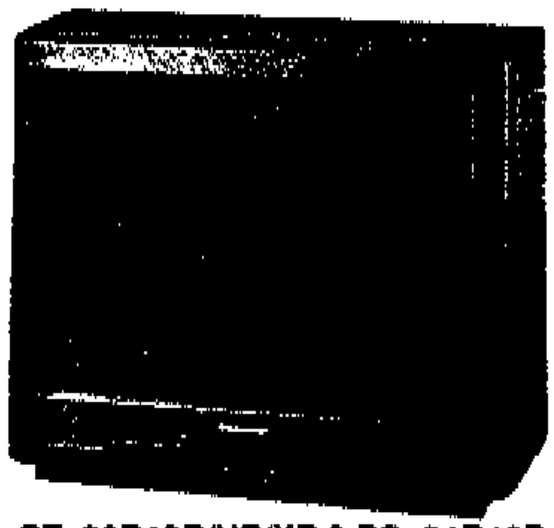
Service Manual

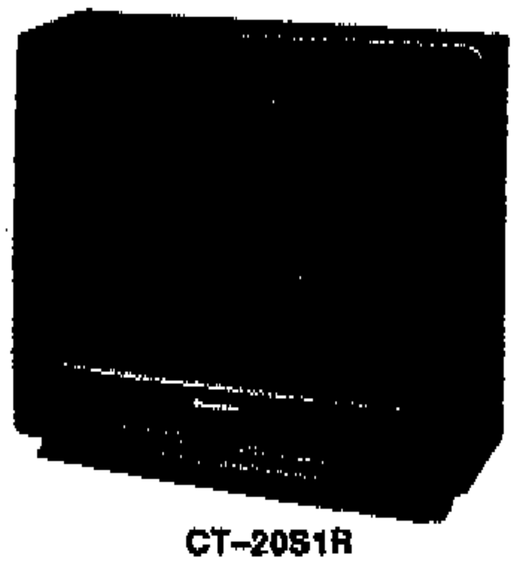


CT–20R10R/HR/XR & PC–21R10R

Color Television
Panasonic (Non Stereo 1.5W)

Model	Chassis
CT–20R10R	ALDP229
CT–20R10HR	AMDP229
CT–20R10XR	AXLDP229
PC–21R10R	YALDP229

NOTE:
Models CT–20R10HR/XR are identical to CT–20R10R except for the magnetic field used in the factory to adjust purity and convergence for different markets.



CT–20S1R

CT–20S10R & PC–21S10R

Panasonic (Stereo 1.5W)

Model	Chassis
CT–20S1R	AEDP229
CT–20S10R	ALEDP229
PC–21S10R	YALEDP229

SP2015J & QC–21S15J

Quasar (Stereo 1.5W)

Model	Chassis
SP2015J	AMEDC229
QC–21S15J	YAMEDC229

(NA3A)

CT–20S15R/LR/PR, CT–20S20R & PC–21XF20R

Panasonic (Stereo 3.5W)

Model	Chassis
CT–20S15R	ALEDP227
CT–20S15LR	ALEDP227
CT–20S15PR	ALEDP227
CT–20S20R	AEDP227
PC–21XF20R	YALEDP227

NOTE:
Models CT–20S15LR/PR are identical to CT–20S15R except for the magnetic field used in the factory to adjust purity and convergence for different markets.

(NA3)

Main Manual

Table of Contents

Followed by 4 Large Separate Pullout Schematic Sheets with All Schematics, Waveforms, Notes, Voltage Charts and Printed Wiring Boards.

Quick Reference Control Operation (Receiver)

(1) **Power Button** – Press to turn ON or OFF.

(2) **Volume Buttons** – Press to adjust sound level.

(3) **Channel Buttons** – Press to select programmed channels.

(4) **Action Button** – Press to display Main Menu and access On Screen feature and Adjustment Menus.

(5) **TV/Video Button** – Press to select TV or any of the Video Inputs.

(17) **TV Speakers Button (In Stereo 1.5W Models)** – Use this button to turn internal speakers ON or OFF when connected to an audio amplifier.

(18) **Earphone Jack (In Non Stereo Models)** – Plug in an optional earphone for private minitoring of sound.

Panasonic
Technics
Quasar

Matsushita Electric
of Canada Limited
5770 Ambler Drive
Mississauga ON L4W 2T3

January 18, 1994

TECHNICAL BULLETIN #PB94-05

TO: All Panasonic CTV Servicentres

FROM: Technical Support / Product Support Division

SUBJECT: **POWER SUPPLY - GL7C SERIES CHASSIS**

AFFECTED MODELS:

CHASSIS #	GL7C	GL7C1	GL7C5
MODEL #	PC-29S90S	PC-29T91S/99S	PC-29V91S
	PC-33S90S	PC-33T82S/86S	PC-33V86S
	PC-33S98S	PC-33T91S/97S	PC-33V92S

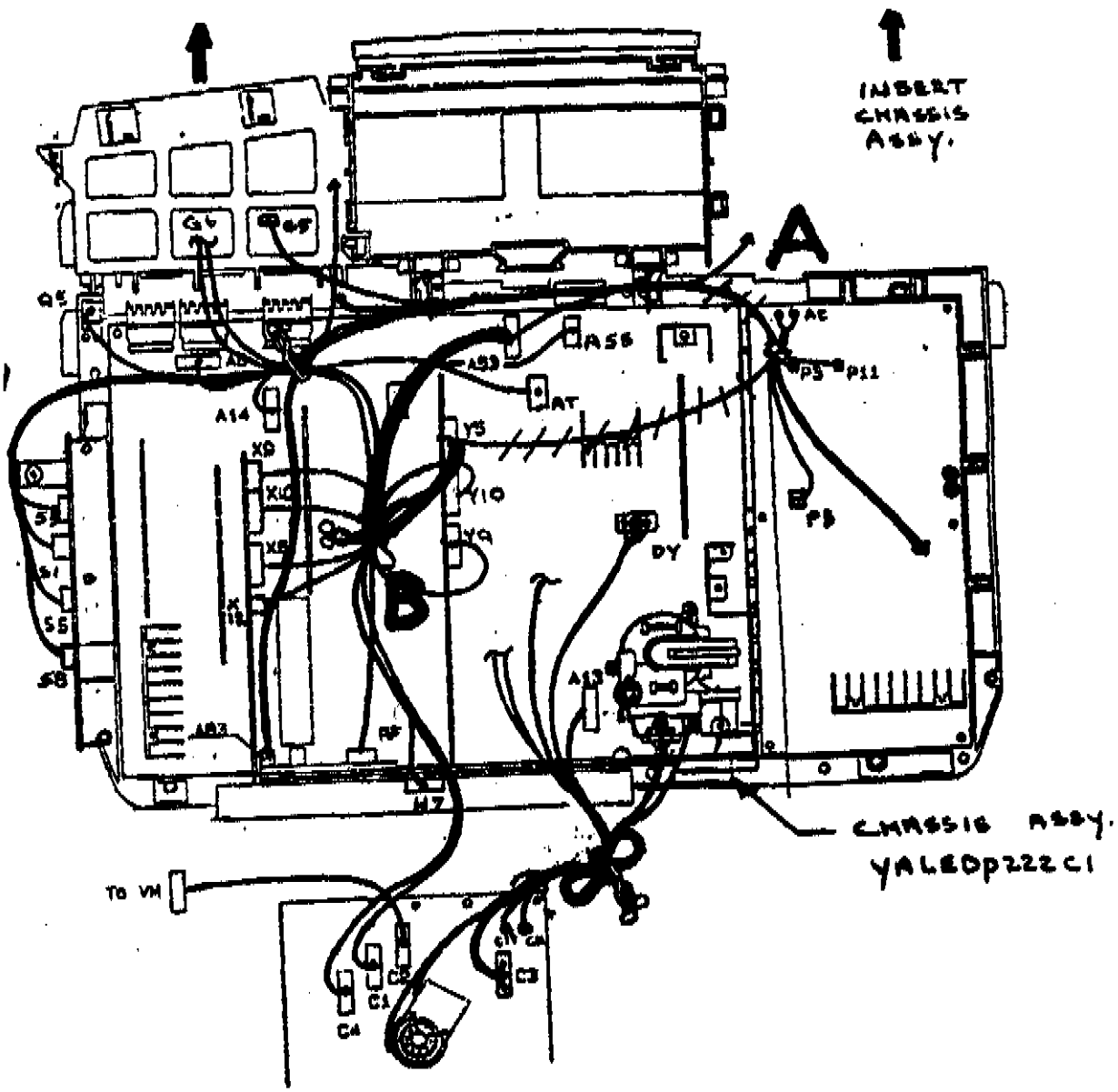
The power supply section of the GL7C series television chassis represents, at the very best, a challenge to those who service it.

We have written this guide in response to requests from the field for help in functionally understanding the power supply, as well as, how to successfully service it.

Please use this information in conjunction with the instruction sheets supplied with the service kit, **Part Number TXANE011SER1**, and the appropriate service manual.

We hope that the guide will prove to be helpful in your servicing activity for these sets.

Our thanks to Roman Jemielity, TFS, for his input.


INSERT CHASSIS Assy.
A
B
CHASSIS Assy.
YALEDp222C1
TO VM
A14
A13
A12
A11
A10
A9
A8
A7
A6
A5
A4
A3
A2
A1
AE
AT
DY
P3
P11
P8
C1
C2
C3
C4
C5
C6

CIRCUIT DESCRIPTION

BASIC OPERATION:

Starting bias current is applied to IC801 (Q1) by R803. Q1 begins operating in its linear region and current flows through the primary winding of T801 and R815 to hot circuit common. The flux produced by the primary is felt by the control winding due to mutual inductance.
Because of the phasing relationship between the primary and control windings of T801, the B1 terminal of the control winding has a positive potential (it is a current source) with respect to B2. C815 then charges allowing additional current to flow into the base of Q1 via R805.
As the magnetic field about the primary winding collapses, current flow through the winding rises becoming maximum and Q1 reaches saturation. Due to the loss of mutual inductance, B1 is no longer a source of current and Q1 comes out of saturation. We now have a reduction (change) in current flow through the primary winding which produces flux in the opposite direction. The B1 terminal now has a negative potential with respect to the B2 terminal and it becomes a current sink. C815 then charges in the opposite direction. Current from R803 is now drawn by C815 and not by the base of Q1. Q1 quickly goes to cut-off and a large field of flux (flyback) is developed.
During this "flyback" time, the energy produced by the primary winding is transferred via the secondary windings, switching diodes D811, D813, D815 and D812 to capacitors C818, C821, C825 and C826. The loads in turn, draw their power from the capacitors.
The process then repeats itself.

The operating rate (frequency) of the power supply is a function of the reactance of the B or control winding and the value of C815. Since the reactance of the B winding changes with load demand, the rate of the supply will change.

KEY COMPONENT FUNCTIONS:

IC801:

Q1 is the main switching transistor. It operates in two modes: cut-off and saturation.
Q2 is a shunt or by-pass for the drive current input to the base of Q1. By controlling the current flow out of pin 1 of IC801, we regulate the power transfer in the supply.
Q3 is an overload detector. If current through R815 increases to overload proportions, Q3 will conduct to remove drive from Q1 via Q2.

IC804:

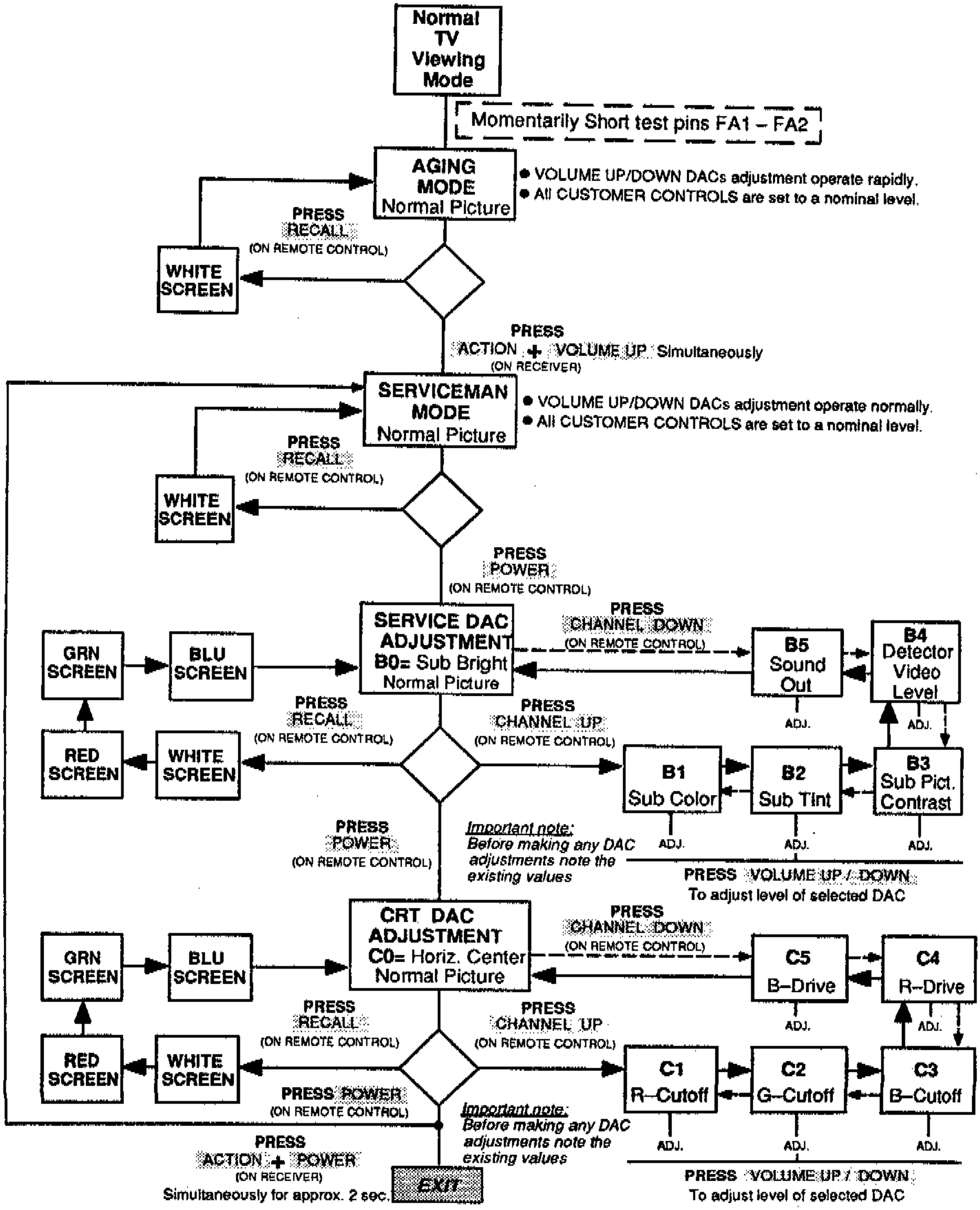
The zener diode (zd) sets the operating potential at the emitter of Q1. Rz sets the zener current. Ra and Rb form a potential divider to set the operating point of Q1 when the 116v rail is at it's nominal value of 116 volts dc.

If load demand decreases, the rail will attempt to go more positive in potential. Q1 will conduct harder (its collector - emitter resistance will decrease). This causes higher current through the LED in IC806, resulting in more light production. This in turn reduces the resistance of the photo transistor. More current is pulled from pin 1 of IC801 and power transfer in the supply will be reduced.
If load demand increases, the opposite effect occurs.

IC806:

Electrically isolates the cold common circuit from the line-operated hot common circuit.
The voltage sensed error signal generated by IC804 is coupled to IC801 via IC806.

SERVICEMAN MODE



Receiver shuts off; then turns on, TUNED TO CHANNEL 3 WITH A PRESET LEVEL OF SOUND.
Note: This will also erase any Programmed Channels, Channels Caption data and some other user defined items.

KEY COMPONENT FUNCTIONS:

Q801:

This switch is used to control the timing of the discharge of C816. Because of the high power demand of the loads, Q1 requires higher drive current that C815/R805 can provide.

Q802:

Is a switch that operates as an over-voltage protector.

If the 16 volt rail increases to a value greater than 20 volts dc, zener diode D827 will conduct, in turn causing Q802 to saturate.

The supply will shut down as all drive is removed from IC801 (Q1). Q802 will then go to cut-off (when C830 discharges) and the sequence will repeat until the over-voltage condition is corrected.

D806 & C807:

Form a sample and hold circuit. When the B1 terminal of T801 goes (-) with respect to the B2 terminal, C807 will charge to a net negative value with respect to hot circuit common. The net charge potential (in volts) will be indirectly proportional to the load demand, and will in turn control the regulation of power transfer on an average basis by changing the bias of the photo-transistor in IC806.

(The LED controls the transistor to provide regulation on a shorter term transient basis).

D808 & D817:

When the B1 terminal of T801 goes (-) with respect to B2 terminal, C816 will charge via D808 and D817. When B1 terminal goes (+), the capacitor will discharge into pin 2 of IC801 when Q801 switches on. R808 is the current source for discharge of C816.

D816:

Is a 200 volt zener diode used as a "crowbar" or fail safe protector.

If feedback regulation fails, the supply will "run away" causing severe damage to the loads. Incoming hydro line transients can cause equally severe damage.

In the above 2 situations, D816 will avalanche to protect the set.

D818 & D819:

Form an OR gate to source power to the LED portion of IC806. D819 is normally conducting and D818 is reverse biased. If the 24 volt rail fails or is overloaded, D818 will conduct as a "back-up" source. If both rails fail (unlikely), D816 will avalanche to protect the loads from over-voltage damage.

Service Adjustments (Mechanical Controls)

RF AFC Delay R106

Adjust only if overloading on strong signal or busy background (snow) is present on moderate strength signals.

1. Adjust RF AGC control R106 until snow appears in picture, then adjust control until snow is eliminated.
2. Check all channels for optimum setting.

AFC Field Adjustment L103

1. Select TV signal mode with Menu.
2. Defeat AFC by applying jumper from TPS7 (R063) to ground (⏚).
3. Connect a digital voltmeter to AFC test point TP16.
4. Use Remote Control to Check all active High Band channels 7~13 for AFC voltage range. Select channel with AFC voltage in approximate center of voltage range.
5. Adjust L103 for 4.6V ±0.1V at TP16.
6. Check all active channels for proper AFC correction. Touch up L103 if required. Remove jumper in step 2.

NOTE: Do not use TV/CABLE channel with offset carriers for adjustment or in determination of low and high range of AFC voltage.

Sound Alignment L201

1. Select active TV channel.
2. Attenuate signal (loosely couple antenna lead or use RF attenuator pad) for noisy sound.
   - Adjust L201 for maximum sound. Signal to noise ratio is best when L201 is peaked.
3. Connect antenna or remove RF attenuator for strong signal.

Comb Filter Adjustment – R3215 and L3202 (X–Board in some sets)

1. Connect an NTSC color bar generator (not rainbow generator) to video Input.
2. Normalize Picture Menu Video Adjustments. Then adjust SHARPNESS to Max. and COLOR to Min.
3. Connect an oscilloscope to any of the following: Connector A3 pin 5 (A–Board), TP47G (CRT–Board) or TP35 (CRT–Board).
4. Set oscilloscope sweep rate to view color burst signal on horizontal sync pulse.
5. Set BALANCE control R3215 fully clockwise. Burst amplitude should increase making it more visible.
6. Adjust phase coil L3202 for Minimum burst amplitude.
7. Re–adjust BALANCE control R3215 for Minimum burst amplitude.
8. Repeat procedure steps 6 & 7.

Vertical Size R453

1. Turn VERTICAL SIZE control R453 CCW until top and bottom edges of raster are visible.
2. Adjust VERTICAL SIZE control CW until top and bottom of raster touch bezel edge. Advance SIZE control CW an additional 30 degrees. This will be approximately 10% overscan. Linearity adjustment is automatic with size adjustment.

Focus (Part of T551)

Preparation

1. Connect Signal generator and select dot pattern.

Procedure

1. Adjust the FOCUS control to obtain the sharpest and clearest dot pattern.
   (a) adjust for best center
   (b) adjust for best area between center and top right corner.

MPU Reference Oscillator C031

Preparation

1. Connect frequency counter from TPS1 (IC001 pin 25) to cold ground (⏚) .

NOTE: Frequency counter probe capacitance should be 8PF or less.

Procedure

1. Turn Receiver "OFF" with AC power applied.
2. Adjust trimmer capacitor C031 for 5461.333µsec ±.033µsec (12MHz ±72Hz).

SERVICING THE GL7C POWER SUPPLY

EQUIPMENT NEEDED:

(1) Isolation Transformer
(2) Variac
(3) AC Voltmeter
(4) AC Ammeter
(5) DVM
(6) Oscilloscope

PREPARATION:

(1) Be certain that D452 has been removed. If it has not, remove and discard it at this time. **DO NOT REPLACE THIS DIODE!**

(2) Refering to the service manual schematic diagram, measure the resistance of all power supply rails with respect to cold circuit common as follows:

B+ RAIL	CHECK POINT	MIN. RESISTANCE
+116v or +124v	TPA86	25 Kohm or greater
+30v	TPA85	20 Kohm or greater
+24v	TPA83	8 Kohm or greater
+16v	TPA84	220 ohm or greater

Performing these checks will help you determine if supply failure was due to overload. If any rail exhibits very low resistance or reads shorted, you must determine what is wrong before applying power to the loads.

For example:

(a) If Q551 or D816 short, the +116 volt rail will read 1/2 to 1 ohm at TPA86.

(b) If IC451 (Vert O/P) shorts, the +24 volt rail will read 0 ohm.

(c) If IC2301 (Audio Out) shorts, the +30 volt rail will read 0 ohm.

NOTE: You must replace any failed components such as these before troubleshooting the power supply. If you don't, they will overload and damage the supply again.

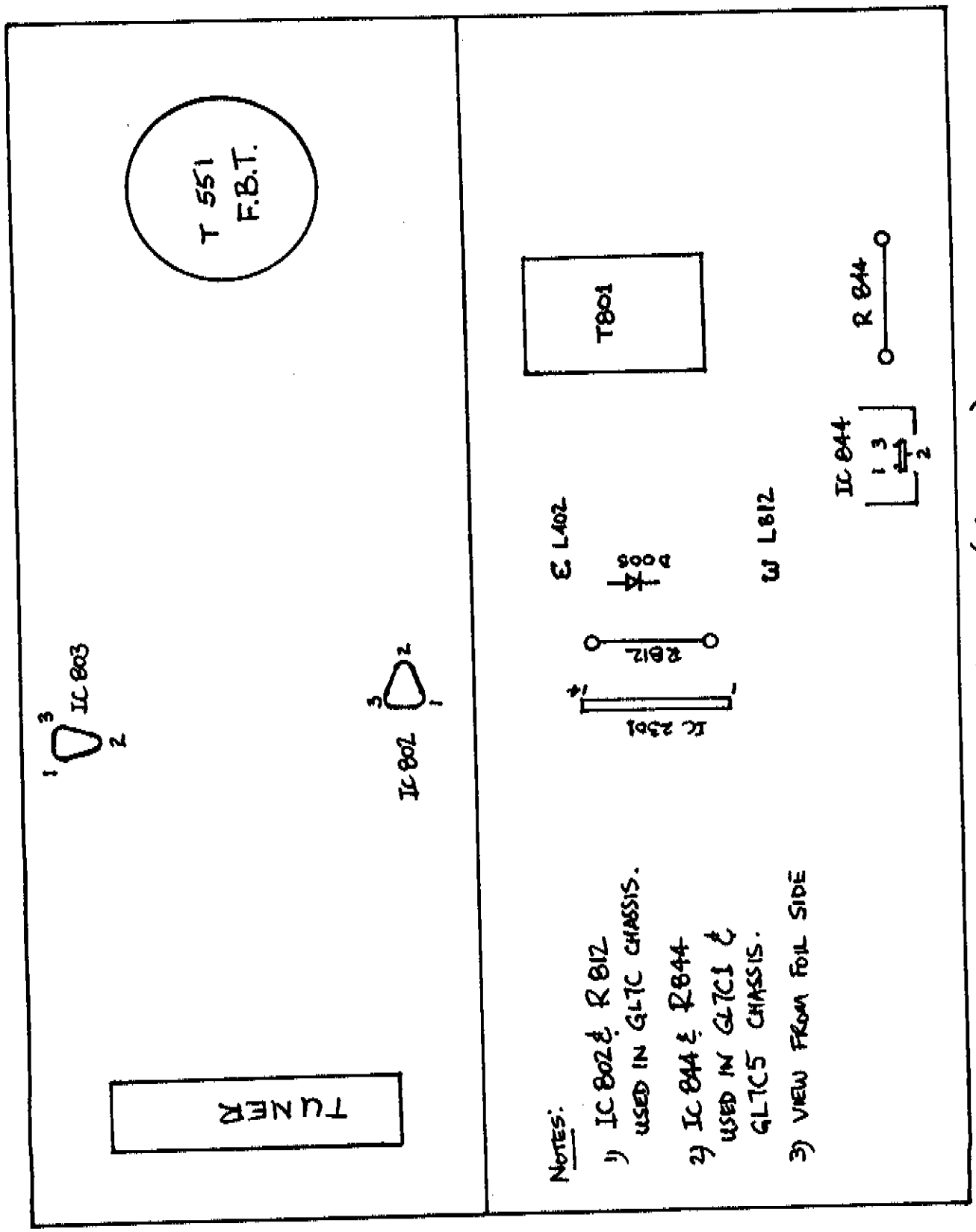

T 551
F.B.T.
TUNER
IC 803
IC 802
T801
R 844
IC 844
E L402
W L812
R812
IC 2561
A - BOARD (FRONT EDGE)
NOTES:
1) IC 802 & R 812 USED IN GL7C CHASSIS.
2) IC 844 & R844 USED IN GL7C1 & GL7C5 CHASSIS.
3) VIEW FROM FOIL SIDE

FIG. 1

PREPARATION: (con't)

(3) To successfully troubleshoot and repair the power supply, it is imperative to disconnect the loads. This can easily be done by unsoldering:

B+ RAIL	COMPONENT
+116v or +124v	L812 (lift one end)
+30v	IC2301 pin 12
+24v	L402 (lift one end)
+16v	a) D005 b) IC803 pin 1 c) IC802 pin 1 **OR** IC844 and R812 (lift one end) and R844 (remove completely)

Refer to Fig. 1 for location of components.

(4a) Connect oscilloscope as follows:

Connection point:	Set scope to:
CH1 hot or (+) lead to pin 3 common or (-) lead to pin 5	Sweep speed - 10μsec/div
CH2 hot or (+) lead to pin 2 common lead as above	Vertical sensitivity CH1 - 100v/div CH2 - .5v/div

b) Connect DC voltmeter across C818 (TPA86 and cold circuit common).

CAUTION:
Remember that your oscilloscope is connected to hot circuit common. Observe proper line isolation procedures, or damage to your test equipment and the TV under test will result.

(5) Tack solder a jumper wire across the main AC relay contacts (RL001).

(6) Connect variac, AC voltmeter, AC ammeter to the TV receiver as shown below.

TESTING AND TROUBLESHOOTING

(1) Slowly increase the variac output to 15 volts AC (no higher!) and monitor the current drawn by the TV receiver. If the current exceeds 1 ampere at anytime, remove the power and determine why. (Check IC801, D816).

Also, at the same time, monitor your oscilloscope for development of 30 KHz (30 usec, 25% duty) 150 volt peak-to-peak pulse. If the pulse is not present, check C815, R805, R826.

Check your DC voltmeter to verify +116 volt DC at TPA86 (across C818). Slowly increase the AC input (adjust the variac) from 15 volts to 20 volts AC while monitoring the 116 volt rail. It should remain at 116 volts.

If the voltage increases, the supply is not regulating correctly. Reduce the AC input to 15 volts AC immediately and troubleshoot to find the cause. (Check R824, R825, IC804, IC806).

NOTE: At 15 volts AC input to the unloaded power supply, all waveforms and DC potentials will be correct and verifiable at the key check points (IC's and transistors) on the schematic diagram.

The benefit to troubleshooting in this manner is that if there is a problem in the feedback loop (no regulation) or excessive drive to IC801, you can diagnose the fault with the supply operating, and with the assurance that components will not be destroyed.

(2) Checking Over-voltage Protection:

If no problems are evident, slowly increase the AC input to the set under test to 105 volts AC.

At this point you will hear a clicking noise from T801, the waveform on the oscilloscope will break-up, and the 116 volt rail will rise to 140 volts DC.

This is due to the operation of the over-voltage protection circuitry. Further increase the AC input to 140 volts AC. There should be no change in behaviour of the supply. Q802 switching on and off will limit the power developed by the supply to a safe level.

(3) If the supply appears to be operating normally, and the load resistance checks are OK, you may reconnect the supply to the loads (reverse the steps under preparation (3).

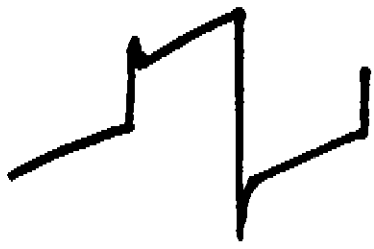
(4) After reconnection, test the set first by applying 70 volts AC. Monitor the 116 volt DC rail and line current for any abnormal behaviour.

Increase the AC input to 90 volts AC. You should have a raster, sound and snowy screen. (Press the power button on the remote control, or on front of the set to power up the tuner for reception).

(5) Remove the power, and disconnect the jumper across the AC relay.

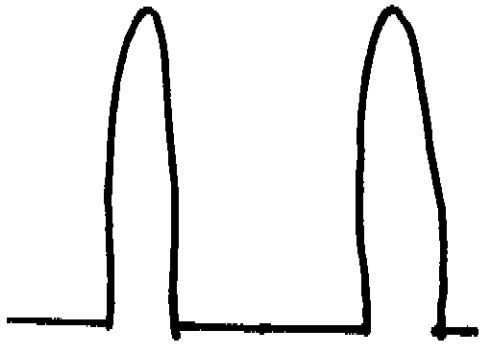
WAVEFORMS

Please make waveform measurements with unit set to video in and blank screen (black field).



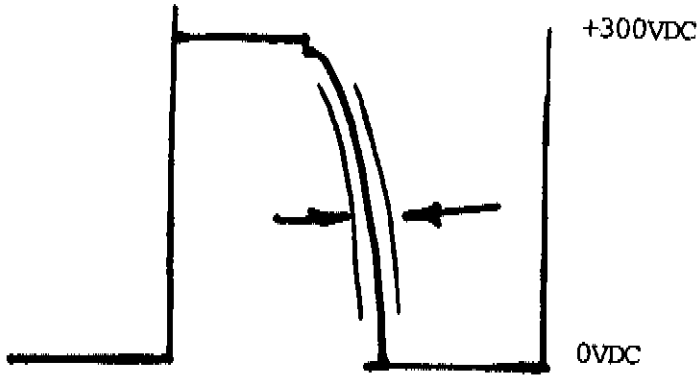
Pin 2 - IC801

Drive waveform



Pin 3 - IC801

Collector voltage waveform with power supply unloaded



Pin 3 IC801

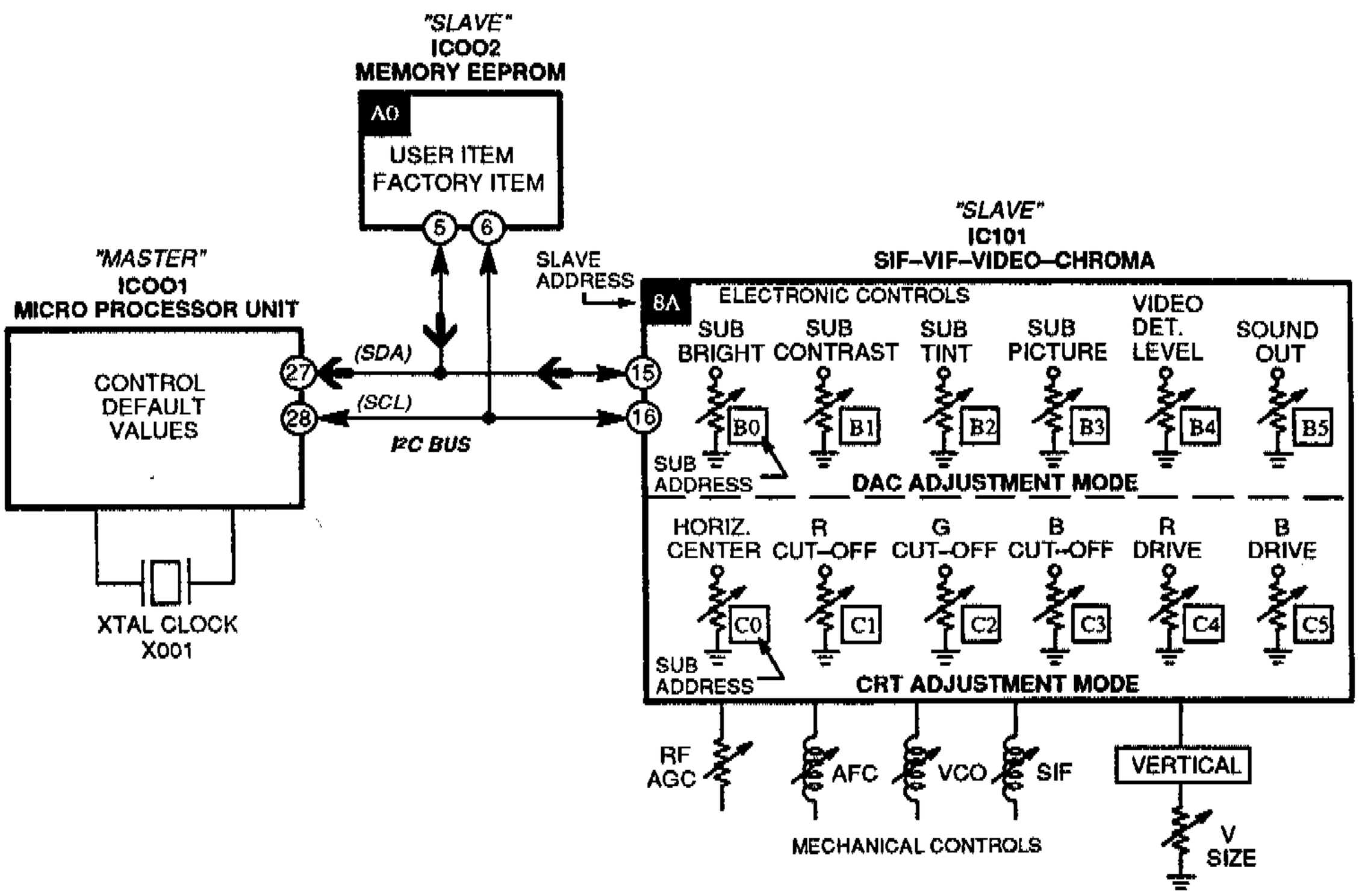
Collector voltage waveform with power supply loaded

I²C Bus Line System

This Receiver makes use of one of the latest electronic technologies by using an I²C (Inter–Integrated Circuit) Bus Line Concept. Two wires, SDA (Serial Data) and SCL (Serial Clock) carry information between devices connected to the Bus. Each device connected to the Bus has a unique address for receiving data information (a Receiver) from a source (the Transmitter).

The devices are also considered to be a "Master" or a "Slave" when data is transmitted or received. In this Receiver, the "Master" (Micro Processor Unit,IC001) is the device which initiates a data transfer in the Bus line and generates the clock signal required to permit the data to be sent. The "Slaves" (MEMORY I²C EEPROM, IC002 and VIF–SIF–VIDEO–CHROMA JUNGLE, IC101) are the devices addressed by the MPU and receive the data transmitted.

This system usually performs as a control function and replaces many of the required mechanical controls needed in a television receiver. Instead of adjusting various mechanical controls individually, many of the control functions can be performed electronically using "On Screen Menus", (The Serviceman Mode).



MAKE NOTE AT ALL SETTINGS

NOTES ON COMPONENT REPLACEMENT

(1) **Do not substitute any parts in the supply.**

All semiconductors are special high speed devices designed to perform in high frequency pulse applications.

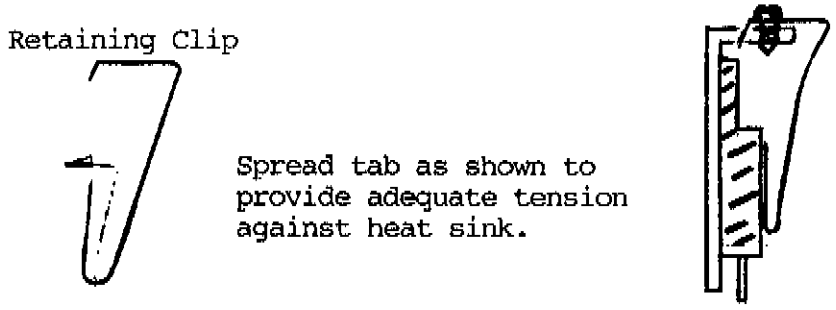
Fuse resistors are designed to open when their power rating is exceeded to protect the set from fire.

(2) When replacing IC801:

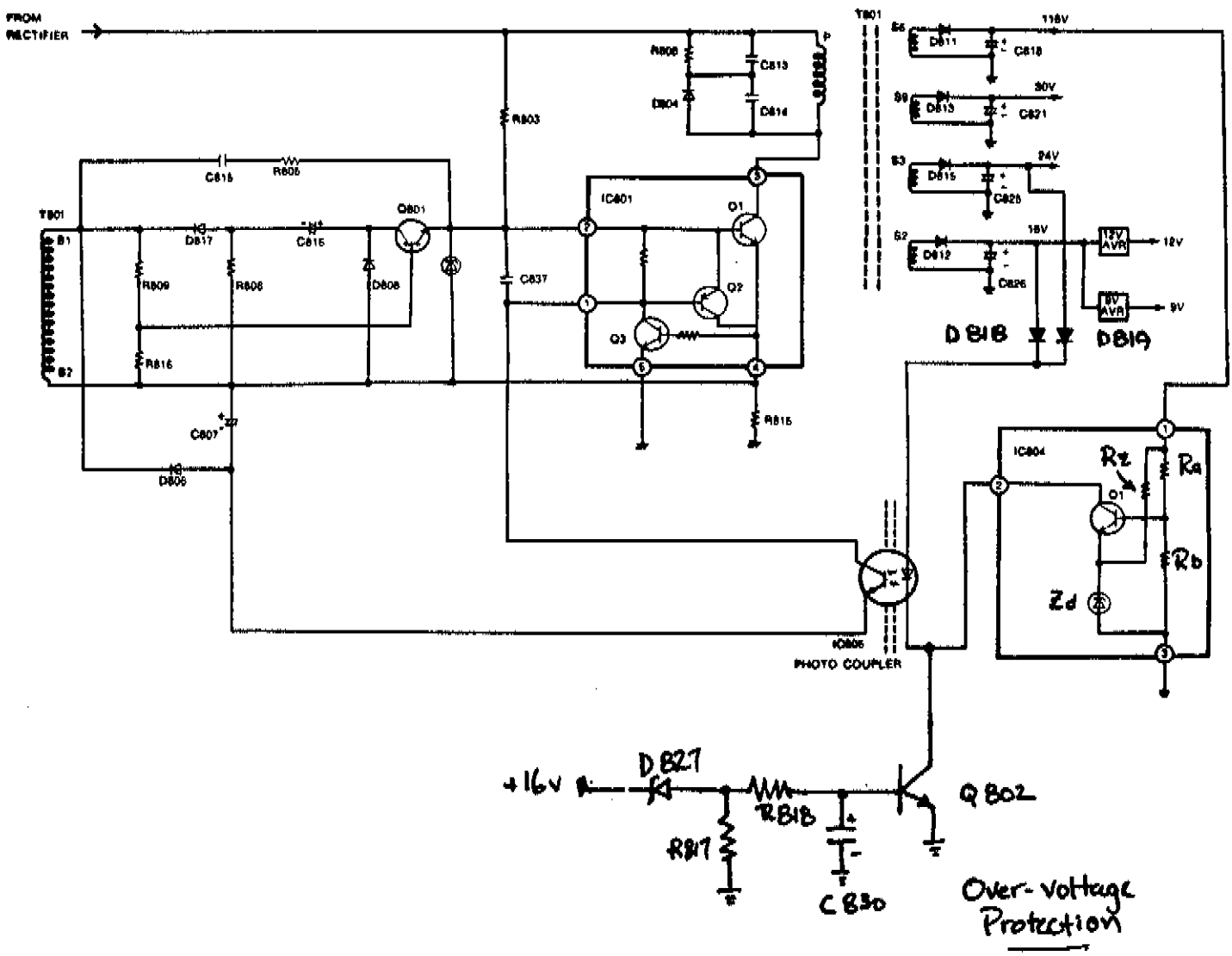
(a) Thoroughly clean the mica insulator and the heat sink. Use a good quality solvent cleaner for this.

(b) Apply new heat sink compound (white type has best thermal transfer characteristics) to both the heat sink and the IC.

(c) To prevent thermal failure of IC801 (device shorts after 2-3 months for no apparent reason), spread tab as shown below. This will ensure IC801 is held tightly against the heat sink.



POWER SUPPLY CIRCUIT



Switching Power Supply (NA3 Chassis)

B+ source voltages are produced at the secondary of T801 by high frequency switching of a MOSFET transistor inside IC801. Also included in the STK730–020 package is an Amplifier, Error Detector and Over Current Protection circuit. Altogether, these circuits produce a semi regulated off line power supply circuit which require few external parts.

Operation

The switching action is done in the following way:
Starter voltage from the bridge rectifier is applied to IC801 pin 4 (the Gate of MOSFET,TR1) through resistors R814 and R808. TR1 turns ON and Drain current starts to flow through the primary winding (NP) of T801. At the same time a voltage is induced at the ND1 winding which keeps a voltage on the Gate and TR1 stays ON. Drain current continues to flow and increases the voltage across the current detecting resistor R805 (IC801 pin 8). This induced voltage is integrated by the R/C time constant of IC801 internal resistor R3 and external capacitor C828 (pin 7). The voltage is applied to the Base of IC801 internal transistor TR3.

Regulation

The primary winding of T801 (NP) and the secondary windings (NS) are wired with opposite polarity. When TR1 is conducting. The current flows through winding NP. The secondary windings (NS) have no current because the B+ rectifier diodes block the flow.

The current flowing through TR1 and NP winding increases at a linear rate. When the voltage between Pins 1 and 3 of IC801 reach a fixed voltage of approximately 40.5V, TR1 turns OFF by the operation of IC801 internal error amp. This provides a state of regulation.

The secondary windings NS are wired so their voltages are in proportion to the voltage across the ND2 winding. Therefore output voltage is controlled by the error amp monitoring the voltage across ND2 winding and controls the conduction of TR1.

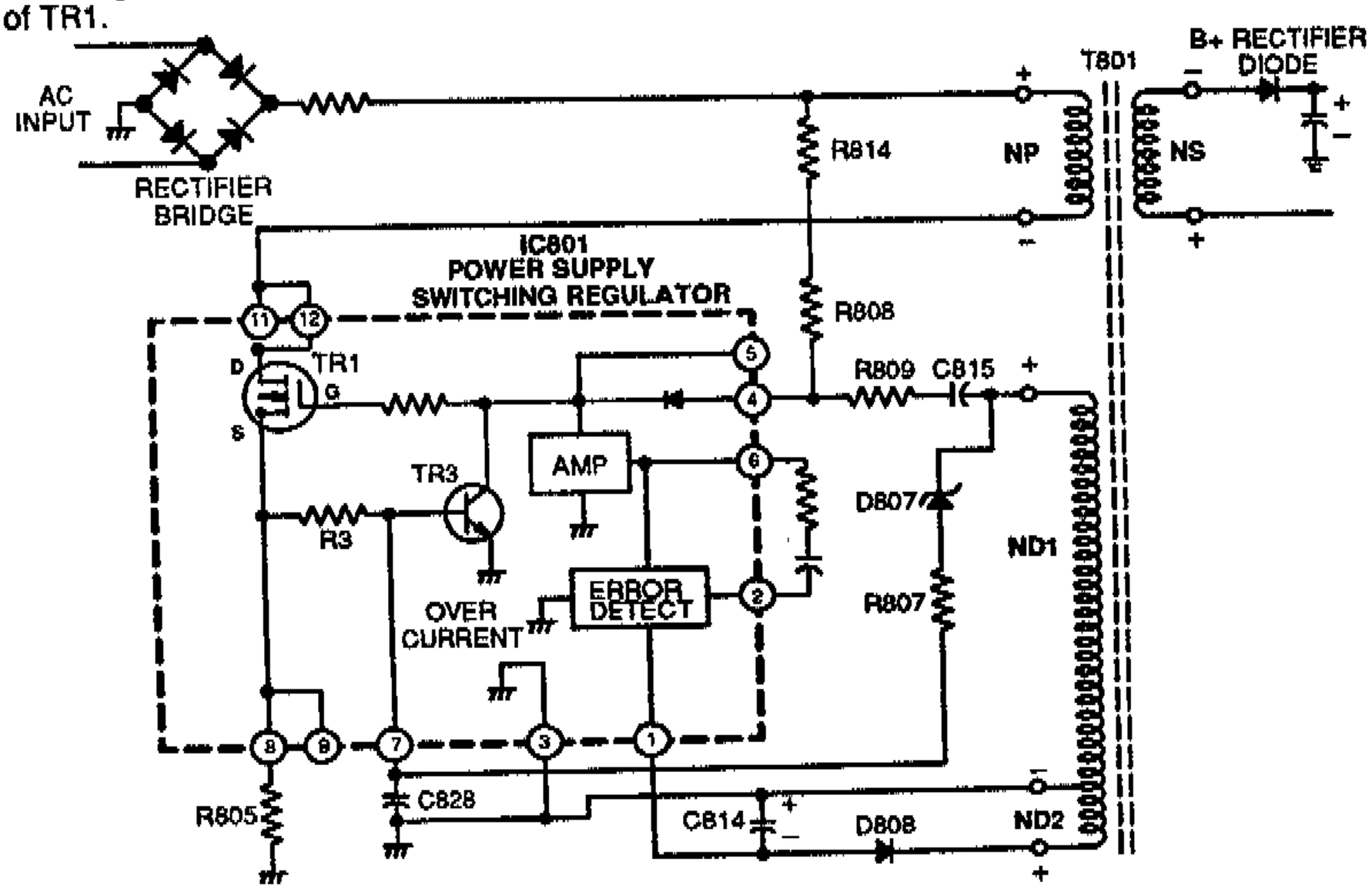
When TR1 turns OFF, the energy stored in T801 primary winding (NP) collapses and induces an opposite polarity voltage across the secondary windings (NS). B+ Rectifier diodes now conduct and allow current flow. When the total energy has collapsed at the primary winding, the ND2 winding also has a low voltage. The voltage across IC801 Pins 1 and 3 is now less than 40.5V and the internal error amp turns OFF to allow TR1 to conduct again. Reverse voltage polarity is again induced across the primary winding. This series of events repeats and the voltages of the secondary windings increase. When TR1 turns OFF, the energy is transferred to the secondary windings and TR1 is turned back on by the backswing. A stable oscillation begins.

Over Current/Voltage Protection

The over current/voltage protection circuit consist of IC801 internal components R3,TR3 and external components R805 (Pins 8, 9), R807, D807 (Pin7). Capacitor C828 (Pin 7) filters the base bias voltage of internal transistor TR3.

When output power increases because of a defect in a B+ source and excessive current flows, the Source current of TR1 increases. The voltage drop across R805 increases to cause oscillation frequency to decrease. Thus output voltage lowers. In other words, when the voltage drop across R805 increases, the base bias for TR3 also increases. When the bias reaches 0.6V,TR3 conducts and loads down the TR1 Gate bias to turn TR1 OFF. At the same time, the ND1 winding's current flows through R807 and D807 to produce a negative voltage and prevents TR1 from turning ON, as an overvoltage protection.

The Source current of TR1 is a triangular wave shape. When output current increase, the on time of TR1 stays constant but the off time becomes longer. As a result, frequency decreases and the output power decreases for over current/voltage protection.



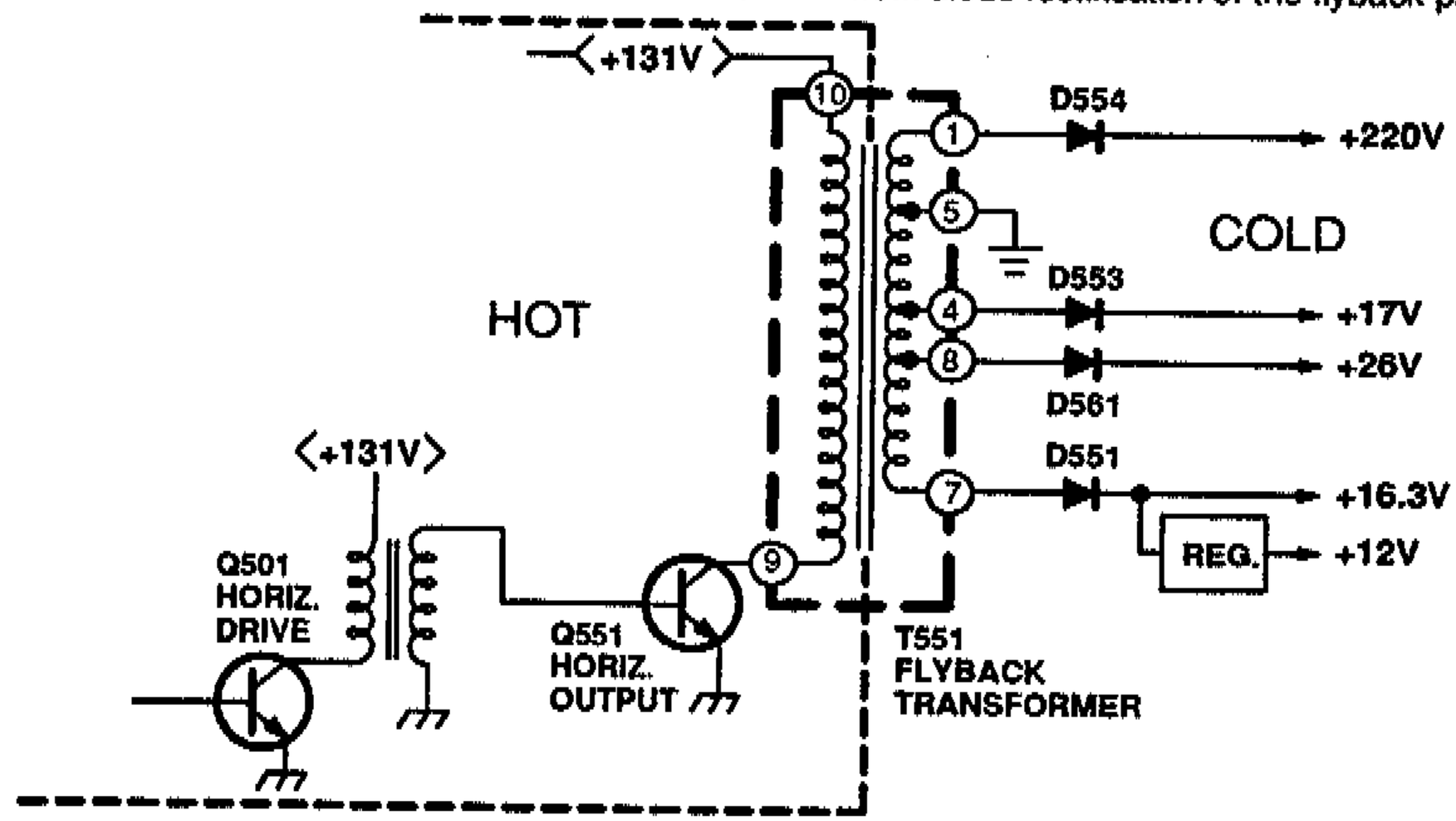
AVR Power Supply (NA3A Chassis)

B+ Source Voltages

The NA3A Chassis is similar to the NA3. They have common features but the NA3A chassis B+ source voltage are derived from secondary windings on the flyback transformer (T551).

B+ for the Horizontal Drive, Horizontal Output (Q501/Q551) and Flyback Transformer (T551) is supplied by an AVR (Automatic Voltage Regulator) 131 volt output. Since the secondary B+ voltages are dependant on scan waveform or flyback pulse amplitude, these voltages are also regulated for AC line and/or load variations.

The +17 volt, +16.3 volt and +26 volt supplies are derived by diode rectification of the scan waveform and are relatively high current supplies. The 16.3 volt B+ source is also coupled to a 12 volt regulator. IC551 suppies +12 volt B+ to most of the Main Board circuitry. The +220 volt is developed from diode rectification of the flyback pulse.

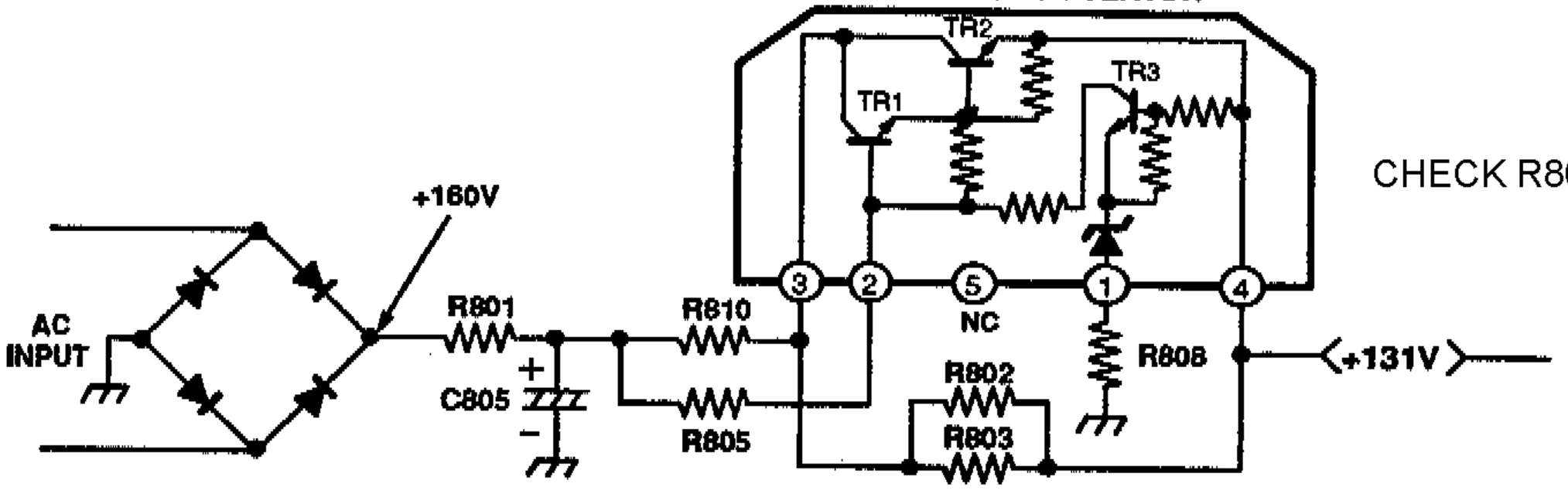


Automatic Voltage Regulation

The AVR (IC801) detects the variations of +131 volts output and corrects any changes to +131 volts. +160 volts from the full wave bridge rectifier is applied to the collector of internal TR1 and TR2. (IC801 pin 3.) This voltage is also applied to the base of TR1 and TR2. (IC801 pin 2) The base voltage TR1, TR2 causes emitter current to flow and generate +131 volts output. (IC801 pin 4.)

If for some reason, output voltage increases, the base voltage of TR3 also increases. The collector voltage of TR3 decreases. The base voltage of TR1 and TR2 will decrease and the output voltage is reduced.

IC801 B+ REGULATOR



CHECK R808 R805

Follow the chart below to observe IC801 voltage regulation. ↗ = voltage increase, ↘ = voltage decrease.

Output Voltage Before Correction	TR3 Base	TR3 Collector	TR1/TR2 Base	Output Voltage After Correction
HIGH	↗	↘	↘	+131V
Normal +131V				+131V
LOW	↘	↗	↗	+131V

R810 SETS MAX LOAD CURRENT

Power Supply Protection*

A new feature has been added to the NA3/NA3A chassis family. MPU (IC001) Pin 19 is a dual function pin. The ACTION button function is activated when Pin 19 voltage is 0.588V or less. An Over Voltage Protect function is activated when Pin 19 voltage is 3.2V or higher.

With the Receiver on, the power supply B+ 16.5V is monitored and voltage divided by R088/R089. As long as the voltage at IC001 Pin 19 is 0.6V~3.1V (depending on power supply operation) the Receiver operates normally.

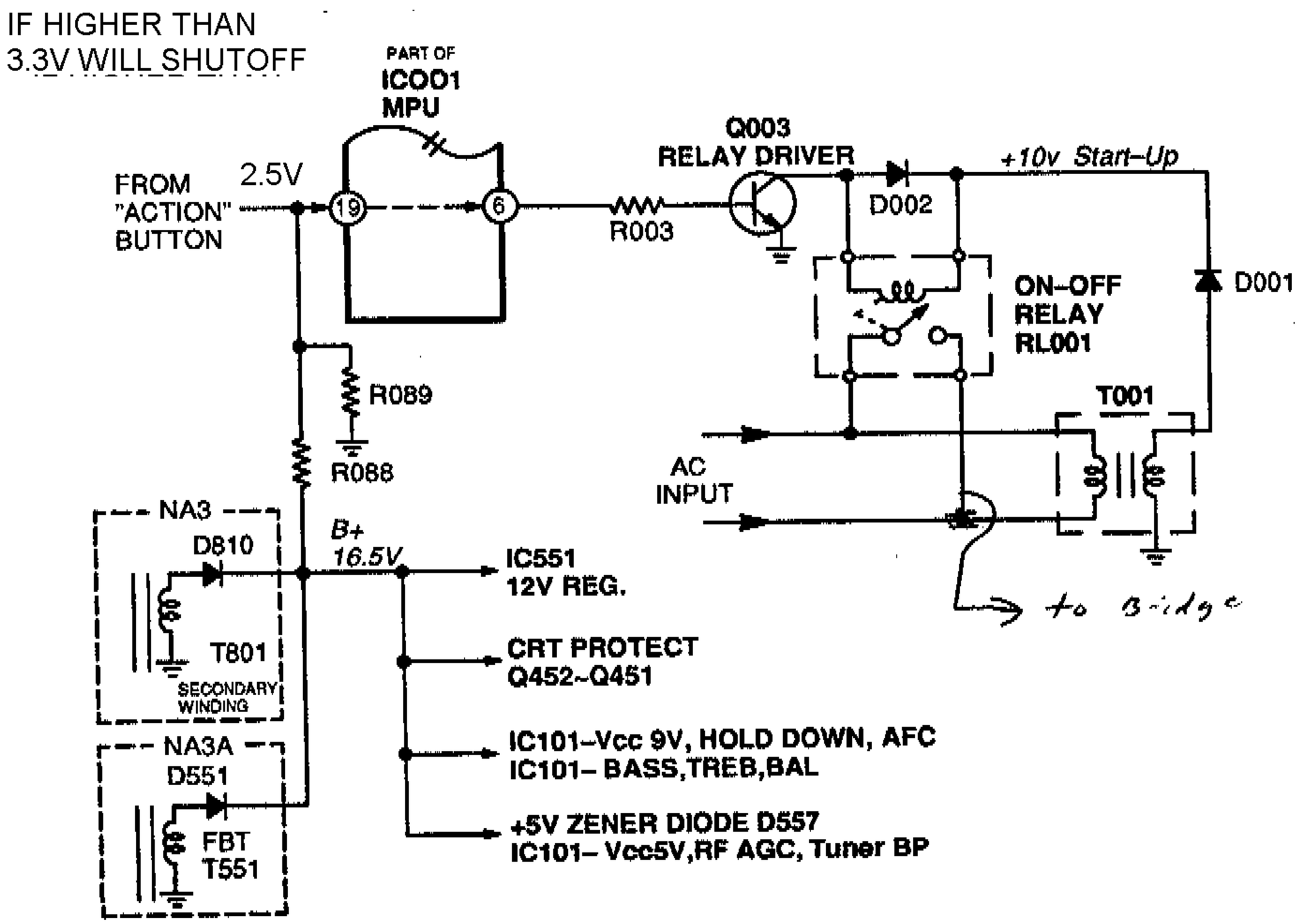
If a major power supply failure occurs, the power supply may far exceed the normal +16.5V ±2V specification. IC001 Pin 19 voltage will increase above 3.2V and internal circuitry of the IC will cause Pin 6 (power) to go low. When this happens, the base of Q003 is held low and it can not conduct. Relay RL001 deenergizes to open the on contact in the relay and shuts the Receiver off.

This condition will remain until AC power is momentarily disconnected.

If when pressing the power button after AC is applied again and the Receiver comes on but goes off after a few seconds, there is a problem in the Receiver's power supply.

WARNING: Because Pin 19 is a dual function pin, do not press the "ACTION" button on the Receiver. Pressing the button when the above symptom appears will inhibit the Overvoltage Protection and if the Receiver is powered on again, severe damage may happen to the entire chassis. If IC801 is changed to correct a power supply failure, also check or change D806, D807and D808 before reapplying power to the chassis. During a major failure, these components can fail, causing the I.C. to appear to operate normally, but it may run very hot, leading to another I.C. failure very quickly.

* It may be noted that this overvoltage protection circuit is absolutely required in the NA3 chassis, due to the nature of the switching supply. It is virtually impossible for this kind of failure to occur in the NA3A chassis. This circuit is included because of the common use of the microprocessor in both chassis.



Horizontal Hold Down Circuit

This circuit protects against excessive high voltage and CRT beam current. If for any reason high voltage and/or CRT beam current exceeds a predetermined level, the Hold Down Circuit operates to increase horizontal frequency. If the level increases more, the Hold Down Circuit will blank the CRT.

CRT heater voltage from pin 6 of flyback transformer (FBT) T551 is rectified by diode D531. This voltage is directly proportional to high voltage variations. The voltage is filtered and divided down by precision resistors R532/R533 to approximately 2.4V and applied to Pin 49 (Hold Down) of IC101. With this voltage as a normal condition, the Hold Down Circuit is inactive and has no effect on horizontal frequency or blanking the CRT.

The Hold Down Circuit inside IC101 is a (NPN) differential amp. One base of the differential amp is connected to Pin 49 (approximately 2.4V). The other is connected to Pin 51 through an internal voltage divided of equal resistance. Pin 51 is clamped at a 6V DC reference voltage by zener diode D532. The voltage at the base of the differential amp is 3V. (1/2 of the reference voltage, 6V)

Basically, the Hold Down Circuit compares the voltage at Pin 49 (approximately 2.4V) to half of Pin 51 (clamped 6V). If CRT heater pulse amplitude from T551 (representative of high voltage) increases, the positive voltage at the cathode of D531 and at Pin 49 of IC101 also increase.

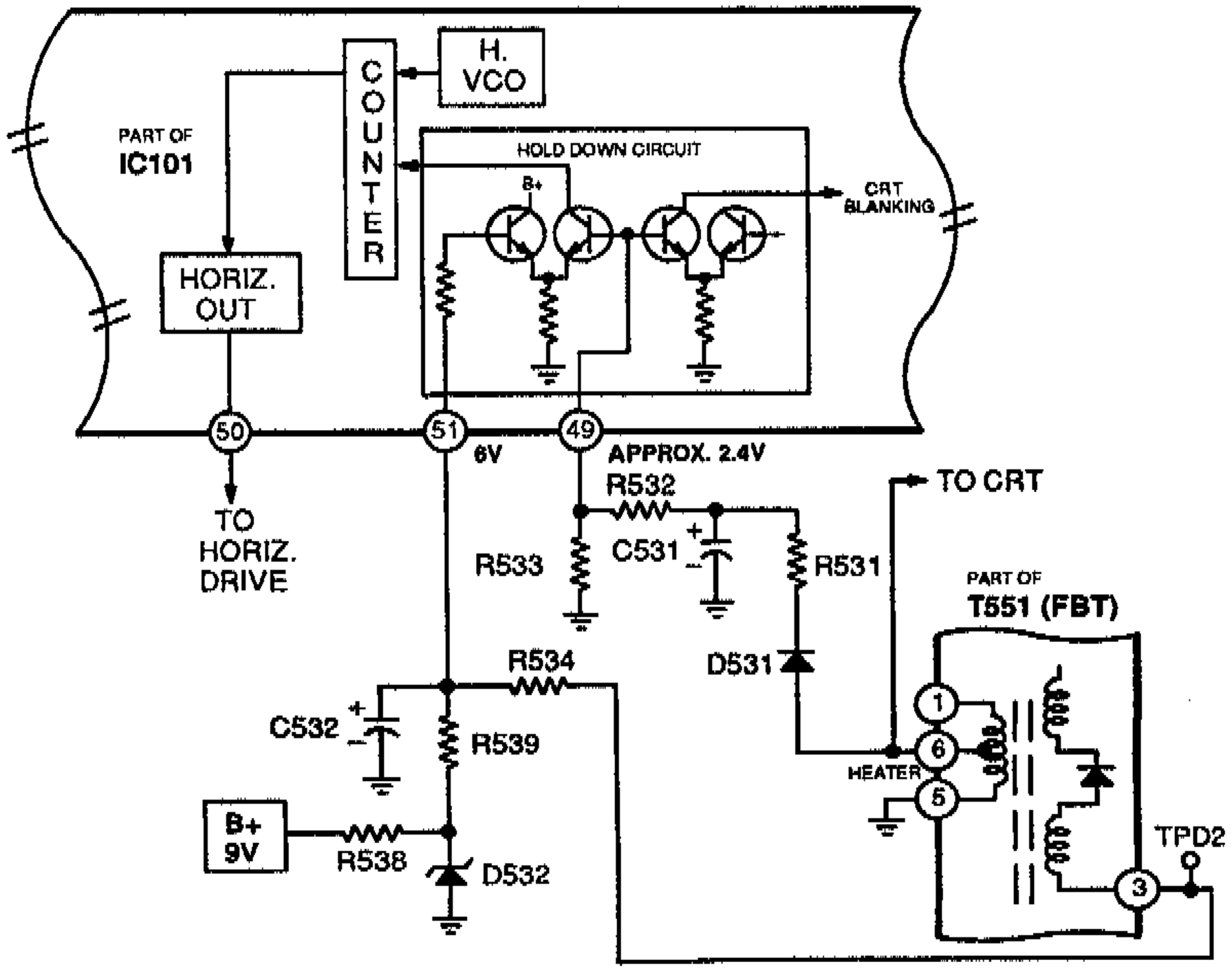
When the increased DC voltage at Pin 49 exceeds half of the Pin 51 reference voltage by a predetermined amount, the Hold Down Circuit (differential amp) changes conduction state and shifts the horizontal count down for a higher sweep frequency (out of sync condition) to prevent unsafe operation. For further safety when the Pin 49 voltage is extremely excessive, another internal differential amp changes state to blank the CRT.

An increase in CRT beam current produces more negative ABL voltage at Pin 3 of T551 (FBT) which is coupled to Pin 51 of IC101 via resistor R534. This increased negative voltage opposes the positive voltage at Pin 51 and lowers the DC reference voltage to less than 6V. This in turn causes the Hold Down Circuit to operate sooner when Pin 49 voltage increases.

Thus excessive levels of high voltage and/or increased CRT beam current cause determining of the horizontal oscillator frequency and eventual blanking of the CRT to assure operation within safe limits.

The B+ circuit and the Hold Down Circuit are not adjustable. If components in the designated areas of the schematic for critical parts are changed, operation of the Hold Down Circuit must be checked to insure that high voltage and CRT beam current does not exceed safe operation parameters. Check the following for possible failure:

1. Measure the DC voltage at Pin 49 of IC101 (reading should be close to +2.4V). If not, check D531, R531, C531, R532, R533 and IC101.
2. Measure the DC voltage at Pin 51 of IC101. (reading should be +6V) if not, check R534, C532, R539, D532, R538 and IC101.



CRT Protection Circuit

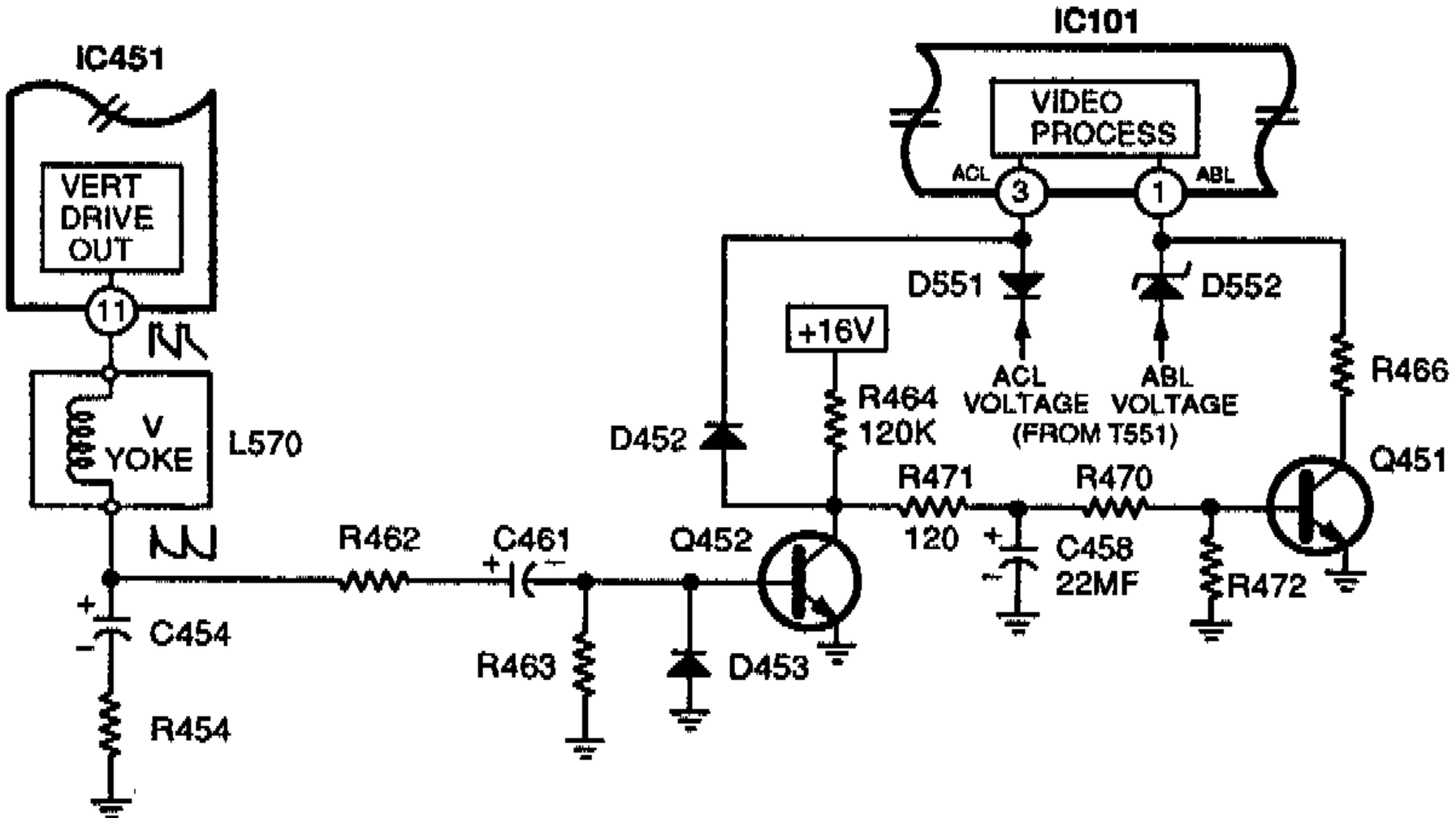
The CRT Protection Circuit is made up of transistors Q452 and Q451. The circuit blanks the CRT in the event of vertical sweep loss.

During normal operation, Q452 monitors vertical sweep by being connected to the low side of the vertical yoke L570. When Q452 is off, C458 starts to charge up from the 16V source through resistors R464 and R471. The RC time constant is such that the charging is slow. When Q452 is conducting, C458 discharges through R471 and the transistor to ground. The RC time constant is such that the discharge is fast. The slow charging and fast discharging along with voltage divider R470/R472 prevents sufficient bias for transistor Q451 to conduct. With Q451 not conducting, Pin 1 of IC101 is high and ABL functions normally.

If yoke current ceases (due to an open yoke or no voltage at IC451 Pin 11), there is no base bias for transistor Q452. The transistor is now always non conductive. Capacitor C458 is now allowed to charge a longer time to supply enough bias through voltage divider R470/R472 for Q451 to conduct. When it does, the voltage at Pin 1 of IC101 goes low and cuts off CRT beam current.

Diode D452 is added to the collector of Q452 to prevent the circuit from operation when Pin 3 of IC101 is grounded for Service Switch function when setting CRT cutoff.

It is important for CRT life that this circuit be checked before returning a repaired receiver to a customer. A quick test is to short Q452 base to ground. The CRT should blank. If not, troubleshoot the circuit for cause.



Service Notes

Leadless Chip Components

Chip transistors must be replaced with identical chip components due to critical foil track spacing. There are no holes in the board to mount standard transistors or diodes. Some chip capacitor or resistor board solder pads may have holes thru the board but hole diameter limits standard resistor replacement to 1/8 watt. Standard capacitor replacement may also be limited for the same reason. It is recommended that identical chip components be used for replacement purposes.

Chip resistors have a three digit numerical resistance code -- 1st and 2nd significant digits and a multiplier. Example: 162=1600 or 1.6K ohm resistor, 0=0 ohms (jumper).

Chip capacitors generally do not have the value indicated. The body color indicates a general range of capacity.

Chip transistors are identified by a two letter code. The first letter indicates the type and the second letter, the grade of transistor. See coding chart.

Chip diodes have a two letter identification code as per the code chart and are a dual diode pack with either common anode or common cathode. Check the parts list for correct diode number.

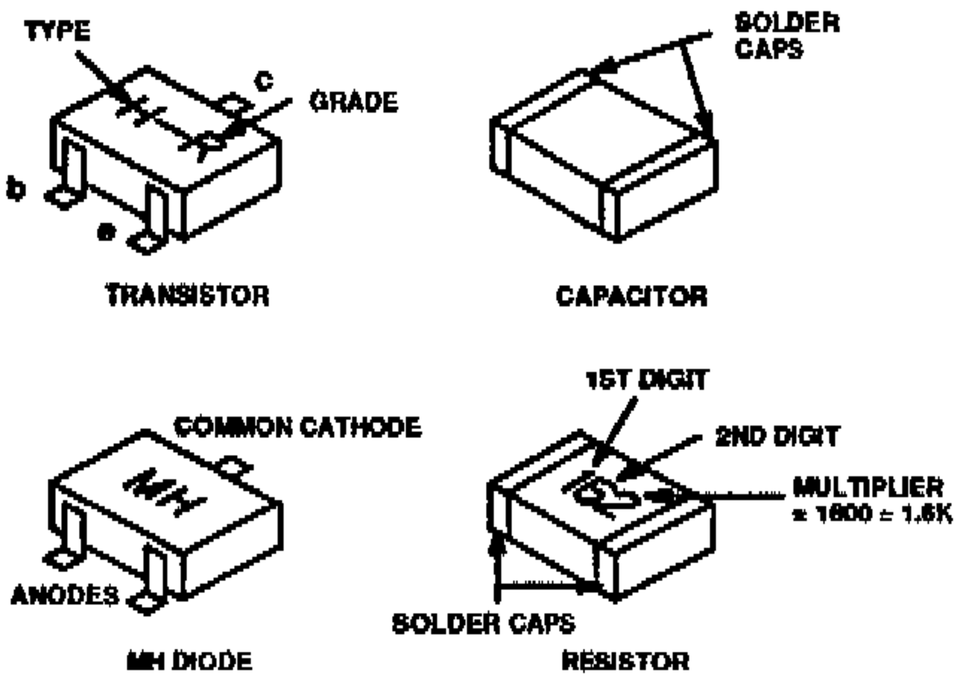
Component Removal

1. Use solder wick to remove solder from component end caps or terminals.
2. Without pulling up, carefully twist the component with tweezers to break the adhesive.
3. Do not reuse removed leadless or chip components since they are subject to stress fracture during removal.

Chip Component Installation

1. Put small amount of solder on board soldering pads.
2. Hold chip component against soldering pads with tweezers or a miniature alligator clip and apply heat to pad area with 30 watt iron until solder flows. Do not apply heat for more than 3 seconds.
3. Remove iron and continue to hold component against pads until solder solidifies.

Chip Components

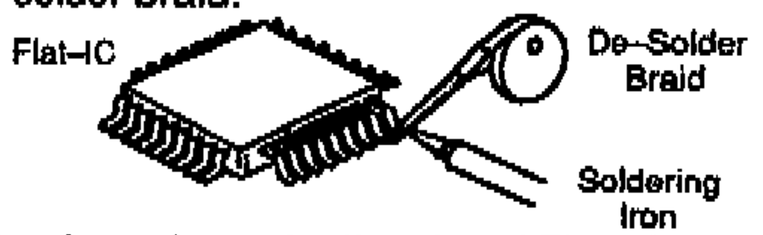


How to Replace Flat–IC

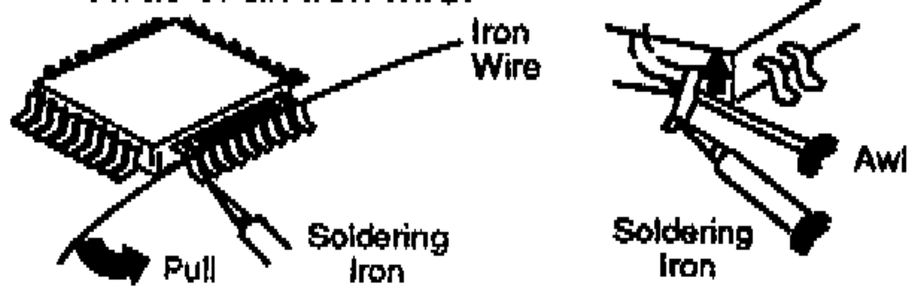
– Tools Required –

- Soldering iron
- De–solder braids
- Iron wire or small awl
- Magnifier

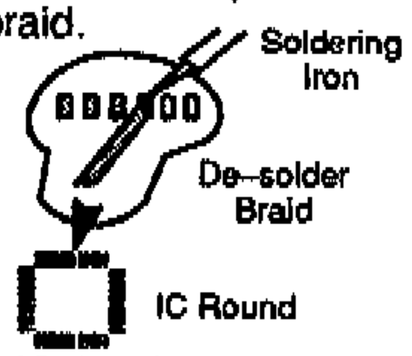
1. Remove the solder from all pins of Flat–IC by using de–solder braid.



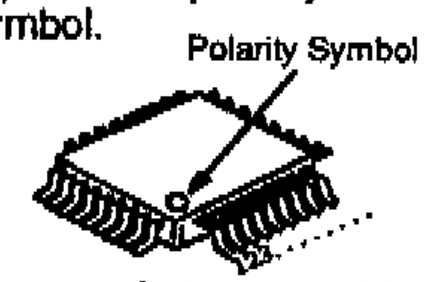
2. Put an iron wire under the pins of Flat–IC and pull it in the directions indicated while heating the pins using a soldering iron. A small awl can be used, instead of an iron wire.



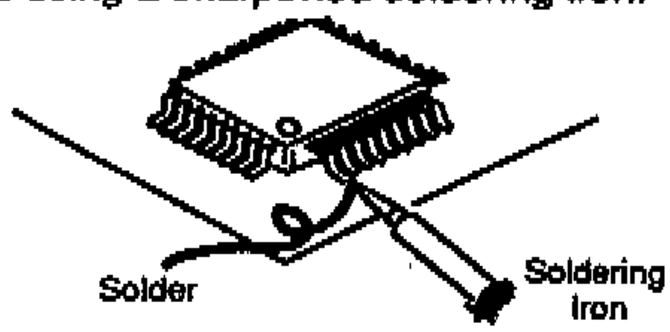
3. Remove the solder from all pads of Flat–IC by using de–solder braid.



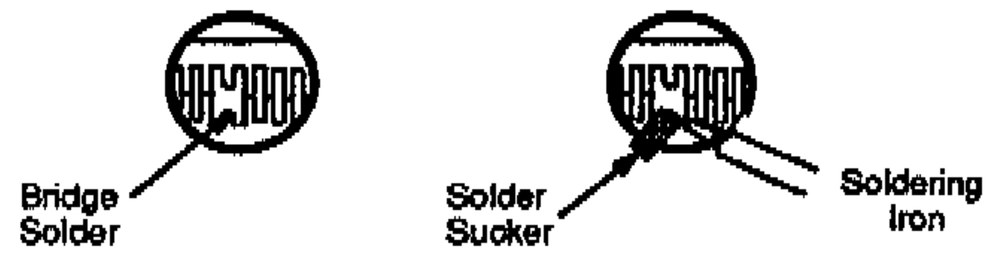
4. Put the new Flat–IC in place (apply the pins of Flat–IC to the soldering pads where the pins must be soldered). Properly determine the positions of the soldering pads and pins by correctly aligning the polarity symbol.



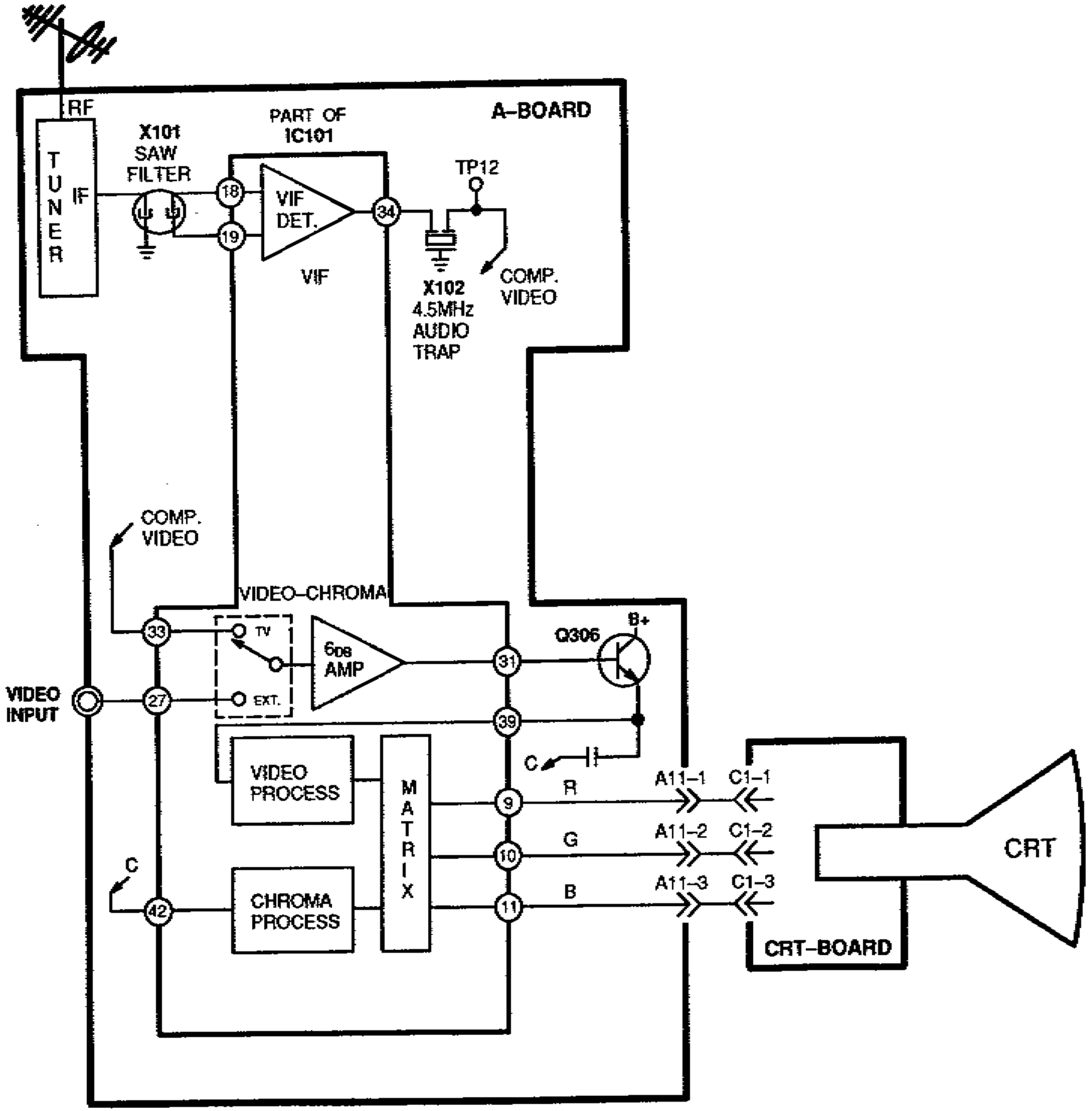
5. Solder all pins properly to connect to the soldering pads using a sharpened soldering iron.



6. Check with a magnifier for unneeded solder bridge between the pins or dry joint between pins and soldering pads. To remove solder bridge, use de–solder braids as shown in figure.



Video–Chroma Signal Path Block Diagram (CT–20S10R, PC–21S10R, SP2015J & QC–21S15J)



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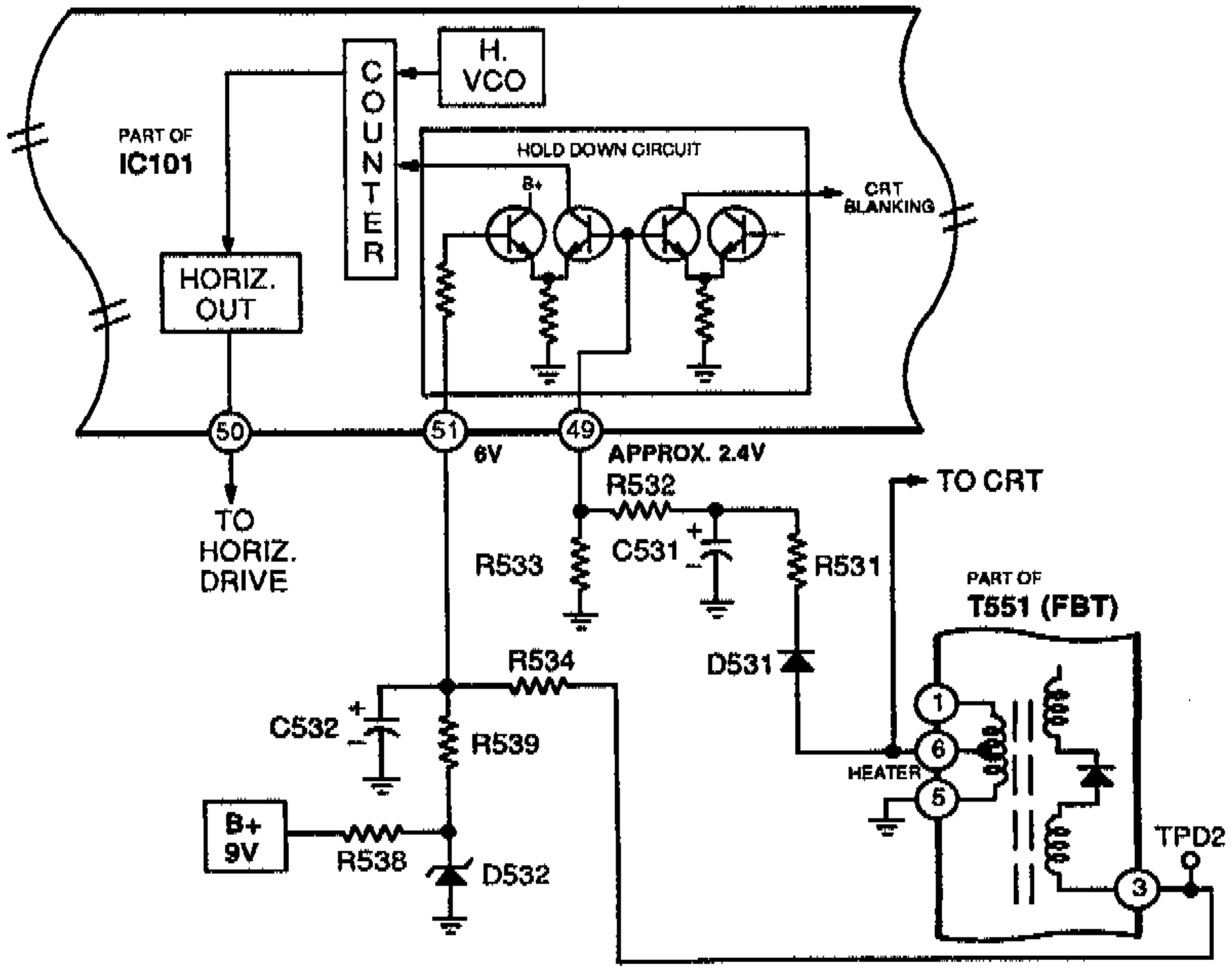
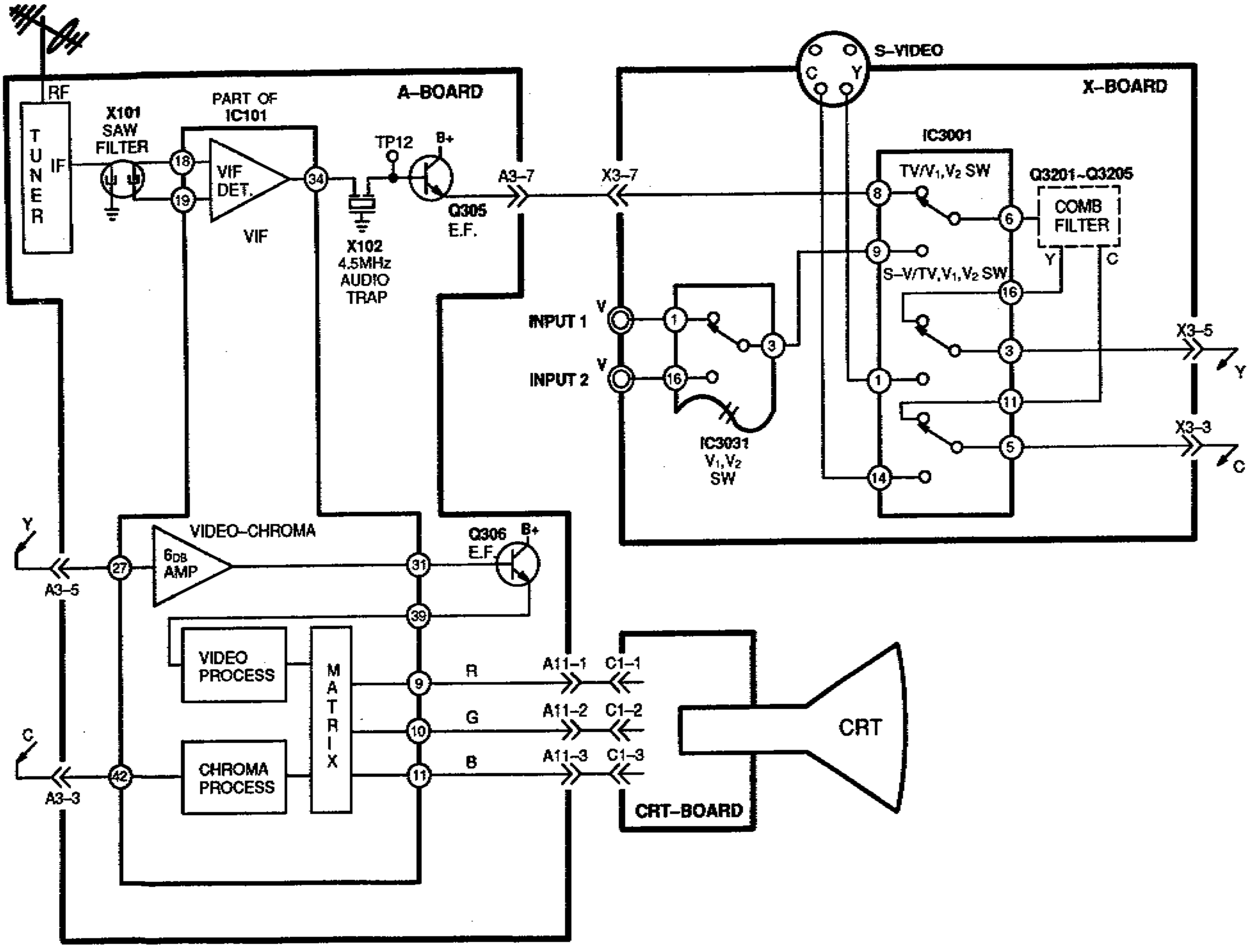
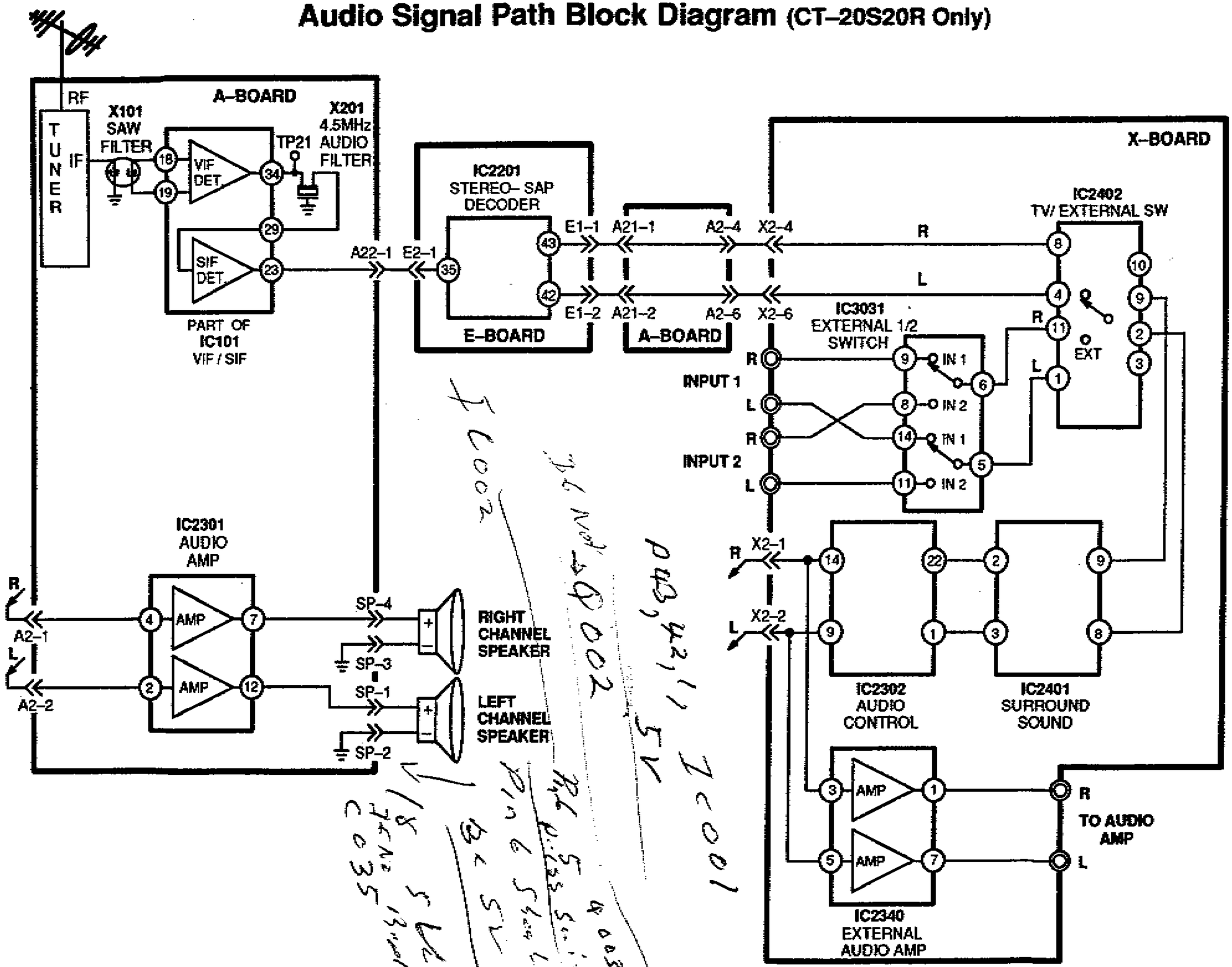


Video–Chroma Signal Path Block Diagram (CT–20S15R, CT–20S15LR/PR & PC–21XF20R)



Audio Signal Path Block Diagram (CT–20S20R Only)



General Information

This manual includes service information for Unique model numbers. The numbers are used to differentiate model features.

Model Differences

Features \ Models	CT–20R10R PC–21R10R CT–20R10HR CT–20R10XR	CT–20S1R	CT–20S10R PC–21S10R SP2015J QC–21S15J	CT–20S15R PC–21XF20R CT–20S15LR CT–20S15PR	CT–20S20R
Chassis	P229/NA3A	P229/NA3A	P229/NA3A C229/NA3A	P227/NA3	P227/NA3
B+ Power Supply	AVR	AVR	AVR	Switch Mode	Switch Mode
Audio Output	1.5W Mono	1.5W x 1.5W	1.5W x 1.5W	3.5W x 3.5W	3.5W x 3.5W Surround
Audio/Video Input	1 A/V	NONE	1 A/V	2 A/V (1) S–Video	2 A/V (1) S–Video
Variable Audio Out	NONE	YES	YES	YES	YES
Audio Adjustments Bass/Treb/Bal	NO	NO	NO	Audio Menu	Audio Menu
TV Speaker Button	NO	YES (Rcvr Back)	YES (Rcvr Back)	Audio Menu	Audio Menu
Remote Control	EUR501050	EUR501050	EUR51763G EUR501050 EUR51766G EUR501051	EUR501050	EUR51763G
Comb Filter	NO	NO	YES	YES	YES
Dimensions	#1	#3	#3	#2	#2

Specifications

Power Source: 120 volts, 60 Hz, AC
Power Consumption: 1.7 amps max. (1.6amps max in some sets)

Antenna Terminal Impedance: 1–UHF/VHF 75Ω input
Channel Capability: 181 Channels
Phase 18
Synthesizer
Off the Air: VHF 2~13, UHF 14~69
Cable: 125 Channels
Video Input Jack: 1V p–p 75Ω, phono jack type
Audio Input Jack: 500mV RMS,
High impedance–10k
Audio Out/Variable: 0~1V, RMS, 10k
(30% Modolation)

Stereo Output Power: (See Chart)
Comb Filter: Separates video from chroma (See chart)

Closed Caption Viewing: Visual depiction of information contained in the audio portion of a television program.

Remote Control: Infra–red system (See Chart)
Picture Tube: 20" diagonal (viewing area)
90 degree deflection
Super Flat, Black Face
A51JXS61S
Anode Voltage: 30KV max. (zero beam)
28.75kV ±1.25KV
Dimensions: #1 Height – 17–13/16" (453mm)
Width –19–3/4" (501mm)
Depth – 18–3/4" (475mm)
Weight: 48 lbs. (21.6kg)
Dimensions: #2 Height – 18" (455mm)
Width – 21–5/8" (548mm)
Depth – 18–3/4" (474mm)
Weight: 52 lbs. (23.6kg)
Dimensions: #3 Height – 18–11/16" (475mm)
Width – 20–1/16" (510mm)
Depth – 18–3/4" (476mm)
Weight: 47 lbs. (21.3kg)

Specifications are subject to change without notice or obligation. Dimensions and weight are approximate measurements.

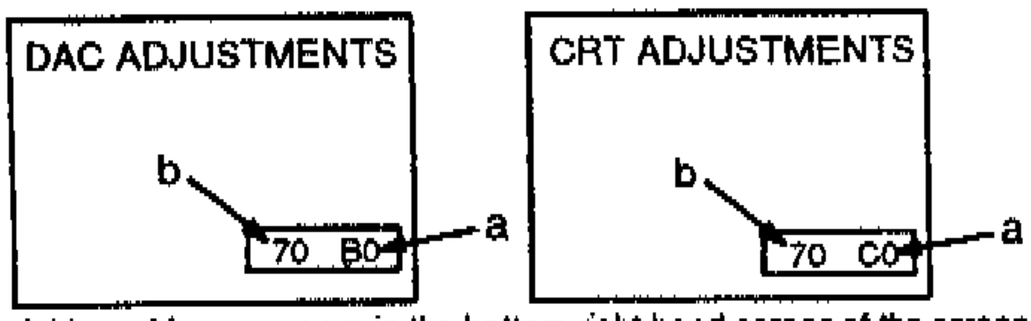
Serviceman Mode (Electronic Controls)

This chassis has new electronic technology using the I2C Bus Concept. The system usually performs as a control function and replaces many of the required mechanical controls. Instead of adjusting various mechanical controls individually, many of the control functions are now performed electronically by using "On Screen Menu". (The Serviceman Adjustment Mode.)

NOTE: It is suggested that a serviceman read all the way through and understand the following procedure for Entering/Exiting the Serviceman Adjustment Mode; then proceed to follow the instructions working with the Receiver. After a person is familiar with this adjustment procedure, use the Instructional Flow Chart for Serviceman Mode as a quick guide.

Entering Serviceman Mode:

1. While the Receiver is ON and operating in Normal Mode, momentarily short test point FA1 to cold ground (⏚) FA2.
   "The Receiver enters the Aging Mode".
   (The VOLUME UP/DOWN will adjust rapidly.)
2. **Press** ACTION button and VOLUME UP button on Receiver Control Panel simultaneously.
   "The Receiver enters the Servicemans Mode".
   (The VOLUME UP/DOWN will adjust normally.)
   (All customer controls are set to a nominal level.)
3. **Press** the POWER button on the Remote Control to select one of three Serviceman Adjustment Modes.
   - B = Serviceman DAC ADJUSTMENTS
   - C = Serviceman CRT ADJUSTMENTS
   - Normal TV = Normal operation of channel▲▼ and volume ▲▼



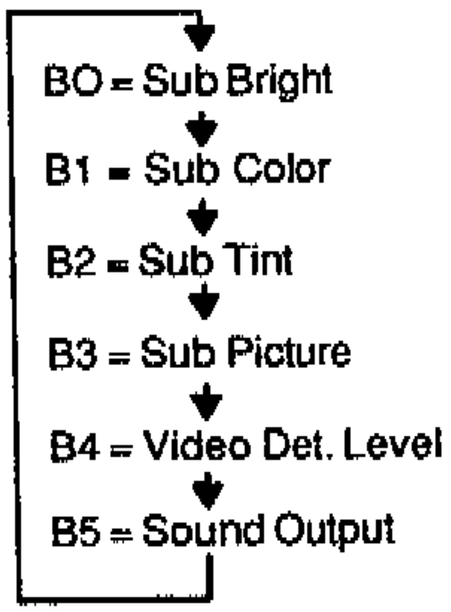
An Address Menu appears in the bottom right hand corner of the screen.

For DAC Adjustments:

a.) **Press** CHANNEL UP/DOWN or DIAMOND UP/DOWN on the Remote Control to select any of 6 Service Adjustment Addresses.

Important Note: Write down the original value (b in detail) for each address adjustment before adjusting anything. It is easy to adjust the wrong item.

b.) **Press** VOLUME UP/DOWN or DIAMOND RIGHT/LEFT on the Remote Control to adjust the level of the selected Service Adjustment.



Adjustment Range and Default level values for Service Adj.

Service Adjustment	Adj Range	Default Level
Sub Bright (BO)	0 ~ 127	67
Sub Color (B1)	0 ~ 63	33
Sub Tint (B2)	0 ~ 63	33
Sub Picture (B3)	0 ~ 63	approx. 35
Video Detector Level (B4)	0 ~ 15	8
Sound Out (B5)	0 ~ 15	8

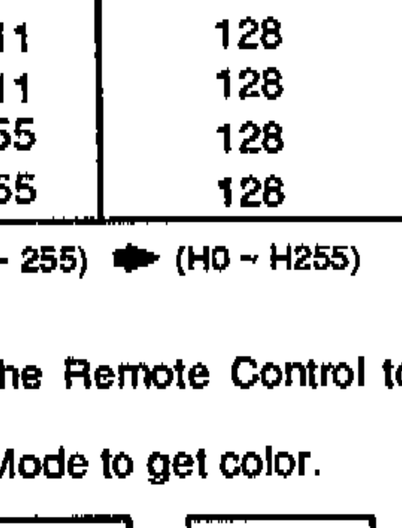
Press the POWER button on the Remote Control to select Serviceman CRT Adjustment Mode.

For CRT Adjustments:

a.) **Press** CHANNEL UP/DOWN or DIAMOND UP/DOWN on the Remote Control to select any of 6 Service Adjustments.

Important Note: Write down the original value (b in detail) for each address adjustment before adjusting anything. It is easy to adjust the wrong item.

b.) **Press** VOLUME UP/DOWN or DIAMOND RIGHT/LEFT on the Remote Control to adjust the level of the selected Service Adjustment.



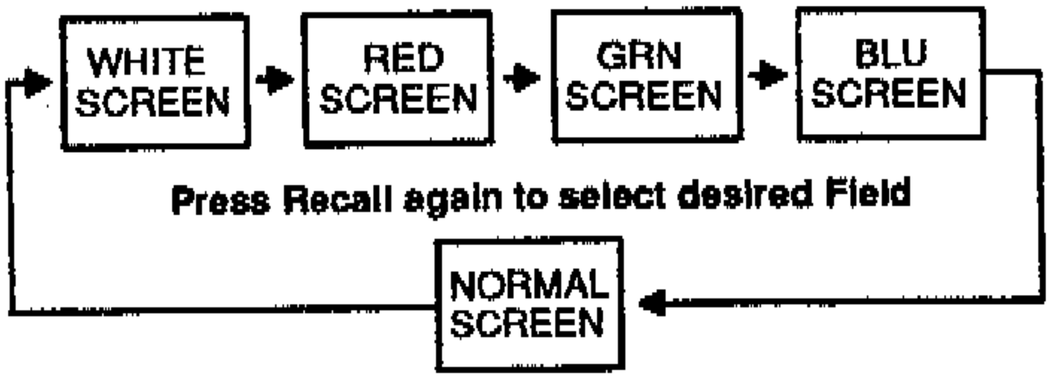
Adjustment Range and Default level values for Service Adj.

CRT Adjustment	Adj Range	Default Level
Horiz Centering (C0)	0 ~ 15	8
RED Cutoff (C1)	*0 ~ 511	128
GRN Cutoff (C2)	*0 ~ 511	128
BLU Cutoff (C3)	*0 ~ 511	128
RED Drive (C4)	0 ~ 255	128
BLU Drive (C5)	0 ~ 255	128

*Adjustment indicated in 2 steps (0 ~ 255) ➨ (H0 ~ H255)

To Check Purity:

Press the RECALL button on the Remote Control to enter Purity Field Check Mode.
NOTE: Must be in Serviceman Mode to get color.



IMPORTANT NOTE:
Always Exit Serviceman Mode After Use.

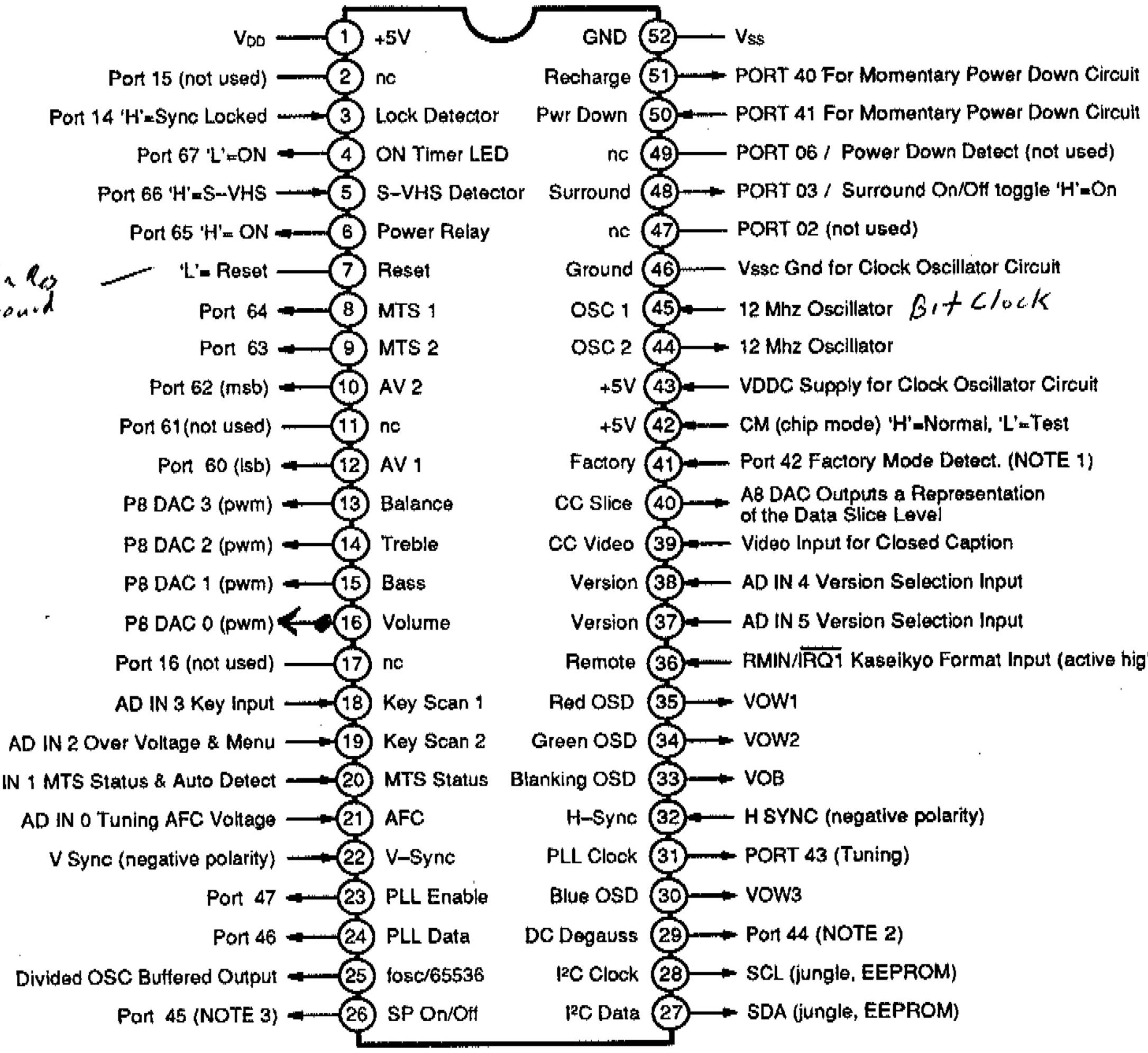
Exit Serviceman Mode:

1. Press ACTION + POWER buttons simultaneously for approximately 2 seconds.
   "The Receiver exits Serviceman Mode".

The Receiver momentarily shuts off; then comes back on tuned to channel 3 with a preset level of sound.

New Circuits

IC001
MPU IN/OUT Pins and Functions



NOTE 1:
Momentarily pulling pin 41 to ground and releasing it will put the microprocessor into factory aging mode. Holding this line at ground will inhibit microprocessor access to I²C bus line.

NOTE 2:
Timing for DC Degauss, 8 seconds after power on outputs a 'High' for 16 milliseconds, then returns to 'L'.

NOTE 3:
Speaker On/Off is also used as audio defeat line.

IC101 Block Diagram