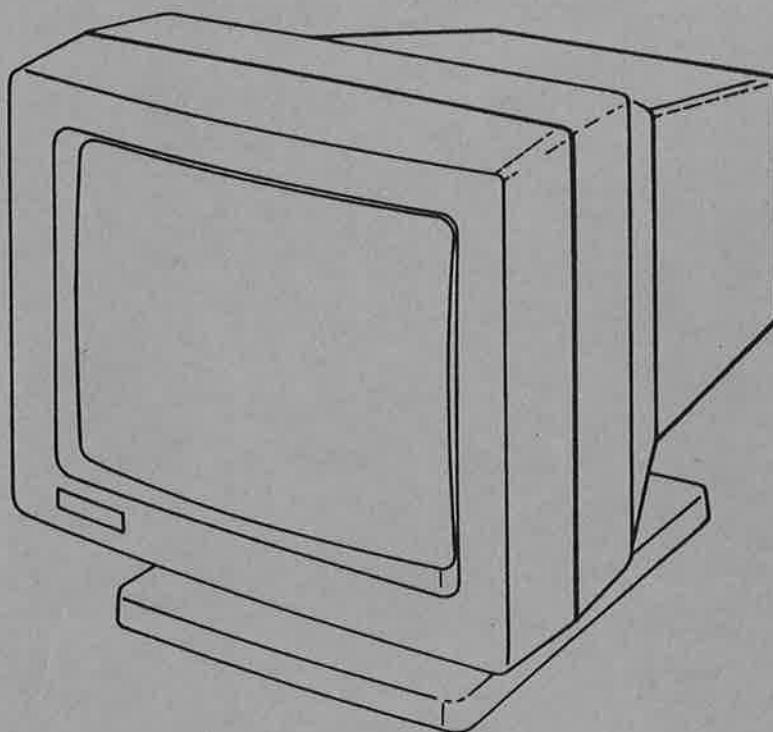


ATARI[®] SM125[™]

**High-Resolution
Monochrome Monitor**



**For Use with All ATARI ST[™] Personal
Computers**

SERVICE'S MANUAL

Printed in Taiwan
P/N C026408

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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 \pm 0.5 inches diagonal 90°C deflection Neck size: 20mm Phosphor: 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) |
| Humidity | : | 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 Figur. 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) oscillation 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 producing 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, t_w 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:

$$t_w (\text{out}) = C_{ext} R_{ext} \ln 2 = 0.7 C_{ext} R_{ext}.$$

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 printed 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 display. 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 probably 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 waveform of collector pulse Q302 present? If waveform 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 waveform of BASE Q302 present? If so, then Q302 or the horizontal flyback is probably bad. If waveform 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

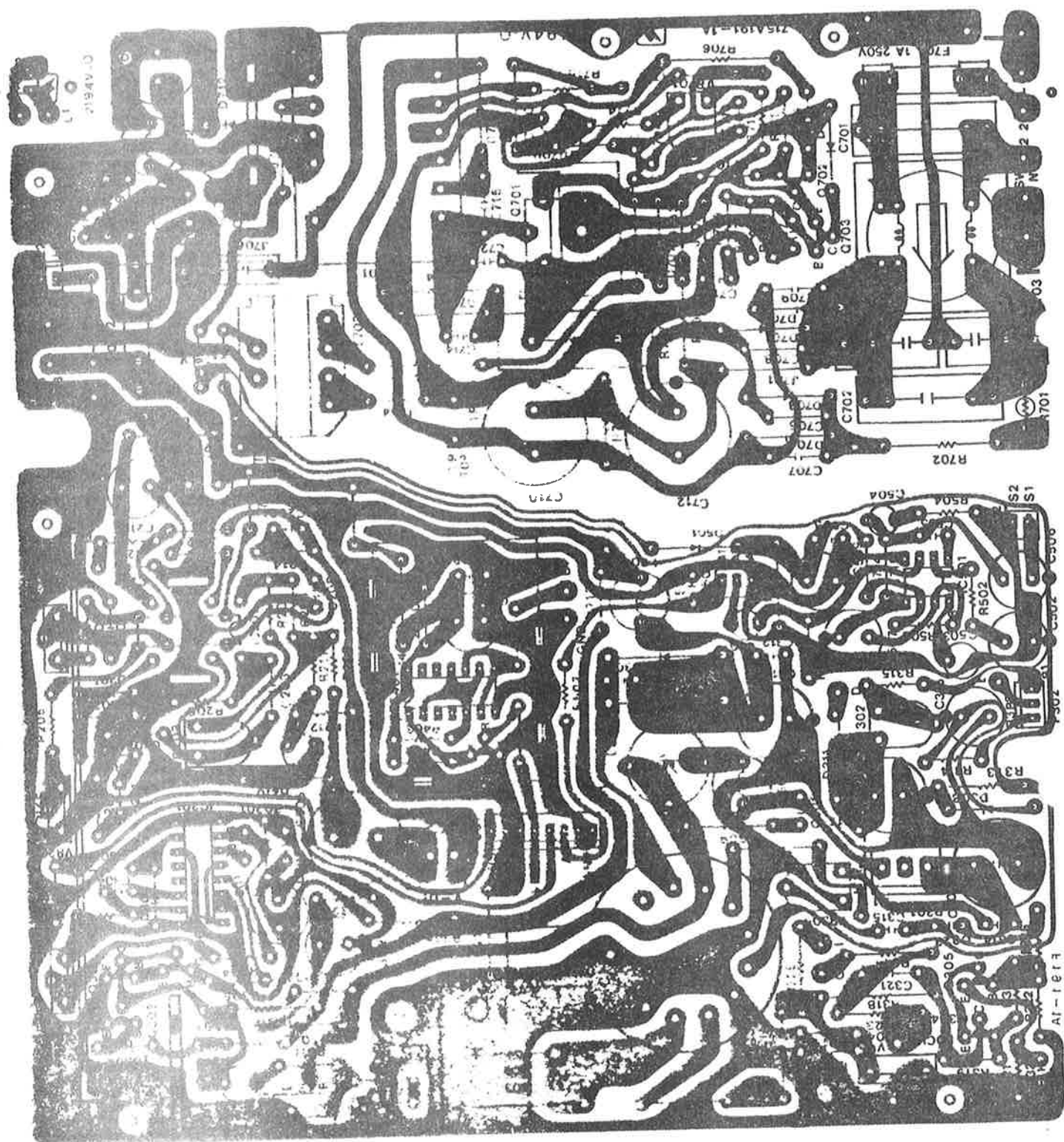
- A. Remove the anode cap from CRT small cavity cap.
- B. Remove the CRT SOCKET from CRT pin BASE.
- C. Loosen the screw of the deflection Yoke, remove the deflection YOKE from CRT CONE.
- D. Remove the four screws.
- E. Take off the CRT ground connector.
- F. Remove the CRT from cabinet.

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.



10) BLOCK DIAGRAM WITH SM125

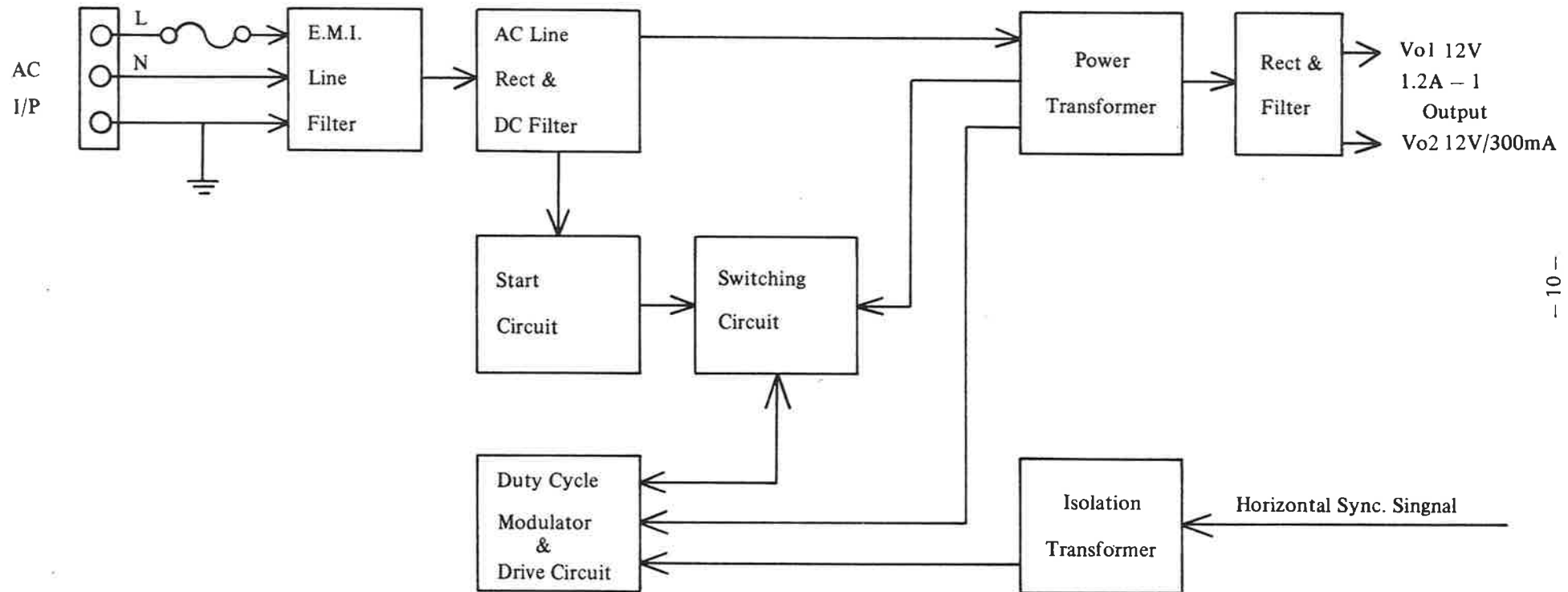


Figure 1

S.M.P.S. BLOCK DIAGRAM

TROUBLE SHOOT

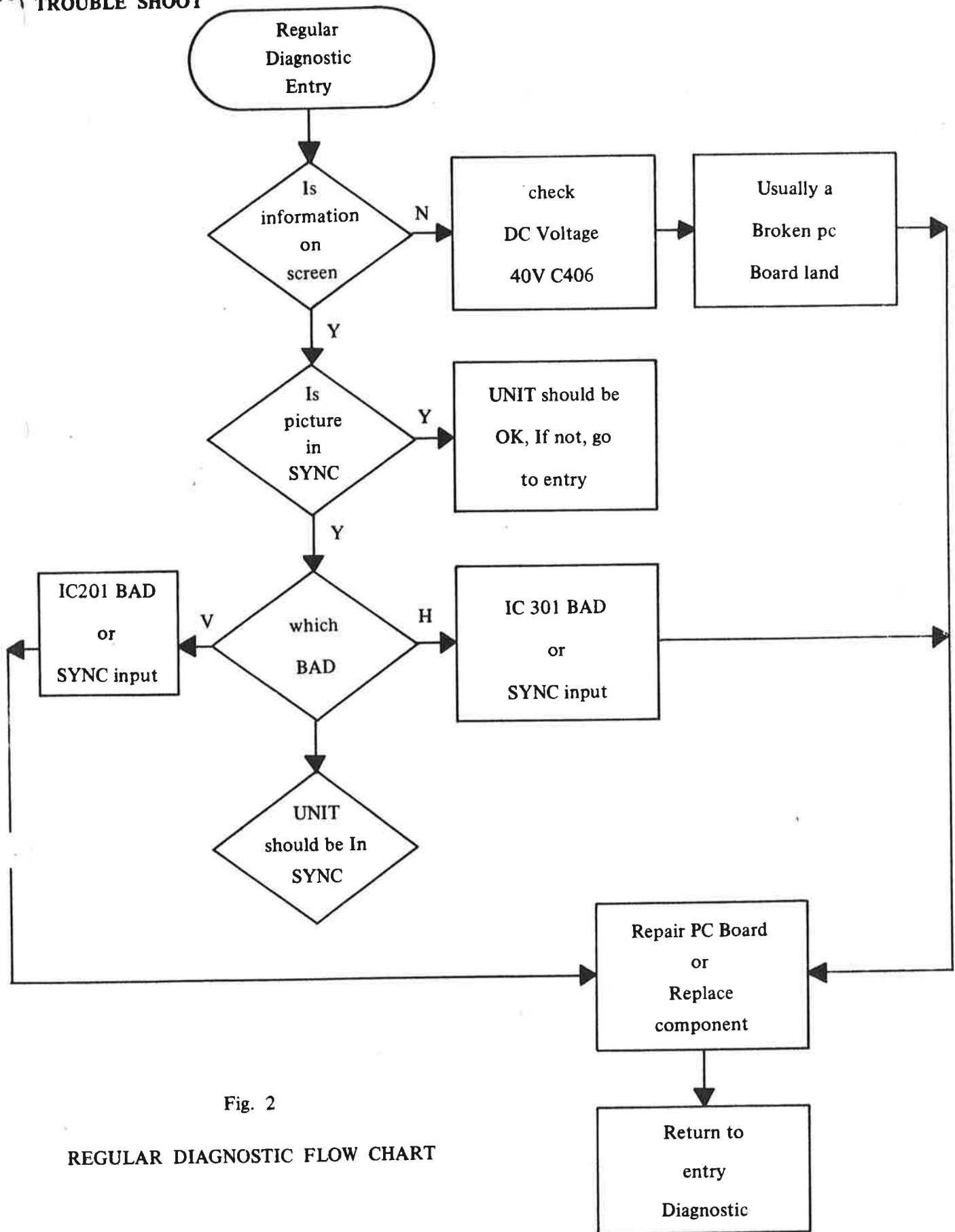


Fig. 2

REGULAR DIAGNOSTIC FLOW CHART

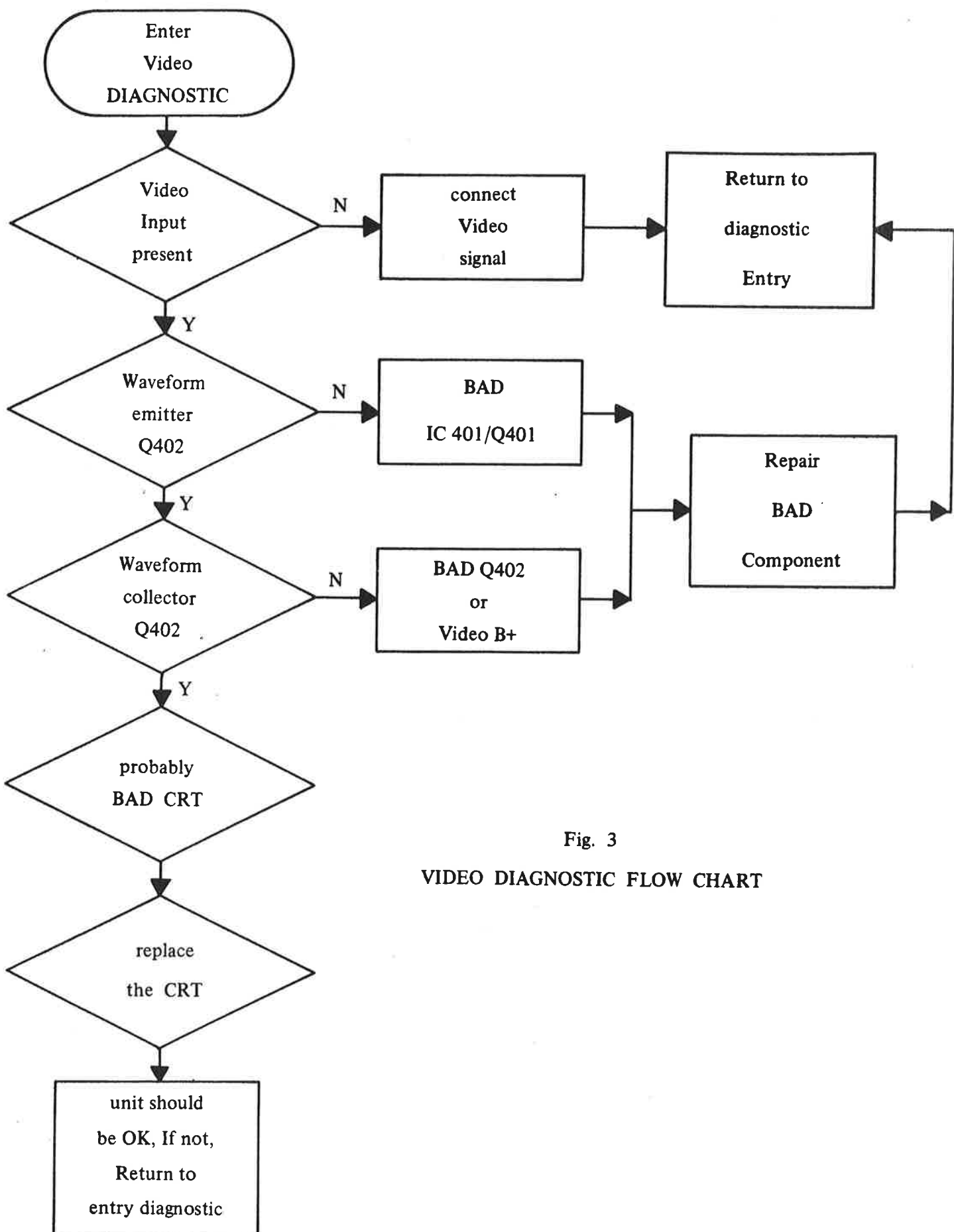


Fig. 3
VIDEO DIAGNOSTIC FLOW CHART

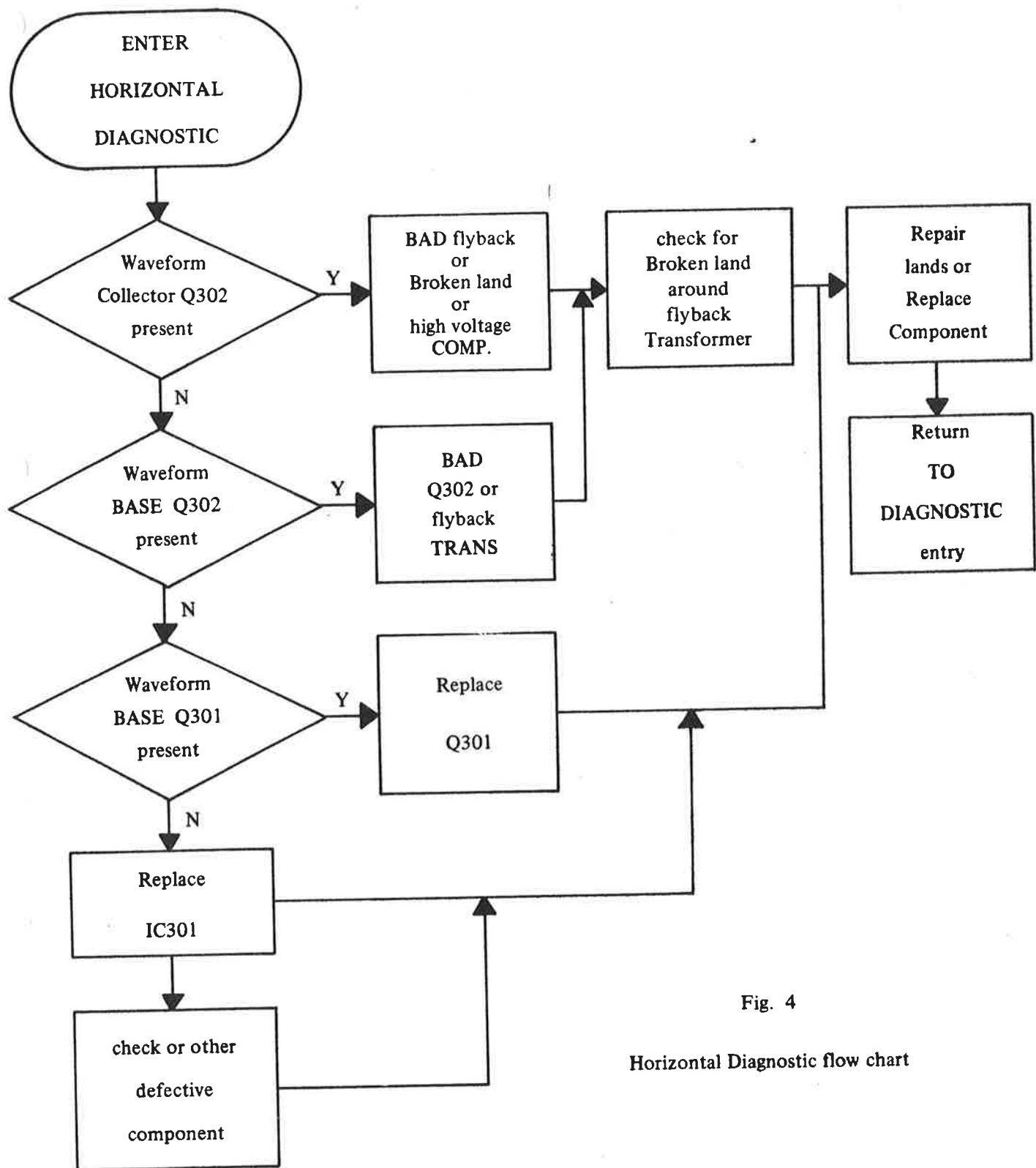
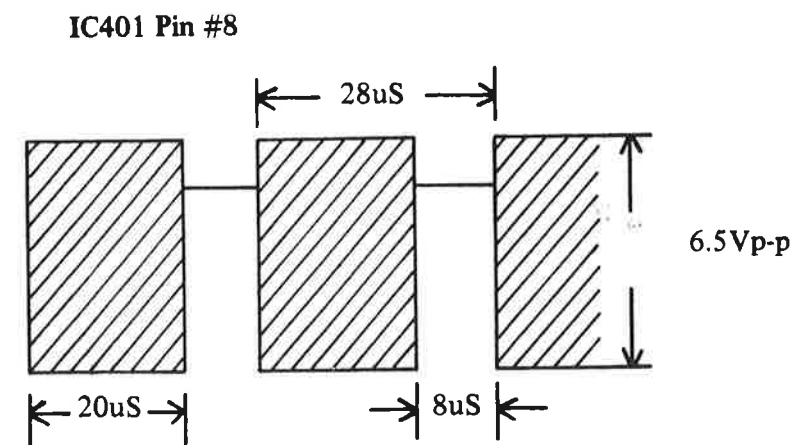
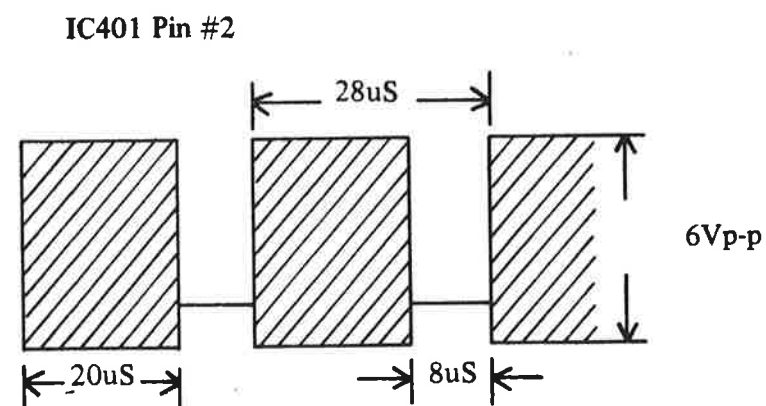
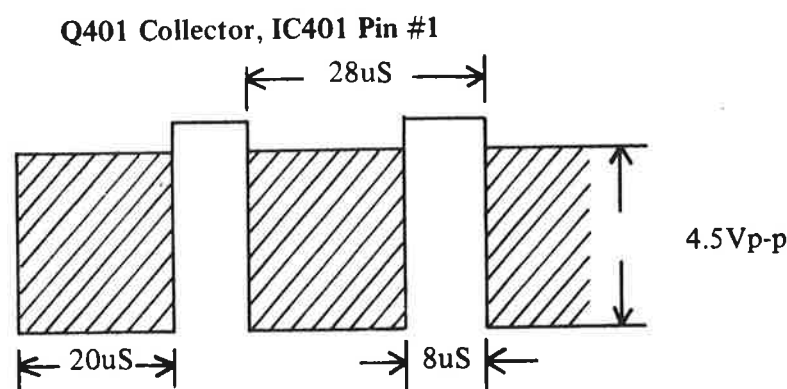
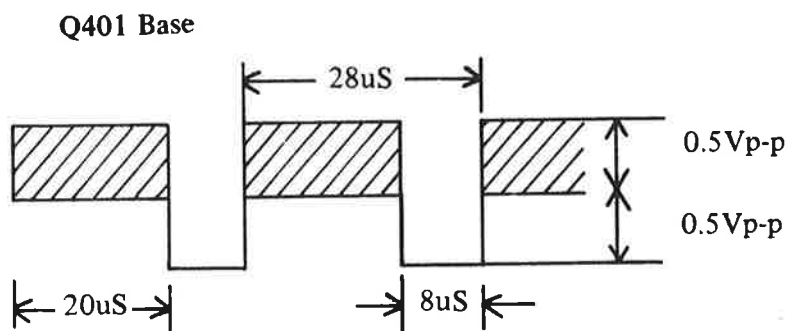


Fig. 4

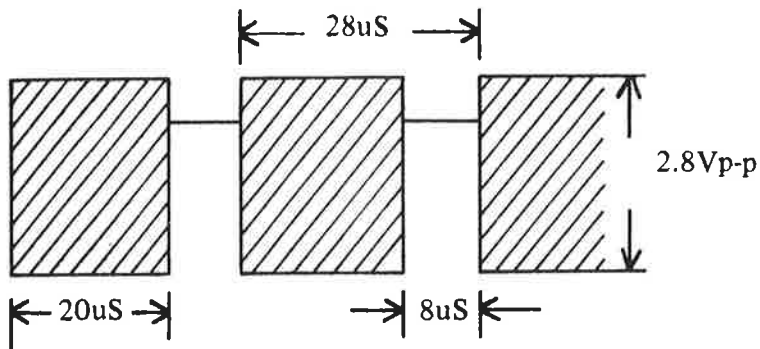
Horizontal Diagnostic flow chart

IV. WAVEFORMS AND VOLTAGES



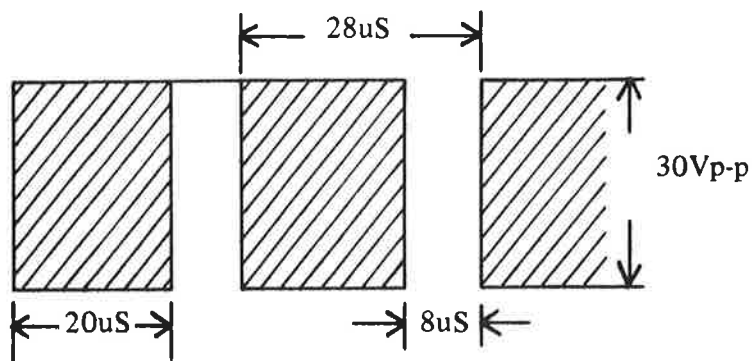
| Q401 | DC Voltage |
|----------------------|------------|
| Base | 0.45V |
| Collector | 2.65V |
| Pin # 1 <u>IC401</u> | 2.65V |
| Pin # 2 | 2.32V |
| Pin # 3 | NC |
| Pin # 4 | NC |
| Pin # 5 | 2.32V |
| Pin # 6 | 2.13V |
| Pin # 7 | 0 |
| Pin # 8 | 2.13V |
| Pin # 9 | 2.32V |
| Pin #10 | 2.13V |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

Q402 Emitter

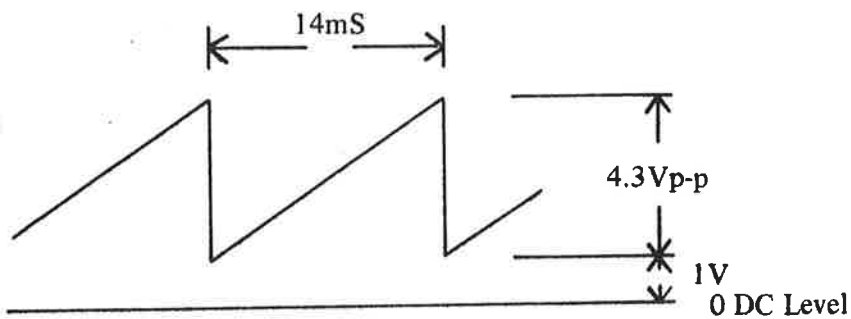


| Q402 | DC Voltage |
|-----------|------------|
| Base | 4.35V |
| Collector | 22.7 V |
| Emitter | 3.86V |

Q402 Collector

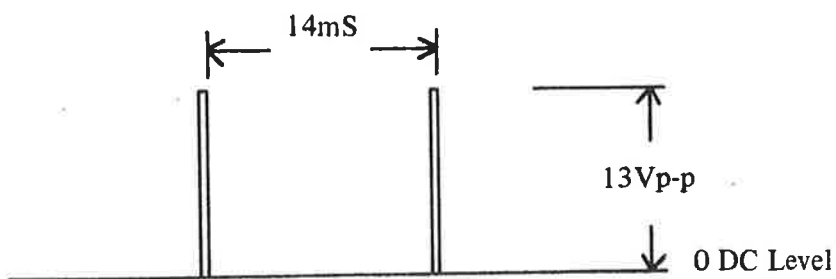


Vertical IC201 56A157-1 PIN #1

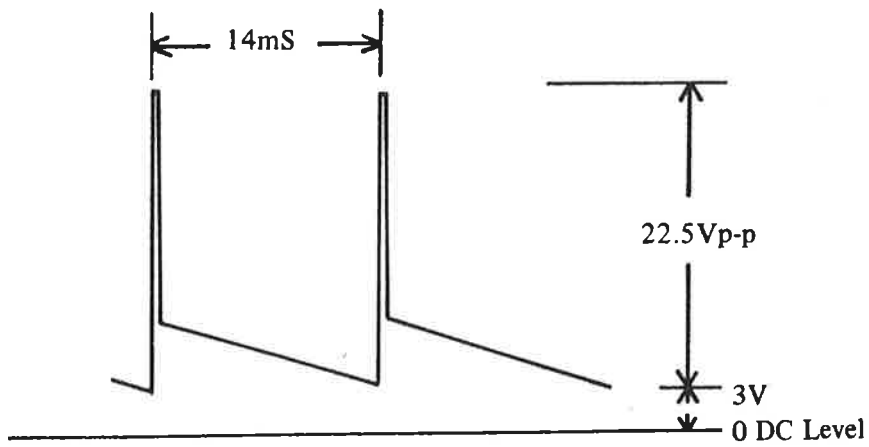


| IC201 | DC Voltage |
|--------|------------|
| Pin #1 | 3.1 V |
| Pin #2 | 12 V |
| Pin #3 | 6.23V |

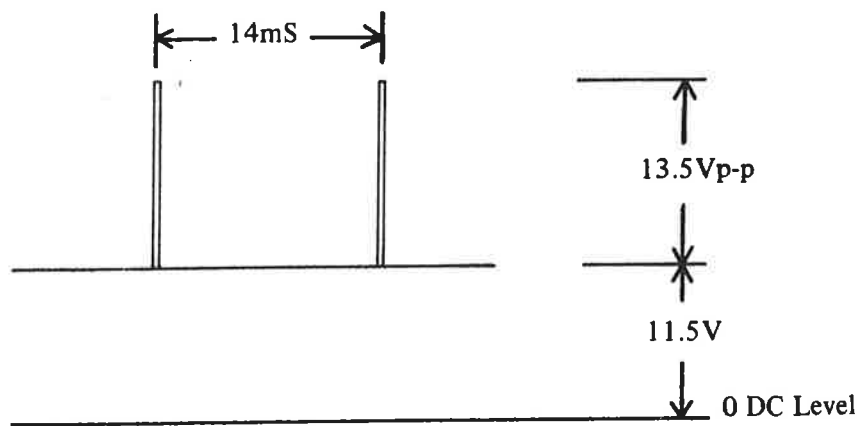
Pin #3



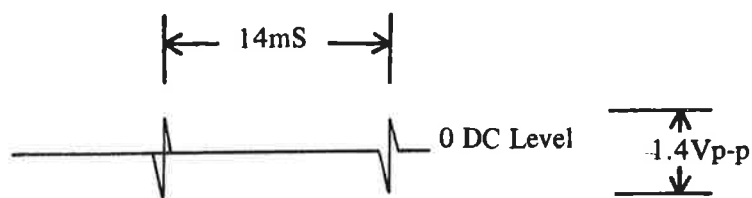
Pin #4



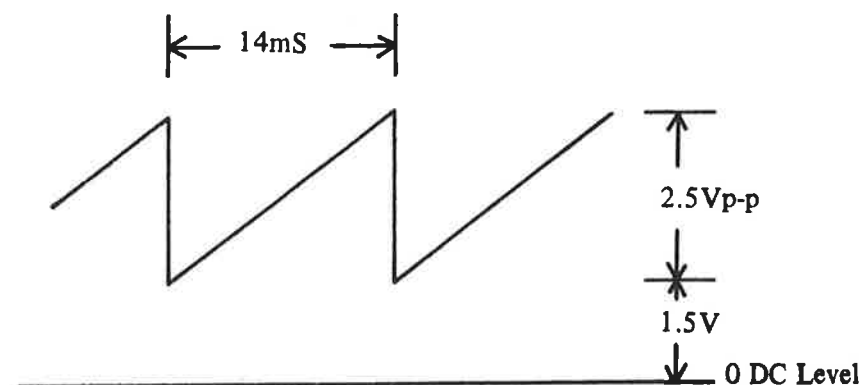
Pin #5



Pin #8



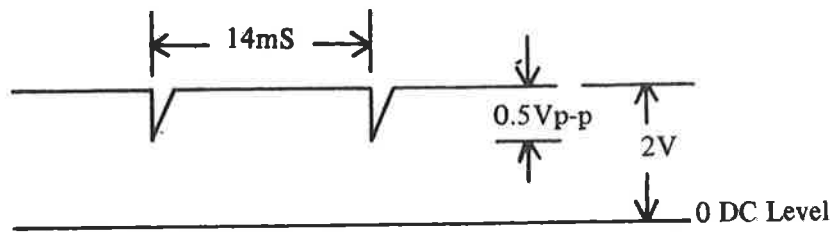
Pin #9



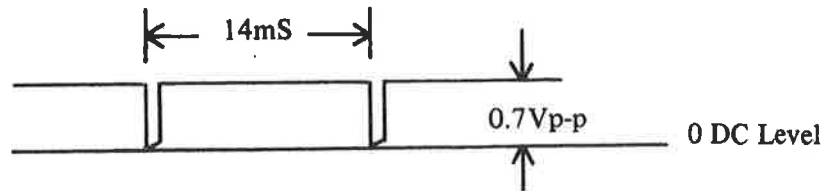
IC201 DC Voltage

| | |
|---------|--------|
| 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 |

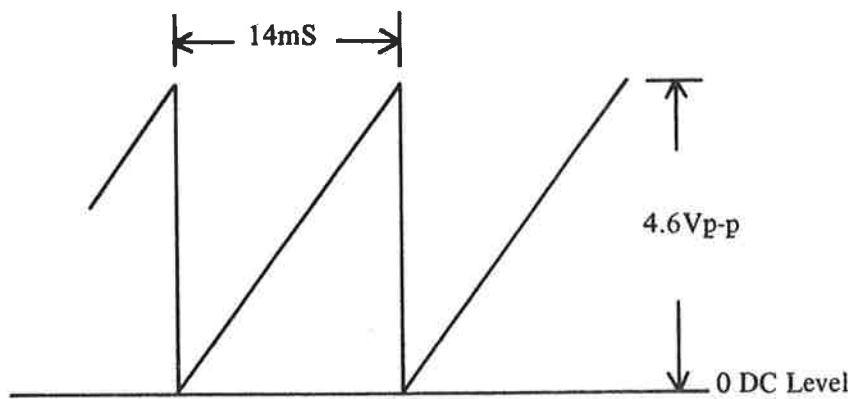
Pin #10



Pin #11

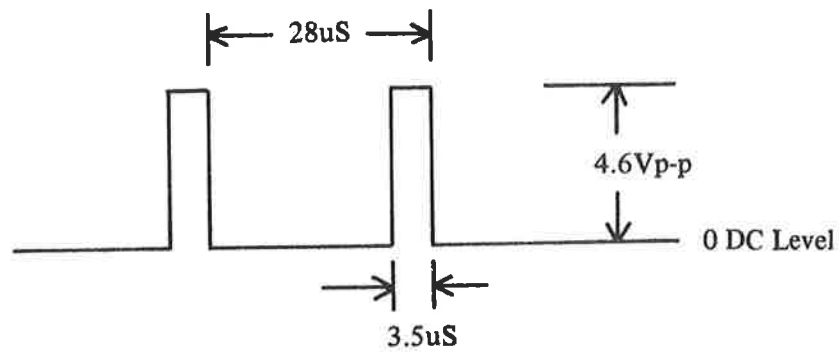


Pin #12

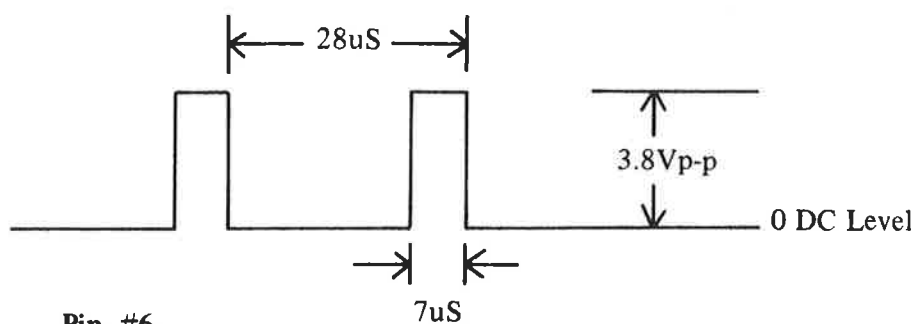


Horizontal IC301 56A74LS-221

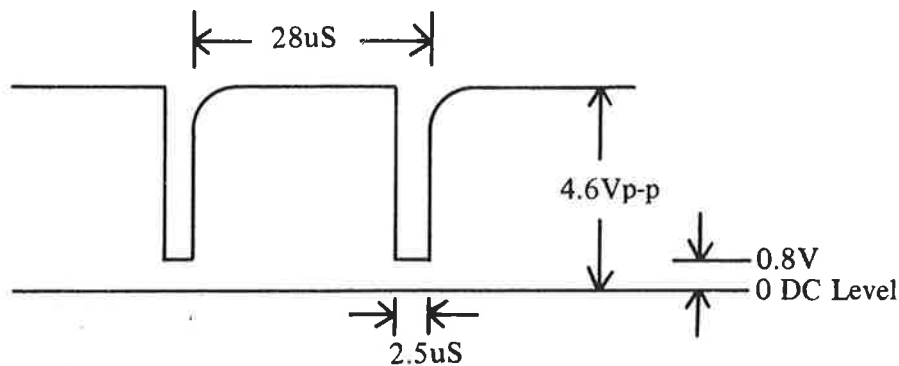
Pin #1 , Pin #5



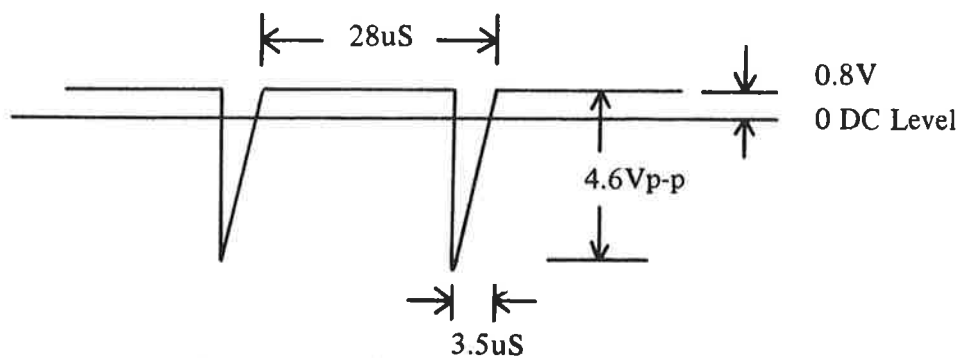
Pin #4



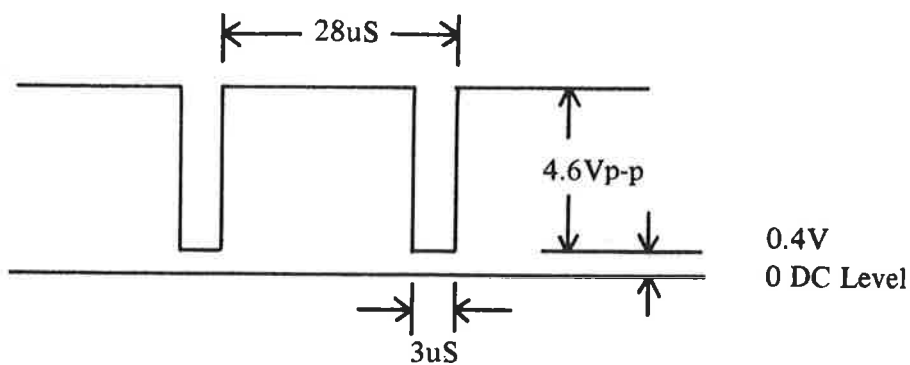
Pin #6



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

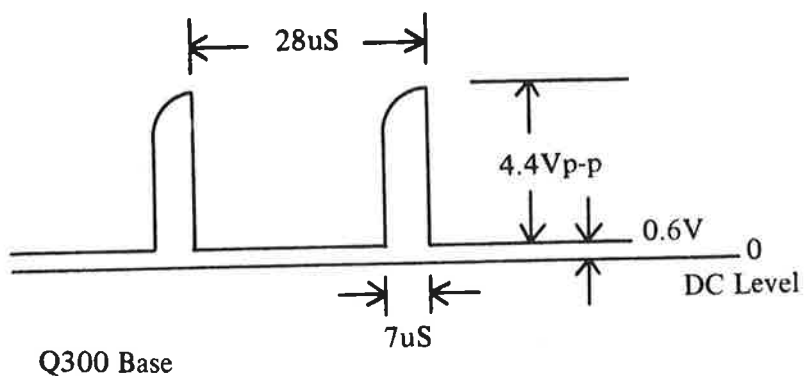
Pin #13 NC

Pin #14 1.7 V

Pin #15 5.18V

Pin #16 5.18V

Pin #14



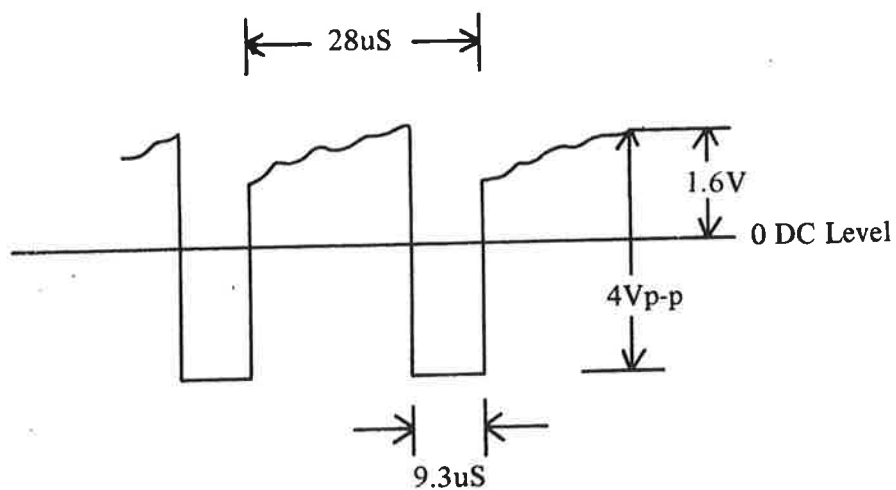
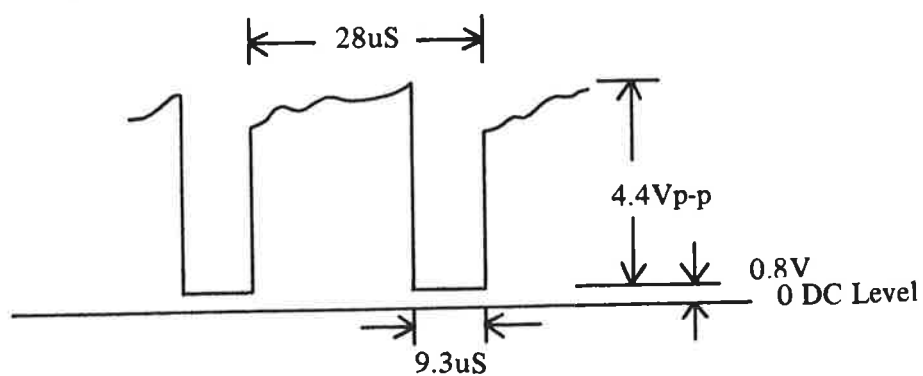
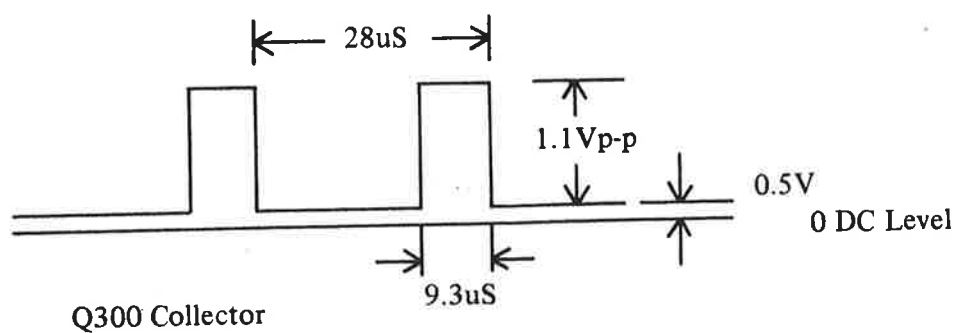
Q300 DC Voltage

Base 0.6 V

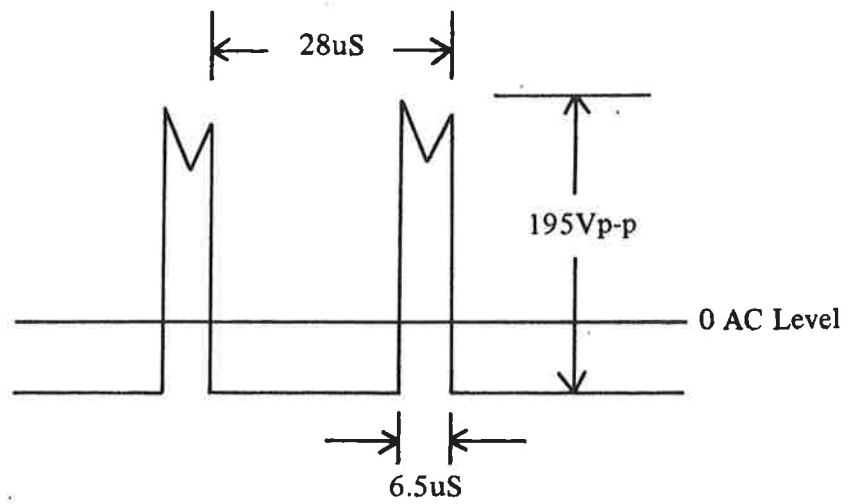
Collector 3.5 V

Q302 Voltage

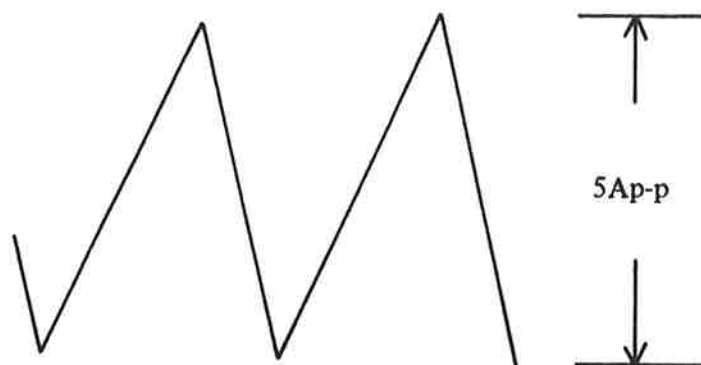
Base 0.32V



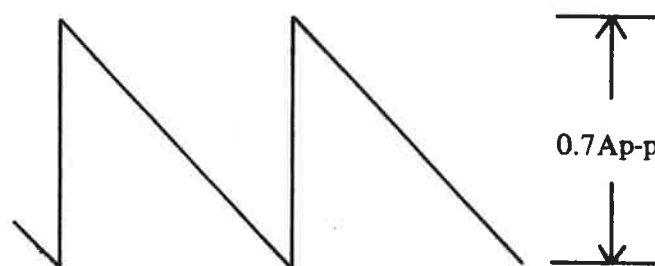
Q302 Collector



Horizontal Deflection YOKE Current



Vertical Deflection YOKE Current



PARTS LISTING

| CIRCUIT NO. | PARTS NO. | DESCRIPTIONS |
|-------------|----------------|--------------------------------|
| | M2CM-02-A | CHAS (12" -35.714KHZ) |
| | MBM2 | CHAS (12" -35.714KHZ) |
| | 1T421-9-128 | MBM-/MCM- (COMMON) |
| | 3C1-40-106 | 4x11 STEEL |
| | 4C1-44-128 | LOCK WASHER |
| | 4C1-55-106 | STELL |
| | 4C1-97-128 | .171x7/16x1/32 STEEL |
| | 5A38-1 | STEEL |
| | 5B38-10 | RUBBER |
| | 5B38-11 | RUBBER |
| | 11D27-3 | RUBBER |
| | 11D27-12 | NYLON |
| | 12T308-2 | NYLON |
| | 15T5308-1 | RUBBER |
| | 23T3047-8 | PCB FRAME |
| | 26A156-24 | ALUMINUM |
| | 33T3262-3 | SERIAL NO. LABEL |
| | 33T3264-1 | A.B.S. PLASTIC |
| | 34E423-6 | A.B.S. PLASTIC |
| | 34E424-10 | A.B.S. PLASTIC |
| | 34E425-10 | A.B.S. PLASTIC |
| | 34E426-5 | A.B.S. PLASTIC |
| | 40A153-2 | LABEL |
| | 40A153-11 | WARNING LABEL |
| | 40A155-224 | WARNING LABEL |
| | 40A156-10 | WARNING LABEL |
| | 40A202-32 | ID LABEL |
| | 41A401-51 | CSA LABEL |
| | 44T3033-8 | CARTON |
| | 89A173-6 | SIGNAL CORD |
| | 89A500-1 | POWER CORD |
| | 97A221-11 | CRT MONO 12V CE745W12K193VR |
| | K1S350-25-128 | M5x25 STEEL |
| | K1S401-805-120 | # 8x5/8 |
| | K1S404-603-128 | # 6x3/8 |
| | M1S440-6-127 | M4x6 |
| | 1T421-4-128 | 3x10 |
| | 2C9-77-128 | STEEL |

| CIRCUIT NO. | PARTS NO. | DESCRIPTIONS |
|-------------|----------------|----------------------|
| | 3C1-111-46 | .166x.610 |
| | 8B7-58 | STEEL |
| | 15T5266-1 | TERNEPLATE |
| | 19B199-6 | PRE-TIN MUSIC WIRE |
| | 44T3033-1 | E.P.S. |
| | 44T3033-2 | E.P.S. |
| | 45C77-1 | TRANSPARENT SHEET |
| | 45C86-1 | PE |
| | 50S102-5 | PLASTIC |
| | 50S103-2 | PLASTIC TIE |
| | G1S140-18-120 | 4MMx18 STEEL |
| | K1S401-805-120 | # 8x5/8 |
| | K1S401-806-128 | # 8x3/4 |
| 15T52 | K1S401-805-120 | # 8x5/8 |
| 34E42 | 15T5267-1 | TERNEPLATE |
| 34E42 | 15T5267-2 | TERNEPLATE |
| 34E42 | K1S401-805-120 | # 8x5/8 |
| 34E42 | G1S140-18-120 | 4MMx18 STEEL |
| 34E42 | K1S401-805-120 | # 8x5/8 |
| | BMPC-02-A | PC BOARD -35.714KHZ |
| | 9A94-1 | BRASS |
| | 9B96-2 | BRASS |
| | 9S206-5 | CONNECTOR |
| | 15T5226-2 | TERNEPLATE |
| | 33T3072-11 | 3P HOUSING PLASTIC |
| | 33T3072-15 | 2P HOUSING |
| | 33A3253-1 | 2 PIN HOUSING |
| | 33A3253-2 | 3 PIN HOUSING |
| | 78A297-1 | SPEAKER |
| | | 1W 16 OHM 2.5" SQUAR |
| | 89A201-2 | CABLE SHIELD AUDIO |
| | 94A376-1 | DEFL YOKE |
| | 95A101-9 | 3x #24 |
| | 95S101-22 | 2x24 WHT |
| | 95S203-51 | 22 AWG STRAND BRN |
| | 95S203-54 | 22 AWG STRAND YEL |
| | 95S205-30 | 18 TOP/CT BLK |
| | 95S205-51 | 22 TOP/CT BRN |
| | 95S205-52 | 22 TOP/CT RED |
| | 95S205-54 | 22 TOP/CT YEL |
| | 95S205-55 | 22 TOP/CT GRN |

| CIRCUIT NO. | PARTS NO. | DESCRIPTIONS |
|-------------|----------------|---|
| | 95S205-56 | 22 TOP/CT BLU |
| | 95S207-57 | #22 STRAND VIO |
| | 95S400-1 | YEL/GRN WIRE (VDE) |
| | 96B29-6 | SHRINK TUBE |
| D713 | 81A7-1 | LED (2x5MM) |
| H | 95S205-52 | 22 TOP/CT RED |
| SW700 | 77A306-3A | SWITCH |
| VR303 | 75D303-15 | VARIABLE RESISTOR 100K \pm 20% 16MM |
| VR501 | 75D303-15 | VARIABLE RESISTOR 100K \pm 20% 16MM |
| | 3C1-1-46 | WASH LCK EX-TTH 4 |
| | 5B42-1 | NYLON |
| | 9A92-13 | BRASS |
| | 32B898-11 | MICA |
| | 33T3346-1 | FUSE COVER |
| | 63S107-1 | CAPACITOR .1UF M 250V AC |
| | 84B33-4 | FUSE CLIP |
| | 87C164-6 | SOCKET CRT |
| | 90T136-3 | HEAT SINK |
| | 90T151-2 | HEAT SINK |
| | 90T156-2 | ALUMINUM |
| | 93D60-73 | DIODE FRD 3A 100V IR 31DF1 |
| | C1S830-9-120 | 3MMx9MM STEEL |
| | K1S330-7-128 | M3x7 STEEL |
| | K1S330-10-128 | M3x10 |
| | K1S404-603-128 | # 6x3/8 |
| | 715A189-1 | PC BOARD (CRT DRIVE) |
| | 715A191-1A | PC BOARD (MAIN BOARD) |
| C201 | 64A185-17-58 | CAPACITOR POLYESTER 0.022UF J 50V |
| C202 | 64A177-25-57 | CAPACITOR POLYESTER 0.1UF J 50V |
| C203 | 64A177-27-57 | CAPACITOR POLYESTER 0.15UF J 50V |
| C204 | 64A177-27-57 | CAPACITOR POLYESTER 0.15UF J 50V |
| C205 | 67A301-220-3 | CAPACITOR ELECTROLYTIC 22UF +100-10% 16V |

| CIRCUIT NO. | PARTS NO. | DESCRIPTIONS |
|-------------|---------------|---|
| C206 | 67S201-222-2 | CAPACITOR ELECTROLYTIC 2200UF +100-10% 10V |
| C207 | 64A177-25-57 | CAPACITOR POLYESTER 0.1UF J 50V |
| C208 | 65S444-471-1 | CAPACITOR CERAMIC 470PF K Z5P 50V |
| C209 | 65S442-330-1 | CAPACITOR CERAMIC 33PF J NPO 50V |
| C210 | 67A301-101-3 | CAPACITOR ELECTROLYTIC 100UF +100-10% 15V |
| C211 | 67S201-471-3 | CAPACITOR ELECTROLYTIC 470UF +100-10% 15V |
| C301 | 67S201-221-3 | CAPACITOR ELECTROLYTIC 220UF +100-10% 15V |
| C302 | 65A452-104-3 | CAPACITOR CERAMIC .1UF +80-20% 16V Z5U |
| C303 | 64A103-23 | CAPACITOR CERAMIC 560PF 50V \pm 5% |
| C304 | 64A103-24 | CAPACITOR POLYPROPYLENE 0.0012UF 5% 50V |
| C305 | 67S301-470-3 | CAPACITOR ELECTROLYTIC 47UF +100-10% 16V |
| C306 | 65A1K-102-1A | CAPACITOR CERAMIC 1000PF K Z5F 1KV |
| C307 | 67A50-229-7 | CAPACITOR ELECTROLYTIC 2.2UF 50V N.P. |
| C308 | 64A140-50-64 | CAPACITOR POLYESTER 0.015UF J 400V |
| C309 | 65A1K-102-1A | CAPACITOR CERAMIC 1000PF K Z5F 1KV |
| C311 | 67S201-102-3M | CAPACITOR ELECTROLYTIC 1000UF +100-10% 15V |
| C312 | 65S444-103-1 | CAPACITOR CERAMIC 10000PF K Z5P 50V |
| C316 | 67S201-100-10 | CAPACITOR ELECTROLYTIC 10UF +100-10% 160V |
| C317 | 67S201-221-7 | CAPACITOR ELECTROLYTIC 220UF +100-10% 50V |
| C318 | 65A1M-103-3B | CAPACITOR CERAMIC 10000PF M Z5U 1KV |
| C319 | 65A1M-103-3B | CAPACITOR CERAMIC |

| CIRCUIT NO. | PARTS NO. | DESCRIPTIONS |
|-------------|---------------|---|
| C320 | 65S444-681-1 | 10000PF M Z5U 1KV CAPACITOR CERAMIC 680PF K Z5P 50V |
| C321 | 65A1M-103-3B | CAPACITOR CERAMIC 10000PF M Z5U 1KV |
| C322 | 67D90-15 | CAPACITOR ELECTROLYTIC 1UF 350V |
| C323 | 64A185-17-58 | CAPACITOR POLYESTER 0.022UF J 50V |
| C401 | 67S201-221-3 | CAPACITOR ELECTROLYTIC 220UF +100-10% 15V |
| C402 | 65A452-104-3 | CAPACITOR CERAMIC .1UF +80-20% 16V Z5U |
| C404 | 67A301-101-3 | CAPACITOR ELECTROLYTIC 100UF +100-10% 15V |
| C405 | 65A1M-103-3B | CAPACITOR CERAMIC 10000PF M Z5U 1KV |
| C406 | 67S201-101-7M | CAPACITOR ELECTROLYTIC 100UF +100-10% 50V |
| C407 | 65A1M-103-3B | CAPACITOR CERAMIC 10000PF M Z5U 1KV |
| C408 | 65A1M-103-3B | CAPACITOR CERAMIC 10000PF M Z5U 1KV |
| C501 | 67A301-100-3 | CAPACITOR ELECTROLYTIC 10UF +100-10% 15V |
| C502 | 67A301-101-3 | CAPACITOR ELECTROLYTIC 100UF +100-10% 15V |
| C503 | 67S301-470-3 | CAPACITOR ELECTROLYTIC 47UF +100-10% 15V |
| C504 | 67A301-228-7 | CAPACITOR ELECTROLYTIC 0.22UF +100-10% 50V |
| C505 | 65S444-681-1 | CAPACITOR CERAMIC 680PF K Z5P 50V |
| C506 | 67S201-221-3 | CAPACITOR ELECTROLYTIC 220UF +100-10% 15V |
| C507 | 67A301-101-3 | CAPACITOR ELECTROLYTIC 100UF +100-10% 15V |
| C508 | 65A452-104-3 | CAPACITOR CERAMIC .1UF +80-20% 16V Z5U |
| C509 | 67S201-471-3 | CAPACITOR ELECTROLYTIC 470UF +100-10% 15V |

| CIRCUIT NO. | PARTS NO. | DESCRIPTIONS |
|-------------|---------------|---|
| C510 | 64S444-472-1 | CAPACITOR CERAMIC 4700PF K Z5P 50V |
| C701 | 63S107-1 | CAPACITOR .1UF M 250V AC |
| C702 | 63S107-1 | CAPACITOR .1UF M 250V AC |
| C703 | 65A306-472-2 | CAPACITOR CERAMIC 4700PF \pm 20% 400VAC |
| C704 | 65A306-472-2 | CAPACITOR CERAMIC 4700PF \pm 20% 400VAC |
| C706 | 65S417-472-1 | CAPACITOR CERAMIC 4700PF K Z5F 500V |
| C707 | 65S417-472-1 | CAPACITOR CERAMIC 4700PF K Z5F 500V |
| C708 | 65S417-472-1 | CAPACITOR CERAMIC 4700PF K Z5F 500V |
| C709 | 65S417-472-1 | CAPACITOR CERAMIC 4700PF K Z5F 500V |
| C710 | 67D90-19 | CAPACITOR ELECTROLYTIC 100UF 200V |
| C712 | 67D90-19 | CAPACITOR ELECTROLYTIC 100UF 200V |
| C714 | 65A2K-561-2A | CAPACITOR CERAMIC 560PF K Z5P 2KV |
| C716 | 64A177-23-58 | CAPACITOR POLYESTER 0.068UF J 50V |
| C717 | 65S450-473-4 | CAPACITOR CERAMIC .047UF Z5V 50V |
| C718 | 65S450-473-4 | CAPACITOR CERAMIC .047UF Z5V 50V |
| C719 | 65S450-473-4 | CAPACITOR CERAMIC .047UF Z5V 50V |
| C720 | 67A301-100-7 | CAPACITOR ELECTROLYTIC 10UF +100-10% 50V |
| C721 | 65S450-473-4 | CAPACITOR CERAMIC .047UF Z5V 50V |
| C722 | 67S201-102-3M | CAPACITOR ELECTROLYTIC 1000UF +100-10% 15V |
| C723 | 67S201-471-3 | CAPACITOR ELECTROLYTIC 470UF +100-10% 15V |
| C725 | 65A1M-103-3B | CAPACITOR CERAMIC |

| CIRCUIT NO. | PARTS NO. | DESCRIPTIONS |
|-------------|------------|---------------------------|
| J715 | 95S90-22 | # 22 TIN COATED |
| J716 | 95S90-22 | # 22 TIN COATED |
| J717 | 95S90-22 | # 22 TIN COATED |
| J718 | 95S90-22 | # 22 TIN COATED |
| J401 | 95S90-22 | # 22 TIN COATED |
| R311 | 95S90-22 | # 22 TIN COATED |
| L301 | 73C253-32 | # 22 CHOKE 5.6UH 3A |
| L302 | 94A483-9A | COIL HORIZ WIDTH |
| L303 | 73C147-16 | COIL H. LINEAR |
| L401 | 73C145-159 | COIL 1.5UH 10% |
| L501 | 73C145-471 | CHOKE 470UH |
| L701 | 73C150-1 | LINE CHOKE 1A 15MHx2 |
| L702 | 73C253-25 | CHOKE 44UH |
| P001 | 33T3072-10 | PLUG PLASTIC 8P |
| P201 | 33T3252-1 | PIN PLUG 2 |
| P301 | 33A3252-2 | PIN PLUG 3 |
| P302 | 33T3072-12 | PLUG PLASTIC 3P |
| P501 | 33T3072-12 | PLUG PLASTIC 3P |
| P502 | 33T3072-16 | PLUG 2P |
| P703 | 33T3072-16 | PLUG 2P |
| Q300 | 57A477-Y | TRANSISTOR 2SC1959(Y) |

| CIRCUIT NO. | PARTS NO. | DESCRIPTIONS |
|-------------|---------------|-------------------------------------|
| Q301 | 57A477-Y | TRANSISTOR 2SC1959(Y) |
| Q302 | 57A504-2S | TRANSISTOR BU806 SGS |
| Q303 | 57B419-P | TRANSISTOR 2SC945P |
| Q304 | 57A490-1 | TRANSISTOR BF459 |
| Q305 | 57A490-1 | TRANSISTOR BF459 |
| Q401 | 57A436-1 | TRANSISTOR BSX20 |
| Q402 | 57A492-1 | TRANSISTOR BSX60 |
| Q701 | 57A486-3 | TRANSISTOR TIPL762A |
| Q702 | 57A507-1 | TRANSISTOR 2SA952M/L |
| Q703 | 57A446-1 | TRANSISTOR 2SC1213AC |
| Q704 | 57A446-1 | TRANSISTOR 2SC1213AC |
| R201 | 61S172-202-57 | RESISTOR CARBON 2K OHM 5% 1/4W |
| R202 | 61S172-102-57 | RESISTOR CARBON 1K OHM 5% 1/4W |
| R203 | 61S172-472-57 | RESISTOR CARBON 4.7K OHM 5% 1/4W |
| R204 | 61S172-104-57 | RESISTOR CARBON 100K OHM 5% 1/4W |
| R205 | 61S172-184-57 | RESISTOR CARBON 180K OHM 5% 1/4W |
| R206 | 61S172-914-57 | RESISTOR CARBON 910K OHM 5% 1/4W |
| R207 | 61S172-473-57 | RESISTOR CARBON 47K OHM 5% 1/4W |
| R208 | 61S172-223-57 | RESISTOR CARBON 22K OHM 5% 1/4W |
| R209 | 61S172-562-57 | RESISTOR CARBON 5600 OHM 5% 1/4W |
| R210 | 61S175-159-64 | RESISTOR CARBON |

| CIRCUIT NO. | PARTS NO. | DESCRIPTIONS |
|-------------|---------------|--|
| R211 | 61S172-682-57 | 1.5 OHM 5% 1/2W RESISTOR CARBON |
| R212 | 61S172-562-57 | 6.8K OHM 5% 1/4W RESISTOR CARBON |
| R213 | 61S172-339-57 | 5600 OHM 5% 1/4W RESISTOR CARBON |
| R214 | 61S172-224-57 | 3.3 OHM 5% 1/4W RESISTOR CARBON |
| R301 | 61S172-202-57 | 220K OHM 5% 1/4W RESISTOR CARBON |
| R302 | 61S172-102-57 | 2K OHM 5% 1/4W RESISTOR CARBON |
| R303 | 61S200-243-57 | 1K OHM 5% 1/4W RESISTOR CARBON |
| R304 | 61S200-472-57 | 24K OHM 1% 1/4W RESISTOR CARBON |
| R305 | 61S172-472-57 | 4.7K OHM 1% 1/4W RESISTOR CARBON |
| R306 | 61S175-331-64 | 4.7K OHM 5% 1/4W RESISTOR CARBON |
| R307 | 61S152-101-59 | 330 OHM 5% 1/2W RESISTOR METAL FILM |
| R308 | 61S172-221-57 | 100 OHM 5% 2W RESISTOR CARBON |
| R309 | 61S175-561-64 | 220 OHM 5% 1/4W RESISTOR CARBON |
| R310 | 61S172-221-57 | 560 OHM 5% 1/2W RESISTOR CARBON |
| R313 | 61S175-470-64 | 220 OHM 5% 1/4W RESISTOR CARBON |
| R314 | 61S172-104-57 | 47 OHM 5% 1/2W RESISTOR CARBON |
| R315 | 61S172-683-57 | 100K OHM 5% 1/4W RESISTOR CARBON |
| R317 | 61S175-470-64 | 68K OHM 5% 1/4W RESISTOR CARBON |
| R318 | 61S152-184-59 | 47 OHM 5% 1/2W RESISTOR METAL FILM |
| R319 | 61S172-334-57 | 180K OHM 5% 2W RESISTOR CARBON |
| | | 330K OHM 5% 1/4W |

| CIRCUIT NO. | PARTS NO. | DESCRIPTIONS |
|-------------|----------------|--------------------------------------|
| R320 | 61S172-334-57 | RESISTOR CARBON 330K OHM 5% 1/4W |
| R321 | 61S172-272-57 | RESISTOR CARBON 2.7K OHM 5% 1/4W |
| R322 | 61S172-103-57 | RESISTOR CARBON 10K OHM 5% 1/4W |
| R323 | 61S175-105-64 | RESISTOR CARBON 1MEG OHM 5% 1/2W |
| R324 | 61S175-223-64 | RESISTOR CARBON 22K OHM 5% 1/2W |
| R325 | 61S175-333-64 | RESISTOR CARBON 33K OHM 5% 1/2W |
| R326 | 61S172-472-57 | RESISTOR CARBON 4.7K OHM 5% 1/4W |
| R327 | 61S172-104-57 | RESISTOR CARBON 100K OHM 5% 1/4W |
| R328 | 61S172-564-57 | RESISTOR CARBON 560K OHM 5% 1/4W |
| R402 | 61S172-331-57 | RESISTOR CARBON 330 OHM 5% 1/4W |
| R403 | 61S172-331-57 | RESISTOR CARBON 330 OHM 5% 1/4W |
| R405 | 61S208-121-64 | RESISTOR METAL FILM 120 OHM 5% 1W |
| R407 | 61S172-560-57 | RESISTOR CARBON 56 OHM 5% 1/4W |
| R411 | 61S172-391-57 | RESISTOR CARBON 390 OHM 5% 1/4W |
| R412 | 61S172-221-57 | RESISTOR CARBON 220 OHM 5% 1/4W |
| R413 | 61S172-339-57 | RESISTOR CARBON 3.3 OHM 5% 1/4W |
| R414 | 61S175-331-64 | RESISTOR CARBON 330 OHM 5% 1/2W |
| R415 | 61S153M-471-59 | RESISTOR METAL FILM 470 OHM 5% 3W |
| R501 | 61S172-103-57 | RESISTOR CARBON 10K OHM 5% 1/4W |
| R502 | 61S172-471-57 | RESISTOR CARBON 470 OHM 5% 1/4W |
| R503 | 61S172-560-57 | RESISTOR CARBON |

| CIRCUIT NO. | PARTS NO. | DESCRIPTIONS |
|-------------|---------------|-------------------------------------|
| R504 | 61S172-109-57 | 56 OHM 5% 1/4W RESISTOR CARBON |
| R505 | 61S208-471-64 | 1 OHM 5% 1/4W RESISTOR METAL |
| R507 | 61S172-202-57 | 470 OHM 5% 1W RESISTOR CARBON |
| R701 | 61C57-7 | 2K 5% 1/4W THERMISTOR |
| R702 | 61S105-478 | 5 OHM RESISTOR WIRE WOUND |
| R703 | 61S175-154-64 | 0.47 OHM 10% 5W RESISTOR CARBON |
| R704 | 61S152-560-59 | 150K OHM 5% 1/2W RESISTOR METAL |
| R705 | 61S175-154-64 | 56 OHM 5% 2W RESISTOR CARBON |
| R706 | 61S152-209-59 | 150K OHM 5% 1/2W RESISTOR METAL |
| R707 | 61D20-214 | 2 OHM 5% 2W RESISTOR WIRE WOUND |
| R708 | 61S172-151-57 | 2 OHM 5% 5W RESISTOR CARBON |
| R709 | 61S172-102-57 | 150 OHM 5% 1/4W RESISTOR CARBON |
| R710 | 61S172-102-57 | 1K OHM 5% 1/4W RESISTOR CARBON |
| R711 | 61S172-151-57 | 1K OHM 5% 1/4W RESISTOR CARBON |
| R712 | 61S172-332-57 | 150 OHM 5% 1/4W RESISTOR CARBON |
| R713 | 61S172-333-57 | 3.3K OHM 5% 1/4W RESISTOR CARBON |
| R714 | 61S172-102-57 | 33K OHM 5% 1/4W RESISTOR CARBON |
| R715 | 61S175-470-64 | 1K OHM 5% 1/4W RESISTOR CARBON |
| R716 | 61S152-120-59 | 47 OHM 1% 1/4W RESISTOR METAL |
| R717 | 61S172-332-57 | 12 OHM 5% 2W RESISTOR CARBON |
| | | 3.3K OHM 5% 1/4W |

| CIRCUIT NO. | PARTS NO. | DESCRIPTIONS |
|-------------|---------------|---|
| R719 | 61S172-102-57 | RESISTOR CARBON 1K OHM 5% 1/4W |
| R720 | 61S175-681-64 | RESISTOR CARBON 680 OHM 5% 1/2W |
| SP402 | 62B2-5 | SPARK-GAP |
| T301 | 79A315-1 | H.O.T. 12V |
| T701 | 80A502-1 | POWER TRANSFORMER |
| T702 | 79A500-1 | DRIVER TRANSFORMER |
| VR201 | 75D209-15 | VARIABLE RESISTOR 200K B |
| VR202 | 75D209-15 | VARIABLE RESISTOR 200K B |
| VR203 | 75A323-104 | VARIABLE RESISTOR 100K OHM \pm 20% |
| VR301 | 75D209-26 | VARIABLE RESISTOR 20KB OHM |
| VR302 | 75A323-204 | VARIABLE RESISTOR 200K OHM \pm 20% |
| VR304 | 75D209-19 | VARIABLE RESISTOR 2MEG B |
| VR701 | 75A323-501 | VARIABLE RESISTOR 500 OHM \pm 20% |
| ZD301 | 93C39-52 | ZENER DIODE 5.1V \pm 5% 0.5W |
| ZD401 | 93C39-52 | ZENER DIODE 5.1V \pm 5% 0.5W |
| ZD709 | 93C39-79 | ZENER DIODE 6.0-6.3/6.12-6.44 |
| ZD713 | 93D39-71 | ZENER DIODE 14.1-14.7V |

PARTS ASSEMBLY TABLE

| ITEM | Q'TY | DESCRIPTION | PARTS NO. | REMARK |
|------|------|-----------------|----------------|--------|
| 1 | 1 | FRONT PANEL | 34E423-5 | |
| 2 | 1 | LED PCB | — | |
| 3 | 1 | SCREW | 1T421-4-128 | |
| 4 | 1 | POWER SWITCH | 77A306-3 | |
| 5 | 2 | KNOB | 33T3262-3 | |
| 6 | 1 | VR BRACKET | 15T5266-1 | |
| 7 | 2 | SCREW | 1T421-9-128 | |
| 8 | 2 | SCREW | K1S401-805-120 | |
| 9 | 1 | SPEAKER | 78A297-1 | |
| 10 | 2 | SCREW | K1S404-603-128 | |
| 11 | 1 | SIDE BRACKET(R) | 15T5267-2 | |
| 12 | 2 | SCREW | K1S401-805-120 | |
| 13 | 1 | SIDE BRACKET(L) | 15T5267-1 | |
| 14 | 2 | SCREW | K1S401-805-120 | |
| 15 | 1 | BASE FASTENER | 33T3264-1 | |
| 16 | 1 | BOTTOM BOARD | 34E425-7 | |
| 17 | 2 | SPEED NUT | 2C9-77-128 | |
| 18 | 1 | BOTTOM BASE | 34E426-4 | |
| 19 | 4 | WASHER | 4C1-44-128 | |
| 20 | 4 | RUBBER FOOT | 12T308-2 | |
| 21 | 4 | SCREW | K1S404-603-128 | |
| 22 | 1 | RUBBER WASHER | 5B38-1 | |
| 23 | 1 | WASHER | 4C1-97-128 | |
| 24 | 1 | SCREW | K1S350-25-128 | |
| 25 | 1 | LINE CORD CLAMP | 11D27-3 | |
| 26 | 1 | LINE CORD CLAMP | 11D27-3 | |
| 27 | 1 | LINE CORD | 89A171-8 | |
| 28 | 1 | SIGNAL CORD | | |
| 29 | 3 | SCREW | K1S401-805-120 | |
| 30 | 1 | CRT | 97A221-11 | |
| 31 | 4 | LOCK WASHER | 3C1-111-46 | |
| 32 | 4 | SCREW | K1S401-806-128 | |
| 33 | 1 | DAG SPRING | 19B199-6 | |
| 34 | 6 | SCREW | K1S401-805-120 | |
| 35 | 12 | RUBBER WASHER | 5B38-10 | |
| 36 | 1 | MAIN PCB | | |
| 37 | 6 | RUBBER WASHER | 5B38-11 | |
| 38 | 1 | BACK COVER | 34E424-6 | |
| 39 | 2 | SCREW | K1S401-805-120 | |
| 40 | 2 | SCREW | G1S140-18-120 | |

| CIRCUIT NO. | PARTS NO. | DESCRIPTIONS |
|-------------|--------------|---|
| C726 | 65A2M-221-3A | 10000PF M Z5U 1KV CAPACITOR CERAMIC 220PF M Z5U 2KV |
| D201 | 93C64-11H | DIODE 1N4148 |
| D202 | 93B52-1 | DIODE 1A 600V 1N4005 |
| D302 | 93D39-54 | ZENER DIODE 12.7V \pm 5% 0.5W |
| D302 | 93C64-11H | DIODE 1N4148 |
| D303 | 93D60-73 | DIODE HER305 |
| D304 | 93C64-11H | DIODE 1N4148 |
| D305 | 93D60-73 | DIODE HER305 |
| D306 | 93D60-73 | DIODE HER305 |
| D308 | 93C60-21 | DIODE FR155 |
| D309 | 93C60-53 | DIODE RGP 10M |
| D310 | 93C60-21 | DIODE FR155 |
| D311 | 93C60-21 | DIODE FR155 |
| D403 | 93C64-11H | DIODE 1N4148 |
| D501 | 93C60-38 | DIODE FR103 |
| D701 | 93B52-27 | DIODE 1N4006 |
| D702 | 93B52-27 | DIODE 1N4006 |
| D703 | 93B52-27 | DIODE 1N4006 |
| D704 | 93B52-27 | DIODE 1N4006 |
| D705 | 93C60-38 | DIODE FR103 |

| CIRCUIT NO. | PARTS NO. | DESCRIPTIONS |
|-------------|-------------|-----------------------|
| D708 | 93C52-14 | DIODE 1N4001 |
| D710 | 93C60-38 | DIODE FR103 |
| D711 | 93C60-38 | DIODE FR103 |
| D712 | 93D60-73 | DIODE HER305 |
| F701 | 84A38-6 | FUSE 250V 1A S-B |
| F702 | 84A40-2 | FUSE 250V 2.5A F-B |
| IC201 | 56A157-1 | IC TDA1170N |
| IC301 | 56A74LS-221 | IC 74LS221 |
| IC401 | 56A228-1 | IC 7406 |
| IC501 | 56A205-2 | IC TBA820M |
| J702 | 95S90-22 | TIN COATED # 22 |
| J703 | 95S90-22 | TIN COATED # 22 |
| J704 | 95S90-22 | TIN COATED # 22 |
| J706 | 95S90-22 | TIN COATED # 22 |
| J707 | 95S90-22 | TIN COATED # 22 |
| J708 | 95S90-22 | TIN COATED # 22 |
| J709 | 95S90-22 | TIN COATED # 22 |
| J711 | 95S90-22 | TIN COATED # 22 |
| J712 | 95S90-22 | TIN COATED # 22 |
| J713 | 95S90-22 | TIN COATED # 22 |
| J714 | 95S90-22 | TIN COATED |

