

SIGNAL-SOURCES SWITCH

The TDA1028 is a quadruple operational amplifier connected as an impedance converter. Each amplifier has 2 switchable inputs which are protected by clamping diodes. The input currents are independent of the switch position and the outputs are short-circuit protected.

The device is intended as an electronic four-channel signal-sources switch in a.f. amplifiers.

QUICK REFERENCE DATA

Supply voltage range (pin 9)	V_P	6 to 23 V
Operating ambient temperature	T_{amb}	-30 to + 80 °C
Supply voltage (pin 9)	V_P	typ. 20 V
Current consumption (pins 4, 5, 12, 13 unloaded)	I_g	typ. 2,9 mA
Maximum input signal handling (r.m.s. value)	$V_{i(rms)}$	typ. 6 V
Voltage gain	G_V	typ. 1
Total harmonic distortion	d_{tot}	typ. 0,01 %
Crosstalk	α	typ. 70 dB
Signal-to-noise ratio	S/N	typ. 120 dB

PACKAGE OUTLINE

16-lead DIL; plastic (SOT-38).

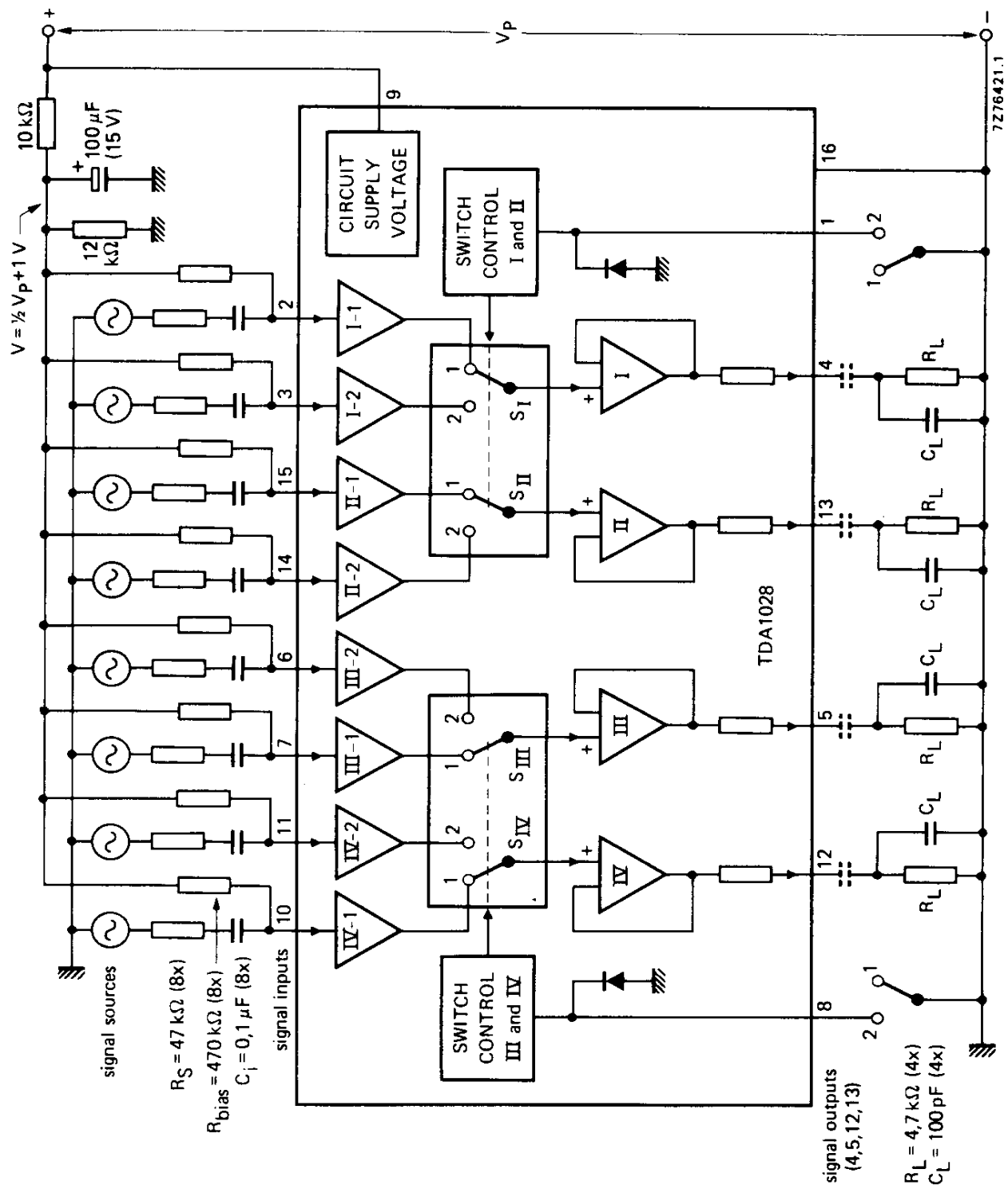


Fig. 1 Block diagram.

RATINGS

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

Supply voltage (pin 9)	V_P	max.	23 V
Input voltages (pins 2, 3, 6, 7, 10, 11, 14, 15)	V_I	max.	V_P
	$-V_I$	max.	0,5 V
Switch control voltage (pin 1 and 8)	V_S		0 to 23 V
Input current	$\pm I_I$	max.	20 mA
Switch control current	$-I_S$	max.	50 mA
Total power dissipation	P_{tot}	max.	800 mW
Storage temperature	T_{stg}		-55 to + 150 °C
Operating ambient temperature	T_{amb}		-30 to + 80 °C

CHARACTERISTICS $V_P = 20 \text{ V}$; $T_{amb} = 25 \text{ °C}$; unless otherwise specified

Current consumption without load; I_4 ; 5; 12; 13 = 0	I_g	typ.	2,9 mA
			1,6 to 4,2 mA
Supply voltage range	V_P		6 to 23 V

Signal inputs

Input offset voltage of switched-on inputs ($R_S < 1 \text{ k}\Omega$)	V_{io}	typ. <	2 mV 10 mV
Input offset current of switched-on inputs	I_{io}	typ. <	20 nA 200 nA
Input offset current of a switched-on input with respect to a non-switched-on input	I_{io}	typ. <	20 nA 200 nA
Input bias current independent of switch position	I_i	typ. <	250 nA 950 nA
Capacitance between adjacent inputs	C	typ.	0,5 pF
D.C. input voltage range	V_I		3 to 19 V
Supply voltage rejection ratio; $R_S < 10 \text{ k}\Omega$	SVRR	typ.	100 $\mu\text{V/V}$
Equivalent input noise voltage $R_S \leq 1 \text{ k}\Omega$; $f = 20 \text{ Hz to } 20 \text{ kHz}$ (r.m.s. value)	$V_{n(rms)}$	typ.	3,5 μV
Equivalent input noise current $f = 20 \text{ Hz to } 20 \text{ kHz}$ (r.m.s. value)	$I_{n(rms)}$	typ.	0,05 nA
Crosstalk between a switched-on input and a non-switched-on input; measured at the output at $R_S < 1 \text{ k}\Omega$; $f = 1 \text{ kHz}$	α	typ.	100 dB

Signal amplifier

Voltage gain of a switched-on input at I_4 ; 5; 12; 13 = 0; $R_L = \infty$	G_V	typ.	1
Current gain of a switched-on amplifier	G_i	typ.	10^5

CHARACTERISTICS (continued)**Signal outputs**

Output resistance

 R_O typ. 400 Ω

Output current capability (pins 4, 5, 12 and 13)

 $\pm I_O$ > 5 mA

Frequency limit of the output voltage

at $V_{i(p-p)} = 1$ V; $R_S < 1$ k Ω ; $R_L = 10$ M Ω ; $C_L = 10$ pF

f typ. 1,3 MHz

Slew rate (unity gain) $\Delta V_{4, 5, 12, 13-16}/\Delta t$ at $R_L = 10$ M Ω ; $C_L = 10$ pFS typ. 2 V/ μ s**Switch control**

switched-on inputs	interconnected pins	control voltages	
		V ₁₋₁₆	V ₈₋₁₆
I-1, II-1	2-4, 15-13	H	—
I-2, II-2	3-4, 14-13	L	—
III-1, IV-1	7-5, 10-12	—	H
III-2, IV-2	6-5, 11-12	—	L

Control inputs (pins 1 and 8)

Required voltage

HIGH

 V_{SH} > 3,3 V *

LOW

 V_{SL} < 2,1 V

Input current

HIGH (leakage current)

 I_{SH} < 1 μ A

LOW (control current)

 $-I_{SL}$ < 200 μ A* Or control inputs open; $R_{1-16}, R_{8-16} > 33$ M Ω .

APPLICATION INFORMATION

$V_P = 20\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$; measured in Fig. 1; $R_S = 47\text{ k}\Omega$; $C_i = 0,1\text{ }\mu\text{F}$; $R_{bias} = 470\text{ k}\Omega$; $R_L = 4,7\text{ k}\Omega$; $C_L = 100\text{ pF}$ (unless otherwise specified)

Voltage gain	G_V	typ.	-1,5 dB
D.C. output voltage variation when switching the inputs (pins 4, 5, 12 and 13)	ΔV_O	typ. <	10 mV 100 mV
Total harmonic distortion over most of signal range (see Fig. 4)	d_{tot}	typ.	0,01 %
at $V_i = 5\text{ V}$; $f = 1\text{ kHz}$	d_{tot}	typ.	0,02 %
at $V_i = 5\text{ V}$; $f = 20\text{ Hz to } 20\text{ kHz}$	d_{tot}	typ.	0,03 %
Output signal handling $d_{tot} = 0,1\%$; $f = 1\text{ kHz}$ (r.m.s. value)	$V_{O(rms)}$	> typ.	5,0 V 5,3 V
Noise output voltage (unweighted) $f = 20\text{ Hz to } 20\text{ kHz}$ (r.m.s. value)	$V_{N(rms)}$	typ.	5 μV
Noise output voltage (weighted) $f = 20\text{ Hz to } 20\text{ kHz}$ (in accordance with DIN 45405)	V_N	typ.	12 μV
Amplitude response (pins 4, 5, 12 and 13) $V_i = 5\text{ V}$; $f = 20\text{ Hz to } 20\text{ kHz}$	ΔV_O	typ.	0,1 dB *
Crosstalk between a switched-on input and a non-switched-on input; measured at the output at $f = 1\text{ kHz}$	α	typ.	75 dB **
Crosstalk between switched-on inputs and the outputs of the other channels; at $f = 1\text{ kHz}$	α	typ.	90 dB **

* The lower cut-off frequency depends on values of R_{bias} and C_i .

** Depends on external circuitry and R_S . The value will be fixed mostly by capacitive crosstalk of the external components.

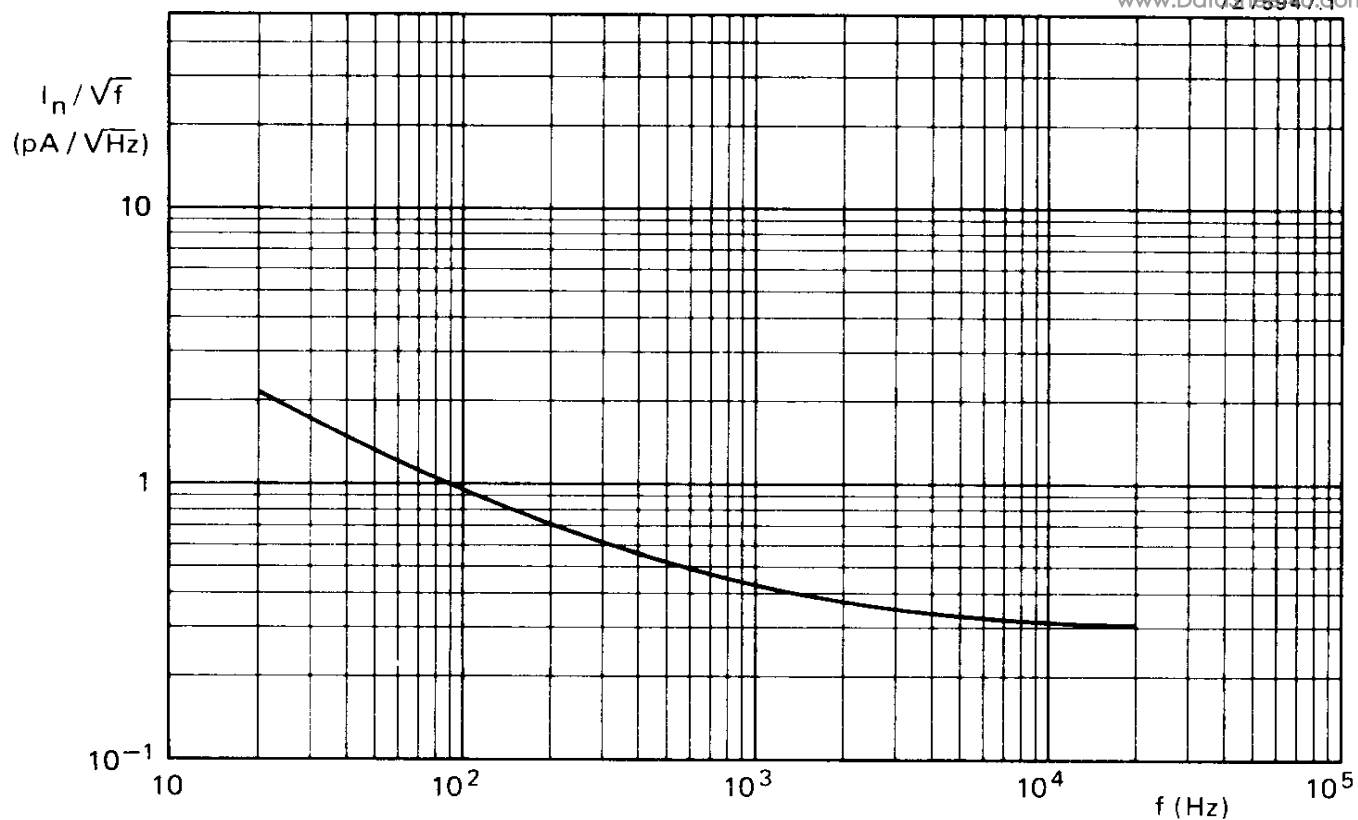


Fig. 2 Equivalent input noise current.

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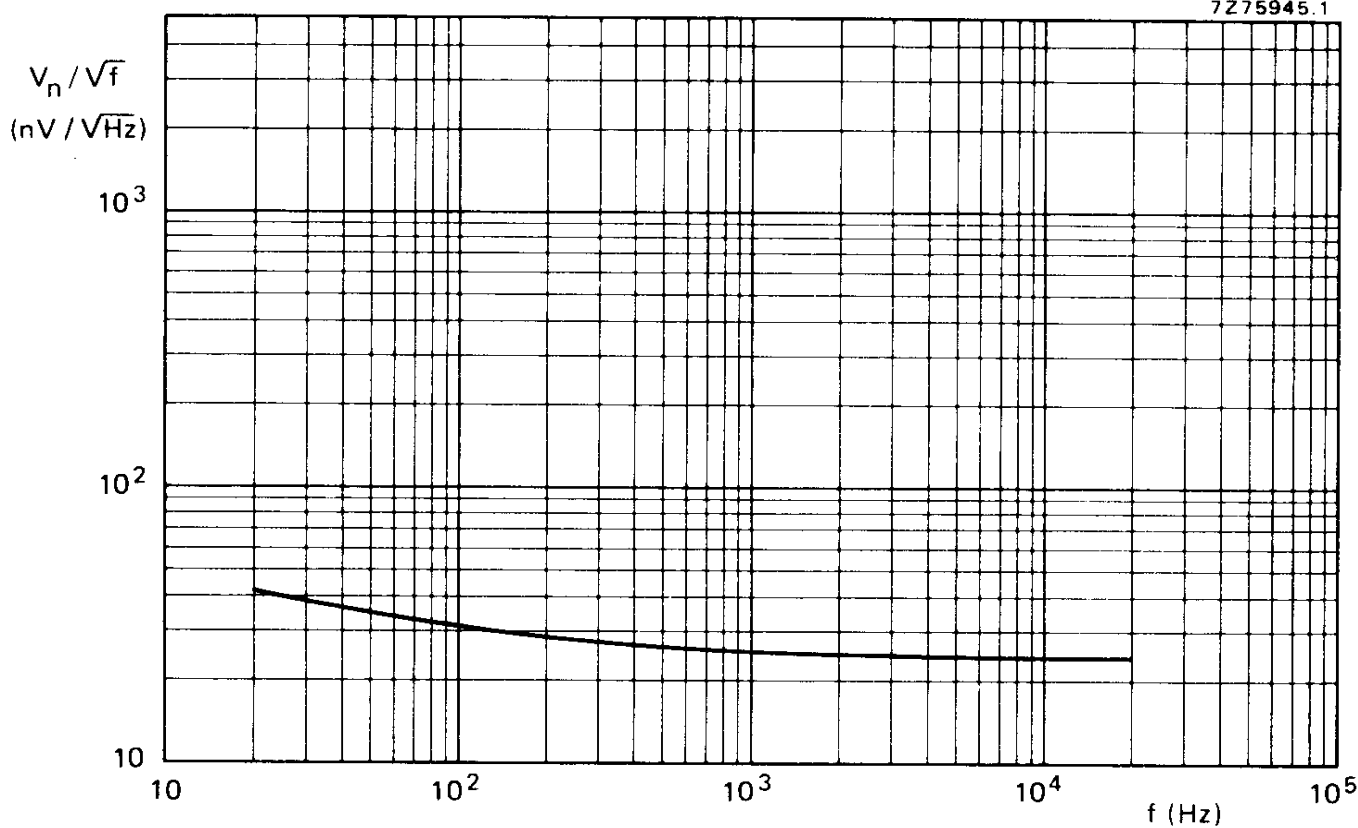


Fig. 3 Equivalent input noise voltage.

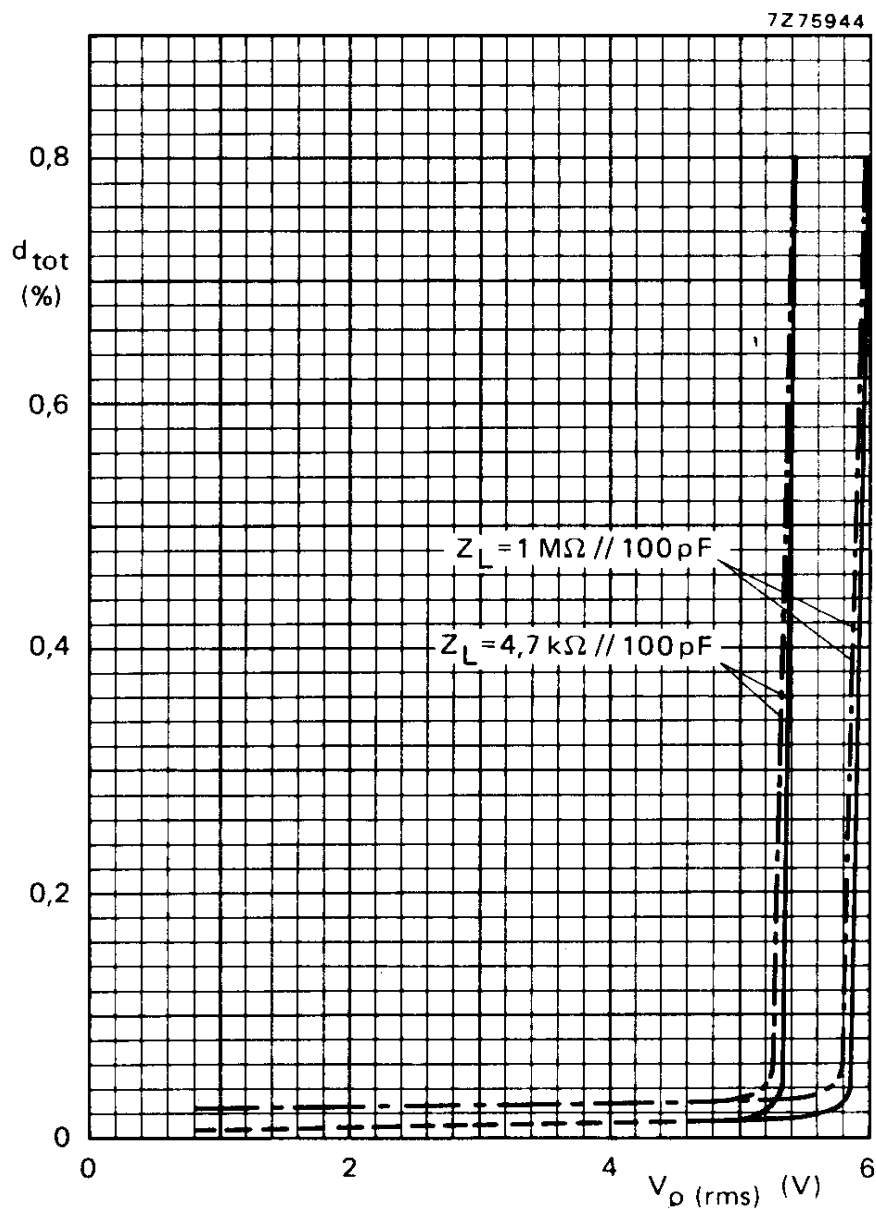


Fig. 4 Total harmonic distortion as a function of r.m.s. output voltage.
— $f = 1\text{ kHz}$; — - — $f = 20\text{ kHz}$.

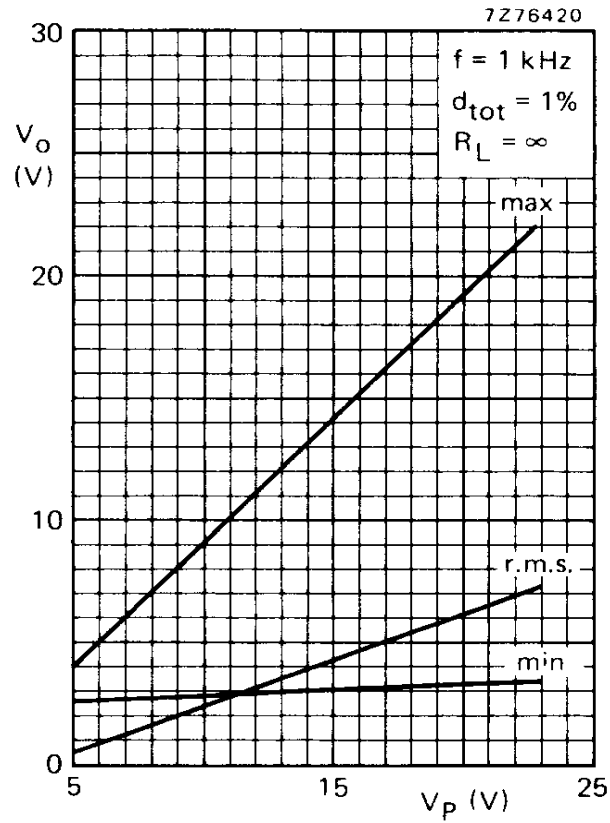
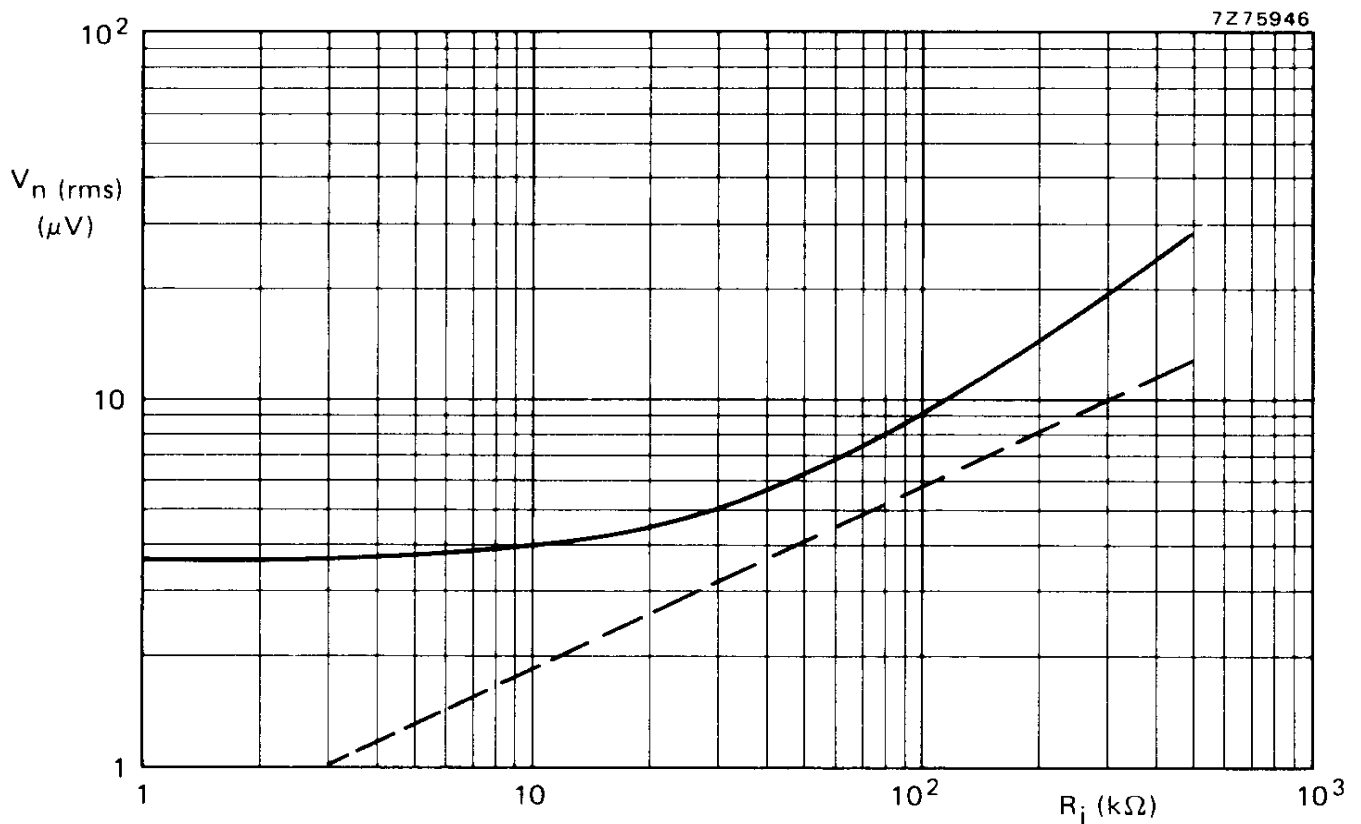


Fig. 5 Output voltage as a function of supply voltage.

Fig. 6 Noise output voltage as a function of input resistance; $G_V = 1$; $f = 20 \text{ Hz to } 20 \text{ kHz}$.
— $V_n \text{ (output)}$; - - - $V_n (R_S)$.

APPLICATION NOTES

Input protection circuit and indication

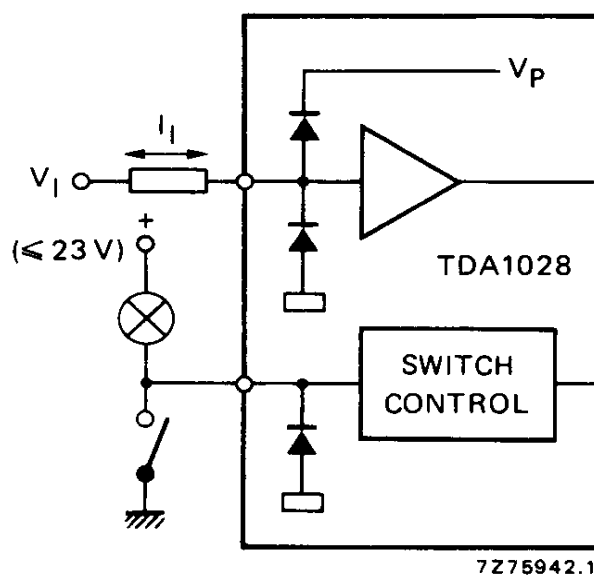


Fig. 7 Circuit diagram showing input protection and indication.

Unused signal inputs

Any unused inputs must be connected to a d.c. (bias) voltage, which is within the d.c. input voltage range.

Circuits with standby operation

The control inputs (pins 1 and 8) are high-ohmic at $V_{SH} \leq 20 \text{ V}$ ($I_{SH} \leq 1 \mu\text{A}$), as well as, when the supply voltage (pin 9) is switched off.

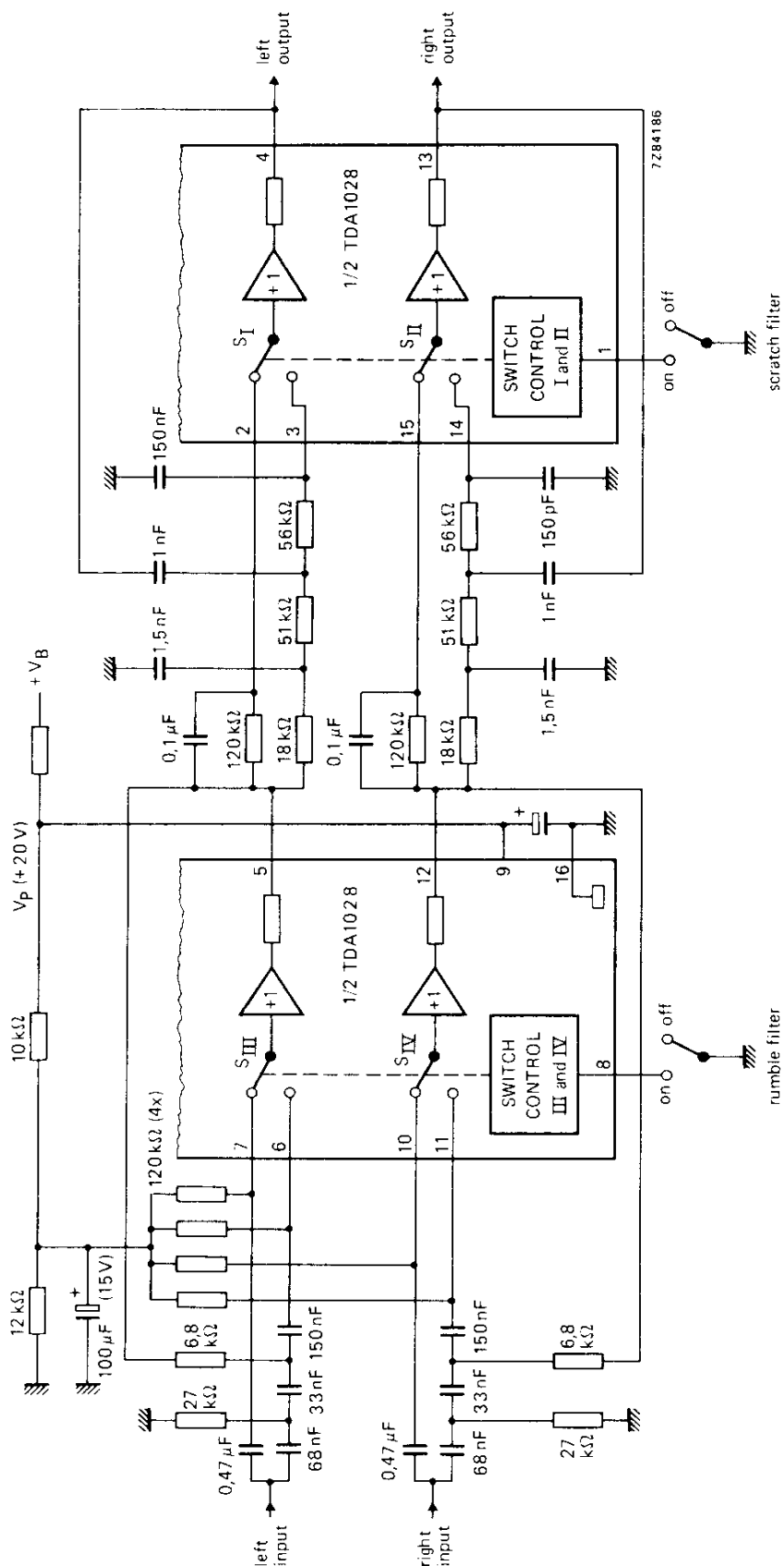


Fig. 8 Typical application diagram for a switchable scratch/rumble filter.

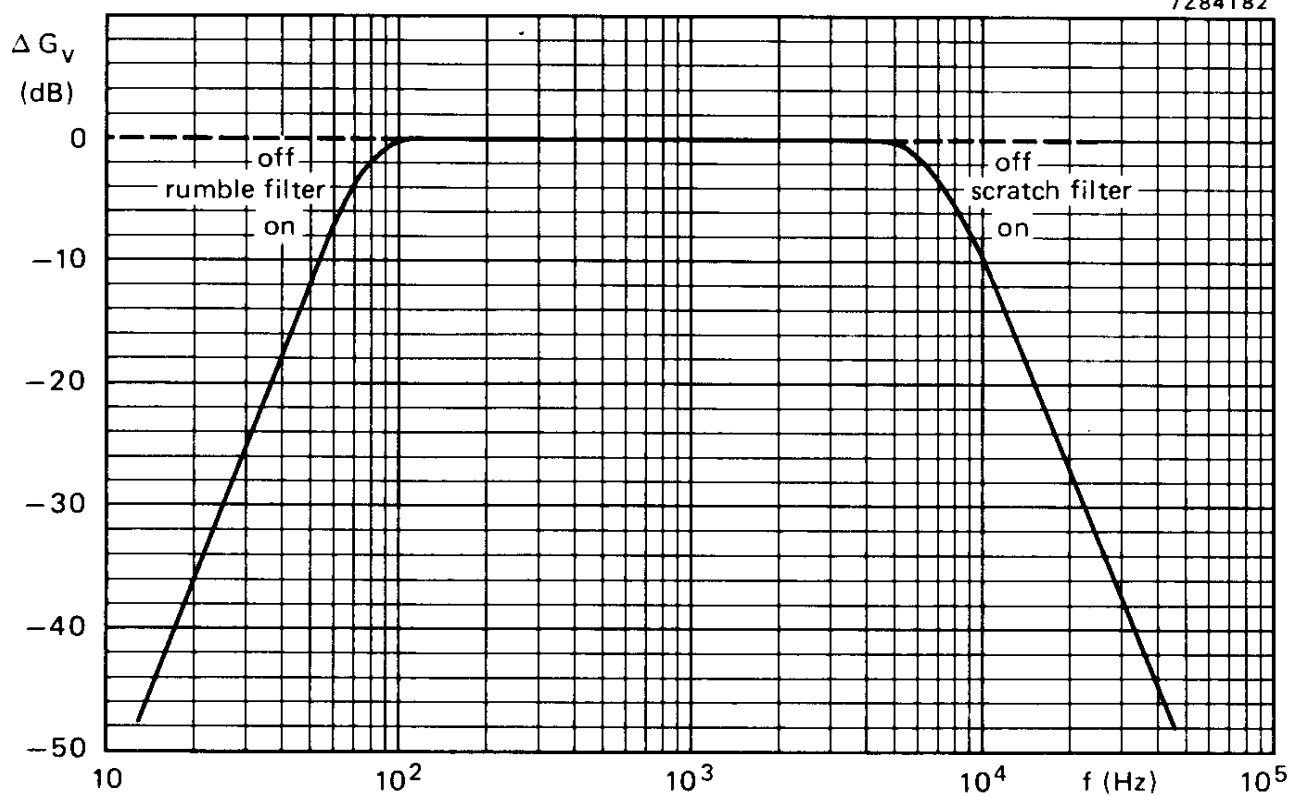


Fig. 9 Frequency response curves for scratch/rumble filters in Fig. 8.

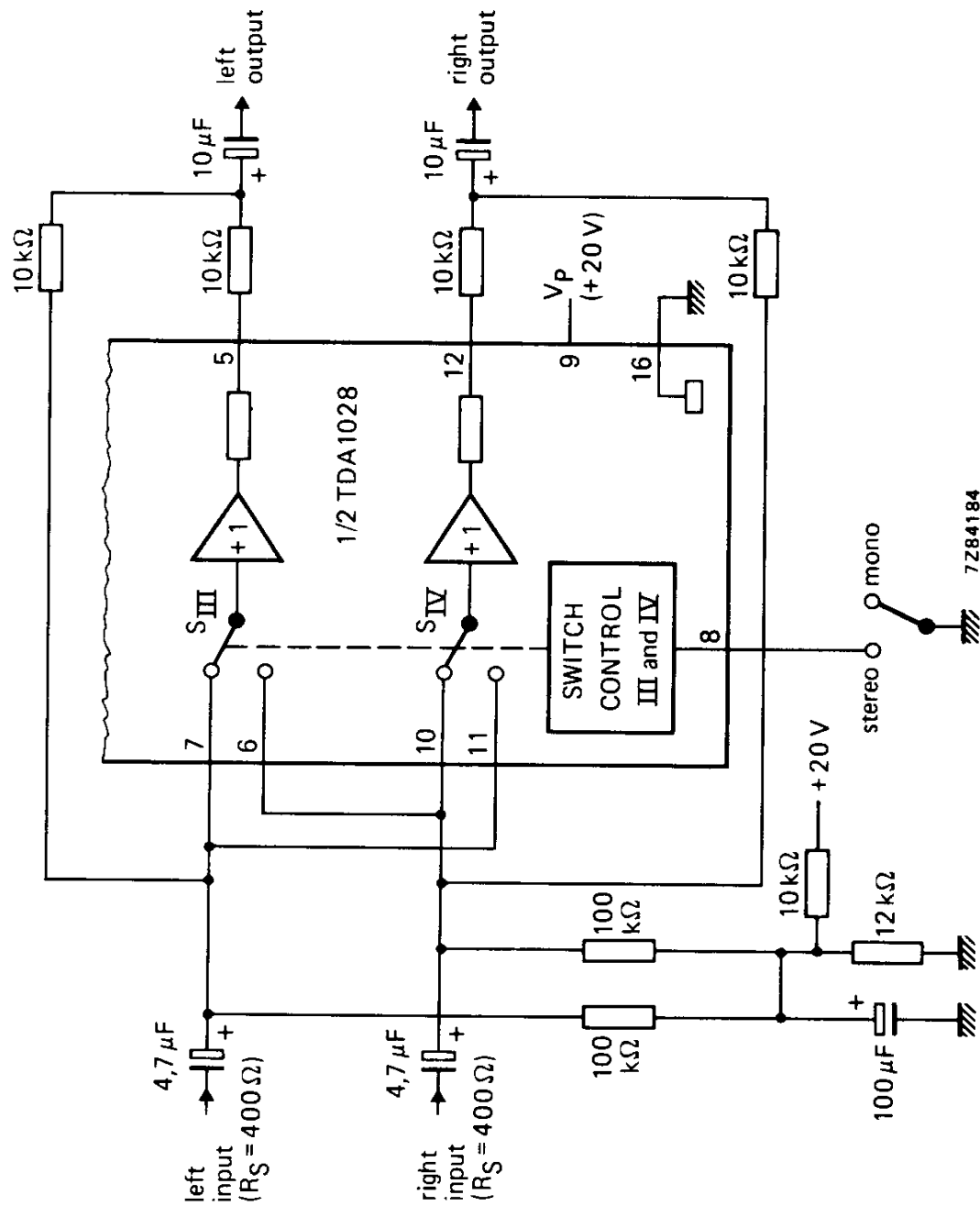


Fig. 10 Half of TDA1028 used as a mono/stereo switch.