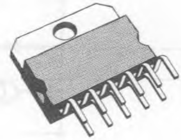
SGS-THOMSON
MICROELECTRONICS

TDA2009A

10 + 10 W SHORT CIRCUIT PROTECTED STEREO AMPLIFIER

- HIGH OUTPUT POWER (10 + 10 W MIN. @ D = 1 %)
- HIGH CURRENT CAPABILITY (UP TO 3.5 A)
- AC SHORT CIRCUIT PROTECTION
- THERMAL OVERLOAD PROTECTION
- SPACE AND COST SAVING : VERY LOW NUMBER OF EXTERNAL COMPONENTS AND SIMPLE MOUNTING THANKS TO THE MULTIWATT ® PACKAGE



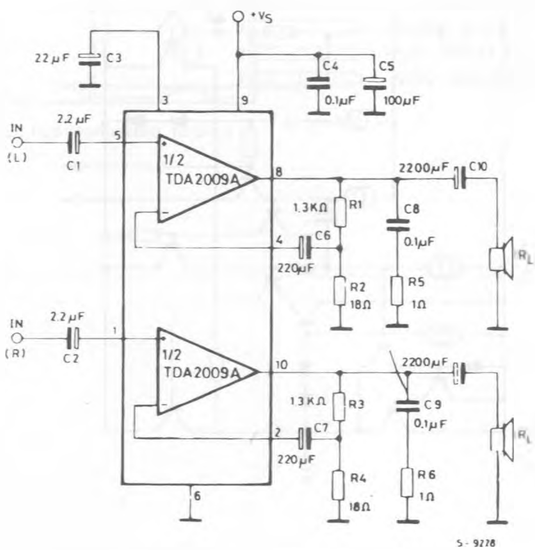
MULTIWATT-11

ORDER CODE : TDA2009A

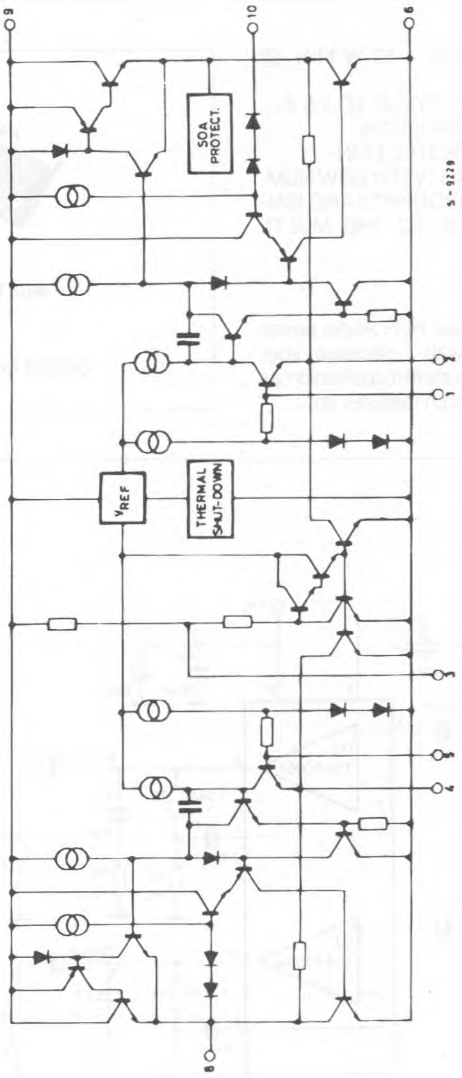
DESCRIPTION

The TDA2009A 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 :

TEST CIRCUIT



SCHEMATIC DIAGRAM



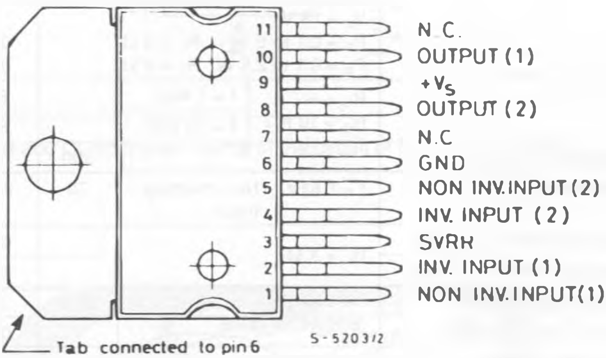
ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_s	Supply Voltage	28	V
I_o	Output Peak Current (repetitive f ≥ 20 Hz)	3.5	A
I_o	Output Peak Current (non repetitive, t = 100 µs)	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

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal Resistance Junction-case Max	3	°C/W

PIN CONNECTION (top view)



ELECTRICAL CHARACTERISTICS (refer to the stereo application circuit, T_{amb} = 25 °C, V_s = 24 V, G_v = 36 dB, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_s	Supply Voltage		8		28	V
V_o	Quiescent Output Voltage	V_s = 24 V		11.5		V
I_d	Total Quiescent Drain Current	V_s = 24 V		60	120	mA
P_o	Output Power (each channel)	d = 1 % V_s = 24 V f = 1 KHz R_L = 4 Ω R_L = 8 Ω		12.5 7		W W
		f = 40 Hz to 12.5 KHz R_L = 4 Ω R_L = 8 Ω	10 5			W W
		V_s = 18 V f = 1 KHz R_L = 4 Ω R_L = 8 Ω		7 4		W W
d	Distortion (each channel)	f = 1 KHz V_s = 24 V P_o = 0.1 to 7 W R_L = 4 Ω P_o = 0.1 to 3.5 W R_L = 8 Ω		0.2 0.1		% %
		V_s = 18 V P_o = 0.1 to 5 W R_L = 4 Ω P_o = 0.1 to 2.5 W R_L = 8 Ω		0.2 0.1		% %
CT	Cross Talk (°°°)	R_L = ∞, R_g = 10 KΩ, f = 1 KHz		60		dB
		R_L = ∞, R_g = 10 KΩ, f = 10 KHz		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 = 4 Ω		20		Hz
f_H	High Frequency Roll off (– 3dB)	R_L = 4 Ω		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 (each channel)	R_g = 10 KΩ f_{ripple} = 100 Hz V_{ripple} = 0.5 V		55		dB
T_J	Thermal Shut-down Junction Temperature			145		°C

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

Figure 1 : Test and Application Circuit (Gv = 36 dB).

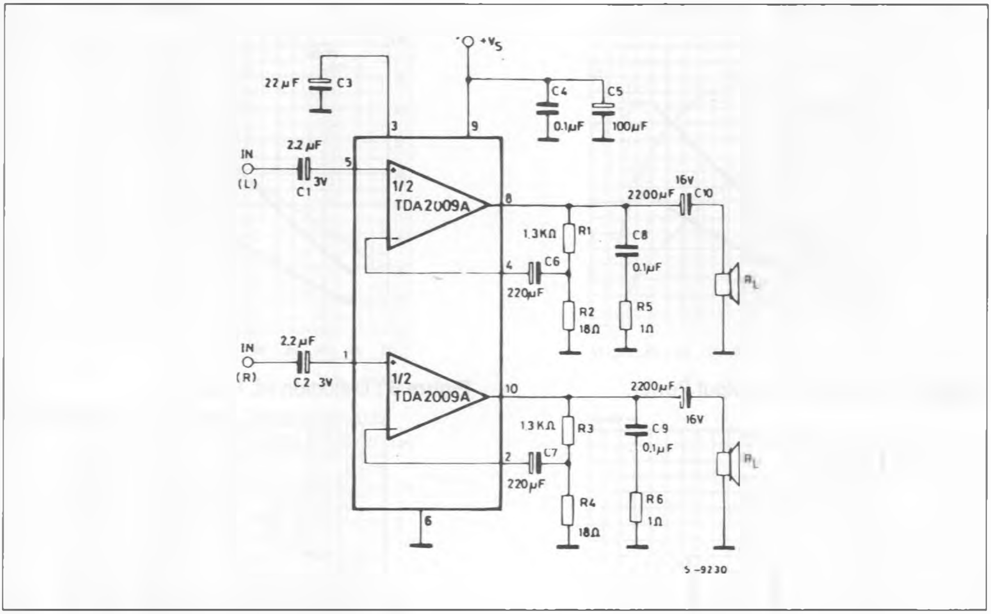


Figure 2 : P.C. Board and Components Layout of the circuit of Fig. 1 (1 : 1 scale).

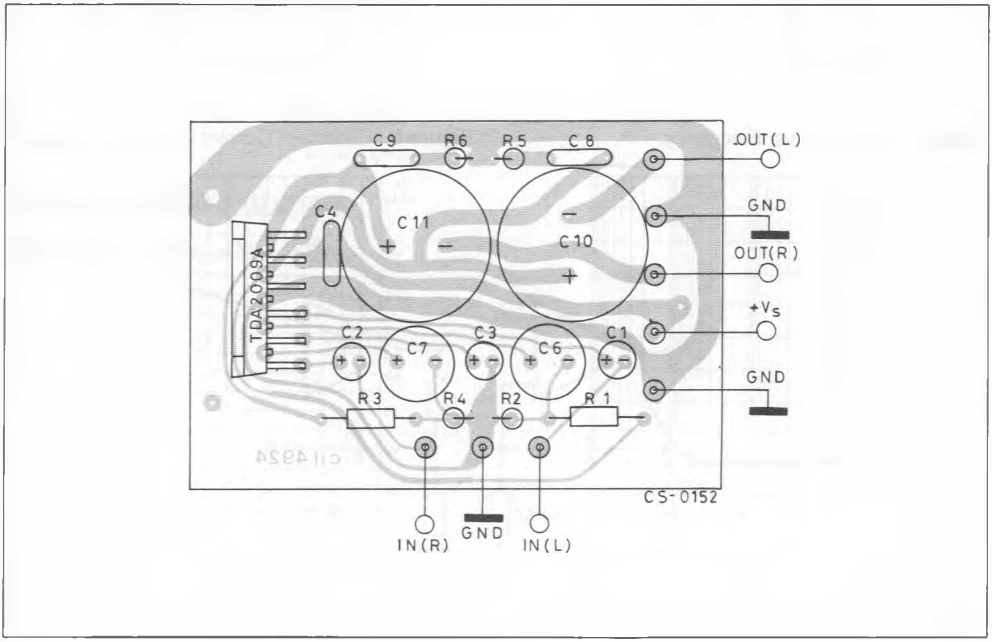


Figure 3 : Output Power vs. Supply Voltage.

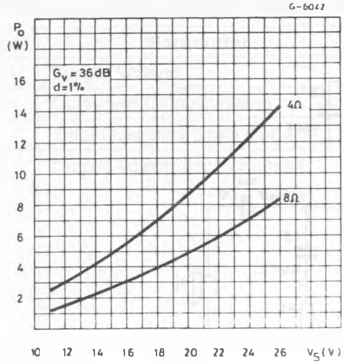


Figure 4 : Output Power vs. Supply Voltage.

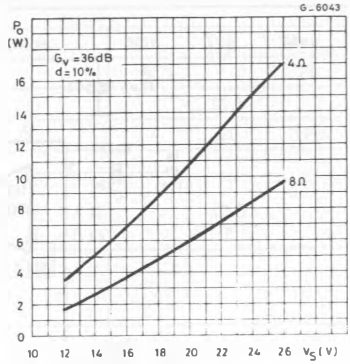


Figure 5 : Distortion vs. Output Power.

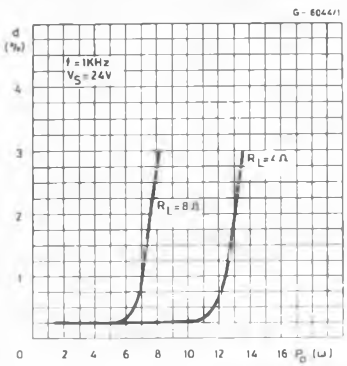


Figure 6 : Distortion vs. Frequency.

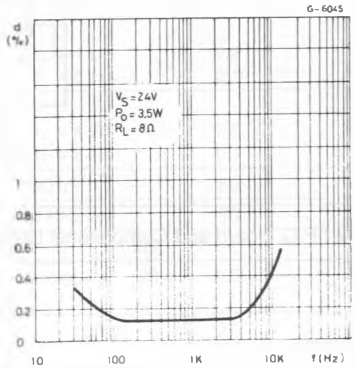


Figure 7 : Distortion vs. Frequency.

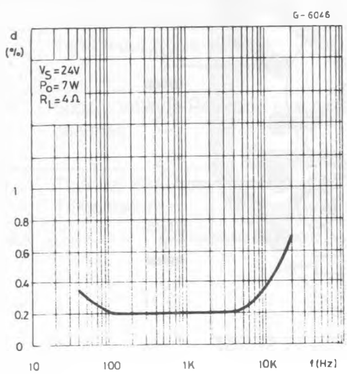


Figure 8 : Quiescent Current vs. Supply Voltage.

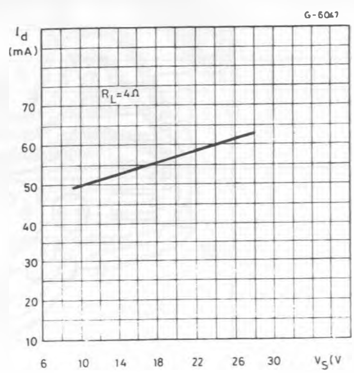


Figure 9 : Supply Voltage Rejection vs. Frequency.

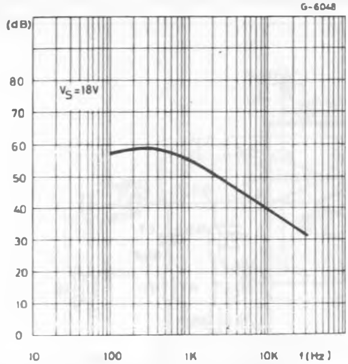


Figure 10 : Total Power Dissipation and Efficiency vs. Output Power.

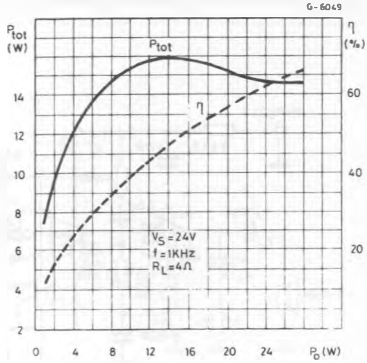
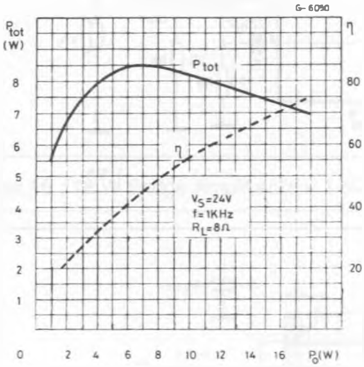
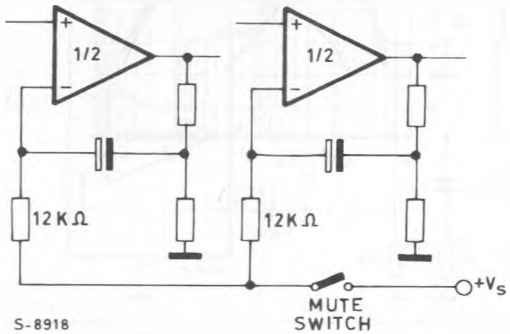


Figure 11 : Total Power Dissipation and Efficiency vs. Output Power .



APPLICATION INFORMATION

Figure 12 : Example of Muting Circuit.



APPLICATION INFORMATION (continued)

Figure 13 : 10 W + 10 W Stereo Amplifier with Tone Balance and Loudness Control.

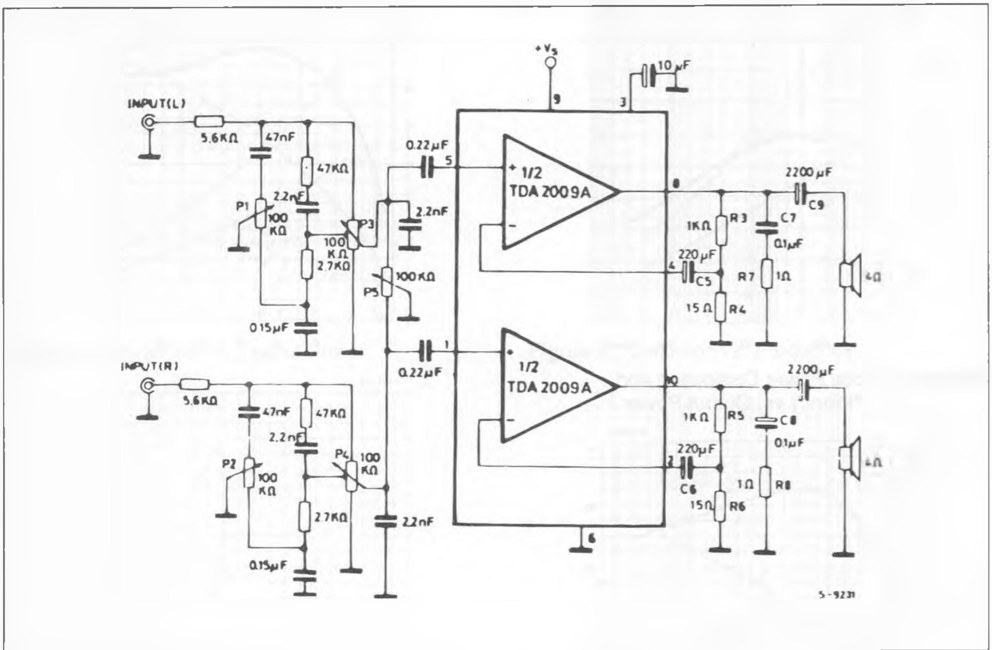
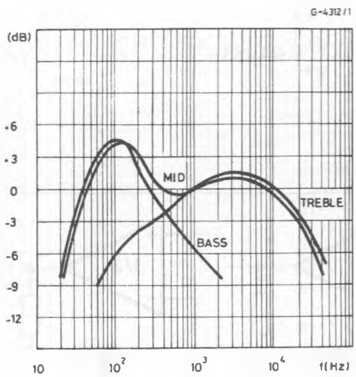


Figure 14 : Tone Control Response (circuit of fig. 13).



APPLICATION INFORMATION (continued)

Figure 15 : High Quality 20 + 20 W Two Way Amplifier for Stereo Music Center (one channel only).

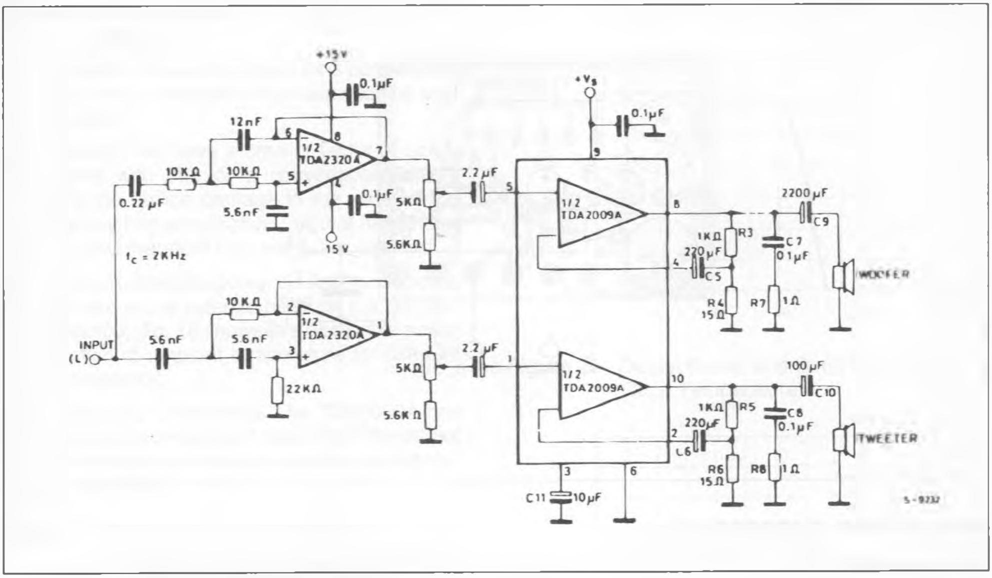


Figure 16 : 18 W Bridge Amplifier (d = 1 %, G_v = 40 dB).

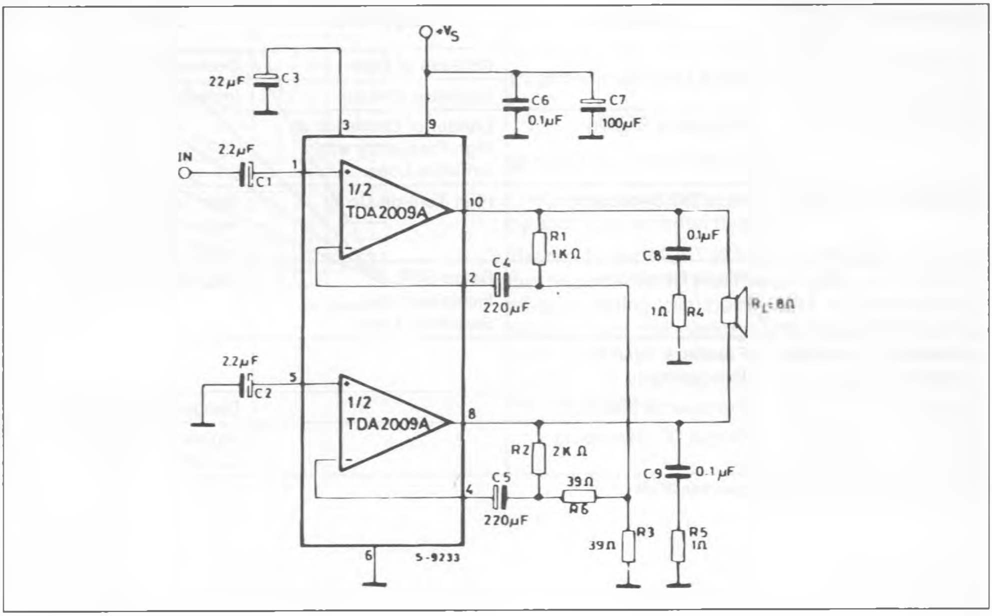
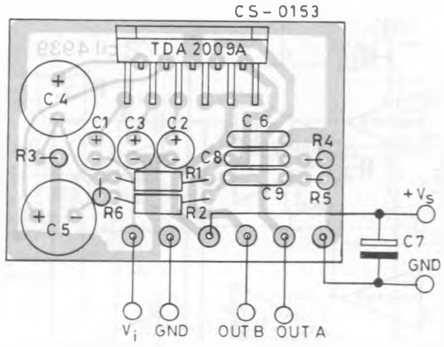


Figure 17 : P.C. Board and Components Layout of the Circuit of Fig. 16 (1 : 1 scale).



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 KΩ		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	Frenquency 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 26 dB

BUILD-IN PROTECTION SYSTEMS

THERMAL SHUT-DOWN

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

1) an averload on the output (even if 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 circuit. 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_o are reduced.

The maximum allowable power dissipation depends upon the size of the external heatsink (i.e. its thermal resistance); fig. 18 shows this dissipable power as a function of ambient temperature for different thermal resistance.

Short circuit (AC Conditions). The TDA2009A can withstand an accidental short circuit from the output and ground made by a wrong connection during normal play operation.

Figure 18 : Maximum Allowable Power Dissipation vs. Ambient Temperature.

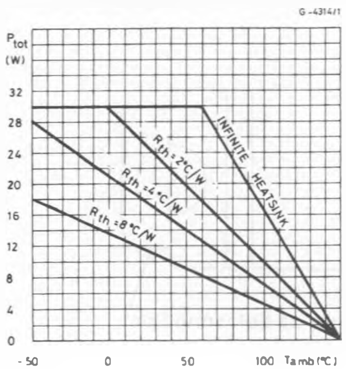


Figure 19 : Output Power vs. Case Temperature.

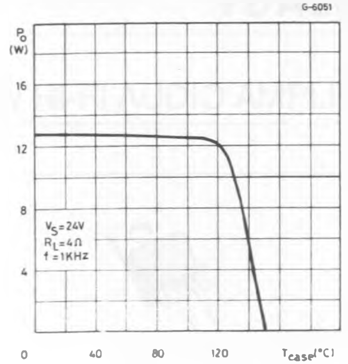
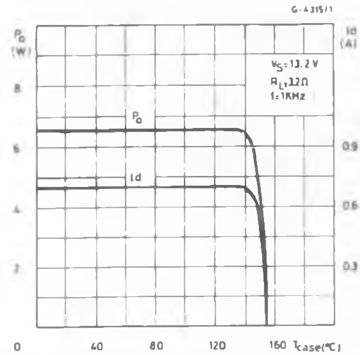


Figure 20 : Output Power and Drain Current vs. Case Temperature.



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.