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AN5273

4.0 W × 2 (18 V, 8 Ω) Power Amplifier with Mute Function and Volume Control

■ Overview

The AN5273 is a monolithic integrated circuit designed for 4.0 W (18 V, 8 Ω) output audio power amplifier. It is a dual channel SEPP IC suitable for stereo operation in TV application.
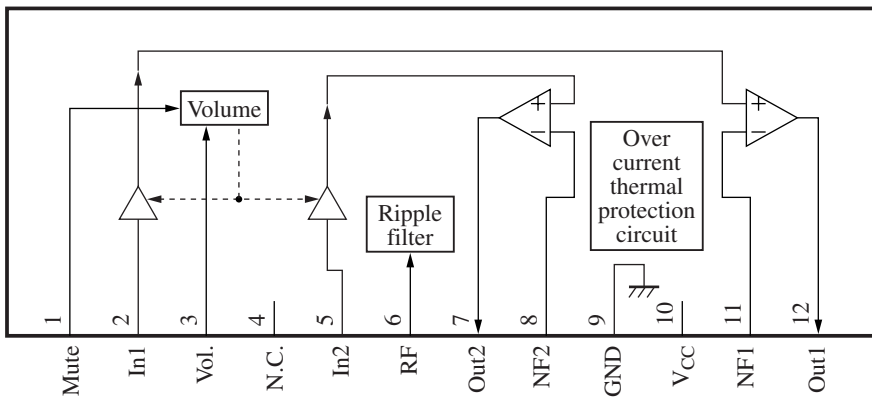
■ Features

- Built-in DC volume control
- Built-in mute circuit
- Built-in thermal protection circuit
- Built-in over current protection circuit
- V_{CC} operating range : 12.2 V to 27.5 V

■ Applications

- TV

Unit : mm

HSIP012-P-0000A
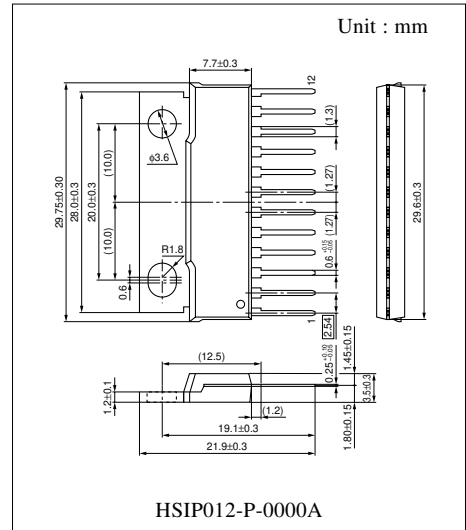
■ Block Diagram

■ Pin Descriptions

Pin No.	Description	Pin No.	Description
1	Mute control	7	Ch.2 output
2	Ch.1 input	8	Negative feedback ch.2
3	Volume control	9	GND
4	N.C.	10	V_{CC}
5	Ch.2 input	11	Negative feedback ch.1
6	Ripple filter	12	Ch.1 output

■ Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage	V_{CC}	30	V
Supply current	I_{CC}	3.5	A
Power dissipation [2]	P_D	37.5	W
Operating ambient temperature [1]	T_{opr}	−25 to +75	°C
Storage temperature [1]	T_{stg}	−55 to +150	°C

Note) [1] : T_a = 25 °C except power dissipation, operating ambient temperature and storage temperature.

[2] : Power dissipation of the package at T_a = 75 °C.

■ Recommended Operating Range

Parameter	Symbol	Range	Unit
Supply voltage	V_{CC}	12.2 to 27.5	V

■ Electrical Characteristics at V_{CC} = 18 V, f = 1 kHz, R_L = 8 Ω, T_a = 25 °C

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Quiescent current	I_{CQ}	No input signal	17	25	33	mA
Voltage gain	G_V	V_{IN} = 90 mV	28	30	32	dB
Total harmonic distortion [1]	THD	V_{IN} = 90 mV		0.3	1.0	%
Output power [1]	P_O	THD = 10 %	3.6	4.1		W
Channel balance	CB	V_{IN} = 90 mV	−1	0	1	dB
Max. volume attenuation [1]	Att	V_{IN} = 90 mV		−70	−64	dB
Mute attenuation [1]	M_{Att}	V_{IN} = 90 mV		−70	−64	dB
Output noise voltage [1]	V_{NO}	R_g = 10 kΩ, Din-Audio Filter		0.6	1.0	mV[rms]

Note) [1] : With a filter band from 20 Hz to 20 kHz used.

■ Application Circuit Example

AN5273

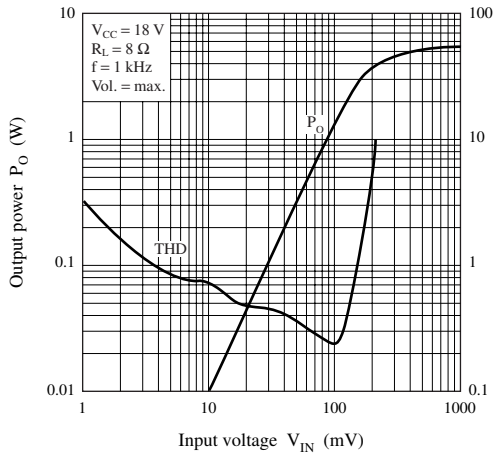| Pin	1	2	3	4	5	6	7	8	9	10	11	12
	Mute	In1	Vol.	N.C.	In2	RF	Out2	NF2	GND	V_{CC}	NF1	Out1
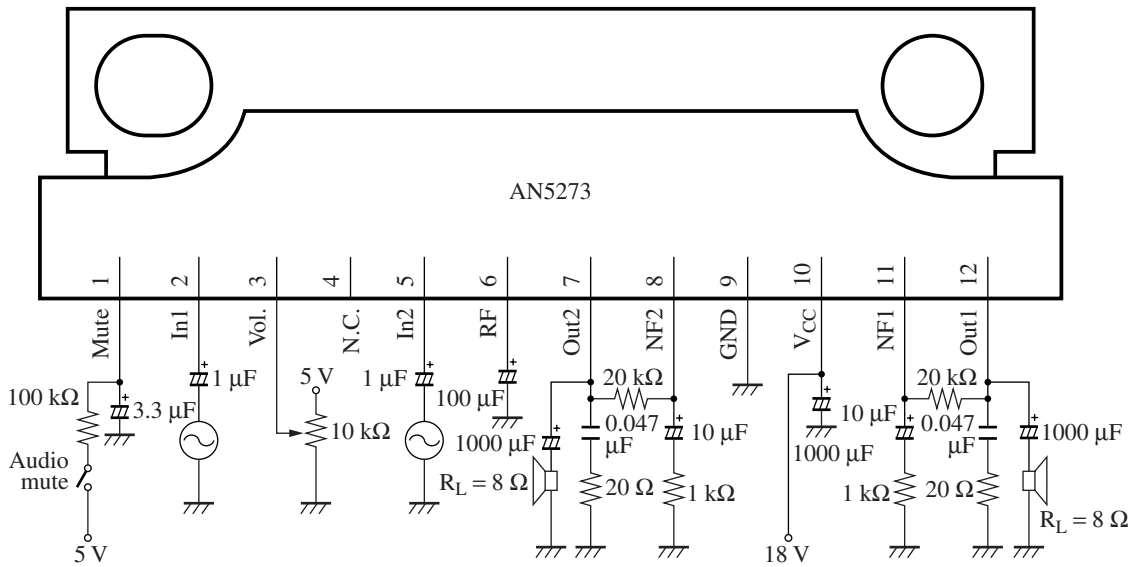
■ Usage Notes

1) Depending on the maximum application output power, external heatsink may be needed.
   External heatsink should be fixed to the chassis.

2) Fin of the IC can be connected to GND.

3) Please prevent output to V_{CC} short and output to GND short.

4) The temperature protection circuit will operate at T_j around 150 °C. However, if the temperature decreases, the
   protection circuit would automatically be deactivated and resume normal operation.
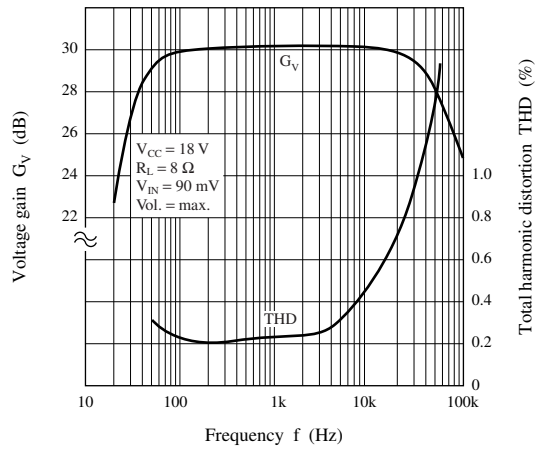
■ Technical Information
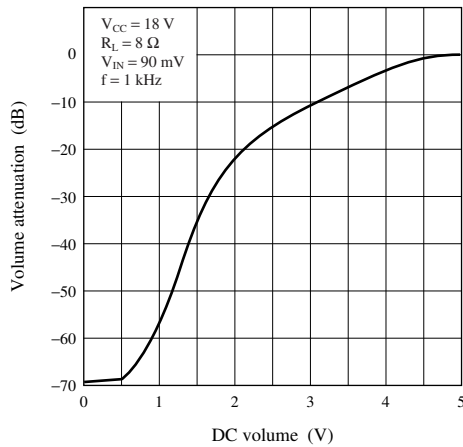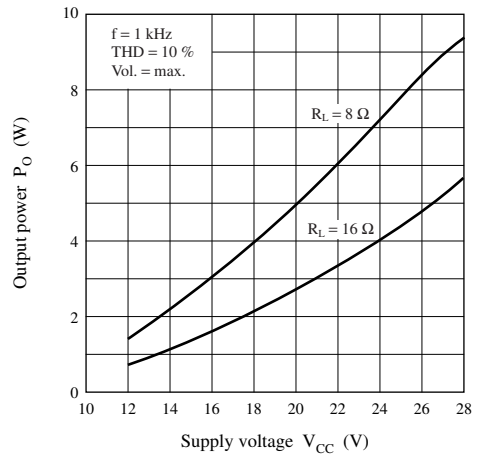
1. Characteristic Curve Chart

P_O, THD — V_{IN}

$V_{CC} = 18$ V
$R_L = 8$ Ω
$f = 1$ kHz
Vol. = max.

P_O

THD

Output power P_O (W)

Total harmonic distortion THD (%)

Input voltage V_{IN} (mV)

G_V, THD — f

$V_{CC} = 18$ V
$R_L = 8$ Ω
$V_{IN} = 90$ mV
Vol. = max.

G_V

THD

Voltage gain G_V (dB)

Total harmonic distortion THD (%)

Frequency f (Hz)

DC volume characteristics

$V_{CC} = 18$ V
$R_L = 8$ Ω
$V_{IN} = 90$ mV
$f = 1$ kHz

Volume attenuation (dB)

DC volume (V)

P_O — V_{CC}

$f = 1$ kHz
THD = 10 %
Vol. = max.

$R_L = 8$ Ω

$R_L = 16$ Ω

Output power P_O (W)

Supply voltage V_{CC} (V)

P_D — T_a

$R_{th(j-c)} = 2$ °C/W
$R_{th(j-a)} = 42$ °C/W

1. No heat sink
2. 10 °C/W heat sink
3. 5 °C/W heat sink
4. 3 °C/W heat sink
5. 2 °C/W heat sink
6. 1 °C/W heat sink
7. Infinity heat sink

Power dissipation P_D (W)

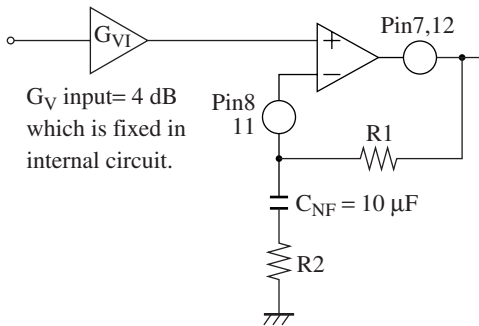Ambient temperature T_a (°C)

■ Technical Information (continued)

2. Application Note

1) Voltage gain

The voltage gain of the AN5273 can be varied by changing the resistor R2 as shown below :

G_{VI}

G_V input= 4 dB which is fixed in internal circuit.

Pin8 11

Pin7,12

R1

C_{NF} = 10 µF

R2

R1 is always fixed at 20 kΩ.

R2 is variable.

$G_{VO} = 20 \log (R_1/R_2)$

Typical values are : $R_1 = 20$ kΩ, $R_2 = 1$ kΩ

$G_{VO} = 20 \log (20\ k/1\ k)$
$\qquad = 26$ dB

$G_{VTOTAL} = G_{VI} + G_{VO}$
$\qquad\quad = 4$ dB + 26 dB
$\qquad\quad = 30$ dB

2) DC volume control

The DC volume control range is 0 V to 5 V. This range is used in order to be easily controlled by micro-computer using PWM output. The recommended circuit and volume attenuation characteristic are shown below :

AN5273

300 Ω   3

Volume control

C4 2.2 µF

R4 18 kΩ

R5 12 kΩ

Microcomputer IC

PWM output

Volume attenuation

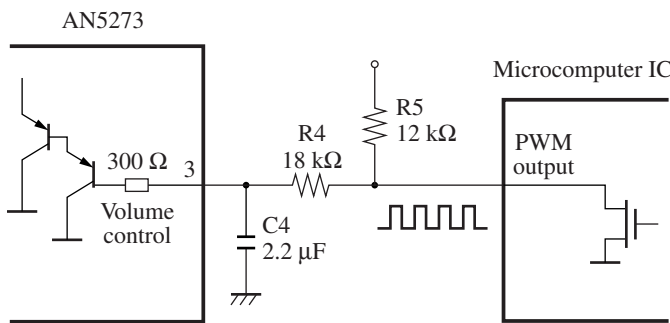0   0.6   5 (V)
Volume at Pin3

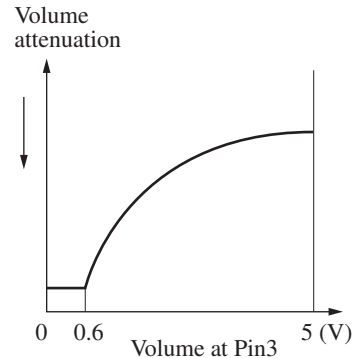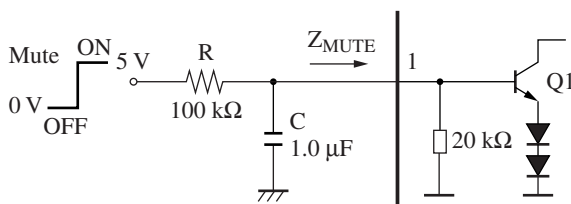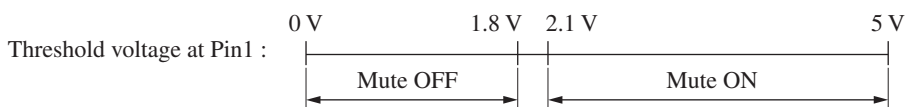Fig. Volume control interface circuit for AN5273

Fig. Volume characteristic of AN5273

3) Mute control

Mute is ON when 5 V is applied to Pin1. Then Q1 would turn ON and able to drive other part of the circuits. The external RC components provide a time constant for switching ON and OFF.

Mute ON 5 V

0 V OFF

R 100 kΩ

C 1.0 µF

Z_{MUTE}

1

20 kΩ

Q1

The purpose of the Mute is to attenuate the AC signal before it goes to the output.

Threshold voltage at Pin1 :

0 V   1.8 V   2.1 V   5 V

Mute OFF   Mute ON

■ Technical Information (continued)

2. Application Note (continued)

4) Oscillation

To prevent oscillation, it is advisable to use RC (Zobel network) at output. C of polyester film capacitor has smaller characteristic fluctuation with temperature and frequency. The resistor R connected in series with C is effective for phase correction at high frequency, and as a result, it improves the oscillation allowance.
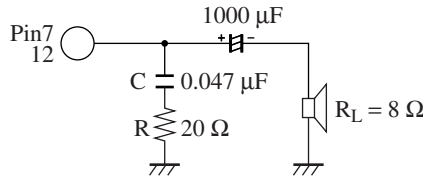
5) Power-ON/OFF pop-noise elimination

The output pins 7, 12 and V_O, during power turn ON and OFF are shown below :
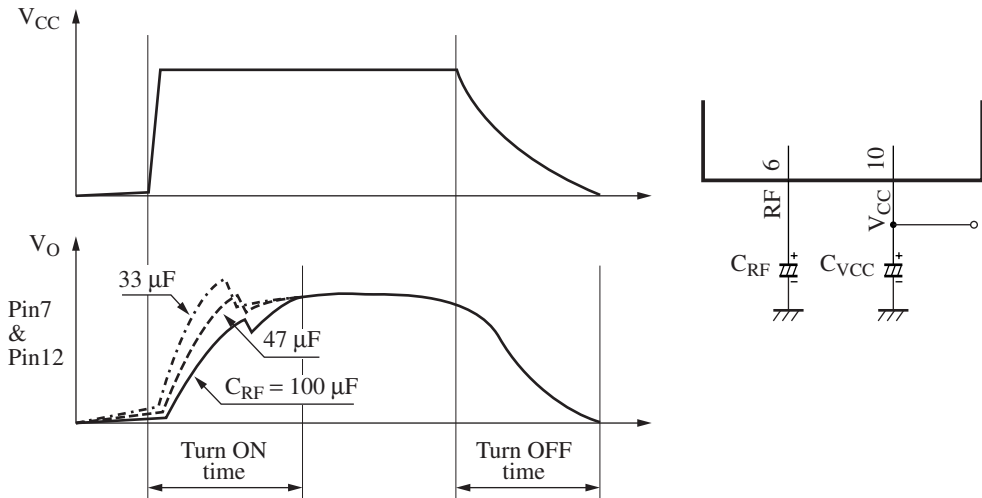
The turn ON time in the AN5273 is determined by the capacitance value of C_{RF}. If value of the C_{RF} is smaller, V_O will turn ON faster.

The turn OFF time is dependent on the capacitance value of C_{VCC}. Pop-noise would occur when V_{CC} voltage declines faster than RF voltage. To solve this, increase the discharge time of V_{CC} by increasing the capacitance values of C_{VCC}.

The recommended values of capacitance for C_{VCC} and C_{RF} are shown below :

No.	C_{RF}	C_{VCC}	Recommended Operating V_{CC} Range	Unit
1	33 μF	470 μF	14.5 to 27.5	V
2	47 μF	470 μF	12.2 to 27.5	V
3	100 μF	1000 μF	12.2 to 27.5	V

■ Technical Information (continued)

2. Application Note (continued)

6) Stand-by circuit

Stand-by function can be implemented in the AN5273 by external solution. It is realised by pulling the RF voltage to low and output voltage would follow RF as shown in the diagram.