

# FRG-9600

## SERVICE MANUAL

**SCHEMATHEEK**

*Beh. T. Hultermans*

*Postbus 4228*

*5604 EE Eindhoven*

**YAESU MUSEN CO., LTD.**

C.P.O. BOX 1500

TOKYO, JAPAN

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This  
info  
Op  
ser  
in  
The  
adj  
adj  
cat  
Ya  
Wh  
for  
Yo  
app  
rec



## FRG-9600 TECHNICAL SUPPLEMENT



This manual is intended to serve as a supplement to the FRG-9600 Operating Manual. Detailed information regarding functions, specifications, options and operation has been provided in the Operating Manual, and is not reprinted herein. Therefore, this supplement is not intended to serve as an independent reference, but to be used in conjunction with the information provided in the Operating Manual.

The FRG-9600 is designed to perform properly for many years without any need for internal adjustment. However, the complexity of the circuitry is such that tampering with the internal adjustments or components will void any warranty and may seriously degrade performance, and cause serious damage. Therefore we recommend that the FRG-9600 be referred to an authorized Yaesu agent for service or modification, if required.

While we believe the technical information in this manual is correct, Yaesu assumes no liability for damage that may occur as a result of typographical or other errors that may be present. Your cooperation in pointing out any inconsistencies in the technical information would be appreciated; however, Yaesu Musen reserves the right to make changes in the circuitry of this receiver, in the interest of technological improvement, without notification of the owners.



# CAT TEST PROGRAM

LIST

```

5  REM RESET FIF-65 I/O CHIP
10 POKE 49345,0: POKE 49345,0: POKE 49345,0
15 REM INITIALIZE FIF-65 I/O CHIP
20 POKE 49345,64: POKE 49345,207: POKE 49345,55
30 HOME : PRINT "INPUT (0) - (7) "
40 PRINT " (0).....FREQUENCY SET"
50 PRINT " (1).....FM-WIDE"
60 PRINT " (2).....FM-NARROW"
70 PRINT " (3).....AM-WIDE"
80 PRINT " (4).....AM-NARROW"
90 PRINT " (5).....USB"
100 PRINT " (6).....LSB"
120 PRINT " (7).....END": PRINT
130 INPUT " SELECT 1 - 7 >";A: IF A > 7 THEN 30
135 REM CALL -958 CLEARS ALL BELOW CURSOR
140 PRINT : IF A = 7 THEN HTAB 1: VTAB 1: CALL - 958: END
150 IF A = 0 THEN N0 = 10: GOTO 1000
160 IF A = 1 THEN N0 = 23
170 IF A = 2 THEN N0 = 22
180 IF A = 3 THEN N0 = 21
190 IF A = 4 THEN N0 = 20
200 IF A = 5 THEN N0 = 17
210 IF A = 6 THEN N0 = 16
220 GOTO 2000

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1000 REM FREQUENCY SET
1010 PRINT "INPUT FREQ. (MHZ)"
1020 PRINT " FREQ. RANGE 60.0 - 905.0 (MHZ) ": PRINT
1030 INPUT FR
1040 IF FR < 60.0 OR FR > 905.0 THEN PRINT : PRINT " OUT OF RANGE !": PRINT
: HTAB 10: PRINT "INPUT AGAIN !": FOR I = 0 TO 1000: NEXT : VTAB 14: CALL
- 958: GOTO 1020
1050 FR = FR * 10000
1060 M1 = INT (FR / 100000)
1070 M2 = INT (FR / 1000) - M1 * 100
1080 M3 = INT (FR / 10) - M1 * 10000 - M2 * 100
1090 L1 = M1 * 100000:L2 = M2 * 1000:L3 = M3 * 10
1100 M4 = FR - L1 - L2 - L3:M4 = INT (M4 + .5) * 10
1110 N1 = INT (M1 / 10) * 16 + M1 - INT (M1 / 10) * 10
1120 N2 = INT (M2 / 10) * 16 + M2 - INT (M2 / 10) * 10
1130 N3 = INT (M3 / 10) * 16 + M3 - INT (M3 / 10) * 10
1140 N4 = INT (M4 / 10) * 16 + M4 - INT (M4 / 10) * 10
2000 REM SEND 5BYTES VIA FIF-65 TO RCVR
2010 POKE 49344,N0: POKE 49344,N1: POKE 49344,N2: POKE 49344,N3: POKE 49
344,N4
2020 GOTO 30

```

]

## CAT SYSTEM PROGRAMMING ADDENDA

### Operating Manual Errata

The second paragraph on page 34 of the Operating Manual is in error with respect to the polarity of the TTL signal levels. It should read, "(0V = "SPACE" and +5V = "MARK")" for serial data to the FRG-9600.

Also, on page 38, in line 20 of the program example, the programming codes in the third and fourth occurrences of CHR\$( ) should be 84 and 50, respectively, allowing for the conversion from hex to decimal as described in the text.

### CAT Test Program

A listing of an Applesoft BASIC test program for the FRG-9600 CAT System with FIF-65 CAT Interface Unit is shown at the right. It can be used as is with an Apple II computer for elementary frequency and mode selection, but should be considered only as the basis for more sophisticated CAT operation with the addition of the user's scanning routines. The same program should work on other computers with appropriate replacements of the POKE and CALL statements. Refer to the CAT System Command Chart on page 39 of the Operating Manual for details of the command codes used in the program.

Lines 10 and 20 clear and initialize the I/O chip in the FIF-65, setting it for 4800 baud, 8 data bits, 2 stop bits and no parity. This port initialization will be different for other computers and interface units. For example, some computers include an I/O chip which can be programmed with BASIC commands such as OPEN COM ... Check the computer manual for the correct instructions under the OPEN command, or the serial I/O procedure.

Lines 30 to 130 print a simple command menu on the display, and accept keyed input of the Menu Selection for the desired command. The menu should be modified for commands added by the user, such as for scanning.

Line 135 just identifies the function of CALL -958, which is equivalent to ctrl-Z or PRINT CHR\$(26) on many terminals.

Line 140 leaves a blank line below the menu, clears the screen and ends the program if menu selection 7 (END) is input.

Line 150 sets the Instruction Byte (NØ) to 10 for Frequency Set, and jumps to the corresponding routine beginning at Line 1000.

Lines 160 to 210 set the corresponding Instruction Byte (NØ), to the decimal value of that shown (in hex) in the Command Chart for the various modes. Line 220 then jumps to the sending routine starting at 2000.

Lines 1000 - 1050 comprise the input portion of the Frequency Set Routine. Lines 1010 to 1040 display the range and accept the keyed input (with a MHz decimal) if within the correct range of the receiver. Line 1050 then eliminates the decimal. Notice that the variable FR must be single-precision in this case. Aside from that nothing here is critical; there are many ways to optimize this input procedure for simplification or operator preference, just as long as FR ends up as the desired new frequency in whole hundreds of Hz.

Lines 1060 to 1140 convert whole decimal number FR into hexadecimal Data Bytes N1 through N4. In Lines 1060 to 1100, M1 - M4 and L1 - L3 are intermediate variables used to separate out the four 2-digit decimal segments of FR. Lines 1110 to 1140 then convert each of the intermediate decimal segments into its hex equivalent. In many computers this entire process can also be done with strings and hex-conversion commands provided in some BASIC dialects. For scanning, it is most important to optimize this routine for maximum speed.

Lines 2000 to 2020 send bytes NØ through N4 to the receiver, and return to the menu. Notice that all five bytes are always sent, even if only the mode is being changed (and this sending routine is called by the jump from Line 220). As mentioned in the Operating Manual, only the first byte (Instruction Byte NØ) has any significance to the receiver when changing modes, but the remaining four bytes must still be sent if the command is to be accepted (their value is irrelevant in such cases, so the fre-

## CIRCUIT DESCRIPTION

This description, together with the block diagram, is intended to provide a general understanding of the electrical functions of the circuits in the FRG-9600. Such an understanding is necessary for troubleshooting the receiver. Refer to the schematic diagrams and parts list for specific component and wiring details.

"VHF" and "UHF", and "band selection" in the following description refer to 60 - 460 MHz (VHF) and 460 - 905 MHz (UHF).

### Front End Stages

Signals from the antenna jack are delivered to the Main Unit for application to the Front End Module (VTY-1U103) according to VHF/UHF band selection by diodes D1005 and D1006 (both 1SS110). When the ATT button on the front panel is depressed, attenuator relay driver Q1001 (2SC458BTZ) inserts attenuation via RL1001.

The Front End Module itself contains pairs of RF amplifiers, varactor-tuned local oscillators (VCOs), local buffers and mixers, one each for VHF and UHF (this Module is not internally serviceable). Band selection control is from the Band Unit, and Varactor Control Voltage (VCV) for tuning is derived from the Local Output signal on the PLL Unit. The 1st IF Output from the Front End Module, at 45.754 MHz, is returned to post-mixer buffer Q1002 (2SC458BTZ) on the Main Unit for SSB, AM and narrow FM; and then passed through monolithic crystal filter XF1001 to remove unwanted mixer products. However, since this filter is too narrow (28 kHz BW) for wide FM and TV, the 1st IF Output is also passed to the WFM Unit and the optional Video Unit (if installed).

For SSB, AM and narrow FM the filtered 1st IF is applied to 2nd mixer Q1003 (3SK73GR), which also receives the 35.06 MHz 2nd local signal generated by TCXO/doubler X1001/Q1004 (2SC458BTZ). The 10.7 MHz product of the 2nd mixer is then delivered to the NFM Unit for filtering by dual monolithic crystal filter XF4001 (15 kHz BW) before application to oscillator/mixer/FM detector

IC Q4001 (MC3357P). Crystal X4001 (10.245 MHz) provides the 3rd local signal, which is mixed with the filtered 2nd IF to produce the 455 kHz 3rd IF. This is passed through ceramic filter CF4001 (15 kHz BW), and delivered to the SSB/AM Unit for those modes. For narrow FM, the filtered 3rd IF is amplified by Q4002 (2SC1623T2BL6) and amplitude limited within Q4001 before FM detection by ceramic discriminator CD4001. D4001 (1SS106) rectifies high frequency noise present at the discriminator when no signal is present, to produce the FM squelch control voltage, for controlling squelch switch Q4003 (2SC1623T2BL6) via the front panel squelch control. Detected FM audio is passed through Q4003 when a signal is present, and delivered to the Mode/Scan Unit for selection.

For SSB and AM modes, the 455 kHz IF signal delivered to the SSB/AM Unit from the N.FM Unit is amplified by Q4505 (3SK73GR) and then passed on to the Fil/Car Unit, where the signal is passed through ceramic filter CF5001 (2.4 kHz BW) for SSB, or CF5002 (6 kHz BW) for AM. After filtering the 3rd IF signal is returned to the SSB/AM Unit for amplification by Q4501 and Q4502 (both 3SK73GR), and buffering by Q4507 (2SC1623T2BL6). Detection for AM and AGC is provided by D4501/D4502 (1SS106 x 2), and the resulting audio is delivered to the Mode/Scan Unit for selection. A sample of the rectified IF is buffered by Q4506 (2SC1623T2BL6) and fed back to IF amplifiers Q4501 and Q4502 to control their gain during fading. The amplified 3rd IF signal from Q4502 is also buffered by Q4503 (2SC1623T2BL6) and applied to diode ring Q4504 (ND487C2-3R) for detection. Q4504 also receives a carrier buffered by Q4508 (2SC1623T2BL6) at either 453.5 kHz (LSB) or 456.5 kHz (USB), generated by either ceramic oscillator CO5001/Q5001 or CO5002/Q5002, respectively, on the Fil/Car Unit. Q5001 and Q5002 are both 2SC945AP, selected by mode data controlling switches Q5003 and Q5004 (both 2SC1623T2BL6), respectively. The resulting demodulated SSB audio is delivered to the Mode/Scan Unit as for the other modes.

quency data can be left in these bytes).

Before adding more functions to this program, first key it in, with the appropriate changes to Lines 10, 20 and 2010 for your serial communications hardware (if not using the FIF-65 and Apple II). Then make sure that it runs as expected.

Next add your own scanning routine: program the keyboard to select the direction and start and stop scanning (use the INKEY\$ command, or similar). Scanning up is done easily by incrementing FR after Line 1050 and recalling Line 1060, and scanning down by decrementing FR in the same way. It may help programming to make Lines 1060 to 2020 into a subroutine. Try adding programmable scan limits with auto-reverse or looping (you will need to connect the Scan Stop and/or AGC lines to make use of these in your program. See below).

Memories can be added to the program by making FR into an array of 7-digit numbers.

If your computer includes a real-time clock you can link to various memories, so that your favorite stations will be selected at different times.

### S-Meter Signal Interfacing

As mentioned in the Operating Manual, certain CAT Interface Units include an A/D (analog-to-digital) converter, which provides the computer with a numerical representation of the signal strength. Including this in your programming allows automatic scan start and stop routines, and automatic selection of the strongest signal among a number of different frequencies.

If the interface that you are using does not include an A/D converter, we suggest using one of the many single-chip devices available for this purpose (some computers already have an A/D converter built in to read joystick input). In most cases the easiest approach is an 8-bit parallel converter which can be connected directly to data bus, enabled by the desired I/O address, I/O request and the read line from the computer cpu. The S-meter output at pin 5 of the CAT jack ranges from zero volts

when receiving no signal signal to approximately 2.5 volts when the S-meter reads full scale. Use a converter with high-impedance (>100k) input, or include a buffer. Using a parallel converter in this way allows signal strength sampling from BASIC with the INP command.

### Squelch Interfacing

The SCAN STOP control signal at pin 6 of the CAT jack is a simple TTL-level on/off signal, which can be read by the computer without conversion. However, it is necessary to connect this pin to a TTL sensing port on the computer, such as a joystick port. The BUSY pin will be at high level when the squelch is open, and low when closed, which level depends on the setting of the front panel SQL control (which is disabled during CAT control). This can certainly be implemented easier than the S-meter signal, but provides less information for programming.

## Wideband FM

As mentioned previously, the 45.754 MHz 1st IF signal from the Front End Module is delivered to the W.FM Unit. This is applied to Mixer/FM detector IC Q3501 (MC3356), along with the 2nd local signal, after buffering by Q1005 (2SC458BTZ) on the Main Unit. Q3501 also scanning control via Q4302 (2SC1623T2BL6) and mode selection control via Q3503 (2SA812T2BM6). Wideband FM audio is delivered to the Mode/Scan Unit for selection as for the other modes.

## Mode/Scan Selection and Control

The Mode/Scan Unit receives mode selection data from the cpu (r01 - r03), which is decoded by Q5501 (MC14028BCP) to provide switching control signals for the analog circuits. Audio from the detector for each mode is buffered by Q5503 - Q5506 (2SC1623T2BL6, exc Q5504, 2SC945AP), for AM, FM-W, FM-N and SSB, respectively. These buffers are controlled by Q5501 via Q5507 - Q5510 (all 2SC1623T2BL6), so that only the audio for the selected mode is returned to the Main Unit for final amplification by Q1013 (MB3713). The decoded mode selection data from Q5501 also selects the appropriate IF filters. The remaining transistors on the Mode/Scan Unit provide squelch and mute control signals for scanning and automatic scan stop.

## Frequency Selection and Display

All frequency selection and display functions are handled digitally on the CPU Unit behind the front panel, by 4-bit custom LSI microprocessor Q2001 (HD614042-FA95). A 2-kilobyte memory for the cpu is provided by Q2002 (HM6116LFP-4). Display data at pins 1 - 11 is delivered via drivers Q2007 - Q2014 (all 2SC1623T2BL6) to fluorescent display tube DS2001 (FIP-14BM7). Negative voltage for the display is developed by DC/DC inverter Q2006 (2SC1959Y) in concert with L01.

One half of quad NAND gate Q2003 (uPD4011BG) provides dial tuning data from photo-interrupter S01 to pin 17 of Q2001, while the other half of Q2003 oscillates to drive beeper BZ01 when pin 51 of Q2001 goes high.

Dual op amp Q2017 (M5218) serves as an A/D converter in conjunction with D/A converter RB2003 to provide AGC data to Q2001 for scan-stop purposes in SSB and CW modes. The other D/A converters, RB2001 and RB2002, provide frequency data to the PLL in 100 Hz steps for the portion of the frequency below 12.8 kHz.

The remaining circuitry around Q19 - Q25 performs cpu and memory reset, backup and off/on timer switching functions.







The high reliability of the chip components and robot assembly used for the FRG-9600 make it unlikely that repair or realignment will be required after it has left the factory. However, if damage does occur and some parts subsequently be replaced, realignment may be required afterwards. In the event of a sudden problem during normal operation, do not attempt realignment. Such problems are usually caused by the failure of a component, which must be located and replaced before realignment is attempted.

Because of the complex digital control circuitry in this receiver we recommend that servicing be attempted only by authorized Yaesu service technicians who are experienced with the circuitry and fully equipped for repair and alignment. Therefore, if a fault is suspected, contact the dealer from whom the receiver was purchased for instructions regarding repair. Authorized Yaesu service technicians make all realignments and complete performance checks to ensure compliance with factory specifications after replacing any faulty components.

Those who do undertake any of the following alignments are cautioned to proceed at their own risk. Yaesu must reserve the right to change circuits and alignment procedures in the interest of improved performance, without notifying owners.

Under no circumstances should any alignment be attempted unless the normal function and operation of the receiver are clearly understood, the cause of the malfunction clearly pinpointed and any faulty components replaced, and the need for realignment determined to be absolutely necessary.

The following test equipment (and thorough familiarity with its correct use) is necessary for complete realignment. Correction of problems caused by misalignment resulting from use of improper test equipment is not covered under the warranty policy.

### Alignment Equipment

Volt-Ohm-Ammeter (50-kilohm/V DC, 10-kilohm/V AC impedance)

AF millivoltmeter

RF standard signal generator (SSG)  
0.1 to 450 MHz, with calibrated level and modulation (see note below)

RF voltmeter (VTVM or equiv.)  
>5% accuracy at 450 MHz, 10 to 1000 dB

SINAD meter (SINADDER)

Frequency counter (0.02 ppm, 6-digit)

Oscilloscope (for signal tracing)

Linear Detector

Spectrum analyzer (HP-141T or equiv.)

Video Monitor (for optional Video Unit only)

Note: SSG levels referred to in the alignment procedure are based on  $0\text{dBu}=1\text{ uV}$  at infinite impedance (unterminated).

### Alignment Precautions

Correct alignment requires that the ambient temperature be the same as that of the receiver and test equipment, and that this temperature be held constant between  $20^{\circ}$  and  $30^{\circ}\text{C}$  ( $68^{\circ}$  to  $86^{\circ}\text{F}$ ). When the receiver is brought into the shop it should be allowed at least 2 hours for thermal equalization before alignment.

Alignments must not be made unless the oscillator shields and circuit boards are firmly affixed in place. Also, the frequency counter must be thoroughly warmed up before beginning. Perform all steps in the order given, as many are interdependent.

Remove the top and bottom covers from the chassis. The top cover is affixed by two screws on either side, plus a grounding clip, so after removing the screws it is necessary to lift the top cover slightly at the rear, and then slide it back about 1 cm. Disconnect the speaker wires before pulling the cover away.

The bottom cover is affixed by eight screws; two on either side and four on the bottom.

Connect the SSG to the ANT jack and the AF millivoltmeter in parallel with an 8-ohm speaker to the EXT SPKR jack.

### 1. PLL Reference Oscillator Frequency

Connect the frequency counter to TP3001 on the PLL Unit, and adjust trimmer TC3001 for 4.096 MHz  $\pm$ 10 Hz on the counter.

### 2. Front End

(This step should be skipped unless the front end module is being replaced)

(a) Remove the left side cover from the front end module, and connect the Hi-Z DC voltmeter to TP3002 on the PLL Unit.

(b) Tune the receiver for 106.999.9 on the display, and adjust the pitch of the coil indicated in Figure 1 for  $26 \pm 1V$  at TP3002. Remove the meter and replace the cover on the module.

### 3. 2nd Local Oscillator Level

Tune the receiver for 80.000.0 on the display, and connect the RF voltmeter to Gate 2 of Q1003 on the Main Unit, shown in Figure 2. Adjust T1006 and then T1005 for peak RF voltage on the meter (approx 1.15  $\pm$ 0.3 Vrms).

### 4. 2nd Local Oscillator Frequency

(a) With the receiver still showing 80.000.0, connect the frequency counter to TP1001 on the Main Unit and adjust T1004 for 35.06 MHz  $\pm$ 50 Hz on the frequency counter.

(b) Retune the receiver so 79.999.9 is displayed, and adjust VR1001 for 35.0473 MHz  $\pm$ 25 Hz on the counter.

### 5. LSB/USB Carrier (BFO) Frequency

(a) Connect the frequency counter to TP1002 on the Main Unit, set the receiver to the LSB mode, and adjust TC5001 on the FIL/CAR Unit for 453.5 kHz  $\pm$ 50 Hz on the counter.

(b) Switch the receiver to the USB mode and adjust TC5002 for 456.5 kHz  $\pm$ 50 Hz on the counter.

### 6. RF Signal Path

(Part 7 must be performed immediately after this part is completed.)

(a) Tune the receiver to 100 MHz, USB mode. Set the SSG output level to 0 dB, with no modulation, close enough to the receiving frequency to produce a heterodyne of about 1 kHz audible in the external speaker.

(b) Adjust T1001 - T1003 for peak audio output. (Adjust the VOL control, if necessary, to keep readings on the AF meter scale).

(c) Adjust the VOL control so the AF millivoltmeter indicates just full scale, and then preadjust VR1005 so that the AF millivoltmeter indicates 10dB lower than full scale. Now repeat the peaking of T1001 - T1003 two or three more times.

(d) If the front end module is being replaced, adjust the transformers indicated in Figure 2 for peak on the AF millivoltmeter.

### 7. Total System Gain

(a) Retune the receiver to 70.500 MHz, and tune the SSG nearby for a heterodyne.

(b) Connect the DC voltmeter (5V range) to TP1003 and set VR1005 fully CCW (The DC voltmeter should show approx 4V).



BOARD LOCATIONS

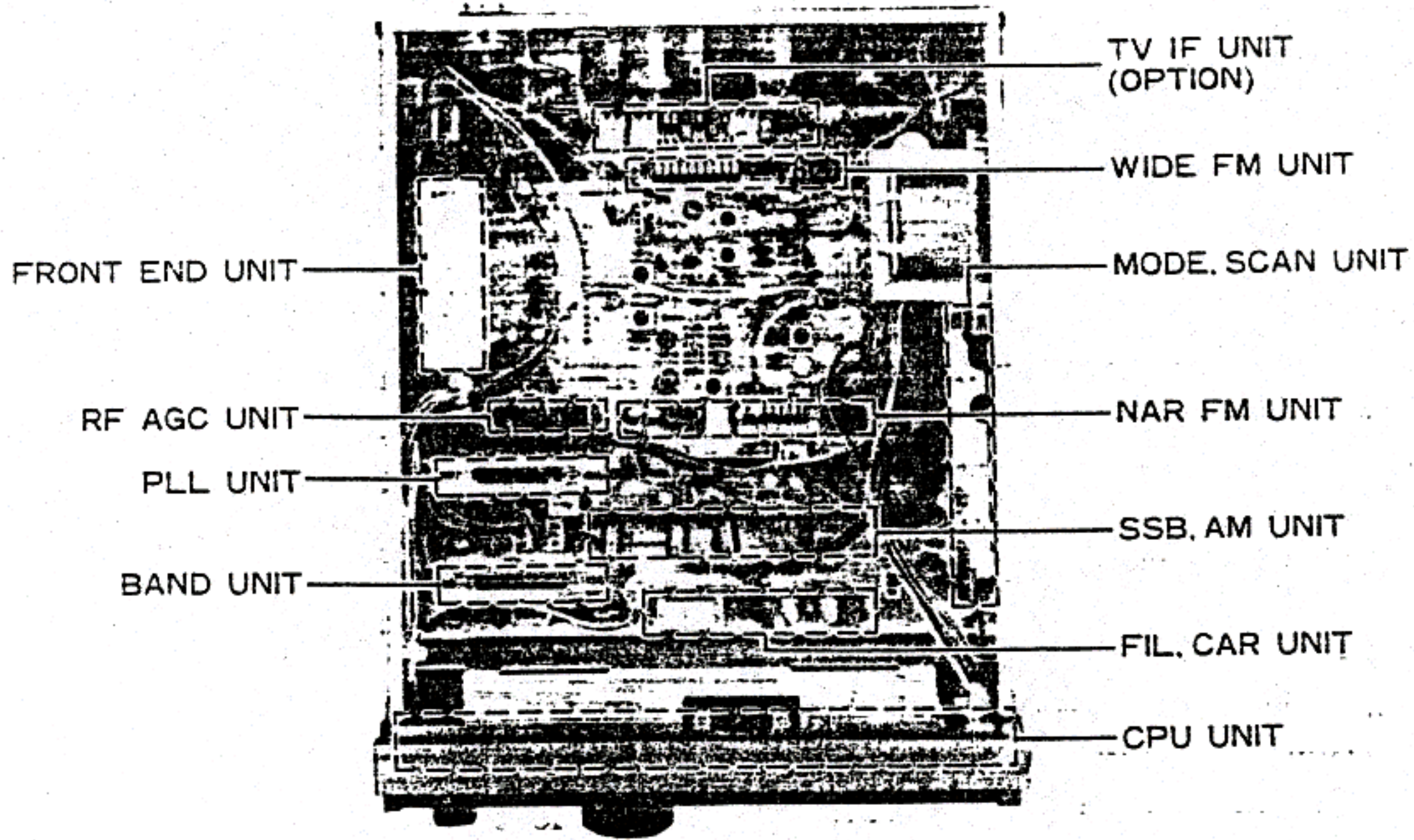


Figure 1

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ALIGNMENT POINTS

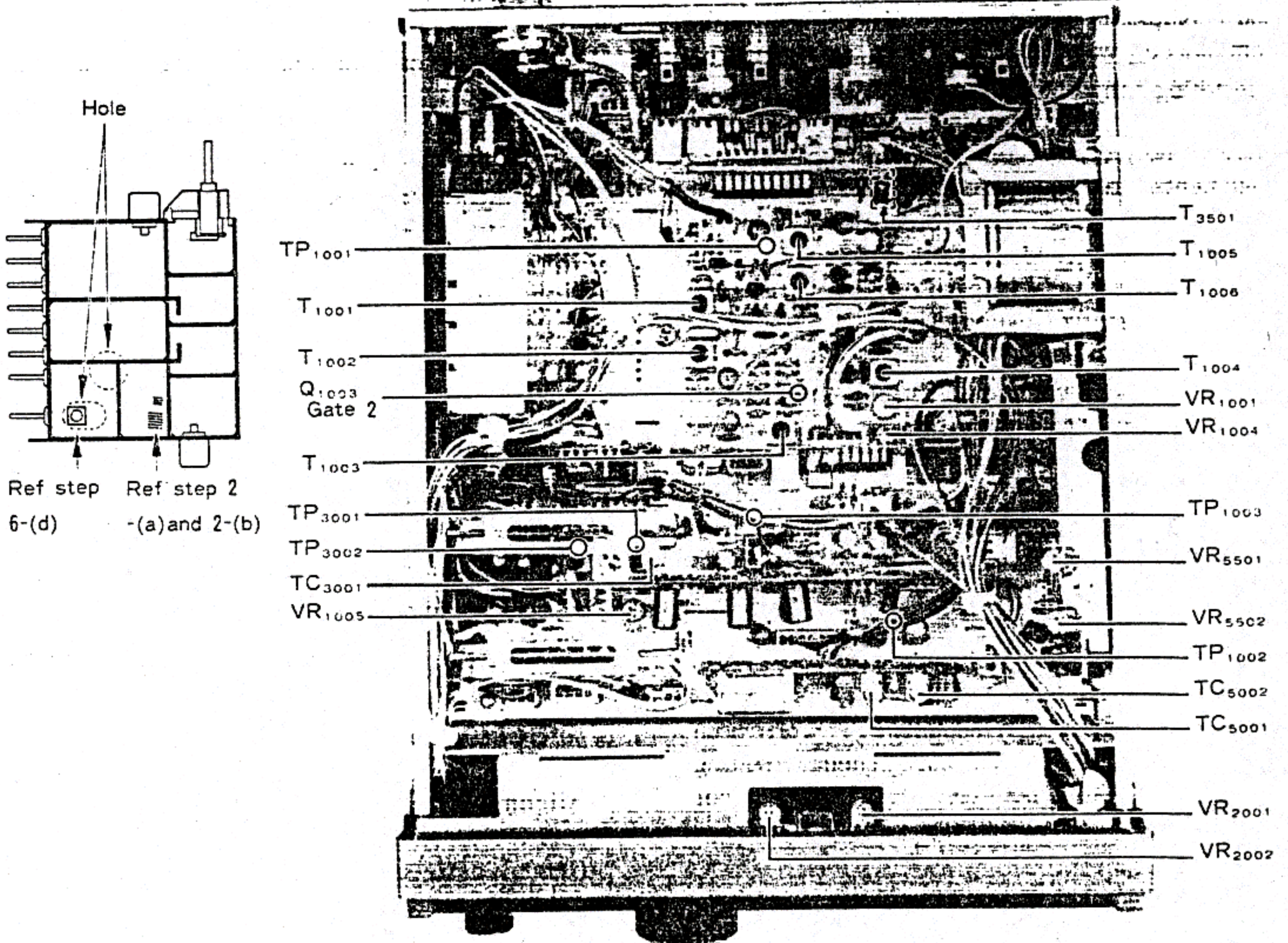
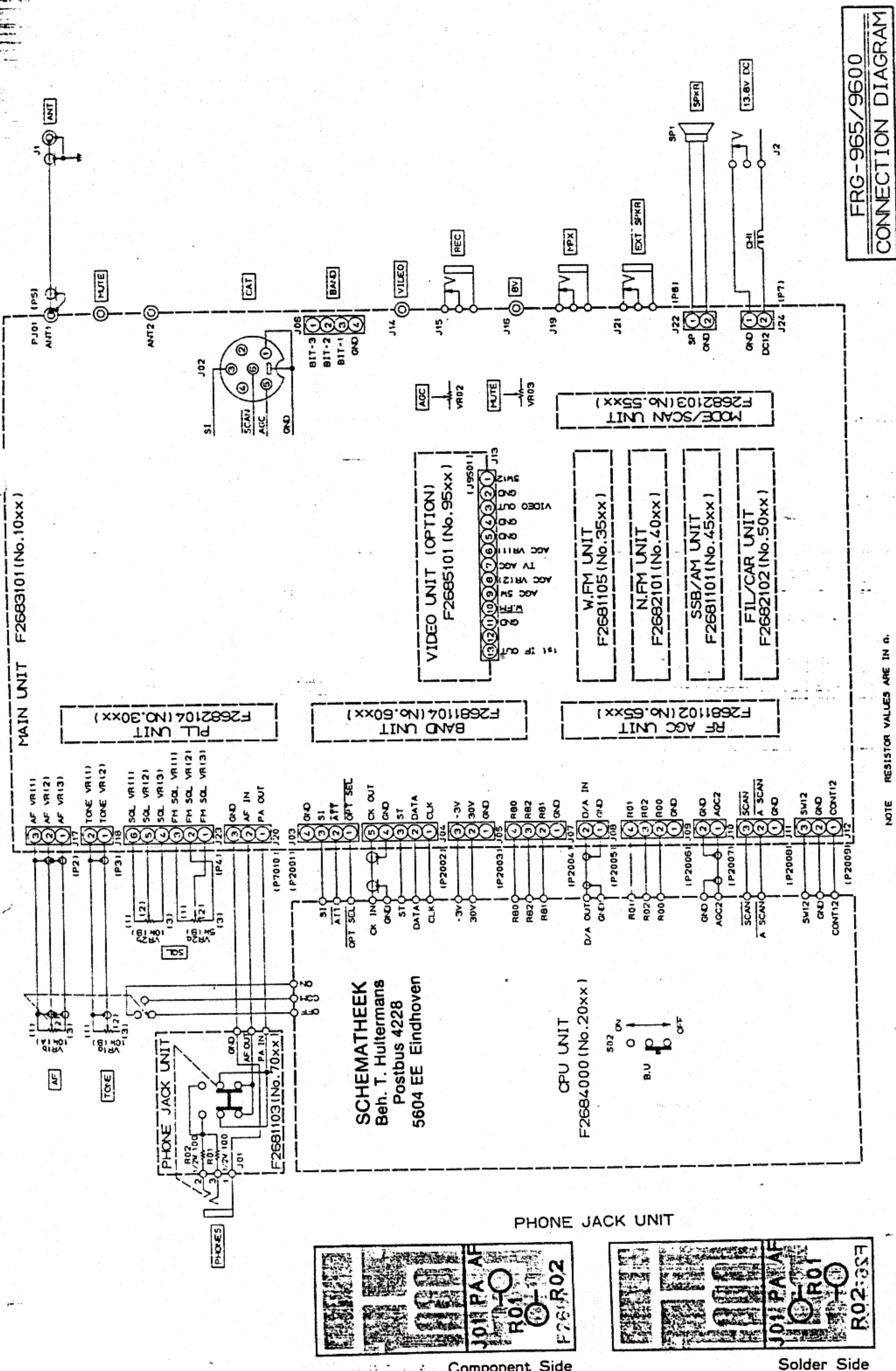


Figure 2

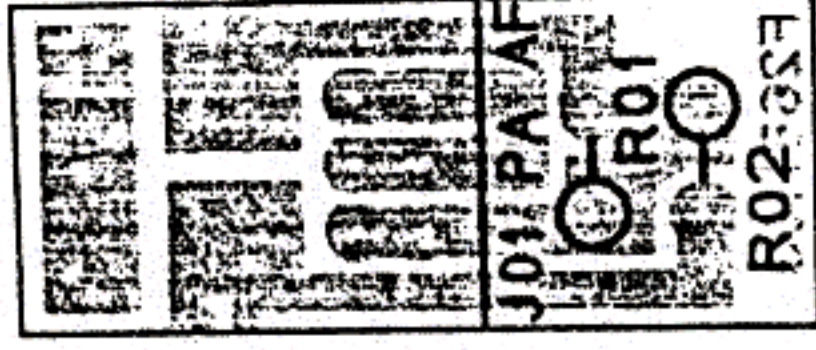
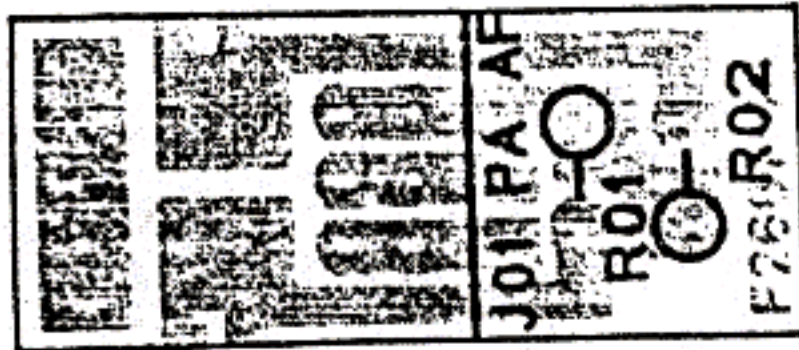
Rei  
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FRG-965/9600  
CONNECTION DIAGRAM

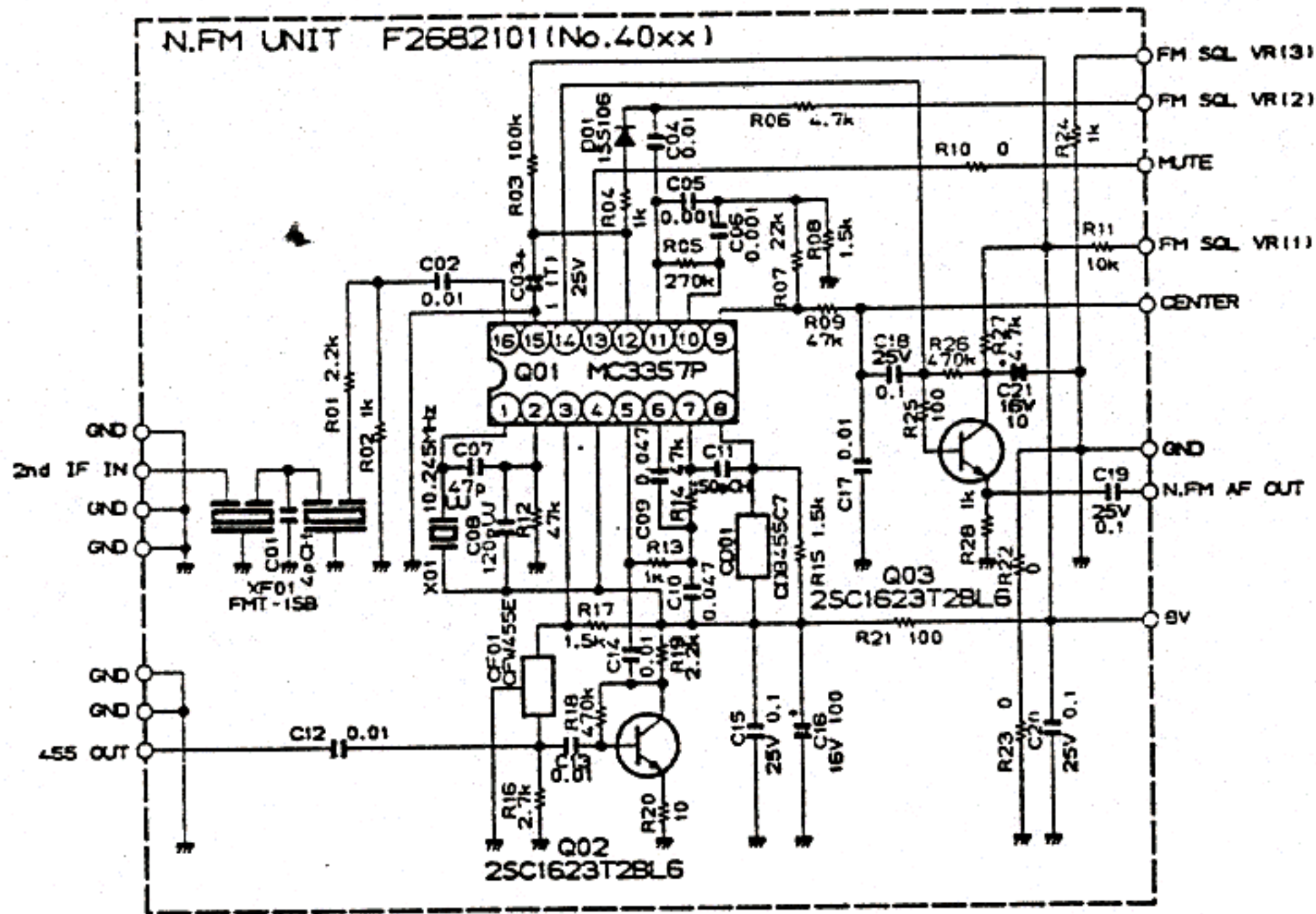
NOTE: RESISTOR VALUES ARE IN Ω.



Component Side

Solder Side



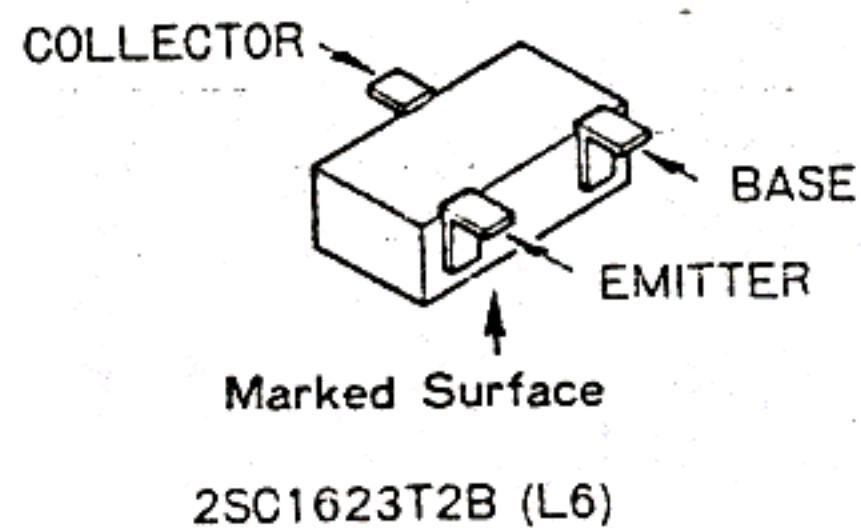
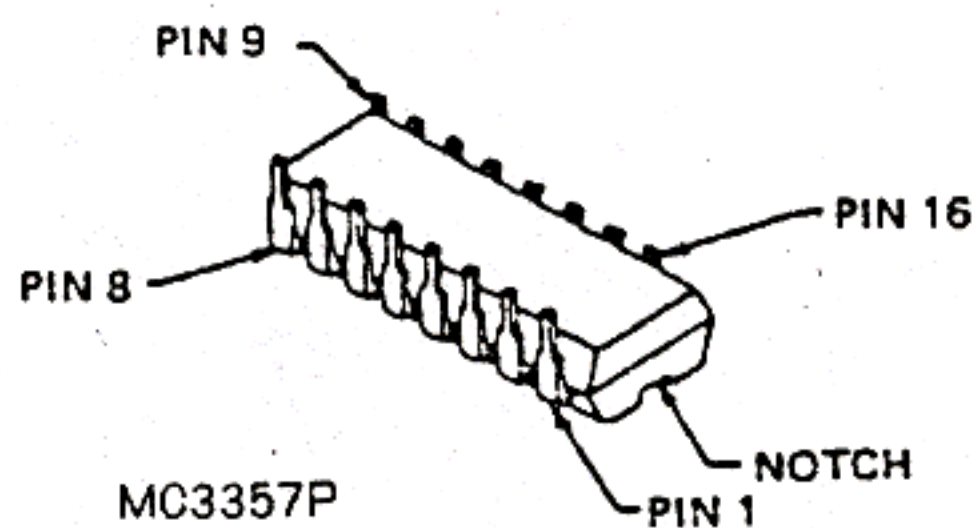


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VOLTAGE CHART (DC VOLTS)

	1	2	3	4	5	6	7	8	REMARKS
Q4001	7.3	7.0	7.1	7.4	1.0	1.0	1.0	7.4	
	9	10	11	12	13	14	15	16	
	2.6	1.9	1.9	0.7/0.5	0.5/6.5	1.6/0	0	1.9	SQL open/close

	E	C	B	REMARKS
Q4002	0	2.8	0.6	
Q4003	1.0/0	3.0/7.8	1.6/0	SQL open/close



- (c) Now increase the SSG level to 6dB and adjust VR1005 gradually to the point where the DC voltage at TP1003 just starts to fall.

#### 8. Squelch Preset Level

Temporarily disconnect the SSG from the antenna jack for the following two steps.

- (a) Select an SSB or AM mode, and set the SQL control on the front panel to the 12 o'clock position. Adjust VR5501 on the MODE/SCAN Unit so that receiver noise is just silenced.
- (b) Select the FM-N mode and adjust VR1004 for the FM squelch threshold point.

#### 9. Scan Stop Signal Level

- (a) Reconnect the SSG to the ANT jack, and set for standard FM modulation ( $\pm 3.5$  kHz deviation of a 1 kHz tone). Set the level to 0 dB at 70.500 MHz.
- (b) Set the receiver to the FM-N mode, with 5 kHz tuning steps. Tune the receiver to the same frequency as the SSG (peak on the AF millivoltmeter).
- (c) Connect the DC voltmeter (10V range) to pin 6 of the CAT jack on the rear panel (which should be at about 5V), and tune the receiver one step up and one step down while adjusting VR5502 on the MODE/SCAN Unit, until the DC voltmeter shows a drop to near zero on each side of the center frequency.

#### 10. FM Wide

- (a) Set the SSG output to +30dB (at 70.500 MHz), and modulate with  $\pm 75$  kHz deviation of a 1 kHz tone.
- (b) Set the receiver to the FM-W mode and again tune for peak audio on the AF millivoltmeter. Then adjust T3501 on the W-FM Unit for peak deflection on the AF millivoltmeter.

#### 11. S-Meter Full Scale

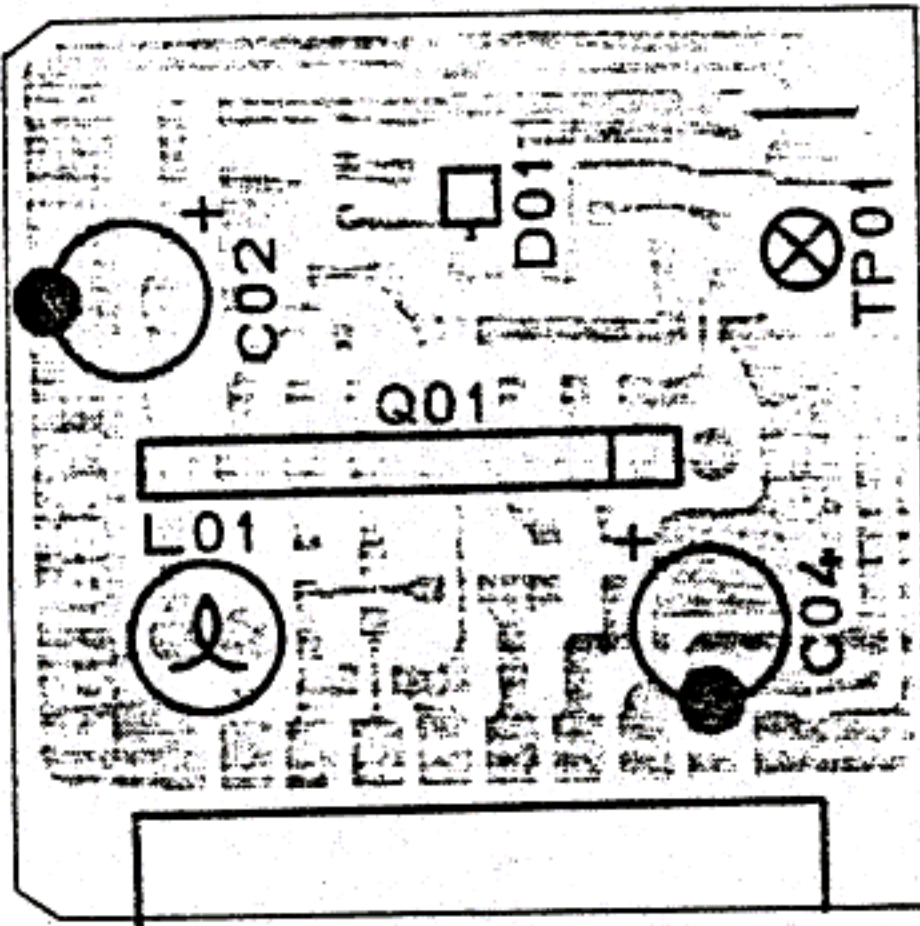
- (a) With the receiver and SSG tuned to 70.500 MHz, set the receiver to USB mode and the SSG level to 0dB with no modulation. Tune the receiver for peak indication on the AF millivoltmeter.
- (b) Preset VR2002 on the CPU Unit fully CCW, increase the SSG level to +30dB, and adjust VR2001 on the CPU Unit so that all segments of the S-Meter are just lit.

#### 12. S-Meter Threshold

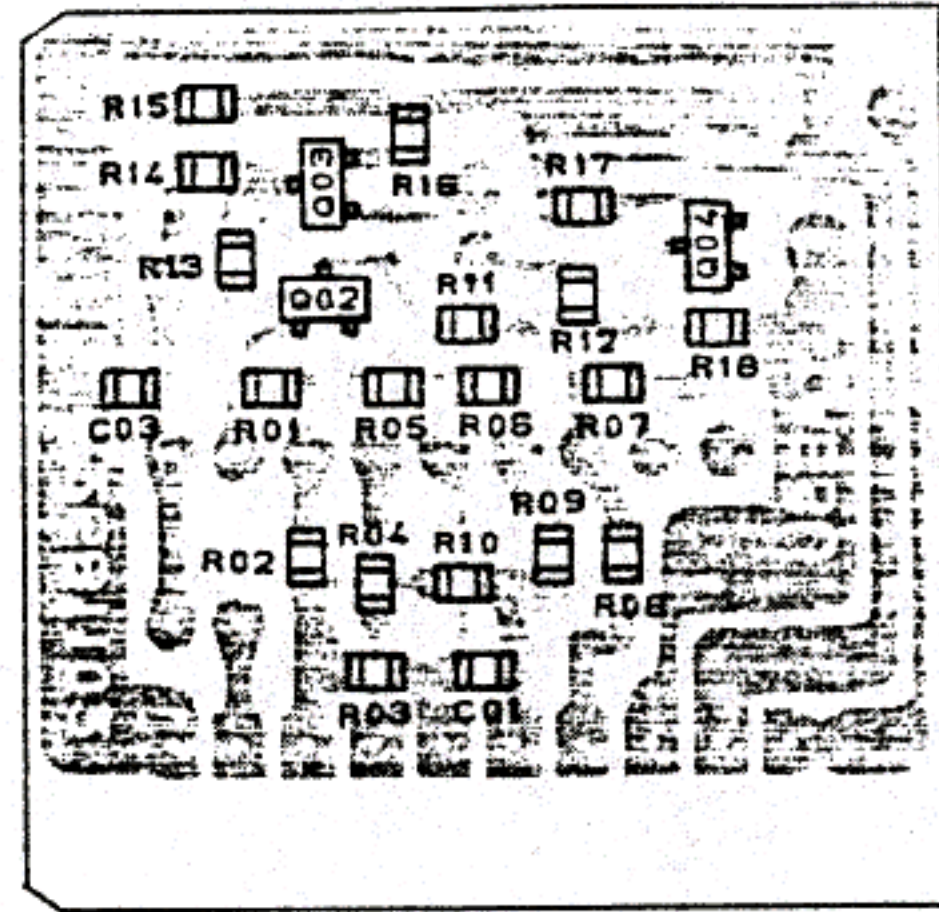
Reduce the SSG output to +10dB, and adjust VR2002 so that just the first two segments are lit. If too many segments remain lit, turn VR2002 fully CCW and then readjust it more slowly.



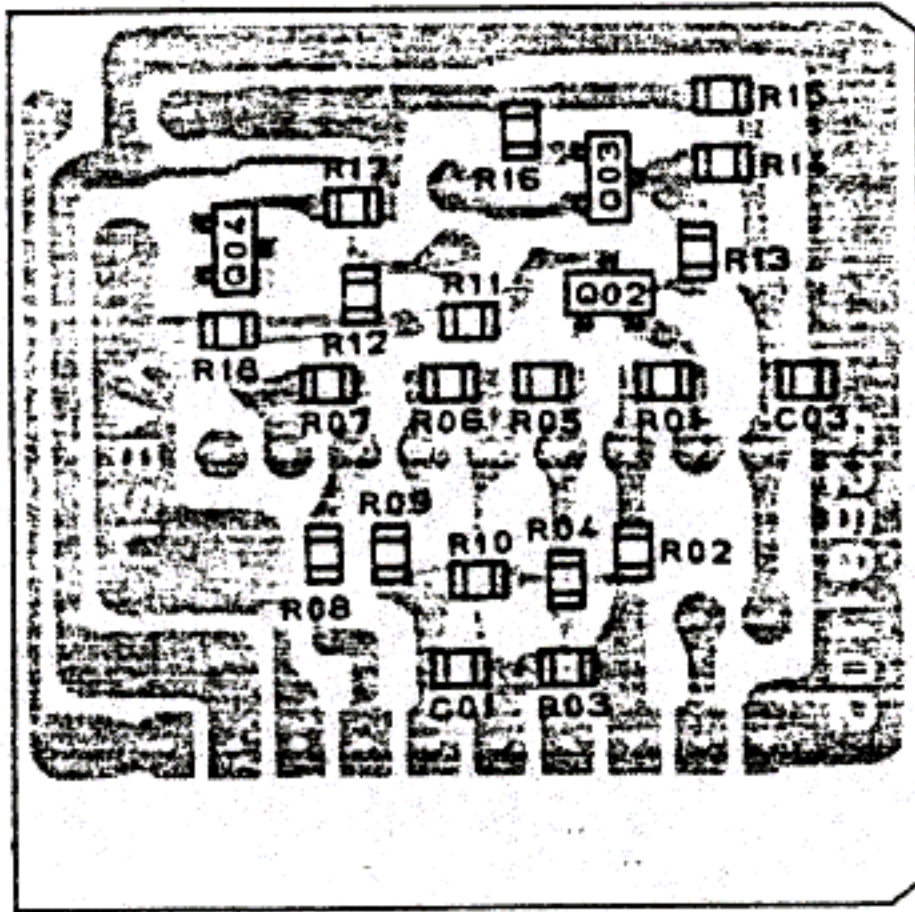
# RF AGC UNIT PARTS LAYOUT



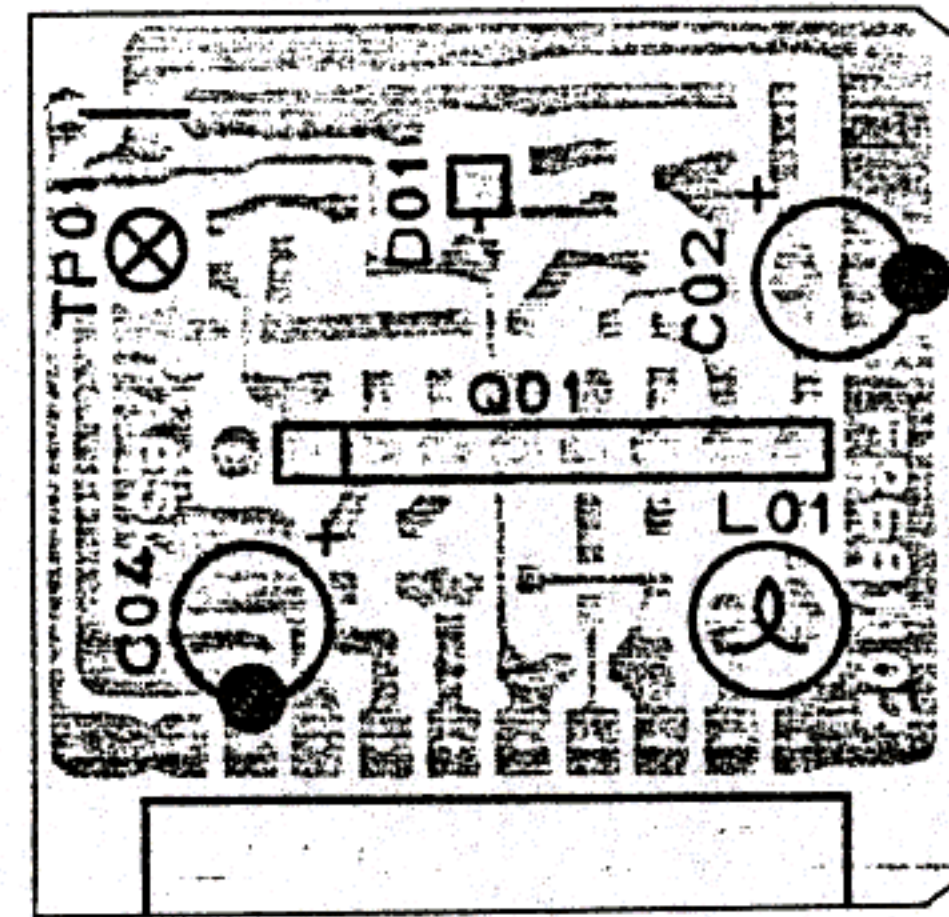
(obverse view of "component" side)



(reverse view of "chip-only" side)



(obverse view of "chip-only" side)



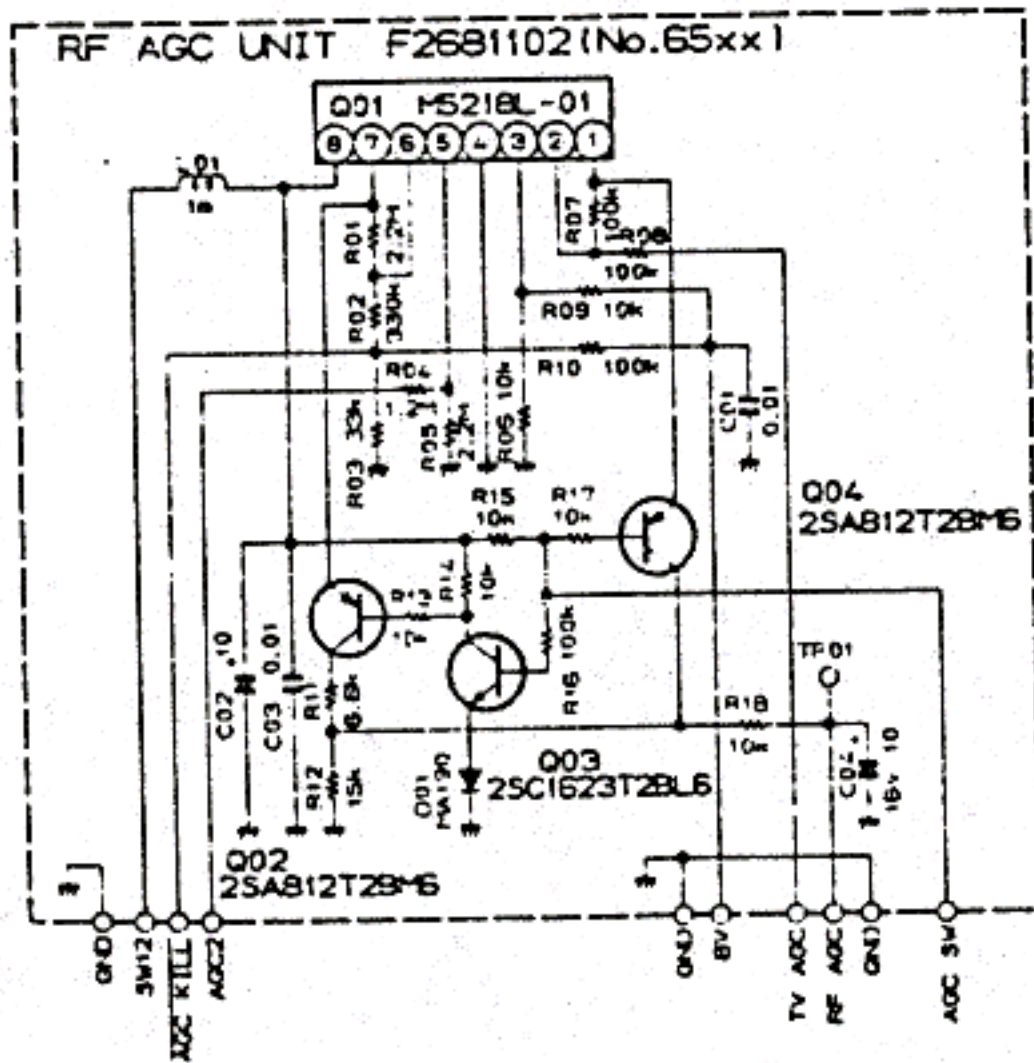
(reverse view of "component" side)

**SCHEMATHEEK**  
Beh. T. Hultermans  
Postbus 4228  
5604 EE Eindhoven

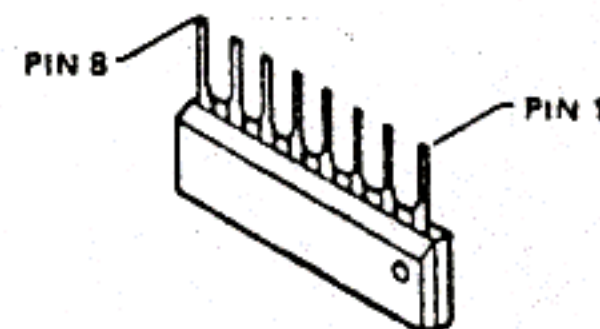
## VOLTAGE CHART (DC VOLTS)

	1	2	3	4	5	6	7	8	REMARK
Q6501	3.9	3.9	3.9	0	2.8/2.9	2.2/3.1	12.6/10.5	13.7	SSB/OTHERS

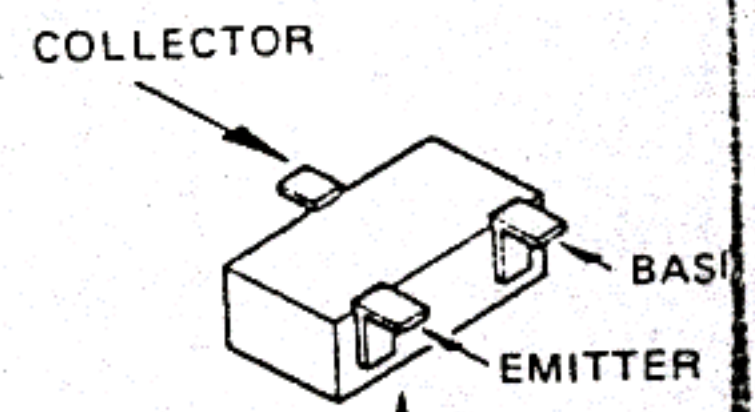
	E	C	B	REMARKS
Q6502	12.6/10.5	12.6/10.5	11.8/9.8	SSB/OTHERS
Q6503	0.7	0.8	1.4	
Q6504	3.9	8.6/7.2	12.5	SSB/OTHERS



NOTE ALL RESISTOR VALUES ARE IN Ω, 10Ω, 100Ω, 1K, 10K, 100K, 1M, UNLESS OTHERWISE NOTED.  
ALL CAPACITOR VALUES ARE IN pF, 50pF, 100pF, 1nF, 10nF, 100nF, 1μF, UNLESS OTHERWISE NOTED.  
ALL INDUCTOR VALUES ARE IN μH, UNLESS OTHERWISE NOTED.



M5218L-01



Marked Surface  
2SA812T2B (M6)  
2SC1623T2B (L6)



C4003	K70140007	Tantalum 25WV 1 $\mu$ F (489D105x0025A1)	C4530	K22170805	" " 0.001 $\mu$ F (C2012B1H102KFA)	B
C4021	K40129012	Electyctic 16WV 10 $\mu$ F (ECE-A1CK100)	C4501, 4502, 4505, 4506, 4510, 4514, 4515, 4520, 4522, 4524, 4525, 4529, 4531, 4535	K22170817	" " 0.01 $\mu$ F (C2012B1H103KFA)	B
C4016	K40129038	" " 100 $\mu$ F (ECE-A1CK101)				
			C4528	K22171008	" " 0.047 $\mu$ F (C2012F1H473ZFA)	F
		<b>CONNECTORS</b>				
	P0090478	3094-07A	C4504, 4507, 4508, 4512, 4516-4519, 4523, 4526, 4532, 4534, 4536	K22141904	" 25WV 0.1 $\mu$ F (C3216D1E104MFA)	D
	P0090479	3094-08A				
		<b>TERMINAL POSTS</b>				
	Q5000036	TP-G	C4511, 4521	K40129012	Electrolytic 16WV 10 $\mu$ F (ECE-A1CK100)	
<b>SSB - AM UNIT</b>						
	F2681101	Printed circuit board			<b>INDUCTORS</b>	
	C026811A	PCB with components	L4501-4503	L1190040	S-4 1mH	
		<b>FETs</b>				
Q4501, 4502, 4505	G4800730G	3SK73GR			<b>CONNECTORS</b>	
				P0090477	3094-09A	
		<b>TRANSISTORS</b>		P0090480	3094-12A	
Q4503, 4506-4508	G3316237F	2SC1623T2BL6				
		<b>DIODE QUAD</b>				
Q4504	G2090135	ND487C2-3R		F2682102	Printed circuit board	
		<b>DIODES</b>		C026822A	PCB with components	
D4503	G2070020	Si 1SS123T2B			<b>TRANSISTORS</b>	
D4501, 4502	G2090244	Schottky 1SS106	Q5001, 5002	G3309451P	2SC945AP	
		<b>THERMISTOR</b>	Q5003, 5004	G3316237F	2SC1623T2BL6	
TH4501	G9090022	SDT-09			<b>DIODES</b>	
		<b>RESISTORS</b>	D5001-5005	G2090237	Si MA190	
R4502, 4510, 4511	J24205470	Chip RMC 1/10T 470J 47 $\Omega$	D5006, 5007	G2090118	Schottky 1SS97	
R4504, 4515, 4521, 4524, 4527, 4529, 4540	J24205101	" " 101J 100 $\Omega$			<b>CERAMIC RESONATORS</b>	
R4503, 4508	J24205471	" " 471J 470 $\Omega$	CO5001	H7900090 (H7900240)	CSB 453.5A2 (or R453.5C)	
R4506, 4513, 4514 4516-4519, 4523, 4530, 4538	J24205102	" " 102J 1k $\Omega$	CO5002	H7900100 (H7900250)	CSB 456.5A2 (or R456.5C)	
R4520	J24205222	" " 222J 2.2k $\Omega$			<b>CERAMIC FILTERS</b>	
R4501, 4505, 4507, 4509, 4525, 4526, 4535, 4539, 4542	J24205103	" " 103J 10k $\Omega$	CF5001	H3900041	CFM 455J1	
R4537	J24205183	" " 183J 18k $\Omega$	CF5002	H3900371	CFW 455HT	
R4541	J24205223	" " 223J 22k $\Omega$			<b>RESISTORS</b>	
R4534	J24205333	" " 333J 33k $\Omega$	R5011	J01215103	Carbon film 1/8W 10k $\Omega$ TJ	
R4531	J24205683	" " 683J 68k $\Omega$	R5005	J24205000	Chip RMC 1/10T 000J 0 $\Omega$	
R4522, 4528	J24205154	" " 154J 150k $\Omega$	R5002, 5008, 5015, 5017	J24205101	" " 101J 100 $\Omega$	
R4512	J24205334	" " 334J 330k $\Omega$	R5013, 5020	J24205222	" " 222J 2.2k $\Omega$	
R4532, 4533	J24205474	" " 474J 470k $\Omega$	R5001, 5003, 5004, 5007, 5009, 5010	J24205472	" " 472J 4.7k $\Omega$	
R4536	J24205105	" " 105J 1M $\Omega$	R5006, 5012, 5014, 5018, 5021	J24205103	" " 103J 10k $\Omega$	
			R5016, 5019	J24205394	" " 394J 390k $\Omega$	
		<b>CAPACITORS</b>			<b>CAPACITORS</b>	
C4513	K22170204	Chip 50WV 3pF CH (C2012C1H030CFA)	C5008, 5014	K22170227	Chip 50WV 47pF CH (C2012CH1H470JFA)	
C4527	K22170211	" " 10pF (C2012CH1H100DFA)	C5012	K22170235	" " 100pF (C2012CH1H101JFA)	
C4503, 4509, 4533	K22170235	" " 100pF (C2012CH1H101JFA)	C5010, 5016	K22170243	" " 220pF (C2012CH1H221JFA)	

C5009, 5015	K22170245	" " 270pF (C2012CH1H271JFA)		C5504-5506, 5508-5511	K40179001	Electrolytic 50WV 1μF (ECE-A1HK010)
C5001-5006, 5011, 5017	K22171008	" " 0.047μF (C2012F1H473ZFA)	F	C5502, 5507, 5513	K40129012	" 16WV 10μF (ECE-A1CK100)
C5007, 5013	K40179001	Electrolytic " 1μF (ECE-A1HK010)				
						INDUCTORS
				L5501, 5502	L1190017	FL5H-102K 1mH
		TRIMMER CAPACITORS				
TC5001, 5002	K91000130	ECV-1ZW 60x60 60pF				
						CONNECTORS
		CONNECTORS		P0090479		3094-08A
	P0090478	3094-07A		P0090477		3094-09A
	P0090480	3094-12A				
						BAND UNIT
				F2681104		Printed circuit board
				C026814A		PCB with components
						IC
				Q6001	G1090088	MC14028BCP
Q5501	G1090088	MC14028BCP				
						TRANSISTORS
				Q6002-6012	G3316237F	2SC1623T2BL6
		TRANSISTORS				
Q5511, 5513	G3108127F	2SA812T2BM6				
Q5504	G3309451P	2SC945AP				
Q5502, 5503, 5505-5510, 5512, 5514-5517	G3316237F	2SC1623T2BL6				DIODES
				D6001-6003	G2090237	Si MA190
		DIODES				RESISTORS
D5501-5513	G2090237	Si MA190		R6012-6015	J01215103	Carbon film 1/8W 10kΩ TJ
				R6007-6009	J01215334	" " " 330kΩ "
				R6001, 6002	J24205000	Chip RMC 1/10T 000J 0Ω
				R6003, 6004, 6016, 6017	J24205682	" " 682J 6.8kΩ
		RESISTORS		R6005, 6006, 6010, 6011	J24205103	" " 103J 10kΩ
R5503, 5507, 5508, 5510, 5512, 5523, 5536, 5538	J24205000	Chip RMC 1/10T 000J 0Ω				
R5515, 5521, 5526	J24205101	" " 101J 100Ω				
R5506	J24205102	" " 102J 1kΩ				
R5514, 5517, 5520, 5527	J24205472	" " 472J 4.7kΩ				CAPACITOR
R5501, 5502, 5504, 5505, 5509, 5511, 5513, 5524, 5528-5532, 5534, 5535, 5541, 5543	J24205103	" " 103J 10kΩ		C6001	K22141904	Chip 25WV 0.1μF D (C3216D1E104MFA)
R5540	J24205153	" " 153J 15kΩ				INDUCTOR
R5533	J24205104	" " 104J 100kΩ		L6001	L1190017	FL5H-102K 1mH
R5516, 5518, 5522, 5525	J24205334	" " 334J 330kΩ				CONNECTOR
					P0090477	3094-09A
						RF AGC UNIT
R5539	J24205105	" " 105J 1MΩ			F2681102	Printed circuit board
R5537, 5542	J24205225	" " 225J 2.2MΩ			C026812A	PCB with components
R5544	J01215564	Carbon film 1/8W 560kΩ TJ				IC
		POTENTIOMETERS		Q6501	G1090649	M5218L-01
VR5502	J50764103	H0622A 10kΩ 10kΩB				
VR5501	J50764473	H0622A 47kΩ 47kΩB				TRANSISTORS
		CAPACITORS		Q6502, 6504	G3108127F	2SA812T2BM6
C5519	K13179008	Ceramic 50WV 0.01μF F (DD106F103Z50)		Q6503	G3316237F	2SC1623T2BL6
C5501, 5503, 5512, 5514-5516	K22170817	Chip 50WV 0.01μF B (C2012B1H103MFA)				
C5517	K22171008	" " 0.047μF F (C2012F1H473ZFA)				DIODE
C5518	K22141904	" 25WV 0.1μF D (C3216D1E104MFA)		D6501	G2090237	Si MA190

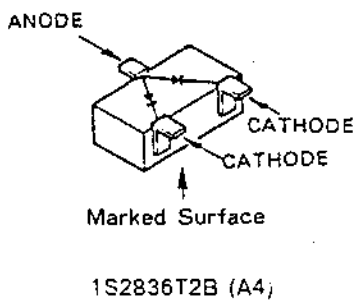
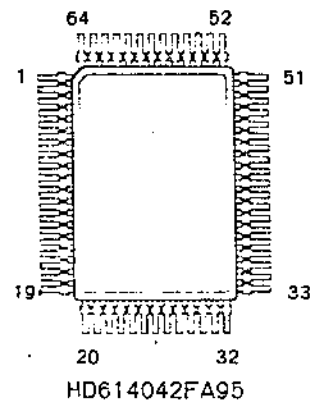
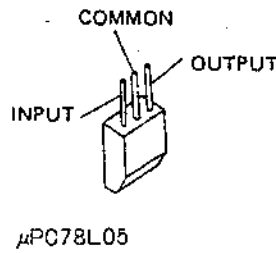
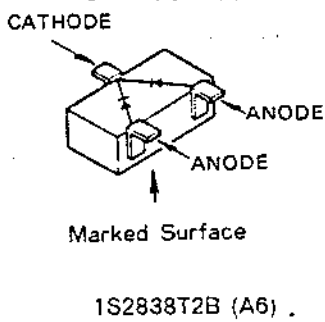
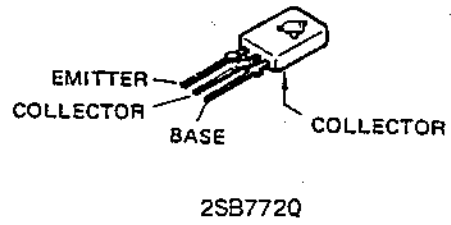
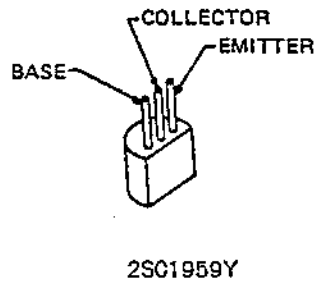
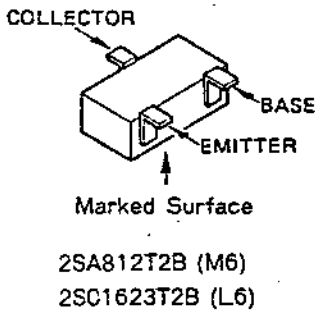
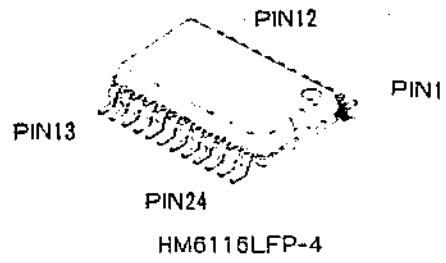
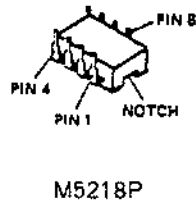
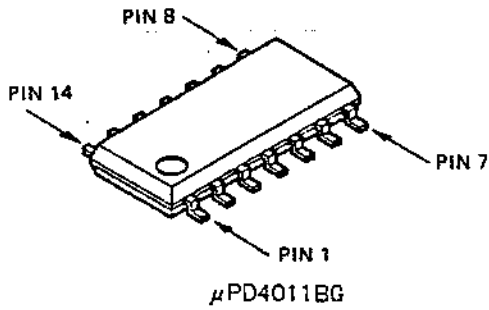
04998 - 96436 WIC

RESISTORS		
R6511	J24205682	Chip RMC 1/10T 682J 6.8kΩ
R6506, 6509, 6513-6515, 6517, 6518	J24205103	" " 103J 10kΩ
R6512	J24205153	" " 153J 15kΩ
R6503	J24205333	" " 333J 33kΩ
R6507, 6508, 6510, 6516	J24205104	" " 104J 100kΩ
R6502	J24205334	" " 334J 330kΩ
R6504	J24205125	" " 125J 1.2MΩ
R6501, 6505	J24205225	" " 225J 2.2MΩ
CAPACITORS		
C6501, 6503	K22170817	Chip 50WV 0.01μF (C2012B1H103MFA)
C6502	K40179014	Electrolytic " 10μF (SORE10)
C6504	K40129012	" 16WV 10μF (ECE-A1CK100)
INDUCTOR		
6501	L1190017	FL5H-102K 1mH
CONNECTOR		
	P0090481	3094-10A
TERMINAL POST		
TP6501	Q5000036	TP-G
PHONE JACK UNIT		
	F2681103	Printed circuit board
	C026813A	PCB with components
RESISTORS		
R7001, 7002	J01215101	Carbon film 1/2W 100Ω TJ
JACK/PLUG		
J7001	P1090435	HSJ0928-01-040
7001 (with wire)	T9204997A	
ACCESSORIES		
ANTENNA		
	Q3000044	T-4144
	R0102530	STAND A
DC POWER CORD		
	T9015799	FSK 55-21-9.5
OPTIONAL AC-DC ADAPTER		
	D3000391	PA-4A 100VAC
	D3000392	PA-4B 120VAC
	D3000393	PA-4C 220-240VAC
SCHEMATHEEK		
		Beh. T. Hultermans
		Postbus 4228
		5604 EE Eindhoven









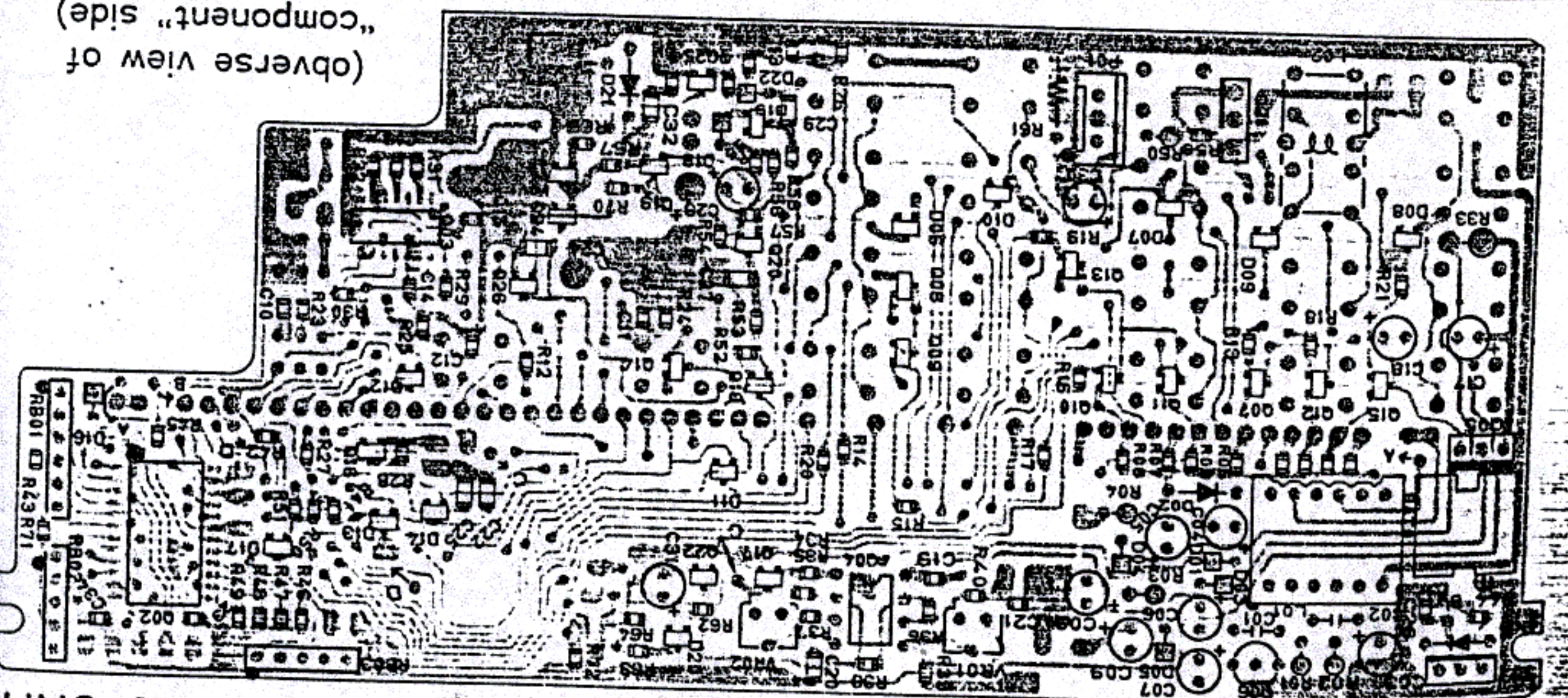
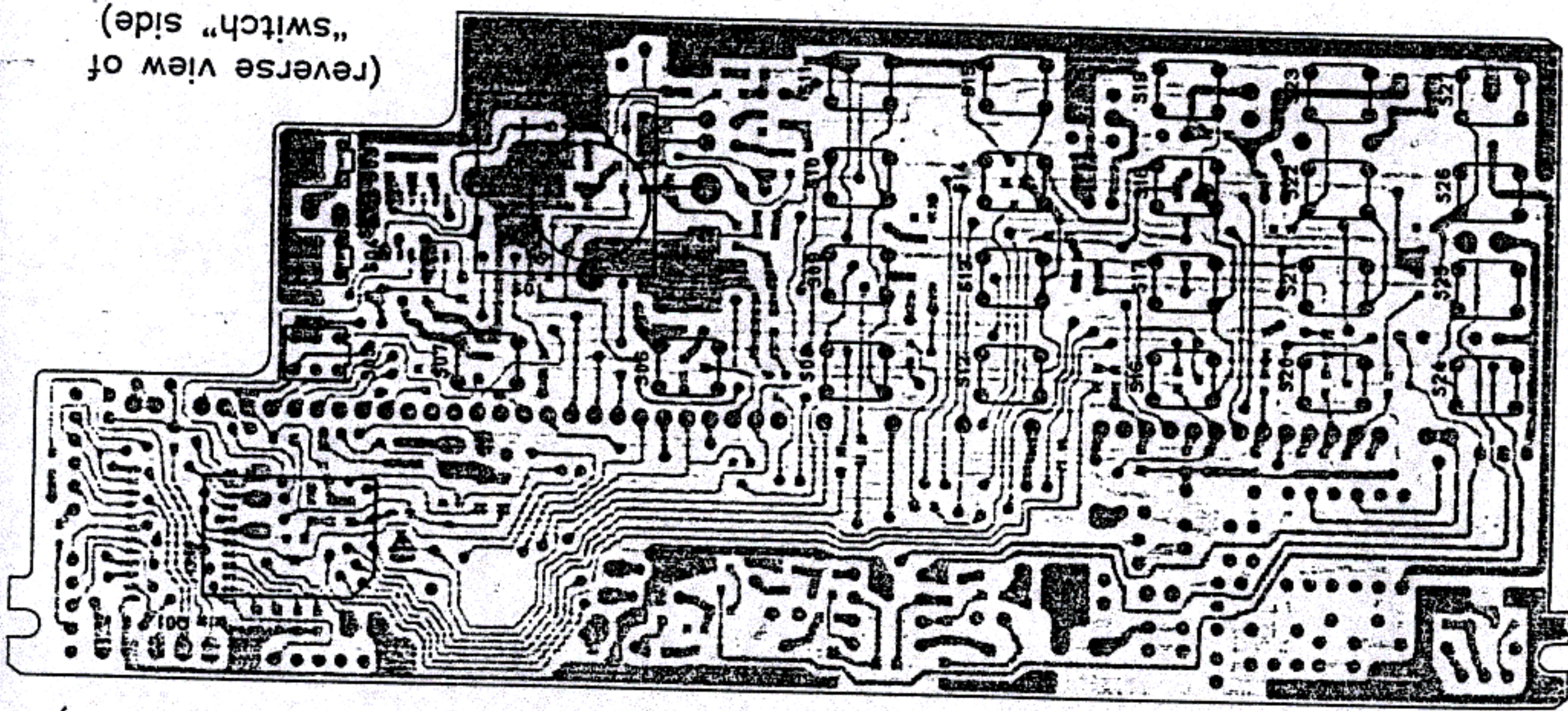


02006	0	13.7	- 1.2	B
02007	-23.5	5.0	-23.5	
02008	-11.9	5.0	-11.9	
02009	-12.1	5.0	-11.9	
02010	- 9.8	5.0	- 9.5	
02011	-12.0	5.0	-11.8	
02012	-12.0	5.0	-11.8	
02013	-12.1	5.0	-11.8	
02014	-23.9	5.0	-23.9	
02015	-23.9	5.0	-23.9	
02016	0	2.5	0.4	

02017	0	0	0.6	B
02018	0	0	0.6	
02019	14.0/17.1	14.0/17.1	13.3/16.5	POWER SW ON/OFF
02020	0	13.4/16.5	0	
02021	14.0/17.1	13.9/ 0.5	13.2/17.1	
02022	0	0.1/ 0	0.6/ 0.2	
02023	0	0	0.6	
02024	0	5.0/ 0	0	POWER SW ON/OFF
02025	0	0 / 0.6	0.6/ 0	
02026	0	5.0/ 0	0 / 0.6	

VOLTAGE CHART (DC VOLTS)

SCHERMATHEEK  
 Beh. T. Hultermans  
 Postbus 4228  
 5604 EE Eindhoven



CPU UNIT

SPKR

X

101

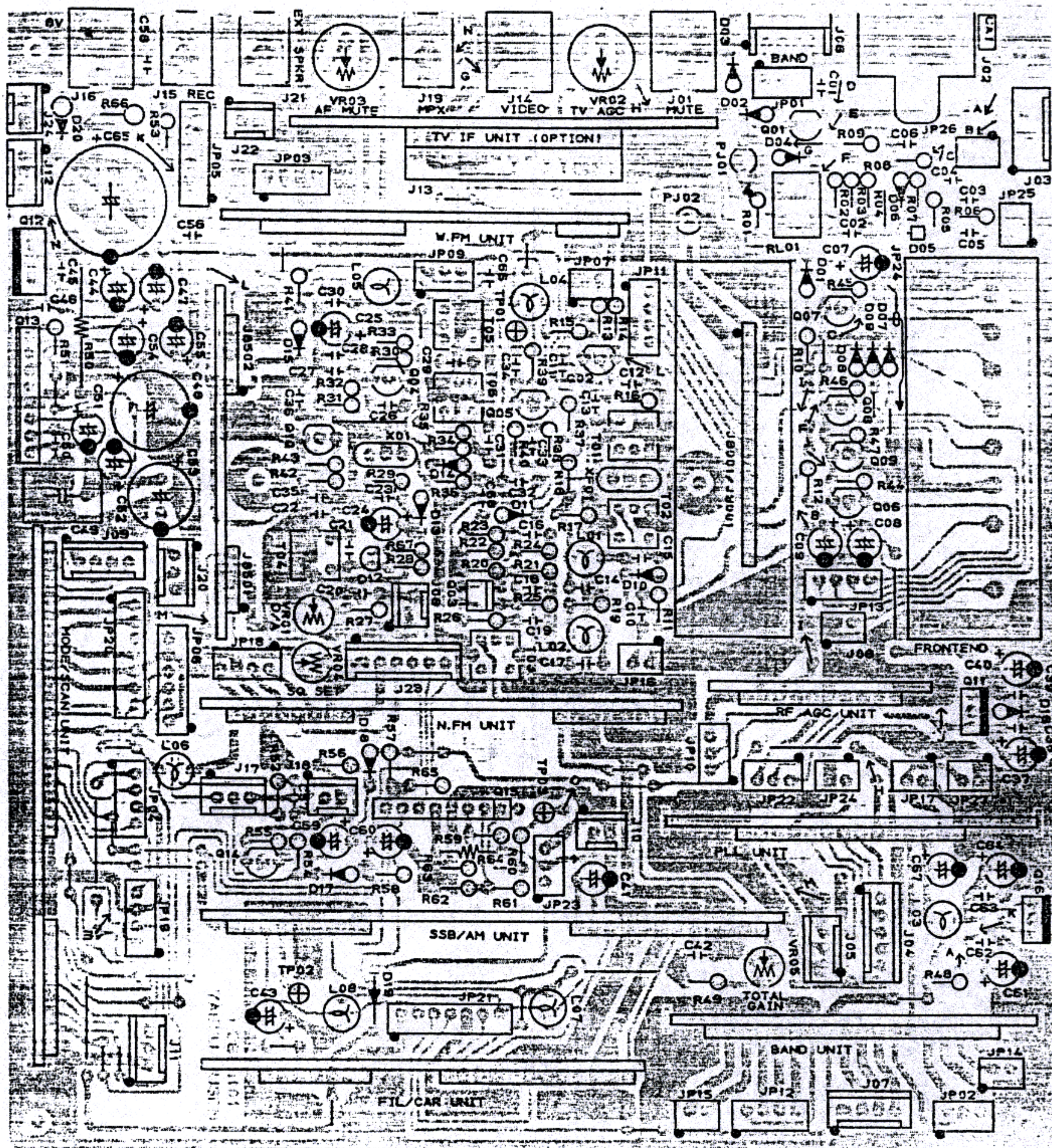






# UNIT PARTS LAYOUT

(viewed from solder side)



**SCHEMATHEEK**  
 Beh. T. Hultermans  
 Postbus 4228  
 5604 EE Eindhoven

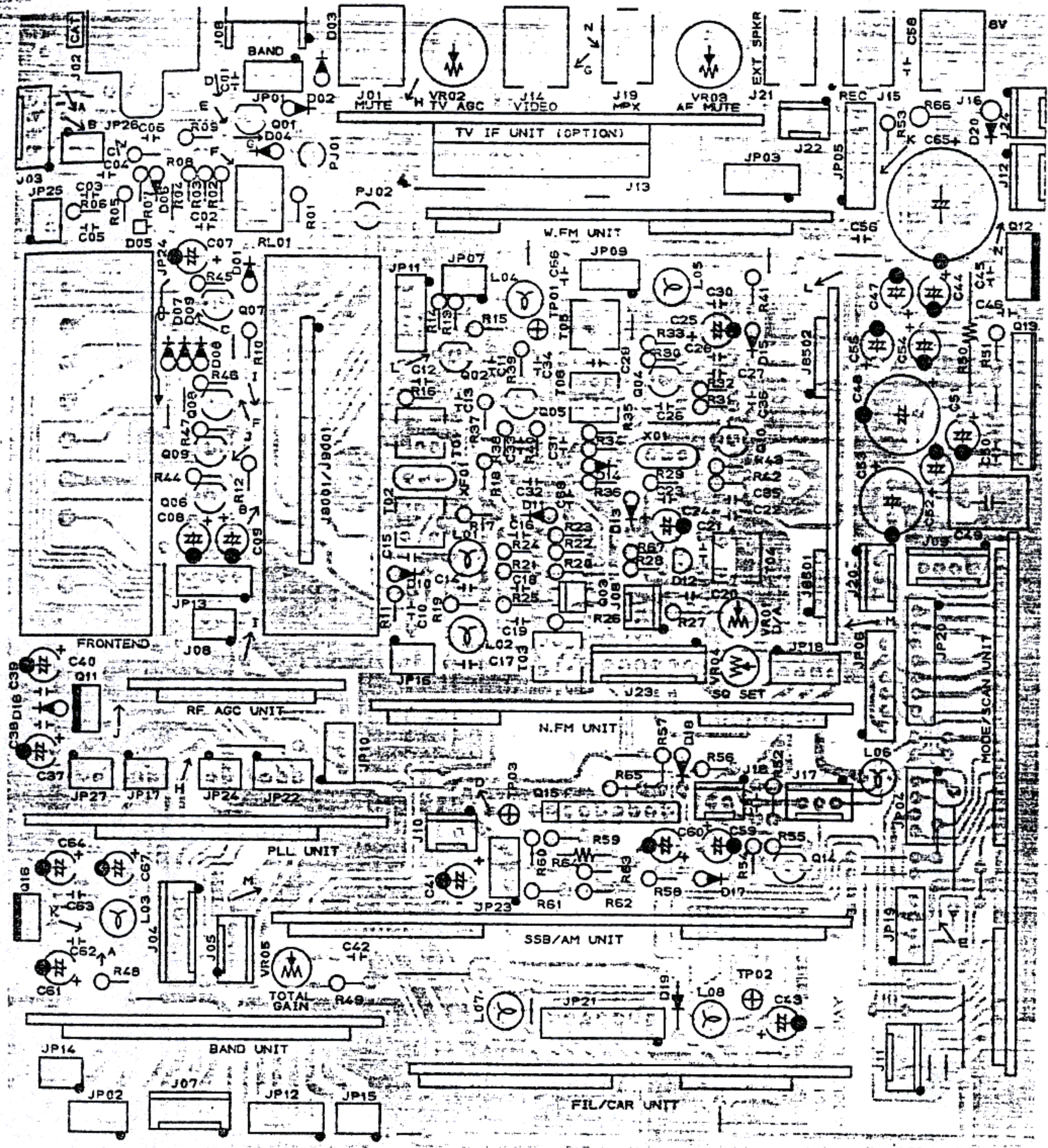
VOLTAGE CHART (DC VOLTS)

	1	2	3	4	5	6	7	8	REMARKS
Q1011	13.7	0	8.1						
Q1012	13.7	0	7.9						
Q1013	6.7	13.6	12.9	0	0	0	0.5	0.6	
Q1015	4.7	2.5	2.2	0	3.8	7.9	1.4	7.9	
Q1016	11.7/14.6	0	5.0						POWER SW ON/OFF



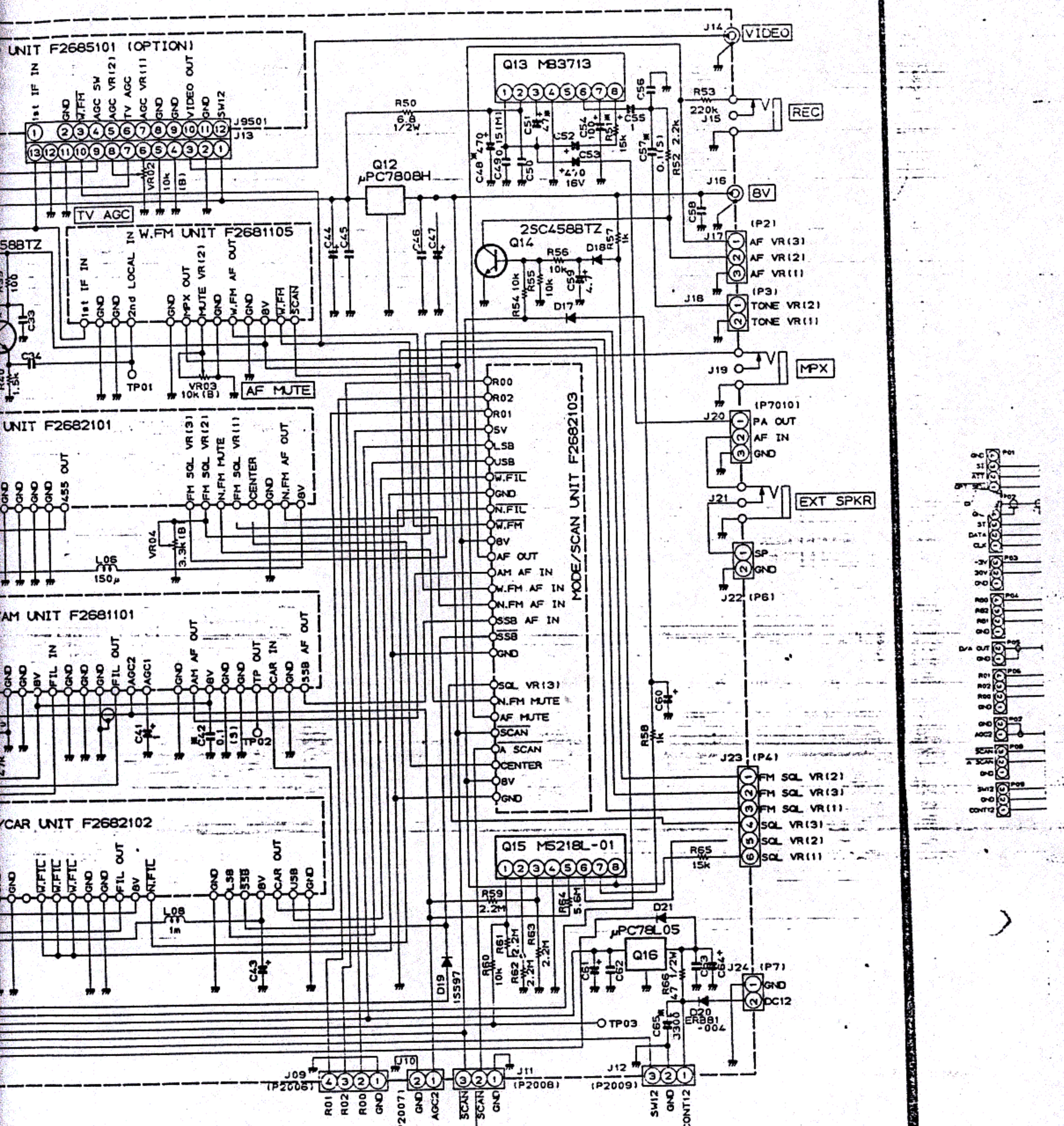
(viewed from component side)

MAIN UNIT PARTS

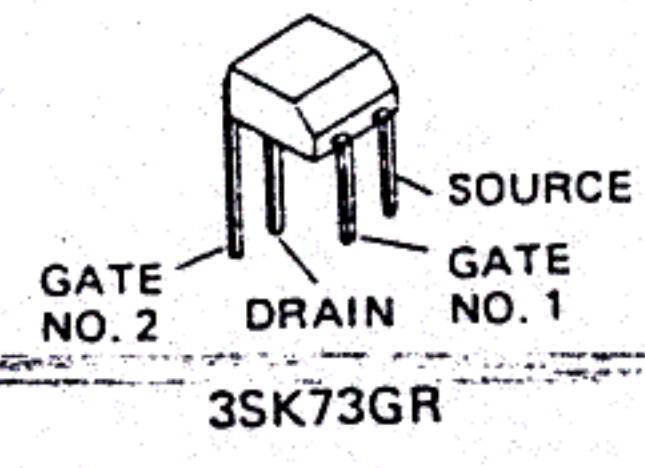
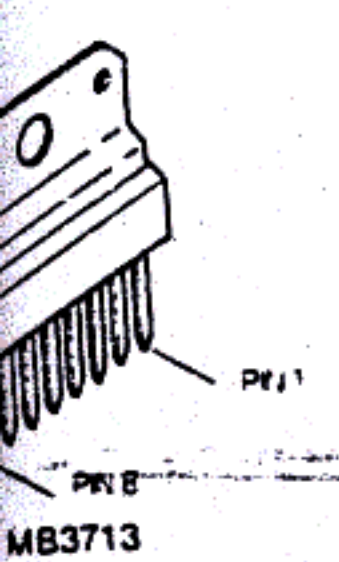


	E(S)	C(D)	B(G1)	(G2)	REMARKS
Q1001	0.8/0	0.9/13.8	1.6/0		ATT SW OFF/ON
Q1002	3.5	7.6	4.2		
Q1003	1.9	7.4	1.8	2.5	<b>SCHEMATHEEK</b> Beh. T. Hultermans Postbus 4228 5604 EE Eindhoven
Q1004	2.2	7.2	2.6		
Q1005	3.3	7.6	4.1		
Q1006	8.0	7.9/0	7.2/8.0		Band VHF1/other Band
Q1007	8.0	8.0/0	7.3/8.0		UHF1/ "
Q1008	8.0	7.9/0	7.3/8.0		VHF3/ "
Q1009	8.0	7.9/0	7.3/8.0		VHF2/ "
Q1010	0	0	0.7		
Q1014	0	0	0.4/0.7		PLL LOCK, UNLOCK





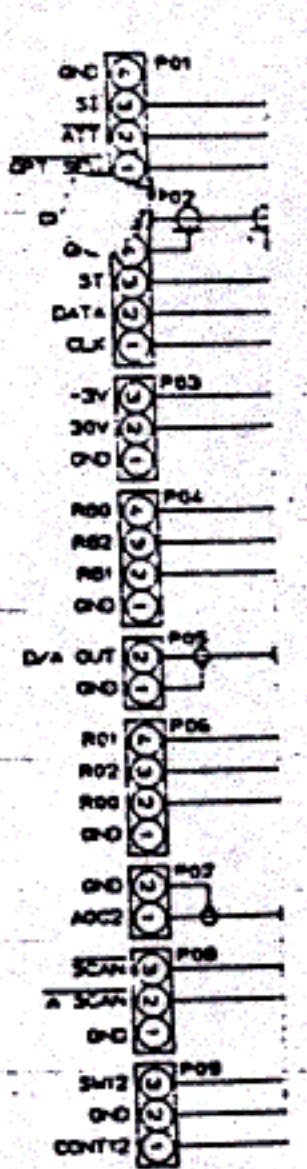
**SCHEMATHEEK**  
 Beh. T. Hultermans  
 Postbus 4228  
 5604 EE Eindhoven



MB3713

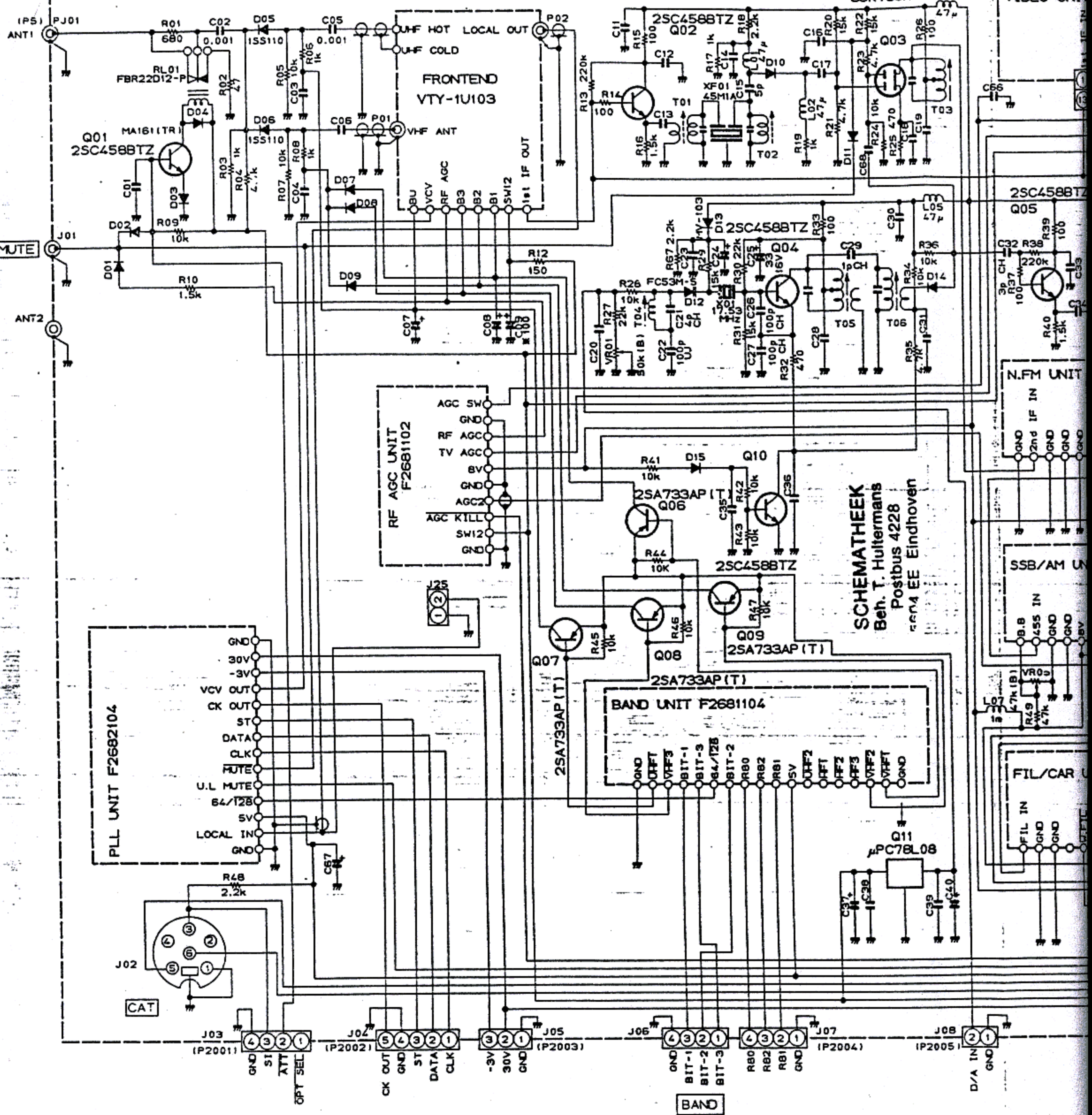
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2SA733AP  
 2SC458B

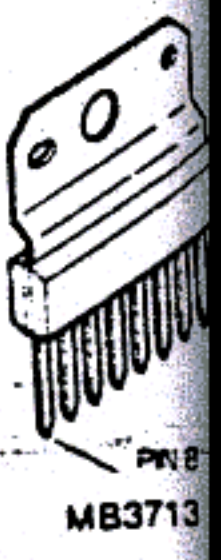
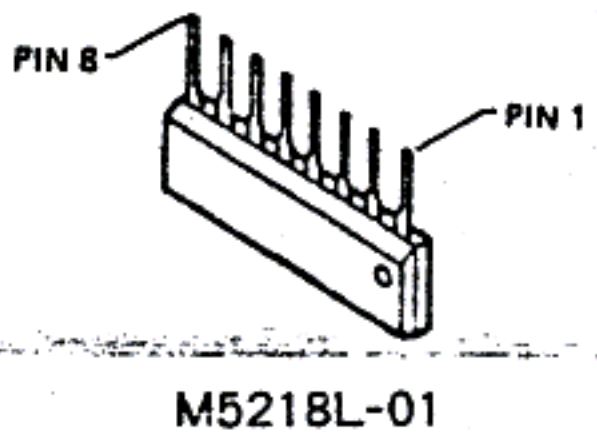
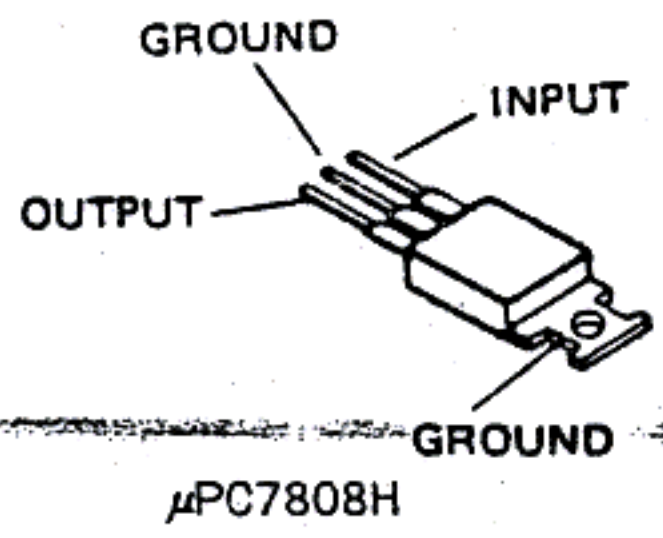
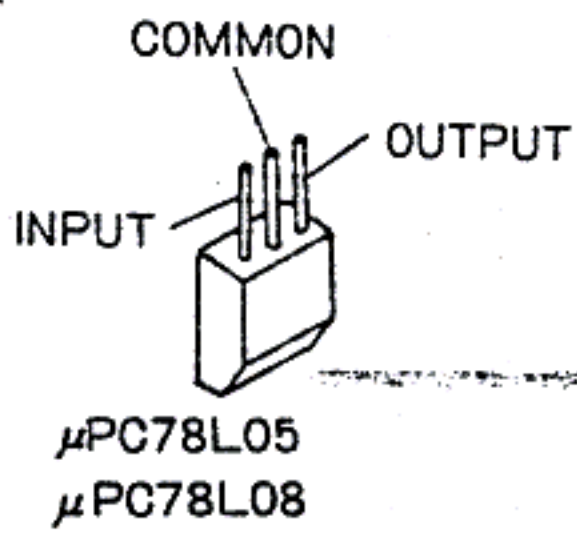




MAIN UNIT F2683101 (No.10xx)

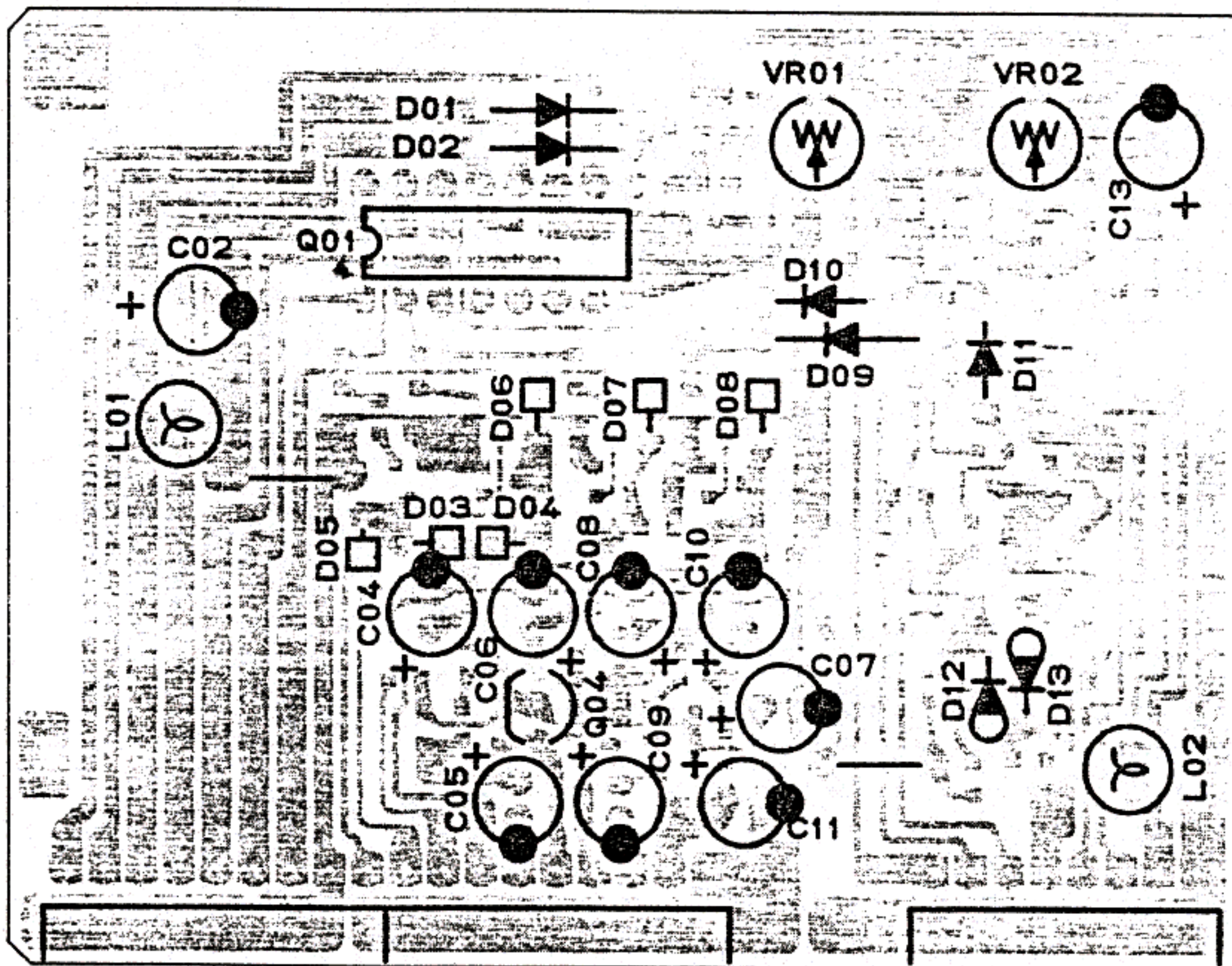


**SCHEMATEEK**  
Beh. T. Huitemans  
Postbus 4228  
6004 EE Eindhoven

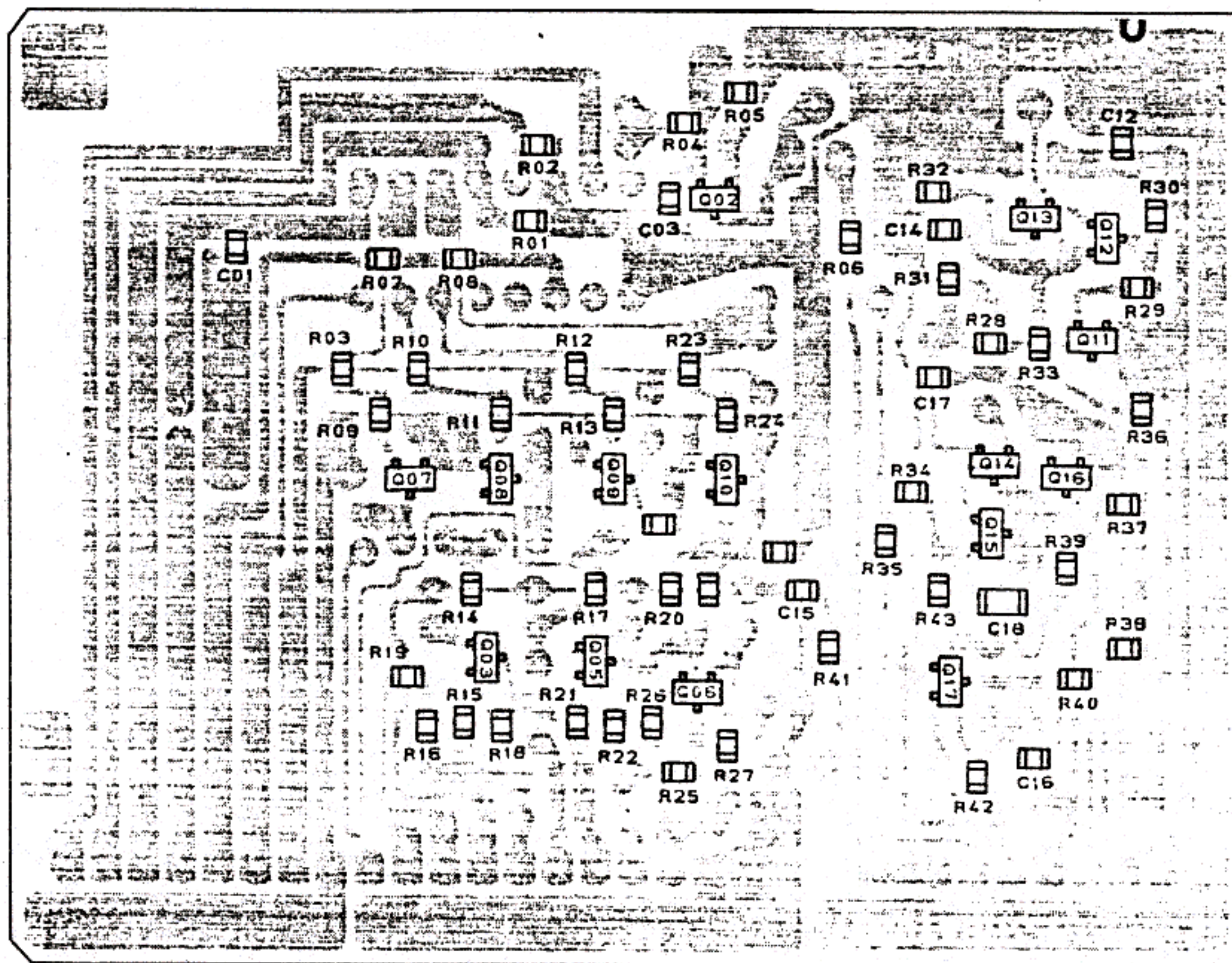




# MODE, SCAN UNIT PARTS LAYOUT



(obverse view of "component" side)



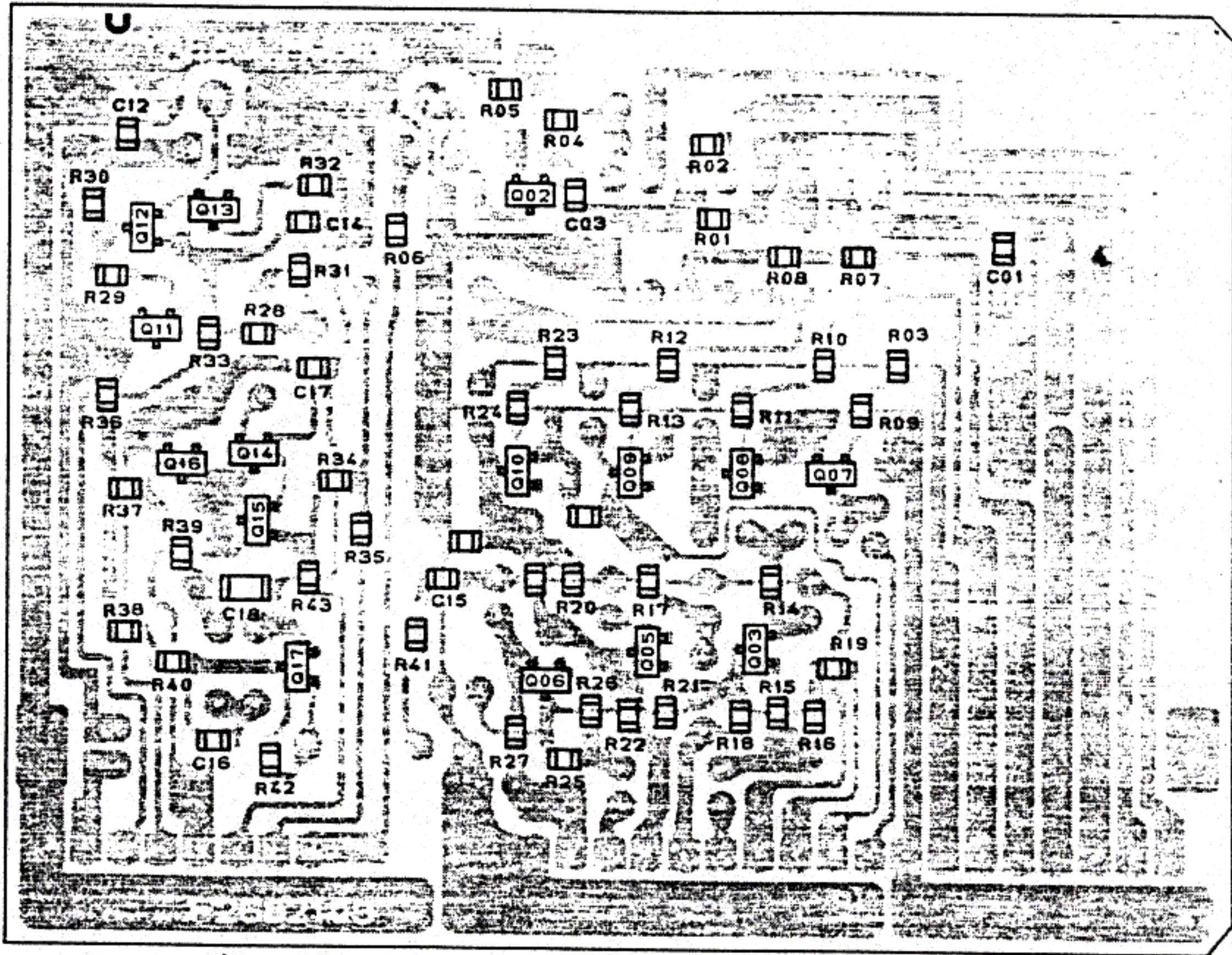
(reverse view of "chip-only" side)

NI

TOR

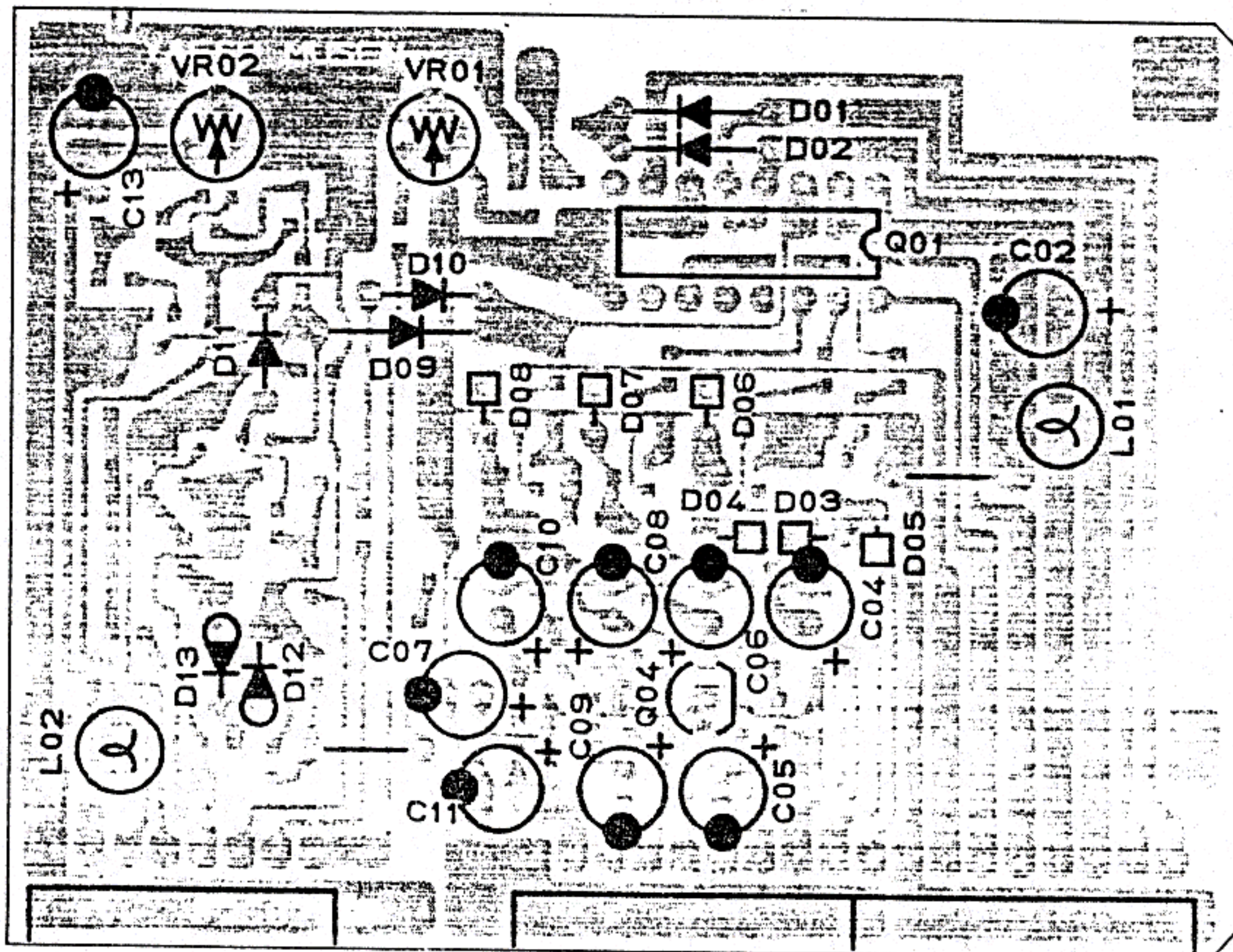


# MODE. SCAN UNIT PARTS LAYOUT



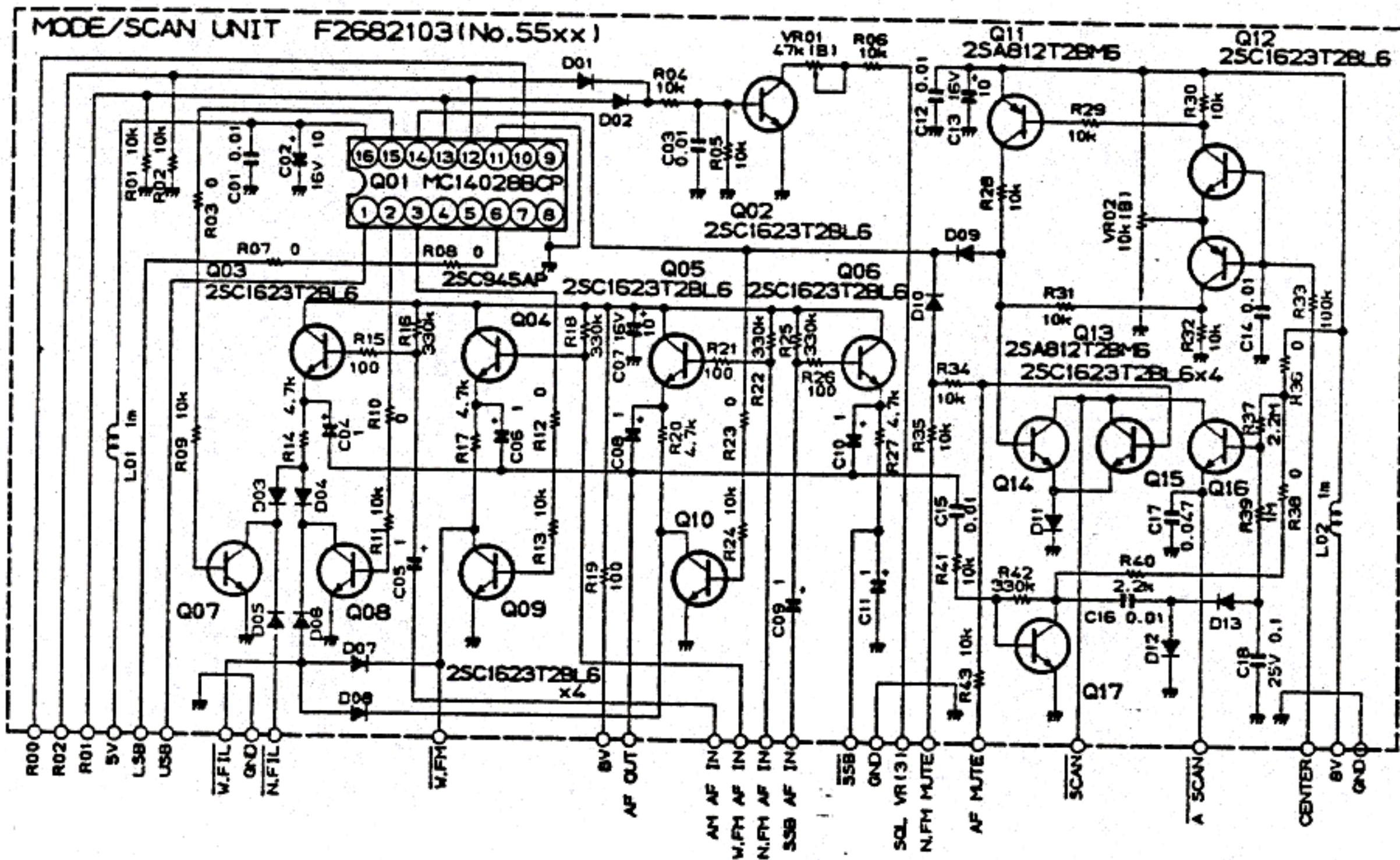
(obverse view of "chip-only" side)

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(reverse view of "component" side)



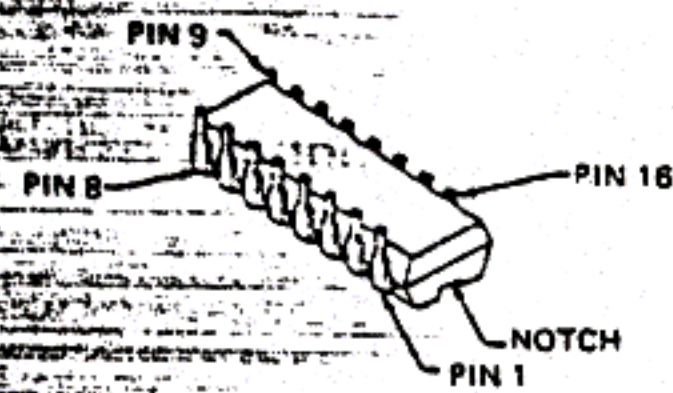


VOLTAGE CHART (DC VOLTS)

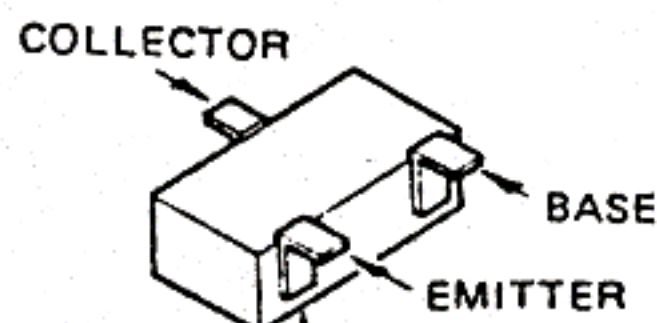
Pin	VDC	REMARKS
1	4.8/0	USB/other
2	4.8/0	AM-W/other
3	4.8/0	FM-W/ "
4	0	
5	0	
6	4.8/0	LSB/other
7	0	
8	0	
9	0	
10	4.8/0	LSB-AM-N-FM-N/other
11	0	
12	4.7/0	SSB/other
13	4.7/0	AM/other
14	4.8/0	FM-N/other
15	4.8/0	AM-N/other
16	5.0	

	E	C	B	REMARKS
Q5502	0	7.8/0	0/0.6	FM /other
Q5503	6.1/7.5	7.7	6.6/7.5	AM / "
Q5504	5.9/7.5	7.7	6.4/7.5	FM-W/ "
Q5505	6.0/7.7	7.7	6.5/7.5	FM-N/ "
Q5506	6.0/7.5	7.7	6.5/7.5	SSB / "
Q5507	0	0/7.1	0.6/0	AM-N/ "
Q5508	0	0/7.1	0.7/0	AM-W/ "
Q5509	0	0/7.4	0.6/0	FM-W/ "
Q5510	0	0/7.4	0.7/0	FM-N/ "
Q5511	7.8	0	7.8	
Q5512	2.7	7.8	2.8	
Q5513	2.7	0	2.8	
Q5514	0.3/0.4(0.7)	5.0/5.0(0.7)	0	AF MUTE NORM/MUTING
Q5515	0.3/0.7	5.0/5.0(0.7)	0.6/0.9(1.3)	" "
Q5517	0	2.6	0.6	

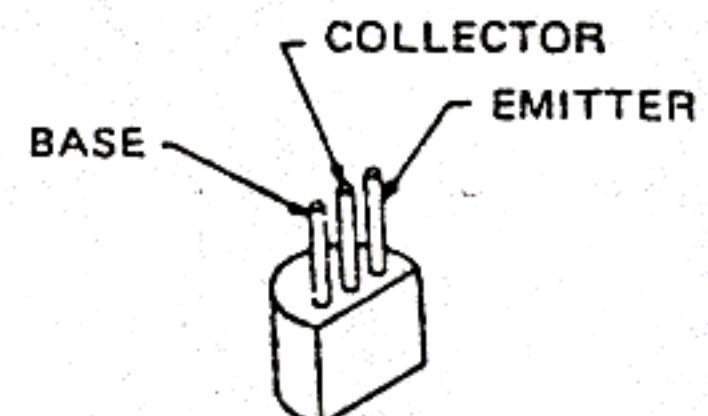
	LSB	USB	AM-N	AM-W	FM-N	FM-W	REMARKS	
Q5516	E	2.5/0.7	2.5/0.7	1.8/0.7	0.3/0.4	0/0.7	0	SQ open/close
	C	5.0/0.7	5.0/0.7	5.0/0.7	5.0/0.7	5.0/0.7	5.0	"
	B	2.7/1.2	2.7/1.2	1.9/1.1	0.5/0.6	-0.5/1.2	-0.4	"



MC14028BCP



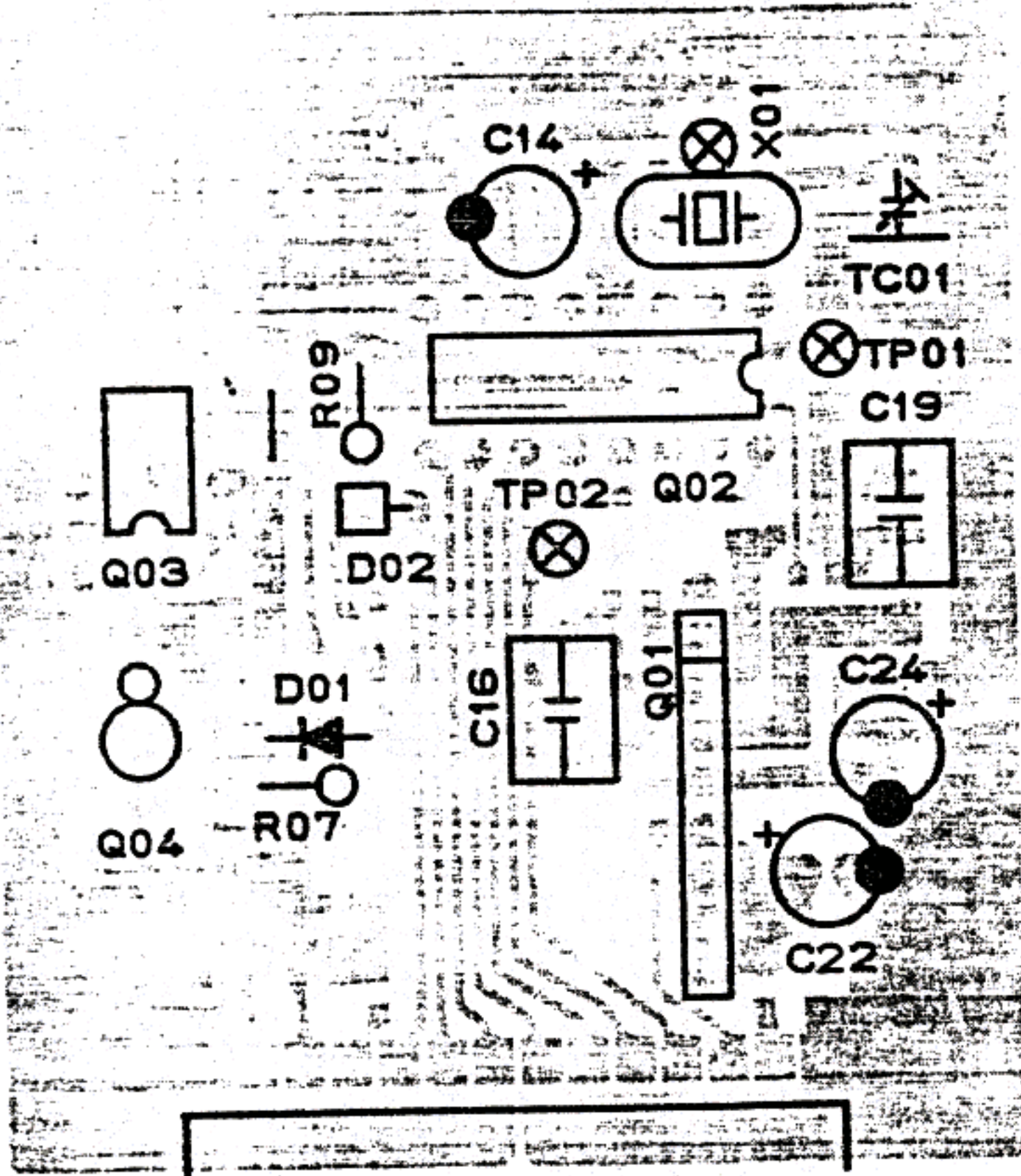
Marked Surface  
2SA812T2B (M6)  
2SC1623T2B (L6)



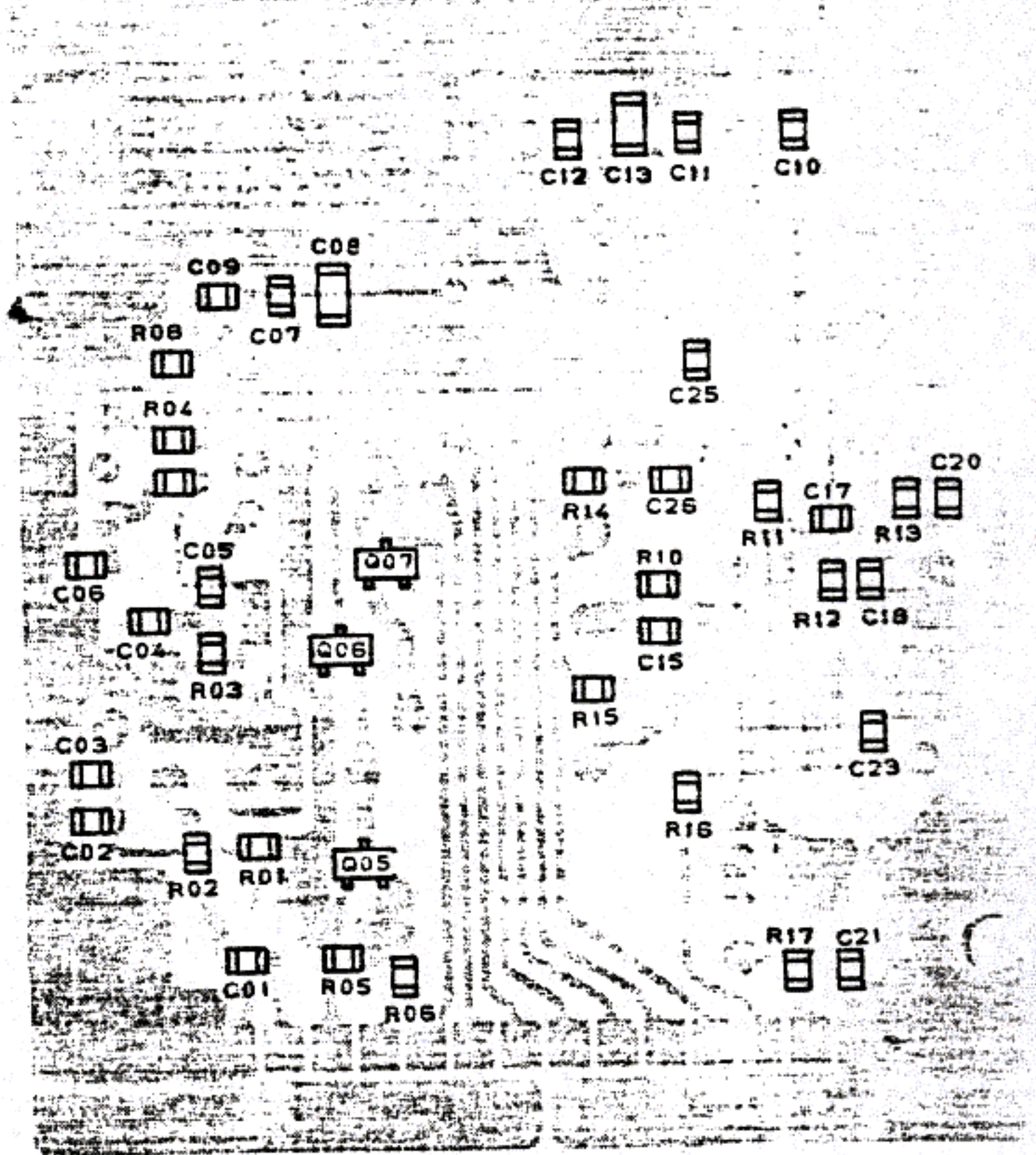
2SC945AP



# PLL UNIT PARTS LAYOUT

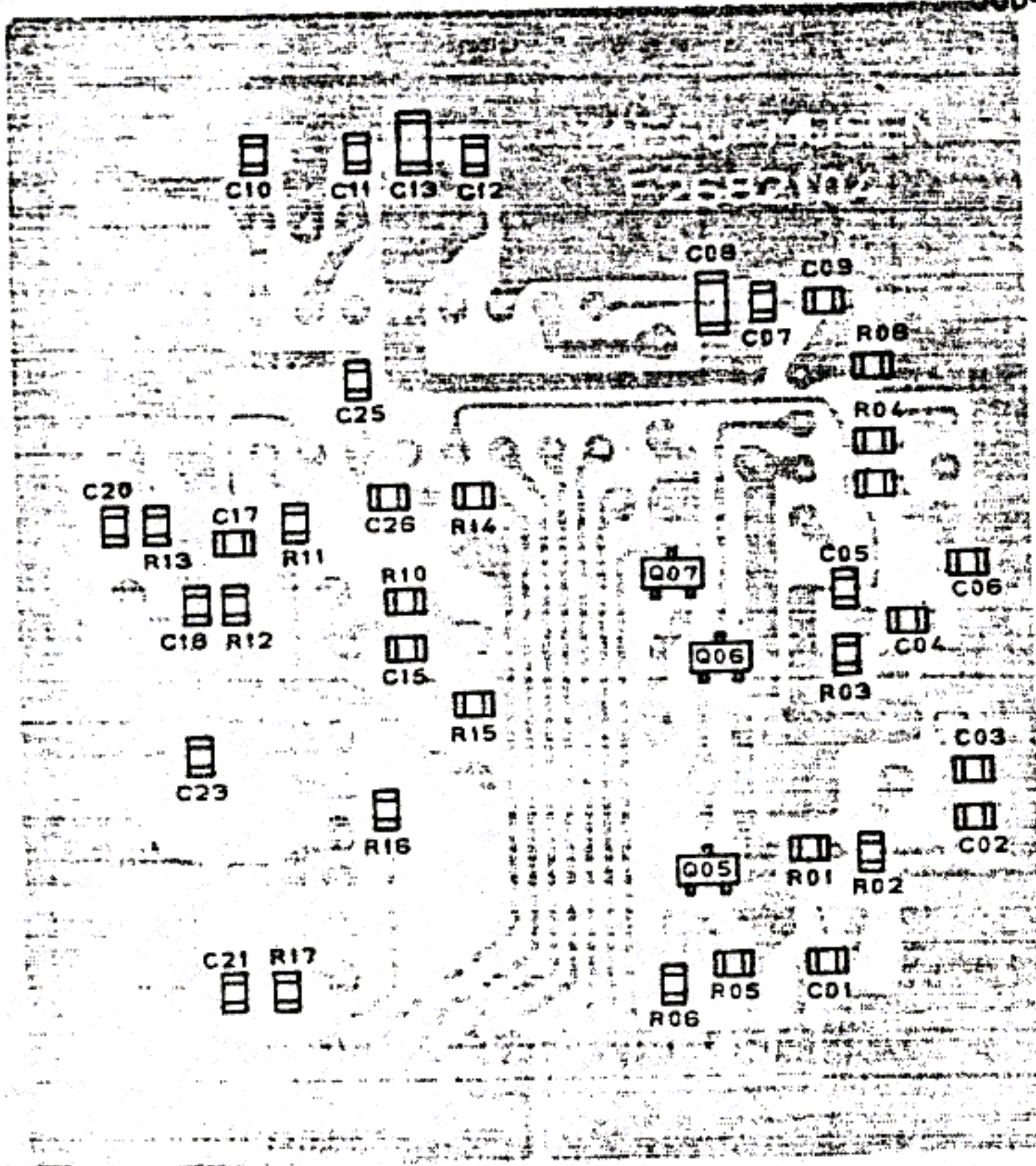


(obverse view of "component" side)

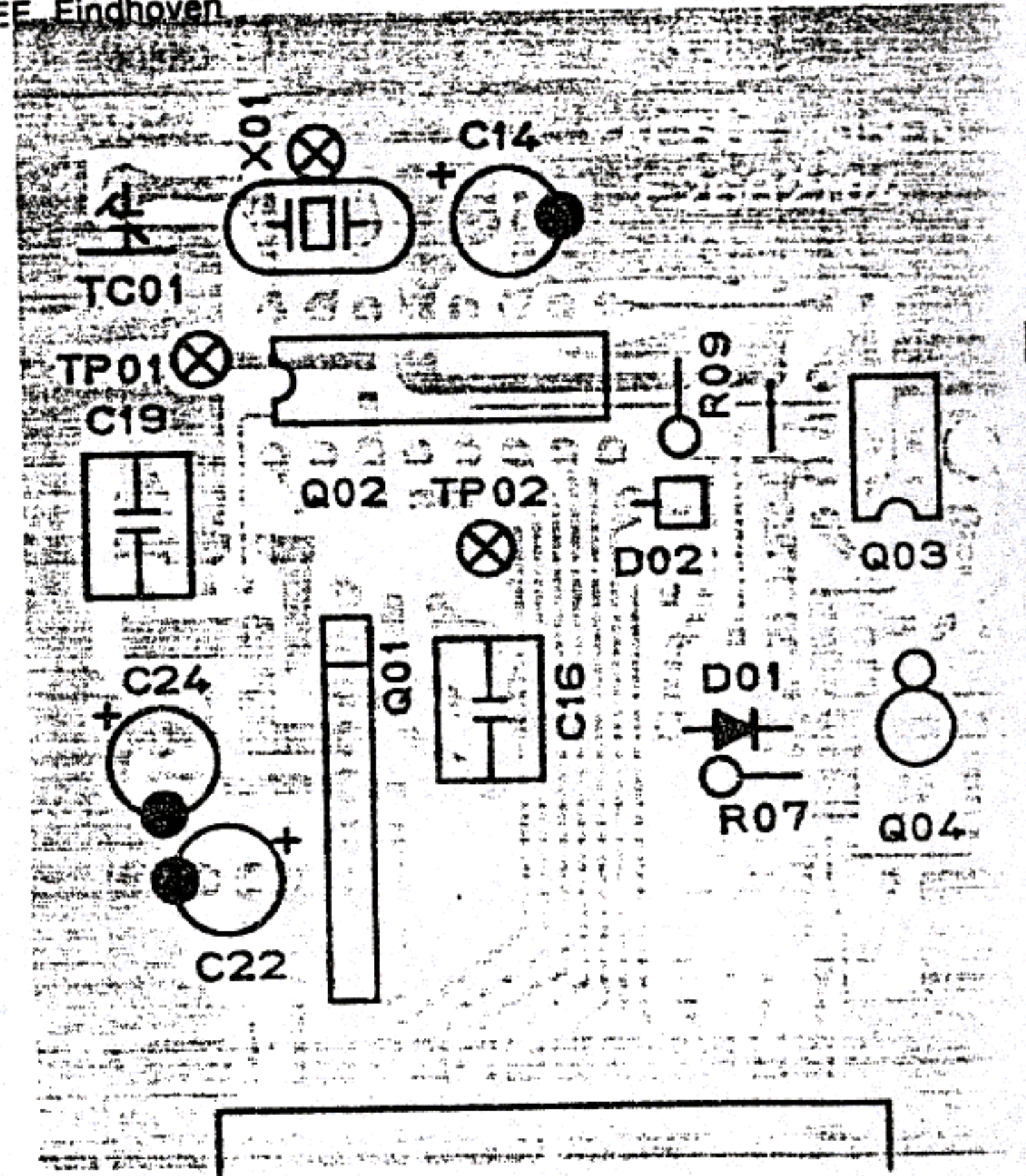


(reverse view of "chip-only" side)

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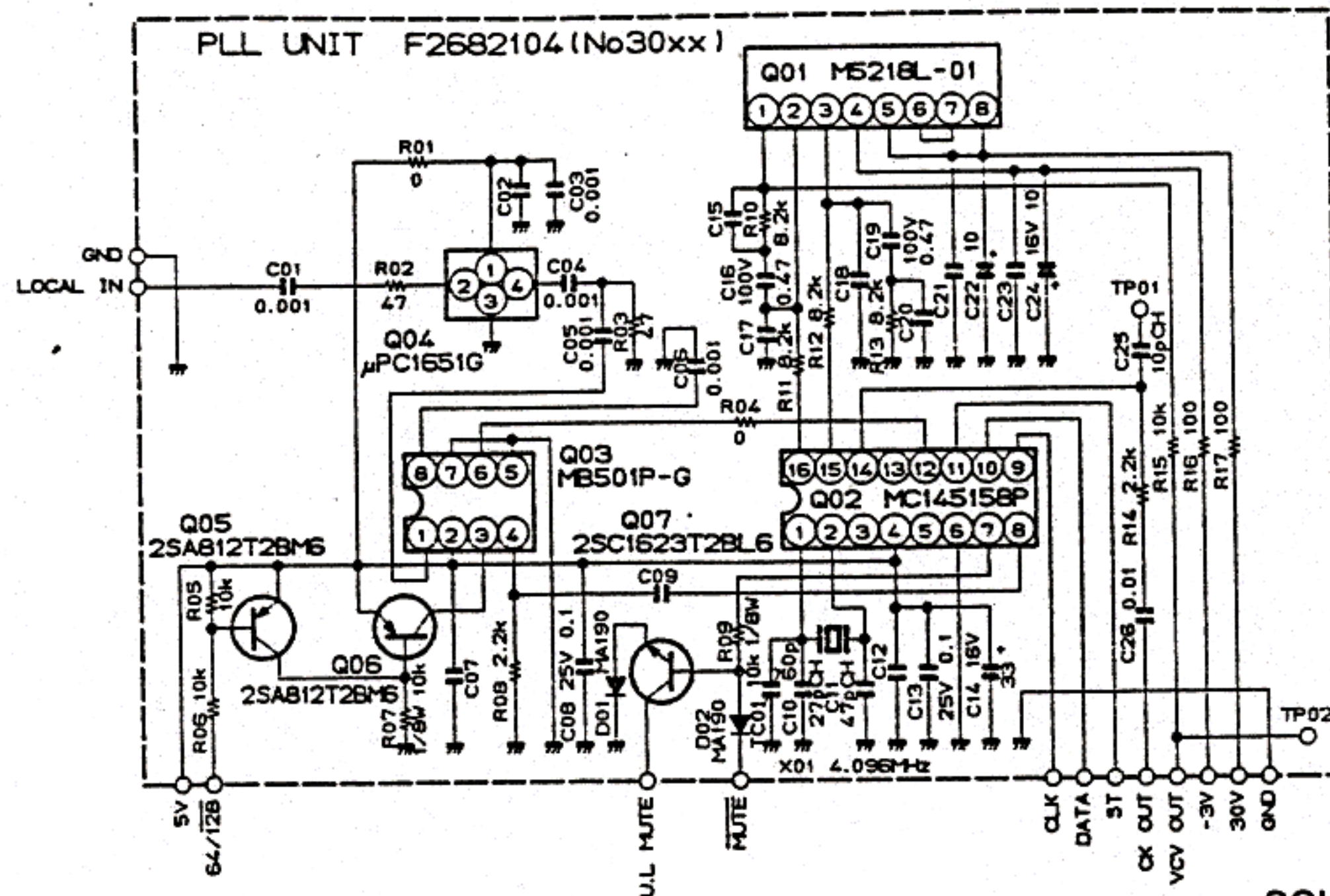


(obverse view of "chip-only" side)



(reverse view of "component" side)



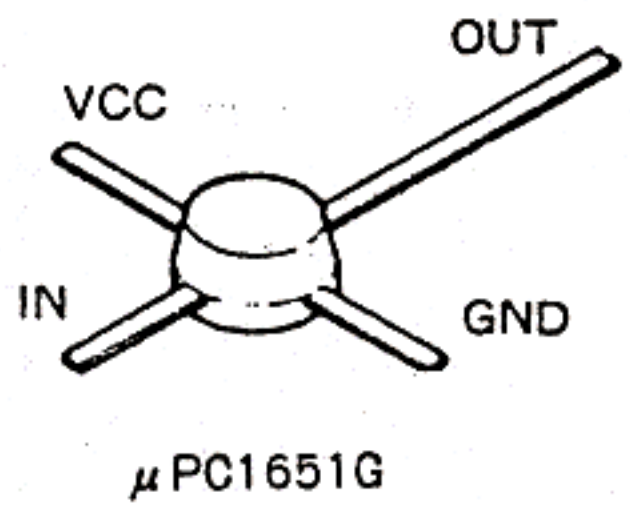
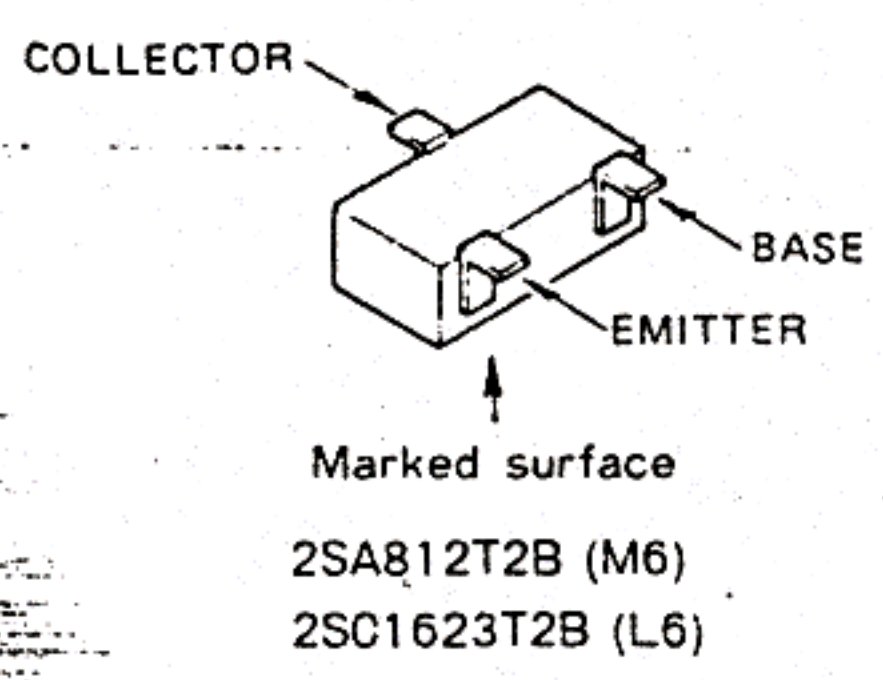
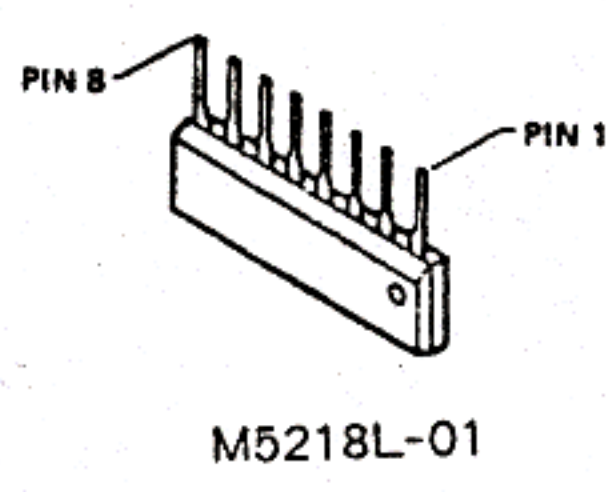
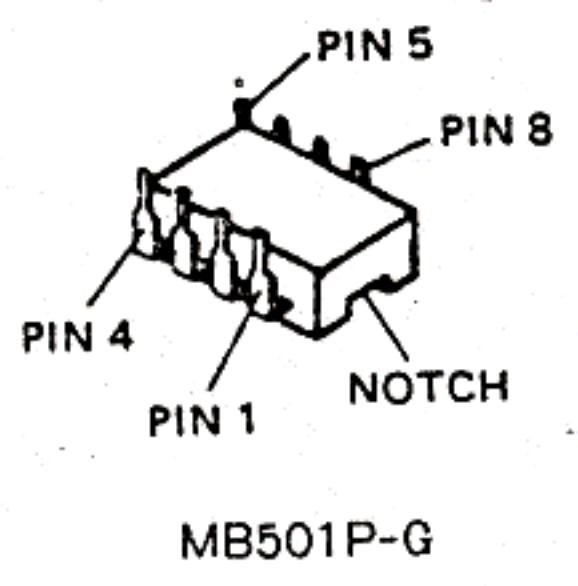
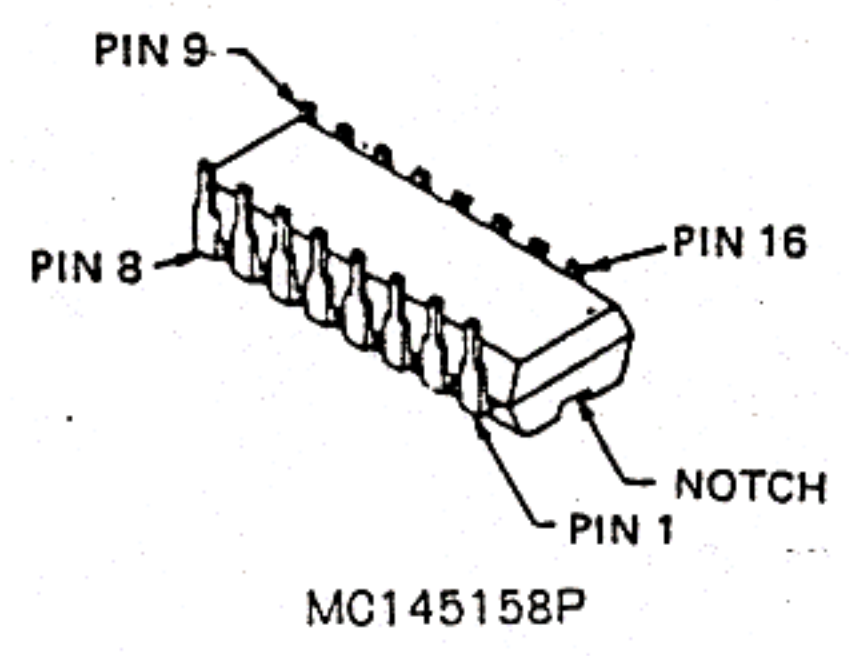


VOLTAGE CHART (DC VOLTS)

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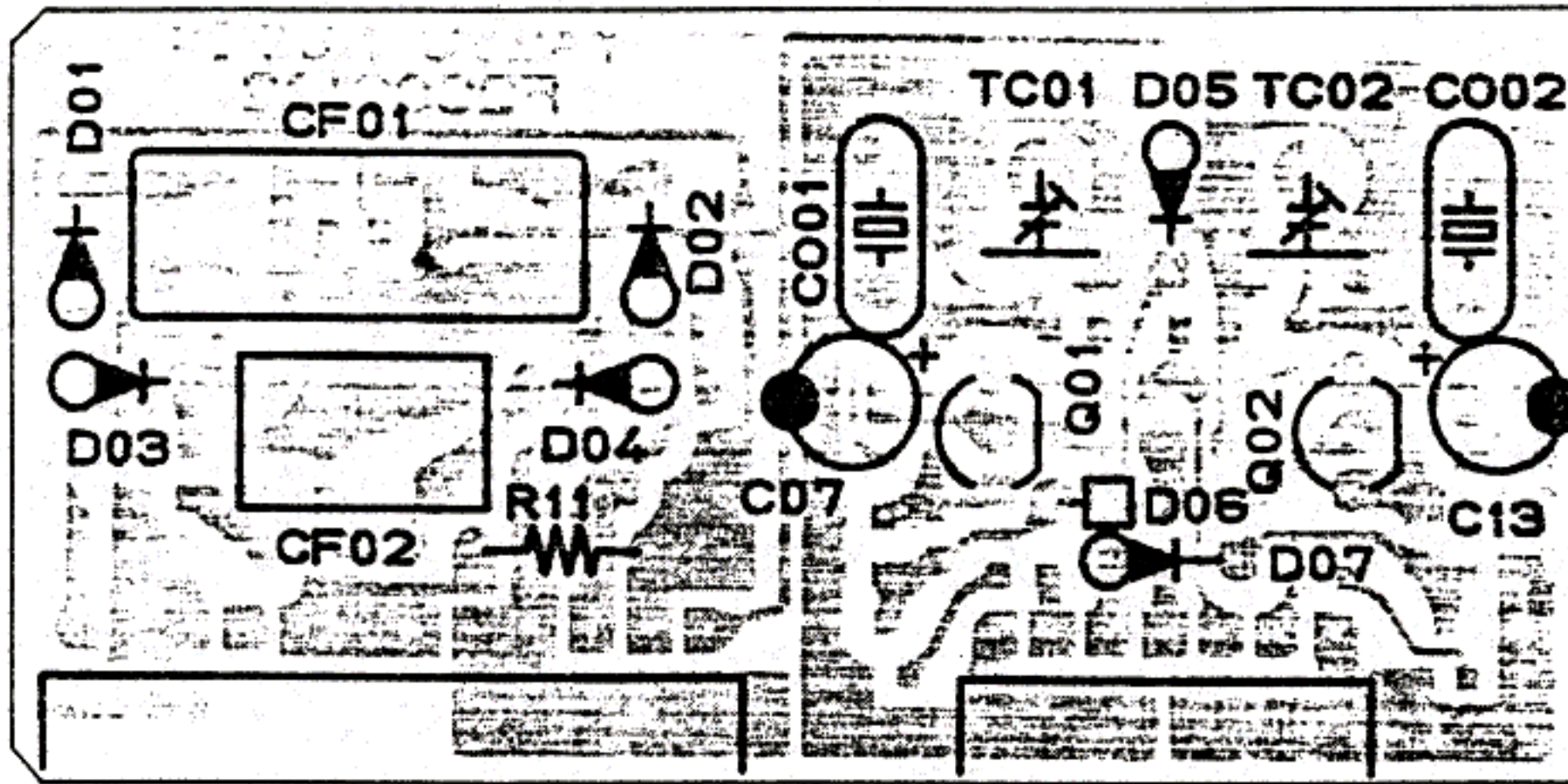
	1	2	3	4	5	6	7	8	REMARKS
Q3001	☆/12.2	4.9/4.2	4.9/4.4	-1.6/4.6	30.4/128	29.7/122	29.7/122	30.4/128	POWER SW ON/OFF
Q3003	2.1	4.6	4.6/0	2.3	0	∞	0	2.1	VHF1 · VHF2/VHF3 · UHF1
Q3004	4.9	0.9	0	2.9/3.1					POWER SW ON/OFF
Q3002	1.8	2.3	0	4.6	2.4/4.6	0	4.4/0	1.7/∞	
	9	10	11	12	13	14	15	16	
	5.0	0	0	∞	0	2.1	4.6	4.6/0	PLL LOCK/UNLOCK

	E	C	B	REMARKS
Q3005	4.6	4.0/4.6	4.6/4.0	VHF1 · VHF2/VHF3 · UHF1
Q3006	4.6	4.6/0	4.0/4.6	" / "
Q3007	0.8/0/0.3	0.8/7.2/7.3	1.4/0/0.6	PLL LOCK/UNLOCK/MUTE

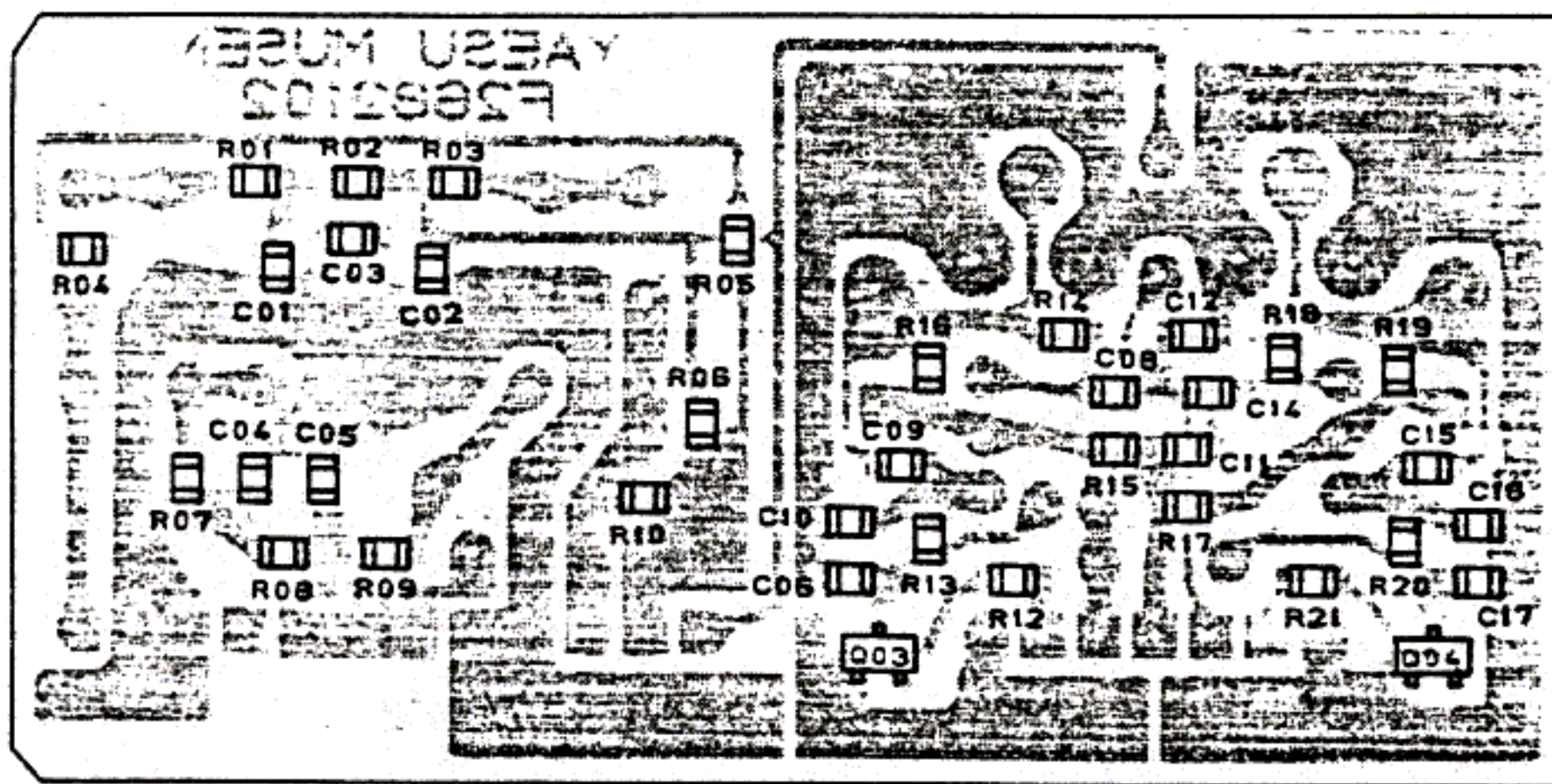




# FILTER, CARRIER UNIT PARTS LAYOUT

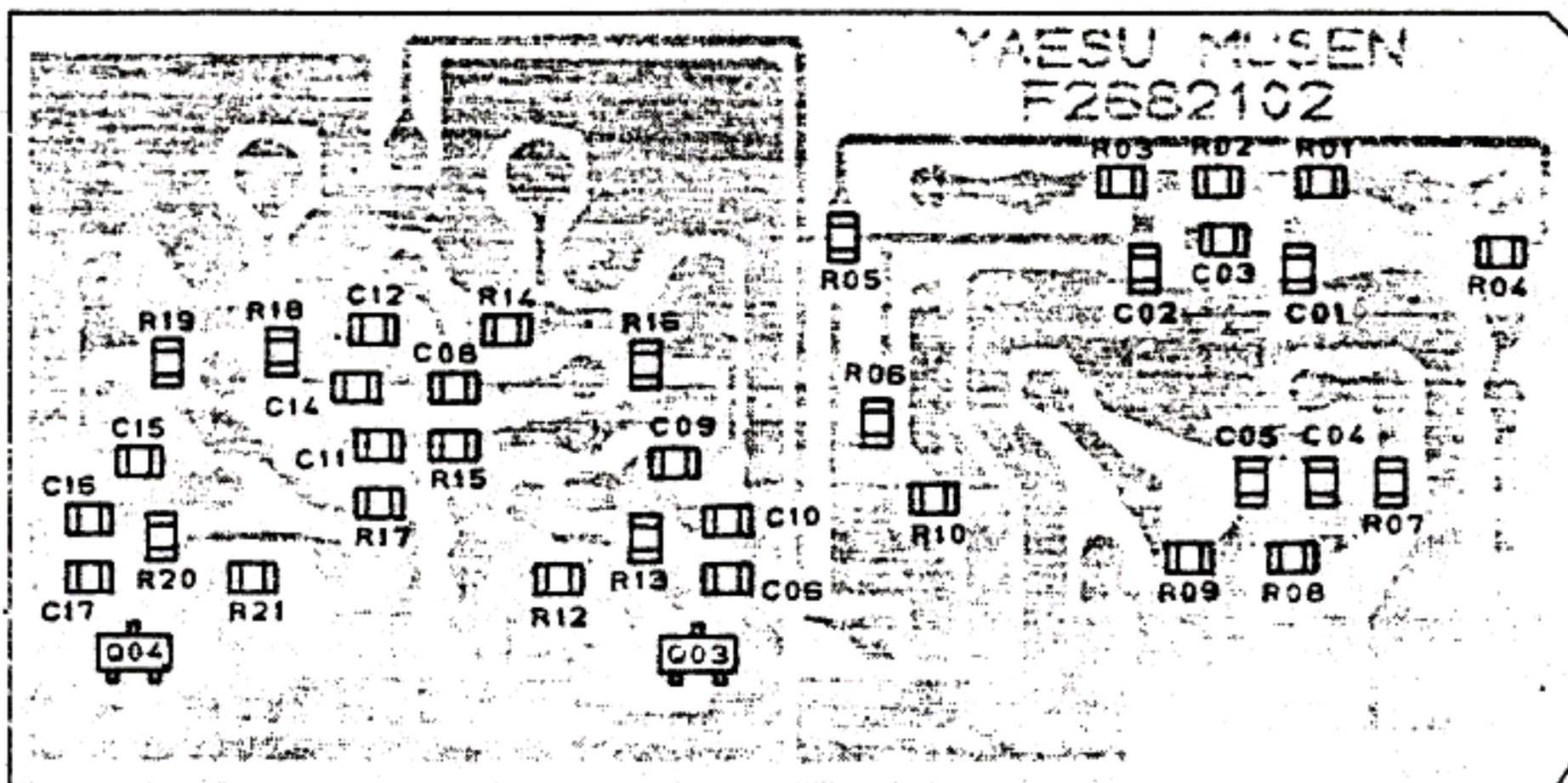


obverse view of  
"component" side

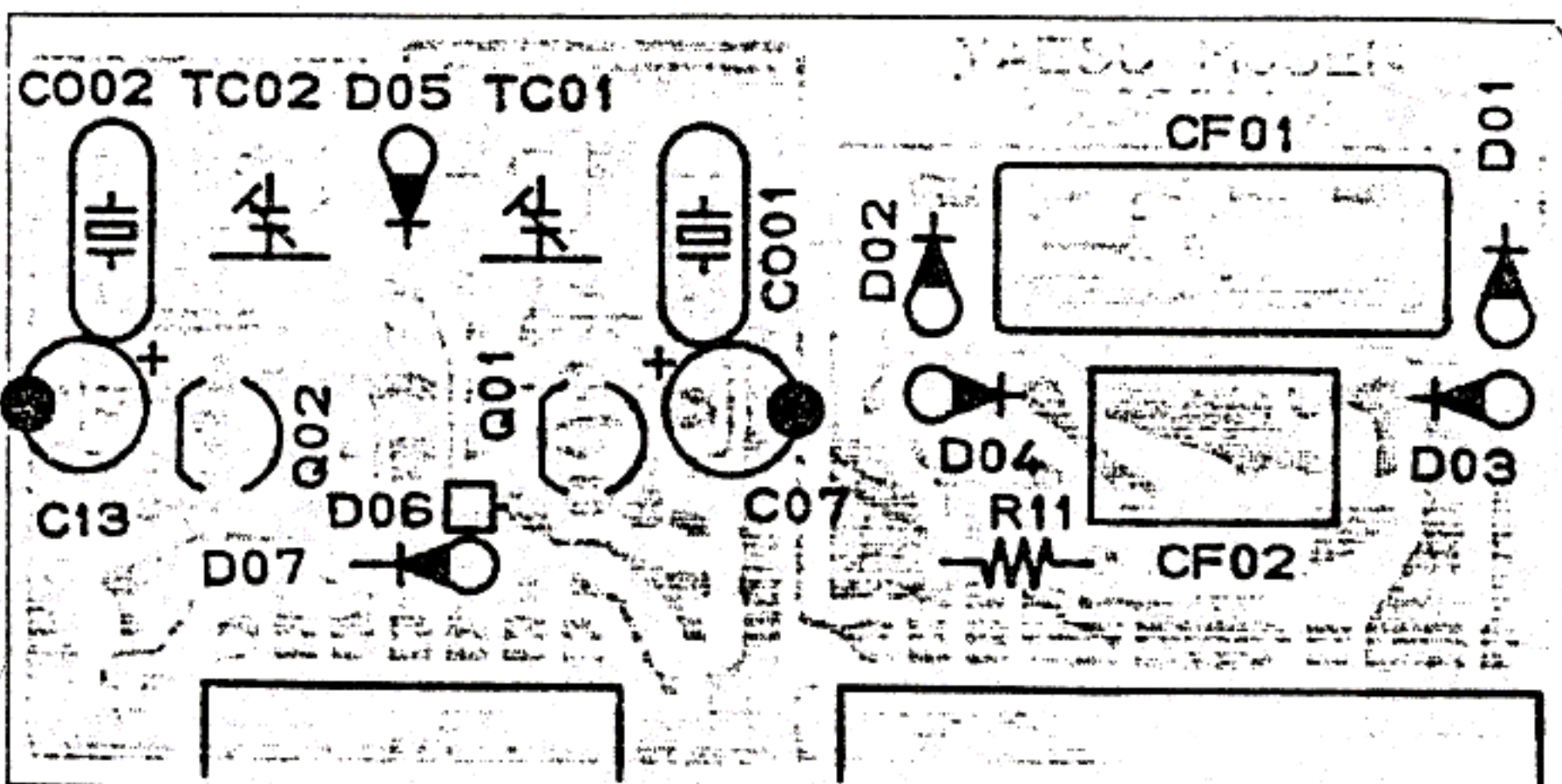


reverse view of  
"chip-only" side

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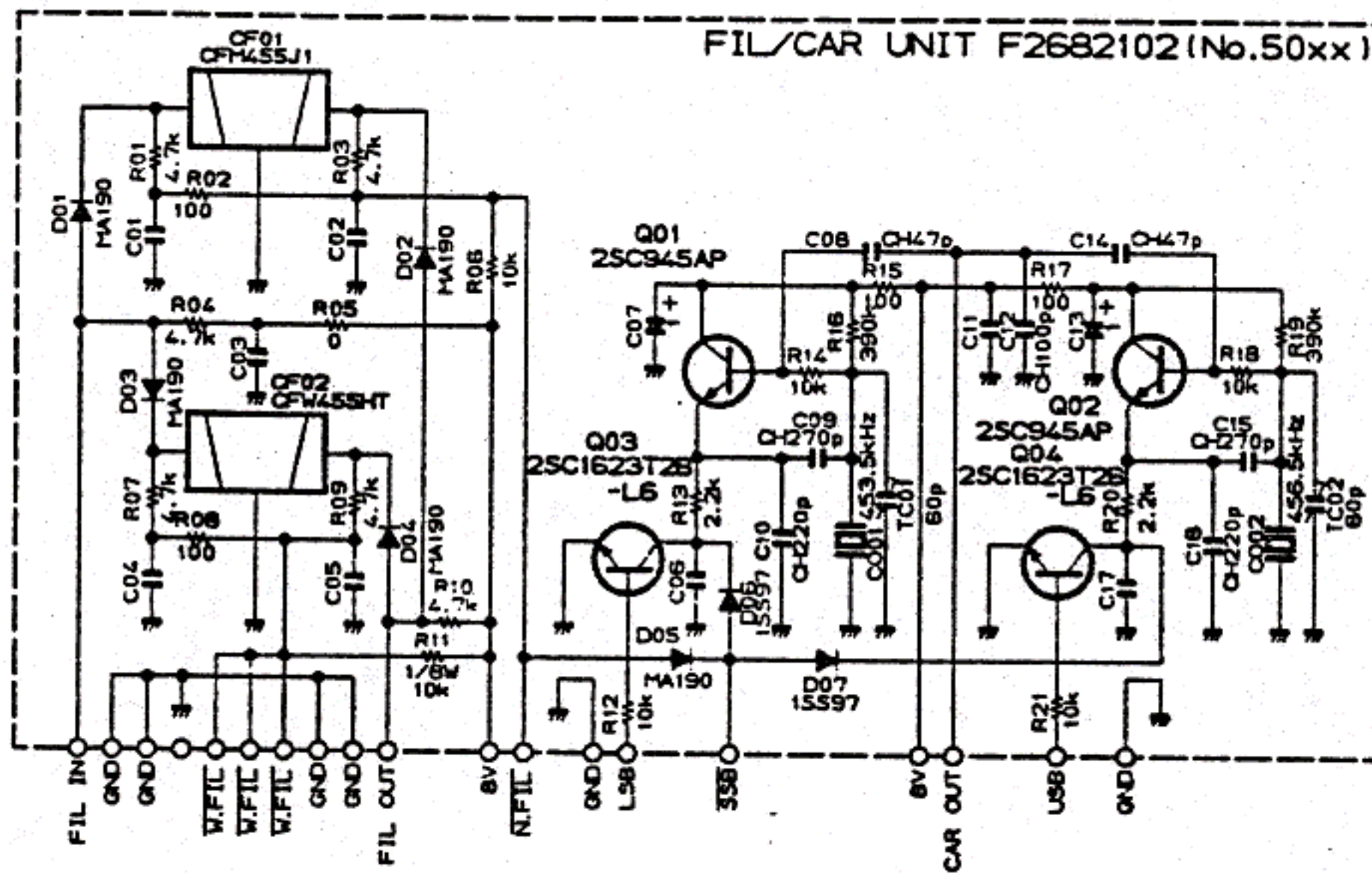


obverse view of  
"chip-only" side



reverse view of  
"component" side

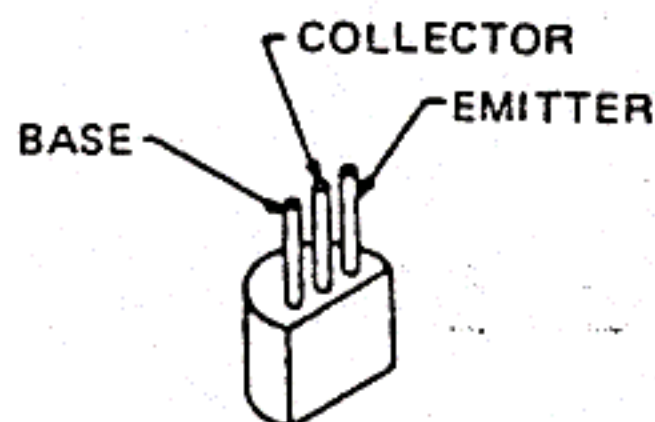




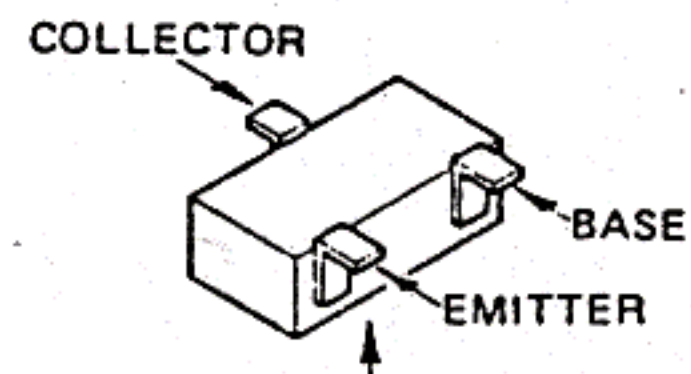
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VOLTAGE CHART (DC VOLTS)

	E	C	B	REMARKS
Q5001	4.9/7.7/7.5	7.6/7.9/7.9	4.3/7.5/7.6	LSB / USB / OTHERS
Q5002	7.8/5.0/5.5	7.9/7.6/7.9	7.5/4.4/7.6	"
Q5003	0	0/7.7/7.5	0.7/0/0	"
Q5004	0	7.8/0/7.5	0/0.7/0	"



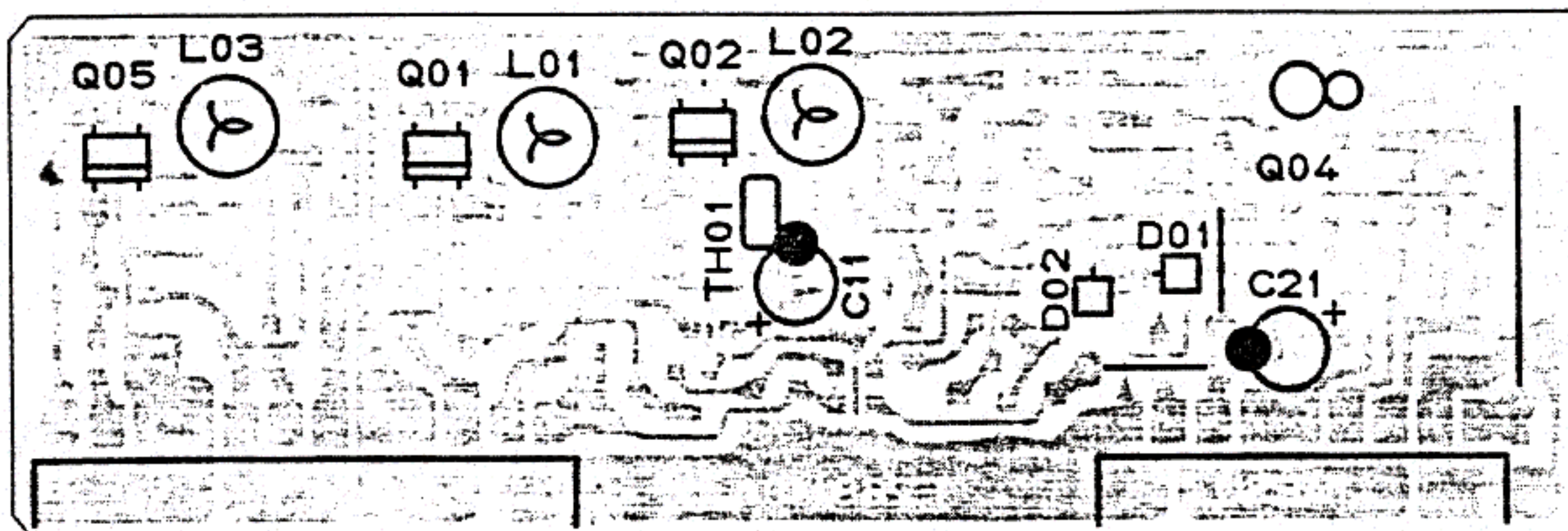
2SC945AP



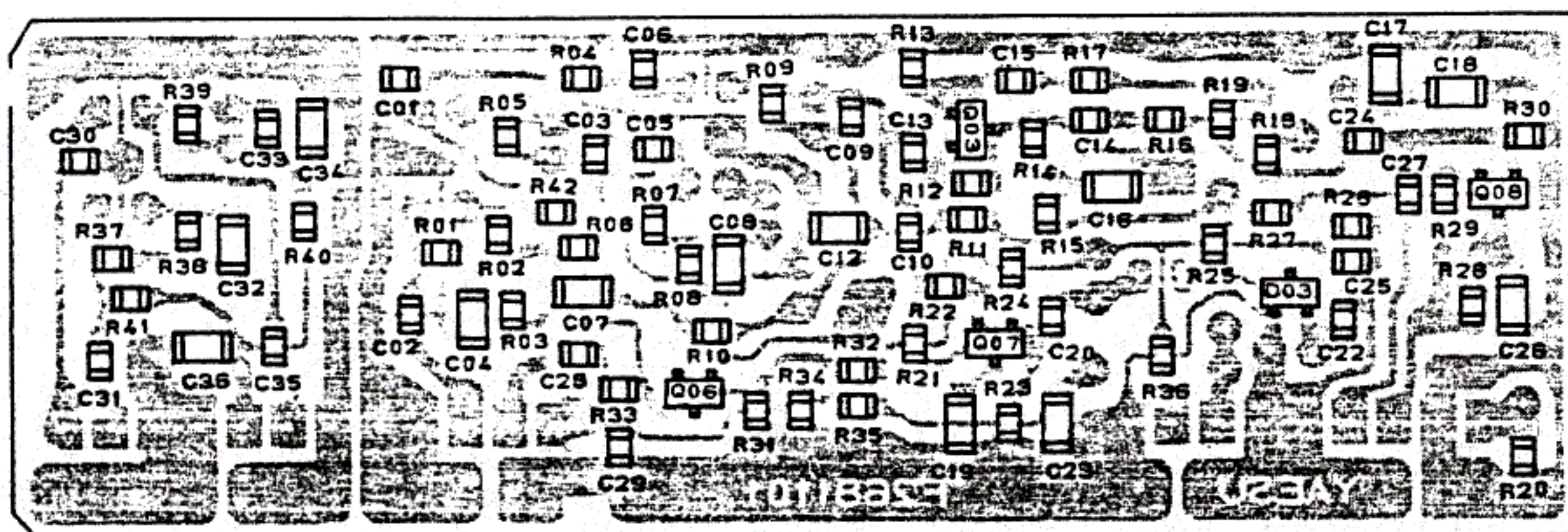
Marked Surface  
2SC1623T2B (L6)



# SSB, AM UNIT PARTS LAYOUT

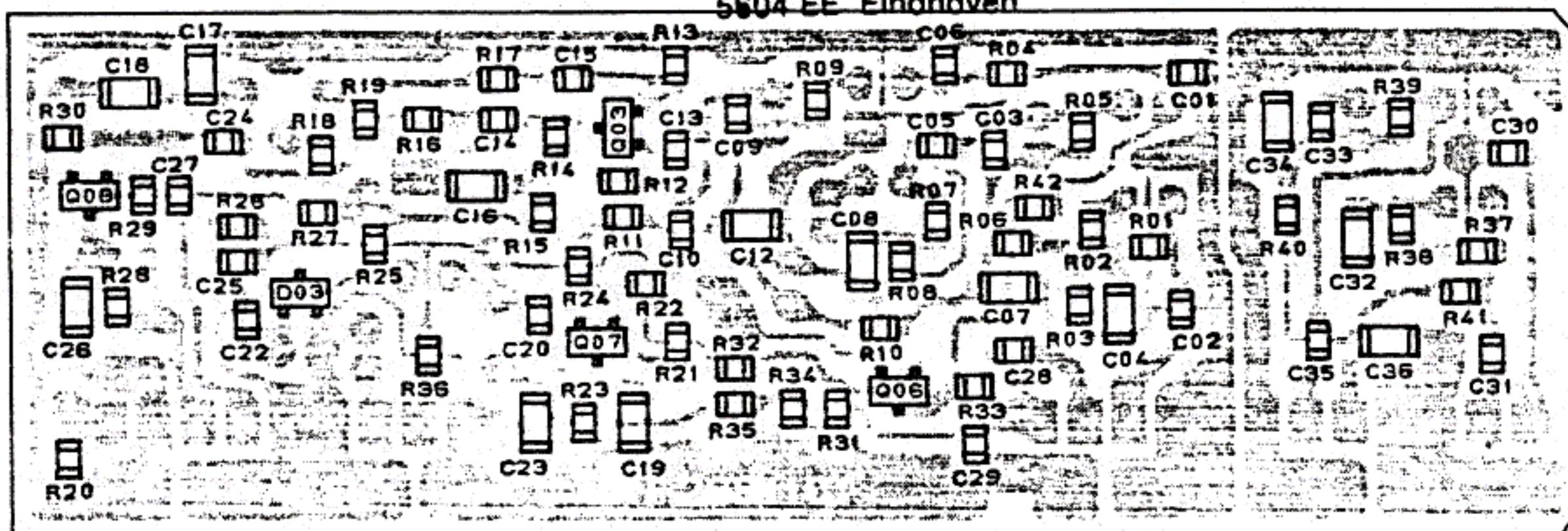


obverse view of  
"component" side

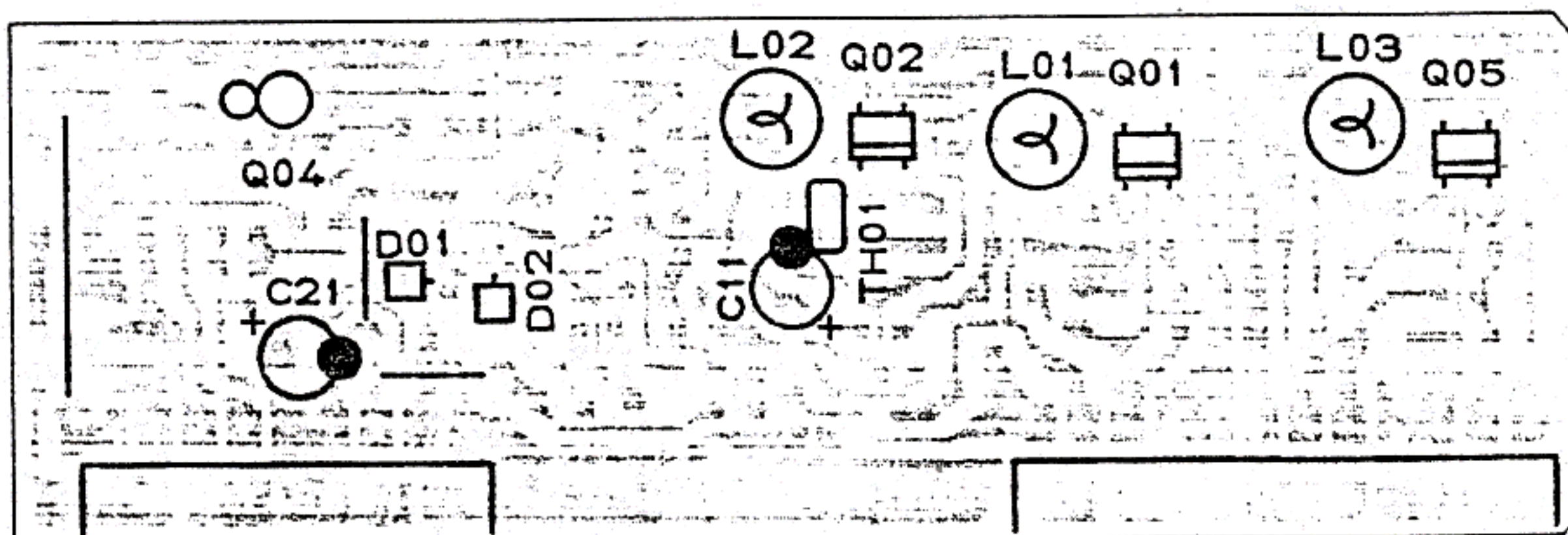


reverse view of  
"chip-only" side

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obverse view of  
"chip-only" side



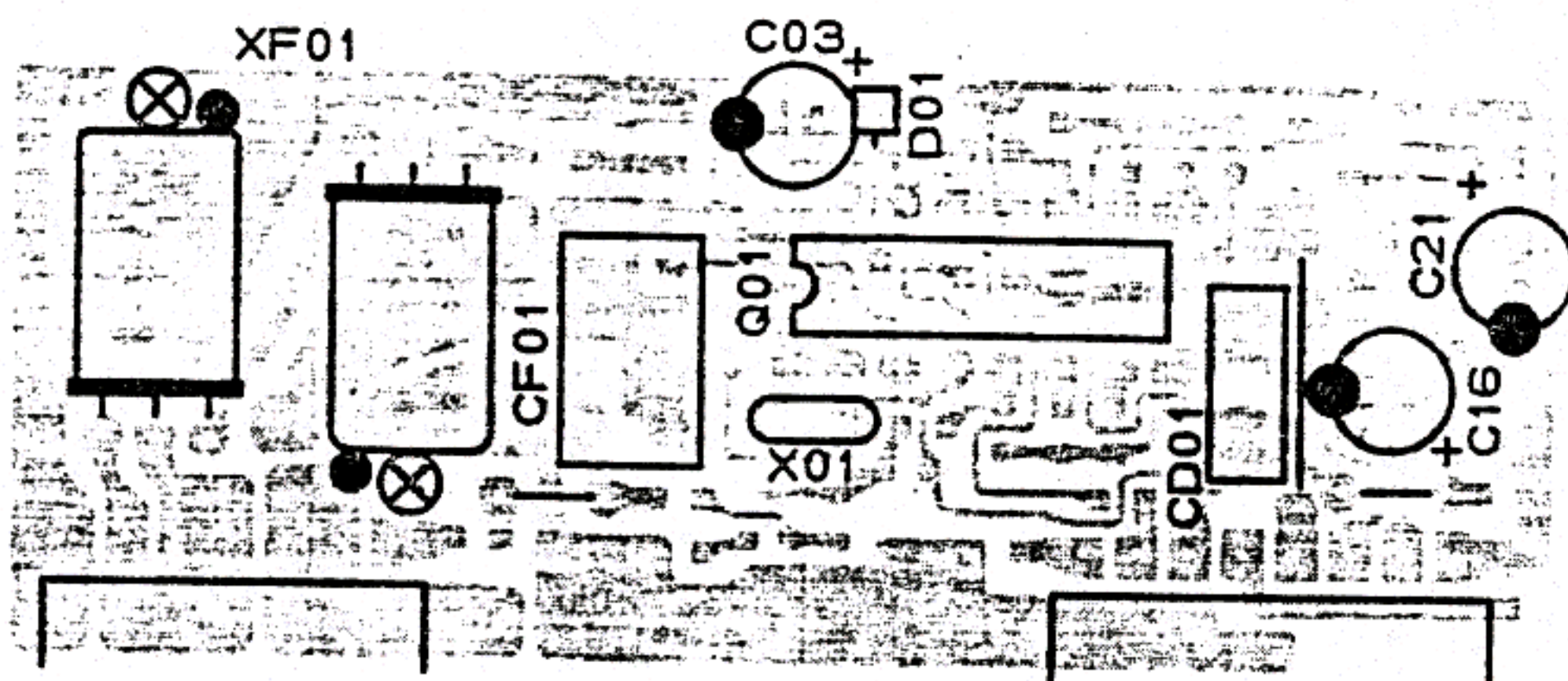
reverse view of  
"component" side





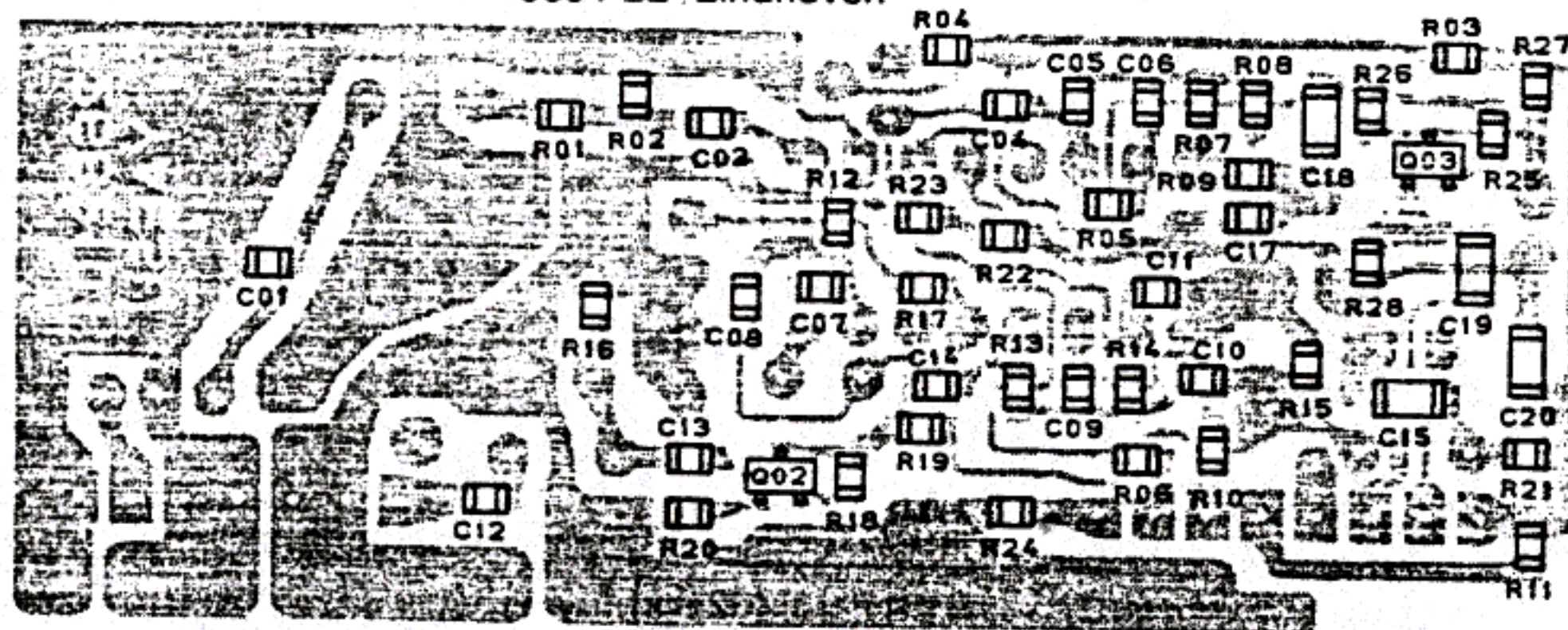


# NARROW FM UNIT PARTS LAYOUT

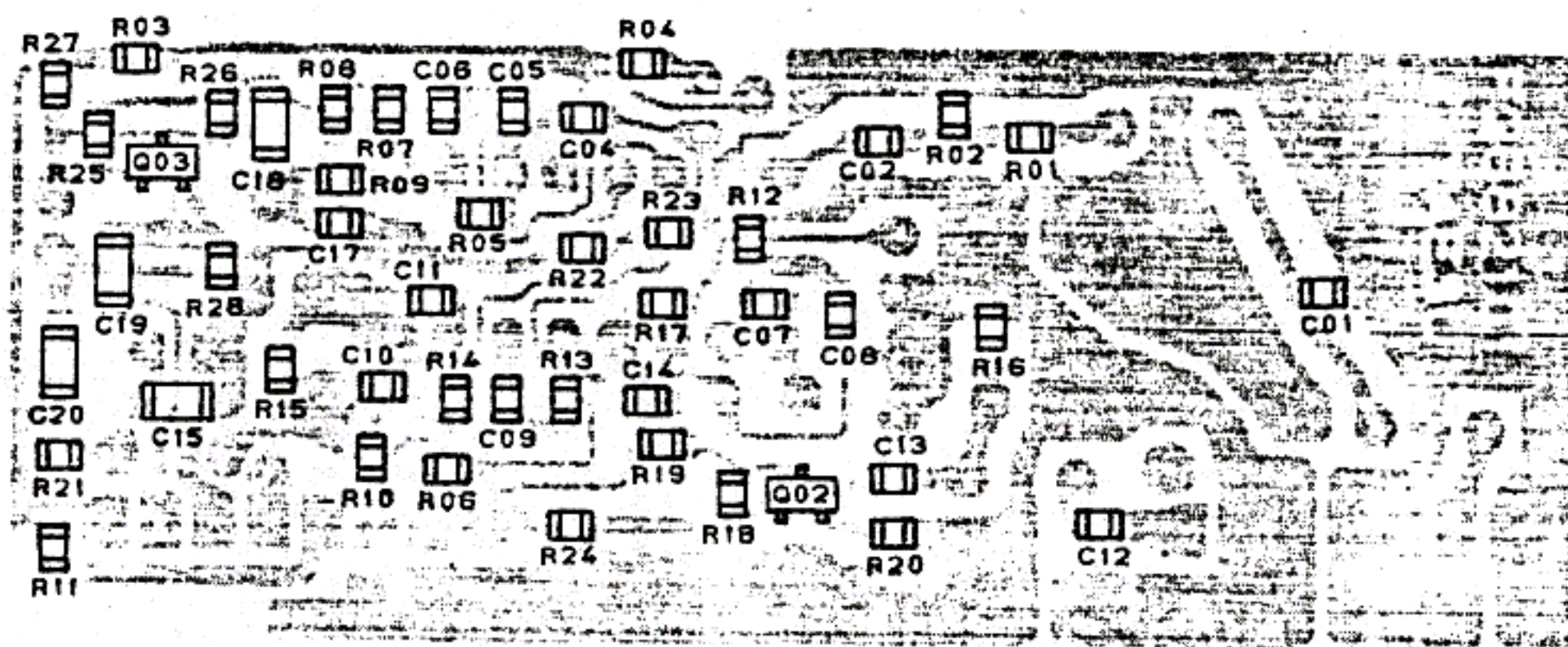


obverse view of  
"component" side

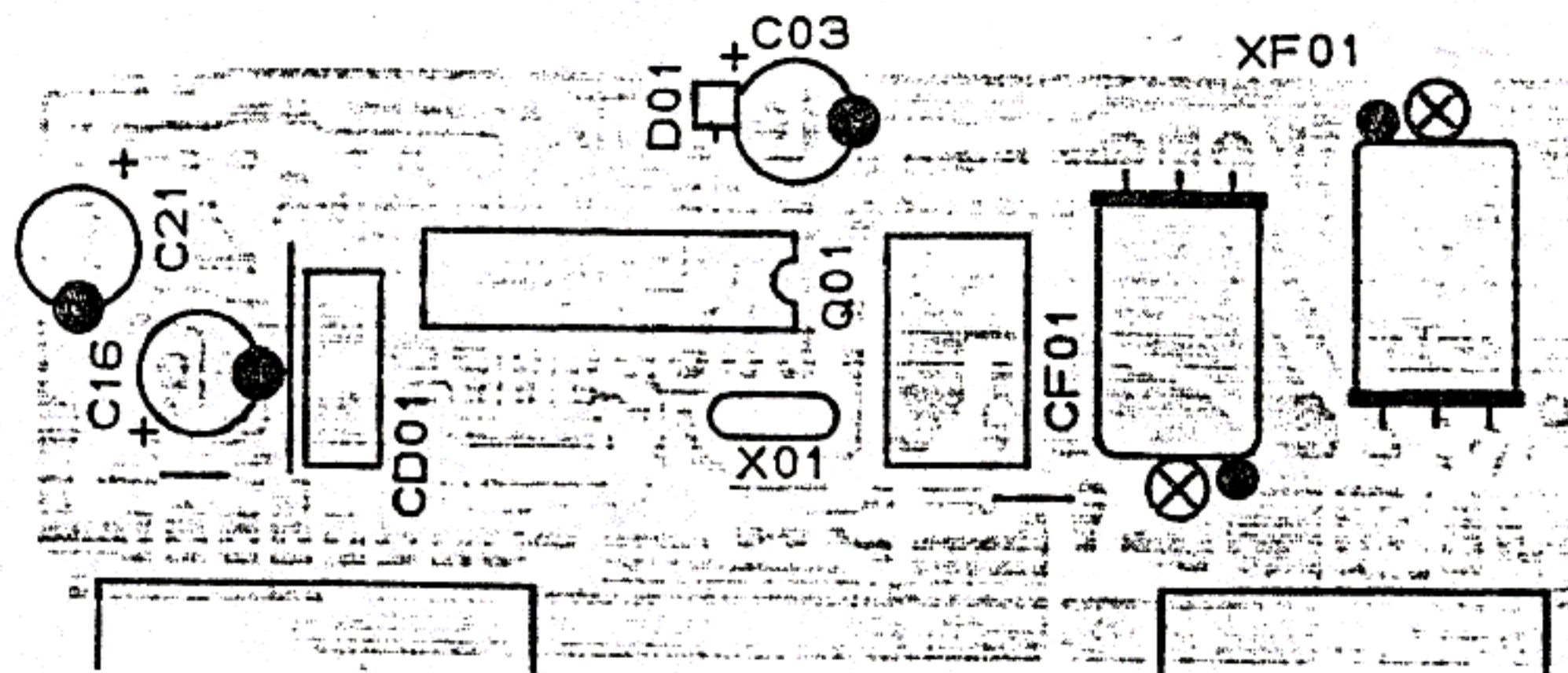
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reverse view of  
"chip-only" side



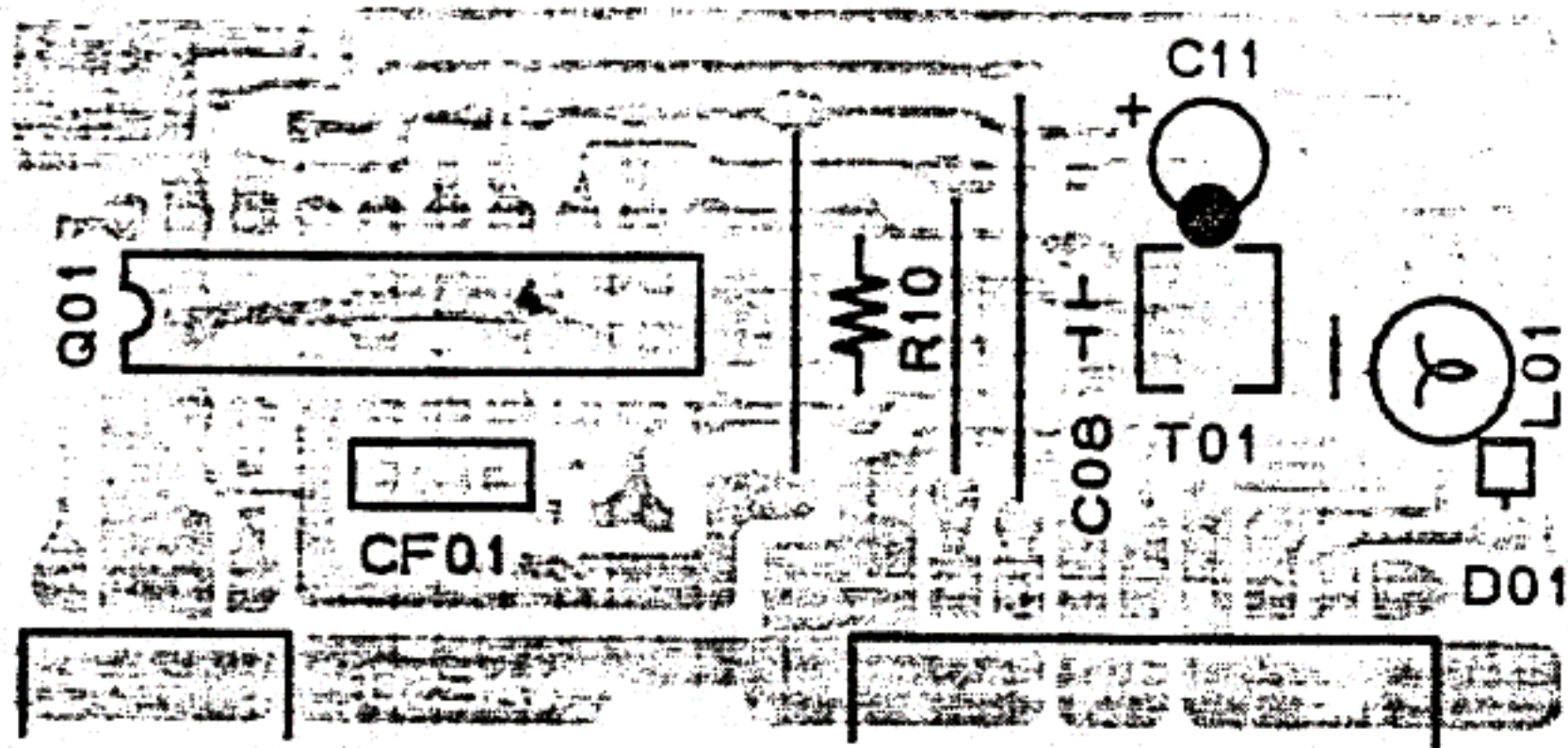
obverse view of  
"chip-only" side



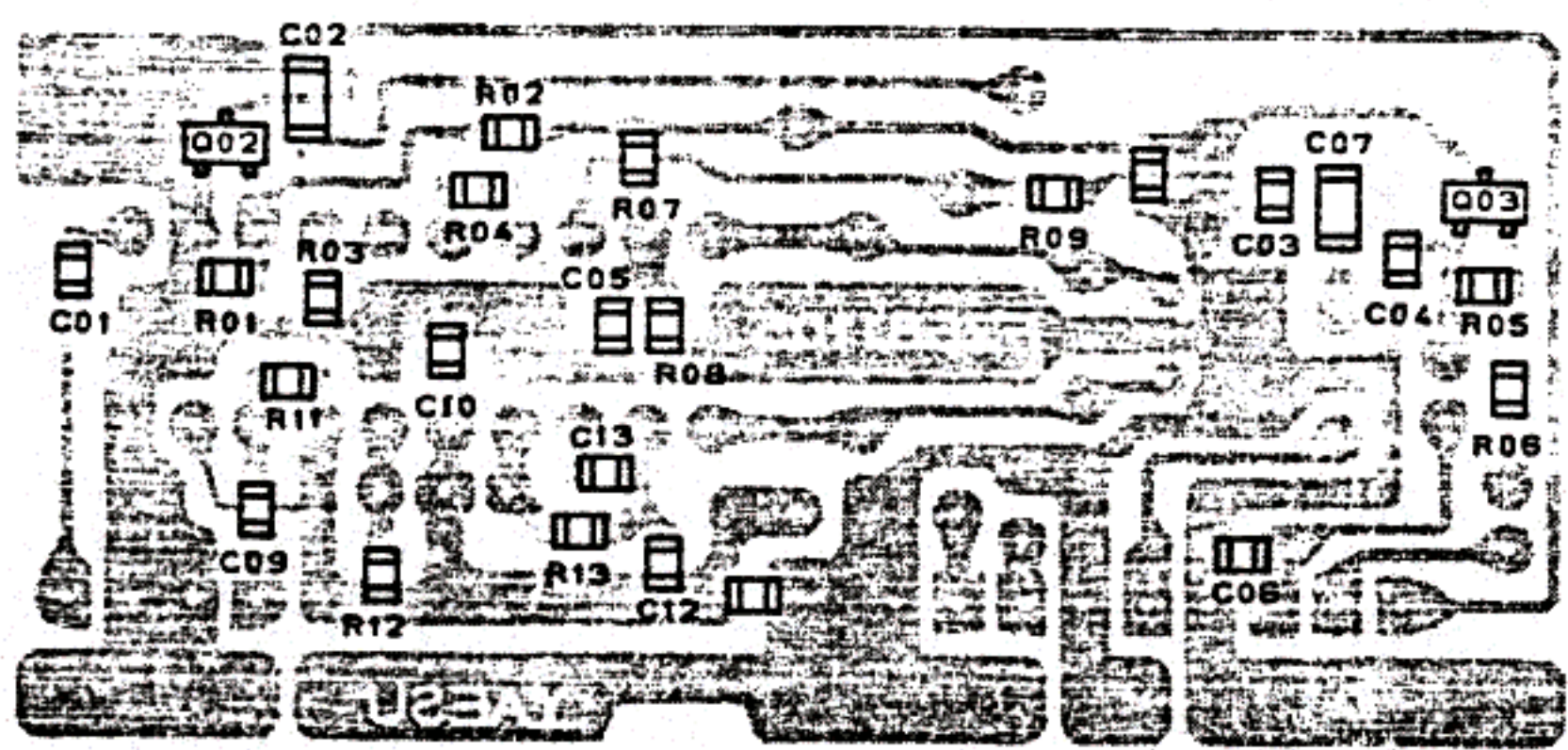
reverse view of  
"component" side



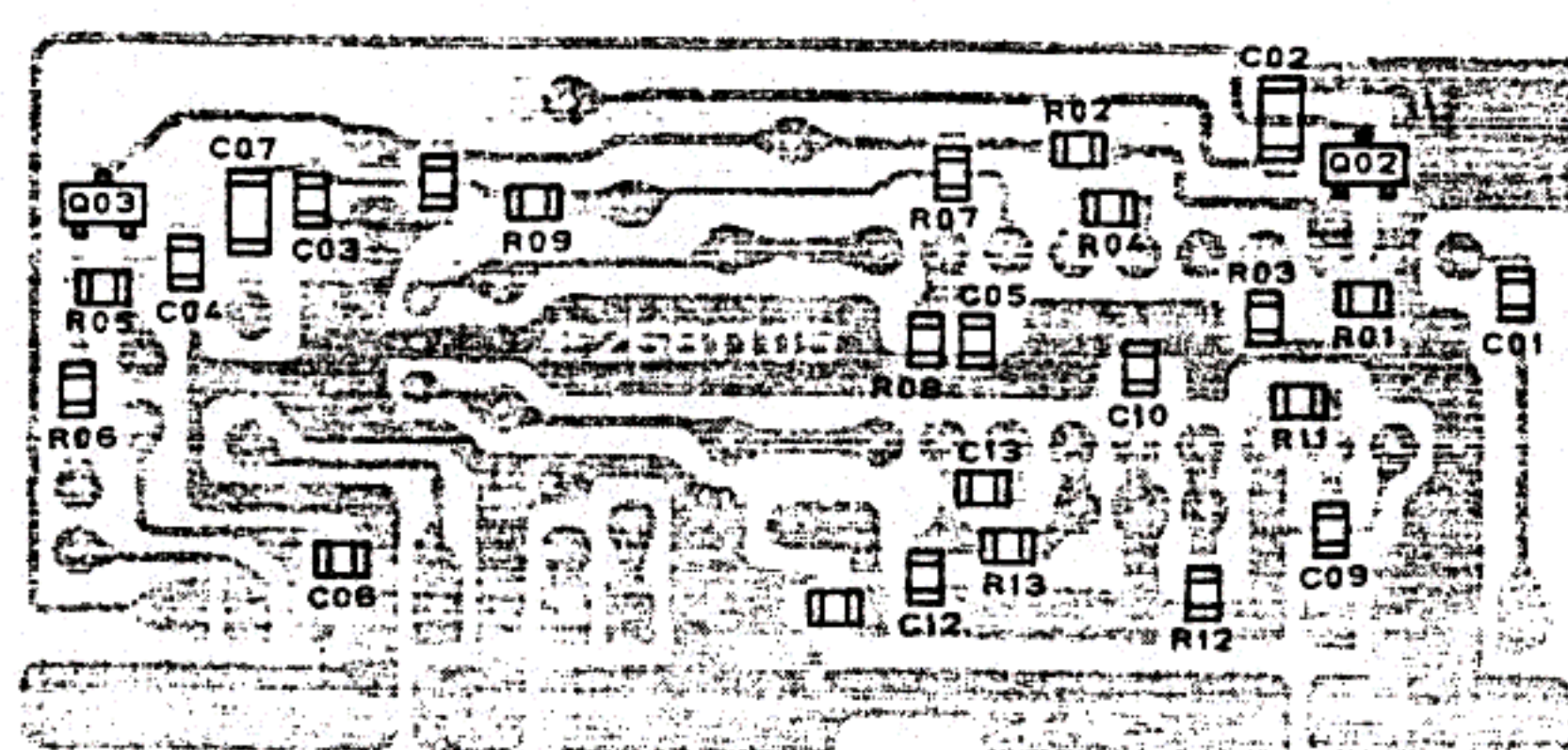
# WIDE FM UNIT PARTS LAYOUT



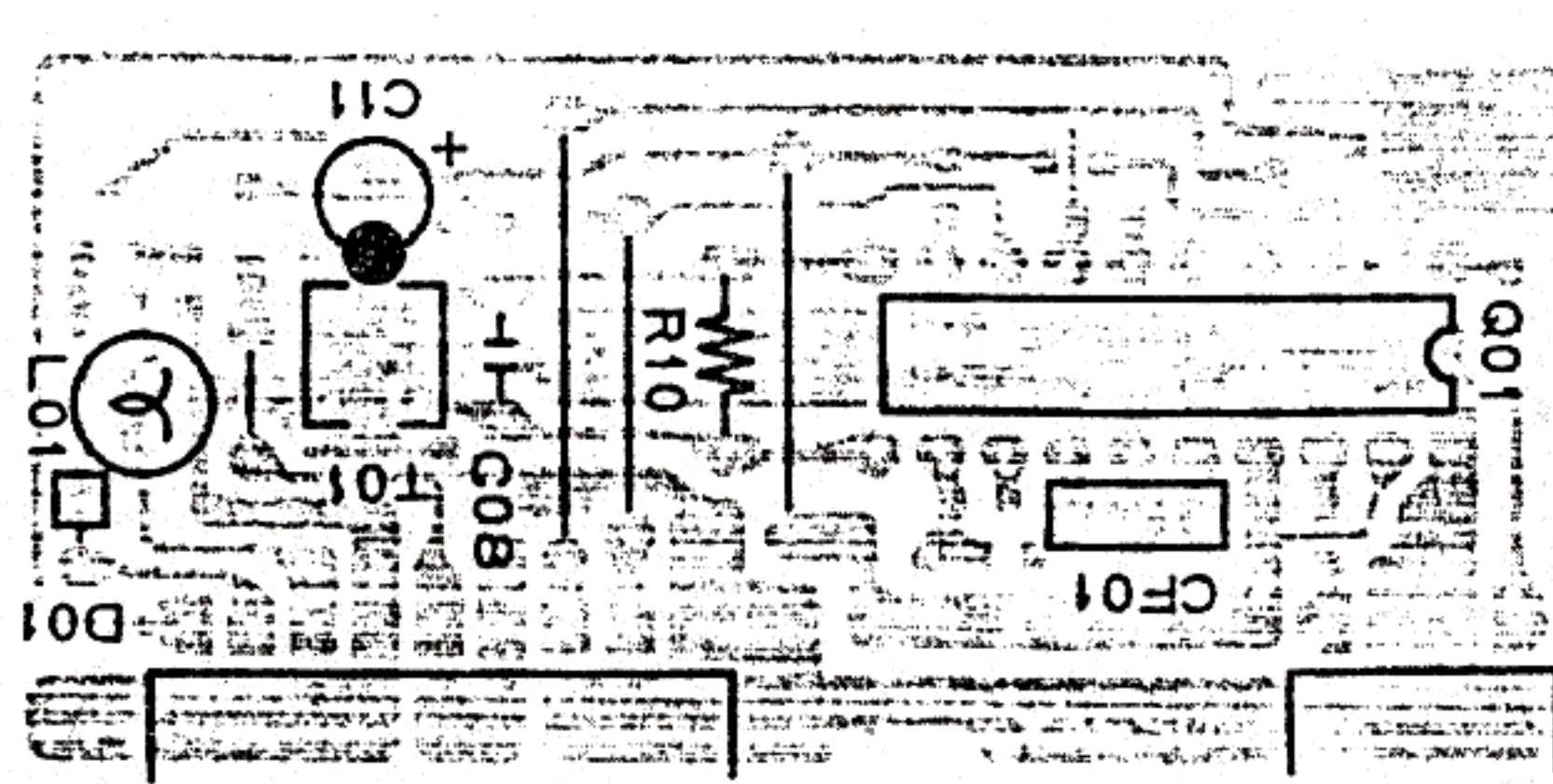
obverse view of  
"component" side



reverse view of  
"chip-only" side

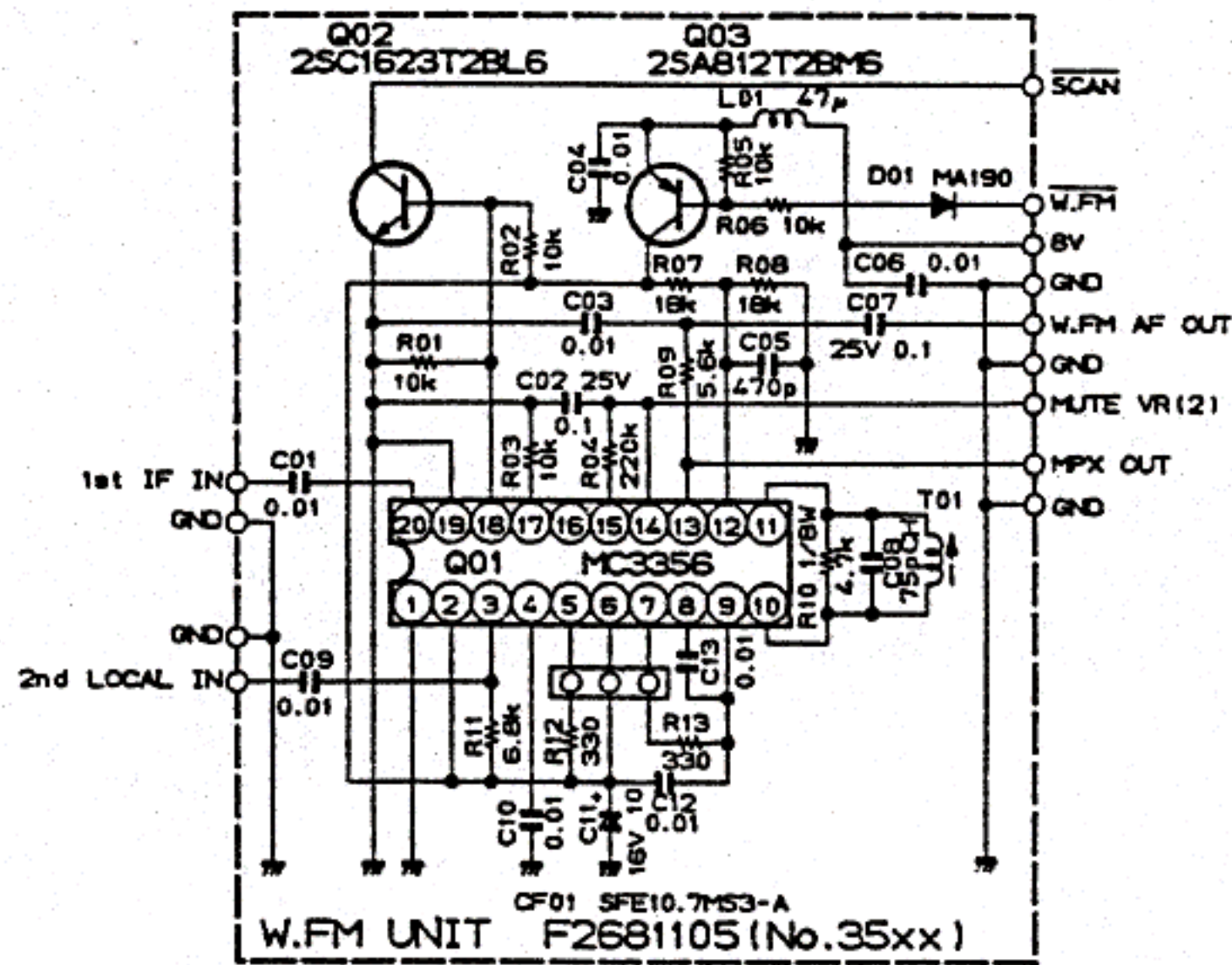


obverse view of  
"chip-only" side



reverse view of  
"component" side

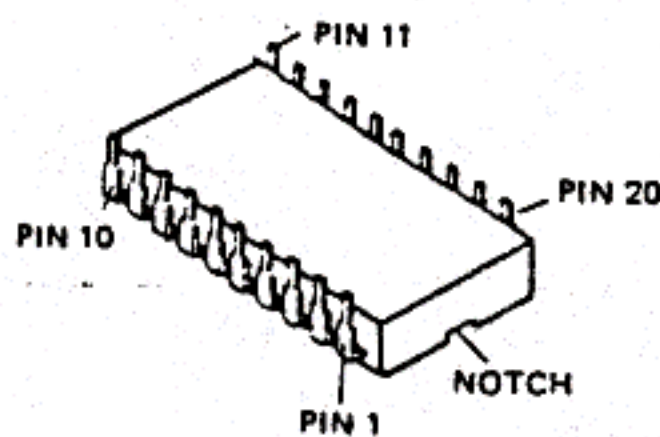




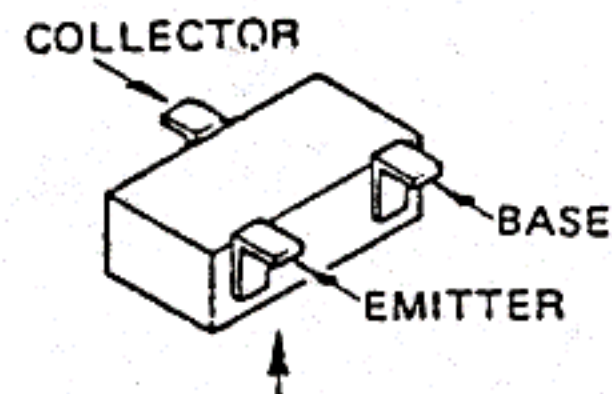
### VOLTAGE CHART (DC VOLTS)

	1	2	3	4	5	6	7	8	9	10	REMARKS
Q3501	0	7.7	7.6	7.7	6.8	7.7	6.6	6.6	6.6	7.7	
	11	12	13	14	15	16	17	18	19	20	
	7.7	3.9	3.2	1.9/0	7.7/0	0.7/0	0.1/0	0.1/0.6	0	1.4	MUTE open/close

	E	C	B	REMARKS
Q3502	0	5.0/0	0.1/0.6	MUTE open/close
Q3503	7.9	7.7	7.1	



MC3356P

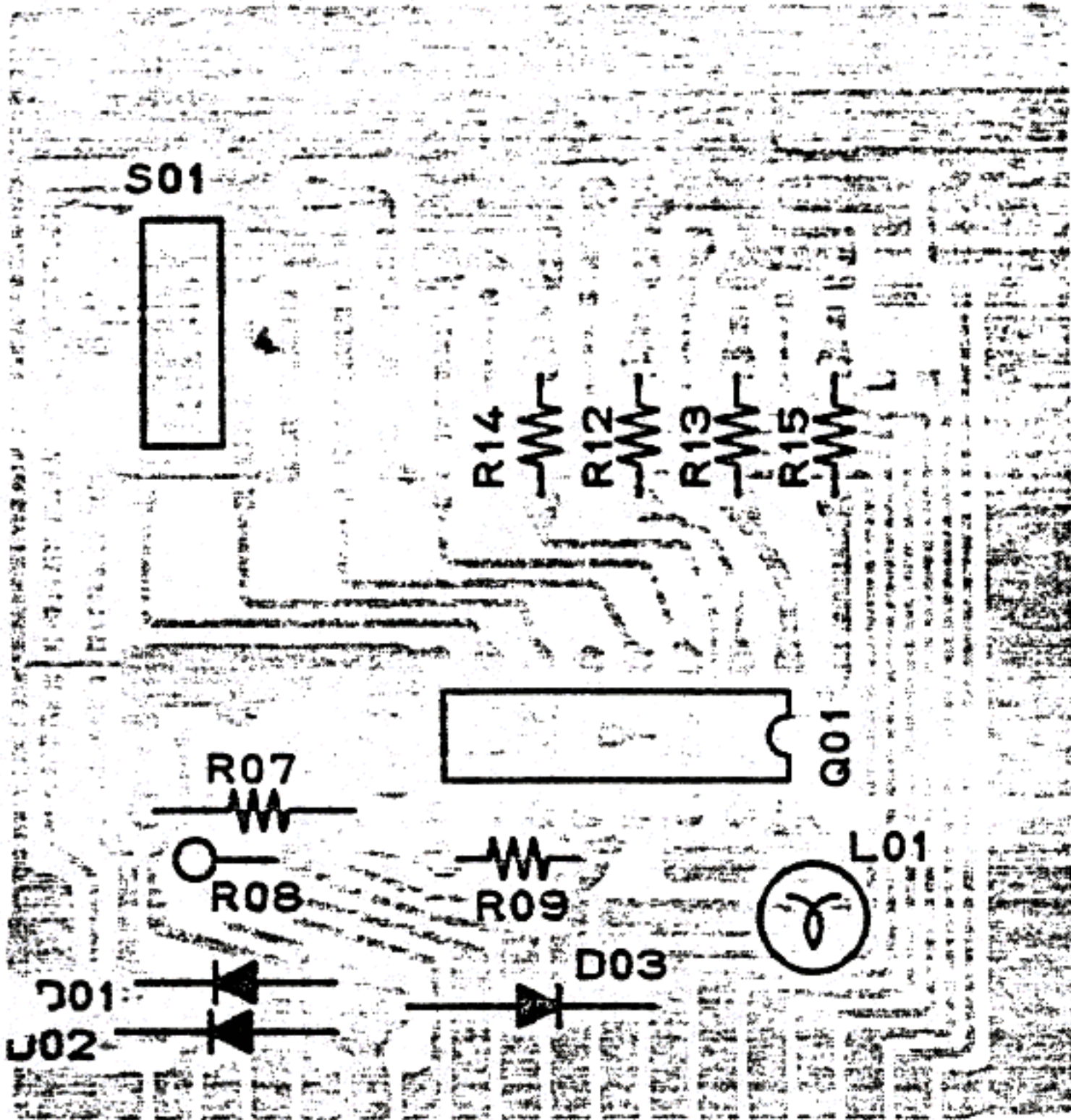


Marked Surface

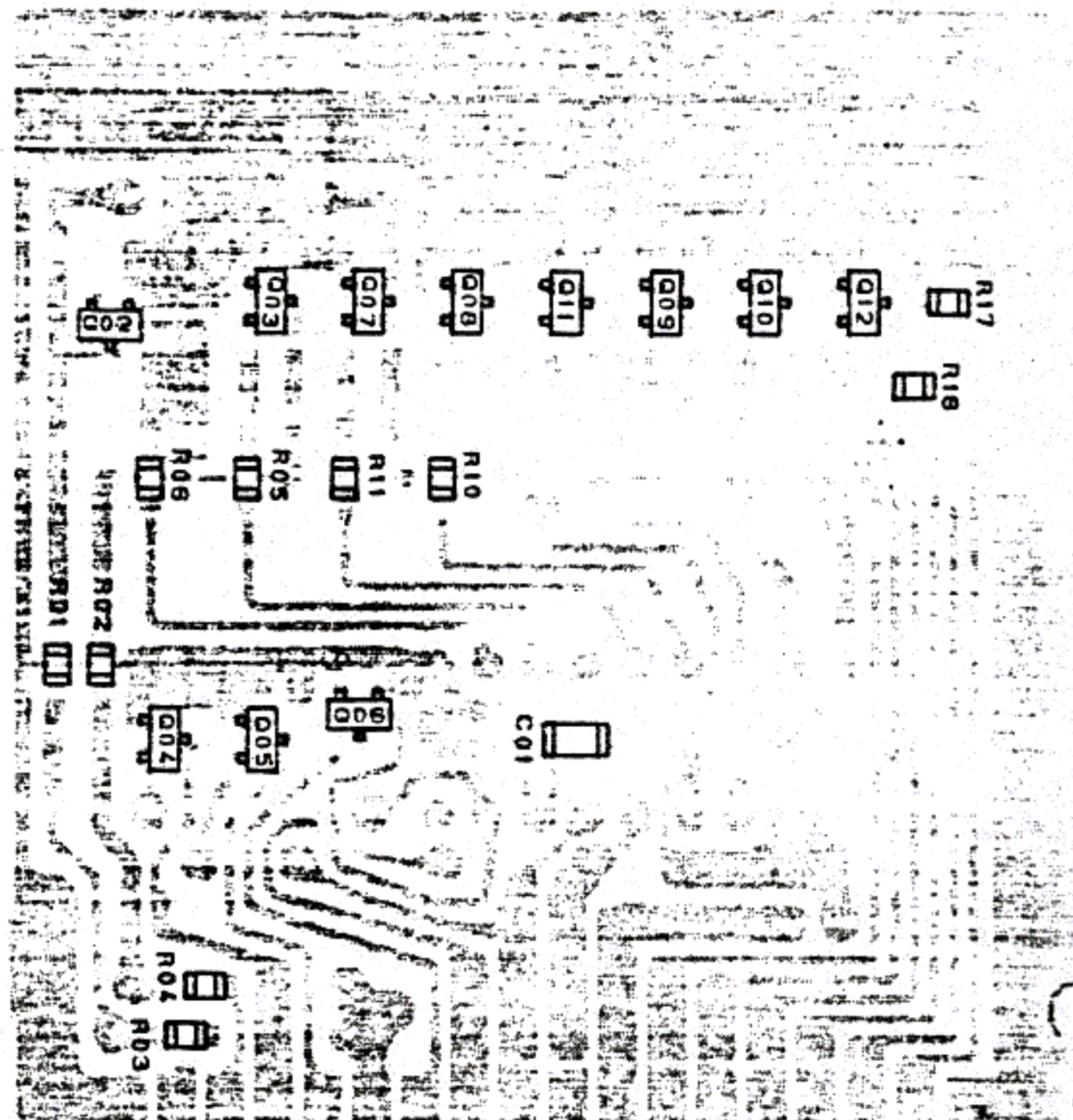
2SA812T2B (M6)  
2SC1623T2B (L6)



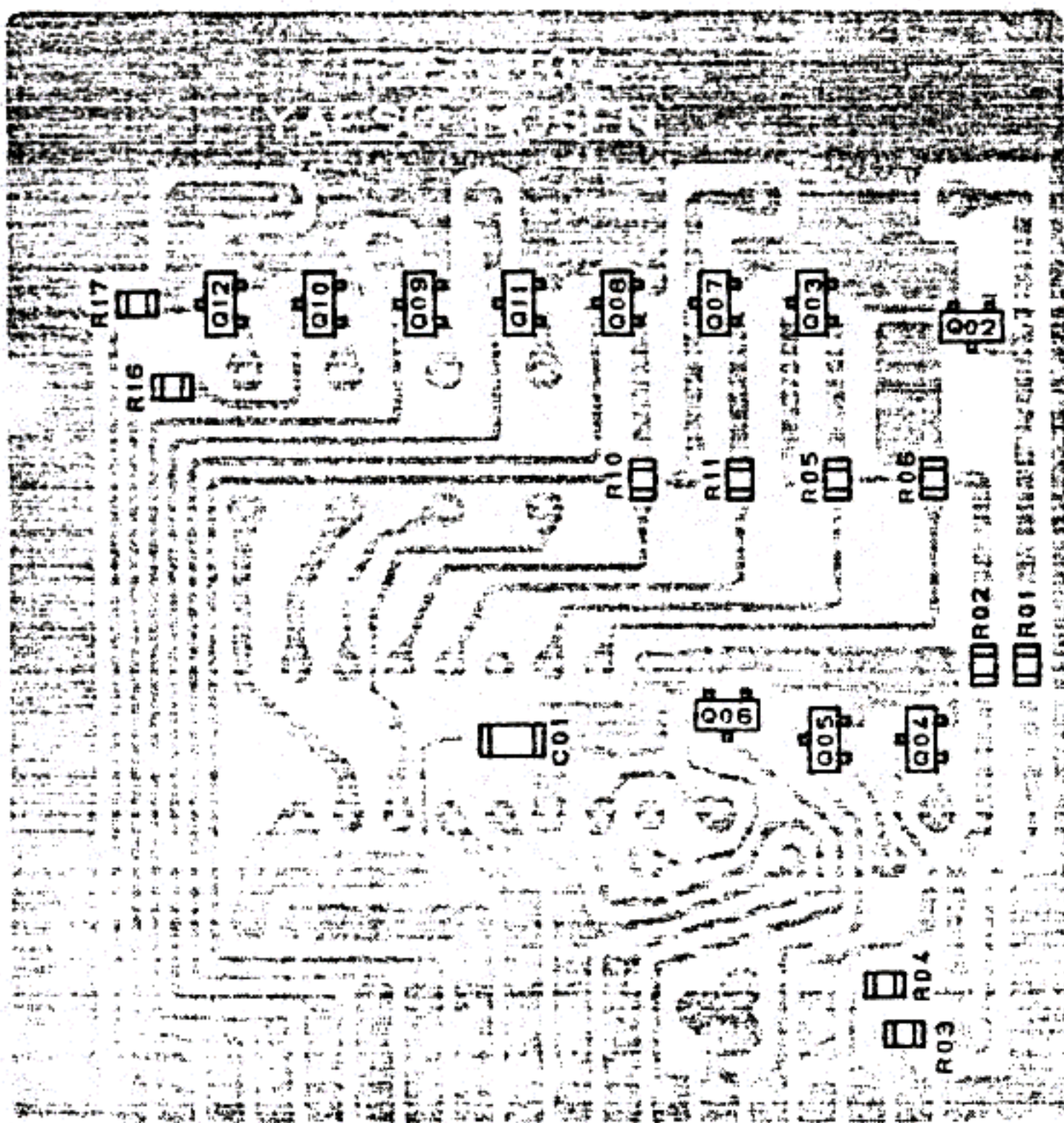
# BAND UNIT PARTS LAYOUT



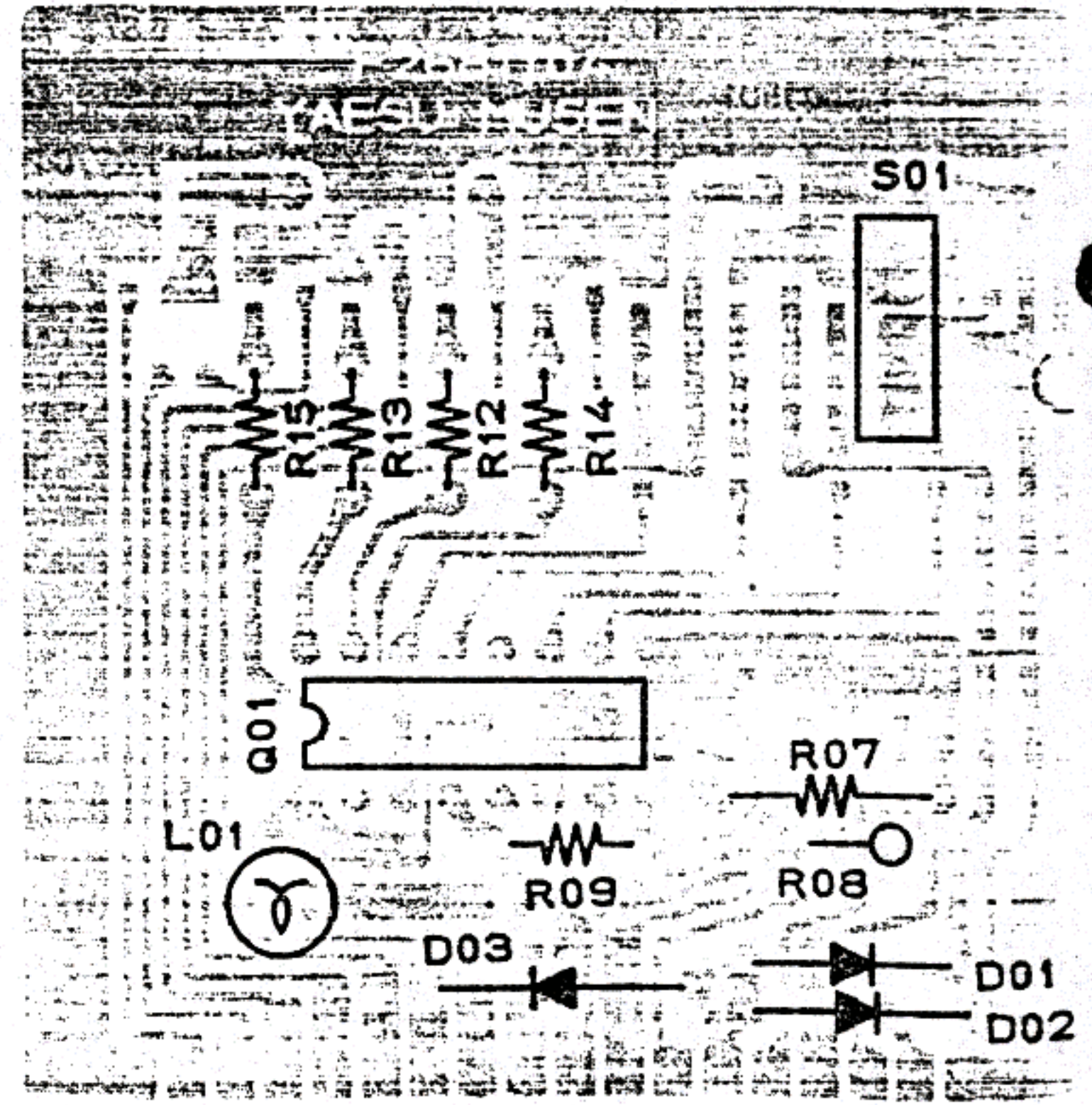
(obverse view of "component" side)



(reverse view of "chip-only" side)

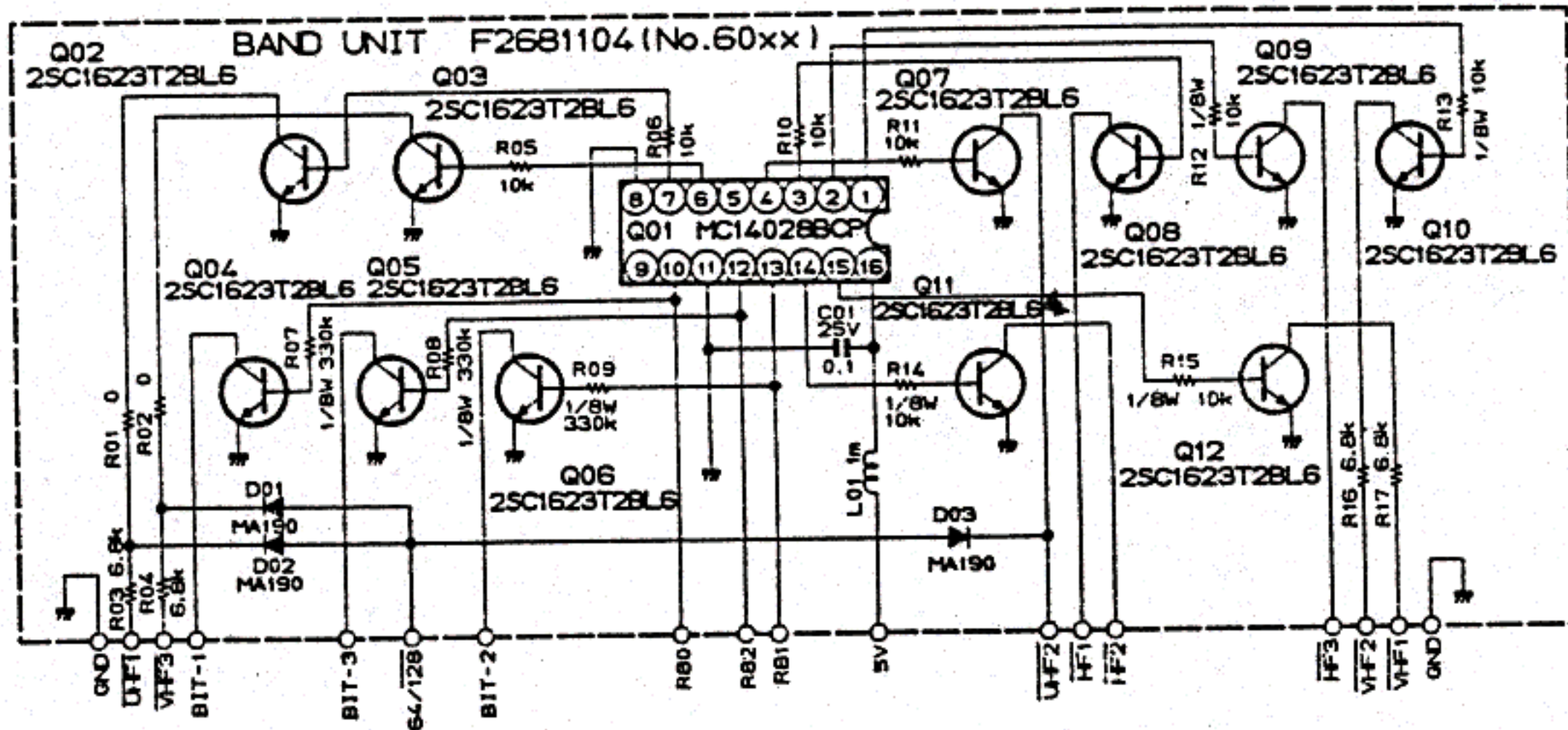


(obverse view of "chip-only" side)



(reverse view of "component" side)





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**VOLTAGE CHART (DC VOLTS)**

Pin	VHF1	VHF2	VHF3	UHF1
1	0	4.8	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	4.8	0
7	0	0	0	4.8
8	0	0	0	0
9	0	0	0	0
10	5.0	0	5.0	0
11	0	0	0	0
12	0	5.0	5.0	5.0
13	5.0	0	0	5.0
14	0	0	0	0
15	4.8	4.8	4.8	4.8
16	5.0	5.0	5.0	5.0

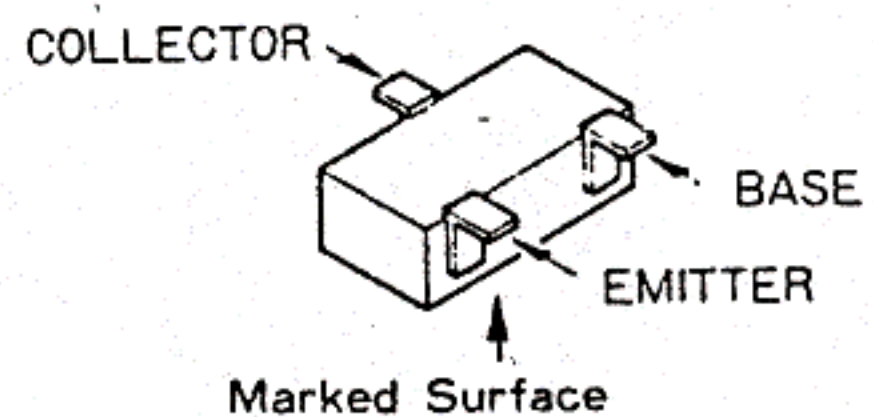
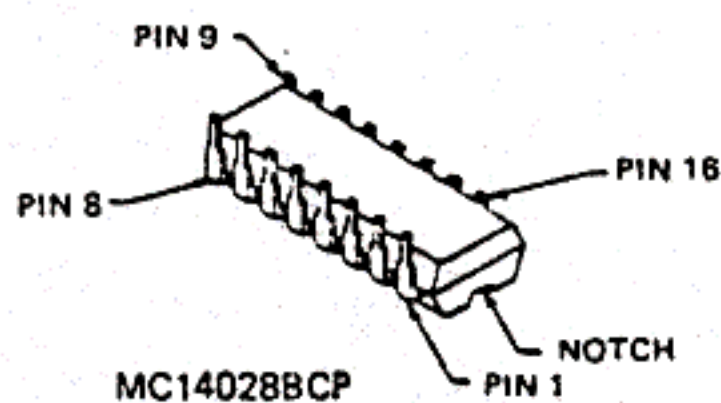
	E	C	B	REMARKS
Q6002	0	0/8.0	0.6/0	UHF1 / other
Q6003	0	0/8.0	0.6/0	VHF3 / "
Q6004	0	OFF/ON	0/0.5	VHF2, UHF2 / other
Q6005	0	OFF/ON	0/0.5	VHF1 / other
Q6006	0	OFF/ON	0/0.5	VHF2,3 / other
Q6007	0	0.3/4.1	0/0	VHF3, UHF1 / other
Q6008	0	OFF	0	
Q6009	0	OFF	0	
Q6010	0	0/8.0	0.6/0	VHF2 / other
Q6011	0	OFF	0	
Q6012	0	0/8.0	0.6/0	VHF1 / "

VHF1 : 60~106.9999MHz

VHF2 : 107~229.9999MHz

VHF3 : 230~459.9999MHz

UHF1 : 460~905MHz



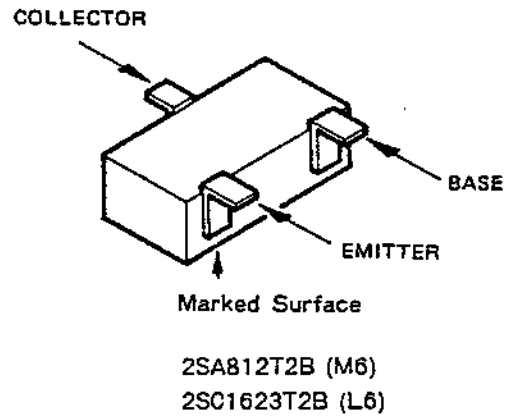
2SC1623T2B (L6)



# CHIP DESCRIPTION AND MARKINGS

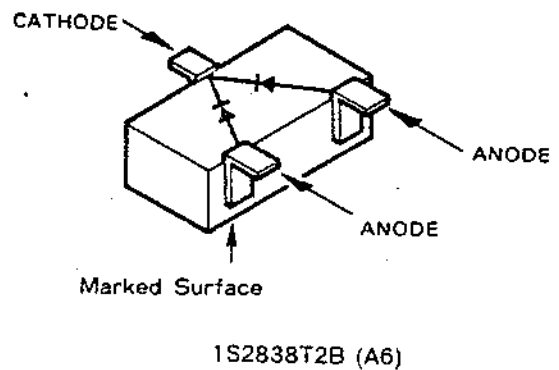
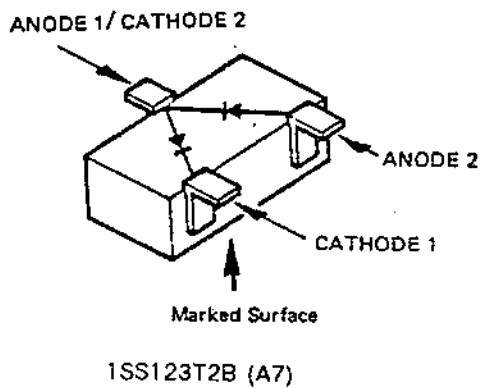
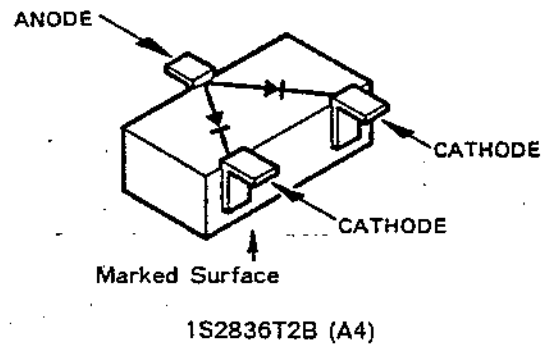
## Bipolar Transistors

Part (Location) No.	Nomenclature	Marking
Q2019, 3005, 3006, 3502, 5511, 5513, 6502, 6504	2SA812T2BM6	M6
Q2007-2018, 2020, 2022, 2026, 3007, 3008, 3501, 4002, 4003, 4503, 4506-4508, 5003, 5004, 5502, 5503, 5505-5510, 5514-5517, 5512, 6002-6012, 6503, 9501	2SC1623T2BL6	L6



## Dual Diodes

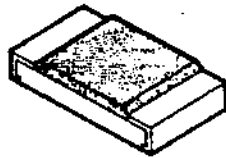
Part (Location) No.	Nomenclature	Marking
D2006-2010, 2012, 2014, 2020	1S2836T2B	A4
D2011, 2013, 2017, 2019, 9501	1S2838T2B	A6
D4503	1SS123T2B	A7





### Resistors

Type RMC1/10W  
Mark\* A1 ..... Z6



A1

Value code

A	1.0	N	3.3
B	1.1	P	3.6
C	1.2	Q	3.9
D	1.3	R	4.3
E	1.5	S	4.7
F	1.6	T	5.1
G	1.8	U	5.6
H	2.0	V	6.2
J	2.2	W	6.8
K	2.4	X	7.5
L	2.7	Y	8.2
M	3.0	Z	9.1

Multiplier code

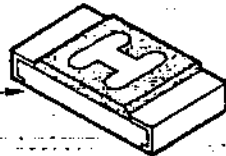
0	1
1	10 <sup>1</sup>
2	10 <sup>2</sup>
3	10 <sup>3</sup>
4	10 <sup>4</sup>
5	10 <sup>5</sup>
6	10 <sup>6</sup>

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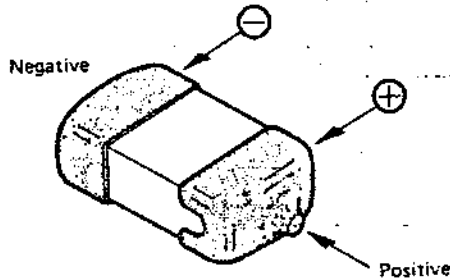
Examples :

A1 = 10Ω  
J3 = 2.2kΩ  
S4 = 47kΩ

Jumper (0Ω) Chip



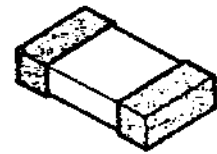
### Tantalum Capacitor



Polarized, Unmarked  
(determine value from layout  
and Parts List)

### Ceramic Capacitors

Types: C2012  
C3216



Mark\* C3216 Bar C2012

A5

A5

Value code

A	1.0	M	3.0	Y	8.2
B	1.1	N	3.3	Z	9.1
C	1.2	P	3.6	a	2.5
D	1.3	Q	3.9	b	3.5
E	1.5	R	4.3	d	4.0
F	1.6	S	4.7	e	4.5
G	1.8	T	5.1	f	5.0
H	2.0	U	5.6	m	6.0
J	2.2	V	6.2	n	7.0
K	2.4	W	6.8	t	8.0
L	2.7	X	7.5	y	9.0

Multiplier code

0	1
1	10 <sup>1</sup>
2	10 <sup>2</sup>
3	10 <sup>3</sup>
4	10 <sup>4</sup>
5	10 <sup>5</sup>
6	10 <sup>6</sup>
7	—
8	10 <sup>-2</sup>
9	10 <sup>-1</sup>

C3216 types use a bar marking for either thermal coefficient or tolerance ranking (according to capacitors value range) as below.

Temperature Compensating Types (low values)

SL ..... No bar

NPO(CH)	N150(PH)	N220(RH)	N330(SH)	N470(TH)	N750(UJ)

Dielectric Constant (Hi K) types (high value)  
Cap. Tolerance

B	D

F ..... No bar

B = 10%  
D = 20%  
F = +80%/-20%

Examples : A1 10pF NPO  
J3| 0.0022μF D  
A3 0.001μF B



# FRG-9600 PARTS LIST

MAIN CHASSIS					DIODES	
Symbol No.	Part No.	Name & Description	D1010, 1014, 1021	G2090237	Si	MA190
		POTENTIOMETERS	D1001-1003, 1007-1009, 1011, 1015, 1017, 1018, 1021	G2015550	"	1S1555
VR1 (with S1)	J62800086	K12B6102V-5N1212 10KA/10KB				
VR2	J61800018	K12260020 5KB/5KB				
			D1004	G1090239	"	MA161
			DI005, 1006	G2090297	"	1SS110
		AF CHOKE COIL	DI012	G2090180	Varactor	FC53M5
CH1	L2030052	20mH 0.5A	DI013	G9090005	Varistor	MV10
			DI019	G2090118	Schottky	1SS97
		SPEAKER	DI020	G2090249	"	ERB81-004
SP1	M4090060	SS-77KB 8Ω 3W				
						CRYSTAL
		JACKS	X1001	H0102664	HC-18/U3P	17.53 MHz
J1	P1090194	FM-MR-M2				
J2	P0090093	X-G9242				CRYSTAL FILTER
			XF1001	H1102093	45M1A	
		MINI PLUGS (w/wire)		H1102097	(or 45M28)	
P2	T9204983A					
P3	T9204984					RESISTORS
P4	T9204985		R1050	J01275689	Carbon film	1/2W 6.8Ω TJ
P5	T9313500B		R1066	J01275470	" "	" 47Ω "
P6	T9204986A		R1002	J02245470	" "	1/4W 47Ω SJ
7	T9204987A		R1014, 1015, 1026, 1033, 1037, 1039	J02245101	" "	" 100Ω "
			R1012	J02245151	" "	" 150Ω "
		KNOBS	R1025, 1032	J02245471	" "	" 470Ω "
	R3109050	MAIN DIAL	R1001	J02245681	" "	" 680Ω "
	R7504490		R1003, 1006, 1008, 1017, 1019, 1051, 1058	J02245102	" "	" 1kΩ "
	R3108960	VOL				
	R7108980					
	R3108970	SQL	R1010, 1016, 1040, 1065	J02245152	" "	" 1.5kΩ "
	R7108980					
	R3073820B	TONE	R1018, 1035, 1048, 1052, 1067	J02245222	" "	" 2.2kΩ "
	R3108910	0-9				
	R3108911	CE	R1004, 1021, 1023, 1036	J02245472	" "	" 4.7kΩ "
	R3108912	TIME SET				
	R3108890	STEP, DIAL, MODE, MR, PRI, CLOCK, D M, M D				
	R3108930	UP	R1005, 1007, 1009, 1024, 1028, 1034, 1041-1047, 1054-1056, 1060	J02245103	" "	" 10kΩ SJ
	R3108920	DOWN				
	R3108900	M CLEAR, ATT, AF SCAN				
			R1020, 1022, 1029, 1031	J02245153	" "	" 15kΩ "
			R1027, 1030, 1053	J02245223	" "	" 22kΩ "
	F2683101	Printed Circuit Board	R1049, 1057	J02245473	" "	" 47kΩ "
	C026830A	PCB with components	R1013, 1038	J02245224	" "	" 220kΩ "
			R1059, 1061-1063	J02245225	" "	" 2.2MΩ "
		FRONT-END ASSY	R1064	J02245565	" "	" 5.6MΩ "
	Q9000306	VTY-1U103				POTENTIOMETERS
			VR1001	J51737503	3321P-1-50KB	50kΩB
		ICs	VR1002, 1003	J51757103	H1052C-10KB	10kΩB
Q1011	G1090080	μPC78L08	VR1005	J51745473	H0651A017-47KB	47kΩB
Q1012	G1090294	μPC7808H	VR1004	J51745104	H0651A019-100KB	100kΩB
Q1013	G1090494	MB3713				
Q1015	G1090649	M5218L-01				
Q1016	G1090084	μPC78L05				
						CAPACITORS
		FET	C1029	K02172010	Ceramic	50WV 1pF CH
Q1003	G4800730G	3SK73GR	C1032	K02172030	" "	3pF "
						(DD104CH010C50)
						(DD104CH030C50)
		TRANSISTORS	C1021	K02172040	" "	4pF "
Q1006-1009	G3107331P	2SA733AP				(DD104CH040C50)
Q1001, 1002, 1004, 1005, 1010, 1014	G3304580B	2SC458B	C1015	K00172050	" "	5pF SL
						(DD104SL050C50)



C1026, 1027	K02175101	" " 100pF CH (DD107CH101J50)	J1005, 1011, 1012, 1017, 1020	P0090192	B3B-XHA
C1022	K06175101	" " 100pF UJ (DD106UM101J50)	J1006	P0090205	S4B-XHA
C1002, 1005	K12170649	" " 0.001μF E (DD104-257E102P50)	J1008, 1010, 1018, 1022, 1024, 1025	P0090191	B2B-XHA
C1001, 1003, 1004, 1006, 1011-1014, 1016-1020, 1023, 1028, 1030, 1031, 1033-1036, 1038, 1039, 1045, 1050, 1056, 1058, 1062, 1063, 1066, 1068	K13179008	" " 0.01μF F (DD106F103Z50)	J1013	P1090043	3024-13CH
			J1015, 1019, 1021	P1090350	S-G8035
			J1023	P0090195	B6B-XHA
			P11001, 1002	P1090210	TMP-IV
					PLUGS
			P1001 (with wire)	T9204980A	
			P1002 ( " )	T9204981A	
					TERMINAL POSTS
C1046	K19149021	" 50WV 0.047μF (UAT08x473K-L45AE)		Q5000036	TP-G
C1042, 1057	K19149025	" 25WV 0.1μF (UAT10x104K-L45AE)			
C1049	K50177154	Mylar 50WV 0.15μF (S0F2U154)		F2684000	Printed circuit board
C1041, 1055	K40179013	Electrolytic " 1μF (S0RE1)		C026840A	PCB with components
059	K40179012	" " 4.7μF (S0RE4.7)	Q2001	G1090650	HD614042FA95
			Q2002	G1090651	HM61116LFP-4
C1007, 1008, 1024, 1037, 1040, 1043, 1044, 1047, 1052, 1060, 1061, 1064, 1067	K40179014	" " 10μF (S0RE10)	Q2003	G1090600	μPD4011BG
			Q2004	G1090633	M5218P
			Q2005	G1090084	μPC78L05
					TRANSISTORS
C1009	K40149028	" 25WV 100μF (RE2-25V101M)	Q2019	G3108127F	2SA812T2BM6
			Q2021	G3207720Q	2SB772Q
C1025	K40129008	" 16WV 33μF (16RE33)	Q2007-2018, 2020 2022-2026	G3316237F	2SC1623T2BL6
C1051	K40149022	" 25WV 47μF (25RE47)	Q2006	G3319590Y	2SC1959Y
C1054	K40149003	" " 100μF (25RE100)			DIODES
C1053	K40129006	" 16WV 470μF (16RE470)	D2001, 2003	G2090239	Si MA161
			D2006-2010, 2012 2014, 2020	G2070024	" 1S2836T2B
C1048	K40149002	" 25WV 470μF (25RE470)	D2011, 2013, 2017, 2019	G2070018	" 1S2838T2B
C1065	K40149027	" " 3300μF (RE2-25V332M)	D2016	G2090237	" MA190
			D2002	G2090154	Zener RD7.5EB1
			D2005	G2090257	" RD33EB1
			D2018, 2021, 2022	G2090042	" RD8.2EB3
L1001, 1002, 1004, 1005	L1190171	LHL06NA470K 47μH	D2015	G2090118	Schottky 1SS97
L1006	L1190177	LHL06NA151K 150μH	D2004	G9090005	Varistor MV103
L1007, 1008	L1190187	LHL06NA102K 1mH			FCD
			DS2001	G6090052	FIP14BM7
		INDUCTORS			
		TRANSFORMERS			
T1001	L0021514				RESISTORS
T1002	L0021515		R2033	J01275820	Carbon film 1/2W 82Ω TJ
T1003	L0021516		R2001	J02245151	" 1/4W 150Ω SJ
T1004	L0021519		R2061	J01245102	" " 1kΩ TJ
T1005, 1006	L0021517		R2060	J01245152	" " 1.5kΩ "
			R2002, 2004	J02245472	" " 4.7kΩ SJ
			R2003	J01275822	" 1/2W 8.2kΩ TJ
		RELAY			
RL1001	M1190051	FBR22D12-P			
		JACKS	R2027, 2035, 2051	J24205102	Chip RMC 1/10T 102J 1kΩ
J1001, 1014, 1016	P1090348	S-Q3097-1	R2042	J24205472	" " 472J 4.7kΩ
J1002	P1090423	TCS4460-01-1111	R2013-2021, 2031, 2034, 2037, 2041 2043, 2044, 2046-	J24205103	" " 103J 10kΩ
J1003, 1007, 1009	P0090193	B4B-XHA			
J1004	P0090194	B5B-XHA			







				CONNECTORS	
C3024	K40129012	"	16WV 10μF		P0090476 3094-04A
		(ECE-A1CK100)			P0090477 3094-09A
C3014	K40129014	"	33μF		
		(ECE-A1CK330)			
<b>NARROW FM UNIT</b>					
		TRIMMER CAPACITOR		F2682101	Printed circuit board
TC3001	K91000130	ECV-1ZW 60x60	60pF	C026821A	PCB with components
		TERMINAL POSTS			IC
TP3001, 3002	Q5000036	TP-G		Q4001	G1090145 MC3357P
		CONNECTOR			TRANSISTORS
	P0090475	3094-14A		Q4002, 4003	G3316237F 2SC1623T2BL6
					DIODE
				D4001	G2015550 1S1555
<b>WIDE FM UNIT</b>					
	F2681105	Printed circuit board			
	C026815A	PCB with components			CRYSTAL
		IC		X4001	H0102666 UM-1 10.245 MHz
Q3501	G1090591	MC3356P			CRYSTAL FILTER
				XF4001	H1102013 FMT-15B
					H1102096 (or 10M15B-Y)
Q3503	G3108127F	2SA812T2BM6			CERAMIC FILTER
Q3502	G3316237F	2SC1623T2BL6			CFW 455E
				CF4001	H3900200
		DIODE			CERAMIC DISCRIMINATOR
D3501	G2090237	Si	MA190	CD4001	H7900180 CDB455C7
					H7900260 (or D455C)
		CERAMIC FILTER			RESISTORS
CF3501	H3900375	SFE 10.7 MS3-A			Chip RMC 1/10T 000J 0Ω
				R4010, 4018, 4022, 4023	J24205000
		RESISTORS		R4021, 4025	J24205101 " " 101J 100Ω
R3510	J01215472	Carbon film	1/8W 4.7kΩ T3	R4002, 4004, 4024, 4028	J24205102 " " 102J 1kΩ
R3512, 3513	J24205331	Chip RMC 1/10T	331J 330Ω	R4008, 4015, 4017	J24205152 " " 152J 1.5kΩ -
R3511	J24205682	"	682J 6.8kΩ	R4001, 4019, 4013	J24205222 " " 222J 2.2kΩ
R3501-3503, 3505, 3506	J24205103	"	103J 10kΩ	R4006, 4027	J24205472 " " 472J 4.7kΩ
R3507, 3508	J24205183	"	183J 18kΩ	R4011	J24205103 " " 103J 10kΩ
R3504	J24205224	"	224J 220kΩ	R4007	J24205223 " " 223J 22kΩ
R3509	J24205334	"	334J 330kΩ	R4012, 4014	J24205473 " " 473J 47kΩ
		CAPACITORS		R4003	J24205154 " " 154J 150kΩ
C3508	K02179018	Ceramic	50WV 75pF CH	R4005	J24205274 " " 274J 270kΩ
		(DD107CH750150V)		R4009	J24205334 " " 334J 330kΩ
C3503	K22170241	"	50WV 180pF CH	R4026	J24205474 " " 474J 470kΩ
		(C2012CH1H181JFA)			CAPACITORS
C3505	K22170801	Chip	470pF B	C4001	K22170205 Chip 50WV 4pF CH
		(C2012B1H471MFA)			(C2012CH1H040CFA)
C3501, 3504, 3506, 3509, 3510, 3512, 3513	K22170817	"	0.01μF B	C4007	K22170327 " " 47pF UJ
		(C2012B1H103MFA)			(C2012UJ1H470JFA)
C3502, 3507	K22141904	"	25WV 0.1μF D	C4008	K22170337 " " 120pF "
		(C3216D1E104MFA)			(C2012UJ1H121JFA)
C3511	K40129012	Electrolytic	16WV 10μF	C4011	K22170239 " " 150pF CH
		(ECE-A1CK100)			(C2012CH1H151JFA)
		INDUCTOR		C4005, 4006	K22170805 " " 0.001μF B
L3501	L1190029	FL5H-470K	47μH	C4017	K22170807 " " 50WV 0.0015μF B
					(C2012B1H152MFA)
				C4002, 4012-4014,	K22170817 " " 0.01μF B
					(C2012B1H103MFA)
		TRANSFORMER		C4009, 4010	K22171008 " " 0.047μF F
T3501	L0021153				(C2012F1H473ZFA)
				C4015, 4018-4020	K22141904 " " 25WV 0.1μF D
					(C3216D1E104MFA)