SGS-THOMSON MICROELECTRONICS

TDA1910

10W AUDIO AMPLIFIER WITH MUTING

DESCRIPTION

The TDA 1910 is a monolithic integrated circuit in MULTIWATT® package, intended for use in Hi-Fi audio power applications, as high quality TV sets.

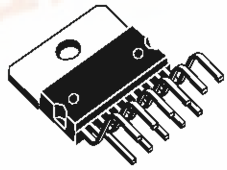
The TDA 1910 meets the DIN 45500 (d = 0.5%) guaranteed output power of 10W when used at 24V/4W. At 24V/8W the output power is 7W min.

Features:

- muting facility
- protection against chip over temperature
- very low noise
- high supply voltage rejection
- low ”switch-on” noise.

The TDA 1910 is assembled in MULTIWATT® package that offers:

- easy assembly
- simple heatsink
- space and cost saving
- high reliability



Multiwatt 11

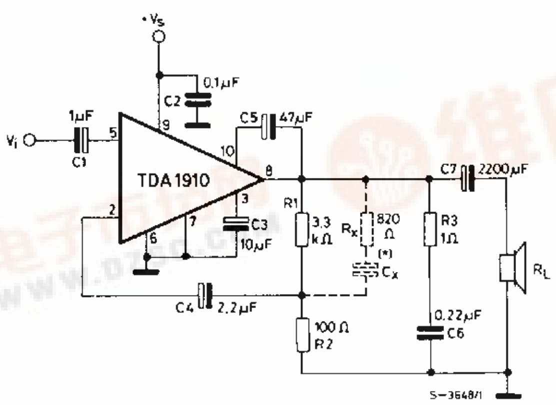
ORDERING NUMBERS:

TDA1910 (Multiwatt11 Vertical)
TDA1910HS (Multiwatt11 Horizontal)

ABSOLUTE MAXIMUM RATINGS

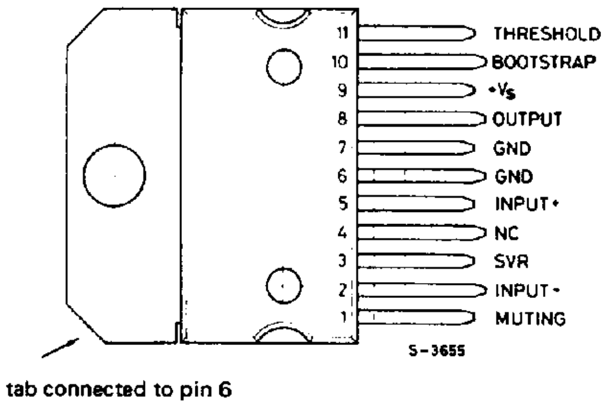
Symbol	Parameter	Value	Unit
V_s	Supply voltage	30	V
I_o	Output peak current (non repetitive)	3.5	A
I_o	Output peak current (repetitive)	3.0	A
V_i	Input voltage	0 to + V_s	V
V_i	Differential input voltage	± 7	V
V_{11}	Muting thresold voltage	V_s	V
P_{tot}	Power dissipation at T_{case} = 90°C	20	W
T_{stg}, T_j	Storage and junction temperature	-40 to 150	°C

TEST CIRCUIT

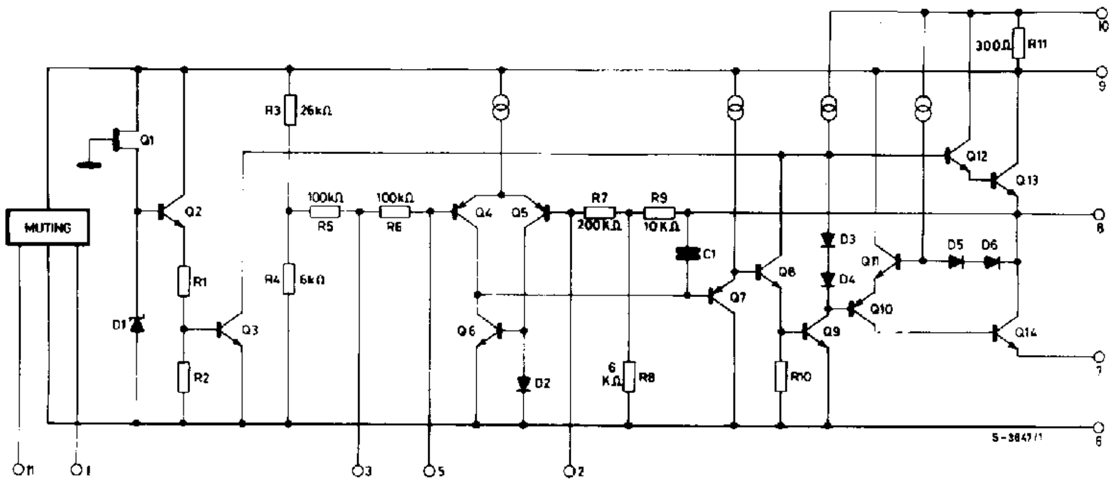


(*) See fig. 13.

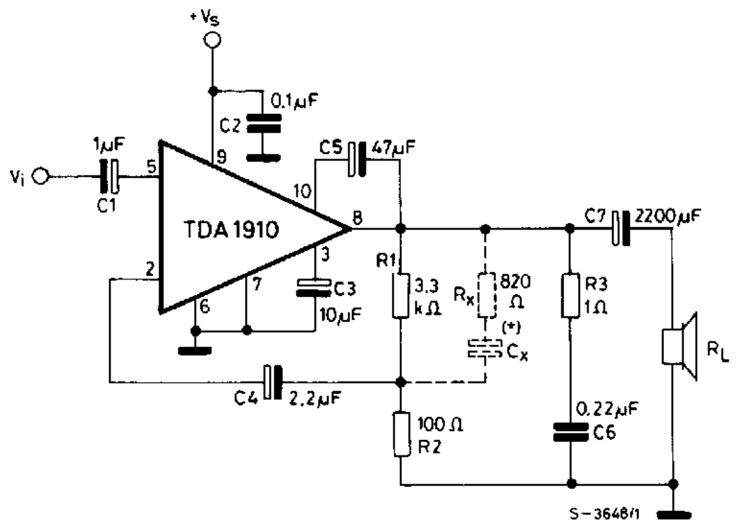
PIN CONNECTION (Top view)



SCHEMATIC DIAGRAM

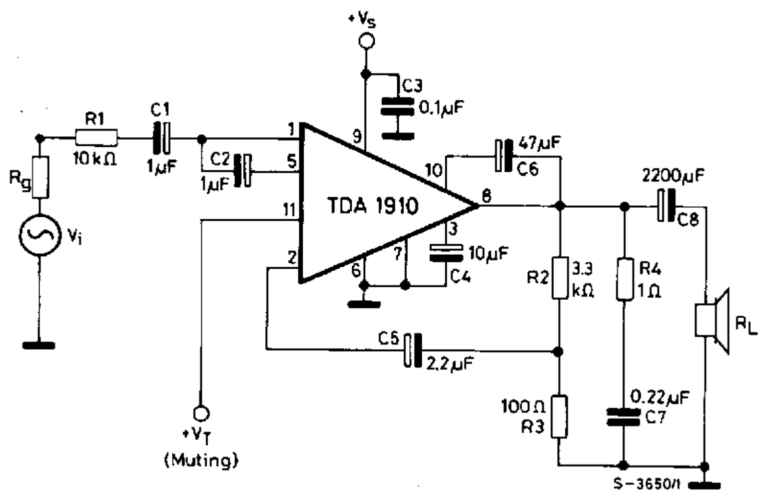


TEST CIRCUIT



(*) See fig. 13.

MUTING CIRCUIT



THERMAL DATA

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

ELECTRICAL CHARACTERISTICS (Refer to the test circuit, T_{amb} = 25 °C, R_{th} (heatsink) = 4°C/W, unless otherwise specified)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_s	Supply voltage		8		30	V
V_o	Quiescent output voltage	V_s = 18V V_s = 24V	8.3 11.5	9.2 12.4	10 13.4	V
I_d	Quiescent drain current	V_s = 18V V_s = 24V		19 21	32 35	mA
$V_{CE\ sat}$	Output stage saturation voltage	I_C = 2A		1		V
		I_C = 3A		1.6		
P_o	Output power	d = 0.5% f = 40 to 15,000Hz V_s = 18V R_L= 4Ω V_s = 24V R_L = 4Ω V_s = 24V R_L = 8Ω	 6.5 10 7	 7 12 7.5		W
		d = 10% f = 1 KHz V_s = 18V R_L = 4Ω V_s = 24V R_L = 4Ω V_s = 24V R_L = 8Ω	8.5 15 9	9.5 17 10		
d	Harmonic distortion	f = 40 to 15,000 Hz V_s = 18V R_L = 4Ω P_o = 50 mW to 6.5W V_s = 24V R_L = 4Ω P_o = 50 mW to 10W V_s = 24V R_L = 8Ω P_o = 50 mW to 7W		0.2 0.2 0.2	0.5 0.5 0.5	%
d	Intermodulation distortion	V_s = 24V R_L = 4Ω P_o = 10W f_1 = 250 Hz f2 = 8 KHz (DIN 45500)		0.2		%
V_i	Input sensitivity	F = 1 KHz, V_s = 18V R_L = 4Ω P_o = 7 W v_s = 24V R_L = 4Ω P_o = 12 W V_s = 24V R_L = 8Ω P_o = 7.5W		 170 220 245		mV
V_i	Input saturation voltage (rms)	V_s = 18V V_s = 24V	1.8 2.4			V
R_i	Input resistance (pin 5)	f = 1 KHz	60	100		KΩ
I_d	Drain current	V_s = 24V f = 1 KHz R_L = 4Ω P_o = 12W RL = 8Ω P_o = 7.5W		 820 475		mA

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test condition		Min.	Typ.	Max.	Unit
h	Efficiency	V_s = 24V f = 1 KHz R_L = 4Ω P_o = 12W R_L = 8Ω P_o = 7.5W			62 65		%
BW	Small signal bandwidth	V_s = 24V R_L = 4Ω P_o = 1W		10 to 120,000			Hz
BW	Power bandwidth	V_s = 24V R_L = 4Ω P_o = 12W d ≤ 5%		40 to 15,000			Hz
G_v	Voltage gain (open loop)	f = 1 KHz			75		dB
G_v	Voltage gain (closed loop)	V_s = 24V R_L = 4Ω f = 1 KHz Po = 1W		29.5	30	30.5	dB
e_N	Total input noise	R_g = 50Ω R_g = 1KΩ (°) R_g = 10KΩ			1.2 1.3 1.5	3.0 3.2 4.0	µV
		R_g = 50Ω R_g = 1KΩ (°°) R_g = 10KΩ			2.0 2.0 2.2	5.0 5.2 6.0	µV
S/N	Signal to noise ratio	V_s = 24V P_o = 12W R_L = 4Ω	R_g = 10KΩ R_g = 0 (°)	97	103 105		dB
			R_g = 10KΩ R_g = 0 (°°)	93	100 100		dB
SVR	Supply voltage rejection	V_s = 24V RL = 4Ω f_{ripple} = 100 Hz Rg = 10 KΩ		50	60		dB
T_{sd}	Thermal sjut-down case (*) temperature	P_{tot} = 8W		110	125		°C

MUTING FUNCTION (Refer to Muting circuit)

V_T	Muting-off threshold voltage (pin 11)		1.9		4.7	V
V_T	Muting-on threshold voltage (pin 11)		0		1.3	V
			6		V_s	
R_1	Input resistance (pin 1)	Muting off	80	200		KΩ
		Muting on		10	30	Ω
R_{11}	Input resistance (pin 11)		150			KΩ
A_T	Muting attenuation	R_g + R_1 = 10 KΩ	50	60		dB

Note :
(°) Weighting filter = curve A.
(° °) Filter with noise bandwidth: 22 Hz to 22 KHz.
(*) See fig. 29 and fig. 30.

Figure 1. Quiescent output voltage vs. supply voltage

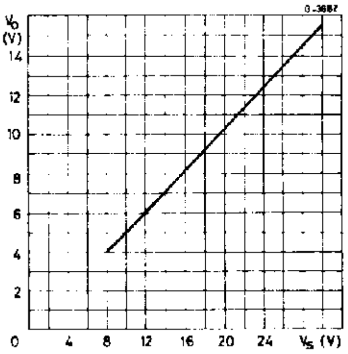


Figure 2. Quiescent drain current vs. supply voltage

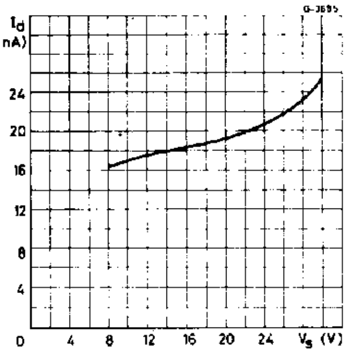


Figure 3. Open loop frequency response

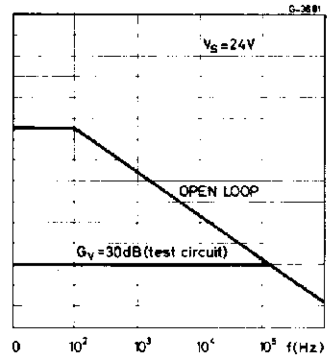


Figure 4. Output power vs. supply voltage

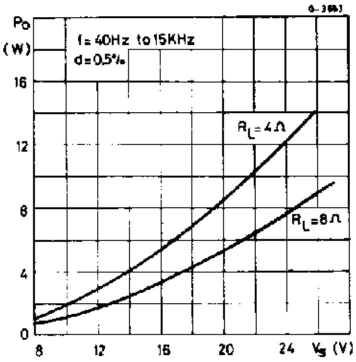


Figure 5. Output power vs. supply voltage

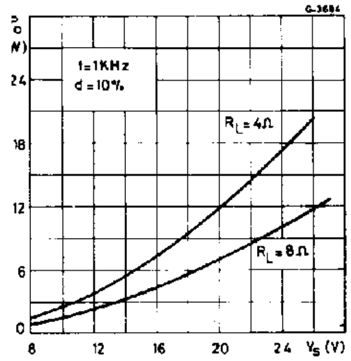


Figure 6. Distortion vs. output power

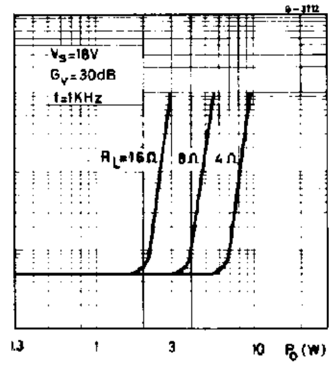


Figure 7. Distortion vs. output power

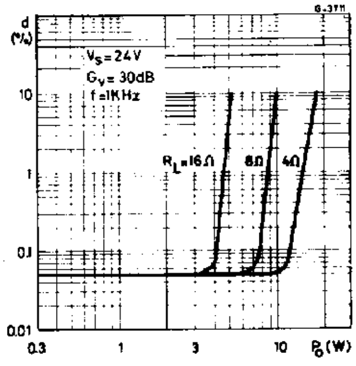


Figure 8. Output power vs. frequency

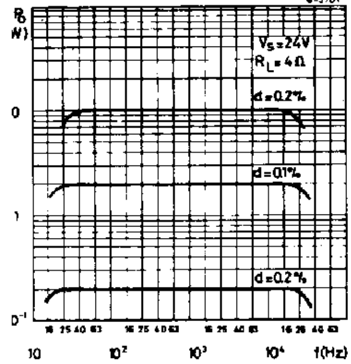


Figure 9. Output power vs. frequency

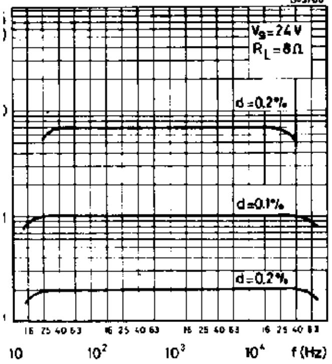


Figure 10. Output power vs. input voltage

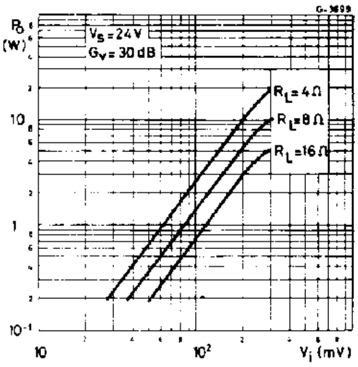


Figure 11. Output power vs. input voltage

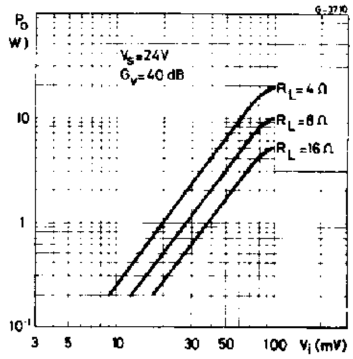


Figure 12. Total input noise vs. source resistance

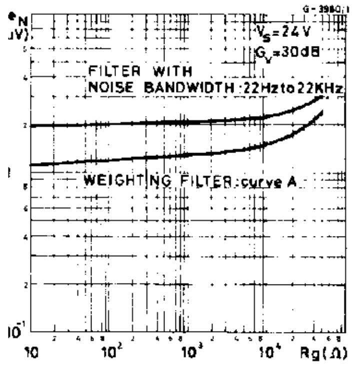


Figure 13. Values of capacitor C_X vs. bandwidth (BW) and gain (G_V)

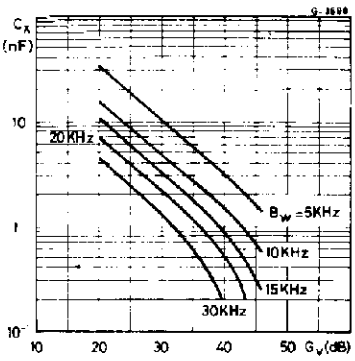


Figure 14. Supply voltage rejection vs. voltage gain

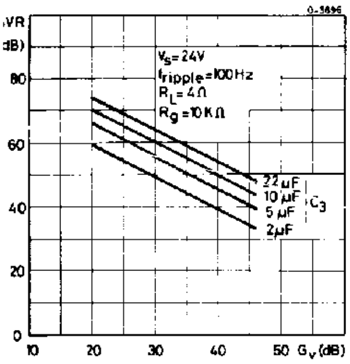


Figure 15. Supply voltage rejection vs. source resistance

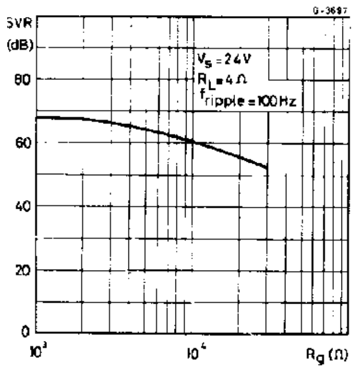


Figure 16. Power dissipation and efficiency vs. output power

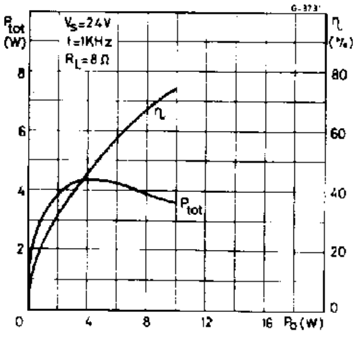


Figure 17. Power dissipation and efficiency vs. output power

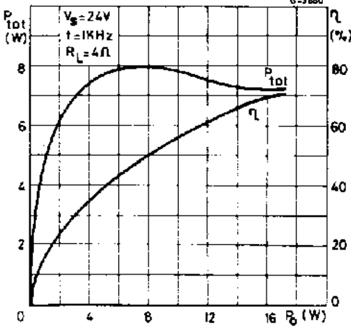
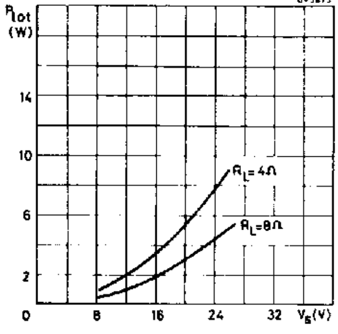


Figure 18. Max power dissipation vs. supply voltage



APPLICATION INFORMATION

Figure 19. Application circuit without muting

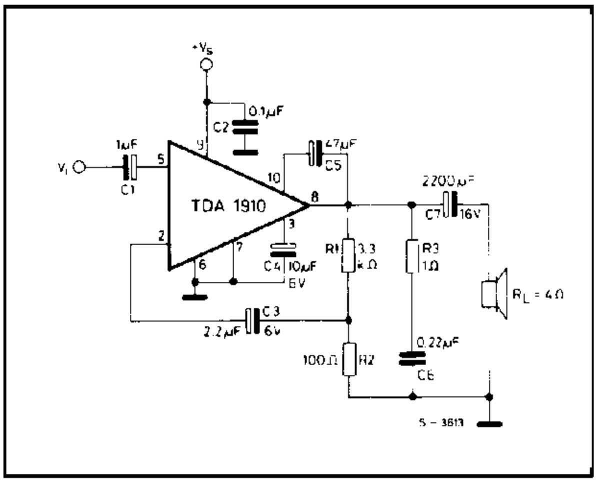


Figure 20. PC board and component lay-out of the circuit of fig. 19 (1:1 scale)

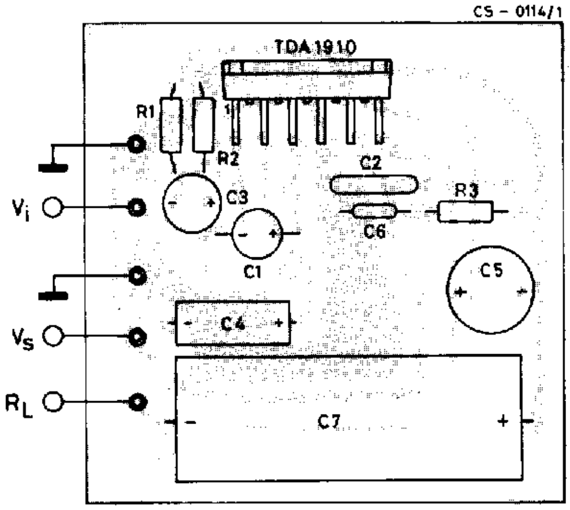
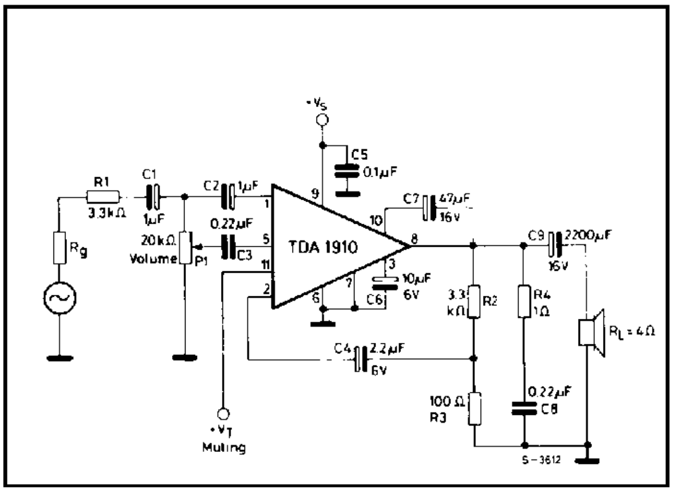


Figure 21. Application circuit with muting



Performance (circuits of fig. 19 and 21)

P_o = 12W (40 to 15000 Hz, d ≤ 0.5%)
V_S = 24V
I_d = 0.82A
G_v = 30 dB

APPLICATION INFORMATION (continued)

Figure 22. Two position DC tone control (10 dB boost 50 Hz and 20 KHz) using change of pin 1 resistance (muting function)

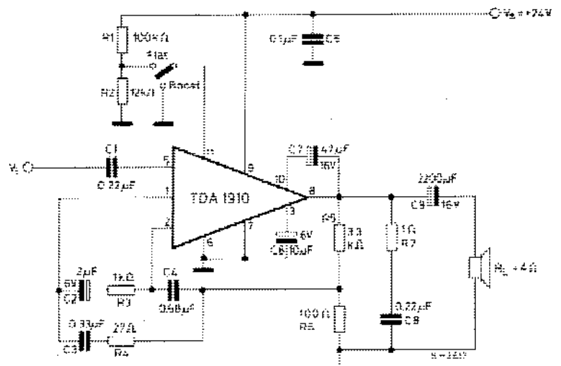


Figure 23. Frequency response of the circuit of fig. 22

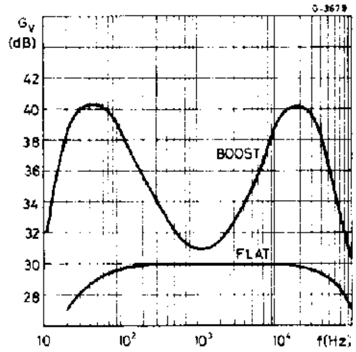


Figure 24. 10 dB 50 Hz boos tone control using change of pin 1 resistance (muting function)

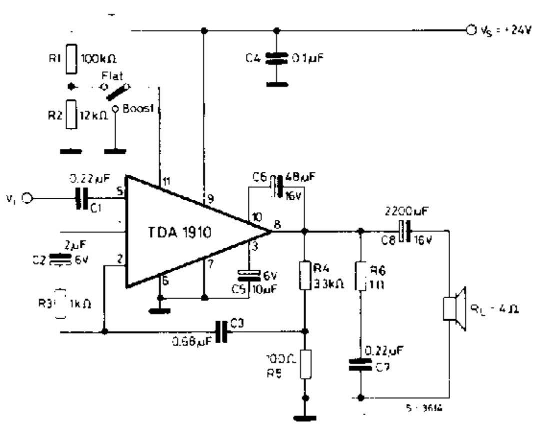


Figure 25. Frequency response of the circuit of fig. 24

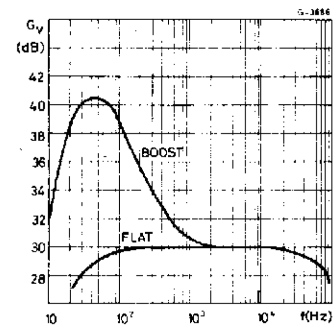


Figure 26. Squelch function in TV applications

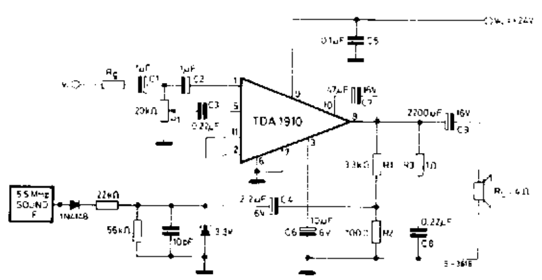
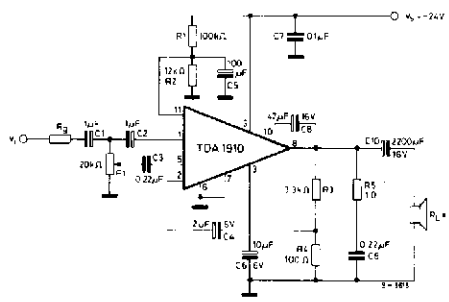


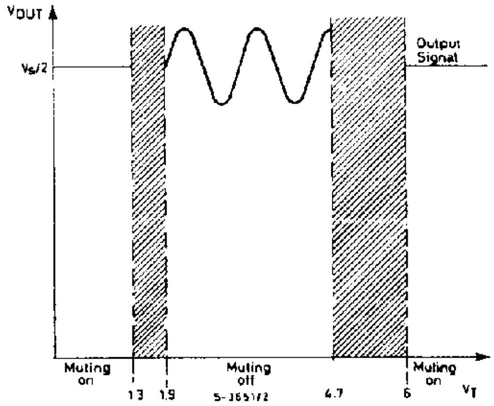
Figure 27. Delayed muting circuit



MUTING FUNCTION

The output signal can be inhibited applying a DC voltage V_T to pin 11, as shown in fig. 28

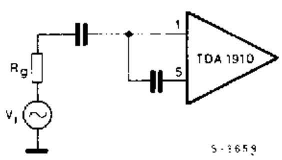
Figure 28



The input resistance at pin 1 depends on the threshold voltage V_T at pin 11 and is typically.

R_1 = 200 KΩ	@	$1.9V \leq V_T \leq 4.7V$	muting-off
R1 = 10 Ω	@	$0V \leq V_T \leq 1.3V$ $6V \leq V_T \leq V_S$	muting-on

Referring to the following input stage, the possible attenuation of the input signal and therefore of the output signal can be found using the following expression.



$$A_T = \frac{V_i}{V_5} = \frac{R_g + R_5 /\!/ R_1}{R_5 /\!/ R_1}$$

where R5 ≅ 100 KΩ

Considering Rg = 10 KΩ the attenuation in the muting-on condition is typically A_T = 60 dB. In the muting-off condition, the attenuation is very low, typically 1.2 dB.

A very low current is necessary to drive the threshold voltage V_T because the input resistance at pin 11 is greater than 150 KΩ. The muting function can be used in many cases, when a temporary inhibition of the output signal is requested, for example:

- in switch-on condition, to avoid preamplifier power-on transients (see fig. 27)
- during commutations at the input stages.
- during the receiver tuning.

The variable impedance capability at pin 1 can be useful in many applications and we have shown 2 examples in fig. 22 and 24, where it has been used to change the feedback network, obtaining 2 different frequency responses.

APPLICATION SUGGESTION

The recommended values of the components are those shown on application circuit of fig. 21. Different values can be used.
The following table can help the designer.

Component	Raccom. value	Purpose	Larger than recommended value	Smaller than recommended value	Allowed range	
					Min.	Max.
$R_g + R_1$	10KΩ	Input signal imped. for muting operation	Increase of the attenuation in muting-on condition. Decrease of the input sensitivity.	Decrease of the attenuation in muting on condition.		
R_2	3.3KΩ	Close loop gain setting.	Increase of gain.	Decrease of gain. Increase quiescent current.	9 R_3	
R_3	100Ω	Close loop gain setting.	Decrease of gain.	Increase of gain.		$R_2/9$
R_4	1Ω	Frequency stability	Danger of oscillation at high frequencies with inductive loads.			
P_1	20KΩ	Volume potentiometer.	Increase of the switch-on noise.	Decrease of the input impedance and of the input level.	10KΩ	100KΩ
C_1 C_2 C_3	1 µF 1 µF 0.22µF	Input DC decoupling.		Higher low frequency cutoff.		
C_4	2.2µF	Inverting input DC decoupling.	Increase of the switch-on noise.	Higher low frequency cutoff.	0.1µF	
C_5	0.1µF	Supply voltage bypass.		Danger of oscillations.		
C_6	10µF	Ripple rejection.	Increase of SVR. Increase of the switch-on time	Degradation of SVR	2.2µF	100µF
C_7	47µF	Bootstrap.		Increase of the distortion at low frequency.	10µF	100µF
C_8	0.22µF	Frequency stability.		Danger of oscillation.		
C_9	2200µF (R_L = 4Ω) 1000 µF (R_L = 8Ω)	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 heatskink 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 increases 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. 31 shows this dissipable power as a function of ambient temperature for different thermal resistance.

Figure 29. Output power and drain current vs. case temperature

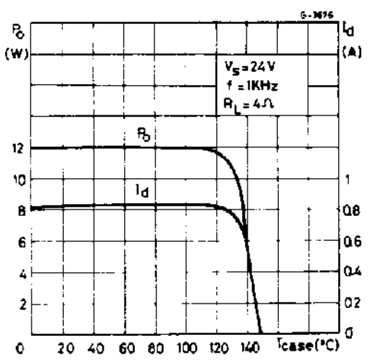


Figure 30. Output power and drain current vs. case temperature

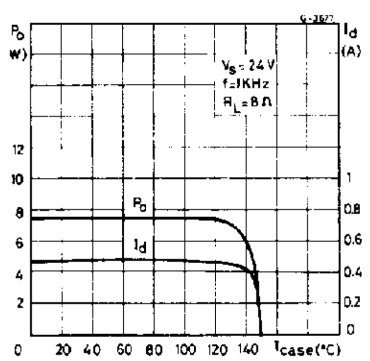
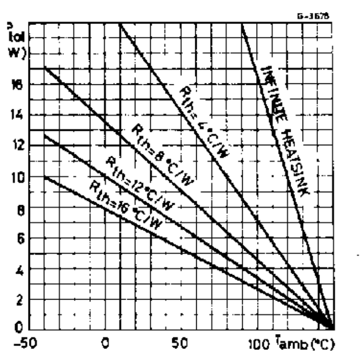


Figure 31. Maximum allowable power dissipation vs. ambient temperature



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.

MULTIWATT 11 VERTICAL PACKAGE MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			5			0.197
B			2.65			0.104
C			1.6			0.063
D		1			0.039	
E	0.49		0.55	0.019		0.022
F	0.88		0.95	0.035		0.037
G	1.57	1.7	1.83	0.062	0.067	0.072
G1	16.87	17	17.13	0.664	0.669	0.674
H1	19.6			0.772		
H2			20.2			0.795
L	21.5		22.3	0.846		0.878
L1	21.4		22.2	0.843		0.874
L2	17.4		18.1	0.685		0.713
L3	17.25	17.5	17.75	0.679	0.689	0.699
L4	10.3	10.7	10.9	0.406	0.421	0.429
L7	2.65		2.9	0.104		0.114
M	4.1	4.3	4.5	0.161	0.169	0.177
M1	4.88	5.08	5.3	0.192	0.200	0.209
S	1.9		2.6	0.075		0.102
S1	1.9		2.6	0.075		0.102
Dia1	3.65		3.85	0.144		0.152