SIEMENS

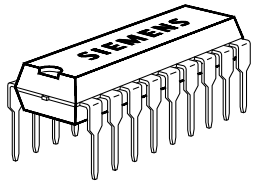
Video IF Amplifier and Demodulator with Full-SCART

TDA 5931-65

Bipolar IC

Features

- Multistandard video IF
- Interference suppression circuitry
- Mean/peak value control
- Area of application: TV set with Full-SCART



P-DIP-18

Type	Ordering Code	Package
TDA 5931-65	Q67000-A5136	P-DIP-18

Functional Description

Video IF for all European standards for positive and negative modulation. The video section contains a Full-SCART interface. An output for the demodulated video signal (pin 9) allows the insertion of a sound trap into the signal path to the input or the SCART switch and the SCART output buffer amplifier (pin 7). The analog setting function (delayed AGC threshold) is controlled via a potentiometer, all other switch functions are controlled via open-collector transistors.

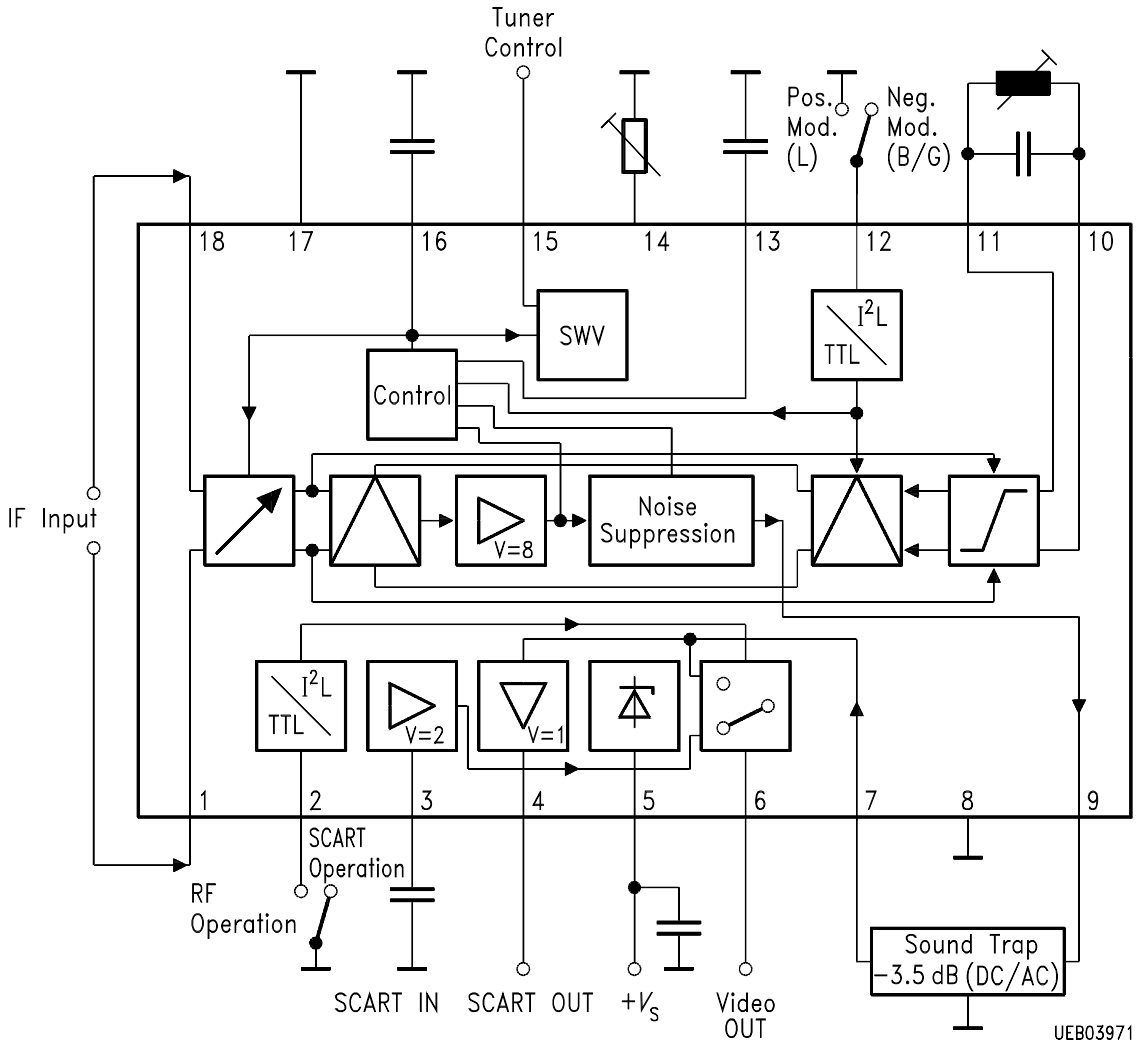
Circuit Description

The component includes a four-stage, capacitively coupled, symmetrically designed and controlled amplifier, a limiter with selection, and a mixer for quasi-synchronous demodulation of positive and negative modulated IF signals. In addition a video output amplifier and noise suppression circuitry are included. This output is used for generating the AGC voltage. The AGC for both modulation types has been realized as integral AGC with noise free peak and mean value detector (only for positive modulation). For SCART applications this output is switched a video source switch with two inputs (for the demodulator signal or SCART socket) and two outputs (SCART- and TV output). The demodulator output (pin 9) provides a video signal output level 3 dB higher than the level required for the operation of the TV set or to drive the SCART connector. Therefore it is possible to insert a sound trap in between this output and the input of the SCART switch (pin 7). The insertion loss of the sound trap has to attenuate the signal level at pin 9 by a factor 2/3 or 3 dB (AC and DC) to avoid distortions in the SCART switch.

The delayed tuner AGC is generated by a threshold amplifier driven by the control voltage. The amplifier response can be controlled by means of an external potentiometer. (The increase of the tuner AGC voltage shall create a higher tuner gain = positive control).

Pin Functions

Pin No.	Function
1	Video IF input
2	SCART switch A/W
3	SCART input
4	SCART input/output
5	+ V_S supply voltage
6	Positive video output
7	Video output of the sound trap (2 Vpp)
8	Ground
9	Video input of the sound trap (3 Vpp)
10	Demodulator tank circuit
11	Demodulator tank circuit
12	TV-standard switch-over (B/G) – (L)
13	Low-pass filter (averaging)
14	Tuner AGC threshold
15	Tuner AGC output
16	AGC-time constant
17	Ground
18	Video IF input



Block Diagram

Absolute Maximum Ratings
T_A = 0 to 70 °C

Parameter	Symbol	Limit Values		Unit
		min.	max.	
Sound trap input	V_7	3.3	8.5	V
Demodulator output	V_9	0	V_5	V
Demodulator output	I_9	– 3	10	mA
Supply voltage	V_5	0	13.2	V
SCART A/W	V_2	0	6	V
Pos. video output	I_6	– 3	5	mA
Pos. video output	V_6	0	8.5	V
Demodulator tank circuit	V_{10}/V_{11}	0	V_5	V
SCART OUT	I_4	– 3	5	mA
SCART OUT	V_4	0	V_5	V
Tuner AGC threshold	V_{14}	0	6	V
Tuner AGC output	V_{15}	0	10	V
IF input	V_1/V_{18}	0	6	V
IF control	V_{16}	0	8.5	V
Norm switch-over	V_{12}	0	6	V
Norm switch-over	V_{13}	0	6	V
SCART IN	V_3	0	6	V
Junction temperature	T_j		150	˚C
Storage temperature	T_{stg}	– 40	125	˚C
Thermal resistance (system-air)	$T_{th\ SA}$		70	K/W

Operating Range

Supply voltage	V_5	10.8	13.2	V
Supply voltage delayed tuner AGC	V_{15}	1.5	13.2	V
Ambient temperature during operation	T_A	0	70	˚C
Input frequency range – 3 dB	f_{IF}	10	100	MHz
Input frequency range – 0.3 dB	f_{IF}	30	75	MHz

All voltage values are referenced to ground, if not stated otherwise.
The current are identified according to the source/sink principle. If the I_C considered a sink (the current flows from the respective pin to ground), it is identified by a negative algebraic sign.
However, if the I_C is the source (the current flows from V_B via the respective pin to ground), it is identified by a positive algebraic sign.

Characteristics
T_A = 25 ℃; V_S = 12 V

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Static Characteristics						
Total current consumption	$-I_5$	38.5	56	71.5	mA	$V_{1/16}$ = 10 mVrms
AGC Voltage						
Min. AGC	V_{16}	0	0.1	0.5	V	$V_{1/16}$ = 45 µVrms
Max. AGC	V_{16}	2.6	2.85	6.0	V	$V_{1/16}$ = 175 mVrms
AGC-Time Constant (by neg. modulation)						
Charge current (I_{max}:2)	I_{16}	0.55	0.7	0.95	mA	V_{16} = 2 V; V_6 < 2.2 V
Discharge current	$-I_{16}$	13	17	23	µA	V_{16} = 2 V; V_6 > 2.8 V
Charge/discharge ratio	V_{16}	55	82	140		
AGC-Time Constant (by pos. modulation)						
Charge current	I_{16}	1.1	1.4	1.7	mA	V_{16} = 2 V; $V_6 \geq$ 4.1 V
Discharge current	$-I_{16}$	0.15	0.25	0.35	µA	V_{16} = 2 V; 3.1 V < V_6 < 4.1 V
Discharge current	$-I_{16}$	70	90	110	µA	V_{16} = 2 V; V_6 < 2.3 V
Charge/discharge ratio	V_{16}	4000	5600	9000		
Averaging by Pos. Modulation						
White level	V_{13}	4.9	5.7	6.5	V	$V_{1/18}$ = 10 mVrms
Zero carrier level	V_{13}	3.3	3.7	4.1	V	$V_{1/18}$ = 0 V; V_{16} = 3 V
Tuner AGC threshold	V_{14}	4.2	4.5	4.8	V	$R_{14/17}$ = ∞
$I_5 = I_{max}$:2	I_{14}	650	850	1050	µA	V_{14} = 0 V
	V_{16}	2.8	3.1	3.4	V	$R_{14/17}$ = 10 kΩ
	V_{16}	0.33	0.38	0.43	V	$R_{14/17}$ = 10 Ω

The characteristics data apply to the supply voltage range V_S stated or in case of alignment to the alignment instructions (**see page 40**). All static voltages are referenced to ground if not stated otherwise.

The input levels are given as rms values referenced to synchronous peak f_{PC} = 38.9 MHz.

Characteristics (cont'd)

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Tuner AGC current max. 1 ms	$-I_{15}$	10	18	30	mA	V_{15} = 0.5 V_5 $V_{1/18}$ = 100 mVrms V_{14} = 0.75 V
	$-I_{15}$	0	–	10	µA	V_{15} = 0.5 V_5 $V_{1/18}$ = 10 mVrms V_{14} = 4.0 V
IF input	V_1, V_{18}	5.7	6.0	6.3	V	
Demodulator tank	V_{10}, V_{11}	V_5 – 3.5	V_5 – 3.8	V_5 – 4.1	V	
Video Output (Demodulator)						
Output current	$-I_9$	1.9	2.6	3.3	mA	V_9 = 6 V, $V_{1,\ 18}$ = carrier no-demod.
Output current	I_9	4			mA	to ground
Sychron level	V_9	5.2	5.6	6.2	V	$V_{1/18}$ = 10 mVrms
Sound Trap Input						
Sychron pulse level	V_7	3.3	3.7		V	Signal ratio $V_{9/7}$ = 3/2
White level	V_7		5.7	6.0	V	Signal ratio $V_{9/7}$ = 3/2 $V_{1/18}$ = 0 V; V_{16} = 3 V 0 V > V_2 > 2.4 V
Pos. Video Output						
Output current	$-I_6$	1.7	2.2	2.7	mA	V_6 = 6 V
	I_6	4			mA	to ground via R = 500 Ω
Pos. modulation (L standard)						**see Sound Trap Input**
White level	V_6	3.9	4.2	4.9	V	$V_{1/18}$ = 10 mVrms
Zero carrier (sync.)	V_6	1.9	2.2	2.7	V	$V_{1/18}$ = 0 V; V_{16} = 3 V
Neg. modulation (BG standard)						
Synchron pulse level	V_6	1.9	2.2	2.7	V	$V_{1/18}$ = 10 mVrms
Zero carrier	V_6	4.1	4.4	5.1	V	$V_{1/18}$ = 0 V; V_{16} = 3 V

Characteristics (cont'd)

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Neg. SCART Output						
Output current	$-I_4$	1.6	2	2.6	mA	$R_L = \infty$; **see Sound Trap Input**
	I_4	4			mA	$V_4 = V_5$
Pos. modulation (L standard)						to ground via R = 500 Ω
White level	V_4	V_5 – 5.3	V_5 – 5.0	V_5 – 4.3	V	$V_{1/18}$ = 10 mVrms
Zero carrier (sync.)	V_4	V_5 – 3.2	V_5 – 2.9	V_5 – 2.5	V	$V_{1/18}$ = 0 V; V_{16} = 3 V
Neg. modulation (BG standard)						
Synchron pulse level	V_4	V_5 – 3.2	V_5 – 2.9	V_5 – 2.5	V	$V_{1/18}$ = 10 mVrms
Zero carrier	V_4	V_5 – 5.5	V_5 – 5.2	V_5 – 4.6	V	$V_{1/18}$ = 0 V; V_{16} = 3 V
Pos. SCART Input 4						
Clamp level	V_3	1.8	1.9	2	V	via R = 270 kΩ at
Output current	I_3	3			mA	ground V_3 = 1.2 V
Switching Voltage						
L = L/E standard	V_{12}	0		1.9	V	
H = B/G standard	V_{12}	2.4		6	V	
o. open						
Switching Voltage						
Open = SCART operat.	V_2					
H = SCART operation	V_2	2.4		6	V	
L = HF operation	V_2	0		1.9	V	
Dynamic Characteristics						
Min. IF-input voltage start of internal AGC operation f_{PC} rms	$V_{1/18}$		45	60	µV	6 Vpp – 1 dB
Max. IF-input voltage (end of internal AGC-control range) f_{PC} rms	$V_{1/18}$	105	140		mV	6 Vpp – 1 dB
IF-control range	Δv	65	70		dB	

Characteristics (cont'd)

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Video output voltages (peak to peak) f_{PC} = 10 mVrms with neg. modulation and residual carrier = 10%; with neg. modulation and residual carrier < 6%						
Pos. video output changes related to TV-standard switch over	V_6 ΔV_6	1.8	2.0 2	2.2 5	Vpp %	0 V < V_2 < 1.9 V 0 V < V_{12} < 1.9 V; 0 < V_2 < 1.9 V 2.4 V < V_{12} < 6 V
Change due to operating voltage			1.5	3	%	$\Delta V_6/\Delta V_5$ 10.8 V < V_5 < 13.2 V
Neg. SCART output	V_4	1.9	2.1	2.3	Vpp	R_L = ∞
Changes of the video output voltage over the control range of 55 dB	ΔV_6		0.2	0.5	dB	
Video gain	V_6/V_3	1.9	2.0	2.1		R_G < 500 Ω; 2.4 < V_2 < 6 V; V_3 = 1 Vpp (2 MHz)
Video bandwidth	$P_{6/3\text{-}3dB}$	8	9		MHz	2.4 < V_2 < 6 V; V_3 = 1 Vpp sinus
Cross talk attenuation	A	40	50		dB	0 < V_2 < 1.9 V; $V_{1/18}$ = 0 V; V_{16} = 3 V; V_3 = 1 Vpp sinus 50 Hz … 10 MHz

Design Notes (no 100% final test)

Input resistance (symmetrical)	$R_{1/18}$	1.5	2	2.5	kΩ	
Input capacitance (symmetrical)	$C_{1/18}$		2	5	pF	
Low pass cut-off	$f_{-3\ dB\ (13)}$	70	100	130	Hz	$C_{13/17}$ = 100 nF ± 10%
Pos. video output white level Synchron pulse level frequency	 V_6 V_6	 3.9 1.9	 4.2 2.2	 4.9 2.7	 V V	2.4 < V_2 = 6 V; (SCART operation) V_3 = 1 Vpp norm video signal V_3 = 1 Vpp norm video signal
Video input voltage ± 3 dB at R_G < 500 Ω	V_3		1		Vpp	

Characteristics (cont'd)

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Intercarrier noise voltages ratio (weighted according CCIR 468) with parallel tank circuit 38.9 MHz, SAW 361 D, f_{TT} = 5.5 MHz (– 13 dB), demod.: TBA 120						
	S/N		48		dB	$V_{1/18}$ = 10 mVpp FuBk mod.
	S/N		17		dB	$V_{1/18}$ = 10 mVpp 2.753 MHZ mod.
FuBk – test picture	$-\Delta S/N$	2		dB		with detuning Δf = – 400 kHz
FuBk – test picture	$-\Delta S/N$		11		dB	with detuning Δf = + 400 kHz
Dyn. Output Resistance						
Pos. video output	R_6	80	115	150	Ω	
Neg. video output	R_4	100	150	200	Ω	
Noise figure $V_{1/18}$ = – 57 dBm = + 50 dB µV R_G = 800 Ω	F		5	7	dB	
Video noise voltage ratio at BT = 10 mVrms 0 dB = 700 mVrms BA						
unweighted	S/N	50	55		dB	
weighted according to CCIR Rec. 567-1	S/N	55	60		dB	
Video Frequency Response						
– 3 dB	$B_{3\ dB}$	8	10	13	MHz	
– 12 dB	$B_{-\ 12\ dB}$	15	17	20	MHz	
Residual Carrier Voltage at Video Output						
f_{PC} = 10 mVrms 38.9 MHz Fundamental wave	V_6		3.0	6.0	mV	
1. harmonic wave f = 77.8 MHz	V_6		0.3	0.6	mV	

Characteristics (cont'd)

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Differential Gain with f_{PC} = 10 mV (staircase signal) Peak to Peak According to CCIR Rec. 567-1						
Staircase signal	DG		4.5	6	%	
Changes via AGC	$\Delta DG/\Delta v$			± 1	%	
Changes via detuning	$\Delta DG/\Delta f$			± 1.5	%	
f_{PC} = 38.9 MHz; Δf ± 400 kHz						
Differential Phase with f_{PC} = 10 mVrms (staircase signal) Peak to Peak According to CCIR Rec. 567-1						
Staircase signal	DP		2	2.5	degree	
Changes via AGC	$\Delta DP/\Delta v$			1	degree	
Changes via detuning	$\Delta DP/\Delta f$			± 1	degree	
f_{PC} = 38.9 MHz; Δf ± 400 kHz						
Interdemodulation Ratio						
With f_{IM} = 1.07 MHz = $f_{TT} - f_{FT}$ With BT = 10 mVeff						
With sound porch – 13 dB	a_{IM}	32	38	–	dB	OFW G 3950
With sound porch – 13 dB	a_{IM}	54	60	–	dB	OFW 361D
With sound porch – 13 dB	a_{IM}	51	57	–	dB	OFW G 1956
Demodulator Tank Circuit Voltage						
f_{PC} = 38.9 MHz; C = 47 pF L = 350 nH $100 \leq Q_0 \leq 120$; $Q_8 \approx 60$; $B \approx 0.8 \ldots 1.0$ MHz	$V_{10/11}$	300	450	600	mVpp	
Synchron pulse	$\Delta V_{Sync}/V_6$			5	%	

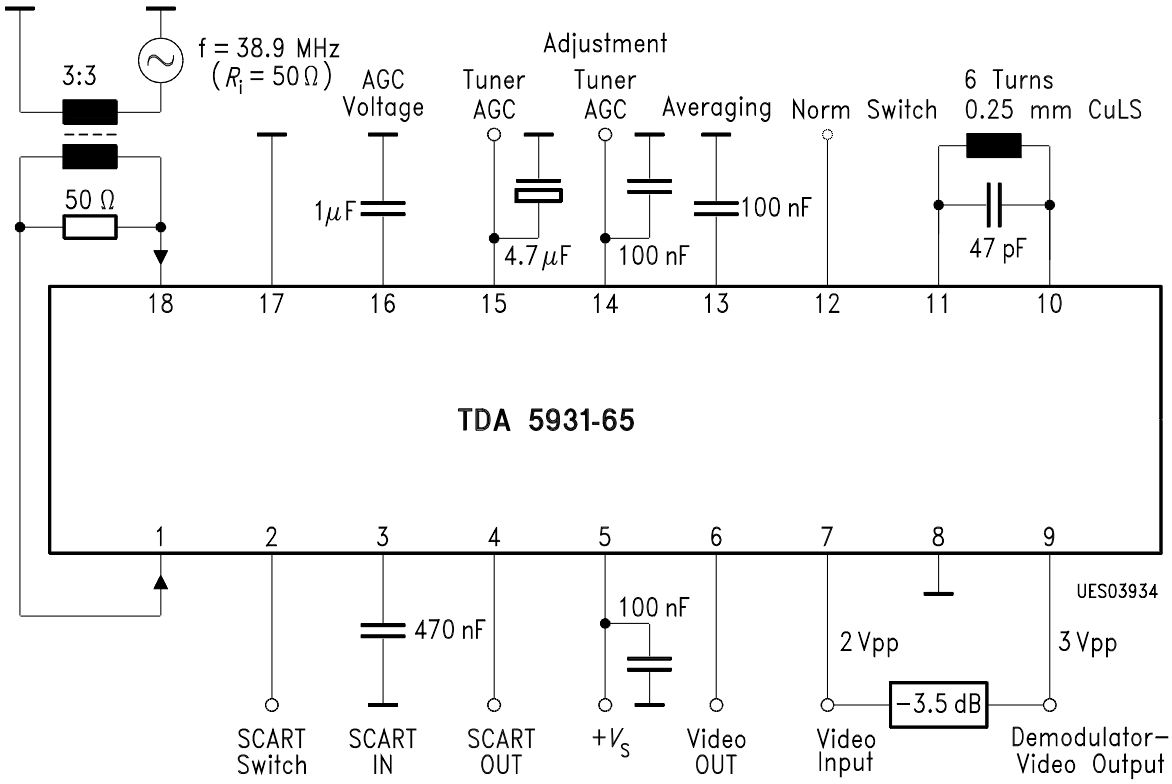
Alignment Instructions

At a video carrier input level of $V_{1/18}$ = 4 mVrms, f_{PC} = 38.9 MHz and a superimposed AGC voltage of V_{16} = 1.5 V the tank circuit is aligned that way, that at the positive video output the demodulated video signal 6 Vpp is at its maximum.

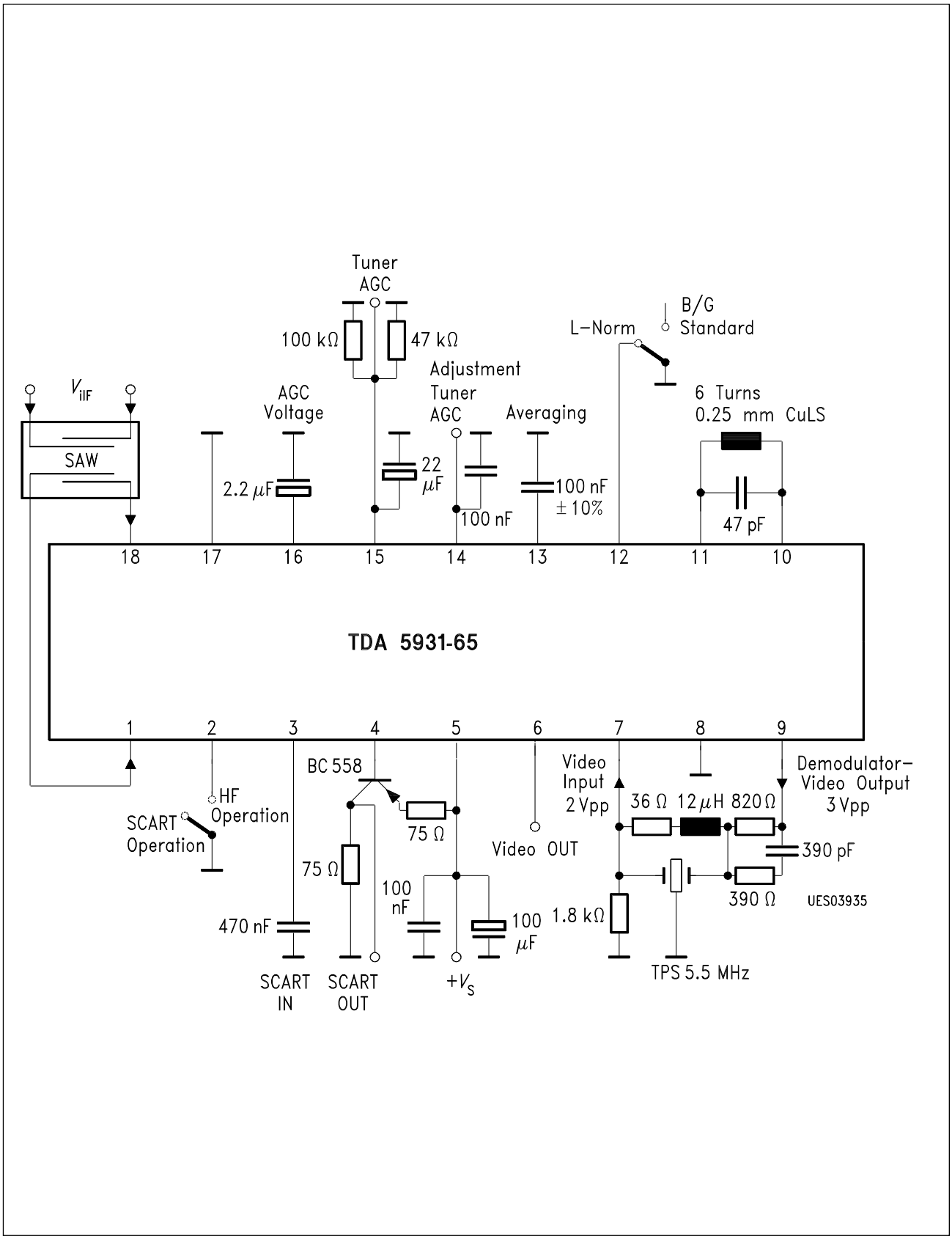
As a modulation every sufficient video test pattern can be used. Then the superimposed AGC-control voltage at pin 16 is reduced until the video signal has an amplitude of approx. 2 Vpp. The video signal is then fine tuned for its maximum.

The adjustment is not critical due to the wide maximum.

The adjustment can also be performed regarding intercarrier signal to noise ratio, differential gain or 2T-pulse response.



Test Circuit



Application Circuit