

## 1 to 4W audio amplifier with preamplifier

## TDA1015

The TDA1015 is a monolithic integrated audio amplifier circuit in a 9-lead single in-line (SIL) plastic package. The device is especially designed for portable radio and recorder applications and delivers up to 4 W in a 4  $\Omega$  load impedance. The very low applicable supply voltage of 3,6 V permits 6 V applications.

Special features are:

- single in-line (SIL) construction for easy mounting
- separated preamplifier and power amplifier
- high output power
- thermal protection
- high input impedance
- low current drain
- limited noise behaviour at radio frequencies

## QUICK REFERENCE DATA

Supply voltage range	$V_p$	3,6 to 18 V
Peak output current	$I_{OM}$	max. 2,5 A
Output power at $d_{tot} = 10\%$		
$V_p = 12\text{ V}; R_L = 4\ \Omega$	$P_o$	typ. 4,2 W
$V_p = 9\text{ V}; R_L = 4\ \Omega$	$P_o$	typ. 2,3 W
$V_p = 6\text{ V}; R_L = 4\ \Omega$	$P_o$	typ. 1,0 W
Total harmonic distortion at $P_o = 1\text{ W}; R_L = 4\ \Omega$	$d_{tot}$	typ. 0,3 %
Input impedance		
preamplifier (pin 8)	$ Z_i $	> 100 k $\Omega$
power amplifier (pin 6)	$ Z_i $	typ. 20 k $\Omega$
Total quiescent current	$I_{tot}$	typ. 14 mA
Operating ambient temperature	$T_{amb}$	-25 to + 150 $^{\circ}\text{C}$
Storage temperature	$T_{stg}$	-55 to + 150 $^{\circ}\text{C}$

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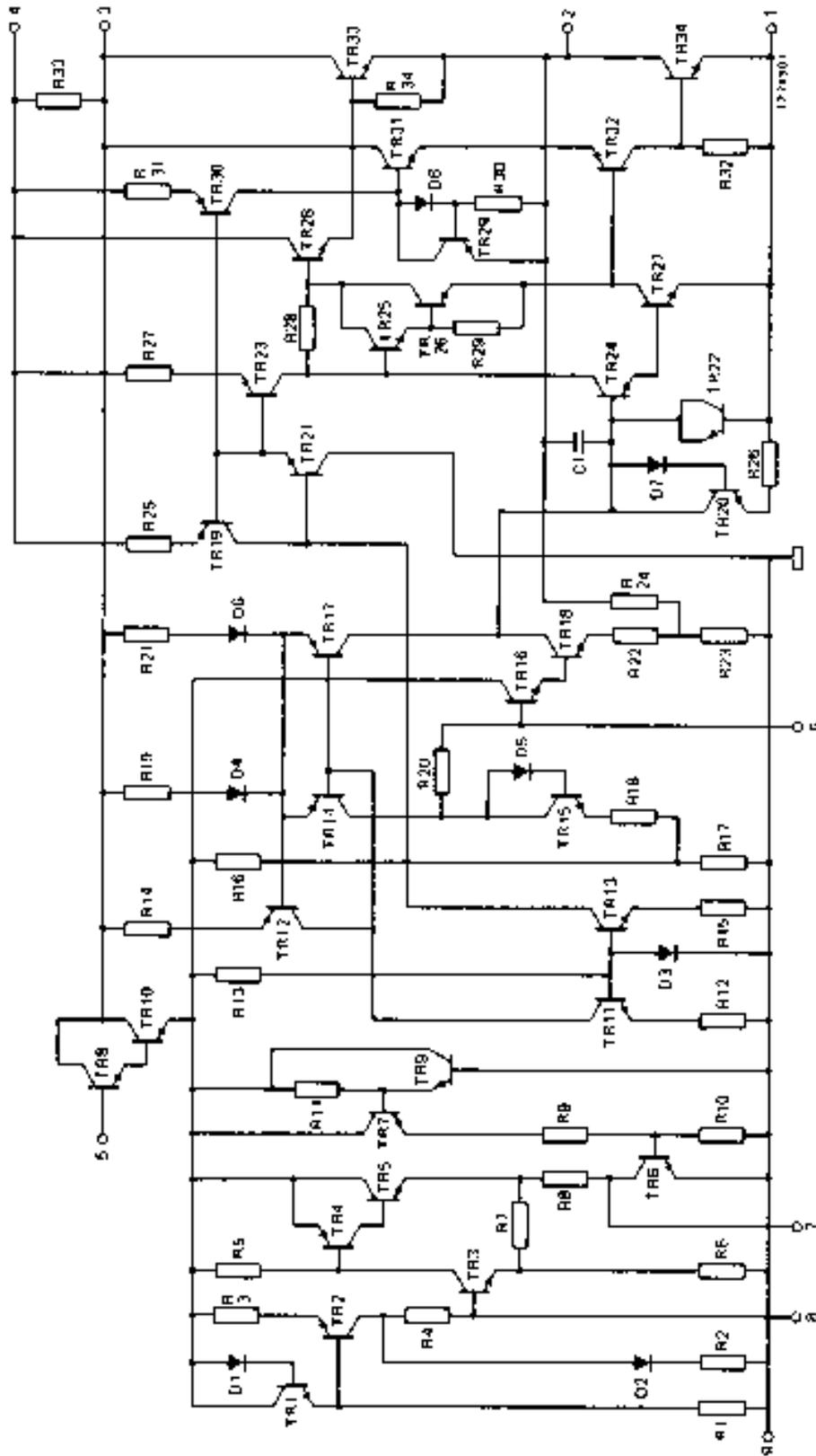


Fig. 1 Circuit diagram.

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## RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage	$V_p$	max.	18 V
Peak output current	$I_{OM}$	max.	2,5 A
Total power dissipation	see derating curve Fig. 2		
Storage temperature	$T_{stg}$	-55 to + 150 °C	
Operating ambient temperature	$T_{amb}$	-25 to + 150 °C	
A.C. short-circuit duration of load during sine-wave drive; $V_p = 12$ V	$t_{sc}$	max.	100 hours

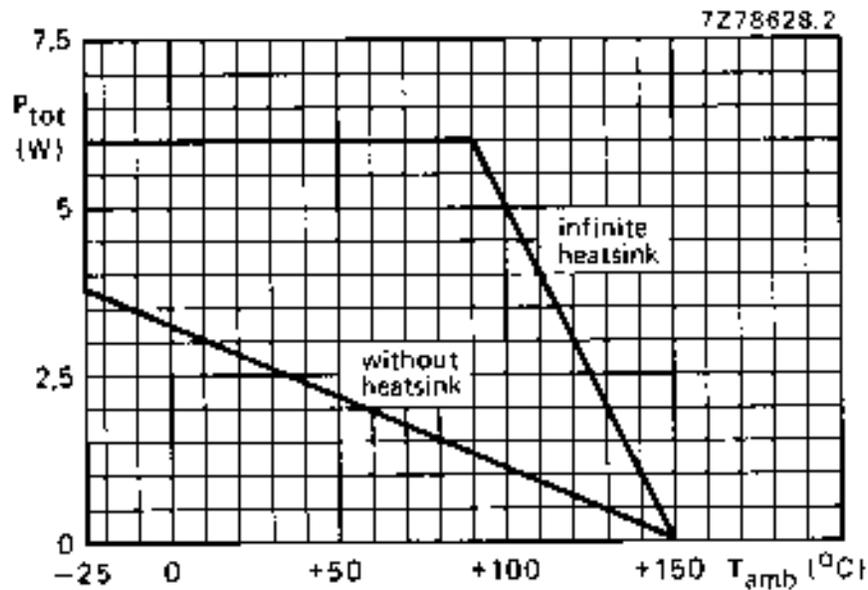


Fig. 2 Power derating curve.

## HEATSINK DESIGN

Assume  $V_p = 12$  V;  $R_L = 4 \Omega$ ;  $T_{amb} = 45$  °C maximum.

The maximum sine-wave dissipation is 1,8 W.

$$R_{thj-a} = R_{thj-tab} + R_{th tab-h} + R_{th h-a} = \frac{150 - 45}{1,8} = 58 \text{ K/W.}$$

Where  $R_{thj-a}$  of the package is 45 K/W, so no external heatsink is required.

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**D.C. CHARACTERISTICS**

Supply voltage range	$V_P$	3,6 to 18 V
Repetitive peak output current	$I_{ORM}$	< 2 A
Total quiescent current at $V_P = 12$ V	$I_{tot}$	typ. 14 mA < 25 mA

**A.C. CHARACTERISTICS**

$T_{amb} = 25$  °C;  $V_P = 12$  V;  $R_L = 4$   $\Omega$ ;  $f = 1$  kHz unless otherwise specified; see also Fig. 3.

A.F. output power at  $d_{tot} = 10\%$  (note 1)

with bootstrap:

$V_P = 12$  V;  $R_L = 4$   $\Omega$   $P_O$  typ. 4,2 W

$V_P = 9$  V;  $R_L = 4$   $\Omega$   $P_O$  typ. 2,3 W

$V_P = 6$  V;  $R_L = 4$   $\Omega$   $P_O$  typ. 1,0 W

without bootstrap:

$V_P = 12$  V;  $R_L = 4$   $\Omega$   $P_O$  typ. 3,0 W

Voltage gain:

preamplifier (note 2)  $G_{V1}$  typ. 23 dB

power amplifier  $G_{V2}$  typ. 29 dB

total amplifier  $G_{V\ tot}$  typ. 52 dB  
49 to 55 dB

Total harmonic distortion at  $P_O = 1,5$  W

$d_{tot}$  typ. 0,3 %  
< 1,0 %

Frequency response; -3 dB (note 3)

$B$  60 Hz to 15 kHz

Input impedance:

preamplifier (note 4)  $|Z_{i1}|$  > 100 k $\Omega$   
typ. 200 k $\Omega$

power amplifier  $|Z_{i2}|$  typ. 20 k $\Omega$

Output impedance preamplifier  $|Z_{o1}|$  typ. 1 k $\Omega$

Output voltage preamplifier (r.m.s. value)

$d_{tot} < 1\%$  (note 2)  $V_{O(rms)}$  typ. 0,8 V

Noise output voltage (r.m.s. value; note 5)

$R_S = 0$   $\Omega$   $V_{n(rms)}$  typ. 0,2 mV

$R_S = 10$  k $\Omega$   $V_{n(rms)}$  typ. 0,5 mV

Noise output voltage at  $f = 500$  kHz (r.m.s. value)

$B = 5$  kHz;  $R_S = 0$   $\Omega$   $V_{n(rms)}$  typ. 8  $\mu$ V

Ripple rejection (note 6)

$f = 100$  Hz  $RR$  typ. 38 dB

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### Notes

1. Measured with an ideal coupling capacitor to the speaker load.
2. Measured with a load resistor of 20 kΩ.
3. Measured at  $P_D = 1\text{ W}$ ; the frequency response is mainly determined by C1 and C3 for the low frequencies and by C4 for the high frequencies.
4. Independent of load impedance of preamplifier.
5. Unweighted r.m.s. noise voltage measured at a bandwidth of 60 Hz to 15 kHz (12 dB/octave).
6. Ripple rejection measured with a source impedance between 0 and 2 kΩ (maximum ripple amplitude : 2 V).
7. The tab must be electrically floating or connected to the substrate (pin 9).

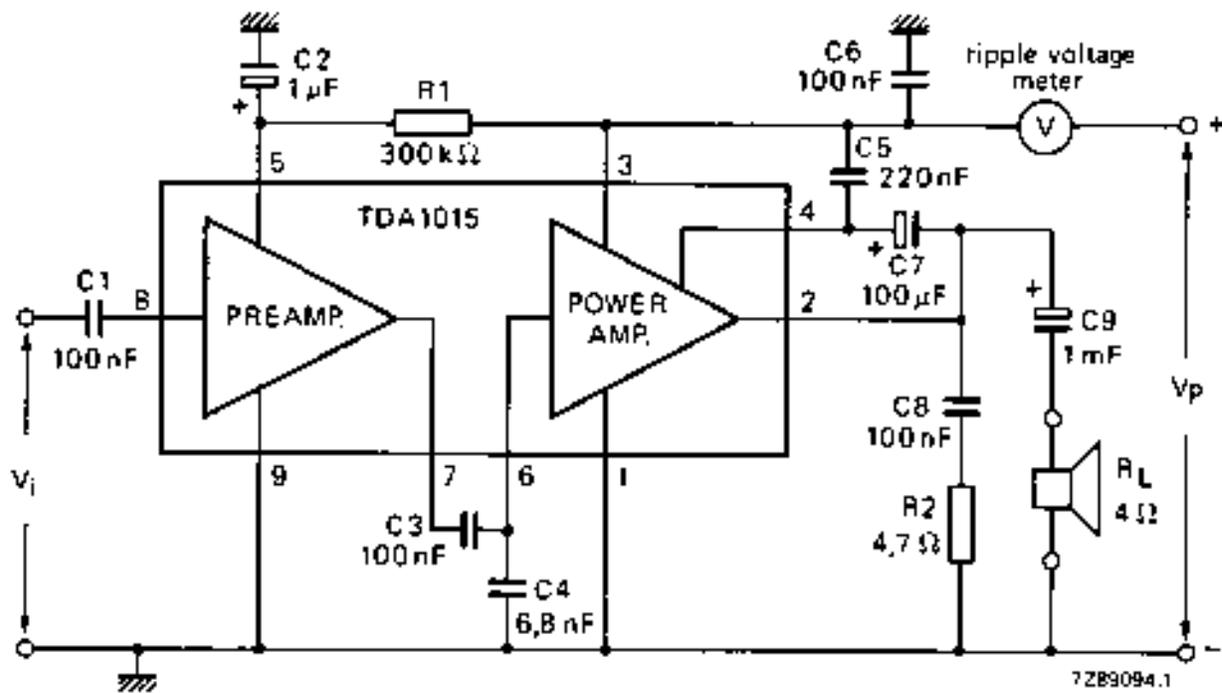


Fig. 3 Test circuit.

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## APPLICATION INFORMATION

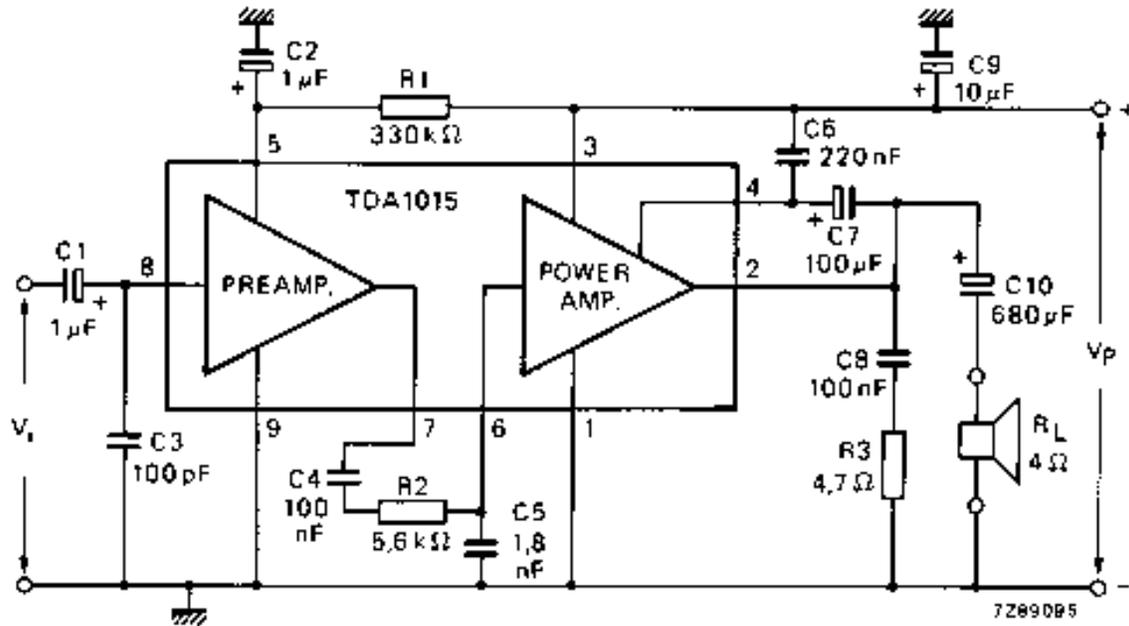


Fig. 4 Circuit diagram of a 1 to 4 W amplifier.

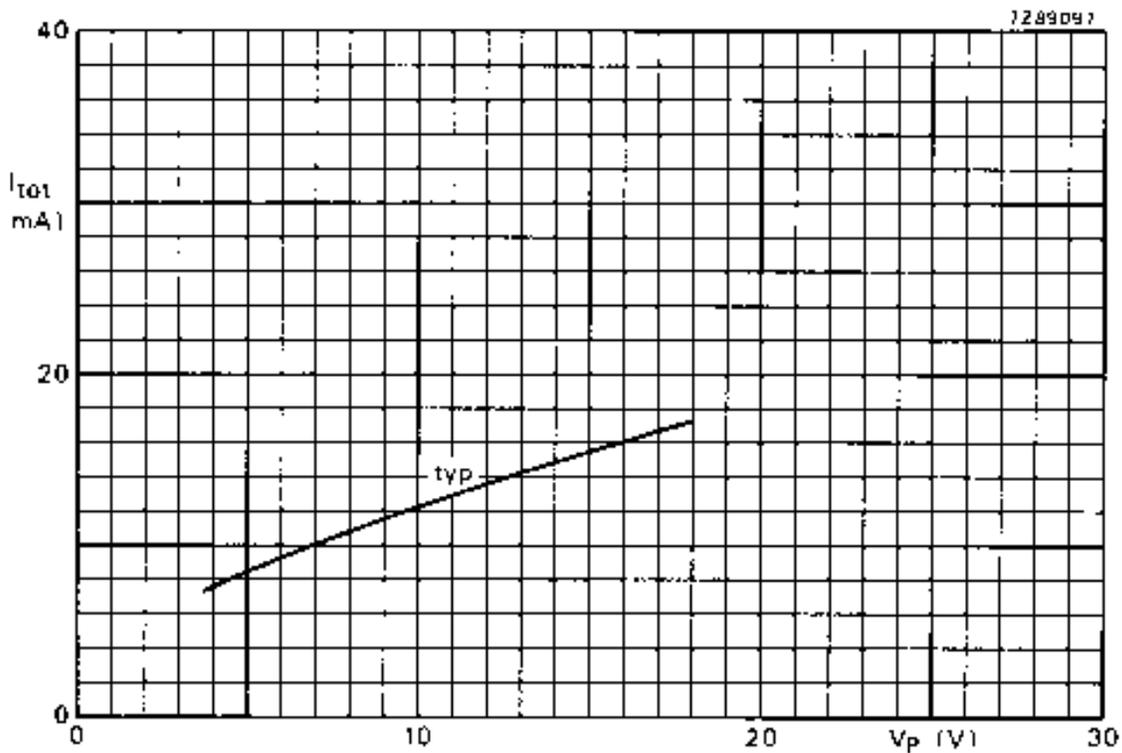


Fig. 5 Total quiescent current as a function of supply voltage.

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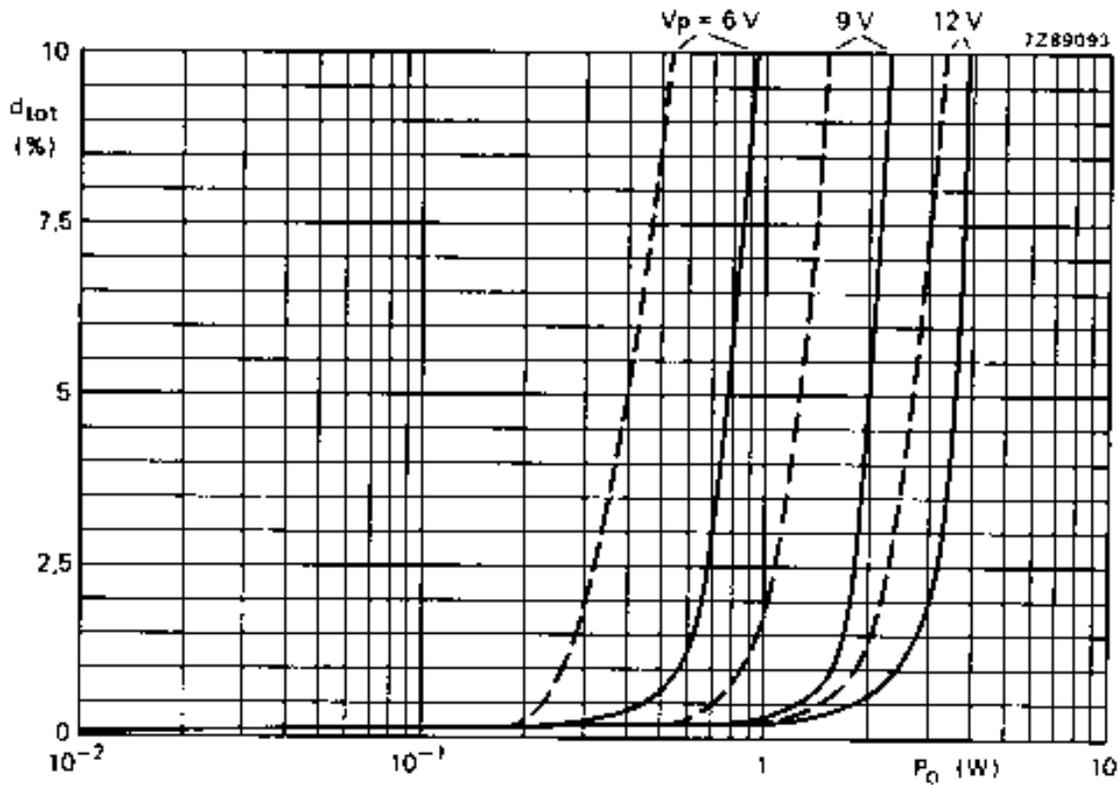


Fig. 6 Total harmonic distortion as a function of output power across  $R_L$ : — with bootstrap; - - - without bootstrap;  $f = 1$  kHz; typical values. The available output power is 5% higher when measured at pin 2 (due to series resistance of C10).

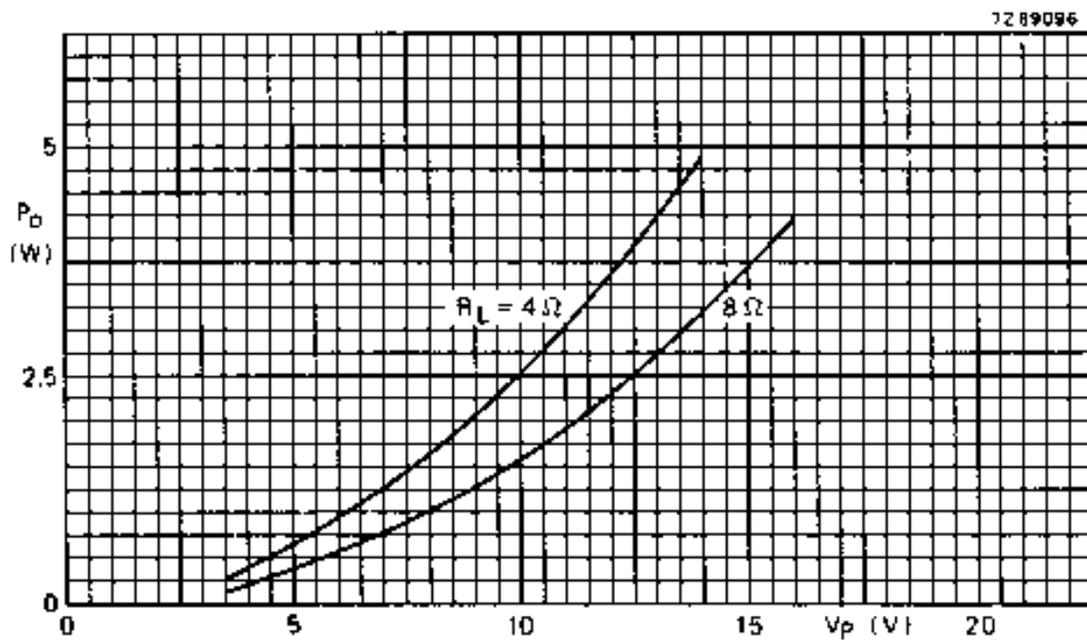


Fig. 7 Output power across  $R_L$  as a function of supply voltage with bootstrap;  $d_{tot} = 10\%$ ; typical values. The available output power is 5% higher when measured at pin 2 (due to series resistance of C10).

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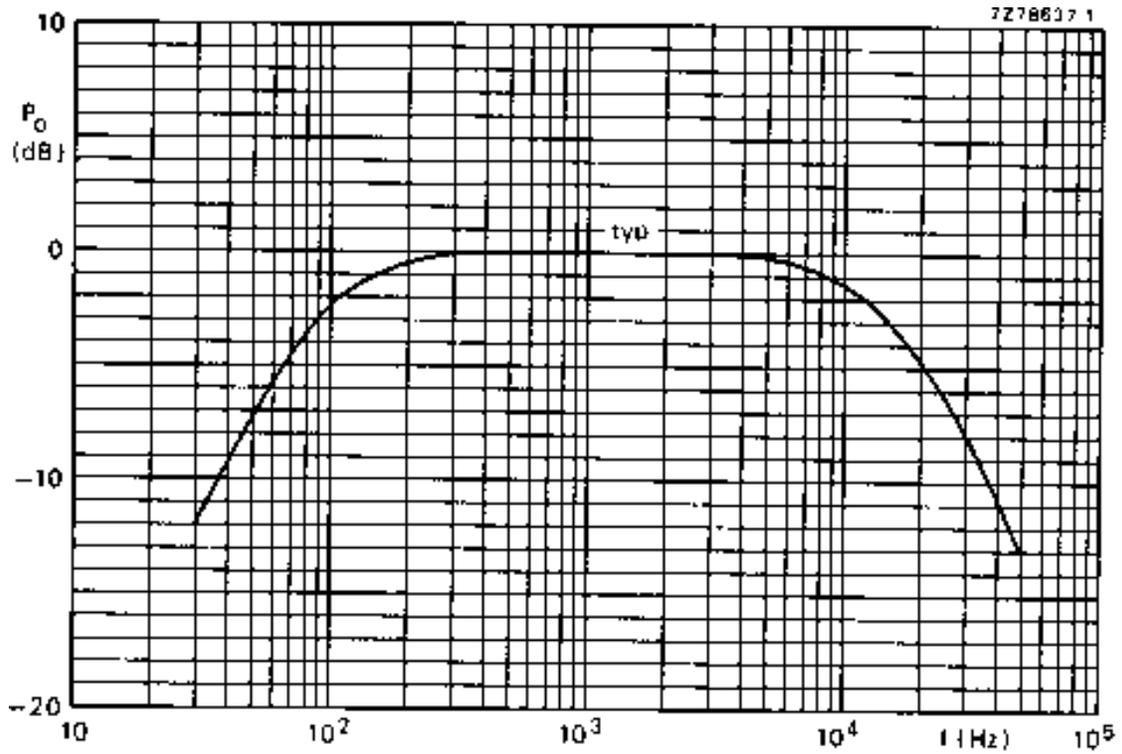


Fig. 8 Voltage gain as a function of frequency;  $P_O$  relative to 0 dB = 1 W;  $V_p = 12$  V;  $R_L = 4 \Omega$ .

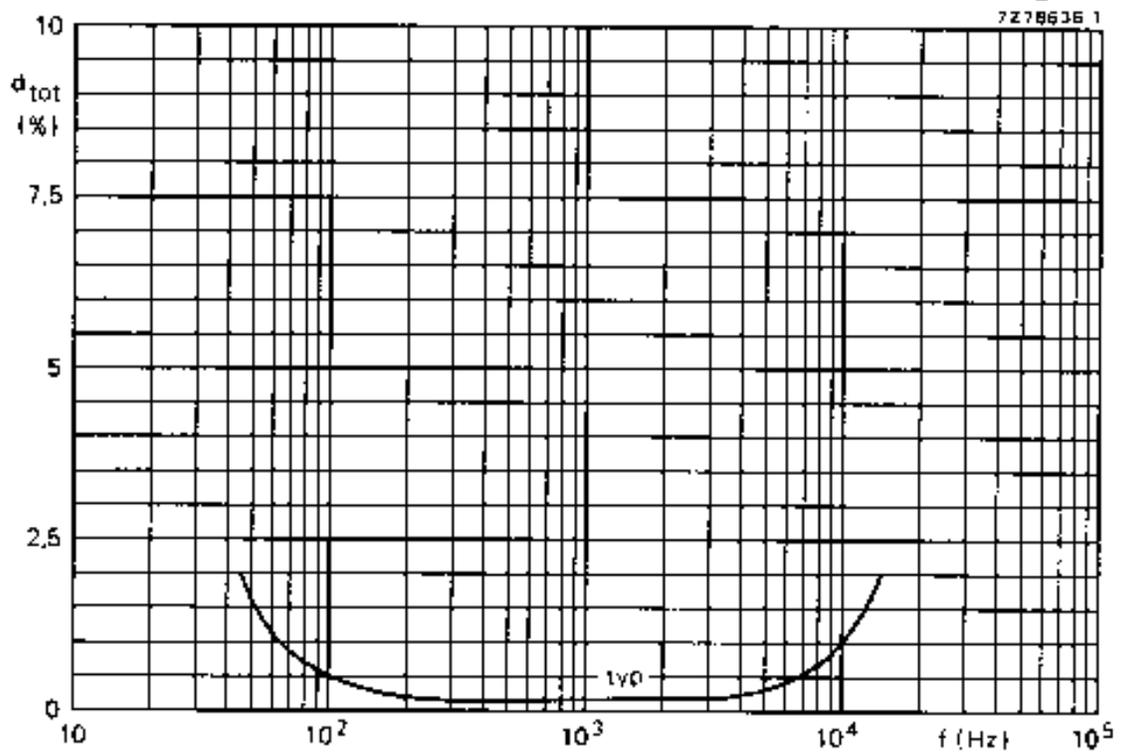


Fig. 9 Total harmonic distortion as a function of frequency;  $P_O = 1$  W;  $V_p = 12$  V;  $R_L = 4 \Omega$ .

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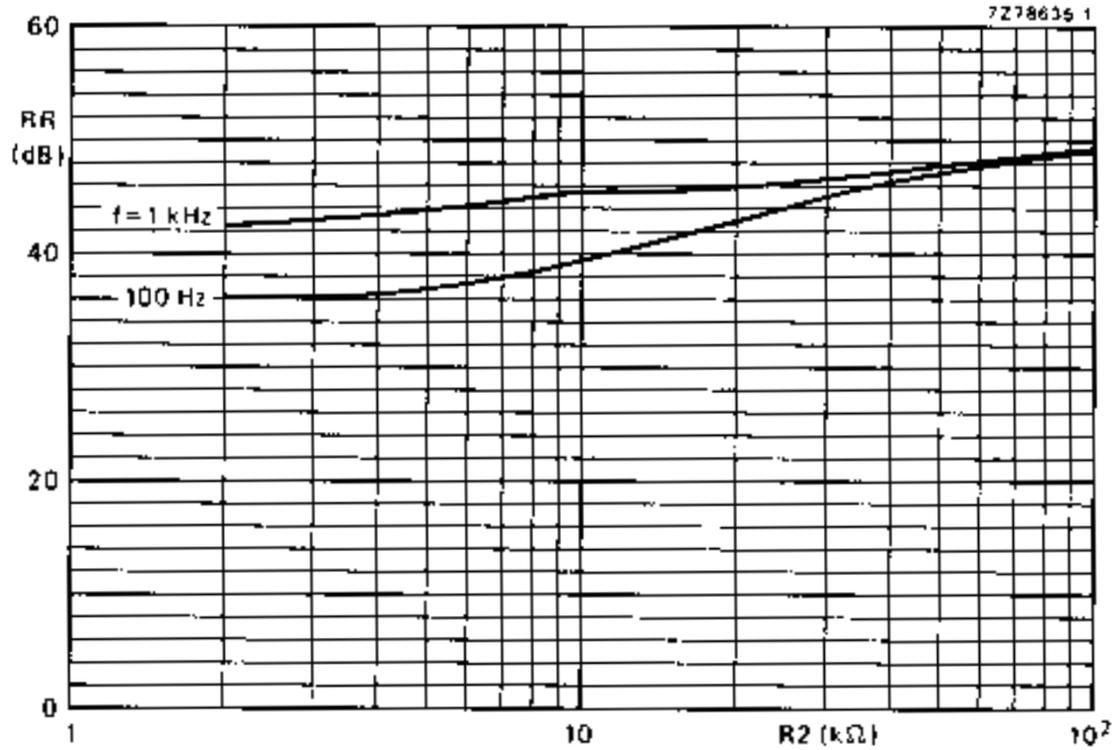


Fig. 10 Ripple rejection as a function of R2 (see Fig. 4);  $R_S = 0$ ; typical values.

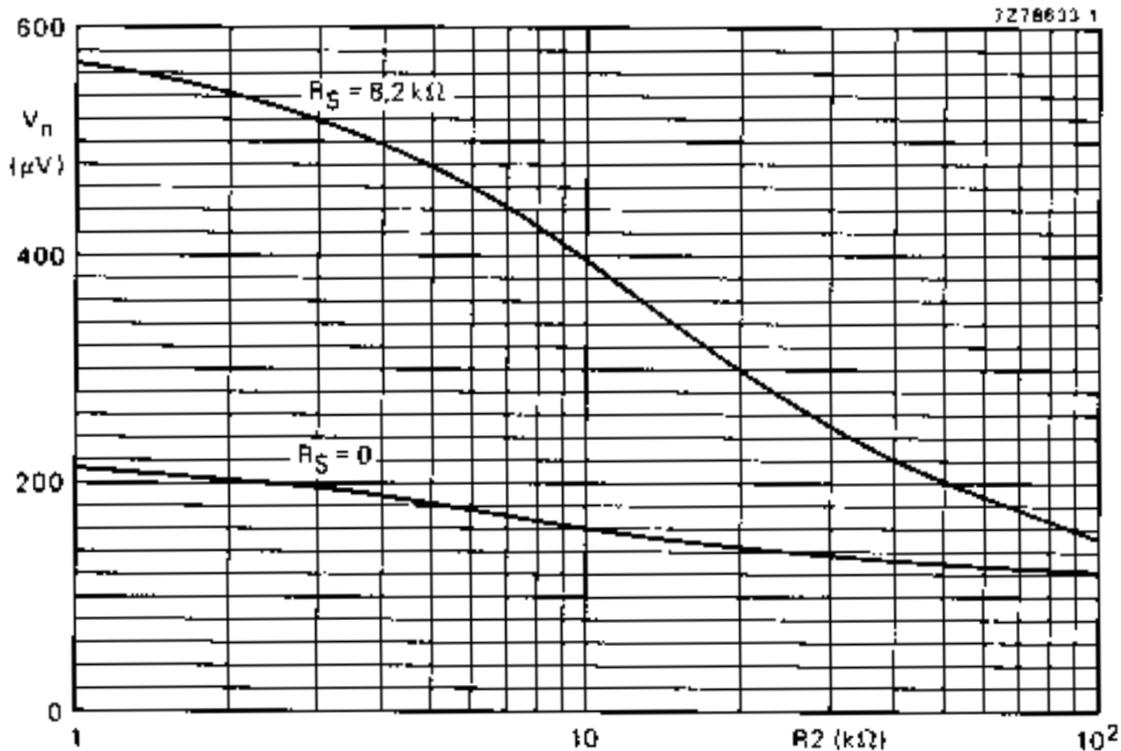


Fig. 11 Noise output voltage as a function of R2 (see Fig. 4); measured according to A-curve; capacitor C5 is adapted for obtaining a constant bandwidth.

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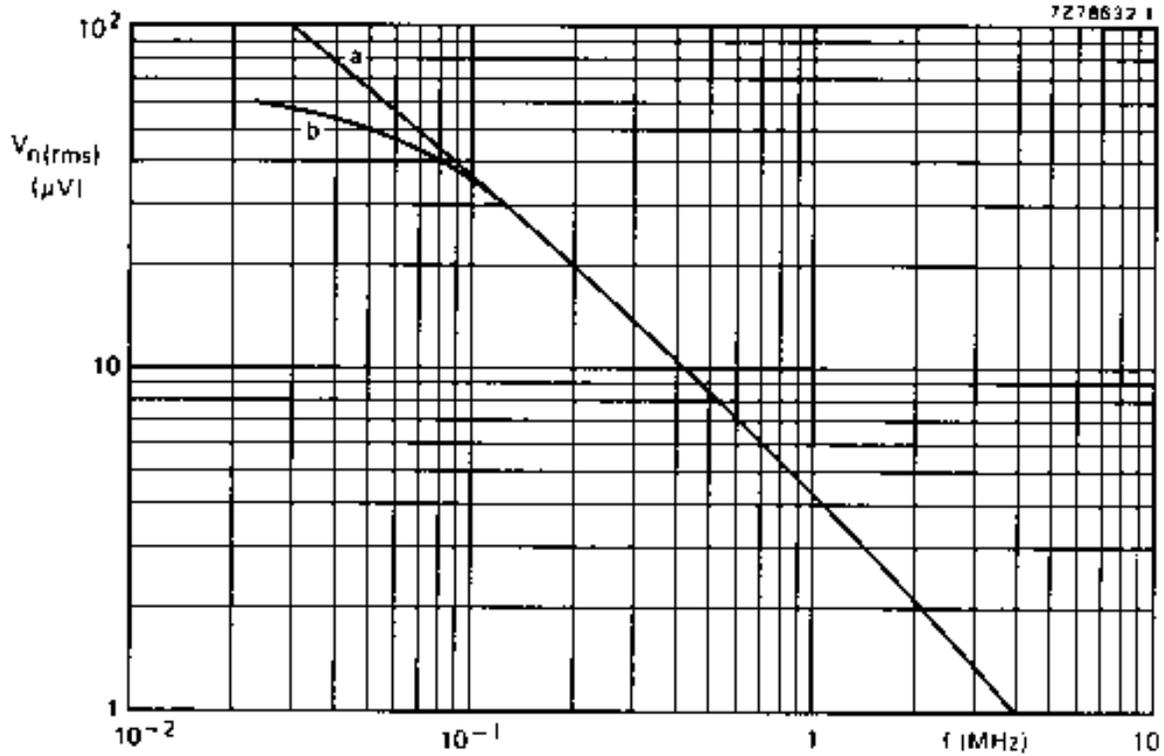


Fig. 12 Noise output voltage as a function of frequency; curve a: total amplifier; curve b: power amplifier;  $B = 5 \text{ kHz}$ ;  $R_S = 0$ ; typical values.

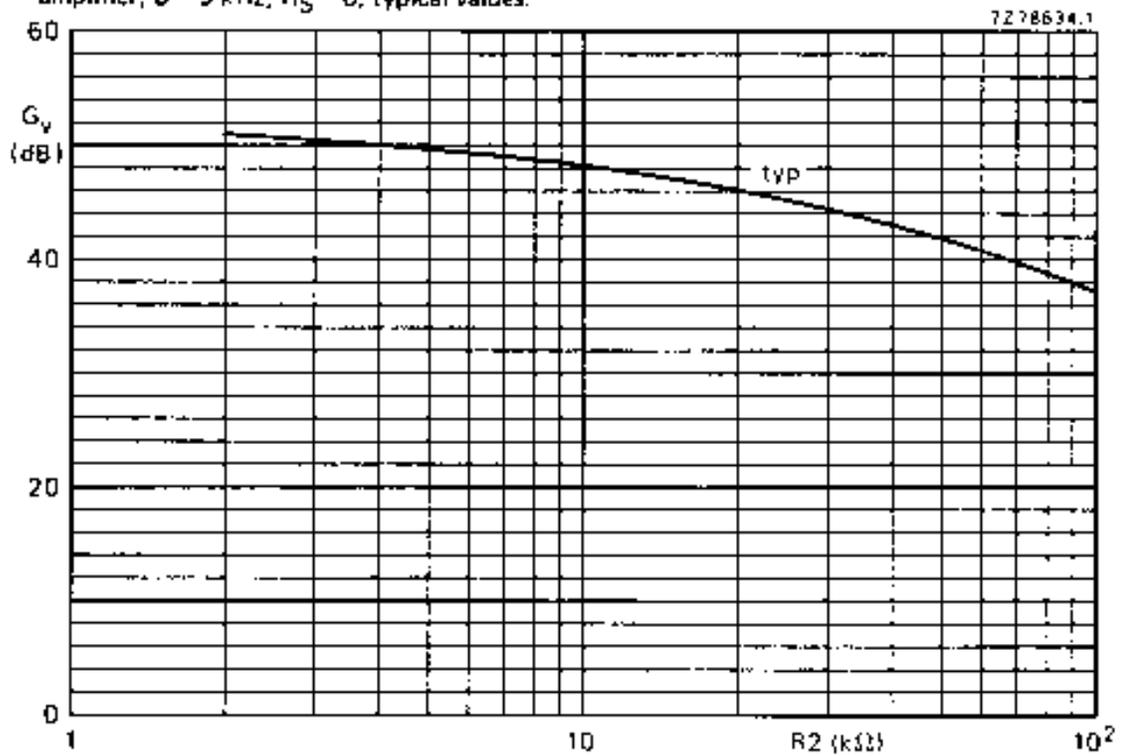


Fig. 13 Voltage gain as a function of  $R_2$  (see Fig. 4).