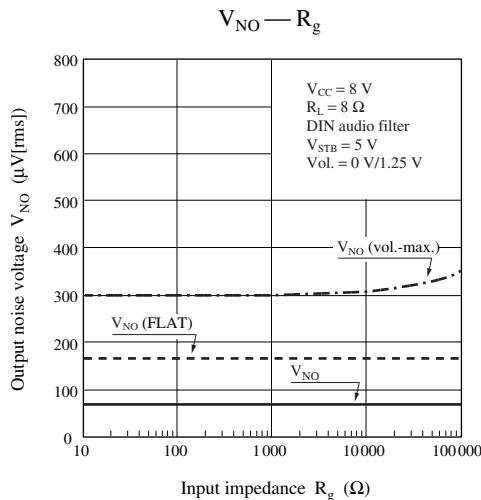
■ Technical Data (continued)

- Main characteristics (continued)



■ Technical Data (continued)

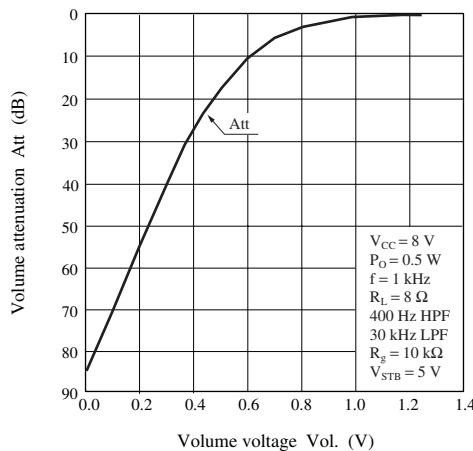
- Main characteristics (continued)



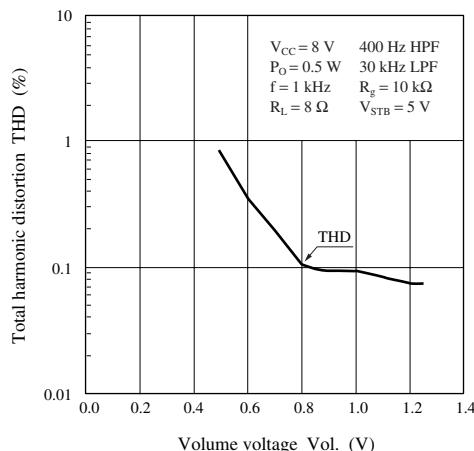
■ Technical Data (continued)

- Main characteristics (continued)

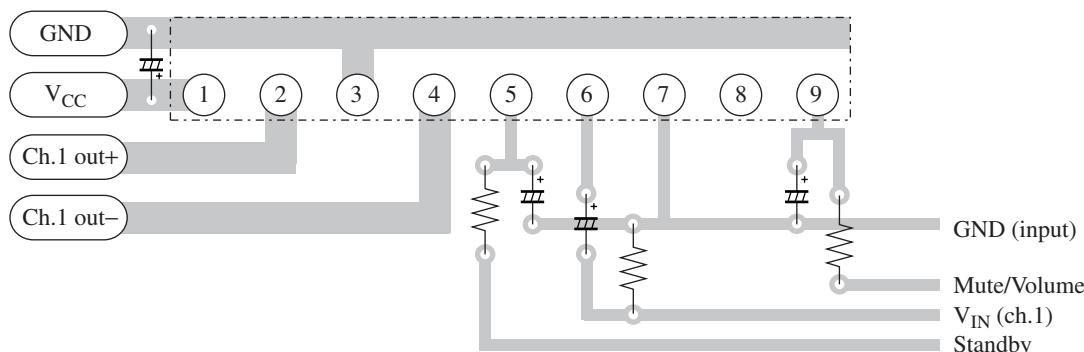
Att — Vol.



THD — Vol.



- Example of PCB pattern



■ Application Circuit Example

