DATA SHEET

TDA1011
2 to 6 W audio power amplifier

Product specification
File under Integrated Circuits, IC01

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Philips Semiconductors

PHILIPS

The TDA1011 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 Ω load impedance. The device can deliver up to 6 W into 4 Ω at 16 V loaded supply in mains-fed applications. The maximum permissible supply voltage of 24 V makes this circuit very suitable for d.c. and a.c. apparatus, while 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 20	V
Peak output current	I_{OM}	max.	3	A
Output power at d_{tot} = 10%				
V_P = 16 V; R_L = 4 Ω	P_o	typ.	6,5	W
V_P = 12 V; R_L = 4 Ω	P_o	typ.	4,2	W
V_P = 9 V; R_L = 4 Ω	P_o	typ.	2,3	W
V_P = 6 V; R_L = 4 Ω	P_o	typ.	1,0	W
Total harmonic distortion at P_o = 1 W; R_L = 4 Ω	d_{tot}	typ.	0,2	%
Input impedance				
preamplifier (pin 8)	$\|Z_i\|$	>	100	kΩ
power amplifier (pin 6)	$\|Z_i\|$	typ.	20	kΩ
Total quiescent current	I_{tot}	typ.	14	mA
Operating ambient temperature	T_{amb}		–25 to + 150	°C
Storage temperature	T_{stg}		–55 to +150	°C

PACKAGE OUTLINE

9-lead SIL; plastic (SOT110B); SOT110-1; 1996 July 23.

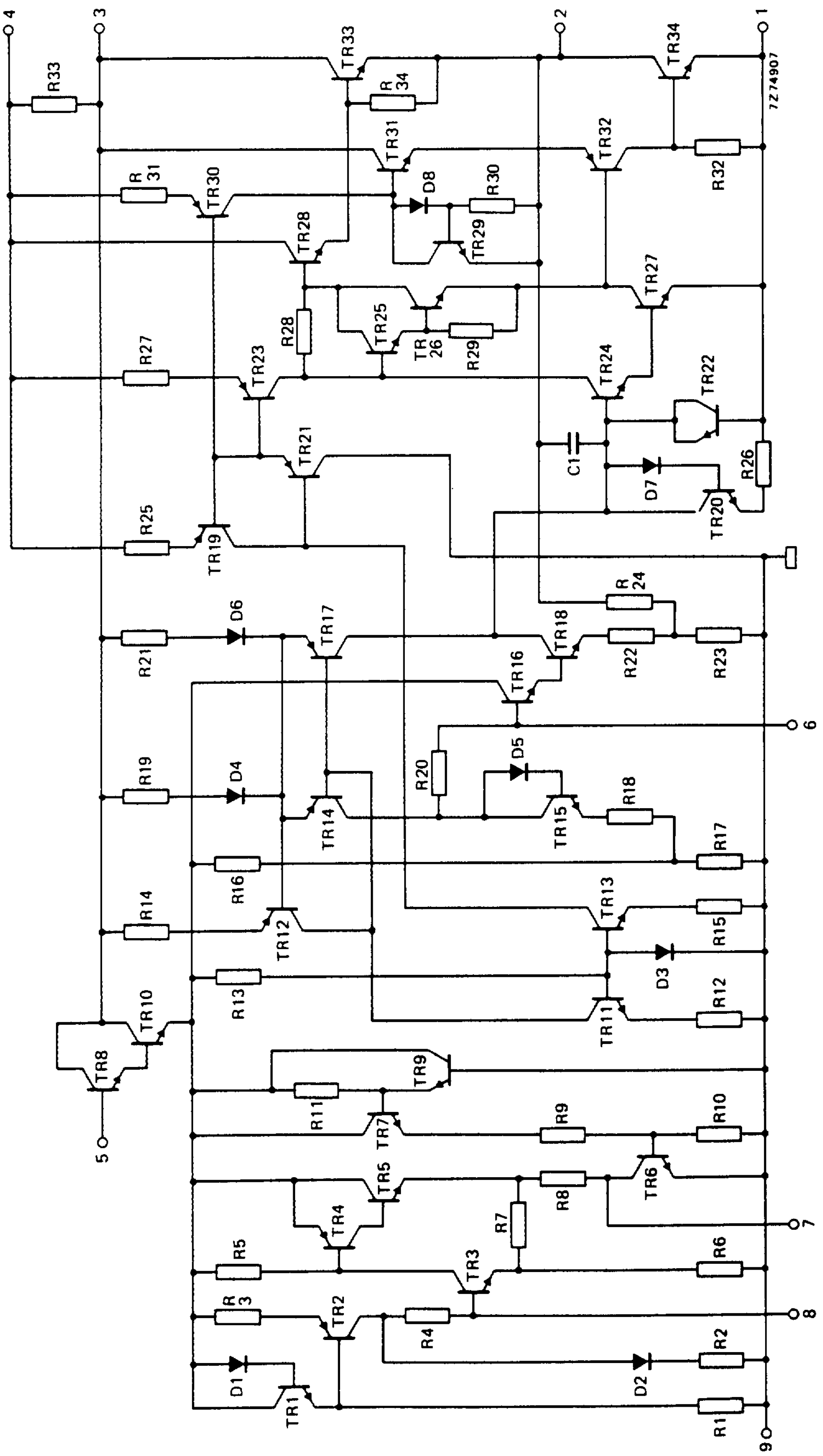

Fig.1 Circuit diagram.

RATINGS

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

Supply voltage	V_P	max.	24	V
Peak output current	I_{OM}	max.	3	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

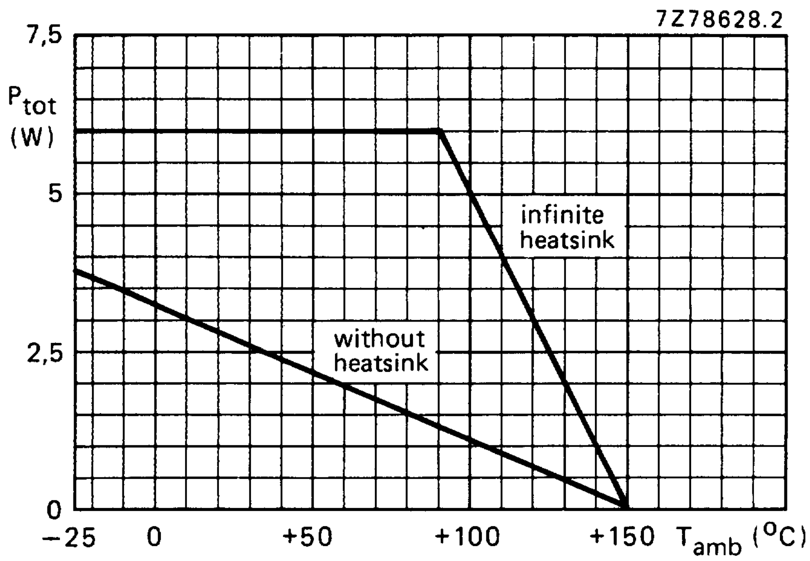

Fig.2 Power derating curve.

HEATSINK DESIGN

Assume V_P = 12 V; R_L = 4 Ω; T_{amb} = 60 °C maximum; P_o = 3,8 W.

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

The derating of 10 K/W of the package requires the following external heatsink (for sine-wave drive):

$R_{th\ j\text{-}a} = R_{th\ j\text{-}tab} + R_{th\ tab\text{-}h} + R_{th\ h\text{-}a} = \frac{150-60}{1,8} = 50$ K/W.

Since $R_{th\ j\text{-}tab}$ = 10 K/W and $R_{th\ tab\text{-}h}$ = 1 K/W, $R_{th\ h\text{-}a}$ = 50 − (10 + 1) = 39 K/W.

D.C. CHARACTERISTICS

Supply voltage range	V_P		3,6 to 20	V
Repetitive peak output current	I_{ORM}	<	2	A
Total quiescent current at V_P = 12 V	I_{tot}	typ.	14	mA
		<	22	mA

A.C. CHARACTERISTICS

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

A.F. output power at d_{tot} = 10% (note 1)				
with bootstrap:				
V_P = 16 V; R_L = 4 Ω	P_o	typ.	6,5	W
V_P = 12 V; R_L = 4 Ω	P_o	>	3,6	W
		typ.	4,2	W
V_P = 9 V; R_L = 4 Ω	P_o	typ.	2,3	W
V_P = 6 V; R_L = 4 Ω	P_o	typ.	1,0	W
without bootstrap:				
V_P = 12 V; R_L = 4 Ω	P_o	typ.	3,0	W
Voltage gain:				
preamplifier (note 2)	G_{v1}	typ.	23	dB
			21 to 25	dB
power amplifier	G_{v2}	typ.	29	dB
			27 to 31	dB
total amplifier	$G_{v\ tot}$	typ.	52	dB
			50 to 54	dB
Total harmonic distortion at P_o = 1,5 W	d_{tot}	typ.	0,3	%
		<	1	%
Frequency response; –3 dB (note 3)	B		60 Hz to 15	kHz
Input impedance:				
preamplifier (note 4)	$\|Z_{i1}\|$	>	100	kΩ
		typ.	200	kΩ
power amplifier	$\|Z_{i2}\|$	typ.	20	kΩ
Output impedance preamplifier	$\|Z_{o1}\|$	typ.	1	kΩ
Output voltage preamplifier (r.m.s. value)				
d_{tot} < 1% (note 2)	$V_{o(rms)}$	>	0,7	V
Noise output voltage (r.m.s. value; note 5)				
R_S = 0 Ω	$V_{n(rms)}$	typ.	0,2	mV
R_S = 10 kΩ	$V_{n(rms)}$	typ.	0,6	mV
		<	1,4	mV
Noise output voltage at f = 500 kHz (r.m.s. value)				
B = 5 kHz; R_S = 0 Ω	$V_{n(rms)}$	typ.	8	μV

Ripple rejection (note 6)			
f = 1 to 10 kHz	RR	typ.	42 dB
f = 100 Hz; C2 = 1 μF	RR	>	35 dB
Bootstrap current at onset of clipping; pin 4 (r.m.s. value)	$I_{4(rms)}$	typ.	35 mA

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_o = 1 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).

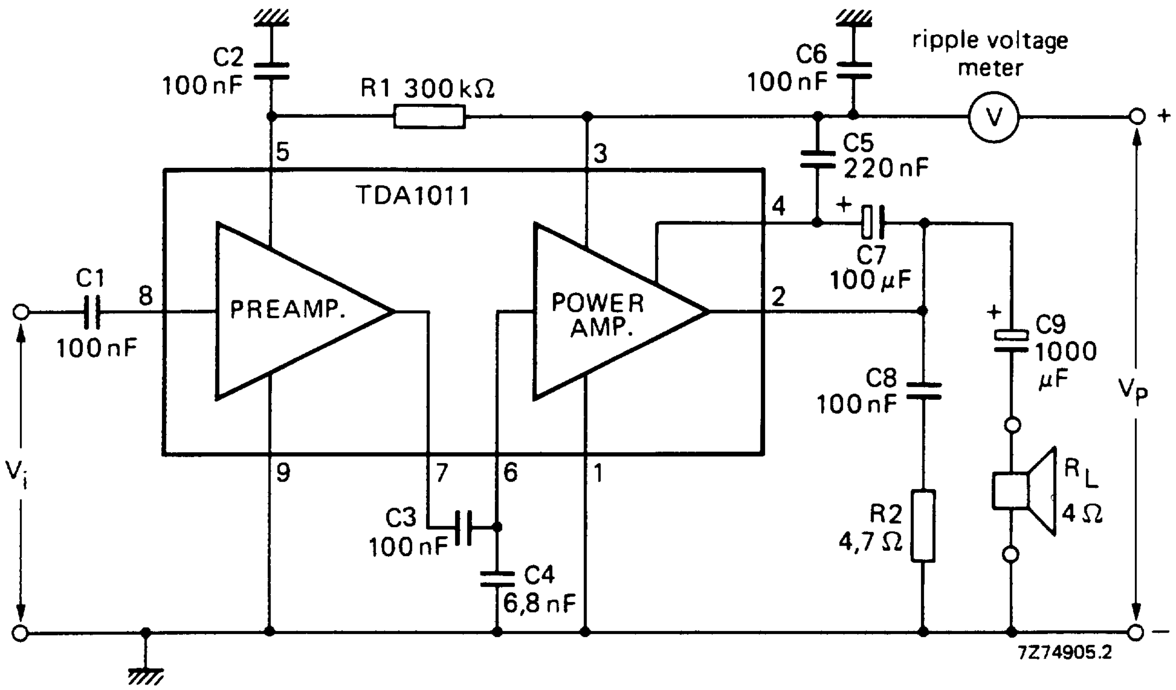

Fig.3 Test circuit.

APPLICATION INFORMATION

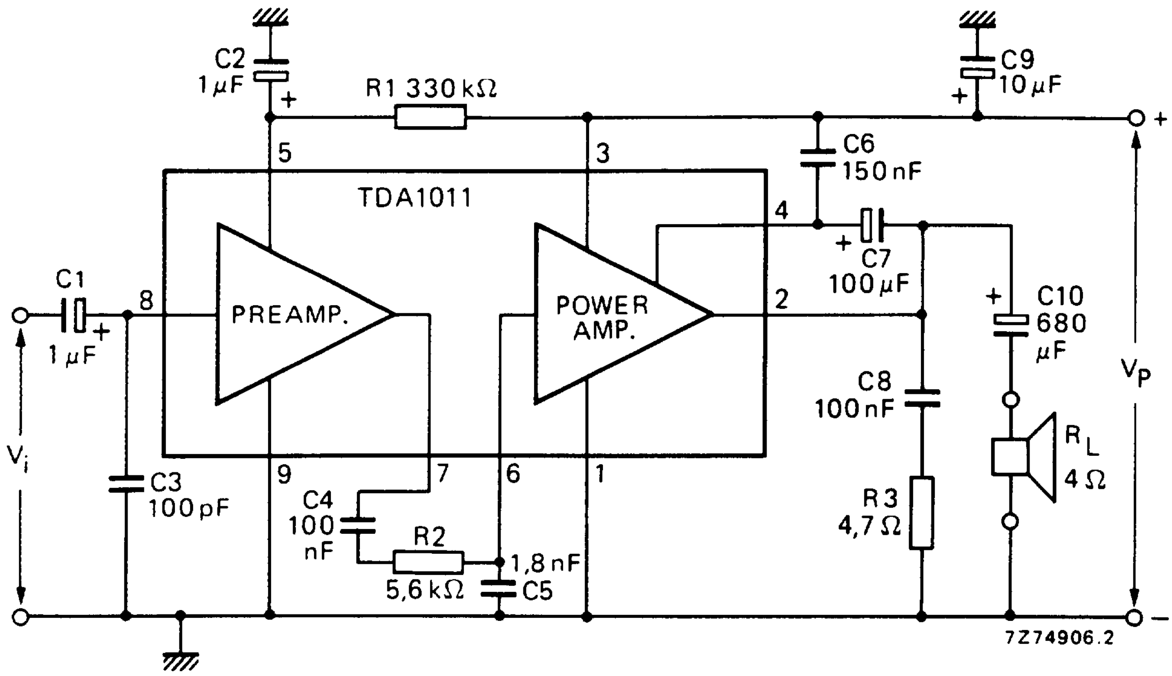

Fig.4 Circuit diagram of a 4 W amplifier.

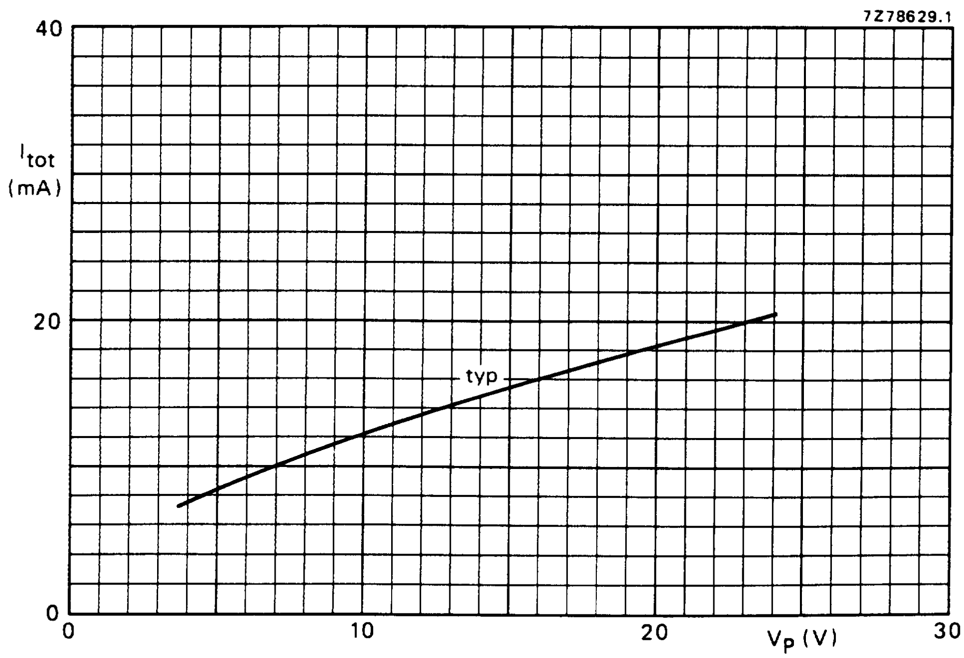

Fig.5 Total quiescent current as a function of supply voltage.

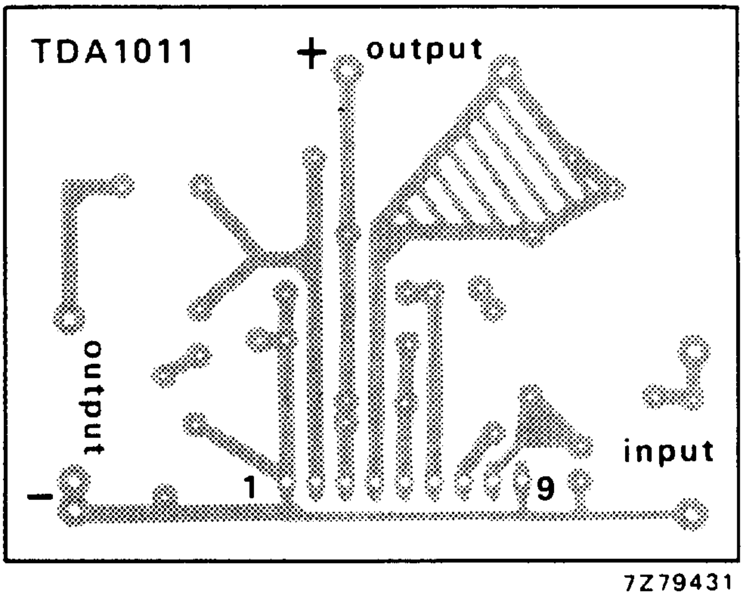

Fig.6 Track side of printed-circuit board used for the circuit of Fig.4; p.c. board dimensions 62 mm × 48 mm.

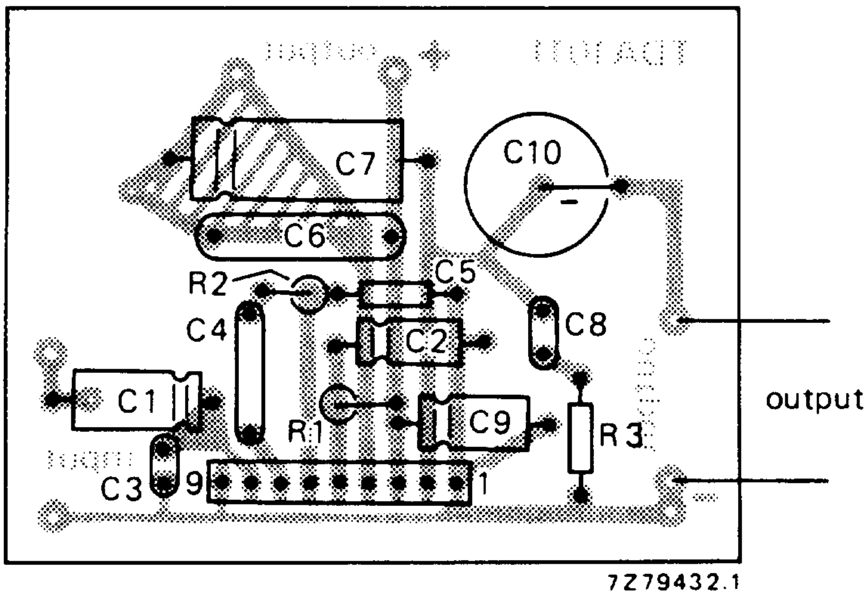

Fig.7 Component side of printed-circuit board showing component layout used for the circuit of Fig.4.

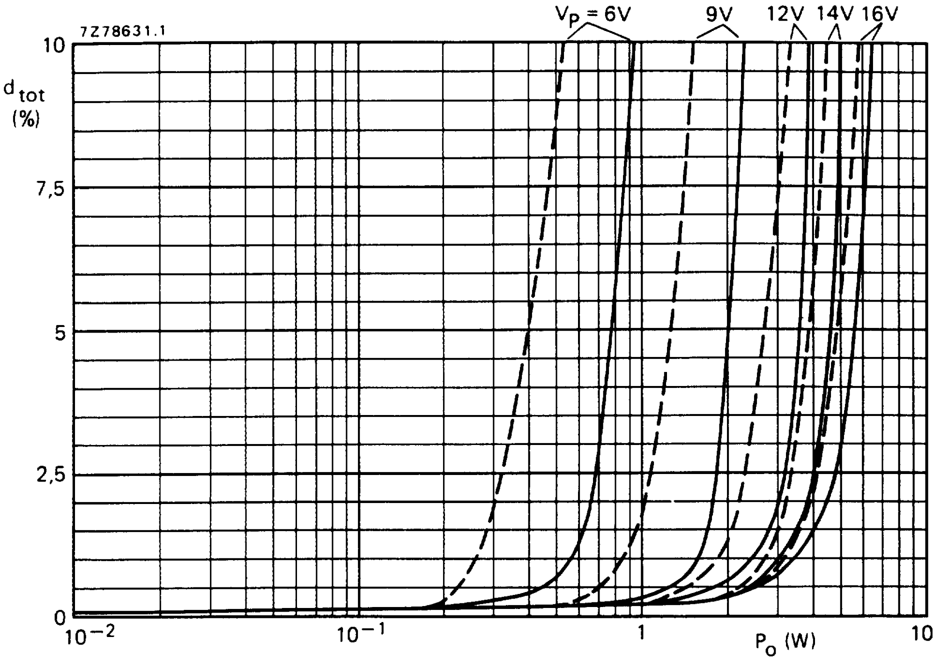

Fig.8 Total harmonic distortion as a function of output power across R_L; _____ with bootstrap; – – – without bootstrap; f = 1 kHz; typical values. The available output power is 5% higher when measured at pin 2 (due to series resistance of C10).

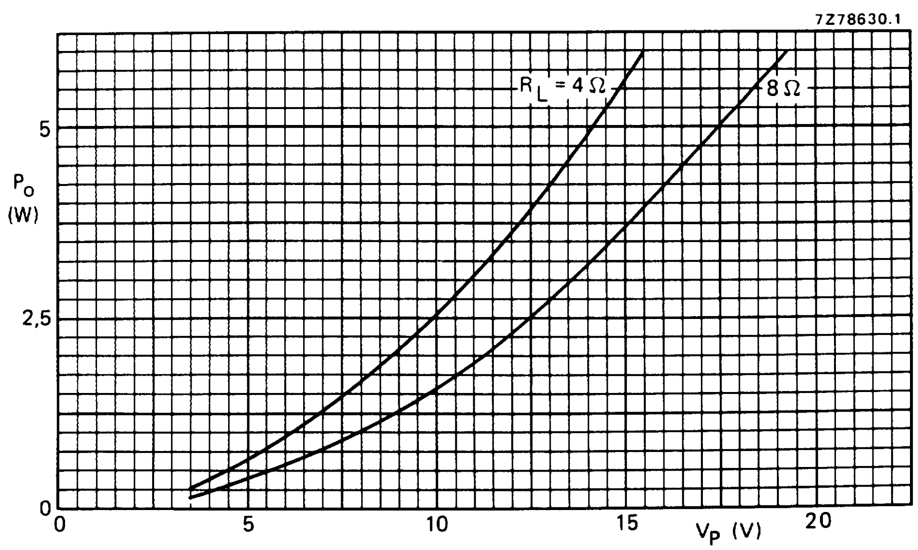

Fig.9 Output power across R_L as a function of supply voltage with bootstrap; d_{tot} = 10%; typical values. The available output power is 5% higher when measured at pin 2 (due to series resistance of C10).

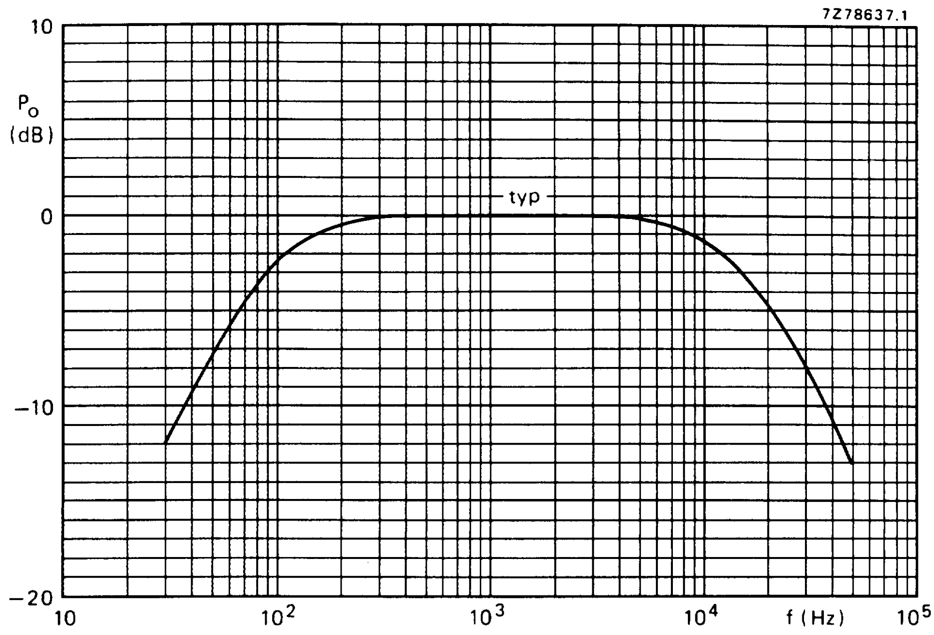

Fig.10 Voltage gain as a function of frequency; P_o relative to 0 dB = 1 W; V_P = 12 V; R_L = 4 Ω.

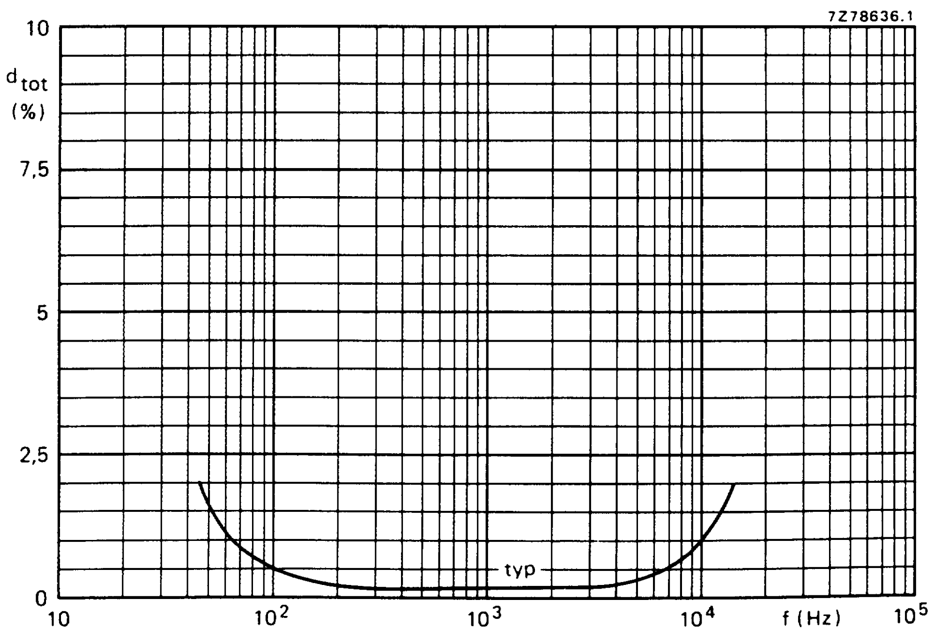

Fig.11 Total harmonic distortion as a function of frequency; P_o = 1 W; V_P = 12 V; R_L = 4 Ω.

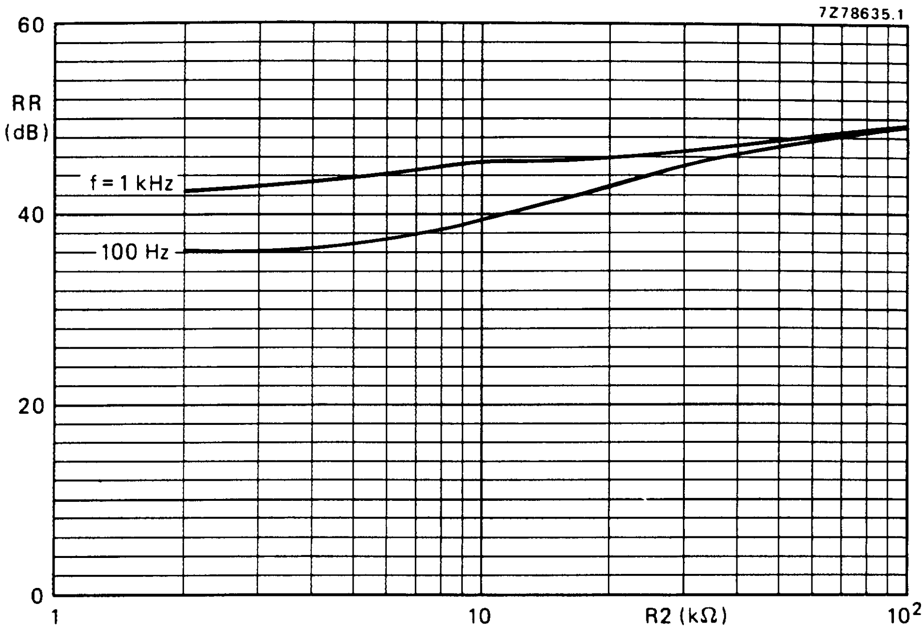

Fig.12 Ripple rejection as a function of R2 (see Fig.4); R_S = 0; typical values.

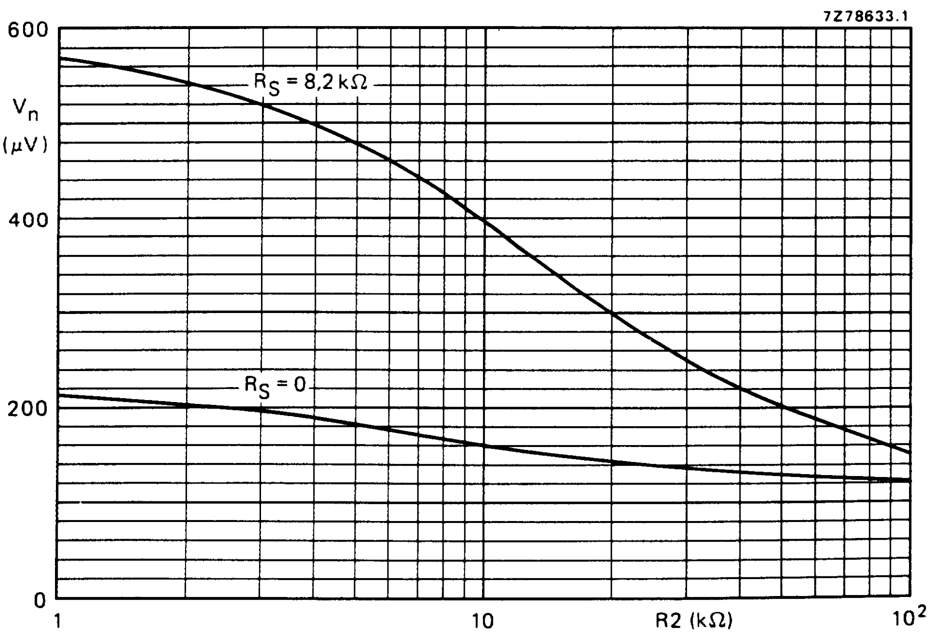

Fig.13 Noise output voltage as a function of R2 (see Fig.4); measured according to A-curve; capacitor C5 is adapted for obtaining a constant bandwidth.