LINEAR INTEGRATED CIRCUIT

TDA 1054

PRELIMINARY DATA

PREAMPLIFIER FOR CASSETTE RECORDERS WITH ALC

- EXCELLENT VERSATILITY in USE (V_s from 4 to 20V)
- HIGH OPEN LOOP GAIN
- LOW DISTORTION
- LOW NOISE
- LARGE AUTOMATIC LEVEL CONTROL RANGE
- GOOD SUPPLY RIPPLE REJECTION

The TDA 1054 is a monolithic integrated circuit in a 16-lead dual in-line plastic package.
The functions incorporated are:
- low noise preamplifier
- automatic level control system (ALC)
- high gain equalization amplifier
- supply voltage rejection facility (SVRF)

It is intended as preamplifier in tape and cassette recorders and players, dictaphones, compressor and expander in telephonic equipments, Hi-Fi preamplifiers and in wire diffusion receivers etc.

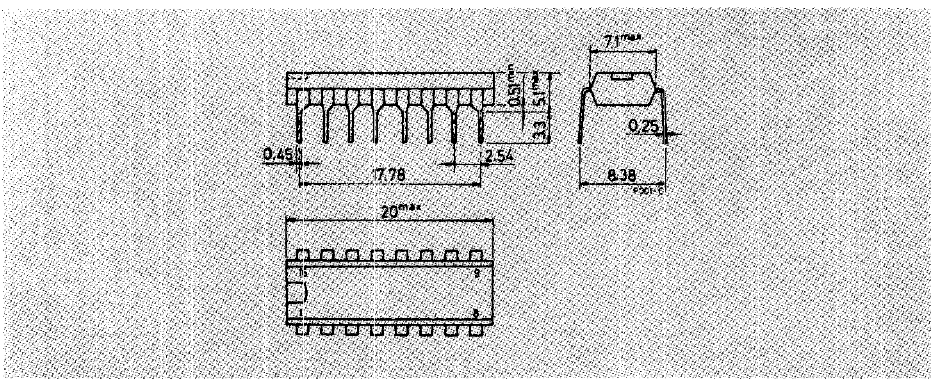
ABSOLUTE MAXIMUM RATINGS

V_s	Supply voltage	20	V
P_{tot}	Total power dissipation at $T_{amb} \leqslant 50$ °C	500	mW
T_{stg}, T_j	Storage and junction temperature	-40 to 150	°C

ORDERING NUMBER: TDA 1054

MECHANICAL DATA

Dimensions in mm



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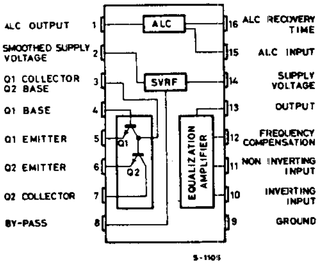
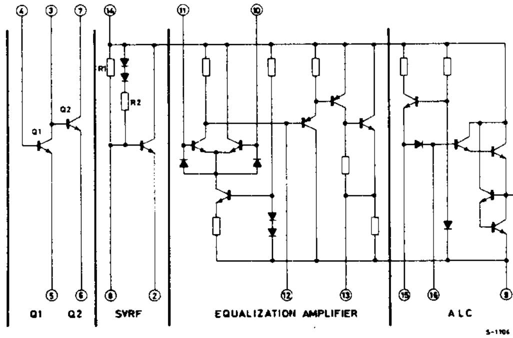
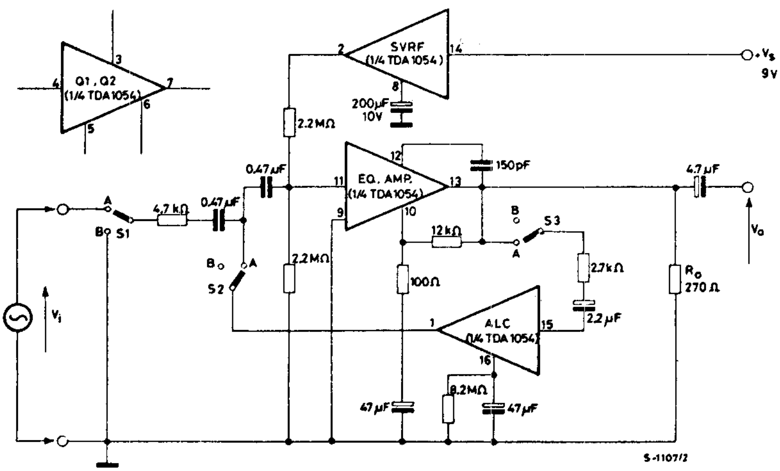
CONNECTION AND SCHEMATIC DIAGRAMS





TEST CIRCUIT



THERMAL DATA

$R_{th\ j\text{-}amb}$	Thermal resistance junction-ambient	max	200	°C/W

ELECTRICAL CHARACTERISTICS (Refer to the test circuit, T_{amb} = 25 °C)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
V_s	Supply voltage		4		20	V
I_d	Quiescent drain current	V_s = 9V $R_o = \infty$ S1 = S2 = S3 = B		6		mA
h_{FE}	DC current gain (Q1 and Q2)	I_C = 0.1 mA V_{CE} = 5V	300	500		–
e_N	Input noise voltage (Q1)	I_C = 0.1 mA V_{CE} = 5V f = 1 kHz		2		$\frac{nV}{\sqrt{Hz}}$
i_N	Input noise current (Q1)	I_C = 0.1 mA V_{CE} = 5V f = 1 kHz		0.5		$\frac{pA}{\sqrt{Hz}}$
NF	Noise figure (Q1)	I_C = 0.1 mA V_{CE} = 5V R_g = 4.7 kΩ B(-3 dB) = 20 to 10,000 Hz		0.5	4	dB
G_v	Open loop voltage gain (equalization amplifier)	V_s = 9V f = 1 kHz		60		dB
V_o	Output voltage with ALC	V_s = 9V V_i = 100mV f = 1 kHz S1=S2=S3=A		0.95		V
R1	(for SVRF system)			7.5		kΩ
R2	(for SVRF system)			120		Ω
e_N	Equivalent input noise voltage (for equalization amplifier pin 11)	V_s = 9V R_g = 4.7 kΩ $G_{v(closed)}$ = 100 S1 = B B(-3 dB) = 20 to 20,000 Hz		1.3		μV
	Drop-out (between pins 14 and 2)	I_d = 6 mA V_s = 9V		0.8		V

Fig. 1 - Equivalent input spot voltage and noise current vs. bias current (input transistor Q1)

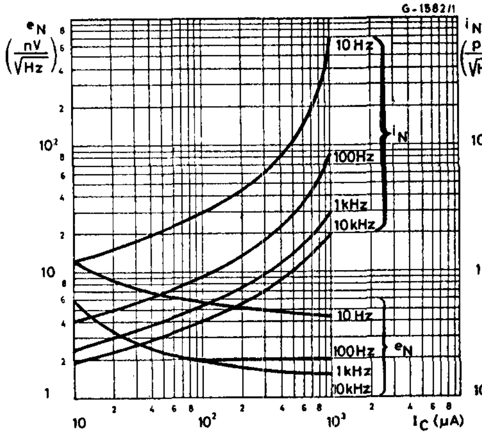


Fig. 2 - Equivalent input noise current vs. frequency (input transistor Q1)

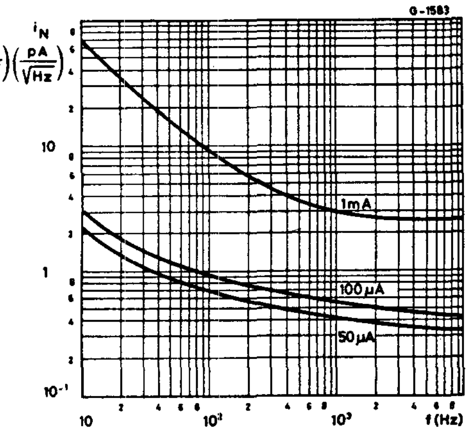


Fig. 3 - Equivalent input noise voltage vs. frequency (input transistor Q1)

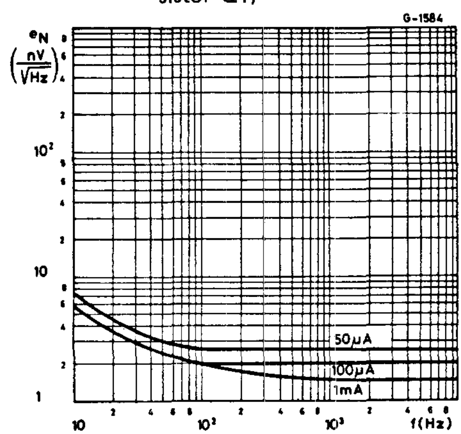


Fig. 4 - Typical noise figure vs. bias current (input transistor Q1)

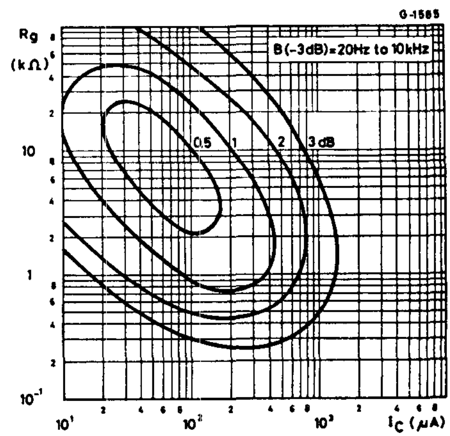


Fig. 5 - Optimum source resistance and minimum NF vs. bias current (input transistor Q1)

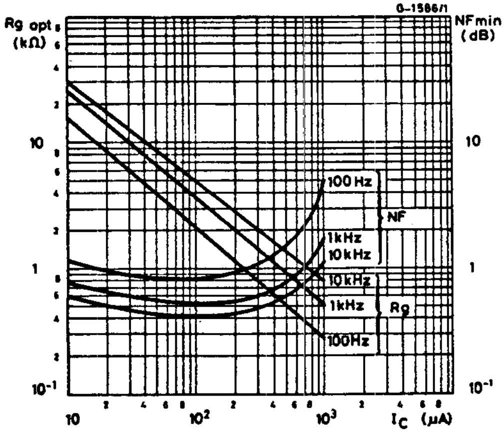


Fig. 6 - Typical current gain vs. collector current (input transistor Q1)

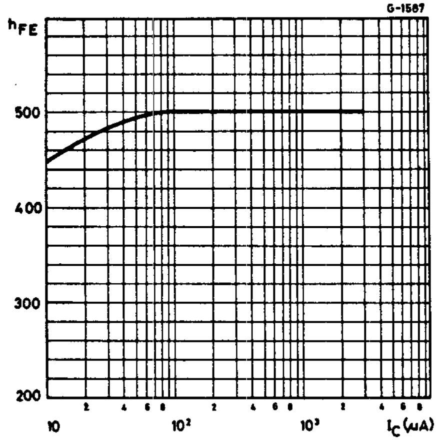


Fig. 7 - Typical open loop gain vs. frequency (equalization amplifier)

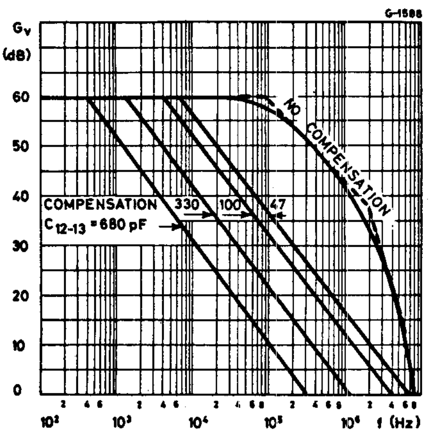
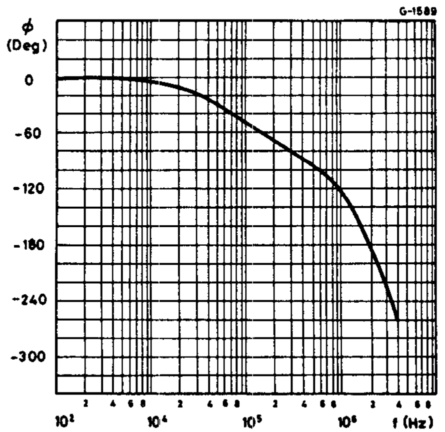


Fig. 8 - Typical open loop phase response vs. frequency (equalization amplifier)



APPLICATION INFORMATION

Fig. 9 - Typical application circuit for battery-main tape and cassette player and recorder

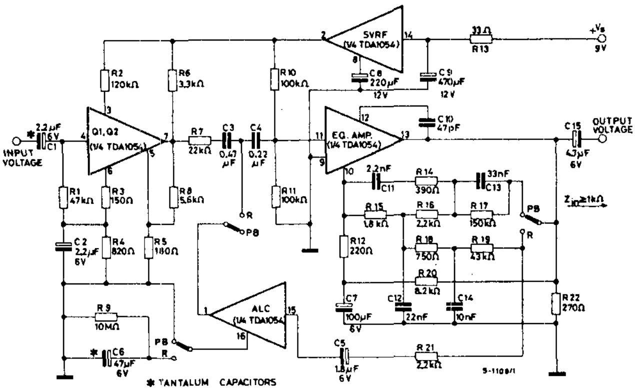
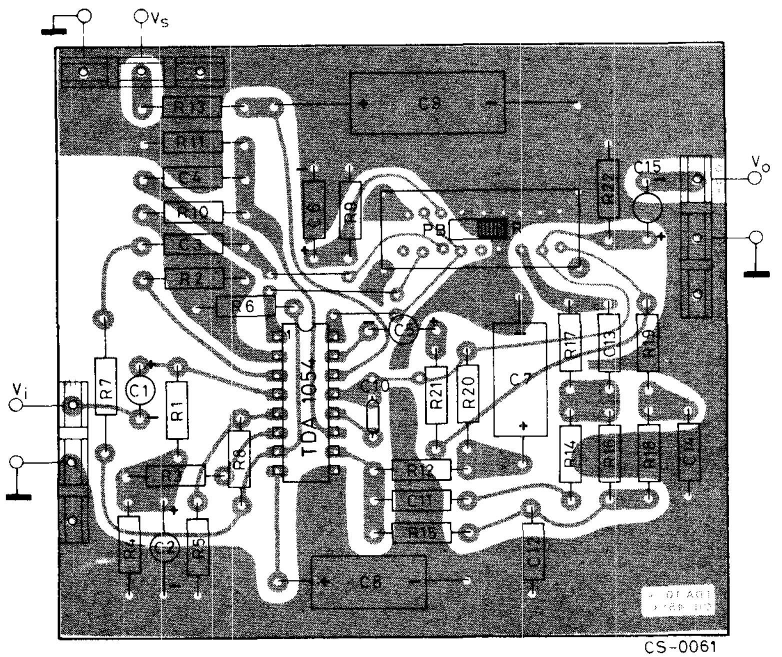


Fig. 10 - P.C. board and component layout of fig. 9 circuit (1:1 scale)



Typical performance of circuit in fig. 9 (T_{amb} = 25°C, V_s = 9V)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
PLAY-BACK						
G_v	Voltage gain (open loop)	f = 20 to 20,000 Hz		110		dB
G_v	Voltage gain (closed loop)	f = 1 kHz		57		dB
$\|Z_i\|$	Input impedance	f = 100 Hz f = 1 kHz f = 10 kHz		10 41 43		kΩ kΩ kΩ
$\|Z_o\|$	Output impedance	f = 1 kHz		12	35	Ω
B	Frequency response			see fig. 12		
d	Distortion	V_o = 1V f = 1 kHz		0.1		%
	Output back-ground noise	Z_g = 300 Ω + 120 mH (DIN 45405)		1.3		mV
	*** Output weighted back-ground noise			1.3		mV
$\frac{S+N}{N}$	Signal to noise ratio	V_o = 1V Z_g = 300 Ω + 120 mH		52		dB
SVR	Supply voltage ripple rejection at the output	$f_{(ripple)}$ = 100 Hz		30		dB
t_{on}**	Switch-on time	V_o = 1V		500		ms
RECORDING						
G_v	Voltage gain (open loop)	f = 20 to 20,000 Hz		110		dB
G_v	Voltage gain (closed loop)	f = 1 kHz		70		dB
B	Frequency response			see fig. 14		
d*	Distortion without ALC	V_o = 1V f = 1 kHz		0.3		%
d	Distortion with ALC	V_o = 0.9V f = 1 kHz		0.4		%

Typical performance of circuit in fig. 9 (continued)

	Parameter	Test conditions	Min.	Typ.	Max.	Unit
ALC	Automatic level control range (for 3 dB of output voltage variation)	$V_i \leqslant 40$ mV f = 10 kHz		54		dB
V_o	Output voltage before clipping without ALC	f = 1 kHz		2.3		V
V_o	Output voltage with ALC	V_i = 30 mV f = 1 kHz		0.9		V
t_l**	Limiting time (see fig. 11)	ΔV_i = +40 dB f = 1 kHz		75		ms
t_{set}**	Level setting time (see fig. 11)			300		ms
t_{rec}**	Recovery time (see fig. 11)	ΔV_i = -40 dB f = 1 kHz		180		s
t_{on}**	Switch-on time	V_o = 1V		500		ms
$\frac{S+N}{N}$	Signal to noise ratio with ALC	V_o = 1V R_g = 470 Ω		56		dB

* Measured with selective voltmeter
** This value depends on external network
*** When the DIN 45511 norm for the frequency response is not mandatory the equalization peak at 10 kHz can be avoided–so halving the output noise

Fig. 11 - Limiting, level setting, recovery time

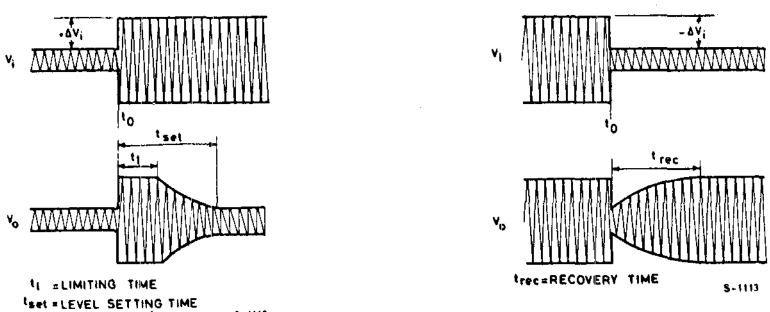


Fig. 12 - Typical relative frequency response of fig. 9 circuit (Play-back)

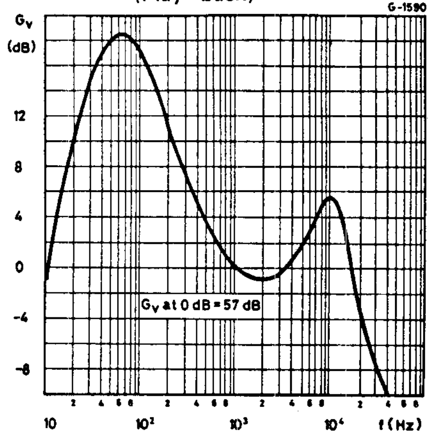


Fig. 13 - Typical distortion vs. frequency of fig. 9 circuit (Play-back)

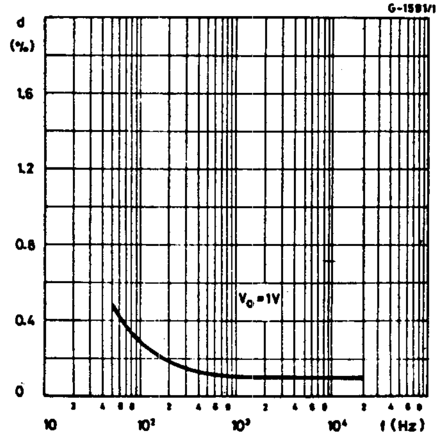


Fig. 14 - Typical relative frequency response of fig. 9 circuit (Recording)

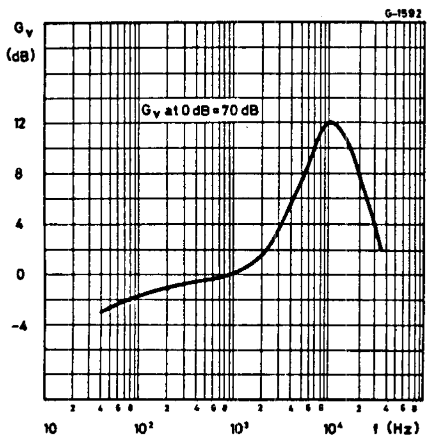


Fig. 15 - Typical output voltage variation and distortion with ALC vs. input voltage of fig. 9 circuit (Recording)

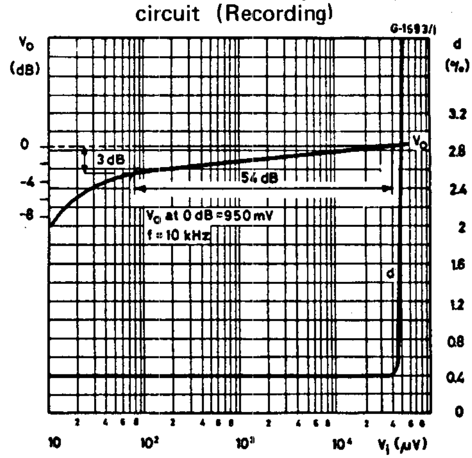


Fig. 16 - Typical distortion vs. frequency with ALC of fig. 9 circuit (Recording)

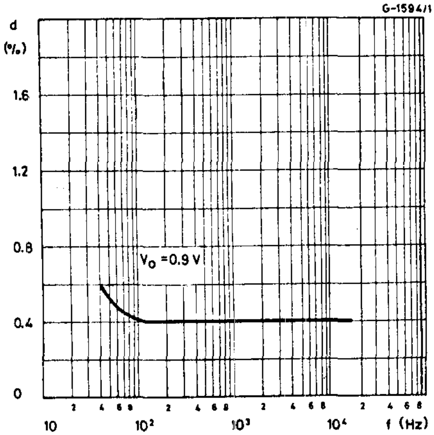


Fig. 17 - Typical limiting and level setting time vs. input signal variation

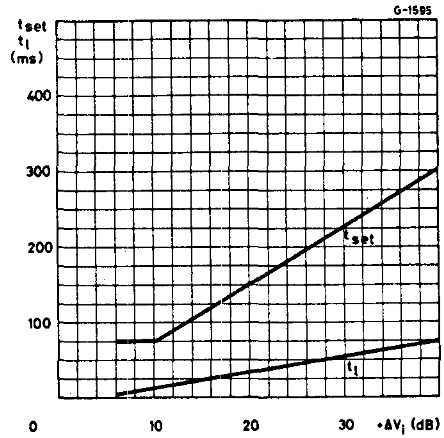


Fig. 18 - Economical application circuit

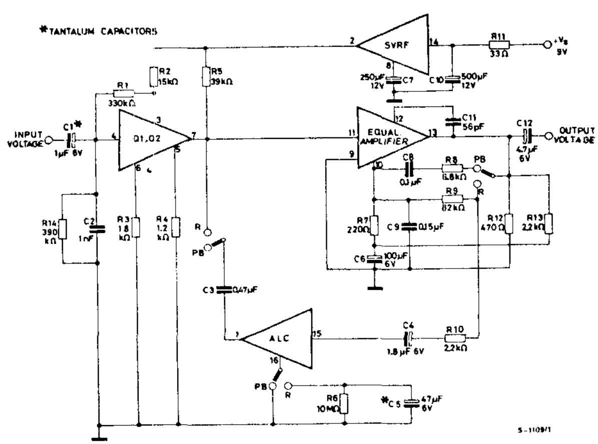
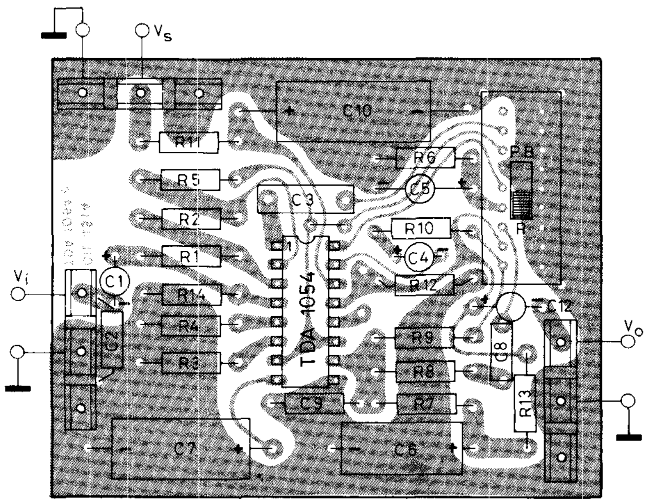


Fig. 19 - P.C. board and component layout of fig. 18 circuit (1:1 scale)



Typical performance of circuit in fig. 18 (T_{amb}= 25°C, V_s= 9V)

	Parameter	Test conditions	Min. Typ. Max.	Unit
PLAY-BACK				
I_d	Quiescent drain current		18	mA
G_v	Voltage gain (closed loop)	f = 1 kHz	56	dB
B	Frequency response	f = 100 Hz f = 1 kHz f = 6 kHz f = 10 kHz f = 60 kHz	12 0 5 11 10	dB dB dB dB dB
d	Distortion	V_o= 1V f = 1 kHz	0.6	%
	Output weighted back-ground noise	Z_g= 300 Ω + 120 mH (DIN 45405)	1.3	mV

Typical performance of circuit in fig. 18 (continued)

	Parameter	Test conditions		Min. Typ. Max.	Unit
RECORDING					
G_v	Voltage gain (closed loop)	f = 1 kHz		70	dB
B	Frequency response	f = 140 Hz f = 1 kHz f = 10 kHz		-3 0 4	dB dB dB
d	Distortion	V_o = 0.9V	f = 10 kHz	0.7	%
ALC	Range for 3 dB of output voltage variation	f = 10 kHz	$V_i \leqslant$ 40 mV	54	dB

Fig. 20 - Complete cassette player and recorder

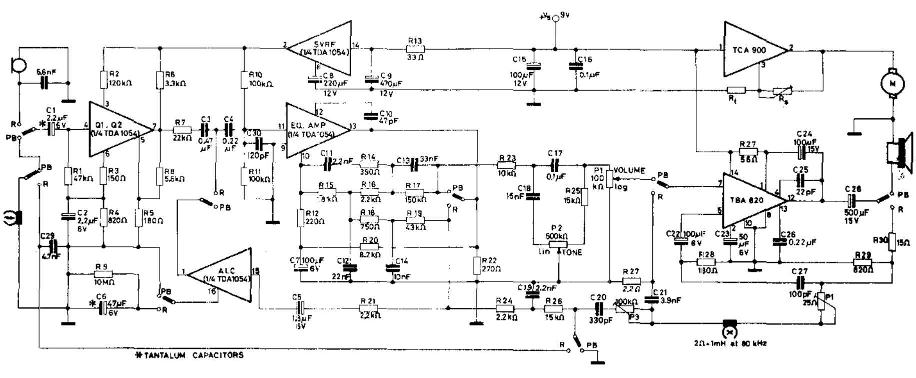
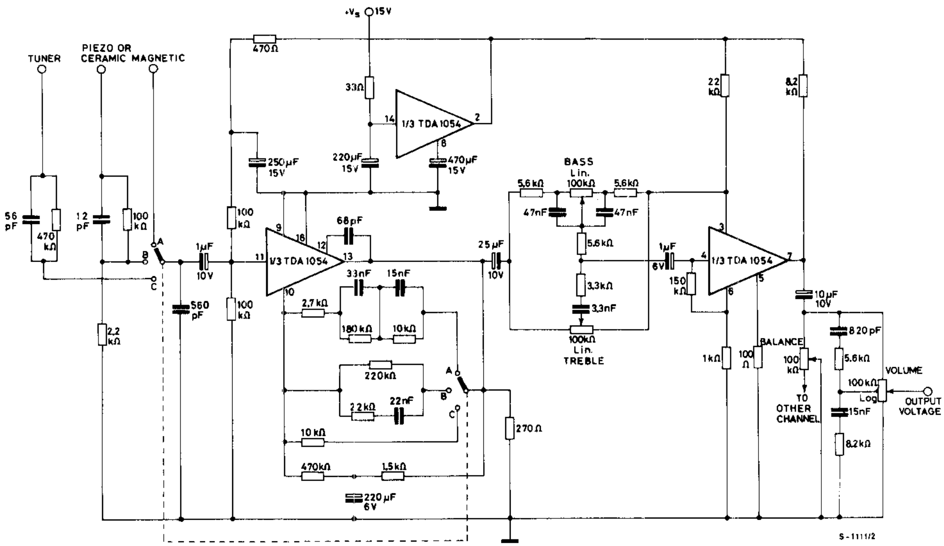


Fig. 21 - Hi-Fi preamplifier for magnetic and ceramic pick-ups



Typical performance of circuit in fig. 21 (T_{amb} = 25°C, V_s = 15V)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
V_s	Supply voltage		10		18	V
V_i	Input sensitivity for magnetic pick-ups	V_o = 300 mV f = 1 kHz		2.5		mV
V_i	Input sensitivity for ceramic pick-ups	V_o = 300 mV f = 1 kHz		100		mV
V_o	Output voltage before clipping	f = 1 kHz		2.5		V
	RIAA equalization for magnetic pick-ups	B = 40 to 18,000 Hz		± 1		dB

Typical performance of circuit in fig. 21 (continued)

Parameter		Test conditions	Min.	Typ.	Max.	Unit
$\frac{S+N}{N}$	Signal to noise ratio for magnetic pick-ups	$R_g = 4.7\ k\Omega$ B (-3 dB) = 20 to 20,000 Hz		66		dB
$\|Z_i\|$	Input impedance for magnetic pick-ups	f = 1 kHz		47		kΩ
$\|Z_i\|$	Input impedance for tuner			470		kΩ
$\|Z_i\|$	Input impedance for ceramic pick-up			100		kΩ

Fig. 22 - Typical distortion vs. frequency (fig. 21 circuit)

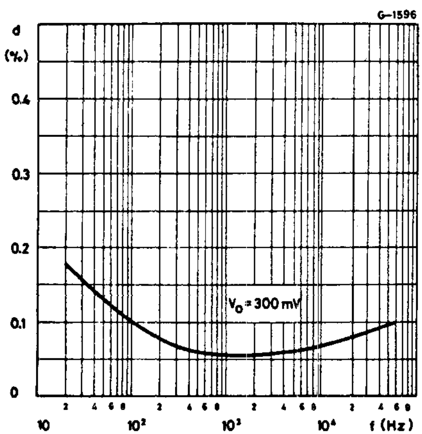


Fig. 23 - Typical frequency response (fig. 21 circuit)