TATUNG K Series

General Information

Also Covers
Proline 1460R, 1460T.

Safety Precautions

SAFETY AND ISOLATION

1.1 General
Under no circumstances should any form of repair or maintenance be attempted by any person other than a competent technician or engineer. The following precautions should be observed:
For purposes of servicing, the chassis should be supplied from an isolation transformer of at least 150W rating.
1) If disturbed, the original lead dressing should be restored. In addition to safety, the position of the leads may also affect the EMC performance of the TV.
2) Components marked "!" on the circuit diagram are safety approved types and have special safety related characteristics. Only the manufacturers replacement components should be used. Replacement with alternative or 'up-rated' parts e.g. higher power resistors definitely does not guarantee the same level of protection and may create a fire, electric shock or X-radiation hazard.
3) Components not bearing the "!" mark should still be replaced with the originally fitted type and should be mounted in the same way.

1.2 The Isolation Barrier
To maintain barrier integrity care should be taken not to reduce any air gaps, e.g. by protruding wires, following component replacement.

1.3 Semiconductor Device Handling Precautions
The chassis contains devices which may be damaged by static electrical charge during handling. To avoid damage, soldering irons should be earthed and service engineers should ideally wear wrist straps earthed through a 1M resistor or at least discharge themselves to an earthed point.

SWITCHED MODE POWER SUPPLY

3.1 Summary
The power supply is a quasi-resonant flyback switching type based upon integrated circuit IC501 (KA3S0765), which contains a high voltage MOSFET with current mode control and protection circuitry. The operating frequency and pulse duty ratio vary according to load and input voltage conditions. The MOSFET switches the main primary winding of T501 across the rectified ac supply voltage stored in the reservoir capacitor C507. Output voltages are generated on secondary wind ings and are half-wave rectified and smoothed by separate diode/capacitor networks to produce DC voltages of +110V(B+), +15V, +17V (audio).

The +15V rail supplies, via series resistor R507, a 5V regulator (IC503) for microcontroller circuits. It also feeds the 12V regulator (IC504) and 8V regulator (IC505). The 8V regulator output then feeds a second 5V regulator (IC506).

3.2 Detailed Description
The ac mains supply is connected to XP502 and filtered by C501, T502 and C502. The degauss coil is connected to thermistor RT501 via XP503. At switch on, the positive coefficient thermistor is low resistance and a high current flows in the degauss coil. As the thermistor warms up, its resistance increases and the current is gradually reduced to almost zero. The filtered mains supply is full-wave rectified by diode bridge MD506, and filtered by C807 to produce a high DC voltage supply. An inrush limit is provided by RT502 which is a negative temperature coefficient thermistor.

At start-up of the power supply, C511 is charged via the start-up resistor R504 from the rectified ac supply. When the start-up voltage reaches 15V (typical), the control circuit within IC501 starts switching the internal MOSFET. When the PSU has started switching, current in the control IC increases to 12mA, which cannot be supplied via R504 alone. Supply to pin 3 of IC501 is then provided via D502 and C511 from a primary winding on T501. This winding is also used to charge the sync capacitor 0508 on pin 5 of IC501 (via D501/R503).

When the MOSFET is switched on, current flows through the primary of T501 (pin 8 to pin 4), to the internal drain terminal (IC501 pin 1) to power supply primary-side 0V. The MOSFET has an internal current sense, hence no external sensing resistors are required. The current in the primary circuit ramps up linearly from zero to a maximum value determined by the on-time control of the PWM controller, IC501. The transformer is now magnetised. When the MOSFET switches off, this stored energy is released into the secondaries as the induced voltage now reverses and current flows through each of the output rectifier diodes.

When all the energy has been discharged, the induced voltage across across T501 primary collapses and the cycle starts again. As the voltage collapses, the primary inductance of T501 rings with C513. This is used to implement quasi-resonant switching. C513 and T501 ring with a predetermined frequency which allows the timing of the switch-on of the next cycle to occur at the precise moment that the voltage is at a minimum. This reduces switching losses and EMI emissions.

Switching frequency varies with load and ac line voltage, which minimises display noise. The frequency is determined according to the charging and discharging of the sync circuit on IC501 pin 5.
The 110V B+ supply is maintained at a constant voltage regardless of load or input conditions (Note: All other secondary rails without secondary regulation will vary slightly). This is achieved by comparing an attenuated representation of the 110V rail to a reference voltage source Q501, and using this error signal to control IC501 on-time via opto-isolator IC502. As a consequence, the output voltage is kept stable. VR501 adjusts the level of attenuated voltage applied to Q501, and therefore indirectly controls the output voltage.

3.3 Standby Operation
When the chassis is in standby mode, pin 6 of microcontroller IC101 is low. This keeps Q508 off, which in turn leaves Q504 (tuning voltage supply switch) and Q502 (+15V supply switch) in the off state. In this condition, +5V is still supplied to the microcontroller from IC503, while it waits for the signal to come out of standby. +17V is still fed to the audio amplifier, IC901, although this is muted. +110V B+ is still fed to the flyback transformer, T601, although the horizontal drive is inoperative. Since Q502 is off, regulators IC504 (12V), IC505 (8V) and IC506 (5V) have no supply.

As the power supply load is much-reduced in standby, the MOSFET on-time is very short. The time available to charge the sync circuit on pin 5 is also short, thus the sync pin voltage does not reach its internal threshold (6.4V typical). IC501 begins to execute burst-mode operation, whereby it switches for a fixed interval and stops and repeats this intermittent switching, reducing switching losses which in turn reduce standby power.

Tuner and IF Stage
The One-Chip IC201 interfaces directly with the tuner and performs all picture and sound IF functions plus video, chroma, sync and deflection processing. The design as implemented passes the combined picture/sound IF signal from the tuner through a single SAW filter and demodulates the combined signal before separating the sound and picture signals (intercarrier sound method).
The main chassis is fitted with a voltage synthesis UHF tuner (for PAL system I). Control of the tuned frequency is achieved by a voltage on pin 2 of the tuner. This voltage is derived from integrating a 31V PWM switched waveform on Q104's collector. This PWM waveform is derived from pin 54 of the microcontroller IC101. AFC is accomplished by 120 communication between IC201 to IC101, the latter adjusting the duty cycle of its PWM output to correct the tuner frequency.

The IF output of the tuner has the picture carrier at 38.9MHz. This is fed to a SAW filter which allows picture and sound content to pass through to IC201's picture IF input (pins 6,7).
A VCO within IC201 is tuned with an LC circuit on pins 15,16 to run at 38.9MHz. This is used by a PLL synchronous demodulator to extract the baseband signal.
The IF amplifier output within IC201 is maintained at a constant level by an AGC system, and an AGC signal is fed from IC201 pin 8 to keep the tuner's output amplitude constant.
The signal extracted from the PLL contains video and audio. This signal goes to two paths:

i) it is presented on IC201 pin 13, then fed through sound-trap(s), Z201/2/3, to give a CVBS signal,
ii) it is taken internally via a sound bandpass circuit to the FM demodulator, which provides an FM mono output on pin 11.

SOURCE SELECTION

5.1 Video Switching
IC201 contains a video switch with three CVBS inputs. Video input is selected with the switch by 1^2C commands from IC101. The source can be selected as:

i) demodulated signal from tuner from IC201 pin 13 (after sound-trap), fed to pin 18,
ii) SCART socket pin 20, fed to IC201 pin 20,
iii) Front AV yellow phono socket, fed to 10201 pin 22.

There is a CVBS output (pin 44) which sends out whatever source is selected, which is used in this design by IC101 (pins 33, 34) for teletext decoding.
The internally demodulated CVBS on IC201 pin 13 is buffered by Q203 and made permanently available on the SCART socket pin 19.

5.2 Audio Switching
IC201 contains an audio switch which can select between internally demodulated audio or external audio (applied to pin 14). There are two sources of external audio: SCART and front AV. Left and right audio input pins on the SCART socket are summed by R221, R222 and then go, via XP5, to the front AV panel. ICA601 (74HC4053) is used to switch between audio from SCART (on ICA601 pin 13) or front AV (on ICA601 pin 12). The selecting signal comes from IC101 pin 9, which controls QA601, which in turn drives pin 11 of ICA601. The selected audio signal comes out on ICA601 pin 14 and goes to the main chassis via XP5, to IC201 pin 14.

5.3 AV Switching
Microcontroller IC 101 pin 8 is used to monitor SCART pin 8 voltage via potential divider R111, R109. If pin 8 of the SCART socket is seen to be high (≥6V) then the set switches its source to AV1, ready to display CVBS from the SCART socket.

5.4 RGB
External RGB signals from SCART pins 15, 11, 7 are fed directly to IC201 pins 27, 26, 25 respectively. Fast blanking from SCART pin 16 is fed to IC201 pin 28. If pin 8 of the SCART socket is high, AV1 mode is selected - if fast blanking is then active on SCART pin 16, this is detected by IC201 and external RGB will then be inserted into the picture automatically. External RGB is matrixed into YUV signals within IC201, hence colour and contrast controls are still operative.

COLOUR DECODER
The luma signal processing and colour decoding are implemented in IC201. An internal luma delay line compensates for the difference between luma and chroma processing times. There are no adjustments required on the colour decoder.

HORIZONTAL AND VERTICAL DEFLECTION

7.1 Auxiliary Scanning Supply Voltages
A flyback transformer is used to generate auxiliary scanning supply voltages: vertical power (+27V), video HT (+175V), CDT heaters (6.3Vrms after series resistor R5 on tube base panel), and the main EHT (23.5/25kV depending on CDT type).

7.2 Horizontal Deflection
Horizontal pulses are fed to the deflection stage from IC201 pin 48 to the horizontal drive transistor Q602. Under start-up conditions, Q602 is powered by the +15V rail via D603. Once the deflection stage is running, the +27V rail will take over via D602. T602 provides a low impedance drive to the deflection transistor Q601. When Q601 conducts, the B+ voltage is effectively placed across the horizontal deflection coil (C617 is charged up to this voltage). This causes current to ramp up through the deflection coil, creating the right-hand half of one horizontal scan line. When Q601 turns off, horizontal flyback takes place and the scan retraces. As the flyback pulse tries to go negative, the internal damper diode in Q602 starts to conduct, and in doing so draws current through the deflection coil which forms the left-hand half of the next scan line. As the scan current reaches zero, Q601 is turned on again by the horizontal drive to repeat the process.

Nominal amplitude of the flyback pulse is 900Vpp. The flyback time is 10.4µs. L601 and C617 are used for linearity correction. Horizontal flyback pulses are attenuated by R632 before being routed back to IC201 pin 49 (combined flyback input/super-sandcastle output).
Beam current information measured at the bottom of the FBT via R617 is fed to R325 then to IC201 pin 46 which provides beam current limit by restricting firstly contrast, then brightness. Also connected to R617 is R616 which goes to IC601 pin 7 to modify vertical scan amplitude in proportion to EHT to improve vertical picture regulation.

7.3 Vertical Deflection
IC201 provides a vertical output pulse which is fed to IC601 pin 3 via R601.
This IC has its own internal ramp generator, power amplifier and flyback generator to provide the required vertical scan current.
Vertical scan amplitude is determined by the dc level on IC601 pin 4 (height adjustment), which is fed from the vertical amplitude DAC on pin 46 of IC201, which in turn is controlled from microcontroller IC101 via the 1^2C bus. IC201 also controls the vertical scan position by varying its vertical pulse amplitude. This is rectified to a dc level by D609, C607 to drive Q902, which acts as an emitter-follower and imposes a voltage onto the inverting input of IC601's power amplifier (pin 9). This allows the dc level across the vertical scan coil to be changed.

TUBE BASE PANEL

8.1 Video Amplifiers
The low voltage red, blue and green video signals from IC201 are amplified to high voltage by discrete transistor cascode amplifier stages based around Q4, Q5, Q7, Q8, Q10, Q11.
Emitter followers Q6, Q9, Q12 then buffer each cascode stage output before driving the CDT cathodes.

8.2 Auto Grey Scale
The return path for the summed collector currents of Q6, Q9, Q12 is taken back to R324 on the main chassis so that the voltage across R324 can be sampled at pin 33 of IC201, as an indication of cathode current. During the vertical blanking period, IC201 sends out test pulses and measures each cathode cut-off current in turn, then measures the total leakage current. The results are used by IC201 to automatically adjust black current and video drive levels for each channel; thus black level beam current and black to white video drives are maintained.

AUDIO AMPLIFIER
The audio power stage, IC901 is a mono 5W amplifier. This is constrained to 1W into a 16 ohm speaker by the design. The amplifier is powered by the +17V rail. Muting of the amplifier in standby/switch-on is done by a signal from IC101 pin 4, which switches Q901 on. This pulls the threshold pin of IC901 down into its non-opererative region, which in turn causes muting by drastically dropping the impedance of the mute pin (pin 5), severely attenuating the input signal.

MICROCONTROLLER

10.1 Summary
The ST92195 microcontroller (IC101) is specifically designed for TV applications and has OSD and teletext decoder functions built-in. It requires a single 4MHz crystal, X101.
IC101 controls the television by serial (1^2C) bus communication, digital switching inputs and outputs, analogue-to-digital inputs and pulse-width-modulation (PWM) outputs.

10.2 Reset
The circuit around Q105 ensures that IC101's reset input, on pin 2, is held in the reset state (low) until the supply voltage exceeds approximately 4.7V. At this point Q105 turns on and pulls the reset pin high (normal operation).

10.3 User Control
Decoded signals from the infra-red receiver (Philips' RC5 protocol) come in on pin 1.
Three local control keys are connected to one ADC input. Depending on which key is pressed, a different dc voltage is measured on pin 56 (ADC input) due to the different values of R141, R142 and R143.

10.4 OSD/Teletext (if available)
The OSD RGB and fast-blanking outputs are available on pins 15-18. These are taken, with a potential divider in each line to reduce the level, to the OSD inputs on IC201. Synchronisation with the display is achieved by the horizontal and vertical-related signals applied on pins 40 and 41. CVBS for teletext decoding is fed in on pin 33, 34 at 1Vpp.

10.5 Non-Volatile Memory
IC102 is an 8k-bit non-volatile RAM. It stores configuration information, user settings and programme tuning records. It is accessed by the 1^2C bus.

11. REMOTE CONTROL

11.1 Infra-Red Transmitter
The hand unit is controlled by U1, type PT2211, surface-mounted on the keypad side of the PCB. A 455kHz ceramic resonator, Xl, governs the frequency of U1's oscillator. This is divided down internally (f/120) to give a 38kHz carrier onto which pulses are modulated.

11.2 Infra-Red Receiver
The chassis uses an integrated receiver, IC103, which provides a fully demodulated output to the microcontroller (IC101 pin 1).

Adjustments

12.1 General Information
In order to carry out alignment of the chassis the following are required : - Suitable r.f. signal source (Philips Complex Test Pattern or equivalent).
Multimeter to 1000V with an input impedance of no less than 10Mohms.
Oscilloscope with 1:100 and 1:10 probes (low capacitance).
Remote Control Hand Unit incorporating the Service' access key. 38.9MHz 50mV carrier source.
To enter the Service mode depress the Service key on the hand unit.
To select the parameter requiring adjustment, use the P+ / P- keys
To adjust the selected parameter use the + and − keys.
Note: Further parameters are accessed by

Recommended Safety Parts

Item	Part No.	Description
	5062690600	TRANSFORMER FLYBACK PET-22-08
	5051290019	CRT 14" A33LPE02X01 EKRANAS or
	5051290014	CRT 14" A34AGT13X27 CPT
	5060191403	DEGAUSSING COIL

TATUNG K Series

Adjustments Cont'd

depressing the OK key whilst in 'Service' mode. After adjustment is completed, the parameter is automatically stored.

Table 1 - Service Parameters

Parameter	Default	Value
Tuner A.G.C.	37	50
Red gain	32	38
Red cut-off	32	32
Green gain	32	38
Green cut-off	32	32
Blue gain	32	38
H Position	32	32
VPOS 50	07	07
VPOS 60	15	08
VAMP 50	31	31
VAMP 60	00	48
VCO Coarse	00	05
VCO Fine	080	094
VCO Coarse L1	05	05
VCO Fine L1	080	080

Table 2 - Extended Service Default Parameters
(Selected by the OK key on the hand unit when in the 'Service' mode).

Parameter	Default	Value
A.G.C. Gain	00	01
Misc 1	00	02
Misc 2	00	00
Misc 3	00	00
HPOS OSD	048	09
VPOS OSD	07	01
HPOS TXT *	032	046
HVPOS TXT *	07	05
VHF / UHF	VHF	U.H.F.

* Teletext models only

12.2 H.T. Setting
The H.T. should be set by adjusting VR501 (see fig 1) to obtain 107V +/- 0.5V HT supply at C514 + which results in a nominal display width.

12.3 A1 Setting
The A1 should be set by monitoring with the oscilloscope and 1:100 probe on the 'Blue' cathode (R23 on the tube base panel). Observe the 'black level' of the video signal (normally visible immediately before and after the blanking pulse) and adjust the A1 so that the black level is 120 volts.

12.4 White levels
An approximate setting of the white levels can be achieved by monitoring the red, green, and blue cathode outputs in turn on the tube base panel and adjusting the relevant parameter in the Service mode to achieve 50 volts black-to-white amplitude. Ensure that the waveform on the oscilloscope is displaying both black and white level signals (an ideal signal for this test is colour bars with colour adjustment set to minimum).

12.5 A.F.C.
Remove any R.F. signal source and prevent any stray signal source from entering the tuner by shorting the tuner input inner contact to the outer screen. Inject the 38.9MHz. carrier into the tuner output pin (pin 11). Select service mode 'VCO Fine' and adjust until the A.F.C. status bar is central in the scale (white). If this cannot be achieved adjust the 'VCO Coarse' (adjust higher if the bar is to the left of centre and adjust lower if the bar is to the right of centre). Then adjust 'VCO Fine' as previously described. When correct 'Ok' will appear alongside the AFC status bar.

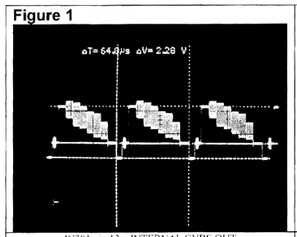
12.6 A.G.C.
The A.G.C. should be adjusted by measuring the tuner R.F. output signal envelope amplitude (pin 11) with the oscilloscope and 1:10 probe. This test may require the use of the 1:100 probe to source an H sync. signal, for example by connecting to the insulation of one of the H scan coil leads. In service mode adjust the A.G.C. parameter so that the sync. voltage measures 500mV peak to peak (approx. 50).

12.7 Focus
Adjust the upper control on the F.B.T (T601) to achieve the best resolution.

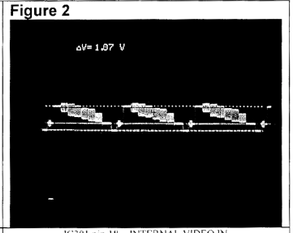
12.8 Geometry
For horizontal size (width) see H.T. setting above.
To adjust the picture position and vertical size, select the appropriate parameter in service mode and adjust as necessary.

12.9 Extended Service Parameters
Select this mode by depressing the OK key on the hand unit and ensure that the values are as shown in Table 2.

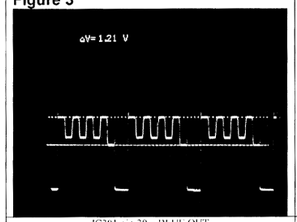
Waveforms

Figure 1


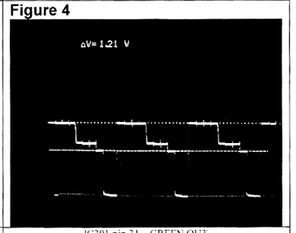
IC301 pin 13 – INTERNAL CVBS OUT

Figure 2


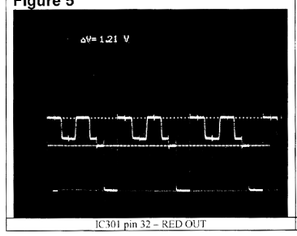
IC301 pin 18 – INTERNAL VIDEO IN

Figure 3


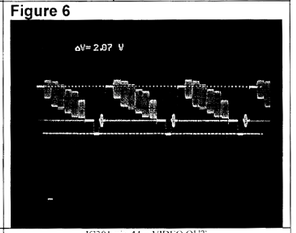
IC301 pin 30 – BLUE OUT

Figure 4


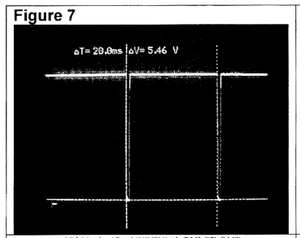
IC301 pin 31 – GREEN OUT

Figure 5


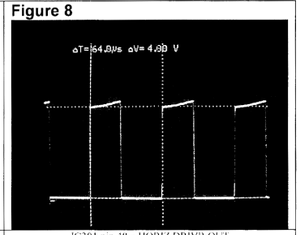
IC301 pin 32 – RED OUT

Figure 6


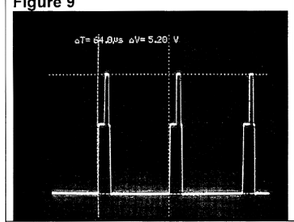
IC301 pin 44 – VIDEO OUT

Figure 7


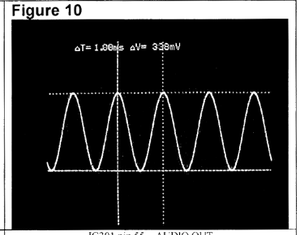
IC301 pin 47 – VERTICAL PULSE OUT

Figure 8


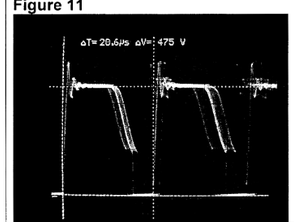
IC301 pin 48 – HORIZ DRIVR OUT

Figure 9


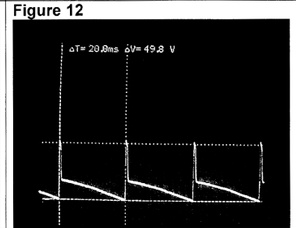
IC301 pin 49 – HORIZ FEEDBACK / SANDCASTLE PULSE

Figure 10


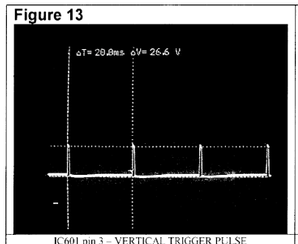
IC301 pin 55 – AUDIO OUT

Figure 11


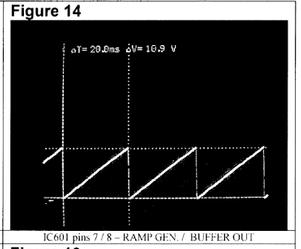
IC501 pin 1 – PSU DRIVE OUTPUT
(ref. PSU 0 volts)

Figure 12


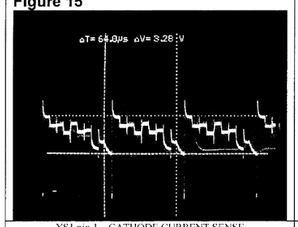
IC601 pin 1 – VERTICAL OUTPUT

Figure 13


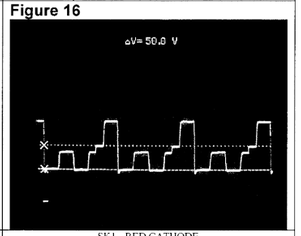
IC601 pin 3 – VERTICAL TRIGGER PULSE

Figure 14


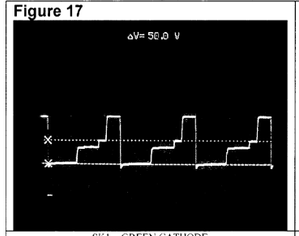
IC601 pins 7 / 8 – RAMP GEN. / BUFFER OUT

Figure 15


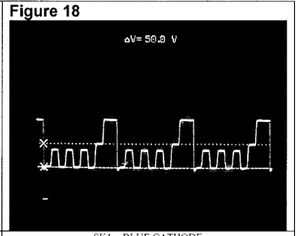
XS1 pin 1 – CATHODE CURRENT SENSE

Figure 16


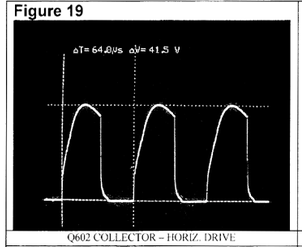
SK1 - RED CATHODE

Figure 17


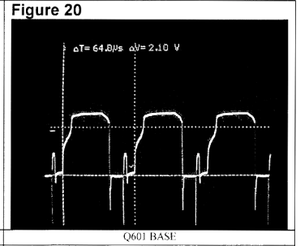
SK1 – GREEN CATHODE

Figure 18


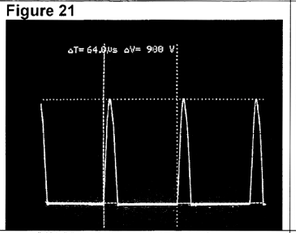
SK1 – BLUE CATHODE

Figure 19


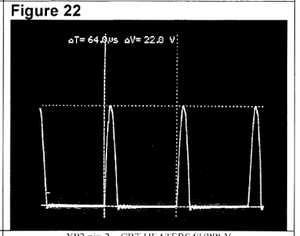
Q602 COLLECTOR – HORIZ. DRIVE

Figure 20


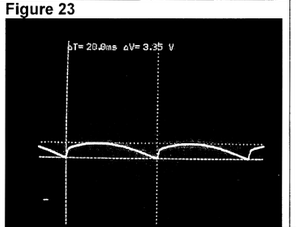
Q601 BASE

Figure 21


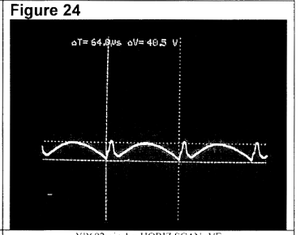
Q601 COLLECTOR - HORIZ. FLYBACK PULSE

Figure 22


XP2 pin 2 - CRT HEATERS SUPPLY

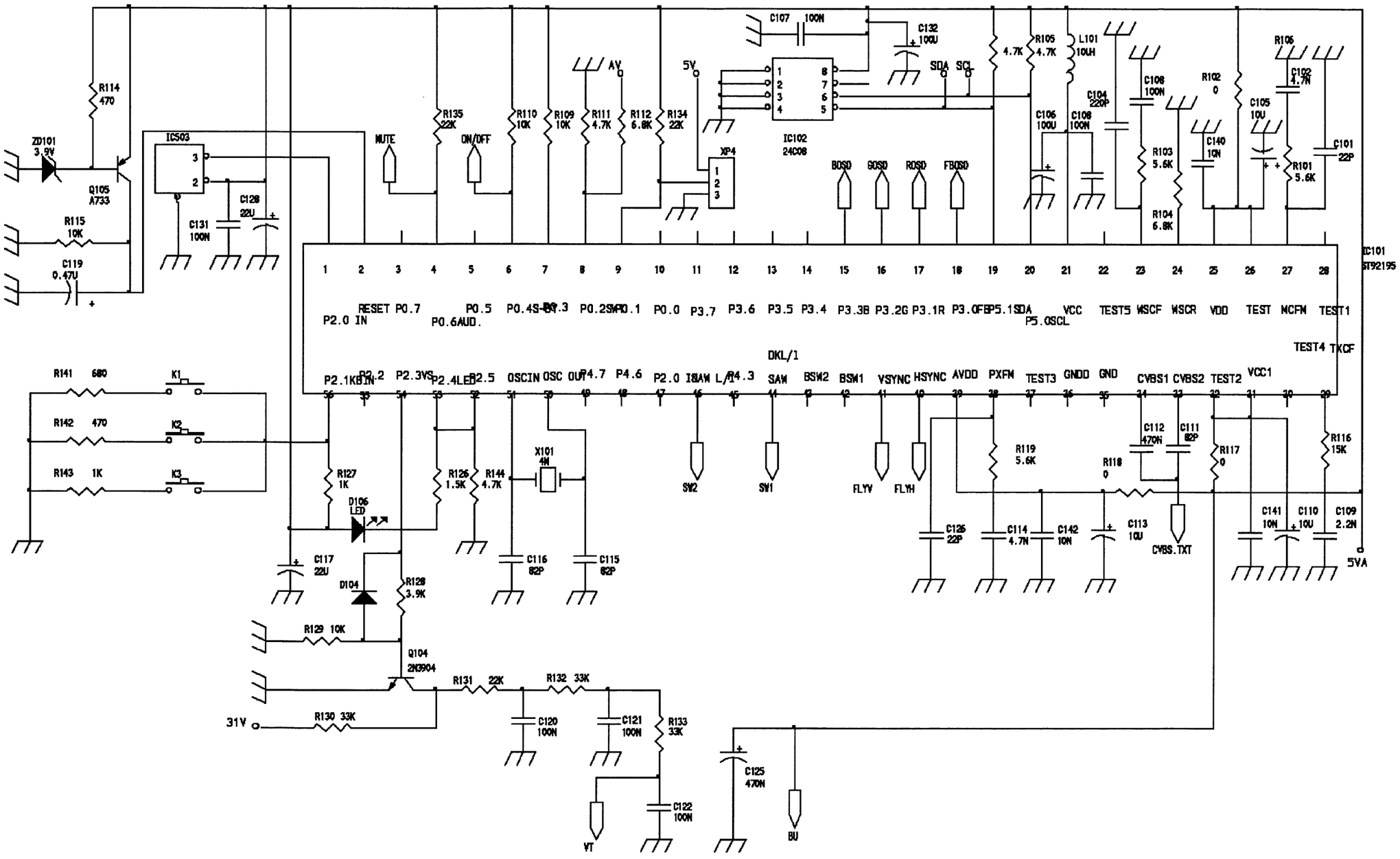
Figure 23


XP601 pin 1 – VERT SCAN -VE

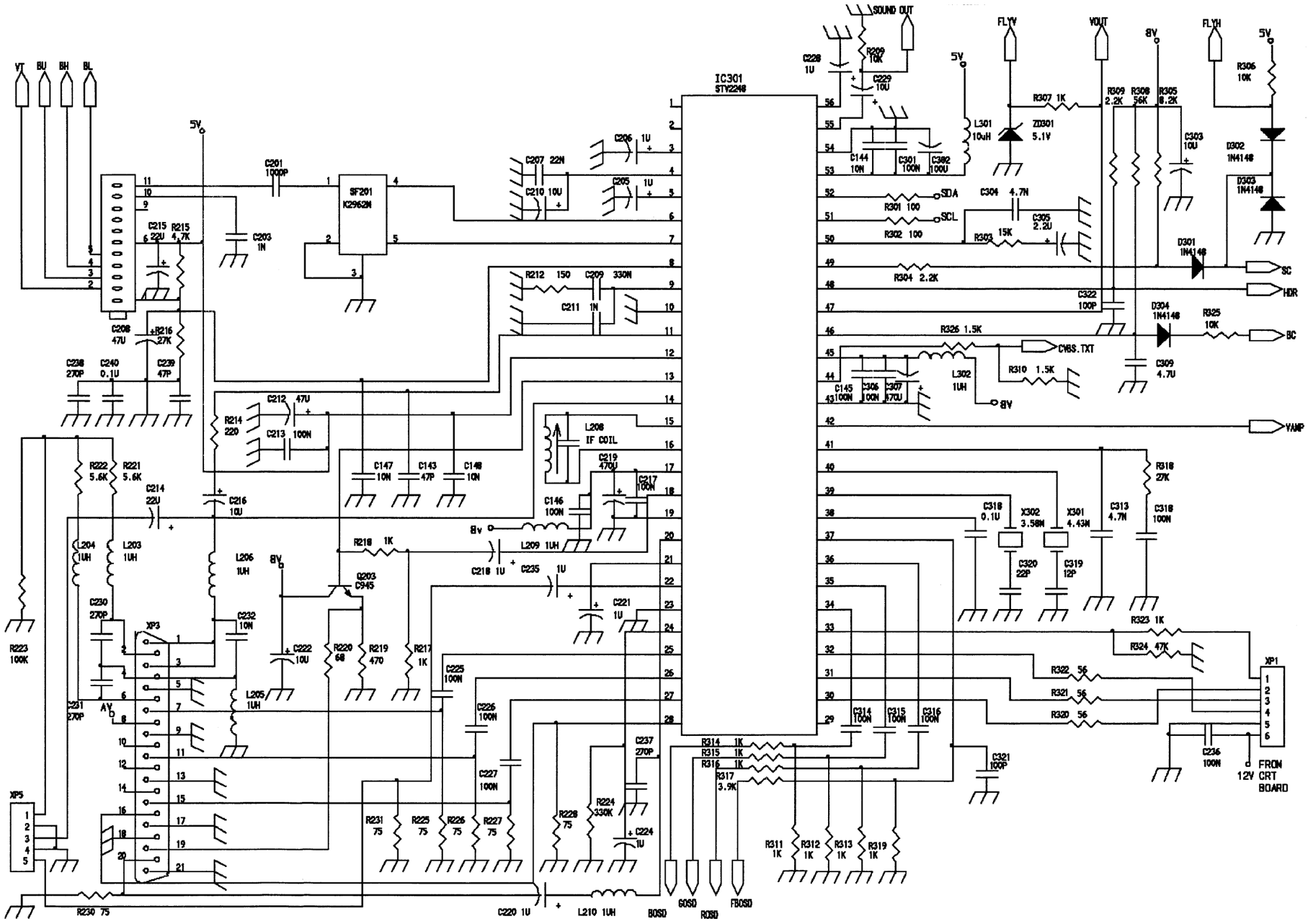
Figure 24


XP602 pin 1 – HORIZ SCAN -VE

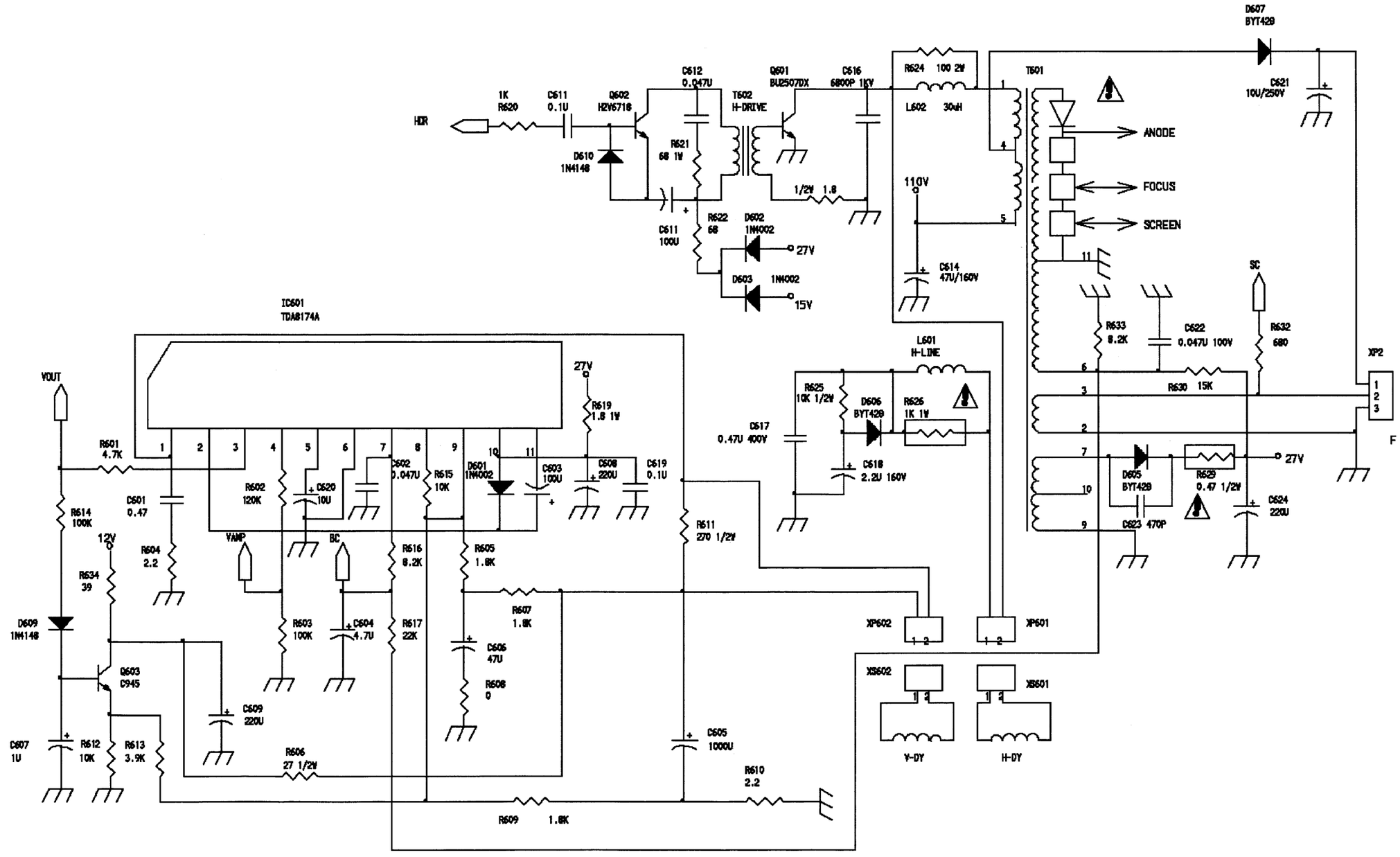
CPU Diagram


R114 470
ZD101 3.9V
Q105 A733
R115 10K
C119 0.47U
IC503
C131 100N
C128 22U
MUTE
ON/OFF
R135 22K
R110 10K
R109 10K
R111 4.7K
R112 6.8K
R134 22K
AV
5V
XP4
C107 100N
C132 10U
IC102 24C08
SDA
SCL
BOSD
GOSD
ROSD
FBOSD
4.7K
R105 4.7K
L101 10UH
C106 100U
C108 100N
C104 220P
R103 5.6K
R104 6.8K
C108 100N
R102 0
C140 10N
C105 10U
R106
C102 4.7N
R101 5.6K
C101 22P
IC101 ST92195
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
P2.0 IN RESET P0.7 P0.6AUD. P0.5 P0.4S-BOY.3 P0.2SWP0.1 P0.0 P3.7 P3.6 P3.5 P3.4 P3.3B P3.2G P3.1R P3.0FBP5.1SDA P5.0SCL VCC TEST5 WSCF WSCR VDD TEST MCPN TEST1 TEST4 TKCF
DKL/1
P2.1KBIN P2.2 P2.3VS P2.4LED P2.5 OSCIN OSC OUT P4.7 P4.6 P2.0 I2AW L/P4.3 SAW BSW2 BSW1 VSYNC HSYNC AVDD PXFM TEST3 GNDD GND CVBS1 CVBS2 TEST2 VCC1
56 55 54 53 52 51 50 49 48 47 46 45 44 43 42 41 40 39 38 37 36 35 34 33 32 31 30 29
R141 680
R142 470
R143 1K
K1
K2
K3
R127 1K
D106 LED
R126 1.5K
R144 4.7K
X101 4M
SW2
SW1
FLYV
FLYH
R119 5.6K
R118 0
C112 470N
C111 82P
R117 0
R116 15K
C125 22P
C114 4.7N
C142 10N
C113 10U
CVBS.TXT
C141 10N
C110 10U
C109 2.2N
5VA
C117 22U
D104
R128 3.9K
C116 82P
C115 82P
R129 10K
Q104 2N3904
R131 22K
R132 33K
R130 33K
31V
C120 100N
C121 100N
R133 33K
C122 100N
VT
C125 470N
BU

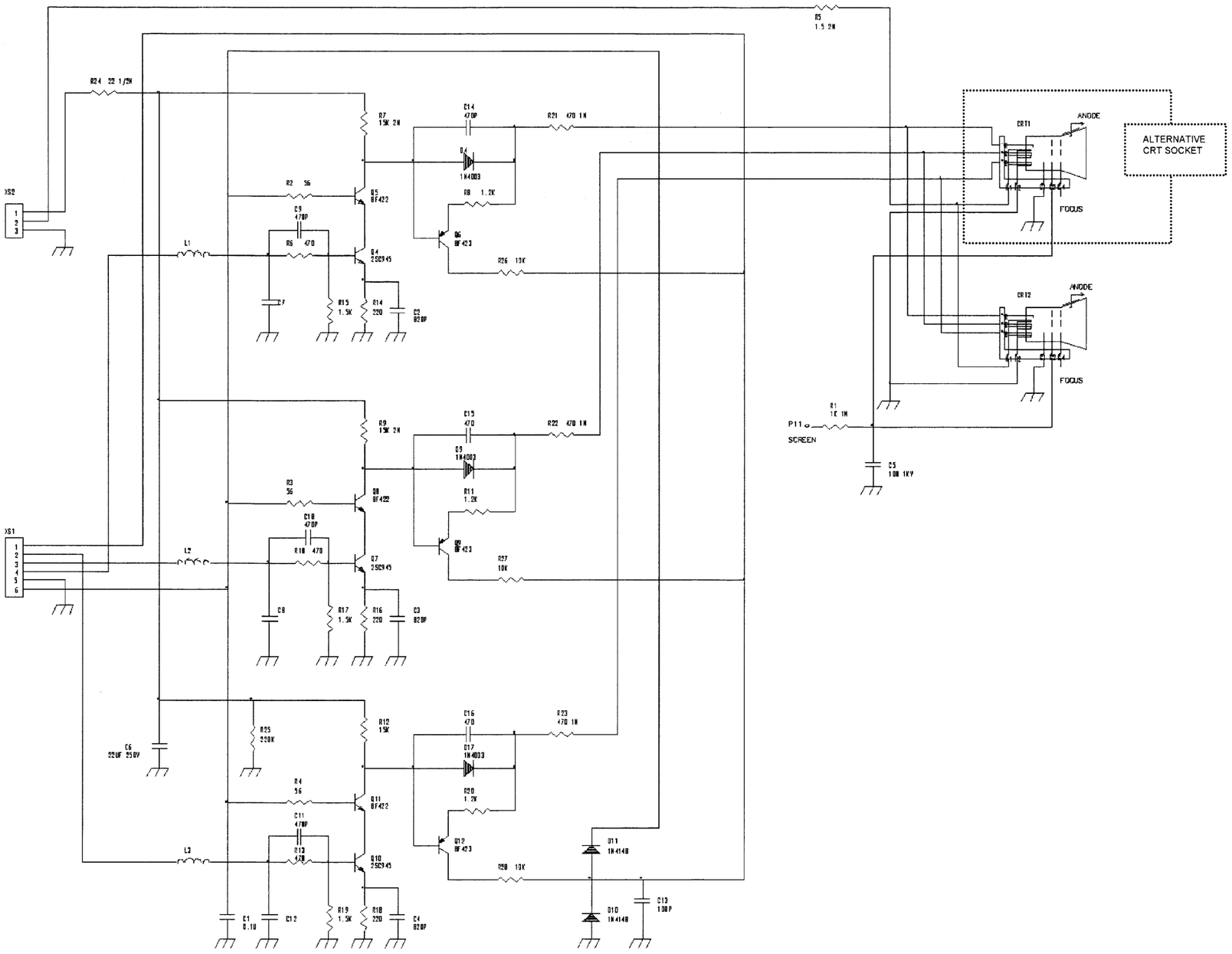
IF Signal Processing Diagram



EHT Deflection Diagram

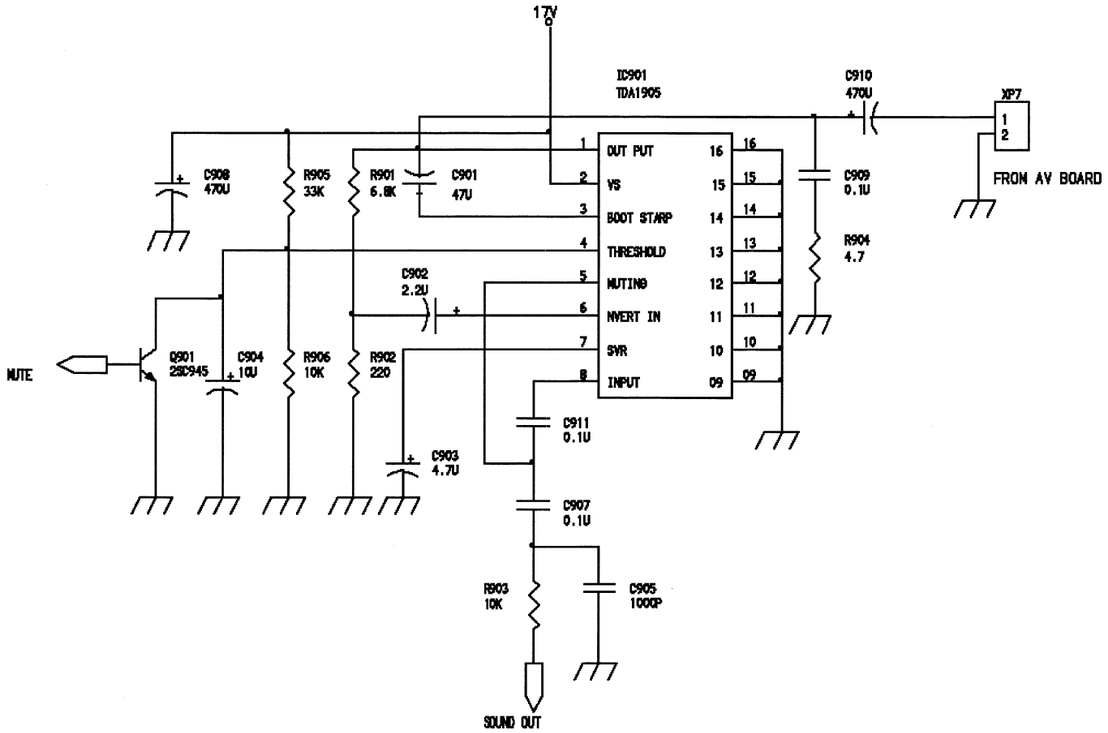


Tube Base Diagram

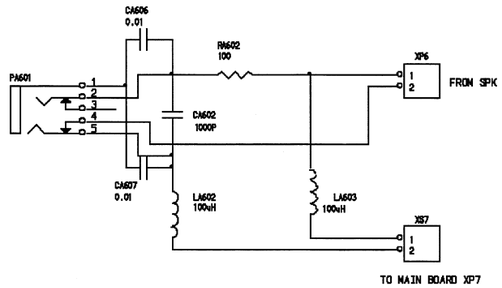


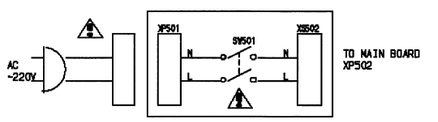
TATUNG K Series

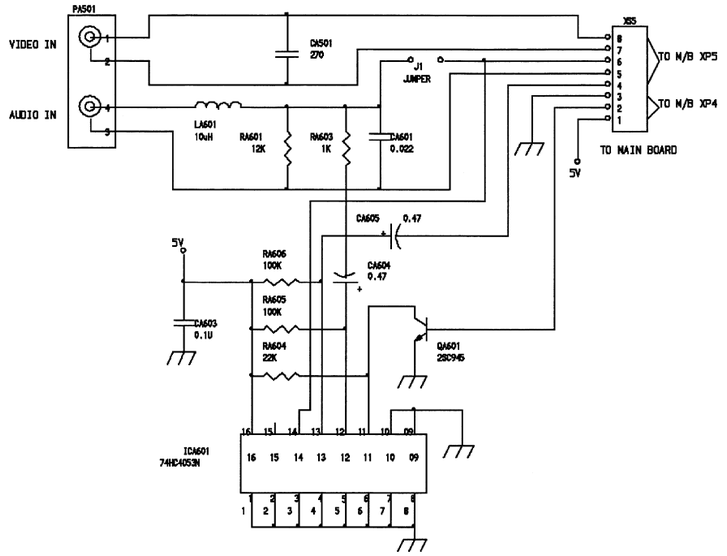
Audio Amp Diagram



Power Switch AV Diagram







Power Supply Diagram