FM/IF SYSTEM

GENERAL DESCRIPTION

The TEA5560 is a monolithic integrated FM/IF system circuit, intended for car radios and home-receivers equipped with a ratio detector.
The system incorporates the following functions:

- a three-stage i.f. limiting amplifier
- a 15 dB field-strength dependent muting circuit
- a field-strength dependent d.c. voltage for e.g.:
  mono/stereo switching
  channel separation control of a stereo decoder
  an indicator ($I_{max} \leqslant 1$ mA)
- standby ON/OFF switching circuit
- a voltage stabilizer, for the internal circuit current and an external current up to 15 mA
- adjustable gain (ΔG = 15 dB)

QUICK REFERENCE DATA

Supply voltage range (pin 6)	V_P	10,2 to 18	V
Ambient temperature	T_{amb}	typ. 25	°C
Supply voltage (pin 6)	V_P	typ. 14,4	V
Frequency	f_o	10,7	MHz
Sensitivity (3 dB limiting)	V_i	typ. 150	μV
Signal-to-noise ratio for V_i = 10 mV	S/N	typ. 80	dB
A.F. output voltage at $\Delta f = \pm 22{,}5$ kHz	V_o	typ. 200	mV
Total harmonic distortion; $\Delta f = \pm 22{,}5$ kHz	THD	typ. 0,3	%
A.M. suppression AM signal: m = 0,3; f_m = 1 kHz FM signal: $\Delta f = \pm 22{,}5$ kHz; f_m = 70 Hz for V_i = 1 mV	AMS	typ. 50	dB

PACKAGE OUTLINE

9-lead SIL; plastic (SOT-142). The tab (on top of the package) is connected to pin 9.

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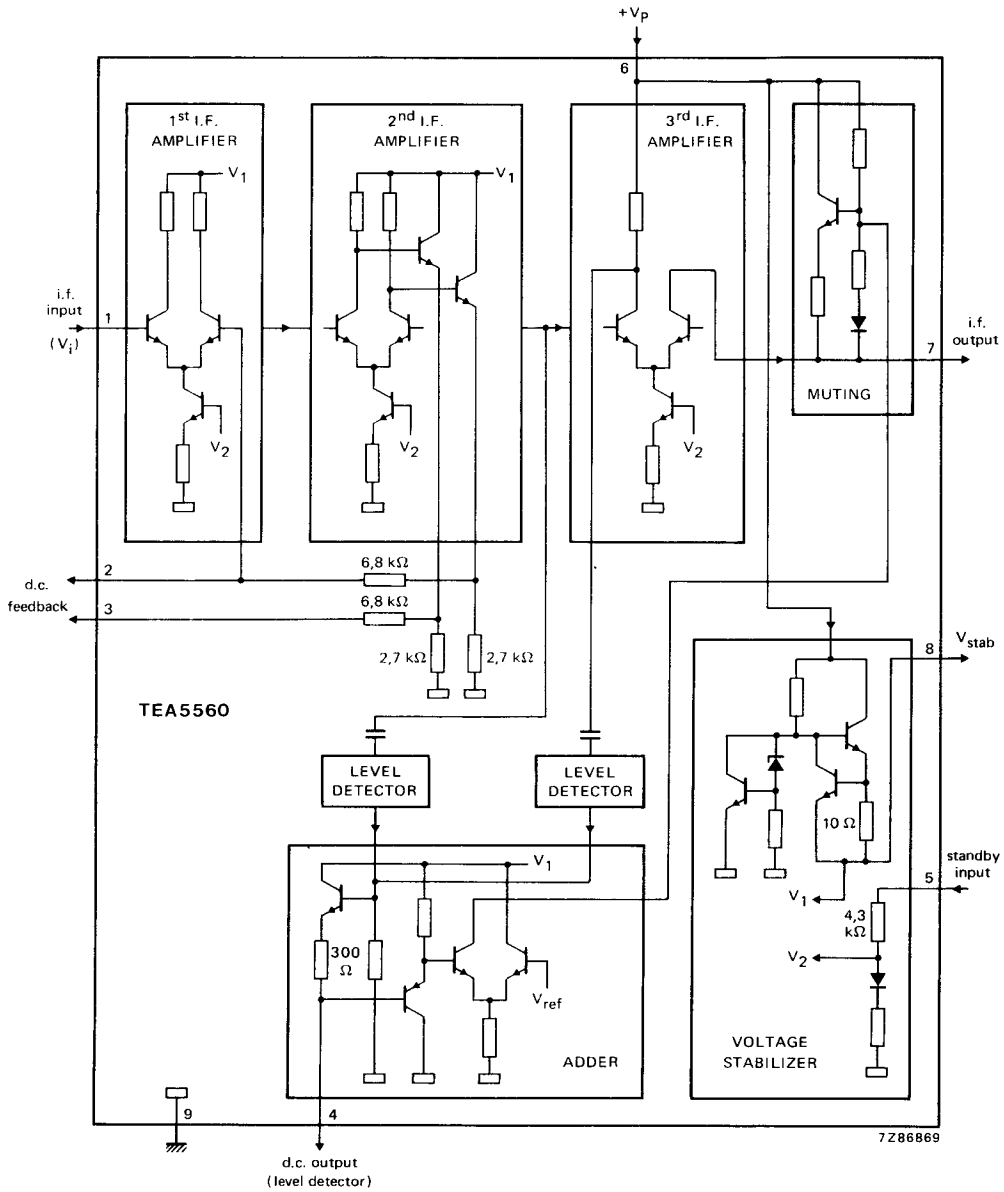


Fig. 1 Block diagram.

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RATINGS

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

Supply voltages			
pin 6	$V_P = V_{6-9}$	max.	24 V
pin 7	V_{7-9}	max.	24 V
Voltage at pin 4	V_{4-9}	max.	6 V
Voltage at pin 5	V_{5-9}	max.	9 V
Non-repetitive peak output current (pin 8)	$-I_{8SM}$	max.	100 mA
Total power dissipation	P_{tot}	max.	1000 mW
Storage temperature range	T_{stg}		−55 to +150 °C
Operating ambient temperature range	T_{amb}		−30 to +85 °C

THERMAL RESISTANCE

From junction to ambient (in free air)	$R_{th\ j\text{-}amb}$	=	75 K/W

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D.C. CHARACTERISTICS

V_P = 14,4 V; T_{amb} = 25 °C; measured in Fig. 2; unless otherwise specified

parameter	symbol	min.	typ.	max.	unit
Supply (pin 6)					
Supply voltage *	$V_P = V_{6-9}$	10,2	14,4	18,0	V
Voltages					
at pin 8; $-I_8 = 0$ **	V_{8-9}	7,5	8,0	8,5	V
at pin 8 when $-I_8$ increases from 0 to 15 mA	ΔV_{8-9}	–	200	300	mV
at pin 8 when V_P reduces from 14,4 V to 10,2 V	ΔV_{8-9}	–	–	1,0	V
at pin 8 when V_P increases from 14,4 V to 18,0 V	ΔV_{8-9}	–	–	200	mV
at pin 4 (level detector)	V_{4-9}	–	–	100	mV
at pins 1, 2 and 3	$V_{1,2,3-9}$	–	2,4	–	V
Currents					
Total supply current; $-I_8 = 0$	I_{tot}	15	20	30	mA
Current supplied from pin 8	$-I_8$	–	–	15	mA
Stand-by current; $V_{5-9} = 0$	I_{sb}	8	11	14	mA
Current into pin 5	I_5	1,0	1,5	2,0	mA
Current into pin 7	I_7	–	3,0	–	mA
Power consumption					
at $-I_8 = 0$	P	–	300	–	mW

* A stabilized supply voltage of 7 to 9 V can also be applied at pin 5 and 6 (linked); for this application pin 8 must not be connected.

** The temperature coefficient of the stabilized voltage at pin 8 is typical −2,3 mV/K.

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A.C. CHARACTERISTICS

V_P = 14,4 V; T_{amb} = 25 °C; V_i = 1 mV; f_o = 10,7 MHz; Δf = ± 22,5 kHz; f_m = 1 kHz; measured in Fig. 2; unless otherwise specified

parameter	symbpl	min.	typ.	max.	unit
I.F. part and ratio detector					
Sensitivity at −3 dB before limiting (pin 1); (without muting) *	V_i	105	150	210	μV
Signal-to-noise S + N/S measured in a bandwidth of 60 Hz to 15 kHz					
at V_i = 20 μV	S/N	40	45	–	dB
at V_i = 150 μV	S/N	–	65	–	dB
at V_i = 1 mV	S/N	–	78	–	dB
at V_i = 10 mV	S/N	–	80	–	dB
A.F. output voltage					
Δf = ± 22,5 kHz	V_o	–	200	–	mV
Δf = ± 75 kHz	V_o	–	600	–	mV
Total harmonic distortion					
Δf = ± 22,5 kHz	THD	–	0,3	–	%
Δf = ± 75 kHz	THD	–	2,0	–	%
AM suppression					
f_m = 1 kHz; m = 0,3 (for AM)					
f_m = 70 kHz; Δf = ± 22,5 kHz (for FM)					
at V_i = 150 μV	AMS	–	40	–	dB
at V_i = 1 mV	AMS	–	50	–	dB
at V_i = 10 mV	AMS	–	55	–	dB
Level detector circuit					
D.C. output voltage (pin 4)					
at V_i = 200 μV	V_{4-9}	–	1,9	–	V
at V_i = 500 μV	V_{4-9}	–	2,8	–	V
at V_i = 1 mV	V_{4-9}	–	3,5	–	V
at V_i = 3 mV	V_{4-9}	–	5,0	–	V
at V_i = 10 mV	V_{4-9}	–	5,7	–	V
Muting circuit (see also Fig. 5)					
Change in output voltage at V_i = 3 μV (with and without muting) *	α_{vo}	10	15	–	dB
Input voltage at a change in output voltage of ⩽ 1 dB* (V_i at α_{vo} ⩽ 1 dB)	V_i	–	–	250	μV

* With muting $V_{4-9} < 0{,}3$ V; without muting V_{4-9} = 1,2 to 6 V.

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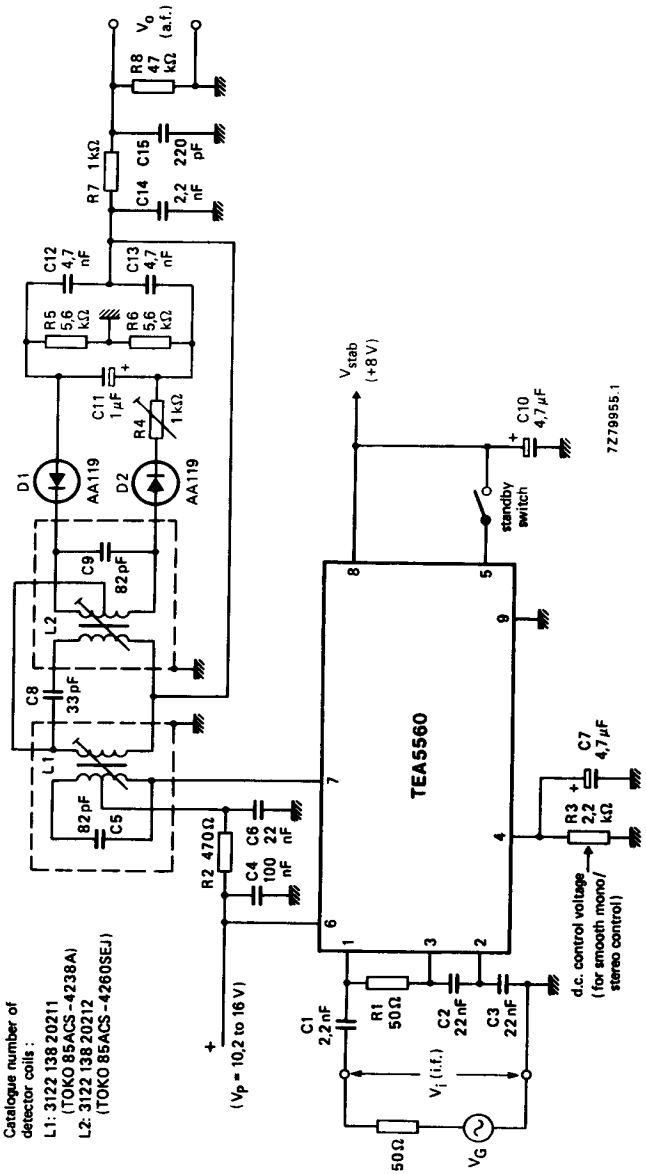


Fig. 2 FM test circuit.

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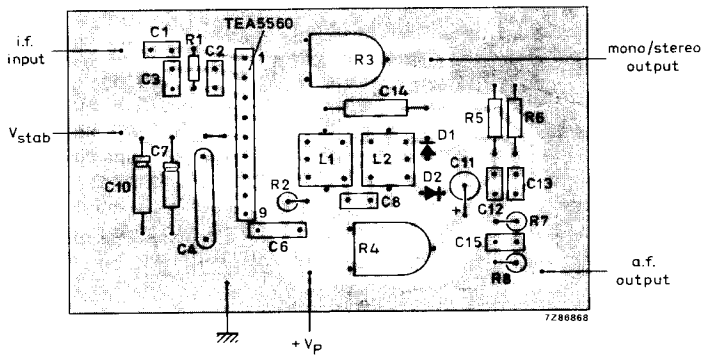


Fig. 3 Printed-circuit board component side, showing component layout. For circuit diagram see Fig. 2.

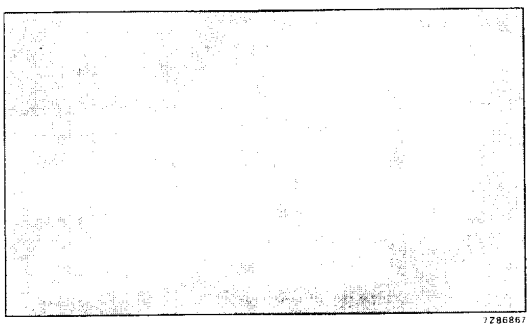
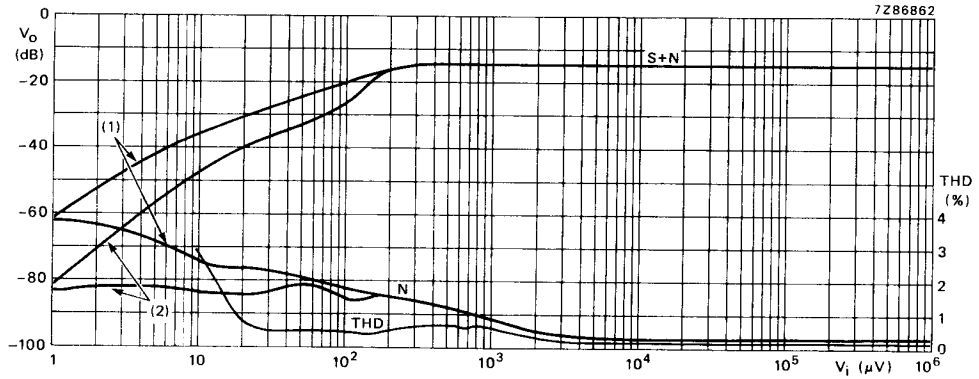


Fig. 4 Printed-circuit board showing track side.

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(1) Without muting.
(2) With muting.

Fig. 5 A.F. output voltage (V_o); reference level 0 dB = 1 V, and the total harmonic distortion (THD) as a function of the i.f. input voltage (V_i). Measured in the test circuit Fig. 2 at $\Delta f = \pm 22{,}5$ kHz; $f_m = 1$ kHz.

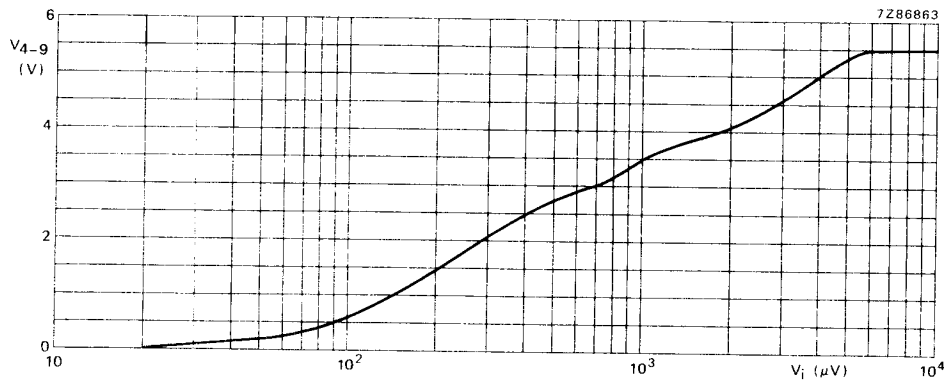
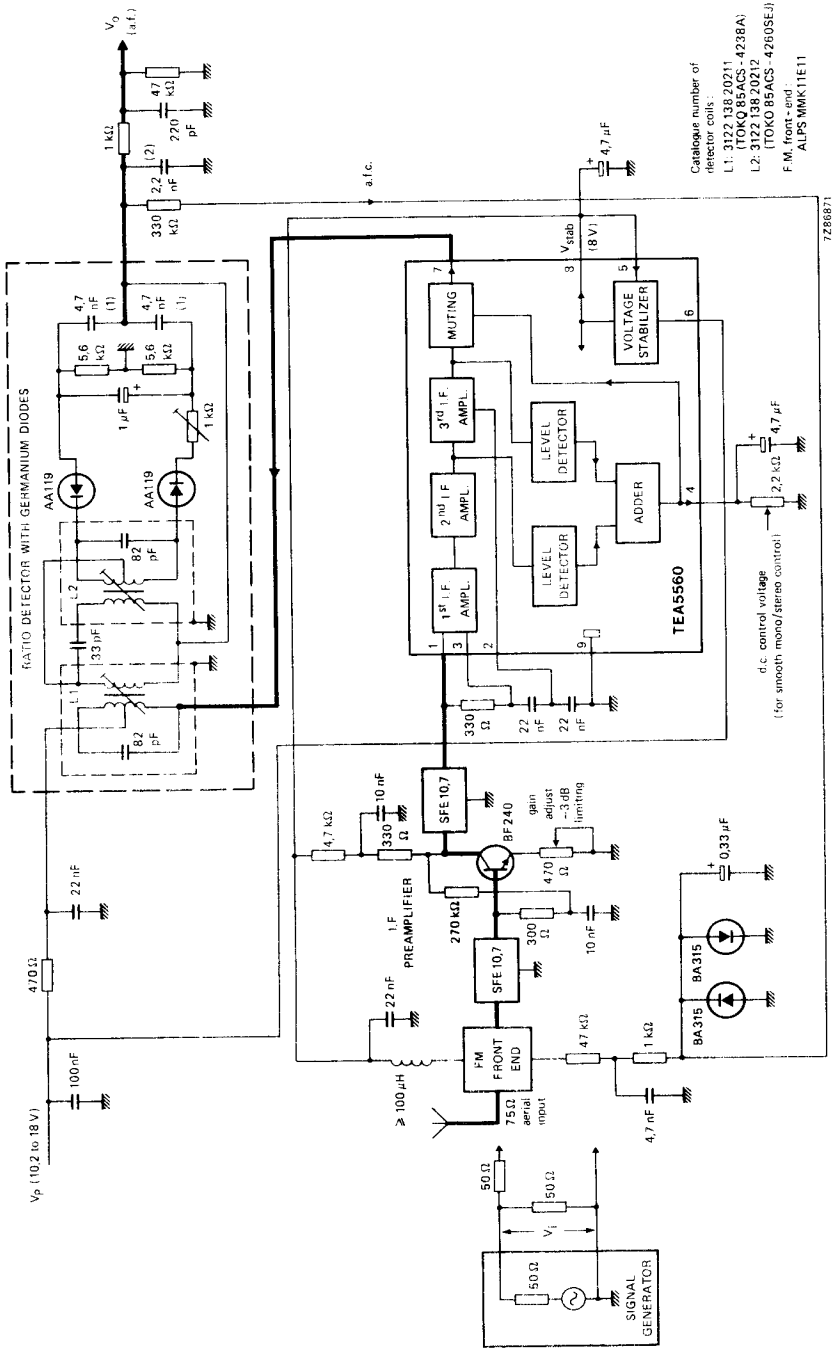


Fig. 6 Level detector d.c. output voltage (pin 4) as a function of the i.f. input voltage. Measured in test circuit Fig. 2.

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APPLICATION INFORMATION

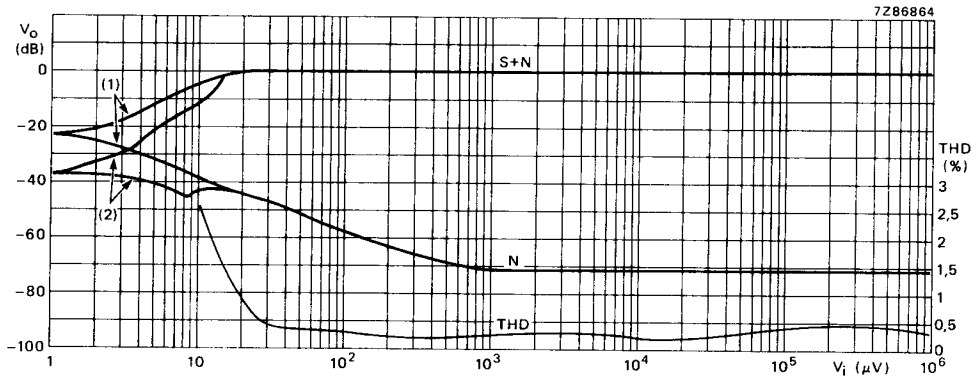


(1) Stereo application 220 pF.
(2) Stereo application 390 pF.

Fig. 7 FM channel for (car) radios using the TEA5560 and a ratio detector with AA119 germanium diodes.

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APPLICATION INFORMATION (continued)



(1) Without muting.
(2) With muting.

Fig. 8 Signal and noise (S + N) and noise (N); reference level 0 dB = 200 mV, and the total harmonic distortion (THD) as a function of the aerial input voltage (V_i). Measured in application circuit Fig. 7 at $\Delta f = \pm 22{,}5$ kHz; $f_m = 1$ kHz.

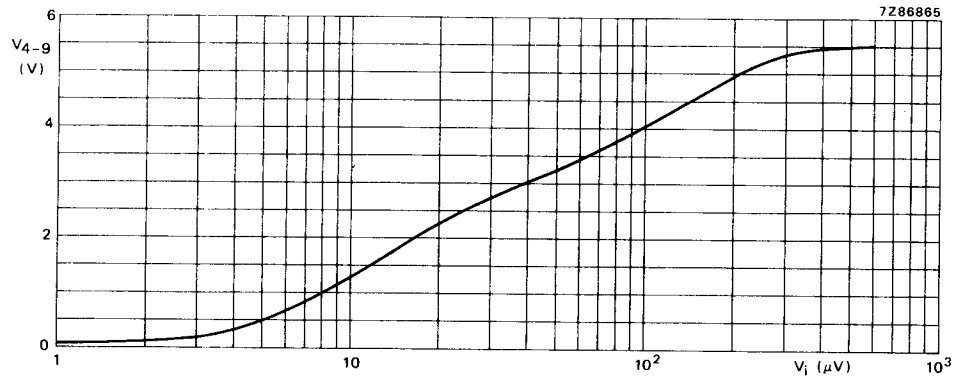
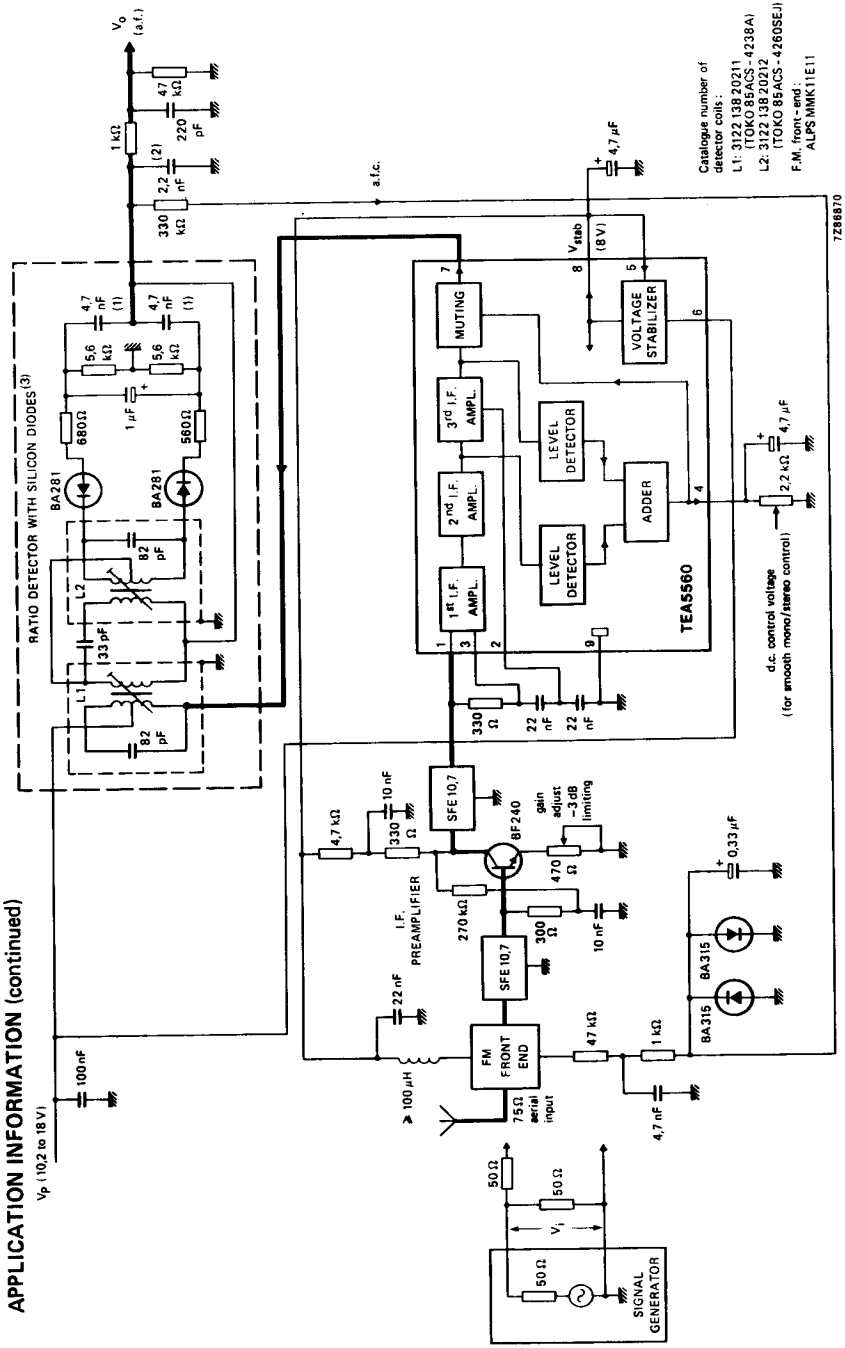


Fig. 9 Level detector d.c. output voltage (pin 4) as a function of the aerial input voltage. Measured in application circuit Fig. 7.

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APPLICATION INFORMATION (continued)



(1) Stereo application 220 pF.
(2) Stereo application 390 pF.
(3) Further detailed information of using silicon diodes is available on request.

Fig. 10 FM channel for (car) radios using the TEA5560 and a ratio detector with BA281 silicon diodes.

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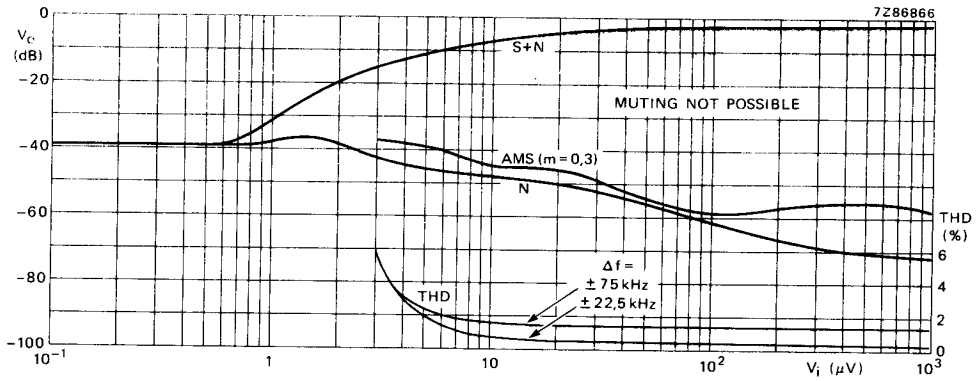


Fig. 11 Signal and noise (S + N) and noise (N); reference level 0 dB = 245 mV, AM suppression (AMS) and total harmonic distortion (THD) as a function of the aerial input voltage (V_i). Measured in application circuit Fig. 10 at $\Delta f = \pm 22{,}5$ kHz; $f_m = 1$ kHz; for AM suppression m = 0,3; $\Delta f = \pm 22{,}5$ kHz.

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