

4W amplifier with DC volume control

TDA1013B

GENERAL DESCRIPTION

The TDA1013B is an integrated audio amplifier circuit with DC volume control, encapsulated in a 9-lead single in-line (SIL) plastic package. The wide supply voltage range makes this circuit ideal for applications in mains and battery-fed apparatus such as television receivers and record players.

The DC volume control stage has a logarithmic control characteristic with a range of more than 80 dB; control is by means of a DC voltage variable between 2 and 6.5 V.

The audio amplifier has a well defined open loop gain and a fixed integrated closed loop. This device requires only a few external components and offers stability and performance.

Features

- Few external components
- Wide supply voltage range
- Wide control range
- Pin compatible with TDA1013A
- Fixed gain
- High signal-to-noise ratio
- Thermal protection

QUICK REFERENCE DATA

parameter	conditions	symbol	min.	typ.	max.	unit
Supply voltage		V_P	10	18	40	V
Repetitive peak output current		I_{ORM}	—	—	1.5	A
Total sensitivity	$P_O = 2.5$ W; DC control at max. gain	V_i	44	55	89	mV
Audio amplifier						
Output power	THD = 10%; $R_L = 8 \Omega$	P_O	4.0	4.2	—	W
Total harmonic distortion	$P_O = 2.5$ W; $R_L = 8 \Omega$	THD	—	0.15	0.1	%
Sensitivity	$P_O = 2.5$ W	V_i	100	125	160	mV
DC volume control unit						
Gain control range		$ \Delta G_V $	80	—	—	dB
Signal handling	THD < 1%; DC control = 0 dB	V_i	1.2	1.7	—	V
Sensitivity (pin 6)	$V_O = 125$ mV; max. voltage gain	V_i	39	45	55	mV
Input impedance (pin 6)		$ Z_i $	23	29	35	k Ω

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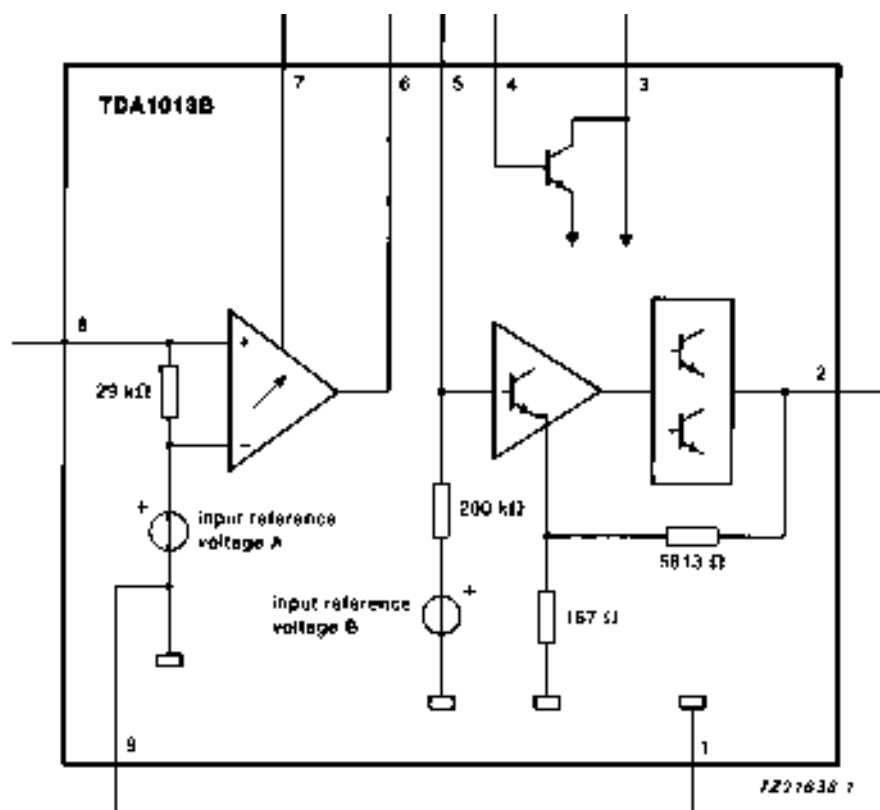


Fig.1 Block diagram.

PINNING

- 1 signal ground
- 2 amplifier output
- 3 supply voltage
- 4 electronic filter
- 5 amplifier input
- 6 control unit output
- 7 control voltage
- 8 control unit input
- 9 power ground

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RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

parameter	symbol	min.	max.	unit
Supply voltage	V _p	—	40	V
Non-repetitive peak output current	I _{OSM}	—	3	A
Repetitive peak output current	I _{ORM}	—	1.5	A
Storage temperature range	T _{stg}	−65	+ 150	°C
Crystal temperature	T _c	—	+ 150	°C
Total power dissipation	P _{tot}	see Fig. 2		

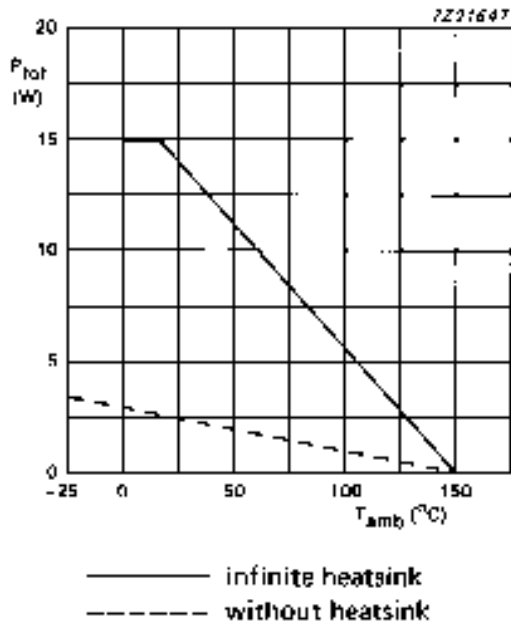


Fig.2 Power derating curve.

HEATSINK DESIGN EXAMPLE

Assume V_p = 18 V; R_L = 8 Ω; T_{amb} = 60 °C; T_c = 150 °C (max.); for a 4 W application, the maximum dissipation is approximately 2.5 W. The thermal resistance from junction to ambient can be expressed as:

$$R_{th\ j-a} = R_{th\ j-tab} + R_{th\ tab-h} + R_{th\ h-a}$$

$$\frac{T_{j\ max} - T_{amb\ max}}{P_{max}} = \frac{150 - 60}{2.5} = 36\ K/W$$

Since R_{th j-tab} = 9 K/W and R_{th tab-h} = 1 K/W, R_{th h-a} = 36 − (9 + 1) = 26 K/W.

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CHARACTERISTICS

$V_P = 18\text{ V}$; $R_L = 8\ \Omega$; $f = 1\text{ kHz}$; $T_{amb} = 25\ ^\circ\text{C}$; see Fig. 10; unless otherwise specified

parameter	conditions	symbol	min.	typ.	max.	unit
Supply voltage range		V_P	10	18	40	V
Total quiescent current		I_{tot}	—	25	60	mA
Noise output voltage	note 1					
at maximum gain	$R_S = 0\ \Omega$	V_n	—	0.5	—	mV
at maximum gain	$R_S = 5\text{ k}\Omega$	V_n	—	0.6	1.4	mV
at minimum gain	$R_S = 0\ \Omega$	V_n	—	0.25	—	mV
Total sensitivity	$P_O = 2.5\text{ W}$; DC control at max. gain	V_i	44	55	69	mV
Audio amplifier						
Repetitive peak output current		I_{ORM}	—	—	1.5	A
Output power	THD = 10%; $R_L = 8\ \Omega$	P_O	4.0	4.2	—	W
Total harmonic distortion	$P_O = 2.5\text{ W}$; $R_L = 8\ \Omega$	THD	—	0.15	1.0	%
Sensitivity	$P_O = 2.5\text{ W}$	V_i	100	125	160	mV
Input impedance (pin 5)		$ Z_i $	100	200	500	k Ω
Power bandwidth		B _P	—	30 to 40 000	—	Hz
DC volume control unit						
Gain control range		$ \Delta G_v $	80	90	—	dB
Signal handling	THD < 1%; DC control = 0 dB	V_i	1.2	1.7	—	V
Sensitivity (pin 6)	$V_a = 125\text{ mV}$; max. voltage gain	V_i	39	44	55	mV
Input impedance (pin 8)		$ Z_i $	23	29	35	k Ω
Output impedance (pin 6)		$ Z_o $	45	60	75	Ω

Note to the characteristics

1. Measured in a bandwidth in accordance with IEC 179, curve 'A'.

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APPLICATION INFORMATION

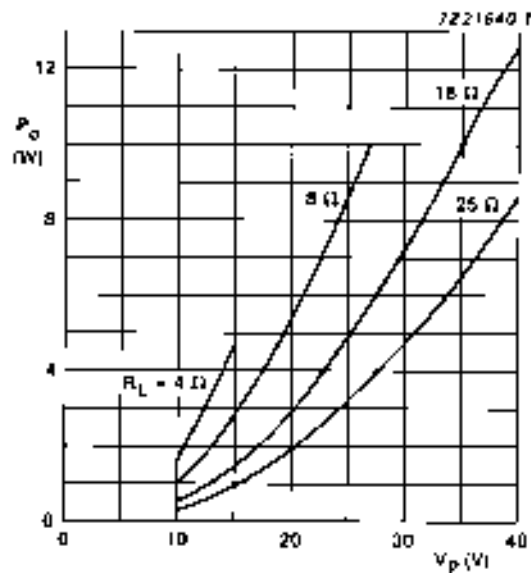


Fig.3 Output power as a function of supply voltage; $f = 1$ kHz;
THD = 10% and control voltage (V_7) = 6.5 V.

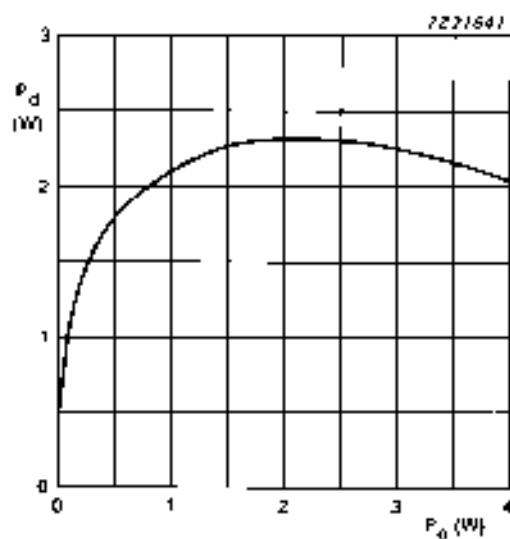


Fig.4 Power dissipation as a function of output power; $V_p = 18$ V;
 $f = 1$ kHz; $R_L = 8 \Omega$ and control voltage (V_7) = 6.5 V.

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APPLICATION INFORMATION (continued)

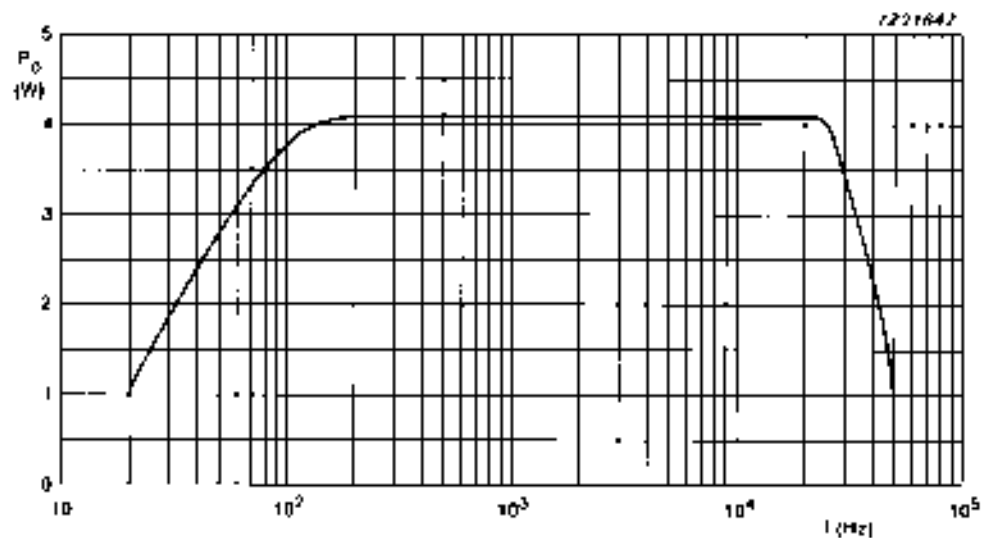


Fig.5 Power bandwidth; $V_P = 18$ V; $R_L = 8 \Omega$;
THD = 10% and control voltage (V_7) = 6.5 V.

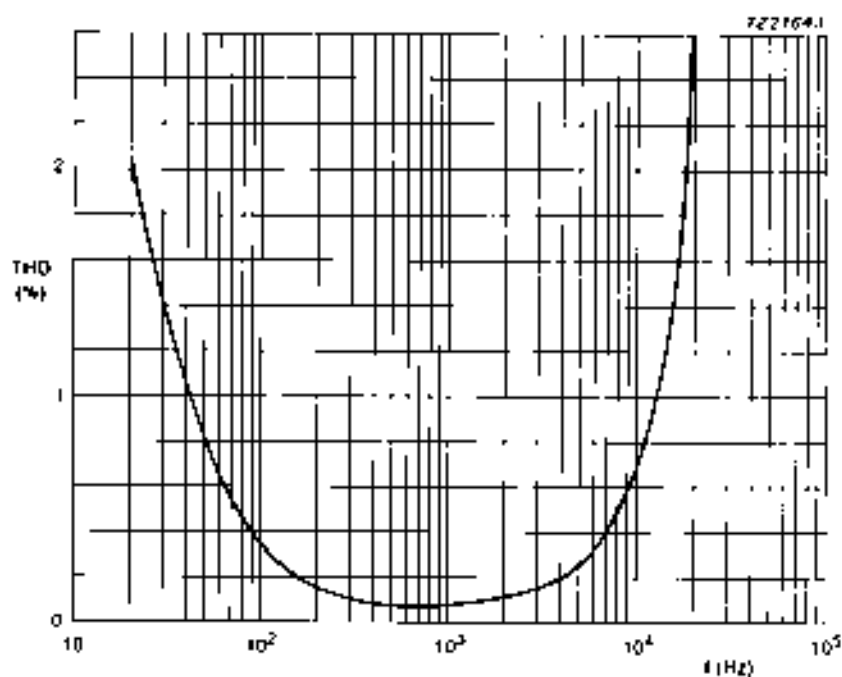


Fig.6 Total harmonic distortion as a function of frequency;
 $V_P = 18$ V; $R_L = 8 \Omega$; $P_O = 2.5$ W and control voltage = 6.5 V.

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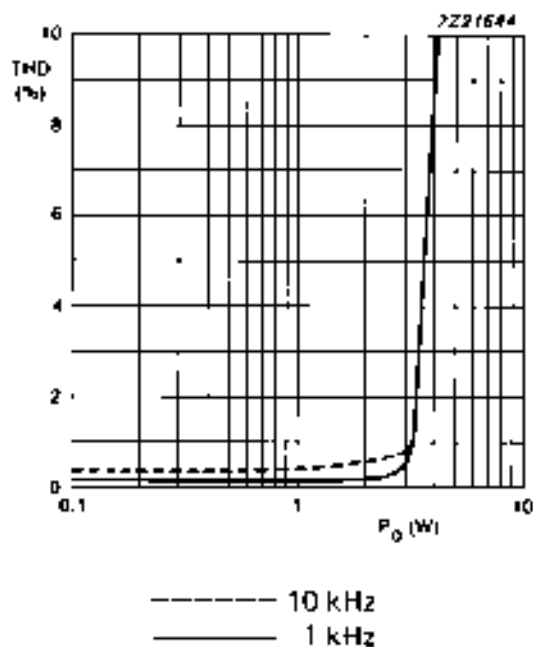


Fig.7 Total harmonic distortion as a function of output power;
 $V_p = 18$ V; $R_L = 8 \Omega$ and control voltage = 6.5 V.

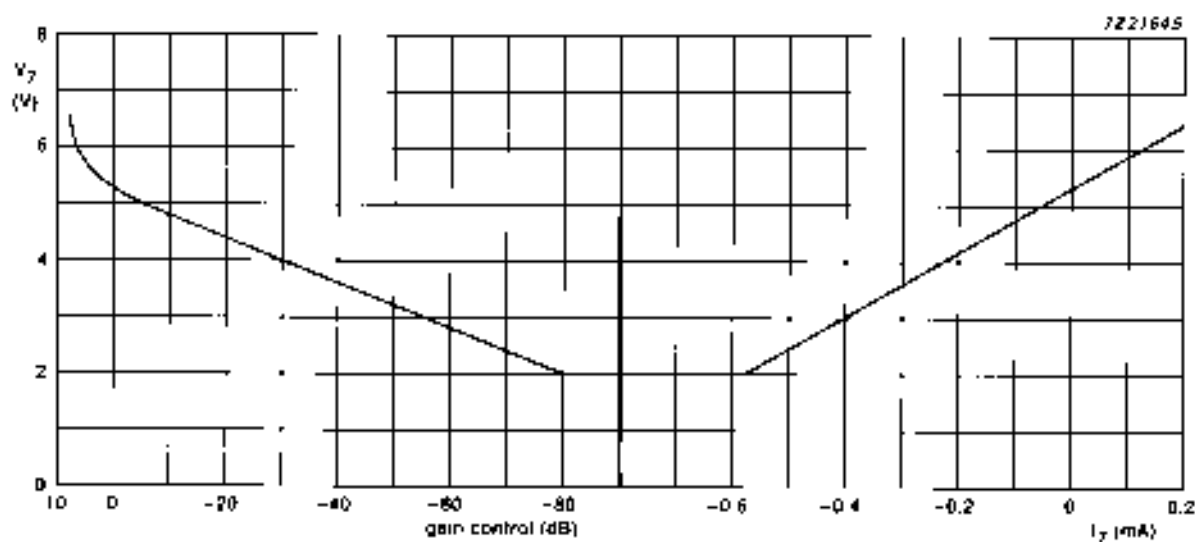


Fig.8 Typical control curve.

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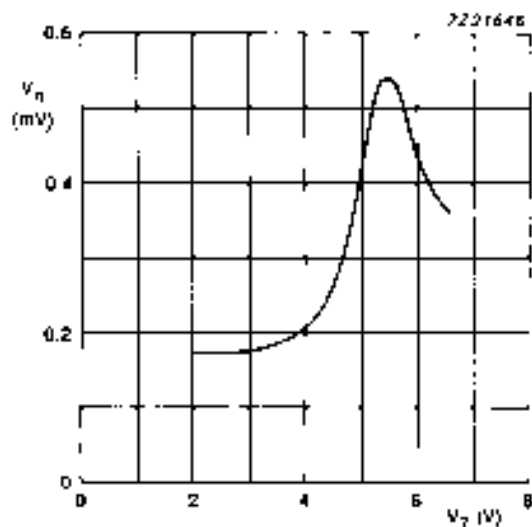
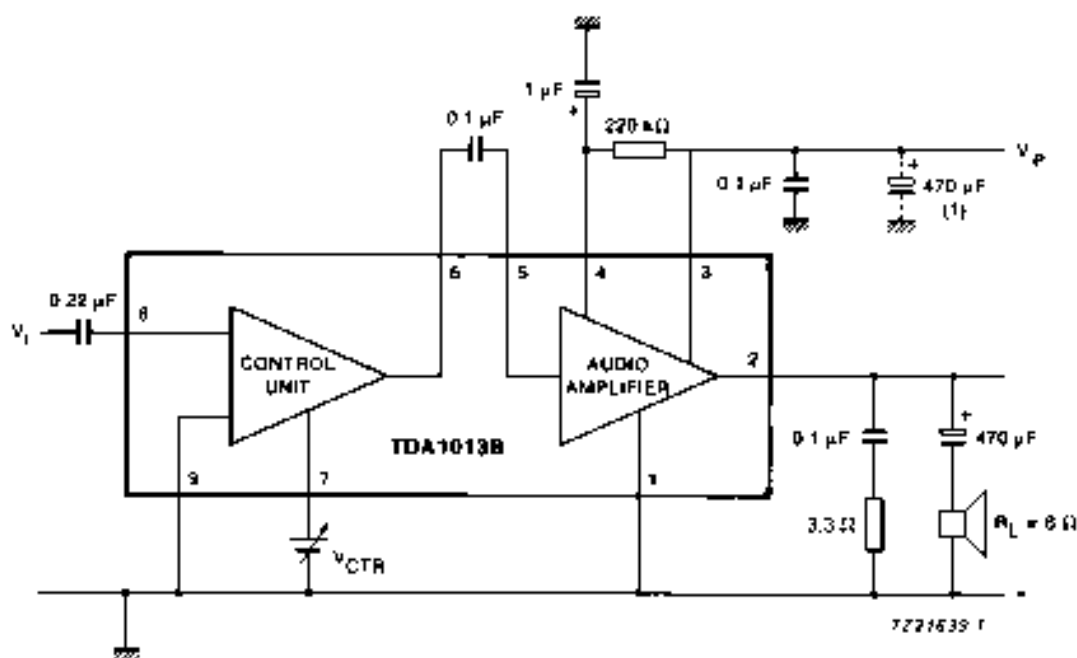
APPLICATION INFORMATION (continued)

Fig.9 Noise output voltage as a function of the control voltage; $V_p = 18 \text{ V}$; $R_L = 8 \text{ }\Omega$ (in accordance with IEC 179, curve 'A').

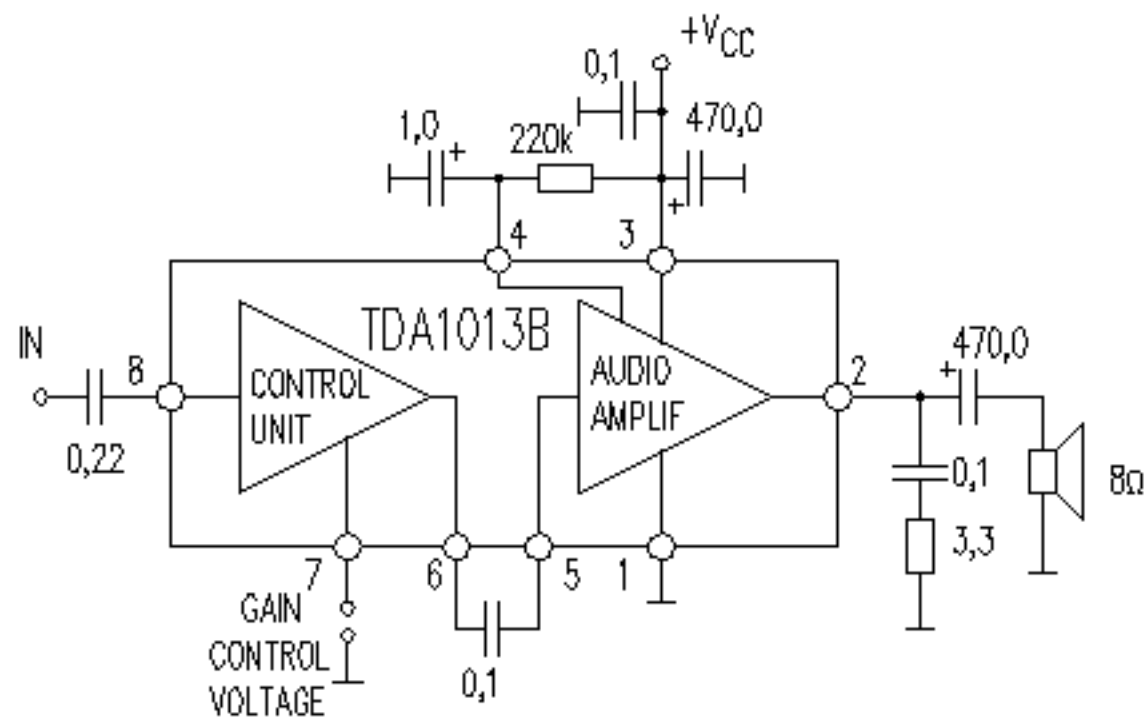


(1) Belongs to power supply circuitry.

Fig.10 Application diagram.

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POWER AMPLIFIER
4,2W



80dB Volume Control

$V_{CC} \text{ MAX} = 18V$
 $V_{CC} \text{ TYP} = 18V$
 $V_{CC} \text{ RNG} = 10...40V$

$P_o = 4,2W$
 $R_L = 8 \Omega$
 $TDH = 10\%$

$I_{CCO} \text{ TYP} = 25mA$
 $I_{CCO} \text{ MAX} = 60mA$
 $I_{MAX} = 1,5A$

$R_{IN} = 200k$
 $\text{Gain} = 38db$
 $\text{Noise} = 1,5mkV$

$R_{THJ-C} = 9C/W$
 Case SIL9MP