

# Mono BTL audio amplifier with DC volume control

TDA7052B; TDA7052BT

## FEATURES

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

## GENERAL DESCRIPTION

The TDA7052B; BT are 1 W and 0.5 W mono BTL output amplifiers with DC volume control. They have been designed for use in TV and monitors, but are also suitable for use in battery-fed portable recorders and radios.

### Missing Current Limiter (MCL)

A MCL protection circuit is built-in. The MCL circuit is activated when the difference in current between the output terminal of each amplifier exceeds 100 mA (typical 300 mA). This level of 100 mA allows for headphone applications (single-ended).

## QUICK REFERENCE DATA

SYMBOL	PARAMETERS	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_P$	positive supply voltage		4.5	—	18	V
$P_O$	output power					
	TDA7052B	$R_L = 8 \Omega$ ; $V_P = 6 \text{ V}$	0.9	1.0	—	W
	TDA7052BT	$R_L = 16 \Omega$ ; $V_P = 6 \text{ V}$	0.5	0.55	—	W
$G_v$	maximum total voltage gain		39.5	40.5	41.5	dB
$\phi$	gain control		68	73.5	—	dB
$I_P$	total quiescent current	$V_P = 6 \text{ V}$ ; $R_L = \infty$	—	9.2	13	mA
THD	total harmonic distortion					
	TDA7052B	$P_O = 0.5 \text{ W}$	—	0.3	1	%
	TDA7052BT	$P_O = 0.25 \text{ W}$	—	0.3	1	%

## ORDERING INFORMATION

EXTENDED TYPE NUMBER	PACKAGE			
	PINS	PIN POSITION	MATERIAL	CODE
TDA7052B	8	DIL	plastic	SOT97DE
TDA7052BT	8	SO8	plastic	SOT96AG

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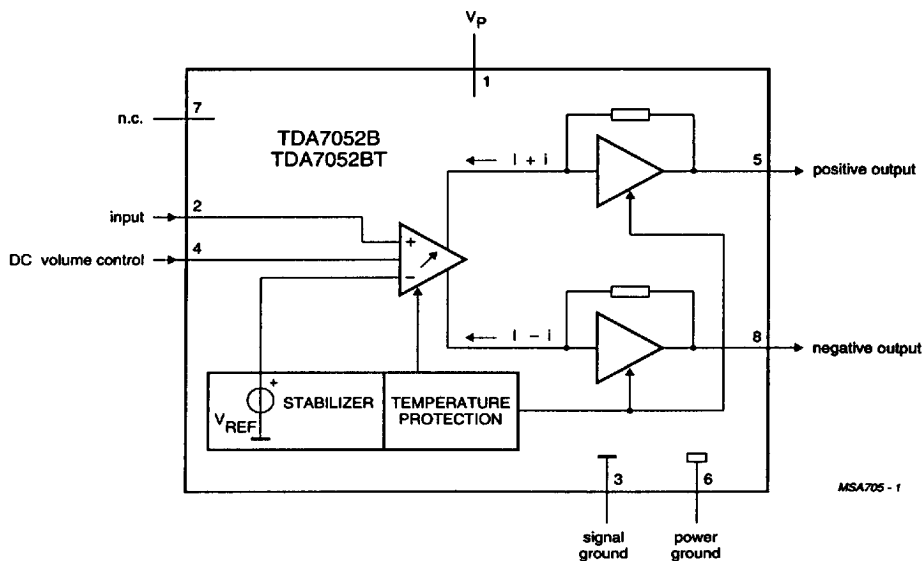


Fig.1 Block diagram.

## PINNING

SYMBOL	PIN	DESCRIPTION
$V_p$	1	positive supply voltage
IN+	2	input
GND1	3	signal ground
VC	4	DC volume control
OUT+	5	positive output
GND2	6	power ground
n.c.	7	not connected
OUT-	8	negative output

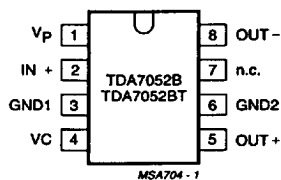


Fig.2 Pin configuration.

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FUNCTIONAL DESCRIPTION

The TDA7052B; BT are mono BTL output amplifiers with DC volume control which have been designed for use in TV and monitors but are also suitable for use in 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 TDA7052B; BT the DC volume control stage is integrated into the input stage so that no coupling capacitors are required. With this configuration, a low offset voltage is maintained and the minimum supply voltage 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.

Consequently, a reduced power supply with smaller capacitors can be used which results in cost reductions.

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.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_P$	positive supply voltage		–	18	V
$I_{ORM}$	repetitive peak output current		–	1.25	A
$I_{OSM}$	non-repetitive peak output current		–	1.5	A
$P_{tot}$	total power dissipation	$T_{amb} \leq 25\text{ }^{\circ}\text{C}$			
	TDA7052B		–	1.25	W
	TDA7052BT		–	0.8	W
$T_{amb}$	operating ambient temperature		–40	+85	$^{\circ}\text{C}$
$T_{stg}$	storage temperature		–55	+150	$^{\circ}\text{C}$
$T_{vj}$	virtual junction temperature		–	+150	$^{\circ}\text{C}$
$T_{sc}$	short-circuit time		–	1	hr
$V_{2,4}$	input voltage pins 2 and 4		–	5	V

THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th\ j-a}$	from junction to ambient in free air	
	TDA7052B	100 K/W
	TDA7052BT	155 K/W

The maximum gain of the amplifier is fixed at 40.5 dB. The DC volume control stage has a logarithmic control characteristic. Therefore, the total gain can be controlled from 40.5 dB to –33 dB. If the DC volume control voltage falls below 0.4 V, the device will switch to the mute mode.

The amplifier is short-circuit proof to ground,  $V_P$  and across the load. Also a thermal protection circuit is implemented. If the crystal temperature rises above +150  $^{\circ}\text{C}$  the gain will be reduced, thereby reducing the output power. Special attention is given to switch-on and switch-off clicks, low HF radiation and a good overall stability.

Power dissipation

Assume for the TDA7052B that  $V_P = 6\text{ V}$ ;  $R_L = 8\text{ }\Omega$ . The maximum sinewave dissipation is 0.9 W. The  $R_{th\ j-a}$  of the package is 100 K/W. Therefore  $T_{amb(max)} = 150 - 100 \times 0.9 = 60\text{ }^{\circ}\text{C}$ .

Assume for the TDA7052BT that  $V_P = 6\text{ V}$ ;  $R_L = 16\text{ }\Omega$ . The maximum sinewave dissipation is 0.46 W. The  $R_{th\ j-a}$  of the package is 155 K/W. Therefore  $T_{amb(max)} = 150 - 155 \times 0.46 = 78\text{ }^{\circ}\text{C}$ .

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## CHARACTERISTICS

$V_P = 6\text{ V}$ ;  $T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  $f = 1\text{ kHz}$ ;  $R_L = 8\text{ }\Omega$  and  $16\text{ }\Omega$ ; unless otherwise specified (see Fig.6).

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_P$	positive supply voltage		4.5	—	18	V
$I_P$	total quiescent current	note 1; $V_P = 6\text{ V}$ ; $R_L = \infty$	—	9.2	13	mA
<b>Maximum gain; <math>V_4 \geq 1.4\text{ V}</math></b>						
$P_O$	output power TDA7052B TDA7052BT	THD = 10%	0.9 0.5	1.0 0.55	— —	W W
THD	total harmonic distortion TDA7052B TDA7052BT	$P_O = 0.5\text{ W}$ $P_O = 0.25\text{ W}$	— —	0.3 0.3	1 1	% %
$G_v$	voltage gain		39.5	40.5	41.5	dB
$V_{I(RMS)}$	input signal handling (RMS value)	$G_v = 0\text{ dB}$ ; THD < 1%	1	—	—	V
$V_{no}$	noise output voltage	note 2; $f = 500\text{ kHz}$	—	210	—	$\mu\text{V}$
B	bandwidth	at -1 dB	—	20 Hz to 300 kHz	—	Hz
SVRR	supply voltage ripple rejection	note 3	34	38	—	dB
$ \Delta V_O $	DC output offset voltage	$ V_8 - V_5 $	—	0	200	mV
$Z_i$	input impedance (pin 3)		15	20	25	k $\Omega$
<b>Mute position</b>						
$V_O$	output voltage in mute position	note 4; $V_4 = 0.4\text{ V} \pm 30\text{ mV}$ ; $V_1 = 1.0\text{ V}$	—	30	40	$\mu\text{V}$
<b>DC volume control</b>						
$\phi$	gain control		68	73.5	—	dB
$I_4$	control current	$V_4 = 0\text{ V}$	20	25	30	$\mu\text{A}$

## Notes

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 divided by  $R_L$ .
2. The noise output voltage (RMS value) at  $f = 500\text{ kHz}$  is measured with  $R_S = 0\text{ }\Omega$  and bandwidth = 5 kHz.
3. The ripple rejection is measured with  $R_S = 0\text{ }\Omega$  and  $f = 100\text{ Hz}$  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  $R_S = 5\text{ k}\Omega$  unweighted.

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## Quality specification

In accordance with SNW-FQ-611 part E, if this type is used as an audio amplifier.

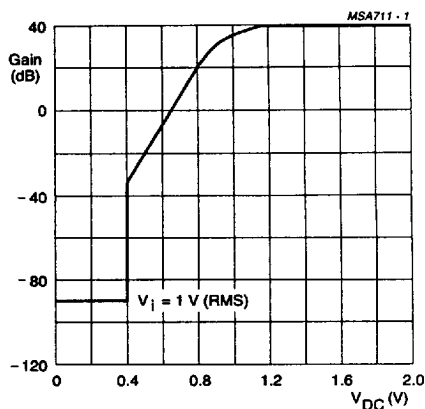
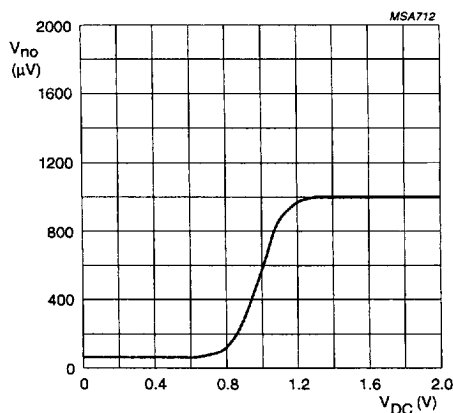


Fig.3 Gain control as a function of DC volume control.



(1) The noise output voltage (RMS value) is measured with  $R_s = 5 \text{ k}\Omega$  unweighted.

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

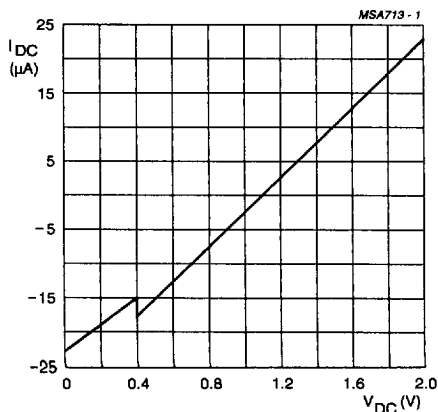
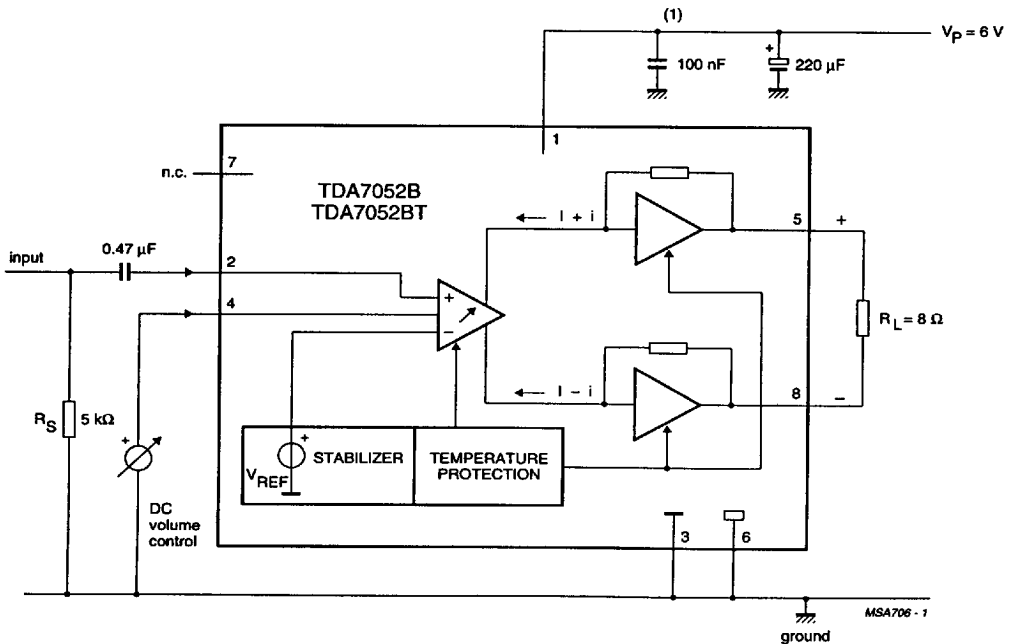


Fig.5 Control current as a function of DC volume control.

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## 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.

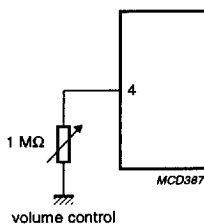


Fig.7 Application with potentiometer as volume control; maximum gain = 34 dB.