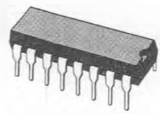
TDA1904

4 W AUDIO AMPLIFIER

- HIGH OUTPUT CURRENT CAPABILITY (up to 2 A)
- PROTECTION AGAINST CHIP OVERTEMPERATURE
- LOW NOISE
- HIGH SUPPLY VOLTAGE REJECTION
- SUPPLY VOLTAGE RANGE : 4 V TO 20 V



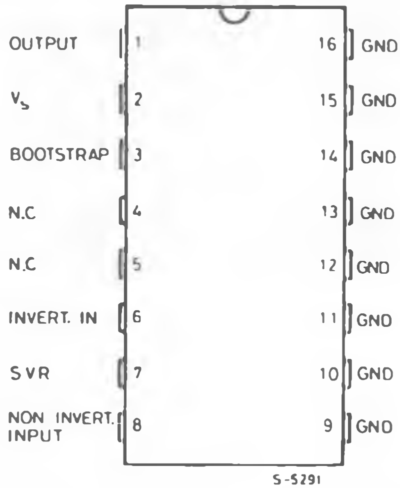
Powerdip
(8 + 8)

ORDER CODE : TDA1904

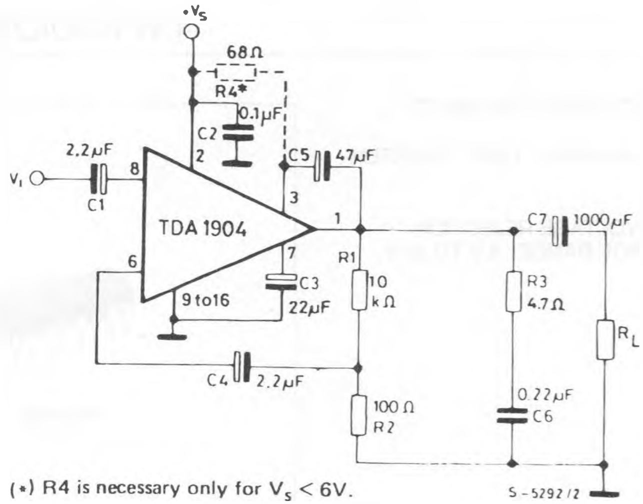
DESCRIPTION

The TDA1904 is a monolithic integrated circuit in POWERDIP package intended for use as low-frequency power amplifier in wide range of applications in portable radio and TV sets.

PIN CONNECTION (top view)



TEST AND APPLICATION CIRCUIT



(*) R4 is necessary only for $V_s < 6V$.

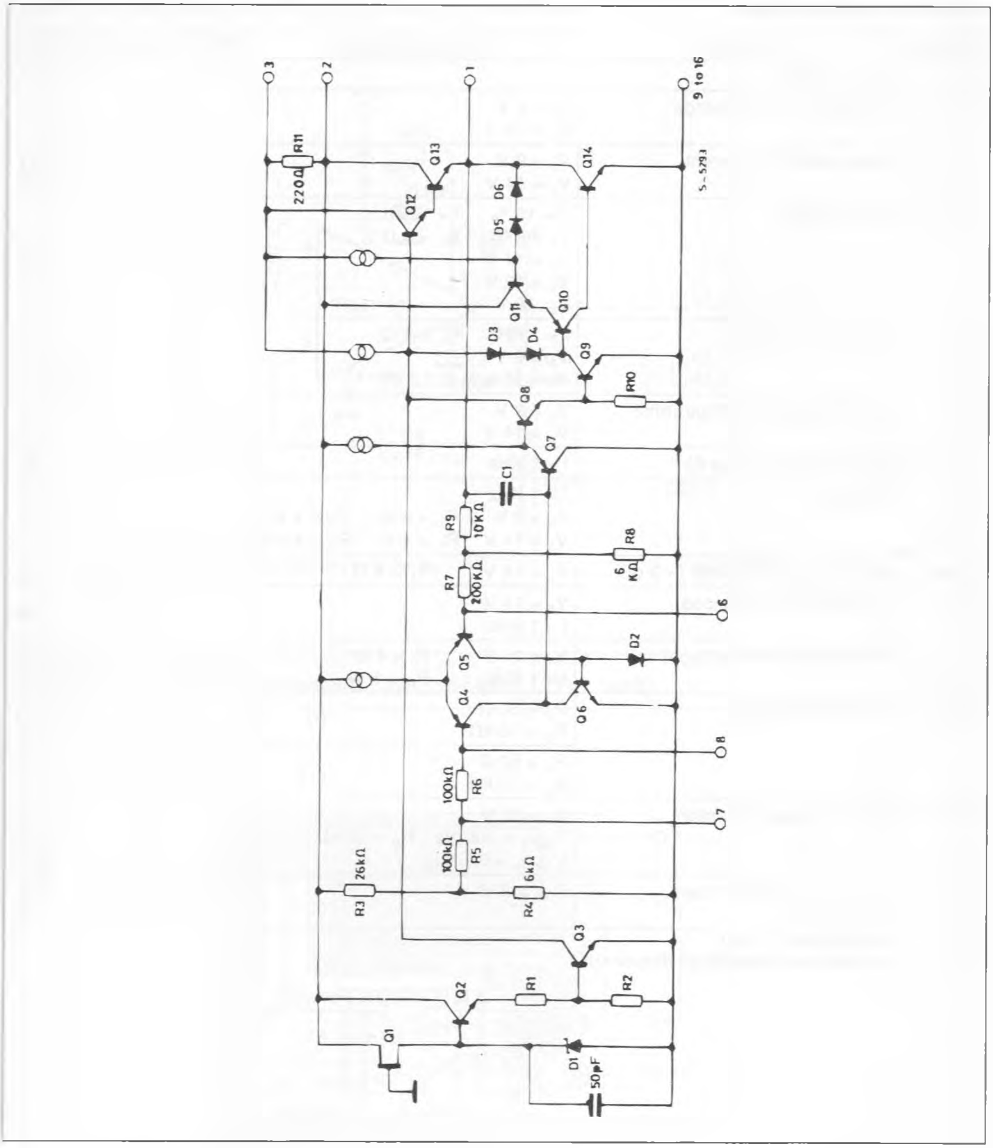
ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_S	Supply Voltage	20	V
I_O	Peak Output Current (non repetitive)	2.5	A
I_O	Peak Output Current (repetitive)	2	A
P_{tot}	Total Power Dissipation at T_{amb} = 80 °C T_{pins} = 60 °C	1 6	W W
T_{stg}, T_j	Storage and Junction Temperature	– 40 to 150	°C

THERMAL DATA

$R_{th\ j\text{-}case}$	Thermal Resistance Junction-pins	Max.	15	°C/W
$R_{th\ j\text{-}amb}$	Thermal Resistance Junction-ambient	Max.	70	°C/W

SCHEMATIC DIAGRAM



ELECTRICAL CHARACTERISTICS (refer to the test circuit, T_{amb} = 25 °C, R_{th} (heatsink) = 20 °C/W, unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_s	Supply Voltage		4		20	V
V_o	Quiescent Output Voltage	V_s = 4 V V_s = 14 V		2.1 7.2		V
I_d	Quiescent Drain Current	V_s = 9 V V_s = 14 V		8 10	15 18	mA
P_o	Output Power	d = 10 % f = 1 KHz V_s = 9 V R_L = 4 Ω V_s = 14 V V_s = 12 V V_s = 6 V	 1.8 4 3.1 0.7	 2 4.5		W
d	Harmonic Distortion	f = 1 KHz R_L = 4 Ω V_s = 9 V Po = 50 mW to 1.2 W		0.1	0.3	%
V_i	Input Saturation Voltage (rms)	V_s = 9 V V_s = 14 V	0.8 1.3			V
R_i	Input Resistance (pin 8)	f = 1 KHz	55	150		kΩ
η	Efficiency	f = 1 KHz V_s = 9 V R_L = 4 Ω P_o = 2 W V_s = 14 V R_L = 4 Ω P_o = 4.5 W		 70 65		%
BW	Small Signal Bandwidth (– 3 dB)	V_s = 14 V R_L = 4 Ω	40 to 40,000			Hz
G_v	Voltage Gain (open loop)	V_s = 14 V f = 1 KHz		75		dB
G_v	Voltage Gain (closed loop)	V_s = 14 V R_l = 4 Ω f = 1 KHz P_o = 1 W	39.5	40	40.5	dB
e_N	Total Input Noise	R_g = 50 Ω (°) R_g = 10 kΩ		1.2 2	 4	μV
		R_g = 50 Ω (°°) R_g = 10 kΩ		2 3		μV
SVR	Supply Voltage Rejection	V_s = 12 V f_{ripple} = 100 Hz R_g = 10 kΩ V_{ripple} = 0.5 V_{rms}	40	50		dB
T_{sd}	Thermal Shut-down Case Temperature	P_{tot} = 2 W		120		°C

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

Figure 1 : Test and Application Circuit.

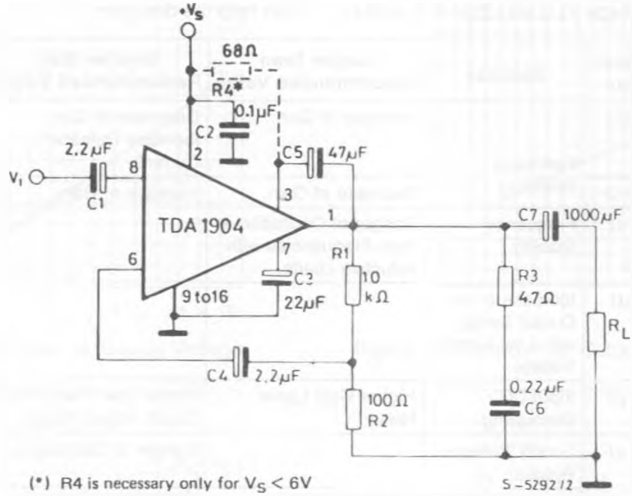
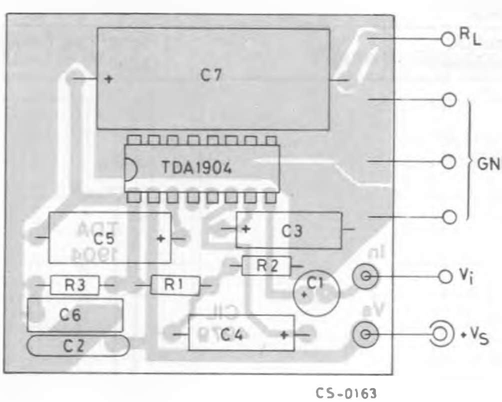


Figure 2 : P.C. Board and Components Layout of Figure 1 (1 : 1 scale).



APPLICATION SUGGESTION

The recommended values of the external components are those shown on the application circuit of fig. 1.

When the supply voltage V_S is less than 6 V, a 68 Ω resistor must be connected between pin 2 and pin 3 in order to obtain the maximum output power.

Different values can be used. The following table can help the designer.

Components	Reccom. Value	Purpose	Larger than Recommended Value	Smaller than Recommended Value	Allowed Range	
					Min.	Max.
R_1	10 kΩ	Feedback Resistors	Increase of Gain.	Decrease of Gain. Increase Quiescent Current.	9 R_3	
R_2	100 Ω		Decrease of Gain.	Increase of Gain.		1 kΩ
R_3	4.7 Ω	Frequency Stability	Danger of Oscillation at High Frequencies with Inductive Loads.			
R_4	68 Ω	Increase of the Output Swing with Low Supply Voltage.			39 Ω	220 Ω
C_1	2.2 µF	Input DC Decoupling.	Higher Cost Lower Noise.	Higher Low Frequency Cutoff. Higher Noise.		
C_2	0.1 µF	Supply Voltage Bypass.		Danger of Oscillations.		
C_3	22 µF	Ripple Rejection	Increase of SVR Increase of the Switch-on Time.	Degradation of SVR.	2.2 µF	100 µF
C_4	2.2 µF	Inverting Input DC Decoupling.	Increase of the Switch-on Noise	Higher Low Frequency Cutoff.	0.1 µF	
C_5	47 µF	Bootstrap.		Increase of the Distortion at Low Frequency.	10 µF	100 µF
C_6	0.22 µF	Frequency Stability.		Danger of Oscillation.		
C_7	1000 µF	Output DC Decoupling.		Higher Low Frequency Cutoff.		

Figure 3 : Quiescent Output Voltage vs. Supply Voltage.

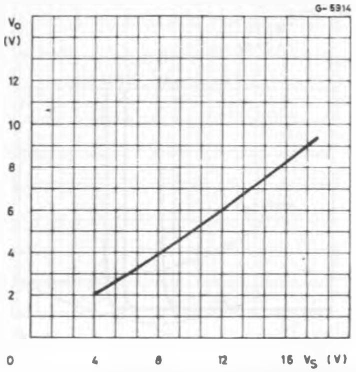


Figure 4 : Quiescent Drain Current vs. Supply Voltage.

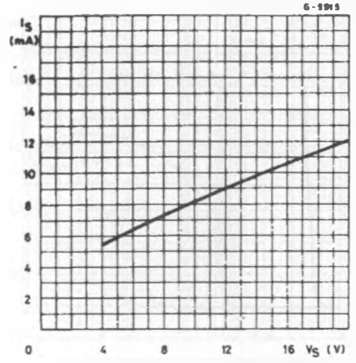


Figure 5 : Output Power vs. Supply Voltage.

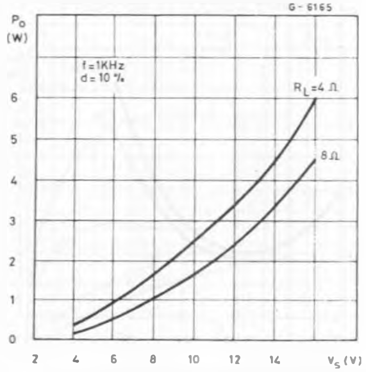


Figure 6 : Distortion vs. Output Power.

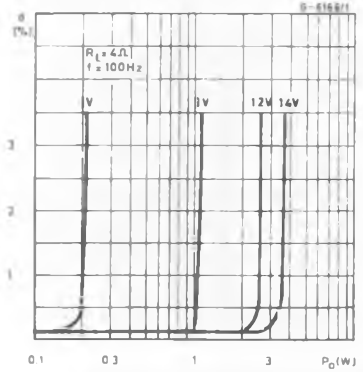


Figure 7 : Distortion Output Power.

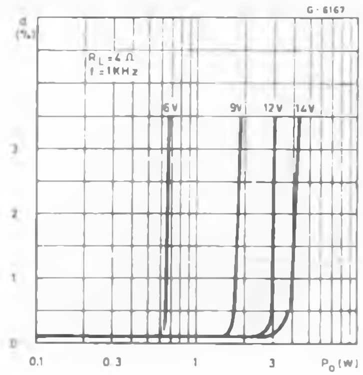


Figure 8 : Distortion vs. Output Power.

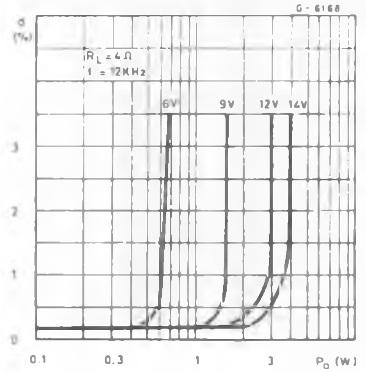


Figure 9 : Distortion vs. Output Power.

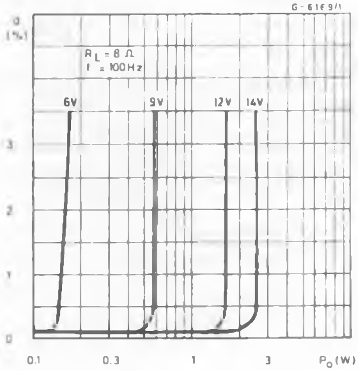


Figure 10 : Distortion vs. Output Power.

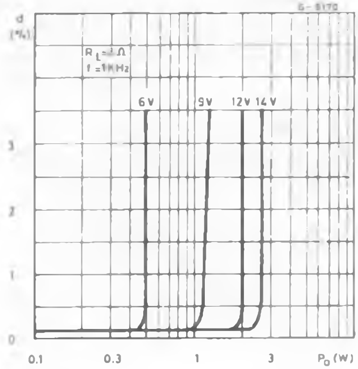


Figure 11 : Distortion vs. Output Power.

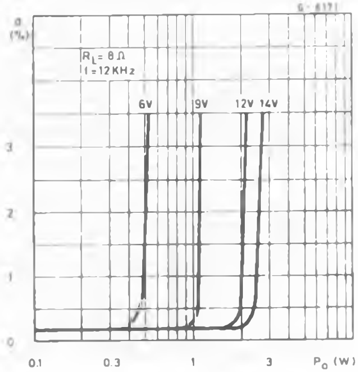


Figure 12 : Distortion vs. Frequency.

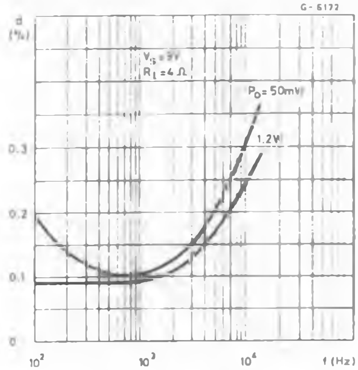


Figure 13 : Distortion vs. Frequency.

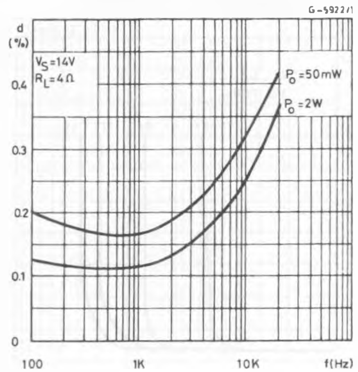


Figure 14 : Distortion vs. Frequency.

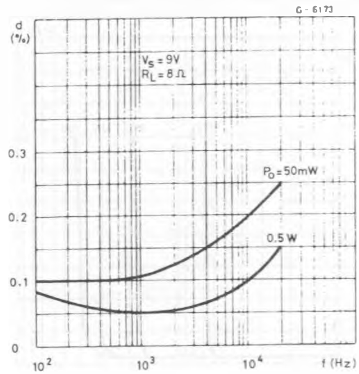


Figure 15 : Distortion vs. Frequency.

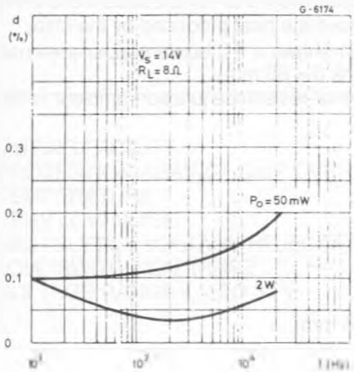


Figure 16 : Supply Voltage Rejection vs. Frequency.

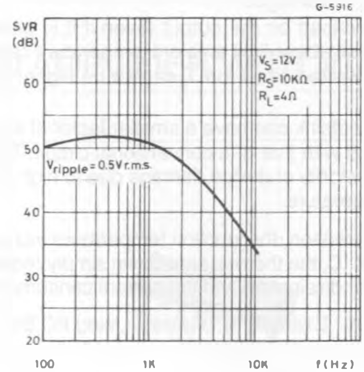


Figure 17 : Total Power Dissipation and Efficiency vs. Output Power.

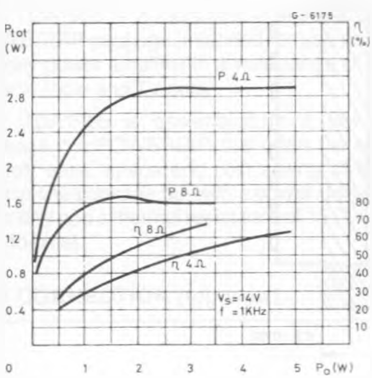


Figure 18 : Total Power Dissipation vs. Output Power.

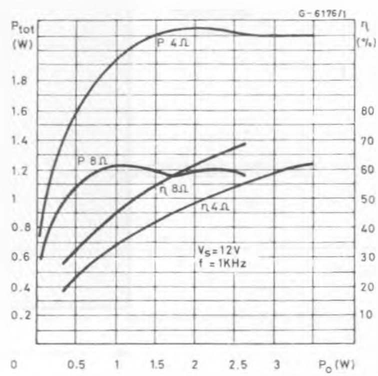


Figure 19 : Total Power Dissipation vs. Output Power.

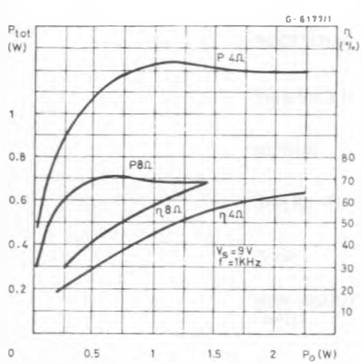
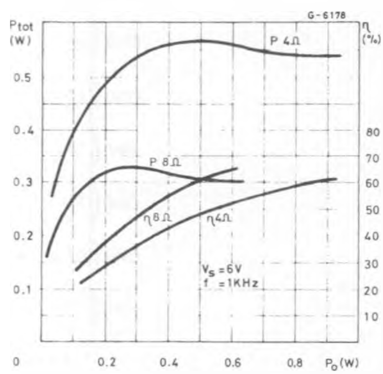


Figure 20 : Total Power Dissipation vs. Output Power.



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 tolerated 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.

MOUNTING INSTRUCTION

The TDA1904 is assembled in the Powerdip, in which 8 pins (from 9 to 16) are attached to the frame and remove the heat produced by the chip.

Figure 21 shows a PC board copper area used as a heatsink (l = 65 mm).

The thermal resistance junction-ambient is 35 °C.

Figure 21 : Example of Heatsink Using PC Board Copper (l = 65 mm).