AM RECEIVER CIRCUIT

The TDA1072 is a monolithic integrated AM receiver circuit provided with the following functions:

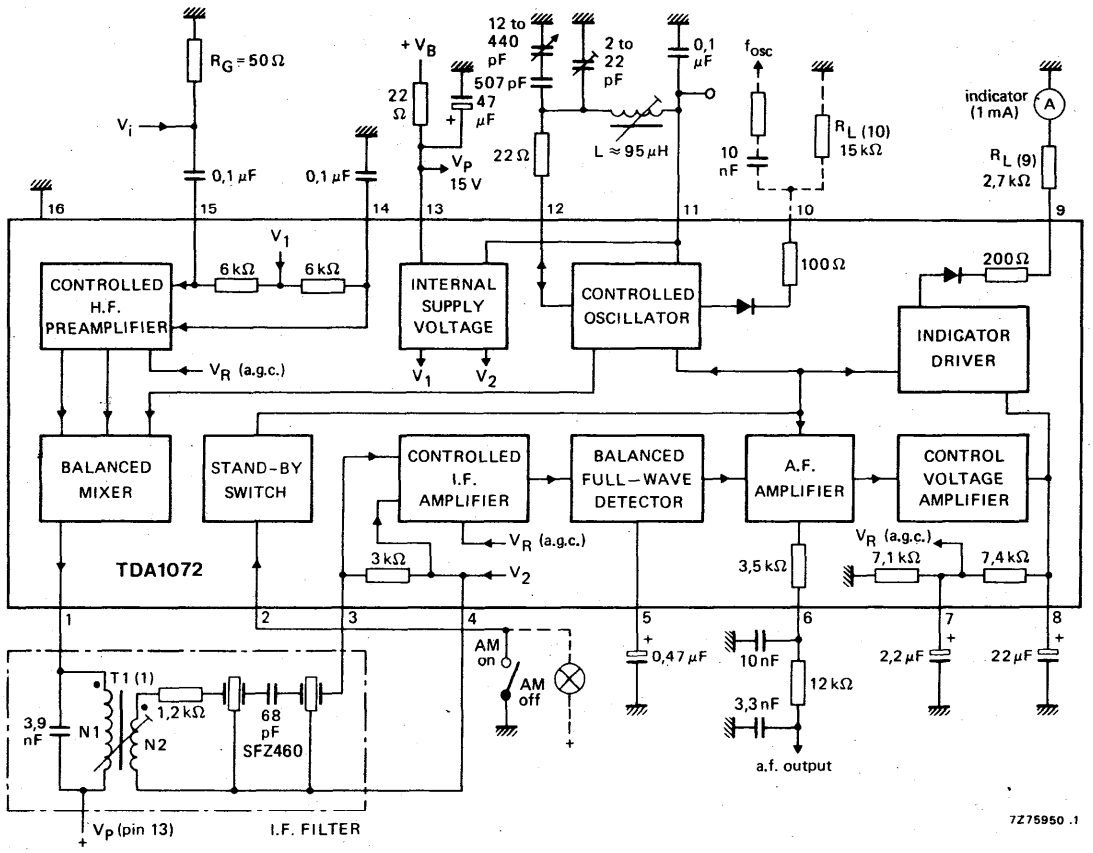
- controlled h.f. preamplifier
- multiplicative balanced mixer
- separate oscillator with amplitude control
- i.f. amplifier with gain control
- balanced full-wave detector
- a.f. preamplifier
- internal a.g.c. voltage
- amplifier for field-strength indication
- electronic stand-by on/off switch

QUICK REFERENCE DATA

Supply voltage (pin 13)	V_P	typ.	15	V
Supply current	I_P	typ.	22	mA
H.F. input voltage				
S + N/N = 6 dB	V_i	typ.	2,2	μV
S + N/N = 26 dB	V_i	typ.	30	μV
H.F. input voltage; d_{tot} = 3%; m = 80%	V_i	typ.	650	mV
A.F. output voltage; V_i = 2 mV	V_o	typ.	340	mV
Total distortion	d_{tot}	typ.	0,5	%
Input voltage range for ΔV_o = 6 dB	ΔV_i	typ.	91	dB
Oscillator frequency range	f_{osc}		0,6 to 31	MHz
Oscillator voltage amplitude	V_{osc}	typ.	140	mV
Field-strength indication range	ΔV_i	typ.	100	dB
Supply voltage range	V_P		7,5 to 18	V
Ambient temperature range	T_{amb}		−30 to + 80	°C

PACKAGE OUTLINE

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



(1) T1 : N1/N2 = 34/9; Q_o = 65; Q_L = 60; Z_{21} = 700 Ω at $R_{L(3)}$ = 3 kΩ; Z_{11} = 5,2 kΩ.

Fig. 1 Block diagram with external components; used as test circuit.

RATINGS

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

Supply voltage (pin 13)	$V_P = V_{13-16}$	max.	23	V
Voltage on pin 2	V_{2-16}		0 to 23	V
H.F. inputs				
Voltages between:				
pins 14 and 15	$\pm V_{14-15}$	max.	12	V
pins 14 and 16	V_{14-16}	max.	V_P	V
pins 15 and 16	V_{15-16}	max.	V_P	V
Or currents:				
pin 14	$\pm I_{14}$	max.	10	mA
pin 15	$\pm I_{15}$	max.	10	mA
Storage temperature range	T_{stg}		−55 to + 150	°C
Operating ambient temperature range	T_{amb}		−30 to + 80	°C

CHARACTERISTICS

V_P = 15 V; T_{amb} = 25 °C; f_i = 1 MHz (h.f.), R_G = 50 Ω; f_m = 0,4 kHz; m = 30%; i.f. frequency = 460 kHz; unless otherwise specified

Supply voltage range (pin 13)	V_P		7,5 to 18	V
Supply current; without load ($I_{L(11)}$ = 0)	I_P	typ.	22	mA
			15 to 30	mA
H.F. preamplifier and mixer				
D.C. input voltages	V_{14-16}; V_{15-16}	typ.	2,75 ($4V_{BE}$)	V
Input impedance				
$V_i < 300\ \mu V$	$Z_{i(14-16)}$;$Z_{i(15-16)}$	typ.	6	kΩ
		typ.	6	pF
$V_i > 10$ mV	$Z_{i(14-16)}$;$Z_{i(15-16)}$	typ.	9	kΩ
		typ.	2,5	pF
Output impedance	$Z_{o(1-16)}$	>	200	kΩ
		typ.	4	pF
Maximum conversion conductance	S_M	typ.	5,5	mA/V*
Maximum i.f. output voltage (peak-to-peak value)	$V_{o(1)(p-p)}$	typ.	2,8	V
Output current capability	$I_{o(1)}$	typ.	1	mA
Control range of preamplifier	ΔS_M	typ.	30	dB
Maximum h.f. input voltage (peak-to-peak value)	$V_{i(14-15)(p-p)}$	typ.	2,8	V

* S_M is defined as $I_{o(1)}/V_i$.

CHARACTERISTICS (continued)

Oscillator				
Frequency range	$f_{osc(12)}$		0,6 to 31	MHz
Oscillator impedance range	$Z_{L(12)}$		1 to 200	kΩ
Controlled oscillator amplitude	$V_{osc(12)}$	typ.	140	mV
		<	200	mV
D.C. output voltage ($I_{L(11)} = 0$)	V_{11-16}	typ.	V_P–1,3	V
Output load current range	$-I_{L(11)}$		0 to 15	mA
Output resistance; $I_{L(11)} = 5 \pm 0{,}5$ mA	$R_{o(11)}$	typ.	7	Ω
Oscillator frequency output (pin 10)				
Output voltage (peak-to-peak value) $R_{10-16} = 15$ kΩ ($R_{L(10)}$)	$V_{o(10)(p-p)}$	typ.	200	mV
Output resistance	$R_{o(10)}$	typ.	150	Ω
Allowable output current (peak value)	$I_{o(10)M}$	<	2	mA
I.F. amplifier and a.f. stage				
D.C. input voltages	V_{3-16}; V_{4-16}	typ.	2	V
Input impedance	$Z_{i(3)}$	typ.	3	kΩ
			2,4 to 3,9	kΩ
		typ.	4	pF
Max. i.f. input voltage; m = 80%; $d_{tot} = 3\%$	$V_{i(3)}$	typ.	75	mV
Control range; $V_o = -6$ dB	ΔV_i	typ.	62	dB
A.F. output voltage; $V_{i(3)} = 2$ mV; without load	$V_{o(6)}$	typ.	350	mV
A.F. output resistance	$R_{o(6)}$	typ.	3,5	kΩ
Field-strength indication				
D.C. indicator voltage $V_i = 0$; $R_{L(9)} = 2{,}7$ kΩ	V_{9-16}	typ.	0	mV
		<	140	mV
$V_i = 500$ mV; $R_{L(9)} = 2{,}7$ kΩ	V_{9-16}	typ.	2,8	V
			2,5 to 3,1	V
Output current capability	$-I_g$	>	1,2	mA
Output resistance; $-I_g = 0{,}5$ mA	$R_{o(9)}$	typ.	250	Ω
Leakage voltage at the output; $\pm I_g \leqslant 1\ \mu A$; at AM switch off ($V_{2-16} \geqslant 3{,}5$ V)	V_{9-16}	typ.	6	V

Stand-by switch

Switching voltage	$V_{2\text{-}16}$	typ.	2,6 V
Required control voltage*			
AM on	$V_{2\text{-}16}$	<	2 V
AM off	$V_{2\text{-}16}$	>	3,5 V**
Input current			
AM on; switching current	$-I_2$	<	100 μA
AM off; leakage current ($V_{2\text{-}16} = V_{3\text{-}16}$)	$\pm I_2$	<	1 μA

APPLICATION INFORMATION

V_P = 15 V; T_{amb} = 25 °C; measured in Fig. 1; f_i = 1 MHz (h.f.); f_m = 0,4 kHz; m = 30%; unless otherwise specified

H.F. input voltage			
S + N/N = 6 dB	V_i	typ.	2,2 μV
S + N/N = 10 dB	V_i	typ.	3,5 μV
S + N/N = 26 dB	V_i	typ.	30 μV
S + N/N = 46 dB	V_i	typ.	550 μV
H.F. input voltage for a.g.c. operation	V_i	typ.	14 μV
Control range for ΔV_o = 6 dB reference value V_i = 500 mV	ΔV_i	typ.	91 dB
Maximum h.f. input voltage			
d_{tot} = 3%; m = 80%	V_i	typ.	0,65 V
d_{tot} = 3%; m = 30%	V_i	typ.	0,9 V
d_{tot} = 10%; m = 30%	V_i	typ.	1,3 V
A.F. output voltage; V_i = 2 mV	V_o	typ.	340 mV
Change of a.f. output voltage; V_i = 2 mV	ΔV_o	typ.	± 2 dB
H.F. input voltage; V_o = 60 mV	V_i	typ.	4 μV
Total distortion of a.f. output voltage			
V_i = 2 mV; m = 80%	d_{tot}	typ.	0,5 %
V_i = 500 mV; m = 80%	d_{tot}	typ. <	1,8 % 3 %
Signal plus noise-to-noise ratio of a.f. output voltage			
V_i = 2 mV	S + N/N	typ.	50 dB
I.F. bandwidth (−3 dB)	B	typ.	4,6 kHz
I.F. selectivity			
Δf = ± 9 kHz	$S_{(9)}$	typ.	30 dB
Δf = ± 36 kHz	$S_{(36)}$	typ.	60 dB

* At allowable ambient temperature range and supply voltage range.

** Also achieved at open input.

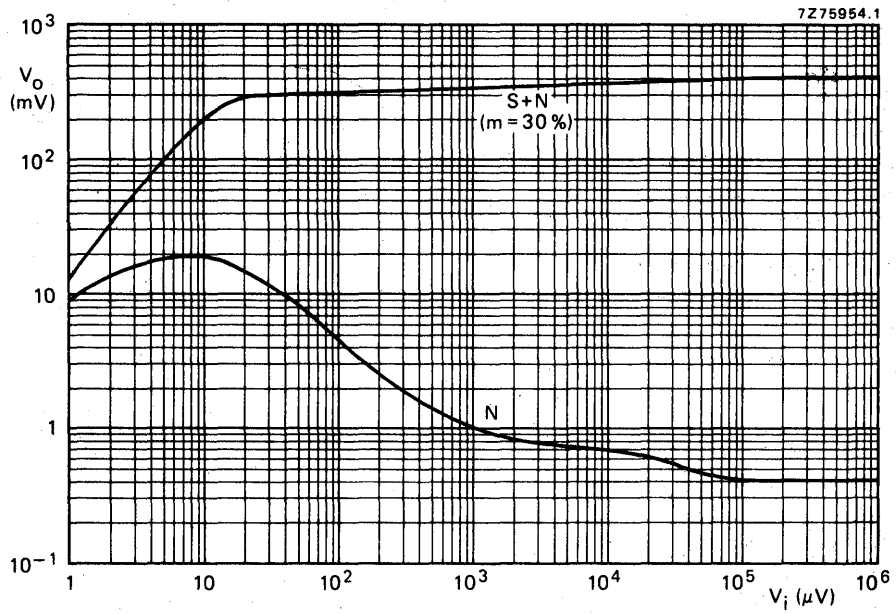


Fig. 2 A.F. output voltage as a function of h.f. input voltage; f_i = 1 MHz (h.f.); R_G = 50 Ω; f_m = 0,4 kHz.

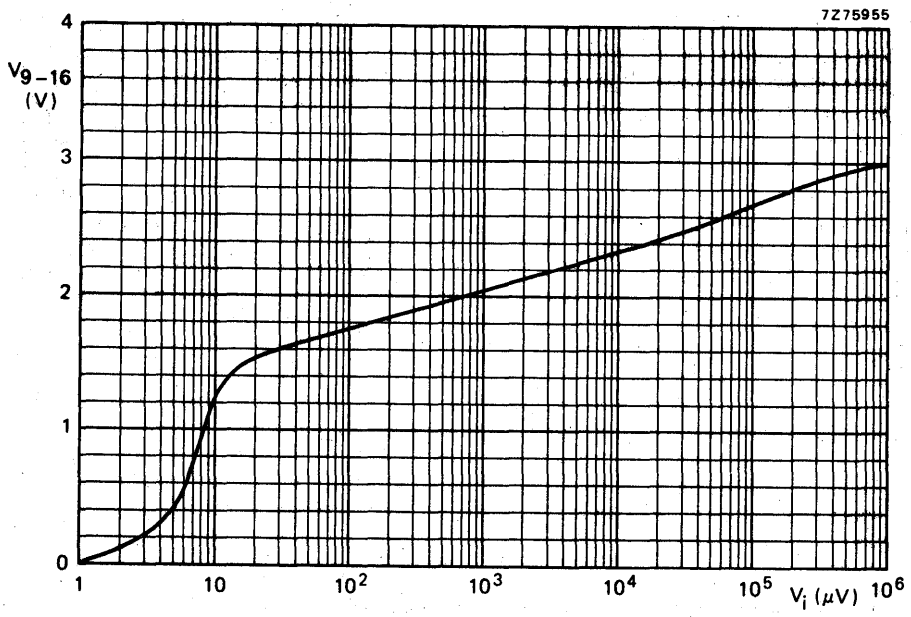


Fig. 3 Indication voltage as a function of h.f. input voltage; R_{9-16} = 2,7 kΩ.

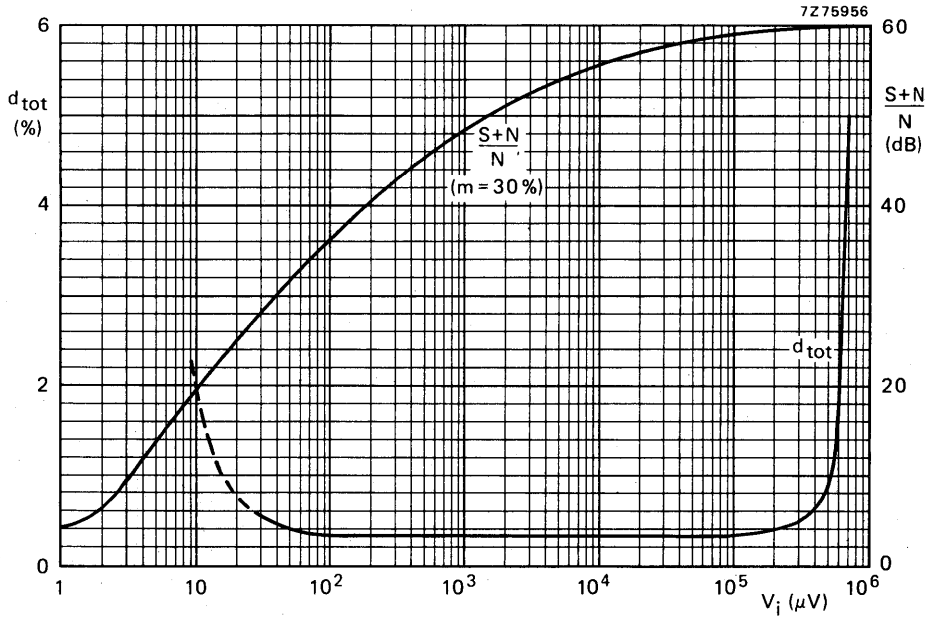


Fig. 4 Total distortion and signal plus noise-to-noise ratio as a function of h.f. input voltage; for d_{tot} : f_m = 0,4 kHz; m = 80%.

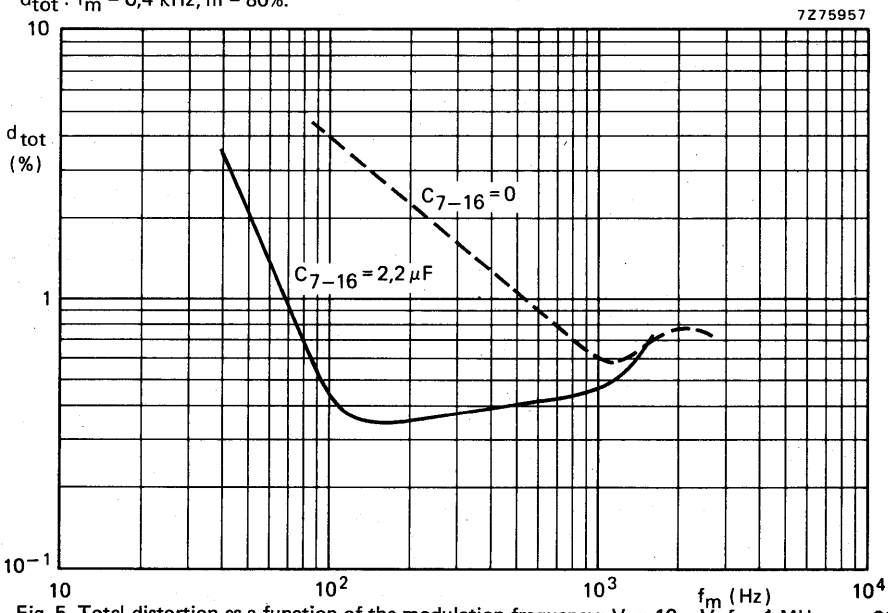


Fig. 5 Total distortion as a function of the modulation frequency; V_i = 10 mV; f_i = 1 MHz; m = 80%. C_{8-16} = 22 μF.

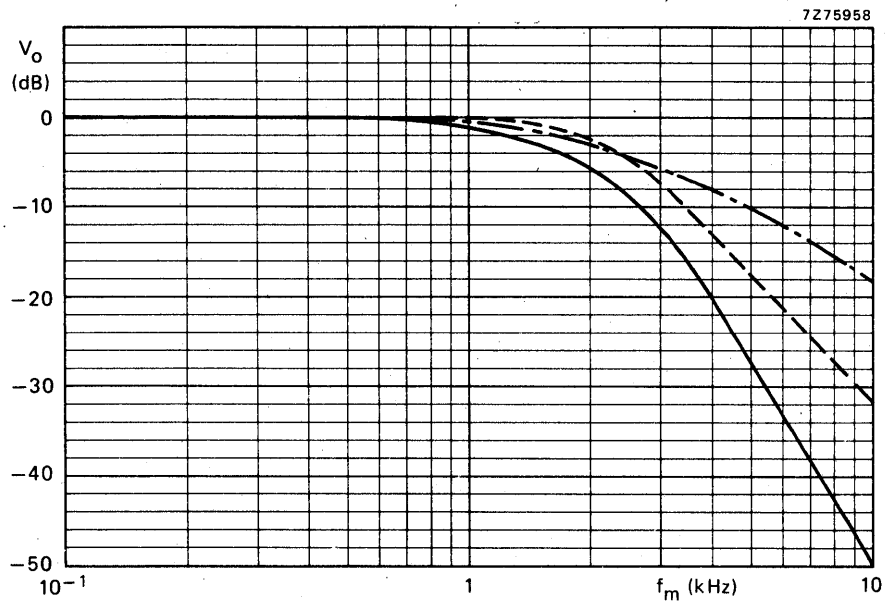
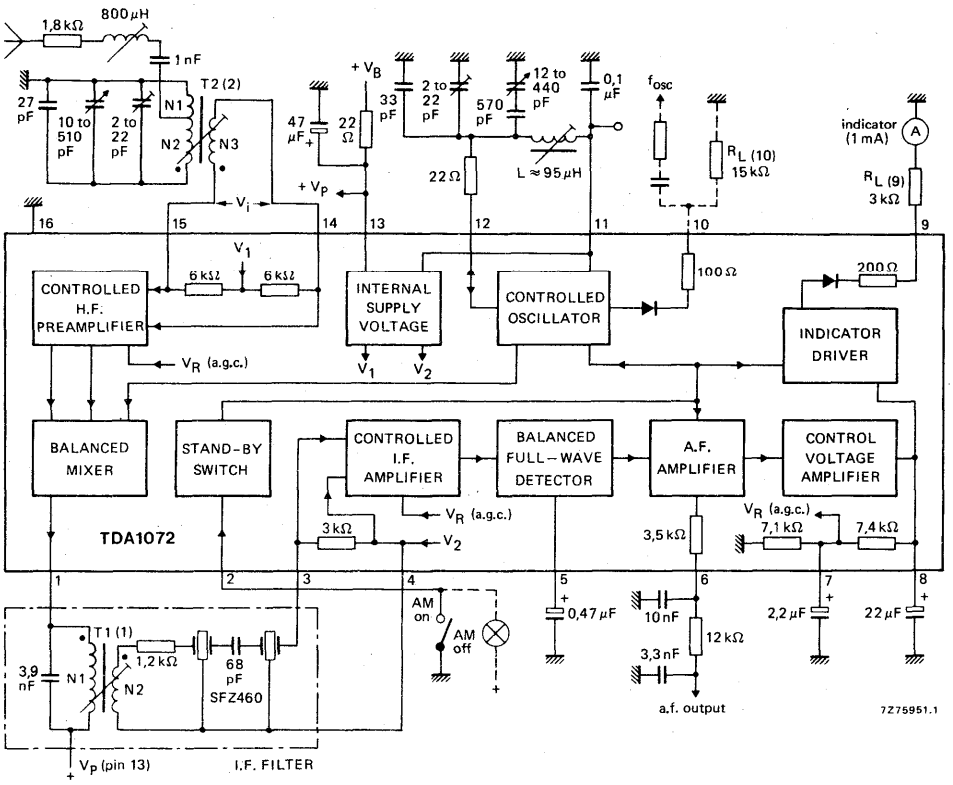


Fig. 6 Frequency responses (wobbled) for various conditions:
——— with a.f. and i.f. filter
– – – with i.f. filter
– · – with a.f. filter



(1) T1 : N1/N2 = 34/9; Q_o = 65; Q_L = 60; Z_{21} = 700 Ω at $R_{L(3)}$ = 3 kΩ; Z_{11} = 5,2 kΩ.
(2) T2 : N1/N2/N3 = 14/67/17; L = 175 μH; Q_o = 145; Q_L = 50 (f = 1 MHz); V_i/V_G = –6 dB.

Fig. 7 Application circuit diagram of a AM-MW receiver with two double variable tuning capacitors; f_i = 510 to 1620 kHz (h.f.); f_i = 460 kHz (i.f.).

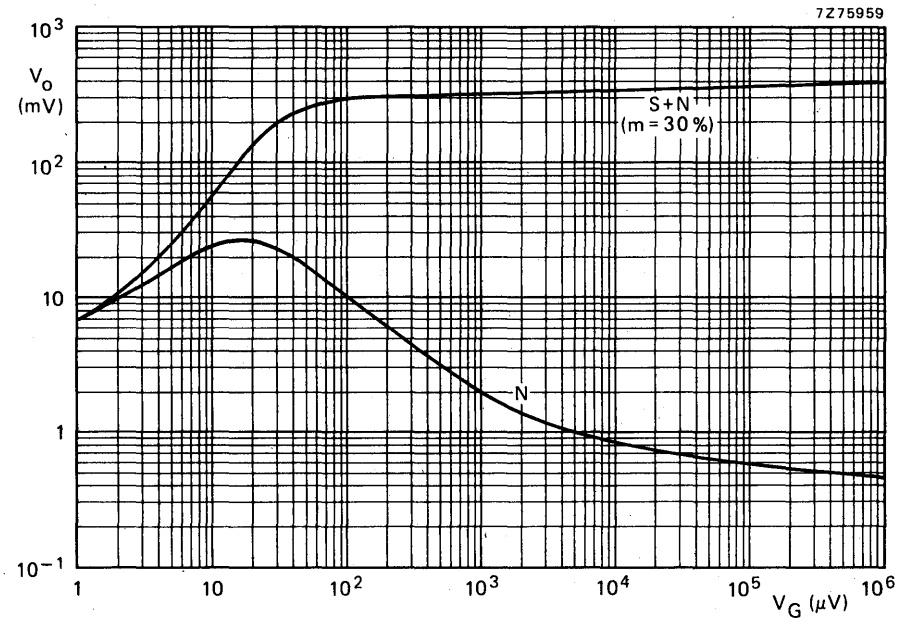


Fig. 8 A.F. output voltage as a function of the h.f. generator input voltage; f_i = 1 MHz (h.f.); f_m = 0,4 kHz.