SGS-THOMSON MICROELECTRONICS

TDA4420

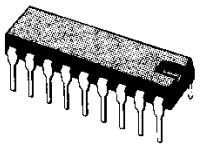
VISION IF SYSTEM WITH AFC

- HIGH GAIN-HIGH STABILITY
- VERY LOW INTERMODULATION PRODUCTS
- MINIMUM DIFFERENTIAL ERROR
- CONSTANT INPUT IMPEDANCE INDEPENDENT OF AGC
- FAST AGC GATING-ACTION, LARGELY INDEPENDENT OF PULSE SHAPE AND AMPLITUDE
- ADJUSTABLE WHITE LEVEL
- LARGE AFC OUTPUT CURRENT SWING (push-pull output)
- SWITCHABLE AFC

DESCRIPTION

The TDA4420 is a monolithic integrated circuit in 18 lead dual in-line plastic package. The functions incorporated are :

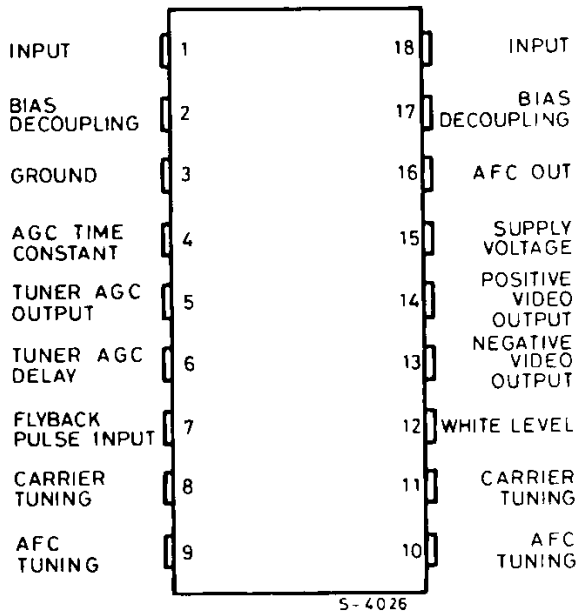
- gain controlled vision IF amplifier
- video demodulator controlled by picture carrier
- AGC detector with gating facility
- AGC amplifier for tuner drive with variable delay
- phase comparator for AFC current generation
- electronic AFC switch, controlled by a DC threshold detector
- thermally compensated push-pull AFC output stage.



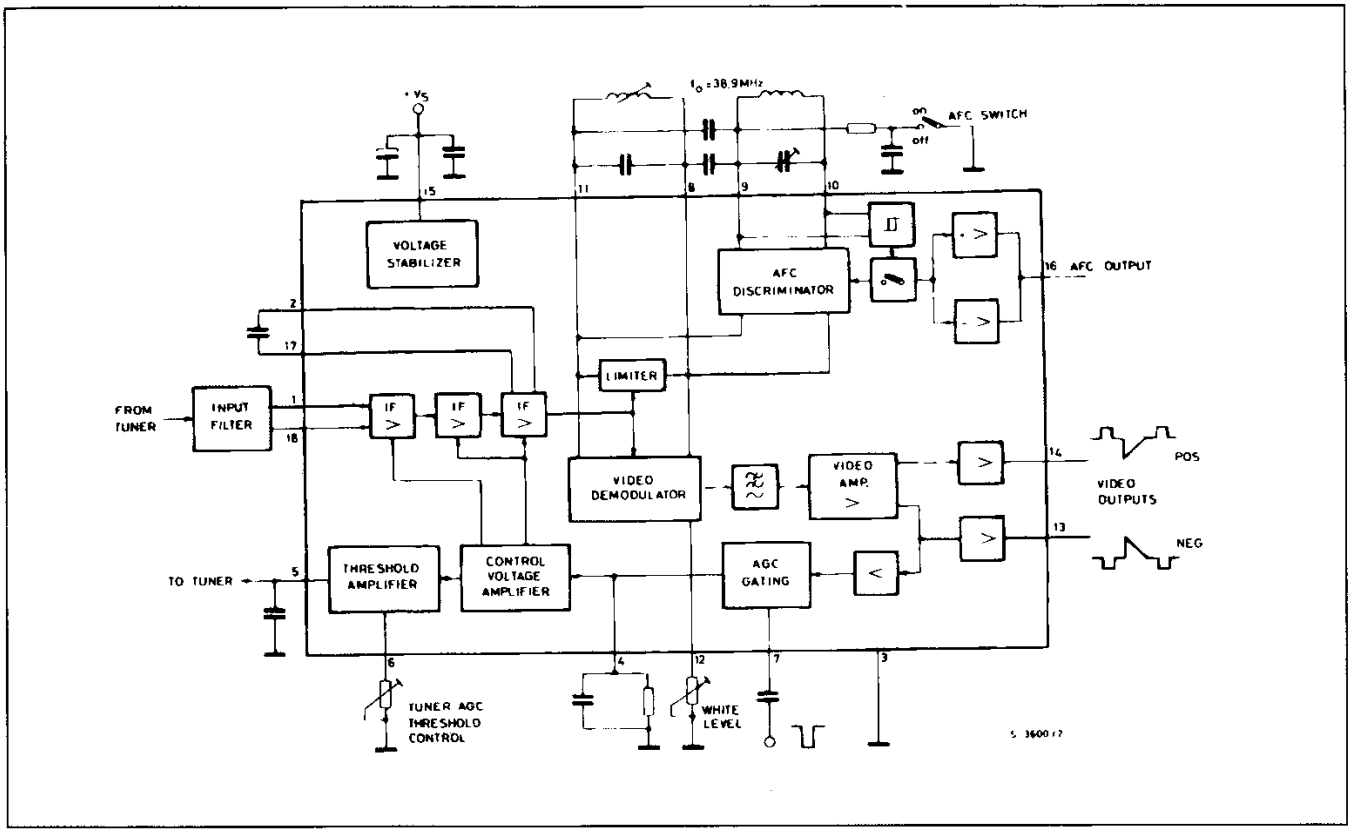
DIP-18

ORDER CODE : TDA4420

CONNECTION DIAGRAM (top view)



BLOCK DIAGRAM



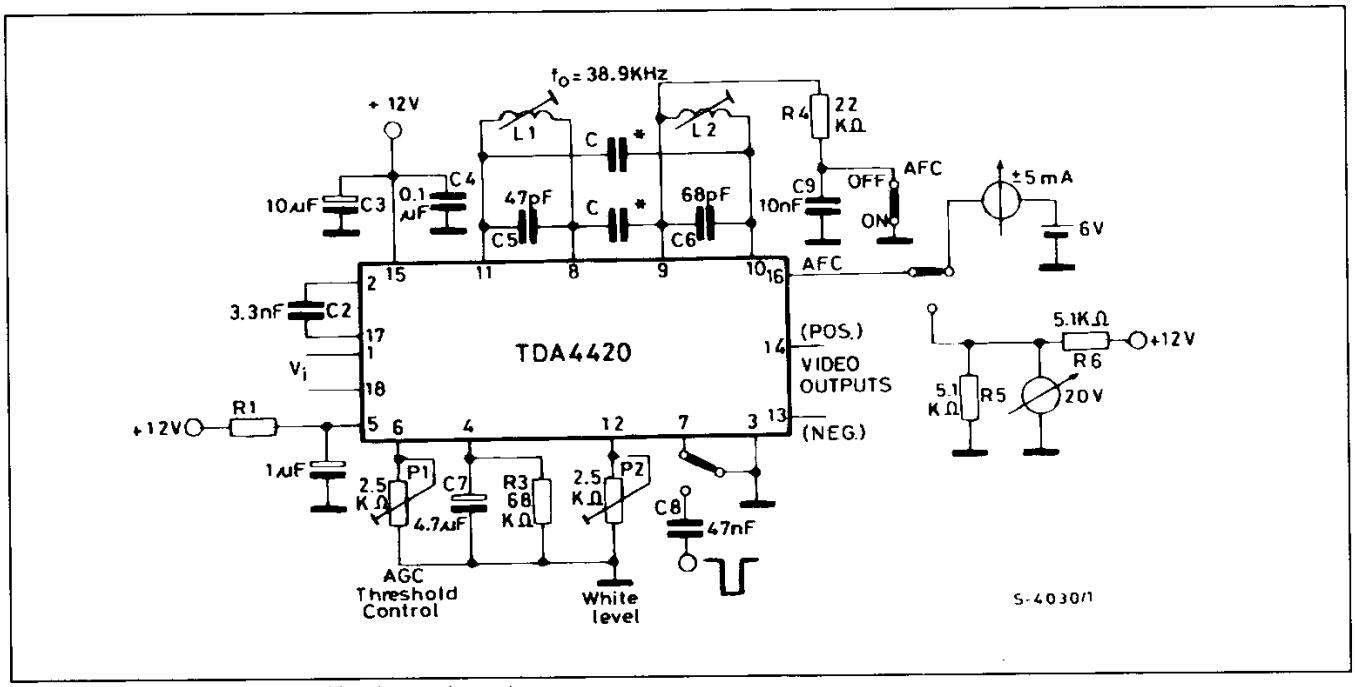
ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_S	Supply Voltage (pin 15)	15	V
V_5	Voltage at Pin 5	15	V
I_{13}, I_{14}	Video DC Output Current	5	mA
P_{tot}	Total Power Dissipation at $T_{amb} \leq 70$ °C	1	W
T_{stg}, T_j	Storage and Junction Temperature	- 40 to 150	°C

THERMAL DATA

$R_{th\ j-amb}$	Thermal Resistance Junction-ambient	Max	80	°C/W

TEST CIRCUIT



Note : (*) C ≅ 1.5 pF (pin and lead capacitance).

ELECTRICAL CHARACTERISTICS (Refer to the test circuit ; V_s = 12 V, f_0 = 38.9 MHz ; P_1 = 2.5 KΩ ; pin 7 connected to GND ; P_2 adjusted for V_{13} = 3.3 Vpp ; AFC off ; T_{amb} = 25 °C unless otherwise specified)

DC CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_S	Supply Voltage Range (pin 15)		10	12	15	V
I_S	Suppply Current (pin 15)			52		mA
V_{14}	Video Output DC Voltage	V_{13} = 5.5 V (1)		5.6		V
V_{13}	Video Output DC Voltage	Pin 12 Open (1)			4.5	V
		Pin 12 Grounded (1)	7			V
V_{13}	Peak Black Clamping Level at Negative Video Output		1.75	1.9	2.15	V
I_{13}	Output DC Current (pin 13)	V_s = 15 V V_{13} = 8 V		1.6		mA
I_9, I_{10}	DC Control Current for AFC off		150	300		µA

Notes :
1. V_{13} and V_{14} are simultaneously adjustable by means of the resistance connected between pin 12 and ground (P_2).
2. ΔV_i = + 60 dB (see note 7) ; f_m = 100 KHz ; m = 0.82.
3. Input at pin 7 through C8.
4. The input voltage V_i can have any value within the AGC range.
5. P_2 adjusted for V_{13} = 5.5 V or V_{13} = 6.4 V ; f_m = 100 KHz ; m = 0.82.
6. ΔV_o = 1 dB ; f_m = 100 KHz ; m = 0.82.
7. The measured amplitude is assumed as 0 dB reference level of V_i that is the rms value of the unmodulated video carrier (modulation down).
8. P_2 is adjusted in order to have V_{13} = 3 Vpp at V_i = 4 mV, then the sensitivity is obtained as the minimum input voltage that maintains this output level. f_m = 100 KHz ; m = 82 %.
9. f_o = 38.9 MHz (video carrier) ; f_a = 33.4 MHz (sound carrier) ; the amplitude of the sound carrier is 30 dB below the amplitude of the video carrier.
10. V_i at f_o = 38.9 MHz (video carrier) ; f_a = 33.4 MHz, 6 dB below V_i (sound carrier) ; f_b = 34.47 MHz, 24 dB below V_i (Chroma subcarrier).
11. V_i = 40 dB ; R_5 = R_6 = 5.1 KΩ ; AFC on ; f_o = 39.9 MHz ; f_o = 37.9 MHz.
12. V_i = 40 dB ; f_o = 39.2 MHz ; AFC on ; V_{16} = 6 V.
13. V_i = 40 dB ; f_o = 38.9 MHz ; f_2 = 39.2 MHz ; AFC on ; V_{16} = 6 V.

ELECTRICAL CHARACTERISTICS (continued)

AC CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_5	Available Tuner AGC Current	(2)		10		mA
V_7	AGC Gating Pulse Input Peak Voltage	f pulse = 15625 Hz (3)	– 1.5	– 3	– 5	V
V_0	Peak to Peak Video Output Signal (pin 13)	V_{13} = 5.5 V (4), (5)		3.3		V
		V_{13} = 6.4 V (4), (5)		4.2		V
ΔV_i	AGC Range	(6)	50	60		dB
B	Frequency Response (– 3 dB)	(4)	8	10		MHz
V_i	Input Sensitivity	(7), (8)	100	150	200	µV
V_{13}, V_{14}	Video carrier and video carrier 2nd harmonic leakage at video output.	V_i = 30 dB f_o = 38.9 MHz (4) 2 f_o = 77.8 MHz			30 50	mV mV
V_{14}	Sound IF at Positive Video Output (5.5 MHz)	(4), (9)	30			mV
d	Differential Distortion of Negative Video Output Signal	V_i = 30 dB (standard staircase modulating signal)		3		%
d_{im}	Intermodulation Product at Video Outputs (1.07 MHz)	(4), (10)		– 50		dB
R_i	Input Resistance between Pins 1 and 18	(4)		1.4		KΩ
C_i	Input Capacitance between Pins 1 and 18			2		pF
V_{16}	AFC Voltage Range	(11)	1		V_s–1.5	V
I_{16}	Maximum Available AFC Current	(12)			± 3	mA
$\frac{\Delta I_{16}}{\Delta f}$	AFC Slope	(13)		± 0.01		$\frac{mA}{KHz}$

Notes :
1. V_{13} and V_{14} are simultaneously adjustable by means of the resistance connected between pin 12 and ground (P_2).
2. ΔV_i = + 60 dB (see note 7) ; f_m = 100 KHz ; m = 0.82.
3. Input at pin 7 through C8.
4. The input voltage V_i can have any value within the AGC range.
5. P_2 adjusted for V_{13} = 5.5 V or V_{13} = 6.4 V ; f_m = 100 KHz ; m = 0.82.
6. ΔV_o = 1 dB ; f_m = 100 KHz ; m = 0.82.
7. The measured amplitude is assumed as 0 dB reference level of V_i that is the rms value of the unmodulated video carrier (modulation down).
8. P_2 is adjusted in order to have V_{13} = 3 Vpp at V_i = 4 mV, then the sensitivity is obtained as the minimum input voltage that maintains this output level. f_m = 100 KHz ; m = 82 %.
9. f_o = 38.9 MHz (video carrier) ; f_a = 33.4 MHz (sound carrier) ; the amplitude of the sound carrier is 30 dB below the amplitude of the video carrier.
10. V_i at f_o = 38.9 MHz (video carrier) ; f_a = 33.4 MHz, 6 dB below V_i (sound carrier) ; f_b = 34.47 MHz, 24 dB below V_i (Chroma subcarrier).
11. V_i = 40 dB ; R_5 = R_6 = 5.1 KΩ ; AFC on ; f_o = 39.9 MHz ; f_o = 37.9 MHz.
12. V_i = 40 dB ; f_o = 39.2 MHz ; AFC on ; V_{16} = 6 V.
13. V_i = 40 dB ; f_o = 38.9 MHz ; f_2 = 39.2 MHz ; AFC on ; V_{16} = 6 V.

Figure 1 : Set-up for Measurement of d_{im}.

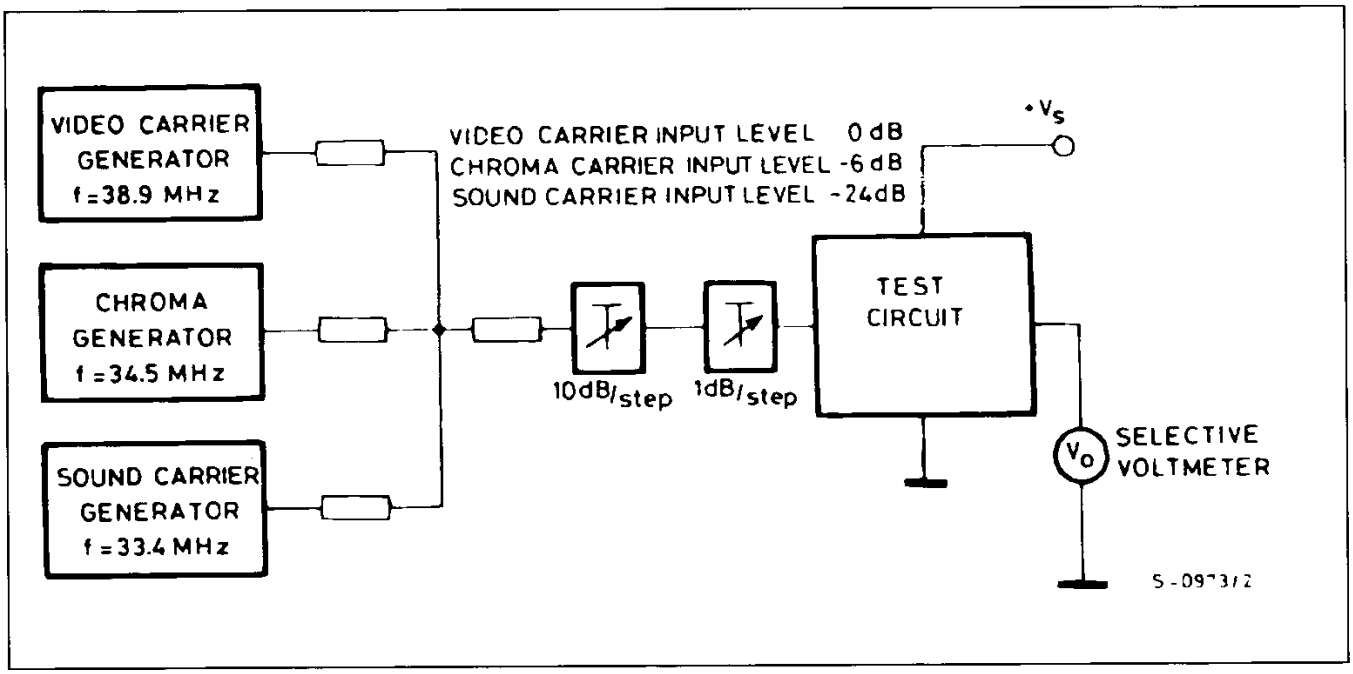


Figure 2 : Set-up for Measurement of ΔV_O.

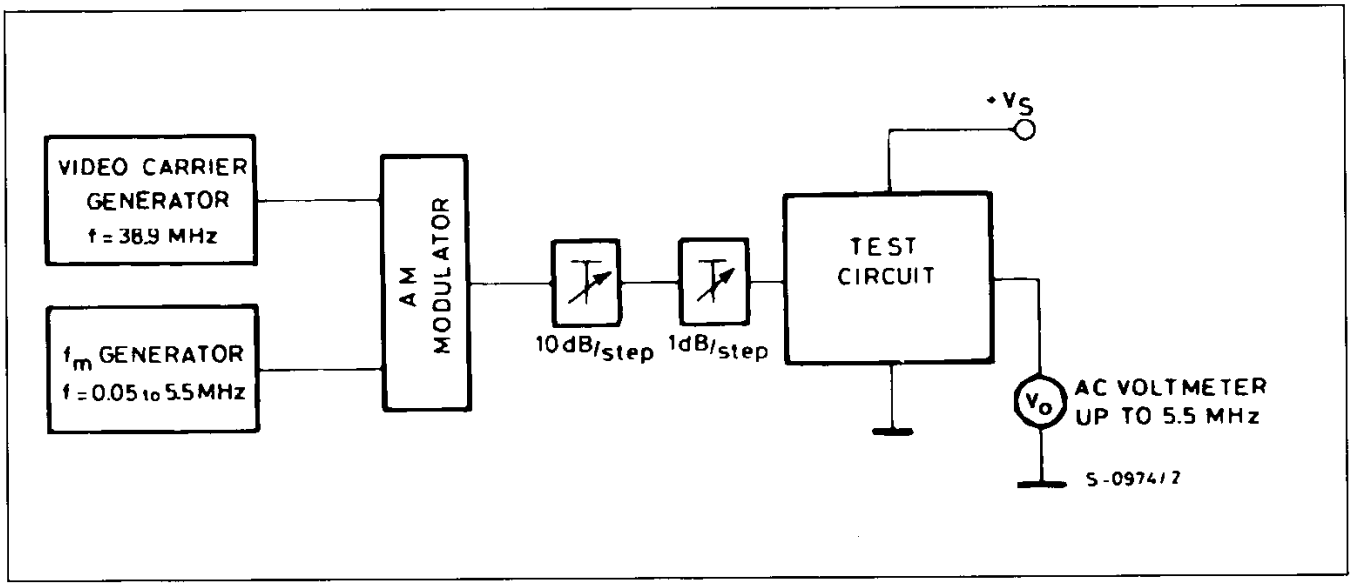


Figure 3 : Application Circuit.

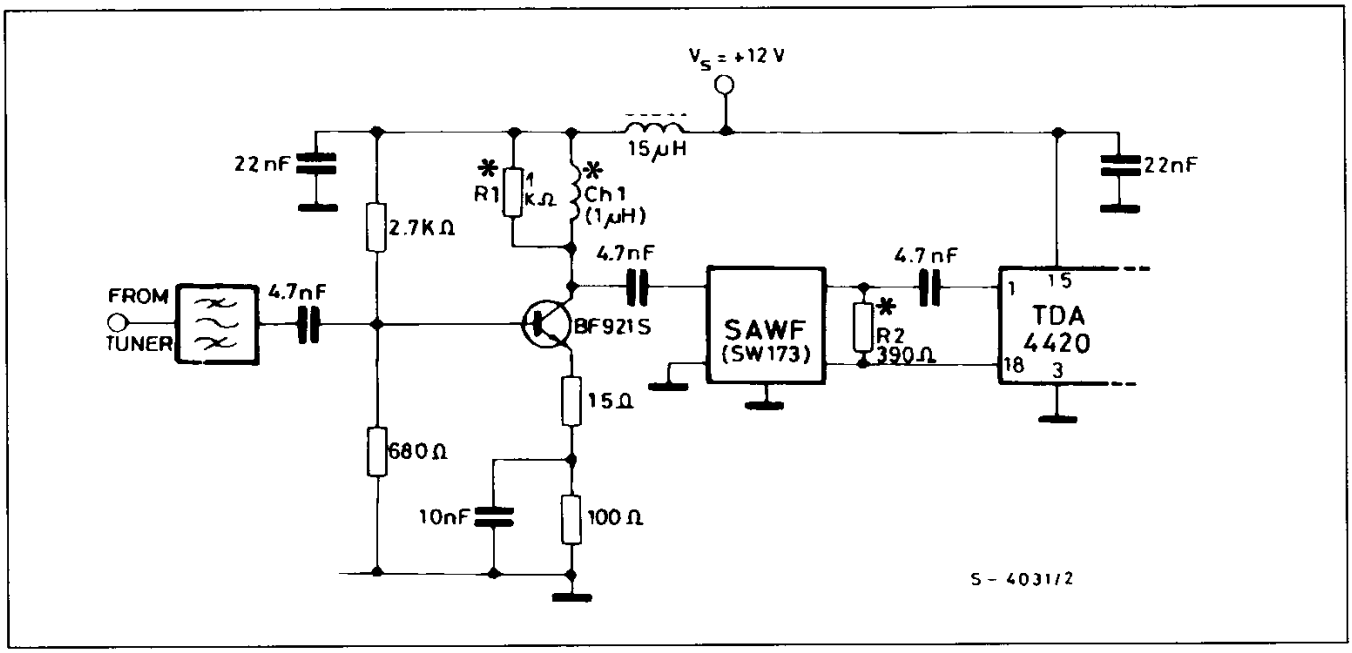
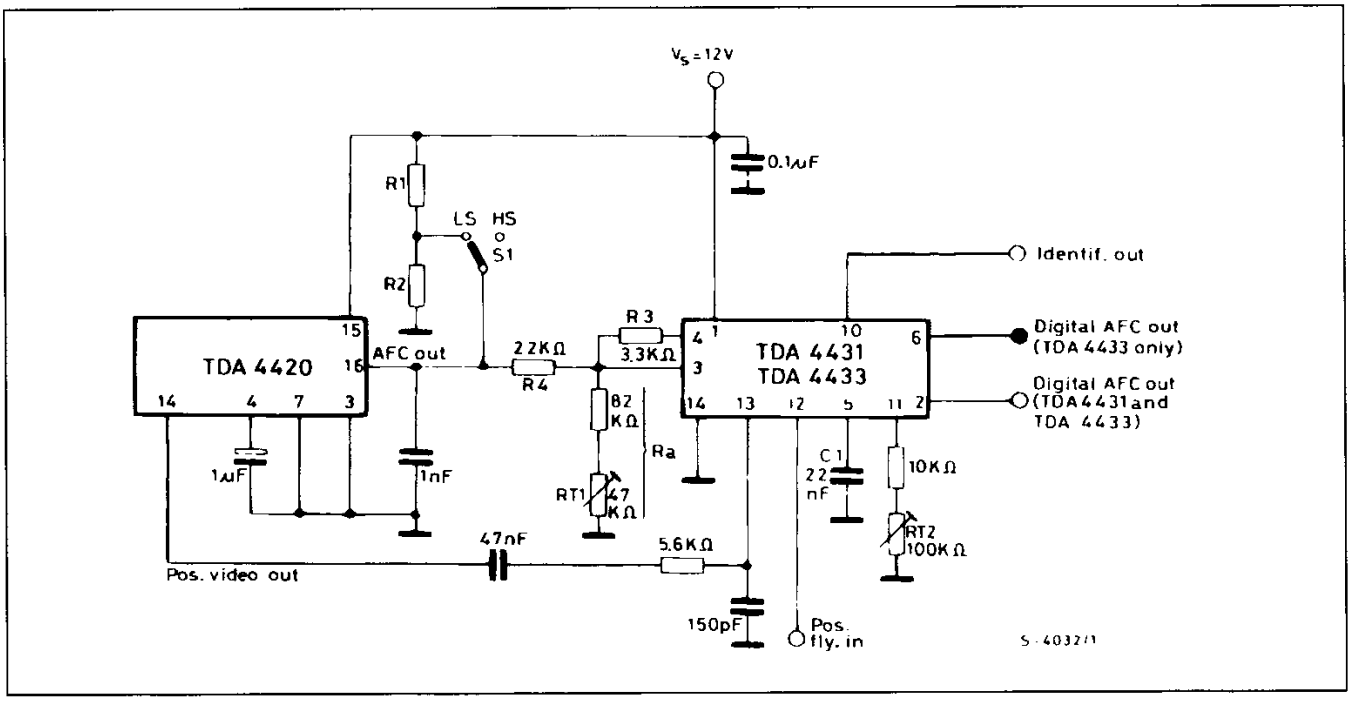


Figure 4 : TV Signal Identification Circuit.



TV signal identification circuit :

The suggested application circuit is shown in fig. 4.

The passive components are chosen as follows :

R_1 and R_2 : these define the AFC response slope. For $R_1 = R_2 = 5.1$ KΩ, the typical slope is 750/11 KHz/V (with AFC output unloaded).

S_1 : switches between low slope (LS) and high slope (HS). The high slope is typically 88/11 KHz/V.

R_3 and R_4 : the ratio $(R_3 + R_4)/R_3$ defines the digital AFC width (δf) calculated from the linear AFC width (2Δf). With V_s = 12 V, the relation is :

$$\delta f = 0.036\ (2\Delta f)\ \frac{R_3 + R_4}{R_3}$$

R_{T1} : by means of this trimmer it is possible to align the linear tuning with the digital one, at the same frequency. The typical relation is :

$$R_a = 33\ R_3$$

with R_3 = 3.3 KΩ, R_a can be a fixed resistor of 110 KΩ.

To make better sensitivity adjustment of trimmer R_{T2}, it is necessary to use only a weak signal at the antenna. The video information must be a black picture or a field of small white points on a black field. Furthermore, the action of the syncs separator must be as quick as possible.

In receivers with automatic program search, S1 should be in the HS position and then the components S1, R1 and R2 can be omitted completely.

Figure 5 : Linear and Digital AFC Characteristics (TDA4420 and TDA4431).