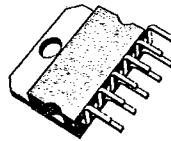


10+10W HIGH QUALITY STEREO AMPLIFIER

The TDA2009 is class AB dual Hi-Fi Audio power amplifier assembled in Multiwatt[®] package, specially designed for high quality stereo application as Hi-Fi and music centers. Its main features are:

- High output power (10+10W min. @ $d = 0.5\%$)
- High current capability (up to 3.5A)
- Thermal overload protection
- Space and cost saving: very low number of external components and simple mounting thanks to the Multiwatt[®] package.

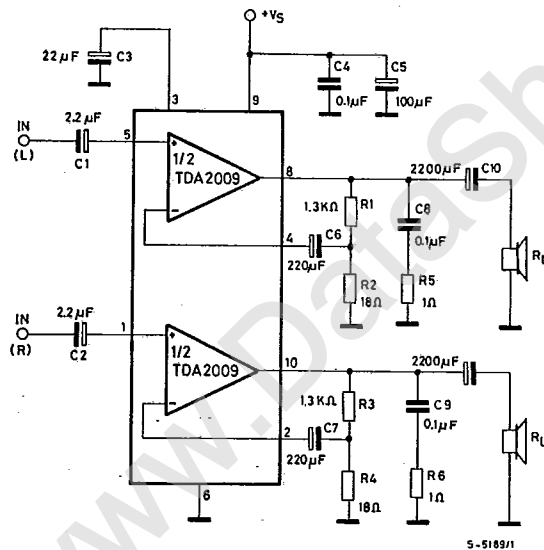


Multiwatt-11

ORDERING NUMBER: TDA2009

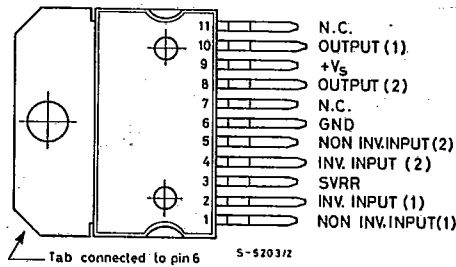
ABSOLUTE MAXIMUM RATINGS

V_s	Supply voltage	28	V
I_o	Output peak current (repetitive $f \geq 20\text{Hz}$)	3.5	A
I_o	Output peak current (non repetitive, $t = 100\mu\text{s}$)	4.5	A
P_{tot}	Power dissipation at $T_{case} = 90^\circ\text{C}$	20	W
T_{stg}, T_j	Storage and junction temperature	-40 to 150	$^\circ\text{C}$

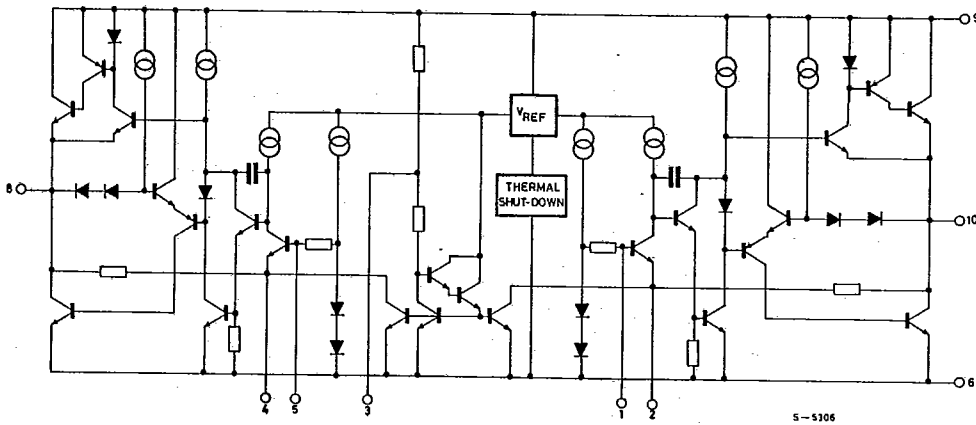
TEST CIRCUIT

CONNECTION DIAGRAM
(top view)

T-74-05-01



SCHEMATIC DIAGRAM



THERMAL DATA

$R_{th \text{ } j\text{-case}}$	Thermal resistance junction-case	max 3 °C/W
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ELECTRICAL CHARACTERISTICS (Refer to the stereo application circuit, $T_{amb} = 25^{\circ}\text{C}$, $V_s = 23\text{V}$, $G_v = 36\text{ dB}$, unless otherwise specified)

Parameters	Test conditions	Min.	Typ.	Max.	Unit
V_s Supply voltage		8		28	V
V_o Quiescent output voltage	$V_s = 23\text{V}$		11		V
I_d Total quiescent drain current	$V_s = 28$		55	120	mA
P_o Output power	$f = 50\text{ Hz to }16\text{ KHz}$ $d = 0.5\%$ $V_s = 23\text{V}$	10	11		W
	$R_L = 4\ \Omega$		6.5		W
	$V_s = 18\text{V}$ $R_L = 4\ \Omega$ $R_L = 8\ \Omega$	5.5	6.5		W
d Distortion	$f = 1\text{ KHz}$ $V_s = 23\text{V}$ $P_o = 100\text{ mW to }8\text{W}$ $R_L = 4\ \Omega$		0.05		%
	$V_s = 23\text{V}$ $P_o = 100\text{ mW to }3\text{W}$ $R_L = 8\ \Omega$		0.05		%
CT Cross talk (°°°)	$R_L = \infty$				
	$R_g = 10\text{ K}\Omega$				
	$f = 1\text{ KHz}$	50	65		dB
	$f = 10\text{ KHz}$	40	50		dB
V_i Input saturation voltage (rms)		300			mV
R_i Input resistance	$f = 1\text{ KHz}$ non inverting input	70	200		$\text{K}\Omega$
f_L Low frequency roll off (-3 dB)	$R_L = 4\ \Omega$		20		Hz
f_H High frequency roll off (-3 dB)			80		KHz
G_v Voltage gain (closed loop)	$f = 1\text{ KHz}$	35.5	36	36.5	dB
ΔG_v Closed loop gain matching			0.5		dB
e_N Total input noise voltage	$R_g = 10\text{ K}\Omega$ (°)		1.5		μV
	$R_g = 10\text{ K}\Omega$ (°°)		2.5	8	μV
SVR Supply voltage rejection	$R_g = 10\text{ K}\Omega$ $f_{\text{ripple}} = 100\text{ Hz}$ $V_{\text{ripple}} = 0.5\text{V}$	43	55		dB
T_J Thermal shut-down junction temperature			145		$^{\circ}\text{C}$

(°) Curve A.

(°°) 22 Hz to 22 KHz.

(°°°) Optimized test box.

Fig. 1 - Test and application circuit ($G_v = 36 \text{ dB}$)

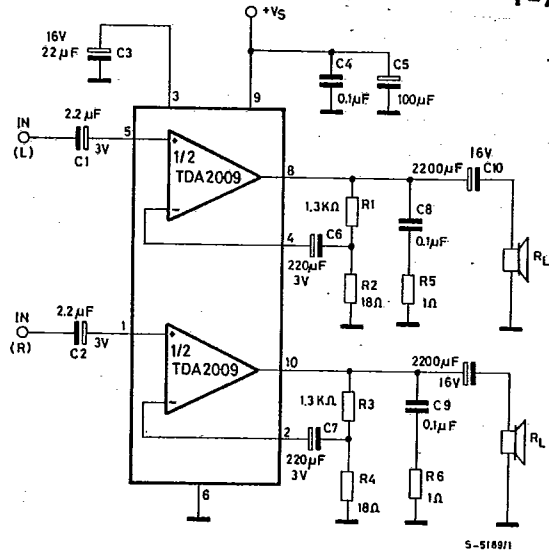


Fig. 2 - P.C. board and components layout of the circuit of fig. 1 (1 : 1 scale)

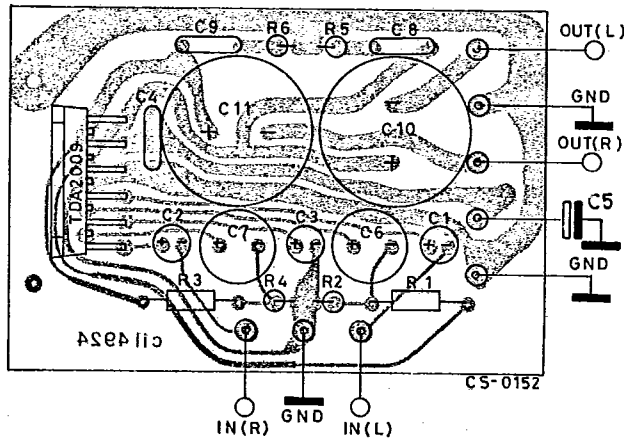


Fig. 3 - Output power vs. supply voltage

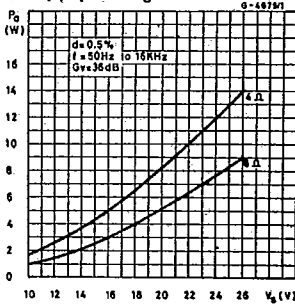


Fig. 4 - Output power vs. supply voltage

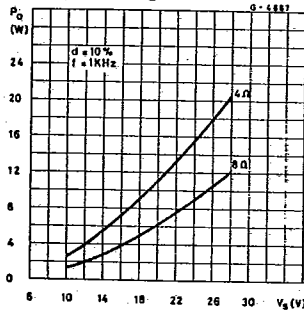


Fig. 5 - Distortion vs. output power

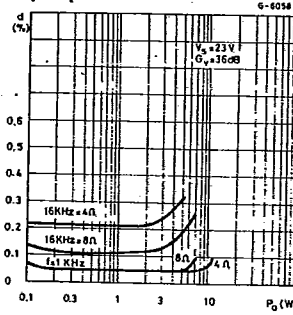


Fig. 6 - Distortion vs. frequency

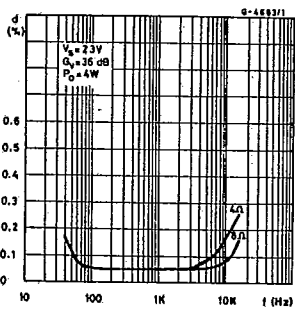


Fig. 7 - Quiescent current vs. supply voltage

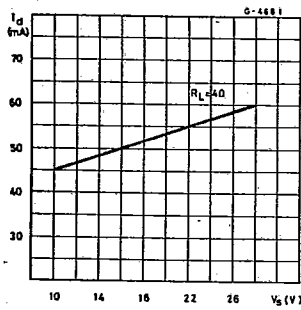


Fig. 8 - Supply voltage rejection vs. value of capacitor C3

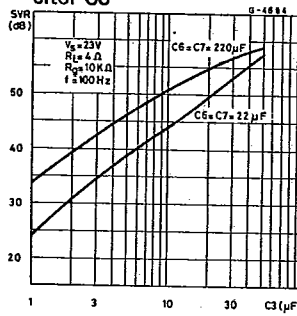


Fig. 9 - Supply voltage rejection vs. frequency

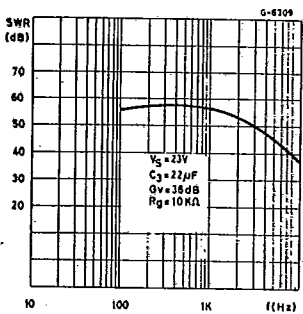


Fig. 10 - Total power dissipation and efficiency vs. output power

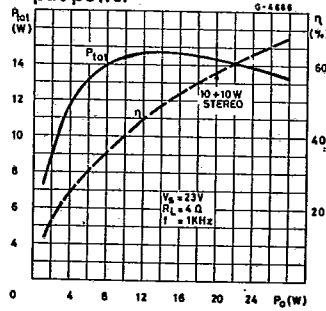


Fig. 11 - Total power dissipation and efficiency vs. output power

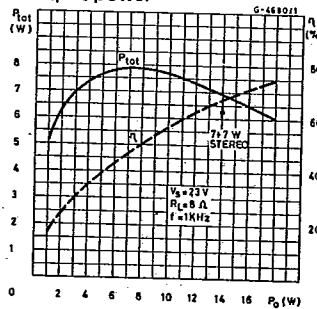


Fig. 12 - Cross-talk vs. frequency

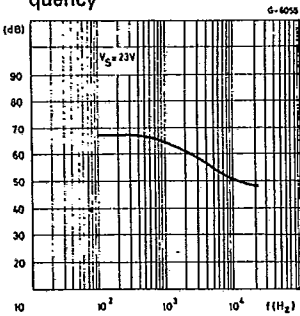


Fig. 13 - Output power vs. closed loop gain

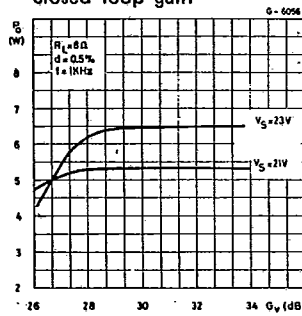
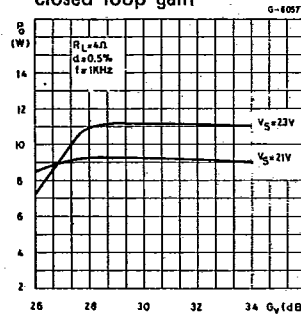


Fig. 14 - Output power vs. closed loop gain



APPLICATION INFORMATION

Fig. 15 - Simple short-circuit protection

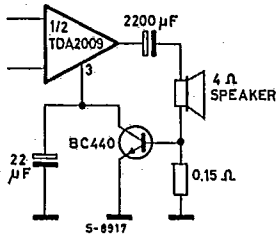


Fig. 16 - Example of muting circuit

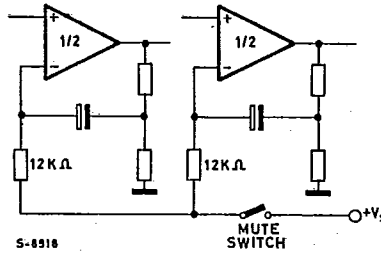


Fig. 17 - 10 + 10W stereo amplifier with tone balance and loudness control

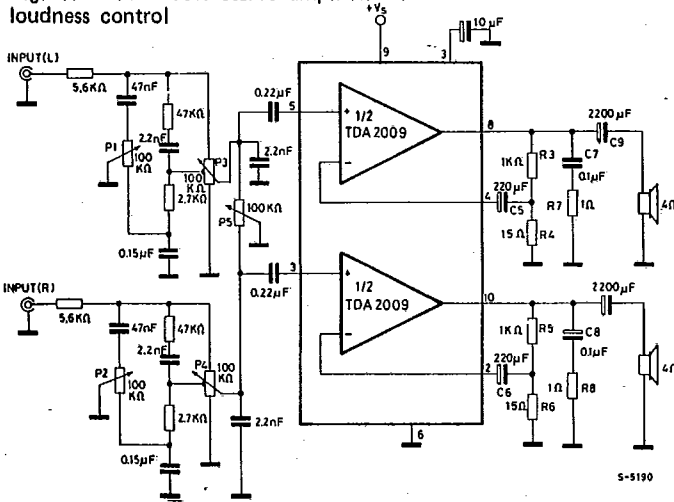
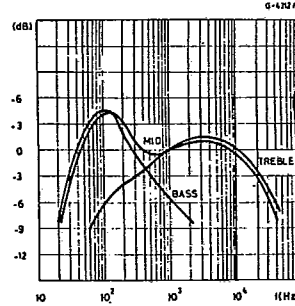


Fig. 18 - Tone control response (circuit of fig. 17)



APPLICATION INFORMATION (continued)

SGS-THOMSON

Fig. 19 - High quality 10 + 20W two way amplifier for stereo music center (one channel only)

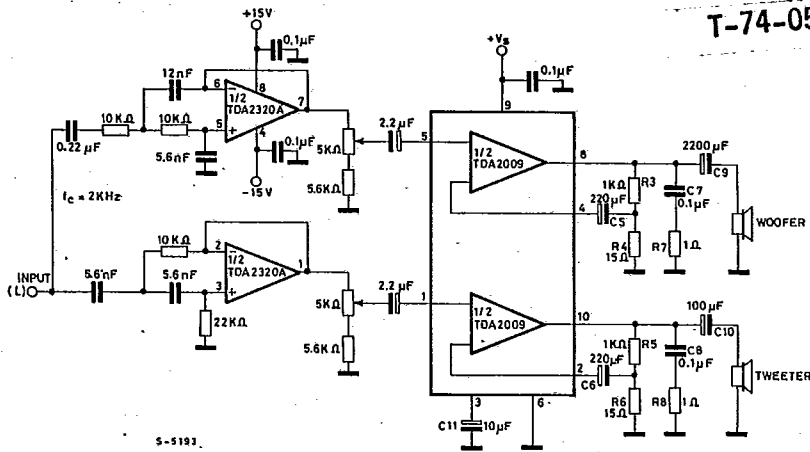
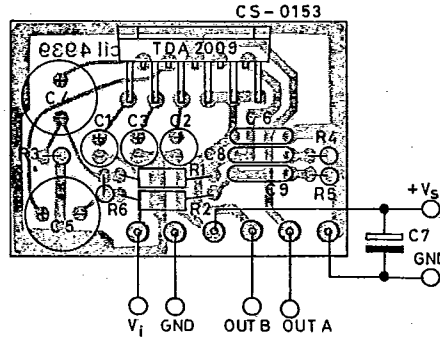
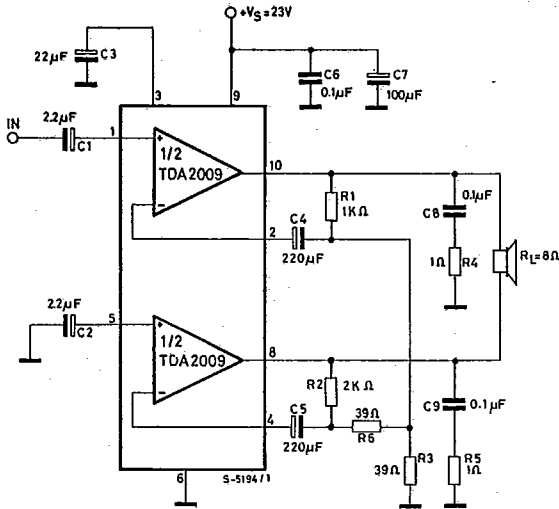


Fig. 20 - 18W bridge amplifier ($d = 0.5\%$, $G_v = 40dB$)

Fig. 21 - P.C. board and components layout of the circuit of fig. 20 (1 : 1 scale)



APPLICATION SUGGESTION

The recommended values of the components are those shown on application circuit of fig. 1. Different values can be used; the following table can help the designer.

Component	Recomm. value	Purpose	Larger than	Smaller than
R1 and R3	1.2 K Ω	Close loop gain setting (*)	Increase of gain	Decrease of gain
R2 and R4	18 Ω		Decrease of gain	Increase of gain
R5 and R6	1 Ω	Frequency stability	Danger of oscillation at high frequency with inductive load	
C1 and C2	2.2 μ F	Input DC decoupling	High turn-on delay	High turn-on pop Higher low frequency cutoff. Increase of noise
C3	22 μ F	Ripple rejection	Better SVR. Increase of the switch-on time	Degradation of SVR.
C6 and C7	220 μ F	Feedback Input DC decoupling.		
C8 and C9	0.1 μ F	Frequency stability.		Danger of oscillation.
C10 and C11	1000 μ F to 2200 μ F	Output DC decoupling.		Higher low-frequency cut-off.

(*) The closed loop gain must be higher than 26dB

BUILD-IN PROTECTION SYSTEMS

Thermal shut-down

The presence of a thermal limiting circuit offers the following advantages:

- 1) an overload on the output (even it is permanent), or an excessive ambient temperature can be easily withstood.
- 2) the heatsink can have a smaller factor of safety compared with that of a conventional

circuits. There is no device damage in the case of excessive junction temperature: all that happens is that P_o (and therefore P_{tot}) and I_d are reduced.

The maximum allowable power dissipation depends upon the size of the external heatsink (i.e. its thermal resistance); fig. 22 shows this dissipable power as a function of ambient temperature for different thermal resistance.

Fig. 22 - Maximum allowable power dissipation vs. ambient temperature

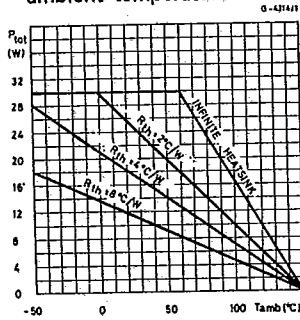
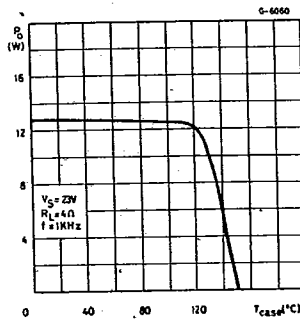


Fig. 23 - Output power vs. case temperature



MOUNTING INSTRUCTIONS

The power dissipated in the circuit must be removed by adding an external heatsink. Thanks to the MULTIWATT® package attaching the heatsink is very simple, a screw or a compression spring (clip) being sufficient. Between

the heatsink and the package it is better to insert a layer of silicon grease, to optimize the thermal contact; no electrical isolation is needed between the two surfaces.