SGS-THOMSON MICROELECTRONICS

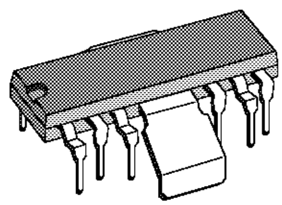
TDA1908

8W AUDIO AMPLIFIER

DESCRIPTION

The TDA1908 is a monolithic integrated circuit in 12 lead quad in-line plastic package intended for low frequency power applications. The mounting is compatible with the old types TBA800, TBA810S, TCA830S and TCA940N. Its main features are:

– flexibility in use with a max output curent of 3A and an operating supply voltage range of 4V to 30V;
– protection against chip overtemperature;
– soft limiting in saturation conditions;
– low "switch-on" noise;
– low number of external components;
– high supply voltage rejection;
– very low noise.



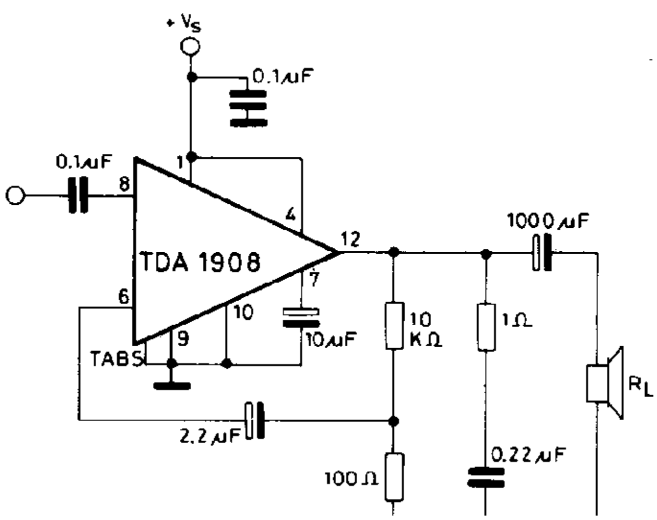
Findip

ORDERING NUMBER : TDA1908

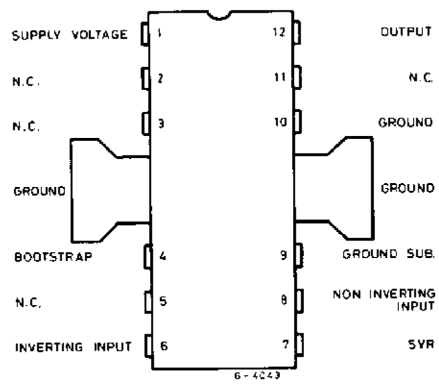
ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_s	Supply voltage	30	V
I_o	Output peak current (non repetitive)	3.5	A
I_o	Output peak current (repetitive)	3	A
P_{tot}	Power dissipation: at T_{amb} = 80°C	1	W
	at T_{amb} = 90°C	5	W
T_{stg}, T_j	Storage and junction temperature	-40 to 150	°C

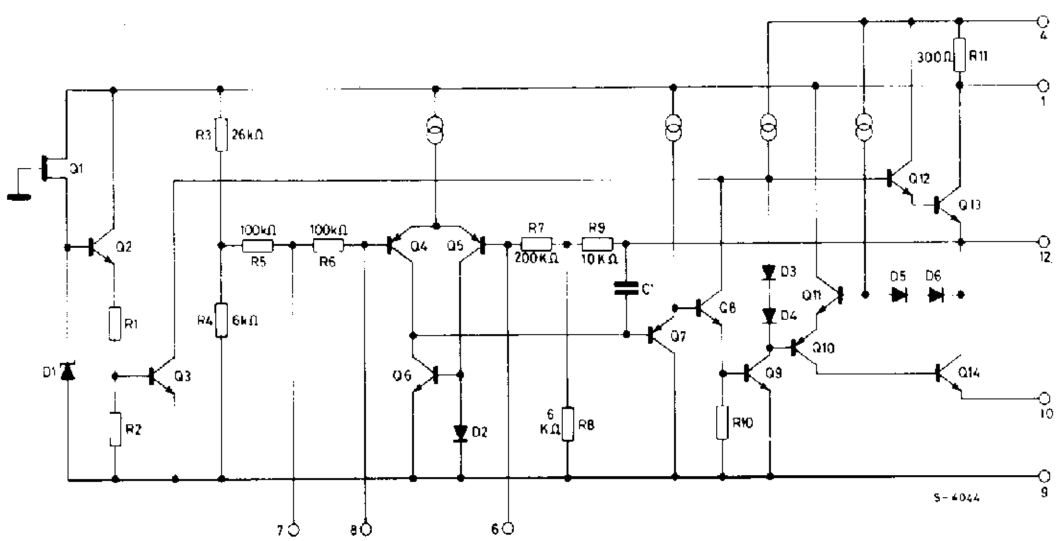
APPLICATION CIRCUIT



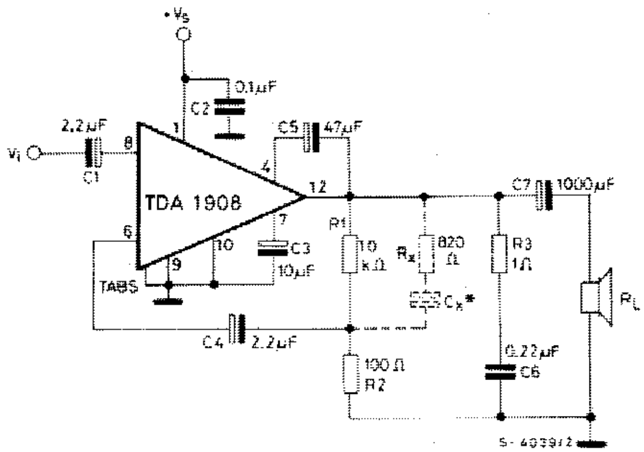
PIN CONNECTION (top view)



SCHEMATIC DIAGRAM



TEST CIRCUIT



* See fig. 12

THERMAL DATA

Symbol	Parameter		Value	Unit
$R_{th\ j\text{-}tab}$	Thermal resistance junction-tab	max	12	°C/W
$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	(°) 70	°C/W

(°) Obtained with tabs soltered to printed circuit board with min copper area.

ELECTRICAL CHARACTERISTICS (Refer to the test circuit, T_{amb} = 25 °C, R_{th} (heatsink)= 8 °C/W, unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_s	Supply voltage		4		30	V
V_o	Quiescent output voltage	V_s = 4V V_s = 18V V_s = 30V	1.6 8.2 14.4	2.1 9.2 15.5	2.5 10.2 16.8	V
I_d	Quiescent drain current	V_s = 4V V_s = 18V V_s = 30V		15 17.5 21	 35	mA
V_{CEsat}	Output stage saturation voltage (each output transistor)	I_C = 1A I_C = 2.5A		0.5 1.3		V
P_o	Output power	d = 10% f = 1KHz V_s = 9V R_L = 4Ω V_s = 14V R_L = 4Ω V_s = 18V R_L = 4Ω V_s = 22V R_L = 8Ω V_s = 24V R_L = 16Ω	 7 6.5 4.5	 2.5 5.5 9 8 5.3		W

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
d	Harmonic distorsion	f = 1KHz V_s = 9V R_L = 4Ω P_o = 50 mW to 1.5 W V_s = 18V R_L = 4Ω P_o = 50 mW to 4W V_s = 24V R_L = 16Ω P_o = 50 mW to 3W		0.1 0.1 0.1		%
V_i	Input sensivity	V_s = 9V R_L = 4Ω P_o = 2.5W V_s = 14V R_L = 4Ω P_o = 5.5W V_s = 18V R_L = 4Ω P_o = 9W V_s = 22V R_L = 8Ω P_o = 8W V_s = 24V R_L = 16Ω P_o = 5.3W		37 52 64 90 110		mV
V_i	Input saturation voltage (rms)	V_s = 9V V_s = 14V V_s = 18V V_s = 24V	0.8 1.3 1.8 2.4			V
R_i	Input resistence (pin 8)	f = 1 KHz	60	100		KΩ
I_s	Drain current	f = 1 KHz V_s = 14V R_L = 4Ω P_o = 5.5W V_s = 18V R_L = 4Ω P_o = 9W V_s = 22V R_L = 8Ω P_o = 8W V_s = 24V R_L = 16Ω P_o = 5.3W		570 730 500 310		mA
η	Efficiency	V_s = 18V f = 1 KHz R_L = 4Ω P_o = 9W		72		%
BW	Small signal bandwitdth (-3 dB)	V_s = 18V R_L = 4Ω P_o = 1W	40 to 40 000			Hz
G_v	Voltage gain (open loop)	f = 1 KHz		75		dB
G_v	Voltage gain (closed loop)	V_s = 18V R_L = 4Ω f = 1 KHz P_o = 1W	39.5	40	40.5	dB
e_N	Total input noise	(°) R_g = 50Ω R_g = 1KΩ R_g = 10KΩ		1.2 1.3 1.5	4.0	µV
		(°°) R_g = 50Ω R_g = 1KΩ R_g = 10KΩ		2.0 2.0 2.2	6.0	µV
S/N	Signal to noise ratio	V_s = 18V P_o = 9W R_L = 4Ω — R_g = 10KΩ, R_g = 0 (°)		92 94		dB
		V_s = 18V P_o = 9W R_L = 4Ω — R_g = 10KΩ, R_g = 0 (°°)		88 90		dB
SVR	Supply voltage rejection	V_s = 18V R_L = 4Ω f_{ripple} = 100 Hz R_g = 10KΩ	40	50		dB
T_{sd}	Termal shut-down junction temperature (*)			145		ÉC

Note :
(°) Weighting filter = curve A.
(° °) Filter with noise bandwidth: 22 Hz to 22 KHz.

Figure 1. Quiescent output voltage vs. supply voltage

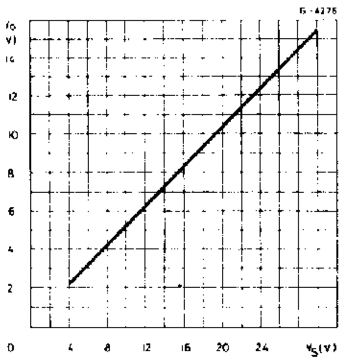


Figure 2. Quiescent drain current vs. supply voltage

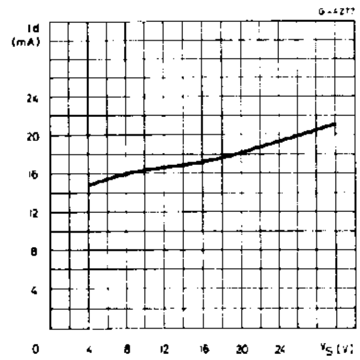


Figure 3. Output power vs. supply voltage

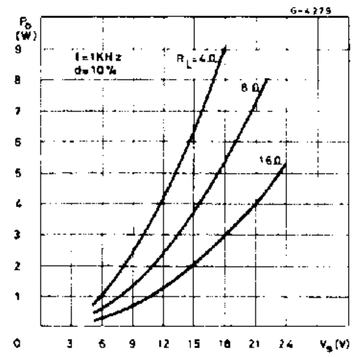


Figure 4. Distortion vs. output power ($R_L = 16\Omega$)

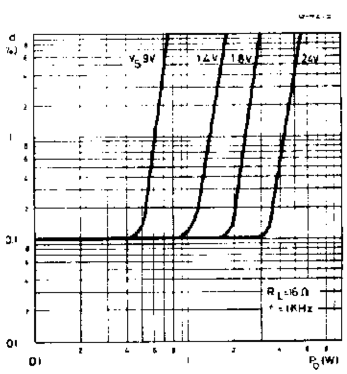


Figure 5. Distortion vs. output power ($R_L = 8\Omega$)

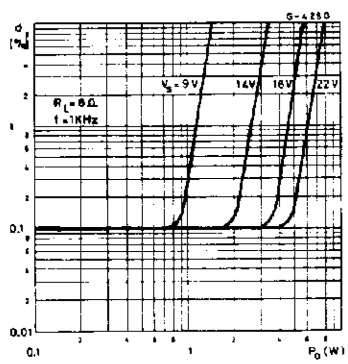


Figure 6. Distortion vs. output power ($R_L = 4\Omega$)

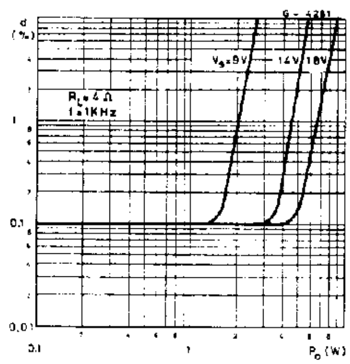


Figure 7. Distortion vs. frequency ($R_L = 16\Omega$)

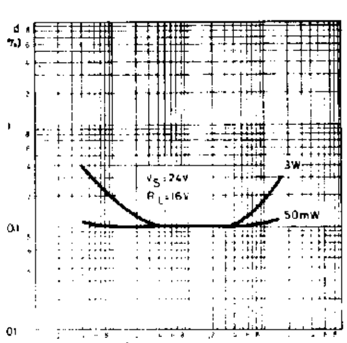


Figure 8. Distortion vs. frequency ($R_L = 8\Omega$)

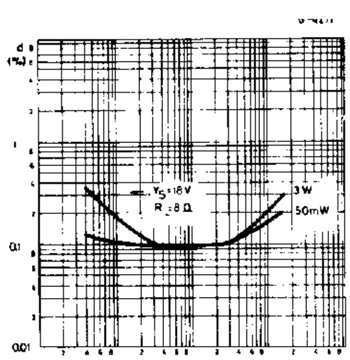


Figure 9. Distortion vs. frequency ($R_L = 4\Omega$)

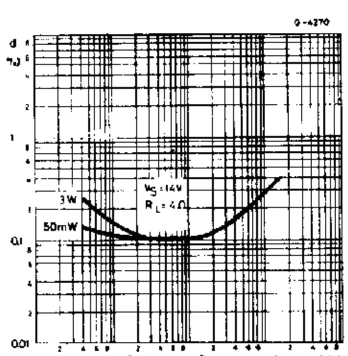


Figure 10. Open loop frequency response

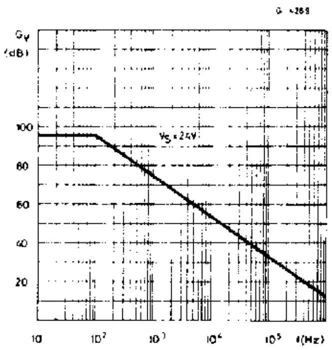


Figure 11. Output power vs. input voltage

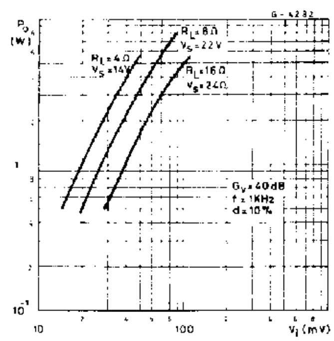


Figure 12. Values of capacitor C_X versus gain and B_W

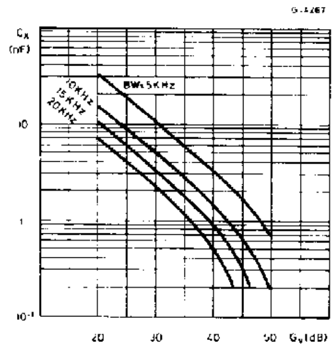


Figure 13. Supply voltage rejection vs. voltage gain

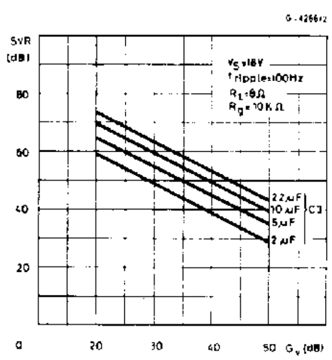


Figure 14. Supply voltage rejection vs. source resistance

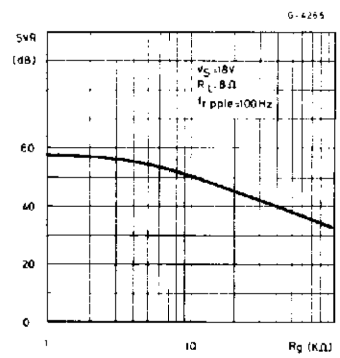


Figure 15. Max power dissipation vs. supply voltage

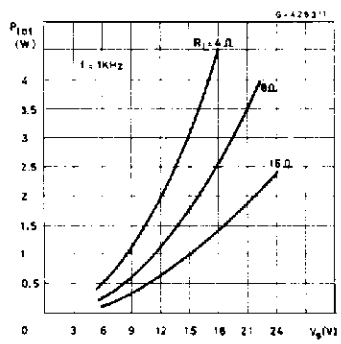


Figure 16. Power dissipation and efficiency vs. output power (V_S = 14V)

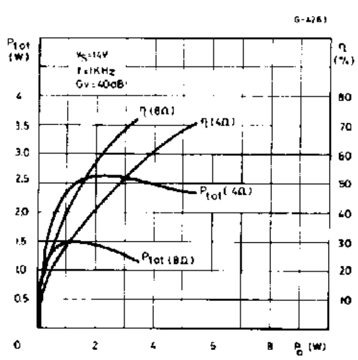


Figure 17. Power dissipation and efficiency vs. output power (V_S = 18V)

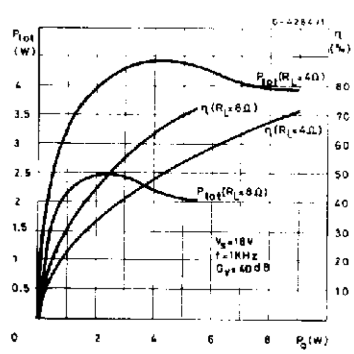
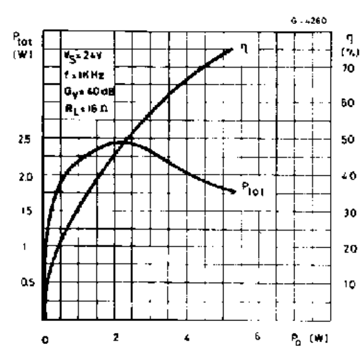
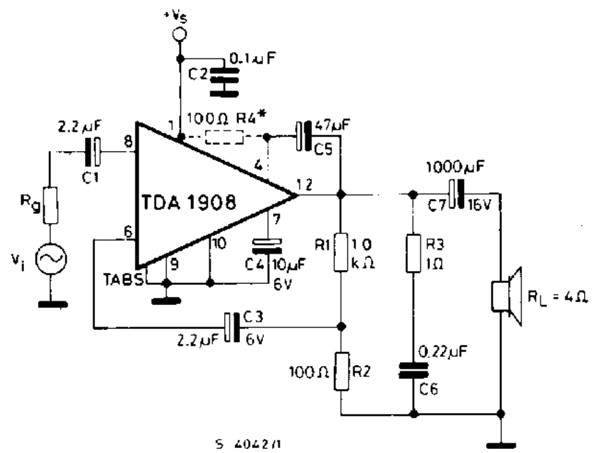


Figure 18. Power dissipation and efficiency vs. output power (V_S = 24V)



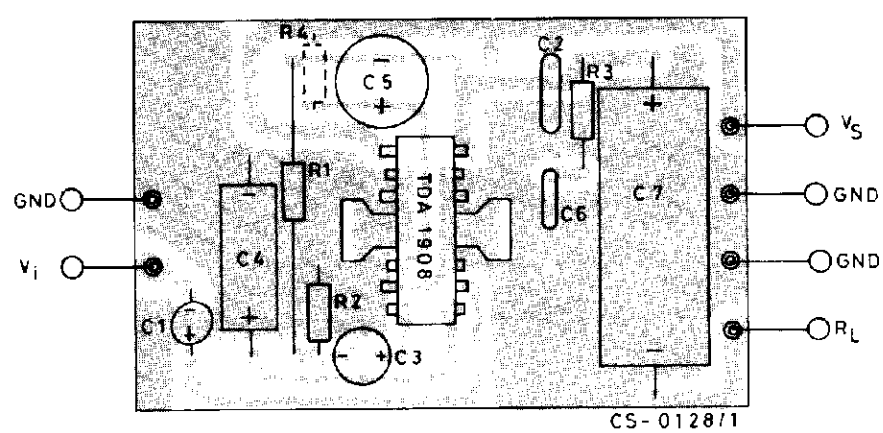
APPLICATION INFORMATION

Figure 19. Application circuit with bootstrap



* R4 is necessary when V_s is less than 10V.

Figure 20. P.C. board and component lay-out of the circuit of fig. 19 (1 : 1 scale)



APPLICATION INFORMATION (continued)

Figure 21. Application circuit without bootstrap

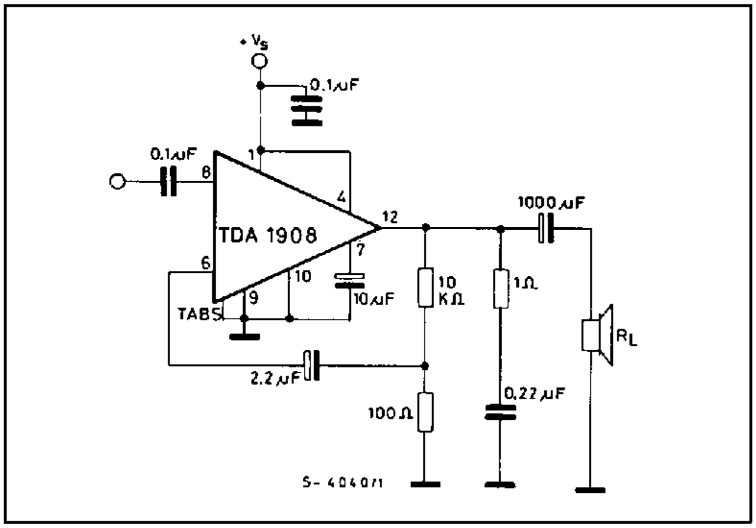


Figure 22. Output power vs. supply voltage (circuit of fig. 21)

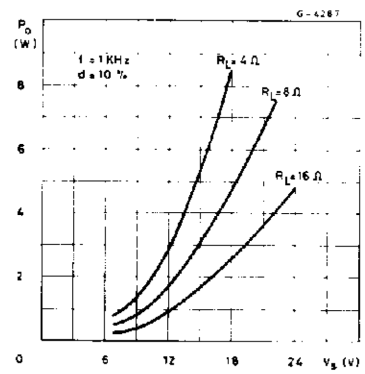
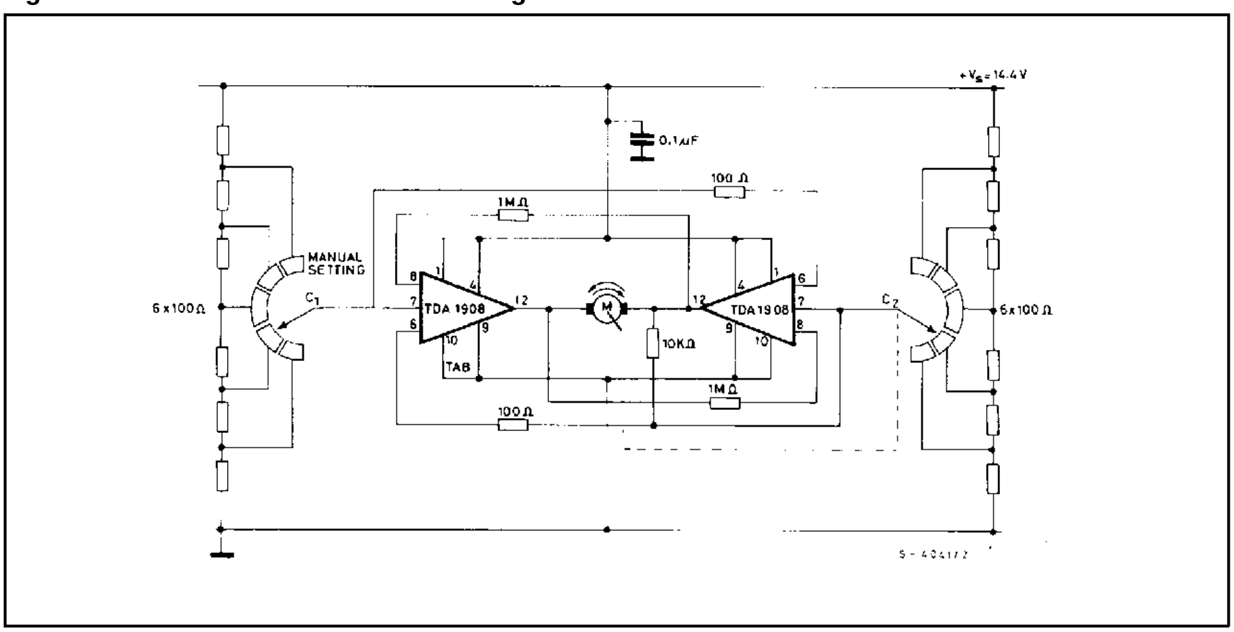


Figure 23. Position control for car headlights



APPLICATION SUGGESTION

The recommended values of the external components are those shown on the application circuit of fig. 19. When the supply voltage Vs is less than 10V, a 100Ω resistor must be connected between pin 1 and pin 4 in order to obtain the maximum output power.
Different values can be used. The following table can help the designer.

Component	Raccom. value	Purpose	Larger than raccomanded value	Smaller than raccomanded value	Allowed range	
					Min.	Max.
R_1	10 KΩ	Close loop gain setting	Increase of gain.	Decrease of gain. Increase quiescent current.	9 R_2	
R_2	100 Ω	Close loop gain setting.	Decrease of gain.	Increase of gain.		R_1/9
R_3	1 Ω	Frequency stability	Danger of oscillation at hight frequencies with inductive loads.			
R_4	100 Ω	Increaseing of output swing with low Vs.			47Ω	330 Ω
C_1	2.2 µF	Input DC decoupling.	Lower noise.	Higher low frequency cutoff. Higher noise.	0.1 µF	
C_2	0,1 µF	Supply voltage bypass.		Danger of oscillations.		
C_3	2.2 µF	Inverting input DC decoupling.	Increase of the switch-on noise	Higher low frequency cutoff.	0.1µF	
C_4	10 µF	Ripple Rejection.	Increase of SVR. Increase of the switch-on time.	Degradation of SVR.	2.2 µF	100 µF
C_5	47 µF	Bootstrap		Increase of the distorsion at low frequency	10 mF	100 µF
C_6	0.22 µF	Frequency stability.		Danger of oscillation.		
C_7	1000 µF	Output DC decoupling.		Higher low frequency cutoff.		

THERMAL SHUT-DOWN

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

1) An overload on the output (even if it is permanent), or an above limit ambient temperature can be easily supported since the T_j cannot be higher than 150°C.
2) The heatsink can have a smaller factor of safety compared with that of a conventional circuit. There is no possibility of device damage due to high junction temperature.

If, for any reason, the junction temperature increase up to 150°C, the thermal shut-down simply reduces the power dissipation and the current consumption.

The maximum allowable power dissipation depends upon the size of the external heatsink (i.e. its thermal resistance); fig. 25 shows the dissipable power as a function of ambient temperature for different thermal resistance.

Figure 24. Output power and drain current vs. case temperature

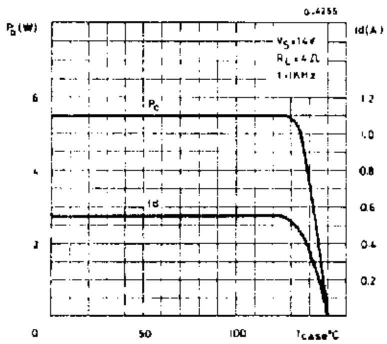


Figure 25. Output power and drain current vs. case temperature

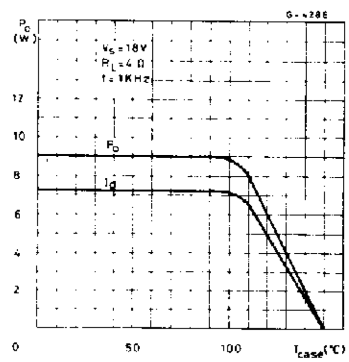
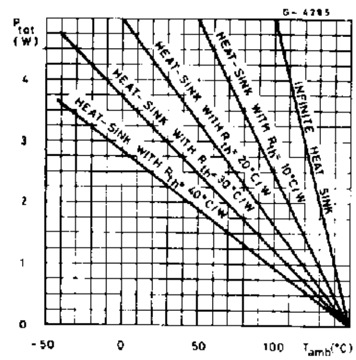


Figure 26. Maximum power dissipation vs. ambient temperature



MOUNTING INSTRUCTIONS

The thermal power dissipated in the circuit may be removed by soldering the tabs to a copper area on the PC board (see Fig. 27).

During soldering, tab temperature must not exceed 260°C and the soldering time must not be longer than 12 seconds.

Figure 27. Mounding example

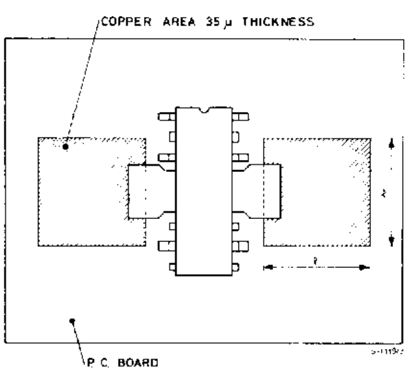
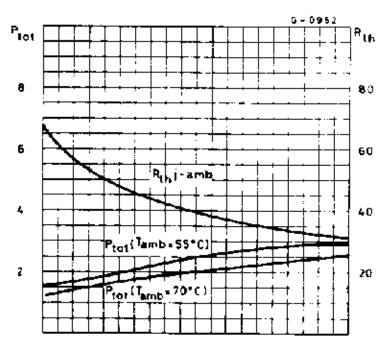


Figure 28. Maximum power dissipation and thermal resistance vs. side "ℓ"



SGS-THOMSON MICROELECTRONICS

FINDIP PACKAGE MEHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	3.8		4.05	0.150		0.159
a1	1.5		1.75	0.059		0.069
b	0.55		0.6	0.022		0.024
b1	0.3		0.35	0.012		0.014
c		1.32			0.052	
c1		0.94			0.037	
D	19.2		19.9	0.756		0.783
E	16.8	17.2	17.6	0.661	0.677	0.693
E1	4.86		5.56	0.191		0.219
E2	10.11		10.81	0.398		0.426
e	2.29	2.54	2.79	0.090	0.100	0.110
e3	17.43	17.78	18.13	0.686	0.700	0.714
e4		7.62			0.300	
e5	7.27	7.62	7.97	0.286	0.300	0.314
e6	12.35	12.7	13.05	0.486	0.500	0.514
F	6.3		7.1	0.248		0.280
F1	6.1		6.7	0.240		0.264
G		9.8			0.386	
I	7.8		8.6	0.307		0.339
K	6.1		6.5	0.240		0.256
L	2.5		2.9	0.098		0.114
M	2.5		3.1	0.098		0.122