



SERVICE MANUAL

VHF TRANSCEIVER

IC-H28

INTRODUCTION

This service manual describes the latest information for the **IC-H28** VHF TRANSCEIVER at the time of publication.

DANGER

NEVER connect the transceiver to an AC outlet or to a DC power supply that uses more than 9 V. This will ruin the transceiver.

DO NOT expose the transceiver to rain, snow or any liquids.

DO NOT reverse the polarities of the power supply when connecting the transceiver.

DO NOT apply an RF signal of more than 20 dBm (100 mW) to the antenna connector. This could damage the transceiver's front end.

INTRINSICALLY SAFE QUALIFICATION

When servicing the **IC-H28**, the following conditions must be met.

Failing to satisfy any of these conditions will invalidate the INTRINSICALLY SAFE certification.

1. Servicing the transceiver should only be undertaken by suitably qualified personnel in a non-hazardous area. Never attempt to remove the case in a hazardous area.
2. **ONLY** the approved battery, ICOM's CM-92 or CM-97 may be removed or charged in a safe area.
3. **USE ONLY** safety critical components as specified in the parts list (SECTION 5), should replacement of any item be necessary.

ORDERING PARTS

Be sure to include the following four points when ordering replacement parts:

1. 10-digit order numbers
2. Component part number and name
3. Equipment model name and unit name
4. Quantity required

< **SAMPLE ORDER** >

1130003830	IC	MC3372MR	IC-H28	RF UNIT	5 pieces
8810000740	Screw	PH A M2 × 15 ZK	IC-H28	Rear panel	10 pieces

Addresses are provided on the inside back cover for your convenience.

REPAIR NOTES

1. Make sure a problem is internal before disassembling the transceiver.
2. **DO NOT** open the transceiver until the transceiver is disconnected from its power source.
3. **DO NOT** force any of the variable components. Turn them slowly and smoothly.
4. **DO NOT** short any circuits or electronic parts. An insulated tuning tool **MUST** be used for all adjustments.
5. **DO NOT** keep power ON for a long time when the transceiver is defective.
6. **DO NOT** transmit power into a signal generator or a sweep generator.
7. **ALWAYS** connect a 40 dB~50 dB attenuator between the transceiver and a deviation meter or spectrum analyzer when using such test equipment.
8. **READ** the instructions of test equipment thoroughly before connecting equipment to the transceiver.



VERSIONS

VERSION NUMBER	MODEL	REGION	FREQUENCY RANGE	SUPPLIED BATTERY PACK	INTRINSICALLY SAFE
#01	IC-H28-1	U.S.A.	150~174 MHz	CM-80	NO
#02	IC-H28-2	U.S.A.	136~150 MHz	CM-80	NO
#03	IC-H28	General	150~174 MHz	CM-80	NO
#04	IC-H28	General	136~150 MHz	CM-80	NO
#11	IC-H28-1	U.S.A.	150~174 MHz	CM-92	YES
#12	IC-H28-2	U.S.A.	136~150 MHz	CM-92	YES

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SECTION 1 SPECIFICATIONS

GENERAL

- Frequency range : See VERSIONS on the right page of inside front cover.
- Type of emission : 16K0F3E (#01, #02, #11, #12), 8K50F3E (#03, #04)
- Number of channels : Up to 16 channels
- Frequency stability : $\pm 0.0005\%$
- Antenna impedance : $50\ \Omega$ (nominal)
- Usable battery pack :

BATTERY PACK	OUTPUT VOLTAGE	INTRINSICALLY SAFE
CM-80	7.2 V/600 mAh	NO
CM-92	7.2 V/600 mAh	YES
CM-97	7.2 V/1400 mAh	YES

- Usable temperature range : $-30^{\circ}\text{C}\sim+60^{\circ}\text{C}$ ($-22^{\circ}\text{F}\sim+140^{\circ}\text{F}$) (#01, #02, #11, #12)
 $-25^{\circ}\text{C}\sim+55^{\circ}\text{C}$ ($-13^{\circ}\text{F}\sim+131^{\circ}\text{F}$) (#03, #04)
- Dimensions (with CM-80) : $58\ (\text{W})\times 149\ (\text{H})\times 29\ (\text{D})\ \text{mm}$
 $2.3\ (\text{W})\times 5.9\ (\text{H})\times 1.1\ (\text{D})\ \text{in}$
- Weight (with CM-80) : 440 g (15.5 oz)

TRANSMITTER

- RF output power (at 7.2 V DC) : High: 5 W, Low 1: 2 W, Low 2: 1 W
- Modulation system : Variable reactance frequency modulation
- Current drain (at 7.2 V DC) : High: 3.5 A, Low 2: 1.8 A
- Microphone impedance : $1.2\ \text{k}\Omega$
- Maximum deviation : $\pm 5\ \text{kHz}$ (#01, #02, #11, #12), $\pm 2.5\ \text{kHz}$ (#03, #04)
- Spurious emissions : $-65\ \text{dB}$ (High), $-60\ \text{dB}$ (Low 1, Low 2)
- FM noise and hum : $-45\ \text{dB}$ (#01, #02, #11, #12), $-35\ \text{dB}$ (#03, #04)
- Audio response : $+1\ \text{dB}\sim-3\ \text{dB}$ of $+6\ \text{dB/octave}$ with 300 Hz to 3000 Hz input (#01, #02, #11, #12)
 $+1\ \text{dB}\sim-3\ \text{dB}$ of $+6\ \text{dB/octave}$ with 300 Hz to 2550 Hz input (#03, #04)

RECEIVER

- Sensitivity : $0.25\ \mu\text{V}$ for 12 dB SINAD
- Intermediate frequency : 1st 30.875 MHz, 2nd 455 kHz
- Squelch threshold sensitivity : $0.25\ \mu\text{V}$
- Modulation acceptance : $\pm 7\ \text{kHz}$
- Current drain (at 7.2 V DC) : Audio Max. 450 mA, Standby 70 mA
- Audio output power : 500 mW
- Adjacent channel selectivity : $-70\ \text{dB}$ (#01, #02, #11, #12), $-60\ \text{dB}$ (#03, #04)
- Spurious response : $-70\ \text{dB}$
- Image rejection : $-70\ \text{dB}$
- Intermodulation rejection : $-65\ \text{dB}$ (#01, #02, #11, #12), $-60\ \text{dB}$ (#03, #04)
- FM noise and hum : $-40\ \text{dB}$ (#01, #02, #11, #12), $-35\ \text{dB}$ (#03, #04)
- Audio response : $+1\ \text{dB}\sim-3\ \text{dB}$ of $-6\ \text{dB/octave}$ with 300 Hz to 3000 Hz modulation (#01, #02, #11, #12)
 $+1\ \text{dB}\sim-3\ \text{dB}$ of $-6\ \text{dB/octave}$ with 300 Hz to 2550 Hz modulation (#03, #04)

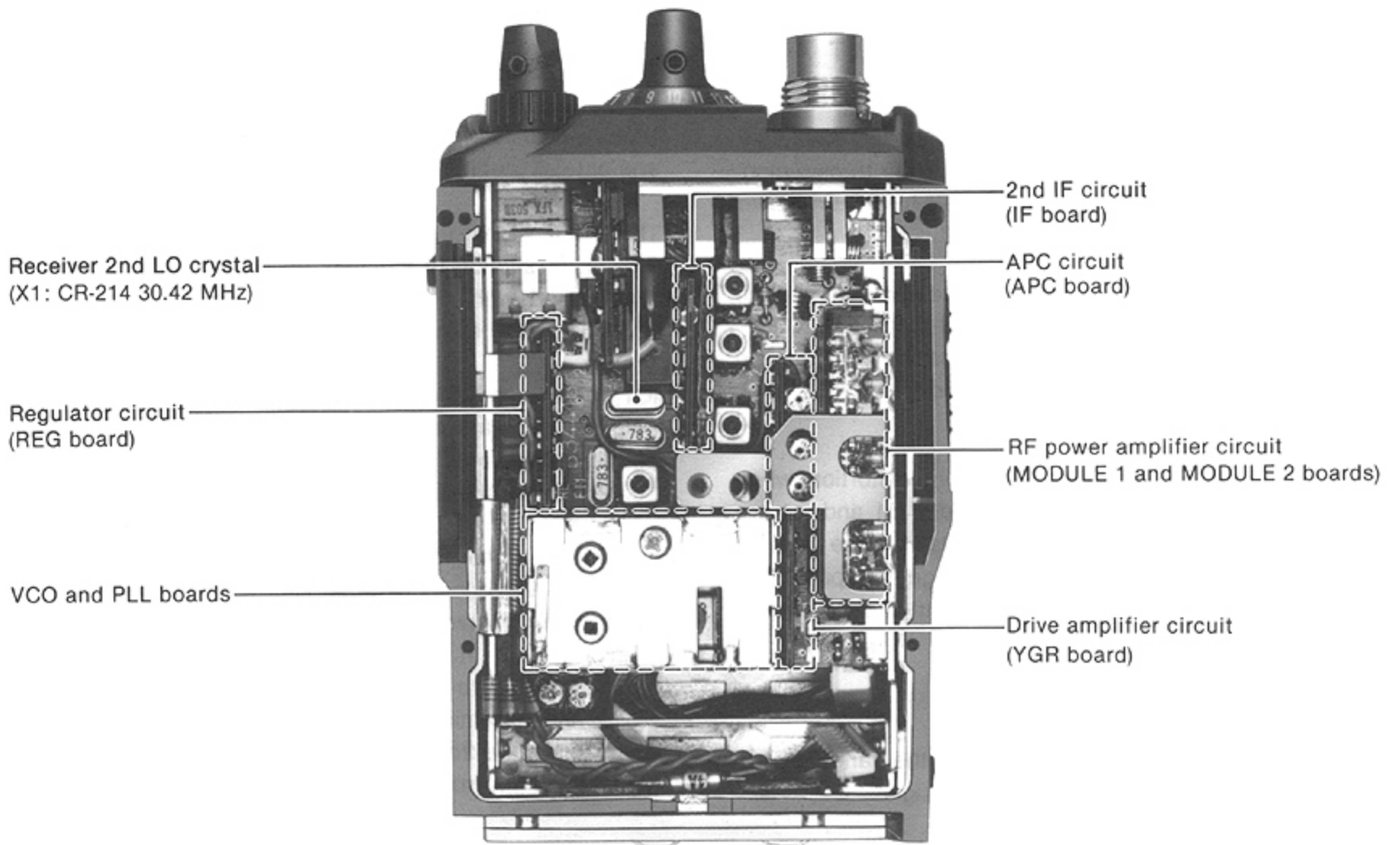
INTERNALLY SELECTABLE FUNCTIONS

The following functions are available with internal soldering. Refer to p. 7-2 for soldering points.

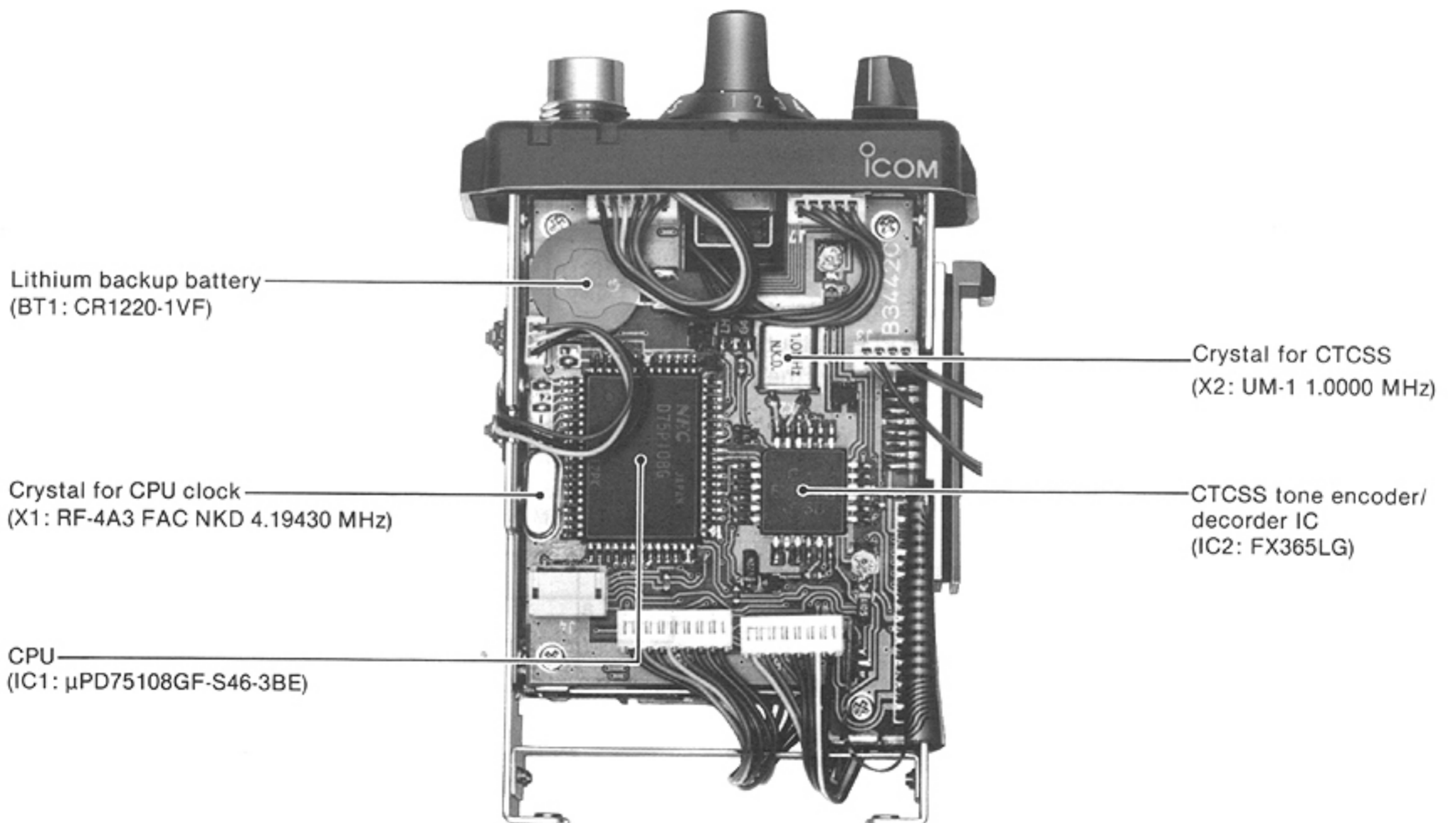
- Squelch sensitivity : Squelch threshold sensitivity and hysteresis can be selected.
- Squelch delay : Squelch open/close period can be delayed.
- Channel beep : A beep sounds each time the channel is changed.
- T.O.T. beep : A beep sounds 5 sec. before the time-out-timer activates.
- 1 W beep : A beep sounds when the manual low power is in use.
- Power saver OFF : Power saver function can be deactivated.

SECTION 2 INSIDE VIEWS

• RF UNIT



• LOGIC UNIT



SECTION 3 CIRCUIT DESCRIPTION

3-1 RECEIVER CIRCUITS

3-1-1 ANTENNA SWITCHING CIRCUIT (RF UNIT)

The antenna switching circuit functions as a low-pass filter while receiving and a resonator circuit while transmitting. The circuit does not allow transmit signals to enter receiver circuits.

Received signals from the antenna connector pass through a two-stage Chebyshev low-pass filter (L13, L14, C64~C68) to suppress out-of-band signals and are then applied to the $\lambda/4$ type antenna switching circuit (D1, D4, L12, C56, C61, C62).

D5 protects an RF amplifier (Q1) from distortion when excessively strong signals are received. D1 and D4 are turned OFF while receiving. The signals from the antenna switching circuit pass through a two-stage bandpass filter (L1, L2, D6, D7, C2~C5) to suppress out-of-band signals and are then applied to the RF circuit.

3-1-2 RF CIRCUIT (RF UNIT)

The RF circuit amplifies signals within the range of frequency coverage and filters out-of-band signals.

The RF amplifier (Q1) amplifies the RF signals with a low noise/high gain FET (3SK140). The amplified signals pass through a two-stage bandpass filter (L3, L4, D8, D9, C11~C13) to suppress out-of-band signals and are then applied to a 1st mixer circuit.

D6~D9 employ varactor diodes, that are controlled by the PLL lock voltage, to track the bandpass filters. These varactor diodes tune the center frequency of an RF passband for wide bandwidth receiving and good image rejection.

3-1-3 1ST MIXER AND IF CIRCUITS (RF UNIT)

The 1st mixer circuit converts the received signal to a fixed frequency of the 1st IF signal with a PLL output frequency. By changing the PLL frequency, only the desired frequency will be passed through a pair of crystal filters at the next stage of the 1st mixer.

The signals from the RF circuit are mixed at Q2 with a 1st LO signal coming from the VCO circuit to produce a 1st IF signal. The 1st LO signal passes through a low-pass filter (L7, C39~C41) and is then applied to the 1st mixer circuit (Q2).

The 30.875 MHz 1st IF signal is obtained at L5 and is then applied to a pair of crystal filters (F11) in order to obtain wide selection capability and to pass only the desired signal. The filtered signal passes through a 1st IF amplifier (Q3). The amplified signal is applied to a 2nd IF circuit on the IF board.

3-1-4 2ND IF AND DEMODULATOR CIRCUITS (IF BOARD AND RF UNIT)

The 2nd mixer circuit converts the 1st IF signal to a 2nd IF signal. A double superheterodyne system (which converts receive signals twice) improves the image rejection ratio and obtains stable receiver gain.

The 1st IF signal from Q3 on the RF unit is applied to a 2nd mixer section of IC1 (pin 16) on the IF board and is then mixed with a 2nd LO signal for conversion to a 455 kHz 2nd IF signal.

IC1 contains the 2nd mixer, local oscillator circuit, limiter amplifier, quadrature detector circuit and active filter circuit. The local oscillator section and X1 generate 30.42 MHz for the 2nd LO signal.

The 2nd IF signal from the 2nd mixer (IC1, pin 3) passes through a high-quality ceramic filter (F12) on the RF unit to suppress unwanted heterodyned frequency signals. It is then amplified at the limiter amplifier section (IC1, pin 5) and applied to the quadrature detector section (IC1, pin 8) and ceramic discriminator X2 on the RF unit) to demodulate the 2nd IF signal into an AF signal. The AF signal is output from IC1 (pin 9).

• 2nd IF AND DEMODULATOR CIRCUITS

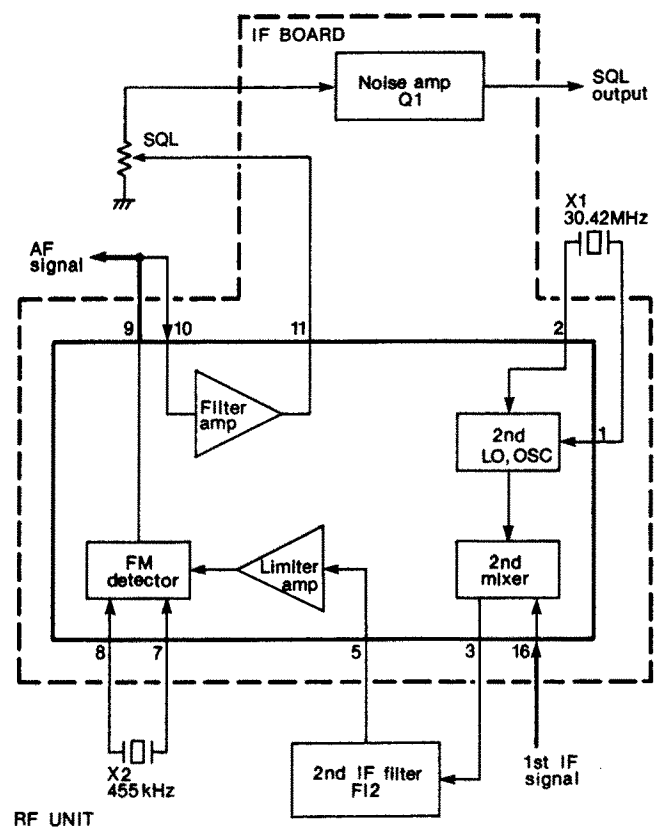


Fig. 1

3-1-5 AF CIRCUIT (RF, LOGIC UNITS AND AF BOARD)

The AF circuit de-emphasizes the demodulated signal with -6 dB/octave and power-amplifies the AF signal to drive a speaker. The AF circuit includes an AF mute circuit to mute the AF signal with a noise squelch and tone squelch (CTCSS, DTCS, etc.).

The AF signal output from IC1 (pin 9) on the IF board passes through the buffer amplifier (Q2) on the LOGIC unit and is then applied to the CTCSS tone encoder/decoder IC (IC2, pins 23, 24). Pin 23 is a speech pass filter input and pin 24 is a CTCSS decoder input. The filtered signal is output from IC2 (pin 19) and is then applied to the de-emphasis circuit (R76, C16). This de-emphasis circuit is an integrated circuit with frequency characteristics of -6 dB/octave. The resulting signal is applied to the AF mute circuit (Q2) through the active high-pass filter (Q1) on the AF board.

When a squelch is closed, Q2 cuts off the AF signal as an AF mute switch. The AF signal is applied to the [VOL] control (R21) on the RF unit and is then power-amplified at an AF power amplifier (IC1) on the AF board to drive a speaker.

Q9 and Q10 on the LOGIC unit are the switching transistors which select the internal or the external speaker. When no external speaker-microphone is connected, no voltage appears on the "S5V" line, thus Q10 is turned OFF and Q9 is then turned ON. Therefore, the internal speaker is driven by the AF signal from the AF power amplifier (IC1) on the AF board. When it is connected, voltage appears on the "S5V" line, thus Q10 is turned ON and Q9 is then turned OFF. The AF signal does not flow to the internal speaker.

3-1-6 SQUELCH CIRCUIT (IF BOARD, RF AND LOGIC UNITS)

The noise squelch circuit of the IC-H28 adopts the CPU pulse number control system to set customer requirements such as squelch sensitivity, hysteresis and open period delay.

Some noise components in the AF signal from IC1 (pin 9) on the IF board are applied to an active filter section (IC1, pin 10). It amplifies the noise components of frequency 20 kHz and above. The noise signal, output from IC1 (pin 11), passes through the [SQUELCH] control (R21 on the RF unit) and is amplified at Q1. The signal is triggered at Q15 on the LOGIC unit and is then applied to the CPU (IC1, pin 35) as the "NOISE" signal.

The CPU (IC1 in the LOGIC unit) counts the number of pulses and outputs the mute signal (RMUT) from pin 48. The AF mute circuit (Q2) on the AF board is deactivated if the "RMUT" signal is "LOW." At this time, Q5 is turned ON. The AF amplifier regulator (Q3, Q4) supplies sufficient voltage to drive an AF power amplifier (IC1).

Q8 on the RF unit turns the "MUT" line to "LOW" to activate the AF amplifier, even when the receive mute (RMUT) is activated, to sound a beep or DTMF tone.

• AF SIGNAL CURRENT

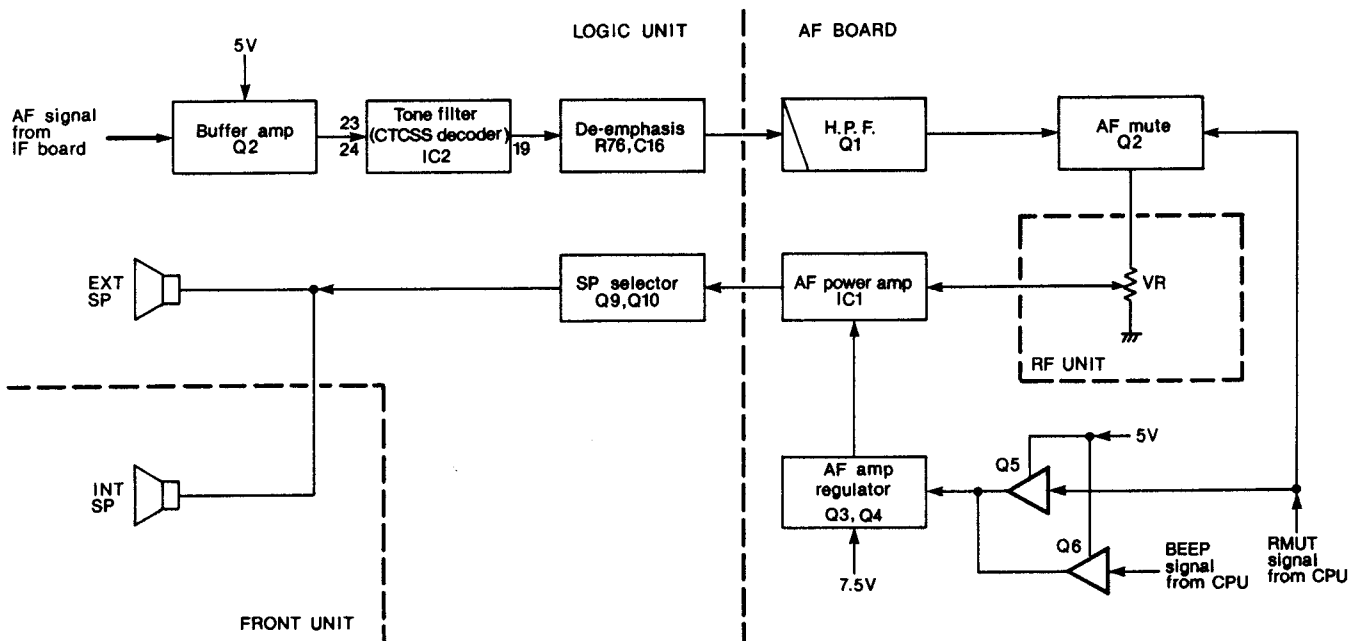


Fig. 2

3-2 TRANSMITTER CIRCUITS

3-2-1 MICROPHONE AMPLIFIER CIRCUIT (FRONT AND LOGIC UNITS)

The microphone amplifier circuit amplifies audio signals with +6 dB/octave pre-emphasis from the microphone to a level needed for the modulation circuit.

The AF signals from the microphone are applied to IC3a (pin 5). IC3a includes a low level amplifier with pre-emphasis and a limiter amplifier. Pre-emphasis is made by C34 and R60 which are connected to pin 6. The output signals from IC3a (pin 7) pass through a splatter filter circuit (IC3b) which eliminates signal components greater than 3 kHz. The "MOD" signal is output from IC3b (pin 1) and is then applied to IC7. The signal is applied to the VCO board as the "MOD1."

3-2-2 MODULATION CIRCUIT (VCO, PLL BOARDS AND RF UNIT)

The modulation circuit modulates the VCO oscillating signal (RF signal) using the microphone audio signals.

The "MOD1" signal changes the reactance of varactor diodes (D1, D5) on the VCO board to modulate the oscillated signal at the transmitter VCO (Q1). The oscillated signal is buffer-amplified at Q5 and Q6.

The "MOD2" signal line is used for a tone frequency (CTCSS, DTCS or 2-tone) and modulates the reference frequency while transmitting.

The amplified signal passes through the low-pass filter (L7, C39~C41) on the RF unit and is then applied to the transmit/receive switching circuit (D12, D13).

The signal passes through the attenuator circuit (R36~R38) and is then applied to the drive amplifier circuit on the YGR board.

3-2-3 DRIVE AMPLIFIER CIRCUIT (YGR BOARD)

The drive amplifier circuit amplifies the VCO oscillating signal to the needed level at the power amplifier.

The signal from the attenuator circuit (R36~R38) on the RF unit is amplified at a drive amplifier (Q1).

3-2-4 RF POWER AMPLIFIER (MODULE 2 BOARD)

IC1 is a power module which provides a stable 5 W (at 7.5 V DC) of output power.

The RF signal from the drive amplifier (Q1) on the YGR board is applied to the power amplifier (IC1, pin 1) on the MODULE 2 board. The amplified signal is output from IC1 (pin 5). The output signal is applied to the antenna connector through the APC circuit, the antenna switching circuit and the low-pass filter.

• MICROPHONE AMPLIFIER CIRCUIT

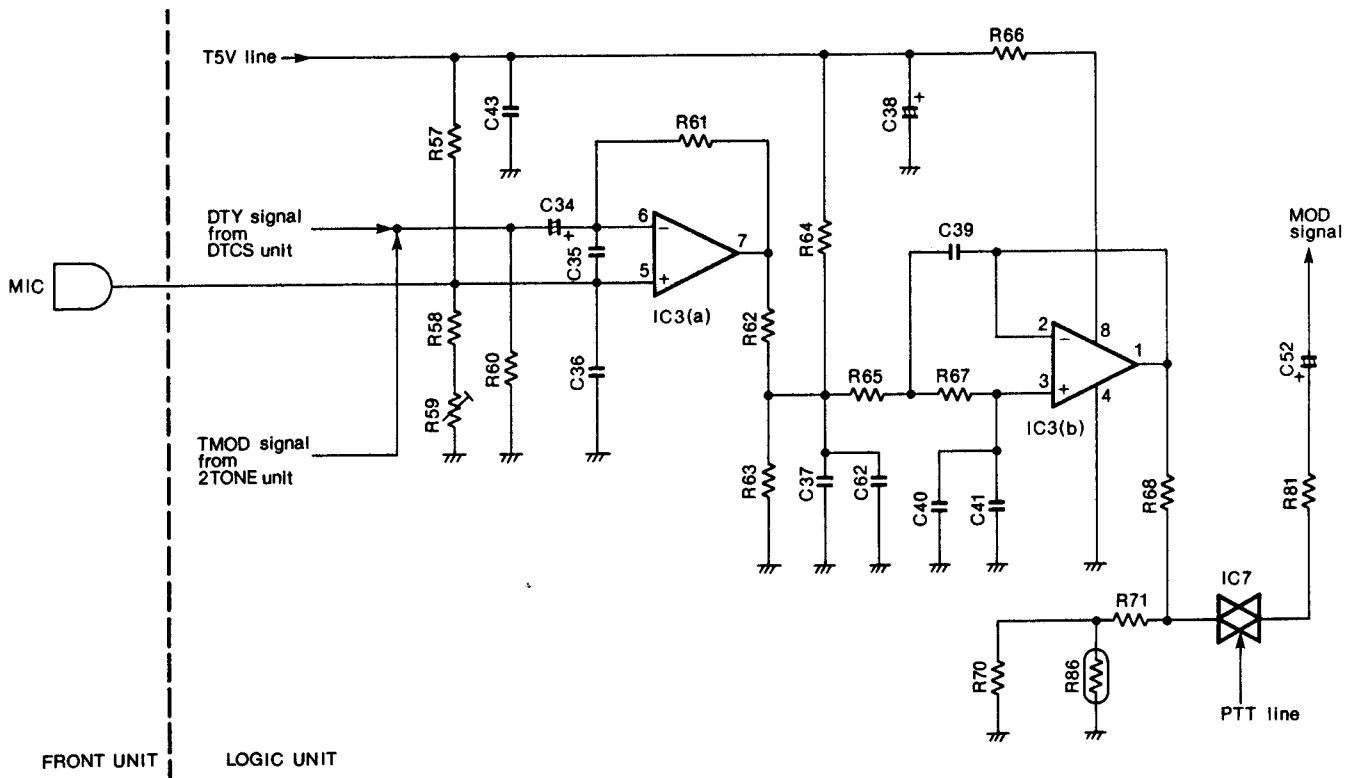


Fig. 3

3-2-5 APC CIRCUIT (APC BOARD)

The APC circuit protects the power module (IC1) on the MODULE 2 board from a mismatched output load and selects HIGH or LOW output power.

The output power from the power module (IC1, pin 5) on the MODULE 2 board is applied to the APC mismatch detector circuit (L10, D2, D3 on the RF unit) to detect a portion of the output power. When the antenna impedance is matched at 50 Ω, the detected voltage is at its minimum. However, when antenna impedance is mismatched, the detected voltage is higher than when it is matched.

The detected voltage is applied to a differential amplifier circuit (Q1, Q2) on the APC board. The APC reference voltage is determined by the power output control circuit (R1~R3) and is then applied to the base of Q1.

When the antenna impedance is mismatched, the base voltage of Q2 exceeds the reference voltage. Thus, the collector voltage of Q2 decreases.

The current from the differential amplifier circuit (Q1, Q2) is amplified at Q4 to control Q3. The control current changes the supply voltage to IC1 on the MODULE 2 board.

This decreases the output power from the power module (IC1) on the MODULE 2 board until the base voltage of Q2 reaches the same level as the voltage of Q1.

3-2-6 POWER OUTPUT CONTROL CIRCUIT (APC BOARD)

The power output control circuit (R1~R3) selects 1 of 3 output levels (HIGH, LOW 1, LOW 2) and controls the RF output power with the APC reference voltage.

When "HIGH" output power is selected, the APC reference voltage is determined by R1.

When "LOW1" or "LOW2" is selected, the APC reference voltage is determined by R2 or R3 respectively.

3-2-7 TX MUTE CIRCUIT (RF UNIT)

When a "TMUT" signal from the CPU (IC1, pin 47) turns Q10 OFF to interrupt the transmission, the bias voltages are prevented from entering Q1 on the YGR board and IC1 on the MODULE 2 board.

3-2-8 ANTENNA SWITCHING CIRCUIT (RF UNIT)

The antenna switching circuit applies the received signal to the receiver circuit and the transmitter signal to the antenna connector.

Q7, D1 and D4 are turned ON to form a parallel resonant circuit (L12, C56, C61, C62) while transmitting. The parallel resonant circuit does not allow the RF output signal from IC1 on the MODULE 2 board to enter the receiver circuit. The RF output signal from IC1 on the MODULE 2 board passes through the low-pass filter (L13, L14, C64~C68) and is then applied to an antenna connector.

• APC CIRCUIT

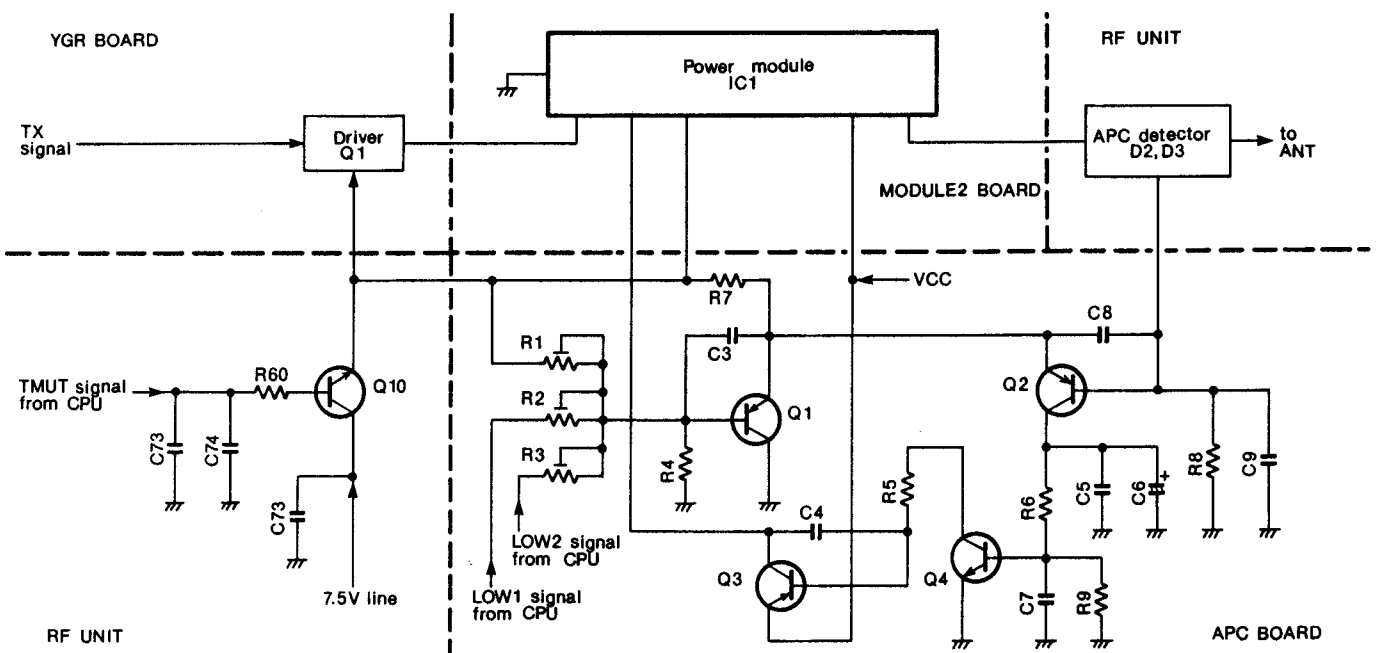


Fig. 4

3-3 PLL CIRCUITS

3-3-1 GENERAL

PLL circuits provide steady oscillation of the transmit frequency and the receive 1st LO frequency. The PLL output frequency is controlled by the divided ratio (N-data) of the programmable divider.

3-3-2 PLL CIRCUIT (PLL BOARD)

The PLL circuit, using a one-chip modulus prescaler (IC1), directly generates the transmit frequency with the transmitter VCO (Q1, D1, D6) and the receive 1st LO frequency with the receiver VCO (Q2, D3, D7) on the VCO board. The modulus prescaler (IC1) sets the dividing ratio based on serial data from the CPU (IC1) on the LOGIC unit and compares the phase of the VCO signal with the reference oscillator frequency. The PLL IC (IC1) detects the out-of-step phase and outputs it from IC1 (pins 18 and 20). A reference frequency is oscillated at Q3 and X1.

3-3-3 REFERENCE OSCILLATOR CIRCUIT (PLL BOARD)

12.8 MHz is generated by Q3 and X1 and is adjusted with C11. D1, R19 and R20 compensate for temperature to maintain frequency stability within ± 5 ppm ($-30^{\circ}\text{C} \sim +60^{\circ}\text{C}$; $-22^{\circ}\text{F} \sim +140^{\circ}\text{F}$). The signal is applied to the PLL IC (IC1, pin 1) and is divided inside the IC to obtain a 5 or a 12.5 kHz PLL reference frequency.

3-3-4 VCO CIRCUIT (VCO BOARD)

The VCO circuit consists of the transmitter VCO (Q1, D1, D6) and the receiver VCO (Q2, D3, D7) and generates the transmit frequency and the receive 1st LO frequency. The varactor diodes (D1, D3, D6, D7) provide frequency control. The output signal from the VCO circuit is applied to a buffer amplifier (Q5).

The amplified signal is re-amplified at Q6 and Q7 which amplify VCO oscillation and do not permit the latter circuit to affect the VCO oscillation. The amplified signal at Q6 is applied to the transmit/receive switching circuit (D12, D13) on the RF unit as the receive 1st LO frequency. At the same time, the amplified signal at Q7 is applied to the PLL IC (IC1, pin 10).

• PLL CIRCUIT

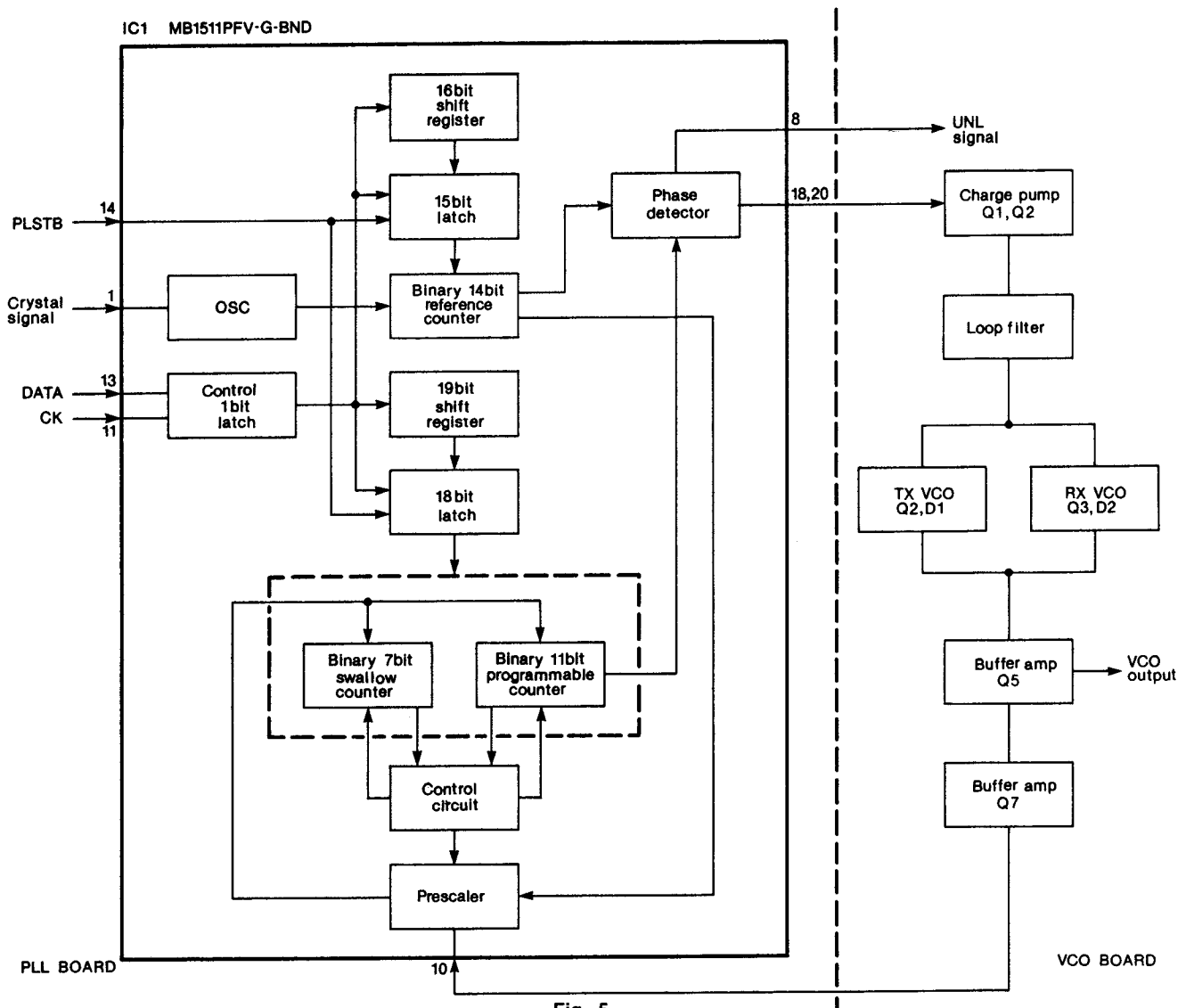


Fig. 5

Q3 and Q4 are VCO selectors which select the transmitter VCO (D1, D6, Q1) or the receiver VCO (D3, D7, Q2) using a transmit 5 V line (T5V).

While transmitting, 5 V appears on the "T5V" line and turns Q4 ON. Thus, Q3a is turned ON to activate only the transmitter VCO. While receiving, "T5V" is at "LOW," and the receiver VCO activates.

3-3-5 PROGRAMMABLE DIVIDER AND PHASE DETECTOR CIRCUITS (PLL BOARD)

The programmable divider shifts the dividing ratio, depending on the operating frequency, with a prescaler and determines the VCO oscillating frequency.

The phase detector circuit detects the out-of-phase components of the VCO frequency using a stable reference frequency.

IC1 is a one-chip PLL IC that contains a two-modulus prescaler, a pulse counter, a programmable divider and a phase detector. IC1 accepts up to 1.1 GHz inputs.

The input signal from the PLL IC (IC1, pin 10) passes through the two-modulus prescaler and the programmable counter sections of IC1. A 12.8 MHz reference frequency from Q3 and X1 is applied to IC1 (pin 1) and passes through a programmable reference counter section of IC1. Both of the divided signals are compared at a phase detector section of IC1. The phase-detected signal (pulse signal) is output from IC1 (pins 18 and 20).

3-3-6 CHARGE PUMP AND LOOP FILTER CIRCUITS (PLL AND VCO BOARDS)

The phase-detected signal (pulse signal) from IC1 (pin 18 and 20) passes through the charge pump circuit (Q1, Q2) and is then applied to a lag-lead loop filter (R2, R3, C6). The pulse signal is converted to DC voltage (PLL voltage) to control the oscillation from the VCO circuit. The charge pump circuit (Q1, Q2) is used to expand the range of the PLL lock voltage. The PLL lock voltage changes the reactance of the varactor diodes (D1, D3, D6, D7) on the VCO board.

3-3-7 UNLOCK SENSOR CIRCUIT (PLL BOARD, RF AND LOGIC UNITS)

When the PLL circuit is unlocked, IC1 (pin 8) becomes "LOW." The "LOW" signal passes through the unlock sensor circuit (IC1, Q5) on the RF unit and is then applied to the CPU (IC1, pin 61) on the LOGIC unit as an unlock signal.

3-4 POWER SUPPLY CIRCUITS

3-4-1 VOLTAGE LINES

LINE	DESCRIPTION
7.5 V	This voltage passes through the fuse (F1) in the FUSE unit and is then applied to the 5 V regulator circuit (IC1, IC3~IC5) in the REG board through the power switch of the [VOL] control (R21) in the RF unit.
5 V	Common 5 V converted from the 7.5 V line at the 5 V regulator circuit (IC5).
S5 V	5 V controlled by a "T/R" signal from the CPU (IC1, pin 45) and a "PSV" signal from the CPU (IC1, pin 21) on the LOGIC unit. Both signals become "HIGH" while receiving. When IC6a (pin 4) on the REG board becomes "HIGH," Q4 is turned ON. Therefore, the 5 V regulator circuit (IC4, pin 4) outputs the "S5 V" signal. This voltage is converted from the 7.5 V line at the 5 V regulator circuit (IC4).
R5 V	Receive 5 V controlled by a "T/R" signal from the CPU (IC1, pin 45) and a "PSV" signal from the CPU (IC1, pin 21) on the LOGIC unit. Both signals become "HIGH" while receiving. When IC6a (pin 4) on the REG board becomes "HIGH," Q2 is turned ON. Therefore, the 5 V regulator circuit (IC3, pin 4) outputs the "R5 V" signal. This voltage is converted from the 7.5 V line at the 5 V regulator circuit (IC3).
T5 V	Transmit 5 V controlled by a "T/R" signal from the CPU (IC1, pin 45) on the LOGIC unit. The CPU (IC1, pin 45) on the LOGIC unit becomes "LOW" while transmitting. The "LOW" signal is inverted at IC2a on the REG board. When Q1 is turned ON, the 5 V regulator circuit (IC1, pin 4) outputs the "T5 V" signal. This voltage is converted from the 7.5 V line at the 5 V regulator circuit (IC1).

3-4-2 CPU POWER SUPPLY CIRCUIT (LOGIC UNIT)

The DC voltage is applied to the CPU (IC1, pins 57 and 58) via D1 from the lithium backup battery (BT1) to provide backup for the memory contents regardless of the power switch supply.

• CPU POWER SUPPLY CIRCUIT

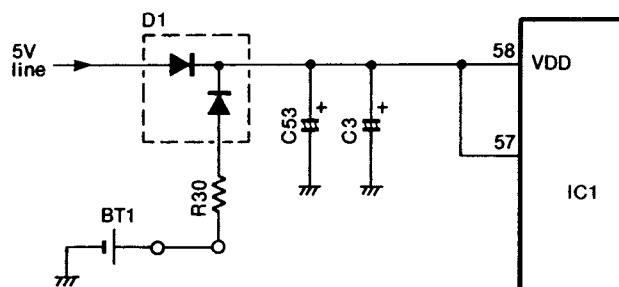


Fig. 6

3-5 LOGIC CIRCUITS

3-5-1 CTCSS TONE ENCODER/DECODER CIRCUIT (LOGIC UNIT)

The CTCSS tone encoder/decoder (IC2) encodes and decodes 67.0 Hz~250.3 Hz tone frequencies which are set by the serial data from the CPU on the LOGIC unit.

IC2 contains a CTCSS tone encoder/decoder, a speech path high-pass filter and a CTCSS tone detector. The tone decoder and speech path high-pass filter have separate inputs and both are protected against the effect of incident RF voltage. The speech path high-pass filter has low passband ripple, low output noise and a cut-off frequency of 300 Hz regardless of the programmed CTCSS tone.

The AF signal input from IC2 (pin 23) passes through the speech path high-pass filter in IC2 to attenuate a CTCSS tone signal and is then output from IC2 (pin 19).

The tone signal is applied to IC2 (pin 24). Pin 14 of IC2 becomes "HIGH" during a successful decode. The CTCSS tone decoded signal is then applied to the CPU (IC1, pin 62).

The tone encoded signal is output from IC2 (pin 16) and is then applied to R80 for tone modulation adjustment.

3-5-2 CPU RESET CIRCUIT (LOGIC UNIT)

This circuit resets the CPU (IC1) with a reset IC (IC4). The reset IC detects increases and decreases in the +5 voltage line to control the RESET port of the CPU (IC1, pin 7) when turning power ON and the INT4 port of the CPU (IC1, pin 44) when turning power OFF.

When the [POWER] switch is turned ON, the reset IC outputs "HIGH" to turn Q1 ON momentarily. When the CPU (pin 7) receives "LOW," the CPU starts operating.

When the [POWER] switch is turned OFF, the INT4 port of the CPU (pin 44) receives "LOW" before voltage disappears on the "VDD" line. At this time, the CPU enters the standby mode.

The CPU has an auto-memory initializing function. If the power is turned ON while pushing the [PTT], [FUNCTION] and [MONITOR] switches, the CPU initializes its memory contents to default values.

3-5-3 TX/BUSY INDICATOR CIRCUIT (LED AND LOGIC UNITS)

The TX/BUSY indicator (DS2) uses a 2-input LED and lights up in red or green.

When transmitting, the TX/BUSY indicator lights up in red by using the "T/R" signal from the CPU (pin 45).

When the squelch opens, the BUSY indicator lights up in green by using the "BUSYO" signal from the CPU (pin 46).

3-5-4 CALL INDICATOR CIRCUIT (LED, LOGIC AND OPTIONAL UT-68 2-TONE UNITS)

The call indicator (DS1) lights up in yellow when a 2-tone is decoded successfully. The 2-tone decoded signal is output from the optional UT-68 2-TONE UNIT through the "DOUT" signal line and is then amplified at Q6 on the LOGIC unit. The amplified signal lights up the call indicator (DS1) in yellow.

3-5-5 CPU (IC1) PORT ALLOCATIONS

• INPUT PORT

PORT No.	PIN No.	TERMINAL NAME	DESCRIPTION
P00	44	INT4	Inputs an interrupt signal for the standby mode of the CPU. The CPU enters the standby mode when the port becomes "LOW."
P10	30	CLI	This port accepts cloning data from the data programmer, EX-704.
P11	29	FUNC	This port becomes "LOW" when the [FUNCTION] switch is pushed.
P12	28	MONI	This port becomes "LOW" when the [MONITOR] switch is pushed.
P30	62	DET	The CPU detects that the same tone frequency is received when this port becomes "HIGH."
P31	61	UNLOCK	The CPU detects that the PLL is unlocked when this port becomes "LOW."
P32	60	PTT	This port becomes "LOW" when the [PTT] switch is pushed.
P40	2	CBE	When this port is set at "LOW," a beep signal is emitted each time the channel selector is rotated.

• RESET CIRCUIT

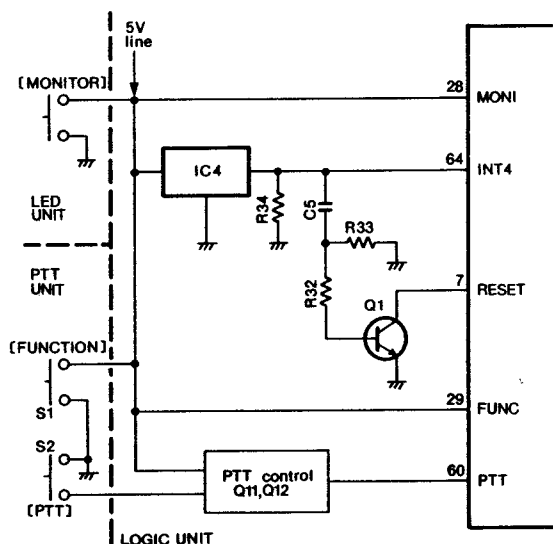


Fig. 7

• INPUT PORT

PORT No.	PIN No.	TERMINAL NAME	DESCRIPTION																				
P41	1	TBO	When this port is set at "LOW," beep signals are emitted 5 sec. before the time-out-timer function cuts the transmission.																				
P42	64	1WBP	When this port is set at "LOW," a beep signal is emitted for manual low power transmission. (simultaneously pushing [PTT] and [FUNCTION].)																				
P43	63	PSVON	When this port is set at "HIGH," the power saver function is activated.																				
P50, P51	6, 5	SEL1, SEL2	When these ports are set in the following combinations, the squelch sensitivity and hysteresis characteristics can be adjusted. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>P50</th> <th>P51</th> <th>SQUELCH SENSITIVITY</th> <th>HYSTERESIS</th> </tr> </thead> <tbody> <tr> <td>L</td> <td>L</td> <td>HIGHEST</td> <td>SMALL</td> </tr> <tr> <td>L</td> <td>H</td> <td>HIGH</td> <td>SMALLER</td> </tr> <tr> <td>H</td> <td>L</td> <td>LOW</td> <td>GREATER</td> </tr> <tr> <td>H</td> <td>H</td> <td>LOWEST</td> <td>GREATEST</td> </tr> </tbody> </table>	P50	P51	SQUELCH SENSITIVITY	HYSTERESIS	L	L	HIGHEST	SMALL	L	H	HIGH	SMALLER	H	L	LOW	GREATER	H	H	LOWEST	GREATEST
P50	P51	SQUELCH SENSITIVITY	HYSTERESIS																				
L	L	HIGHEST	SMALL																				
L	H	HIGH	SMALLER																				
H	L	LOW	GREATER																				
H	H	LOWEST	GREATEST																				
P52	4	SEL3	When this port is set at "HIGH," the squelch delay activates. The squelch delay prevents the open-close noise from weak signals.																				
P53	3	V/U	When this port set at "LOW," VHF data is used during the auto-memory initializing function. This port must be "LOW" for the IC-H28.																				
P70 P73	14 17	K0 K3	Detects the signals for the channel selector switch.																				
T11	35	NOISE	Inputs a pulse-type noise signal for counting to activate the noise squelch.																				

• OUTPUT PORT

PORT No.	PIN No.	TERMINAL NAME	DESCRIPTION
P91	24	LOW1	Output port for a low power control signal. Outputs "LOW" when the transceiver is programmed for low power output (2 W).
P92	23	LOW2	Output port for a low power control signal. Outputs "LOW" for the manual low power (pushing [PTT] and [FUNCTION] simultaneously) output.
P120	48	RMUT	Outputs a receiver mute signal. The port becomes "HIGH" when receiver audio output is muted. This port becomes "LOW" when the transceiver receives audio signals when the [MONITOR] switch is turned ON or when a tone signal is matched.
P121	47	TMUT	Outputs a transmit mute signal. This port becomes "LOW" when transmitting. This port becomes "HIGH" when the PLL is unlocked.
P122	46	BUSYO	Outputs a busy signal synchronized with the "BUSY" input. Drives the [TX/BUSY] indicator directly.
P123	45	T/R	Outputs a Transmit/Receive switching signal. This port becomes "LOW" when transmitting. The [TX/BUSY] indicator lights up in red.

• OUTPUT PORT

PORT No.	PIN No.	TERMINAL NAME	DESCRIPTION
P01	43	CK	Outputs clock signals for the serial data.
P02	42	DATA	Outputs serial data.
P20	40	BEEPO	Outputs a beep signal for each function.
P21	39	PLSTB	Outputs a strobe signal for the PLL.
P22	38	CTSTB	Outputs a strobe signal for the CTCSS tone encoder/decoder.
P23	37	DTSTB	Outputs a strobe signal for an optional UT-69 DTCS ENCODER/DECODER UNIT.
P80	21	PSV	Outputs a power save control signal. This port becomes "LOW" when the power save function is activated.
P81	20	TONE-2	Outputs a control signal for an optional UT-68 2-TONE DECODER UNIT. This port becomes "HIGH" when an optional UT-68 2-TONE DECODER UNIT is connected.
P82	19	Y0	Outputs the signal for the channel selector.
P90	25	CPO	Outputs clone data.

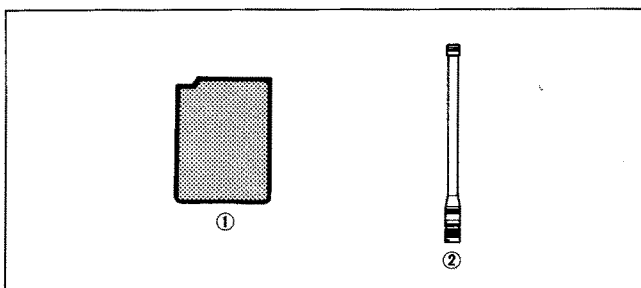
SECTION 4 MECHANICAL PARTS AND DISASSEMBLY

• CHASSIS PARTS

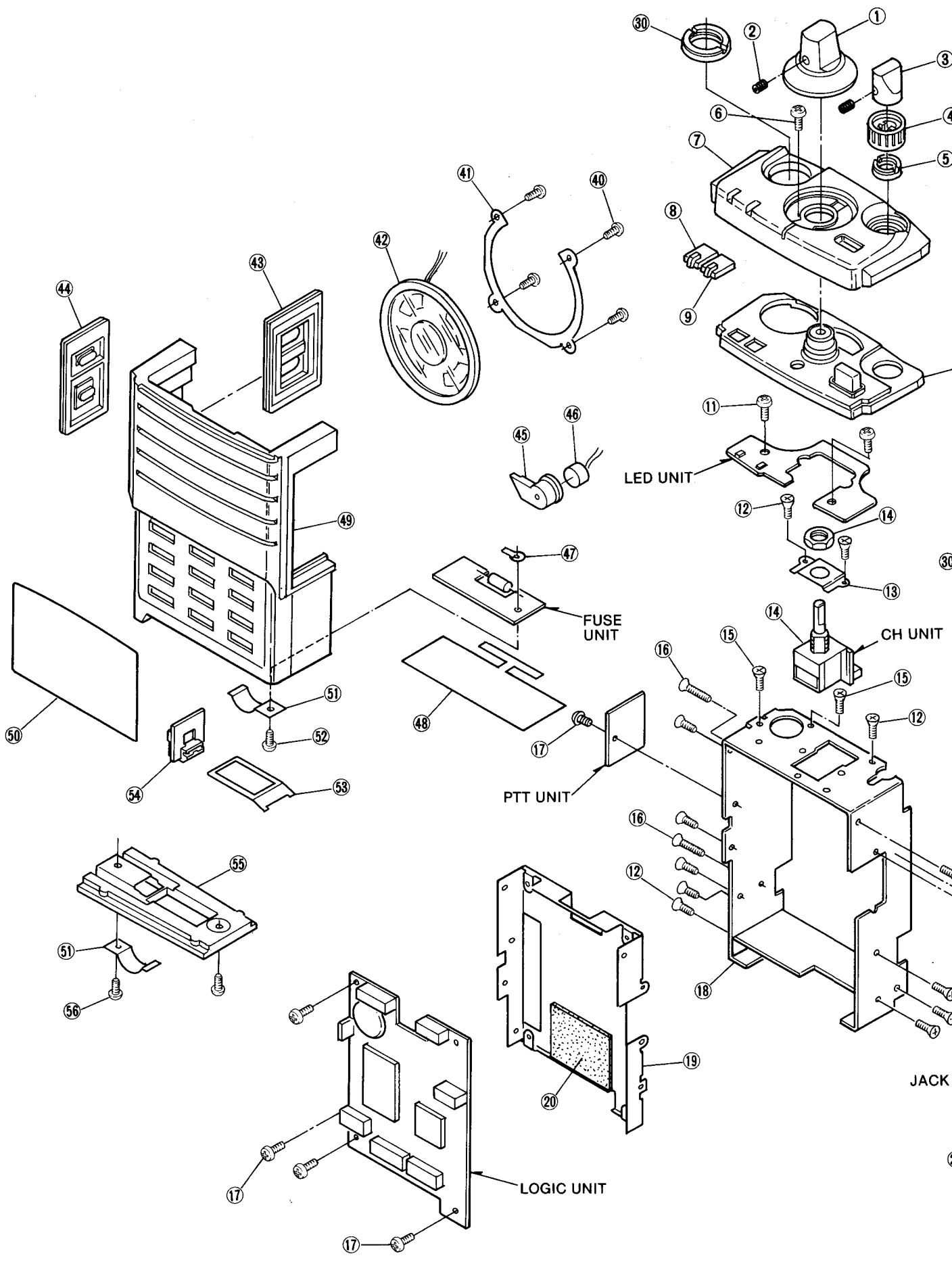
LABEL NUMBER	ORDER NO.	DESCRIPTION	QTY.	LABEL NUMBER	ORDER NO.	DESCRIPTION	QTY.
①	8610007580	Knob N176 [CHANNEL SELECTOR]	1	⑳	8510007471	858 ANT shield-1	1
②	8810003520	Allen screw M3×3 ZK	2	㉑	6510013960	ANT connector TNC-R (incl. nut)	1
③	8610007560	Knob N183 [PWR/VOL]	1	㉒	7210001510	RK0972211007A [PWR/VOL/SQL]	1
④	8610007570	Knob N184 [SQL]	1	㉓	8930004081	Ground spring (B)-1	1
⑤	8830000570	VR nut (A)	1	㉔	8930023680	858 VCO shield plate	1
⑥	8810000530	Screw PH No. 0 M2×5 ZK	3	㉕	8930022030	M holder	1
⑦	8210006450	858 top panel	1	㉖	6510013450	Connector FCN-154J024-G/AA	1
⑧	8930021640	L lens	1	㉗	8930024110	858 spring	3
⑨	8930021630	R lens	1	㉘	8310025760	Front seal	1
⑩	8930021660	858 top seal	1	㉙	8010011580	Rear panel (B)-2	1
⑪	8810004870	Screw PH No. 0 M2×2.5	2	㉚	8810000740	Screw PH A M2×15 ZK	4
⑫	8810007100	Screw FH No. 0 M2×2.5 NI	12	㉛	8810004800	Screw PH B0 No. 0 M2×4	4
⑬	8930022010	CH plate	1	㉜	8930017361	Speaker holder (A)-1	1
⑭	2250000090	Encoder EC10SP16-20 (incl. nut)	1	㉝	2510000450	Speaker EAS-3P123D	1
⑮	8810006980	Screw FH No. 0 M2×3.5 NI	2	㉞	8930021680	PTT seal	1
⑯	8810007090	Screw FH No. 0 M2×5 NI	2	㉟	8930021670	PTT rubber	1
⑰	8810005860	Screw PH No. 0 M2×3 NI	5	㊱	8930020130	MIC seal	1
⑱	8010011570	Chassis	1	㊲	7700000480	Microphone KUC2023-01-006	1
⑲	8010011560	LOGIC chassis	1	㊳	8860000580	Screw lug M 3	1
㉑	8930013520	Sponge (BJ)	1	㊴	8930023340	858 power sheet	1
㉒	8930019820	Side-spring	1	㊵	8210007400	Front panel (M)-2	1
㉓	8930021590	Connector plate	1	㊶	8310021721	Front plate (A)-1	1
㉔	8310025570	858 seal	1	㊷	8930021940	Contact spring (A)	2
㉕	8930021650	Connector seal	1	㊸	8810007410	Screw PH M3×6 NI	1
㉖	6510013620	Terminal plate YM-260	1	㊹	8930014161	Lock spring-1	1
㉗	8930021580	858 side plate	1	㊺	8930014371	Release button-1	1
㉘	8820000660	858 screw	1	㊻	8010008181	Sliding plate-1	1
㉙	8930023360	O ring (H)	1	㊼	8810006090	Icom screw E 5	2

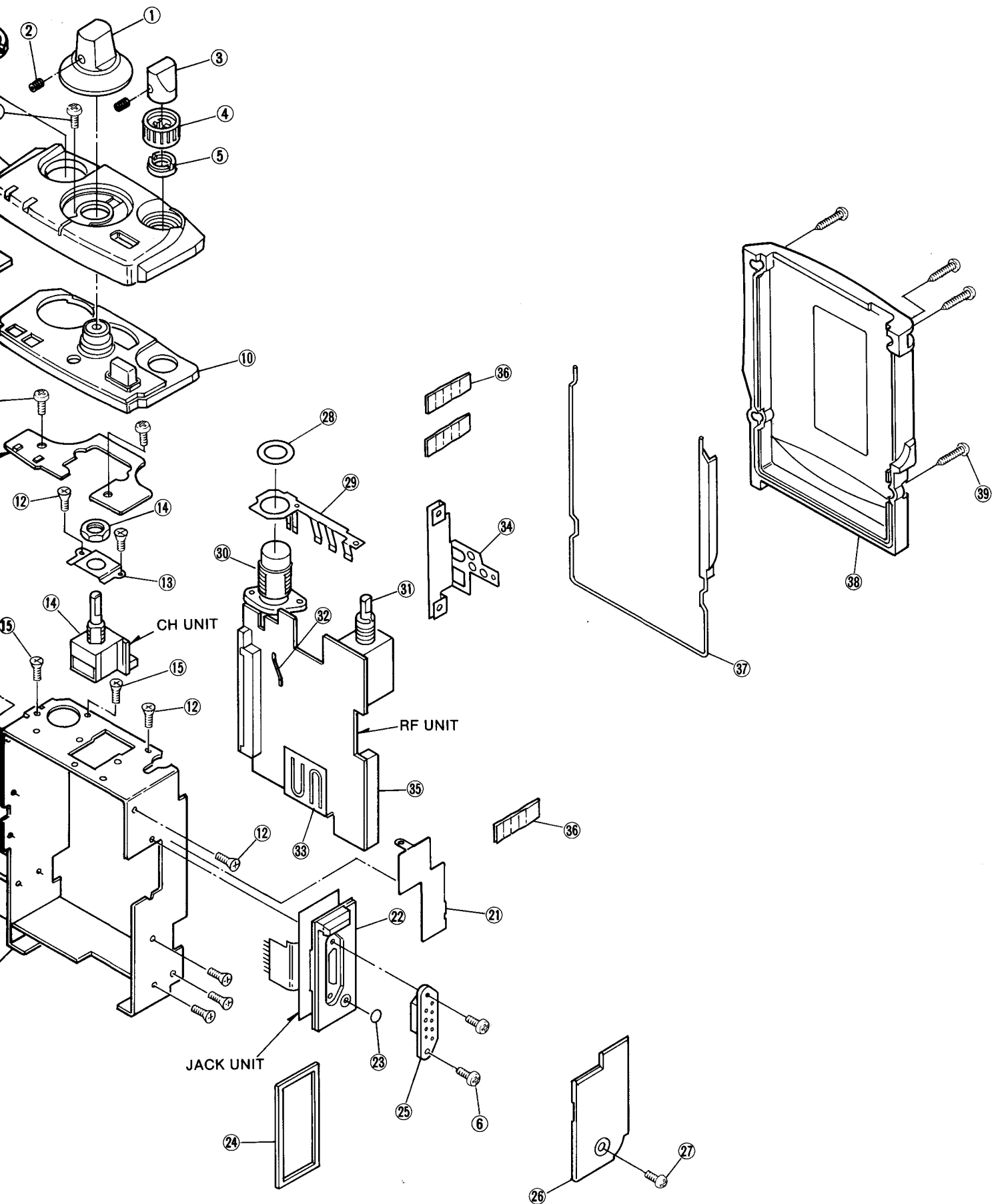
Screw abbreviations B0: Self-tapping screw PH: Pan head FH: Flat head NI: Nickel ZK: Black

• ACCESSORIES



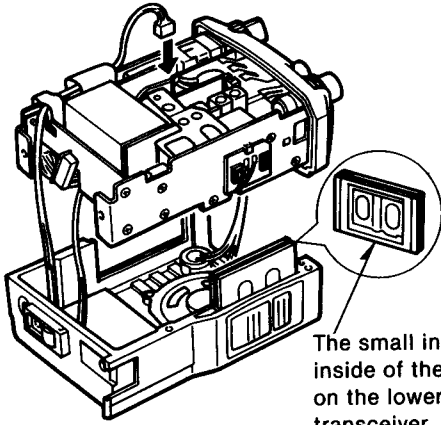
LABEL NUMBER	ORDER NO.	DESCRIPTION	QTY.
①	Optional product	Battery pack CM-80	1
②	3310000140	Flexible antenna #208-10 (#02, #04, #12)	1
	3310000820	Flexible antenna FA-155T (#208-11) (#01, #03, #11)	





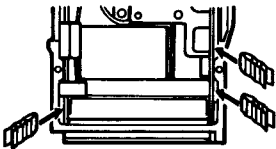
■ ASSEMBLY NOTES

• PTT seal insertion

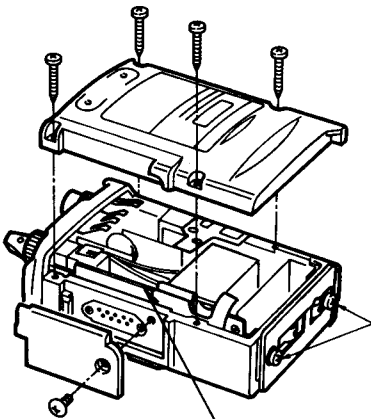


- ① Pay attention to the PTT seal.
 - The small indent should be on the lower side.
- ② Insert 1/3 of the PTT seal into the front panel.
- ③ Slide the PTT seal together with the transceiver main body.

• 858 spring insertion



• Rear panel



Be careful that the red wires are not put between the PC board and the rear panel.

SECTION 5 PARTS LIST

[CHASSIS PART]

REF. NO.	ORDER NO.	DESCRIPTION
J1	6510013960	CONNECTOR TNC-R [ANT]

[CH UNIT]

REF. NO.	ORDER NO.	DESCRIPTION
S1	2250000090	ENCODER EC10SP16-20 [CHANNEL SELECTOR]
EP1	0910034240	PCB B 3448 (CH)

[PTT UNIT]

REF. NO.	ORDER NO.	DESCRIPTION
S1	2260001610	S. SWITCH SW-134 (SKQDAB) [FUNCTION]
S2	2260001610	S. SWITCH SW-134 (SKQDAB) [PTT]
EP1	0910034301	PCB B 3452A (PTT)

[LED UNIT]

REF. NO.	ORDER NO.	DESCRIPTION
DS1	5010000110	S. LED LT1H53A [CALL]
DS2	5010000100	S. LED LT1ET53A [TX/BUSY]
EP1	0910034251	PCB B 3449A (LED)

[FRONT PARTS]

REF. NO.	ORDER NO.	DESCRIPTION
C1	4030006850	S. CERAMIC C1608 JB 1H 471K-T-A
MC1	7700000480	MICROPHONE KUC2023-01-006
SP1 *	2510000450	SPEAKER EAS-3P123D

[FUSE UNIT]

REF. NO.	ORDER NO.	DESCRIPTION
C2	4010000460	CERAMIC DD104 B 471K 50V
C3	4010000460	CERAMIC DD104 B 471K 50V
F1	5210000300	FUSE MC 4
EP1	0910021370	PCB B 2122 (FUSE)

[RF UNIT]

REF. NO.	ORDER NO.	DESCRIPTION
IC1	1130003830	S. IC TC7S04F (TE85R)
Q1	1580000350	S. FET 3SK140-Y (TE85R)
Q2	1580000400	S. FET 3SK151-Y (TE85R)
Q3	1530002600	S. TRANSISTOR 2SC4215-O (TE85R)
Q4	1590000430	S. TRANSISTOR DTC144EU T107
Q5	1530002690	S. TRANSISTOR 2SC4116-GR (TE85R)
Q6	1560000540	S. FET 2SK880-Y (TE85R)
Q7	1530002690	S. TRANSISTOR 2SC4116-GR (TE85R)
Q8	1530002690	S. TRANSISTOR 2SC4116-GR (TE85R)
Q10	1530002980	S. TRANSISTOR 2SC3650-TD
Q13	1530002050	S. TRANSISTOR 2SC3661-TA
Q14	1590000910	S. TRANSISTOR IMZ2 T108
D1	1710000580	DIODE 1SS265
D2	1720000360	S. DIODE HSU88TRF
D3	1720000360	S. DIODE HSU88TRF
D4	1790000960	S. DIODE 1SS317-T
D5	1790000490	S. DIODE HSM88AS-TR
D6	1790000640	S. VARICAP MA363B (TX)
D7	1790000640	S. VARICAP MA363B (TX)
D8	1790000640	S. VARICAP MA363B (TX)
D9	1790000640	S. VARICAP MA363B (TX)
D10	1790000980	S. DIODE MA742 (TX)
D11	1750000240	S. DIODE DA112 T107

* Safety critical component
S. = Surface mount

[RF UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
D12	1790000960	S. DIODE	1SS317-T
D13	1790000960	S. DIODE	1SS317-T
D14	1750000270	S. DIODE	1SS301 (TE85R)
D15	1790001000	S. ZENER	MA8062-L (TX)
D16	1790000590	S. DIODE	MA110 (TW)
D17	1790000660	S. DIODE	MA728 (TW)
X1	6050005010	XTAL	CR-214
X2	6070000080	DISCRIMINATOR	CDBM455C16
FI1	2010000230	MONOLITHIC	30M15B (FL-76) (#01, #02, #11, #12)
	2010000940	FILTER	30M 7B (FL-107) (#03, #04)
FI2	2020000490	CERAMIC	CFZM455E10 (#01, #02, #11, #12)
	2020000770	CERAMIC	CFZM455G (#03, #04)
L1	6150003890	S. COIL	LS-442
L2	6150003890	S. COIL	LS-442
L3	6150003900	S. COIL	LS-443
L4	6150003890	S. COIL	LS-442
L5	6150003910	S. COIL	LS-444
L7	6200000110	S. COIL	LQN 2A 33NM
L10	6110001540	COIL	LA-234
L11	6200000880	S. COIL	NL 322522T-4R7M
L12	6110001570	COIL	LA-237
L13	6110002000	COIL	LA-226
L14	6110001540	COIL	LA-234
R1	7030003700	S. RESISTOR	ERJ3GEYJ 154 V (150 kΩ)
R2	7030003700	S. RESISTOR	ERJ3GEYJ 154 V (150 kΩ)
R4	7030003370	S. RESISTOR	ERJ3GEYJ 271 V (270 Ω)
R6	7030003200	S. RESISTOR	ERJ3GEYJ 100 V (10 Ω)
R7	7030003700	S. RESISTOR	ERJ3GEYJ 154 V (150 kΩ)
R8	7030003700	S. RESISTOR	ERJ3GEYJ 154 V (150 kΩ)
R9	7030003560	S. RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R11	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R14	7030003300	S. RESISTOR	ERJ3GEYJ 680 V (68 Ω)
R15	7030003380	S. RESISTOR	ERJ3GEYJ 331 V (330 Ω) (#03, #04)
	7030003420	S. RESISTOR	ERJ3GEYJ 681 V (680 Ω) (#01, #02, #11, #12)
R17	7030003720	S. RESISTOR	ERJ3GEYJ 224 V (220 kΩ)
R19	7030003320	S. RESISTOR	ERJ3GEYJ 101 V (100 Ω)
R20	7030003580	S. RESISTOR	ERJ3GEYJ 153 V (15 kΩ)
R21	7210001510	VARIABLE	RK0972211007A (50KB/10KA) [PWR/VOL/SQ]
R22	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R23	7030003760	S. RESISTOR	ERJ3GEYJ 474 V (470 kΩ)
R24	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R25	7030003530	S. RESISTOR	ERJ3GEYJ 562 V (5.6 kΩ)
R27	7030003760	S. RESISTOR	ERJ3GEYJ 474 V (470 kΩ)
R28	7310002580	S. TRIMMER	RV-108 (RH03A3A15X05A) 104
R29	7030003760	S. RESISTOR	ERJ3GEYJ 474 V (470 kΩ)
R30	7030003710	S. RESISTOR	ERJ3GEYJ 184 V (180 kΩ)
R31	7310002580	S. TRIMMER	RV-108 (RH03A3A15X05A) 104
R32	7030003560	S. RESISTOR	ERJ3GEYJ 103 V (10 kΩ) (#01, #02, #11, #12)
	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ) (#03, #04)
R33	7030003290	S. RESISTOR	ERJ3GEYJ 560 V (56 Ω)
R34	7030003560	S. RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R35	7030003560	S. RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R36	7030003330	S. RESISTOR	ERJ3GEYJ 121 V (120 Ω)
R37	7030003290	S. RESISTOR	ERJ3GEYJ 560 V (56 Ω)
R38	7030003280	S. RESISTOR	ERJ3GEYJ 470 V (47 Ω)
R39	7030003420	S. RESISTOR	ERJ3GEYJ 681 V (680 Ω)

[RF UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
R40	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R41	7030003440	S. RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R42	7030003480	S. RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R43	7030003520	S. RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R44	7030003520	S. RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R45	7030003480	S. RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R46	7030003800	S. RESISTOR	ERJ3GEYJ 105 V (1 MΩ)
R47	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R48	7030003380	S. RESISTOR	ERJ3GEYJ 331 V (330 Ω)
R49	7030004050	S. RESISTOR	ERJ3GEYJ 1R0 V (1 Ω)
R50	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R51	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R53	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R54	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R55	7030003560	S. RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R56	7030003360	S. RESISTOR	ERJ3GEYJ 221 V (220 Ω)
R58	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R59	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R60	7030003240	S. RESISTOR	ERJ3GEYJ 220 V (22 Ω)
R61	7030003450	S. RESISTOR	ERJ3GEYJ 122 V (1.2 kΩ)
R63	7030003560	S. RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R64	7030003670	S. RESISTOR	ERJ3GEYJ 823 V (82 kΩ)
R67	7030003760	S. RESISTOR	ERJ3GEYJ 474 V (470 kΩ)
R69	7030003500	S. RESISTOR	ERJ3GEYJ 332 V (3.3 kΩ)
R70	7030003450	S. RESISTOR	ERJ3GEYJ 122 V (1.2 kΩ)
R71	7030003560	S. RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R72	7030003560	S. RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R73	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R74	7030003770	S. RESISTOR	ERJ3GEYJ 564 V (560 kΩ)
R75	7030003530	S. RESISTOR	ERJ3GEYJ 562 V (5.6 kΩ)
R76	7030003330	S. RESISTOR	ERJ3GEYJ 121 V (120 Ω)
R77	7030003290	S. RESISTOR	ERJ3GEYJ 560 V (56 Ω)
R78	7030003330	S. RESISTOR	ERJ3GEYJ 121 V (120 Ω)
R79	7030003500	S. RESISTOR	ERJ3GEYJ 332 V (3.3 kΩ)
C1	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C2	4030006930	S. CERAMIC	C1608 CH 1H 020C-T-A (#01, #03, #11)
	4030006970	S. CERAMIC	C1608 CH 1H 060D-T-A (#02, #04, #12)
C3	4030007080	S. CERAMIC	C1608 CH 1H 390J-T-A (#02, #04, #12)
	4030007110	S. CERAMIC	C1608 CH 1H 680J-T-A (#01, #03, #11)
C4	4030006920	S. CERAMIC	C1608 CH 1H 010C-T-A
C5	4030007080	S. CERAMIC	C1608 CH 1H 390J-T-A (#02, #04, #12)
	4030007100	S. CERAMIC	C1608 CH 1H 560J-T-A (#01, #03, #11)
C7	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C8	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C9	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C10	4030006950	S. CERAMIC	C1608 CH 1H 040C-T-A (#02, #04, #12)
C11	4030007080	S. CERAMIC	C1608 CH 1H 390J-T-A (#02, #04, #12)
	4030007100	S. CERAMIC	C1608 CH 1H 560J-T-A (#01, #03, #11)
C12	4030006910	S. CERAMIC	C1608 CH 1H 0R5C-T-A
C13	4030007080	S. CERAMIC	C1608 CH 1H 390J-T-A (#02, #04, #12)
	4030007100	S. CERAMIC	C1608 CH 1H 560J-T-A (#01, #03, #11)
C14	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C15	4030006990	S. CERAMIC	C1608 CH 1H 080D-T-A (#01, #02, #11, #12)
C16	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C17	4030006940	S. CERAMIC	C1608 CH 1H 030C-T-A (#02, #04, #12)
C18	4030006960	S. CERAMIC	C1608 CH 1H 050C-T-A
C19	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C20	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C22	4030007050	S. CERAMIC	C1608 CH 1H 220J-T-A
C23	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A

* Safety critical component
S.=Surface mount

[RF UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
C25	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A (#01, #02, #11, #12)
	4030007040	S. CERAMIC	C1608 CH 1H 180J-T-A (#03, #04)
C26	4030007020	S. CERAMIC	C1608 JB 1H 120J-T-A (#01, #02, #11, #12)
	4030007060	S. CERAMIC	C1608 CH 1H 270J-T-A (#03, #04)
C27	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A (#01, #02, #11, #12)
	4030008880	S. CERAMIC	C1608 JB 1C 223K-T-A (#03, #04)
C28	4030008630	S. CERAMIC	C1608 JF 1C 104Z-T-A
C31 *	4550003040	S. TANTALUM	TEMSVB2 0J 106M-8L
C32	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C35 *	4550003080	S. TANTALUM	TEMSVA 1A 335M-8L
C36	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C37 *	4550000420	S. TANTALUM	TESVA 1A 105M1-8L
C39	4030007050	S. CERAMIC	C1608 CH 1H 220J-T-A
C40	4030006990	S. CERAMIC	C1608 CH 1H 080D-T-A
C41	4030007050	S. CERAMIC	C1608 CH 1H 220J-T-A
C42	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C43	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C45	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C46	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C47	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C48	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C52	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C53	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C54	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C55	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C56	4030006760	S. CERAMIC	C1608 SL 1H 121J-T-A (#01, #03, #11)
	4030006780	S. CERAMIC	C1608 SL 1H 181J-T-A (#02, #04, #12)
C57	4030007050	S. CERAMIC	C1608 CH 1H 220J-T-A (#01, #03, #11)
	4030007060	S. CERAMIC	C1608 CH 1H 270J-T-A (#02, #04, #12)
C58	4030007050	S. CERAMIC	C1608 CH 1H 220J-T-A (#01, #03, #11)
	4030007060	S. CERAMIC	C1608 CH 1H 270J-T-A (#02, #04, #12)
C59	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C60	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C61	4030007030	S. CERAMIC	C1608 CH 1H 150J-T-A
C62	4030007030	S. CERAMIC	C1608 CH 1H 150J-T-A
C63	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C64	4030007010	S. CERAMIC	C1608 CH 1H 100D-T-A
C65	4030006930	S. CERAMIC	C1608 CH 1H 020C-T-A
C66	4030007060	S. CERAMIC	C1608 CH 1H 270J-T-A
C67	4030006960	S. CERAMIC	C1608 CH 1H 050C-T-A (#01, #03, #11)
	4030006980	S. CERAMIC	C1608 CH 1H 070D-T-A (#02, #04, #12)
C68	4030007000	S. CERAMIC	C1608 CH 1H 090D-T-A
C69	4030008630	S. CERAMIC	C1608 JF 1C 104Z-T-A
C70	4030006710	S. CERAMIC	C1608 SL 1H 470J-T-A
C72 *	4550003040	S. TANTALUM	TEMSVB2 0J 106M-8L
C73	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C74	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C75	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C76	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C77 *	4550003090	S. TANTALUM	TEMSVB2 1A 685M-8L
C78	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C79	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C81	4030006710	S. CERAMIC	C1608 SL 1H 470J-T-A
C82	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C83 *	4550004040	S. TANTALUM	TEMSVA 0J 685M-8L
C84	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C85	4030006940	S. CERAMIC	C1608 CH 1H 030C-T-A (#02, #04, #12)
C86	4030008880	S. CERAMIC	C1608 JB 1C 223K-T-A
C87	4030007050	S. CERAMIC	C1608 CH 1H 220J-T-A
C88	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A

[RF UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
C89	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C90 *	4550003030	S. TANTALUM	TEMSVA 0J 475M-8L
C91	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C92	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C93	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C94	4030008630	S. CERAMIC	C1608 JF 1C 104Z-T-A
C95 *	4550002890	S. TANTALUM	TESVA 1A 225M1-8L
C96	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C97	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C98	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C100	4030008880	S. CERAMIC	C1608 JB 1C 223K-T-A
C101 *	4550002890	S. TANTALUM	TESVA 1A 225M1-8L
C102	4550003250	S. TANTALUM	TEMSVA 1V 474M-8L
C103	4030007050	S. CERAMIC	C1608 CH 1H 220J-T-A
C104	4030006930	S. CERAMIC	C1608 CH 1H 020C-T-A
C105	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C106	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C107	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C108	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C109	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
J1	6510013450	CONNECTOR	FCN-154J024-G/AA
J2	6510007080	CONNECTOR	PI28A-02M
W1	7120000380	JUMPER	JPW 01 R-01
W3	7120000380	JUMPER	JPW 01 R-01
EP1	0910034652	PCB	B 3441B (RF)

[REG BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
IC1	1180000750	S. IC	TK11450MTR
IC2	1130003920	S. IC	TC4S69F (TE85R)
IC3	1180000750	S. IC	TK11450MTR
IC4	1180000750	S. IC	TK11450MTR
IC5	1180000750	S. IC	TK11450MTR
IC6	1130003760	S. IC	TC4S81F (TE85R)
Q1	1590000430	S. TRANSISTOR	DTC144EU T107
Q2	1590000430	S. TRANSISTOR	DTC144EU T107
Q4	1590000430	S. TRANSISTOR	DTC144EU T107
R5	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R6	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R8	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
C1 *	4550003080	S. TANTALUM	TEMSVA 1A 335M-8L
C2	4030008630	S. CERAMIC	C1608 JF 1C 104Z-T-A
C3 *	4550003040	S. TANTALUM	TEMSVB2 0J 106M-8L
C4	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C5 *	4550003040	S. TANTALUM	TEMSVB2 0J 106M-8L
C6 *	4550003080	S. TANTALUM	TEMSVA 1A 335M-8L
C7 *	4550003080	S. TANTALUM	TEMSVA 1A 335M-8L
C8 *	4550003040	S. TANTALUM	TEMSVB2 0J 106M-8L
C9	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C11 *	4550003040	S. TANTALUM	TEMSVB2 0J 106M-8L
C12	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C13	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A

* Safety critical component
S. = Surface mount

[REG BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
C14	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
W1	7030003860	S. JUMPER	ERJ3GE JPW V
W2	7030003860	S. JUMPER	ERJ3GE JPW V
EP1	0910034212	PCB	B 3444B (REG)
EP2	6910003110	LEADFRAME	HFB2.0-0.7-8 (N)

[APC BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
C3	4030006710	S. CERAMIC	C1608 SL 1H 470J-T-A
C4	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C5	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C6 *	4550003170	S. TANTALUM	TEMSVA 1D 155M-8L
C7	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C8	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C9	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
EP1	0910034231	PCB	B 3446A (APC)
EP2	6910003110	LEADFRAME	HFB2.0-0.7-8 (N)

[YGR BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
Q1	1530002920	S. TRANSISTOR	2SC4226-T2 R25
L1	6200001020	S. COIL	NL 322522T-082M
L2	6200000110	S. COIL	LQN 2A 33NM
R1	7030003500	S. RESISTOR	ERJ3GEYJ 332 V (3.3 kΩ)
R2	7030003450	S. RESISTOR	ERJ3GEYJ 122 V (1.2 kΩ)
R3	7030003260	S. RESISTOR	ERJ3GEYJ 330 V (33 Ω)
C1	4030007050	S. CERAMIC	C1608 CH 1H 220J-T-A
C2	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C3	4030007030	S. CERAMIC	C1608 CH 1H 150J-T-A
C4	4030006660	S. CERAMIC	C1608 SL 1H 220J-T-A
C5	4030006600	S. CERAMIC	C1608 SL 1H 090D-T-A
C6	4030006660	S. CERAMIC	C1608 SL 1H 220J-T-A
EP1	0910034261	PCB	B 3453A (YGR)
EP2	6910003110	LEADFRAME	HFB2.0-0.7-8 (N)

[AF BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
IC1	1110002420	S. IC	NJM2073M (T1)
Q1	1530002690	S. TRANSISTOR	2SC4116-GR (TE85R)
Q2	1590001390	S. FET	2SJ144-Y (TE85R)
Q3	1520000560	S. TRANSISTOR	2SB1123T-TD
Q4	1530002690	S. TRANSISTOR	2SC4116-GR (TE85R)
Q5	1590000720	S. TRANSISTOR	DTA144EU T107
Q6	1590000720	S. TRANSISTOR	DTA144EU T107
R1	7030003800	S. RESISTOR	ERJ3GEYJ 105 V (1 MΩ)
R2	7030003740	S. RESISTOR	ERJ3GEYJ 334 V (330 kΩ)
R3	7030003540	S. RESISTOR	ERJ3GEYJ 682 V (6.8 kΩ)
R4	7030003620	S. RESISTOR	ERJ3GEYJ 333 V (33 kΩ)
R5	7030003430	S. RESISTOR	ERJ3GEYJ 821 V (820 Ω)
R6	7030003800	S. RESISTOR	ERJ3GEYJ 105 V (1 MΩ)
R7	7030003800	S. RESISTOR	ERJ3GEYJ 105 V (1 MΩ)
R8	7030003800	S. RESISTOR	ERJ3GEYJ 105 V (1 MΩ)
R9	7030004050	S. RESISTOR	ERJ3GEYJ 1R0 V (1 Ω)
R10	7030003420	S. RESISTOR	ERJ3GEYJ 681 V (680 Ω)
R11	7030003450	S. RESISTOR	ERJ3GEYJ 122 V (1.2 kΩ)
R12	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R13	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R14	7030003390	S. RESISTOR	ERJ3GEYJ 391 V (390 Ω)
R16	7030003650	S. RESISTOR	ERJ3GEYJ 563 V (56 kΩ)
C1 *	4550003040	S. TANTALUM	TEMSVB2 0J 106M-8L
C2	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C3	4030008880	S. CERAMIC	C1608 JB 1C 223K-T-A
C4	4030006900	S. CERAMIC	C1608 JB 1E 103K-T-A
C5	4550000530	S. TANTALUM	TESVA 1V 104M1-8L
C6 *	4550003040	S. TANTALUM	TEMSVB2 0J 106M-8L
C7	4030008630	S. CERAMIC	C1608 JF 1C 104Z-T-A
C8 *	4550002060	TANTALUM	DN 1A 680M
C9	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C10	4030006900	S. CERAMIC	C1608 JB 1E 103K-T-A
C11	4550000550	S. TANTALUM	TESVA 1V 224M1-8L
EP1	0910035830	PCB	B 3451 (AF)
EP2	6910003110	LEADFRAME	HFB2.0-0.7-8 (N)

[APC BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
Q1	1510000670	S. TRANSISTOR	2SA1588-GR (TE85R)
Q2	1510000670	S. TRANSISTOR	2SA1588-GR (TE85R)
Q3	1520000530	S. TRANSISTOR	2SB1119S-TD
Q4	1530002690	S. TRANSISTOR	2SC4116-GR (TE85R)
R1	7310003510	S. TRIMMER	RV-222 (RH03AVAS4) 473
R2	7310003560	S. TRIMMER	RV-220 (RH03AVAJ4) 223
R3	7310003640	S. TRIMMER	RV-218 (RH03AVA14J) 103
R4	7030003600	S. RESISTOR	ERJ3GEYJ 223 V (22 kΩ)
R5	7030003520	S. RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R6	7030003710	S. RESISTOR	ERJ3GEYJ 184 V (180 kΩ)
R7	7030003670	S. RESISTOR	ERJ3GEYJ 823 V (82 kΩ)
R8	7030003600	S. RESISTOR	ERJ3GEYJ 223 V (22 kΩ)
R9	7030003770	S. RESISTOR	ERJ3GEYJ 564 V (560 kΩ)

* Safety critical component
S. = Surface mount

[IF BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
IC1	1110002200	S. IC	MC3372MR
Q1	1530002690	S. TRANSISTOR	2SC4116-GR (TE85R)
L1	6200001230	S. COIL	MLF2012A 1R0M-T
L2	6200001230	S. COIL	MLF2012A 1R0M-T
L3	6200001310	S. COIL	MLF2012A 4R7M-T
L4	6200001230	S. COIL	MLF2012A 1R0M-T
R1	7030003600	S. RESISTOR	ERJ3GEYJ 223 V (22 kΩ)
R2	7030003440	S. RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R4	7030003540	S. RESISTOR	ERJ3GEYJ 682 V (6.8 kΩ)
R6	7030003660	S. RESISTOR	ERJ3GEYJ 683 V (68 kΩ)
R8	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R9	7030003740	S. RESISTOR	ERJ3GEYJ 334 V (330 kΩ)
R10	7030003540	S. RESISTOR	ERJ3GEYJ 682 V (6.8 kΩ)
R13	7030003460	S. RESISTOR	ERJ3GEYJ 152 V (1.5 kΩ)
R14	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R15	7030003520	S. RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R18	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R19	7030003400	S. RESISTOR	ERJ3GEYJ 471 V (470 Ω)
R20	7030003480	S. RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
C1	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C2	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C3	4030007170	S. CERAMIC	C1608 CH 1H 221J-T-A
C4	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C5	4030006830	S. CERAMIC	C1608 SL 1H 331J-T-A (#01, #02, #11, #12)
	4030009580	S. CERAMIC	C1608 JB 1H 681K-T-A (#03, #04)
C6	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C8	4030007050	S. CERAMIC	C1608 CH 1H 220J-T-A
C9	4030007060	S. CERAMIC	C1608 CH 1H 270J-T-A
C11	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C12 *	4550003040	S. TANTALUM	TEMSVB2 0J 106M-8L
C13	4030008630	S. CERAMIC	C1608 JF 1C 104Z-T-A
C14	4030008630	S. CERAMIC	C1608 JF 1C 104Z-T-A
C15	4030006670	S. CERAMIC	C1608 SL 1H 270J-T-A
C16	4030006890	S. CERAMIC	C1608 JF 1H 103Z-T-A
C17	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C19	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C20	4030007080	S. CERAMIC	C1608 CH 1H 390J-T-A
EP1	0910034223	PCB	B 3445C (IF)
EP2	6910003110	LEADFRAME	HFB2.0-0.7-8 (N)

[VCO BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
Q1	1560000490	S. FET	2SK508 K52 T2B
Q2	1560000490	S. FET	2SK508 K52 T2B
Q3	1590001480	S. TRANSISTOR	FMA5 T148
Q4	1590000430	S. TRANSISTOR	DTC144EU T107
Q5	1530002920	S. TRANSISTOR	2SC4226-T2 R25
Q6	1530002920	S. TRANSISTOR	2SC4226-T2 R25
Q7	1530002920	S. TRANSISTOR	2SC4226-T2 R25
D1	1720000220	S. VARICAP	1SV166-T2B

[VCO BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
D2	1790000660	S. DIODE	MA728 (TW)
D3	1720000220	S. VARICAP	1SV166-T2B
D4	1790000660	S. DIODE	MA728 (TW)
D5	1790000640	S. VARICAP	MA363B (TX)
D6	1720000220	S. VARICAP	1SV166-T2B
D7	1720000220	S. VARICAP	1SV166-T2B
L1	6200000150	S. COIL	NL 322522T-1R0M
L2	6190000820	COIL	MC131-E537AN-030072 (WHITE) (#01, #03, #11)
	6190000830	COIL	MC131-E537AN-030073 (ORANGE) (#02, #04, #12)
L3	6200001600	S. COIL	NL 322522T-3R9M
L4	6200002060	S. COIL	NL 322522T-1R8M
L5	6200000150	S. COIL	NL 322522T-1R0M
L6	6190000840	COIL	MC131-E537AN-040034 (PURPLE) (#01, #03, #11)
	6190000850	COIL	MC131-E537AN-040033 (RED) (#02, #04, #12)
L7	6200001600	S. COIL	NL 322522T-3R9M
L8	6200002060	S. COIL	NL 322522T-1R8M
L9	6200001730	S. COIL	NL 322522T-R10M
L10	6200001730	S. COIL	NL 322522T-R10M
L11	6200000880	S. COIL	NL 322522T-4R7M
R1	7030003280	S. RESISTOR	ERJ3GEYJ 470 V (47 Ω)
R2	7030003530	S. RESISTOR	ERJ3GEYJ 562 V (5.6 kΩ)
R3	7030003320	S. RESISTOR	ERJ3GEYJ 101 V (100 Ω)
R4	7030003300	S. RESISTOR	ERJ3GEYJ 680 V (68 Ω)
R5	7030003320	S. RESISTOR	ERJ3GEYJ 101 V (100 Ω)
R6	7030003280	S. RESISTOR	ERJ3GEYJ 470 V (47 Ω)
R7	7030003300	S. RESISTOR	ERJ3GEYJ 680 V (68 Ω)
R8	7030003320	S. RESISTOR	ERJ3GEYJ 101 V (100 Ω)
R9	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R10	7030003400	S. RESISTOR	ERJ3GEYJ 471 V (470 Ω)
R11	7030003410	S. RESISTOR	ERJ3GEYJ 561 V (560 Ω) (#02, #04, #12)
	7030003430	S. RESISTOR	ERJ3GEYJ 821 V (820 Ω) (#01, #03, #11)
R12	7030003610	S. RESISTOR	ERJ3GEYJ 273 V (27 kΩ)
R13	7030003560	S. RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R15	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R16	7030003440	S. RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R17	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R18	7030003560	S. RESISTOR	ERJ3GEYJ 103 V (10 kΩ) (#02, #04, #12)
	7030003590	S. RESISTOR	ERJ3GEYJ 183 V (18 kΩ) (#01, #03, #11)
R19	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R20	7030003620	S. RESISTOR	ERJ3GEYJ 333 V (33 kΩ)
C2	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C3	4030006960	S. CERAMIC	C1608 CH 1H 050C-T-A (#01, #03, #11)
	4030006990	S. CERAMIC	C1608 CH 1H 080D-T-A (#02, #04, #12)
C4	4030007020	S. CERAMIC	C1608 CH 1H 120J-T-A (#01, #03, #11)
	4030007040	S. CERAMIC	C1608 CH 1H 180J-T-A (#02, #04, #12)
C5	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C6 *	4550004040	S. TANTALUM	TEMSVA 0J 685M-8L
C7	4030006910	S. CERAMIC	C1608 CH 1H 0R5C-T-A
C9	4030007010	S. CERAMIC	C1608 CH 1H 100D-T-A (#01, #03, #11)
	4030007040	S. CERAMIC	C1608 CH 1H 180J-T-A (#02, #04, #12)
C10	4030007050	S. CERAMIC	C1608 CH 1H 220J-T-A (#01, #03, #11)
	4030007080	S. CERAMIC	C1608 CH 1H 390J-T-A (#02, #04, #12)

* Safety critical component
S.=Surface mount

[VCO BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
C11	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C12 *	4550004040	S. TANTALUM	TEMSVA 0J 685M-8L
C13	4030006910	S. CERAMIC	C1608 CH 1H 0R5C-T-A
C14	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C16	4030006960	S. CERAMIC	C1608 CH 1H 050C-T-A (#01, #03, #11)
	4030007020	S. CERAMIC	C1608 CH 1H 120J-T-A (#02, #04, #12)
C17	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C19	4030007030	S. CERAMIC	C1608 CH 1H 150J-T-A (#01, #03, #11)
	4030007070	S. CERAMIC	C1608 CH 1H 330J-T-A (#02, #04, #12)
C20	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C21	4030006950	S. CERAMIC	C1608 CH 1H 040C-T-A (#01, #03, #11)
	4030006970	S. CERAMIC	C1608 CH 1H 060D-T-A (#02, #04, #12)
C22	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C23	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C24	4030006980	S. CERAMIC	C1608 CH 1H 070D-T-A (#01, #03, #11)
	4030007010	S. CERAMIC	C1608 CH 1H 100D-T-A (#02, #04, #12)
C25	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C26	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C27	4030008630	S. CERAMIC	C1608 JF 1C 104Z-T-A
C28	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C29 *	4550004040	S. TANTALUM	TEMSVA 0J 685M-8L
C30	4030006930	S. CERAMIC	C1608 CH 1H 020C-T-A
C31 *	4030008680	S. CERAMIC	C2012 JF 1C 105Z-T-A
C32	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C33	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C34 *	4030008680	S. CERAMIC	C2012 JF 1C 105Z-T-A
C35	4030006900	S. CERAMIC	C1608 JB 1E 103K-T-A
J1	6910006600	CONNECTOR	IMSA-9230B-1-10Z030-T
J2	6910006510	CONNECTOR	IMSA-9230B-1-05Z030-T
W1	7030003860	S. JUMPER	ERJ3GE JPW V
EP1	0910034522	PCB	B 3447B (VCO)

[PLL BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
L1	6200002190	S. COIL	MLF2012A 4R7K-T
R1	7030003400	S. RESISTOR	ERJ3GEYJ 471 V (470 Ω)
R2	7030003430	S. RESISTOR	ERJ3GEYJ 821 V (820 Ω)
R3	7030003380	S. RESISTOR	ERJ3GEYJ 331 V (330 Ω)
R4	7030003560	S. RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R5	7030003600	S. RESISTOR	ERJ3GEYJ 223 V (22 kΩ)
R6	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R7	7030003590	S. RESISTOR	ERJ3GEYJ 183 V (18 kΩ)
R8	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R9	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R10	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R11	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R12	7030003480	S. RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R13	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R14	7030003700	S. RESISTOR	ERJ3GEYJ 154 V (150 kΩ)
R15	7030003560	S. RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R16	7030003200	S. RESISTOR	ERJ3GEYJ 100 V (10 Ω)
R17	7030003540	S. RESISTOR	ERJ3GEYJ 682 V (6.8 kΩ)
R18	7030003480	S. RESISTOR	ERJ3GEYJ 222 V (2.2 kΩ)
R19	7510000430	S. THERMISTOR	DTN-T203K202LS (T)
R20	7510000430	S. THERMISTOR	DTN-T203K202LS (T)
R21	7030003580	S. RESISTOR	ERJ3GEYJ 153 V (15 kΩ)
R22	7030003440	S. RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
C1	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C2	4030008630	S. CERAMIC	C1608 JF 1C 104Z-T-A
C3	4030006900	S. CERAMIC	C1608 JB 1E 103K-T-A
C4	4030008630	S. CERAMIC	C1608 JF 1C 104Z-T-A
C5	4030006900	S. CERAMIC	C1608 JB 1E 103K-T-A
C6 *	4550003080	S. TANTALUM	TEMSVA 1A 335M-8L
C7	4030007090	S. CERAMIC	C1608 CH 1H 470J-T-A
C8	4030007130	S. CERAMIC	C1608 CH 1H 101J-T-A
C9	4030007170	S. CERAMIC	C1608 CH 1H 221J-T-A
C10	4030006950	S. CERAMIC	C1608 CH 1H 040C-T-A
C11	4610001260	S. TRIMMER	ECR-JA020 E12W
C12	4030007070	S. CERAMIC	C1608 CH 1H 330J-T-A
C13	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C14	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C15 *	4550004040	S. TANTALUM	TEMSVA 0J 685M-8L
C16	4030007110	S. CERAMIC	C1608 CH 1H 680J-T-A
C17	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
EP1	0910034512	PCB	B 3443B (PLL)

[PLL BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
IC1	1140002130	S. IC	MB1511PFV-G-BND
Q1	1510000770	S. TRANSISTOR	2SA1586-GR (TE85R)
Q2	1530002690	S. TRANSISTOR	2SC4116-GR (TE85R)
Q3	1530002690	S. TRANSISTOR	2SC4116-GR (TE85R)
D1	1720000180	S. VARICAP	1SV164-T2B
X1	6050007760	XTAL	CR-368

[MODULE 1 BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
EP1	0910034280	PCB	B 3455 (MODULE1)
EP2	6910003110	LEADFRAME	HFB2.0-0.7-8 (N)

* Safety critical component
S.=Surface mount

[MODULE 2 BOARD]

REF. NO.	ORDER NO.	DESCRIPTION	
IC1	1150001230	IC	SC-1224 (#02, #04, #12)
	1150001240	IC	SC-1223 (#01, #03, #11)
C1	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C2	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C3	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C4	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C5	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C6	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
EP1	0910034270	PCB	B 3454 (MODULE2)
EP2	6910003110	LEADFRAME	HFB2.0-0.7-8 (N)

[LOGIC UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
R7	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R8	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R9	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R10	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R11	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R12	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R13	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R14	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R15	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R16	7030003420	S. RESISTOR	ERJ3GEYJ 681 V (680 Ω)
R17	7030003420	S. RESISTOR	ERJ3GEYJ 681 V (680 Ω)
R18	7030003420	S. RESISTOR	ERJ3GEYJ 681 V (680 Ω)
R19	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R20	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R21	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R22	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R23	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R24	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R25	7030003560	S. RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R26	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R27	7030003440	S. RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R28	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R29	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R30	7030003440	S. RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R31	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R32	7030003560	S. RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R33	7030003560	S. RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R34	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R35	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R36	7030003580	S. RESISTOR	ERJ3GEYJ 153 V (15 kΩ)
R37	7030003560	S. RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R38	7030003800	S. RESISTOR	ERJ3GEYJ 105 V (1 MΩ)
R39	7030003460	S. RESISTOR	ERJ3GEYJ 152 V (1.5 kΩ)
R40	7030003720	S. RESISTOR	ERJ3GEYJ 224 V (220 kΩ)
R41	7030003400	S. RESISTOR	ERJ3GEYJ 471 V (470 Ω)
			(#03, #04)
	7030003420	S. RESISTOR	ERJ3GEYJ 681 V (680 Ω)
			(#01, #02, #11, #12)
R42	7030003670	S. RESISTOR	ERJ3GEYJ 823 V (82 kΩ)
R44	7030003440	S. RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R45	7030003620	S. RESISTOR	ERJ3GEYJ 333 V (33 kΩ)
R46	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R47	7030003410	S. RESISTOR	ERJ3GEYJ 561 V (560 Ω)
R48	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R49	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R50	7030003440	S. RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R51	7030003450	S. RESISTOR	ERJ3GEYJ 122 V (1.2 kΩ)
R52	7030003560	S. RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R53	7030003400	S. RESISTOR	ERJ3GEYJ 471 V (47 Ω)
R54	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R55	7030003560	S. RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R56	7030003540	S. RESISTOR	ERJ3GEYJ 682 V (6.8 kΩ)
R57	7030003710	S. RESISTOR	ERJ3GEYJ 184 V (180 kΩ)
R58	7030003710	S. RESISTOR	ERJ3GEYJ 184 V (180 kΩ)
R59	7310002800	S. TRIMMER	RV-156 (RH03A3AJ5) 224
R60	7030003360	S. RESISTOR	ERJ3GEYJ 221 V (220 Ω)
R61	7030003950	S. RESISTOR	ERJ3GEYF 204 V (200 kΩ)
R62	7030003710	S. RESISTOR	ERJ3GEYJ 184 V (180 kΩ)
R63	7030003720	S. RESISTOR	ERJ3GEYJ 224 V (220 kΩ)
R64	7030003690	S. RESISTOR	ERJ3GEYJ 124 V (120 kΩ)
R65	7030003670	S. RESISTOR	ERJ3GEYJ 823 V (82 kΩ)
R66	7030003440	S. RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R67	7030003670	S. RESISTOR	ERJ3GEYJ 823 V (82 kΩ)
R68	7030003520	S. RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)
R70	7030003500	S. RESISTOR	ERJ3GEYJ 332 V (3.3 kΩ)
R71	7030003500	S. RESISTOR	ERJ3GEYJ 332 V (3.3 kΩ)
R76	7030003560	S. RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R77	7030003820	S. RESISTOR	ERJ3GEYJ 155 V (1.5 MΩ)
R78	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R79	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R80	7310002580	S. TRIMMER	RV-108 (RH03A3A15X05A) 104
R81	7030003440	S. RESISTOR	ERJ3GEYJ 102 V (1 kΩ)
R82	7030003560	S. RESISTOR	ERJ3GEYJ 103 V (10 kΩ)
R83	7030003520	S. RESISTOR	ERJ3GEYJ 472 V (4.7 kΩ)

[LOGIC UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
IC1	1140003290	S. IC	μPD75108GF-S46-3BE
IC2	1130005100	S. IC	FX365LG
IC3	1110001220	S. IC	BA4558F T1
IC4	1110001550	S. IC	S-8054ALB-LM-T1
IC5	1130003760	S. IC	TC4S81F (TE85R)
IC7	1130004200	S. IC	TC4S66F (TE85R)
Q1	1530002690	S. TRANSISTOR	2SC4116-GR (TE85R)
Q2	1530002690	S. TRANSISTOR	2SC4116-GR (TE85R)
Q3	1590000430	S. TRANSISTOR	DTC144EU T107
Q4	1590000720	S. TRANSISTOR	DTA144EU T107
Q5	1590000430	S. TRANSISTOR	DTC144EU T107
Q6	1530002690	S. TRANSISTOR	2SC4116-GR (TE85R)
Q7	1590000720	S. TRANSISTOR	DTA144EU T107
Q8	1590000430	S. TRANSISTOR	DTC144EU T107
Q9	1530002980	S. TRANSISTOR	2SC3650-TD
Q10	1530002690	S. TRANSISTOR	2SC4116-GR (TE85R)
Q11	1510000770	S. TRANSISTOR	2SA1586-GR (TE85R)
Q12	1590000430	S. TRANSISTOR	DTC144EU T107
Q13	1510000770	S. TRANSISTOR	2SA1586-GR (TE85R)
Q14	1590001330	S. TRANSISTOR	DTA114EU T107
Q15	1530002690	S. TRANSISTOR	2SC4116-GR (TE85R)
Q16	1590001330	S. TRANSISTOR	DTA114EU T107
D1	1750000020	S. DIODE	1SS184 (TE85R)
D2	1750000270	S. DIODE	1SS301 (TE85R)
D3	1750000160	S. DIODE	DA114 T107
D4	1750000160	S. DIODE	DA114 T107
D5	1750000270	S. DIODE	1SS301 (TE85R)
D6	1750000220	S. DIODE	DA113W T107
D7	1790000660	S. DIODE	MA728 (TW)
D8	1790000660	S. DIODE	MA728 (TW)
X1	6050003110	XTAL	RF-4A3 FAC NKD (4.194304M)
X2	6050000130	XTAL	UM-1 1.0000M
R1	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R2	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R3	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R4	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R5	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R6	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)

* Safety critical component
S.=Surface mount

[LOGIC UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
R84	7030003680	S. RESISTOR	ERJ3GEYJ 104 V (100 kΩ)
R85	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
R86	7510000410	S. THERMISTOR	DTN-T204C682LS (T)
R87	7030003640	S. RESISTOR	ERJ3GEYJ 473 V (47 kΩ)
C1	4030006630	S. CERAMIC	C1608 SL 1H 150J-T-A
C2	4030006630	S. CERAMIC	C1608 SL 1H 150J-T-A
C3 *	4550004040	S. TANTALUM	TEMSVA 0J 685M-8L
C4	4030006890	S. CERAMIC	C1608 JF 1H 103Z-T-A
C5	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C6	4030006730	S. CERAMIC	C1608 SL 1H 680J-T-A
C7 *	4550003030	S. TANTALUM	TEMSVA 0J 475M-8L
C8	4030006690	S. CERAMIC	C1608 SL 1H 330J-T-A
C9	4030006570	S. CERAMIC	C1608 SL 1H 060D-T-A
C10	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C11	4030006890	S. CERAMIC	C1608 JF 1H 103Z-T-A
C12	4030008630	S. CERAMIC	C1608 JF 1C 104Z-T-A
C13	4030008960	S. CERAMIC	C2012 JB 1C 104K-T-A
C14	4030008960	S. CERAMIC	C2012 JB 1C 104K-T-A
C15	4550003250	S. TANTALUM	TEMSVA 1V 474M-8L
C16	4550000530	S. TANTALUM	TESVA 1V 104M1-8L
C17 *	4550003030	S. TANTALUM	TEMSVA 0J 475M-8L
C18	4030006890	S. CERAMIC	C1608 JF 1H 103Z-T-A
C19	4550000550	S. TANTALUM	TESVA 1V 224M1-8L
C20	4030006710	S. CERAMIC	C1608 SL 1H 470J-T-A
C21	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C22	4030006710	S. CERAMIC	C1608 SL 1H 470J-T-A
C23	4030006890	S. CERAMIC	C1608 JF 1H 103Z-T-A
C24	4030006710	S. CERAMIC	C1608 SL 1H 470J-T-A
C25	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C26	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C27	4030008630	S. CERAMIC	C1608 JF 1C 104Z-T-A
C28 *	4550004040	S. TANTALUM	TEMSVA 0J 685M-8L
C29	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C30	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C31	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C32	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C33	4030006730	S. CERAMIC	C1608 SL 1H 680J-T-A
C34	4550000530	S. TANTALUM	TESVA 1V 104M1-8L
C35	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C36	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C37	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C38 *	4550003030	S. TANTALUM	TEMSVA 0J 475M-8L
C39	4030006870	S. CERAMIC	C1608 JB 1H 222K-T-A
C40	4030007060	S. CERAMIC	C1608 CH 1H 270J-T-A
C41	4030007130	S. CERAMIC	C1608 CH 1H 101J-T-A
C43	4030009580	S. CERAMIC	C1608 JB 1H 681K-T-A
C44	4030009580	S. CERAMIC	C1608 JB 1H 681K-T-A
C45	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C46	4030006710	S. CERAMIC	C1608 SL 1H 470J-T-A
C47	4030006710	S. CERAMIC	C1608 SL 1H 470J-T-A
C48	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C49 *	4550000420	S. TANTALUM	TESVA 1A 105M1-8L
C50	4030006890	S. CERAMIC	C1608 JF 1H 103Z-T-A
C51 *	4550000420	S. TANTALUM	TESVA 1A 105M1-8L
C52	4550003250	S. TANTALUM	TEMSVA 1V 474M-8L
C53 *	4550004040	S. TANTALUM	TEMSVA 0J 685M-8L
C54	4030008630	S. CERAMIC	C1608 JF 1C 104Z-T-A
C55	4030006750	S. CERAMIC	C1608 SL 1H 101J-T-A
C56	4030008630	S. CERAMIC	C1608 JF 1C 104Z-T-A
C57	4030006750	S. CERAMIC	C1608 SL 1H 101J-T-A
C58	4030008630	S. CERAMIC	C1608 JF 1C 104Z-T-A
C59	4030006750	S. CERAMIC	C1608 SL 1H 101J-T-A
C60	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C61 *	4550000420	S. TANTALUM	TESVA 1A 105M1-8L
C62	4030006850	S. CERAMIC	C1608 JB 1H 471K-T-A
C63	4030008860	S. CERAMIC	C1608 JB 1C 153K-T-A
BT1	3020000060	LITHIUM	CR1220-1VF
J2	6510009390	CONNECTOR	B6B-ZR
J3	6510009370	CONNECTOR	B4B-ZR

[LOGIC UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
J4	6510009490	CONNECTOR	S5B-ZR
J7	6510009380	CONNECTOR	B5B-ZR
W1	7030003860	S. JUMPER	ERJ3GE JPW V
W2	7030003860	S. JUMPER	ERJ3GE JPW V
W3	7030003860	S. JUMPER	ERJ3GE JPW V
W4	7030003860	S. JUMPER	ERJ3GE JPW V
W5	7030003860	S. JUMPER	ERJ3GE JPW V
W6	7030003860	S. JUMPER	ERJ3GE JPW V
W7	7030003860	S. JUMPER	ERJ3GE JPW V
W8	7030003860	S. JUMPER	ERJ3GE JPW V
W10	7030003860	S. JUMPER	ERJ3GE JPW V
W11	7030003860	S. JUMPER	ERJ3GE JPW V
W12	7030003860	S. JUMPER	ERJ3GE JPW V
W15	7030003860	S. JUMPER	ERJ3GE JPW V
EP1	0910034203	PCB	B 3442C (LOGIC)
EP2	0910031742	FPC	B 3096B

[JACK UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
L1	6200000150	S. COIL	NL 322522T-1R0M
L2	6200001670	S. COIL	NL 322522T-R47M
L3	6200001670	S. COIL	NL 322522T-R47M
C1	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
C2	4030006860	S. CERAMIC	C1608 JB 1H 102K-T-A
J1	6510013620	CONNECTOR	YM-260
EP1	0910037560	FPC	B 3712

* Safety critical component
S.=Surface mount

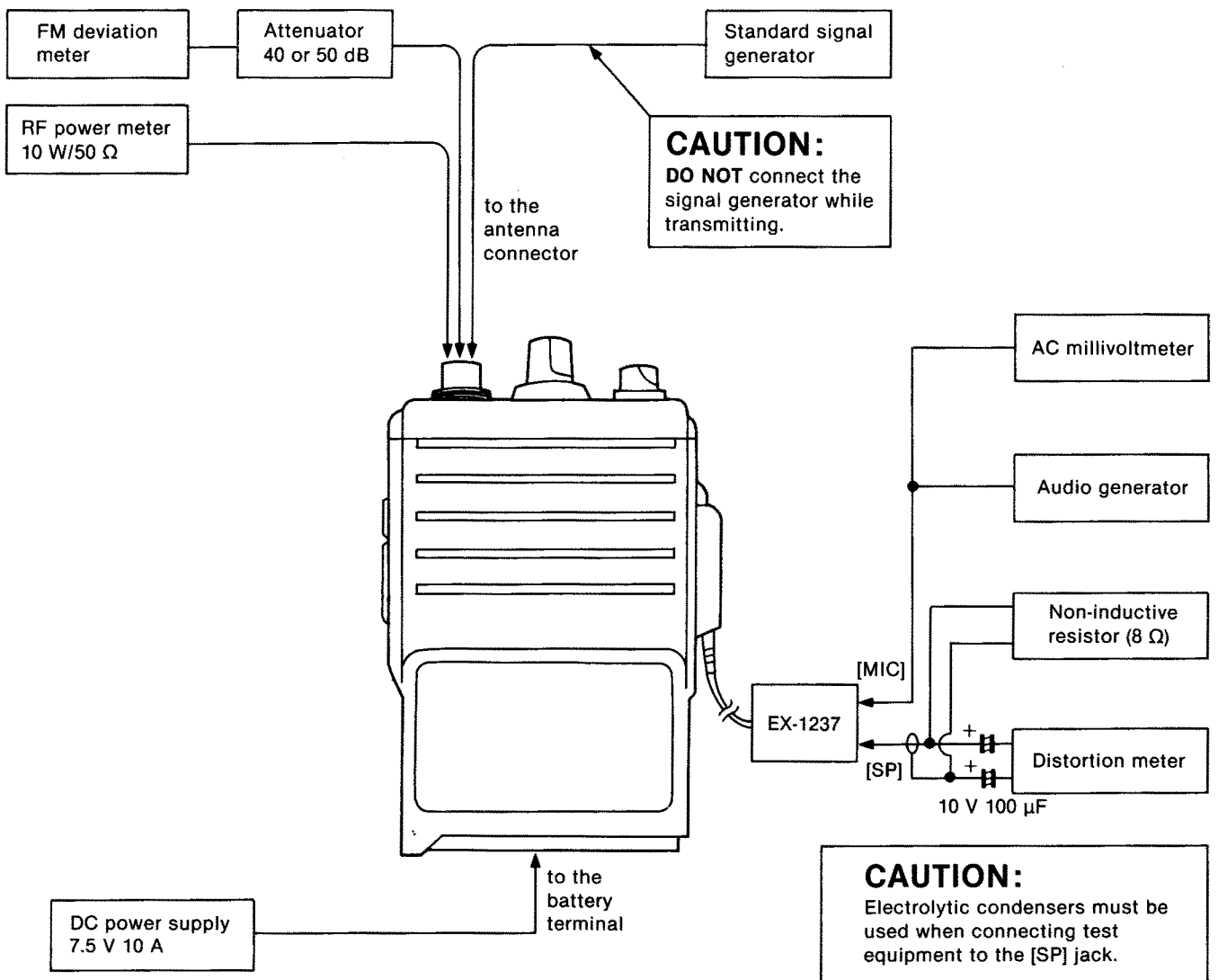
SECTION 6 ADJUSTMENT PROCEDURES

6-1 PREPARATION BEFORE SERVICING

■ REQUIRED TEST EQUIPMENT

EQUIPMENT	GRADE AND RANGE	EQUIPMENT	GRADE AND RANGE
DC power supply	Output voltage : 7.5 V DC Current capacity : 10 A or more	Audio generator	Frequency range : 300~3000 Hz Output level : 1~100 mV
RF power meter (terminated type)	Measuring range : 1~10 W Frequency range : 120~180 MHz Impedance : 50 Ω SWR : Less than 1.2 : 1	Attenuator	Power attenuation : 40 or 50 dB Capacity : 10 W or more
Frequency counter	Frequency range : 0.1~180 MHz Frequency accuracy : ±1 ppm or better Sensitivity : 100 mV or better	AC millivoltmeter	Measuring range : 2~200 mV
Distortion meter	Frequency range : 1 kHz ± 10 Hz Measuring range : 1~100 %	Non-inductive resistor	Impedance : 8 Ω
Standard signal generator (SSG)	Frequency range : 0.1~180 MHz Output level : -127~-17 dBm (0.1 μV~32 mV)	DC voltmeter	Input impedance : 50 kΩ/DC or better
		FM deviation meter	Frequency minimum : 180 MHz Measuring range : 0~±5 kHz
		Digital multimeter or oscilloscope	Input impedance : 1 MΩ/DC or better

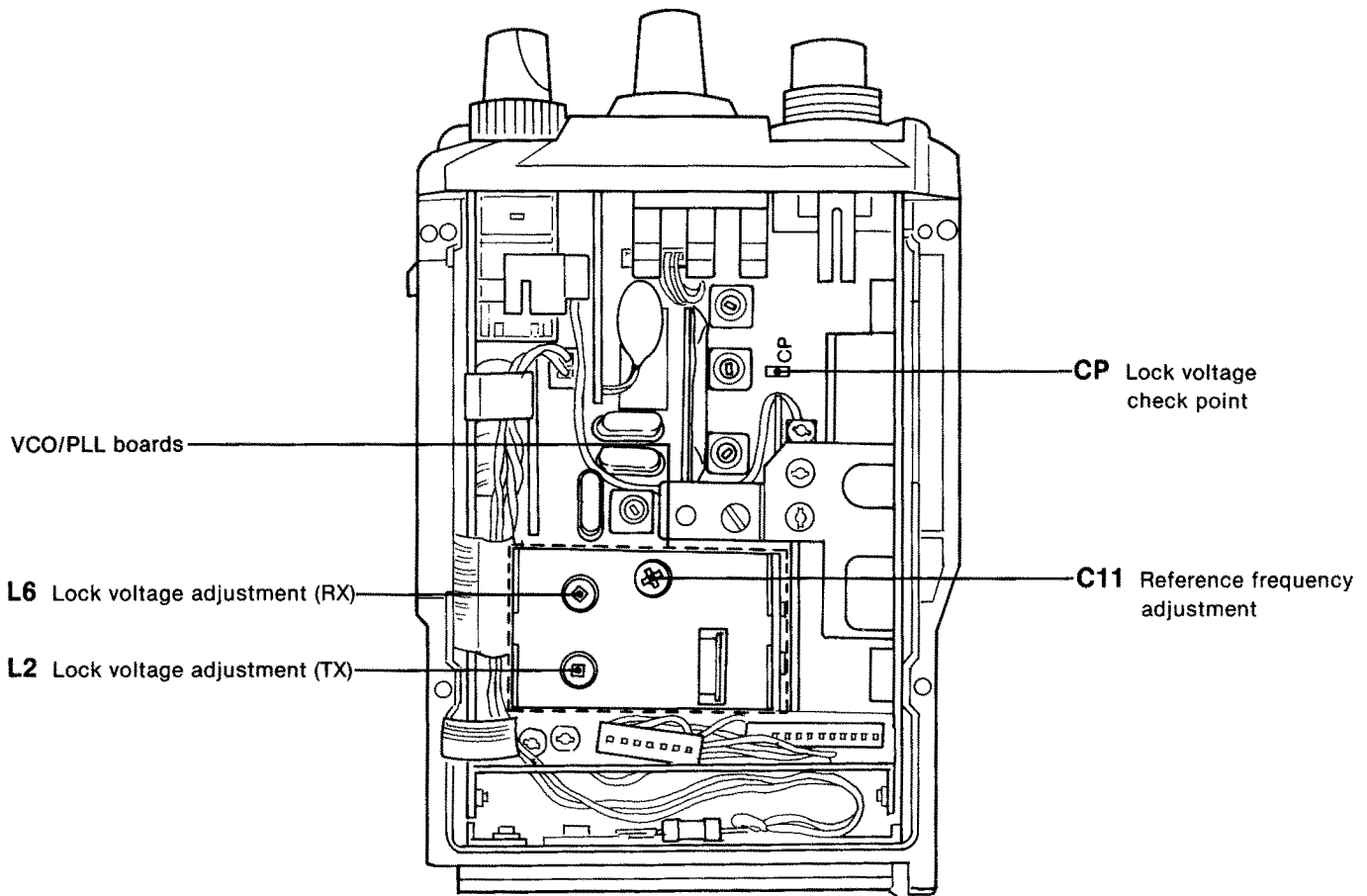
■ CONNECTION



6-2 PLL ADJUSTMENT

ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT		
		UNIT	LOCATION		BOARD	ADJUST	
LOCK VOLTAGE	NOTE: Lock voltage affects the C/N ratio. If you adjust the lock voltage, set the frequency with the EX-704.						
	1	<ul style="list-style-type: none"> Operating frequency: 174.0000 MHz (#01, #03, #11) 150.0000 MHz (#02, #04, #12) Receiving 	RF	Connect the digital multimeter or oscilloscope to CP on RF unit.	5.3 V	VCO	L6
	2	<ul style="list-style-type: none"> Transmitting 			5.3 V		L2
REFERENCE FREQUENCY	1	<ul style="list-style-type: none"> Select any channel. Connect the RF power meter or a 50 Ω dummy load to the antenna connector. Transmitting 	Top panel	Loosely couple the frequency counter to the antenna connector.	The same frequency as the programmed one.	PLL	C11
	NOTE: Perform this adjustment carefully. Consider that the reference frequency decreases when the VCO cover is attached.						

• RF UNIT

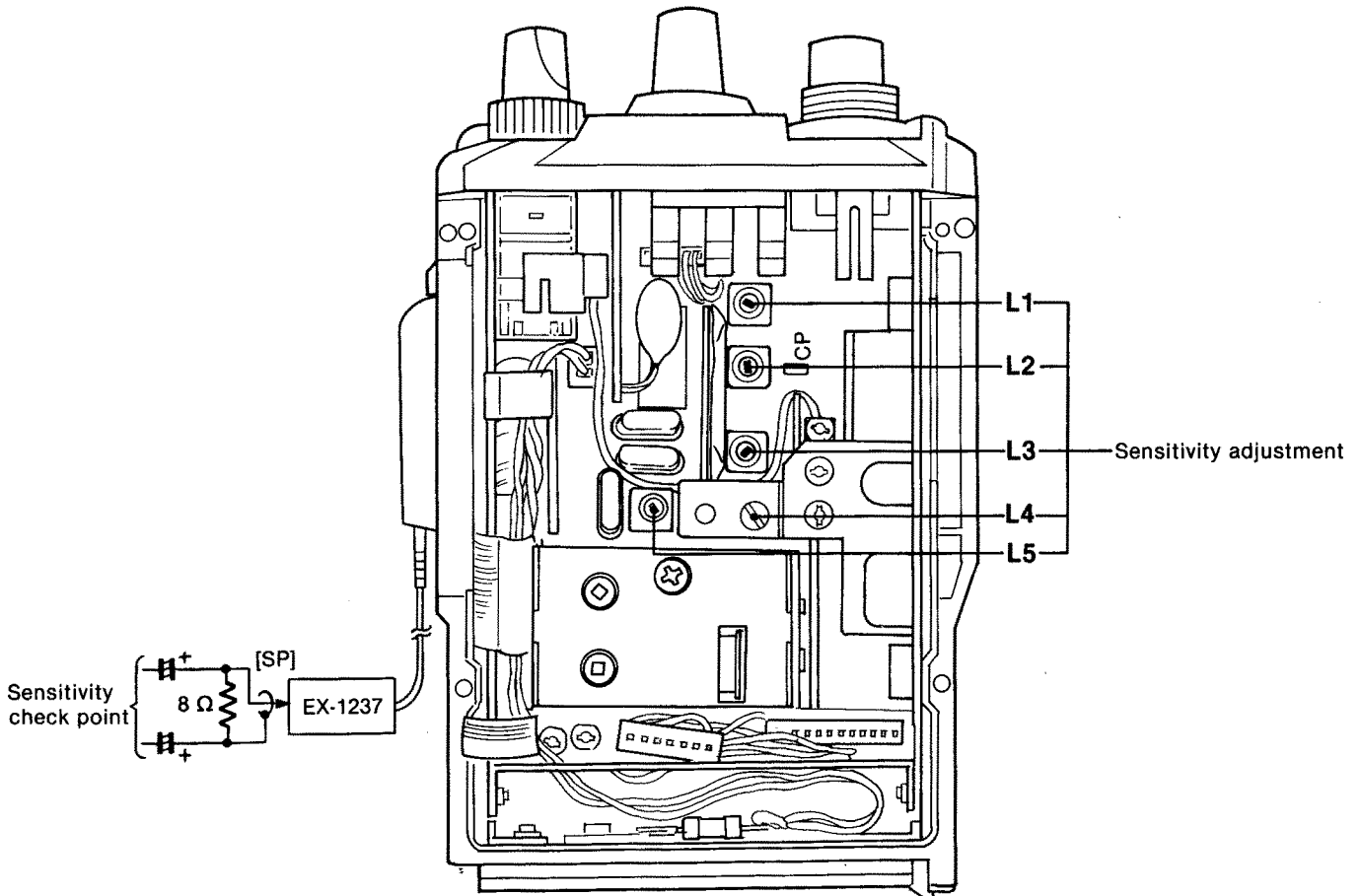


6-3 RECEIVER ADJUSTMENT

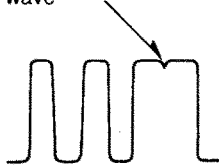
ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT		
		UNIT	LOCATION		UNIT	ADJUST	
SENSITIVITY	NOTE: The EX-704 is required to perform the receiver adjustments. When the sensitivity is less than $0.25 \mu\text{V}$ (12 dB SINAD) on every channel, the following sensitivity adjustment is not necessary.						
	1	<ul style="list-style-type: none"> • Operating frequency: Lower of the frequency coverage • Connect the SSG to the antenna connector and set as: Level : $0.25 \mu\text{V}^*$ (-119 dBm) Modulation: 1 kHz Deviation : $\pm 3.0 \text{ kHz}$ (#01, #02, #11, #12) $\pm 1.5 \text{ kHz}$ (#03, #04) • [MONITOR] switch : ON • Receiving 	Connected EX-1237	Connect the distortion meter to the [SP] jack with an 8Ω load.	Minimum distortion level	RF	Adjust in sequence L1~L5

*This output level of the standard signal generator (SSG) is indicated as SSG's open circuit.

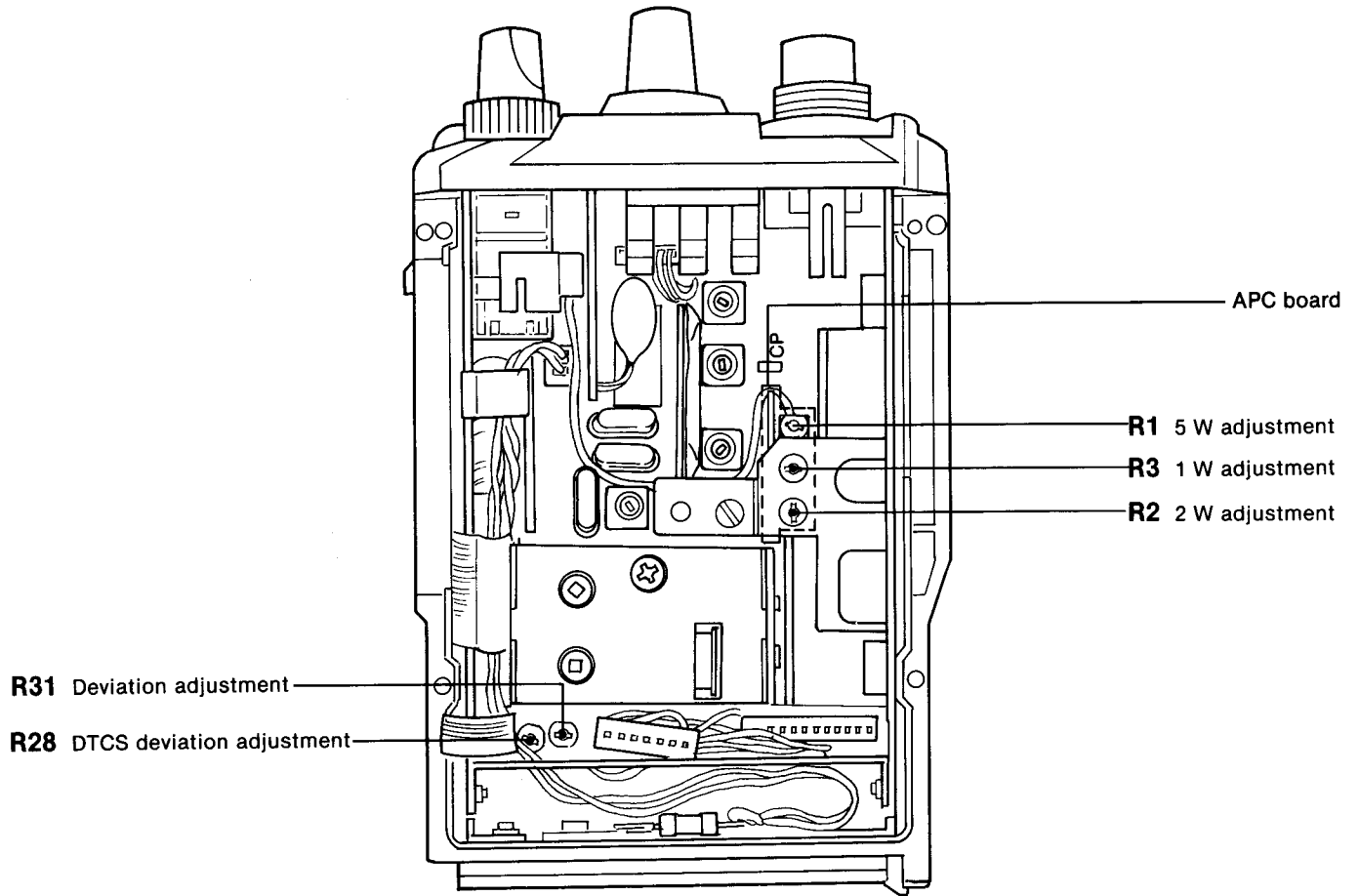
• RF UNIT



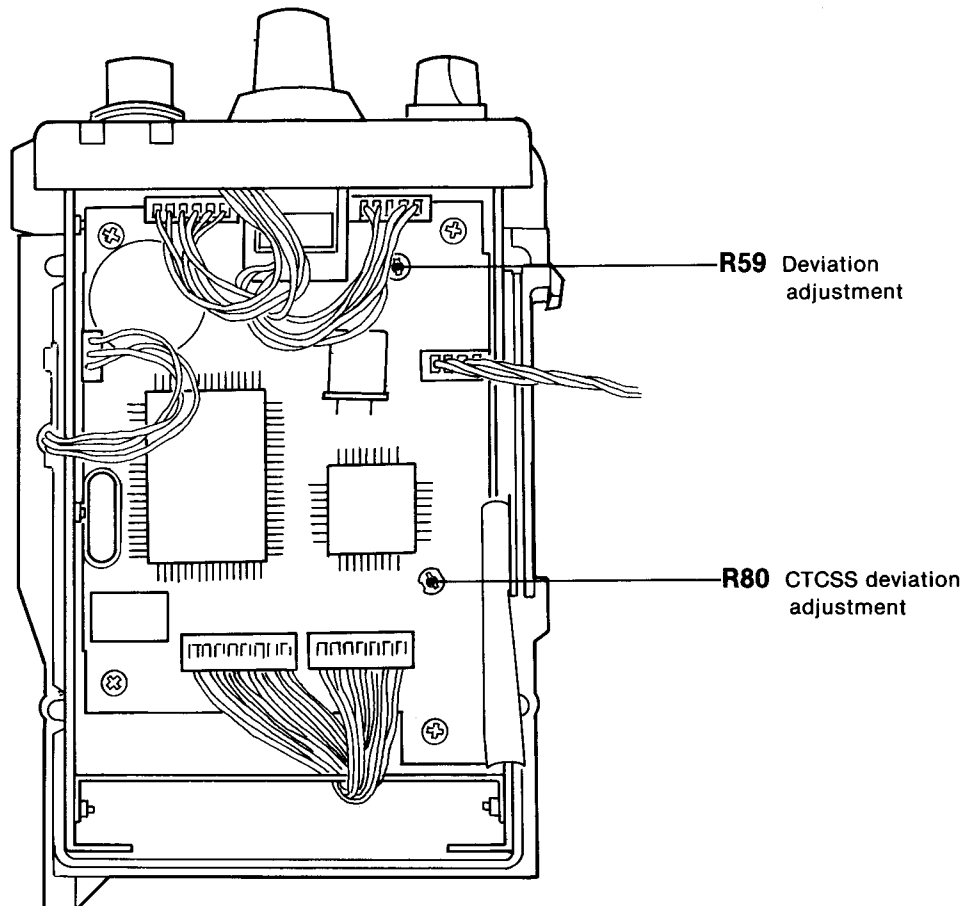
6-4 TRANSMITTER ADJUSTMENT

ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT		
		UNIT	LOCATION		UNIT	ADJUST	
OUTPUT POWER	1	<ul style="list-style-type: none"> Select the channel where the high power is programmed. Transmitting 	Top panel	Connect the RF power meter to the antenna connector.	5 W	APC board	R1
	2	<ul style="list-style-type: none"> Select the channel where the low power is programmed. 			2 W		R2
	3	<ul style="list-style-type: none"> Low power transmission. (Push [PTT] and [FUNCTION] simultaneously) 			1 W		R3
DEVIATION	1	<ul style="list-style-type: none"> Set the FM deviation meter as: <ul style="list-style-type: none"> HPF : OFF LPF : 20 kHz De-emphasis: OFF Detector : (P-P)/2 Select the lowest frequency channel. Connect the audio generator with an AC millivoltmeter and set as: <ul style="list-style-type: none"> Level : 150 mV Frequency : 1.0 kHz Transmitting 	Top panel	Connect the FM deviation meter to the antenna connector via the attenuator.	±4.1 kHz (#01, #02, #11, #12) ±2.0 kHz (#03, #04)	RF	R31
	2	<ul style="list-style-type: none"> Set the FM deviation meter as: <ul style="list-style-type: none"> Detector : P and -P 			Symmetrical deviation level		LOGIC
CTCSS DEVIATION	1	<ul style="list-style-type: none"> Select the channel which is the lowest frequency in CTCSS programmed channels. Apply no signal to the microphone connector. Set the FM deviation meter as: <ul style="list-style-type: none"> HPF : OFF LPF : 20 kHz De-emphasis: OFF Detector : (P-P)/2 Transmitting 	Top panel	Connect the FM deviation meter to the antenna connector via the attenuator.	±0.75 kHz (#01, #02, #11, #12) ±0.35 kHz (#03, #04)	LOGIC	R80
DTCS DEVIATION (#01, #02, #11, #12 only)	1	<ul style="list-style-type: none"> Connect the UT-69 DTCS UNIT. Select the channel where the DTCS is programmed. Apply no signal to the microphone connector. Set the FM deviation meter as: <ul style="list-style-type: none"> HPF : OFF LPF : 20 kHz De-emphasis: OFF Detector : (P-P)/2 Transmitting 	Top panel	Connect the FM deviation meter to the antenna connector via the attenuator.	Minimum drop on the wave 	RF	R28

• RF UNIT



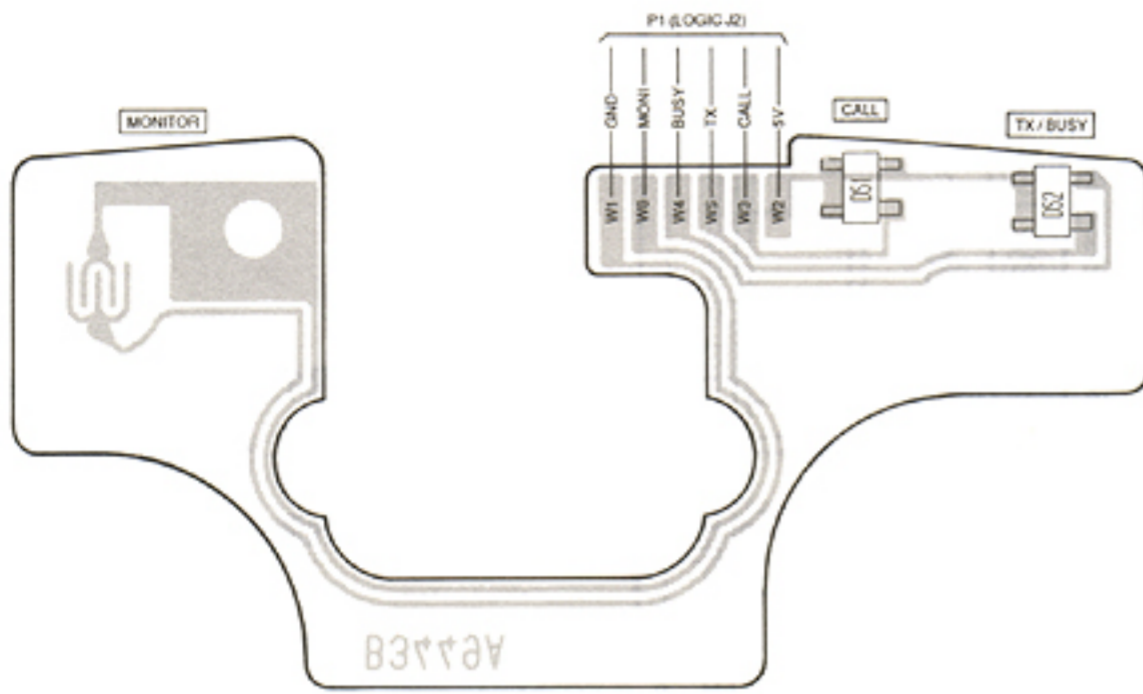
• LOGIC UNIT



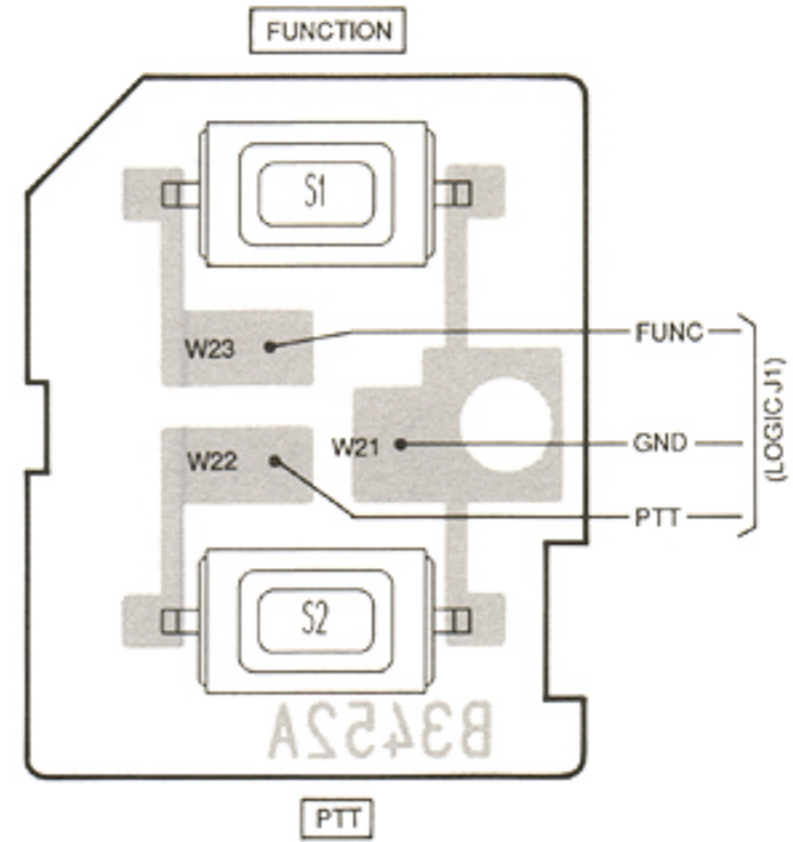
SECTION 7 BOARD LAYOUTS

7-1 LOGIC UNIT

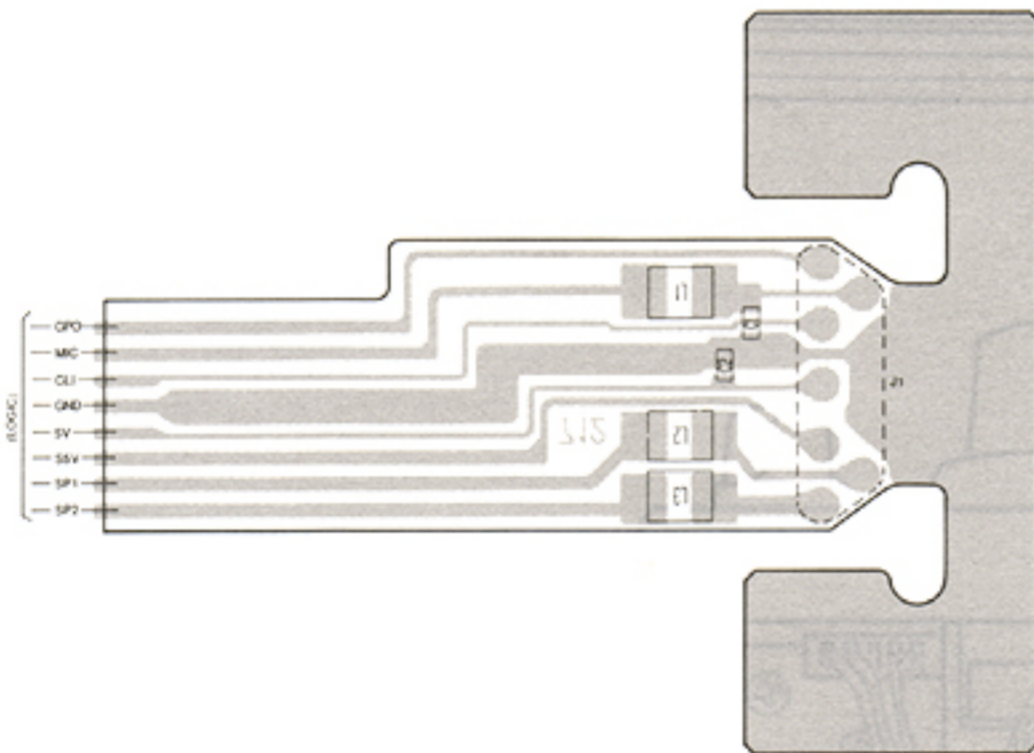
• LED UNIT



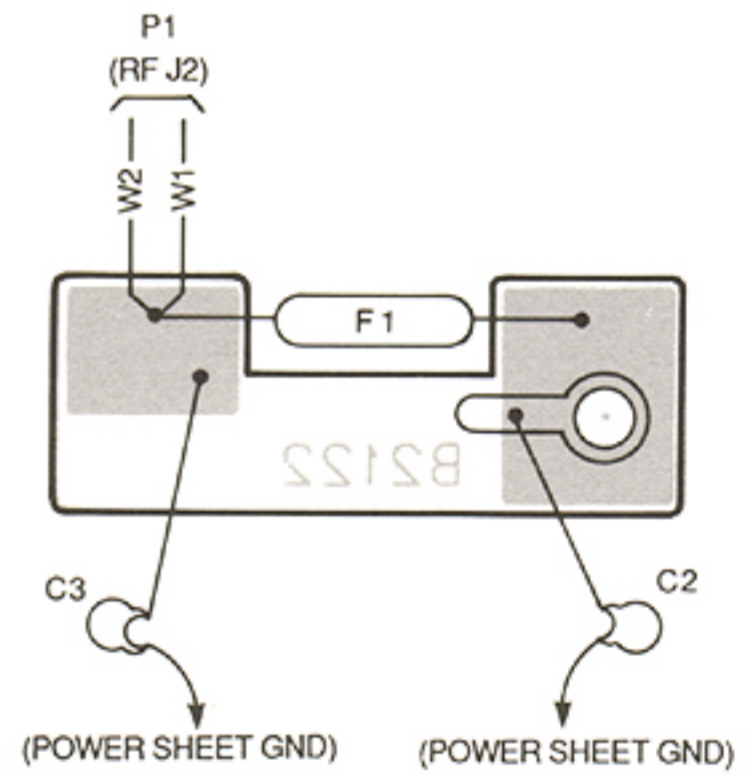
• PTT UNIT



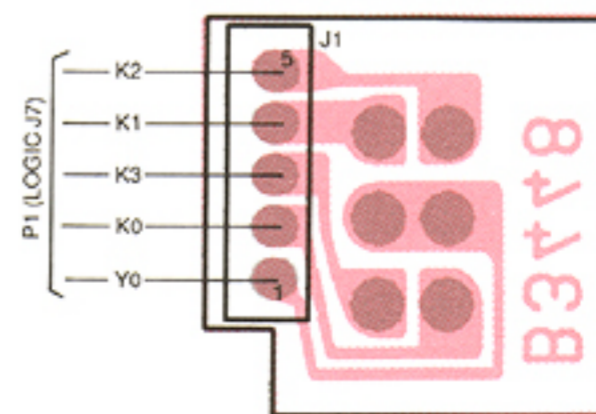
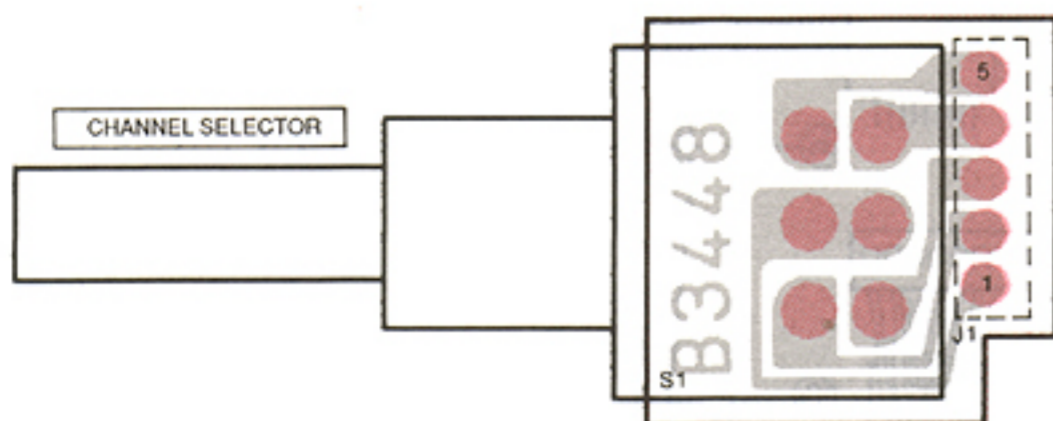
• JACK UNIT



• FUSE UNIT

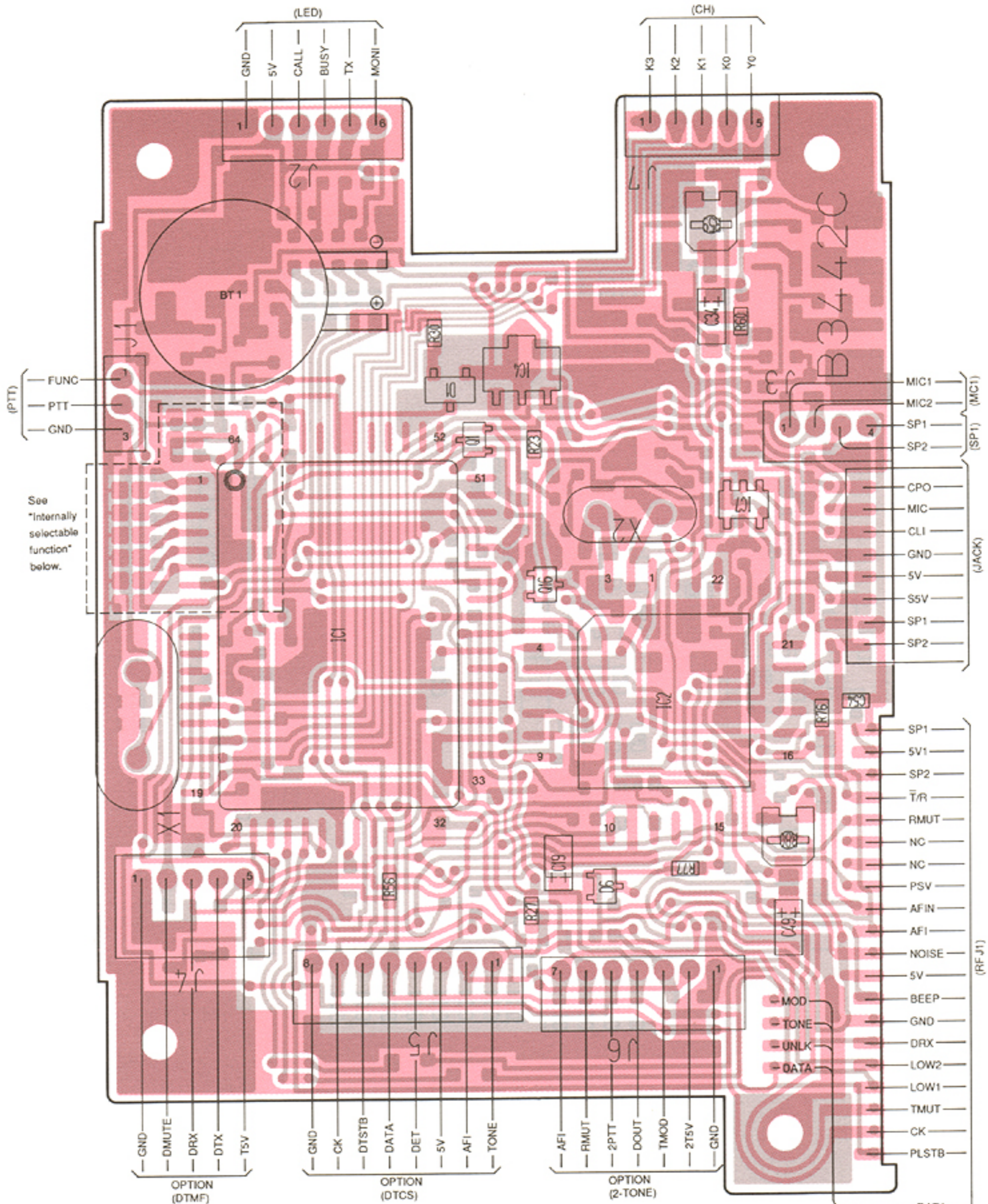


• CH UNIT

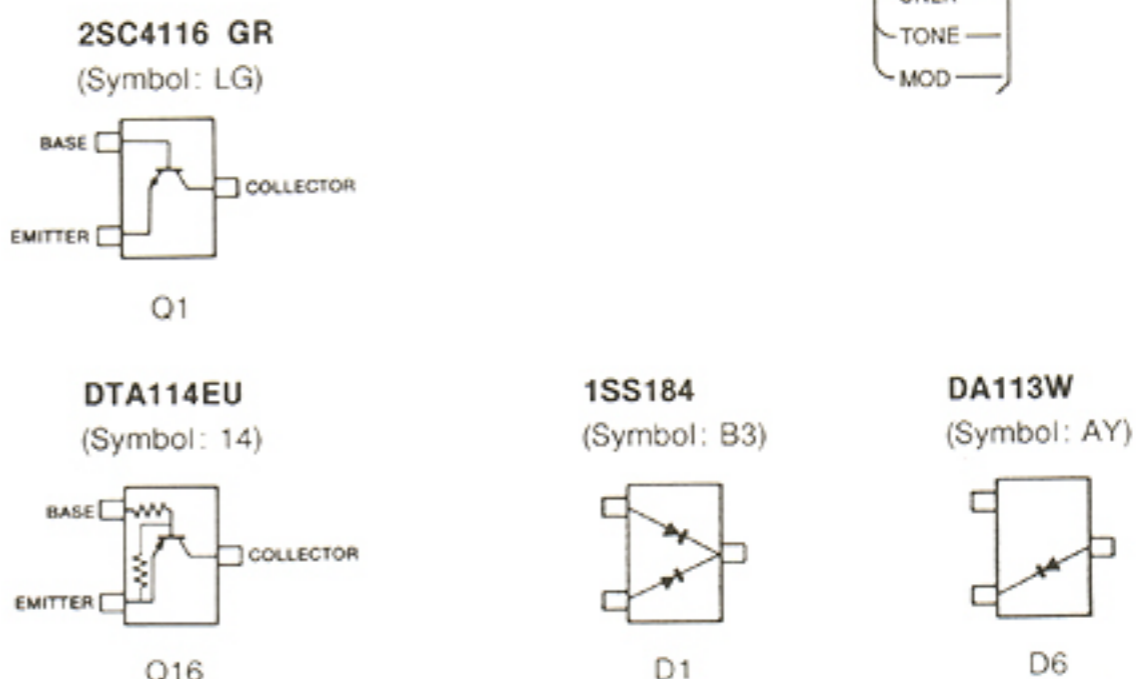
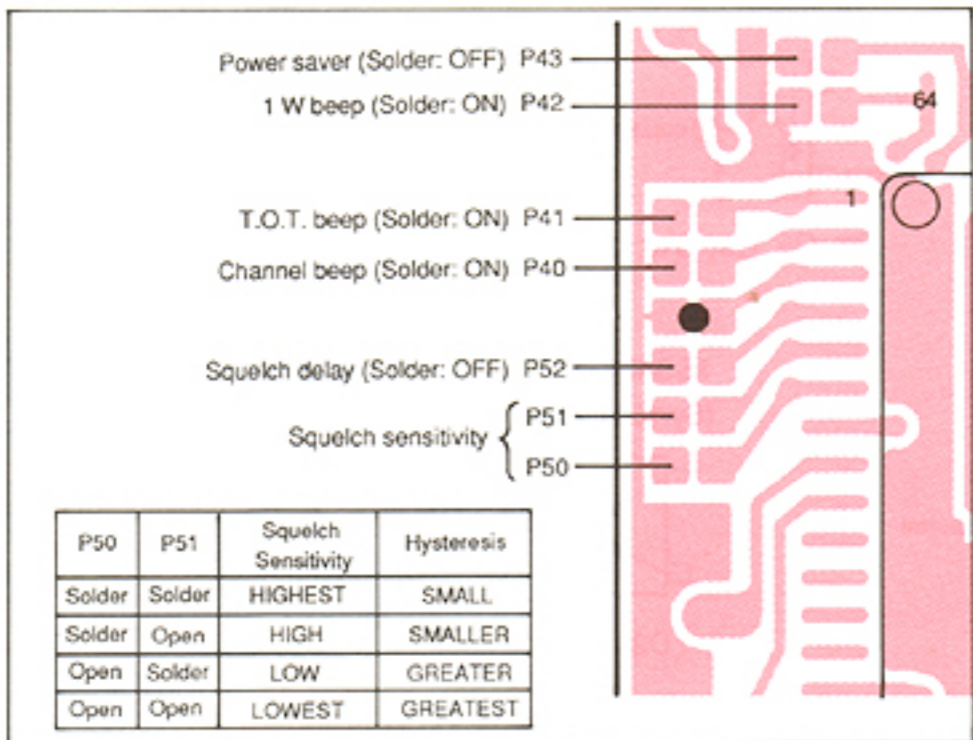


• LOGIC UNIT

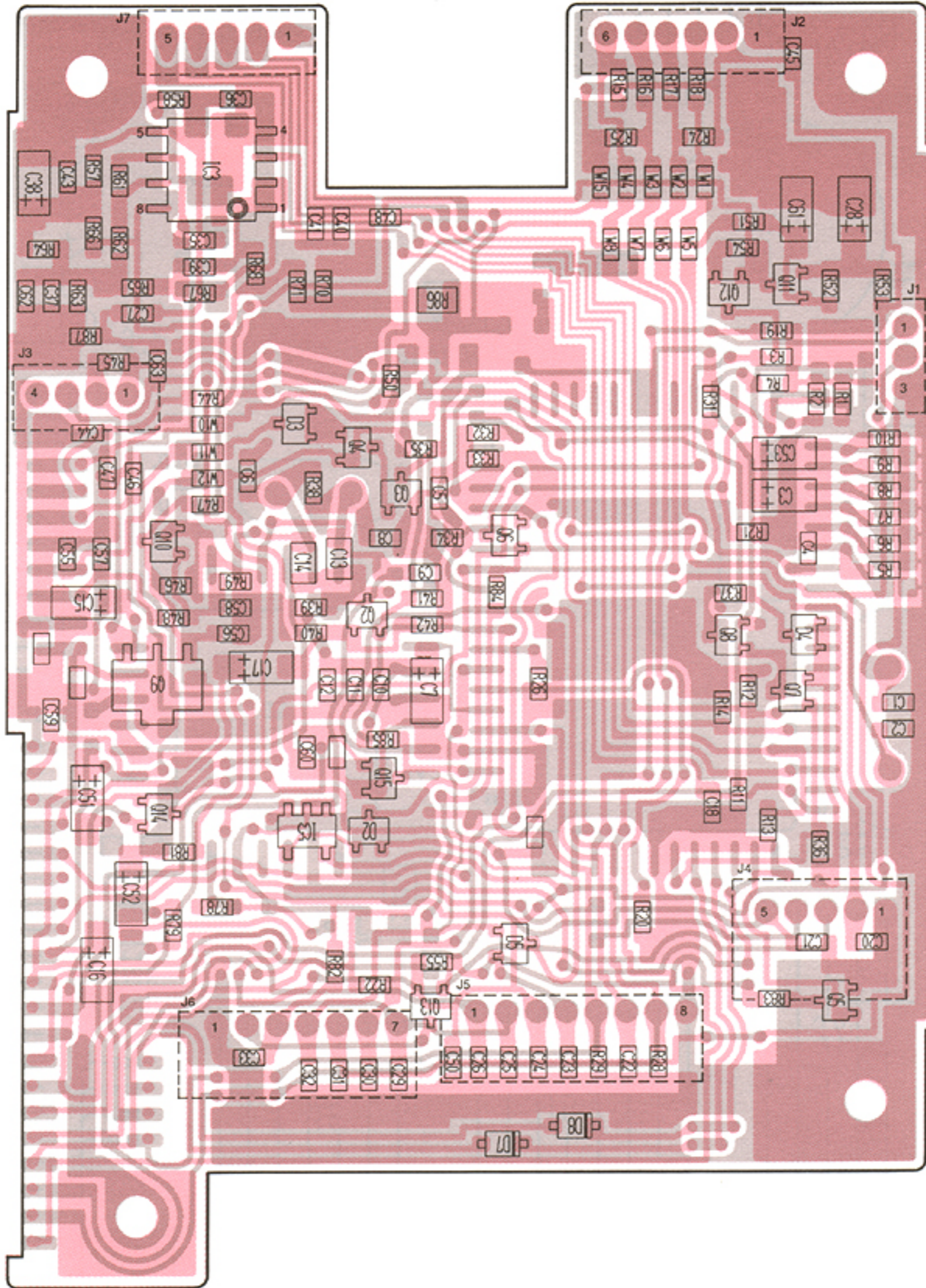
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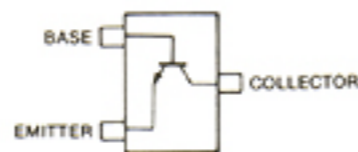
• Internally selectable functions



• LOGIC UNIT

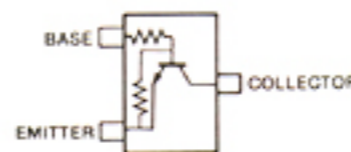


2SC4116 GR
(Symbol: LG)



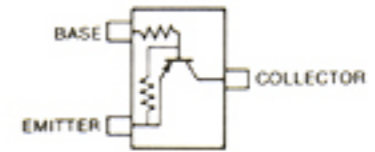
Q2, Q6, Q10, Q15

DTC144EU
(Symbol: 26)



Q3, Q5, Q8, Q12

DTA144EU
(Symbol: 16)



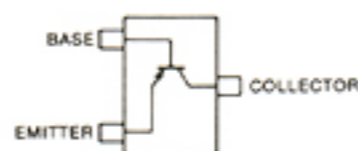
Q4, Q7

2SC3650 TD
(Symbol: CF)



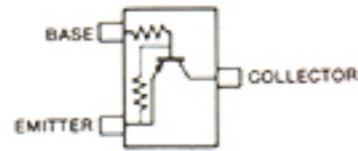
Q9

2SA1586 GR
(Symbol: SG)



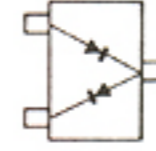
Q11, Q13

DTA114EU
(Symbol: 14)



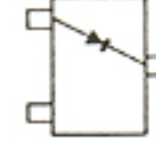
Q14

1SS301
(Symbol: B3)



D2, D5

DA114
(Symbol: AV)

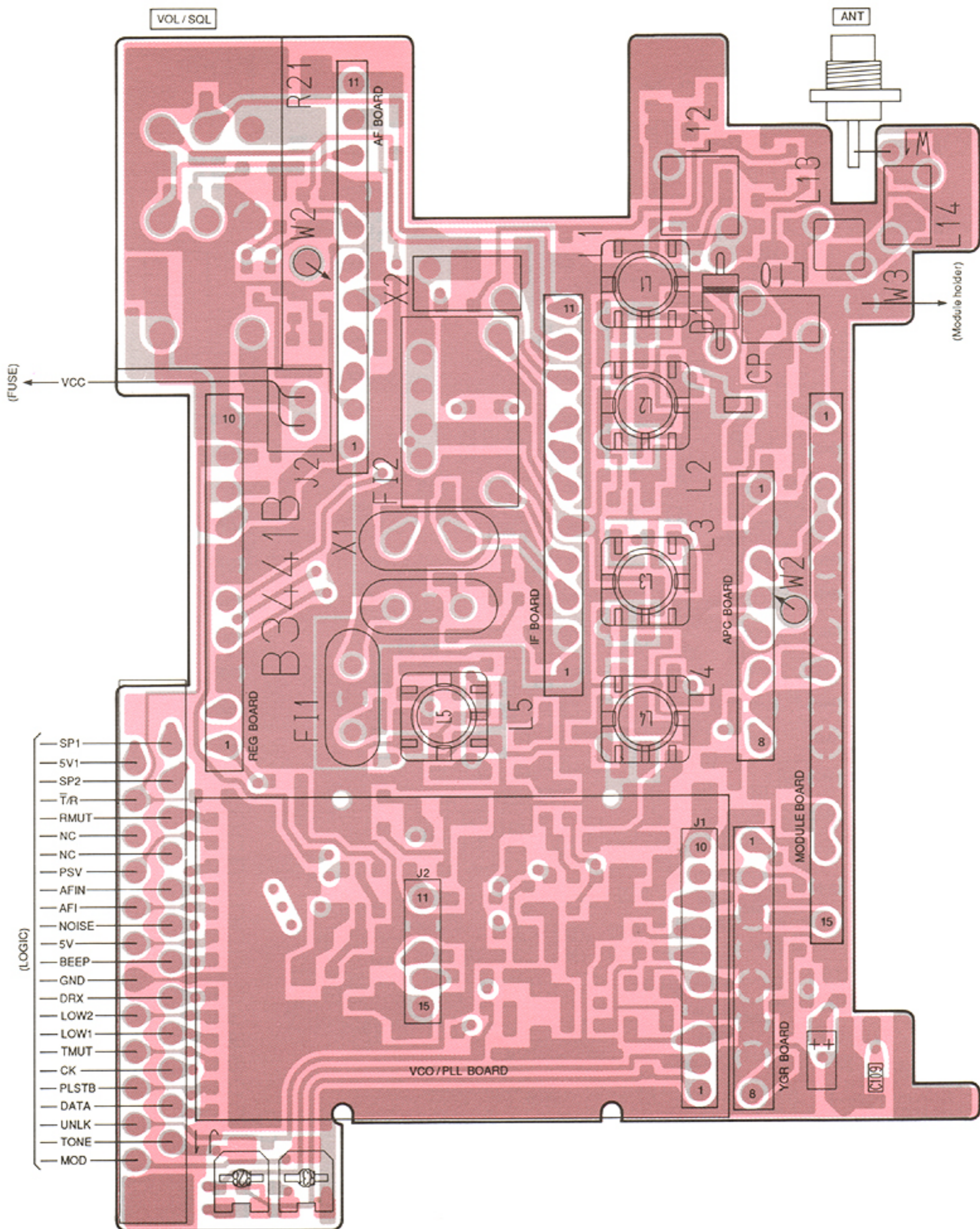


D3, D4

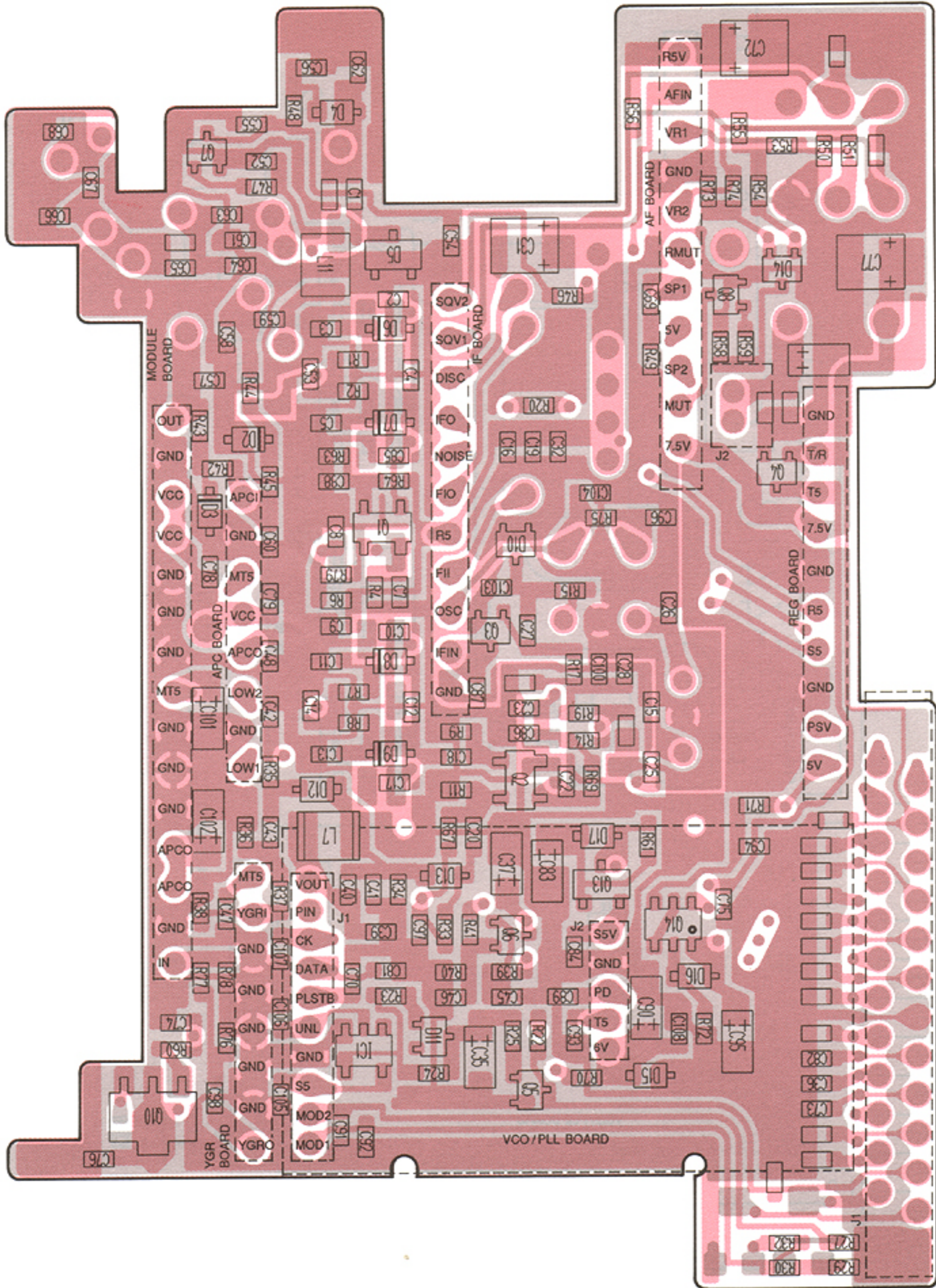
7-2 RF UNIT AND REG BOARD

• RF UNIT

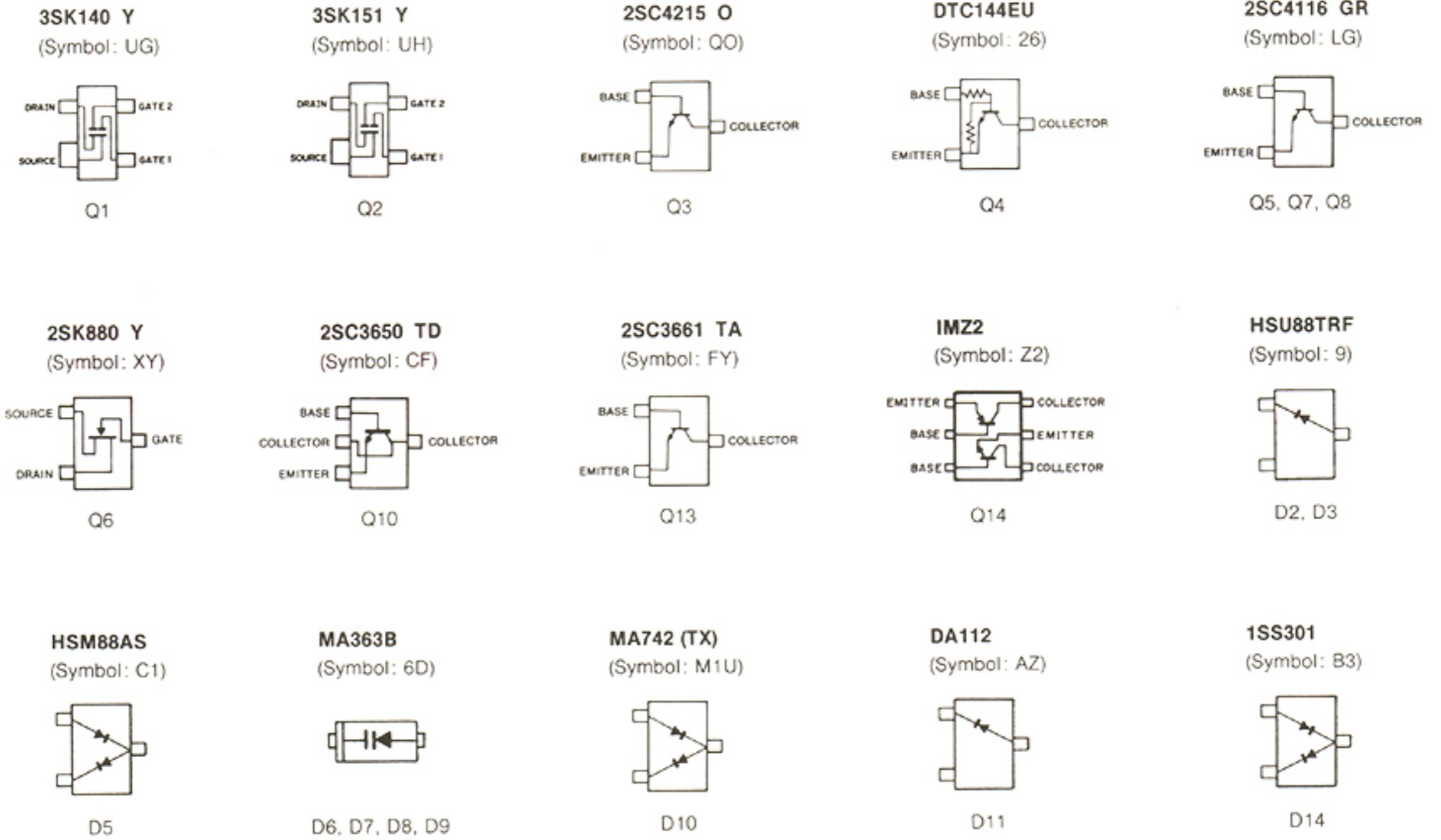
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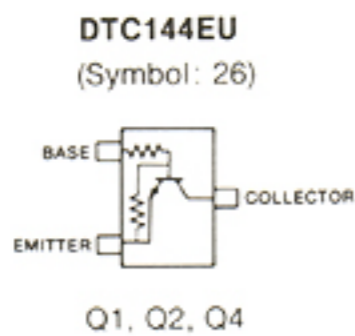
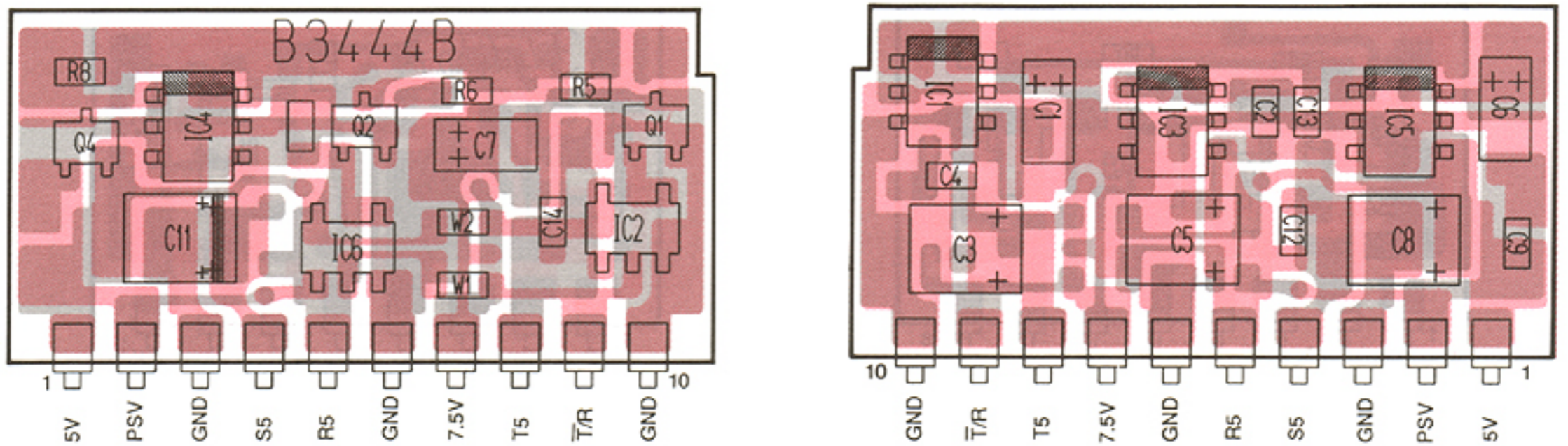
• RF UNIT



• RF UNIT

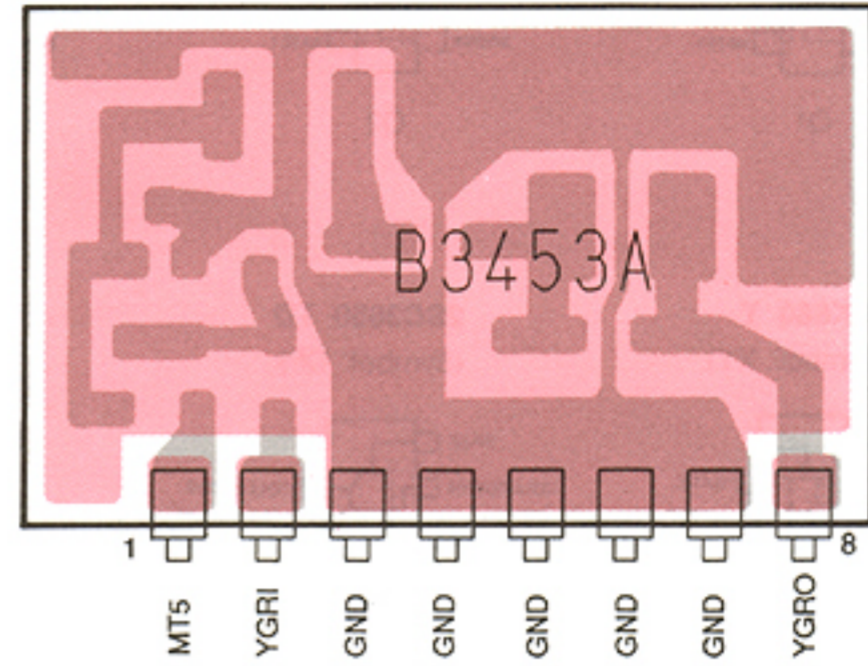
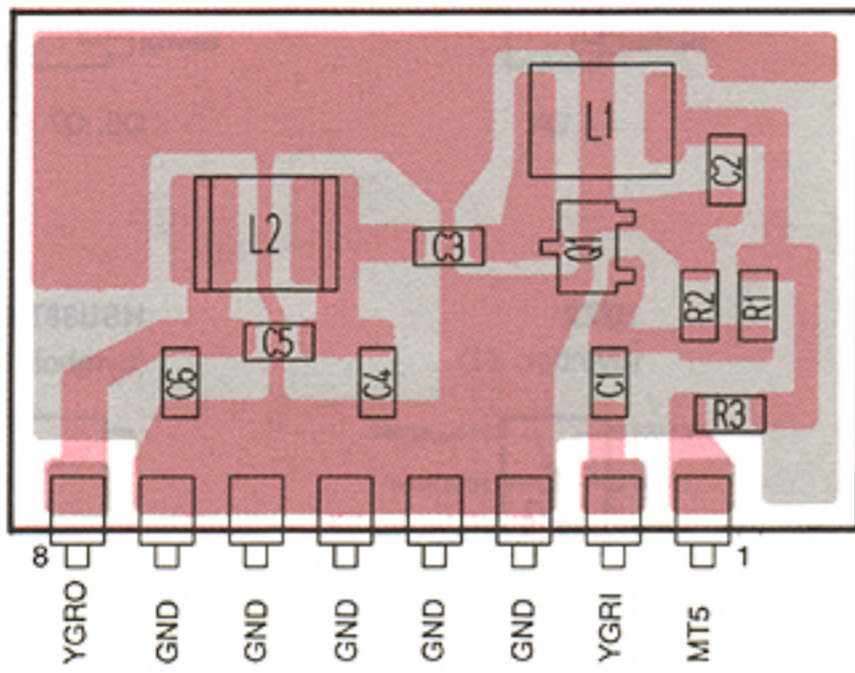


• REG BOARD

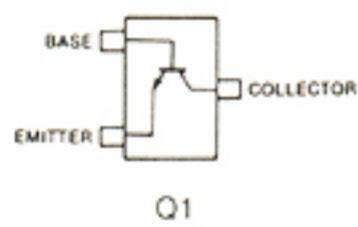


7-3 YGR, APC, AF AND IF BOARDS

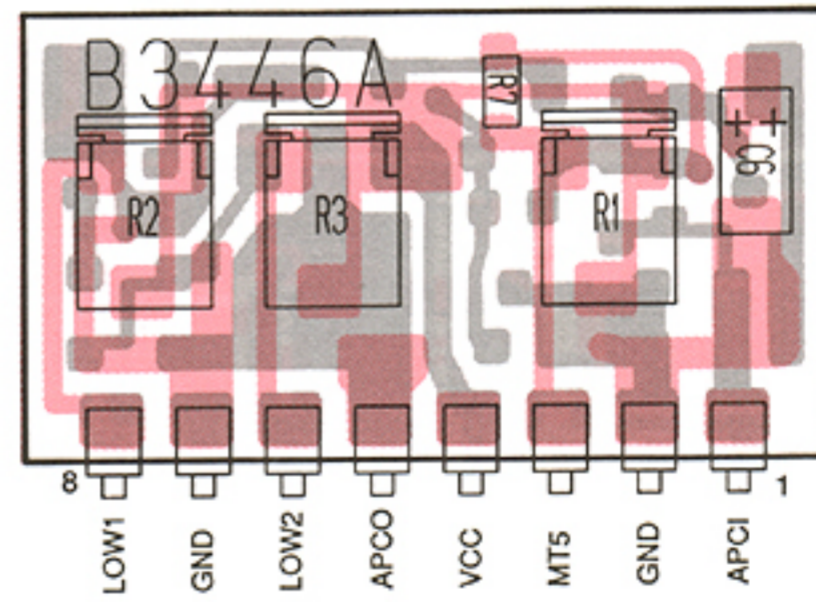
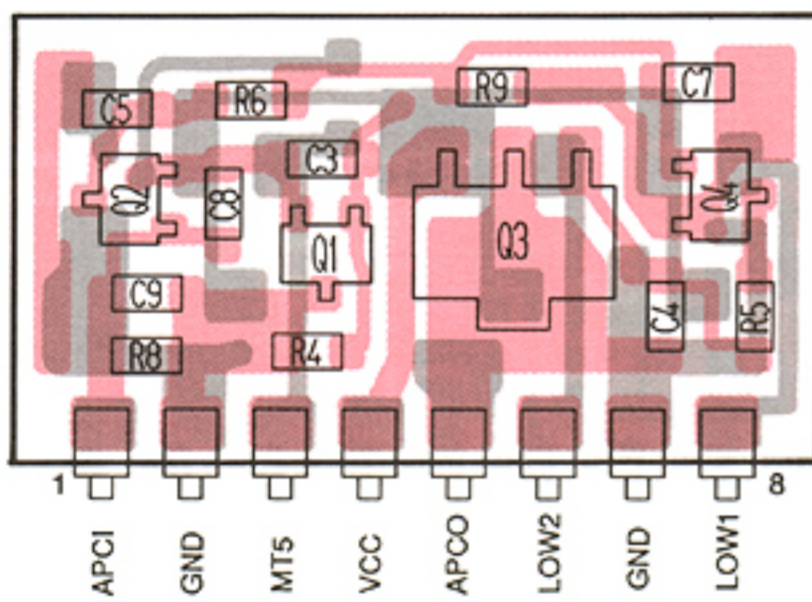
• YGR BOARD



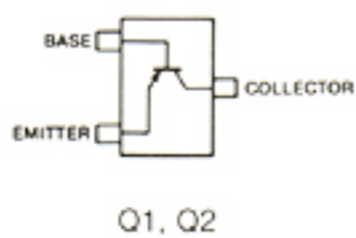
2SC4226 T2 R25
(Symbol: R25)



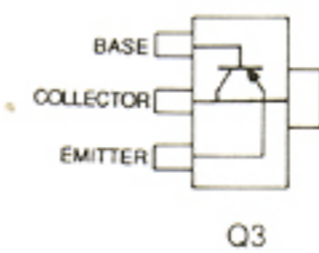
• APC BOARD



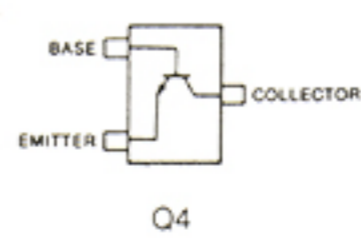
2SA1588 GR
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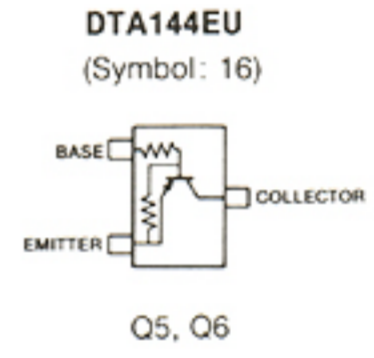
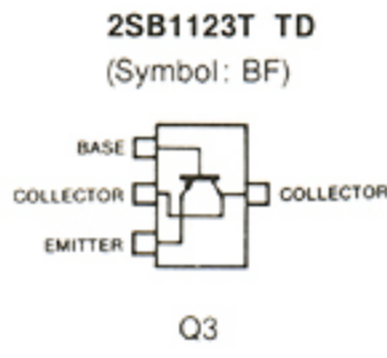
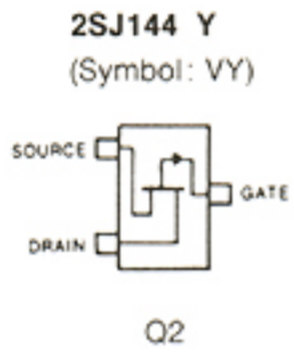
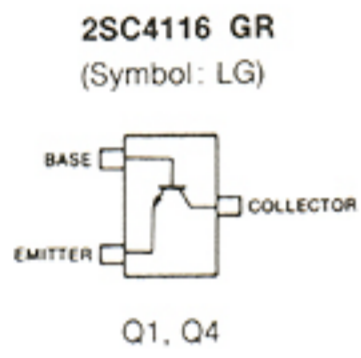
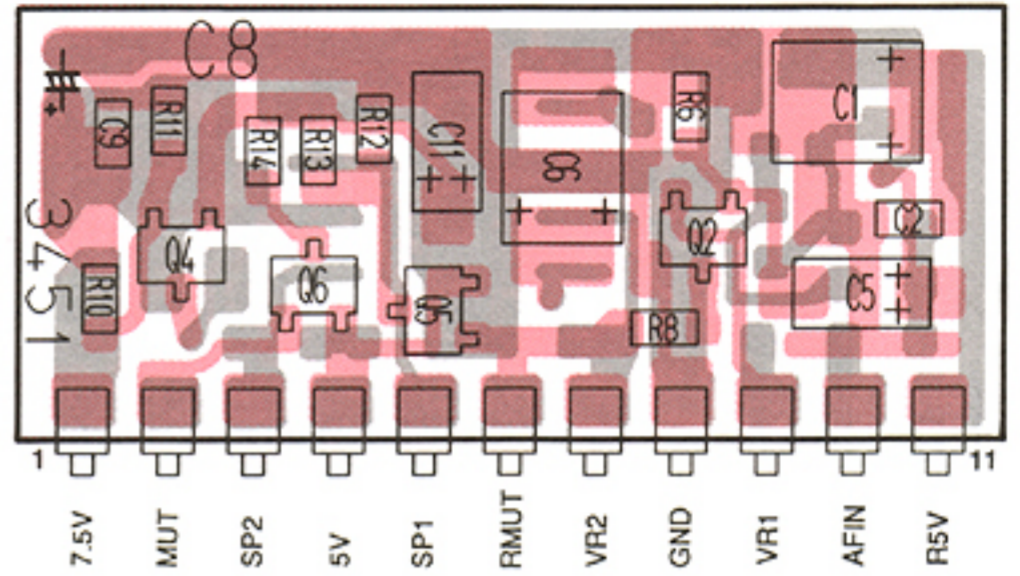
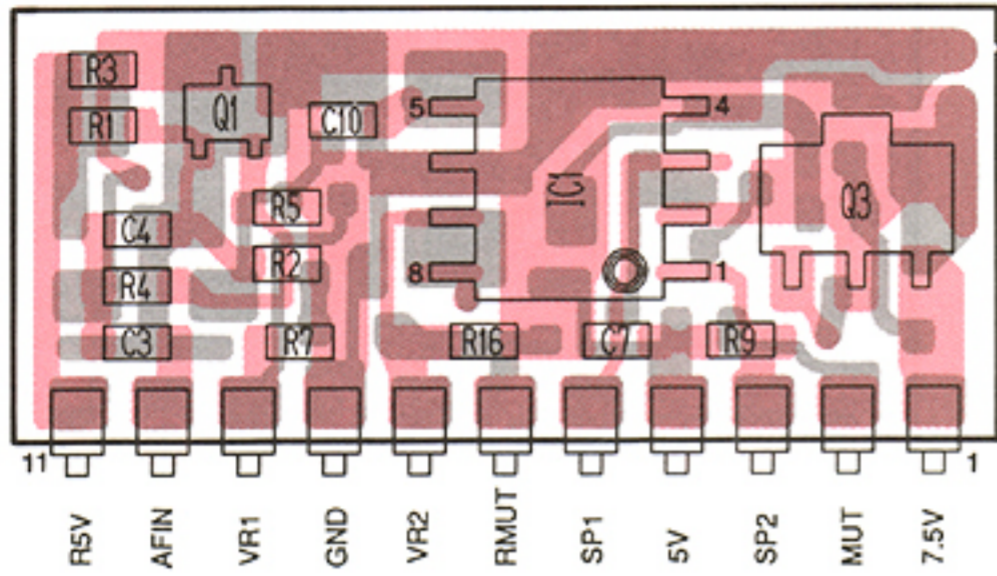
2SB1119S TD
(Symbol: 88)



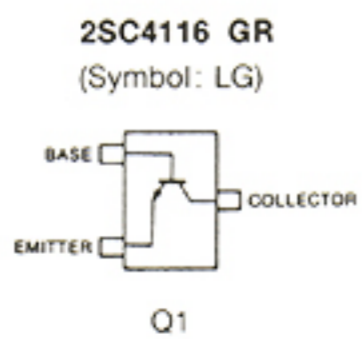
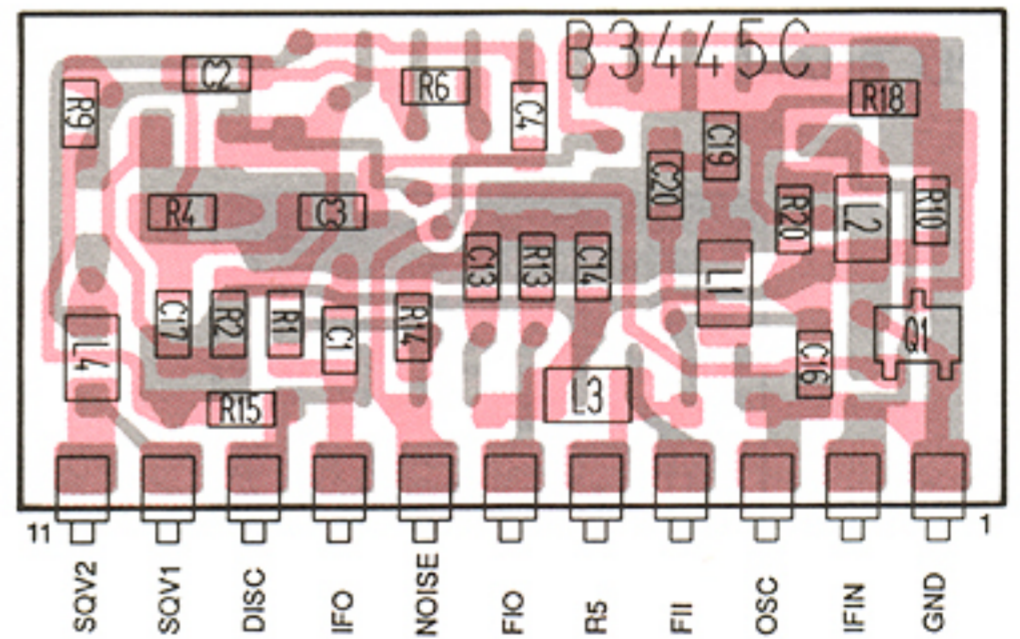
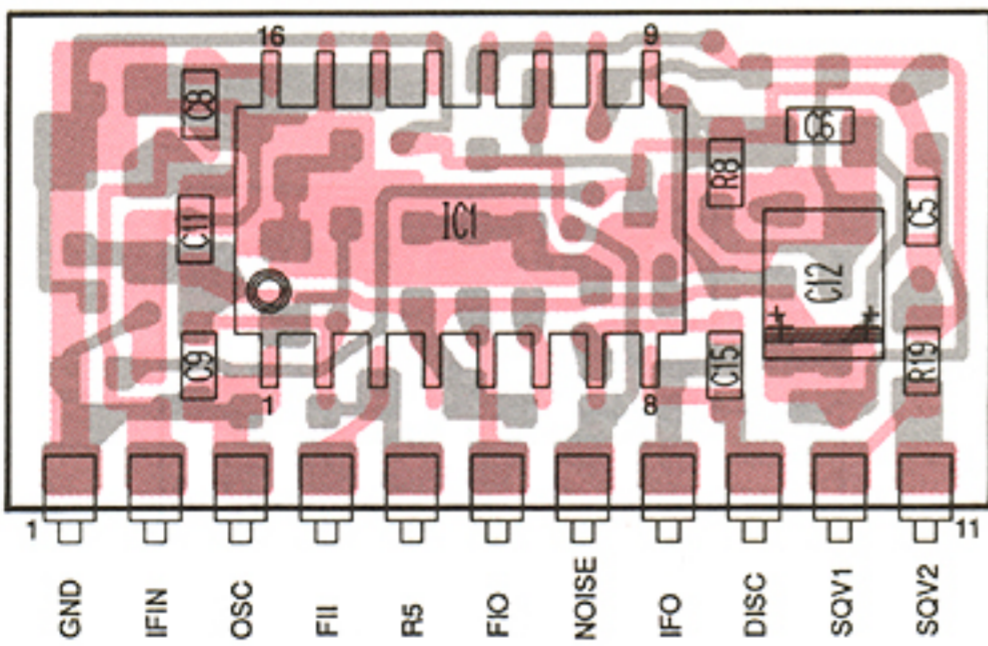
2SC4116 GR
(Symbol: LG)



• AF BOARD

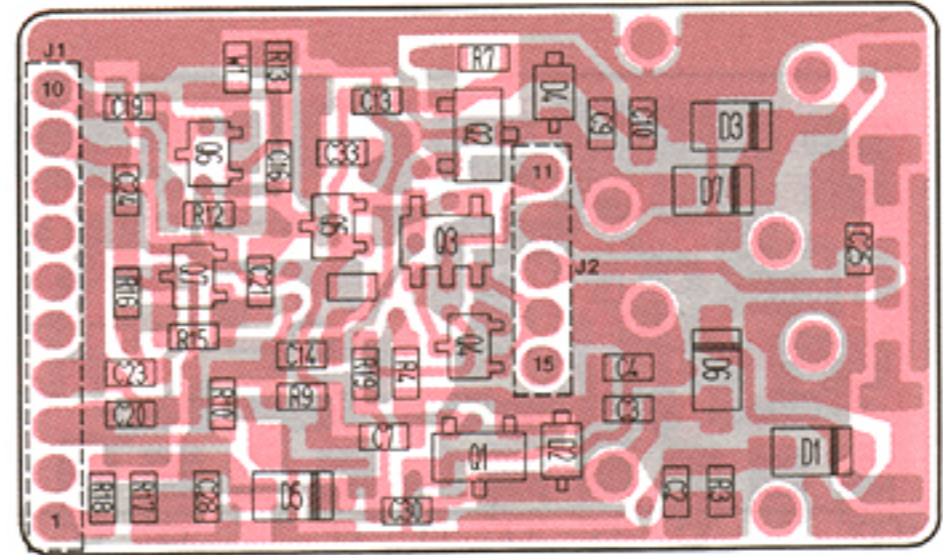
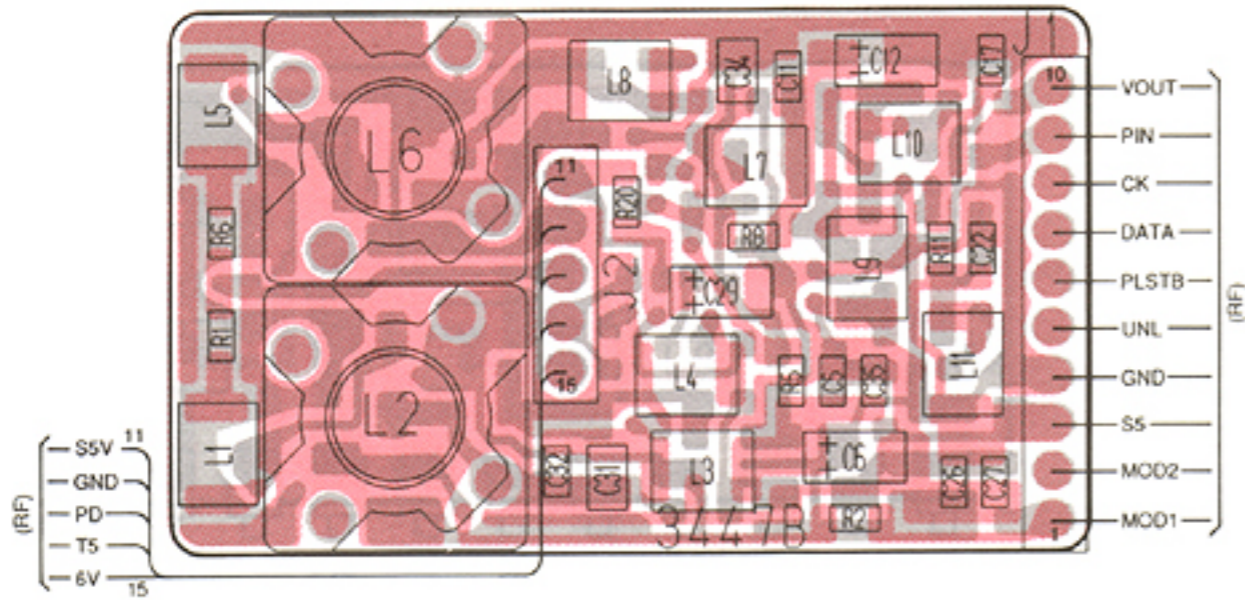


• IF BOARD

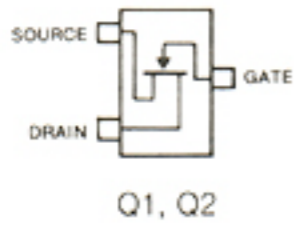


7-4 VCO, PLL, MODULE 1 AND MODULE 2 BOARDS

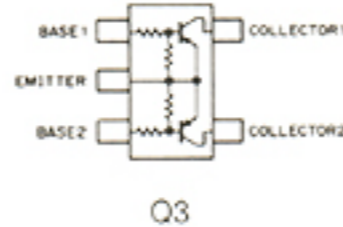
• VCO BOARD



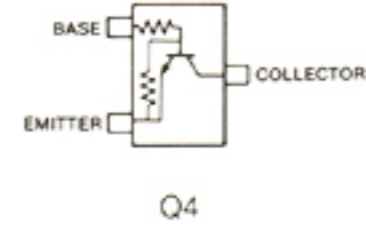
2SK508 K52
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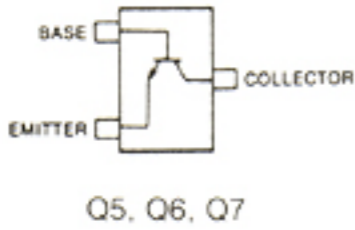
FMA5 T148
(Symbol: A5)



DTC144EU
(Symbol: 26)



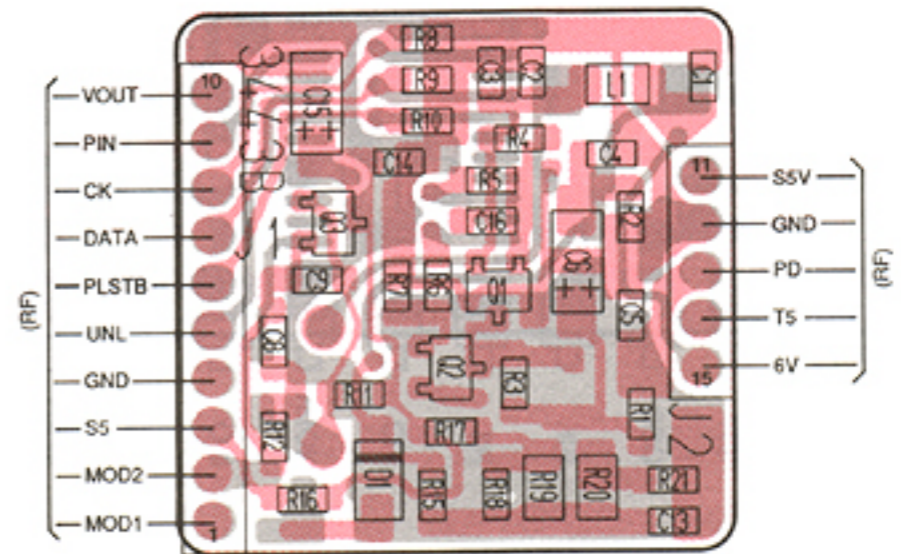
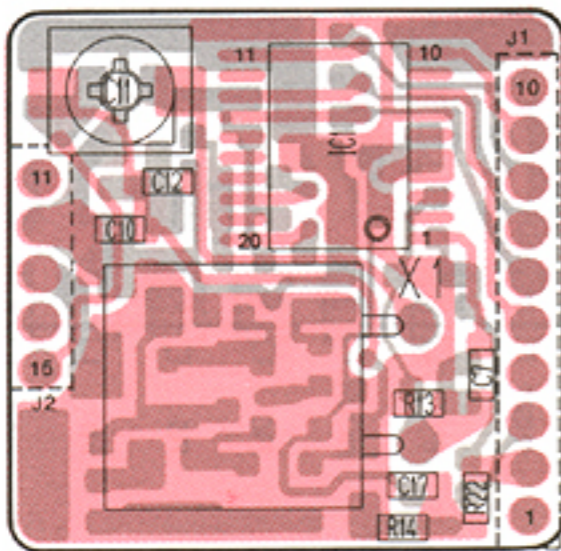
2SC4226 T2 R25
(Symbol: R25)



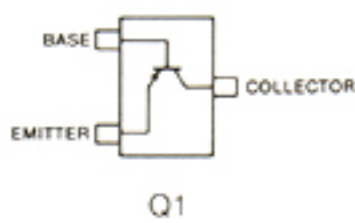
MA363B
(Symbol: 6D)



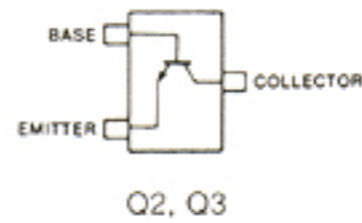
• PLL BOARD



2SA1586 GR
(Symbol: SG)



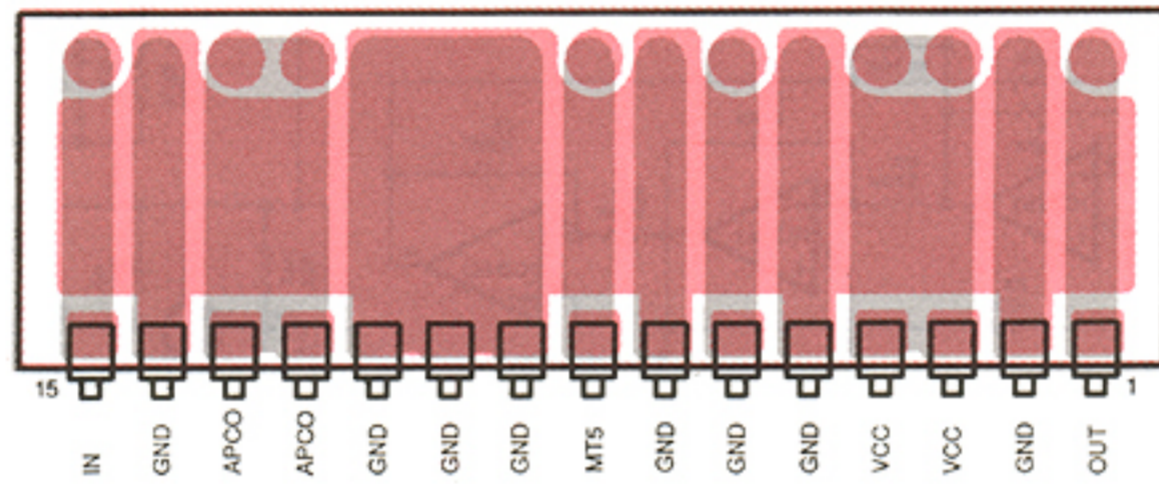
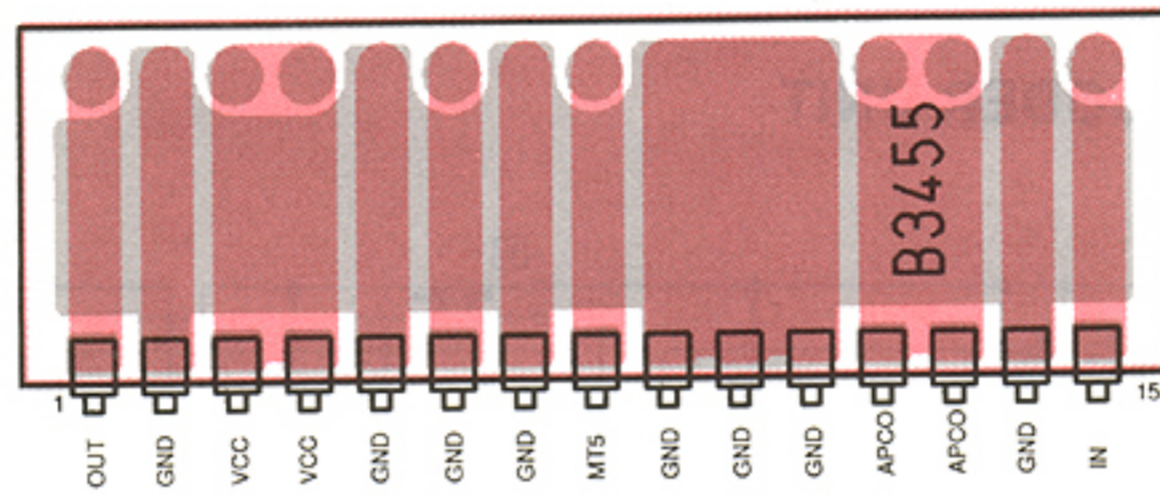
2SC4116 GR
(Symbol: LG)



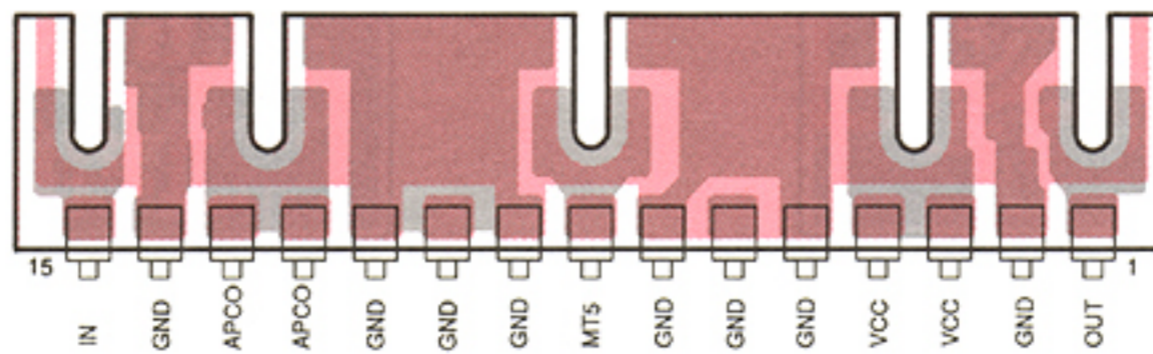
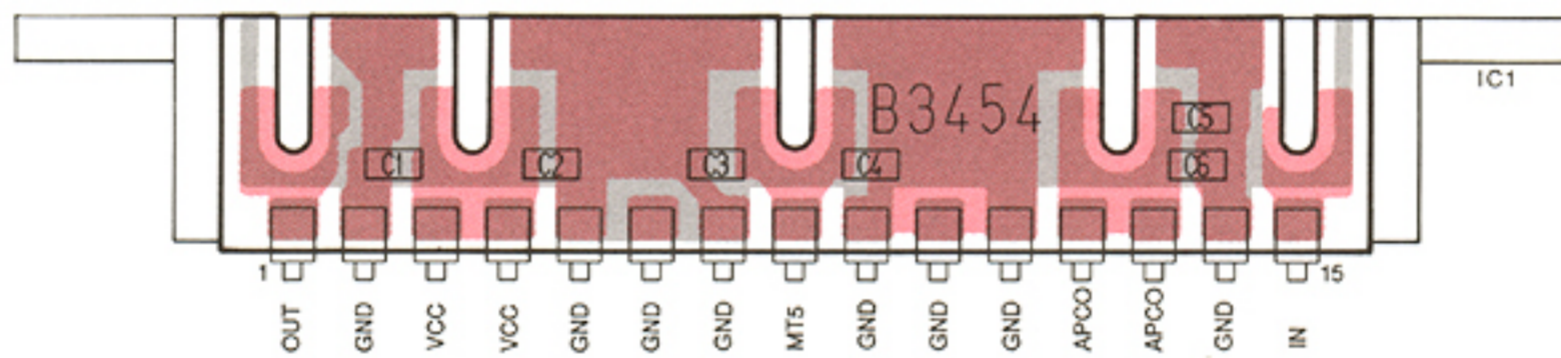
1SV164
(No symbol, orange line)



• MODULE 1 BOARD

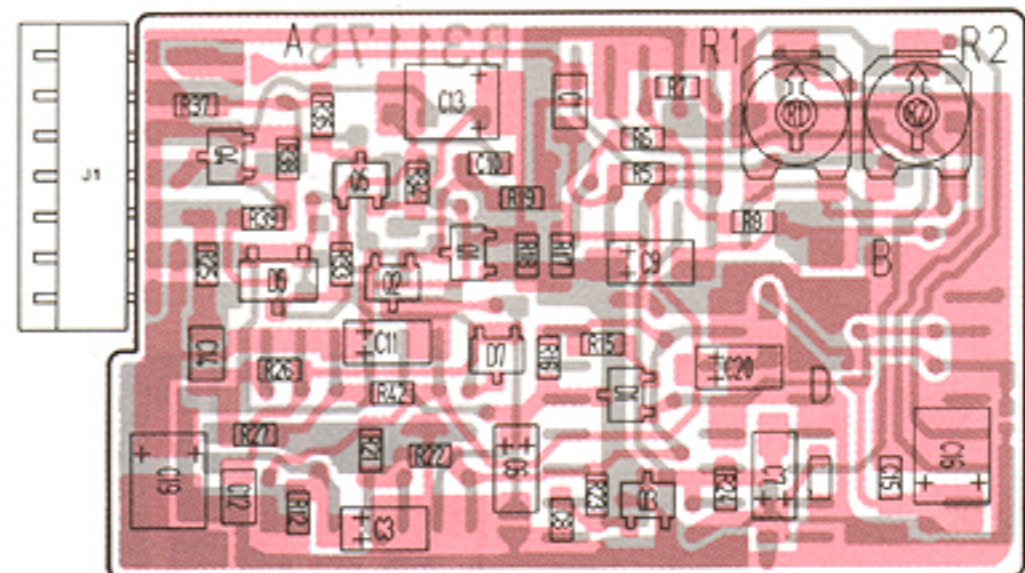
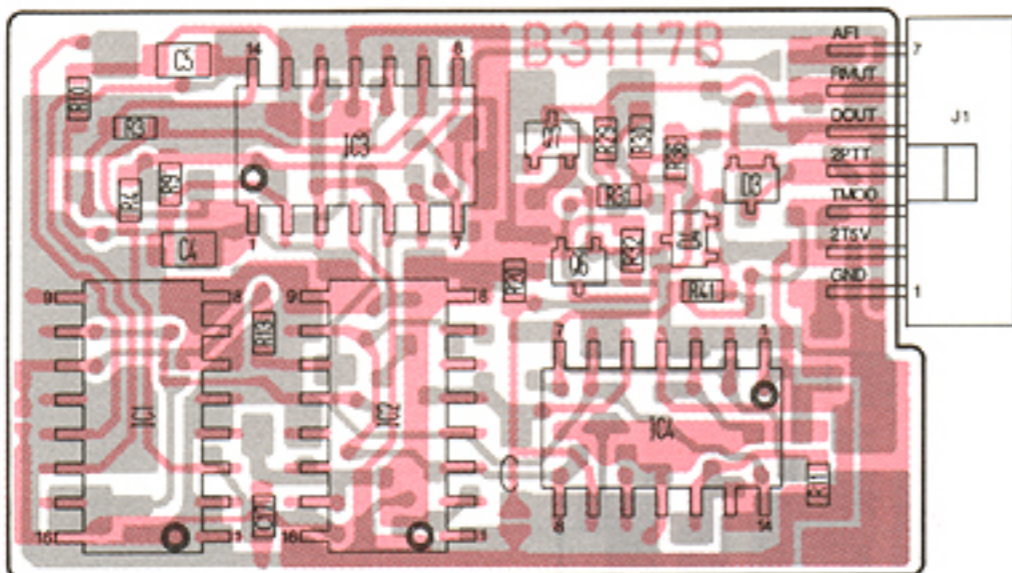
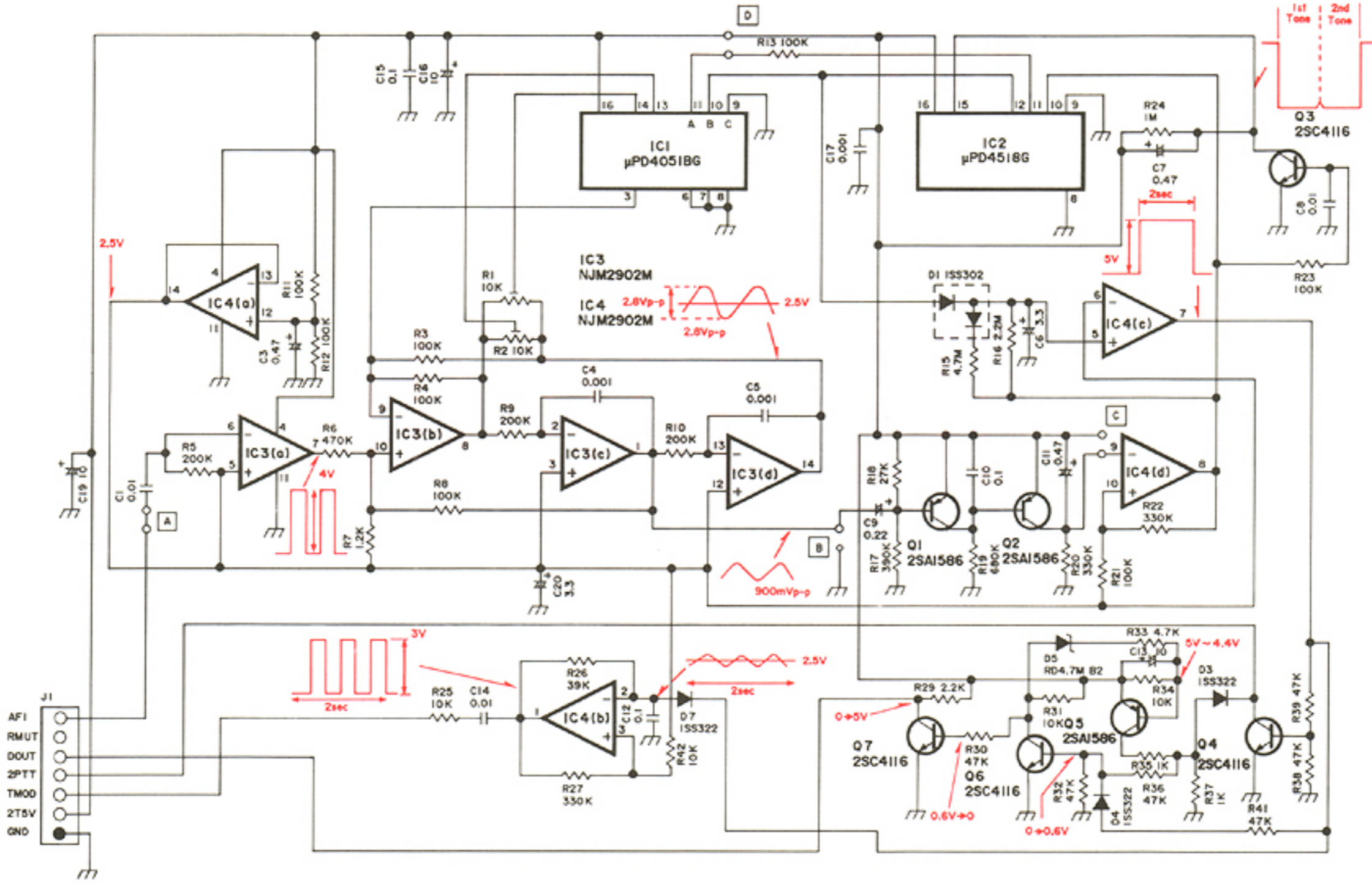


• MODULE 2 BOARD

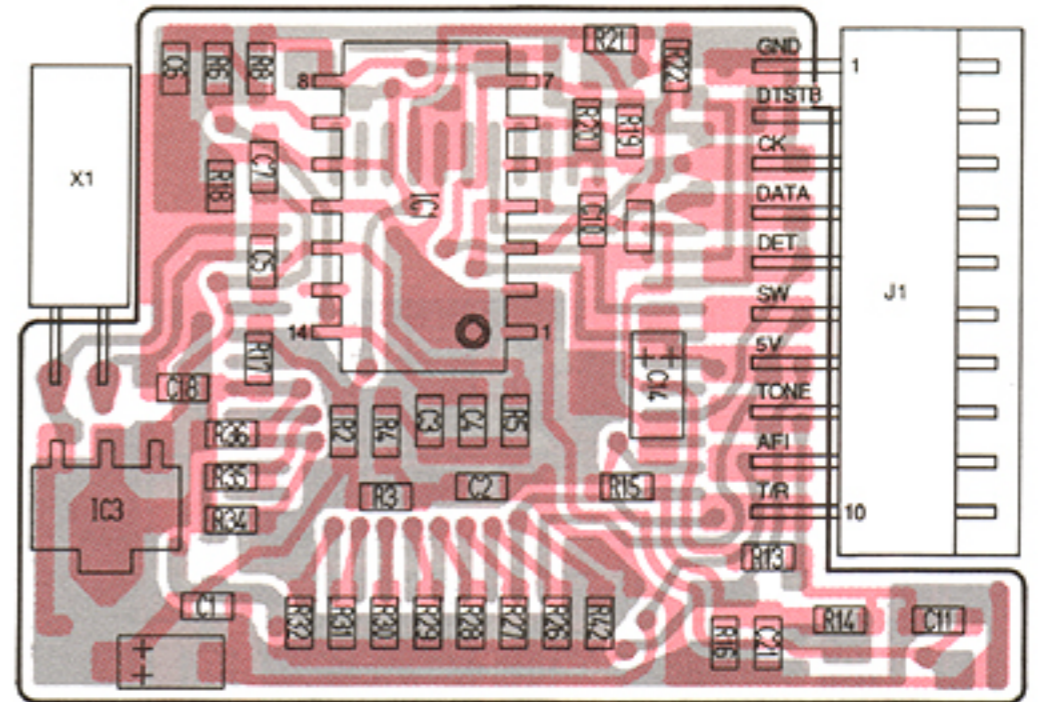
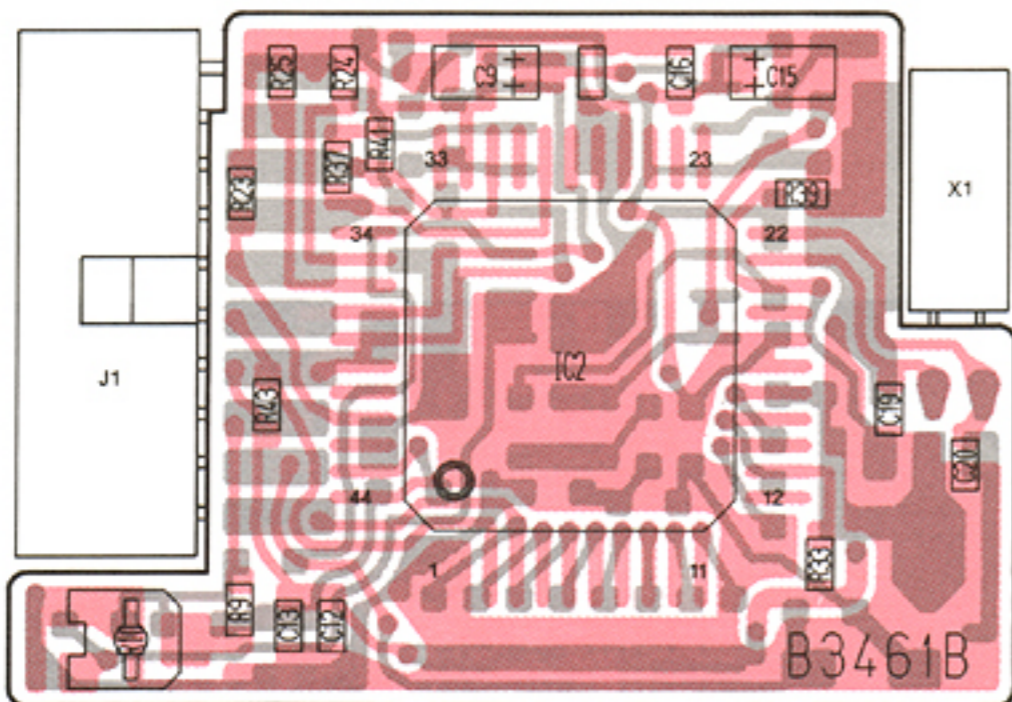
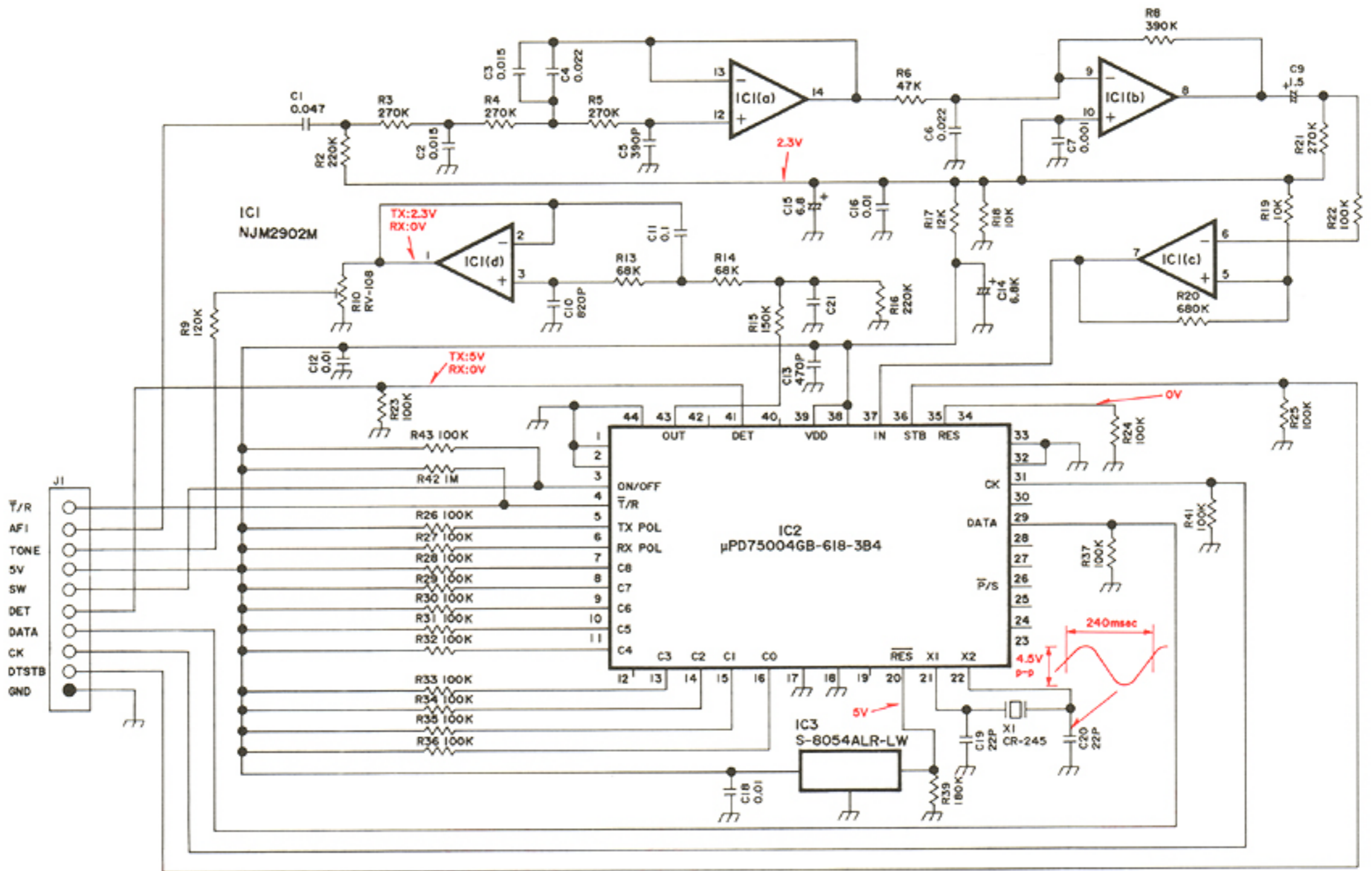


SECTION 8 OPTIONAL UNITS

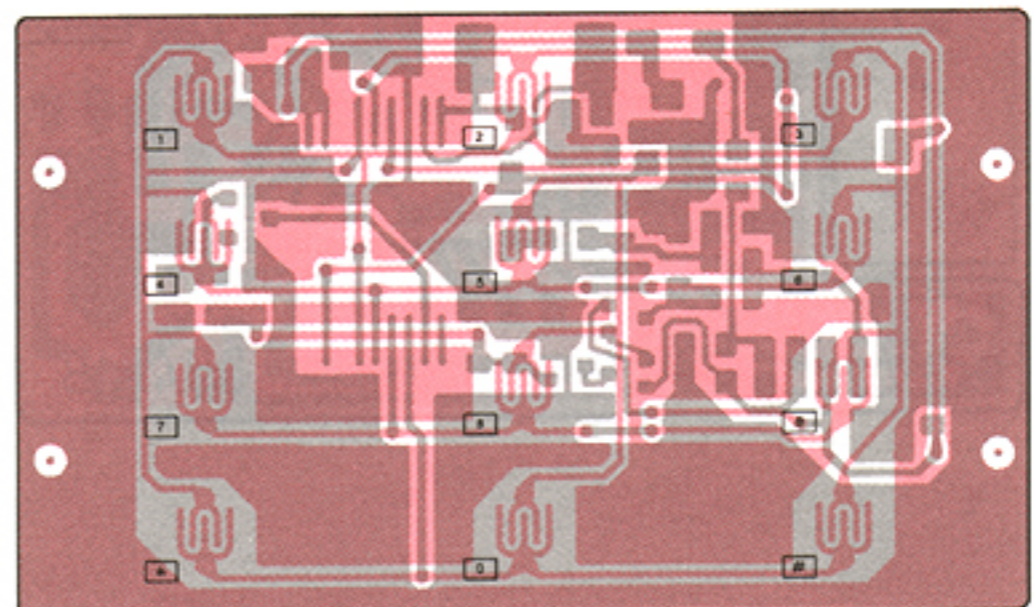
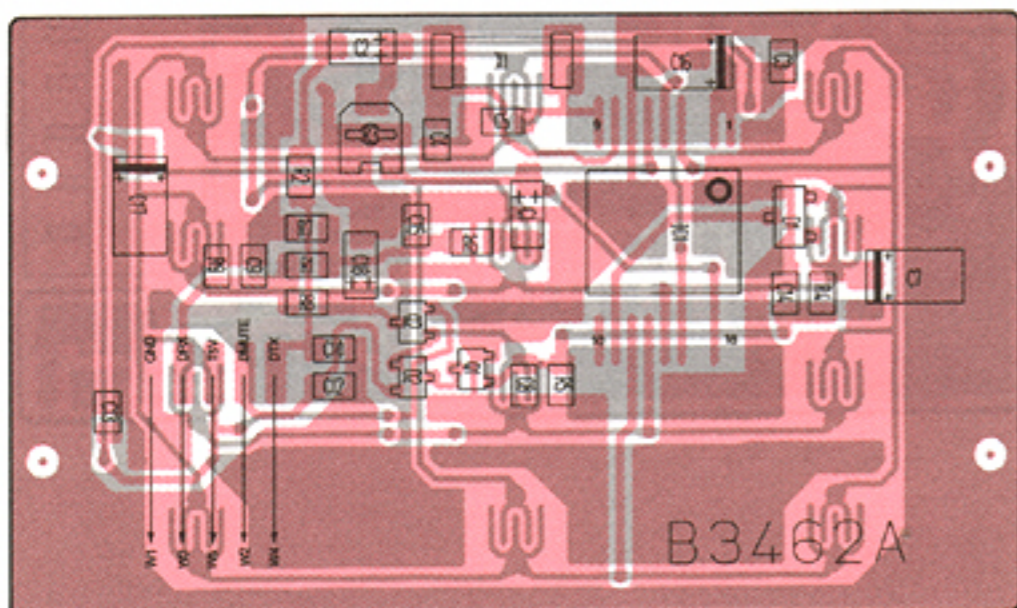
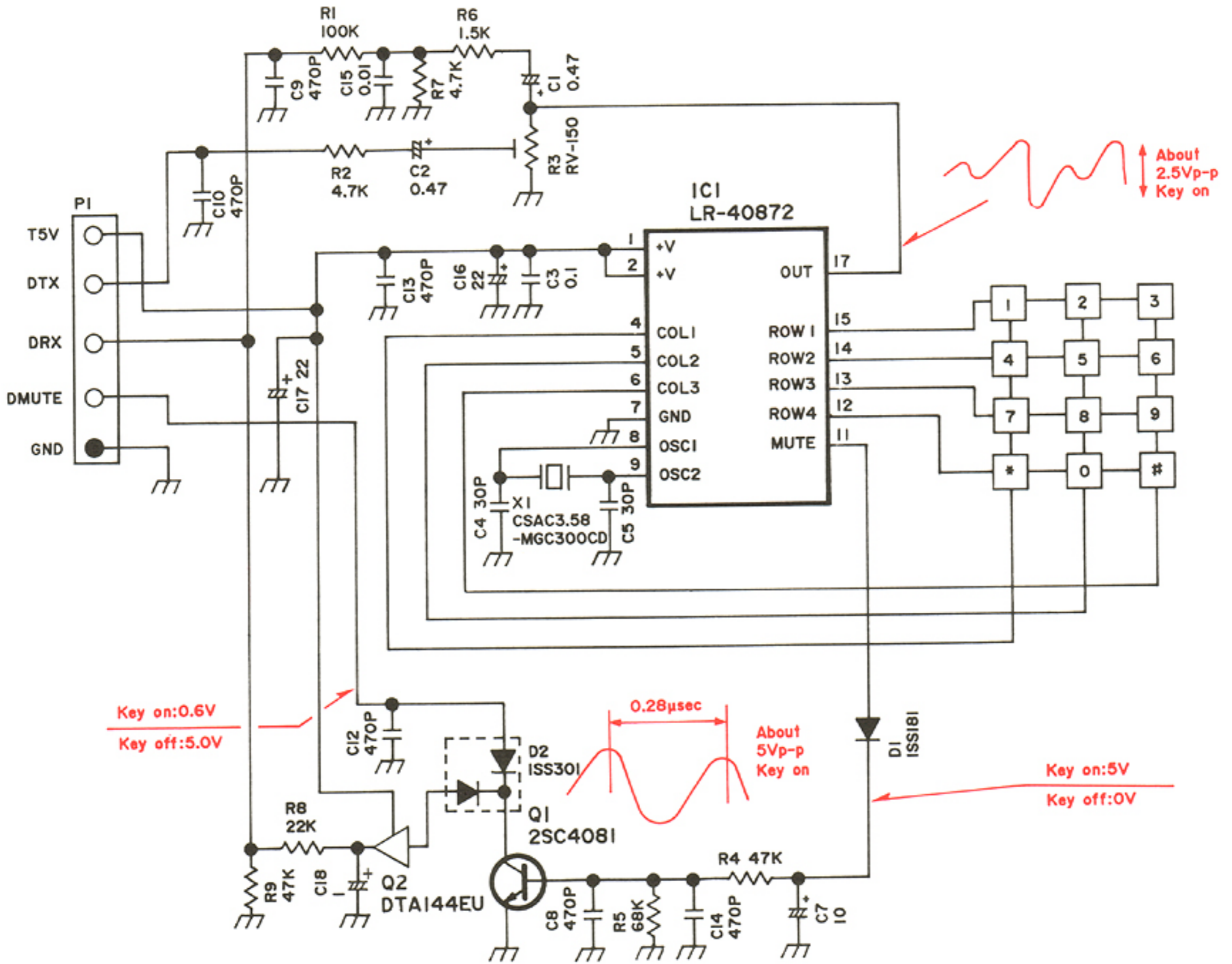
8-1 UT-68 2 TONE DECODER UNIT



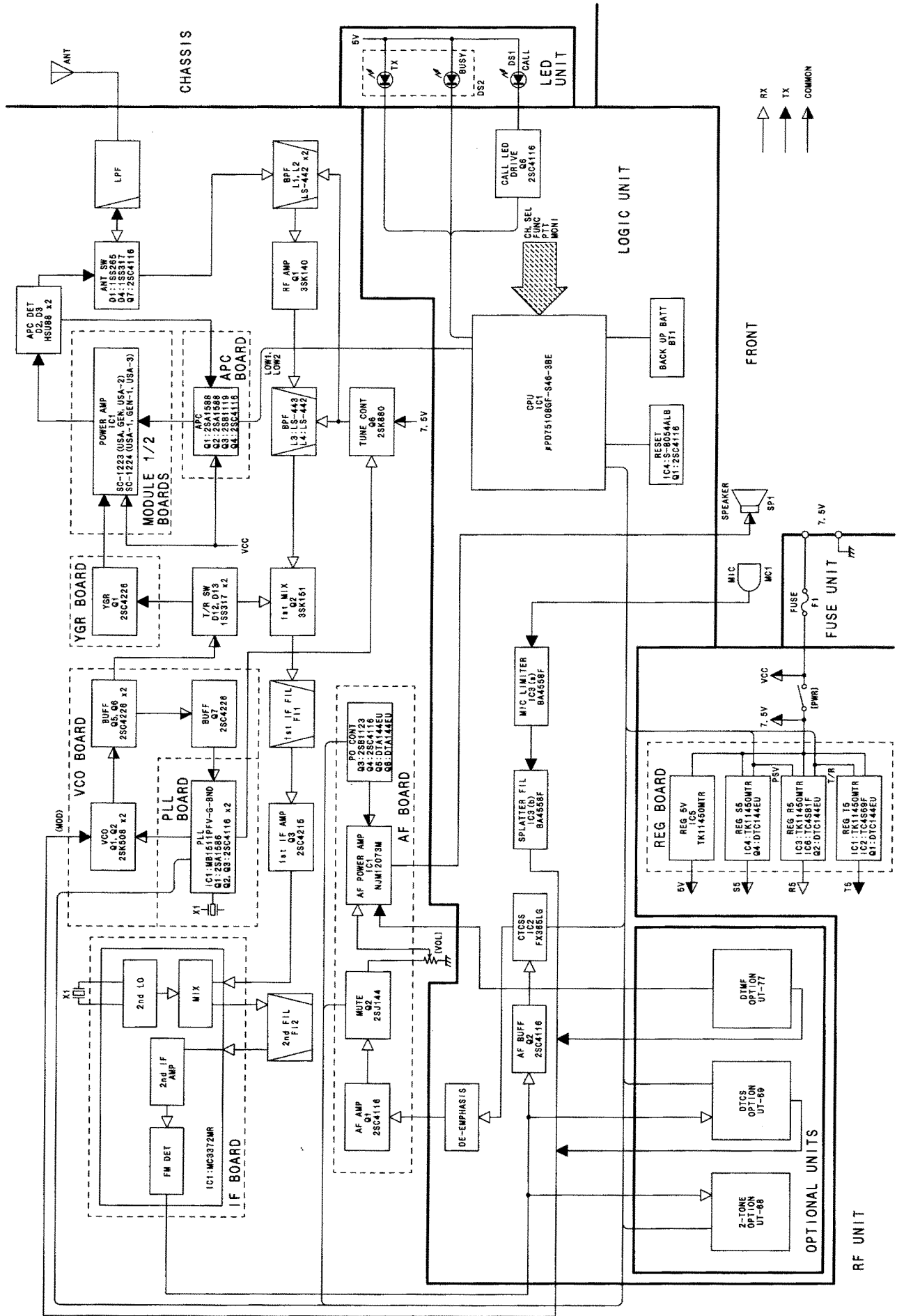
8-2 UT-69 DTCS ENCODER/DECODER UNIT



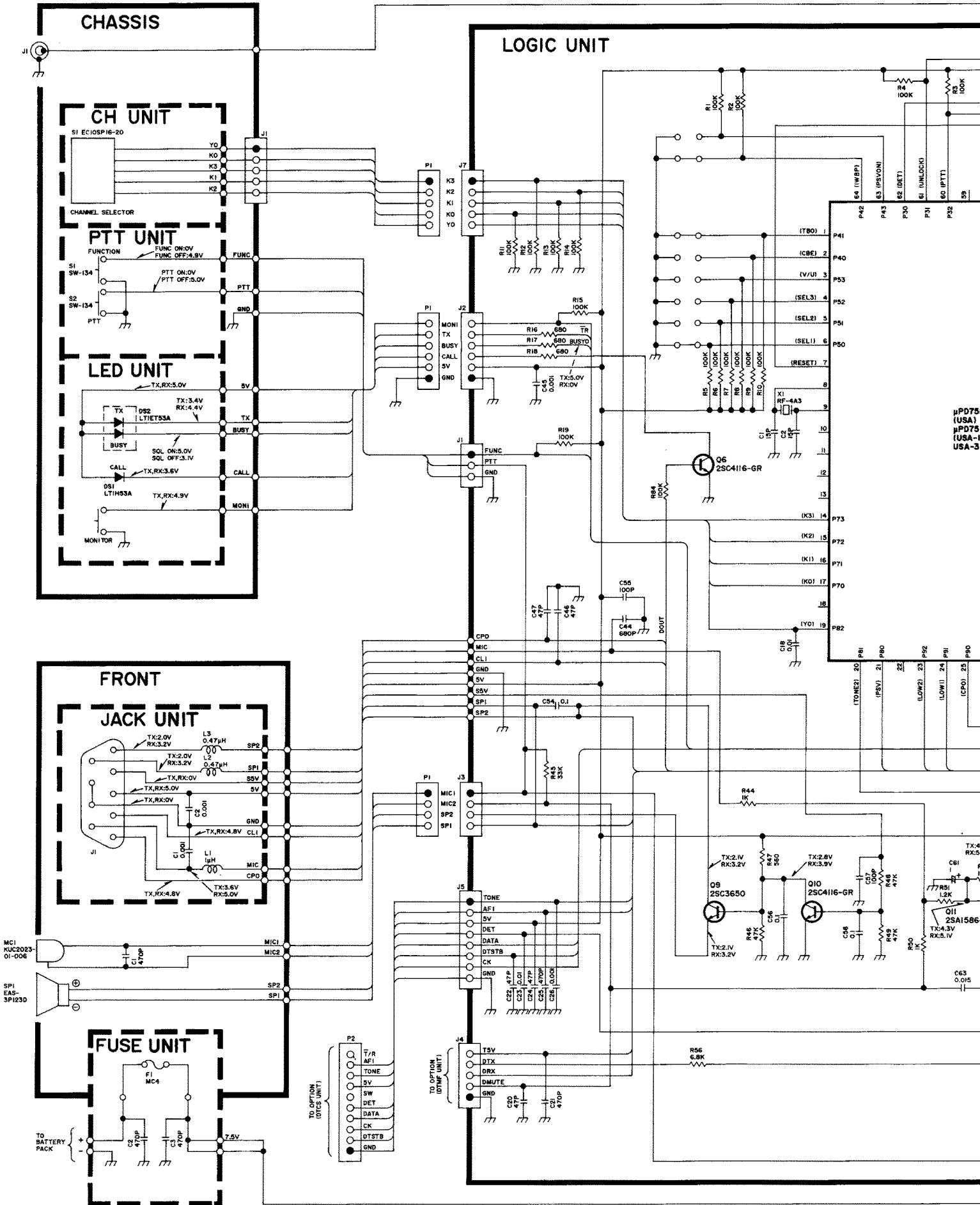
8-3 UT-77 DTMF ENCODER UNIT

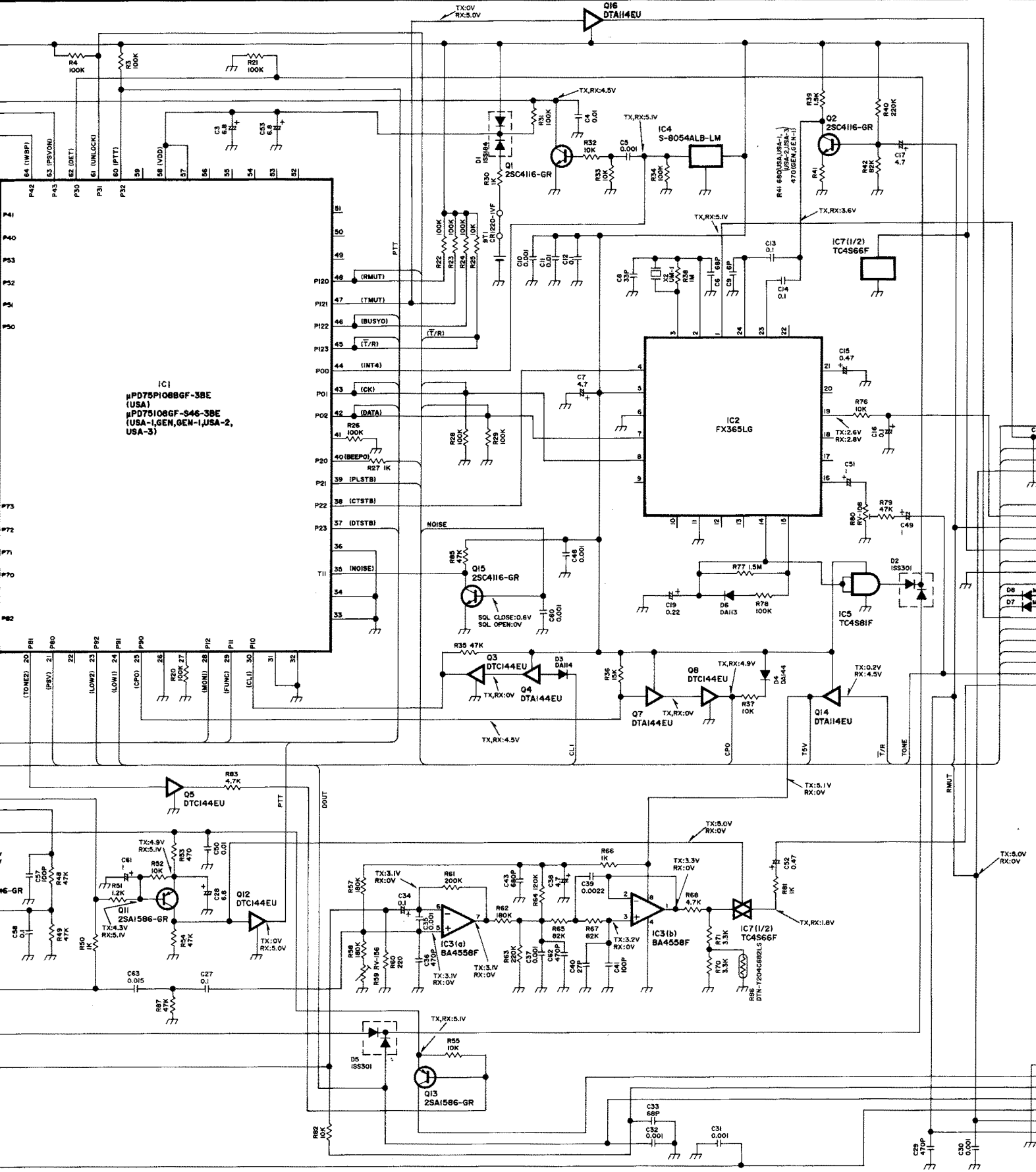


SECTION 9 BLOCK DIAGRAM



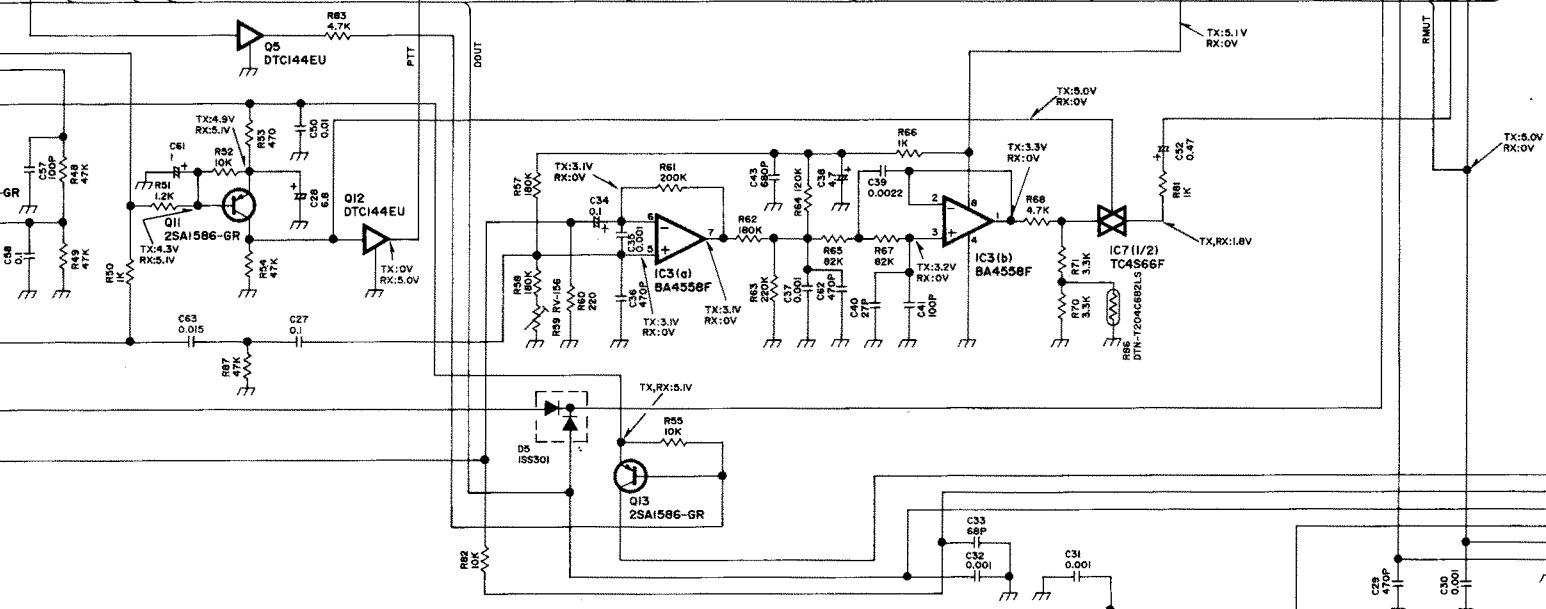
SECTION 10 VOLTAGE DIAGRAM

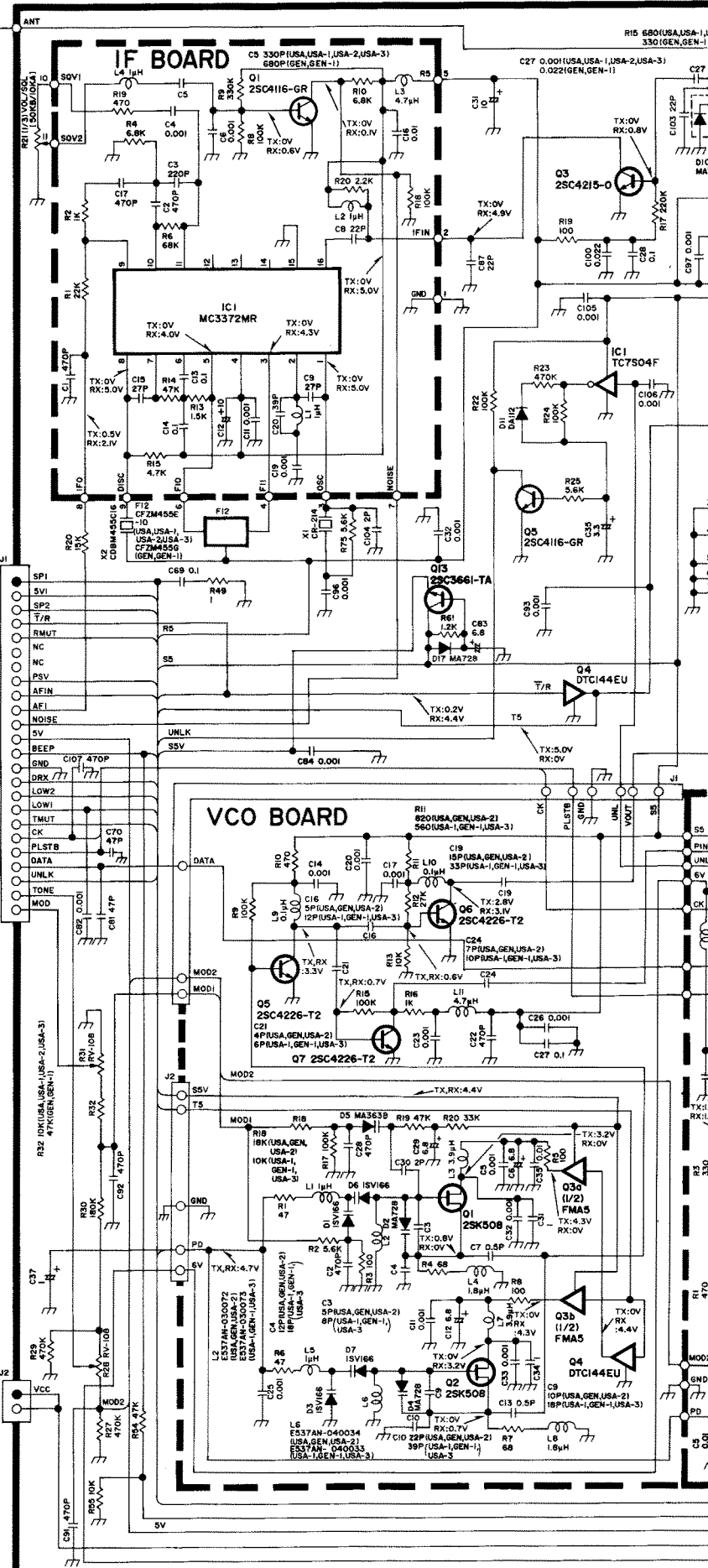
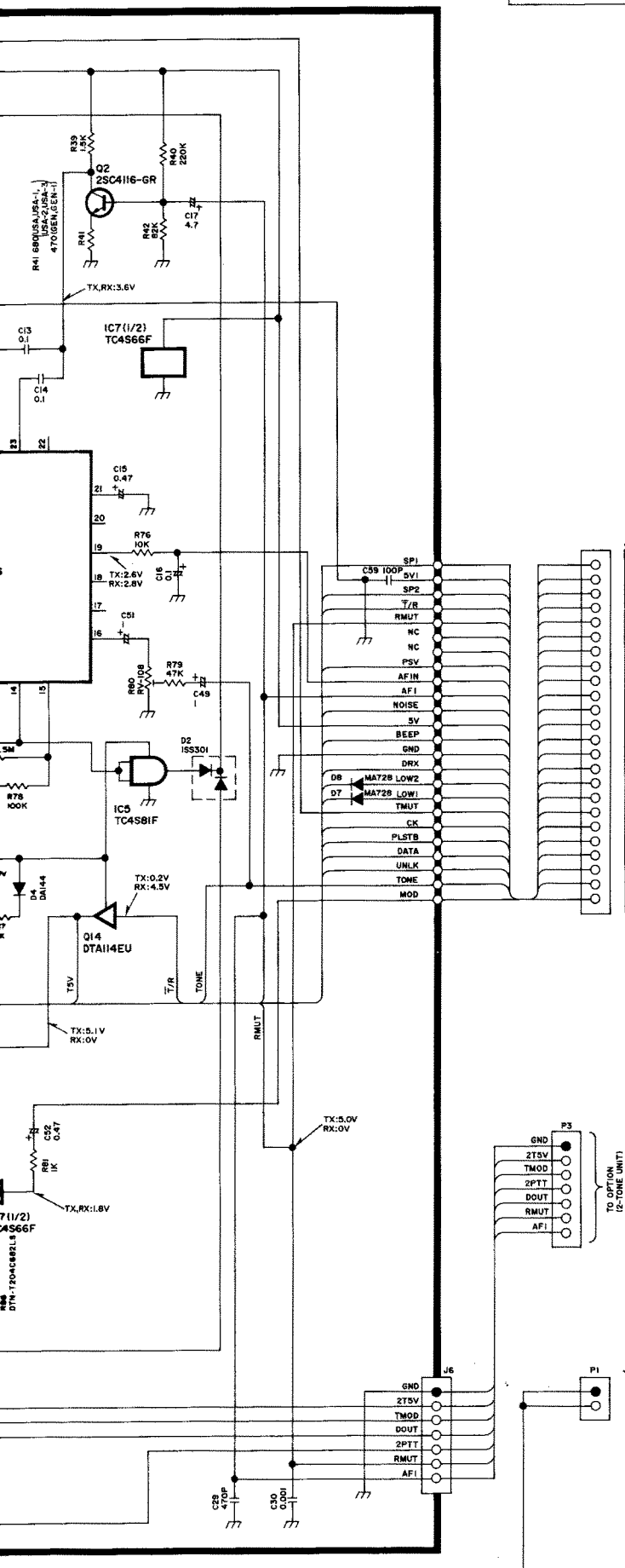


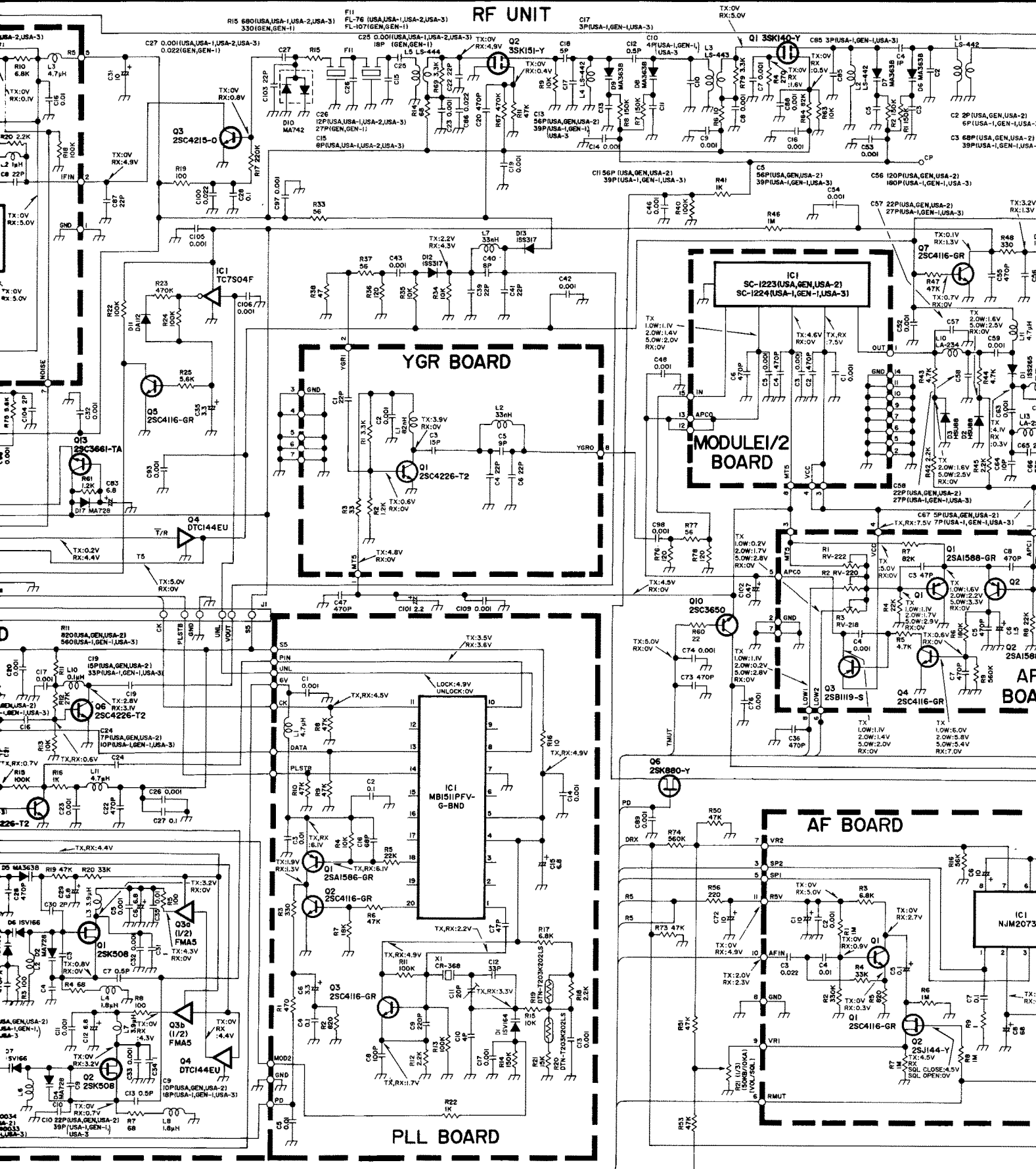


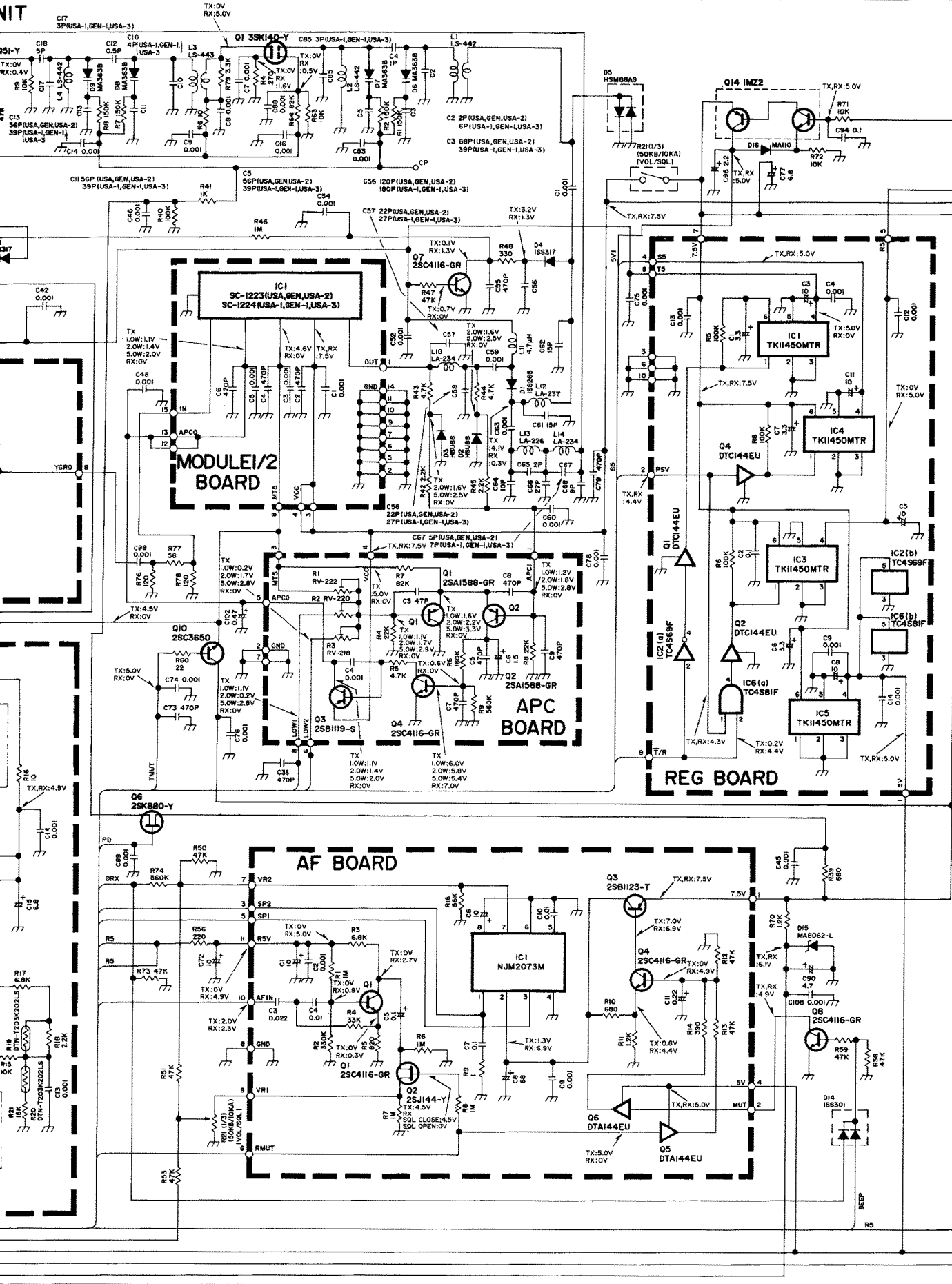
IC1
#PD751086GF-3BE
(USA)
#PD751086GF-346-3BE
(USA-1, GEN, 0EN-1, USA-2,
USA-3)

P42	64 (WBPF)
P43	63 (PSV/DH)
P30	62 (DET)
P31	61 (UNLOCK)
P32	60 (PTT)
P29	59
P28	58 (VDD)
P27	57
P26	56
P25	55
P24	54
P23	53
P22	52
P21	51
P20	50
P19	49
P18	48 (RMUT)
P17	47 (TMUT)
P16	46 (BUSY)
P15	45 (T/R)
P14	44 (INT4)
P13	43 (CK)
P12	42 (DATA)
P11	41 (R26 100K)
P10	40 (BEEP)
P9	39 (PLSTB)
P8	38 (CTSTB)
P7	37 (DTSTB)
P6	36
P5	35 (NOISE)
P4	34
P3	33
P2	32
P1	31
P0	30 (CLI)
P30	29 (FUNG)
P29	28 (MOD)
P28	27 (LCP)
P27	26 (LOW)
P26	25 (LOW)
P25	24 (PSV)
P24	23 (TONE)
P23	22
P22	21
P21	20
P20	19
P19	18
P18	17
P17	16
P16	15
P15	14
P14	13
P13	12
P12	11
P11	10
P10	9
P9	8
P8	7
P7	6
P6	5
P5	4
P4	3
P3	2
P2	1









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