

\*Refer to parts list on page 42.

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## CIRCUIT DESCRIPTION

**Note:** This text is concerned primarily with the TS-140. those parts that pertain to the TS-680 will be marked with an asterisk (\*).

### GENERAL

The TS-140 is a transceiver incorporating a general coverage receiver section utilizing double conversion principles with a first intermediate frequency (IF) of 40.005 MHz and a second IF of 455kHz.

The TS-140 covers all amateur bands from 1.9MHz to 30MHz (\*1.9 thru 50MHz). It contains a 10Hz step digital PLL circuit using single crystal frequency management and microprocessor control to provide high accuracy and stability.

The major functions are as follows:

- Receiving section: General coverage from 500kHz to 30 MHz (\*500kHz to 30MHz, and 50 to 54MHz)
- Covers all amateur bands from 1.9 to 30MHz (\*1.9 to 54 MHz)
- Full CW break-in
- 28MHz (\*50MHz) band Preamplifier control
- Manual switching of AGC time constant
- Built-in variable threshold noise blanker

- Built-in woodpecker noise blanker (NB2)
- Frequency control function with a second sub-control
- Frequency configured using a single reference oscillator
- Range specified memory

### FREQUENCY CONFIGURATION

The TS-140 operates using a double conversion system for both transmit and receive (it operates using single conversion in the FM transmit mode).

Figure 1 shows the frequency configuration of the transmit and receive systems. The receiver section will be covered first.

Assume that the input frequency from the antenna is  $f_{IN}$ , the RX MIX1 local input is  $f_{VCO}$ , and the RX MIX2 local input is  $f_{HET}$ . When the incoming signal is zero beat the following relationships will hold true.

$$f_{IN} = f_{VCO} - f_{HET} - f_{CAR} \dots\dots\dots ①$$

$$\text{for VCO4, } \frac{f_{VCO4}}{J} = \frac{f_{STD}}{8K} \therefore f_{VCO4} = \frac{J}{8K} f_{STD} \dots\dots\dots ②$$

$$\text{for VCO3, } \frac{f_{VCO3}}{L} = \frac{f_{STD}}{8 \times 900} \therefore f_{VCO3} = \frac{L}{7200} f_{STD} \dots\dots\dots ③$$

$$\text{for VCO2, } \frac{f_{VCO2}}{M} = \frac{f_{STD}}{8 \times 4500} \therefore f_{VCO2} = \frac{M}{36000} f_{STD} \dots\dots\dots ④$$

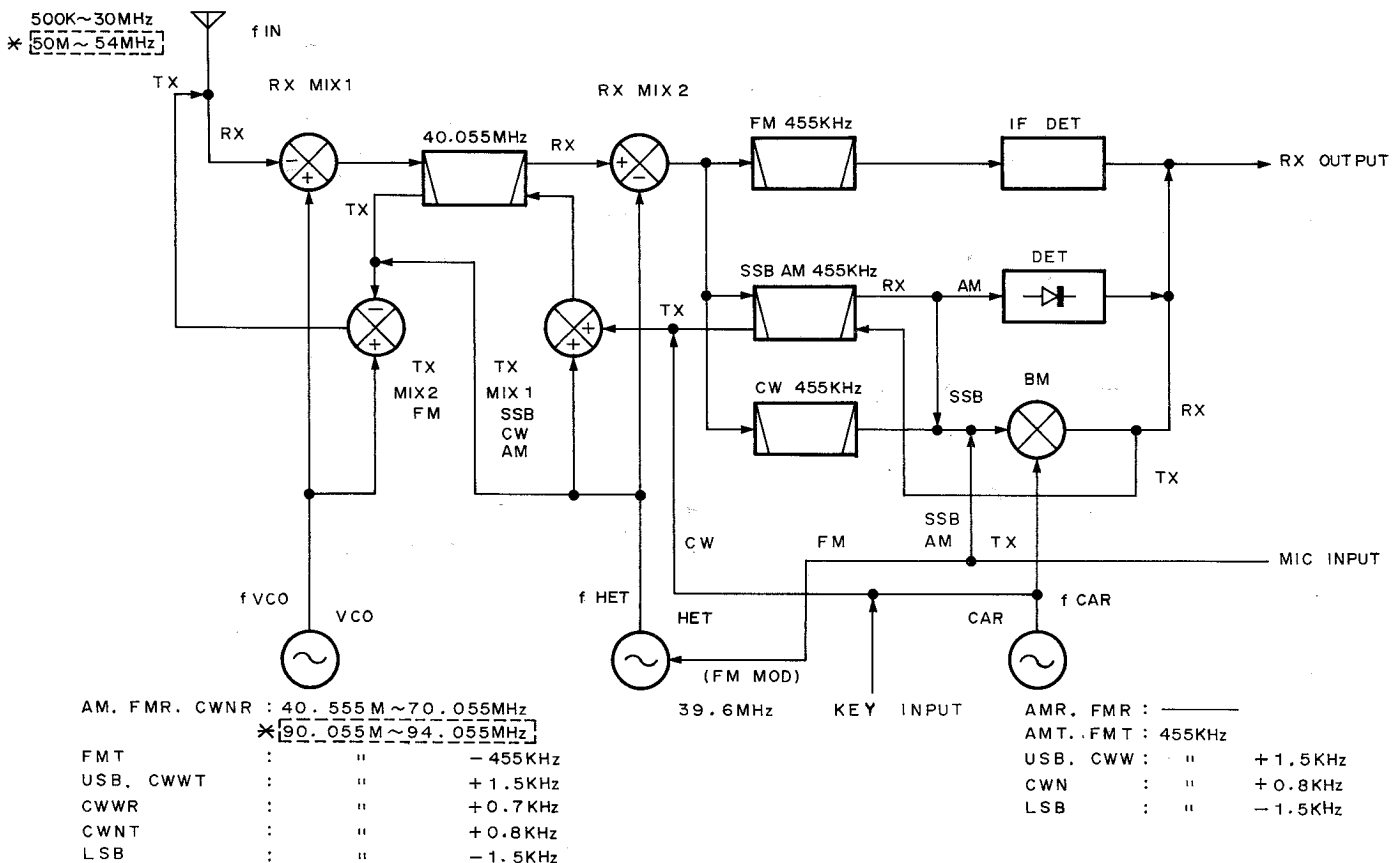


Fig. 1 Signal system frequency configuration

## CIRCUIT DESCRIPTION

for VCO1, in the range of 500kHz to 30MHz

$$f_{VCO1} - \left( \frac{f_{VCO2}}{100} + \frac{f_{VCO3}}{200} + \frac{f_{STD}}{8} + f_{STD} - \frac{f_{STD}}{8} \right) = \frac{f_{STD}}{8 \times 90}$$

$$\therefore f_{VCO1} = \left( \frac{N}{720} + \frac{M}{3600000} + \frac{L}{1440000} + 1 \right) f_{STD} \dots\dots\dots (5)$$

Each local oscillator frequency may be summarized as follows:

$$f_{VCO} = f_{VCO1} \dots\dots\dots (6)$$

$$f_{HET} = f_{VCO4} \dots\dots\dots (7)$$

$$f_{CAR} = \frac{f_{VCO3}}{200} = \frac{L}{1440000} f_{STD} \dots\dots\dots (8)$$

Therefore,  $f_{IN}$  in equation (1) is expressed as follows:

VCO1-A: 500kHz to 10.5MHz:

$$f_{IN} = \left( \frac{N}{720} + \frac{M}{3600000} - \frac{J}{8K} + 1 \right) f_{STD} \dots\dots\dots (9)$$

Similarly, VCO1-B and VCO1-C are represented as follows:

VCO1-B: 10.5MHz to 21.5MHz:

$$f_{IN} = \left( \frac{N}{720} + \frac{M}{3600000} - \frac{J}{8K} + \frac{9}{8} \right) f_{STD} \dots\dots\dots (10)$$

VCO1-C: 21.5MHz to 30MHz:

$$f_{IN} = \left( \frac{M}{3600000} - \frac{N}{720} - \frac{J}{8K} + \frac{17}{8} \right) f_{STD} \dots\dots\dots (11)$$

\*VCO1-D: 50MHz to 54MHz:

$$f_{IN} = \left( \frac{N}{720} + \frac{M}{3600000} - \frac{J}{8K} + \frac{17}{8} \right) f_{STD} \dots\dots\dots (12)$$

As we have shown in equations (9) to (12) above the term  $f_{CAR}$  can be eliminated, therefore the receive frequency is determined only by the reference  $f_{STD}$  and division ratios J to N (except L) (\*J,K,M and N).

These equations may be further analyzed as follows:

- (1) The division ratios are determined according to the desired operating frequency, by the microprocessor, and can be assumed to essentially contain no errors.
- (2) Since each relationship is expressed using the  $f_{STD}$  linear equation, the reference frequency accuracy equals the operating frequency accuracy.
- (3) The operating frequency remains unchanged even when the value of L changes.

When  $f_{IN} = 14\text{MHz}$  (USB) equation (10) is as follows:

J = 180, K = 1,584, L = 18,260, M = 55,000, N = 251

Therefore,  $f_{IN} = 1.25 f_{STD} \dots\dots\dots (13)$

When  $f_{IN} = 29.99999\text{MHz}$  (USB) equation (11) is as follows:

J = 180, K = 1,584, L = 18,260, M = 59,999, N = 149

Therefore,  $f_{IN} = 1.82 f_{STD} \dots\dots\dots (14)$

\*When  $f_{IN} = 53.99999\text{MHz}$  (USB) equation (12) is as follows:

J = 180, K = 1,584, L = 18,260, M = 59,999, N = 330

Therefore,  $f_{IN} = 2.49 f_{STD} \dots\dots\dots (15)$

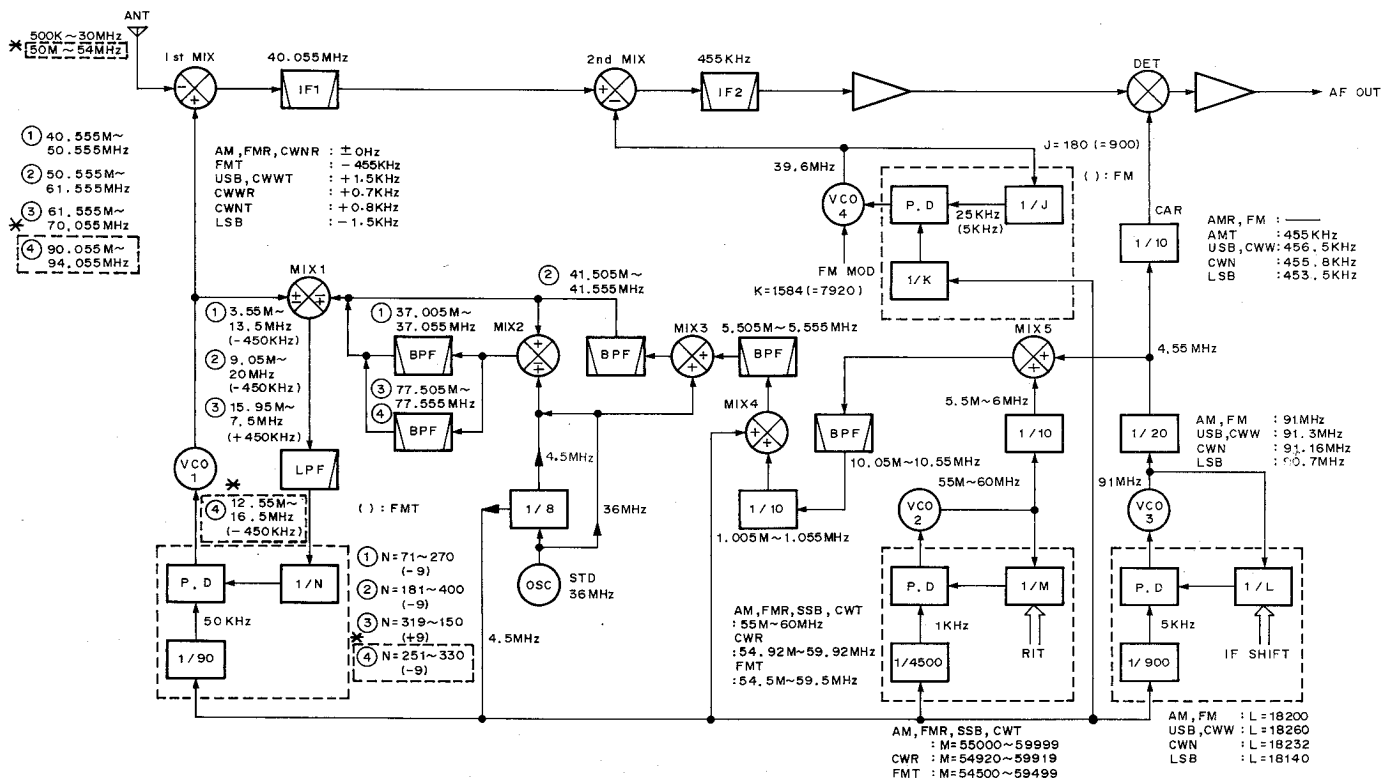


Fig. 2 PLL system frequency configuration

## CIRCUIT DESCRIPTION

Since the accuracy of the reference crystal oscillator used in the TS-140 is 10PPM (-10 to +50 deg C), the overall accuracy is obtained by equations (9) to (12) according to characteristics (1) and (2). It is  $\pm 450\text{Hz}$  for 14MHz, and  $\pm 660\text{Hz}$  maximum for the frequency range of 500kHz to 30MHz. The accuracy of the transceiver is very stable.

\*The total accuracy is  $\pm 900\text{Hz}$  at maximum for 50 to 54 MHz.

The variable band functions such as the IF shift are controlled by the microprocessor, by controlling the value of L, thus taking advantage of the characteristics (3). The carrier point setting and initial IF shift setting are adjusted by fine tuning of fCAR.

The receive frequency in SSB mode has been discussed already. In the other modes and during transmit operations the other modes and during transmit operations frequency is determined by the reference and division ratios in the same manner as in the SSB mode in.

For CW receive the fVCO frequency is shifted down 800Hz at fVCO2.

For FM transmit the fVCO frequency is shifted down 455Hz at fVCO1 and fVCO2. The audio signal from the microphone is applied to VCO4, and fHET is directly modulated.

fCAR is stabilized by shift data During transmit and receive in the AM mode, and during receive in the FM mode.

The displayed frequency in each mode is listed in table 1.

| Mode     | Display frequency          |
|----------|----------------------------|
| USB, LSB | Carrier point frequency    |
| CW       | Transmit carrier frequency |
| AM, FM   | IF filter center frequency |

Table 1 Display frequencies in modes

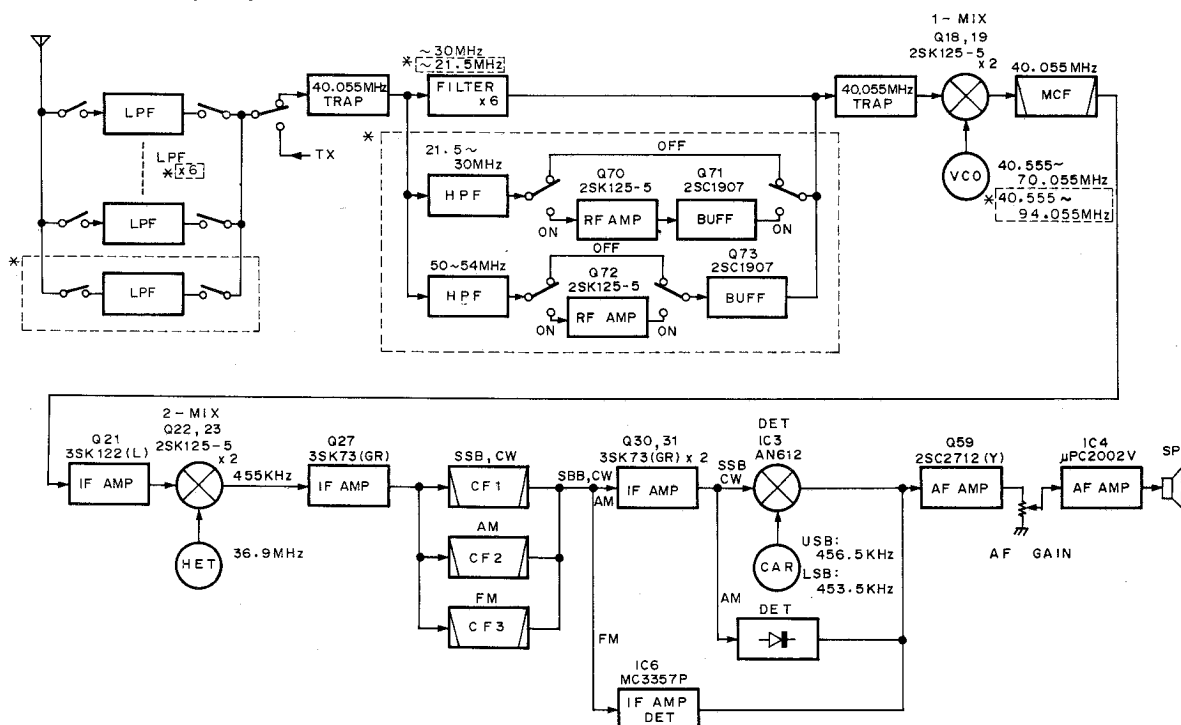


Fig. 3 Receive circuit configuration

### Receive Circuit Configuration

The TS-140 receive system operates using double conversion with a first IF of 40.055MHz and a second IF of 455kHz.

The incoming signal from the ANT terminal passes through the filter unit LPF (Low Pass Filter) and transmit/receive switching relay, and is then applied to the RAT terminal of the signal unit. This signal passes through the 20dB attenuator circuit and an IF trap, and enters the 7 part HPF (High Pass Filter) (BPF for 1.6 to 2.5MHz). It combines with the LPF of the filter unit to give the required band rejection for each band.

\*When the signal passes through the HPF, the preamplifier can be turned off or on via relays controlled by Q70 (2SK125-5) and Q71 (2SC1907) for 21.5 to 30 MHz or Q72 (2SK125-5) for 50 to 54MHz. When the preamplifier is turned on the signal is amplified approximately 10dB. For 50 to 54MHz the signal passes through buffer amplifier Q73 (2SC1907) for impedance matching regardless of the preamplifier state.

The signal passes through the IF trap again, and is combined with the VCO (Voltage Controlled Oscillator) in the first mixer, Q18 and Q19 (2SK125-5), to generate the first UF of 40.055MHz. The VCO circuit consists of Q9 thru Q11 (2SC2668Y), and generates 40.555 thru 70.055MHz by dividing it into three bands. The frequency is controlled by the DC signal (VCV) from the control unit.

## CIRCUIT DESCRIPTION

\*90.055 to 94.055MHz is generated by the VCO Q12 (2SK192A GR \*J). Therefore the circuit contains four VCO's.

The first IF signal of 40.055MHz passes through the two stage MCF (Monolithic Crystal Filter) that is used in both transmit and receive, and is then amplified by the first IF amplifier Q21 (3SK122L), mixed with the 39.6MHz heterodyne signal by the second mixer, Q22 and Q23 (2SK125-5), to generate the second IF of 455kHz. The heterodyne signal is generated by the control unit, then amplified for use by Q78\* (2SK73GR). One portion of the 455kHz signal is applied to the noise blanker amplifier, and the other is amplified by Q27 (2SK73GR), passed through the mode specific ceramic filter (CF1 to CF3) or an optional filter to generate the necessary bandwidth, divided into appropriate mode, and fed into each amplifier circuit.

In modes other than FM, the signal is amplified by IF amplifier Q30 and Q31 (3SK73GR), detected by IC3 (AN612) for SSB and CW, and envelope detected by D75 for the AM mode.

In the FM mode the signal is transmitted to IC6 (MC3357P) for limiting, amplification, and detection. This circuit is noise squelch controlled.

The AF signal in each mode after detection is selected by analog switch IC7 (TC4066BP), amplified by Q56 (2SC2717Y), applied to the AF volume control, and amplified the final level by IC4 ( $\mu$ PC2002V).

| Item  | Rating                |
|---|-----------------------|
| Nominal center frequency (fo)                   | 455kHz                |
| 6dB bandwidth                                   | $\pm 2$ kHz or less   |
| 40dB bandwidth                                  | $\pm 7.5$ kHz or less |
| Insertion loss                                  | 6dB or less           |
| Guaranteed attenuation (Within fo $\pm 100$ Hz) | 35dB or more          |
| I/O termination impedance                       | 2.0k $\Omega$         |

**Table 4 Ceramic filter (L72-0355-05)  
(Signal unit CF2)**

| Item   | Rating                 |
|--|------------------------|
| Nominal center frequency (fo)                    | 455kHz $\pm 1$ kHz     |
| 6dB bandwidth (From 455kHz)                      | $\pm 6$ kHz or more    |
| 50dB bandwidth (From 455kHz)                     | $\pm 12.5$ kHz or less |
| Ripple (Within fo $\pm 4$ kHz)                   | 3dB or less            |
| Insertion loss                                   | 6dB or less            |
| Guaranteed attenuation (Within fo $\pm 100$ kHz) | 35dB or more           |
| I/O termination impedance                        | 2.0k $\Omega$          |

**Table 5 Ceramic filter (L72-0315-05)  
(Signal unit CF3)**

| Item  | Rating  |
|---|---|
| Nominal center frequency (fo) and declination | 40.055MHz $\pm 0.75$ kHz or more  |
| Pass bandwidth                                | fo $\pm 7.5$ kHz or more at 3dB   |
| Attenuation bandwidth                         | fo $\pm 25$ kHz or more at 30dB<br>fo $\pm 150$ kHz or more at 60dB<br>Spurious is 30dB or more |
| Guaranteed attenuation                        | 60dB or more at<br>fo $\pm 150$ kHz $\sim$ fo $\pm 1000$ kHz                                    |
| Ripple  | 1.5dB or less   |
| Insertion loss                                | 4dB or less   |
| I/O termination impedance                     | 4.2k $\Omega$   |

**Table 2 MCF (L71-0275-05) (Signal unit XF1)**

| Item                                     | Rating                     |
|--|----------------------------|
| Center frequency at 6dB                  | 455kHz $\pm 0.20$ kHz      |
| 6dB bandwidth (total)                    | $\pm 1.1 \sim \pm 1.3$ kHz |
| 60dB bandwidth                           | 4.5kHz or less             |
| Guaranteed attenuation (0.1 $\sim$ 1MHz) | 60dB or more               |
| Spurious (600 $\sim$ 700kHz)             | 40dB or more               |
| Ripple at 6dB bandwidth                  | 2dB or less                |
| Insertion loss                           | 2dB or less                |
| I/O termination impedance                | 2k $\Omega$                |

**Table 3 Ceramic filter (L72-0356-05)  
(Signal unit CF1)**

### Noise Blanker Circuit

#### NB1

NB1 is a noise blanker circuit which is designed for short duration noise interference such as might be encountered in an automobile. The 455kHz IF signal generated from the first IF of 40.055MHz by the second MIX is amplified by the noise amplifiers Q45, Q46, Q47 (2SC2712Y), buffered by Q48, and noise detected by D86. This signal switches Q51 (2SC2712Y), turns on Q28 (2SA1162Y) and Q29 (2SC2712Y), and switches the IF signal line according to variations in the incoming noise.

When NB1 turns on, a DC voltage is applied to the emitter of Q51 from the threshold control, VR4. The effect of the noise blanker is controlled by varying this emitter voltage.

## CIRCUIT DESCRIPTION

### NB2

NB2 is a noise blanker circuit which blanks noises that have a relatively long duration, such as is generated by the so called "Russian Woodpecker". The noise signal is first amplified by noise amplifiers Q45 thru Q47, and then detected by D87, just as occurs with NB1. The threshold voltage on the emitter of Q50 (2SC2712Y) is also controlled by VR4. Q50's output enters the NB2 module unit X59-3350-00 to synchronize pulse width and period signals with the woodpecker noise.

1/4, 4/4 and 2/4, 3/4 of IC1 (TC4011BF), are adjusted to a pulse width of 40ms.

Normally, woodpecker type noise has a pulse width of 3 to 4ms and a period of 80 to 100ms, but some woodpecker noise signals might have a period of approximately 50ms, although rare.

Therefore, even woodpecker noise with a large pulse width can be blanked by switching the noise at a 5ms rate. However, if noise with a period of several ms is encountered, such as ignition noise, and is blanked at this same interval, then the signal level will drop or become zero. To prevent this from occurring a one-shot multivibrator, composed of IC1 2/4, 3/4, is utilized so that the next pulse does not occur until after a delay of 40ms, from the last output from IC1 1/4, 4/4.

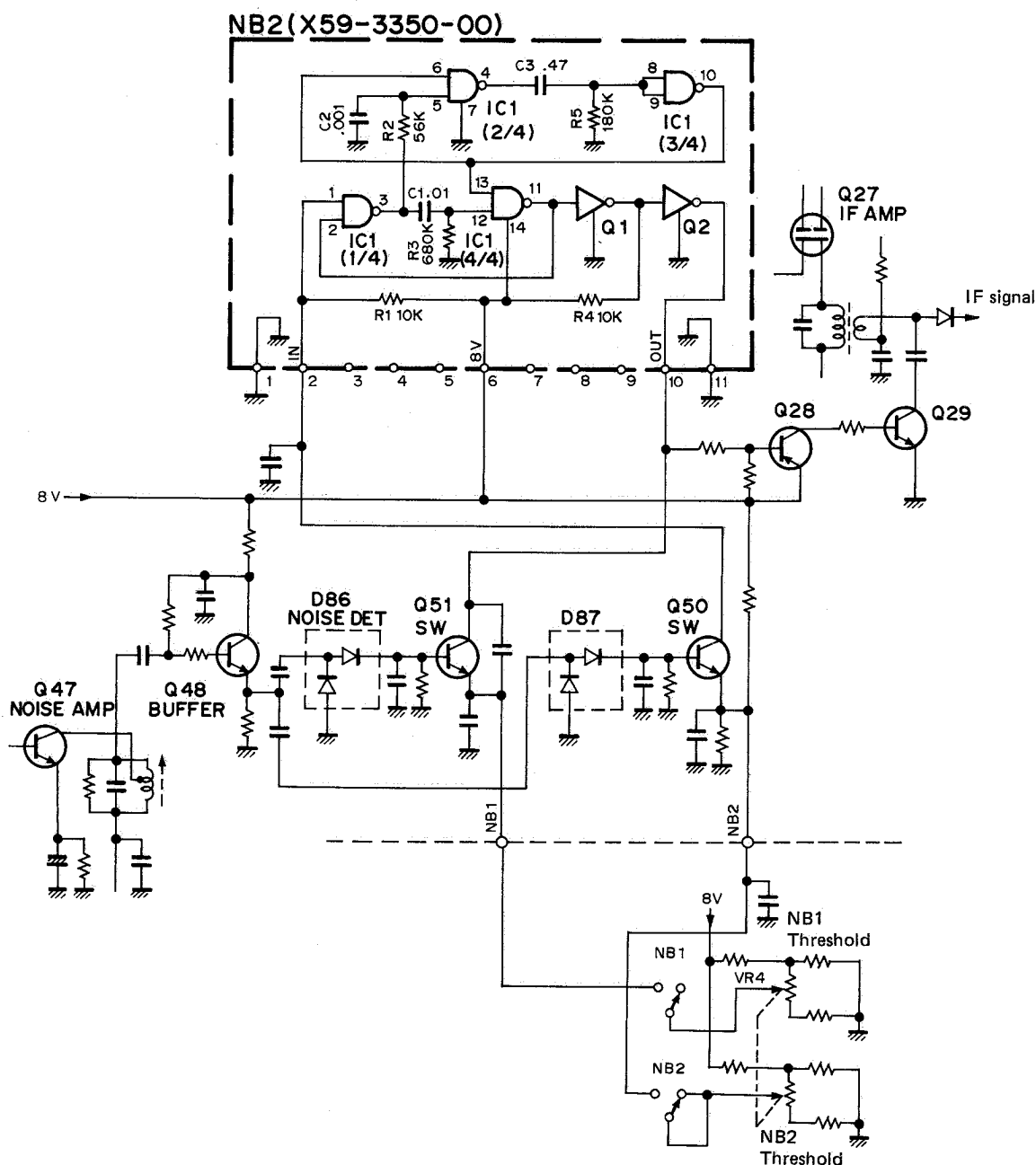


Fig. 4 Noise blanker circuit

## CIRCUIT DESCRIPTION

### Transmit Circuit Configuration

The transmit system operates utilizing double conversion for SSB, CW and AM and single conversion when operating in the FM mode.

The audio signal from the microphone terminal enters from the switch unit (CN5 "MIC"), and divides into a modulation and a VOX signal. The modulation signal is amplified by approximately 20dB by IC1. Signals from data communications devices enter the ACC2 terminal on the rear panel of the radio and are applied to IC1. The output from IC1 is applied directly to the MIC GAIN control on the front panel and to the FM modulation circuit.

The VOX signal is amplified by Q6 and enters the signal unit (CN501 "VOX"), and then enters the VOX module (X59-1080-00). The output from this module passes through the VOX switch and enters the DELAY TIME module (X59-3360-00) to control the transmitter and receiver.

During SSB and AM operation the signal that passes through the microphone gain control will enter the signal unit (CN1 "MV2"), where it is amplified by Q74 (2SC2712 Y) and applied to the balanced modulator IC3 (AN612). In the AM mode, however, the balance of IC3 is upset to generate the AM signal. Q74 does not operate in FM and

CW modes because the voltage is applied to the emitter through diode D89. The 455kHz DSB (Double Side Band) signal generated by IC3 passes through the transmit switching diodes D55 and D64, filter switching diodes D56, D57 (SSB), or D57, D60 (AM) to generate the 455kHz SSB or AM signal.

The SSB and AM signals pass through transmit switching diode D55, and are amplified by IF amplifier Q86. The carrier in CW mode optimizes the level past the PIN diode D74. The signal then passes through switching diodes D109, D110, and D122 and enters Q86 (3SK73GR).

Q86 is used to perform ALC (Automatic Level Control) and CW keying.

The 39.6MHz HET signal from the control unit enters the signal unit (CN21 "HET") and is amplified by HET amplifier Q78 (3SK73GR). This HET signal passes through switching diode D100, in the SSB, CW and AM modes, and is fed into the first transmit mixer IC5.

The output from the IF amplifier also enters IC5 and is combined with the HET signal to generate a 40.055MHz signal.

The output from IC5 passes through a MCF, which removes spurious components and enters the second transmit mixer Q79 and Q80 (3SK122L).

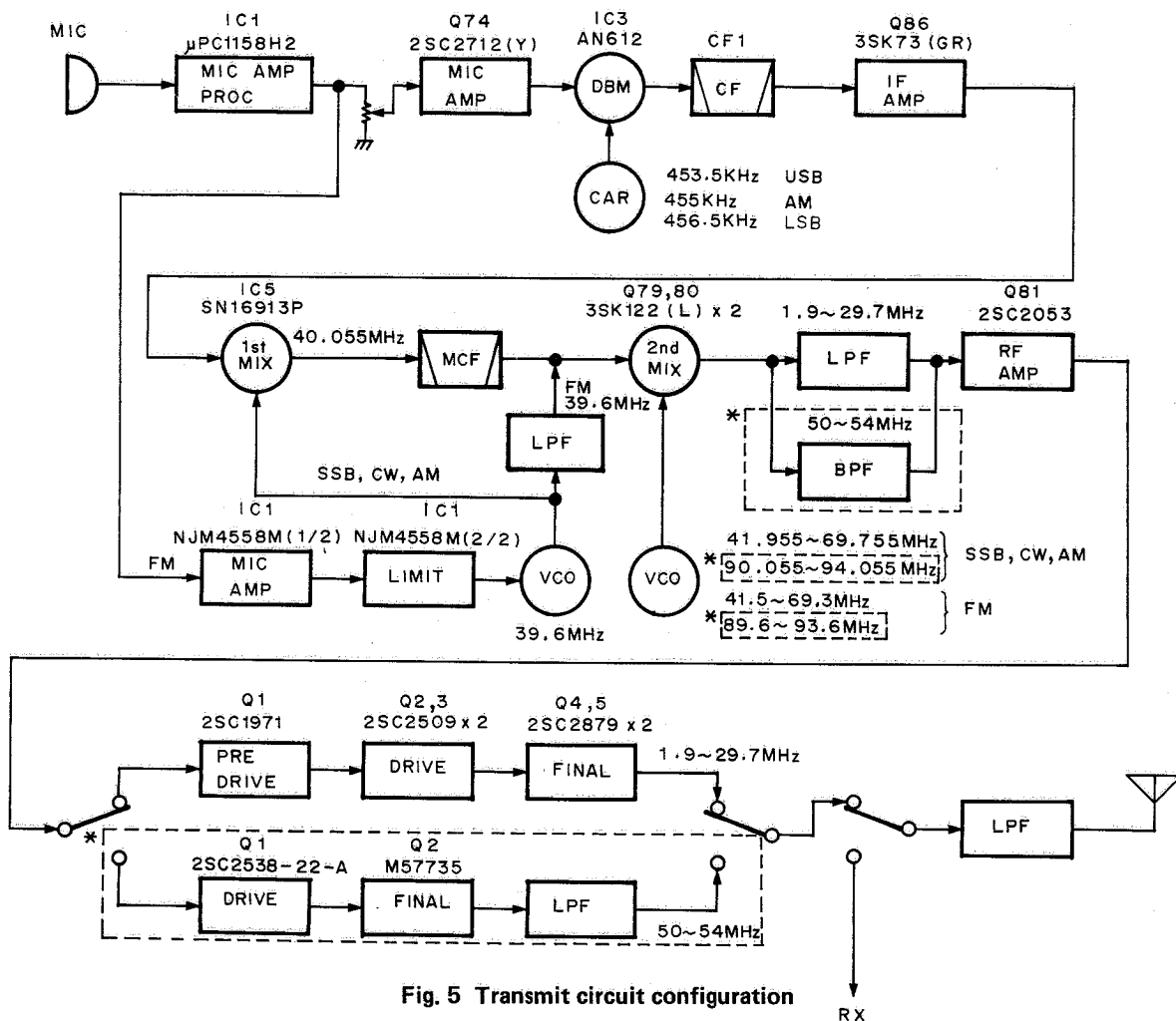


Fig. 5 Transmit circuit configuration

## CIRCUIT DESCRIPTION

In FM the output of the MIC amplifier, IC1 of the switch unit, enters the signal unit FM MIC amplifier module (X59-3000-02). This module also functions as the MIC amplifier, limiter circuit, and low-pass filter circuit. The output enters the control unit from the FMM terminal and modulates the 39.6MHz oscillator, VCO4. In modes other than FM, the power of the FM microphone amplifier module is not turned on, and therefore modulation is not affected.

The 39.6MHz signal from the control unit to the signal unit is the HET signal for SSB, AM, and CW modes and the first IF frequency in the FM mode. The IF frequency which enters the signal unit is amplified by IF amplifier Q78. Q78 is the ALC controller. The second gate of Q78 has a fixed bias in modes other than FM, therefore ALC does not function.

The output from Q78 (3SK73GR) passes through switching diodes D101, D102, and D124, a low-pass filter, and is delivered to the final mixer (the second mixer in modes other than FM). Since the IF frequency in the FM mode is different from that in the other modes, the frequency is corrected by the final VCO.

The signal is converted into an actual transmit frequency by the final mixer and passes through the IF trap (40.055 MHz) and low pass filter, is amplified by RF amplifier Q81, and passes through output transformer L111 to become the driver output.

The driver output from the signal unit now enters the final unit.

The output is amplified by final unit transistors Q1, Q2, Q3, Q4 and Q5 to generate a 100W final output. Then enters the filter unit.

The final unit output passes through the transmit/receive switching relay, K16, and individual low-pass filters for each band, and is then applied to the antenna terminal.

The ALC is detected by the output section of the low pass filter.

\*The 50MHz band signal is separate from the HF band signal after it passes through the IF trap. This signal for the 50MHz band passes through switching diodes D104, and D106 and a band-pass filter. It is then amplified by RF amplifier Q81 (2SC2053), which is shared by the HF bands. Then the signal passes through the output transformer L11, enters the final unit, and is split from the HF path by relay K1. The signal is then applied to the filter unit. This signal is amplified to the required level by the drive amplifier (Q1) and power module Q2. It passes through the low pass filter, and is supplied to the antenna.

### Standby Control Circuit

To switch between transmit and receive for full break-in, or for AMTOR/Packet use, the microprocessor sends various timing signals to control the transmit/receive circuits.

When the standby signal SS from the Standby switch is applied to the microprocessor, three signals are generated, CTX, RB, and CKY. Signals TXB, RXB, and RL are generated based upon these signals to operate the transmit/receive circuit.

The role of each of these signals is describe below:

SS: Reference signal to control each signal (standby switch, PTT switch, and key input)

CTX: Control signal from the microprocessor to generate TXB

RB: Control signal to mute the receive signal line

CKY: Control signal for keying

TXB: 8V line for the transmit circuits

RXB: 8V line for the receive circuits

RL: 13.8V line for the transmit circuits

CKB: 8V line for keying generated by CKY

The signal timings are shown in the figure 6.

The timing after the standby switch is switched to transmit and until the system return to the receive state is as follows:

1. When SS goes low, the microprocessor judges whether the frequency is transmittable or not. If so, the microprocessor switches CTX high 10ms after SS goes low.
2. Module unit (X59-3340-00) receive the CTX signal, and causes TXB and RL to go high.
3. CKY goes high 2ms after TXB goes high, CKB is driven to generate the keying voltage.
4. The transmit signal is emitted approximately 7ms after the CKB is actuated.
5. To return to receive, the transmit signal stops approximately 7ms after the SS line goes high, and TXB and RL return low, as RXB goes high.
6. The RB voltage used for turning on the receive signal line goes high 12ms after RXB goes high, and a signal is received.



## CIRCUIT DESCRIPTION

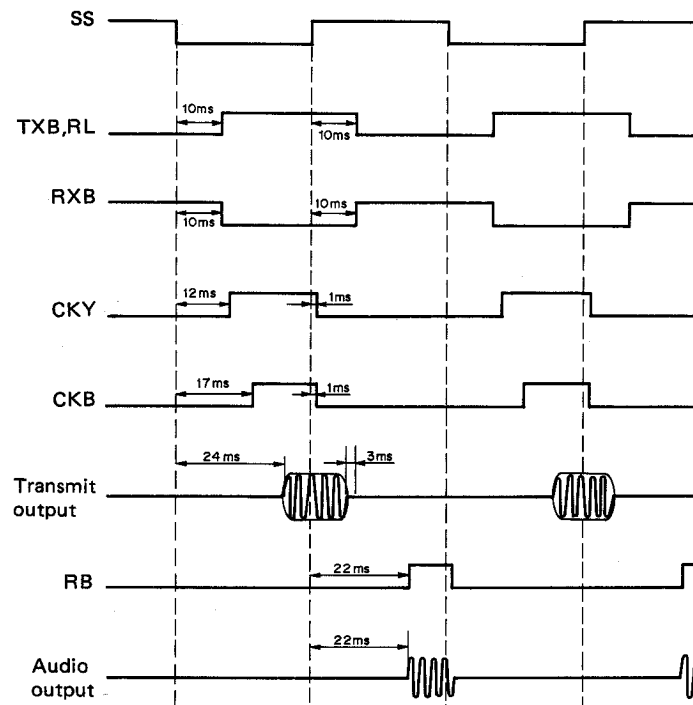


Fig. 6 Transmit/Receive timing chart

### Break-in Operation

#### Manual keying

When the standby switch is turned ON, the base of Q90 (2SA1162Y) goes low, and Q91 (DTC114EK) turns on. CSS goes low, and CTX from the microprocessor turns on Q4 (DTC114EK) of the module unit (X59-3340-00). RL is emitted from Q1 (2SA1204Y), and TXB is applied from Q2 (2SA1204Y). Microprocessor output CKY turns on Q5 (DTC114EK) of the module unit (X59-3360-00), causing the emitter of Q7 (DTC114TK) to go to ground. One end of the Q7 collector is connected to Q87 (2SA1162Y) of the signal unit (X57-3190-00), and the other is connected to the key jack from Q84 (DTC114EK) from the COM terminal via the break-in changeover switch.

Q87 (2SA1162Y) is turned on and produce the CKB voltage when the key is closed, and Q86 (3SK73GR) of the send IF amplifier is keyed.

#### Semi-Break-In Keying

CW8 is applied to the base of Q84 and Q99. Therefore, they are ready to turn on when the emitter is connected to ground.

When the key is closed, the SEM terminal of the module unit (X59-3360-00) is connected to ground through Q99 and Q84 keys.

Q6 and Q2 in the module unit turn on, and trigger one-shot multivibrator IC1 (MB74LS122). A pulse is output from pin 8 to turn Q1 on and connect the SS line to ground.

When the key is closed, the IC8 output pulse returns to a low level and the SS line goes high after a time constant determined by setting of the VOX delay control VR7 and C254.

The key line switches Q87 via the COM terminal at this same time, and keys Q86 in real time.

#### Full Break-In

The key connects to the SS line and has the same function as the standby switch. When the key is closed, Q84 turns on, the base of Q90 is connected to the ground, Q91 is turned on, and CSS is switched low. The TXB and RL voltages are generated by the CTX signal, and the CKB voltage is used to generate the CKY signal voltage just as in manual keying.

Full break-in is different from manual keying in that the base of Q87 is controlled directly by the key in manual keying. In full break-in Q87 is controlled via Q5 and Q7 of the module unit (X59-3360-00) by the CKY signal from the microprocessor by turning the SS line on and off.

The reason is that in full break-in, the timing the transmit signal is set so that the radio signal is transmitted after the control signal is completely switched and the transmit system become stable; control is passed to receive after the signal stops, a receive signal is output, and the receive system becomes stable.

## CIRCUIT DESCRIPTION

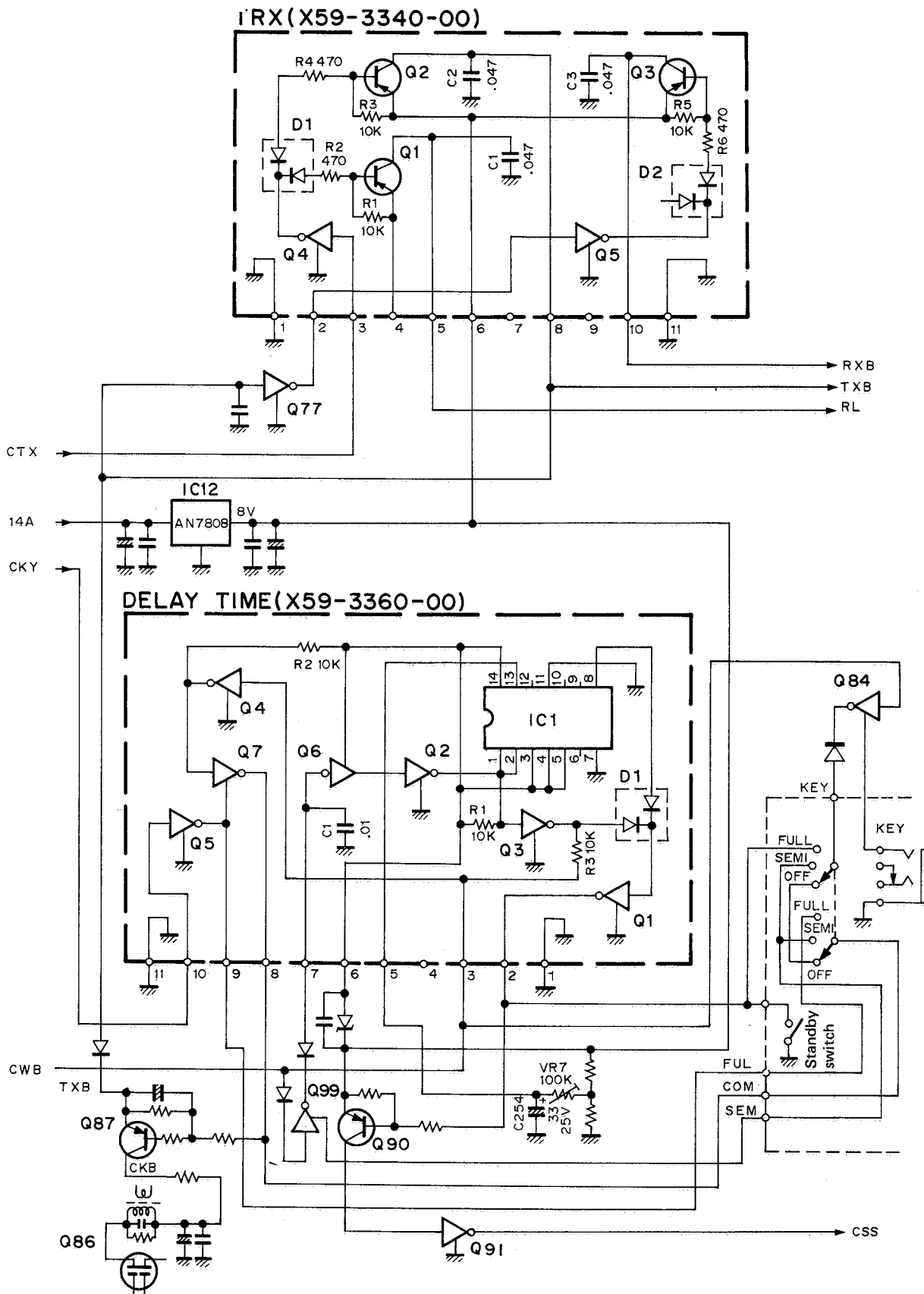


Fig. 7 Standby control circuit

## CIRCUIT DESCRIPTION

### ALC Circuit

A new ALC circuit is used to control the output according to the selected mode.

The output in the HF band is 100W for the CW mode, 110W for the SSB mode, and 50W for FM. therefore, the ALC detection voltage is different for each mode. CW is used as the standard reference mode. The gain of IC11 (3/4), in the ALC circuit, is varied according to the mode and transmit power. For example, since the output in FM is 50W, the gain of IC11(3/4) must be increased by 3dB, with respect to the CW reference, to correct any deficiencies in the feedback voltage.

\*Since the 50MHz band has only 10 watts output the gain of IC11(3/4) is increased by 10dB.

IC11(1/4) controls the ALC and power. IC11(1/4) functions as a differential amplifier in which the signal from IC11(3/4) enters the negative terminal and the power control voltage enters the positive terminal. As the transmitter output increases, the voltage at the negative terminal increases, and the output from IC11(1/4) decreases. When this output falls below the ALC reference of 2.5V, ALC action will begin.

The power is controlled by changing the voltage at the positive terminal of IC11(1/4). For the AM and CW modes the power is fixed at its maximum full power state since the center of VR2 (PC2) is held open.

The power control voltage (PCV) changes with power, voltage and temperature. When the power, or voltage rises, the PCV is limited by zener diode D116 to avoid excessive

power output. When the voltage falls, the power is increased. As the temperature rises, the resistance of thermister TH4 decreases, and the PCV rises, but excessive power output is prevented by the (negative) temperature coefficient of the zener diode. When the temperature falls, the PCV is reduced by the thermister, and power is reduced.

The drive level is also controlled in the FM mode. The input to IF amplifier Q78 (HET amplifier in modes other than FM) is controlled by PIN diode D96. The capacitor connected in parallel is provided to gain the minimum drive level at the maximum power.

### VSWR Protection Circuit

To determine a time constant for the reflected wave, the reflected wave voltage is amplified by IC11(2/4) and applied to IC11(3/4) to provide protection.

### Temperature Protection Circuit

The temperature detection circuit of the final unit is made modular to reduce its size. The surface temperature of the radiator is as follows:

- Cooling fan start ..... 50 deg C
- Cooling fan stop ..... 45 deg C
- Temperature protection start ..... 80 deg C
- Temperature protection stop ..... 70 deg C

When the temperature protection operates the ALC voltage and the power fall. The system does not return to the receive state.

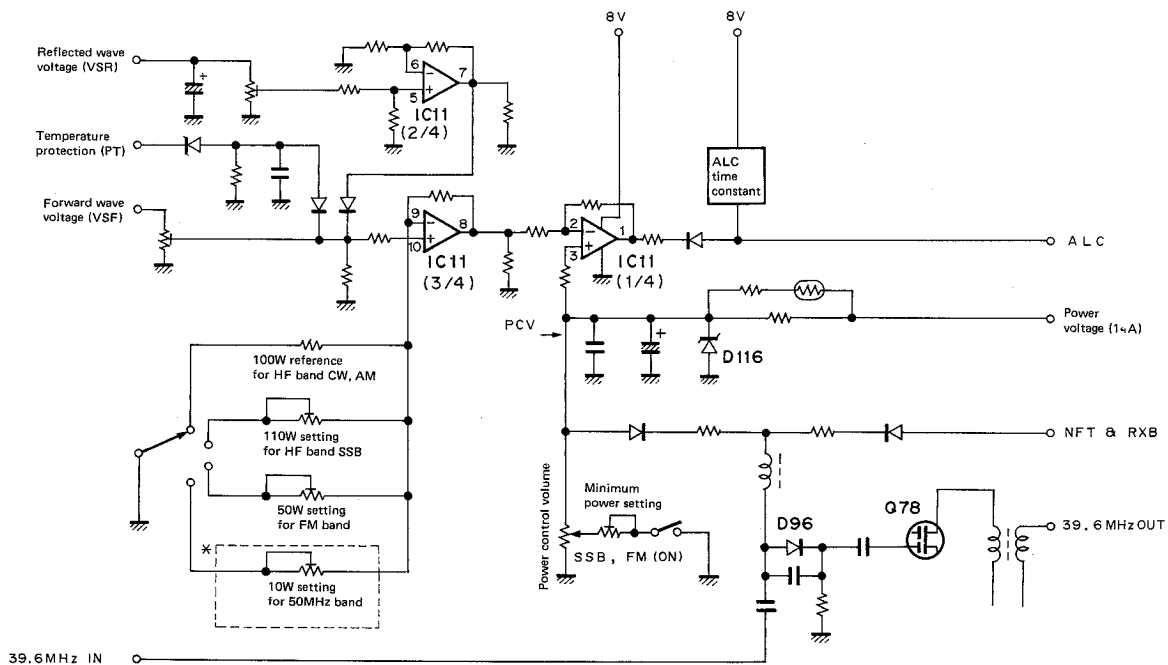


Fig. 8 ALC and power control circuit

## CIRCUIT DESCRIPTION

### Speech Processor Circuit

The SWITCH UNIT (A/4) IC1 is an audio type speech processor which also function as the first stage microphone amplifier. When the processor switch is OFF, the switch unit operates as a 20dB microphone amplifier. When the processor switch is ON, it operates as an ALC controlled amplifier with ALC with a maximum gain of 40dB.

The compression is set to approximately 20dB when the input signal to the MIC terminal is 10mV.

When the processor switch is ON, 8V DC is applied to the base of the gain adjustment switching transistor Q1. Simultaneously the feedback amplifier begins operating.

When the switch unit is put on stand-by remotely by data from terminal units connected to accessory terminal number 2 (such as packet, and AMTOR) Q2, Q3, and Q4 are turned ON, the microphone circuit is muted, the SS terminal is switched low, thus stabilizing the transmission.

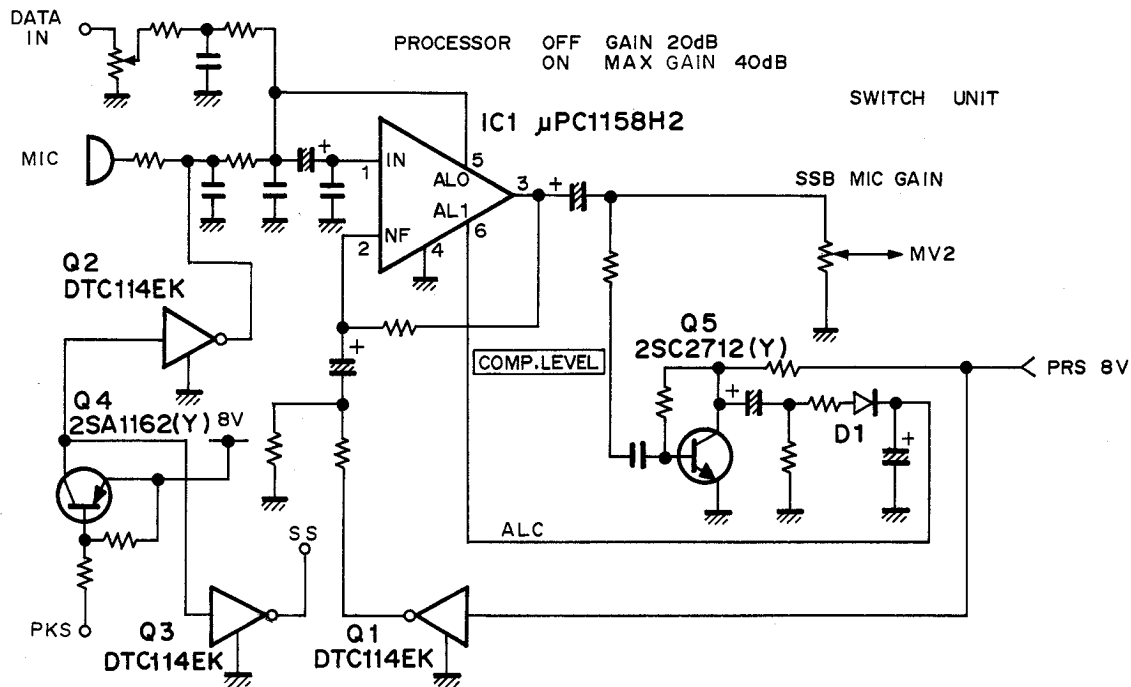


Fig. 9 Speech processor circuit

### PLL Circuit

The TS-140 PLL circuit consists of three PLL loops which cover 500kHz to 30MHz in 10Hz steps with a reference frequency of 36MHz.

\*The PLL circuit consists of four PLL loops, including 50MHz to 54MHz.

The carrier frequency is inserted into the PLL loop to provide the IF shift function. The carrier circuit PLL loop and the HET circuit PLL loop that always generates a 39.6 MHz frequency are also included. Division ratio data to these PLL loops controlled by the microprocessor. A single crystal frequency management method, in which phases are compared with that of a reference frequency fSTD, is used for this transceiver.

The block diagram of the PLL circuit is provided in figure 10.

The reference frequency fSTD, which is used as a basis for TS-140 frequency control, is generated by a 36MHz crystal and oscillator Q9 (2SC2787L). The fSTD passes through buffers Q10 and Q12 (2SC2668Y), enters IC10 (SN16913P), passes through a LPF, and enters IC11 (SN16913P). This signal passes through buffer Q11 (2SC2668Y), and is divided by 8 in IC8 (M74LS93P) to generate a 4.5MHz signal. This signal passes through a LPF, and enters IC9 and IC11 (SN16913P) in the main loop. The signal passes through a LPF, and become the 4.5MHz reference frequency, fR, for each PLL circuit.

## CIRCUIT DESCRIPTION

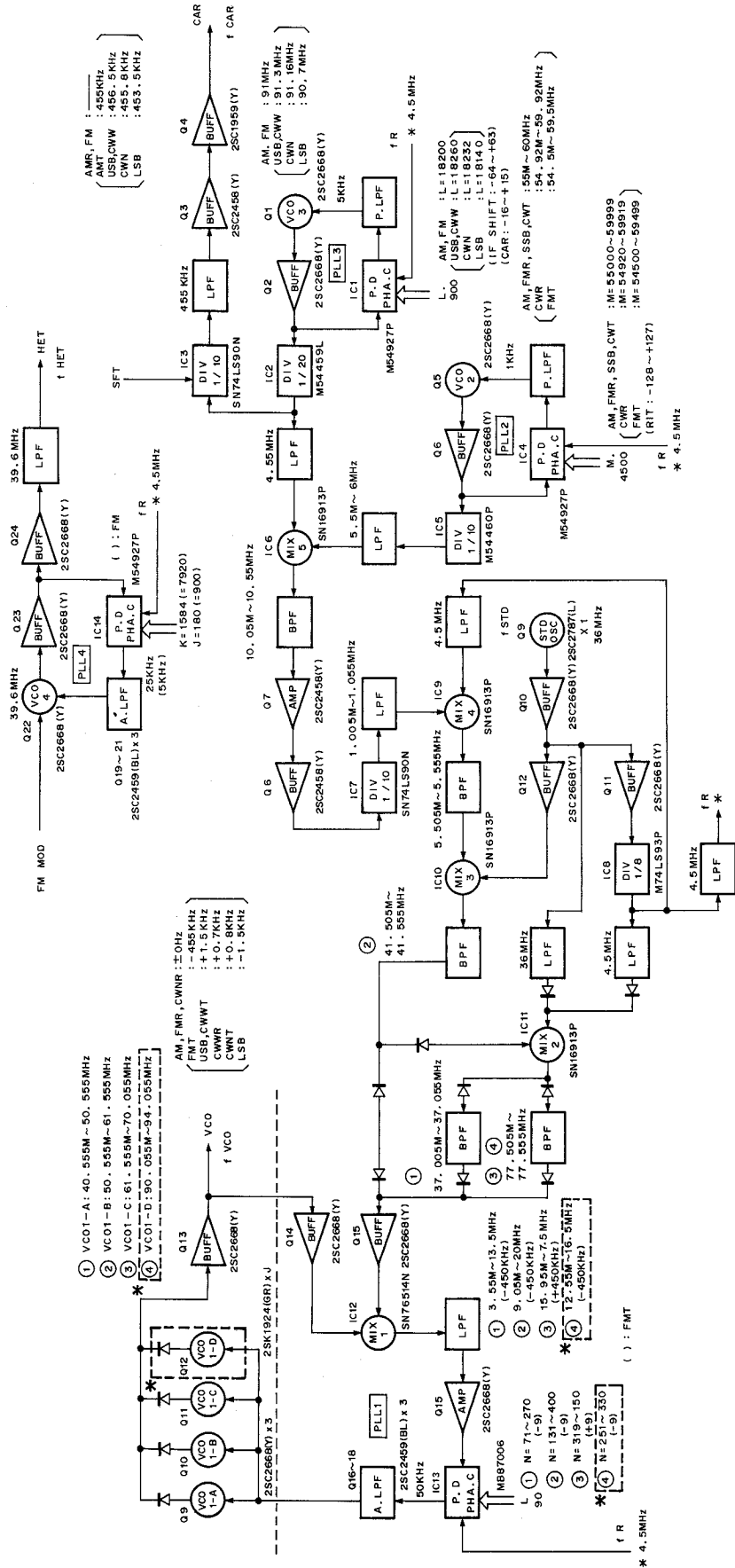


Fig. 10 PLL block diagram

## CIRCUIT DESCRIPTION

### PLL4

PLL4 consists of IC14 (M54927P), and VCO4, Q22 (2SC2668Y), is locked at 39.6MHz. The 4.5MHz reference frequency,  $f_R$ , is applied to IC14 pin 15, and is divided internally by 180 (900 for FM) to generate a comparison frequency of 25kHz (5kHz for FM). The from VCO4 output passes through buffer Q23 (2SC2668Y), applied to IC14 pin 3, and divided internally by 1584 (7920 for FM). The resulting signal is compared with the 25kHz (5kHz for FM) reference signal by the phase comparator, thus locking VCO4. Division ratios K and J are transmitted from digital control circuit via DA, CK, and PR4.

The output from PLL4 passes through Q24 (2SC2668Y) and a LPF and is fed into the signal unit as the HET signal.

### PLL3

PLL3 consists of IC1 (M54927P), and VCO3, Q1 (2SC2668Y), is locked at about 91MHz with a frequency that varies with the mode.

The 4.5MHz reference frequency,  $f_R$ , is applied to IC1 pin 15, and divided internally by 900 to generate a 5kHz comparison frequency. The output from VCO3 passes through buffer Q2 (2SC2668Y), is applied to IC1 pin 3, and multiplied internally by the division ratio (about 1/18200) determined according to the mode. The resulting signal is compared with the 5kHz reference signal by the phase comparator, thus locking VCO3. Division ratio L is transmitted from the digital control circuit via DA, CK, and PR3.

The PLL3 output is divided by 20 in IC2 (M54459L), and directed to two circuits. One signal enters IC3 (SN74LS90N) of the carrier circuit, is divided by 10, passes through a LPF, buffers, Q3 (2SC2458Y) and Q4 (2SC1959Y) and fed into the signal unit as a carrier signal. During AM reception and AM/FM transmission, IC3 operation is stopped by the SFT data signal to remove the carrier signal.

The other signal is divided by 20, passes through a LPF, and enters MIX5 IC6 (SN16913P) in the main loop, which is part of the digital VFO. Therefore, the operating frequency remains unchanged even if the carrier frequency is changed to implement features, such as USB/LSB mode switching, IF shift, and fine adjustment of the carrier point. IF shift allows a shift of  $\pm 1$ kHz or more during SSB and CW receive. The carrier point can be finely adjusted, in the SSB mode, thru a range of  $-400$ Hz to  $+375$ Hz.

### PLL2

PLL2 consists of IC4 (M54927P), and VCO2, Q5 (2SC2668Y), is locked thru a range of 55MHz to 59.999MHz, except in CW receive and FM transmit. The 4.5MHz reference frequency,  $f_R$ , is applied to IC4 pin 15, and divided internally by 4500 to generate a 1kHz comparison frequency. The from VCO2 output passes through buffer Q6 (2SC2688Y), is applied to IC4 pin 3, and divided internally by M. The resulting signal is compared with the 1kHz reference signal, by the phase comparator, thus locking VCO2. Division ratio, M, is transmitted from the digital control circuit as division data in 4,999 steps (55,000 to 59,999) corresponding to the range of 0.00kHz to 49.99kHz or 50.00kHz to 99.99kHz via DA, CK,, and PR2.

Correction is performed according to the mode and RIT operation. To obtain the 800Hz beat tone obtained during CW reception, M is shifted (54,920 to 59,919) by about 80. Since the VCO1 output frequency during FM transmit is 455kHz lower than that during receive, it is corrected 5kHz (54,500 to 59,499) by VCO2. (450kHz is corrected by PLL1.) When the RIT is operating, the M division ratio is varied so that the from VCO1 output frequency is shifted  $\pm 1.2$ kHz or more.

In AM and FM modes, the frequency is shifted 10 steps, and operates in 100Hz steps as shown in the frequency display.

The PLL2 output is divided by 10 in IC5 (M54460L), passes through a LPF, and is applied to pin 2 of MIX5 IC6 (SN16913P). The signal is mixed with the signal generated by PLL3, passes through a BPF, and become a signal of 10.05MHz to 10.5499MHz, in 100Hz steps. The signal passes through amplifier Q7 (2SC2458Y), buffer Q8 (2SC2458Y), is divided by 10 in IC7 (SN74LS90N), passes thru a LPF, and is applied to pin 2 of MIX5 IC9 (SN16913P). The signal is mixed with the 4.5MHz signal generated by dividing the reference frequency by 8 in MIX4 (SN16913P), passes through a BPF, become a signal of 5.505MHz to 5.55499MHz in 10Hz steps, and is applied to pin 2 of MIX3 IC10 (SN16913P). In addition, the signal is mixed with the 36MHz reference frequency by MIX3, passes through a BPF, and become a signal of 41.505MHz to 41.50499MHz.

## CIRCUIT DESCRIPTION

### PLL1

The final PLL1 loop consists primarily of IC13 (MB 87006). The final VCO1 is located in the signal unit, and consists of three VCOs, VCO1A to VCO1C, that cover a dial frequency of 500kHz to 30MHz. (\*The final VCO1 consists of four VCOs, VCO1A to VCO1D, in the range of 50MHz to 54MHz.) Any of the VCOs can be selected according to band information from the digital control circuit. The VCO1 signal passes through buffer Q13 (2SC2688Y) of the signal unit, and is applied to the PLL circuit of the control unit. This signal passes through buffer Q14 (2SC 2668Y), and is applied to pin 5 of MIX1 IC12 (SN76514N). The signal is mixed with the signals generated by PLL3 and PLL2. This input signal is also divided into three signals according to band information.

One of the signals generated in the previous loop is applied directly to buffer Q13 (2SC2668Y) by the diode switch according to the band information. The other signal is applied to pin 2 of MIX2 IC11 (SN16913P). When the operating frequency is 500kHz to 10.5MHz, the signal is mixed with the 4.5MHz signal generated by dividing the reference signal by 8 in MIX2, passes through a BPF, become a signal of 37.005MHz to 37.05499MHz, and is applied to buffer Q13. When the operating frequency is 10.5 MHz to 21.5 MHz, the signal is applied directly to buffer Q13 without passing through MIX2. When the operating frequency is 21.5MHz to 30MHz, the signal is mixed with the reference frequency in MIX2, passes through a BPF, becomes a signal of 77.505MHz to 77.55499MHz, and is applied to buffer Q13.

\*When the operating frequency is 50MHz to 54MHz, the signal is processed in the same way as the signal for 21.5MHz to 30MHz.

These signals are applied to pin 11 of MIX1 IC12 through buffer Q13. The difference signal passes through a LPF to become a signal of 3.55MHz to 20MHz, passes through amplifier Q15 (2SC2668Y), and is applied to pin 8 of PLL IC13.

The 4.5MHz reference frequency,  $f_R$ , is applied to IC13 pin 1, and divided internally by 90 to generate a 50kHz comparison frequency. The signal input to IC13 is divided by N, and compared with the 50kHz reference signal, by the phase comparator. The signal passes through an active LPF, Q16 to Q18 (2SC2459BL), and is sent to the signal unit as the VCO voltage, to control the varactor diode of the last VCO1.

Division ratio, N, covers the overall operating frequency range in 50kHz steps, except during FM transmit. During FM transmit, N is shifted 9 steps (450kHz) so that the VCO1 output frequency becomes  $-455$ kHz. The division ratio is sent from the digital control circuit via DA, CK, and PR1.

Therefore, the final output of PLL1 is 40.555MHz to 70.05499MHz (shifted by  $-455$ kHz for FM transmission) as determined by the values of L, M, and N, in 10Hz steps.

\*The final output of PLL is 40.555MHz to 70.05499 MHz or 90.055MHz to 94.05499MHz in 10Hz steps.

### UNLOCK Detection

If any PLL loop becomes unlocked, pin 11 of IC1, IC4, IC14 and/or pin 7 of IC13 go low, and act as an OR circuit. These signals pass through switching transistors Q25 (DTA 124ES) and Q26 (DTA124ES), and the "L" is sent to the digital control circuit.

At this point, the microprocessor will display the unlock status, and emits the SBK signal to stop the IF signal before the filter via Q29 (2SC2712Y), and the MUTE signal for stopping the audio signal via Q57 (2SC2712Y) before entering the volume control.

### 50kHz Marker Signal

IC13's 50kHz comparison frequency is emitted from pin 13 and used as a marker signal.

## CIRCUIT DESCRIPTION

### Digital Control Circuit

#### Configuration of microprocessor peripheral circuits

As shown in figure 11, the units around microprocessor IC18 (BU18400A) include 16K ROM, IC21 (MBM27C128-25JAJ2), 2K static RAM, IC20 (TC5518CPL), extended I/O IC (TMP8255AP-5; IC22 and IC23 for output only, and IC24 for input only), encoder processing gate array IC26 (LZ92K37), and the microprocessor optional IF-IOC communication IC ( $\mu$ PD8251AFC). The microprocessor address signal is selected by transmitting the chip select signal from IC19 (SN74LS138N). IC15 (PST520D) generates a reset signal according to changes in the 5V line, to reset the microprocessor, the extended I/O IC, and communications IC. The reset signal is also sent to RAM to prevent data destruction due to shock noise when switching power on and

off. IC16 (TC4069UBP) rectifies the waveform of the reset signal, and also functions as the buzzer oscillator circuit and system clock oscillator circuit. The timer IC, IC17 (NE555C), generates an AC signal for dynamic lighting of the fluorescent display tube, and gives an interrupt signal to the microprocessor. The dynamic lighting function is controlled by the microprocessor. The  $\mu$ PC6300C is the fluorescent display tube driver IC. IC27 (MB4052) is an A/D converter IC to which a voltage corresponding to the rotational position is applied by a variable resistor such as the RIT. IC25 (TC4069UBP) operates as a chatter absorption circuit for the mechanical-type sub-dial rotary encoder.

Most of these circuit are located in the control unit, but the fluorescent display tube, drive IC ( $\mu$ PD6300C), and voltage generation DC/DC module (CPS1175B) are in the display unit.

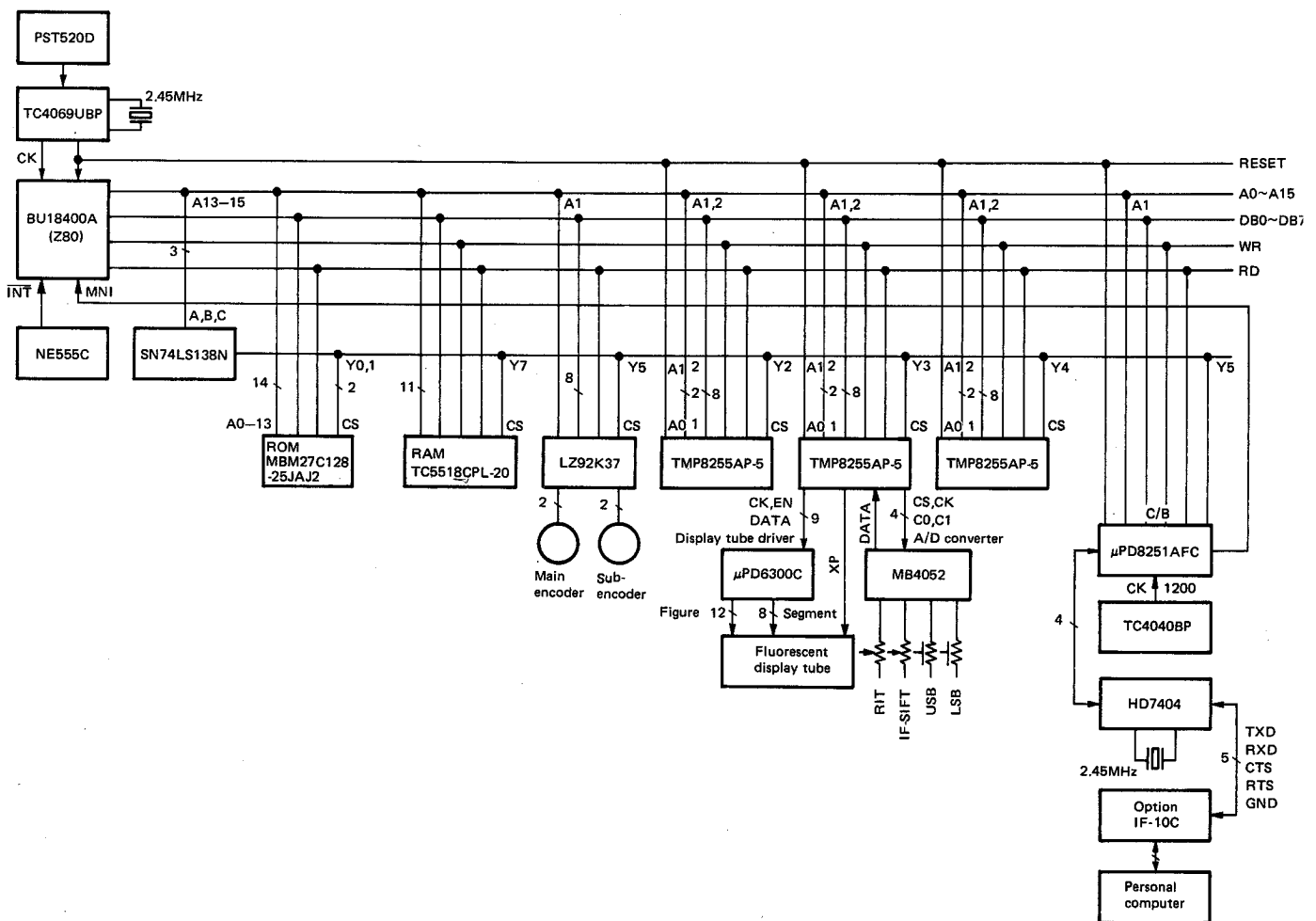


Fig. 11 CPU peripheral circuit



## CIRCUIT DESCRIPTION

### System Clock Oscillation and System Reset Circuit

Microprocessor IC18 (BU18400A) requires a 2.45MHz system clock. Ceramic oscillator X2 and IC16 (TC4069UBP) are used to generate the system clocks (figure 12).

IC15 (PST520D) is a reset IC which sends a reset signal to the microprocessor and I/O when the power supply voltage reaches about 4.3V, which halts all function immediately. When the power supply voltage exceeds approximately 4.3V, the reset signal is emitted and after the time constant set by R151 and C219 elapses, the microprocessor is initialized and operation resumes (figure 13).

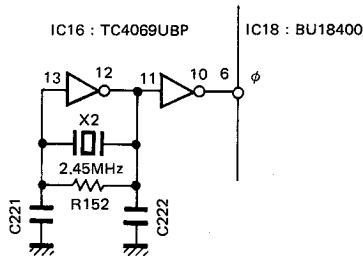


Fig. 12 System clock oscillation circuit

### Address Control

Microprocessor address lines A0 to A15 cannot select ICs directly, so they are decoded into selection signals by IC19 (SN74LS138N). IC19 has a 64K-bytes memory area which is divided equally into 8 blocks (8K bytes each) and assigned to the ICs. Address control division is shown in figure 14.

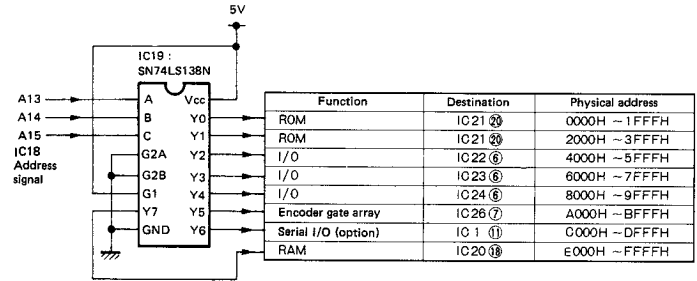


Fig. 14 Address control division

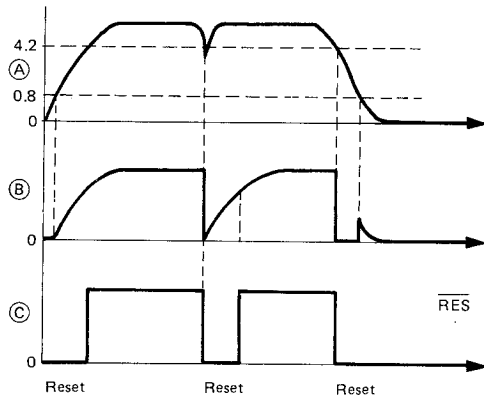
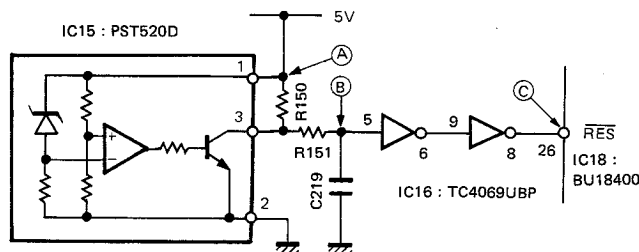


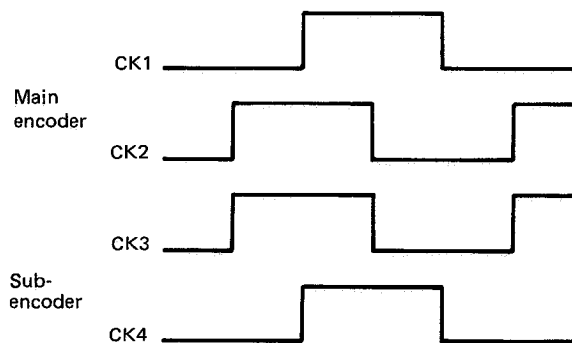
Fig. 13 Reset circuit

## CIRCUIT DESCRIPTION

### Encoder Peripheral Circuit

IC26 (LZ92K37) detects the rotational direction from the dual-phase rotary encoder pulse input, counts up or down, and has two inputs. CK1 and CK2 count all leading and trailing pulse edges, and performs quadruple functions. CK3 and CK4 count the leading and trailing edges of CK3, and performs dual functions. The main dial is an optical type, which inputs signals directly. The sub-dial is a mechanical type, which inputs signals through the chatter absorption circuit.

Count data can be read in the same manner as when reading RAM. CK1 and CK2 have one counter, CK3 and CK4 have another counter. When IC26 A0 is low, the CK1 and CK2 data is read. When A0 is high, the CK3 and CK4 data is read.



CK1 to CK4 input terminals have built-in pullup resistors.

Fig. 16 Waveforms of IC26, CK1 to CK4, when the dial is turned clockwise

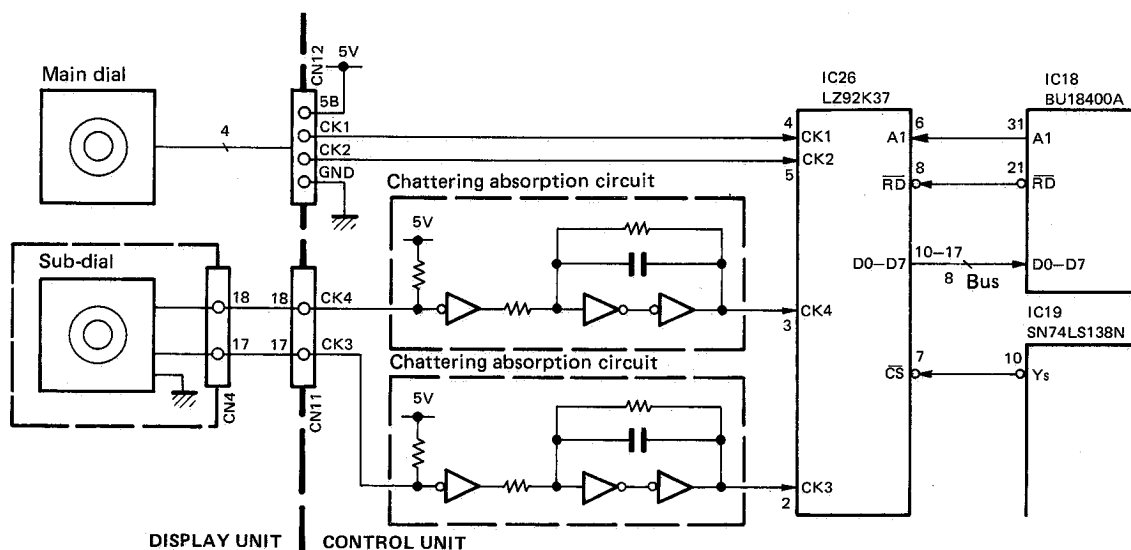


Fig. 15 Encoder peripheral circuit

### Display Circuit

The fluorescent display tube is dynamically lit by IC18 (BU18400). The lighting period for one column is given by a negative pulse of IC17 (NE555C). When a low level is applied to the INT input, IC18 starts its interrupt procedure, outputs one column of display data, and the column signal to the fluorescent display tube driver MPD6300C through IC23 (TMP8255AP-5), and outputs data and control signal to the XP terminal, via IC22 port C7. Normally, one cycle ends when the data and signal are output 12 times, since there are 12 columns. However, for yellow (mode) display columns, the data and signal are output 3 times in one cycle because of a lack of sufficient intensity.

Display unit, T1, is the DC/DCE module which generates the drive voltage and filament voltage of the fluorescent display tube. The filament voltage waveform is generated by the oscillator circuit in that module. The frequency fluctuates because the column loads differ from each other, causing a variation in the oscillator frequency. The  $\mu$ PD 6300C input waveforms are seen in each of the oscillator periods of IC17 (See figure 18). Data is shown in figure 19. It is output from the left.

## CIRCUIT DESCRIPTION

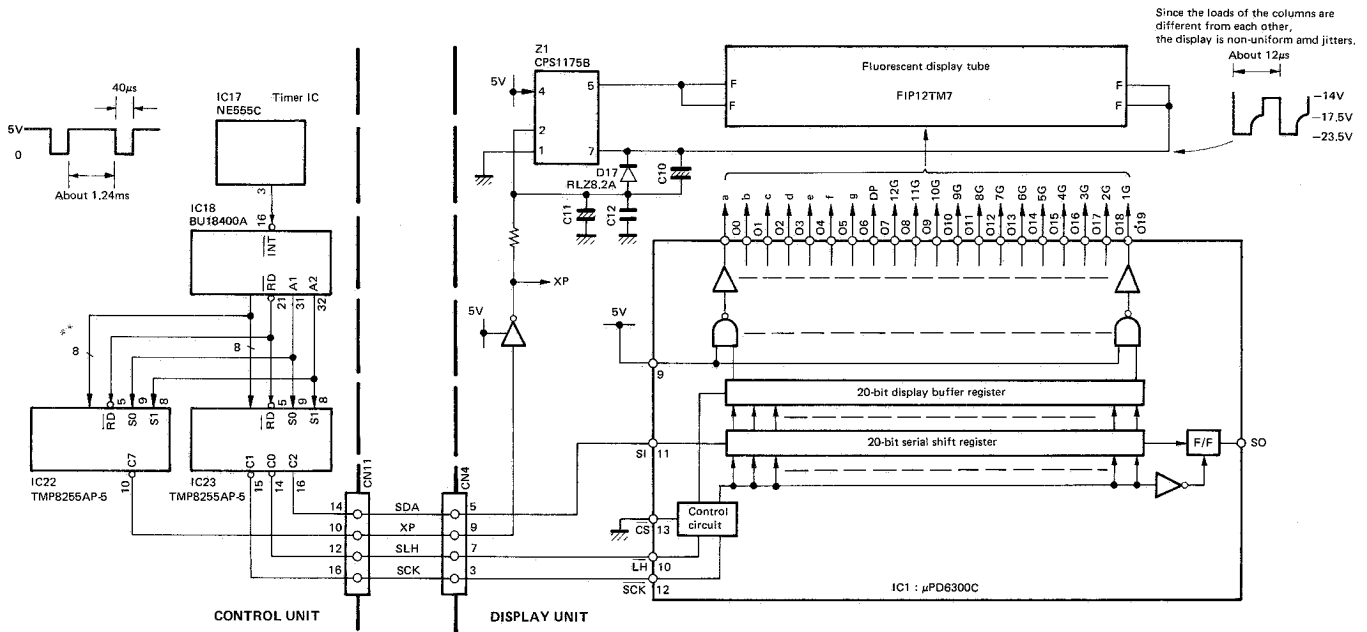


Fig. 17 Display circuit

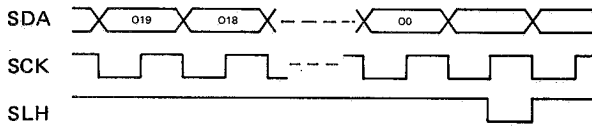


Fig. 18

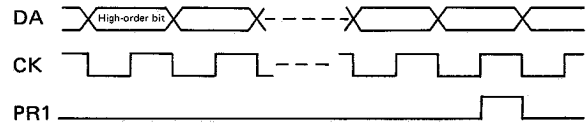


Fig. 20

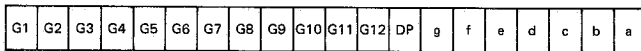


Fig. 19

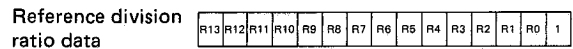
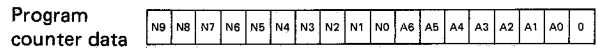


Fig. 21

### PLL Data Output

Four PLLs are controlled. The 50kHz-step loop PLL1 uses the MB87006, and other loops use the M54927P.

Data is output for the MB87006 as shown in figure 20.

Both reference division ratio data and program counter data are given to the MB87006. Reference division ratio data are supplied only when the power is turned on. The data formats are as shown in figure 21. Data is output from the left.

Data is output to the M54927P as shown in figure 22.

Data output to the M54927P is shown in figure 23. It is output from the left.

This PLL data is output only to the PLL when changed.

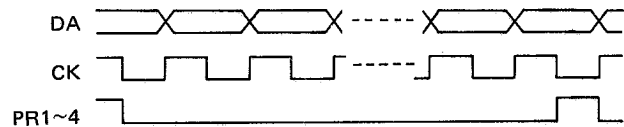


Fig. 22

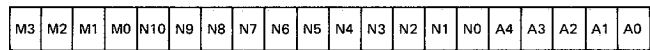


Fig. 23

## CIRCUIT DESCRIPTION

### Band Output

The BPF and LPF are switched by output ports A0 to A4 (B0 to B4) of IC22 (TMP8255AP-5). The PLLs are switched by output ports C4 to C6 (VB1 to VB3). The levels of the ports in each frequency range are shown in the figure below:

| Freq' (MHz) | B4 | B3 | B2 | B1 | B0 | VB3 | VB2 | VB1 |
|-------------|----|----|----|----|----|-----|-----|-----|
| 0 — 0.5     | H  | L  | L  | L  | L  | L   | L   | H   |
| 0.5 — 1.6   | H  | L  | L  | L  | H  | L   | L   | H   |
| 1.6 — 2.5   | L  | L  | L  | H  | L  | L   | L   | H   |
| 2.5 — 4.0   | L  | L  | L  | H  | H  | L   | L   | H   |
| 4.0 — 6.5   | H  | L  | H  | L  | L  | L   | L   | H   |
| 6.5 — 7.5   | L  | L  | H  | L  | H  | L   | L   | H   |
| 7.5 — 10.5  | H  | L  | H  | H  | L  | L   | L   | H   |
| 10.5 — 14.5 | L  | L  | H  | H  | H  | L   | H   | L   |
| 14.5 — 19.0 | H  | H  | L  | L  | L  | L   | L   | L   |
| 19.0 — 21.5 | L  | H  | L  | L  | L  | L   | L   | L   |
| 21.5 — 25.0 | H  | H  | L  | L  | H  | H   | L   | L   |
| 25.0 — 30.0 | L  | H  | L  | L  | H  | H   | L   | L   |
| 50.0 — 54.0 | L  | H  | L  | H  | L  | H   | L   | L   |

Table 6

### A/D Converter Analog Input

The four types of analog input, RIT, IF shift, carrier point correction for LSB and USB, are A/D converted, and loaded into the microprocessor as digital values. The control unit has the A/D converter, IC27 (MB4052), to which a channel select signal (CS) and data input control signals (C0 and C1) are applied.

The microprocessor sends a channel select signal first, then a positive pulse from the A2 port of IC23 (TMP8255 AP-5) to reset the A/D converter IC27 (MB4052). After 9 clock pulses have been sent from IC23 C6 port, the converted digital values are sent from A/D converter IC27 to the C6 port of IC24: TMP8255AP-5 in synchronization with the clock pulses. The A/D converter peripheral circuit and timing charts are shown in figures 24 and 25.

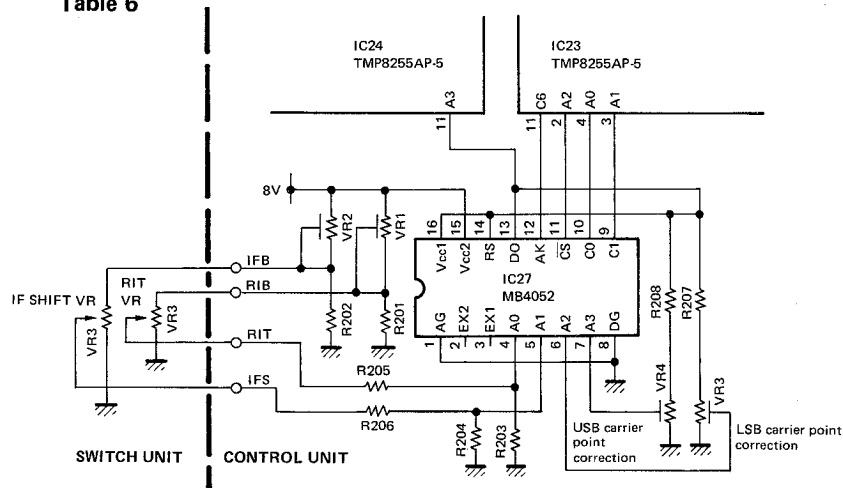


Fig. 24 A/D converter peripheral circuit

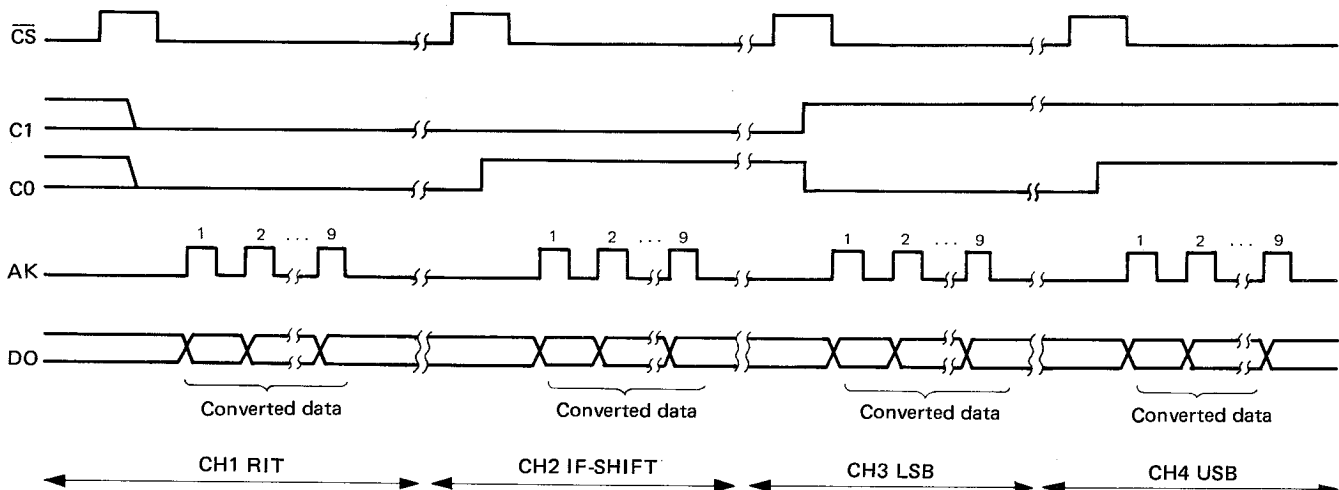


Fig. 25 A/D converter data read timing chart

## CIRCUIT DESCRIPTION

### Key Scan and Extended Diode

A key scan signal with a negative pulse is sent from ports B4 to B7 and C5 of IC23 (TMP8255AP-5). One column, corresponding to ports B0 to B3 of IC24 (TMP8255AP-5) is selected, and the ON/OFF state of the switch is sensed. When the switch at an intersection of the matrix is on, the corresponding bit of ports B0 to B3 of IC24 goes low, thus detecting. The activation of the switch.

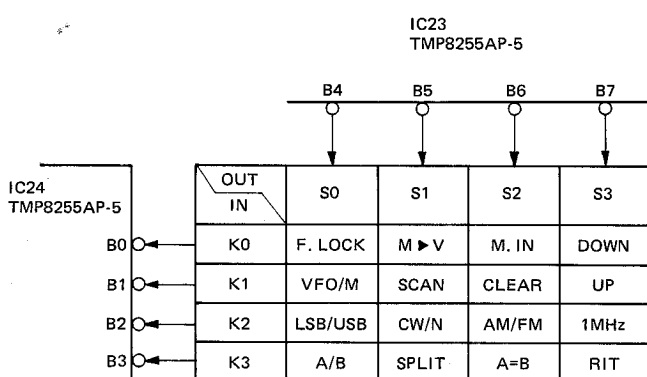


Fig. 26

### Transmit Timing Control Signal

The full Break-in timing is generated by the microprocessor, and is sent as the CTX, RB, and CKY signals from port C of IC22 (TMP8255AP-5). When transmit/receive switching is detected at port A6 of IC24 (TMP8255AP-5), the CSS signal is output with the following timing.

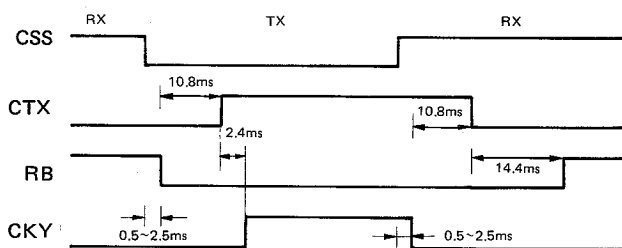


Fig. 27

### SFT Output

The SFT output signal is output during FM and AM reception, and stops the CAR output.

### TOB Output

The TOB output is stored in the memory channel, split channel, in FM mode, and output only during transmission. Repeater subtone control signal.

### 14V Input

To clear any meaningless display when the power switch is turned on or off, the 13.8V line is monitored. When this input goes low, the display is cleared.

### SBK and MUT Output

This signal cuts the PLL switching noise.

### I/O port functions

#### 1) IC22 (Output only)

| Terminal Name | Pin No. | Symbol | Function  | Active level |                        |
|---------------|---------|--------|---|--------------|------------------------|
| A0            | 4       | B0     | Band switching output. (See the text.)              | H            |                        |
| A1            | 3       | B1     |   |              |                        |
| A2            | 2       | B2     |   |              |                        |
| A3            | 1       | B3     |   |              |                        |
| A4            | 40      | B4     | Unused.   | H            |                        |
| A5            | 39      | 50M    |   |              |                        |
| A6            | 37      | HFL    |   |              |                        |
| A7            | 37      | HFL    | Cut the AF signal.                                  | H            |                        |
| B0            | 18      | MUT    |   |              |                        |
| B1            | 19      | PD     |   |              | 28MHz band power down. |
| B2            | 20      | SBK    |   |              | Cut the RF signal.     |
| B3            | 21      | CWN    | Indicates CW-N.                                     | H            |                        |
| B4            | 22      | FM     | Mode output.  | H            |                        |
| B5            | 23      | AM     |   |              |                        |
| B6            | 24      | CW     |   |              |                        |
| B7            | 25      | SSB    |   |              |                        |
| C0            | 14      | CTX    | Transmit control signal. (See the text.)            | H            |                        |
| C1            | 15      | RB     |   |              |                        |
| C2            | 16      | CKY    |   |              |                        |
| C3            | 17      | TOB    | Output the subtone (Option).                        | H            |                        |
| C4            | 13      | PB0    | PLL band switching signal. (See the text.)          | H            |                        |
| C5            | 12      | PB1    |   |              |                        |
| C6            | 11      | PB2    |   |              |                        |
| C7            | 10      | XP     | Fluorescent display tube red letter segment signal. | L            |                        |

## CIRCUIT DESCRIPTION/SEMICONDUCTOR DATA

### 2) IC23 (Output only)

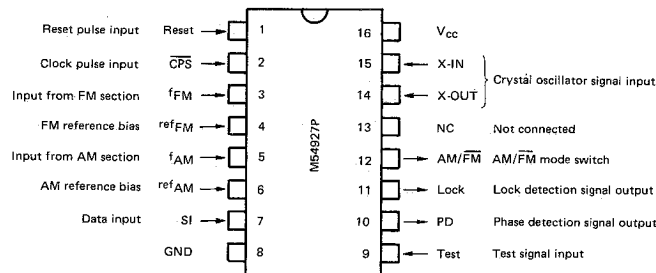
| Terminal Name | Pin No. | Symbol | Function                                       | Active level |
|---------------|---------|--------|--|--------------|
| A0            | 4       | C0     | IC27:MB4052 control signal.<br>(See the text.) |              |
| A1            | 3       | C1     |  |              |
| A2            | 2       | CS     |  |              |
| A3            | 1       | SFT    | CAR cut signal.                                | H            |
| A4            | 40      | PR1    | PLL enable signal.<br>(See the text.)          |              |
| A5            | 39      | PR2    |  |              |
| A6            | 38      | PR3    |  |              |
| A7            | 37      | PR4    |  |              |
| B0            | 18      | LF     | F. LOCK LED signal.                            | H            |
| B1            | 19      | LM     | M. SCR LED signal.                             | H            |
| B2            | 20      | L1     | 1MHz LED signal.                               | H            |
| B3            | 21      | —      | Unused.  |              |
| B4            | 22      | S0     | Key scan output.<br>(See the text.)            | L            |
| B5            | 23      | S1     |  |              |
| B6            | 24      | S2     |  |              |
| B7            | 25      | S3     |  |              |
| C0            | 14      | SLH    | Fluorescent display tube drive IC signal.      |              |
| C1            | 15      | SCK    | (See the text.)                                |              |
| C2            | 16      | SDA    | Unused.  |              |
| C3            | 17      | EN     | PLL data signal.<br>(See the text.)            |              |
| C4            | 13      | DA     | Unused.  |              |
| C5            | 12      | CK     | IC27:MB4052 control signal.<br>(see the text.) |              |
| C6            | 11      | AK     | Turns the buzzer oscillator circuit on.        | H            |
| C7            | 10      | BZ     |  |              |

### 3) IC24 (Input only)

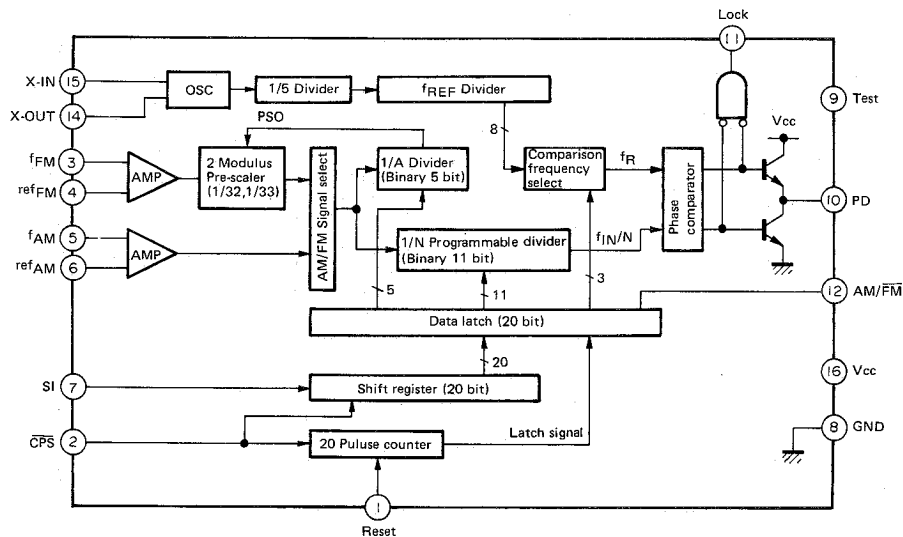
| Terminal Name | Pin No. | Symbol | Function                                | Active level |
|---------------|---------|--------|---|--------------|
| A0            | 4       | —      | Unused.                                 |              |
| A1            | 3       | —      |   |              |
| A2            | 2       | UL     | Detect the unlock state.                | L            |
| A3            | 1       | AD     | IC27:MB4052 data signal.                |              |
| A4            | 40      | MU     | MIC UP/DOWN switch.                     | L            |
| A5            | 39      | MD     |   |              |
| A6            | 38      | CSS    | CSS line signal transmission detection. | L            |
| A7            | 37      | 14V    | Power switch off detection.             | L            |
| B0            | 18      | —      | Unused.                                 |              |
| B1            | 19      | —      |   |              |
| B2            | 20      | —      |   |              |
| B3            | 21      | —      |   |              |
| B4            | 22      | —      |   |              |
| B5            | 23      | —      |   |              |
| B6            | 24      | —      |   |              |
| B7            | 25      | —      | Unused.                                 |              |
| C0            | 14      | —      |   |              |
| C1            | 15      | —      |   |              |
| C2            | 16      | —      |   |              |
| C3            | 17      | —      |   |              |
| C4            | 13      | —      |   |              |
| C5            | 12      | —      |   |              |
| C6            | 11      | —      |   |              |
| C7            | 10      | —      |   |              |

### M54927P : PLL IC (Control unit IC1, 4, 14)

#### • Terminal connection diagram



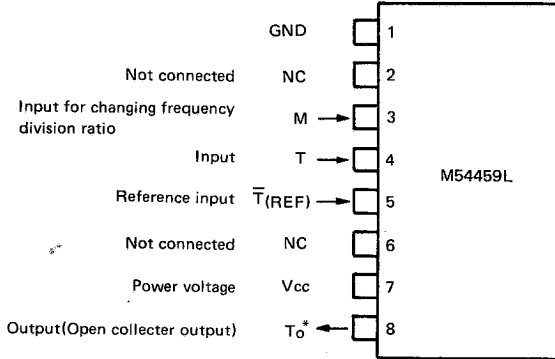
#### • Block diagram



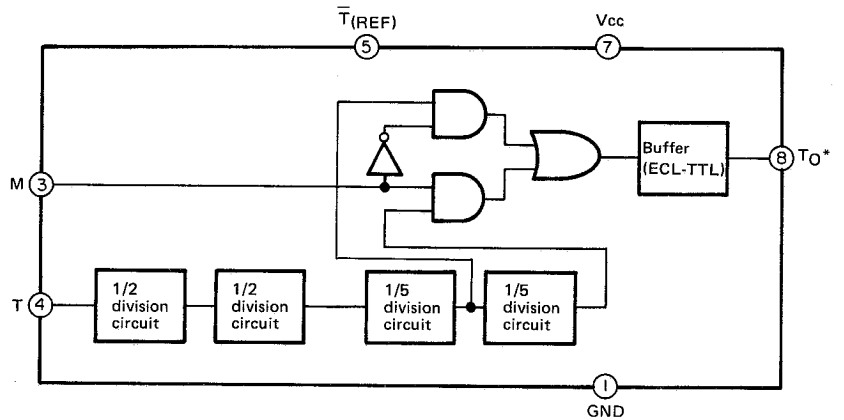
## SEMICONDUCTOR DATA

### M54459L : Divider (Control unit IC2)

• Terminal connection diagram



• Block diagram

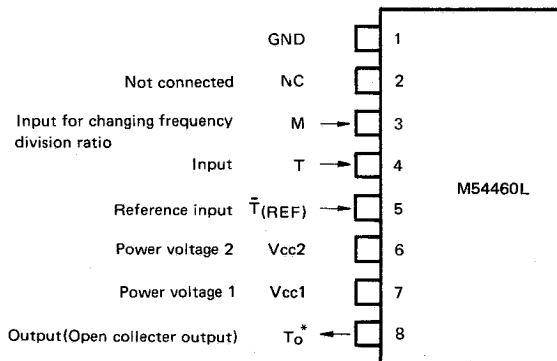


• Input for changing frequency division ratio (M) and division ratio

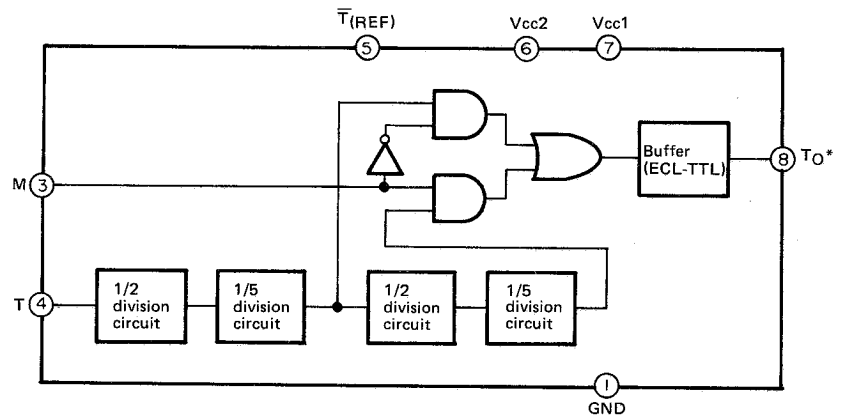
| M              | "L"  | "H"   |
|----------------|------|-------|
| Division ratio | 1/20 | 1/100 |

### M54460L : Divider (Control unit IC5)

• Terminal connection diagram

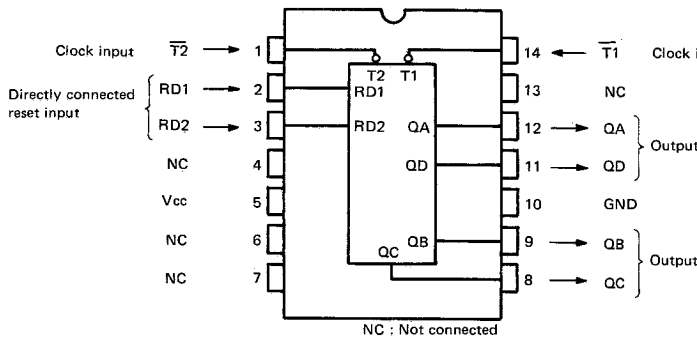


• Block diagram

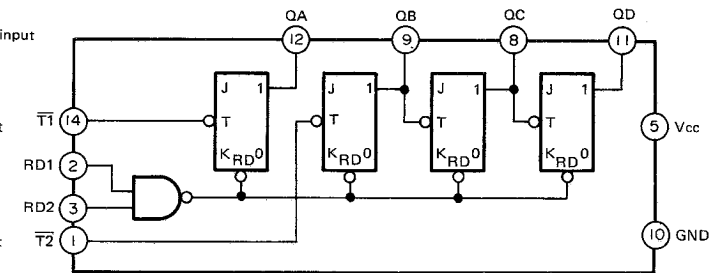


### M74LS93P : Divider (Control unit IC8)

• Terminal connection diagram



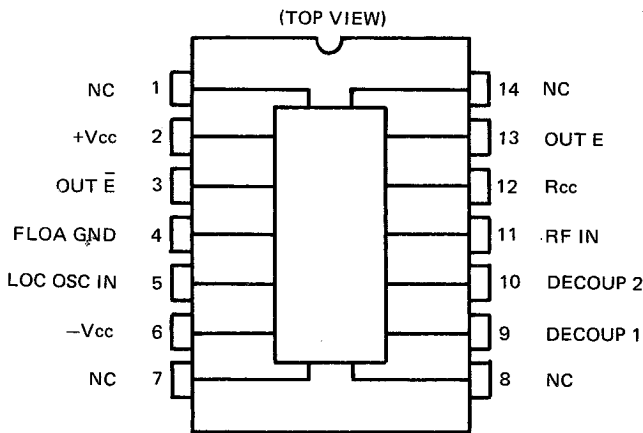
• Logic circuit



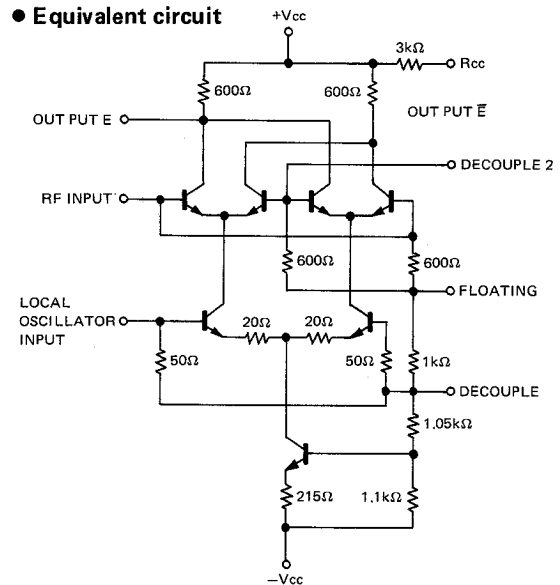
## SEMICONDUCTOR DATA

### SN76514N : Mixer (Control unit IC12)

#### Terminal connection diagram

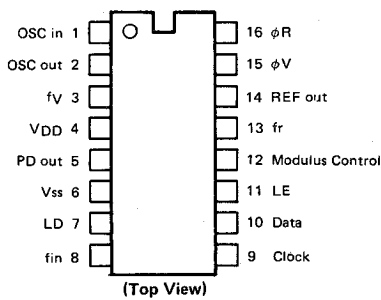


#### Equivalent circuit



### MB87006 : PLLIC (Control unit IC13)

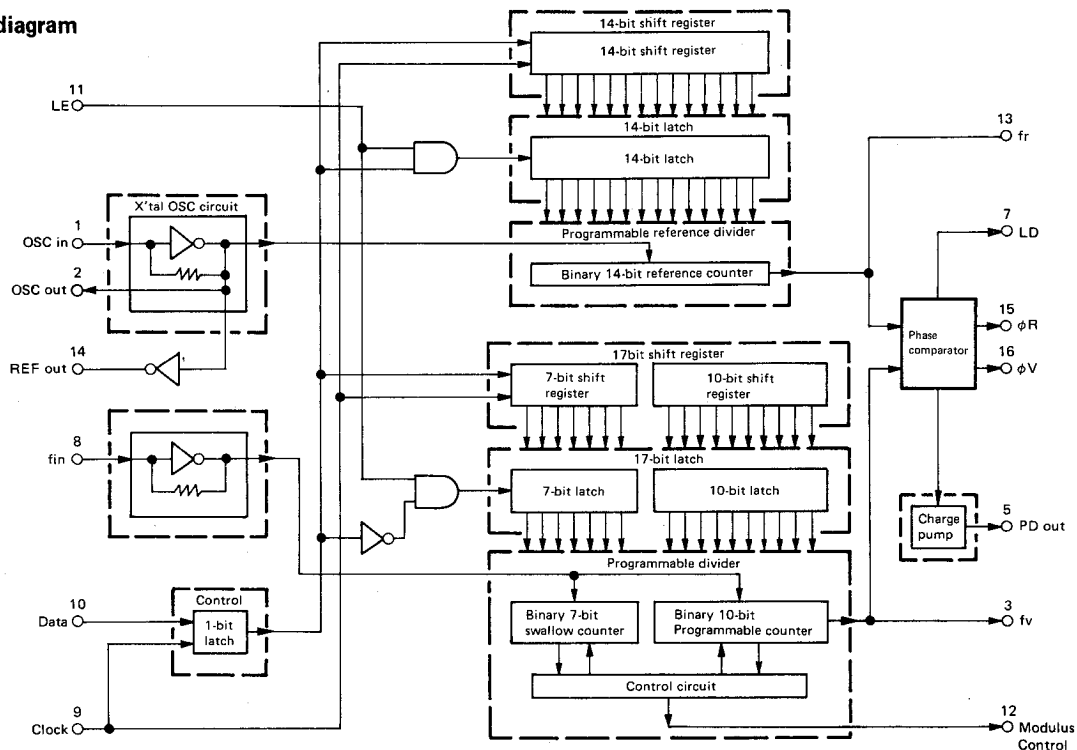
#### Terminal connection diagram



#### Terminal function

| Terminal No. | I/O | Terminal name | Terminal No. | I/O | Terminal name   |
|--------------|-----|---------------|--------------|-----|-----------------|
| 1            | I   | OSC in        | 9            | I   | Clock           |
| 2            | O   | OSC out       | 10           | I   | Data            |
| 3            | O   | fv            | 11           | I   | LE              |
| 4            | -   | VDD           | 12           | O   | Modulus Control |
| 5            | O   | PD out        | 13           | O   | fr              |
| 6            | -   | VSS           | 14           | O   | REF out         |
| 7            | O   | LD            | 15           | O   | φV              |
| 8            | I   | fin           | 16           | O   | φR              |

#### Block diagram

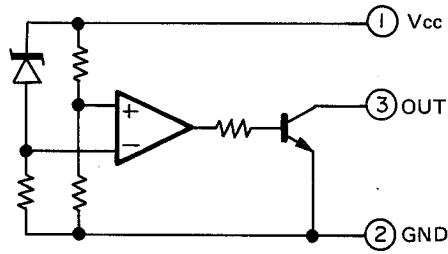




## SEMICONDUCTOR DATA

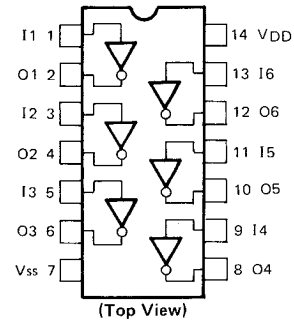
### PST520D : System reset (Control unit IC15)

● Equivalent circuit



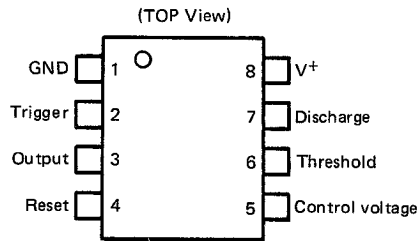
### TC4069UBP : Inverter (Control unit IC16,25)

● Block diagram

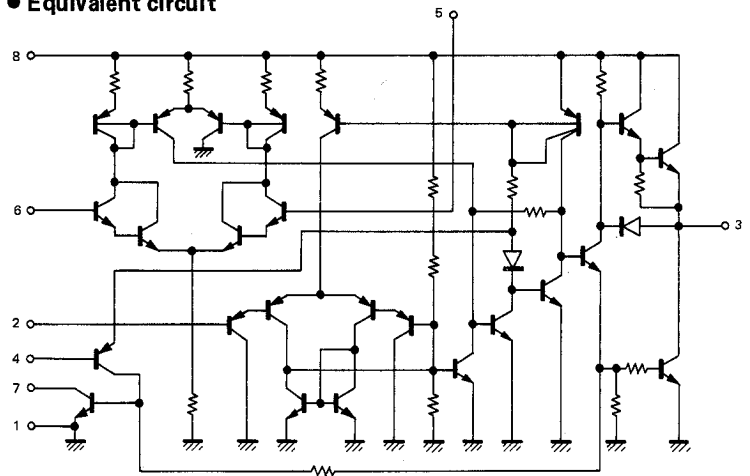


### NE555C : System clock oscillator (Control unit IC17)

● Terminal connection diagram

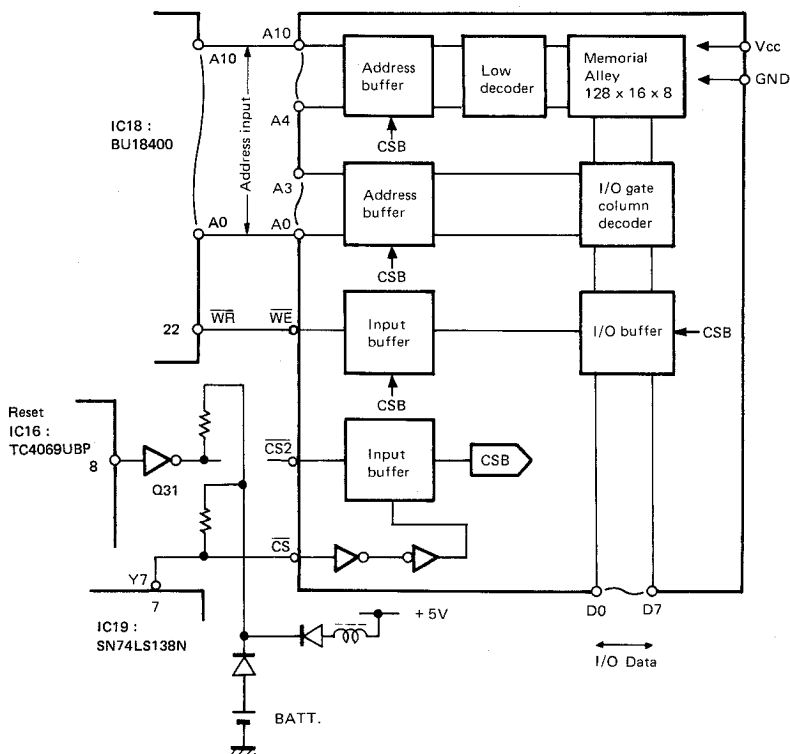


● Equivalent circuit



### TC5518CPL-20 : Static RAM (Control unit IC20)

● Block diagram



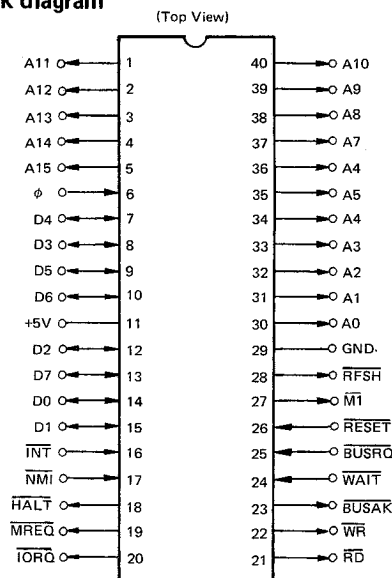
● Terminal function

| Terminal name | Function            |
|---------------|---------------------|
| A0~A10        | Address input       |
| D0~D7         | Data input/output   |
| CS            | Chip select 1       |
| CS2           | Chip select 2       |
| WE            | Write enable        |
| Vcc           | Power supply (+ 5V) |
| GND           | Ground              |

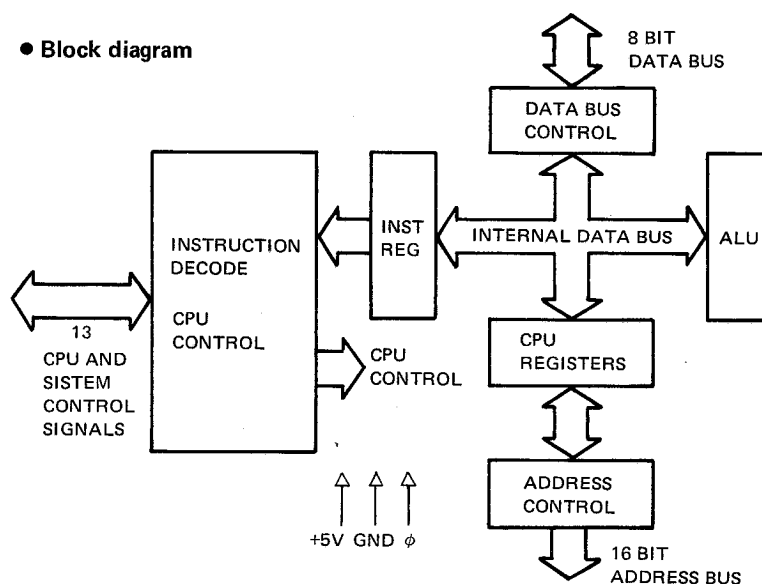
## SEMICONDUCTOR DATA

### BU18400A : CPU (Control unit IC18)

#### ● Block diagram



#### ● Block diagram



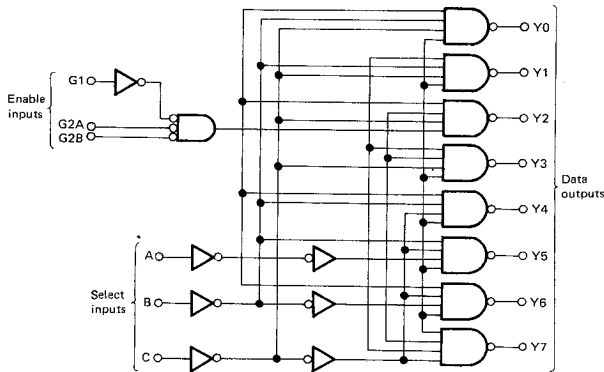
#### ● Terminal function

| Terminal (Signal) name          | Input/Output                       | Terminal (Signal) function  |
|---------------------------------|------------------------------------|---|
| A0 ~ A15<br>(Address Bus)       | 3-state output<br>Active "H"       | 16-bit address bus. Outputs address of memory or I/O device No.. When memory is refreshed, refreshed address is output to seven bits at lower places.   |
| D0 ~ D7<br>(Data Bus)           | 3-state Input/output<br>Active "H" | 8-bit data bus. Used to transfer data between memory or I/O device and CPU.   |
| M1<br>(Machin Cycle one)        | Output<br>Active "L"               | Signal which indicates started machine cycle is OP code fetch cycle.  |
| MREQ<br>(Memory Request)        | 3-state output<br>Active "L"       | Signal which indicates address information necessary for reading and writing memory is output to address bus.   |
| IORQ<br>(Input/Output Request)  | 3-state output<br>Active "L"       | During M1 cycle<br>This signal request outside devices to add interruption response vector to data bus when maskable interruption is acknowledged.<br>Out of M1 cycle<br>This signal indicates I/O device No. necessary for reading and writing I/O is output to the address bus. |
| RD<br>(Read)                    | 3-state output<br>Active "L"       | Signal which indicates data is being input in data bus.<br>Memory or I/O device sends data to the data bus, synchronizing with this signal.   |
| WR<br>(Write)                   | 3-state output<br>Active "L"       | Signal which indicates data is being output by data bus. Data to be sent to memory or I/O device is supplied to data bus, synchronizing with this signal.   |
| RFSH<br>(Refresh)               | Output<br>Active "L"               | Signal which indicates refreshed address for dynamic RAM is output to seven bits at lower places of address during M1 cycle. Dynamic RAM reads refreshed address by using MREQ signal output at the same time as RFSH signal.   |
| HALT<br>(Halt State)            | Output<br>Active "L"               | Signal which indicates HALT command is executed and CPU is set under HALT condition. When returning from HALT condition, any one of INT, NMI or RESET signals is necessary. CPU continues to refresh memory executing NOP command during HALT.                                    |
| WAIT<br>(Wait)                  | Input<br>Active "L"                | While this signal is active, CPU continues to wait. If this signal is used, low-speed memory or I/O device can be directly connected to CPU. While CPU is waiting, memory is not refreshed.   |
| INT<br>(Interrupt Request)      | Input<br>Active "L"                | Input terminal for interruption request signal. If this signal becomes active while interruption is permitted, CPU starts interruption program after finishing command being executed.  |
| NMI<br>(Non Maskable Interrupt) | Input<br>Negative edge trigger     | Input terminal for nonmaskable interruption request signal. If this signal becomes active, CPU jumps to address 0066 (16) after finishing command being executed, regardless of permission of interruption. Priority higher than INT signal is given to NMI signal.               |
| RESET<br>(Reset)                | Input<br>Active "L"                | If this signal becomes active, CPU is reset.  |
| BUSRQ<br>(Bus Request)          | Input<br>Active "L"                | If this signal becomes active, CPU heighten impedance of address bus (A0 ~ A15), data bus (D0 ~ D7) and 3-state system control terminals (MREQ, IORQ, RD, and WR). Thus, other devices can use above external buses.<br>Priority higher than NMI signal is given to BUSRQ signal. |
| BUSAK<br>(Bus Acknowledge)      | Output<br>Active "L"               | Signal which indicates CPU has received BUSRQ signal and heightened impedance of address bus, data bus and 3-state system control terminal.   |
| φ<br>(Clock)                    | Input                              | +5V single-phase clock input terminal.  |

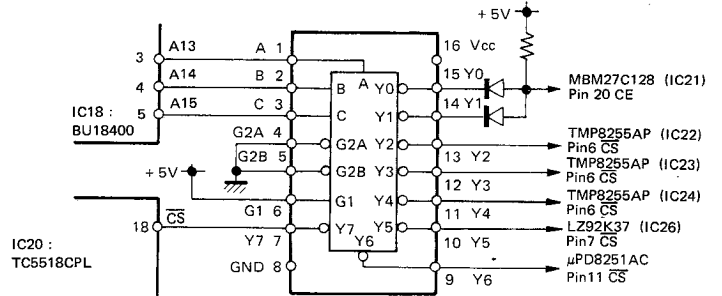
## SEMICONDUCTOR DATA

### SN74LS138N : Address decoder (Control unit IC19)

● Logic circuit



● Block diagram



● Truth table

| INPUT  |    |        |   |   | OUTPUT |    |    |    |    |    |    |    |
|--------|----|--------|---|---|--------|----|----|----|----|----|----|----|
| Enable |    | Select |   |   | Y0     | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 | Y7 |
| G1     | G2 | C      | B | A |        |    |    |    |    |    |    |    |
| X      | H  | X      | X | X | H      | H  | H  | H  | H  | H  | H  | H  |
| L      | X  | X      | X | X | H      | H  | H  | H  | H  | H  | H  | H  |
| H      | L  | L      | L | L | L      | H  | H  | H  | H  | H  | H  | H  |
| H      | L  | L      | L | H | H      | L  | H  | H  | H  | H  | H  | H  |
| H      | L  | L      | H | L | H      | H  | L  | H  | H  | H  | H  | H  |
| H      | L  | L      | H | H | H      | H  | H  | L  | H  | H  | H  | H  |
| H      | L  | H      | L | L | H      | H  | H  | H  | L  | H  | H  | H  |
| H      | L  | H      | L | H | H      | H  | H  | H  | H  | L  | H  | H  |
| H      | L  | H      | H | L | H      | H  | H  | H  | H  | H  | L  | H  |
| H      | L  | H      | H | H | H      | H  | H  | H  | H  | H  | H  | L  |

Note 1 : G2 = G2A + G2B

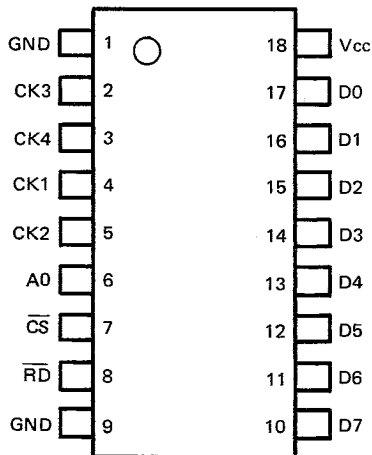
Note 2 : H : High level

L : Low level

X : Either "H" or "L"

### LZ92K37 : Counter (Control unit IC26)

● Terminal connection diagram



● Terminal function

| Pin No. | I/O | Signal name | Pin No. | I/O | Signal name |
|---------|-----|-------------|---------|-----|-------------|
| 1       | —   | GND         | 10      | TO  | D7          |
| 2       | Icu | CK3         | 11      | TO  | D6          |
| 3       | Icu | CK4         | 12      | TO  | D5          |
| 4       | Icu | CK1         | 13      | TO  | D4          |
| 5       | Icu | CK2         | 14      | TO  | D3          |
| 6       | Ic  | A0          | 15      | TO  | D2          |
| 7       | Ic  | CS          | 16      | TO  | D1          |
| 8       | Ic  | RD          | 17      | TO  | D0          |
| 9       | —   | GND         | 18      | —   | Vcc         |

Ic : C-MOS level input buffer

Icu : Input buffer with C-MOS level pull-up resistance

TO : Tristate output buffer

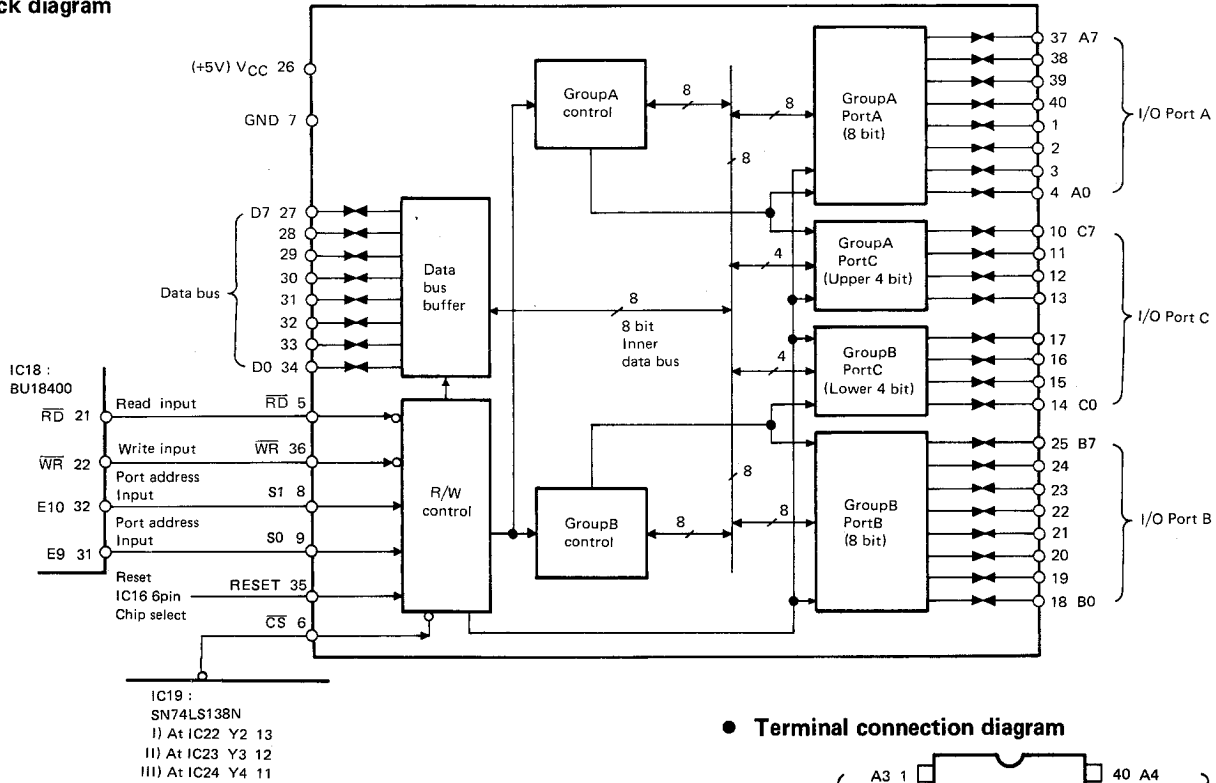
● Terminal function

| Terminal name | Terminal function                                  |
|---------------|--|
| CK1, 2        | Rotary encoder pulse input                         |
| CK3, 4        | Rotary encoder pulse input                         |
| A0            | Output data selection input, 0 = CK1, 2 1 = CK3, 4 |
| CS            | Chip select input                                  |
| RD            | Read enable input                                  |
| D0 ~ D7       | Data bus output                                    |

## SEMICONDUCTOR DATA

### TMP8255AP-5 : I/O Port (Control unit IC22~24)

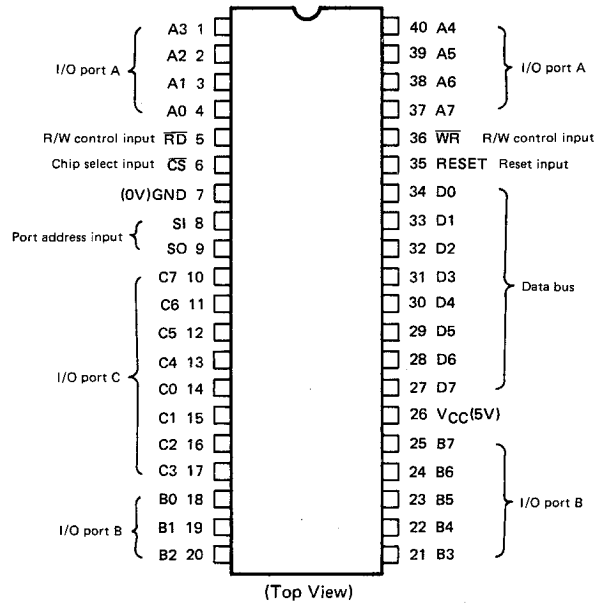
#### ● Block diagram



#### ● Basic function

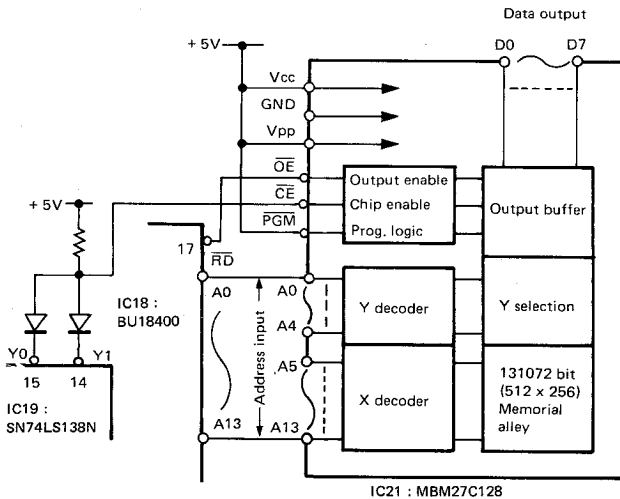
| SI | SO | CS | RD | WR | Function                                 |
|----|----|----|----|----|--|
| L  | L  | L  | L  | H  | Data bus ← Port A                        |
| L  | H  | L  | L  | H  | Data bus ← Port B                        |
| H  | L  | L  | L  | H  | Data bus ← Port C                        |
| L  | L  | L  | H  | L  | Port A ← Data bus                        |
| L  | H  | L  | H  | L  | Port B ← Data bus                        |
| H  | L  | L  | H  | L  | Port C ← Data bus                        |
| H  | H  | L  | H  | L  | Control register ← Data bus              |
| —  | —  | H  | —  | —  | Data bus is in the high-impedance state. |
| H  | H  | L  | L  | H  | Prohibit assortment                      |

#### ● Terminal connection diagram



### MBM27C128-25JAJ2 : ROM (Control unit IC21)

#### ● Block diagram



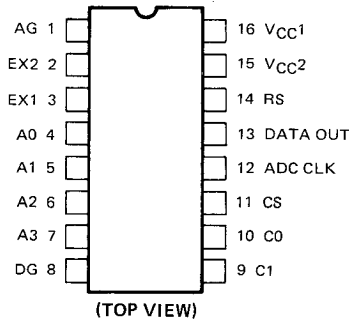
#### ● Terminal function

| Terminal name | Function             |
|---------------|----------------------|
| A0~A13        | Address input        |
| D0~D7         | Data output          |
| CE            | Chip enable input    |
| OE            | Output enable input  |
| PGM           | Program input        |
| Vcc           | Power supply         |
| Vpp           | Program power supply |
| GND           | Ground               |

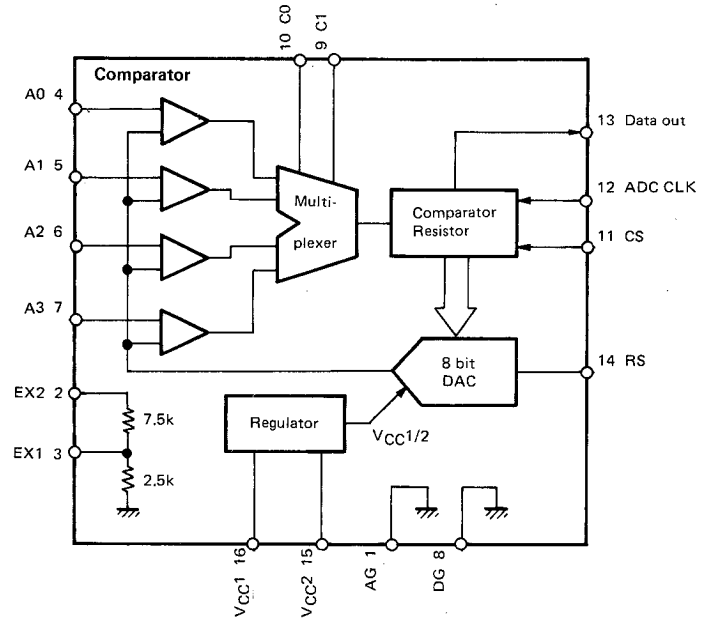
## SEMICONDUCTOR DATA

### MB4052 : A/D Converter (Control unit IC27)

#### ● Terminal connection diagram



#### ● Block diagram



#### ● I/O signal pin function

| Pin No. | Pin name                                 | Symbol       | Function  |
|---------|--|--------------|---|
| 1       | Analog ground                            | AG           | Ground terminal   |
| 2       | Range expander input                     | EX2          | Analog input pin for expanding the range. Analog output pin for expanding the range. Connect to any pin from A0 to A3. By using EX1, EX2, the range is expanded to the X 4 range.   |
| 3       | Range expander output                    | EX1          |   |
| 4~7     | Analog entrance                          | A0~A3        | 4-ch analog input pin. Channel 1 is selected by channel select input C0 to C1.  |
| 8       | Digital ground                           | DG           | Ground terminal   |
| 9       | Channel select input                     | C0           | The input pin to designate the analog input channel for A/D converter. This signal is latched at the trailing edge of CS.   |
| 10      |  | C1           |   |
| 11      | Chip select input                        | CS           | This is the chip select input pin. When CS is inverted from "1" to "0", A/D converting starts and data output is enabled. After A/D converting is over or when an interrupt is required, set the CS back to "1".  |
| 12      | A/D conversion clock                     | ADC CLK      | This is the clock input pin for A/D conversion input to the comparator register sequentially. Conversion speed is determined by the clock speed. In the case of 8-bit, approx. 10 clocks will be needed. However, it is not necessary that the clock period be fixed. |
| 13      | Data output                              | DATA OUT     | This is the open collector to output the result of A/D conversion. The data is output in the order of the start bit, most significant bit, 2nd significant bit, . . . , least significant bit, and the stop bit, synchronized with ADCCLK.                            |
| 14      | Range select input                       | RS           | This is the input pin for selecting the voltage range of analog input. The VFS = VCC1/8 range is selected at "0", and the range of FVS = VCC1/2 is selected at "1". During conversion, hold this pin to "0" or "1".   |
| 15      | Power supply pin 2<br>Power supply pin 1 | VCC2<br>VCC1 | When driving with 3.5V to 6.0V of power, connect VCC1 and VCC2 to each other, and apply the power voltage to them.  |
| 16      |  |              | When driving 8 to 18V of power, apply the power voltage to VCC2. At this time, the 5V stabilized voltage is output to VCC1, and approx. 10mA current can be supplied externally to the IC.  |
|         |  |              | When either 3.5~6.0V or 8~18V power is used, VCC1 is the reference voltage for A/D conversion.  |

#### ● Channel select

| C1 | C0 | Selected Ch. |
|----|----|--------------|
| 0  | 0  | A0           |
| 0  | 1  | A1           |
| 1  | 0  | A2           |
| 1  | 1  | A3           |

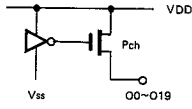
#### ● Range select

| RS | Conversion voltage range   |
|----|----------------------------|
| 0  | $0 \sim \frac{V_{CC1}}{8}$ |
| 1  | $0 \sim \frac{V_{CC1}}{2}$ |

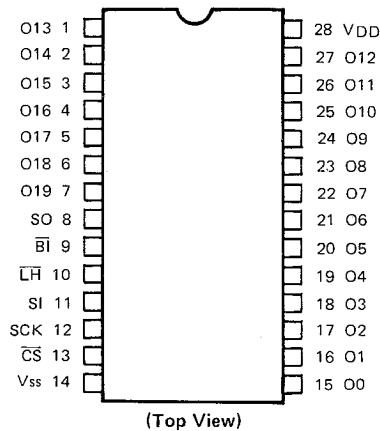
## SEMICONDUCTOR DATA

### μPD6300C : Fluorescent display tube driver (Display unit IC1)

#### • Terminal function

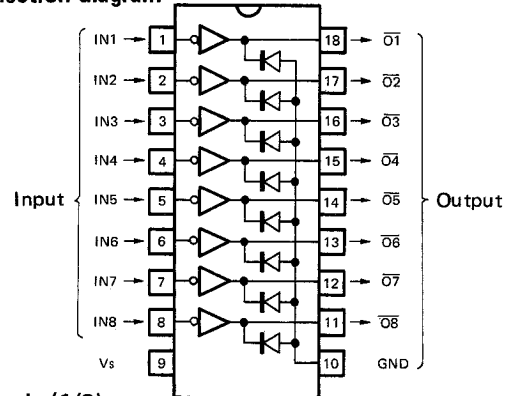
| Terminal No. | Symbol                 | Terminal name          | I/O | Function   |
|--------------|------------------------|------------------------|-----|--|
| 1~7          | O13~O19                | FIP segment driver     | O   | High dielectric-strength (40V) output in the Pch open. Corresponds to the output of O13~O19.   |
| 8            | SO                     | Serial data output pin | O   | Output serial data the trailing edge of SCK, when the n-number of μPD6300Cs are connected in series, this can be connected to the SI of the following stage.                       |
| 9            | $\overline{\text{BI}}$ | Blanking pin           | I   | This input can turn off all indicator or displays, and can dim them by applying a random duty pulse from outside. Active low.  |
| 10           | LH                     | Latch pin              | I   | Transmits the connects of the serial shift register to the buffer register at low level, to latch the connects at the rising time. Active rising (leading) edge.                   |
| 11           | SI                     | Serial data input pin  | I   | This is the data input pin. Inputs data to the shift register at the rising edge of SCK.   |
| 12           | SCK                    | Serial clock input pin | I   | Reads out the SI data to the shift register at the rising edge of SCK. Outputs data from SO at the trailing edge of SCK.   |
| 13           | $\overline{\text{CS}}$ | Chip select pin        | I   | When CS is high, this inhibits SCK and LH, and when CS is low, activates SCK and LH.   |
| 14           | Vss                    | GND                    | -   | Connect to the GND terminal of the system.   |
| 15~27        | O0~O12                 | FIP segment driver     | O   | Pch open-drain system, high dielectric-strength output. Corresponds to the output of O0~O12.<br> |
| 28           | VDD                    | Power supply pin       | -   | 5V±10%   |

#### • Terminal connection diagram

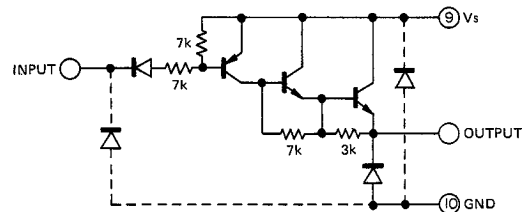


### M54581P : Band data driver (Signal unit IC1)

#### • Terminal connection diagram

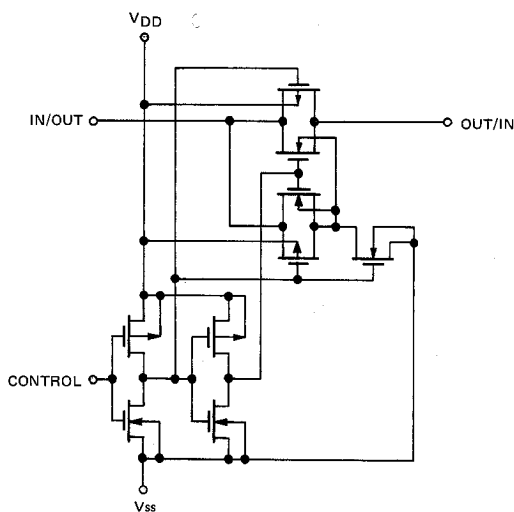


#### • Equivalent circuit (1/8)

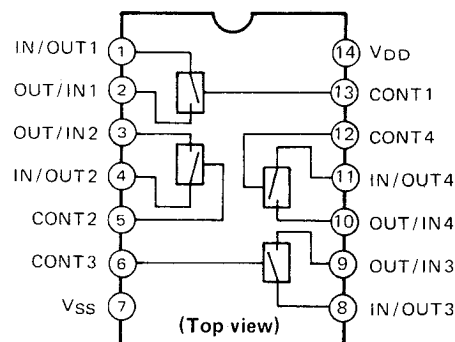


### TC4066BP : Switch (Signal unit IC7~ 10)

#### • Equivalent circuit (1/4)



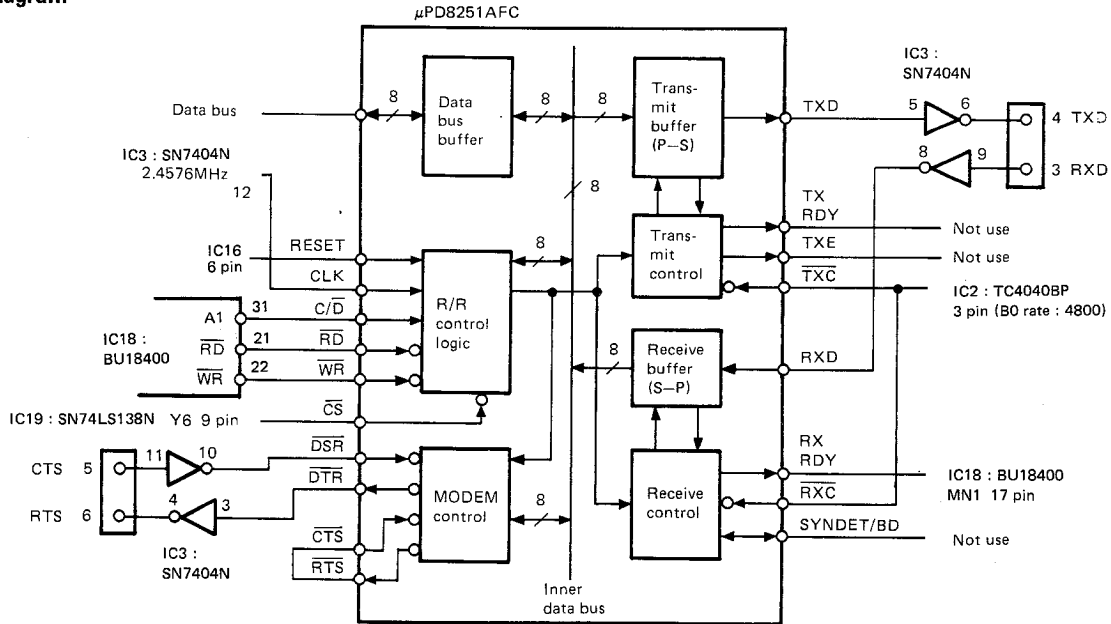
#### • Terminal connection diagram



## SEMICONDUCTOR DATA

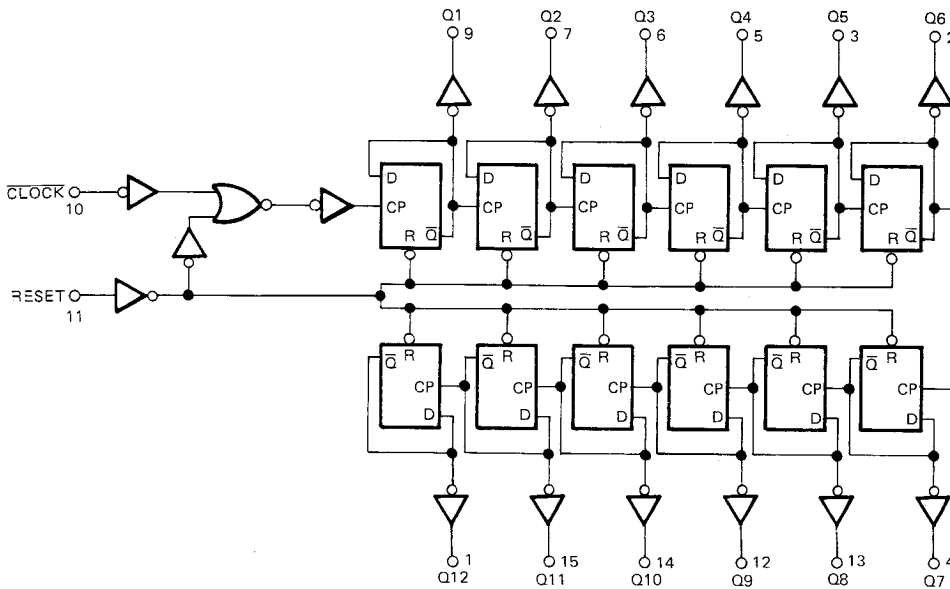
### μPD8251AFC (Option IF-10C IC1)

• Block diagram



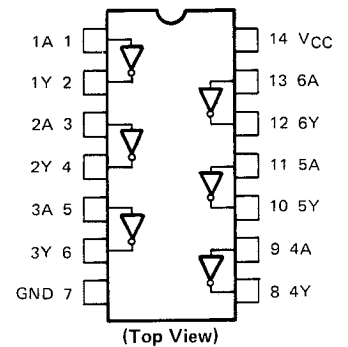
### TC4040BP (Option IF-10C IC2)

• Block diagram



### HD7404P (Option IF-10C IC3)

• Block diagram



## DESCRIPTION OF COMPONENTS

### SWITCH UNIT (X41-3030-XX)

| Component | Use/Function                    | Operation/Condition/Compatibility                   |
|-----------|---------------------------------|---|
| IC1       | Microphone amplifier            | Processing of audio signals, speech processor.      |
| Q1        | Switching transistor            | Q1 is ON when PRS is "H".                           |
| Q2~4      | Switching transistor            | Q2~4 are ON when PKS is "L".                        |
| Q5        | Amplification of control signal |   |
| Q6        | Amplifier                       | For VOX. <b>TS-140S only</b>                        |
| D1        | Detection of control signal     |   |
| D2,3      | Switching diode                 | D2 is ON when RXB is "H". D3 is ON when PKS is "L". |

### 100W FINAL UNIT (X45-3100-XX)

| Component | Use/Function                     | Operation/Condition/Compatibility                                |
|-----------|----------------------------------|--|
| Q1        | Pre-drive amplifier              | Wide-band amplification of HF band.                              |
| Q2,3      | Drive amplifier                  | Push-pull wide-band amplification of HF band.                    |
| Q4,5      | Final amplifier                  | Push-pull wide-band amplification of HF band.                    |
| Q6        | Supply of bias for drive         | Temperature compensation of drive.                               |
| Q7        | Supply of bias for final         | Temperature compensation of final.                               |
| Q8        | Constant-voltage power supply    | 5V for digital system.   |
| Q9        | Constant-voltage power supply    | 5V for PLL system.   |
| D1        | Temperature compensation         | Temperature sensing of pre-drive.                                |
| D2        | Temperature compensation         | Temperature sensing of drive.                                    |
| D3        | Temperature compensation         | Temperature sensing of final.                                    |
| D4        | Absorption of surge voltage      | Relay for changing over HF and VHF of drive. <b>TS-680S only</b> |
| D5        | Absorption of surge voltage      | For fan motor.   |
| D6        | Protection of inverse connection | For power supply terminal.                                       |
| D7        | Constant-voltage power supply    | Power supply of 8.2V for temperature sensor module.              |

### FILTER UNIT (X51-3040-XX)

| Component | Use/Function                         | Operation/Condition/Compatibility                     |
|-----------|--------------------------------------|---|
| Q1        | Drive amplifier of 50MHz band        | <b>TS-680S only</b>                                   |
| Q2        | Final amplifier of 50MHz band        | <b>TS-680S only</b>                                   |
| Q3        | Switching of RAT                     | Grounds receiving antenna terminal when transmitting. |
| D1        | Absorption of surge voltage of relay | For relay of 500kHz~2.5MHz LPF.                       |
| D2        | Absorption of surge voltage of relay | For relay of 2.5MHz~4.0MHz LPF.                       |
| D3        | Absorption of surge voltage of relay | For relay of 4.0MHz~7.5MHz LPF.                       |
| D4        | Absorption of surge voltage of relay | For relay of 7.5MHz~14.5MHz LPF.                      |
| D5        | Absorption of surge voltage of relay | For relay of 14.5MHz~21.5MHz LPF.                     |
| D6        | Absorption of surge voltage of relay | For relay of 21.5MHz~30MHz LPF.                       |
| D7        | Absorption of surge voltage of relay | For relay of 50MHz~54MHz LPF. <b>TS-680S only</b>     |
| D8        | Absorption of surge voltage of relay | For changeover of TX and RX.                          |
| D9        | Rectification of traveling wave      | High-frequency rectification.                         |
| D10       | Rectification of reflected wave      | High-frequency rectification.                         |
| D11       | Protection from lightning surge      | Surge absorber of receiving antenna terminal.         |



## DESCRIPTION OF COMPONENTS

CONTROL UNIT (X53-3100-XX)

VCO1-D mode is TS-680S only

| Component | Use/Function                               | Operation/Condition/Compatibility   |
|-----------|--|---|
| IC1       | PLL3 (BFO PLL)                             | 1,2,7: Frequency division ratio setting input.<br>3: 91MHz input (VCO3) in AM mode.<br>10: VCO lock voltage output.<br>11: UL line. "L" in UL mode.<br>15: 4.5MHz input (1/8 fSTD).   |
| IC2       | Frequency divider (1/20)                   | 4: 91MHz input.<br>8: 4.55MHz output.   |
| IC3       | Frequency divider (1/10)                   | 1: 4.55MHz input.<br>2: SFT line. Output is OFF when "H" is input.<br>12: 455kHz output.  |
| IC4       | PLL2<br>(VFO 10Hz step for covering 50kHz) | 1,2,7: Frequency division ratio setting input.<br>3: 55~60MHz input (VCO2).<br>10: VCO lock voltage output.<br>11: UL line. "L" in UL mode.<br>15: 4.5MHz input (1/8 fSTD).   |
| IC5       | Frequency divider (1/10)                   | 4: 55~60MHz input.<br>8: 5.5~6.0MHz output.   |
| IC6       | Mixer (MIX5)                               | 1: 10.05~10.55MHz output.<br>2: 5.5~6.0MHz input.<br>5: 4.55MHz input.  |
| IC7       | Frequency divider (1/10)                   | 1: 10.05~10.55MHz input.<br>12: 1.005~1.055MHz output.  |
| IC8       | Frequency divider (1/8)                    | 8: 4.5MHz output (1/8 fSTD).<br>14: Input of reference frequency of 36MHz (fSTD).   |
| IC9       | Mixer (MIX4)                               | 1: 5.505~5.555MHz output.<br>2: 1.005~1.055MHz input.<br>5: 4.5MHz output.  |
| IC10      | Mixer (MIX3)                               | 1: 41.505~41.555MHz output.<br>2: 5.505~5.555MHz input.<br>5: 36MHz input.  |
| IC11      | Mixer (MIX2)                               | 1: Output of 37.005~37.055MHz (in VCO1-A mode)<br>or 77.505~77.555MHz (in VCO1-C,D mode).<br>2: 41.505~41.555MHz input.<br>5: Input of 4.5MHz (in VCO1-A mode) or 36MHz (in VCO1-C,D mode).   |
| IC12      | Mixer (MIX1)                               | 3: Output of 3.55~13.5MHz (in VCO1-A mode)<br>or 9.05~20.0MHz (in VCO1-B mode)<br>or 15.95~7.5MHz (in VCO1-C mode)<br>or 12.55~16.5MHz (in VCO1-D mode).<br>5: Input of 40.555~50.555MHz (in VCO1-A mode)<br>or 50.555~61.555MHz (in VCO1-B mode)<br>or 61.555~70.055MHz (in VCO1-C mode)<br>or 90.055~94.055MHz (in VCO1-D mode).<br>11: Input of 37.005~37.055MHz (in VCO1-A mode)<br>or 41.505~41.555MHz (in VCO1-B mode)<br>or 77.505~77.555MHz (in VCO1-C mode). |
| IC13      | PLL1 (VFO 50kHz step, last VCO)            | 1: 4.5MHz input (1/8 fSTD).<br>5: VCO lock voltage output.<br>7: UL line. "L" in UL mode.<br>8: Input of 3.55~13.5MHz (in VCO1-A mode)<br>or 9.05~20.0MHz (in VCO1-B mode)<br>or 15.95~7.5MHz (in VCO1-C mode)<br>or 12.55~16.5MHz (in VCO1-D mode).<br>9,10,11: Frequency division ratio setting input.<br>13: Signal for 50kHz output marker.   |

## DESCRIPTION OF COMPONENTS

| Component | Use/Function                        | Operation/Condition/Compatibility  |
|-----------|-------------------------------------|--|
| IC14      | PLL4 (HET PLL)                      | 1,2,7: Frequency division ratio setting input.<br>3: 39.6MHz input (VCO4).<br>10: VCO lock voltage output.<br>11: UL line. "L" in UL mode.<br>15: 4.5MHz input (1/8 fSTD). |
| IC15      | System reset                        | Generates reset signal when source voltage rises or lowers to make timing of operation and backing up of microprocessor.   |
| IC16      | Inverter                            | 1/6, 2/6: Beep tone oscillator.<br>3/6, 4/6: Shaping of system reset signal wave form.<br>5/6, 6/6: System clock oscillator (2.45MHz).                                     |
| IC17      | System clock oscillation            | Generates interrupt signal for dynamic lighting of indicator lamp.   |
| IC18      | CPU                                 | 8-bit microprocessor, Z80 (See CIRCUIT DESCRIPTION).   |
| IC19      | Address decoder                     | Divides address signal of CPU and converts chip select signal of each IC and divides memory area of 64kbytes into 8kbytes x 8blocks.                                       |
| IC20      | Static RAM                          | Makes data such as VFO, memory, etc. for microprocessor.<br>Area capacity: 2kbytes x 8bits. Backed up by system reset signal.  |
| IC21      | ROM                                 | Control program (including program for outside control) is built in.<br>Area capacity: 16kbytes x 8bits.   |
| IC22,23   | I/O port                            | Bus interface I/O port. All are set by output ports. (See I/O PORT FUNCTIONS.)   |
| IC24      | I/O port                            | Bus interface I/O port. All are set by input ports. (See I/O PORT FUNCTIONS.)  |
| IC25      | Inverter                            | Absorbs chattering of encoder.   |
| IC26      | Counter                             | Counts pulses of encoder. Two system of quadruplication (CK1,2) and duplication (CK3,4).   |
| IC27      | A/D converter                       | Converts analog voltage input to digital data and output it.<br>4: RIT.<br>5: IF shift.<br>6: Carrier point (LSB) compensation.<br>7: Carrier point (USB) compensation.    |
| Q1        | VCO3 (PLL3)                         | 90.7~91.3MHz.  |
| Q2        | VCO3 buffer                         |  |
| Q3,4      | BFO buffer                          | 453.5~456.5kHz.  |
| Q5        | VCO2 (PLL2)                         | 55.0~60.0MHz.  |
| Q6        | VCO2 buffer                         |  |
| Q7        | MIX5 output amplifier               | 10.05~10.55MHz.  |
| Q8        | TTL input buffer                    |  |
| Q9        | Reference crystal oscillation (OSC) | 36MHz (fSTD).  |
| Q10       | OSC buffer                          |  |
| Q11       | TTL input buffer                    |  |
| Q12       | MIX3 input buffer                   | 36MHz  |
| Q13       | MIX1 input buffer                   | 37.005~37.055MHz (VCO1-A mode) or 41.505~41.555MHz (VCO1-B mode) or 77.505~77.555MHz (VCO1-C,D mode).  |
| Q14       | VCO1 buffer                         | 40.555~70.055MHz or 90.055~94.055MHz.  |
| Q15       | PLL IF signal amplification         | 2.5~22.5MHz.   |
| Q16~18    | PLL1 low-pass filter                | Active (Reference frequency: 50kHz).   |
| Q19~21    | PLL4 low-pass filter                | Active (Reference frequency: 5kHz or 25kHz).   |
| Q22       | VCO4 (PLL4)                         | 39.6MHz.   |
| Q23       | VCO4 buffer                         |  |
| Q24       | HET buffer                          |  |
| Q25,26    | Shaping of UL signal wave form      | Output is "L" in UL mode.  |

## DESCRIPTION OF COMPONENTS

| Component | Use/Function                         | Operation/Condition/Compatibility   |
|-----------|--------------------------------------|---|
| Q27       | BPF (PLL) buffer                     | MIX1 input of 37.005~37.055MHz in VCO1 - A mode.  |
| Q28       | BPF (PLL) buffer                     | MIX1 input of 41.505~41.555MHz in VCO1 - B mode.  |
| Q29       | BPF (PLL) buffer                     | MIX1 input of 77.505~77.555MHz in VCO1 - C,D mode.  |
| Q30       | Outside interrupt control            | Transfers to program for outside control of personal computer.                            |
| Q31       | RAM backup control                   | Transfers to backup mode of RAM when power is OFF.  |
| Q32       | BPF (PLL) buffer                     | Active is "H" in VCO1 - C,D mode.   |
| Q33       | BPF (PLL) buffer and VCO1 - B buffer | Active is "H" in VCO1 - B mode.   |
| Q34       | BPF (PLL) buffer and VCO1 - A buffer | Active is "H" in VCO1 - A mode.   |
| Q35       | TONE UNIT signal buffer              | Active is "H" in FM transmission mode of split memory CH.                                 |
| Q36       | SSB mode signal buffer               | Active is "H" in SSB mode.  |
| Q37       | CW mode signal buffer                | Active is "H" in CW mode (including CWN mode).  |
| Q38       | AM mode signal buffer                | Active is "H" in AM mode.   |
| Q39       | FM mode signal buffer                | Active is "H" in FM mode.   |
| Q40       | CWN mode signal buffer               | Active is "H" in CWN mode.  |
| Q41       | MSCR LED driver                      | Drives LED when memory is scrolling.  |
| Q42       | F.LOCK LED driver                    | Drives LED in F.LOCK mode.  |
| Q43       | 1 MHz LED driver                     | Drives LED in 1 MHz mode.   |
| D1        | VCO3 varicap                         | Frequency variable.   |
| D2,3      | VCO2 varicap                         | Frequency variable.   |
| D4,5      | BPF changeover switch                | ON in VCO1 - B mode.  |
| D6        | BPF changeover switch                | ON in VCO1 - A,C,D mode.  |
| D7,8      | Wired OR                             | "H" in VCO1 - A,C,D mode.   |
| D9,10     | LPF changeover switch                | ON in VCO1 - C,D mode.  |
| D11       | LPF changeover switch                | ON in VCO1 - A mode.  |
| D12,13    | BPF changeover switch                | ON in VCO1 - C,D mode.  |
| D14,15    | BPF changeover switch                | On in VCO1 - A mode.  |
| D16       | Wired OR                             | Composition of PLL1, UL signal.   |
| D17       | VCO4 varicap                         | Frequency variable.   |
| D18       | Beep switch                          | Beep oscillator is turned ON/OFF by beep pulse. Active is "H".                            |
| D19,20    | Composition of ROM chip select       | Makes 2 blocks of select signal of 8kbytes and use them as ROM select signal of 16kbytes. |
| D21,23,24 | Power supply changeover switch       | Changes power supply in RAM backup mode.  |
| D22       | Stabilization of voltage             | For Lithium battery.  |
| D25~27    | Prevention of reverse current        |   |
| D29,31    | Extended function switch             |   |

## DESCRIPTION OF COMPONENTS

### DISPLAY UNIT (X54-3050-XX)

| Component | Use/Function  | Operation/Condition/Compatibility  |
|-----------|---|--|
| IC1       | Serial input-type high-voltage fluorescent indicator lamp | Converts serial indication data from CONTROL UNIT in parallel and turns on fluorescent indicator lamp. |
| Q1        | Fluorescent indicator lamp driver                         |  |
| D1        | Switching   | F.LOCK   |
| D2        | Switching   | M ▶ V  |
| D3        | Switching   | M.IN   |
| D4        | Switching   | DOWN   |
| D5        | Switching   | VFO/M  |
| D6        | Switching   | SCAN   |
| D7        | Switching   | CLEAR  |
| D8        | Switching   | UP   |
| D9        | Switching   | USB/LSB  |
| D10       | Switching   | CW (N/W)   |
| D11       | Switching   | FM/AM  |
| D12       | Switching   | 1 MHz  |
| D13       | Switching   | A/B  |
| D14       | Switching   | SPLIT  |
| D15       | Switching   | A=B  |
| D16       | Switching   | RIT  |
| D17       | Generation of filament bias voltage                       | Generates bias for filament of fluorescent indicator lamp.   |
| D18       | Indication  | Turns on red lamp in transmission mode.  |
| D19       | Indication  | Turns on yellow lamp when M.SCR is ON.   |
| D20       | Indication  | Turns on green lamp when F.LOCK is ON.   |
| D21       | Indication  | Turns on green lamp when 1 MHz is ON.  |

### SIGNAL UNIT (X57-3190-00: TS-680S) (X57-3200-XX: TS-140S)

| Component  | Use/Function                        | Operation/Condition/Compatibility                       |
|------------|-------------------------------------|---|
| IC1        | Band data driver                    | 13.8V output.   |
| IC2        | Decoding of band data               | Open collector. Active is "L".                          |
| IC3        | RX: Product detection, TX: BM       | 455kHz↔AF.  |
| IC4        | Audio power amplifier               |   |
| IC5        | TX 1st mixer                        | 455kHz→40.055MHz.                                       |
| IC6        | FM IF amplifier, detection, squelch |   |
| IC7 (1/4)  | DC switch                           | Turned ON in TX mode.                                   |
| IC7 (2/4)  | AF signal switch                    | Turned ON in SSB and CW mode.                           |
| IC7 (3/4)  | AF signal switch                    | Turned ON in FM mode.                                   |
| IC7 (4/4)  | AF signal switch                    | Turned ON in AM mode.                                   |
| IC8 (1/4)  | AGC time constant switch            | Turned ON in AM mode.                                   |
| IC8 (2/4)  | AGC time constant switch            | Turned ON in AGC and SLOW mode.                         |
| IC8 (3/4)  | Changeover switch of meter          | Turned ON in TX/ALC mode.                               |
| IC8 (4/4)  | Changeover switch of meter          | Turned ON in TX/PWR mode.                               |
| IC9 (1/4)  | S-meter sensitivity switch          | Turned ON in 50MHz band mode.                           |
| IC9 (2/4)  | S-meter sensitivity switch          | Turned ON in HF mode.                                   |
| IC9 (3/4)  | Changeover switch of meter          | Turned ON in RX mode.                                   |
| IC9 (4/4)  | S-meter sensitivity switch          | Turned ON in FM mode.                                   |
| IC10 (1/4) | ALC level switch                    | Turned ON in AM and CW mode.                            |
| IC10 (2/4) | ALC level switch                    | Turned ON in SSB mode.                                  |
| IC10 (3/4) | ALC level switch                    | Turned ON in power-down mode.                           |
| IC10 (4/4) | ALC level switch                    | Turned ON in mode other than power-down mode.           |
| IC11 (1/4) | ALC amplifier                       |   |
| IC11 (2/4) | Reflected wave voltage amplifier    |   |
| IC11 (3/4) | Detected output amplifier           | Amplifies voltage of traveling wave and reflected wave. |
| IC11 (4/4) | Power meter amplifier               |   |
| IC12       | 8V AVR                              |   |

## DESCRIPTION OF COMPONENTS

| Component | Use/Function                    | Operation/Condition/Compatibility                           |
|-----------|---------------------------------|---|
| Q1        | 13.8V line switching            | Turned ON in 2MHz band mode.                                |
| Q2        | 13.8V line switching            | Turned ON in 50MHz band mode. <b>TS-680S only</b>           |
| Q3,4      | Switching                       | Turned "L" in 50MHz band mode. <b>TS-680S only</b>          |
| Q5        | 8V line switching               | Turned ON in 50~54MHz mode. <b>TS-680S only</b>             |
| Q6        | 8V line switching               | Turned ON in 21.5~30.0MHz mode.                             |
| Q7        | 8V line switching               | Turned ON in 10.5~21.5MHz mode.                             |
| Q8        | 8V line switching               | Turned ON in 0.5~10.5MHz mode.                              |
| Q9~11     | VCO                             | Q9: 0.5~10.5MHz Q10: 10.5~21.5MHz Q11: 21.5~30.0MHz         |
| Q12       | VCO                             | 50.0~54.0MHz. <b>TS-680S only</b>                           |
| Q13,14    | VCO output buffer               |   |
| Q15       | VCO output amplifier            |   |
| Q16,17    | Switching                       | Reduces noise when RF AMP and ATT are turned ON/OFF.        |
| Q18,19    | RX 1st mixer                    | Receiving frequency→40.055MHz.                              |
| 20        | 13.8V line switching            | Turned ON in RX mode.                                       |
| Q21       | Post amplifier                  | 40.055MHz.  |
| Q22,23    | RX 2nd mixer                    | 40.055MHz→455 kHz.  |
| Q27       | IF amplifier                    | 455kHz.   |
| Q28,29    | Switching                       | Shunt IF circuit when NB pulse is generated.                |
| Q30,31    | IF amplifier                    | 455kHz.   |
| Q32,34    | 8V line switching               | Turned ON in CW mode (excluding CWN).                       |
| Q35~39    | 8V line switching               | Q35: SSB Q36: AM Q37: FM Q38: CW Q39: CWN                   |
| Q40,41    | Switching                       | Shunt of TX circuit in RX mode.                             |
| Q42       | Switching                       | Shunt of RX circuit in TX mode.                             |
| Q43       | 8V line switching               | Generates RB.   |
| Q44       | 8V line switching               | Generates AMT and SST.                                      |
| Q45~47    | NB amplifier                    | 455kHz.   |
| Q48       | NB buffer                       |   |
| Q49       | NB AGC amplifier                |   |
| Q50       | Switching                       | Set to "L" when NB pulse is generated in NB2.               |
| Q51       | Switching                       | Set to "L" when NB pulse is generated in NB1.               |
| Q52       | Switching                       | Set to "L" when SKB pulse is generated.                     |
| Q53       | IF buffer                       | AGC, AM.  |
| Q54       | AF buffer                       | AM.   |
| Q55       | Switching                       | Set to "L" in TX mode.                                      |
| Q56       | AF amplifier                    |   |
| Q57       | Switching                       | Set to "L" in MUT and TX mode.                              |
| Q58       | AF amplifier                    | FM.   |
| Q59       | AGC amplifier                   |   |
| Q60       | Generation of S-meter voltage.  |   |
| Q61       | S-meter amplifier               |   |
| Q62       | Switching                       | Prevents S-meter from over-reading when power is turned ON. |
| Q63       | Switching                       | Generates HF voltage. <b>TS-680S only</b>                   |
| Q64       | Switching                       | Generates 50MHz band voltage. <b>TS-680S only</b>           |
| Q65,66    | Switching                       | Sets AGC time constant in mode other than FM mode.          |
| Q67       | Switching                       | Invalidates changeover of FAST/SLOW of AGC in FM mode.      |
| Q68       | Generation of ALC meter voltage |   |
| Q69       | ALC meter amplifier             |   |
| Q70       | RF amplifier                    | 28MHz band. <b>TS-680S only</b>                             |
| Q71       | Buffer                          | 28MHz band. <b>TS-680S only</b>                             |
| Q72       | RF amplifier                    | 50MHz band. <b>TS-680S only</b>                             |
| Q73       | Buffer                          | 50MHz band. <b>TS-680S only</b>                             |

## DESCRIPTION OF COMPONENTS

| Component    | Use/Function                         | Operation/Condition/Compatibility                                     |
|--------------|--------------------------------------|---|
| Q74          | TX AF amplifier                      |   |
| Q75          | Switching                            | Shunt of FMM in RX mode.  |
| Q76          | 8V line switching                    | Turned ON in TOC (Tone transmission) mode.                            |
| Q77          | Switching                            | Generates RXB. Set to "L" in TX mode.                                 |
| Q78          | HET amplifier                        | 39.6MHz.  |
| Q79,80       | TX 2nd mixer                         | 40.055MHz (39.6MHz in FM mode)→Transmission frequency.                |
| Q81          | RF amplifier                         |   |
| Q82          | 8V line switching                    | Turned ON in FM/TX mode.  |
| Q83,85       | 13.8V line switching                 | Turned ON in 50MHz band. <b>TS-680S only</b>                          |
| Q84          | Switching                            | Connects KEY line in CW mode.   |
| Q86          | TX IF amplifier                      | 455kHz.   |
| Q87          | 8V line switching                    | Turned ON in TX mode. Generates KEYING timing.                        |
| Q88          | 8V line switching                    | Turned ON in FM, CW and TX mode.                                      |
| Q89          | AF amplifier                         | Output to RX packet terminal.   |
| Q90,91       | Switching                            | Generates SS and CSS.   |
| Q92          | Switching                            | Set to "L" in power-down mode.  |
| Q93          | Switching                            | Set to "L" in mode other than power-down mode.                        |
| Q94          | Switching                            | Set to "L" in HF mode. <b>TS-680S only</b>                            |
| Q95          | Switching                            | Set to "L" in 50MHz mode. <b>TS-680S only</b>                         |
| Q96          | Switching                            | Set to "L" in SSB and FM mode.  |
| Q97          | Switching                            | Generates squelch signal for packet.                                  |
| Q98          | Switching                            | Generates NFT.  |
| Q99          | Switching                            | Connects SEM line in CW mode.   |
| D1~3         | Switching                            | Changeover of BPF.  |
| D5,6,9,10    | Protection from lightning surge.     |   |
| D7,8,11~20   | Switching                            | Changeover of BPF.  |
| D21,22       | Switching                            | Changeover of BPF. <b>TS-680S only</b>                                |
| D23          | Absorption of surge voltage of relay | For attenuator relay.   |
| D24          | Prevention of reverse current        | Information on 28F 28MHz band and 50F 50MHz band. <b>TS-680S only</b> |
| D25          | Absorption of surge voltage of relay | For RF AMP changeover relay. <b>TS-680S only</b>                      |
| D26~29       | Prevention of reverse current        | Decodes band information.   |
| D30          | Voltage shift                        |   |
| D31          | Prevention of reverse current        | Decodes band information. <b>TS-680S only</b>                         |
| D33          | Prevention of reverse current        |   |
| D34,35       | Change of VCO frequency              | 0.5~10.5MHz.  |
| D36,37       | Change of VCO frequency              | 10.5~21.5MHz.   |
| D38          | VCO switching                        | For 10.5~21.5MHz.   |
| D39,40       | Change of VCO frequency              | 21.5~30.0MHz.   |
| D41          | VCO switching                        | For 21.5~30.0MHz.   |
| D42,43       | Change of VCO frequency              | 50.0~54.0MHz. <b>TS-680S only</b>                                     |
| D44          | VCO switching                        | For 50.0~54.0MHz. <b>TS-680S only</b>                                 |
| D45          | Switching                            | For TX mixer of VCO output.   |
| D46          | Switching                            | For RX mixer of VCO output.   |
| D47          | Attenuator                           | For CAR level.  |
| D48          | Prevention of reverse current        | RXB+SSB.  |
| D49          | Prevention of reverse current        |   |
| D50,53       | Switching                            | Receiving 1st IF MCF circuit.   |
| D51,52       | Switching                            | Transmission 2nd IF MCF circuit.                                      |
| D54          | Switching                            | Receiving 2nd IF circuit.   |
| D55          | Switching                            | Transmission 1st IF circuit.  |
| D56,57,60~63 | Switching                            | Selects 455kHz filter.  |
| D58,59       | Prevention of reverse current        | SSB+CW wide.  |
| D64          | Switching                            | Transmission 1st IF circuit.  |

## DESCRIPTION OF COMPONENTS

| Component | Use/Function                         | Operation/Condition/Compatibility               |
|-----------|--------------------------------------|---|
| D65       | Switching                            | Receiving 2nd IF circuit.                       |
| D66       | Switching                            | RB line.  |
| D67       | Switching                            | SS line.  |
| D68       | Prevention of reverse current        | SSB+AMB.  |
| D69       | Prevention of reverse current        | SSB+CWB.  |
| D70       | Prevention of reverse current        | MUT+RB.   |
| D71       | Noise detection                      | FM squelch circuit.                             |
| D72       | Switching                            | FM 2nd IF circuit.                              |
| D73,74    | AGC detection                        |   |
| D75       | AM detection                         |   |
| D76       | Prevention of reverse current        | TXB.  |
| D77       | Prevention of reverse current        | FMB+CWB.  |
| D78       | Temperature compensation             | S-meter circuit.                                |
| D79       | Prevention of reverse current        | 50W+PPD.  |
| D80       | Prevention of reverse current        | PD+FMB.   |
| D81       | Prevention of reverse current        | AMB+CWB.  |
| D82       | Prevention of reverse current        | VSF.  |
| D83       | Prevention of reverse current        | ALC.  |
| D85       | Prevention of reverse current        | Protection.                                     |
| D86       | Noise detection                      | NB1.  |
| D87       | Noise detection                      | NB2.  |
| D88       | Voltage shift                        | SBK.  |
| D89       | Prevention of reverse current        | CWB+FMB.  |
| D90       | Absorption of surge voltage of relay | For remote control relay.                       |
| D91,92    | Voltage shift                        | Outside ALC.                                    |
| D93       | Voltage shift                        | For DELAY TIME module VCC.                      |
| D95       | Prevention of reverse current        |   |
| D96       | Switching                            | HET amplifier input.                            |
| D97,98    | Prevention of reverse current        | RXB+NFT+ALC.                                    |
| D99       | Switching                            | Receiving HET output.                           |
| D100      | Switching                            | Transmission HET output.                        |
| D101,102  | Switching                            | FM transmission IF output.                      |
| D103~106  | Switching                            | Changeover of transmission BPF.                 |
| D107      | Prevention of reverse current        | RXB+NFT.  |
| D108      | Prevention of reverse current        | CWB.  |
| D109,110  | Switching                            | CAR TIF input circuit.                          |
| D111      | Temperature compensation             | TIF amplifier.                                  |
| D112      | Prevention of reverse current        | RB.   |
| D113      | Prevention of reverse current        | Power supply circuit for keying.                |
| D114      | Prevention of reverse current        | KEY.  |
| D115      | Prevention of reverse current        | PC1.  |
| D116      | Stabilization of voltage             | For ALC amplifier.                              |
| D117      | Prevention of reverse current        | Unbalancing circuit of AM carrier.              |
| D118      | VCO switching                        | For 0.5~105 MHz.                                |
| D119      | Prevention of reverse current        | SSB+FMB.  |
| D120      | Prevention of reverse current        | For IC8 VCC.                                    |
| D122      | Switching                            | CAR TIF input circuit.                          |
| D123      | Prevention of reverse current        | CWB.  |
| D124      | Switching                            | FM transmission IF output.                      |
| D125      | Voltage shift                        | Protection circuit.                             |
| D126      | Switching                            | Transmission output in mode other than FM mode. |
| D501      | Isolator                             | CWB.  |
| D502      | Isolator                             | VOX line.                                       |
| D503      | Voltage shift                        | VOX line.                                       |

## DESCRIPTION OF COMPONENTS

### SIDE TONE UNIT (X59-1060-00)

| Component | Use/Function                  | Operation/Condition/Compatibility |
|-----------|-------------------------------|-----------------------------------|
| Q1        | SIDE TONE oscillation         | 800Hz.                            |
| D1        | Switching                     | Turned ON when KEY DOWN.          |
| D2        | Prevention of reverse current |                                   |
| D3        | Temperature compensation      |                                   |

### VOX UNIT (X59-1080-00)

| Component | Use/Function                  | Operation/Condition/Compatibility |
|-----------|-------------------------------|-----------------------------------|
| IC1 (1/2) | Comparison of VOX level       |                                   |
| IC1 (2/2) | Comparison of ANTI VOX level  |                                   |
| IC2       | NOR circuit (RS flip-flop)    |                                   |
| Q1        | Switching transistor          | Q1 is ON when IC2/11pin is "H"    |
| D1,2      | Prevention of reverse current |                                   |

### FM MIC AMP UNIT (X59-3000-02)

| Component | Use/Function       | Operation/Condition/Compatibility |
|-----------|--------------------|-----------------------------------|
| IC1 (1/2) | Low-pass filter    | 1,2: Output                       |
| IC1 (2/2) | Limiting amplifier | 6: Input 7: Output                |
| Q1        | SUB TONE           |                                   |

### TRX UNIT (X59-3340-00)

| Component | Use/Function         | Operation/Condition/Compatibility                                      |
|-----------|----------------------|--|
| Q1~5      | Switching transistor | Q3,5 are ON in receiving mode, and Q1,2,4 are ON in transmission mode. |
| D1,2      | Switching            |  |

### NB2 UNIT (X59-3350-00)

| Component | Use/Function            | Operation/Condition/Compatibility                                    |
|-----------|-------------------------|--|
| IC1       | One-shot multi vibrator | Synchronized to pulse, with width of 1/4,4/4: 5mS and 2/4,3/4: 40mS. |
| Q1        | Switching transistor    | Turned ON when pulse is 15mS.  |
| Q2        | Switching transistor    | Turned OFF when pulse is 40mS.                                       |

### DELAY TIME UNIT (X59-3360-00)

| Component | Use/Function                  | Operation/Condition/Compatibility |
|-----------|-------------------------------|-----------------------------------|
| IC1       | One-shot multi vibrator       |                                   |
| Q1,2,6    | Switching transistor          | Turned ON when CW KEY DOWN.       |
| Q3~5,7    | Switching transistor          | Turned OFF when CW KEY DOWN.      |
| D1        | Prevention of reverse current |                                   |

### FAN UNIT (X59-3370-00)

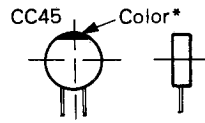
| Component | Use/Function          | Operation/Condition/Compatibility        |
|-----------|-----------------------|--|
| IC1       | Temperature detection | 1/2: Power down 2/2: Fan motor operation |
| Q1        | Switching transistor  |  |



## PARTS LIST

### CAPACITORS

CC 45 TH 1H 220 J  
 1 2 3 4 5 6



#### Capacitor value

1 0 3 = 0.01μF

- 1 = Type ..... ceramic, electrolytic, etc.
- 2 = Shape ..... round, square, etc.
- 3 = Temp. coefficient
- 4 = Voltage rating
- 5 = Value
- 6 = Tolerance

- 0 1 0 = 1pF
- 1 0 0 = 10pF
- 1 0 1 = 100pF
- 1 0 2 = 1000pF = 0.001μF

2 2 0 = 22pF  
 1st number | Multiplier  
 2nd number

#### Temperature Coefficient

| 1st Word | C     | L   | P      | R      | S     | T    | U      |
|----------|-------|-----|--------|--------|-------|------|--------|
| Color*   | Black | Red | Orange | Yellow | Green | Blue | Violet |
| ppm/°C   | 0     | -80 | -150   | -220   | -330  | -470 | -750   |

| 2nd Word | G    | H    | J     | K     | L     |
|----------|------|------|-------|-------|-------|
| ppm/°C   | ± 30 | ± 60 | ± 120 | ± 250 | ± 500 |

Example CC45TH = -470 ± 60 ppm/°C

#### Tolerance

| Code | C      | D     | G   | J   | K    | M    | X            | Z            | P            | No code                     |
|------|--------|-------|-----|-----|------|------|--------------|--------------|--------------|-----------------------------|
| (%)  | ± 0.25 | ± 0.5 | ± 2 | ± 5 | ± 10 | ± 20 | + 40<br>- 20 | + 80<br>- 20 | + 100<br>- 0 | 10μF-10~+50<br>4.7μF-10~+75 |

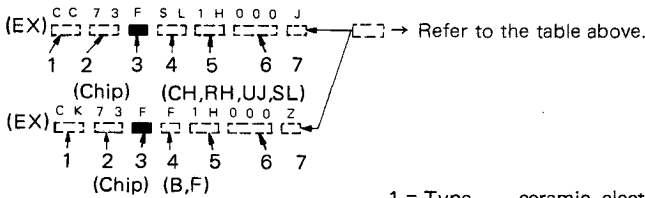
| Code | B     | C      | D     | F   | G   |
|------|-------|--------|-------|-----|-----|
| (pF) | ± 0.1 | ± 0.25 | ± 0.5 | ± 1 | ± 2 |

Less than 10 pF

#### Rating voltage

| 1st word \ 2nd word | A    | B    | C    | D    | E    | F    | G    | H    | J    | K    | V  |
|---------------------|------|------|------|------|------|------|------|------|------|------|----|
| 0                   | 1.0  | 1.25 | 1.6  | 2.0  | 2.5  | 3.15 | 4.0  | 5.0  | 6.3  | 8.0  | -  |
| 1                   | 10   | 12.5 | 16   | 20   | 25   | 31.5 | 40   | 50   | 63   | 80   | 35 |
| 2                   | 100  | 125  | 160  | 200  | 250  | 315  | 400  | 500  | 630  | 800  | -  |
| 3                   | 1000 | 1250 | 1600 | 2000 | 2500 | 3150 | 4000 | 5000 | 6300 | 8000 | -  |

#### Chip capacitors



#### Dimension

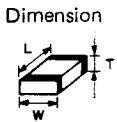
| Dimension code | L         | W          | T              |
|----------------|-----------|------------|----------------|
| Empty          | 5.6 ± 0.5 | 5.0 ± 0.5  | Less than 2.0  |
| E              | 3.2 ± 0.2 | 1.6 ± 0.2  | Less than 1.25 |
| F              | 2.0 ± 0.3 | 1.25 ± 0.2 | Less than 1.25 |

#### Dimension

| Dimension code | L         | W          | T    | Wattage |
|----------------|-----------|------------|------|---------|
| E              | 3.2 ± 0.2 | 1.6 ± 0.2  | 0.57 | 2B      |
| F              | 2.0 ± 0.3 | 1.25 ± 0.2 | 0.45 | 2A      |

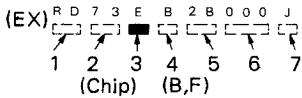
#### Rating wattage

| Cord | Wattage | Cord | Wattage | Cord | Wattage |
|------|---------|------|---------|------|---------|
| 2A   | 1/10W   | 2E   | 1/4W    | 3A   | 1W      |
| 2B   | 1/8W    | 2H   | 1/2W    | 3D   | 2W      |
| 2C   | 1/6W    |      |         |      |         |



### RESISTORS

#### Chip resistor (Carbon)



#### Carbon resistor (Normal type)



- 1 = Type ..... ceramic, electrolytic, etc.
- 2 = Shape ..... round, square, etc.
- 3 = Dimension
- 4 = Temp. coefficient
- 5 = Voltage rating
- 6 = Value
- 7 = Tolerance.

## PARTS LIST

× New Parts

Parts without Parts No. are not supplied.


Les articles non mentionnes dans le Parts No. ne sont pas fournis.

Teile ohne Parts No. werden nicht geliefert.

| Ref. No.<br>参照番号    | Address<br>位置 | New<br>Parts<br>新 | Parts No.<br>部品番号 | Description<br>部品名 / 規格       | Desti-<br>nation<br>仕 向 | Re-<br>marks<br>備考 |
|---------------------|---------------|-------------------|-------------------|-------------------------------|-------------------------|--------------------|
| <b>TS-140S/680S</b> |               |                   |                   |                               |                         |                    |
| 1                   | 1B            | *                 | A01-1032-02       | CASE (UPPER)                  |                         |                    |
| 2                   | 3B            | *                 | A01-1033-02       | CASE (LOWER)                  |                         |                    |
| 3                   | 2F            | *                 | A10-1286-01       | CHASSIS                       |                         |                    |
| 4                   | 3C            | *                 | A11-0404-01       | SUB CHASSIS                   |                         |                    |
| 5                   | 2G            | *                 | A20-2622-03       | PANEL ASSY                    |                         | B                  |
| 5                   | 2G            | *                 | A20-2638-03       | PANEL ASSY                    |                         | A                  |
| 6                   | 1H            | *                 | A22-0753-02       | SUB PANEL                     |                         |                    |
| 7                   | 2F            | *                 | A23-1498-13       | REAR PANEL                    |                         |                    |
| 8                   | 1H            | *                 | A33-0408-04       | REFLECTOR                     |                         |                    |
| 13                  | 2H            | *                 | B01-0660-03       | PANEL ESCUTCHEON ASSY         |                         |                    |
| 14                  | 2G            | *                 | B10-1101-03       | FRONT GLASS                   |                         | B                  |
| 14                  | 2G            | *                 | B10-1102-03       | FRONT GLASS                   |                         | A                  |
| 15                  | 2H            | *                 | B11-0447-04       | OPTICAL FIBER ASSY            |                         |                    |
| 17                  | 2H            | *                 | B11-0450-04       | FILTER                        |                         |                    |
| 18                  | 1I            |                   | B30-0817-15       | PILOT LAMP (14V,80MA)         |                         |                    |
| 19                  | 1H            | *                 | B31-0661-05       | METER                         |                         |                    |
| 22                  | 1K            |                   | B46-0410-20       | WARRANTY CARD                 | K                       |                    |
| 23                  | 1K            | *                 | B50-8199-20       | INSTRUCTION MANUAL            |                         |                    |
| -                   |               | *                 | B01-0659-03       | ESCUTCHEON                    |                         |                    |
| -                   |               | *                 | B40-3782-04       | MODEL NAME PLATE              | MTW                     |                    |
| -                   |               | *                 | B40-3799-04       | MODEL NAME PLATE              |                         | B                  |
| -                   |               | *                 | B40-3839-04       | MODEL NAME PLATE              | K                       |                    |
| C1                  |               |                   | CK45F1H103Z       | CERAMIC 0.010UF Z             |                         |                    |
| 30                  | 2D            |                   | E04-0167-05       | RF COAXIAL CABLE RECEPTACLE   |                         |                    |
| 31                  | 1J            |                   | E07-0751-05       | 7P DIN PLUG (ACSY)            |                         |                    |
| 32                  | 1J            |                   | E30-2065-05       | DC POWER CORD ASSY (ACSY)     |                         |                    |
| 33                  | 1J            |                   | E31-2154-05       | CONNECTING WIRE(CAL)ACSY      |                         |                    |
| 34                  | 1J            |                   | E07-1351-05       | 13P PLUG (ACSY)               |                         |                    |
| -                   |               |                   | E07-0852-15       | 8P METAL PLUG (MIC)           | KM                      |                    |
| -                   |               | *                 | E31-3297-05       | FLEXIBLE CABLE                |                         |                    |
| -                   |               | *                 | E31-3298-05       | FLEXIBLE CABLE                |                         |                    |
| -                   |               | *                 | E31-3299-05       | FLEXIBLE CABLE                |                         |                    |
| -                   |               | *                 | E31-3300-05       | FLEXIBLE CABLE                |                         |                    |
| 38                  | 1J            |                   | F05-2036-05       | FUSE (20A)                    |                         |                    |
| 40                  | 1C            | *                 | F11-1069-02       | SHIELDING COVER               |                         |                    |
| 41                  | 1E            | *                 | F11-1088-04       | SHIELDING COVER(SIGNAL UNIT)  |                         |                    |
| -                   |               |                   | F11-0818-24       | SHIELDING COVER               |                         |                    |
| -                   |               | *                 | F19-0657-04       | BLIND PLATE (REAR PANEL)      |                         | B                  |
| -                   |               |                   | F20-0521-04       | INSULATING SHEET(LITHUM BATT) |                         |                    |
| 47                  | 2G            |                   | G02-0505-05       | KNOB FIXED SPRING             |                         |                    |
| 48                  | 1C, 1I        | *                 | G02-0578-04       | LEAF SPRING                   |                         |                    |
| 49                  | 3C            |                   | G10-0610-04       | FELT                          |                         |                    |
| 50                  | 1A, 2H        | *                 | G10-0656-04       | FELT (SP)                     |                         |                    |
| 51                  | 2H            | *                 | G10-0660-04       | FELT (PANEL)                  |                         |                    |
| 52                  | 2E            | *                 | G10-0668-04       | FELT (SIGNAL UNIT)            |                         |                    |
| 53                  | 2E            |                   | G10-0633-04       | FELT (CHASSIS SIDE)           |                         |                    |
| 54                  | 1A            |                   | G13-0684-04       | CUSHION (SUB CHASSIS)         |                         |                    |
| 55                  | 2G            |                   | G13-0831-04       | CUSHION (SIGNAL UNIT)         |                         |                    |
| 56                  | 2G            | *                 | G13-0848-04       | CUSHION (KNOB)                |                         |                    |
| 57                  | 2G, 2H        | *                 | G13-0849-04       | CUSHION (KNOB)                |                         |                    |
| 58                  | 2H            | *                 | G13-0850-04       | CUSHION (KNOB)                |                         |                    |

E: Scandinavia & Europe    K: USA    P: Canada  
 U: PX(Far East, Hawaii)    T: England    M: Other Areas  
 UE: AAFES(Europe)    X: Australia

A : TS-140S (K,M,T,W)  
 B : TS-680S (K)

 indicates safety critical components.

## PARTS LIST

× New Parts

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|------------------|---------------|-------------------|-------------------|----------------------------------|-------------------------|--------------------|
| 59               | 2H            | *                 | G13-0863-04       | CUSHION (ESCUTCHEON)             |                         |                    |
| 60               | 1I            | *                 | G13-0864-04       | CUSHION (REFLECTOR)              |                         |                    |
| 62               | 1A, 1B        |                   | G53-0509-04       | PACKING (CASE SIDE)              |                         |                    |
| -                |               |                   | G02-0565-04       | FLAT SPRING                      |                         |                    |
| -                |               |                   | G11-0609-04       | CUSHION (MIC)                    | KM                      |                    |
| -                |               |                   | G13-0656-04       | CUSHION (FLEXIBLE CABLE)         |                         |                    |
| -                |               |                   | G13-0855-04       | CUSHION (MIC)                    |                         |                    |
| -                |               | *                 | G13-0885-04       | CUSHION (FLEXIBLE CABLE)         |                         |                    |
| -                |               | *                 | G13-0891-04       | CUSHION                          | W                       |                    |
| 66               | 3K            | *                 | H01-8146-04       | CARTON BOX                       |                         | A                  |
| 66               | 3K            | *                 | H01-8165-04       | CARTON BOX                       |                         | B                  |
| 68               | 2J            | *                 | H10-2633-02       | PACKING FIXTURE(FRONT)           |                         |                    |
| 69               | 2K            | *                 | H10-2634-02       | PACKING FIXTURE(REAR)            |                         |                    |
| 70               | 2J            |                   | H12-1315-04       | CUSHION                          |                         |                    |
| 71               | 2J            | *                 | H12-1405-04       | CUSHION (FRONT)                  |                         |                    |
| 72               | 2K            |                   | H20-1410-03       | PROTECTIVE COVER                 |                         |                    |
| 73               | 1J            |                   | H25-0112-04       | PROTECTIVE BAG (DC CORD)         |                         |                    |
| 74               | 1J            |                   | H25-0079-04       | PROTECTIVE BAG (MIC)             | KM                      |                    |
| 77               | 3B            |                   | J02-0323-05       | FOOT (REAR)                      |                         |                    |
| 78               | 3A            |                   | J02-0440-04       | ASSISTANT FOOT                   |                         |                    |
| 79               | 1A, 3A        |                   | J02-0441-05       | FOOT (SMALL TYPE)                |                         |                    |
| 80               | 3A, 3B        |                   | J02-0442-04       | FOOT (FOOT)                      |                         |                    |
| 82               | 1I, 2I        |                   | J21-2664-14       | MOUNTING HARDWARE(SW)            |                         |                    |
| 83               | 3A            |                   | J21-4208-04       | MOUNTING HARDWARE(ASSIST FOOT)   |                         |                    |
| 84               | 1H            |                   | J31-0141-04       | SPACER RING (MIC)                |                         |                    |
| 85               | 1H            |                   | J32-0792-04       | HEX BOSS                         |                         |                    |
| 86               | 2F            |                   | J42-0442-05       | HOLE BUSHING                     |                         |                    |
| 87               | 2A            | *                 | J50-0401-05       | HINGE                            |                         |                    |
| 88               | 3C            | *                 | J50-0402-05       | HINGE                            |                         |                    |
| -                |               |                   | J13-0404-05       | FUSE HOLDER(DC POWER CORD ASSY)  |                         |                    |
| -                |               |                   | J61-0307-05       | WIRE BAND                        |                         |                    |
| 92               | 1B            |                   | K01-0407-05       | CARRING HANDLE                   |                         |                    |
| 93               | 2G            |                   | K21-0778-02       | MAIN KNOB                        |                         |                    |
| 94               | 2G            |                   | K23-0710-04       | KNOB (INSIDE)                    |                         |                    |
| 95               | 2G            |                   | K29-0741-34       | KNOB (OUTSIDE)                   |                         |                    |
| 96               | 1H            |                   | K29-0758-14       | PUSH KNOB (POWER SW)             |                         |                    |
| 97               | 2G            | *                 | K29-3078-04       | KNOB (CW SW)                     |                         |                    |
| 98               | 2G            | *                 | K29-3079-04       | KNOB (PWR, MIC, RFGIN, NB LEVEL) |                         |                    |
| 99               | 2G            | *                 | K29-3080-14       | KNOB (M, CH)                     |                         |                    |
| 100              | 2G            | *                 | K29-3081-04       | KNOB (A/B)                       |                         |                    |
| 101              | 2G            | *                 | K29-3082-04       | KNOB (SPLIT)                     |                         |                    |
| 102              | 2G            | *                 | K29-3083-04       | KNOB (A=B)                       |                         |                    |
| 103              | 2G            | *                 | K29-3084-04       | KNOB (LSB/USB)                   |                         |                    |
| 104              | 2G            | *                 | K29-3085-04       | KNOB (CW/N)                      |                         |                    |
| 105              | 2G            | *                 | K29-3086-04       | KNOB (AM/FM)                     |                         |                    |
| 106              | 2G            | *                 | K29-3087-04       | KNOB (CLEAR)                     |                         |                    |
| 107              | 2G            | *                 | K29-3088-04       | KNOB (SCAN)                      |                         |                    |
| 108              | 2G            | *                 | K29-3089-04       | KNOB (VFO/M)                     |                         |                    |
| 109              | 2G            | *                 | K29-3090-04       | KNOB (F. LOCK)                   |                         |                    |
| 110              | 2G            | *                 | K29-3091-04       | KNOB (M-V)                       |                         |                    |
| 111              | 2G            | *                 | K29-3092-04       | KNOB (M. IN)                     |                         |                    |
| 112              | 2G            | *                 | K29-3093-04       | KNOB (BAND)                      |                         |                    |
| 113              | 2H            | *                 | K29-3094-04       | KNOB (NB ETC)                    |                         |                    |

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|--|---------------|-------------------|-------------------|--------------------------------|-------------------------|--------------------|
| 120  | 3C            |                   | N15-1040-46       | FLAT WASHER                    |                         |                    |
| 121  | 2G            |                   | N19-0637-04       | FLAT WASHER (MAIN KNOB)        |                         |                    |
| A  | 2H            |                   | N09-0256-05       | GND SCREW (SUB PANEL)          |                         |                    |
| B  | 3D            |                   | N09-0372-04       | SCREW (PULLEY)                 |                         |                    |
| C  | 1F            |                   | N88-2608-46       | FLAT HEAD TAPTITE SCREW        |                         |                    |
| D  | 2G, 2H        |                   | N09-0644-14       | BIND SCREW (FRONT GLASS)       |                         |                    |
| E  | 2F            |                   | N30-2606-41       | PAN HEAD MACHINE SCREW         |                         |                    |
| F  | 3C            |                   | N30-4014-41       | PAN HEAD MACHINE SCREW (GND)   |                         |                    |
| G  | 2G, 1I        |                   | N32-2606-46       | FLAT HEAD MACHINE SCREW        |                         |                    |
| H  | 2A            |                   | N32-3006-46       | FLAT HEAD MACHINE SCREW        |                         |                    |
| I  | 3C            |                   | N09-0623-04       | SEMUS SCREW (50MHZ MODULE)     |                         | B                  |
| J  | 1A, 1B        |                   | N33-3006-41       | OVAL HEAD MACHINE SCREW(CASE)  |                         |                    |
| K  | 3E, 2C        |                   | N87-2606-46       | BRAZIER HEAD TAPTITE SCREW     |                         |                    |
| L  | 2F            |                   | N87-3006-41       | BRAZIER HEAD TAPTITE SCREW     |                         |                    |
| M  | 2A, 1C        |                   | N87-3006-46       | BRAZIER HEAD TAPTITE SCREW     |                         |                    |
| N  | 3A            |                   | N87-3008-41       | BRAZIER HEAD TAPTITE SCREW     |                         |                    |
| O  | 2A            |                   | N88-3006-46       | FLAT HEAD TAPTITE SCREW        |                         |                    |
| P  | 2D            |                   | N87-3010-41       | BRAZIER HEAD TAPTITE SCREW(ANT |                         |                    |
| R  | 2G            |                   | N90-2606-46       | TP HEAD MACHINE SCREW          |                         |                    |
| R1   |               |                   | RS14AB3A560J      | FL-PROOF RS 56 J 1W            |                         |                    |
| 129  | 1H            |                   | S40-2437-15       | PUSH SWITCH (POWER)            |                         |                    |
| -  |               |                   | S50-1406-05       | SENSITIVE SWITCH(MICROPHONE)   | KM                      |                    |
| 133  | 3C            | *                 | T07-0252-05       | SPEAKER                        |                         |                    |
| 134  | 1J            |                   | T91-0352-15       | MICROPHONE                     | KM                      |                    |
| 137  | 1I            | *                 | W02-0802-05       | ENCODER ASSU                   |                         |                    |
| 138  | 3F            | *                 | W09-0515-05       | LITHIUM BATTERY                |                         |                    |
| 142  | 1I, 1H        | *                 | X41-3030-00       | SWITCH UNIT                    |                         | B                  |
| 142  | 1I, 1H        | *                 | X41-3030-11       | SWITCH UNIT                    |                         | A                  |
| 144  | 1C            | *                 | X45-3100-00       | FINAL UNIT                     |                         | B                  |
| 144  | 1C            | *                 | X45-3100-11       | FINAL UNIT                     |                         | A                  |
| 145  | 2C, 1F        | *                 | X51-3040-00       | FILTER UNIT                    |                         | B                  |
| 145  | 2C, 1F        | *                 | X51-3040-11       | FILTER UNIT                    |                         | A                  |
| 146  | 3F            | *                 | X53-3100-11       | CONTRØL UNIT                   |                         | A                  |
| 146  | 3F            | *                 | X53-3100-12       | CONTRØL UNIT                   |                         | B                  |
| 147  | 1I            | *                 | X54-3050-00       | DISPLAY UNIT                   | KMT                     |                    |
| 147  | 1I            | *                 | X54-3050-61       | DISPLAY UNIT                   | W                       |                    |
| 148  | 2E            | *                 | X57-3190-00       | SIGNAL UNIT                    |                         | B                  |
| 148  | 2E            | *                 | X57-3200-10       | SIGNAL UNIT                    | KMT                     |                    |
| 148  | 2E            | *                 | X57-3200-61       | SIGNAL UNIT                    | W                       |                    |
| <b>SWITCH UNIT (X41-3030-XX) -00 : TS-680S -11 : TS-140S</b> |               |                   |                   |                                |                         |                    |
| C1   | , 2           |                   | CK41FY1E102M      | CYLND CHIP C 100PF             | M                       |                    |
| C3   |               |                   | CC41FSL1H101J     | CYLND CHIP C 100PF             | J                       |                    |
| C4   |               |                   | CE04EW1H010M      | ELECTRØ                        | 1.0UF 50WV              |                    |
| C5   | , 6           |                   | CC41FSL1H101J     | CYLND CHIP C 100PF             | J                       |                    |
| C7   |               |                   | CK41FY1E222M      | CYLND CHIP C 220PF             | M                       |                    |
| C8   |               |                   | CE04EW1H4R7M      | ELECTRØ                        | 4.7UF 50WV              |                    |
| C9   |               |                   | CE04EW1A470M      | ELECTRØ                        | 47UF 10WV               |                    |
| C10  | , 11          |                   | CE04EW1H010M      | ELECTRØ                        | 1.0UF 50WV              |                    |
| C12  |               |                   | CE04EW1H100M      | ELECTRØ                        | 10UF 50WV               |                    |
| C13  |               |                   | CE04EW1A470M      | ELECTRØ                        | 47UF 10WV               |                    |
| C14  |               |                   | CE04EW1H4R7M      | ELECTRØ                        | 4.7UF 50WV              |                    |
| C15  |               |                   | CC41FSL1H101J     | CYLND CHIP C 100PF             | J                       | A                  |

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|---|---------------|-------------------|-------------------|-------------------------------|-------------------------|--------------------|
| C16 .17   |               |                   | CE04EW1H010M      | ELECTRØ 1.0UF 50WV            |                         | A                  |
| C18   |               |                   | CE04EW1H100M      | ELECTRØ 10UF 50WV             |                         | A                  |
| C19   |               |                   | CE04EW1A470M      | ELECTRØ 47UF 10WV             |                         | A                  |
| CN1   |               |                   | E40-3241-05       | PIN CONNECTØR (6P)            |                         |                    |
| CN2   |               |                   | E40-3237-05       | PIN CONNECTØR (2P)            |                         |                    |
| CN3   |               |                   | E40-3239-05       | PIN CONNECTØR (4P)            |                         |                    |
| CN4   |               |                   | E40-3237-05       | PIN CONNECTØR (2P)            |                         | A                  |
| CN5   |               |                   | E40-3239-05       | PIN CONNECTØR (4P)            |                         |                    |
| CN6   |               | *                 | E31-3307-05       | CONNECTING WIRE(AF,SD)        |                         |                    |
| CN7   |               | *                 | E31-3306-05       | CONNECTING WIRE(RIT,IF SHIFT) |                         |                    |
| CN8   |               |                   | E40-3247-05       | PIN CONNECTØR (3P)            |                         |                    |
| J1  | 1H            |                   | E11-0413-05       | PHONE JACK                    |                         |                    |
| R1 -3   |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W       |                         |                    |
| R4  |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W      |                         |                    |
| R5  |               |                   | RD41FB2BØ21J      | CYLND CHIP R 82Ø J 1/8W       |                         |                    |
| R6  |               |                   | RD41FB2B101J      | CYLND CHIP R 10Ø J 1/8W       |                         |                    |
| R7  |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W       |                         |                    |
| R8 .9   |               |                   | RD41FB2B101J      | CYLND CHIP R 10Ø J 1/8W       |                         |                    |
| R10   |               |                   | RD41FB2B822J      | CYLND CHIP R 8.2K J 1/8W      |                         |                    |
| R11   |               |                   | RD41FB2B823J      | CYLND CHIP R 82K J 1/8W       |                         |                    |
| R12 .13   |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W      |                         |                    |
| R14   |               |                   | RD41FB2B332J      | CYLND CHIP R 3.3K J 1/8W      |                         |                    |
| R15   |               |                   | RD41FB2B101J      | CYLND CHIP R 10Ø J 1/8W       |                         |                    |
| R16   |               |                   | RD41FB2B221J      | CYLND CHIP R 22Ø J 1/8W       |                         |                    |
| R17   |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W      |                         |                    |
| R18   |               |                   | RD41FB2B101J      | CYLND CHIP R 10Ø J 1/8W       |                         | A                  |
| R19   |               |                   | RD41FB2B562J      | CYLND CHIP R 5.6K J 1/8W      |                         | A                  |
| R20   |               |                   | RD41FB2B104J      | CYLND CHIP R 100K J 1/8W      |                         | A                  |
| R21   |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W       |                         | A                  |
| R22   |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W       |                         | A                  |
| R23   |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W      |                         | A                  |
| VR1   |               |                   | R12-3127-05       | TRIMMING PØT. (10K)           |                         |                    |
| VR2   | 2I            | *                 | R19-9411-05       | PØTENTIØMETER (AF,SQL)        |                         |                    |
| VR3   | 1I            | *                 | R19-3424-05       | PØTENTIØMETER (RIT,IF SHIFT)  |                         |                    |
| W1 -11  |               |                   | R92-0670-05       | CHIP R 0 ØHM                  |                         |                    |
| D1  |               |                   | 1N6Ø              | DIØDE                         |                         |                    |
| D2 .3   |               |                   | RLS73             | CHIP DIØDE                    |                         |                    |
| IC1   |               |                   | UPC1158H2         | IC(ALC AMP)                   |                         |                    |
| Q1 -3   |               |                   | DTC114EK          | DIGITAL TRANSISTØR            |                         |                    |
| Q4  |               |                   | 2SA1162(Y)        | TRANSISTØR                    |                         |                    |
| Q5 .6   |               |                   | 2SC2712(Y)        | TRANSISTØR                    |                         |                    |
| Q6  |               |                   | 2SC2712(Y)        | CHIP TEANSISTØR               |                         | A                  |
| <b>FINAL UNIT (X45-3100-XX) -00 : TS-680S -11 : TS-140S</b> |               |                   |                   |                               |                         |                    |
| C1  |               |                   | CK45B1H561K       | CERAMIC 56ØPF K               |                         |                    |
| C9  |               |                   | CM93D2H681J       | MICA 68ØPF J                  |                         |                    |
| C10 .11   |               |                   | C91-1004-05       | CERAMIC 0.0068UF J            |                         |                    |
| C12   |               |                   | CC45SL2H151J      | CERAMIC 15ØPF J               |                         |                    |
| C13   |               |                   | CM73F2H122J       | CHIP C 120ØPF J               |                         |                    |
| C15   |               |                   | C91-0119-05       | CERAMIC 0.047UF K             |                         |                    |
| C16   |               |                   | CE04EW1H100M      | ELECTRØ 10UF 50WV             |                         |                    |
| C18   |               |                   | CE04EW1E101M      | ELECTRØ 100UF 25WV            |                         |                    |
| C21   |               |                   | C91-0119-05       | CERAMIC 0.047UF K             |                         |                    |
| C22   |               |                   | CE04EW1H100M      | ELECTRØ 10UF 50WV             |                         |                    |

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|------------------|---------------|-------------------|-------------------|-------------------------------|------------------------|--------------------|
| C24              |               |                   | CE04EW1E101M      | ELECTRØ 100UF 25WV            |                        |                    |
| C28              |               |                   | CE04EW1E470M      | ELECTRØ 47UF 25WV             |                        |                    |
| C32 ,33          |               |                   | C90-0817-05       | ELECTRØ 1000UF 16WV           |                        |                    |
| C36              |               |                   | CE04EW1E470M      | ELECTRØ 47UF 25WV             |                        |                    |
| C37              |               |                   | C91-0119-05       | CERAMIC 0.047UF K             |                        |                    |
| C38              |               |                   | CE04EW1E470M      | ELECTRØ 47UF 25WV             |                        |                    |
| C40 ,41          |               |                   | CE04EW1E470M      | ELECTRØ 47UF 25WV             |                        |                    |
| C42              |               |                   | C91-0119-05       | CERAMIC 0.047UF K             |                        |                    |
| C43              |               |                   | CC45SL2H121J      | CERAMIC 120PF J               |                        |                    |
| -                |               |                   | E31-2067-05       | COAXIAL CABLE WITH PLUG (50D) |                        | B                  |
| -                |               |                   | E31-3028-05       | COAXIAL CABLE WITH PLUG (PØ)  |                        |                    |
| -                |               | *                 | E31-3304-05       | COAXIAL CABLE WITH PLUG (DRV) |                        |                    |
| -                |               | *                 | E31-3322-05       | CONNECTING WIRE               |                        |                    |
| -                |               | *                 | E31-3324-05       | CONNECTING WIRE (FAN)         |                        |                    |
| -                |               | *                 | E31-3327-05       | CONNECTING WIRE               |                        |                    |
| CN1              |               |                   | E40-3238-05       | PIN CONNECTØR (3P)            |                        |                    |
| CN2              |               |                   | E40-3239-05       | PIN CONNECTØR (4P)            |                        |                    |
| CN3              |               |                   | E40-3238-05       | PIN CONNECTØR (3P)            |                        |                    |
| CN4              |               | *                 | E31-3317-05       | CONNECTING WIRE               |                        | B                  |
| CN5              |               |                   | E40-3237-05       | PIN CONNECTØR (2P)            |                        |                    |
| 158              | 1C            |                   | F29-0014-05       | INSULATOR                     |                        |                    |
| 172              | 2D            | *                 | F01-0954-01       | HEAT SINK                     |                        |                    |
| 176              | 1C            | *                 | F09-0417-05       | FAN (MØTØR)                   |                        |                    |
| -                |               |                   | F20-0078-05       | INSULATING BOARD              |                        |                    |
| -                |               | *                 | F20-0582-04       | INSULATING BOARD              |                        |                    |
| 178              | 2D            | *                 | G02-0574-04       | LEAF SPRING                   |                        |                    |
| -                |               |                   | G02-0571-04       | FLAT SPRING (Ø2)              |                        |                    |
| -                |               |                   | L92-0102-05       | TRØIDAL CØRE (KT-41)          |                        |                    |
| -                |               |                   | L92-0106-05       | TRØIDAL CØRE (KT-41)          |                        |                    |
| L1               |               |                   | L40-1501-14       | SMALL FIXED INDUCTØR          |                        |                    |
| L2               |               |                   | L40-3391-14       | SMALL FIXED INDUCTØR          |                        |                    |
| L3               |               |                   | L19-0315-25       | TRØIDAL CØIL                  |                        |                    |
| L4 ,5            |               | *                 | L33-0699-05       | CHØKE CØIL                    |                        |                    |
| L6 ,7            |               |                   | L33-0232-05       | CHØKE CØIL (1ØH)              |                        |                    |
| L8               |               | *                 | L33-0699-05       | CHØKE CØIL                    |                        |                    |
| L9               |               |                   | L19-0342-05       | DRIVE TRANSFORMER             |                        |                    |
| L10 ,11          |               |                   | L33-0617-05       | TRØIDAL CØIL                  |                        |                    |
| L12              |               |                   | L39-0424-05       | NFB CØIL                      |                        |                    |
| L13              |               | *                 | L39-0431-05       | TRØIDAL CØIL                  |                        |                    |
| L14              |               |                   | L33-0651-05       | CHØKE CØIL                    |                        |                    |
| L15              |               |                   | L33-0617-05       | TRØIDAL CØIL                  |                        |                    |
| L16              |               |                   | L40-1011-14       | SMALL FIXED INDUCTØR          |                        |                    |
| L17              |               |                   | L15-0016-05       | LOW-FREQUENCY CHØKE CØIL      |                        |                    |
| Ø                | 1C,1D         |                   | N87-3008-46       | BRAZIER HEAD TAPTITE SCREW    |                        |                    |
| S                | 1C            |                   | N09-0623-04       | SEMS SCREW                    |                        |                    |
| T                | 2C            |                   | N35-3006-46       | BINDING HEAD MACHINE SCREW    |                        |                    |
| RS               |               |                   | RC05GF2H3R9J      | RC 3.9 J 1/2W                 |                        |                    |
| RB ,9            |               |                   | RS14DB3A181J      | FL-PROØF RS 180 J 1W          |                        |                    |
| R10 -13          |               |                   | RS14DB3A5R6J      | FL-PROØF RS 5.6 J 1W          |                        |                    |
| R14 ,15          |               |                   | RS14DB3A150J      | FL-PROØF RS 15 J 1W           |                        |                    |
| R16 ,17          |               |                   | RS14DB3A3R3J      | FL-PROØF RS 3.3 J 1W          |                        |                    |
| R18              |               |                   | RS14DB3A100J      | FL-PROØF RS 10 J 1W           |                        |                    |

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|--|---------------|-------------------|--|---|---|--------------------|
| VR1 ,2<br>W1<br>W2 ,3  |               |                   | R12-1431-05<br>R92-0150-05<br>R92-1061-05                                    | TRIMMING PNT. (1K)<br>JUMPER REST 0 OHM<br>JUMPER REST 0 OHM        |   | A                  |
| K1   |               |                   | S51-2417-05  | RELAY   |   | B                  |
| D1<br>D2 ,3<br>D4<br>D5<br>D6                                |               |                   | MV-5T<br>SV-03YS<br>1S1555<br>1S1555<br>SG-5L(R)                             | VARISTER<br>VARISTER<br>DIODE<br>DIODE<br>DIODE                     |   | B                  |
| D7<br>Q1<br>Q2 ,3<br>Q4 ,5<br>Q6 ,7                          |               |                   | MTZ8.2JA<br>2SC1971<br>2SC2509<br>2SC2879<br>2SD1406(Y)                      | ZENER DIODE<br>TRANSISTOR<br>TRANSISTOR<br>TRANSISTOR<br>TRANSISTOR |   |                    |
| Q8 ,9<br>TH1   |               |                   | AN7805<br>5TP41L   | IC(VOLTAGE REGULATOR/ +5V)<br>THERMISTOR                            |   |                    |
| 192  | 1D            | *                 | X59-3370-00  | MODULE UNIT   |   |                    |
| <b>FILTER UNIT (X51-3040-XX) -00 : TS-680S -11 : TS-140S</b> |               |                   |  |   |   |                    |
| C1<br>C2<br>C3<br>C4<br>C5                                   |               |                   | CM93D2H152J<br>CM93D2H471J<br>CM93D2H152J<br>CM93D2H221J<br>CM93D2H821J      | MICA<br>MICA<br>MICA<br>MICA<br>MICA                                | 1500PF J<br>470PF J<br>1500PF J<br>220PF J<br>820PF J |                    |
| C6<br>C7<br>C8 ,9<br>C10<br>C11                              |               |                   | CC45SL2H431J<br>CC45SL2H241J<br>CC45SL2H431J<br>CC45SL2H151J<br>CC45SL2H331J | CERAMIC<br>CERAMIC<br>CERAMIC<br>CERAMIC<br>CERAMIC                 | 430PF J<br>240PF J<br>430PF J<br>150PF J<br>330PF J   |                    |
| C12<br>C13<br>C14<br>C15<br>C16                              |               |                   | CC45SL2H820J<br>CC45SL2H331J<br>CC45SL2H101J<br>CC45SL2H431J<br>CC45SL2H331J | CERAMIC<br>CERAMIC<br>CERAMIC<br>CERAMIC<br>CERAMIC                 | 82PF J<br>330PF J<br>100PF J<br>430PF J<br>330PF J    |                    |
| C17<br>C18<br>C19 ,20<br>C21<br>C22                          |               |                   | CC45SL2H151J<br>CC45SL2H330J<br>CC45SL2H151J<br>CC45SL2H121J<br>CC45SL2H181J | CERAMIC<br>CERAMIC<br>CERAMIC<br>CERAMIC<br>CERAMIC                 | 150PF J<br>33PF J<br>150PF J<br>120PF J<br>180PF J    |                    |
| C23<br>C24<br>C25<br>C26<br>C27                              |               |                   | CC45SL2H820J<br>CC45SL2H680J<br>CC45SL2H181J<br>CC45SL2H121J<br>CC45SL2H101J | CERAMIC<br>CERAMIC<br>CERAMIC<br>CERAMIC<br>CERAMIC                 | 82PF J<br>68PF J<br>180PF J<br>120PF J<br>100PF J     |                    |
| C28<br>C29<br>C30<br>C31<br>C32                              |               |                   | CC45SL2H470J<br>CC45SL2H680J<br>CC45SL2H330J<br>CC45SL2H820J<br>CC45SL2H680J | CERAMIC<br>CERAMIC<br>CERAMIC<br>CERAMIC<br>CERAMIC                 | 47PF J<br>68PF J<br>33PF J<br>82PF J<br>68PF J        |                    |
| C33<br>C34<br>C35 ,36<br>C37<br>C38                          |               |                   | CC45SL2H100D<br>CC45SL2H820J<br>CC45SL2H330J<br>CC45SL2H270J<br>CC45SL2H120J | CERAMIC<br>CERAMIC<br>CERAMIC<br>CERAMIC<br>CERAMIC                 | 10PF D<br>82PF J<br>33PF J<br>27PF J<br>12PF J        | B<br>B             |

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|------------------|---------------|-------------------|-------------------|-------------------------|-------------------------|--------------------|
| C39              |               |                   | CC45SL2H270J      | CERAMIC 27PF J          |                         | B                  |
| C40 ,41          |               |                   | CC45SL2H330J      | CERAMIC 33PF J          |                         |                    |
| C42 ,43          |               |                   | CC45SL2H560J      | CERAMIC 56PF J          |                         | B                  |
| C66              |               |                   | CC45CH2H030C      | CERAMIC 3.0PF C         |                         |                    |
| C67              |               |                   | CC45CH1H560J      | CERAMIC 56PF J          |                         |                    |
| C68              |               |                   | CC45CH1H101J      | CERAMIC 100PF J         |                         |                    |
| C79              |               |                   | CC45CH1H680J      | CERAMIC 68PF J          |                         | B                  |
| C80              |               |                   | CK45B1H472K       | CERAMIC 4700PF K        |                         | B                  |
| C81 ,82          |               |                   | CE04EW1E470M      | ELECTRO 47UF 25WV       |                         | B                  |
| C83              |               |                   | CE04EW1H3R3M      | ELECTRO 3.3UF 50WV      |                         | B                  |
| C84 ,85          |               |                   | CK45B1H472K       | CERAMIC 4700PF K        |                         | B                  |
| TC1              |               |                   | C05-0309-05       | TRIMMING CAP (40P)      |                         | B                  |
| TC2              |               |                   | C05-0030-15       | TRIMMING CAP (20P)      |                         |                    |
| CN1              |               |                   | E40-3238-05       | PIN CONNECTOR (3P)      |                         |                    |
| CN2              |               |                   | E40-3238-05       | PIN CONNECTOR (3P)      |                         | B                  |
| CN3              |               |                   | E40-3242-05       | PIN CONNECTOR (7P)      |                         |                    |
| CN4              |               |                   | E40-3239-05       | PIN CONNECTOR (4P)      |                         |                    |
| CN5              |               |                   | E04-0157-05       | PIN CONNECTOR           |                         |                    |
| CN6              |               |                   | E04-0157-05       | PIN CONNECTOR           |                         | B                  |
| CN7              |               |                   | E40-5059-05       | PIN CONNECTOR (5P)      |                         |                    |
| CN8 ,9           |               | *                 | E31-3330-15       | CONNECTING WIRE         |                         |                    |
| CN10             |               |                   | E40-5059-05       | PIN CONNECTOR (5P)      |                         |                    |
| 196              | 1F            |                   | J32-0761-04       | BOSS                    |                         |                    |
| -                |               |                   | L92-0102-05       | TROIDAL COIL (KT-41)    |                         |                    |
| -                |               |                   | L92-0107-05       | TROIDAL COIL (T50-2)    |                         |                    |
| -                |               |                   | L92-0108-05       | TROIDAL COIL (T50-6)    |                         |                    |
| L1               |               |                   | L34-3148-05       | TROIDAL COIL            |                         |                    |
| L2               |               |                   | L34-3147-05       | TROIDAL COIL            |                         |                    |
| L3               |               |                   | L34-3150-05       | TROIDAL COIL            |                         |                    |
| L4               |               |                   | L34-3149-05       | TROIDAL COIL            |                         |                    |
| L5               |               |                   | L34-3152-05       | TROIDAL COIL            |                         |                    |
| L6               |               |                   | L34-3151-05       | TROIDAL COIL            |                         |                    |
| L7               |               |                   | L34-3153-05       | TROIDAL COIL            |                         |                    |
| L8               |               |                   | L34-3154-05       | TROIDAL COIL            |                         |                    |
| L9 ,10           |               |                   | L34-3156-05       | COIL                    |                         |                    |
| L11              |               |                   | L34-3157-05       | COIL                    |                         |                    |
| L12              |               |                   | L34-3158-05       | COIL                    |                         |                    |
| L13 -15          |               |                   | L34-1021-05       | COIL                    |                         | B                  |
| L16              |               |                   | L33-0222-05       | COIL                    |                         | B                  |
| L17              |               |                   | L34-1022-05       | COIL                    |                         | B                  |
| L18              |               |                   | L34-1027-05       | COIL                    |                         | B                  |
| L19              |               |                   | L39-0406-05       | TROIDAL COIL            |                         |                    |
| L20              |               |                   | L33-0651-05       | CHOKE COIL              |                         | B                  |
| L21 ,22          |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR    |                         |                    |
| L22              |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR    |                         | B                  |
| L23 ,24          |               |                   | L40-1021-14       | SMALL FIXED INDUCTOR    |                         |                    |
| L25 -30          |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR    |                         |                    |
| L31              |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR    |                         | B                  |
| L32              |               |                   | L40-6825-04       | SMALL FIXED INDUCTOR    |                         |                    |
| U                | 1F            |                   | N30-3006-46       | PAN HEAD MACHINE SCREW  |                         |                    |
| VR1              |               |                   | R12-0431-05       | TRIMMING PNT. (100)     |                         |                    |
| W17 -19          |               |                   | R92-0150-05       | JUMPER REST 0 OHM       |                         |                    |

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|---|---------------|-------------------|-------------------|-------------------------|-------------------------|--------------------|
| W20   |               |                   | R92-0150-05       | JUMPER REST 0 8HM       |                         | A                  |
| K1 -12  |               |                   | S51-1432-05       | RELAY                   |                         | B                  |
| K13 -15   |               |                   | S51-1432-05       | RELAY                   |                         | B                  |
| K16   |               |                   | S51-1429-05       | RELAY                   |                         | B                  |
| D1 -6   |               |                   | 1S1555            | DIODE                   |                         | B                  |
| D7  |               |                   | 1S1555            | DIODE                   |                         | B                  |
| D8  |               |                   | 1S1555            | DIODE                   |                         | B                  |
| D9 ,10  |               |                   | 1SS101            | DIODE                   |                         | B                  |
| D11   |               |                   | DSP-301N          | SURGE ABSORBER          |                         | B                  |
| Q1  |               |                   | 2SC2538-22-A      | TRANSISTOR              |                         | B                  |
| Q2  |               |                   | M57735            | IC (POWER MODULE)       |                         | B                  |
| Q3  |               |                   | 2SC2459 (BL)      | TRANSISTOR              |                         | B                  |
| <b>CONTROL UNIT (X53-3100-XX) -11 : TS-140S -12 : TS-680S</b> |               |                   |                   |                         |                         |                    |
| C2  |               |                   | CE04EW1C470M      | ELECTRO 47UF 16WV       |                         |                    |
| C3 ,4   |               |                   | CK41FY1E102M      | CYLND CHIP C 1000PF M   |                         |                    |
| C5  |               |                   | CO92M1H473K       | MYLAR 0.047UF K         |                         |                    |
| C6  |               |                   | CO92M1H223K       | MYLAR 0.022UF K         |                         |                    |
| C7  |               |                   | CK41FY1E222M      | CYLND CHIP C 2200PF M   |                         |                    |
| C9  |               |                   | CE04EW1C470M      | ELECTRO 47UF 16WV       |                         |                    |
| C10   |               |                   | CC41FUJ1H220J     | CYLND CHIP C 22PF J     |                         |                    |
| C11   |               |                   | CC41FCH1H100D     | CYLND CHIP C 10PF D     |                         |                    |
| C13   |               |                   | CC41FCH1H150J     | CYLND CHIP C 15PF J     |                         |                    |
| C14   |               |                   | CC41FCH1H120J     | CYLND CHIP C 12PF J     |                         |                    |
| C15   |               |                   | CC41FCH1H050C     | CYLND CHIP C 5.0PF C    |                         |                    |
| C16   |               |                   | CK41FY1E102M      | CYLND CHIP C 1000PF M   |                         |                    |
| C17   |               |                   | CE04EW1C470M      | ELECTRO 47UF 16WV       |                         |                    |
| C18 ,19   |               |                   | CK41FY1E102M      | CYLND CHIP C 1000PF M   |                         |                    |
| C21   |               |                   | CK41FY1E102M      | CYLND CHIP C 1000PF M   |                         |                    |
| C23   |               |                   | CE04EW1C220M      | ELECTRO 22UF 16WV       |                         |                    |
| C25   |               |                   | CK41FB1H391K      | CYLND CHIP C 390PF K    |                         |                    |
| C26   |               |                   | CK41FW1H821M      | CYLND CHIP C 820PF M    |                         |                    |
| C27   |               |                   | CK41FB1H391K      | CYLND CHIP C 390PF K    |                         |                    |
| C30   |               |                   | CE04EW1C220M      | ELECTRO 22UF 16WV       |                         |                    |
| C33   |               |                   | CC41FSL1H330J     | CYLND CHIP C 33PF J     |                         |                    |
| C34   |               |                   | CC41FSL1H680J     | CYLND CHIP C 68PF J     |                         |                    |
| C35   |               |                   | CC41FSL1H330J     | CYLND CHIP C 33PF J     |                         |                    |
| C38   |               |                   | CE04EW1C470M      | ELECTRO 47UF 16WV       |                         |                    |
| C40   |               |                   | CK41FY1E102M      | CYLND CHIP C 1000PF M   |                         |                    |
| C41   |               |                   | CO92M1H223K       | MYLAR 0.022UF K         |                         |                    |
| C42   |               |                   | CO92M1H103K       | MYLAR 0.010UF K         |                         |                    |
| C43   |               |                   | CK41FY1E222M      | CYLND CHIP C 2200PF M   |                         |                    |
| C45   |               |                   | CE04EW1C470M      | ELECTRO 47UF 16WV       |                         |                    |
| C46   |               |                   | CC41FCH1H100D     | CYLND CHIP C 10PF D     |                         |                    |
| C48   |               |                   | CC41FCH1H220J     | CYLND CHIP C 22PF J     |                         |                    |
| C49   |               |                   | CC73FCH1H270J     | CHIP C 27PF J           |                         |                    |
| C50   |               |                   | CC41FCH1H050C     | CYLND CHIP C 5.0PF C    |                         |                    |
| C52   |               |                   | CE04EW1C470M      | ELECTRO 47UF 16WV       |                         |                    |
| C58   |               |                   | CC41FSL1H270J     | CYLND CHIP C 27PF J     |                         |                    |
| C59   |               |                   | CC41FSL1H560J     | CYLND CHIP C 56PF J     |                         |                    |
| C60   |               |                   | CC41FSL1H270J     | CYLND CHIP C 27PF J     |                         |                    |
| C72   |               |                   | CK41FA1H181K      | CYLND CHIP C 180PF K    |                         |                    |
| C73   |               |                   | CK41FB1H391K      | CYLND CHIP C 390PF K    |                         |                    |
| C74   |               |                   | CK41FA1H181K      | CYLND CHIP C 180PF K    |                         |                    |

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|------------------|---------------|-------------------|-------------------|-------------------------|-------------------------|--------------------|
| C77              |               |                   | CC41FCH1H030C     | CYLND CHIP C 3.0PF C    |                         |                    |
| C78              |               |                   | CC73FCH1H560J     | CHIP C 56PF J           |                         |                    |
| C79              |               |                   | CC41FUJ1H180J     | CYLND CHIP C 18PF J     |                         |                    |
| C80              |               |                   | CC41FCH1H020C     | CYLND CHIP C 2.0PF C    |                         |                    |
| C82              |               |                   | CE04EW1C220M      | ELECTR0 22UF 16WV       |                         |                    |
| C87,88           |               |                   | CC41FSL1H560J     | CYLND CHIP C 56PF J     |                         |                    |
| C90              |               |                   | CC41FSL1H330J     | CYLND CHIP C 33PF J     |                         |                    |
| C91              |               |                   | CC41FSL1H560J     | CYLND CHIP C 56PF J     |                         |                    |
| C92              |               |                   | CC41FSL1H330J     | CYLND CHIP C 33PF J     |                         |                    |
| C99              |               |                   | CC41FCH1H020C     | CYLND CHIP C 2.0PF C    |                         |                    |
| C101             |               |                   | CC41FCH1H030C     | CYLND CHIP C 3.0PF C    |                         |                    |
| C102             |               |                   | CC41FCH1H100D     | CYLND CHIP C 10PF D     |                         |                    |
| C110,111         |               |                   | CC41FCH1H010C     | CYLND CHIP C 1.0PF C    |                         |                    |
| C118-120         |               |                   | CC41FCH1H040C     | CYLND CHIP C 4.0PF C    |                         |                    |
| C121             |               |                   | CC41FCH1H150J     | CYLND CHIP C 15PF J     |                         |                    |
| C124             |               |                   | CC41FSL1H560J     | CYLND CHIP C 56PF J     |                         |                    |
| C125             |               |                   | CC41FSL1H121J     | CYLND CHIP C 120PF J    |                         |                    |
| C126             |               |                   | CC41FSL1H560J     | CYLND CHIP C 56PF J     |                         |                    |
| C133             |               |                   | CK41FY1E102M      | CYLND CHIP C 1000PF M   |                         |                    |
| C134,135         |               |                   | CC41FCH1H0R5C     | CYLND CHIP C 0.5PF C    |                         |                    |
| C136             |               |                   | CK41FY1E102M      | CYLND CHIP C 1000PF M   |                         |                    |
| C138,139         |               |                   | CC41FCH1H010C     | CYLND CHIP C 1.0PF C    |                         |                    |
| C144             |               |                   | CK41FY1E102M      | CYLND CHIP C 1000PF M   |                         |                    |
| C153             |               |                   | CC41FCH1H030C     | CYLND CHIP C 3.0PF C    |                         |                    |
| C154             |               |                   | CC41FCH1H150J     | CYLND CHIP C 15PF J     |                         |                    |
| C155             |               |                   | CC41FCH1H040C     | CYLND CHIP C 4.0PF C    |                         |                    |
| C156             |               |                   | CC41FCH1H150J     | CYLND CHIP C 15PF J     |                         |                    |
| C157             |               |                   | CC41FCH1H040C     | CYLND CHIP C 4.0PF C    |                         |                    |
| C158             |               |                   | CC41FCH1H150J     | CYLND CHIP C 15PF J     |                         |                    |
| C159             |               |                   | CC41FCH1H030C     | CYLND CHIP C 3.0PF C    |                         |                    |
| C162             |               |                   | CC73FCH1H560J     | CHIP C 56PF J           |                         |                    |
| C166             |               |                   | CE04EW1C470M      | ELECTR0 47UF 16WV       |                         |                    |
| C167,168         |               |                   | CK41FY1E102M      | CYLND CHIP C 1000PF M   |                         |                    |
| C169             |               |                   | CC41FCH1H0R5C     | CYLND CHIP C 0.5PF C    |                         |                    |
| C170             |               |                   | C092M1H103K       | MYLAR 0.010UF K         |                         |                    |
| C171             |               |                   | C91-1083-05       | FILM 0.47UF 63WV        |                         |                    |
| C173             |               |                   | CE04EW1C101M      | ELECTR0 100UF 16WV      |                         |                    |
| C177             |               |                   | CE04EW1C470M      | ELECTR0 47UF 16WV       |                         |                    |
| C179             |               |                   | CK41FY1E102M      | CYLND CHIP C 1000PF M   |                         |                    |
| C180             |               |                   | C092M1H223K       | MYLAR 0.022UF K         |                         |                    |
| C181             |               | *                 | C91-1101-05       | FILM 0.22UF 63WV        |                         |                    |
| C182             |               |                   | CE04EW1H100M      | ELECTR0 10UF 50WV       |                         |                    |
| C183             |               |                   | C91-0117-05       | CERAMIC 0.01UF K        |                         |                    |
| C184             |               |                   | CS15E1VR47M       | TANTAL 0.47UF 35WV      |                         |                    |
| C186             |               |                   | CE04EW1C470M      | ELECTR0 47UF 16WV       |                         |                    |
| C187             |               |                   | CK45B1H182K       | CERAMIC 1800PF K        |                         |                    |
| C188             |               |                   | CC41FUJ1H070D     | CYLND CHIP C 7.0PF D    |                         |                    |
| C189             |               |                   | CC41FCH1H100D     | CYLND CHIP C 10PF D     |                         |                    |
| C191,192         |               |                   | CC73FCH1H330J     | CHIP C 33PF J           |                         |                    |
| C193             |               |                   | CC41FCH1H050C     | CYLND CHIP C 5.0PF C    |                         |                    |
| C195             |               |                   | CE04EW1C470M      | ELECTR0 47UF 16WV       |                         |                    |
| C197             |               |                   | CC41FCH1H120J     | CYLND CHIP C 12PF J     |                         |                    |
| C198             |               |                   | CC41FCH1H100D     | CYLND CHIP C 10PF D     |                         |                    |
| C201             |               |                   | CC41FSL1H270J     | CYLND CHIP C 27PF J     |                         |                    |
| C202             |               |                   | CC41FCH1H220J     | CYLND CHIP C 22PF J     |                         |                    |

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|------------------|---------------|-------------------|-------------------|-----------------------------|------------------------|--------------------|
| C203             |               |                   | CC41FSL1H270J     | CYLND CHIP C 27PF J         |                        |                    |
| C204-209         |               |                   | CC41FSL1H101J     | CYLND CHIP C 100PF J        |                        |                    |
| C215             |               |                   | CE04EW1C470M      | ELECTR0 47UF 16WV           |                        |                    |
| C217             |               |                   | CE04EW1C101M      | ELECTR0 100UF 16WV          |                        |                    |
| C220             |               |                   | CK41FB1H471K      | CYLND CHIP C 470PF K        |                        |                    |
| C221,222         |               |                   | CC73FCH1H270J     | CHIP C 27PF J               |                        |                    |
| C223             |               |                   | CC41FCH1H100D     | CYLND CHIP C 10PF D         |                        |                    |
| C224             |               |                   | CK73FB1H332K      | CHIP C 3300PF K             |                        |                    |
| C229             |               |                   | CE04EW1C470M      | ELECTR0 47UF 16WV           |                        |                    |
| C232             |               |                   | C90-2041-05       | ELECTR0 10UF 10WV           |                        |                    |
| C234             |               |                   | CE04EW1C470M      | ELECTR0 47UF 16WV           |                        |                    |
| C237             |               |                   | CE04EW1C470M      | ELECTR0 47UF 16WV           |                        |                    |
| C260-267         |               |                   | CK41FB1H471K      | CYLND CHIP C 470PF K        |                        |                    |
| C273,274         |               |                   | CK41FB1H471K      | CYLND CHIP C 470PF K        |                        |                    |
| C277,278         |               |                   | CK41FY1E102M      | CYLND CHIP C 1000PF M       |                        |                    |
| C280-283         |               |                   | CK41FY1E102M      | CYLND CHIP C 1000PF M       |                        |                    |
| C286-293         |               |                   | CC41FSL1H101J     | CYLND CHIP C 100PF J        |                        |                    |
| TC1              |               |                   | C05-0309-05       | TRIMMING CAP (40PF)         |                        |                    |
| -                |               |                   | E23-0512-05       | TERMINAL                    |                        |                    |
| CN1              |               |                   | E40-3237-05       | PIN CONNECTOR (2P)          |                        |                    |
| CN2              |               |                   | E40-3238-05       | PIN CONNECTOR (3P)          |                        |                    |
| CN3              |               |                   | ED4-0157-05       | RF COAXIAL CABLE RECEPTACLE |                        |                    |
| CN4              |               |                   | E40-3238-05       | PIN CONNECTOR (3P)          |                        |                    |
| CN5              |               |                   | E40-3237-05       | PIN CONNECTOR (2P)          |                        |                    |
| CN6              |               |                   | ED4-0157-05       | RF COAXIAL CABLE RECEPTACLE |                        |                    |
| CN7              |               |                   | E40-3237-05       | PIN CONNECTOR (2P)          |                        |                    |
| CN8              |               |                   | E40-3242-05       | PIN CONNECTOR (7P)          |                        |                    |
| CN9              |               |                   | E40-5066-05       | PIN CONNECTOR (9P)          |                        |                    |
| CN10             |               | *                 | E40-5141-05       | FPC CONNECTOR (26P)         |                        |                    |
| CN11             |               | *                 | E40-5133-05       | FPC CONNECTOR (18P)         |                        |                    |
| CN12             |               |                   | E40-3239-05       | PIN CONNECTOR (4P)          |                        |                    |
| CN13             |               |                   | E40-3240-05       | PIN CONNECTOR (5P)          |                        |                    |
| CN14             |               |                   | E40-3238-05       | PIN CONNECTOR (3P)          |                        |                    |
| CN15             |               |                   | ED2-2001-05       | IC SOCKET (28P)             |                        |                    |
| A1 -4            |               |                   | F11-0817-04       | SHIELDING COVER             |                        |                    |
| A5               |               |                   | F10-1222-14       | SHIELDING COVER             |                        |                    |
| A6               |               |                   | F11-1021-04       | SHIELDING COVER             |                        |                    |
| A9 -12           |               |                   | F10-1344-04       | SHIELDING PLATE             |                        |                    |
| L1               |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR        |                        |                    |
| L2               |               |                   | L40-1001-14       | SMALL FIXED INDUCTOR        |                        |                    |
| L3               |               |                   | L32-0666-15       | COIL (VCO 91MHZ)            |                        |                    |
| L4 ,5            |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR        |                        |                    |
| L6 ,7            |               |                   | L40-3311-14       | SMALL FIXED INDUCTOR        |                        |                    |
| L8 ,9            |               |                   | L40-3301-17       | SMALL FIXED INDUCTOR        |                        |                    |
| L10              |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR        |                        |                    |
| L11              |               |                   | L40-1501-14       | SMALL FIXED INDUCTOR        |                        |                    |
| L12              |               |                   | L32-0649-05       | COIL (VCO 55MHZ)            |                        |                    |
| L13 ,14          |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR        |                        |                    |
| L15 ,16          |               |                   | L40-2201-17       | SMALL FIXED INDUCTOR        |                        |                    |
| L17              |               | *                 | L34-4053-05       | COIL (10MHZ BPF)            |                        |                    |
| L18              |               | *                 | L34-4054-15       | COIL (10MHZ BPF)            |                        |                    |
| L19              |               | *                 | L34-4053-05       | COIL (10MHZ BPF)            |                        |                    |
| L20              |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR        |                        |                    |

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|------------------|---------------|-------------------|-------------------|--------------------------|-------------------------|--------------------|
| L21 ,22          |               |                   | L40-1211-17       | SMALL FIXED INDUCTOR     |                         |                    |
| L23 ,24          |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR     |                         |                    |
| L25              |               |                   | L40-2201-17       | SMALL FIXED INDUCTOR     |                         |                    |
| L26 ,27          |               |                   | L40-3301-17       | SMALL FIXED INDUCTOR     |                         |                    |
| L28 ,29          |               |                   | L34-4055-05       | COIL (5.5MHZ BPF)        |                         |                    |
| L30 -32          |               |                   | L34-4057-05       | COIL (78MHZ BPF)         |                         |                    |
| L33 -35          |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR     |                         |                    |
| L36              |               |                   | L40-1292-17       | SMALL FIXED INDUCTOR     |                         |                    |
| L37 ,38          |               |                   | L40-2201-17       | SMALL FIXED INDUCTOR     |                         |                    |
| L39 -41          |               | *                 | L34-4056-05       | COIL (39MHZ BPF)         |                         |                    |
| L42 -44          |               |                   | L34-4057-05       | COIL (78MHZ BPF)         |                         |                    |
| L45              |               |                   | L40-3991-17       | SMALL FIXED INDUCTOR     |                         |                    |
| L46 ,47          |               |                   | L40-3391-17       | SMALL FIXED INDUCTOR     |                         |                    |
| L48              |               |                   | L40-3991-17       | SMALL FIXED INDUCTOR     |                         |                    |
| L49              |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR     |                         |                    |
| L51              |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR     |                         |                    |
| L52              |               |                   | L40-2211-14       | SMALL FIXED INDUCTOR     |                         |                    |
| L53              |               |                   | L40-2201-14       | SMALL FIXED INDUCTOR     |                         |                    |
| L54              |               | *                 | L34-4060-05       | COIL (VCO 40MHZ)         |                         |                    |
| L55              |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR     |                         |                    |
| L56              |               |                   | L34-1124-05       | COIL                     |                         |                    |
| L57              |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR     |                         |                    |
| L58              |               |                   | L40-1011-13       | SMALL FIXED INDUCTOR     |                         |                    |
| L59              |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR     |                         |                    |
| L60 ,61          |               |                   | L40-1011-13       | SMALL FIXED INDUCTOR     |                         |                    |
| L62              |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR     |                         |                    |
| X1               |               |                   | L77-1299-05       | CRYSTAL RESONATOR(36MHZ) |                         |                    |
| X2               |               |                   | L78-0015-05       | RESONATOR (2.45MHZ)      |                         |                    |
| CP1              |               |                   | R90-0229-05       | MULTI-COMP 10KX8 J 1/6W  |                         |                    |
| R2               |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                         |                    |
| R3               |               |                   | RD41FB2B332J      | CYLND CHIP R 3.3K J 1/8W |                         |                    |
| R4               |               |                   | RD41FB2B393J      | CYLND CHIP R 39K J 1/8W  |                         |                    |
| R5               |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R6               |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                         |                    |
| R7               |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R8               |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                         |                    |
| R9               |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R10              |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                         |                    |
| R11              |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                         |                    |
| R12              |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R13              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R14              |               |                   | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W  |                         |                    |
| R15              |               |                   | RD41FB2B392J      | CYLND CHIP R 3.9K J 1/8W |                         |                    |
| R16 ,17          |               |                   | RD41FB2B182J      | CYLND CHIP R 1.8K J 1/8W |                         |                    |
| R18 ,19          |               |                   | RD41FB2B681J      | CYLND CHIP R 680 J 1/8W  |                         |                    |
| R20              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R21              |               |                   | RD41FB2B153J      | CYLND CHIP R 15K J 1/8W  |                         |                    |
| R22              |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R23              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R24              |               |                   | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W  |                         |                    |
| R25 ,26          |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R27              |               |                   | RD41FB2B182J      | CYLND CHIP R 1.8K J 1/8W |                         |                    |
| R28              |               |                   | RD41FB2B681J      | CYLND CHIP R 680 J 1/8W  |                         |                    |
| R30              |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                         |                    |

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|------------------|---------------|-------------------|-------------------|--------------------------|------------------------|--------------------|
| R31              |               |                   | RD41FB2B182J      | CYLND CHIP R 1.8K J 1/8W |                        |                    |
| R32              |               |                   | RD41FB2B823J      | CYLND CHIP R 82K J 1/8W  |                        |                    |
| R33              |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                        |                    |
| R34              |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                        |                    |
| R35              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                        |                    |
| R36              |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                        |                    |
| R37              |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                        |                    |
| R38              |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                        |                    |
| R39              |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                        |                    |
| R40              |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                        |                    |
| R41              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                        |                    |
| R42              |               |                   | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W  |                        |                    |
| R43              |               |                   | RD41FB2B392J      | CYLND CHIP R 3.9K J 1/8W |                        |                    |
| R44              |               |                   | RD41FB2B182J      | CYLND CHIP R 1.8K J 1/8W |                        |                    |
| R45              |               |                   | RD41FB2B681J      | CYLND CHIP R 680 J 1/8W  |                        |                    |
| R46              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                        |                    |
| R47              |               |                   | RD41FB2B681J      | CYLND CHIP R 680 J 1/8W  |                        |                    |
| R48              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                        |                    |
| R49              |               |                   | RD41FB2B333J      | CYLND CHIP R 33K J 1/8W  |                        |                    |
| R50              |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                        |                    |
| R52              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                        |                    |
| R53              |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                        |                    |
| R54              |               |                   | RD41FB2B332J      | CYLND CHIP R 3.3K J 1/8W |                        |                    |
| R55              |               |                   | RD41FB2B181J      | CYLND CHIP R 180 J 1/8W  |                        |                    |
| R56              |               |                   | RD41FB2B222J      | CYLND CHIP R 2.2K J 1/8W |                        |                    |
| R57              |               |                   | RD41FB2B681J      | CYLND CHIP R 680 J 1/8W  |                        |                    |
| R58              |               |                   | RD41FB2B562J      | CYLND CHIP R 5.6K J 1/8W |                        |                    |
| R59              |               |                   | RD41FB2B682J      | CYLND CHIP R 6.8K J 1/8W |                        |                    |
| R60              |               |                   | RD41FB2B561J      | CYLND CHIP R 560 J 1/8W  |                        |                    |
| R61              |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                        |                    |
| R62              |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                        |                    |
| R63              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                        |                    |
| R64              |               |                   | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W  |                        |                    |
| R65              |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                        |                    |
| R66              |               |                   | RD41FB2B332J      | CYLND CHIP R 3.3K J 1/8W |                        |                    |
| R67              |               |                   | RD41FB2B181J      | CYLND CHIP R 180 J 1/8W  |                        |                    |
| R68              |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                        |                    |
| R69              |               |                   | RD41FB2B681J      | CYLND CHIP R 680 J 1/8W  |                        |                    |
| R70              |               |                   | RD41FB2B182J      | CYLND CHIP R 1.8K J 1/8W |                        |                    |
| R71              |               |                   | RD41FB2B681J      | CYLND CHIP R 680 J 1/8W  |                        |                    |
| R72              | 73            |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                        |                    |
| R74              |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                        |                    |
| R75              |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                        |                    |
| R76              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                        |                    |
| R78              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                        |                    |
| R79              |               |                   | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W  |                        |                    |
| R80              |               |                   | RD41FB2B221J      | CYLND CHIP R 220 J 1/8W  |                        |                    |
| R81              |               |                   | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W  |                        |                    |
| R82              |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                        |                    |
| R83              |               |                   | RD41FB2B681J      | CYLND CHIP R 680 J 1/8W  |                        |                    |
| R84              |               |                   | RD41FB2B331J      | CYLND CHIP R 330 J 1/8W  |                        |                    |
| R85              |               |                   | RD41FB2B272J      | CYLND CHIP R 2.7K J 1/8W |                        |                    |
| R86              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                        |                    |
| R87              |               |                   | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W  |                        |                    |
| R88              |               |                   | RD41FB2B332J      | CYLND CHIP R 3.3K J 1/8W |                        |                    |

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|------------------|---------------|-------------------|-------------------|--------------------------|-------------------------|--------------------|
| R89              |               |                   | RD41FB2B122J      | CYLND CHIP R 1.2K J 1/8W |                         |                    |
| R90              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R91              |               |                   | RD41FB2B122J      | CYLND CHIP R 1.2K J 1/8W |                         |                    |
| R92              |               |                   | RD41FB2B181J      | CYLND CHIP R 180 J 1/8W  |                         |                    |
| R93              |               |                   | RD41FB2B561J      | CYLND CHIP R 560 J 1/8W  |                         |                    |
| R94              |               |                   | RD41FB2B181J      | CYLND CHIP R 180 J 1/8W  |                         |                    |
| R95              |               |                   | RD41FB2B561J      | CYLND CHIP R 560 J 1/8W  |                         |                    |
| R96              |               |                   | RD41FB2B681J      | CYLND CHIP R 680 J 1/8W  |                         |                    |
| R97              |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                         |                    |
| R98              |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R99              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R101             |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R102             |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                         |                    |
| R103             |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R104             |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R105             |               |                   | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W  |                         |                    |
| R106,107         |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R108             |               |                   | RD41FB2B681J      | CYLND CHIP R 680 J 1/8W  |                         |                    |
| R109             |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R110             |               |                   | RD41FB2B333J      | CYLND CHIP R 33K J 1/8W  |                         |                    |
| R111             |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R112             |               |                   | RD41FB2B220J      | CYLND CHIP R 22 J 1/8W   |                         |                    |
| R113             |               |                   | RD41FB2B681J      | CYLND CHIP R 680 J 1/8W  |                         |                    |
| R114             |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R115             |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                         |                    |
| R116             |               |                   | RD41FB2B822J      | CYLND CHIP R 8.2K J 1/8W |                         |                    |
| R117,118         |               |                   | RD41FB2B182J      | CYLND CHIP R 1.8K J 1/8W |                         |                    |
| R119             |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                         |                    |
| R121             |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                         |                    |
| R122,123         |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                         |                    |
| R124             |               |                   | RD41FB2B123J      | CYLND CHIP R 12K J 1/8W  |                         |                    |
| R125             |               |                   | RD41FB2B182J      | CYLND CHIP R 1.8K J 1/8W |                         |                    |
| R126             |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                         |                    |
| R127             |               |                   | RD41FB2B331J      | CYLND CHIP R 330 J 1/8W  |                         |                    |
| R128             |               |                   | RD41FB2B392J      | CYLND CHIP R 3.9K J 1/8W |                         |                    |
| R129             |               |                   | RD41FB2B104J      | CYLND CHIP R 100K J 1/8W |                         |                    |
| R130             |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R131             |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                         |                    |
| R132             |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R133             |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                         |                    |
| R134             |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                         |                    |
| R135             |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R136             |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R137             |               |                   | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W  |                         |                    |
| R138             |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R139             |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                         |                    |
| R140             |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R141             |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R142-148         |               |                   | RD41FB2B221J      | CYLND CHIP R 220 J 1/8W  |                         |                    |
| R149             |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R150             |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                         |                    |
| R151             |               |                   | RD41FB2B220J      | CYLND CHIP R 22 J 1/8W   |                         |                    |
| R152,153         |               |                   | RD41FB2B105J      | CYLND CHIP R 1.0M J 1/8W |                         |                    |
| R154             |               |                   | RD41FB2B104J      | CYLND CHIP R 100K J 1/8W |                         |                    |
| R155             |               |                   | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W  |                         |                    |

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|------------------|---------------|-------------------|-------------------|---------------------------|-------------------------|--------------------|
| R156             |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W   |                         |                    |
| R157             |               |                   | RD41FB2B184J      | CYLND CHIP R 180K J 1/8W  |                         |                    |
| R158             |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W  |                         |                    |
| R159             |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W   |                         |                    |
| R160             |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W   |                         |                    |
| R163             |               |                   | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W   |                         |                    |
| R164             |               |                   | RD41FB2B474J      | CYLND CHIP R 470K J 1/8W  |                         |                    |
| R165             |               |                   | RD41FB2B104J      | CYLND CHIP R 100K J 1/8W  |                         |                    |
| R166             |               |                   | RD41FB2B183J      | CYLND CHIP R 18K J 1/8W   |                         |                    |
| R167-169         |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W   |                         |                    |
| R170-183         |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W  |                         |                    |
| R184-188         |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W   |                         |                    |
| R189-193         |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W   |                         |                    |
| R194             |               |                   | RD41FB2B274J      | CYLND CHIP R 270K J 1/8W  |                         |                    |
| R195             |               |                   | RD41FB2B684J      | CYLND CHIP R 680K J 1/8W  |                         |                    |
| R196             |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W   |                         |                    |
| R197             |               |                   | RD41FB2B274J      | CYLND CHIP R 270K J 1/8W  |                         |                    |
| R198             |               |                   | RD41FB2B684J      | CYLND CHIP R 680K J 1/8W  |                         |                    |
| R199,200         |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W   |                         |                    |
| R201,202         |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W  |                         |                    |
| R203,204         |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W   |                         |                    |
| R205,206         |               |                   | RD41FB2B123J      | CYLND CHIP R 12K J 1/8W   |                         |                    |
| R207,208         |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W   |                         |                    |
| R209             |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W  |                         |                    |
| R210             |               |                   | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W   |                         |                    |
| R211             |               |                   | RD41FB2B684J      | CYLND CHIP R 680K J 1/8W  |                         |                    |
| R212             |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W   |                         |                    |
| VR1 ,2           |               | *                 | R12-1067-05       | TRIMMING PNT. (2.2K)      |                         |                    |
| VR3 ,4           |               |                   | R12-3096-05       | TRIMMING PNT. (10K)       |                         |                    |
| W2 ,3            |               |                   | R92-1061-05       | JUMPER REST 0 0HM         |                         |                    |
| D1               |               |                   | 1SV53A            | VARI-CAP DIODE            |                         |                    |
| D2 ,3            |               |                   | ITT310TE          | VARICAP DIODE             |                         |                    |
| D4 -6            |               |                   | RLS135            | CHIP DIODE                |                         |                    |
| D7 ,8            |               |                   | RLS73             | CHIP DIODE                |                         |                    |
| D9 -15           |               |                   | RLS135            | CHIP DIODE                |                         |                    |
| D16              |               |                   | RLS73             | CHIP DIODE                |                         |                    |
| D17              |               |                   | 1SV153            | VARI-CAP DIODE            |                         |                    |
| D18 -21          |               |                   | RLS73             | CHIP DIODE                |                         |                    |
| D24 -27          |               |                   | RLS73             | CHIP DIODE                |                         |                    |
| D29              |               |                   | 1SS133            | DIODE                     |                         | A                  |
| D31              |               |                   | 1SS133            | DIODE                     |                         |                    |
| IC1              |               | *                 | M54927P           | IC(FREQ SYNTHESIZER PLL)  |                         |                    |
| IC2              |               |                   | M54459L           | IC(PRE SCALER)            |                         |                    |
| IC3              |               |                   | SN74LS90N         | IC(DECADE COUNRERS)       |                         |                    |
| IC4              |               | *                 | M54927P           | IC(FREQ SYNTHESIZER PLL)  |                         |                    |
| IC5              |               |                   | M54460L           | IC(PRE SCALER)            |                         |                    |
| IC6              |               |                   | SN16913P          | IC(DUBLE BALANCED MIXERS) |                         |                    |
| IC7              |               |                   | SN74LS90N         | IC(DECADE COUNRERS)       |                         |                    |
| IC8              |               |                   | M74LS93P          | IC                        |                         |                    |
| IC9 -11          |               |                   | SN16913P          | IC(DUBLE BALANCED MIXERS) |                         |                    |
| IC12             |               |                   | SN76514N          | IC                        |                         |                    |
| IC13             |               |                   | MBB7006           | IC(FREQ SYNTHESIZER PLL)  |                         |                    |
| IC14             |               | *                 | M54927P           | IC(FREQ SYNTHESIZER PLL)  |                         |                    |
| IC15             |               |                   | PST520D           | IC(LOW POWER RESET)       |                         |                    |
| IC16             |               |                   | TC4069UBP         | IC(INVERTER X6)           |                         |                    |

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|--|---------------|-------------------|-------------------|---------------------------------|------------------------|--------------------|
| IC17   |               | *                 | NE555C            | IC(TIMER)                       |                        |                    |
| IC18   |               | *                 | BU18400A          | IC(CPU)                         |                        |                    |
| IC19   |               |                   | SN74LS138N        | IC(DECODERS)                    |                        |                    |
| IC20   |               | *                 | TC5518CPL-20      | RAM IC                          |                        |                    |
| IC21   |               | *                 | 27C128-25JAJ2     | ROM IC(MBM)                     |                        |                    |
| IC22-24  |               |                   | TMP8255AP-5       | IC(PROGRAMMABLE INTERFACE)      |                        |                    |
| IC25   |               |                   | TC4069UBP         | IC(INVERTER X6)                 |                        |                    |
| IC26   |               | *                 | LZ92K37           | IC(COUNTER)                     |                        |                    |
| IC27   |               |                   | MB4052            | IC(4CH 8BIT A/D CONVERTER(ADC)) |                        |                    |
| Q1 ,2  |               |                   | 2SC2668(Y)        | TRANSISTOR                      |                        |                    |
| Q3   |               |                   | 2SC2458(Y)        | TRANSISTOR                      |                        |                    |
| Q4   |               |                   | 2SC1959(Y)        | TRANSISTOR                      |                        |                    |
| Q5 ,6  |               |                   | 2SC2668(Y)        | TRANSISTOR                      |                        |                    |
| Q7 ,8  |               |                   | 2SC2458(Y)        | TRANSISTOR                      |                        |                    |
| Q9   |               |                   | 2SC2787(L)        | TRANSISTOR                      |                        |                    |
| Q10 -15  |               |                   | 2SC2668(Y)        | TRANSISTOR                      |                        |                    |
| Q16 -21  |               |                   | 2SC2459(BL)       | TRANSISTOR                      |                        |                    |
| Q22 -24  |               |                   | 2SC2668(Y)        | TRANSISTOR                      |                        |                    |
| Q25  |               |                   | DTA124ES          | DIGITAL TRANSISTOR              |                        |                    |
| Q26  |               |                   | DTC124ES          | DIGITAL TRANSISTOR              |                        |                    |
| Q27 -29  |               |                   | DTA143ES          | DIGITAL TRANSISTOR              |                        |                    |
| Q30 -40  |               |                   | DTC144WS          | DIGITAL TRANSISTOR              |                        |                    |
| Q41 -43  |               |                   | DTC143TS          | DIGITAL TRANSISTOR              |                        |                    |
| <b>DISPLAY UNIT (X54-3050-XX) -00 : TS-140S(K, M, T), TS-680S -61 : TS-140S(W)</b> |               |                   |                   |                                 |                        |                    |
| D18  |               |                   | B30-0855-05       | LED(RED)                        | ON AIR                 |                    |
| D19  |               |                   | B30-0857-05       | LED(YLW)                        | M. SCR                 |                    |
| D20 ,21  |               |                   | B30-0856-05       | LED(GRN)                        | F. LOCK, 1MHZ          |                    |
| C1 ,2  |               |                   | CK73FF1E104Z      | CHIP C                          | 0.10UF Z               |                    |
| C3   |               |                   | CK73FB1H103K      | CHIP C                          | 0.010UF K              |                    |
| C4   |               |                   | CK73FF1E104Z      | CHIP C                          | 0.10UF Z               |                    |
| C5   |               |                   | C91-0119-05       | CERAMIC                         | 0.047UF K              |                    |
| C6   |               |                   | CK73FF1E104Z      | CHIP C                          | 0.10UF Z               |                    |
| C7 ,8  |               |                   | CK73FB1H103K      | CHIP C                          | 0.010UF K              |                    |
| C9   |               |                   | CE04EW1C220M      | ELECTRO                         | 22UF 16WV              |                    |
| C10  |               |                   | CE04EW1H100M      | ELECTRO                         | 10UF 50WV              |                    |
| C11  |               |                   | CE04EW1H470M      | ELECTRO                         | 47UF 50WV              |                    |
| C12  |               |                   | CK73FF1H473Z      | CHIP C                          | 0.047UF Z              |                    |
| C13  |               |                   | C90-2009-05       | ELECTRO                         | 470UF 16WV             |                    |
| C14 ,15  |               |                   | CK73FF1E104Z      | CHIP C                          | 0.10UF Z               |                    |
| C16  |               |                   | CK73FB1H103K      | CHIP C                          | 0.010UF K              |                    |
| C21  |               |                   | C91-0105-05       | CERAMIC                         | 0.0047UF K             |                    |
| C22  |               |                   | CE04EW1H470M      | ELECTRO                         | 47UF 50WV              |                    |
| TC1 ,2   |               |                   | C05-0315-05       | TRIMMING CAP                    | (60PF)                 | W                  |
| CN1  |               |                   | E40-3237-05       | PIN CONNECTOR                   | (2P)                   |                    |
| CN2 ,3   |               | *                 | E40-5131-05       | FPC CONNECTOR                   | (16P)                  |                    |
| CN4  |               |                   | E40-5133-05       | FPC CONNECTOR                   | (18P)                  |                    |
| CN5  |               |                   | E40-3252-05       | PIN CONNECTOR                   |                        |                    |
| J1   | 1H            |                   | E06-0858-05       | CYLINDRICAL RECEPTACLE          | (8P, MIC)              |                    |
| A1   |               |                   | F10-1344-04       | SHIELDING PLATE                 |                        |                    |
| -  |               | *                 | G13-0862-04       | CUSHION                         |                        |                    |
| -  |               | *                 | J19-1427-03       | HOLDER                          |                        |                    |

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| L1 -3<br>L4<br>L5  |               |                   | L40-1011-13<br>L40-2292-14<br>L40-2792-14   | SMALL FIXED INDUCTOR<br>SMALL FIXED INDUCTOR<br>SMALL FIXED INDUCTOR  | W<br>W                 |                    |
| CP1<br>CP2<br>CP3<br>R2<br>R5  |               |                   | R90-0462-05<br>R90-0274-05<br>R90-0462-05<br>RD41FB2B222J<br>RD41FB2B562J         | MULTI-COMP 47KX8 J 1/4W<br>MULTI-COMP 47KX5 J 1/6W<br>MULTI-COMP 47KX8 J 1/4W<br>CYLND CHIP R 2.2K J 1/8W<br>CYLND CHIP R 5.6K J 1/8W   |                        |                    |
| R6<br>R7<br>R8<br>R9<br>R10  |               |                   | RD41FB2B152J<br>RD41FB2B102J<br>RD41FB2B101J<br>RD41FB2B152J<br>RD41FB2B102J      | CYLND CHIP R 1.5K J 1/8W<br>CYLND CHIP R 1.0K J 1/8W<br>CYLND CHIP R 100 J 1/8W<br>CYLND CHIP R 1.5K J 1/8W<br>CYLND CHIP R 1.0K J 1/8W |                        |                    |
| R11<br>R12<br>R13 -15<br>R16<br>VR1  |               |                   | RD41FB2B101J<br>RD41FB2B471J<br>RD41FB2B560J<br>RD41FB2B471J<br>* R13-1402-05     | CYLND CHIP R 100 J 1/8W<br>CYLND CHIP R 470 J 1/8W<br>CYLND CHIP R 56 J 1/8W<br>CYLND CHIP R 470 J 1/8W<br>SLIDE TYPE PNT(1K,1K)POWER   |                        |                    |
| VR2 ,3<br>VR4<br>VR5   |               | *                 | R13-3405-05<br>* R13-1402-05<br>R12-3129-05                                       | SLIDE TYPE PNT(10K)MIC,RF GAIN<br>SLIDE TYPE PNT(1K,1K)NB<br>TRIMMING PNT. (22K)  |                        |                    |
| S1 -6<br>S7<br>S8 ,9<br>S10 -20<br>S21   |               |                   | S40-2440-15<br>S31-2409-05<br>S40-2440-15<br>S50-1412-05<br>S40-2441-15           | PUSH SWITCH<br>SLIDE SWITCH (CW)<br>PUSH SWITCH<br>TACT SWITCH<br>PUSH SWITCH (1MHZ)  |                        |                    |
| S22 -24<br>S25   |               |                   | S50-1412-05<br>S40-2441-15  | TACT SWITCH<br>PUSH SWITCH (RIT)  |                        |                    |
| -<br>D1 -16<br>D17<br>IC1<br>Q1  |               | *                 | * FIP12TM7<br>RL573<br>* RLZJ8.2A<br>UPD6300C<br>DTA114EK                         | FLUORESCENT INDICATOR TUBE<br>CHIP DIODE<br>CHIP ZENER DIODE<br>IC(FL LATCH DRIVER)<br>DIGITAL TRANSISTOR                               |                        |                    |
| S26<br>Z1  |               | *                 | W02-0388-05<br>* W02-0804-05  | ENCODER ASSY<br>ELECTRIC UNIT   |                        |                    |
| <b>SIGNAL UNIT (X57-3190-00) : TS-680S (X57-3200-XX) -10 : TS-140S(K, M, T) -61 : TS-140S(W)</b> |               |                   |   |   |                        |                    |
| C2<br>C3<br>C4<br>C5<br>C6 ,7  |               |                   | CK73EF1E474Z<br>CK41FY1E152M<br>CK73FB1H272K<br>CK41FY1E152M<br>CK73EF1E474Z      | CHIP C 0.47UF Z<br>CYLND CHIP C 1500PF M<br>CHIP C 2700PF K<br>CYLND CHIP C 1500PF M<br>CHIP C 0.47UF Z                                 |                        |                    |
| C9<br>C10 ,11<br>C13<br>C14<br>C16   |               |                   | CE04EW1H010M<br>CK41FB1H471K<br>CK41FY1E152M<br>CK73FB1H122K<br>CE04EW1H010M      | ELECTRO 1.0UF 50WV<br>CYLND CHIP C 470PF K<br>CYLND CHIP C 1500PF M<br>CHIP C 1200PF K<br>ELECTRO 1.0UF 50WV                            |                        |                    |
| C17<br>C23<br>C24<br>C25<br>C27  |               |                   | CC41FCH1H150J<br>CC41FSL1H820J<br>CC41FCH1H220J<br>CC41FSL1H121J<br>CC41FSL1H390J | CYLND CHIP C 15PF J<br>CYLND CHIP C 82PF J<br>CYLND CHIP C 22PF J<br>CYLND CHIP C 120PF J<br>CYLND CHIP C 39PF J                        |                        |                    |
| C28 ,29<br>C31   |               |                   | CK41FW1H681M<br>CE04EW1H010M  | CYLND CHIP C 680PF M<br>ELECTRO 1.0UF 50WV  |                        |                    |

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|------------------|---------------|-------------------|-------------------|-------------------------|-------------------------|--------------------|
| C32              |               |                   | CK41FW1H681M      | CYLND CHIP C 680PF M    |                         |                    |
| C33              |               |                   | CK41FB1H471K      | CYLND CHIP C 470PF K    |                         |                    |
| C35              |               |                   | CE04EW1H010M      | ELECTRØ 1.0UF 50WV      |                         |                    |
| C36 ,37          |               |                   | CK73EF1E474Z      | CHIP C 0.47UF Z         |                         |                    |
| C38              |               |                   | CK73EF1E474Z      | CHIP C 0.47UF Z         |                         | B                  |
| C39              |               |                   | CK73EF1E474Z      | CHIP C 0.47UF Z         |                         |                    |
| C47              |               |                   | CK41FB1H271K      | CYLND CHIP C 270PF K    |                         |                    |
| C48              |               |                   | CK41FB1H471K      | CYLND CHIP C 470PF K    |                         |                    |
| C51              |               |                   | CE04EW1H010M      | ELECTRØ 1.0UF 50WV      |                         |                    |
| C52              |               |                   | CC41FSL1H151J     | CYLND CHIP C 150PF J    |                         |                    |
| C53              |               |                   | CK41FA1H181K      | CYLND CHIP C 180PF K    |                         |                    |
| C55              |               |                   | CE04EW1H010M      | ELECTRØ 1.0UF 50WV      |                         |                    |
| C56              |               |                   | CK41FY1E222M      | CYLND CHIP C 2200PF M   |                         |                    |
| C57              |               |                   | CC41FSL1H330J     | CYLND CHIP C 33PF J     |                         | B                  |
| C58              |               |                   | CK41FY1E222M      | CYLND CHIP C 2200PF M   |                         | B                  |
| C60              |               |                   | CC41FSL1H560J     | CYLND CHIP C 56PF J     |                         | B                  |
| C62              |               |                   | CE04EW1H010M      | ELECTRØ 1.0UF 50WV      |                         | B                  |
| C64              |               |                   | CC41FCH1H120J     | CYLND CHIP C 12PF J     |                         | B                  |
| C67              |               |                   | CC41FSL1H270J     | CYLND CHIP C 27PF J     |                         | B                  |
| C70              |               |                   | CC45SL1H151J      | CERAMIC 150PF J         |                         |                    |
| C71              |               |                   | CK41FA1H181K      | CYLND CHIP C 180PF K    |                         |                    |
| C72              |               |                   | CC45SL1H151J      | CERAMIC 150PF J         |                         |                    |
| C74              |               |                   | CE04EW1H010M      | ELECTRØ 1.0UF 50WV      |                         |                    |
| C76              |               |                   | CC41FCH1H050C     | CYLND CHIP C 5.0PF C    |                         |                    |
| C77              |               |                   | CE04EW1E470M      | ELECTRØ 47UF 25WV       |                         |                    |
| C78              |               |                   | CC41FCH1H220J     | CYLND CHIP C 22PF J     |                         |                    |
| C79              |               |                   | CC73FCH1H330J     | CHIP C 33PF J           |                         |                    |
| C82              |               |                   | CC41FCH1H050C     | CYLND CHIP C 5.0PF C    |                         |                    |
| C83              |               |                   | CE04EW1E470M      | ELECTRØ 47UF 25WV       |                         |                    |
| C84              |               |                   | CC41FCH1H100D     | CYLND CHIP C 10PF D     |                         |                    |
| C85              |               |                   | CC41FCH1H220J     | CYLND CHIP C 22PF J     |                         |                    |
| C88 ,89          |               |                   | CC41FCH1H050C     | CYLND CHIP C 5.0PF C    |                         |                    |
| C90              |               |                   | CC41FCH1H180J     | CYLND CHIP C 18PF J     |                         |                    |
| C91              |               |                   | CE04EW1E470M      | ELECTRØ 47UF 25WV       |                         |                    |
| C94              |               |                   | C91-0119-05       | CERAMIC 0.047UF K       |                         |                    |
| C95              |               |                   | CC41FCH1H220J     | CYLND CHIP C 22PF J     |                         | B                  |
| C96              |               |                   | CE04EW1E470M      | ELECTRØ 47UF 25WV       |                         | B                  |
| C98              |               |                   | CC41FCH1H150J     | CYLND CHIP C 15PF J     |                         | B                  |
| C101             |               |                   | CK73FB1E223K      | CHIP C 0.022UF K        |                         |                    |
| C103             |               |                   | CC41FCH1H180J     | CYLND CHIP C 18PF J     |                         |                    |
| C104             |               |                   | CC41FCH1H220J     | CYLND CHIP C 22PF J     |                         |                    |
| C107             |               |                   | CC41FSL1H330J     | CYLND CHIP C 33PF J     |                         |                    |
| C112             |               |                   | CC41FSL1H820J     | CYLND CHIP C 82PF J     |                         | B                  |
| C113             |               |                   | CC41FCH1H150J     | CYLND CHIP C 15PF J     |                         | B                  |
| C116,117         |               |                   | CK73FB1H472K      | CHIP C 4700PF K         |                         |                    |
| C121             |               |                   | CC41FCH1H060D     | CYLND CHIP C 6.0PF D    |                         |                    |
| C122             |               |                   | CC41FCH1H020C     | CYLND CHIP C 2.0PF C    |                         |                    |
| C123             |               |                   | CC41FCH1H040C     | CYLND CHIP C 4.0PF C    |                         |                    |
| C128,129         |               |                   | CK73FB1H472K      | CHIP C 4700PF K         |                         |                    |
| C132             |               |                   | CK73FB1E223K      | CHIP C 0.022UF K        |                         |                    |
| C145,146         |               |                   | CC41FCH1H100D     | CYLND CHIP C 10PF D     |                         |                    |
| C164,165         |               |                   | CE04EW1HR22M      | ELECTRØ 0.22UF 50WV     |                         |                    |
| C166             |               |                   | CE04EW1E470M      | ELECTRØ 47UF 25WV       |                         |                    |
| C171             |               |                   | CC41FCH1H150J     | CYLND CHIP C 15PF J     |                         |                    |
| C173             |               |                   | CE04EW1HR47M      | ELECTRØ 0.47UF 50WV     |                         |                    |

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|--|---------------|-------------------|---|---|-------------------------|--------------------|
| C174<br>C176<br>C177<br>C187,188<br>C190     |               |                   | CE04EW1H010M<br>CE04EW1HR47M<br>CC41FSL1H101J<br>CE04EW1H010M<br>CC41FSL1H101J  | ELECTR0 1.0UF 50WV<br>ELECTR0 0.47UF 50WV<br>CYLND CHIP C 100PF J<br>ELECTR0 1.0UF 50WV<br>CYLND CHIP C 100PF J |                         |                    |
| C194<br>C198<br>C201<br>C202<br>C203         |               |                   | CE04EW1H2R2M<br>CC41FCH1H120J<br>C90-2022-05<br>CC41FSL1H101J<br>CE04EW1H100M   | ELECTR0 2.2UF 50WV<br>CYLND CHIP C 12PF J<br>05 22UF 16WV<br>CYLND CHIP C 100PF J<br>ELECTR0 10UF 50WV          |                         |                    |
| C204,205<br>C206,207<br>C209<br>C210<br>C211 |               |                   | CC41FSL1H470J<br>CK41FB1H221K<br>CE04EW1H100M<br>CE04EW1H010M<br>CK73FB1E473M   | CYLND CHIP C 47PF J<br>CYLND CHIP C 220PF K<br>ELECTR0 10UF 50WV<br>ELECTR0 1.0UF 50WV<br>CHIP C 0.047UF M      |                         | A                  |
| C212<br>C213<br>C214<br>C215<br>C216,217     |               |                   | CK73FF1E473Z<br>CE04EW1E470M<br>CE04EW1HOR1M<br>CE04EW1H100M<br>CK73FB1H472K    | CHIP C 0.047UF Z<br>ELECTR0 47UF 25WV<br>ELECTR0 0.1UF 50WV<br>ELECTR0 10UF 50WV<br>CHIP C 4700PF K             |                         |                    |
| C218<br>C219<br>C220<br>C221<br>C224         |               |                   | CE04EW1H100M<br>C90-0866-05<br>CE04EW1C102M<br>CK73FB1E223K<br>CE04EW1A221M     | ELECTR0 10UF 50WV<br>ELECTR0 470UF 6.3WV<br>ELECTR0 1000UF 16WV<br>CHIP C 0.022UF K<br>ELECTR0 220UF 10WV       |                         |                    |
| C226<br>C227<br>C229<br>C230<br>C232         |               |                   | CK41FY1E222M<br>CK41FB1H471K<br>CK41FY1E152M<br>CK73FB1E223K<br>CE04EW1E220M    | CYLND CHIP C 2200PF M<br>CYLND CHIP C 470PF K<br>CYLND CHIP C 1500PF M<br>CHIP C 0.022UF K<br>ELECTR0 22UF 25WV |                         |                    |
| C233<br>C234<br>C235<br>C236<br>C237         |               |                   | CK73FB1H562K<br>CK73FB1E223K<br>CC41FSL1H470J<br>CE04EW1E220M<br>CE04EW1HR47M   | CHIP C 5600PF K<br>CHIP C 0.022UF K<br>CYLND CHIP C 47PF J<br>ELECTR0 22UF 25WV<br>ELECTR0 0.47UF 50WV          |                         |                    |
| C238<br>C239<br>C240<br>C241,242<br>C243     |               |                   | CE04EW1E330M<br>CE04EW1H100M<br>CE04EW1H010M<br>CE04EW1E470M<br>CE04EW1H010M    | ELECTR0 33UF 25WV<br>ELECTR0 10UF 50WV<br>ELECTR0 1.0UF 50WV<br>ELECTR0 47UF 25WV<br>ELECTR0 1.0UF 50WV         |                         |                    |
| C244<br>C245<br>C247,248<br>C249<br>C252     |               |                   | CE04EW1H100M<br>CK73FB1H123K<br>CE04EW1E470M<br>CE04EW1H4R7M<br>CK45E2H222P     | ELECTR0 10UF 50WV<br>CHIP C 0.012UF K<br>ELECTR0 47UF 25WV<br>ELECTR0 4.7UF 50WV<br>CERAMIC 2200PF P            |                         |                    |
| C254<br>C258,259<br>C261-264<br>C266<br>C268 |               |                   | CE04EW1E330M<br>CK73FB1H472K<br>CK73FB1H472K<br>CK73FB1H472K<br>CC41FSL1H680J   | ELECTR0 33UF 25WV<br>CHIP C 4700PF K<br>CHIP C 4700PF K<br>CHIP C 4700PF K<br>CYLND CHIP C 68PF J               |                         |                    |
| C271<br>C273<br>C278<br>C279<br>C280         |               |                   | CK73FB1E223K<br>CK73FB1E223K<br>CC41FSL1H330J<br>CC41FSL1H820J<br>CC41FSL1H270J | CHIP C 0.022UF K<br>CHIP C 0.022UF K<br>CYLND CHIP C 33PF J<br>CYLND CHIP C 82PF J<br>CYLND CHIP C 27PF J       |                         | B<br>B<br>B        |


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|------------------|---------------|-------------------|-------------------|-------------------------|------------------------|--------------------|
| C281             |               |                   | CC41FSL1H121J     | CYLND CHIP C 120PF J    |                        | B                  |
| C282             |               |                   | CC41FSL1H470J     | CYLND CHIP C 47PF J     |                        | B                  |
| C287             |               |                   | CC41FSL1H470J     | CYLND CHIP C 47PF J     |                        |                    |
| C288             |               |                   | CC41FSL1H270J     | CYLND CHIP C 27PF J     |                        |                    |
| C289             |               |                   | CC41FSL1H121J     | CYLND CHIP C 120PF J    |                        |                    |
| C290             |               |                   | CC41FSL1H330J     | CYLND CHIP C 33PF J     |                        |                    |
| C291             |               |                   | CC41FSL1H390J     | CYLND CHIP C 39PF J     |                        |                    |
| C294             |               |                   | CK73FB1E223K      | CHIP C 0.022UF K        |                        |                    |
| C295             |               |                   | CE04EW1H100M      | ELECTRØ 10UF 50WV       |                        |                    |
| C297             |               |                   | CK73FB1H472K      | CHIP C 4700PF K         |                        |                    |
| C301             |               |                   | CC41FSL1H470J     | CYLND CHIP C 47PF J     |                        |                    |
| C308             |               |                   | CE04EW1H4R7M      | ELECTRØ 4.7UF 50WV      |                        |                    |
| C309             |               |                   | CE04EW1H010M      | ELECTRØ 1.0UF 50WV      |                        |                    |
| C312             |               |                   | CE04EW1H100M      | ELECTRØ 10UF 50WV       |                        |                    |
| C314             |               |                   | CE04EW1HR47M      | ELECTRØ 0.47UF 50WV     |                        |                    |
| C315             |               |                   | CE04EW1E470M      | ELECTRØ 47UF 25WV       |                        |                    |
| C316             |               |                   | CE04EW1H4R7M      | ELECTRØ 4.7UF 50WV      |                        |                    |
| C318             |               |                   | CE04EW1HR47M      | ELECTRØ 0.47UF 50WV     |                        |                    |
| C319,320         |               |                   | CE04EW1H100M      | ELECTRØ 10UF 50WV       |                        |                    |
| C322             |               |                   | CE04EW1HR47M      | ELECTRØ 0.47UF 50WV     |                        |                    |
| C326             |               |                   | CE04EW1C102M      | ELECTRØ 1000UF 16WV     |                        |                    |
| C327             |               |                   | CE04EW1E470M      | ELECTRØ 47UF 25WV       |                        |                    |
| C330             |               |                   | CE04EW1E470M      | ELECTRØ 47UF 25WV       |                        |                    |
| C334             |               |                   | CC41FSL1H470J     | CYLND CHIP C 47PF J     |                        | B                  |
| C336             |               |                   | CE04EW1H4R7M      | ELECTRØ 4.7UF 50WV      |                        |                    |
| C338             |               |                   | CK73FB1E223K      | CHIP C 0.022UF K        |                        |                    |
| C340             |               |                   | CK41FY1B682M      | CYLND CHIP C 6800PF M   |                        |                    |
| C354             |               |                   | CE04EW1H4R7M      | ELECTRØ 4.7UF 50WV      |                        |                    |
| C356             |               |                   | CC41FSL1H470J     | CYLND CHIP C 47PF J     |                        | B                  |
| C357             |               |                   | CE04EW1A101M      | ELECTRØ 100UF 10WV      |                        |                    |
| C358             |               |                   | CE04EW1H010M      | ELECTRØ 1.0UF 50WV      |                        |                    |
| C359             |               |                   | CK73FF1E473Z      | CHIP C 0.047UF Z        |                        |                    |
| C362             |               |                   | CC41FSL1H101J     | CYLND CHIP C 100PF J    |                        |                    |
| C363             |               |                   | CC41FCH1H180J     | CYLND CHIP C 18PF J     |                        |                    |
| C365             |               |                   | CC41FCH1H040C     | CYLND CHIP C 4.0PF C    |                        |                    |
| C367             |               |                   | CC41FSL1H470J     | CYLND CHIP C 47PF J     |                        |                    |
| C368             |               |                   | CC41FSL1H151J     | CYLND CHIP C 150PF J    |                        | B                  |
| C369             |               |                   | CK73EF1C105Z      | CHIP C 1.0UF Z          |                        |                    |
| C370             |               |                   | CC41FCH1H040C     | CYLND CHIP C 4.0PF C    |                        |                    |
| C372             |               |                   | C91-0119-05       | CERAMIC 0.047UF K       |                        |                    |
| C373             |               |                   | CE04EW1E101M      | ELECTRØ 100UF 25WV      |                        |                    |
| C374             |               |                   | C91-0117-05       | CERAMIC 0.01UF K        |                        |                    |
| C376             |               |                   | CK73FB1E473M      | CHIP C 0.047UF M        |                        |                    |
| C501             |               |                   | CE04EW1H100M      | ELECTRØ 10UF 50WV       |                        | A                  |
| C502             |               |                   | CE04EW1E470M      | ELECTRØ 47UF 25WV       |                        | A                  |
| C505             |               |                   | CK73FF1E473Z      | CHIP C 0.047UF Z        |                        | A                  |
| CN1 ,2           |               |                   | E40-5131-05       | FPC CONNECTØR (16P)     |                        |                    |
| CN3              |               |                   | E40-5141-05       | FPC CONNECTØR (26P)     |                        |                    |
| CN4              |               |                   | E40-3238-05       | PIN CONNECTØR (3P)      |                        |                    |
| CN5              |               |                   | E40-3242-05       | PIN CONNECTØR (7P)      |                        |                    |
| CN6              |               | *                 | E31-3320-05       | CONNECTING WIRE(VCV)    |                        |                    |
| CN7              |               |                   | E40-3237-05       | PIN CONNECTØR (2P)      |                        |                    |
| CN8              |               |                   | E40-3239-05       | PIN CONNECTØR (4P)      |                        |                    |
| CN9              |               |                   | E40-3241-05       | PIN CONNECTØR (6P)      |                        |                    |


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|------------------|---------------|-------------------|-------------------|--------------------------------|-------------------------|--------------------|
| CN10             |               |                   | E40-3240-05       | PIN CONNECTOR (5P)             |                         |                    |
| CN11             |               |                   | E40-3238-05       | PIN CONNECTOR (3P)             |                         |                    |
| CN12             |               |                   | E40-3237-05       | PIN CONNECTOR (2P)             |                         |                    |
| CN13             |               |                   | E40-3239-05       | PIN CONNECTOR (4P)             |                         |                    |
| CN14             |               |                   | E40-3237-05       | PIN CONNECTOR (2P)             |                         |                    |
| CN15             |               |                   | E40-5067-05       | PIN CONNECTOR (10P)            |                         |                    |
| CN16             |               |                   | E40-3237-05       | PIN CONNECTOR (2P)             |                         |                    |
| CN17             |               |                   | E40-3239-05       | PIN CONNECTOR (4P)             |                         |                    |
| CN18,19          |               |                   | E40-3237-05       | PIN CONNECTOR (2P)             |                         |                    |
| CN20-22          |               |                   | ED4-0157-05       | RF COAXIAL CABLE RECEPTACLE    |                         |                    |
| CN23             |               |                   | ED6-0752-05       | CYLINDRICAL RECEPTACLE(REMOTE) |                         |                    |
| CN24             |               |                   | E11-0418-05       | PHONE JACK (KEY)               |                         |                    |
| CN25             |               |                   | E11-0414-05       | PHONE JACK (EXT,SP)            |                         |                    |
| CN26             |               | *                 | ED6-0859-05       | CYLINDRICAL RECEPTACLE(ACC3)   |                         |                    |
| CN27             |               |                   | E40-3266-05       | PIN CONNECTOR (8P)             |                         |                    |
| CN28             |               |                   | ED6-1351-05       | CYLINDRICAL RECEPTACLE(ACC2)   |                         |                    |
| CN501            |               |                   | E40-3237-05       | PIN CONNECTOR (2P)             |                         | A                  |
| TP1              |               |                   | E23-0512-05       | TERMINAL                       |                         |                    |
| TP2 ,3           |               |                   | E23-0465-05       | TERMINAL                       |                         |                    |
| A1               |               | *                 | F11-1071-14       | SHIELDING CASE                 |                         |                    |
| A2               |               | *                 | F11-1072-14       | SHIELDING CASE                 |                         |                    |
| A3 ,4            |               | *                 | F11-1073-04       | SHIELDING CASE                 |                         |                    |
| A5               |               |                   | F10-1344-04       | SHIELDING PLATE                |                         |                    |
| A6               |               | *                 | FD2-0435-04       | HEAT SINK                      |                         |                    |
| A9               |               | *                 | F10-1376-04       | SHIELDING PLATE                |                         |                    |
| -                |               |                   | G02-0574-04       | FLAT SPRING                    |                         |                    |
| CF1              |               |                   | L72-0356-05       | CERAMIC FILTER (SSB)           |                         |                    |
| CF2              |               |                   | L72-0355-05       | CERAMIC FILTER (AM)            |                         |                    |
| CF3              |               |                   | L72-0315-05       | CERAMIC FILTER (FM)            |                         |                    |
| L1               |               | *                 | L34-4046-15       | COIL                           |                         |                    |
| L2               |               |                   | L40-8291-17       | SMALL FIXED INDUCTOR(8.2UH)    |                         |                    |
| L3               |               |                   | L40-1001-17       | SMALL FIXED INDUCTOR(10UH)     |                         |                    |
| L4 ,5            |               |                   | L40-1021-14       | SMALL FIXED INDUCTOR(1MH)      |                         |                    |
| L6               |               |                   | L40-1592-17       | SMALL FIXED INDUCTOR(1.5UH)    |                         |                    |
| L7               |               |                   | L40-2292-17       | SMALL FIXED INDUCTOR(2.2UH)    |                         |                    |
| L8               |               |                   | L40-3391-17       | SMALL FIXED INDUCTOR(3.3UH)    |                         |                    |
| L9               |               |                   | L40-2292-17       | SMALL FIXED INDUCTOR(2.2UH)    |                         |                    |
| L10              |               |                   | L40-5691-17       | SMALL FIXED INDUCTOR(5.6UH)    |                         |                    |
| L11              |               |                   | L40-1021-14       | SMALL FIXED INDUCTOR(1MH)      |                         |                    |
| L12              |               |                   | L40-2282-17       | SMALL FIXED INDUCTOR(0.22UH)   |                         |                    |
| L13              |               |                   | L40-3382-17       | SMALL FIXED INDUCTOR(0.33UH)   |                         |                    |
| L14              |               |                   | L40-2282-17       | SMALL FIXED INDUCTOR(0.22UH)   |                         |                    |
| L15 ,16          |               |                   | L40-3991-17       | SMALL FIXED INDUCTOR(3.3UH)    |                         |                    |
| L17              |               |                   | L40-4791-17       | SMALL FIXED INDUCTOR(4.7UH)    |                         |                    |
| L18              |               |                   | L40-1021-14       | SMALL FIXED INDUCTOR(1MH)      |                         |                    |
| L20              |               |                   | L40-1021-14       | SMALL FIXED INDUCTOR(1MH)      |                         |                    |
| L21              |               |                   | L40-2292-17       | SMALL FIXED INDUCTOR(2.2UH)    |                         |                    |
| L22              |               |                   | L40-1592-17       | SMALL FIXED INDUCTOR(1.5UH)    |                         |                    |
| L23              |               |                   | L40-2292-17       | SMALL FIXED INDUCTOR(2.2UH)    |                         |                    |
| L24              |               |                   | L40-1021-14       | SMALL FIXED INDUCTOR(1MH)      |                         |                    |
| L25 ,26          |               |                   | L40-2282-17       | SMALL FIXED INDUCTOR(0.22UH)   |                         |                    |
| L27              |               |                   | L40-3982-17       | SMALL FIXED INDUCTOR(0.39UH)   |                         |                    |
| L28              |               |                   | L40-1292-17       | SMALL FIXED INDUCTOR(1.2UH)    |                         |                    |

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|------------------|---------------|-------------------|-------------------|------------------------------|-------------------------|--------------------|
| L29              |               |                   | L40-6882-17       | SMALL FIXED INDUCTOR(0.68UH) |                         |                    |
| L31              |               |                   | L40-1292-17       | SMALL FIXED INDUCTOR(1.2UH)  |                         |                    |
| L32              |               |                   | L40-1021-14       | SMALL FIXED INDUCTOR(1MH)    |                         |                    |
| L33              |               |                   | L40-4782-17       | SMALL FIXED INDUCTOR(0.47UH) |                         |                    |
| L34              |               |                   | L40-3982-17       | SMALL FIXED INDUCTOR(0.39UH) |                         |                    |
| L35              |               |                   | L40-4782-17       | SMALL FIXED INDUCTOR(0.47UH) |                         |                    |
| L36              |               |                   | L40-1021-14       | SMALL FIXED INDUCTOR(1MH)    |                         |                    |
| L37              |               |                   | L34-4002-05       | COIL                         |                         | B                  |
| L38              |               |                   | L40-1001-17       | SMALL FIXED INDUCTOR(10UH)   |                         | B                  |
| L39              |               |                   | L40-4701-17       | SMALL FIXED INDUCTOR(47UH)   |                         |                    |
| L40 ,41          |               | *                 | L34-1204-05       | COIL (8T)                    |                         | B                  |
| L42              |               |                   | L34-4002-05       | COIL                         |                         | B                  |
| L44              |               |                   | L40-1092-17       | SMALL FIXED INDUCTOR(1UH)    |                         | B                  |
| L45              |               |                   | L40-1001-17       | SMALL FIXED INDUCTOR(10UH)   |                         | B                  |
| L46              |               | *                 | L34-4046-15       | COIL                         |                         |                    |
| L47              |               |                   | L34-1162-05       | COIL (6T)                    |                         | B                  |
| L48              |               |                   | L19-0344-05       | TOROIDAL COIL                |                         |                    |
| L49              |               |                   | L19-0324-05       | TOROIDAL COIL                |                         |                    |
| L50 ,51          |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR(100UH)  |                         |                    |
| L52              |               |                   | L34-2267-05       | COIL                         |                         |                    |
| L53              |               | *                 | L34-4047-05       | COIL                         |                         |                    |
| L54 ,55          |               | *                 | L34-4048-05       | COIL                         |                         |                    |
| L56              |               |                   | L40-1001-17       | SMALL FIXED INDUCTOR(10UH)   |                         |                    |
| L57              |               | *                 | L34-4049-05       | COIL                         |                         |                    |
| L58              |               |                   | L40-1011-17       | SMALL FIXED INDUCTOR(100UH)  |                         |                    |
| L59 ,60          |               |                   | L34-0664-05       | COIL                         |                         |                    |
| L61              |               |                   | L40-1021-14       | SMALL FIXED INDUCTOR(1MH)    |                         |                    |
| L64              |               |                   | L34-2124-05       | COIL                         |                         |                    |
| L65              |               |                   | L34-0945-05       | COIL                         |                         |                    |
| L66              |               |                   | L40-6825-04       | SMALL FIXED INDUCTOR(6.8MH)  |                         |                    |
| L67              |               |                   | L40-2201-14       | SMALL FIXED INDUCTOR(22UH)   |                         |                    |
| L68              |               |                   | L32-0198-05       | COIL                         |                         |                    |
| L69              |               |                   | L40-1801-14       | SMALL FIXED INDUCTOR(18UH)   |                         |                    |
| L70              |               |                   | L32-0649-05       | COIL                         |                         |                    |
| L71              |               |                   | L40-1501-14       | SMALL FIXED INDUCTOR(4.7UH)  |                         | B                  |
| L72              |               |                   | L32-0639-05       | COIL                         |                         |                    |
| L73              |               |                   | L40-4791-14       | SMALL FIXED INDUCTOR(10UH)   |                         |                    |
| L74              |               |                   | L32-0666-15       | COIL                         |                         | B                  |
| L75              |               |                   | L40-1021-14       | SMALL FIXED INDUCTOR(1MH)    |                         |                    |
| L76              |               |                   | L40-1511-17       | SMALL FIXED INDUCTOR(150UH)  |                         |                    |
| L77              |               |                   | L40-4782-17       | SMALL FIXED INDUCTOR(0.47UH) |                         |                    |
| L78              |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR(100UH)  |                         |                    |
| L79              |               |                   | L19-0344-05       | TOROIDAL COIL                |                         |                    |
| L80 ,81          |               |                   | L40-1021-14       | SMALL FIXED INDUCTOR(1MH)    |                         |                    |
| L82              |               |                   | L40-1092-17       | SMALL FIXED INDUCTOR(1UH)    |                         |                    |
| L83              |               |                   | L40-1021-14       | SMALL FIXED INDUCTOR(1MH)    |                         |                    |
| L84              |               |                   | L34-0540-05       | COIL                         |                         |                    |
| L85              |               |                   | L34-0863-05       | COIL                         |                         |                    |
| L86              |               |                   | L30-0503-05       | COIL                         |                         |                    |
| L87              |               |                   | L40-1021-14       | SMALL FIXED INDUCTOR(1MH)    |                         |                    |
| L88              |               |                   | L40-3391-13       | SMALL FIXED INDUCTOR(3.3UH)  |                         |                    |
| L89              |               |                   | L34-2283-05       | COIL                         |                         |                    |
| L90 -93          |               |                   | L40-4701-17       | SMALL FIXED INDUCTOR(47UH)   |                         |                    |
| L94              |               | *                 | L39-0432-05       | TOROIDAL COIL                |                         |                    |
| L95              |               |                   | L34-2289-05       | COIL                         |                         |                    |

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|------------------|---------------|-------------------|-------------------|------------------------------|-------------------------|--------------------|
| L96              |               | *                 | L39-0440-05       | TOROIDAL COIL                |                         |                    |
| L97              |               | *                 | L34-4046-15       | COIL                         |                         |                    |
| L98              |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR(100UH)  |                         | B                  |
| L99              |               |                   | L40-3382-17       | SMALL FIXED INDUCTOR(0.33UH) |                         |                    |
| L100             |               |                   | L40-2282-17       | SMALL FIXED INDUCTOR(0.22UH) |                         |                    |
| L101             |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR(100UH)  |                         | B                  |
| L102             |               | *                 | L34-1204-05       | COIL (8T)                    |                         | B                  |
| L103-105         |               |                   | L34-1162-05       | COIL (6T)                    |                         | B                  |
| L106,107         |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR(100UH)  |                         | B                  |
| L108             |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR(100UH)  |                         |                    |
| L109             |               |                   | L40-2292-17       | SMALL FIXED INDUCTOR(2.2UH)  |                         |                    |
| L110             |               |                   | L40-4701-14       | SMALL FIXED INDUCTOR(47UH)   |                         |                    |
| L111             |               |                   | L19-0328-05       | TOROIDAL COIL                |                         |                    |
| L112             |               |                   | L40-1021-14       | SMALL FIXED INDUCTOR(1MH)    |                         |                    |
| L113             |               |                   | L34-2124-05       | COIL                         |                         |                    |
| L114             |               |                   | L40-1011-17       | SMALL FIXED INDUCTOR(100UH)  |                         |                    |
| L117             |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR(100UH)  |                         |                    |
| L118-120         |               |                   | L40-2292-17       | SMALL FIXED INDUCTOR(2.2UH)  |                         |                    |
| L121,122         |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR(100UH)  |                         |                    |
| L124,125         |               |                   | L40-1011-14       | SMALL FIXED INDUCTOR(100UH)  |                         |                    |
| L126             |               |                   | L40-1011-17       | SMALL FIXED INDUCTOR(100UH)  |                         |                    |
| L127,128         |               |                   | L40-2282-17       | SMALL FIXED INDUCTOR(0.22UH) |                         |                    |
| XF1              |               | *                 | L71-0275-05       | MCF                          |                         |                    |
| -                |               |                   | ND9-0641-05       | SCREW                        |                         |                    |
| CP1              |               |                   | R90-0455-05       | MULTI-COMP 4.7KX8            |                         |                    |
| CP2              |               |                   | R90-0286-05       | MULTI-COMP 4.7KX4            |                         |                    |
| R1               |               |                   | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W      |                         |                    |
| R2               |               |                   | RD41FB2B470J      | CYLND CHIP R 47 J 1/8W       |                         |                    |
| R3               |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W      |                         |                    |
| R4               |               |                   | RD41FB2B680J      | CYLND CHIP R 68 J 1/8W       |                         |                    |
| R5               |               |                   | RD41FB2B221J      | CYLND CHIP R 220 J 1/8W      |                         |                    |
| R7               |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W      |                         |                    |
| R8               |               |                   | RD41FB2B680J      | CYLND CHIP R 68 J 1/8W       |                         |                    |
| R9               |               |                   | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W      |                         |                    |
| R10 ,11          |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W      |                         |                    |
| R12              |               |                   | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W      |                         |                    |
| R13              |               |                   | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W      |                         |                    |
| R14              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W      |                         |                    |
| R15              |               |                   | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W      |                         |                    |
| R16              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W      |                         |                    |
| R17              |               |                   | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W      |                         |                    |
| R18              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W      |                         |                    |
| R19              |               |                   | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W      |                         |                    |
| R20              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W      |                         |                    |
| R21              |               |                   | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W      |                         |                    |
| R22              |               |                   | RD41FB2B221J      | CYLND CHIP R 220 J 1/8W      |                         |                    |
| R23              |               |                   | RD41FB2B330J      | CYLND CHIP R 33 J 1/8W       |                         | B                  |
| R24              |               |                   | RD41FB2B820J      | CYLND CHIP R 82 J 1/8W       |                         | B                  |
| R25              |               |                   | RD41FB2B122J      | CYLND CHIP R 1.2K J 1/8W     |                         | B                  |
| R26              |               |                   | RD41FB2B100J      | CYLND CHIP R 10 J 1/8W       |                         | B                  |
| R27              |               |                   | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W      |                         | B                  |
| R28              |               |                   | RD41FB2B221J      | CYLND CHIP R 220 J 1/8W      |                         |                    |
| R29              |               |                   | RD41FB2B221J      | CYLND CHIP R 220 J 1/8W      |                         | B                  |
| R30              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W      |                         | B                  |


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|------------------|---------------|-------------------|-------------------|--------------------------|------------------------|--------------------|
| R31              |               |                   | RD41FB2B122J      | CYLND CHIP R 1.2K J 1/8W |                        | B                  |
| R32              |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                        | B                  |
| R34              |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                        |                    |
| R35              |               |                   | RD41FB2B152J      | CYLND CHIP R 1.5K J 1/8W |                        |                    |
| R36              |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                        | B                  |
| R37              |               |                   | RD41FB2B152J      | CYLND CHIP R 1.5K J 1/8W |                        | B                  |
| R38              |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                        | B                  |
| R39 ,40          |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                        |                    |
| R41              |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                        |                    |
| R42              |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                        | B                  |
| R43              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                        |                    |
| R44              |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                        |                    |
| R45              |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                        |                    |
| R46 ,47          |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                        |                    |
| R48              |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                        |                    |
| R49              |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                        |                    |
| R50 ,51          |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                        |                    |
| R52              |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                        |                    |
| R53              |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                        |                    |
| R54              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                        |                    |
| R55              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                        | B                  |
| R56              |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                        | B                  |
| R57              |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                        | B                  |
| R58              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                        | B                  |
| R59              |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                        |                    |
| R60              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                        |                    |
| R61              |               |                   | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W  |                        |                    |
| R62 ,63          |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                        |                    |
| R64              |               |                   | RD41FB2B330J      | CYLND CHIP R 33 J 1/8W   |                        |                    |
| R65              |               |                   | RD41FB2B271J      | CYLND CHIP R 270 J 1/8W  |                        |                    |
| R66              |               |                   | RD41FB2B151J      | CYLND CHIP R 150 J 1/8W  |                        |                    |
| R67              |               |                   | RD41FB2B220J      | CYLND CHIP R 22 J 1/8W   |                        |                    |
| R68              |               |                   | RD41FB2B470J      | CYLND CHIP R 47 J 1/8W   |                        |                    |
| R69              |               |                   | RD41FB2B681J      | CYLND CHIP R 680 J 1/8W  |                        |                    |
| R70              |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                        |                    |
| R71              |               |                   | RD41FB2B220J      | CYLND CHIP R 22 J 1/8W   |                        |                    |
| R72              |               |                   | RD41FB2B150J      | CYLND CHIP R 15 J 1/8W   |                        |                    |
| R73 -75          |               |                   | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W  |                        |                    |
| R76 ,77          |               |                   | RD41FB2B821J      | CYLND CHIP R 820 J 1/8W  |                        |                    |
| R78 -80          |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                        |                    |
| R81              |               |                   | RD41FB2B393J      | CYLND CHIP R 39K J 1/8W  |                        |                    |
| R82              |               |                   | RD41FB2B104J      | CYLND CHIP R 100K J 1/8W |                        |                    |
| R83              |               |                   | RD41FB2B474J      | CYLND CHIP R 470K J 1/8W |                        |                    |
| R84              |               |                   | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W  |                        |                    |
| R85              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                        |                    |
| R86              |               |                   | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W  |                        |                    |
| R87 ,88          |               |                   | RD41FB2B151J      | CYLND CHIP R 150 J 1/8W  |                        |                    |
| R89              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                        |                    |
| R91 ,92          |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                        |                    |
| R93              |               |                   | RD41FB2B333J      | CYLND CHIP R 33K J 1/8W  |                        |                    |
| R94 ,95          |               |                   | RD41FB2B104J      | CYLND CHIP R 100K J 1/8W |                        |                    |
| R96              |               |                   | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W  |                        |                    |
| R97              |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                        |                    |
| R98 -100         |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                        |                    |
| R101             |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                        |                    |

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|------------------|---------------|-------------------|-------------------|--------------------------|------------------------|--------------------|
| R102             |               |                   | RD41FB2B682J      | CYLND CHIP R 6.8K J 1/8W |                        |                    |
| R103, 104        |               |                   | RD41FB2B332J      | CYLND CHIP R 3.3K J 1/8W |                        |                    |
| R105             |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                        |                    |
| R106             |               |                   | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W  |                        |                    |
| R107             |               |                   | RD41FB2B221J      | CYLND CHIP R 220 J 1/8W  |                        |                    |
| R108             |               |                   | RD41FB2B562J      | CYLND CHIP R 5.6K J 1/8W |                        |                    |
| R109             |               |                   | RD41FB2B152J      | CYLND CHIP R 1.5K J 1/8W |                        |                    |
| R110             |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                        |                    |
| R111             |               |                   | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W  |                        |                    |
| R112             |               |                   | RD41FB2B221J      | CYLND CHIP R 220 J 1/8W  |                        |                    |
| R113             |               |                   | RD41FB2B562J      | CYLND CHIP R 5.6K J 1/8W |                        |                    |
| R114             |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                        |                    |
| R115             |               |                   | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W  |                        |                    |
| R116             |               |                   | RD41FB2B221J      | CYLND CHIP R 220 J 1/8W  |                        |                    |
| R117             |               |                   | RD41FB2B562J      | CYLND CHIP R 5.6K J 1/8W |                        |                    |
| R118             |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                        |                    |
| R119             |               |                   | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W  |                        |                    |
| R120             |               |                   | RD41FB2B221J      | CYLND CHIP R 220 J 1/8W  |                        |                    |
| R121             |               |                   | RD41FB2B562J      | CYLND CHIP R 5.6K J 1/8W |                        |                    |
| R122             |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                        |                    |
| R123, 124        |               |                   | RD41FB2B562J      | CYLND CHIP R 5.6K J 1/8W |                        |                    |
| R125             |               |                   | RD41FB2B682J      | CYLND CHIP R 6.8K J 1/8W |                        |                    |
| R126             |               |                   | RD41FB2B104J      | CYLND CHIP R 100K J 1/8W |                        |                    |
| R127             |               |                   | RD41FB2B333J      | CYLND CHIP R 33K J 1/8W  |                        |                    |
| R128             |               |                   | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W  |                        |                    |
| R129             |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                        |                    |
| R130             |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                        |                    |
| R131             |               |                   | RD41FB2B333J      | CYLND CHIP R 33K J 1/8W  |                        |                    |
| R132             |               |                   | RD41FB2B104J      | CYLND CHIP R 100K J 1/8W |                        |                    |
| R133             |               |                   | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W  |                        |                    |
| R134, 135        |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                        |                    |
| R136, 137        |               |                   | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W  |                        |                    |
| R138             |               |                   | RD41FB2B224J      | CYLND CHIP R 220K J 1/8W |                        |                    |
| R139             |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                        |                    |
| R140             |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                        |                    |
| R141             |               |                   | RD41FB2B332J      | CYLND CHIP R 3.3K J 1/8W |                        |                    |
| R142             |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                        |                    |
| R143             |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                        |                    |
| R145, 146        |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                        |                    |
| R147             |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                        |                    |
| R148             |               |                   | RD41FB2B222J      | CYLND CHIP R 2.2K J 1/8W |                        |                    |
| R149             |               |                   | RD41FB2B682J      | CYLND CHIP R 6.8K J 1/8W |                        |                    |
| R151             |               |                   | RD41FB2B221J      | CYLND CHIP R 220 J 1/8W  |                        |                    |
| R152             |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                        |                    |
| R153             |               |                   | RD41FB2B222J      | CYLND CHIP R 2.2K J 1/8W |                        |                    |
| R154             |               |                   | RD41FB2B153J      | CYLND CHIP R 15K J 1/8W  |                        |                    |
| R155             |               |                   | RD41FB2B333J      | CYLND CHIP R 33K J 1/8W  |                        |                    |
| R156             |               |                   | RD41FB2B683J      | CYLND CHIP R 68K J 1/8W  |                        |                    |
| R157             |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                        |                    |
| R158, 159        |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                        |                    |
| R160             |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                        |                    |
| R161             |               |                   | RD41FB2B221J      | CYLND CHIP R 220 J 1/8W  |                        |                    |
| R162             |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                        |                    |
| R163             |               |                   | RD41FB2B563J      | CYLND CHIP R 56K J 1/8W  |                        |                    |
| R164             |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                        |                    |

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|------------------|---------------|-------------------|-------------------|--------------------------|-------------------------|--------------------|
| R165             |               |                   | RD41FB2B681J      | CYLND CHIP R 680 J 1/8W  |                         |                    |
| R166             |               |                   | RD41FB2B333J      | CYLND CHIP R 33K J 1/8W  |                         |                    |
| R167             |               |                   | RD41FB2B152J      | CYLND CHIP R 1.5K J 1/8W |                         |                    |
| R168             |               |                   | RD41FB2B333J      | CYLND CHIP R 33K J 1/8W  |                         |                    |
| R169,170         |               |                   | RD41FB2B474J      | CYLND CHIP R 470K J 1/8W |                         |                    |
| R171             |               |                   | RD41FB2B273J      | CYLND CHIP R 27K J 1/8W  |                         |                    |
| R172             |               |                   | RD41FB2B153J      | CYLND CHIP R 15K J 1/8W  |                         |                    |
| R173             |               |                   | RD41FB2B334J      | CYLND CHIP R 330K J 1/8W |                         |                    |
| R174             |               |                   | RD41FB2B333J      | CYLND CHIP R 33K J 1/8W  |                         |                    |
| R175             |               |                   | RD41FB2B152J      | CYLND CHIP R 1.5K J 1/8W |                         |                    |
| R176             |               |                   | RD41FB2B562J      | CYLND CHIP R 5.6K J 1/8W |                         |                    |
| R177             |               |                   | RD41FB2B682J      | CYLND CHIP R 6.8K J 1/8W |                         |                    |
| R178             |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R179             |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R180             |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                         |                    |
| R181             |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                         |                    |
| R182             |               |                   | RD41FB2B224J      | CYLND CHIP R 220K J 1/8W |                         |                    |
| R183             |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R184             |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                         |                    |
| R185             |               |                   | RD41FB2B682J      | CYLND CHIP R 6.8K J 1/8W |                         |                    |
| R186             |               |                   | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W  |                         |                    |
| R187             |               |                   | RD41FB2B224J      | CYLND CHIP R 220K J 1/8W |                         |                    |
| R188             |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R189             |               |                   | RD41FB2B222J      | CYLND CHIP R 2.2K J 1/8W |                         |                    |
| R190             |               |                   | RD41FB2B104J      | CYLND CHIP R 100K J 1/8W |                         |                    |
| R191             |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                         |                    |
| R192,193         |               |                   | RD41FB2B104J      | CYLND CHIP R 100K J 1/8W |                         |                    |
| R194             |               |                   | RD41FB2B224J      | CYLND CHIP R 220K J 1/8W |                         |                    |
| R195             |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R196,197         |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                         |                    |
| R198             |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R199             |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                         |                    |
| R200             |               |                   | RD41FB2B104J      | CYLND CHIP R 100K J 1/8W |                         |                    |
| R201             |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R202             |               |                   | RD41FB2B222J      | CYLND CHIP R 2.2K J 1/8W |                         |                    |
| R203             |               |                   | RD41FB2B821J      | CYLND CHIP R 820 J 1/8W  |                         |                    |
| R204             |               |                   | RD41FB2B331J      | CYLND CHIP R 330 J 1/8W  |                         |                    |
| R205             |               |                   | RD41FB2B332J      | CYLND CHIP R 3.3K J 1/8W |                         |                    |
| R206             |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                         |                    |
| R207             |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R208             |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                         |                    |
| R209             |               |                   | RK73FB2A2R2J      | CHIP R 2.2 J 1/10W       |                         |                    |
| R210             |               |                   | RD41FB2B331J      | CYLND CHIP R 330 J 1/8W  |                         |                    |
| R211             |               |                   | RK73FB2A2R2J      | CHIP R 2.2 J 1/10W       |                         |                    |
| R212             |               |                   | RD41FB2B104J      | CYLND CHIP R 100K J 1/8W |                         |                    |
| R213             |               |                   | RD41FB2B823J      | CYLND CHIP R 82K J 1/8W  |                         |                    |
| R214             |               |                   | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W  |                         |                    |
| R215,216         |               |                   | RD41FB2B222J      | CYLND CHIP R 2.2K J 1/8W |                         |                    |
| R217             |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                         |                    |
| R218             |               |                   | RD41FB2B104J      | CYLND CHIP R 100K J 1/8W |                         |                    |
| R219             |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R220             |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                         |                    |
| R221             |               |                   | RD41FB2B153J      | CYLND CHIP R 15K J 1/8W  |                         |                    |
| R224             |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                         |                    |
| R225             |               |                   | RD41FB2B821J      | CYLND CHIP R 820 J 1/8W  |                         |                    |


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|------------------|---------------|----------------|-------------------|--------------------------|-------------------------|--------------------|
| R226, 227        |               |                | RD41FB2B104J      | CYLND CHIP R 100K J 1/8W |                         |                    |
| R228             |               |                | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                         |                    |
| R229, 230        |               |                | RD41FB2B122J      | CYLND CHIP R 1.2K J 1/8W |                         |                    |
| R231             |               |                | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W  |                         |                    |
| R232             |               |                | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W  |                         |                    |
| R233             |               |                | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R234             |               |                | RD41FB2B333J      | CYLND CHIP R 33K J 1/8W  |                         |                    |
| R235             |               |                | RD41FB2B104J      | CYLND CHIP R 100K J 1/8W |                         |                    |
| R236             |               |                | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W  |                         |                    |
| R237             |               |                | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R238             |               |                | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W  |                         |                    |
| R239             |               |                | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W  |                         |                    |
| R240             |               |                | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R241             |               |                | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                         |                    |
| R242             |               |                | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R243, 244        |               |                | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W  |                         |                    |
| R246-248         |               |                | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W  |                         |                    |
| R250             |               |                | RD41FB2B273J      | CYLND CHIP R 27K J 1/8W  |                         |                    |
| R251             |               |                | RD41FB2B563J      | CYLND CHIP R 56K J 1/8W  |                         |                    |
| R252             |               |                | RD41FB2B332J      | CYLND CHIP R 3.3K J 1/8W |                         |                    |
| R253-256         |               |                | RD41FB2B330J      | CYLND CHIP R 33 J 1/8W   |                         |                    |
| R257             |               |                | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R258             |               |                | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                         |                    |
| R259, 260        |               |                | RD41FB2B152J      | CYLND CHIP R 1.5K J 1/8W |                         | B                  |
| R261             |               |                | RD41FB2B332J      | CYLND CHIP R 3.3K J 1/8W |                         |                    |
| R262             |               |                | RD41FB2B561J      | CYLND CHIP R 560 J 1/8W  |                         |                    |
| R263             |               |                | RD14BB2E100J      | RD 10 J 1/4W             |                         |                    |
| R264             |               |                | RD41FB2B681J      | CYLND CHIP R 680 J 1/8W  |                         |                    |
| R265             |               |                | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                         |                    |
| R266             |               |                | RD41FB2B124J      | CYLND CHIP R 120K J 1/8W |                         |                    |
| R267             |               |                | RD41FB2B221J      | CYLND CHIP R 220 J 1/8W  |                         |                    |
| R268             |               |                | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R269             |               |                | RD41FB2B222J      | CYLND CHIP R 2.2K J 1/8W |                         |                    |
| R270             |               |                | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R271             |               |                | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W  |                         |                    |
| R272             |               |                | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R273             |               |                | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W  |                         |                    |
| R274             |               |                | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R275, 276        |               |                | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R277             |               |                | RD14CB2C224J      | RD 220K J 1/6W           |                         |                    |
| R278             |               |                | RD41FB2B104J      | CYLND CHIP R 100K J 1/8W |                         |                    |
| R279             |               |                | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R280             |               |                | RD14BB2C4R7J      | RD 4.7 J 1/6W            |                         |                    |
| R281             |               |                | RD41FB2B562J      | CYLND CHIP R 5.6K J 1/8W |                         |                    |
| R282             |               |                | RD41FB2B332J      | CYLND CHIP R 3.3K J 1/8W |                         |                    |
| R284             |               |                | RD41FB2B222J      | CYLND CHIP R 2.2K J 1/8W |                         |                    |
| R285             |               |                | RD41FB2B332J      | CYLND CHIP R 3.3K J 1/8W |                         |                    |
| R286             |               |                | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R287             |               |                | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W  |                         |                    |
| R288             |               |                | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         | B                  |
| R289, 290        |               |                | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R291             |               |                | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                         |                    |
| R292             |               |                | RD41FB2B562J      | CYLND CHIP R 5.6K J 1/8W |                         |                    |
| R293             |               |                | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                         |                    |
| R294             |               |                | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |

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|------------------|---------------|-------------------|-------------------|--------------------------|-------------------------|--------------------|
| R295             |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                         |                    |
| R296             |               |                   | RD41FB2B222J      | CYLND CHIP R 2.2K J 1/8W |                         |                    |
| R297             |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R298             |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R299             |               |                   | RD41FB2B682J      | CYLND CHIP R 6.8K J 1/8W |                         |                    |
| R300             |               |                   | RD41FB2B563J      | CYLND CHIP R 56K J 1/8W  |                         |                    |
| R301             |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                         |                    |
| R302             |               |                   | RD41FB2B333J      | CYLND CHIP R 33K J 1/8W  |                         |                    |
| R303             |               |                   | RD41FB2B124J      | CYLND CHIP R 120K J 1/8W |                         |                    |
| R304             |               |                   | RD41FB2B221J      | CYLND CHIP R 220 J 1/8W  |                         |                    |
| R305             |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                         |                    |
| R306             |               |                   | RD41FB2B562J      | CYLND CHIP R 5.6K J 1/8W |                         |                    |
| R307             |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                         |                    |
| R308             |               |                   | RD41FB2B683J      | CYLND CHIP R 68K J 1/8W  |                         |                    |
| R309             |               |                   | RD41FB2B821J      | CYLND CHIP R 820 J 1/8W  |                         |                    |
| R310             |               |                   | RD41FB2B222J      | CYLND CHIP R 2.2K J 1/8W |                         |                    |
| R311             |               |                   | RD41FB2B104J      | CYLND CHIP R 100K J 1/8W |                         |                    |
| R312             |               |                   | RD41FB2B332J      | CYLND CHIP R 3.3K J 1/8W |                         |                    |
| R315             |               |                   | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W  |                         |                    |
| R316, 317        |               |                   | RD41FB2B564J      | CYLND CHIP R 560K J 1/8W |                         |                    |
| R318             |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R319             |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                         |                    |
| R320             |               |                   | RD41FB2B104J      | CYLND CHIP R 100K J 1/8W |                         |                    |
| R321             |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R322             |               |                   | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W  |                         |                    |
| R323             |               |                   | RD41FB2B104J      | CYLND CHIP R 100K J 1/8W |                         |                    |
| R324             |               |                   | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W  |                         |                    |
| R325, 326        |               |                   | RD41FB2B104J      | CYLND CHIP R 100K J 1/8W |                         |                    |
| R327             |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R328             |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                         |                    |
| R329, 330        |               |                   | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W  |                         |                    |
| R331             |               |                   | RD41FB2B562J      | CYLND CHIP R 5.6K J 1/8W |                         |                    |
| R332             |               |                   | RD41FB2B332J      | CYLND CHIP R 3.3K J 1/8W |                         |                    |
| R334             |               |                   | RD41FB2B224J      | CYLND CHIP R 220K J 1/8W |                         |                    |
| R339             |               |                   | RD41FB2B562J      | CYLND CHIP R 5.6K J 1/8W |                         |                    |
| R340             |               |                   | RD41FB2B152J      | CYLND CHIP R 1.5K J 1/8W |                         |                    |
| R341             |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         |                    |
| R342             |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                         |                    |
| R343             |               |                   | RD41FB2B471J      | CYLND CHIP R 470 J 1/8W  |                         |                    |
| R345, 346        |               |                   | RD41FB2B101J      | CYLND CHIP R 100 J 1/8W  |                         | B                  |
| R347             |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                         |                    |
| R348             |               |                   | RD41FB2B224J      | CYLND CHIP R 220K J 1/8W |                         |                    |
| R349             |               |                   | RD41FB2B473J      | CYLND CHIP R 47K J 1/8W  |                         |                    |
| R350-352         |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                         |                    |
| R353, 354        |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                         |                    |
| R355             |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R356             |               |                   | RD41FB2B104J      | CYLND CHIP R 100K J 1/8W |                         |                    |
| R357             |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                         |                    |
| R359             |               |                   | RD41FB2B222J      | CYLND CHIP R 2.2K J 1/8W |                         |                    |
| R360             |               |                   | RD41FB2B103J      | CYLND CHIP R 10K J 1/8W  |                         |                    |
| R361             |               |                   | RD41FB2B222J      | CYLND CHIP R 2.2K J 1/8W |                         |                    |
| R362             |               |                   | RD41FB2B104J      | CYLND CHIP R 100K J 1/8W |                         |                    |
| R363             |               |                   | RD41FB2B223J      | CYLND CHIP R 22K J 1/8W  |                         |                    |
| R365             |               |                   | RD41FB2B102J      | CYLND CHIP R 1.0K J 1/8W |                         |                    |
| R366             |               |                   | RD41FB2B472J      | CYLND CHIP R 4.7K J 1/8W |                         |                    |


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|--|---------------|-------------------|--|---|-------------------------|--------------------|
| R367<br>R368,369<br>R370<br>R371<br>R372   |               |                   | RD41FB2B105J<br>RD41FB2B104J<br>RD14CB2C103J<br>RD14BB2C100J<br>RD41FB2B332J | CYLND CHIP R 1.0M J 1/8W<br>CYLND CHIP R 100K J 1/8W<br>RD 10K J 1/6W<br>RD 10 J 1/6W<br>CYLND CHIP R 3.3K J 1/8W           |                         |                    |
| R373<br>R501-504<br>R505<br>VR1<br>VR2     |               |                   | RD41FB2B101J<br>RD41FB2B103J<br>RD41FB2B102J<br>R12-0435-05<br>R12-1431-05   | CYLND CHIP R 100 J 1/8W<br>CYLND CHIP R 10K J 1/8W<br>CYLND CHIP R 1.0K J 1/8W<br>TRIMMING P&T. (300)<br>TRIMMING P&T. (1K) |                         | A<br>A             |
| VR3 ,4<br>VR5 ,6<br>VR7<br>VR8<br>VR9 ,10  |               | *                 | R12-2414-05<br>R12-3447-05<br>R05-5401-05<br>R12-1432-05<br>R12-7407-05      | TRIMMING P&T. (5K)<br>TRIMMING P&T. (10K)<br>P&TENTIOMETER (100K)<br>TRIMMING P&T. (2K)<br>TRIMMING P&T. (500K)             |                         |                    |
| VR11<br>VR12<br>VR13<br>VR14<br>VR15       |               |                   | R12-7407-05<br>R12-7407-05<br>R12-5418-05<br>R12-5417-05<br>R12-5417-05      | TRIMMING P&T. (500K)<br>TRIMMING P&T. (500K)<br>TRIMMING P&T. (200K)<br>TRIMMING P&T. (100K)<br>TRIMMING P&T. (100K)        |                         | B<br>B             |
| VR16,17<br>VR18<br>VR19<br>VR20,21<br>VR22 |               |                   | R12-4414-05<br>R12-0435-05<br>R12-1431-05<br>R12-4414-05<br>R12-3448-05      | TRIMMING P&T. (50K)<br>TRIMMING P&T. (300)<br>TRIMMING P&T. (1K)<br>TRIMMING P&T. (50K)<br>TRIMMING P&T. (20K)              |                         |                    |
| VR23<br>VR24<br>VR25<br>VR26<br>VR501      |               | *                 | R12-4414-05<br>R12-3447-05<br>R12-1431-05<br>R12-3447-05<br>R05-3443-05      | TRIMMING P&T. (50K)<br>TRIMMING P&T. (10K)<br>TRIMMING P&T. (1K)<br>TRIMMING P&T. (10K)<br>P&TENTIOMETER (10K)              |                         | A                  |
| VR502<br>W1 -7<br>W8<br>W9<br>W10          |               | *                 | R05-0402-05<br>R92-0150-05<br>R92-1061-05<br>R92-0150-05<br>R92-0687-05      | P&TENTIOMETER (300)<br>JUMPER REST 0 0HM<br>JUMPER REST 0 0HM<br>JUMPER REST 0 0HM<br>CHIP R 0 0HM                          |                         | A<br>B             |
| W11<br>W12<br>W13 ,14<br>W501,502<br>W503  |               |                   | R92-0687-05<br>R92-1061-05<br>R92-1061-05<br>R92-1061-05<br>R92-0687-05      | CHIP R 0 0HM<br>JUMPER REST 0 0HM<br>JUMPER REST 0 0HM<br>JUMPER REST 0 0HM<br>CHIP R 0 0HM                                 | W                       | A<br>A             |
| W504,505<br>W506                           |               |                   | R92-0338-05<br>R92-0687-05   | CLYND CHIP R 0 0HM<br>CHIP R 0 0HM  |                         | A<br>A             |
| K1<br>K2 ,3<br>K4<br>S1<br>S2              |               | *                 | S51-1436-05<br>S51-2422-05<br>S51-1432-05<br>S31-1411-05<br>S31-1411-05      | RELAY (ATT)<br>RELAY<br>RELAY<br>SLIDE SWITCH<br>SLIDE SWITCH   |                         | B<br>B             |
| D1 -3<br>D5<br>D6<br>D7 ,8<br>D9           |               | *                 | DAN235(K)<br>US1090<br>V08(G)<br>RLS135<br>V08(G)                            | CHIP DIODE<br>DIODE<br>DIODE<br>CHIP DIODE<br>DIODE   |                         |                    |
| D10<br>D11                                 |               |                   | US1090<br>RLS135   | DIODE<br>CHIP DIODE   |                         |                    |

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|------------------|---------------|-------------------|-------------------|-------------------------|------------------------|--------------------|
| D12              |               | *                 | DAN235(K)         | CHIP DIODE              |                        |                    |
| D13 -20          |               |                   | RLS135            | CHIP DIODE              |                        |                    |
| D21 ,22          |               |                   | RLS135            | CHIP DIODE              |                        | B                  |
| D23              |               |                   | 1S1555            | DIODE                   |                        |                    |
| D24              |               |                   | DAN202(K)         | CHIP DIODE              |                        | B                  |
| D25              |               |                   | 1S1555            | DIODE                   |                        | B                  |
| D26              |               |                   | DAP202(K)         | CHIP DIODE              |                        |                    |
| D27              |               |                   | RLS73             | CHIP DIODE              |                        |                    |
| D28 ,29          |               |                   | DAP202(K)         | CHIP DIODE              |                        |                    |
| D30              |               |                   | UZ3.0B            | ZENER DIODE             |                        |                    |
| D31              |               |                   | DAP202(K)         | CHIP DIODE              |                        | B                  |
| D33              |               |                   | RLS73             | CHIP DIODE              |                        |                    |
| D34 -37          |               |                   | ITT310TE          | VARI-CAP DIODE          |                        |                    |
| D38              |               |                   | RLS135            | CHIP DIODE              |                        |                    |
| D39 ,40          |               |                   | ITT310TE          | VARI-CAP DIODE          |                        |                    |
| D41              |               |                   | RLS135            | CHIP DIODE              |                        |                    |
| D42 ,43          |               |                   | ITT310TE          | VARI-CAP DIODE          |                        | B                  |
| D44              |               |                   | RLS135            | CHIP DIODE              |                        | B                  |
| D45 ,46          |               |                   | RLS135            | CHIP DIODE              |                        |                    |
| D47              |               |                   | MI204             | DIODE                   |                        |                    |
| D48              |               |                   | DAN202(K)         | CHIP DIODE              |                        |                    |
| D49              |               |                   | RLS73             | CHIP DIODE              |                        |                    |
| D50 -53          |               |                   | RLS135            | CHIP DIODE              |                        |                    |
| D54 -56          |               |                   | RLS73             | CHIP DIODE              |                        |                    |
| D57              |               |                   | DAN202(K)         | CHIP DIODE              |                        |                    |
| D58 -60          |               |                   | RLS73             | CHIP DIODE              |                        |                    |
| D61              |               |                   | DAN202(K)         | CHIP DIODE              |                        |                    |
| D62 -67          |               |                   | RLS73             | CHIP DIODE              |                        |                    |
| D68 ,69          |               |                   | DAN202(K)         | CHIP DIODE              |                        |                    |
| D70              |               |                   | RLS73             | CHIP DIODE              |                        |                    |
| D71              |               |                   | HSM88AS           | CHIP DIODE              |                        |                    |
| D72 -74          |               |                   | RLS73             | CHIP DIODE              |                        |                    |
| D75              |               |                   | 1N60PSPA          | DIODE                   |                        |                    |
| D76              |               |                   | RLS73             | CHIP DIODE              |                        |                    |
| D77              |               |                   | DAN202(K)         | CHIP DIODE              |                        |                    |
| D78              |               |                   | RLS73             | CHIP DIODE              |                        |                    |
| D79 -81          |               |                   | DAN202(K)         | CHIP DIODE              |                        |                    |
| D82              |               |                   | HSM88AS           | CHIP DIODE              |                        |                    |
| D83              |               |                   | RLS73             | CHIP DIODE              |                        |                    |
| D85              |               |                   | DAN202(K)         | CHIP DIODE              |                        |                    |
| D86 ,87          |               |                   | HSM88AS           | CHIP DIODE              |                        |                    |
| D88              |               |                   | RLS73             | CHIP DIODE              |                        |                    |
| D89              |               |                   | DAN202(K)         | CHIP DIODE              |                        |                    |
| D90              |               |                   | 1S1555            | DIODE                   |                        |                    |
| D91              |               |                   | MTZ9.1JB          | ZENER DIODE             |                        |                    |
| D92              |               |                   | RLS73             | CHIP DIODE              |                        |                    |
| D93              |               |                   | UZ3.0B            | ZENER DIODE             |                        |                    |
| D95              |               |                   | RLS73             | CHIP DIODE              |                        |                    |
| D96              |               |                   | MI204             | DIODE                   |                        |                    |
| D97              |               |                   | DAN202(K)         | CHIP DIODE              |                        |                    |
| D98              |               |                   | 1N60PSPA          | DIODE                   |                        |                    |
| D99 -102         |               |                   | RLS135            | CHIP DIODE              |                        |                    |
| D103-106         |               |                   | RLS135            | CHIP DIODE              |                        | B                  |
| D107             |               |                   | DAN202(K)         | CHIP DIODE              |                        |                    |
| D108             |               |                   | RLS73             | CHIP DIODE              |                        |                    |


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|------------------|---------------|-------------------|-------------------|--------------------------------|-------------------------|--------------------|
| D109,110         |               |                   | RLS135            | CHIP DIODE                     |                         |                    |
| D111             |               |                   | KB369             | VARI-CAP DIODE                 |                         |                    |
| D112-115         |               |                   | RLS73             | CHIP DIODE                     |                         |                    |
| D116             |               | *                 | RLZ3.6B           | CHIP ZENER DIODE               |                         |                    |
| D117             |               |                   | RLS73             | CHIP DIODE                     |                         |                    |
| D118             |               |                   | RLS135            | CHIP DIODE                     |                         |                    |
| D119             |               |                   | DAN202(K)         | CHIP DIODE                     |                         |                    |
| D120             |               |                   | RLS73             | CHIP DIODE                     |                         |                    |
| D122             |               |                   | RLS135            | CHIP DIODE                     |                         |                    |
| D123             |               |                   | RLS73             | CHIP DIODE                     |                         |                    |
| D124             |               |                   | RLS135            | CHIP DIODE                     |                         |                    |
| D125             |               | *                 | RLZ3.6B           | CHIP ZENER DIODE               |                         |                    |
| D126             |               |                   | RLS135            | CHIP DIODE                     |                         |                    |
| D127             |               |                   | 1SS133            | DIODE                          |                         | B                  |
| D128             |               |                   | RLS73             | CHIP DIODE                     |                         |                    |
| D129             |               |                   | RLS73             | CHIP DIODE                     |                         | B                  |
| D501,502         |               |                   | RLS73             | DIODE                          |                         | A                  |
| D503             |               |                   | UZ3.0B            | CHIP ZENER DIODE               |                         | A                  |
| IC1              |               | *                 | M54581P           | IC                             |                         |                    |
| IC2              |               |                   | M74LS145P         | IC(DECIMAL DECODER/DRIVER BCD) |                         |                    |
| IC3              |               |                   | AN612             | IC(BALANCE MODULATOR)          |                         |                    |
| IC4              |               |                   | UPC2002V          | IC(OP AMP X2)                  |                         |                    |
| IC5              |               |                   | SN16913P          | IC(DUBLE BALANCED MIXERS)      |                         |                    |
| IC6              |               |                   | MC3357P           | IC(LOW POWER FM IF)            |                         |                    |
| IC7 -10          |               |                   | TC4066BP          | IC(ANALOG/ DIGITAL SW)         |                         |                    |
| IC11             |               |                   | LM324N            | IC(QUAD OP AMP X4)             |                         |                    |
| IC12             |               |                   | AN7808            | IC(VOLTAGE REGULATOR/ +8V)     |                         |                    |
| Q1               |               |                   | 2SA1162(Y)        | CHIP TRANSISTOR                |                         | B                  |
| Q2               |               |                   | 2SA1162(Y)        | CHIP TRANSISTOR                |                         | B                  |
| Q3 ,4            |               |                   | DTC114EK          | DIGITAL TRANSISTOR             |                         | B                  |
| Q5               |               |                   | DTA143EK          | DIGITAL TRANSISTOR             |                         | B                  |
| Q6 -8            |               |                   | DTA143EK          | DIGITAL TRANSISTOR             |                         |                    |
| Q9 -11           |               |                   | 2SC2668(Y)        | TRANSISTOR                     |                         |                    |
| Q12              |               |                   | 2SK192A(GR)*J     | FET                            |                         | B                  |
| Q13              |               |                   | 2SC2668(Y)        | TRANSISTOR                     |                         |                    |
| Q14              |               |                   | 2SC1907           | TRANSISTOR                     |                         |                    |
| Q15              |               |                   | 2SC2053           | TRANSISTOR                     |                         |                    |
| Q16              |               |                   | DTA114EK          | DIGITAL TRANSISTOR             |                         |                    |
| Q17              |               |                   | DTC114EK          | DIGITAL TRANSISTOR             |                         |                    |
| Q18 ,19          |               |                   | 2SK125-5          | FET                            |                         |                    |
| Q20              |               | *                 | FMC3              | DIGITAL TRANSISTOR             |                         |                    |
| Q21              |               |                   | 3SK122(L)         | FET                            |                         |                    |
| Q22 ,23          |               |                   | 2SK125-5          | FET                            |                         |                    |
| Q27              |               |                   | 3SK73(GR)         | FET                            |                         |                    |
| Q28              |               |                   | 2SA1162(Y)        | CHIP TRANSISTOR                |                         |                    |
| Q29              |               |                   | 2SC2712(Y)        | CHIP TRANSISTOR                |                         |                    |
| Q30 ,31          |               |                   | 3SK73(GR)         | FET                            |                         |                    |
| Q32              |               | *                 | FMC3              | DIGITAL TRANSISTOR             |                         |                    |
| Q34              |               |                   | DTC114EK          | DIGITAL TRANSISTOR             |                         |                    |
| Q35 -39          |               |                   | DTA143EK          | DIGITAL TRANSISTOR             |                         |                    |
| Q40 -42          |               |                   | 2SC2712(Y)        | CHIP TRANSISTOR                |                         |                    |
| Q43 ,44          |               | *                 | FMC3              | DIGITAL TRANSISTOR             |                         |                    |
| Q45 -54          |               |                   | 2SC2712(Y)        | CHIP TRANSISTOR                |                         |                    |
| Q55              |               |                   | DTC114EK          | DIGITAL TRANSISTOR             |                         |                    |
| Q56 -59          |               |                   | 2SC2712(Y)        | CHIP TRANSISTOR                |                         |                    |

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| Q60                            |               |                   | 2SK192A(Y)        | FET                     |                         |                    |
| Q61                            |               |                   | 2SA1162(Y)        | CHIP TRANSISTOR         |                         |                    |
| Q62                            |               |                   | DTC114TK          | DIGITAL TRANSISTOR      |                         |                    |
| Q63                            |               |                   | DTC114EK          | DIGITAL TRANSISTOR      |                         | B                  |
| Q64                            |               |                   | DTC114TK          | DIGITAL TRANSISTOR      |                         | B                  |
| Q65 -67                        |               |                   | DTC114EK          | DIGITAL TRANSISTOR      |                         |                    |
| Q68                            |               |                   | 2SK192A(Y)        | FET                     |                         |                    |
| Q69                            |               |                   | 2SA1162(Y)        | CHIP TRANSISTOR         |                         |                    |
| Q70                            |               |                   | 2SK125-5          | FET                     |                         | B                  |
| Q71                            |               |                   | 2SC1907           | TRANSISTOR              |                         | B                  |
| Q72                            |               |                   | 2SK125-5          | FET                     |                         | B                  |
| Q73                            |               |                   | 2SC1907           | TRANSISTOR              |                         | B                  |
| Q74                            |               |                   | 2SC2712(Y)        | CHIP TRANSISTOR         |                         |                    |
| Q75                            |               |                   | DTC114EK          | DIGITAL TRANSISTOR      |                         |                    |
| Q76                            |               |                   | DTA143EK          | DIGITAL TRANSISTOR      |                         |                    |
| Q77                            |               |                   | DTC114EK          | DIGITAL TRANSISTOR      |                         |                    |
| Q78                            |               |                   | 3SK73(GR)         | FET                     |                         |                    |
| Q79 ,80                        |               |                   | 3SK122(L)         | FET                     |                         |                    |
| Q81                            |               |                   | 2SC2053           | TRANSISTOR              |                         |                    |
| Q82                            |               | *                 | FMC3              | DIGITAL TRANSISTOR      |                         |                    |
| Q83                            |               |                   | DTC114EK          | DIGITAL TRANSISTOR      |                         | B                  |
| Q84                            |               |                   | DTC114EK          | DIGITAL TRANSISTOR      |                         |                    |
| Q85                            |               | *                 | FMC3              | DIGITAL TRANSISTOR      |                         | B                  |
| Q86                            |               |                   | 3SK73(GR)         | FET                     |                         |                    |
| Q87                            |               |                   | 2SA1162(Y)        | CHIP TRANSISTOR         |                         |                    |
| Q88                            |               | *                 | FMC3              | DIGITAL TRANSISTOR      |                         |                    |
| Q89                            |               |                   | 2SC2712(Y)        | CHIP TRANSISTOR         |                         |                    |
| Q90                            |               |                   | 2SA1162(Y)        | CHIP TRANSISTOR         |                         |                    |
| Q91 ,92                        |               |                   | DTC114EK          | DIGITAL TRANSISTOR      |                         |                    |
| Q93                            |               |                   | DTC114TK          | DIGITAL TRANSISTOR      |                         |                    |
| Q94 ,95                        |               |                   | DTC114TK          | DIGITAL TRANSISTOR      |                         | B                  |
| Q96 ,97                        |               |                   | DTC114EK          | DIGITAL TRANSISTOR      |                         |                    |
| Q98                            |               |                   | 2SC2712(Y)        | CHIP TRANSISTOR         |                         |                    |
| Q99                            |               |                   | DTC114EK          | DIGITAL TRANSISTOR      |                         |                    |
| TH1 -4                         |               |                   | 112-502-2         | THERMISTOR              |                         |                    |
| -                              |               |                   | X59-1060-00       | SIDE TONE UNIT          |                         |                    |
| -                              |               |                   | X59-1080-00       | VX UNIT                 |                         | A                  |
| -                              |               | *                 | X59-3000-02       | FM MIC UNIT             |                         |                    |
| -                              |               | *                 | X59-3340-00       | TRX UNIT                |                         |                    |
| -                              |               | *                 | X59-3350-00       | NB2 UNIT                |                         |                    |
| -                              |               | *                 | X59-3360-00       | DELAY TIME UNIT         |                         |                    |
| <b>SIDE TONE (X59-1060-00)</b> |               |                   |                   |                         |                         |                    |
| C1                             |               |                   | CK73FB1E223K      | CHIP C 0.022UF K        |                         |                    |
| C2 -5                          |               |                   | CK73FB1H123K      | CHIP C 0.012UF K        |                         |                    |
| C6 -8                          |               |                   | CK73FB1E223K      | CHIP C 0.022UF K        |                         |                    |
| -                              |               |                   | E23-0471-05       | TERMINAL                |                         |                    |
| R1 ,2                          |               |                   | RK73FB2A823J      | CHIP R 82K J 1/10W      |                         |                    |
| R3                             |               |                   | RK73FB2A223J      | CHIP R 22K J 1/10W      |                         |                    |
| R4                             |               |                   | RK73FB2A472J      | CHIP R 4.7K J 1/10W     |                         |                    |
| R5                             |               |                   | RK73FB2A102J      | CHIP R 1.0K J 1/10W     |                         |                    |
| R6                             |               |                   | RK73FB2A103J      | CHIP R 10K J 1/10W      |                         |                    |
| R7 ,8                          |               |                   | RK73FB2A333J      | CHIP R 33K J 1/10W      |                         |                    |
| R9                             |               |                   | RK73FB2A103J      | CHIP R 10K J 1/10W      |                         |                    |

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| R10<br>R11<br>W1 -6              |               |                   | RK73FB2A333J<br>RK73FB2A183J<br>R92-0670-05   | CHIP R 33K J 1/10W<br>CHIP R 18K J 1/10W<br>CHIP R 0 OHM   |                         |                    |
| D1<br>D2<br>D3<br>Q1             |               |                   | DAN202(K)<br>DAP202(K)<br>DAN202(K)<br>2SC2712(Y)   | CHIP DIODE<br>CHIP DIODE<br>CHIP DIODE<br>CHIP TRANSISTOR  |                         |                    |
| <b>VOX (X59-1080-00)</b>         |               |                   |   |  |                         |                    |
| C1<br>C2<br>-                    |               |                   | CK73FB1H102K<br>CK73FB1E223K<br>E23-0471-05   | CHIP C 1000PF K<br>CHIP C 0.022UF K<br>TERMINAL  |                         |                    |
| R1<br>R2 -5<br>R6 ,7<br>R8<br>R9 |               |                   | RK73FB2A104J<br>RK73FB2A103J<br>RK73FB2A105J<br>RK73FB2A474J<br>RK73FB2A105J                  | CHIP R 100K J 1/10W<br>CHIP R 10K J 1/10W<br>CHIP R 1.0M J 1/10W<br>CHIP R 470K J 1/10W<br>CHIP R 1.0M J 1/10W |                         |                    |
| R10<br>W1 -3                     |               |                   | RK73FB2A103J<br>R92-0670-05   | CHIP R 10K J 1/10W<br>CHIP R 0 OHM   |                         |                    |
| D1 ,2<br>IC1<br>IC2<br>Q1        |               |                   | DAP202(K)<br>NJM2904M<br>TC4001BF<br>2SC2712(Y)   | CHIP DIODE<br>IC(OP AMP X2)<br>IC(NOR X6)<br>CHIP TRANSISTOR   |                         |                    |
| <b>FM MIC AMP. (X59-3000-02)</b> |               |                   |   |  |                         |                    |
| C1<br>C2<br>C3<br>C4<br>C5<br>-  |               |                   | CC73FCH1H680J<br>CK73FB1H561K<br>CC73FCH1H390J<br>CK73FB1H102K<br>CK73FB1E223K<br>E23-0471-05 | CHIP C 68PF J<br>CHIP C 560PF K<br>CHIP C 39PF J<br>CHIP C 1000PF K<br>CHIP C 0.022UF K<br>TERMINAL            |                         |                    |
| JR1<br>R1<br>R2<br>R3<br>R4      |               |                   | R92-0670-05<br>RK73FB2A105J<br>RK73FB2A823J<br>RK73FB2A562J<br>RK73FB2A472J                   | CHIP R 0 OHM<br>CHIP R 1.0M J 1/10W<br>CHIP R 82K J 1/10W<br>CHIP R 5.6K J 1/10W<br>CHIP R 4.7K J 1/10W        |                         |                    |
| R5 -7<br>R8<br>R9                |               |                   | RK73FB2A224J<br>RK73FB2A182J<br>RK73FB2A104J  | CHIP R 220K J 1/10W<br>CHIP R 1.8K J 1/10W<br>CHIP R 100K J 1/10W  |                         |                    |
| IC1<br>Q1                        |               |                   | NJM4558M<br>2SC2712(Y)  | IC(OP AMP X2)<br>CHIP TRANSISTOR   |                         |                    |
| <b>TRX (X59-3340-00)</b>         |               |                   |   |  |                         |                    |
| C1 -3<br>-                       |               |                   | CK73EB1H473K<br>E23-0471-05   | CHIP C 0.047UF K<br>TERMINAL   |                         |                    |
| R1<br>R2<br>R3<br>R4<br>R5       |               |                   | RK73FB2A103J<br>RK73FB2A471J<br>RK73FB2A103J<br>RK73FB2A471J<br>RK73FB2A103J                  | CHIP R 10K J 1/10W<br>CHIP R 470 J 1/10W<br>CHIP R 10K J 1/10W<br>CHIP R 470 J 1/10W<br>CHIP R 10K J 1/10W     |                         |                    |
| R6<br>W1 ,2                      |               |                   | RK73FB2A471J<br>R92-0670-05   | CHIP R 470 J 1/10W<br>CHIP R 0 OHM   |                         |                    |

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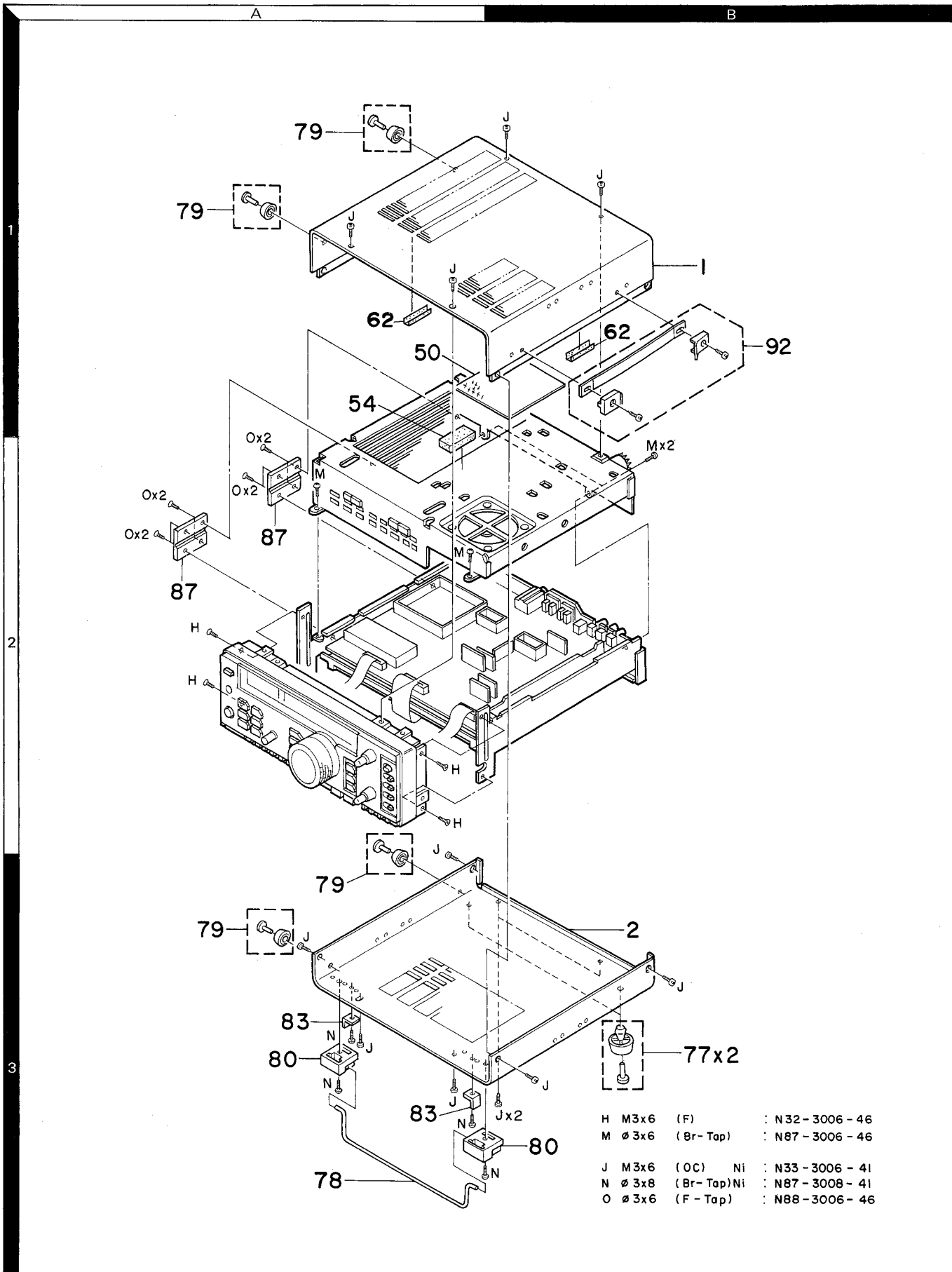
| Ref. No.<br>参照番号  | Address<br>位置 | New<br>Parts<br>新 | Parts No.<br>部品番号  | Description<br>部品名/規格   | Desti-<br>nation<br>仕向 | Re-<br>marks<br>備考 |
|---|---------------|-------------------|--|---|------------------------|--------------------|
| D1 .2<br>Q1 .2<br>Q3<br>Q4 .5   |               | *                 | DAN202(K)<br>2SA1204(Y)<br>2SA1182(Y)<br>DTC114EK  | CHIP DIODE<br>CHIP TRANSISTOR<br>CHIP TRANSISTOR<br>DIGITAL TRANSISTOR  |                        |                    |
| <b>NB2 (X59-3350-00)</b>  |               |                   |  |   |                        |                    |
| C1<br>C2<br>C3<br>-<br>R1<br>R2<br>R3<br>R4<br>R5<br>W1 -3<br>IC1<br>Q1 .2              |               |                   | CK73FB1H103K<br>CK73FB1H102K<br>CK73EF1E474Z<br>E23-0471-05<br>RK73FB2A103J<br>RK73FB2A563J<br>RK73FB2A684J<br>RK73FB2A103J<br>RK73FB2A184J<br>R92-0670-05<br>TC4011BF<br>DTC114EK                                   | CHIP C 0.010UF K<br>CHIP C 1000PF K<br>CHIP C 0.47UF Z<br>TERMINAL<br>CHIP R 10K J 1/10W<br>CHIP R 56K J 1/10W<br>CHIP R 680K J 1/10W<br>CHIP R 10K J 1/10W<br>CHIP R 180K J 1/10W<br>CHIP R 0 OHM<br>IC(NAND X4)<br>DIGITAL TRANSISTOR   |                        |                    |
| <b>DELAY TIME (X59-3360-00)</b>   |               |                   |  |   |                        |                    |
| C1<br>-<br>R1 -3<br>W1 -7<br>D1<br>IC1<br>Q1 -5<br>Q6<br>Q7                             |               | *                 | CK73FB1H103K<br>E23-0471-05<br>RK73FB2A103J<br>R92-0670-05<br>DAN202(K)<br>MB74LS122<br>DTC114EK<br>DTA114EK<br>DTC114TK   | CHIP C 0.010UF K<br>TERMINAL<br>CHIP R 10K J 1/10W<br>CHIP R 0 OHM<br>CHIP DIODE<br>IC<br>DIGITAL TRANSISTOR<br>DIGITAL TRANSISTOR<br>DIGITAL TRANSISTOR  |                        |                    |
| <b>FAN (X59-3370-00)</b>  |               |                   |  |   |                        |                    |
| C1<br>-<br>R1<br>R2<br>R3<br>R4<br>R5<br>R6<br>R7<br>R8<br>R9 .10<br>W1 .2<br>IC1<br>Q1 |               |                   | CK73FB1H103K<br>E23-0471-05<br>RK73FB2A103J<br>RK73FB2A223J<br>RK73FB2A562J<br>RK73FB2A122J<br>RK73FB2A562J<br>RK73FB2A332J<br>RK73FB2A562J<br>RK73FB2A223J<br>RK73FB2A103J<br>R92-0670-05<br>NJM4558M<br>2SC2712(Y) | CHIP C 0.010UF K<br>TERMINAL<br>CHIP R 10K J 1/10W<br>CHIP R 22K J 1/10W<br>CHIP R 5.6K J 1/10W<br>CHIP R 1.2K J 1/10W<br>CHIP R 5.6K J 1/10W<br>CHIP R 3.3K J 1/10W<br>CHIP R 5.6K J 1/10W<br>CHIP R 22K J 1/10W<br>CHIP R 10K J 1/10W<br>CHIP R 0 OHM<br>IC(OP AMP X2)<br>CHIP TRANSISTOR |                        |                    |

E: Scandinavia & Europe K: USA P: Canada  
 U: PX(Far East, Hawaii) T: England M: Other Areas  
 UE: AAFES(Europe) X: Australia

A : TS-140S (K,M,T,W)  
 B : TS-680S (K)

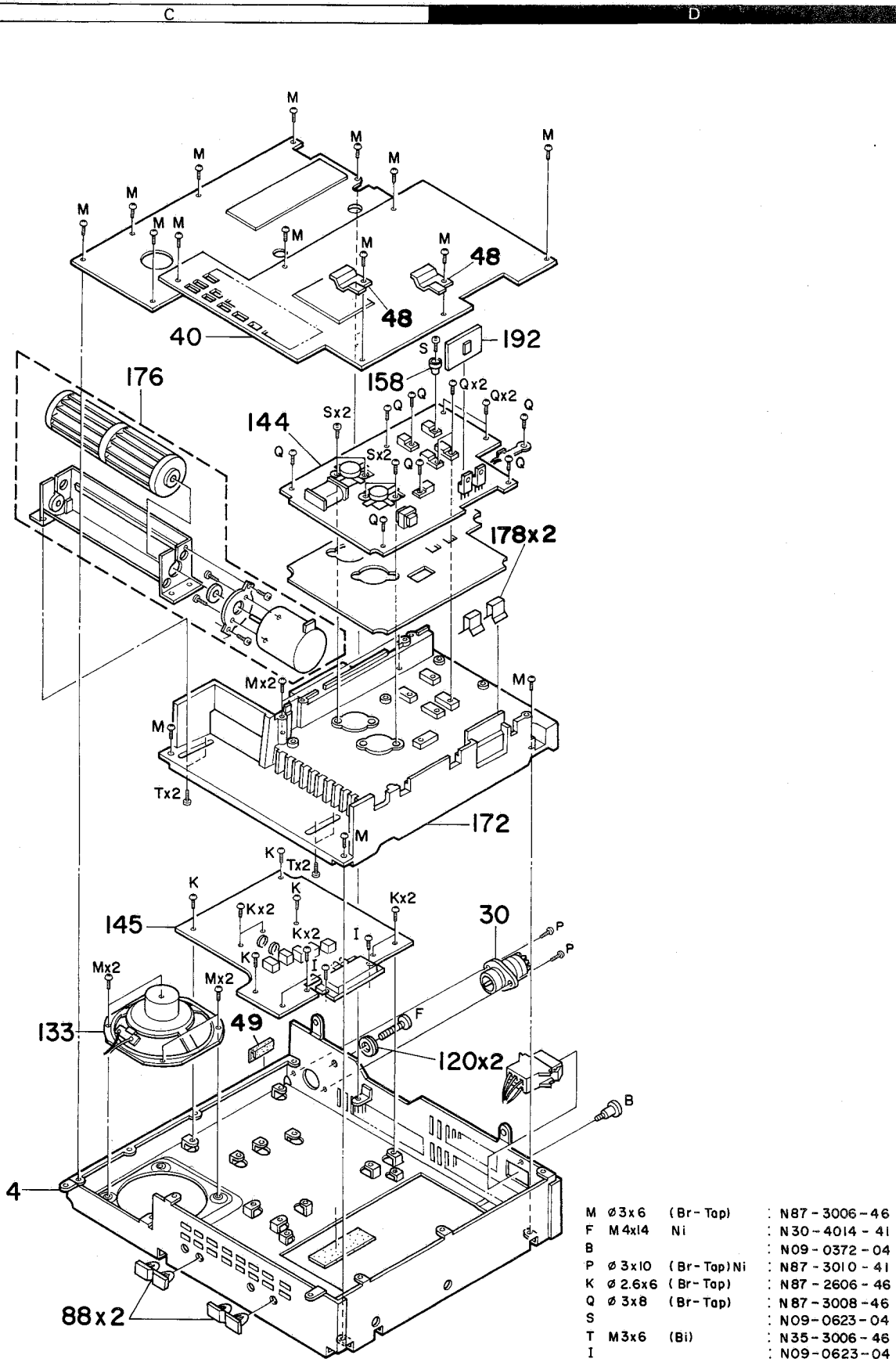
 indicates safety critical components.

## DISASSEMBLY

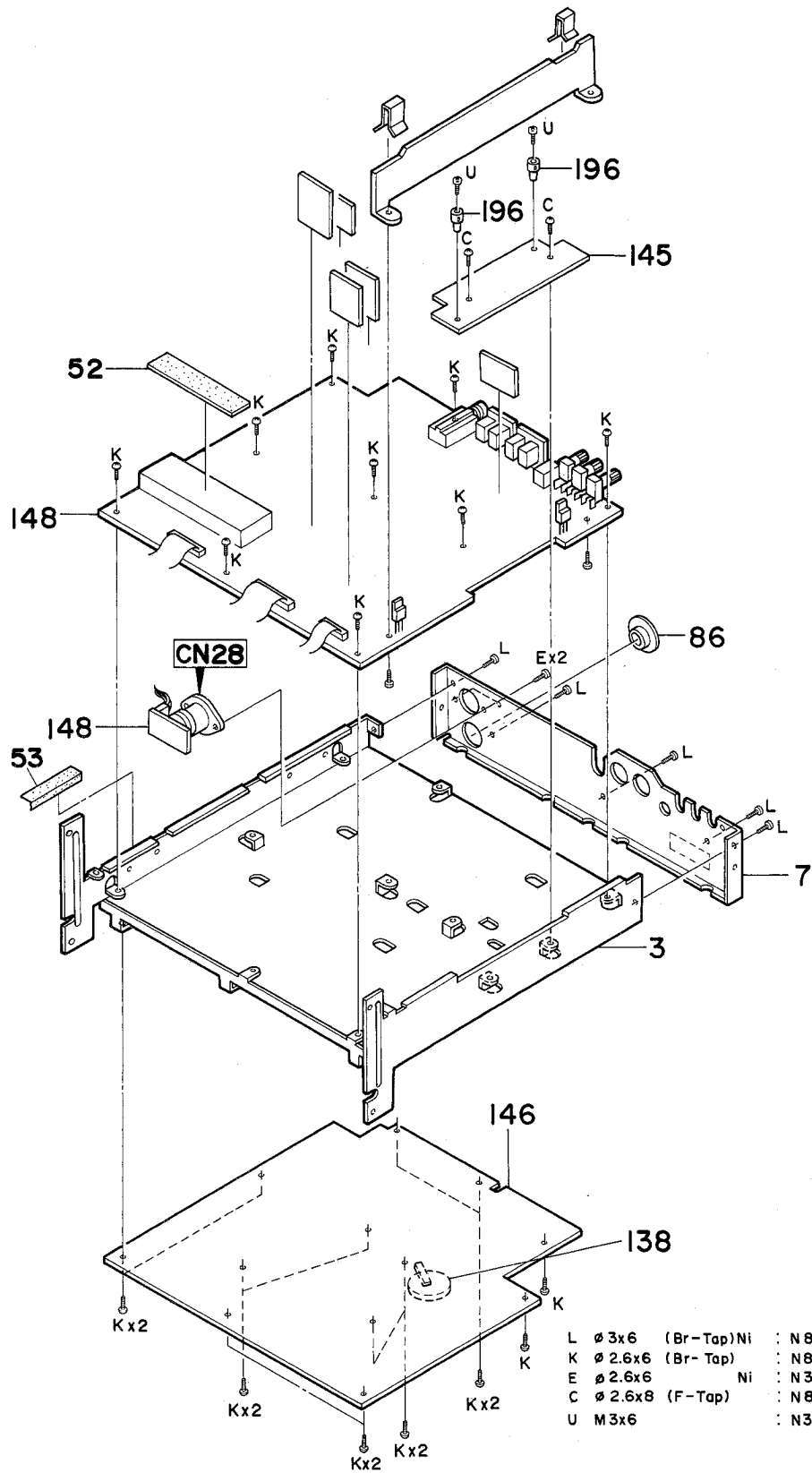


|   |                  |   |             |
|---|------------------|---|-------------|
| H | M3x6 (F)         | : | N32-3006-46 |
| M | ∅ 3x6 (Br-Tap)   | : | N87-3006-46 |
| J | M3x6 (OC) Ni     | : | N33-3006-41 |
| N | ∅ 3x8 (Br-Tap)Ni | : | N87-3008-41 |
| O | ∅ 3x6 (F-Tap)    | : | N88-3006-46 |

## DISASSEMBLY

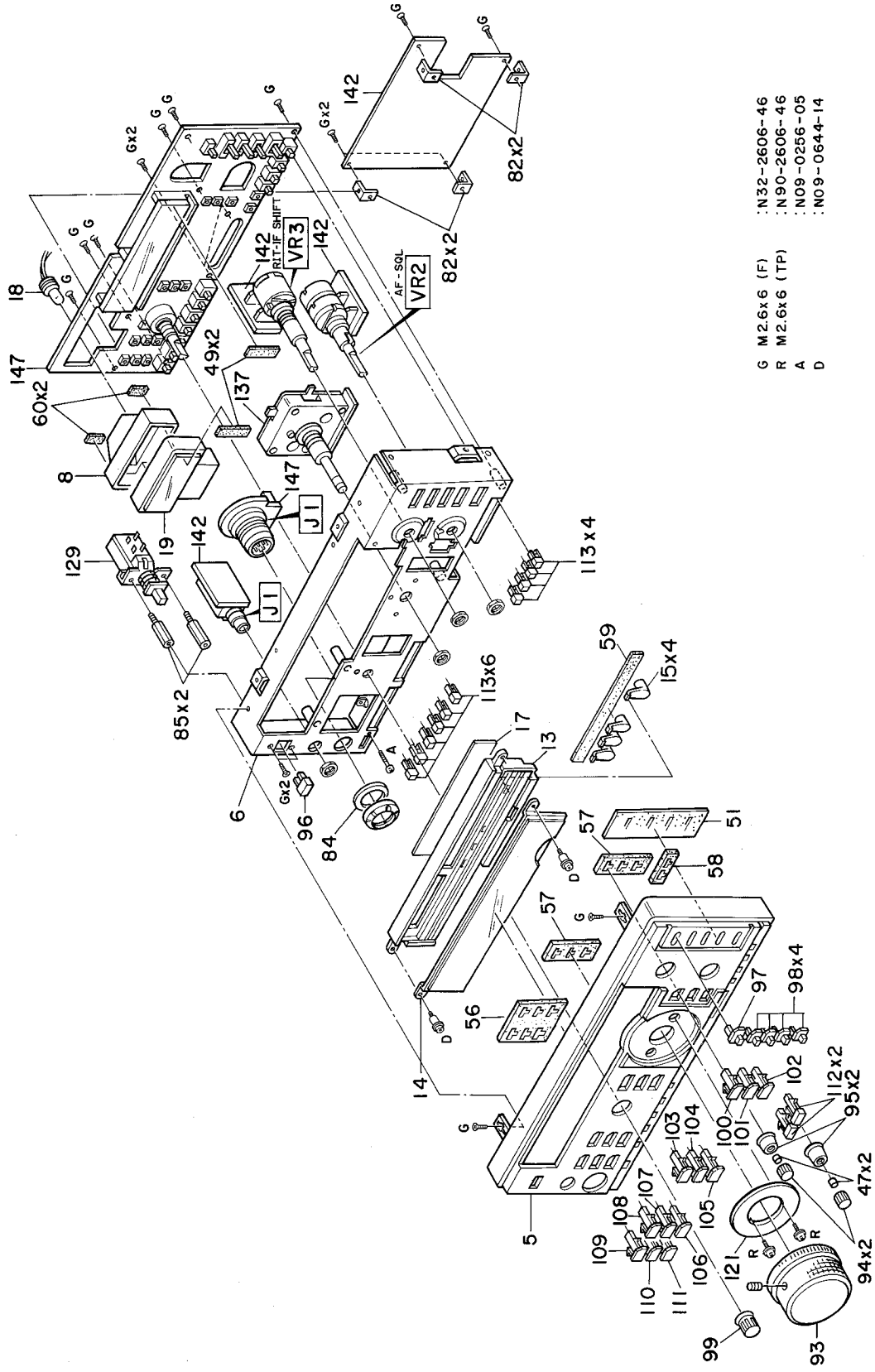


## DISASSEMBLY



|   |  |                    |
|---|--|--------------------|
| L | $\varnothing 3 \times 6$ (Br-Tap) Ni   | : N 87 - 3006 - 41 |
| K | $\varnothing 2.6 \times 6$ (Br-Tap) Ni | : N 87 - 2606 - 46 |
| E | $\varnothing 2.6 \times 6$ Ni          | : N 30 - 2606 - 41 |
| C | $\varnothing 2.6 \times 8$ (F-Tap)     | : N 88 - 2608 - 46 |
| U | M3x6                                   | : N 30 - 3006 - 46 |

## DISASSEMBLY



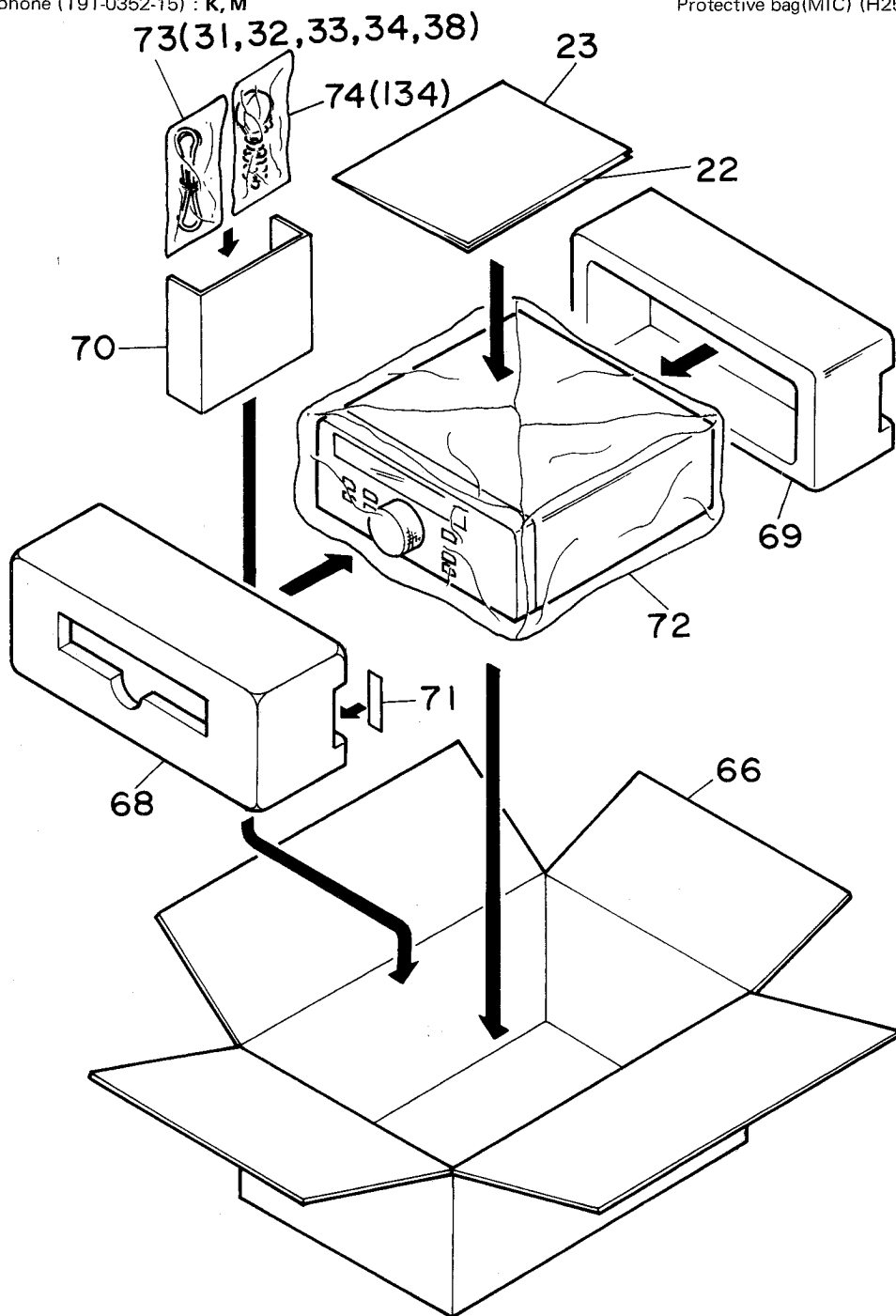
- G M 2.6x6 (F) : N32-2606-46
- R M 2.6x6 (TP) : N90-2606-46
- A : N09-0256-05
- D : N09-0644-14

## PACKING

### Accessory

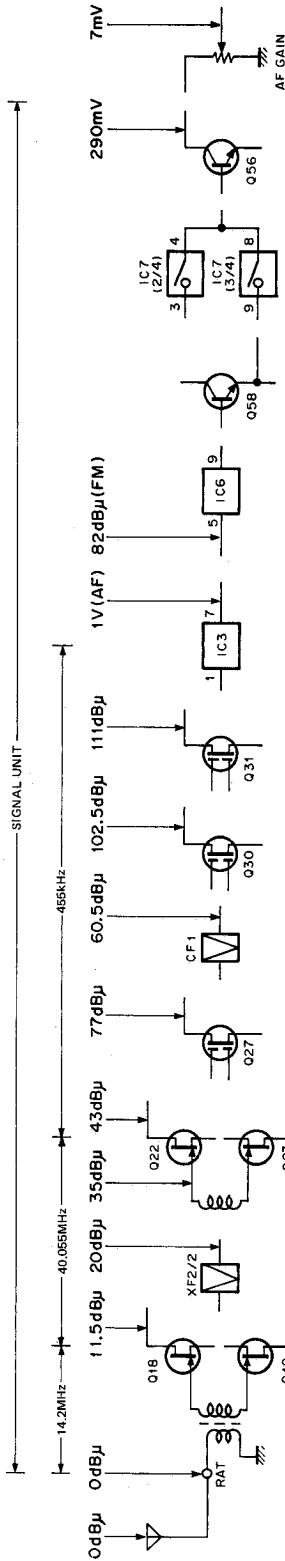
Warranty card (B46-0410-20) : **K**  
 Instruction manual (B50-8199-20)  
 7P DIN plug (E07-0751-05)  
 DC power cord ass'y (E30-2065-05)  
 Connecting wire(CAL) (E31-2154-05)  
 13P plug (E07-1351-05)  
 Fuse(20A) (F05-2036-05)  
 Microphone (T91-0352-15) : **K, M**

Carton box (H01-8146-04) : **TS-140S**  
 Carton box (H01-8165-04) : **TS-680S**  
 Packing fixture(FRONT) (H10-2633-02)  
 Packing fixture(REAR) (H10-2634-02)  
 Cushion (H12-1315-04)  
 Cushion(FRONT) (H12-1405-04)  
 Protective cover (H20-1410-03)  
 Protective bag(DC CORD) (H25-0112-04)  
 Protective bag(MIC) (H25-0079-04) : **K, M**



## LEVEL DIAGRAM

### RX SECTION



Frequency : 14,200MHz

Input : 0dBμ

AF output : 0.63V/8Ω

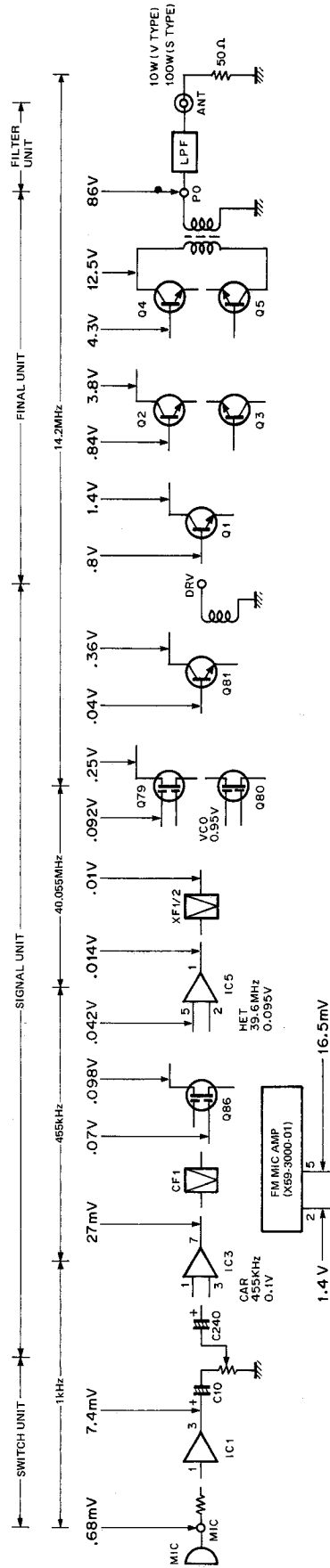
Note1 : The SSG signal of 14,200MHz/0dBμ is input from the ANT terminal, and the audio output of 0.63V/8Ω is obtained by adjusting the AF GAIN VR.

The SSG signal levels at various points necessary to obtain the same audio output at this time with the AF GAIN VR at a fixed position are plotted here.

Note2 : In FM mode, this signal level is used to obtain the same value as the S/N at time when 0dBμ is input.

Note3 : The SSG output is measured through a capacitor of 0.01μF.

### TX SECTION



Frequency : 14,200MHz

Note1 : The high-frequency part is measured with the RF V.M in the CW mode.

The low-frequency part is measured with the AF V.M in the USB mode.

Note2 : The audio input voltage in the USB mode is the input for obtaining 1kHz single tone which reads almost the maximum value in the ALC zone, and that in the FM mode is the input for realizing the standard modulation (±3kHz DEV.).

Note3 : MIC VR is set to the maximum point.



## ADJUSTMENT

### REQUIRED TEST EQUIPMENT

1. **DC Voltmeter (DC V.M)**
  - 1) Input resistance : More than  $1M\Omega$
  - 2) Voltage range : 1.5 to 1000 V AC/DC

**NOTE** : A high-precision multimeter may be used. However, accurate readings can not be obtained for high-impedance circuits.
2. **DC Ammeter**
  - 1) Current range : 1.5A, 3A, 20A, High-precision ammeter may be used.
3. **RF VTVM (RF V.M)**
  - 1) Input impedance :  $1M\Omega$  and less than  $3pF$ , min.
  - 2) Voltage range : 10mV to 300V
  - 3) Frequency range : 10kHz to 100MHz or greater
4. **AF Voltmeter (AF V.M)**
  - 1) Frequency range : 50Hz to 10kHz
  - 2) Input resistance :  $1M\Omega$  or greater
  - 3) Voltage range : 10mV to 30V
5. **AF Generator (AG)**
  - 1) Frequency range : 200Hz to 5kHz
  - 2) Output : 1mV or less to 1V, low distortion
6. **AF Dummy Load**
  - 1) Impedance :  $8\Omega$
  - 2) Dissipation : 3W or greater
7. **Oscilloscope (SCOPE)**

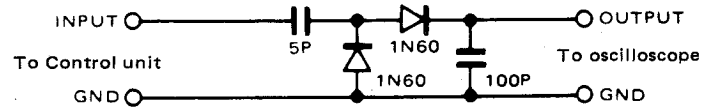
Vertical amplifier which has frequency characteristics higher than 100MHz.

Requires high sensitivity, and external synchronization capability.
8. **Tracking generator**
  - 1) Center frequency : 50kHz to 90MHz
  - 2) Frequency deviation : Maximum  $\pm 35$ MHz
  - 3) Output voltage : 0.1V or greater
  - 4) Sweep rate : At least 0.5sec/cm
9. **Standard Signal Generator (SSG)**
  - 1) Frequency range : 50kHz to 500MHz
  - 2) Output :  $-20dB/0.1\mu V$  to  $120dB/1V$
  - 3) Output impedance :  $50\Omega$
  - 4) AM and FM modulation can be possible.

**NOTE** : Generator must be frequency stable.
10. **Frequency Counter (FREQ.C)**
  - 1) Minimum input voltage : 50mV
  - 2) Frequency range : 500MHz or greater
  - 3) Output impedance :  $50\Omega$
11. **Noise Generator**

Must generate ignition noise containing harmonics beyond 30MHz.
12. **RF Dummy Load**
  - 1) Impedance :  $150\Omega$
  - 2) Dissipation : 150W or greater
13. **Power Meter**
  - 1) Impedance :  $50\Omega$
  - 2) Dissipation : 150W continuous or greater
  - 3) Frequency limits : 60MHz or greater

14. **Spectrum Analyzer (SPE-ANA)**
  - 1) Frequency range : 100kHz to 500MHz or greater
  - 2) Bandwidth : 1kHz to 3MHz
15. **Detector**
  - 1) For adjustment of PLL/VCO BPF



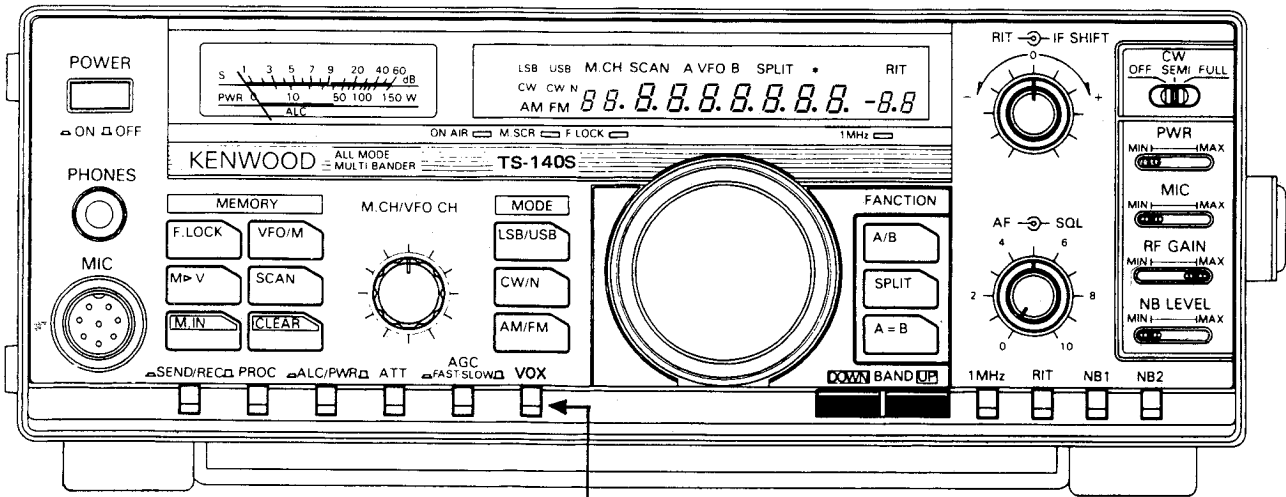
16. **Directional Coupler**
17. **Power**
  - PS-430, PS-50 (S Type)
  - PS-21 (V Type)
18. **Microphone**
  - MC-60S8 or MC-42S

### PREPARATION

Unless otherwise specified, set the controls as follows :

|                      |                           |
|----------------------|---------------------------|
| POWER..... ON        | PROC..... OFF             |
| BAND..... 14         | ALC/PWR..... PWR          |
| AF..... MIN          | ATT..... OFF              |
| SQL..... MIN         | AGC..... SLOW             |
| IF SHIFT..... CENTER | VOX (TS-140S)..... OFF    |
| OW..... OFF          | RF AMP (TS-680S)..... OFF |
| PWR..... MIN         | 1MHz..... OFF             |
| MIC..... MIN         | RIT..... OFF              |
| RF GAIN..... MAX     | NB1..... OFF              |
| NB LEVEL..... MIN    | NB2..... OFF              |
| F. LOCK..... OFF     | VFO A/B..... A            |
| SEND/REC..... REC    | SPLIT..... OFF            |

## ADJUSTMENT



TS-680S : RF AMP

### RESET

| Item     | Condition   | Measurement    |      |          | Adjustment |       |        | Specifications/Remarks          |
|----------|---|----------------|------|----------|------------|-------|--------|---------------------------------|
|          |   | Test-equipment | Unit | Terminal | Unit       | Parts | Method |                                 |
| 1. Reset | 1) Set the power SW ON, while depressing the A=B key. |                |      |          |            |       |        | A VFO<br>14.000.0<br>MODE : USB |

### VOLTAGE CHECK

| Item           | Condition  | Measurement    |        |            | Adjustment |       |        | Specifications/Remarks |
|----------------|--|----------------|--------|------------|------------|-------|--------|------------------------|
|                |  | Test-equipment | Unit   | Terminal   | Unit       | Parts | Method |                        |
| 1. Voltage     | <p>OTOB<br/>OSSB<br/>L79<br/>CWBO ORXB<br/>AMBO<br/>FMBO<br/>CWNO<br/>8V O TXB<br/>CN3</p> <p>L68 L70 L72 L74<br/>CN6 CN7 CN8 CN2</p> <p>IC26<br/>IC25<br/>CN12 CN11</p> | DC V.M         | Signal | ⑧-4        |            |       | 13.8V  | 13.1 ~ 14.3V           |
|                |  |                |        | 8V(Silk)   |            |       | 7.7V   | 7.2 ~ 8.0V             |
|                |  |                |        | TXB(Silk)  |            |       | 7.5V   | 7.0 ~ 8.0V             |
|                |  |                |        | RXB(Silk)  |            |       | 7.5V   | 7.0 ~ 8.0V             |
|                |  |                |        | FMB(Silk)  |            |       |        | 6.5 ~ 8.0V             |
|                |  |                |        | AMB(Silk)  |            |       |        | 6.5 ~ 8.0V             |
|                |  |                |        | CWN(Silk)  |            |       |        | 6.5 ~ 8.0V             |
|                |  |                |        | CWB(Silk)  |            |       |        | 6.5 ~ 8.0V             |
|                |  |                |        | SSB(Silk)  |            |       |        | 6.5 ~ 8.0V             |
|                |  |                |        | 9)         |            | Ctrl  | ⑫-1    |                        |
| 2. RFG voltage | 1) RF GAIN VR : MAX  |                | Signal | RXB (Silk) | Signal     | VR22  | 3.1V   | 3.05 ~ 3.15V           |

## ADJUSTMENT

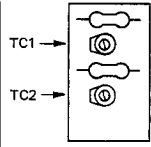
### PLL ADJUSTMENT

| Item                   | Condition   | Measurement    |        |            | Adjustment |                     |   | Specifications/Remarks                         |
|------------------------|---|----------------|--------|------------|------------|---------------------|---|--|
|                        |   | Test-equipment | Unit   | Terminal   | Unit       | Parts               | Method  |  |
| 1. Reference frequency | 1)  | f. counter     | Ctrl   | TP5 (R77)  | Ctrl       | TC1                 | 36.000000MHz                                  | ±10Hz  |
| 2. VCO-4               | 1)  | DC V.M         |        | TP8 (L53)  |            | L54                 | 5.0V  | 4.8 ~ 5.2V                                     |
| 3. VCO-3               | 1) FREQ. : 14.000.00<br>MODE : AM   |                |        | TP1 (L2)   |            | L3                  | 2.4V  | 2.3 ~ 2.5V                                     |
|                        | 2) FREQ. : 14.000.00<br>MODE : USB<br>IF SHIFT VR : Center<br>Control unit VR4 : CW MAX | f. counter     |        | ①-1        |            | VR2                 | 455.700kHz                                    | ±5Hz   |
|                        | 3) IF SHIFT VR : CW MAX   |                |        |            |            |                     | Check   | 457.250kHz or more.                            |
|                        | 4) IF SHIFT VR : CCW MAX  |                |        |            |            |                     |   | 454.125kHz or less.                            |
|                        | 5) IF SHIFT VR : Center<br>Control unit VR4 : Center                                    |                |        |            |            |                     |   |  |
| 4. VCO-2               | 1) FREQ. : 13.999.90<br>MODE : AM   | DC V.M         |        | TP2 (L11)  |            | L12                 | 1.2V  | 1.1 ~ 1.3V                                     |
|                        | 2) FREQ. : 14.000.00<br>MODE : AM   |                |        |            |            |                     | Check   | 3.1 ~ 3.7V                                     |
| 5. VCO-2 BPF           | 1) FREQ. : 14.025.00<br>MODE : AM   | Oscilloscope   |        | TP3 (R51)  |            | L17~<br>L19         | Repeat 2 ~ 3 times.<br>Level MAX.             | 1.4V/p-p or more.<br>(Ref. level : 1.75V/p-p)  |
|                        |   |                |        | TP4 (W2)   |            | L28,<br>L29         |   | 0.3V/p-p or more.<br>(Ref. level : 0.4V/p-p)   |
|                        |   |                |        | TP6 (R100) |            | L30~<br>L32         |   | 120mV/p-p or more.<br>(Ref. level : 150mV/p-p) |
|                        | 2) FREQ. : 10.025.00<br>MODE : AM   |                |        |            |            | L32,<br>L42~<br>L44 | 80mV/p-p or more.<br>(Ref. level : 100mV/p-p) |  |
|                        | 3) FREQ. : 24.525.00<br>MODE : AM   |                |        |            |            | L39~<br>L41         |   |  |
| 6. VCO-1               | 1) FREQ. : 59.999.90<br>MODE : AM<br>TS-680S only.                                      | DC V.M         | Signal | ⑥-2        | Signal     | L74                 | 2.0V  | 1.9 ~ 2.1V                                     |
|                        | 2) FREQ. : 45.000.00<br>MODE : AM<br>TS-680S only.                                      |                |        |            |            |                     | Check   | 5.0 ~ 6.0V                                     |
|                        | 3) FREQ. : 34.999.90<br>MODE : AM   |                |        |            |            | L72                 | 6.0V  | 5.9 ~ 6.1V                                     |
|                        | 4) FREQ. : 21.500.00<br>MODE : AM   |                |        |            |            |                     | Check   | 2.0 ~ 3.0V                                     |
|                        | 5) FREQ. : 21.499.90<br>MODE : AM   |                |        |            |            | L70                 | 2.0V  | 1.9 ~ 2.1V                                     |
|                        | 6) FREQ. : 10.500.00<br>MODE : AM   |                |        |            |            |                     | Check   | 5.0 ~ 6.0V                                     |
|                        | 7) FREQ. : 10.499.90<br>MODE : AM   |                |        |            |            | L68                 | 2.0V  | 1.9 ~ 2.1V                                     |
|                        | 8) FREQ. : 50.00  |                |        |            |            |                     | Check   | 5.5 ~ 6.5V                                     |

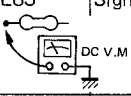
## ADJUSTMENT

### RX ADJUSTMENT

| Item                                   | Condition  | Measurement                                       |      |          | Adjustment |  |  | Specifications/Remarks        |
|--|--|---|------|----------|------------|--|--|-------------------------------|
|  |  | Test-equipment                                    | Unit | Terminal | Unit       | Parts                                      | Method   |                               |
| 1. RX AMP.                             | 1) FREQ. : 14.175.00<br>MODE : USB<br>SSG output : Optional output from 10dBμ to -6dBμ                                 | SSG<br>AF V.M<br>Oscilloscope<br>8Ω<br>dummy load |      | EXT.SP   | Signal     | L52~<br>L55,<br>L57,59<br>L60,64<br>L65,89 | Adjust from L52 to L89.  | MAX. AF output.               |
|  | L52~<br>L55  |   |      |          |            | Repeat 2 ~ 3 times.                        | MAX. AF output.  |                               |
| 2. FM AMP.                             | 1) FREQ. : 28.800.00<br>MODE : FM<br>SSG output : 30dBμ<br>(MOD : 1kHz, DEV : ±3kHz)                                   |   |      |          |            | L86  | MAX. AF output.  | No distortion in AF waveform. |
| 3. 1st MIX balance                     | 1) FREQ. : 100.00<br>MODE : USB<br>SSG output : OFF  |   |      |          |            | VR1  | MIN. AF noise output.  |                               |
| 4. 2nd MIX balance                     | 1) FREQ. : 14.175.00<br>MODE : USB<br>SSG output : OFF   |   |      |          |            | VR2  | MAX. AF noise output.  |                               |
| 5-1. IF trap                           | 1) FREQ. : 29MHz<br>MODE : USB<br>SSG output : 60dBμ~80dBμ<br>SSG FREQ. : 40.055MHz                                    |   |      |          |            | L1,46                                      | 1) MIN. AF output at 60dBμ of SSG output.<br>2) Readjust to MIN. AF output at 80dBμ of SSG output. | 50dB or more.                 |
| 5-2. IF trap<br>TS-140S<br>W type only | 1) FREQ. : 11.800.00<br>MODE : USB<br>SSG output : 0dB   |   |      |          |            | TC2  | MIN. AF output.  |                               |
|  | 2) FREQ. : 15.200.00   |   |      |          |            | TC1  | MIN. AF output.<br>Repeat 2 ~ 3 times.   |                               |
| 6. RF AMP.<br>TS-680S only.            | 1) FREQ. : 28.800.00<br>MODE : USB<br>SSG output : -10dBμ<br>RF AMP SW : ON  |   |      |          |            | L37  | MAX. AF output.  |                               |
|  | 2) FREQ. : 50.500.00   |   |      |          |            | L42  |  |                               |
|  | 3) RF AMP SW : OFF   |   |      |          |            |  |  |                               |
| 7. S-meter                             | 1) FREQ. : 14.175.00<br>MODE : USB<br>AGC SW : FAST  |   |      |          |            |  |  |                               |
|  | • ϕ point<br>SSG output : OFF  |   |      |          |            | VR26                                       | Set to starting point, (Meter zero)  |                               |
|  | • S1<br>SSG output : 6dBμ  |   |      |          |            | VR3  | S-meter "1".   |                               |
|  | • S9<br>SSG output : 32dBμ   |   |      |          |            | VR10                                       | S-meter "9".   |                               |
|  | • S1 check<br>SSG output : 6dBμ  |   |      |          |            |  | Check  | 6dBμ ± 3dBμ                   |
|  | • VHF S-meter (TS-680S only)<br>FREQ. : 50.500.00<br>MODE : USB<br>SSG output : 32dBμ                                  |   |      |          |            | VR11                                       | S-meter "9".   |                               |
|  | • FM meter<br>FREQ. : 28.800.00<br>MODE : FM<br>SSG output : 30dBμ<br>(MOD : OFF)<br>RF AMP SW : OFF<br>(TS-680S only) |   |      |          |            | VR12                                       | S-meter "9 + 20".  |                               |
|  |  |   |      |          |            |  |  |                               |
|  |  |   |      |          |            |  |  |                               |
|  |  |   |      |          |            |  |  |                               |

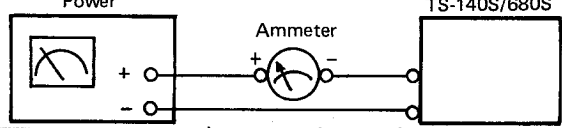


## ADJUSTMENT

| Item   | Condition  | Measurement     |        |  | Adjustment |        |  | Specifications/Remarks                                      |
|--------|--|-----------------|--------|--|------------|--------|--|---|
|        |  | Test-equipment  | Unit   | Terminal   | Unit       | Parts  | Method   |   |
| 8. RIT | 1) Set the Power SW ON, while depressing the CLEAR key.                      |                 |        | Display  |            |        | Check  | Display of 10Hz is displayed.                               |
|        | 2) FREQ. : 14.000.00<br>MODE : USB<br>RIT VR : Center<br>RIT SW : ON         |                 |        |  | Ctrl       | VR1    | Set display to MAIN<br>14.000.00<br>RIT<br>0.0 |   |
|        | 3) RIT VR : CW MAX   |                 |        |  |            |        | Check  | Display<br>MAIN : 14.001.27 or more<br>RIT : 1.2 or more.   |
|        | 4) RIT VR : CCW MAX  |                 |        |  |            |        | Check  | Display<br>MAIN : 13.998.72 or less.<br>RIT : -1.2 or less. |
|        | 5) RIT VR : Center<br>RIT SW : OFF   |                 |        |  |            |        |  |   |
| 9. NB  | 1) FREQ. : 14.200.00<br>MODE : USB<br>SSG output : 30dB $\mu$<br>NB1 SW : ON | SSG<br>DC V.M   | Signal | L83<br> | Signal     | L84,85 | MIN. voltage.                                  |   |
|        | 2) Connect the noise generator to the ANT terminal.                          | Noise generator |        | S-meter  |            |        | Check  | The same effect as NB1 is obtained.                         |
|        | 3) NB1 SW : OFF<br>NB2 SW : ON   |                 |        |  |            |        |  |   |
|        | 4) Disconnect the noise generator from the ANT terminal.<br>NB2 SW : OFF     |                 |        |  |            |        |  |   |


### TX ADJUSTMENT

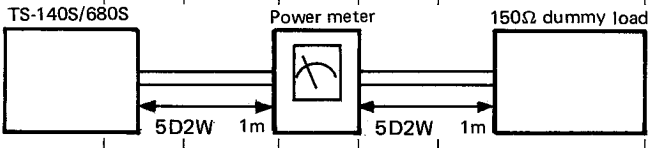
| Item               | Condition   | Measurement       |        |          | Adjustment |  |  | Specifications/Remarks                            |
|--------------------|---|-------------------|--------|----------|------------|--|--|---|
|                    |   | Test-equipment    | Unit   | Terminal | Unit       | Parts  | Method   |   |
| 1. TX AMP          | 1) FREQ. : 50.200.00 (TS-680S)<br>FREQ. : 21.200.00 (TS-140S)<br>MODE : CW<br>Signal unit VR19 : Center<br>CW SW : FULL<br>SEND/REC SW : SEND | Spectrum analyzer | Signal | DRV      | Signal     | L89,95<br>L113<br>VR20   | Adjust CAR VR to level no to be saturated, and MAX. output.                                  | MAX. output.<br>(Ref. level : 13dBm or more)      |
|                    | 2) SEND/REC SW : REC  |                   |        |          |            |  |  |   |
| 2. 455kHz spurious | 1) FREQ. : 50.200.00 (TS-680S)<br>FREQ. : 21.200.00 (TS-140S)<br>SEND/REC SW : SEND   |                   |        |          |            | L53  | MIN. Spurious level of 455kHz.   |   |
|                    | 2) After adjustment, reconnected DRV.<br>SEND/REC SW : REC  |                   |        |          |            |  |  |   |
| 3. Base current    | 1) FREQ. : 14.200.00<br>MODE : USB<br>MIC VR : MIN<br>PWR VR : MIN<br>Final unit VR1, 2 : CCW MAX<br>SEND/REC SW : SEND                       | Ammeter           |        | DC cord  | Final      | VR1  | 1) Record current before adjusting VR1 and VR2.<br>2) Adjust VR1 for an increase for +250mA. | 250mA $\pm$ 50mA.<br>(Total current : 1.7 ~ 1.8A) |
|                    | VR2   |                   |        |          |            | Adjust VR2 so that the current is increase of above item 2) 250mA. | 500mA $\pm$ 50mA.<br>(Total current : 1.95 ~ 2.05A)  |   |
|                    | 2) SEND/REC SW : REC  |                   |        |          |            |  |  |   |



Power Ammeter TS-140S/680S

## ADJUSTMENT

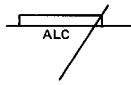
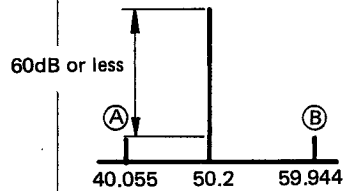
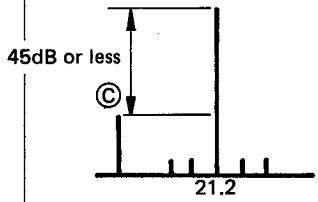
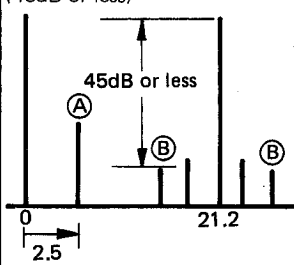
| Item          | Condition  | Measurement                    |        |                   | Adjustment |             |  | Specifications/Remarks |
|---------------|--|--------------------------------|--------|-------------------|------------|-------------|--|------------------------|
|               |  | Test-equipment                 | Unit   | Terminal          | Unit       | Parts       | Method   |                        |
| 4. Power      | <ul style="list-style-type: none"> <li>• CW</li> <li>1) FREQ. : 14.200.00<br/>MODE : CW<br/>PWR VR : MAX  S2 LO<br/>Signal unit S2 : HI<br/>SEND/REC SW : SEND</li> <li>2) SEND/REC SW : REC</li> </ul> | Power meter                    | Rear   | ANT               | Signal     | VR17        | 95W  | ±5W                    |
|               | <ul style="list-style-type: none"> <li>• FM</li> <li>3) FREQ. : 29.700.00<br/>MODE : FM<br/>Filter unit VR1 : Center<br/>PWR VR : MAX<br/>Signal unit S2 : HI<br/>SEND/REC SW : SEND</li> <li>4) SEND/REC SW : REC</li> </ul>  |                                |        |                   |            | VR14        | 50W  |                        |
|               | <ul style="list-style-type: none"> <li>• SSB</li> <li>5) FREQ. : 14.200.00<br/>MODE : USB<br/>PWR VR : MAX<br/>MIC VR : Center<br/>Display unit VR5 : CCW MAX<br/>MIC input : 1kHz, 5mV<br/>SEND/REC SW : SEND</li> <li>6) SEND/REC SW : REC</li> </ul>                                  |                                |        |                   |            | VR13        | 100W   | ±5W                    |
|               | <ul style="list-style-type: none"> <li>• 50MHz (TS-680S only)</li> <li>7) FREQ. : 51.200.00<br/>MODE : CW<br/>PWR VR : Center<br/>Signal unit VR15 : CW MAX<br/>SEND/REC SW : SEND</li> <li>8) PWR VR : MAX</li> <li>9) SEND/REC SW : REC</li> </ul>                                     |                                |        |                   |            | Filter TC1  | Adjust PWR VR to set output about 10W. MAX. output at TC1. |                        |
|               | <ul style="list-style-type: none"> <li>• MIN. POWER</li> <li>10) FREQ. : 51.200.00 (TS-680S)<br/>FREQ. : 29.700.00 (TS-140S)<br/>MODE : FM<br/>PWR VR : MIN<br/>SEND/REC SW : SEND</li> <li>11) SEND/REC SW : REC<br/>PWR VR : MAX</li> </ul>  |                                |        |                   |            | Signal VR15 | 11W  | ±0.5W                  |
|               |  |                                |        |                   |            | VR18        | 1W (TS-680S)<br>5W (TS-140S)                               |                        |
|               |  |                                |        |                   |            |             |  |                        |
|               |  |                                |        |                   |            |             |  |                        |
|               |  |                                |        |                   |            |             |  |                        |
|               |  |                                |        |                   |            |             |  |                        |
|               |  |                                |        |                   |            |             |  |                        |
| 5. NULL       | <ul style="list-style-type: none"> <li>1) FREQ. : 3.700.00<br/>MODE : CW<br/>SEND/REC SW : SEND</li> <li>2) SEND/REC SW : REC</li> </ul>   | Power meter<br>DC V.M          | Signal | VSR<br>( (13) -2) | Filter     | TC2         | MIN  |                        |
| 6. Protection | <ul style="list-style-type: none"> <li>1) FREQ. : 14.200.00<br/>MODE : CW<br/>SEND/REC SW : SEND</li> <li>2) SEND/REC SW : REC</li> </ul>  | Power meter<br>150Ω dummy load | Rear   | ANT               | Signal     | VR16        | 30W  |                        |



TS-140S/680S      Power meter      150Ω dummy load

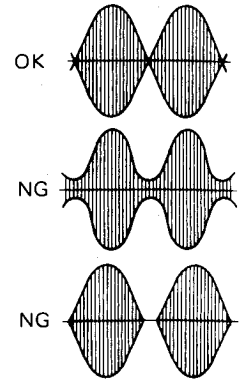
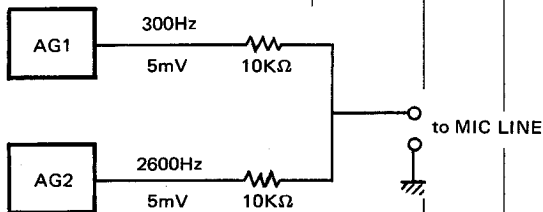
5D2W 1m      5D2W 1m

## ADJUSTMENT

| Item                                     | Condition  | Measurement                      |      |           | Adjustment |             |   | Specifications/Remarks  |
|--|--|----------------------------------|------|-----------|------------|-------------|---|---|
|  |  | Test-equipment                   | Unit | Terminal  | Unit       | Parts       | Method  |   |
| 7. Power meter                           | 1) FREQ. : 14.200.00<br>MODE : CW<br>ALC/PWR SW : PWR<br>SEND/REC SW : SEND<br>2) SEND/REC SW : REC                | Power meter                      | Rear | ANT       | Signal     | VR25        | Adjust to 90W by CAR VR.  | RF meter : 90W  |
| 8. ALC meter                             | 1) FREQ. : 14.200.00<br>MODE : USB<br>PWR VR : MAX<br>MIC VR : MAX<br>ALC/PWR SW : ALC<br>Filter unit VR5 : Center | Power meter<br>AG<br>AF V.M      |      | ALC meter | Signal     |             |   |   |
|  | • $\phi$ point<br>2) SEND/REC SW : SEND  |                                  |      |           |            | VR8         | Adjust to the "0" of ALC meter reading.                                       |   |
|  | 3) SEND/REC SW : REC   |                                  |      |           |            |             |   |   |
|  | • Start point<br>4) MIC input : 1kHz, 1.5mV<br>SEND/REC SW : SEND  |                                  |      |           |            |             | Adjust to the "0" of ALC meter reading by MIC VR.                             |   |
|  | 5) SEND/REC SW : REC   |                                  |      |           |            |             |   |   |
|  | • MAX<br>6) MIC input : 1kHz, 3mV<br>SEND/REC SW : SEND  |                                  |      |           |            | VR9         | Adjust ALC meter MAX. within ALC zone.  |                      |
| 7) ALC/PWR SW : PWR<br>SEND/REC SW : REC |  |                                  |      |           |            |             |   |   |
| 9-1. Spurious<br>TS-680S only.           | • 50MHz<br>1) FREQ. : 50.200.00<br>MODE : CW<br>PWR VR : MAX<br>SEND/REC SW : SEND                                 | Power meter<br>Spectrum analyzer | Rear | ANT       | Signal     | VR19        | Adjust as shown at right.<br>(MIN. spurious of A and B.)                      | (60dB or less)<br> |
|  | 2) SEND/REC SW : REC   |                                  |      |           |            |             |   |   |
|  | • 21MHz<br>3) FREQ. : 21.200.00<br>SEND/REC SW : SEND  |                                  |      |           |            | L97         | Adjust as shown at right.<br>(MIN. spurious of C.)                            | (45dB or less)<br> |
| 2) SEND/REC SW : REC                     |  |                                  |      |           |            |             |   |   |
| 9-2. Spurious<br>TS-140S only.           | 1) FREQ. : 21.200.00<br>MODE : CW<br>PWR VR : MAX<br>SEND/REC SW : SEND  |                                  |      |           |            | VR19<br>L97 | 1) Adjust L97 to MIN. spurious of A.<br>2) Adjust VR19 to MIN. spurious of B. | (45dB or less)<br> |
|  | 2) SEND/REC SW : REC   |                                  |      |           |            |             |   |   |

## ADJUSTMENT

| Item                        | Condition   | Measurement  |      |          | Adjustment |                        |   | Specifications/Remarks |
|-----------------------------|---|--|------|----------|------------|------------------------|---|------------------------|
|                             |   | Test-equipment   | Unit | Terminal | Unit       | Parts                  | Method  |                        |
| 10. CAR suppression         | 1) FREQ. : 14.200.00<br>MODE : USB or LSB<br>MIC VR : MIN<br>SEND/REC SW : SEND   | Power meter<br>Oscilloscope or Spectrum analyzer       | Rear | ANT      | Signal     | VR4<br>VR5             | MIN.<br>Adjust for no difference between USB and LSB. | -40dB or less.         |
|                             | 2) SEND/REC SW : REC  |  |      |          |            |                        |   |                        |
| 11. TX frequency response   | 1) FREQ. : 14.200.00<br>MODE : USB or LSB<br>AG output : 2 tone, 5mV<br>300Hz, 2600Hz<br>SEND/REC SW : SEND<br>MIC VR : ALC meter "0" | Power meter<br>Oscilloscope or Spectrum analyzer<br>AG |      |          | Ctrl       | VR3 (LSB)<br>VR4 (USB) | Adjust as shown at right.                             |                        |
|                             | 2) SEND/REC SW : REC  |  |      |          |            |                        |   |                        |
| 12. Processor               | 1) FREQ. : 14.200.00<br>MODE : USB<br>PROC SW : ON<br>ALC/PWR SW : ALC<br>AG output : 1kHz, 10mV<br>SEND/REC SW : SEND                | Power meter<br>AG<br>AF V.M                            |      |          |            |                        | Adjust for ALC zone MAX. with MIC GAIN VR.            |                        |
|                             | 2) AG output : 20dB down  |  |      |          |            | Check                  | The meter deflection is within the ALC zone.          |                        |
|                             | 3) SEND/REC SW : REC  |  |      |          |            |                        |   |                        |
| 13. FM DEV                  | 1) FREQ. : 28.700.00<br>MODE : FM<br>MIC input : 1kHz, 30mV<br>SEND/REC SW : SEND   | Power meter<br>AG<br>AF V.M<br>Linear detector         |      |          | Signal     | VR24                   | 4.6kHz  | ±0.1kHz                |
|                             | 2) MIC input : 1kHz, 3mV  |  |      |          |            | VR6                    | 3kHz  | ±0.1kHz                |
|                             | 3) SEND/REC SW : REC  |  |      |          |            |                        |   |                        |
| 14. Side tone monitor level | 1) FREQ. : 14.200.00<br>MODE : CW<br>AF VR : Center<br>Signal unit VR7 : CW MAX<br>CW SW : SEMI<br>Connect the KEY to the KEY jack.   | Power meter<br>AF V.M<br>Oscilloscope<br>8Ω dummy load |      | EXT. SP  |            | VR21                   | 0.25V/8Ω  | ±0.05V                 |
|                             | 2) Disconnect the KEY from the KEY jack.<br>CW SW : OFF   |  |      |          |            |                        |   |                        |
| 15. Beep sound              | 1) Depress the LSB/USB key continuously.  |  |      |          |            | VR23                   | Check   | 200 ~ 400mV.           |

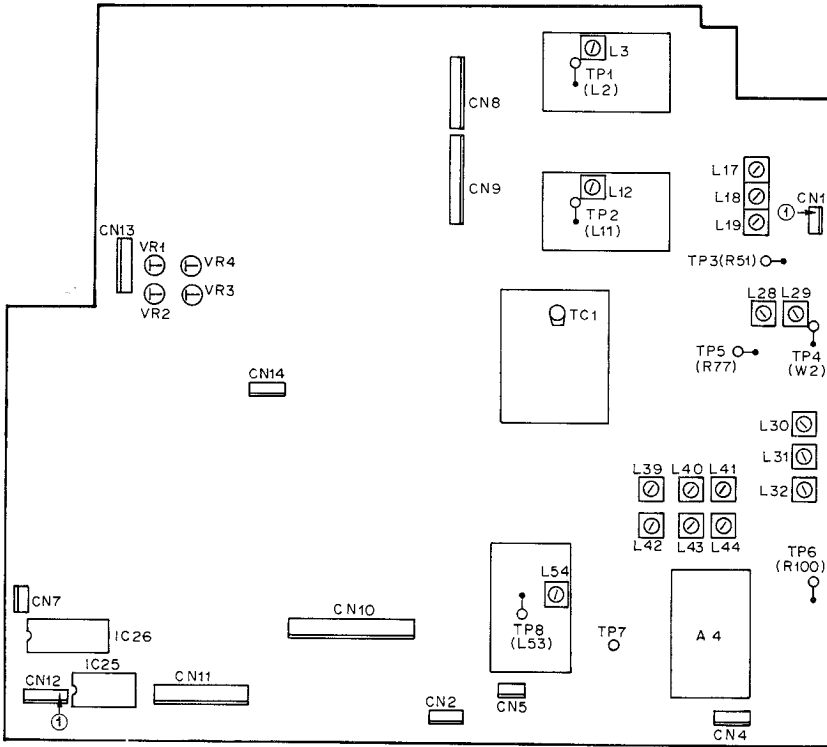




## ADJUSTMENT

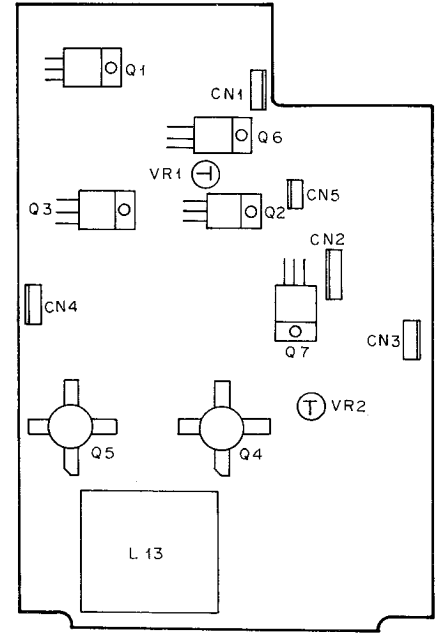
### ADJUSTMENT POINT (Bottom view)

#### ● CONTROL UNIT

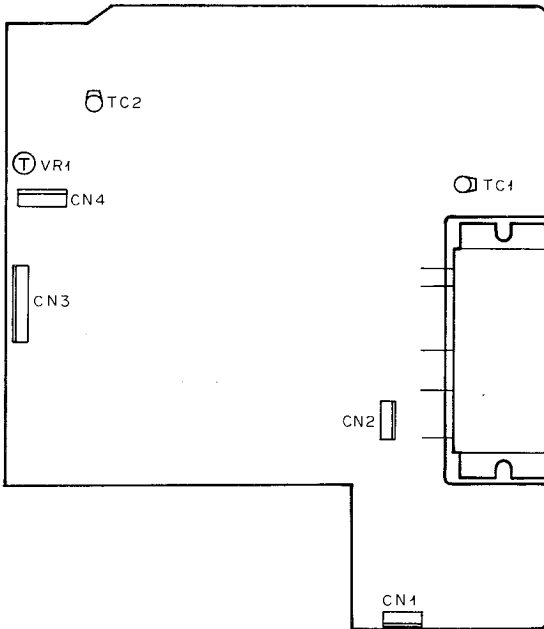


### (Top view)

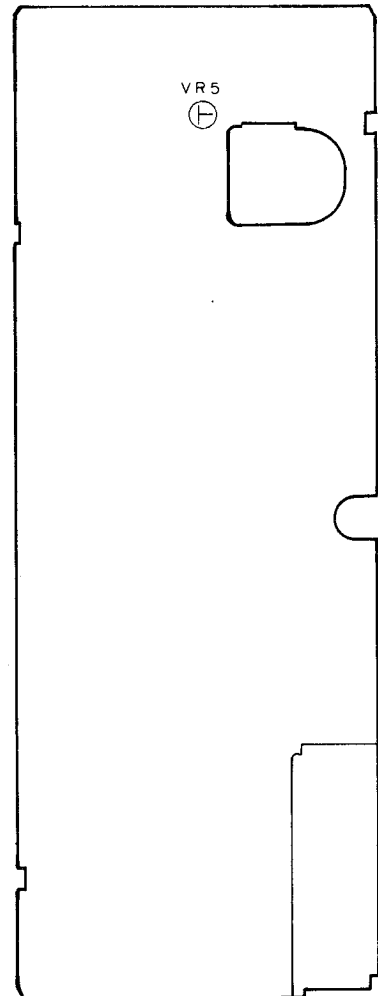
#### ● FINAL UNIT



#### ● FILTER UNIT

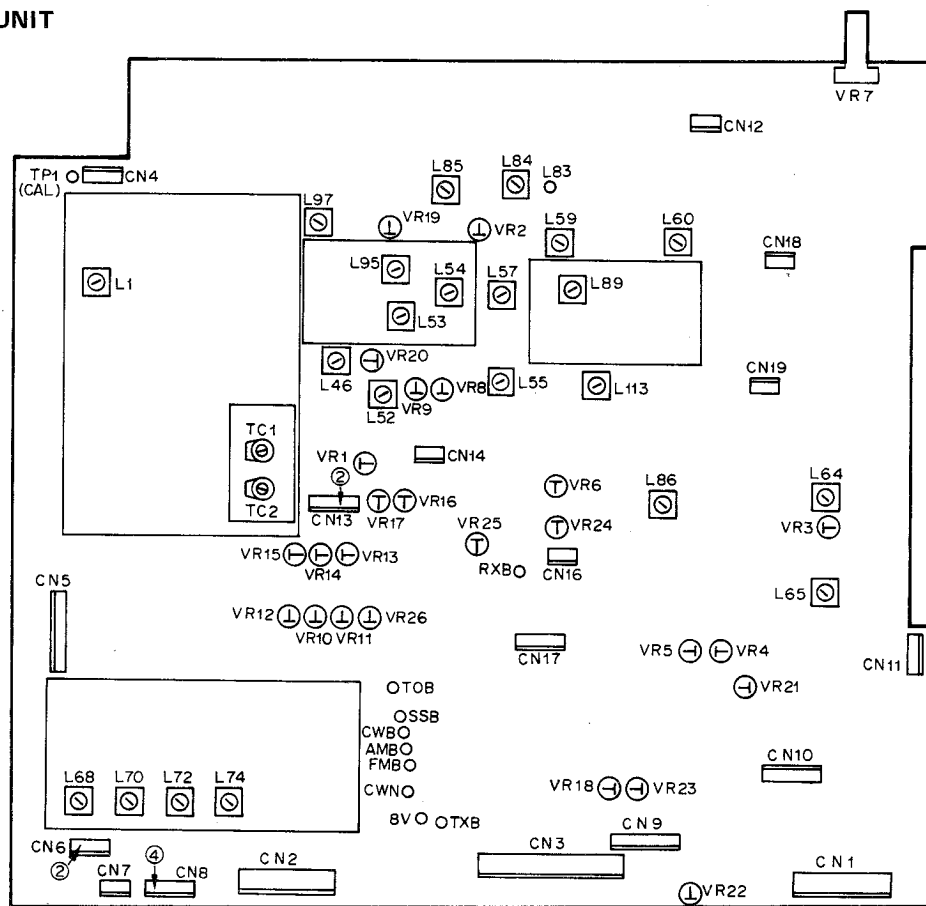


#### ● DISPLAY UNIT

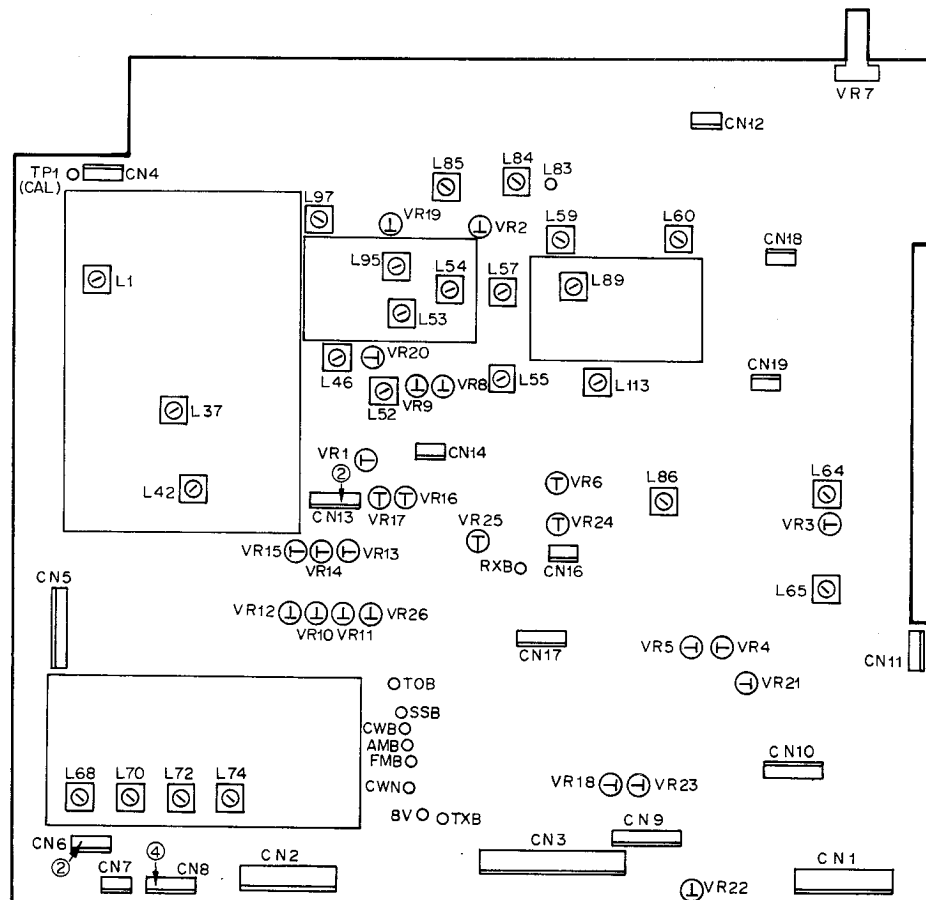


## ADJUSTMENT

### ● SIGNAL UNIT (TS-140S)

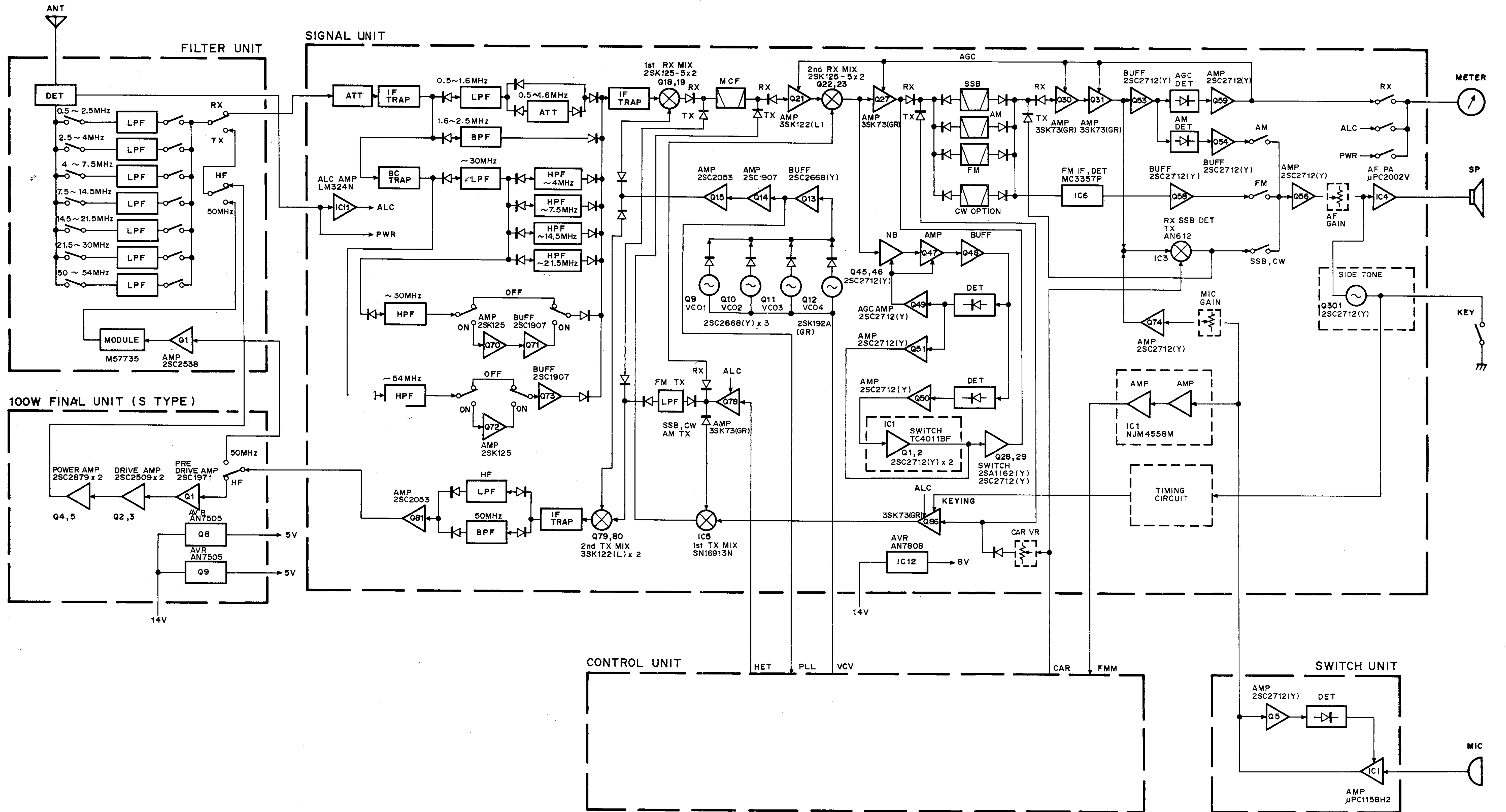


### (TS-680S)



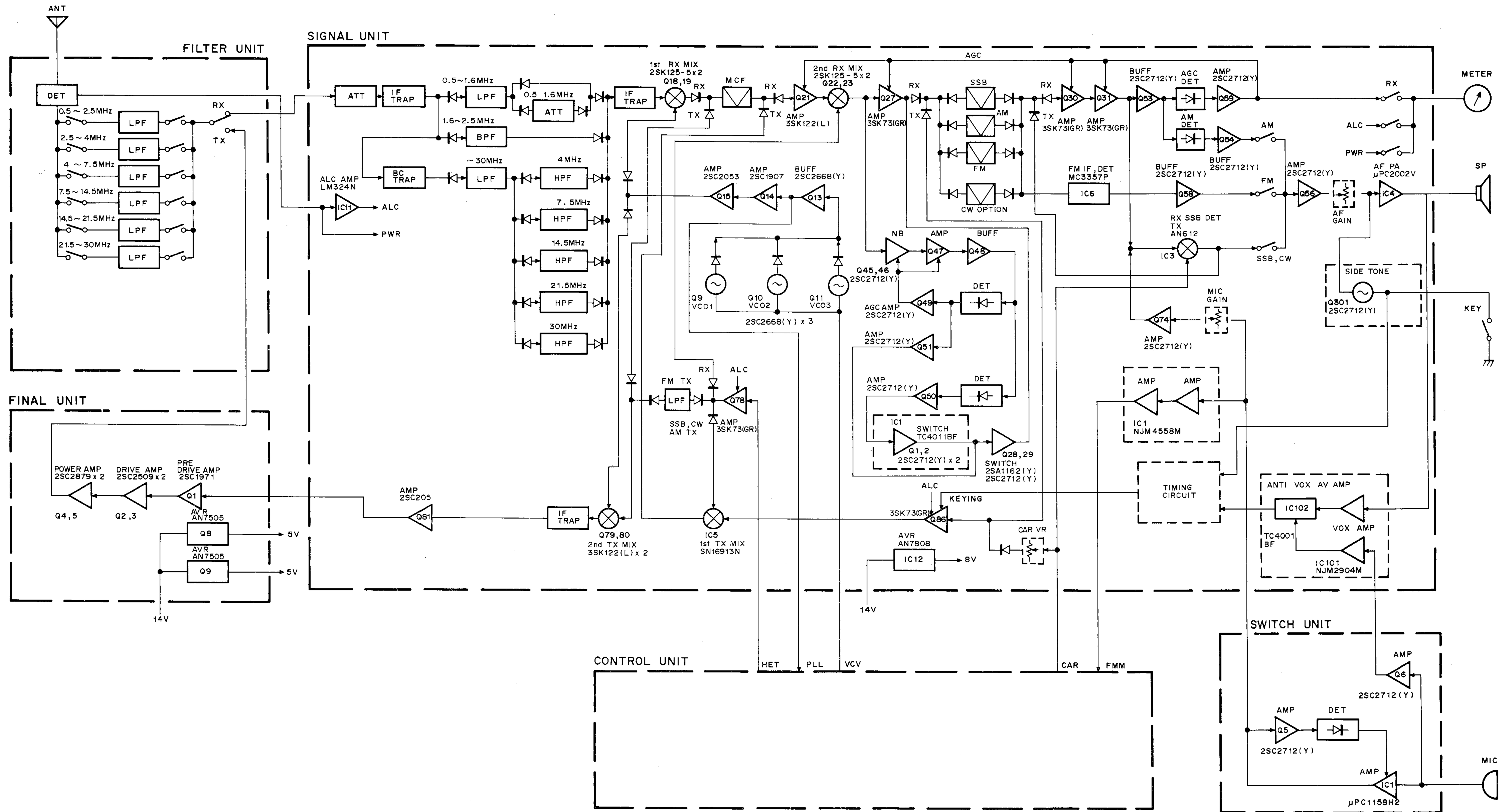
# TS-140S/680S

## BLOCK DIAGRAM (TS-680S)



# TS-140S/680S

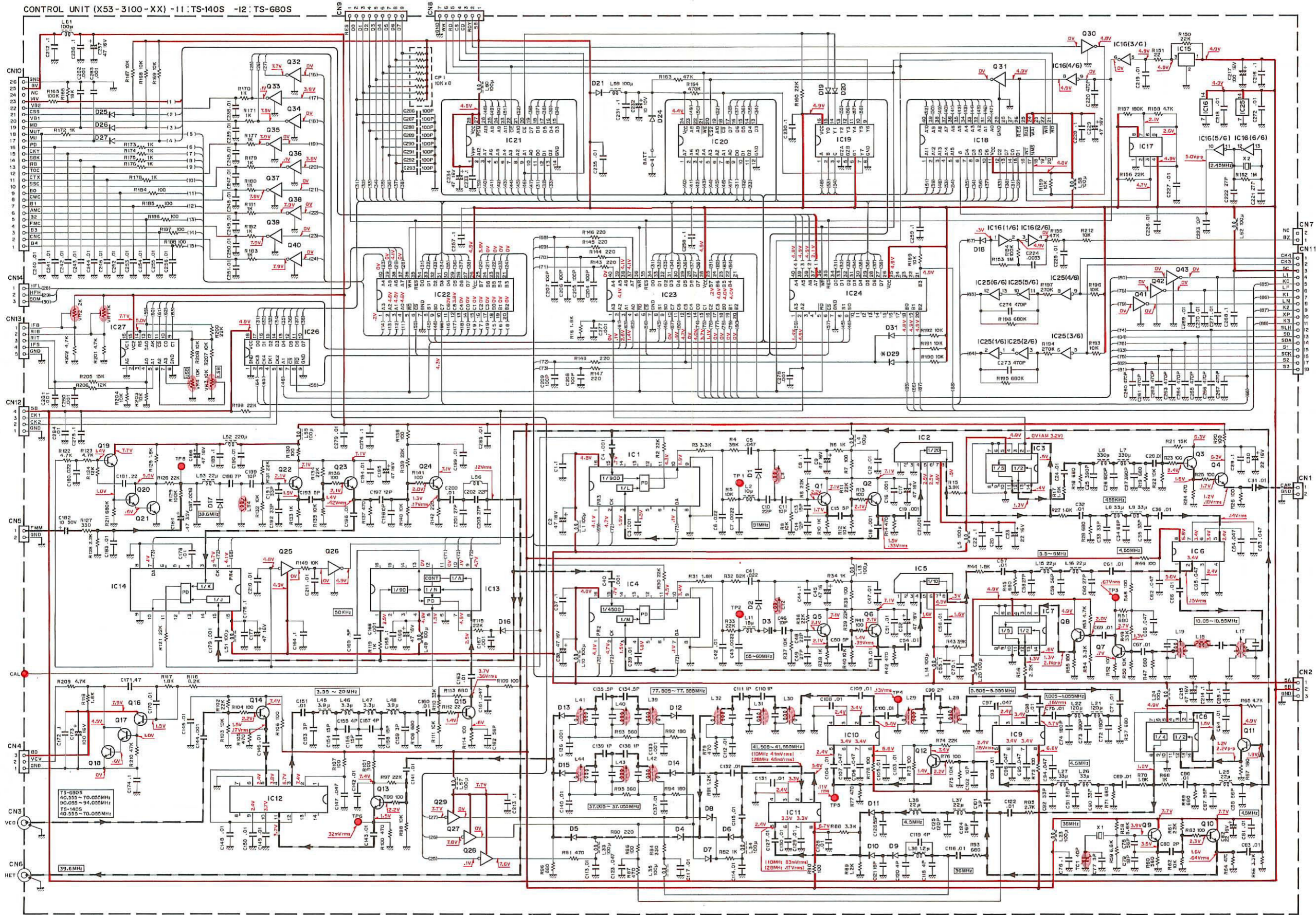
## BLOCK DIAGRAM (TS-140S)



# TS-140S/680S CIRCUIT DIAGRAM

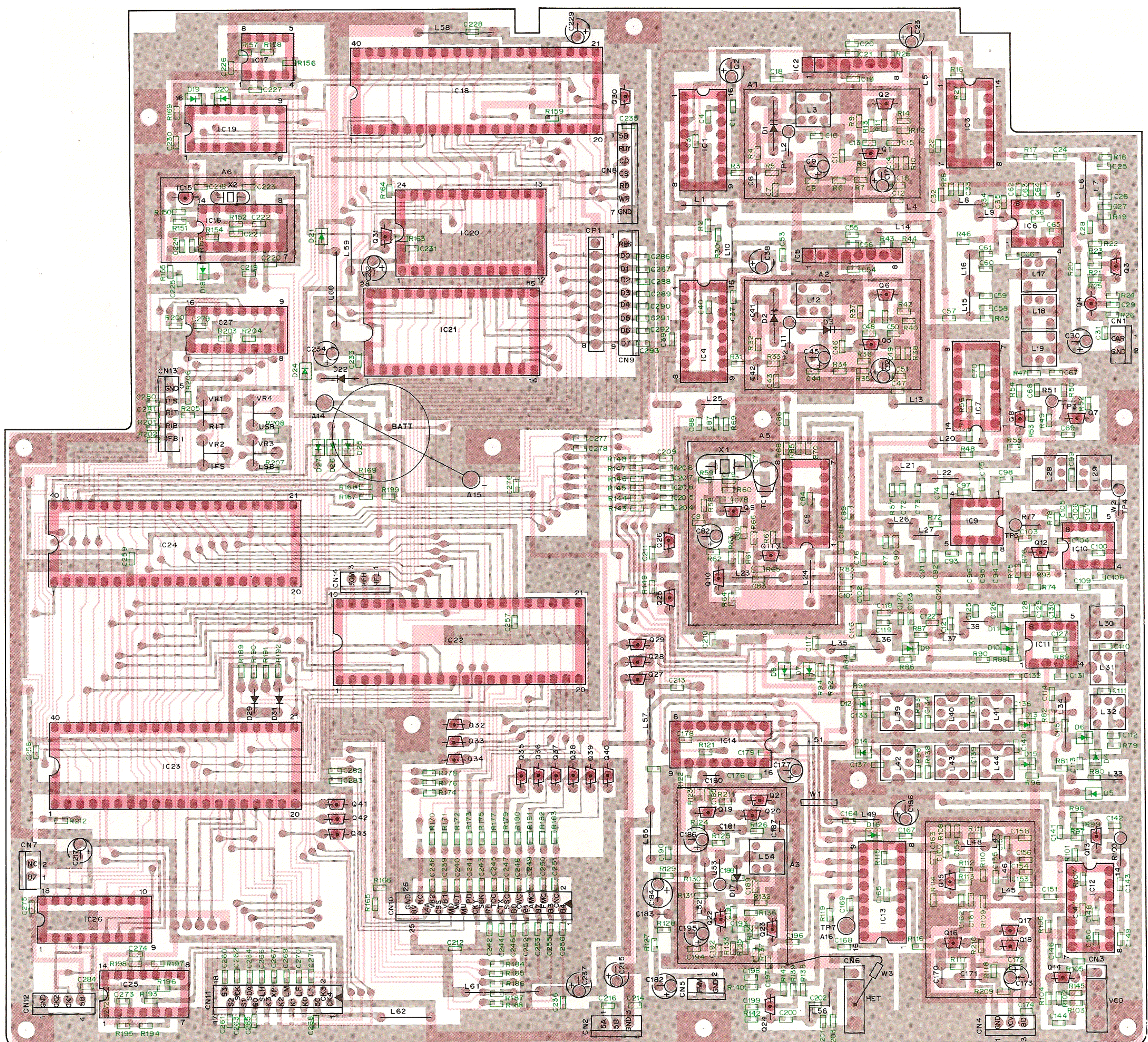
Voltage measurement condition f = 14MHz, Mode : USB. ( ) : TX.

## CONTROL UNIT (X53-3100-XX)

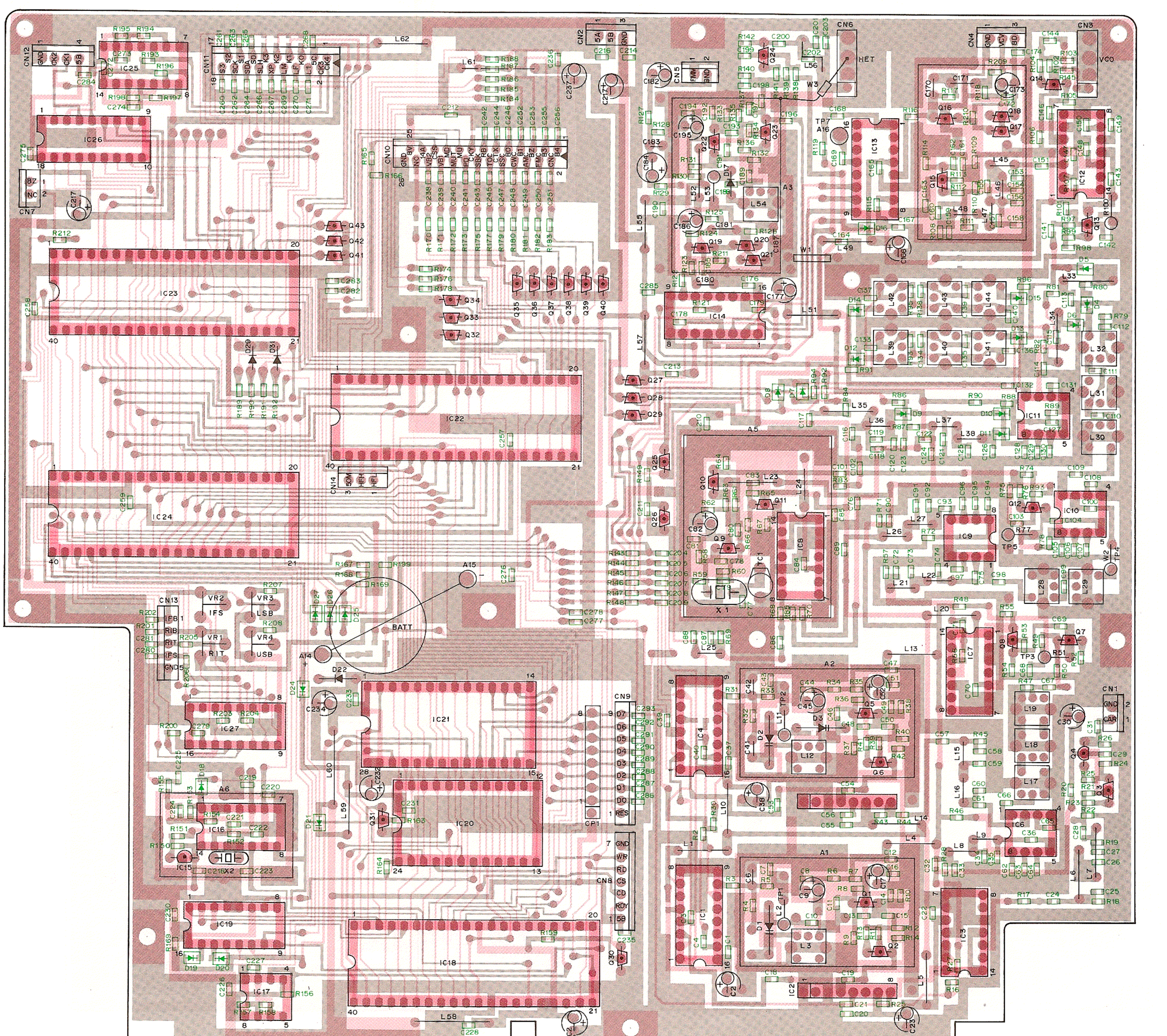


- D1 : 1S53A
- D2,3 : ITT310TE
- D4,7,6 : RLS135
- 9,7,15
- D7,9,16 : RLS73
- 19,1,21
- 24,1,27
- D17 : 1S5153
- D29,31 : 1S5133
- (D29: TS-140S ONLY)
- IC1,4,14 : M54927P
- IC2 : M54459L
- IC3,7 : SN74LS90N
- IC5 : M54460L
- IC6,9,10,11 : SN16913P
- IC8 : M74LS93P
- IC12 : SN76514N
- IC13 : MB87006A
- IC15 : PST520D
- IC16,25 : TC4069UBP
- IC17 : NE555C
- IC18 : BU18400A
- IC19 : SN74LS138N
- IC20 : TC5518CPL-20
- IC21 : MBM27C128-25JAJ2
- IC22,24 : TMP8255AP-5
- IC26 : LZ92K37
- IC27 : MB4052
- Q1,2,5,6 : 2SC2668(Y)
- 10,1,15
- 22,1,24
- Q3,7,8 : 2SC2458(Y)
- Q4 : 2SC1959(Y)
- Q9 : 2SC2787(L)
- Q16,21 : 2SC2459(BL)
- Q25 : DTA124ES
- Q26 : DTC124ES
- Q27,29 : DTA143ES
- Q30,1,40 : DTC144WS
- Q41,43 : DTC143TS

CONTROL UNIT (X53-3100-XX) -11: TS-140S -12: TS-680S Component side view



CONTROL UNIT (X53-3100-XX) -11: TS-140S -12: TS-680S Foil side view

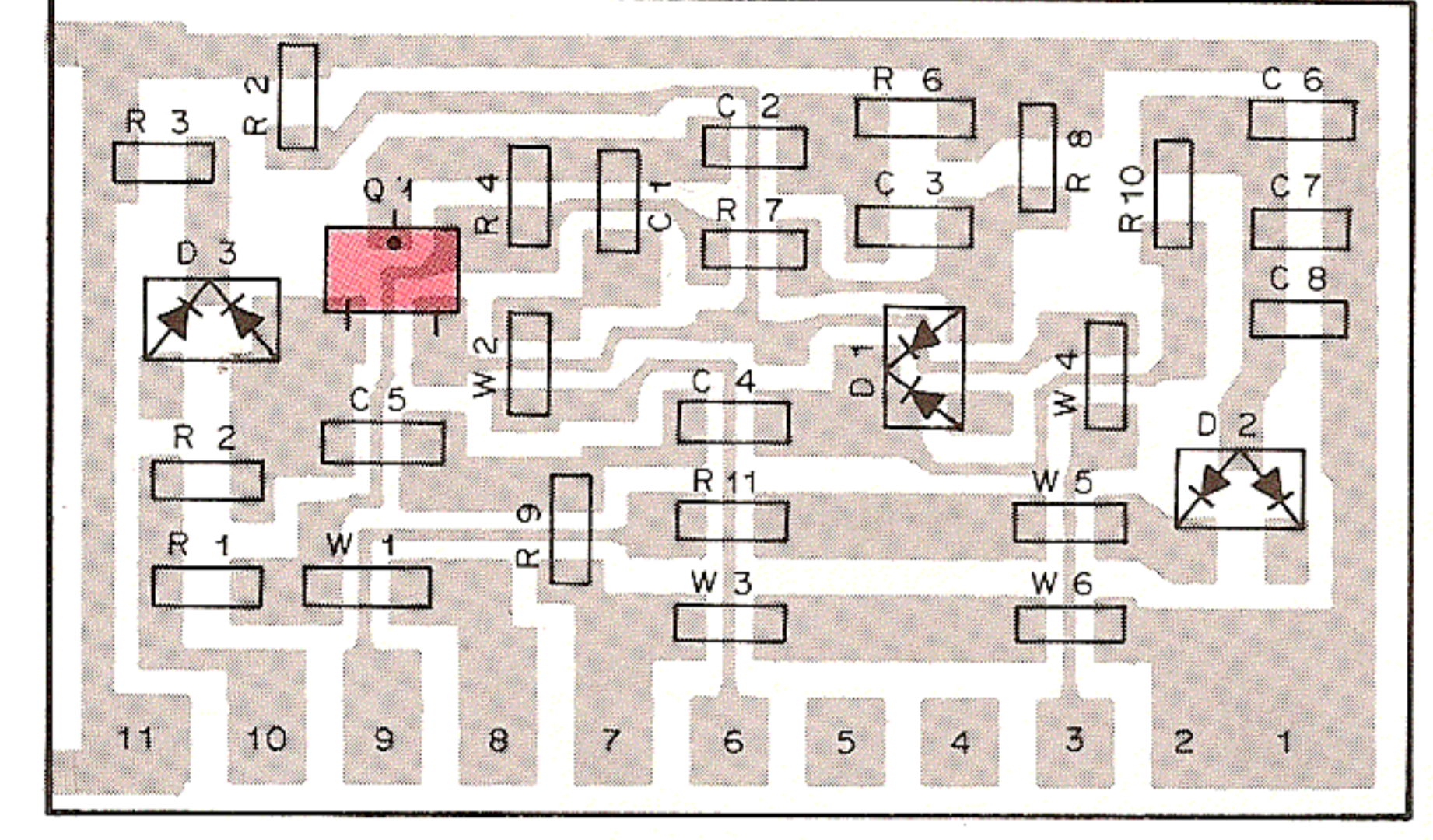


# PC BOARD VIEWS TS-140S/680S

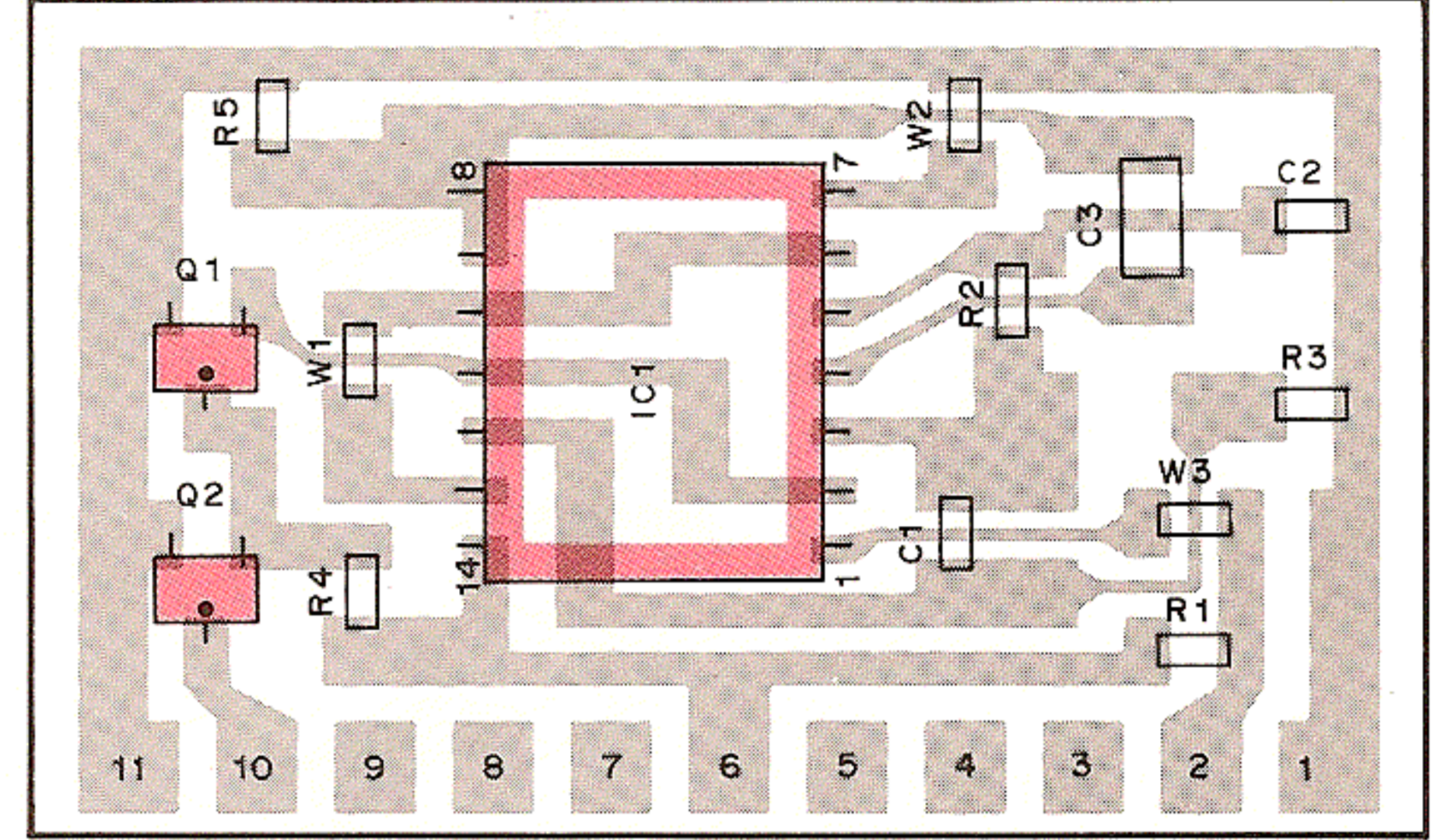
- |                       |  |                      |
|-----------------------|--|----------------------|
| 2SC1959(Y)<br>2SC1971 | MB87006<br>MB4052  | 2SC2787(L)           |
|                       |  |                      |
| 2SC2509               | PST520D  | DTC124ES             |
|                       |  |                      |
| 2SD1406(Y)            | TC4069UBP  | M74LS93P<br>SN76514N |
|                       |  |                      |
| AN7805                | SN74LS138N   | BU18400A             |
|                       |  |                      |
| M54927P               | TC5518CPL-20   | MBM27C128-25JAJ2     |
|                       |  |                      |
| M54459L<br>M54460L    | TMP8255AP-5  |                      |
|                       |  |                      |
| SN74LS90N             | LZ92K37  |                      |
|                       |  |                      |
| SN16913P<br>NE555C    | 2SC2458(Y) DTA143ES<br>2SC2459(BL) DTC144WS<br>2SC2668(Y) DTC143TS<br>DTA124ES |                      |
|                       |  |                      |

# TS-140S/680S PC BOARD VIEWS (TS-680S)

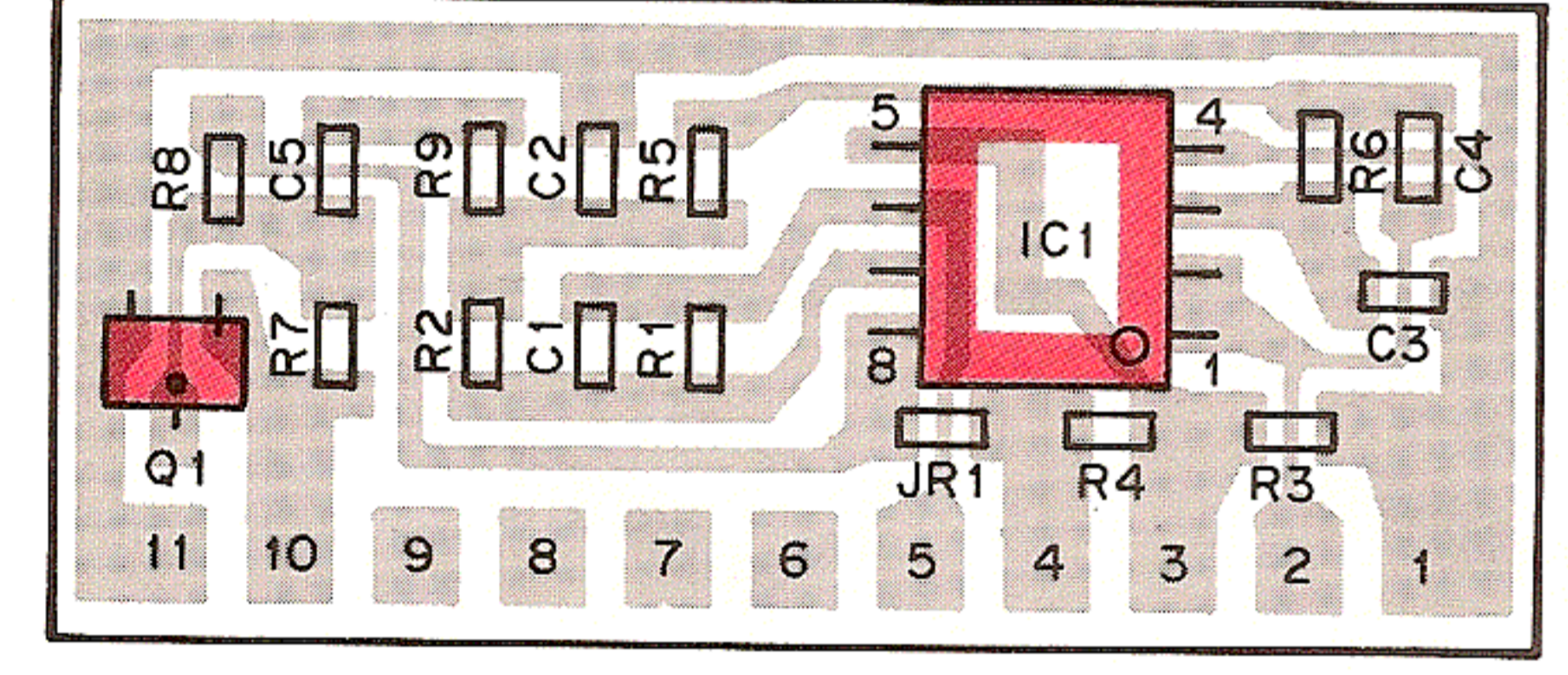
**SIDE TONE (X59-1060-00)**  
Component side view



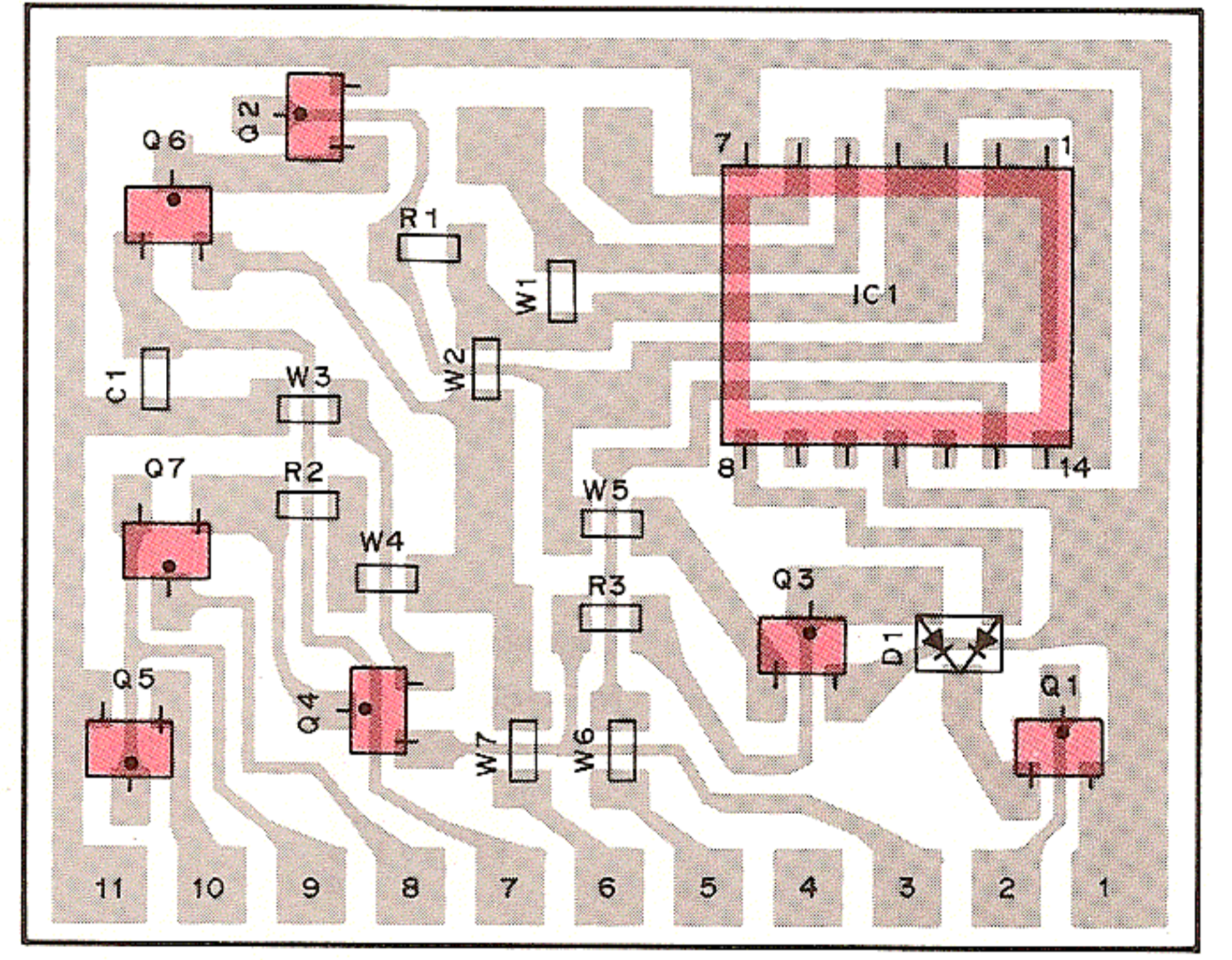
**NB2 (X59-3350-00)**  
Component side view



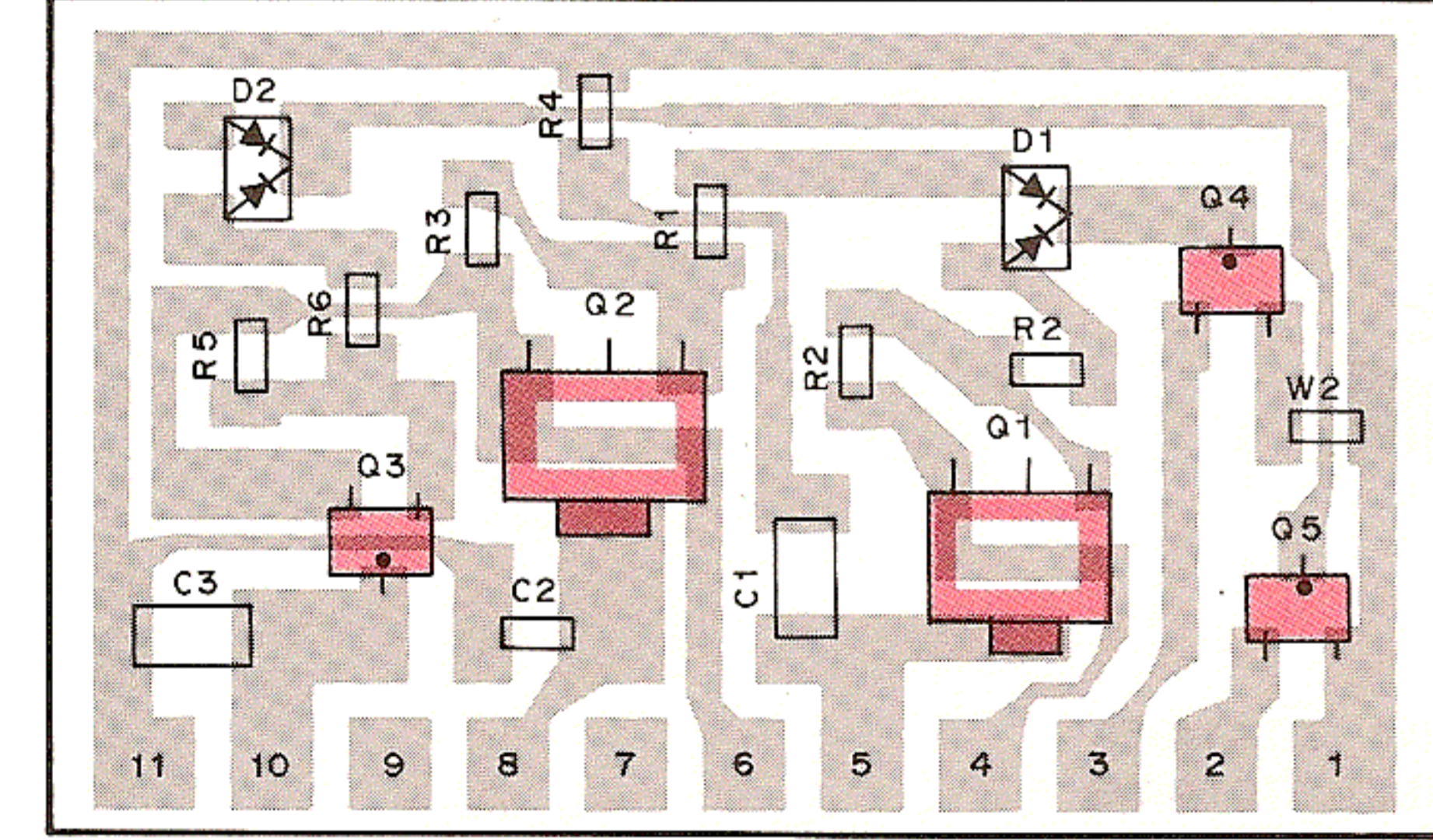
**FM MIC AMP. (X59-3000-02)**  
Component side view



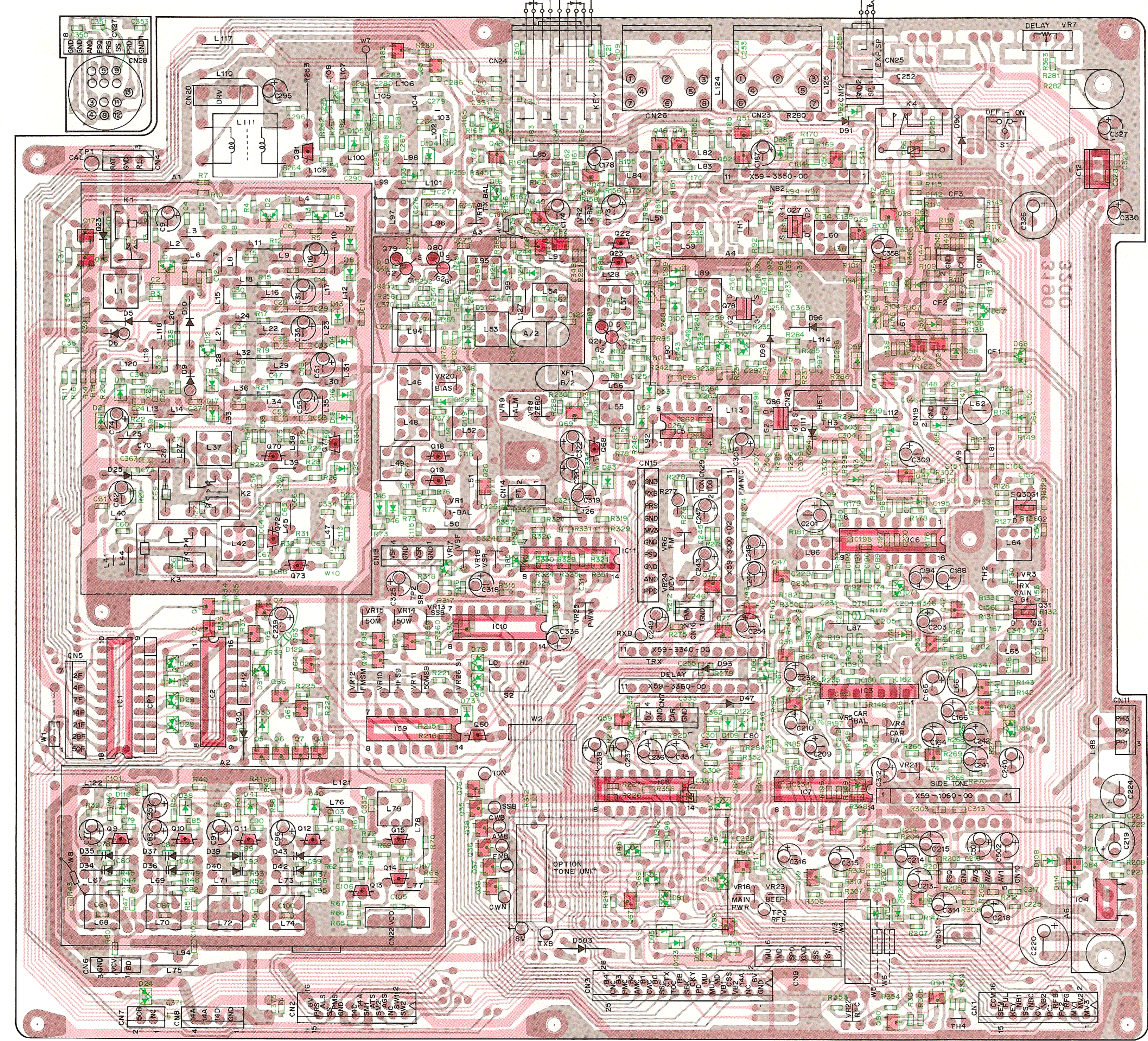
**DELAY TIME (X59-3360-00)**  
Component side view



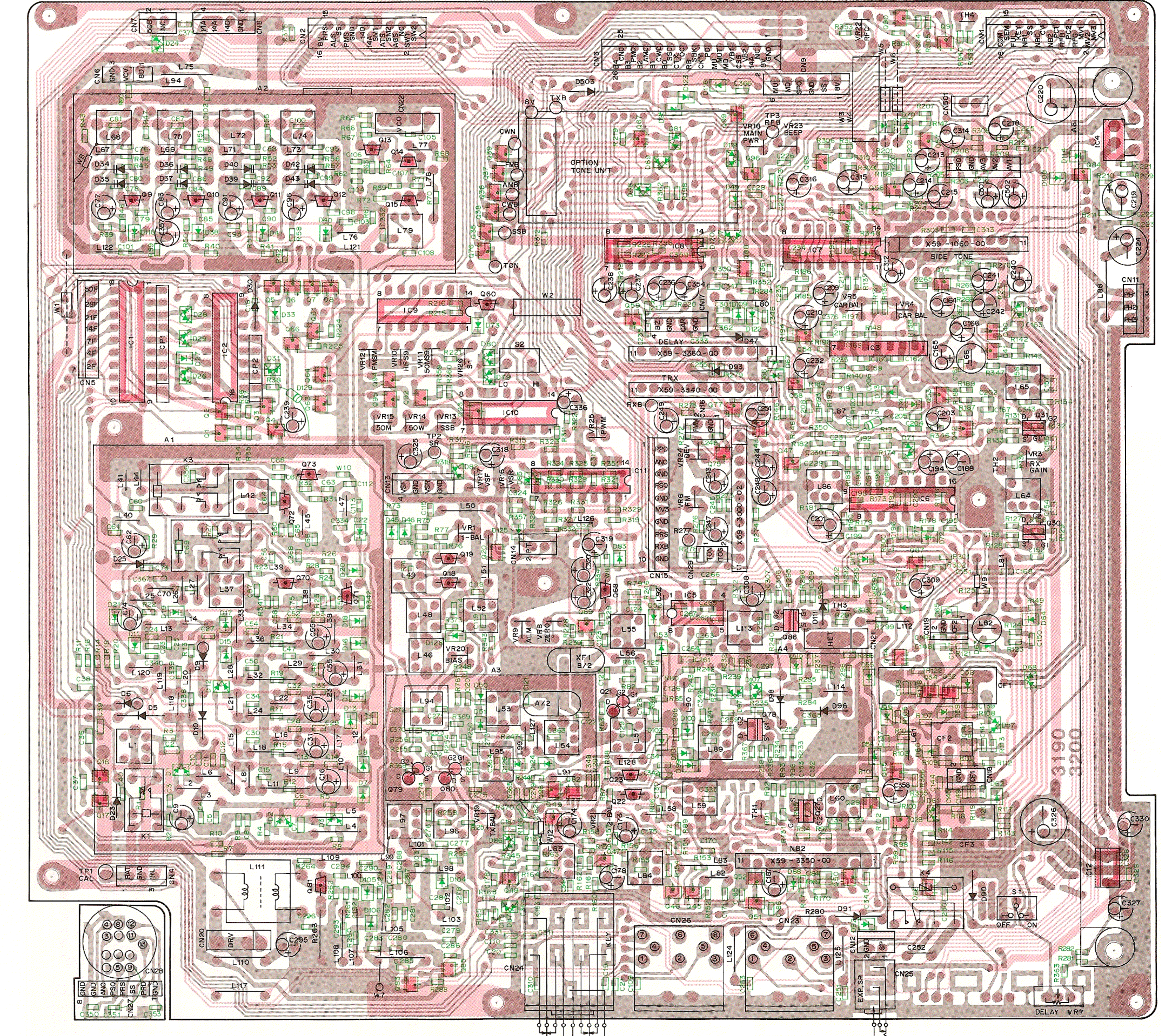
**TRX (X59-3340-00)**  
Component side view

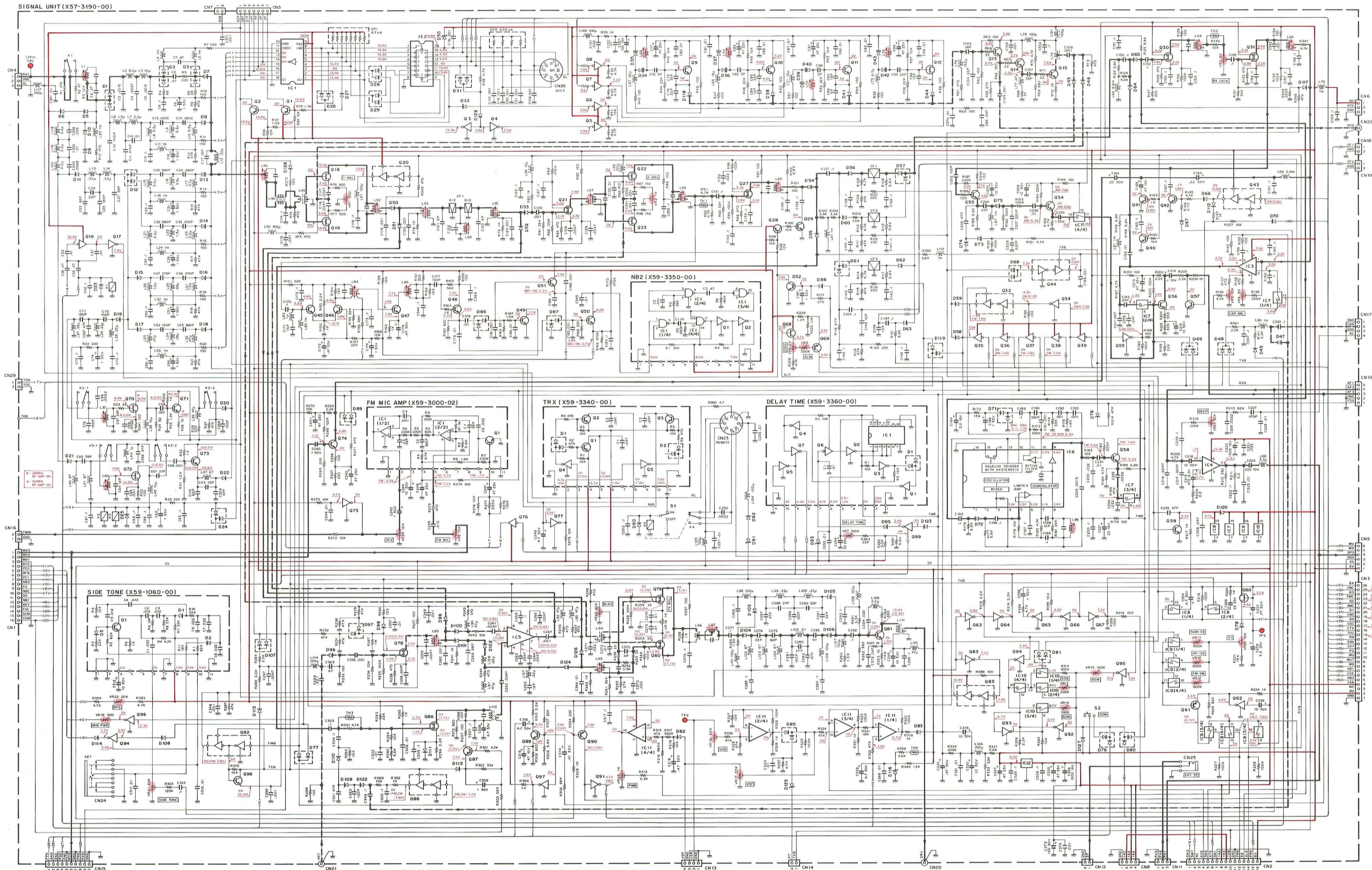


**SIGNAL UNIT (X57-3190-00) Component side view**

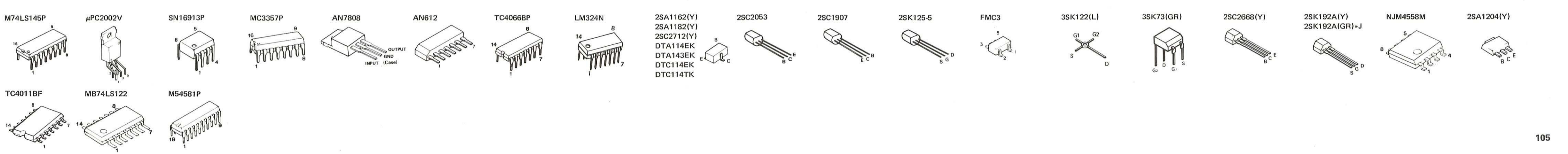


**SIGNAL UNIT (X57-3190-00) Foil side view**





- (X57-3190-00)
  - Q1, 2, 26, 61, 69, 87, 90 : 2SA1162(Y)
  - Q3, 4, 17, 34, 55, 63, 65-67, 75, 77, 83, 84, 91, 92, 96, 97, 99
  - Q5-8, 35-39, 76 : DTC114EK
  - Q9-11, 13 : 2SC2668(Y)
  - Q12 : 2SK192A(GR)+J
  - Q14, 71, 73 : 2SC1907
  - Q15, 81 : 2SC2053
  - Q16 : DTA114EK
  - Q18, 19, 22, 23, 70, 72 : 2SK125-5
  - Q20, 32, 43, 44, 82, 85, 88 : FMC3
  - Q21, 79, 80 : 3SK122(L)
  - Q27, 30, 31, 78, 86 : 3SK73(GR)
  - Q29, 40-42, 45-54, 56-59 : 2SC2712(Y)
  - Q4, 89, 98 : 2SC2712(Y)
  - Q60, 68 : 2SK192A(Y)
  - Q62, 64, 93-95 : DTC114TK
- IC 1 : M54581P
- IC 2 : M74LS145P
- IC 3 : AN612
- IC 4 : JPC2002V
- IC 5 : SN16913P
- IC 6 : MC3357P
- IC 7-10 : TC4066BP
- IC 11 : LM324N
- IC 12 : AN7808
- D1-3, 12 : DAN235K
- D5, 10 : US1050
- D6, 9 : VOB(6)
- D7, 8, 11, 13-22, 38, 41, 44-46, 50-53, 59-106, 109, 110, 182, 122, 124, 126 : RL5135
- D23, 25, 90 : 1S1555
- D24, 48, 57, 61, 68, 69, 77, 79-81, 85, 89, 97, 107, 119 : DAN202K
- D26, 28, 29, 31 : DAN202K
- D27, 33, 49, 54-56, 58-60, 62-67, 70, 72-74, 76, 78, 83, 88, 92, 95, 108, 112-115, 117, 120, 123, 125, 129 : RL573
- D30, 93 : UZ-3.0B
- D34-37, 39, 40, 42, 43 : IIT310TE
- D47, 96 : M1204
- D71, 82, 86, 87 : HSM88AS
- D91 : MT2914B
- K1 : KB-369
- D116, 125 : RLZ3.6B
- D75, 98 : IN6045PSPA
- D127 : 1S5133
- TH1-4 : 112-502-2
- (X59-1060-00)
  - Q1 : 2SC2712(Y)
  - D1, 3 : DAN202K
  - D2 : DAP202K
- (X59-3000-02)
  - IC 1 : NJM4558M
- (X59-3340-00)
  - Q1, 2 : 2SA1204(Y)
  - Q3 : 2SA1182(Y)
  - Q4, 5 : DTC114EK
- D1, 2 : DAN202(K)
- (X59-3350-00)
  - Q1, 2 : DTC114EK
  - IC 1 : TC4011BF
- (X59-3360-00)
  - Q1-5 : DTC114EK
  - Q6 : DTA114EK
  - Q7 : DTC114TK
  - D1 : DAN202(K)
  - IC 1 : MB74LS122





## TERMINAL FUNCTION

| Connector No.                        | Terminal No. | Terminal Name | Terminal Function                                       |
|--------------------------------------|--------------|---------------|---|
| <b>SWITCH UNIT (X41-3030-XX)</b>     |              |               |   |
| CN1                                  | 1            | GND           | GND   |
|                                      | 2            | PPD           | Packet power down                                       |
|                                      | 3            | RXB           | RX power supply (+8V)                                   |
|                                      | 4            | PRS           | Processor switch  |
|                                      | 5            | NC            | Not connected   |
|                                      | 6            | MV3           | Mic amp. output   |
| CN2                                  | 1            | SS            | Standby switch  |
|                                      | 2            | 8V            | +8V   |
| CN3                                  | 1            | SS            | Standby switch  |
|                                      | 2            | PKS           | Packet standby  |
|                                      | 3            | GND           | GND   |
|                                      | 4            | PDK           | Packet data input                                       |
| CN4<br>(TS-140S)                     | 1            | GND           | GND   |
|                                      | 2            | VOX           | VOX   |
| CN5                                  | 1            | MIC           | Mic amp. input  |
|                                      | 2            | GND           | GND   |
|                                      | 3            | 8M            | +8V (Mic)   |
|                                      | 4            | SS            | Standby switch  |
| CN6                                  | 1            | AF1           | AF GAIN GND   |
|                                      | 2            | AF2           | AF GAIN volume  |
|                                      | 3            | AF3           | AF GAIN input   |
|                                      | 4            | GND           | GND   |
|                                      | 5            | FSQ           | Squelch volume  |
|                                      | 6            | NC            | Not connected   |
| CN7                                  | 1            | GND           | GND   |
|                                      | 2            | RIT           | RIT data  |
|                                      | 3            | RIB           | RIT volume  |
|                                      | 4            | IFS           | IF shift data   |
|                                      | 5            | IFB           | IF shift volume   |
| CN8                                  | 1            | PH2           | Phone output  |
|                                      | 2            | PH1           | Phone input   |
|                                      | 3            | PH3           | Phone GND   |
| <b>100W FINAL UNIT (X45-3100-XX)</b> |              |               |   |
| CN1                                  | 1            | TXB           | TX power supply (+8V)                                   |
|                                      | 2            | 50B (NC)      | 50MHz power supply (TS-680S)<br>Not connected (TS-140S) |
|                                      | 3            | PT            | Temperature protection signal                           |
| CN2                                  | 1            | GND           | GND   |
|                                      | 2            | 14D           | +14V (DC-DC converter)                                  |
|                                      | 3            | 14A           | +14V  |
|                                      | 4            | 14A           | +14V  |
| CN3                                  | 1            | 5A            | +5V (PLL)   |
|                                      | 2            | 5B            | +5V (Microprocessor)                                    |
|                                      | 3            | GND           | GND   |
| CN4<br>(TS-680S)                     | 1            | 50T           | 50MHz TX power supply (+8V)                             |
|                                      | 2            | 14S           | +14V  |
|                                      | 3            | 14S           | +14V  |
| CN5                                  | 1            | MOT +         | Fun motor power supply +                                |
|                                      | 2            | MOT -         | Fun motor power supply -                                |
|                                      |              | DRV           | Drive input   |
|                                      |              | GND           | GND   |
|                                      |              | PO            | Power output  |
|                                      |              | GND           | GND   |
| (TS-680S)                            |              | 50D           | 50MHz drive output                                      |
|                                      |              | GND           | GND   |
|                                      |              | 14S           | +14V  |
|                                      |              | 14            | +14V  |
|                                      |              | GND           | GND   |

| Connector No.                    | Terminal No. | Terminal Name | Terminal Function                               |
|----------------------------------|--------------|---------------|---|
| <b>FILTER UNIT (X51-3040-XX)</b> |              |               |   |
| CN1                              | 1            | RL            | Relay power supply (TX 13V)                     |
|                                  | 2            | RAT           | RX antenna output                               |
|                                  | 3            | GND           | GND   |
| CN2<br>(TS-680S)                 | 1            | 50T           | 50MHz TX power supply                           |
|                                  | 2            | 14S           | +14V  |
|                                  | 3            | 14S           | +14V  |
| CN3                              | 1            | 50F (NC)      | 50 ~ 54MHz (TS-680S)<br>Not connected (TS-140S) |
|                                  | 2            | 14F           | 7.5 ~ 14.5MHz                                   |
|                                  | 3            | 28F           | 21.5 ~ 30MHz                                    |
|                                  | 4            | 7F            | 4 ~ 7.5MHz                                      |
|                                  | 5            | 21F           | 14.5 ~ 21.5MHz                                  |
|                                  | 6            | 4F            | 2.5 ~ 4MHz                                      |
|                                  | 7            | 2F            | ~ 2.5MHz  |

Filter  
band  
data

|                                   |   |     |                              |
|-----------------------------------|---|-----|------------------------------|
| CN4                               | 1 | VSF | Forward wave voltage         |
|                                   | 2 | GND | GND                          |
|                                   | 3 | VSR | Reflected wave voltage       |
|                                   | 4 | GND | GND                          |
| CN5                               |   | PO  | Power input                  |
|                                   |   | GND | GND                          |
| CN6<br>(TS-680S)                  |   | 50D | 50MHz drive input            |
|                                   |   | GND | GND                          |
|                                   |   | ANT | Tntenna                      |
|                                   |   | GND | GND                          |
| <b>CONTROL UNIT (X53-3100-XX)</b> |   |     |                              |
| CN1                               | 1 | CAR | Carrier output (455kHz)      |
|                                   | 2 | GND | GND                          |
| CN2                               | 1 | 5A  | +5V (PLL)                    |
|                                   | 2 | 5B  | +5V (Microprocessor)         |
|                                   | 3 | GND | GND                          |
| CN3                               |   | VCO | VCO input                    |
|                                   |   | GND | GND                          |
| CN4                               | 1 | GND | GND                          |
|                                   | 2 | VCV | VCO control voltage          |
|                                   | 3 | 8D  | +8V (Active low-pass filter) |
| CN5                               | 1 | FMM | FM modulation signal input   |
|                                   | 2 | GND | GND                          |
| CN6                               |   | HET | Heterodyne output            |
|                                   |   | GND | GND                          |
| CN7                               | 1 | BZ  | Beep sound output            |
|                                   | 2 | NC  | Not connected                |
| CN8                               | 1 | 5B  | +5V (Interface)              |
|                                   | 2 | RDY | Ready                        |
|                                   | 3 | CD  | Control data                 |
|                                   | 4 | CS  | Chip select                  |
|                                   | 5 | RD  | Read enable                  |
|                                   | 6 | WR  | Write enable                 |
|                                   | 7 | GND | GND                          |

IF-10C  
(Option)

|     |   |     |                                  |
|-----|---|-----|----------------------------------|
| CN9 | 1 | RES | Reset                            |
|     | 2 | D0  | Microprocessor<br>data bus 0 ~ 7 |
|     | 3 | D1  |                                  |
|     | 4 | D2  |                                  |
|     | 5 | D3  |                                  |
|     | 6 | D4  |                                  |
|     | 7 | D5  |                                  |
|     | 8 | D6  |                                  |
|     | 9 | D7  |                                  |

IF-10C  
(Option)

## TERMINAL FUNCTION

| Connector No. | Terminal No. | Terminal Name | Terminal Function                  |
|---------------|--------------|---------------|------------------------------------|
| CN10          | 1            | B4            | Band data                          |
|               | 2            | CNC           | CW narrow mode data                |
|               | 3            | B3            | Band data                          |
|               | 4            | FMC           | FM mode data                       |
|               | 5            | B2            | Band data                          |
|               | 6            | AMC           | AM mode data                       |
|               | 7            | B1            | Band data                          |
|               | 8            | CWC           | CW mode data                       |
|               | 9            | B0            | Band data                          |
|               | 10           | SSC           | SSB mode data                      |
|               | 11           | CTX           | Transmit timing control signal     |
|               | 12           | TOC           | Sub-tone control signal            |
|               | 13           | RB            | Receive timing control signal      |
|               | 14           | SBK           | Blanking signal                    |
|               | 15           | CKY           | Keying control signal              |
|               | 16           | PD            | Power down signal                  |
|               | 17           | MU            | Mic up data                        |
|               | 18           | MUT           | Mute signal                        |
|               | 19           | MD            | Mic down data                      |
|               | 20           | VB1           | VCO switching signal               |
|               | 21           | CSS           | Standby control data               |
|               | 22           | VB2           | VCO switching signal               |
|               | 23           | 14A           | +14V                               |
|               | 24           | NC            | Not connected                      |
|               | 25           | 8V            | +8V                                |
|               | 26           | GND           | GND                                |
| CN11          | 1            | CK4           | Sub-encoder pulse input            |
|               | 2            | CK3           | Sub-encoder pulse input            |
|               | 3            | 5C            | +5V (Display)                      |
|               | 4            | L1            | LED (1MHz)                         |
|               | 5            | K0            | Key scan input                     |
|               | 6            | LF            | LED (F. LOCK)                      |
|               | 7            | K1            | Key scan input                     |
|               | 8            | LM            | LED (M.SCR)                        |
|               | 9            | K2            | Key scan input                     |
|               | 10           | XP            | Display function signal            |
|               | 11           | K3            | Key scan input                     |
|               | 12           | SLH           | Display serial data (Latch signal) |
|               | 13           | S0            | Key scan output                    |
|               | 14           | SDA           | Display serial data                |
|               | 15           | S1            | Key scan output                    |
|               | 16           | SCK           | Display serial clock               |
|               | 17           | S2            | Key scan output                    |
|               | 18           | S3            | Key scan output                    |
| CN12          | 1            | GND           | GND                                |
|               | 2            | CK2           | Main encoder pulse input           |
|               | 3            | CK1           | Main encoder pulse input           |
|               | 4            | 5B            | +5V (Main encoder)                 |
| CN13          | 1            | IFB           | If shift volume                    |
|               | 2            | RIB           | RIT volume                         |
|               | 3            | RIT           | RIT data                           |
|               | 4            | IFS           | IF shift data                      |
|               | 5            | GND           | GND                                |
| CN14          | 1            | HFL           | HF low                             |
|               | 2            | HFH           | HF high                            |
|               | 3            | 50M           | 50MHz                              |
|               |              | CAL           | Antenna select signal              |

| Connector No.                     | Terminal No. | Terminal Name | Terminal Function                  |
|-----------------------------------|--------------|---------------|------------------------------------|
| <b>DISPLAY UNIT (X54-3050-XX)</b> |              |               |                                    |
| CN1                               | 1            | SM1           | S meter -                          |
|                                   | 2            | SM2           | S meter +                          |
| CN2                               | 1            | 8V            | +8V                                |
|                                   | 2            | PRS           | Processor switch                   |
|                                   | 3            | ALS           | ALC meter switch                   |
|                                   | 4            | SS            | Standby switch                     |
|                                   | 5            | PMS           | Power meter switch                 |
|                                   | 6            | GND           | GND                                |
|                                   | 7            | TXB           | TX power supply (+8V)              |
|                                   | 8            | 14D           | +14V (DC-DC converter)             |
|                                   | 9            | 14A           | +14V                               |
|                                   | 10           | SM1           | S meter -                          |
|                                   | 11           | ATS           | RF ATT switch                      |
|                                   | 12           | SM2           | S meter +                          |
|                                   | 13           | AGS           | AGC switch                         |
|                                   | 14           | NC            | Not connected                      |
|                                   | 15           | SW1           | RF amplifier signal (TS-680S)      |
|                                   | 16           | SW2           | VOX signal (TS-140S)               |
| CN3                               | 1            | COM           | Break in input                     |
|                                   | 2            | SEM           | Semi-break in signal               |
|                                   | 3            | FUL           | Full break in signal               |
|                                   | 4            | KEY           | Key signal                         |
|                                   | 5            | NB1           | Noise blanker 1 switch             |
|                                   | 6            | SS            | Standby signal                     |
|                                   | 7            | NBC           | NB time constant                   |
|                                   | 8            | CV            | Carrier volume                     |
|                                   | 9            | NB2           | Noise blanker 2 switch             |
|                                   | 10           | PC1           | Power control volume               |
|                                   | 11           | RFB           | RF GAIN input                      |
|                                   | 12           | PC2           | Power control volume               |
|                                   | 13           | RFG           | RF GAIN volume output              |
|                                   | 14           | MV1           | Mic volume GND                     |
|                                   | 15           | MV2           | Mic volume output                  |
|                                   | 16           | MV3           | Mic volume input                   |
| CN4                               | 1            | S3            | Key scan input                     |
|                                   | 2            | S2            | Key scan input                     |
|                                   | 3            | SCK           | Display serial clock               |
|                                   | 4            | S1            | Key scan input                     |
|                                   | 5            | SDA           | Display serial data                |
|                                   | 6            | S0            | Key scan input                     |
|                                   | 7            | SLH           | Display serial data (Latch signal) |
|                                   | 8            | K3            | Key scan output                    |
|                                   | 9            | XP            | Display function signal            |
|                                   | 10           | K2            | Key scan output                    |
|                                   | 11           | LM            | LED (M.SCR)                        |
|                                   | 12           | K1            | Key scan output                    |
|                                   | 13           | LF            | LED (F. LOCK)                      |
|                                   | 14           | K0            | Key scan output                    |
|                                   | 15           | L1            | LED (1MHz)                         |
|                                   | 16           | 5C            | +5V (Display)                      |
|                                   | 17           | CK3           | Sub-encoder pulse output           |
|                                   | 18           | CK4           | Sub-encoder pulse output           |
| CN5                               | 1            | SPO           | Speaker output                     |
|                                   | 2            | 8M            | +8V                                |
|                                   | 3            | GND           | GND                                |
|                                   | 4            | MU            | Mic up data                        |
|                                   | 5            | MD            | Mic down data                      |
|                                   | 6            | SS            | Standby switch                     |
|                                   | 7            | MIC           | Microphone                         |
|                                   | 8            | GND           | GND (Mic)                          |

## TERMINAL FUNCTION

| Connector No.                              | Terminal No. | Terminal Name | Terminal Function              |
|--|--------------|---------------|--------------------------------|
| <b>SIGNAL UNIT (X57-3190-00) : TS-680S</b> |              |               |                                |
| <b>SIGNAL UNIT (X57-3200-XX) : TS-140S</b> |              |               |                                |
| CN1  | 1            | MV3           | Mic volume output              |
|  | 2            | MV2           | Mic volume input               |
|  | 3            | MV1           | Mic volume GND                 |
|  | 4            | RFG           | RF GAIN volume input           |
|  | 5            | PC2           | Power control volume           |
|  | 6            | RFB           | RF GAIN output                 |
|  | 7            | PC1           | Power control volume           |
|  | 8            | NB2           | Noise blanker 2 switch         |
|  | 9            | CV            | Carrier volume                 |
|  | 10           | NBC           | NB time constant               |
|  | 11           | SS            | Standby switch                 |
|  | 12           | NB1           | Noise blanker 1 switch         |
|  | 13           | KEY           | Key signal                     |
|  | 14           | FUL           | Full break in signal           |
|  | 15           | SEM           | Semi-break in signal           |
|  | 16           | COM           | Full break in output           |
| CN2  | 1            | SW2           | RF amplifier signal (TS-680S)  |
|  | 2            | SW1           | VOX signal (TS-140S)           |
|  | 3            | NC            | Not connected                  |
|  | 4            | AGS           | AGC switch                     |
|  | 5            | SM2           | S meter +                      |
|  | 6            | ATS           | RF ATT switch                  |
|  | 7            | SM1           | S meter -                      |
|  | 8            | 14A           | +14V                           |
|  | 9            | 14D           | +14V (DC-DC converter)         |
|  | 10           | TXB           | TX power supply (+8V)          |
|  | 11           | GND           | GND                            |
|  | 12           | PMS           | Power meter switch             |
|  | 13           | SS            | Standby switch                 |
|  | 14           | ALS           | ALC meter switch               |
|  | 15           | PRS           | Processor switch               |
|  | 16           | 8V            | +8V                            |
| CN3  | 1            | GND           | GND                            |
|  | 2            | 8V            | +8V                            |
|  | 3            | NC            | Not connected                  |
|  | 4            | 14A           | +14V                           |
|  | 5            | VB2           | VCO switching signal           |
|  | 6            | CSS           | Standby control data           |
|  | 7            | VB1           | VCO switching signal           |
|  | 8            | MD            | Mic down data                  |
|  | 9            | MUT           | Mute signal                    |
|  | 10           | MU            | Mic up data                    |
|  | 11           | PD            | Power down signal              |
|  | 12           | CKY           | Keying control signal          |
|  | 13           | SBK           | Blanking signal                |
|  | 14           | RB            | Receive timing control signal  |
|  | 15           | TOC           | Sub-tone control signal        |
|  | 16           | CTX           | Transmit timing control signal |
|  | 17           | SSC           | SSB mode data                  |
|  | 18           | B0            | Band data                      |
|  | 19           | CWC           | CW mode data                   |
|  | 20           | B1            | Band data                      |
|  | 21           | AMC           | AM mode data                   |
|  | 22           | B2            | Band data                      |
|  | 23           | FMC           | FM mode data                   |
|  | 24           | B3            | Band data                      |
|  | 25           | CNC           | CW narrow mode data            |
|  | 26           | B4            | Band data                      |
| CN4  | 1            | RAT           | RX antenna input               |
|  | 2            | GND           | GND                            |
|  | 3            | RL            | Relay power supply (TX 13V)    |

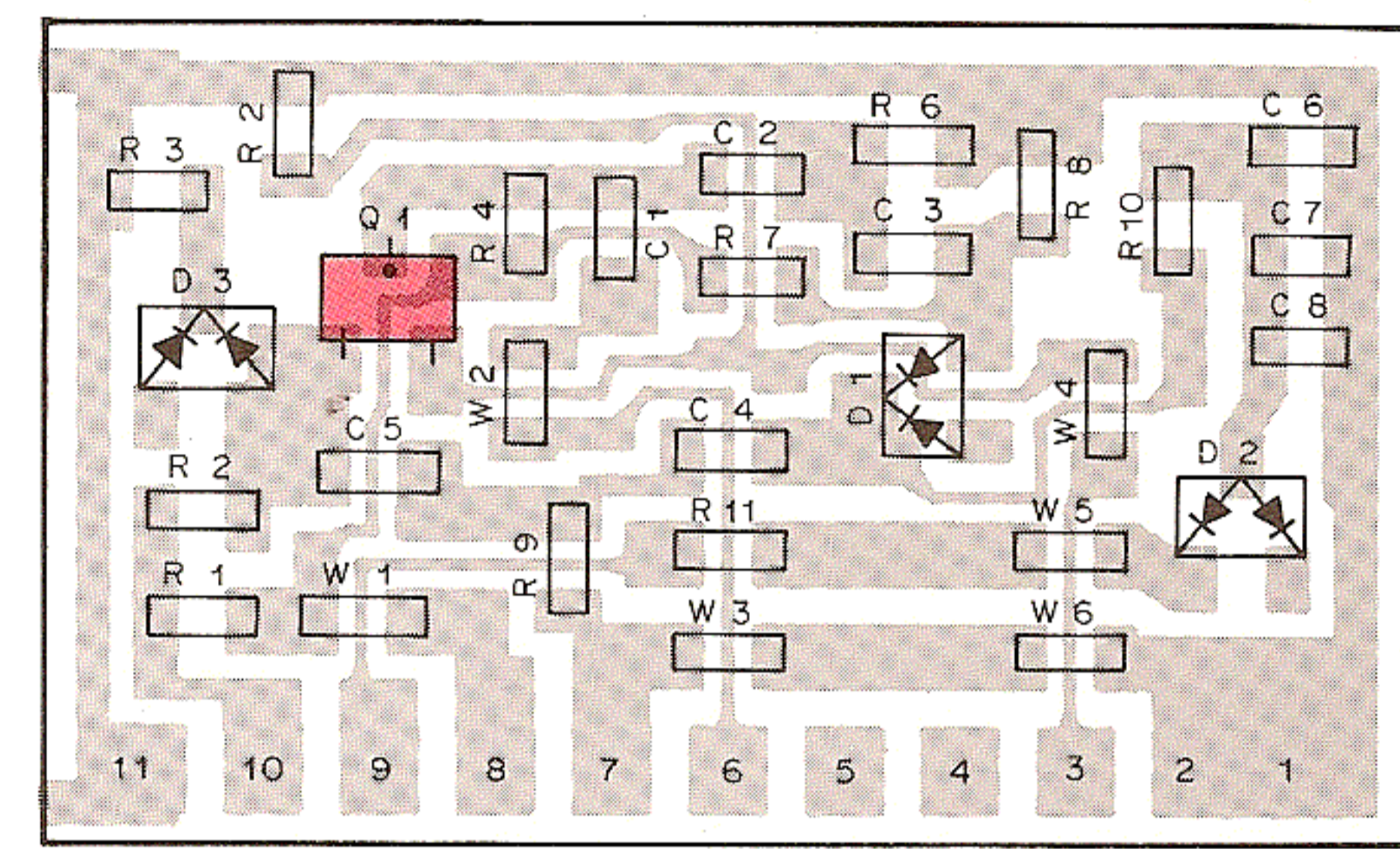
| Connector No.    | Terminal No. | Terminal Name | Terminal Function                               |
|------------------|--------------|---------------|---|
| CN5              | 1            | 50F (NC)      | 50 ~ 54MHz (TS-680S)<br>Not connected (TS-140S) |
|                  | 2            | 28F           | 21.5 ~ 30MHz                                    |
|                  | 3            | 21F           | 14.5 ~ 21.5MHz                                  |
|                  | 4            | 14F           | 7.5 ~ 14.5MHz                                   |
|                  | 5            | 7F            | 4 ~ 7.5MHz                                      |
|                  | 6            | 4F            | 2.5 ~ 4MHz                                      |
|                  | 7            | 2F            | ~ 2.5MHz  |
| CN6              | 1            | 8D            | +8V (Active low-pass filter)                    |
|                  | 2            | VCV           | VCO control voltage                             |
|                  | 3            | GND           | GND   |
| CN7<br>(TS-680S) | 1            | NC            | Not connected                                   |
|                  | 2            | 50B           | 50MHz power supply                              |
| CN8              | 1            | GND           | GND   |
|                  | 2            | 14D           | +14V (DC-DC converter)                          |
|                  | 3            | 14A           | +14V (DC-DC converter)                          |
|                  | 4            | 14A           | +14V (DC-DC converter)                          |
| CN9              | 1            | 8V            | +8V   |
|                  | 2            | SS            | Standby switch                                  |
|                  | 3            | GND           | GND   |
|                  | 4            | SPO           | Speaker output                                  |
|                  | 5            | MD            | Mic down data                                   |
|                  | 6            | MU            | Mic up data                                     |
| CN10             | 1            | FSQ           | Squelch volume                                  |
|                  | 2            | GND           | GND   |
|                  | 3            | AF3           | AF GAIN output                                  |
|                  | 4            | AF2           | AF GAIN volume                                  |
|                  | 5            | AF1           | AF GAIN GND                                     |
| CN11             | 1            | PH3           | Phone GND                                       |
|                  | 2            | PH2           | Phone input                                     |
|                  | 3            | PH1           | Phone output                                    |
| CN12             | 1            | SP            | Speaker output                                  |
|                  | 2            | GND           | GND   |
| CN13             | 1            | GND           | GND   |
|                  | 2            | VSR           | Reflected wave voltage                          |
|                  | 3            | GND           | GND   |
|                  | 4            | VSF           | Forward wave voltage                            |
| CN14             | 1            | TXB           | TX power supply (+8V)                           |
|                  | 2            | PT            | Temperature protection signal                   |
| CN15             | 1            | PPD           | Packet power down                               |
|                  | 2            | ANO           | RX audio output                                 |
|                  | 3            | GND           | GND   |
|                  | 4            | PSQ           | Packet squelch                                  |
|                  | 5            | GND           | GND   |
|                  | 6            | MV3           | Mic amp. output                                 |
|                  | 7            | GND           | GND   |
|                  | 8            | PRS           | Processor switch                                |
|                  | 9            | RXB           | RX power supply (+8V)                           |
|                  | 10           | GND           | GND   |
| CN16             | 1            | FMM           | FM modulation signal                            |
|                  | 2            | GND           | GND   |
| CN17             | 1            | GND           | GND   |
|                  | 2            | CAR           | Carrier input (455kHz)                          |
|                  | 3            | GND           | GND   |
|                  | 4            | BZ            | Beep sound input                                |
| CN18             | 1            | CF1           | Option filter output                            |
|                  | 2            | GND           | GND   |
| CN19             | 1            | CF2           | Option filter input                             |
|                  | 2            | GND           | GND   |
| CN20             |              | DRV           | Drive output                                    |
|                  |              | GND           | GND   |

## TERMINAL FUNCTION

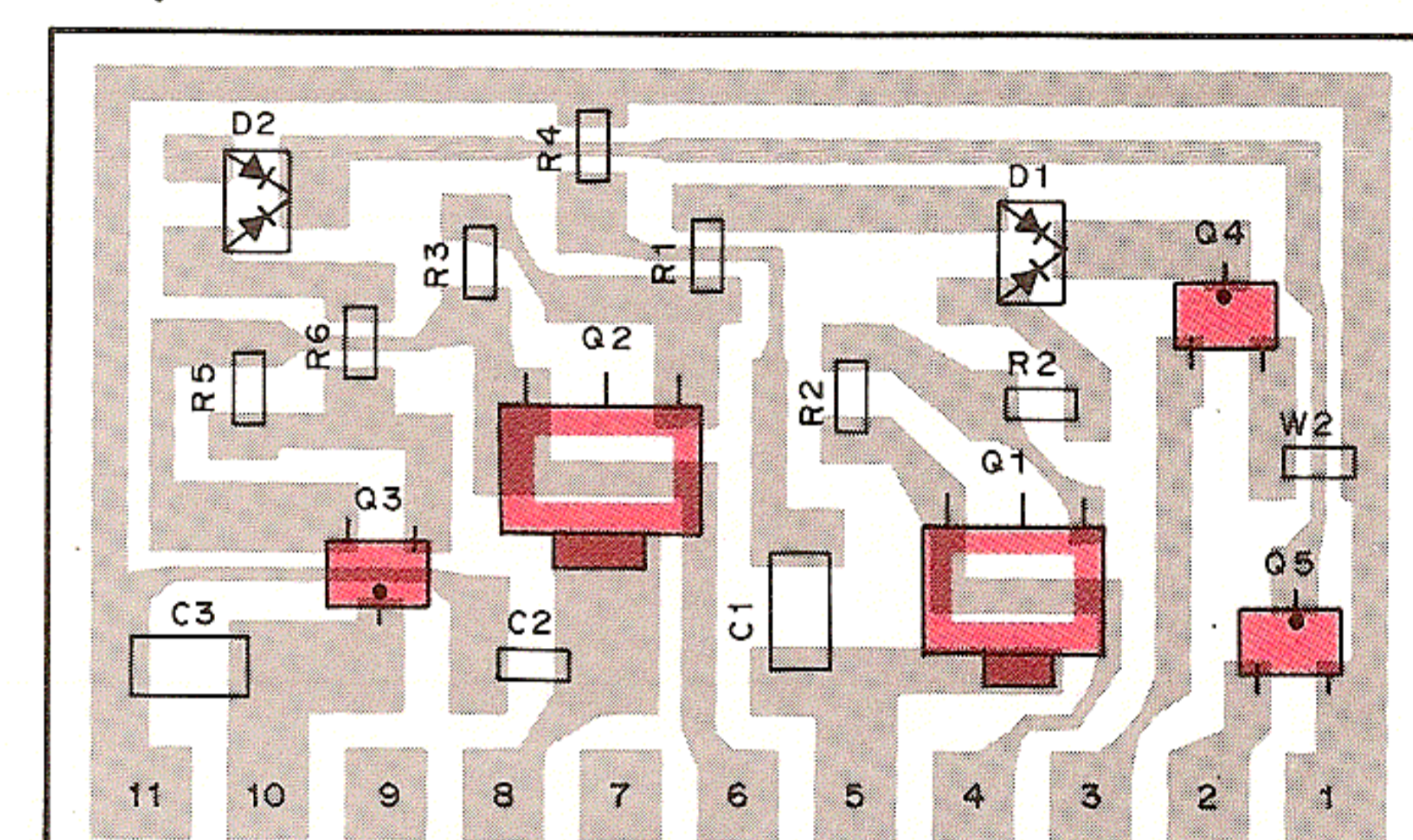
| Connector No.      | Terminal No. | Terminal Name | Terminal Function           |
|--------------------|--------------|---------------|-----------------------------|
| CN21               |              | HET           | Heterodyne input (39.6MHz)  |
|                    |              | GND           | GND                         |
| CN22               |              | VCO           | VCO output                  |
|                    |              | GND           | GND                         |
| CN501<br>(TS-140S) | 1            | GND           | GND                         |
|                    | 2            | VOX           | VOX                         |
| CN27               | 1            | GND           | GND                         |
|                    | 2            | PKD           | Packet data                 |
|                    | 3            | SS            | Standby switch              |
|                    | 4            | PKS           | Packet standby              |
|                    | 5            | PSQ           | Packet squelch              |
|                    | 6            | ANO           | RX audio output             |
|                    | 7            | GND           | GND                         |
|                    | 8            | GND           | GND                         |
| CN28               | 1            | NC            | Not connected               |
|                    | 2            | NC            | Not connected               |
|                    | 3            | ANO           | RX audio output             |
|                    | 4            | GND           | GND                         |
|                    | 5            | PSQ           | Packet squelch              |
|                    | 6            | NC            | Not connected               |
|                    | 7            | NC            | Not connected               |
|                    | 8            | GND           | GND                         |
|                    | 9            | PKS           | Packet standby              |
|                    | 10           | NC            | Not connected               |
|                    | 11           | PKD           | Packet power down           |
|                    | 12           | GND           | GND                         |
|                    | 13           | SS            | Standby switch              |
| CN29               | 1            | TON           | Sub-tone input              |
|                    | 2            | TOG           | Sub-tone GND                |
|                    |              | TOB           | Sub-tone power supply (+8V) |
|                    |              | CAL           |                             |

# TS-140S/680S PC BOARD VIEWS (TS-140S)

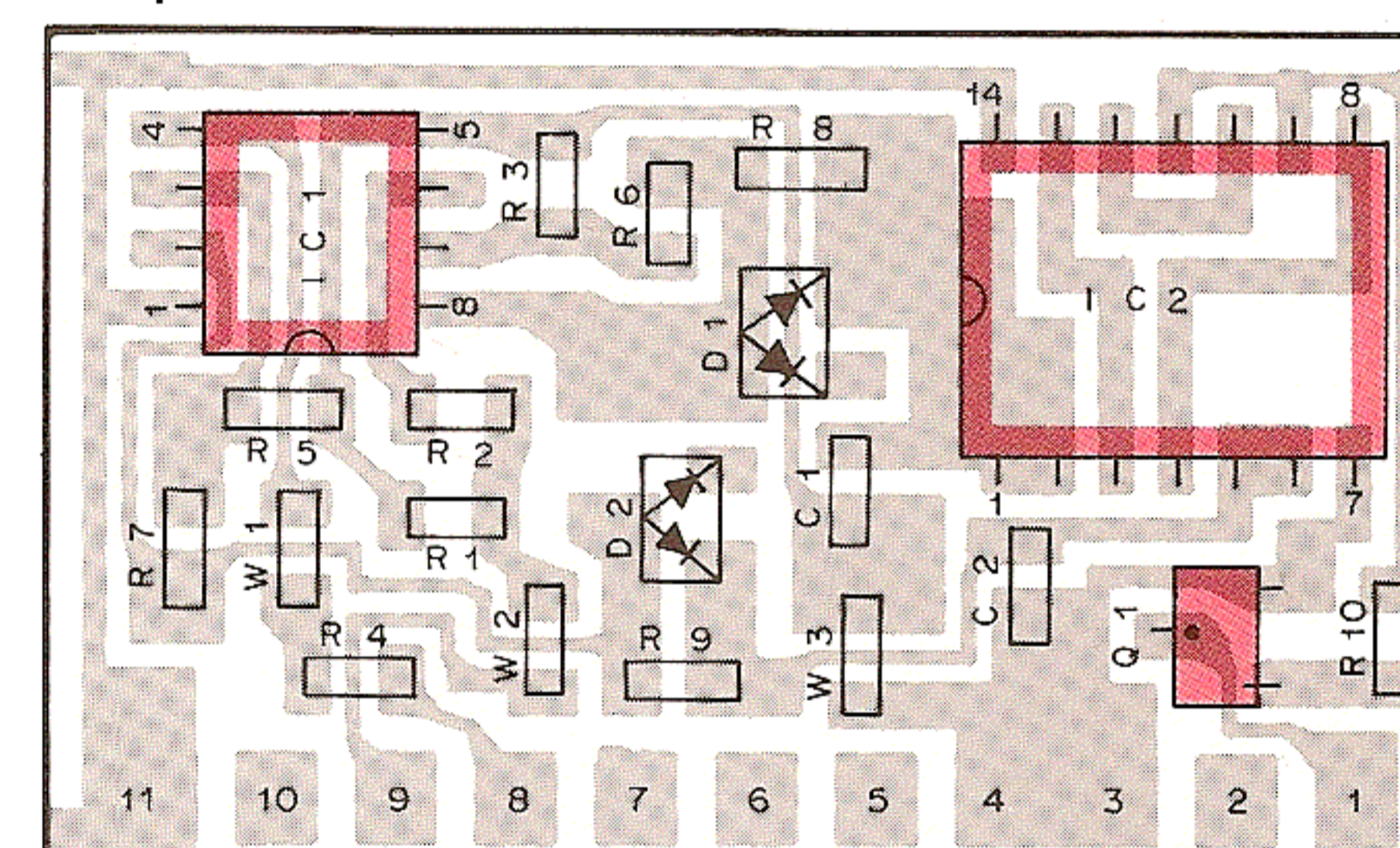
**SIDE TONE (X59-1060-00)**  
Component side view



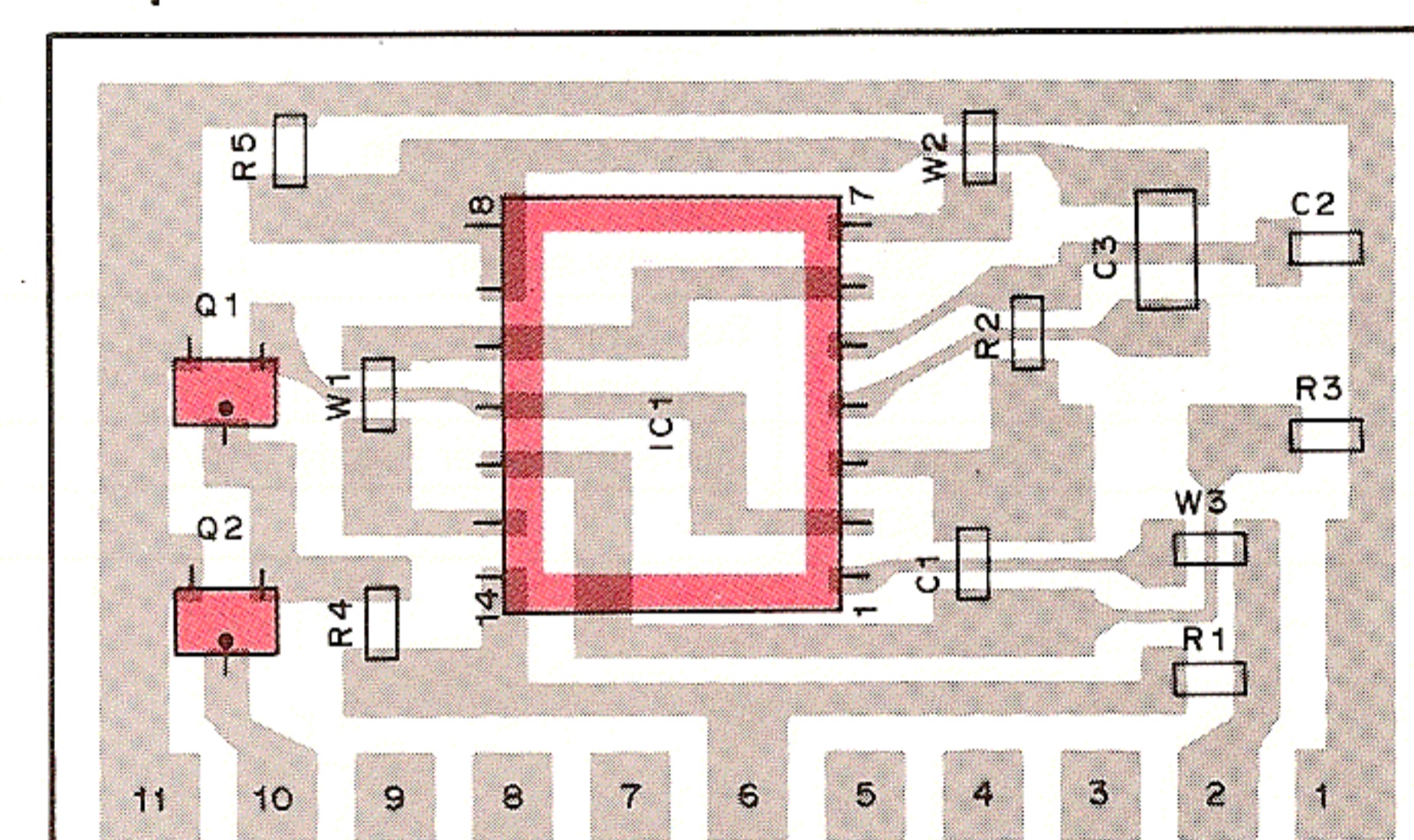
**TRX (X59-3340-00)**  
Component side view



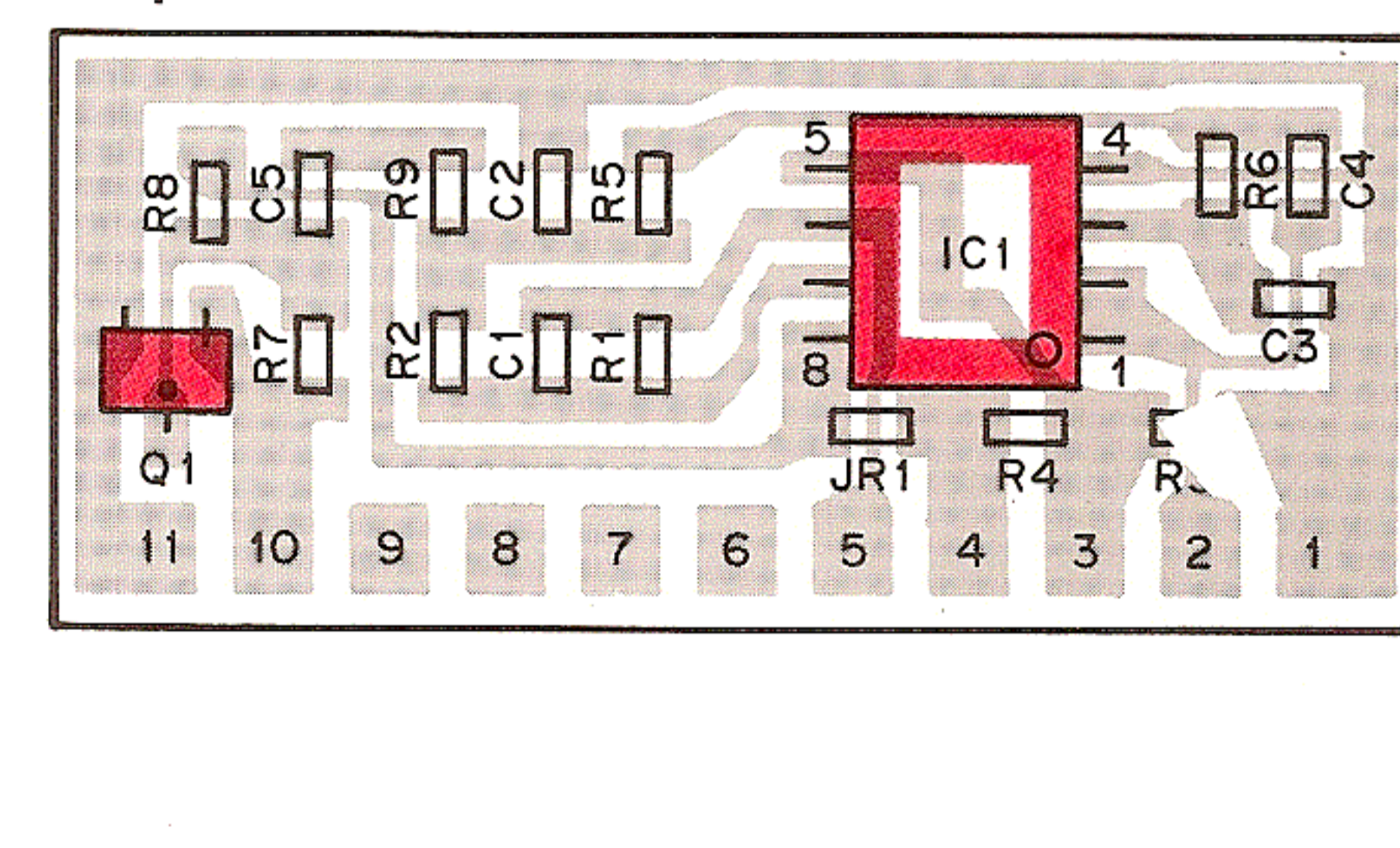
**VOX (X59-1080-00)**  
Component side view



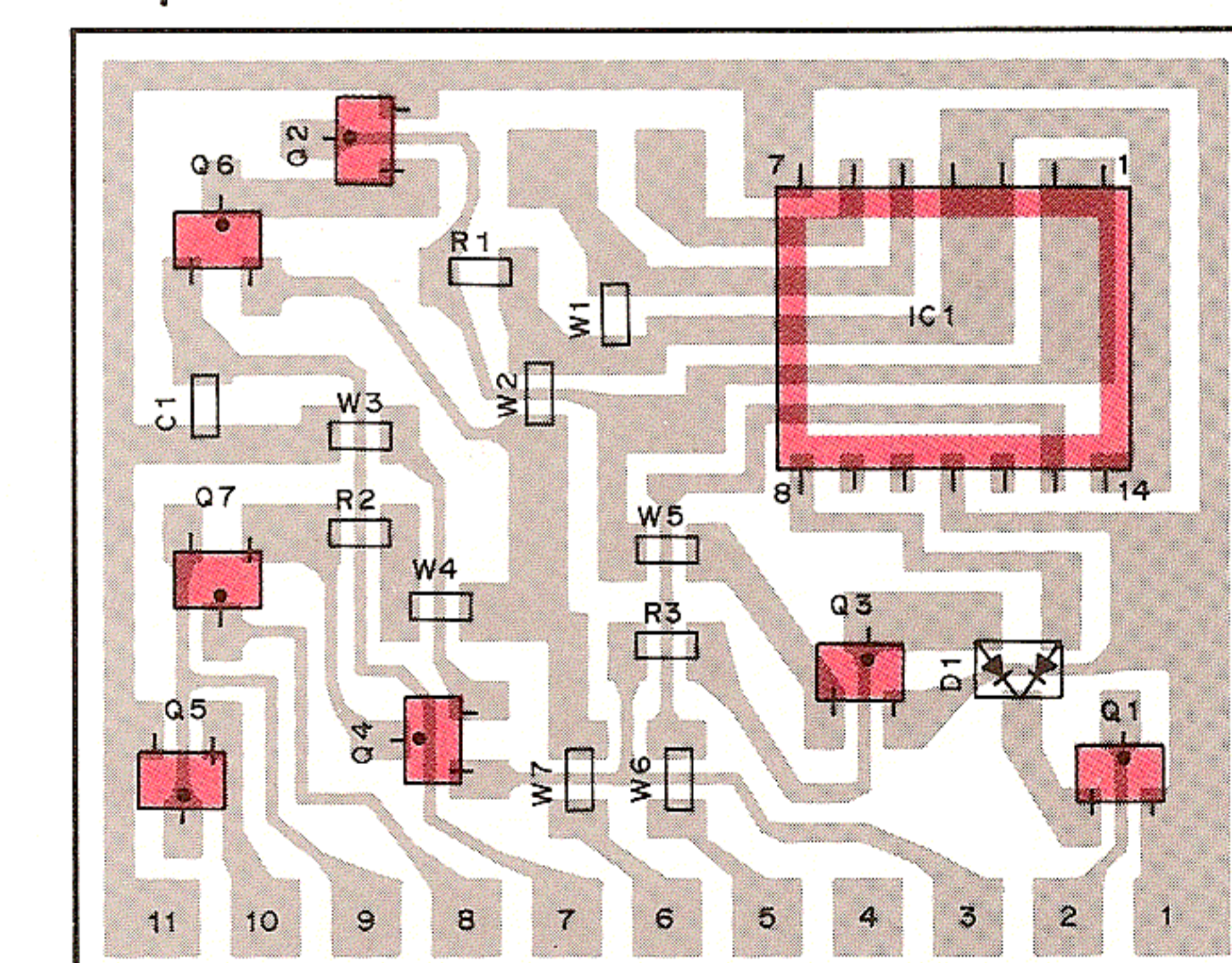
**NB2 (X59-3350-00)**  
Component side view



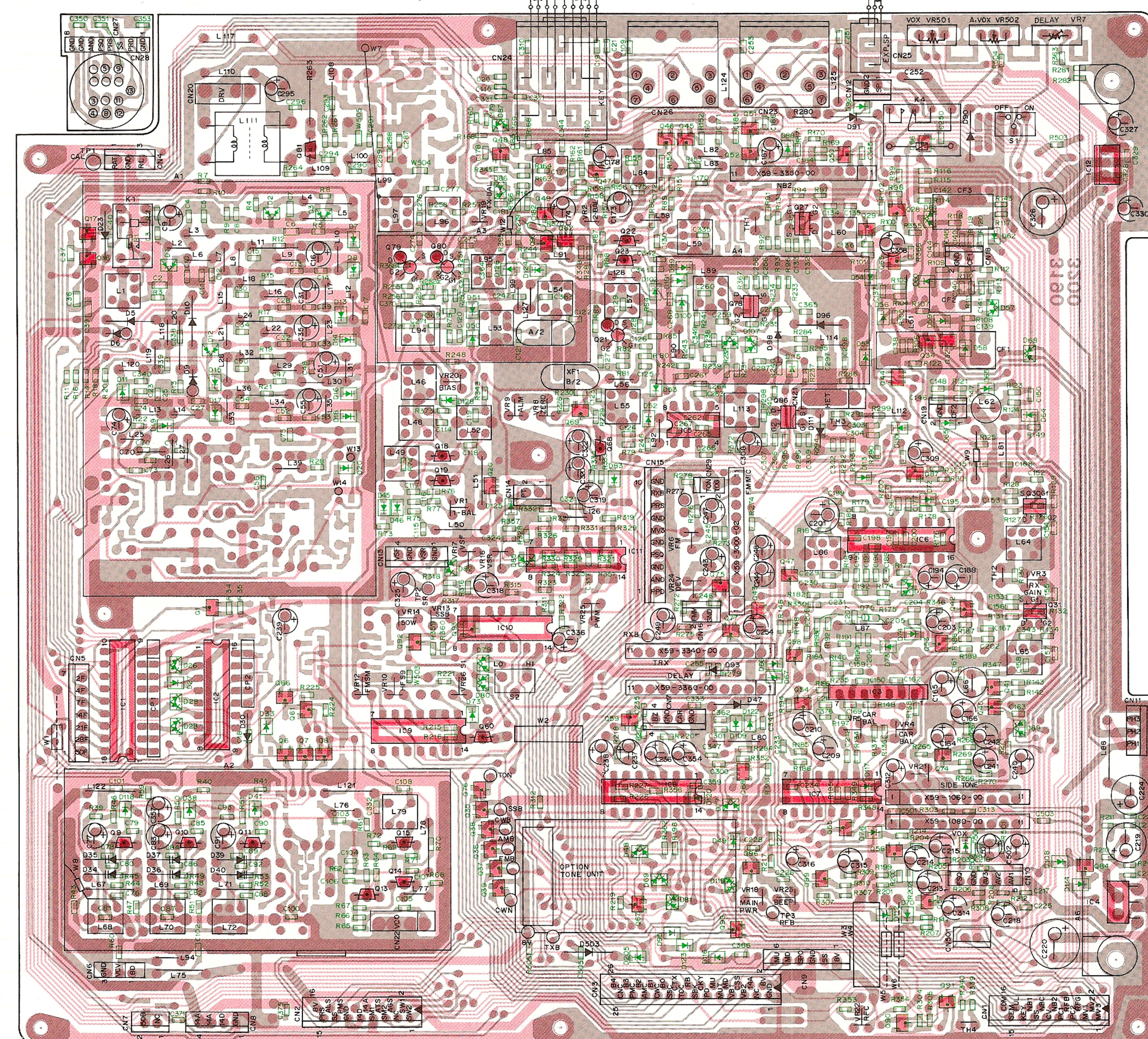
**FM MIC AMP. (X59-3000-02)**  
Component side view



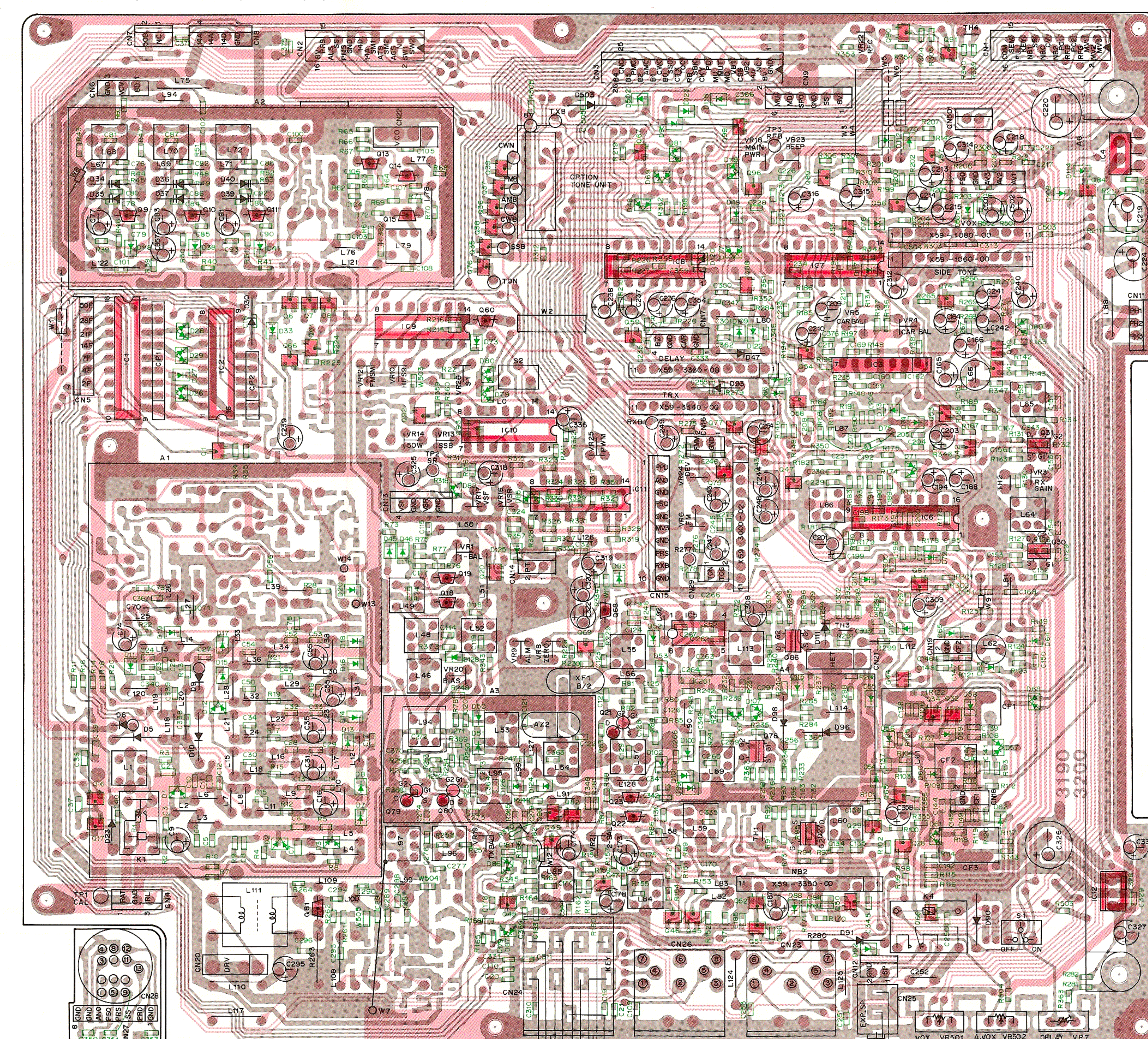
**DELAY TIME (X59-3360-00)**  
Component side view



SIGNAL UNIT (X57-3200-XX) -10 : K, M, T -61 : W Component side view



SIGNAL UNIT (X57-3200-XX) -10 : K, M, T -61 : W Foil side view

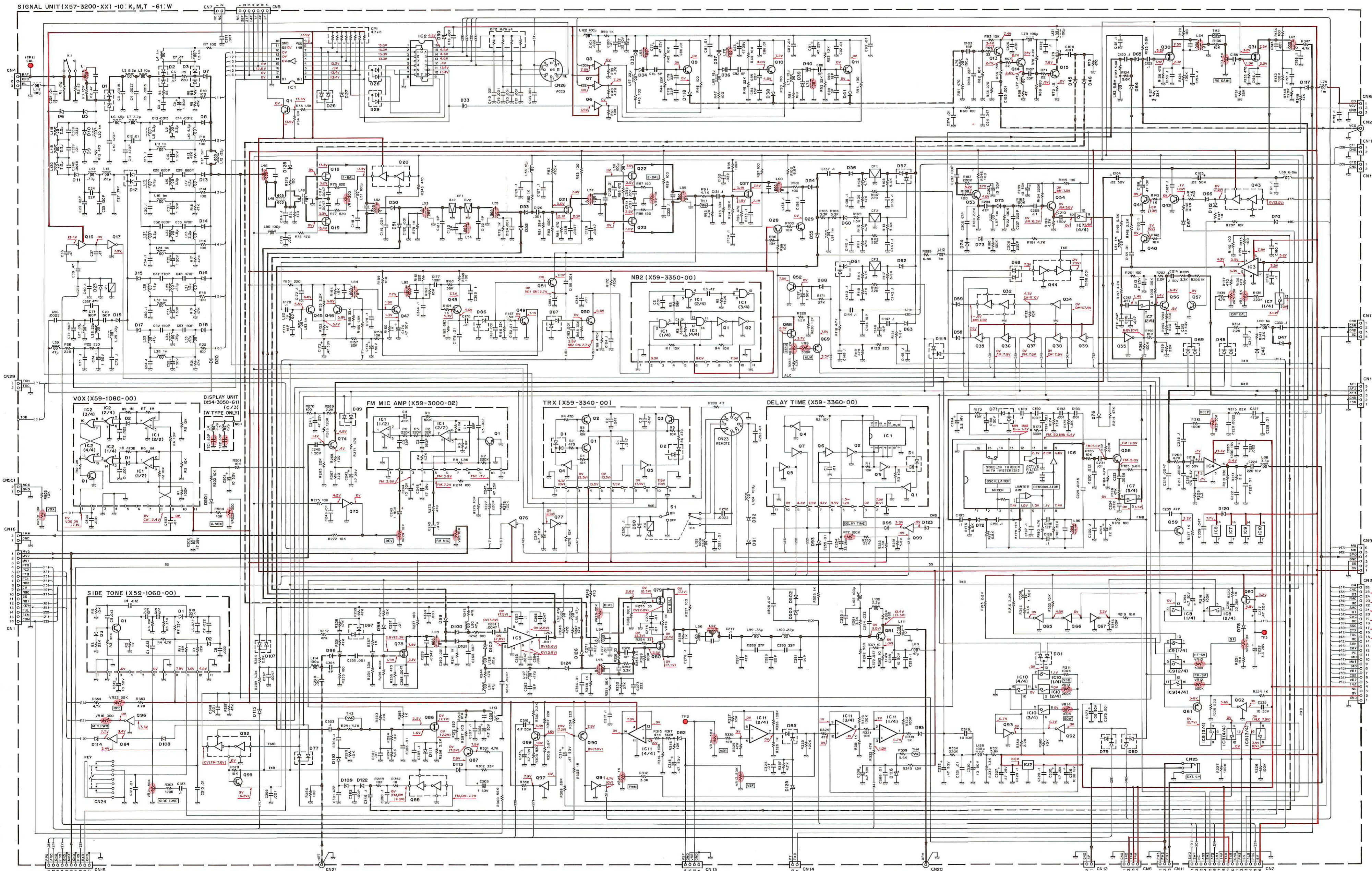


SIGNAL UNIT (X57-3200-XX)

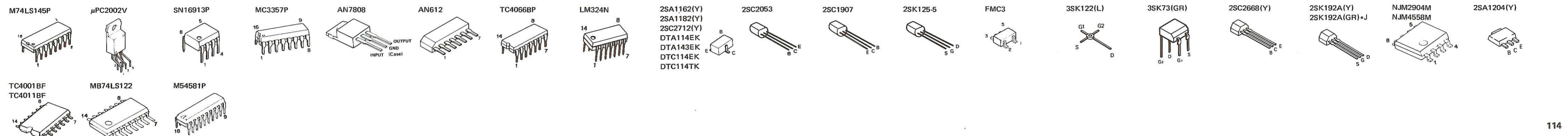
SIGNAL UNIT (X57-3200-XX) - IO: K, M, T - 61: W

Voltage measurement condition f = 14MHz, Mode : USB. ( ) : TX.

CIRCUIT DIAGRAM (TS-140S) TS-140S/680S

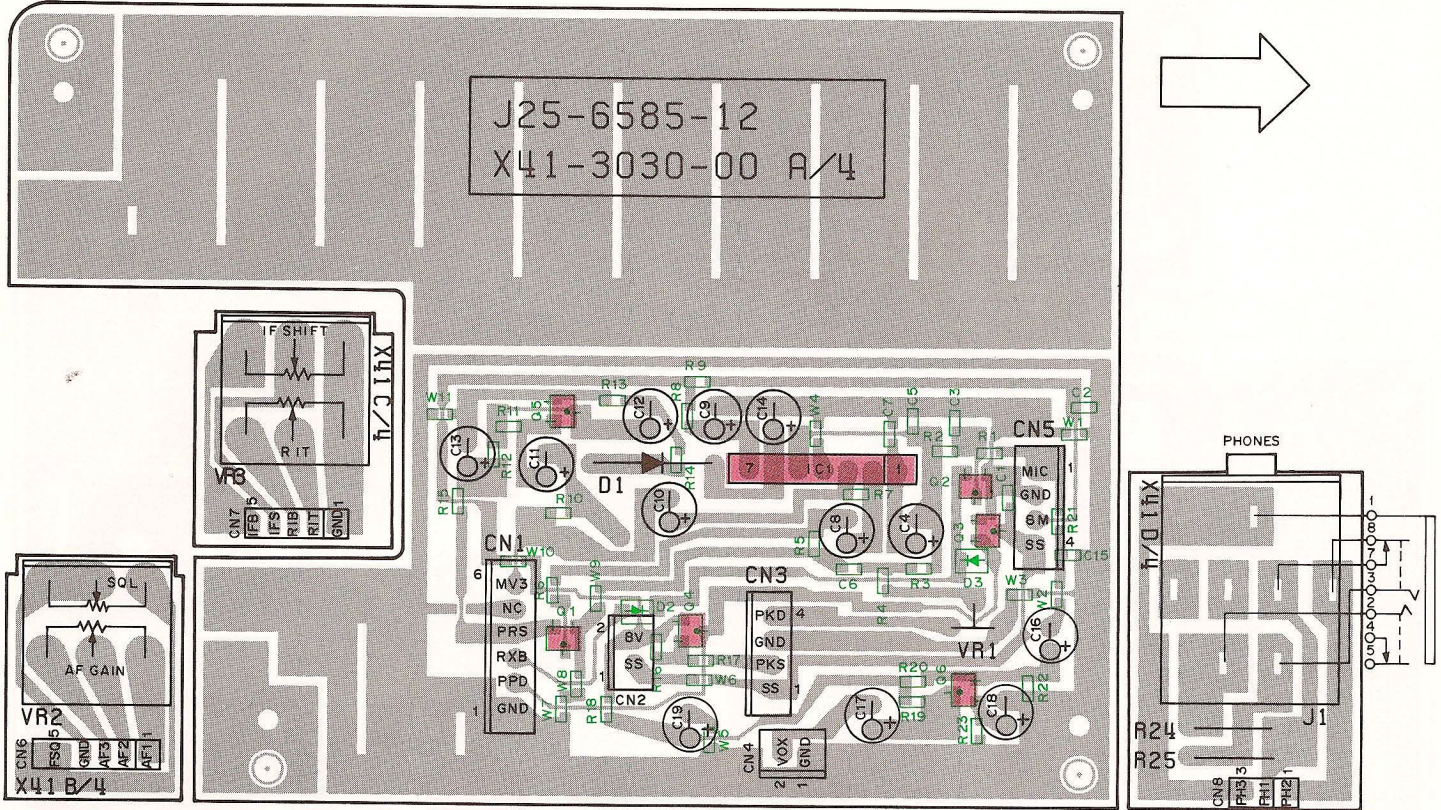


- (X57-3200-XX)
  - Q1, 28, 61, 69, 87, 90 : 2SA1162(Y)
  - Q17, 34, 53, 65, 67, 75, 77, 84, 91, 92, 96, 97, 99 : DTC114EK
  - Q6-8, 35-39, 76 : DTA143EK
  - Q9-11, 13 : 2SC2668(Y)
  - Q14 : 2SC1907
  - Q15, 81 : 2SC2053
  - Q16 : DTA114EK
  - Q18, 19, 23, 23 : 2SK125-5
  - Q20, 32, 43, 44, 82, 88 : FMC3
  - Q21, 79, 80 : 3SK122(L)
  - Q27, 30, 31, 78, 86 : 3SK73(GR)
  - Q29, 40-42, 45-54, 56-59, 74, 89, 98 : 2SC2712(Y)
  - Q60, 68 : 2SK192A(Y)
  - Q62, 93 : DTC114TK
- IC1 : M54581P
- IC2 : M74LS145P
- IC3 : AN612
- IC4 :  $\mu$ PC2002V
- IC5 : SN16913P
- IC6 : MC3357P
- IC7-10 : TC4066BP
- IC11 : LM324N
- IC12 : AN7808
- D1-3, 12 : DAN235K
- D5, 10 : LS1500
- D6, 9 : V08(G)
- D7, 8, 11, 13-20, 38, 41, 45, 46, 50-53, 59-102, 109, 110, 118, 122, 124, 126 : RL1535
- D23, 90 : 1S1505
- D48, 57, 61, 68, 69, 77, 79-81, 85, 89, 97, 107, 119 : DAN202K
- D26, 38, 29 : DAN202K
- D27, 33, 49, 54-56, 58-60, 62-67, 70, 72-74, 76, 78, 83, 88, 92, 95, 108, 112-115, 117, 120, 123, 128, 501, 502 : RL1573
- D30, 93, 503 : UZ-3.0B
- D34-37, 39, 40 : ITT310TE
- M1204 : M1204
- D71, 82, 86, 87 : HSM88AS
- D91 : MTZ9-14B
- K3-369 : K3-369
- D116, 125 : RLZ3.6B
- D75, 98 : 1M60PSPA
- TH1-4 : TH1-4
- TH2 : TH2
- (X59-1060-00)
  - Q1 : 2SC2712(Y)
- D1, 3 : DAN202K
- D2 : DAP202K
- (X59-1080-00)
  - Q1 : 2SC2712(Y)
  - Q4, 95 : NJM2904M
  - IC1 : NJM2904M
  - IC2 : TC4001BF
- D1, 2 : DAP202K
- (X59-3000-02)
  - Q1 : 2SC2712(Y)
  - Q4, 95 : NJM4558M
  - IC1 : NJM4558M
- (X59-3340-00)
  - Q1, 2 : 2SA1204(Y)
  - Q3 : 2SA1182(Y)
  - Q4, 5 : DTC114EK
- D1, 2 : DAN202(K)
- (X59-3350-00)
  - Q1, 2 : DTC114EK
  - IC1 : TC4001BF
- (X59-3360-00)
  - Q1-3 : DTC114EK
  - Q6 : DTA114EK
  - Q7 : DTC114TK
  - D1 : DAN202(K)
  - IC1 : M74LS142

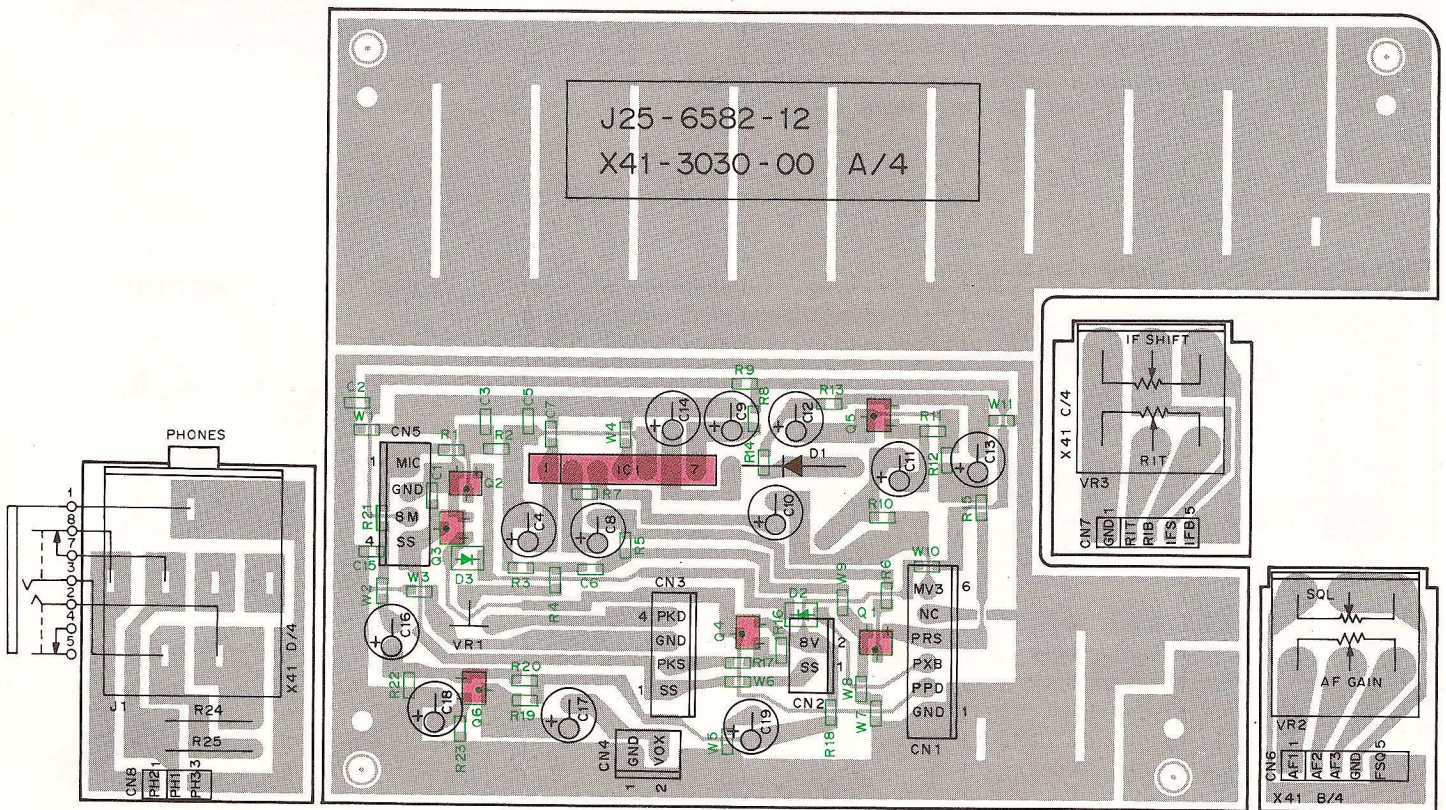


# PC BOARD VIEWS TS-140S/680S

SWITCH UNIT (X41-3030-XX) -00 : TS-680S -11 : TS-140S Component side view



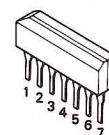
SWITCH UNIT (X41-3030-XX) -00 : TS-680S -11 : TS-140S Foil side view



Q1-3 : DTC114EK Q4 : 2SA1162(Y) Q5,6 : 2SC2712(Y)  
 IC1 :  $\mu$ PC1158H2  
 D1 : 1N60 D2,3 : RLS73

CN4,Q6 } TS-140S only  
 C16-C19 }  
 R18-R23 }

$\mu$ PC1158H2

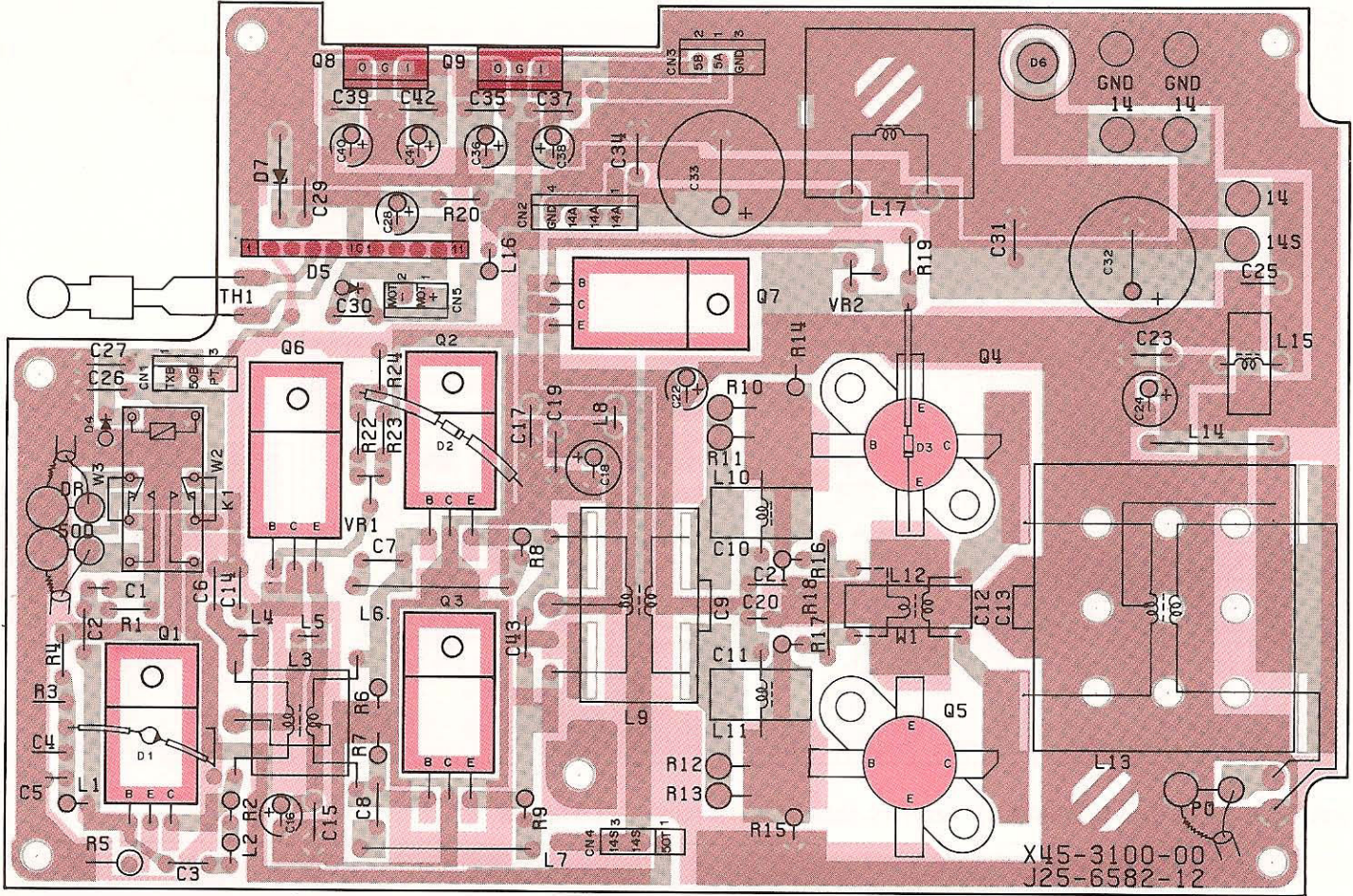


2SA1162(Y)  
 2SC2712(Y)  
 DTC114EK



# TS-140S/680S PC BOARD VIEWS

FINAL UNIT (X45-3100-XX) -00: TS-680S -11: TS-140S Component side view

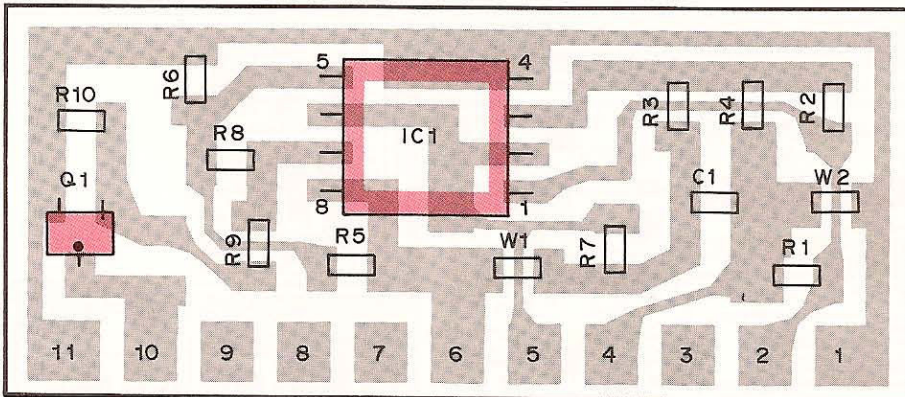


Q1 : 2SC1971 Q2,3 : 2SC2509 Q4,5 : 2SC2879 Q6,7 : 2SD1406(Y) Q8,9 : AN7805  
 D1 : MV-5T D2,3 : SV-03YS D4,5 : 1S1555 D6 : SG-5LR D7 : MTZ8.2JA  
 TH1 : 5TP41L

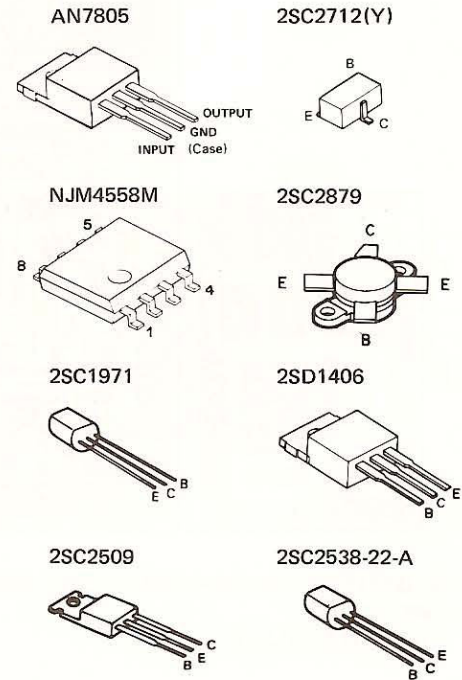
K1, D4, CN4, 50D : TS-680S only  
 W2, 3 : TS-140S only

X45-3100-00  
 J25-6582-12

## FAN (X59-3370-00) Component side view

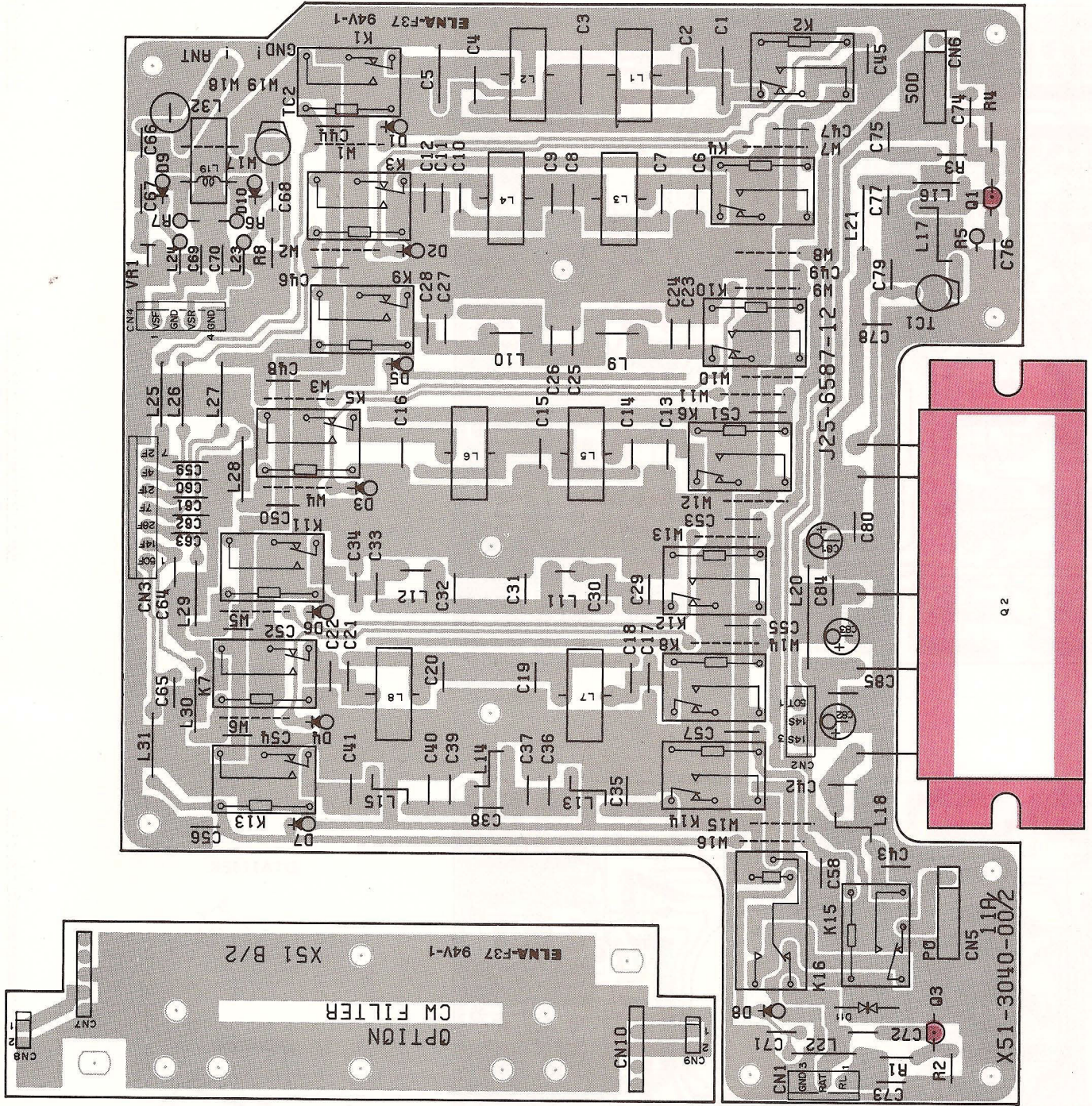


Q1 : 2SC2712(Y)  
 IC1 : NJM4558M





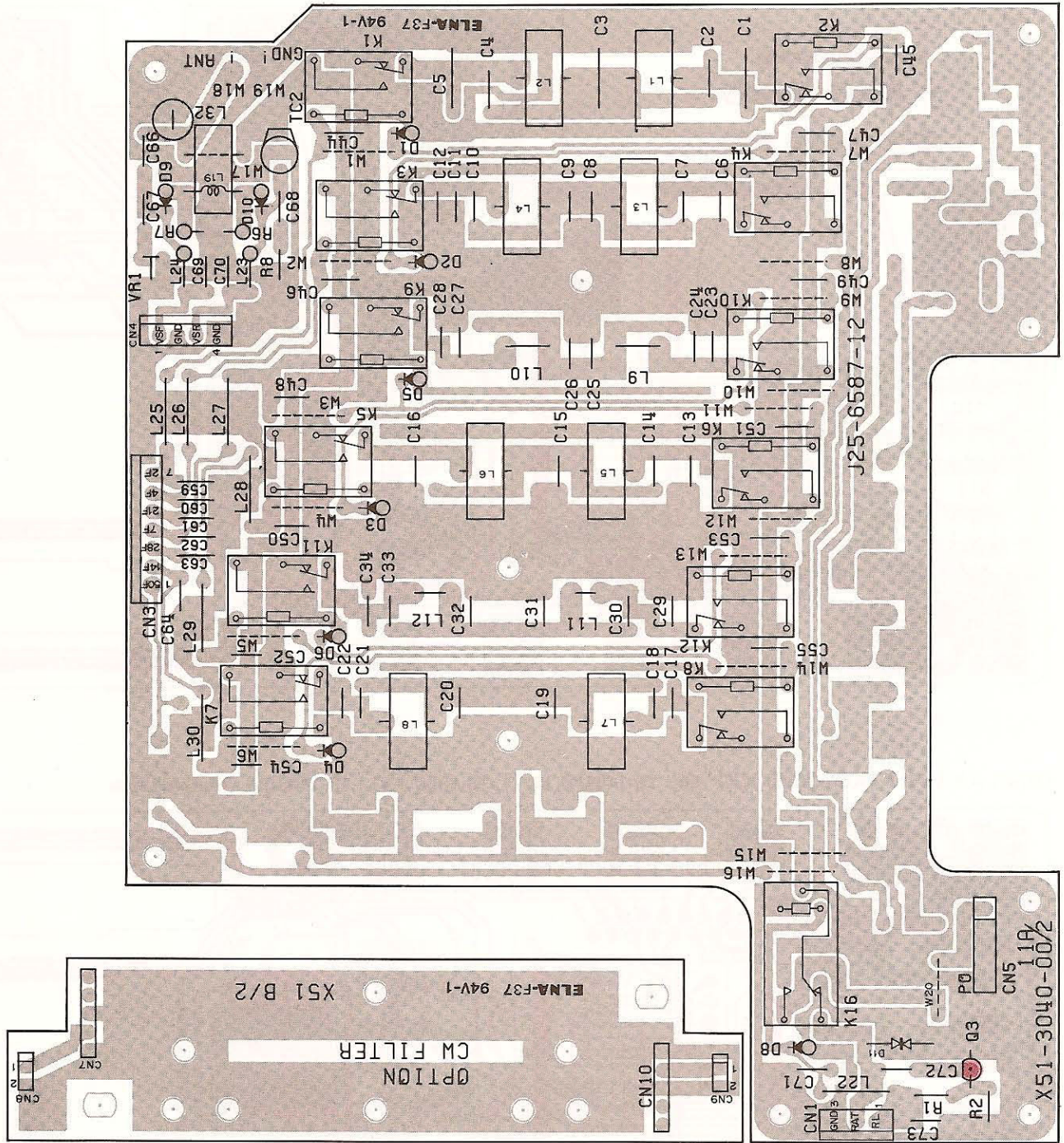
FILTER UNIT (X51-3040-00) : TS-680S Component side view



- Q1 : 2SC2538-22-A Q2 : M57735 Q3 : 2SC2459(BL)  
 D1-8 : 1S1555 D9,10 : 1SS101 D11 : DSP301N

# PC BOARD VIEWS TS-140S/680S

FILTER UNIT (X51-3040-11) : TS-140S Component side view

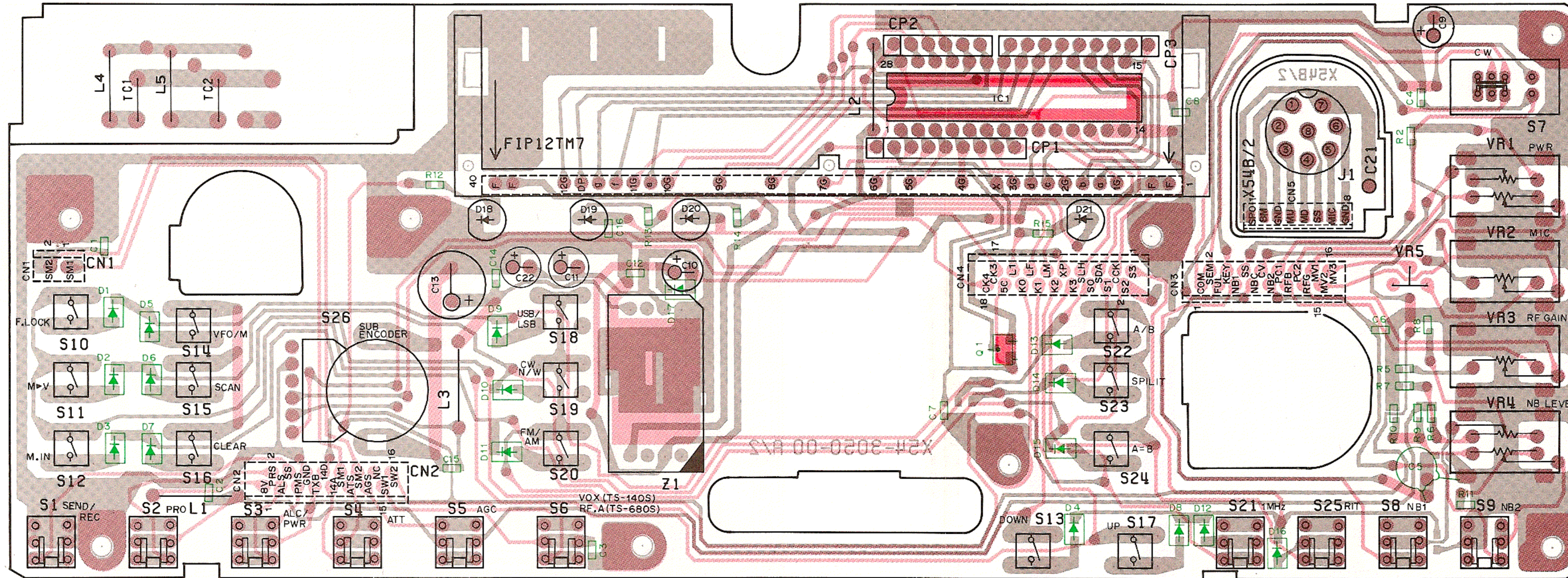


Q3 : 2SC2459(BL)

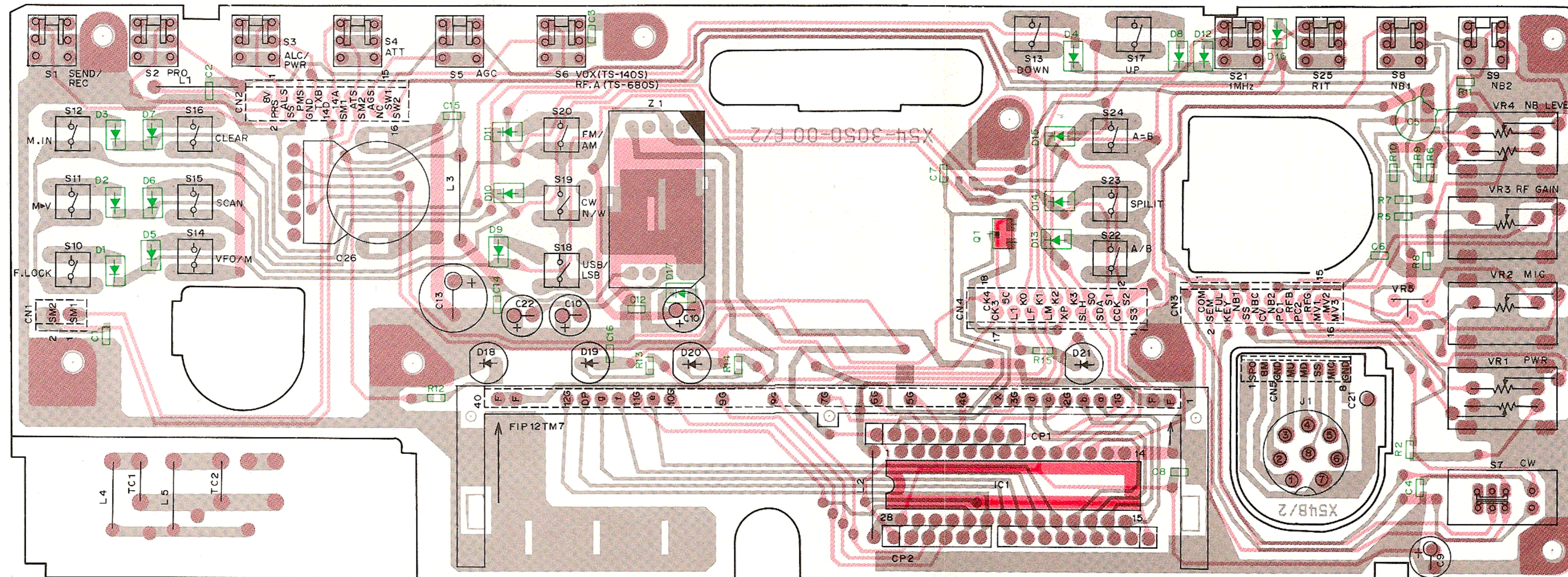
D1-6,8 : 1S1555 D9,10 : 1SS101 D11 : DSP301N

# TS-140S/680S PC BOARD VIEWS

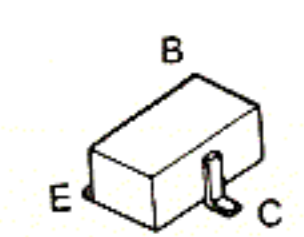
DISPLAY UNIT (X54-3050-XX) -00 : TS-140S(K, M, T), TS-680S -61 : TS-140S(W) Component side view



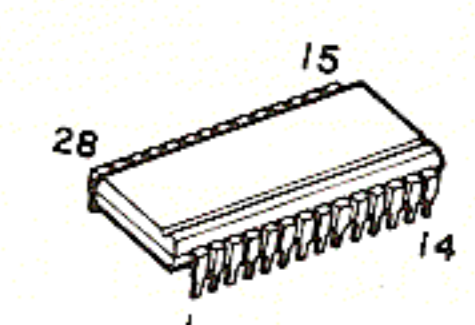
DISPLAY UNIT (X54-3050-XX) -00 : TS-140S(K, M, T), TS-680S -61 : TS-140S(W) Foil side view



DTA114EK



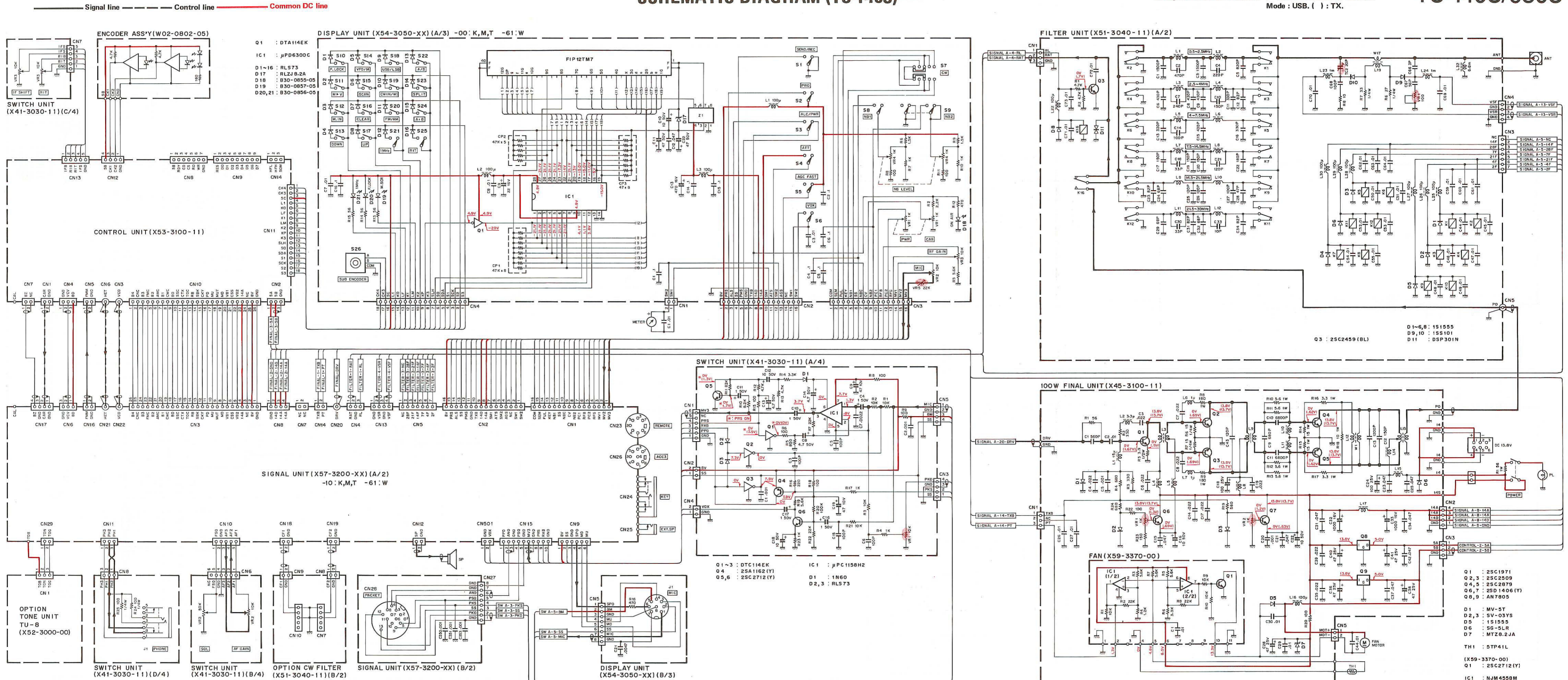
μPD6300C



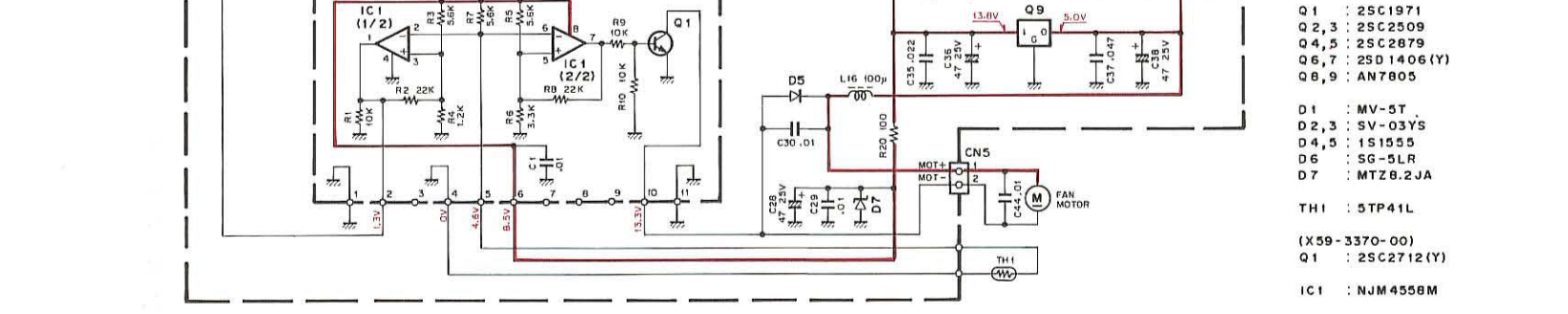
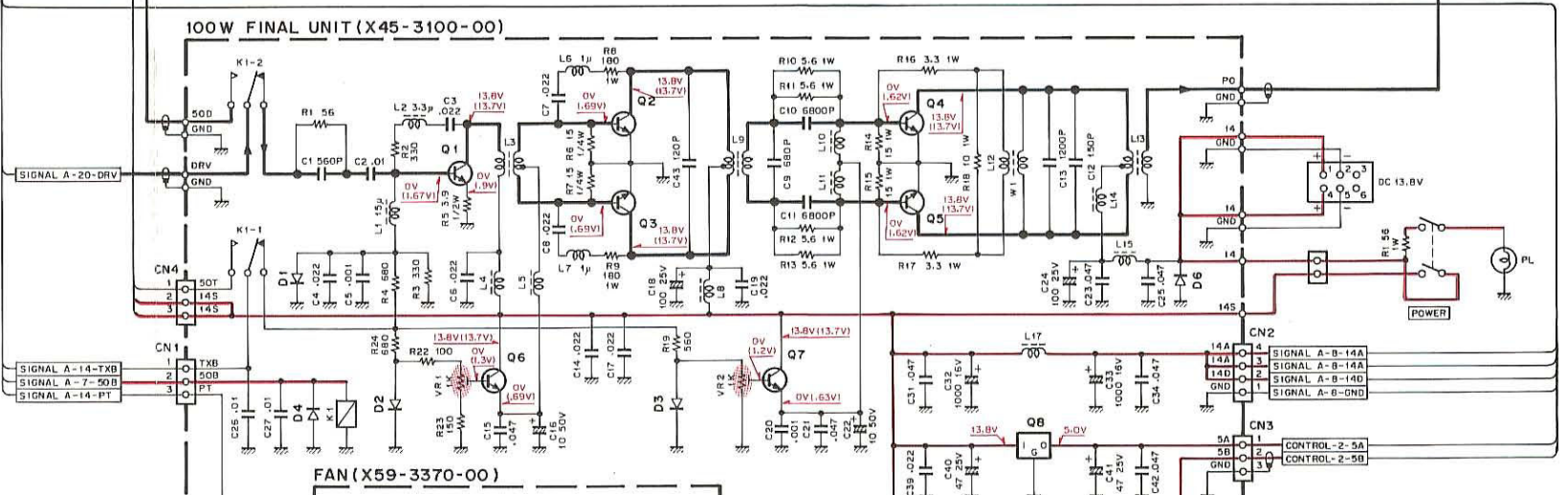
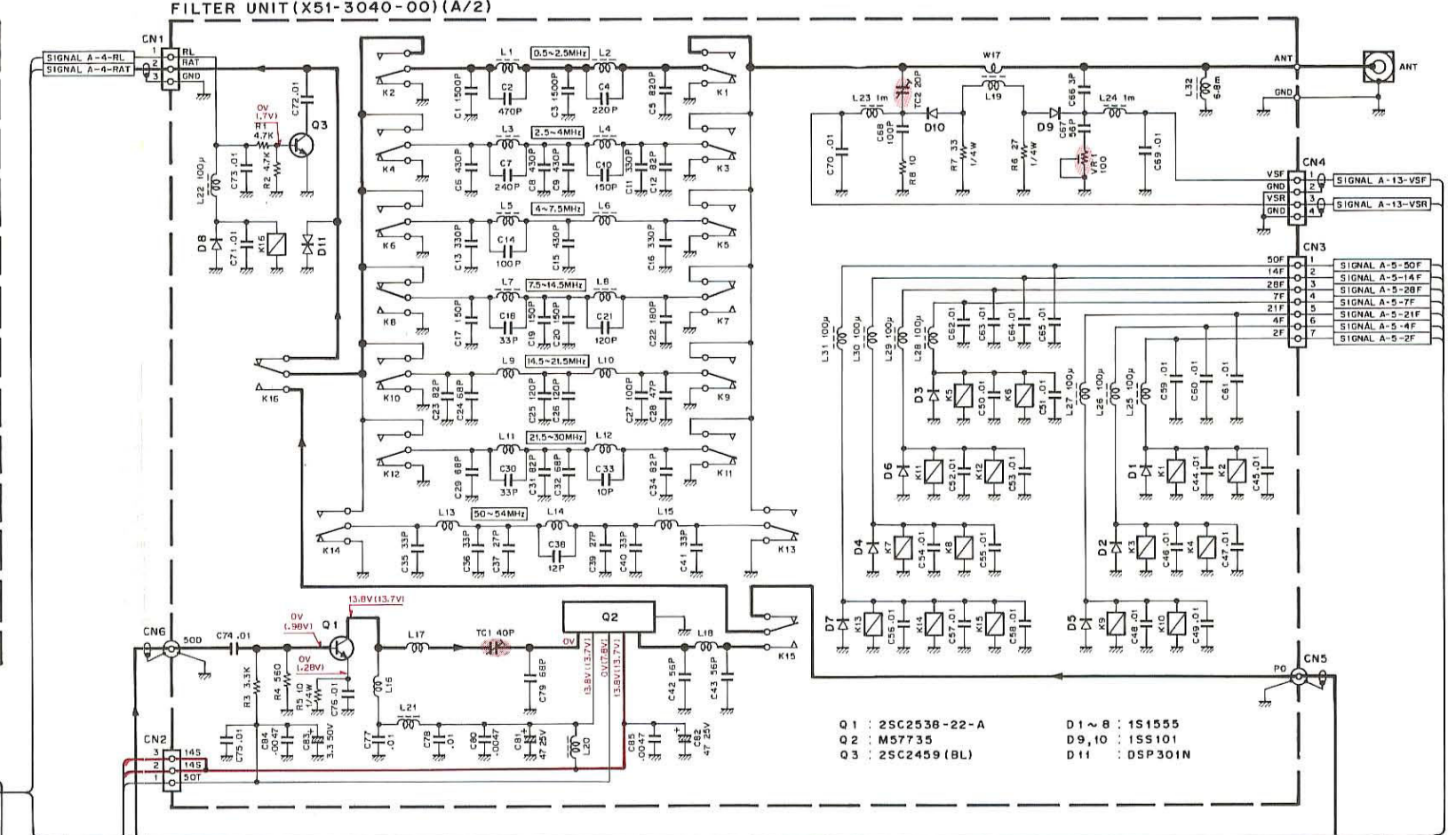
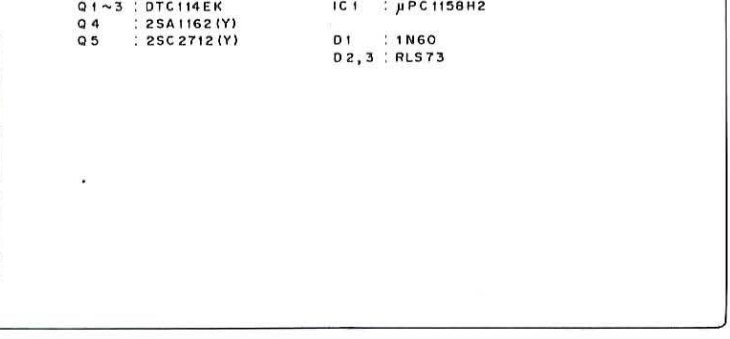
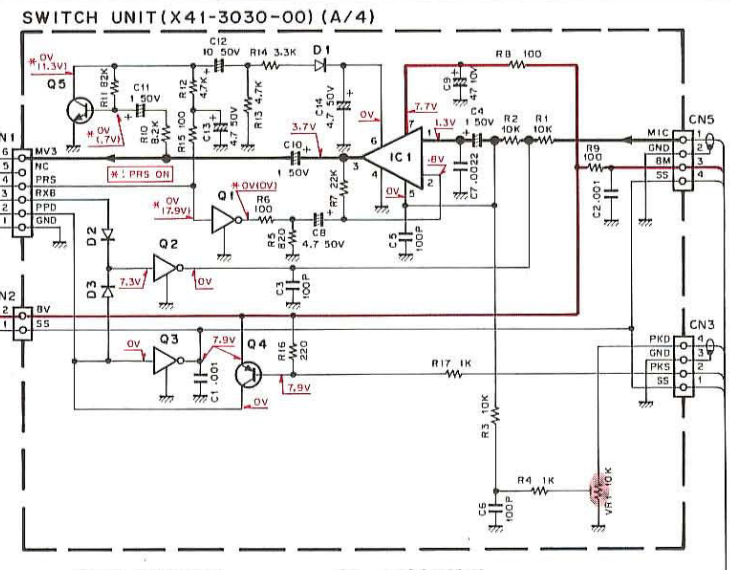
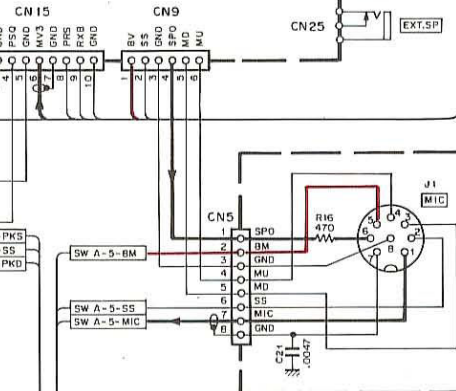
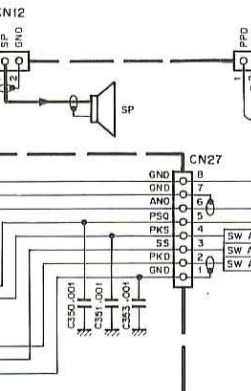
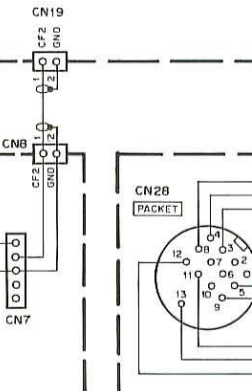
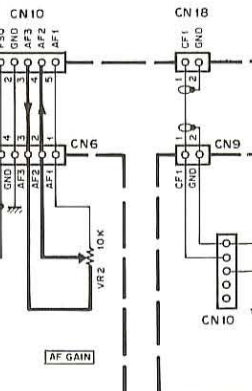
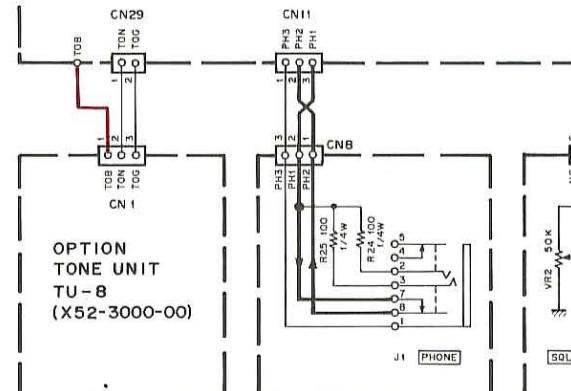
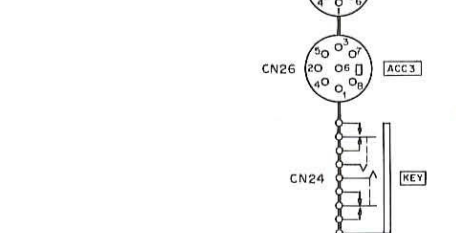
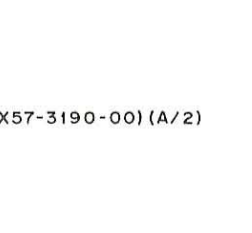
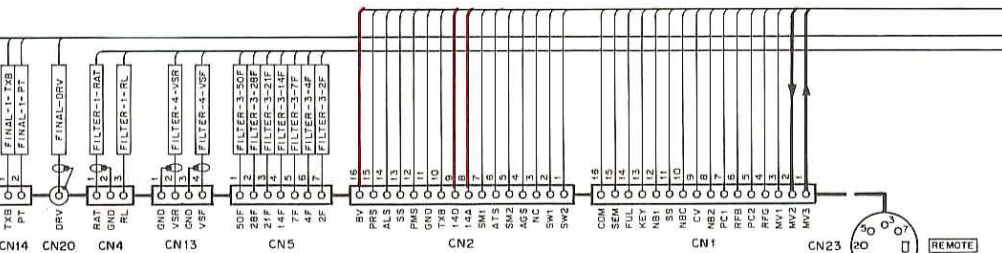
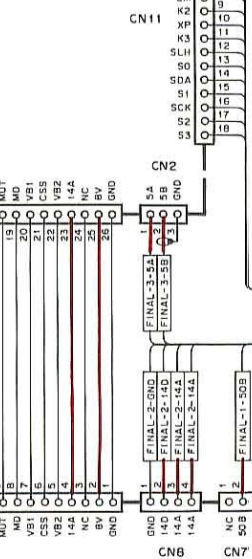
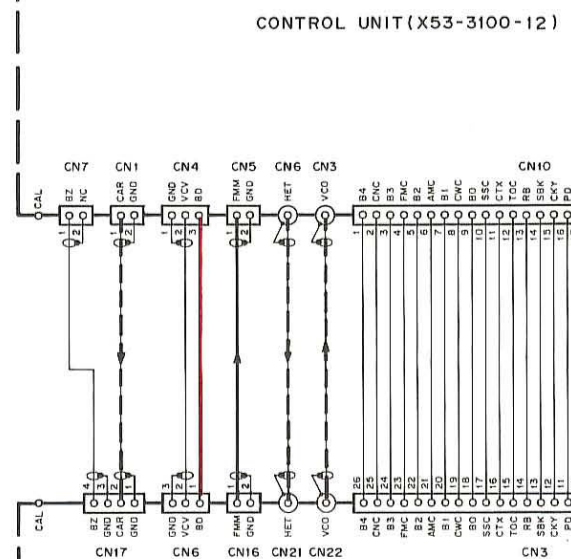
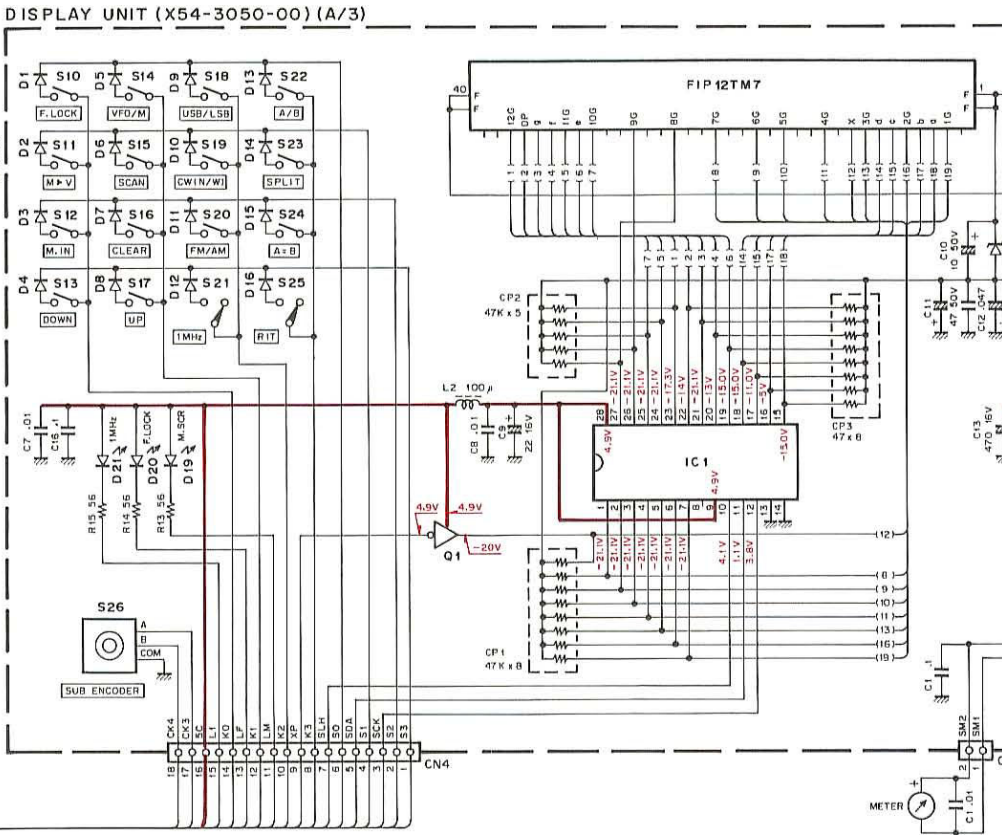
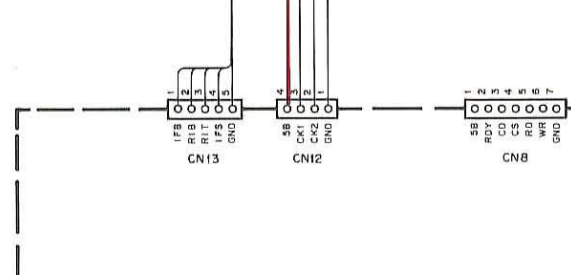
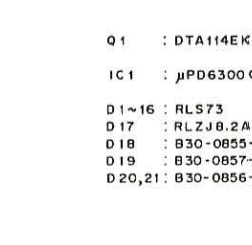
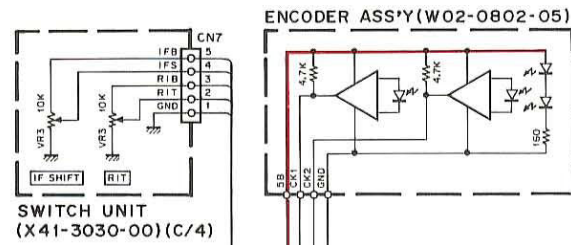
# SCHEMATIC DIAGRAM (TS-140S)

TS-140S/680S

Voltage measurement condition f= 14MHz, SSB MIC GAIN MIN.  
Mode : USB ( ) : TX.

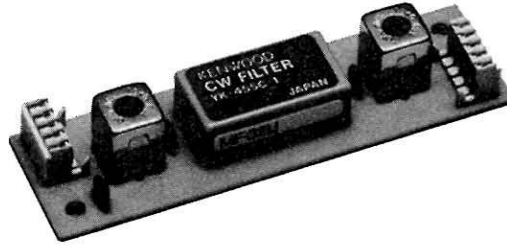


Signal line ——— Control line ——— Common DC line ———



## TK-455C-1 (CW FILTER)

### YK-455C-1 EXTERNAL VIEW

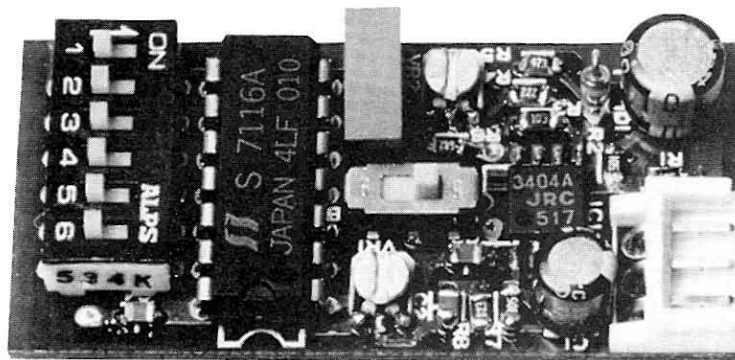


### YK-455C-1 ELECTRICAL CHARACTERISTICS

| Item                          | Rating                               |
|-------------------------------|--------------------------------------|
| Nominal center frequency (fo) | 455kHz                               |
| Center frequency declination  | Within fo ± 0.1kHz at 6dB            |
| 6dB pass bandwidth            | fo ± 0.25kHz or more                 |
| 60dB attenuation bandwidth    | fo ± 1.1kHz or less                  |
| Ripple                        | 3dB or less<br>at within fo ± 0.2kHz |
| Insertion loss                | 8dB or less                          |
| Spurious attenuation          | 70dB or more<br>at within fo ± 60kHz |
| I/O terminating impedance     | 2kΩ ± 5%                             |

## TU-8 (TONE UNIT)

TU-8 EXTERNAL VIEW



### TU-8 SPECIFICATIONS

|  |   |
|--|---|
| <b>Frequency range</b> . . . . .       | 38CH in 67.0–250.3Hz and 1750Hz, 1800Hz               |
| <b>Frequency Deviation</b> . . . . .   | Within $\pm 0.5\%$                                    |
| <b>Max. Output Power</b> . . . . .     | 2.0V <sub>rms</sub> $\pm 5\%$ at 1800Hz/1.5k $\Omega$ |
| <b>Operating temperature</b> . . . . . | –20°C to +60°C  |
| <b>Power Supply Voltage</b> . . . . .  | 8V $\pm 5\%$  |
| <b>Semi-conductors</b> . . . . .       | ICs : 2 Diode : 1                                     |
| <b>Weight</b> . . . . .                | Approx. 10 grams                                      |
| <b>Dimensions</b> . . . . .            | 45 mm W<br>22 mm D<br>8 mm H (without cushion, etc.)  |

## TU-8 (TONE UNIT)

### TU-8 CIRCUIT DISCRIPTION

The TU-8 is a tone unit designed for the repeater operation of the TS-140S/680S.

#### ● Outline

1. A six position DIP switch (Fig. 1) has been provided to allow selection of the desired tone frequency, 40 different frequencies are available (See Table 1.).  
Use the DIP switch and Table 1 to select the desired tone frequency.

| Freq. (Hz) | P1 | P2 | P3 | P4 | P5 | P6 | Freq. (Hz) | P1 | P2 | P3 | P4 | P5 | P6 |
|------------|----|----|----|----|----|----|------------|----|----|----|----|----|----|
| 67.0       | 1  | 0  | 0  | 0  | 0  | 0  | 136.5      | 1  | 0  | 1  | 0  | 1  | 0  |
| 71.9       | 0  | 1  | 0  | 0  | 0  | 0  | 141.3      | 0  | 1  | 1  | 0  | 1  | 0  |
| 74.4       | 1  | 1  | 0  | 0  | 0  | 0  | 146.2      | 1  | 1  | 1  | 0  | 1  | 0  |
| 77.0       | 0  | 0  | 1  | 0  | 0  | 0  | 151.4      | 0  | 0  | 0  | 1  | 1  | 0  |
| 79.7       | 1  | 0  | 1  | 0  | 0  | 0  | 156.7      | 1  | 0  | 0  | 1  | 1  | 0  |
| 82.5       | 0  | 1  | 1  | 0  | 0  | 0  | 162.2      | 0  | 1  | 0  | 1  | 1  | 0  |
| 85.4       | 1  | 1  | 1  | 0  | 0  | 0  | 167.9      | 1  | 1  | 0  | 1  | 1  | 0  |
| 88.5       | 0  | 0  | 0  | 1  | 0  | 0  | 173.8      | 0  | 0  | 1  | 1  | 1  | 0  |
| 91.5       | 1  | 0  | 0  | 1  | 0  | 0  | 179.9      | 1  | 0  | 1  | 1  | 1  | 0  |
| 94.8       | 0  | 1  | 0  | 1  | 0  | 0  | 186.2      | 0  | 1  | 1  | 1  | 1  | 0  |
| 97.4       | 1  | 1  | 0  | 1  | 0  | 0  | 192.8      | 1  | 1  | 1  | 1  | 1  | 0  |
| 100.0      | 0  | 0  | 1  | 1  | 0  | 0  | 203.5      | 0  | 0  | 0  | 0  | 0  | 1  |
| 103.5      | 1  | 0  | 1  | 1  | 0  | 0  | 210.7      | 1  | 0  | 0  | 0  | 0  | 1  |
| 107.2      | 0  | 1  | 1  | 1  | 0  | 0  | 218.1      | 0  | 1  | 0  | 0  | 0  | 1  |
| 110.9      | 1  | 1  | 1  | 1  | 0  | 0  | 225.7      | 1  | 1  | 0  | 0  | 0  | 1  |
| 114.8      | 0  | 0  | 0  | 0  | 1  | 0  | 233.6      | 0  | 0  | 1  | 0  | 0  | 1  |
| 118.8      | 1  | 0  | 0  | 0  | 1  | 0  | 241.8      | 1  | 0  | 1  | 0  | 0  | 1  |
| 123.0      | 0  | 1  | 0  | 0  | 1  | 0  | 250.3      | 0  | 1  | 1  | 0  | 0  | 1  |
| 127.3      | 1  | 1  | 0  | 0  | 1  | 0  | 1750.0     | 1  | 1  | 1  | 1  | 0  | 1  |
| 131.8      | 0  | 0  | 1  | 0  | 1  | 0  | 1800.0     | 0  | 0  | 0  | 0  | 1  | 1  |

Table 1 Program

(1 : ON 0 : OFF)

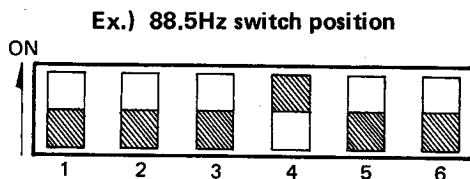


Fig. 1 DIP Switch

### TU-8 ADJUSTMENT

#### ● Deviation adjustment

The TU-8 has been present at factory for  $\pm 600\text{Hz}$ . The deviation is adjusted by with VR1 to Max.  $\pm 2\text{kHz}$  with the deviation potentiometer full clockwise when the TU-8 is installed on the TS-140S/680S.

- \*1 Tone-burst or continuous-tone selection :

A switch is provided to allow selection of either the tone-burst or continuous tone mode.

The burst duration can be adjusted by with VR2.

#### \*1 Tone-burst mode :

A tone will be generated for a brief period at the beginning of each transmission.

#### \*2 Continuous-tone mode :

A tone will be generated as long as the PTT switch is depressed. Since the tone is adjusted for a sub-audible level, this should not interfere with normal communications.

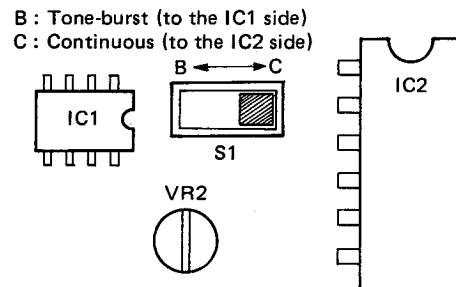


Fig. 2 Tone-burst or continuous-tone selection switch

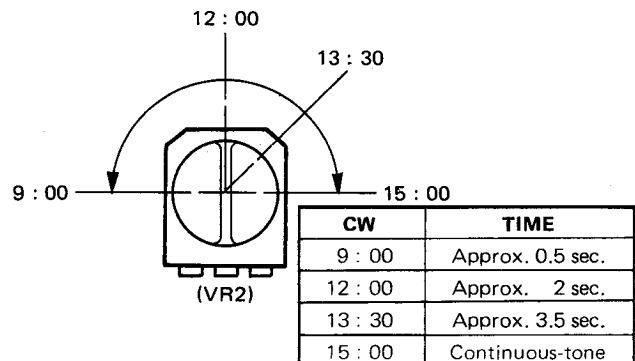


Table 2

Fig. 3 Burst time adjustment



## TU-8 (TONE UNIT)

× New Parts

Parts without Parts No. are not supplied.

Les articles non mentionnés dans le Parts No. ne sont pas fournis.

Telle ohne Parts No. werden nicht geliefert.

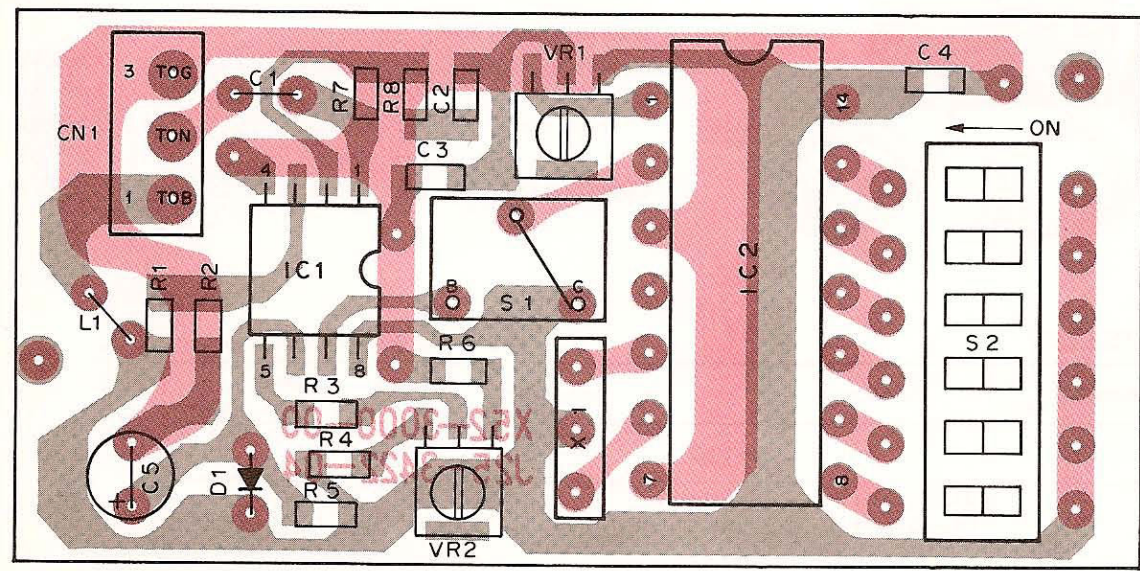
### TU-8 PARTS LIST

| Ref. No.<br>参照番号               | Address<br>位置 | New<br>Parts<br>新 | Parts No.<br>部品番号 | Description<br>部品名 / 規格      | Desti-<br>nation<br>仕向 | Re-<br>marks<br>備考 |
|--------------------------------|---------------|-------------------|-------------------|------------------------------|------------------------|--------------------|
| <b>TU-8</b>                    |               |                   |                   |                              |                        |                    |
| -                              |               | *                 | X52-3000-00       | TONE UNIT                    |                        |                    |
| <b>TONE UNIT (X52-3000-00)</b> |               |                   |                   |                              |                        |                    |
| C1                             |               |                   | CE04CW1A220M      | ELECTRØ 22ØF 10WV            |                        |                    |
| C2                             | -4            |                   | CK73FB1E103K      | CHIP C 0.010UF K             |                        |                    |
| C5                             |               |                   | CE04CW1A470M      | ELECTRØ 47ØF 10WV            |                        |                    |
| C6                             |               |                   | CC45SL1H102J      | CERAMIC 100ØF J              |                        |                    |
| L1                             |               |                   | L40-2211-17       | SMALL FIXED INDUCTØR         |                        |                    |
| X1                             |               |                   | L78-0018-05       | CERAMIC ØSCILLATØR (3.58MHZ) |                        |                    |
| R1                             | :2            |                   | RK73FB2A105J      | CHIP R 1.0M J 1/10W          |                        |                    |
| R3                             |               |                   | RK73FB2A103J      | CHIP R 10K J 1/10W           |                        |                    |
| R4                             |               |                   | RK73FB2A222J      | CHIP R 2.2K J 1/10W          |                        |                    |
| R5                             |               |                   | RK73FB2A473J      | CHIP R 47K J 1/10W           |                        |                    |
| R6                             |               |                   | RK73FB2A682J      | CHIP R 6.8K J 1/10W          |                        |                    |
| R7                             |               |                   | RK73FB2A105J      | CHIP R 1.0M J 1/10W          |                        |                    |
| R8                             |               |                   | RK73FB2A823J      | CHIP R 82K J 1/10W           |                        |                    |
| VR1                            | :2            | *                 | R12-4418-05       | TRIMMING PØT (50K)           |                        |                    |
| S1                             |               |                   | S31-1411-05       | SLIDE SWITCH (3P)            |                        |                    |
| S2                             |               | *                 | S59-6401-05       | DIP SWITCH (SSGM16 6P)       |                        |                    |
| D1                             |               |                   | 1SS133            | DIØDE                        |                        |                    |
| IC1                            |               | *                 | NJM3404AM         | IC(ØP AMP X2)                |                        |                    |
| IC2                            |               |                   | S7116A            | IC(TØNE ENCØDER)             |                        |                    |

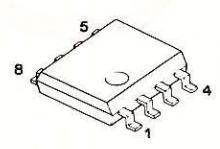
## TU-8 (TONE UNIT)

### TU-8 PC BOARD VIEW

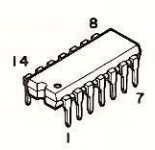
### TONE UNIT (X52-3000-00) Component side view



NJM3404AM

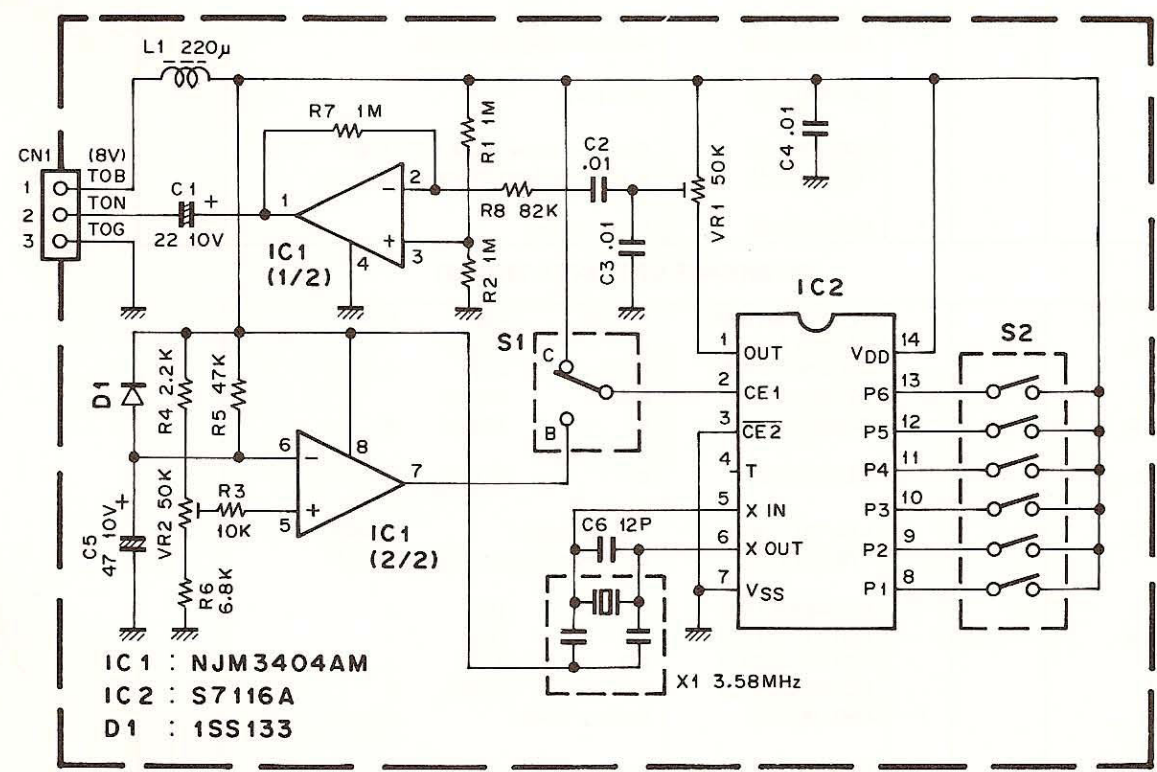


S7116A



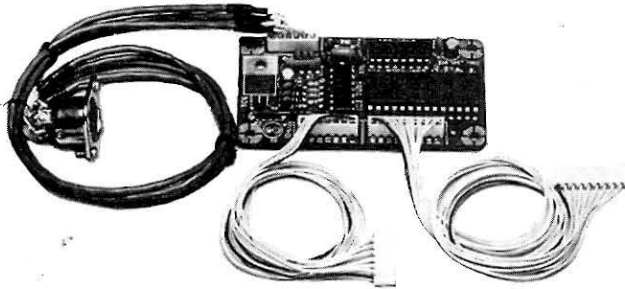
### TU-8 SCHEMATIC DIAGRAM

### TONE UNIT (X52-3000-00)



## IF-10C (INTERFACE KIT)

### IF-10C EXTERNAL VIEW



### IF-10C SPECIFICATIONS

|                        |                      |
|------------------------|----------------------|
| Power requirement      | DC 5.0V (4.5 ~ 5.5V) |
| Current drain          | 100mA                |
| Interface signal level |                      |
| Output signal          | "L" level 0 ~ 0.4V   |
|                        | "H" level 2.4 ~ 5V   |
| Input signal           | "L" level 0 ~ 0.8V   |
|                        | "H" level 2 ~ 5V     |
| Operating temperature  | -10°C ~ +50°C        |

### IF-10C PARTS LIST

\* : New Parts

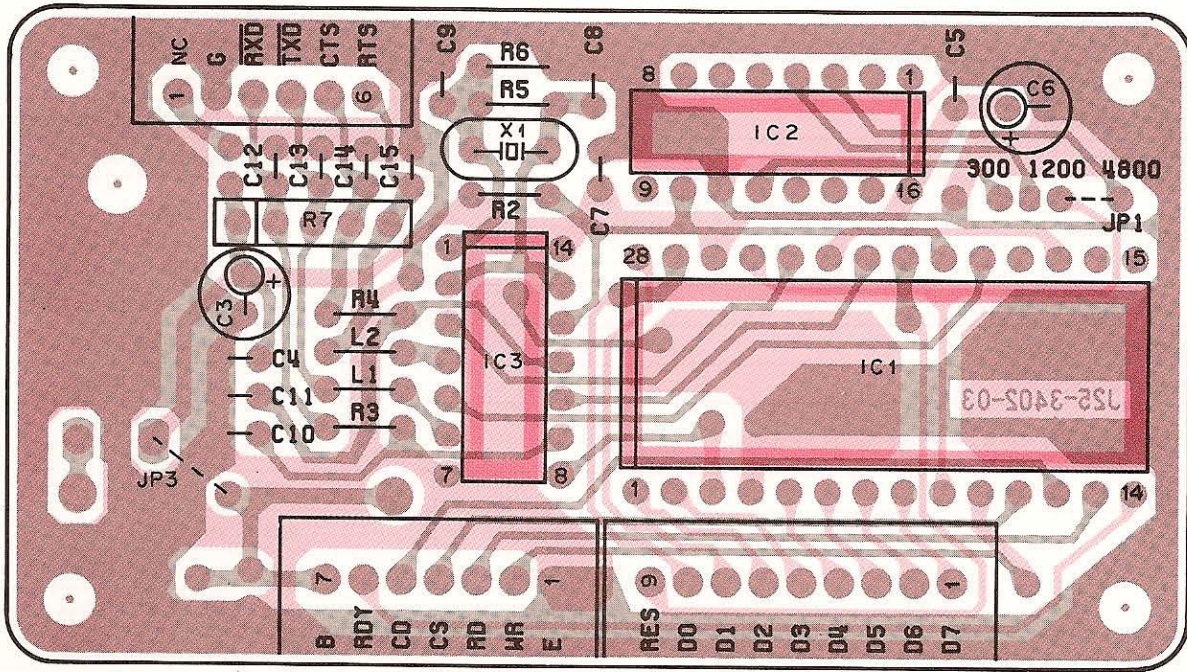
Parts without Parts No. are not supplied.

| Ref. No.                            | Address | New Parts | Parts No.                  | Description                         | Destination | Remarks |
|-------------------------------------|---------|-----------|----------------------------|-------------------------------------|-------------|---------|
| <b>IF-10C</b>                       |         |           |                            |                                     |             |         |
|                                     |         | *         | B42-3317-04<br>B42-3319-04 | Serial plate<br>Plate               | K           |         |
|                                     |         |           | CK45F1H103Z                | C            0.01μF    Z (DIN)      |             |         |
|                                     |         | *         | E06-0655-05                | 6P DIN Connector                    |             |         |
|                                     |         | *         | E31-3331-05                | Connector with lead (DIN)           |             |         |
|                                     |         | *         | E31-3333-05                | Connector with lead 7P              |             |         |
|                                     |         | *         | E31-3334-05                | Connector with lead 9P              |             |         |
|                                     |         | *         | H13-0804-04                | Protection plate                    |             |         |
|                                     |         | *         | H25-0711-04                | Antistatic bag                      |             |         |
|                                     |         | *         | H25-0712-04                | Antistatic bag (PC board)           |             |         |
|                                     |         |           | J61-0307-05                | Wire band                           |             |         |
|                                     |         |           | N30-2605-41                | Pan head screw M2.6 x 5 (DIN)       |             |         |
|                                     |         |           | N87-2606-46                | Brazier head taptite screw φ2.6 x 6 |             |         |
|                                     |         | *         | X57-1160-02                | Interface unit                      |             |         |
| <b>INTERFACE UNIT (X57-1160-02)</b> |         |           |                            |                                     |             |         |
| C3                                  |         |           | CE04CW0J470M               | Electro    47μF    6.3WV            |             |         |
| C4, 5                               |         |           | C91-0117-05                | C            0.01μF                 |             |         |
| C6                                  |         |           | CE04CW0J470M               | Electro    47μF    6.3WV            |             |         |
| C7                                  |         |           | C91-0117-05                | C            0.01μF                 |             |         |
| C8, 9                               |         |           | CK45B1H102K                | C            1000pF    K            |             |         |
| C10 - 15                            |         |           | C91-0117-05                | C            0.01μF                 |             |         |
| L1, 2                               |         |           | L40-1011-16                | Ferri-inductor            100μH     |             |         |
| X1                                  |         | *         | L78-0015-05                | Ceramic resonator CSA2.45MG11       |             |         |
| R2                                  |         |           | RD14BB2C103J               | RD            10K        J          |             |         |
| R3, 4                               |         |           | RD14BB2C101J               | RD            100        J          |             |         |
| R5                                  |         |           | RD14BB2C222J               | RD            2.2K       J          |             |         |
| R6                                  |         |           | RD14BB2C472J               | RD            4.7K       J          |             |         |
| R7                                  |         | *         | R90-0597-05                | Resistor block            1K x 4    |             |         |
| JP1, 3                              |         |           | R92-1061-05                | Jumper wire                         |             |         |
| IC1                                 |         | *         | μPD8251AFC                 | IC                                  |             |         |
| IC2                                 |         | *         | TC4040BP                   | IC                                  |             |         |
| IC3                                 |         | *         | HD7404P                    | IC                                  |             |         |

## IF-10C (INTERFACE KIT)

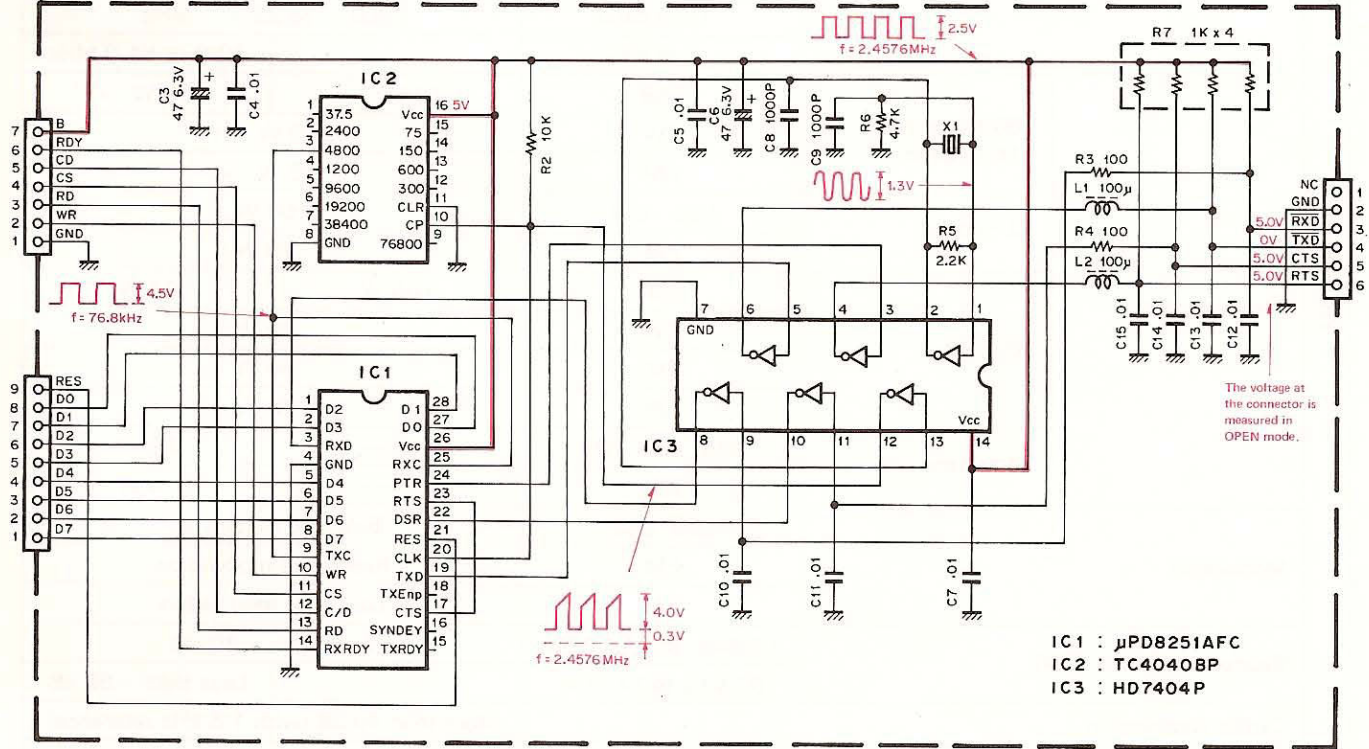
### IF-10C PC BOARD VIEW

#### INTERFACE UNIT (X57-1160-02)



### IF-10C SCHEMATIC DIAGRAM

#### INTERFACE UNIT (X57-1160-02)



## SPECIFICATIONS

| Specifications                   |   | Model                                    | TS-140S  | TS-680S              |                  |
|----------------------------------|---|--|--|----------------------|------------------|
| General                          | Mode  |  | J3E (LSB, USB), A1A (CW), A3E (AM), F3E (FM)     |                      |                  |
|                                  | Antenna impedance                             |  | 50 ohms  |                      |                  |
|                                  | Power requirement                             |  | 12 to 16 VDC (13.8 VDC reference)                |                      |                  |
|                                  | Grounding                                     |  | Negative   |                      |                  |
|                                  | Current drain                                 | Receive mode with no input signal        |  | 1.5 A                |                  |
|                                  |   | Transmit mode                            |  | 20 A                 |                  |
|                                  | Operating temperature                         |  | -10 to +50°C (+14 to +122°F)                     |                      |                  |
|                                  | Frequency stability                           |  | Less than ±10 PPM                                |                      |                  |
|                                  | Frequency accuracy                            |  | Less than ±10 PPM                                |                      |                  |
|                                  | Dimensions (W × H × D) (Projections included) |  | 281 × 107 × 305 mm<br>(11-1/16" × 4-7/32" × 12") |                      |                  |
|                                  | Weight  |  | 6.1 kg (13.4 lbs)                                |                      |                  |
| Transmitter                      | Frequency range                               |  | 160 m band                                       | 1.8 to 2.0 MHz       |                  |
|                                  |   |  | 80 m band  | 3.5 to 4.0 MHz       |                  |
|                                  |   |  | 40 m band  | 7.0 to 7.3 MHz       |                  |
|                                  |   |  | 30 m band  | 10.1 to 10.15 MHz    |                  |
|                                  |   |  | 20 m band  | 14.0 to 14.35 MHz    |                  |
|                                  |   |  | 17 m band  | 18.068 to 18.168 MHz |                  |
|                                  |   |  | 15 m band  | 21.0 to 21.45 MHz    |                  |
|                                  |   |  | 12 m band  | 24.89 to 24.99 MHz   |                  |
|                                  |   |  | 10 m band  | 28.0 to 29.7 MHz     |                  |
|                                  |   |  | 6 m band   | —                    | 50.0 to 54.0 MHz |
|                                  | Output power                                  | 160 m band ~<br>15 m band                | SSB  | 110 W *1             | 100 W *1         |
|                                  |   |  | CW   | 100 W *1             |                  |
|                                  |   |  | AM   | 40 W *1              |                  |
|                                  |   | 12 m band                                | SSB · CW   | 100 W                |                  |
|                                  |   |  | AM   | 40 W                 |                  |
|                                  |   | 10 m band                                | SSB  | 100 W                | 95 W             |
|                                  |   |  | CW   | 95 W                 |                  |
|                                  |   |  | FM   | 50 W                 |                  |
|                                  |   |  | AM   | 40 W                 |                  |
|                                  |   | 6 m band                                 | SSB · CW · FM                                    | —                    | 10 W             |
|                                  | AM  |  | —  | 4 W                  |                  |
|                                  | Modulation                                    | LSB, USB                                 |  | Balanced modulation  |                  |
|                                  |   | FM                                       |  | Reactance modulation |                  |
| AM                               |   | Low level modulation                     |  |                      |                  |
| Spurious radiation (CW)          | 1.9 MHz to 29.7 MHz                           |  | Less than -40 dB                                 |                      |                  |
|                                  | 50 MHz to 54 MHz                              |  | —  | Less than -60 dB     |                  |
| Carrier suppression              |   | More than 40 dB (with 1.5 kHz reference) |  |                      |                  |
| Unwanted sideband suppression    |   | More than 50 dB (with 1.5 kHz reference) |  |                      |                  |
| Maximum frequency deviation (FM) |   | ±5 kHz                                   |  |                      |                  |
| Frequency response (-6 dB)       |   | 400 to 2600 Hz                           |  |                      |                  |
| Microphone impedance             |   | 500 ohms to 50 kΩ                        |  |                      |                  |

## SPECIFICATIONS

| Specifications           |                                  | Model                           | TS-140S                                   | TS-680S                               |
|--------------------------|----------------------------------|---------------------------------|---|---------------------------------------|
| Circuitry                |                                  |                                 | Double conversion superheterodyne         |                                       |
| Frequency range          |                                  |                                 | 500 kHz to 30 MHz                         | 500 kHz to 30 MHz<br>50 MHz to 54 MHz |
| Intermediate frequency   |                                  |                                 | 1st: 40.055 MHz, 2nd: 455 kHz             |                                       |
| Receiver                 | LSB, USB, CW<br>(at 10 dB S+N/N) | 500 kHz to 1.62 MHz             | Less than 3.98 $\mu$ V                    |                                       |
|                          |                                  | 1.62 MHz to 21.5 MHz            | Less than 0.25 $\mu$ V                    |                                       |
|                          |                                  | 21.5 MHz to 30 MHz              | Less than 0.25 $\mu$ V                    | Less than 0.18 $\mu$ V *2             |
|                          |                                  | 50 MHz to 54 MHz                | ————                                      | Less than 0.16 $\mu$ V *2             |
|                          | AM<br>(at 10 dB S+N/N)           | 500 kHz to 1.62 MHz             | Less than 39.8 $\mu$ V                    |                                       |
|                          |                                  | 1.62 MHz to 21.5 MHz            | Less than 2.5 $\mu$ V                     |                                       |
|                          |                                  | 21.5 MHz to 30 MHz              | Less than 2.5 $\mu$ V                     | Less than 1.78 $\mu$ V *2             |
|                          |                                  | 50 MHz to 54 MHz                | ————                                      | Less than 1.58 $\mu$ V *2             |
|                          | FM<br>(at 12 dB SINAD)           | 21.5 MHz to 30 MHz              | Less than 0.35 $\mu$ V                    | Less than 0.18 $\mu$ V *2             |
|                          |                                  | 50 MHz to 54 MHz                | ————                                      | Less than 0.18 $\mu$ V *2             |
| Selectivity              | LSB, USB, CW                     | -6 dB: 2.2 kHz, -60 dB: 4.4 kHz |   |                                       |
|                          | AM                               | -6 dB: 6 kHz, -50 dB: 18 kHz    |   |                                       |
|                          | FM                               | -6 dB: 12 kHz, -50 dB: 25 kHz   |   |                                       |
| Image ratio              |                                  |                                 | More than 50 dB                           |                                       |
| 1st IF rejection         |                                  |                                 | More than 50 dB                           |                                       |
| IF SHIFT variable range  |                                  |                                 | More than $\pm$ 1.2 kHz                   |                                       |
| RIT variable range       | 10 Hz STEP                       | More than $\pm$ 1.2 kHz         |   |                                       |
|                          | 20 Hz STEP                       | More than $\pm$ 2.5 kHz         |   |                                       |
| Squelch sensitivity (FM) |                                  |                                 | Less than 0.32 $\mu$ V                    |                                       |
| Output                   |                                  |                                 | 1.5 W across 8 ohms load (10% distortion) |                                       |
| Output load impedance    |                                  |                                 | 8 ~ 16 ohms                               |                                       |

### Notes:

- \*1: The output power on the 160 m band is limited to 10 W depending on local regulations.
- \*2: This is valuable when the RF AMP switch is turned ON.
- Circuit and ratings are subject to change without notice due to advancements in technology.

### ACCESSORIES

Unpack your TS-140S/680S carefully and confirm that it is supplied with the following accessories.

|   |                   |        |
|---|-------------------|--------|
| Dynamic microphone (Except European and U.K. version) ..... | T91-0352-05 ..... | 1 ea.  |
| DIN plug (7-pin) .....                                      | E07-0751-05 ..... | 1 ea.  |
| DIN plug (13-pin) .....                                     | E07-1351-05 ..... | 1 ea.  |
| DC power cable assembly .....                               | E30-2065-05 ..... | 1 ea.  |
| Calibration cable.....                                      | E31-2154-05 ..... | 1 ea.  |
| Fuse (20A).....   | F05-2036-05 ..... | 1 ea.  |
| Instruction manual.....                                     | B50-8199-XX ..... | 1 copy |
| Warranty card (U.S.A. only).....                            |                   | 1 ea.  |

After unpacking

Shipping container:

Save the boxes and packing in the event your unit needs to be transported for remote operation, maintenance, or service.

**TS-140S/680S**

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