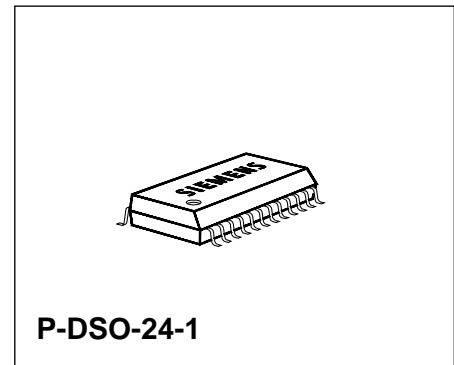# SIEMENS

## Video and Sound IF with FM-PLL Demodulator, AFC and V & S SCART

### TDA 5950X

**Bipolar IC**

### Features

● Features video and sound IF
● Video and sound SCART
● AFC
● NTSC option

**P-DSO-24-1**

| Type | Ordering Code | Package |
|------|---------------|---------|
| TDA 5950X | Q67000-A5112 | P-DSO-24-1 (SMD) |
| TDA 5950X | Q67007-A5112 | P-DSO-24-1 Tape and Reel dry |

### Functional Description

#### Video IF Section

Video IF-broadband amplifier followed by a quasi-synchronous demodulator for negative modulated IF signals. A video switch interface is included in the video section. A separate video output after the demodulator permits the installation of one or more sound traps at the input of the video switch. The tuner AGC threshold is set by means of a potentiometer, all other functions can switched with open collector transistors.

#### Sound IF Section

FM-IF limiter with FM-PLL demodulator for the frequency range of 5.5 MHz to 6.5 MHz. The AF section includes an audio switch followed by an audio buffer output.

#### Application

The TDA 5950X is suitable for application in television receivers or video tape recorders with A/V switches.

## Circuit Description

### Video IF Section

The video IF section incorporates a four-stage, capacitively coupled, symmetrical and controlled amplifier, a limiter with selection and a mixer for quasi-synchronous demodulation of negative modulated IF signals followed by a video output amplifier. The video demodulator output and the video switch input are connected by means of a sound trap. The video switch has two inputs (for signals from video demodulator and from external source) and two outputs. Parallel to the video output amplifier the video signal is used for generating the AGC voltage. The control circuit is designed on the integralaction AGC principle, employing a noise-free peak value detector. A delayed tuner AGC voltage with positive control direction is derived from the AGC voltage via a threshold amplifier that is set by means of an external potentiometer. An AFC push pull output current is generated from picture carrier tank circuit.
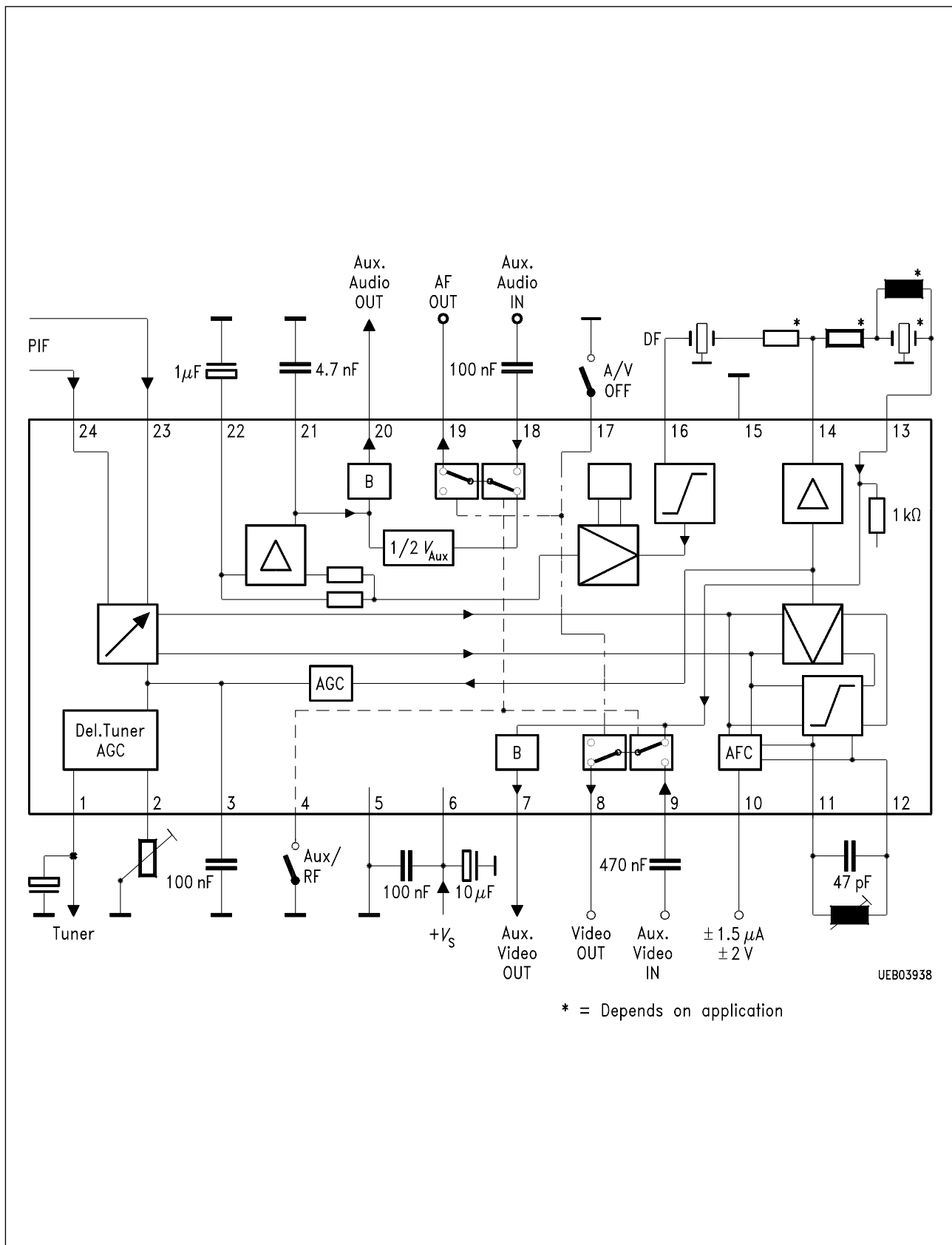
### Sound IF Section

The sound IF section incorporates a five-stage, symmetrical limiter amplifier followed by a PLL demodulator. The AF section contains an audio switch followed by an output buffer.

### Switch Matrix

| AUX/RF-Control (Pin 4) | AV-OFF (Pin 17) | Output (Pin 8 / Pin 19) |
|---|---|---|
| 0 | 0 | muted |
| 0 | 1 | IF |
| 1 | 0 | muted |
| 1 | 1 | SCART |

**Pin Functions**

| Pin No. | Function |
|---------|----------|
| 1 | Delayed tuner AGC output |
| 2 | Delayed tuner AGC threshold |
| 3 | AGC-time constant |
| 4 | Aux / RF control |
| 5 | Ground |
| 6 | $+ V_S$ supply voltage |
| 7 | Auxiliary video output |
| 8 | Video output |
| 9 | Auxiliary video input |
| 10 | AFC output |
| 11 | Demodulator tank circuit |
| 12 | Demodulator tank circuit |
| 13 | Video input at sound trap output |
| 14 | Video demodulator output |
| 15 | Sound IF ground |
| 16 | Sound IF input |
| 17 | A / V OFF |
| 18 | Auxiliary audio input |
| 19 | Audio output |
| 20 | Auxiliary audio output |
| 21 | De-emphasis capacitor |
| 22 | Low-pass capacitor |
| 23 | Video IF input |
| 24 | Video IF input |

UEB03938

\* = Depends on application

**Block Diagram**

**Absolute Maximum Ratings**

$T_A$ = 0 to 70 ℃

| Parameter | Symbol | Limit Values | | Unit |
|---|---|---|---|---|
| | | min. | max. | |
| Supply voltage | $V_6$ | 0 | 8 | V |
| Junction temperature | $T_j$ | 0 | 150 | ℃ |
| Storage temperature | $T_{stg}$ | − 40 | 125 | ℃ |
| Thermal resistance | $R_{th\ JA}$ | | 70 | K/W |

**Operating Range**

| Parameter | Symbol | Limit Values | | Unit |
|---|---|---|---|---|
| Supply voltage | $V_6$ | 4.5 | 8 | V |
| Supply voltage delayed tuner AGC | $V_1$ | 1 | 13.2 | V |
| Ambient temperature during operation | $T_A$ | 0 | 70 | ℃ |
| Input frequency range | $f_{IF}$ | 12 | 80 | MHz |

## DC Characteristics

$T_A$ = 0 to 70 °C; $V_S$ = 5.0 V

| Parameter | Symbol | Limit Values | | | Unit | Test Condition |
|-----------|--------|------|------|------|------|----------------|
| | | min. | typ. | max. | | |
| Total current | $I_6$ | 47 | 55 | 63 | mA | |
| DC voltage; pin 1 | $V_1$ | | | 12 | V | |
| Aux/RF switch; pin 4<br>H/open = Aux<br>L = RF | $V_4$<br>$V_4$ | 2.4<br>0 | | 5.5<br>1.5 | V<br>V | |
| Sync tip level; pin 7 | $V_7$ | 1.35 | 1.5 | 1.65 | V | $R_L \geq 2.7\ \text{k}\Omega\|$<br>10 pF |
| Sync tip level; pin 8 | $V_8$ | 1.35 | 1.5 | 1.65 | V | $R_L \geq 2.7\ \text{k}\Omega\|$<br>10 pF |
| Sync tip level; pin 9 | $V_9$ | 1.35 | 1.5 | 1.65 | V | |
| DC voltage; pin 10 | $V_{10}$ | 0.4 | | $V_6 - 0.4$ | V | |
| DC voltage; pin 11 | $V_{11}$ | | $V_6 - 1.3$ | | V | |
| DC voltage; pin 12 | $V_{12}$ | | $V_6 - 1.3$ | | V | |
| Sync tip level; pin 13 | $V_{13}$ | 1.35 | 1.5 | 1.65 | V | |
| Sync tip level; pin 14 | $V_{14}$ | 1.15 | 1.3 | 1.45 | V | |
| DC voltage; pin 16 | $V_{16}$ | | 0 | | V | |
| DC voltage; pin 18 | $V_{18}$ | 1.6 | 2 | 2.4 | V | |
| DC voltage; pin 19 | $V_{19}$ | 1.6 | 2 | 2.4 | V | |
| DC voltage; pin 20 | $V_{20}$ | 1.6 | 2 | 2.4 | V | |
| DC voltage; pin 21 | $V_{21}$ | 1.6 | 2 | 2.4 | V | |
| DC voltage; pin 22 | $V_{22}$ | | 2.2 | | V | |
| DC voltage; pin 23 | $V_{23}$ | | 3.6 | | V | |
| DC voltage; pin 24 | $V_{24}$ | | 3.6 | | V | |

## AC Characteristics

$T_A$ = 0 to 70 ℃; $V_S$ = 5.0 V

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

**Video IF Section**

| Parameter | Symbol | min. | typ. | max. | Unit | Test Condition |
|---|---|---|---|---|---|---|
| IF-input sensitivity | $V_{23/24}$ | | 70 | 100 | μV | $V_{Video}$ − 3 dB |
| Max. IF-input voltage | $V_{23/24}$ | 100 | 140 | | mV | $V_{Video}$ + 3 dB |
| IF-control range | $\Delta V_{IF}$ | 60 | 66 | 72 | dB | |
| Video demodulator output voltage | $V_{14pp}$ | 1.35 | 1.5 | 1.65 | V | $V_{IF\ IN}$ = 10 mV |
| | | | 3.6 | | V | upper video clipping |
| | | | 3.0 | | V | zero carrier level |
| | | | 1.1 | | V | lower video clipping |
| | | | 1.3 | | V | sync tip level |
| − 3 dB video bandwidth | $B_{14}$ | 8 | 10 | | MHz | $C_L$ < 20 pF, $R_L$ > 1 kΩ |
| Output impedance | $R_{14}$ | | | 10 | Ω | |
| Output sink current | $I_{14}$ | | | 2 | mA | DC and AC |
| Output source current | $I_{14}$ | | | − 3 | mA | DC and AC |

**Sound IF Section**

| Parameter | Symbol | min. | typ. | max. | Unit | Test Condition |
|---|---|---|---|---|---|---|
| Min. sound IF-input voltage (min. control) | $V_{16}$ | | 70 | 100 | μV | |
| AF-output voltage | $V_{19}$ | 175 | 250 | 350 | mV | $\Delta f$ = 30 kHz $f_{mod}$ = 1 kHz $F_{SIF}$ = 5.5 MHz…6.5 MHz |
| Aux. AF-output voltage | $V_{20}$ | 350 | 500 | 700 | mV | $\Delta f$ = 30 kHz $f_{mod}$ = 1 kHz $F_{SIF}$ = 5.5 MHz…6.5 MHz |
| Total harmonic distortion | $THD_{AFo}$ | | 0.2 | 0.3 | % | $\Delta f$ = 30 kHz $f_{mod}$ = 1 kHz $F_{SIF}$ = 5.5 MHz…6.5 MHz |
| Max. aux. input voltage | $V_{18rms}$ | | | 1 | V | |
| Gain audio switch | $G_{18\text{-}19}$ | | 1 | | | |
| AM-Suppression | $\alpha_{AM19/20}$ | | | | | $f_{mod}$ = 1 kHz $m$ = 30 % |
| | | 50 | 55 | | dB | $V_{16}$ = 1 mV…100 mV |
| Signal to noise ratio (weighted) | $S/N_{19/20}$ | 50 | 55 | | dB | $V_{16}$ = 500 μV…1 mV |
| | | 60 | 65 | | dB | $V_{16}$ = 1 mV…100 mV |

## AC Characteristics (cont'd)

$T_A$ = 0 to 70 °C; $V_S$ = 5.0 V

| Parameter | Symbol | Limit Values | | | Unit | Test Condition |
|---|---|---|---|---|---|---|
| | | min. | typ. | max. | | |
| Ripple rejection | $RR_{19/20}$ | 35 | 40 | | dB | |
| Input impedance | $Z_{18}$ *) | | 50 | | kΩ | |

### SCART-SWITCH

| Parameter | Symbol | Limit Values | | | Unit | Test Condition |
|---|---|---|---|---|---|---|
| Input impedance | $Z_{13}$ | | 1 ‖ 2 | | kΩ ‖ pF | |
| Gain of Video switch Aux. $V_{IN}$-video output Video$_{IN}$-aux. output Video$_{IN}$-video output $f_{mod}$ = 5 MHz | $G_{9\text{-}8}$ $G_{13\text{-}7}$ $G_{13\text{-}8}$ | 0.9 0.9 0.9 | 1 1 1 | 1.1 1.1 1.1 | | |
| − 3 dB video bandwidth − 3 dB video bandwidth | $B_7$ $B_8$ | 8 8 | 10 10 | | MHz MHz | $C_L$ < 20 pF, $R_L$ > 1 kΩ $C_L$ < 50 pF, $R_L$ > 1 kΩ |
| Cross talk attenuation $f_{mod}$ = 5 MHz | $a_{9\text{-}8}$ | 50 | | | dB | $V_4$ = 0 V |
| Intermodulation | $\alpha_{7/8}$ | 54 | 60 | | dB | $f_{1.07\ MHz}$ = $f_{SC} - f_{CC}$ |
| Suppression of video signal harmonics | | 35 | 40 | | dB | |
| Signal to noise ratio (weighted) | $S/N_{7/8}$ | 56 | 60 | | dB | CCIR − 567 |
| Ripple rejection on pin 7 and 8 | $RR_{7/8}$ | 35 | 40 | | dB | $f_{Vs}$ = 0…100 kHz |
| Max. input current | $I_9$ | | 0.5 | 1 | µA | |

### AFC

| Parameter | Symbol | Limit Values | | | Unit | Test Condition |
|---|---|---|---|---|---|---|
| AFC-control steepness | $\Delta I_{10}/\Delta f$ | 0.6 | 0.8 | 1.0 | µA/kHz | |

### Tuner AGC

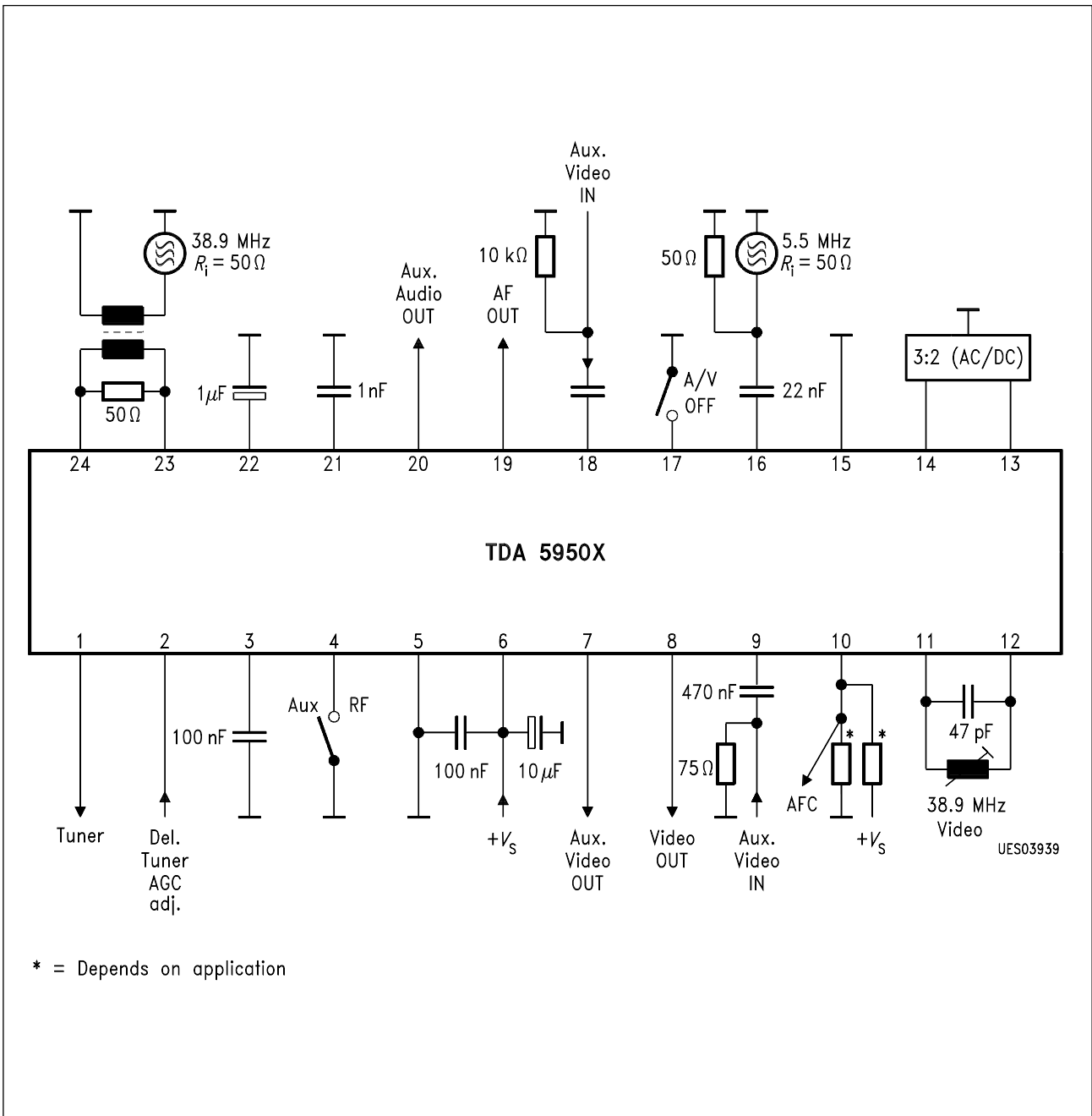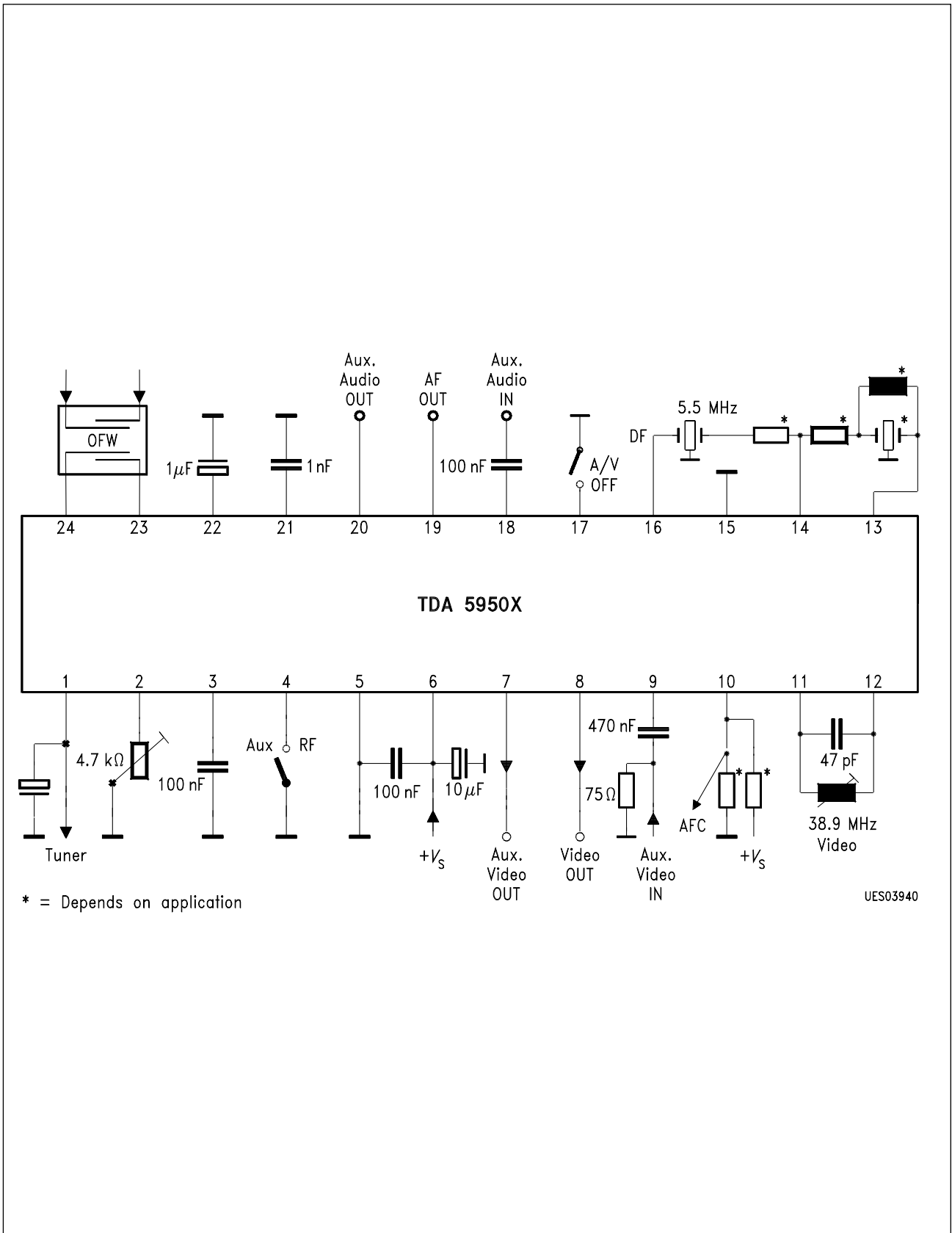| Parameter | Symbol | Limit Values | | | Unit | Test Condition |
|---|---|---|---|---|---|---|
| Sink current | $I_1$ | 0 2.5 | 3.5 | 10 | µA mA | no tuner gain reduction max. tuner gain reduction |
| Threshold range for del. Tuner-AGC | $V_{IF}$ | 50 | | 5 | mV mV | $R_2$ = 4.7 kΩ $R_2$ = 0 Ω |

*) Design hints

## Alignment Instructions

At a video carrier input level of $V_{23/24}$ = 4 mVrms, $f_{P/C}$ = 38.9 MHz, and a superimposed AGC voltage of $V_3$ = 1.5 V, the demodulator tank circuit is preliminarily aligned until a max. video signal 14 Vpp is obtained at the video output. Any suitable video test signal can be used for modulation. The AGC voltage $V_3$ is reduced until the signal is approx. 1 Vpp and the max. video signal is obtained when fine-aligning the demodulator tank circuit. The alignment is not critical due to relatively large bandwidth of the demodulator tank circuit. Fine-tuning to intercarrier $S/N$, differential phase or 2T-pulse characteristics is possible.
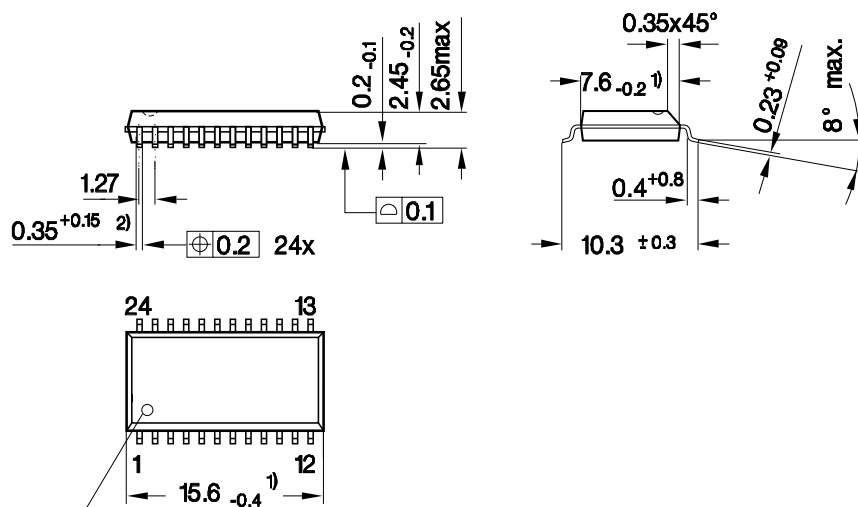


**Test Circuit**

UES03940

* = Depends on application

**Application Circuit**

## Package Outlines

**Plastic-Package, P-DSO-24-1 (SMD)**
(Plastic Dual Small Outline)



Index Marking

1) Does not include plastic or metal protrusion of 0.15 max. per side

2) Does not include dambar protrusion of 0.05 max. per side

GPS05144

**Sorts of Packing**
Package outlines for tubes, trays etc. are contained in our
Data Book "Package Information"

SMD = Surface Mounted Device

Dimensions in mm