

## 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 micro-processor. The TDA1600 operates from a mains-fed asymmetrical power supply. For application purposes the voltage output can be either  $\frac{1}{2} V_p$  asymmetrical or  $\frac{1}{2} V_p$  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 ( $\frac{1}{2} V_p$ )
- Logic part

### QUICK REFERENCE DATA

parameter	conditions	symbol	min.	typ.	max.	unit
Supply voltage range		$V_p$	10	—	20	V
<b>Playback amplifier</b>						
Open loop gain		$G_o$	—	106	—	dB
Minimum closed loop gain		$G_c$	—	30	—	dB
S/N ratio	$V_O = 50 \text{ mV}$	S/N	—	65	—	dB
Total harmonic distortion	$V_O = 50 \text{ mV}$	THD	—	-60	—	dB
<b>Head-switch</b>						
Maximum voltage (peak-to-peak value)		$V_{OM}$	—	—	120	V
<b>Oscillator</b>						
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
<b>LED driver</b>						
Maximum d.c. output current		$I_{OM}$	—	—	$\pm 15$	mA
<b>Reference voltage</b>						
Output voltage		$V_{REF}$	—	$\frac{1}{2} V_p$	—	V
Maximum load current		$I_{L \text{ max}}$	—	—	$\pm 18$	mA
<b>Logic part</b>						
Input current		$I_I$	—	-1	—	$\mu\text{A}$

### PACKAGE OUTLINE

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

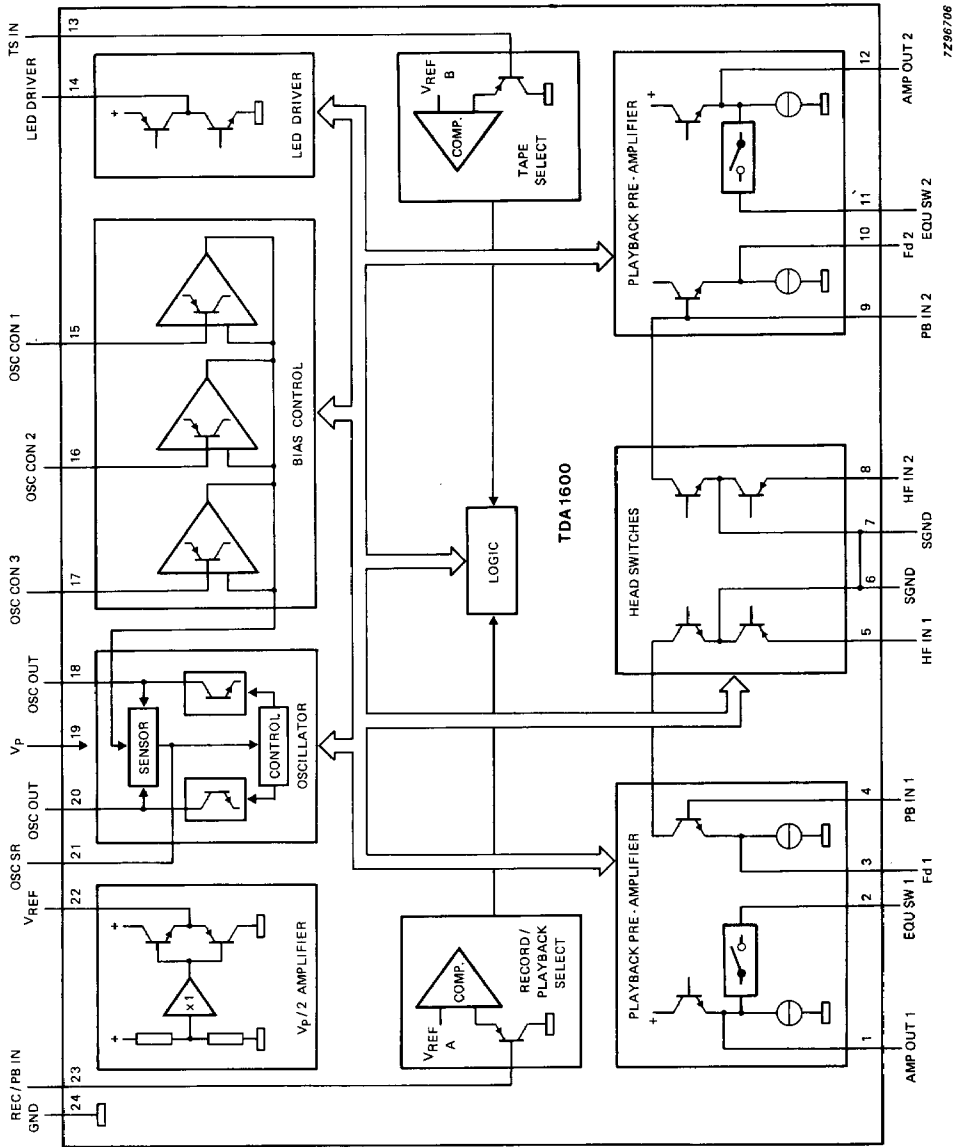


Fig. 1 Block diagram.

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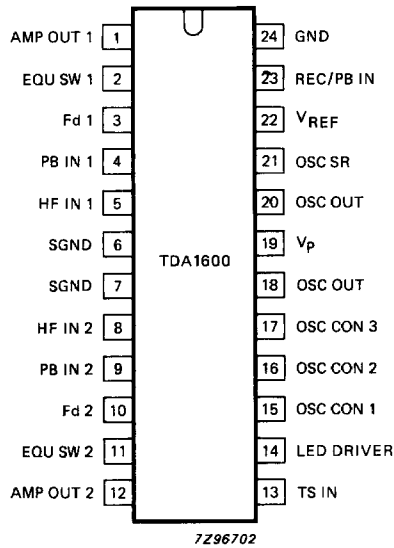


Fig. 2 Pinning diagram.

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 <sub>p</sub>	supply voltage
20	OSC OUT	oscillator output
21	OSC SR	smoothing oscillator regulator
22	V <sub>REF</sub>	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  $\mu$ s and 120  $\mu$ s) 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 ( $\text{FeO}_2$ ), Chrome ( $\text{CrO}_2$ ) 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,  $\frac{1}{2} V_P$  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 ( $+\frac{1}{2} V_P$  and  $-\frac{1}{2} V_P$ ), 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	$V_l$	0	$V_p$	V
Control input voltage	pins 15, 16 and 17	$V_l$	0	$V_p$	V
Head-switch voltage	pins 5 and 8	$V_l$	-60	+60	V
Total power dissipation	$T_{amb} = +60\text{ }^\circ\text{C}$	$P_{tot}$	—	2,5	W
Storage temperature range		$T_{stg}$	-65	+150	$^\circ\text{C}$
Junction temperature		$T_j$	—	+150	$^\circ\text{C}$

DEVELOPMENT DATA

## CHARACTERISTICS

$V_p = 15 \text{ V}$ ;  $f = 315 \text{ Hz}$ ;  $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ , unless otherwise specified (see Fig. 6)

parameter	conditions	symbol	min.	typ.	max.	unit
<b>Supply</b>						
Supply voltage range		$V_p$	10	15	20	V
Supply current	note 1, playback mode record mode	$I_p$	—	25	45	mA
		$I_p$	—	50	70	mA
<b>Playback amplifier</b>						
Open loop gain	position $\text{FeO}_2$	$G_o$	86	106	—	dB
Closed loop gain	note 2, $\text{FeO}_2$	$G_c$	49	50	51	dB
Closed loop gain	$\text{CrO}_2$ and Metal	$G_c$	30	31	32	dB
Output voltage	$V_I = 150 \mu\text{V}$	$V_O$	—	50	—	mV
Total harmonic distortion	$V_O = 50 \text{ mV}$	THD	—	—60	—55	dB
	$V_O = 500 \text{ mV}$	THD	—	—50	—45	dB
S/N ratio	note 3; weighted curve 20 Hz to 20 kHz at position $\text{CrO}_2$ and Metal see Fig. 5, weighted curve A (IEC 179) at position $\text{CrO}_2$ and Metal	S/N	59	65	—	dB
	weighted curve 20 Hz to 20 kHz at position $\text{CrO}_2$ and Metal	S/N	—	61	—	dB
	weighted curve 20 Hz to 20 kHz at position $\text{CrO}_2$ and Metal	S/N	—	54	—	dB
Frequency response				see Fig. 3		

DEVELOPMENT DATA

parameter	conditions	symbol	min.	typ.	max.	unit
Channel separation	$V_O = 50 \text{ mV}$		45	60	—	dB
Ripple rejection	$V_{rip} = 100 \text{ mV}$ , $f = 100 \text{ Hz}$ and $R_S = 1 \text{ k}\Omega$	-				
		RR	35	41	—	dB
Input impedance		$Z_I$	100	—	—	$\text{k}\Omega$
Input bias current		$I_{bias}$	—	0,8	1,5	$\mu\text{A}$
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, $V_I = 20 \text{ mV}$ , $f = 85 \text{ kHz}$		—	65	—	dB
<b>Head-switch</b>						
Impedance ON	playback mode, ( $V_{23} = 2 \text{ V}$ ) between pins 5/8 and 6/7 at $I = 100 \mu\text{A}$ (rms)	$Z_{on}$	—	40	80	$\Omega$
Impedance ON	record mode, ( $V_{23} = 13 \text{ V}$ ) between pins 4/9 and 6/7 at $I = 1,5 \text{ mA}$ (rms) $f = 85 \text{ kHz}$	$Z_{on}$	—	10	30	$\Omega$
Leakage current	between pins 5/8 and 6/7 at $V_{DC} = \pm 60 \text{ V}$	$ I_I $	—	1,0	2,5	$\mu\text{A}$

## CHARACTERISTICS (continued)

parameter	conditions	symbol	min.	typ.	max.	unit
<b>Erase and bias oscillator</b>						
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	—	—	$\mu$ A
Distortion of output voltage	between pins 18 and 20, $I_O = 80$ mA	THD	—	-65	—	dB
<b>LED driver</b>						
Output voltage	$V_{13} = 15$ V, (FeO <sub>2</sub> ) and $R_{load} = 10$ k $\Omega$	$ V_{14-22} $	—	—	10	V
Output voltage loss	$V_{13} = 7,5$ V, (CrO <sub>2</sub> ) and $I_O = -15$ mA	$V_{14-24}$	1,5	2,0	2,5	V
Output voltage loss	$V_{13} = 0$ V, (Metal) and $I_O = 15$ mA	$V_{14-19}$	1,5	2,0	2,5	V
Output current limit		$I_O$	$\pm 15$	$\pm 20$	—	mA

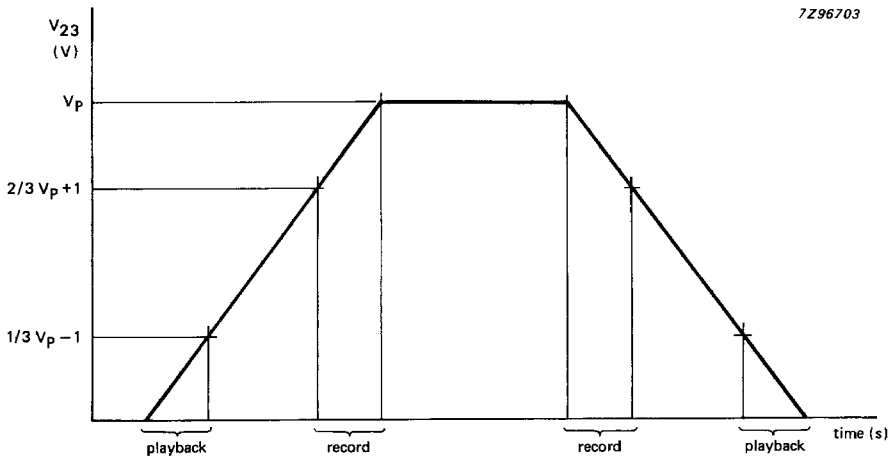
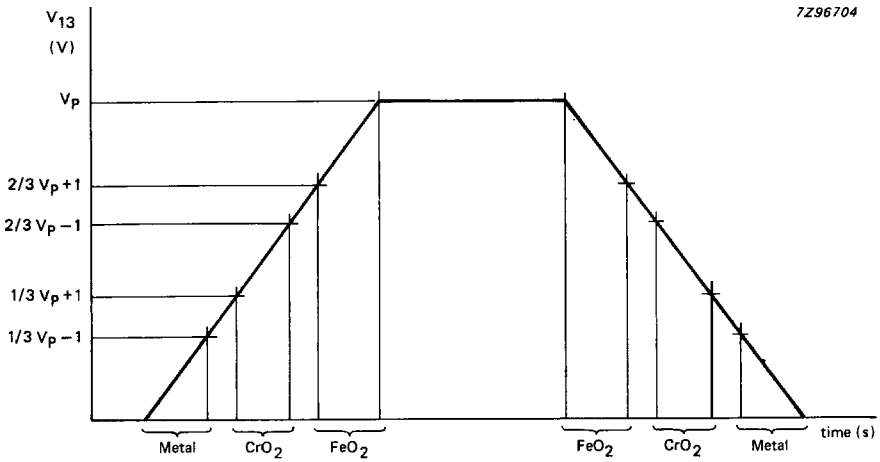
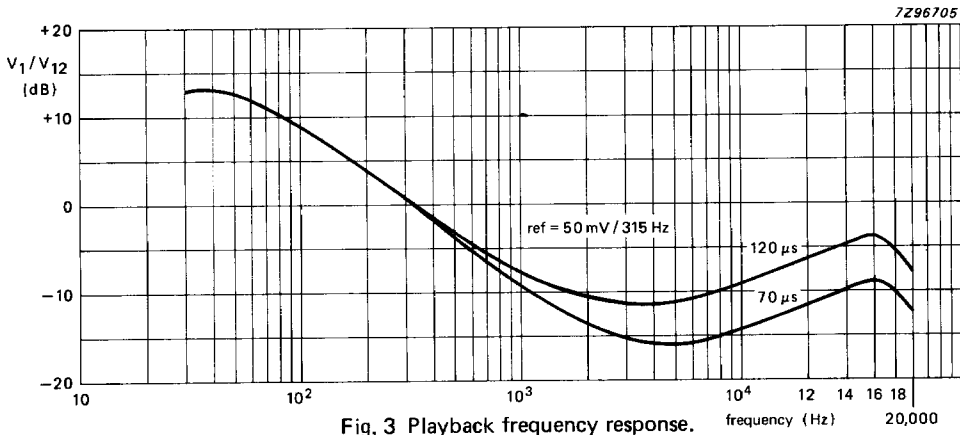


DEVELOPMENT DATA

parameter	conditions	symbol	min.	typ.	max.	unit
<b>Reference voltage</b>						
Output voltage	note 6, no external load	$V_{22-24}$	7,25	7,50	7,75	V
Output voltage deviation	$\Delta I_1 = 15 \text{ mA}$	$\Delta V_O$	—	30	90	mV
Load current		$I_L$	—	—	18	mA
Output current limit		$I_{O1}$	20	30	—	mA
<b>Logic inputs</b>						
Input for tape selection						
pin 13						
Input current		$I_1$	—	-1	-20	$\mu\text{A}$
Input voltage	FeO <sub>2</sub>	$V_1$	11	—	15	V
Input voltage	CrO <sub>2</sub>	$V_1$	6	—	9	V
Input voltage	Metal	$V_1$	0	—	4	V
Input for record/playback mode selection						
pin 23						
Input current		$I_1$	—	-1	-20	$\mu\text{A}$
Input voltage	see Fig. 4					
	playback mode	$V_1$	0	—	4	V
	record mode	$V_1$	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  $\frac{1}{2} V_p$  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<sub>2</sub> position, by  $R_{FeO_2}/R_{CrO_2}$  in the CrO<sub>2</sub> 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  $V_O = 50 \text{ mV}$  (at  $f = 315 \text{ Hz}$ ) and  $R_S = 1 \text{ k}\Omega$ .
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  $-(V_p - 2 \text{ V})$  min. and  $-2 \text{ V}$  max. with respect to  $V_p$ .
6. The output voltage is independent of the operating mode (playback/record).



APPLICATION INFORMATION

DEVELOPMENT DATA

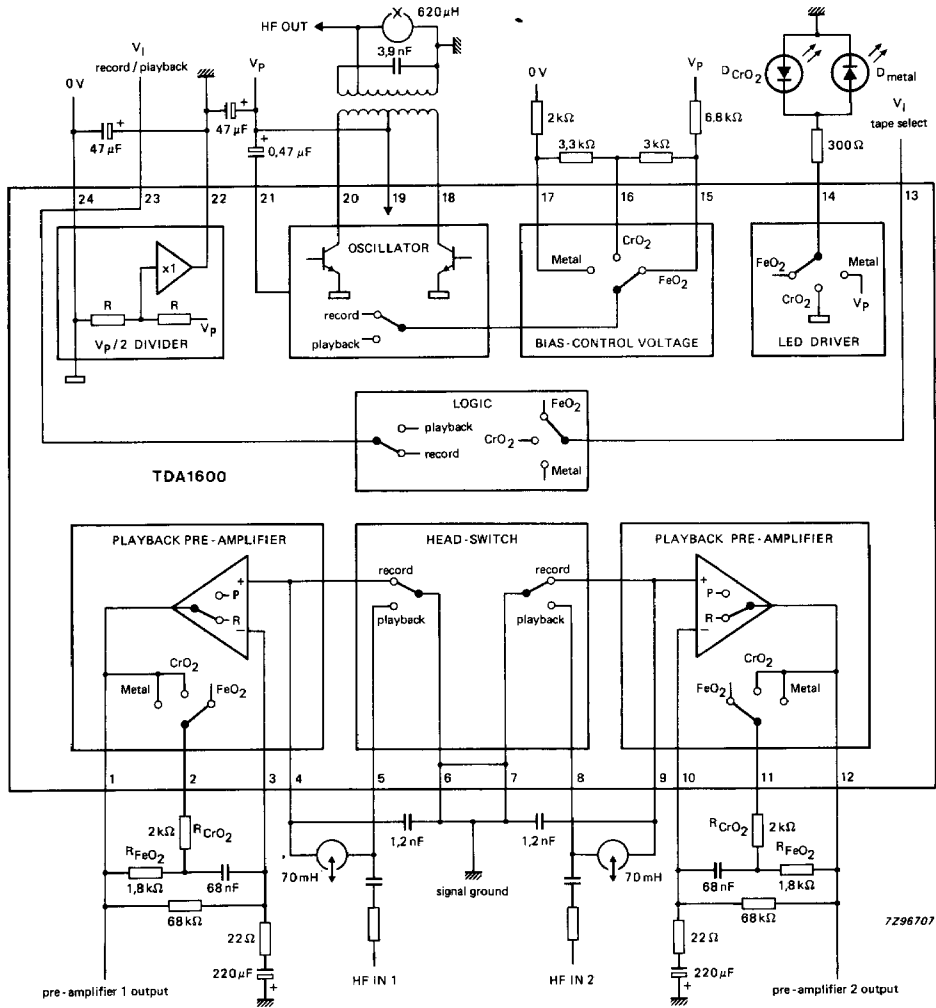


Fig. 5 Application diagram.

APPLICATION INFORMATION (continued)

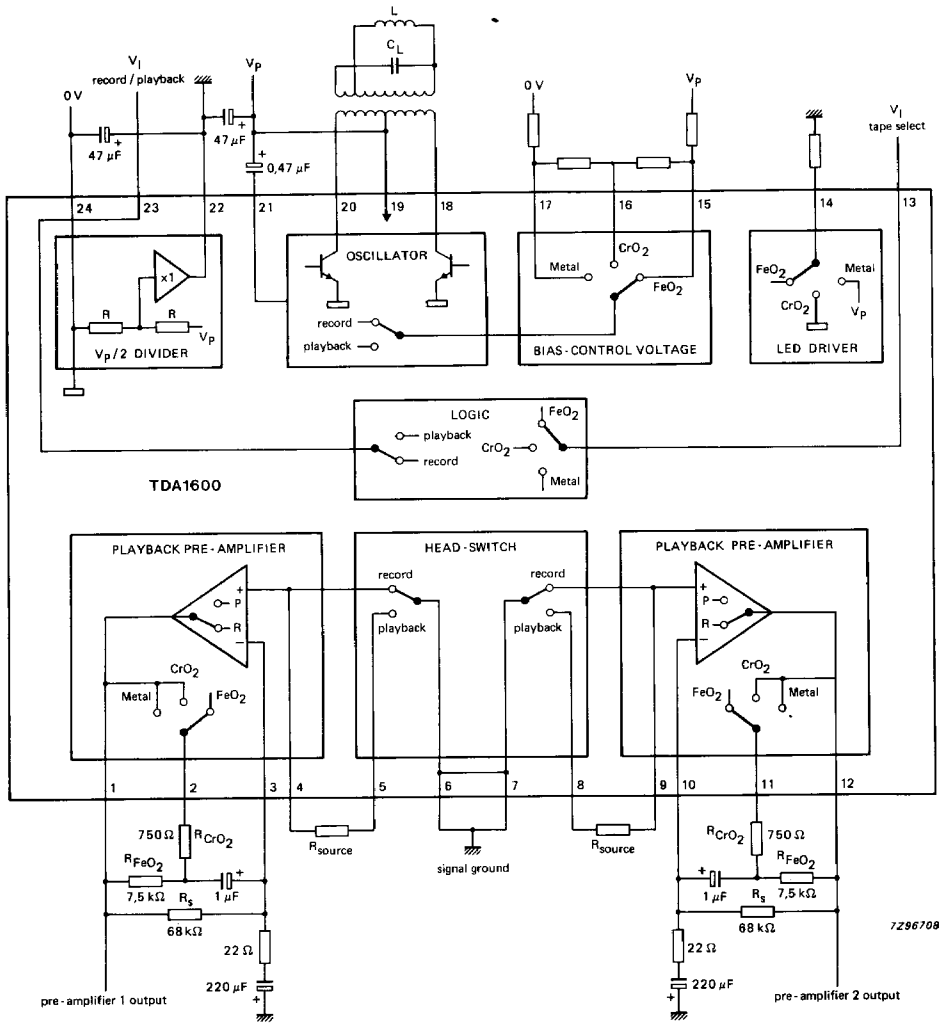


Fig. 6 Test circuit diagram.