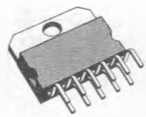
10W AUDIO AMPLIFIER WITH MUTING

- MUTING FACILITY
- PROTECTION AGAINST CHIP OVER TEMPERATURE
- VERY LOW NOISE
- HIGH SUPPLY VOLTAGE REJECTION
- LOW "SWITCH-ON" NOISE

The TDA1910 is assembled in MULTIWATT® package that offers :

- EASY ASSEMBLY
- SIMPLE HEATSINK
- SPACE AND COST SAVING
- HIGH RELIABILITY.



Multiwatt 11

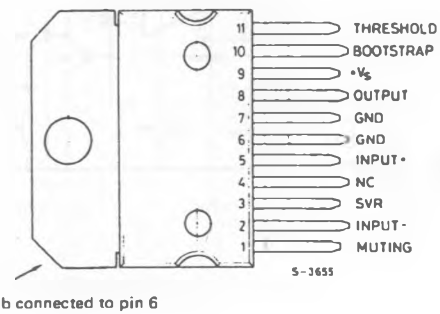
ORDER CODE : TDA1910

DESCRIPTION

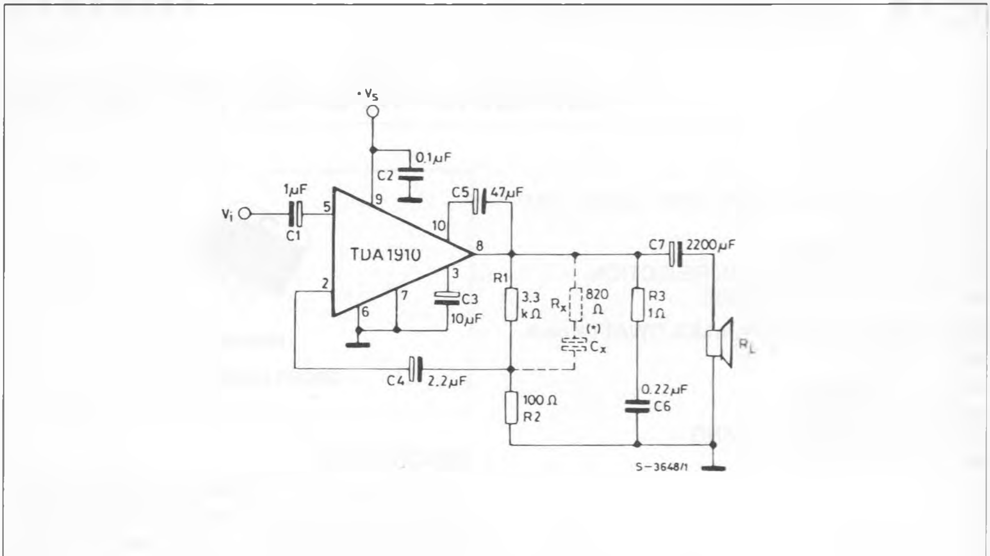
The TDA1910 is a monolithic integrated circuit in MULTIWATT® package, intended for use in Hi-Fi audio power applications, as high quality TV sets.

The TDA1910 meets the DIN 45500 (d = 0.5 %) guaranteed output power of 10 W when used at 24V/4Ω At 24V/8Ω the output power is 7W min.

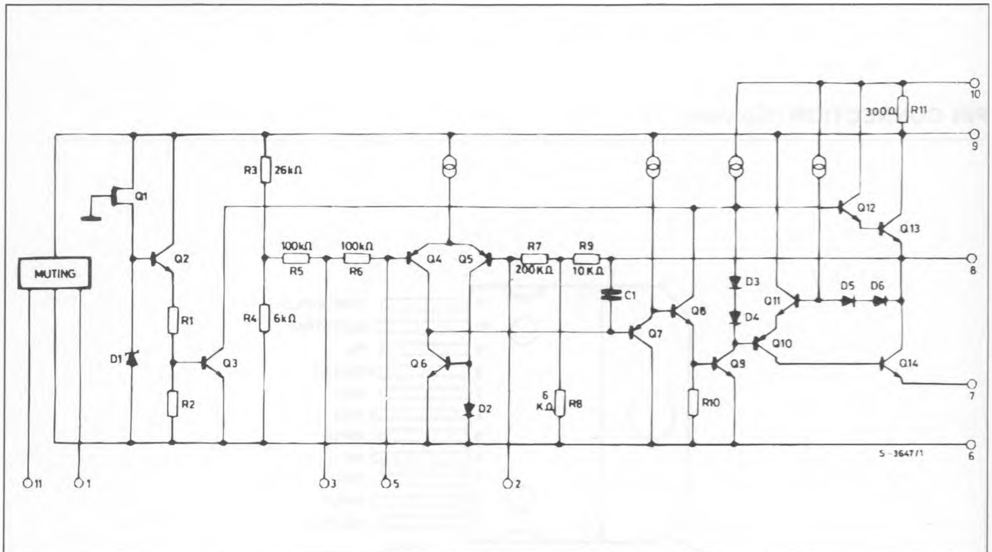
PIN CONNECTION (top view)



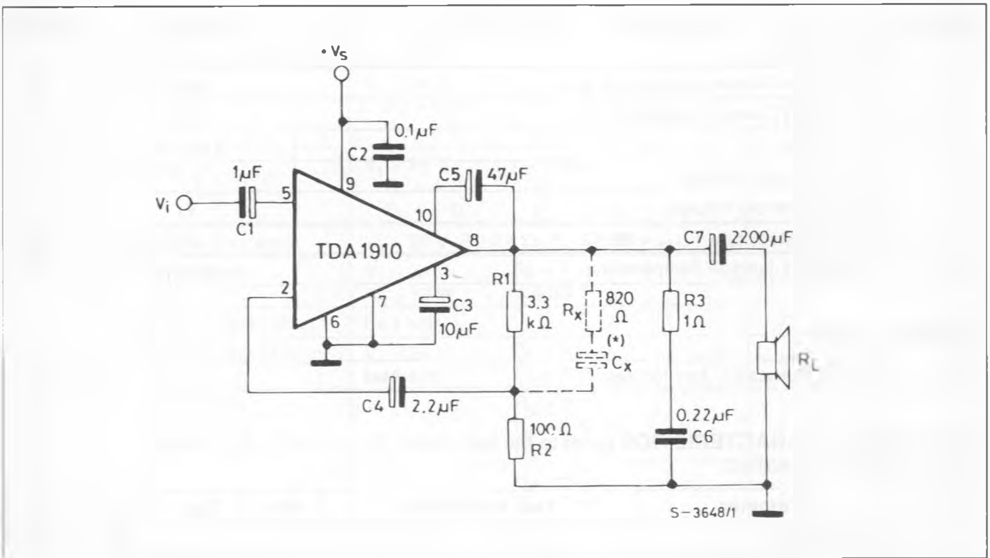
TEST CIRCUIT



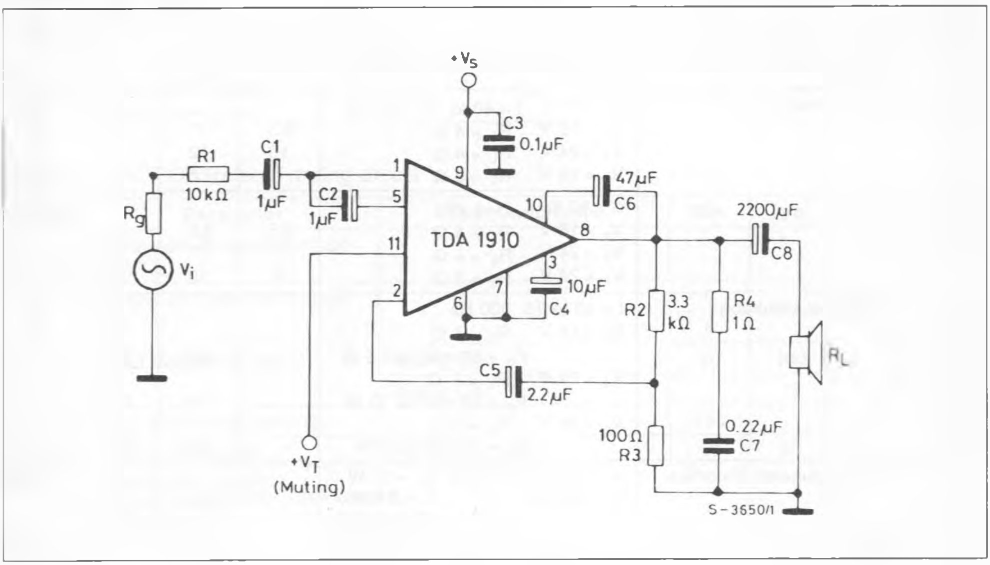
SCHEMATIC DIAGRAM



TEST CIRCUIT



MUTING CIRCUIT



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 Threshold Voltage	V_s	V
P_{tot}	Power Dissipattion at T_{case} = 90 °C	20	W
T_{stg}, T_j	Storage and Junction Temperature	– 40 to 150	°C

THERMAL DATA

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

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_s	Supply Voltage		8		30	V
V_o	Quiescent Output Voltage	V_s = 18 V V_s = 24 V	8.3 11.5	9.2 12.4	10 13.4	V
I_d	Quiescent Drain Current	V_s = 18 V V_s = 24 V		19 21	32 35	mA
$V_{CE\ sat}$	Output Stage Saturation Voltage	I_C = 2 A		1		V
		I_C = 3 A		1.6		
P_o	Output Power	d = 0.5 % f = 40 to 15, 000 Hz V_s = 18 V R_L = 4 Ω V_s = 24 V R_L = 4 Ω V_s = 24 V R_L = 8 Ω	 6.5 10 7	 7 12 7.5		W
		d = 10 % f = 1 kHz V_s = 18 V R_L = 4 Ω V_s = 24 V R_L = 4 Ω V_s = 24 V R_L = 8 Ω	 8.5 15 9	 9.5 17 10		W
d	Harmonic Distortion	f = 40 to 15, 000 Hz V_s = 18 V R_L = 4 Ω P_o = 50 mW to 6.5 W V_s = 24 V R_L = 4 Ω P_o = 50 mW to 10 W V_s = 24 V R_L = 8 Ω P_o = 50 mW to 7 W		 0.2 0.2 0.2	 0.5 0.5 0.5	%
d	Intermodulation Distortion	V_s = 24 V R_L = 4 Ω P_o = 10 W f_1 = 250 Hz f_2 = 8 kHz (DIN 45500)		 0.2		%
V_i	Input Sensitivity	f = 1 kHz V_s = 18 V R_L = 4 Ω P_o = 7 W V_s = 24 V R_L = 4 Ω P_o = 12 W V_s = 24 V R_L = 8 Ω P_o = 7.5 W		 170 220 245		mV
V_i	Input Saturation Voltage (rms)	V_s = 18 V V_s = 24 V	1.8 2.4			V

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R_i	Input Resistance (pin 5)	f = 1 kHz	60	100		kΩ
I_d	Drain Current	V_s = 24 V f = 1 kHz R_L = 4 Ω P_o = 12 W R_L = 8 Ω P_o = 7.5 W		 820 475		mA
η	Efficiency	V_s = 24 V f = 1 kHz R_L = 4 Ω P_o = 12 W R_L = 8 Ω P_o = 7.5 W		 62 65		%
BW	Small Signal Bandwidth	V_s = 24 V R_L = 4 Ω P_o = 1 W	10 to 120, 000			Hz
BW	Power Bandwidth	V_s = 24 V R_L = 4 Ω P_o = 12 W d ≤ 0.5 %	40 to 15. 000			Hz
G_v	Voltage Gain (open loop)	f = 1 kHz		75		dB
Gv	Voltage Gain (closed loop)	V_s = 24 V R_L = 4 Ω f = 1 kHz P_o = 1 W	29.5	30	30.5	dB
e_N	Total Input Noise	R_g = 50 Ω R_g = 1 kΩ (°) R_g = 10 kΩ		1.2 1.3 1.5	3.0 3.2 4.0	µV
		R_g = 50 Ω R_g = 1 kΩ (°°) R_g = 10 kΩ		2.0 2.0 2.2	5.0 5.2 6.0	µV
S/N	Signal to Noise Ratio	V_s = 24 V, P_o = 12 W, R_L = 4 Ω; R_g = 10 kΩ, R_g = 0 (°)	97	103 105		dB
		R_g = 10 kΩ, R_g = 0 (°°)	93	100 100		dB
SVR	Supply Voltage Rejection	V_s = 24 V R_L = 4 Ω f_{ripple} = 100 Hz R_g = 10 kΩ	50	60		dB
T_{sd}	Thermal Shut-down CaseTemperature (*)	P_{tot} = 8 W	110	125		°C

MUTING FUNCTION (refer to muting circuit)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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	V
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.

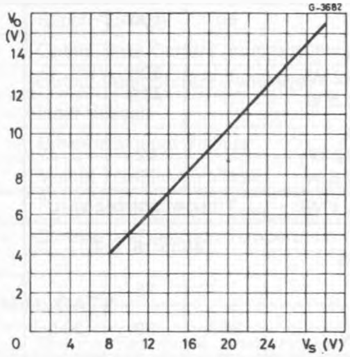


Figure 2 : Quiescent Drain Current vs. Supply Voltage.

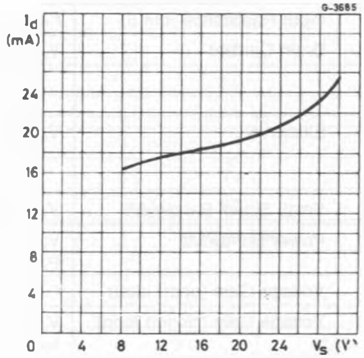


Figure 3 : Open Loop Frequency Response.

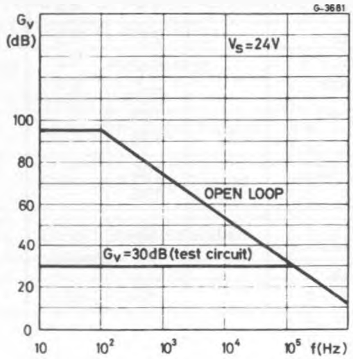


Figure 4 : Output Power vs. Supply Voltage.

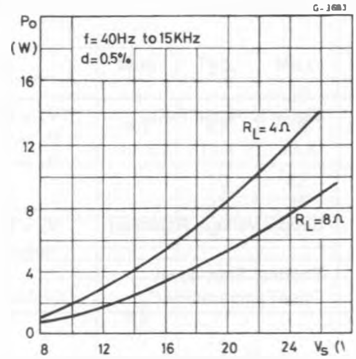


Figure 5 : Output Power vs. Supply Voltage.

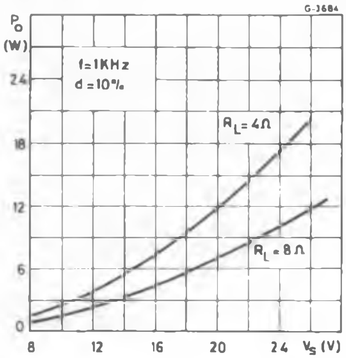


Figure 6 : Distortion vs. Output Power.

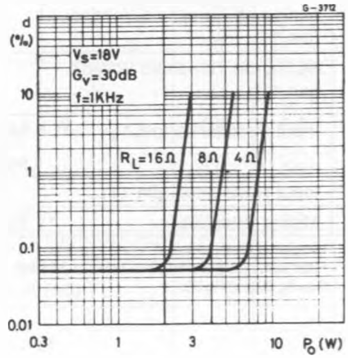


Figure 7 : Distortion vs. Output Power.

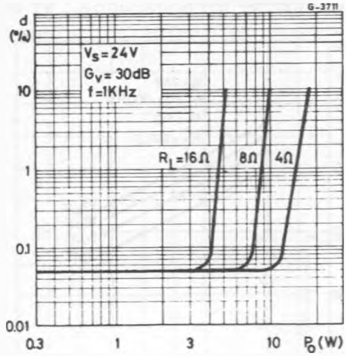


Figure 8 : Output Power vs. Frequency.

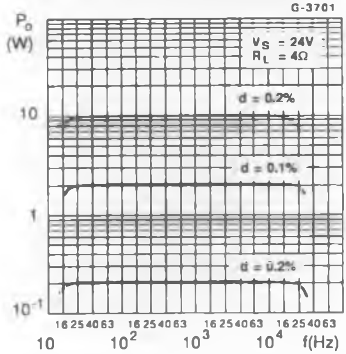


Figure 9 : Output Power vs. Frequency.

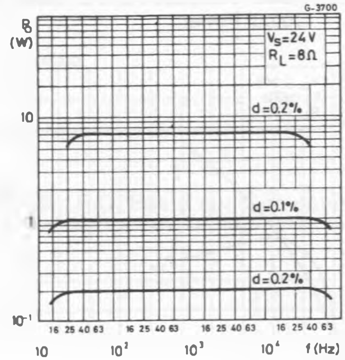


Figure 10 : Output Power vs. Input Voltage.

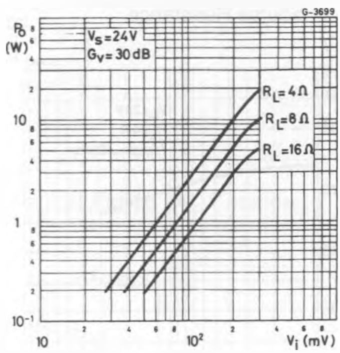


Figure 11 : Output Power vs. Input Voltage.

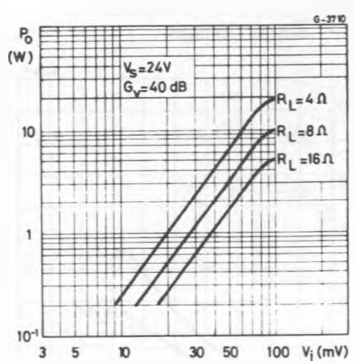


Figure 12 : Total Input Noise vs. Source Resistance.

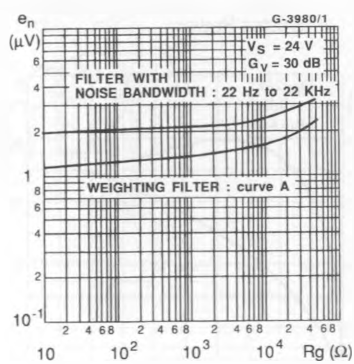


Figure 13 : Values of Capacitor Cx vs. Bandwidth (BW) and Gain (Gv).

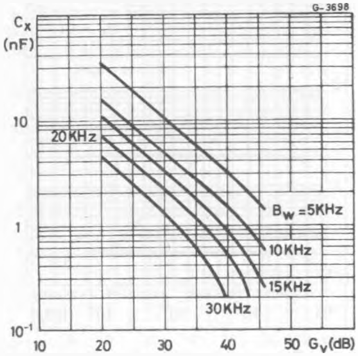


Figure 14 : Supply Voltage Rejection vs. Voltage Gain.

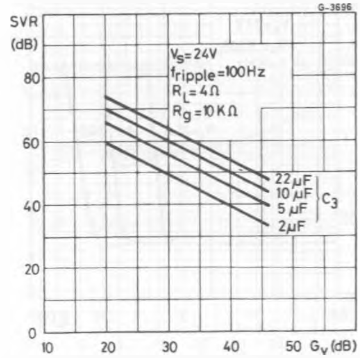


Figure 15 : Supply Voltage Rejection vs. Source Resistance.

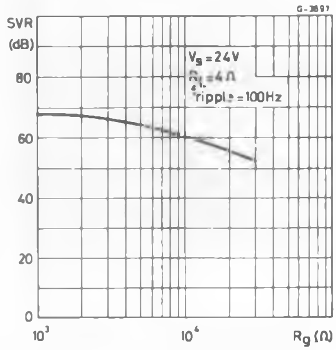


Figure 16 : Power Dissipation and Efficiency vs. Output Power.

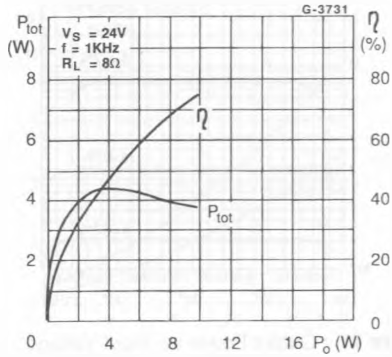


Figure 17 : Power Dissipation and Efficiency vs. Output Power.

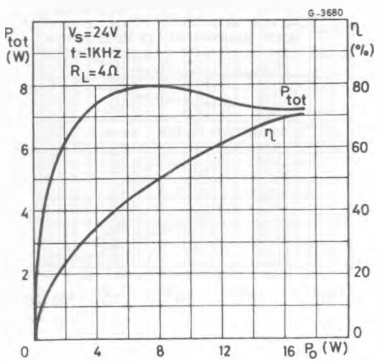
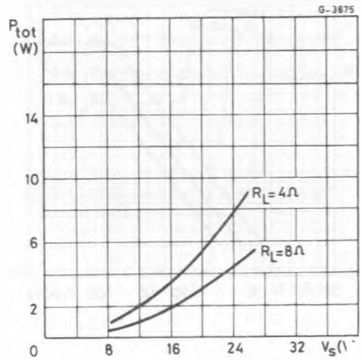


Figure 18 : Max Power Dissipation vs. Supply Voltage.



APPLICATION INFORMATION

Figure 19 : Application Circuit without Muting.

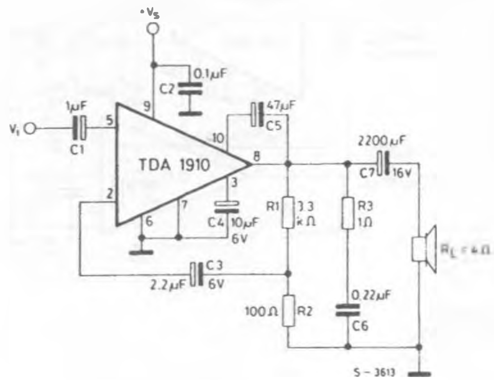


Figure 20 : P.C. Board and Component layout of the Circuit of Fig.19 (1 : 1 scale).

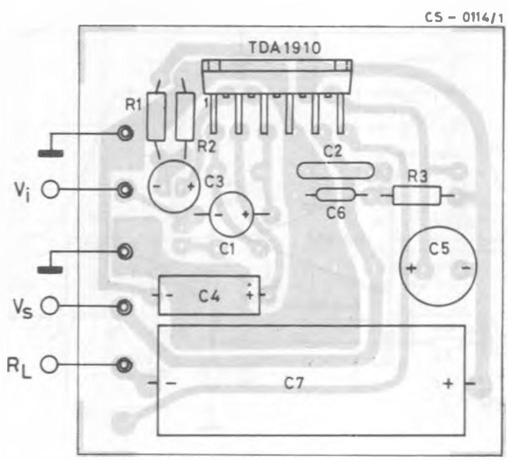
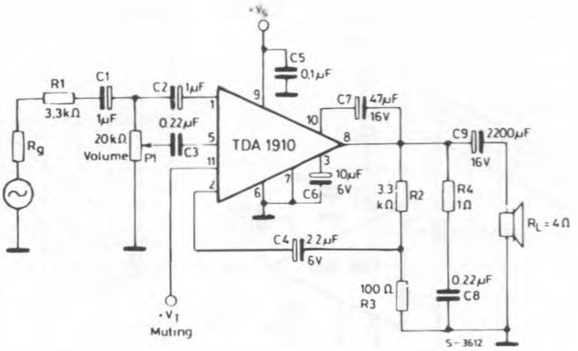


Figure 21 : Application Circuit with Muting.



Performance (circuits of fig.19 and 21)

P_O = 12W (40 to 15000Hz, d ≤0.5%)

V_S = 24V

I_d = 0.82A

G_v = 30dB

Figure 22 : Two Position DC Tone Control (10dB boost 50Hz and 20kHz) using Change of Pin 1 Resistance (muting function).

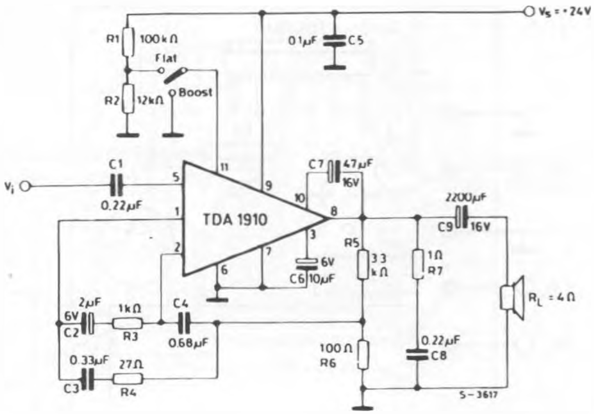


Figure 23 : 10dB 50Hz Boost Tone Control using Change of Pin 1 Resistance (muting function).

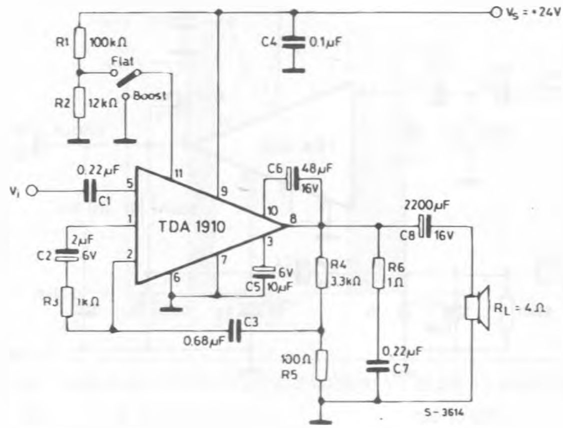


Figure 24 : Frequency Response of the Circuit of fig.22

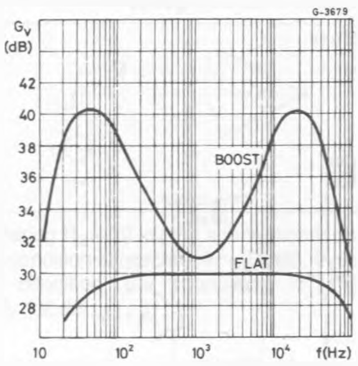


Figure 25 : Frequency Response of the Circuit of fig.23

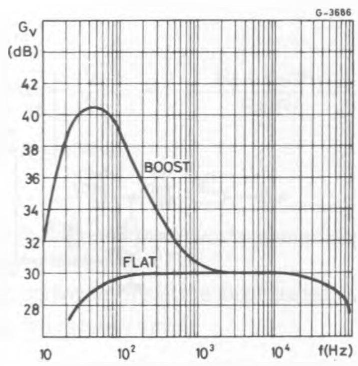


Figure 26 : Squelch Function in TV Applications.

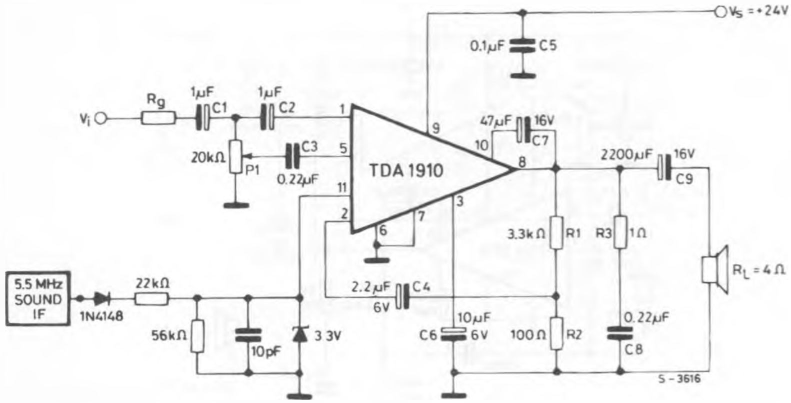
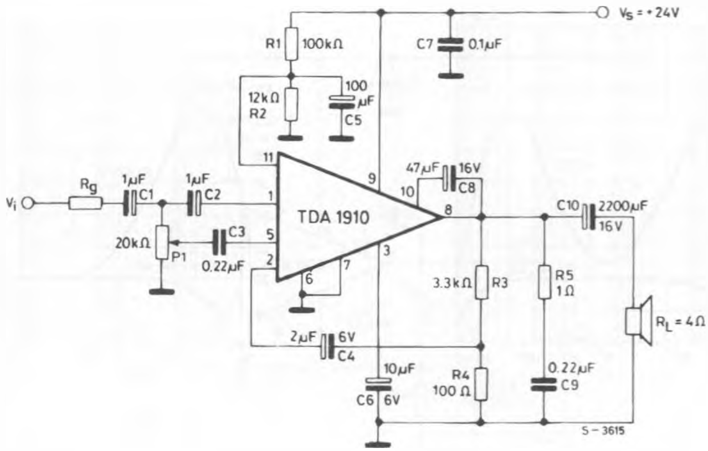


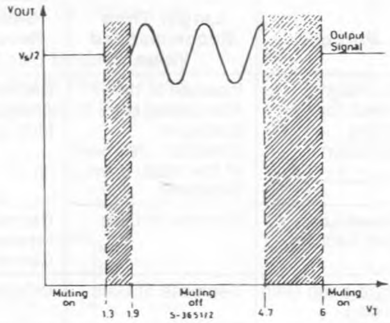
Figure 27 : Delayed Muting Circuit.



MUTING FUNCTION

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

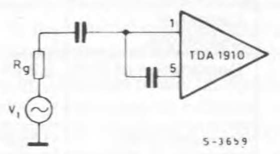
Figure 28.



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

$R_1 = 200\ k\Omega$	@	$1.9\ V \leq V_T \leq 4.7\ V$	muting-off
$R1 = 10\Omega$	@	$0\ V \leq V_T \leq 1.3\ V$ $6\ V \leq V_T \leq V_S$	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 = 100kΩ

Considering $R_g = 10\ k\Omega$ 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	Recomm. Value	Purpose	Larger Than Recommanded Value	Smaller Than Recommanded Value	Allowed Range	
					Min.	Typ.
$R_g + R_1$	10 kΩ	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	3.3 kΩ	Closed Loop Gain Setting	Increase of Gain	Decrease of Gain Increase Quiescent Current	9 R_3	
R_3	100 Ω	Close Loop Gain Setting	Decrease of Gain	Increase of Gain		$R_2/9$
R_4	1 Ω	Frequency Stability	Danger of Oscillation at High Frequencies with Inductive Loads			
P_1	20 kΩ	Volume Potentiometer	Increase of the Switch-on Noise	Decrease of the Input Impedance and The Input Level	10 kΩ	100 kΩ
C_1 C_2 C_3	1 µF 1 µF 0.22 µF	Input DC Decoupling		Higher Low Frequency Cutoff		
C_4	2.2 µF	Inverting Input DC Decoupling	Increase of the Switch-on Noise	Higher Low Frequency Cutoff	0.1 µF	
C_5	0.1 µF	Supply Voltage Bypass		Danger of Oscillations		
C_6	10 µF	Ripple Rejection	Increase of SVR Increase of the Switch-on Time	Degradation of SVR	2.2 µF	100 µF
C_7	47 µF	Boostrap.		Increase of the Distortion at Low Frequency	10 µF	100 µF
C_8	0.22 µF	Frequency Stability		Danger of Oscillation		
C_9	2200 µF (R_L = 4 Ω) 1000 µF (R_L = 8 Ω)	Output DC Decoupling		Higher Low Frequency Cutoff		

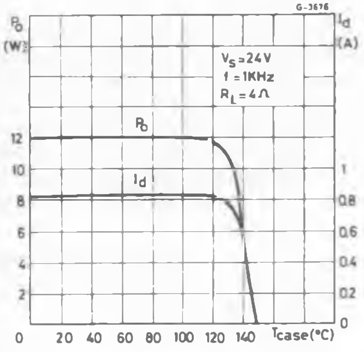
THERMAL SHUT–DOWN

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.

Figure 29 : Output Power and Drain Current vs. Case 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 30 : Output Power and Drain Current vs. Case Temperature.

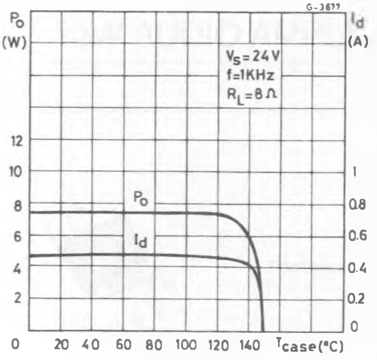
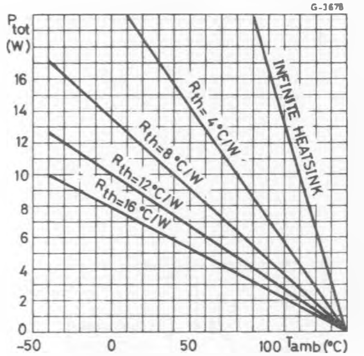


Figure 31 : Maximum allowable Power Dissipation vs . Ambient Temperature.



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.