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_9	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).

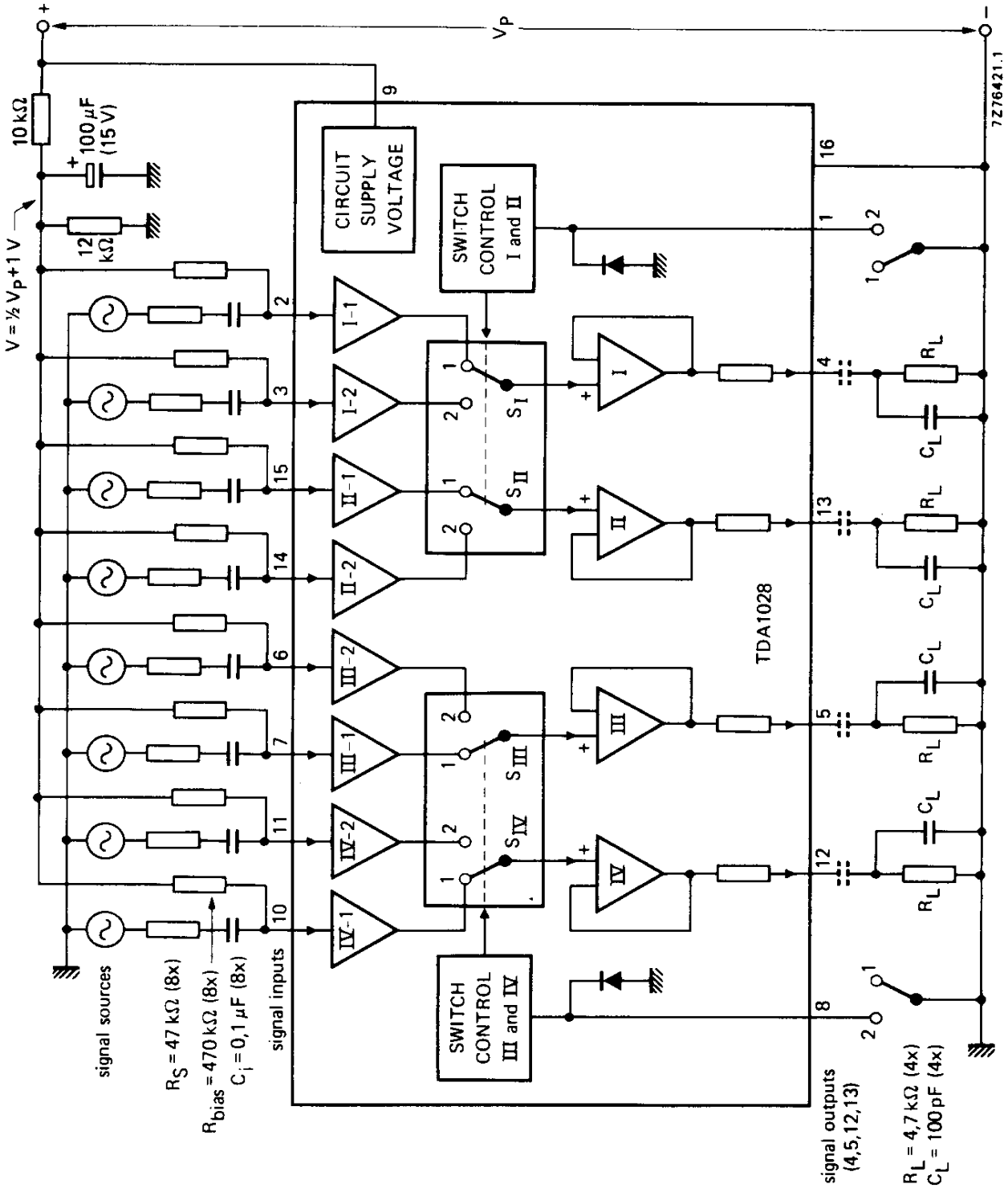

Fig. 1 Block diagram.

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 V; T_{amb} = 25 °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 ($R_S < 1$ kΩ)	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; $R_S < 10$ kΩ	SVRR	typ.	100	μV/V
Equivalent input noise voltage $R_S \leqslant 1$ kΩ; f = 20 Hz to 20 kHz (r.m.s. value)	$V_{n(rms)}$	typ.	3,5	μV
Equivalent input noise current f = 20 Hz to 20 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 $R_S < 1$ kΩ; f = 1 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 kΩ; R_L = 10 MΩ; C_L = 10 pF	f	typ.	1,3 MHz
Slew rate (unity gain) $\Delta V_{4;\,5;\,12;\,13\text{-}16}/\Delta t$ at R_L = 10 MΩ; C_L = 10 pF	S	typ.	2 V/μs

Switch control

switched-on inputs	interconnected pins	control voltages	
		$V_{1\text{-}16}$	$V_{8\text{-}16}$
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 μA
LOW (control current)	$-I_{SL}$	<	200 μA

* Or control inputs open; $R_{1\text{-}16}$, $R_{8\text{-}16}$ > 33 MΩ.

APPLICATION INFORMATION

V_P = 20 V; T_{amb} = 25 °C; measured in Fig. 1; R_S = 47 kΩ; C_i = 0,1 μF; R_{bias} = 470 kΩ; R_L = 4,7 kΩ; C_L = 100 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. <	10 100	mV mV
Total harmonic distortion				
over most of signal range (see Fig. 4)	d_{tot}	typ.	0,01	%
at V_i = 5 V; f = 1 kHz	d_{tot}	typ.	0,02	%
at V_i = 5 V; f = 20 Hz to 20 kHz	d_{tot}	typ.	0,03	%
Output signal handling				
d_{tot} = 0,1%; f = 1 kHz (r.m.s. value)	$V_{o(rms)}$	> typ.	5,0 5,3	V V
Noise output voltage (unweighted)				
f = 20 Hz to 20 kHz (r.m.s. value)	$V_{n(rms)}$	typ.	5	μV
Noise output voltage (weighted)				
f = 20 Hz to 20 kHz (in accordance with DIN 45405)	V_n	typ.	12	μV
Amplitude response (pins 4, 5, 12 and 13)				
V_i = 5 V; f = 20 Hz to 20 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 kHz	α	typ.	75	dB **
Crosstalk between switched-on inputs and the outputs of the other channels; at f = 1 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.

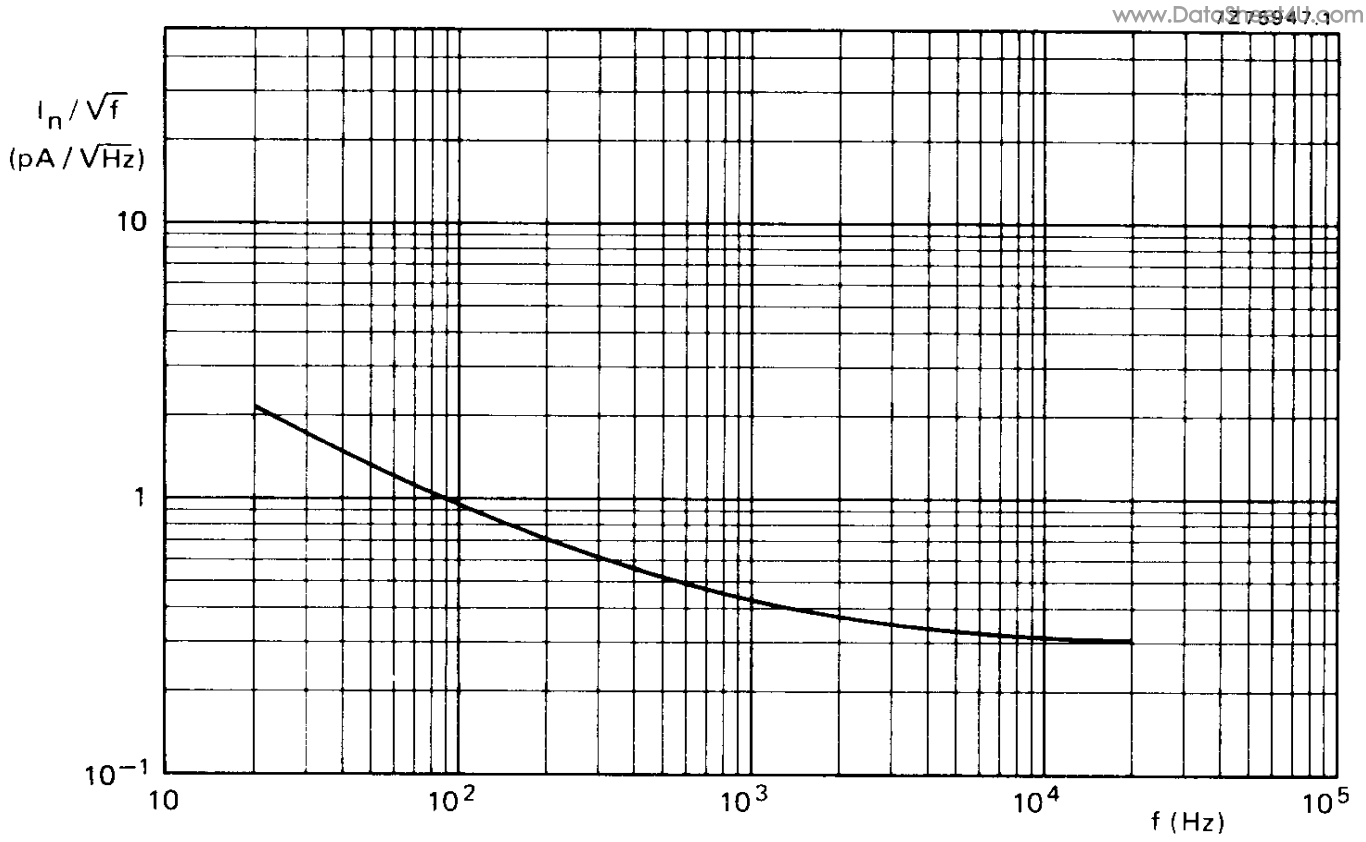

Fig. 2 Equivalent input noise current.

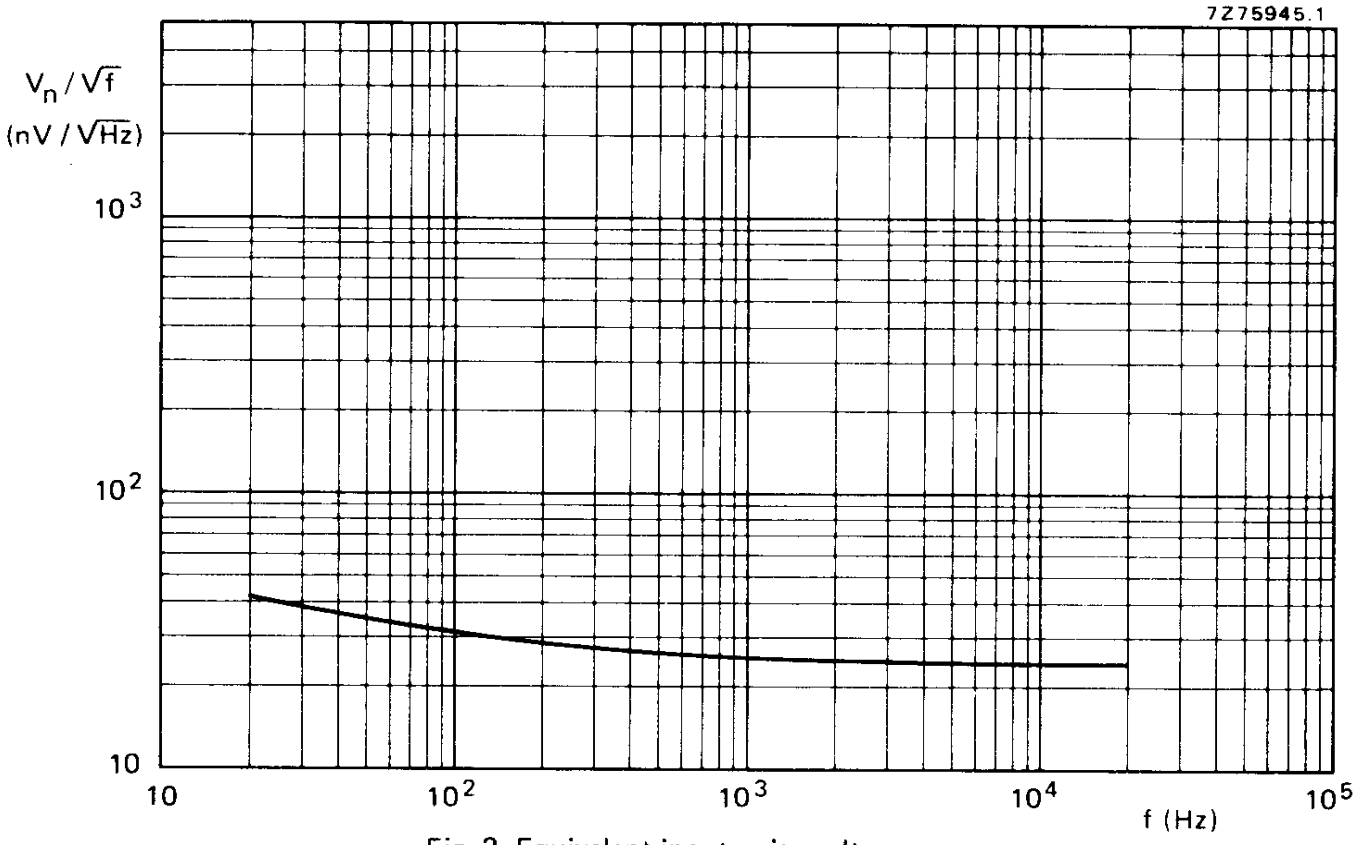

Fig. 3 Equivalent input noise voltage.

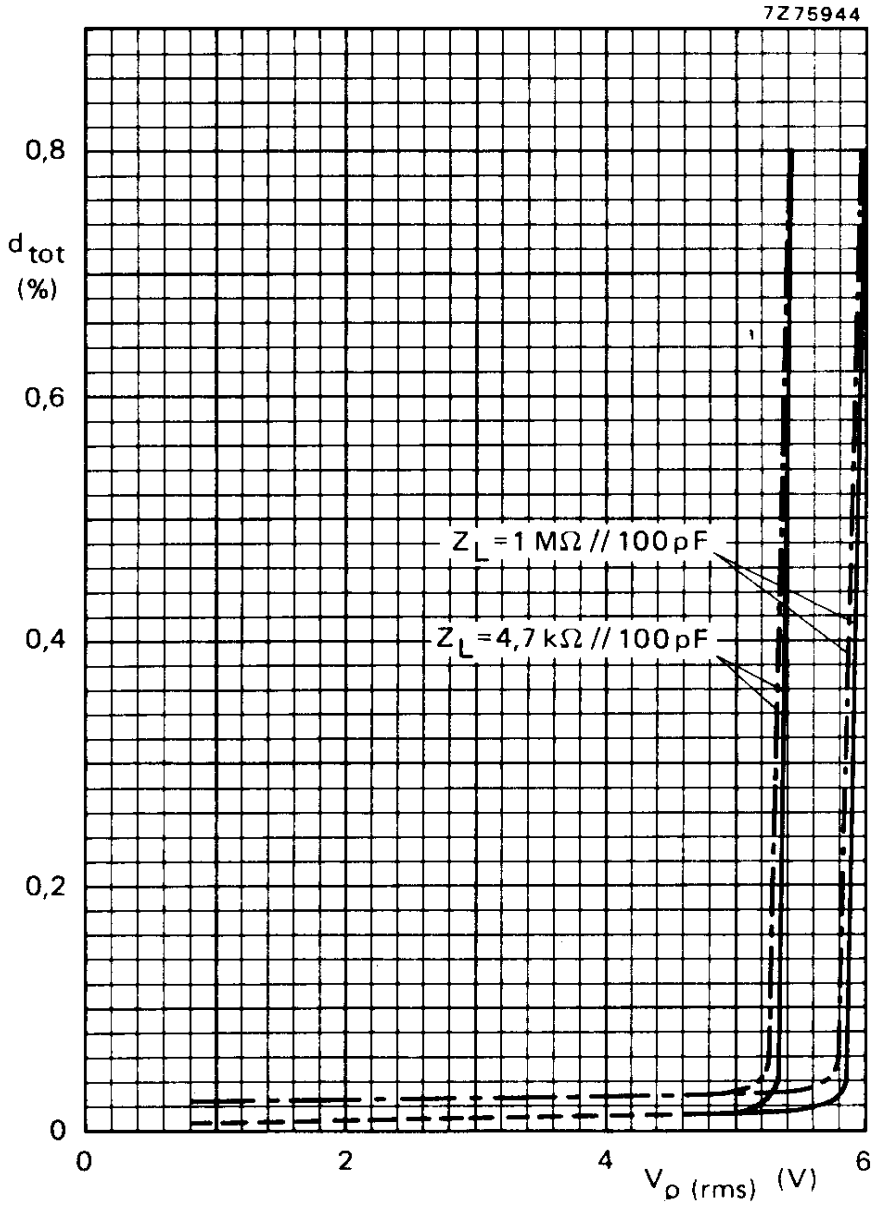

Fig. 4 Total harmonic distortion as a function of r.m.s. output voltage.
—— f = 1 kHz; — - — - f = 20 kHz.

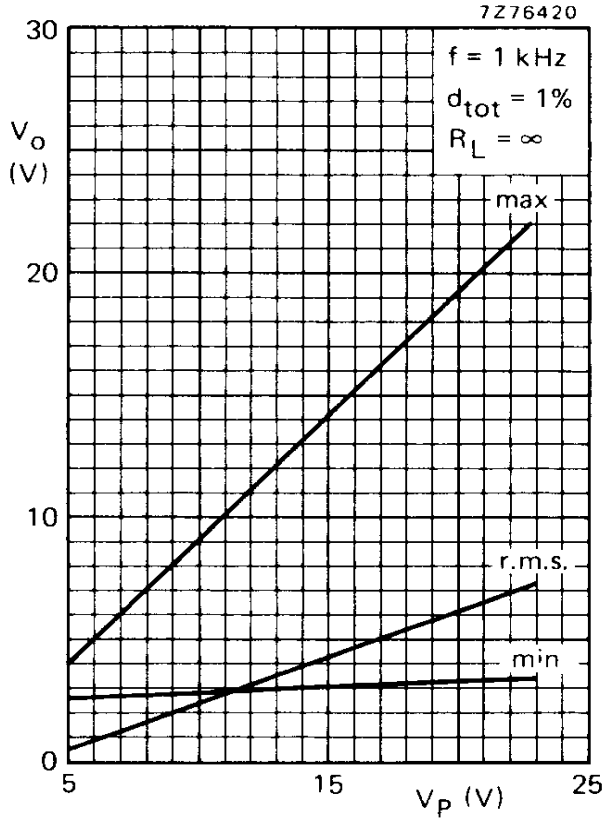

Fig. 5 Output voltage as a function of supply voltage.

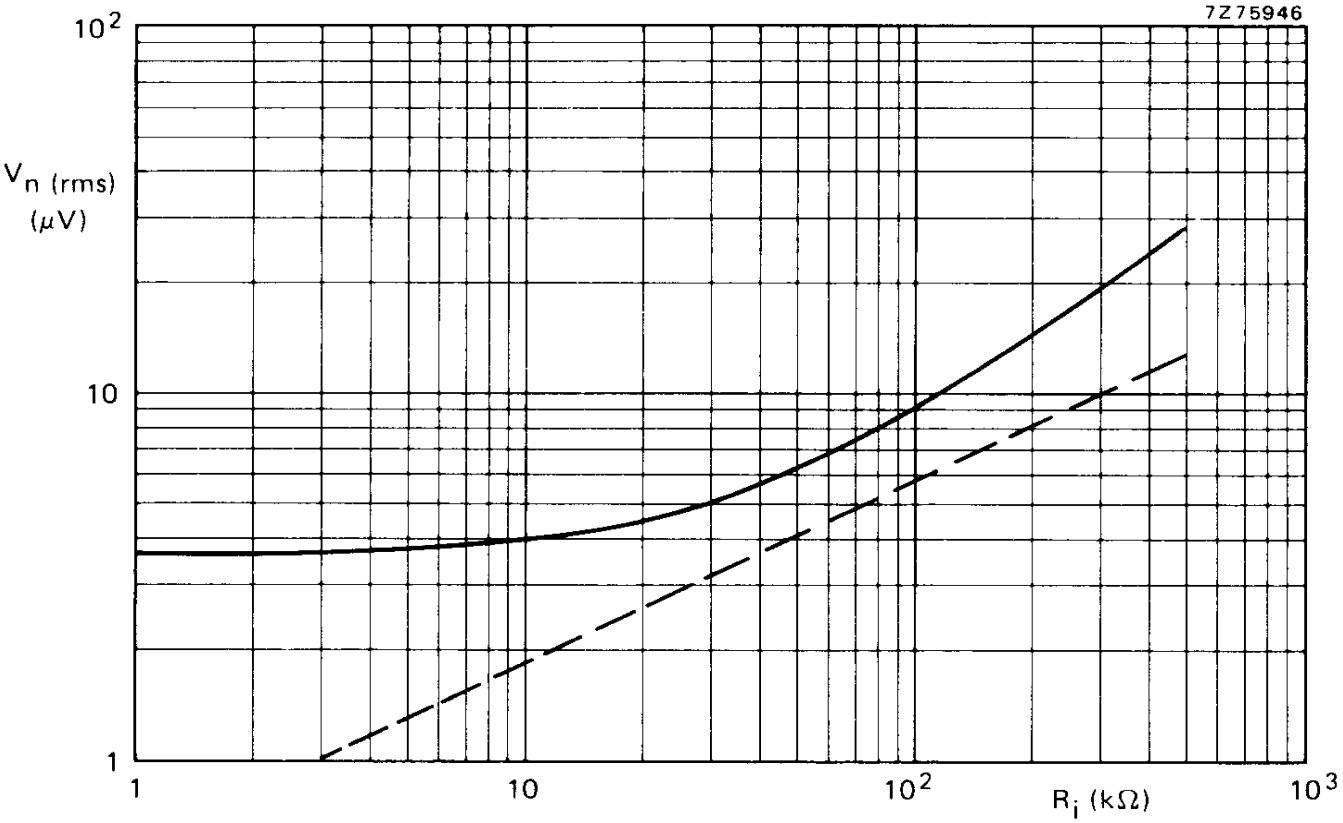

Fig. 6 Noise output voltage as a function of input resistance; G_V = 1; f = 20 Hz to 20 kHz.
—— V_n (output); – – – V_n (R_S).

APPLICATION NOTES

Input protection circuit and indication

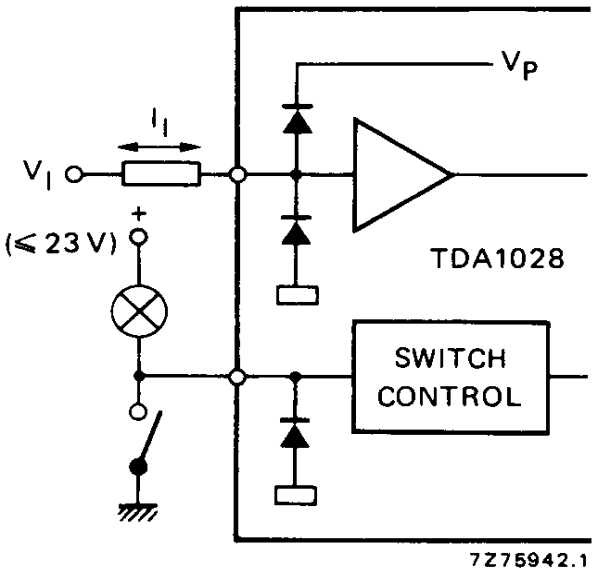

Fig. 7 Circuit diagram showing input protection and indication.

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 $V_{SH} \leqslant 20$ V ($I_{SH} \leqslant 1$ μA), as well as, when the supply voltage (pin 9) is switched off.

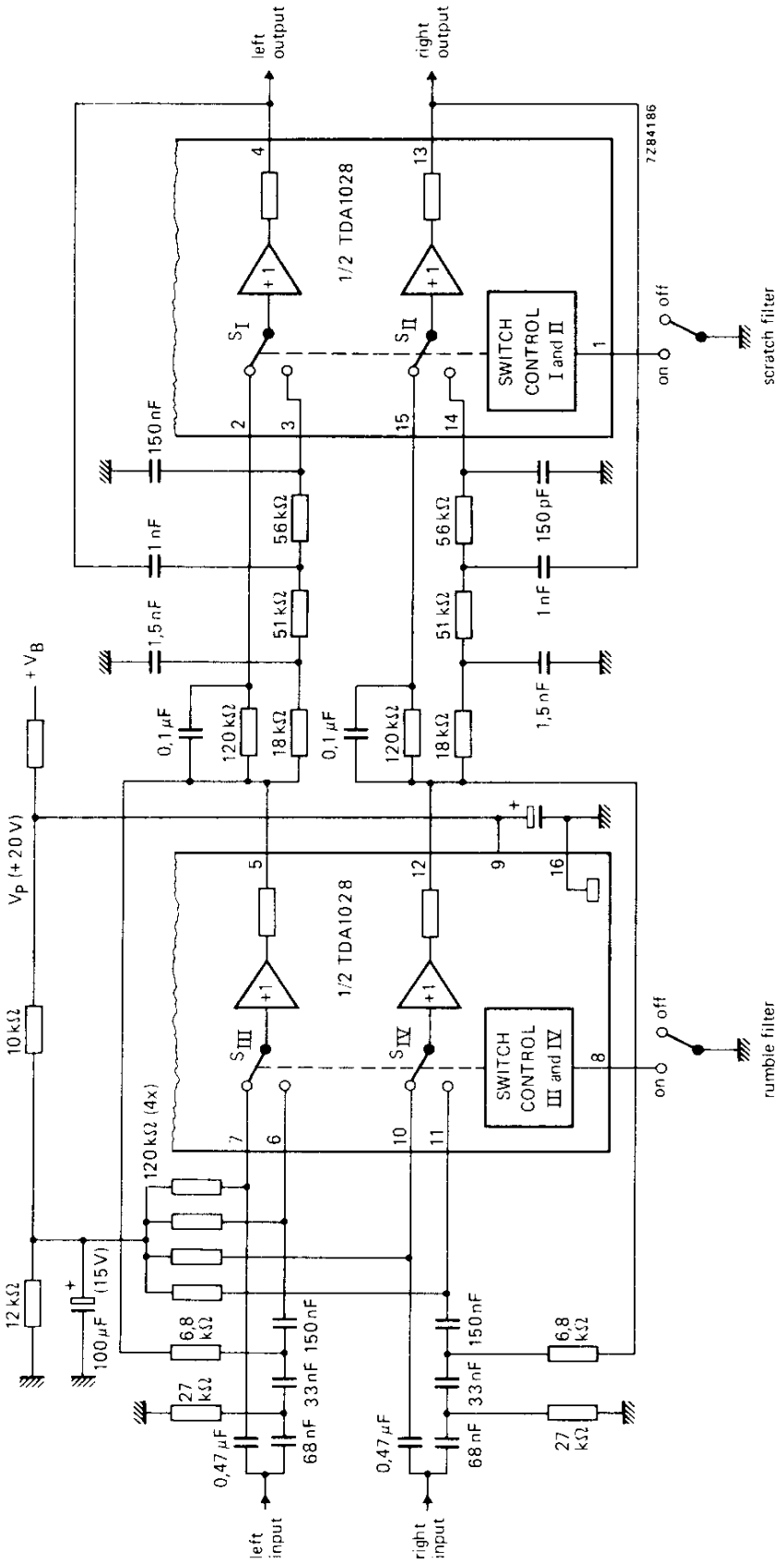

Fig. 8 Typical application diagram for a switchable scratch/rumble filter.

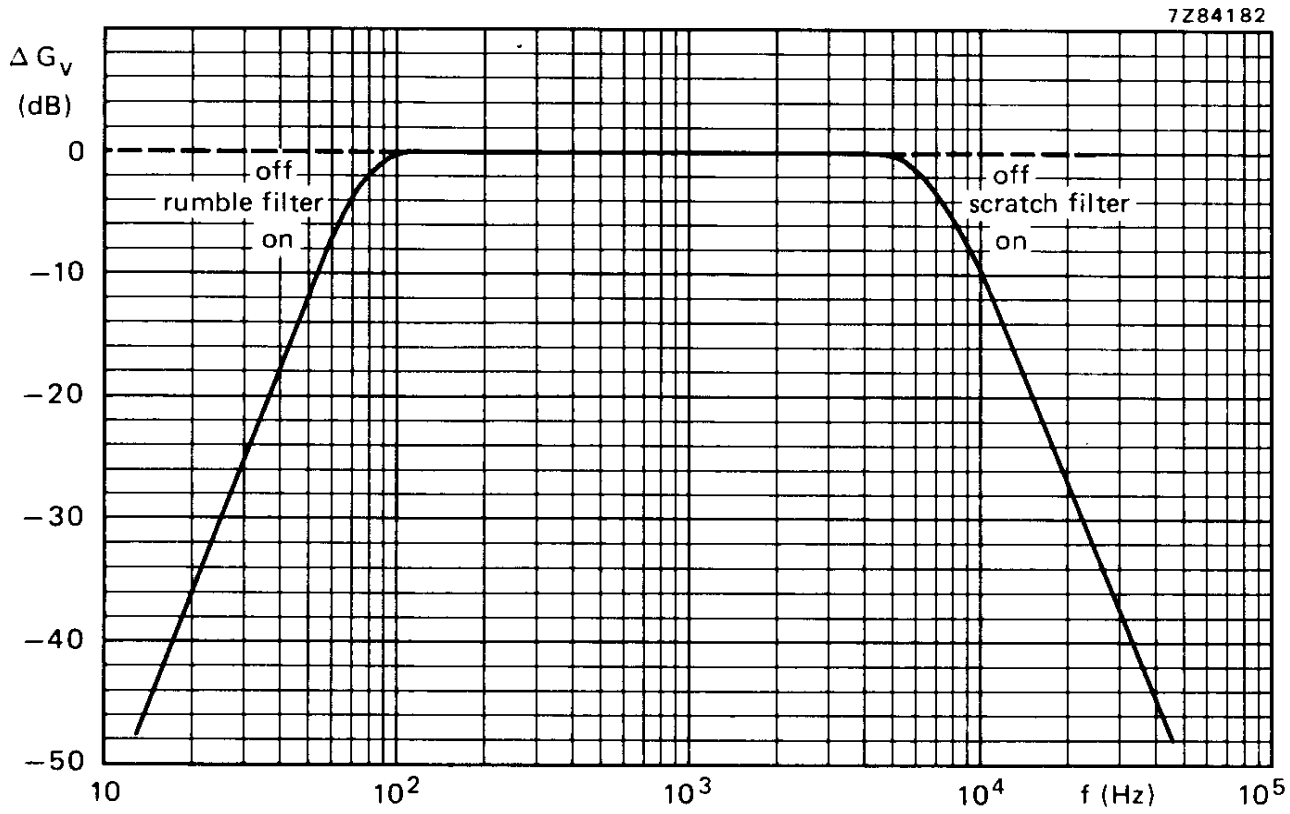

Fig. 9 Frequency response curves for scratch/rumble filters in Fig. 8.

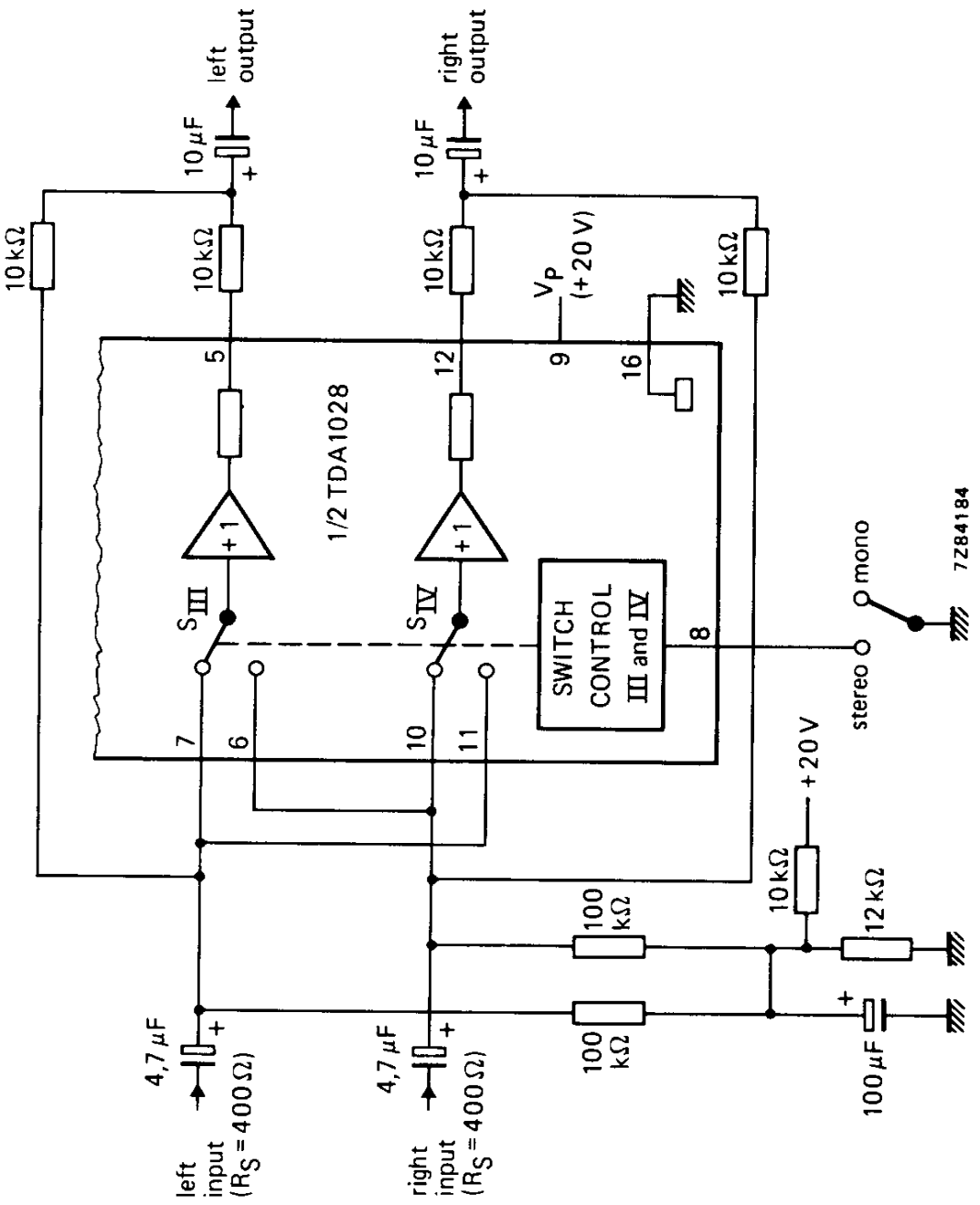

Fig. 10 Half of TDA1028 used as a mono/stereo switch.