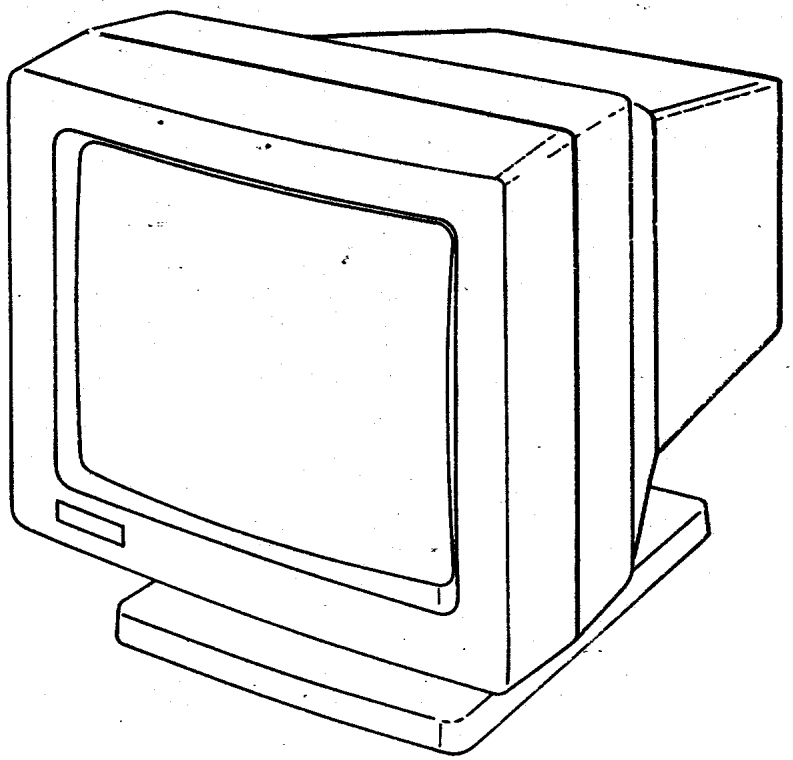
ATARI® SM125™

High-Resolution Monochrome Monitor



For Use with All ATARI ST™ Personal Computers

SERVICE'S MANUAL

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I. INTRODUCTION

The following general characteristics, electrical specifications and safety precautions are provided for your information and use in maintaining the performance of the monitor.

1. Twelve inch monochrome display characteristics.

AC Input	:	230V AC, 50Hz 22 Watts Maximum or 115V AC, 60Hz (jumper wire selectable)
Frequency Response	:	Video bandwidth: 30MHz −3dB at 30Vp-p signal at CRT cathode Rise and fall time: 10nsec.
Cathode Ray Tube	:	12 inches ± 0.5 inches diagonal 90°C deflection Neck size: 20mm Phosophor: P193 CIE color coordinate X = 0.307 ± 0.02 Y = 0.350 ± 0.02 Screen effect: chemical etching
Scanning Frequency	:	Vertical 71.41Hz Horizontal 35.714KHz
Input Impedance/ Polarity	:	Vertical 2K ohm / negative Horizontal 2K ohm / negative
Resolution	:	640 x 400 dots
Geometric Distortion/ Linearity	:	Within 10%
Ambient Temperature	:	0°C to 55°C (operating) 0°C to 65°C (storage)
Humidty	:	20% to 90% RH
Controls	:	A. Internal: Sub-Brightness V-Linearity Focus H-Width B+ 12V adjustment H-Phase V-Hold V-Size B. External: Brightness Volume On/Off SW
Dimensions	:	Approx 323 x 323 x 325 mm (W x D x H)

Weight : Approx 7.5Kg

2. Adjustments

2.1 Brightness adjustment

Procedure:

Step 1. Connect input signal cable.

Step 2. Rotate external brightness control VR303 to maximum.

Step 3. Rotate internal sub-brightness control VR302 to the threshold of the raster.

Step 4. Adjust the external brightness VR for the desired brightness level.

2.2 Vertical size/Linearity adjustment

Procedure:

Step 1. Connect a test pattern generator whose output is identical to the signal normally used.

Step 2. Rotate the vertical size control VR202, until optimum size display is obtained.

Step 3. Rotate the vertical linearity control VR203, until extreme top and bottom characters are equal in height to the center characters.

Step 4. Readjust VR202 until the desired height is obtained.

2.3 Focus adjustment

Procedure:

The optimum focus of the monitor is obtained by adjusting the focus control VR304, for best focus at a point that is near the center and approximately 1/3 down from the top of the monitor.

2.4 Raster centering adjustment

Procedure:

Step 1. Adjust vertical size control, VR202, so that all edges of the raster are visible.

Step 2. Reposition the YOKE into the CRT for best raster centering.

Step 3. Readjust the vertical size control, VR202, to specified dimensions.

Step 4. Secure and bond the YOKE to the neck of the CRT using hot melt adhesive to prevent slipping off.

3. Safety precautions

NOTICE: Observe all cautions and safety related notes located inside the receiver cabinet and on the receiver chassis.

WARNING

To prevent fire or shock hazard
Do not expose this appliance to
rain or moisture.

X-Radiation Warning

To avoid possible exposure to X-Radiation take X-Radiation protective measures for personnel.

During Servicing

See service instructions for specified replacement parts and service adjustments.

II. OPERATION THEORY

A. SWITCHING MODE POWER SUPPLY

1.0 Scope

The chapter provides service information for a 22 Watts single output (12V), single phase input (120 or 240 VAC) switching-mode power supply (S.M.P.S.).

2.0 General Specifications

2.1	AC operation voltage I/P	:	120VAC (90 – 130VAC) or 240VAC (180 – 260VAC)
2.2	AC operation frequency I/P	:	47 – 63 Hz
2.3	DC O/P regulation	:	12 ± 1% VDC for Vo1; ± 5% for Vo2
2.4	DC O/P current	:	1.2 – 1.5A for Vo1; 300 mA for Vo2

3.0 Theory of operation

Reference to Figure 1, S.M.P.S. block diagram and Figure circuit diagram.

3.1 Block diagram description

The AC Line is connected to rectifier (D701 – D704) through the line filter (L701, C701 – C704), when the power switch (SW700) is turned on. The rectifier and DC filter circuit produce about 300 VDC from the AC Line. After the input capacitors (C710, C712) are charged, the start circuit (R705, C716 etc) make the switching circuit (Q701) and the power transformer (T701) operate. The power transformer converts the 300 VDC to 35.714KHz (Horizontal Frequency) oscilation square wave and transfers the high voltage to appropriate level for the output voltage which is produced by half wave rectification and LC filter (D712, C722, C723, L702 etc). The outputs are 12 VDC which are sensed and regulated by the power transformer that control duty cycle modulator (ZD702, Q702 – Q704 etc) and drive circuit (C716, R706 etc).

4.0 Circuit description

The following paragraphs describe each block of the Block Diagram

4.1 Rectifier and DC filter (120 VAC operation)

When the power supply is connected for 120 VAC line operation the jumper wire J701 should be short. That the rectifier (D701 – D704) is connected as doubler producting 300 VDC.

4.2 Rectifier and DC filter (240 VAC operation)

When the power supply is connected for 240 VAC, the jumper wire J701 should be open. That the rectifier circuit is used as a bridge rather than a doubler as in the 120 VAC connection. In this case, the rectifier output is also approximate 300 VDC.

4.3 Start circuit, Switching circuit, Power transformer

When the rectifier output is reaching 300 VDC, the start circuit make the switching circuit operation, then the power transformer converts 300 VDC to 35.714 KHz square wave and transfers it to the appropriate level for the output.

4.4 Duty cycle modulator & drive circuit

Duty cycle modulator provide a reference voltage DC 6.2V (ZD709) to compare with output voltage sensor (12V output voltage adjustment VR701) that control the feedback voltage of the transformer, so duty cycle modulation and switching operation will be completed.

4.5 Isolation transformer (T702)

It makes the oscillation frequency of the switching circuit synchronize with the horizontal frequency.

B. VIDEO CIRCUIT

The video signal is applied to the input connector cable. The IC 401 SN7406 is utilized as video buffer/former circuit. The video amplifier gain is decided by R407, and load resistor R415. The peaking coil L401 is compensated for video frequency response. D403 is a protection diode.

C. CRT CIRCUIT

High voltage is applied to the CRT bulb to provide anode voltage. "CAUTION". This is very high voltage, over several thousand volts. D311 rectified the pulse from flyback then filtered by C406 to maintain at a normal 40 Volts is used for Q402 collector. Grid G2 is the acceleration grid and is maintained at a normal 600 Volts rectified by D309 and C318, G4 is the focus grid. VR304 adjust the focus voltage from –100V to 600V to improve focus.

D. VERTICAL CIRCUIT

3.1 The vertical IC TDA1170N is a monolithic integrated circuit in a 12 – lead quad

in-line plastic package. The functions incorporated are:

1) Synchronization circuit
2) Oscillator and ramp generator
3) High power gain amplifier
4) Flyback generator
5) Voltage regulator

3.2 Oscillator circuit

The vertical sync pulses are coupled through C201 to pin 8 of IC201, VR201 adjusts the frequency of the vertical oscillator. The D202, C210 is made up of pump up voltage.

3.3 Vertical output

The vertical sweep output is obtained at pin 4, 10 and 11 of IC201. R212, C205, R211 are made up of DC feedback of amplifier. R209, R210 are AC feedback.

The vertical size of the raster or amplitude of the sweep is adjusted by VR202. The linearity of the vertical sweep is adjusted by VR203.

E. HORIZONTAL CIRCUIT

The IC301 SN74LS221 is a dual, monolithic, non-retriggerable, high-stability one shot. The output pulse width, tw can be varied over 9 decades of timing by proper selection of the external timing components, C303 and R304, C304 and R303. Pulse width is defined by the relationship:

tw (out) = Cext Rext ln 2 = 0.7 Cext Rext.

The flyback transformer generates the high voltage necessary for the anode voltage of the CRT. A secondary winding supplied G1; G2. The deflection coil current source is also obtained from the output of Q302. The amplitude of the pulse is approximately 190Vp-p, L302 adjust horizontal width, and L303 controls the horizontal linearity. C307 is a S-shaping capacitor.

F. HIGH VOLTAGE SUPPLY CIRCUIT

High voltage is obtained by rectification of the high voltage output of the flyback transformer T301. This diode is molded into the transformer housing.

G. AUDIO CIRCUIT

The IC501 is an audio amplifier. The power supply is provided from pin 6. Pin 4 is the ground lead. The input audio signal is coupled from pin 3 and after amplified the output signal is from pin 5 to the speaker. VR501 is volume adjustment. C505 is a compensation capacitor to avoid from high frequency oscillation. R504, C504 can increase the high frequency loading and keep from the high-frequency oscillation. R502 is a voltage gain resistor. C502 is a DC block capacitor. R503, C507 are the impedance matching components R501 is

the bias resistor. C501, C510 and C506 are the signal coupling capacitor. C508 is the filter capacitor.

III. SERVICE NOTES

The service notes given here are to be utilized in maintaining monitor. The theory of operation in chapter II can be used for normal operation. The flow charts in this chapter should help isolate any given failed component.

1. Circuit tracing

Component reference numbers are printer on top and bottom of the circuit board to facilitate circuit tracing. In addition, control names and board terminal numbers are also shown and are referenced on the chassis schematic diagram in this manual.

2. Component removal

Removal components from the etched board is facilitated by the fact that the circuitry appears on one side of the board only and the component leads are inserted straight through the holes and are not bent or crimped. The nozzle of the soldering gun is inserted directly over the component lead and when sufficiently heated, the solder is drawn away leaving the lead free from the copper plating.

3. General troubleshooting

The brightness control should be adjusted to maximum, when power up, the examination of the unit should follow the flow chart shown in Fig. 2. Does the unit have a high frequency sound? If it does, this means that high voltage is being generated. If not, then go to the horizontal diagnostic flow chart. If there is high voltage and a visible raster, then the problem may be diagnosed using the regular diagnostic flow chart. If there is high voltage but no visible raster, there is probably a video problem. Follow the video diagnostic flow chart. If the unit is completely dead, one and both fuses probably blown.

4. Troubleshooting video circuit

Fig. 3 contains a step-by-step troubleshooting guide for isolating the malfunctioning components in your monochrome diplay. Is there a video source connected to the unit? If not, check for broken connections or a loose connector. If the waveform of the emitter of Q402 exists, see if the waveform of the collector of Q402 exists? If not, then Q402 or video B+ is defective. If waveform of the emitter of Q402 not exist, IC401 or Q401 may be bad or there may be a bad passive component in this area. If Q402 collector waveform exist, the CRT is probable bad. Use safety precautions to handle the CRT and remember to discharge the aquadag voltage built up on the CRT.

5. Troubleshooting vertical circuit

The vertical circuit in general are all contained in IC201. If the unit has only a horizontal line or a very distorted vertical image, check the deflection YOKE for a short or IC201 may be defective or a passive components is bad. Due to the complete vertical circuit being contained in one integrated circuit, very few problems have been encountered in this area.

6. Troubleshooting horizontal circuit

The horizontal circuits are diagnosed using the flow chart shown in Fig. 4 The methodology used, is to start at the back and work forward. Is wavefrom of collector pulse Q302 present? If wavefrom is present but there is no high voltage being generated, the problem is usually a broken printed board land around the horizontal flyback transformer. If waveform is not present, is wavefrom of BASE Q302 present? If so, then Q302 or the horizontal flyback is probably bad. If wavefrom is not present, then IC301 is probably defective.

7. Troubleshooting high voltage circuit

If the horizontal processing and sweep generator are functioning, the unit is probably generating both the bootstrap and aquadag voltages. If not, then check for broken printed circuit board lands or defective diodes. The rectifier diode for the quadag voltage is not accessible. The horizontal flyback transformer must be replaced.

8. Mechanical adjustments

8.1 CRT replacement

A. Remove the anode cap from CRT small cavity cap.

B. Remove the CRT SOCKET from CRT pin BASE.

C. Loosen the screw of the deflection Yoke, remove the deflection YOKE from CRT CONE.

D. Remove the four screws.

E. Take off the CRT ground connector.

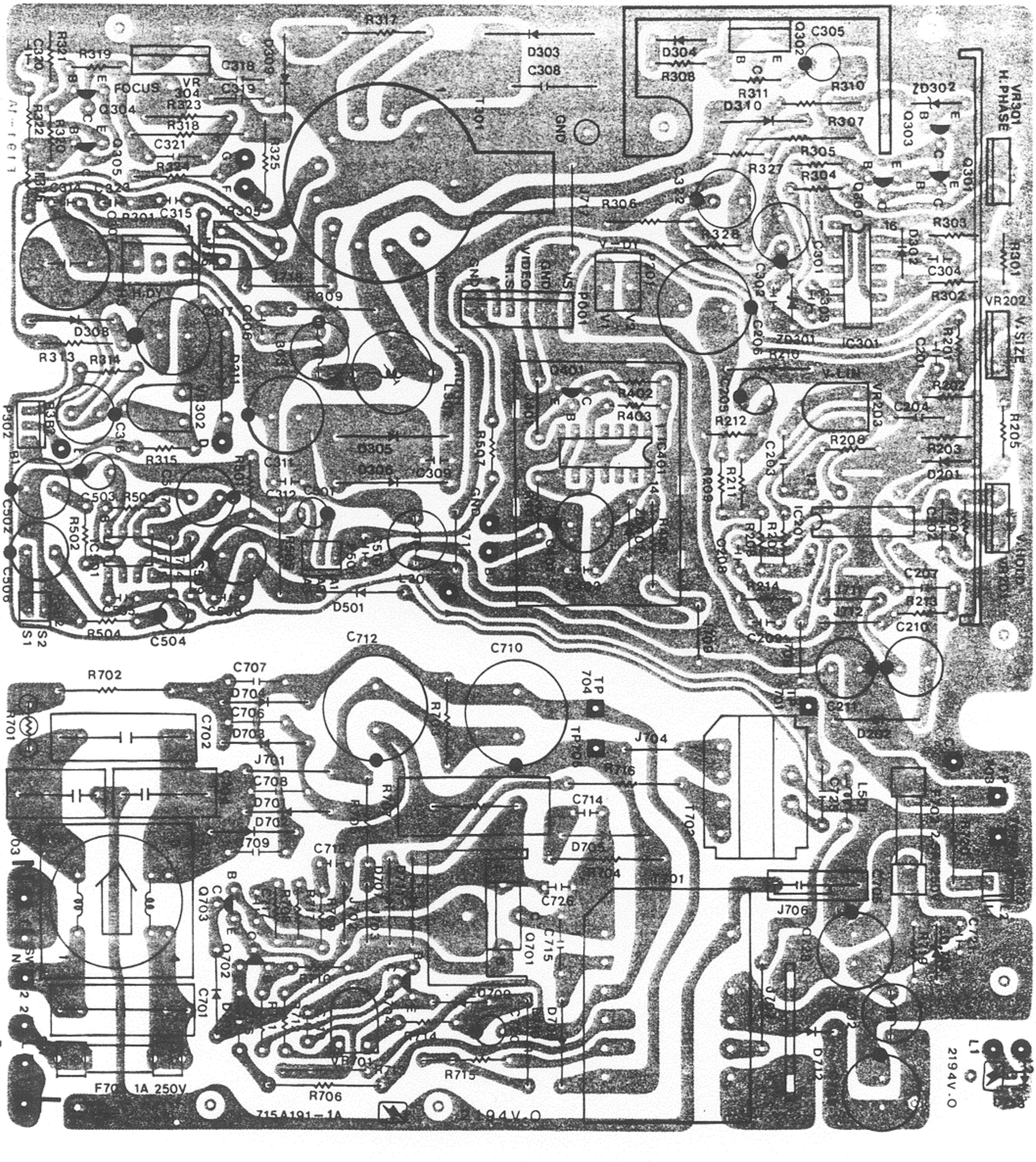
F. Remove the CRT from cabinet.

8.2 Raster centering

The centering device consists of two levers attached to the rear of the deflection YOKE. By turning these two levers alternately, you can adjust the picture so that it will come to the center of the screen.

8.3 Deflection YOKE

When the scanning lines of the raster are not horizontal or corner shades appear, loosen the screw securing the deflection YOKE and press the deflection YOKE hard against the root of the neck of the picture tube, adjust by turning to the right or left so that the scanning line of the raster will be horizontal.


R317
D303
C308
T301
GND
D304
R308
C305
Q302
R311
R310
D310
R307
ZD302
VR301
H.PHASE
Q303
R305
R304
R327
R306
R303
R301
C304
R302
VR202
V.SIZE
R319
FOCUS
VR
304
C318
C319
R323
R318
C321
Q304
Q305
D309
R325
C315
H.DY
D308
R313
R314
R309
V-DY
P001
Q401
R402
R403
IC401
D305
D306
R507
IC301
ZD301
R210
V.LIN
VR203
R212
C204
R206
R203
R205
D201
C203
R211
IC201
R214
C207
R213
C210
C209
C211
D202
P302
R315
C311
C503
R503
R502
C502
C506
C312
D501
R504
C504
S2
S1
C712
C710
R702
C707
D704
C706
D703
C702
R701
J701
C708
TP
704
TP706
J704
R716
C714
T702
D705
C711
R704
C726
Q703
Q701
C715
J706
Q702
C701
R710
D700
R714
VR701
R706
R715
F701 1A 250V
715A191-1A
194V-0
L1
2194V.O

10) BLOCK DIAGRAM WITH SM125

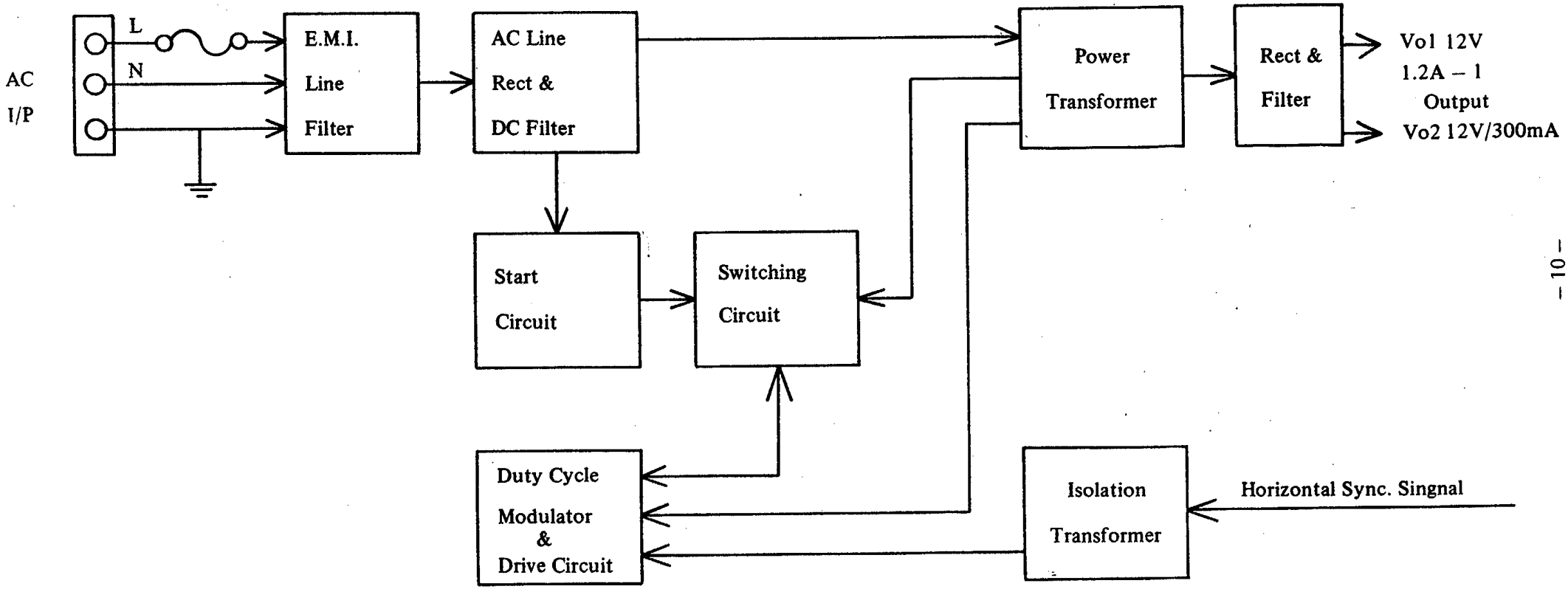


Figure 1

S.M.P.S. BLOCK DIAGRAM

11) TROUBLE SHOOT

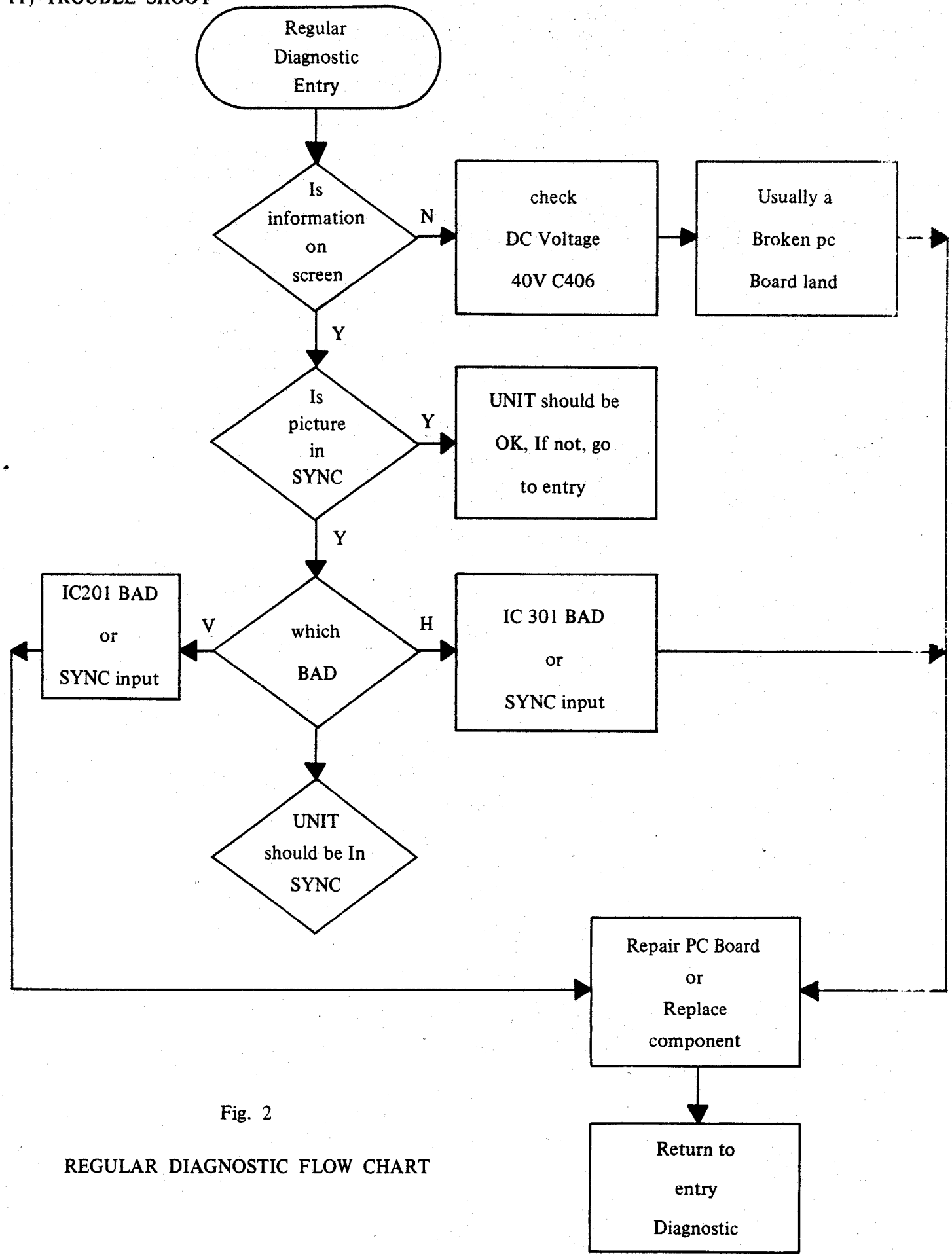


Fig. 2

REGULAR DIAGNOSTIC FLOW CHART

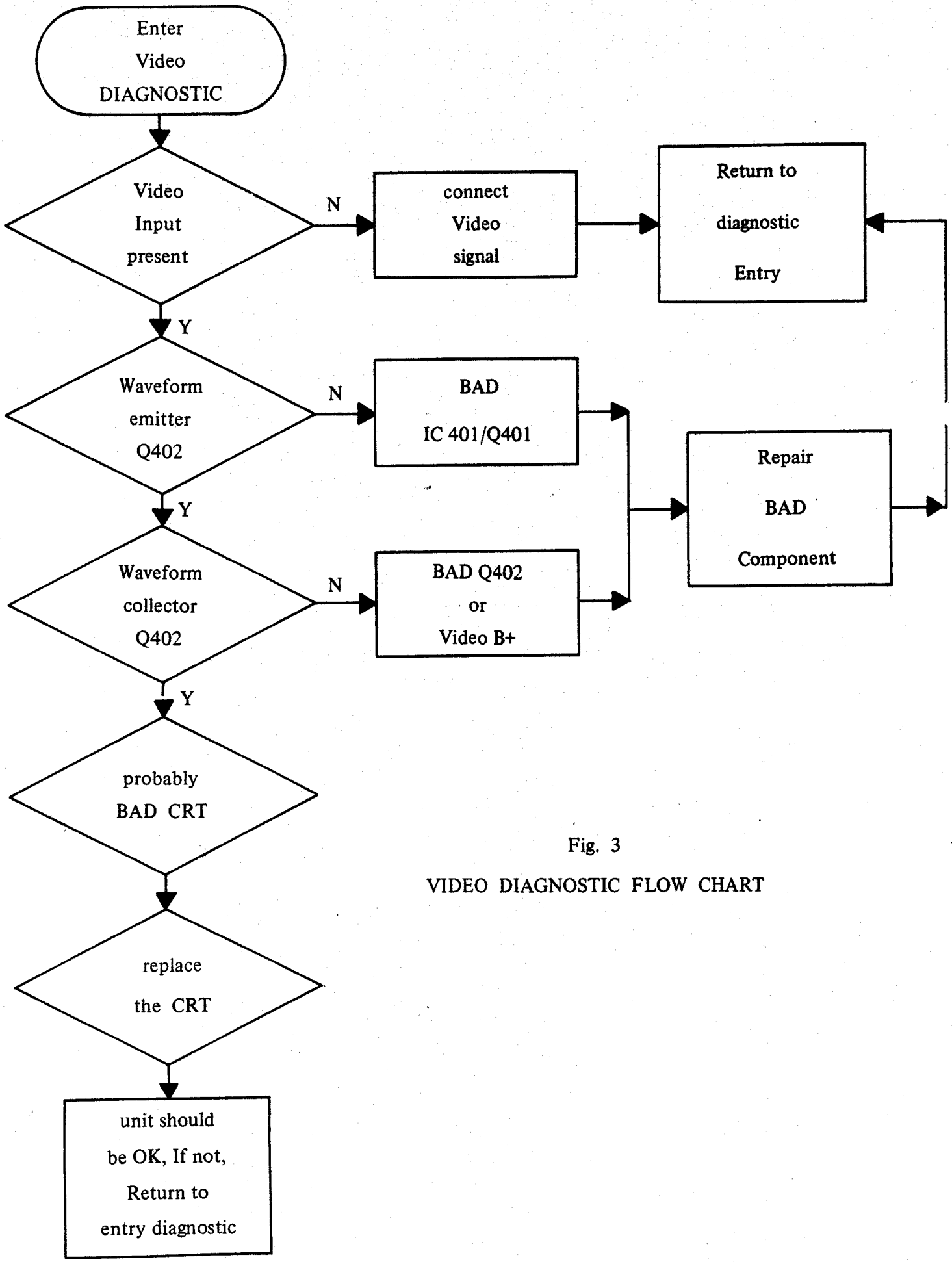


Fig. 3

VIDEO DIAGNOSTIC FLOW CHART

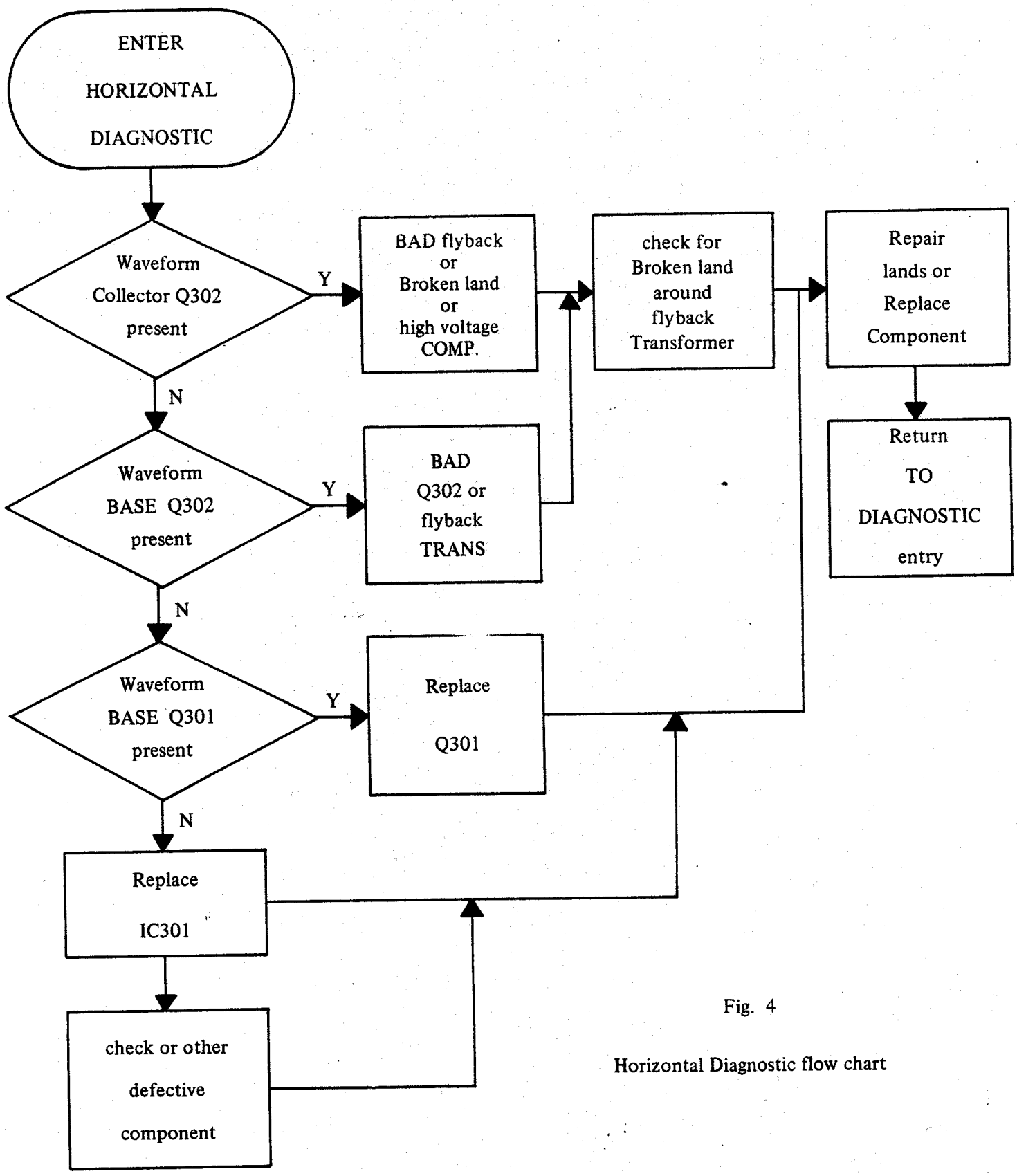
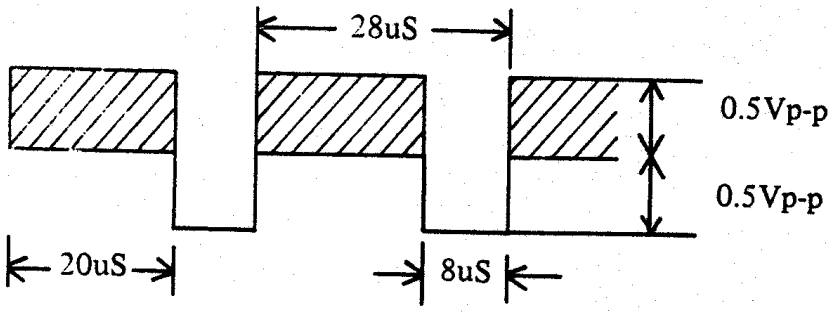


Fig. 4

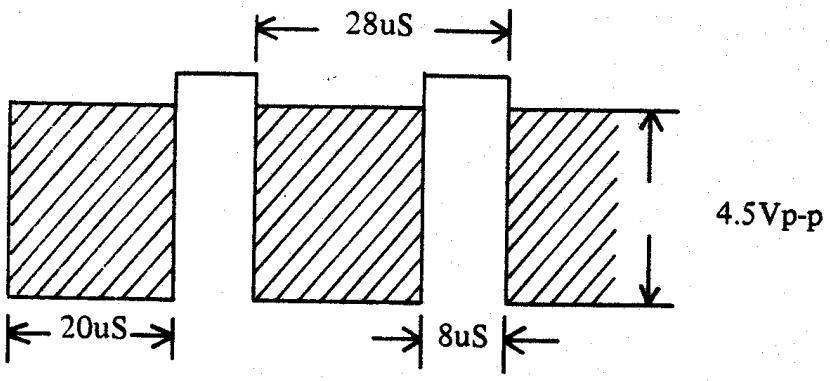
Horizontal Diagnostic flow chart

IV. WAVEFORMS AND VOLTAGES

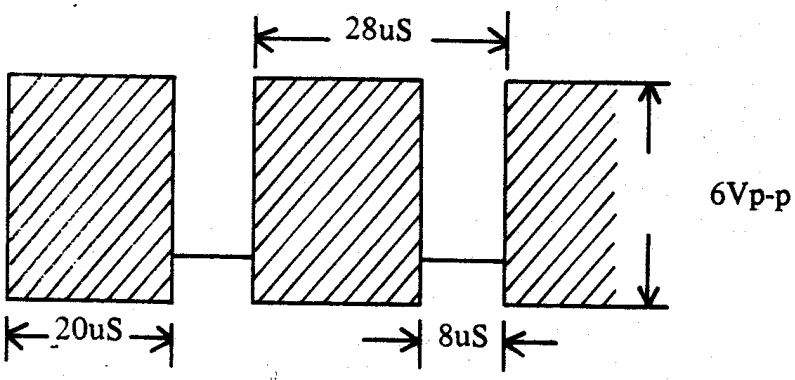
Q401 Base



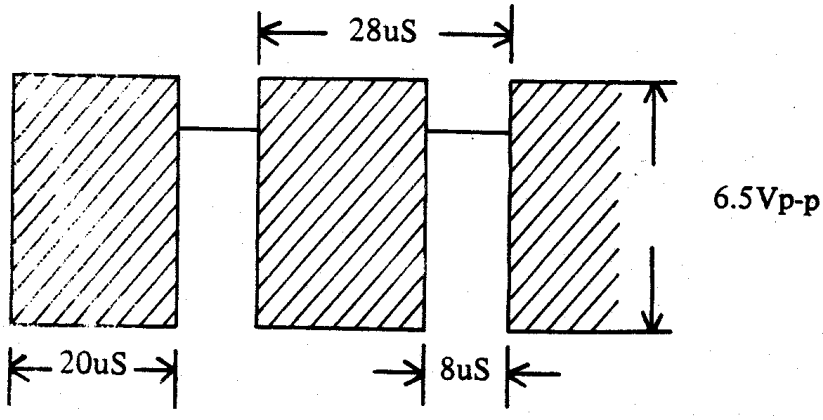
Q401 Collector, IC401 Pin #1



IC401 Pin #2

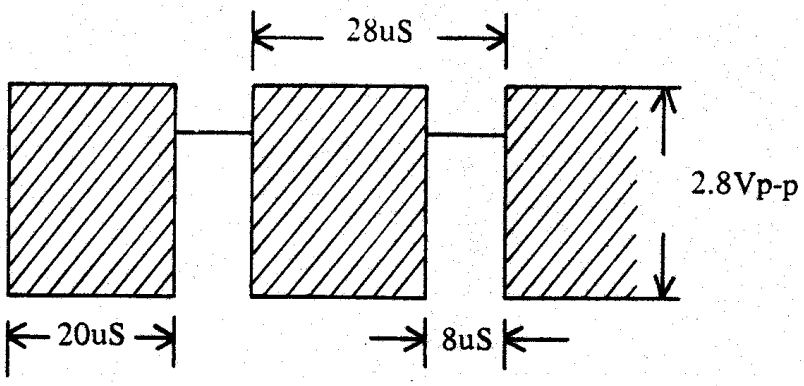


IC401 Pin #8



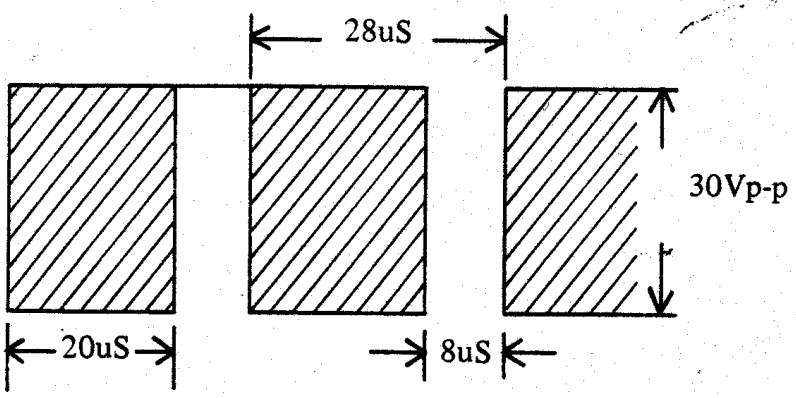
Q401	DC Voltage
Base	0.45V
Collector	2.65V
IC401	
Pin # 1	2.65V
Pin # 2	2.32V
Pin # 3	NC
Pin # 4	NC
Pin # 5	2.32V
Pin # 6	2.13V
Pin # 7	0
Pin # 8	2.13V
Pin # 9	2.32V
Pin #10	2.13V
Pin #11	2.32V
Pin #12	NC
Pin #13	NC
Pin #14	5.17V

Q402 Emitter

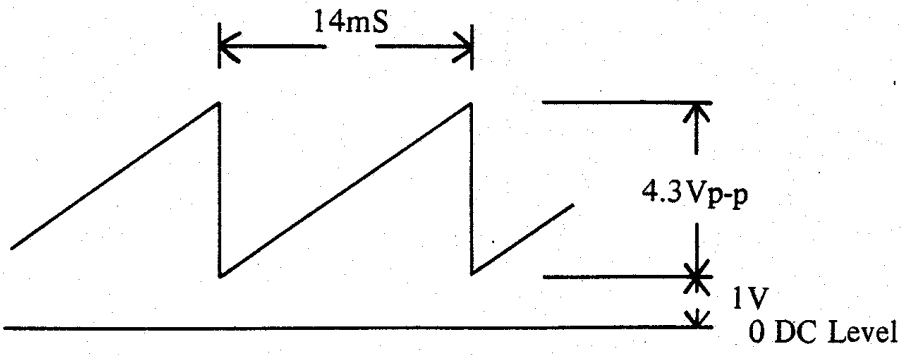


Q402	DC Voltage
Base	4.35V
Collector	22.7 V
Emitter	3.86V

Q402 Collector

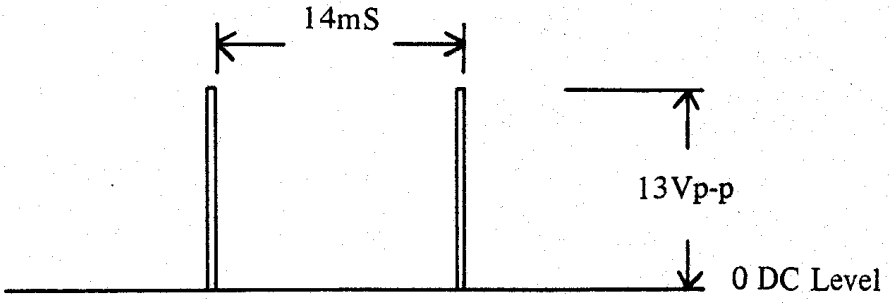


Vertical IC201 56A157-1
PIN #1

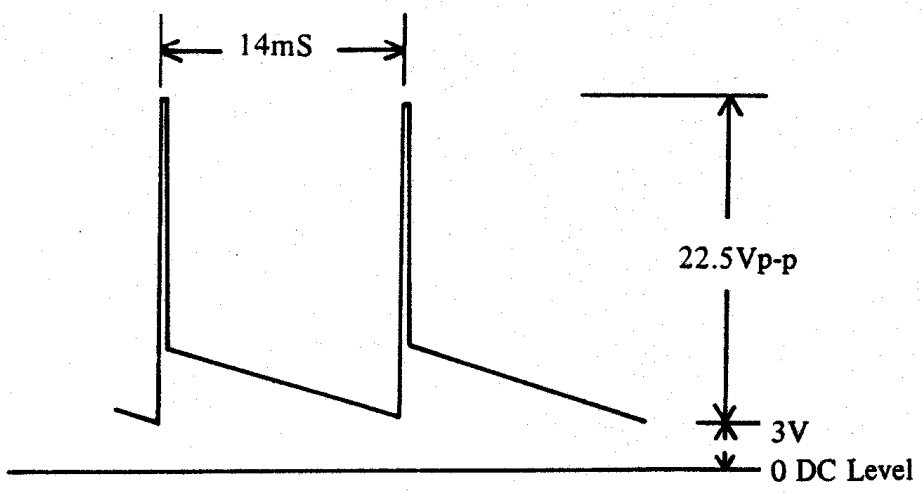


IC201	DC Voltage
Pin #1	3.1 V
Pin #2	12 V
Pin #3	6.23V

Pin #3

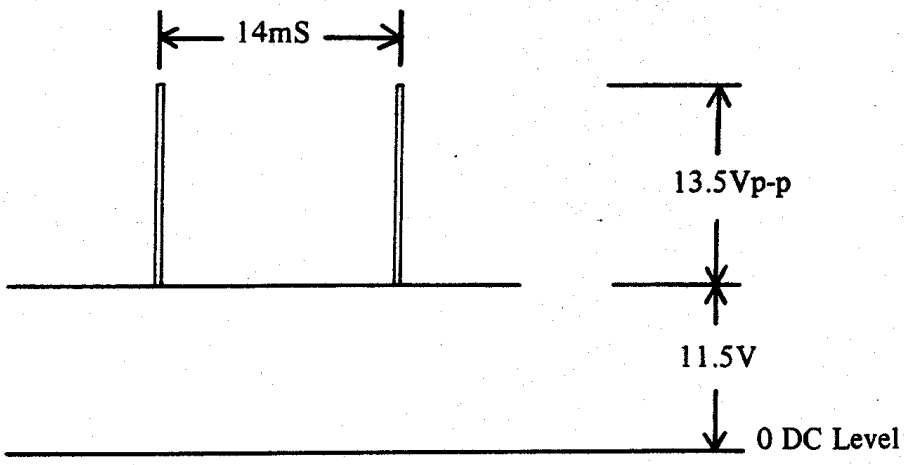


Pin #4

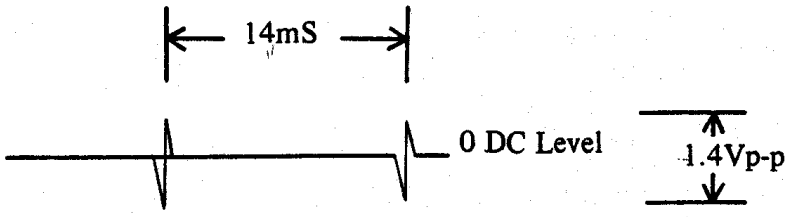


IC201	DC Voltage
Pin # 4	6.3 V
Pin # 5	11.6 V
Pin # 6	6.59V
Pin # 7	6.69V
Pin # 8	0
Pin # 9	2.85V
Pin #10	2.1 V
Pin #11	0.69V
Pin #12	2.4 V

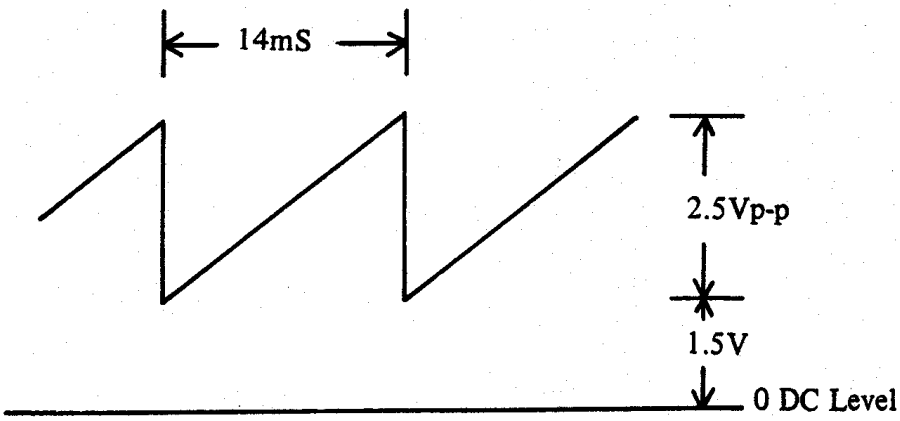
Pin #5



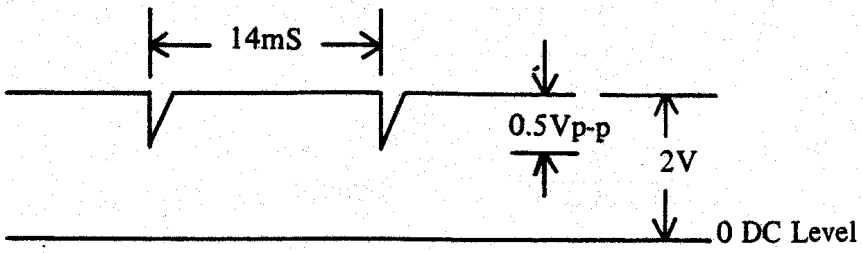
Pin #8



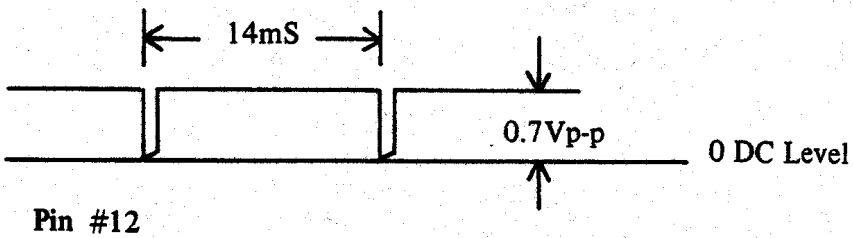
Pin #9



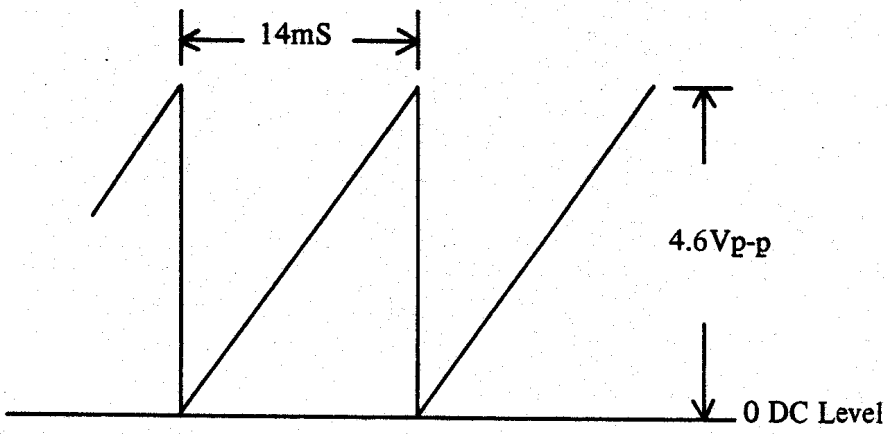
Pin #10



Pin #11

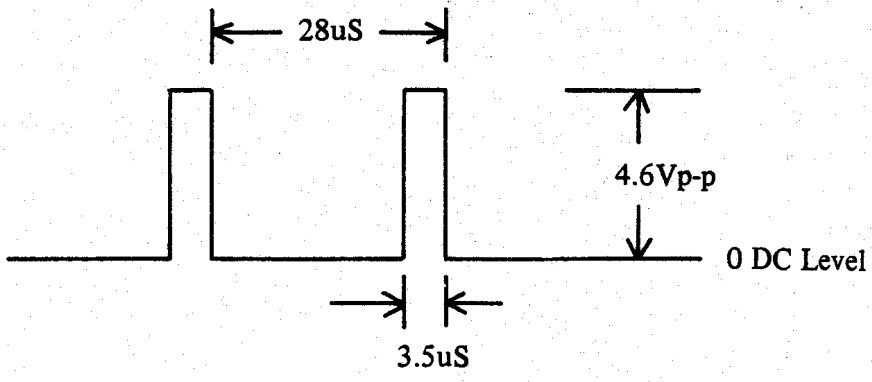


Pin #12

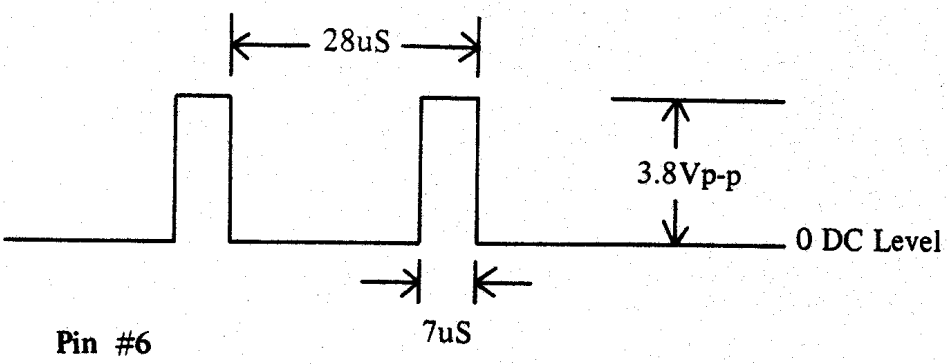


Horizontal IC301 56A74LS-221

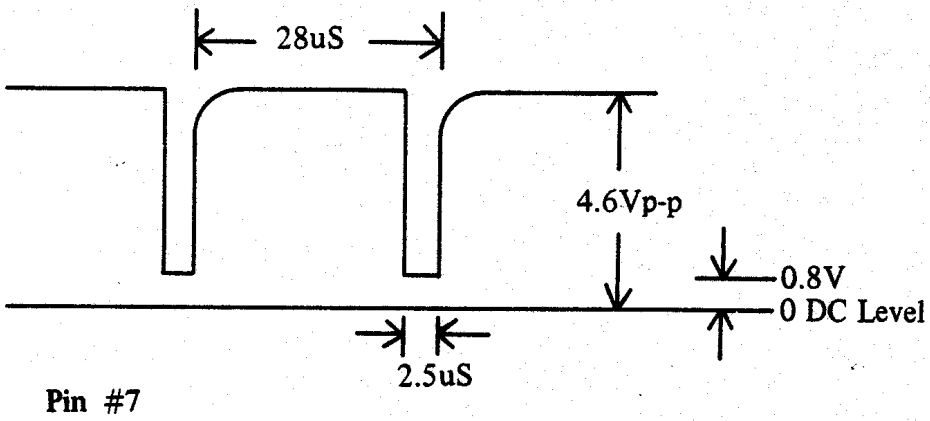
Pin #1 , Pin #5



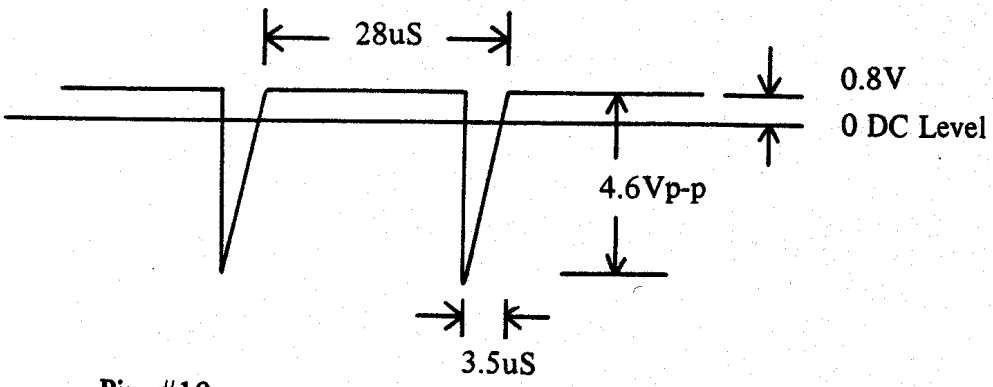
Pin #4



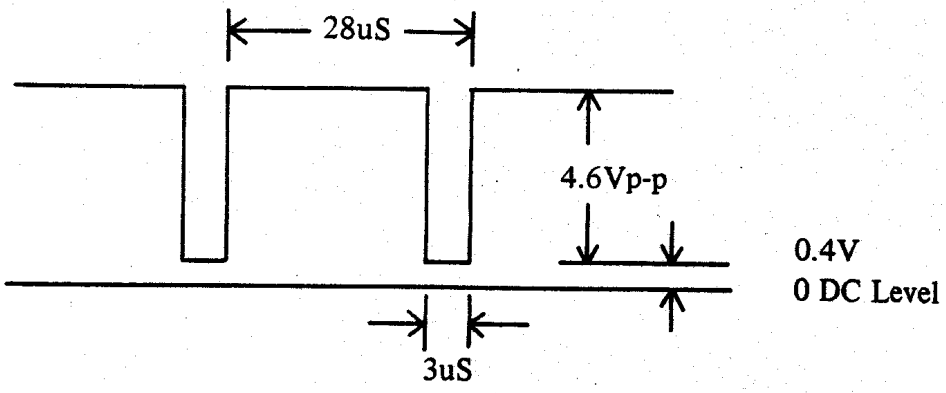
Pin #6



Pin #7

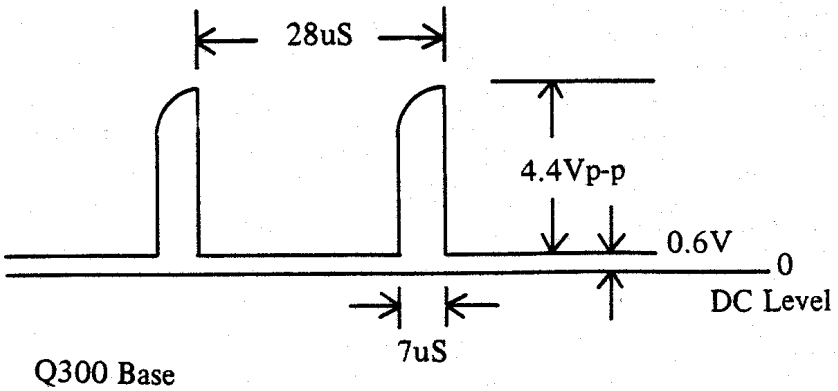


Pin #10

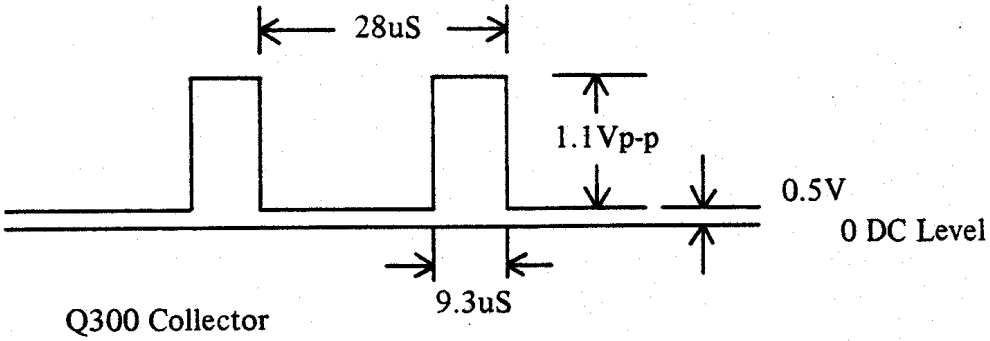


IC301	DC Voltage
Pin # 1	0.63V
Pin # 2	5.18V
Pin # 3	5.18V
Pin # 4	1 V
Pin # 5	0.63V
Pin # 6	4.5 V
Pin # 7	0.56V
Pin # 8	0
Pin # 9	0
Pin #10	4.41V
Pin #11	5.18V
Pin #12	NC
Pin #13	NC
Pin #14	1.7 V
Pin #15	5.18V
Pin #16	5.18V

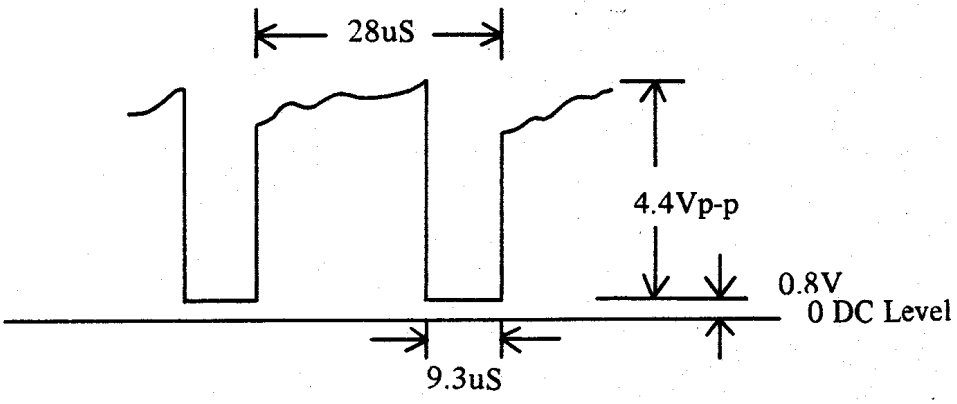
Pin #14



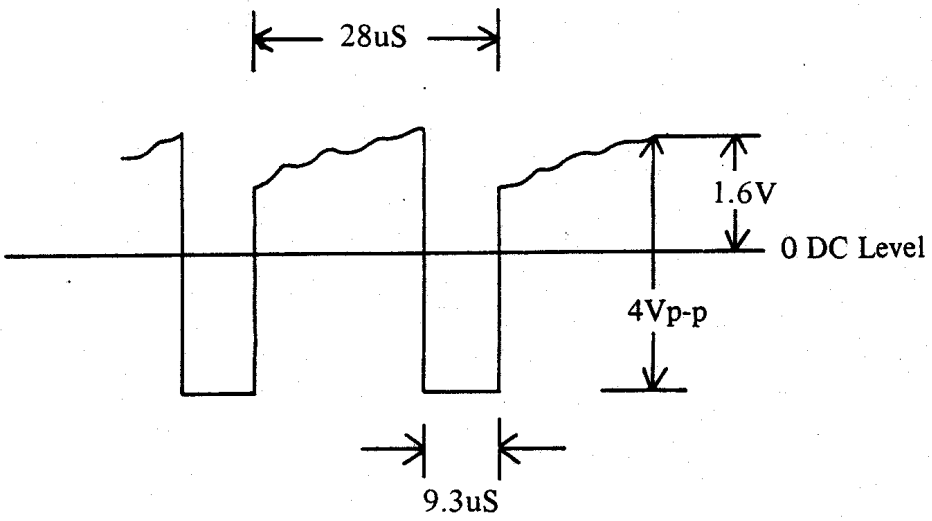
Q300 Base



Q300 Collector

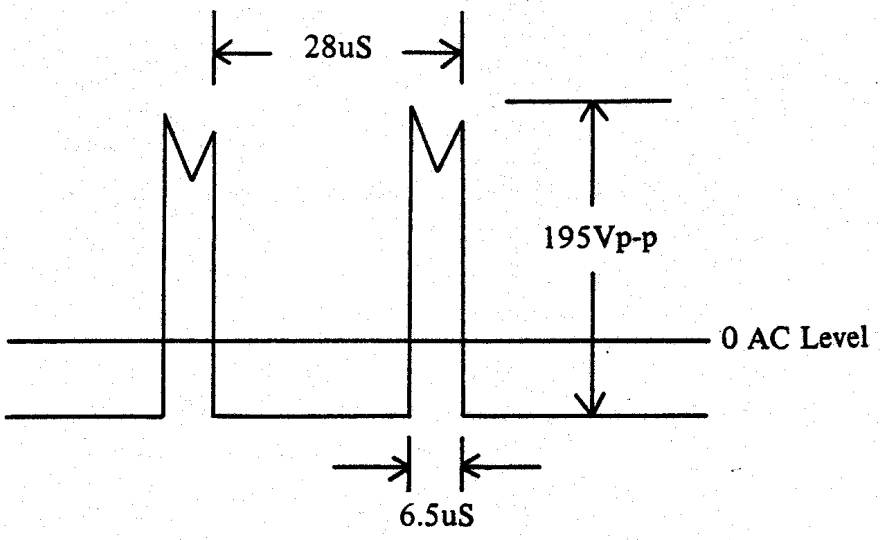


Q302 Base

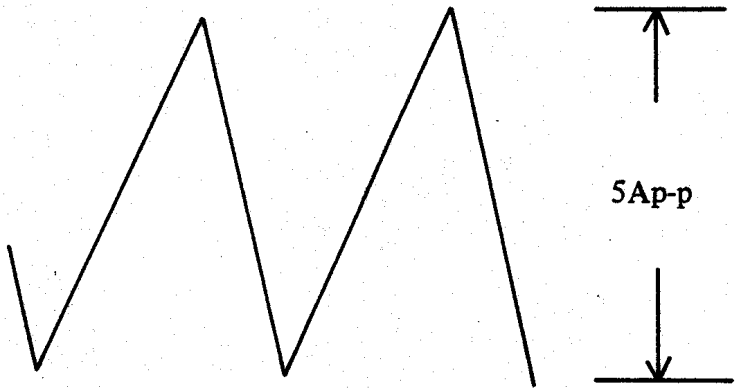


Q300	DC Voltage
Base	0.6 V
Collector	3.5 V
Q302	Voltage
Base	0.32V

Q302 Collector



Horizontal Deflection YOKE Current



Vertical Deflection YOKE Current