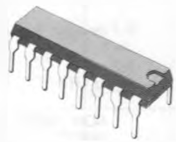
4W AUDIO AMPLIFIER

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

The TDA 1904 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.



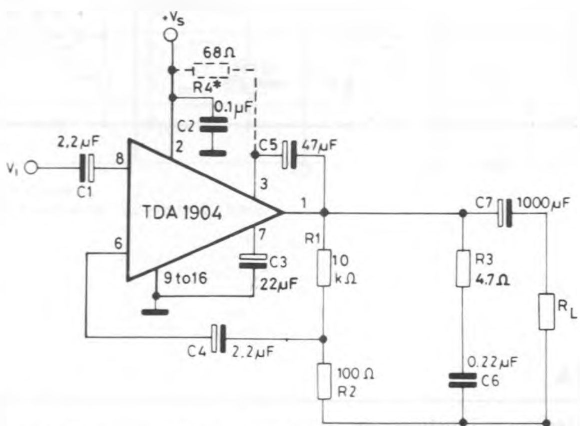
Powerdip
(8 + 8)

ORDERING NUMBER: TDA 1904

ABSOLUTE MAXIMUM RATINGS

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 $T_{amb} = 80°C$	1	W
	at $T_{pins} = 60°C$	6	W
T_{stg}, T_j	Storage and junction temperature	-40 to 150	°C

TEST AND APPLICATION CIRCUIT



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

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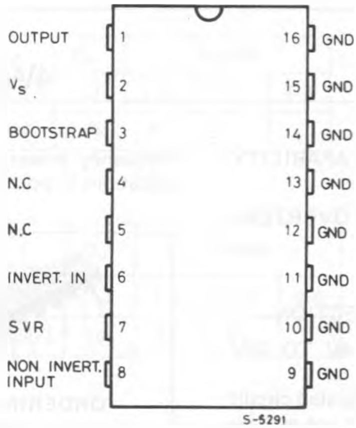
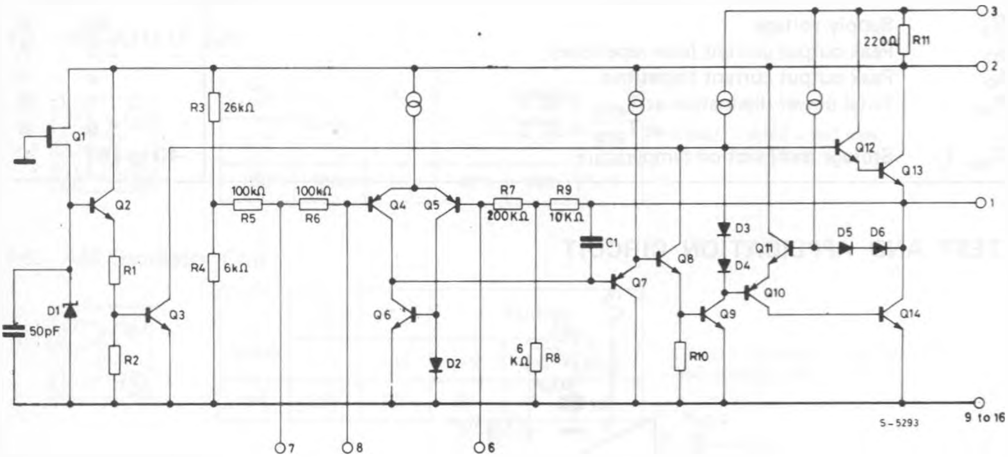
CONNECTION DIAGRAM
(top view)



SCHEMATIC DIAGRAM



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

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

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_s	Supply voltage		4		20	V
V_o	Quiescent output voltage	V_s = 4V V_s = 14V		2.1 7.2		V
I_d	Quiescent drain current	V_s = 9V V_s = 14V		8 10	15 18	mA
P_o	Output power	d = 10% f = 1 KHz V_s = 9V R_L = 4Ω V_s = 14V V_s = 12V V_s = 6V	 1.8 4 3.1 0.7	 2 4.5		W
d	Harmonic distortion	f = 1 KHz V_s = 9V R_L = 4Ω P_o = 50 mW to 1.2W		0.1	0.3	%
V_i	Input saturation voltage (rms)	V_s = 9V V_s = 14V	0.8 1.3			V
R_i	Input resistance (pin 8)	f = 1 KHz	55	150		KΩ
η	Efficiency	f = 1 KHz V_s = 9V R_L = 4Ω P_o = 2W V_s = 14V R_L = 4Ω P_o = 4.5W		 70 65		%
BW	Small signal bandwidth (-3 dB)	V_s = 14V R_L = 4Ω	40 to 40,000			Hz
G_v	Voltage gain (open loop)	V_s = 14V f = 1 KHz		75		dB
G_v	Voltage gain (closed loop)	V_s = 14V 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 = 10 KΩ		1.2 2	 4	μV
		R_g = 50Ω (°°) R_g = 10 KΩ		2 3		μV
SVR	Supply voltage rejection	V_s = 12V f_{ripple} = 100 Hz R_g = 10 KΩ V_{ripple} = 0.5Vrms	40	50		dB
T_{sd}	Thermal shut-down case temperature	P_{tot} = 2W		120		°C

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

Fig. 1 - Test and application circuit

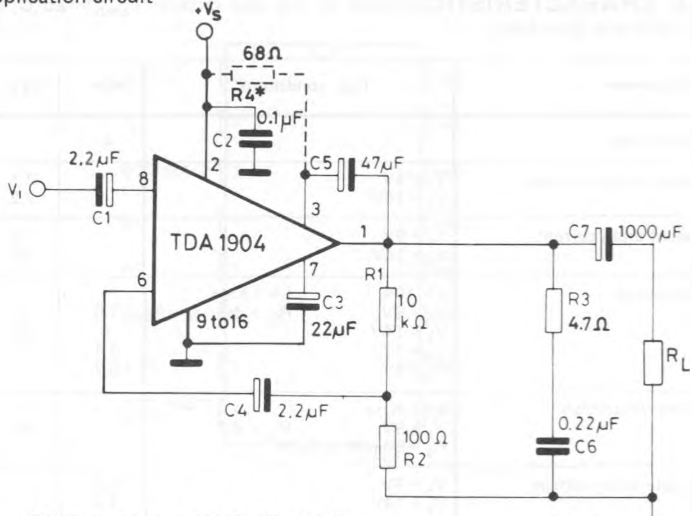
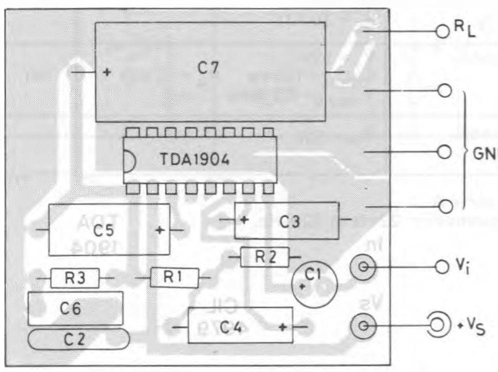


Fig. 2 - P.C. board and components layout of fig. 1 (1 : 1 scale)



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 6V, a 68Ω 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	Recomm. value	Purpose	Larger than recommended value	Smaller than recommended value	Allowed range	
					Min.	Max.
R1	10 KΩ	Feedback resistors	Increase of gain.	Decrease of gain. Increase quiescent current.	9 R3	
R2	100 Ω		Decrease of gain.	Increase of gain.		1 KΩ
R3	4.7 Ω	Frequency stability	Danger of oscillation at high frequencies with inductive loads.			
R4	68 Ω	Increase of the output swing with low supply voltage.			39 Ω	220 Ω
C1	2.2 µF	Input DC decoupling.	Higher cost lower noise.	Higher low frequency cutoff. Higher noise.		
C2	0.1 µF	Supply voltage bypass.		Danger of oscillations.		
C3	22 µF	Ripple rejection	Increase of SVR increase of the switch-on time.	Degradation of SVR.	2.2 µF	100µF
C4	2.2 µF	Inverting input DC decoupling.	Increase of the switch-on noise	Higher low frequency cutoff.	0.1 µF	
C5	47 µF	Bootstrap.		Increase of the distortion at low frequency.	10 µF	100µF
C6	0.22 µF	Frequency stability.		Danger of oscillation.		
C7	1000 µF	Output DC decoupling.		Higher low frequency cutoff.		

Fig. 3 - Quiescent output voltage vs. supply voltage

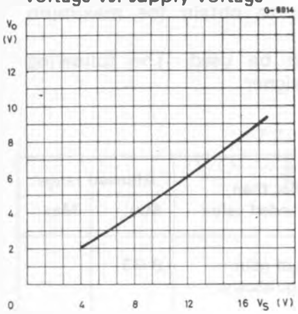


Fig. 4 - Quiescent drain current vs. supply voltage

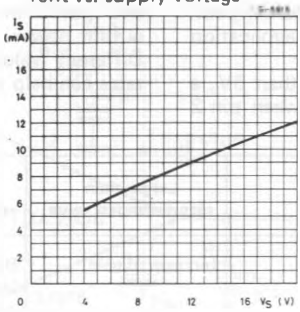


Fig. 5 - Output power vs. supply voltage

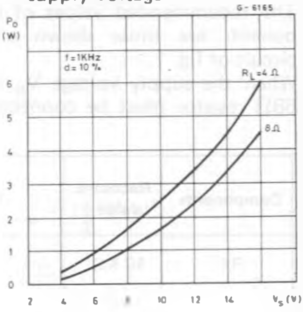


Fig. 6 - Distortion vs. output power

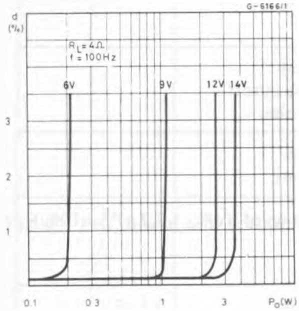


Fig. 7 - Distortion vs. output power

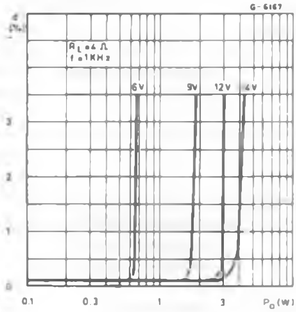


Fig. 8 - Distortion vs. output power

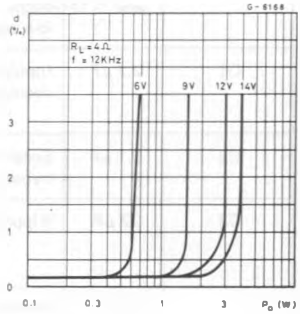


Fig. 9 - Distortion vs. output power

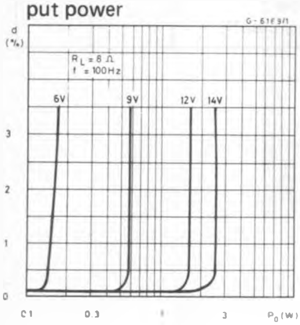


Fig. 10 - Distortion vs. output power

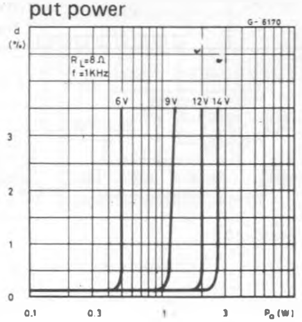


Fig. 11 - Distortion vs. output power

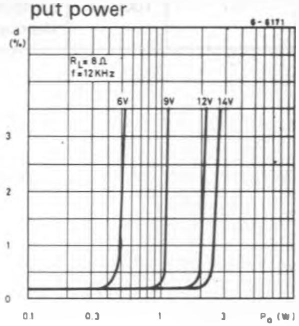


Fig. 12 - Distortion vs. frequency

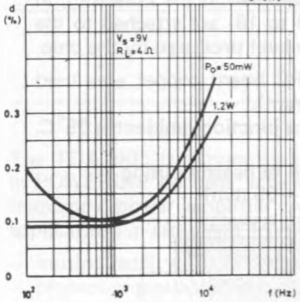


Fig. 13 - Distortion vs. frequency

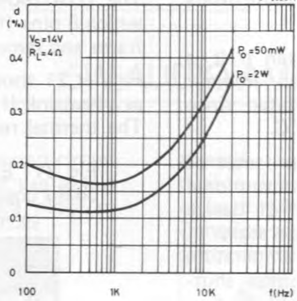


Fig. 14 - Distortion vs. frequency

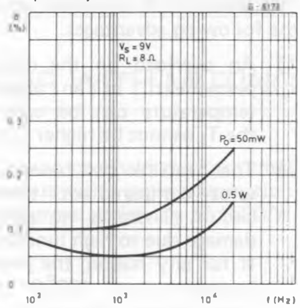


Fig. 15 - Distortion vs. frequency

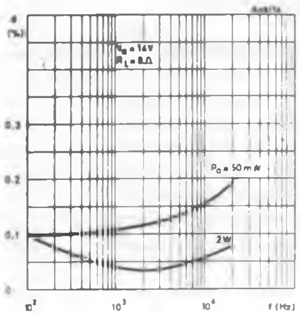


Fig. 16 - Supply voltage rejection vs. frequency

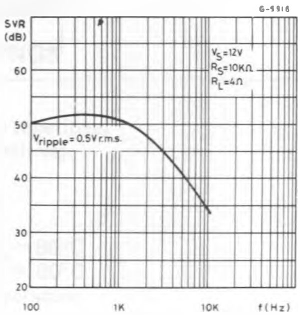


Fig. 17 - Total power dissipation and efficiency vs. output power

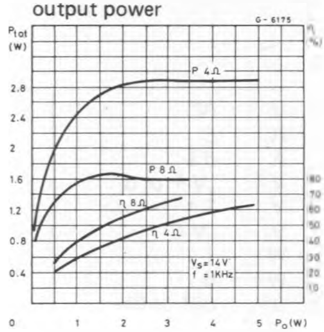


Fig. 18 - Total power dissipation vs. output power

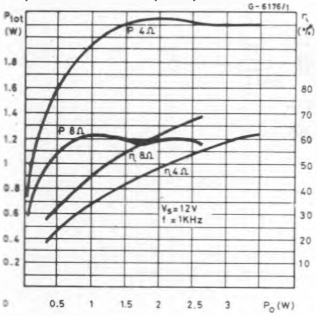


Fig. 19 - Total power dissipation vs. output power

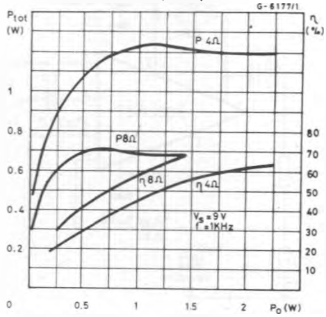
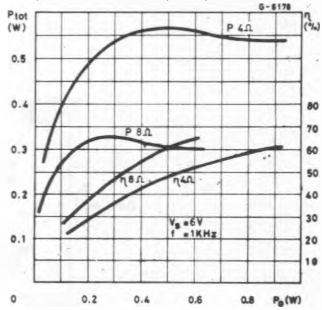


Fig. 20 - Total power dissipation vs. output power



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 INSCTRUCTION

The TDA 1904 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.

Fig. 21 - Example of heatsink using PC board copper (l = 65 mm)