SGS-THOMSON MICROELECTRONICS

S G S-THOMSON

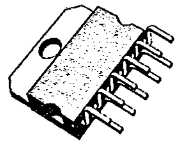
TDA2009

T-74-05-01

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.



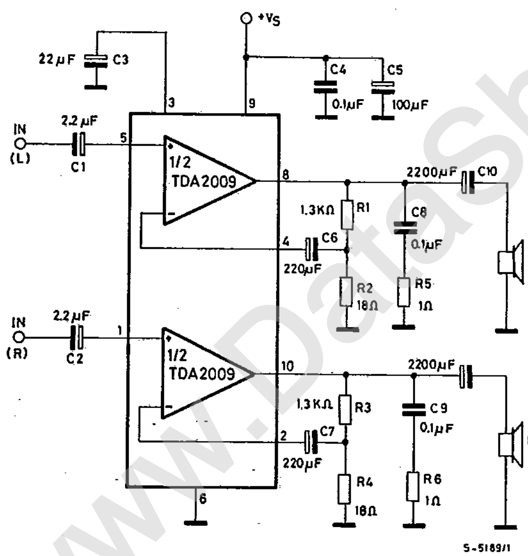
Multiwatt-11

ORDERING NUMBER: TDA2009

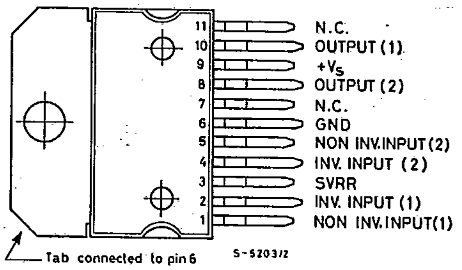
ABSOLUTE MAXIMUM RATINGS

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

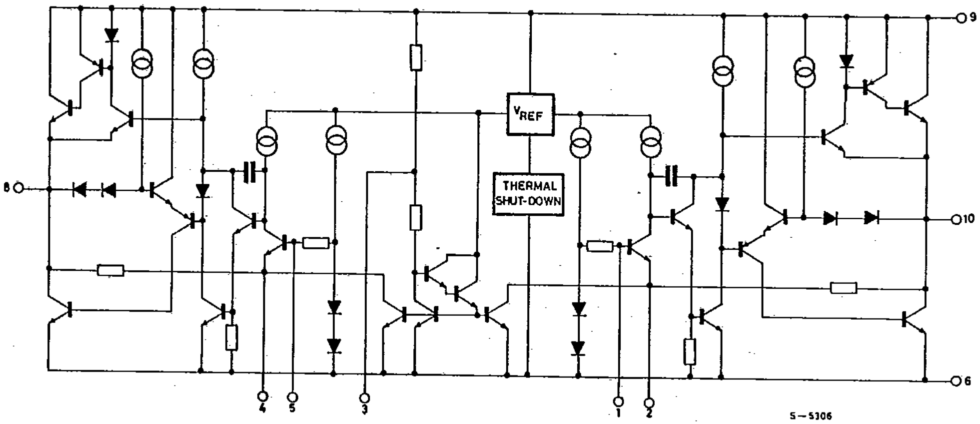
TEST CIRCUIT



CONNECTION DIAGRAM
(top view)



SCHEMATIC DIAGRAM



THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal resistance junction-case	max	3	°C/W

ELECTRICAL CHARACTERISTICS (Refer to the stereo application circuit, T_{amb} = 25°C, V_s = 23V, G_v = 36 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 = 23V			11		V
I_d	Total quiescent drain current	V_s = 28			55	120	mA
P_o	Output power	f = 50 Hz to 16 KHz d = 0.5% V_s = 23V R_L = 4 Ω R_L = 8 Ω V_s = 18V R_L = 4 Ω R_L = 8 Ω		10 5.5	11 6.5 6.5 4		W W W W
d	Distortion	f = 1 KHz V_s = 23V R_L = 4 Ω P_o = 100 mW to 8W V_s = 23V R_L = 8 Ω P_o = 100 mW to 3W			0.05 0.05		%
CT	Cross talk (°°°)	R_L = ∞	f = 1 KHz	50	65		dB
		R_g = 10 KΩ	f = 10 KHz	40	50		dB
V_I	Input saturation voltage (rms)			300			mV
R_I	Input resistance	f = 1 KHz	non inverting input	70	200		KΩ
f_L	Low frequency roll off (-3 dB)	R_L = 4Ω			20		Hz
f_H	High frequency roll off (-3 dB)				80		KHz
G_v	Voltage gain (closed loop)	f = 1 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 KΩ (°)			1.5		μV
		R_g = 10 KΩ (°°)			2.5	8	μV
SVR	Supply voltage rejection	R_g = 10 KΩ f_{ripple} = 100 Hz V_{ripple} = 0.5V		43	55		dB
T_J	Thermal shut-down junction temperature				145		°C

(°) Curve A. (°°) 22 Hz to 22 KHz. (°°°) Optimized test box.

Fig. 1 - Test and application circuit (G_v = 36 dB)

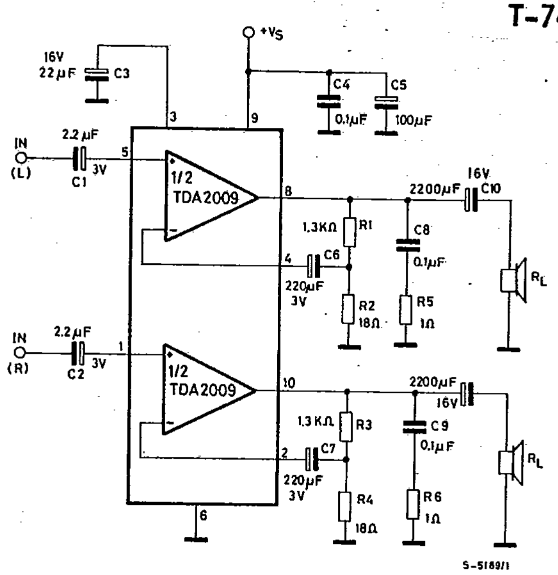


Fig. 2 - P.C. board and components layout of the circuit of fig. 1 (1 : 1 scale)

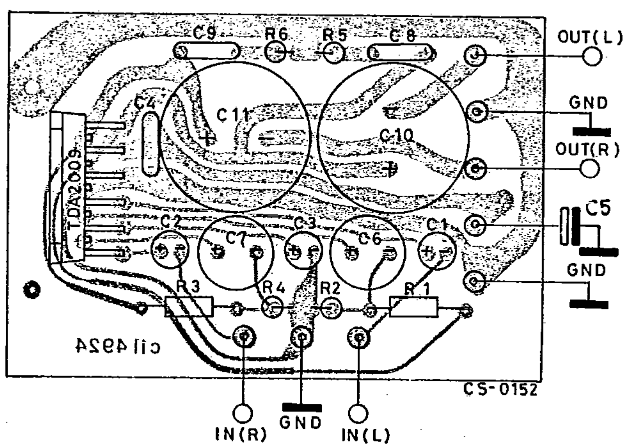


Fig. 3 - Output power vs. supply voltage

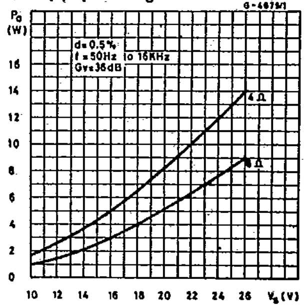


Fig. 4 - Output power vs. supply voltage

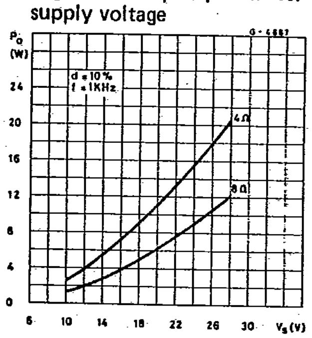


Fig. 5 - Distortion vs. output power

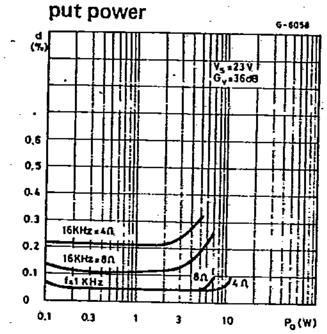


Fig. 6 - Distortion vs. frequency

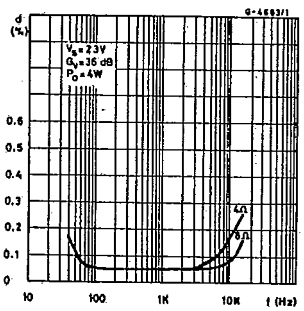


Fig. 7 - Quiescent current vs. supply voltage

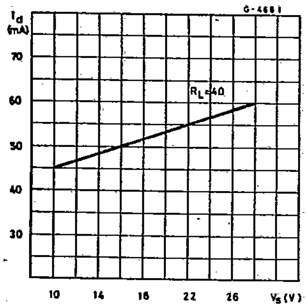


Fig. 8 - Supply voltage rejection vs. value of capacitor C3

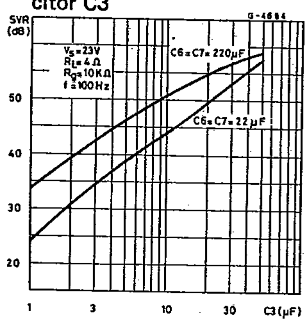


Fig. 9 - Supply voltage rejection vs. frequency

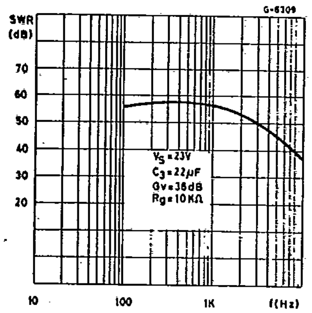


Fig. 10 - Total power dissipation an efficiency vs. output power

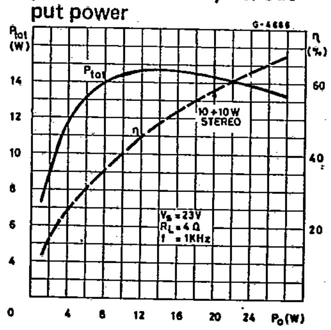


Fig. 11 - Total power dissipation and efficiency vs. output power

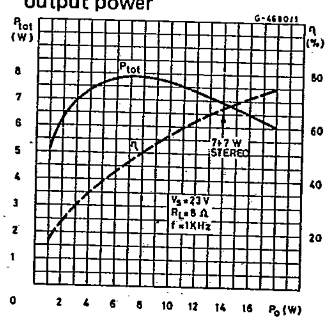


Fig. 12 - Cross-talk vs. frequency

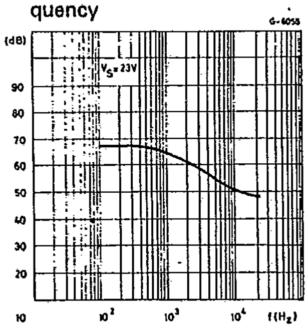


Fig. 13 - Output power vs. closed loop gain

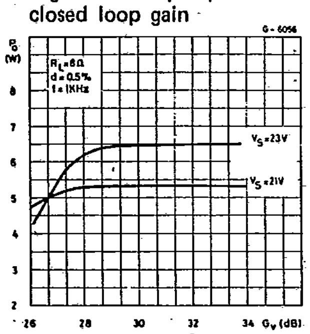
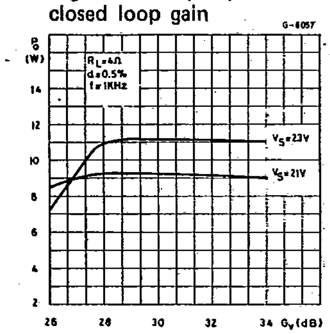


Fig. 14 - Output power vs. closed loop gain



APPLICATION INFORMATION

Fig. 15 - Simple short-circuit protection

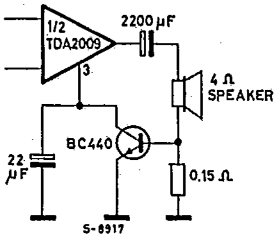


Fig. 16 - Example of muting circuit

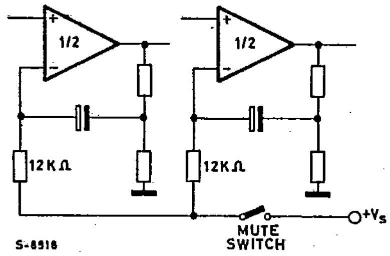


Fig. 17 - 10 + 10W stereo amplifier with tone balance and loudness control

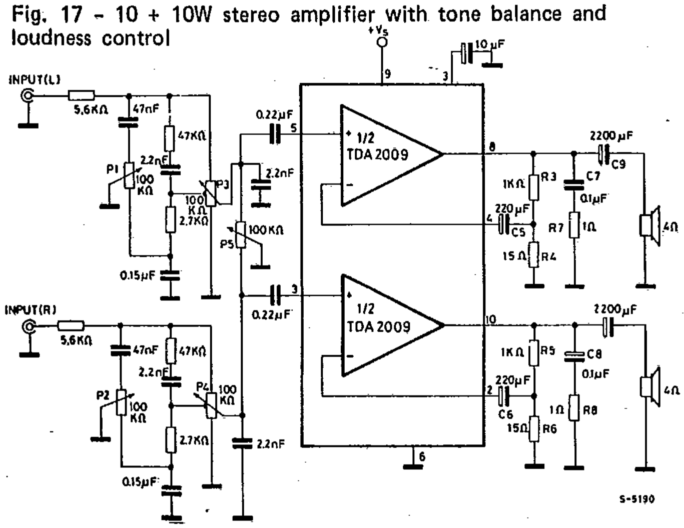
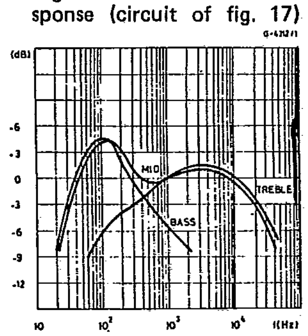


Fig. 18 - Tone control response (circuit of fig. 17)



APPLICATION INFORMATION (continued)

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

T-74-05-01

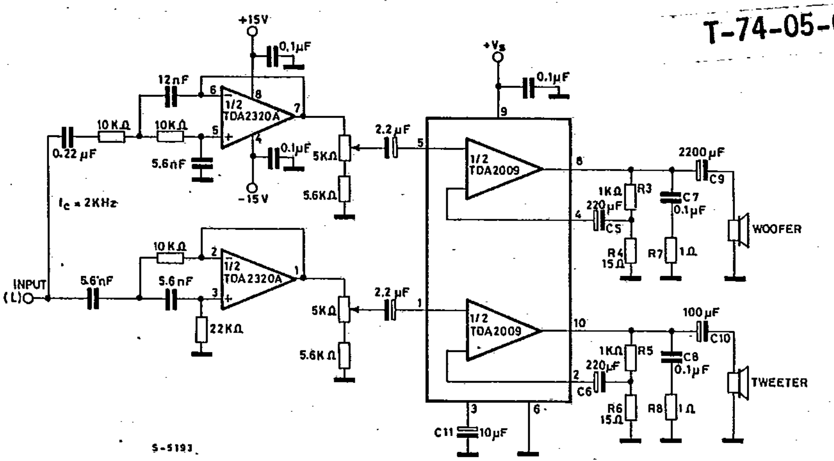


Fig. 20 - 18W bridge amplifier (d = 0.5%, G_v = 40dB)

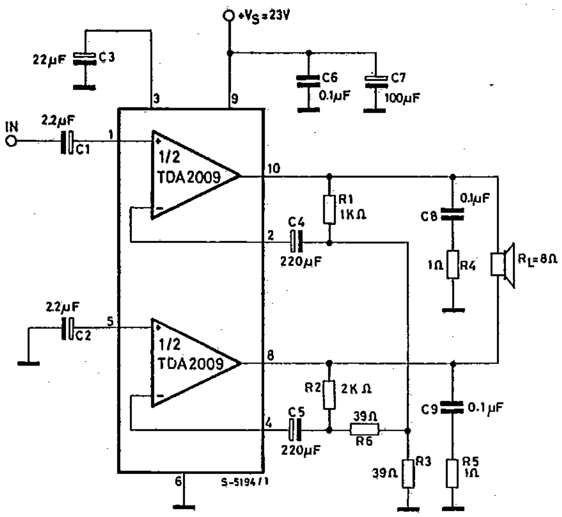
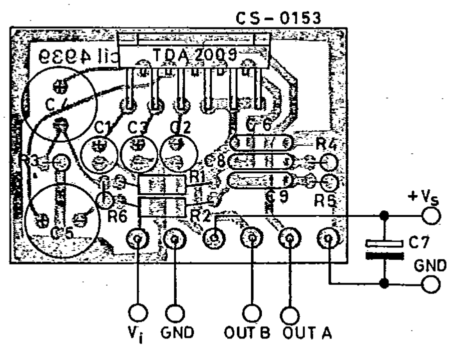


Fig. 21 - P.C. board and components layout of the circuit of fig. 20 (1 : 1 scale)



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 KΩ	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 μF	Input DC decoupling	High turn-on delay	High turn-on pop Higher low frequency cutoff. Increase of noise
C3	22 μF	Ripple rejection	Better SVR. Increase of the switch-on time	Degradation of SVR.
C6 and C7	220 μF	Feedback Input DC decoupling.		
C8 and C9	0.1 μF	Frequency stability.		Danger of oscillation.
C10 and C11	1000 μF to 2200 μF	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

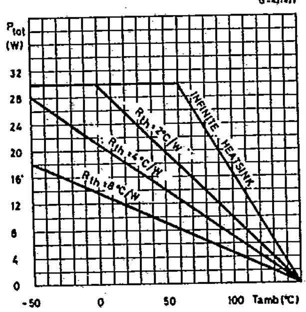
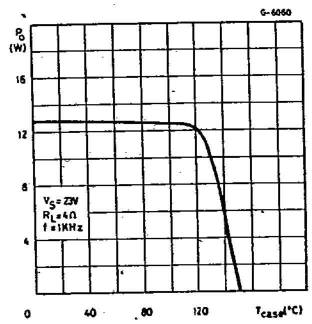


Fig. 23 - Output power vs. case temperature



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.