SGS-THOMSON MICROELECTRONICS

TDA7232

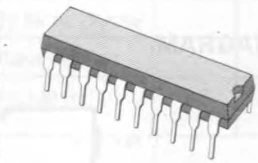
LOW NOISE PREAMPLIFIER COMPRESSOR

- SINGLE SUPPLY OPERATION (10 to 30V)
- HIGH SUPPLY VOLTAGE REJECTION
- COMPRESSOR FACILITY
- VERY LOW NOISE AND DISTORTION
- HIGH COMMON MODE REJECTION
- SHORT CIRCUIT PROTECTION

The TDA 7232 is a preamplifier mainly intended for car-radio applications, requiring very low noise and distortion performance.

It consists of a unity gain differential input amplifier with a very high common mode rejection, a compressor wich avoids the output clipping and three multipurpose operational amplifiers.

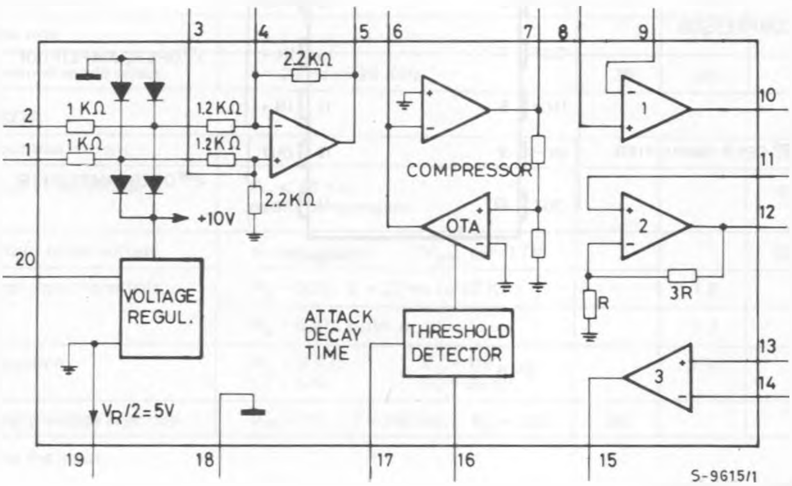
A high stability voltage regulator is also included. The TDA 7232 is assembled in a 20 lead dual in line plastic package.



DIP-20 Plastic
(0.4)

ORDER CODE: TDA 7232

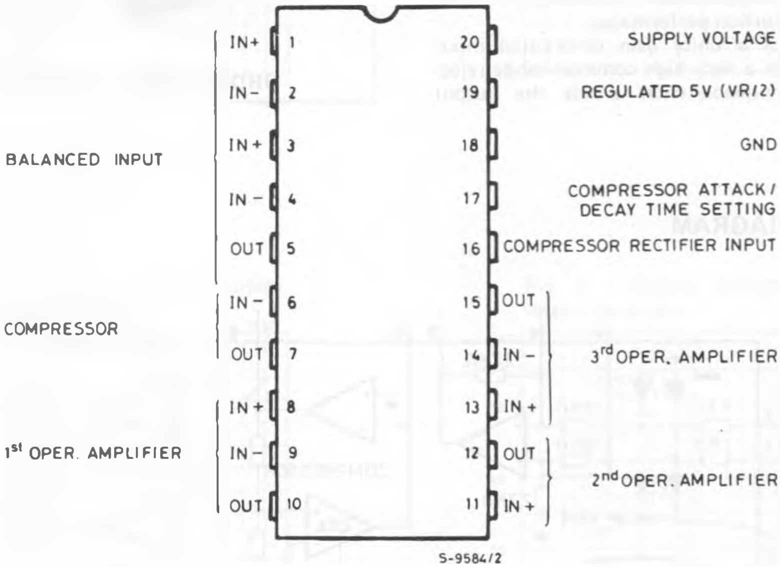
BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

V_s	Operating supply voltage	30	V
V_s	Peak supply voltage (for 50 ms)	40	V
V_i	Input voltage	$\pm V_s$	
T_{op}	Operating temperature	-25 to 85	°C
P_{tot}	Total power dissipation at T_{amb} = 70°C	1	W

CONNECTION DIAGRAM



THERMAL DATA

$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	80	°C/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25°C, V_s = 14.4V, G_v = 30 dB, refer to test circuit amplifier fig. 1)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
V_s	Supply voltage		10		30	V
I_s	Supply current			10	16	mA
G_v	Closed loop gain	Pin 1-2 to pin 15	29	30	31	dB
d	Total harmonic distortion	f = 1 KHz out of compression V_o = 2 V_{RMS}		0.03	0.12	%
		in compression V_i = 0.7 V_{RMS}		0.15	0.5	%
V_o	Output volt. swing		7.5	8.4		V
e_N	Total output noise	B = 22 Hz to 22 KHz		160		μV
		R_g = 50Ω Curve A		120		μV
SVR	Supply volt. rejection (°)	R_g = 50Ω f = 100 Hz V_R = 1 V_{RMS}	90	110		dB

INPUT DIFFERENTIAL AMPLIFIER

V_{OS}	Input offset voltage			1	7	mV
G_v	Voltage gain	f = 20 Hz to 20 KHz	0.98	1	1.02	V/V
e_N	Total input noise voltage	R_g = 50Ω; B = 22 Hz to 22 KHz		1.5		μV
		R_g = 50Ω; curve A		1.1		μV
d	Distortion	R_L = 2 KΩ V_o = 1 V_{RMS} f = 1 KHz		0.01		%
V_o	Output swing	R_L = 2 KΩ	7.5	8.4		V_{pp}
SR	Slew rate			1		V/μS
CMR	Common mode reject.	f = 20 Hz to 20 KHz	36	50		dB

COMPRESSOR

I_b	Input bias current			60	300	nA
V_{os}	Input offset voltage	R_g ≤ 10 KΩ out of compression		1	3.5	mV
V_{os}	Output offset voltage	in compression $V_{pin.17}$ = 0.7V			350	mV
e_N	Total input noise volt.	R_g = 50Ω; B = 22 Hz to 22 KHz		1.8		μV
		R_g = 50Ω; curve A		1.3		μV
d	Distortion	R_L = 2 KΩ V_o = 1 V_{RMS} f = 1 KHz G_v = 20 dB		0.01		%
SVR	Supply voltage rejection	V_R = 1V, f = 100 Hz, R_g = 50Ω	86			dB

(°) Referred to the input.

ELECTRICAL CHARACTERISTICS (continued)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_o	DC output voltage swing	$R_L = 2\ K\Omega$	7.5	8.4		V
SR	Slew rate			0.7		V/µS

1st AND 3rd OPERATION AMPLIFIER

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_b	Input bias current			60	300	nA
I_{os}	Input offset current			20	50	nA
V_{os}	Input offset voltage	$R_g \leq 10\ K\Omega$		1	3.5	mV
CMR	Common mode rejection		86			dB
SVR	Supply volt. rejection	$V_R = 1V$, f = 100 Hz, $R_g = 50\Omega$	86			dB
e_N	Total inp. noise volt.	$R_g = 50\Omega$; B = 22 Hz to 22 KHz		1.4		µV
		$R_g = 50\Omega$; curve A		1.1		µV
V_o	Output volt. swing	$R_L = 2\ K\Omega$	7.5	8.4		V_{pp}
d	Total harmonic distortion	$R_L = 2\ K\Omega$ $V_o = 1\ V_{RMS}$ f = 1 KHz $G_v = 20$ dB		0.01		%
G_v	Open loop gain	$R_L = 2\ K\Omega$	86	100		dB
SR	Slew rate	$R_L = 2\ K\Omega$		1		V/µS

2nd OPERATIONAL AMPLIFIER (G_v = 12 dB internally set)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{os}	Output offset voltage			4	15	mV
SVR	Supply voltage rejection	$V_R = 1V$ f = 100 Hz	86			dB
e_N	Total input noise voltage	$R_g = 50\Omega$; B = 22 Hz to 22 KHz		2.2		µV
		$R_g = 50\Omega$; curve A		1.4		µV
V_o	DC output volt. swing	$R_L = 2\ K\Omega$	7.5	8.4		V
d	Total harmonic distortion	$R_L = 2\ K\Omega$, f = 1 KHz $V_o = 1\ V_{RMS}$		0.01		%
G_v	Voltage gain	f = 20 Hz to 20 KHz	11.5	12	12.5	dB
SR	Slew rate	$R_L = 2\ K\Omega$		1		V/µS

VOLTAGE REGULATOR

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_o	Output voltage	Pin 19 $I_{sink,\ source}$ from 0 to 12 mA	4.6	5	5.4	V
I_o	Output max. current	I_{source}		12		mA
		I_{sink}		12		mA

Fig. 1 - Test circuit

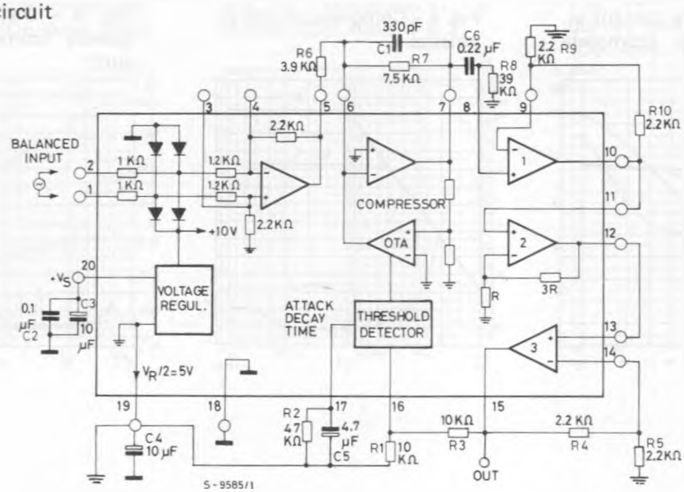


Fig. 2 - P.C. board and components layout of the test circuit of fig. 1 (1:1 scale)

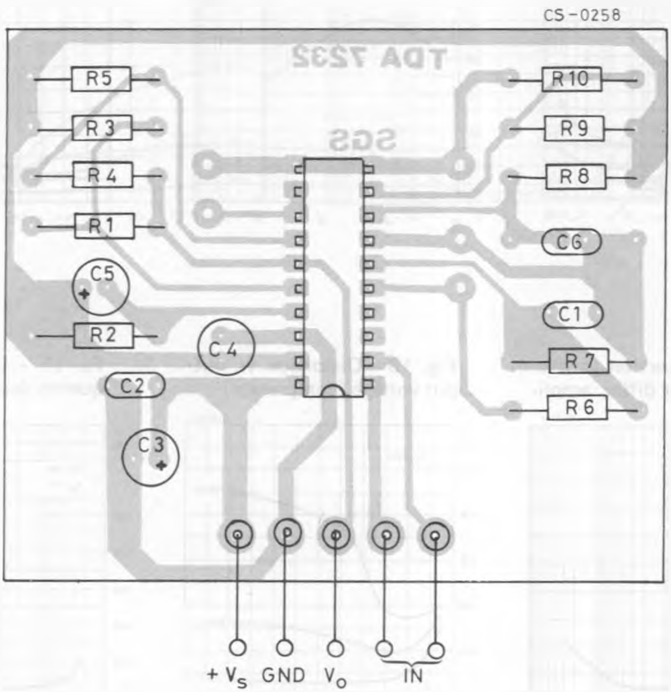


Fig. 3 - Supply current vs. supply voltage (complete test circuit)

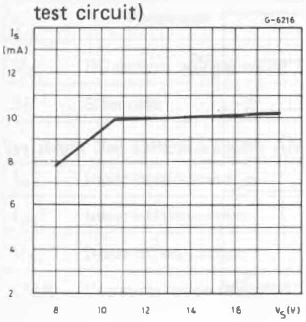


Fig. 4 - Compression characteristics

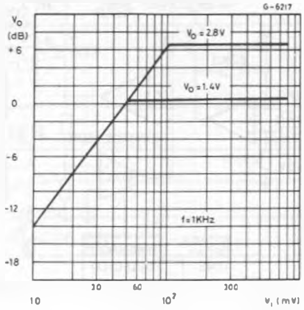


Fig. 5 - Distortion vs. frequency (complete test circuit)

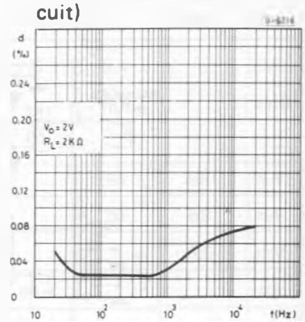


Fig. 6 - Distortion vs. input signal level (complete test circuit)

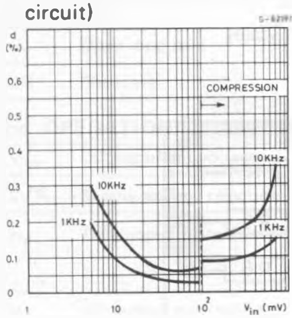


Fig. 7 - Supply voltage rejection vs. frequency (complete test circuit)

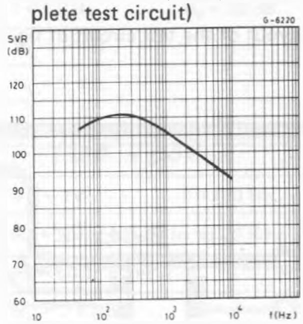


Fig. 8 - Distortion vs. output voltage (input differ. amplifier)

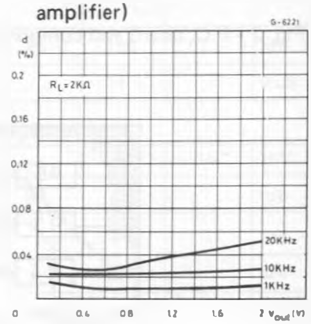


Fig. 9 - Distortion vs. frequency (input differ. amplifier)

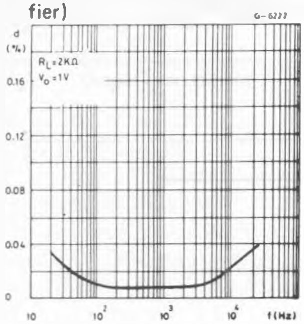
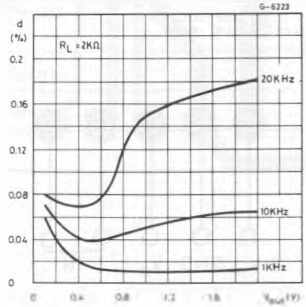


Fig. 10 - Distortion vs. output voltage (compressor)



Fi. 11 - Distortion vs. frequency (compressor)

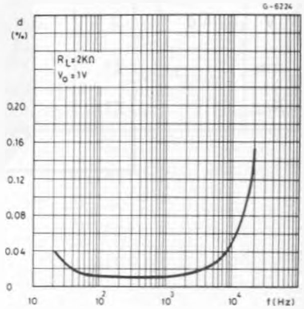


Fig. 12 - Distortion vs. output voltage (Op. Amp. 1&3)

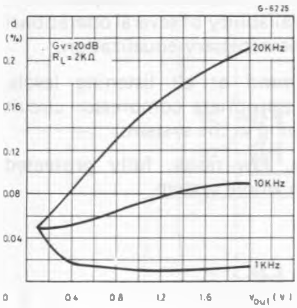


Fig. 13 - Distortion vs. frequency (Op. Amp. 1 & 3)

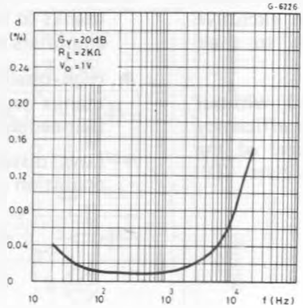


Fig. 14 - Open loop frequency and phase response (Op. Amp. 1 & 3)

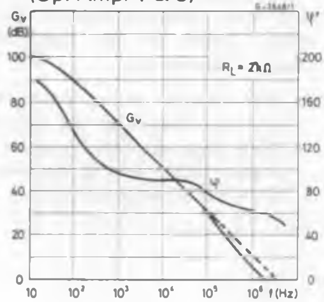


Fig. 15 - Distortion vs. output voltage (Op. Amp. 2)

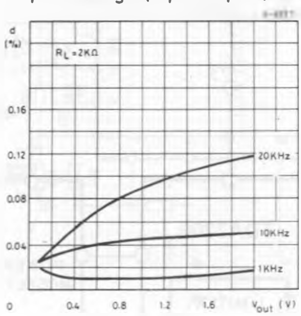
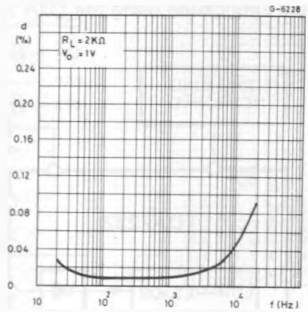


Fig. 16 - Distortion vs. frequency (Op. Amp. 2)

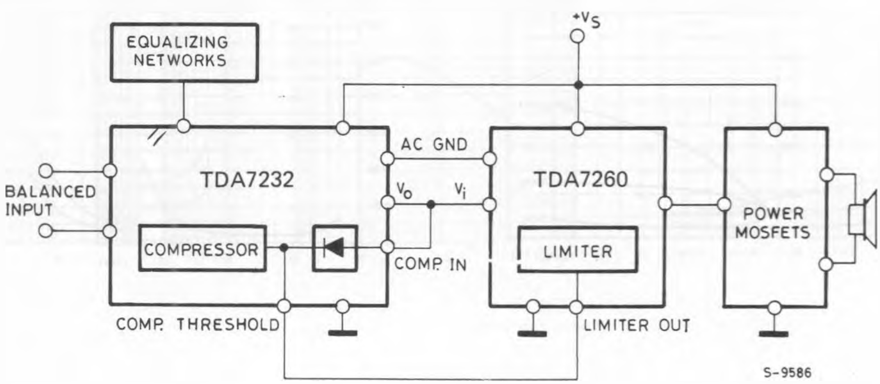


APPLICATION INFORMATION

The devices TDA 7232 and TDA 7260 realize with four external POWER MOS an exclusive audio system for car radio, thanks to their unique features as:

- 25W output power (d = 0.3%) without heatsink, thanks to the extra-high efficiency (85% typ. at rated output power) of the power stage, which operates in class "D" (pulse width modulation).
- In-car frequency response compensation, thanks to the availability of several operational amplifiers for the necessary equalization.
- High-quality sound at all listening levels, thanks to an appropriate compressor circuit that avoids clipping in the system.
- Low distortion, low noise, fully protected operation of the whole system.

Fig. 17 - Suggested application using the TDA 7260 audio PWM amplifier



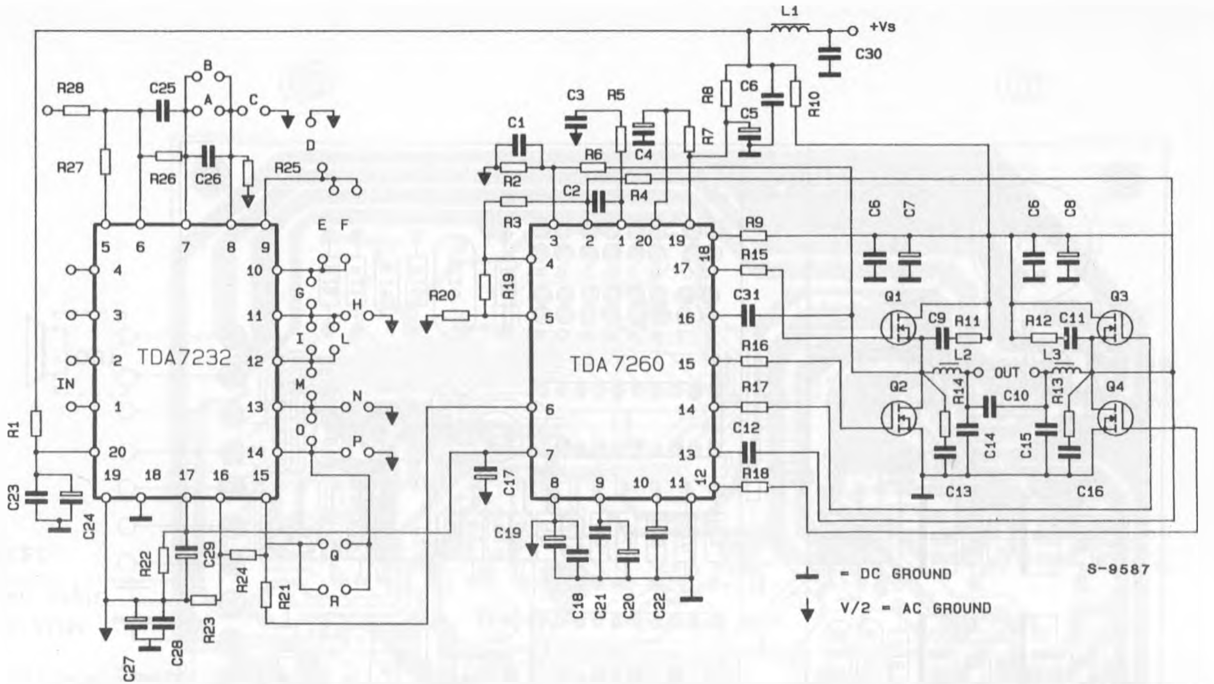


Fig. 18 - 25W application circuit using the TDA7260 audio PWM

COMPONENT LIST

R1 = 39Ω
R2 = 25KΩ
R3 = 25KΩ
R4 = 100KΩ
R5 = 1KΩ
R6 = 100KΩ
R7 = 470KΩ
R8 = 2.7Ω
R9 = 1KΩ
R10 = 0.025Ω
R11 = 20Ω
R12 = 20Ω
R13 = 20Ω
R14 = 20Ω
R15 = (Jumper)
R16 = (Jumper)
R17 = (Jumper)
R18 = (Jumper)
R19 = 10KΩ
R20 = 10KΩ
R21 = 10KΩ
R22 = 47KΩ
R23 = 10KΩ
R24 = 10KΩ
R25 = 39KΩ
R26 = 7.5KΩ
R27 = 3.9KΩ
R28 = t.b.d.

C1 = 390pF
C2 = 390pF
C3 = 150pF
C4 = 2.2μF - 16V
C5 = 47μF - 16V
C6 = 100nF pol.
C7 = 470μF - 25V
C8 = 470μF - 25V
C9 = 390pF
C10 = 470nF
C11 = 390pF
C12 = 100nF
C13 = 390pF
C14 = 100nF
C15 = 100nF
C16 = 390pF
C17 = 4.7μF - 16V
C18 = 100nF
C19 = 10μF - 16V
C20 = 10μF - 16V
C21 = 100nF
C22 = 1μF - 16V
C23 = 100nF
C24 = 10μF - 25V
C25 = 330pF
C26 = 220nF
C27 = 10μF - 25V
C28 = 100nF
C29 = 4.7μF - 16V
C30 = 100nF
C31 = 100nF

L1 = 150uH
L2 = 15uH
L3 = 15uH

NOTE
Q1 = P321 (SGS)
Q2 = P321 (SGS)
Q3 = P321 (SGS)
Q4 P321 (SGS)

WITH NO EQUALIZATION FLAT RESPONSE, $G_{v\,tot}$ = 42dB

(A) = OPEN
(B) = OPEN
(C) = OPEN
(D) = R = 2.2KΩ
(E) = R = 2.2KΩ
(F) = OPEN
(G) = JUMPER
(H) = OPEN
(I) = OPEN
(L) = OPEN
(M) = JUMPER
(N) = OPEN
(O) = OPEN
(P) = R = 2.2KΩ
(Q) = R = 2.2KΩ
(R) = OPEN

Fig. 19 - P.C. board and components layout of the circuit of fig. 18 (1 : 1 scale)

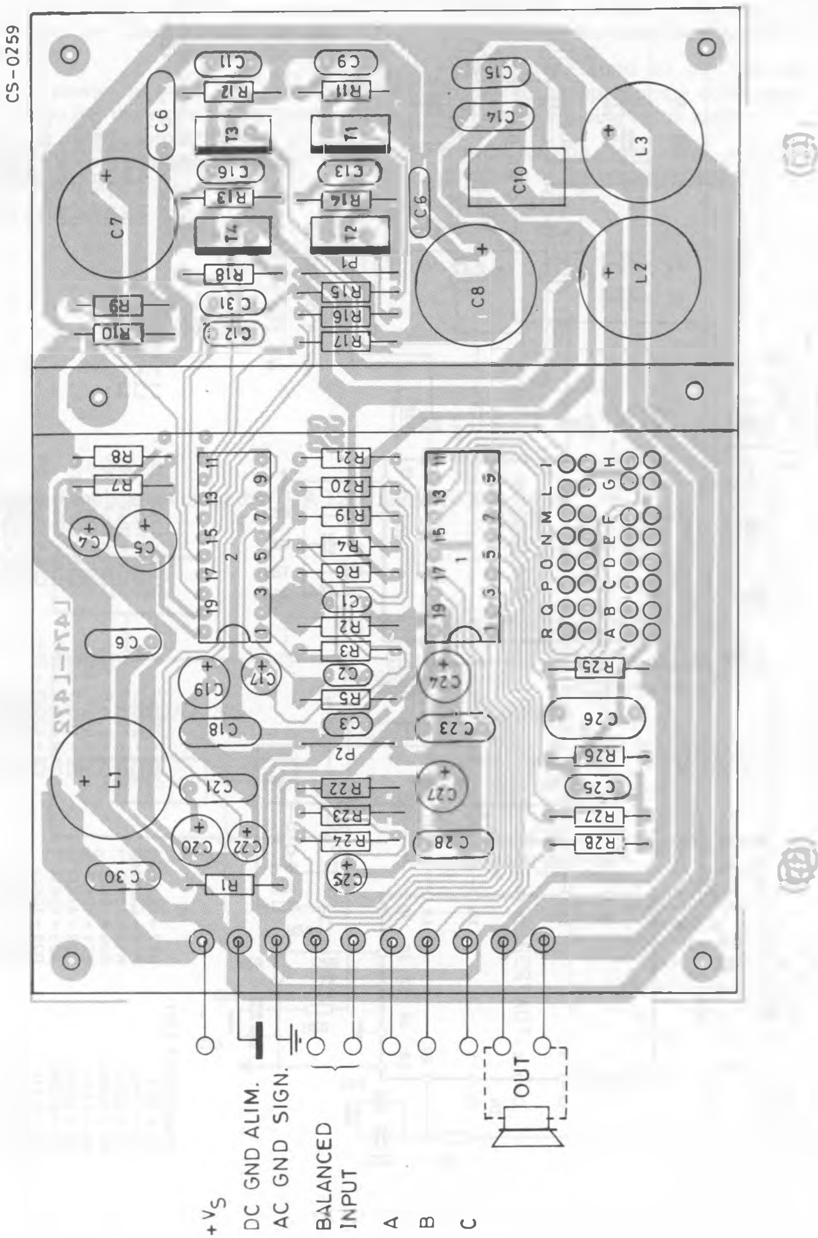


Fig. 20 - Five bands equalizer with compression indicator

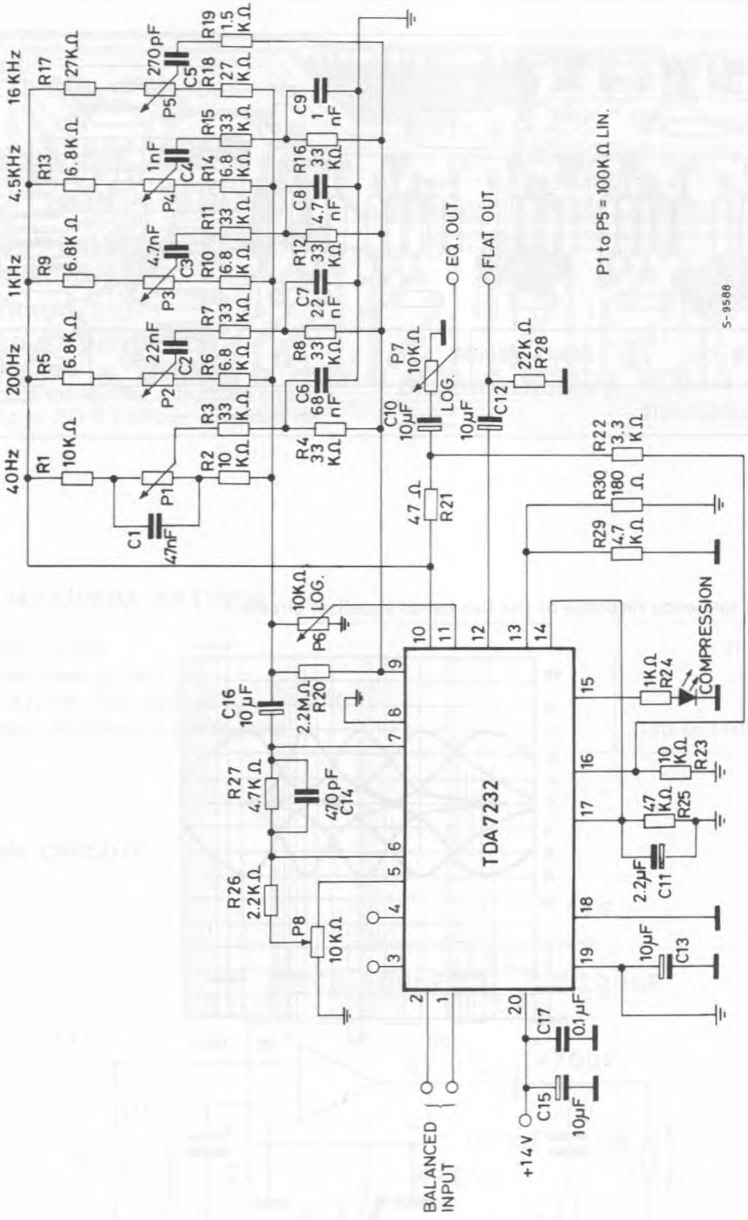


Fig. 21 - P.C. and components layout of the circuit of Fig. 20 (1 : 1 scale)

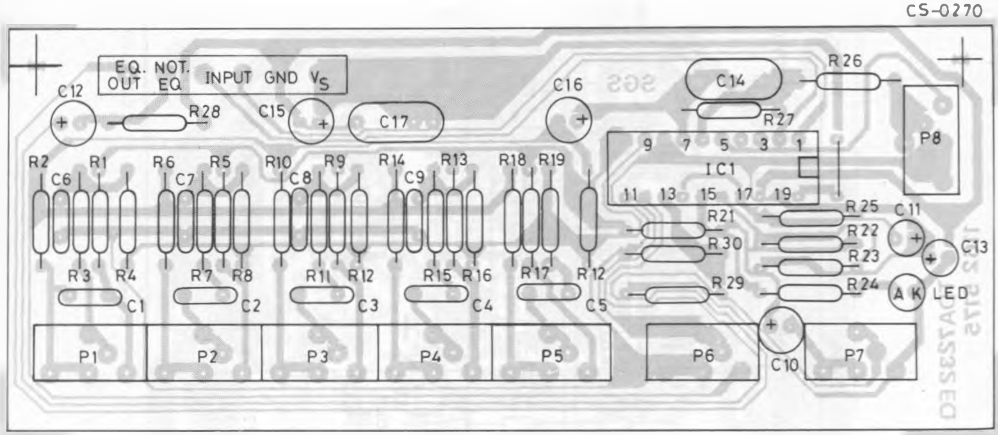


Fig. 22 - Frequency response of the five bands equalizer circuit