

VIDEO I.F./AFT**TDA3540/41**

The TDA3540 and TDA3541 are i.f. amplifier and demodulator circuits for colour and black and white television receivers, using n-p-n tuners for the TDA3540 and p-n-p tuners for the TDA3541.

They incorporate the following functions:

- gain-controlled wide-band amplifier, providing complete i.f. gain
- synchronous demodulator with excellent intermodulation
- white spot inverter
- video preamplifier with noise protection
- a.f.c. circuit with a.f.c. on/off switch
- a.g.c. circuit with noise gating
- tuner a.g.c. output (n-p-n tuners: **TDA3540**; p-n-p tuners: **TDA3541**)
- external video switch which switches off the video output; e.g. for insertion of a VCR playback signal, by either a high or a low level.

QUICK REFERENCE DATA

Supply voltage	V_{11-13}	typ.	12 V
Supply current	I_{11}	typ.	50 mA
I.F. input sensitivity at 38.9 MHz (r.m.s. value)	$V_{1-16}(\text{rms})$	typ.	60 μV
Video output voltage (white at 10% of top sync)	$V_{12-13}(\text{p-p})$	typ.	2.7 V
I.F. voltage gain control range	G_V	typ.	64 dB
Signal-to-noise ratio at $V_i = 10 \text{ mV}$	S/N	typ.	58 dB
A.F.C. output voltage swing (peak-to-peak value)	$V_{5-13}(\text{p-p})$	typ.	10.7 V

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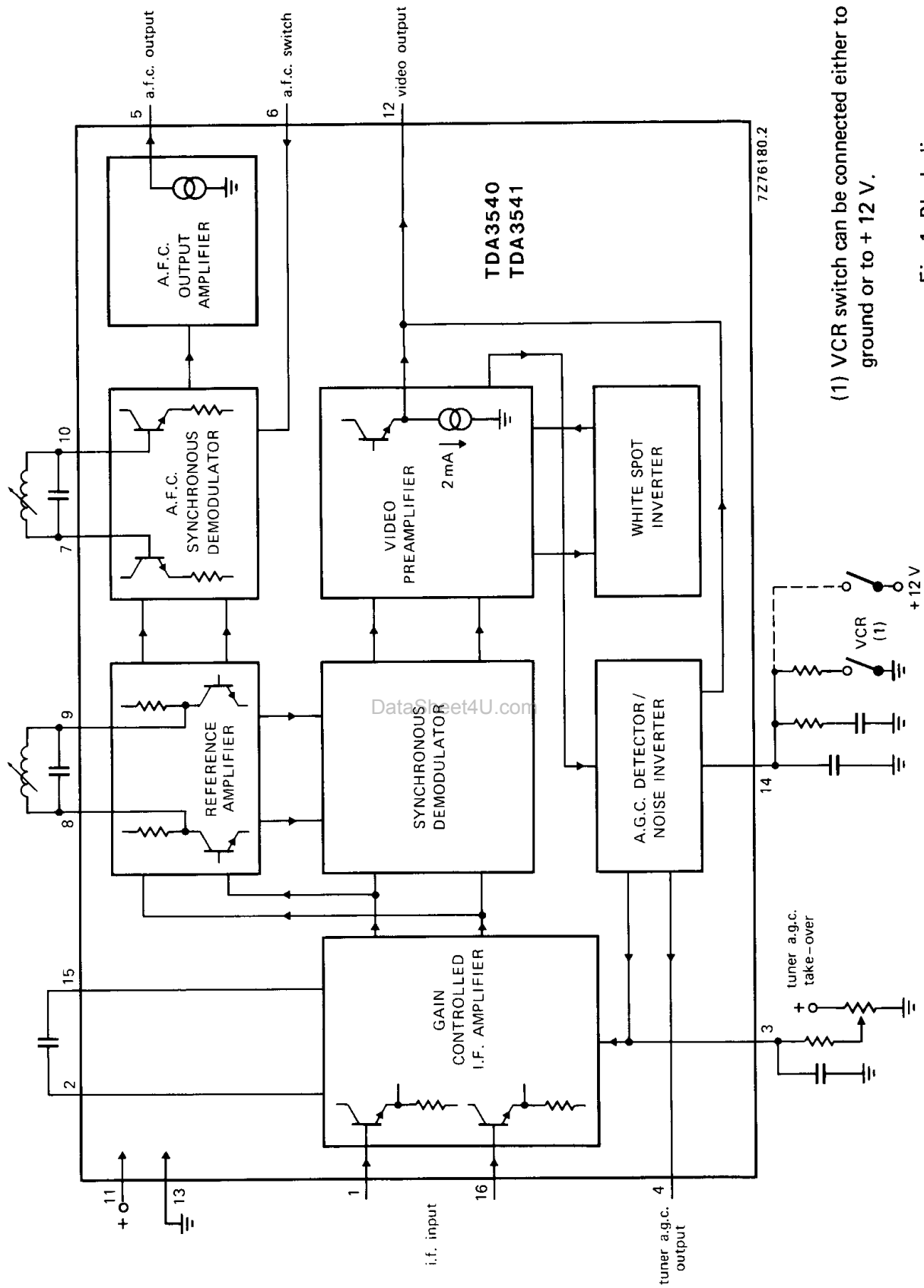
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PACKAGE OUTLINES

TDA3540; TDA3541: 16-lead DIL; plastic (SOT-38).

TDA3540Q; TDA3541Q: 16-lead QIL; plastic (SOT-58).

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(1) VCR switch can be connected either to ground or to +12 V.

Fig. 1 Block diagram.

VIDEO I.F./AFT**TDA3540/41****PINNING**

- 1 - 16 Balanced i.f. input.
- 2 - 15 Decoupling capacitor for the d.c. feedback loop of the i.f. amplifier.
- 3 Adjusting pin for starting point of tuner a.g.c.
- 4 Tuner a.g.c. output.
- 5 A.F.C. output.
- 6 A.F.C. on/off switch.
- 7 - 10 A.F.C. circuitry to obtain $\pi/2$ phase shift of the reference carrier.
- 8 - 9 Circuitry for passive regeneration of the i.f. picture carrier.
- 11 Positive power supply.
- 12 Video output.
- 13 Ground.
- 14 I.F. a.g.c.; VCR switch.

RATINGS

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

Supply voltage	V ₁₁₋₁₃	max.	13.2 V
I.F. a.g.c. voltage/VCR switch	V ₁₄₋₁₃	max.	13.2 V
Tuner a.g.c. voltage	V ₄₋₁₃	max.	12 V
A.F.C. switch voltage	V ₆₋₁₃	max.	13.2 V
Maximum voltage level at pin 12 with VCR switch active	V ₁₂₋₁₃	max.	5.0 V
D.C. output current at video output	I ₁₂	max.	10 mA
Total power dissipation	P _{tot}	max.	1.2 W
Storage temperature range	T _{stg}		-65 to + 150 °C
Operating ambient temperature range	T _{amb}		-25 to + 70 °C

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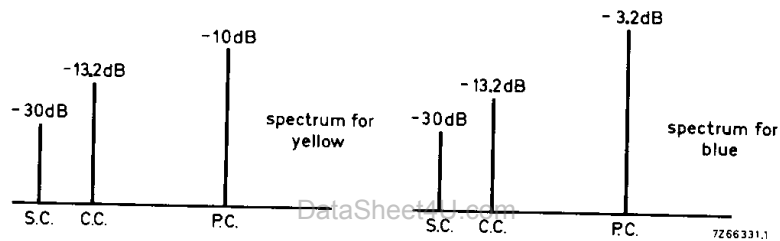
VIDEO I.F./AFT

TDA3540/41

CHARACTERISTICS (measured in Fig. 8)

Supply voltage range	V_{11-13}	typ.	12 V 10.2 to 13.2 V
The following characteristics are measured at $T_{amb} = 25\text{ }^{\circ}\text{C}$; $V_{11-13} = 12\text{ V}$			
Current consumption (no input signal)	I_{11}	typ.	50 mA 35 to 70 mA
I.F. amplifier (note 1)			
I.F. sensitivity (onset of a.g.c.)	V_{1-16}	typ. <	60 μV 100 μV
Input resistance (differential)	R_{1-16}	typ.	2 k Ω 1.5 to 3 k Ω
Input capacitance (differential)	C_{1-16}	typ. <	2 pF 5 pF
Gain control range	G_V	typ.	64 dB
Output signal expansion for 50 dB input signal variation (note 2)	ΔV_{12-13}	<	0.5 dB
Maximum input signal	V_{1-16}	>	70 mV
Tuner a.g.c. (note 1)			
Starting point tuner a.g.c.; adjustable (note 3) pin 3 connected with 39 k Ω to pin 11			
TDA3540	V_{1-16}	<	3 mV
TDA3541	V_{1-16}	<	3 mV
pin 3 connected with 39 k Ω to ground	V_{1-16}	>	70 mV
Maximum tuner a.g.c. output current swing	I_4	>	10 mA
Input signal variation (note 4) for a tuner a.g.c. current variation of:			
9 mA to 1 mA (TDA3540)	ΔV_{1-16}	typ.	5 dB
1 mA to 9 mA (TDA3541)	ΔV_{1-16}	typ.	5 dB
Output saturation voltage at $I_4 = 7\text{ mA}$	$V_{4-13sat}$	typ. <	200 mV 300 mV
Leakage current at $V_{4-13} = 12\text{ V}$	I_4	<	1 μA
Tuner a.g.c. characteristic	see Fig. 5		
Video output (note 5)			
Zero-signal output level (note 6)	V_{12-13}	typ.	6 V 5.7 to 6.3 V
Top sync output level	V_{12-13}	typ.	2.95 V 2.80 to 3.10 V
Video output signal (peak-to-peak value) white at 10% of top sync	$V_{12-13(p-p)}$	typ.	2.7 V

Internal bias current of n-p-n emitter-follower output transistor		typ.	2 mA
			1 to 3 mA
Bandwidth of demodulated output signal	B	>	5.5 MHz
		typ.	6.5 MHz
Differential gain (note 7)	dG	typ.	3 %
		<	10 %
Differential phase (note 8)	dφ	typ.	2°
		<	10°
Residual carrier signal (r.m.s. value)	V _{12-13(rms)}	typ.	3.5 mV
		<	30.0 mV
Residual 2nd harmonic of carrier signal (r.m.s. value)	V _{12-13(rms)}	typ.	15 mV
		<	30 mV
Intermodulation (see Figs 2 and 3) at 1.1 MHz: blue (note 9)		>	56 dB
		typ.	62 dB
yellow (note 9)		>	53 dB
		typ.	57 dB
at 3.3 MHz (note 10)		>	66 dB



S.C. : sound carrier level
 C.C. : chrominance carrier level
 P.C. : picture carrier level

} with respect to top sync level

Fig. 2 Input conditions for intermodulation measurements; standard colour bar with 75% contrast.

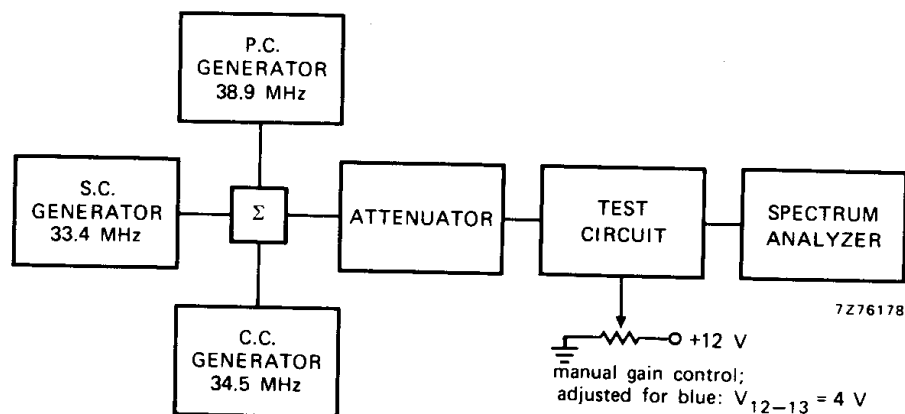


Fig. 3 Test set-up for intermodulation.

CHARACTERISTICS (continued)

Signal-to-noise ratio (note 11) at 10 mV input signal	S/N	>	50 dB
		typ.	58 dB
at end of gain control range	S/N	>	54 dB
		typ.	61 dB
as a function of the input signal	see Fig. 6		
White spot and noise inverter (see Fig. 4)			
White spot inverter threshold level	V ₁₂₋₁₃	typ.	6.8 V
			6.3 to 7.3 V
White spot insertion level	V ₁₂₋₁₃	typ.	4.5 V
			4.2 to 4.8 V
Noise inverter threshold level	V ₁₂₋₁₃	typ.	1.8 V
			1.6 to 2.0 V
Noise insertion level	V ₁₂₋₁₃	typ.	3.8 V
			3.4 to 4.1 V

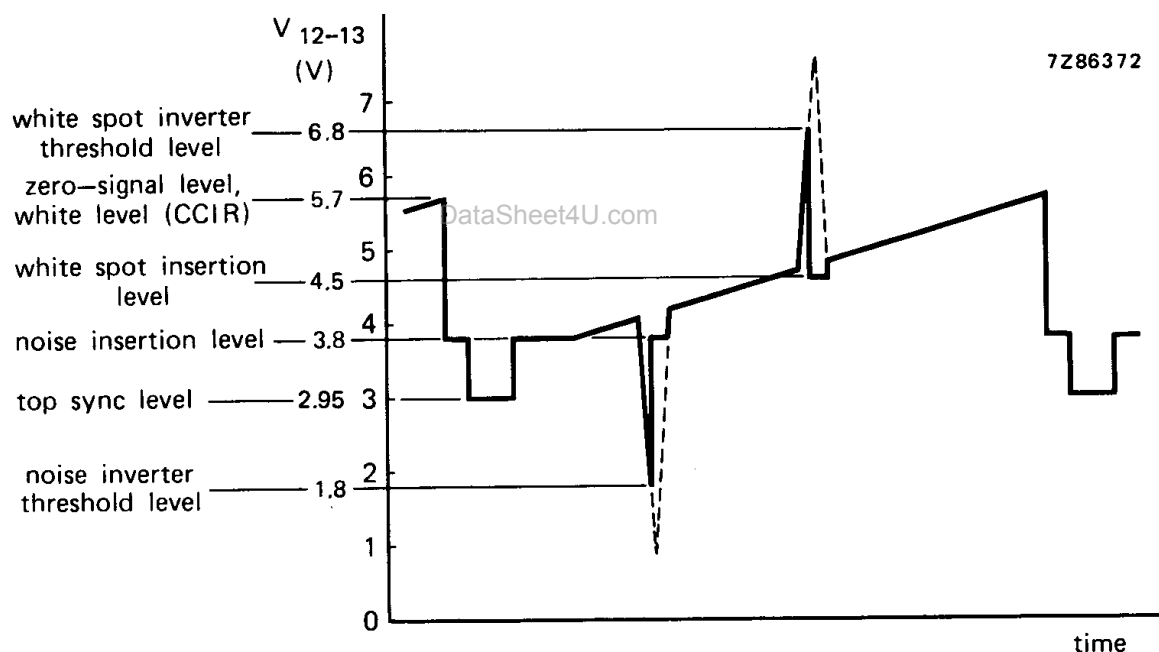


Fig. 4 Video output waveform showing white spot and noise inverter threshold levels.

VCR switch

Switches the output off:			typ.	1.9 V
below	V ₁₄₋₁₃			1.4 to 2.4 V
above	V ₁₄₋₁₃		typ.	10.7 V
				10 to 11.3 V

A.F.C. (note 12)

A.F.C. output voltage swing (peak-to-peak value)

$V_{5-13(p-p)}$	>	10 V
	typ.	10.7 V

Change of frequency for an a.f.c. output voltage swing of 10 V at 100% picture carrier

Δf	typ.	70 kHz
	<	150 kHz

at 10% picture carrier

Δf	typ.	100 kHz
	<	200 kHz

A.F.C. output voltage when tuned at 38.9 MHz

V_{5-13}	typ.	6 V
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A.F.C. output voltage (no input signal)

V_{5-13}	typ.	6 V
		4 to 8 V

A.F.C. switch switches off below

V_{6-13}	typ.	2.9 V
		1.6 to 3.5 V

Recommended a.f.c. active voltage

V_{6-13}		3.5 to 6 V
or: pin 6 floating		

A.F.C. switch leakage current at $V_{6-13} = 6$ V

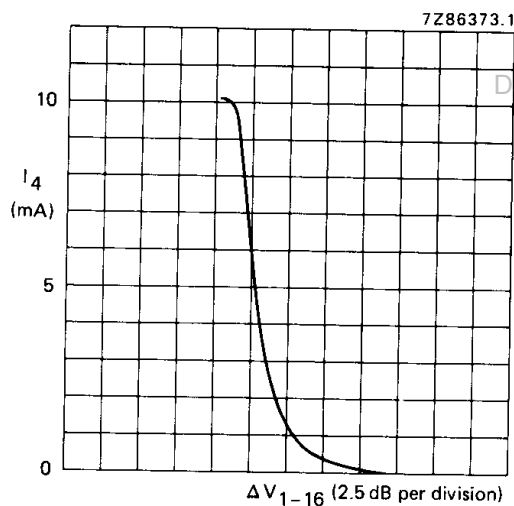
I_6	<	1 μ A
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A.F.C. output current during a.f.c. off measured with $f_o \pm 300$ kHz and $V_{6-13} = 1.5$ V

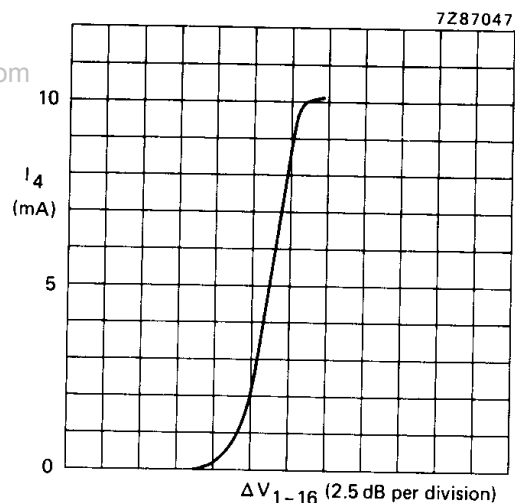
I_5		-2.5 to +2.5 μ A
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A.F.C. output current during a.f.c. on

I_5	>	1 mA
	typ.	2 mA



(a)



(b)

Fig. 5 Typical tuner a.g.c. characteristics;
pin 3 connected to the supply voltage (pin 11) with 39 k Ω .

a: TDA3540

b: TDA3541

CHARACTERISTICS (continued)

Notes to characteristics

1. All input signals are measured r.m.s. at top sync and 38,9 MHz.
2. Measured with 0 dB = 200 μ V.
3. Starting point of the tuner a.g.c. is defined as the input signal level where the tuner a.g.c. current is 9 mA for the TDA3540 and 1 mA for the TDA3541.
4. Measured with pin 3 connected with 39 k Ω to the supply voltage (pin 11).
5. Measured at 10 mV r.m.s. top sync input signal.
6. So-called 'projected zero point', e.g. with switched demodulator.
7. Measured according to EBU test, line 330.
The differential gain is expressed as a percentage of the difference in peak amplitudes between the largest and smallest section relative to the sub-carrier amplitude at blanking level.
8. Measured according to EBU test, line 330.
The differential phase is defined as the difference in degrees between the largest and smallest phase angle of the six sections.
9. $20 \log \frac{V_o \text{ at } 4.4 \text{ MHz}}{V_o \text{ at } 1.1 \text{ MHz}} + 3.6 \text{ dB}$.
10. $20 \log \frac{V_o \text{ at } 4.4 \text{ MHz}}{V_o \text{ at } 3.3 \text{ MHz}}$.
11. Measured with a 75 Ω source; $S/N = 20 \log \frac{V_o \text{ black-to-white}}{V_{n(\text{rms})} \text{ at } B = 5 \text{ MHz}}$.
12. Measured with an input signal $V_{1-16} = 10 \text{ mV}$ and a.f.c. output pin 5 symmetrically loaded with 100 k Ω to the supply voltage (V_{11-13}) and 100 k Ω to ground.

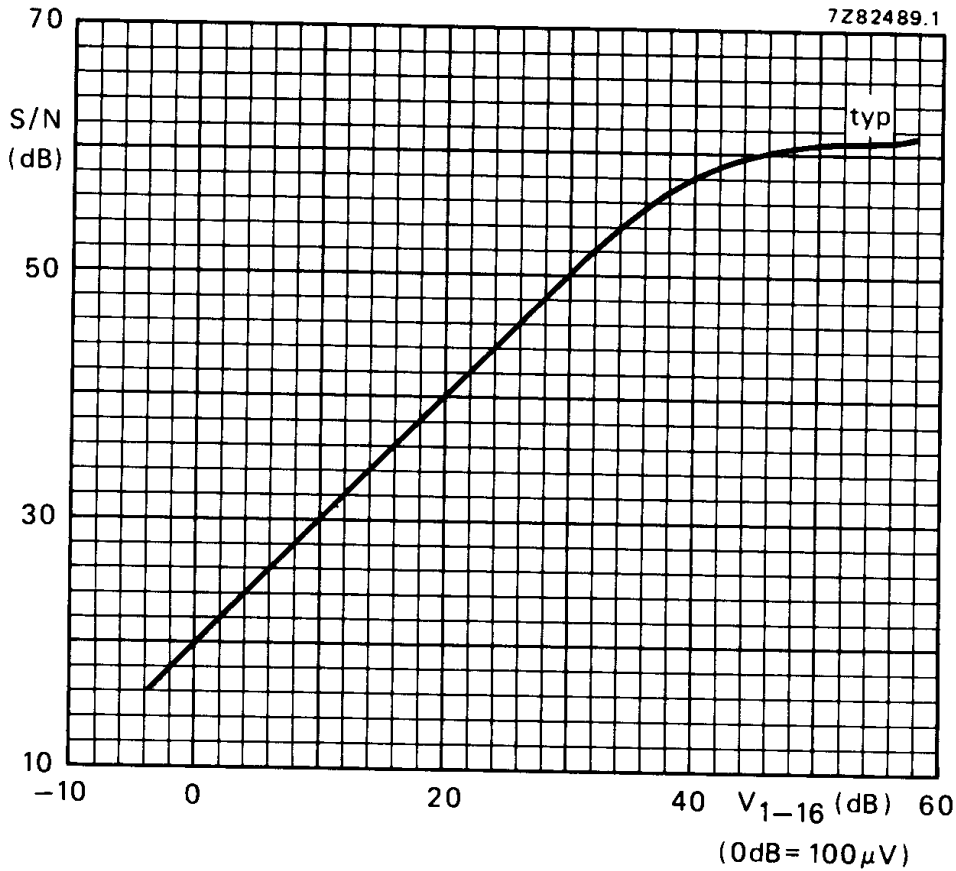


Fig. 6 Signal-to-noise ratio as a function of the input voltage (V_{1-16}).

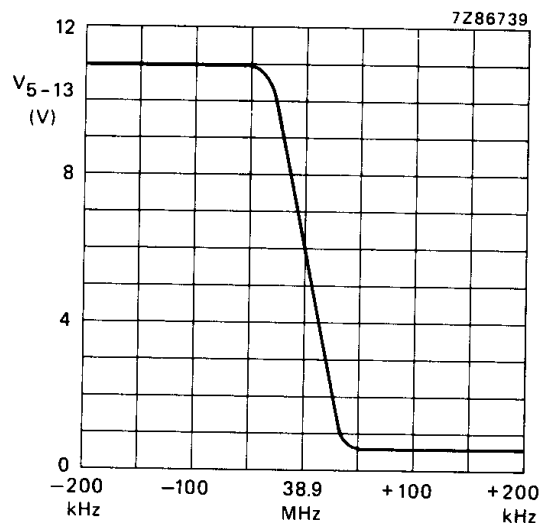
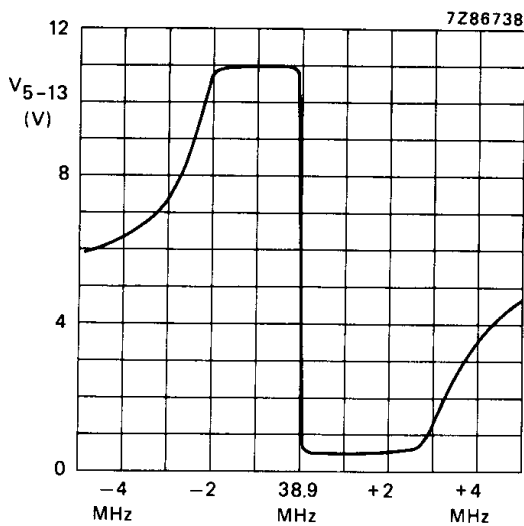
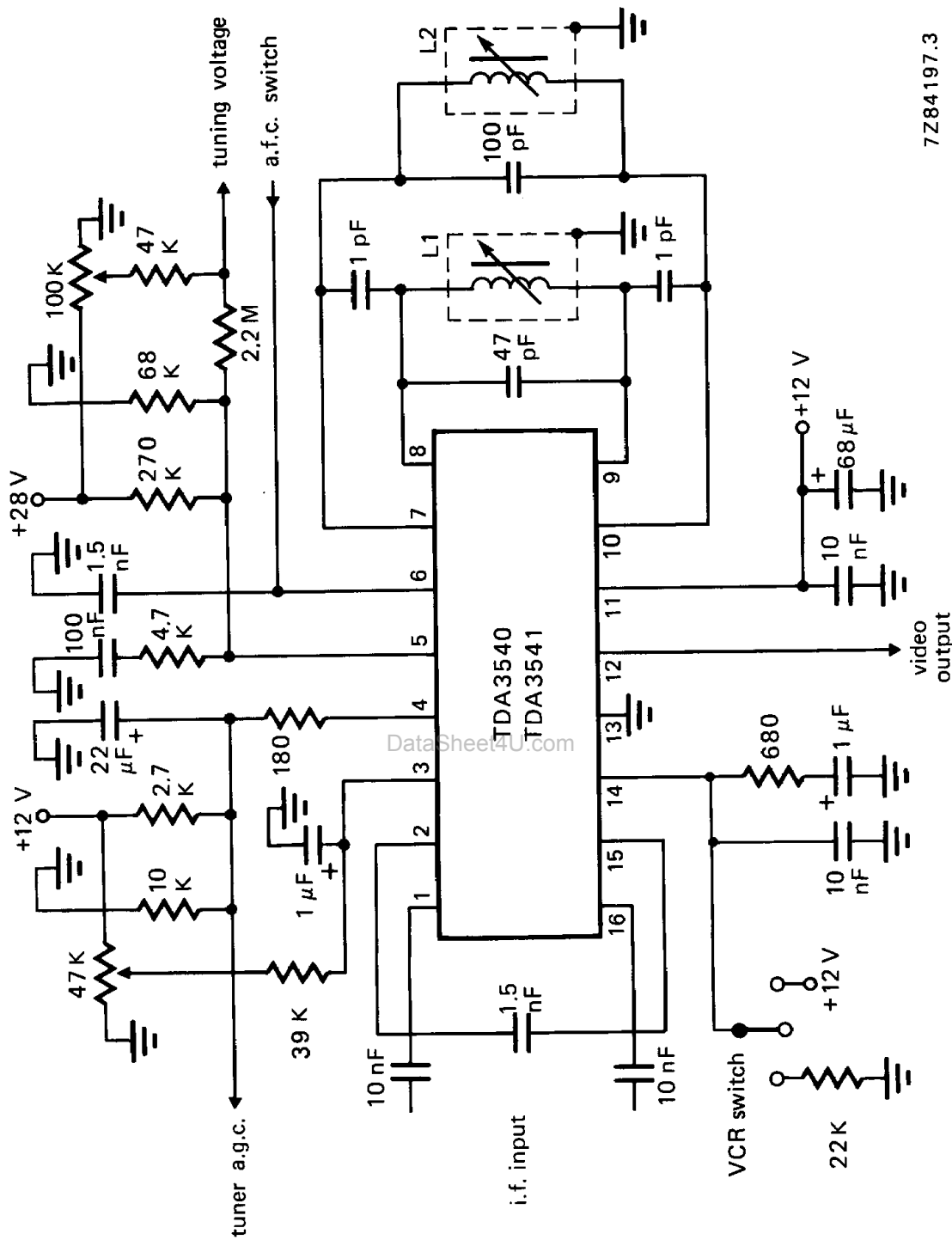


Fig. 7 A.F.C. output voltage (V_{5-13}) as a function of deviation of the i.f. vision carrier from its nominal frequency.

APPLICATION INFORMATION

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Fig. 8 Typical application circuit diagram; Q of L1 and L2 = 80; $f_o = 38.9$ MHz.

PAL-type devices
20L8, 20R8, 20R6, 20R4

PLUS20R8D/-7 Series

T-46-19-13

SNAP RESOURCE SUMMARY DESIGNATIONS (Continued)

