

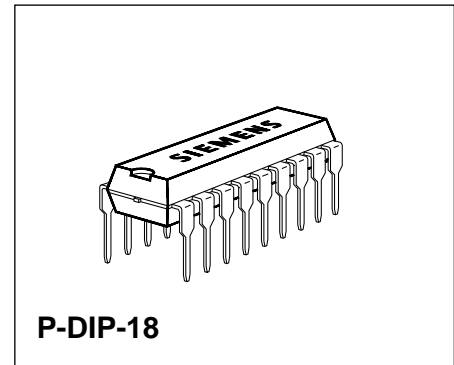
Video IF Amplifier and Demodulator with Full-SCART

TDA 5931-65

Bipolar IC

Features

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



| 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.

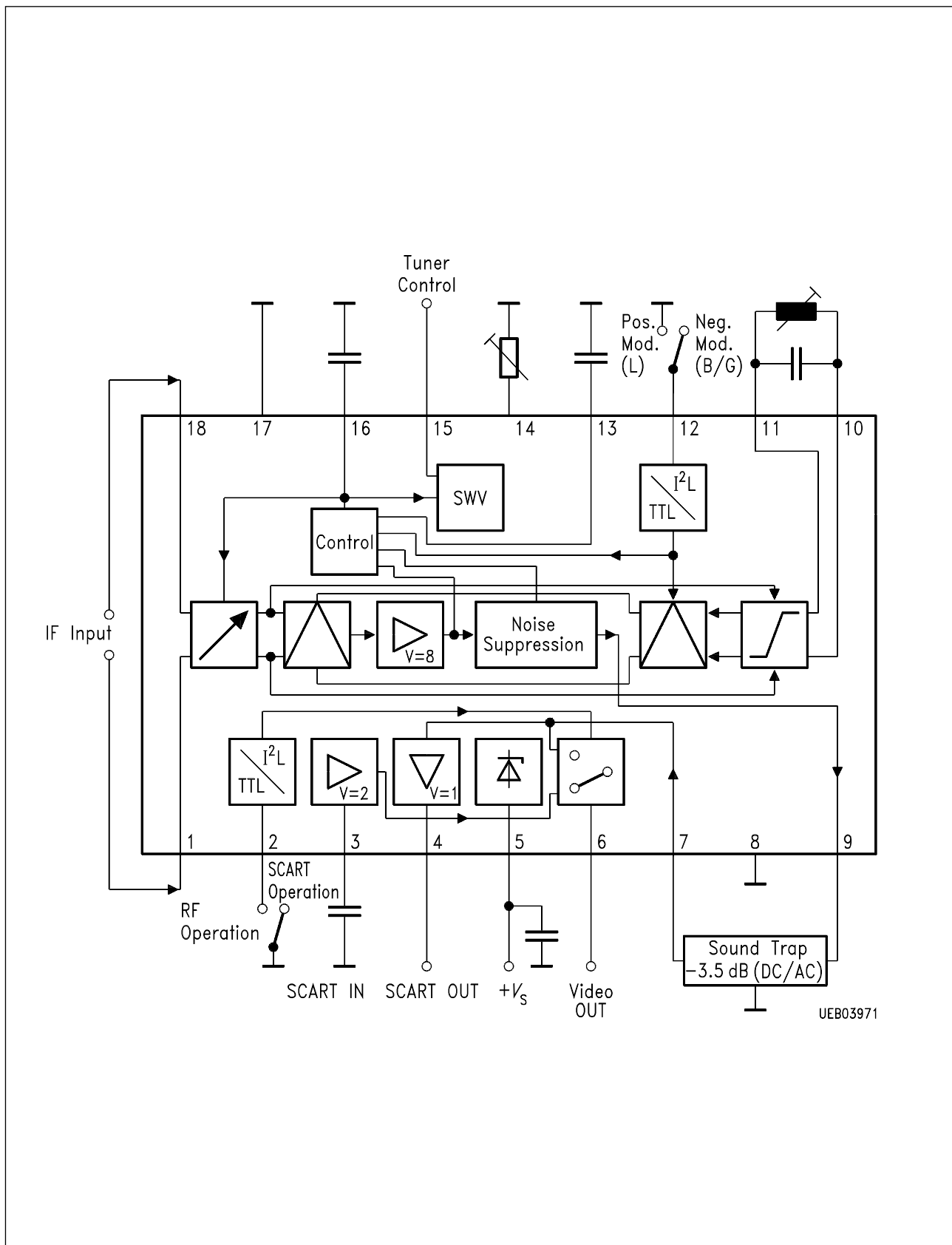
Circuit Description

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

$T_A = 25\text{ °C}$; $V_S = 12\text{ V}$

| Parameter | Symbol | Limit Values | | | Unit | Test Condition |
|-----------|--------|--------------|------|------|------|----------------|
| | | min. | typ. | max. | | |

Static Characteristics

| | | | | | | |
|---------------------------|--------|------|----|------|----|------------------------------|
| Total current consumption | $-I_5$ | 38.5 | 56 | 71.5 | mA | $V_{1/16} = 10\text{ mVrms}$ |
|---------------------------|--------|------|----|------|----|------------------------------|

AGC Voltage

| | | | | | | |
|----------|----------|-----|------|-----|---|---------------------------------------|
| Min. AGC | V_{16} | 0 | 0.1 | 0.5 | V | $V_{1/16} = 45\text{ }\mu\text{Vrms}$ |
| Max. AGC | V_{16} | 2.6 | 2.85 | 6.0 | V | $V_{1/16} = 175\text{ mVrms}$ |

AGC-Time Constant (by neg. modulation)

| | | | | | | |
|---------------------------------------|-----------|------|-----|------|---------------|--|
| Charge current ($I_{\max \cdot 2}$) | I_{16} | 0.55 | 0.7 | 0.95 | mA | $V_{16} = 2\text{ V}$; $V_6 < 2.2\text{ V}$ $V_{16} = 2\text{ V}$; $V_6 > 2.8\text{ V}$ |
| Discharge current | $-I_{16}$ | 13 | 17 | 23 | μA | |
| 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 | $V_{16} = 2\text{ V}$; $V_6 \geq 4.1\text{ V}$ $V_{16} = 2\text{ V}$; $3.1\text{ V} < V_6 < 4.1\text{ V}$ |
| Discharge current | $-I_{16}$ | 0.15 | 0.25 | 0.35 | μA | |
| Discharge current | $-I_{16}$ | 70 | 90 | 110 | μA | $V_{16} = 2\text{ V}$; $V_6 < 2.3\text{ V}$ |
| Charge/discharge ratio | V_{16} | 4000 | 5600 | 9000 | | |

Averaging by Pos. Modulation

| | | | | | | |
|--------------------------|----------|------|------|------|---------------|--|
| White level | V_{13} | 4.9 | 5.7 | 6.5 | V | $V_{1/18} = 10\text{ mVrms}$ |
| Zero carrier level | V_{13} | 3.3 | 3.7 | 4.1 | V | $V_{1/18} = 0\text{ V}$; $V_{16} = 3\text{ V}$ |
| Tuner AGC threshold | V_{14} | 4.2 | 4.5 | 4.8 | V | $R_{14/17} = \infty$ $V_{14} = 0\text{ V}$ $R_{14/17} = 10\text{ k}\Omega$ $R_{14/17} = 10\text{ }\Omega$ |
| $I_5 = I_{\max \cdot 2}$ | I_{14} | 650 | 850 | 1050 | μA | |
| | V_{16} | 2.8 | 3.1 | 3.4 | V | |
| | V_{16} | 0.33 | 0.38 | 0.43 | V | |

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 $f_{PC} = 38.9\text{ MHz}$.

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 | $V_{15} = 0.5 V_5$ $V_{1/18} = 100 \text{ mVrms}$ $V_{14} = 0.75 \text{ V}$ $V_{15} = 0.5 V_5$ $V_{1/18} = 10 \text{ mVrms}$ $V_{14} = 4.0 \text{ V}$ |
| | $-I_{15}$ | 0 | – | 10 | μA | |
| 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 | $V_9 = 6 \text{ V}$, $V_{1, 18} =$ carrier no-demod. to ground $V_{1/18} = 10 \text{ mVrms}$ |
| Output current | I_9 | 4 | | | mA | |
| Synchron level | V_9 | 5.2 | 5.6 | 6.2 | V | |

Sound Trap Input

| | | | | | | |
|----------------------|-------|-----|-----|-----|---|--|
| Synchron pulse level | V_7 | 3.3 | 3.7 | | V | Signal ratio $V_{9/7} = 3/2$ Signal ratio $V_{9/7} = 3/2$ $V_{1/18} = 0 \text{ V}$; $V_{16} = 3 \text{ V}$ $0 \text{ V} > V_2 > 2.4 \text{ V}$ |
| White level | V_7 | | 5.7 | 6.0 | V | |

Pos. Video Output

| | | | | | | |
|----------------------------------|--------|-----|-----|-----|----|---|
| Output current | $-I_6$ | 1.7 | 2.2 | 2.7 | mA | $V_6 = 6 \text{ V}$ to ground via $R = 500 \Omega$ see Sound Trap Input |
| | I_6 | 4 | | | mA | |
| Pos. modulation (L standard) | | | | | | |
| White level | V_6 | 3.9 | 4.2 | 4.9 | V | $V_{1/18} = 10 \text{ mVrms}$ |
| Zero carrier (sync.) | V_6 | 1.9 | 2.2 | 2.7 | V | $V_{1/18} = 0 \text{ V}$; $V_{16} = 3 \text{ V}$ |
| Neg. modulation (BG standard) | | | | | | |
| Synchron pulse level | V_6 | 1.9 | 2.2 | 2.7 | V | $V_{1/18} = 10 \text{ mVrms}$ |
| Zero carrier | V_6 | 4.1 | 4.4 | 5.1 | V | $V_{1/18} = 0 \text{ V}$; $V_{16} = 3 \text{ V}$ |

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 $V_4 = V_5$ to ground via $R = 500 \Omega$ |
| | I_4 | 4 | | | mA | |
| Pos. modulation (L standard) | | | | | | |
| White level | V_4 | $V_5 - 5.3$ | $V_5 - 5.0$ | $V_5 - 4.3$ | V | $V_{1/18} = 10 \text{ mVrms}$ |
| Zero carrier (sync.) | V_4 | $V_5 - 3.2$ | $V_5 - 2.9$ | $V_5 - 2.5$ | V | $V_{1/18} = 0 \text{ V}; V_{16} = 3 \text{ V}$ |
| Neg. modulation (BG standard) | | | | | | |
| Synchron pulse level | V_4 | $V_5 - 3.2$ | $V_5 - 2.9$ | $V_5 - 2.5$ | V | $V_{1/18} = 10 \text{ mVrms}$ |
| Zero carrier | V_4 | $V_5 - 5.5$ | $V_5 - 5.2$ | $V_5 - 4.6$ | V | $V_{1/18} = 0 \text{ V}; V_{16} = 3 \text{ V}$ |

Pos. SCART Input 4

| | | | | | | |
|----------------|-------|-----|-----|---|----|--|
| Clamp level | V_3 | 1.8 | 1.9 | 2 | V | via $R = 270 \text{ k}\Omega$ at ground $V_3 = 1.2 \text{ V}$ |
| Output current | I_3 | 3 | | | mA | |

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 $f_{PC} \text{ rms}$ | $V_{1/18}$ | | 45 | 60 | μV | 6 Vpp – 1 dB |
| Max. IF-input voltage (end of internal AGC-control range) $f_{PC} \text{ rms}$ | $V_{1/18}$ | 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. | | |
| Pos. video output changes related to | V_6 ΔV_6 | 1.8 | 2.0 | 2.2 | Vpp % | $0\text{ V} < V_2 < 1.9\text{ V}$ $0\text{ V} < V_{12} < 1.9\text{ V};$ $0 < V_2 < 1.9\text{ V}$ $2.4\text{ V} < V_{12} < 6\text{ V}$ |
| TV-standard switch over | | | | | | |
| Change due to operating voltage | | | 1.5 | 3 | % | $\Delta V_6/\Delta V_5$ $10.8\text{ V} < V_5 < 13.2\text{ V}$ |
| Neg. SCART output | V_4 | 1.9 | 2.1 | 2.3 | Vpp | $R_L = \infty$ |
| 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 | | $R_G < 500\ \Omega;$ $2.4 < V_2 < 6\text{ V};$ $V_3 = 1\text{ Vpp (2 MHz)}$ |
| Video bandwidth | $P_{6/3-3dB}$ | 8 | 9 | | MHz | $2.4 < V_2 < 6\text{ V};$ $V_3 = 1\text{ Vpp sinus}$ |
| Cross talk attenuation | A | 40 | 50 | | dB | $0 < V_2 < 1.9\text{ V};$ $V_{1/18} = 0\text{ V}; V_{16} = 3\text{ V};$ $V_3 = 1\text{ Vpp sinus}$ 50 Hz ... 10 MHz |

Design Notes (no 100% final test)

| | | | | | | |
|--|-------------------------|-----|-----|-----|------------|--|
| Input resistance (symmetrical) | $R_{1/18}$ | 1.5 | 2 | 2.5 | k Ω | |
| Input capacitance (symmetrical) | $C_{1/18}$ | | 2 | 5 | pF | |
| Low pass cut-off | $f_{-3\text{ dB (13)}}$ | 70 | 100 | 130 | Hz | $C_{13/17} = 100\text{ nF} \pm 10\%$ |
| Pos. video output | | | | | | $2.4 < V_2 = 6\text{ V};$ (SCART operation) |
| white level | V_6 | 3.9 | 4.2 | 4.9 | V | $V_3 = 1\text{ Vpp norm}$ video signal |
| Synchron pulse level frequency | V_6 | 1.9 | 2.2 | 2.7 | V | $V_3 = 1\text{ Vpp norm}$ video signal |
| Video input voltage $\pm 3\text{ dB}$ at $R_G < 500\ \Omega$ | 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 $\Delta f = -400$ kHz |
| FuBk – test picture | $-\Delta S/N$ | | 11 | | dB | with detuning $\Delta f = +400$ 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 μ V $R_G = 800 \Omega$ | 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 | $B_{3\text{ dB}}$ | 8 | 10 | 13 | MHz | |
| – 12 dB | $B_{-12\text{ dB}}$ | 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; $\Delta f \pm 400$ 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; $\Delta f \pm 400$ 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 $100 \leq Q_0 \leq 120$; $Q_8 \approx 60$; $B \approx 0.8 \dots 1.0$ MHz | $V_{10/11}$ | 300 | 450 | 600 | mVpp | |
| Synchron pulse | $\Delta V_{Sync} / V_6$ | | | 5 | % | |

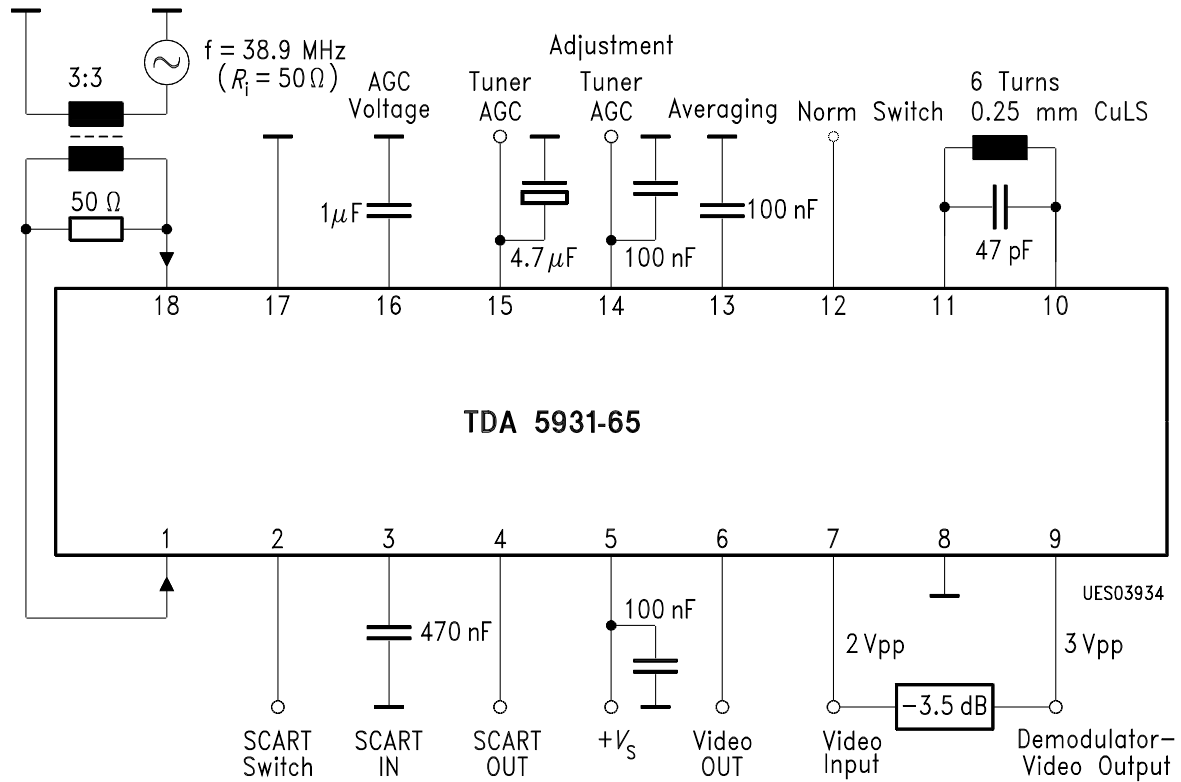
Alignment Instructions

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

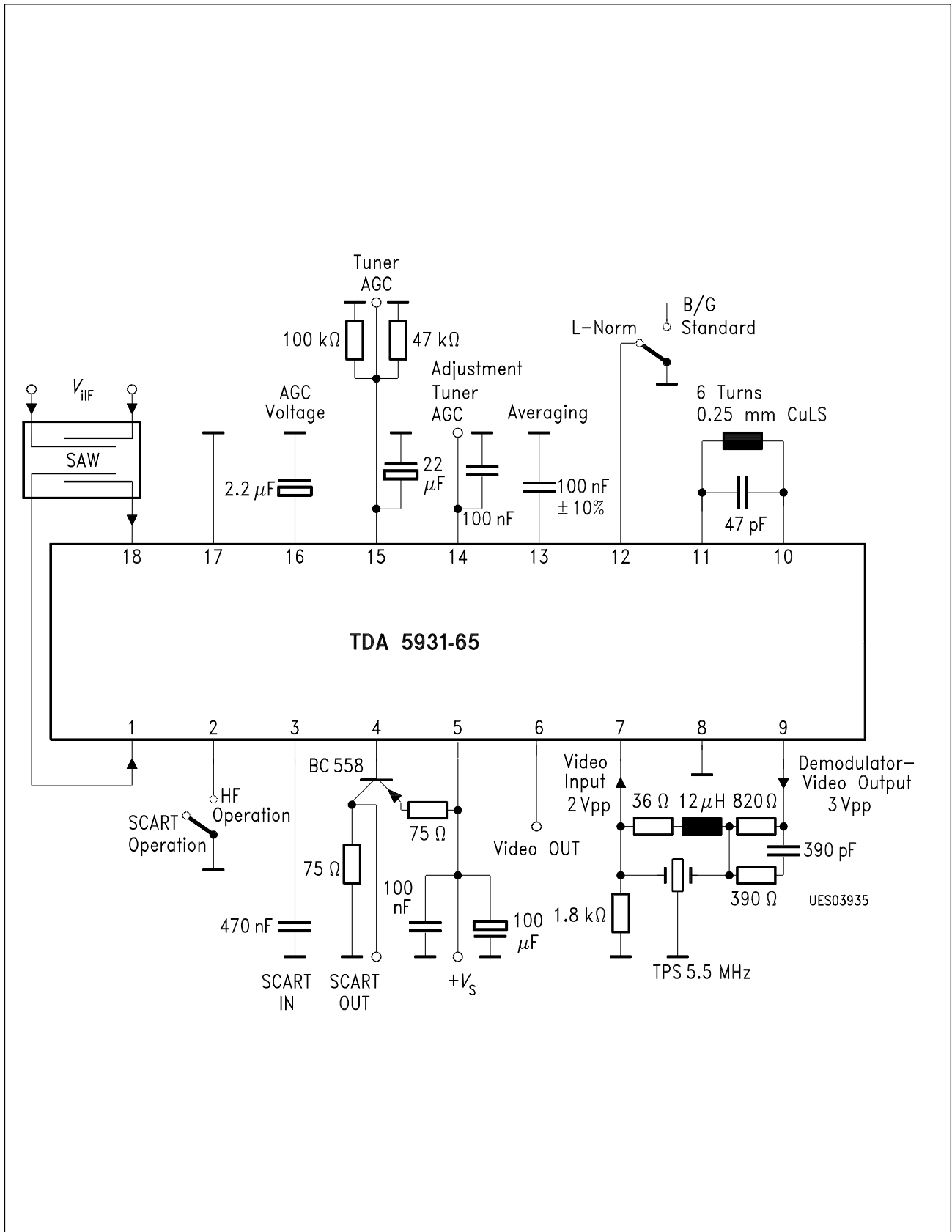
As a modulation every sufficient video test pattern can be used. Then the superimposed AGC-control voltage at pin 16 is reduced until the video signal has an amplitude of approx. 2 Vpp . The video signal is then fine tuned for its maximum.

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