
SELECO FORMENTI SPA PORDENONE
SWING - FPC2002.0 cod. 530001031SW100
PROG. ELET BENVENUTO - COLUSSI - BROVEDANI
PROG. CAD DE LUCA 30.11.2001
SYMBOLS
CER.SMD
CER.DISK
MKT
MKP
1/8W SMD
1/4W
1/2W
1W
2W
3W
FUSE RES
SMD
SAFETY COMPONENT
IC1 UOC-FM/OSS
TDA9350 : MONO PAL BG
TDA9351 : MONO PAL-SEC BG/L
TDA9366 : STEREO PAL BG
TDA9367 : STEREO PAL-SEC BG/L
IC251
MSP3405 stereo
MSP3415 stereo nicam
IC221 TDA 7267A
IC201 TDA 7267A
IC3 TDA 9830
IC4 74HC4066
IC2 M24C08-WBN6
IC701 TDA6108JF
IC301 TDA 8357J
IC405 SFH617A-2
IC406 TL431
IC401 TDA16846
IC404 TDA 8133
IC407 IL410
TR602
TR402
TU500
CN202
CN201
CN102A
CN102B
CN301
CN601A
CN601B
CRT1
CRT2
RIGHT
LEFT
21/25KV
VERT YOKE
HORIZZ YOKE
6.3V HEATHER
DEGAUSS
RETE 230V
TV STEREO
Adj +VB=115V (20"-21")
TV MONO
Adjust for 105V (14"-17")
Adjust for 115V (20"-21")
STD BG=0V
STD L=3V
STD L-3V
STD L1=0V
H-WRITE PROT.
SDA MEM
SCL MEM
IR IN
KEY IN
LED OUT
RESET OPT
V SAF PULSE
MUTE OUT ST.
VIDEO OUT
EXT A IN
OSS OUT
TV ST+ B/SC2 IN
TV MONO+ MUTE OUT
(RF) VIDEO IN
Mono+ AUDIO OUT
VIDEO SCART IN
VSC1/VSC2 SEL
BG/L SEL.
L/L1 SEL.
IFAU-ST IN
FM Out
C-OFF
+8VB=V UOC(ION)
+3V3B=VUOC(S1-by)
+300V
+105V
+115V
+15V(MONO)
+17V(STEREO)
12,5Vdc
+180V

SERVICE MANUAL

CHASSIS

SWING
(PC 2002)

SELECO - FORMENTI

SERVICE NOTES

"PC2002 SWING *CHASSIS"*

CONTENTS

Document drawn up by: **IFI- PEL** ***Benvenuto Renato***

(Pordenone - October 2001)

1- INTRODUCTION

The Swing chassis drives 90° tubes in 4/3 aspect ratios without additional cards.
The chassis can receive stations broadcasting in the BG, DK, I, LL', M and N standards with PAL, SECAM, NTSC 4.43 and NTSC 3.58 colour standards.
Frequency synthesized tuning with search by channel and/or frequency with the possibility of automatic station search.
100 programmes can be stored.
Audio can be mono, stereo dual carrier or nicam.
OSD, on-screen-display, is available in 6 languages the user can choose from and can be used to control all TV functions.
It can store 1 teletext page in the mono chassis version and 10 teletext pages in the stereo chassis version.
The same printed circuit, PC2002, can be used for both mono and stereo TV, differentiated by inserting the corresponding circuits as described in detail further on.

- Description of the mono/stereo application block diagrams.

The mono chassis block diagram is in Fig. 1.1 while the stereo one is given in Fig. 1.2.
The heart of the chassis consists of the UOC (Ultimate One Chip) TDA93xX that carries out the functions of microcontroller, text decoder, display and memory for 1/10 Teletext pages, medium video and audio frequency, sync separator, H and V driving, chroma decoder and driving of the video final stage.
At the time of drawing up this document the following types of UOC ICs are foreseen:

1. TDA9350 plugged into mono TV sets, standard PAL colour with 1 teletext page and 48K ROM.
2. TDA9351 plugged into mono TV sets, standard PAL/SECAM colour with 1 teletext page and 48K ROM.
3. TDA9366 plugged into stereo TV sets with standard PAL colour + 10 teletext pages and 48K ROM.
4. TDA9367 plugged into stereo TV sets with standard PAL/SECAM + 10 teletext pages and 48K ROM.

In the mono application FM sound demodulation is also done inside the UOC that drives only one audio final stage directly.
In the stereo application the QSS signal in output from the UOC is demodulated by MSP34XXG and taken to the audio final stages which, in turn, drive the two speakers.

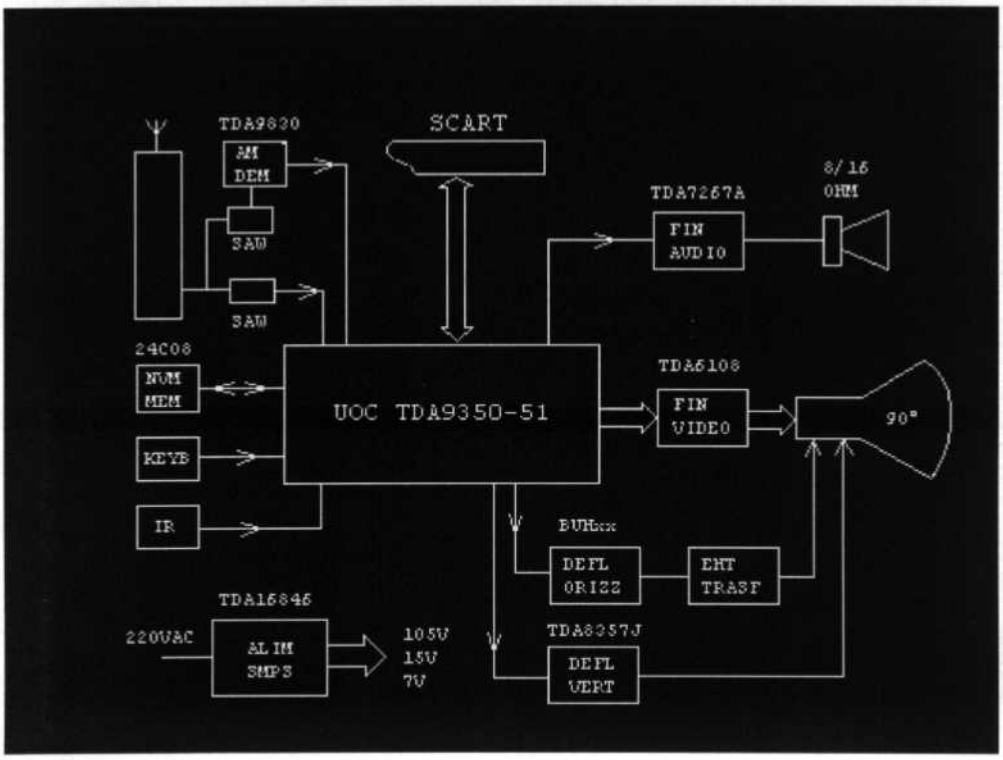


Fig.: 1.1 Chassis block diagram in the mono application

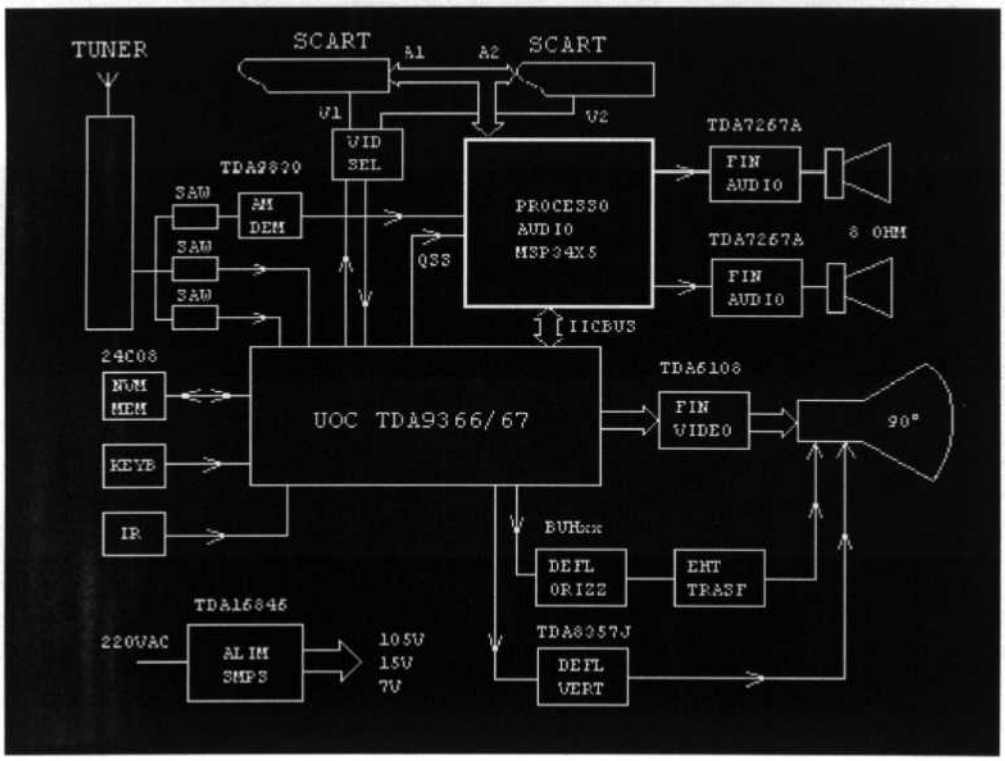


Fig.: 1.2 Chassis block diagram in the stereo application

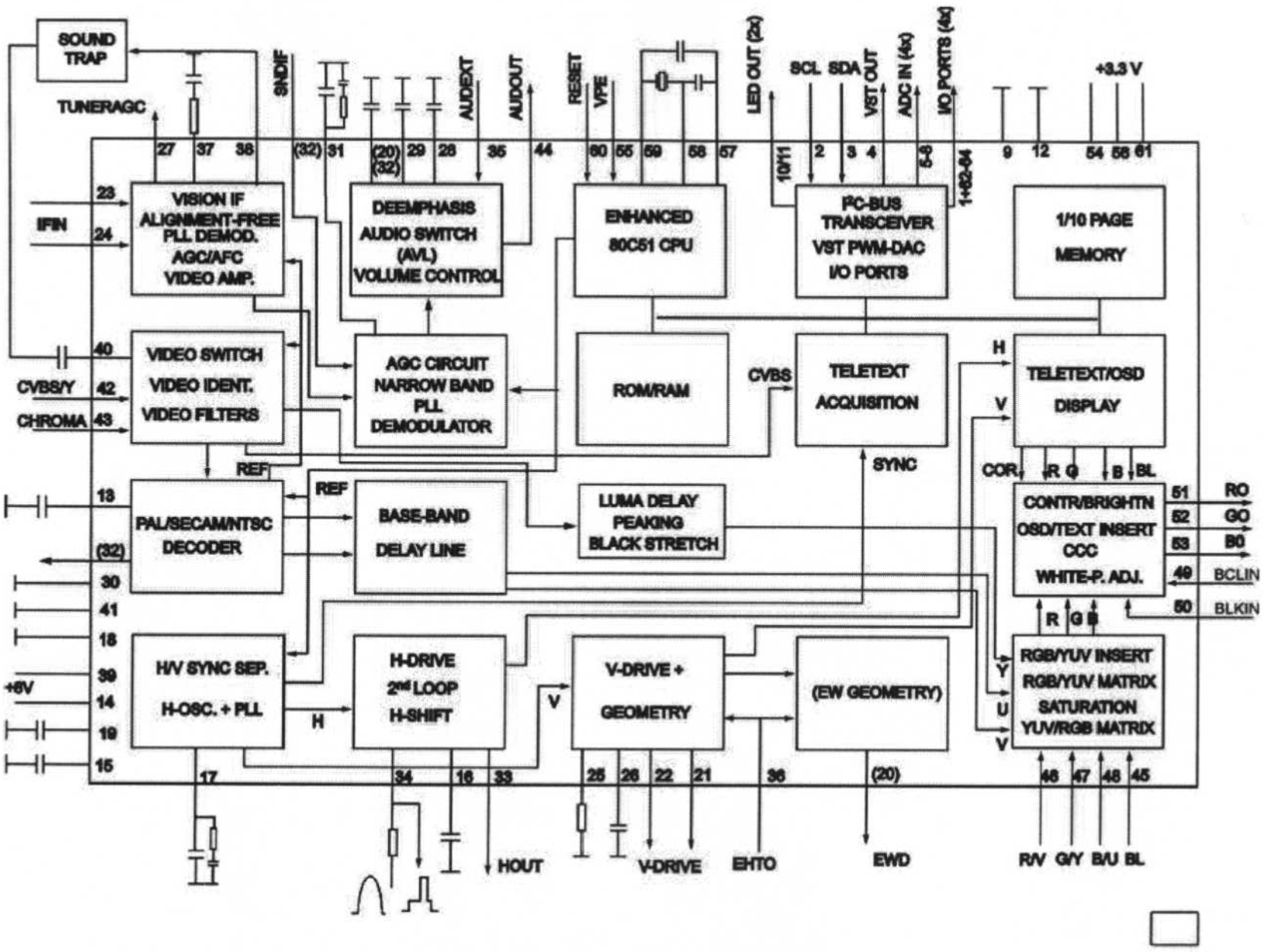


Fig. 1 Block diagram TDA935X/6X8X PS/N2 with mono intercarrier sound demodulator

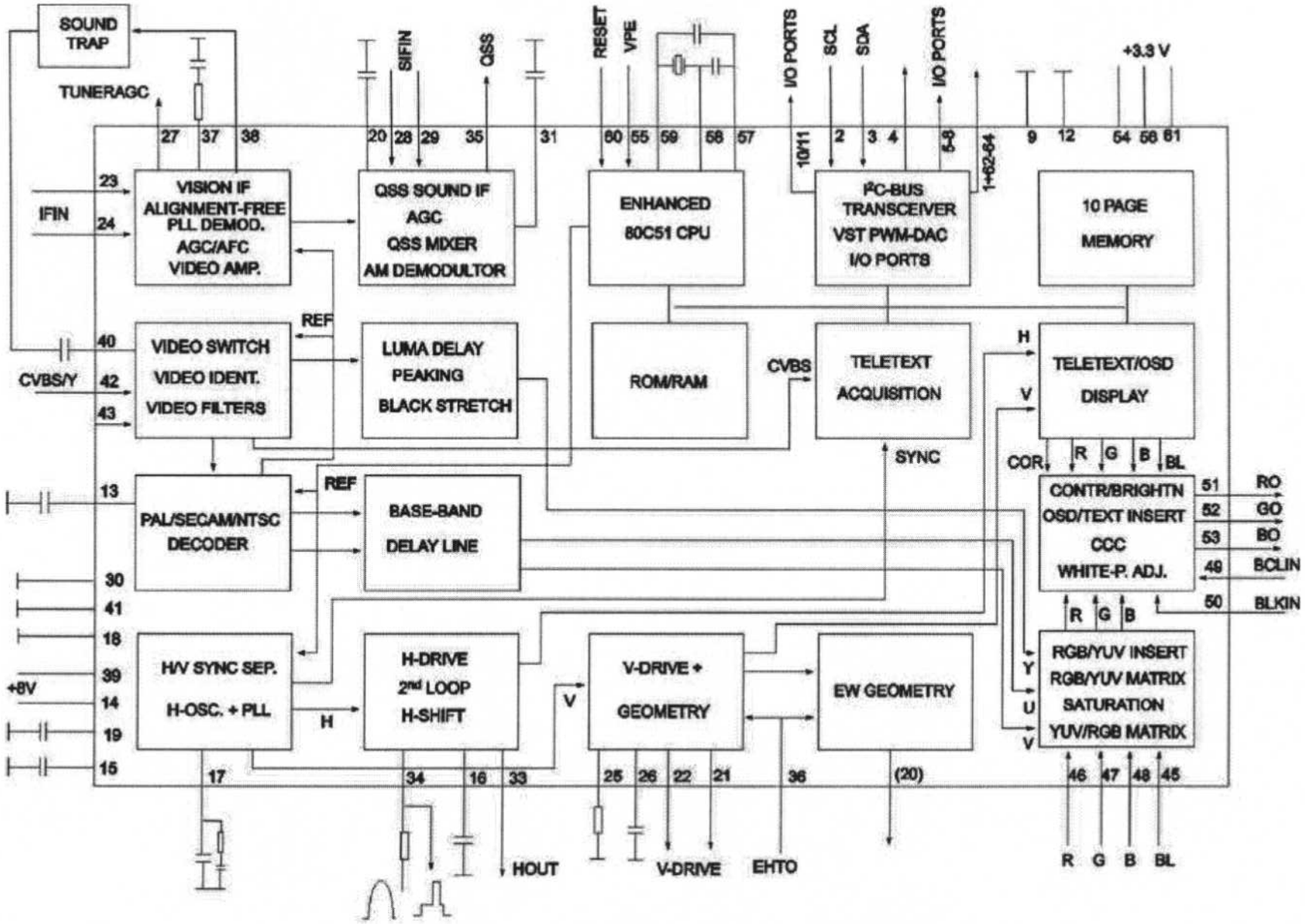


Fig - 1.4 Block diagram TDA 936X PS/N2 with QSS IF sound channel

2 – POWER SUPPLY

The power supply used is the flyback type with power factor correction and low consumption in stand-by.

The power supply can be divided basically into blocks with specific functions.

- The first block consists of the mains filter that is immediately after the switch and fuse, and of the rectifying and filtering section.
- The second block consists of the switching power supply which is a traditional flyback working discontinuously and at a variable frequency and whose primary and secondary section circuits can be distinguished

The driver consists of the IC401(TDA16846) while the switch is the power mos transistor T401.

The IC401 integrated circuit, to stabilise the +VB battery voltage, varies either the ON-OFF cycle or the frequency. It also executes the following protections:

- limitation of the short circuit current,
- protection against over voltages and under voltages of the secondary winding,
- protection against under voltages of the primary winding which would give rise to high current in the transistor

The block diagram of the IC401 integrated circuit = TDA16846 is in the following Fig 2.1:

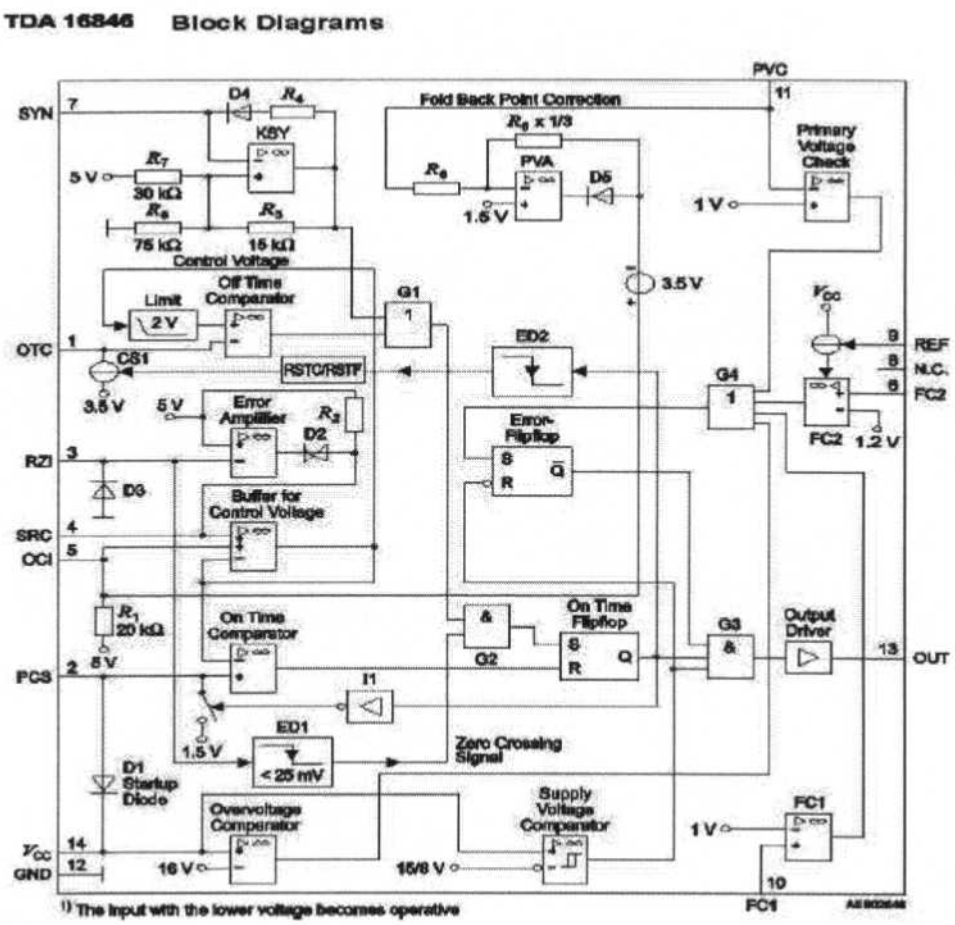


Fig. 2.1 Block diagram of the TDA16846

The general wiring diagram of the Swing project reproduces all the components that can be installed on different applications.
The "mains" input part, with its filters and rectifier bridge, is common to all applications while the control and stabilising part is different for the mono and stereo applications.
To easily understand the circuits, the following wiring diagrams give the real application of the power supply used on mono and stereo TV sets.

Mains input section power:

- It is made up of a 2A fuse F401, a filter, CH401, and capacitor C401, reducing interference caused by the switch that would otherwise be sent to the mains.
- The rectifier block is made up of a diode bridge D401-D404 and an electrolytic condenser C407.
- Degaussing section: the degaussing coil of the cathodic tube is normally connected directly to the mains immediately after the CH401 filter. If you wish to reduce consumption in stand-by a triac can be plugged in that conducts only in the TV-ON condition, therefore degaussing is activated at each "power ON", safeguarding consumption in stand-by. The command for the triac is obtained by means of the opto coupler IC407 controlled by the presence of the +5VA.

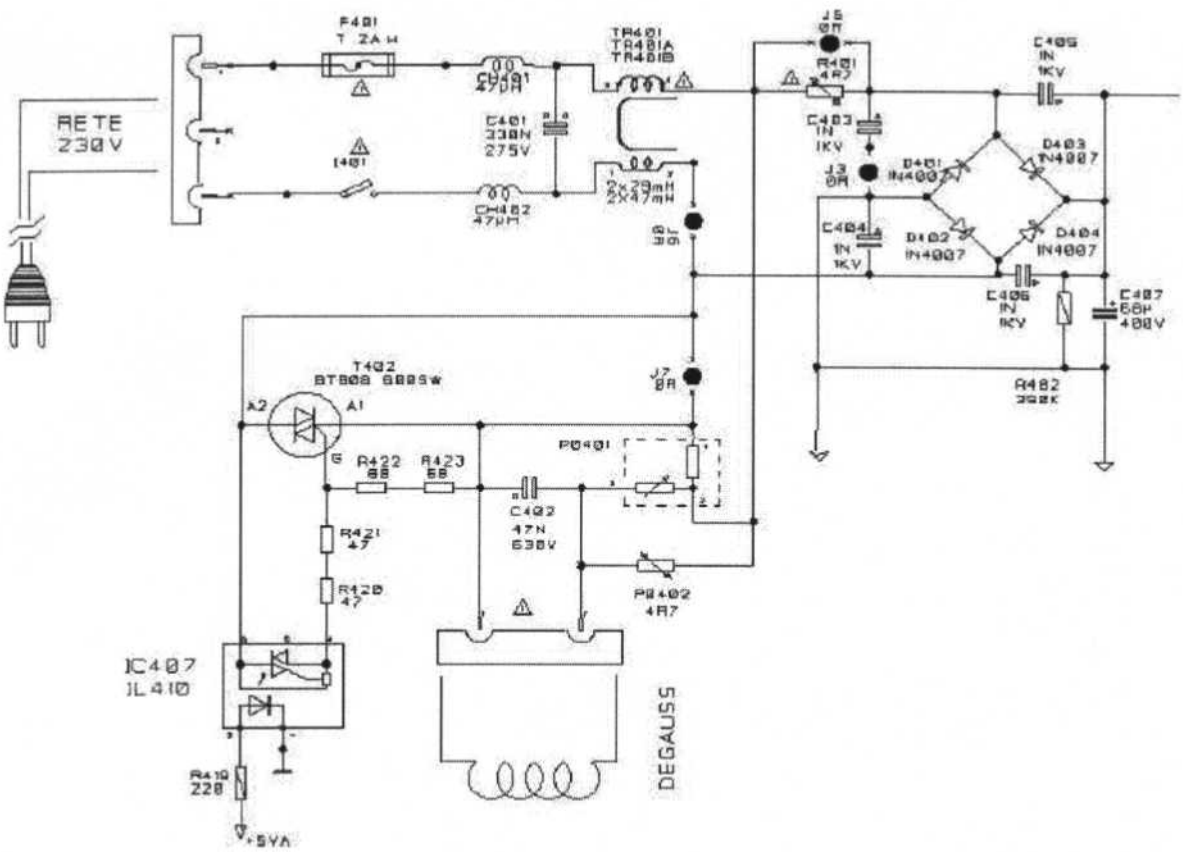


Figure 2.2: applicative wiring diagram of the power input section.

Setting and control circuit applied to mono TV sets:

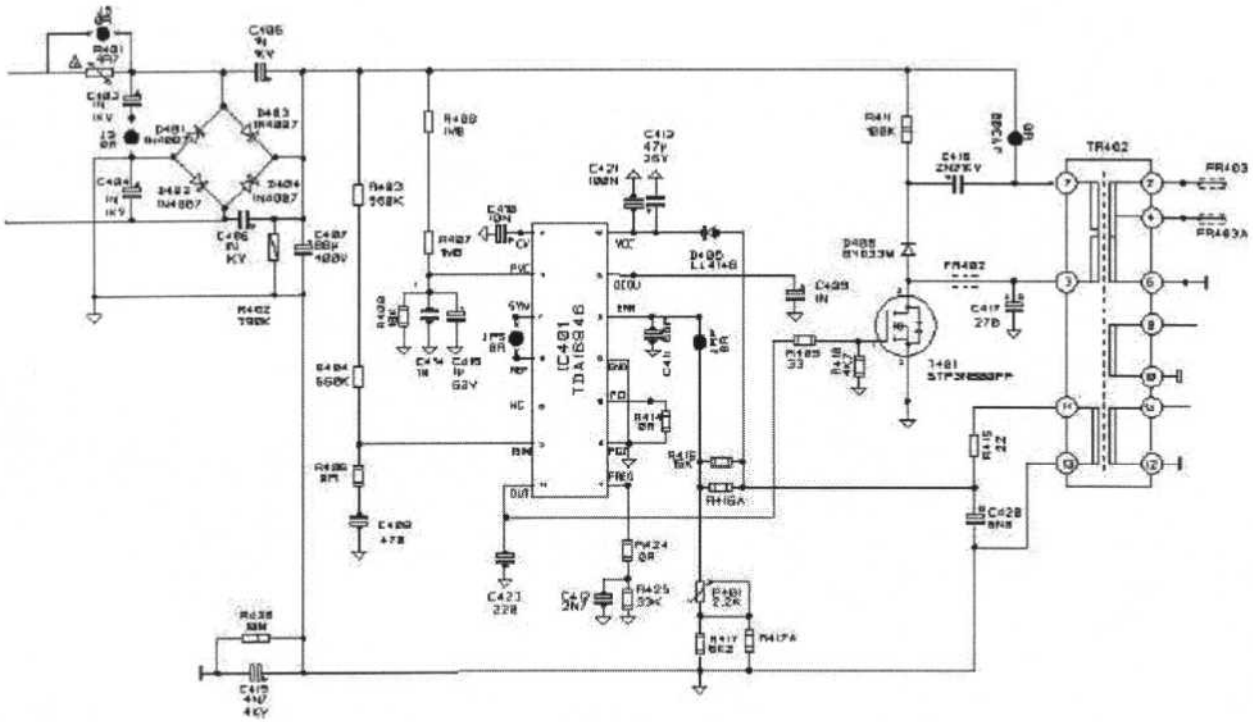


Fig. 2.3 Adjustment circuit applied to mono TV sets.

The divider R406+R407 and R408 supplies pin 11 with a fraction of the voltage rectified by the bridge of diodes and stops the power supply working when mains voltage drops below 160V approx.
A maximum amplitude ramp of 2.5 V p.p. is generated on pin 2 by means of R 403+R404 and C408 that corresponds to the so called "load current simulation" and that interrupts power if the ramp exceeds certain limits.
Capacitor C410, connected to pin 4, ensures a soft power start that should also ensure greater reliability of the power supply itself.
Unit R425 and C412 primarily determines normal operating frequency of the power supply that also depends on the primary's inductance, on the C417 value and on the load itself. Operating frequency in stand-by is about 20Khz and chosen beyond audible frequencies. The operating frequency when the television is on varies from 40 to 50 KHz depending on video content, brightness, contrast and volume level.
The IC401's output signal to control the T401 mosfet transistor is on pin 13 and consists of a square wave signal and a variable full-empty frequency and ratio depending on the load.
R411, C416 and D 406 make up the "Snubber" circuit that protects the mosfet from over voltages.
To make sure the power circuits are reliable always check that the above mentioned components are in proper working order.
The stabilising and control circuit consists of the integrated circuit IC401 and voltage taken from the 11-13 winding of the input transformer. The divider R 416, P401, R417 supplies a portion of the winding's signal to pin 3 of IC401. The supply voltage of the integrated circuit itself is also taken from the same winding by means of the diode D405 and C 413.
Thanks to this "primary" feedback the secondary windings' voltage can be stabilised but an output voltage value higher than 10-20% is usually measured in stand-by.

Setting and control circuit applied to stereo TV sets:

This differs from the previous circuit in the type of setting, defined as "secondary", in that feedback occurs by using an opto-coupler IC405 that reproduces the condition present on the +VB output on pin 5 of IC401 with the aid of the components associated to IC 406.

Stabilisation obtained in this way is more effective than the previous one, consequently voltages remain fixed even in the stand-by condition except for very slight tolerances.

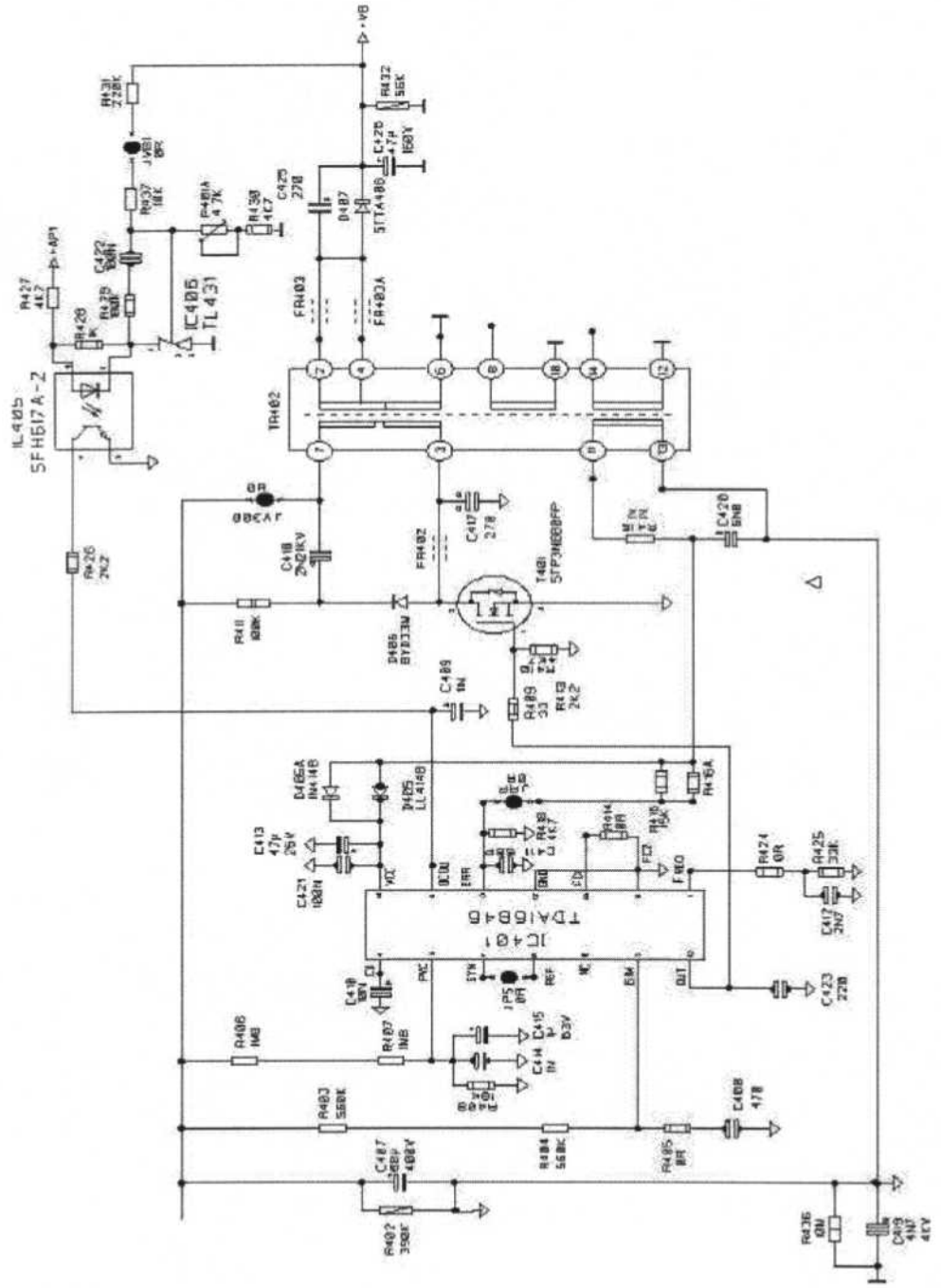


Fig. 2.4: Adjustment circuit applied to stereo TV sets.

Power supply secondary winding

The secondary has three windings:

1. **Horizontal deflection supply voltage (+VB),** depending on the CRT used: 105V for the 14"-17" are foreseen, obtained when the ferrite bead FR403A is inserted, or 115V for the 20" and 21", obtained when the ferrite bead FR403 is inserted.
   The 105V and 115V voltages are adjusted by means of the potentiometer P401 if the TV is mono, or P401A in the case of stereo. The +VB voltage must be adjusted when the TV is on and with the contrast and light at minimum.
2. **6.5-8V service voltage** from which, via the IC403, the 3.3 V are taken used to power the microprocessor section of the IC1(TDA9350-TDA9351-TDA9367) and the IC2 memory (24C08). The +HD = 6.5-8V voltage on the IC 403 stabiliser input also supplies the T 601 plugged into the horizontal deflection driver stage.
3. **Audio final stage supply voltage 15.3V (15-16V) on mono or 17.3V (17-17.9) on stereo.**

You will also find these voltages in the stand-by condition but only the +HD voltage and the 3.3 V for powering the UP (internal section of the UOC935x) are necessary in this situation.

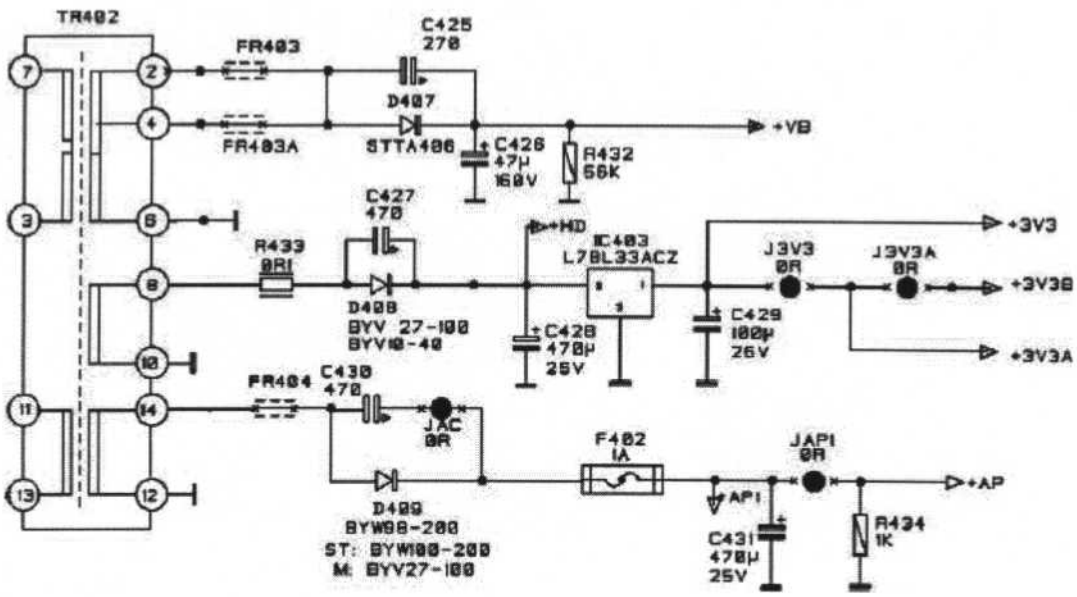


Fig.3: Secondary winding of the supply

3 - TUNER – IF

The tuner is the MK3 type with PLL digitally controlled via the IIC bus by the UOC.
It is powered at +5V and 33V for the varicap.
It receives the 1st and 3rd band channels, UHF, channels via cable S and hyperband ranging from 48.25MHz to 855.25MHz.
The signal leaves the tuner, balanced and at an intermediate frequency, reaching the SAW ground wave filters according to the following block diagrams and applicative wiring diagrams:

1) Mono TV:

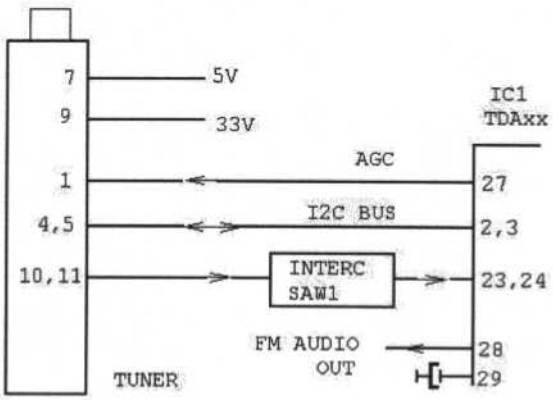


Fig. 3.1:

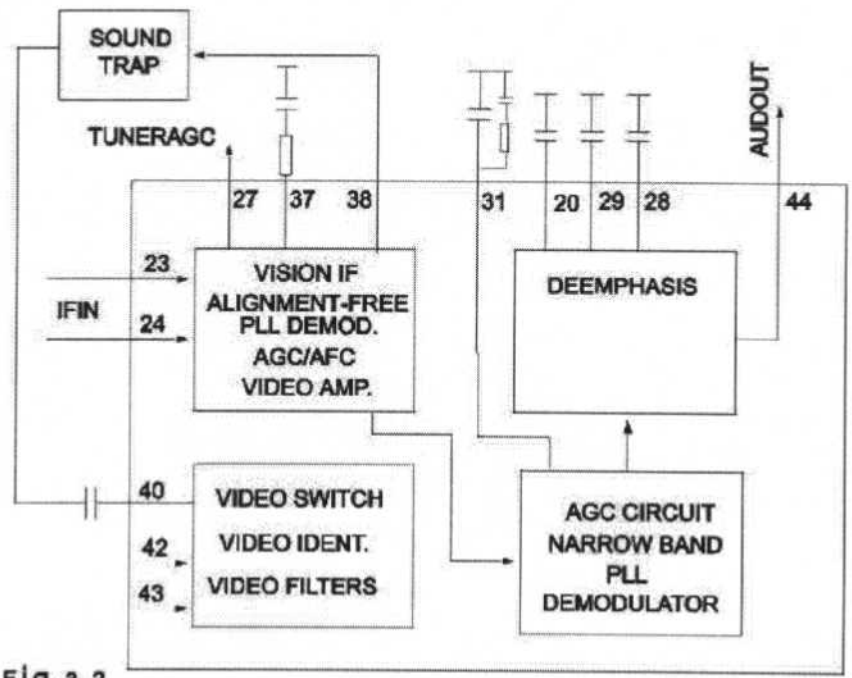


Fig. 3.2
Block diagram TDA935X with mono intercarrier sound demod

- **The intercarrier type SAW1 filter** lets through both the IF video carrier at 38.9 MHz and the IF sound carrier at 33.4MHz and the signal enters the UOC on pins 23,24.
  The video signal, at the intermediate frequency of 38.9MHz if it is the BG standard or 33.9MHz if it is the L standard, is amplified and demodulated inside the UOC by means of the demodulator with PLL without calibrations.
  The VCO frequency is obtained numerically using the Q1 quartz frequency of 12MHz as reference.
  The intermediate frequencies of the various television standards (33.9MHz, 38MHz, 38.9MHz, 45,75MHz, 58.75MHz) are selectable via service.
  The video signal and the audio signal are processed entirely inside the UOC. The video signal in base band leaves pin 38 and sent to the sound trap FC1,2 returning to pin 40 while the audio signal, with controlled volume, leaves pin 44 and sent to the audio final stage.
  The de-emphasised FM audio signal leaves pin 28, with the condenser connected to its ends, and sent to the scart audio output by means of the components associated to the T14-T15 that adapt its amplitude.
- **Automatic tuner gain control (AGC)**
  This is done by the UOC that, through pin27, controls tuner gain to maintain the demodulated video signal constant. Under the no-control condition, that is, when the signal in input is below 500uV, the AGC control voltage, determined by R32,R31, is filtered by R33 and C16 and is about 4V. Service is used, parameter AG, to modify the intervention point of the control as described in settings.
- **Automatic frequency control (AFC)**
  The control voltage is supplied by the digital tuning system through two bits inside the UOC and managed by the I2C bus. This function can be turned on and off via software.

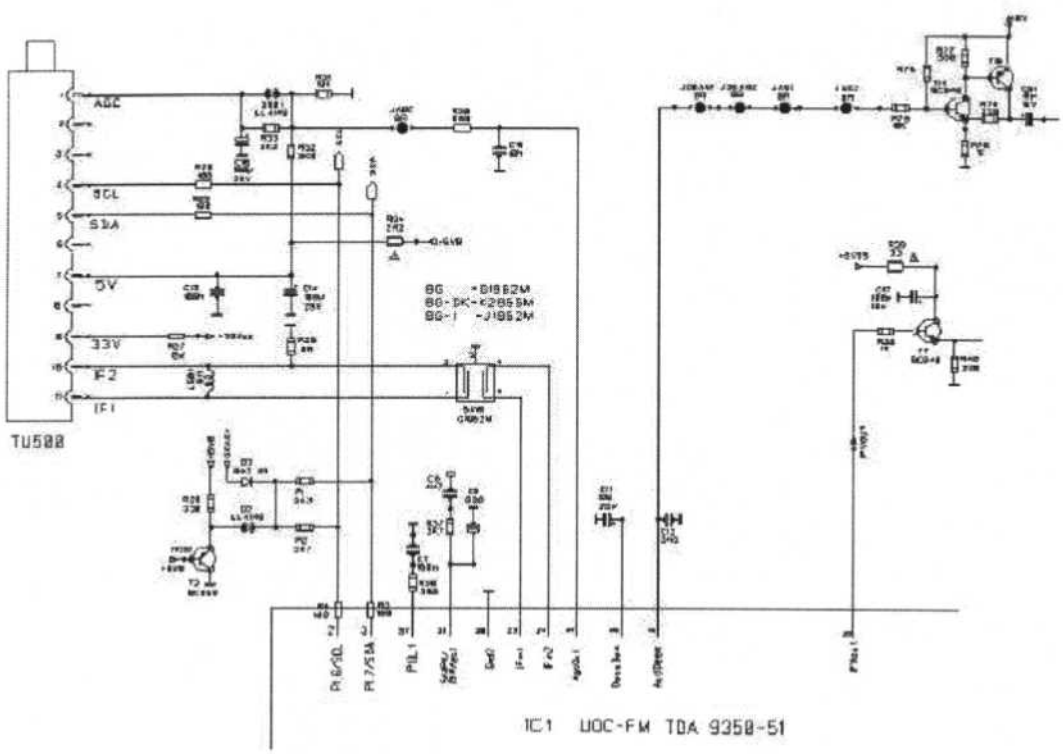


Fig 3.3 Section IF applied to mono TV sets.

In the mono France models the SAW1 filter must be able to let through both the standard L video carrier at 38.9MHz and the standard L' video carrier at 33.9 together with the IF associated audio carriers which is why it is the K2962M type.
Since sound is transmitted with amplitude modulation, an external modulator is added consisting of IC 3 TDA9830. The IF input signal reaches pins 1-16 through the commutable filter SAW4, type L9453M . The L/L' command leaving pin 11 of the UOC selects the IF audio signal at 32.4MHz or 40.4MHz through T104-T105 that act on the SAW filter input.
The demodulated AM audio signal coming from pin 6 of the TDA 9830 must enter pin 28 which is usually the output of the demodulated FM audio signal inside the UOC but becomes the AM audio input for the France standard. To avoid hardware conflicts the IC4 integrated circuit is plugged in which is an analogue switch with contacts 8 – 9 closed only when a programme in the French standard is selected. The closing command reaches the integrated circuit via T 106 which is controlled by the BG/L signal coming from the UOC's pin 5.

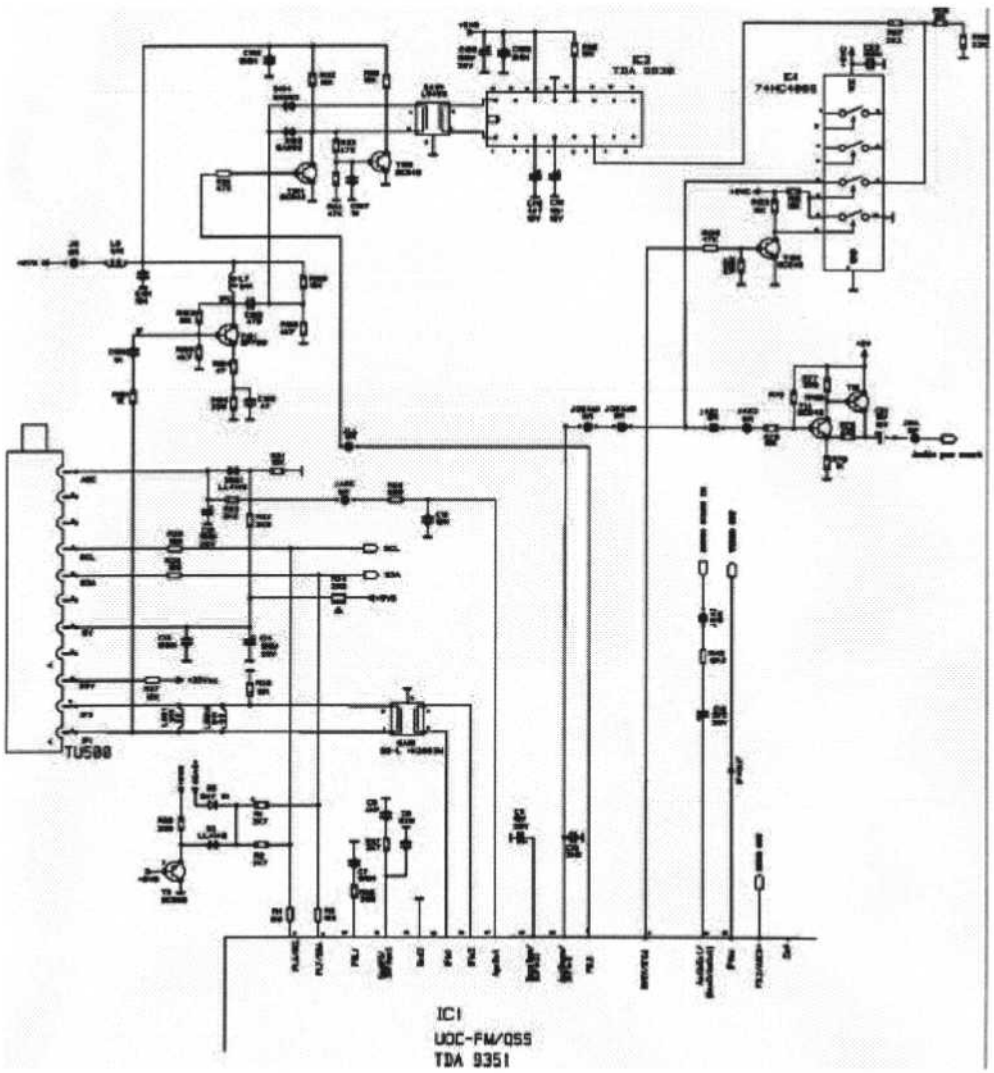


Fig. 3.4: Mono TV BG/L standard:

2) Stereo TV BG-I-DK standard:

The SAW1 intercarrier filter is substituted by two filters:
SAW2 = The filter selects the intermediate video frequency and blanks the audio carrier of the channel selected. The signal in output from the filter is sent in a balanced way to the UOC pins 23 and 24.
SAW3 = The SAW3 filter is dedicated to the audio channel of the tuned channel. Its balanced output is sent to the UOC's other demodulator pin28, 29.

The video signal is processed completely inside the UOC while the audio signal (output QSS on pin 35) is sent to the MSP for complete processing.

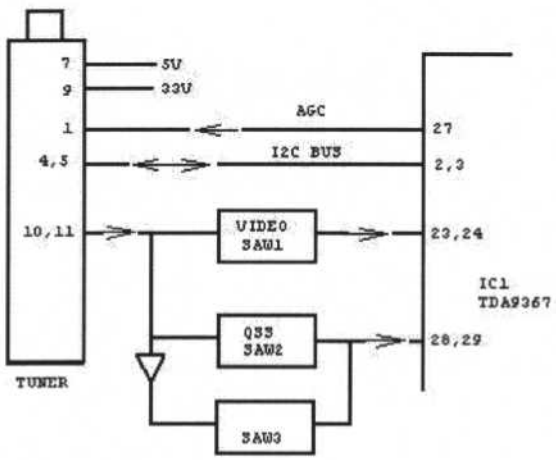


Fig. 3.5: IF management philosophy

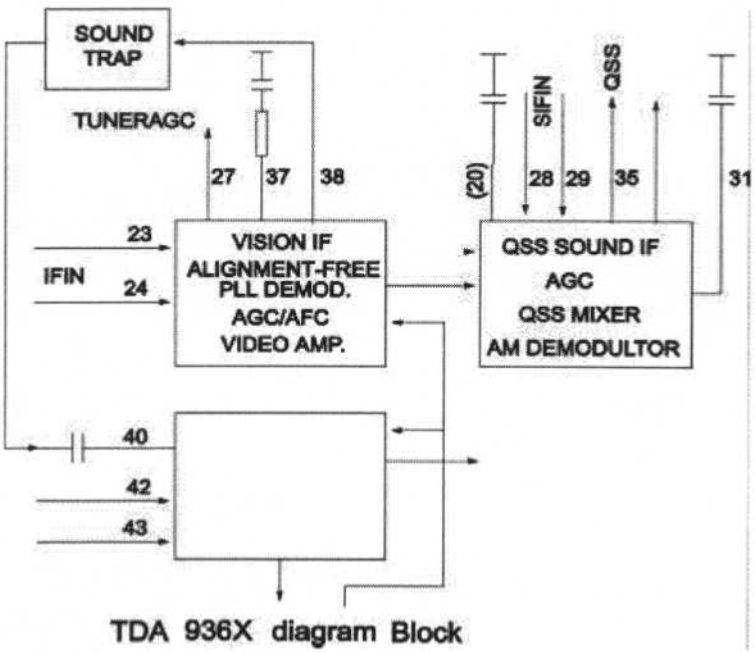


Fig.2: Blocks used inside the UOC for the IF

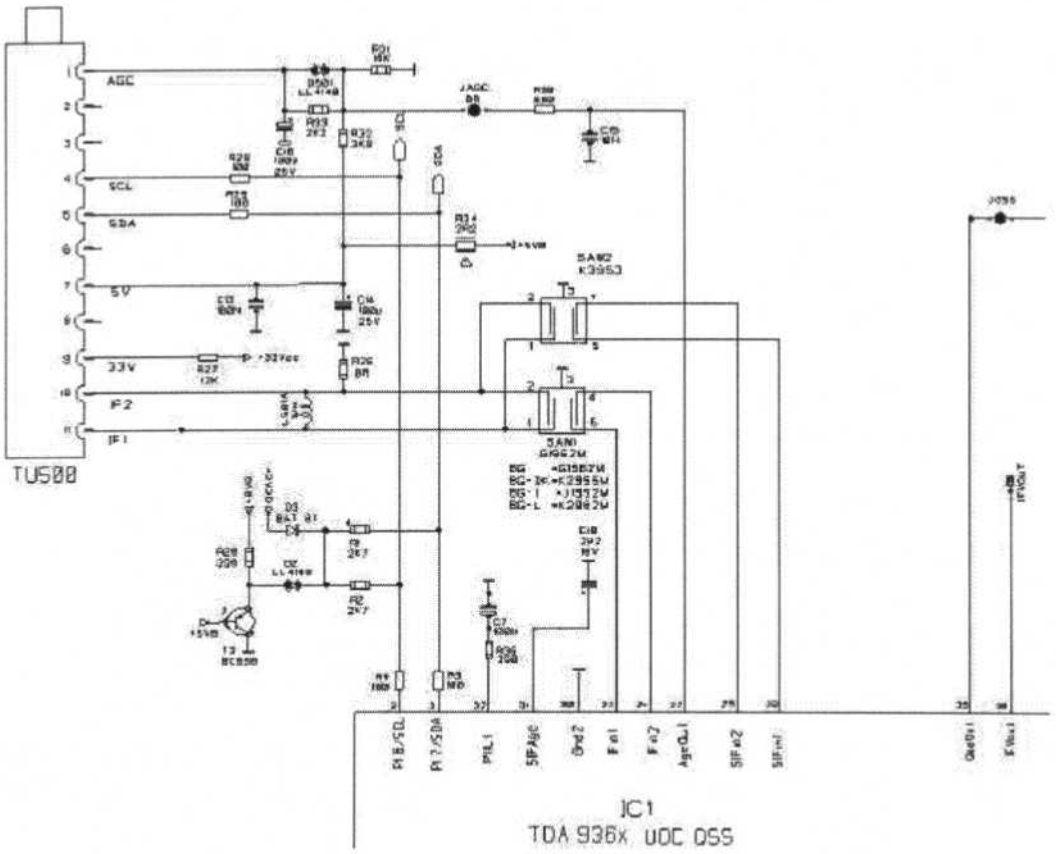


Fig. 3.7: Wiring diagram of the IF section applied to a stereo chassis.

In the France models the SAW2 audio filter is substituted by the SAW3 commutable filter. In this case, an amplifier (T101 BF799) has been interposed between the tuner and the filter to recover signal loss which occurs when connecting to just one branch of the tuner's IF output.
As for the mono chassis, the AM audio signal is demodulated with the IC3 TDA9830
Unlike the mono application, the output signal from pin 6 does not enter pin 28 of the UOC but sent to the MSP mono input; it is managed via software and used if transmission is in mono only or when the NICAM reception quality deteriorates below certain limits.
The commands to select IF at 32.4Mhz or 40.4MHz on SAW filter 4 are the same as those described previously.

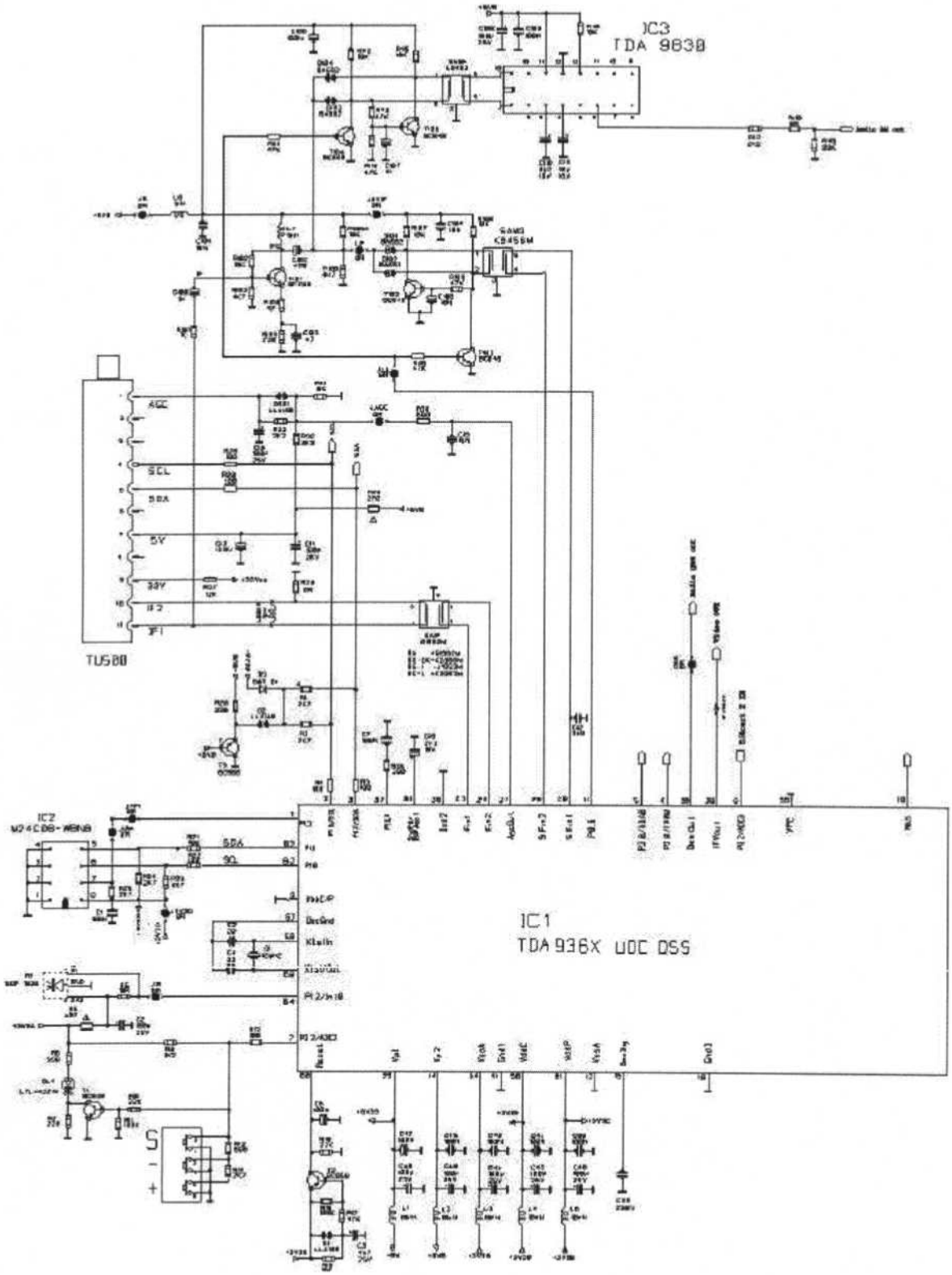
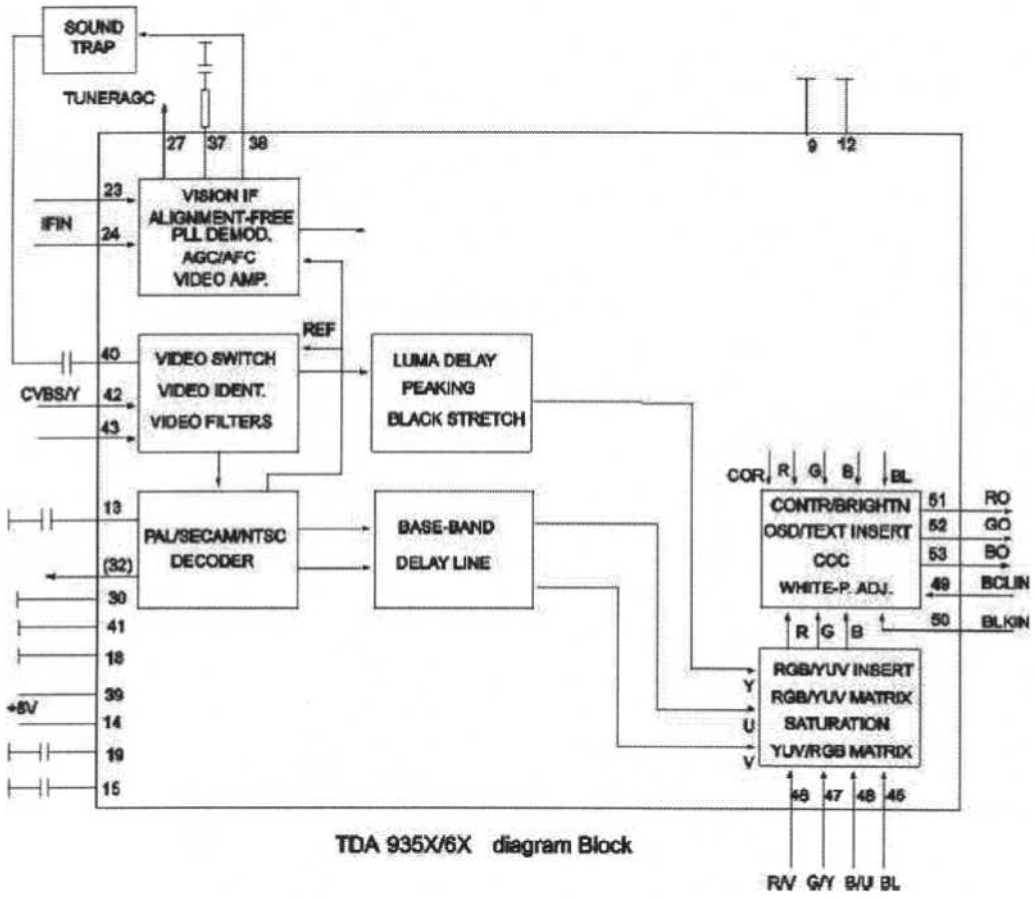


Fig. 3.8: Wiring diagram of the IF section applied to stereo TV sets.

4 - VIDEO PROCESS

The demodulated composite video signal is available on pin38 of the UOC integrated circuit with the residual FM audio over it. The TPSI sound trap sees to filtering the FM residual with a notch filter that, for the BG system, is centred at 5.5MHz, and the resulting video signal is sent to pin40 to be reprocessed and transformed into an RGB signal by demodulating the chromatic information.
Fig. 4.1 shows how the signal is processed inside the UOC.



TDA 935X/6X diagram Block

Fig. 4.1: blocks inside the UOC in the video process.

The video switch selects either the internal signal, coming that is from the aerial signal, or one of the signals coming from the external sources that is, from scart 1 or 2. It is identified and then separated into a brightness and chrominance signal.
The colour decoder requires no additional quartzes. It uses only the one quartz, 12MHz, digitally taking the frequencies necessary to decode the various standards from it (4.43MHz 3.582MHz 3.575MHz 3.579MHz). The chroma delay line is the next block before the matrix that converts the available Y signals and colour differences into RGB.
The contrast, brightness and saturation controls are in the last blocks. These blocks are used to limit the beam current to a maximum set value with a feedback that acts on the UOC pin 49.
The RGB output is then sent to the video final stage.

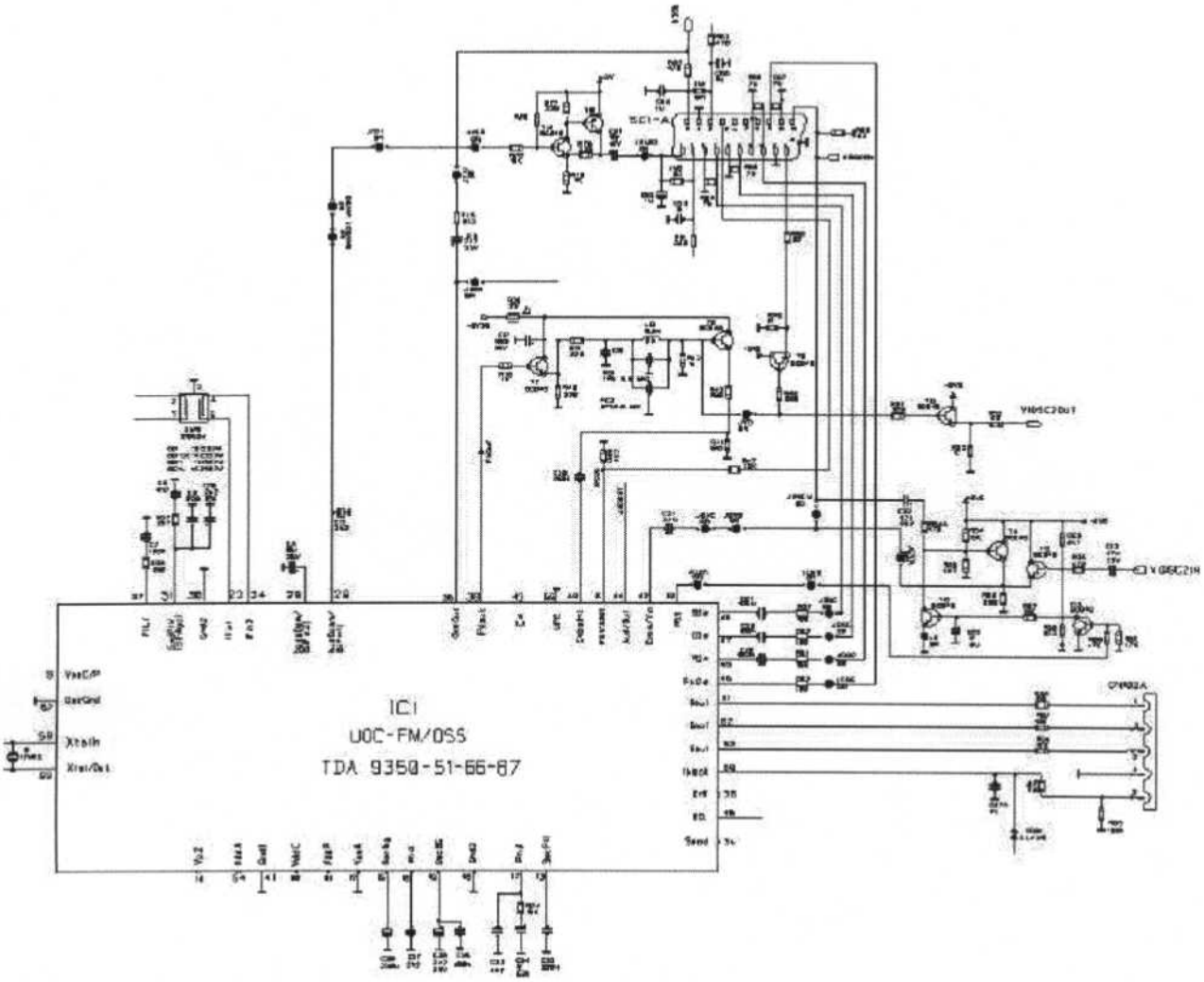


Fig. 4.2: Wiring diagram of the video process section.

Description: The video signal in base band, complete with syncs, brightness, chrominance and IF audio carrier, generated by demodulation of the aerial signal, comes from the UOC pin 38 at an amplitude of 2Vpp and feeds the T7 transistor with the emitter follower function to drive the sound trap at 5.5MHz – 6MHz – 6.5MHz of the various standards supported by the chassis.

In this way we obtain, after the trap, the composite CVBS video that will be sent along two different paths:

1 – Via the divider T8 - R43 –R44 the 1Vpp amplitude video signal returns to the UOC pin 40 to be used in the TV programmes (Pr1- Pr99).

2 - Via T9 – R50 the signal leaves pin 19 of scart 1. T10 and R 53 perform the same function for scart 2.

If there is only one scart the video signal coming from the scart's pin 20 enters the UOC pin 42 via C21 because the copper jumpers JVSC1A + JEVB + JEVC are plugged into the chassis and will be used when the AV programme is selected.

If there are two scarts the two video signals feed T 11 and T12; only one of these transistors lets the incoming video signal pass while the other is blocked.

The command that executes this video selection from SCART 1 or SCART2 leaves the UOC pin 10.

T13 and T16 are plugged in to limit the interference of one video signal on another to the maximum extent.

Managing the video signal from external sockets.
These are the inputs and outputs:

- Rear SCART 1 socket with composite video input, RGB inputs, composite video output from RF, stereo or mono audio inputs and mono or stereo audio outputs from the RF signal.
- On stereo models only: Rear SCART 2 socket with composite video input, composite video output from RF, stereo audio inputs and stereo audio outputs from the RF signal.
- Front CINCH Socket with composite video input and mono audio input if applied to mono TV sets and Front CINCH Socket with composite video input and stereo audio input if applied to stereo TV sets.

5 - VIDEO FINAL STAGE

It drives the tube's electron guns, amplifying the signal from the UOC output level by 2Vpp, to a level of about 100Vpp.
The RGB signal is amplified by means of a single integrated circuit, STV5112, that contains three identical amplifiers. It requires only one power, 170-185V, applied to pin 6.
The cut-off current flows from pin 5 which, with the green and blue currents, is carried to the UOC pin 50 for automatic stabilisation of the black level.
The spot cut-off circuit is realised with C706, R712, R717 connected to grid G1.
The bases for the "minineck" or "narrowneck" type electron guns can be mounted on the video final stage printed circuit. For this reason the respective resistors mounted according to the type of base are also indicated with an N or M.
The final stage gain is internally fixed at xx; the video input signal, like the red signal for instance, enters pin 1 of the TDA6108JF integrated circuit and pin 9 duly amplified to drive the corresponding cathode directly.
The resistors in series R705 – R708 for the narrowneck, or R 708A for the minineck and the diode D701 ensure against possible discharges of the picture tube and increase circuit reliability.

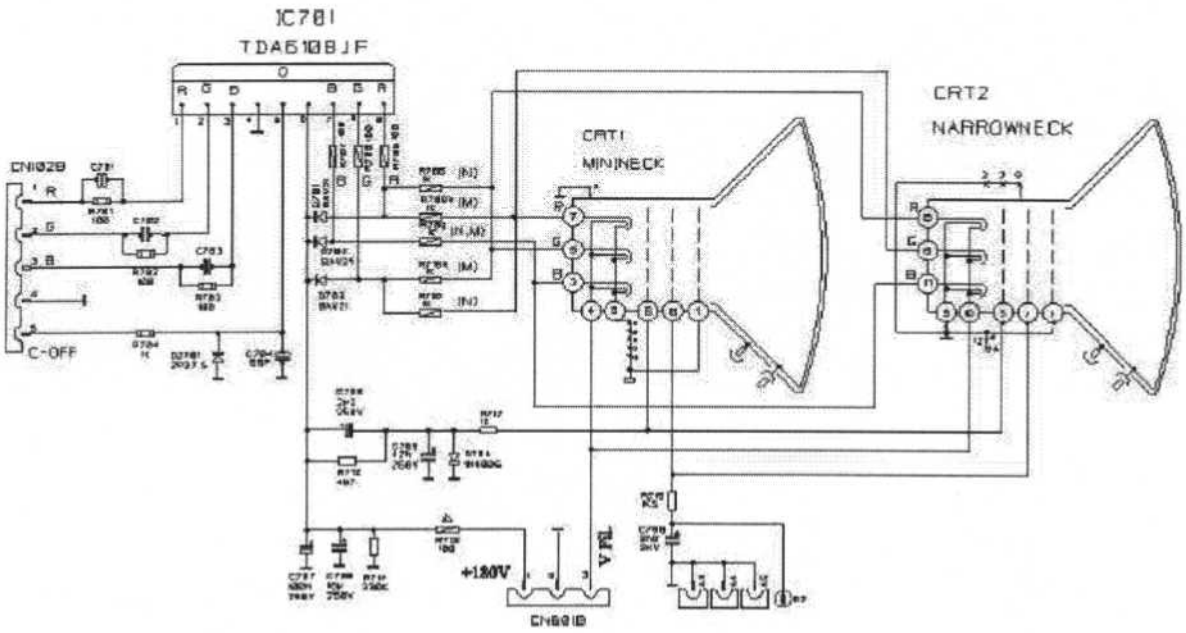


Fig. 5.1: video final stage

6 – HORIZONTAL DEFLECTION

It generates the driving current of the tube's horizontal deflection yoke as well as the voltages needed by the tube (EHT), the video final stage, the final vertical stage and the 5V and 8V stabiliser.
The command to turn the TV on is not obtained with a hardware line that enables powers as used to happen on the previous generation of TVs, but with a software command that enables the driving signal of the H deflection, leaving the UOC pin 33 in the shape of a square wave.
By way of the common base T601 the signal is applied capacitively to driver T602 that drives the TR601 transformer's primary winding.
The secondary winding of the driver transformer drives the T603A base on the collector with a suitable current, of which the components necessary for horizontal deflection are installed.
The line transformer is powered at 105V for the 14"-17" TV sets or 115V for the 20"- 21" sets.
R607 effects a compensation on horizontal pumping.

The following service voltages are taken from the line transformer's secondary windings.

- **6.3V**: (6.1-6.5V) Power for the tube filament taken from transformer pin 12
- **12.5V**: (12.2-13V) Power of the vertical final stage IC301 taken from rectification of the signal leaving the transformer's pin 7 via D 410 and filtering of C432 - CH403 and C 433.
- **45V**: Power of the vertical flyback stage, obtained from the signal of pin 8 with rectification of D603 and filtering of C 611. From the 45V thus obtained, we get the 33V, stabilised by IC601, for the tuner's varicap circuit.
  The horizontal flyback is taken from pin 9, limited in amplitude to 8Vpp by zener DZ601 and added, via resistor R 614, to the vertical signal generated inside the UOC to form the "supersandcastle" signal.
- **175-185V** : Power for the video final stage taken from rectification of the signal leaving the transformer's pin 5 via D602 and C 606.
- **EHT, FOCUS and G2 .**

The high EHT voltage is not referred to earth but, by means of chip resistors R620 and R621, to the stabilised voltage of 8V generated by IC404. The drop in voltage on the resistors is proportional to the beam current and voltage on the R628 - C615 – R620 node that drops as the beam current increases; it is fed back to the UOC to obtain maximum current limitation.
Feedback is controlled by the T604 circuit.
The signal on the R628 - C615 – R620 node is also used by means of R 625 – R626 - R627 – for vertical pumping compensation on the UOC pin 36 which is normally a result of EHT voltage variation.
From rectification of the positive pedestal of the flyback impulse, leaving pin 7 of the line transformer TR602, effected by D410 and filtered by C432, we obtain 12.5V that will power the integrated circuit of the vertical IC301 and the stabiliser IC404.
5V dc and 8V dc are available in output from this stabiliser and will be used to power many devices on the chassis like, for instance, the tuner, the MSP, the UOC and so on.

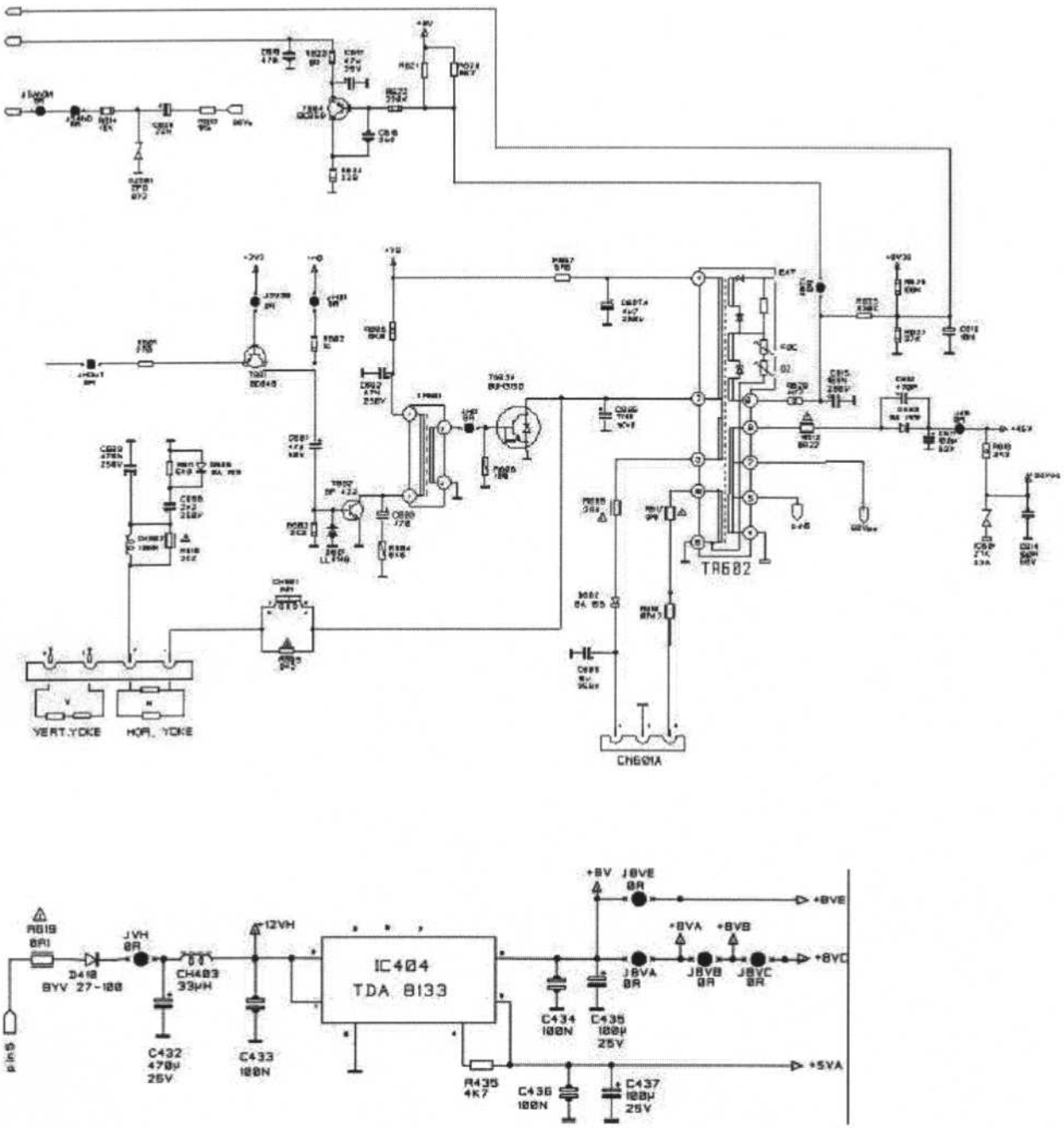


Fig. 6.1: Wiring diagram of the horizontal deflection.

7 – VERTICAL DEFLECTION

Vertical deflection is obtained by making a ramp current circulate on the vertical deflection's yoke coils at a repetition frequency of either 50 or 60 Hz.
The vertical ramp forms in the UOC, precisely on the capacitor connected to pin 26.
The ramp is applied to pins 1 and 2 of the vertical final stage IC301 in a differential way. The IC's output stage, jumper type, is able to drive the vertical deflection yoke directly.
The current in the yoke is determined by the input signal, by the feedback resistor R306 and by the control on pin 9 via R305.
Amplitude, linearity and shift settings are effected via the IICbus with the aid of the remote in the service environment.

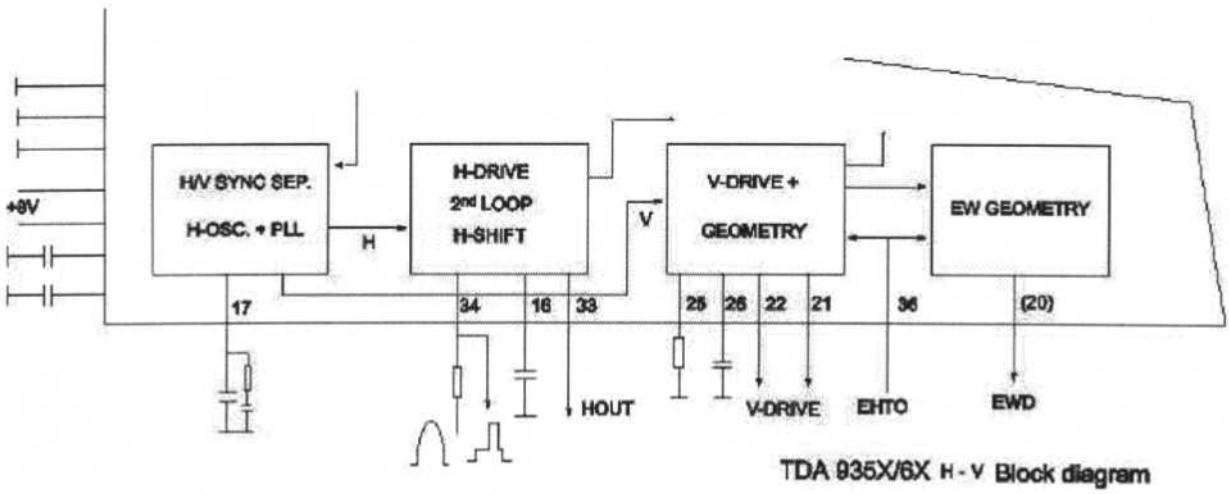


Fig. 7.1: Blocks inside the UOC for deflection.

The IC301 needs two separate power supplies which are only present when the TV is on:

1. 12V applied to pin 3 for normal functioning during scanning and taken via the stabiliser IC404
2. 45V applied to pin 6 for powering the vertical retrace line circuit and taken from rectification of a horizontal flyback via D 603 and the filtering of C611.

The R309, in parallel with the yoke, stops any oscillation, with the appearance of horizontal lines especially at the beginning of scanning.
The IC also features a safety circuit that furnishes a control signal in output from pin8. The impulse is sent to UOC, pin 50, to execute the "vertical safety" function which turns the screen off should the vertical deflection fail. This prevents damaging the tube's phosphors.
The positive and negative ramp generated by the UOC is applied to the input of the vertical deflection stage.
The adjustments of the vertical deflection to regulate amplitude, shift and vertical linearity, effected in the service environment, consist in modifying the amplitude, in the variation of the continuous level on which the ramp is and in changing its shape.

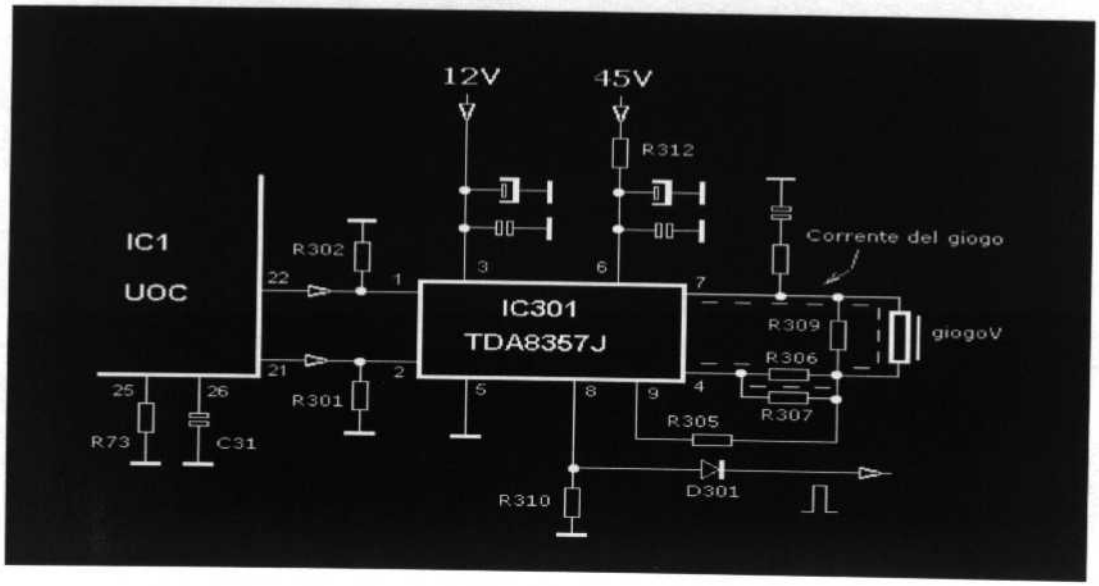


Fig. 7.2: Functions of the vertical deflection.

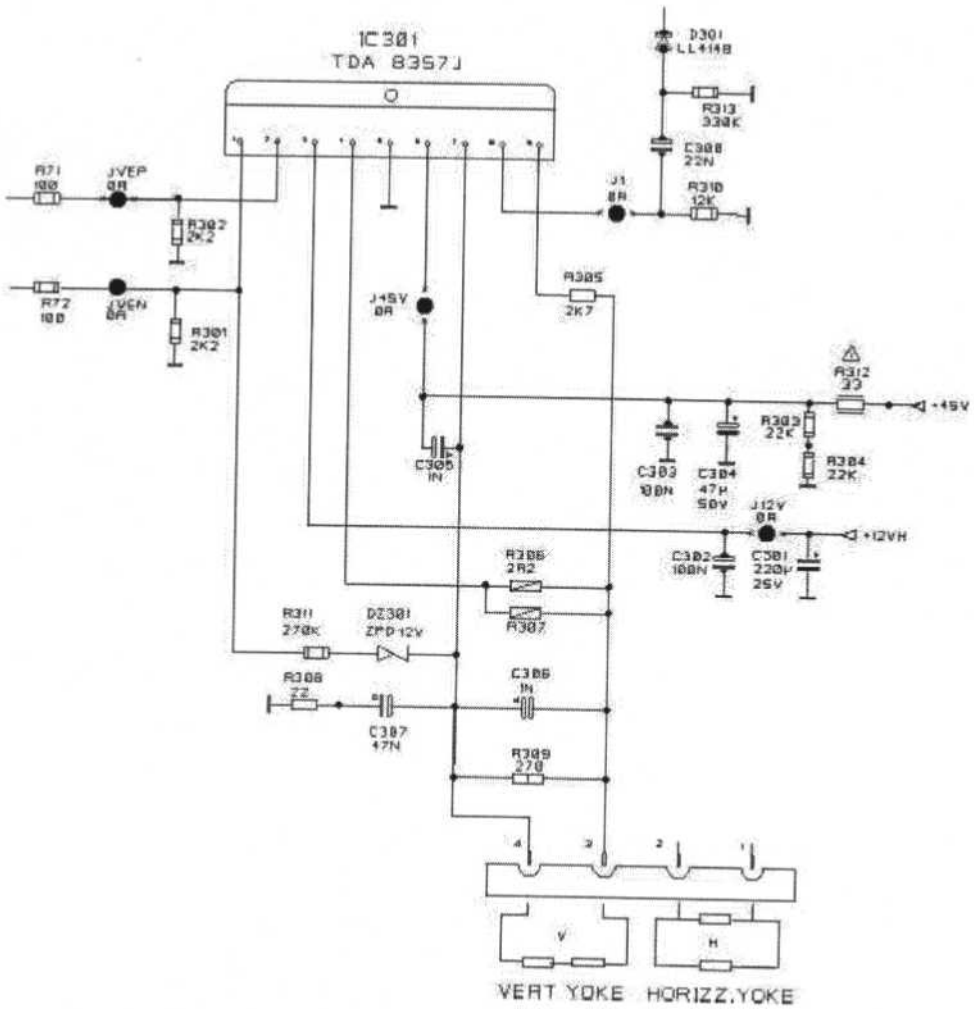


Fig. 7.3: applicative wiring diagram of the vertical deflection

8 - MICROCONTROLLER

The microcontroller, part of the TDA936X's section, generates all the signals necessary for driving the other parts of the television.

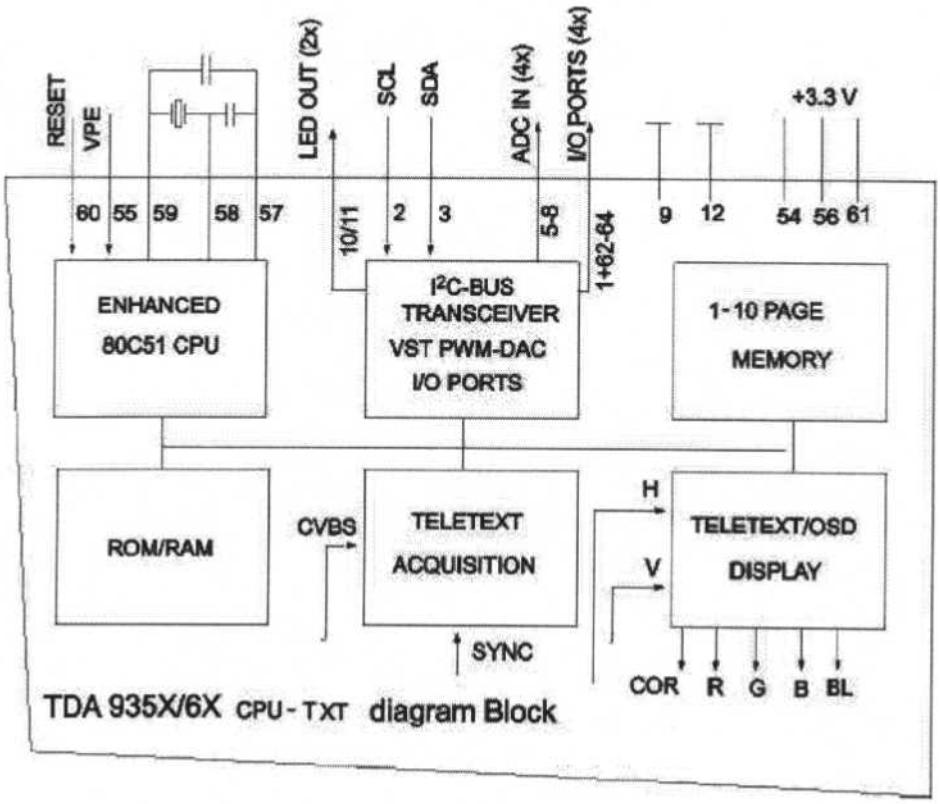


Fig. 8.1: Blocks of the micro inside the UOC.

Main features:

- 80C51 standard core
- 12MHz clock
- internal ROM for the programme 32K-128K byte
- internal RAM 3K-12K byte

- TELETEXT

The teletext decoder is inside TDA936X (UOC) and, due to the capability of the character generator, it is also used as the OSD (on screen display).
Some features:

- 1 page memory for the mono versions and 10 pages for the stereo.
- VPS and WSS recognition (broadcasting aspect)
- FLOF and TOP decoding

- **IIC bus**

Permitting communication with the peripherals with two lines:
SCL pin2 clock line for tuning the data transmitted or those read by the micro
SDA pin3 bi-directional data line

- **I/O ports**

UOC has 11 I/O lines that can be configured separately as input or output of the *open drain, high impedance, push-pull,* or *quasi bi-directional* type.
Management software has configured them in the following way:

Pin1 (P1.3) *open drain* : **"write protection" command output** that goes to level L only when the memory really has to be written.
Pin4 (P2.0) N.u.
Pin5 (P3.0) *open drain* **: output of the BG/L command** used to command the IC4 analogue switch that lets the AM audio signal enter, in the case of a programme associated to the France standard, being demodulated externally to the integrated circuit TDA9830.
Pin6(P3.1) input connected to pin8 of scart1 for reading the voltage and automatically switching to AV1 if the VCR is in play mode.
Pin7 (P3.2) analogue input, it reads the voltage present on the **local keypad** and, via software, recognises the key pressed. In time sharing it becomes the output to control the stand-by LED and indication that a local or remote command has been received
Pin8 (P3.0) has a dual function:

- On a mono TV: *push-pull* **output mute command** for the audio final stage.
- On a stereo TV: **input connected to pin8 of scart2** for reading the voltage and automatically switching to AV2 if the VCR is in play mode.

Pin10 (P0.5) output, *push-pull* **for video selection** coming from scart 1 or scart2.
Pin11(P0.6) output, *push-pull* **of the L/L' command** used for switching the audio filter SAW3 and SAW4 for the France models.
Pin62 (P1.0) CLOCK signal of the IIC bus dedicated only to the non volatile memory IC2
Pin63 (P1.1) DATA signal of the IIC bus dedicated only to the non volatile memory IC2
Pin64 (P1.2) input, *high impedance,* reception of the I.R. signal coming from the infrared receiver.

- RESET

The reset command is necessary to initialise software when switching the TV on.
Reset is carried out, taking pin60 to a logic value H.
It is generated by the transistor chip T2 after a certain delay from when switching the TV on, determined by R16 and C5.
The external reset circuit is omitted if the N2 version of the UOC IC is used which has an identical hardware circuit inside.
In this case the 22K resistor R19 is substituted with the value 0 Ohm.

- IR receiver

The IR1 module receives impulses from the remote control and converts them into an electric signal for the micro. It is powered at 3.3V.

- LOCAL KEYPAD

The keypad features five keys connected to a network of resistors powered at 3.3V and connected to the micro's A/D converter. The variable divider obtained, (R9,R13,R14) with each depression of a key, determines a voltage which, read by the micro, is associated to the key selected.
Port 3.2, corresponding to pin 7, acts as an input when it has to read a pressed key or as an output when it has to drive LED lighting.
The LED is on with a steady light in the stand-by condition, it turns off when the TV is switched on and flashes with each local command given or when a valid IR command is received.

It is T1, together with R8, that drive the LED with a current that is sufficient for its lighting.

- NON VOLATILE MEMORY

The 1K byte EEPROM IC2 memory has the task of storing data corresponding to the programmes, to the geometry as well as the data of some audio and video registers.
For addressing, writing and reading use the IIC bus SDA and CLK protocol which is dedicated only to storing, coming from pins 62 and 63.

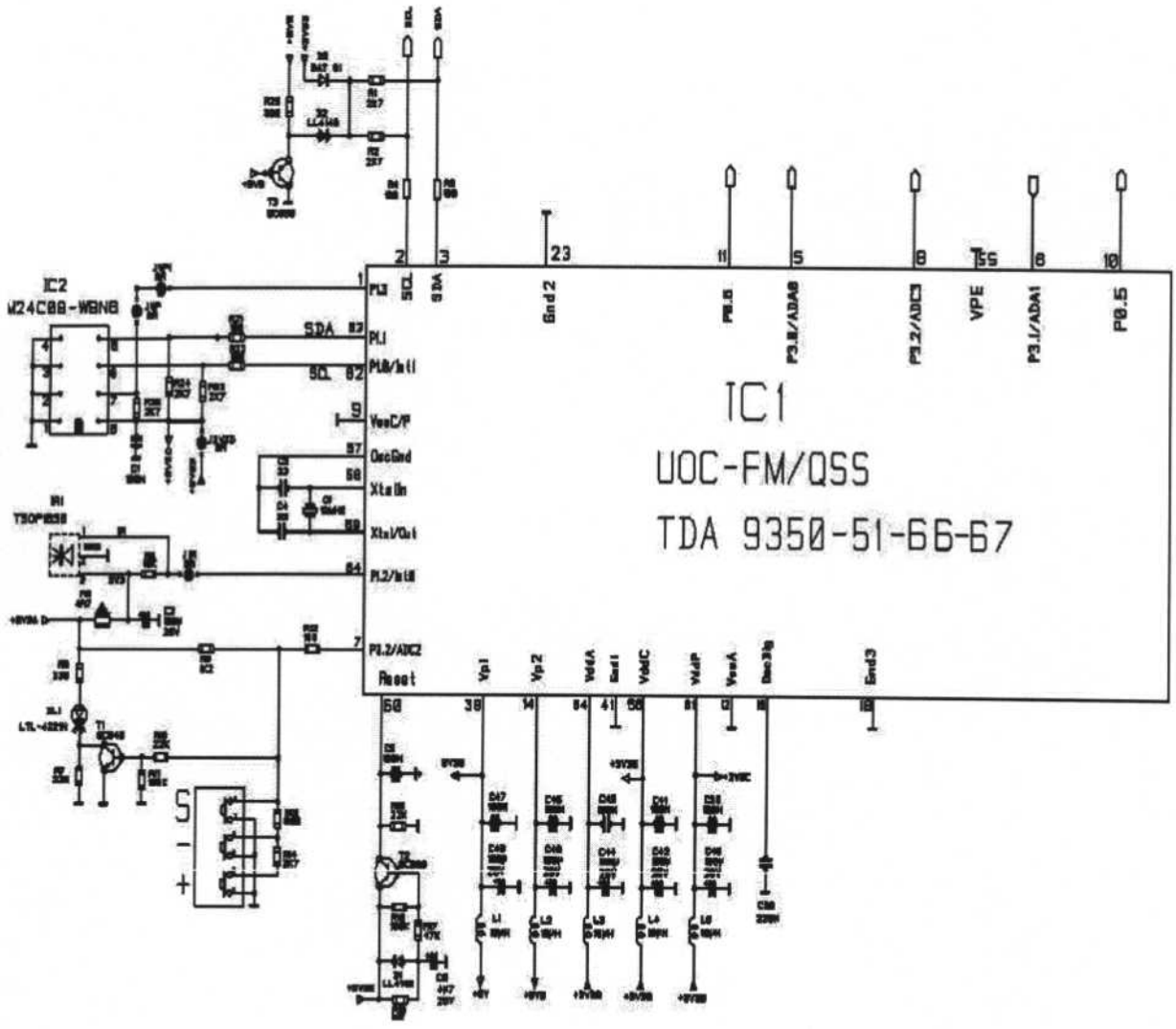


Fig. 8.2 :Applicative wiring diagram of the uP section and teletext.

9 – MONO TV AUDIO PROCESS

The mono audio process is effected completely inside the UOC using the blocks shown in the following figure. The intercarrier type SAW filter supplies the IF signal on pins 23-24.

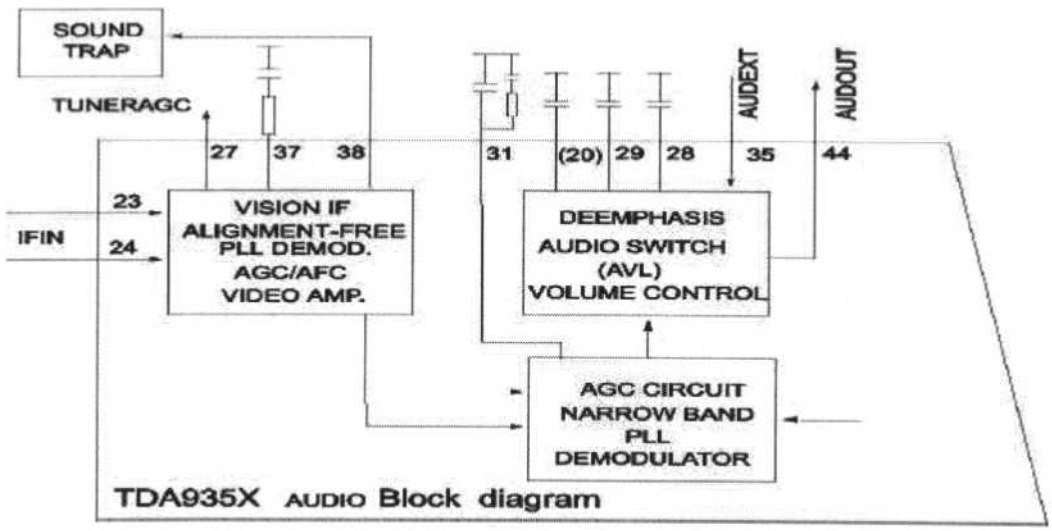


Fig. 9.1: Blocks inside the UOC for the audio section.

The audio taken from the demodulation process follows two paths:

1. Available on pin 28 with the de-emphasis process effected by C12; this signal is sent to the SCART output via transistors T14-T15 which, with the associated passive components, amplify the signal to adapt it to scart requirements. Audio comes from pins 1 and 3 connected together with an amplitude of 0.5 –2VRMS depending on the depth of broadcasting modulation.
2. It powers an internal switch where commutation takes place between the internal audio signal coming from the aerial signal and the scart audio signal entering pin 35.

The audio controlled in amplitude by the volume command is available on pin 44, sent via R202 to the audio final stage.
The audio final stage is realised with the TDA7267A which is able to supply 3W RMS with a compact heatsink and realised, in this case, with a copper plate that, in actual fact, increases the heatsink surface.
The supply voltage on the mono chassis is 15.3 +/- 0.5V ensuring a power of 3WRMS on an 8Ohm load or 1.5WRMS on a 16Ohm load.
The voltage is supplied on pin 1, the audio input on pin 4 and the output on pin 2.
A mute command is possible on pin 3 realised on command of the microprocessor via the output of pin 8 which, on mono TV sets, is the muting output while on stereo TV sets it is the command input for scart2.
In the latter case the muting command takes place via an output port of the MSP.
Since the muting command also corresponds to a resetting of the audio signal coming from pin 44 the hardware muting circuit realised with T 201- T202 can be omitted.

The signal for the head phones is also taken from the speaker output consequently the volume command influences the head phones' signal and when the head phones' plug is inserted the speaker is excluded.

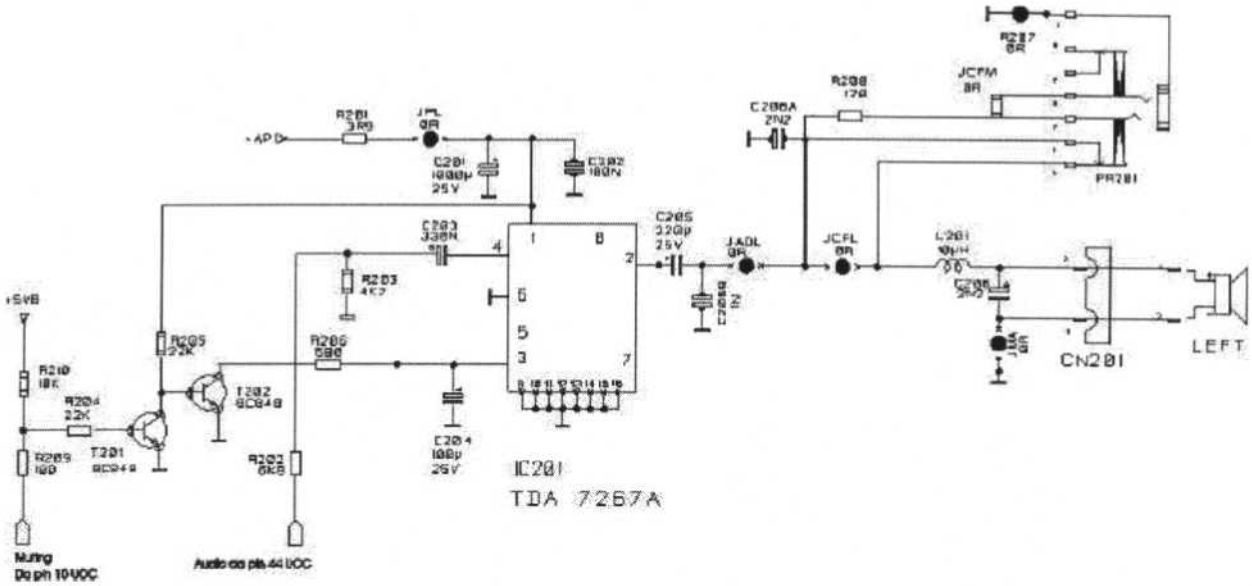


Fig. 9.2: Mono audio amplifier final stage.

10 – STEREO TV AUDIO PROCESS

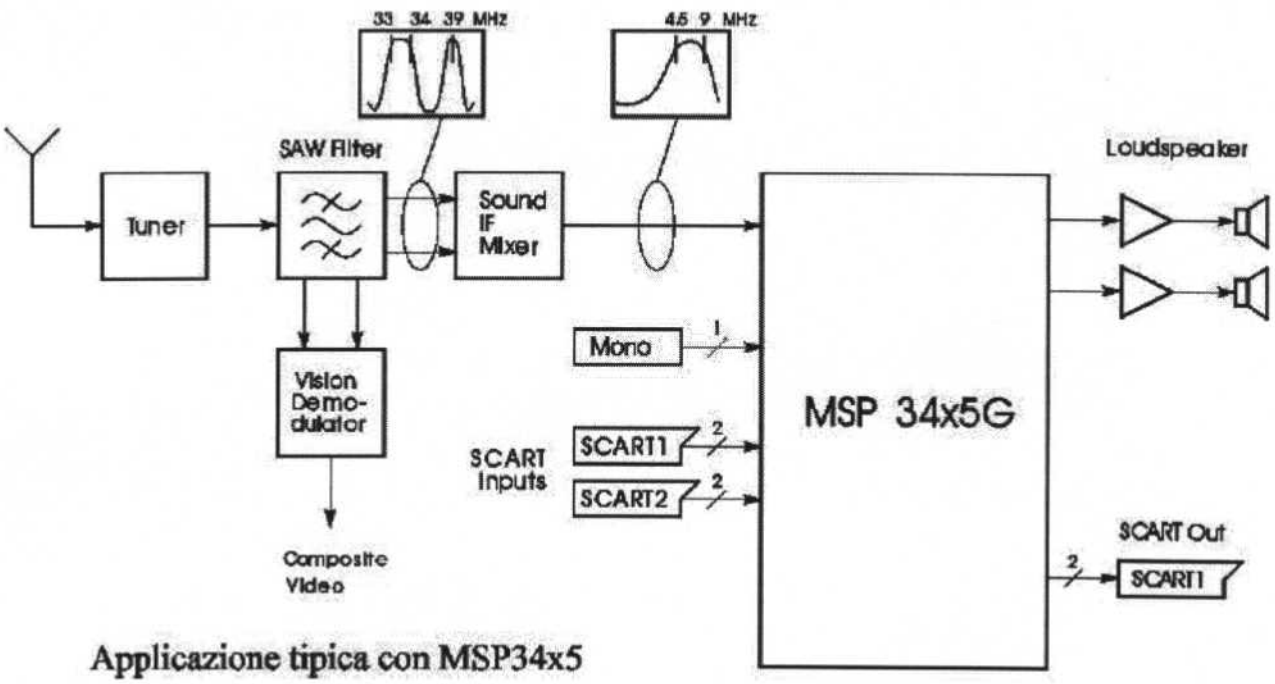
The aerial signal with the channel tuned by the system's tuning section, leaves the tuner and applied to the SAW filters.
The QPT type audio filter powers the UOC on pins 28,29 and the IF audio signal leaves pin 35 and applied to the MSP input.
No audio processing is done on the UOC. All signal processing is handled by the MSP34X5 IC which can decode mono and stereo audio signals with two carriers and Nicam.

We are talking about MSP34x5 because two types of MSP can be used indifferently:

1. MSP3405 = stereo decoder in the "Dual tone" broadcasting standard used, for example, in Italy, Germany, Holland, etc.
2. MSP3415 = stereo decoder in the "Dual tone" broadcasting standard and " NICAM" used, for example, in France, Spain, Scandinavian countries, England, etc.

As can be seen in the following block and as described in detail further on, the signals from and to the scart sockets and the main output that drives the audio final stages are added to the FM signal.

The IC9 amplifier receives the low frequency audio signal from MSP pin25 and pin26 and after having amplified it sends it from pin 1 and pin 3 to the stereo head phones. There is power on pin2, taken from the 8V with an RC filter.
By using the IC9 amplifier the volume in the head phones can be adjusted independently from the main audio channel. Furthermore, if the broadcast is bilingual, the language wanted can be selected for the head phones independently from that of the main audio channel.



Applicazione tipica con MSP34x5

Typical application with MSP34x5

Fig. 10: Blocks of the stereo audio process.

The MSP IC processes the signal inside it with the following blocks:

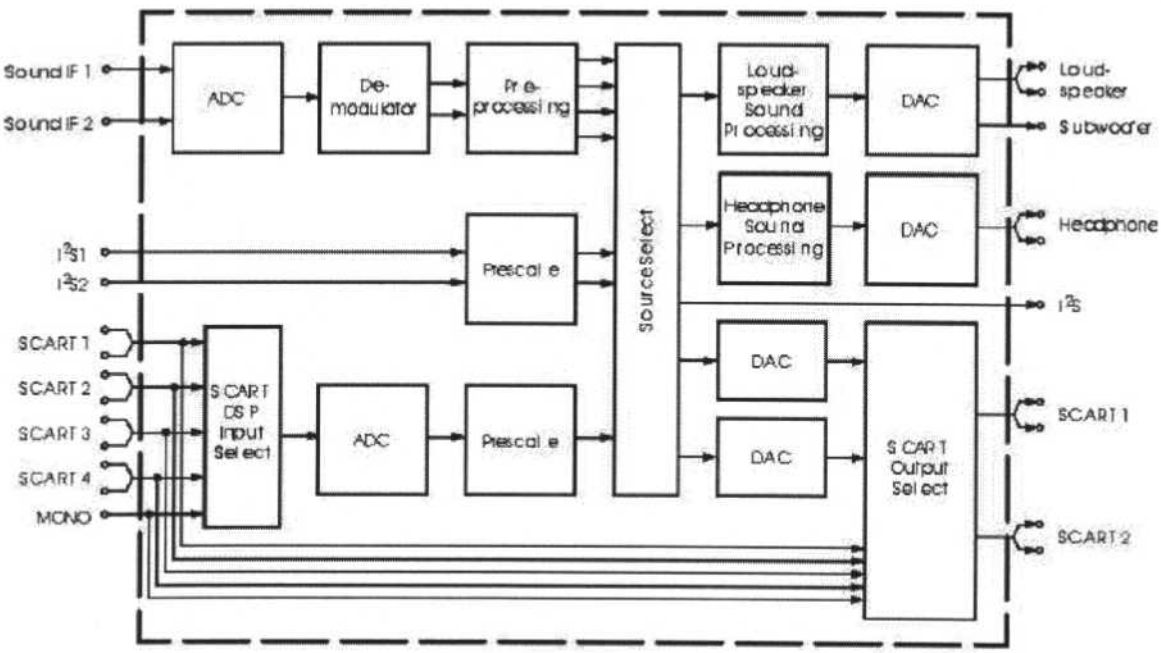


Fig. 1 : Simplified functional block diagram of the MSP 34x

Fig. 10.2: Blocks inside the MSP for the audio.

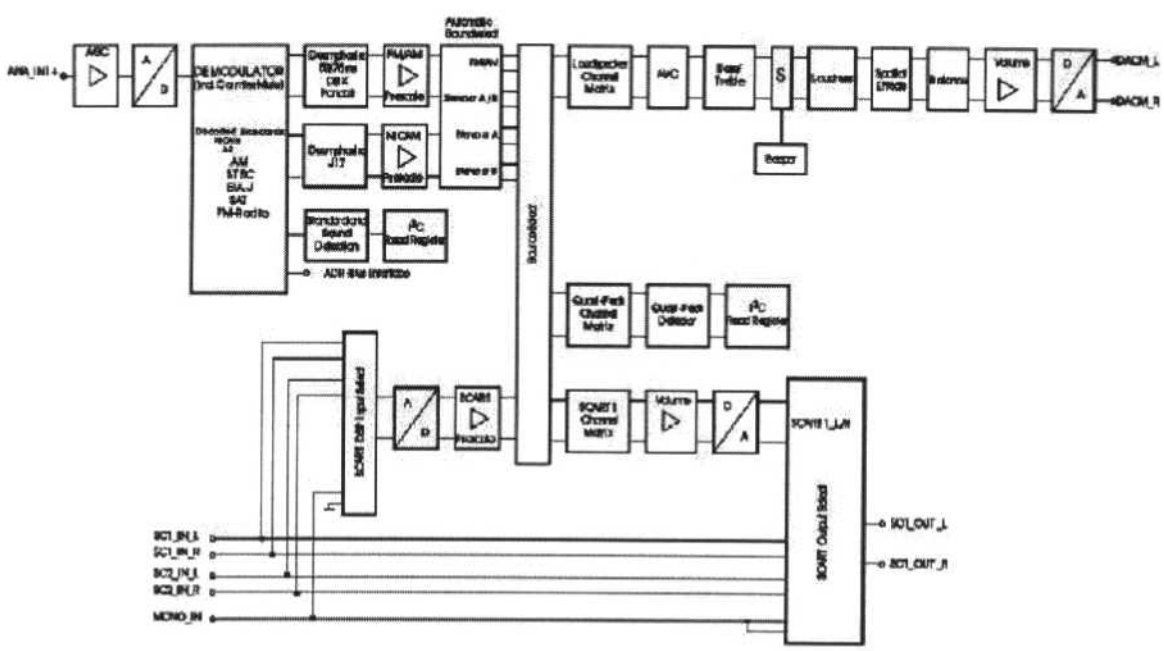


Fig. 2-1: Signal flow block diagram of MSP 34x5G (Input and output names correspond to pin names)

Two scart sockets can be controlled and the choice of the signals in output is controlled by the software.
From the selection of the inputs and processing of the signal we obtain the following signals in output:
R and L main audio.

It is powered with two voltages, 8V and 5V. 18.432MHz quartz is present on pins 62 and 63. All adjustments, volume, equaliser, balancing etc., are done inside the MSP by means of commands (datagrams) received from the UOC through the I^2C bus on pins 9 and 10.

Circuit description:

The FM modulated QSS signal, or QPSK modulated if Nicam, comes from the UOC pin35 with an amplitude of approximately 300mV pp and is applied to input 47 of the MSP via the CRC unit comprising Cxx-R265-C280. The amplifier stage, consisting of T251-T250, is not used but remains a printed circuit for future use, likewise trap TPS250.
In the case of standard BG/L chassis the AM audio signal demodulated by IC3 TDA9830 is added to pin 44.
According to the project, the AM demodulating section will also be used inside MSP34x5. In this case the external AM signal, applied to pin 44, is omitted.

The audio signals coming from the scarts and front sockets are applied as described below:
- scart1 R in – enters pin 42
- scart1 L in – enters pin 41
- scart2 R in – enters pin 39
- scart2 L in – enters pin 40

The front socket is connected in parallel to scart 1 if there is only one scart or in parallel to scart 2 if there are two.

Outputs:
- scart 1 and 2 R out – leaves pin 30
- scart 1 and 2 L out – leaves pin 31

From the selection of the inputs and processing of the signal we obtain the following signals for the power amplifier in output:
main audio R "pin24" – main audio L "pin25"

The output of the low frequency audio corresponding to the right and left channel is on pins 24 and 25 respectively and the amplitude of the signal sent to the final stages is under the control of the volume realised, as always, inside the MSP.

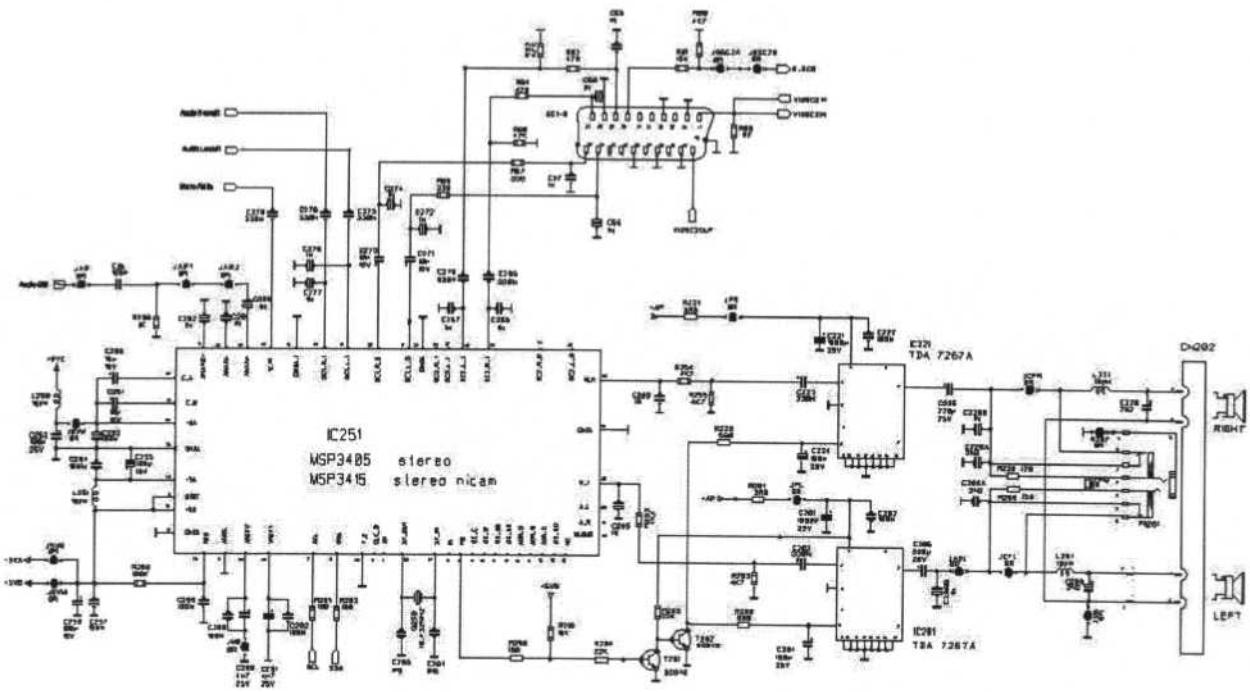


Fig. 10.4: Audio, signal processing

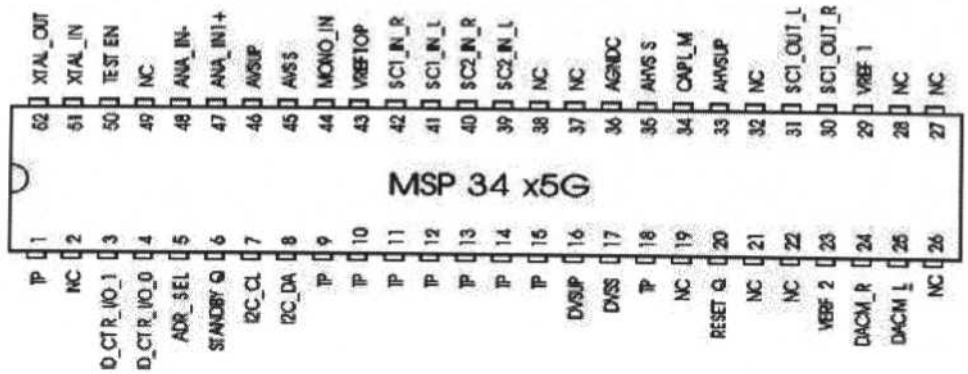


Fig. 10.5: MSP pin layout.

12 – SETTINGS of the SWING – PC 2002 chassis

SERVICE **How to enter service:** with the TV ON press the OSD push button on the panel near the power supply switch' and immediately press OFF on the remote control.

- How to exit service: press the TV key on the remote.

FAST SERVICE

With the SR Fact bit in the Option Byte n 5 set on 1 the TV is always in the open service condition. The software version is shown on the screen and by pressing the ? key the service function is activated. The first settable parameter appears on the screen. To exit the service setting condition while remaining in the service environment press the TV key on the remote.

1) Power supply

Conditions: brightness and contrast at minimum, dark screen

Operations: adjust P401 for 105V ± 1V with CRT 14", 17"
adjust P401 for 115V ± 1V with CRT 20", 21"

2) AGC calibration

Conditions: signal in III band with standard modulation and level 1mV.
2 – connect a voltmeter on the positive of C16 .

Operations: adjust register AG inside SERVICE for a voltage of 3.5V.
Typical register value AG 'xx'

3)Geometries

Conditions: 1 - standard aerial monoscope signal
2 - Standardised contrast colour light

Operations: 1 - adjust register VS inside SERVICE so that the black half of the picture coincides with the middle line of the monoscope.

- 2 - adjust register VA inside SERVICE until the amplitude of the monoscope is inside the useful area of the screen.

- 3 - adjust register VSH inside SERVICE so as to centre the monoscope in the picture area.

- 4 - adjust the vertical linearity register SC inside SERVICE so as to have a circle that is as round as possible or so that the distance between the lines is as even as possible.

- 5 - adjust the horizontal shift register HSH inside SERVICE.

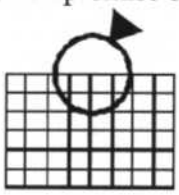
4) CUT OFF calibration

Conditions: 1 - standard aerial monoscope signal
- 2 - adjust average contrast and brightness so that the last bar of the greys scale is off.
- 3 - With the 100:1 probe of the oscilloscope, find the cathode that has the highest cut-off value, measuring on resistors R705, R706 and R707 towards the diodes D701, D702 and D703.

Operations: 1 - turn the G2 potentiometer (on the deflection transformer) to position the cut-off impulse at 110V for the 14,17" picture tubes
and at 120V for the 20,21 picture tubes.

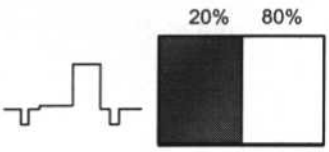
7) Focusing

Use the focus potentiometer to achieve the best focus (located on the deflection transformer) in the zone see fig. below, to get the best thickness compromise between the horizontal and vertical lines.



8) White adjustment

Conditions: Video signal half grey and half white picture



Operations: 1) positioning the colour temperature measuring device on the 20% grey zone, adjust the BLR and BLG registers inside SERVICE so as to obtain the temperature wanted. 2) positioning the colour temperature measuring device on the 80% white zone adjust the WR-WG-WB registers inside SERVICE so as to obtain the temperature wanted.

13 – SERVICE FUNCTIONS

Parameter	Description	Default BG	Default BG, L	
AG	AGC take-over point	32	32	
HSH	Shift H	37	37	
VSL	Vertical centring adjustment	32	32	
VSH	Shift V	34	34	
VA	Amplitude V	27	27	
VSC	Correction S	25	25	
VSD	Disable Scanning V	off	off	
BLR	Low light colour R temperature adjustment	48	48	

BLG	Low light colour G temperature adjustment	48	48	
WR	Green colour temperature adjustment	32	32	
WG	Green colour temperature adjustment	32	32	
WB	Blue colour temperature adjustment	32	32	
CL	Cathode drive level	08	08	
RGB	RGB-Brightness	00	00	
HSH RGB	Shift H adjustment for AV1 RGB	39	39	
Yp	Luma Delay adjustment for PAL	09	09	
Ys	Luma Delay adjustment for SECAM	14	14	
Yn	Luma Delay adjustment for NTSC	09	09	
YAVp	Luma Delay adjustment for PAL	00	00	
YAVs	Luma Delay adjustment for SECAM	00	00	
YAVn	Luma Delay adjustment for NTSC	00	00	
OSD-MODE	Menu choice switch on/off	FF	FF	
IF	IF-PLL	38.9	38.9	
IFL1	IF-PLL L'	33.9	33.9	
AG	AGC speed	01	01	

Op1	Option Byte n.1	**21**	**A1**
	▪ 1: PAL-BG enable	1	1
	▪ 1: PAL-DK enable	0	0
	▪ 1: PAL-I enable	0	0
	▪ 1: PAL-M enable	0	0
	▪ 1: PAL-N enable	0	0
	▪ 1: SECAM-BG enable	1	1
	▪ 1: SECAM-DK enable	0	0
Op2	Option Byte no.2	**14 or 04**	**14 or 04**
	▪ 1: NTSC-M enable	0	0
	--		
	▪ Tn 3Bands 1: 3-band tuning; 0: only UHF	1	1
	▪ Tn Freq 0: tuning by channel; 1: tuning by frequency	0	0
	▪ AV2 1: 2nd SCART enable	1	1
	--		
	--		
	--		
Op3	Option Byte no.3	**5E**	**5E**
	▪ Tx TOP 1: TXT TOP enable	0	0
	▪ Vblank 1: Video Blanking at progr. change	1	1
	▪ Aut OFF 1: Automatic switching off enable when there is no aerial signal after 5'	1	1
	▪ BKS 1: Black Stretch enable	1	1
	▪ 1: Volume bar enabled	1	1
	▪ No Stby 1: the TV turns on without going into stand-by; 0: the TV turns on in stand-by	0	0
	▪ Lock 1: Programme lock enable	1	1
	Hotel 1: Hotel Mode (tuning disabled, volume limited)	0	0
Op4	Option Byte no.4	**16**	**16**

	▪ RGB All 0: RGB enabled only in AV1; ▪ 1: RGB enabled in all programmes	0	0
	NVM WP 1: NVM enables protection of memory in writing	1	1
	▪ VG-Check *(Not modifiable)*	1	1
	▪ MSP Curr. : 1 For TC B7-B8 (only if J5)	0	0
	▪ BLUE MUTE : 1 = Blue screen when there is no aerial signal and OSD enabled	1	1
	--		
Op5	Option Byte no.5	**00**	**00**
	▪ Sr Fact 1: Enables the fast "Factory service". Enter service by pressing the "**?**" on the remote	0	0
	▪ Sr NVM Rs 1: "INIT" with NVM loading with default values including channels; ▪ 0: loads default values without channels	0	0
	--		
	▪ Tx BS0 TXT Basic Set selection	0	0
	▪ Tx BS1 TXT Basic Set selection	0	0
	▪ Tx TS0 TXT 2nd Set selection	0	0
	▪ Tx TS1 TXT 2nd Set selection	0	0
	• Tx TEN TXT Swing character enable	0	0
Op6	Option Byte no.6	**00**	**00**
	▪ NOT0 TXT National Option Table selection	0	0
	▪ NOT1 TXT National Option Table selection	0	0
	▪ NOT2 TXT National Option Table selection	0	0
	▪ NOT3 TXT National Option Table selection	0	0
	▪ TC0 TXT National Option Group selection	0	0
	▪ TC1 TXT National Option Group selection	0	0
	▪ TC2 TXT National Option Group selection	0	0
	▪ EW TXT East-West Table selection	0	0
TSL	Start low band frequency in MHz	45	45

TEL	End low band frequency	160	160
TSM	Start medium band frequency	161	161
TEM	End medium band frequency	459	459
TSH	Start high band frequency	460	460
TEH	End high band frequency	870	870
TBL	Value necessary for tuning the low band	$A1_{hex}$	$A1_{hex}$
TBM	Value necessary for tuning the medium band	92_{hex}	92_{hex}
TBH	Value necessary for tuning the high band	34_{hex}	34_{hex}
STEP SIZES	-	0	0
STEP DELAYS	-	0	0
VOL MAX	Maximum value with TV in "Hotel Mode"	32	32
AUTO FM	For stereo TV only: error rate level to go to mono	80	80
INIT SWING	Initialisation with default data inside the UOC		

IMPORTANT: remember to disable the SR Fact register in Option Byte no. 5 forcing the value to 0 before the television leaves the factory or repairs lab.

Direct selection using the numbers from 0 to 9 on the remote:

<0>	AG	AGC intervention point
<1>	IF	IF Selection
<2>	VS	Vertical slope
<3>	EW16	East west amplitude 16:9
<4>	EW4	East west amplitude 4:3
<5>	WR	Amplification of the Red channel
<6>	Ys	Y-delay for SECAM
<7>	Op1	Option byte 1
<8>	TSL	Start low band frequency in MHz
<9>	INIT	NVM initialisation

14 – CHANNELS: CHANNELS IN EUROPE

OSD Num CH type	Frequency (MHz)	RF Channel	OSD Num CH type	Frequency (MHz)	RF Channel	OSD Num Type S	Frequency (MHz)	RF Channel
2	48,25	E02	21	471,25	21	1	105,25	S1
3	55,25	E03	22	479,25	22	2	112,25	S2
4	62,25	E04	23	487,25	23	3	119,25	S3
5	175,25	E05	24	495,25	24	4	126,25	S4
6	182,25	E06	25	503,25	25	5	133,25	S5
7	189,25	E07	26	511,25	26	6	140,25	S6
8	196,25	E08	27	519,25	27	7	147,25	S7
9	203,25	E09	28	527,25	28	8	154,25	S8
10	210,25	E10	29	535,25	29	9	161,25	S9
11	217,25	E11	30	543,25	30	10	168,25	S10
12	224,25	E12	31	551,25	31	11	231,25	S11
13	231,25		32	559,25	32	12	238,25	S12
14	238,25		33	567,25	33	13	245,25	S13
15	245,25		34	575,25	34	14	252,25	S14
16	252,25		35	583,25	35	15	259,25	S15
17	259,25		36	591,25	36	16	266,25	S16
18	447,25		37	599,25	37	17	273,25	S17
19	455,25		38	607,25	38	18	280,25	S18
20	463,25		39	615,25	39	19	287,25	S19
			40	623,25	40	20	294,25	S20
			41	631,25	41	21	303,25	S21
			42	639,25	42	22	311,25	S22
			43	647,25	43	23	319,25	S23
			44	655,25	44	24	327,25	S24
			45	663,25	45	25	335,25	S25
			46	671,25	46	26	343,25	S26
			47	679,25	47	27	351,25	S27
			48	687,25	48	28	359,25	S28
			49	695,25	49	29	367,25	S29
			50	703,25	50	30	375,25	S30
			51	711,25	51	31	383,25	S31
			52	719,25	52	32	391,25	S32
			53	727,25	53	33	399,25	S33
			54	735,25	54	34	407,25	S34
			55	743,25	55	35	415,25	S35
			56	751,25	56	36	423,25	S36
			57	759,25	57	37	431,25	S37
			58	767,25	58	38	439,25	S38
			59	775,25	59	39	447,25	S39
			60	783,25	60	40	455,25	S40
			61	791,25	61	41	463,25	S41
			62	799,25	62	42	69,25	X
			63	807,25	63	43	76,25	Y
			64	815,25	64	44	83,25	Z
			65	823,25	65	45	90,25	Z+1
			66	831,25	66	46	97,25	Z+2
			67	839,25	67			
			68	847,25	68			
			69	855,25	69			

CHANNELS IN ITALY

OSD Num CH type	Frequency (MHz)	RF Channel	OSD Num CH type	Frequency (MHz)	RF Channel	OSD Num Type S	Frequency (MHz)	RF Channel
2	48,25	E02	21	471,25	21	1	105,25	S1
3	55,25	E03	22	479,25	22	2	112,25	S2
4	62,25	E04	23	487,25	23	3	119,25	S3
5	175,25	E05	24	495,25	24	4	126,25	S4
6	182,25	E06	25	503,25	25	5	133,25	S5
7	189,25	E07	26	511,25	26	6	140,25	S6
8	196,25	E08	27	519,25	27	7	147,25	S7
9	203,25	E09	28	527,25	28	8	154,25	S8
10	210,25	E10	29	535,25	29	9	161,25	S9
11	217,25	ITALY H1	30	543,25	30	10	168,25	S10
12	224,25	ITALY H2	31	551,25	31	11	231,25	S11
13	53,75	ITALY A	32	559,25	32	12	238,25	S12
14	62,25	ITALY B	33	567,25	33	13	245,25	S13
15	82,25	ITALY C	34	575,25	34	14	252,25	S14
16	175,25	ITALY D	35	583,25	35	15	259,25	S15
17	183,75	ITALY E	36	591,25	36	16	266,25	S16
18	192,25	ITALY F	37	599,25	37	17	273,25	S17
19	200,25	ITALY G	38	607,25	38	18	280,25	S18
20	207,25	ITALY H	39	615,25	39	19	287,25	S19
			40	623,25	40	20	294,25	S20
			41	631,25	41	21	303,25	S21
			42	639,25	42	22	311,25	S22
			43	647,25	43	23	319,25	S23
			44	655,25	44	24	327,25	S24
			45	663,25	45	25	335,25	S25
			46	671,25	46	26	343,25	S26
			47	679,25	47	27	351,25	S27
			48	687,25	48	28	359,25	S28
			49	695,25	49	29	367,25	S29
			50	703,25	50	30	375,25	S30
			51	711,25	51	31	383,25	S31
			52	719,25	52	32	391,25	S32
			53	727,25	53	33	399,25	S33
			54	735,25	54	34	407,25	S34
			55	743,25	55	35	415,25	S35
			56	751,25	56	36	423,25	S36
			57	759,25	57	37	431,25	S37
			58	767,25	58	38	439,25	S38
			59	775,25	59	39	447,25	S39
			60	783,25	60	40	455,25	S40
			61	791,25	61	41	463,25	S41
			62	799,25	62	42	69,25	X
			63	807,25	63	43	76,25	Y
			64	815,25	64	44	83,25	Z
			65	823,25	65	45	90,25	Z+1
			66	831,25	66	46	97,25	Z+2
			67	839,25	67			
			68	847,25	68			
			69	855,25	69			

CHANNELS IN FRANCE

OSD Num CH type	Frequency (MHz)	RF Channel	OSD Num CH type	Frequency (MHz)	RF Channel	OSD Num Type S	Frequency (MHz)	RF Channel
1	47,75		21	471,25	21	1	116,75	S1
2	55,75	FB	22	479,25	22	2	128,75	S2
3	60,5	FC1	23	487,25	23	3	140,75	S3
4	63,75	FC	24	495,25	24	4	152,75	S4
5	176	F1	25	503,25	25	5	164,75	S5
6	184	F2	26	511,25	26	6	176,75	S6
7	192	F3	27	519,25	27	7	188,75	S7
8	200	F4	28	527,25	28	8	200,75	S8
9	208	F5	29	535,25	29	9	212,75	S9
10	216	F6	30	543,25	30	10	224,75	S10
11	224		31	551,25	31	11	236,75	S11
12	232		32	559,25	32	12	248,75	S12
13	240		33	567,25	33	13	260,75	S13
14	248		34	575,25	34	14	272,75	S14
15	256		35	583,25	35	15	284,75	S15
16	264		36	591,25	36	16	296,75	S16
17	272		37	599,25	37	17	303,25	S17
18	280		38	607,25	38	18	311,25	S18
19	288		39	615,25	39	19	319,25	S19
20	296		40	623,25	40	20	327,25	S20
			41	631,25	41	21	335,25	S21
			42	639,25	42	22	343,25	S22
			43	647,25	43	23	351,25	S23
			44	655,25	44	24	359,25	S24
			45	663,25	45	25	367,25	S25
			46	671,25	46	26	375,25	S26
			47	679,25	47	27	383,25	S27
			48	687,25	48	28	391,25	S28
			49	695,25	49	29	399,25	S29
			50	703,25	50	30	407,25	S30
			51	711,25	51	31	415,25	S31
			52	719,25	52	32	423,25	S32
			53	727,25	53	33	431,25	S33
			54	735,25	54	34	439,25	S34
			55	743,25	55	35	447,25	S35
			56	751,25	56	36	455,25	S36
			57	759,25	57	37	463,25	S37
			58	767,25	58			
			59	775,25	59			
			60	783,25	60			
			61	791,25	61			
			62	799,25	62			
			63	807,25	63			
			64	815,25	64			
			65	823,25	65			
			66	831,25	66			
			67	839,25	67			
			68	847,25	68			
			69	855,25	69			

OIRT CHANNELS

OSD Num CH type	Frequency (MHz)	RF Channel	OSD Num CH type	Frequency (MHz)	RF Channel	OSD Num Type S	Frequency (MHz)	RF Channel
1	49,75	R1	21	471,25	21	1	105,25	S1
2	59,25	R2	22	479,25	22	2	112,25	S2
3	77,25	R3	23	487,25	23	3	119,25	S3
4	85,25	R4	24	495,25	24	4	126,25	S4
5	93,25	R5	25	503,25	25	5	133,25	S5
6	175,25	R6	26	511,25	26	6	140,25	S6
7	183,25	R7	27	519,25	27	7	147,25	S7
8	191,25	R8	28	527,25	28	8	154,25	S8
9	199,25	R9	29	535,25	29	9	161,25	S9
10	207,25	R10	30	543,25	30	10	168,25	S10
11	215,25	R11	31	551,25	31	11	231,25	S11
12	223,25	R12	32	559,25	32	12	238,25	S12
13			33	567,25	33	13	245,25	S13
14			34	575,25	34	14	252,25	S14
15			35	583,25	35	15	259,25	S15
16			36	591,25	36	16	266,25	S16
17			37	599,25	37	17	273,25	S17
18			38	607,25	38	18	280,25	S18
19			39	615,25	39	19	287,25	S19
20			40	623,25	40	20	294,25	S20
			41	631,25	41	21	303,25	S21
			42	639,25	42	22	311,25	S22
			43	647,25	43	23	319,25	S23
			44	655,25	44	24	327,25	S24
			45	663,25	45	25	335,25	S25
			46	671,25	46	26	343,25	S26
			47	679,25	47	27	351,25	S27
			48	687,25	48	28	359,25	S28
			49	695,25	49	29	367,25	S29
			50	703,25	50	30	375,25	S30
			51	711,25	51	31	383,25	S31
			52	719,25	52	32	391,25	S32
			53	727,25	53	33	399,25	S33
			54	735,25	54	34	407,25	S34
			55	743,25	55	35	415,25	S35
			56	751,25	56	36	423,25	S36
			57	759,25	57	37	431,25	S37
			58	767,25	58	38	439,25	S38
			59	775,25	59	39	447,25	S39
			60	783,25	60	40	455,25	S40
			61	791,25	61	41	463,25	S41
			62	799,25	62	42	69,25	X
			63	807,25	63	43	76,25	Y
			64	815,25	64	44	83,25	Z
			65	823,25	65	45	90,25	Z+1
			66	831,25	66	46	97,25	Z+2
			67	839,25	67			
			68	847,25	68			
			69	855,25	69			