1-Watt low voltage audio power amp with DC volume control

TDA7052A/AT

FEATURES

- DC volume control
- Few external components
- Mute mode
- Thermal protection
- Short-circuit proof
- No switch on and off clicks
- Good overall stability
- Low power consumption
- Low HF radiation
- ESD protected on all pins

GENERAL DESCRIPTION

The TDA7052A/AT are mono BTL output amplifiers with DC volume control. They are designed for use in TV and monitors, but also suitable for battery-fed portable recorders and radios.

ORDERING INFORMATION

EXTENDED TYPE NUMBER	PACKAGE			
	PINS	PIN POSITION	MATERIAL	CODE
TDA7052A	8	DIL	plastic	SOT97
TDA7052AT	8	mini-pack	plastic	SOT96A

QUICK REFERENCE DATA

SYMBOL	PARAMETERS	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_P	supply voltage range		4.5	–	18	V
P_O	output power					
	in 8 Ω (TDA7052A)	$V_P = 6$ V	1	1.1	–	W
	in 16 Ω (TDA7052AT)	$V_P = 6$ V	0.5	0.55	–	W
G_v	maximum total voltage gain		35	36	37	dB
ϕ	gain control range		75	80	–	dB
I_P	total quiescent current	$V_P = 6$ V; $R_L = \infty$	–	6	12	mA
THD	total harmonic distortion	$P_O = 0.5$ W	–	0.2	1	%

FUNCTIONAL DESCRIPTION

The TDA7052A/AT are mono BTL output amplifiers with DC volume control, designed for use in TV and monitors but also suitable for battery fed portable recorders and radios.
In conventional DC volume circuits the control or input stage is AC coupled to the output stage via external capacitors to keep the offset voltage low.
In the TDA7052A/AT the DC volume control stage is integrated into the input stage so that no coupling capacitors are required and yet a low offset voltage is maintained. At the same time the minimum supply remains low.

The BTL principle offers the following advantages:

- Lower peak value of the supply current
- The frequency of the ripple on the supply voltage is twice the signal frequency.

Thus a reduced power supply with smaller capacitors can be used which results in cost savings.

For portable applications there is a trend to decrease the supply voltage, resulting in a reduction of output power at conventional output stages. Using the BTL principle increases the output power.

The maximum gain of the amplifier is fixed at 36 dB. The DC volume control stage has a logarithmic control characteristic.

The total gain can be controlled from 36 dB to –44 dB. If the DC volume control voltage is below 0.3 V, the device switches to the mute mode. The amplifier is short-circuit proof to ground and V_P. Also a thermal protection circuit is implemented. If the crystal temperature rises above 150 °C the gain will be reduced, so the output power is reduced. Special attention is given to switch on and off clicks, low HF radiation and a good overall stability.

LIMITING VALUES

In accordance with the Absolute Maximum System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_P	supply voltage range		–	18	V
I_{ORM}	repetitive peak output current		–	1	A
I_{OSM}	non-repetitive peak output current		–	1.5	A
P_{tot}	total power dissipation	$T_{amb} \leq 25\%$			
	TDA7052A		–	1.25	W
	TDA7052AT		–	0.64	W
T_{amb}	operating ambient temperature range		–40	85	°C
T_{stg}	storage temperature range		–55	150	°C
T_{vj}	virtual junction temperature		–	150	°C
T_{sc}	short-circuit time		–	1	hr
V_2	input voltage pin 2		–	8	V
V_4	input voltage pin 4		–	8	V

THERMAL RESISTANCE

SYMBOL	PARAMETER	TYP.	MAX.	UNIT
$R_{th\ j\text{-}a}$	from junction to ambient in free air			
	TDA7052A	–	100	K/W
	TDA7052AT	–	155	K/W

Note

TDA7052A: $V_P = 6$ V; $R_L = 8\ \Omega$.
The maximum sine-wave dissipation is 0.9 W.
Therefore $T_{amb(max)} = 150 - 100 \times 0.9 = 60$ °C.
TDA7052AT: $V_P = 6$ V; $R_L = 16\ \Omega$.
The maximum sine-wave dissipation is 0.46 W.
Therefore $T_{amb(max)} = 150 - 155 \times 0.46 = 78$ °C.

CHARACTERISTICS

V_P = 6 V; T_{amb} = 25 °C; f = 1 kHz; unless otherwise specified (see Fig.6).
TDA7052A: R_L = 8 Ω;
TDA7052AT: R_L = 16 Ω;

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_P	supply voltage range		4.5	–	18	V
I_P	total quiescent current	V_P = 6 V; R_L = ∞ note 1	–	6	12	mA
Maximum gain; V_4 = 1.4 V						
P_O	output power	THD = 10%				
	TDA7052A		1	1.1	–	W
	TDA7052AT		0.5	0.55	–	W
THD	total harmonic distortion					
	TDA7052A	P_O = 0.5 W	–	0.2	1	%
	TDA7052AT	P_O = 0.25 W	–	0.2	1	%
G_v	voltage gain		35	36	37	dB
V_I	input signal handling	V_4 = 1 V; THD < 1%	0.6	–	–	V
$V_{no(rms)}$	noise output voltage (RMS value)	f = 500 kHz; note 2	–	tbf	–	µV
B	bandwidth		–	20 Hz to 20 kHz	–	
RR	ripple rejection	note 3	40	–	–	dB
$\|V_{off}\|$	DC output offset voltage		–	tbf	150	mV
Z_I	input impedance (pin 2)		15	20	25	kΩ
Minimum gain; V_4 = 0.5 V						
G_v	voltage gain		–	–44	–	dB
$V_{no(rms)}$	noise output voltage RMS value)	note 4	–	20	30	µV
Mute position						
V_O	output voltage in mute position	V_4 ≤ 0.3 V; V_I = 600 mV	–	–	30	µV
DC volume control						
ϕ	gain control range		75	80	–	dB
I_4	control current	V_4 = 0.4 V	tbf	65	tbf	µA

Notes to the characteristics

1. With a load connected to the outputs the quiescent current will increase, the maximum value of this increase being equal to the DC output offset voltage dividend by R_L.
2. The noise output voltage (RMS value) at f = 500 kHz is measured with R_S = 0 Ω and bandwidth = 5 kHz.
3. The ripple rejection is measured with R_S = 0 Ω and f = 100 Hz to 10 kHz. The ripple voltage of 200 mV, (RMS value) is applied to the positive supply rail.
4. The noise output voltage (RMS-value) is measured with R_S = 5 kΩ unweighted.

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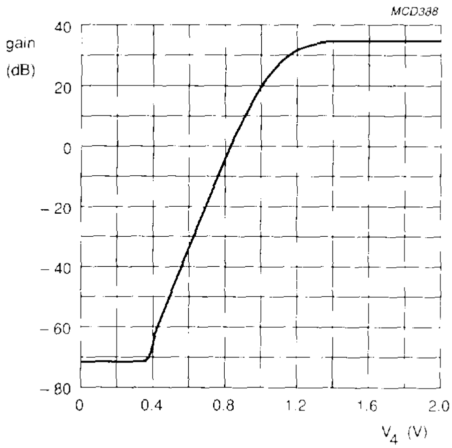


Fig.3 Gain control as a function of DC volume control.

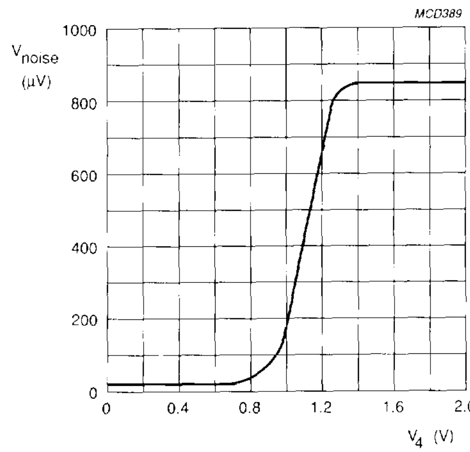


Fig.4 Noise output voltage as a function of DC volume control.

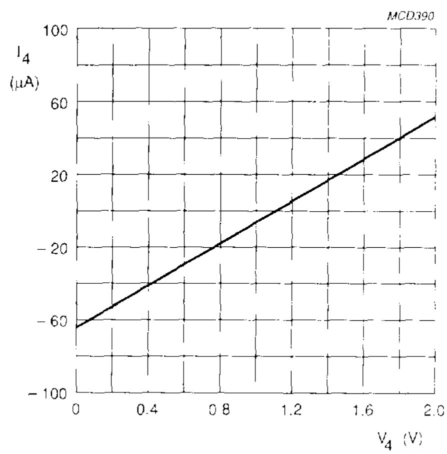
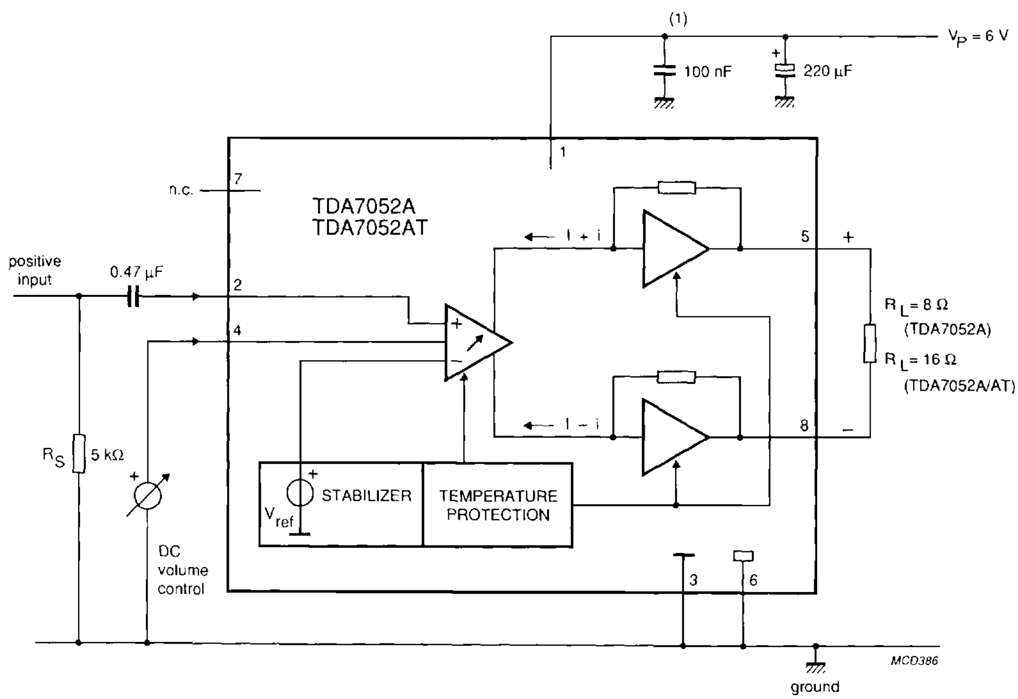


Fig.5 Control current as a function of DC volume control.

APPLICATION INFORMATION



(1) This capacitor can be omitted if the 220 µF electrolytic capacitor is connected close to pin 1.

Fig.6 Test and application diagram.

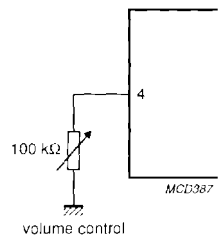


Fig.7 Application with potentiometer as volume control; maximum gain = 30 dB.