MULTI-FUNCTION OSCILLATOR SWITCH FOR AN AUDIO CASSETTE RECORDER

GENERAL DESCRIPTION

The TDA1600 is a bipolar circuit designed for high fidelity cassette recorders. This device contains several functions (see 'features') which can be selected by external d.c. voltage levels or via a microprocessor. The TDA1600 operates from a mains-fed asymmetrical power supply. For application purposes the voltage output can be either ½ V_P asymmetrical or ½ V_P symmetrical. The output of all the functions are current protected.

Features

- Stereo playback amplifier
- Electronic switch for playback equalization
- Electronic head-switch (two times)
- Erase and bias oscillator
- LED driver
- Tape selector
- Reference voltage source (½ V_P)
- Logic part

QUICK REFERENCE DATA

parameter	conditions	symbol	min.	typ.	max.	unit
Supply voltage range		V_P	10	–	20	V
Playback amplifier						
Open loop gain		Go	–	106	–	dB
Minimum closed loop gain		Gc	–	30	–	dB
S/N ratio	V_O = 50 mV	S/N	–	65	–	dB
Total harmonic distortion	V_O = 50 mV	THD	–	–60	–	dB
Head-switch						
Maximum voltage (peak-to-peak value)		V_{OM}	–	–	120	V
Oscillator						
Frequency range		f_o	60	–	120	kHz
Maximum output current (peak value)		I_{OM}	–	–	80	mA
Maximum output voltage (peak value)		V_{OM}	–	–	40	V
LED driver						
Maximum d.c. output current		I_{OM}	–	–	± 15	mA
Reference voltage						
Output voltage		V_{REF}	–	½ V_P	–	V
Maximum load current		$I_{L\,max}$	–	–	± 18	mA
Logic part						
Input current		I_I	–	–1	–	μA

PACKAGE OUTLINE

24-lead DIL; plastic, with internal heatspreader (SOT101B).

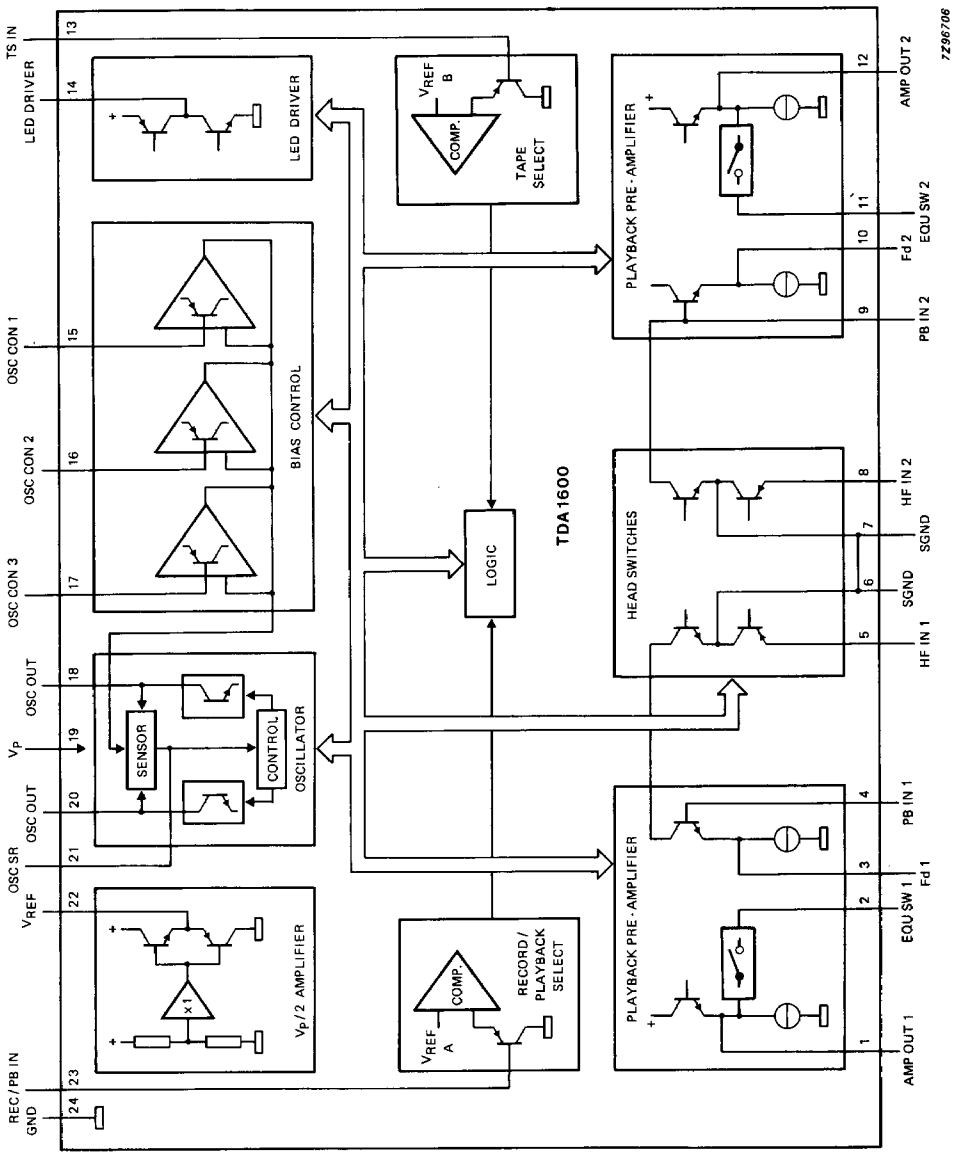

Fig. 1 Block diagram.

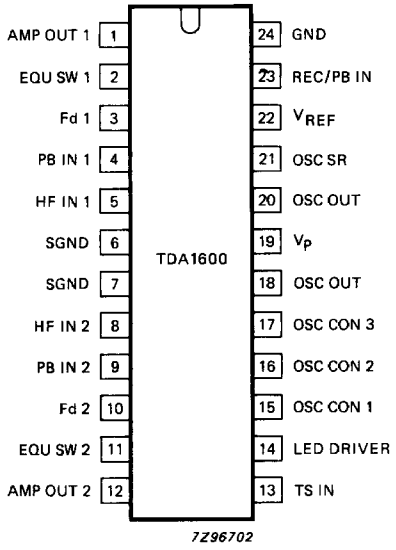

Fig. 2 Pinning diagram.

DEVELOPMENT DATA

PINNING

1	AMP OUT 1	pre-amplifier 1 output
2	EQU SW 1	equalization switching for pre-amplifier 1
3	Fd 1	feedback to pre-amplifier 1
4	PB IN 1	input to pre-amplifier 1 from playback side of head
5	HF IN 1	H.F. input from recording side of head
6	SGND	signal ground
7	SGND	signal ground
8	HF IN 2	H.F. input from recording side of head
9	PB IN 2	input to pre-amplifier 2 from playback side of head
10	Fd 2	feedback to pre-amplifier 2
11	EQU SW 2	equalization switching for pre-amplifier 2
12	AMP OUT 2	pre-amplifier 2 output
13	TS IN	tape select input
14	LED DRIVER	LED driver output
15	OSC CON 1	control input for oscillator
16	OSC CON 2	control input for oscillator
17	OSC CON 3	control input for oscillator
18	OSC OUT	oscillator output
19	V_P	supply voltage
20	OSC OUT	oscillator output
21	OSC SR	smoothing oscillator regulator
22	V_{REF}	reference voltage
23	REC/PB IN	record/playback select input
24	GND	ground

FUNCTIONAL DESCRIPTION

Playback amplifier

The playback amplifier is a low noise pre-amplifier which is internally connected to the head-switch. The gain of the amplifier can be externally fixed, to provide an optimal output voltage for a noise reduction system (e.g. Dolby). The playback constants (70 μs and 120 μs) are determined by external components, while the switch over is controlled by the logic part of the circuit. In the record mode, the playback amplifier is switched OFF.

Head-switch

The electronic head-switch has two positions:

- record mode: the playback side of the head is switched to signal ground, while the recording side is opened to allow the bias and audio current to be fed to the head.
- playback mode: the recording side of the head is switched to signal ground, while the playback side is connected to the input of the playback amplifier.

Both of these positions are controlled by the logic part of the circuit.

Erase and bias oscillator

Every audio hi-fidelity cassette recorder contains a high frequency bias current for linearization of the magnetic recording process on the tape. The high frequency bias current is added to the audio current (from a recording amplifier) and fed into the recording head. The oscillator generates a voltage which is converted into a bias current by an external resistor. The oscillator output voltage is dependent upon the type of tape selected; Ferro (FeO_2), Chrome (CrO_2) or Metal. The selection of the voltage level is controlled by the logic part, while the ratio level is determined by four external resistors. The oscillator also provides the current necessary for erasing the tape. The bias oscillator is only activated during the record mode.

LED driver

This circuit provides the voltage which drives the LED tape indicator. The circuit has three output positions; 0, ½ V_P or V_P, all of which are controlled by the logic part of the device.

Reference voltage

The circuit delivers an output voltage which is half the supply voltage. By using this output as signal ground, a symmetrical power supply is available (+ ½ V_P and −½ V_P), which can be used for the overall recording system. This application allows some flexibility in the choice of other IC's and components for the overall system.

Logic part

The logic part converts the incoming information, from the tape selector switches and from the record/playback switch, into the necessary switching signals. The switching signals are required for the analogue parts of the circuit. This conversion is determined by the input signal level and is independent of the rise or fall-time of this signal.

RATINGS

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

parameter	conditions	symbol	min.	max.	unit
Supply voltage range		V_P	–	20	V
Logic input voltage	pins 13 and 23	V_I	0	V_P	V
Control input voltage	pins 15, 16 and 17	V_I	0	V_P	V
Head-switch voltage	pins 5 and 8	V_I	–60	+60	V
Total power dissipation	T_{amb} = +60 °C	P_{tot}	–	2,5	W
Storage temperature range		T_{stg}	–65	+150	°C
Junction temperature		T_j	–	+150	°C

DEVELOPMENT DATA

CHARACTERISTICS

V_P = 15 V; f = 315 Hz; T_{amb} = 25 °C, unless otherwise specified (see Fig. 6)

parameter	conditions	symbol	min.	typ.	max.	unit
Supply						
Supply voltage range		V_P	10	15	20	V
Supply current	note 1,					
	playback mode	I_P	–	25	45	mA
	record mode	I_P	–	50	70	mA
Playback amplifier	position FeO_2					
Open loop gain		Go	86	106	–	dB
Closed loop gain	note 2, FeO_2	Gc	49	50	51	dB
Closed loop gain	CrO_2 and Metal	Gc	30	31	32	dB
Output voltage	V_I = 150 μV	V_O	–	50	–	mV
Total harmonic distortion	V_O = 50 mV	THD	–	–60	–55	dB
	V_O = 500 mV	THD	–	–50	–45	dB
S/N ratio	note 3; weighted curve 20 Hz to 20 kHz at position CrO_2 and Metal	S/N	59	65	–	dB
	see Fig. 5, weighted curve A (IEC 179) at position CrO_2 and Metal	S/N	–	61	–	dB
	weighted curve 20 Hz to 20 kHz at position CrO_2 and Metal	S/N	–	54	–	dB
Frequency response				see Fig. 3		

DEVELOPMENT DATA

parameter	conditions	symbol	min.	typ.	max.	unit
Channel separation	V_O = 50 mV		45	60	–	dB
Ripple rejection	V_{rip} = 100 mV, f = 100 Hz and R_S = 1 kΩ	RR	35	41	–	dB
Input impedance		Z_I	100	–	–	kΩ
Input bias current		I_{bias}	–	0,8	1,5	μA
D.C. output voltage w.r.t. $V_{6/7}$	pins 6 and 7	V_O	−1,1	−0,9	–	V
D.C. output voltage w.r.t. $V_{6/7}$	record mode pins 6 and 7	V_O	−1,1	−0,9	–	V
Input signal suppression	record mode, V_I = 20 mV, f = 85 kHz		–	65	–	dB
Head-switch						
Impedance ON	playback mode, (V_{23} = 2 V) between pins 5/8 and 6/7 at I = 100 μA (rms)	Zon	–	40	80	Ω
Impedance ON	record mode, (V_{23} = 13 V) between pins 4/9 and 6/7 at I = 1,5 mA (rms) f = 85 kHz	Zon	–	10	30	Ω
Leakage current	between pins 5/8 and 6/7 at V_{DC} = ± 60 V	$\|I_I\|$	–	1,0	2,5	μA

CHARACTERISTICS (continued)

parameter	conditions	symbol	min.	typ.	max.	unit
Erase and bias oscillator						
Oscillator frequency	note 4	f_o	–	85	–	kHz
Output current (peak value)		I_O	–	–	80	mA
Maximum output voltage (peak)	V_P = 20 V	V_{OM}	–	–	40	V
Control voltage range	pins 15, 16 and 17	V_O	−13	–	−2	V
Output voltage (peak) w.r.t. V_P	note 5, control voltage = −2 V	V_O	1,8	2,0	2,2	V
Output voltage (peak) w.r.t. V_P	note 5, control voltage = −13 V	V_O	12,8	13,0	13,2	V
Input current at control inputs		I_I	−4	–	–	μA
Distortion of output voltage	between pins 18 and 20, I_O = 80 mA	THD	–	−65	–	dB
LED driver						
Output voltage	V_{13} = 15 V, (FeO_2) and R_{load} = 10 kΩ	$\lvert V_{14\text{-}22}\rvert$	–	–	10	V
Output voltage loss	V_{13} = 7,5 V, (CrO_2) and I_O = −15 mA	$V_{14\text{-}24}$	1,5	2,0	2,5	V
Output voltage loss	V_{13} = 0 V, (Metal) and I_O = 15 mA	$V_{14\text{-}19}$	1,5	2,0	2,5	V
Output current limit		I_O	± 15	± 20	–	mA

parameter	conditions	symbol	min.	typ.	max.	unit
Reference voltage						
Output voltage	note 6, no external load	V_{22-24}	7,25	7,50	7,75	V
Output voltage deviation	ΔI_I = 15 mA	ΔV_O	–	30	90	mV
Load current		I_L	–	–	18	mA
Output current limit		I_{OI}	20	30	–	mA
Logic inputs						
Input for tape selection	pin 13					
Input current		I_I	–	–1	–20	μA
Input voltage	FeO_2	V_I	11	–	15	V
Input voltage	CrO_2	V_I	6	–	9	V
Input voltage	Metal	V_I	0	–	4	V
Input for record/playback mode selection	pin 23					
Input current		I_I	–	–1	–20	μA
Input voltage	see Fig. 4					
	playback mode	V_I	0	–	4	V
	record mode	V_I	11	–	15	V

Notes to the characteristics

1. The supply current is measured in the test circuit without loading the LED driver or the additional load of the ½ V_P amplifier. In the record mode the tape selector is at Metal position.
2. The closed loop gain will be fixed by R_{FeO_2} in the FeO_2 position, by $R_{FeO_2}//R_{CrO_2}$ in the CrO_2 position and by $R_{FeO_2}//R_{CrO_2}$ in the Metal position. The gain of the amplifier must not be lower than 30 dB.
3. The S/N ratio is related to V_O = 50 mV (at f = 315 Hz) and R_S = 1 kΩ.
4. The oscillator frequency is determined by L and C_L and may be adjusted between 60 kHz and 120 kHz.
5. The voltage applied to the control inputs (pins 15, 16 and 17) is $-(V_P - 2\ V)$ min. and –2 V max. with respect to V_P.
6. The output voltage is independent of the operating mode (playback/record).

DEVELOPMENT DATA

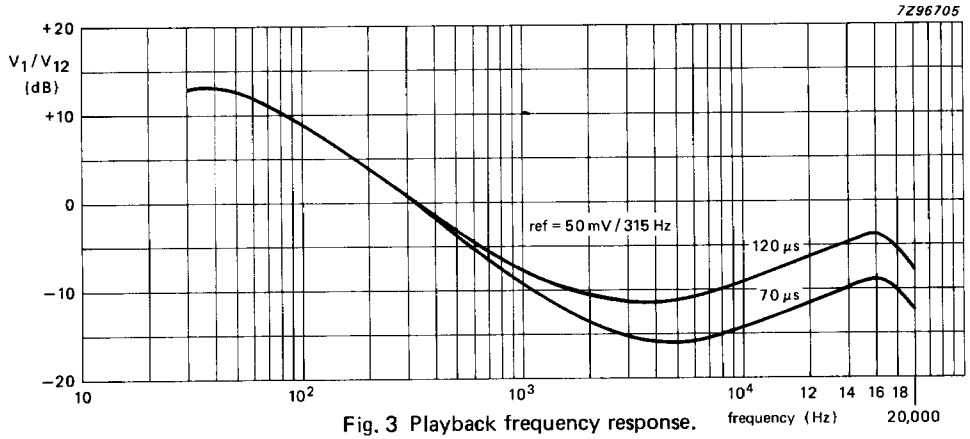

Fig. 3 Playback frequency response.

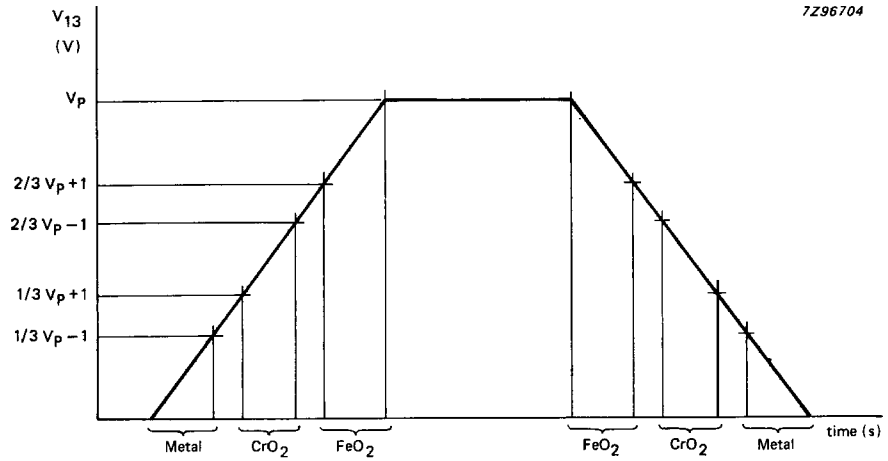

Fig. 4(a) Tape select input.

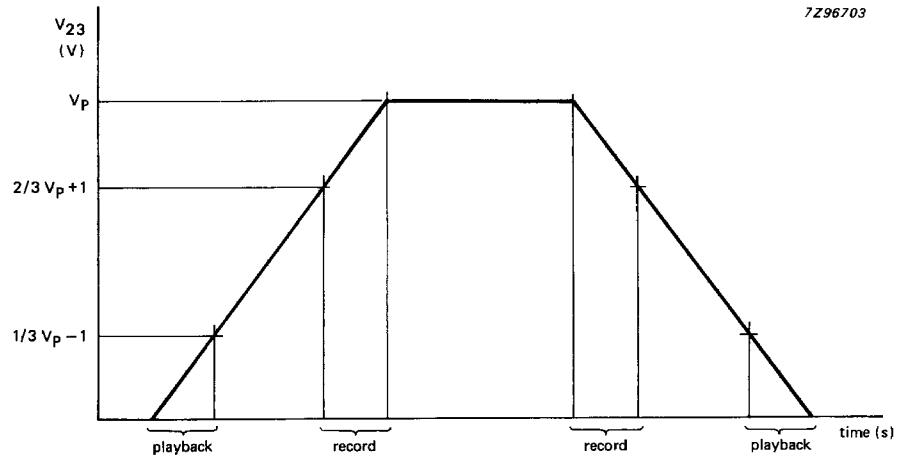

Fig. 4(b) Record/playback input.

APPLICATION INFORMATION

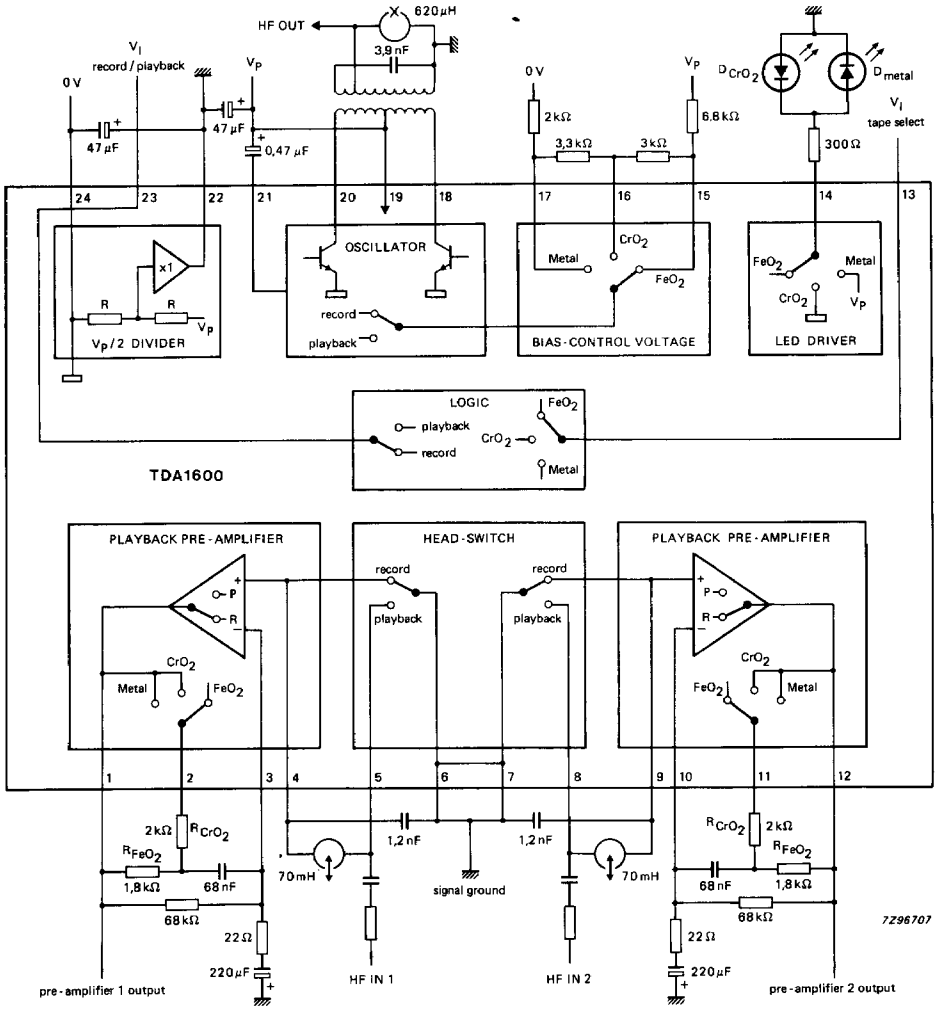

Fig. 5 Application diagram.

DEVELOPMENT DATA

APPLICATION INFORMATION (continued)

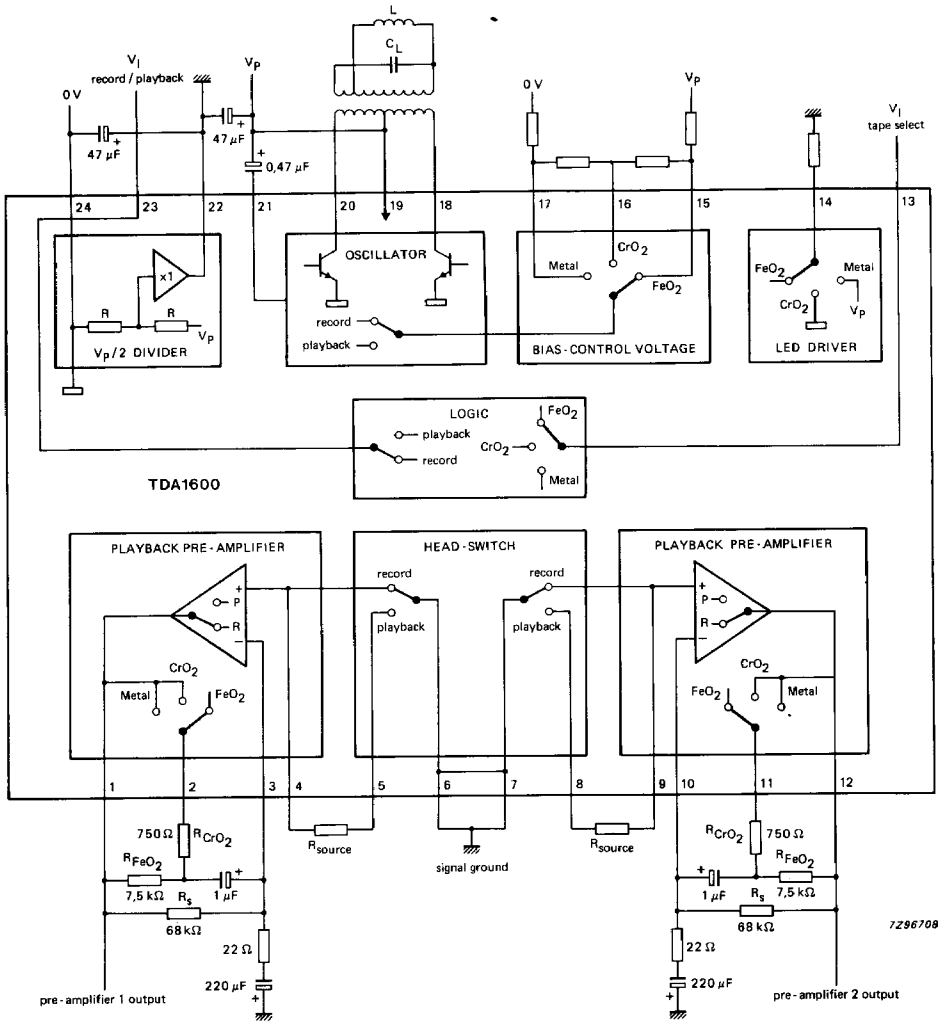

Fig. 6 Test circuit diagram.